OnPOZ
Precision Positioning

EZSurv®

GNSS Post-Processing

User Guide // Version 2.94

effigis
GEO SOLUTIONS

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Contents

1 Installation 1
1.1 System Requirements 1
1.2 Installing the software 1
1.3 Licensing 2

2 Introduction 3
2.1 Processing Mode 3
2.1.1 Differential Positioning mode 3
2.1.2 Precise Point Positioning mode (PPP) 4
2.2 File Status 4
2.3 Software Environment 6
2.3.1 Starting application 6
2.3.2 Selecting the language 6
2.3.3 Main windows 7

3 GNSS Processing Workflow 8
3.1 Creating or opening a project 8
3.1.1 New project 8
3.1.2 Open an existing project 9
3.2 Importing Data 10
3.2.1 Importing your Data 10
3.2.2 Determining File Status during Import 11
3.2.3 Changing File Status 12
3.2.4 Supported File Formats 13
3.3 Fixing a Reference Site 14
3.4 Processing 15
3.4.1 Pre-Process 16
3.4.2 Process All Data 21
3.4.3 Generate Loops 22
3.4.4 Adjust Network 23
3.5 Analyzing 24
3.5.1 Process Summary 24
3.5.2 Pre-Process Log 31
3.6 Saving project 32
3.7 Exporting 33
3.8 Archiving Project 33
3.8.1 Create an Archive 34

3.8.2 Open an Archive 35

4 Process Parameters 37
4.1 Processing Mode 37
4.1.1 Setting Processing Mode for current project 37
4.1.2 Setting default Processing Mode 37
4.2 Process Parameters 38
4.2.1 Setting Process Parameters for current project 38
4.2.2 Setting default Process Parameters 40
4.3 Rejected Satellites 41

5 Antenna Models 43
5.1 Antenna Models Editor 45
5.1.1 New antenna model 45
5.1.2 Import a predefined model from a list 45
5.1.3 Use a different predefined antenna models file list 46
5.1.4 Remove an antenna model 46
5.1.5 Edit an antenna model 46
5.2 Measuring Antenna Heights 47
5.2.1 Vertical Height Measurement to Antenna Reference Point (ARP) 47
5.2.2 Slant Height Measurement to Measurement Mark 47
5.2.3 Height Measurement Directly to L1 Phase Center 48
5.3 Absolute versus Relative Antenna Calibration 49

6 Geoid 50
6.1 Setting geoid for current project 51
6.2 Setting default geoid 52
6.3 Geoid Manager 52
6.3.1 Importing an Existing Geoid Model to the List 52
6.3.2 Renaming a Geoid Model 53
6.3.3 Deleting a Geoid Model 54
6.3.4 Closing 55

7 Views 56
7.1 Toolbars 56
7.2 Plan View 56
7.2.1 Site and Rover 57
7.2.2 Baseline and Trajectory 58
7.2.3 Loops 60
7.2.4 Network error ellipses 60

7.2.5 Site Ellipse 60
7.2.6 Vector Ellipse 61
7.2.7 Ellipses for trajectory positions 61
7.2.8 Toggling data/results On/Off from the Plan View 61
7.2.9 Plan View Modes 63
7.3 Project Manager 63
7.3.1 Project Folder 65
7.3.2 Baselines Folder 66
7.3.3 Loops Folder 68
7.3.4 Observations Folder 69
7.3.5 Orbits Folder 71
7.3.6 PPP Folder 73
7.3.7 Rovers Folder 76
7.3.8 Sites Folder 77
7.3.9 Trajectories Folder 79
7.4 Analysis 82

8 Options 83
8.1 General 83
8.1.1 File Handling 83
8.1.2 Toggles 84
8.1.3 Settings 84
8.1.4 Units 84
8.2 Plan View 85
8.2.1 Display Toggles 85
8.2.2 Background 86
8.2.3 Scale Bars 86
8.2.4 Symbol Settings 86
8.2.5 All Site Symbols Height 86
8.2.6 Trajectory Ellipse Settings 86
8.2.7 Rover PPP Ellipse Settings 87
8.3 Time 87
8.3.1 Date/Time Format 87
8.4 Combinations 88
8.4.1 Baselines 89
8.4.2 Trajectories 89
8.4.3 PPP 90
8.5 Data Files 90
8.5.1 When importing an observation file containing no site 91

8.5.2 Other options 91
8.6 Limits 91
8.6.1 Site Occupation Validator 91
8.7 Orbits 93
8.7.1 Adding a Precise Orbits Provider 94
8.8 Updates 94
8.9 Format 95
8.9.1 External Data Collector 95
8.9.2 ESRI Shapefile 96
8.10 Loop 97
8.10.1 Generate 98
8.10.2 Filter 98
8.10.3 Failure Criteria 98
8.10.4 Summary section 99
8.11 Network 99
8.11.1 Network Adjustment 99
8.11.2 Summary Sections 100
8.11.3 Ellipses in Plan View 100
8.11.4 Vectors Validation 100

9 Base Stations 102
9.1 Providers Manager 102
9.1.1 Provider Registration 104
9.1.2 Get More Info 105
9.1.3 Coordinate List 105
9.2 Finder 107

10 Mapping Systems 111
10.1 About Mapping Systems 111
10.1.1 Geodetic Datums 111
10.1.2 Map Projections 112
10.1.3 Vertical Datums 112
10.1.4 Earth-Centered, Earth-Fixed (ECEF) 112
10.2 Selecting a Mapping System 112
10.3 Customizing a Mapping System 114
10.3.1 Adding a new mapping system 115
10.3.2 Deleting a custom Mapping System 118
10.3.3 Customizing a Datum 118
10.3.4 Deleting a Datum 120

10.3.5 Exporting Mapping Systems 120
10.3.6 Importing Mapping Systems 121
10.3.7 Setting a Local Grid Mapping System 121

11 Editing 124
11.1 Site 124
11.1.1 Site Information 125
11.1.2 Occupations 130
11.2 Rover 133
11.2.1 Site Occupations 135
11.3 Combinations 136
11.3.1 Baseline 136
11.3.2 Trajectory 141
11.3.3 PPP 145

12 Analysis 149
12.1 Raw Observations 149
12.1.1 Number of Observed Satellites 149
12.1.2 Observed Satellites 152
12.2 Observation File Time 154
12.2.1 User Time 156
12.3 Precise Orbits 156
12.3.1 Segment 157
12.4 Baseline Results 158
12.4.1 Baseline Summary 159
12.4.2 Baseline Residuals 163
12.4.3 Residuals Options 165
12.5 Trajectory Results 166
12.5.1 Trajectory Summary 167
12.5.2 Trajectory Residuals 172
12.5.3 Trajectory Site Comparison 173
12.6 PPP Results 176
12.6.1 PPP Summary 176
12.6.2 PPP Residuals 180
12.7 Pre-Process Log 181
12.8 Process Summary 181
12.9 Network Adjustment 182
12.9.1 Network Adjustment Summary 182
12.9.2 Network Adjustment Residuals 190

12.10 Loop Summary 191
12.10.1 Header 192
12.10.2 Statistics for ALL loops 193
12.10.3 Loops 193
12.10.4 Vector used 194
12.11 Survey Sites 195
12.11.1 Field Coordinates 195
12.11.2 Post-Processed Coordinates 198
12.12 Inverse Computation 201
12.13 GIS Feature Summary 205

13 Export 209
13.1 Profile Editor 209
13.2 Baselines 210
13.3 Trajectories 213
13.3.1 ASCII 215
13.3.2 Waypoint 216
13.4 Rover PPP 217
13.5 Sites 217
13.6 Features 219
13.6.1 Introducing Export Features 219
13.6.2 Graphical User Interface 222
13.6.3 Understanding the output 228
13.7 Loops 232
13.8 Observations/Orbits (RINEX files) 234

14 Global Sites 236
14.1 Global Sites Editor 236

Appendix A – Post-Processing Carlson SurvCE™ RW5 file 238
Importing Data 238
Analyzing 239
Saving project 239

Appendix B – Post-Processing MicroSurvey RAW file 240
Importing Data 240
Analyzing 241
Saving project 241

Appendix C – Post-Processing Geo-Plus VisionTerrain file 242

Importing Data 242
Analyzing 243
Saving project 243

Appendix D – Post-Processing GMS (GeoMobileSolution) files 244
Importing Data 244
Analyzing 245
Saving project 245

Appendix E – Post-Processing ArcPad data 246
Shapefile Options 246
Import 247
Mapping System 247
GIS Feature Summary 248
Applying post processed positions to your shapefiles 249

Appendix F – Licensing by GNSS receivers 251
Licensing Rules 251
Automatic License Updates 252
License Updates when importing files 252
Viewing your Licensed GNSS Receivers 254

Appendix G – Licensing by computer 256
RINEX license 256
OPEN license 256
Adding a computer license 256
Viewing your computer License 258
Removing a computer license 259

Appendix H – Solution Type 262

Appendix I – Network Adjustment 264
GNSS Network Adjustment 264
The Estimated Variance Factor 264
Chi Squared Test 265
Standardized Residuals 265
Practical Examples 266
Example – Case 1 266
Example – Case 2 267
Example – Case 3 268
Example – Case 4 269

Conclusions 270

Appendix J – CSV Export 271

CSV Header file 271

CSV Data file 272

Appendix K – GRD Text Format 278

Appendix L – Export Features Command-Line Interface 279

Command-Line Interface 279

Result Codes 280

The TAGEX Format 280

Appendix M – Customizing Export Features Output 282

AutoCAD DXF 282

Google Earth KMZ 282

// GNSS Post-Processing

User Guide

Chapter 1

1 Installation

IMPORTANT: For more information about this application, you can also consult our **Knowledge Base** at http://www.onpoz.com/Support/KBData/KbMainPage.aspx

1.1 System Requirements

Feature	Requirements
Operating System	Microsoft Windows XP, Windows Vista, Windows 7, Windows 8 or Windows 8.1
Disk	300 MB of free storage space on disk (additional space is required during installation and later for manipulating your data)
RAM	256MB or more

1.2 Installing the software

IMPORTANT before you install: Uninstall any previous version of the software on this PC.

On Windows XP:

a. Open **Control Panel**.

b. Click **Add or Remove Programs**.

c. Select **EZSurv** from the list.

d. Click **Remove**.

On Windows Vista, Windows 7, Windows 8 or Windows 8.1:

a. Open **Control Panel**.

b. Click **Programs and Features**.

c. Select **EZSurv** from the list.

d. Click **Uninstall/Change**.

a. Click **setup.exe** to start the installation.

b. The installation is started. Wait a few seconds until the InstallShield Wizard window is displayed.

c. Click **Next** to continue.

d. Read the license agreement. If you approve this license agreement click on **I accept the terms of the license agreement**.

e. Click **Next** to continue.
f. Select **Complete** (advanced users may select **Custom** instead) and click **Next**.
g. A progress bar will indicate the percentage of completion of the installation.
h. Click **Finish** once the installation is complete.

1.3 Licensing

See appendix ***Licensing by GNSS Receivers*** and ***Licensing by computer*** for detailed information about the licensing mechanism.

2 Introduction

This software is an application designed to edit, process and analyze raw GNSS (Global Navigation Satellite System) data in order to get high accuracy position results in post-mission (sub-centimeter to sub-foot accuracy depending on your GNSS observations). The software supports single and dual frequency data.

In **Differential Positioning** mode, the software can process baseline vectors when GNSS raw data are recorded simultaneously at different sites. It can also process trajectories when kinematic GNSS raw data are combined with base station data.

In **Precise Point Positioning (PPP)** mode, the software can achieve centimeter level accuracy when processing few hours of static or kinematic data recorded under good environment.

The software supports batch processing mode. Static and kinematic data can be imported all together and the software will sort automatically all possible combinations according to user criteria's. To better support trajectories calculation, the software can access automatically hourly or daily raw data from several Base Station providers all over the world. In PPP mode, the software can access automatically precise orbit and clock files (daily file) from several Computing Center all over the world.

Typical calculation mode like static, rapid static, kinematic, semi-kinematic, OTF (On the Fly) and Precise Point Positioning are all supported by the software.

In short, the software can be used for geodetic, survey and GIS work.

Typical advantages of processing your field data in post-mission are the following:

- Apply a rigorous QA procedure on your RTK (Real-Time Kinematic) results;
- Get the best out of your GNSS data by rigorously combining a forward/backward processing.
- Fill RTK failures;
- Secure centimeter accuracy when there is no real-time correction infrastructure available in the survey area;
- Perform sub-centimeter geodetic survey and network adjustment;
- Significantly enhance single frequency receiver accuracy for survey or GIS applications;

2.1 Processing Mode

The software support two different processing modes: the typical **Differential Positioning** mode that generates baselines and trajectories (with respect to a base station), and the **Precise Point Positioning** mode (PPP) using precise orbit and clock data.

2.1.1 Differential Positioning mode

This is the typical post-processing mode. It is applied in these two following survey cases:

- When you have static observations, which means a GNSS receiver setup on a survey pole or on a tripod (static) recording data for few minutes (or hours). The recorded raw GNSS data will later be post-processed using data from a (near-by) base station to compute a baseline vector (it is the 3D components with respect to the base station coordinate). This is typically used to establish geodetic markers of high precision.
- When you have kinematic observations, which means a receiver roving (for few minutes or hours) and collecting GNSS data on a regular data interval (typically 1 second). This rover receiver will typically record survey points (or GIS features) here and there for few seconds (or only one epoch). Typically such a procedure is known as "stop and go mode". This data set will later be post-processed using data from a (near-by) base station to compute a trajectory (which is a series of 3D components with respect the base station). This is typically used by surveyors to establish centimeter accuracy survey points and by GIS users to establish sub-meter/sub-foot features.

❖ The well-known RTK mode is a **Differential Positioning** mode computed in real-time. Every single position recorded in RTK can be recomputed in Post-Processing if the GNSS raw data is properly recorded.

❖ When computing a position in kinematic mode, the post-processing algorithm takes advantage of the data before and after the position epoch. RTK systems take only advantage of data before the position epoch. In many situations this will help the post-processing algorithm providing better results.

2.1.2 Precise Point Positioning mode (PPP)

Precise Point Positioning (PPP) is an enhanced single point positioning technique for code and carrier phase measurements using precise orbits and clocks instead of broadcast data. The precise orbital data are provided by organizations like the International GNSS Service (IGS).

PPP is considered as a rather cost efficient technique as it enables precise positioning with a single GNSS receiver. By applying PPP to dual frequency measurements, centimeter to decimeter accuracies can be achieved.

The convergence time to reach decimeter accuracy is typically about 30 minutes under normal conditions. To reach centimeter accuracies the PPP algorithms needs significantly longer (convergence time is the time span from start to a stable accurate solution).

❖ PPP mode is an improved version of real time SBAS positioning (since PPP using precise orbits and clocks computed using real observations, whereas SBAS is using prediction)

❖ PPP algorithm also takes advantage of working with the data before and after the fact. This will typically provide PPP results much more homogeneous than SBAS results.

2.2 File Status

Typically, in the field, GNSS data can be recorded in different modes depending on the dynamic of your antenna and/or your field procedure. These modes can be modified as needed once imported in the software. For instance, a kinematic mode could have been set by mistake in the field instead of static mode, so this can easily be changed in the software. Here are the 4 observation modes supported by the software:

- **Base**: A file downloaded from a base provider. It is completely recorded in static mode (the antenna never moved) and its coordinate is known. So such file could be used to correct a **Rover** file in **Differential Processing** mode or to create a **Baseline** with a **Static** file.
- **Static**: A file can be set as **Static** when it is completely recorded in static mode (the antenna never moved) and its position is unknown. Typically such a file is part of a **Baseline**. After calculation (baseline), if you can get an accurate coordinate of this station you could use it to correct a **Rover** file in **Differential Processing** mode.
- **Rover**: A file can be set as **Rover** when it is recorded in motion (the antenna is roving, this is kinematic data). We could also describe it as a Kinematic file. Such a file could include or not

some static periods where point information have been collected (a rover file including point information is sometime referred to a stop-and-go file).

- **Semi-kinematic**: A file can be set as **Semi-kinematic** when a rover file is recorded in motion using an initialization procedure. The initialization could be done on an "initialization bar" of 20 cm (2 minutes of data), on a known location (20 seconds of data) or on an unknown location (20-45 minutes of data / the required time to establish accurate coordinates in static mode, the number of minutes depends on the baseline length). This is typically a single frequency data set that will take advantage of a specific ambiguity initialization process. Such a file could include or not static periods (point information).

In the software, we also have the concept of **Site**. A site is typically a static period where a receiver antenna remains few seconds, minutes our hours at the same location (which is the site location). The same site can be occupied several times in the same project; this is creating the concept of a site occupation. So a **Base** file includes one site, a **Static** file also includes one site and finally, a **Rover** and a **Semi-kinematic** file may include many sites (few seconds or minutes each, the concept of stop-and-go file).

With **Static** files, the software creates **baselines** between data set recorded simultaneously at different sites. A **Rover** file, when combined with **Base** or **Static** file, will generate a **Trajectory**.

- **Baseline:** It is a 3D vector between two **Sites** coming from **Static** files or **Base** files. In a Post Processing environment, a baseline can be defined between two sites if they have simultaneous observations. The amount of data required to consider simultaneous data as sufficient to define a baseline (5, 10, 30, 60 minutes) is user defined. As with sites, you may create baseline occupations. A baseline might have been observed more than once, which means that both sites being part of the same baseline have been occupied at least twice. Typically a baseline is expected to be computed at the centimeter accuracy level.
- **Trajectory:** It is a series of 3D vectors between a fixed site (base station) and each position of a rover file (either **Rover** or **Semi-kinematic**). As opposed to a baseline between two sites which provide one position (the unknown site), a trajectory can be seen as a series of positions (one per epoch) computed with respect to the base site. To define a trajectory, you need a rover file and site data recorded simultaneously (site data can be from a **Base** or a **Static** file). Depending on the rover data (from L1 or L1/L2 receiver), trajectories can be computed at the centimeter accuracy level or at the sub-foot/sub-meter level.

While working in PPP mode, precise orbits and clocks used along **Static** and **Rover** data files will generate what we call a **PPP-Static** and a **PPP-Rover**, the first is cumulating all data to output only one position, whereas the second is computing one position per epoch. The following Tables summarize all possible combinations by combining different files.

File Status	BASE	STATIC	ROVER	SEMI-KINEMATIC
BASE	N/A	Baseline	Trajectory	Trajectory
STATIC	Baseline	Baseline	Trajectory	Trajectory
ROVER	Trajectory	Trajectory	N/A	N/A
SEMI-KINEMATIC	Trajectory	Trajectory	N/A	N/A

Possible combinations in Differential Positioning mode

File Status	Precise orbits
BASE	N/A
STATIC	PPP-Static
ROVER	PPP-Rover
SEMI-KINEMATIC	N/A

Possible combinations in PPP mode

2.3 Software Environment

2.3.1 Starting application

To open the software:

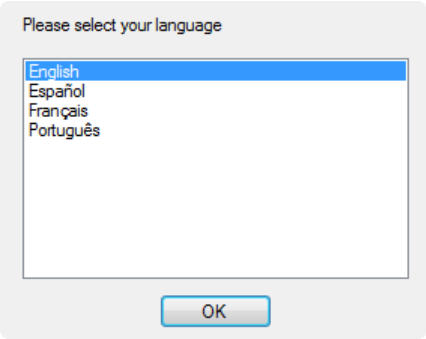
- Select **Start** from the Windows taskbar. The start menu is displayed.
- Select **All Programs**.
- Select the **Effigis** program group.
- Select **EZSurv**. EZSurv® module is displayed on the desktop.

Ensure that you have a valid software license registered. See the ***Licensing*** appendix for more details.

> You can also start the application by double clicking on an SPR project file in Windows Explorer.
>
> You can only start one instance of the application at a time.

2.3.2 Selecting the language

The first time you start EZSurv®, you will be asked for the language to use.



Select your language dialog

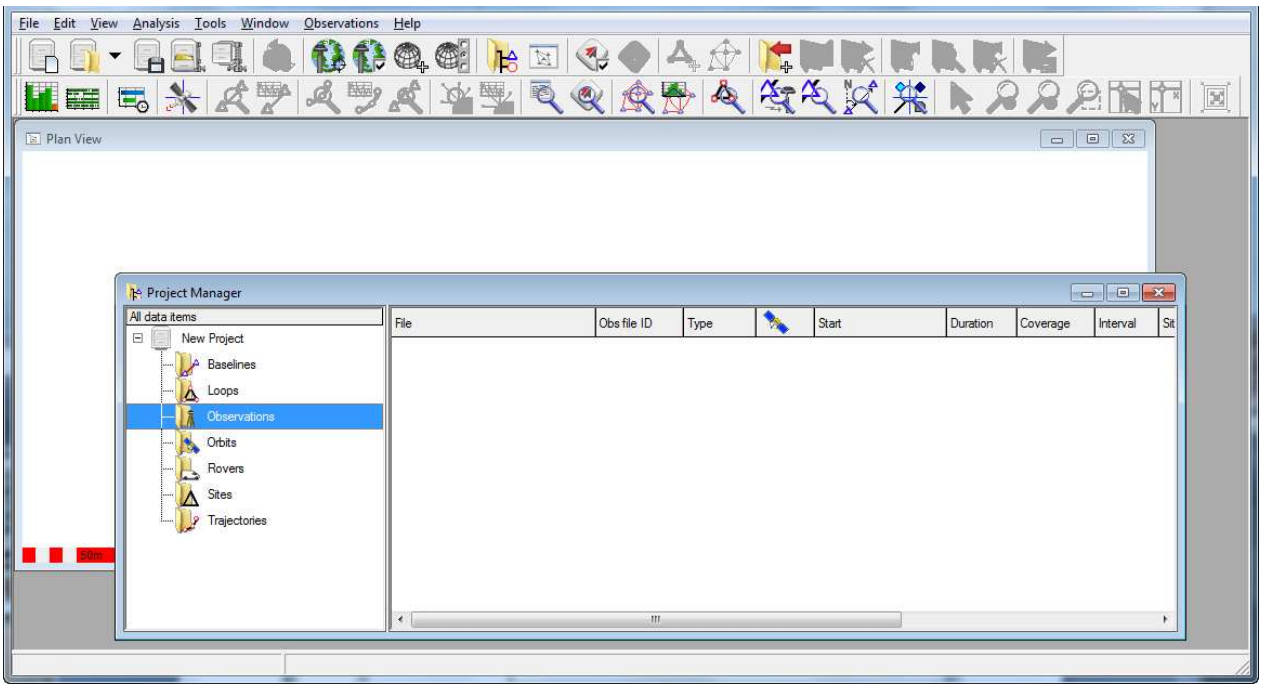
If you want to select another language later, you can

- Close EZSurv® if it is already running.
- Select **Start** from the Windows taskbar. The start menu is displayed.
- Select **All Programs**.
- Select the **Effigis** program group.
- Select **EZSurv Language Selector**.

2.3.3 Main windows

Depending on which initial display preferences have been set in the software, the windows appearing overlaid on the software may vary. The software contains a variety of windows. The main windows are:

- **Plan View**;
- **Project Manager**;



Plan View and Project Manager

3 GNSS Processing Workflow

In this section, we describe in detail how to process your GNSS data. There are two ways to process GNSS data with the software: automatically or manually.

> We strongly recommend that the person in charge of the GNSS processing has a basic understanding of what has been recorded in the field. It helps a lot when there are some data editing to do before processing.

A post-processing project file is a file that keeps all information related to your processing session. When you are creating a new project, the software creates a database in order to manage all related information (sites, baselines, rovers, trajectories, loops, etc.). It involves several files with a specific naming convention. Your project file manages all these files. All you have to do is create a project file with a significant name (e.g. JOB112.SPR).

The typical workflow is:

- Creating or opening a project;
- Importing GNSS raw Data;
- Fixing a reference site (if working in differential mode);
- Processing your data;
- Analyzing the results;
- Saving project;
- Exporting your results;
- Archiving project;

3.1 Creating or opening a project

3.1.1 New project

When the software starts, a new project is automatically created.

At any time, a new project can be created by selecting **File > New** from the menu bar, or by clicking on the **Main** toolbar.

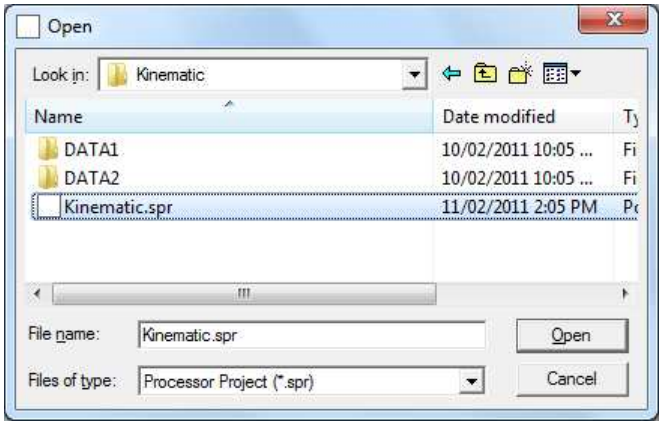
You will notice that the title bar in the window displays the words: **New Project**.

Title bar after creating a new project

3.1.2 Open an existing project

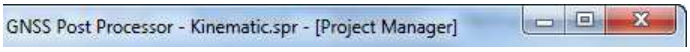
- Browse for project

a. Select **File > Open** from the main menu, or click on the **Main** toolbar. The standard **Open** is displayed.



Open project

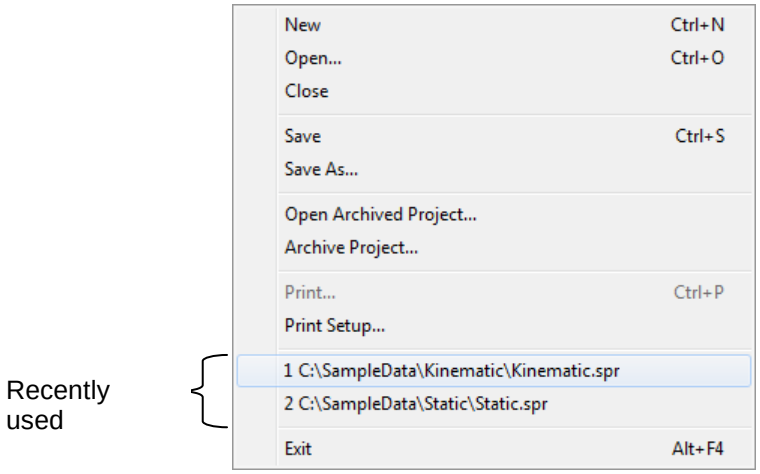
b. Select the directory in which the post-processing project file is located.
c. Select the project file you want to open. The file name is displayed in the **File Name** text box.
d. Click **OK**. The dialog box closes and the project file name is displayed in the title bar of the software window.



Title bar after opening a project

- Open recently used project

a. Select **File** from the main menu and select one of the recently used projects.



Recently used projects from the File menu

3.2 Importing Data

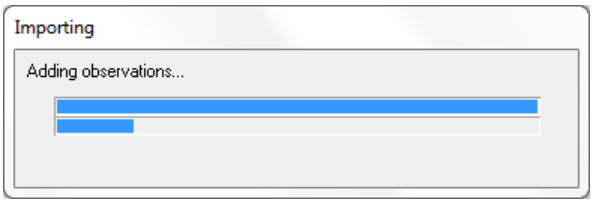
Once you have created a new post-processing project, you are ready to import GNSS raw data files (observations and orbits) into your project. Data import is managed by **Observations** and **Orbits** within the **Project Manager**.

3.2.1 Importing your Data

Although it is a good habit to locate all GNSS data related to a specific job within the same location, the Project Manager allows you to import GNSS data from different locations.

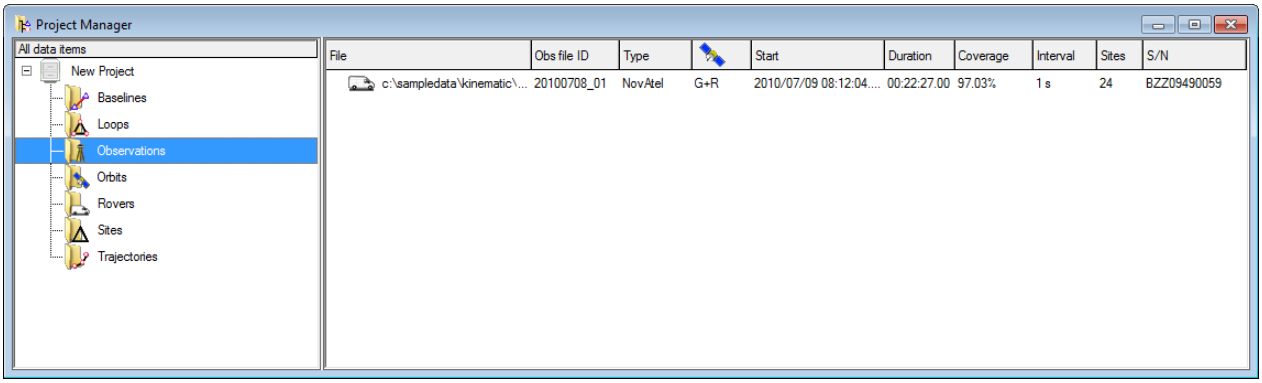
All data importing is done from the **Project Manager**. You can open it by selecting **View > Project Manager** from the main menu, or by pressing **F3** on the keyboard. The **Observations** node is automatically selected.

- Import to the Project Manager
  a. From the **Observations** or **Orbits** node in the **Project Manager**, right-click and select **Import**. The **Open** dialog is displayed.
  b. In the **Files of Type** drop-down list box, select the appropriate file type.
  c. Select the file(s) you want to import in your project. The selected file name is displayed in the **File Name** text box.
  d. Click **OK**. The file header is read to ensure that it is a valid file, the associated project database files are updated and the **Importing** window is displayed detailing the progress.



Importing

  e. The **Observations** and **Orbits** nodes within the **Project Manager** are updated with information on the imported data files.



Project Manager – Observations – After importing data files

We cannot import files recorded with an interval less than 0.01 second.

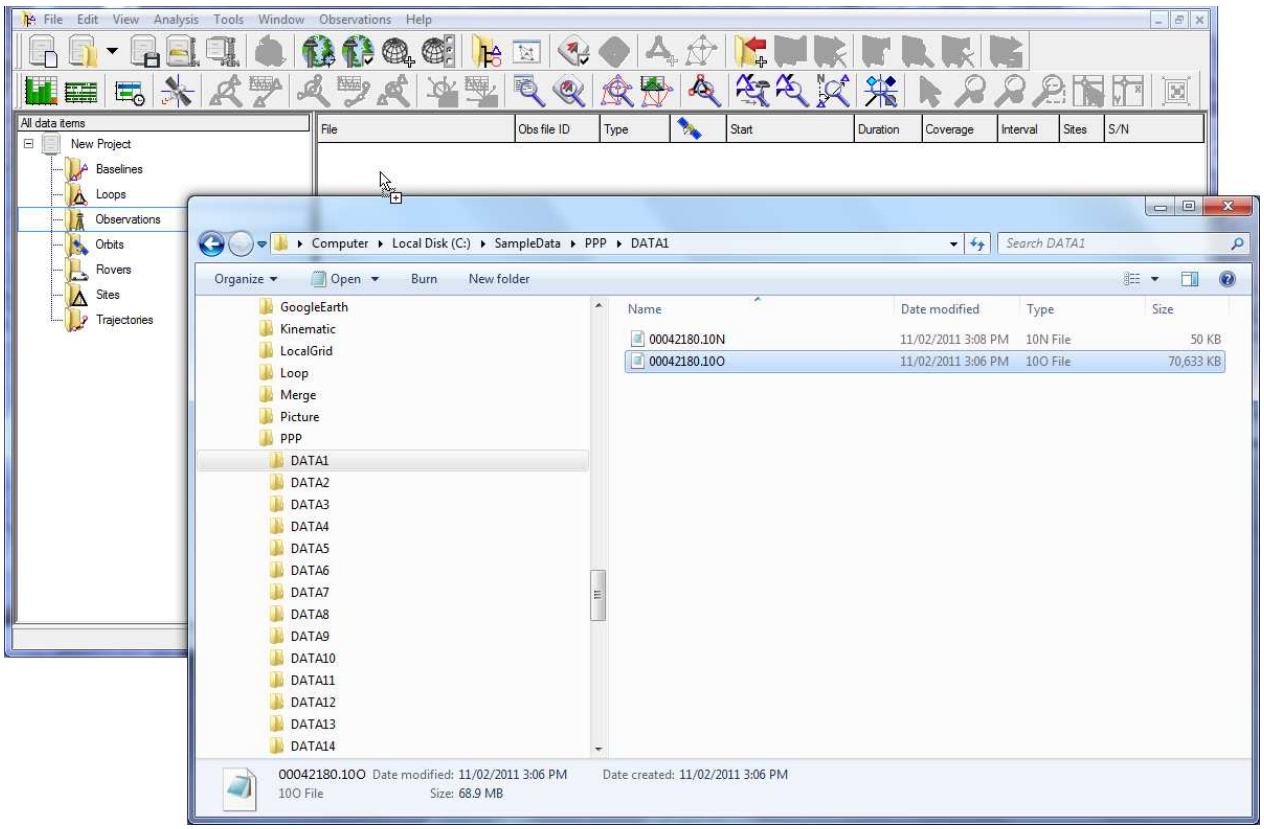
- If you have selected the Site Validation option in **Options** (specifying a minimum distance between sites), a **Site Occupation Validator** dialog box may be displayed. Refer to ***Options – Limits – Site Occupation Validator*** for more information about this option.

- When opening an OBS file (recorded by an OnPOZ product) for the first time, the software will create a backup of the POS and TAG file in a _RT1.POS and _RT1.TAG file. These files contain the Real-Time version of the data collected.

- POS files are generated for Rover and Semi-kinematic when importing any observation files that do not already have them. These POS file will be used by the **Export Features** when exporting unprocessed positions and for faster display in the Plan View.

- Drag and drop files to the Project Manager

An alternative procedure to import observations or orbits is to drag and drop selected files from Windows Explorer directly in the **Observations** or **Orbits** viewer in the **Project Manager**,



Importing data by dragging and dropping a file within Project Manager

3.2.2 Determining File Status during Import

While importing an observation file, the program will try to determine the file status (static, rover or semi-kinematic). The file status can be changed at any time later while manipulating your data.

If the observation is part of a known project type, it will set the file status according to the project type.

- The file status is detected automatically for RINEX files and all projects collected with OnPOZ GNSS Driver for ArcPad, OnPOZ GNSS Control Panel, OnPOZ EZTag CE™, OnPOZ EZField™, Carlson SurvCE™, Geo-Plus VisionTerrain, MicroSurvey FieldGenius™, NavCom FieldGenius™, MicroSurvey Seismic Surveyor™ and MapScenes Evidence Recorder™.

❖ Only the semi-kinematic project in OnPOZ EZField™ can set automatically the file status to semi-kinematic when importing.

If it is not part of a known project, it chooses using site information:

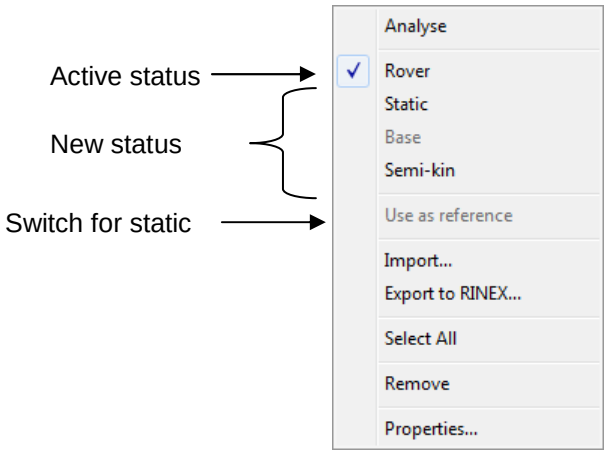
- **No site**: It will set the file status either to static or rover according to the value set in **Tools > Options > Data Files**.
- **One site**: If the site covers the whole observations file, it will set the file status to static. Otherwise, it will set the file status to rover.
- **More than one site**: It will be set the file status to rover.

3.2.3 Changing File Status

The file status is displayed as a symbol in **File** column of the **Observations** page:

- indicates a static (data recorded without motion);
- indicates a static used as reference (data recorded without motion);
- indicates a rover (a kinematic file);
- indicates a semi-kinematic (kinematic file with initialization, typically for L1 data) ;
- indicates a base (file downloaded from Base Station providers);

If you need to change the status, first select the file name, right-click, select the new status in the speed menu:



Project Manager – Observations – Speed menu

For a static, you can also switch between **Use as reference** or not within the same menu. This is the same as changing **Use as reference coordinate** within the **Site Editor**.

Rules when switching file status:

- You cannot set the status of a base. Bases are reserved for files downloaded automatically from a base provider.
- Changing from static to rover or semi-kinematic will delete the attached site.
- Changing between rover and semi-kinematic will not change the state of any site.
- Changing from rover or semi-kinematic to static depends on how many sites the rover or semi-kinematic has:

- **No site**: It will change to static and create a site covering the whole time span.
- **One site**: It will change to static and adjust the site time span to cover the whole static.
- **More than one site**: It will refuse to switch. If you really want to switch to static, you will need to delete manually all sites within the rover or semi-kinematic and then try again.

From	To			
	BASE	STATIC	ROVER	SEMI-KINEMATIC
BASE	N/A	N/A	N/A	N/A
STATIC	N/A	N/A	Remove site	
ROVER	N/A	Special rules	N/A	No change
SEMI-KINEMATIC	N/A		No change	N/A

Rules for changing file status

When changing the file status after processing, you might delete results attached to it (for example, changing **Rover** to **Static** status will destroy all trajectory results related to this file). Before destroying results, you will be prompted to confirm your decision.

Depending on the type of data, some status may not be permitted.

3.2.4 Supported File Formats

Files that can be imported in the software are the following:

- Altus-PS raw binary files.
- Ashtech™ ProMax500 raw binary files.
- Carlson SurvCE™ files (CRD and RW5) along with proper raw observations and orbits files.
- CHC Navigation raw binary files.
- GENEQ raw binary files (BIN).
- Geo-Plus VisionTerrain files (MDB) along with proper raw observations and orbits files.
- Hemisphere GNSS™ raw binary files.
- Hi-Target raw binary files.
- ikeGPS™ raw binary files.
- Javad™ raw binary files.
- Kolida raw binary files.
- Magellan eXplorist Pro 10 raw binary files.
- MicroSurvey FieldGenius™, NavCom FieldGenius™, MicroSurvey Seismic Surveyor™ or MapScenes Evidence Recorder™ files (RAW) along with proper GNSS observations and orbits files.
- NavCom raw binary files.
- NovAtel raw binary files (PDC).
- NVS Technologies AG raw binary files (BINR).
- OnPOZ EZTag CE™ or OnPOZ EZField™ project files (GPS), observation files (OBS) and orbit files (ORB).
- OnPOZ GNSS Driver for ArcPad project files (GNSSP).
- Pentax raw binary files.

- Precise orbit files (SP3).
- Precise satellite clock files (CLK and CLK_30S).
- RINEX V2 and V3 observation (yyO) and compressed observation (yyD) files.
- RINEX V2 and V3 orbit files: GPS (yyN), GLONASS (yyG), Galileo (yyL), BeiDou (yyC) and mixed GNSS (yyP).
- Septentrio™ raw binary files (SBF).
- SiRF raw binary files.
- South GPS raw binary files.
- Stonex® raw binary files.
- TechGeo raw binary files (GTR and PGL).
- Topcon raw binary files.
- u-blox™ raw binary files.
- UniStrong raw binary files.

❖ Depending on your post-processor brand or your license, some file formats may not be permitted.

3.3 Fixing a Reference Site

IMPORTANT: When processing mode is PPP, this step should be ignored.

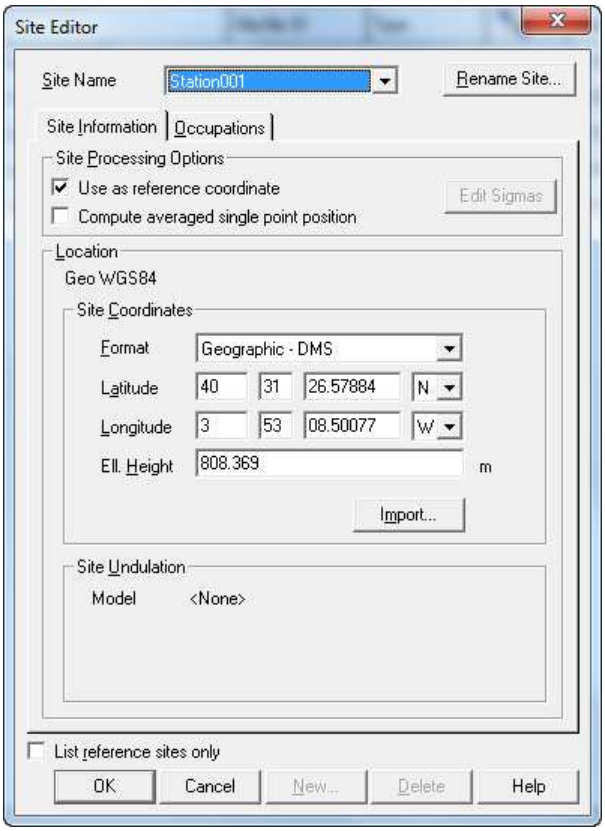
IMPORTANT: For users that use automatic base download, this step should be ignored.

If you do not select a reference site before processing, the software will select one automatically and will compute a point positioning solution to establish its best possible position. Although this procedure can be useful in some circumstances, in other cases it might generate undesirable results.

In this section, we describe how to set a site as a base site (reference station) to process trajectories or to fix the first site of a network of GNSS vectors.

■ To fix a reference site

Select **Edit > Site** from the main menu. The **Site Editor** is displayed.



Site Editor

a. Select the site you want to use as a reference in the **Site Name** drop-down list.
b. Select the **Use as reference coordinate** checkbox to set the selected site as a reference.
c. Enter the known coordinate in the **Site Coordinates** area of the dialog box.
d. Click **OK** to save the changes and close the **Site Editor**.

For more information about the **Site Editor**, see ***Editing – Site*** section.

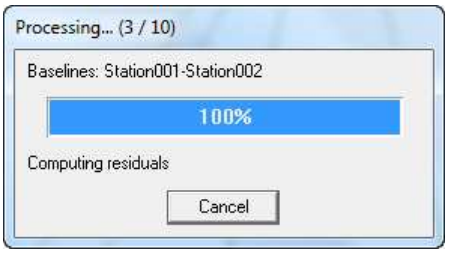
3.4 Processing

There are two types of processing:

- **Automatic processing**: It is usually used when the same type of data collection is done on a regular basis in areas where the quality of observed data is well known.
- **Manual processing**: It is usually used when you are doing trials to achieve the best possible results (testing results with different mask angles, removing part of the data, etc.). Executing each step (in the proper order) of the manual processing is identical to doing an automatic processing.

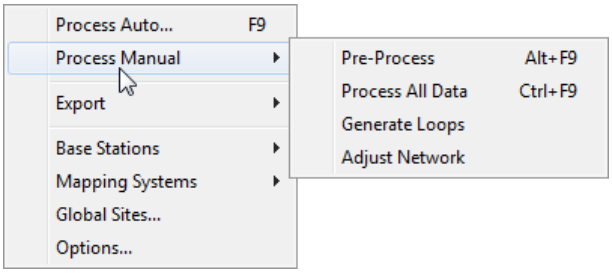
■ To launch the automatic processing

a. Select **Tools > Process Auto...** from the main menu, or click on the **Main** toolbar. The **Processing...** window is displayed, detailing progress.



Progress indicator

- To launch the manual processing
  a. Select **Tools > Process Manual** from the main menu and choose the step you want to execute from the following. Each step is described below.



Process Manual menu

3.4.1 Pre-Process

IMPORTANT: An Internet connection is required to download files

The Pre-process consists of several steps that are done in the following order:

Step	Processing Mode		Configuration of the step
	Differential	PPP	
Search for broadcast orbits	Yes	Yes	Edit > Process Parameters,
Search for base stations	Yes	No	Tools > Base Stations > Providers Manager, Tools > Options > Combinations and Edit > Process Parameters
Search for precise orbits	Yes	Yes	Edit > Process Parameters and Tools > Options > Orbits
Merge base stations	Yes	No	None
Generate PPP	No	Yes	Tools > Options > Combinations
Generate baselines	Yes	No	Tools > Options > Combinations
Generate trajectories	Yes	No	Tools > Options > Combinations

Depending on the **Processing Mode** and your active options, some of the previous step might be skipped.

3.4.1.1 Search for…

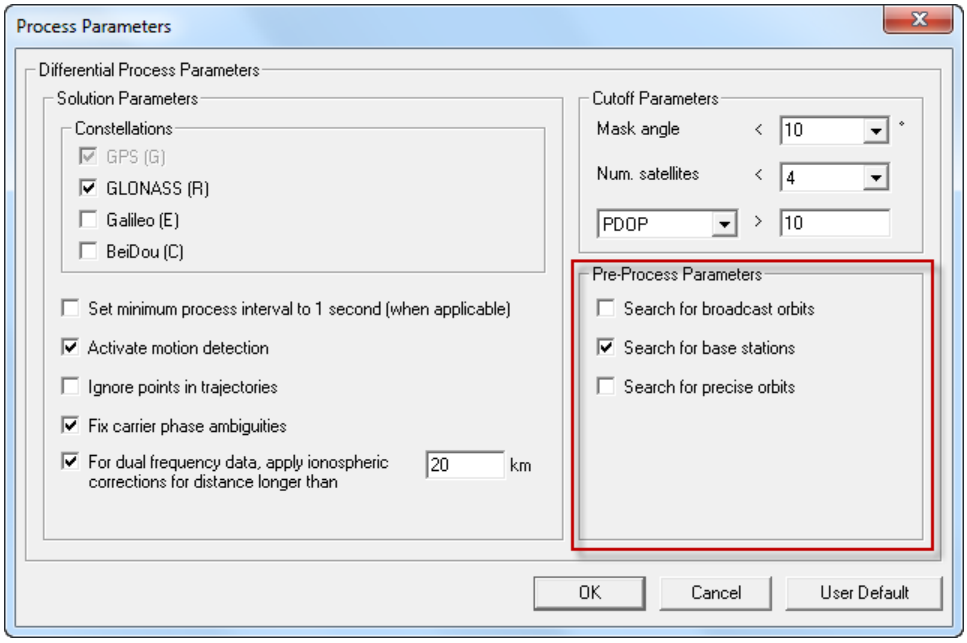
These steps are responsible for downloading broadcast orbits, bases and precise orbits into the project.

Basically, it checks all project files, determine what is missing for processing statics, rovers and semi-kinematics and then try to get files required to complete the project. If a project already has everything it needs then nothing is downloaded (for instance, if a project already contains a rover and a fully overlapping base). Any error, warning or message during this step is added to the **Pre-Process Log**.

More details about each step:

- **Search for broadcast orbits**: These orbits are available in one or more daily files for all satellites of all constellations requested in **Constellations** section. They can be used anywhere on the globe and are usually available the next day.
- **Search for base stations**: This refers to observation and orbit files associated to the nearest base station that covers the data to be post-processed. The base station provider can be set in **Tools > Base Stations > Providers Manager**.
- **Search for precise orbits**: These orbits consist of satellite coordinates and clocks corrections estimated by Computing Centers. They represent a more precise solution compared to broadcast orbits but take more time to produce (a couple of weeks for the highest precision version). The precise orbits provider can be set in **Tools > Options > Orbits**.

Each of the previous steps is controlled by the **Pre-Process Parameters** section within the **Process Parameters**. The step is done only when the corresponding **Search for…** option is checked.



Process Parameters – Pre-Process Parameters

- Configuring Search for base stations
  a. Activate **Search for base stations** in **Edit > Process Parameters**.
  b. Set at least one base station provider in **Tools > Base Stations > Providers Manager**. For more details, see ***Base Stations*** chapter.
  c. Configure the combinations in **Tools > Options > Combinations**. For more details, see ***Options – Combinations*** section.

- Configuring Search for precise orbits
  a. Activate **Search for precise orbits** in **Edit > Process Parameters**.
  b. Choose your precise orbits provider in **Tools > Options > Orbits**. For more details, see ***Options – Orbits*** section.

- Configuring Search for broadcast orbits
  a. Activate **Search for broadcast orbits** in **Edit > Process Parameters**.

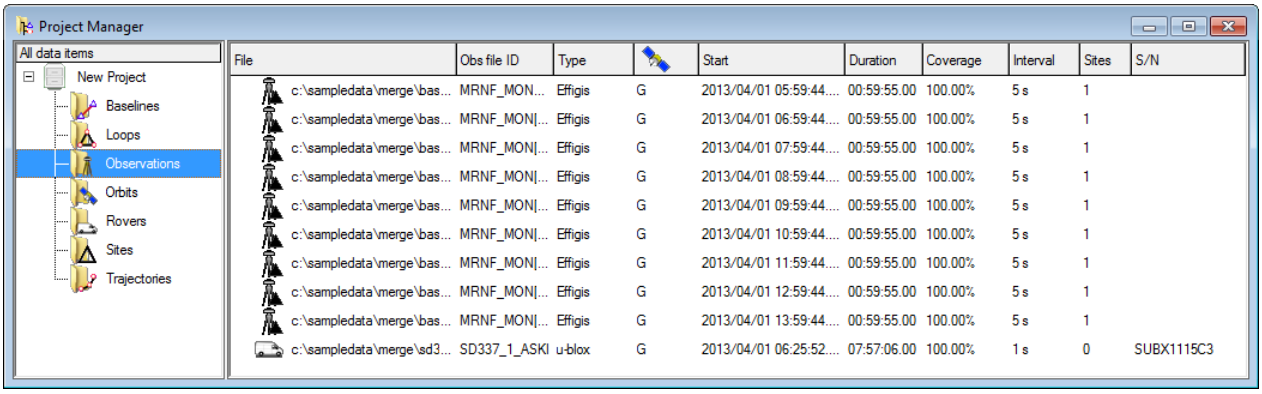
3.4.1.2 Merge Base Stations

This step will try to merge previously downloaded base stations and static used as reference files into files that cover completely your data.

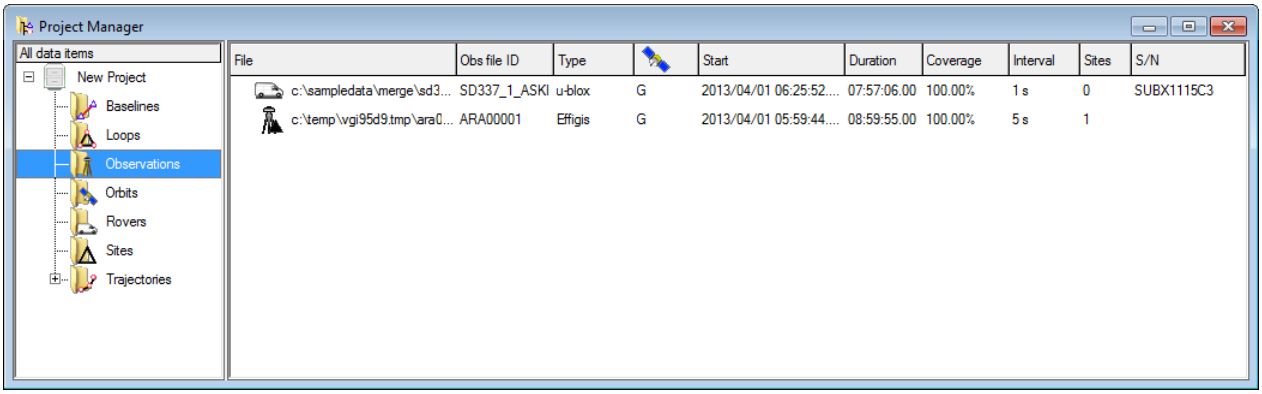
When downloading files from a base station provider, they usually come in blocks of one hour or one day (depending on the provider). To properly cover your rover, semi-kinematic or static, it may require several consecutive blocks of file. Merging them will allow the next step to match your data with a single file.

Any error, warning or message during this step is added to the **Pre-Process Log**.

Example: Here is a rover lasting close to 8 hours. To fully cover it, we have imported 9 observation files, each lasting an hour (static used as reference). Once, the step is completed, the static used as reference files are merged to a single 9 hours observation file ready for the next step.



Merge base stations – Before merge



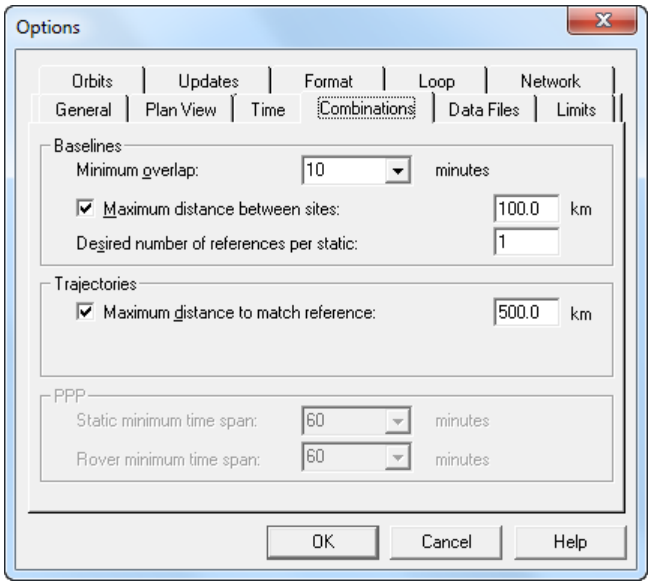
Merge base stations – After merge

3.4.1.3 Generate…

These steps generate all possible baselines, trajectories and PPP combinations according to the **Combinations** parameters.

Any error, warning or message during this step is added to the **Pre-Process Log**.

It uses the options set in **Tools > Options > Combinations**.



Options > Combinations dialog

The kind of combinations to be generated depends on the **Processing Mode**:

- **Differential Positioning**: It will generate baselines and trajectories.
- **Precise Point Positioning**: It will generate only PPP (PPP-Static or PPP-Rover).

■ Rules for baselines generation (for Differential positioning only)

It will try every pair of sites coming from a base or a static within the project.

a. Both sites must not belong to a base station or a static used as reference. If only one site belongs to a base station or a static used as reference, it is acceptable.
b. The site pair must overlap each other time for at least the minimum of minutes required (**10 minutes** in the above example).
c. If there is a maximum distance active, the distance between both sites must not exceed the limit defined (**100 km** in the above example).
d. For any site pair matching all previous requirements, a baseline is created.

■ Rules for trajectories generation (for Differential positioning only)

It will try every pair of site and rover/semi-kinematic within the project.

a. The site must be part of a static used as reference or a base.
b. If the site is part of a base, it must cover the rover completely to be used.
c. If the site is part of a static used as reference, any coverage is good enough.
d. If there is a maximum distance active, the distance between the site and the rover must not exceed the limit defined (**500 km** in the above example). The distance is calculated

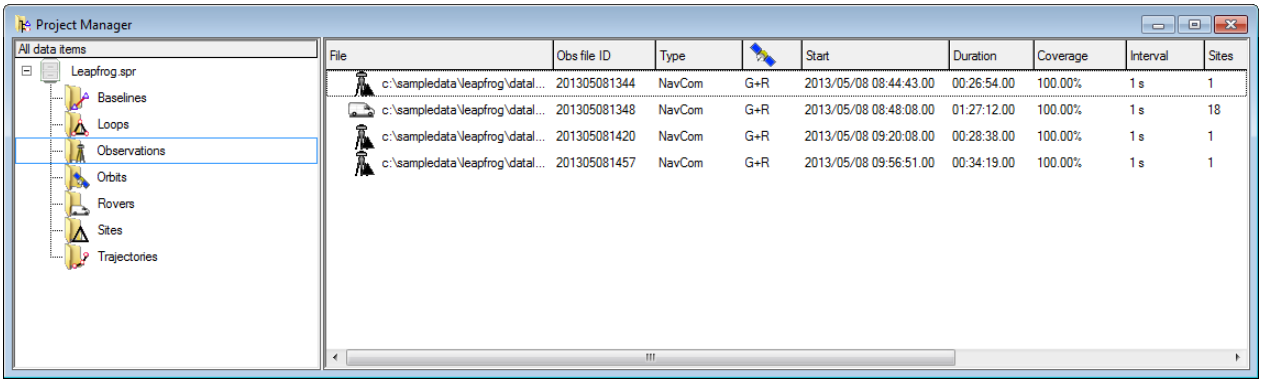
using the approximate center of the rover so this value may not be very precise. For very long rovers, you may need to adjust the maximum distance accordingly.

e. For any rover/semi-kin, if there is only one combination matching all previous requirements, a trajectory is created.

f. If there is more than one combination matching all previous requirements, it will create a trajectory using the combination with the highest coverage.
   - If there is more than one combination with the same coverage, it will choose the one with the closest distance between the site and the rover.

Normally, it will try to generate a single trajectory per rover/semi-kin but if the user has collected several statics, each covering a different part of the rover, it will generate a trajectory for each part.

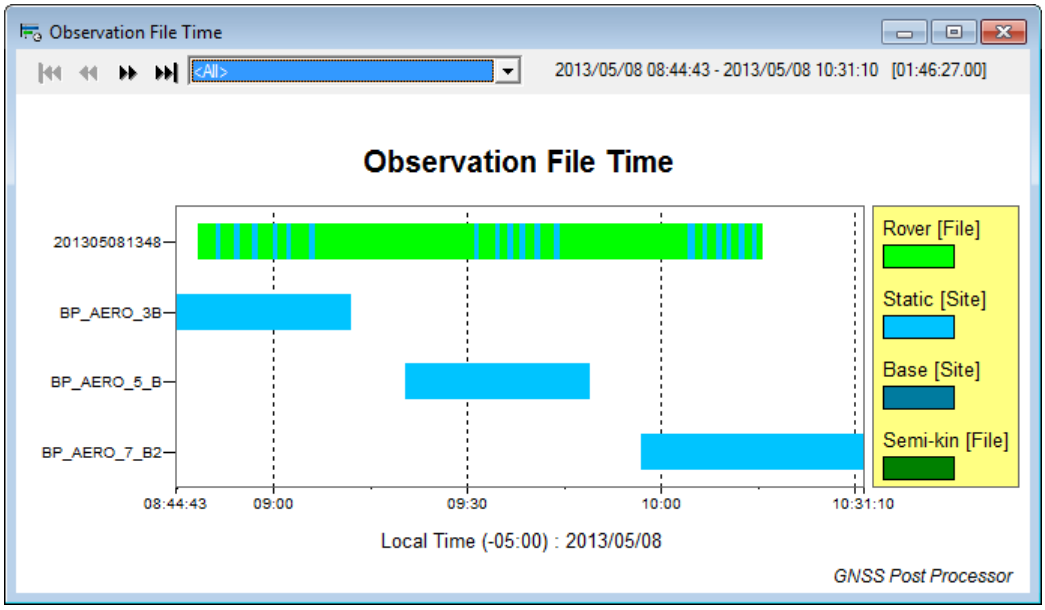
This is represented by a project like this: a rover with 18 sites that is covered in parts by three separate statics used as reference.



Observations – Rover with partial coverage by multiple statics

The situation is more obvious when looking at the **Observation File Time**. Here we have the first six sites that are covered by the first static, the following six sites by the second static and the last six sites by the third static.

Any single trajectory could only post-process 6 out of 18 sites. To post-process all 18 sites successfully, we will generate three separate trajectories.



Observation File Time – Rover with partial coverage by multiple statics

- Rules for PPP generation (for Precise Point Positioning only)

  It will try every rover and static within the project.

  a. A static shorter than the **Static minimum time span** is rejected (**60 minutes** in the above example),
  b. A rover shorter than the **Rover minimum time span** is rejected (**60 minutes** in the above example),
  c. Reject any static or rover without precise orbits covering 100% of the time span.
  d. Reject if the precise orbits used previously does not have corresponding clocks at a maximum rate of 5 minutes.
  e. For any static matching all the previous requirements, a PPP-static is created.
  f. For any rover matching all the previous requirements, a PPP-rover is created.

3.4.2 Process All Data

This step, in differential mode, will process all the following results in order (if they are properly defined):

- single point positioning;
- baselines;
- trajectories;

In PPP mode, the software will generates all PPP-Statics as well as all PPP-Mobiles results

It uses the parameters set in the **Process Parameters**.

The summary of the post-processing is displayed in the **Process Summary**.

Warnings and errors are available in specific summaries (baseline summary, trajectory summary or PPP summary). Please note that site average does not have a summary.

3.4.2.1 Process single point positioning

This step is available only in **Differential Positioning**. This is typically used when you do not know the position of your reference station. A single point positioning using broadcast orbits provides you with a position at the +/- 1 - 5 meters accuracy.

This step will search for all sites where the **Compute averaged single point position** is checked in the **Site Editor** (accessible thru **Edit > Site**).

a. It will compute an average position.
b. The position calculated will be set in the site coordinates.
c. The check for **Compute averaged single point position** is removed.

Site Editor – Compute averaged single point position

3.4.2.2 Process all baselines

This step is available only in **Differential Positioning**.

This step will process all baselines within the project.

They are post-processed by propagation starting at one reference point (user defined or chosen by the software if none is defined) until all baselines are post-processed.

3.4.2.3 Process all trajectories

This step is available only in **Differential Positioning**.

This step will process all trajectories within the project.

3.4.2.4 Process all PPP

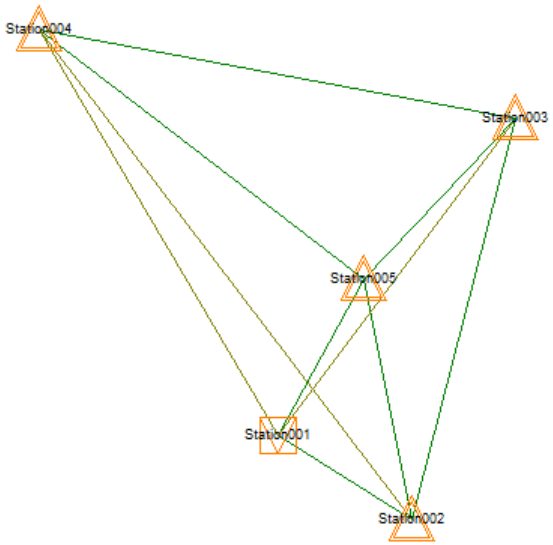
This step is available only in **Precise Point Positioning**.

This step will process all PPP within the project.

3.4.3 Generate Loops

The loop closure is a tool provided to validate baseline and trajectory site (vector) results. Survey networks must include closed figures in order to best use the loop closure tool. Closed figures (or closed loops) consist of contiguous segments from processed baseline occupations or trajectory sites where the first and the last station of the figure are the same.

Loop validation consists basically of a summation of all baseline or trajectory site components part of the closed loop. Since the loop starts and ends at the same point in a 3D reference system, the summation should be zero in all three components. The departure from zero will give you an estimate of the accuracy of your survey.



Example of a network including closed loops

Generate Loops may be called from:

- In manual mode with **Tools > Process Manual > Generate Loops**.
- In automatic mode, the generate loops step will be done only if **Automatically generate loops after automatic processing** is checked in **Tools > Options > Loop**.
- Click the button on the **Main** toolbar;
- In the project manager while the **Loops** node is selected:
  - **Generate loops** from the Loop menu;
  - **Generate loops** from the speed menu;
  - Click the button on the **Main** toolbar;

This step will remove any existing loops and generate new loops automatically based on the setting in **Tools > Options > Loop**.

The summary of the loop generation is displayed in the **Loop Summary**.

IMPORTANT: When any modification is done on any baseline or any trajectory used by any existing loop, all loops will be removed. You will need to generate loops again manually.

3.4.4 Adjust Network

IMPORTANT: This step is not available in PPP.

This step will do a least square adjustment of all vectors (baselines and trajectory sites) within the project to get a best possible accuracy for your sites.

A network is defined as a group of vectors that connect to each other. To be able to adjust a network, you need redundancy, meaning multiple instances of the same vector or multiple paths to the same site. A simple case of redundancy is a triangle where A is linked to B, B linked to C and C linked to A. Assuming A is a base (a known position), you will get the best position for B and C by doing a network adjustment.

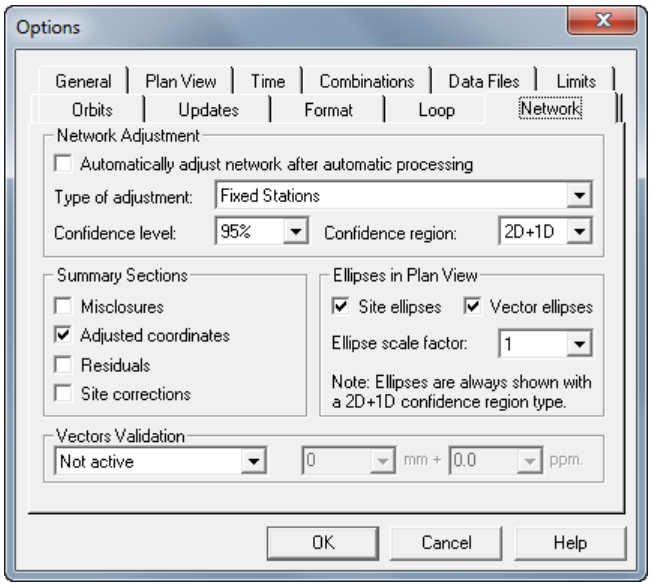
Adjust Network may be called from:

- In manual mode with **Tools > Process Manual > Adjust Network**.
- In automatic mode, the network adjustment step will be done only if **Automatically adjust network after automatic processing** is checked in **Tools > Options > Network**.
- Click the button on the **Main** toolbar.

This step uses the options set in **Tools > Options > Network**.

When the **Adjust Network** step is done, a notification is added in the **Process Summary**.

For detailed information about your adjusted results, consult the **Network Adjustment Summary**.



Options – Network

3.5 Analyzing

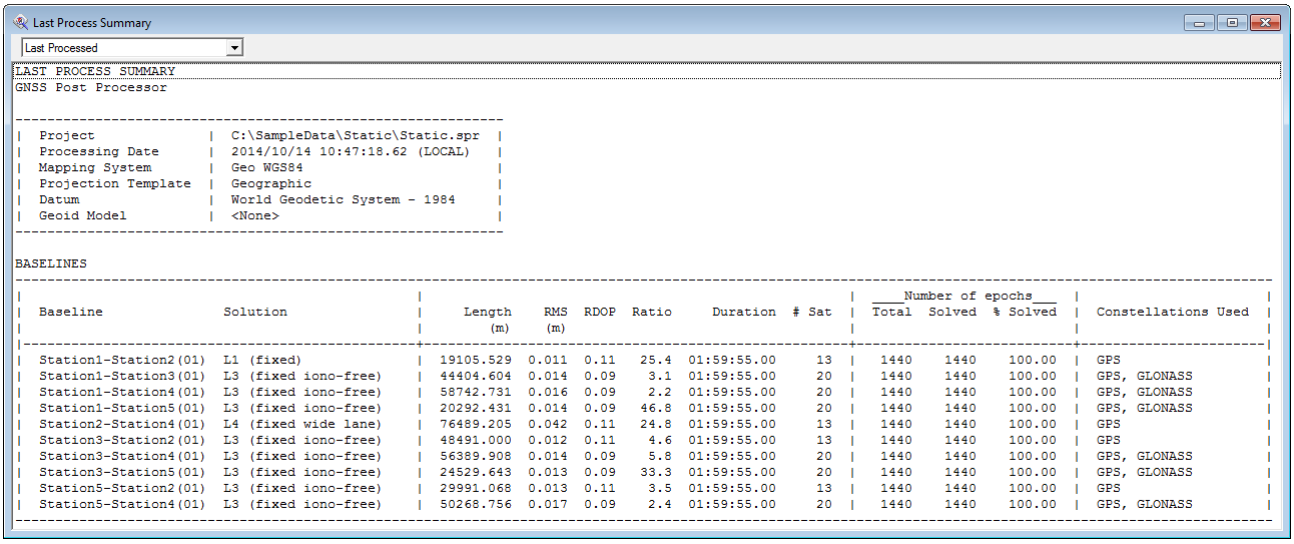
For a quick report on the state of your project, use the **Process Summary**.

For troubleshooting why your combinations were not created properly, use the **Pre-Process Log**.

For analyzing specific results, refer to ***Analysis*** chapter.

3.5.1 Process Summary

The **Process Summary** window is displayed automatically after a successful automatic processing. It is also displayed after a **Process All Data** (in a manual processing).



Last Process Summary

Last Processed

```
LAST PROCESS SUMMARY
GNSS Post Processor

-------------------------------------------------------------
|  Project              |  C:\SampleData\Static\Static.spr  |
|  Processing Date      |  2014/10/14 10:47:18.62 (LOCAL)   |
|  Mapping System       |  Geo WGS84                        |
|  Projection Template  |  Geographic                       |
|  Datum                |  World Geodetic System - 1984     |
|  Geoid Model          |  <None>                           |
-------------------------------------------------------------

BASELINES
-------------------------------------------------------------------------------------------------------------------------------
|                                                |                                                        |  ____Number of epochs___  |                                |
|  Baseline                Solution              |     Length    RMS   RDOP   Ratio     Duration   # Sat  |  Total  Solved  % Solved  |  Constellations Used           |
|                                                |       (m)     (m)                                      |                           |                                |
|------------------------------------------------+--------------------------------------------------------+---------------------------+--------------------------------|
|  Station1-Station2(01)  L1 (fixed)             |  19105.529  0.011  0.11   25.4  01:59:55.00     13  |  1440    1440    100.00   |  GPS                           |
|  Station1-Station3(01)  L3 (fixed iono-free)   |  44404.604  0.014  0.09    3.1  01:59:55.00     20  |  1440    1440    100.00   |  GPS, GLONASS                  |
|  Station1-Station4(01)  L3 (fixed iono-free)   |  58742.731  0.016  0.09    2.2  01:59:55.00     20  |  1440    1440    100.00   |  GPS, GLONASS                  |
|  Station1-Station5(01)  L3 (fixed iono-free)   |  20292.431  0.014  0.09   46.8  01:59:55.00     20  |  1440    1440    100.00   |  GPS, GLONASS                  |
|  Station2-Station4(01)  L4 (fixed wide lane)   |  76489.205  0.042  0.11   24.8  01:59:55.00     13  |  1440    1440    100.00   |  GPS                           |
|  Station3-Station2(01)  L3 (fixed iono-free)   |  48491.000  0.012  0.11    4.6  01:59:55.00     13  |  1440    1440    100.00   |  GPS                           |
|  Station3-Station4(01)  L3 (fixed iono-free)   |  56389.908  0.014  0.09    5.8  01:59:55.00     20  |  1440    1440    100.00   |  GPS, GLONASS                  |
|  Station3-Station5(01)  L3 (fixed iono-free)   |  24529.643  0.013  0.09   33.3  01:59:55.00     20  |  1440    1440    100.00   |  GPS, GLONASS                  |
|  Station5-Station2(01)  L3 (fixed iono-free)   |  29991.068  0.013  0.11    3.5  01:59:55.00     13  |  1440    1440    100.00   |  GPS                           |
|  Station5-Station4(01)  L3 (fixed iono-free)   |  50268.756  0.017  0.09    2.4  01:59:55.00     20  |  1440    1440    100.00   |  GPS, GLONASS                  |
-------------------------------------------------------------------------------------------------------------------------------
```

Process Summary

Process Summary has three possible variations, chosen from the combo box on the top left:

- **Last Processed**: Report for what processed last time a process was requested.
- **All Processed**: Report on everything that is processed in the project.
- **Project**: Report on everything in the project.

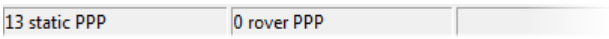
The **Process Summary** is composed of several sections that are shown when applicable:

- **Header**: Always present.
- **Single Point Site**: Present when the user request single point positioning on some sites
- **Baselines**: Present when the project contains baselines.
- **Trajectories**: Present when the project contains trajectories.
- **PPP**: Present when the project contains PPP (when **Processing Mode** is **Precise Point Positioning**).
- **Unprocessed**: Present when some rover could not be combined to produce a trajectory or a PPP.
- **Network**: Present when a network adjustment was done.

The status bar has two possible styles depending on the **Processing Mode**:

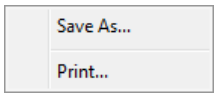
Process Summary – Status bar for Differential Positioning

- **(Left pane)**: Number of single point sites in view.
- **(Middle pane)**: Number of baselines in view.
- **(Right pane)**: Number of trajectories in view.



Process Summary – Status bar for PPP

- **(Left pane)**: Number of Static PPP in view.
- **(Right pane)**: Number of Rover PPP in view.



Process Summary – Speed menu

- **Save As...:** Save this view as a text file.
- **Print...:** Print this view

3.5.1.1 Single Point Sites

This section is present when the user request single point positioning on some sites. See ***GNSS Processing Workflow – Processing – Process All Data – Process All Single Point Positioning*** section for more details.

SINGLE POINT SITES

Site	Status	Position		
		Latitude	Longitude	EllHgt (m)
Station001	SUCCESS	N 40°31'26.71449"	W 3°53'08.50856"	813.965

Process Summary – Single Point Sites

- **Site**: Site name.
- **Status**: Status after processing.
- **Latitude/Longitude/EllHgt**: Latitude, longitude and ellipsoid height for the site position when the current mapping system is a geographic system.
- **X/Y/EllHgt**: X Y and ellipsoid height for the site position when the current mapping system is a projected system.

3.5.1.2 Baselines

This section gives you the state of all processed baselines.

For more detail information about each baseline, consult the **Baseline Summary**.

BASELINES

Baseline	Solution	Length (m)	RMS (m)	RDOP	Ratio	Duration	# Sat	Number of epochs Total	Solved	% Solved	Constellations Used
Station1-Station2(01)	L1 (fixed)	19105.529	0.011	0.11	25.4	01:59:55.00	13	1440	1440	100.00	GPS
Station1-Station3(01)	L3 (fixed iono-free)	44404.604	0.014	0.09	3.1	01:59:55.00	20	1440	1440	100.00	GPS, GLONASS
Station1-Station4(01)	L3 (fixed iono-free)	58742.731	0.016	0.09	2.2	01:59:55.00	20	1440	1440	100.00	GPS, GLONASS
Station1-Station5(01)*	L3 (fixed iono-free)	20292.431	0.0[illegible]	0.09	46.8	01:59:55.0[illegible]	20	1440	1440	100.00	GPS, GLONASS[illegible]

Process Summary – Baselines

- **Baseline**: Baseline name and occupation number;
- **Solution**: Solution Type. See the ***Solution Type*** Appendix for more details. When a solution has been computed but some warnings were found, it will display an asterisk (*****) on the right of the solution type and a note at the bottom of the baselines section. See ***Baseline Summary*** for more details.

```
|  VTUV-VCAP(02)  L4 (fixed wide lane)  *  |   54200.174  0.070  0.18    0.0  0
|  VTUV-VCAP(03)  L4 (fixed wide lane)  *  |   54200.129  0.051  0.18    0.0  0
-------------------------------------------------------------------------------
Baselines marked with "*" have warnings. Please consult Baseline Summary.
```

Process Summary – Baseline with warning

- **Length**: Distance between the two sites of the baseline (vector) after processing.
- **RMS**: Root Mean Square for the vector calculated between both sites.
- **RDOP**: Relative Dilution of Precision
- **Ratio**: The **ratio quality factor** is different from zero when the solution type is **Fixed**, i.e. the carrier phase ambiguities are fixed to integer values. The smallest value for a **Fixed** solution is 2.5. The largest the **ratio quality factor** is, the more confidence you can have in the result. A **ratio quality factor** larger than 5 means that the result can be accepted with a very good confidence.
- **Duration**: Observation time span of the baseline (simultaneous observation time of the two baseline sites).
- **# Sat**: Number of satellites used in the vector calculation.
- **Number of epochs**:
  - **Total**: Total number of epochs covering the baseline.
  - **Solved**: Number of epochs used to calculate the baseline.
  - **% Solved**: Percentage of solved epochs compared to the total epochs.
- **Constellations Used**: List of constellations used by the baseline. Possible values are:
  - **GPS**
  - **GLONASS**
  - **Galileo**
  - **BeiDou**

3.5.1.3 Trajectories

This section gives you the state of all processed trajectories.

For more detail information about each trajectory, consult the **Trajectory Summary**.

```
TRAJECTORIES

--------------------------------------------
|  Base Station      |  sa58               |
|  Constellations    |  GPS                |
|  Latitude          |  N 45°25'26.95909"  |
|  Longitude         |  W 73°56'15.50653"  |
|  Ellipsoid Height  |  24.522 m           |
|  Undulation        |  0.000 m            |
|  Mean Sea Level    |  24.522 m           |
--------------------------------------------

-------------------------------------------------------------------------------------------------------------------
|                        |  ____Number of epochs___  |  _____________Number of sites_____________  |                |
|  Rover        Distance |  Total  Solved  % Solved  |  Total  Fixed  Float  PSR  Failed  Unproc  |  Constellations Used  |
|                   (km) |                           |                                            |                |
|------------------------+---------------------------+--------------------------------------------+----------------|
|  20100708_01      31.9 |   1308    1308    100.00  |     24     24      0    0       0       0  |  GPS           |
-------------------------------------------------------------------------------------------------------------------
```

Process Summary – Trajectories

The **Trajectories** section is composed of a minimum of two tables and a maximum of five tables:

- **Base**: Information about a base site.
- **Rovers**: a table for all rovers using the same base. This table includes sites stats if any are present within rover.

- **Points**: a table for all points (if any).
- **Discrete lines/polygons**: a table for all discrete lines and discrete polygons (if any)
- **Continuous lines/polygons**: a table for all continuous lines and continuous polygons (if any)

The **Base** table is composed of the base station name and its position:

- **Base Station**: Base station name.
- **Constellations**: List of constellations present in the base observation file. Possible values are:
  - **GPS**
  - **GLONASS**
  - **Galileo**
  - **BeiDou**
- **Latitude/Longitude**: Latitude and longitude for the base position when the current mapping system is a geographic system.
- **X/Y**: X and Y for the base position when the current mapping system is a projected system.
- **Ellipsoid Height**: Ellipsoid height for the base position.
- **Undulation**: Undulation of the geoid. The geoid model used is indicated in the header section.
- **Mean Sea Level**: Mean Sea Level height of the base position.

The **Rover** table is composed of:

- **Rover**: Rover name.
- **Distance**: Distance between the rover and the base site. The rover position is roughly the center of the rover so this is more an average distance than an exact distance.
- **Number of epochs**:
  - **Total**: Total number of epochs covering the rover.
  - **Solved**: Number of epochs covering the trajectory where a position could be calculated.
  - **% Solved**: Percentage of solved epochs compared to the total epochs.
- **Number of sites** (if any site is present, otherwise this section is omitted):
  - **Total**: Total number of sites being observed in this rover file
  - **Fixed**: Number of sites with an ambiguity **Fixed** solution.
  - **Float**: Number of sites with an ambiguity **Float** solution.
  - **PSR**: Number of sites with a pseudorange solution type (no carrier phase).
  - **Failed**: Number of sites that could not be processed. Please check **Trajectory Summary** for more details.
  - **Unproc**: Number of unprocessed sites. This is the number of sites within the rover but not within the trajectory. This could happen in three cases:
    - Some sites were collected (in real time mode) before or after the raw GNSS observation file was collected. Since there is NO observation available for these sites, these sites <u>WILL NEVER</u> be processed. Please review your collect procedure to avoid it.
    - The base site covers only part of the rover. It is normal that sites that are not within the trajectory will still be unprocessed.
    - The trajectory was manually edited to cover only part of the rover. All sites within the rover but outside the trajectory will not be processed. To process them again, please adjust the boundary of the trajectory to match the rover.

- **Constellations Used**: List of constellations used by the trajectory. Possible values are:
  - **GPS**
  - **GLONASS**
  - **Galileo**
  - **BeiDou**

[Points]		____Number of points___		
Type	Feature	Total	Solved	% Solved
Point	Job	1	1	100.00
Point	Point	18	18	100.00

Process Summary – Trajectories – Points

The **Points** table is reserved for points and point averages and is composed of:

- **Type**: Always **Point**.
- **Feature**: Feature name
- **Number of points**: Stats for points of specific feature within the above rovers
  - **Total**: Total number of points.
  - **Solved**: Number of points calculated.
  - **% Solved**: Percentage of solved points compared to the total points.

[Discrete lines/polygons]			____Number of points___		
Type	Feature	Label	Total	Solved	% Solved
Line	Line	1	2	2	100.00
Polygon	Polygon	3	7	7	100.00

Process Summary – Trajectories – Discrete lines/polygons

The **Discrete lines/polygons** table is composed of:

- **Type**: Either **Line** or **Polygon**.
- **Feature**: Feature name
- **Label**: Label for that particular line or polygon.
- **Number of points**: Stats for points within a particular discrete line or polygon
  - **Total**: Total number of points.
  - **Solved**: Number of points calculated.
  - **% Solved**: Percentage of solved points compared to the total points.

[Continuous lines/polygons]		
Type	Feature	Count
Line	Line Feature	3

Process Summary – Trajectories – Continuous lines/polygons

The **Continuous lines/polygons** table is composed of:

- **Type**: Either **Line** or **Polygon**.

- **Feature**: Feature name
- **Count**: Number of lines or polygons of that specific feature that are touched by above rovers and therefore should be processed.

3.5.1.4 PPP

This section gives you the state of all processed PPP.

For more detail information about each PPP, consult the **PPP Summary**.

PRECISE POINT POSITIONING (PPP)

		Number of epochs			Number of sites					
File	Type	Total	Solved	% Solved	Total	Float	PSR	Failed	Unproc	Constellations Used
00042240	Static	85794	85794	100.00	1	1	0	0	0	GPS
00042250	Static	87329	87329	100.00	1	1	0	0	0	GPS
00042262	Static	68150	68143	99.99	1	1	0	0	0	GPS
00042280	Static	59641	59641	100.00	1	1	0	0	0	GPS
00042292	Static	86409	86409	100.00	1	1	0	0	0	GPS
00042300	Static	69899	69899	100.00	1	1	0	0	0	GPS
00042310	Static	85636	85636	100.00	1	1	0	0	0	GPS
00042320	Static	86951	86951	100.00	1	1	0	0	0	GPS
00042180	Static	85492	85492	100.00	1	1	0	0	0	GPS
00042190	Static	86602	86602	100.00	1	1	0	0	0	GPS
00042200	Static	84261	84261	100.00	1	1	0	0	0	GPS
00042223	Static	62484	62482	100.00	1	1	0	0	0	GPS
00042230	Static	85263	85263	100.00	1	1	0	0	0	GPS

Process Summary – Precise Point Positioning

- **File**: Rover or static file name.
- **Type**: Type of PPP:
  - **Rover**: A PPP result associated with a rover (many position).
  - **Static**: A PPP result associated with a static (one position).
- **Number of epochs**:
  - **Total**: Total number of epochs covering the PPP.
  - **Solved**: Number of epochs used in the PPP calculation
  - **% Solved**: Percentage of solved epochs compared to the total epochs.
- **Number of sites**:
  - **Total**: Total number of sites associated to the rover/static
  - **Float**: Number of sites with an ambiguity **Float** solution (PPP results cannot be Fixed).
  - **PSR**: Number of sites with a pseudorange solution type (no carrier phase).
  - **Failed**: Number of sites that could not be processed. Please check **PPP Summary** for more details.
  - **Unproc**: Number of unprocessed sites. It is always 0 for a static. For a rover, it is the number of sites within the rover but not within the PPP. This could happen is two cases:
    - Some sites were collected (in RTK mode) before or after the raw GNSS observation file was collected. Since there is NO observation available for these sites, these sites WILL NEVER be processed. Please review your collect procedure to avoid it.
    - The PPP was manually edited to cover only part of the rover. All sites within the rover but outside the PPP will not be processed. To process them again, please adjust the boundary of the PPP to match the rover.
- **Constellations Used**: List of constellations used by the PPP. Possible values are:
  - **GPS**
  - **GLONASS**

- **Galileo**
- **BeiDou**

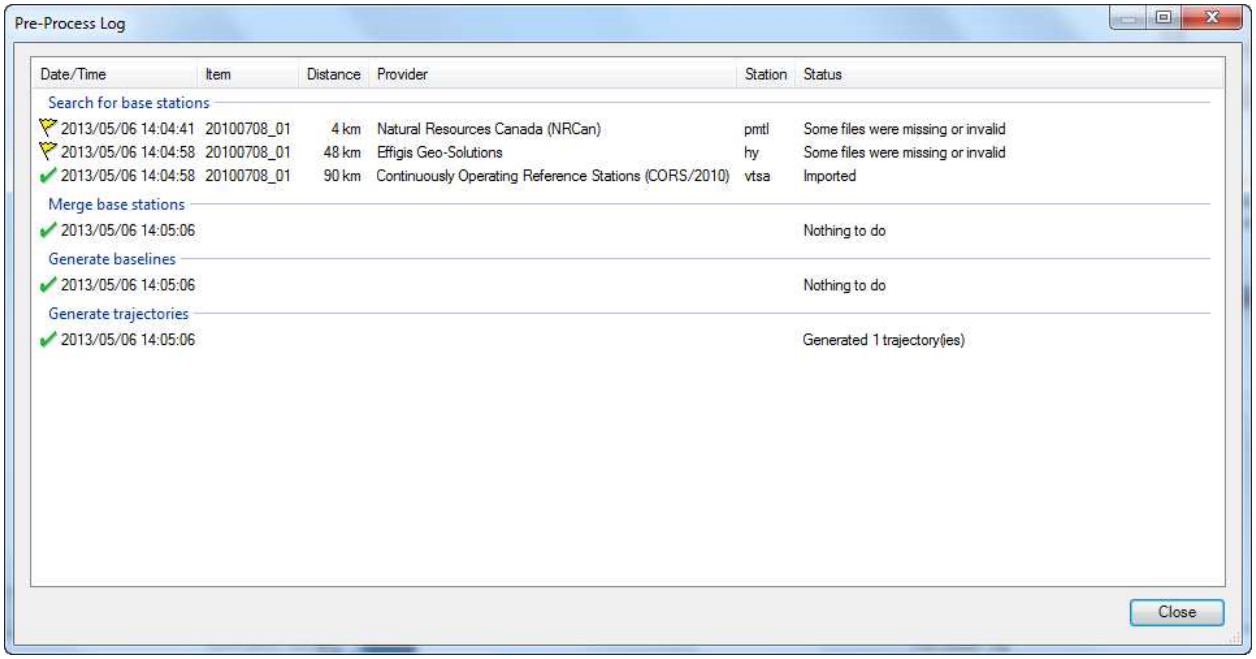
3.5.2 Pre-Process Log

The **Pre-Process Log** is displayed by calling **Analysis > Pre-Process Log** or by clicking in the **Analysis** toolbar.

