User Manual

Version V1.0-20171024

User Manual

Tersus Geomatics Office

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Manual Revision

Revision Date	Revision Level	Description
2017-10-22	Release	Tersus Geomatic Office User Manual1.0

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1. Installation and Uninstall

1.1 Software component

The whole software contains a CD and an operation instruction.

The CD contains all the installation procedure; this instruction introduces the operation of the software.

1.2 Installation

TGO software can be installed directly from the CD or the hard disk. It needs at least 32M internal storage and 200M hard disk. This software can be operated in the environment below:

- Microsoft ® Windows 95, 97, 98,SE, ME
- Microsoft ® Windows NT Service Pack 4 and the latter version
- Microsoft ® Windows 2000/XP
- Microsoft ® Windows7
- Microsoft .Net Frameworks 2.0

Installation steps:

If your computer has not installed Microsoft NET Framework 2.0 framework, please install the package "NetFrame2.exe first.

Run the program “TERSUS Geomatics Office.msi” which in the installation directory.

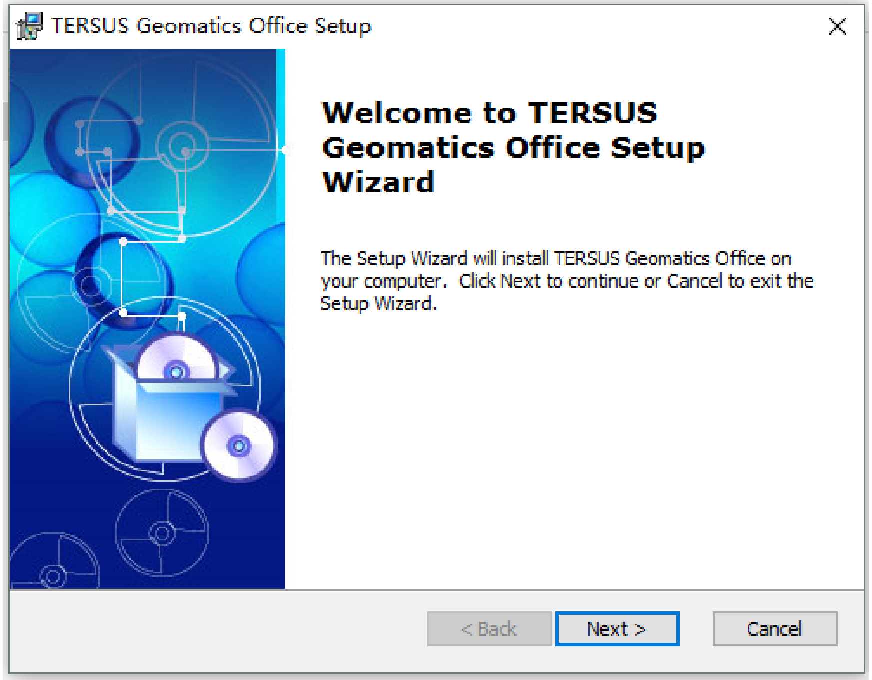


Figure 1-1 GTO wizard

Click ***Next***:

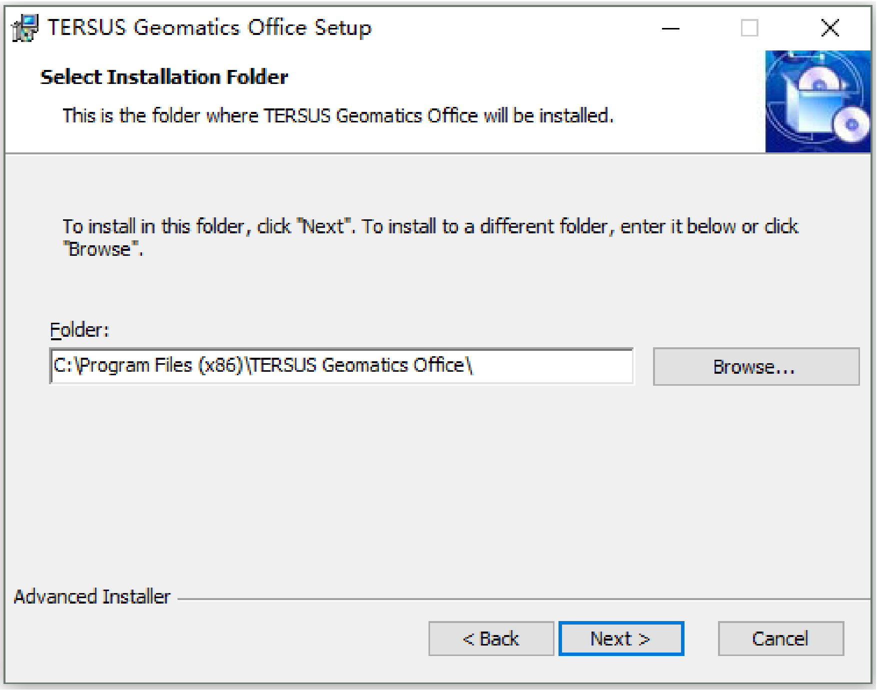


Figure 1-2 TGO installation 1

Choose an installation path and then click ***Next***:

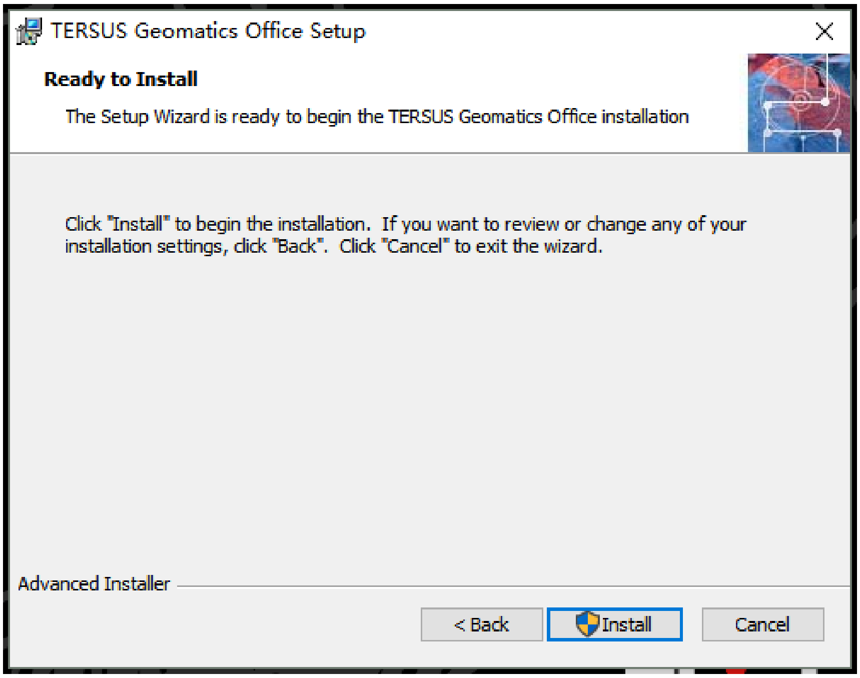


Figure 1-3 TGO installation 2

Click ***Install***:

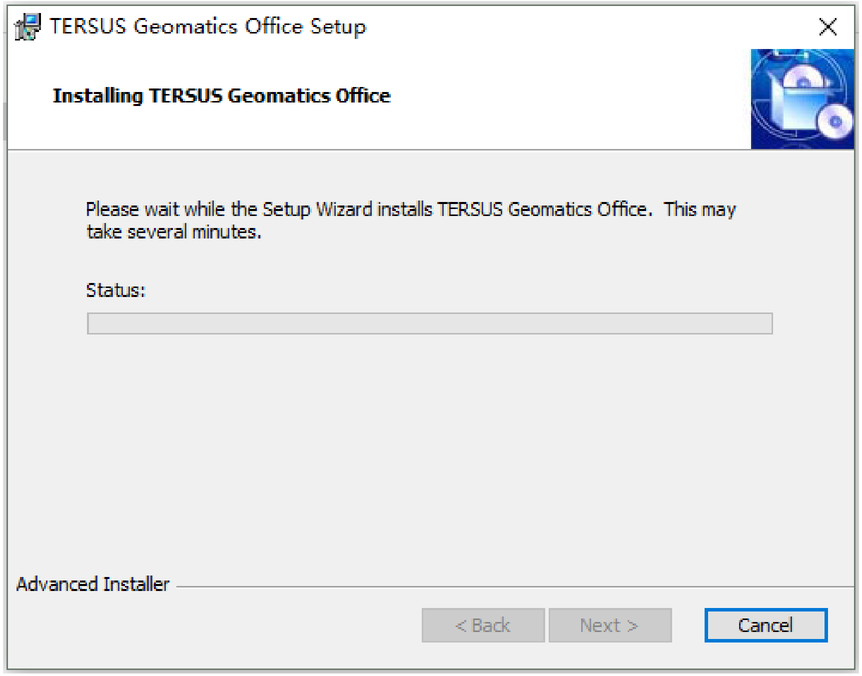


Figure 1-4 TGO installation 3

Wait until the entire program is installed successfully, then you will see the interface below:

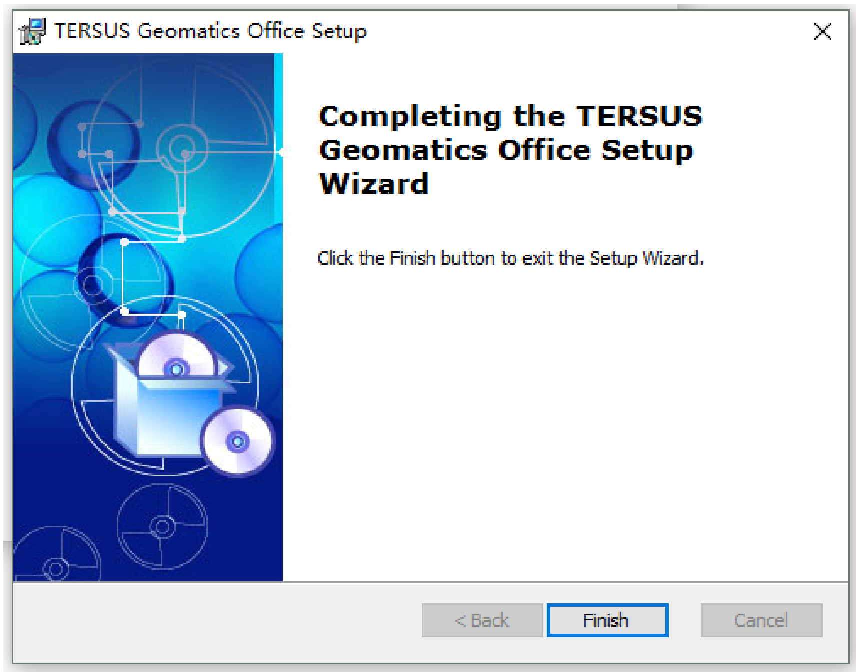


Figure 1-5 TGO installation 4

There will be a ***Tersus Geomatics Office*** directory generated automatically in the ***Start*** menu, and this file contains several icons (look at the picture below).

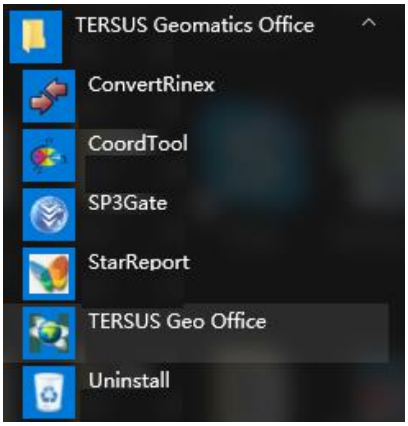


Figure 1-6 Start menu

1.3 Uninstall

Select Start\Program\Tersus-Geomatics Office\Uninstall to uninstall TGO.

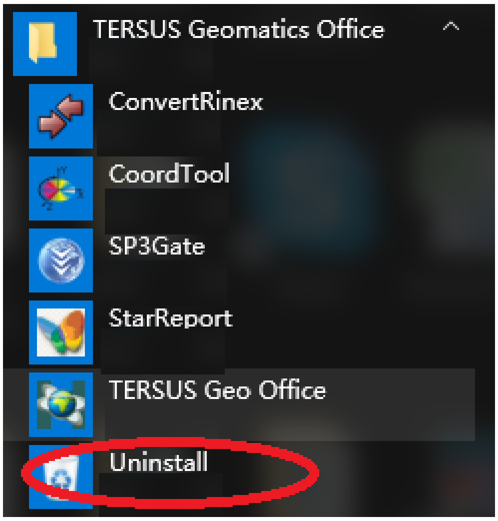


Figure 1-7 Uninstall

2. Quick Start Guide

In this chapter, we will provide the draft procedure about TGO software to resolve the data of static or dynamic. This chapter helps you to complete data processing roughly.

2.1 Static GPS Data Processing

2.1.1 Create a new project

Run TGO software, click  button in the navigation field to create a new project (Figure 2- 1). If necessary, set the project name and folder to store the project files. Otherwise, the files will be stored in the installation folder (Figure 2- 2). Click ***OK*** button to finish the project creation.

Figure 2- 1 Project menu

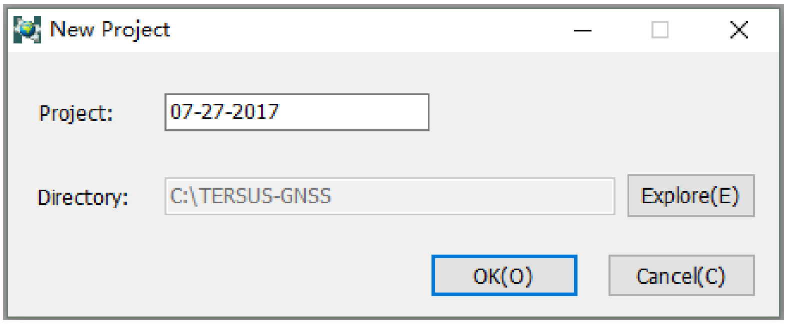


Figure 2- 2 New project

The project name and the directory to save the project files can be changed.

2.1.2 Set Property of the Project

Follow the wizard or click  button in the navigation field, the Project Properties dialog appears as Figure 2- 3. You can set the detail info of the project. Generally, you need to set the tolerance tab.

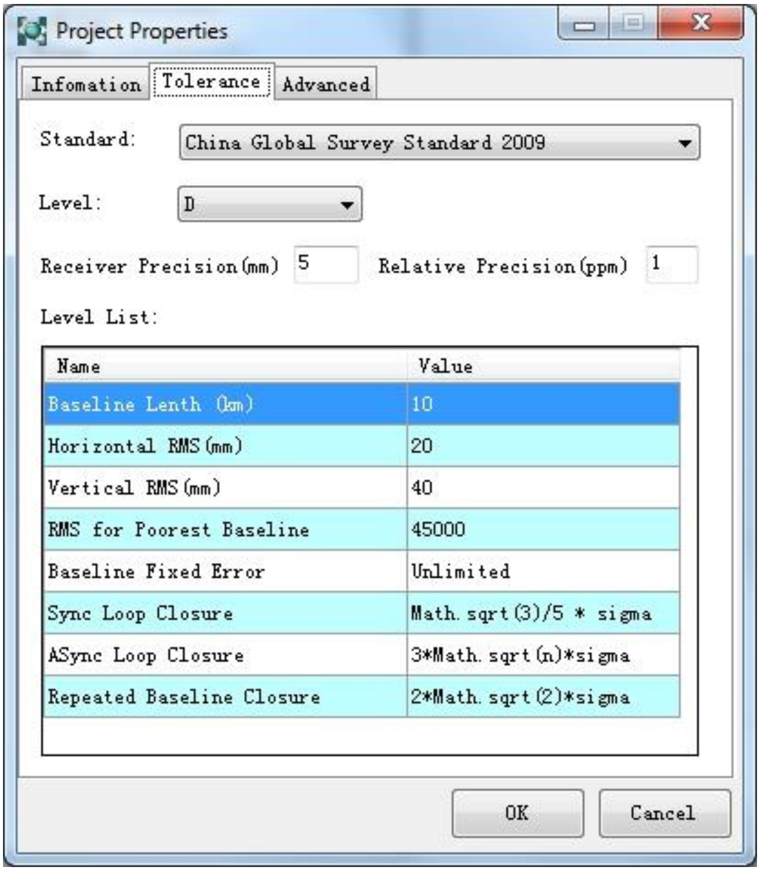


Figure 2- 3 Tolerance bar

2.1.3 Set up a Coordinate System

It is necessary to set up the coordinate system parameters for a new project. Click  button in the navigation field, the following dialog appears as Figure 2- 4. Generally, it's only needed to set the fields in **Ellipsoid**, **Projection** and **Convert** tabs. You can find more details of coordinate parameter setting in the following sections.

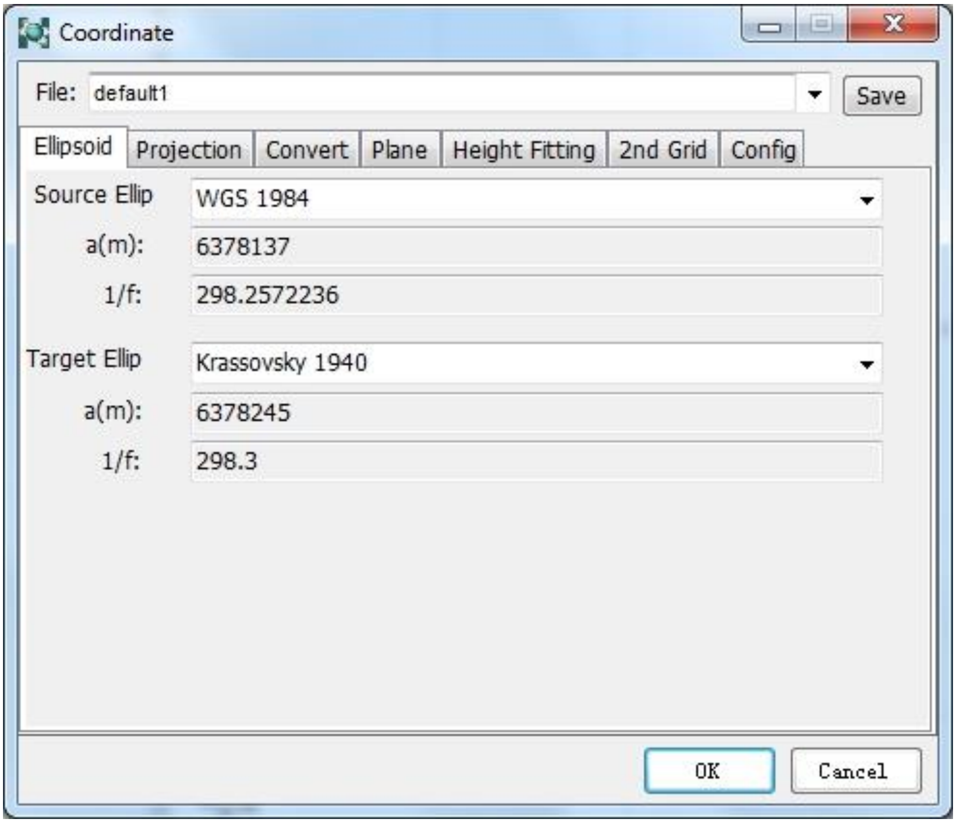


Figure 2- 4 Coordinate system

2.1.4 Import Static Data

Once you have set up your TGO project, you can import data into it.

Select  Import Files item in the navigation field, we can load on GPS data observation files (Figure 2- 5). Select static or auto mode in the dialog, click Select Files button or double-click to enter the file selection page, as Figure 2- 6:

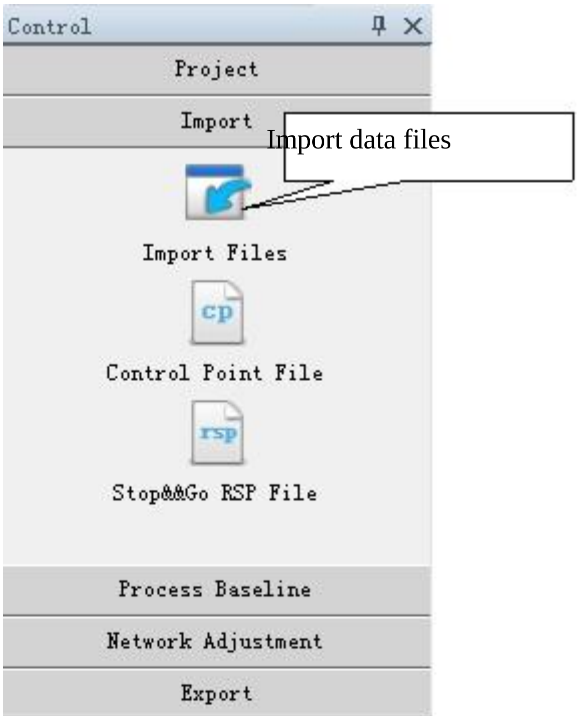


Figure 2- 5 Import menu

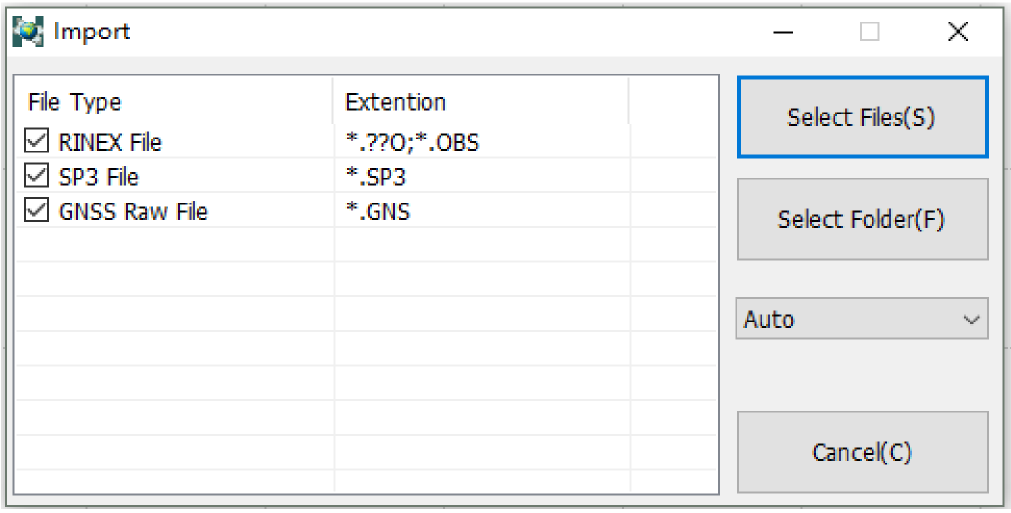


Figure 2- 6 Import files

Select the static files, as Figure 2- 7, you can press ***CTRL*** or ***SHIFT*** key to select multi-files, click ***Open*** to import the files (Figure 2- 8):

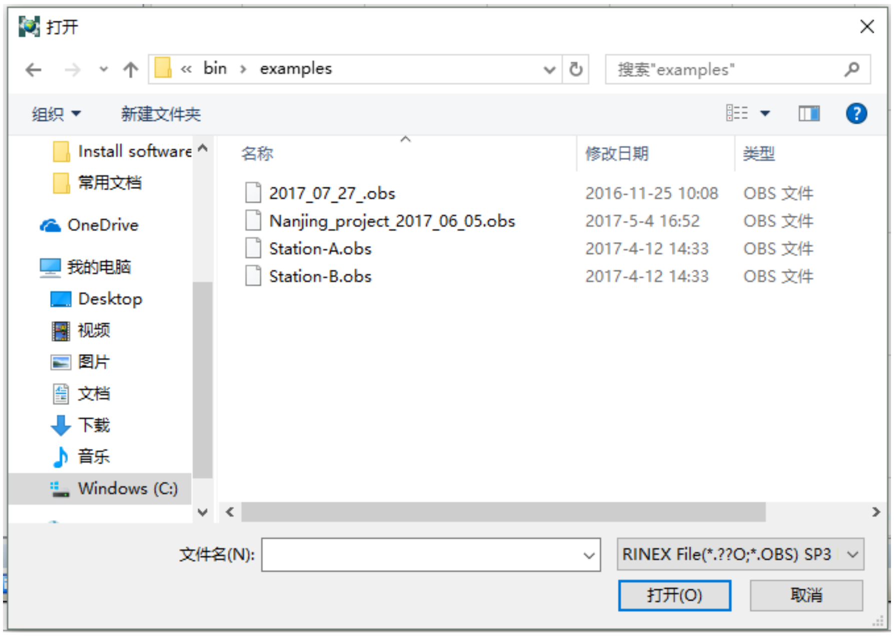


Figure 2- 7 Select mutiple files

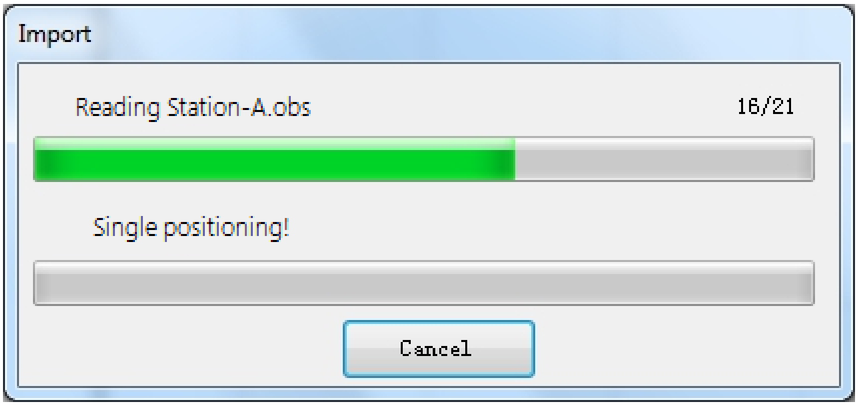


Figure 2- 8 Imorting files

After importing the files, TGO software can automatically generate the baselines, repeat baseline, sync loop, asynchronous loop and so on (Figure 2- 9).

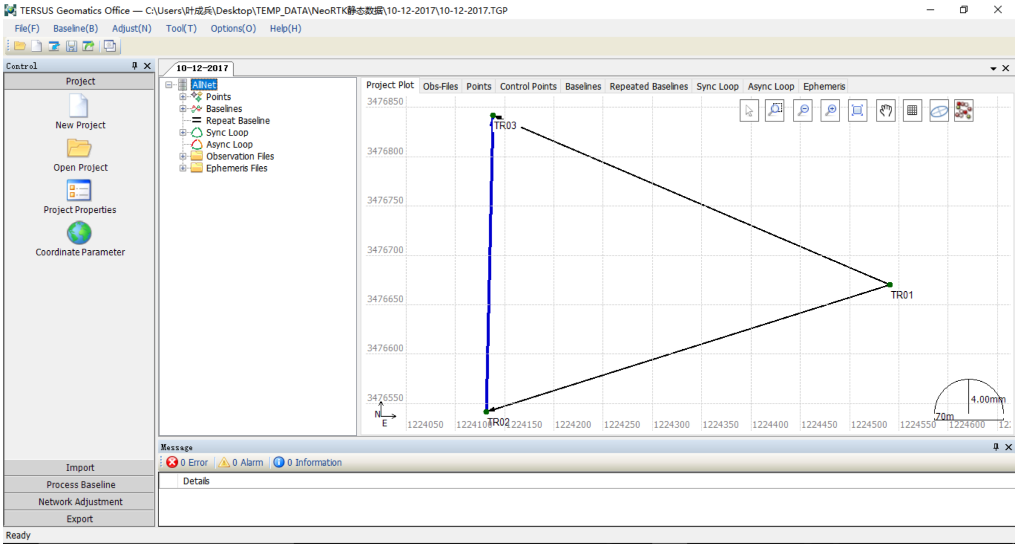


Figure 2- 9 Import files successfully

2.1.5 Edit Files Information

After all the files are loaded, TGO will display all the observation files. Select the Observation files and switch to ***Obs-files*** tab in the working field, and then you can see all files (Figure 2- 10). Double click one file to enter the editor window. Make sure the height antenna, the type of receiver and antenna are right (Figure 2- 11). Check these items for all files.

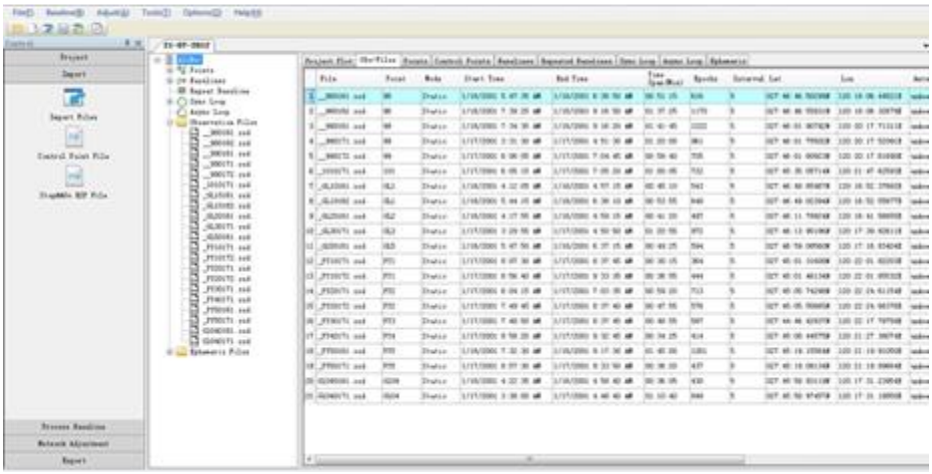


Figure 2- 10 Observations files

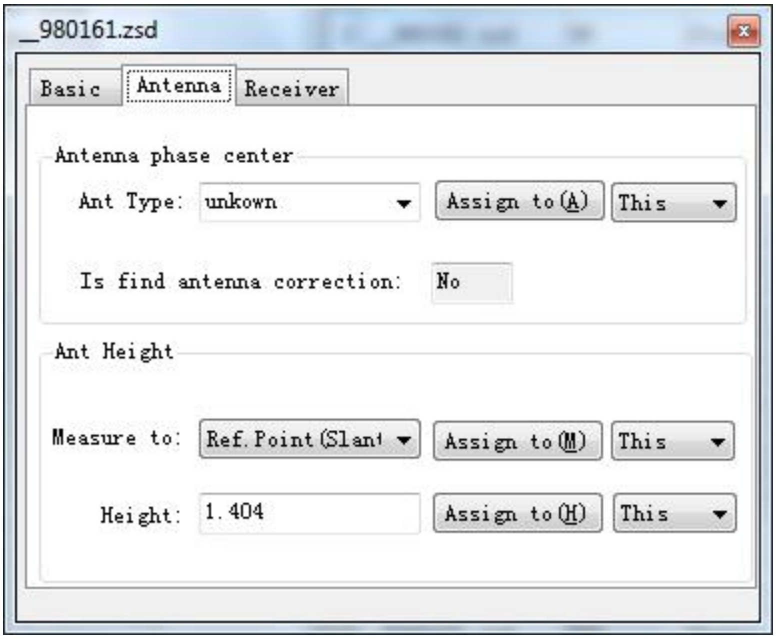


Figure 2- 11 Edit an observation file

2.1.6 Baseline Processing

After all the data are loaded, TGO shows all the GPS baseline vectors and the plane view shows all the information about the GPS network.

Then you can process the baseline, click ***Process Baseline*** ->  button on the navigation field to process baselines, TGO will process all the baselines according to the default settings (Figure 2- 12)

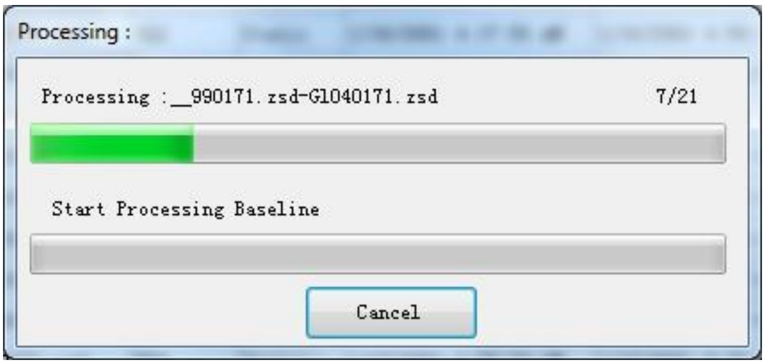


Figure 2- 12 Baseline processing

During the processing, program shows the schedule of the baselines as Figure 2- 13, we can find the processing information about each baseline processing in the list of ***Baselines***.

