



# **NS1102X Navigation Signal Simulator**

## **User Manual**

**Saluki Technology Inc.**

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## **1. Products Outline**

### **1.1. Products Introduction**

Navigation Signal Simulator can offer signal simulation for Global Satellite Navigation System. Each frequency point can generate 12 satellite signals. It supports signal simulation output of two-frequency point combined by GPS-L2 and GALILEO-E1. It provides the standard 1PPS pulse signal in high stability and 10MHZ clock signal output. It is a multi-constellation navigating signal simulator source, which can satisfy user device design and development, production test, teaching demonstration, equipment test and conventional test application for global satellite navigation system.

### **1.2. Model Configuration and Product Indicators**

#### 1.2.1. Products Model

NS1102X

#### 1.2.2. Products Configuration

GPS: L2

GALILEO: E1

### **1.3. First Use**

Follow below steps when using Simulator:

- 1) Power on the simulator and computer workstation respectively;
- 2) Launch high dynamic Control Software “RNSS\_Multi.exe” of satellite simulator on computer workstation;
- 3) Proceeding simulation control to Simulator by using “RNSS\_Multi.exe”;  
(Please refer to the usage manual of the control software for details);
- 4) When completed, sign out the control software firstly, and then cut off the

device power. Strictly carry out all above operation steps in sequence, otherwise, simulator may appear abnormal usage problem.

**Remarks: If users need to apply External Time Frequency, the strength of the 10M reference signal from external input must be >6dBm.**

## 2. Control Software Usage Manual

### 2.1. Running the Control Procedure “RNSS\_Multi.exe”

Double-click the program icon to enter the automatic check for hardware configuration window. show as Figure 2-1 below.

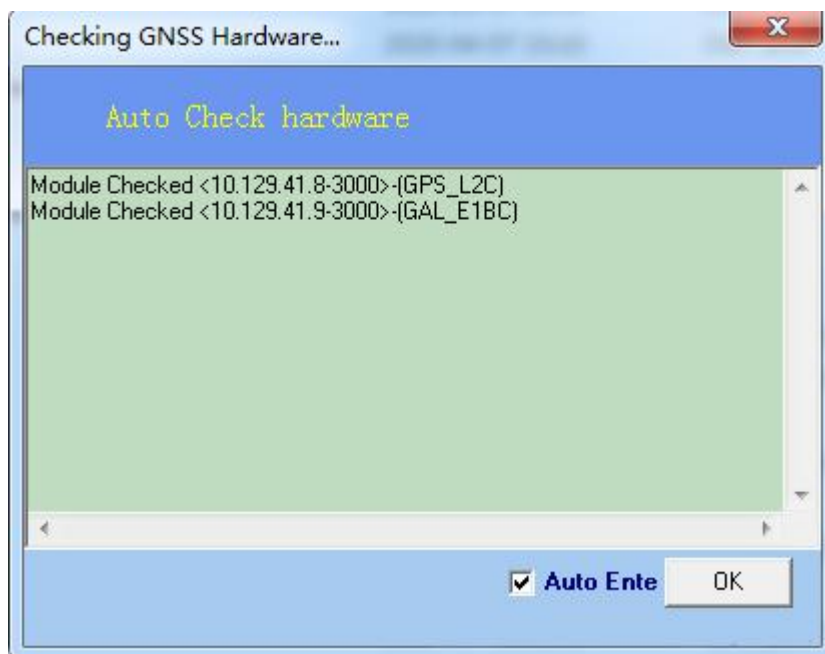


Figure2-1 Automatic Check Hardware Configuration Window

Confirming the module found, the user could enter the control software interface by clicking the "OK" button at the bottom.

If the control device connects to the simulator correctly and the simulator be powered on, the icons in the toolbar at the top of the interface can be displayed normally, the bottom status bar will display “GNSS Hardware OK !”, show as Figure 2-2.

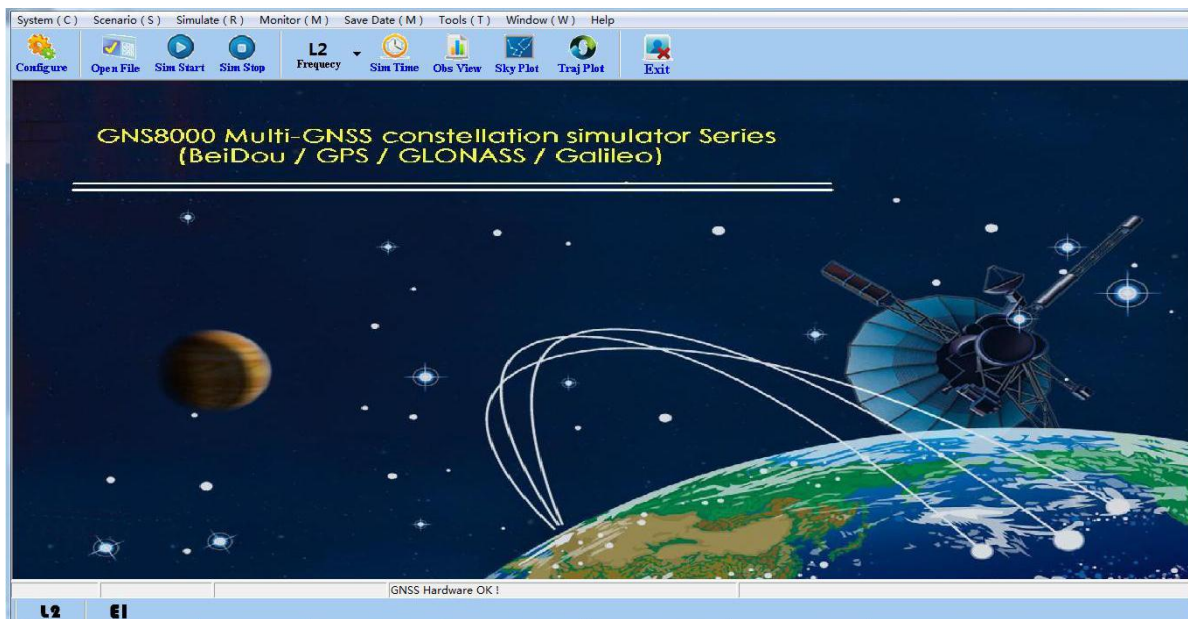



Figure 2-2 Software Interface

If no module found, the automatic check hardware will always be in detection status.

In this case, the user firstly needs to confirm whether the simulator be powered on, whether the network of PC for the simulator connects correctly and whether the IP of the PC is in network segment “10.129.41.XXX”.

## 2.2. Select Editing Simulation Scenario

After confirmed the control device connects correctly with the simulator,

click the menu “” in the program toolbar to pop up the dialog box of selecting simulation scenario file, show as Figure 2-3 below.

Select the scene storage path and the corresponding scene in the window, then just click “OK” button.

Users can also edit scenes according to their own needs. For specific operations, please check the editing section of simulation scenario in Chapter 3.

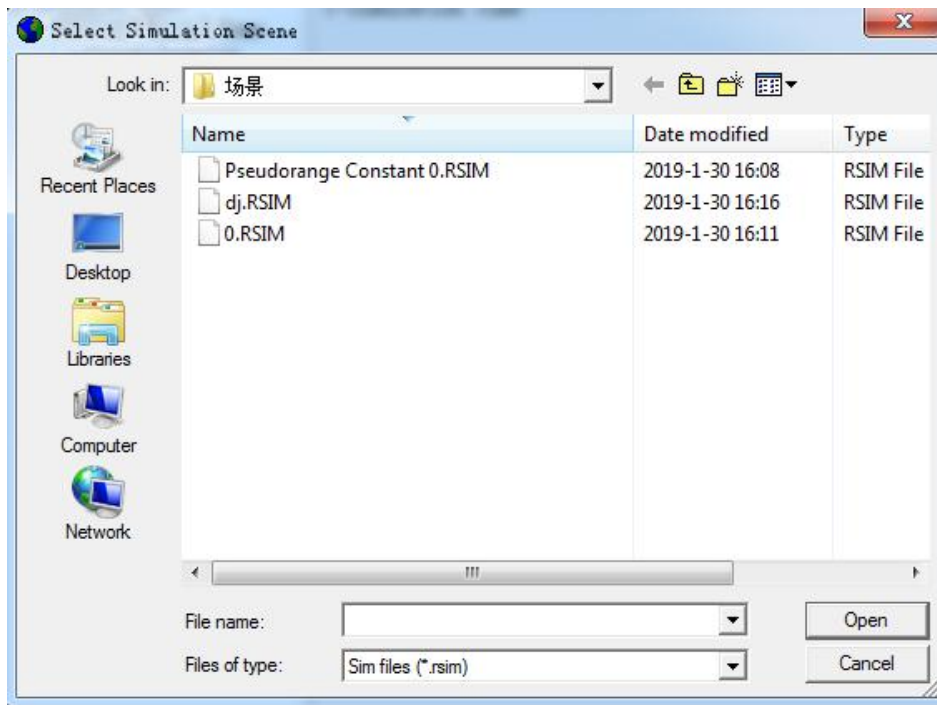


Figure 2-3 Simulation Scene Path Selection Diagram

### 2.3. Launch Signal Simulation

After completing the system configuration and scenario selection, select the "Launch Signal Generation " option in the "Run" menu, or directly click the "Simulation Start" icon in the toolbar to start signal simulation. If real-time closed-loop simulation test is required, please click "Launch Closed-loop Simulation".