The **Pre-Process Log** is a log of all messages, warnings and errors that occurred during the **Pre-Process** step in processing.

The **Pre-Process Log** is cumulative. It will keep track of all pre-processing operations in the current project since that project was created. It cannot be cleared.

The main purpose of the **Pre-Process Log** is to help the users determine why a specific step failed in the "processing chain" in order to fix it and reprocess it again. In the example below, it indicates the two closest base stations were rejected because some files were missing or invalid.



Pre-Process Log

- **Step**: Steps are displayed in blue and represents one or more operations. Possible steps are:
  - **Search for broadcast orbits**
  - **Search for base stations**
  - **Search for precise orbits**
  - **Merge base stations**
  - **Generate PPP**
  - **Generate baselines**
  - **Generate trajectories**
- **Icon**: Final state of an operation

- ✔: Success
- : Warning
- : Error

- **Date/Time**: Date and time of the operation.
- **Item**: Rover, Semi-kinematic or site name. Empty if not applicable.
- **Distance**: Distance between base and item. Empty if not applicable.
- **Provider**: Provider name. Empty if not applicable.
- **Station**: Base station name. Empty if not applicable.
- **Status**: Final status of an operation
- **Close**: Closes the Pre-Process Log.

3.6 Saving project

IMPORTANT: OnPOZ EZTag CE™, OnPOZ EZField™, OnPOZ GNSS Driver for ArcPad, Carlson SurvCE™, Geo-Plus VisionTerrain, NavCom or MicroSurvey software users must save their projects to update all related files after post-processing.

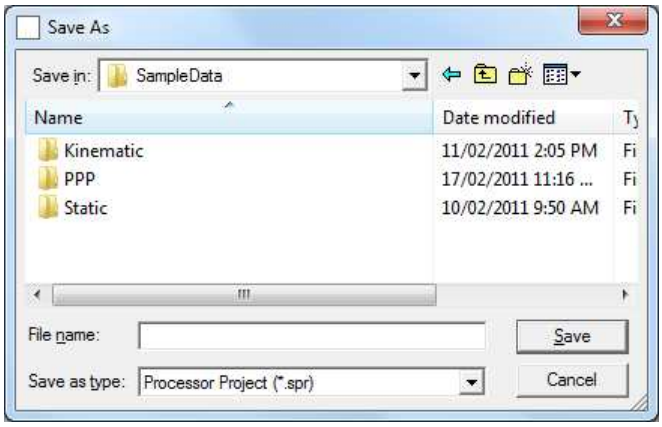
Once you finished processing your project, you can save it. Saving a project will have the following effect:

- Save changes to files that originally contained real-time positions recorded on the field:
  - Update POS files for all rovers or semi-kinematic;
  - Update TAG files for OnPOZ EZTag CE™ and OnPOZ EZField™ files;
  - Update shapefiles for GNSSP files;
  - Update any supported external data collector files:
    - RW5 files for Carlson SurvCE™
    - MDB files for Geo-Plus VisionTerrain
    - RAW files for MicroSurvey FieldGenius™, MicroSurvey Seismic Surveyor™, MapScenes Evidence Recorder™ or NavCom FieldGenius™
- Keep all project files together in the directory specified by the user;
- Update all database and result files required by the project.

A project is saved in the location specified by the user. If you want to move your project to another location and access its content later, then you should create an archive after saving the project. Archiving a project is explained in the next section.

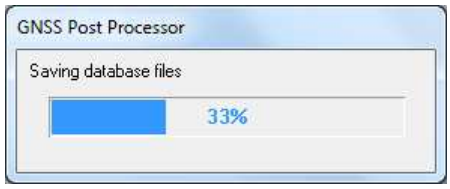
■ To save a project

a. From the main menu, select **File > Save** or click on in the **Main** toolbar**.** If the project is saved for the first time, the **Save As** is displayed:



Saving project

b. Select the directory in which you want to save your project (a folder is proposed by the software).
c. Type a new name for the main project file in the **File name** box (a project name is proposed by the software). The extension of this file will be **spr**.
d. Click **Save**. A progress window is displayed, detailing progress.



Saving project – Progress bar

e. From here, you can continue to work with the software or close it if you are finished.

- If you continue to work in the software and post-process your data again using different process parameters, you must save your project again to apply changes in external files. In this situation, you do not need to specify a new project name. You can select **File > Save** to save the current project with the same name.
- Once saved, you can open an SPR directly from Windows Explorer by double-clicking on it. It will open the software and open the project right away.
- You must keep all files related to the project database in the same directory. Database files are saved in the same location as your project file.

3.7 Exporting

After post-processing, you can export sites, baselines, trajectories, PPP results and features.

See ***Export*** chapter for details.

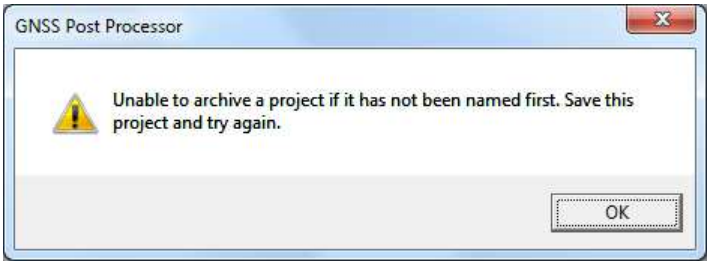
3.8 Archiving Project

Once your project is finished processing and all your results are exported, you can archive your project. When you save your project as an archive, all data related to your project (e.g. observations, project database files) are stored in one file with the **spr.zip** extension. The objective of an archive is to make a project moveable to any location without having to manage the directories in which the project's data files are stored. The project archive can be opened in a folder different from the original location of the project (or even on another computer) and then used normally.

Archives are created and opened through the **File** menu.

3.8.1 Create an Archive

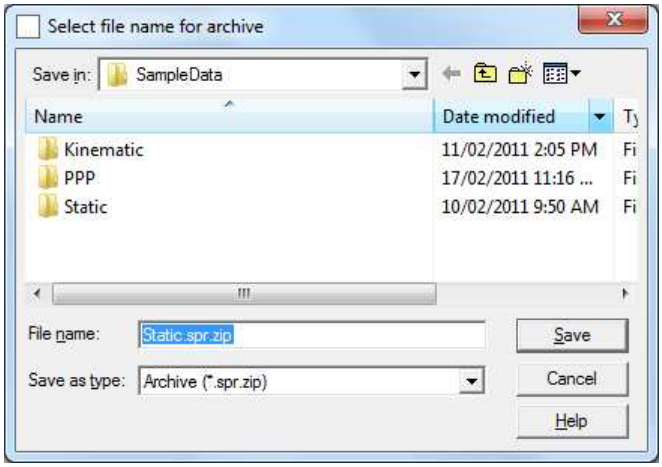
Before creating an archive, you must first save your project in a project file. Look in section ***GNSS Processing Workflow – Saving Project*** for information how to save your project. If no project file exists before trying to create an archive, the following message box will be displayed:



Error – Unable to archive a project

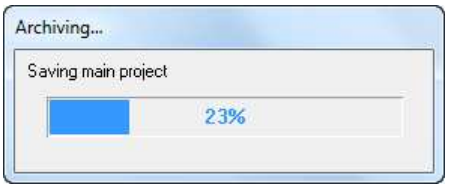
- To create an archive

a. From the main menu, select **File > Archive Project...** or click on in the **Main** toolbar. The **Select file name for archive** is displayed.



Select file name for archive

b. Select the directory in which you want to save your project archive.
c. Type a new name for the archive file in the **File name** box or accept the default.
d. Click **Save**. The **Archiving...** progress window is displayed, detailing progress.



Create an archive – Progress bar

During the archiving process, the current project is saved automatically before saving the archive.

e. Once the archiving process is finished, the current project is closed. The archive file is available in the directory you have selected.

The archive contains all data files related to the project. This includes:

- Project database files;
- Data input files collected on the field and required for post-processing, such as observations and orbits data files;
- Result files if they exist;
- All other files required by the project.

> The archive will contain only the files required for Post Processing purpose. Extra files collected by your GNSS collector may NOT be included.

The internal archive file format uses the standard ZIP format. All project files are stored in the root of the ZIP file. All data input files are stored in a temporary tree structure inside the archive file to insure that files with the same name and a different directory location are properly stored and not overlapped. All data files coming from a particular directory will be stored under the same directory. Observations and orbits data files added during automatic base download are stored with the project in the root of the ZIP file.

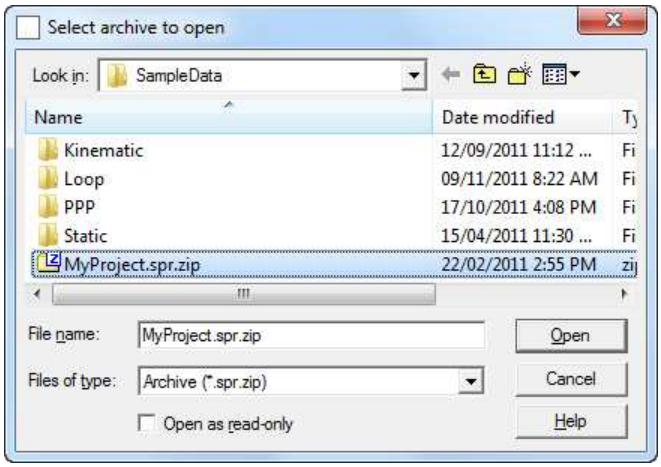
> The ZIP file is encrypted with a password to insure the integrity of the data. Therefore, you can only open the archive with the software to restore your project files.

3.8.2 Open an Archive

You can restore an archived project by opening the archive. Once the archive is opened, you have access to your old project and you can modify it, e.g. adding new files, re-computing data. You can archive it again after modifications.

■ To open an archive

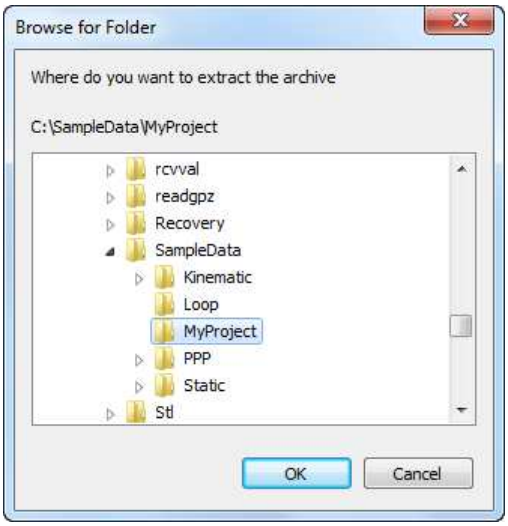
a. From the main menu, select **File > Open Archived Project…** or click on in the **Main** toolbar. The **Select archive to open** is displayed.



Select archive to open

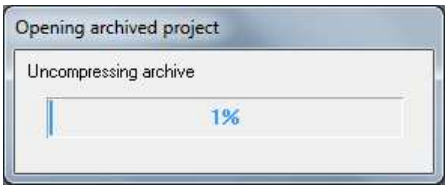
b. Select the directory in which your project archive is located. Then select the name of the archive. It will be displayed in the **File name** box. Click **Open**.

c. The **Browse for Folder** window is displayed, asking in which directory you want to extract the archive. Select a folder and click **OK**.



Open Archive – Browse for Folder

d. The **Opening archived project** progress window is displayed, detailing progress.



Open Archive – Progress bar

❖ If another project was already opened in the software, this project will be closed before extracting the archive. You will be prompted to save your project if it was modified since last saved.

e. Once the extraction is completed, the project is displayed in the software.

4 Process Parameters

In the software we have tried to minimize the process parameters in order to ease the user experience. Process parameters are used by the software to help you to get the best out your GNSS raw data (pseudorange, carrier phase and doppler data). These parameters include mask angles, DOP cutoff, data interval, etc. When you first install the software, default values are set for all process parameters.

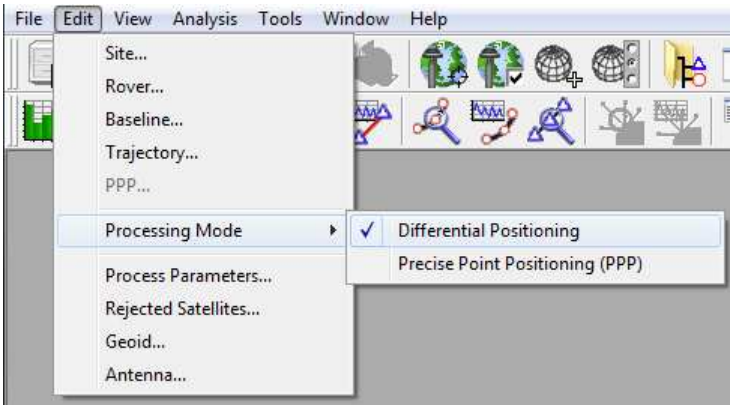
- When you modify process parameters within a project, they are saved with the project and they remain the same until a new modification.
- To set process parameters as default parameters (to be used every time you start the software), you have to set them when there is no project opened. In this case, process parameters will be set as global defaults.

4.1 Processing Mode

4.1.1 Setting Processing Mode for current project

The software supports two processing modes, the **Differential Positioning** and the **Precise Point Positioning** (PPP) mode. You have to select your processing mode first. In the same project, you cannot mix differential and PPP processing, you select one or the other. The default mode is **Differential Positioning**.

a. From the **Edit** menu, open **Processing Mode** and select the new Processing Mode.
b. The active Processing Mode is indicated by a check mark on the left of the item.



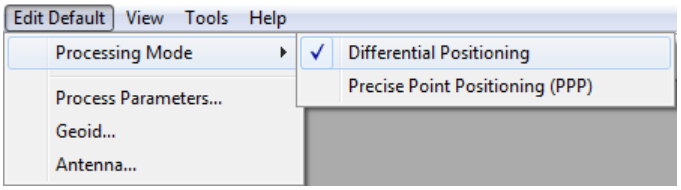
Setting Processing Mode for current project

4.1.2 Setting default Processing Mode

a. Close any active project using **File** > **Close**.

b. From the **Edit Default** menu, open **Processing Mode** and select the new default Processing Mode.

c. The default processing mode is indicated by a check mark on the left of the item.



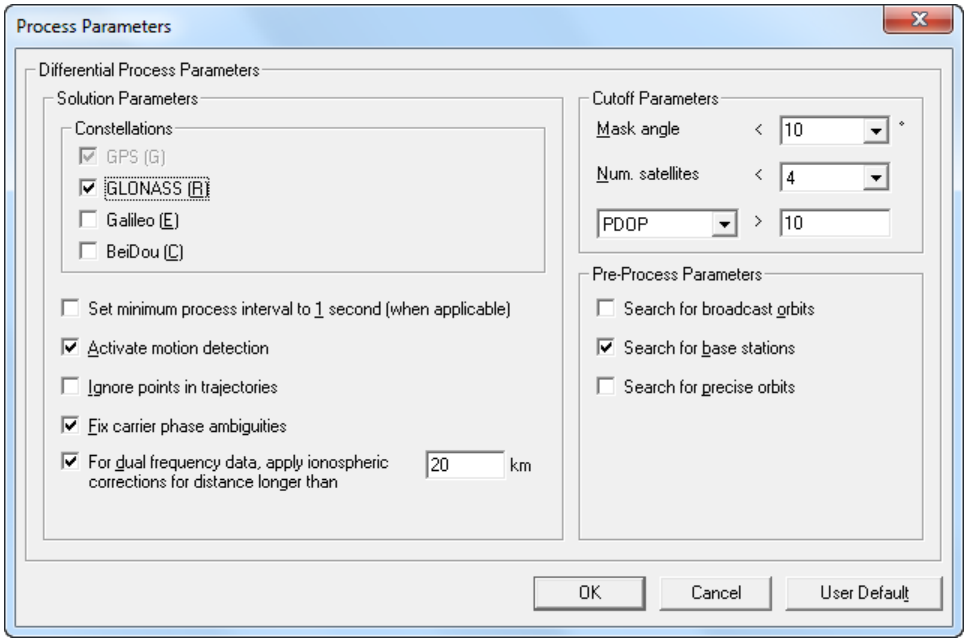
Setting default Processing Mode

4.2 Process Parameters

All process parameters are edited using the **Process Parameters** dialog box. This dialog box can be displayed by following one of these procedures:

- Select **Edit > Process Parameters** from the main menu;
- Click on the **Main** toolbar.

4.2.1 Setting Process Parameters for current project



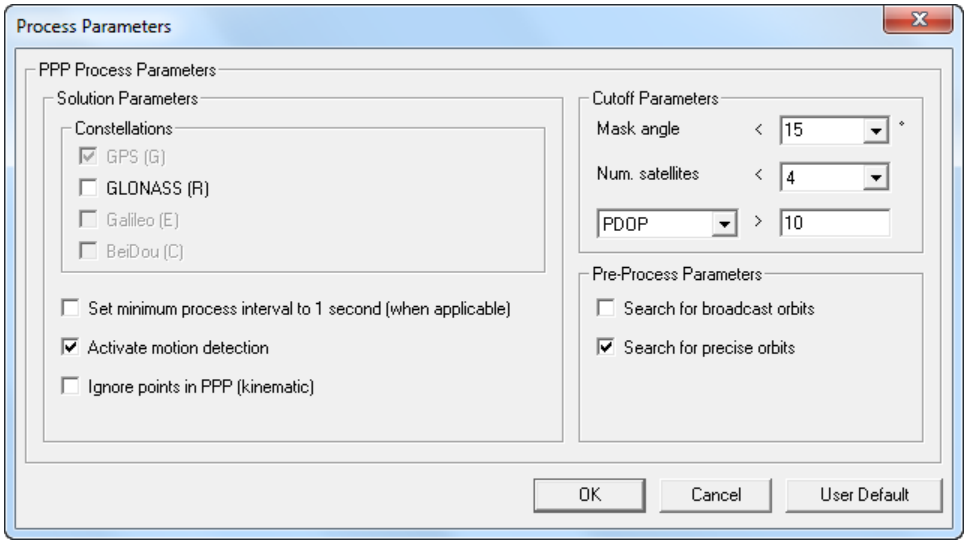
Process Parameters for Differential Positioning

- **Solutions parameters**:
  - **Constellations**: Selecting more than one constellation will give you extra satellites which usually mean a better position accuracy. This option has no effect when no data of that constellation has been collected.
    - **GPS (G)**: GPS (G) are always processed.
    - **GLONASS (R)**: When checked, GLONASS data will be processed.
    - **Galileo (E)**: When checked, Galileo data will be processed.

        - **BeiDou (C)**: When checked, BeiDou data will be processed.
    - **Set minimum process interval to 1 second (when applicable)**: This option is applicable only to a small data intervals like 0.01, 0.02, 0.04, 0.05, 0.10, 0.20, 0.25 and 0.5 second. When checked, the resulting trajectory will be generated at an interval of 1 second. This speed up the process a little and avoid generating an exceeding large trajectory file.
    - **Activate motion detection**: Automatically detect if the observed location is static or in movement. This should be checked when you do static or stop-and-go data collection. However, when observing a slowly moving object (tidal gauge), you should uncheck it.
    - **Ignore points in trajectories:** Process trajectory without using any sites or points already present within the rover file. This is typically used for debugging purpose. For instance you may have set a site observation while you were moving. Such a situation may corrupt you post-processed positions. By checking this option you will be in a position to detect such problem.
    - **Fix carrier phase ambiguities**: Allow the software to launch its ambiguity fixing algorithm (for Survey applications). In harsh environment (under canopy) you should uncheck this option (otherwise it may sometimes generate bad fixes). So when processing typical GIS data (sub-meter/sub-foot), this option should be unchecked.
    - **For dual frequency data, apply ionospheric corrections for distance longer than**: This option is for L1/L2 receiver only. When checked, it applies ionospheric corrections if the distance separation between the known position (base station) and the unknown position is longer than the specified value. More specifically it will compute an L3 solution (ionospheric free combination).
- **Cutoff parameters**:
    - **Mask angle:** Specify the minimum mask angle to be used. A low angle allows the software to use more satellites, but at the same time increases the potential of including bad data into the processing (multipath effects). Low observations are usually noisier. A proper mask angle should be between 10 and 15 degrees.
    - **Num. satellites:** If at a specific epoch the number of satellites used to compute the position is lower than the specified value, this epoch is rejected.
    - **Geometry cutoff:** First select the type of geometry cutoff (DOP), and then enter the maximum value for it. If at a specific epoch the DOP value is higher than the specified value, this epoch is rejected; The type of geometry supported are:
        - **PDOP**: Position dilution of precision. Use horizontal and vertical precision;
        - **GDOP**: General dilution of precision. Use horizontal, vertical and time precision;
        - **HDOP**: Horizontal dilution of precision; Use only the horizontal precision;
- **Pre-Process Parameters**:
    - **Search for broadcast orbits:** Download and add broadcast orbits to your project. These are daily orbits files for all satellites of all constellations requested in **Constellations** section so they can be used with any project. Broadcast orbits usually come with your data and from base stations so in most cases, you do not need these extra orbits. Please note that these broadcast orbits take at least a full day before being available.
    - **Search for base stations**: Download and add base stations from the providers defined in **Tools** > **Base Providers** > **Providers Manager**. You must keep at least one base provider active for this option to work.
    - **Search for precise orbits**: Download and add precise orbits from the providers defined in **Tools** > **Options** > **Orbits**. Please note that precise orbits takes at least a full day before being available and the best quality (final orbits) is available only about two weeks after collect.

- **User Default:** Reset all values back to the default values.

When PPP mode is selected, the **Process Parameters** dialog is slightly different. It is a subset of the one described above.



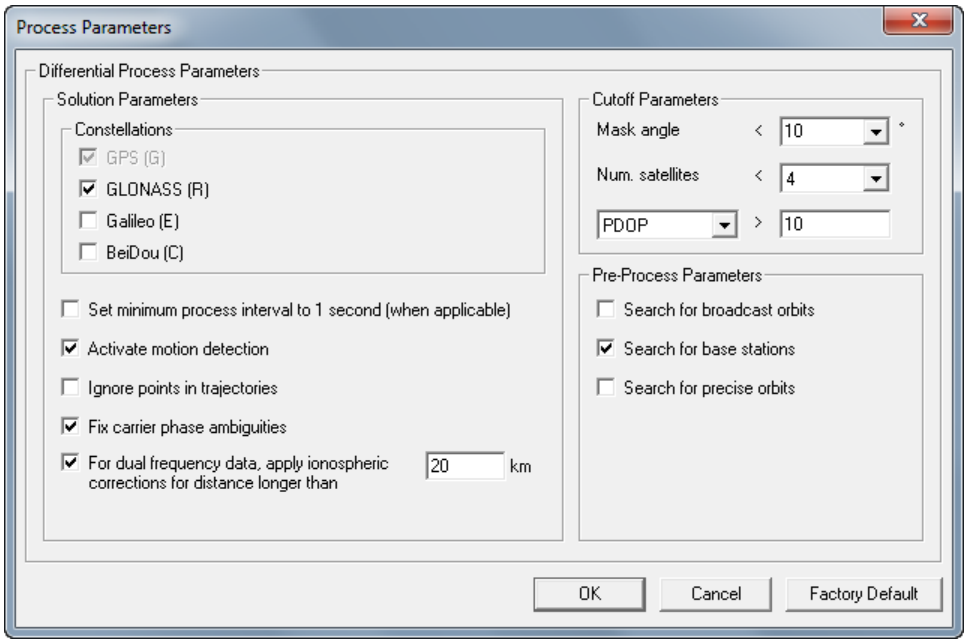
Process Parameters for PPP

4.2.2 Setting default Process Parameters

The default **Process Parameters** are used for new project only. When opening an existing project, that project keeps its original parameters.

Setting the default **Process Parameters** is almost identical to setting the **Process Parameters** for the current project.

a. Close any active project using **File** > **Close**.
b. From the **Edit Default** menu, select **Process Parameters…**
c. Modify any parameters you want to change.
d. Click **OK**.



Default Process Parameters for Differential Positioning

The **Factory Default** button will reset all parameters to factory defaults. These are the recommended setting for general projects.

The same procedure applied to the PPP **Process Parameters**.

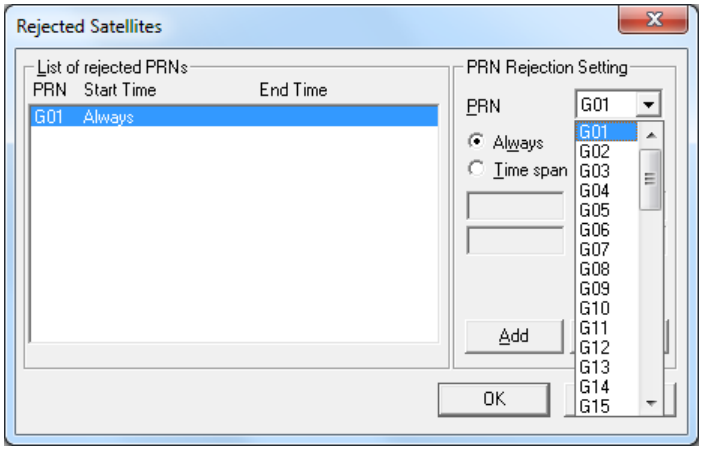
4.3 Rejected Satellites

This option allows you to reject one or several satellites from the processing. Satellites can be rejected totally or can be rejected for a specific period of time.

The **Rejected Satellites** dialog is available from the **Edit** > **Rejected Satellites…** menu.

- Reject a satellite
  a. Click **Add**. If this is the first satellite to be added to the list, the **List of rejected PRNs** and the **PRN Rejection Setting** portions of the dialog box are activated and a new record is displayed in the **List of rejected PRNs**. If other satellites exist in the list, the currently selected record will be copied.
  b. Select the satellite **PRN** number you want to reject from processing from the drop-down list on the right side of the dialog box. The record in the list is updated with the new information.
     - **GPS** satellites start with a “G”.
     - **GLONASS** satellites start with an “R”.
     - **Galileo** satellites start with an “E”.
     - **BeiDou** satellites start with a “C”.
  c. Select one of the following option buttons:
     - **Always**: This option causes the selected satellite to be rejected in all computation.
     - **Time span**: This option allows you to reject a portion of an orbital arc from processing. When selected, the boxes directly under the option button are activated, enabling you to specify the start/end date/time of rejected period.

d. Click **OK** to save the information and close the dialog box.



Rejected Satellites

Remove a rejected satellite

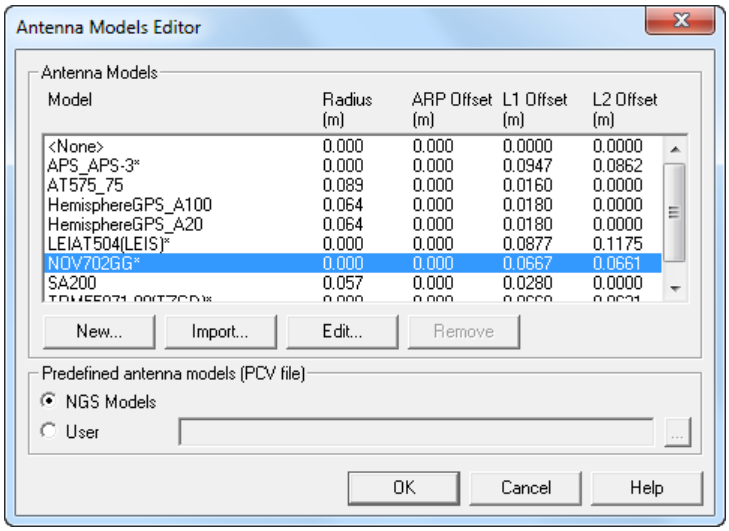
a. Select the rejected satellite (from the **List of rejected PRNs**) you want to delete. The record is highlighted.

b. Click **Remove**. The satellite is removed from the list.

c. Click **OK** to save the information and close the dialog box.

5 Antenna Models

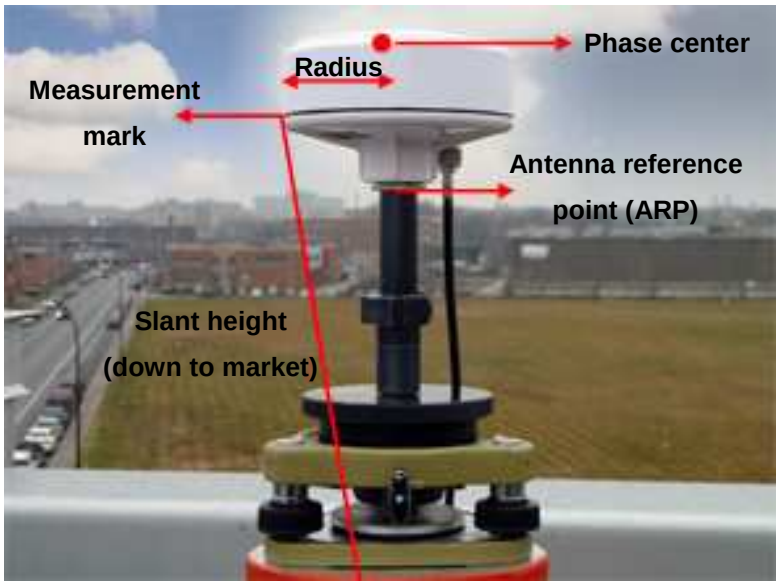
Antenna models can be defined and selected in the **Antenna Models Editor** accessed through **Edit > Antenna…** from the main menu.



Antenna Models Editor

Antenna models are usually required when processing observations collected with survey grade receivers. When selecting the appropriate antenna model, it is possible to reduce slant antenna heights (measured in the field) to vertical heights and to account correctly for antenna phase center vertical offset. This latter issue is particularly important when the user is seeking for centimeter level accuracy and is using antennas of different models at the base and the remote receiver. Within this dialog, you have the functionality to define, import, edit, and delete antenna models.

An antenna model is defined by a model name, a radius, an ARP offset and a vertical offset for L1 and L2 frequencies. The vertical offset for L2 will be zero if the antenna is single frequency. The radius is measured from the center to the edge of the antenna at the measurement mark (when measuring antenna height). The vertical offset is the distance from the reference point of height measurement (usually the measurement mark or the Antenna Reference Point (ARP)) to the antenna phase center. Various reference points of measurement and methods to measure antenna heights are presented in next section (***Antenna Models – Measuring Antenna Heights***).



Antenna radius and phase center vertical offset parameters of a GNSS antenna

Models can be defined by the user by clicking on **New…**. They can also be imported from a predefined list by clicking on **Import…**. The NGS list is the official list of antenna models calibrated by the U.S. National Geodetic Survey (NGS) (http://www.ngs.noaa.gov/ANTCAL/). Absolute calibration values are used; information about the difference between absolute and relative antenna calibration is given in next section (***Antenna Models – Measuring Antenna Heights***). The NGS list is provided with the software and updated on your computer through Automatic Updates (section ***Options – Updates***).

You can also load your own predefined antenna models file. Antenna models in the file must be NGS format.

- The software is distributed with a short list of predefined antenna models not available in NGS list. Their L1 and L2 vertical offsets are computed with respect to their respective measurement mark. The radius is given at the measurement mark.

- When RINEX files are downloaded through base station providers using Automatic Download, the antenna model indicated in the base station file header can be automatically loaded in addition to the base station antenna height. It will be loaded if this antenna model matches exactly one of the antenna model name listed in the predefined antenna models file.

If you are creating your own model instead of using a predefined model, please refer to the technical specifications provided by the manufacturer of your antenna for the radius value and antenna phase center vertical offsets. These specifications can vary with the antenna model, hardware revision, and the use of chockerings or other device. You can also get more information on GNSS antenna calibration at the U.S. National Geodetic Survey (NGS) web site (http://www.ngs.noaa.gov/ANTCAL/).

- The antenna model highlighted in the Antenna Models window is the default. It means that this model will be associated to each observation file to be imported in your project unless you specify another model to be associated with a particular file. To change the default model, select another model from the list and click **OK** on the **Antenna Models Editor** dialog.

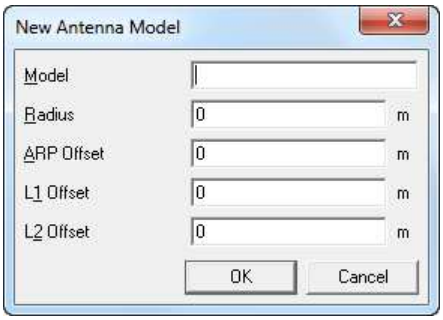
- There are three ways to associate an antenna model different from the default to a particular observation file:

  1) through the **Site Editor** window in **Occupation** tab (see section ***Editing – Site***);
  2) through the **Rover Editor** window (see section ***Editing – Rover***);
  3) when downloading a RINEX base station file through Automatic Download.

5.1 Antenna Models Editor

5.1.1 New antenna model

From the **Antenna Models Editor**, click **New…**. The **New Antenna Model** is displayed.



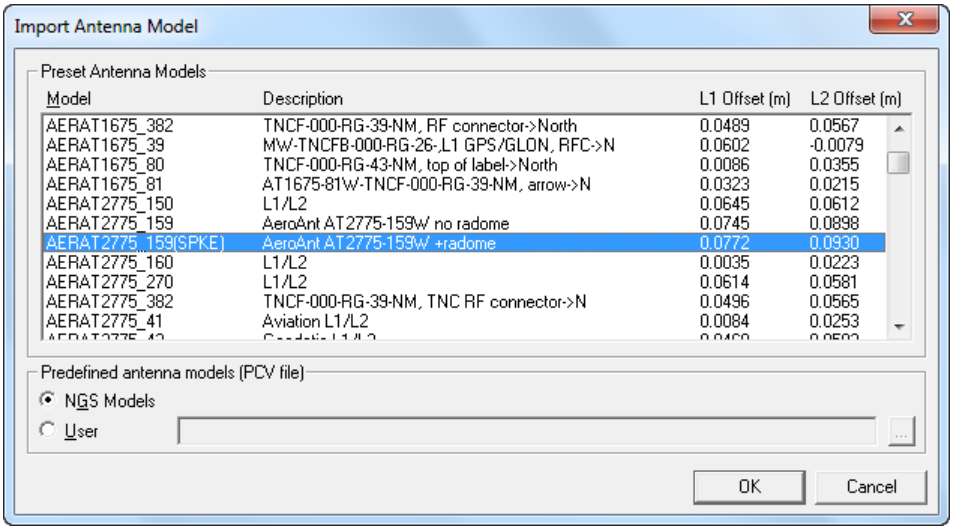
New Antenna Model

- **Model:** Name of your new antenna model.
- **Radius:** Radius of the antenna model. If you measure heights vertically on the field and do not need to correct for slant height, enter **0**.
- **ARP Offset**: If your measurement mark is distinct from your ARP, you need to enter the **ARP Offset**. If your measurement is already at the ARP, enter **0**.
- **L1/L2 Offset**: These values should be the vertical offset between the antenna phase center and the reference point of measurement (when measuring antenna height) for each frequency. If the antenna is single frequency instead of dual frequency, enter **0** for the **L2 Offset**.

Click **OK**. You are back to the **Antenna Models Editor** dialog and the name of your new antenna model appears in the **Antenna Models** list and is highlighted as the default model.

5.1.2 Import a predefined model from a list

a. From the **Antenna Models Editor**, click **Import…**. The **Import Antenna Model** is displayed with antenna models as calibrated by NGS (absolute values).

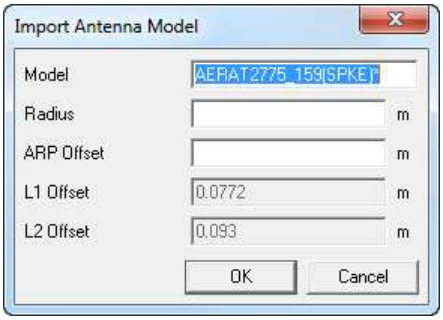


Import Antenna Model

b. Select the antenna model you want to import from the list. Click **OK.**

c. An **Import Antenna Model** edit box is displayed with the name of the selected model, a blank **Radius** and **ARP Offset**, and the **L1 Offset** and **L2 Offset**. The **Model** name cannot be saved with its original name so a "*****" is appended to your selected name. You can edit the name before adding it to your list. The **Radius** and **ARP Offset** must be edited. If you measure heights vertically on the field and your measurement point is at ARP, enter **0** for these two parameters. The **L1 Offset** and **L2 Offset** values cannot be edited.

> **L1 Offset** and **L2 Offset** from NGS's predefined models all refer to the Antenna Reference Point (ARP), which is the bottom of the antenna. If you want to use one of these predefined models but measure antenna height at a point that is not the ARP, see section ***Antenna Models – Measuring Antenna Heights*** to know how to define your antenna model.



Import Antenna Model – Edit

d. Click **OK**. You are back in the **Antenna Models Editor** and the name of your new antenna model appears in the **Antenna Models** list and is highlighted as the default model.

5.1.3 Use a different predefined antenna models file list

a. From the **Antenna Models Editor**, click **Import…**. The **Import Antenna Model** is displayed.

b. Select the **User** radio in the **Predefined antenna models** section.

c. Use the **[…]** button on the right and select your file.

d. Click **OK**.

> The file selected must be compatible with U.S. National Geodetic Survey (NGS) format.

5.1.4 Remove an antenna model

a. Select the antenna model to be deleted from the **Antenna Models** list.

b. Click on **Remove**.

c. A message box requesting a confirmation will show up.

d. Click **Yes**. The model is removed from the list.

> You cannot delete the default model **<None>** from the list.

5.1.5 Edit an antenna model

a. Select the antenna model to be edited from the **Antenna Models** list.

b. Click **Edit**. The **Edit Antenna Model** is displayed. It is the same dialog box as the **New Antenna Model** dialog box.

c. If the model was originally created using **New…**, all fields can be edited. However, if the model was imported from the predefined list, only the **Model** name, **Radius** and **ARP Offset** can be edited.
d. Edit the antenna model.
e. Click **OK** to save the changes. You are back in the **Antenna Models Editor**, the changes are applied and the name of your antenna model is highlighted in the **Antenna Models** list and is the default model.

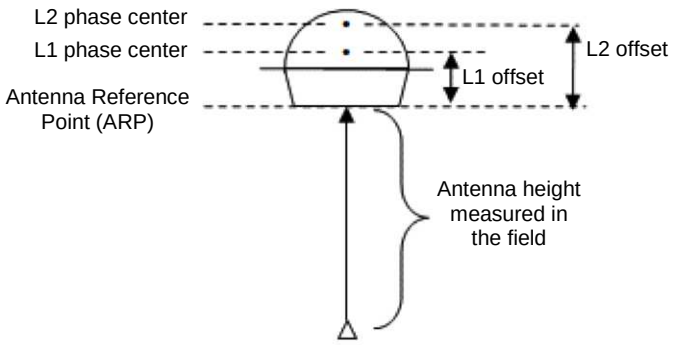
5.2 Measuring Antenna Heights

This section describes how to measure antenna heights and define the associated antenna models in different field situations to account correctly for antenna height during processing.

In all situations, if your antenna is single frequency (L1) only, enter **0** for the **L2 Offset**.

5.2.1 Vertical Height Measurement to Antenna Reference Point (ARP)

This method is used if the antenna is fixed on a permanent structure, such as a pillar, or on top of a surveying pole. The ARP is the bottom of the antenna (typical antenna setup of a permanent Base Station).



Vertical height measurement to Antenna Reference Point (ARP)

Two methods to define your model:

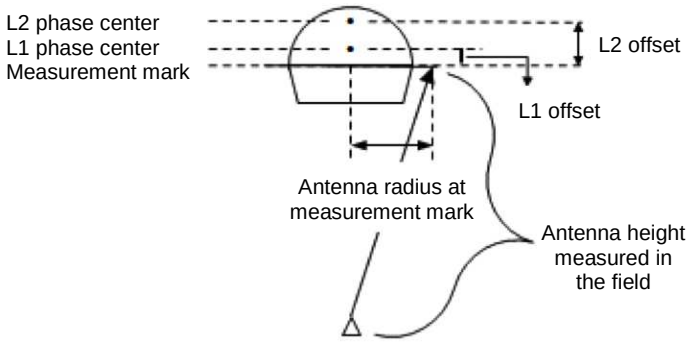
- **New:** Enter **L1 Offset** and **L2 Offset** with respect to the bottom of the antenna. Use the values provided by the manufacturer of your antenna. Set **Radius** and **ARP Offset** to **0**.
- **Import:** Import the model directly from NGS's list. Set **Radius** and **ARP Offset** to **0**.

> This case is standard with Base Station Providers. Refer to the information sheet included with your base station data, or the header of the RINEX base station observation file, for information about the antenna model to use with the base station observation file.

5.2.2 Slant Height Measurement to Measurement Mark

This method is used when it is not possible to measure height vertically to the bottom of the antenna, for instance when the antenna is on a surveying tripod. On survey grade antennas, there is a measurement mark around the circumference of the antenna, and antenna height is measured slant to this mark. When you define a radius different from zero in your antenna model, this value is automatically used to transform the slant height into vertical height.

The software's preset antenna models (*not* NGS list) were defined for slant height measurement. Their L1 and L2 vertical offsets are computed with respect to their respective measurement mark. The radius is given at the measurement mark.



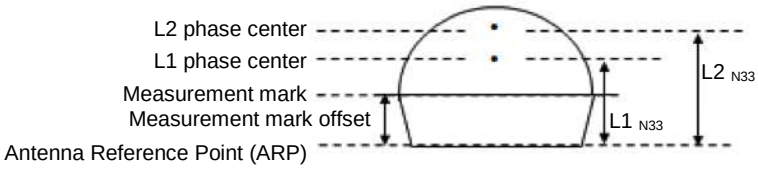
Slant height measurement to measurement mark

Two methods to define your model:

- **New…:** Enter **L1 Offset** and **L2 Offset** with respect to the measurement mark on the antenna, and enter the **Radius**. Use the values provided by the manufacturer of your antenna. If the measurement mark is at the ARP, set the **ARP Offset** to **0**.
- **Import…:** You can use the **Import** button if the measurement mark coincides with the bottom of the antenna (ARP). In this situation, the **Radius** will be the radius of the antenna at the measurement mark. Set the **ARP Offset** to **0**.

IMPORTANT: If your antenna measurement mark is not at the ARP read the following indication

- If the measurement mark is not at the antenna ARP mark, you have to input the proper offset in the **ARP Offset** input box. If the measurement mark is above the ARP, the value is positive, whereas a measurement mark under the ARP is negative.

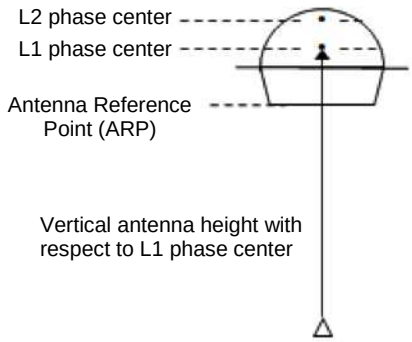


Vertical antenna height = Measure vertical height – Measurement mark offset

Antenna Measurement Mark is not at ARP Mark

5.2.3 Height Measurement Directly to L1 Phase Center

This method is used when the coordinates of a station are computed at the antenna phase center. This situation can occur with certain Base Station Providers, where their published station coordinates are at the antenna phase center. The height is computed at L1 phase center unless specified otherwise.



Height measurement directly to L1 antenna phase center

Two methods to define your model:

- **New…:** Enter a value of **0** for the **Radius** and enter the L1 Offset as a negative value for **ARP Offset**. By doing this, you bring back the antenna height at the ARP mark.
- **Import…:** import the model directly from NGS's list. As previously explained enter a value of **0** for the **Radius** and enter the L1 Offset as a negative value for **ARP Offset**. By doing this, you bring back the antenna height at the ARP mark.

5.3 Absolute versus Relative Antenna Calibration

There are currently two types of antenna calibration models that exist: relative and absolute calibration. For users seeking centimeter level accuracy, the distinction between both types of calibration is important.

Relative calibration was the first calibration method developed: all antenna phase center offsets were computed with respect to a specific type of antenna, namely the Dorne Margolin AOAD/M_T antenna.

Absolute calibration was recently adopted to be consistent with Precise Point Positioning (PPP) applications, where centimeter to decimeter level accuracy is reached without the use of a base station, and to be consistent with absolute satellite antenna phase center offsets used in PPP.

For a given antenna model, relative and absolute phase center vertical offsets can differ by a few centimeters. Since the GNSS community is evolving towards using absolute antenna calibration, NGS's absolute antenna models list was implemented in the software instead of relative models.

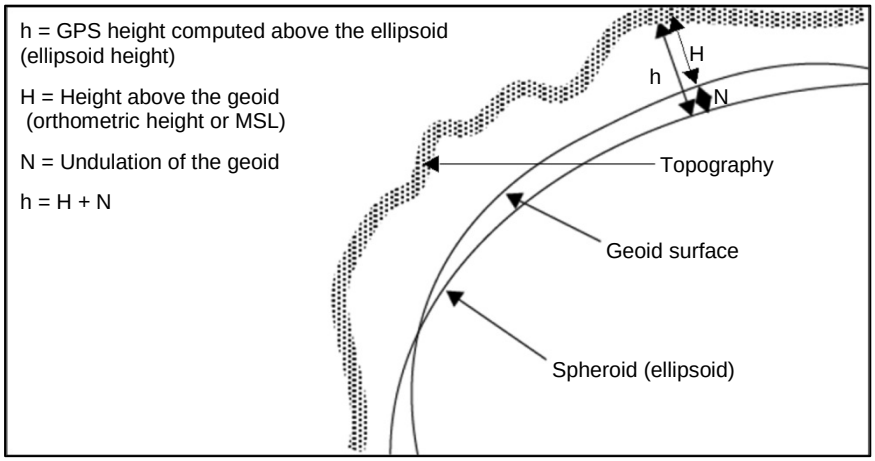
From a practical point of view, the following rules must be applied when seeking centimeter level accuracy and mixing antenna models:

- **If you are processing with a base station**, ensure that antenna models at the base and rover/static are both absolute models, or that they are both relative models. Avoid mixing absolute and relative antenna models. Keep in mind that NGS's predefined models are absolute models.
- **If you are processing in Precise Point Positioning (PPP) mode (no base station)**, ensure that the antenna model at the rover is an absolute model. PPP is using absolute model for satellite antenna phase center offset values.

6 Geoid

In GNSS positioning, heights are computed with respect to a reference ellipsoid. You must apply geoid undulation corrections if you want to reduce your GNSS heights to the mean sea level (orthometric height). These corrections are usually computed using geoid proprietary tables provided by government agencies. The software supports the following geoid models:

- NGS (USA) bin and geo files;
- NRCan (Canada) byn files;
- IGeS Text gra files;
- IGeS Text grd files;
- Surfer binary grd files;
- NASA/NIMA (USA) geo files;
- SLV (Canada) slv files;
- EGM 2008 (Little-endian) files;
- New Zealand 2009 sid files;
- Australia AUSGeoid09 txt files;

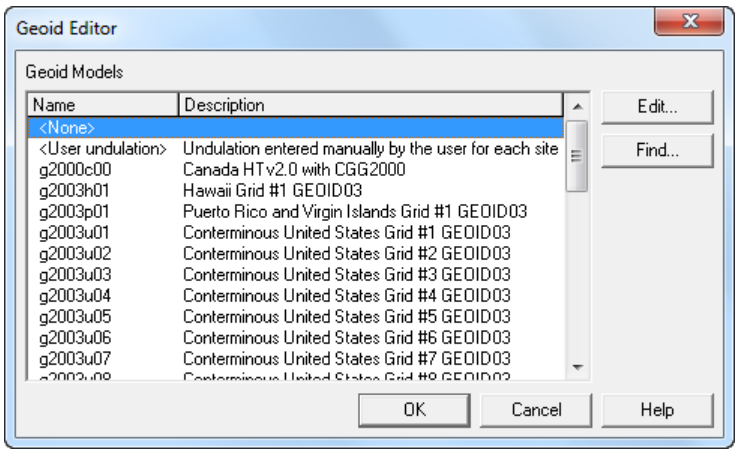


Relation between the ellipsoid and the geoid

❖ If you wish to select a geoid model other than the ones available in the software, you must communicate with the appropriate government agency and then communicate with Effigis in order to incorporate this new format in our next release. An alternative is to transform your model in the GRD text format. A description of this format is given in the GRD Text Format appendix.

6.1 Setting geoid for current project

Select **Edit > Geoid…** from the main menu. The **Geoid Editor** is displayed. It allows you to select the active geoid for your current project and to edit the list of available geoids.

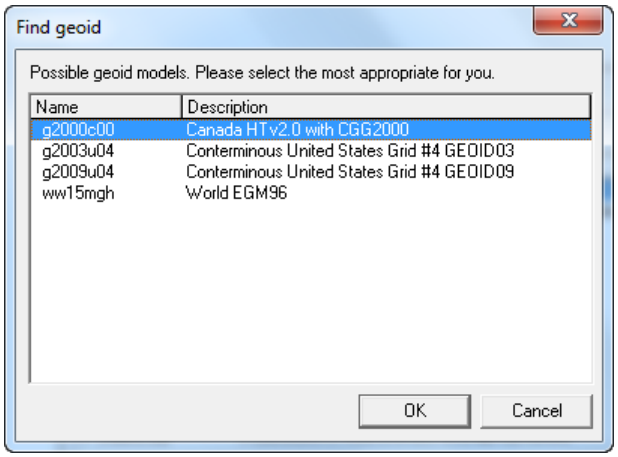


Edit – Geoid

- **Geoid Models**: The selected model will be used to reduce your ellipsoidal heights to the mean sea level.
  - **<None>**: No geoid selected. Mean Sea Level will not be available. Only Ellipsoid Height will be used.
  - **<User undulation>**: User requires all undulations to be set manually. Each site will have an undulation of zero until the user has edited it manually. This is not recommended. It is a lot easier to use an existing geoid instead.
- **Edit**: Click the **Edit…** button to open the **Geoid Manager** and edit the geoid models list.

> The geoid models list is global. This means that adding a new geoid will make it available in any project. Be careful if you remove a geoid. If you open an existing project that used a geoid that is no longer available, it will use <None> instead.

- **Find**: Using data already in the project, it will find all possible geoid models and display the result in the **Find Geoid** dialog. Select the most appropriate geoid for your area.



Find Geoid

6.2 Setting default geoid

The default **Geoid** is used for new project only. When opening an existing project, that project keeps its original geoid.

Setting the default **Geoid** is almost identical to setting the **Geoid** for the current project.

a. Close any active project using **File** > **Close**.
b. From the **Edit Default** menu, select **Geoid…**
c. Select the default geoid.
d. Click **OK**.

6.3 Geoid Manager

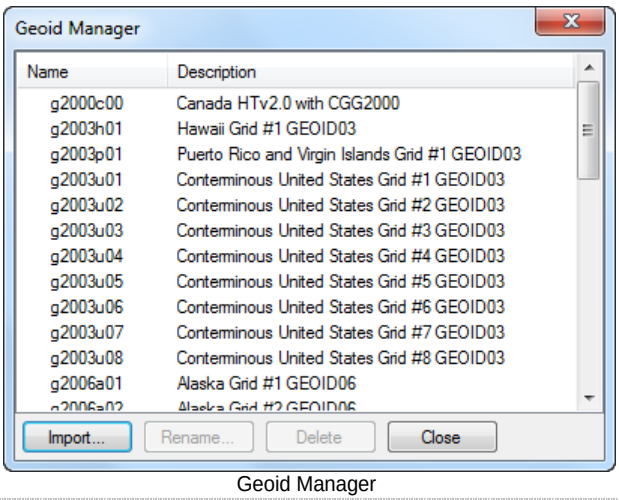
There are two ways to open the Geoid Manager:

a. From **Tools > Export > Features…** menu. Then, use the button on the right of **Models** in the **Spatial Reference** page.
b. Use the **Edit…** button from the **Edit > Geoid…** page.

6.3.1 Importing an Existing Geoid Model to the List

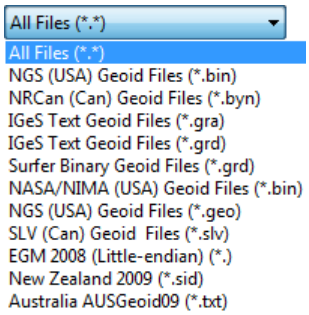
Follow these steps to import an existing geoid model to the list.

a. Open the **Geoid Manager**.



Geoid Manager

b. Click **Import…** to import a new geoid model file to the list. This opens a file selection dialog. Use the list at the bottom to filter the type of geoid file to display:



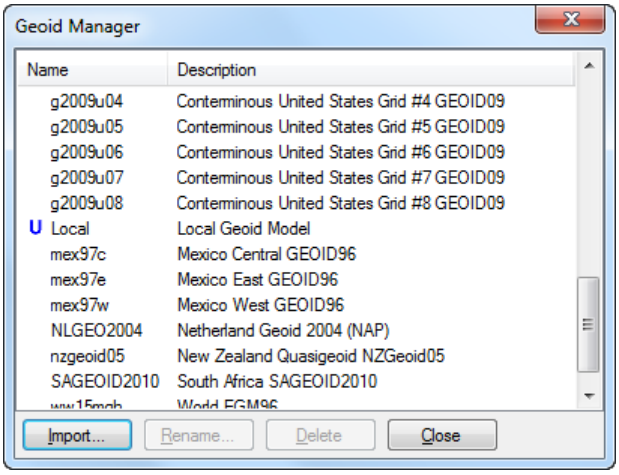
Geoid Manager – Open dialog – filter

c. Select a geoid file and click **Open**.

d. Enter a name and description for the geoid model and then click **OK**.

Import Geoid

e. This imports the new model to the list, preceded by a **U** to indicate that it is a user-defined model, rather than a preset model. Only user-defined models can be renamed and deleted.

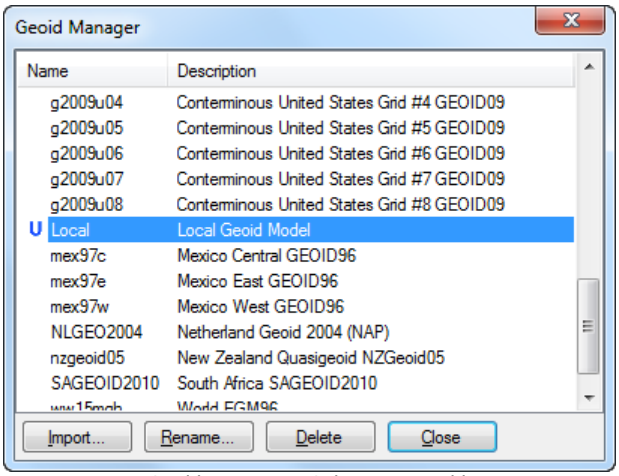


Geoid Manager – With a user geoid

6.3.2 Renaming a Geoid Model

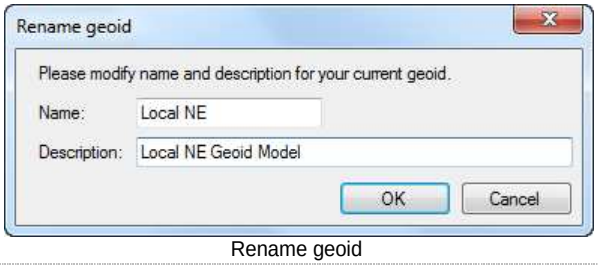
Follow these steps to rename a geoid model that you have previously imported to the list.

a. Open the **Geoid Manager**. Select a user-defined geoid model from the list (one with a **U** besides the name)



Geoid Manager – Select user geoid

b. Click **Rename**… Enter changes to the **Name** and **Description** then click **OK**.

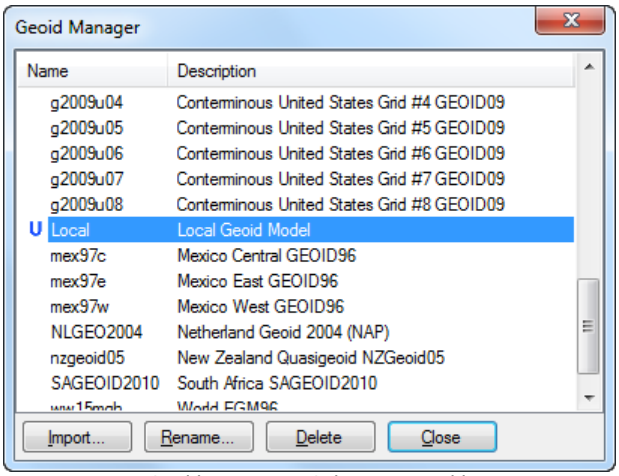


Rename geoid

6.3.3 Deleting a Geoid Model

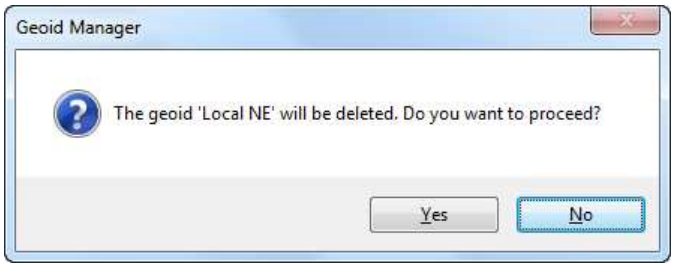
Follow these steps to delete a geoid model that you have previously imported to the list.

a. Open the **Geoid Manager**. Select a user-defined geoid model from the list (one with a **U** besides the name).



Geoid Manager – Select user geoid

b. Click **Delete.** Click **Yes** to confirm.



Geoid Manager – Delete Confirmation

6.3.4 Closing

You can close the geoid manager using the **Close** button or the on the top right.

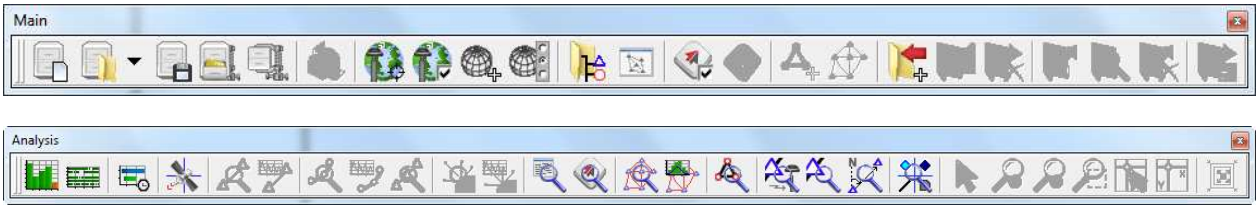
7 Views

The software allows you to look at raw data and/or results using different windows (or views). The main views supported are the following:

- Plan View;
- Graphical Analysis Views (raw data and results);
- Text Views (results);
- Project Manager.

7.1 Toolbars

The software uses two toolbar groups. These are floating toolbars that can be docked to the edge of the program window. You can resize a floating toolbar by moving the pointer over any edge until it changes to a double-headed arrow, and then drag the edge of the toolbar. You display the toolbar through **View > Toolbars** from the main menu. When you move your cursor over a toolbar button, its function is displayed.



Toolbars

7.2 Plan View

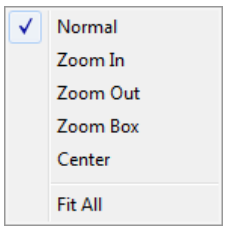
The **Plan View** is used to display field data as well as post-processed results. The **Plan View** has two components: the plan view itself to display graphically the software's data and results (sites, rovers, baselines, trajectories, PPP and loops) and a scale bar providing you with distance information.

You can display the Plan View using **View > Plan** or by clicking on the button in the **Main** toolbar.

Plan View – Status bar

- **(Left pane)**: Coordinate information (position of the cursor)
- **(Right pane)**: Mapping system used

If you right-click anywhere in the background of the Plan View, you will get a speed menu with the basic command. Right-clicking on a graphic element will display extra commands on the speed menu.



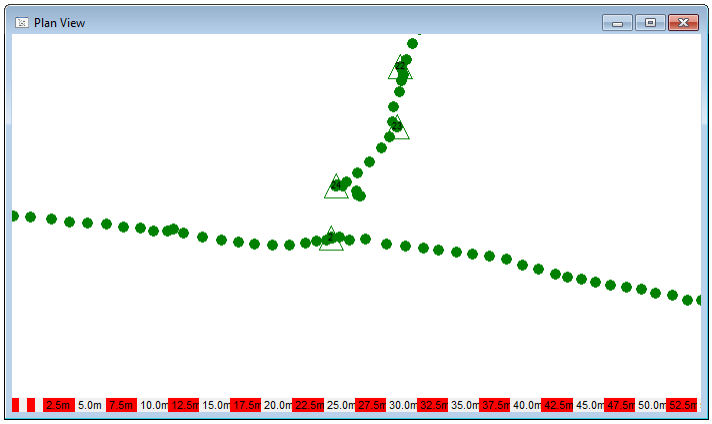
Plan View – Sites – Speed Menu

- **Normal**: Set the normal mode. See the ***Plan View Modes*** section below for more details.
- **Zoom In**: Set the Zoom in mode. See the ***Plan View Modes*** section below for more details.
- **Zoom Out**: Set the Zoom out mode. See the ***Plan View Modes*** section below for more details.
- **Zoom Box**: Set the Zoom box mode. See the ***Plan View Modes*** section below for more details.
- **Center**: Set the Center mode. See the ***Plan View Modes*** section below for more details.
- **Fit All**: Display all data at a maximum resolution in the **Plan View** window.

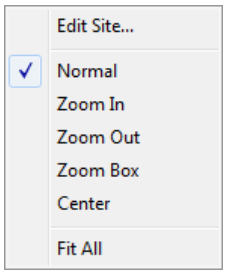
7.2.1 Site and Rover

Sites are displayed along with their site name using a user defined symbol (). If the site has been occupied more than once, its number of occupations is displayed in parenthesis below its symbol (). Sites within rover files (or trajectories) can be displayed separately from sites defined in static files (sites within rover files are referred as trajectory sites).

Rovers include several epochs (for instance, a few hours at 1 sec data interval), and the software displays the position of each epoch of the trajectory as a series of symbols (). If you did not record positions in the field (so recording only raw GNSS data), the software will compute a position at epoch of the raw GNSS data file in order to display rover epoch positions.

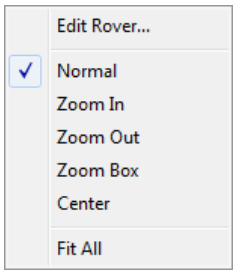


Plan View with sites and a rover



Plan View – Site – Speed Menu

- **Edit Sites…**: Display the **Site Editor**.

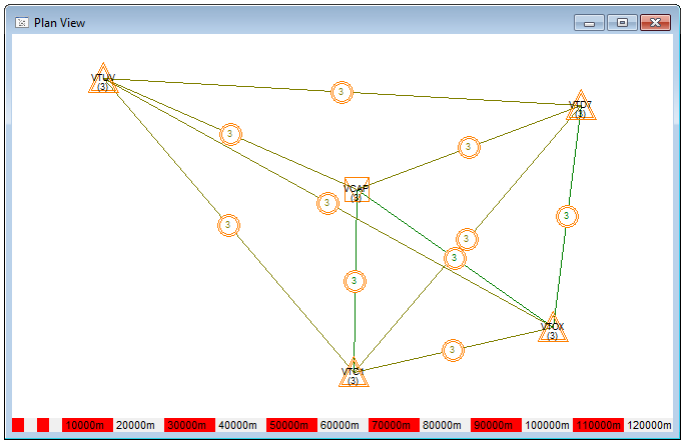


Plan View – Rover – Speed Menu

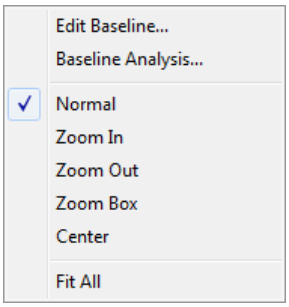
- **Edit Rover…**: Display the **Rover Editor**.

7.2.2 Baseline and Trajectory

Baselines are displayed as solid lines connecting two site symbols through their centers. If a baseline has more than one occupation, the number of occupations is displayed in the center of the line, encircled ( ).



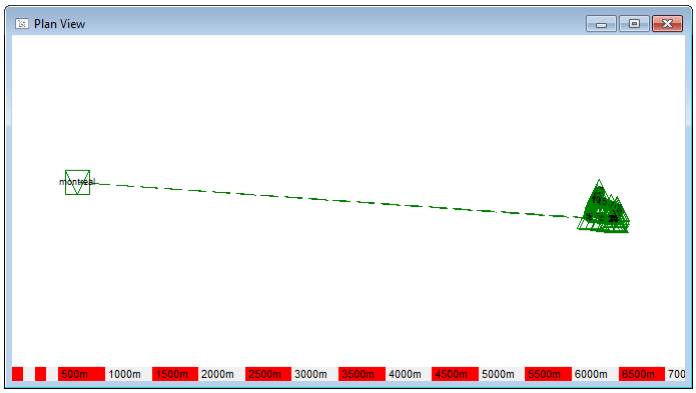
Plan View with baselines



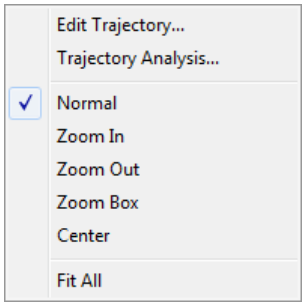
Plan View – Baselines – Speed Menu

- **Edit Baseline…**: Display the **Baseline Editor**.
- **Baseline Analysis**…: Display the **Baseline Summary**.

A trajectory is displayed as dashed lines connecting its base site (reference station) when the trajectory is processed. Additionally, as opposed to a rover, each position of the file is connected. As you will notice, usually rover paths are more or less accurate since epoch files are from point positioning results. When you generate a trajectory, you connect the rover points. After processing trajectories, the epoch file is updated with the trajectory results (you will notice the benefit of processing a trajectory).



Plan View with trajectory

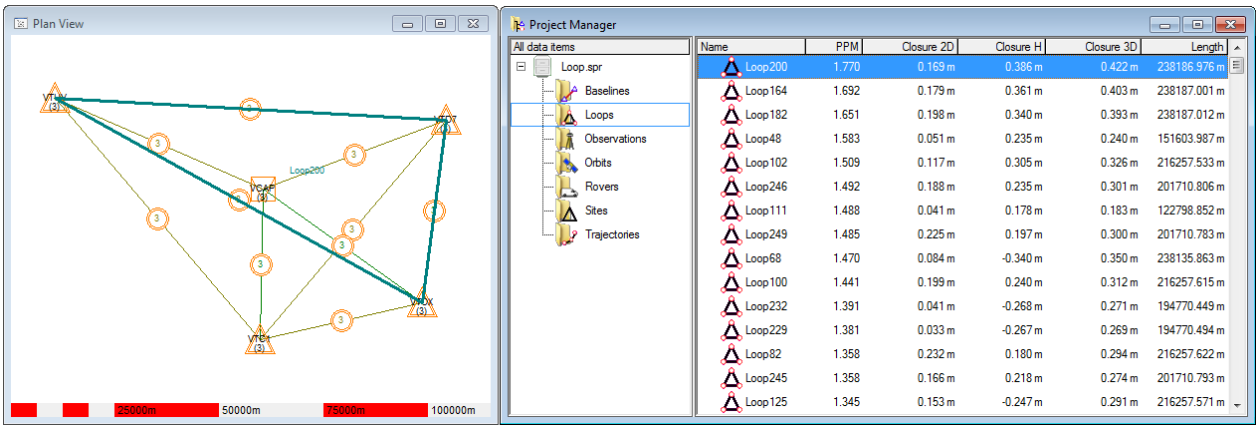


Plan View – Trajectory – Speed Menu

- **Edit Trajectory…**: Display the **Trajectory Editor**.
- **Trajectory Analysis**…: Display the **Trajectory Summary**.

7.2.3 Loops

When the plan view and the project manager are opened simultaneously, you can select a loop in the project manager and that loop is displayed in the **Plan View** along with its loop name.



Plan View with current loop highlighted

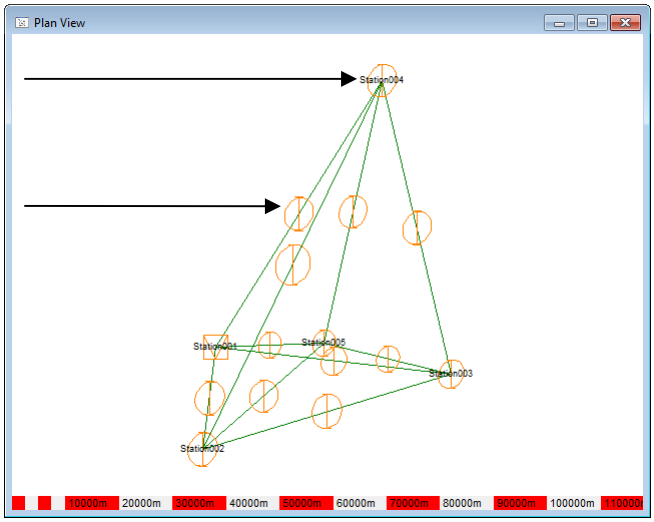
7.2.4 Network error ellipses

Error ellipses are the result of a network adjustment. These ellipses (for sites and vectors) are displayed in the **Plan View** window.

The size of these ellipses gives you an indication of the quality of your network adjustment. When an ellipse seems to be too big, you can refer to the analysis window (text) in order to determine the cause of this problem.

Site error ellipse

Vector error ellipse



Plan View with ellipses

The ellipses are always shown in two dimensions, exactly like a confidence region type of 2D + 1D.

7.2.5 Site Ellipse

This ellipse is shown for a site when a network adjustment has been done, if this ellipse is big enough to be shown and if the **Site ellipses** option is selected in the **Network** page of the **Tools > Options** dialog box.

If the ellipse is not big enough to be shown, the usual site symbol is displayed. However, its color is changed to orange and the symbol itself is doubled (

).

7.2.6 Vector Ellipse

This ellipse is shown only if the network adjustment has been done, if this ellipse is large enough to be shown and if the **Vector ellipses** are selected in the **Network** page of the **Tools > Options** dialog box.

Note that the ellipse is placed in the middle of the vector.

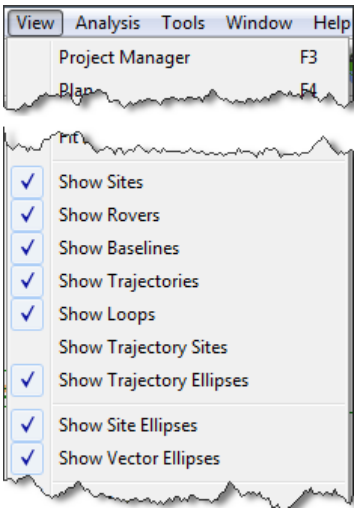
7.2.7 Ellipses for trajectory positions

The error ellipse associated to the position of each epoch of the rover will be displayed on the **Plan View** if the **Trajectory Ellipses** Toggle is checked in the **Plan View** page of the **Tools > Options** dialog box. When unchecked, the rover symbol will be displayed instead of the ellipse.

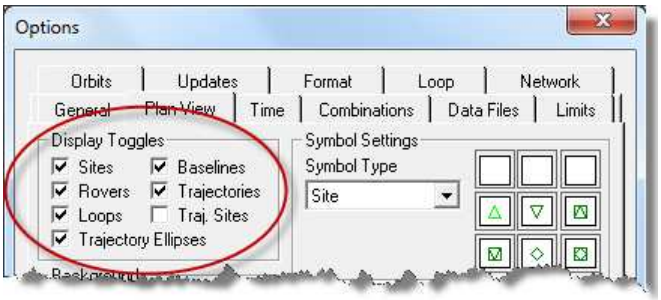
The ellipse is calculated in 3D (but displayed in 2D + 1D) using the variance-covariance matrix for the current position and the confidence level.

7.2.8 Toggling data/results On/Off from the Plan View

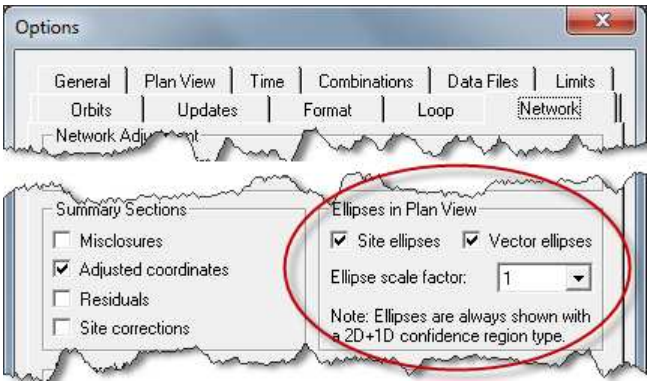
All data and/or results that can be displayed in the **Plan View** can be toggled On/Off using the **View** menu. Under this menu you will be able to toggle On/Off all data/results (sites, rovers, baselines, trajectories, loops, trajectory sites, trajectory ellipses, sites ellipses, vectors ellipses). You will notice some dependencies in the view: for example, if rovers are toggled off, trajectories are disabled from the menu (you need rovers to display trajectories). These settings are also available in the **Plan View** and **Network** pages of the **Tools > Options** dialog box.



View Menu – Data/Result (In Differential Positioning Mode)

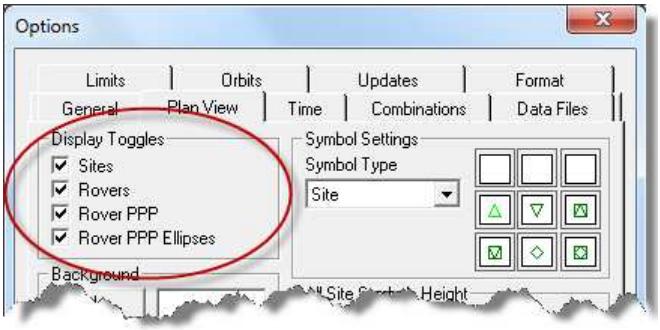


Options – Plan View – Display Toggles (In Differential Positioning Mode)



Options – Network – Site/Vector Ellipses (In Differential Positioning Mode)

View Menu – Data/Result (In Precise Point Positioning Mode)



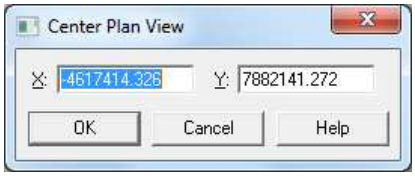
Options – Plan View – Display Toggles (In Precise Point Positioning Mode)

7.2.9 Plan View Modes

These different modes are used to navigate through the **Plan View**. Each mode has its own cursor. The supported modes are the following:

Button	Cursor	Name	Details
		Normal	It is the standard mode. When you are in a normal mode, you can double-click an object and a dialog box will be displayed allowing you to do an action on this specific object.
		Zoom In	It is used to zoom in an area. When you zoom in, you see less area but you see it in more details.
		Zoom Out	To zoom out an area. When you zoom out, you see a larger area with fewer details.
		Zoom Box	It is used to magnify a specific area. Position the pointer to the left of the area in which you wish to zoom and click and hold down the left mouse button. Drag the pointer across the area that you wish to zoom. A border is displayed over the selected area. Release the mouse button. The selected area is centered and expanded in the **Plan View** window at a maximum zoom factor.
		Fit all	It is used to display all data at a maximum resolution in the **Plan View** window.
		Center	It is used to center your view on a selected point (no scale change).
		Center XY	It is used to center your view around a selected point entered using the keyboard.

All these cursor modes can be set by the **View** menu or by the speed menu while the cursor is over the **Plan View** (except for **Center XY** mode that is not available from the speed menu) or by buttons in the **Analysis** toolbar.



Center Plan View

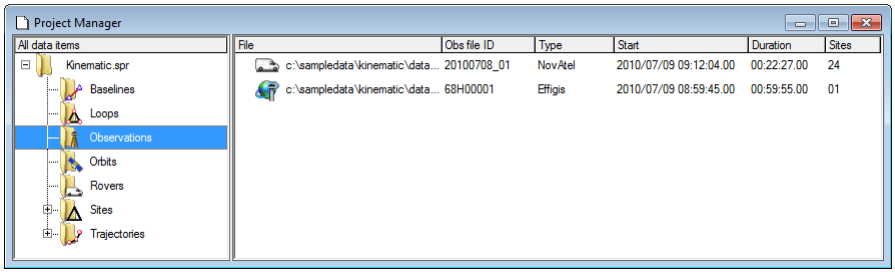
7.3 Project Manager

The **Project Manager** is accessed by selecting **View > Project Manager** from the main menu. It is a tool to control the software without the help of the main menu. All operations can be done through the Project Manager. The project manager concept is similar to the one used by Windows Explorer. We assume that users are familiar with Windows Explorer.

You can display the Project Manager using **View > Project Manager** or by clicking on the button in the **Main** toolbar.

The Project Manager window consists of two panes:

- **Selector**: located on the left side of the Project Manager window, it consists of a single-column tree view which displays all available files (observation and orbit files) and objects (primitive and derived) in the project. These data folders are located under the **All data items** heading. Clicking on a data folder causes it to expand, displaying all related data items, underneath the data folder.
- **Viewer**: located on the right side of the Project Manager window, it displays the data associated with the item selected on the **Selector**.



Project Manager

Data items can be sorted alphabetically in both ascending and descending order. To reverse the order, click the Data items heading.

If the column titles are truncated, you can expand them by moving the pointer over the border separating one title from the next. You will notice that the pointer changes shape. Click and hold down the left mouse button while dragging the border to adjust size. Release the button when the title is of the desired length.

There is a group of buttons in the **Main** toolbar that are reserved for the **Project Manager**:

Project Manager buttons in the Main Toolbar

The toolbar buttons are the following:

Add a new item.

Display selected item's properties.

Delete the selected items.

Process the selected items.

Analyze the selected items.

Delete results of the selected items.

Export selected items.

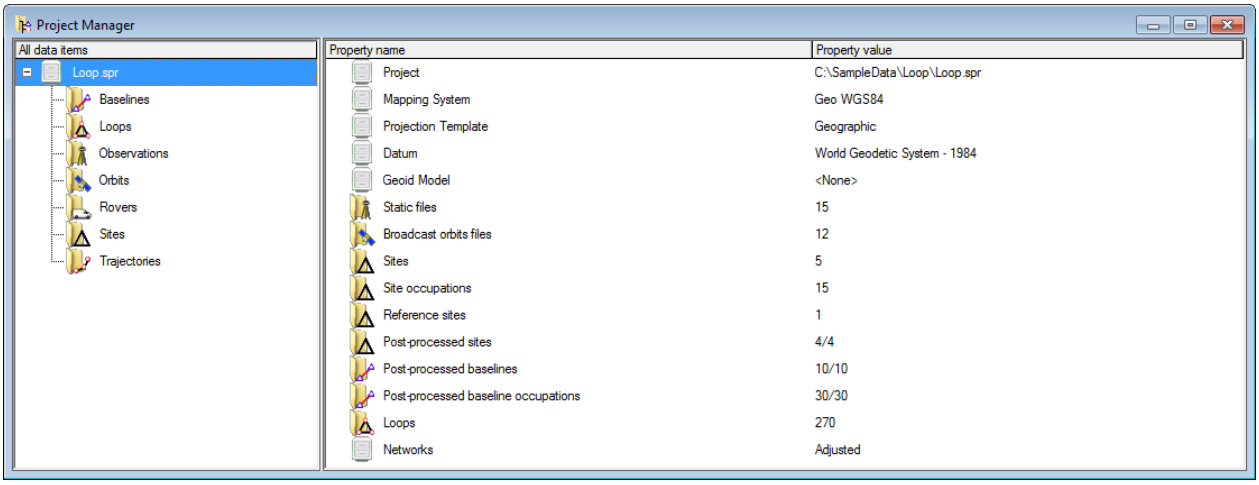
Deleting results is basically putting a baseline, trajectory or PPP back to the unprocessed state. This is very useful in **Network Adjustment** to ignore contribution of a vector that produces undesired results.

In the following section, we present the content of each data item.

7.3.1 Project Folder

The Project folder is a summary of your project.

- **Property name**: a symbol indicating where the property comes from and a name;
- **Property value**: the value associated with that property;



Project Manager – Project

The five properties at the beginning are fixed properties.

All the other properties depend on the content of the project.

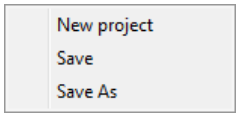
Properties starting with the symbol use information not found in any folder of the **Project Manager**.

Properties starting with any other symbol get its information from the folder with the corresponding symbol. For instance, the property starting with comes from the **Orbits** folder.

For each property with a folder symbol, you will find the same information in the status bar of that folder.

Project Manager – Project – Status bar

- **(Left pane)**:Always empty
- **(Right pane)**: Always empty



Project Manager – Project – Speed menu

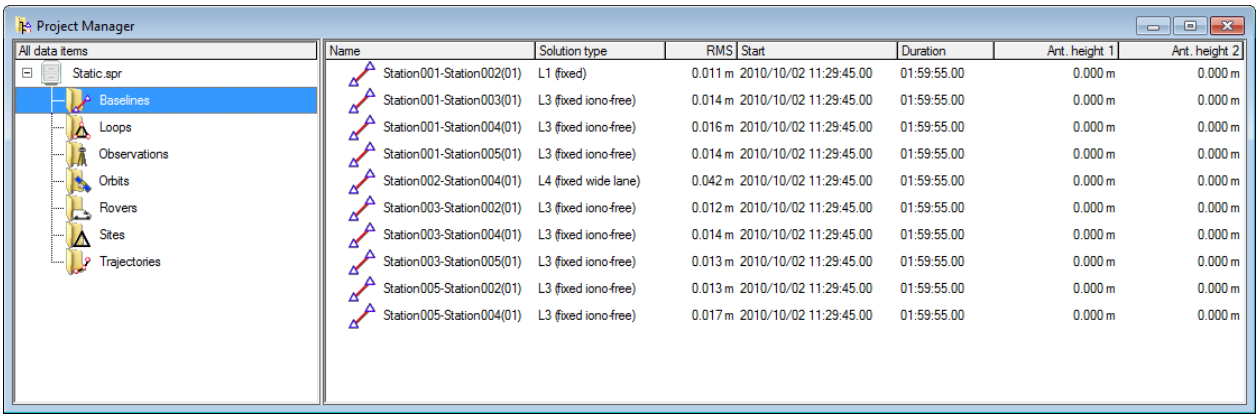
- **New project**: Close the current project and start a new project. This is equivalent to **File > New**.
- **Save**: Save project. This is equivalent to **File > Save**.
- **Save As**: Save project under a new name. This is equivalent to **File > Save As**.

7.3.2 Baselines Folder

IMPORTANT: Baselines Folder is only available when working in Differential Positioning mode.

The **Baselines** folder is used to display all generated baselines within your project.

- **Name**: a symbol indicating a baseline along its name and occupation number;
- **Solution Type**: the solution type computed by the software;
- **RMS**: the root mean square of the computed solution;
- **Start**: the start time of the baseline;
- **Duration**: the time span of the baseline;
- **Ant. height 1**: the reduced antenna height for the fixed station;
- **Ant. height 2**: the reduced antenna height for the remote station;

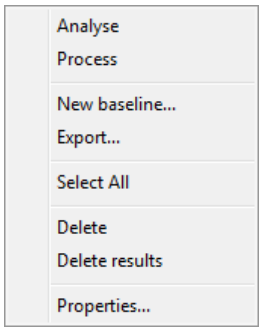


Project Manager – Baselines

You will notice that when you select the **Baselines** folder, a new menu item **Baselines** is available from the main menu allowing you to perform some operations on your baseline data. These operations are also available from a speed menu while your cursor is over the viewer pane. The **Main** toolbar offers you shortcuts to some of these functions.