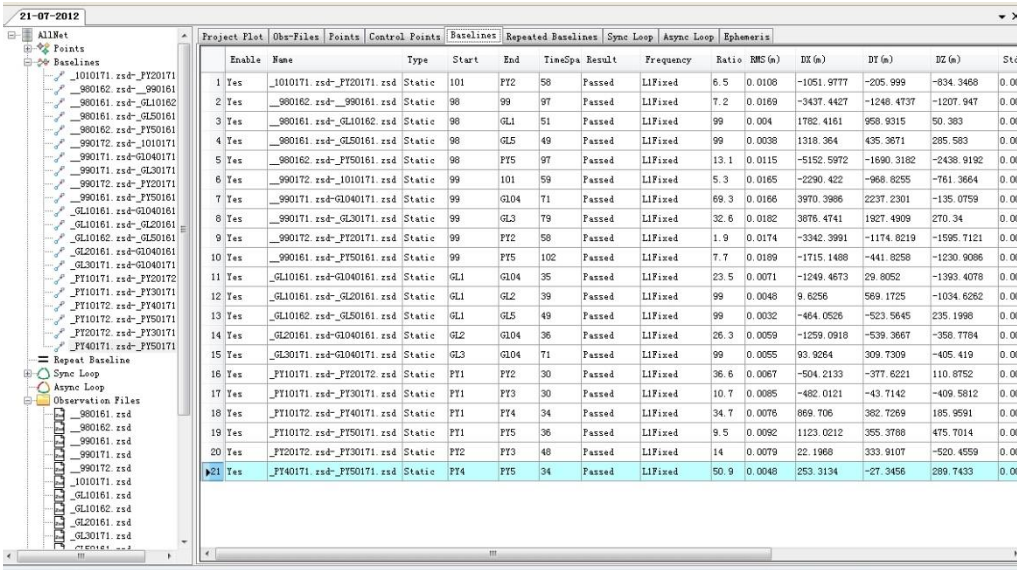


Figure 2- 13 Baselines' schedule

The time of baseline solution depends on the number of the baseline, the time of the observation, the baseline processing setting and the performance of the computer. After all baselines are completed, the baseline solution result displays in the baseline list window.

The color of the previous unsolved baseline in the map changes from light to dark green. (Figure 2- 14)

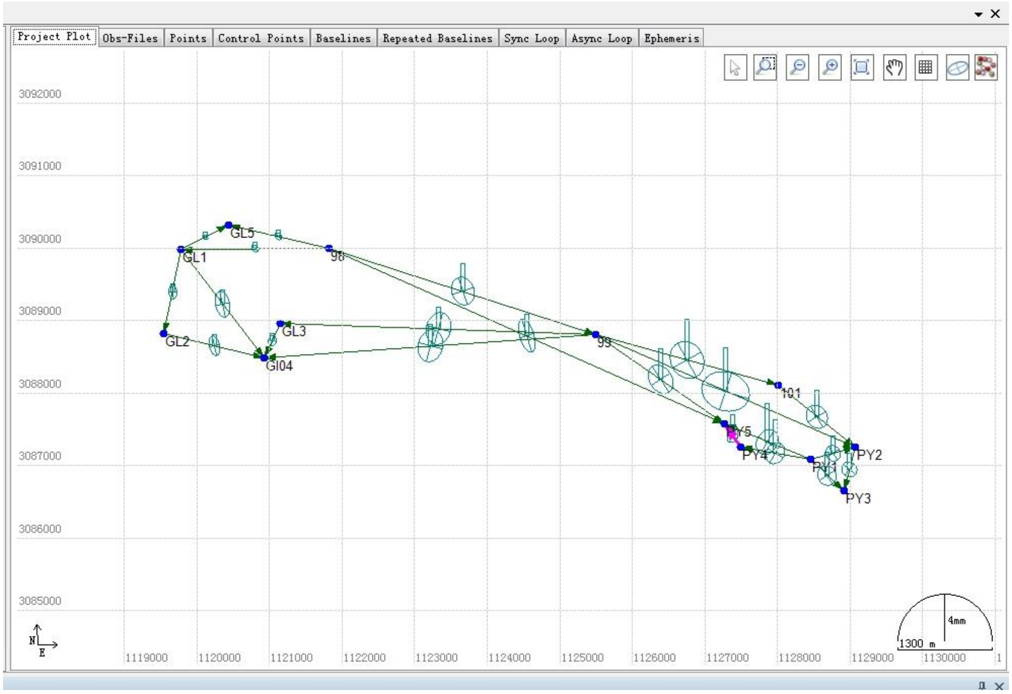


Figure 2- 14 Processing result

2.1.7 Adjustment Setting

After the baseline processing, it is needed to check the adjustment result. But for this simple section, we suppose all the baselines are good. Generally, if the observation condition is good, we can process all the baselines once successfully.

It is needed to delete part of a baseline, according to the quality of synchronous observation after the solution. Here we will not explain it, too.

Now we begin to prepare the network adjustment.

First we should set some points as control points. Switch work field to ***Points*** tab, select one site and right-click the selected site. Then select ***Set as Control Point***, the selected point will be add to the list of control points automatically (Figure 2- 15).

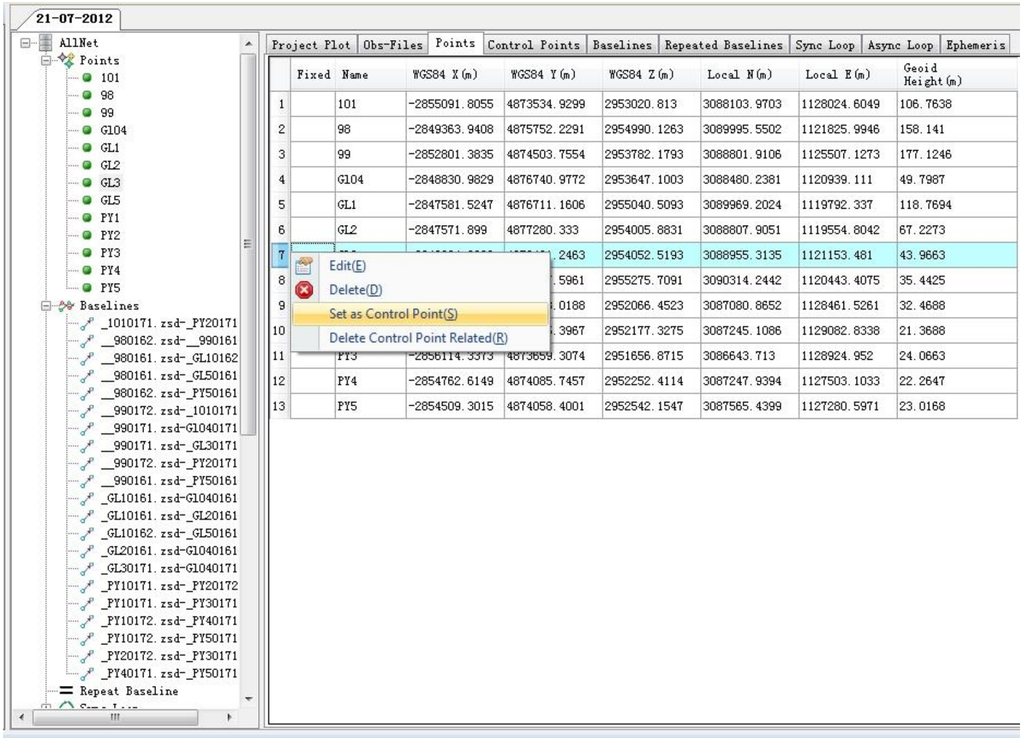


Figure 2- 15 Set control point

Switch work field to ***Points*** tab, you will find this point which you set as control point (Figure 2- 16). Double click one point's name, you can edit these points as Figure 2- 17. Do this for all control points.

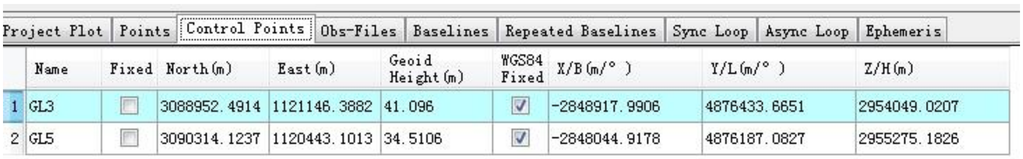


Figure 2- 16 Control points

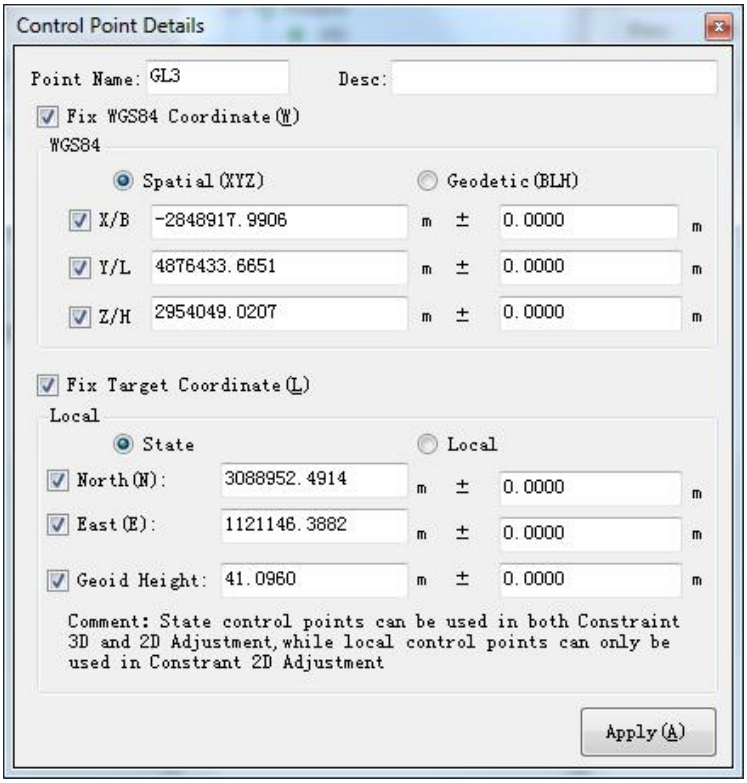


Figure 2- 17 Control point details

2.1.8 Network Adjustment

Click  button in the navigation field in the navigation field, enter the adjustment setting window (Figure 2- 18). After setting adjustment options, you can choose  Adjust item, then Network Adjustment tool window appears in Figure 2- 19.

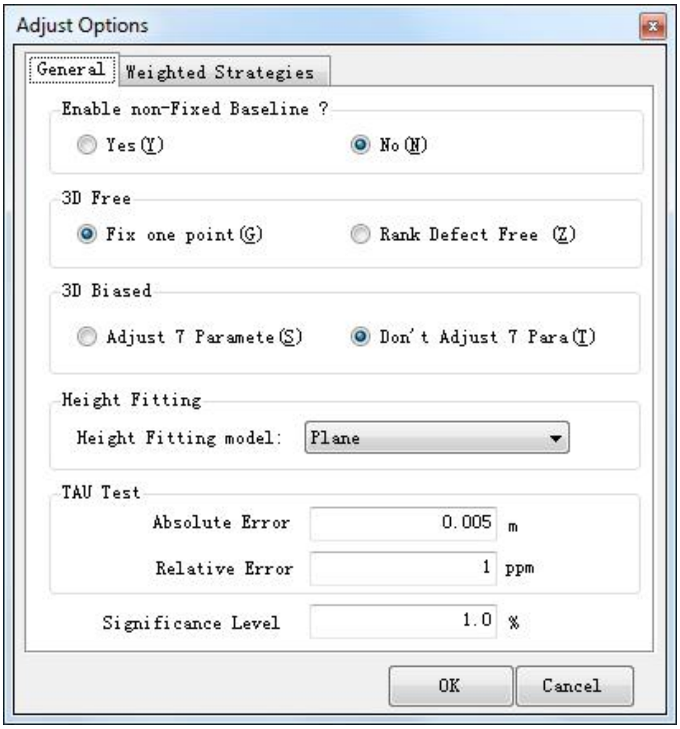


Figure 2- 18 Adjust options

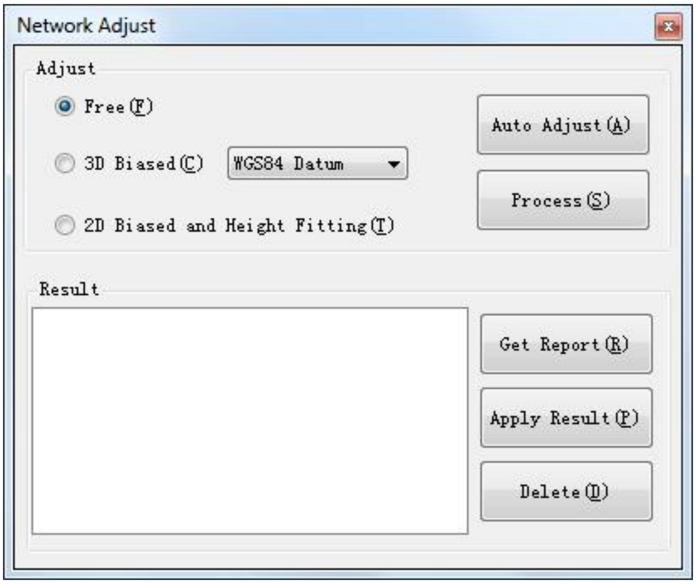


Figure 2- 19 Network adjust

Click ***Auto Adjust*** button, it will do free 3D adjustment, constraint 3D adjustment under WGS84 ellipsoid, constraint 3D adjustment and 2D adjustment under local ellipsoid according to the settings above. It also can generate adjustment result list.

2.1.9 Report

Click button in the navigation field, you can set output items which you want to view in the adjustment report and the format of adjustment report (Figure 2- 20).

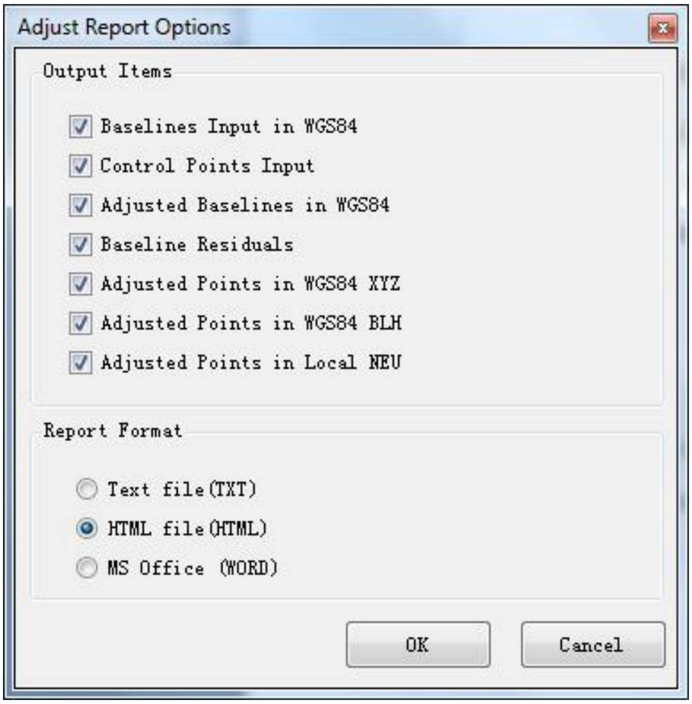
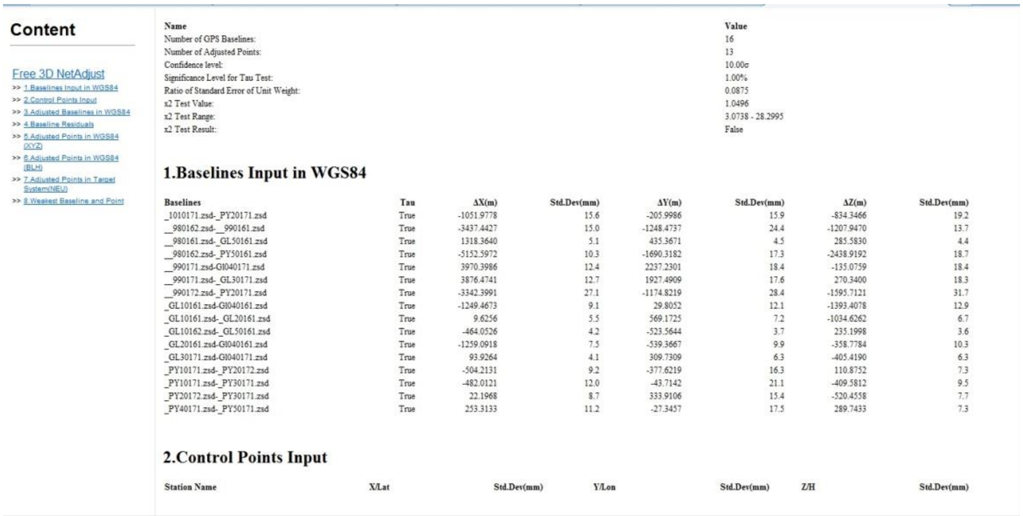


Figure 2- 20 Report options

Then click  to select one result which you want to view in the adjustment result lists, click Get Report button. It will generate adjustment report as Figure 2- 21.You can find the content of the report in the following chapter.



Content

Free 3D NetAdjust
>> 1.Baselines Input in WGS84
>> 2.Control Points Input
>> 3.Adjusted Baselines in WGS84
>> 4.Baseline Residuals
>> 5.Adjusted Points in WGS84 (XYZ)
>> 6.Adjusted Points in WGS84 (BLH)
>> 7.Adjusted Points in Target System(NEU)
>> 8.Weakest Baseline and Point

Name	Value
Number of GPS Baselines:	16
Number of Adjusted Points:	13
Confidence level:	10.00σ
Significance Level for Tau Test:	1.00%
Ratio of Standard Error of Unit Weight:	0.0875
x2 Test Value:	1.0496
x2 Test Range:	3.0738 - 28.2995
x2 Test Result:	False

1.Baselines Input in WGS84

Baselines	Tau	ΔX(m)	Std.Dev(mm)	ΔY(m)	Std.Dev(mm)	ΔZ(m)	Std.Dev(mm)
_1010171.zsd-_PY20171.zsd	True	-1051.9778	15.6	-205.9986	15.9	-834.3466	19.2
__980162.zsd-__990161.zsd	True	-3437.4427	15.0	-1248.4737	24.4	-1207.9470	13.7
__980161.zsd-_GL50161.zsd	True	1318.3640	5.1	435.3671	4.5	285.5830	4.4
__980162.zsd-_PY50161.zsd	True	-5152.5972	10.3	-1690.3182	17.3	-2438.9192	18.7
__990171.zsd-GI040171.zsd	True	3970.3986	12.4	2237.2301	18.4	-135.0759	18.4
__990171.zsd-_GL30171.zsd	True	3876.4741	12.7	1927.4909	17.6	270.3400	18.3
__990172.zsd-_PY20171.zsd	True	-3342.3991	27.1	-1174.8219	28.4	-1595.7121	31.7
_GL10161.zsd-GI040161.zsd	True	-1249.4673	9.1	29.8052	12.1	-1393.4078	12.9
_GL10161.zsd-_GL20161.zsd	True	9.6256	5.5	569.1725	7.2	-1034.6262	6.7
_GL10162.zsd-_GL50161.zsd	True	-464.0526	4.2	-523.5644	3.7	235.1998	3.6
_GL20161.zsd-GI040161.zsd	True	-1259.0918	7.5	-539.3667	9.9	-358.7784	10.3
_GL30171.zsd-GI040171.zsd	True	93.9264	4.1	309.7309	6.3	-405.4190	6.3
_PY10171.zsd-_PY20172.zsd	True	-504.2131	9.2	-377.6219	16.3	110.8752	7.3
_PY10171.zsd-_PY30171.zsd	True	-482.0121	12.0	-43.7142	21.1	-409.5812	9.5
_PY20172.zsd-_PY30171.zsd	True	22.1968	8.7	333.9106	15.4	-520.4558	7.7
_PY40171.zsd-_PY50171.zsd	True	253.3133	11.2	-27.3457	17.5	289.7433	7.3

2.Control Points Input

Station Name	X/Lat	Std.Dev(mm)	Y/Lon	Std.Dev(mm)	Z/H	Std.Dev(mm)

Figure 2- 21 Report demo

At this time, the processing is completed. You can select in the navigation field to export the solution result.

Next we will introduce how to process dynamic GPS data.

2.2 Dynamic Route Processing

Dynamic GPS data processing has three solving mode: RTD, Stop&Go, PPK (Post Process Kinematic). The difference of them can be found in chapter 4.55.1.

2.2.1 Import Data

First we create a project as static GPS data processing. Because during the outdoor observation, one dynamic baseline includes two files at least, one is a static observation file and the other is a dynamic observation file, they are collected synchronously. When you import the observation data files with dynamic and static mode, make sure which file is static and which is dynamic. Generally, data files exported from rover is dynamic files, from base or CORS is static file. If you import data files by auto mode, you just need to import all observation data files (Figure 2- 23).

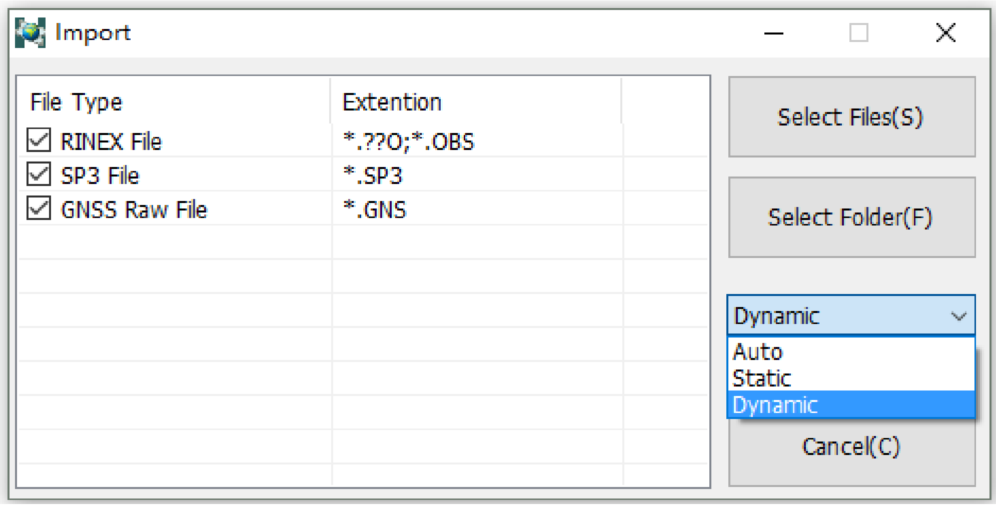


Figure 2- 22 Import files

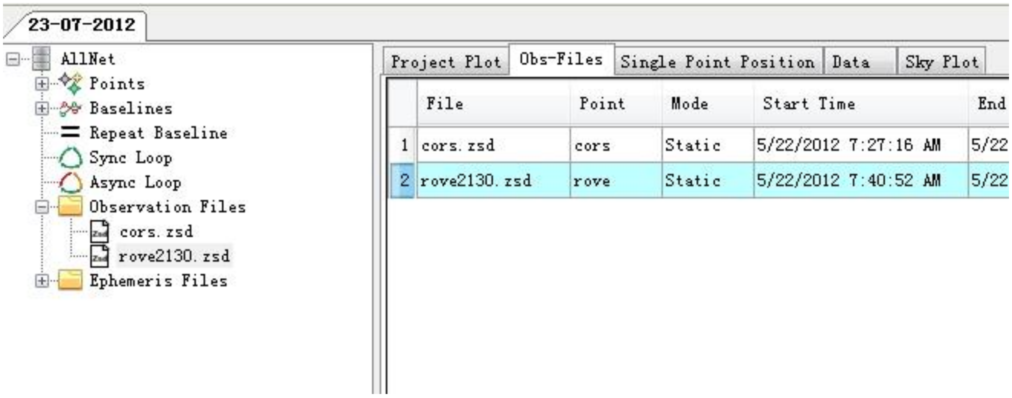


Figure 2- 23 Static and dynamic file

2.2.2 Set Property of Observation Files and Points

Set the Mode of Observation Files

If you import data files by auto mode, you need to convert the data file which is exported by rover to dynamic mode. Click ***Switch to Static/Kinematic*** menu in the pop-up menu as Figure 2- 24.

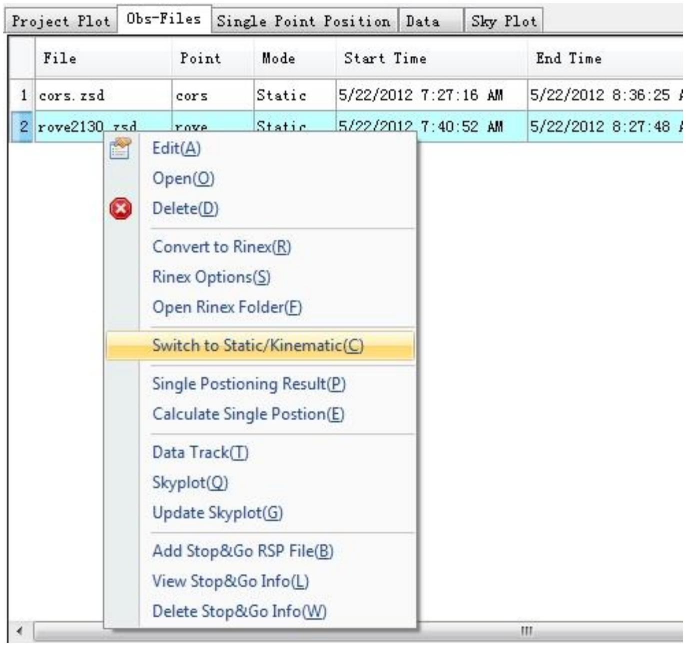


Figure 2- 24 Observations files mode

Edit the Coordinate of Points

Select the ***Points*** node in the left of work field, choose the base point (reference station) and double click it, Station window displays as Figure 2- 25. Edit and confirm the coordinate of the station.

Notice: The coordinate of reference station must be accurate, or the error will be introduced to the solution.

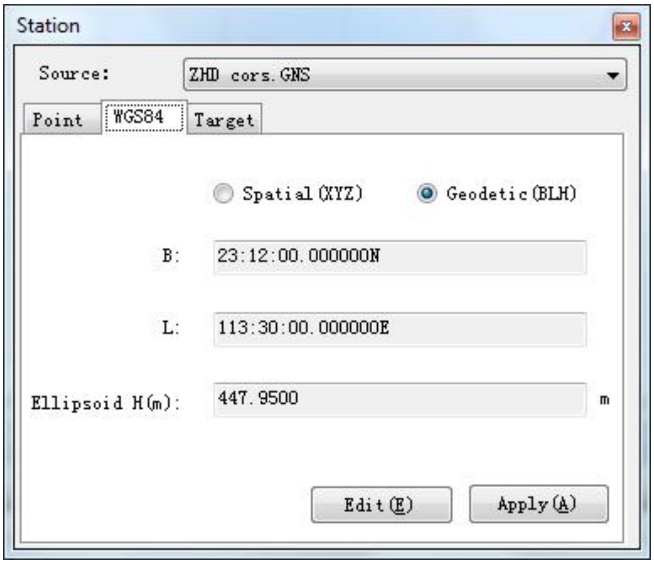


Figure 2- 25 Reference station position

Add Stop&Go RSP File

Stop&Go RSP file is a time file which record the start time and end time of a stop stage in field work. If you do stop&go or PPK processing, you can add stop&go RSP file to dynamic observation file. If you don't add stop&go RSP file, TGO will do processing, too. In fact, the result is just pure dynamic solution and you only get go stage solution in the report. Select ***Stop&Go RSP File*** menu item in the pop-up menu as Figure 2- 26, add corresponding stop&go RSP file.

Notice: Because observation file is divided into stop stage files by RSP file, the correctness of RSP file is very important. Make sure that the observation time of RSP file is consistent with observation files.

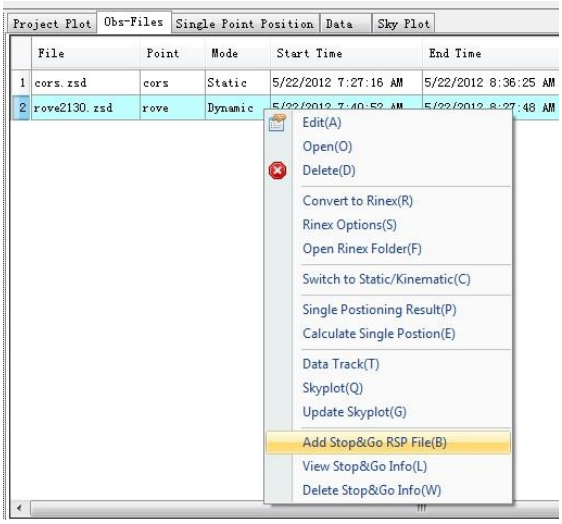


Figure 2- 26 Add RSP file

2.2.3 Dynamic GPS Data Solution

After the operation of the above, the next step is to process baselines.

Processing Settings

Select the ***Baselines*** node in the tree list view, you can see the detail view switch to ***Baselines*** tab page. Right click one or more baselines. Select ***Process Options*** menu item in the pop-up menu (Figure 2- 27), enter the following window as Figure 2- 28.

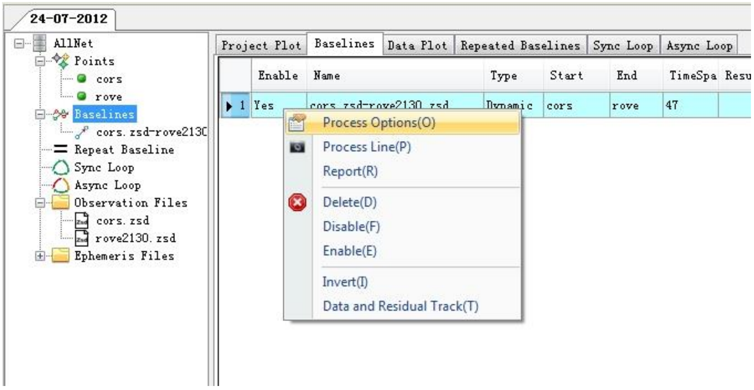


Figure 2- 27 Process options

Notice: If you do Stop&Go processing, it's suggested that you set the minimum epoch to 180s. If the minimum epoch is too small, the integer ambiguity will not be fixed.

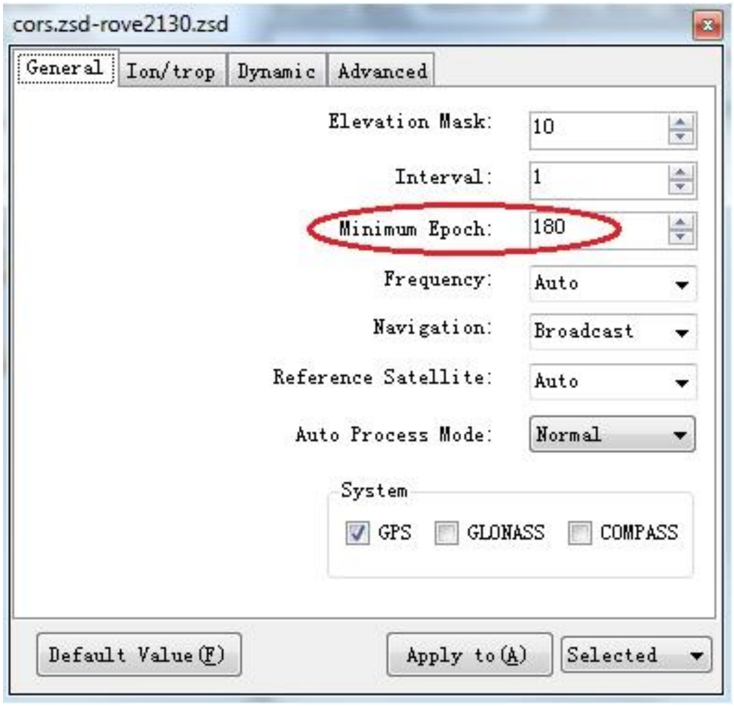


Figure 2- 28 Minimum time for stop&go

Select Dynamic tab page in the above window, set the mode of procession as Figure 2- 29. After you finish your settings, click ***Apply to*** button to complete setting and back to work window.