The status area at the bottom of the main control procedure displays the status information of the running procedure in real time. Users can know the running situation of the system through the status information.

After the simulation started, the RF Signal Output Port outputs the simulated RF signal according to the selected imitation scenes. In the simulation process, the icons of "System Configuration", "Scene Selection" and "Simulation Start" are all gray.



Click the "Simulation Stop" or select the "Stop Signal Generation" option in the "Run" menu icon to stop the simulation signal.

## 2.4. System Monitoring Window

In the running process of the control procedure, various parameters of the ideal signal in current running scene displayed in real time through various View Windows. Click the “Monitor” menu to see the six sub-menus shown as below Figure 2-4.

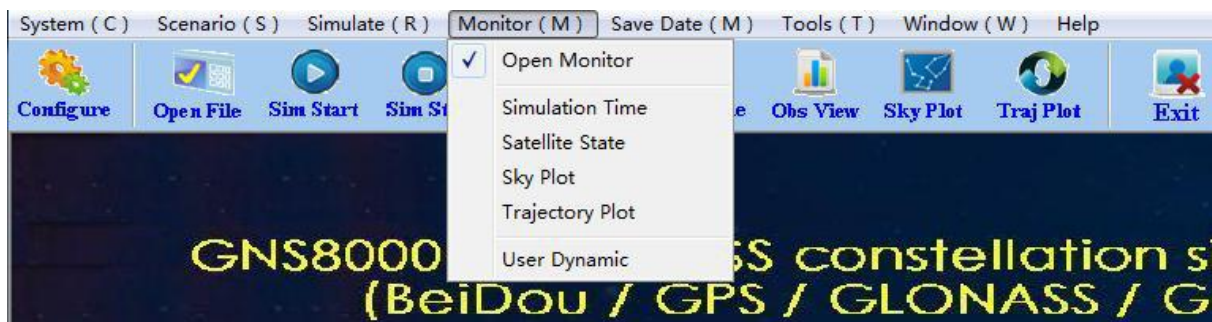


Figure 2-4 “Monitor” Menu Schematic Diagram

Click on each item will pop up the corresponding window, showing the corresponding real-time ideal signal information. The user can also click the icon on the toolbar to open the corresponding window. Tick the first item "Open Monitor" in the Monitor menu, so that the corresponding monitoring information can display in each monitoring window. If not ticked, no signal information displayed in each monitoring window. This option defaults to the ticked state.

The functions of each view window described as follows:

### 2.4.1. Simulation Time

In the “Simulation Time” window, users can accurately understand the simulation types, simulation duration, current simulation time, entire week

counting, seconds number in a week and the progress of simulation completion.

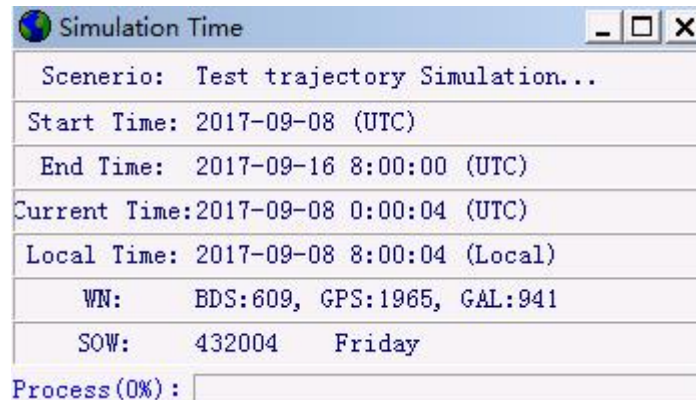
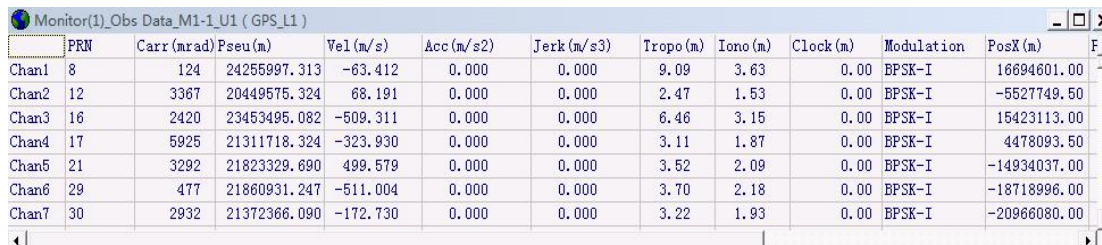


Figure 2-5 Simulation Time Window

### 2.4.2. Satellite Status

In the Satellite Status Window, users can monitor Satellite Asterisk, Carrier, Pseudo-distance, Velocity, Acceleration, Jerk, Signal Modulation Type, Real-time Satellite Coordinate, Pitch Angle, I/Q Branch Power at the Monitored Frequency Point.



	PRN	Carr (mrad)	Pseu (m)	Vel (m/s)	Acc (m/s <sup>2</sup> )	Jerk (m/s <sup>3</sup> )	Tropo (m)	Iono (m)	Clock (m)	Modulation	PosX (m)
Chan1	8	124	24255997.313	-63.412	0.000	0.000	9.09	3.63	0.00	BPSK-I	16694601.00
Chan2	12	3367	20449575.324	68.191	0.000	0.000	2.47	1.53	0.00	BPSK-I	-5527749.50
Chan3	16	2420	23453495.082	-509.311	0.000	0.000	6.46	3.15	0.00	BPSK-I	15423113.00
Chan4	17	5925	21311718.324	-323.930	0.000	0.000	3.11	1.87	0.00	BPSK-I	4478093.50
Chan5	21	3292	21823329.690	499.579	0.000	0.000	3.52	2.09	0.00	BPSK-I	-14934037.00
Chan6	29	477	21860931.247	-511.004	0.000	0.000	3.70	2.18	0.00	BPSK-I	-18718996.00
Chan7	30	2932	21372366.090	-172.730	0.000	0.000	3.22	1.93	0.00	BPSK-I	-20966080.00

Figure 2-6 Data Observation Window

Double-click the “Satellite Status” window, the corresponding channel control preferences window will pop up.

The Channel Control Preferences consists of three parts: "AGC Attenuation", "Attenuator" and "Output power and Modulation Type".

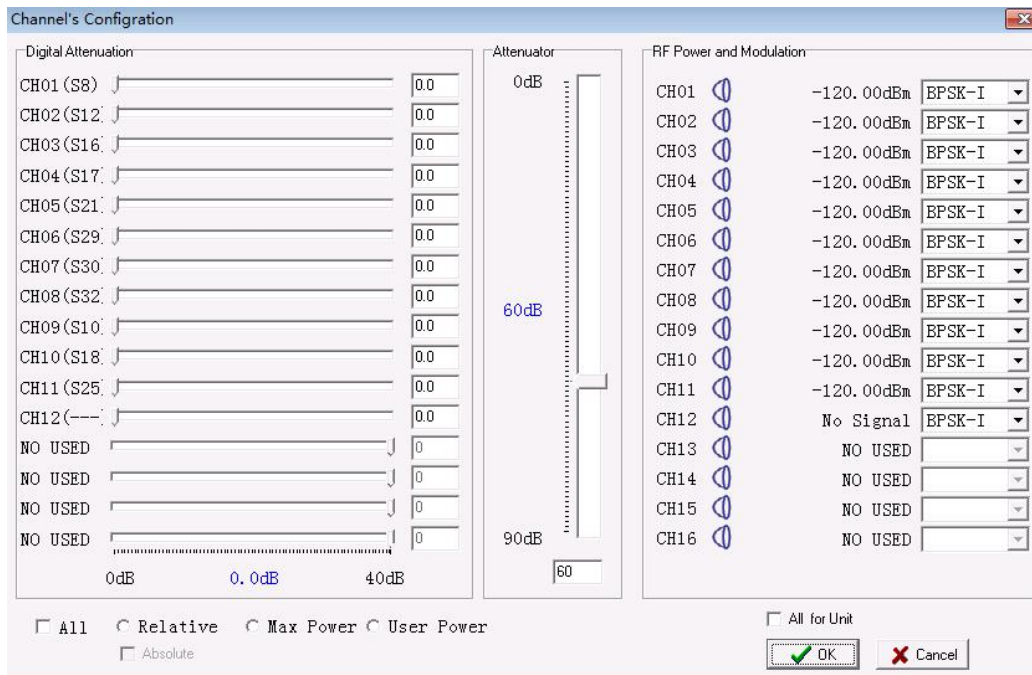


Figure2-7 Channel Control Preferences Window

"AGC Attenuation" refers to the fine-tuning part of power attenuation control. The attenuation range is 0 to -40dBm, and the stepping accuracy is 0.1dBm. Users can directly pull the slider for setting.