Project Manager – Baselines – Status bar

- **(Left pane)**:Number of post-processed baseline occupations
- **(Right pane)**: Number of post-processed baselines

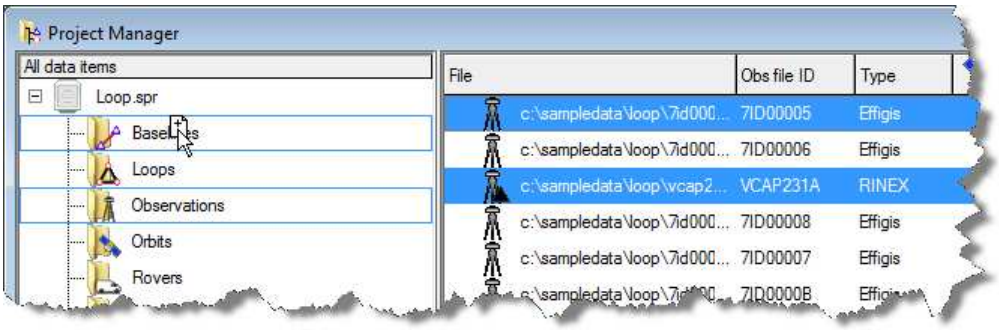


Project Manager – Baselines – Speed menu

- **/ Analyse**: Display the **Baseline Summary**.
- **/ Process**: Process the selected baselines.
- **/ New baseline…**: Display the **New Baseline Occupation**.
- **/ Export…**: Display the **Baseline Export**.
- **Select All**: Select all baselines.
- **/ Delete**: Delete the selected baselines after confirmation.
- **/ Delete results**: Delete results of the selected baselines after confirmation.
- **/ Properties… / (double click)**: Display the **Baseline Editor** for the selected baseline.

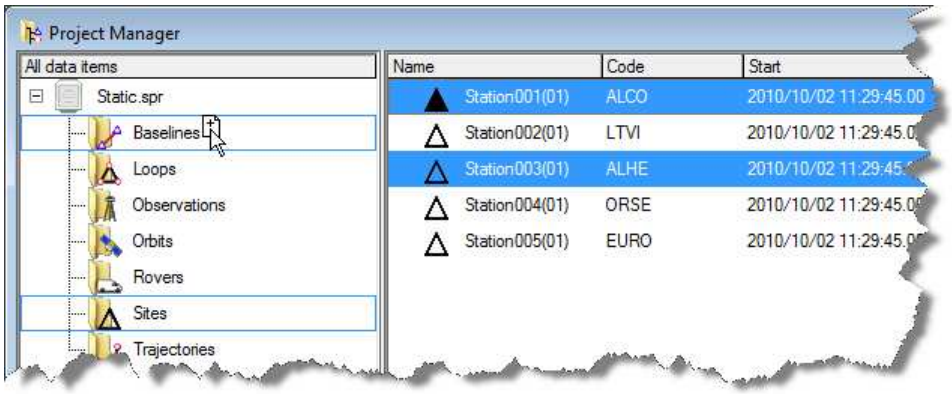
■ Drag and drop

- You can generate new baselines by selecting two or more statics (or bases) in the **Observations** folder and then dragging and dropping them over the **Baselines**. This will generate all combinations possible with the subset of files you selected.



Project Manager – Creating baselines with drag and drop from Observations

- You can generate new baselines by selecting two or more sites in the **Sites** folder and then dragging and dropping them over the **Baselines**. This will generate all combinations possible with the subset of sites you selected.



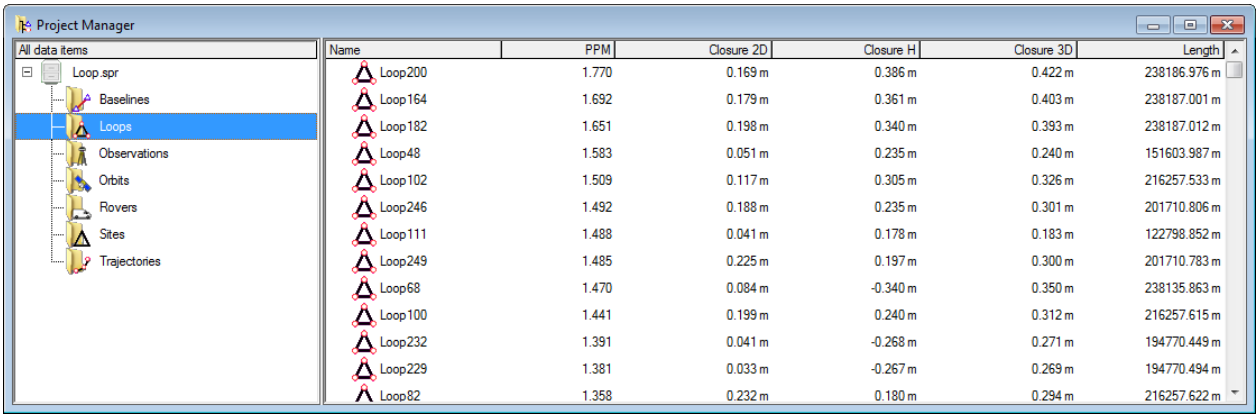
Project Manager – Creating baselines with drag and drop from Sites

7.3.3 Loops Folder

IMPORTANT: Loops Folder is only available when working in **Differential Positioning** mode.

The **Loops** folder is used to display loop closure information. This information includes:

- **Name:** the loop symbol and name;
  - Indicating a closed loop
  - Indicating an opened loop
- **PPM:** The loop closure ppm (part per million) with respect to the total length of the loop;
- **Closure 2D**: the closure of the loop in planimetry;
- **Closure H**: the closure of the loop in altimetry;
- **Closure 3D**: the closure of the loop using both planimetry and altimetry;
- **Length**: the length of the loop;



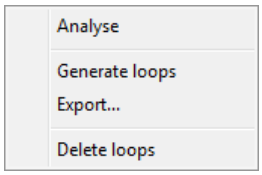
Name	PPM	Closure 2D	Closure H	Closure 3D	Length
Loop200	1.770	0.169 m	0.386 m	0.422 m	238186.976 m
Loop164	1.692	0.179 m	0.361 m	0.403 m	238187.001 m
Loop182	1.651	0.198 m	0.340 m	0.393 m	238187.012 m
Loop48	1.583	0.051 m	0.235 m	0.240 m	151603.987 m
Loop102	1.509	0.117 m	0.305 m	0.326 m	216257.533 m
Loop246	1.492	0.188 m	0.235 m	0.301 m	201710.806 m
Loop111	1.488	0.041 m	0.178 m	0.183 m	122798.852 m
Loop249	1.485	0.225 m	0.197 m	0.300 m	201710.783 m
Loop68	1.470	0.084 m	-0.340 m	0.350 m	238135.863 m
Loop100	1.441	0.199 m	0.240 m	0.312 m	216257.615 m
Loop232	1.391	0.041 m	-0.268 m	0.271 m	194770.449 m
Loop229	1.381	0.033 m	-0.267 m	0.269 m	194770.494 m
Loop82	1.358	0.232 m	0.180 m	0.294 m	216257.622 m

Project Manager – Loops

You will notice that when you select the **Loops** folder, a new menu item **Loops** is available from the main menu allowing you to perform some operations on your Loop data. These operations are also available from a speed menu while your cursor is over the viewer pane. The **Main** toolbar offers you shortcuts to some of these functions.

Project Manager – Loops – Status bar

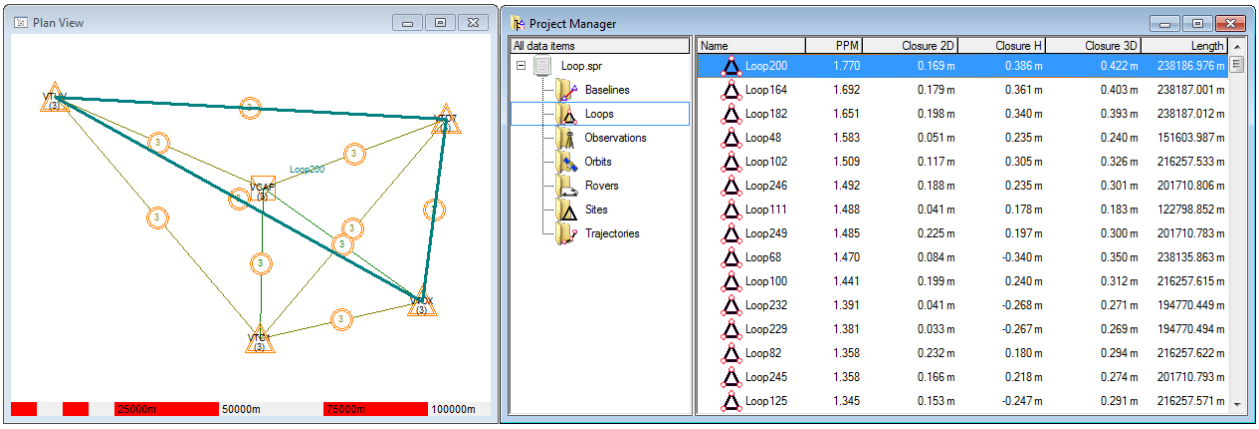
- **(Left pane)**: Either the number of loops or the percentage of failed loops (if any **Failure Criteria** is active)
- **(Right pane)**: Empty or the number of loops (when not shown in the left pane).



Project Manager – Loops – Speed menu

- **/ Analyse / (double click)**: Display the **Loop Summary** Analysis.
- **/ Generate loops**: This will remove any existing loops and generate new loops automatically based on the setting in **Tools > Options > Loop**.
- **/ Export…**: Display the **Loop Export**.
- **/ Delete loops**: This will remove any existing loops.

When the plan view and the project manager are opened simultaneously, you can select a loop in the project manager and that loop is displayed in the **Plan View** along with its loop name.



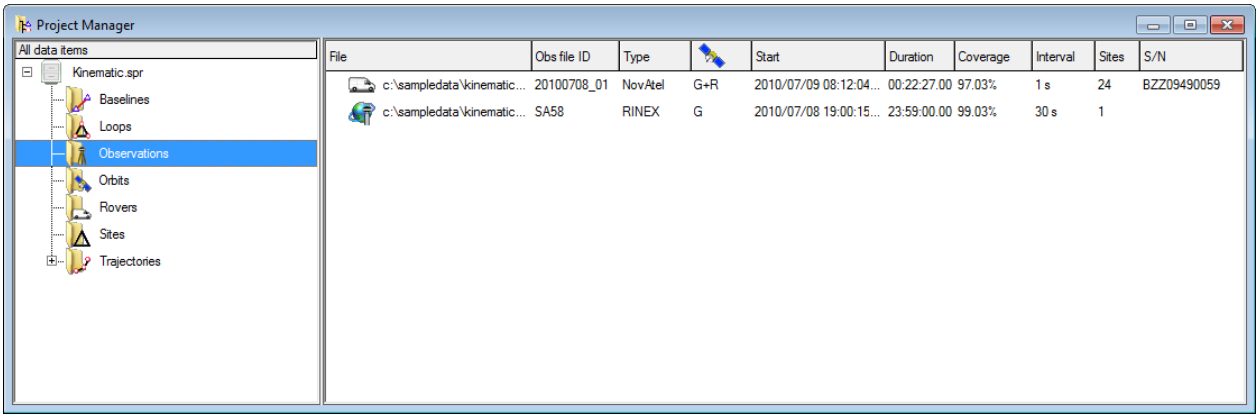
Plan View with current loop highlighted

7.3.4 Observations Folder

The **Observations** folder is used to display information about all observation files imported into your project. Observation files are listed in the viewer pane along with the following information:

- **File**: the file status symbol (can be changed by selecting a file and using the speed menu) and the file name along with its complete path:
  - o indicates a static;

  - indicates a static used as reference;
  - indicates a rover;
  - indicates a semi-kinematic;
  - indicates a base;
- **Obs file ID**: the observation file identifier;
- **Type**: the type of data in observation file (RINEX for example);
- : The list of constellations present in the file.
  - **G**: **GPS**;
  - **R**: **GLONASS**;
  - **E**: **Galileo**;
  - **C**: **BeiDou**
- **Start**: the start time of the file;
- **Duration**: the duration of the file;
- **Coverage**: the percentage of epochs found. Anything less than 100% means there are some holes in your data. Use **Analysis > Raw Observations** views to see where these holes are.
- **Interval**: the recording interval in seconds.
- **Sites**: number of site occupation within the file (one for static/base, and could be many for rover files);
- **S/N**: the serial number of the receiver used to collect data (when known).



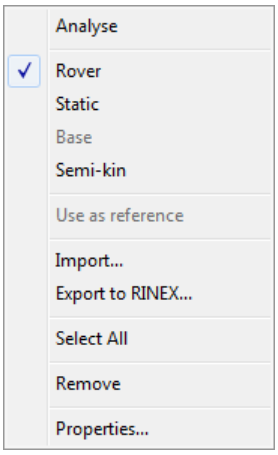
Project Manager – Observations

You will notice that, when you select the **Observations** folder, a new menu item **Observations** is available from the main menu allowing you to perform some operations on your observation files. These operations are also available from a speed menu while your cursor is over the viewer pane. The **Main** toolbar offers you shortcuts to some of these functions.

Project Manager – Observations – Status bar

- **(Left pane)**: Number of observations files
- **(Right pane)**: The number of files in the each of the following category:

- Rover files
- Semi-kin files
- Base station provider files
- Static files



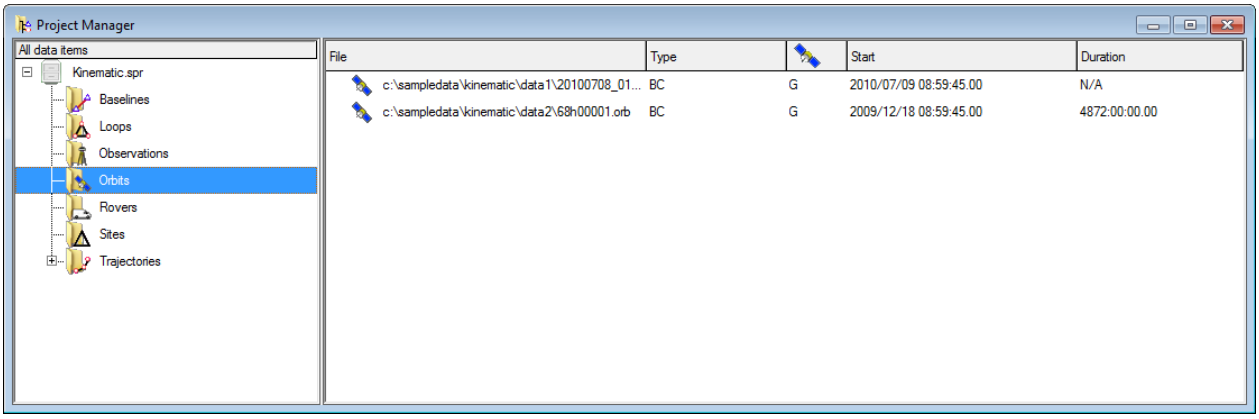
Project Manager – Observations – Speed menu

- **/ Analyse / (double click)**: Display the **Raw Observations > Observed Satellites**.
- **Rover**: Checked when selected items are rovers. It will switch all selected observations files to rover.
- **Static**: Checked when selected items are statics. It will switch all selected observations files to static.
- **Base**: Checked when selected items are bases. We cannot switch to or from a base. Bases are imported in the project from base providers.
- **Semi-kin**: Checked when selected items are semi-kinematics. It will switch all selected observations files to semi-kinematic.
- **Use as reference**: For bases, it always checked and disabled. For static, it activates or deactivates the **Use as reference coordinate** options. When it is activated, it will open the **Site Editor** to confirm the static coordinate.
- **/ Import…**: Add new observations files in the project.
- **/ Export to RINEX…**: Display the **GNSS Data Converter to RINEX**.
- **Select All**: Select all observations.
- **/ Remove**: Remove the selected observations after confirmation.
- **/ Properties…**: Display the **Rover Editor** for the selected rover.

7.3.5 Orbits Folder

The **Orbits** folder is used to display information about all orbit files imported in your project. Orbit files are listed in the viewer pane along with the following information:

- **File**: the symbol indicating an orbit file and the file name along with its complete path;
- **Type**: the orbit file type which could be:
  - **BC** for broadcast orbits.
  - **SP3** for precise orbits. An **SP3** will also display the quality within parenthesis:
    - **Final**: best quality – Typically available after two weeks.
    - **Rapid**: medium quality – Typically available after a week.
    - **Ultra**: low quality – Typically available after few days.
  - **CLK** for precise clocks. A **CLK** will also display the frequency in minutes or in seconds within parenthesis.
- : The list of constellations present in the file.
  - **G**: **GPS**;
  - **R**: **GLONASS**;
  - **E**: **Galileo**;
  - **C**: **BeiDou**
- **Start**: the start time of the file;
- **Duration**: the duration of the file (orbital arc time span);

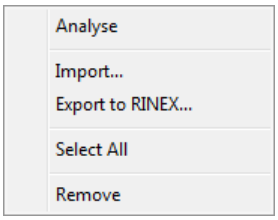


Project Manager – Orbits

You will notice that when you select the **Orbits** folder, a new menu item **Orbits** is available from the main menu allowing you to perform some operations on your orbit files. These operations are also available from a speed menu while your cursor is over the viewer pane. The **Main** toolbar offers you shortcuts to some of these functions.

Project Manager – Orbits – Status bar

- **(Left pane)**: Number of orbits files
- **(Right pane)**: The number of files in the each of the following category:
  - Broadcast orbits files
  - Precise orbits files
  - Imported IGS broadcast orbits files



Project Manager – Orbits – Speed menu

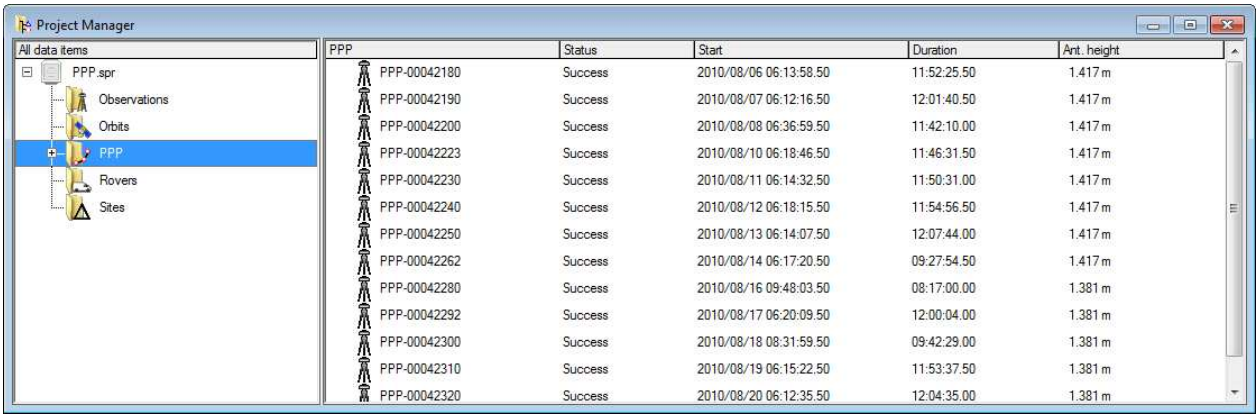
- **/ Analyse / (double click)**: Display the **Precise Orbits Summary**.
- **/ Import…**: Add new orbits files in the project.
- **/ Export to RINEX…**: Display the **GNSS Data Converter to RINEX**.
- **Select All**: Select all orbits.
- **/ Remove**: Remove the selected orbits after confirmation.

7.3.6 PPP Folder

IMPORTANT: PPP Folder is only available when working in **Precise Point Positioning (PPP)** mode.

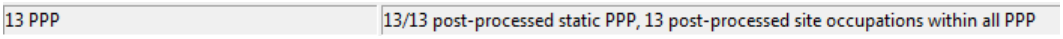
The **PPP** folder is used to display basic information about all PPP results related to your project. PPP are listed in the viewer pane along with the following information:

- **PPP**: the symbol and the PPP name;
  - indicates a rover PPP;
  - indicates a static PPP;
- **Status** : Indicate the post-processing status:
  - **(empty)**: unprocessed.
  - **Success**: post-processing is successful.
  - **Failure**: PPP could not be post-processed. For more information, display the PPP Summary.
  - **Canceled**: The user has canceled the last-processing.
  - **Warning**: The processing is successful but there are some warnings. For more information, display the PPP Summary.
- **Start**: the start time of the PPP results;
- **Duration**: the time span of the PPP results;
- **Ant. height**: the reduced antenna height to be used in the computation;



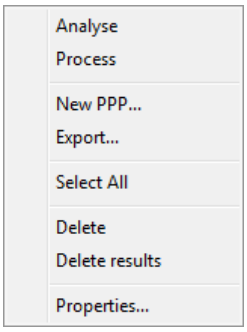
Project Manager – PPP

You will notice that when you select the **PPP** folder, a new menu item **PPP** is available from the main menu allowing you to perform some operations on your PPP data. These operations are also available from a speed menu while your cursor is over the viewer pane. The **Main** toolbar offers you shortcuts to some of these functions.



Project Manager – PPP – Status bar

- **(Left pane)**: Number of PPP
- **(Right pane)**: The number of PPP in the each of the following category:
  - post-processed static PPP
  - post-processed rover PPP
  - post-processed site occupations within all PPP



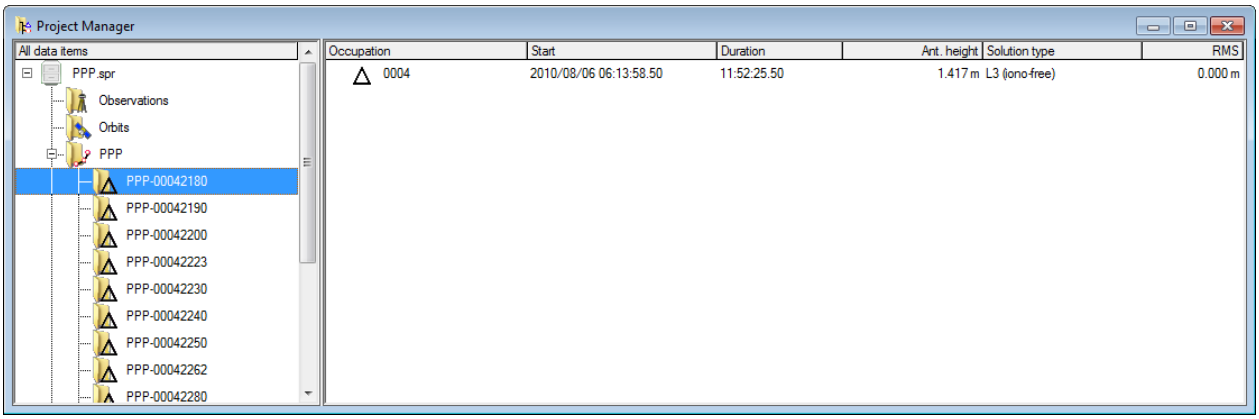
Project Manager – PPP – Speed menu

- **/ Analyse**: Display the **PPP Summary**.
- **/ Process**: Process the selected PPP.
- **/ New PPP…**: Display the **New PPP**.
- **/ Export…**: Display the **Rover PPP Export**.
- **Select All**: Select all PPP.

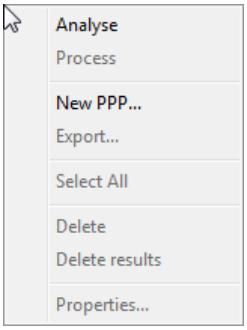
- **/ Delete**: Delete the selected PPP after confirmation.
- **/ Delete results**: Delete results of the selected PPP after confirmation.
- **/ Properties… / (double click)**: Display the **PPP Editor** for the selected PPP.

When selecting a specific PPP on the selector pane, the viewer pane will contains PPP sites information. PPP sites are only available once a PPP is post-processed and when the PPP actually contains sites.

- **Occupation**: the symbol △ indicating a site along its name and its occupation number;
- **Start:** the start time of the site occupation;
- **Duration:** the time span of the site occupation;
- **Ant. height**: the reduced antenna height to be used in the computation;
- **Solution type**: the solution type of the PPP site occupation;
- **RMS**: the root mean square of the PPP site occupation;



Project Manager – PPP sites



Project Manager – PPP sites – Speed menu

- **/ Analyse / (double click)**: Display the **PPP Summary**.
- **/ New PPP…**: Display the **New PPP**.

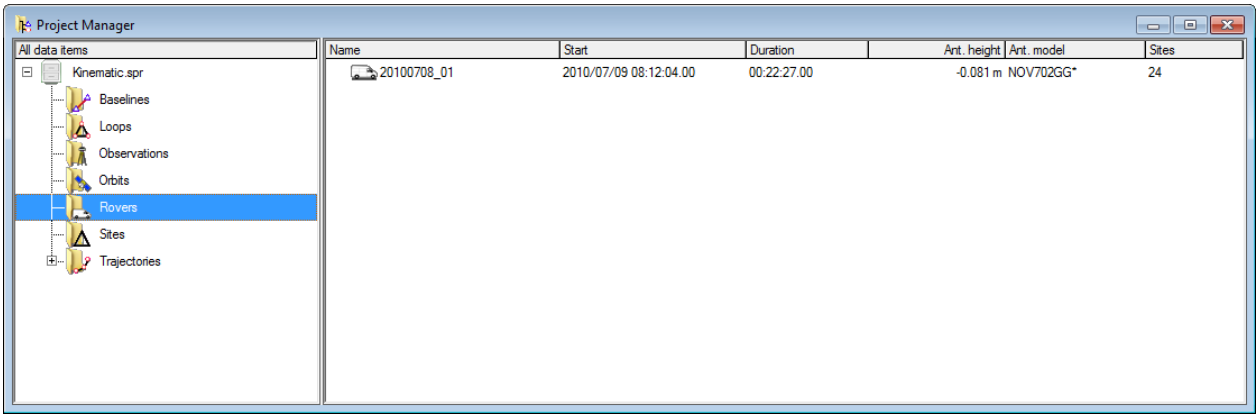
Project Manager – PPP sites – Status bar

- **(Left pane)**: Number of post-processed sites.
- **(Right pane)**: Always empty

7.3.7 Rovers Folder

The **Rovers** folder is used to display basic information about all rovers related to your project. Rover files are listed in the viewer pane along with the following information:

- **Name**: the file status symbol and the rover file name
  - o indicates a rover;
  - o indicates a semi-kinematic;
- **Start**: the start time of the rover file;
- **Duration**: the time span of the rover file;
- **Ant. height**: the reduced antenna height to be used in the computation;
- **Ant. model**: the antenna model used;
- **Sites**: the number of site occupations in the rover file;

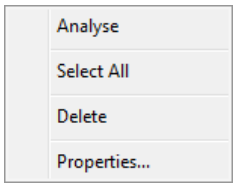


Project Manager – Rovers

You will notice that when you select the **Rovers** folder, a new menu item **Rovers** is available from the main menu allowing you to perform some operations on your rover data. These operations are also available from a speed menu while your cursor is over the viewer pane. The **Main** toolbar offers you shortcuts to some of these functions.

Project Manager – Rovers – Status bar

- **(Left pane)**: Number of rovers.
- **(Right pane)**: Always empty



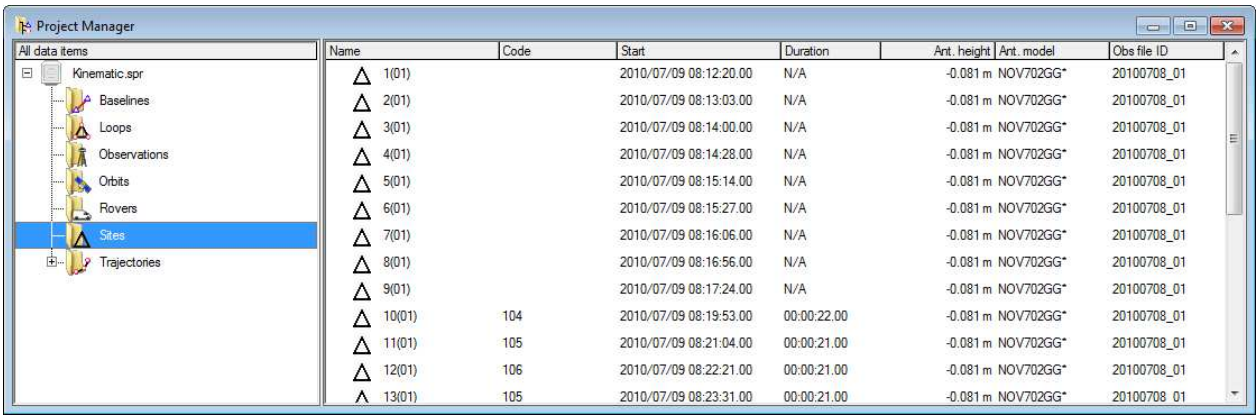
Project Manager – Rovers – Speed menu

- **/ Analyse**: Display the **Raw Observations > Observed Satellites**.
- **Select All**: Select all rovers.
- **/ Delete**: Remove the selected rovers after confirmation.
- **/ Properties… / (double click)**: Display the **Rover Editor**.

7.3.8 Sites Folder

The **Sites** folder is used to display basic information about all sites related to your project. Sites are represented with a folder along its site name. Underneath the site folder, all occupations are displayed along with the following information:

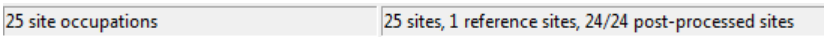
- **Name**: A symbol along with its name and occupation number;
  - ▲: Indicates a reference site.
  - △: Indicates a non-reference site.
- **Code**: the site code (if any);
- **Start:** the start time of the occupation;
- **Duration:** the time span of the occupation;
- **Ant. height**: the reduced antenna height to be used in the computation;
- **Ant. Model**: the antenna model for the related rover or static file;
- **Obs file ID**: the file ID for the related rover or static file;



Project Manager – Sites

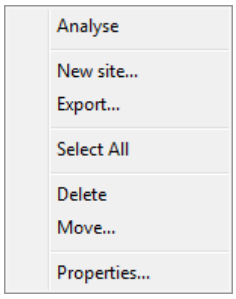
You will notice that when you select the **Sites** folder, a new menu item **Sites** is available from the main menu allowing you to perform some operations on your site data. These operations are also available

from a speed menu while your cursor is over the viewer pane. The **Main** toolbar offers you shortcuts to some of these functions.



Project Manager – Sites – Status bar

- **(Left pane)**: Number of site occupations.
- **(Right pane)**: The number of sites in the each of the following category:
  - Sites
  - Reference sites
  - Post-processed sites

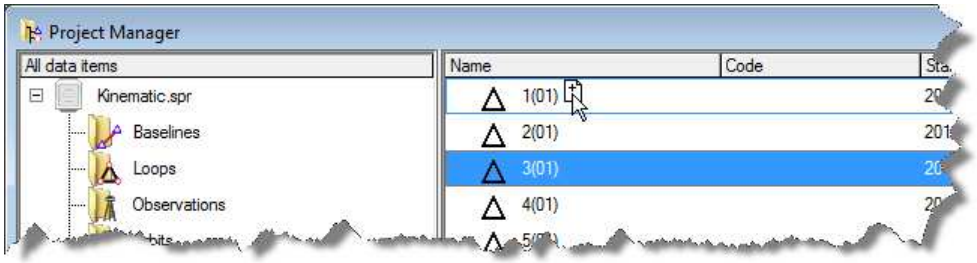


Project Manager – Sites – Speed menu

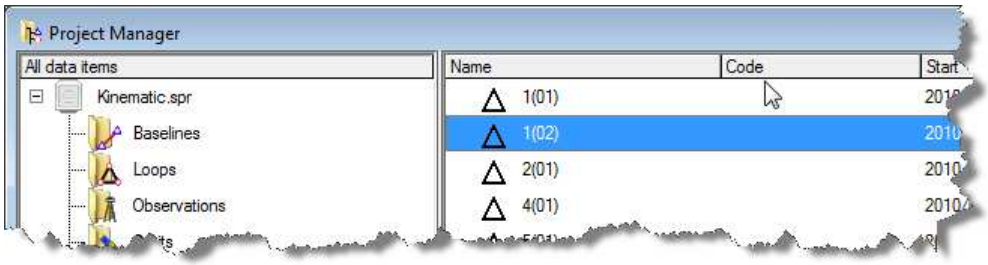
- **/ Analyse**: When selecting exactly two sites, it displays the **Inverse Computation**. Otherwise, it displays the **Post-Processed Coordinates**.
- **/ New site…**: Display the **New Site Occupation**.
- **/ Export…**: Display the **Site Export**.
- **Select All**: Select all sites.
- **/ Delete**: Delete the selected sites after confirmation.
- **Move…**: Display the **Move Site Occupation**.
- **/ Properties… / (double click)**: Display the **Site Editor** for the selected site.

Drag and drop

You can move occupations from one site to another. Select the site occupation you want to move, drag and drop it over the destination site. The site occupation is moved.



Project Manager – Sites – Moving a site with drag and drop



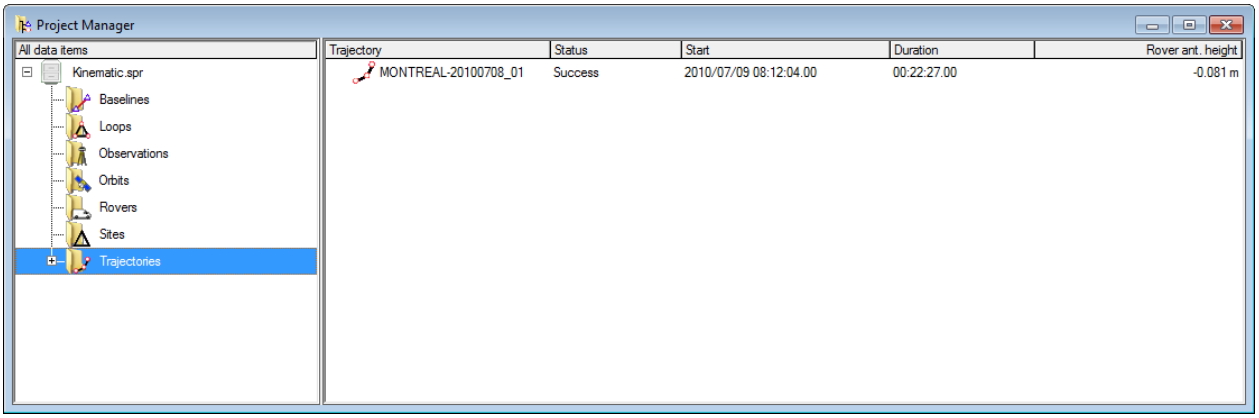
Project Manager – Sites – After the site movement

7.3.9 Trajectories Folder

IMPORTANT: Trajectories Folder is only available when working in **Differential Positioning** mode.

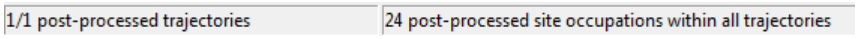
The **Trajectories** folder is used to display basic information about all trajectories related to your project. Trajectories are listed in the viewer pane along with the following information:

- **Trajectory**: the symbol indicating a trajectory along with its name;
- **Status** : Indicate the post-processing status:
  - **(empty)**: unprocessed.
  - **Success**: post-processing is successful.
  - **Failure**: trajectory could not be post-processed. For more information, display the **Trajectory Summary**.
  - **Canceled**: The user has canceled the last-processing.
  - **Warning**: The processing is successful but there are some warnings. For more information, display the **Trajectory Summary**.
- **Start**: the start time of the trajectory;
- **Duration**: the time span of the trajectory;
- **Rover ant. height**: the reduced antenna height to be used in the computation;



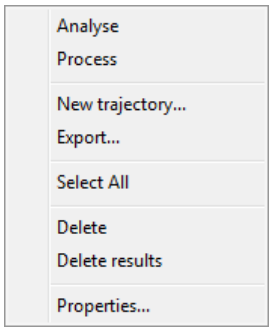
Project Manager – Trajectories

You will notice that when you select the **Trajectories** folder, a new menu item **Trajectories** is available from the main menu allowing you to perform some operations on your trajectory data. These operations are also available from a speed menu while your cursor is over the viewer pane. The **Main** toolbar offers you shortcuts to some of these functions.



Project Manager – Trajectories – Status bar

- **(Left pane)**: Number of post-processed trajectories.
- **(Right pane)**: Number of post-processed site occupations within all trajectories



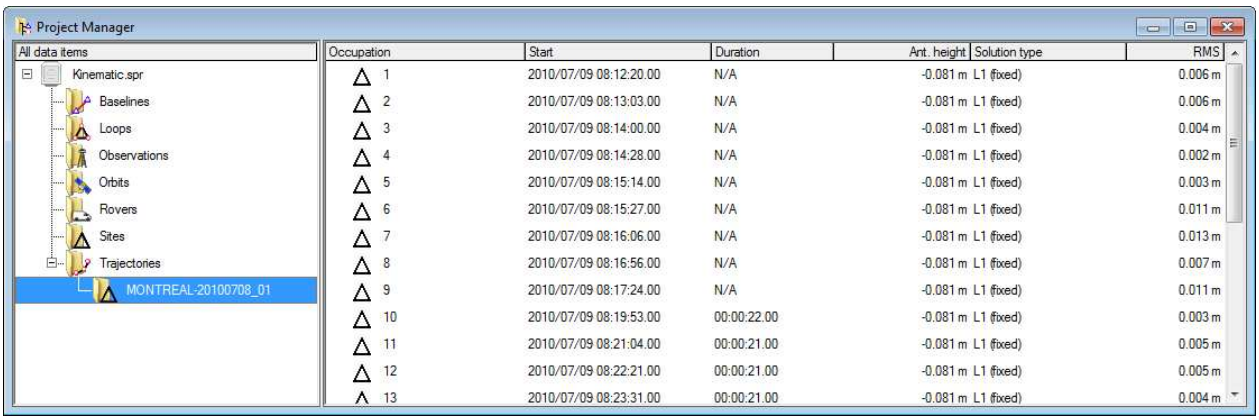
Project Manager – Trajectories – Speed menu

- **/ Analyse**: Display the **Trajectory Summary**.
- **/ Process**: Process the selected trajectory.
- **/ New trajectory…**: Display the **New Trajectory**.
- **/ Export…**: Display the **Trajectory Export**.
- **Select All**: Select all trajectories.
- **/ Delete**: Delete the selected trajectories after confirmation.

- **/ Delete results**: Delete results of the selected trajectories after confirmation.
- **/ Properties… / (double click)**: Display the **Trajectory Editor** for the selected trajectory.

When selecting a specific trajectory on the selector pane, the viewer pane will contains trajectory sites information. Trajectory sites are only available once a trajectory is post-processed and when that trajectory actually contains sites.

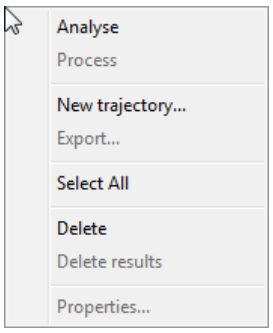
- **Occupation**: the symbol Δ indicating a site along with its name and occupation number;
- **Start:** the start time of the site occupation;
- **Duration:** the time span of the site occupation;
- **Ant. height**: the reduced antenna height to be used in the computation;
- **Solution type**: the solution type of the trajectory site occupation;
- **RMS**: the root mean square of the trajectory site occupation;



Project Manager – Trajectory sites

Project Manager – Trajectory sites – Status bar

- **(Left pane)**: Number of post-processed sites.
- **(Right pane)**: Always empty

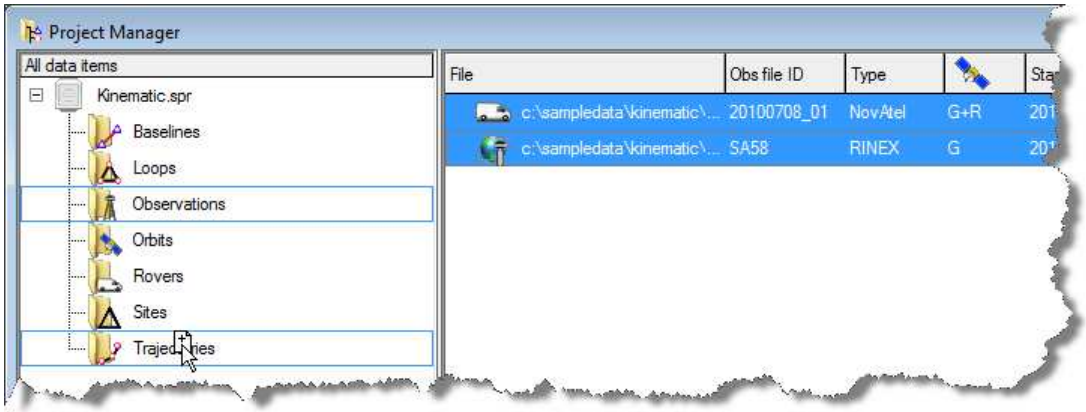


Project Manager – Trajectories sites – Speed menu

- **/ Analyse / (double click)**: Display the **Trajectory Site Comparison**.
- **/ New trajectory…**: Display the **New Trajectory**.
- **Select All**: Select all trajectory sites.
- **/ Delete**: Delete the selected trajectory sites after confirmation.

■ Drag and drop

You can generate new trajectories by selecting rovers (or semi-kin) with statics (or bases) in the **Observations** folder and then dragging and dropping them over the **Trajectories**. This will generate all combinations possible with the subset of files you selected.



Project Manager – Create trajectories using drag and drop

7.4 Analysis

There are several graphic and text view possible for analysis purpose. See ***Analysis*** chapter for detailed descriptions on each analysis view.

8 Options

Prior to processing your data, different options can be set in order to facilitate the processing. Note that default settings could meet 95% of your needs. These options are the following:

- **General:** options about backup files, toggling on/off some warning pop-up windows and initial settings of the software display, and setting measure units (metric, international feet, US survey feet);
- **Plan View:** options to set the **Plan View** layout (scale bar, symbol, colors, etc.);
- **Time:** options to set a time unit (UTC, local);
- **Combinations:** options to set the time and distance requirement criteria for baseline, trajectory and PPP generation (minimum overlap, maximum distance);
- **Data files:** options to configure import data (mode, reference coordinates and search for broadcast);
- **Limits:** options to set limits for the site validator;
- **Orbits**: options to define the orbit providers to use in the process;
- **Updates:** options to configure and perform file updates from the OnPOZ server, such as files for the catalog of base stations, leap second definitions, and more. However, it is NOT for software updates.
- **Format:** options related to external data collector files and shapefile;
- **Loop**: options to configure all the parameters related to loop generation.
- **Network:** options to configure all the parameters related to network adjustment.

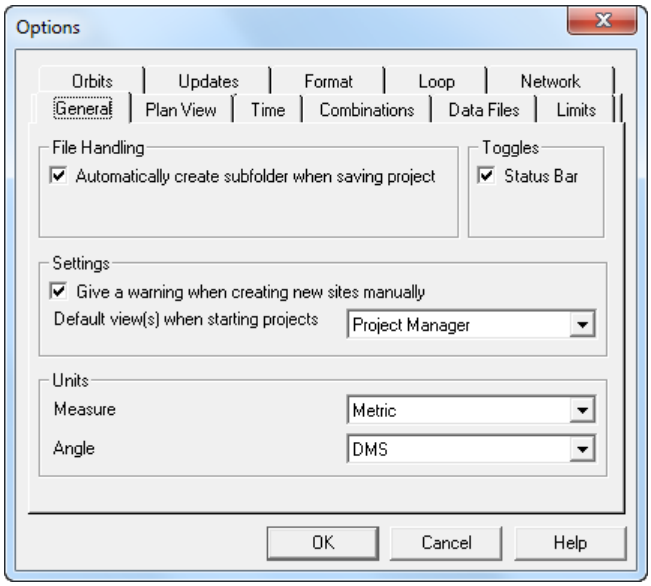
All of these options are set using **Tools > Options** from the main menu. The **Options** is displayed with multiple pages.

8.1 General

The **General** options are divided in four parts: the File Handling, the Toggles, the Settings, and the Units section.

8.1.1 File Handling

- **Automatically create subfolder when saving project**: When inactive, it will propose to save the project in the same folder as your observation files. When active, it will propose to save the project in a specific subfolder under your observation files folder.



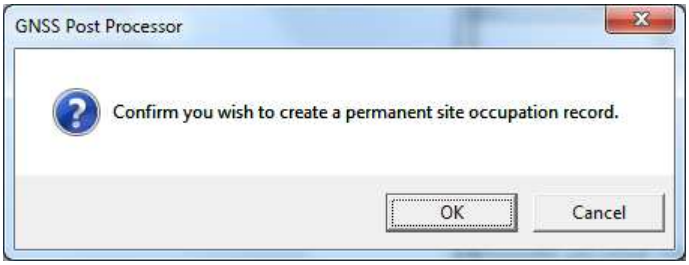
Options – General

8.1.2 Toggles

- **Status bar:** to toggle on/off the status bar.

8.1.3 Settings

- **Give a warning when creating new sites manually**: This will prompt the following warning when creating a new site manually.



Confirmation when creating new sites manually

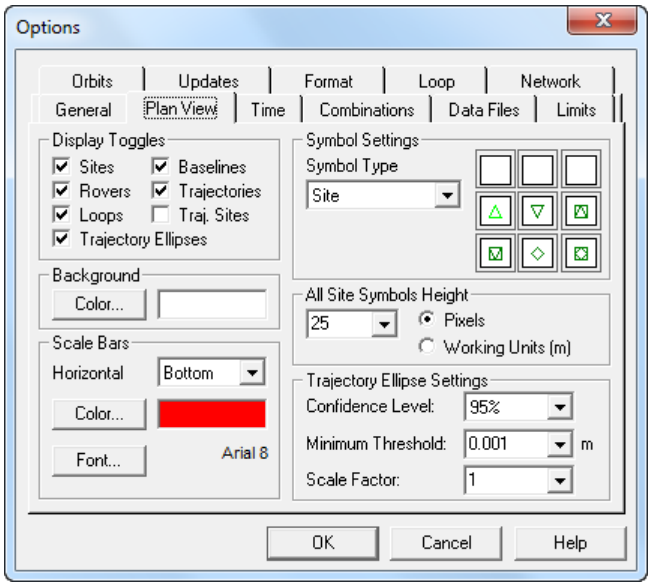
- **Default view(s) when starting project**: This option is used to set the initial default view(s) of the software. The default view(s) will be displayed automatically when the application starts, a new project is created or an existing project is opened.

8.1.4 Units

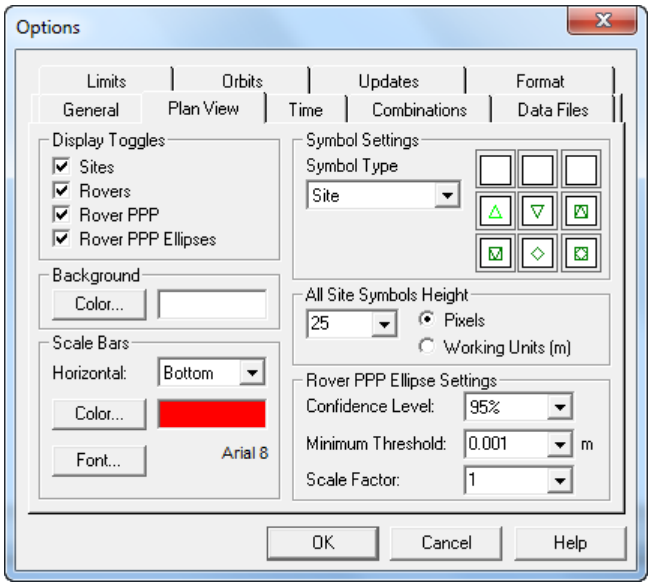
- **Measure:** This option is used to select the measurement units to use in the software.
- **Angle:** This option configures the presentation of angle (latitude and longitude mostly)
  - **DMS:** All angles are presented in degree, minute and second.
  - **Decimal Degree:** All angles are presented in degree with fraction of degree.

8.2 Plan View

The **Plan View** options are grouped into six sections: a section to set which data and/or results are to be displayed on the **Plan View**, one to set the **Plan View** background color, another one to set the scale bar display settings, a section related to symbols, a section to set the symbol size (as well as the size of the displayed labels) and finally, a section to set trajectory ellipses display.



Options – Plan View (in Differential Positioning mode)



Options – Plan View (in Precise Point Positioning mode)

8.2.1 Display Toggles

- Used to set which data and/or results are to be displayed on the **Plan View** (see section ***Views – Plan View – Toggling Data/Results On/Off from the Plan View*** for more details).

8.2.2 Background

- **Color:** This option is used to set the **Plan View** background color.

8.2.3 Scale Bars

- **Horizontal:** It is used to set the position of the scale bar within the **Plan View**. Available settings are the following:
  - **None**: no scale bar is displayed;
  - **Top**: at the top of the **Plan View**;
  - **Bottom**: at the bottom of the **Plan View**;
- **Color:** It is used to set the main color of the scale bar. The second scale bar color is defined automatically according to Window Color and Appearance.
- **Font:** Use this option to set the font used by the scale bar.

8.2.4 Symbol Settings

- **Symbol type:** This section is used to set a specific symbol to be displayed on the **Plan View** for site, rover and reference site.
  - To set a symbol, select an object from the drop-down list and select a symbol.
  - When symbol type is rover, only the first three symbols are available:

  - When symbol type is site or reference site, the last six symbols are available:

> In the **Plan View**, rover symbols are red when the position is unprocessed and green when it is post-processed.
>
> In the **Plan View**, rover symbols are displayed half the size of site symbols.

8.2.5 All Site Symbols Height

The **All Site Symbols Height** set in this section is applied to all symbols, trajectory ellipse and texts displayed on the **Plan View**.

- **Pixels**: Selecting this option will cause symbol, ellipse and text height to remain the same regardless of the scale.
- **Working Units**: Selecting this option will cause symbol, ellipse and text height to resize according to the plot scale of your **Plan View**.

> When **Pixels** option is activated, printing may be different from what you see on screen because printer resolution may not match screen resolution.

8.2.6 Trajectory Ellipse Settings

These settings apply only if the Trajectory Ellipses toggle is checked. If unchecked, the rover symbol will be displayed instead of the ellipse for each position of the rover.

- **Confidence Level**: This option allows you to select the confidence level of the ellipses. This will affect the size of the ellipses displayed.

- **Minimum Threshold**: Only ellipses with a 2D major axis larger than this value will be displayed on the **Plan View**; otherwise it will display with the rover symbol. This is a way to highlight positions with errors larger than a given threshold.
- **Scale Factor**: This value is a multiplier of any ellipse size so it can be more easily visible in the **Plan View**.

The trajectory ellipse color follows the same rule as the rover symbol color, and is drawn either with a fixed size or relative size depending on the **All Site Symbols Height** active option.
Regardless of the other options, if the trajectory ellipse is too small to be drawn, the rover symbol will be drawn instead.

8.2.7 Rover PPP Ellipse Settings

These settings apply only if the Rover PPP Ellipses toggle is checked. If unchecked, the rover symbol will be displayed instead of the ellipse for each position of the rover.

- **Confidence Level**: This option allows you to select the confidence level of the ellipses. This will affect the size of the ellipses displayed.
- **Minimum Threshold**: Only ellipses with a 2D major axis larger than this value will be displayed on the **Plan View**; otherwise it will display with the rover symbol. This is a way to highlight positions with errors larger than a given threshold.
- **Scale Factor**: This value is a multiplier of any ellipse size so it can be more easily visible in the **Plan View**.

The rover PPP ellipse color follows the same rule as the rover symbol color, and is drawn either with a fixed size or relative size depending on the **All Site Symbols Height** active option.
Regardless of the other options, if the rover PPP ellipse is too small to be drawn, the rover symbol will be drawn instead.

8.3 Time

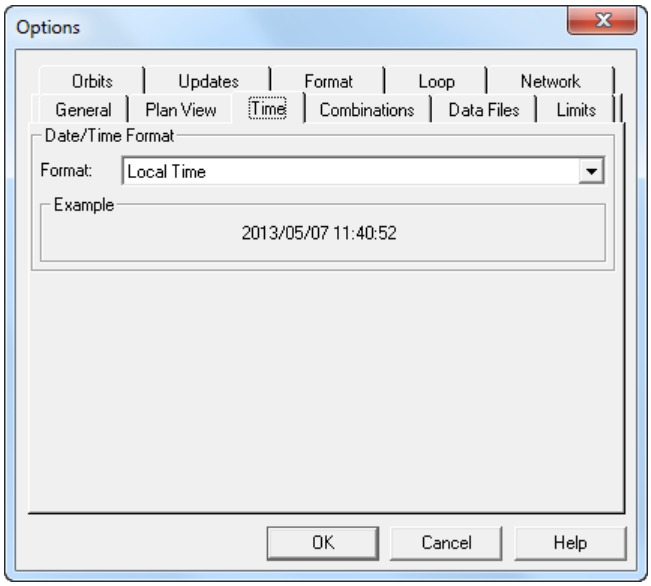
The **Time** options are used to set a time unit to be used everywhere in the software

8.3.1 Date/Time Format

This section is used to select a time unit among the three available choices:

- **GPS Time.** This is the time returned by the GNSS receiver. It consists of a week number and the number of second since the beginning of the week in the GPS time frame.
- **UTC Time.** This is the Coordinated Universal Time.
- **Local Time**. The software gets the **time zone** from your PC. You can select this value from your **Control Panel > Date and Time > Change time zone**.

The format of the selected time unit is displayed in the **Example** section.

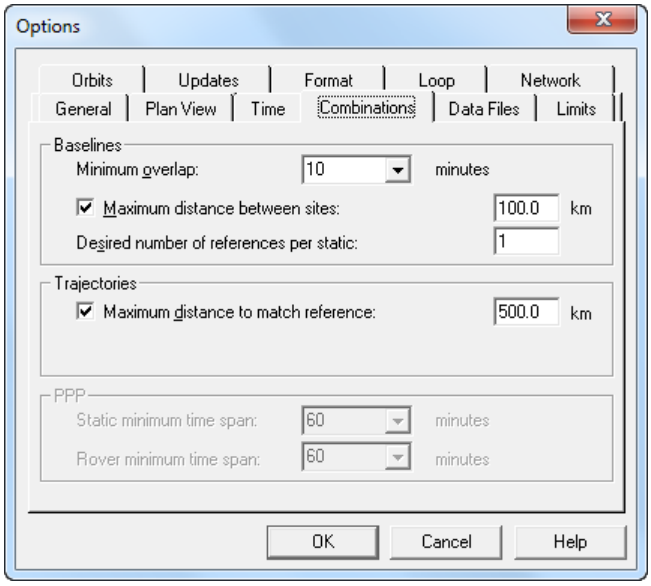


Options – Time

8.4 Combinations

The **Combinations** options are used to generate automatically baselines, trajectories and PPP.

These time criteria are used to generate all possible baselines, trajectories and PPP using all site occupations and rover files. This process is done by analyzing the time span of site occupations as well as the time span of rover files. A baseline will be generated if two different sites have been observed simultaneously for a minimum of time (minimum overlapping time). If a site occupation and a rover have been observed simultaneously for a minimum of time (minimum overlapping time), a trajectory will be created. If precise orbits are fully overlapping rovers or sites, a PPP will be created.



Options – Combinations

8.4.1 Baselines

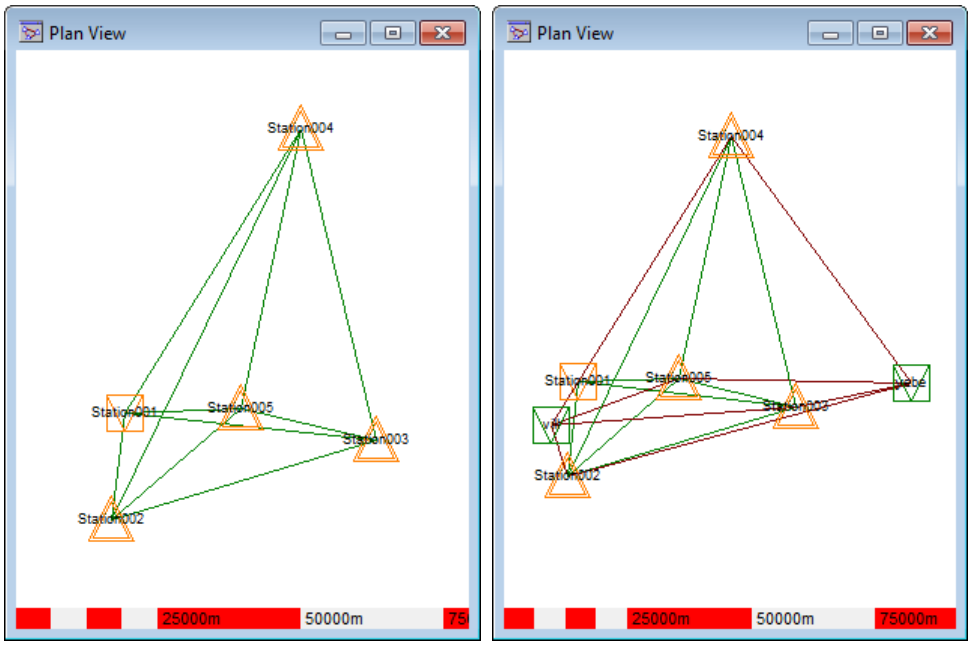
IMPORTANT: The **Baselines** section is only enabled when working in Differential Positioning mode.

All baselines options are regrouped under **Baselines.**

Only sites coming from a base or a static will be considered.

No baselines are generated between two references (either static used as reference or base)

- **Minimum overlap:** Minimum time criteria in minutes.
- **Maximum distance between sites:** Maximum distance permitted between a pair of sites to create a baseline.
- **Desired number of reference per static:** You enter the number of references (either bases or static used as references) that should be connected to each static file. It does so by trying to download enough base stations to accommodate the requested number. Use this option when you want to tie your network to a National reference network as typically used by National Base Station providers.
    - **Example**: The following project includes four static (**Station002** to **Station005**) and one static used as reference (**Station001**). Each file overlaps every other. When you set **Desired number of reference per static** to **3**, it will download two base stations to complete the project. Now, each static has three baselines connecting them directly to a reference: one to **Station001** (static used as reference), one to **vill** (base station) and one to **yebe** (base station)



Plan view before and after downloading

8.4.2 Trajectories

IMPORTANT: The **Trajectories** section is only enabled when working in Differential Positioning mode.

All trajectories options are regrouped under **Trajectories.**

Only sites coming from a base or a static will be considered to connect to a rover. They will be referred as base site.

> This software will not download a base that have less than complete coverage.
>
> This software will not download a base when you have static used as reference in the project that covers at least a part of the rover.

- **Maximum distance to match reference:** Represents the maximum distance between the base site and the rover file. When the base site-rover distance separation is longer than this value, the base site is ignored.

> The distance between base site and rover is computed using the rover average position. This could sometimes lead to an undesired base station selection. For instance, a flight doing aerial survey may travel hundreds of kilometers before reaching the area of interest, so the average position of this data set might select a base station far away from the relevant area. In such a case you will have to force the base station selection (if you know which one you want to use).

8.4.3 PPP

IMPORTANT: The **PPP** section is only enabled when working in Precise Point Positioning mode.

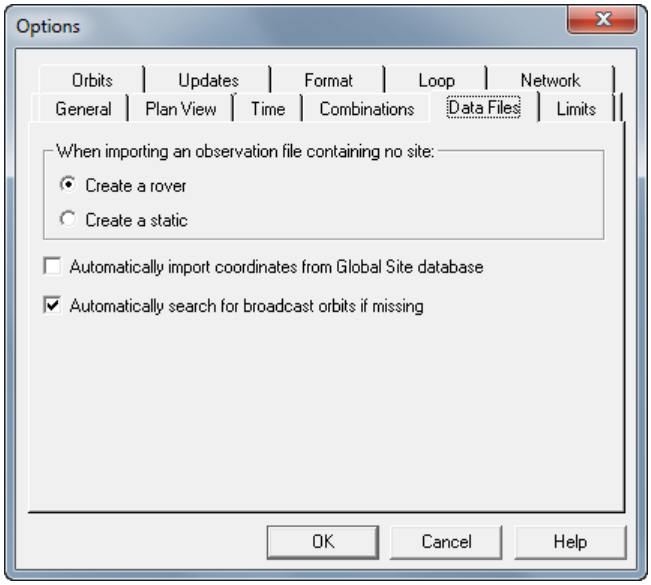
All PPP options are regrouped under **PPP.**

Typically PPP cannot be used successfully with less than 60 minutes of good dataset.

- **Static minimum time span:** will generate a static PPP only for statics that last at least the requested time.
- **Rover minimum time span:** will generate a rover PPP only for rovers that last at least the requested time.

8.5 Data Files

The **Data Files** option is used to configure the Import process. See ***Importing Data*** section for more details.



Options – Data Files

8.5.1 When importing an observation file containing no site

While importing an observation file, the program will try to determine the file status (**Static**, **Rover** or **Semi-kinematic**). The file status can be changed at any time later while manipulating your data.

> File status can easily be changed within the **Observations** folder of the **Project Manager**: select your observation file in the viewer pane, right-click to get the speed menu and select the new status: **Rover**, **Static**, **Semi-kin**.

If the observations files have been recorded by data collection software compatible with EZSurv®, the file status will automatically be detected.

> The file status is detected automatically for all observations collected with OnPOZ GNSS Driver for ArcPad, OnPOZ GNSS Control Panel, OnPOZ EZTag CE™, OnPOZ EZField™, Carlson SurvCE™, Geo-Plus VisionTerrain, MicroSurvey FieldGenius™, NavCom FieldGenius™, MicroSurvey Seismic Surveyor™ and MapScenes Evidence Recorder™.
>
> Only the semi-kinematic project in OnPOZ EZField™ can set automatically the file status to semi-kinematic when importing.

If the observations files are RINEX files, the file status will be automatically detected.

Otherwise, EZSurv® chooses using site information:

- **No site**: Configurable by the user in this page. See below.
- **One site**: If the site covers the whole observations file, it will set the file status to **Static**. Otherwise, it will set the file status to **Rover**.
- **More than one site**: It will be set the file status to **Rover**.

When a file contains **no site**, you can set it as a **Rover** or as a **Static** file. Usually these files are rover files. However, it might be a static file. That is usually the case with static files imported in native binary format from some GNSS receivers.

- **Create a rover**: It will set the file status to **Rover** when it has no site.
- **Create a static**: It will set the file status to **Static** when it has no site.

8.5.2 Other options

- **Automatically import coordinates from Global Site database**: When active, this option will try to match any site you are importing to the name of a site in Global Site database.
    - For each site with a matching name:
        - It copies the position from the Global Site to that site.
        - That site is marked as **Use as reference coordinate** (as seen within **Edit > Sites**).

- **Automatically search for broadcast orbits if missing**: When active, importing an observation file that does not have any orbits associated will launch the search for broadcast orbits.

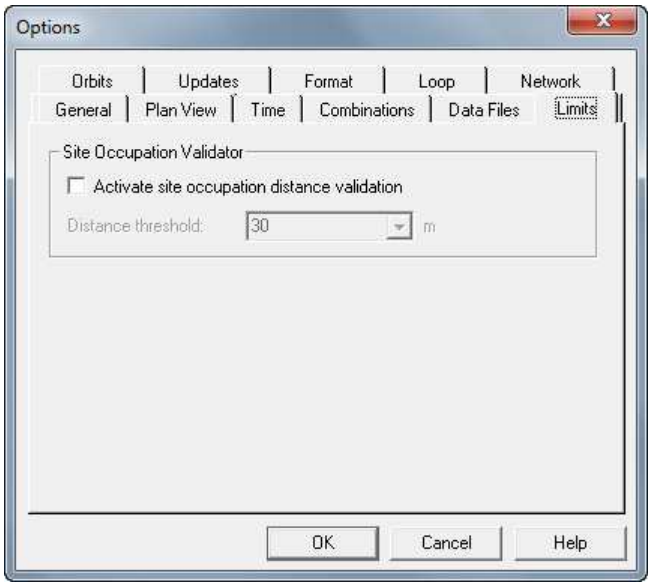
8.6 Limits

8.6.1 Site Occupation Validator

In the software, you cannot have two sites using the same name. However you can visit the same sites many times. The software takes advantages of multiple occupations of the same site. So having two different sites with the same name will corrupt the results which could lead to bad ambiguity fixes with unexpected standard deviation.

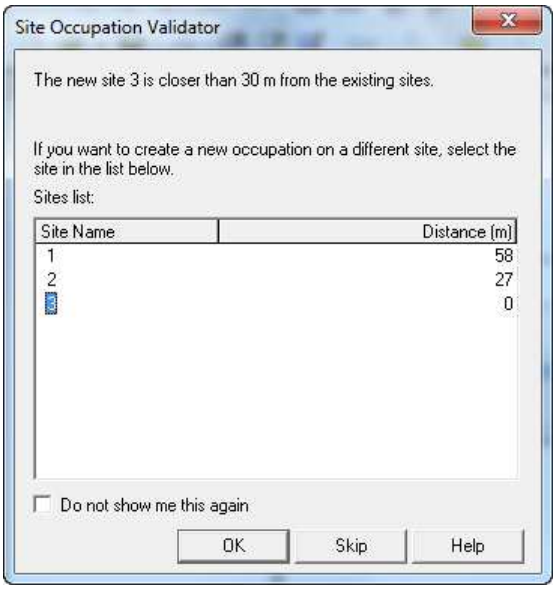
The site validator allows you to detect these site name labeling errors. Sometimes, in the field, you can accidently input wrong site name (e.g. inputting an existing site name, so creating two different sites with the same name). By setting a minimum distance tolerance between sites, you can easily detect these errors. However, to use this option, your sites have to be located a few meters apart. The validator is used when you are importing data, when you are creating a new site or renaming a site.

- **Activate site occupation distance validation:** A check mark indicates that the validator is activated and you will be prompted each time the software will detect a new site occupation that is closer than the tolerance value.
- **Distance threshold**: Select or type the value to be used as the minimum distance. If two points fall within this distance, you will be prompted to clarify if it is two different points or it is a second occupation on the same point.



Options – Limits

When you are importing data, if two sites are within the tolerance value, you will be prompted with the following dialog box:



Site Occupation Validator

Since the software assumes that the imported site occupation has been labeled incorrectly, and it also assumes that the current site occupation is probably related to an existing site, you are prompted to select an existing site for which this new site data could be attached. There are three alternatives:

- if you want to consider the site as a new occupation of an existing site, select the name of the site in the list and click **OK**; this will create a new site occupation to the selected existing site;
- if you established two sites close to each other, within the tolerance value, then the default site name that is highlighted is the name of your new site; click **OK** to import the site;
- if you do not want to import this site, click the **Skip** button (or press the button); the site will not be added to the **Sites** folder of the **Project Manager**;

If you do not want to be prompted again, check the **Do not show me this again** checkbox. It will deactivate the site occupation validator.

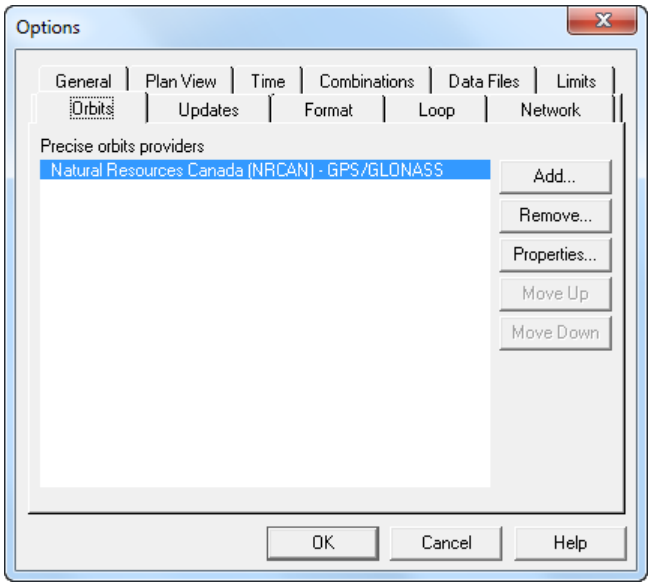
8.7 Orbits

IMPORTANT: An Internet connection is required in order to use the **Orbits** options.

The **Orbits** tab is used to define the precise orbits providers to use in the process. With this tab, you can add, remove and order the precise orbits providers' parameters.

- **Add…:** Add a new precise orbits provider. The **Add Precise Orbits Provider** is displayed.
- **Remove…:** Remove the selected provider.
- **Properties…:** Open an Internet Explorer window on the provider website.
- **Move up** and **Move down**: Modify the order of providers in the list. The software will search in the order in the Precise Orbits providers list.

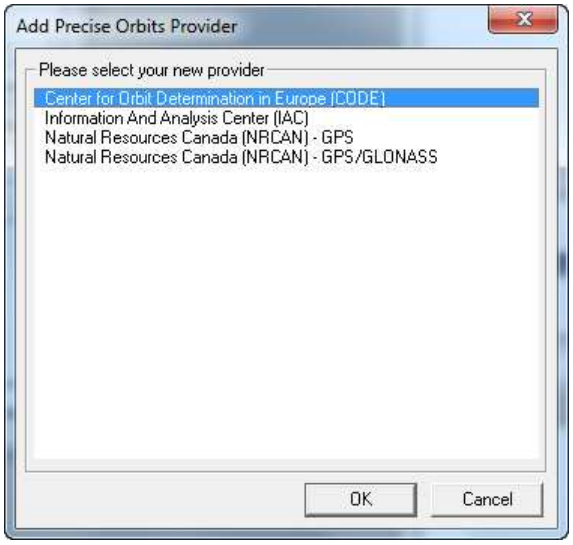
If the **Search for precise orbits** checkbox is not activated in the **Process Parameters**, the software will not search for precise orbits.



Options – Orbits

8.7.1 Adding a Precise Orbits Provider

a. To add a new precise orbits provider, click **Add…**;



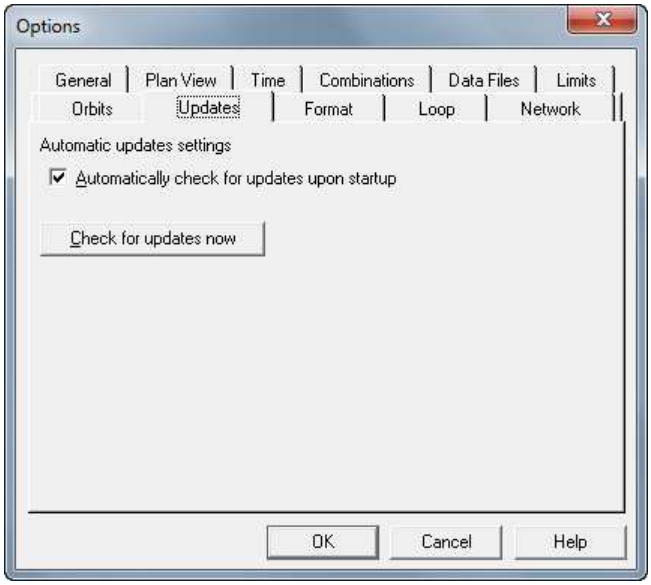
Add Precise Orbits Provider

b. Select your new provider from the list in the **Add Precise Orbits Provider** dialog box;
c. Click **OK**.

8.8 Updates

IMPORTANT: An Internet connection is required in order to use automatic updates.

The **Updates** page in the **Tools > Options** dialog box is used to configure automatic updates.

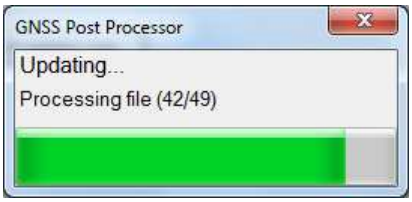


Options – Updates page

Automatic updates are useful to ensure that important files used by the software are always up to date on your computer. These updates are maintained on the OnPOZ server, and include files such as a catalog of base stations, leap second definitions, and more. However, it is NOT for software updates.

- **Automatically check for updates upon startup:** Enable (recommended) or disable automatic updates.
- **Check for updates now**: Do a check for updates right away.

The automatic updates, if enabled, are performed each time you start the software. The following message is displayed while updates are being checked:



Checking for Data Updates

8.9 Format

The **Format** page in the **Tools > Options** dialog box is used to configure some options related external data collectors and ESRI Shapefiles.

8.9.1 External Data Collector

These options currently apply to these following data collection software:

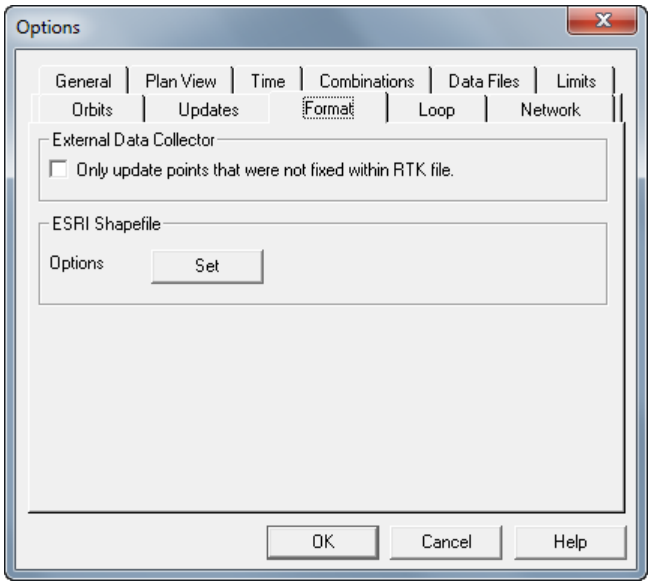
- Carlson SurvCE™;
- Geo-Plus VisionTerrain;
- MapScenes Evidence Recorder™;

- MicroSurvey FieldGenius™;
- MicroSurvey Seismic Surveyor™;
- NavCom FieldGenius™;

For more information about manipulating external data collector, see the following appendices: ***Post-Processing Carlson SurvCE™ RW5 file***, ***Post-Processing MicroSurvey RAW file*** *and* ***Post-Processing Geo-Plus VisionTerrain***.

Only update points that were not fixed within RTK file: if this option is checked, the software will only update points that were not FIXED in RTK mode but were fixed by the software. If this option is NOT checked, the software will update ALL points.

IMPORTANT: When the project is saved after post-processing, the results are written within the external data collector files using the rule stated by this option.

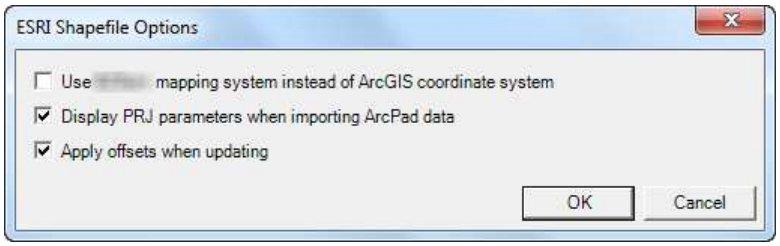


Options – Format

8.9.2 ESRI Shapefile

The ESRI Shapefile options apply only to GNSSP projects created by the OnPOZ GNSS Driver for ArcPad software. More information about GNSSP projects is available in ***Post-Processing ArcPad data*** appendix.

In the **ESRI Shapefile** section, click on the **Set** button. The **ESRI Shapefile Options** window will appear.



ESRI Shapefile Options

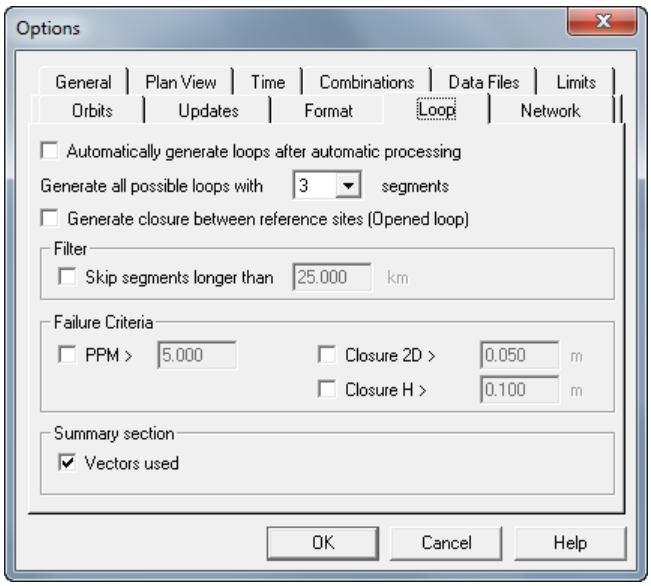
- **Use EZSurv mapping system instead of ArcGIS coordinate system:** This is not recommended. When you have ArcGIS, it is better to use it since it will make sure the shapefiles are updated with coordinates in the same mapping system. Use this option only if you do have ArcGIS but for whatever reason (expired licensed, floating licensed all used, etc.), you do not want this software to use it.
- **Display PRJ parameters when importing ArcPad data**: When ArcGIS is not present, this will find the ESRI projection file associated with the project and display side by side the ESRI projection and the current mapping system. When ArcGIS is present, this option is ignored.
- **Apply offsets when updating:** It is recommended to keep it active. When offsets are not applied, calculated points remain at the position given by ArcPad. All other kinds of points, lines and polygons will be updated with post-processed position without applying offset.

8.10 Loop

IMPORTANT: Loop is only available when working in Differential Positioning mode.

The **Loop** page in the **Tools > Options** dialog box is used to configure the options for the loop generation.

This page is divided loosely in four sections, which are: **Generate**, **Filter**, **Failure Criteria**, and **Summary section**.



Options – Loop

8.10.1 Generate

- **Automatically generate loops after automatic processing**: When enabled, the **Generate Loops** step will be executed when requesting an automatic processing (**Tools > Process Auto…**).
    - Regardless of the state here, it will always be possible to manually request to generate loops (**Tools > Process Manual > Generate Loops**)
- **Generate all possible loops with 'n' segments**: Exact number of segments for all loops to be generated.
    - It will generate all valid combinations of closed loops with the specified number of vectors.
    - When requesting two segments, it will use only common vectors to form a loop.
    - When requesting more than two segments, it will only use unique vectors to form a loop.
    - Example: Assume a project with the following vectors: A-B(1), A-B(2), B-C(1), B-C(2) and C-A.
        - With 2 segments, it will generate:
            - Loop 1: A-B(1), B-A(2);
            - Loop2: B-C(1),C-B(2)
        - With 3 segments, it will generate:
            - Loop1: A-B(1), B-C(1), C-A;
            - Loop2: A-B(2), B-C(1), C-A;
            - Loop3: A-B(1), B-C(2), C-A;
            - Loop4: A-B(2), B-C(2), C-A
        - With 4 segments, it will generate:
            - No loop because it is not possible to make a loop with 4 segments with this set of unique vectors.
- **Generate closure between reference sites (Opened loop)**: When enabled, it will generate opened loops as well as the closed loops.
    - An opened loop is a loop that starts on a reference site and ends on another reference sites.
    - It will generate all valid combinations of opened loops with the specified number of vectors.

8.10.2 Filter

- **Skip segments longer than**: When enabled, if any segment is longer than the length specified here, it will not be used to generate a loop.

> This could be used to avoid creating loops with a base station in it because these loops will have a very long perimeter.

8.10.3 Failure Criteria

If no failure criterion is enabled, it will generate all loops as described above.

However, it <u>at least</u> one failure criterion is enabled; it will <u>only keep failed loops</u>.

If multiple failure criteria are enabled, any loop that failed at least one criterion will be kept.

Keeping only the failed loops is better since it may otherwise generate a very long list of loops and the failed ones could be lost within them.

- **PPM >**: When enabled, the loop is considered a failure if the ppm is greater than the specified value.
- **Closure 2D >**: When enabled, the loop is considered a failure if the closure horizontally is greater than the specified value.
- **Closure H >**: When enabled, the loop is considered a failure if the closure vertically is greater than the specified value.

8.10.4 Summary section

This option applies only to the **Loop Summary** report.

- **Vectors used**: When enabled, it will display the **Vector used** section in the **Loop Summary**.

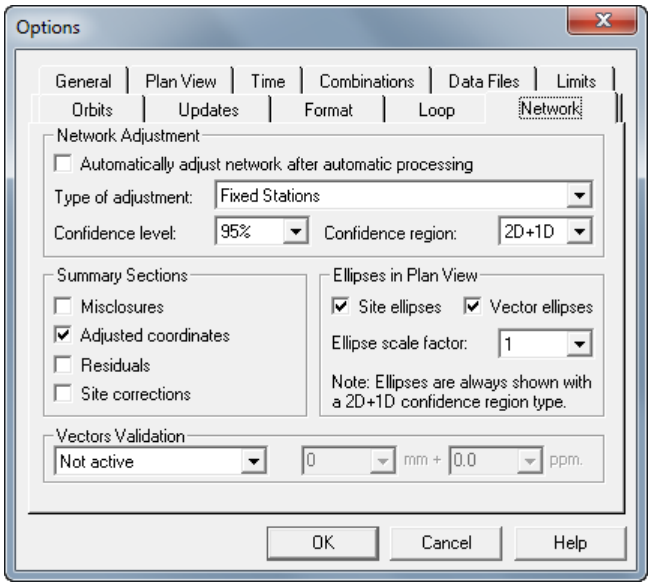
8.11 Network

IMPORTANT: Network is only available when working in Differential Positioning mode.

The **Network** page in the **Tools > Options** dialog box is used to configure the options for the network adjustment.

For more information about Network Adjustment, consult the ***Network Adjustment*** appendix.

This page is divided in four sections, which are: **Network Adjustment**, **Summary Sections**, **Ellipses in Plan View**, and **Vectors Validation**.



Options – Network

8.11.1 Network Adjustment

The **Network Adjustment** section contains parameters for the adjustment that will affect all reports.

- **Automatically adjust network after automatic processing**: If checked, an automatic processing will start network adjustment after the baseline and trajectory processing.
- **Type of adjustment**: It will affect the way the adjustment is performed. Possible values are:

- **Fixed Stations:** In a **Fixed Stations** adjustment, at least one station has to be held fixed. By default, the software will keep fixed all stations which have been selected as reference site (see section ***GNSS Processing Workflow – Fixing a Reference Site*** to know how to set a reference site). If none of them are checked, the program will automatically select one to generate a minimally constrained solution.
- **Weighted Stations:** A **Weighted Stations** adjustment is one in which reference stations are kept free and are represented by a set of coordinate observations with their corresponding sigmas. Normally, the weighted station coordinates and their corresponding covariance matrix (sigmas) is from a previous network adjustment. Add the sigmas of the reference stations by clicking the **Edit Sigmas** button of the **Site Editor** (see section ***Editing – Site***).
- **Fixed Stations with Auxiliary Parameters:** This option should be selected if you want to solve for datum misalignment parameters through the network adjustment process. This type of adjustment should be used only after you have performed a minimally constrained adjustment and validate your network results. Then, when you enable auxiliary parameters and adjust your network, the Post-Processor will remove 3 rotations and a scale factor from the GNSS observations to make the whole network more closely fit your control values (a minimum of 3 fixed stations are required).

> ❖ Obviously if you do not have a lot of control, then the estimated values for rotation and scale will not be very good and the parameters solved for may be meaningless. It is extremely important to check the confidence regions for the auxiliary parameters in the listing before accepting an adjustment.

- **Confidence level:** This option is used to scale the Network Adjustment statistics.
- **Confidence region:** This option allows you to select between **2D+1D** and **3D** error ellipse calculation. **2D+1D** is more appropriate when the user wants to separate planimetric and altimetric observations (like distance and leveling). It is given as an “historical” purpose since GNSS is a fully 3D system.

8.11.2 Summary Sections

The **Summary Sections** of the dialog box indicates which sections should be shown in the **Network Adjustment Summary** view. The optional sections are:

- **Misclosures**;
- **Adjusted coordinates**;
- **Residuals**;
- **Site corrections**.

8.11.3 Ellipses in Plan View

The **Ellipses in Plan View** section is used to display site and vector ellipses in the **Plan View**.

- **Site ellipses**: Check if you want to display site ellipses when available.
- **Vector ellipses**: Check if you want to display vector ellipses when available.
- **Ellipse scale factor**: This is a multiplier of any ellipse size so it can be visible in the **Plan View**.

8.11.4 Vectors Validation

This section is only available when the **Confidence region** is **2D+1D**.

In the **Network Adjustment Summary** view, for each vector, a value in **ppm** (part per million) is given for relative confidence region and represents the ratio between the major axe length or height and the

vector's distance. The **Vectors Validation** section of the dialog box is used to compare this value in ppm with a limit set by the user.

- Select the type of validation in the combo. Possible values are:
  - **Not active**: No validation
  - **Horizontal**: Compare with the major axe length only
  - **Vertical**: Compare with the height only
- Select or type a value for the constant part and for the relative part (in part per million, ppm). A vector that exceeds this limit (absolute + relative) will be flagged in the **Network Adjustment Summary** view.

9 Base Stations

IMPORTANT: An Internet connection is required in order to use the **Base Stations**.

To apply differential corrections to your data, you have the capability to get GNSS data from a reference station (base information). If you want to use a Base Station provider as a source for your reference data, these options allows you to select the Base Station Provider of your choice.