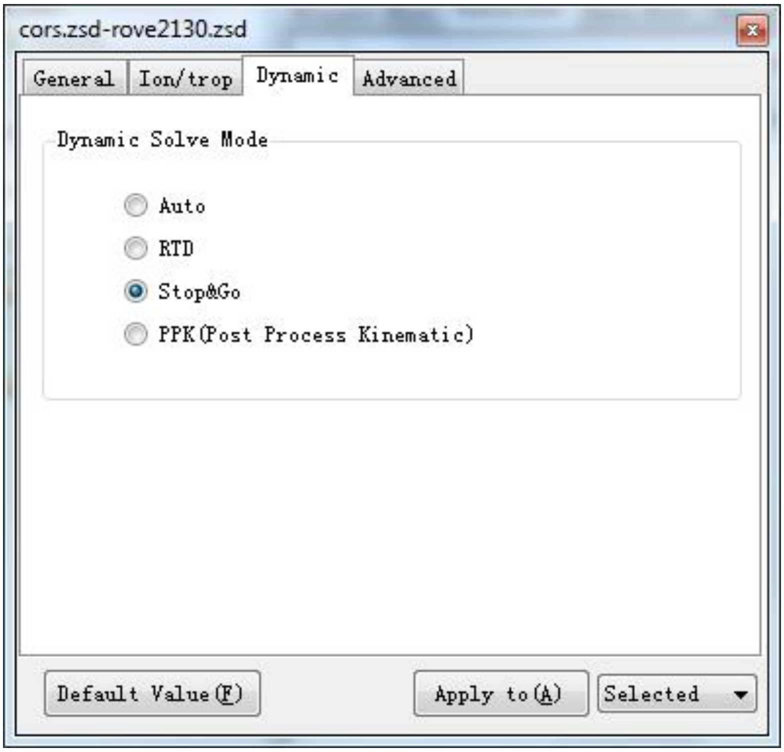


Figure 2- 29 Dynamic options

Process Baseline

Select Process Line menu item in the pop-up menu, begin to process the chosen baselines. You can see solution status on the process status bar as Figure 2- 30.

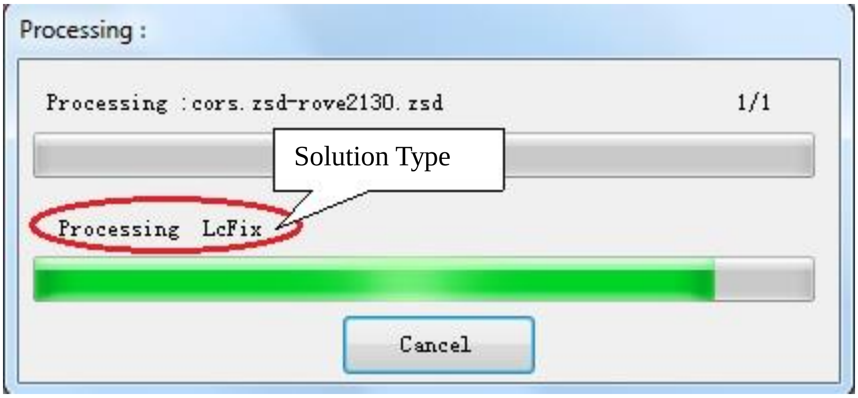


Figure 2- 30 Porcessing status

After processing, you can view the plan map of dynamic route. The green color means fixed solution, yellow is float, red is single.

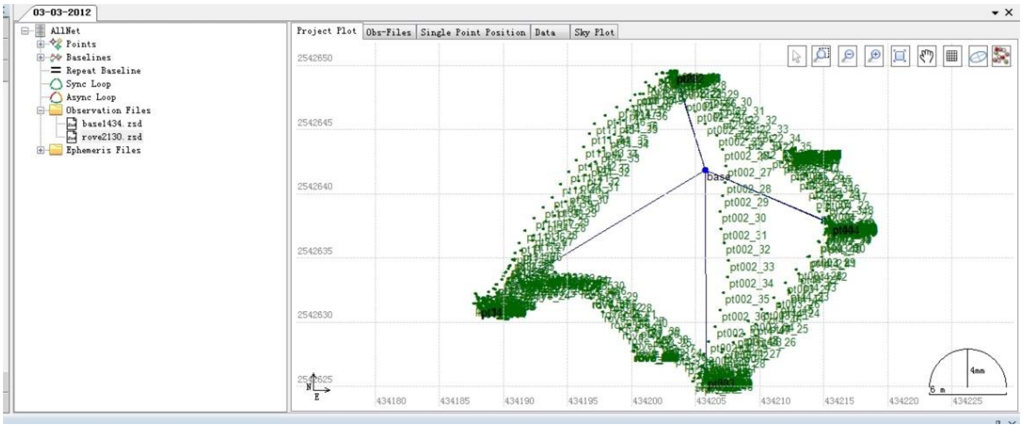


Figure 2- 31 Project plot

Click button, the map display as Figure 2- 32.The map just display the stop points.

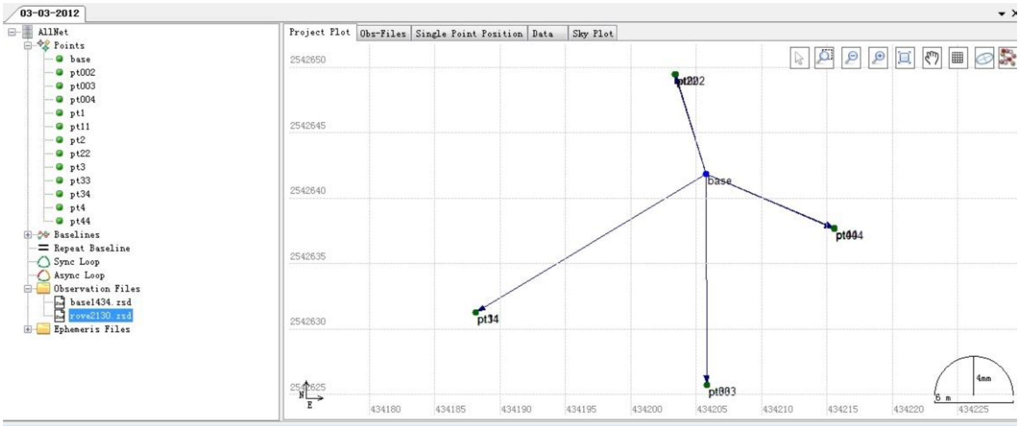
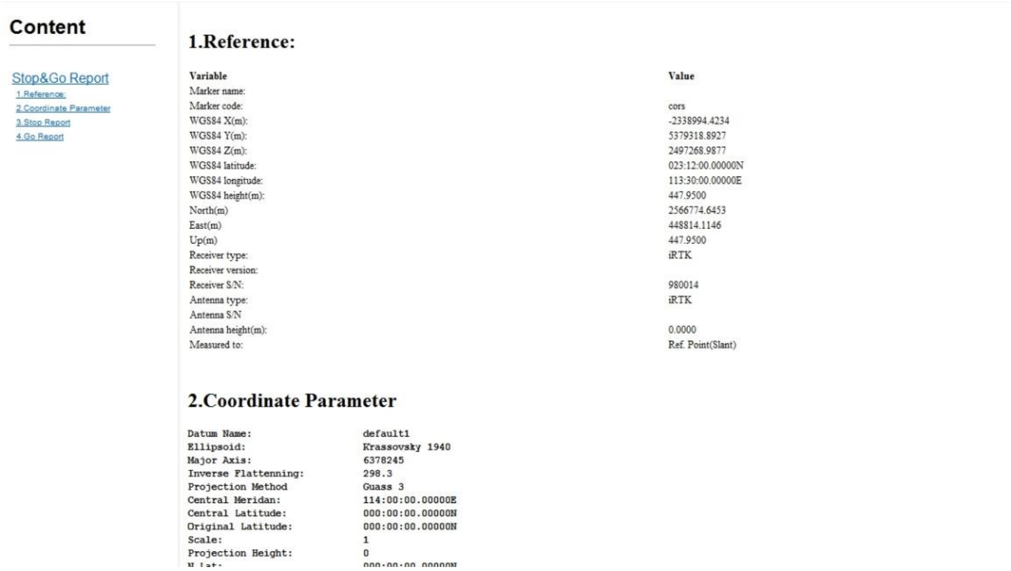


Figure 2- 32 Stop points

Report

Select Process Line menu item in the pop-up menu to generate the solution result report.



Content

Stop&Go Report
1.Reference:
2.Coordinate Parameter
3.Stop Report
4.Go Report

1.Reference:

Variable	Value
Marker name:	
Marker code:	cors
WGS84 X(m):	-2338994.4234
WGS84 Y(m):	5379318.8927
WGS84 Z(m):	2497268.9877
WGS84 latitude:	023:12:00.00000N
WGS84 longitude:	113:30:00.00000E
WGS84 height(m):	447.9500
North(m)	2566774.6453
East(m)	448814.1146
Up(m)	447.9500
Receiver type:	iRTK
Receiver version:	
Receiver S/N:	980014
Antenna type:	iRTK
Antenna S/N	
Antenna height(m):	0.0000
Measured to:	Ref. Point(Slant)

2.Coordinate Parameter

Datum Name:	default1
Ellipsoid:	Krassovsky 1940
Major Axis:	6378245
Inverse Flattenning:	298.3
Projection Method	Guass 3
Central Meridan:	114:00:00.00000E
Central Latitude:	000:00:00.00000N
Original Latitude:	000:00:00.00000N
Scale:	1
Projection Height:	0

Figure 2- 33 Report demo

A static baseline control network has been processed now. You can select  to export the solution result.

3. Main Window

3.1 TGO Main Window

Run Tersus Geometrics office Software Package in the Start menu, or directly press Icon, it enters the main window. Now you can get the window as Figure 3-1. This window includes Menu bar, Tool bar, Status bar, Navigation field, Message field, Work file, etc.

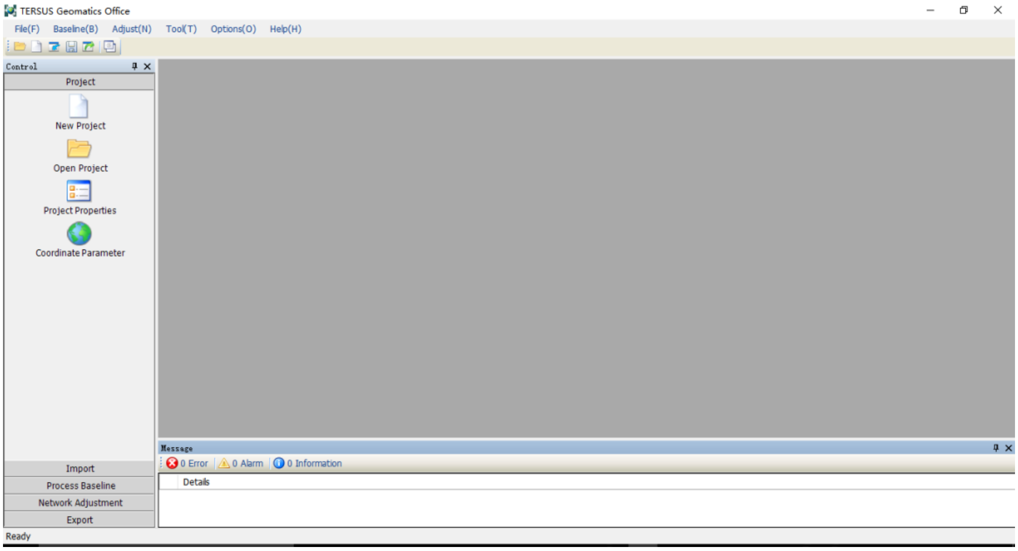


Figure 3- 1 Main window

Select file menu or select a project in the Project Navigation Filed, open a project, if you select GPS (China) Pro which is a demonstration project, you will find the window in Figure 3- 2.

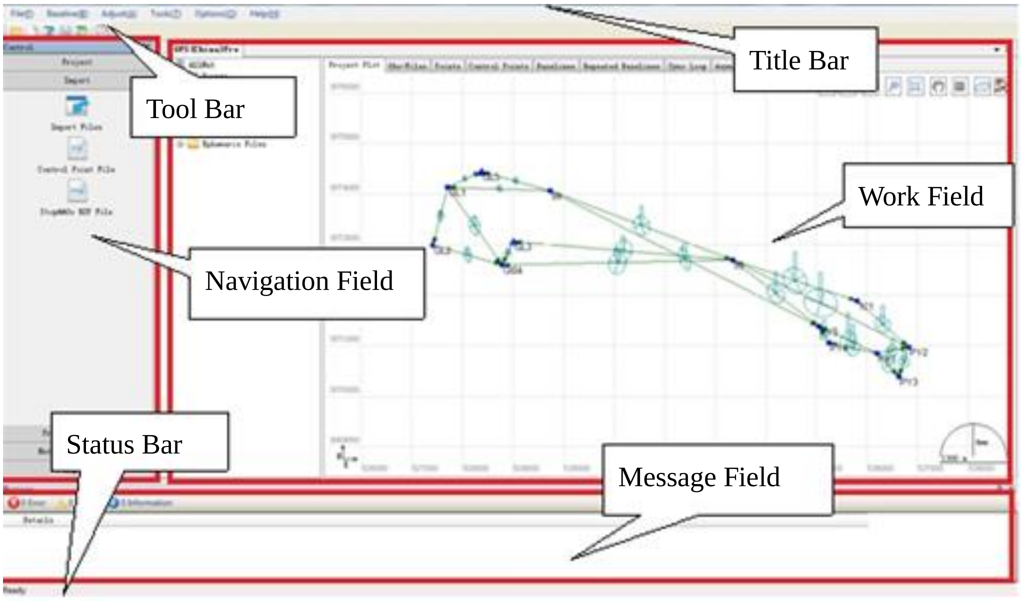


Figure 3- 2 Fields in main window

According to the design, user window includes fields as following:

Title bar: Title bar can help you quickly determine the type of current application. And you can do a few programs controlling, such as, Maximum, Minimum and Exit program. If you open a project, it will display the project name.

Menu bar: The list menu is an important part of any type window. It supplies many commands to create engineering files, process data, and manage data.

Tool bar: Provide majority common shortcut keys to fast operation.

Status bar: Display a few guides about current operations.

Work field: It is the user's main work field, generally includes every type views related to the project.

Navigation field: Provide common shortcut keys for fast operation.

Message field: Output message of processing.

We shall explain all the operations to the main program in the following sections.

3.1 Menu and Toolbars

Menu

The main menu of the program includes File, Baseline, Adjust, Tools, Options and Help. Every menu item has a window shortcut key. The menus provide the operation to complete most of the data processing work and the main processing steps.

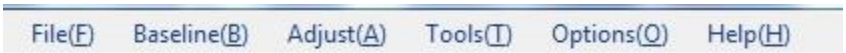


Figure 3- 3 Main menus

Tool Bar

You can achieve a few common operations and accelerate the rate via the Toolbars in the main program. It includes create new project, open project, save project, import data, export data, get default view (Figure 3- 4).

Figure 3- 4 Tool bar

3.2 Navigation Field

The navigation field is a quick entrance of menus; you can show or hide it. It is used to make user’s operation faster.

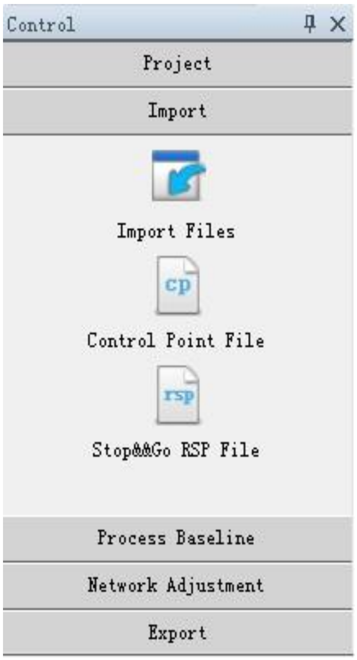


Figure 3- 5 Import sub-menu

3.3 Plan View

Plan view in the work field mainly displays the added information, such as site, baseline, error ellipsoid, scale, grid and so on.

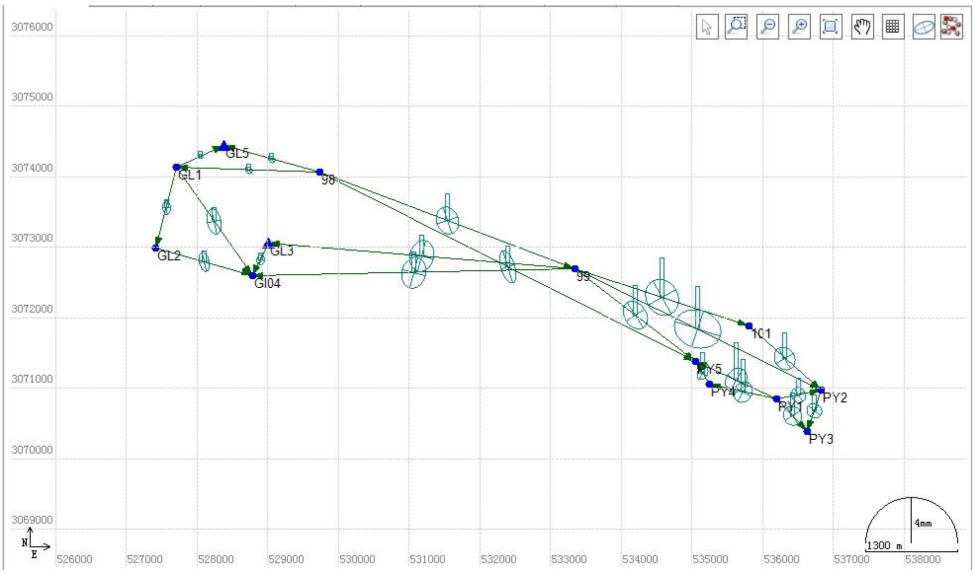


Figure 3- 6 Plan view

Observation Site

In the map, ▲ means that GPS observation site have been associated with the control site. ● means that GPS observation site is a common site.

Baseline

The static baseline is marked by arrowhead line, and the arrowhead can be hidden. When it can't be resolved, or hasn't been resolved, the baseline is gray.

Move the mouse, when you click the site or baseline, the site or the baseline will be high-lighted as Figure 3- 7.

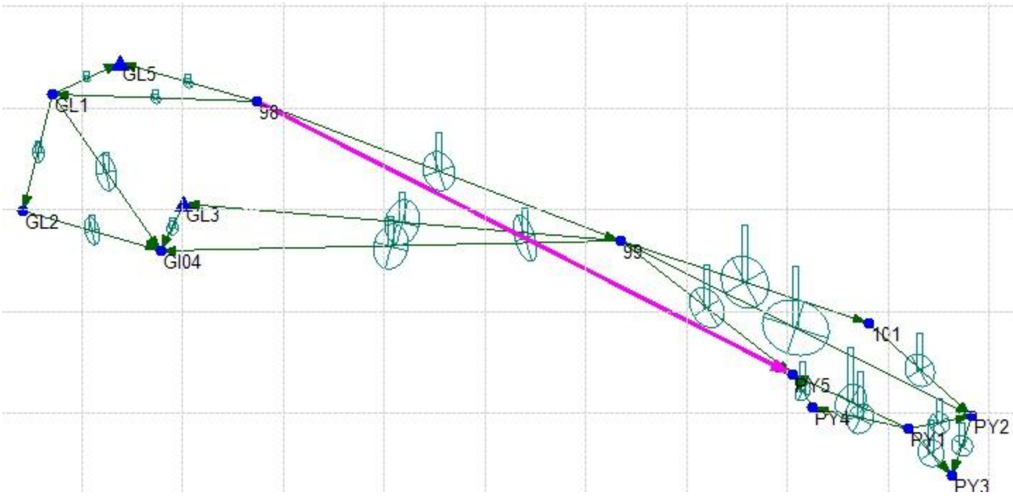


Figure 3- 7 Sites and baselines

Error Ellipsoid

After finishing baseline processing the error ellipsoid and the height residual of baselines will be displayed with green color. It shows the baseline resolving quality.

Graphical Operation Tools

Graphical operation tools are on the upper right corner of the plan view. Click the tool firstly, then click the network graph, you will achieve the corresponding graphical operation.

Figure 3- 8 Operation tools

 Select Button: Select the site and baseline of the network graph.

 Square Select Zoom Button

 Zoom Out Button

 Zoom In Button

 Full Screen Button

 Pan Move Button

 Grid Reference Line Displayed Button

 Error Ellipse Displayed Button

 Rover Point Displayed Button

Setting the Drawing Mode of Plan Grid Reference Line

Choosing ***Options***->***Customize*** menu item to enter custom configuration dialog (Figure 3-9), you can choose the language and the drawing mode of plan grid reference line as plan or geodetic coordinate.

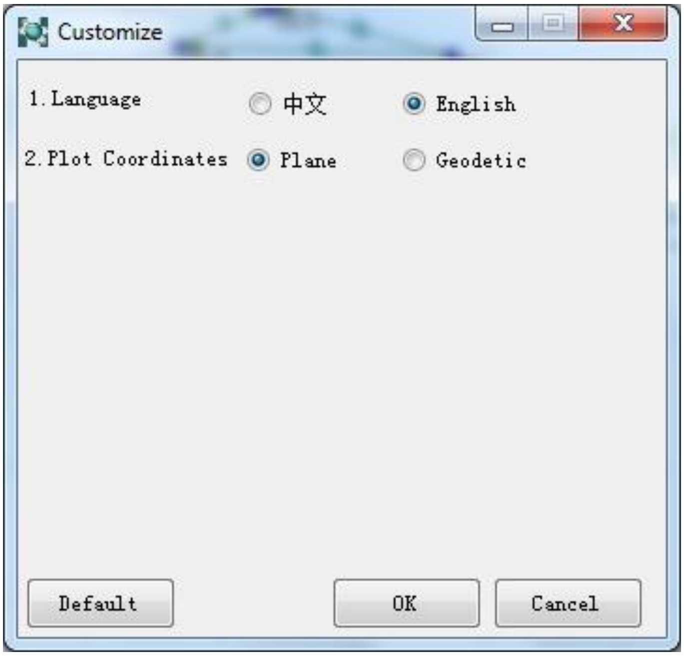


Figure 3- 9 Customized options

3.4 Tree List View of Work Field

The left of the work field is a tree list view. It's used to manage all contents of the project, including points list, baselines list, synchronous loop list, asynchronous loop list, observation files list and ephemeris files list. Click one node in the list, the detailed view will display some related information according to the selected node. For example, click ***Points*** node, the detail view will display Project Plot, Points and Control Points and position on Points tab (Figure 3- 10).

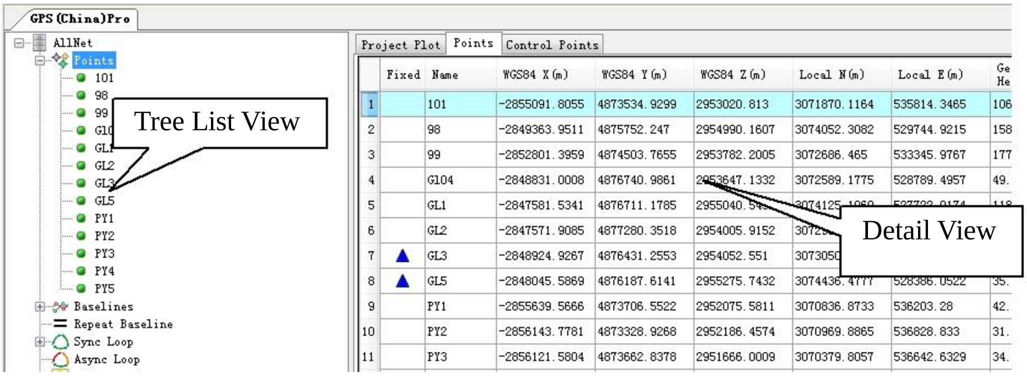


Figure 3- 10 Tree list view

3.5 Detail view of Work Field

The detail view of work field contains several tabs, every tab will display or hide to get different display combinations according to the selected node of tree list.

Notice: The tabs of detail view will change automatically according to the selected node of tree list, users don't need to search.

Pop-up Menu of Detail View

Select one item in the detail view, and right click it, the pop-up menu will display as Figure 3- 11.

Notice: Pop-up menu will change when the tab content changes.

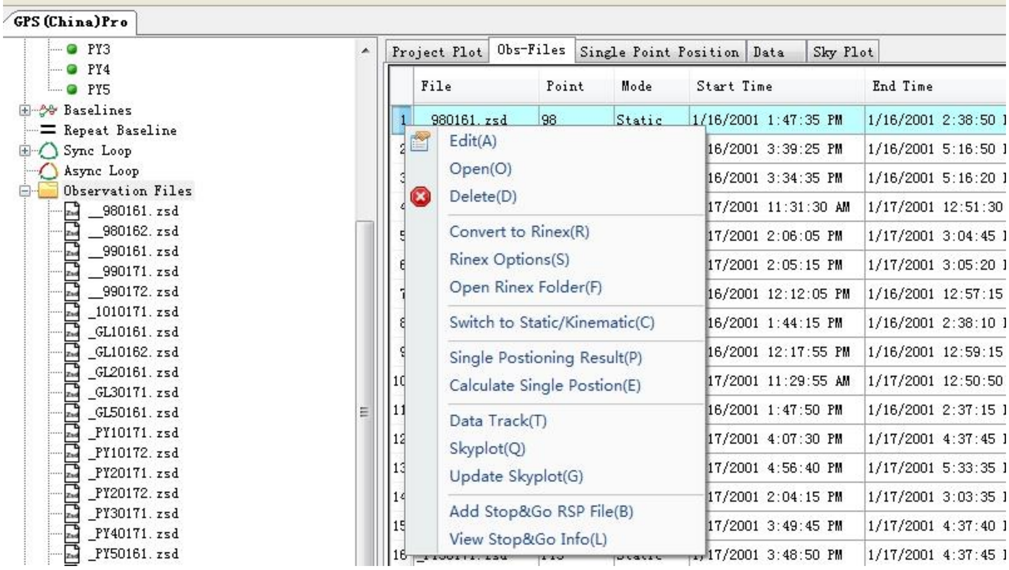


Figure 3- 11 Pop-up menu

Property Window

Choose ***Edit*** in the pop-up menu, you can edit properties of the chosen item. Property Window is different as different tab of detail view.

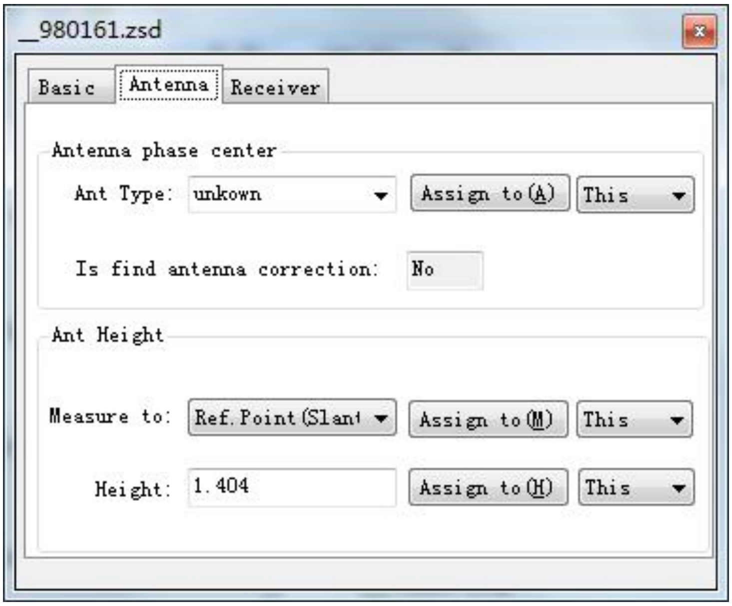


Figure 3- 12 Edit properties

4. Project Management

Tersus Geomatics Office Software Package is managed via the Object Oriented method, so whether you do point positioning, do static baseline processing, dynamic route processing, or even do network adjustment, you should create a new project or open an existed project firstly.

Follow the steps below to create a new project:

1. Create a new project firstly, enter the project name and the save path;
2. Enter property and tolerance of the project;
3. Enter the coordinate parameters in the coordinate management system.

After this, you can do the next operations.

4.1 Create a New Project

Set the Property of a Project

Click ***Project*** / ***Project property*** or click  in the navigation field to set the property of the project.

Base Information

The basic Information all display in the report of the network adjustment.

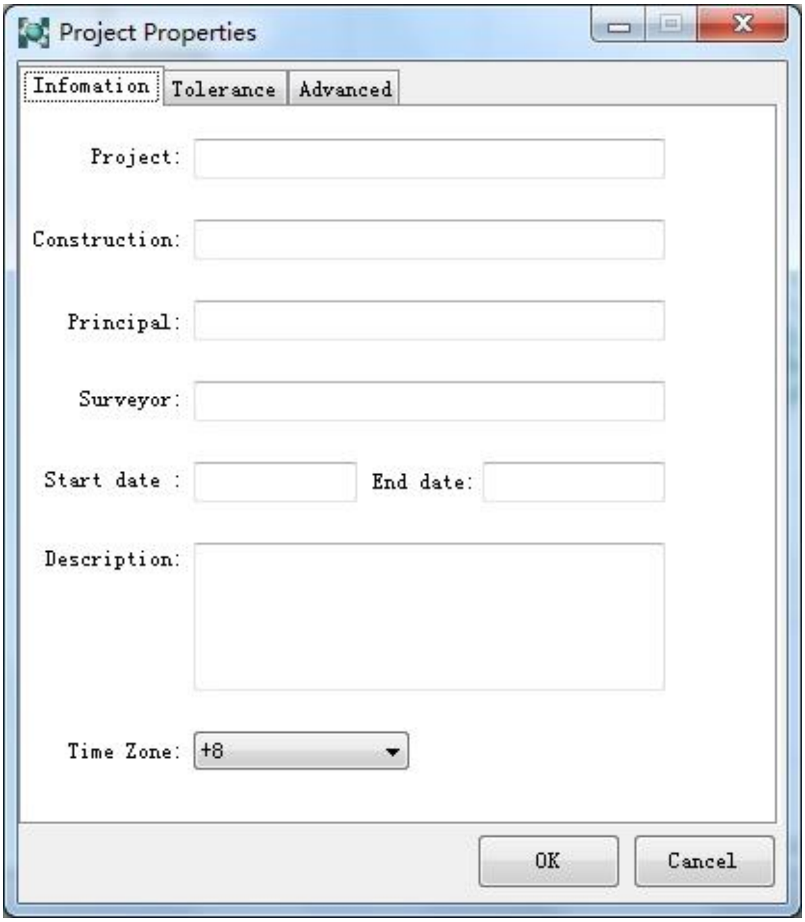


Figure 4- 1 Project properties

Tolerance

The tolerance of project is very important. You can choose national standard or custom define standard. Many tests are conducted according to the tolerance settings during data processing. The details precision dilution can be found in the Global Position System (GPS) Survey Criterion.

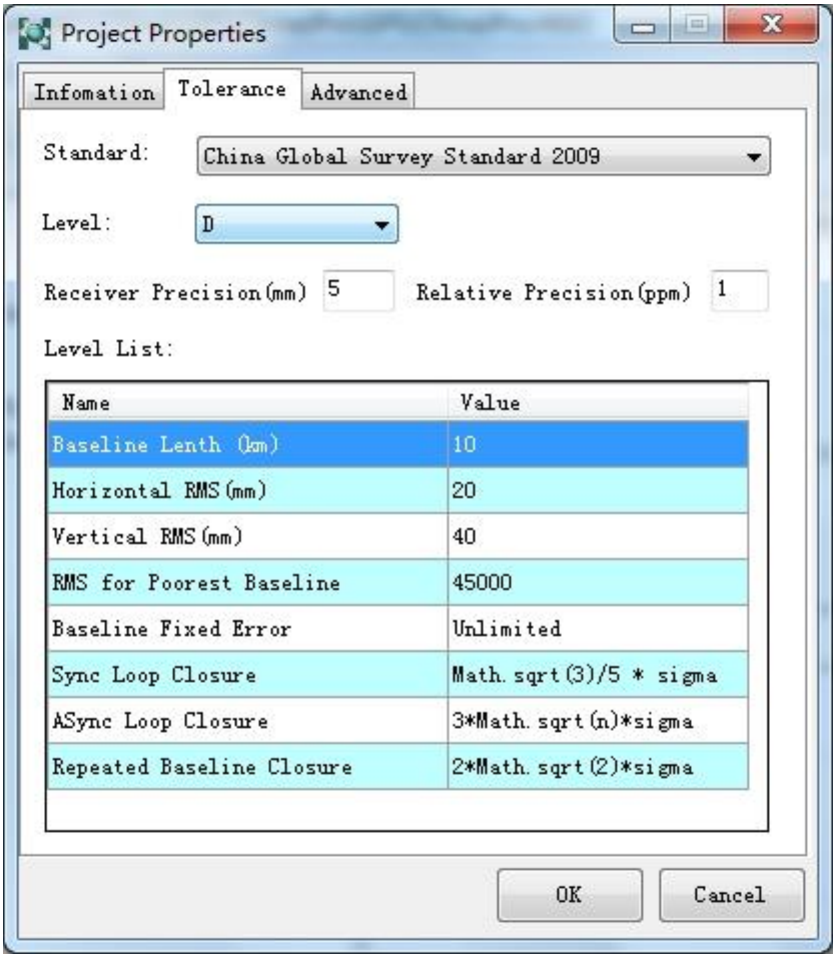


Figure 4- 2 Tolerance tab

Advance

Advance setting determines the control item of data processing, such as using first four characters of *TRS file as the point name of observation file, Minimum Time span of Static Baseline and Dynamic Baseline.