"Attenuator" means the coarse adjustment part of power attenuation control. The attenuation range is 0 to -90dbm, and the stepping accuracy is 1dBm. Users can directly pull the slider for setting.

In the table "Output Power and Modulation Type", the left side automatically displays the output power set by each channel of the current simulator. The right side is the modulation type for the output signal of each channel. The user can select the desired signal modulation type through this drop-down menu, the modulation type show as the picture on the right.



BPSK-I represents I branch under BPSK modulation, BPSK-Q represents Q branch under BPSK modulation, and QPSK represents I and Q branches under QPSK modulation. There are also Single Carrier and Close options. Users can adjust the settings according to actual use.

The three radio buttons at the bottom of the window facilitate the user's operation.

When choosing radio button “ All ”, current channel control parameters set by the user can be applied to all channels.

When choosing radio button “ Max Power ”, directly default the channel has the maximum satellite power.

When choosing radio button “ Relative ”, the RF signal will change according to the power of each channel for the real satellite, and after selection, the power of each channel for the satellite cannot be controlled by the user.

After setting the channel control parameters, click “ ” to finish or click “ ” to cancel setting.

After setting, the control software can automatically store the user's current setting. Before setting parameters next time, the simulator will always output RF signals according to the current power setting.

### 2.4.3. Sky Plot

Display the current valid satellites in the sky and their azimuth and elevation information, shown as Figure 2-8 below. In the figure, the center point is the ideal position of the simulation user, and the Angle is 0 degrees in the Due North Direction. The two coordinate axes intersect, and clockwise

respectively represent 0 degrees, 90 degrees, 180 degrees and 270 degrees. The circle with the central point as the center represents different elevation angles, and the central point is 90 degrees elevation, outward successively is 60 degrees, 30 degrees, and 0 degrees.



Figure 2-8 Sky Plot Window

In Figure 2-8, the data on the yellow icon is BD2 satellite number and the figure on the white icon is GPS satellite number.

The DOP values shown at the bottom are the geometric dilution of precision for the satellite distribution at the current time.

#### 2.4.4. Trajectory Plot

Trajectory Plot provides the track diagram simulated by the current simulator in real time for users.

Users can accurately know the theoretical value of the positioning in the simulation scene (including Longitude and latitude, Elevation, speed in XYZ three directions and user speed) by Trajectory Plot. It is convenient for users to compare the positioning result with the theoretical value.

Trajectory Plot show as Figure 2-9.

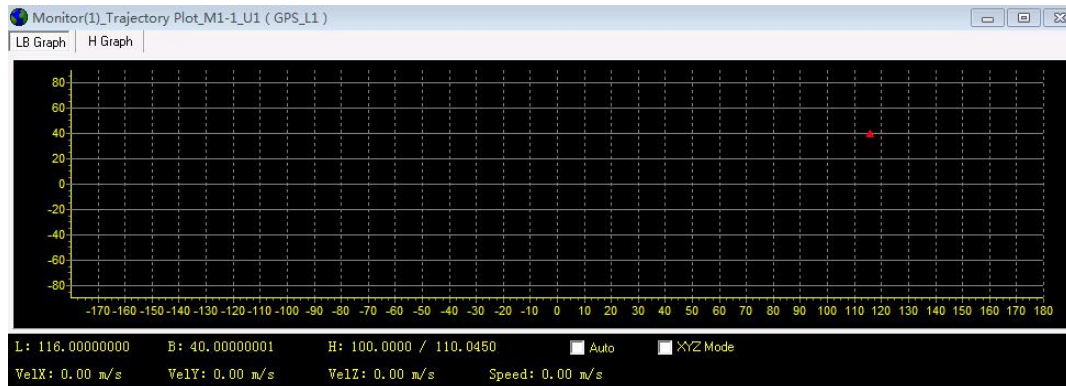


Figure 2-9 Trajectory Plot Window

### 2.4.5. User Dynamic

In user's dynamic visual window (menu monitor: User Dynamic), the user can see the dynamic indicators visually and accurately. It includes the real time velocity of the simulated user's motion, the course of the navigation coordinate system and the real time velocity in the direction of X, Y and Z in the rectangular coordinate system. Users can choose different units in different conditions: m/s, km/s, knots. In the right of user dynamic information bar, respectively display the BD Time, Position, the Speed in the X, Y and Z three directions, Acceleration and Jerk.

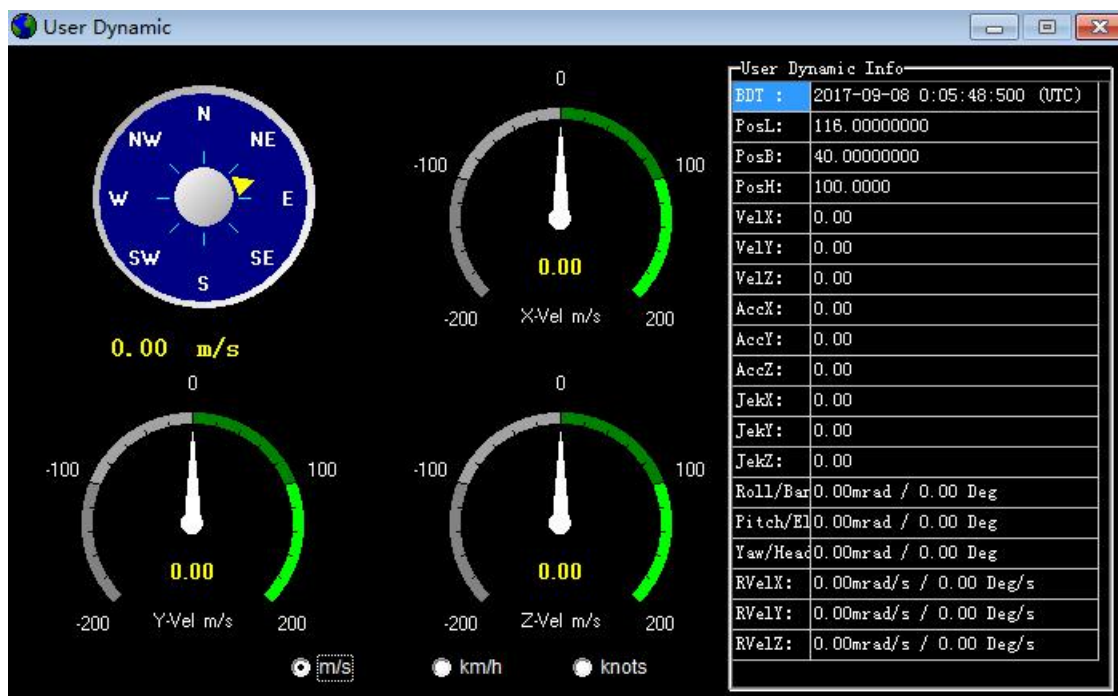


Figure 2-10 User Dynamic Window

## 2.5. Save Menu

The “Save” Menu in the control interface includes “Save Satellite Track”, “Save User Track”, “Save Observation Data”, “Save Navigation Message”, “Save Raw Navigation Message(Raw)”, “Save Waas Info of Beidou”, “Transform Data” and other tools choices. Show as Figure 2-11.