There are several base station data providers available to download from the Internet. The software supports several of these providers.

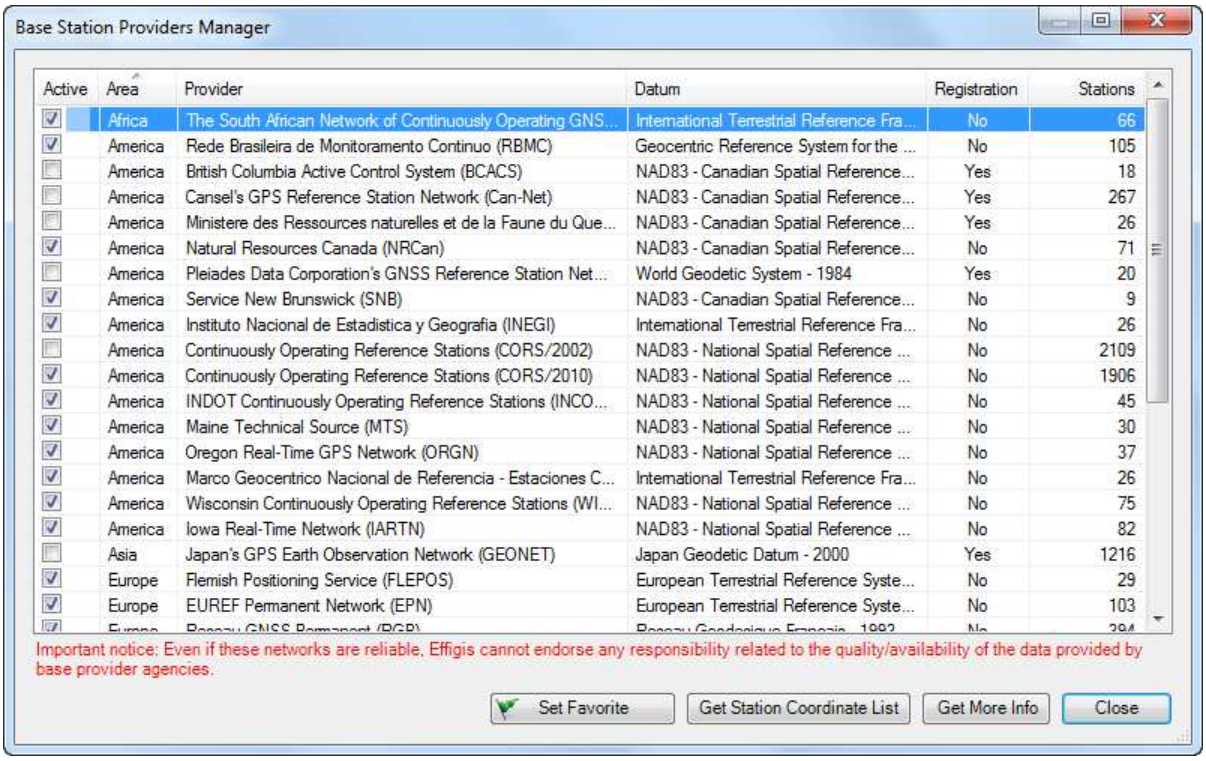
- Even if these networks are very reliable, the post-processing software is not responsible for any missing base data or processing errors related to the use of these networks. Please make sure that you have an adequate base station available at the time you are doing your field data collection projects, otherwise you may have to redo the field data collection again. If needed, use your own base station.
- If the Search for base stations checkbox is not activated in the Process Parameters, the software will not search for bases.

It is also possible to use other base stations not supported by the software. But you will have to import them manually. And they will appear as “static used as reference” and not as a “base”. Base status is reserved for files download automatically by the software.

9.1 Providers Manager

The **Base Station Providers Manager** is used to select the base station providers to use in the **Search for base stations** step in **Pre-Process** (**Tools > Process Auto** or **Tools > Process Manual > Pre-Process)**.

The **Base Station Providers Manager** is available from the **Tools > Base Stations > Providers Manager** menu or by pressing the in the **Main** toolbar.



Base Station Providers Manager

- **Grid**: List of all available base providers
  - **Active**: Checkbox indicating which base providers are active.
    - Putting a check on a provider that needs registration will display the **Provider Registration** dialog.
    - Some providers are mutually exclusive. So putting a check on a base provider may deactivate another. When this happens, a message will tell you which provider was deactivated.
    - This column may also include the favorite flag:
  - **Area**: General area of coverage for a base provider.
  - **Provider**: Full base provider name.
  - **Datum**: Full datum name for all positions within the base provider.
  - **Registration**: Indicate if the base provider required registration.
  - **Stations**: Number of base stations within the base provider.
    - If you manually disable some base stations within a provider, it will display both the number of active base stations and the total number of base stations like this:

260/261

- **Set Favorite/Reset Favorite**: A favorite provider is a provider that will be searched exclusively unless all bases within are rejected.
  - Only one favorite is permitted at any time.
  - A favorite provider is optional. None is set by default.
  - Only an active base provider may become a favorite.
  - When a favorite is set, a flag is added in the Active column:

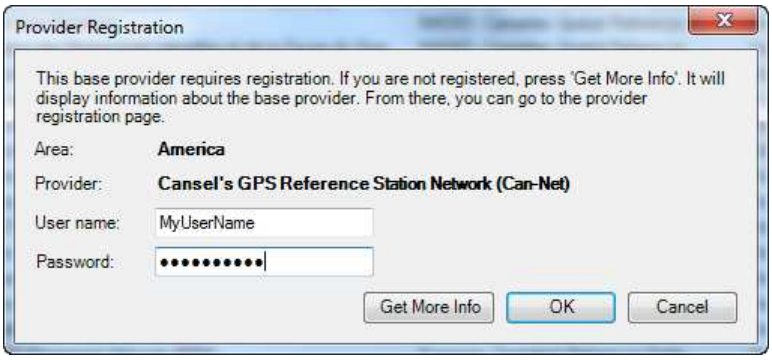
- When selecting the favorite provider, the button changes to **Reset Favorite**. It will remove the favorite flag when pressed.

- **Get Station Coordinate List**: Display the **Coordinate List** dialog.
- **Get More Info**: Display more information related to the selected base provider. See section below.
- **Close**: Close the dialog and save your changes.

> If you deactivate **Automatically check for updates upon startup** (in **Tools > Options > Update**), your provider list may not be up to date. In that case, you can update the list right away using the **Check for updates now** (in **Tools > Options > Update**).
>
> New base providers and base stations are added from time to time. All new base providers that do not required registration will be active by default. All new base stations will be activated.

9.1.1 Provider Registration

The **Provider Registration** is displayed when activating a base provider that requires registration in **Base Station Providers Manager**.

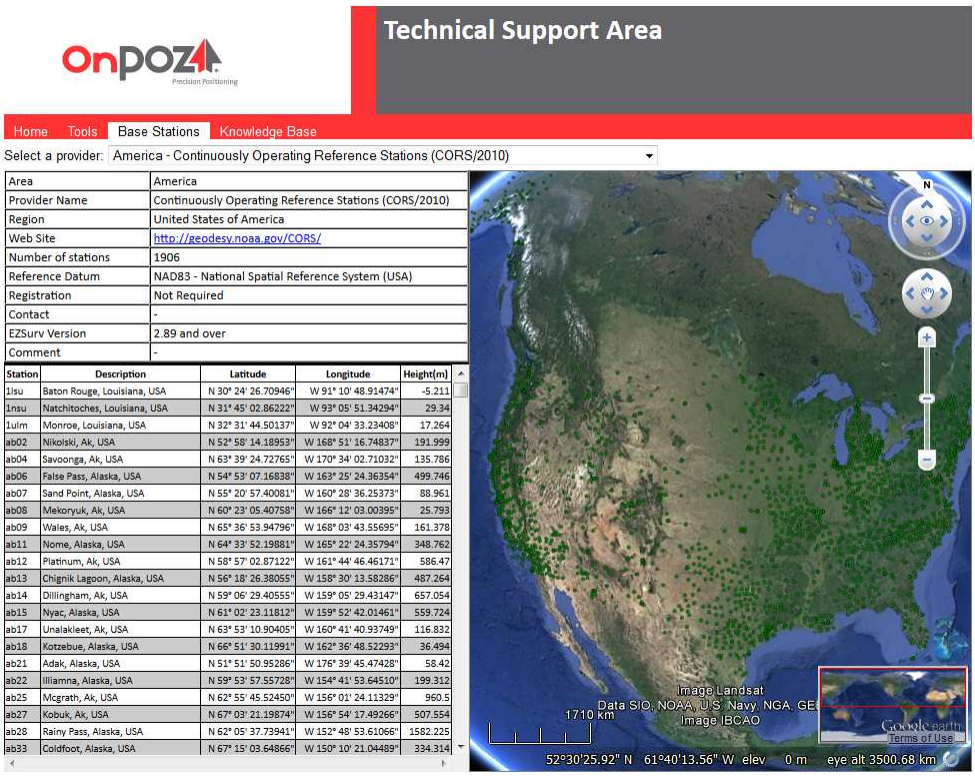


Provider Registration

- **Area**: General area of coverage for a base provider.
- **Provider**: Full base provider name.
- **User name** / **Password**: Enter the user name and password to access the base provider. If you are not registered, press **Get More Info** to find the web site for the base provider and contact them.
- **Get More Info**: Display more information related to the selected base provider. See section below.
- **OK**: It will try to connect to the base provider to validate the user name and password. If the connection succeeded, the dialog closes and the provider is now active.
- **Cancel**: Close the dialog and deactivate this provider.

9.1.2 Get More Info

Display more information related to the base provider. This opens your favorite Internet Browser with extra information on the base provider.



Area	America
Provider Name	Continuously Operating Reference Stations (CORS/2010)
Region	United States of America
Web Site	http://geodesy.noaa.gov/CORS/
Number of stations	1906
Reference Datum	NAD83 - National Spatial Reference System (USA)
Registration	Not Required
Contact	-
EZSurv Version	2.89 and over
Comment	-

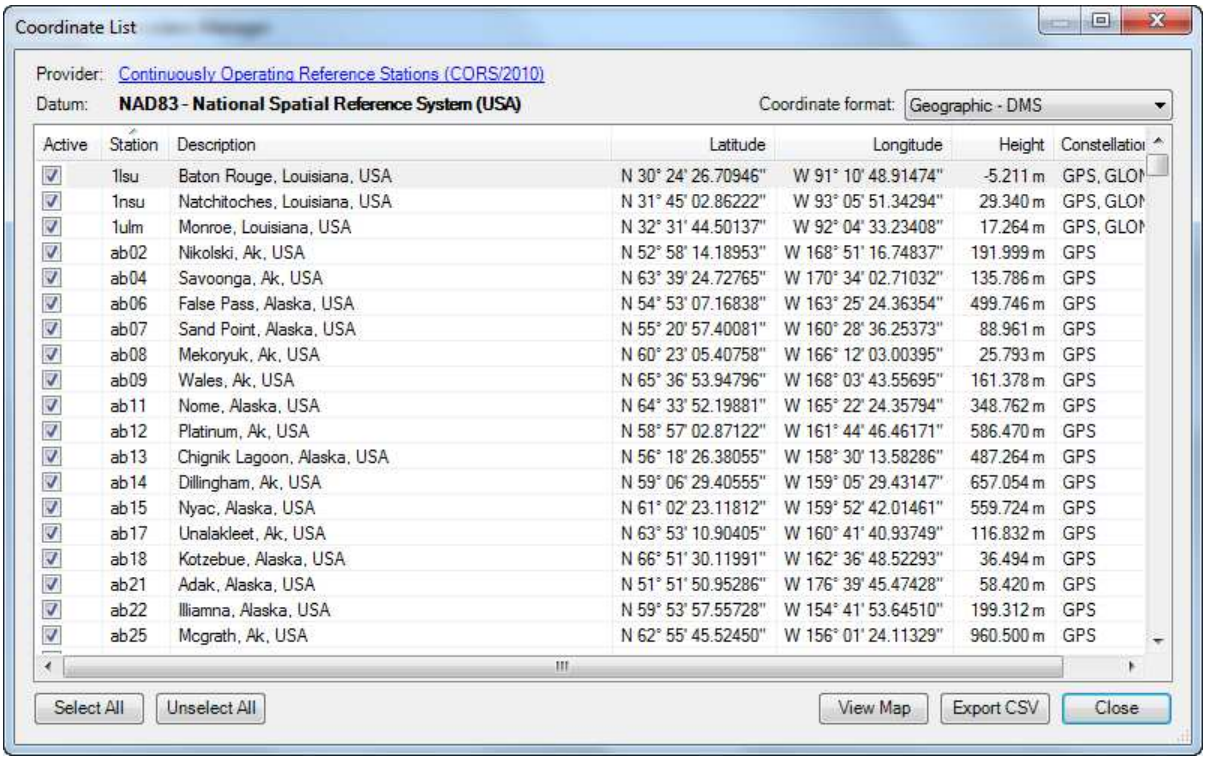
Station	Description	Latitude	Longitude	Height(m)
1lsu	Baton Rouge, Louisiana, USA	N 30° 24' 26.70946"	W 91° 10' 48.91474"	-5.211
1nsu	Natchitoches, Louisiana, USA	N 31° 45' 02.86222"	W 93° 05' 51.34294"	29.34
1ulm	Monroe, Louisiana, USA	N 32° 31' 44.50137"	W 92° 04' 33.23408"	17.264
ab02	Nikolski, Ak, USA	N 52° 58' 14.18953"	W 168° 51' 16.74837"	191.999
ab04	Savoonga, Ak, USA	N 63° 39' 24.72765"	W 170° 34' 02.71032"	135.786
ab06	False Pass, Alaska, USA	N 54° 53' 07.16838"	W 163° 25' 24.36354"	499.746
ab07	Sand Point, Alaska, USA	N 55° 20' 57.40081"	W 160° 28' 36.25373"	88.961
ab08	Mekoryuk, Ak, USA	N 60° 23' 05.40758"	W 166° 12' 03.00395"	25.793
ab09	Wales, Ak, USA	N 65° 36' 53.94796"	W 168° 03' 43.55695"	161.378
ab11	Nome, Alaska, USA	N 64° 33' 52.19881"	W 165° 22' 24.35794"	348.762
ab12	Platinum, Ak, USA	N 58° 57' 02.87122"	W 161° 44' 46.46171"	586.47
ab13	Chignik Lagoon, Alaska, USA	N 56° 18' 26.38055"	W 158° 30' 13.58286"	487.264
ab14	Dillingham, Ak, USA	N 59° 06' 29.40555"	W 159° 05' 29.43147"	657.054
ab15	Nyac, Alaska, USA	N 61° 02' 23.11812"	W 159° 52' 42.01461"	559.724
ab17	Unalakleet, Ak, USA	N 63° 53' 10.90405"	W 160° 41' 40.93749"	116.832
ab18	Kotzebue, Alaska, USA	N 66° 51' 30.11991"	W 162° 36' 48.52293"	36.494
ab21	Adak, Alaska, USA	N 51° 51' 50.95286"	W 176° 39' 45.47428"	58.42
ab22	Illiamna, Alaska, USA	N 59° 53' 57.55728"	W 154° 41' 53.64510"	199.312
ab25	Mcgrath, Ak, USA	N 62° 55' 45.52450"	W 156° 01' 24.11329"	960.5
ab27	Kobuk, Ak, USA	N 67° 03' 21.19874"	W 156° 54' 17.49266"	507.554
ab28	Rainy Pass, Alaska, USA	N 62° 05' 37.73941"	W 152° 48' 53.61066"	1582.225
ab33	Coldfoot, Alaska, USA	N 67° 15' 03.64866"	W 150° 10' 21.04489"	334.314

Base Stations on OnPOZ Technical Support Area

You can use the **Web Site** field to reach the base provider official Web site and register if registration is required.

9.1.3 Coordinate List

The **Coordinate List** is available when pressing the **Get Station Coordinate List** button in **Base Station Providers Manager**.



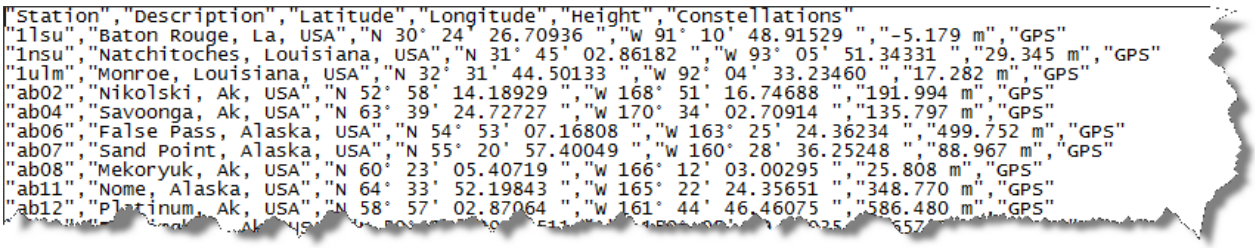
Active	Station	Description	Latitude	Longitude	Height	Constellatio
☑	1lsu	Baton Rouge, Louisiana, USA	N 30° 24' 26.70946"	W 91° 10' 48.91474"	-5.211 m	GPS, GLON
☑	1nsu	Natchitoches, Louisiana, USA	N 31° 45' 02.86222"	W 93° 05' 51.34294"	29.340 m	GPS, GLON
☑	1ulm	Monroe, Louisiana, USA	N 32° 31' 44.50137"	W 92° 04' 33.23408"	17.264 m	GPS, GLON
☑	ab02	Nikolski, Ak, USA	N 52° 58' 14.18953"	W 168° 51' 16.74837"	191.999 m	GPS
☑	ab04	Savoonga, Ak, USA	N 63° 39' 24.72765"	W 170° 34' 02.71032"	135.786 m	GPS
☑	ab06	False Pass, Alaska, USA	N 54° 53' 07.16838"	W 163° 25' 24.36354"	499.746 m	GPS
☑	ab07	Sand Point, Alaska, USA	N 55° 20' 57.40081"	W 160° 28' 36.25373"	88.961 m	GPS
☑	ab08	Mekoryuk, Ak, USA	N 60° 23' 05.40758"	W 166° 12' 03.00395"	25.793 m	GPS
☑	ab09	Wales, Ak, USA	N 65° 36' 53.94796"	W 168° 03' 43.55695"	161.378 m	GPS
☑	ab11	Nome, Alaska, USA	N 64° 33' 52.19881"	W 165° 22' 24.35794"	348.762 m	GPS
☑	ab12	Platinum, Ak, USA	N 58° 57' 02.87122"	W 161° 44' 46.46171"	586.470 m	GPS
☑	ab13	Chignik Lagoon, Alaska, USA	N 56° 18' 26.38055"	W 158° 30' 13.58286"	487.264 m	GPS
☑	ab14	Dillingham, Ak, USA	N 59° 06' 29.40555"	W 159° 05' 29.43147"	657.054 m	GPS
☑	ab15	Nyac, Alaska, USA	N 61° 02' 23.11812"	W 159° 52' 42.01461"	559.724 m	GPS
☑	ab17	Unalakleet, Ak, USA	N 63° 53' 10.90405"	W 160° 41' 40.93749"	116.832 m	GPS
☑	ab18	Kotzebue, Alaska, USA	N 66° 51' 30.11991"	W 162° 36' 48.52293"	36.494 m	GPS
☑	ab21	Adak, Alaska, USA	N 51° 51' 50.95286"	W 176° 39' 45.47428"	58.420 m	GPS
☑	ab22	Illiamna, Alaska, USA	N 59° 53' 57.55728"	W 154° 41' 53.64510"	199.312 m	GPS
☑	ab25	Mcgrath, Ak, USA	N 62° 55' 45.52450"	W 156° 01' 24.11329"	960.500 m	GPS

Coordinate List

- **Provider**: Full base provider name.
  - It is also a hyperlink to the provider web site.
- **Datum**: Full datum name for all positions within the base provider.
- **Coordinate format**: Choose the way the base coordinate is presented
  - **Geographic – DMS**: Display Latitude and Longitude in degree, minute and second. Display ellipsoid height in the current measure unit (**Tools > Options > General**).
  - **Geographic – Decimal Degree**: Display Latitude and Longitude in degree and fraction of degree. Display ellipsoid height in the current measure unit (**Tools > Options > General**).
  - **3D Coordinates – XYZ**: Display X, Y and Z coordinates in the current measure unit (**Tools > Options > General**).
- **Grid**:
  - **Active**: Checkbox indicating which base stations are active
  - **Station**: Base station name
  - **Description**: Base station description
  - **Latitude / Longitude / Height**: Base coordinates if **Coordinate format** is one of the **Geographic**.
  - **X / Y / Z**: Base coordinates if **Coordinate format** is **3D Coordinates**.
  - **Constellations**: Indicates which constellations are supported by the base station. Possible values are:
    - **GPS**
    - **GLONASS**
    - **Galileo**

- **BeiDou**

- **Select All**: Set all base stations active.
- **Unselect All**: Set all base stations inactive.
- **View Map**: Display more information related to the selected base station.
- **Export CSV**: Export the content of the grid as is in a text file where every column is separated by a comma.
  - It will not export the content of the **Active** column.



```
"Station","Description","Latitude","Longitude","Height","Constellations"
"1lsu","Baton Rouge, La, USA","N 30° 24' 26.70936 ","W 91° 10' 48.91529 ","-5.179 m","GPS"
"1nsu","Natchitoches, Louisiana, USA","N 31° 45' 02.86182 ","W 93° 05' 51.34331 ","29.345 m","GPS"
"1ulm","Monroe, Louisiana, USA","N 32° 31' 44.50133 ","W 92° 04' 33.23460 ","17.282 m","GPS"
"ab02","Nikolski, Ak, USA","N 52° 58' 14.18929 ","W 168° 51' 16.74688 ","191.994 m","GPS"
"ab04","Savoonga, Ak, USA","N 63° 39' 24.72727 ","W 170° 34' 02.70914 ","135.797 m","GPS"
"ab06","False Pass, Alaska, USA","N 54° 53' 07.16808 ","W 163° 25' 24.36234 ","499.752 m","GPS"
"ab07","Sand Point, Alaska, USA","N 55° 20' 57.40049 ","W 160° 28' 36.25248 ","88.967 m","GPS"
"ab08","Mekoryuk, Ak, USA","N 60° 23' 05.40719 ","W 166° 12' 03.00295 ","25.808 m","GPS"
"ab11","Nome, Alaska, USA","N 64° 33' 52.19843 ","W 165° 22' 24.35651 ","348.770 m","GPS"
"ab12","Platinum, Ak, USA","N 58° 57' 02.87064 ","W 161° 44' 46.46075 ","586.480 m","GPS"
```

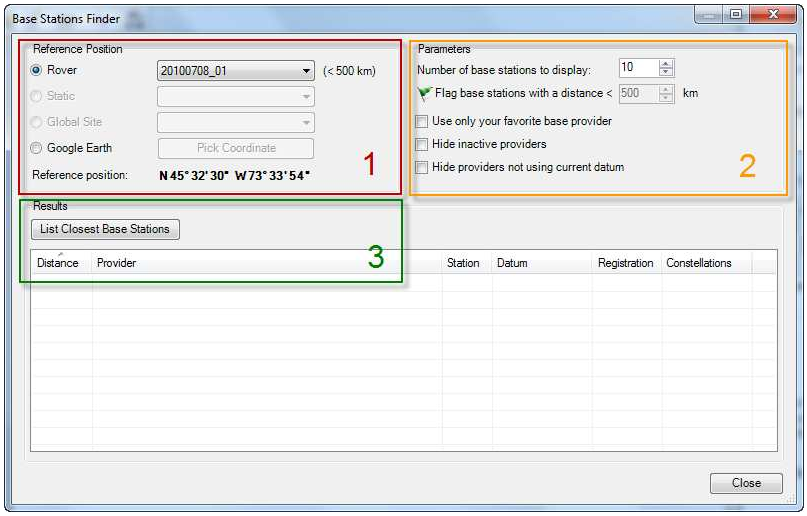
Export CSV file

- **Close**: Close the dialog

9.2 Finder

The **Base Station Finder** is a tool to help locate base stations in the area of your data. It will help you determine which base providers are in your area and if you need a base provider that requires registration to have base stations close enough for your needs.

The **Base Station Finder** is available from the **Tools > Base Stations > Finder** menu or by pressing the in the **Main** toolbar.

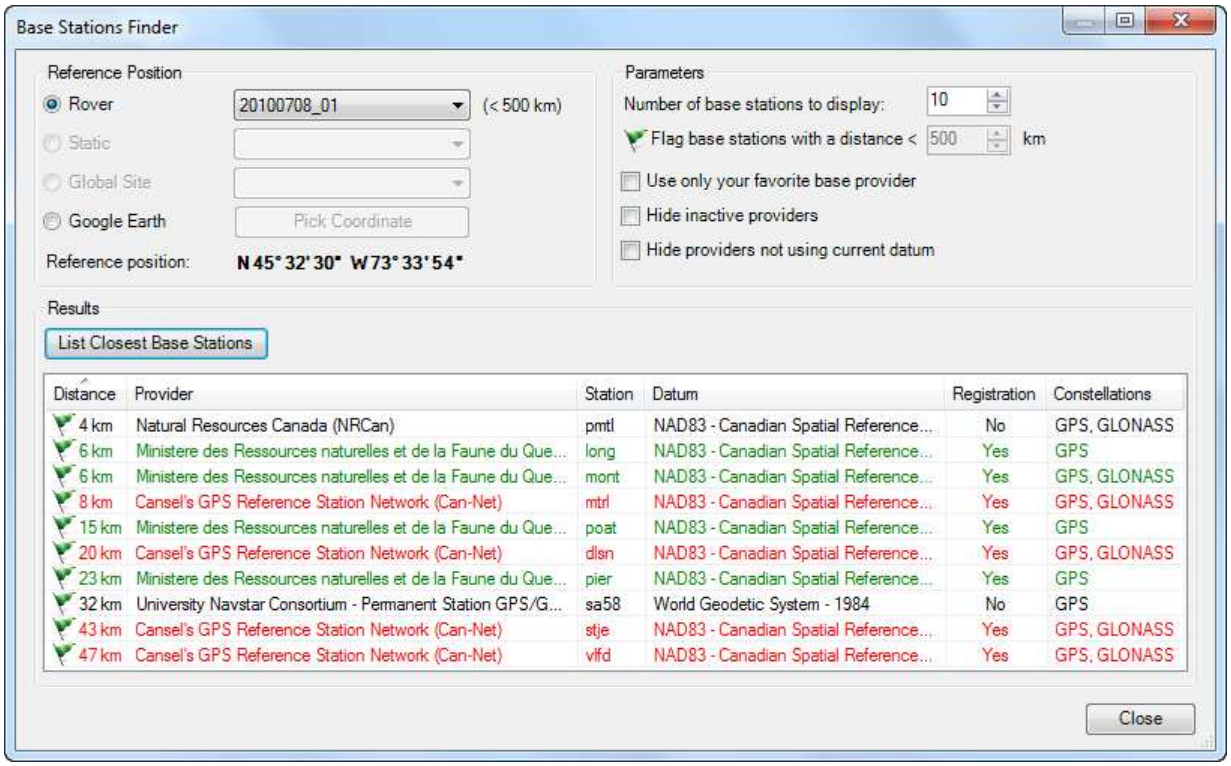


Base Stations Finder – Steps to use

The three steps to use the **Base Stations Finder**:

- **Step 1**: Choose your reference position
- **Step 2**: Choose your parameters (optional)
- **Step 3**: Press **List Closest Base Stations**.

At any time, you can modify your reference position or the parameters and press **List Closest Base Stations** to display the updated list.



Base Stations Finder – Results

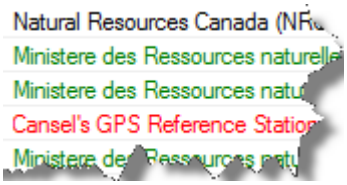
- **Reference Position**: Choose the reference position. Several sources are available:
  - **Rover**: Select a rover as the source for your reference position.
    - **Combo box**: List of all rovers in your project.
      - Only available if you have at least a rover in your project.
    - When available, it also indicates the value of the **Maximum distance to match reference** in **Tools > Options > Combinations > Trajectories**.
  - **Static**: Select a static as the source for your reference position.
    - **Combo box**: List of all statics in your project.
      - Only available if you have at least a static in your project.
    - When available, it also indicates the value of the **Maximum distance between sites** in **Tools > Options > Combinations > Baselines**.
  - **Global Site**: Select a global site as the source for your reference position.
    - **Combo box**: List of all global sites in your application.
      - Only available if your **Global Sites Editor** is not empty (**Tools > Global Sites**)

- **Google Earth**: Select Google Earth as the source for your reference position.
  - **Pick Coordinate**: Choose a new position within Google Earth.
    - Only available if Google Earth radio is selected.
- **Reference position**: Reference position currently selected.

- **Parameters**: Other parameters that will affect the result of the search.
  - **Number of base stations to display**: Number of items to display in the grid
  - **Flag base stations with a distance <**: Add a flag to all base stations closer than a particular distance. These base stations could be used if an actual **Search for base stations** is launched.
    - When **Rover** or **Static** is selected as the source for reference position, the value is locked to the distance that would be used in an actual **Search for base stations**.

  - **Use only your favorite base provider**: Check if you only want to see the list of the closest base station for your favorite provider. In an actual download, remember the favorite provider is used before any other.
    - Only available if you have a favorite provider.
  - **Hide inactive providers:** Do not display any inactive providers in the results grid.
  - **Hide providers not using the current datum:** Do not display base stations coming from provider using a datum that differs from the one selected in your current mapping system. Precision is always better if coordinate are in the same datum through the whole project.

- **Results**: Display the results according to the reference positions and all other parameters.
  - **List the Closest Base Stations**: This will update the content of the grid.
  - **Grid**: List of base stations matching above criteria.
    - **Text color**: The text color indicates the state of the base provider.
      - **Green**: Indicate base station comes from the favorite provider.
      - **Black**: Indicate base station comes from an active provider.
      - **Red**: Indicate base station comes from an inactive provider.



Active provider
Favorite provider
Favorite provider
Inactive provider
Favorite provider

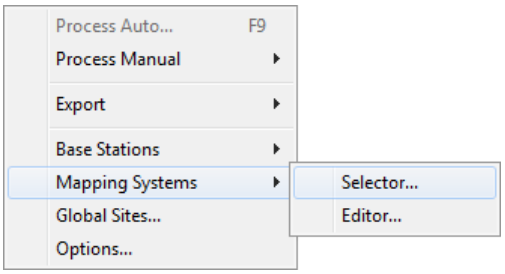
    - **Distance**: Distance between the base station and the reference position.
      - If distance is lower than the value in **Flag base stations with a distance**, it will add a before the distance.
    - **Provider**: Full base provider name.
    - **Station**: Base station name.
    - **Datum**: Full datum name for all positions within the base provider.
    - **Registration**: Indicate if the base provider required registration.
    - **Constellations**: Indicates which constellations are supported by the base station. Possible values are:

    - **GPS**
    - **GLONASS**
    - **Galileo**
    - **BeiDou**
- **Close**: Close the dialog.

10 Mapping Systems

In the software, data is displayed and exported using the selected mapping system. If there is no selected mapping system, the software exports positions in WGS84 geodetic coordinates.

The mapping systems selector and editor are accessed through **Tools > Mapping Systems…** from the main menu.



Mapping System Menu

10.1 About Mapping Systems

3D coordinates in OnPOZ software applications are usually expressed in geographic or projected coordinate reference systems, called **mapping systems**.

- A mapping system which expresses coordinates using **X, Y and height** on a plane is a **projected** mapping system. For instance the Universal Transverse Mercator (UTM) mapping system is a popular projected mapping system used around the world.
- A mapping system which expresses coordinates using **longitude, latitude and height** is a **geographic** mapping system. For instance, the fundamental geographic mapping system in GNSS applications is WGS84.

10.1.1 Geodetic Datums

Every mapping system, whether geographic or projected, is defined relative to a specific geodetic **datum**. For short, a geodetic datum is called a datum.

- A geodetic datum is modeled using an **ellipsoid**, which is an approximation of the shape of the Earth.
- In addition, any datum can carry a **datum transformation,** used to relate the datum to the WGS84 datum. This transformation provides a mean to translate coordinates from any datum to any other datum, using WGS84 as the common reference.

❖ While the complete definition of datum involves more parameters, for all practical purposes in the software it is modeled by an ellipsoid along its transformation parameters with respect to WGS84

❖ A datum transformation is defined using 15 parameters (3 translations, 3 rotations, 1 scale factor, an annual rate of change for each previous 7 parameters and a year of reference), which are used to translate, rotate and scale the datum's ellipsoid with regards to that of the WGS84 datum.

10.1.2 Map Projections

All the projected mapping systems are defined based on a **map projection**, in addition to the geodetic datum described above. A map projection defines the transformation to convert geographic (longitude, latitude) coordinates to projected (X, Y) coordinates. Examples of map projections include Universal Transverse Mercator (UTM) and Stereographic.

10.1.3 Vertical Datums

All heights in geographic and projected mapping systems are defined as **ellipsoidal heights**, meaning heights measured relative to the ellipsoid.

See the ***Geoid*** chapter for definitions and details about how to use geoid models to transform ellipsoidal heights to **mean sea level heights**.

10.1.4 Earth-Centered, Earth-Fixed (ECEF)

3D coordinates are sometimes expressed as (**X, Y, Z**) in a **geocentric coordinate reference system**, which is a 3D Cartesian coordinate system centered on the Earth's mass center. Our current Mapping systems engine do not currently address converting to and from geocentric coordinates.

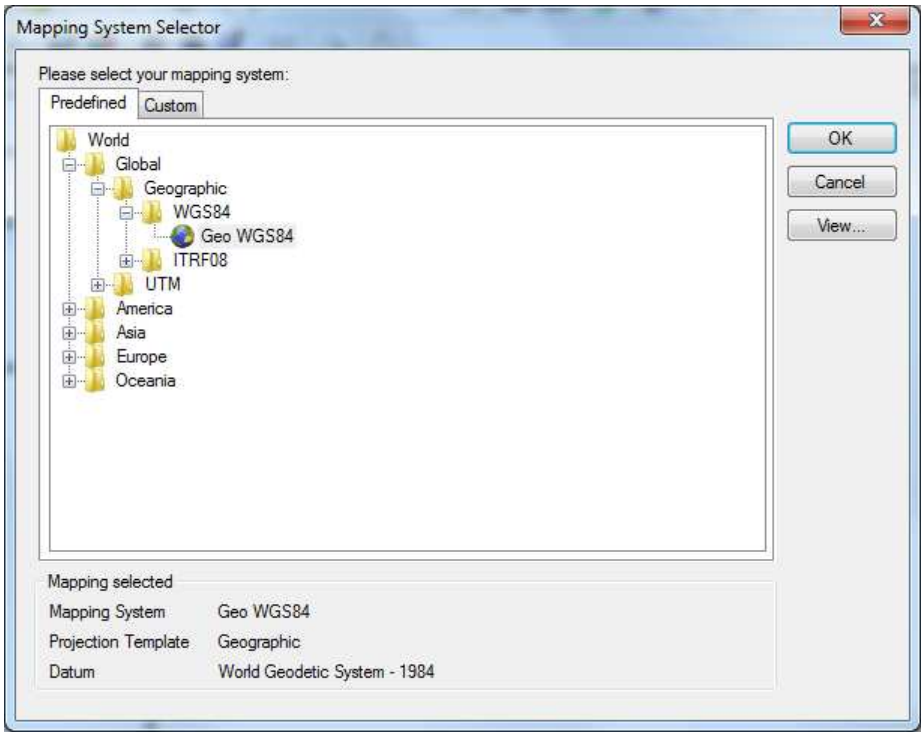
It is also commonly known as Earth-Centered, Earth-Fixed (ECEF).

10.2 Selecting a Mapping System

The software comes with a set of predefined projected and geographic systems. The Mapping System Selector allows you to select the current mapping system for use in the software.

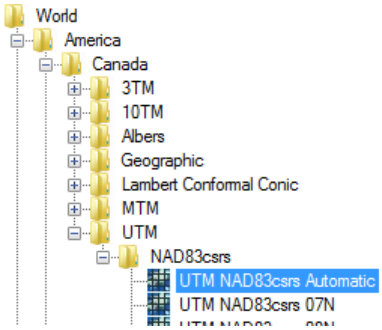
❖ Other tools and applications, such as **Export Features**, also provide their own interfaces for mapping system selection.

Open the **Mapping System Selector** dialog with **Tools > Mapping Systems… > Selector…** or click on the button in the **Main** toolbar.



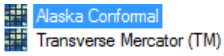
The Mapping System Selector dialog box

- To select a mapping system
  a. Choose from Predefined or Custom list by pressing the **Predefined** or the **Custom** tab at the top of the dialog.
  b. Navigate to the mapping system and select it.
     - In the **Predefined** list, open nodes until you reached the mapping system you desire.



Selecting a predefined mapping system

     - In the **Custom** list, the list is flat so select the mapping system you desire.



Selecting a custom mapping system

> ❖ The **Custom** list is empty initially. ***Customizing a Mapping System*** section explains how to create and manage custom mapping systems.

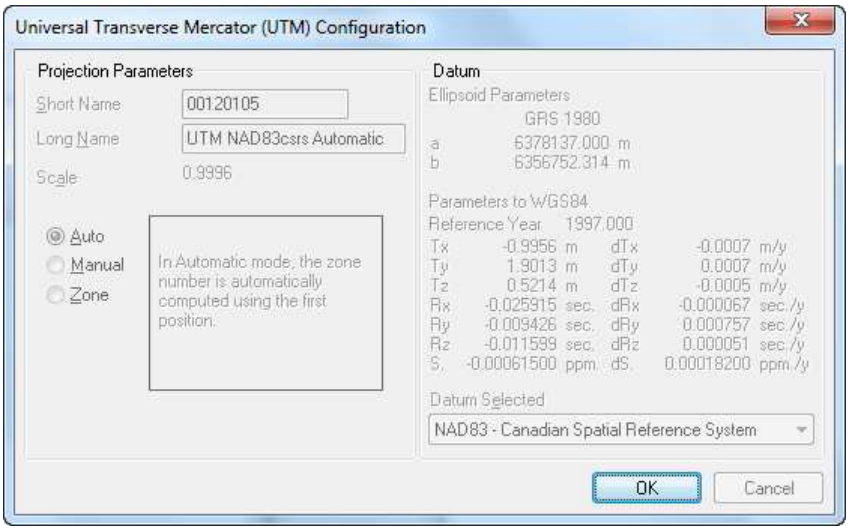
c. Some extra information about the mapping system you selected is display in the **Mapping selected** section.

d. Click **OK**. The dialog box closes and the selected mapping system becomes active.

■ To view detailed information about a mapping system

a. Select a mapping system if it is not already done.

b. Press the **View…** button.



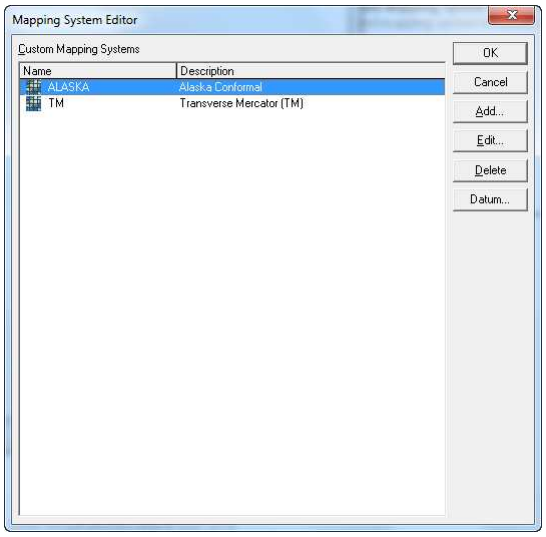
View detailed information about a mapping system

c. Press **OK**.

10.3 Customizing a Mapping System

In this section, we present how to customize a mapping system.

Open the **Mapping System Editor** dialog with **Tools > Mapping Systems… > Editor…** or click on the button in the **Main** toolbar.



Mapping System Editor

10.3.1 Adding a new mapping system

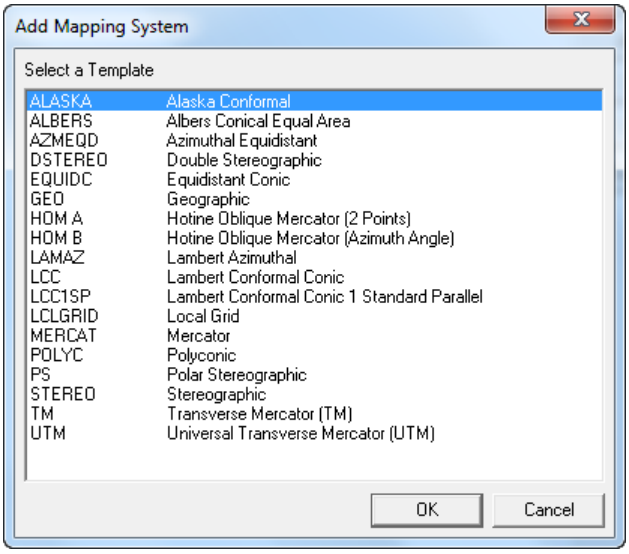
We first describe the general procedure and then we present how to set a UTM system.

10.3.1.1 General Procedure

To define a new mapping system, you will select a mapping system template and then enter the parameters for your mapping system.

- To customize a mapping system

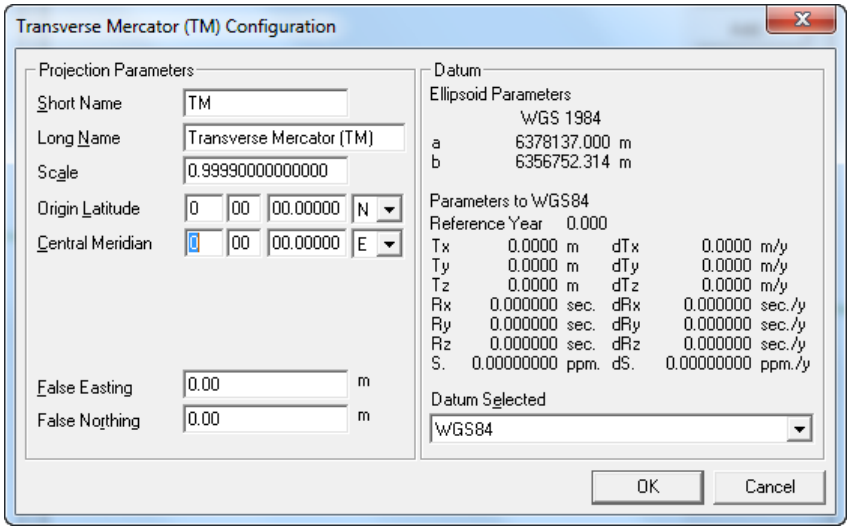
a. From the **Mapping System Editor** dialog box, click **Add...**. The **Add Mapping System** is displayed containing a list of all the supported mapping system templates.



Add Mapping System

b. Select the desired template from the **Select a Template** list. As an example, select **Transverse Mercator (TM).**

c. Click **OK**. This closes the **Add Mapping System** and display a configuration dialog box. The title bar of the new dialog box displays the name of the selected mapping system template. In this case, it displays **Transverse Mercator (TM) Configuration**.



Transverse Mercator (TM) Configuration

d. Enter the parameters that fit your area:

- In the **Projection Parameters** or **Parameters** section, enter a **Short Name** and a **Long Name** to identify your customized mapping system. In most cases (for example when the mapping system template is a map projection) you will also have to input additional parameters. In this example (TM) you have to input a **Scale** factor (to define a 3 or a 6 degree zone), **Origin Latitude**, **Central Meridian**, **False Easting** and **False Northing**.
- In the **Datum Selected** field, select a geodetic datum from the drop-down list.

> To create a new datum, see ***Customizing a Datum*** section below.

e. Click **OK** to save the new information and close the dialog box.

f. Your new projection is listed in the **Mapping System Editor** dialog box ready to be used.

> There is a template like the “TM template” for each type of supported map projection. You have to understand very well every specific parameter before setting them. You do not have to understand each map projection template, just concentrate on the one used in your area. Contact your local mapping agency to get more details about the mapping systems used in your area. Your local sale representative should also provide you with the necessary details about the most commonly used mapping system in your area.

10.3.1.2 Setting Up a UTM Mapping System

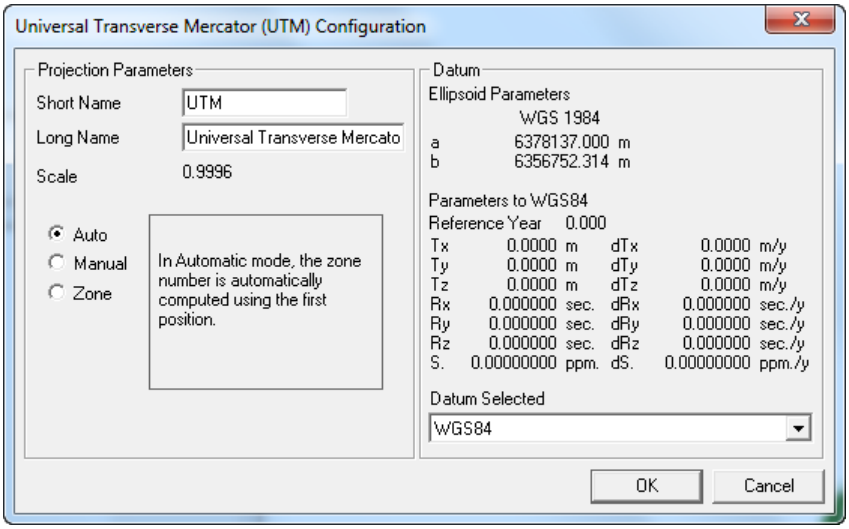
The UTM map projection is a used worldwide. The world is divided into 60 UTM zones of 6 degrees (known as zone 1 to 60). It is also divided in two hemispheres: north and south for a total of 120 combinations.

The Mapping Systems tool allows you to set your UTM zone using the zone number and hemisphere, by setting a central meridian or by letting the system compute itself the zone using the first coordinate at hand (in your project).

■ To customize a UTM map projection

a. From the **Mapping System Editor** dialog box, click **Add...**. The **Add Mapping System** is displayed containing a list of all the supported mapping systems templates.

b. Select **Universal Transverse Mercator (UTM)** and click **OK**. The **Universal Transverse Mercator (UTM) Configuration** is displayed.



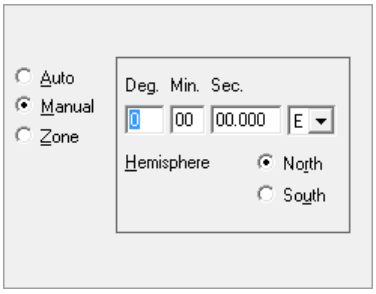
Universal Transverse Mercator: Automatic setting

c. Input a **Short Name** and a **Long Name** to identify your customized UTM map projection.

d. Select a datum from the **Datum Selected** drop-down list.

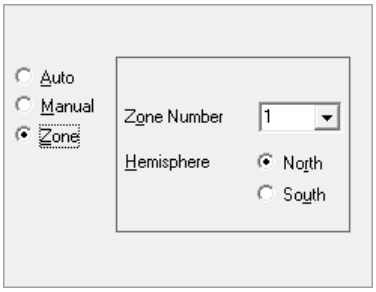
e. As you can see on the left side of the dialog box, you have the choice of three option buttons:

- **Auto:** There is nothing to configure.
- **Manual:** Enter your central meridian. Set the proper side of your location with respect to Greenwich (East or West) and select the proper **Hemisphere**.



Universal Transverse Mercator: Manual setting

- **Zone:** Enter your **Zone Number** and set the proper **Hemisphere**.



Universal Transverse Mercator: Zone setting

❖ If one of these simple parameters is not properly set, you can get coordinates very far from their real location.

f. Click **OK** to save the new information and to close the dialog box. You will return to the **Mapping System Editor** dialog box with your newly created UTM map projection listed.

10.3.2 Deleting a custom Mapping System

You can delete custom mapping systems that you no longer require from the **Mapping System Editor** dialog box.

■ To delete a mapping system

a. From the **Mapping System Editor** dialog box, select the mapping system you want to delete in the **Custom Mapping Systems** list and click **Delete**. The selected mapping system is removed from the list.

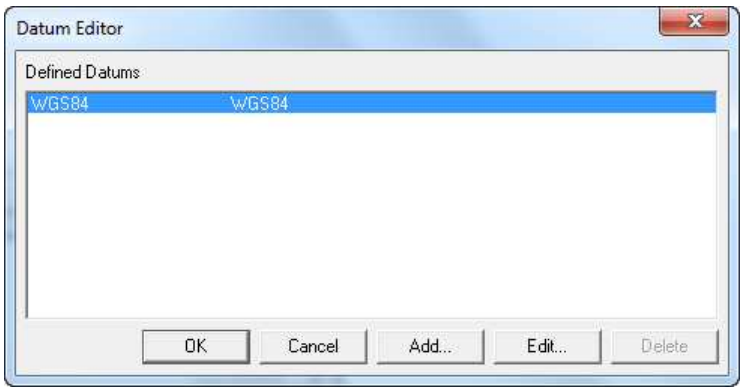
b. Click **OK** to save the changes and close the dialog box.

10.3.3 Customizing a Datum

A datum is defined by an ellipsoid, and is associated with 15 transformation parameters to the WGS84 datum. Datums are accessed from the **Datum Editor**.

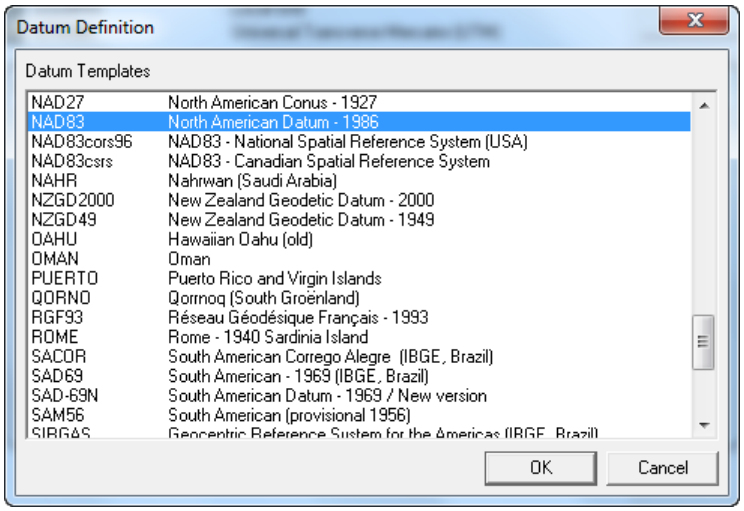
■ To customize a datum

a. From the **Mapping System Editor** dialog box, click **Datum...** The **Datum Editor** is displayed.



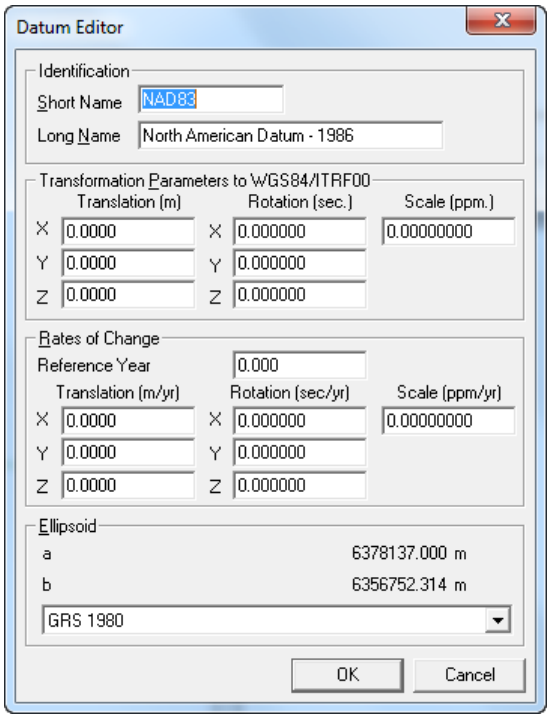
Datum Editor

b. Click **Add...**. The **Datum Definition** is displayed. All predefined datum are listed.



Datum Definition

c. Select a datum and click **OK**. The **Datum Editor** is displayed.



Datum Editor

d. Enter a **Short Name** and a **Long Name** for your customized datum.

e. Edit as needed the transformation parameters and their rates of change to WGS84/ITRF00.

> ❖ Only very experienced users should edit transformation parameters. Wrong input might provide extremely bad transformation results.

f. If needed, select another ellipsoid.

g. Click **OK** to close the dialog box. You will return to the **Datum Editor** with your newly customized datum listed.
h. Click **OK** to return to the **Mapping System Editor**.

10.3.4 Deleting a Datum

You can delete a datum that you no longer require from the **Datum Editor**.

> Never delete a datum currently in use by one of your mapping system. Deleting a datum used by one of your mapping system will delete the mapping system as well.

■ To delete a datum

a. From the **Mapping System Editor** dialog box, click **Datum...** The **Datum Editor** is displayed.
b. Select the datum to be deleted and click **Delete**. The selected datum is removed from the list.
c. Click **OK** to return to the **Mapping System Editor**.

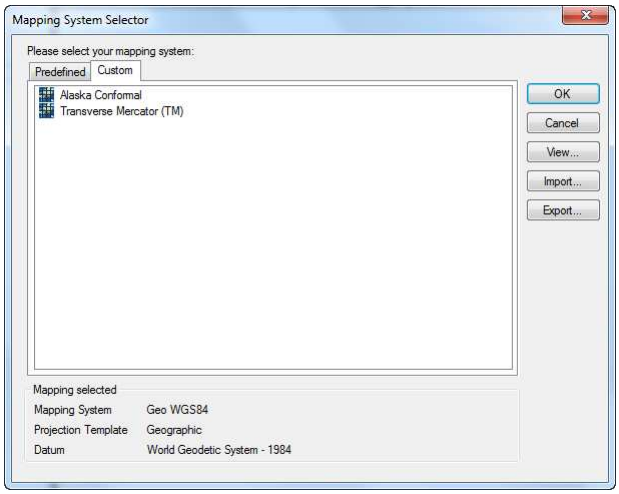
10.3.5 Exporting Mapping Systems

Here are the reasons you may want to export your Custom mapping systems:

- You want to copy Custom mapping systems from one PC to another or from one user to another on the same PC.
- You want to use them in your Windows Mobile device with to OnPOZ EZTag CE™ or OnPOZ EZField™.

■ To export mapping systems

a. Open the **Mapping System Selector**.
b. Select the **Custom** tab.



Mapping System Selector – Custom

c. Click **Export…**
d. Select the location to save your files and click **OK.** The files are exported.

■ To copy mapping systems to OnPOZ EZTag CE™ on Windows Mobile

a. Copy the **CustomProjections.DAT** and **CustomDatums.DAT** files from your PC to the **\Application Data\VGI Solutions\EZTag CE\Mapping Systems** folder on your Windows Mobile device.

- To copy mapping systems to OnPOZ EZTag CE™ on PC

a. Copy the **CustomProjections.DAT** and **CustomDatums.DAT** files to your Application Data folder. The actual position depends on your operating system and your user name.

   a. **Windows XP**: C:\Documents and Settings\<*User Name*>\Application Data\VGI Solutions\EZTag CE\Mapping Systems
   b. **Windows Vista, Windows 7, Windows 8 or Windows 8.1**: C:\Users\<*User Name*>\AppData\Roaming\VGI Solutions\EZTag CE\Mapping Systems

10.3.6 Importing Mapping Systems

In the same way that you exported mapping system, you can import them. This might be useful when you transfer your data from one PC to another. If you have a lot of mapping systems already defined, export them first (see above section for more details), transfer them to the other PC and re-import them.

- To import mapping systems from a location on your PC

a. Open the **Mapping System Selector**.
b. Select the **Custom** tab.
c. Click **Import...**
d. Select the location where your files are located (they have to be in the same folder) and click **OK**. The files are imported.

❖ Importing replace all your existing mapping systems

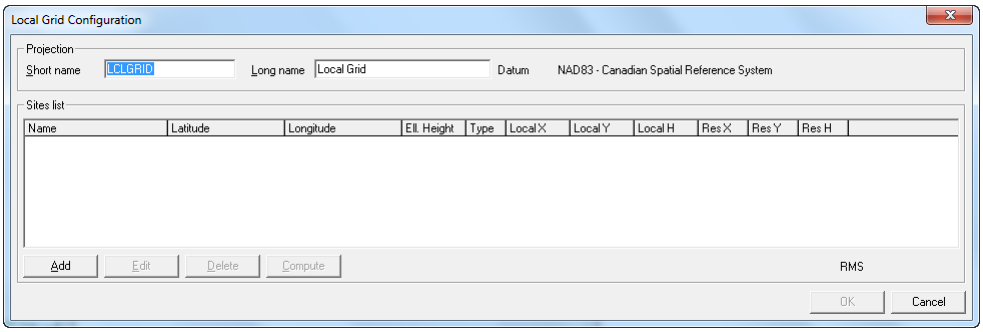
10.3.7 Setting a Local Grid Mapping System

A local grid allows you to work on an area with a local north. But this area must be small; otherwise the earth curvature will introduce biases in the transformation parameters and inaccuracy in your coordinates. Geodetic coordinates have to be used on larger areas. This being said, local grids are still largely used by surveyors. They usually set a reference point to an arbitrary value (e.g., X=10000, Y=10000, H=100) with a reference direction on a tower (or some high target). When working in a local grid with a GPS system, we have to establish the relation between few points of the local system and the WGS84 system used in GPS positioning.

Establishing a relation means that we need at least 3 stations where we know coordinates in both systems, local and geodetic. It is a 3D transformation resolving 3 translation, 3 rotations and 1 scale factor.

- To customize a local grid

a. From the **Mapping System Editor** dialog box, click **Add...**. The **Add Mapping System** is displayed containing a list of all the supported mapping systems templates.
b. Select the **Local Grid** (LCLGRID). The **Local Grid Configuration** is displayed.



Local Grid Configuration

c. Enter a **Short name** and a **Long name** for your local grid system.

d. Create a new record by clicking **Add**. It opens the **Local Grid Site Editor**. An empty record is displayed. Fill it and save it.

e. Enter at least three points. If you enter a bad site, you can delete it by pressing **Delete**.

f. Click **Compute** to compute the transformation parameters.

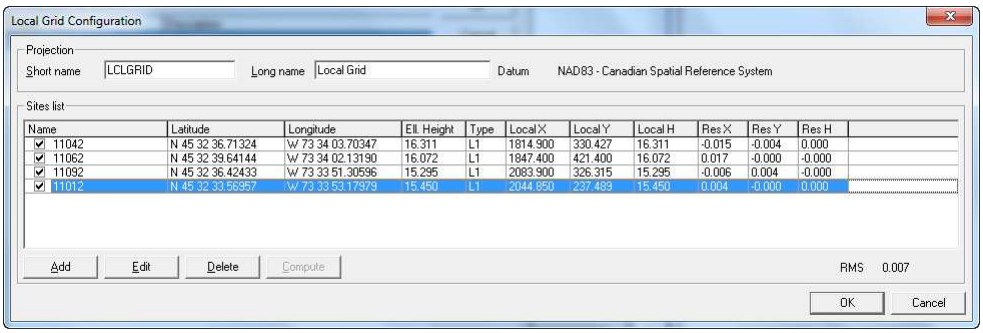
g. The residuals of the adjustment are displayed in the **Res X**, **Res Y** and **Res H** columns (2 points are not enough to resolves 3 translation, 3 rotation and a scale, you need at least 3 points, using more than 3 points is suitable).

h. The RMS of the calculation is displayed at the bottom of the dialog box. This number should be very small if you are doing surveying work (+/- few centimeters). This number is telling you “how good” are the consistency between both coordinate systems.

i. You can enter additional sites and re-compute your transformation parameters.

j. If the residuals on a specific site are too large, just remove this site from your computation by un-checking its box at the left side of its record and recomputing a transformation.

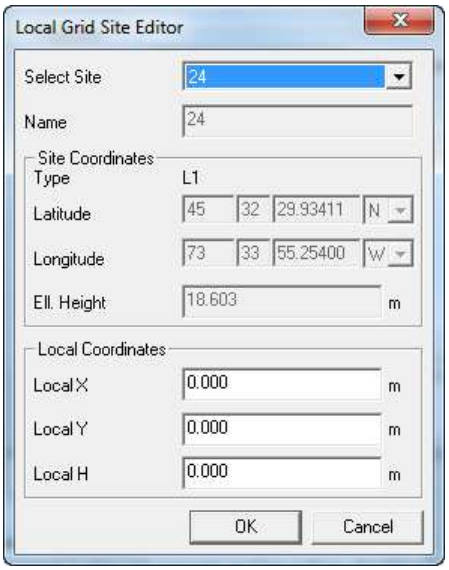
Transformation parameters associated with a large RMS value should not be accepted.



Local Grid Configuration – Compute

k. When you are satisfied with your RMS value, click **OK** to close the dialog box. You will return to the **Mapping System Editor** dialog box with your newly local grid listed.

10.3.7.1 Local Grid Site Editor



Local Grid Site Editor

- **Select Site**: List of all sites in project. When you select one, it will fill **Name** and **Site Coordinates** with information related to that site.
    - **User**: An extra item in the list. When selected, you can fill **Name** and **Site Coordinates** manually (be careful when inputting manual coordinates, make sure it is in the same reference system that the other one).
- **Name**: Name to help you identify this coordinates.
- **Site Coordinates**: Geodetic coordinates in the current datum
    - **Type**: Solution type for the position of the site.
    - **Latitude**: Latitude in current datum.
    - **Longitude**: Longitude in current datum.
    - **Ell. Height**: Ellipsoid height.
- **Local Coordinates**: Associated local coordinates
    - **Local X**: X component for local coordinates.
    - **Local Y**: Y component for local coordinates.
    - **Local H**: Height component for local coordinates.
- **OK**: Save and close dialog.
- **Cancel**: Close dialog without saving.

11 Editing

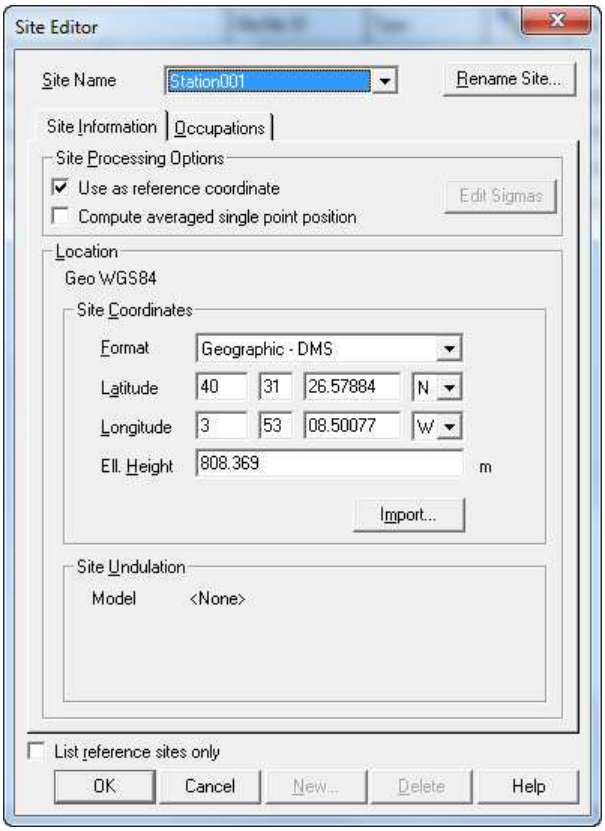
11.1 Site

Site editing is performed using the **Site Editor**. The **Site Editor** can be displayed by following one of these procedures:

- From the main menu:
  - Select **Edit > Site...**;
- From the **Plan View:**
  - Double-click on a site symbol;
  - While your cursor is over a site symbol, right-click and select **Edit Site...** in the speed menu.
- From the **Project Manager**, when the **Sites** folder is selected:
  - Double-click on a site occupation;
  - Select the site to be edited (or a site occupation). From the speed menu or the **Sites** main menu, select **Properties**;

The **Site Editor** is divided in two parts:

- **Site Information:** Contains information related to the site itself.
- **Occupations**: Contains information specifically related to each occupation of this site.



Site Editor

11.1.1 Site Information

The information on this page is specific to a site. It is used to define and modify properties that are specific to the selected site. Changes to this page affect all of the occupations associated to the site.

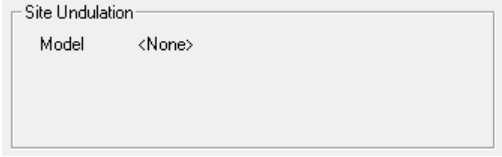
- **Site Name**: Site name.
- **Site Processing Options**:
  - **Use as reference coordinate**: If checked, the site coordinates displayed in the **Site Coordinates** area of the **Site Editor** is enabled and will be used as a fixed reference during processing. You may use this option in semi-kinematic processing to set your initialization sites. In static positioning, this option causes the software to use this site to start the computation of the network of vectors. For a trajectory, this option is used to fix the coordinate of a site that will be used as a base station (a static file set as a reference is equivalent to a file set as a Base).
  - **Compute averaged single point position**: If checked, the software will compute a single-point position for the site. This option could be used when you do not know your reference site coordinate (it provides results at +/- few meters using broadcast orbits).
- **Location:**
  - **Text**: Display the current mapping system name. To select another mapping system, use **Tools > Mapping Systems… > Selector…** from the main menu.
  - **Site Coordinates**: Used to edit the position of the currently selected site. The option **Use as reference coordinate** must be checked to activate the data edition. The input

coordinates will be held fixed in the processing. You must enter valid site coordinates. The more accurate your site coordinates are, the more accurate your differential results will be, especially if you are performing phase calculation. Absolute accuracy is directly related to the accuracy of your reference site.

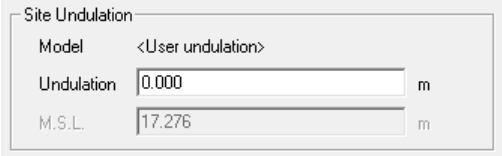
- **Format**: Format to present the following coordinates. Possible values are:
  - **Geographic – DMS**: Display latitude and longitude in degree, minute, second using current datum. Display also ellipsoid height.
  - **Geographic – Decimal Degree**: Display latitude and longitude in decimal degree using current datum. Display also ellipsoid height.
  - **3D-Cartesian – XYZ**: Display X, Y and Z (geocentric) using current datum.
    - Only available if no geoid model is selected.
  - **Mapping – XY**: Display X, Y and Ellipsoid height using current mapping system.
    - Only available if the current mapping system is cartographic.
- **Import**: Import the coordinate for this site from the Global site. See ***Import a position*** for more details.

> There is an option to import coordinates from Global Site during import. If your site name matches a global site, it will copy the coordinates. It is available in **Tools > Options > Data Files**.

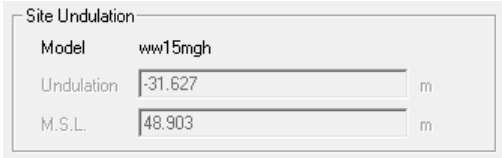
- **Site Undulation**: The content will depend on the current geoid.



Site Editor – Site Undulation – <None>



Site Editor – Site Undulation – <User undulation>



Site Editor – Site Undulation – Any geoid

- **Model**: Geoid model used. To select another geoid model, use **Edit > Geoid…** from the main menu.
- **Undulation**: Editable only when the model is **<User undulation>.**
  - When the current geoid is **<User undulation>**, the undulation is zero by default for all sites. The user must set manually undulations on all sites.

- When the current geoid is a regular geoid, it displays the undulation value computed at the site position using the selected geoid model.

▪ **M.S.L.**: Used to display the orthometric height (or height with respect to the mean sea level).

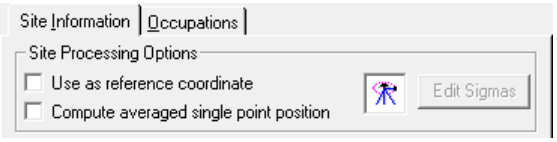
❖ Ellipsoid height and MSL are never active at the same time. When the geoid model is <None>, ellipsoid height is active. In all other case, MSL is active.

- **List reference sites only**: When checked, the **Site Name** combo will display only sites where the **Use as reference coordinate** is checked.

Site for Semi-Kinematic Survey

Note that the next options are only applied to the rover of a semi-kinematic survey:

- When the user enabled the **Use as reference coordinate** checkbox for a site, the coordinates of this site are used during the semi-kinematic processing.
- When the user disabled the **Use as reference coordinate** checkbox for a site, the coordinates of the site are unknown and are computed during processing.
- When a site was recorded as an EZBar (as provided with OnPOZ products), the icon appears on the right side of the **Use as reference coordinate** checkbox.



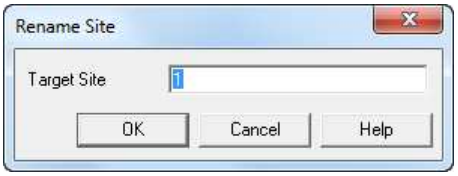
Site Editor with EZBar

- Once the user click **OK**, all occupations of sites with the option **Use as reference coordinate** activated will have a known position.

Rename a site

You can modify the name of a site. For example, if by mistake you assign the name 78KF094 to a site instead of 78KP044, you can rename the site before processing it.

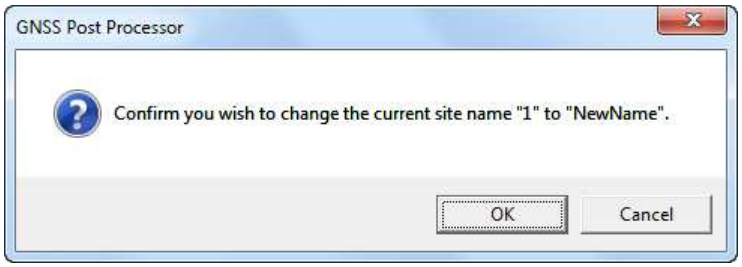
a. From the **Site Editor**, click the **Rename Site...** button. The **Rename Site** is displayed.



Rename Site

b. Type a new name for the site in the **Target Site** text box.

c. Click **OK**. A confirmation window is displayed.

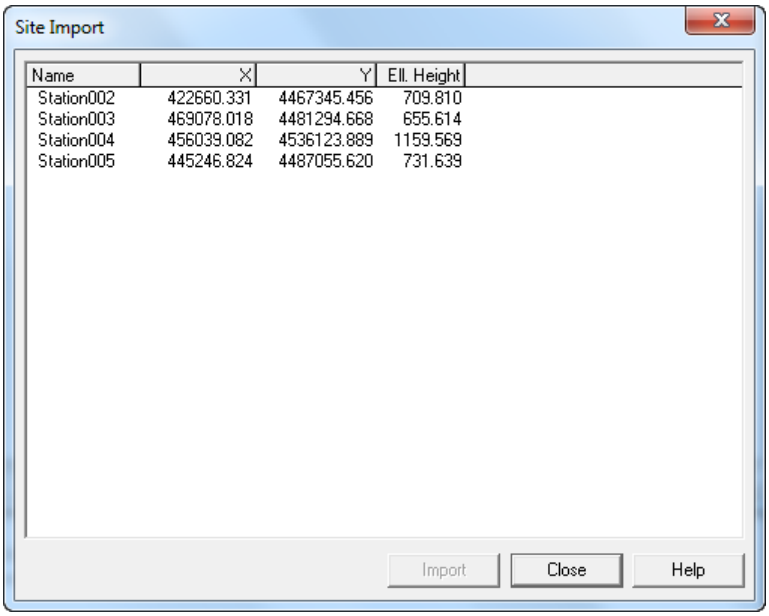


Rename Site confirmation

d. Click **OK** to confirm the action. You are back to the **Site Editor**.

Import a position

From the **Site Editor**, click the **Import** button. The **Site Import** is displayed.



Site Import

All sites listed here come from the Global Sites; see section ***Export – Sites*** to explain how to export a site in the Global Sites.

Select a site in the table displayed. Click the **Import** button. You are back to the **Site Editor**. Only coordinates are imported (they are applied to the selected site in the **Site Editor**).

Delete a site

a. From the **Site Editor**, select the site that you want to delete from the **Site Name**.

b. Click **Delete** at the bottom of the **Site Editor**. A confirmation window is displayed.

Delete Site confirmation

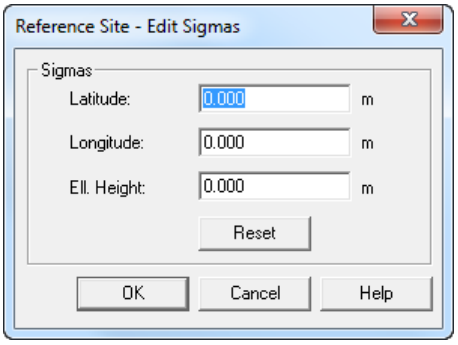
c. Click **OK** to confirm the deletion. You are back to the **Site Editor**.

- Sites can be deleted from a project but they cannot be restored.
- When you delete a site, you are also deleting all the results, baselines, trajectories, and loops attached to the site.
- Sites can be easily deleted by using the **Project Manager**. Select the **Sites** folder from the selector pane. In the viewer pane, select the site(s) to be deleted, press the **Del** key or select **Delete** from the speed menu or click on the **Main** toolbar.

Edit Sigmas

This button is enabled only when the network adjustment type is set to **Weighted Stations** (see section ***Options – Network*** for details) and **Use as reference coordinate** is checked. It is used to enter the sigmas of a reference station to be used in the network adjustment.

a. From the **Site Editor**, select the site that you want to set as a reference station from the **Site Name.**
b. Select the **Use as reference coordinate** checkbox.
c. Click on the **Edit Sigmas** button. The **Reference Site – Edit Sigmas** is displayed.
d. Enter the sigma value for each component: **latitude**, **longitude** and **ell. height** (ellipsoid height).

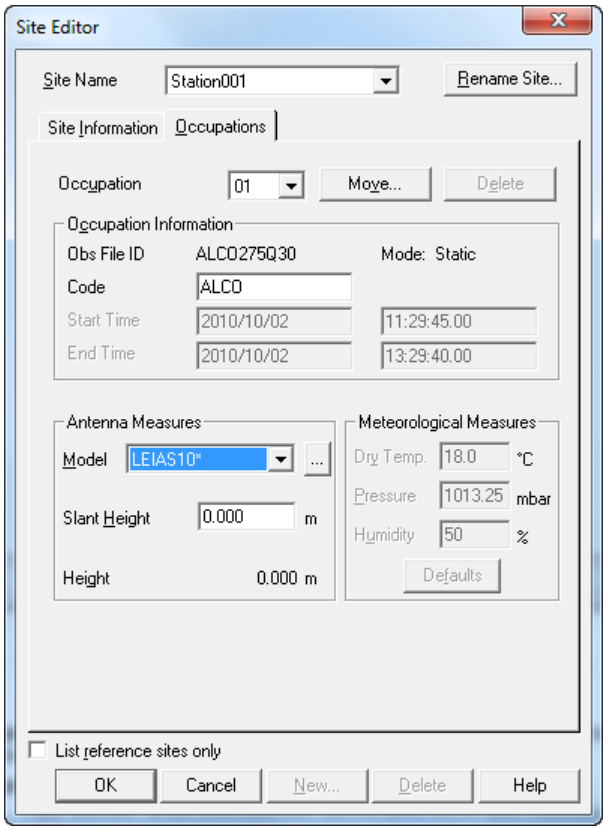


Reference Site – Edit Sigmas

e. Click **OK** to confirm your values. You are back to the **Site Editor**.

11.1.2 Occupations

As we previously explained, a site can be observed more than once, so for a specific site, we may have more than one occupation. The information in this page is specific to the selected occupation. The properties edited here affect only the currently selected occupation.



Site Editor – Occupations

- **Occupation**: Used to select the site occupation you want to edit. The drop-down list contains all the site occupations for the currently selected site.
- **Occupation Information:**
  - **Obs File ID:** Field indicating the observation file ID that contains the current site occupation data.
  - **Mode:** File status for the observation file.
  - **Code:** Code information attached to the site (if any).
  - **Start Time:** Used to edit the start date and time of the selected site occupation.
  - **End Time:** Used to edit the end date and time for the selected site occupation.
- **Antenna Measures:**
  - **Model:** Used to select an antenna model from the drop-down list. To select a model not displayed in the list, select the ... button. Refer to ***Antenna Models*** chapter for information on antenna models.
  - **Slant Height:** Used to edit the antenna slant height entered in the field.

- **Height:** Vertical antenna height as calculated by the slant height and the antenna model.

- **Meteorological Measures:**
  - **Dry Temp.:** N/A. The software uses standard meteorological values.
  - **Pressure:** N/A. The software uses standard meteorological values.
  - **Humidity:** N/A. The software uses standard meteorological values.

Move a site occupation

This operation is different from renaming a site. For instance, in the field you want to observe twice the site B and only once the site A, but in the field, when the operator were back to site B, he named it as A. So in your data file you have two occupations for site A and only one for site B. If you process your data without correcting this “naming problem” you will have unpredictable results since you have two occupations of site A without the same location. In this case you need to move the site occupation A(2) to site B.

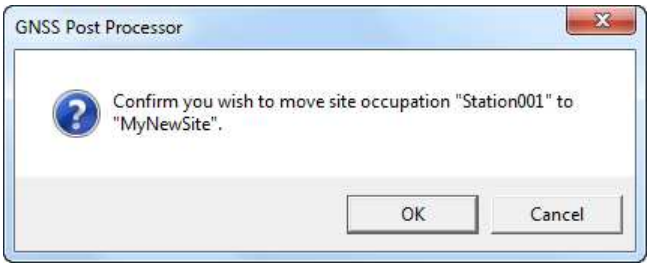
When renaming a site, only the name of the site is changed, and all other information attached to the site is preserved (e.g. coordinates, occupations). When moving a site occupation from site A to site B, we take all the information related to the selected occupation of site A (e.g. start and end time, antenna height) and we assign it to site B (site B already exists). The occupation previously attached to site A is automatically removed and is now assigned to site B. In other words, this operation does not rename a site; it is moving all the information of a site occupation (associated to the wrong site) to its proper site.

- If you move all site occupations of a site, the site will be deleted.
- When activated, the **Site Validator** is used when moving a site.

a. From the **Site Editor**, select the site that contains an occupation to move to another site.
b. From the **Occupations** page, select the occupation number to be moved from the **Occupations** drop-down list.
c. Click **Move**. The **Move Site Occupation** is displayed.

Move Site Occupation

d. If you want to move the site occupation to an existing site, check the radio **To an existing site** and select a site in the combo box below.
e. If you want to move the site occupation to a new site, check the radio **To a new site** and enter a new site name in the edit box below.
f. Click **OK**. A confirmation pop-up window is displayed.



Move Site Occupation confirmation

g. Click **OK** to confirm the action. You are back to the **Occupations** page of the **Site Editor**.

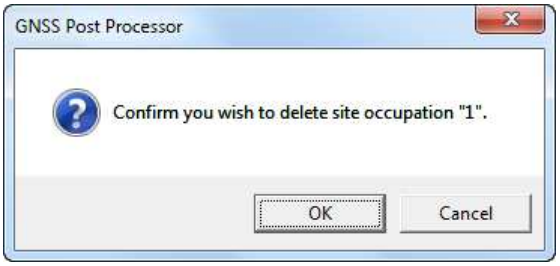
> Multiple site occupations can be moved easily by using the **Project Manager**. Select the **Sites** folder from the selector pane. In the viewer pane select the site occupation(s) to be moved, and drag and drop it on an occupation of the site in which you want to move it.
>
> In the **Project Manager**, **Sites** folder, you can also move a single site occupation using the **Move…** command in the contextual menu.

Delete a site occupation

You can delete one or more site occupations from a site. Like a site, these occupations cannot be restored.

> If you delete all the site occupations of a site, the site will also be deleted.

a. Select the site occupation to be deleted from the **Occupations** drop-down list.
b. Click **Delete** on the right side of the **Site Editor**. A confirmation pop-up window is displayed.



Delete Site Occupation confirmation

c. Click **OK** to confirm the deletion. You are back to the **Occupations** page in the **Site Editor**.

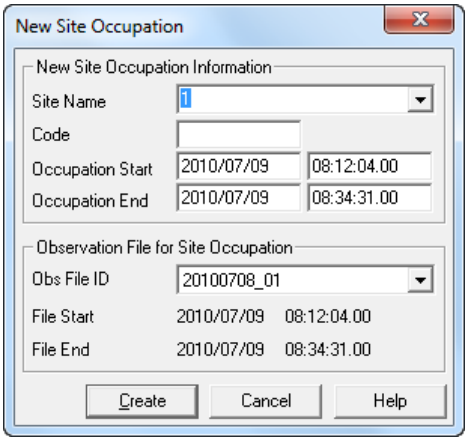
> Site occupations can be deleted easily by using the **Project Manager**. Select the **Sites** folder from the selector pane. In the viewer pane select the site occupation(s) to be deleted, press the **Del** key or select Delete from the speed menu or click on the **Main** toolbar.

Add a new site or new site occupation

You may have to add new sites or new site occupations to your project. For example, during a field session, you may have recorded an observation file in static mode without associating a site

occupation to this file. If you want to process this file in static mode, a site has to be associated to the file.

a. Click **New**. The **New Site Occupation** is displayed.



New Site Occupation

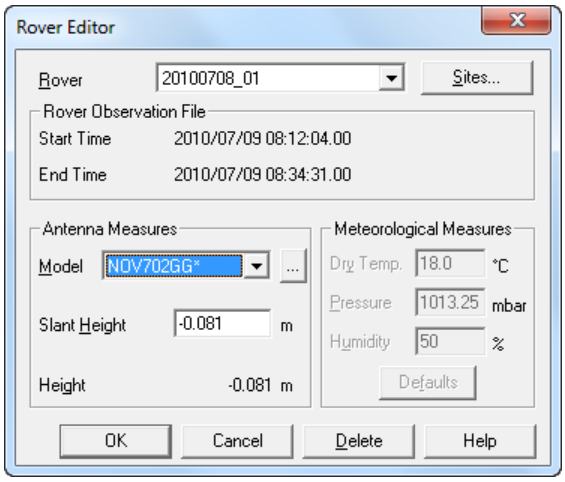
b. Type a new site name or select an existing site to which you want to add a new occupation in the **Site Name** drop-down list.
c. You may edit the **Code** if needed.
d. The start and end times of the selected file are displayed in the **Occupation Start** and **Occupation End** boxes. You can edit this time span as needed.
e. Select the observation file that is to be associated with the new site occupation from the **Obs File ID** drop-down list.
f. Click **Create**.

- You may be prompted to confirm the new site creation if the option **Give warning when creating new sites manually** is active in **Tools > Options > General**.
- When a new site occupation is created, the antenna model and the antenna slant height for the new site are taken from the observation file associated with the new occupation.

11.2 Rover

The **Rover Editor** can be displayed by following one of these procedures:

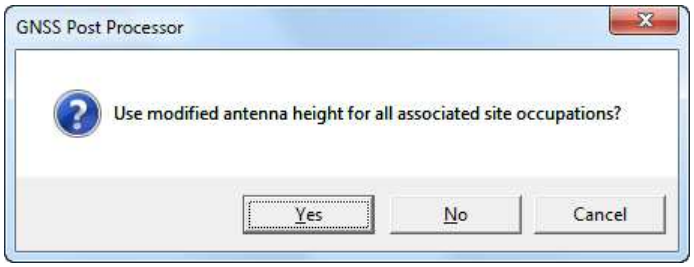
- From the main menu:
  - Select **Edit > Rover...**;
- From the **Plan View:**
  - Double-click on a rover;
  - While your cursor is over a rover, right-click and select **Edit Rover...** in the speed menu.
- From the **Project Manager**, when the **Rovers** folder is selected:
  - Double-click on a rover;
  - Select the rover to be edited. From the speed menu or the **Rovers** main menu, select **Properties**;



Rover Editor

- **Rover**: Rover name
- **Sites**…: Display the **Site Occupations** dialog. See the ***Editing – Rover – Site Occupations*** section for more details.
- **Rover Observation File:**
  - **Start Time:** Start date and time of the rover
  - **End Time:** End date and time of the rover.
- **Antenna Measures:**
  - **Model:** Used to select an antenna model from the drop-down list. To select a model not displayed in the list, select the ... button. Refer to ***Antenna Models*** chapter for information on antenna models.
  - **Slant Height:** Used to edit the antenna slant height entered in the field.
  - **Height:** Vertical antenna height as calculated by the slant height and the antenna model.
- **Meteorological Measures:**
  - **Dry Temp.:** N/A. The software uses standard meteorological values.
  - **Pressure:** N/A. The software uses standard meteorological values.
  - **Humidity:** N/A. The software uses standard meteorological values.

Changing antenna height on the rover will offer to apply the new antenna height to all site occupations from this rover.



Change Rover Antenna Height confirmation

- **Yes**: All site occupations from this rover will be updated with the new antenna height.
- **No**: All site occupations from this rover will keep their own antenna height.

■ Delete rover

a. Select the rover you want to delete from the **Rover** drop-down list.
b. Click **Delete**. A confirmation window is displayed.