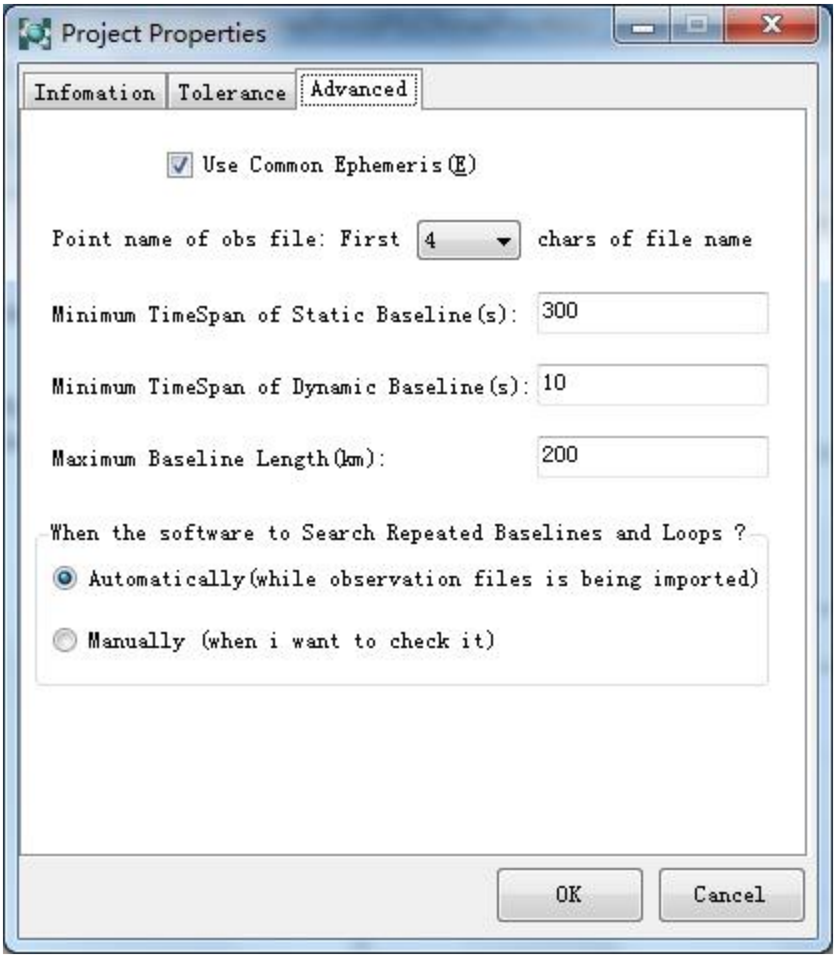


Figure 4- 3 Advance tab

Set the Coordinate Parameters

Click ***File*** menu->***Coordinate System*** item or click  in the Project navigation field to set the coordinate parameters. Generally, you can set coordinate parameters by following common three steps.

Set Ellipsoid

Ellipsoid tab page can set the Source Ellipsoid and Target Ellipsoid. You just need to select the ellipsoid name in the Ellipsoid combo box. If the ellipsoid can't be found in TGO, please contact our support to get parameters of the ellipsoid.

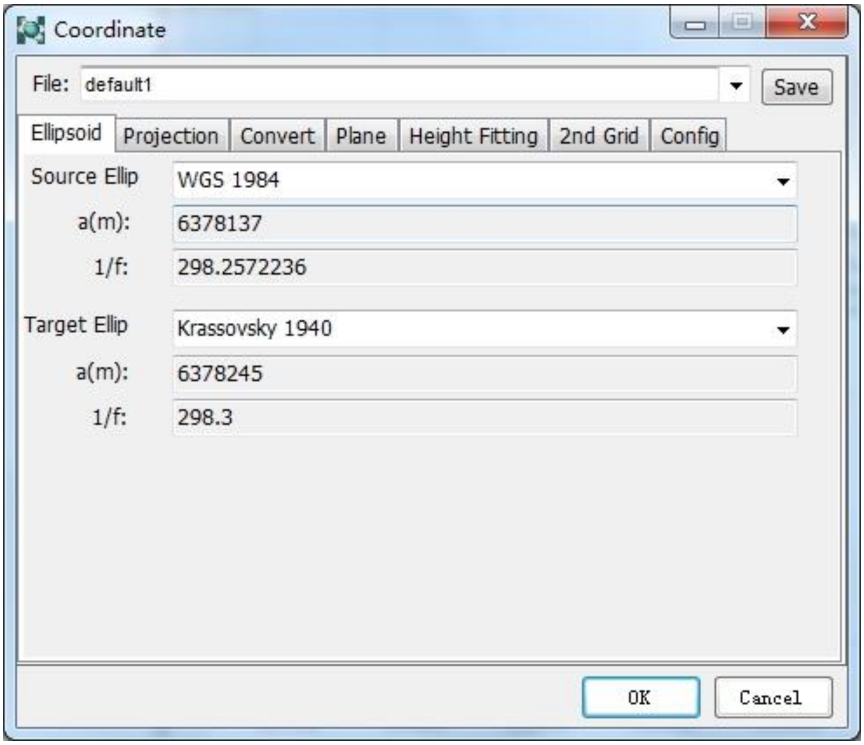


Figure 4- 4 Ellipsoid tab

Set Projection

Projection tab page includes projection method and parameters of projection. Select the projection method and enter the corresponding parameters. If the projection method is not available, please contact our technicians and provide the calculation method and corresponding parameters.

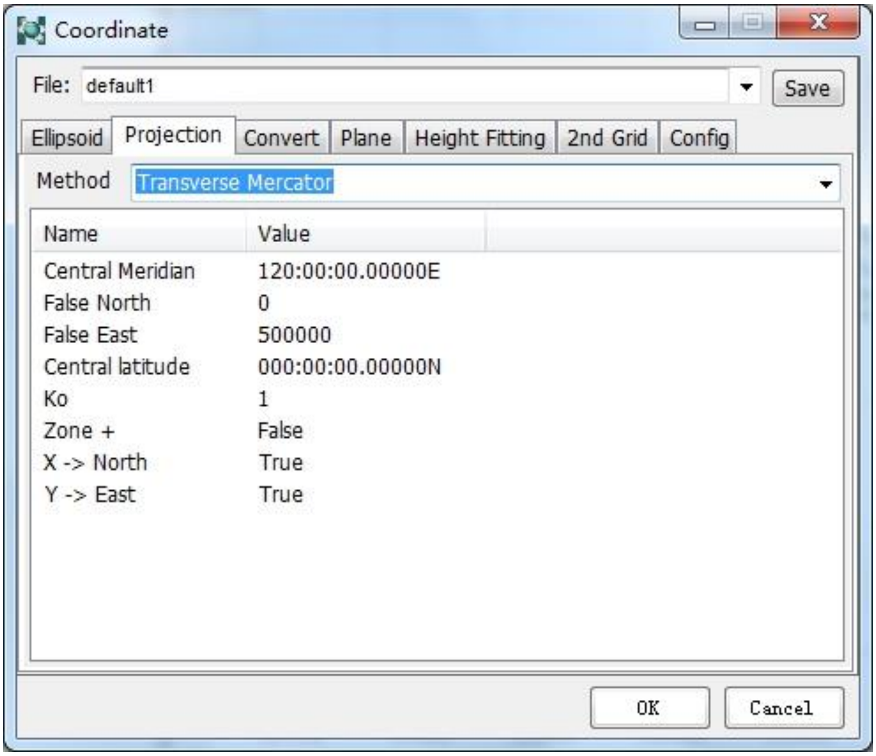


Figure 4- 5 Projection tab

Set Conversion

Convert tab page is used to set parameters of datum conversion. Select one model in the Model combo box and enter the corresponding parameters. If you have no model parameters, you can use our Coord Tool to calculate. If the model is not available, please contact our technicians and provide the calculation method and corresponding parameters.

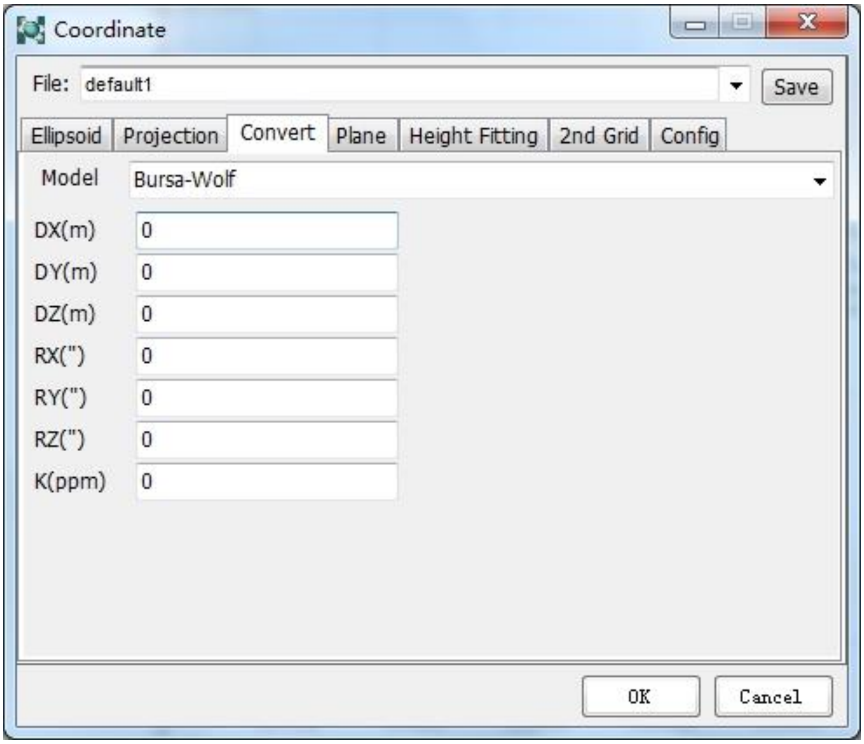


Figure 4- 6 Convert tab

The files will be created during a project processing. These files are saved in the project route and subdirectory. When we view the project subdirectory (Figure 4-7), we can find a project file "*.TGO" and six subdirectories created in the project directory. Adjust subdirectory is used for save the information during adjustment processing, Baseline subdirectory is used for keep the baseline processing information, EphBinData subdirectory is used for save the Ephemeris data, ObsBinDat subdirectory is used for save the observation data, Report subdirectory is used for save the report document, Rinex subdirectory is used for save the rinex files transformed from the observation files.

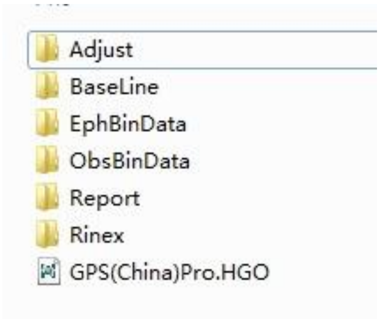


Figure 4- 7 Project subdirectory

So all the data and the processing information are saved in the same subdirectory, when completed this project, you can pack and save the whole directory and the corresponding subdirectory. In addition, the project folder can be transplanted from one computer to another computer and be opened.

4.2 Observation File

The data formats exported by the GPS receiver are NEMA0183 and the original survey data. In the term of TGO (Tersus Geomatics Office) Software Package, it needs the original survey format. The original surveying data of most GPS receivers is binary format, which is different from each other.

TGO Software Package can process data with the defined format, the data from several popular GPS receiver. It supports RINEX text format, too.

The Content of the Observation File

The observation files mainly save the original observation data of each ephemeris recorded by the GPS receiver. Each ephemeris includes observation time and the satellite information of every channel, C/A code, P1 code pseudo-range, P2 code pseudo-range, L1 carrier phase, L2 carrier phase. For the static observation files of the TGO Software Package, it is necessary to include the observation time, C/A code pseudo-range, L1 carrier phase; For dynamic observation files it is necessary to include the observation time and the C/A code pseudo-range.

The observation files include information besides the above of the point information, initial coordinate and the ephemeris information correlative the observations files.

In order to process stop&go data, stop& go time files is necessary except for static data file. It includes the start observation time and end observation time of a point.

The observation files can be expressed as the follow Figure 4-8:

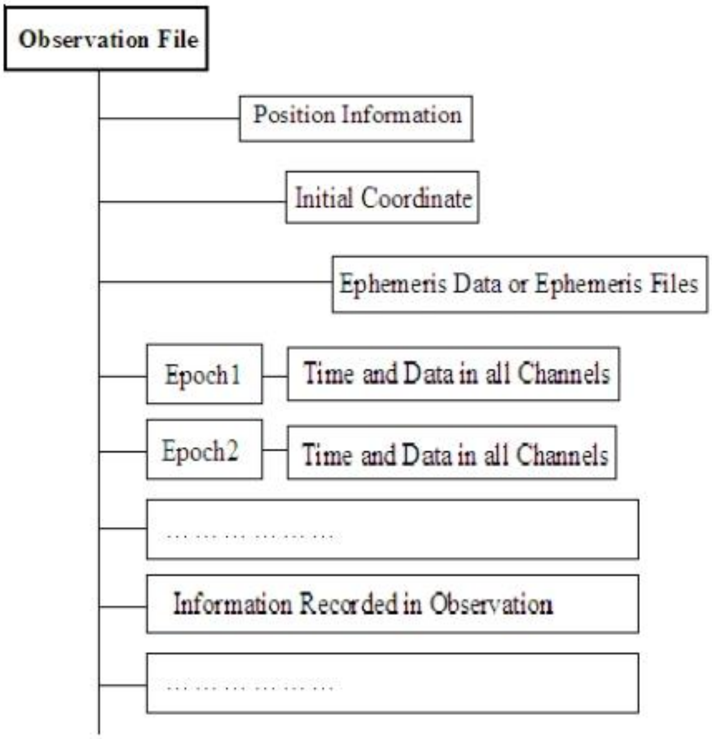


Figure 4- 8 Observation files format

The TRS/GNS Format Observations of Tersus Receiver

The observation files of the TRS or GNS Format defined by Tersus include the original observations, ephemeris data, the coordinate of the start and end points, several editions including the point information and the rout information of the dynamic capture record.

The Observation in the RINEX Format

In order to process the data unified collected by different types of receivers, the RINEX format, which is a universal data format, is established. The RINEX format is brought forward by the Berne University, Astro Institution in Switzerland. It has become a standard format among all the manufacturers, schools and institutes now. And currently the main GPS receivers are all supporting to transform the observations to RINEX format.

Other Observation Format

TGO also support other observation format, such as SP3 format.

Data Preparation

The TGO Package has the ability to process a few types of data format.

Generally, you should do the next steps before processing a group of GPS observations:

Import Data

Click File menu->Import or click  in the navigation field.

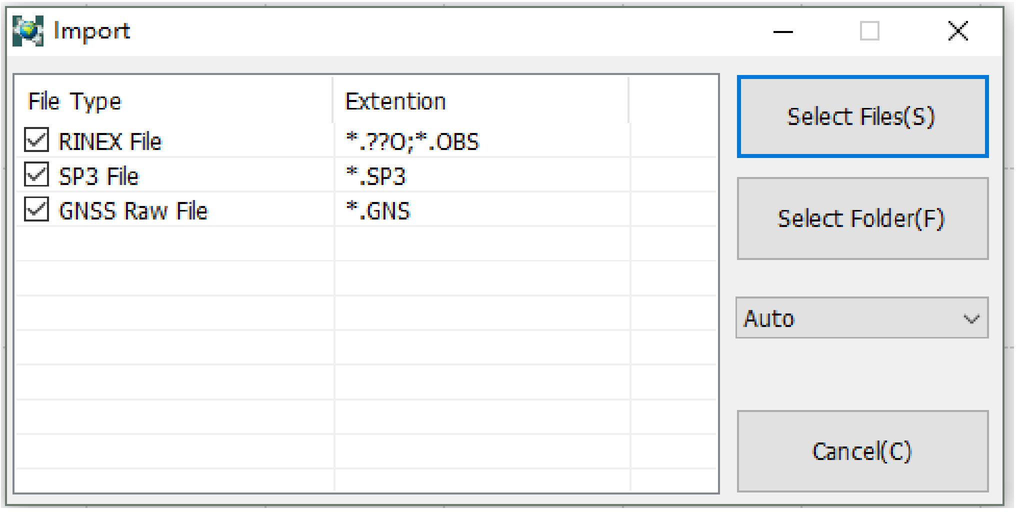


Figure 4- 9 Import files

At the right of the dialog, there is an Observation file mode combo box, it includes three modes: Auto, Static and Dynamic.

Auto: Import both static and dynamic data file. The mode of all imported files is static.

Static: Import static data file.

Dynamic: Import dynamic data files which is exported by rover.

Import folder, the TGO Package can import all files which meet the conditions automatically.

If you select import GNS data files, the program will pop-up a file dialog as Figure 4-10.File dialog will be transferred to the path of current project and lists all files with corresponding extension. You can select one or multiple files.

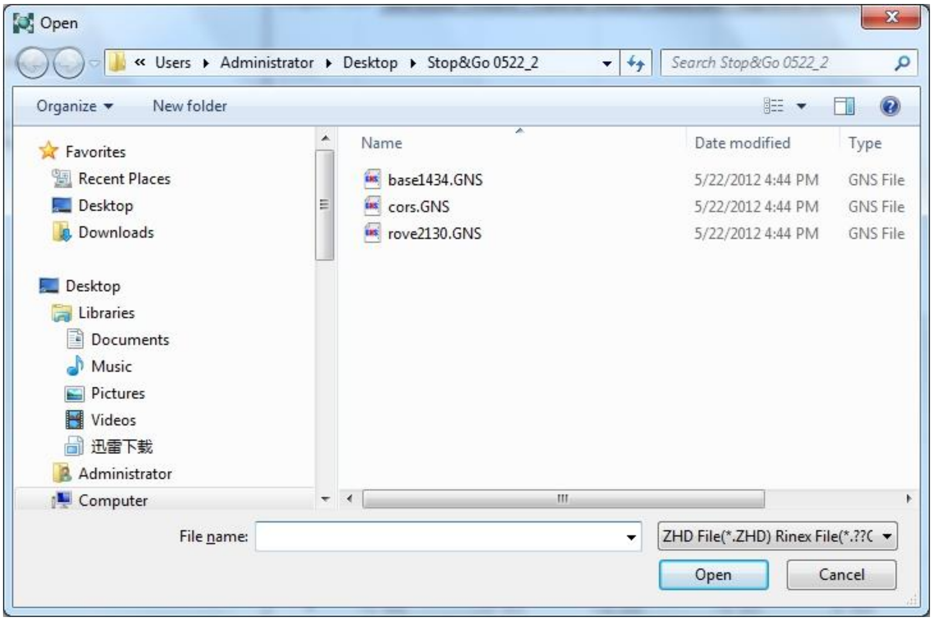
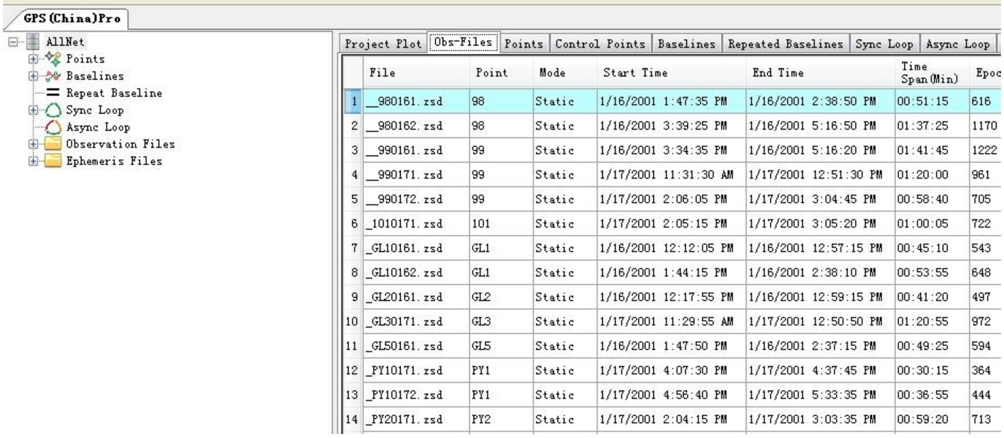


Figure 4- 10 GNS files

File import only imports observation files. In fact, at the same time, it imports the corresponding ephemeris files. For the files in the TRS/GNS format, the observations file and the ephemeris are included in one file, so they are imported at the same time. For other format, the observation file and the ephemeris may be not in the same file, then they should be saved in one directory, and the software will automatically distinguish and import the ephemeris by the format of the file. Or, the user should input the ephemeris in the post processing.

After all the files are imported, TGO will get the observation station from the observation files and automatically assemble to the static baseline and the dynamic route by the observation time spans, you will find more detail in the following (Figure 4-11).



	File	Point	Mode	Start Time	End Time	Time Span (Min)	Epoc
1	__980161.zsd	98	Static	1/16/2001 1:47:35 PM	1/16/2001 2:38:50 PM	00:51:15	616
2	__980162.zsd	98	Static	1/16/2001 3:39:25 PM	1/16/2001 5:16:50 PM	01:37:25	1170
3	__990161.zsd	99	Static	1/16/2001 3:34:35 PM	1/16/2001 5:16:20 PM	01:41:45	1222
4	__990171.zsd	99	Static	1/17/2001 11:31:30 AM	1/17/2001 12:51:30 PM	01:20:00	961
5	__990172.zsd	99	Static	1/17/2001 2:06:05 PM	1/17/2001 3:04:45 PM	00:58:40	705
6	_1010171.zsd	101	Static	1/17/2001 2:05:15 PM	1/17/2001 3:05:20 PM	01:00:05	722
7	_GL10161.zsd	GL1	Static	1/16/2001 12:12:05 PM	1/16/2001 12:57:15 PM	00:45:10	543
8	_GL10162.zsd	GL1	Static	1/16/2001 1:44:15 PM	1/16/2001 2:38:10 PM	00:53:55	648
9	_GL20161.zsd	GL2	Static	1/16/2001 12:17:55 PM	1/16/2001 12:59:15 PM	00:41:20	497
10	_GL30171.zsd	GL3	Static	1/17/2001 11:29:55 AM	1/17/2001 12:50:50 PM	01:20:55	972
11	_GL50161.zsd	GL5	Static	1/16/2001 1:47:50 PM	1/16/2001 2:37:15 PM	00:49:25	594
12	_PY10171.zsd	PY1	Static	1/17/2001 4:07:30 PM	1/17/2001 4:37:45 PM	00:30:15	364
13	_PY10172.zsd	PY1	Static	1/17/2001 4:56:40 PM	1/17/2001 5:33:35 PM	00:36:55	444
14	_PY20171.zsd	PY2	Static	1/17/2001 2:04:15 PM	1/17/2001 3:03:35 PM	00:59:20	713

Figure 4- 11 All the observations files

Pop-up menu of the Observation File

Select a file in the Obs-Files tab in the detail view, right click it, then the pop-up menu will display as Figure 4- 12, then you can operate the observation file.

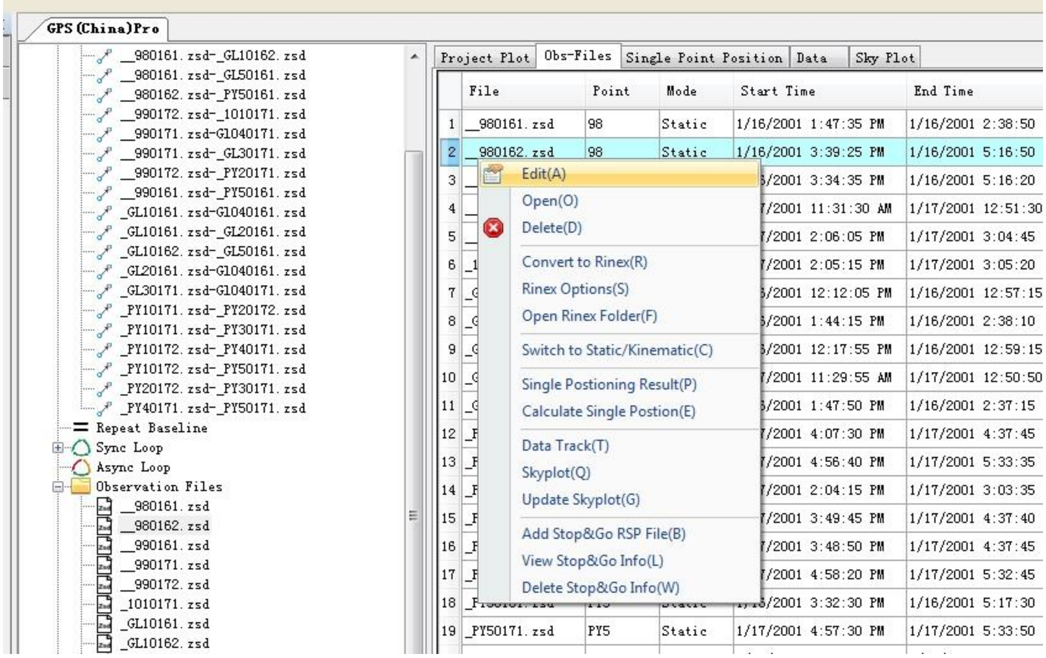


Figure 4- 12 Pop-up menu

Property of Observation File

Select a file in the Obs-Files tab in the detail view, right click or double click it, and select ***Edit*** in the pop-up menu. You can edit the property of the selected observation file in Figure 4- 13.

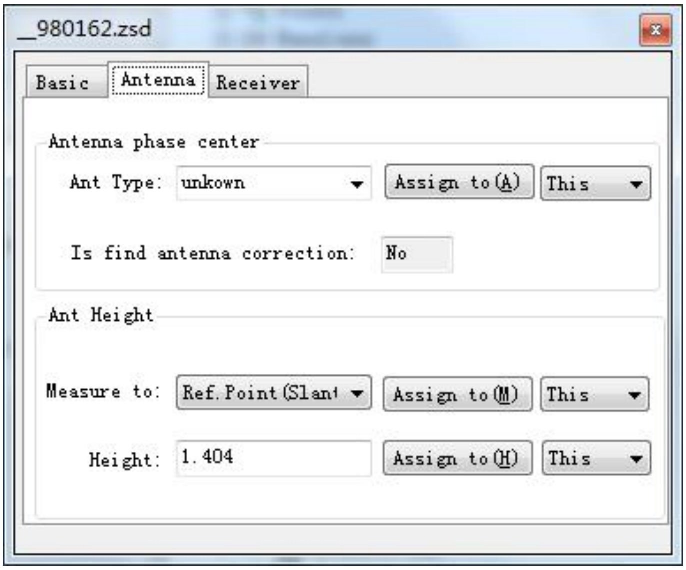


Figure 4- 13 Edit observation property

Single Point Positioning Result of Observation File

Choose a file in the Obs-Files tab in the detail view, right click it, and select ***Single Positioning Result*** in the pop-up menu. Then Single Point Position tab will be activated, the single point positioning result of the observation file will display in the plan view, as Figure 4- 14.

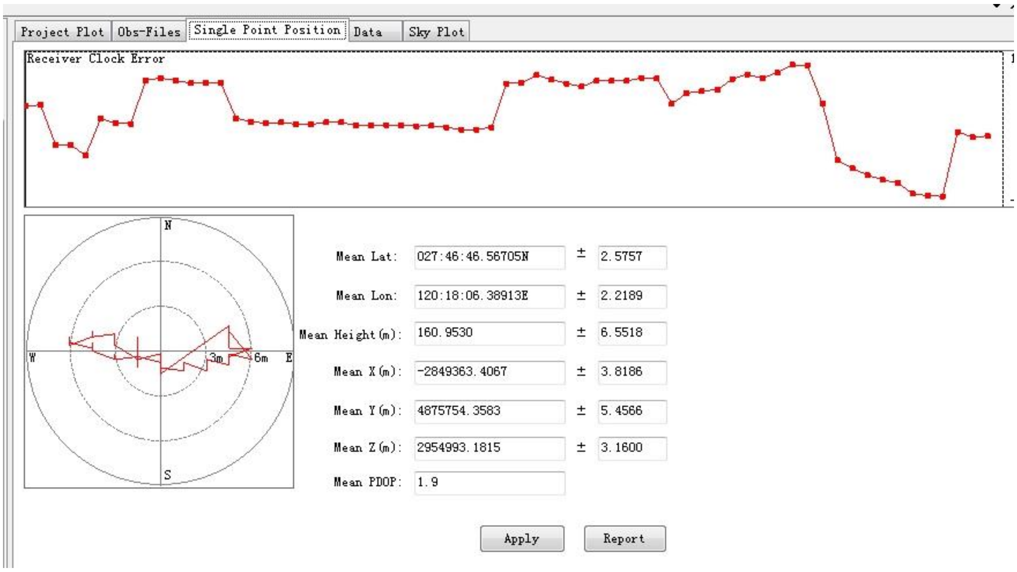


Figure 4- 14 Single position menu

The Data Track Map of Observation

Choose a file in the Obs-Files tab of the detail view, right click it, and select ***Data Track*** in the pop-up menu. Then Data tab will be activated, the tracking information about each satellite of the selected observation file displays in the plan view as Figure 4- 15. The interruption part means blockage of the satellites of the receiver.

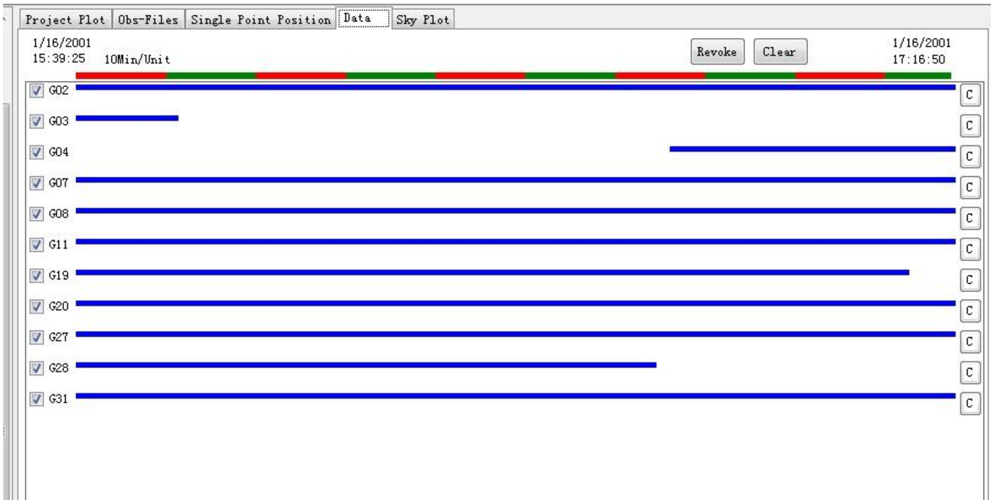


Figure 4- 15 Data track status

The Tracking Satellite Map of Observation

Select a file in the Obs-Files tab of the detail view, right click it, and select ***Skyplot*** in the pop-up menu. Then Sky Plot tab will be activated, the sky plot and SNR (Signal to Noise Ratio) plot about all the tracking satellites of the selected observation file displays in the plan view as Figure 4- 16.