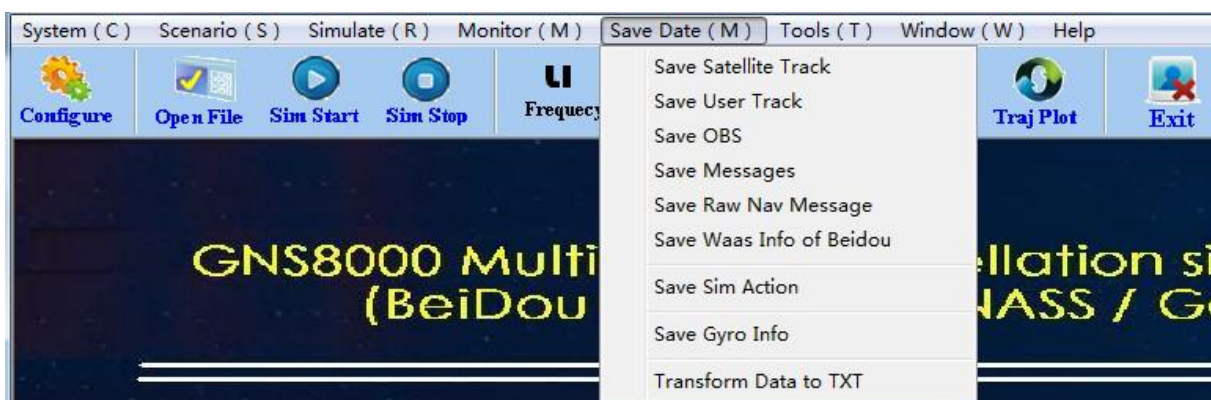


Figure 2-11 “Save” Menu Diagram

If users need to store “Save Satellite Track”, “Save User Track”, “Save Observation Data” and “Save Navigation Message”, please select those want to

store before starting the simulation. These items are not actionable in the “Save” menu during the period of signal simulation.

#### 2.5.1. Save Satellite Track

After selected the "Save Satellite Track" in the tools menu, the system can automatically save the specific satellite track data of the simulation scene in the catalog of the folder where the Control Software is located. The folder named by the date automatically, for example: 2012-11-9.

The simulated satellite track information saved as a Data File in the folder of 2012-11-9. Such as

“RT\_Test\_Trj.RSIM(M1-GPS-L2)GnssStars(20121109-1345).dat”,

“RT\_Test\_Trj” is the Scenario name.

#### 2.5.2. Save User Track

After selected the "Save User Track" in the tools menu, the system can automatically save the specific user track data of the simulation scene in the catalog of the folder where the Control Software is located. For example:

The simulated satellite track information saved as a Data File in the folder of 2012-11-9. Such as “RT\_Test\_Trj.RSIM(M1)GnssTrj(20121109-1409).dat”,

“RT\_Test\_Trj” is the Scenario name.

#### 2.5.3. Save Observation Data

After selected "Save Simulation Data" in the tools menu, the system will automatically save the specific data of the simulation scene and the ideal track data of simulation in the catalog of the folder where the Control Software is located. The folder named by the date automatically, for example: 2012-11-9.

The satellite information of the simulated frequency points saved in the



form of frequency points, such as

“RT\_Test\_Trj.RSIM(M1-GPS\_L2)GnssObs(20121109-1414).dat” ,

“RT\_Test\_Trj” is the Scenario name. Information saved in text includes 11 kinds of specific parameters of channel: satellite numbers, seconds in a week, Pseudo-range (PS), speed (ps/s), Acceleration (ps/s<sup>2</sup>), Jerk (ps/s<sup>3</sup>), satellite position X(m), satellite position Y(m), satellite position Z(m), satellite elevation (degree), satellite azimuth (degree).

#### 2.5.4. Save Navigation Message

After selected the "Save Navigation Message" in the tools menu, the system can automatically save the specific navigation message data of each satellite in the simulation scene under the catalog of the folder where the Control Software is located. The folder named by the date automatically, for example: 2012-11-9.

The satellite information of the simulated frequency points saved in the form of frequency points, such as

“RT\_Test\_Trj.RSIM(M1-GPS\_L2)GnssNav(20121109-1516).dat” ,

“RT\_Test\_Trj” is the Scenario name. The information saved by the text is Raw Navigation Message output from each channel.

#### 2.5.5. Save Waas Info of Beidou

After selected the "Save Waas Info of Beidou" in the tools menu, the system can automatically save the specific navigation message data of each satellite in the simulation scene under the catalog of the folder where the Control Software is located. The folder named by the date automatically, for example: 2012-11-9.

The satellite information of the simulated frequency points saved in the form of frequency points, such as

“RT\_Test\_Trj.RSIM\_(M1-GPS\_L2)\_Waas.dat”, “RT\_Test\_Trj” is the Scenario name. The information saved by the text is Waas Info of Beidou output from each channel.

### 2.5.6. Transform Saved Dat

After selected the "Transform Log Data to TXT" in the tools menu, the system can automatically pops up below window as Figure 2-12.

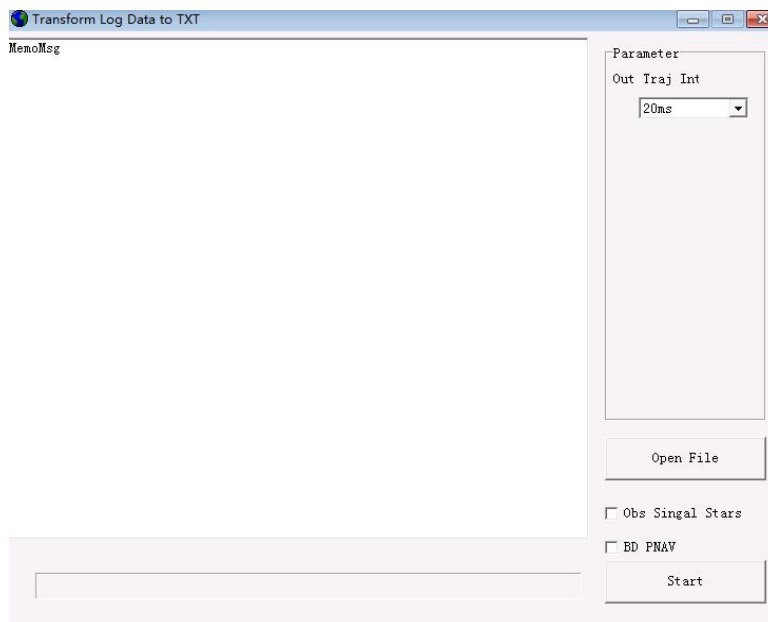


Figure 2-12 Transform Saved Data Window

Select the file in “.dat” to be converted, click “Start”, then the system will automatically convert “.dat”file to “.TXT” file and save in the original folder.

## 2.6. Tools Menu

The “Tools” menu under the Control Interface includes “System Logo Message”, “Vector Trajectory Fitting” and “Vector Trajectory Transform” and other options.

### 2.6.1. System Logo Message

Our technicians use “System Logo Message” to judge system failures. During the running period of the Control Software, it will reflect some system parameters to users through “System Message” Window. Show as Figure 2-13.

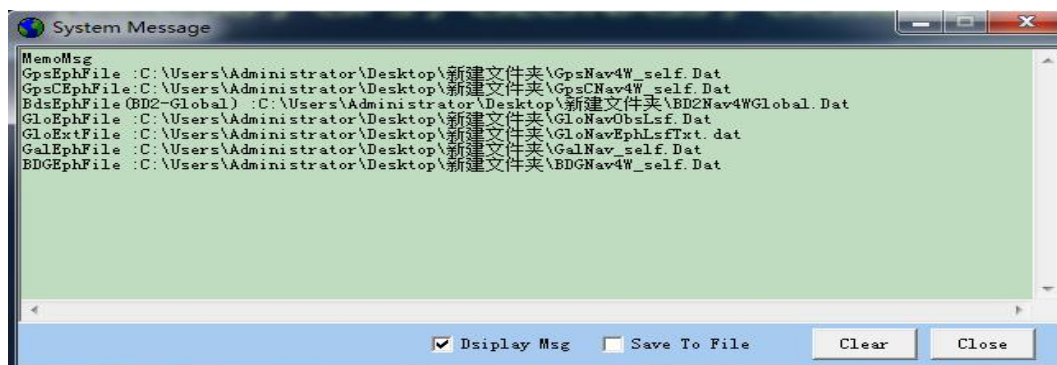


Figure 2-13 System Message Window

### 2.6.2. Vector Trajectory Fitting

After choose “Vector Trajectory Fitting”, the system will pop up “Vector Trajectory Fitting (V1.1)” window.