Delete Rover confirmation

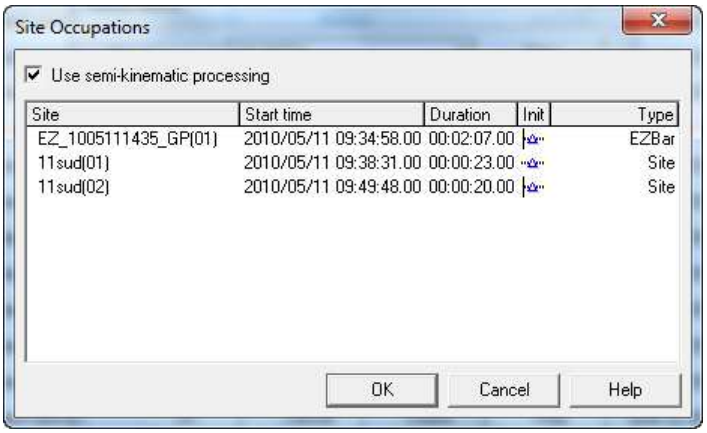
c. Click **OK** to confirm the deletion. You are back to the **Rover Editor**.

❖ When a rover is deleted, all results attached to this rover are deleted as well (trajectory results). However the observation file is not deleted, **it is changed to static mode.**

11.2.1 Site Occupations

The **Site Occupations** dialog is available from the **Rover Editor**, the **Trajectory Editor** and from the **PPP Editor**.

a. Open the **Rover Editor**, **Trajectory Editor** or **PPP Editor**.
b. Click on **Sites...**. The **Site Occupations** dialog is displayed.



Site Occupations

- **Use semi-kinematic processing**: This option is checked for a semi-kinematic observation file, and unchecked for a rover observation file.
  - Changing this checkbox will change the observation file type as well.

- If the **Use semi-kinematic processing** checkbox is unchecked, the **Init** and **Type** columns are not shown.

- **Site:** Displays the site name and occupation number.
- **Start time**: Displays the start time of the site occupation.
- **Duration:** Displays the duration of the site occupation.
- **Init:** Indicates an initialization/re-initialization or a regular site.
  - " indicates either an initialization or a re-initialization.
  - " indicates a regular site.
- **Type:** Type of a site. Click on a type in the list in order to display this drop-down list. The possible values are:
  - **Reference**: Mark the site as a **Use as reference coordinate.**
  - **Site**: A regular site.
  - **EZBar**: Initialization is done on a special horizontal Initialization bar set 20 cm from an antenna mounted on a tripod.

EZBar mounted on a tripod

11.3 Combinations

11.3.1 Baseline

IMPORTANT: Baseline is only available when working in Differential Positioning mode.

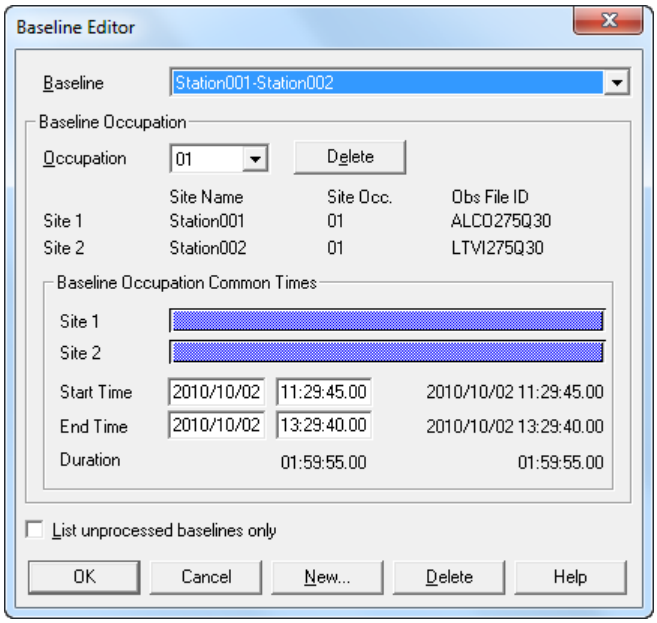
A baseline's name is derived from the two site names, separated by a hyphen. The site names appear in alphabetical order and include the site occupation number relating to the baseline. An example of a baseline name is: SiteA(02)—SiteB (SiteB has only one occupation whereas SiteA has more than one occupation).

Baseline edition is done through the **Baseline Editor**. Using this editor, you can edit common observation time, delete baselines and baseline occupations and create new baselines.

The **Baseline Editor** can be displayed by following one of these procedures:

- From the main menu:
  - Select **Edit > Baseline...**;
- From the **Plan View:**
  - Double-click on a baseline;
  - While your cursor is over a baseline, right-click and select **Edit Baseline...** in the speed menu.

- From the **Project Manager**, when the **Baselines** folder is selected:
  - Double-click on a baseline;
  - Select the baseline to be edited. From the speed menu or the **Baselines** main menu, select **Properties**;



Baseline Editor

- **Baseline**: Baseline name.
- **Baseline Occupation**:
  - **Occupation**: Baseline occupation number.
  - **Site Name**: Column for the site name.
  - **Site Occ.**: Column for the site occupation number.
  - **Obs File ID**: Column for the site associated observation file identifier.
  - **Site 1**: Line for information about the first site of the pair forming the baseline.
  - **Site 2**: Line for information about the second site of the pair forming the baseline.
  - **Baseline Occupation Common Times**:
    - **Site 1/Site 2**: The **Site 1** and **Site 2** graphic boxes display time bars representing total site occupations for sites 1 and 2, respectively. They provide a visual representation of the time overlap. The total width of the graphic box represents the total time between the earliest and latest times for the site occupations. The following colors are used in the graphic display:
      - : Data with overlapping time.
      - : Data with overlapping time but unselected.
      - : Data without overlapping time.
      - : No data.
    - **Start Time**: Both the current start date/time and the limit for the baseline start date/time.

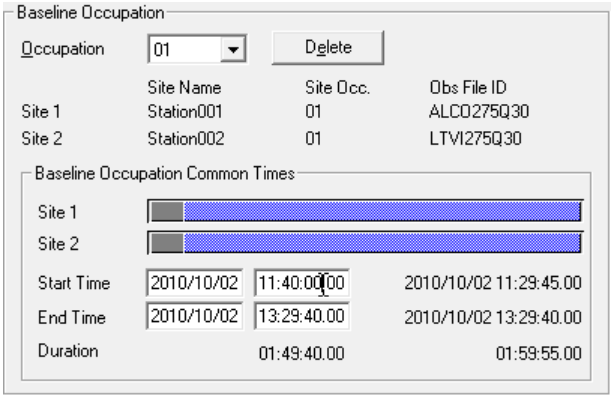
- **End Time**: Both the current end date/time and the limit for the baseline end date/time.
- **Duration**: Duration for both the current baseline time span and the limit time span.

- **List unprocessed baselines only**: When checked, the **Baseline** combo on top will display only unprocessed baselines.

Edit baselines occupations common time

After processing, depending on results obtained, you may want to edit the baseline common time. For example, you may want to change the time span of a baseline due to extensive multipath problems.

a. Select the baseline to be edited from the **Baseline** drop-down list.
b. Modify the baseline occupation start and end times as needed in the **Start Time** and the **End Time** boxes. Please note the section in the graph for the unselected part.



Baseline Editor – Baseline Occupation Common Times

c. Click **OK** to save your change.

To reset the baseline to the original limits, enter the same start/end time displayed on the right.

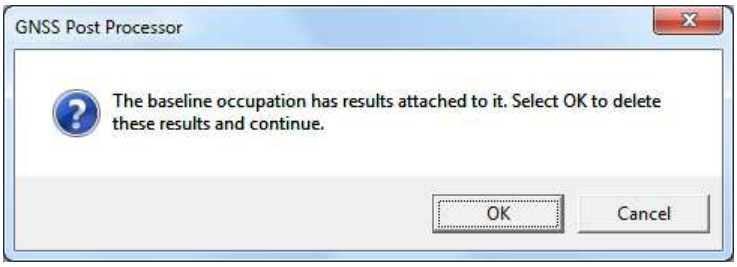
Delete a baseline occupation

When you delete a baseline occupation, all results and loops attached to the baseline occupation are deleted as well. If you choose to delete the last baseline occupation for a baseline, the baseline will be removed as well.

a. Select the baseline for which you want to delete an occupation from the **Baseline** drop-down list.
b. Select the baseline occupation to be deleted from the **Occupation** drop-down list.
c. Click **Delete** (the one located beside the **Occupation** drop-down list). A confirmation pop-up window is displayed.

Delete Baseline Occupation confirmation

d. Click **OK** to confirm the deletion.
e. If the occupation has results attached to it, a second confirmation pop-up window is displayed.



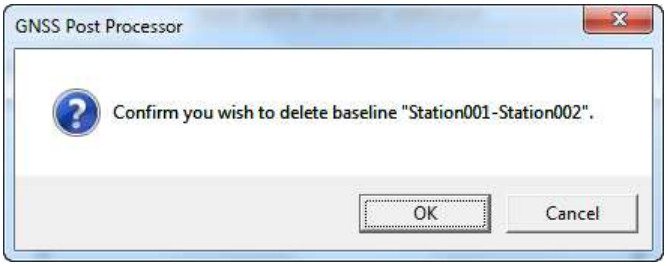
Delete Baseline Occupation confirmation with attached results

f. Click **OK**, once again, to confirm the deletion. The occupation is removed from the list.
g. Click **OK** to close the **Baseline Editor**.

Delete a baseline

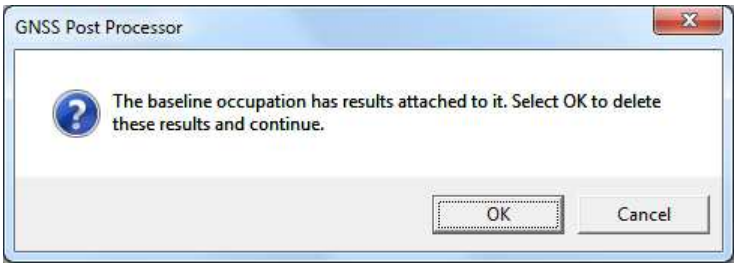
When you delete a baseline, all results and loops attached to it are deleted as well.

a. Select the baseline you want to delete.
b. Click **Delete** at the bottom of the dialog box. A confirmation pop-up window is displayed.



Delete Baseline confirmation

c. Click **OK** to confirm the deletion.
d. If the baseline has results attached to it, a second confirmation pop-up window is displayed.



Delete Baseline confirmation with attached results

e. Click **OK** once again to confirm the deletion. The baseline is removed from the menu.

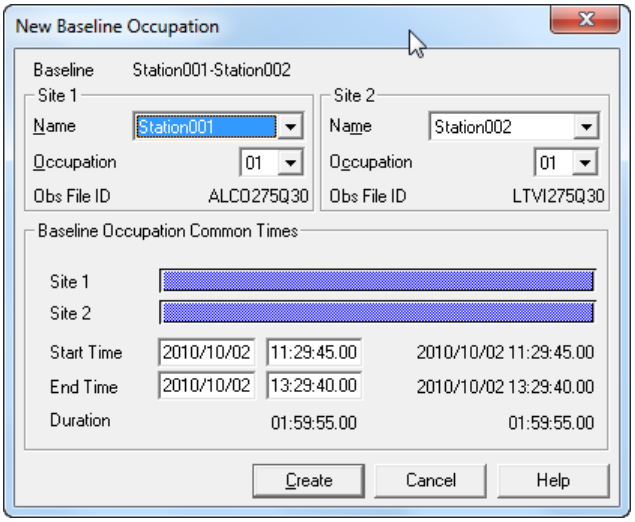
f. Click **OK** to close the **Baseline Editor**.

> Baselines and baselines occupation(s) can be deleted easily by using the **Project Manager**. Select the **Baselines** folder from the selector pane. In the viewer pane, select the baseline or baseline occupation(s) to be deleted, then press the **Del** key or select **Delete** from the speed menu or click on the **Main** toolbar.

To create a new baseline occupation

Sometimes you may need to create baselines manually. For example, you may have generated baselines automatically with a minimum overlap time of 30 minutes, but for some reasons you have a few site occupations with only 20 minutes of overlapping time. So, these potential baselines have not been generated. If you want to process these baselines, you will have to create them manually. In this specific example, another solution would be to regenerate your baselines with an overlapping time of 20 minutes.

a. Click **New**. The **New Baseline Occupation** is displayed.



New Baseline Occupation

b. For the **Site 1** and **Site 2** (both end of the baseline) portions of the dialog box:

- Select the site to be part of the new baseline occupation in the **Name** drop-down list.

- Select the site occupation associated with the selected site in the **Occupation** drop-down list. The name of the observation file associated with the selected site occupation is displayed after **Obs File ID**.

c. In the **Baseline Occupation Common Times** area of the dialog box, you can edit the common observation time of the new baseline occupation.

> If there is no common occupation time between the two selected sites, the **Start Time** and **End Time** boxes are dimmed.

d. Click **Create** to create the new baseline occupation. You are back to the **Baseline Editor** and the new baseline information is displayed in the dialog box.

> You can also add new baseline occupations using the **Project Manager**. Select the **Baselines** folder in the selector pane, in the viewer pane select **New Baseline** from the speed menu, the **New Baseline Occupation** is displayed.

11.3.2 Trajectory

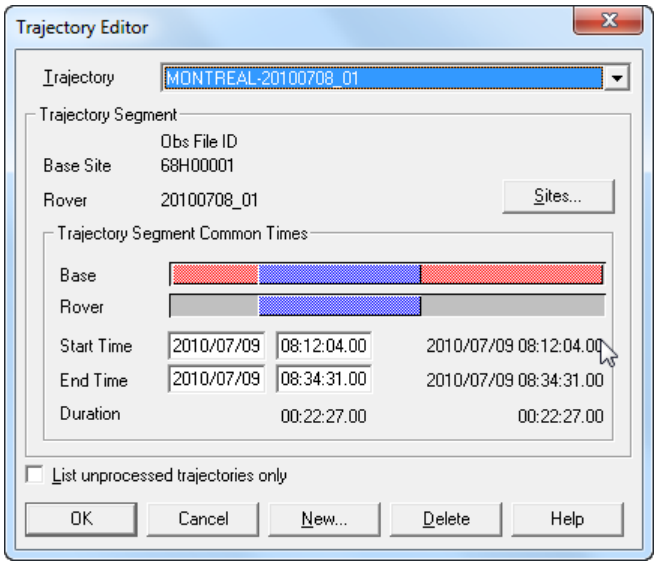
IMPORTANT: Trajectory is only available when working in Differential Positioning mode.

A trajectory's name is derived from its site and rover, separated by a hyphen. The site's name with its occupation number appears in parentheses first, followed by the rover's name. An example of a trajectory name is: SiteA(02)—RoverC.

Trajectory editing is done through the **Trajectory Editor**. Using this editor, you can edit common observation time, delete trajectories, create new trajectories and change process parameters.

The **Trajectory Editor** can be displayed by following one of these procedures:

- From the main menu:
  - Select **Edit > Trajectory...**;
- From the **Plan View:**
  - Double-click on a trajectory;
  - While your cursor is over a trajectory, right-click and select **Edit Trajectory...** in the speed menu.
- From the **Project Manager**, when the **Trajectories** folder is selected:
  - Double-click on a trajectory;
  - Select the trajectory to be edited. From the speed menu or the **Trajectories** main menu, select **Properties**;



Trajectory Editor

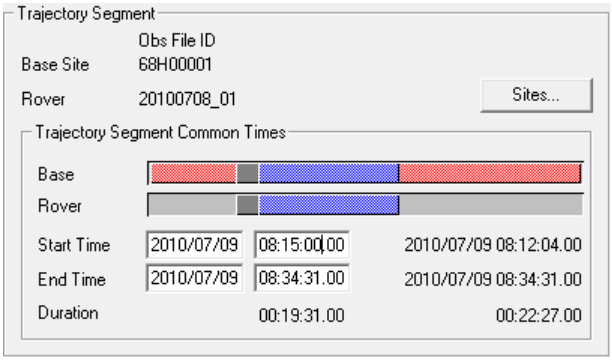
- **Trajectory**: Trajectory name.
- **Trajectory Segment**:
  - **Base Site**: Base name
  - **Rover**: Rover name
  - **Sites**…: Display the **Site Occupations** dialog. See the ***Editing – Rover – Site Occupations*** section for more details.
  - **Trajectory Segment Common Times**:
    - **Base/Rover**: The **Base** and **Rover** graphic boxes display time bars representing total site occupation for the Base and total observation time for the Rover. They provide a visual representation of the time overlap. The total width of the graphic box represents the total time between the earliest and latest times for base and rover. The following colors are used in the graphic display:
      - : Data with overlapping time.
      - : Data with overlapping time but unselected.
      - : Data without overlapping time.
      - : No data.
    - **Start Time**: Both the current start date/time and the limit for the trajectory start date/time.
    - **End Time**: Both the current end date/time and the limit for the trajectory end date/time.
    - **Duration**: Duration for both the current trajectory time span and the limit time span.
- **List unprocessed trajectories only**: When checked, the **Trajectory** combo on top will display only unprocessed trajectories.

Edit trajectory segment common time

After processing, depending on results obtained, you may want to edit the trajectory common time. For example, you may want to change the time span of a trajectory due to severe multipath problems, etc.

a. Select the trajectory to be edited from the **Trajectory** drop-down list.

b. Modify the start and end times as needed in the **Start Time** and the **End Time** boxes. Please note the ▬ section in the graph for the unselected part.



Trajectory Editor – Trajectory Segment Common Times

c. Click **OK** to save your change.

❖ To reset the trajectory to the original limits, enter the same start/end time displayed on the right.

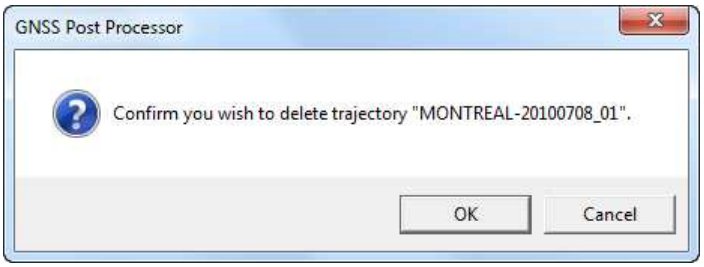
Delete a trajectory

When you delete a trajectory, all results attached to it are deleted as well (residuals, position file, etc.).

a. From the **Trajectory** drop-down list, select the trajectory you want to delete.

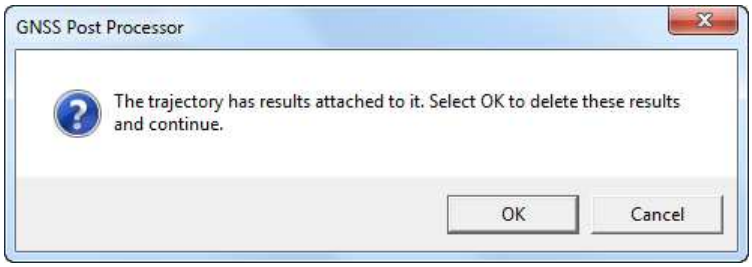
b. Click **Delete**. A confirmation pop-up window is displayed.

c. Click **OK** to confirm the deletion.



Delete Trajectory confirmation

d. If the trajectory has results attached to it, a second confirmation pop-up window is displayed.



Delete Trajectory confirmation with attached results

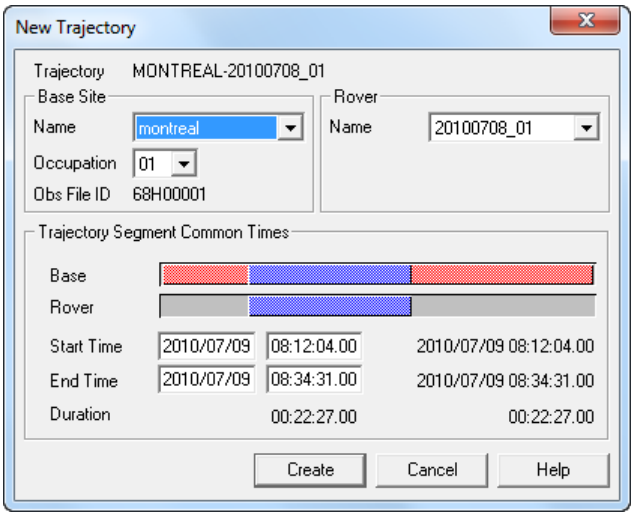
e. Click **OK** once again to confirm the deletion. The trajectory is removed.

> Trajectories can be deleted easily by using the **Project Manager**. Select the **Trajectories** folder from the selector pane. In the viewer pane, select the trajectory to be deleted, and then press the **Del** key or select **Delete** from the speed menu or click on the **Main** toolbar.

Create a new trajectory

Sometimes you may need to create trajectories manually. For example, you may have generated trajectories automatically with coverage of 100%, but for some reasons you have a few rovers that are covered only by 90 or 95%. So these potential trajectories have not been generated. If you want to process these trajectories, you will have to create them manually. In this specific example, another solution would be to regenerate your trajectories with an overlapping coverage of 90%.

a. Click **New**. The **New Trajectory** is displayed.



New Trajectory

b. In the **Base Site** area of the dialog box, select the site to be used as the base site for the new trajectory in the **Name** drop-down list.

c. Select the site occupation associated with the selected site in the **Occupation** drop-down list. The name of the observation file associated with the selected site occupation is displayed after **Obs File ID**.

d. In the **Rover** area of the dialog box, select the rover to be used in the new trajectory in the **Name** drop-down list.

e. In the **Trajectory Segment Common Times** area of the dialog box, you can edit the common observation time of the new trajectory.

> If there is no common occupation time between the selected site and rover, the Start Time and End Time boxes are dimmed.

f. Click **Create** to create the new trajectory.

> You can also add new trajectories using the **Project Manager**. Select the **Trajectories** folder in the selector pane. In the viewer pane, select **New trajectory...** from the speed menu. The **New Trajectory** is displayed.

> You can create a **point positioning trajectory** (absolute positioning) by selecting **<none>** in the name box of the Base Site area of the **New Trajectory** dialog box. This is not recommended because the results will be of a very low quality. When you do not have a base site, it is better to change the **Processing Mode** to **Precise Point Positioning** and download precise orbits for your rover.

11.3.3 PPP

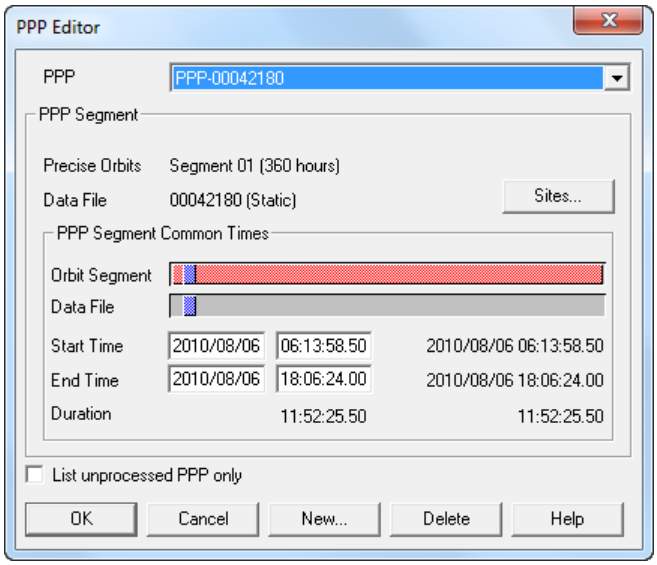
IMPORTANT: PPP is only available when working in Precise Point Positioning (PPP) mode.

When the file status is either rover or static, we can post-process them using a PPP.

PPP editing is done through the **PPP Editor**. Using this editor, you can edit the observation time, delete PPP, create new PPP and change process parameters.

The **PPP Editor** can be displayed by following one of these procedures:

- From the main menu:
  - Select **Edit > PPP...**;
- From the **Plan View:**
  - Double-click on a PPP;
  - While your cursor is over a PPP, right-click and select **Edit PPP...** in the speed menu.
- From the **Project Manager**, when the **PPP** folder is selected:
  - Double-click on a PPP;
  - Select the PPP to be edited. From the speed menu or the **PPP** main menu, select **Properties**;



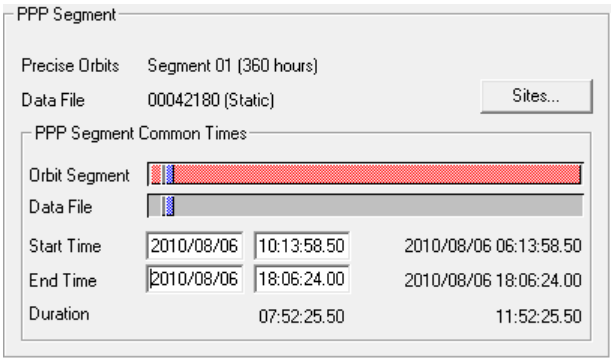
PPP Editor

- **PPP**: PPP name.
- **PPP Segment**:
  - **Precise Orbits**: Segment number from the precise orbits cache with the length covered by the segment in parenthesis. See ***Analysis – Precise Orbits*** section for more details about segment number.
  - **Data File**: Rover or static file name with its observation mode in parenthesis.
  - **Sites**…: Display the **Site Occupations** dialog. See the ***Editing – Rover – Site Occupations*** section for more details.
  - **PPP Segment Common Times**:
    - **Orbit Segment/Data File**: The **Orbit Segment** and **Data File** graphic boxes display time bars representing total time span for orbit segment and data file. They provide a visual representation of the time overlap. The total width of the graphic box represents the total time between the earliest and latest times for orbit segment and data file. The following colors are used in the graphic display:
      - : Data with overlapping time.
      - : Data with overlapping time but unselected.
      - : Data without overlapping time.
      - : No data.
    - **Start Time**: Both the current start date/time and the limit for the PPP start date/time.
    - **End Time**: Both the current end date/time and the limit for the PPP end date/time.
    - **Duration**: Duration for both the current PPP time span and the limit time span.
- **List unprocessed PPP only**: When checked, the **PPP** combo on top will display only unprocessed PPP.

Edit PPP segment common time

After processing, depending on results obtained, you may want to edit the PPP common time. For example, you may want to change the time span of a PPP due to severe multipath problems, etc.

a. Select the PPP to be edited from the **PPP** drop-down list.
b. Modify the start and end times as needed in the **Start Time** and the **End Time** boxes. Please note the section in the graph for the unselected part.



PPP Editor – PPP Segment Common Times

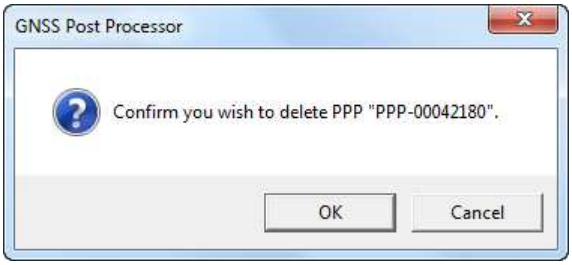
c. Click **OK** to save your change.

> ❖ To reset the PPP to the original limits, enter the same start/end time displayed on the right.

■ Delete a PPP

When you delete a PPP, all results attached to it are deleted as well.

a. From the **PPP** drop-down list, select the PPP you want to delete.
b. Click **Delete**. A confirmation pop-up window is displayed.
c. Click **OK** to confirm the deletion.



Delete PPP confirmation

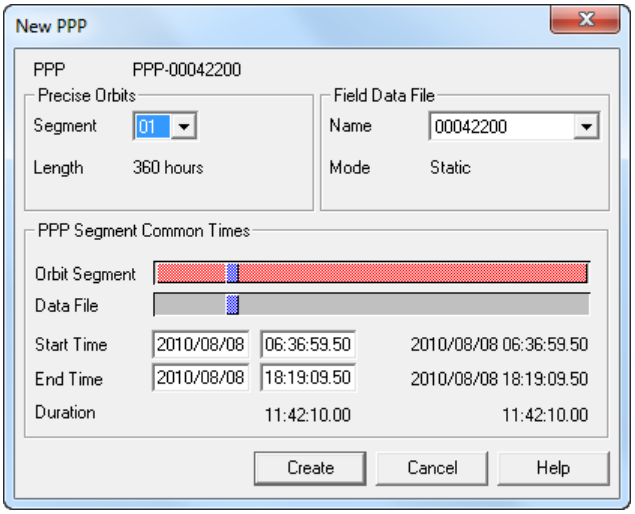
d. If the PPP has results attached to it, a second confirmation pop-up window is displayed.
e. Click **OK** once again to confirm the deletion. The PPP is removed.

> ❖ PPP can be deleted easily by using the **Project Manager**. Select the **PPP** folder from the selector pane. In the viewer pane, select the PPP to be deleted, and then press the **Del** key or select **Delete** from the speed menu or click on the **Main** toolbar.

■ Create a new PPP

Sometimes you may need to create PPP manually. For example, if you have only partial coverage for precise orbits.

a. Click **New**. The **New PPP** is displayed.



New PPP

b. In the **Precise Orbits** area of the dialog box, select the **Segment** to be used. The length of the current segment is displayed in the **Length** section.

c. In the **Field Data File** area of the dialog box, select the rover/static to be used in the new PPP in the **Name** drop-down list. The actual mode of the item selected in displayed in the **Mode** section.

d. In the **PPP Segment Common Times** area of the dialog box, you can edit the common observation time of the new PPP.

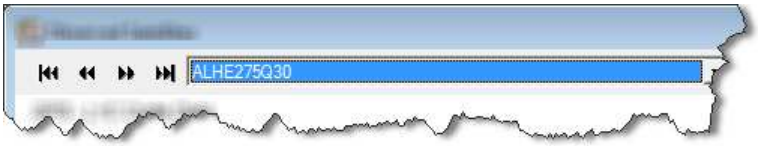
> If there is no common occupation time between the selected orbit segment and mobile or static file, the Start Time and End Time boxes are dimmed.

e. Click **Create** to create the new PPP.

> You can also add new PPP using the **Project Manager**. Select the **PPP** folder in the selector pane. In the viewer pane, select **New PPP...** from the speed menu. The **New PPP** is displayed.

12 Analysis

You will notice that most analysis view has a toolbar containing a set of arrow buttons used to navigate from one item to another and a drop-down list allowing you to select a specific item to be analyzed.



Analysis View – toolbar

The navigation buttons are used as follows:

- Click the buttons to select the previous or next item in the drop-down list.
- Click the buttons to select the first or last item in the drop-down list.
- Use the drop-down list to select an item directly.

12.1 Raw Observations

You can view the satellite visibility for each observation file (raw data) related to your project. You can plot this information as **Number of Observed Satellites** or as **Observed Satellites**. The latter provides you with a graphical view of the tracking of each recorded satellite signal. Tracking can be displayed for code observations (L1C/A, L1P, L2C and L2P) as well as for carrier phase observations (L1 and L2). On these plots, cycle slips as well as data gaps are also displayed.

This analysis capability is very useful to detect bad satellite data. For example, when doing static positioning, you might have problems to get a fix ambiguity solution. By analyzing your raw data (both site occupations) you may realize that a specific satellite has very bad tracking (a lot of data gaps and cycle slips caused by obstructions). From this analysis, you may reject this satellite from the processing.

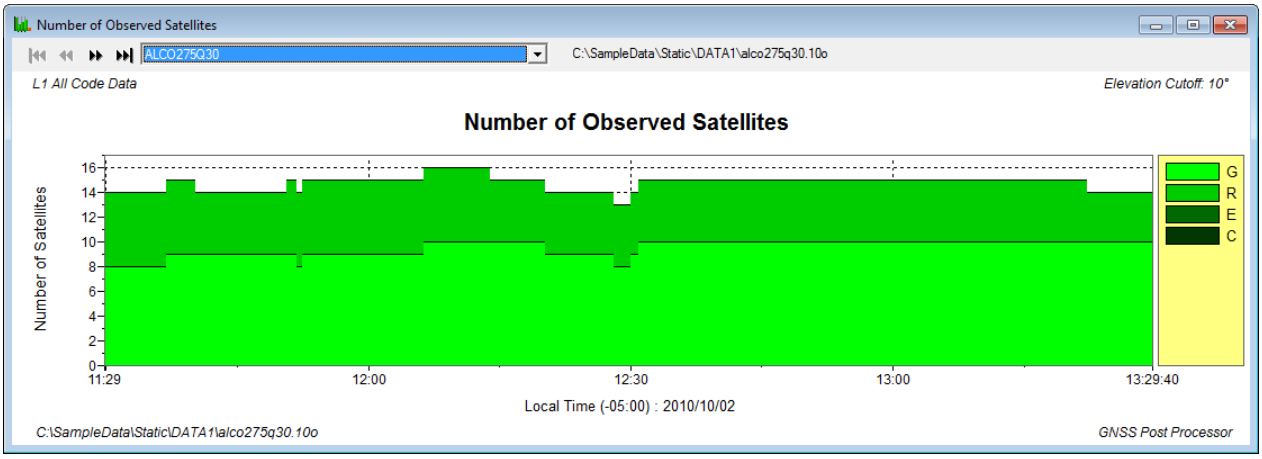
Using **Analysis > Raw Observations** from the main menu, you can display two types of information related to your imported files:

- **Number of Observed Satellites**;
- **Observed Satellites**.

12.1.1 Number of Observed Satellites

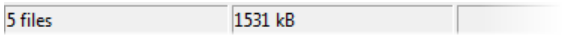
The **Number of Observed Satellites** can be displayed by following one of these procedures:

- From the main menu, select **Analysis > Raw Observations > Number of Observed Satellites**;
- From the **Analysis** toolbar, press the button.



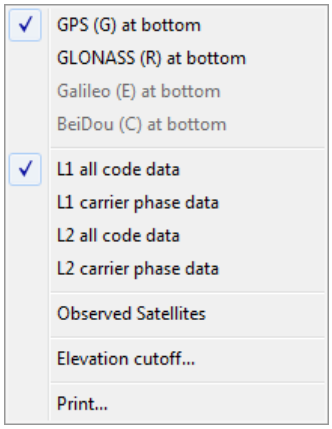
Number of Observed Satellites

- **Data type** (Top left): Data being analyzed. Possible values are:
  - **L1 All Code Data**: For each epoch, the number of satellites having L1 code data (L1C or L1P).
  - **L1 carrier phase data**: For each epoch, the number of satellites having L1 carrier phase data.
  - **L2 All Code Data:** For each epoch, the number of satellites having L2 code data (L2C or L2P).
  - **L2 carrier phase data**: For each epoch, the number of satellites having L2 carrier phase data.
- **Elevation Cutoff** (Top right): Mask angle
- **Observation file name** (Bottom left): Full path for the current observation file being analyzed.
- **Number of Satellites** (vertical axis): Total number of satellites for each epoch
- **Time** (horizontal axis): Covers the whole observation file from Start time (left) to End time (right).
- **Graphic** (center): For each epoch, the total number of satellites
  - : GPS contribution when there are less than 4 satellites.
  - : GLONASS contribution when there are less than 4 satellites.
  - : Galileo contribution when there are less than 4 satellites.
  - : BeiDou contribution when there are less than 4 satellites.
  - : GPS contribution when there are exactly 4 satellites.
  - : GLONASS contribution when there are exactly 4 satellites.
  - : Galileo contribution when there are exactly 4 satellites.
  - : BeiDou contribution when there are exactly 4 satellites.
  - : GPS contribution when there are more than 4 satellites.
  - : GLONASS contribution when there are more than 4 satellites.
  - : Galileo contribution when there are more than 4 satellites.
  - : BeiDou contribution when there are more than 4 satellites.



Number of Observed Satellites – Status bar

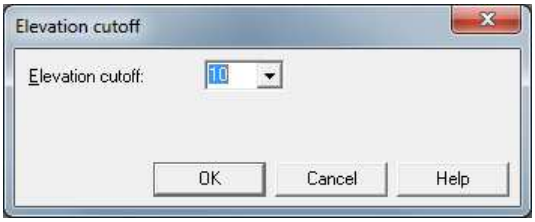
- **(Left pane)**: Number of observation files in project.
- **(Middle pane)**: Size of current observation file in kilobytes.



Number of Observed Satellites – Speed menu

- **GPS (G) at bottom**: Put contribution for GPS on the bottom and all other constellations on top. The number of satellites for the GPS constellation is directly readable.
- **GLONASS (R) at bottom**: Put contribution for GLONASS on the bottom and all other constellations on top. The number of satellites for the GLONASS constellation is directly readable.
- **Galileo (E) at bottom**: Put contribution for Galileo on the bottom and all other constellations on top. The number of satellites for the Galileo constellation is directly readable.
- **BeiDou (C) at bottom**: Put contribution for BeiDou on the bottom and all other constellations on top. The number of satellites for the BeiDou constellation is directly readable.
- **L1 all code data**: Display the number of satellites having L1 code data (L1C or L1P).
- **L1 carrier phase data**: Display the number of satellites having L1 carrier phase data.
- **L2 all code data**: Display the number of satellites having L2 code data (L2C or L2P).
- **L2 carrier phase data**: Display the number of satellites having L2 carrier phase data.
- **Observed Satellites**: Switch to the **Observed Satellites** view.
- **Elevation cutoff**: Display the **Elevation cutoff** dialog. Use this to preview satellite visibility for processing. The default elevation cutoff when displaying this view is the same as the **Mask Angle** in the **Process Parameters**. When no orbits are available within project, it will display "**No orbit data**" and display the number of satellites at an elevation cutoff of zero.
- **Print...:** Print this view

The **Elevation cutoff** dialog box allows you to set the elevation mask angle.



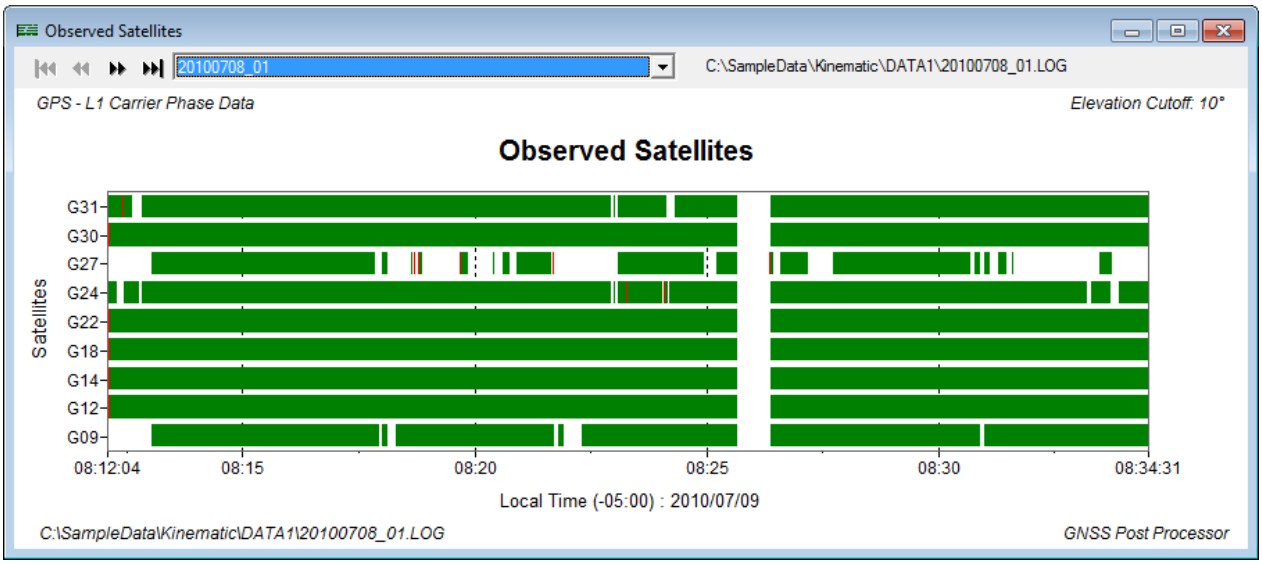
Elevation Cutoff

12.1.2 Observed Satellites

Using **Observed Satellites** view, you can analyze separately the pseudorange (on L1C, L1P, L2C and L2P) as well as the carrier phase tracking (on L1 or L2). You can detect any existing gaps in the recorded data. Moreover, if you are analyzing carrier phase, cycle slips are displayed within the visibility bar.

The **Observed Satellites** can be displayed by following one of these procedures:

- From the main menu, select **Analysis > Raw Observations > Observed Satellites**;
- From the **Analysis** toolbar, press the button.

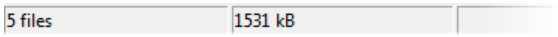


Observed Satellites

- **Data type** (Top left): Data being analyzed. It is a combination of constellation (left) and data type (right)
  - Constellation (left part of the name):
    - **GPS**: Display only GPS satellites
    - **GLONASS**: Display only GLONASS satellites.
    - **Galileo**: Display only Galileo satellites.
    - **BeiDou**: Display only BeiDou satellites.
  - Data type (right part of the name):
    - **L1C code data**: Display the presence of L1C code data in satellite observation.
    - **L1P code data**: Display the presence of L1P code data in satellite observation.

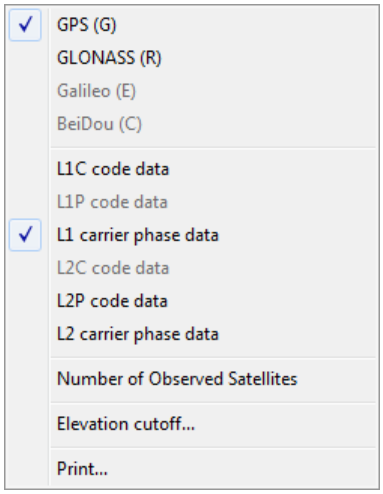
- **L1 carrier phase data**: Display the presence of L1 carrier phase data in satellite observation.
- **L2C code data**: Display the presence of L2C code data in satellite observation.
- **L2P code data**: Display the presence of L2P code data in satellite observation.
- **L2 carrier phase data**: Display the presence of L2 carrier phase data in satellite observation.

- **Elevation Cutoff** (Top right): Mask angle
- **Observation file name** (Bottom left): Full path for the current observation file being analyzed.
- **Satellites** (vertical axis): Satellite number for each active satellite of the current constellation.
- **Time** (horizontal axis): Covers the whole observation file from Start time (left) to End time (right).
- **Graphic** (center): Each satellite is displayed with a different color. For each satellite, the color represents:
  - : Continuous data. It is represented as a solid green bar.
  - : A hole in the data.
  - : A cycle slip within data. A cycle slip is represented as a red bar and is only displayed on carrier phase data.



Observed Satellites – Status bar

- **(Left pane)**: Number of observation files in project.
- **(Middle pane)**: Size of current observation file in kilobytes.



Observed Satellites – Speed menu

- **GPS (G)**: Display only the GPS constellation.
- **GLONASS (R)**: Display only the GLONASS constellation.
- **Galileo (E)**: Display only the Galileo constellation.
- **BeiDou (C)**: Display only the BeiDou constellation.
- **L1C code data**: Display only L1C code data.

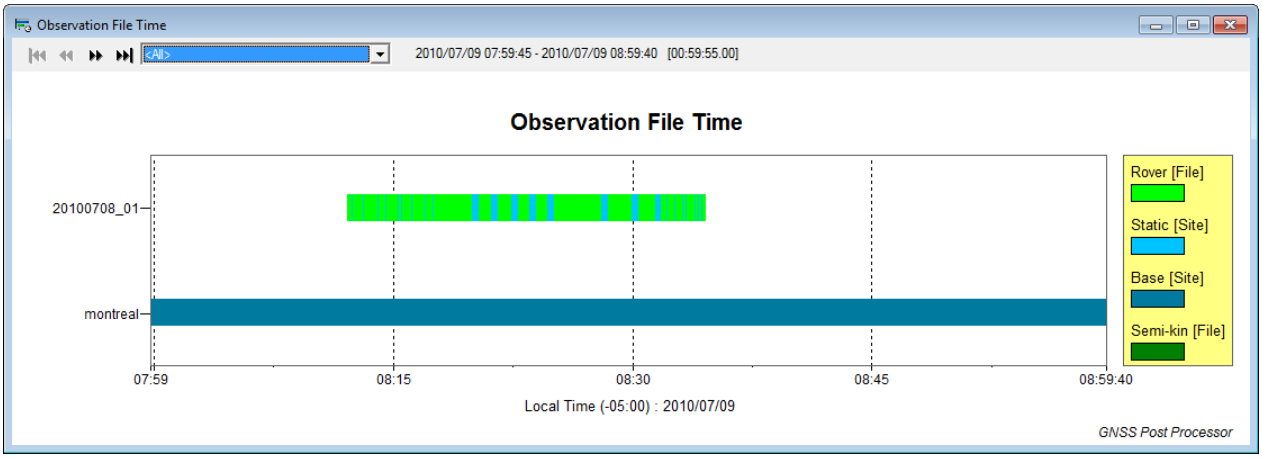
- **L1P code data**: Display only L1P code data.
- **L1 carrier phase data**: Display only L1 carrier phase data.
- **L2C code data**: Display only L2C code data.
- **L2P code data**: Display only L2P code data.
- **L2 carrier phase data**: Display only L2 carrier phase data.
- **Number of Observed Satellites**: Switch to the **Number of Observed Satellites** view.
- **Elevation cutoff**: Display the **Elevation cutoff** dialog. Use this to preview satellite visibility for processing. The default elevation cutoff when displaying this view is the same as the **Mask Angle** in the **Process Parameters**. When no orbits are available within project, it will display "**No orbit data**" and display the data at an elevation cutoff of zero.
- **Print...:** Print this view

12.2 Observation File Time

The **Observation File Time** is a tool to visualize observation time spans in order to have a better understand of what really happened in the field.

The **Observation File Time** can be displayed by following one of these procedures:

- From the main menu, select **Analysis > Observation File Time**;
- From the **Analysis** toolbar, press the button.

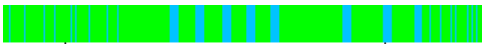


Observation File Time

- **Reference** (top left): Name of the site or rover file selected in the filter
  - When **<All>** is selected, this section is empty.
- **File/Site** (vertical axis): Either a file name (for rover or semi-kinematic) or a site name (for base or static).
- **Time** (horizontal axis): Covers the whole time span of the object selected in the top filter from Start time (left) to End time (right).
- **Graphic** (center): Color block representing the time span covered
  - The color represent the file status:
    - : Rover
    - : Static

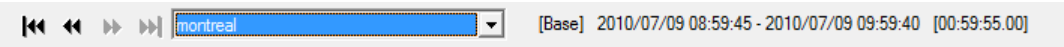
- : Base
- : Semi-kinematic

o Site time span within rover or semi-kin are drawn the same color as a static.



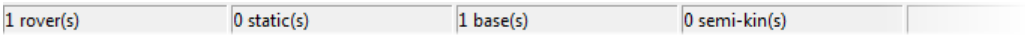
o Multiple occupations in static or base are represented by multiple blocks on the same line:

o The item selected in the filter is highlighted with a red box around each of its blocks:



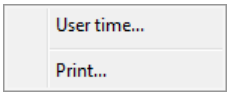
Observation File Time – Toolbar

- **VCR controls** (4 controls on the left): See ***Analysis*** chapter for more details.
- **Filter** (combo box): List of all rovers, semi-kinematics and sites coming from a static or a rover.
  - o The value selected will determine the time span displayed (horizontal scale).
  - o Any observation file that overlaps the area will be displayed.
  - o There are some special values:
    - **<All>**: Select the time span for the whole project.
    - **<User time>**: Configurable time span set by the user. Normally used in very long or complex projects to check very specific time span.
- **Details** (remaining text):
  - o **File status**: The file status for the item currently selected in filter.
    - Empty for **<All>** and **<User time>**.
  - o **Start time**: The precise start time for the item selected.
  - o **End time**: The precise end time for the item selected.
  - o **Duration**: The duration for the item selected.



Observation File Time – Status bar

- **(First pane)**: Number of rovers
- **(Second pane)**: Number of statics
- **(Third pane)**: Number of bases
- **(Fourth pane)**: Number of semi-kinematic

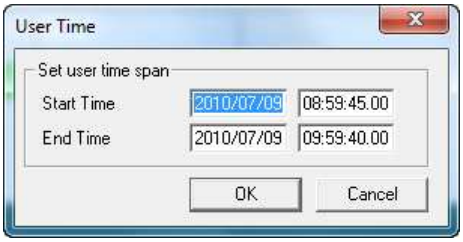


Observation File Time – Speed menu

- **User time...:** Display the **User Time** dialog. This configures the time used in the **<User time>** item in the filter.
- **Print...:** Print this view

12.2.1 User Time

The **User Time** dialog configures the time used in the **<User time>** item in the filter.



User Time

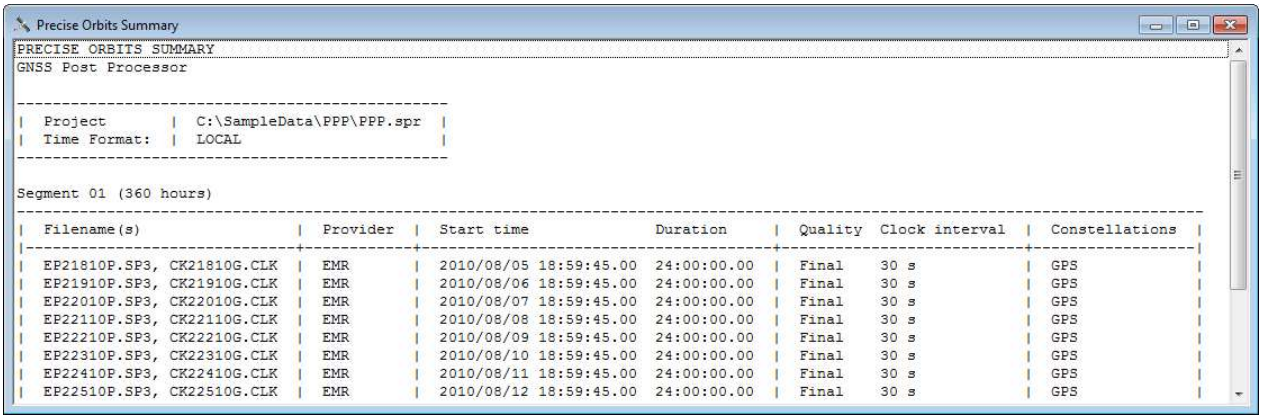
- **Set user time span**: Configure the start and end time to use for **<Use time>** in the filter.
  - **Start Time**: Start time.
  - **End Time**: End time.
- **OK**: Close the dialog, save the new user time span and select **<Use time>** in the filter.
- **Cancel**: Close the dialog without changing the user time span.

12.3 Precise Orbits

The **Precise Orbits** summary regroups all usable precise orbits and precise clocks within the project into segments and will list all orbits files within segments. See ***Analysis – Precise Orbits – Segment*** below for more details about segment generation.

The **Precise Orbits** can be displayed by following one of these procedures:

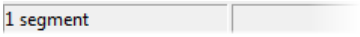
- From the main menu, select **Analysis > Precise Orbits**;
- From the **Analysis** toolbar, press the button.



Precise Orbits

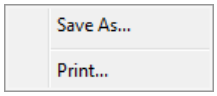
- **Segment**: Segment number and length in parenthesis.
- **Filename(s)**:Precise and clock file names

- **Provider(s)**: Provider identifier for the precise file. This is the Data Center that produced the precise orbit.
- **Start time**: Start time for the precise orbit.
- **Duration**: Duration for the precise orbit.
- **Quality**: Quality for the precise orbit file.
    - **Final**: best quality – Typically available after two weeks.
    - **Rapid**: medium quality – Typically available after a week.
    - **Ultra**: low quality – Typically available after few days.
- **Clock interval**: Clock interval in minutes or in seconds. 15 minutes is the highest possible interval giving the worst accuracy in PPP mode (although very good for differential). The shorter the interval, the better accuracy will be
- **Constellations**: Constellations present in precise orbits files. Possible values are:
    - **GPS**
    - **GLONASS**
    - **Galileo**
    - **BeiDou**



Precise Orbits – Status bar

- **(Left pane)**: Number of segments



Precise Orbits – Speed menu

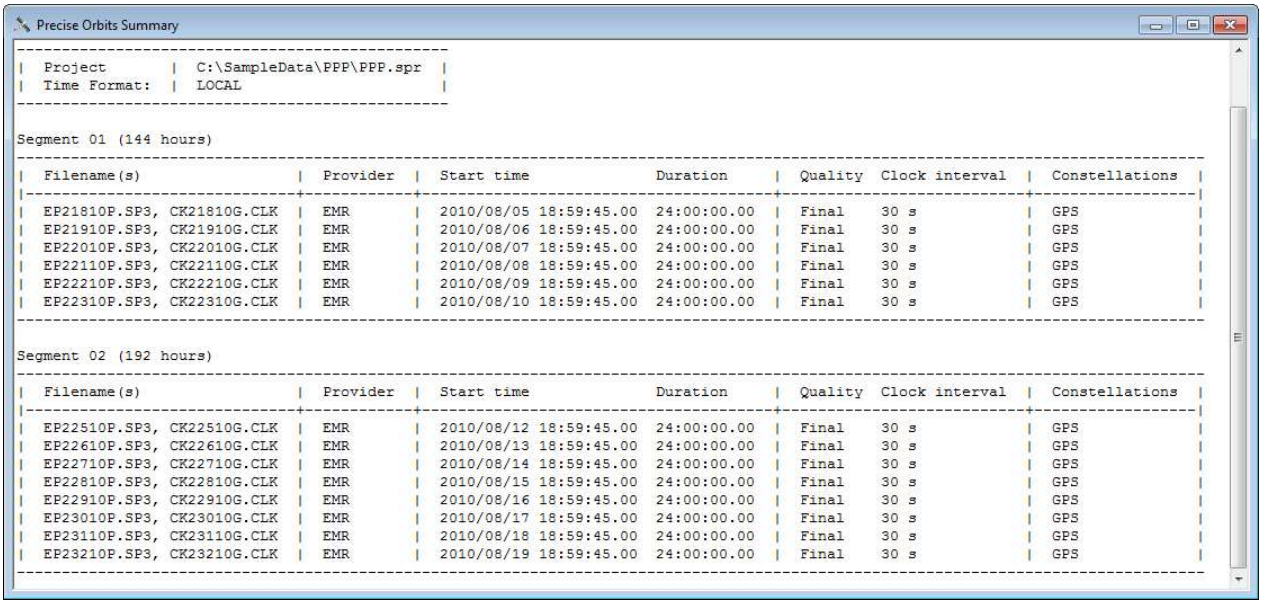
- **Save As...:** Save this view as a text file.
- **Print...:** Print this view

12.3.1 Segment

First and foremost, a precise orbit **segment** is defined as a consecutive block of precise orbits.

The first **segment** (in temporal order) is named "**01**", the second "**02**" and so on.

Some precise orbit and/or precise clock files may be rejected for various reasons but rejected files are never deleted from the project.



Precise Orbits Summary

Project	C:\SampleData\PPP\PPP.spr
Time Format:	LOCAL

Segment 01 (144 hours)

Filename(s)	Provider	Start time	Duration	Quality	Clock interval	Constellations
EP21810P.SP3, CK21810G.CLK	EMR	2010/08/05 18:59:45.00	24:00:00.00	Final	30 s	GPS
EP21910P.SP3, CK21910G.CLK	EMR	2010/08/06 18:59:45.00	24:00:00.00	Final	30 s	GPS
EP22010P.SP3, CK22010G.CLK	EMR	2010/08/07 18:59:45.00	24:00:00.00	Final	30 s	GPS
EP22110P.SP3, CK22110G.CLK	EMR	2010/08/08 18:59:45.00	24:00:00.00	Final	30 s	GPS
EP22210P.SP3, CK22210G.CLK	EMR	2010/08/09 18:59:45.00	24:00:00.00	Final	30 s	GPS
EP22310P.SP3, CK22310G.CLK	EMR	2010/08/10 18:59:45.00	24:00:00.00	Final	30 s	GPS

Segment 02 (192 hours)

Filename(s)	Provider	Start time	Duration	Quality	Clock interval	Constellations
EP22510P.SP3, CK22510G.CLK	EMR	2010/08/12 18:59:45.00	24:00:00.00	Final	30 s	GPS
EP22610P.SP3, CK22610G.CLK	EMR	2010/08/13 18:59:45.00	24:00:00.00	Final	30 s	GPS
EP22710P.SP3, CK22710G.CLK	EMR	2010/08/14 18:59:45.00	24:00:00.00	Final	30 s	GPS
EP22810P.SP3, CK22810G.CLK	EMR	2010/08/15 18:59:45.00	24:00:00.00	Final	30 s	GPS
EP22910P.SP3, CK22910G.CLK	EMR	2010/08/16 18:59:45.00	24:00:00.00	Final	30 s	GPS
EP23010P.SP3, CK23010G.CLK	EMR	2010/08/17 18:59:45.00	24:00:00.00	Final	30 s	GPS
EP23110P.SP3, CK23110G.CLK	EMR	2010/08/18 18:59:45.00	24:00:00.00	Final	30 s	GPS
EP23210P.SP3, CK23210G.CLK	EMR	2010/08/19 18:59:45.00	24:00:00.00	Final	30 s	GPS

Precise Orbits with 2 segments

Within each **segment**, precise clocks and precise orbits are ordered by time.

- If there is more than one precise orbits file at a specific time, the highest **Quality** file is kept and the rest is rejected.
- If there is more than one precise clocks file at a specific time, the lowest **Clock interval** is kept and the rest is rejected.

A new **segment** starts when a hole is detected between precise orbits files.

The **Clock interval** within a **segment** must remain constant. If they are not, the highest interval present in the **segment** will be applied to all files of that **segment**. Example: One clock file at 5 minutes and the rest at 30 seconds within the same **segment**, the clock interval finally used will be 5 minutes for the whole **segment**.

For a **Differential Positioning**:

- Clocks are ignored. So the **Clock interval** will always comes from the precise orbits file and therefore always be 15 minutes (since in differential mode, satellite clocks parameters are not as crucial as in PPP mode).

For **Precise Point Positioning**:

- Clocks with more than a 5 minutes **Clock interval** are rejected.
- A precise orbits file without a matching precise clocks file is rejected.

12.4 Baseline Results

There are two possible views:

- **Baseline Summary**
- **Baseline Residuals**

Both views have a common toolbar:

Baseline Results – Toolbar

- **VCR controls** (5 controls on the left): See ***Analysis***, the beginning of this chapter for more details.
- **Filter** (last control in toolbar): Select one of the following options in the drop-down list to filter baselines:
  - **Last Processed**: When selected, only baselines processed in the last processing session are available in the view.
  - **All Processed**: When selected, all processed baselines in your project are available in the view.

Both views have common tabs on the bottom of the view:

- : The tabs at the bottom of the screen are used to display the various occupation results of a baseline, with each processed occupation shown as a separate tab.
- : Scroll the bottom tabs when there are too many to display in the space available.

Both views have common information on the status bar:

Baseline Results – Status bar

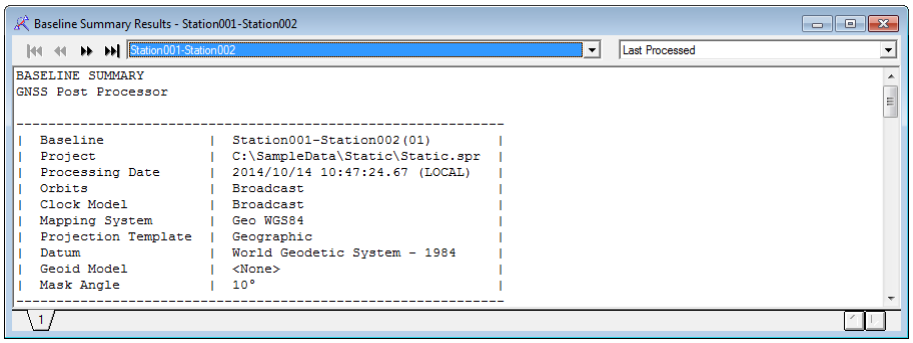
- **(Left pane)**: Number of baselines in project.

12.4.1 Baseline Summary

The **Baseline Summary** provides you with results on the processing along with some statistical results.

The **Baseline Summary** can be displayed by following one of these procedures:

- From the main menu, select **Analysis > Baseline Results > Baseline Summary**;
- From the **Analysis** toolbar, press the button.

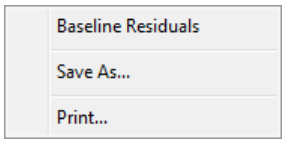


Baseline Summary

This view displays several sections:

- **Header**: General information about the baseline and the project.
- **Base Station**: Position and general information about the site used as base station in the baseline.

- **Remote Station**: Position and general information about the site used as remote station in the baseline.
- **Baseline Results**: Detailed vector information.
- **ECEF Lower Covariance Matrix**: Covariance matrix
- **Rejected satellites**: Present only if some satellites were rejected in **Edit > Rejected Satellites**.
- **Warnings**: List of any processing problems encountered during vector calculation



Baseline Summary – Speed menu

- **Baseline Residuals**: Switch to the **Baseline Residuals** view.
- **Save As...:** Save this view as a text file.
- **Print...:** Print this view

12.4.1.1 Header

```
-------------------------------------------------------------
|  Baseline              |  Station001-Station002(01)        |
|  Project               |  C:\SampleData\Static\Static.spr  |
|  Processing Date       |  2014/10/14 10:47:24.67 (LOCAL)   |
|  Orbits                |  Broadcast                        |
|  Clock Model           |  Broadcast                        |
|  Mapping System        |  Geo WGS84                        |
|  Projection Template   |  Geographic                       |
|  Datum                 |  World Geodetic System - 1984     |
|  Geoid Model           |  <None>                           |
|  Mask Angle            |  10°                              |
-------------------------------------------------------------
```

Baseline Summary – Header

- **Baseline**: Baseline name.
- **Project**: Full project path.
- **Processing Date**: Date, time and time format in parenthesis.
- **Orbits**: Indicates the type of orbits used. Possible values are:
  - **Broadcast**: Use broadcast orbits
  - **Precise**: Use precise orbits
- **Clock Model**: Indicate the type of clock model used. Possible values are:
  - **Broadcast**: Use clock model within broadcast orbits.
  - **SP3**: Use clock model within SP3 files.
  - **Precise**: Use clock model within CLK files.
- **Mapping System**: Full name of the current projection
- **Projection Template**: Full name of the type of the current projection
- **Datum**: Full datum name for the current projection.
- **Geoid Model**: Name of the geoid model (if any)

- **Mask Angle**: Mask angle applied to the satellite height above horizon when doing the processing.

12.4.1.2 Base/Remote Station

The **Base Station** and **Remote Station** tables contain the same information for the base and remote site respectively:

```
BASE STATION
-----------------------------------------------------------------------
|  Base Site              |  Station001(01)                           |
|  Observation File       |  C:\SampleData\Static\Data\alco275q30.100 |
|  Antenna Model          |  LEIAS10*                                 |
|  Antenna Height         |  0.000 m                                  |
|  Measurement Interval   |  5 seconds                                |
|  Constellations         |  GPS, GLONASS                             |
|  Latitude               |  N 40°31'26.57884"                        |
|  Longitude              |  W  3°53'08.50077"                        |
|  Ellipsoid Height       |  808.369 m                                |
|  Undulation             |  0.000 m                                  |
|  Mean Sea Level         |  808.369 m                                |
-----------------------------------------------------------------------
```

Baseline Summary – Base/Remote Station

- **Base Site/Remote Site**: Site name and occupation number in parenthesis for the base or remote site in the baseline.
- **Observation File**: Full path for observation file containing this site.
- **Antenna Model**: Antenna model for the site.
- **Antenna Height**: Antenna height at the site position (vertical).
- **Measurement Interval**: Measurement interval when recording the site.
- **Constellations**: List of constellations found in the data. Possible values are:
  - **GPS**
  - **GLONASS**
  - **Galileo**
  - **BeiDou**
- **Latitude/Longitude**: Latitude and longitude for the site position when the current mapping system is a geographic system.
- **X/Y**: X and Y for the site position when the current mapping system is a projected system.
- **Ellipsoid Height**: Ellipsoid height for the site position.
- **Undulation**: Undulation at the site location. Undulation is obtained from the **Geoid Model** indicated the header section. It may be set manually in the **Site Editor** when **Geoid Model** is **<User undulation>**.
- **Mean Sea Level**: Mean Sea Level height of the site position.
- **Scale Factor**: Scale factor (for **UTM** only)
- **Central Meridian**: Central meridian (for **UTM** only)

12.4.1.3 Baseline Results

The **Baseline Results** contains detailed information about the result vector.

```
BASELINE RESULTS
-----------------------------------------------------------------------
|  Solution Type            |  L1 (fixed)                              |
|  Processing Mode          |  Static                                  |
|  Processing Interval      |  5 seconds                               |
|  Constellations Used      |  GPS                                     |
|  Start time               |  2010/10/02 12:29:45.00 (LOCAL)          |
|  Duration                 |  01:59:55.00                             |
|  Total Epochs             |  1440                                    |
|  Solved Epochs            |  1440                                    |
|  % Solved Epochs          |  100.00%                                 |
|  RMS                      |  0.011 m                                 |
|  Ratio Quality Factor     |  25.4                                    |
|  RDOP                     |  0.11                                    |
|  GPS (G) Satellites Used  |  G03 G06 G07 G11 G14 G16 G18 G19 G20 G22 |
|                           |  G24 G28 G32                             |
|                           |                                          |
|  ECEF Vector              |                                          |
|  DX                       |  12067.492 m                             |
|  DY                       |  -2953.037 m                             |
|  DZ                       |  -14514.697 m                            |
|  Dist 3D                  |  19105.529 m                             |
|                           |                                          |
|  Geodetic data            |                                          |
|  Fwd azimuth              |  186°23'47.57109"                        |
|  Bwd azimuth              |  6°22'49.07223"                          |
|  Fwd vert angle           |  90°22'53.73161"                         |
|  Bwd vert angle           |  89°47'25.55508"                         |
|  Dist geo                 |  19103.002 m                             |
-----------------------------------------------------------------------
```

Baseline Summary – Baseline Results

- **Solution Type**: Solution Type. See the ***Solution Type*** appendix for more details.
- **Processing Mode**: Algorithm used to process the baseline. Possible values are:
  - **Static**: Normal static processing. This algorithm is optimized for baselines with a long time span.
  - **Rapid Static**: Rapid static processing. This algorithm is optimized for baselines with a short time span.
- **Processing Interval**: Processing interval. This value usually corresponds to the data interval but may be overridden in the **Process Parameters**.
- **Constellations Used**: List of constellations used by the baseline. Possible values are:
  - **GPS**
  - **GLONASS**
  - **Galileo**
  - **BeiDou**
- **Start time**: Start time for the baseline.
- **Duration**: Observation time span of the baseline (simultaneous observation time of the two baseline sites).
- **Total Epochs**: Total number of epochs covering the baseline.
- **Solved Epochs**: Number of epochs used to calculate the baseline.
- **% Solved Epochs**: Percentage of solved epochs compared to the total epochs.
- **RMS**: Root Mean Square of the baseline solution.
- **Ratio Quality Factor**: The **Ratio Quality Factor** is different from zero when the solution type is **Fixed**, i.e. the carrier phase ambiguities are fixed to integer values. The smallest value for a **Fixed** solution is 2.5. The largest the **ratio quality factor** is, the more confidence you can have in the

result. A **ratio quality factor** larger than 5 means that the result can be accepted with a very good confidence. Baselines with a ratio less than 5 should be properly tested within loops or other external data.

- **RDOP**: Relative Dilution of Precision.
- **GPS (G) Satellites Used**: List of all GPS satellites used in the baseline calculation.
- **GLONASS (R) Satellites Used**: List of all GLONASS satellites used in the baseline calculation. This line is present only if GLONASS satellites are used.
- **Galileo (E) Satellites Used**: List of all Galileo satellites used in the baseline calculation. This line is present only if Galileo satellites are used.
- **BeiDou (C) Satellites Used**: List of all BeiDou satellites used in the baseline calculation. This line is present only if BeiDou satellites are used.
- **ECEF Vector**: Earth-Centered, Earth-Fixed vector from base to remote.
    - **DX/DY/DZ**: Component of the vector in each of the three axes in ECEF.
    - **Dist 3D**: 3D distance for the vector.
- **Geodetic Data**:
    - **Fwd azimuth**: Forward azimuth.
    - **Bwd azimuth**: Backward azimuth.
    - **Fwd vert angle**: Forward vertical angle.
    - **Bwd vert angle**: Backward vertical angle.
    - **Dist geo**: Geodetic distance.
- **Mapping data**: These columns are present when the current mapping system is a projected system.
    - **Azimuth**: Azimuth between base station and remote station.
    - **Dist map**: Mapping distance

12.4.1.4 ECEF lower covariance matrix

The **ECEF lower covariance matrix** gives the full covariance matrix. Since the matrix is symmetrical, the upper part can be deduced easily.

Matrix

X^2		
YX	**Y^2**	
ZX	**ZY**	**Z^2**

```
ECEF LOWER COVARIANCE MATRIX (meters^2)

-----------------------------------------------------
|   2.510794e-05  |                 |                |
|  -1.797391e-05  |   5.057478e-05  |                |
|   7.200344e-07  |  -7.766004e-06  |  1.538848e-05  |
-----------------------------------------------------
```

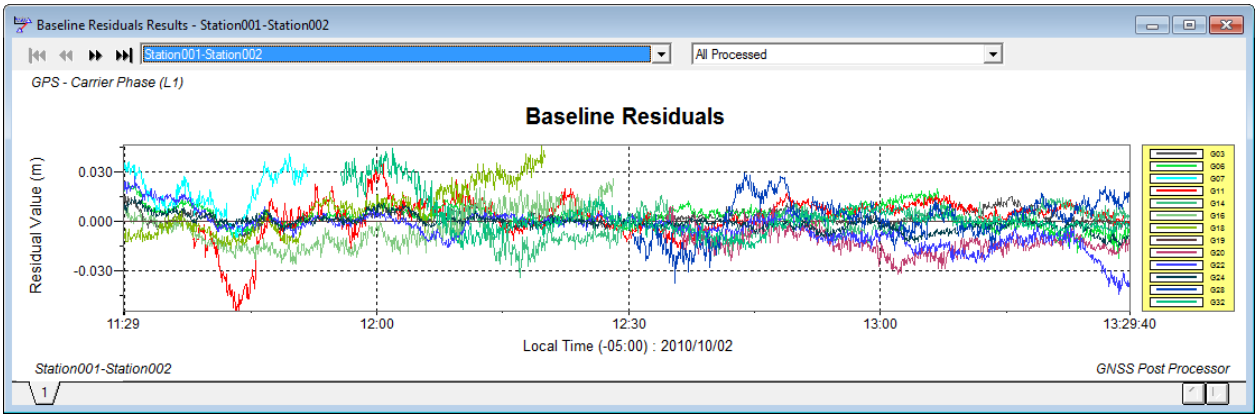
Baseline Summary – ECEF Lower Covariance Matrix

12.4.2 Baseline Residuals

These views require more experience to be properly analyzed. The architecture of the residuals window is almost the same as the raw analysis window.

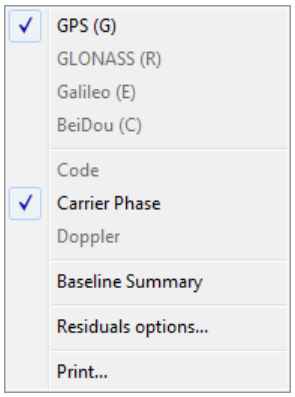
The **Baseline Residuals** can be displayed by following one of these procedures:

- From the main menu, select **Analysis > Baseline Results > Baseline Residuals**;
- From the **Analysis** toolbar, press the button.



Baseline Residuals

- **Data type** (Top left): Data being analyzed. It is a combination of constellation (left) and data type (right)
  - Constellation (left part of the name):
    - **GPS**: Display only GPS satellites
    - **GLONASS**: Display only GLONASS satellites.
    - **Galileo**: Display only Galileo satellites.
    - **BeiDou**: Display only BeiDou satellites.
  - Data type (right part of the name):
    - **Code**: Display residuals for code observations.
    - **Carrier Phase**: Display residuals for the carrier phase. The solution type for the carrier phase is displayed in parenthesis.
    - **Doppler**: Display residuals for doppler observations.
- **Baseline name** (Bottom left): Baseline name.
- **Residuals value** (vertical axis): Residual values. The scale is configurable using the **Residual value range** in the **Residuals Options** dialog (from the speed menu).
- **Time** (horizontal axis): Covers the whole baseline from Start time (left) to End time (right).
- **Graphic** (center): Residuals for each satellite are displayed with a different color. When the vertical scale is fixed to a specific value (see **Residuals Options**), value that are out-of-bound are not displayed. It is also possible to reject some satellites from the graphic to help analyze the rest (from the speed menu).



Baseline Residuals – Speed menu

- **GPS (G)**: Display only the GPS constellation
- **GLONASS (R)**: Display only the GLONASS constellation.
- **Galileo (E)**: Display only the Galileo constellation.
- **BeiDou (C)**: Display only the BeiDou constellation.
- **Code**: Display only code residuals (when available).
- **Carrier Phase**: Display only carrier phase residuals.
- **Doppler**: Display only doppler residuals (when available).
- **Baseline Summary**: Switch to the **Baseline Summary** view.
- **Residuals options…**: Display the **Residuals Options** dialog. See ***Analysis – Baselines Results – Residuals Options*** section for more details.
- **Print...:** Print this view

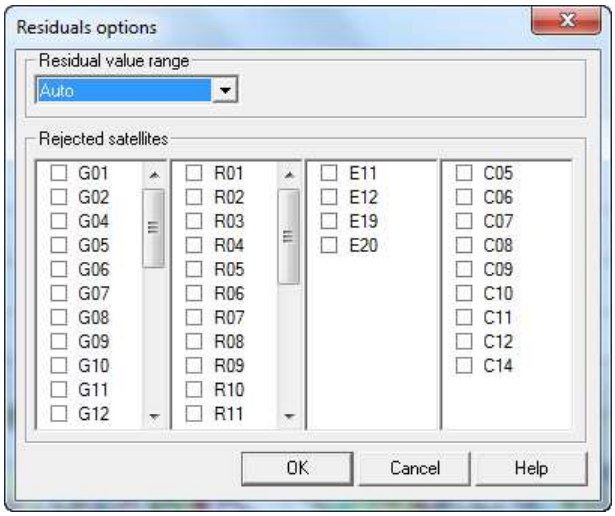
12.4.3 Residuals Options

The **Residuals Options** controls some parameters from any residuals view.

The **Residuals Options** can be displayed by following this procedure:

a. Open a residual view:
   - From the main menu:
     - Select **Analysis > Baseline Results > Baseline Residuals**;
     - Select **Analysis > Trajectory Results > Trajectory Residuals**;
     - Select **Analysis > PPP Results > PPP Residuals**;
   - From the **Analysis** toolbar
     - Press the button, the button or the button.

b. Select **Residuals options…** from the speed menu within the residuals view.



Residuals Options

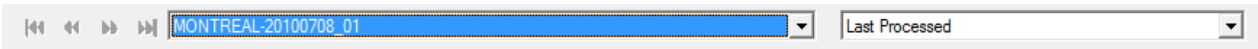
- **Residual value range**: It controls the vertical scale of the **Residuals** graph.
  - **Auto**: **Auto** scale the current view to fit with active satellites
  - **Others**: All others are proposed values for the limit of the current graph. For example, "± 0.100 m" will display a graph between -0.100 and 0.100. Any value that goes out of bound will be truncated at the border.
- **Rejected satellites**: It represents the list of available satellites (satellites being part of the residuals window). A check mark indicates that the selected satellite will not be displayed in the **Residuals** graph. Each column represents a constellation. The column is empty if the constellation is not used.

12.5 Trajectory Results

The **Trajectory Summary** provides you with some parameters used in the processing along with trajectory site results (if any). You will notice that trajectory results themselves (i.e. epoch position of the kinematic segment) are not provided in this summary. To get epoch positions along with solution types, you have to export them.

Along with this summary, the **Trajectory Residuals** can be displayed graphically. When working in RTK, a **Trajectory Site Comparison report** is also available to compare real-time positions with their post-processed positions.

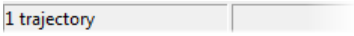
All views have a common toolbar:



Trajectory Results – Toolbar

- **VCR controls** (5 controls on the left): See ***Analysis***, the beginning of this chapter for more details.
- **Filter** (last control in toolbar): Select one of the following options in the drop-down list to filter trajectories:
  - **Last Processed**: When selected, only trajectories processed in the last processing session are available in the view.
  - **All Processed**: When selected, all processed trajectories in your project are available in the view.

All views have common information on the status bar:



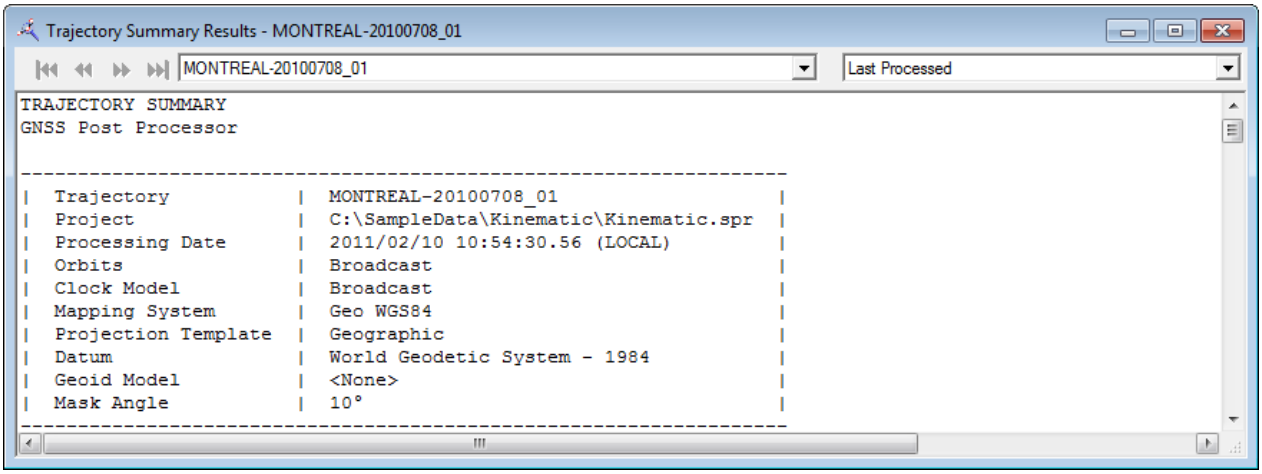
Trajectory Results – Status bar

- **(Left pane)**: Number of trajectories in project.

12.5.1 Trajectory Summary

The **Trajectory Summary** can be displayed by following one of these procedures:

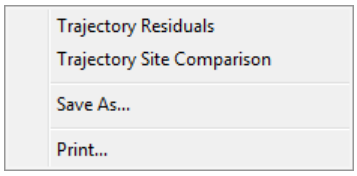
- From the main menu, select **Analysis > Trajectory Results > Trajectory Summary**;
- From the **Analysis** toolbar, press the button.



Trajectory Summary

This view displays several sections:

- **Header**: General information about the trajectory and the project.
- **Base Station**: Position and general information about the site used as base station in the trajectory.
- **Rover**: General information about the rover
- **Trajectory Info**: General information about the trajectory.
- **Sites – Metadata**: Metadata for all trajectory sites within current trajectory (stop-and-go sites).
- **Sites – Coordinates**: Coordinates for all trajectory sites within the current trajectory.
- **Sites – Vectors**: Vectors for all trajectory sites within the current trajectory.
- **Rejected satellites**: Present only if some satellites were rejected in **Edit > Rejected Satellites**.
- **Warnings**: List of any processing problems encountered during trajectories calculation



Trajectory Summary – Speed menu

- **Trajectory Residuals**: Switch to the **Trajectory Residuals** view.
- **Trajectory Site Comparison**: Switch to the **Trajectory Site Comparison** view.
- **Save As...:** Save this view as a text file.
- **Print...:** Print this view

12.5.1.1 Header

This section is almost identical to the header section in **Baseline Summary**. See ***Header*** section is ***Baseline Summary*** for more details.

The baseline line is replaced with:

- **Trajectory**: trajectory name.

12.5.1.2 Base station

```
BASE STATION
---------------------------------------------------------------------------
|  Base Site              |  montreal(01)                                  |
|  Observation File       |  C:\SampleData\Kinematic2\Data\68h00001.obs    |
|  Antenna Model          |  TRM29659    TCWD*                             |
|  Antenna Height         |  0.068 m                                       |
|  Measurement Interval   |  5 seconds                                     |
|  Constellations         |  GPS                                           |
|  Latitude               |  N 45°32'45.98017"                             |
|  Longitude              |  W 73°38'19.78310"                             |
|  Ellipsoid Height       |  73.676 m                                      |
|  Undulation             |  0.000 m                                       |
|  Mean Sea Level         |  73.676 m                                      |
---------------------------------------------------------------------------
```

Trajectory Summary – Base Station

- **Base Site**: Site name and occupation number in parenthesis for the base site in the trajectory.
- **Observation File**: Full path for observation file containing this site.
- **Antenna Model**: Antenna model for the site.
- **Antenna Height**: Antenna height at the site position (vertical).
- **Measurement Interval**: Measurement interval when recording the site.
- **Constellations**: List of constellations found in the data. Possible values are:
  - **GPS**
  - **GLONASS**
  - **Galileo**
  - **BeiDou**
- **Latitude/Longitude**: Latitude and longitude for the site position when the current mapping system is a geographic system.
- **X/Y**: X and Y for the site position when the current mapping system is a projected system.

- **Ellipsoid Height**: Ellipsoid height for the site position.
- **Undulation**: Undulation at the site location. Undulation is obtained from the **Geoid Model** indicated the header section. It may be set manually in the **Site Editor** when **Geoid Model** is **<User undulation>**.
- **Mean Sea Level**: Mean Sea Level height of the site position.
- **Scale Factor**: Scale factor (for **UTM** only)
- **Central Meridian**: Central meridian (for **UTM** only)

12.5.1.3 Rover

```
ROVER
-------------------------------------------------------------------------
|  Rover                  |  20100708_01                                |
|  Observation File       |  C:\SampleData\Kinematic2\Data\20100708_01.LOG  |
|  Antenna Model          |  NOV702GG                                   |
|  Antenna Height         |  2.000 m                                    |
|  Measurement Interval   |  1 second                                   |
|  Constellations         |  GPS, GLONASS                               |
|  Distance From Base     |  5.8 km                                     |
-------------------------------------------------------------------------
```

Trajectory Summary – Rover

- **Rover**: Rover name.
- **Observation File**: Full path for observation file associated to the rover.
- **Antenna Model**: Antenna model for the rover.
- **Antenna Height**: Antenna height at the rover (vertical).
- **Measurement Interval**: Recording interval for observations.
- **Constellations**: List of constellations found in the data. Possible values are:
  - **GPS**
  - **GLONASS**
  - **Galileo**
  - **BeiDou**
- **Distance from Base**: Distance between the rover and the base site. The rover position is roughly the center of the rover so this is more an average distance than an exact distance.

12.5.1.4 Trajectory Info

```
TRAJECTORY INFO
-------------------------------------------------------------
|  Processing Interval   |  1 second                        |
|  Constellations Used   |  GPS                             |
|  Start time            |  2010/07/09 09:12:04.00 (LOCAL)  |
|  Duration              |  00:22:27.00                     |
|  Total Epochs          |  1308                            |
|  Solved Epochs         |  1308                            |
|  % Solved Epochs       |  100.00%                         |
-------------------------------------------------------------
```

Trajectory Summary – Trajectory Info

- **Processing Interval**: Processing interval. This value usually corresponds to the data interval but may be overridden in the **Process Parameters**.
- **Constellations Used**: List of constellations used by the trajectory. Possible values are:

- **GPS**
- **GLONASS**
- **Galileo**
- **BeiDou**

- **Start time**: Start time for the trajectory.
- **Duration**: Observation time span of the trajectory (simultaneous observation time of the base site and the rover).
- **Total Epochs**: Total number of epochs covering the trajectory.
- **Solved Epochs**: Number of epochs used to calculate the trajectory
- **% Solved Epochs**: Percentage of solved epochs compared to the total epochs.

12.5.1.5 Sites – Metadata

SITES - METADATA

Site	Start time (LOCAL)	Duration	Antenna Model	Antenna Height (m)	Antenna Slant (m)	Number of epochs Total	Number of epochs Solved	Number of epochs % Solved
1(01)	2010/07/09 08:12:20.00	N/A	NOV702GG*	-0.081	N/A	1	1	100.00
2(01)	2010/07/09 08:13:03.00	N/A	NOV702GG*	-0.081	N/A	1	1	100.00
3(01)	2010/07/09 08:14:00.00	N/A	NOV702GG*	-0.081	N/A	1	1	100.00
4(01)	2010/07/09 08:14:28.00	N/A	NOV702GG*	-0.081	N/A	1	1	100.00
5	2010/[illegible] 08[illegible]4.00	N/A	NOV702GG*	-0.081	N/A	1	1	100.00

Trajectory Summary – Sites – Metadata

- **Site**: Site name and occupation number.
- **Start time**: Start time for the site
- **Duration**: Site duration. If the site has a single epoch, duration is **N/A** (not applicable).
- **Antenna**:
  - **Model**: Antenna model. Refer to ***Antenna Models*** chapter for information on antenna models.
  - **Height**: Vertical antenna height as calculated by the slant height and the antenna model.
  - **Slant**: Antenna slant height.
- **Number of epochs:**
  - **Total:** Total number of epochs covering the trajectory site.
  - **Solved:** Number of epochs used to calculate the trajectory site.
  - **% Solved:** Percentage of solved epochs compared to the total epochs.