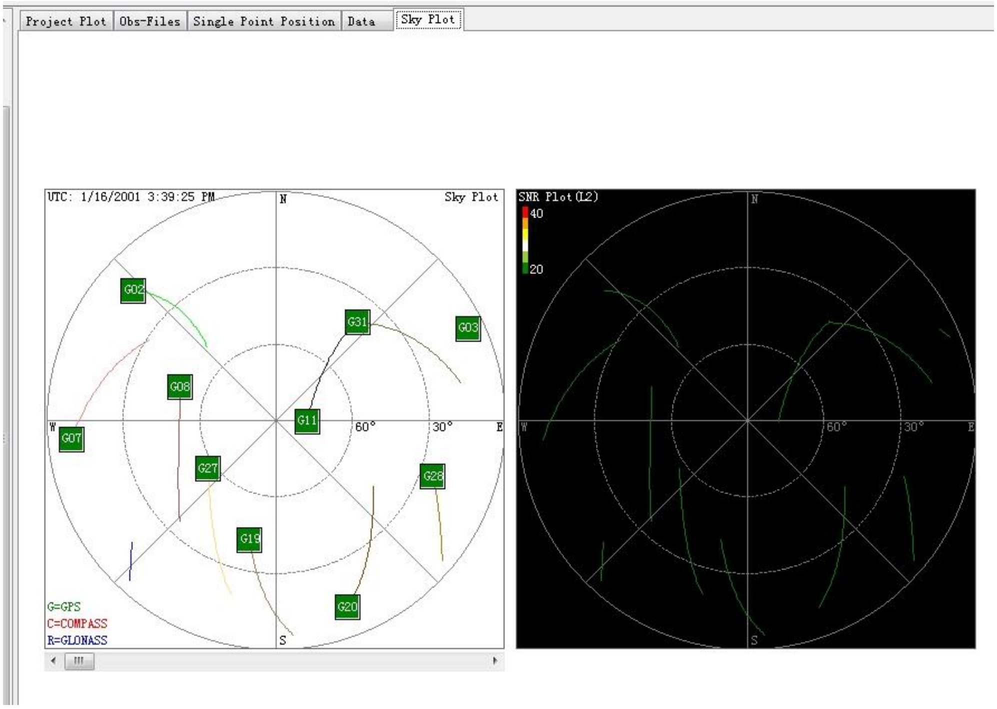


Figure 4- 16 Skyplot infomation

Transform Observation Data to the RINEX Format

Choose a file in the Obs-Files tab of the detail view, right click it, and select ***Convert to Rinex*** in the pop-up menu. Then the selected observation file will be converted to a RINEX format (Figure 4- 17). The options of RINEX file can be selected by choosing ***Rinex Options*** item menu in the pop-up menu to set up (Figure 4- 18). The created Rinex file is saved in the RINEX subdirectory of the corresponding project directory. You can view them by clicking ***Open Rinex Folder*** menu.

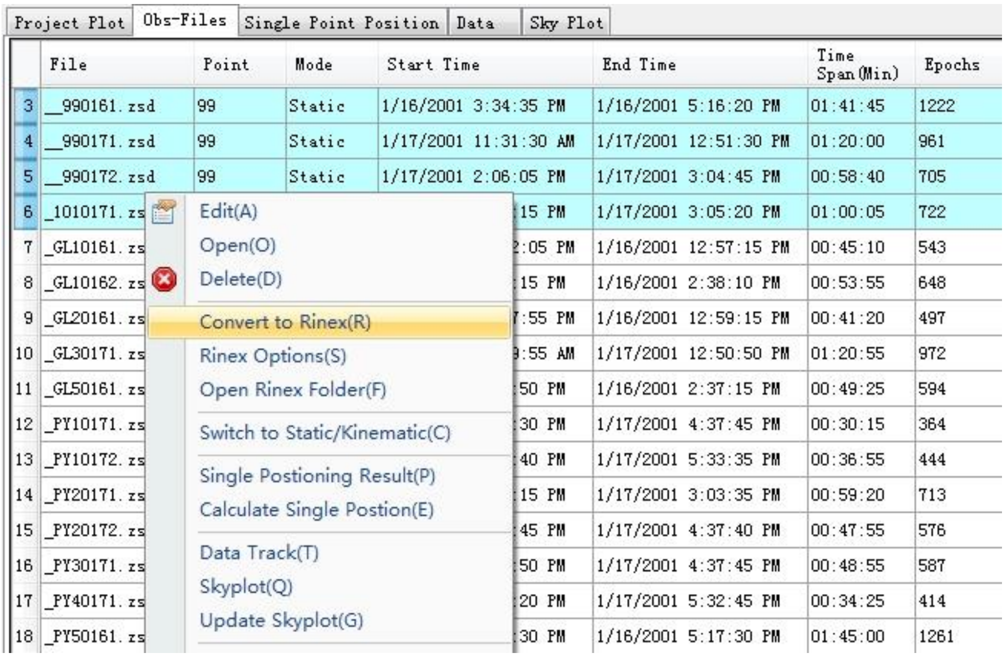


Figure 4- 17 Convert to Rinex format

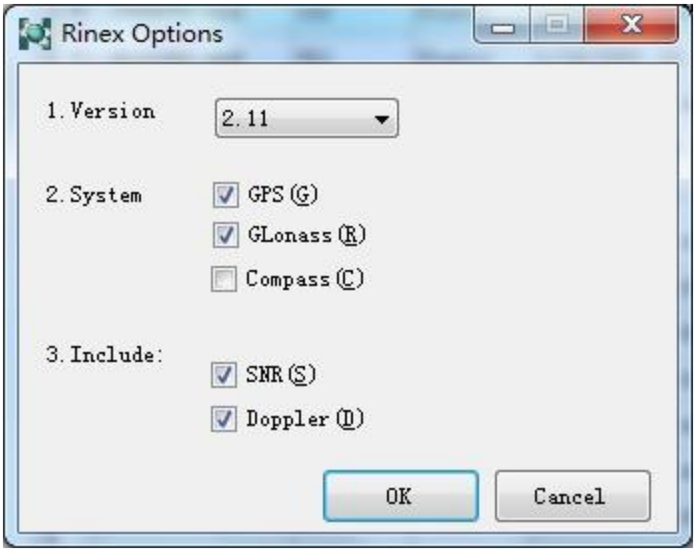


Figure 4- 18 Rinex options

Stop &Go RSP File

If you do stop&go data processing, you need to add stop&go RSP File (stop&go time file) to dynamic file. Choose a file in the Obs-Files tab of the detail view, right click it, and select ***Add Stop&Go File*** in the pop-up menu (Figure 4- 19) to add a RSP file to this observation file. Click ***View Stop&Go RSP File*** to view the RSP file you have added.

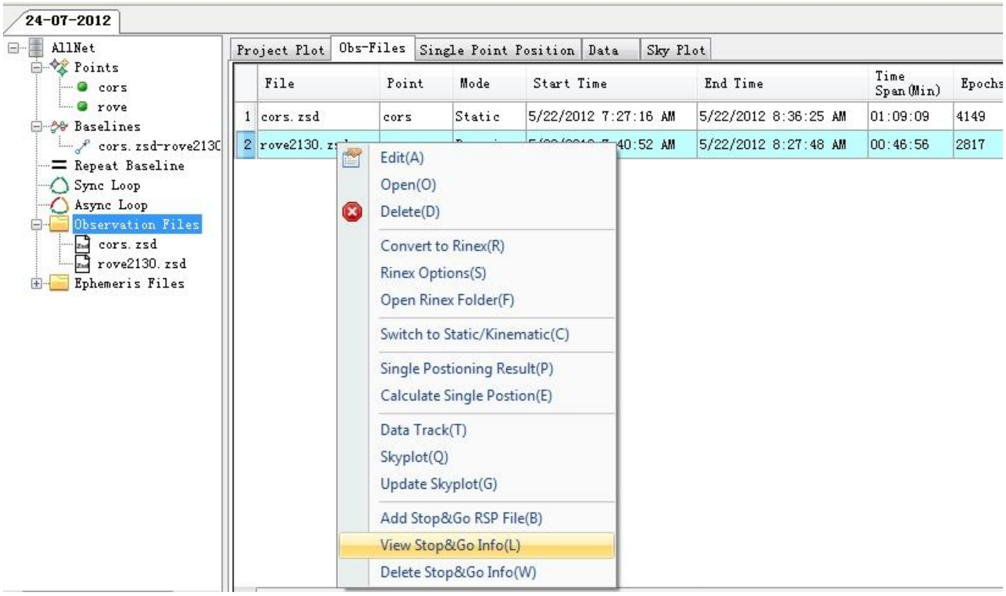
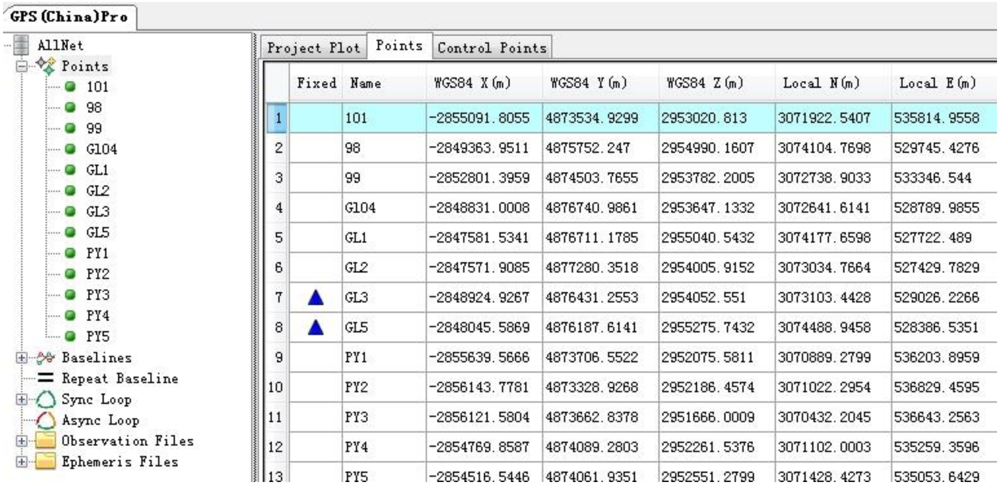


Figure 4- 19 View stop&go info

You can delete stop&go RSP File too, just select ***Delete Stop&Go Info*** menu item in the pop-up menu.

4.3 Observation Station

Click the ***Points*** node in the tree list view, and the right detail view will display information about site. There are two tabs in the right detail view, including points tab, control points. The control point list information is used to adjust network, and has nothing to do with baseline procession.



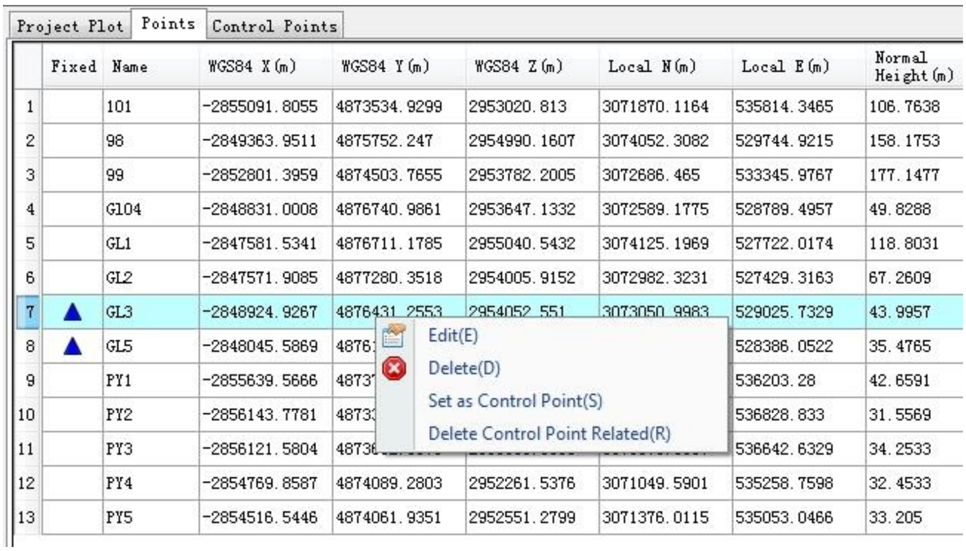
	Fixed	Name	WGS84 X(m)	WGS84 Y(m)	WGS84 Z(m)	Local N(m)	Local E(m)
1		101	-2855091.8055	4873534.9299	2953020.813	3071922.5407	535814.9558
2		98	-2849363.9511	4875752.247	2954990.1607	3074104.7698	529745.4276
3		99	-2852801.3959	4874503.7655	2953782.2005	3072738.9033	533346.544
4		G104	-2848831.0008	4876740.9861	2953647.1332	3072641.6141	528789.9855
5		GL1	-2847581.5341	4876711.1785	2955040.5432	3074177.6598	527722.489
6		GL2	-2847571.9085	4877280.3518	2954005.9152	3073034.7664	527429.7829
7	▲	GL3	-2848924.9267	4876431.2553	2954052.551	3073103.4428	529026.2266
8	▲	GL5	-2848045.5869	4876187.6141	2955275.7432	3074488.9458	528386.5351
9		PY1	-2855639.5666	4873706.5522	2952075.5811	3070889.2799	536203.8959
10		PY2	-2856143.7781	4873328.9268	2952186.4574	3071022.2954	536829.4595
11		PY3	-2856121.5804	4873662.8378	2951666.0009	3070432.2045	536643.2563
12		PY4	-2854769.8587	4874089.2803	2952261.5376	3071102.0003	535259.3596
13		PY5	-2854516.5446	4874061.9351	2952551.2799	3071428.4273	535053.6429

Figure 4- 20 Points

The detail view lists each observation site name, fixed (whether the control points associated with it), spatial rectangular coordinate under WGS84 coordinate system and grid coordinate in local system.

Pop-up Menu of Observation Station

Right click the selected site, pop-up menu display as Figure 4- 21. You can change the properties of the point.



	Fixed	Name	WGS84 X(m)	WGS84 Y(m)	WGS84 Z(m)	Local N(m)	Local E(m)	Normal Height(m)
1		101	-2855091.8055	4873534.9299	2953020.813	3071870.1164	535814.3465	106.7638
2		98	-2849363.9511	4875752.247	2954990.1607	3074052.3082	529744.9215	158.1753
3		99	-2852801.3959	4874503.7655	2953782.2005	3072686.465	533345.9767	177.1477
4		G104	-2848831.0008	4876740.9861	2953647.1332	3072589.1775	528789.4957	49.8288
5		GL1	-2847581.5341	4876711.1785	2955040.5432	3074125.1969	527722.0174	118.8031
6		GL2	-2847571.9085	4877280.3518	2954005.9152	3072982.3231	527429.3163	67.2609
7	▲	GL3	-2848924.9267	4876431.2553	2954052.551	3073050.9983	529025.7329	43.9957
8	▲	GL5	-2848045.5869	4876[illegible]	[illegible]	[illegible]	528386.0522	35.4765
9		PY1	-2855639.5666	4873[illegible]	[illegible]	[illegible]	536203.28	42.6591
10		PY2	-2856143.7781	4873[illegible]	[illegible]	[illegible]	536828.833	31.5569
11		PY3	-2856121.5804	4873[illegible]	[illegible]	[illegible]	536642.6329	34.2533
12		PY4	-2854769.8587	4874089.2803	2952261.5376	3071049.5901	535258.7598	32.4533
13		PY5	-2854516.5446	4874061.9351	2952551.2799	3071376.0115	535053.0466	33.205

Figure 4- 21 Pop-up menu for points

Property of Observation Site

Select ***Edit*** in the pop-up menu or double click selected site, you can set the property of the observation site, such as its name, WGS coordinate, local grid coordinate.

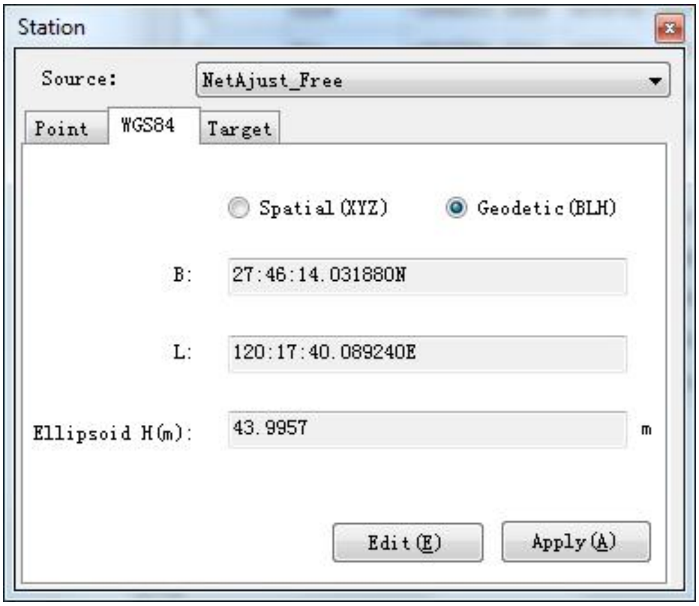


Figure 4- 22 Edit site

TGO software package record all coordinate source, such as an observation file. You can change the coordinate source of a site by selecting source in the source pull down menu and apply it by clicking ***Apply*** button. Click ***Edit*** button to enter coordinate.

4.4 Baseline

Click the ***Baselines*** node in the tree list view, and the right detail view will display information about baselines (Figure 4- 23).

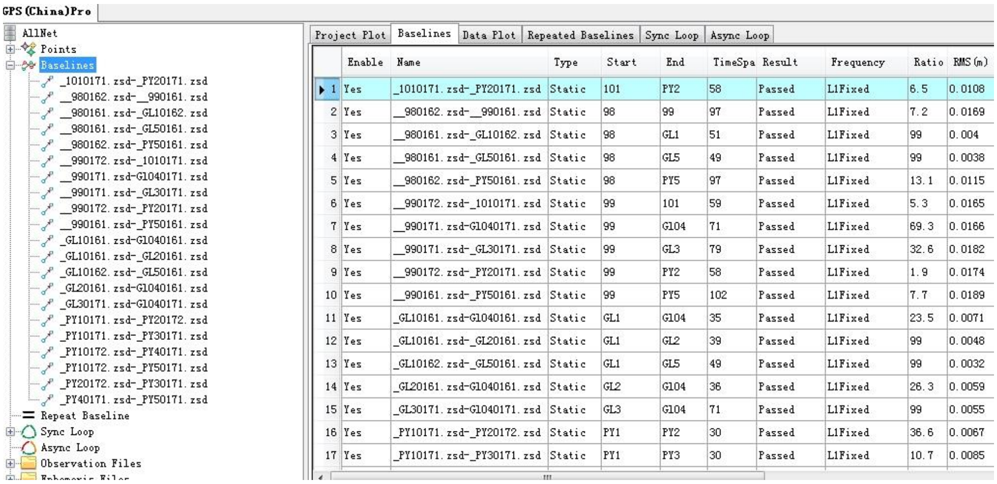


Figure 4- 23 Baseline menu

Pop-up Menu of Baseline

Click the ***Baselines*** node in the tree list view, and the right detail view will display information about baselines (Figure 4- 24).

With this pop-up menu, you can set procession option, process baseline, view report and delete baseline.

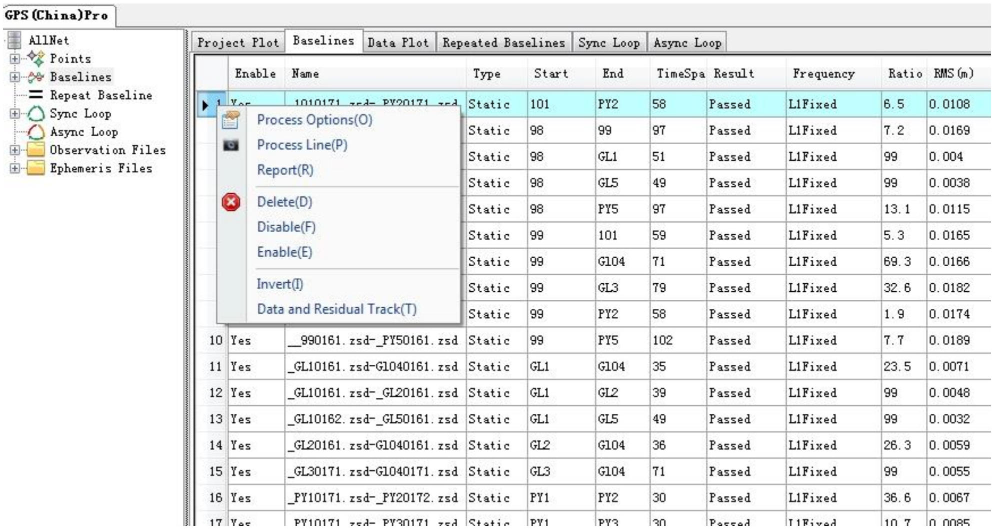


Figure 4- 24 Pop-up menu for baseline

4.5 Repeat Baseline

Click the ***Repeat Baseline*** node in the tree list view, and the right detail view will display information about repeat baseline (Figure 4- 25).

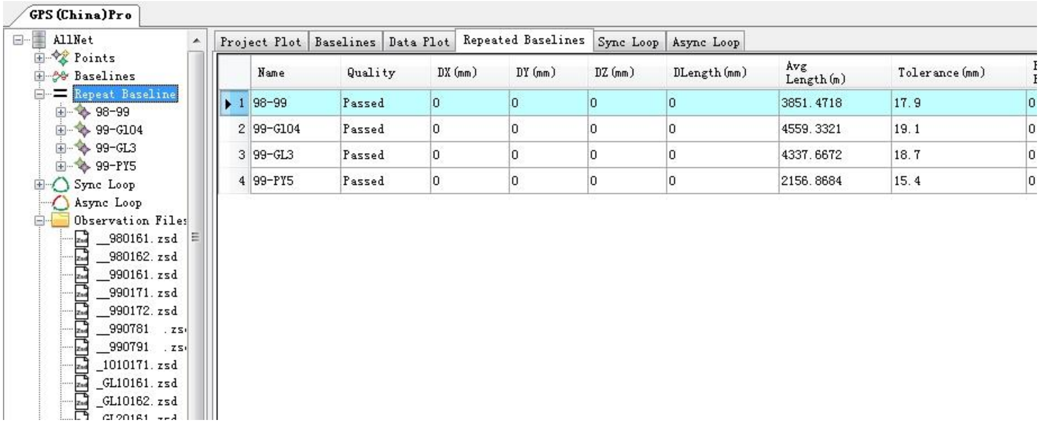
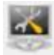


Figure 4- 25 Repeat baseline info

5. **Baseline Processing**

5.1 Processing Options

Before processing baseline, processing options must be set. Right click one baseline, select ***Process Option*** item in the pop-up menu, or click  in the navigation filed, the following dialog display:

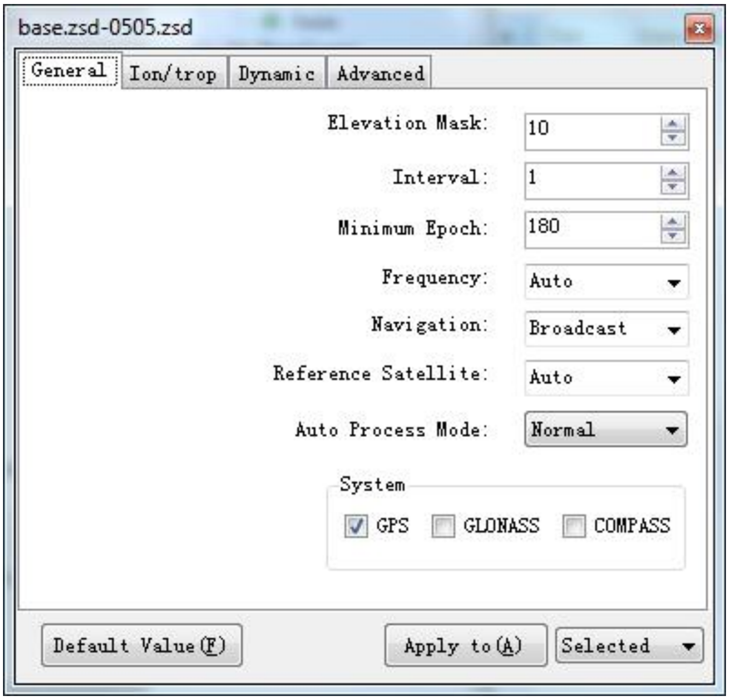


Figure 5- 1 Baseline processing options

The dialog is consisting of four setting pages: General, Ion/trop, Dynamic and Advanced.

General Setting

For static baselines, the minimum epoch count is 5s, or observation data can't form the baseline; for dynamic baseline, the minimum epoch count is 180, or the integer ambiguity can’t be fixed.

Cutoff Angle

Cutoff angle is used to limit the satellite data with relatively lower height angle, these data won't be processed when you processed baseline.

The signals from low cutoff satellites are not easy to use. Besides, the signals of lower height can be influenced by several factors, such as multi-path effect, electromagnetic waves or an in deliberate jammer. So generally the quality of these signals is not good. These signals should be removed from the procession.

From the atmosphere refraction perspective, observation for a short distance can be reduced cutoff angle height; for long distance observation, cutoff angle should be increased. The shorter the distance, atmospheric refraction affects is easier to be removed. Cutoff angle should be determined according to the field condition.

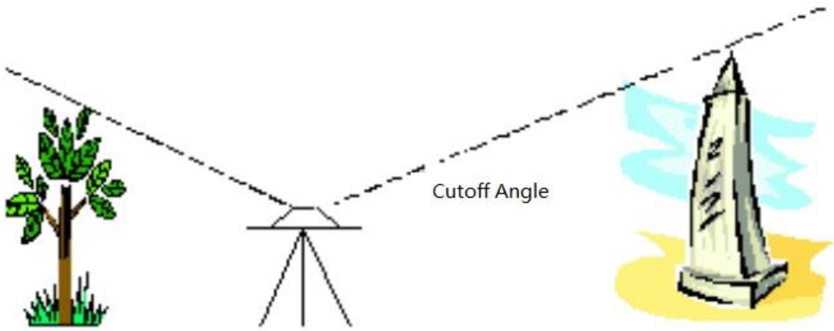


Figure 5- 2 Cutoff angle

The default cutoff angle is 20 in TGO software package.

Sampling Interval

The epoch interval is the data interval taken from the original observational data drawn Take in the baseline process.

For example: when two receivers are processing static surveying, they are set up to capture a group of data every 5 seconds. But when it comes to the inside processing, this high density data usually degrades the accuracy of the baseline processing, instead of increase. So in order to accelerate the processing rate, user can increase the interval time appropriately. Generally, for the short line, and the observation time is not long, you can reduce the interval time appropriately, while for the long line, you can increase the interval time. e.g. For a static baseline shorter than 2 k, and the observation time within 20 minutes, then you can set up the interval to be 5seconds. But if the baseline is longer, you can increase the interval to 60 or 120 seconds.

Why set up so little interval surveying in outdoors? Because the random of the Observations and the limit of the software, you can change the epoch interval then process the baseline again to get a better result when you have the worse data. The default epoch interval is 60 seconds.

Minimum number of epoch

Because the dual-difference is formed via the difference of the single-difference observations among the satellites, for simple processing purpose, the software fixes a reference satellite when form the dual-difference observation value. The default minimum number of epoch is 5.

Observations (Frequency)

You can choose different combinations of observed values to process baseline, such as wide lane Lw, narrow lane Ln and so on. When auto mode is chosen, TGO can automatically select the type of observations according to the baseline length. Generally, baseline less than 5km use L1 observations, baseline greater than 5km use a Lc ionosphere-free combination observations.

Ephemeris (Navigation)

You can choose the broadcast ephemeris or precise ephemeris to process. Generally, if baselines are very long, precise ephemeris can improve the accuracy of the baseline solution; for short-distance baselines, the broadcast ephemeris can meet the requirements.

Reference Satellite

The default of reference satellite is auto. In this mode, TGO will select the observation data from the satellites with the greatest elevation angle as a reference satellite.

However, due to the influence of the conditions of observation, such choice may not be the most reasonable .When the reference satellite selected is not reasonable, the results of the baseline processing will be affected. Under this condition, you need to set the reference satellite based on observation data.

Auto-Process Mode

TGO software package can remove the gross errors in satellite data automatically. It can help users to reduce the work of removing the data manually and get the qualified baseline solution in short time. This feature can be enabled if "enhanced" is chosen. If the user wants to remove the data manually, just choose "general".

Dynamic Solving Mode

This page is used to set dynamic route procession mode. This tab is only used for dynamic route processing. Dynamic GPS data processing has three solving mode: RTD, Stop&Go, PPK (Post Process Kinematic).

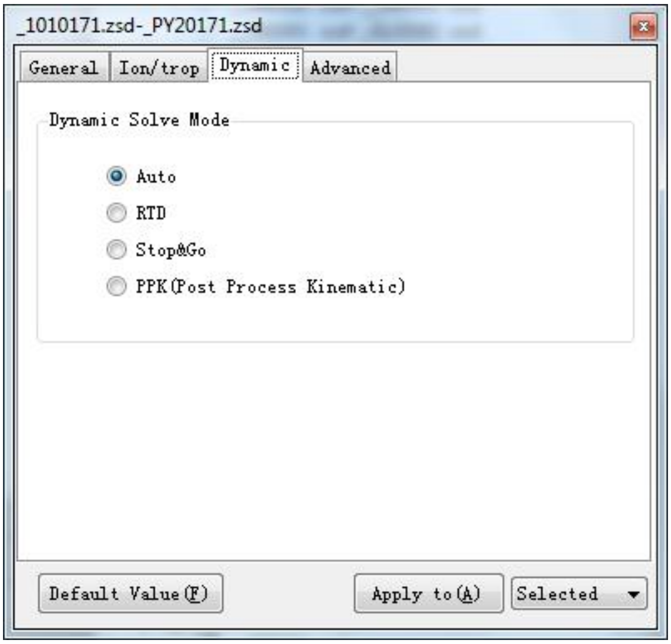


Figure 5- 3 Dynamic mode

Auto: Software will choose mode to process baseline according to the existence of stop&go RSP file. No RSP file, using RTD mode, or Stop&Go mode.

RTD: The solving method of integer ambiguity for RTD solution mode is pure dynamic method. It can achieve 5 m precision within 300 kilometers and above 1m precision within 100 kilometers.

Stop&Go: This solution mode is suitable for short, middle, long baseline processing. Both stop stage and go stage is processed according to the principle of least squares method. The solving method of integer ambiguity, for stop stage, is fast static method and for go stage, is pure dynamic method. The precision of solution mode has better repetition than PPK, because it only has one ratio value.

PPK: This solution mode is suitable for short, middle baseline processing. Both stop stage and go stage are processed according to Kalman Filtering method. The solving method of integer ambiguity, for go stage, is pure dynamic method. For stop stage, integer ambiguity is obtained according to the dynamic single epoch results. The precision of this solution mode has less repetition, because every epoch has a ratio value.

Notice: If the quality of satellites single is good, the result of PPK and Stop&Go is much same. But if the quality of satellites single is worse, you'd better choose PPK solution method.

Ionosphere/ Troposphere

In general, not need to change the troposphere, ionosphere settings. Long baseline can improve the solution setting precision according to actual situation.

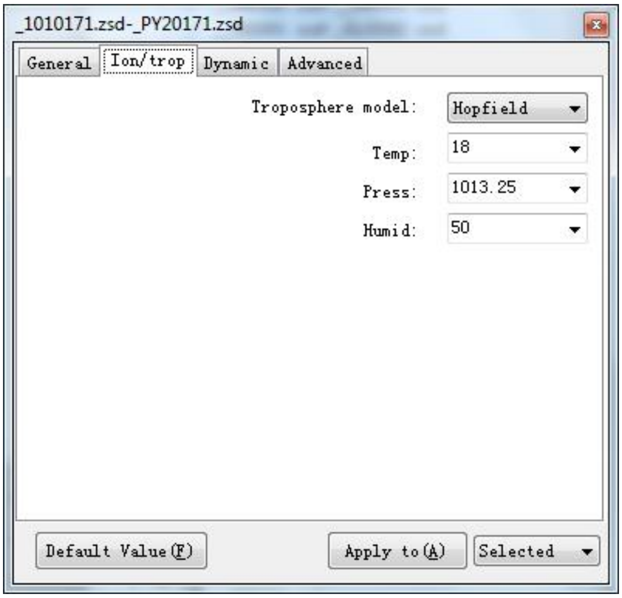


Figure 5- 4 Ion/trop options

Advanced

In general, the default value can meet the requirements. It's recommended that users keep all the default parameters in this tab, any change may influence the solution stability.

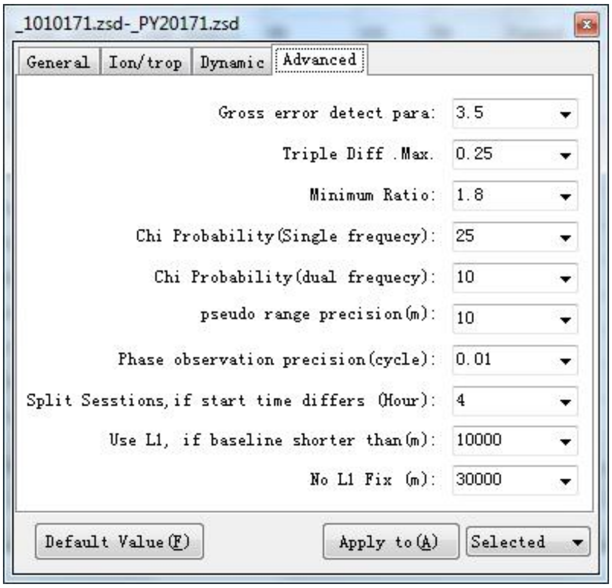


Figure 5- 5 Advanced options

5.2 Baseline Processing

After all the settings are finished, select Baseline/Process line all baselines, or click  in the navigation field, the software will process each baseline in sequence and display the information frame.