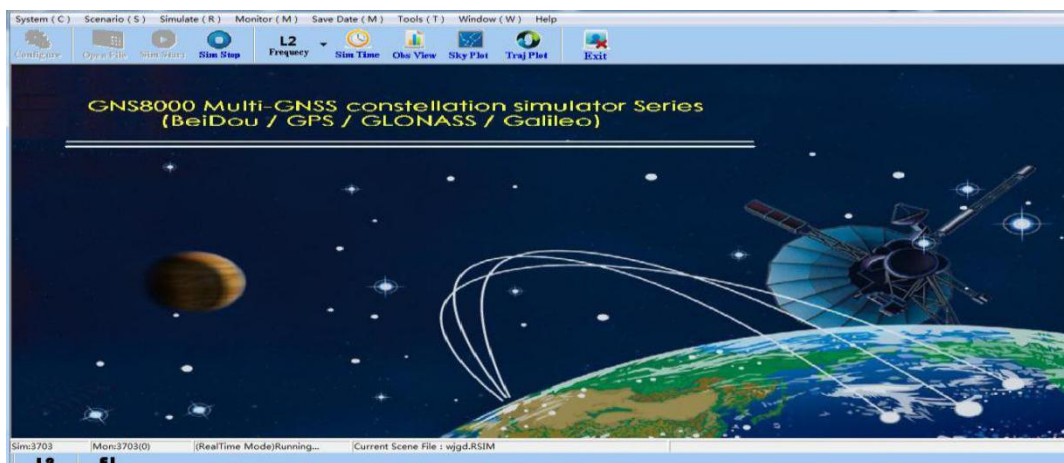


Figure 2-14 Tools Menu Diagram

Click “...” and select “.txt” format to save the trajectory files, shown as below:



**Remarks: The three locative parameters in trajectory files can be WGS84 Coordinate**

### System and Geodetic Coordinate System.

The user can select any Coordinate System at the bottom of the window according to the actual situation of the data (shown as the red frame in Figure 2-15). The data from three directions of Velocity, Acceleration and Jerk must be in “WGS84 Coordinate System”.

The Input Trajectory Files should have six parameters in position and speed.

After input data into “Vector Trajectory Fitting”, users input the corresponding sequence number in the Number-box of position parameter setting.

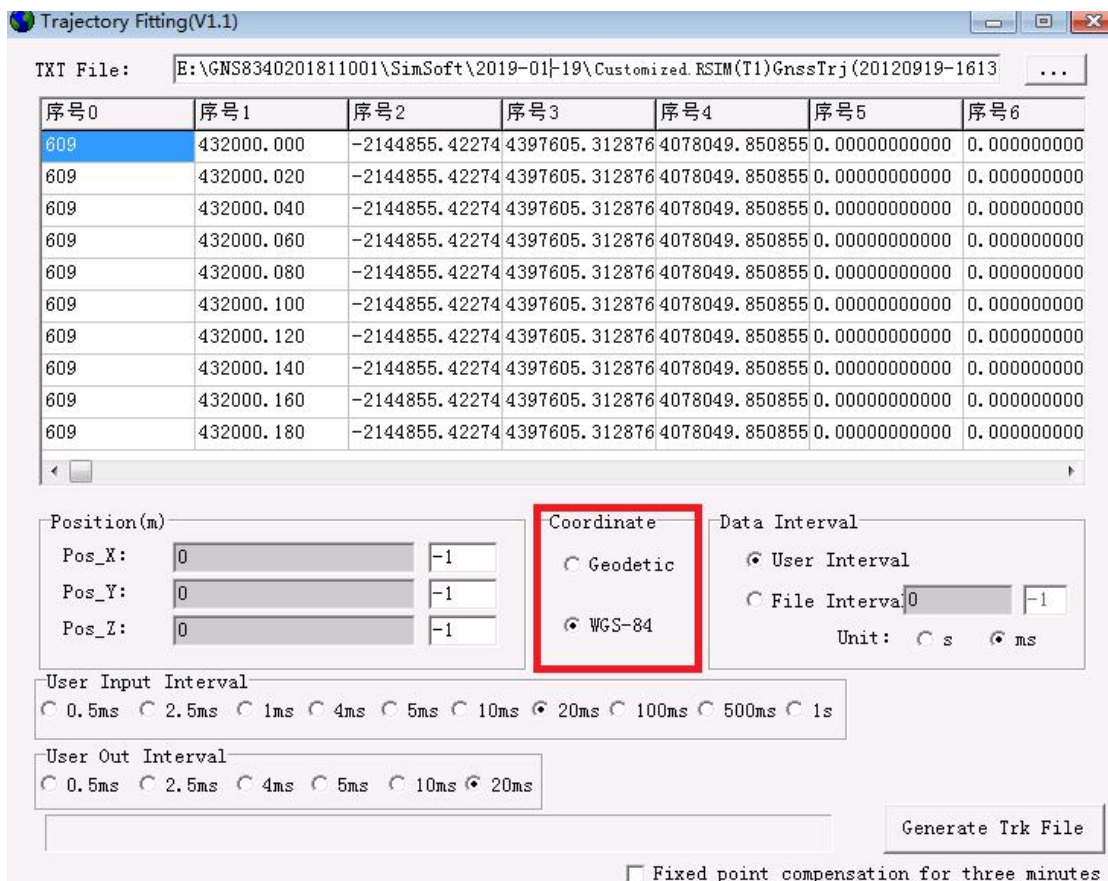
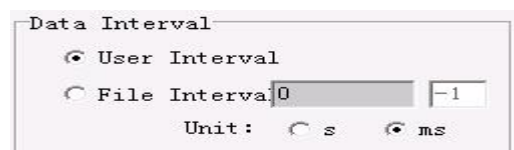


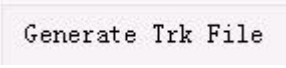
Figure 2-15 Vector Trajectory Fitting Window

Users set the corresponding interval in the “Data Interval” modes window according to



the interval in the Trajectory Files.



After settings done, click “  ” then generate corresponding “Trk” format files, select the file save path in the pop-up save window. Show as Figure 2-16.

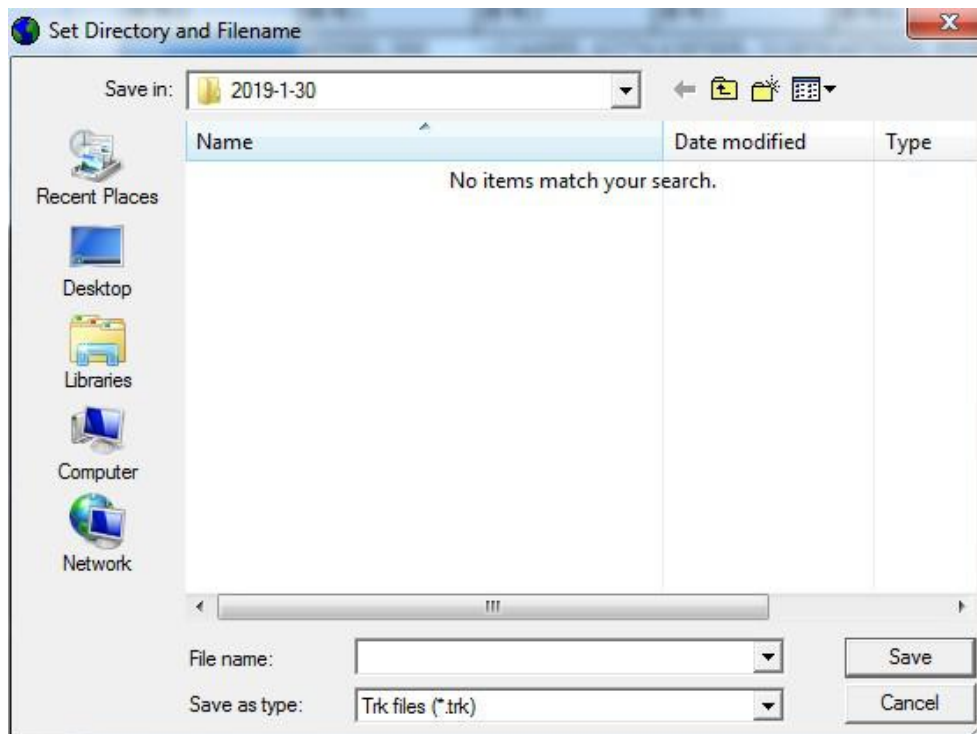



Figure 2-16 Specified Files Generate Path Diagram

**Remarks: Users trajectory files are in “.trk” format.**

### 2.6.3. Vector Trajectory Transform

Click “Vector Trajectory Fitting” tools menu, then pops up “Vector Trajectory Transform (V1.0)” editing window.



When using the tool, click “  ” in the window to select “.txt” format

for saving Trajectory Files. (The input Trajectory Files should have six parameters in position and speed from three directions.)

Then users should input the corresponding files column number in the Number-box of parameter setting for Position, Velocity, Acceleration and Jerk (inputted column number should be  $\geq 0$  and integer). Meanwhile, users select corresponding coordinate system in “Coordinate” editing frame according to the related input trajectory data (WGS84 Coordinate System and Geodetic Coordinate System).