12.5.1.6 Sites – Coordinates

SITES - COORDINATES

Site	Solution	Position X (m)	Position Y (m)	Position EllHgt (m)	RMS (m)	Standard deviation X (m)	Standard deviation Y (m)	Standard deviation Hgt (m)	UTM CM	UTM SCF
1(01)	L1 (fixed)	612032.203	5044114.945	18.382	0.006	0.005	0.009	0.015	W 75°	0.9997543
2(01)	L1 (fixed)	612001.503	5044120.302	18.494	0.006	0.003	0.004	0.008	W 75°	0.9997542
3(01)	L1 (fixed)	611974.576	5044123.210	18.684	0.004	0.003	0.003	0.007	W 75°	0.9997542
4(01)	L1 (fixed)	611944.522	5044127.414	18.797	0.002	0.001	0.002	0.003	W 75°	0.9997541
5(01)	L1 (fixed)	61[illegible]938	5044134.53[illegible]	18.995	0.003	0.002	0.002	0.005	[illegible]°	0.9997539

Trajectory Summary – Sites – Coordinates

- **Site**: Site name and occupation number.
- **Solution**: Solution type for the trajectory site. See the ***Solution Type*** appendix for more details.
- **Position**: Trajectory site position.
  - **Latitude/Longitude**: Latitude and longitude for the trajectory site position when the current mapping system is a geographic system.
  - **X/Y**: X and Y for the trajectory site position when the current mapping system is a projected system.
  - **EllHgt**: Ellipsoid height for the trajectory site position.
  - **Und**: Undulation of the geoid at that position. This column is present only if geoid is **<User undulation>**.
  - **MSL**: Mean sea level for the trajectory site position. This column is present if geoid is not **<None>**.
- **RMS**: Root Mean Square of the trajectory site solution.
- **Standard deviation**: Standard deviation for trajectory site.
  - **Lat/Lon**: Standard deviation in the latitude/longitude direction when the current mapping system is a geographic system.
  - **X/Y**: Standard deviation in the X/Y direction when the current mapping system is a projected system.
  - **Hgt**: Standard deviation in the height direction.
- **UTM**: These columns are present when the current mapping system is UTM
  - **CM**: Central meridian
  - **SCF**: Scale factor

12.5.1.7 Sites – Vectors

SITES - VECTORS

Site	ECEF Vector DX (m)	DY (m)	DZ (m)	Dist 3D (m)	Geodetic data Fwd azimuth	Bwd azimuth	Fwd vert angle	Bwd vert angle	Dist geo (m)	Mapping data Azimuth	Dist map (m)
1(01)	5624.297	1320.995	-393.520	5790.734	94°58'15.35439"	275°01'25.15171"	90°35'02.44133"	89°28'04.50207"	5790.417	93°59'57.28279"	5788.949
2(01)	5593.770	1316.303	-389.303	5759.729	94°56'20.63538"	274°59'29.42577"	90°35'08.74470"	89°27'57.19763"	5759.412	93°58'02.56230"	5757.951
3(01)	5567.344	1310.892	-386.793	5732.658	94°55'43.26226"	274°58'51.16839"	90°35'10.99043"	89°27'54.07792"	5732.341	93°57'25.18837"	5730.888
4(01)	5537.652	1305.580	-383.392	5702.379	94°54'26.56392"	274°57'33.48369"	90°35'17.13222"	89°27'46.95853"	5702.062	93°56'08.48887"	5700.616
5(01)	5479.005	1294.228	-377.518	5642.433	94°52'36.39059"	274°55'41.35407"	[illegible]	89°27'31.71355"	5642.116	[illegible]	5640.684

Trajectory Summary – Sites – Vectors

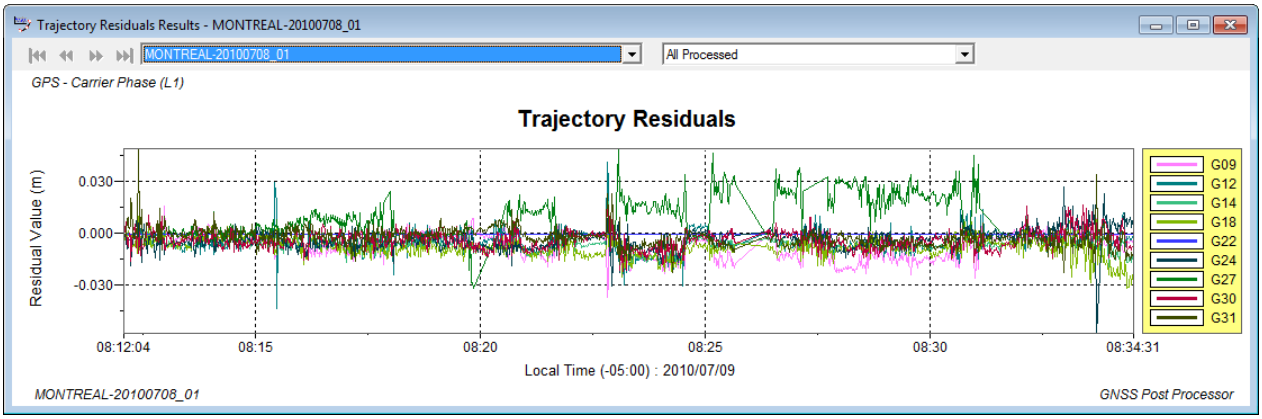
- **Site**: Site name and occupation number.
- **ECEF Vector**: Earth-Centered, Earth-Fixed vector from base site to trajectory site
  - **DX/DY/DZ**: Component of the vector in each of the three axes in ECEF.
  - **Dist 3D**: 3D distance for the vector.
- **Geodetic data**:
  - **Fwd azimuth**: Forward azimuth.
  - **Bwd azimuth**: Backward azimuth.
  - **Fwd vert angle**: Forward vertical angle.
  - **Bwd vert angle:** Backward vertical angle.
  - **Dist geo**: Geodetic distance.

- **Mapping data**: These columns are present when the current mapping system is a projected system.
  - **Azimuth**: Azimuth
  - **Dist map**: Mapping distance

12.5.2 Trajectory Residuals

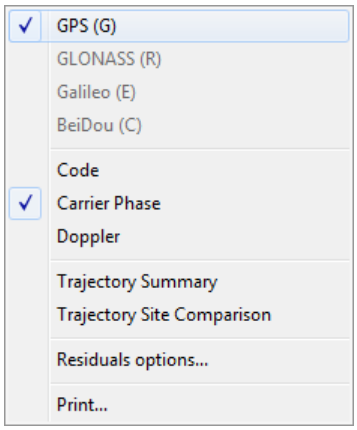
The **Trajectory Residuals** can be displayed by following one of these procedures:

- From the main menu, select **Analysis > Trajectory Results > Trajectory Residuals**;
- From the **Analysis** toolbar, press the button.



Trajectory Residuals

- **Data type** (Top left): Data being analyzed. It is a combination of constellation (left) and data type (right)
  - Constellation (left part of the name):
    - **GPS**: Display only GPS satellites
    - **GLONASS**: Display only GLONASS satellites.
    - **Galileo**: Display only Galileo satellites.
    - **BeiDou**: Display only BeiDou satellites.
  - Data type (right part of the name):
    - **Code**: Display residuals for the code.
    - **Carrier Phase**: Display residuals for the carrier phase. The solution type for the carrier phase is displayed in parenthesis.
    - **Doppler**: Display residuals for the doppler.
- **Trajectory name** (Bottom left): Trajectory name.
- **Residuals value** (vertical axis): Residual values. The scale is configurable using the **Residual value range** in the **Residuals Options** dialog (from the speed menu).
- **Time** (horizontal axis): Covers the whole trajectory file from Start time (left) to End time (right).
- **Graphic** (center): Residuals for each satellite are displayed with a different color. When the vertical scale is fixed to a specific value (see **Residuals Options**), value that are out-of-bound are not displayed. It is also possible to reject some satellites from the graphic to help analyze the rest.



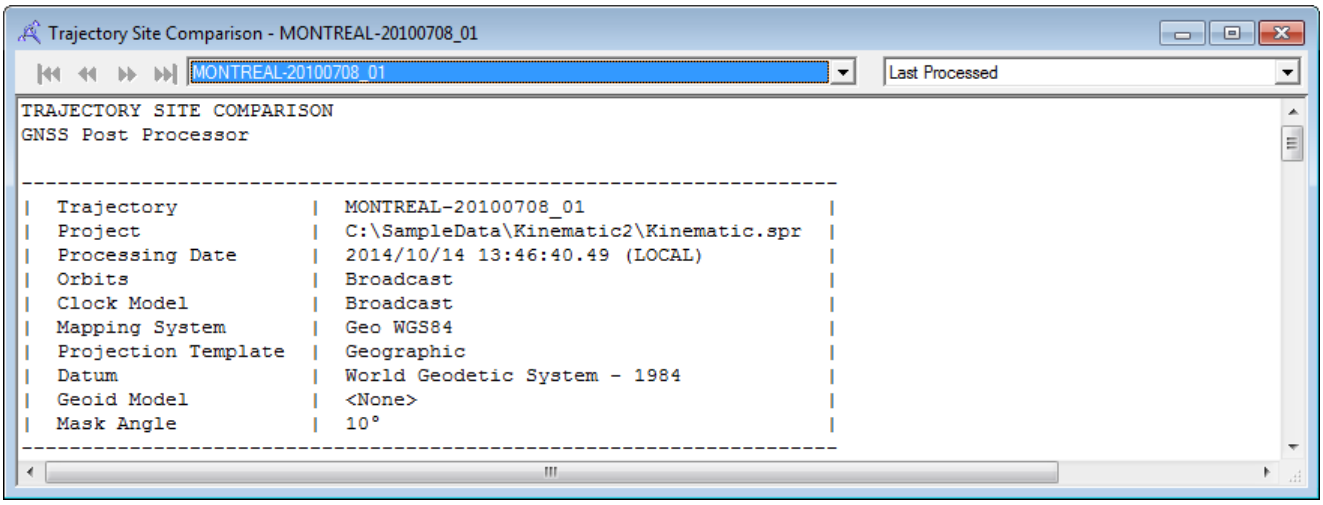
Trajectory Residuals – Speed menu

- **GPS (G)**: Display only the GPS constellation
- **GLONASS (R)**: Display only the GLONASS constellation.
- **Galileo (E)**: Display only the Galileo constellation.
- **BeiDou (C)**: Display only the BeiDou constellation.
- **Code**: Display only code residuals
- **Carrier Phase**: Display only carrier phase residuals.
- **Doppler**: Display only doppler residuals
- **Trajectory Summary**: Switch to the **Trajectory Summary** view.
- **Trajectory Site Comparison**: Switch to the **Trajectory Site Comparison** view.
- **Residuals options…**: Display the **Residuals Options** dialog. See ***Analysis – Baselines Results – Residuals Options*** section for more details.
- **Print...:** Print this view

12.5.3 Trajectory Site Comparison

The **Trajectory Site Comparison** can be displayed by following one of these procedures:

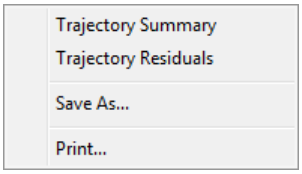
- From the main menu, select **Analysis > Trajectory Results > Trajectory Site Comparison**;
- From the **Analysis** toolbar, press the button.



Trajectory Site Comparison

This view displays several sections:

- **Header**: General information about the trajectory and the project.
- **Base Station**: Position and general information about the site used as base station in the trajectory. Identical to the same section **Trajectory Summary**.
- **Rover**: General information about the rover. Identical to the same section **Trajectory Summary**.
- **Site Comparison**: Main trajectory site comparison section



Trajectory Site Comparison – Speed menu

- **Trajectory Summary**: Switch to the **Trajectory Summary** view.
- **Trajectory Residuals**: Switch to the **Trajectory Residuals** view.
- **Save As...:** Save this view as a text file.
- **Print...:** Print this view

12.5.3.1 Header

This section is almost identical to the header section in **Baseline Summary**. See ***Header*** section is ***Baseline Summary*** for more details.

The baseline line is replaced with:

- **Trajectory**: trajectory name.

12.5.3.2 Site Comparison

All sites are on two lines:

- The **first** line refers to the real-time position. If there is no real-time position, then the real-time information is filled with **N/A** (not available).
- The **second** line refers to the post-processed positions from the trajectory site.

SITE COMPARISON

Site	Solution	Position X (m)	Position Y (m)	Position EllHgt (m)	Standard deviation X (m)	Standard deviation Y (m)	Standard deviation Hgt (m)	Difference DX (m)	Difference DY (m)	Difference DH (m)
1(01)	FIXED	299726.768	5044629.085	16.311	0.017	0.017	0.021			
	L1 (fixed)	299726.926	5044629.039	16.297	0.005	0.009	0.015	0.158	-0.046	-0.014
2(01)	FIXED	299696.159	5044635.015	16.425	0.016	0.016	0.019			
	L1 (fixed)	299696.327	5044634.969	16.409	0.003	0.004	0.008	0.168	-0.045	-0.016
3(01)	FIXED	299669.288	5044638.434	16.595	0.011	0.011	0.014			
	L1 (fixed)	299669.455	5044638.381	16.599	0.003	0.003	0.007	0.167	-0.053	0.004
4(01)	FIXED	299639.319	5044643.197	16.726	0.011	0.011	0.014			

Trajectory Site Comparison – Site Comparison

- **Site**: Site name and occupation number.
- **Solution**: Solution type for the real-time and post-processed site position. See the ***Solution Type*** appendix for more details.
- **Position**: Real-time and trajectory site position
  - **Latitude/Longitude**: Latitude and longitude for the real-time and trajectory site position when the current mapping system is a geographic system.
  - **X/Y**: X and Y for the real-time and trajectory site position when the current mapping system is a projected system.
  - **EllHgt**: Ellipsoid height for the real-time and trajectory site position.
- **Standard deviation**: Standard deviation for real-time and trajectory site.
  - **Lat/Lon**: Standard deviation in the latitude/longitude direction when the current mapping system is a geographic system.
  - **X/Y**: Standard deviation in the X/Y direction when the current mapping system is a projected system.
  - **Hgt**: Standard deviation in the height direction.
- **Difference**: If the real-time position is available, difference between the real-time and the post-processed position. If there was no real-time position, then **N/A** (not available) is displayed.
  - **DN/DE/DH**: Difference component when the current mapping system is a geographic system.
  - **DX/DY/DH**: Difference component when the current mapping system is a projected system.

For external data collector users (like Carlson SurvCE™ or MicroSurvey/NavCom FieldGenius™), when using the “Fill RTK failures” mode (see section ***Options – Format***), you can verify that your “post-process reference system” is well aligned with your “RTK reference system”, by comparing RTK and post-processed positions.

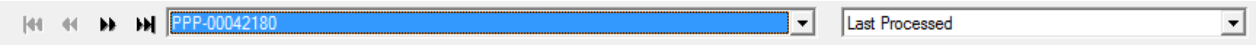
RTK **Fixed** positions should fall within few centimeters from post-processed **Fixed** positions.

12.6 PPP Results

The **PPP Summary** provides you with some parameters used in the processing along with PPP site results (if any). You will notice that PPP results themselves (i.e. epoch position of the kinematic segment) are not provided in this summary. To get epoch positions along with solution types, you have to export them.

Along with this summary, the **PPP Residuals** file can be displayed graphically.

All views have a common toolbar:



PPP Results – Toolbar

- **VCR controls** (5 controls on the left): See ***Analysis***, the beginning of this chapter for more details.
- **Filter** (last control in toolbar): Select one of the following options in the drop-down list to filter PPP:
  - **Last Processed**: When selected, only PPP processed in the last processing session are available in the view.
  - **All Processed**: When selected, all processed PPP in your project are available in the view.

All views have common information on the status bar:

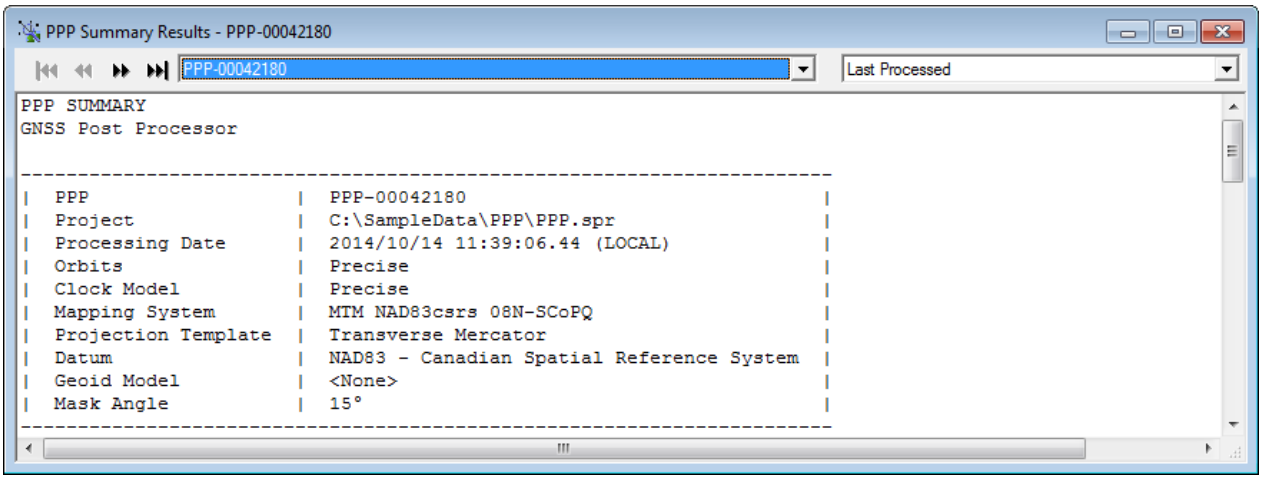
PPP Results – Status bar

- **(Left pane)**: Number of Static PPP in project.
- **(Right pane)**: Number of Rover PPP in project.

12.6.1 PPP Summary

The **PPP Summary** can be displayed by following one of these procedures:

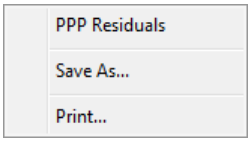
- From the main menu, select **Analysis > PPP Results > PPP Summary**;
- From the **Analysis** toolbar, press the button.



PPP Summary

This view displays several tables:

- **Header**: General information about the PPP and the project.
- **Rover/Static**: General information about the rover (for Rover PPP) or the static (Static PPP).
- **PPP Info**: General information about the PPP.
- **Sites – Metadata**: Metadata for all PPP sites within current PPP.
- **Sites – Coordinates**: Coordinates for all PPP sites within the current PPP.
- **Rejected satellites**: Present only if some satellites were rejected in **Edit > Rejected Satellites**.
- **Warnings**: List of any processing problems encountered during PPP calculation



PPP Summary – Speed menu

- **PPP Residuals**: Switch to the **PPP Residuals** view.
- **Save As...:** Save this view as a text file.
- **Print...:** Print this view

12.6.1.1 Header

This section is almost identical to the header section in **Baseline Summary**. See ***Header*** section is ***Baseline Summary*** for more details.

The baseline line is replaced with:

- **PPP**: Rover PPP or Static PPP name.

12.6.1.2 Rover / Static

```
STATIC
-------------------------------------------------------------------
|  Rover                  |  00042180                              |
|  Observation File       |  C:\SampleData\PPP\Data\00042180.10O   |
|  Antenna Model          |  TRM41249.00*                          |
|  Antenna Height         |  1.417 m                               |
|  Measurement Interval   |  0.5 second                            |
|  Constellations         |  GPS                                   |
-------------------------------------------------------------------
```

PPP Summary – Rover/Static

- **Rover/Static**: Rover or static name.
- **Observation File**: Full path for observation file containing this rover/static.
- **Antenna Model**: Antenna model for the rover/static.
- **Antenna Height**: Antenna height at the rover/static position.
- **Measurement Interval**: Recording interval for observations
- **Constellations**: List of constellations found in the data. Possible values are:
  - **GPS**
  - **GLONASS**
  - **Galileo**
  - **BeiDou**

12.6.1.3 PPP Info

```
PPP INFO
-------------------------------------------------------------
|  Processing Interval   |  0.5 second                       |
|  Constellations Used   |  GPS                              |
|  Start time            |  2010/08/06 07:13:58.50 (LOCAL)   |
|  Duration              |  11:52:25.50                      |
|  Total Epochs          |  85492                            |
|  Solved Epochs         |  85492                            |
|  % Solved Epochs       |  100.00%                          |
-------------------------------------------------------------
```

PPP Summary – PPP Info

- **Processing Interval**: Processing interval. This value usually corresponds to the data interval but may be overridden in the **Process Parameters**.
- **Constellations Used**: List of constellations used by the PPP. Possible values are:
  - **GPS**
  - **GLONASS**
  - **Galileo**
  - **BeiDou**
- **Start time**: Start time for the PPP.
- **Duration**: Observation time span of the PPP.
- **Total Epochs**: Total number of epochs covering the PPP.
- **Solved Epochs**: Number of epochs used to calculate the PPP
- **% Solved Epochs**: Percentage of solved epochs compared to the total epochs.

12.6.1.4 Sites – Metadata

SITES - METADATA

Site	Start time (LOCAL)	Duration	Antenna Model	Antenna Height (m)	Antenna Slant (m)	Number of epochs Total	Number of epochs Solved	Number of epochs % Solved
0004(01)	2010/08/06 06:13:58.50	11:52:25.50	TRM41249.00*	1.417	N/A	85492	85492	100.00

PPP Summary – Sites – Metadata

- **Site**: Site name and occupation number.
- **Start time**: Start time for the site
- **Duration**: Site duration. If the site has a single epoch, duration is **N/A** (not applicable).
- **Antenna**:
  - **Model**: Antenna model. Refer to ***Antenna Models*** chapter for information on antenna models.
  - **Height**: Vertical antenna height as calculated by the slant height and the antenna model.
  - **Slant**: Antenna slant height.
- **Number of epochs:**
  - **Total:** Total number of epochs covering the PPP site.
  - **Solved:** Number of epochs used to calculate the PPP site.
  - **% Solved:** Percentage of solved epochs compared to the total epochs.

12.6.1.5 Sites – Coordinates

SITES - COORDINATES

Site	Solution	Position X (m)	Position Y (m)	Position EllHgt (m)	RMS (m)	Standard deviation X (m)	Standard deviation Y (m)	Standard deviation Hgt (m)	UTM CM	UTM SCF
0004(01)	L3 (iono-free)	377439.381	9348136.726	170.854	0.000	0.272	0.086	0.451	W 75°	0.9997859

PPP Summary – Sites – Coordinates

- **Site**: Site name and occupation number.
- **Solution**: Solution type for the PPP site. See the ***Solution Type*** appendix for more details.
- **Position**: PPP site position.
  - **Latitude/Longitude**: Latitude and longitude for the PPP site position when the current mapping system is a geographic system.
  - **X/Y**: X and Y for the PPP site position when the current mapping system is a projected system.
  - **EllHgt**: Ellipsoid height for the PPP site position.
  - **Und**: Undulation of the geoid at that position. This column is present only if geoid is **<User undulation>**.
  - **MSL**: Mean sea level for the PPP site position. This column is present if geoid is not **<None>**.
- **RMS**: Root Mean Square of the PPP site solution.
- **Standard deviation**: Standard deviation for PPP site.

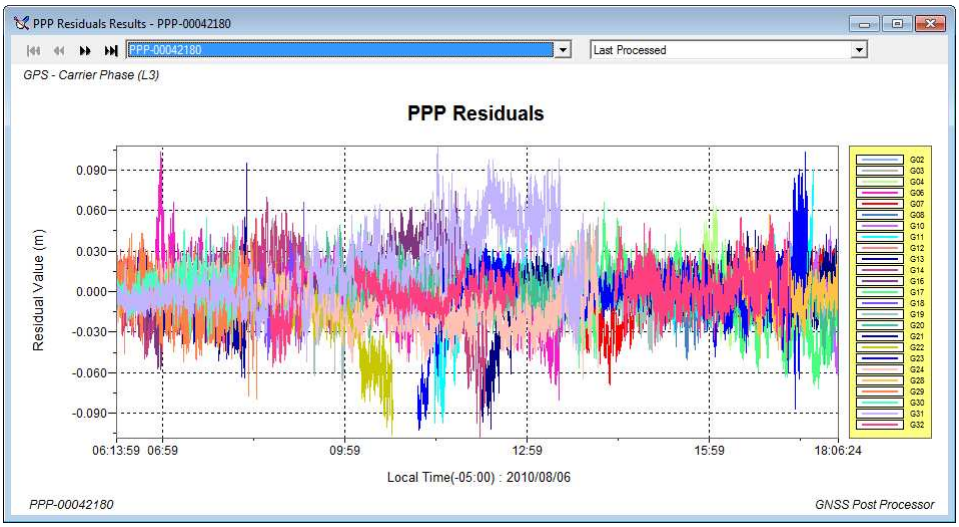
- **Lat/Lon**: Standard deviation in the latitude/longitude direction when the current mapping system is a geographic system.
- **X/Y**: Standard deviation in the X/Y direction when the current mapping system is a projected system.
- **Hgt**: Standard deviation in the height direction.

- **UTM**: These columns are present when the current mapping system is UTM
  - **CM**: Central meridian
  - **SCF**: Scale factor

12.6.2 PPP Residuals

The **PPP Residuals** can be displayed by following one of these procedures:

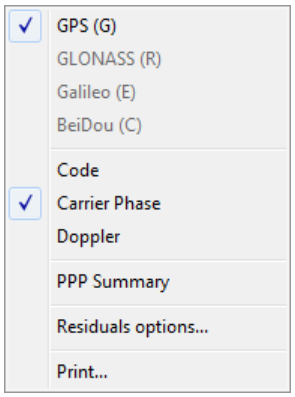
- From the main menu, select **Analysis > PPP Results > PPP Residuals**;
- From the **Analysis** toolbar, press the button.



PPP Residuals

- **Data type** (Top left): Data being analyzed. It is a combination of constellation (left) and data type (right)
  - Constellation (left part of the name):
    - **GPS**: Display only GPS satellites
    - **GLONASS**: Display only GLONASS satellites.
    - **Galileo**: Display only Galileo satellites.
    - **BeiDou**: Display only BeiDou satellites.
  - Data type (right part of the name):
    - **Code**: Display residuals for the code.
    - **Carrier Phase**: Display residuals for the carrier phase. The solution type for the carrier phase is displayed in parenthesis.
    - **Doppler**: Display residuals for the doppler.

- **PPP name** (Bottom left): PPP name.
- **Residuals value** (vertical axis): Residual values. The scale is configurable using the **Residual value range** in the **Residuals Options** dialog.
- **Time** (horizontal axis): Covers the whole PPP file from Start time (left) to End time (right).
- **Graphic** (center): Residuals for each satellite are displayed with a different color. When the vertical scale is fixed to a specific value (see **Residuals Options**), value that are out-of-bound are not displayed. It is also possible to reject some satellites from the graphic to help analyze the rest.



PPP Residuals – Speed menu

- **GPS (G)**: Display only the GPS constellation
- **GLONASS (R)**: Display only the GLONASS constellation.
- **Galileo (E)**: Display only the Galileo constellation.
- **BeiDou (C)**: Display only the BeiDou constellation.
- **Code**: Display only code residuals
- **Carrier Phase**: Display only carrier phase residuals.
- **Doppler**: Display only doppler residuals
- **PPP Summary**: Switch to the **PPP Summary** view.
- **Residuals options…**: Display the **Residuals Options** dialog. See ***Analysis – Baselines Results – Residuals Options*** section for more details.
- **Print...:** Print this view

12.7 Pre-Process Log

The **Pre-Process Log** can be displayed by following one of these procedures:

- From the main menu, select **Analysis > Pre-Process Log**;
- From the **Analysis** toolbar, press the button.

The **Pre-Process Log** is already covered in the ***GNSS Processing Workflow – Analyzing – Pre-Process Log*** section. Please refer to that section for more details.

12.8 Process Summary

The **Process Summary** can be displayed by following one of these procedures:

- From the main menu, select **Analysis > Process Summary**;
- From the **Analysis** toolbar, press the button.

The **Process Summary** is already covered in **the *GNSS Processing Workflow – Analyzing – Process Summary*** section. Please refer to that section for more details.

12.9 Network Adjustment

Network Adjustment views are available once a network adjustment is done.

The network adjustment consists of a rigorous least-squares adjustment of your baselines in order to get the best possible position of your sites.

The network adjustment can be performed automatically or manually.

- **Automatically**: It will be part of the processing if automatic processing is called (**Tools > Process Auto…**) and **Automatically adjust network after automatic processing** is checked in **Network** page of **Options**.
- **Manually**: Select **Tools > Process Manual > Adjust Network** from the main menu, or click on the **Main** toolbar.

For more information about Network Adjustment, consult the ***Network Adjustment*** appendix.

There are two possible views:

- **Network Adjustment Summary**;
- **Network Adjustment Residuals**;

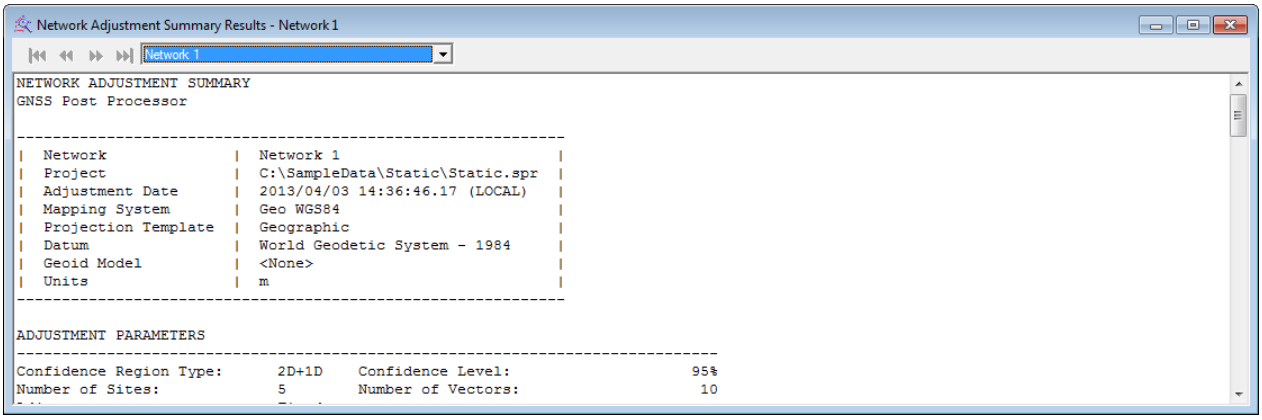
Network Adjustment – Status bar

- **(Left pane)**:Number of networks in project

12.9.1 Network Adjustment Summary

The **Network Adjustment Summary** can be displayed by following one of these procedures:

- From the main menu, select **Analysis > Network Adjustment > Network Adjustment Summary**;
- From the **Analysis** toolbar, press the button.

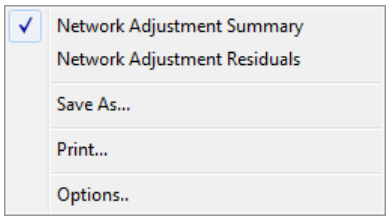


Network Adjustment Summary

The view includes the following sections:

- **Header**: General information about the network and the project.
- **Adjustment parameters**: The adjustment parameters that were used to perform the network adjustment.
- **Adjustment results**: General results about the network adjustment;
- **Auxiliary Parameters**: Auxiliary parameters calculated if adjustment type is **Fixed Station with Auxiliary Parameters**.
- **A priori reference stations coordinates**: This section lists the sites that were used as reference stations for the network adjustment.
- **Misclosures:** This section displays vector misclosure per iteration for vector occupation used in the network adjustment.
- **Adjusted coordinates**: This section lists the site coordinates obtained at the end of the last iteration.
- **Residuals**: This section presents individual vector residuals. It is the most important section in the listing for analysis purposes.
- **Site corrections**: This section lists all sites corrections per iteration.
- **Confidence regions**: This section displays textually the error ellipses.
- Adjustment error messages, if any.

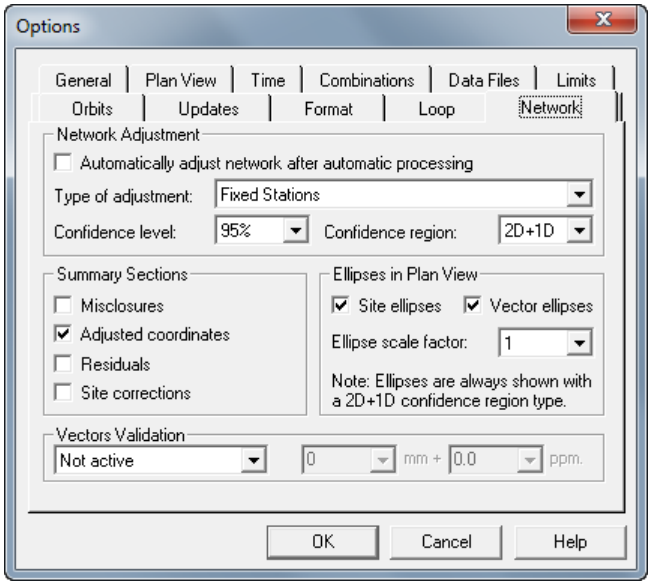
If a network adjustment failed, the summary will only include the Header and Adjustment error messages sections.



Network Adjustment Summary – Speed menu

- **Network Adjustment Summary**: The checkbox on the left indicates it is the active view.
- **Network Adjustment Residuals**: Switch to the **Network Adjustment Residuals** view.

- **Save As...:** Save this view as a text file.
- **Print...:** Print this view
- **Options…**: Display the **Network** page in **Options**. All other pages are locked. This is useful to display or hide specific **Summary Sections**.



Network Adjustment Summary – Options…

12.9.1.1 Header

```
-------------------------------------------------------------------------------
|  Network              |  Network 1                                          |
|  Project              |  C:\SampleData\Static\Static.spr                    |
|  Adjustment Date      |  2013/04/03 15:36:46.17 (LOCAL)                     |
|  Mapping System       |  UTM NAD83csrs Automatic                            |
|  Projection Template  |  Universal Transverse Mercator, Automatic (UTM-A)   |
|  Datum                |  NAD83 - Canadian Spatial Reference System          |
|  Geoid Model          |  <None>                                             |
|  Units                |  m                                                  |
-------------------------------------------------------------------------------
```

Network Adjustment Summary – Header

- **Network**: Network name.
- **Project**: Full project path.
- **Adjustment Date**: Date, time and time format in parenthesis of the network adjustment.
- **Mapping System**: Full name of the current projection
- **Projection Template**: Full name of the type of the current projection
- **Datum**: Full datum name for the current projection.
- **Geoid Model**: Name of the geoid model (if any)
- **Units**: Measurement units in the following report

12.9.1.2 Adjustment parameters

These parameters were set using the **Tools > Options > Network** page. See the ***Options – Network*** section for details about the options of the network adjustment.

```
ADJUSTMENT PARAMETERS
-------------------------------------------------------------------------------
Confidence Region Type:      2D+1D    Confidence Level:                    95%
Number of Sites:             5        Number of Vectors:                    10
Adjustment type:             Fixed
```

Network Adjustment Summary – Adjustment Parameters

- **Confidence Region Type**: Value is either **2D+1D** or **3D**. It corresponds to the **Confidence region** in the **Network** page.
- **Confidence Level**: It corresponds to the **Confidence level region** in the **Network** page.
- **Number of Sites**: Number of sites (fixed and unfixed) present in the network.
- **Number of Vectors**: Number of vectors present in the network.
- **Adjustment type**: It corresponds to the **Type of adjustment** in the **Network** page.
    - **Fixed**: **Fixed Stations**
    - **Weighted: Weighted Stations**

12.9.1.3 Adjustment Results

This section gives general results about the network adjustment.

```
ADJUSTMENT RESULTS
-------------------------------------------------------------------------------
Iterations:                  2        Residual Critical Value:           2.971
Degrees of Freedom:          18       Residuals over Critical Value:         0
Estimated Variance Factor:   7.7040   Chi2 Test:   4.399 < 1 < 16.848 (FAILED)
```

Network Adjustment Summary – Adjustment Results

- **Iterations**: The number of iterations (2 iterations is a common result for a stable network)
- **Residual Critical Value**: The residual critical value, as computed by the adjustment, is used to flag suspicious residuals in the residual section.
- **Degrees of Freedom**: Degrees of Freedom. The more redundancy you have, the higher this value will be.
- **Residuals over Critical Value**: Number of residual(s) over the critical value. When this value is 0, it usually means a good adjustment.
- **Estimated Variance Factor**: A posterior estimated variance factor
- **Chi2 Test**: Result of the Chi-squared test of the estimated variance factor (passed or failed)

12.9.1.4 Apriori Reference Stations Coordinates

This section lists sites used as reference stations for the network adjustment. The name and coordinates of each site are displayed,

```
APRIORI REFERENCE STATIONS COORDINATES
------------------------------------------------------------------------------
N.B. Fix status codes are (U)ser fixed and (S)oftware fixed.
     Fix order is Latitude, Longitude, Height.

UUU Station001
     WGS84                                m    ETRS89                          m
     Lat:  N 40 31 26.57884    +/-  0.000    Lat:  N 40 31 26.58736 +/-  0.000
     Lon:  W  3 53 08.50077    +/-  0.000    Lon:  W  3 53 08.48036 +/-  0.000

     Elevation (m)                           Elevation (m)
     Hgt:  808.369             +/-  0.000    Hgt:  808.377          +/-  0.000
     Und:  0.000                             Und:  0.000
     MSL:  808.369                           MSL:  808.377

                                             00320284 (m)
                                             X:    -637799.039      +/-  0.000
                                             Y:    -787462.039      +/-  0.000
```

Network Adjustment Summary – Apriori Reference Stations Coordinates

- **UUU/SSS**: Three letter code on the left of the site name to indicate if the site was fixed by the user (**U**) or by the software (**S**). Each letter is for respectively the latitude, longitude, and height components. They are normally the same for the three components.
- **Name**: Site name
- **WGS84**: Site position in WGS84.
  - **Lat/Lon/Hgt**: Latitude, Longitude and ellipsoid height
  - **Und**: Undulation at the site location. Undulation is obtained from the **Geoid Model** indicated the header section. It may be set manually in the **Site Editor** when **Geoid Model** is **<User undulation>**.
  - **MSL**: Mean Sea Level height
- **(Current datum)**: Site position in the current datum if the datum does not correspond to WGS84 (ETRS89 in this example)
  - **Lat/Lon/Hgt**: Latitude, Longitude and ellipsoid height
  - **Und**: Undulation at the site location. Undulation is obtained from the **Geoid Model** indicated the header section. It may be set manually in the **Site Editor** when **Geoid Model** is **<User undulation>**.
  - **MSL**: Mean Sea Level height
- **(Projected coordinate system)**: Site position in a projected coordinate system (UTM in this example)
  - **X/Y**: X and Y position
  - **SCF**: Scale factor (for **UTM** only)
  - **CM**: Central meridian (for **UTM** only)

12.9.1.5 Auxiliary Parameters

This section is present only if you select **Fixed Stations with Auxiliary Parameters** as type of adjustment. It should be selected if you want to solve for datum misalignment parameters through the network adjustment process. This type of adjustment should be used only after you have performed a minimally constrained adjustment and validate your network results. Then, when you enable auxiliary parameters and adjust your network, the Post-Processor will remove 3 rotations and a scale factor from the GNSS observations to make the whole network more closely fit your control values (a minimum of 3 fixed stations are required).

> Obviously if you don't have a lot of control, then the estimated values for rotation and scale will not be very good and the parameters solved for may be meaningless. It is extremely important to check the confidence regions for the auxiliary parameters in the listing before accepting an adjustment.

```
AUXILIARY PARAMETERS
-------------------------------------------------------------------------------

Rotation around X axis:              -0.953" +/- 0.052"
Rotation around Y axis:              -0.021" +/- 0.046"
Rotation around Z axis:              -2.039" +/- 0.053"

Scale Parameter:                      1.009  +/- 0.064 ppm
```

Network Adjustment Summary – Auxiliary Parameters

- **Rotation around X axis**: Rotation in second with its standard deviation.
- **Rotation around Y axis**: Rotation in second with its standard deviation.
- **Rotation around Z axis**: Rotation in second with its standard deviation.
- **Scale Parameter**: Scale in part per million with its standard deviation.

12.9.1.6 Misclosures

This section displays misclosure per iteration of each vector occupation being part of the network adjustment.

This section is only displayed if selected in the **Network** page of **Tools > Options**.

```
MISCLOSURES
-------------------------------------------------------------------------------
  Vector                StdDev            Misclosure per iteration
                                                 1
Station001-Station002
  dx:   12067.495  +/-  0.008    0.007
  dy:   -2953.038  +/-  0.005    0.001
  dz:  -14514.694  +/-  0.006   -0.010
```

Network Adjustment Summary – Misclosures

- **Name**: Vector name
- **dx/dy/dz**: Vector component.
- **StdDev**: Standard deviation of the three component of vector.
- **Misclosure per iteration**: A column for each iteration with the misclosure component at that iteration.

12.9.1.7 Adjusted coordinates

This section lists the site coordinates obtained at the end of the last iteration.

This section is only displayed if selected in the **Network** page of **Tools > Options**.

See **Apriori Reference Stations Coordinates** for details about position information.

```
ADJUSTED COORDINATES
-------------------------------------------------------------------------------

    Station002
     WGS84                                  m    ETRS89                              m
     Lat:  N 40 21 11.10763    +/-  0.011    Lat:  N 40 21 11.11614 +/-  0.011
     Lon:  W  3 54 38.68864    +/-  0.010    Lon:  W  3 54 38.66825 +/-  0.010

     Elevation (m)                           Elevation (m)
     Hgt:  709.810             +/-  0.014    Hgt:  709.818          +/-  0.014
     Und:  0.000                             Und:  0.000
     MSL:  709.810                           MSL:  709.818

                                             00320284 (m)
                                             X:    -642201.885      +/-  0.010
                                             Y:    -806316.649      +/-  0.011
```

Network Adjustment Summary – Adjusted Coordinates

12.9.1.8 Residuals

This section presents the residuals of the adjusted vectors. It is the most important section in the listing for analysis purposes.

This section is only displayed if selected in the **Network** page of **Tools > Options**.

```
RESIDUALS
-------------------------------------------------------------------------------
  Vector                StdDev        Residual              (Limit 2.971) StdRes

Station001-Station002(01)    [L1 (fixed)]
  dx:    12067.495  +/-  0.014           0.012                              1.035
  dy:    -2953.038  +/-  0.009          -0.010                             -1.367
  dz:   -14514.694  +/-  0.010          -0.011                             -1.412
```

Network Adjustment Summary – Residuals

- **Name**: It contain the following fields:
  - **Vector name**
  - **Baseline occupation number**: Empty for a trajectory site.
  - **Solution type**

> Solution type may help to determine which vector is the cause of high residuals within a group of vectors with high residuals.

- **dx/dy/dz**: Vector component (original values).
- **StdDev**: Standard deviation of the three component of vector.
- **Residual**: The residual value for each vector component.
- **StdRes**: The standardized residual for each component. A large standardized residual (larger than the statistical critical value) usually indicates a problem with that measurement.
  - Residuals that are over the critical value are shown as flagged (which is a series of symbols “**********>”). Note that these symbols are placed on the left of the standardized residual value.

12.9.1.9 Site corrections

This section lists site corrections per iteration.

This section is only displayed if selected in the **Network** page of **Tools > Options**.

```
SITE CORRECTIONS
--------------------------------------------------------------------------------
   Start Coordinates                    Correction per iteration
                                   1
Station002
   X:   422660.373              -0.049
   Y:  4467345.367               0.013
   H:      709.808              -0.000
```

Network Adjustment Summary – Site Corrections

- **Name**: Site Name.
- **X/Y/H**: X, Y and ellipsoid height coordinates of each site at the start of the adjustment.
- **Corrections per iteration**: Displays the corrections applied after each iteration, on each component.

12.9.1.10 Confidence regions

This section displays textually the error ellipses. The content of the section will depend on the confidence region (either **2D+1D** or **3D**).

```
2D+1D CONFIDENCE REGIONS
--------------------------------------------------------------------------------
2D Expansion Factor:         2.448    Confidence Level:                    95%
1D Expansion Factor:         1.960

Site                                                Major Az    Minor   Vert.
Station002                                          0.028  23   0.023   0.028
Station003                                          0.027  26   0.022   0.027
Station004                                          0.032  26   0.026   0.031
Station005                                          0.022  26   0.018   0.022

Vector                            PPM     Distance   Major Az    Minor   Vert.
Station001-Station002
                                 1.44    19105.540   0.028  23   0.023   0.028
Station001-Station003
                                 0.62    44404.625   0.027  26   0.022   0.027
```

Network Adjustment Summary – 2D+1D Confidence Regions

```
3D CONFIDENCE REGIONS
--------------------------------------------------------------------------------
3D Expansion Factor:         2.796    Confidence Level:                    95%

Site                             Major Az VAng    Med. Az VAng   Minor Az VAng
Station002                       0.041 184  64   0.029  43  20   0.025 128  15
Station003                       0.040 182  68   0.030  38  18   0.025 124  12
Station004                       0.045 182  68   0.035  37  18   0.029 123  12
Station005                       0.032 182  68   0.025  38  18   0.020 123  12

Vector        PPM     Distance   Major Az VAng    Med. Az VAng   Minor Az VAng
Station001-Station002
             2.17    19105.540   0.041 184  64   0.029  44  20   0.025 128  15
Station001-Station003
             0.89    44404.625   0.040 182  68   0.030  38  18   0.025 124  12
```

Network Adjustment Summary – 3D Confidence Regions

- **Expansion Factor**: 2D+1D or 3D expansion factor as selected by the user
- **Confidence Level**: It corresponds to the **Confidence level region** in the **Network** page.
- **Site**: A list of all sites, with their associated error ellipse parameters

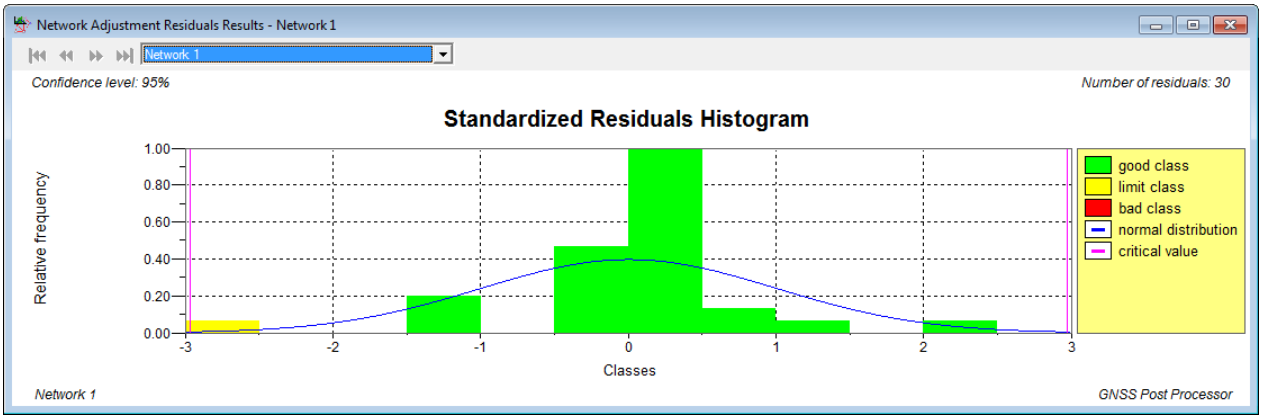
- **Site**: Site name
- **Ellipses components** (for 2D+1D):
  - **Major**: Length of major axis
  - **Az**: Azimuth of major axis.
  - **Minor**: Length of minor axis.
  - **Vert**: Vertical height
- **Ellipses components** (for 3D):
  - **Major**: Length of major axis.
  - **Az**: Azimuth of major axis.
  - **VAng**: Vertical angle of major axis.
  - **Med.**: Length of medium axis.
  - **Az**: Azimuth of medium axis.
  - **VAng**: Vertical angle of medium axis.
  - **Minor**: Length of minor axis.
  - **Az**: Azimuth of minor axis.
  - **VAng**: Vertical angle of minor axis.

- **Vector**: A list of all vectors, with their associated error ellipse parameters in ppm factor (part per million). Vectors can be flagged ("**Warning**") if they exceed a maximum limit (absolute in mm + relative in ppm) set in the **Tools > Options > Network** options page.
  - **Vector**: Vector name
  - **PPM**: Part per million.
  - **Distance**: Vector distance
  - **Ellipses components**: Same as the **Site** section above.

12.9.2 Network Adjustment Residuals

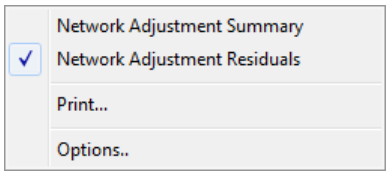
The **Network Adjustment Residuals** can be displayed by following one of these procedures:

- From the main menu, select **Analysis > Network Adjustment > Network Adjustment Residuals**;
- From the **Analysis** toolbar, press the button.



Network Adjustment Residuals

- **Confidence level (top left)**: Current confidence level
- **Number of residuals (top right)**: Number of residuals used in the program
- **Network (bottom left)**: Current network number
- **Relative frequency (Y axis)**: Relative frequency for a particular class
- **Classes (X axis)**: Residuals in classes of 0.5 (standardized residual is unit less)
- **Graph**: Residuals are grouped in classes with color representing good, limit or bad residuals. The graph also displays the normal distribution curve and two vertical lines representing the critical values.
    - : Good residuals
    - : Residuals not so good, very close to the critical value
    - : Bad residuals outside critical value.
    - : Normal distribution curve
    - : Critical values



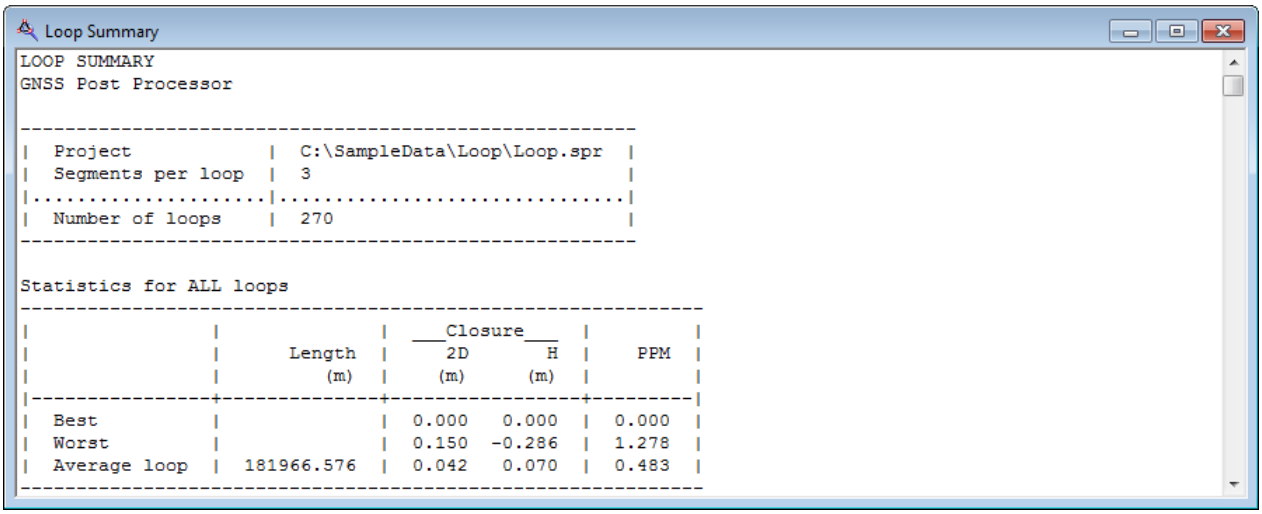
Network Adjustment Residuals – Speed menu

- **Network Adjustment Summary**: Switch to the **Network Adjustment Summary** view.
- **Network Adjustment Residuals**: The checkbox on the left indicates it is the active view.
- **Print...:** Print this view
- **Options…**: Display the **Network** page in **Options**. All other pages are locked. This is useful to display or hide specific **Summary Sections**.

12.10 Loop Summary

The **Loop Summary** can be displayed by following one of these procedures:

- From the main menu, select **Analysis > Loop Summary**;
- From the **Analysis** toolbar, press the button.



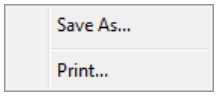
Loop Summary

The **Loop Summary** is a text summary containing:

- **Header**: General information about the loops and the project.
- **Statistics for ALL loops**: Best, worst and average information found for all loops.
- **Loops**: If there is no failed criterion, this is the list of all loops in decreasing order of ppm. If there is at least a failed criterion, this is the list of all failed loops in decreasing order of ppm.
- **Vector Used**: List of all vectors used in the above Loops section.

Loop Summary – Status bar

- **(Left pane)**: Number of loops in project.



Loop Summary – Speed menu

- **Save As...:** Save this view as a text file.
- **Print...:** Print this view

12.10.1 Header

```
-------------------------------------------------------------
|  Project                  |  C:\SampleData\Loop\Loop.spr  |
|  Segments per loop        |  3                            |
|  Failed criteria          |  > 1.000 ppm                  |
|...........................|...............................|
|  Number of loops          |  270                          |
|  Number of failed loops   |  10 (3.70%)                   |
-------------------------------------------------------------
```

Loop Summary – Header

- **Project**: Project name
- **Segments per loop**: Number of segments per loop as defined in the **Loop** page in **Tools > Options**.

Options – Loop – Number of segments

- **Failed criteria**: List of failed criteria enabled in the **Loop** page in **Tools > Options**.

Options – Loop – Failure Criteria

- **Number of loops**: Total number of loops produced before failure criteria are applied.
- **Number of failed loops**: Number of failed loops with the percentage of failed loops out of the total number of loops. Present only when at least a failed criterion is enabled.

12.10.2 Statistics for ALL loops

```
Statistics for ALL loops
-------------------------------------------------------------
|                |              |  ___Closure___  |         |
|                |      Length  |     2D       H  |    PPM  |
|                |          (m) |    (m)      (m) |         |
|----------------+--------------+-----------------+---------|
|  Best          |              |  0.000   0.000  |  0.000  |
|  Worst         |              |  0.150  -0.286  |  1.278  |
|  Average loop  |  181966.576  |  0.042   0.070  |  0.483  |
-------------------------------------------------------------
```

Loop Summary – Statistics for ALL loops

- **Length**: Average length of all loops.
- **Closure 2D**: This is the best, worst and average value found for the closure in planimetry in all loops.
- **Closure H**: This is the best, worst and average value found for the closure in altimetry in all loops.
  - The best and worst are compared in absolute values (regardless of sign).
  - The average is done using absolute value so it will always be positive.
- **PPM**: This is the best, worst and average value found for the ppm in all loops.

12.10.3 Loops

If there is no failed criterion, this is the list of all loops.

If there is at least a failed criterion, this is the list of all failed loops.

The list is sorted by decreasing order of ppm.

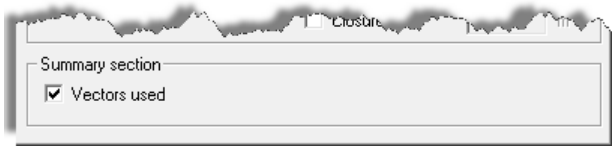
```
Loop118 (Closed - 1.770 ppm)
-----------------------------------------------------------------------------------------------------------
|                          |                          |             ECEF Vector             |               |
|  Segment          Occ    |  Solution                |          DX          DY          DZ |      Length   |
|                          |                          |         (m)         (m)         (m) |          (m)  |
|--------------------------+--------------------------+-------------------------------------+---------------|
|  VTD7-VTOX         03    |  L3 (fixed iono-free)    |    2550.040  -30904.262  -31097.865 |   43916.436   |
|  VTOX-VTUV         01    |  L3 (iono-free)          |  -93287.493    8346.701   36722.557 |  100602.038   |
|  VTUV-VTD7         02    |  L3 (iono-free)          |   90737.666   22557.242   -5624.517 |   93668.503   |
|                          |                          |                                     |               |
|..........................|..........................|.....................................|...............|
|  Closure                 |                          |       0.213      -0.319       0.175 |  238186.976   |
|  Closure 2D    0.169 m   |                          |                                     |               |
|  Closure H     0.386 m   |                          |                                     |               |
|  Closure 3D    0.422 m   |                          |                                     |               |
-----------------------------------------------------------------------------------------------------------
```

Loop Summary – A loop

- **Loop**: Loop name, type and ppm value.
  - **Name**: Loop name.
  - **Type**: Type of the loop.
    - **Closed**: This is a loop that starts and ends on the same site.
    - **Open**: This is a loop between two reference points.
  - **ppm**: ppm (part per million) with respect to the total length of the loop.
- **Segment**: List of all vectors part of the loop. The vector may be reversed to form a closed figure and the name of both components will be swapped when it happens.
- **Occ**: List of corresponding occupations for the vectors.
- **Solution**: Solution type for the vector.
- **ECEF Vector**: Vector in Earth-Centered, Earth-Fixed coordinates. If the vector is reversed, all signs are of the vector are reversed.
- **Length**: Length of the vector.
- **Closure**: This line contains the sum of the **DX**, **DY** and **DZ** components taken individually and the sum of the length of all segments.
- **Closure 2D**: Horizontal closure of the loop.
- **Closure H**: Vertical closure of the loop.
- **Closure 3D**: Vertical and horizontal closure of the loop.

12.10.4 Vector used

This is a list of all vectors used in loops, sorted by decreasing order of the number of occurrence.
This section is displayed when the corresponding option is enabled in the **Loop** page in **Tools > Options**.



Options – Loop – Summary section

Vectors used

Vector	Count	Solution	Length (m)	RMS (m)	RDOP	Ratio	Duration	# Sat
VTOX-VTUV(01)	48	L3 (iono-free)	100602.038	0.021	0.14	0.0	00:59:59	11
VTC1-VTOX(03)	30	L4 (fixed wide lane)	39986.334	0.042	0.18	14.2	00:59:59	9
VTC1-VTUV(02)	26	L4 (fixed wide lane)	75669.194	0.054	0.18	7.1	00:59:59	9
VTOX-VTUV(03)	26	L3 (iono-free)	100602.043	0.016	0.18	0.0	00:59:59	9
VTD7-VTUV(02)	25	L3 (iono-free)	93668.503	0.015	0.18	0.0	00:59:59	9
VTC1-VTOX(02)	21	L4 (fixed wide lane)	39986.360	0.046	0.18	12.5	00:59:59	9

Loop Summary – Vector used

- **Vector**: Baseline or trajectory site name with occupation number is parenthesis.
- **Count**: Number of occurrences this vector is used in the loops.
- **Solution**: Solution type for the vector.
- **Length**: Length of the vector.
- **RMS**: Root mean square for the vector.
- **RDOP**: Relative Dilution of Precision of the vector.
- **Ratio**: The **ratio quality factor** is different from zero when the solution type is **Fixed**, i.e. the carrier phase ambiguities are fixed to integer values. The smallest value for a **Fixed** solution is 2.5. The largest the **ratio quality factor** is, the more confidence you can have in the result. A **ratio quality factor** larger than 5 means that the result can be accepted with a very good confidence.
- **Duration**: Duration of the vector.
- **# Sat**: Number of satellites for the vector.

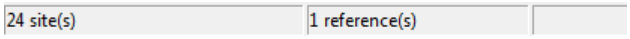
When the vector is a trajectory site, **RDOP**, **Ratio** and **# Sat** are filled with N/A because it is not applicable.

12.11 Survey Sites

There are two possible views:

- **Field Coordinates**: Original site coordinates before any post-processing.
- **Post-Processed Coordinates**: Post-processed coordinates (when available).

All views have common information on the status bar:



Survey Sites – Status bar

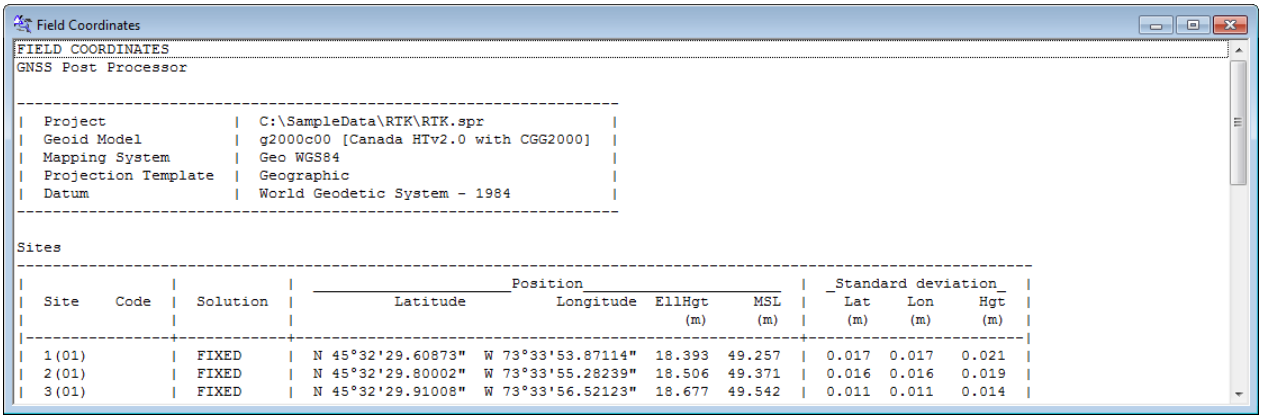
- **(Left pane)**: Number of sites in project.
- **(Right pane)**: Number of references in project.

12.11.1 Field Coordinates

The **Site Coordinates** of all sites within your project can be displayed by following one of these procedures:

- From the main menu, select **Analysis > Survey Sites > Field Coordinates**;
- From the **Analysis** toolbar, press the button.

The field coordinate is a report of original field coordinates for all sites in project.



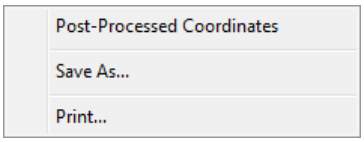
```
Field Coordinates
FIELD COORDINATES
GNSS Post Processor

-------------------------------------------------------------------
|  Project               |  C:\SampleData\RTK\RTK.spr              |
|  Geoid Model           |  g2000c00 [Canada HTv2.0 with CGG2000]  |
|  Mapping System        |  Geo WGS84                              |
|  Projection Template   |  Geographic                             |
|  Datum                 |  World Geodetic System - 1984           |
-------------------------------------------------------------------

Sites
-------------------------------------------------------------------------------------------------------------
|                |            |  ______________________Position______________________  |  _Standard deviation_  |
|  Site    Code  |  Solution  |          Latitude          Longitude  EllHgt     MSL  |    Lat     Lon     Hgt  |
|                |            |                                          (m)      (m)  |    (m)     (m)     (m)  |
|----------------+------------+-----------------------------------------------------+-----------------------|
|  1(01)         |  FIXED     |  N 45°32'29.60873"  W 73°33'53.87114"  18.393  49.257  |  0.017  0.017   0.021  |
|  2(01)         |  FIXED     |  N 45°32'29.80002"  W 73°33'55.28239"  18.506  49.371  |  0.016  0.016   0.019  |
|  3(01)         |  FIXED     |  N 45°32'29.91008"  W 73°33'56.52123"  18.677  49.542  |  0.011  0.011   0.014  |
```

Field Coordinates

If you open an existing project created prior to 2.88, positions will be filled with N/A since field coordinates were not kept.



Field Coordinates – Speed menu

- **Post-Processed Coordinates**: Switch to the Post-Processed Coordinates view.
- **Save As...:** Save this view as a text file.
- **Print...:** Print this view

The **Field Coordinates** is composed of:

- **Header**: General information about the project.
- **Sites table**
- **References table**

Each table is displayed only when it is not empty.

12.11.1.1 Header

```
-------------------------------------------------------------------
|  Project               |  C:\SampleData\RTK\RTK.spr              |
|  Geoid Model           |  g2000c00 [Canada HTv2.0 with CGG2000]  |
|  Mapping System        |  Geo WGS84                              |
|  Projection Template   |  Geographic                             |
|  Datum                 |  World Geodetic System - 1984           |
-------------------------------------------------------------------
```

Field Coordinates – Header

- **Project**: Full project path.
- **Geoid Model**: Name of the geoid model (if any)
- **Mapping System**: Full name of the current projection
- **Projection Template**: Full name of the type of the current projection

- **Datum**: Full datum name for the current projection.

12.11.1.2 Common columns

Here is the definition of common columns. These columns appear is several tables so they are defined here once:

- **Site**: Site name with occupation number in parenthesis when applicable.
  - When present, occupation number is always two digits. Example: **Site(01)**.
- **Code**: Code name.
- **Solution**: Solution type. See the ***Solution Type*** appendix for more details.
- **Position**:
  - **Latitude/Longitude**: Latitude and longitude for the site position when the current mapping system is a geographic system.
  - **X/Y**: X and Y for the site position when the current mapping system is a projected system.
  - **EllHgt**: Ellipsoid height for the site position.
  - **Und**: Undulation of the geoid at that position. This column is present only if geoid is **<User undulation>**.
  - **MSL**: Mean sea level for the site position. This column is present if geoid is not **<None>**.
- **Standard deviation**: Values are at "**N/A**" when they are exactly **0**.
  - **Lat/Lon**: Standard deviation in the latitude/longitude direction when the current mapping system is a geographic system.
  - **X/Y**: Standard deviation in the X/Y direction when the current mapping system is a projected system.
  - **Hgt**: Standard deviation in the height direction.
- **Source**: Source of position. Possible values are:
  - **Base Provider**: from an automatic base download.
  - **Baseline**: from a baseline results.
  - **Field**: from the field (not post-processed yet).
  - **Network**: from a least-squares adjustment of your baselines (these are the best possible positions).
  - **PPP**: from a PPP result.
  - **Single Point Position**: from a point positioning solution.
  - **Trajectory**: from site coordinates computed within a trajectory.
  - **User**: from user input (e.g. reference site).
- **Provider**: Full provider name.
  - **N/A**: Not available. For static used as reference or base provider that could not be resolved.

12.11.1.3 Sites

This table displays the field coordinates of all site occupations that are NOT used as reference in the project.

This table displays **Site**, **Code**, **Solution**, **Position** and **Standard deviation**.

Sites

Site	Code	Solution	Position X (m)	Position Y (m)	Position EllHgt (m)	Position MSL (m)	Standard deviation X (m)	Standard deviation Y (m)	Standard deviation Hgt (m)
1(01)		FIXED	612032.044	5044114.988	18.393	49.257	0.017	0.017	0.021
2(01)		FIXED	612001.334	5044120.344	18.506	49.371	0.016	0.016	0.019
3(01)		FIXED	611974.408	5044123.260	18.677	49.542	0.011	0.011	0.014

Field Coordinates – Sites

12.11.1.4 References

This table displays the current coordinates of all reference sites in the project.

This table displays **Site**, **Position**, **Source** and **Provider**.

References

Site	Position Latitude	Position Longitude	Position EllHgt (m)	Position MSL (m)	Source	Provider
VTSA	N 44°48'32.68145"	W 73°04'57.30550"	116.424	145.239	Base Provider	N/A

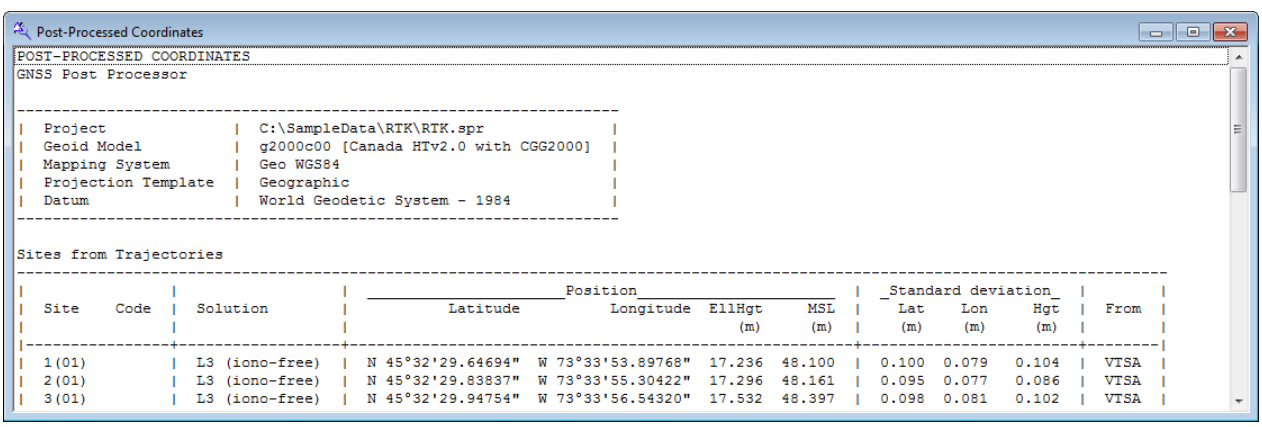
Field Coordinates – References

12.11.2 Post-Processed Coordinates

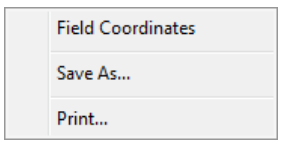
The **Site Coordinates** of all sites within your project can be displayed by following one of these procedures:

- From the main menu, select **Analysis > Survey Sites > Post-Processed Coordinates**;
- From the **Analysis** toolbar, press the button.

If the processing has not been done yet, this view is empty.



Post-Processed Coordinates



Field Coordinates – Speed menu

- **Field Coordinates**: Switch to the Field Coordinates view.
- **Save As...:** Save this view as a text file.
- **Print...:** Print this view

The **Post-Processed Coordinates** is composed of:

- **Header**: Same as **Field Coordinates**.
- **Unprocessed sites table**
- **Sites from Trajectories table**
- **Sites from PPP table**
- **Sites from Baselines table**
- **Adjusted Results table**
- **References table**

Each table is displayed only when it is not empty.

12.11.2.1 Unprocessed sites

All site occupations that are not part of a reference site, a trajectory, a PPP, a baseline and where the site Source is not **Network** ends up in this table.

This table contains only field coordinates.

This table displays **Site**, **Code**, **Solution**, **Position** and **Standard deviation**.

Unprocessed Sites (Field Coordinates)

Site	Code	Solution	Position X (m)	Position Y (m)	Position EllHgt (m)	Position MSL (m)	Standard deviation X (m)	Standard deviation Y (m)	Standard deviation Hgt (m)
1(01)		FIXED	612032.044	5044114.988	18.393	49.257	0.017	0.017	0.021
2(01)		FIXED	612001.334	5044120.344	18.506	49.371	0.016	0.016	0.019
3(01)		FIXED	611974.408	5044123.260	18.677	49.542	0.011	0.011	0.014

Post-Processed Coordinates – Unprocessed sites

12.11.2.2 Sites from Trajectories

It displays all site position calculated from trajectory sites.

- It skips any site used as reference.
- It skips any site occupation where the site source is already **Network**.

It displays the following columns: **Site**, **Code**, **Solution**, **Position**, **Standard deviation** and **From**.

- **From**: Indicates the base site of the trajectory. If the trajectory does not contain a base site, the column indicates **Single Point Positioning**.

Sites from Trajectories

Site	Code	Solution	Position X (m)	Position Y (m)	Position EllHgt (m)	Position MSL (m)	Standard deviation X (m)	Standard deviation Y (m)	Standard deviation Hgt (m)	From
10(01)	104	L1 (fixed)	611814.652	5044331.527	48.250	79.120	0.004	0.006	0.011	montreal
11(01)	105	L1 (fixed)	611826.696	5044377.039	48.205	79.076	0.004	0.005	0.009	montreal
12(01)	106	L1 (fixed)	611847.115	5044422.477	48.014	78.886	0.004	0.007	0.012	montreal

Post-Processed Coordinates – Sites from Trajectories

12.11.2.3 Sites from PPP

It displays all site position calculated from PPP sites.

- It skips any site used as reference.
- It skips any site occupation where the site source is already **Network**.

It displays the following columns: **Site**, **Code**, **Solution**, **Position** and **Standard deviation.**

Sites from PPP

Site	Code	Solution	Position Latitude	Position Longitude	Position EllHgt (m)	Standard deviation Lat (m)	Standard deviation Lon (m)	Standard deviation Hgt (m)
0004(01)	0004	L3 (iono-free)	S 5°53'46.70449"	W 76°06'25.82592"	168.728	0.086	0.272	0.451
0004(02)	0004	L3 (iono-free)	S 5°53'46.70431"	W 76°06'25.82570"	168.716	0.087	0.271	0.444
0004(03)	0004	L3 (iono-free)	S 5°53'46.70448"	W 76°06'25.82577"	168.690	0.083	0.253	0.450

Post-Processed Coordinates – Sites from PPP

12.11.2.4 Sites from Baselines

For every site, it finds all baselines that use this site and display one line per site with at least one post-processed baseline.

- It skips any site used as reference.
- It skips any site where the site source is already **Network**.

It includes the following columns: **Site**, **Solution**, **Position**, **Standard deviation** and **Baseline count**.

- **Baseline count**: Indicate s the number of post-processed baselines attached to this site.

When **Baseline count** is **1**, it displays the full position like all other table. But if it is greater than **1**, **Solution** and **Standard deviation** are ***** to indicate this is only a rough position that will need network adjustment.

The note "*** Not adjusted**" is present when at least one site have more than one processed baseline.

Sites from Baselines

Site	Solution	Position X (m)	Position Y (m)	Position EllHgt (m)	Standard deviation X (m)	Standard deviation Y (m)	Standard deviation Hgt (m)	Baseline count
Station002	*	422660.331	4467345.456	709.810	*	*	*	4
Station003	*	469078.018	4481294.668	655.614	*	*	*	4
Station004	*	456039.082	4536123.889	1159.569	*	*	*	4
Station005	*	445246.824	4487055.620	731.639	*	*	*	4

* Not adjusted

Post-Processed Coordinates – Sites from Baselines

12.11.2.5 Adjusted Results

It includes all sites where the source is **Network**.

It displays the following columns: **Site**, **Position**, **Standard deviation** and **Source**.

Adjusted Results (from Least Squares)

Site	Position X (m)	Position Y (m)	Position EllHgt (m)	Standard deviation X (m)	Standard deviation Y (m)	Standard deviation Hgt (m)	Source
Station002	422660.282	4467345.468	709.810	0.010	0.011	0.014	Network
Station003	469077.979	4481294.682	655.608	0.010	0.011	0.014	Network
Station004	456038.984	4536123.831	1159.609	0.011	0.012	0.016	Network
Station005	445246.776	4487055.632	731.634	0.008	0.009	0.011	Network

Post-Processed Coordinates – Adjusted Results

12.11.2.6 References

This table displays the current coordinates of all reference sites in the project.

This table displays **Site**, **Position**, **Source** and **Provider**.

References

Site	Position Latitude	Position Longitude	Position EllHgt (m)	Position MSL (m)	Source	Provider
VTSA	N 44°48'32.68145"	W 73°04'57.30550"	116.424	145.239	Base Provider	N/A

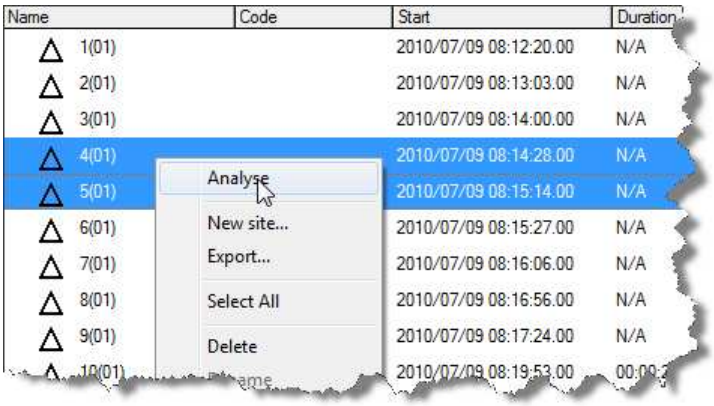
Post-Processed Coordinates – References

12.12 Inverse Computation

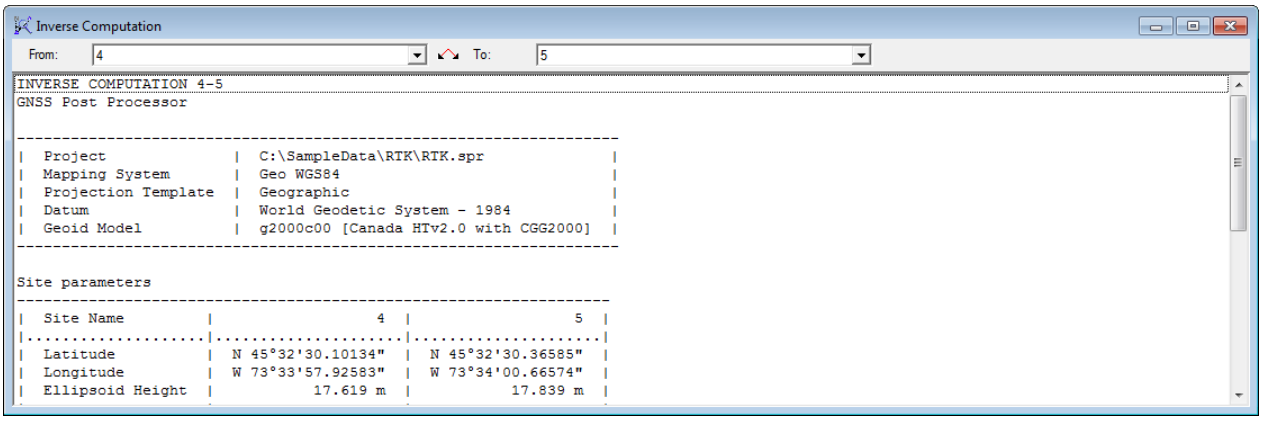
The **Inverse Computation** is a Survey report related to site and the vector parameters between two specific sites. Some parameters depend on the selected mapping systems, full parameters are displayed when a Transverse Mercator is selected.

The **Inverse Computation** can be displayed by following one of these procedures:

- From the main menu, select **Analysis > Inverse Computation**;
- From the **Analysis** toolbar, press the button.
- From the **Project Manager**, when the **Sites** node is active and when selecting exactly two sites and doing this:
  - **Analyse** from speed menu;
  - **Analyse** from the **Site** menu;
  - Click from the **Analysis** toolbar;



Request Inverse Computation using Project Manager – Sites



Inverse Computation

The **Inverse Computation** has a toolbar:

Inverse Computation – Toolbar

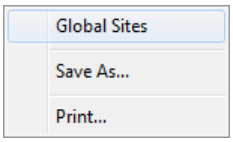
- **From** drop down list: Select a first site for the vector.
  - List of sites and optionally of global sites as well.
  - **(Please select a site)**: Initial selection letting the user knows a site must be selected.
- **:** This will swap the selection in the “from” drop down list with the “to” drop down list.
- **To** drop down list: Select the second site for the vector.
  - List of sites and optionally of global sites as well.
  - **(Please select a site)**: Initial selection letting the user knows a site must be selected.

Before a report is generated, two different sites must be selected in the toolbar.

The report is divided in several sections:

- **Header**: General information about the project.

- **Site parameters**
- **Vector parameters**



Inverse Computation – Speed menu

- **Global Sites**: Append Global Sites or not in both toolbar drop down lists.
- **Save As...:** Save this view as a text file.
- **Print...:** Print this view

12.12.1.1 Header

```
-------------------------------------------------------------
|  Project                |  C:\SampleData\Static\Static.spr  |
|  Mapping System         |  Geo WGS84                        |
|  Projection Template    |  Geographic                       |
|  Datum                  |  World Geodetic System - 1984     |
|  Geoid Model            |  <None>                           |
-------------------------------------------------------------
```

Inverse Computation – Header

- **Project**: Full project path.
- **Mapping System**: Full name of the current projection
- **Projection Template**: Full name of the type of the current projection
- **Datum**: Full datum name for the current projection.
- **Geoid Model**: Name of the geoid model (if any)

12.12.1.2 Site parameters

```
Site parameters
-----------------------------------------------------------------------
|  Site Name              |          Station002  |          Station005  |
|.........................|......................|......................|
|  Mapping - X            |        422660.331 m  |        445246.824 m  |
|  Mapping - Y            |       4467345.456 m  |       4487055.620 m  |
|  Undulation             |             0.000 m  |             0.000 m  |
|  Mean Sea Level         |           709.810 m  |           731.639 m  |
|.........................|......................|......................|
|  Latitude               |  N 40°21'11.10723"   |  N 40°31'56.76101"   |
|  Longitude              |  W  3°54'38.68656"   |  W  3°38'47.35518"   |
|  Ellipsoid Height       |           709.810 m  |           731.639 m  |
|.........................|......................|......................|
|  3D-Cartesian - X       |       4856620.064 m  |       4845222.076 m  |
|  3D-Cartesian - Y       |       -332006.282 m  |       -308782.521 m  |
|  3D-Cartesian - Z       |       4108400.792 m  |       4123573.364 m  |
|.........................|......................|......................|
|  Mapping Scale Factor   |         0.999673628  |         0.999636901  |
|  Convergence            |      0°00'37.05434"  |      0°00'26.39882"  |
-----------------------------------------------------------------------
```

Inverse Computation – Site parameters

This is a three columns table:

- First column is label only
- Second column contains information on the first site of the vector ("**From**").
- Third column contains information on the second site of the vector ("**To**").

- **Site Name**: Site or global site name.
- **Mapping – X, Mapping – Y**: X and Y for the site position when the current mapping system is a projected system.
- **Undulation:** Undulation at the site location. Undulation is obtained from the **Geoid Model** indicated the header section. It may be set manually in the **Site Editor** when **Geoid Model** is **<User undulation>**.
- **Mean Sea Level**: Mean sea level height for the site.
- **Latitude, Longitude, Ellipsoid Height**: Latitude, longitude and ellipsoid height for the site.
- **3D-Cartesian – X, 3D-Cartesian – Y, 3D-Cartesian – Z**: Geocentric position in the current datum.
- **Mapping Scale Factor**: Mapping scale factor (for Transverse Mercator mapping system only)
- **Convergence**: Convergence (for Transverse Mercator mapping system only)

12.12.1.3 Vector parameters

```
Vector parameters
-----------------------------------------------------
|  Mapping Azimuth             |  186°58'15.23695"  |
|  Forward Geodetic Azimuth    |  186°23'47.00647"  |
|  Backward Geodetic Azimuth   |    6°22'48.50898"  |
|  t-T Correction              |   -0°00'03.64920"  |
|..............................|....................|
|  ECEF - DX                   |       12067.513 m  |
|  ECEF - DY                   |       -2952.988 m  |
|  ECEF - DZ                   |      -14514.713 m  |
|..............................|....................|
|  Delta Height (MSL)          |          -98.559 m |
|  Delta Height (Ell.)         |          -98.559 m |
|..............................|....................|
|  Line Scale Factor           |       0.999671441  |
|  Elevation Scale Factor      |       0.999880711  |
|  Combined Scale Factor       |       0.999552191  |
|..............................|....................|
|  Mapping distance            |       19096.744 m  |
|  Geodetic distance           |       19103.021 m  |
|  3D distance                 |       19105.547 m  |
|  Ground distance             |       19105.300 m  |
-----------------------------------------------------
```

Inverse Computation – Vector parameters

- **Mapping Azimuth**: Mapping Azimuth. Only present when the mapping is not geographic.
- **Forward Geodetic Azimuth**: Forward azimuth (first site to second site)
- **Backward Geodetic Azimuth**: Backward azimuth (second site to first site)
- **t-T Correction**: Also known as Arc to chord. It is the difference in angle between the initial direction of the curved geodesic and the straight line grid bearing (for Transverse Mercator mapping system only).
- **ECEF – DX, ECEF – DY, ECEF – DZ**: Earth-Centered, Earth-Fixed vector from first site to second site.