During the processing, click ***Cancel*** button, then you can stop process baseline.

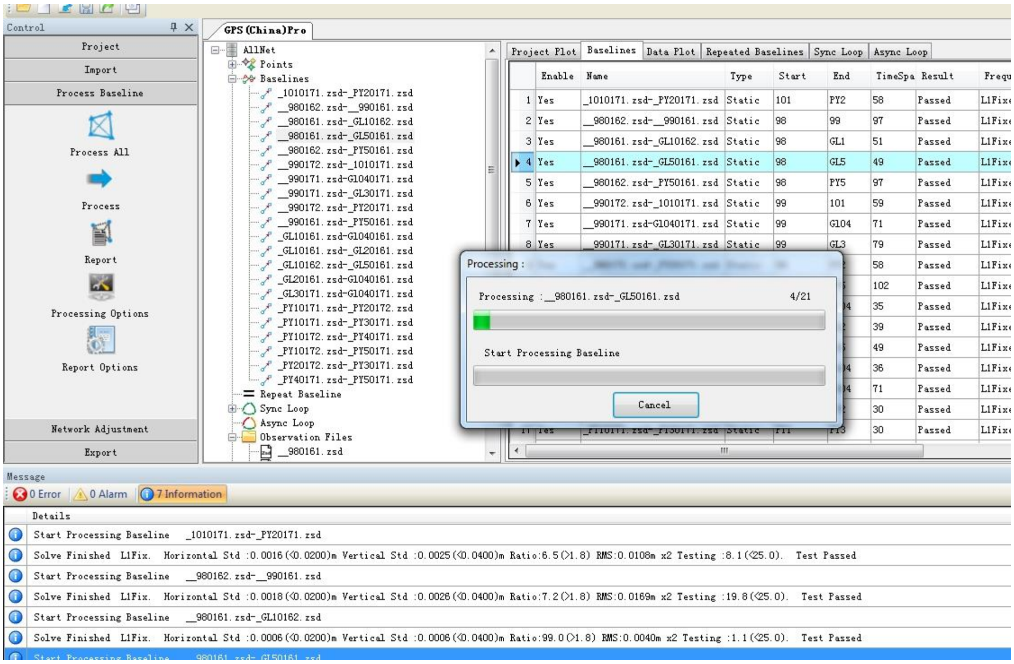


Figure 5- 6 Baseline processing

The baseline solution result will display in the message filed after the solution as Figure 5-7.

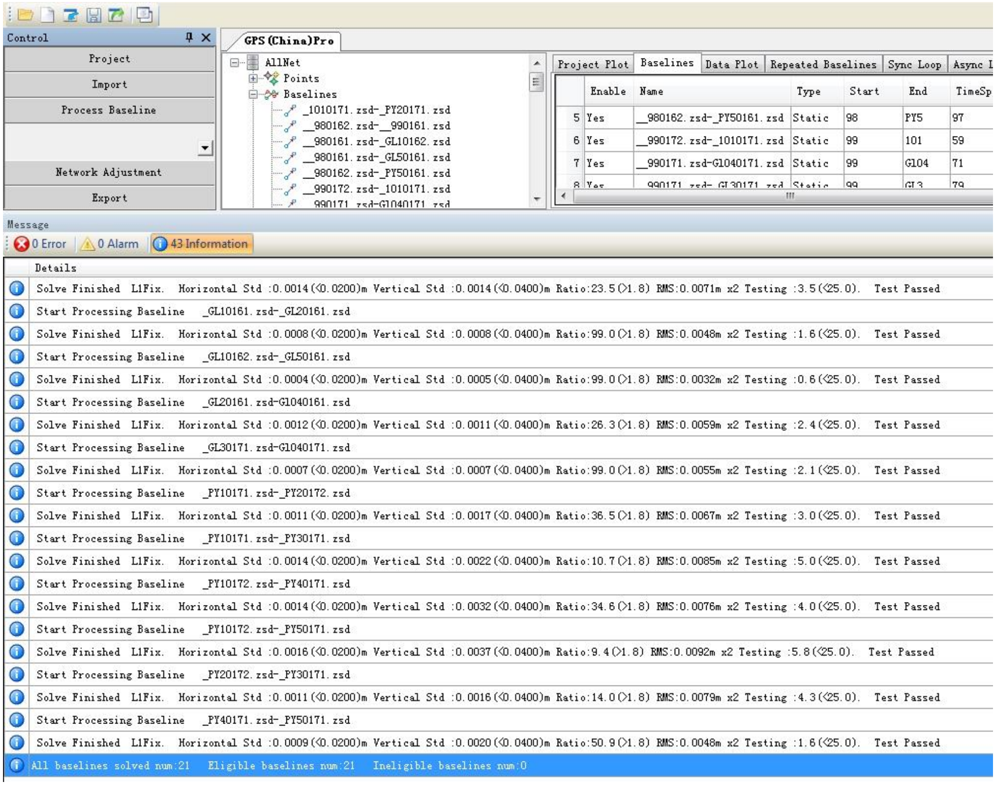


Figure 5- 7 Baseline information

If there is warning, click one warning message and you will find the corresponding baseline in the list. The result of the solution can form the baseline report via select ***Baseline->Report*** or click on  to create a baseline report.

5.3 Test Baseline Processing Result

Control Baseline Quality

After the baseline is processed, you can check the quality of the baseline by the quality standards such as RATIO, RMS and the point precision.

5.3.1 RATIO

The RATIO is the ratio of the less least RMS and the Least RMS after the integer ambiguity analysis, that is:

$$RATIO = \frac{RMS_{\sec}}{RMS_{\min}}$$

The RATIO reflects the reliability of the integer ambiguity parameter, which is determined by a few factors. It is related to the observation quality and the observation time.

The RATIO is a key factor to the quality of the baseline, generally, the RATIO is required to be bigger than 1.8.

RMS

RMS is the Root Mean Square, that is:

$$RMS = \sqrt{\frac{V^T PV}{n - f}}$$

V is the residual of the observations;

P is the weight of the observations;

n - f is that the total numbers of observations subtracts to the number of known number.

RMS means the quality of the observations. The smaller the value of RMS is, the better the quality will be; The RMS is not effected by the observation time.

According the theory of Symbolic Statistics Mathematical Statistics, the rate of the observation error within the 1.96 times RMS is 95%.

Point Precision

Point precision is an important standard of the internal accuracy of solution results. It is depended on line with the strength of the satellite geometry and RMS, it can be divided into the precision of horizontal direction, precision of the vertical direction, the baseline length precision and so on. The software will check the different accuracy standard according to tolerance setting of a project.

5.3.2 Closed Loop and Repeat Baseline Testing

Closed Loop

1. The Definition of the Misclosure

The closed loop test is an useful way to verify the quality of the baseline. The closed loop includes the synchronous loop, asynchronous loop and the duplicate baseline. In theory, the misclosure of the closed loop is zero, but in practice, surveying a certain deviation is allowed. Please refer to the relation information about the deviation limit.

The types of the misclosure are as the followings:

1. Component misclosure, that is:

$$\begin{cases} W_{\Delta X} = \sum \Delta X \\ W_{\Delta Y} = \sum \Delta Y \\ W_{\Delta Z} = \sum \Delta Z \end{cases}$$

2. Total misclosure, that is:

$$W_s = \sqrt{W_{\Delta X}^{\ 2} + W_{\Delta Y}^{\ 2} + W_{\Delta Z}^{\ 2}}$$

2. Synchronous closed loop

The misclosure of the closed loop is the misclosure of the closed loop formed by the observation baselines. Because of the relativity among the baselines, the misclosure should be zero in theory. If the deviation of the misclosure is out of the limit, then one baseline vector is wrong at least. If the misclosure is within the limit, it generally means that most static baselines are OK.

3. Asynchronous closed loop

The asynchronous closed loop is a closed loop formed by all the baselines synchronously. The misclosure of the asynchronous loop is the asynchronous loop's misclosure. If the misclosure is within the limit of the deviation, it means the baseline vector is OK. If the misclosure is greater than the limit of the deviate, it means that at least one vector is not OK. You can check which baseline vector is not OK by the vicinity asynchronous loop and the duplicate baselines.

Repeated Baselines

The observation result between two stations at different observation times is the repeat baselines. The difference between the repeat baselines is the repeat baselines comparability difference.

5.3.3 Identify Every Effect Factors

Effect Factors

Factors effecting on the baseline's result are as follows:

1. The starting coordinate setting is wrong when you process the baseline. The wrong starting coordinate will cause the baseline deviation in the scale and direction.

2. The too short observation time cannot decide the integer ambiguity of the satellite. And for the baseline processing, if the integer ambiguity corresponding is not computed, the baseline processing result will be effected.

3. The number of the cycle slips is too big during some time and cause the cycle slips repairing is not perfect.

4. The multi-path effect is very much during the data collection, and the corrections of the observation value are general big;

5. The effect on the troposphere and ionosphere is too much;

6. The electromagnetic noise cannot be ignored.

7. The receiver itself has problem and cause the quality of the data too bad, e.g. the degraded phase accuracy of the receiver or the clock of the receiver is not accurate.

Problems and the Solutions:

1. The identification of the effect factors on the GPS baseline resolution

In the effect factors, some are easy to distinguish, such as the too short observation time, too many cycle slips, serious multi-path effect and too much effect from the troposphere or ionosphere. But other factors are not easy to tell, such as the inaccurate starting coordinate.

The inaccurate starting coordinate

It's not easy to tell the effect of inaccurate starting coordinate to the quality of the baseline solution, so the beginning coordinate have to be as accurate as possible.

The identification of the short observation time

You can tell this factor easily. You can view the number of each satellite's observations in the record files. The TGO Software Package supplies the visible satellite map.

The identification of many cycle slips

You can analyze the observation residual of the baseline solution to tell the cycle slips. Now most baseline processing software use the dual-difference value, so when the observations include the uncorrected cycle slips, all the residual of the dual-difference corresponding to the cycle slips will have the obviously increase at several times.

The Identification of the serious multi-path effect and the too much effect of the troposphere or the ionosphere refraction

To the multi-path effect and the refraction of the troposphere or the ionosphere, we distinguish them by the residual of the baseline, too. But different to the integer cycle slips, when the multi-path effect and the refraction effect of the troposphere or the ionosphere serious, the residual increase within one time not several times and obviously bigger the normal residual.

2. Solutions

1）Inaccurate starting coordinate

To solve the problem starting from the inaccurate points, you can use the most accurate point as the starting point when you process the baseline. The relative accurate starting coordinate can be got by the long time point positioning or connecting with the more accurate the WGS-84 coordinate, or do as the following way:

When you resolve the baseline in a network, select one point's coordinate as the derivation of all the points' coordinate, so it is the baseline's starting coordination, then all the baselines have the same system error, so you can introduce the system parameter to resolve it during the network adjustment.

2） Too short observation time

If the observation time is too short, you can delete their observations. So you can improve the result by preventing them from solution.

3）Too many cycle slips

If in an observation time, many satellites have lots of cycle slips, you can remove this time to improve the solution quality. If only one or two satellites have too many cycle slips, you can delete the satellites to improve the solution quality.

4）Serious effect of the multi-path

The result of the multi-path effect is that the observation value residual is too big, so the big residual observation value can be deleted by reducing the edit dilution. Or you can delete the observation time or the satellite effected on serious by the multi-path.

5）Serious effect of the troposphere or the ionosphere refraction:

- ✧ Increase the elevation cutoff angle and delete the data of little elevation angle which is effected on by the refraction easily. But this method is not smart, because the signal of little elevation angle may not be effected severely.
- ✧ Modify the delay of the troposphere’s or the ionosphere’s model.
- ✧ If the observation value is dual-frequency, you can use the value, the fraction of the ionosphere is not used.

The Residual Map

The residual map is a useful tool to condense the baseline processing. When you process a baseline, it's often necessary to solve the solution problem, for example, which satellites, or during which observation time, has problem. The residual map is useful to solve this problem. The baseline residual map is a figure expressing the residual of the observations. Select the ***Previous*** or the ***Next***, you can view the residual of the combination of each dual-difference. See Figure 5- 8.

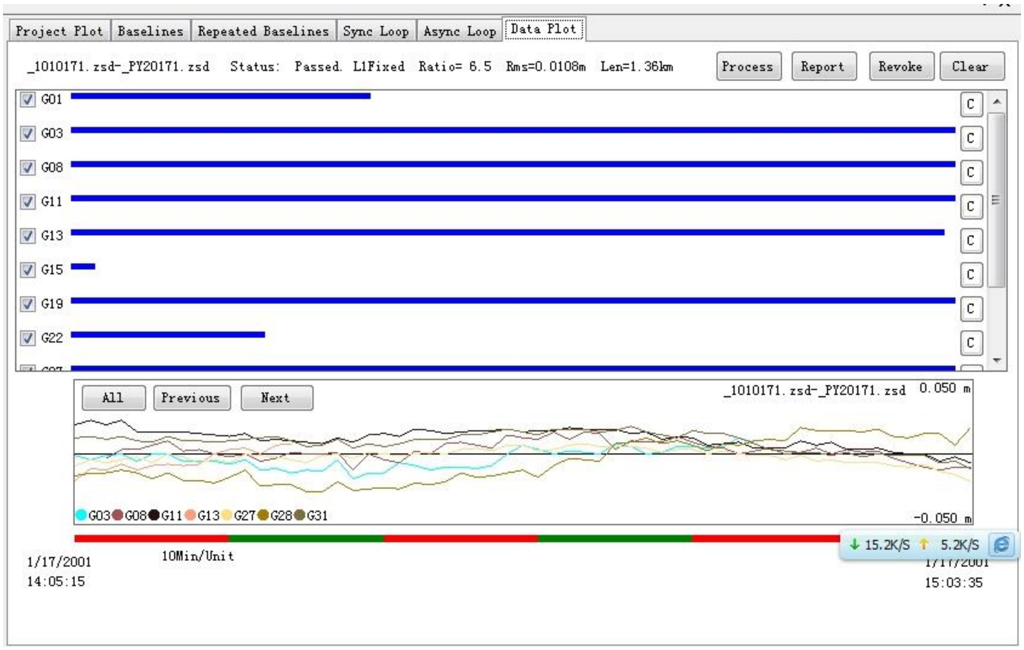


Figure 5- 8 Residual map

This picture above is a general format of the baseline residual map. The horizontal axe is the observation time, the vertical axes are the observation residual.

The residual value fluctuates with the zero axes, and the amplitude is within 0.1 cycle.

5.4 Reprocess a Baseline

If the reason for the baseline's quality is found, you can reprocess this baseline by changing the baseline processing setting or editing the observation time of the baseline.

In the observation map, you can drag the mouse to select the deleted data. See Figure 5- 9 Processing edit, the data in the broken lines box will be removed, and will not be processed.

Figure 5- 9 Processing edit

When you find the processing is not qualified during the baseline surveying, you need to change the setting of the baseline or edit the observation time. If you still cannot get the qualified solution, you should prevent this baseline from being processed by the network adjustment or delete this baseline. If the baseline is mandatory in the control network, you should resurvey this baseline.

5.5 Dynamic Route Processing

The dynamic route post-processing is the post-difference data processing. The post-difference is different from the Real Time Kinematic, which can get the surveying result at once, while the post-difference cannot get the result until the inner processing is finished. If the post-difference processing cannot get the qualified result from the observations processing, the dynamic post processing will not be completed successfully.

The operation of dynamic post-processing is easy, do it as dynamic route processing section of quick start guide chapter.

6. Network Adjustment

After you process the baseline, you should test again the result of the processing, optimize the result, and transform the coordinate to the needed national coordinate or the local coordinate. All the above is the content of the network adjustment. The method of this software network adjustment is the Least Square method.

6.1. Function and Steps of Network Adjustment

TGO has the function of processing the free network adjustment, the 3D constrained adjustment, the 2D constrained adjustment and the height fitting.

Please see Figure 6- 1 for the basic network adjustment steps for the TGO Software Package, the network adjustment includes three procedures.

- The preparations done by the user. You need to set up the coordinate, enter the latitude and longitude, the coordinate, the elevation of the known points;
- Process the network adjustment, which is done by the software;
- The analysis and control to the quality of the processing result, which are done by the user.

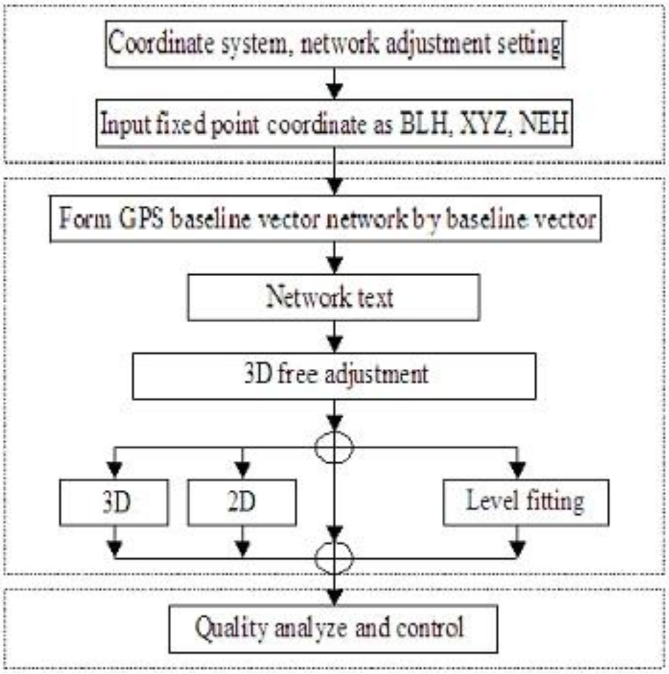


Figure 6- 1Network adjustment steps

We can find that, the software only achieves the solution of the network adjustment. What is more important is the involvement of the user to get a right result, and this is often an iterative procedure.

6.2. Network Adjustment Preparation

Coordinate Setting

You should check the setting of the coordinate before set up the network adjustment. The details of setting coordinate system, please reference to **Set the Coordinate Parameters** in section 4.1.

Network Adjustment Setting

Select ***Adjust*** /***Adjust options*** menu or click  in the navigation field, the dialog in Figure 6- 2 will display, you can set adjustment parameters and test parameters.

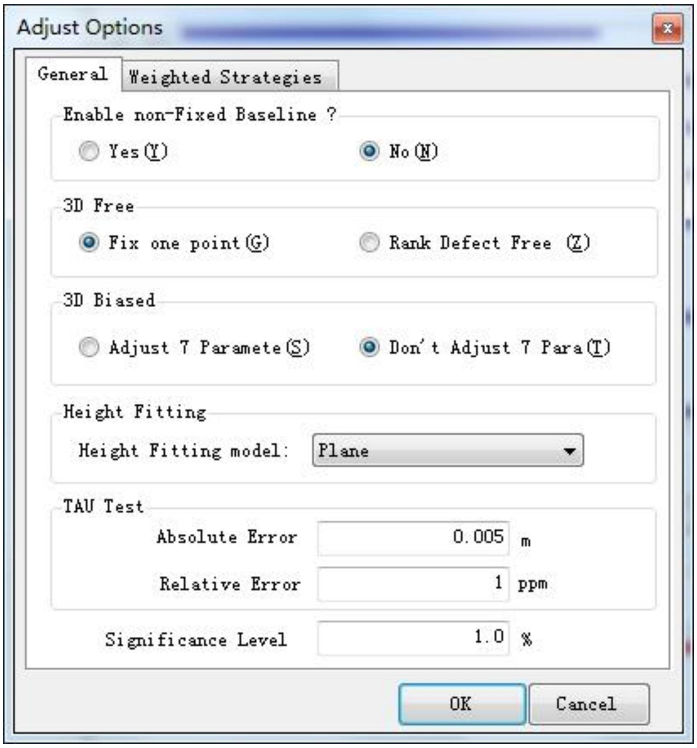


Figure 6- 2 Adjust options

Control-point Coordinates

After network adjustment setting is completed, you need to enter control-point coordinate, or you cannot do constrained adjustment. There are several methods to enter the control-point coordinate:

1. Click ***Set as Control Point*** in the pop-up menu of sites list to set the site to control point.

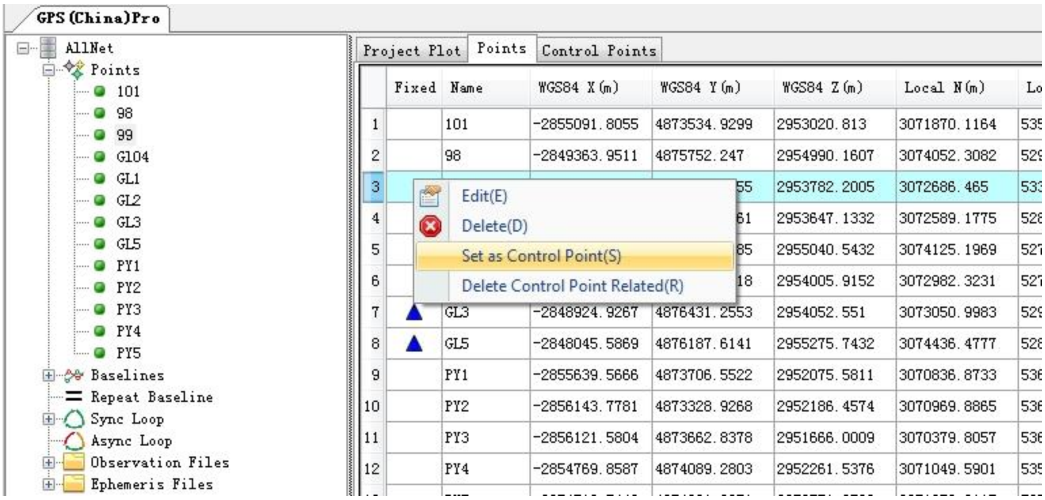


Figure 6- 3 Control points setting 1

2. Click ***Set as Control Point*** in the pop-up menu of control point list to enter the control point info.

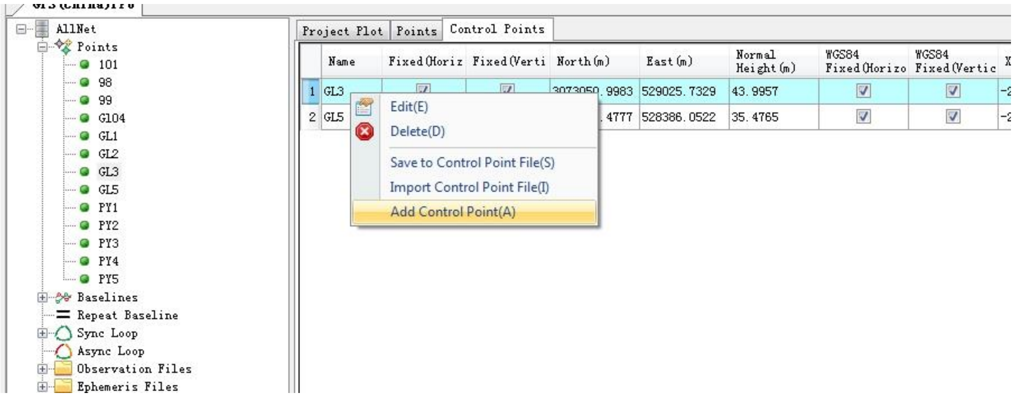


Figure 6- 4Control points setting 2

3. Click ***Import Control Point File*** in the pop-up menu of control point list to import the existing control point file to the project.

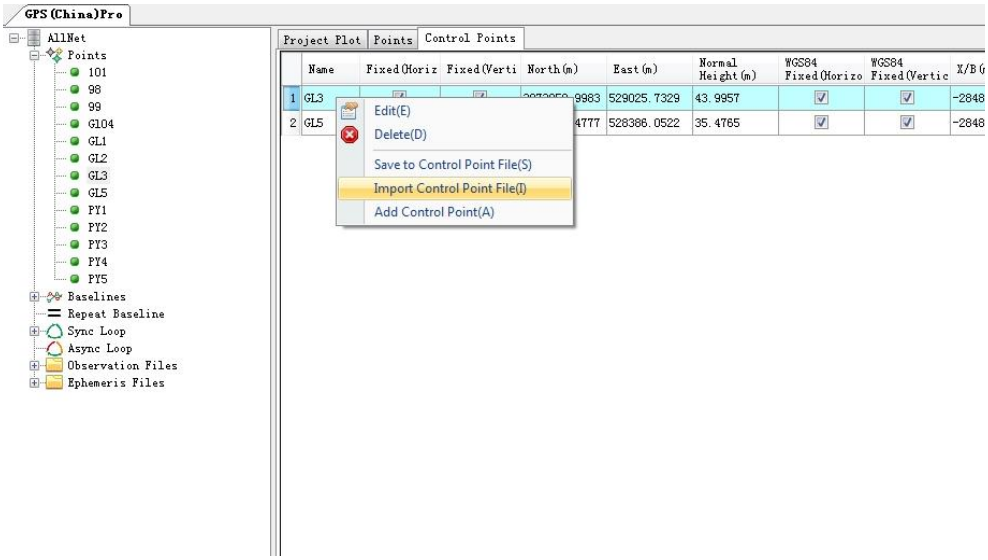
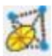


Figure 6- 5 Control points setting 3

After entering control point info, you can click ***Save to Control Point File*** in the pop-up menu of control point list to save control point file.

6.3. Run Network Adjustment

Run Adjust in the Adjust menu, or click  button in the navigation field. Generally, just choose ***auto adjust*** mode, TGO will process network adjustment based on the known baseline processing result, the network adjustment setting, the observation point's coordinate. When adjustment is completed, the software will form the adjustment results list, select an adjustment result, then click Get Report button, you can view the corresponding adjustment report.

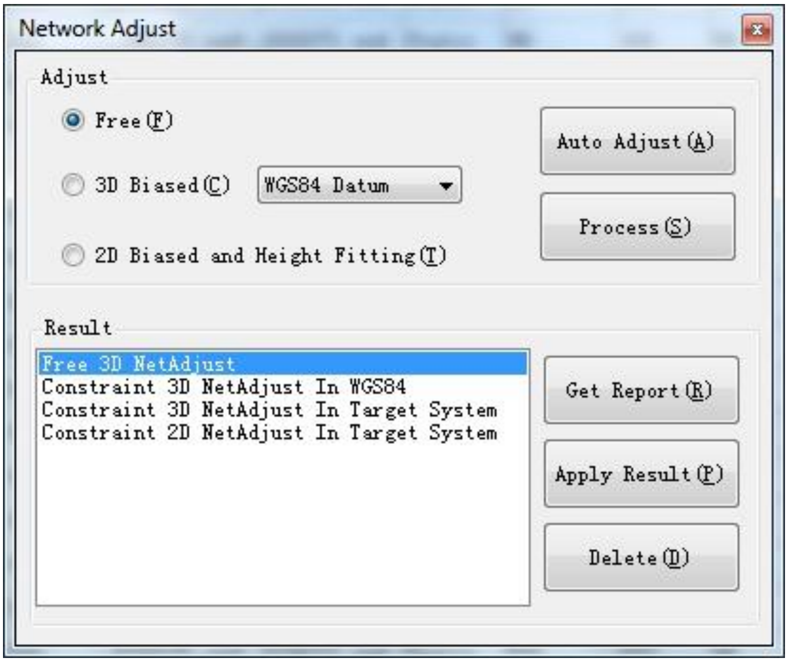


Figure 6- 6 Network Adjust page

Get Baseline Vector Network

The first step to run the network adjustment is to get the baseline vector network. The principles to form the vector are listed below:

1. This baseline is in this project and it is not be deleted;
2. This baseline has a starting name and a calculation name;
3. This baseline is computed and display as a qualified baseline in the vector list ;
4. This baseline is not set up to not attending the solution and the network adjustment.

The baseline meeting the items above will be downloaded in the first step of the network adjustment and form a baseline vector network.

Check Connectivity of Baseline Vector Network

If you process the adjustment with the network not connective, the result of the adjustment cannot converge. TGO will test the connectivity of the network automatically before the adjustment. If the network is not connective, you will find the error message as Figure 6- 7:

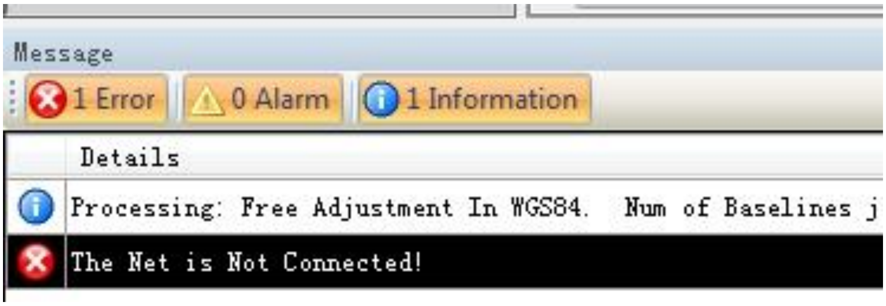


Figure 6- 7 Network error message

So you should test the baseline vector, the observation point name of the baseline vector network. The steps are listed below:

1. Check the map whether it is divided into several parts, or it has the separated observation sites or baselines, if yes, delete the separate point or process baseline respectively.

2. Make sure the key baseline is computed successfully, and it is not prevented from the network adjustment. You should reprocess or resurvey the key baseline if it is in the above situation.

3. Make sure no observation site with two difference names, which will be shown on the map two points with little distance. Because the two points observation is the observation of the same site at different time, so they cannot form a baseline and the map is not connective. The solution is to modify the error station name in the observations property.

Adjustment Report

The results of the adjustment will be reflected in the report. Adjustment report content and display format can be set in the Adjust Report Options window (Figure 6- 8). A network adjustment example is given in Figure 6- 9.