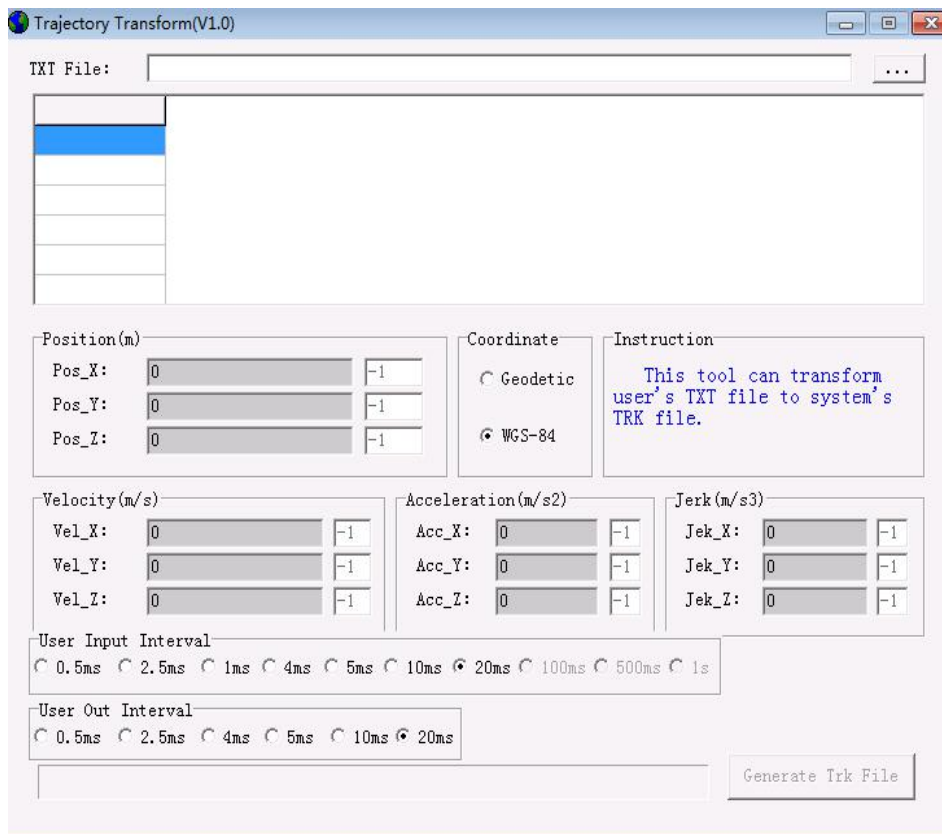
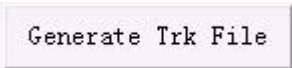


Figure 2-17 Vector Trajectory Transform

When using this tool, the required interval in the entered trajectory file fixed at 20ms.

When all the above settings completed, click “” to generate corresponding “Trk” format files, select save file path in the pop-up

window, the saved picture is the same as that of Trajectory Fittings.

#### 2.6.4. Ins File Generation

Click “Ins File Generation” menu to pop up “Generate Ins File” tool editing window, show as Figure 2-18.

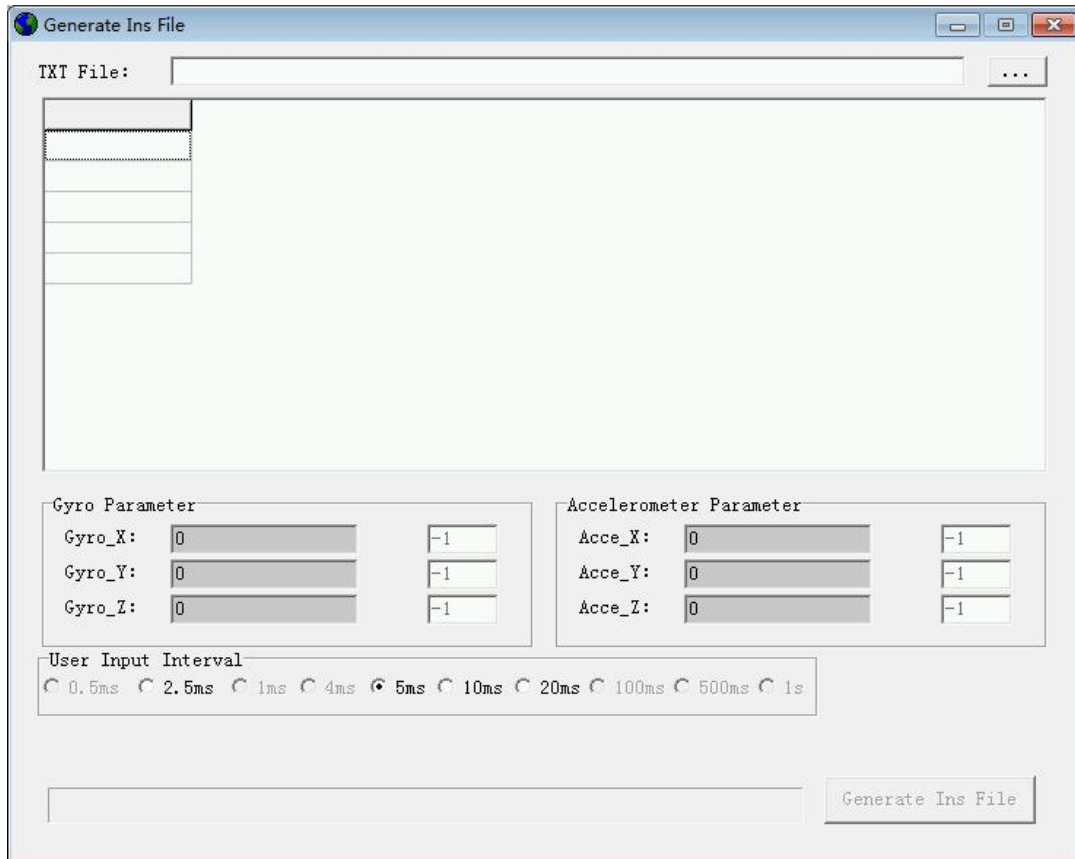


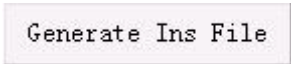
Figure 2-18 Generate Ins File Window

When using the tool, click “...” in the window to select “.txt” format for Ins Generation Data Files.



**Remarks: Generate Ins File saved in “.txt” format should include six parameters: “Gyro-X”, “Gyro-Y”, “Gyro-Z”, “Accelerometer-X”, “Accelerometer-Y”, “Accelerometer-Z”.**

Then input corresponding file column number in the Number-box of “Generate Ins Parameter” and “Accelerometer Parameter” setting. (Input column number should be  $\geq 0$  and integer).

When all the above settings completed, click “  ” to generate corresponding “Ins” format files, then select save file path in the pop-up window. Generate Ins File is the user’s inertial navigation file that can be directly used by simulator.

**Remarks: The INS file should provide the original inertial navigation file with fixed time interval of 4ms.**

### 2.6.5. Posture File Generation

Click “Posture File Generation” menu to pop up “Generate Pos File” tool editing window, show as Figure 2-19.

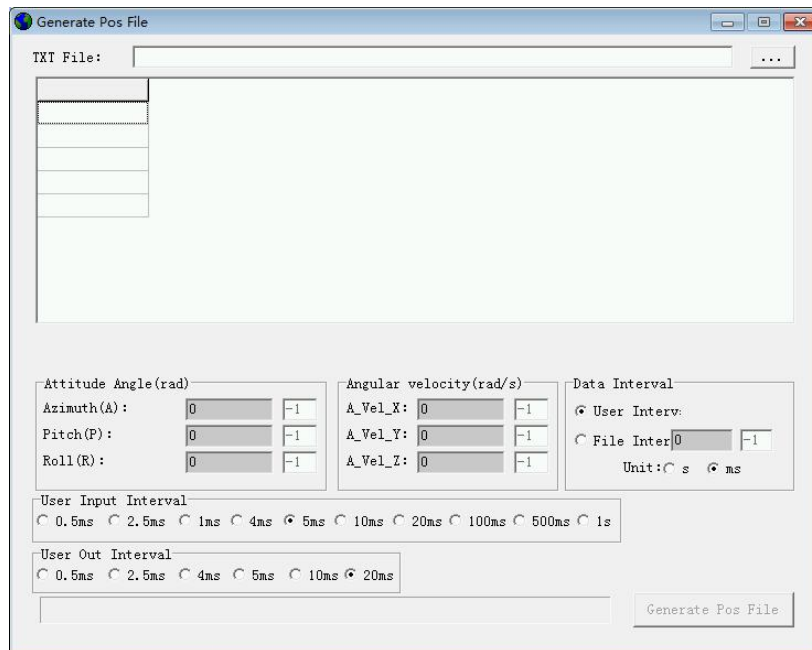



Figure 2-19 Generate Pos File Window

When using the tool, click “  ” in the window to select “.txt” format for Pos Generation Data Files.