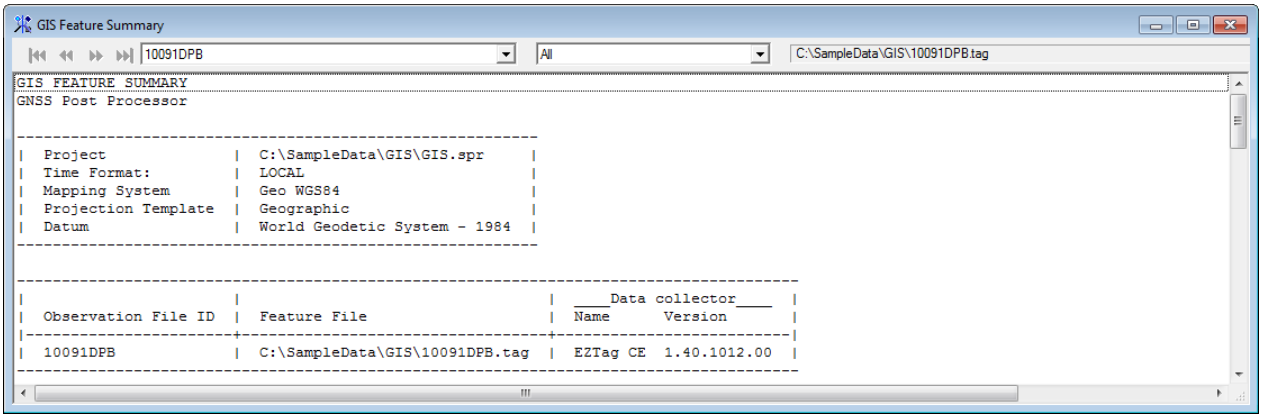
- **Delta Height (MSL)**: Difference in the mean sea level height between base and remote. Only present when the mapping is not geographic
- **Delta Height (Ell.)**: Difference in the ellipsoid height between base and remote.
- Scale Factor section (for Transverse Mercator mapping system only):
  - **Line Scale Factor**: Line scale factor for the vector.
  - **Elevation Scale Factor**: Elevation scale factor for vector.
  - **Combined Scale Factor**: This is the **Line Scale Factor** multiplied by the **Elevation Scale Factor**.
- **Mapping Distance**: Mapping distance for the vector. Only present when the mapping is not geographic (calculated with grid coordinates).
- **Geodetic Distance**: Geodetic distance for the vector (on the ellipsoid). This is the **Mapping Distance** divided by the **Line Scale Factor**.
- **3D Distance**: 3D distance for the vector (calculated with ECEF coordinates). This is the **Geodetic Distance** divided by the **Elevation Scale Factor**.
- **Ground Distance**: Ground distance for the vector (for Transverse Mercator mapping system only). This is the **Mapping Distance** divided by the **Combined Scale Factor**

12.13 GIS Feature Summary

The **GIS Feature Summary** is provided to make sure that all points related to a feature have been properly computed by the software. It may happen, in some circumstances that a GNSS point could not be processed. In this situation, the field position will be used if the process failed. The **GIS Feature Summary** provides you with a quick reference to analyze this problem.

The **GIS Feature Summary** can be displayed by following one of these procedures:

- From the main menu, select **Analysis > GIS Feature Summary**;
- From the **Analysis** toolbar, press the button.



GIS Feature Summary

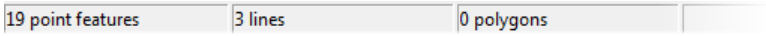
The **GIS Feature Summary** has a toolbar:

GIS Feature Summary – Toolbar

- **VCR controls** (5 controls on the left): See ***Analysis***, the beginning of this chapter for more details.
  - The first drop-down list may have an extra item:
    - **<All Features Files>**: Display a combined report of all feature files instead of one from a single feature file. This item is present when there is more than one feature file in the project.
- **Filter** (second drop-down control in toolbar): Select one of the following options in the drop-down list to filter trajectories:
  - **All**: Display all features within a single report.
  - **All Processed**: Display only processed features.
  - **Unprocessed**: Display only unprocessed features.
- **Feature file**: Full path of the feature file displayed.

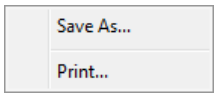
The summary is divided in several sections:

- **Header**
- **Observation Files**
- **Points**
- **Lines**
- **Polygons**



GIS Feature Summary – Status bar

- **(Left pane)**: Number of point features in feature file.
- **(Middle pane)**: Number of line features in feature file.
- **(Right pane)**: Number of polygon features in feature file.



GIS Feature Summary – Speed menu

- **Save As...:** Save this view as a text file.
- **Print...:** Print this view

12.13.1.1 Header

```
-------------------------------------------------------------
|  Project               |  C:\SampleData\GIS\GIS.spr       |
|  Time Format:          |  LOCAL                           |
|  Mapping System        |  Geo WGS84                       |
|  Projection Template   |  Geographic                      |
|  Datum                 |  World Geodetic System - 1984    |
-------------------------------------------------------------
```

GIS Feature Summary – Header

- **Project**: Full project path.

- **Time Format**: Format of time in the report. Possible values are:
  - **GPS**
  - **LOCAL**
  - **UTC**
- **Mapping System**: Full name of the current projection
- **Projection Template**: Full name of the type of the current projection
- **Datum**: Full datum name for the current projection.

12.13.1.2 Observation Files

Observation File ID	Feature File	Data collector Name	Data collector Version
10091DPB	C:\SampleData\GIS\10091DPB.tag	EZTag CE	1.40.1012.00

GIS Feature Summary – Observation Files

- **Observation File ID:** Observation files identifier corresponding with the feature file.
- **Feature File:** Feature file name with full path.
- **Data collector**:
  - **Name**: Data collector name used to collect the feature file.
  - **Version**: Version of data collector used to collect the feature file.

12.13.1.3 Points

[Points] Feature	Label	Start time	Duration	Solution	Position Latitude	Position Longitude	Position EllHgt (m)	Standard deviation Lat (m)	Standard deviation Lon (m)	Standard deviation Hgt (m)
Job	Job	2010/04/01 16:10:45	00:01:32	Field (GNSS)	N 52°26'27.82903"	W121°18'15.31162"	882.867	7.923	7.923	15.472
Point	poc	2010/04/01 16:12:29	00:00:28	Field (GNSS)	N 52°26'27.27479"	W121°18'15.68025"	890.635	7.928	7.928	19.294

GIS Feature Summary – Points

- **Feature:** Feature name
- **Label:** Feature label
- **Start time**: Start time for point
- **Duration**: Duration for point or **N/A** (not applicable) if point has a single epoch.
- **Solution**: Solution type. See the ***Solution Type*** appendix for more details.
- **Position**:
  - **Latitude/Longitude**: Latitude and longitude for the point position when the current mapping system is a geographic system.
  - **X/Y**: X and Y for the point position when the current mapping system is a projected system.
  - **EllHgt**: Ellipsoid height for the point position.
  - **Und**: Undulation of the geoid at that position. This column is present only if geoid is **<User undulation>**.
  - **MSL**: Mean sea level for the point position. This column is present if geoid is not **<None>**.
- **Standard deviation**: Standard deviation for point position

- **Lat/Lon**: Standard deviation in the latitude/longitude direction when the current mapping system is a geographic system.
- **X/Y**: Standard deviation in the X/Y direction when the current mapping system is a projected system.
- **Hgt**: Standard deviation in the height direction.

12.13.1.4 Lines/Polygons

Lines and **Polygons** section is identical except that type will be either Line or Polygon. Lines and polygons are built with vertices. Each vertex represents a position.

[Lines] Feature	Label	Start time	Duration	Solution	Position Latitude	Longitude	EllHgt (m)	Standard deviation Lat (m)	Lon (m)	Hgt (m)
Line	1									
o	Vertex	2012/07/10 14:03:49	N/A	Pseudoranges (raw)	N 45°32'31.77127"	W 73°33'54.09727"	15.666	1.170	1.074	3.404
o	Vertex	2012/07/10 14:09:29	N/A	Pseudoranges (raw)	N 45°32'34.39050"	W 73°33'55.59463"	16.699	1.155	0.815	2.610

Total: 1 line feature(s) (2 vertices, 2 processed)

GIS Feature Summary – Lines

Each line or polygon starts with a special line with information in the first two columns only:

- **Feature:** Feature name
- **Label:** Feature label

It is followed by the list of vertex for that line or polygon. The content of the vertex section is identical to the **Point Features** table except for the first two columns:

- **Feature:** Continuous and discrete state
  - [... : Vertex that starts a continuous section.
  - ..o.. : Vertex in a continuous section.
  - ...] : Vertex that ends a continuous section.
  - o : Vertex in a discrete section.
- **Label:** Source of vertex
  - **Point**: A point was collected within the line.
  - **Manual**: A manual vertex was collected.
  - **Trace ON**: A vertex was collected because the line/polygon was switched to continuous.
  - **Trace OFF**: A vertex was collected because the line/polygon was switched to discrete.
  - **Pause**: A vertex was collected because the line/polygon was paused. It could be to collect something else nearby before resuming the line/polygon.
  - **Resume**: A vertex was collected because the line/polygon was resumed. Usually found right after a **Pause** vertex.
  - **Auto**: A vertex was automatically collected because the system was configured to collect vertex at a fixed interval.
  - **Open**: Start of the line/polygon.
  - **Close**: End of the line/polygon.
  - **Recover**: A vertex was inserted when recovering a feature file with an unclosed line/polygon. This vertex will act as **Close**.

13 Export

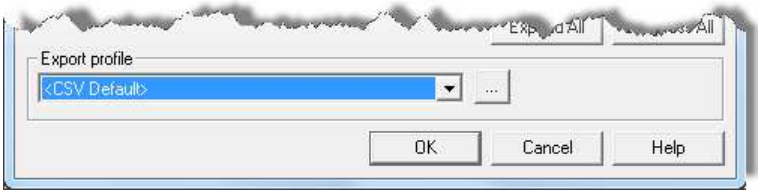
This is usually the last step of a processing session. With the software, you can export site coordinates, baseline components, epoch positions (trajectories or PPP), as well as feature data.

It is also possible to export observation and orbit files in the RINEX format.

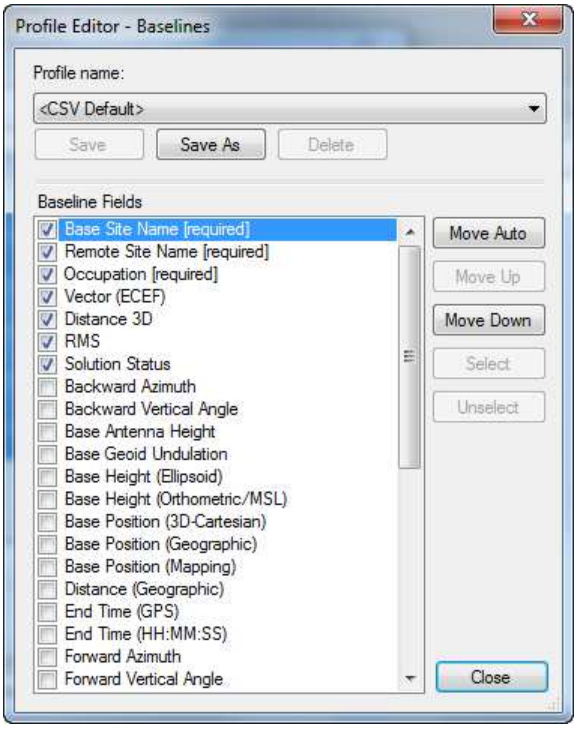
13.1 Profile Editor

The profile editor is available from several export dialogs.

When the **Export profile** section is present, press the ... button to enter the **Profile Editor**.



Export – Export profile



Profile Editor

- **Profile name**: List all profiles currently available for a particular export.
  - **<CSV Default>**: Default profile. You can use it as template for creating your own profile. Edit the fields section as you see fit, then press **Save As** to keep it under a new name.
  - A confirmation is asked before changing profile when the current profile was modified.
- **Save**: Save the current profile.
- **Save As**: Save the current profile under a new name.

Profile Save As

- **Delete**: Delete the current profile after a confirmation.
- **Fields**: Check list containing all possible fields to export. Each item corresponds to a column or a group of related columns. For more details, consult the ***CSV Export*** appendix.
  - You can select or unselect a field by clicking on an already highlighted item.
- **Move Auto**: Move automatically all selected fields on the top of the list while preserving their relative order. All unselected fields are moved to the bottom and sorted in alphabetical order.
- **Move Up**: Move up the highlighted field.
- **Move Down**: Move down the highlighted field.
- **Select**: Select the highlighted field.
- **Unselect**: Unselect the highlighted field.

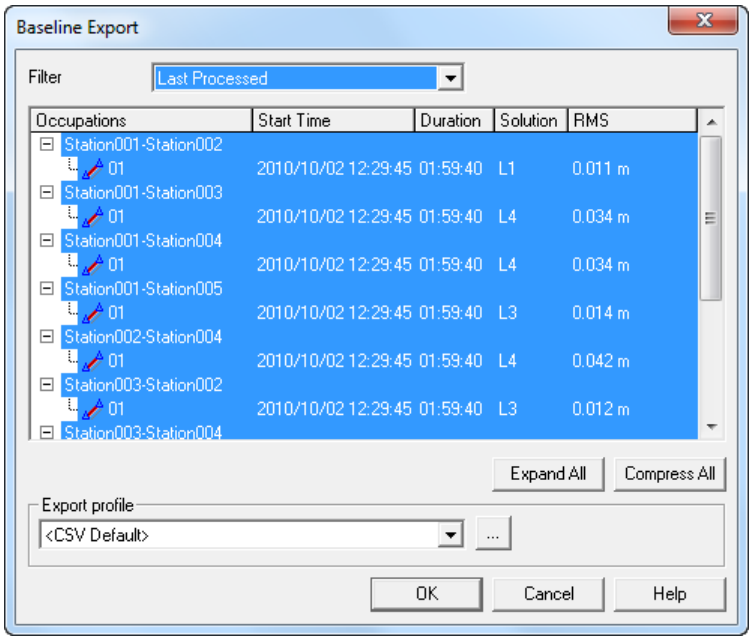
> Some fields are required and therefore cannot be unselected. However, you can still move them around.

- **Close**: Close the **Profile Editor**. A confirmation is asked before closing when the current profile was modified.

13.2 Baselines

Baselines are exported either to a CSV file, a standard GeoLab™ format or SurvNET™ format. You can export all processed baselines or a subset of your baselines.

Select **Tools > Export > Baselines...** from the main menu. The **Baseline Export** is displayed.



Baseline Export

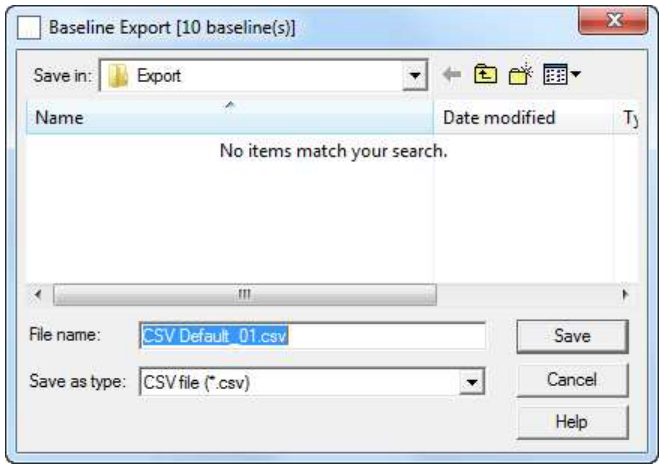
- **Filter**:
  - **Last processed:** If selected, only baselines computed in the last process will be displayed in the Baseline list.
  - **All Processed:** If selected, all baselines that have been processed will be displayed in the Baseline list.
- **Expand All:** to view all baseline occupations. The ⊞ signs preceding the main records are replaced by ⊟ signs and occupations are listed below the related baseline.
- **Compress All:** to view hide all baseline occupations. The ⊟ signs are replaced by ⊞ signs, and occupations are hidden.

a. Select the baselines or baseline occupations you want to export.

> To select more than one baseline or baseline occupation, drag the pointer across the lines, or press and hold down the **Ctrl** key while clicking each line. You can select a range of baselines by selecting the first item and then hold down the **Shift** key while selecting the last item.

b. Select the **Export profile** you want. Press the ... button to enter the **Profile Editor**.
   - **<CSV Default>**: Default export to CSV. For more details, consult the ***CSV Export*** appendix.
   - **<GeoLab>**: Export to GeoLab™
   - **<SurvNET>**: Export to SurvNET™
   - All the other profiles are user defined CSV exports. For more details, consult the ***CSV Export*** appendix.

c. Click **OK**. A standard Windows is displayed to select an output file.



Baseline Export – Save

d. Select the directory that you want to export in the new data file.
e. Type a new name for the data file in the **File name** box or accept the default name.
f. Click **OK**. The data export process starts.

```
"BaseSiteName","RemoteSiteName","Occ","ECEF_DX","ECEF_DY","ECEF_DZ","Dist3D","RMS","Solution"
"Station001","Station002",1,12067.495,-2953.038,-14514.694,19105.528,0.011,"L1 (fixed)"
"Station001","Station003",1,5719.851,43881.543,-3669.856,44404.666,0.034,"L4 (fixed wide lane)"
"Station001","Station004",1,-30384.501,32707.204,38180.326,58742.799,0.034,"L4 (fixed wide lane)"
"Station001","Station005",1,669.518,20270.711,657.862,20292.431,0.014,"L3 (fixed iono-free)"
"Station002","Station004",1,-42452.025,35660.266,52695.061,76489.205,0.042,"L4 (fixed wide lane)"
"Station003","Station002",1,6347.664,-46834.531,-10844.857,48491.000,0.012,"L3 (fixed iono-free)"
"Station003","Station004",1,-36104.273,-11174.333,41850.178,56389.907,0.014,"L3 (fixed iono-free)"
"Station003","Station005",1,-5050.326,-23610.771,4327.715,24529.644,0.013,"L3 (fixed iono-free)"
"Station005","Station002",1,11397.989,-23223.761,-15172.572,29991.068,0.013,"L3 (fixed iono-free)"
"Station005","Station004",1,-31053.947,12436.438,37522.463,50268.756,0.017,"L3 (fixed iono-free)"
```

Baseline Export – CSV

```
TITL Processor Project [Static]
ELIP WGS84            6378137.0000  6356752.3142  0.0       0.0       0.0
HIST END GPS Observations (standardized residuals)
PADJ YES YES NO  NO  YES YES
PLH  000 Station001   N 40 31 26.578842 W  3 53  8.500772 808.3690
PLH  000 Station002   N 40 21 11.107626 W  3 54 38.688643 709.8100
PLH  000 Station003   N 40 28 54.357752 W  3 21 53.395077 655.6080
PLH  000 Station004   N 40 58 30.342289 W  3 31 21.057444 1159.6090
PLH  000 Station005   N 40 31 56.761406 W  3 38 47.357228 731.6340
*    10 solutions
GRP  Static[199] 1
3DD
DXYZ     Station001   Station002   12067.4950    -2953.0380    -14514.69400
COV  CT UPPR 0.0        1.0        0.0        1.0        0.0
ELEM 6.429893e-05            -4.638216e-06            9.286295e-06
ELEM 2.825685e-05            2.660021e-06
ELEM 3.043462e-05
GRP  Static[199] 2
3DD
DXYZ     Station001   Station003   5719.8510     43881.5430    -3669.85600
COV  CT UPPR 0.0        1.0        0.0        1.0        0.0
ELEM 1.039749e-04            -6.696423e-06            1.706115e-05
ELEM 5.190755e-05            8.722360e-06
ELEM 6.525466e-05
GRP  Static[199] 3
```

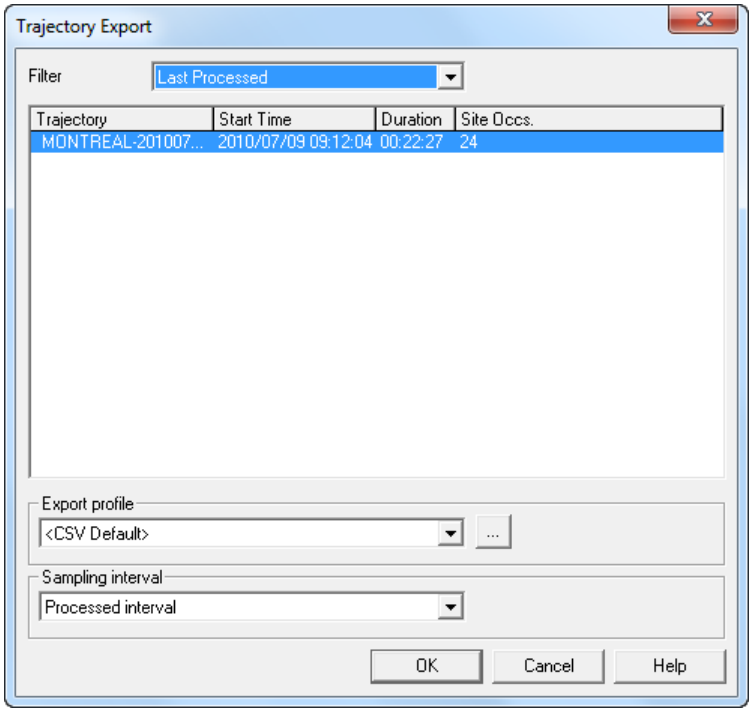
Baseline Export – GeoLab™

```
SurvGNSS [illegible] Vector Output
G1  Station001-Station002   12067.49500000   -2953.03800000  -14514.69400000
G2   6.429893e-005  2.825685e-005  3.043462e-005
G3  -4.638216e-006  9.286295e-006  2.660021e-006
G1  Station001-Station003    5719.85100000   43881.54300000   -3669.85600000
G2   1.039749e-004  5.190755e-005  6.525466e-005
G3  -6.696423e-006  1.706115e-005  8.722360e-006
G1  Station001-Station004  -30384.50100000   32707.20400000   38180.32600000
G2   1.550002e-004  7.788042e-005  9.862243e-005
G3  -1.120873e-005  2.554011e-005  1.222068e-005
G1  Station001-Station005     669.51800000   20270.71100000     657.86200000
G2   2.581487e-005  1.290555e-005  1.616529e-005
G3  -1.717021e-006  4.171809e-006  2.118928e-006
G1  Stati[illegible]02-Stati[illegible]00000  35660.266000[illegible]  52695.06100000
```

Baseline Export – SurvNET™

13.3 Trajectories

Select **Tools > Export > Trajectories...** from the main menu. The **Trajectory Export** is displayed.



Trajectory Export

Filter:

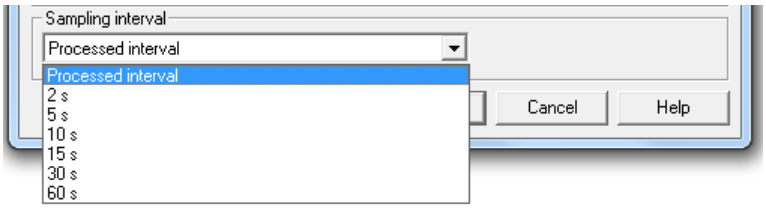
- **Last processed:** If selected, only trajectories computed in the last process will be displayed in the Trajectory list.
- **All Processed:** If selected, all trajectories that have been processed will be displayed in the Trajectory list.

a. Select the trajectories you want to export.

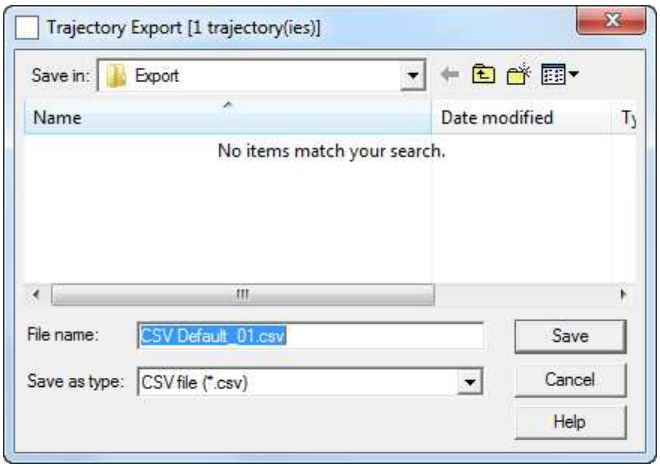
> ❖ To select more than one trajectory, drag the pointer across the lines, or press and hold down the **Ctrl** key while clicking each line. You can select a range of trajectories by selecting the first item and then hold down the **Shift** key while selecting the last item.

b. Select the **Export profile** you want. Press the button to enter the **Profile Editor**.
   - **<ASCII Brief – Geographic>**: Export to ASCII file:
     - Export in geographic format (according to the selected datum)
     - Does not include standard deviation and GDOP columns.
   - **<ASCII Brief – Mapping>**: Export to ASCII file:
     - Export using current mapping system.
     - Does not include standard deviation and GDOP columns.
   - **<ASCII Detailed – Geographic>**: Export corresponding to actual:
     - Export in geographic format (according to the selected datum)
     - Includes standard deviation and GDOP columns.
   - **<ASCII Detailed – Mapping>**: Export corresponding to actual:
     - Export using current mapping system.
     - Includes standard deviation and GDOP columns.
   - **<CSV Default>**: Default export to CSV. For more details, consult the ***CSV Export*** appendix.
   - **<Waypoint>**: Generate a Waypoint velocities file (Waypoint format).
   - All the other profiles are user defined CSV exports. For more details, consult the ***CSV Export*** appendix.

c. Select the **Sampling Interval** you want. It always propose **Processed interval** but if you can reduce the sampling interval further if you do not need as much positions.



d. Click **OK**. A standard Windows is displayed to select an output file



Trajectory Export – Save

e. Select the directory where to export your data
f. Type a new name for the data file in the **File name** box or accept the default name.
g. Click **OK**. The data export process starts.

13.3.1 ASCII

Trajectories are exported in text files with a header providing the basic information used to compute the trajectory.

```
GNSS Post Processor                                TRAJECTORY EPOCH FILE(detailed)
TRAJECTORY:  MONTREAL-20100708_01

Project:          C:\SampleData\Kinematic\Kinematic.spr
Processing Date:  2012/09/28 14:23 (Local)
Orbits:           Broadcast                  Clock Model:      Broadcast
Mapping System:   UTM NAD83csrs Automatic
Datum:            NAD83 - Canadian Spatial Reference System
Geoid Model:      g2000c00 [Canada HTv2.0 with CGG2000]

BASE STATION:  montreal            [C:\SampleData\Kinematic\DATA2\68h00001.obs]
-------------------------------------------------------------------------------
Site Occupation:        001          Antenna Height:     0.068 [Slant:   0.068]
Measurement Interval:   5.0 seconds   Antenna Model:   APS_APS-3* (m)

WGS84                        NAD83 - Canadian Spatial ReferUTM NAD83csrs Automatic (m)
Lat: N 45 32 45.980174       Lat: N 45 32 45.945075        X: 606257.350
Lon: W 73 38 19.783100       Lon: W 73 38 19.765945        Y: 5044518.686
Hgt: 73.676                  Hgt: 74.782
MSL: 104.632                 MSL: 105.737

ROVER INFORMATION  (20100708_01)    [C:\SampleData\Kinematic\DATA1\20100708_01.LOG
-------------------------------------------------------------------------------
Measurement Interval:     1.0 second
Antenna Height:   -0.081  [Slant:  -0.081]   Antenna Model: NOV702GG* (m)

TRAJECTORY RESULTS
-------------------------------------------------------------------------------
Processing Interval: 1.0 second
Time Interval: 2010/07/09 09:12:04 to 2010/07/09 09:34:31 (Local)    [ 22 min.]
Observations:  11291                  Observations Used: 11291      [100.00% ]
```

Trajectory Export – ASCII header

```
Observations:  11291                  Observations Used: 11291      [100.00% ]

2010/07/09,09:12:04.00,4,7,612032.118,5044114.950,18.381,49.245,0.0053,0.0130,0.0199,3.8
2010/07/09,09:12:05.00,4,7,612032.096,5044114.964,18.383,49.248,0.0038,0.0077,0.0122,3.8
2010/07/09,09:12:06.00,4,7,612032.103,5044114.959,18.383,49.247,0.0044,0.0091,0.0143,3.8
2010/07/09,09:12:07.00,4,7,612032.108,5044114.962,18.382,49.247,0.0038,0.0079,0.0125,3.8
2010/07/09,09:12:08.00,4,7,612032.106,5044114.973,18.383,49.248,0.0045,0.0093,0.0147,3.8
2010/07/09,09:12:09.00,4,7,612032.118,5044114.970,18.385,49.249,0.0050,0.0103,0.0162,3.8
2010/07/09,09:12:10.00,4,7,612032.114,5044114.960,18.386,49.250,0.0037,0.0076,0.0120,3.8
2010/07/09,09:12:11.00,4,7,612032.127,5044114.953,18.384,49.249,0.0037,0.0076,0.0120,3.8
2010/07/09,09:12:12.00,4,7,612032.126,5044114.958,18.385,49.250,0.0042,0.0086,0.0136,3.8
2010/07/09,09:12:13.00,4,7,612032.110,5044115.007,18.385,49.250,0.0110,0.0226,0.0357,3.8
2010/07/09,09:12:14.00,4,7,612032.073,5044115.042,18.389,49.254,0.0059,0.0119,0.0192,3.8
2010/07/09,09:12:15.00,4,7,612032.062,5044115.095,18.402,49.266,0.0048,0.0098,0.0155,3.8
2010/07/09,09:12:16.00,4,6,612032.080,5044115.096,18.398,49.263,0.0051,0.0090,0.0139,3.9
2010/07/09,09:12:17.00,4,7,612032.079,5044115.092,18.399,49.263,0.0040,0.0070,0.0109,3.8
2010/07/09,09:12:18.00,4,7,612032.071,5044115.091,18.399,49.263,0.0056,0.0097,0.0151,3.8
2010/07/09,09:12:19.00,4,7,612032.082,5044115.079,18.398,49.262,0.0042,0.0074,0.0114,3.8
2010/07/09,09:12:20.00,4,7,612032.203,5044114.945,18.383,49.247,0.0055,0.0094,0.0146,3.8
2010/07/09,09:12:21.00,4,7,612032.199,5044114.787,18.438,49.302,0.0042,0.0073,0.0114,3.8
2010/07/09,09:12:22.00,4,6,612031.999,5044114.946,18.400,49.265,0.0144,0.0150,0.0305,4.3
```

Trajectory Export – ASCII data

Columns exported in text file (comma separated values):

- **Date**: Date for position in YYYY/MM/DD format where YYYY is the year, MM is the month and DD is the day.

- **Time**: Time for position in a 24 hours format
- **Solution Code**: Solution type as a numeric code. See the ***Solution Type*** appendix for more details.
- **Number of satellites**: Total number of satellites in all constellations used by the processing of the position.
- **Planimetric position**:
  - **X, Y**: When the **Export Profile** is **<ASCII Brief – Mapping>** or **<ASCII Detailed – Mapping>**.
  - **Lat, Lon**: When the **Export Profile** is **<ASCII Brief – Geographic>** or **<ASCII Detailed – Geographic>**.
- **Altimetric:**
  - **Ellipsoid height**: Ellipsoid height.
  - **MSL:** Mean Sea Level height.
- **Standard deviation columns**: Not always present:
  - **StdX/StdY/StdHgt**: When the **Export Profile** is **<ASCII Detailed – Mapping>**.
  - **StdLat/StdLon/StdHgt**: When the **Export Profile** is **<ASCII Detailed – Geographic>**.
- **GDOP**: Global Dilution of Precision. Present only when **Export Profile** is **<ASCII Detailed – Mapping>** or **<ASCII Detailed – Geographic>**.

13.3.2 Waypoint

The velocities export is a text file containing positions and velocities.

```
Project:      MONTREAL-20100708_01
Program:      GNSS Post Processor
Profile:      aeroctrl
Source:       GPS Epochs(Combined)

Datum:        WGS84, (processing datum)
Master Pos.: 45 32 45.980174, -73 38 19.783100, 73.676 m (WGS84, Ellipsoidal hgt)
Ant. Height: Master=  0.068 m, Remote= -0.081 m

GPSTime,NS,Q,Latitude,Longitude,H-Ell,VNorth,VEast,VUp,SDNorth,SDEast,SDHeight,SD-VN,SD-VE,SD-VH
(sec),,,(Deg),(Deg),(m),(m/s),(m/s),(m/s),(m),(m),(m),(m/s),(m/s),(m/s)
479539.000,7,1,45.541567389,-73.564968005,17.274,0.012,-0.023,-0.014,0.013,0.005,0.020,1.691,0.685,2.599
479540.000,7,1,45.541567513,-73.564968283,17.277,-0.025,0.013,0.032,0.008,0.004,0.012,1.691,0.685,2.599
479541.000,7,1,45.541567464,-73.564968198,17.276,-0.084,0.004,0.062,0.009,0.004,0.014,1.691,0.685,2.599
479542.000,7,1,45.541567493,-73.564968124,17.276,0.004,0.010,0.079,0.008,0.004,0.012,1.690,0.685,2.599
479543.000,7,1,45.541567596,-73.564968155,17.277,-0.035,-0.004,0.088,0.009,0.004,0.014,1.690,0.685,2.599
479544.000,7,1,45.541567567,-73.564967998,17.279,-0.102,0.039,0.091,0.010,0.005,0.016,1.690,0.685,2.600
479545.000,7,1,45.541567477,-73.564968052,17.280,-0.014,0.010,0.093,0.009,0.004,0.014,1.690,0.685,2.600
479546.000,7,1,45.541567409,-73.564967890,17.278,-0.006,0.004,0.072,0.008,0.004,0.013,1.690,0.685,2.600
479547.000,7,1,45.541567458,-73.564967902,17.279,0.045,-0.016,0.001,0.009,0.004,0.013,1.689,0.685,2.600
479[illegible].000,7,1,45.541567[illegible],-73.564968[illegible],17.279,0.025,-0.051,0.028,0.022[illegible]035[illegible]0.685,2.601
```

Trajectory Export – Velocities

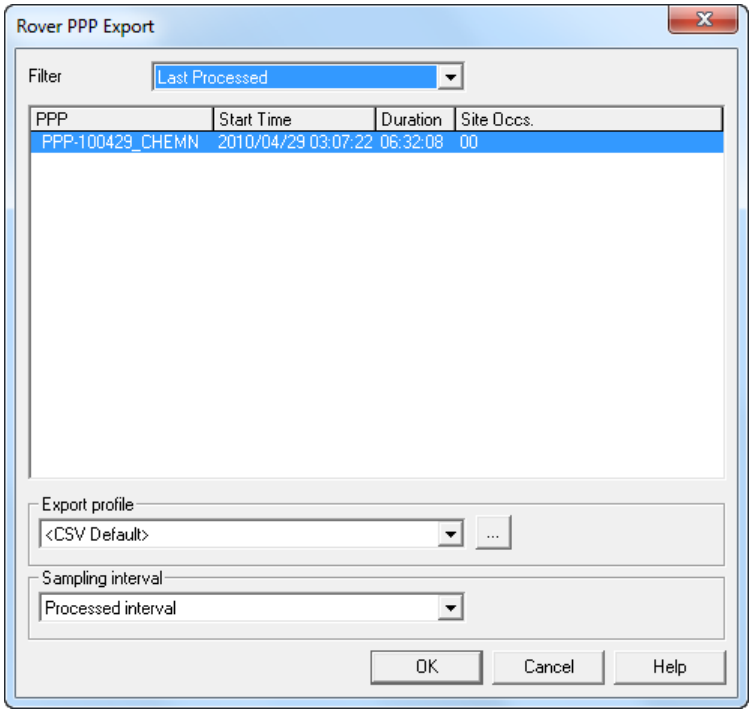
The export produces an ASCII header and position/velocities in text file:

- **GPSTime**: GPS second for position (second)
- **NS**: Number of satellites
- **Q**: Quality. Always **1**.
- **Latitude/Longitude/H-Ell**: Position in WGS84 (degree, m)
- **VNorth/VEast/VUp**: Velocities in the north, east and height direction (m/s).
- **SDNorth/SDEast/SDHeight**: Standard deviation for the position (m).
- **SD-VN/SD-VE/SD-VH**: Standard deviation for the velocities (m/s).

13.4 Rover PPP

This export will only use Rover PPP. Static PPP are exported as regular sites in **Tools > Export > Sites**.

Select **Tools > Export > Rover PPP...** from the main menu. The **Rover PPP Export** is displayed.

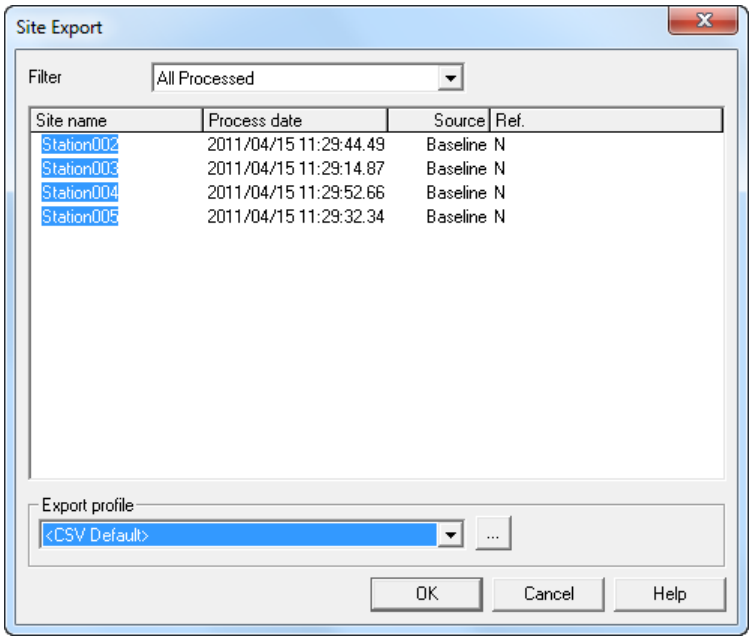


Rover PPP Export

Rover PPP Export is identical to the **Trajectory Export**. Please check in the ***Export – Trajectories*** section for details.

13.5 Sites

Select **Tools > Export > Sites...** from the main menu. The **Site Export** is displayed.



Site Export

Filter:

- **Last processed:** If selected, only sites computed in the last process will be displayed within the Site list.
- **All sites:** If selected, all sites will be displayed within the Site List.
- **All processed:** If selected, all sites that have been processed will be displayed within the Site list.

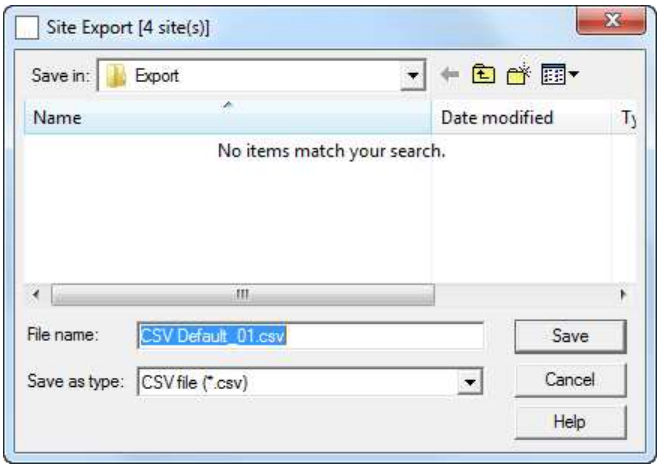
a. Select the sites you want to export.

> To select more than one site, drag the pointer across the lines, or press and hold down the **Ctrl** key while clicking each line. You can select a range of sites by selecting the first item and then hold down the **Shift** key while selecting the last item.

b. Select the **Export profile** you want. Press the ... button to enter the **Profile Editor**.

- **<CSV Default>**: Default export to CSV. For more details, consult the ***CSV Export*** appendix.
- **<DXF>:** Export in an AutoCAD DXF (Drawing Exchange Format) file.
- **<Global Sites>**: Export to the global site file. This is an internal database in your software. The **Global Sites** database can be accessed through the **Site Editor** and be used to retrieve base station coordinates (refer to ***Editing – Site*** section). So you can export some of your sites in this database (sites to be used in future processing sessions).
- All the other profiles are user defined CSV exports. For more details, consult the ***CSV Export*** appendix.

c. Click **OK**. A standard Windows is displayed to select an output file (this dialog box is not displayed if the **Global Sites** file is selected).



Site Export – Save

d. Select the directory where to export your data.
e. Type a new name for the data file in the **File name** box or accept the default name.
f. Click **OK**.
g. If the sites selected require network adjustment, a confirmation is displayed. It is highly recommended to press **No**, exit the Export, and do a Network Adjustment (**Tools > Process Manual > Adjust Network**) before exporting again.
h. The data export process is launched.

13.6 Features

IMPORTANT: This section is mainly dedicated to users using OnPOZ data collection software.

Use the **Tools > Export > Features…** menu to export features (points, sites, lines and polygons) from TAG files as well as GNSS positions from POS files.

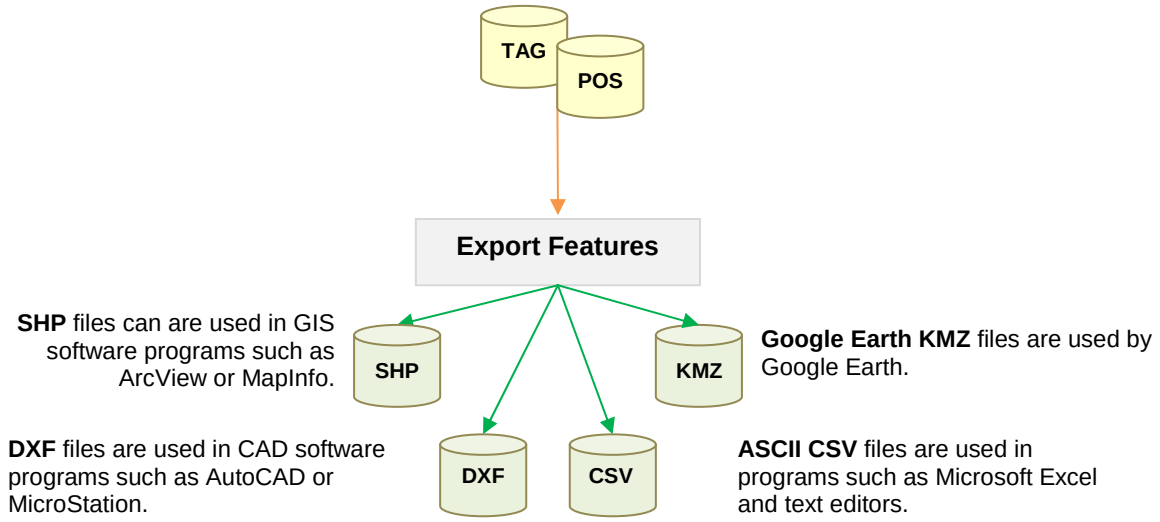
13.6.1 Introducing Export Features

Export Features is a software application for exporting features (points, lines and polygons) as well as trajectory positions to formats such as ESRI Shapefile, AutoCAD DXF, ASCII CSV and Google Earth KMZ.

Export Features provides an easy-to-use graphical user interface as well as a command-line interface (see ***Export Features Command-line interface*** appendix for more details) for inclusion into automated application workflows. It also includes reusable export profiles to enable exporting to the same output specifications across all your projects over time.

13.6.1.1 Input and Output Files

Export Features accepts **TAG** and **POS** files. The output options are ESRI Shapefile, AutoCAD DXF, ASCII CSV and Google Earth KMZ.



Inputs and Outputs

13.6.1.2 Output Layers

Export Features can create the following types of output layers from **TAG** files:

- **Points layers** from point features;
- **Sites layers** from site features;
- **Lines layers** from line features;
- **Polygons layers** from polygon features;
- **Vertices layers** from all vertices of line or polygon features.
- **GNSS Positions layers** from positions in the POS files.

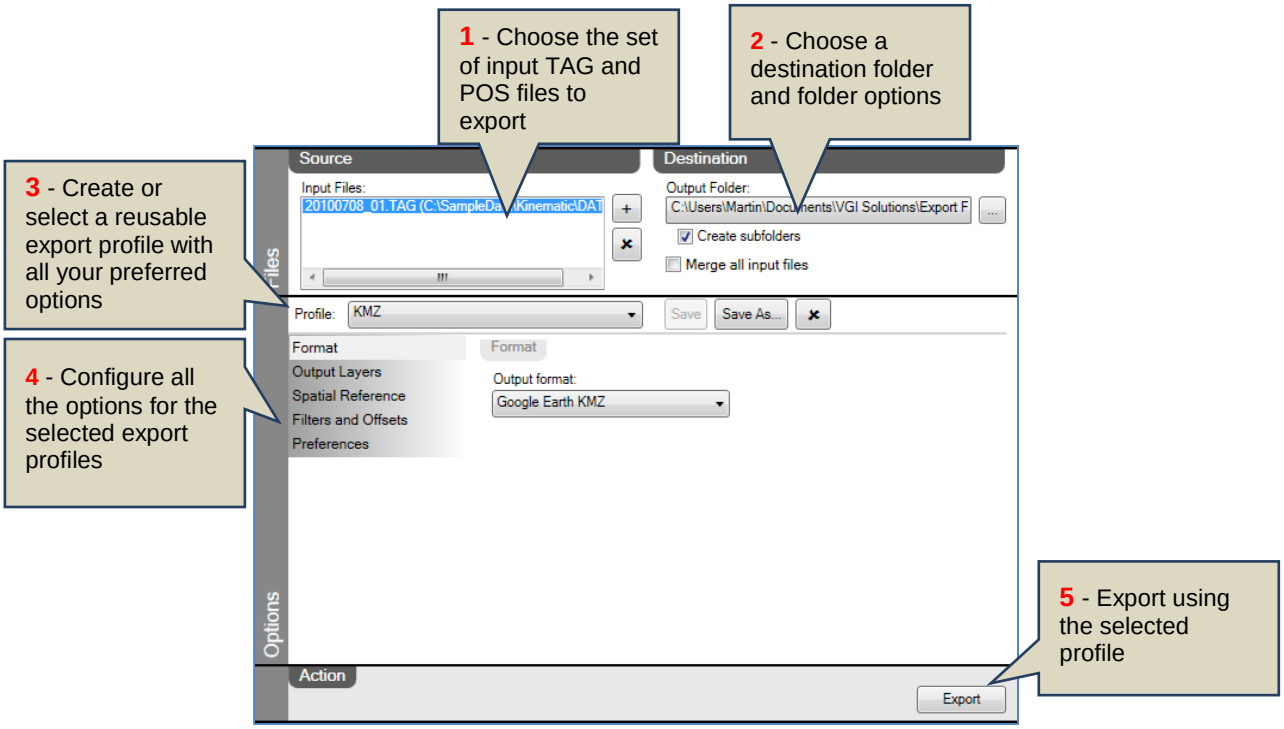
> For Points, Lines and Polygons output layers, the attribute data is written in the table record for each point, line and polygon entity.
>
> For Points, Vertices and GNSS Positions output layers, there is an option to include the coordinates and the GNSS metadata (time, number of satellites, DOP, accuracy, solution and standard deviations) as part the table record for each location.

Export Features can create the following types of output layers from **POS** files:

- **GNSS Positions layers** from positions in the POS files.

13.6.1.3 Graphical User Interface Overview

Export Features is designed to let you create reusable export profiles for your most frequent export tasks. The following picture illustrates the steps for exporting features and positions.



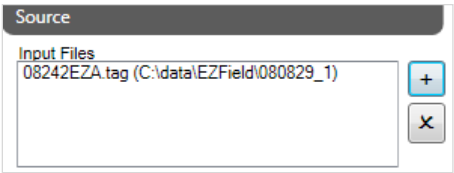
13.6.2 Graphical User Interface

13.6.2.1 The Files Section

The Files section is where you will specify the set of input files to export, as well as the output folder and related output settings. If you want to export the current project, you must save it prior to export it.

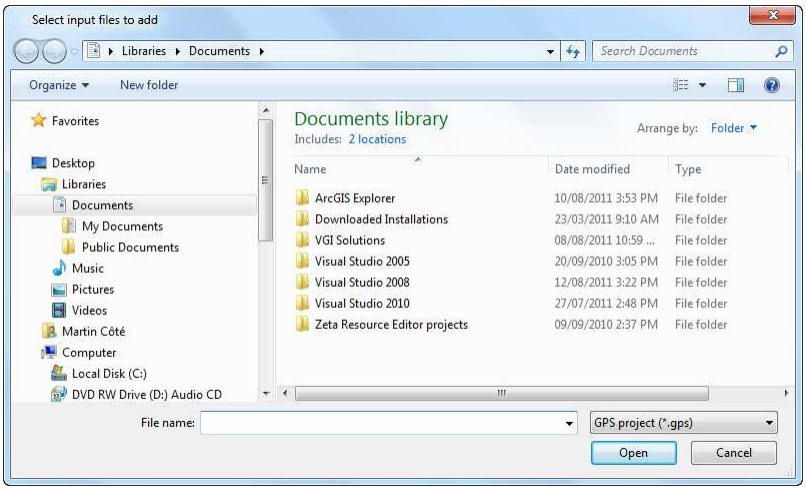
13.6.2.2 Selecting Input Files

Use the **Input Files** area to select the input **TAG** and **POS** files.

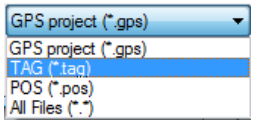


- To add an input file

a. Click the + button. This opens a file selection dialog box with a listing of available **GPS** projects:



b. To list **TAG** or **POS** files instead of **GPS** projects, use the filter combo box at the bottom right of the dialog box.



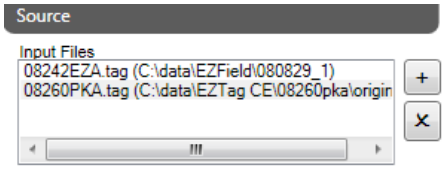
c. Select one or more of the following types of file(s) from a folder on your disk, and then click **Open**:

- A **TAG** file adds a **TAG** file and its associated **POS** file to the list of input files.
- A **POS** file adds only a **POS** file to the list of input files, without the **TAG** file.
- A **GPS** project adds the **POS** file for that project and the **TAG** file if it is available.

❖ To select more than one file use the Ctrl or Shift key, while clicking on the file names.

❖ Alternatively, you can drag and drop files to the Input Files area.

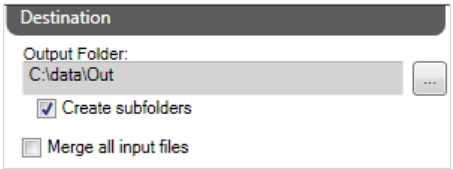
d. This adds **TAG** and **POS** file(s) to the list. For any **TAG** file in the list, the associated **POS** file is automatically considered as an additional input but it is not listed.



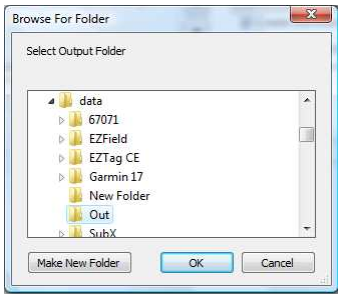
- To remove an input file
  a. Select a **TAG** or **POS** file from the **Input Files** list.
  b. Click the **X** button. This removes the selected file from the list.

13.6.2.3 Selecting an Output Folder and Related Settings

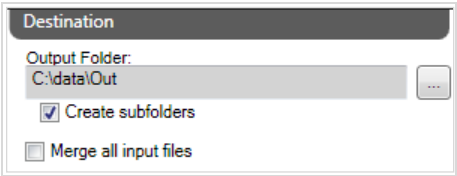
Use the **Output Folder** area to select the output folder, as well as some related settings. The folder name and these settings are not saved as part of the export profile (described in the Options section below) but are saved as the current settings until you change them.



- To select the output folder
  a. Click the button. This opens a folder selection dialog box:



  b. Select a folder and click **OK**.
  c. The selected folder will be shown under **Output Folder**:



  d. Check the **Create subfolders** box if you want the data to be exported to a subfolder of the selected output folder. This is recommended.

- To merge the content of all input files to the output
  a. Check the **Merge all input files** box if you need that all input files be merged into a single output data set.

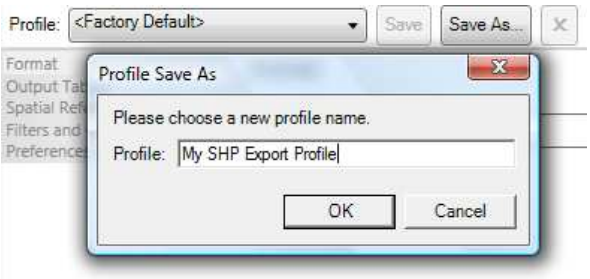
13.6.2.4 The Options Section

The **Options** section is where you will edit the options for your export profiles. An export profile is required in order to perform any export operation.

13.6.2.5 Creating a New Export Profile

Export Features comes with the **<Factory Defaults>** export profile, which is setup to export to **SHP** with some preset options. You can use this profile as a template to create and edit your own profiles.

- To create an new export profile
  a. Select **<Factory Defaults**> from the list (or any other profile you may already have) and click **Save As…**
  b. Enter the name of your new profile then click **OK**.



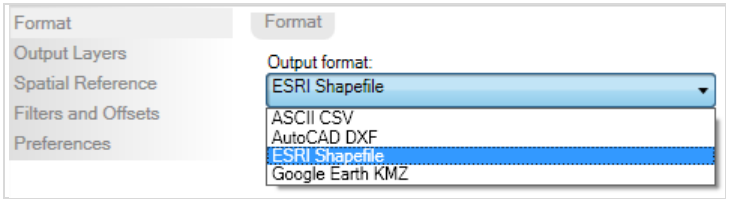
  c. Your new profile will be shown as the currently selected profile, and is ready to be edited.

13.6.2.6 Editing the Options for a Profile

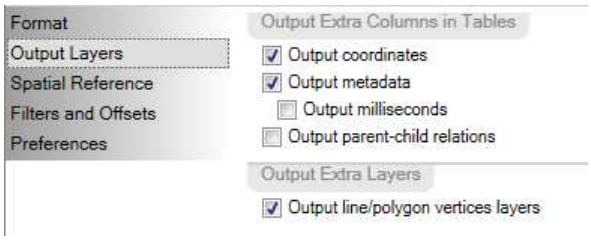
- To edit and save a profile
  a. Use the **Profile** field to select the profile to edit :

  b. Proceed to edit the options (as described in sections below) and click **Save** when done. Alternatively use **Save As…** to save to a new profile. Note that if you have selected the **<Factory Defaults>** profile only the **Save As…** button will be available.

- To edit the choice of output file format
  a. Select the **Format** page.
  b. Select the desired format from the **Output format** list:



- To edit the choice of output layers settings
  a. Select the **Output Layers** page.



b. Check the **Output coordinates** box if you wish to have the coordinates of the points and vertices included in the output tables. This is always checked if the output is ASCII CSV.

c. Check the **Output metadata** box if you wish to output GNSS metadata columns to points and vertices tables.

d. Check the **Output milliseconds** box if you wish to output an extra column for the fraction of second of the GNSS time.

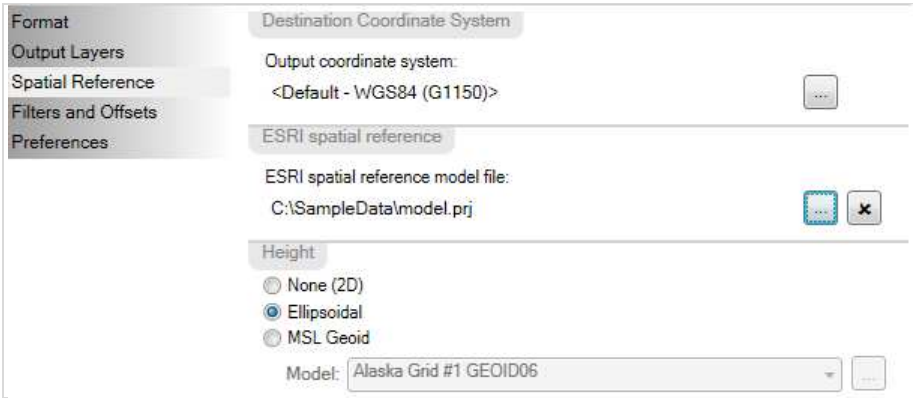
e. Check the **Output parent-child relations** box if your dictionary includes parent-child relations. This will export extra columns to link tables together.

f. Check the **Output line/polygon vertices layers** box if you wish to output special vertices layers for line and polygon features, in addition to the usual line and polygon feature layers. A vertex layer contains one point for each position of line or polygon features along with its GNSS metadata.

- To edit the spatial reference of the output

a. Select the **Spatial Reference** page.

b. Use the **Output coordinate system** button to select the desired output coordinate system.



c. Use the ESRI spatial reference model file if you want your ESRI Shapefile exports to include a PRJ file. When a model file is selected, its content is copied as is. You must choose an ESRI spatial reference that corresponds to your **Output coordinate system**. Use the button to select a new model file. Use the button to remove the model file.

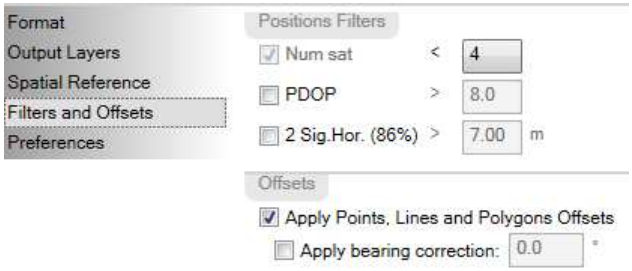
d. Under **Height**, select **None (2D)** to output 2D positions or select either **Ellipsoidal** or **MSL Geoid** to output 3D positions.

e. If you have selected **MSL Geoid**, select a geoid model from the list. You can also use the button to open the **Geoid Manager** in order to edit the list of available geoid models. See chapter ***Geoid*** for details.

- To edit the filters settings

a. Select the **Filters and Offsets** page.

b. Use the **Num sat** field to select the minimum number of satellites required for a position to be present on output.



c. Check the **DOP** box (PDOP, GDOP, HDOP or VDOP depending on the DOP setting in the Preferences page) to prevent output of positions that exceed the DOP value specified on the right.

d. Check the **Accuracy** box (1 Sig. Hor. (39%), 2 Sig. Hor. (86%), or 3 Sig. Hor. (99%) depending on the Accuracy level setting in the Preferences page) to prevent output of positions with accuracies that are worse than the accuracy value specified on the right.

- To edit the offset settings

a. Select the **Filters and Offsets** page.

b. Use the **Apply Points, Lines and Polygons Offsets** to apply points, lines and polygon offsets that were captured with OnPOZ EZTag CE™ on the field.

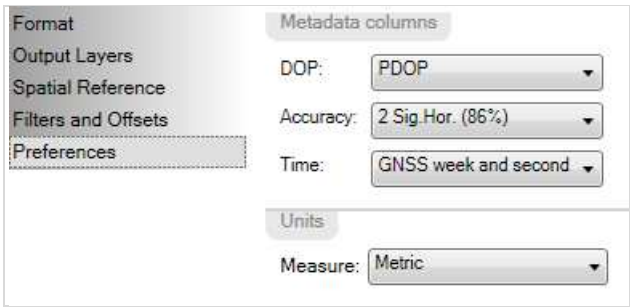
c. Use the **Apply bearing correction** to apply a final correction on any bearing used in point offsets. This can be used to adjust a wrong magnetic declination entered in OnPOZ EZTag CE™ at collect time. Enter a value in decimal degree. That value will be added to all bearings in any offset parameters. The final offset position will be adjusted accordingly.

- Sometimes, magnetic declination is given relative to East or West. For East, enter a positive value. For West, enter a negative value.

- To edit other preferences

a. Select the **Preferences** page.

b. Use the **DOP** field to select the type of DOP to use in the Filters and Offsets page as well as in the output data columns. Select between **PDOP** (3D position), **GDOP** (3D position + time), **HDOP** (2D horizontal position) and **VDOP** (1D vertical position).



c. Use the **Accuracy** field to select the type of horizontal accuracy confidence level to be used in the Filters and Offsets page as well as in the output data columns. Select between **1 Sig. Hor. (39%)** (1 times horizontal (2D) variance), **2 Sig. Hor. (86%)** (2 times horizontal (2D) variance) and **3 Sig. Hor. (99%)** (3 times horizontal (2D) variance).

d. Use the **Time** field to select the type of time to use in the output data columns. Select between **GNSS week and second**, **UTC date/time** and **Local date/time**.

e. Use the **Measure** field to select the measurement units for output. Select between **Metric**, **International Feet**, and **US Survey Feet**.

- Save your changes to the current export profile
  a. Click the **Save** or **Save As…** button to save your changes to the current profile.

13.6.2.7 Selecting an Export Profile

Before exporting, select the profile that you want to use for the export process. The selected profile will be remembered across sessions, until you change it.

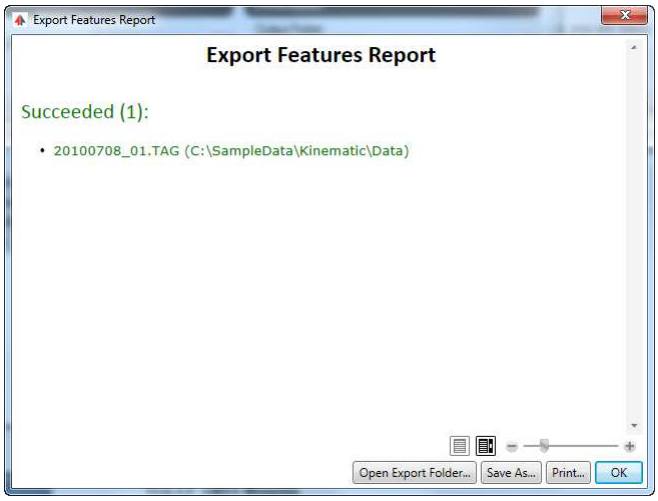
- To select the profile to use for exporting
  a. Select a profile from the **Profile** list:

13.6.2.8 Starting the Export Process

Once you have selected the input files, the output folder and the profile, you are ready to export your data.

- To export the input files to the output folder using the selected profile
  a. Click the **Export** button.

  b. Wait until the export process displays the **Export Features Report** window indicating either success or failure for all the exported files. Use **Open Export Folder** to open a Windows Explorer window in the folder used for export, **Save As…** to save the report or **Print** to print it. Click **OK** to close this window.



13.6.3 Understanding the output

13.6.3.1 GNSS Metadata

GNSS Metadata is always included in the GNSS Positions output layers, and is optional for Point, Site and Vertices output layers. This option is configured with the **Output metadata** check box in the **Output layers** page.

GNSS Metadata contains the following columns:

- Two columns to contain the starting time of capture of the GNSS location. The pair of columns will be as follows, depending on the selection made in the **Time** field of the **Preferences** page:
  - **GNSSWeek** and **GNSSSec** if **GNSS week and second** is selected;
  - **UTCDate** and **UTCTime** if **UTC date/time** is selected;
  - **LocalDate** and **LocalTime** if **Local date/time** is selected;
- The **Sats** column contains the number of satellites used for computing this location;
- A DOP column contains the DOP value associated with this location. It will be **PDOP**, **GDOP**, **HDOP** or **VDOP**, depending on the choice of **DOP** in the **Preferences** page.
- An accuracy column contains the horizontal (2D) accuracy value associated with this location. The title of the column will be **HOR_1SIGMA**, **HOR_2SIGMA** or **HOR_3SIGMA**, and will match the choice of **Accuracy** level filter in the **Preferences** page.
- The **Solution** column contains a value that indicates the type of solution used for computing this location. Possible values are:
  - **USER** : the location was set manually by the user;
  - **OFFSETTED** : Offsetted point from one or two reference points
  - **GNSS** : the location was computed in real-time, using GNSS only;
  - **DGNSS** : the location was computer in real-time, using GNSS and real-time corrections such as WAAS or RTCM;
  - **RTK FLOAT**: the location was computed in real-time, using RTK;
  - **RTK FIXED**: the location was computed in real-time, using RTK;
  - **RAW** : the location was computed after post-processing, using a pseudorange algorithm;
  - **PP FLOAT** : the location was computed after post-processing, using a float ambiguity algorithm;
  - **PP FIXED** : the location was computed after post-processing, using a fixed ambiguity algorithm;
  - **NETWORK**: the location was computed after post-processing and then adjusted by **Network Adjustment**.
- Three columns contain the standard deviation values for the location. These will be **StdDevX**, **StdDevY** and **StdDevHgt** if output is in a projected coordinate system, or **StdDevLon**, **StdDevLat** and **StdDevHgt** if output is in a geographic coordinate system.

> The **StdDevHgt** column will not be present in 2D outputs.
>
> The content of any standard deviation column is multiplied by the current accuracy factor meaning 1 for 1 Sig. Hor. (39%), 2 for 2 Sig. Hor. (86%) and 3 for 3 Sig. Hor. (99%).

Milliseconds are optional for GNSS Positions, Point, Site and Vertices output layers. This option is configured with the **Output milliseconds** check box in the **Output layers** page. It is only available when **Output Metadata** is requested and if **GNSS week and second** is not selected in **Time** field of the **Preferences** page.

Milliseconds contain the following column:

- Column to contain the millisecond of the starting time of capture of the GNSS location. The column will be named as follows, depending on the selection made in the **Time** field of the **Preferences** page:
    - **UTCMSec** if **UTC date/time** is selected;
    - **LocalMSec** if **Local date/time** is selected;

Output Parent-Child relations are never included in the GNSS Positions output layers, and are optional for Point, Site and Vertices output layers. This option is configured with the **Output Parent-Child relations** check box in the **Output layers** page.

Output Parent-Child relations contain the following columns:

- **FeatureID**: The GUID associated to this feature,
- **ParentID**: The GUID of the parent (if any)
- **ParentFeat**: The parent table name (if any)
- **ParentAttr**: The attribute name in the parent table that owns this feature (if any).

13.6.3.2 ESRI Shapefile Output Layers

Each ESRI Shapefile output layer contains three or four files with extensions SHP, SHX, DBF and PRJ. The SHP contains the geometry, the SHX is a geometry index file and the DBF contains attribute data. The PRJ is optional. When present, the PRJ contains the ESRI spatial reference.

13.6.3.3 AutoCAD DXF Output Layers

Each AutoCAD DXF output layer contains a single file with extension DXF, containing both the attribute data and the geometry. This format supports some customizing; see ***Customizing Export Features Output*** appendix for more details.

13.6.3.4 ASCII CSV Output Layers

Each ASCII CSV output layer contains a single file with extension CSV, containing attribute data.

13.6.3.5 Google Earth KMZ Output Layers

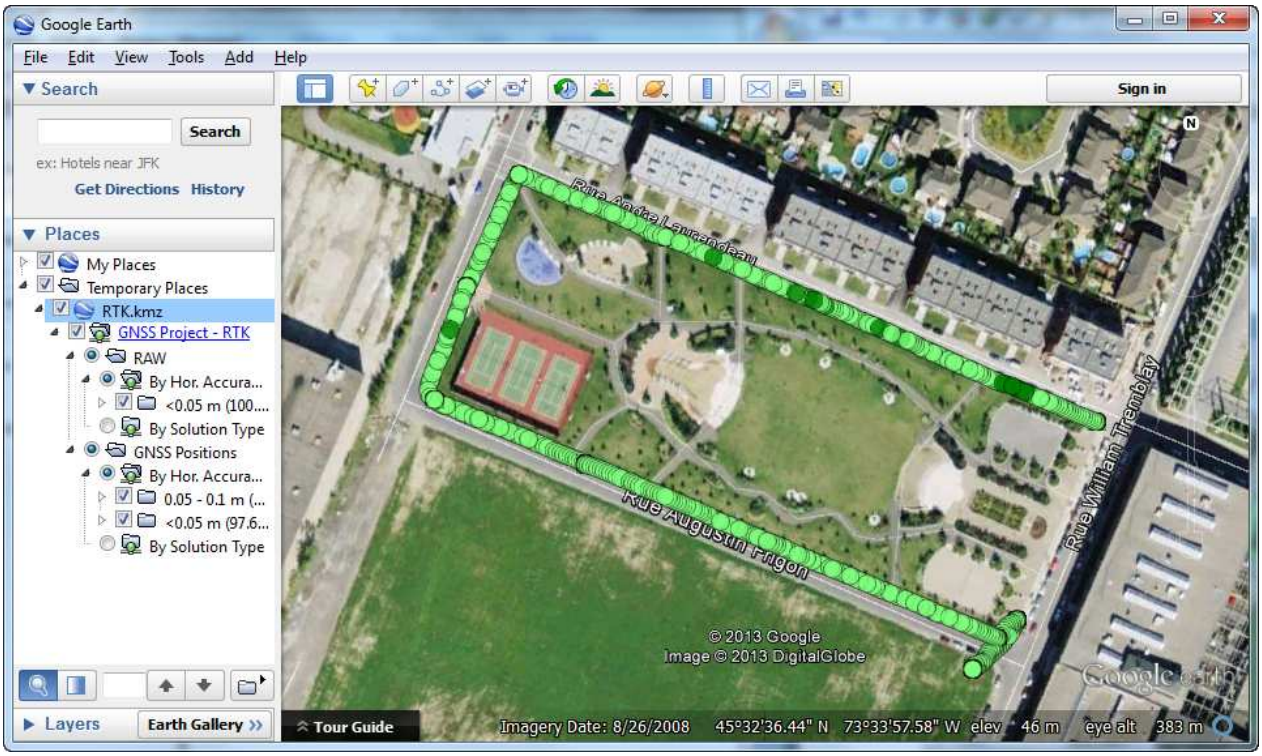
The KMZ output is intended to be used for viewing and analyzing the GNSS and GIS layers in the free Google Earth software. Google Earth allows viewing GIS layers with high resolution images as background layers.

It is recommended to use the latest version of Google Earth, freely downloadable at http://earth.google.com/download-earth.html.

All the layers are exported in a single KMZ file containing KML files.

This format supports some customizing; see ***Customizing Export Features Output*** appendix for more details.

When double-clicking on the exported KMZ files, you project is automatically displayed in Google Earth.



Google Earth

Since this type of output is used for analysis purpose, the GNSS metadata is always exported.

Since the Google Earth software only deals with a geographic coordinate system, the layers are always exported in the WGS84 referential system.

■ Exploring the layer tree

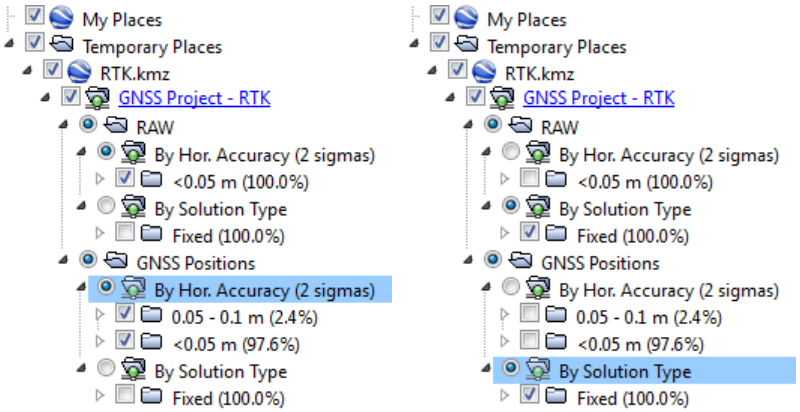
Each layer is intended to be displayed using two different types of representation:

- By horizontal accuracy criteria
- By GNSS Solution type criteria

For each type of representation, data are grouped using range of values.

The type of horizontal accuracy level you selected in the **Export Features** preference screen is used in the layer tree.

These renders are mutually exclusive. Clicking on the option group in the layer tree, you can choose from one type of representation to another one depending on your analysis.



Google Earth – Selecting by horizontal accuracy or by solution type

Click on the **GNSS Project** node to display more information about the current project.

GNSS Project - RTK

Property	Value
Software	
GNSS State	Post Processed
UTC Start Time	06/20/2012 19:23:44
UTC End Time	06/20/2012 19:47:25
Original Files	C:\SampleData\GoogleEarth\RTK.TAG C:\SampleData\GoogleEarth\RTK.pos

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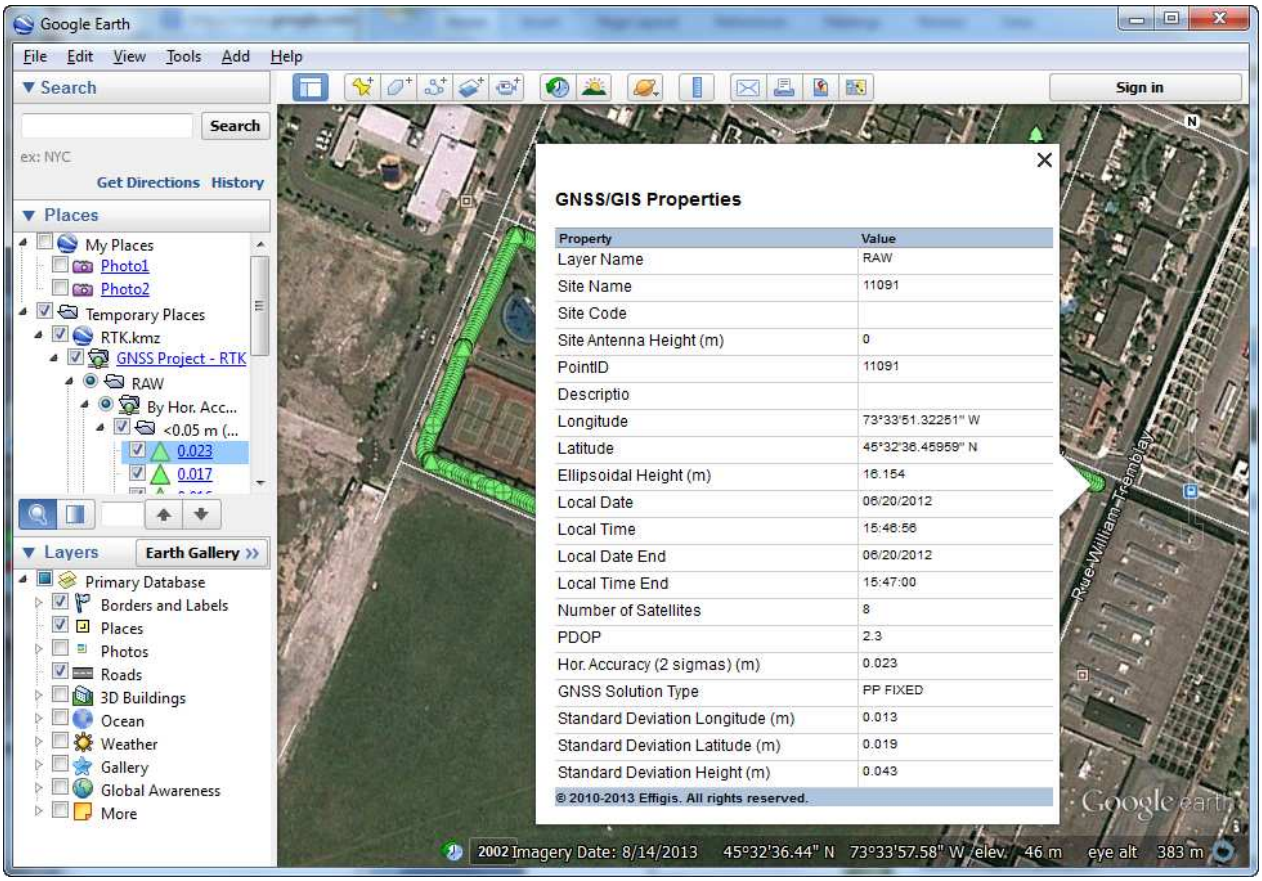
Google Earth – GNSS Project

■ Viewing the GNSS/GIS data

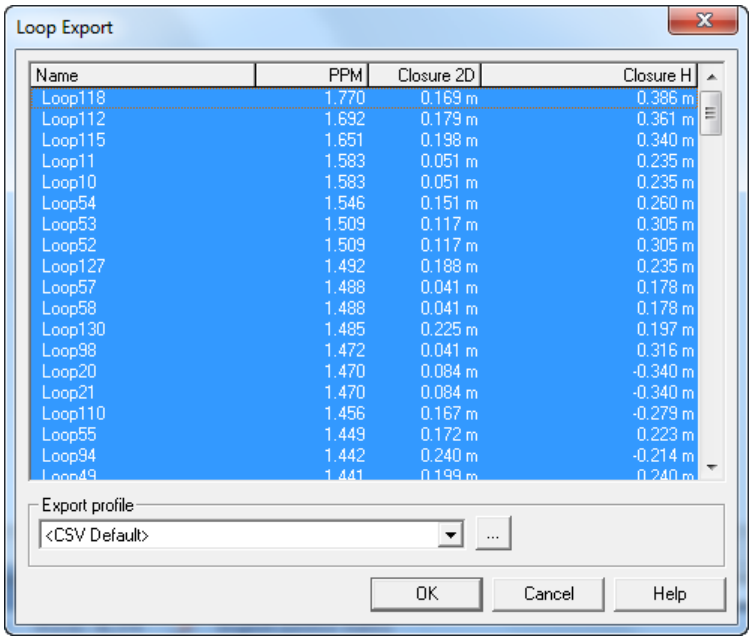
On the map view, clicking the symbol displays a Google Earth balloon containing the GNSS and GIS data for the current selected feature.



Google Earth – GNSS/GIS Properties

13.7 Loops

Select **Tools > Export > Loops...** from the main menu. The **Loop Export** is displayed.



Loop Export

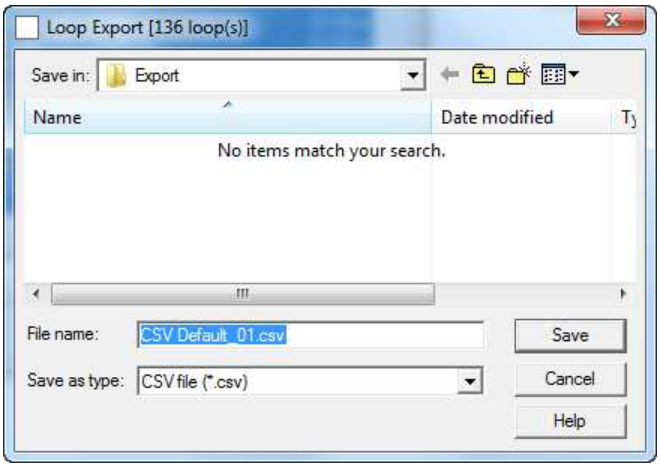
a. Select the loops you want to export.

> To select more than one loop, drag the pointer across the lines, or press and hold down the **Ctrl** key while clicking each line. You can select a range of loops by selecting the first item and then hold down the **Shift** key while selecting the last item.

b. Select the **Export profile** you want. Press the button to enter the **Profile Editor**.

- **<CSV Default>**: Default export to CSV. For more details, consult the ***CSV Export*** appendix.
- All the other profiles are user defined CSV exports. For more details, consult the ***CSV Export*** appendix.

c. Click **OK**. A standard Windows is displayed to select an output file.



Loop Export – Save

d. Select the directory where to export your data.
e. Type a new name for the data file in the **File name** box or accept the default name.
f. Click **OK**.
g. The data export process is launched.

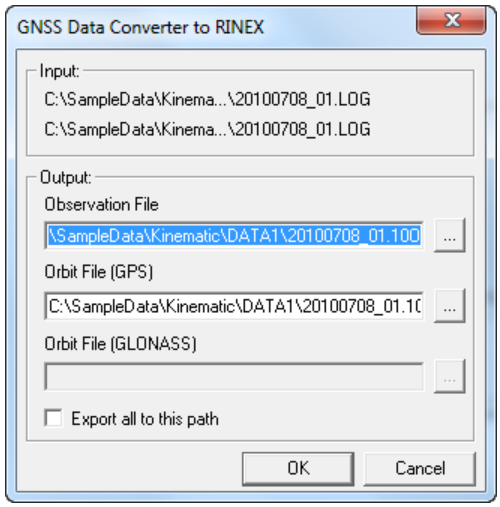
13.8 Observations/Orbits (RINEX files)

Observations and orbits files can be exported in the RINEX format (Receiver Independent Exchange Format) version 2.10. When exporting observations and orbits files, up to 3 RINEX can be created with the following extension (where **yy** stands for the last two digits of data collection year):

- **yyO**: The RINEX observations file which contains all the raw measurement information. Raw measurements of all constellations are in the same file;
- **yyN**: The RINEX navigation file (the orbits file) which contains all the broadcast ephemeris for the GPS constellation.
- **yyG**: The RINEX navigation file (the orbits file) which contains all the broadcast ephemeris for the GLONASS constellation.

■ Export using the Project Manager

a. In the **Project Manager**, select the **Observations** folder.
b. In the pane view, select the observation file you want to export in RINEX.
c. From the speed menu, select **Export to RINEX...** Or click on the **Main** toolbar. The **GNSS Data Converter to RINEX** is displayed.



GNSS Data Converter to RINEX

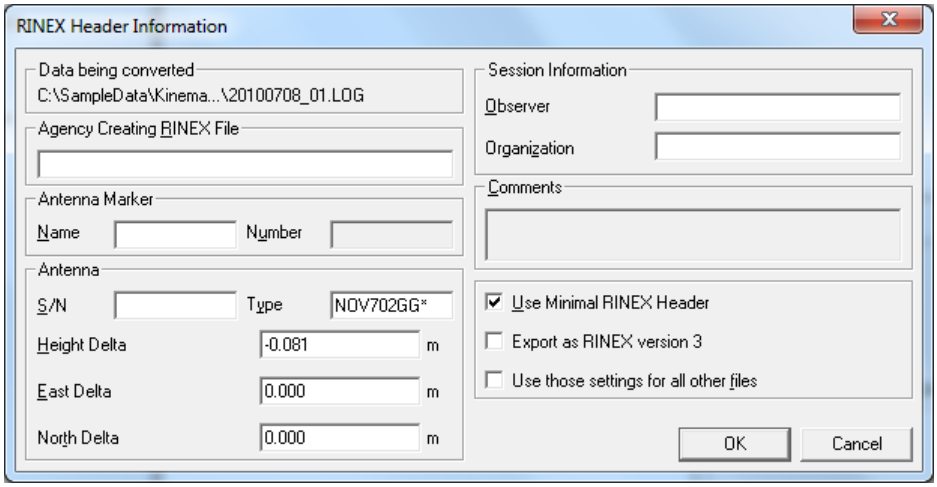
- **Export all to this path**: If more than one file is selected to be exported at once, this dialog will be repeated for each file to export. If you want to export all RINEX files to the same directory, check the **Export all to this path** and this dialog will no longer be asked for the remaining files to be exported.

d. The **Input** section displays which files (observation and/or orbits) were selected to export. The **Output** section is used to select the path and file name of these files in RINEX format. The default

path and file name can be changed by clicking the button. Navigate to the location where you want to export your file, and change the file name if required.

> When you select an observation file, the orbit file associated with this observation file is automatically selected to be exported in RINEX too. However, if you select directly an orbit file, only the orbit file will be exported in RINEX.

e. Click **OK**. The dialog box closes and the selected file name is displayed in the **RINEX header information** dialog box. You can optionally fill the empty fields with your information to create a custom header in the RINEX files.



RINEX Header Information

> RINEX header information is kept into a configuration file for future use.

f. Click **OK**. The file export will begin and a window is displayed, detailing progress.

g. When the export is completed, the **GNSS Data Converter to RINEX – Results** is displayed. Each file selected to be exported in RINEX is listed with a **Success**/**Failure** result indicator.

GNSS Data Converter to RINEX – Results

h. Click **OK**. Your software's data file has now been exported to a RINEX data file.

14 Global Sites

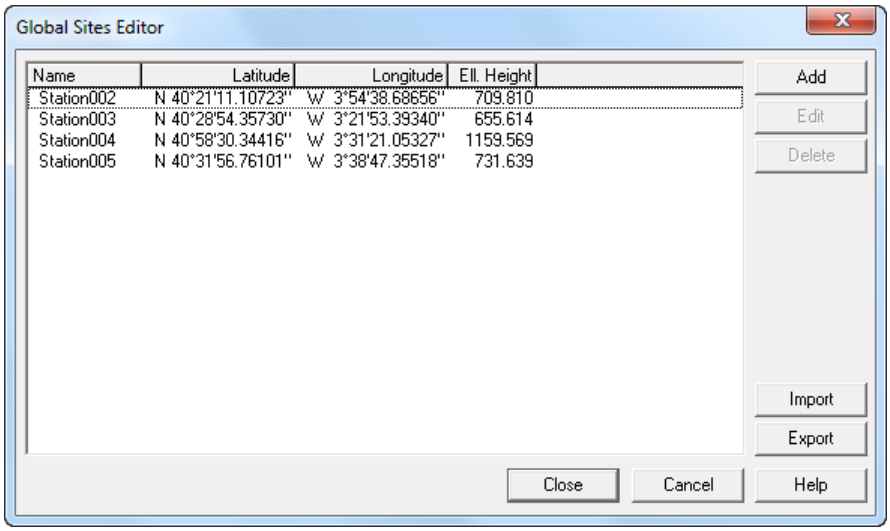
The software includes an internal database to handle Global Sites . There are sites kept in “reserve” so they can be used in another projet.

Global sites are used in four places:

- In the **Import Site** dialog accessible from the **Site Editor** (**Edit > Site**).
- As a destination for export (**<Global Sites>**) in the **Site Export** dialog (**Tools > Export > Sites**)
- In the **Global Sites Editor** (**Tools > Global Sites**).
- In the Inverse Computation (**Analysis > Inverse Computation**)

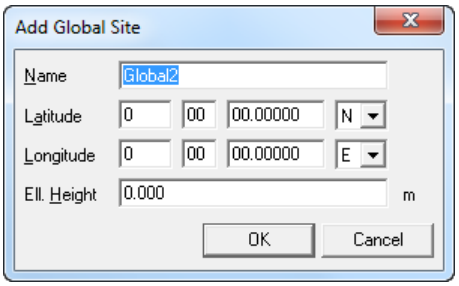
14.1 Global Sites Editor

The **Global Sites Editor** is available from the **Tools > Global Sites…** main menu.