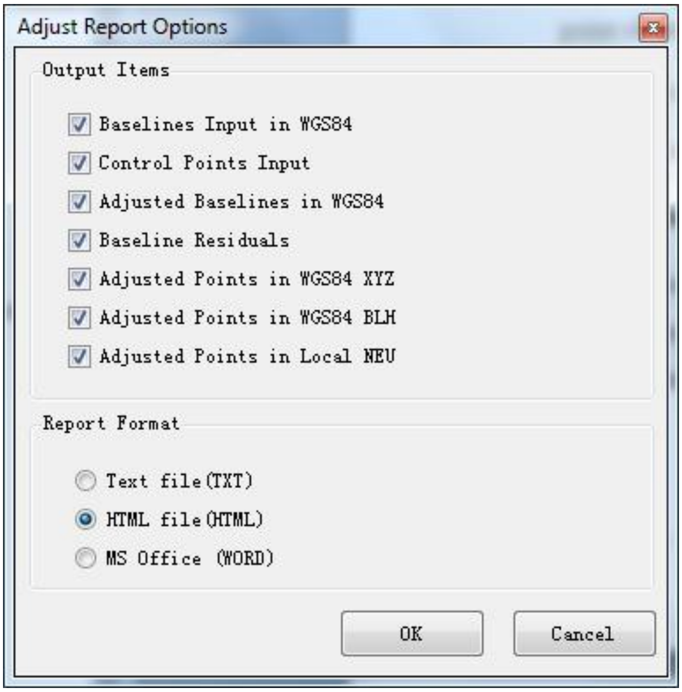
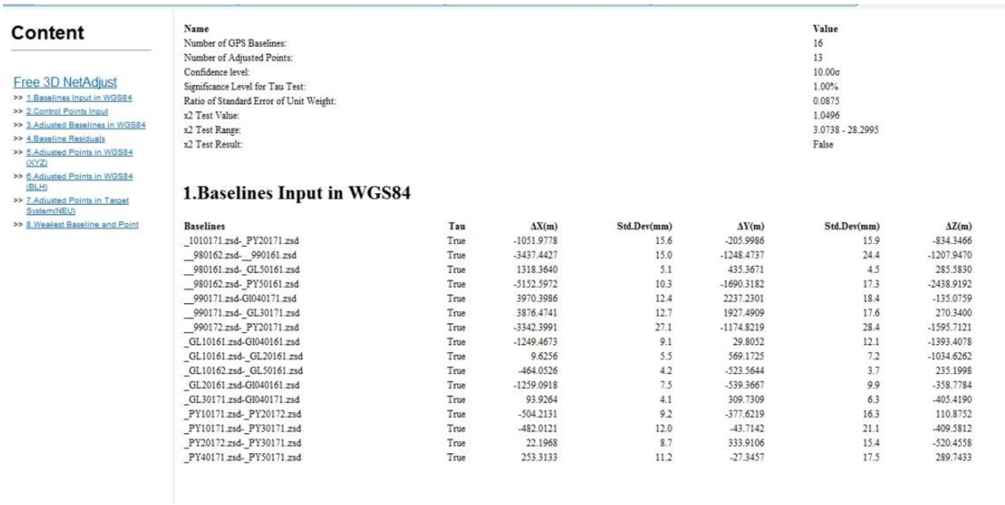


Figure 6- 8 Adjust report options



Content

Free 3D NetAdjust
>> 1.Baselines Input in WGS84
>> 2.Control Points Input
>> 3.Adjusted Baselines in WGS84
>> 4.Baseline Residuals
>> 5.Adjusted Points in WGS84 (XYZ)
>> 6.Adjusted Points in WGS84 (BLH)
>> 7.Adjusted Points in Target System(NEU)
>> 8.Weakest Baseline and Point

Name	Value
Number of GPS Baselines:	16
Number of Adjusted Points:	13
Confidence level:	10.00σ
Significance Level for Tau Test:	1.00%
Ratio of Standard Error of Unit Weight:	0.0875
x2 Test Value:	1.0496
x2 Test Range:	3.0738 - 28.2995
x2 Test Result:	False

1.Baselines Input in WGS84

Baselines	Tau	ΔX(m)	Std.Dev(mm)	ΔY(m)	Std.Dev(mm)	ΔZ(m)
_1010171.zsd-_PY20171.zsd	True	-1051.9778	15.6	-205.9986	15.9	-834.3466
__980162.zsd-__990161.zsd	True	-3437.4427	15.0	-1248.4737	24.4	-1207.9470
__980161.zsd-_GL50161.zsd	True	1318.3640	5.1	435.3671	4.5	285.5830
__980162.zsd-_PY50161.zsd	True	-5152.5972	10.3	-1690.3182	17.3	-2438.9192
__990171.zsd-Gl040171.zsd	True	3970.3986	12.4	2237.2301	18.4	-135.0759
__990171.zsd-_GL30171.zsd	True	3876.4741	12.7	1927.4909	17.6	270.3400
__990172.zsd-_PY20171.zsd	True	-3342.3991	27.1	-1174.8219	28.4	-1595.7121
_GL10161.zsd-Gl040161.zsd	True	-1249.4673	9.1	29.8052	12.1	-1393.4078
_GL10161.zsd-_GL20161.zsd	True	9.6256	5.5	569.1725	7.2	-1034.6262
_GL10162.zsd-_GL50161.zsd	True	-464.0526	4.2	-523.5644	3.7	235.1998
_GL20161.zsd-Gl040161.zsd	True	-1259.0918	7.5	-539.3667	9.9	-358.7784
_GL30171.zsd-Gl040171.zsd	True	93.9264	4.1	309.7309	6.3	-405.4190
_PY10171.zsd-_PY20172.zsd	True	-504.2131	9.2	-377.6219	16.3	110.8752
_PY10171.zsd-_PY30171.zsd	True	-482.0121	12.0	-43.7142	21.1	-409.5812
_PY20172.zsd-_PY30171.zsd	True	22.1968	8.7	333.9106	15.4	-520.4558
_PY40171.zsd-_PY50171.zsd	True	253.3133	11.2	-27.3457	17.5	289.7433

Figure 6- 9 An adjust example

Test Network Adjustment Result

The result of the network adjustment should be checked after the adjustment. To evaluate the quality of the network adjustment, the corrections, the mean square error and the corresponding data statistics result should be checked.

The net adjustment of mathematical statistics test includes the X2 test and Tau test.

- X2 test shows the reliability of the results of adjustment. If the X2 test value is less than the theoretical value, it indicates that adjustment result of the error is smaller than the theoretical error. That is, the adjustment results are good enough, and generally no need to deal with or select the appropriate "baseline standard deviation confidence level (relaxation factor) to make the X2 test. If the X2 test value is greater than the theoretical value, the error of the adjustment results exceed the range which can be accepted, it means the baseline solution error is too large or the control point information has gross errors, you should find the problem with baseline or control points, and process again until test passed.
- Tau test is used to test the existence of gross errors in the baselines involving adjustment. Generally, the test result depends on every baseline corrections. If a baseline Tau test cannot be passed, you need to process baseline again and then make it participate in the adjustment, or disable the baseline directly.

If the result of the network is disqualified, the following items are for your reference:

1. Make sure the coordinate setting is right;

2. Make sure the known point is correct and in the same system;

3. Make sure the baseline vector map is correct. If there is a disqualified static baseline, you can prevent it from network adjustment. If this baseline cannot be deleted or is very important in the baseline network, you need to compute this baseline again or survey again if it's needed;

4. Make sure the observation site and antenna height is correct for the observation files. If it is wrong, the misclosure or the result of the free network adjustment will be very bad.

7. Report

In this chapter, we will introduce the detail context of various reports.

7.1 Static Baseline Processing Report

The static processing report consists of reference, rover, processing controls, tracking, baseline solution, ambiguities.

Figure 7- 1 Static report

Reference and Rover Info

It records the reference point/rover info, such as name, code, the spatial rectangular coordinate under WGS84 coordinate system, geodetic coordinate under WGS84 coordinate system, receiver info and Antenna info.

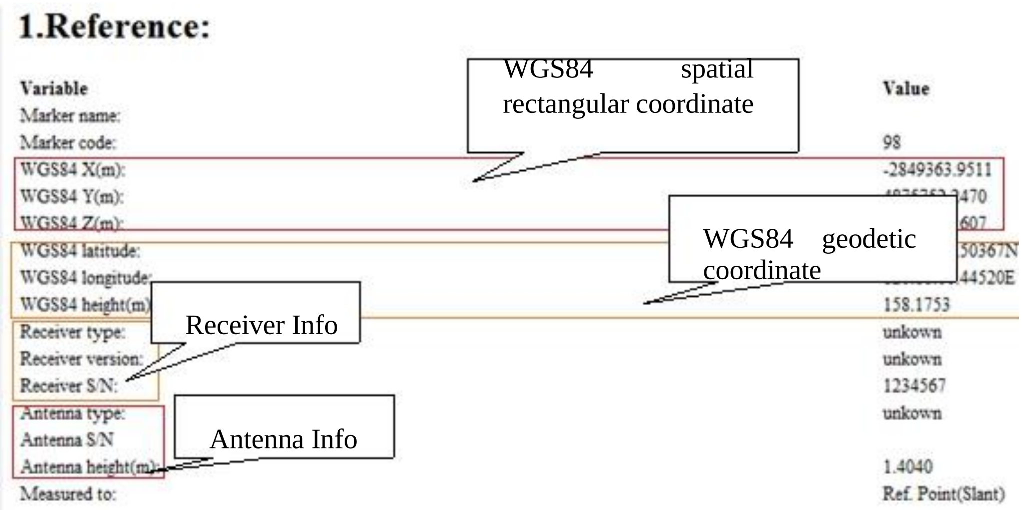


Figure 7- 2 Reference information

Processing Control

This part mainly record the observation start time of baseline and end time some processing control parameters which you set in the procession options window.

Ambiguities

This part records the status of integer ambiguities solution, such as the following figure:

float ambiguity summary(L1)

System	SVID	Week	Seconds	Interval	Float
GPS	28	1097	200365	900	616828.8255
GPS	19	1097	200365	3060	728840.2383
GPS	31	1097	200365	4740	548507.8070
GPS	8	1097	200365	5760	-291432.8050
GPS	2	1097	201385	4740	-834005.8204
GPS	20	1097	202045	4080	-571803.9298
GPS	7	1097	203125	3000	2139850.2347

fixed ambiguity summary(L1)

System	SVID	Week	Seconds	Interval	Fixed	Ra
GPS	28	1097	200365	900	616829	
GPS	19	1097	200365	3060	728840	
GPS	31	1097	200365	4740	548508	

Figure 7- 3 Ambiguities report

7.2 Network Adjustment Report

This report is generated by network adjusting. Here we just introduce one report with adjustment-free method.

Free 3D NetAdjust

>> 1.Baselines Input in WGS84

>> 2.Control Points Input

>> 3.Adjusted Baselines in WGS8

>> 4.Baseline Residuals

>> 5.Adjusted Points in WGS84 (XYZ)

>> 6.Adjusted Points in WGS84 (BLH)

>> 7.Adjusted Points in Target System(NEU)

>> 8.Weakest Baseline and Point

Figure 7- 4 Network Adjustment report

The header of report is the result of adjustment test. You can know the adjustment result by these values. For example the test result in Figure 7- 5, the X2 Test result is not in the accepted range, it is not passed. You need to check the baseline according to above chapter.

Name	Value
Number of GPS Baselines:	21
Number of Adjusted Points:	13
Confidence level:	10.00σ
Significance Level for Tau Test:	1.00%
Ratio of Standard Error of Unit Weight:	0.3949
x2 Test Value:	10.6616
x2 Test Range:	11.8076 - 49.6449
x2 Test Result:	False

Figure 7- 5 Report header

If the result of the network is under qualified, the baseline of problematic vector will be highlighted in red as Figure 7- 6. You need to check the baseline according to above chapter.

3.Adjusted Baselines in WGS84

Baselines	Tau	ΔX(m)	Std.Dev(mm)	ΔY(m)
_1010171.zsd-_PY20171.zsd	True	-1051.9830	8.6	-205.9945
__980162.zsd-__990161.zsd	True	-3437.4406	5.0	-1248.4660
__980161.zsd-_GL10162.zsd	True	1782.4153	2.5	958.9313
__980161.zsd-_GL50161.zsd	True	1318.3638	2.5	435.3672
__980162.zsd-_PY50161.zsd	False	-5152.6008	5.4	-1690.3245
__990172.zsd-_1010171.zsd	False	-2290.4346	9.9	-968.8154
__990171.zsd-Gl040171.zsd	True	3970.4021	4.6	2237.2396
__990171.zsd-_GL30171.zsd	True	3876.4791	4.8	1927.4921
__990172.zsd-_PY20171.zsd	False	-3342.4162	7.8	-1174.8054
__990161.zsd-_PY50161.zsd	True	-1715.1489	5.9	-441.8211
_GL10161.zsd-Gl040161.zsd	True	-1249.4680	3.7	29.8029
_GL10161.zsd-_GL20161.zsd	True	9.6257	3.1	569.1717
_GL10162.zsd-_GL50161.zsd	True	-464.0525	2.3	-523.5645
_GL20161.zsd-Gl040161.zsd	True	-1259.0915	3.7	-539.3677
_GL30171.zsd-Gl040171.zsd	True	93.9269	2.5	309.7310
_PY10171.zsd-_PY20172.zsd	True	-504.2149	4.6	-377.6186
_PY10171.zsd-_PY30171.zsd	True	-482.0105	5.4	-43.7139

Figure 7- 6 Adjusted baseline report

7.3 Dynamic Route Processing Report

There are three types of reports: RTD report, Stop&Go report and PPK report. RTD report includes three parts: Reference point info, Coordinate system parameters and every point info of the rover. And the stop&go report and PPK report has stop point info besides RTD report context.

8. Import and Export

In this chapter, we will introduce the import and export function of the software.

The TGO Software Package can support many kinds of function about import and export. Generally, the output part will be hand in, as a part of the result, when you hand in the result text.

8.1 Import and Export Observations and Ephemeris

For imported observations, we can convert them to RENIX file by choosing ***Convert to RINEX*** item in the pop-up menu (Figure 8- 1).

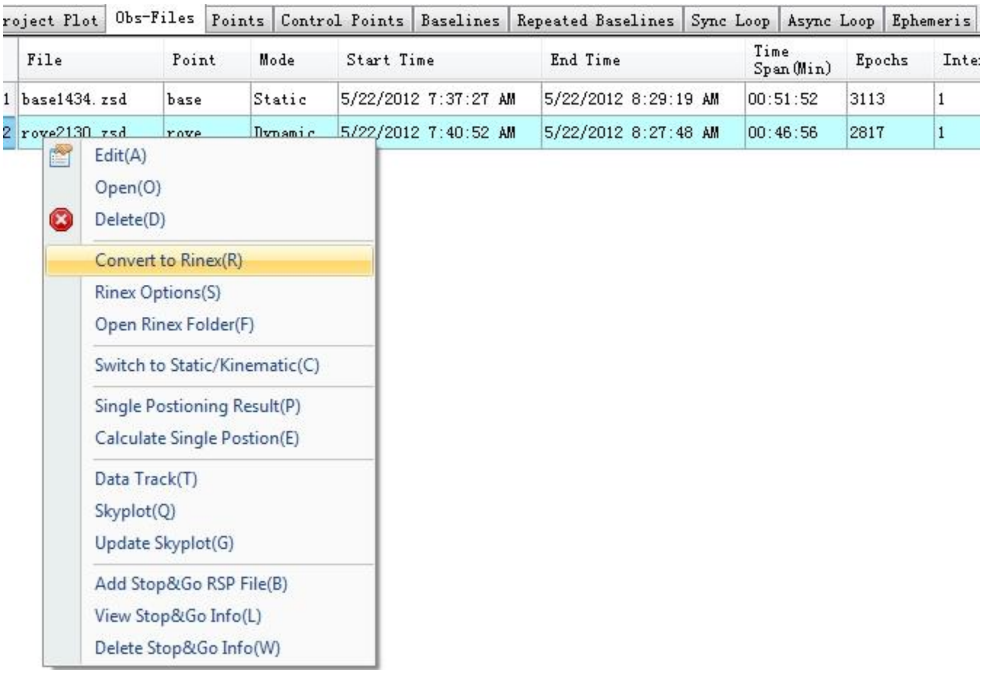


Figure 8- 1 Convert to Rinex format

You can select  in the navigation to batch conversion (Figure 8- 2). The export achievements are in the "Rinex" folder under project folder.

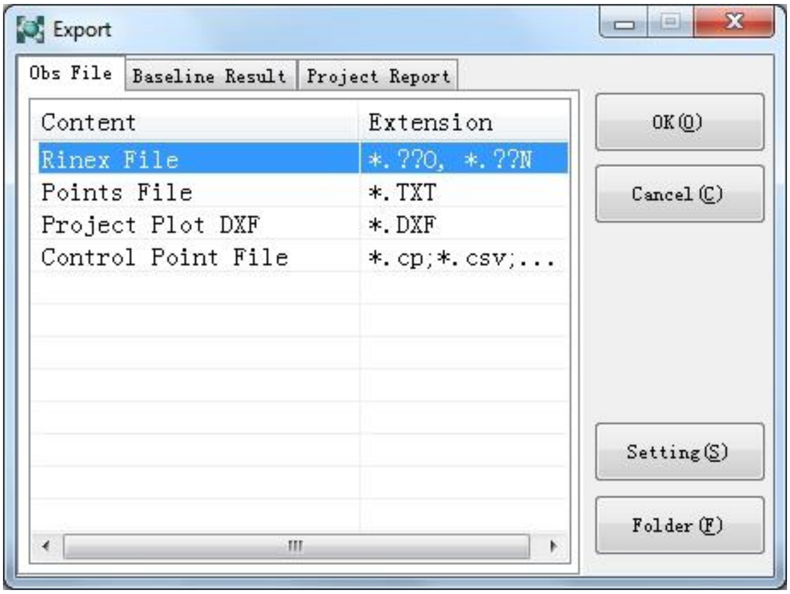


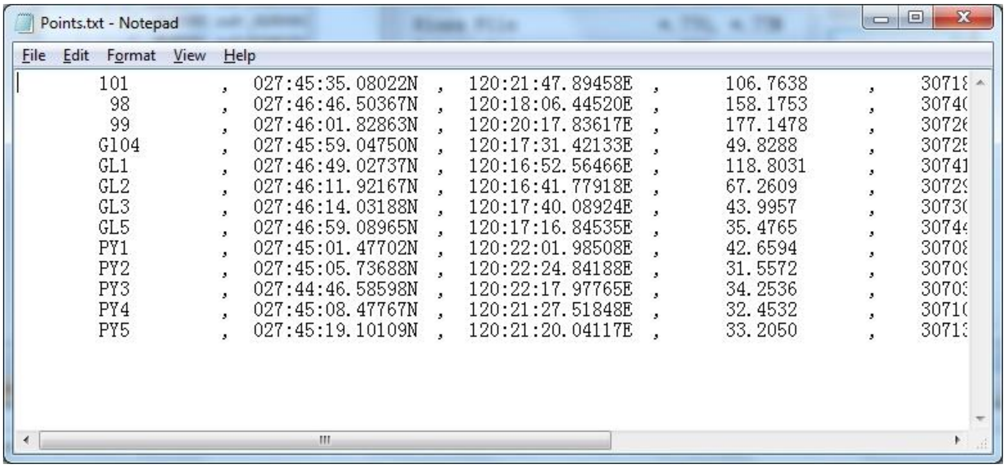
Figure 8- 2 Batch convert

8.2 Export the Coordinates of Result Points

In Figure 8- 2, if ***Points Files*** item to export is selected, you can get the coordinate of result point of TXT format.

The coordinate of point is separated by ‘,’ symbol:

Point name, Latitude, Longitude, Ellipsoidal Height, Northing, Easting, Normal Height



Points.txt - Notepad

File Edit Format View Help

101	027:45:35.08022N	120:21:47.89458E	106.7638	3071
98	027:46:46.50367N	120:18:06.44520E	158.1753	3074
99	027:46:01.82863N	120:20:17.83617E	177.1478	3072
G104	027:45:59.04750N	120:17:31.42133E	49.8288	3072
GL1	027:46:49.02737N	120:16:52.56466E	118.8031	3074
GL2	027:46:11.92167N	120:16:41.77918E	67.2609	3072
GL3	027:46:14.03188N	120:17:40.08924E	43.9957	3073
GL5	027:46:59.08965N	120:17:16.84535E	35.4765	3074
PY1	027:45:01.47702N	120:22:01.98508E	42.6594	3070
PY2	027:45:05.73688N	120:22:24.84188E	31.5572	3070
PY3	027:44:46.58598N	120:22:17.97765E	34.2536	3070
PY4	027:45:08.47767N	120:21:27.51848E	32.4532	3071
PY5	027:45:19.10109N	120:21:20.04117E	33.2050	3071

Figure 8- 3 Export points

8.3 Export Network Map

TGO software package can export Network Map with DXF format. Select ***Project Plot DXF*** item to export Network Map.

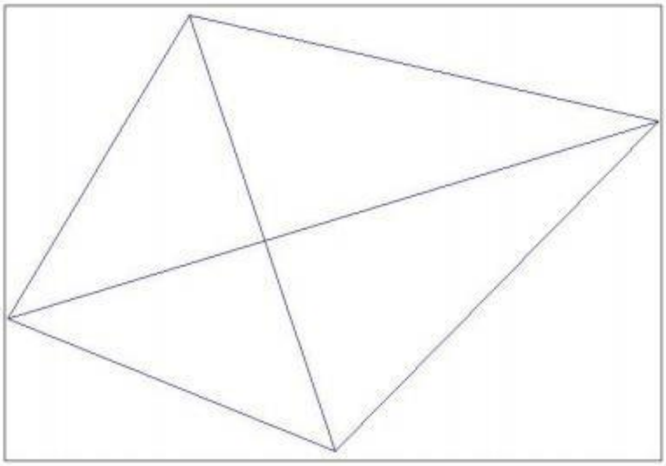


Figure 8- 4 Network map export

Notice: If graphics can't be shown in CAD software, it's in out of the zoom range. Please type the command e, z in the CAD software, it will automatically zoom to graphics view area

8.4 Export Baseline Result

TGO software package can export baseline result as Figure 8- 5. After exporting, click ***Folder*** button, you can view the corresponding format baseline result.

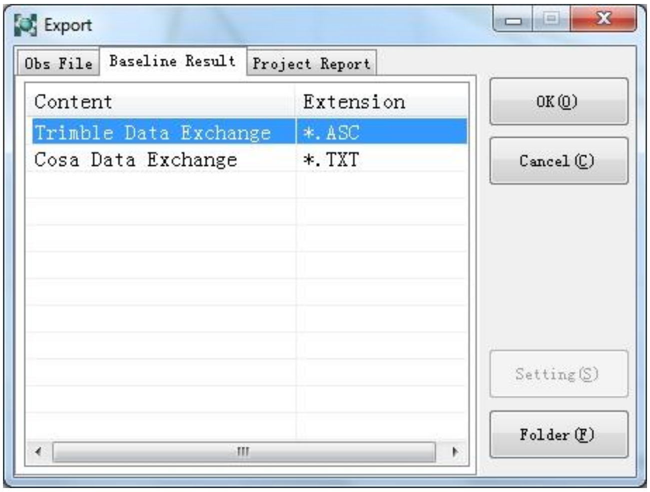


Figure 8- 5 Export baseline

8.5 Export Report

TGO software package can export project report with format:
TXT, DOC, HTML

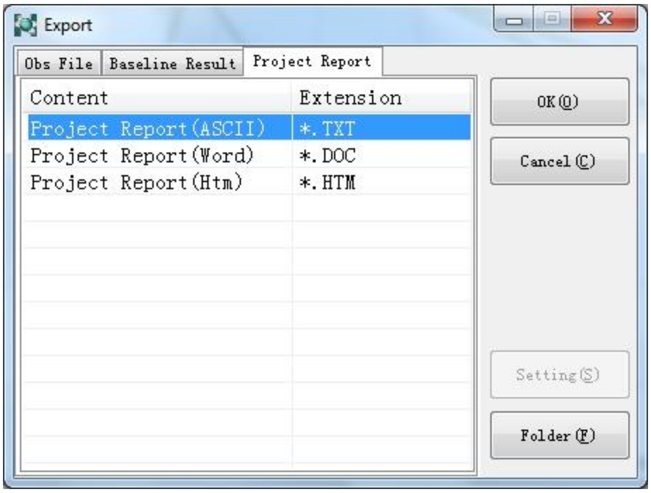


Figure 8- 6 Report format

9. Using of Tools Software

The Common tools software of the TGO Data Processing Software Package includes the antenna manager, the satellite prediction software, the Coordinate transformation tool, and the Precise ephemeris download tool. This chapter mainly introduces the methods and the answer to some common questions.

9.1 Usage of Antenna Manager

Antenna manager is designed for updating and editing the receiver parameter file (The "HitAnt.Ini" file). When you used the unknown receiver type but know the geometric parameter of the receiver and the phase center height parameters, you can use this tool to add the receiver you needed.

Select ***Tools-*** > ***Receivers*** in the menu, there will be pop-up window, in the ***Antenna***, you can set up some commonly used parameters here, such as the radius, the phase center height. See Figure 9-1:

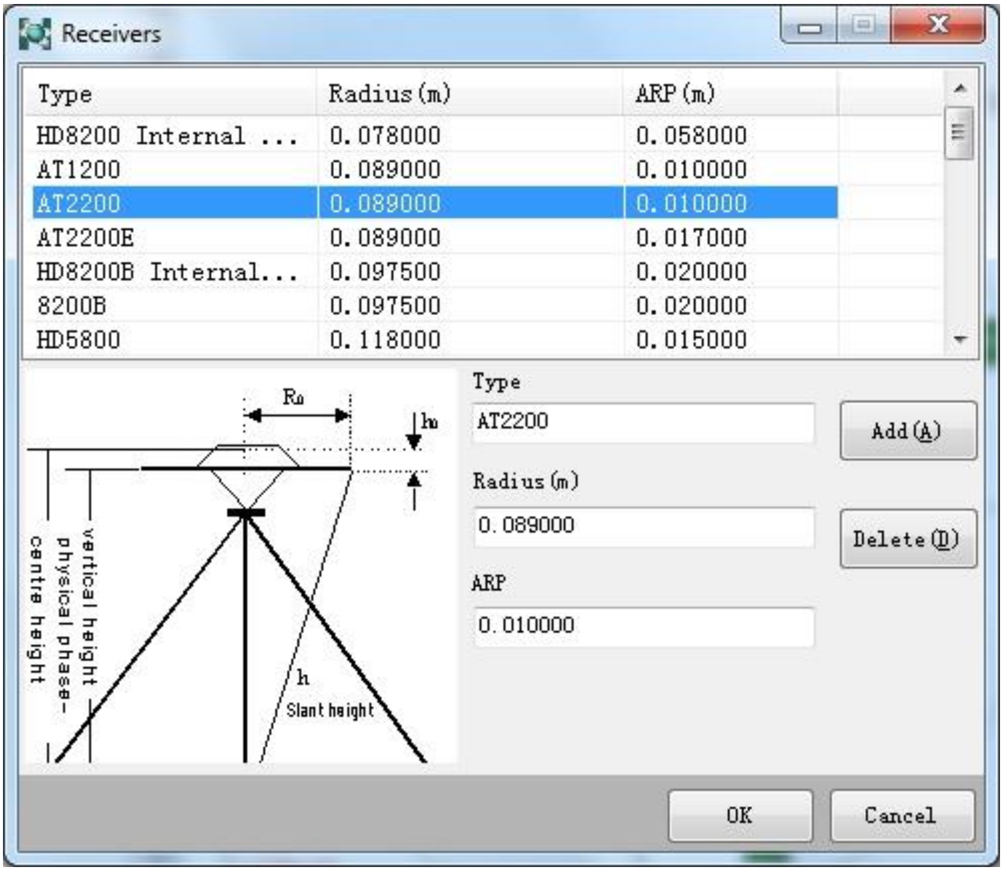


Figure 9- 1 Receiver antenna information

In the list window, select the name of the antenna, you can change the corresponding parameters directly.

Notice: This file would influence the data achievement, please don't change it easily!

9.2 Coordinate Transformation Tool

The TGO Data Processing Software Package supplies the coordinate transformation tool. Choose ***Coord Tool*** in the ***Tools*** menu to function the coordinate transformation tool.

This software can transform between the local coordinate and the WGS84 coordinate, meanwhile it can calculate the parameter. The following is about these tools in details:

9.3 Summarize

Firstly, you should know the representation of each coordinate. The common methods are the Longitude-Latitude and Ellipsoid Height (BLH), the Space Rectangular Coordinate (XYZ), the Plane Rectangular Coordinate and the Geoidal Height (xyh/NEU). The ellipsoid height is a geometric sense and the geoidal height is a physical quantity.

The WGS84 is of the BLH system, the Beijing 54 is of the Plane Rectangular Coordinate.

Now it comes to the accuracy of the transformation. In an ellipsoid, the transformation is rigor (BLH--XYZ), but the transformation in different ellipsoid is not rigor. e.g. There is no a transformation parameters can be used all over the national between the WGS84 coordinate and the Beijing 54 coordinate, because the WGS84 coordinate is a geocentric coordinate system, but the Beijing 54 coordinate is a local geodetic reference system. The elevation's transformation is between geoidal height and physical quantity. So in each place must use local ellipsoid fitting, usually with seven parameter model to fitting.

Generally, the more rigor method to transform coordinate between different ellipsoid is the seven parameters transformation. That is the X plane, the Y plane, The Z plane, the X Spin, the Y spin, the Z spin and the Scale Dilution K. For getting the seven parameters in a location, you should have more than three points. If the area is not large, the furthest point is within 30km, and you can use the three parameters, that is X plane, the Y plane, and the Z plane. The X spin, the Y spin, the Z spin and the Scale Dilution K are regards to be zero. The tree parameters are the special of the seven parameters.

The essence of the seven parameter model with a local ellipsoid is to fit the form of local coordinate system; so the local ellipsoid height after transformation is the geoidal height. Of course, we can also fit it in the different direction of plane and elevation. For example, using the four parameter model to fit in the plane, and using the secondary surface model to fit in the elevation direction. This mode of handled separately is more freedom than seven parameter model. But because the four parameters model has less parameter, a weak ability of expression, usually uses for small regional coordinate transformation.

To sum up, the TGO coordinate transformation tool provides two practical transformation strategies to choosing by the customers:

1. Seven parameter model, one step to get local plane and level data.

2. Four parameters and elevation fitting model, which is divided into two steps to get local plane and level data.

Because each company has a different definition of the model and process, here is our company's conversion process, its description as follows:

The conversion process of seven parameters model is in below:

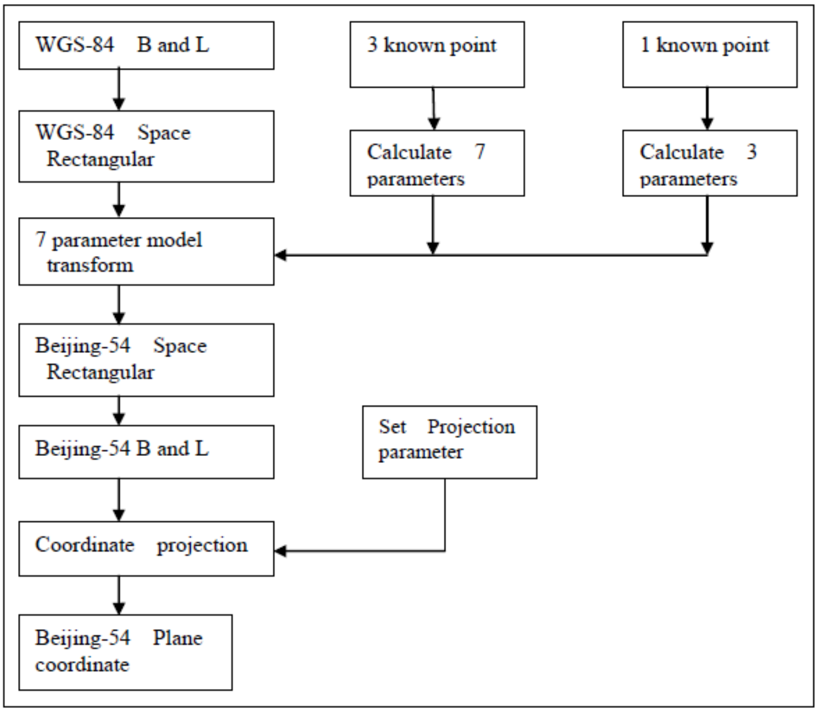


Figure 9- 2 Conversion process of seven parameters model

The conversion process of four parameters model is like this:

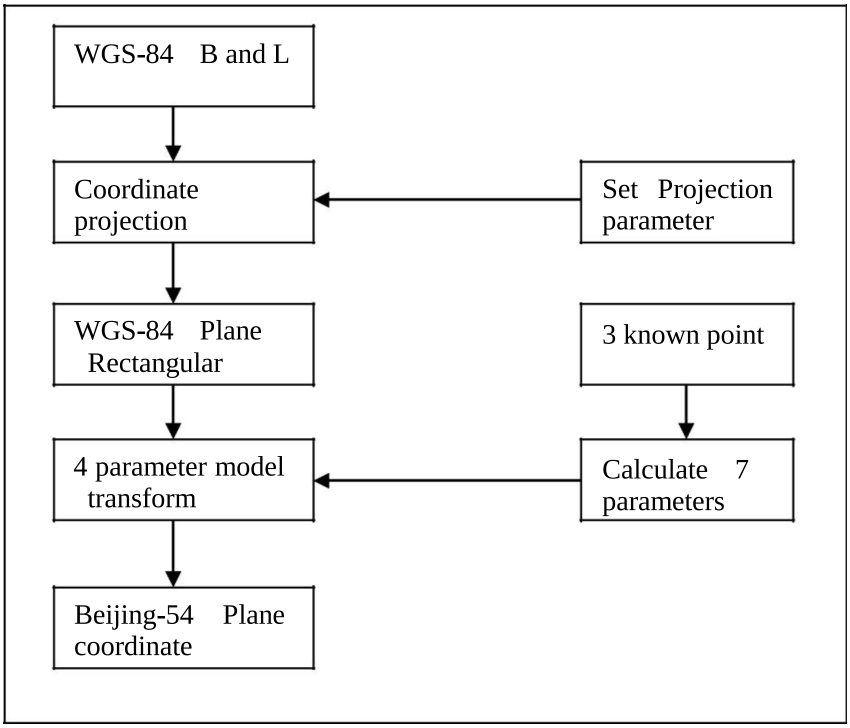


Figure 9- 3 Conversion process of four parameters model

The conversion process of elevation fitting is in below:

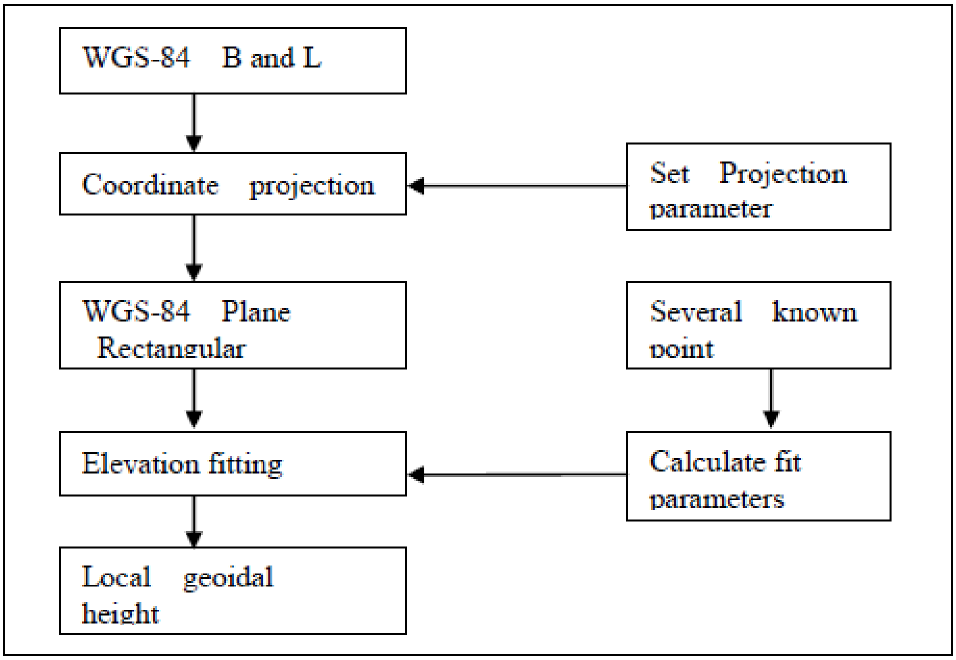


Figure 9- 4 Conversion process of elevation fitting

Use Software to Transform Coordinate

This software manages the coordinate transformation parameters with file (*.dam), you can save a group of transformation parameters in a file, and next time you can open this file to transfer the parameters in the file menu.