**Remarks: The Generate Pos File should include Azimuth parameters from X, Y, Z three directions and angular velocity parameters of the carrier's own motion under WGS84 Coordinate System, meanwhile, the three parameters should be under WGS84 Coordinate System. Then input corresponding file column number in the Number-box**



of “Attitude Angle Parameter” and “Angular Velocity Parameter” setting. (Input column number should be  $\geq 0$  and integer).

When all the above settings completed, click “**Generate Pos File**” for generating corresponding “Pos” format file available for the simulator.

### 2.6.6. Power File Generation

Click “Power File Generation” menu to pop up “Generate Power File” tool editing window, show as Figure 2-20.

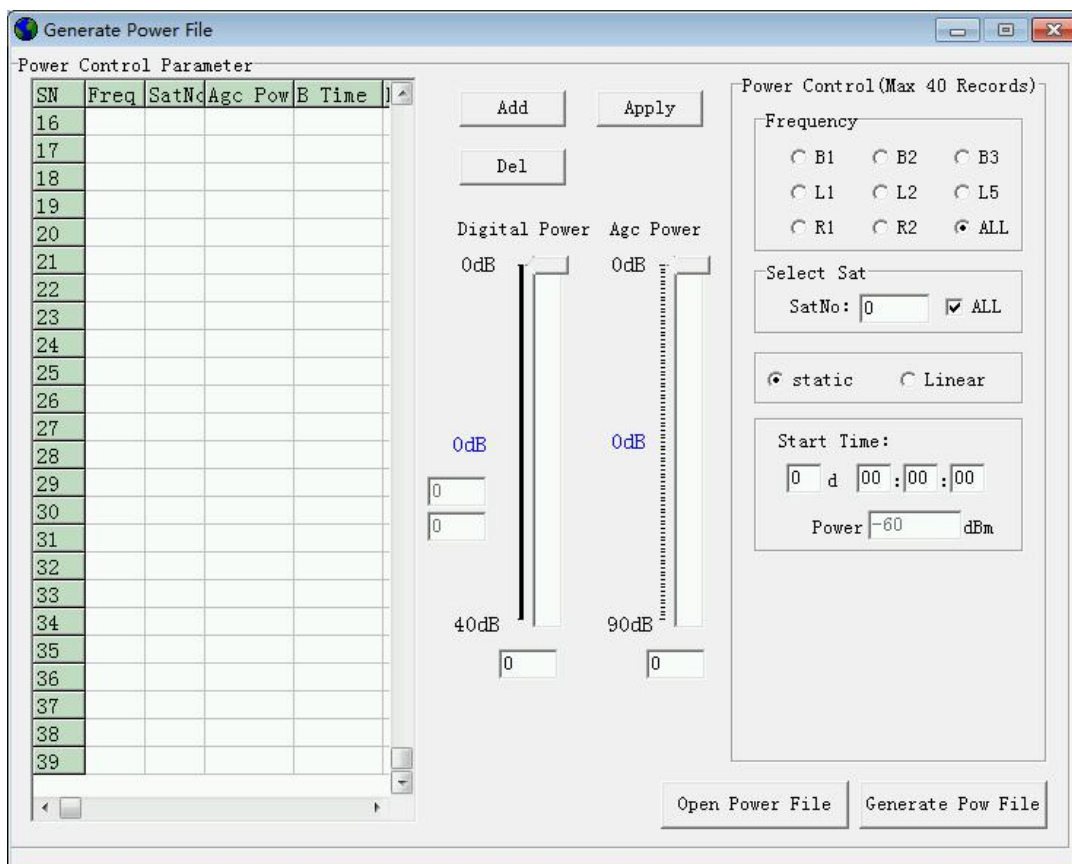
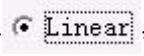

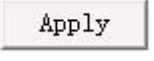



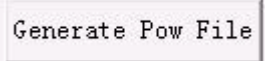
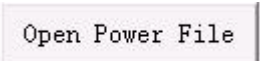
Figure 2-20 Generate Power Control File Window

In the "Power Control Parameter" editing box on the right side of the window, the user can select the “Frequency” point to set the power change in the sub-editing box of "Select Frequency Point".

In the "Power Control Parameter" sub-editing box, users can set satellite number, power adjusted motion time, adjusting watt level and power change method. Among it, the power adjusted motion time is the relative value set

relative to the simulation starting time, the minimum unit of power setting is 0.1dBm. Power variation has direct variation and linear variation. If select linear variation, choose “” and set both the end time of power adjustment and the cutoff power.

After finish setting parameter, click “”, add the parameter to the list on the left, and then click “”. Click “”, then can delete each group of parameter in the list.

After finish all the parameter setting, please click the “” window on the right lower corner. Select save file path in the save window that pops up (Generate User Track File is in “.pow” format). Click “” can open existing power file, windows can automatically read the power parameter. Users can revise the parameter in the basis of existing one.

**Remarks: Users can add 40 groups of parameter into the list in total.**

#### 2.6.7. Pseudorange File Generation

When select “Pseudorange File Generation” tool, it will pop up “Generate Pseud File” window, show as Figure 2-21. In the editing frame “Pseud Control Parameter” on the right of the window, users can select the frequency point of set power variation by using the “Select Frequency Point” sub-editing box.

In the sub-edit box of "Pseud Change Parameters", users can set the satellite number, the action time of Pseud Jump Change and the Pseud Jump Value. Among them, the action time of Pseud Jump Change is the relative value set relating to the time of starting simulation, and the unit set for Jump Value is “ps”.

After finish setting parameter, click “**Add**”, add the parameter to the list on the left, and then click “**Apply**”. Click “**Del**”, then can delete each group of parameter in the list.

After finish all the parameter setting, please click the “**Generate Pseud File**” window on the right lower corner. Select save file path in the save window that pops up (Generate User Pseud File is in “.pru” format). Click

“**Open Pseud File**” can open existing Pseud file, windows can automatically read the power parameter. Users can revise the parameter in the basis of existing one.

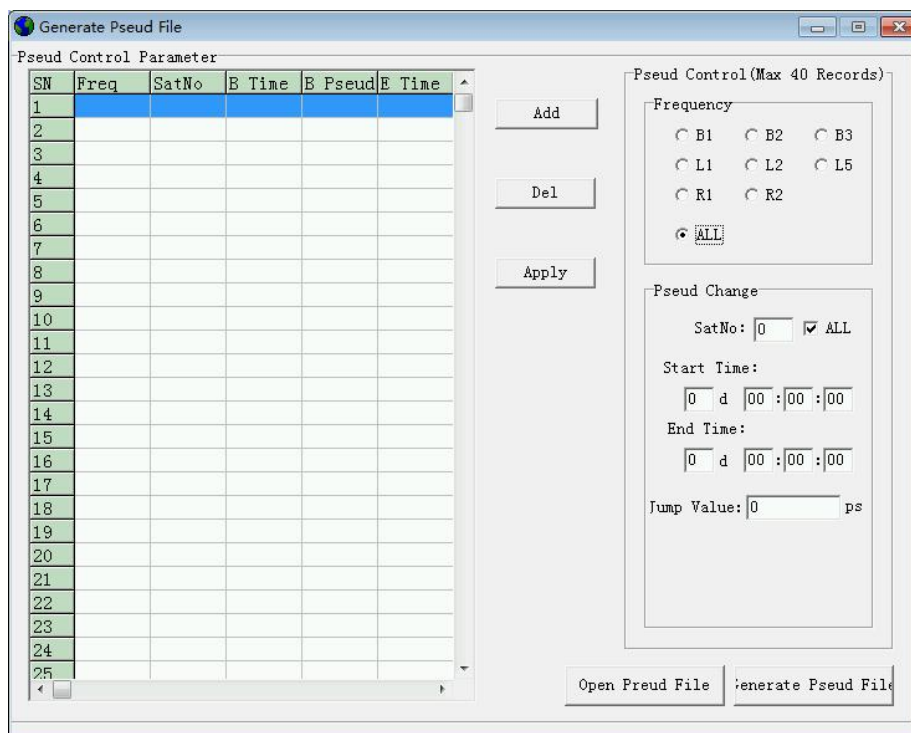



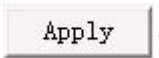
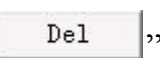
Figure 2-21 Generate Pseud Control File Window

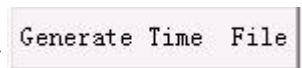

**Remarks: Users can add 40 groups of parameter into the list in total.**

### 2.6.8. Time File Generation

When select “Time File Generation” tool, it will pop up “Generate Time File” window, show as Figure 2-22. In the editing frame “Time Control Parameter” on

the right of the window, users can select the frequency point of set power variation by using the “Select Sys In the sub-editing frame “Time Jump Parameter”, users can set Jump Time, Week Jump Value and Seconds Jump Value in a week, etc.