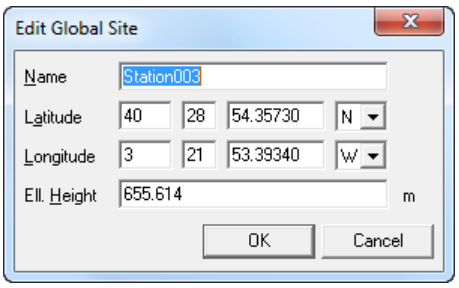
Global Sites Editor

- **Add**: Add a global site.



Add Global Site

- **Edit**: Edit the current global site.



Edit Global Site

- **Delete**: Delete the current global site.
- **Import**: Replace the whole global sites database with a previously exported copy of the database.
- **Export**: Export the whole global sites database. This could be done for several reasons:
  - Backup purpose in case you need to restore the global sites database to this state one day.
  - Synchronization with another instance of this application on another computer. Export the global database on the first computer and import it on the second computer to have a copy of the global sites database on the second one. Use a shared folder on a network or a USB key to transfer your files.
  - Copy the global sites database to OnPOZ EZField™. Export the global sites database on your computer, and then copy the files on the mobile device. See the ***EZField User Guide*** for more details.
- **Close**: Close and save all changes in this dialog.
- **Cancel**: Close and cancel all changes in this dialog.

Appendix A – Post-Processing Carlson SurvCE™ RW5 file

Carlson SurvCE™ users can use the software to post-process their **RW5** files collected on the field.

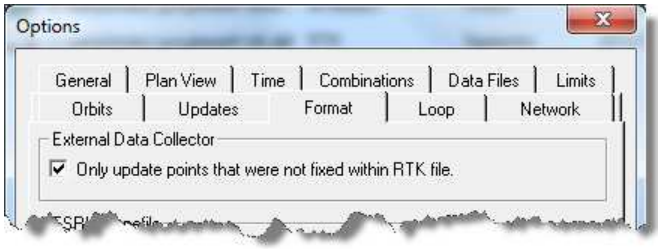
Post-processing requires two types of files recorded by Carlson SurvCE™: After the post-processing is completed, when the project is saved, the RW5 file is updated with the corrected positions.

- **RW5 file**: Contains point information (point numbers and associated GPS time), including coordinate obtained on the field (RTK, DGPS or Autonomous);
- **GNSS raw observations file**: Contains GNSS raw observations and orbits as recorded simultaneously with the **RW5** file. An example of this file is the log file recorded by Carlson SurvCE™ with Carlson Surveyor+ GPS receiver.

Importing Data

- Configuration before importing

  These options are set from the main menu by selecting **Tools > Options > Format.** Here is a summary of these options:



Options – Format – External Data Collector

- **Only update points that were not fixed within RTK file**: If this option is checked, the software will only update points that were not **FIXED** in RTK mode. If this option is NOT checked, the software will update all points.

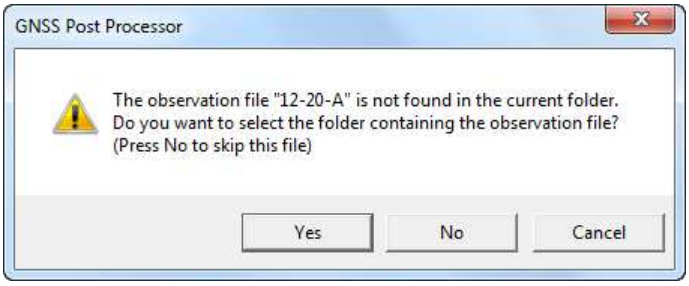
- Importing

  a. Importing your data is done from the **Project Manager**. See the section ***GNSS Processing Workflow – Importing Data*** for more details.

  b. In the **Open observation and orbits** dialog, make sure the **Files of type** is set to **SurvCE (*.crd, *.rw5)** and then select your **RW5** or **CRD** file.

Open Observations and Orbits

c. When importing **RW5** files in the software, the GNSS raw observation file(s) will automatically be imported if it is located in the same directory. Otherwise, the user is prompted to manually select the folder containing the raw data file:



Importing RW5 without matching GNSS raw observation file

d. Answer **Yes**. Then, browse for the folder containing the missing GNSS raw observation file. You may have to repeat the procedure if you have more than one GNSS raw observation file and you put them in separate folders.

Analyzing

Once the post-processing is completed, a **Trajectory Site Comparison** view is available to compare real-time positions with respect to their post-processed positions by selecting **Analysis > Trajectory Results > Trajectory Site Comparison.** A complete description of the **Trajectory Site Comparison** is provided in chapter ***Analysis***

Saving project

When the project is saved after post-processing, the results are written in the **RW5** file using the rules stated by the above options. From there, Carlson SurvCE™ users can go back to their usual data flow with their corrected **RW5** file.

Appendix B – Post-Processing MicroSurvey RAW file

This section applies to the following applications:

- MicroSurvey FieldGenius™
- MicroSurvey Seismic Surveyor™
- MapScenes Evidence Recorder™
- NavCom FieldGenius™

The software can be used to post-process the **RAW** files collected on the field. After the post-processing is completed, when the project is saved, the RAW file is updated with the corrected positions.

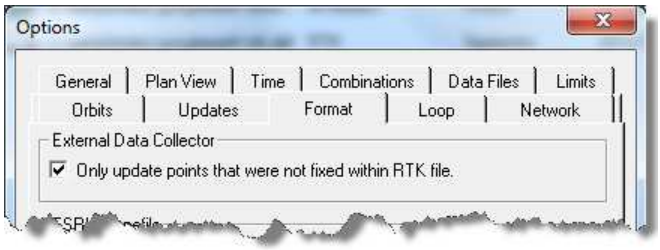
Post-processing requires two types of files:

- **RAW file**: Contains point information (point numbers and associated GPS time), including coordinate obtained on the field (RTK, DGPS or Autonomous);
- **GNSS raw observations file(s)**: Contains GNSS raw observations and orbits as recorded simultaneously with the **RAW** file. There may be one file or more depending on your collecting procedure.

Importing Data

- Configuration before importing

  These options are set from the main menu by selecting **Tools > Options > Format.** Here is a summary of these options:



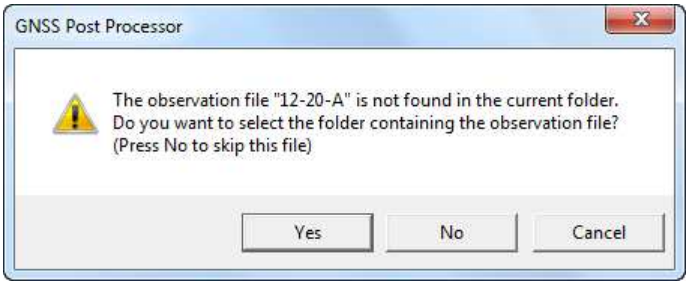
Options – Format – External Data Collector

- **Only update points that were not fixed within RTK file**: If this option is checked, the software will only update points that were not **FIXED** in RTK mode. If this option is NOT checked, the software will update all points.

- Importing
  a. Importing your data is done from the **Project Manager**. See the section ***GNSS Processing Workflow – Importing Data*** for more details.
  b. In the **Open observation and orbits** dialog, make sure the **Files of type** is set to **MicroSurvey (*.raw)** and then select your **RAW** file.

Open Observations and Orbits

  c. When importing **RAW** files in the software, the GNSS raw observation file(s) will automatically be imported if it is located in the same directory. Otherwise, the user is prompted to manually select the folder containing the raw data file:



Importing RAW without matching GNSS raw observation file

  d. Answer **Yes**. Then, browse for the folder containing the missing GNSS raw observation file. You may have to repeat the procedure if you have more than one GNSS raw observation file and you put them in separate folders.

Analyzing

Once the post-processing is completed, a **Trajectory Site Comparison** view is available to compare real-time positions with respect to their post-processed positions by selecting **Analysis > Trajectory Results > Trajectory Site Comparison.** A complete description of the **Trajectory Site Comparison** is provided in chapter ***Analysis***

Saving project

When the project is saved after post-processing, the results are written in the **RAW** file using the rules stated by the above options. From there, MicroSurvey users can go back to their usual data flow with their corrected **RAW** file.

Appendix C – Post-Processing Geo-Plus VisionTerrain file

Geo-Plus VisionTerrain users can use the software to post-process their **MDB** files collected on the field.

After the post-processing is completed, when the project is saved, the MDB file is updated with the corrected positions.

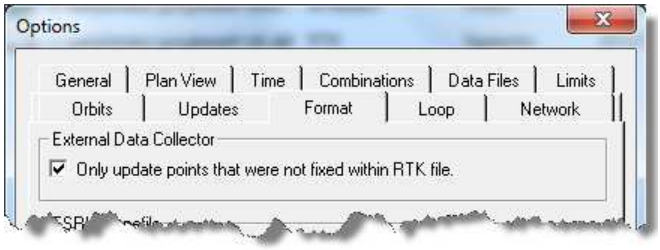
Post-processing requires two types of files recorded by Geo-Plus VisionTerrain:

- **MDB file**: Contains point information (point numbers and associated GPS time), including coordinate obtained on the field (GPS, DGP, RTK Float or RTK Fixed);
- **GNSS raw observations file**: Contains GNSS raw observations and orbits as recorded simultaneously with the **MDB** file.

Importing Data

- Configuration before importing

  These options are set from the main menu by selecting **Tools > Options > Format.** Here is a summary of these options:



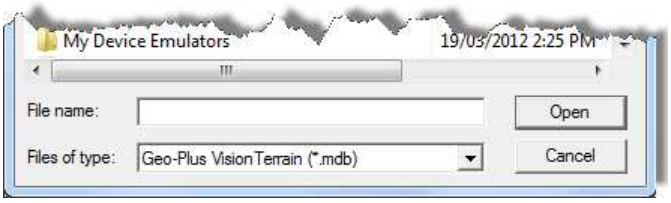
Options – Format – External Data Collector

- **Only update points that were not fixed within RTK file**: If this option is checked, the software will only update points that were not **FIXED** in RTK mode. If this option is NOT checked, the software will update all points.

- Importing

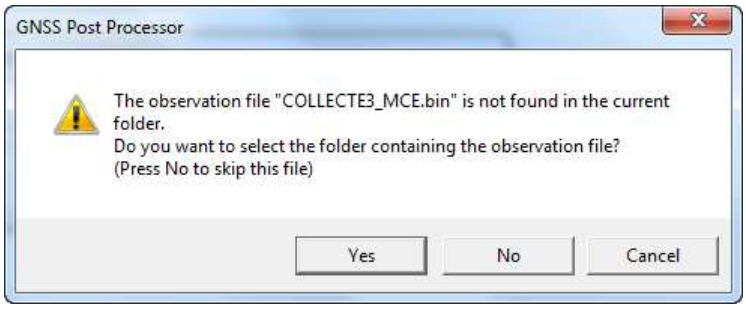
  a. Importing your data is done from the **Project Manager**. See the section ***GNSS Processing Workflow – Importing Data*** for more details.

  b. In the **Open observation and orbits** dialog, make sure the **Files of type** is set to **Geo-Plus VisionTerrain (*.mdb)** and then select your **MDB** file.



Open Observations and Orbits

c. When importing **MDB** files in the software, the GNSS raw observation file(s) will automatically be imported if it is located in the same directory. Otherwise, the user is prompted to manually select the folder containing the raw data file:



Importing MDB without matching GNSS raw observation file

d. Answer **Yes**. Then, browse for the folder containing the missing GNSS raw observation file.

Analyzing

Once the post-processing is completed, a **Trajectory Site Comparison** view is available to compare real-time positions with respect to their post-processed positions by selecting **Analysis > Trajectory Results > Trajectory Site Comparison.** A complete description of the **Trajectory Site Comparison** is provided in chapter ***Analysis***

Saving project

When the project is saved after post-processing, the results are written in the **MDB** file using the rules stated by the above options. From there, Geo-Plus VisionTerrain users can go back to their usual data flow with their corrected **MDB** file.

Appendix D – Post-Processing GMS (GeoMobileSolution) files

BAP Precision GMS (GeoMobileSolution) users can use the software to post-process their **EMP** files collected on the field.

After the post-processing is completed, when the project is saved, all **EMA** files are updated with the corrected positions.

Post-processing requires two types of files recorded by GMS:

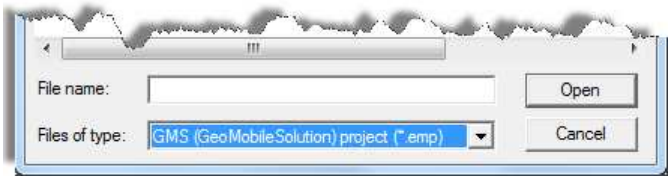
- **EMA file(s)**: An SQLite file that contains point, line or polygon information, including coordinate obtained on the field and GPS times;
- **BP3 file(s)**: Contains GNSS raw observations and orbits associated with the project.

IMPORTANT: In GMS Mobile, you must check the **Post-Process** option in **Project > New** so files can be used by the post-process software.

Importing Data

IMPORTANT: All files for a GMS project must be put in the same folder. Otherwise, import will fail.

- Importing
  a. Importing your data is done from the **Project Manager**. See the section ***GNSS Processing Workflow – Importing Data*** for more details.
  b. In the **Open observation and orbits** dialog, make sure the **Files of type** is set to **GMS (GeoMobileSolution) project (*.emp)** and then select your **EMP** project.



Open Observations and Orbits

  c. When importing **EMP** files in the software, the GNSS raw observation file(s) will automatically be imported.

Analyzing

Once the post-processing is completed, a **Trajectory Site Comparison** view is available to compare real-time positions with respect to their post-processed positions by selecting **Analysis > Trajectory Results > Trajectory Site Comparison.** A complete description of the **Trajectory Site Comparison** is provided in chapter ***Analysis***

Saving project

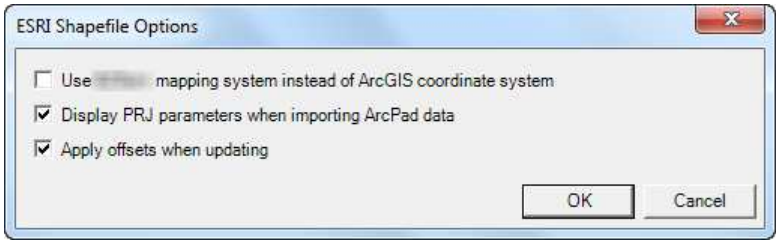
When the project is saved after post-processing, the results are written in the **EMA** files. From there, GMS users can now open their corrected **EMP** project in GMS Office.

Appendix E – Post-Processing ArcPad data

GNSSP projects are generated by OnPOZ GNSS Driver for ArcPad software.

Shapefile Options

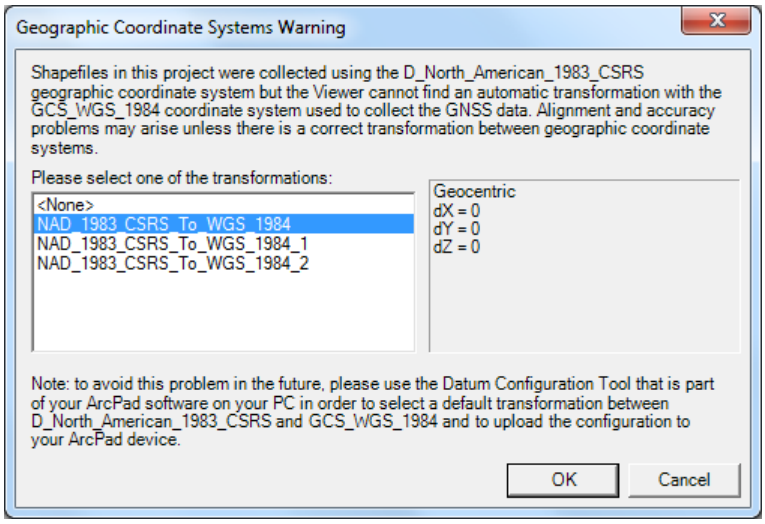
Shapefile options can be defined from the **Tools > Options > Format** page, in section **ESRI Shapefile**. Then, click on **Set** to open the **ESRI Shapefile Options** window.



ESRI Shapefile Options

- **Use EZSurv mapping system instead of ArcGIS coordinate system:** This is not recommended. When you have ArcGIS, it is better to use it since it will make sure the shapefiles are updated with coordinates in the same mapping system. Use this option only if you do have ArcGIS but for whatever reason (expired licensed, floating licensed all used, etc.), you do not want this software to use it.
- **Display PRJ parameters when importing ArcPad data**: When ArcGIS is not present, this will find the ESRI projection file associated with the project and display side by side the ESRI projection and the current mapping system. When ArcGIS is present, this option is ignored.
- **Apply offsets when updating:** It is recommended to keep it active. When offsets are not applied, calculated points remain at the position given by ArcPad. All other kinds of points, lines and polygons will be updated with post-processed position without applying offset.

IMPORTANT: If you are using ArcGIS, you might be prompted to select a datum transformation when saving your project. This may happen if more than one transformation is available in ArcGIS.



Geographic Coordinate Systems Warning

Import

Importing a GNSSP project is done like any other project. You can import it by selecting the GNSSP file, the GPS file or even the OBS file. The software will detect the presence of the GNSSP file automatically and open it like a GNSSP project.

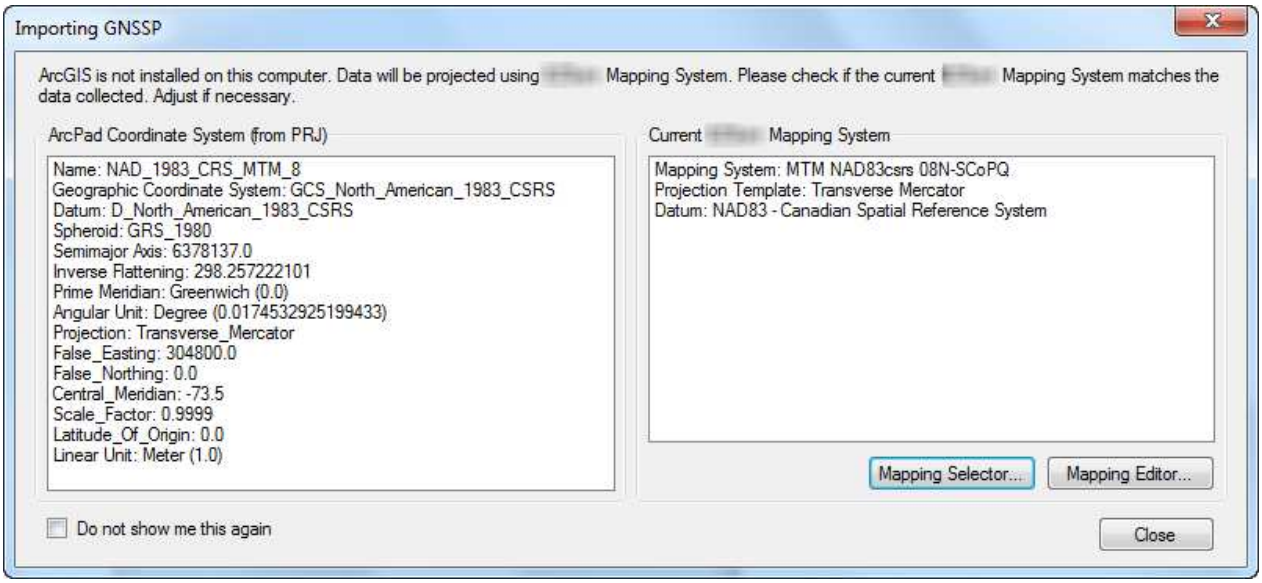
The backup when importing a GNSSP project will be a lot more extensive. It will back up the GNSSP file, the POS file and all shapefiles that were used.

Mapping System

If ArcGIS is installed on this computer, it will use ArcGIS to do any projection for shapefiles. The currently selected mapping system in this software will have no effect on the shapefile.

However if ArcGIS is not installed or ignored by using an override in **Options**, you must select the projection manually in EZSurv®. Make sure that you select a mapping system that matches the one defined in the PRJ file. You must do so for each ArcPad map you want to post-process, unless all maps share the same coordinate system (in which case you can do it once). Each map having a separate coordinate system must be post-processed separately, after selection of the appropriate mapping system.

During the import process, the following dialog will be displayed:



Importing GNSSP

- **ArcPad Coordinate System (from PRJ)**: The PRJ associated with the GNSSP project (if any) is displayed in a readable format.
- **Current EZSurv Mapping System**: Current mapping system in EZSurv®
- **Mapping Selector**…: Opens the **Mapping System Selector** dialog. Choose a mapping system that matches as closely as possible the one displayed in ArcPad Coordinate System. If none matches, please create one using the **Mapping System Editor** and then select it again in **Mapping System Selector**.
- **Mapping Editor…**: Opens the **Mapping System Editor** dialog. It may be required if none of the pre-defined mapping system matches the one displayed in ArcPad Coordinate System.
- **Do not show me this again**: You must set the mapping system at least once. If you always use the same one in ArcPad and never change the current mapping system, you can skip this dialog. Once deactivated, you can reactivate it using the **Display PRJ parameters when importing ArcPad data** in **ESRI Shapefile Options**.
- **Close**: This closes the dialog.

GIS Feature Summary

The **GIS Feature Summary** will display special points to handle ArcPad's point offset. ArcPad supports one point and two points offsetting. With a one point offset, you got one reference point which is the original position, and one calculated point which is the offset position. With a two points offset, you got two reference points and one calculated point which is the offset position.

The **GIS Feature Summary** displays these special points with a special **Label**:

- **Reference**: A reference point used for one point or two points offsets. Reference points are treated like any other GNSS point.
- **Calculated**: Calculated points are shown only to mark their presence. They are not post-processed by the software directly. They have no position because the software internal engine is

not the one that will do the actual offsetting. Offsetting will be applied directly to the shapefile when the project is saved.

GIS Feature Summary

QUICKPROJECT | All | C:\SampleData\gnssp2\data1\QuickProject.tag

[Points] Feature	Label	Start time	Duration	Solution	Position Latitude	Longitude	EllHgt (m)	Standard deviation Lat (m)	Lon (m)	Hgt (m)
Point Average	0	2009/03/12 10:34:45	00:00:09	Field (WAAS)	N 45°32'28.23108"	W 73°33'30.17196"	7.368	2.609	2.609	4.371
Point Average	1	2009/03/12 10:37:25	00:00:09	Field (WAAS)	N 45°32'30.71832"	W 73°33'28.78704"	6.349	2.215	2.215	4.178
Point Average	2	2009/03/12 10:38:43	00:00:09	Field (WAAS)	N 45°32'32.28612"	W 73°33'28.07964"	7.878	2.225	2.225	4.263
Point Average	3	2009/03/12 10:39:50	00:00:09	Field (WAAS)	N 45°32'32.56044"	W 73°33'27.89208"	8.316	2.237	2.237	4.304
Point Average	4	2009/03/12 10:41:22	00:00:09	Field (WAAS)	N 45°32'31.97112"	W 73°33'26.39880"	6.869	2.483	2.483	4.402
Point Average	5	2009/03/12 10:42:45	00:00:09	Field (GNSS)	N 45°32'31.78356"	W 73°33'24.56856"	10.717	4.636	4.636	5.117
Point Average	6	2009/03/12 10:43:59	00:00:09	Field (WAAS)	N 45°32'31.37028"	W 73°33'22.18644"	7.689	3.944	3.944	5.659
Point Average	7	2009/03/12 10:45:47	00:00:09	Field (GNSS)	N 45°32'29.51412"	W 73°33'18.34956"	-1.949	2.775	2.775	4.784
Point Average	8	2009/03/12 10:46:37	00:00:09	Field (GNSS)	N 45°32'30.43176"	W 73°33'17.57988"	-0.726	4.058	4.058	4.694
Point Average	9	2009/03/12 10:47:24	00:00:09	Field (GNSS)	N 45°32'29.41872"	W 73°33'17.55396"	-10.215	2.438	2.438	4.495
Point Average	11	2009/03/12 10:48:33	00:00:09	Field (GNSS)	N 45°32'29.24304"	W 73°33'16.46316"	-10.626	3.504	3.504	5.189
Point Average	12	2009/03/12 10:49:20	00:00:09	Field (WAAS)	N 45°32'29.26428"	W 73°33'16.46856"	-12.488	2.675	2.675	4.643
Point Average	13	2009/03/12 10:53:38	00:00:10	Field (WAAS)	N 45°32'26.20536"	W 73°33'06.45084"	-8.304	3.012	3.012	5.219
Point Average	14	2009/03/12 10:56:32	00:00:09	Field (WAAS)	N 45°32'22.16508"	W 73°33'09.01368"	-9.213	3.458	3.458	4.405
Point	Reference 17	2009/03/12 11:02:51	N/A	Field (GNSS)	N 45°32'15.74484"	W 73°33'13.19220"	1.612	2.966	2.966	6.183
Point	Reference 19	2009/03/12 11:05:00	N/A	Field (WAAS)	N 45°32'16.51272"	W 73°33'14.37804"	-19.573	2.818	2.818	5.054
Point Average	Reference 22	2009/03/12 11:08:49	00:00:10	Field (WAAS)	N 45°32'17.33820"	W 73°33'17.03196"	-8.448	2.939	2.939	5.894
Point Average	Reference 23	2009/03/12 11:09:56	00:00:10	Field (WAAS)	N 45°32'18.23784"	W 73°33'19.70640"	-3.845	2.963	2.963	6.029
Point Average	25	2009/03/12 11:20:36	00:00:09	Field (WAAS)	N 45°32'27.10680"	W 73°33'30.77172"	9.429	2.543	2.543	4.280
Point Average	26	2009/03/12 11:31:26	00:00:09	Field (WAAS)	N 45°32'17.31048"	W 73°33'24.59664"	0.492	2.906	2.906	4.470
Point Average	27	2009/03/12 11:36:18	00:00:09	Field (WAAS)	N 45°32'38.75100"	W 73°33'27.42012"	15.632	2.559	2.559	4.333
Point	Calculated 21	N/A	N/A	User						
Point	Calculated 16	N/A	N/A	User						
Point	Calculated 18	N/A	N/A	User						

GIS Feature Summary for a GNSSP project with point offsets

Offsets can also appear in lines or polygons. When used in line or polygon, a manual vertex is present

GIS Feature Summary

QUICKPROJECT | All | C:\SampleData\gnssp\DATA1\QuickProject.tag

[Points] Feature	Label	Start time	Duration	Solution	Position Latitude	Longitude	EllHgt (m)	Standard deviation Lat (m)	Lon (m)	Hgt (m)
Point Average	Reference 1	2009/02/03 15:52:24	00:00:59	L1 (float)	N 45°32'28.83509"	W 73°33'27.18524"	11.894	0.111	0.287	0.338
Point Average	Reference 2	2009/02/03 15:54:51	00:00:59	L1 (float)	N 45°32'27.39373"	W 73°33'27.98456"	12.450	0.101	0.288	0.333
Point Average	Reference 3	2009/02/03 15:56:40	00:00:59	L1 (float)	N 45°32'27.08040"	W 73°33'28.15950"	12.683	0.106	0.315	0.359
Point Average	Reference 4	2009/02/03 15:58:15	00:00:59	L1 (float)	N 45°32'26.76796"	W 73°33'28.32172"	12.597	0.097	0.315	0.359
Point Average	Reference 5	2009/02/03 16:00:07	00:00:59	L1 (float)	N 45°32'25.96426"	W 73°33'28.78502"	13.172	0.596	1.092	1.185

Total: 5 point feature(s) (0 processed)

[Lines] Feature	Label	Start time	Duration	Solution	Position Latitude	Longitude	EllHgt (m)	Standard deviation Lat (m)	Lon (m)	Hgt (m)
Line	0									
o	Vertex	N/A	N/A	User						
o	Vertex	N/A	N/A	User						
o	Vertex	N/A	N/A	User						
o	Vertex	N/A	N/A	User						
o	Vertex	N/A	N/A	User						

GIS Feature Summary for a GNSSP project with offsets within lines

In the above example, we have created a line with five discrete vertices with each vertex created using a one point offset. In this case, you see five **Reference** entries in the **point** section, each corresponding to the reference point of one of the vertices. In the **line** section, you see a line containing five vertices all marked as **User** with no position associated. These vertices are all calculated point. They have no position because the software's internal engine is not the one that will do the actual offsetting. Offsetting will be applied directly to the shapefile when the project is saved.

Applying post processed positions to your shapefiles

Select **File** > **Save** to save the post-processed data and to correct the Shapefiles (see section ***GNSS Processing Workflow – Saving project***). The GNSSP project will change state after each step is

completed. It is the “save” process that is updating the Shapefile with post-processed positions as well as applying the offsets to reference points

IMPORTANT: If you are not using ArcGIS, make sure the current mapping system still matches the PRJ before doing Save.

IMPORTANT: You must save in order to apply the corrections to the Shapefiles.

Once a GNSSP project includes offset points, it cannot be processed again. However, if you are not satisfied with the post-processing done on it, you can reload the original data and process it from the start.

- How to process again a GNSSP project with offsetted points
  a. Start a new post-processing project.
  b. Import the GNSSP project file. A dialog will ask you to confirm you want the data to revert back to the state before it was post-processed.
  c. Your choices are:
     - **OK**: It will revert back the whole project. It’s like the previous post-processing has never happened. Once you pressed **OK**, you cannot undo it. You have to process it again.
     - **Cancel**: The project stays in the post-processed state and is NOT imported.
  d. Post-process it like any regular project.

Appendix F – Licensing by GNSS receivers

This section describes how to license the software using licenses that are attached to your GNSS receivers.

Licensing Rules

The software enforces the following licensing rules when importing data:

- **Non-RINEX:** Data files are imported in the software only if they were collected using a GNSS receiver that is **authorized by a license** (as described in the following sections).
  The following conditions also apply:
  - All licenses have a **starting GNSS date**. Only data files that were started on the field after that GNSS date can be imported in the software;
  - Some licenses also have an **ending GNSS date**. If it is the case, only data files ended on the field before that date can be imported in the software;
  - Post-processing can be done at any time, as long at the license is valid, as described above;
- **RINEX:** Data files are imported in the software only if they have a GNSS time that overlap with at least one licensed (and therefore **non-RINEX**) data file.

> Tip: Import your RINEX data last, since the non-RINEX data files are pre-requisites.

The software enforces the following licensing rules when changing data type:

- **Non-RINEX:** No restriction as long as the file is authorized by a license.
- **RINEX:** Can only be switched to static or base.

The software enforces the following licensing rules when generating baselines:

- A baseline between two **RINEX** files is not permitted.
- A baseline with one **RINEX** is permitted as long as the other is a **Non-RINEX** licensed file.

The software enforces the following licensing rule when generating trajectories:

- The rover must be a **Non-RINEX** licensed file.

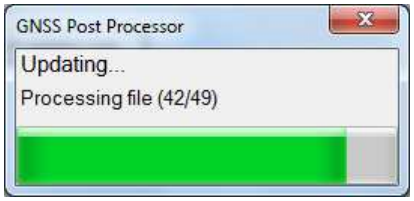
The software enforces the following licensing rule when generating PPP:

- The rover or static must be a **Non-RINEX** licensed file.

Automatic License Updates

The software automatically checks for license updates at startup. This is the easiest way to ensure that all your data files collected with GNSS receivers that are licensed for the software are automatically accepted.

During the automatic check, the following dialog briefly appears if your computer is connected to the Internet:

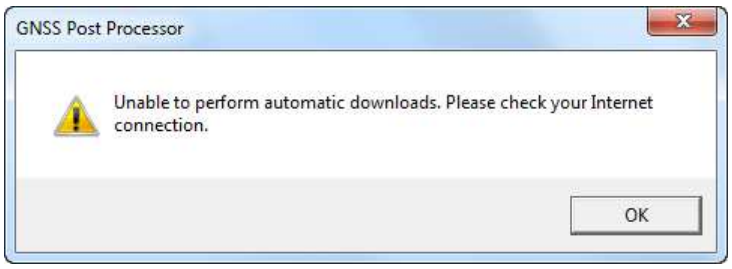


Checking for Data Updates

If you do not wish to have automatic updates, you can uncheck the **Automatically check for updates upon startup** box from **Tools > Options… > Updates** page.

RECOMMENDED: It is strongly recommended to leave automatic updates ON, unless you know that you are never going to be connected to the Internet. If you turn it OFF then you may be prompted to obtain a license later on (if you buy a new receiver). Automatic updates also provide the latest versions of base providers and other parameter files.

If for any reason the software is not able to contact the license server, then the following message will be displayed:



Unable to perform automatic downloads

Reasons for this message may be that your Internet cable is not properly hooked up, or that your enterprise firewall prevents Internet connections from the software. Please check with your system administrator.

License Updates when importing files

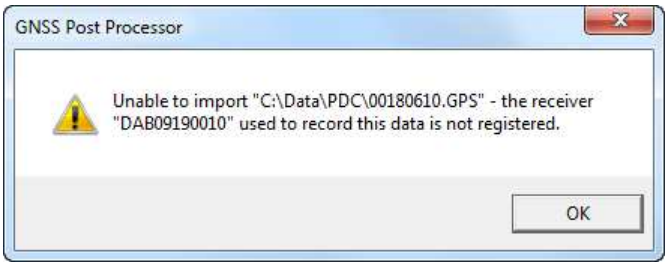
The software performs a license check whenever you import data files using the **Project Manager**.

If the software detects a data file for a properly licensed GNSS receiver, then the import goes on normally, according to the rules described in the Licensing Rules section above. However, if the software detects a data file for an unlicensed GNSS receiver, then it will display the following message:

GNSS Post Processing Licensing

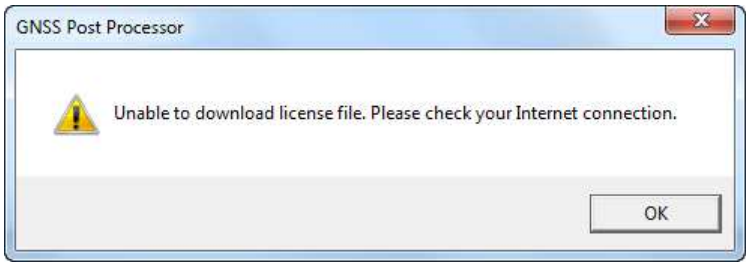
Updating from the Internet

If you are connected to the Internet, select **Update from the Internet** and click **Update**. If your GNSS receiver is licensed for the software then your data file will be imported normally, otherwise the following message will be displayed, indicating that your GNSS receiver is not licensed for the software. Ask your dealer for a software license for this GNSS receiver.



Error – Receiver not registered

If for any reason the software is not able to contact the license server then the following message will be displayed:



Error – Unable to download license file

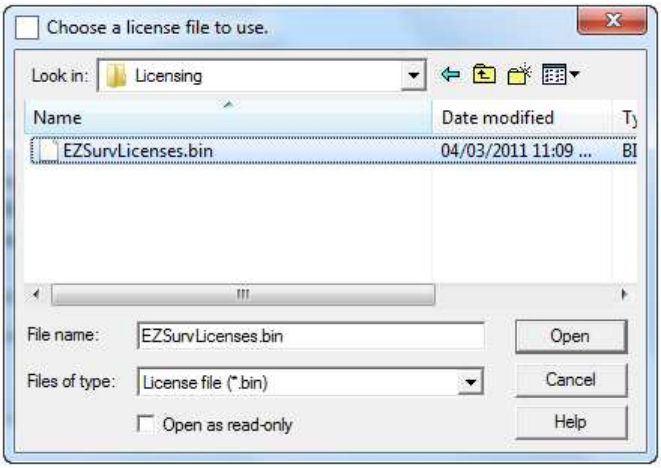
This may be because you do not have a working Internet connection. Please check with your system administrator.

Updating from a File

If you still do not have an Internet connection then you can request a license file from your dealer. Once you have obtained the license file:

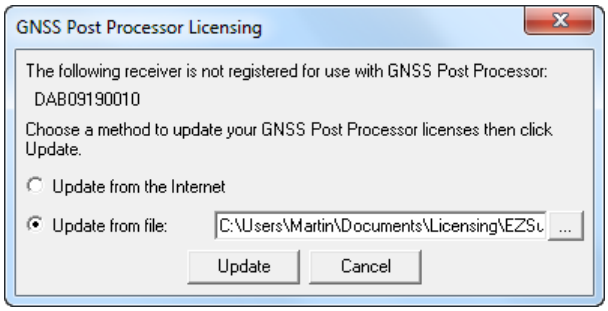
a. Select **Update from file**.

b. Click on the ... button. The **Choose a license file to use** dialog is shown.



Choose a license file to use

c. Select the file, click **Open**. You are back to the **GNSS Post Processor Licensing** dialog.

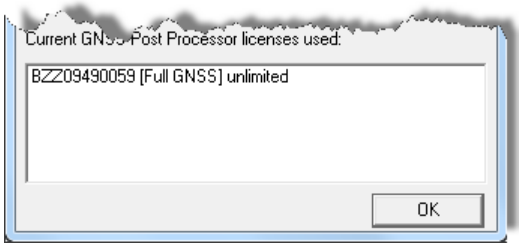


GNSS Post Processing Licensing – Update from file

d. Click **Update**.

Viewing your Licensed GNSS Receivers

Select **Help > About...** to view the list of licensed GNSS receivers associated with data files that have been imported into the software.



About EZSurv®

It includes the following information:

- Receiver ID (BZZ09490059 in the above example)
- License ([Full GNSS] in the above example) It is composed of bands and constellations.
    - Bands: Possible values are:
        - **Full**: Use all bands (L1/L2).
        - **L1**: Use only L1 band.
        - **Lite**: Use only L1 band and are limited to FLOAT solution (sub-meter/sub-foot).
    - Constellations: Possible values are:
        - **GPS**: Use only GPS constellation.
        - **GNSS**: Use any constellation.
- License start date (if any, none in the above example)
- License end date or unlimited if it does not expire (unlimited in the above example)

Appendix G – Licensing by computer

IMPORTANT: An Internet connection is required to add or remove this type of license.

IMPORTANT: You need administrator privilege on your computer to add or remove this type of license.

There are two types of license by computer: RINEX and OPEN.

These two licenses are mutually exclusive.

You need to contact your reseller to purchase one of these licenses.

Upon purchase, your reseller will provide an **Activation Code**.

An **Activation Code** is valid for one computer only.

However, it is possible to remove the license on one computer and then register it on another computer.

RINEX license

The RINEX license supports importing any recognized RINEX files

The RINEX license can be used in complement of the licensing by GNSS receiver (see ***Licensing by GNSS Receiver*** section for more details). It supports both licensed receivers binary format and import recognized RINEX files.

OPEN license

The OPEN license supports importing any recognized receiver binary format and any recognized RINEX files.

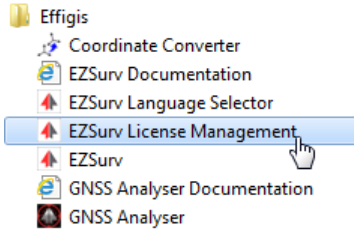
Since OPEN license import binary as well as RINEX formats, there is no need for any license by GNSS receiver as described in ***Licensing by GNSS Receiver*** section.

Adding a computer license

IMPORTANT: Both an Internet connection and administrator privileges are required to add a computer license.

Close EZSurv if it is open.

Start **EZSurv License Management** under Windows Main Menu under **Effigis**.



EZSurv License Manager in Star Menu

It displays the **License Manager**.

License Manager

Click on **Activate a License for this computer**. It will display the **License Information**.

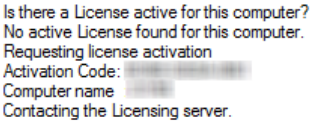
License Information

Enter the **Activation Code** provided by your reseller.

You can optionally edit the **Computer Name** to replace the default name. The **Computer Name** is for your internal use. If you try using the same **Activation Code** on another computer, you will be reminded where the **Activation Code** is currently in use.

Click on **Request Activation** button.

It will connect to the Internet and request license activation.



License Manager - messages

If the **Activation Code** is not used by any computer, it will attach the **Activation Code** to this computer and display the **License Registration Result**.

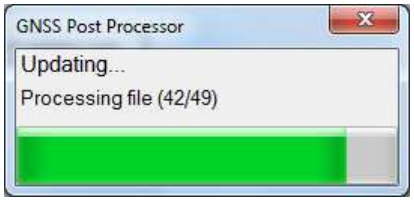
License Registration Result

Click on **OK** and the **License Management** closes.

A new license is now ready for you on the Effigis server. It still needs to be transferred to your computer.

Start EZSurv.

During Data Updates, your new license is transferred to your computer.



Checking for Data Updates

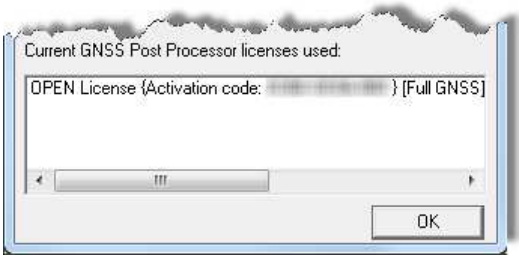
Once Data Updates is completed, your new license is active on this computer.

IMPORTANT: Uninstalling the software does not remove the license. If you want to uninstall the software and move the license from one computer to another, you need to remove the license first, and then uninstall the software.

Viewing your computer License

To check if you have a computer license and which type, select **Help > About…**.

The type of license is indicated in the **Current GNSS Post Processor licenses used** section:



About – Licensed used

It includes the following information:

- Type of license (OPEN in the above example). Possible values are:
  - **OPEN**
  - **RINEX**
- Activate Code: The **Activate Code** used to license this computer.
- License ([Full GNSS] in the above example) It is composed of bands and constellations.
  - Bands: Possible values are:
    - **Full**: Use all bands (L1/L2).
    - **L1**: Use only L1 band.
    - **Lite**: Use only L1 band and are limited to FLOAT solution (sub-meter/sub-foot).
  - Constellations: Possible values are:
    - **GPS**: Use only GPS constellation.
    - **GNSS**: Use any constellation.
- License start date (if any)
- License end date or unlimited if it does not expire.

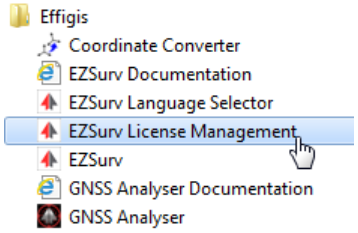
Removing a computer license

IMPORTANT: Both an Internet connection and administrator privileges are required to remove a computer license.

IMPORTANT: Uninstalling the software does not remove the license. If you want to uninstall the software and move the license from one computer to another, you need to remove the license first, and then uninstall the software.

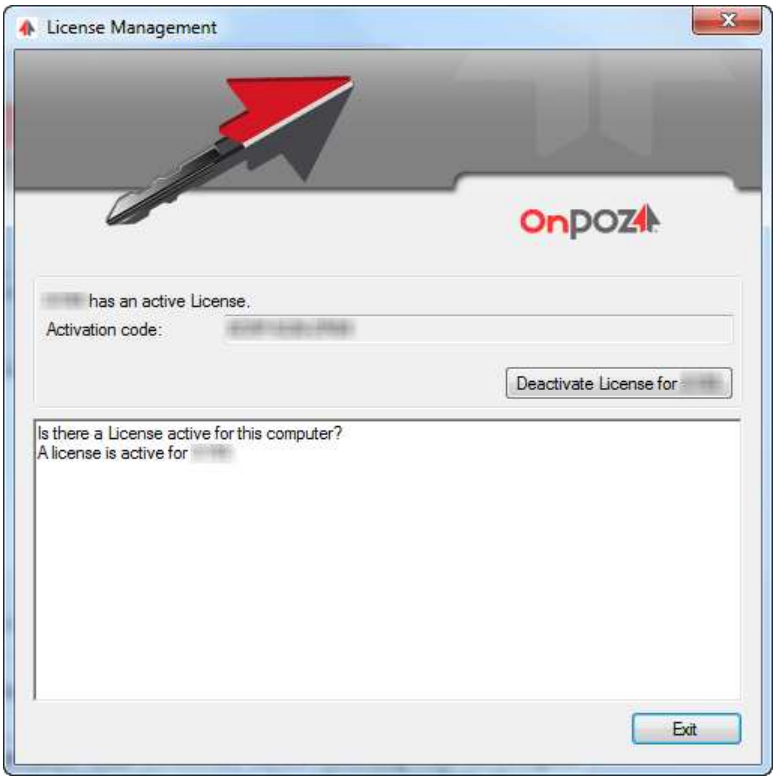
Close EZSurv if it is open.

Start **EZSurv License Management** under Windows Main Menu under **Effigis**.



EZSurv License Manager in Star Menu

It displays the **License Manager**.



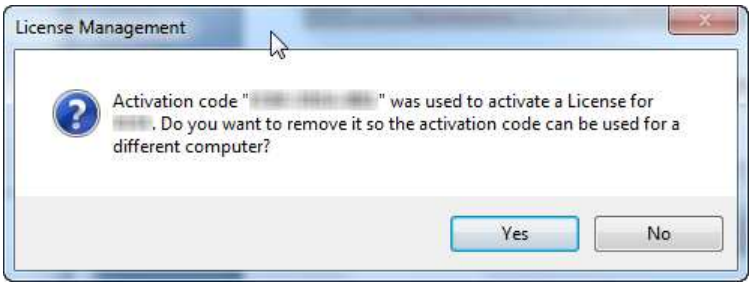
License Manager

At this point, you should see your active license.

IMPORTANT: Please write down your **Activation Code** somewhere before continuing. After removing the license, the **Activation Code** will no longer be listed on this computer. You will need your **Activation Code** to license another computer. If you lose your **Activation Code**, you will need to contact your reseller.

Click on **Deactivate License** button.

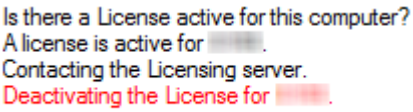
You will be prompted to confirm you want to remove the license.



License Manager - confirmation

Click **Yes**.

It will connect to the Internet and request license deactivation.



License Manager - messages

It displays the **License Registration Result**.

License Registration Result

Click **OK** and the **License Management** closes.

EZSurv is no longer licensed on this computer.

Appendix H – Solution Type

Solution types are used thru the software to indicate the quality of a position.

From best to worst, here is the relative quality of a particular solution type:

- Network
- Fixed
- Float
- Pseudorange
- DGNSS
- GNSS
- None

Code	Short name	Long name	Category
1	PSR	Pseudoranges (raw)	Pseudorange
4	L1	L1 (fixed)	Fixed
6	L3	L3 (fixed iono-free)	Fixed (L1/L2 combination)
7	L4	L4 (fixed wide lane)	Fixed
9	L1f	L1 (float)	Float
10	L3f	L3 (iono-free)	Float (L1/L2 combination)
126	Network	Network	Network

Post-Processed Solution Types

Code	Short name	Long name	Category
0	None	None	None
128	USR	User	None
129	GNSS	Field (GNSS)	GNSS
130	RTCM	Field (RTCM)	DGNSS
131	RT20	Field (RT20)	DGNSS
132	RT2	Field (RT2)	DGNSS
133	RT*	Field (RTSTAR)	DGNSS
134	WAAS	Field (WAAS)	DGNSS

135	GNSS+DR	Field (GNSS+DR)	DGNSS
136	DR	Field (DR)	DGNSS
137	N/A	N/A	None
138	RTK fixed	Field (FIXED)	Fixed (RTK)
139	RTK float	Field (FLOAT)	Float (RTK)
160	None	NO_SOLUTION	None
161	Auto	AUTONOMOUS	GNSS
162	DGPS	DGPS	DGNSS
163	FLOAT	FLOAT	Float (RTK)
164	FIXED	FIXED	Fixed (RTK)
165	StarFire dual	StarFire dual	DGNSS
166	RTK Float	RTK Float	Float (RTK)
167	RTK X	RTK X	Fixed (RTK)
168	RTK WL fixed	RTK WL fixed	Fixed (RTK)
169	RTK L1 fixed	RTK L1 fixed	Fixed (RTK)
170	RTK dual fixed	RTK dual fixed	Fixed (RTK)
171	StarFire Degrade	StarFire Degrade	DGNSS

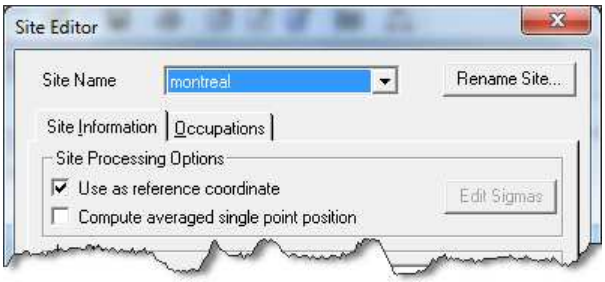
Unprocessed Solution Types

Appendix I – Network Adjustment

GNSS Network Adjustment

Whether a large or a small GNSS campaign has been carried out, it is a common procedure to integrate each individual GNSS baseline into a network adjustment. The goal of the adjustment is to obtain a unique set of coordinates as well as valid representation of their accuracies.

The software's network adjustment module takes as input vector's solutions with their corresponding covariance's matrix. This matrix is used to weight properly the vector's solution in the adjustment. So, very accurate observations should therefore have higher weights than less accurate observations. Also, a task that needs to be done before starting an adjustment is to select station(s) that will be held fixed during the process. The software will keep fixed all stations which have been selected as reference site (marked **Use as reference coordinate** in the **Site Editor**). If none of them are checked, the software will automatically select one to generate a minimally constrained solution. You can see in the network's summary, which station(s) were held fixed by looking at the **Apriori Reference Stations Coordinates** section.

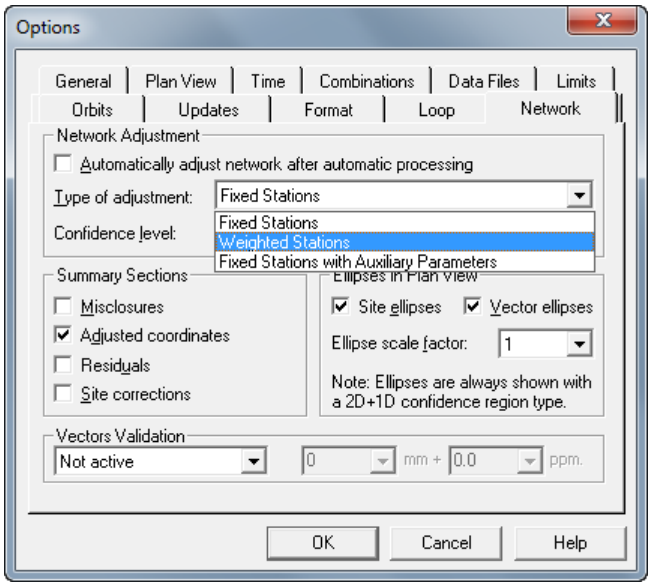


Site Editor – Use as reference coordinate

The Estimated Variance Factor

One important adjustment result given by the report is the estimated variance factor ($\hat{\sigma}_0^2$). Since the a priori variance factor is assumed to be known and equal to 1, the $\hat{\sigma}_0^2$ value will basically shows the coherence of the covariance matrix along with their observations. For that reason, all covariance matrices resulting from the software's adjustment module are scaled with that value. If the $\hat{\sigma}_0^2$ value is larger than 1, then the input covariance matrices are too small for the network (as a whole) so the observations were adjusted more than expected (vector corrections are larger than what could be expected from the covariance matrix). On the same principle, if the $\hat{\sigma}_0^2$ value is smaller than 1, then the input covariance matrices are too large and the observations were adjusted less than expected.

The $\hat{\sigma}_0^2$ scaling is also important when combining GNSS with other type of observations as it's done in a weighted stations adjustment. A weighted stations adjustment is an adjustment where reference stations are kept free and are represented by a set of coordinate observations with their corresponding sigmas. Normally the source of the "observed" coordinates and the corresponding covariance matrix is a previous network adjustment. In the software, you can do this kind of adjustment by selecting the **Weighted Stations** type of adjustment in the **Network** page in the **Options** dialog and then by adding sigmas to your reference stations with the **Edit Sigmas** button in the **Site Editor**.



Options – Network – Choosing type of adjustment

Chi Squared Test

A common statistical test often used in network adjustment is performed by comparing the $\hat{\sigma}_0^2$ value against the chi-squared distribution. The confidence level and the degrees of freedom are other values involved in the computation of the chi-squared test. If the test fails for a GNSS adjustment it may indicate the presence of one or more of the following problems:

- Poor estimate of standard deviations and correlations of observations. The observation residuals are significantly larger or smaller than those implied by the input covariance's matrices. They may be inappropriate and may require re-scaling.
- Model or systematic error. Are enough parameters held fixed?
- Significant gross errors in one or more of the observations, for example, blunders in the measurement of antenna height propagating into an incorrect baseline solution.
- Poor quality (low precision) observations.

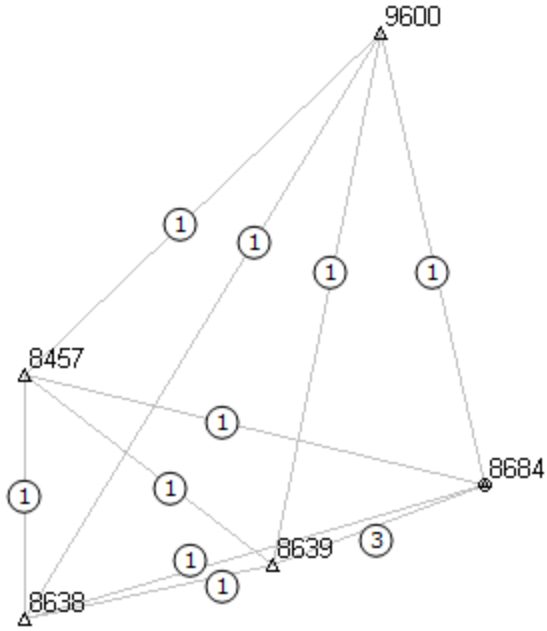
It is however possible to make such errors and have a solution that still pass the chi squared test!

Standardized Residuals

Another tool to analyze the adjustment results is by comparing all standardized residual (ratio of a residual over its sigma) against a statistical constant known as the residual critical value which is computed from the degrees of freedom and the Student statistical distribution. Any standardized residual greater than the critical value is flagged in the report and may represent an observation outlier that needs to be rejected.

Practical Examples

To clarify some network adjustment concepts, let's look at results obtained from the network showed by the following picture which consists of 5 stations and 12 GNSS vectors. In that network, all vectors have been observed during the same time span except for the 2 redundant vectors of 8639-8684. The first 2 cases shows the impact of vectors selection in a network adjustment while case 3 and 4 address the weighted stations type of adjustment.



Network of GNSS observations

Example – Case 1

The first case shows a minimally constrained solution with all 12 vectors. The results show a small $\hat{\sigma}_0^2$ value with a failing chi-squared test. In this case, with $\hat{\sigma}_0^2$ less than 1, it could be fine (observations are more accurate than expected, it comes from the fact that there are dependant vectors in the adjustment that could lead to optimistic statistics) Notice also that since it's a fixed stations adjustment, the reference station (UUU) has no sigmas.

```
ADJUSTMENT PARAMETERS
-------------------------------------------------------------------------------
Number of Sites:             5        Number of Vectors:                    12
Adjustment type:             Fixed

ADJUSTMENT RESULTS
-------------------------------------------------------------------------------
Iterations:                  1        Residual Critical Value:           3.096
Degrees of Freedom:          24       Residuals over Critical Value:         1
Estimated Variance Factor:   0.4633   Chi2 Test:    0.282 < 1 < 0.896 (FAILED)

ADJUSTED COORDINATES
-------------------------------------------------------------------------------
N.B. Fix status codes are (N)ot fixed, (U)ser fixed and (S)oftware fixed.
     Fix order is Latitude, Longitude, Height.

NNN 8457                                    UUU 8684
     WGS84                        (meters)          WGS84                        (meters)
```

```
     Lat:  N 45 19 21.42778    +/-  0.001          Lat:  N 45 18 51.97924    +/-  0.000
     Lon:  W 74 01 09.11858    +/-  0.001          Lon:  W 73 57 26.52939    +/-  0.000

     Elevation (meters)                            Elevation (meters)
     Hgt:             2.109    +/-  0.003          Hgt:           -12.318    +/-  0.000

NNN 8638                                       NNN 9600
     WGS84                       (meters)          WGS84                       (meters)
     Lat:  N 45 17 58.94735    +/-  0.001          Lat:  N 45 21 22.35016    +/-  0.001
     Lon:  W 74 01 02.85481    +/-  0.001          Lon:  W 73 58 27.25444    +/-  0.001

     Elevation (meters)                            Elevation (meters)
     Hgt:           -13.475    +/-  0.003          Hgt:           -21.692    +/-  0.003

NNN 8639
     WGS84                       (meters)
     Lat:  N 45 18 21.73928    +/-  0.001
     Lon:  W 73 59 06.12486    +/-  0.001

     Elevation (meters)
     Hgt:           -11.836    +/-  0.002
```

Example – Case 2

The next case shows the same kind of adjustment except that it uses only independent vectors. For example, we've dropped the vector 8457-8684 since its information is all included in vectors 9600-8457 and 9600-8684 (because all 3 vectors have been collected on the same period of time). From the previous adjustment, we only have kept 6 independent vectors. Even if this network is not quite strong in term of redundancy, we notice that we obtain a $\hat{\sigma}_0^2$ value closer to 1, a successful chi-squared test and more realistic sigmas.

```
ADJUSTMENT PARAMETERS
-------------------------------------------------------------------------------
Number of Sites:             5        Number of Vectors:                     6
Adjustment type:             Fixed

ADJUSTMENT RESULTS
-------------------------------------------------------------------------------
Iterations:                  2        Residual Critical Value:           2.311
Degrees of Freedom:          6        Residuals over Critical Value:         0
Estimated Variance Factor:   0.7537   Chi2 Test:    0.313 < 1 < 3.653 (PASSED)

ADJUSTED COORDINATES
-------------------------------------------------------------------------------
N.B. Fix status codes are (N)ot fixed, (U)ser fixed and (S)oftware fixed.
     Fix order is Latitude, Longitude, Height.

NNN 8457                                       UUU 8684
     WGS84                       (meters)          WGS84                       (meters)
     Lat:  N 45 19 21.42779    +/-  0.003          Lat:  N 45 18 51.97924    +/-  0.000
     Lon:  W 74 01 09.11845    +/-  0.002          Lon:  W 73 57 26.52939    +/-  0.000

     Elevation (meters)                            Elevation (meters)
     Hgt:             2.114    +/-  0.006          Hgt:           -12.318    +/-  0.000

NNN 8638                                       NNN 9600
     WGS84                       (meters)          WGS84                       (meters)
     Lat:  N 45 17 58.94738    +/-  0.003          Lat:  N 45 21 22.35013    +/-  0.003
     Lon:  W 74 01 02.85467    +/-  0.002          Lon:  W 73 58 27.25436    +/-  0.002

     Elevation (meters)                            Elevation (meters)
     Hgt:           -13.468    +/-  0.005          Hgt:           -21.689    +/-  0.005

NNN 8639
```

```
     WGS84                        (meters)
     Lat:  N 45 18 21.73931    +/-  0.003
     Lon:  W 73 59 06.12475    +/-  0.002

     Elevation (meters)
     Hgt:           -11.829    +/-  0.005
```

Example – Case 3

In this case, we've done the same process than case 1 except that we've performed a weighted stations adjustment by adding sigmas (0.050m, 0.050m and 0.100m) to our reference station. In fact, adding only one weighted reference station will give the same results as case 1 but will scale the resulting sigmas. Notice the unit $\hat{\sigma}_0$ value resulting from the pre-process iteration to scale GNSS observations alone. It is also normal to get all stations with the same sigmas if the ones coming from the reference station are significantly larger than the ones obtained from the GNSS vectors results alone. An approximate way to compute a resulting sigma is given by:

$$Sigma_{Weighted} = \sqrt{Sigma^2_{ObsCrds} + Sigma^2_{ObsGPS}}$$

```
ADJUSTMENT PARAMETERS
-------------------------------------------------------------------------------
Number of Sites:             5        Number of Vectors:                    12
Adjustment type:             Weighted

ADJUSTMENT RESULTS
-------------------------------------------------------------------------------
Iterations:                  2        Residual Critical Value:           3.096
Degrees of Freedom:          24       Residuals over Critical Value:         0
Estimated Variance Factor:   1.0000   Chi2 Test:    0.610 < 1 < 1.935 (PASSED)

ADJUSTED COORDINATES
-------------------------------------------------------------------------------
N.B. Fix status codes are (N)ot fixed, (U)ser fixed and (S)oftware fixed.
     Fix order is Latitude, Longitude, Height.

NNN 8457                                     UUU 8684
     WGS84                        (meters)          WGS84                        (meters)
     Lat:  N 45 19 21.42778    +/-  0.050           Lat:  N 45 18 51.97924    +/-  0.050
     Lon:  W 74 01 09.11859    +/-  0.050           Lon:  W 73 57 26.52939    +/-  0.050

     Elevation (meters)                             Elevation (meters)
     Hgt:             2.109    +/-  0.100           Hgt:           -12.318    +/-  0.100

NNN 8638                                     NNN 9600
     WGS84                        (meters)          WGS84                        (meters)
     Lat:  N 45 17 58.94735    +/-  0.050           Lat:  N 45 21 22.35015    +/-  0.050
     Lon:  W 74 01 02.85481    +/-  0.050           Lon:  W 73 58 27.25444    +/-  0.050

     Elevation (meters)                             Elevation (meters)
     Hgt:           -13.474    +/-  0.100           Hgt:           -21.691    +/-  0.100

NNN 8639
     WGS84                        (meters)
     Lat:  N 45 18 21.73928    +/-  0.050
     Lon:  W 73 59 06.12487    +/-  0.050

     Elevation (meters)
     Hgt:           -11.836    +/-  0.100
```

Example – Case 4

The last case shows a weighted adjustment with 2 reference stations (8684 and 9600) which have received 0.050m, 0.050m and 0.100m for latitude, longitude and height sigmas respectively. Also, the input coordinates of those stations have been changed by the near same amount:

```
UUU 8684                                    UUU 9600
     WGS84                        (meters)          WGS84                        (meters)
     Lat:  N 45 18 51.97700    +/-  0.050           Lat:  N 45 21 22.35200    +/-  0.050
     Lon:  W 73 57 26.52600    +/-  0.050           Lon:  W 73 58 27.25700    +/-  0.050

     Elevation (meters)                              Elevation (meters)
     Hgt:           -12.200    +/-  0.100           Hgt:           -21.800    +/-  0.100
```

From the results shown below, we notice that reference stations are not fixed anymore. Also, the overall accuracy of network stations have improved (of 1-2 cm) since GNSS observations have tied the network. Be aware that since reference stations coordinates can changed in that type of process, they will be updated as normal sites with their new sigmas values in the software's database. Weighted adjustment should be used by expert users, unexpected results can be generated if weights are not properly apply.

```
ADJUSTMENT PARAMETERS
-------------------------------------------------------------------------------
Number of Sites:             5        Number of Vectors:                    12
Adjustment type:             Weighted

ADJUSTMENT RESULTS
-------------------------------------------------------------------------------
Iterations:                  2        Residual Critical Value:           3.127
Degrees of Freedom:          27       Residuals over Critical Value:         0
Estimated Variance Factor:   1.3369   Chi2 Test:    0.836 < 1 < 2.477 (PASSED)

ADJUSTED COORDINATES
-------------------------------------------------------------------------------
N.B. Fix status codes are (N)ot fixed, (U)ser fixed and (S)oftware fixed.
     Fix order is Latitude, Longitude, Height.

NNN 8457                                    UUU 8684
     WGS84                        (meters)          WGS84                        (meters)
     Lat:  N 45 19 21.42758    +/-  0.041           Lat:  N 45 18 51.98108    +/-  0.041
     Lon:  W 74 01 09.11817    +/-  0.041           Lon:  W 73 57 26.53194    +/-  0.041

     Elevation (meters)                              Elevation (meters)
     Hgt:             2.114    +/-  0.082           Hgt:           -12.427    +/-  0.082

NNN 8638                                    UUU 9600
     WGS84                        (meters)          WGS84                        (meters)
     Lat:  N 45 17 58.94715    +/-  0.041           Lat:  N 45 21 22.34792    +/-  0.041
     Lon:  W 74 01 02.85439    +/-  0.041           Lon:  W 73 58 27.25105    +/-  0.041

     Elevation (meters)                              Elevation (meters)
     Hgt:           -13.470    +/-  0.082           Hgt:           -21.574    +/-  0.082

NNN 8639
     WGS84                        (meters)
     Lat:  N 45 18 21.73908    +/-  0.041
     Lon:  W 73 59 06.12445    +/-  0.041

     Elevation (meters)
```

```
    Hgt:           -11.831    +/-  0.082
```

Conclusions

The general steps for adjusting a network using the software are:

- Uncheck all reference stations in the **Site Editor**.
- Select the **Fixed Stations** type of adjustment from the **Tools > Options > Network** page.
- Perform a preliminary process. This step will help you to find/repair any possible outliers.
- Change to a **Weighted Stations** type of adjustment if you want to add sigmas to your reference station(s).
- Fix your reference station(s), enter their coordinates and set their sigmas (if applicable).
- Perform a final process.

Another recommendation is to try to keep a balance between redundancy and independence. It is clear that the more you have independent vectors in your network the more the adjustment results and statistics will be reliable.

Appendix J – CSV Export

This appendix concerns the CSV export for export baselines, trajectories, rover PPP, sites and loops.

All CSV export generated two files:

- **<your_export_name>.csv**: The CSV export requested.
- **<your_export_name>_header.csv**: Another CSV file containing the header file for the CSV export requested.

A CSV file is a Comma Separated Value file. The format is the following:

- Each line contains the same number of columns.
- Each column is either:
  - **Number**: A number is written in the form xxx.yyy
  - **String**: A string is enclosed within quotes.
- Each column is separated by a comma.

CSV Header file

The header file contains general information at the time of the export.

The first column contains properties name.

The second column contains the current information for that property.

```
"Datum","NAD83 - Canadian Spatial Reference System"
"Ellipsoid","GRS 1980/WGS84"
"Geoid Model","<None>"
"Mapping System","MTM NAD83csrs 08N-SCoPQ [Transverse Mercator]"
"Measure Unit","Metric"
"Project Name","C:\SampleData\Static\Static.spr"
"Software Name","GNSS Post Processor"
"Software Version",""
"Time Unit","LOCAL"
```

CSV Header File

Fields	Description
Datum	Datum name for the current Mapping System.
Ellipsoid	Ellipsoid name from the current Mapping System.
Geoid Model	Geoid Model currently set in **Edit > Geoid…**
Mapping System	Mapping System currently set in **Tools > Mapping Systems… > Selector**
Measure Unit	Measure set in **Tools > Options > General**.

Project Name	Full project filename
Software Name	This application name
Software Version	This application version
Time Unit	Time unit set in **Tools > Options > Time**.

CSV Data file

The first line contains titles for each column.

All the other lines contain the data requested.

```
"SiteName","Lat","Lon","EllHgt","StdDevLat","StdDevLon","StdDevHgt","Solution"
"Station002",40.3530853413,-3.9107462669,709.810,0.005,0.005,0.007,"L3 (fixed iono-free)"
"Station003",40.4817659180,-3.3648315006,655.614,0.008,0.007,0.010,"L4 (fixed wide lane)"
"Station004",40.9750956012,-3.5225147977,1159.569,0.015,0.013,0.019,"L4 (fixed wide lane)"
"Station005",40.5324336152,-3.6464875512,731.639,0.004,0.004,0.005,"L3 (fixed iono-free)"
```

CSV Data file

All CSV are customizable using the **Profile Editor**. The user selects fields and chooses the order to export them. Each field corresponds to a column or a group of related columns

Some columns may be empty when there are not applicable. For example, a Position (Mapping) will be empty if the current mapping system is WGS84.

Here are all fields with their description and the corresponding columns:

Field	**Description and columns**
Backward Azimuth	Backward azimuth (remote to base) in decimal degree Column name: **BackAz**
Backward Vertical Angle	Backward vertical angle (remote to base) in decimal degree Column name: **BackVertAngle**
Base Antenna Height	Antenna height of the base in the current measure unit. Column name: **BaseAntHgt**
Base Data Type	Type of data in the base observation file (RINEX for example). Column name: **BaseDataType**
Base Geoid Undulation	Undulation of the base in the current measure unit. Column name: **BaseUnd**
Base Height (Ellipsoid)	Ellipsoid height of the base in the current measure unit. Column name: **BaseEllHgt**
Base Height (Orthometric/MSL)	Mean Sea Level height of the base in the current measure unit. Column name: **BaseMSL**
Base Position (3D-Cartesian)	Geocentric position of the base in the current datum and in the current measure unit. Column names: **Cart_BaseX**, **Cart_BaseY** and **Cart_BaseZ**
Base Position (Geographic)	Position of the base in decimal degree in the current datum. Column names: **BaseLat** and **BaseLon**

Base Position (Mapping)	Position of the base in the current mapping and in the current measure unit. Column names: **BaseX** and **BaseY**.
Base Site Name [required]	Site name of the base. Column name: **BaseSiteName**
Base Station Provider	Base station provider name when the base was downloaded. Column name: **Provider**
Closure (ECEF)	Closure in Earth-Centered, Earth-Fixed coordinates in meters. Column names: **ClosureDX**, **ClosureDY** and **ClosureDZ**.
Closure 2D	Closure in planimetry in the current measure unit. Column name: **Closure2D**
Closure 3D	Closure in altimetry and planimetry in the current measure unit. Column name: **Closure3D**
Closure H	Closure in altimetry in the current measure unit. Column name: **ClosureH**
Code	Site Code. Column name: **Code**
Data Type	Type of data in the observation file (RINEX for example). Column name: **DataType**
Distance (Geographic)	Geodetic distance for the vector in the current measure unit. Column name: **DistGeo**
Distance 3D	3D distance for the vector in the current measure unit. Column name: **Dist3D**
DOP	All variation of Dilution of Precision. No units. Column names: **NDOP**: North Dilution of Precision **EDOP**: East Dilution of Precision **VDOP**: Vertical Dilution of Precision **TDOP**: Time Dilution of Precision **HDOP**: Horizontal Dilution of Precision **PDOP**: Position Dilution of Precision **GDOP**: General Dilution of Precision
Ellipse (2D+1D)	Error ellipse parameters in planimetry and altimetry in the current measure unit. Column names: **EllipseMajorAz**: Ellipse major azimuth in decimal degree. **EllipseMajorLength (*XX.X*%)**: Ellipse major length. **EllipseMinorLength (*XX.X*%)**: Ellipse minor length. **EllipseVertical (*XX.X*%)**: Ellipse vertical height. **(*XX.X*%)**: Confidence level used for scaling ellipse. The value is taken from **Tools > Options > Network**. Possible values are: **68%**, **90%**, **95%**, **97.5%** and **99%**.
End Time (GPS)	End time in GPS. Column names:

	EndGPSWeek: GPS week **EndGPSSec**: GPS second
End Time (HH:MM:SS)	End time in the current time unit. Column names: **EndDate**: date in the YYYY/MM/DD format **EndTime**: time in the HH:MM:SS format **EndSecDec**: fraction of the second (between 0.0 and 0.999)
Forward Azimuth	Forward azimuth (base to remote) in decimal degree. Column name: **ForAz**
Forward Vertical Angle	Forward vertical angle (base to remote) in decimal degree. Column name: **ForVertAngle**
Geoid Undulation	Undulation in the current measure unit. Column name: **Und**
Height (Ellipsoid)	Ellipsoid height in the current measure unit. Column name: **EllHgt**
Height (Orthometric/MSL)	Mean Sea Level in the current measure unit. Column name: **MSL**
Height Standard Deviation	Standard deviation for the height in the current measure unit. Column name: **StdDevHgt**
Length	Length in the current measure unit. Column name: Length
Loop Name	Loop Name Column name: **Name**
Lower Covariance Matrix (ECEF)	Lower covariance matrix in square meters. Column names: **ECEF_CovarXX**, **ECEF_CovarYX**, **ECEF_CovarYY**, **ECEF_CovarZX**, **ECEF_CovarZY** and **ECEF_CovarZZ**
Mask Angle	Mask angle in decimal degree. Column name: **MaskAngle**
Number of Occupation	Number of occupations. Column name: **OccCount**
Number Of Pseudorange Used	Number of code observations used. Column name: **CodeCount**
Number of Satellites	Number of satellites used per constellation. Column names: **SatCountG**, **SatCountR**, **SatCountE** and **SatCountC** are for GPS, GLONASS, Galileo and BeiDou respectively.
Occupation [required]	Occupation number. Column name: **Occ**
Orbit/Clock Type	Type of orbits and clock used. Possible values are: **Broadcast**, **Precise** and **SP3**. Column names: **Orbits** and **ClockModel**
Position (3D-Cartesian)	Geocentric position in the current datum and in the current measure unit. Column names: **Cart_X**, **Cart_Y** and **Cart_Z**
Position (Geographic)	Position in decimal degree in the current datum.

	Column names: **Lat** and **Lon**
Position (Mapping)	Position in the current mapping and in the current measure unit. Column names: **X** and **Y**
Position Standard Deviation (Geo)	Standard deviation for the position in the current measure unit. Column names: **StdDevLat** and **StdDevLon**
Position Standard Deviation (Map)	Standard deviation for the position in the current measure unit. Column names: **StdDevX** and **StdDevY**
PPM	Closure in ppm (part per million) Column name: PPM
Processing Interval	Processing interval in second. Column name: **ProcInterval**
Ratio Quality Factor	Ratio quality factor. Column name: **Ratio**
RDOP	Relative Dilution of Precision. No unit. Column name: **RDOP**
Reference	“Y” if the site is used as a reference and “N” otherwise. Column name: **Reference**
Remote Antenna Height	Antenna height of the remote in the current measure unit. Column name: **RemoteAntHgt**
Remote Data Type	Type of data in the remote observation file (RINEX for example). Column name: **RemoteDataType**
Remote Geoid Undulation	Undulation of the remote in the current measure unit. Column name: **RemoteUnd**
Remote Height (Ellipsoid)	Ellipsoid height of the remote in the current measure unit. Column name: **RemoteEllHgt**
Remote Height (Orthometric/MSL)	Mean Sea Level height of the remote in the current measure unit. Column name: **RemoteMSL**
Remote Position (3D-Cartesian)	Geocentric position of the remote in the current datum and in the current measure unit. Column names : **Cart_RemoteX**, **Cart_RemoteY** and **Cart_RemoteZ**
Remote Position (Geographic)	Position of the remote in decimal degree in the current datum. Column names: **RemoteLat** and **RemoteLon**
Remote Position (Mapping)	Position of the remote in the current mapping and in the current measure unit. Column names: **RemoteX** and **RemoteY**
Remote Site Name [required]	Remote site name. Column name: **RemoteSiteName**
RMS	Root Mean Square in the current measure unit. Column name: **RMS**
Rover Antenna Height	Antenna height of the rover in the current measure unit. Column name: **RoverAntHgt**
Site Name [Required]	Site name.

	Column name: **SiteName**
Solution Status	Solution type. Column name: **Solution**
Solved Epochs	Number of solved epochs. Column name: **SolvedEpochs**
Solved Observations	Number of solved observations. Column name: **SolvedObservations**
Source	Site position source (how the position was obtained). Column name: **Source**
Speed (Geographic)	Speed in the current measure unit per second. Column names: **VNorth**: North component **VEast**: East component **VUp**: Vertical component
Speed Standard Deviation (Geo)	Standard deviation for the speed in the current measure unit per second. Column name: **StdDevVNorth**: Standard deviation in north direction. **StdDevVEast**: Standard deviation in the east direction. **StdDevVUp**: Standard deviation in the vertical direction.
Start Time (GPS)	Start time in GPS. Column names: **StartGPSWeek** : GPS week **StartGPSSec**: GPS second
Start Time (HH:MM:SS)	Start time in current time unit. Column names: **StartDate**: date in the YYYY/MM/DD format **StartTime**: time in the HH:MM:SS format **StartSecDec**: fraction of the second (between 0.0 and 0.999)
State	Type of loop. Possible values are **Closed** and **Open**. Column name: **State**
Time (GPS)	Time in GPS. Column names: **GPSWeek**: GPS week **GPSSecond**: GPS second
Time (HH:MM:SS)	Time in the current time unit. Column names: **Date**: date in the YYYY/MM/DD format **Time**: time in the HH:MM:SS format **SecDec**: fraction of the second (between 0.0 and 0.999)
Total Epochs	Total number of epochs. Column name: **TotalEpochs**
Total Observations	Total number of observations.

	Column name: **TotalObservations**
Troposphere Modeling Parameters	Parameters used for modeling the troposphere within calculation. Column names: **Tropospheric Model**: Name of the tropospheric model **DryTemperature**: Dry temperature in centigrade. **Pressure**: Pressure in millibar. **Humidity**; Humidity in percentage.
Used GNSS Frequencies	List of GNSS frequencies used by calculation for each constellation. Column names: **GPS**, **GLONASS**, **Galileo** and **BeiDou**: Column is empty if constellation is unused, multiple GNSS frequency are separated by a "/" (L1 or L1/L2 for example)
Vector (ECEF)	Earth-Centered, Earth-Fixed vector in the current measure unit. Column names: **ECEF_DX**, **ECEF_DY** and **ECEF_DZ**
Vectors	List of all segments used by a loop. It includes the vector name with the occupation in parenthesis. Column names: **Vector1**, **Vector2**, **Vector3** and **Vector4**

Appendix K – GRD Text Format

The GRD format comes both in text or binary format. This section describes only the text format.

The first line of the file is the header. It contains six values, separated by spaces or tabs. The header values are:

- Southern-most latitude in decimal degrees
- Northern-most latitude in decimal degrees
- Western-most longitude in decimal degrees
- Eastern-most longitude in decimal degrees
- Latitude spacing in decimal degrees
- Longitude spacing in decimal degrees

The header is followed by lines of data. Each data value is a geoid undulation in meters, separated by spaces, tabs, CR or LF characters. A line is usually 80 characters long. The scan order is from north to south and from west to east.

Example:

```
 27.00000    36.97500   -14.00000    -0.02500     0.02500     0.02500
 52.383     52.342     52.302     52.257     52.205     52.147     52.073     51.978
 51.864     51.742     51.619     51.498     51.378     51.261     51.144     51.029
 50.916     50.805     50.695     50.588     50.484     50.391     50.301     50.212
 50.122     50.029     49.930     49.821     49.700     49.571     49.437     49.298
 49.155     49.006     48.853     48.697     48.539     48.379     48.220     48.063
 47.912     47.767     47.631     47.503     47.385     47.275     47.175     47.083
```

Appendix L – Export Features Command-Line Interface

Command-Line Interface

ExportFeatures.exe can be called on the command-line using one of the following syntaxes, with parameters between brackets being optional.

ExportFeatures -tagex *filename*
[-log *filename***] [-window** *hwnd***] [-merge]**

ExportFeatures -input *filename* [*filename*]* **-outfolder** *foldername* [**-***subfolders*]
-profile *profilename*
[-log *filename***] [-window** *hwnd***] [-merge]**

ExportFeatures -job *filename*
-profile *profilename*
[-log *filename***] [-window** *hwnd***] [-merge]**

The command-line parameters are as follow. Parameters can appear in any order on the command-line.

Parameter	Short	Description
-? or **-help**	**-h**	Displays command-line help.
-branding *name*	**-b**	Set the branding (advanced)
-culture *language*	**-c**	Set the language. Valid languages are 'en' (English),'es' (Spanish), 'fr' (French) and 'pt' (Portuguese).
-input *filename [filename]**	**-i**	Full file name(s) of the input **TAG** or **POS** file(s) to export.
-job *filename*	**-j**	Full filename of a TAGEX file containing a valid **<Job>** tag. If an **<Options>** tag is present, it will be ignored. If this parameter is used, then the **-input, -outfolder**, and **-subfolders** parameters are ignored.
-log *filename*	**-l**	Full destination file name for the log file. The log file will contain information, warning and error messages in English.
-merge	**-m**	Merge all input files.
-outfolder *foldername*	**-o**	Full path name of the output folder.
-profile *profilename*	**-p**	Specifies the name of the profile from which to read the options.

		This parameter is required when not using the **-tagex** parameter.
-subfolders	**-su**	Create subfolders on output. This option is ignored if **-outfolder** parameter is not present.
-tagex *filename*	**-t**	Full file name of a TAGEX containing valid **<Options>** and **<Job>** tags. If this parameter is used, then the **-input, -outfolder**, **-subfolders**, **-job** and **-profile** parameters are ignored.
-window *hwnd*	**-w**	Handle of the parent window (if any).

Result Codes

ExportFeatures.exe returns one of the following result codes:

Code	Description
0	Success
1	Failed
2	Bad installation
3	File not found
4	Invalid file
8	Invalid path
9	Export with failures

The TAGEX Format

The **TAGEX** format contains an XML description of the options and job parameters.

- The **<TagExport>** tag is always present;
- Options are contained within the **<Options**> tag;
- Job-specific parameters are contained within the **<Job>** tag;
- When both the **<Options>** and **<Job>** tag are present, then the TAGEX file can be used with the **-tagex** option;
- When at least the **<Job>** tag is present, then the TAGEX file can be used with the **-job** option.

The **Export Features** graphical user interface save export profiles to TAGEX format. An export profile contains the **<Options>** tag, but not the **<Job>** tag.

Example:

```
<?xml version="1.0" encoding="UTF-8"?>
- <TagExport Language="en" Version="1" xmlns:xsd="http://www.w3.org/2001/XMLSchema"
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance">
  - <Options>
      <Format Name="KML"/>
      <Offsets BearingCorrectionValue="0" BearingCorrection="false" Output="true"/>
    - <Filters>
        <SatsFilter MinValue="4"/>
        <DOPFilter Active="false" MaxValue="8"/>
        <AccuracyFilter Active="false" MaxValue="7"/>
        <PathsFilter Active="false" Value="50"/>
      </Filters>
    - <CoordinatesBlock Output="true">
        <Height Output="true" User="false" GeoidName="" Type="Ellipsoidal"/>
      </CoordinatesBlock>
      <MetadataBlock Output="true"/>
      <ParentChildRelations Output="false"/>
      <Millisecond Output="false"/>
      <VerticesTables Output="true"/>
    - <Standards>
        <DOP Name="PDOP"/>
        <Accuracy Name="HOR_2SIGMA"/>
        <Time Name="Local"/>
        <Measure Name="Meter"/>
      </Standards>
      <CoordinateSystem Name="" WGS84="true"/>
  </Options>
  - <Job>
    - <Input>
        <File Name="C:\SampleData\GoogleEarth\RTK.TAG"/>
        <File Name="C:\SampleData\GoogleEarth\RTK.pos"/>
      </Input>
      <Output Subfolders="true" Folder="C:\Users\Martin\Documents\Effigis\Export
        Features"/>
  </Job>
</TagExport>
```

Appendix M – Customizing Export Features Output

AutoCAD DXF

By default each AutoCAD DXF output layer contains a single file with extension DXF, containing both the attribute data and the geometry.

You can edit the file **WriterDXF.xml** to change this default behavior in order to output one DXF file per layer.
On Windows Vista, Windows 7, Windows 8 or Windows 8.1, this file is located under **C:\ProgramData\VGI Solutions\Export Features\en**.

On Windows XP, this file is located under **C:\Documents and Settings\All Users\VGI Solutions\Export Features\en**.

In **WriterDXF.xml**, set the value of the **Output.OnlyOneDocument** key as follows:

- **"true"** (which is the default) : to output all layers to a single DXF file
- "**false"** to output each layer to a separate DXF file

Example:

```
<add value="true" key="Output.OnlyOneDocument"/>
```

TIP: When using separate DXF files for layers, use Insert > Block… in AutoCAD to load each layer successively into a single View.

Google Earth KMZ

The way in which the layers are built can be customized using configuration files. You can edit the file **WriterKML.xml** to change this default behavior in order to output layers using different symbols, scales, or ranges for grouping values. Details are at the top of the XML file.
On Windows Vista, Windows 7, Windows 8 or Windows 8.1, the English version of this file is located under **C:\ProgramData\VGI Solutions\Export Features\en**.

On Windows XP, the English version of this file is located under **C:\Documents and Settings\All Users\VGI Solutions\Export Features\en**.

Example:

```
<add value="1" key="GNSSLayerDocument.Range.HOR_1SIGMA.Meter.MinValue.2"/>
<add value="5" key="GNSSLayerDocument.Range.HOR_1SIGMA.Meter.MaxValue.2"/>
<add value="1 - 5 m ({0:F1}%)" key="GNSSLayerDocument.Range.HOR_1SIGMA.Meter.Label.2"/>
<add value="C80000EE" key="GNSSLayerDocument.Range.HOR_1SIGMA.Meter.Color.2"/>
<add value="0.5" key="GNSSLayerDocument.Range.HOR_1SIGMA.Meter.Scale.2"/>
```

For other languages, look into **fr** (French), **es** (Spanish) and **pt** (Portuguese) folders.

You can also change the symbols used to display features on the map. These files are located under the **KML** folder at the same location as above.

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