The coordinate transformation parameters are generally include the ellipsoid parameter, projection parameters, seven parameters, four parameters, elevation fitting parameters, level grid files. All these parameters' input integrated to the following page. After input the parameters, input a file name, and click ***Save*** button, will create a "*.dam" parameter file in the "GeoPath" directory which in the "Program" folder.

Click the ***Parameter*** menu:

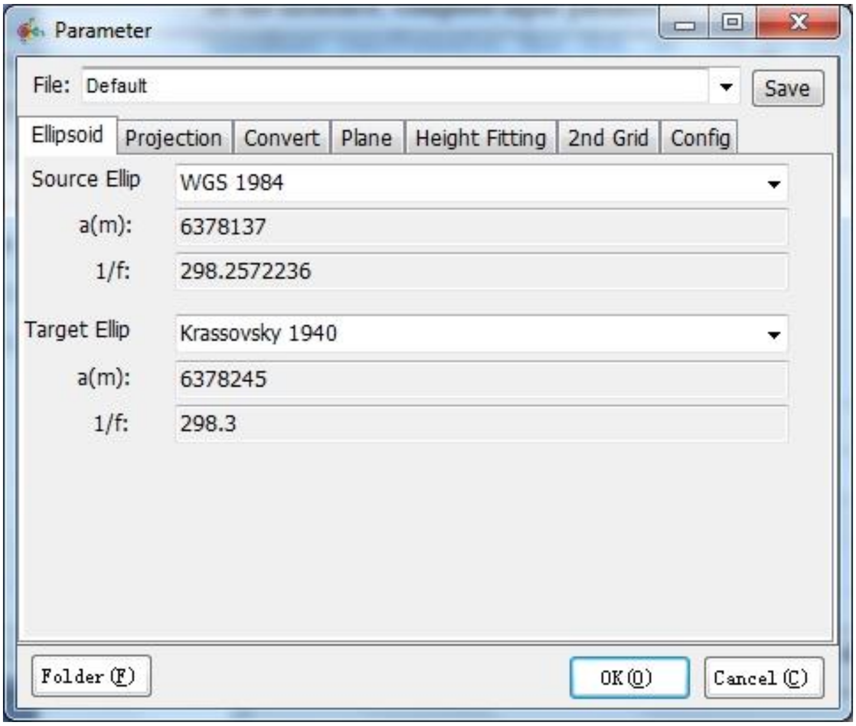


Figure 9- 5 Parameters

In this page, complete inputting parameters, or click [V] drop-down button to select a file of coordinate transformation, then click the ***Ok*** button, will get back to the main window to positive and inverse transform coordinate:

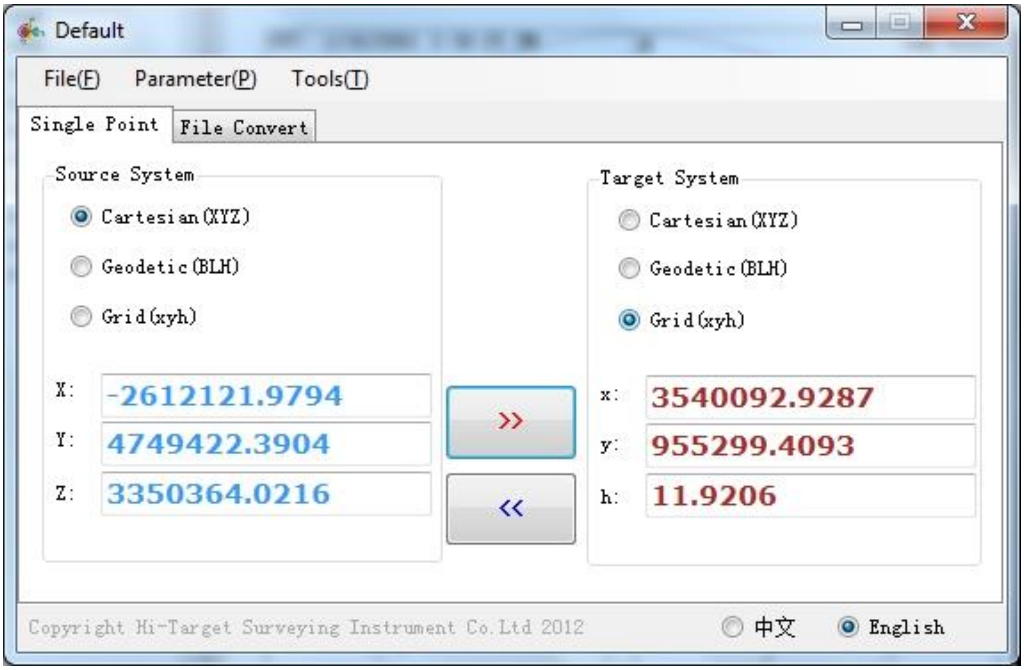


Figure 9- 6 Transformer window

Parameter Calculation

When users have a group of control points (these points have both WGS84 coordinate and local coordinate), you can use this software to calculate the parameters. As previously mentioned, this software provides seven parameters model and four parameters and elevation fitting model solution, the calculation of two models is completed in the same interface, it's convenient to users to compare and choose different precision model. In the main interface, click the ***Parameter Clac*** in the ***Tools*** menu, can open the parameter calculation interface (if you have not input the ellipsoid and projection parameters, you will be prompted by pop-up the "Parameter" window).

The process of parameter calculation is:

1. Input basic parameters: First, input local ellipsoid and projection parameters.

2. Import data: Add points coordinate one by one or to one data, or prepared the text file first then click the ***Open*** button (prepare note: file format is [Name, B, L, H, x, y, H]).

3. Calculate parameters: The software support two modes of coordinate transformation, click the ***Calc Bursha Parameter*** or ***Calc Helmert 2D + Height***, if use the second mode, please selected the model of elevation fitting firstly.

4. Check the result: In the result bar will show the calculated parameters, the user can copy and save them.

5. Use parameters: Click the ***Parameter settings*** button to check the transformation parameters, the ellipsoid parameters and the projection parameters. Make sure these are correct, then you can input a name and save as a “*.dam" file, this file also can be used in other Tersus software.

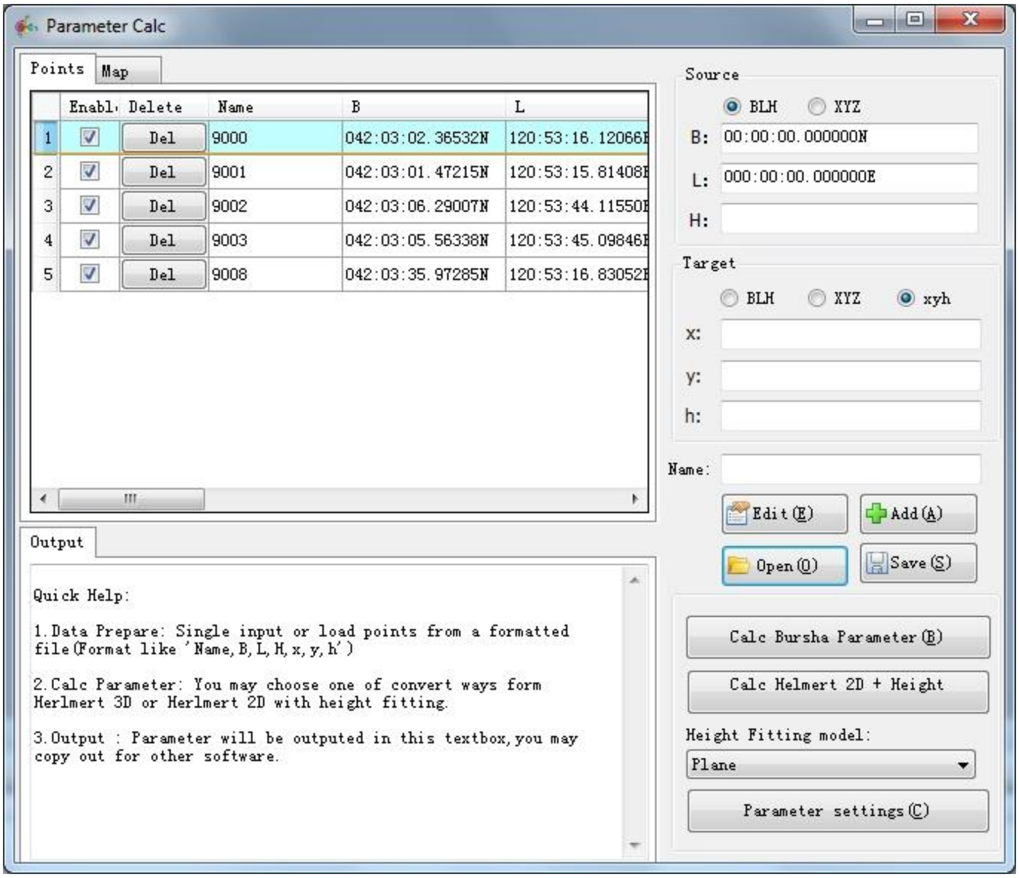


Figure 9- 7 Parameter calculation

Notice : Please switch to the ***Map*** view and check the geometric distribution of the points used to calculation (Avoiding the points are presented a linear distribution, lead to the parameters has poor applicability and stability.

9.4 Satellite Prediction Software

The TGO Data Processing Software Package supplies the Satellite Prediction software. Choose ***Star Report*** in the ***Tools*** menu to inactive the Satellite Prediction software.

Satellite prediction is used to forecast the distribution conditions of satellites at a certain time in a certain area according to the satellite almanacs data collected by receivers. The field engineer can choose proper time to do fieldwork, which will make the fieldwork more effective and the data better.

The general steps of this software are given below:

1. Update historical data;
2. Set stations' position and time, elevation angle;
3. Forecast, check the number of satellites, check the sequence chart of DOP value, and choose the measuring time.

Input Almanacs Data (Yuma format)

Yuma is a kind of almanacs data format broadcast on internet by America. GPS users all over the world can download the latest almanacs data on the specific official website:

http://www.navcen.uscg.gov/ftp/GPS/almanacs/yuma/

Select ***Download Yuma (GPS)*** in the ***Help*** menu, the software will download the latest Yuma files, save it automatically and show you "download finished". See Figure 9- 8:

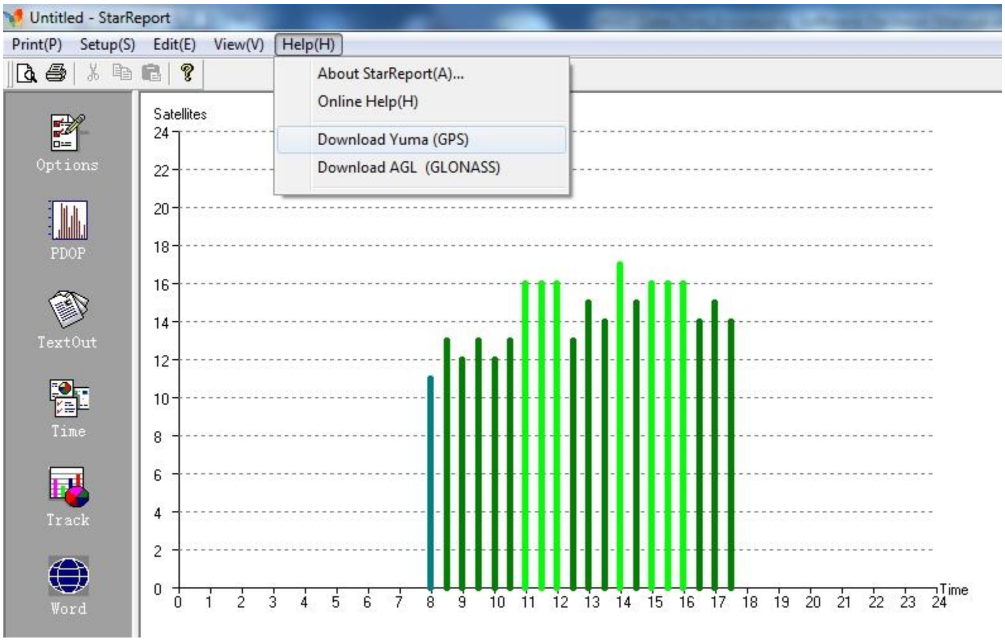


Figure 9- 8 Star report

Observation Station Coordinate and Observing Period Setting

After the latest almanacs data is loaded, you need to set up the station BL, height, height cutoff angle, observation period and so on, which will enable the software to calculate the parameters.

You can set up the date in ***Status*** window. The default value is the date of computer system. Users can choose any day by
“reviou”, “Today”, “Next”, “Manual”. See Figure 9- 9:

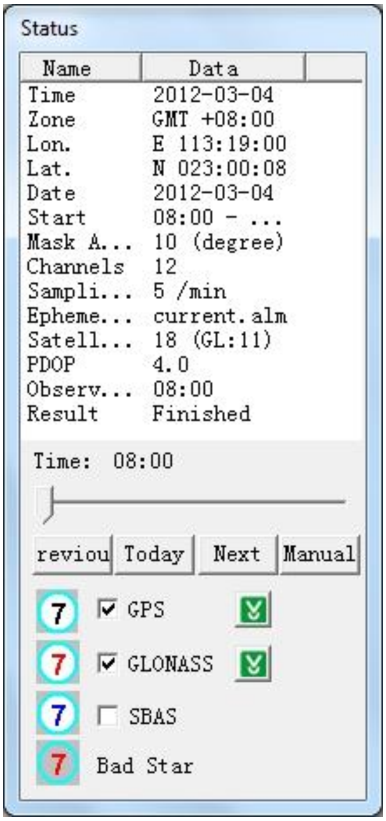


Figure 9- 9 Status window

Click ***Setup*** **->*Option…*** to set up the station BL, height, elevation cutoff angle, observation period. See Figure 9- 10:

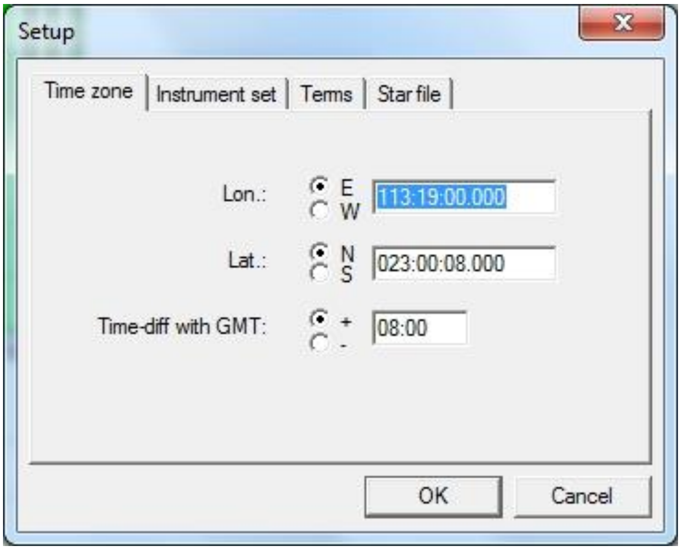


Figure 9- 10 Setup options

The BL coordinate can be coarse, 1~2 km precision will be ok. Users who does not know the BL coordinate can get it as follows:

With the coordinate transformation software, users can transform the XYZ of a known point to BLH and then input them into the software to do satellite prediction.

Get the BLH format coordinate by specific GPS instruments as HD8100, HD8088, or HD8800, input the BLH into the software to do satellite prediction.

Please pay attention to the selection of the local time and GPS time when you set up the observation period. And ensure the difference between local time and UTC time when you input the observation period in ***local time*** setting. Usually the computer will suggest you to choose time zone while installing.

When entering the observation period, please make sure that the difference between the start time and the end time is several hours to 24 hours, and the start time is always ahead of the end time. See Figure 9- 11:

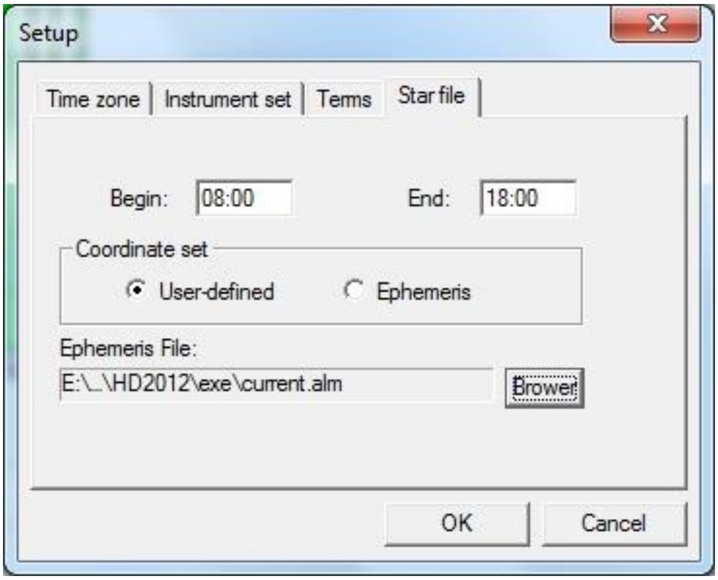


Figure 9- 11 Time config

The angle will limit the azimuths of the prediction satellites in the way that only the satellites whose azimuths are over the threshold can do the prediction. Sampling rate control the data output interval. The smaller the sampling rate, the more detailed the data are. See Figure 9- 12:

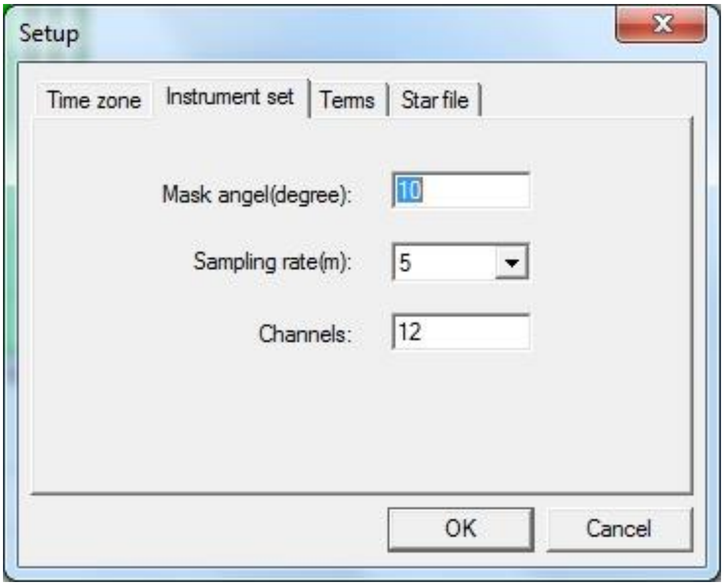


Figure 9- 12 Instrument set

Satellite Status Prediction

After the observation station coordinate and the observing period are input, click ***ok*** button, you can check the satellite status in any view window.

1. Export satellite detailed status, Click button See Figure 9- 13:

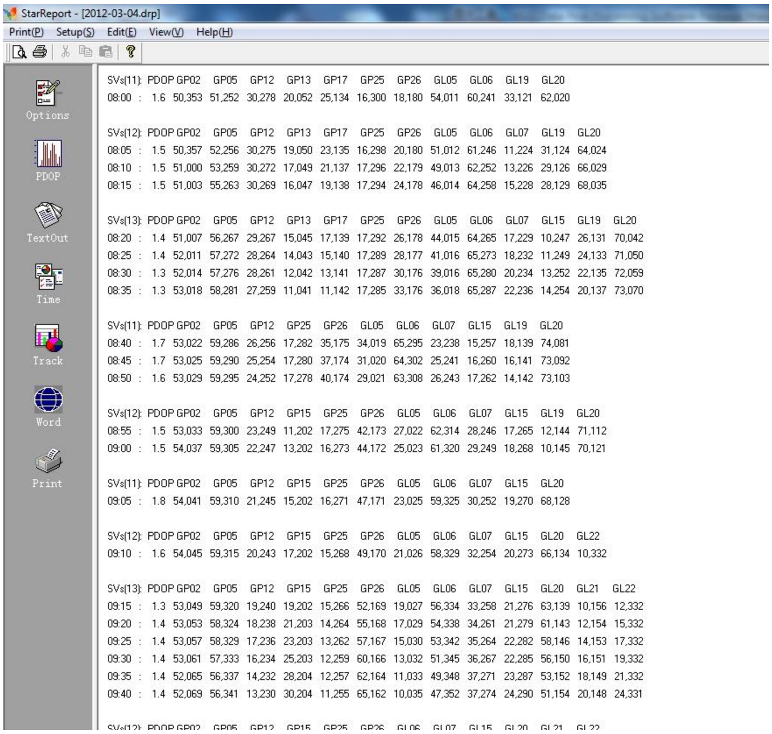


Figure 9- 13 Detailed satellites' status

2. Satellite tracking map

Satellite tracking map shows the change of the number of the visible satellites with the time elapsing in the limited period. With the map, users can choose the period when the visible satellites are more to do observation so as to improve the fieldwork. Click button. See Figure 9- 14:

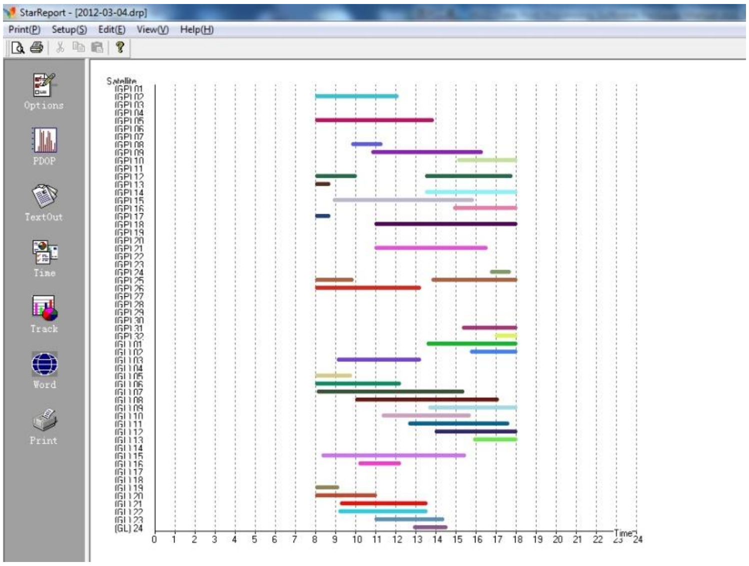


Figure 9- 14 Satellites tracking map

3. Constellations map

Constellations map shows the distribution conditions and the movement of satellites at a certain time in a certain area. For example, in the Figure (click ), the satellite 32 will travel northwest to south in prediction. And the map shows the BL coordinate as well as the observing period.

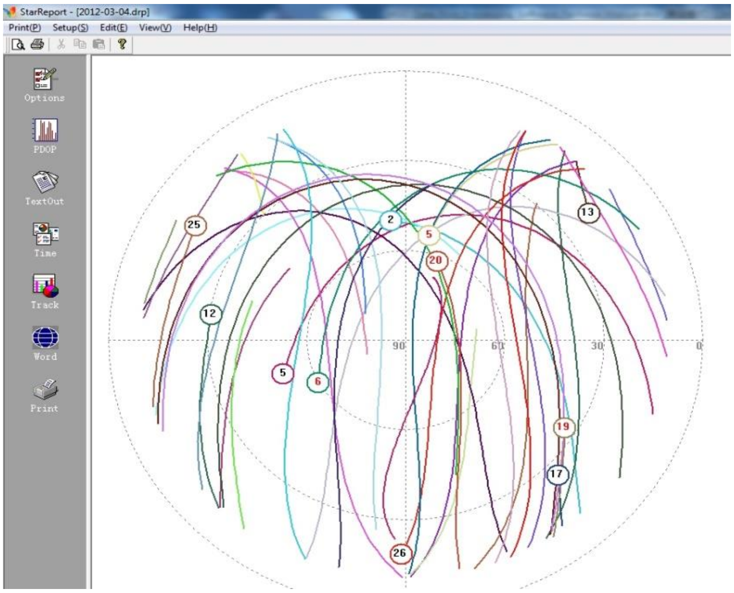


Figure 9- 15 Constellations map

4. Number of the visible satellites and the PDOP

Click  the relationship of the satellites number and the time will show in upside map while the PDOP will show in the downside map. The PDOP denotes how the positioning accuracy acts on satellites distribution. See Figure 9- 16:

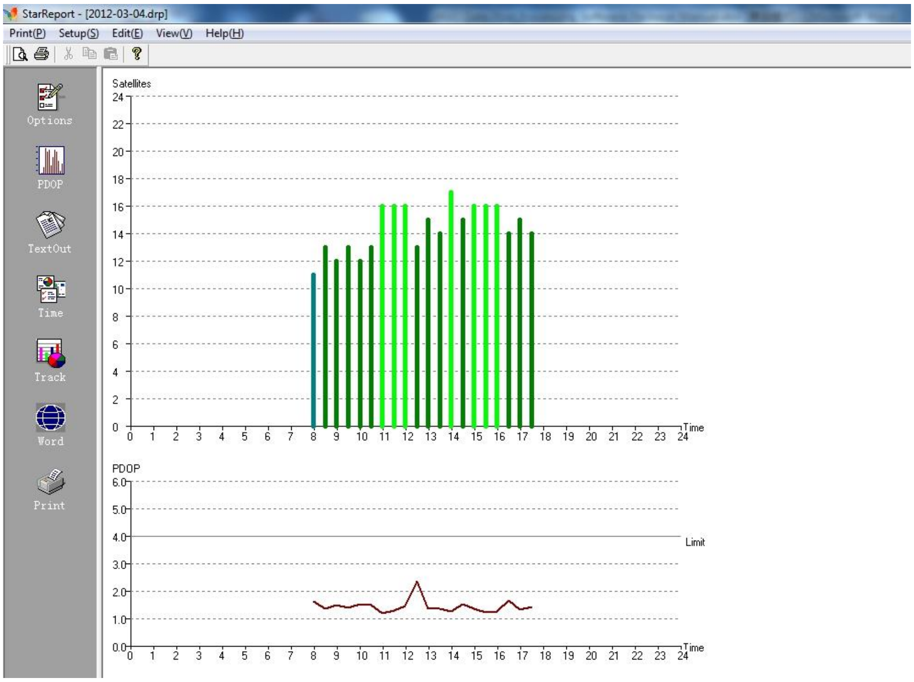


Figure 9- 16 PDOP value

5. World map Click , you can see the satellites traveling tracks in the world map. See Figure 9- 17:

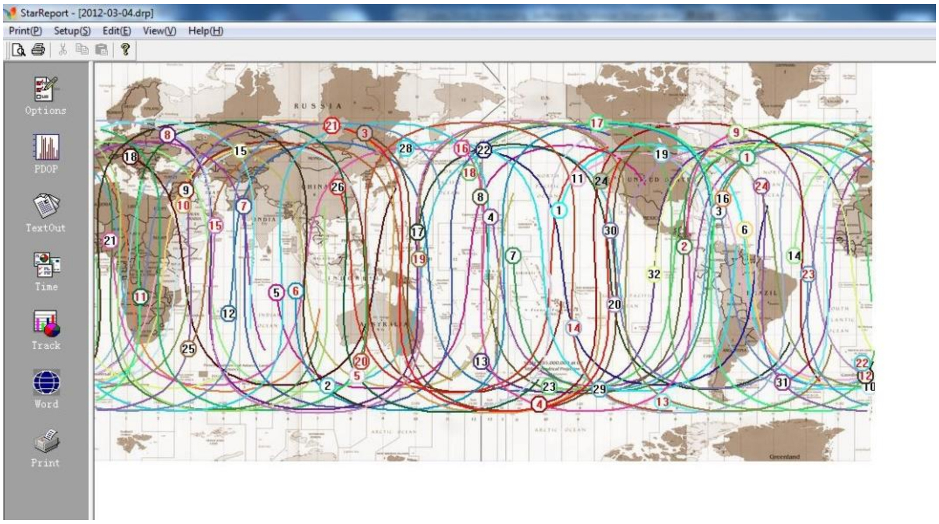


Figure 9- 17 Satellites world map

6. Print out

File shows, satellite number, PDOP value and satellites distribution all can be print out.

Update Ephemeris Data

To predict satellites precisely, the ephemeris data should be updated often. It's recommended that ephemeris should be updated once in a month. The config of the software can prompt users to update the ephemeris when it's necessary.

Precise Ephemeris Download Tool

In order to improve the precision of the static data processing software, you can download SP3 precision ephemeris data from the FTP server which is provided by the United States IGS. This tool is developed for automatic download the data rapidly and easily from the data server. It's easy to use, just select the data date and data types, click ***Start*** to download.

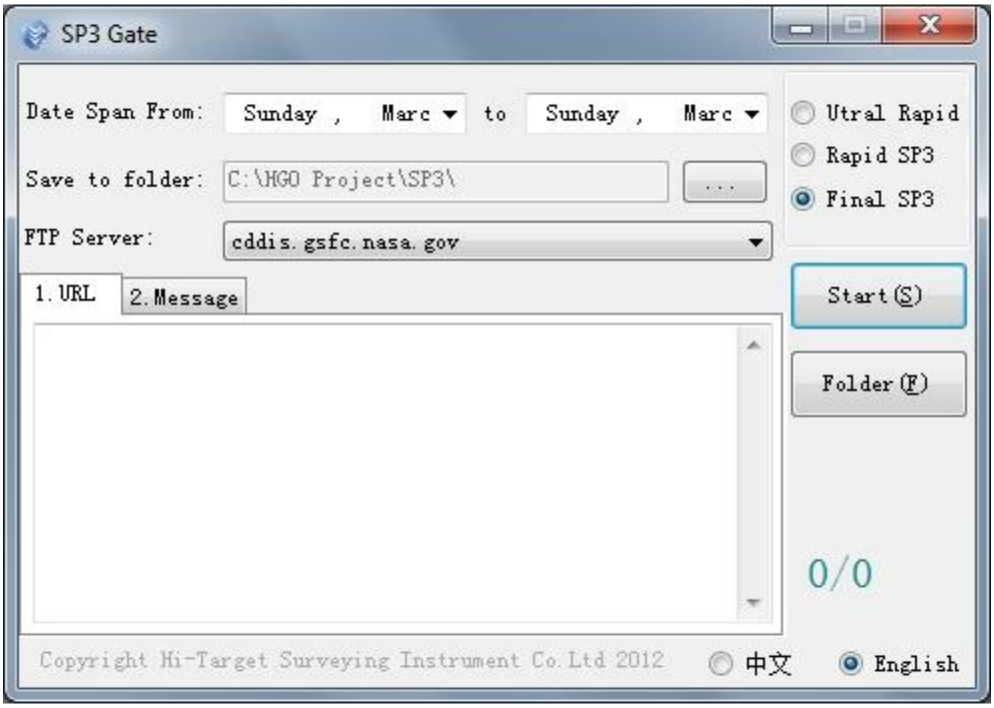


Figure 9- 18 Download SP3 file

Notice : In the whole world, there are multiple FTP servers providing data download service. Please choose a proper download site to download the data according to your field site.