After finish setting parameter, click “”, add the parameter to the list on the left, and then click “”. Click “”, then can delete each group of parameter in the list.

After finish all the parameter setting, please click the “”, window on the right lower corner. Select save file path in the save window that pops up (Generate User Pseud File is in “.pru” format). Click “” can open existing Pseud file, windows can automatically read the power parameter. Users can revise the parameter in the basis of existing one.

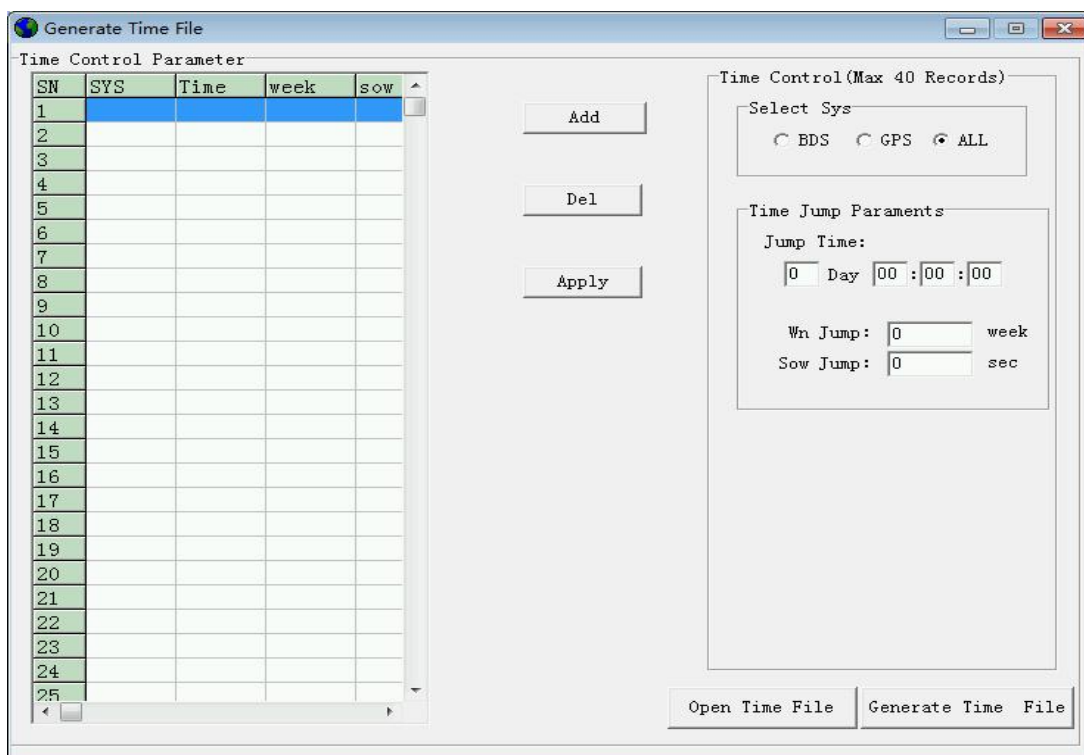


Figure 2-22 Time Control Parameter Setting Window

## 2.7. Window Options

In the "Window" menu of the control interface, we provide "Default Layout", "Tile Layout" and "Cascade Layout" for users. After the system runs normally, the "Default Layout" monitors window distribution, show as Figure 2-23:

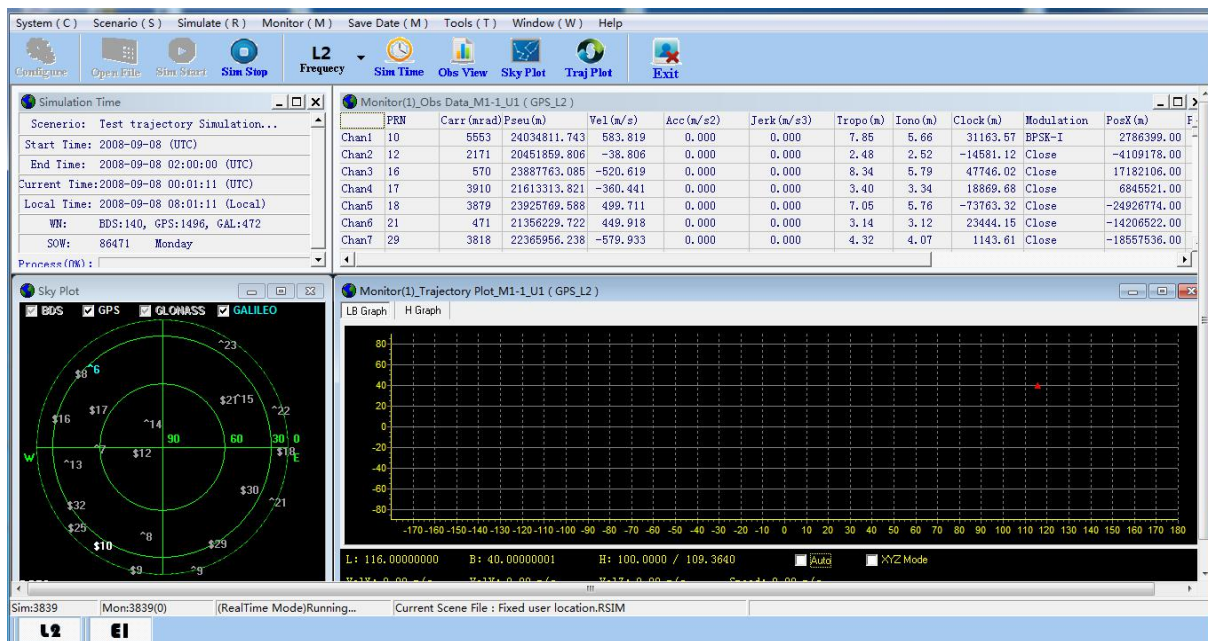


Figure 2-23 "Default Layout" Monitor Window Distribution Diagram

The "Tile Layout" monitors window distribution, show as Figure 2-24:

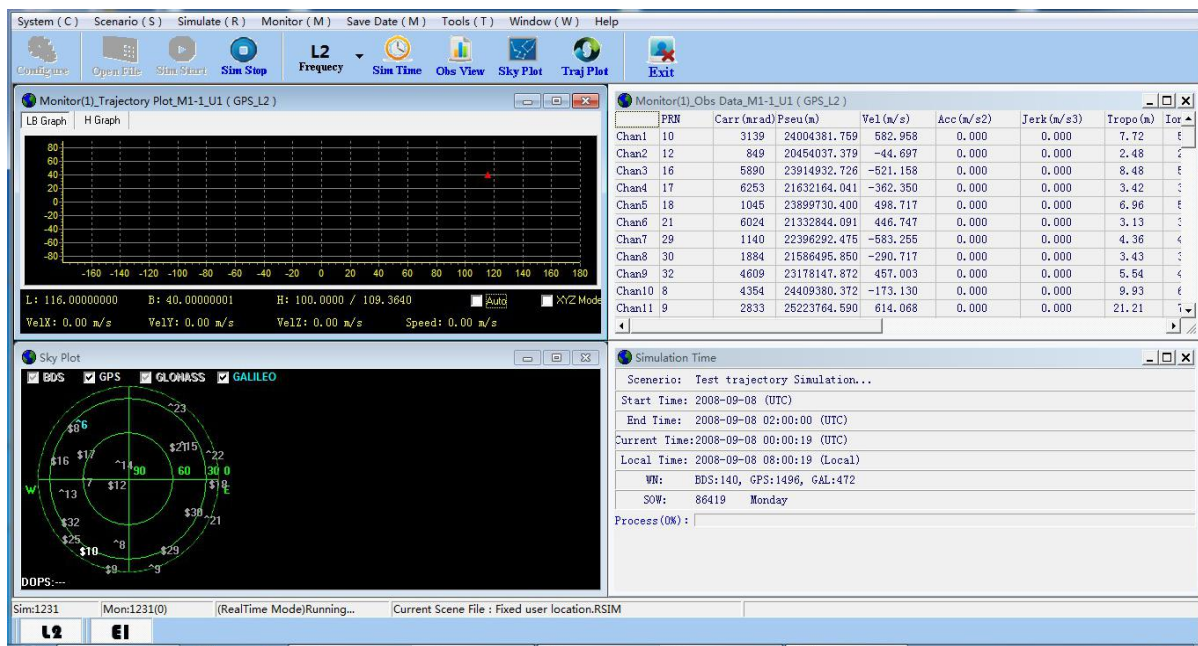


Figure 2-24 "Tile Layout" Monitor Window Distribution Diagram

The "Cascade Layout" monitors window distribution, show as Figure 2-25:

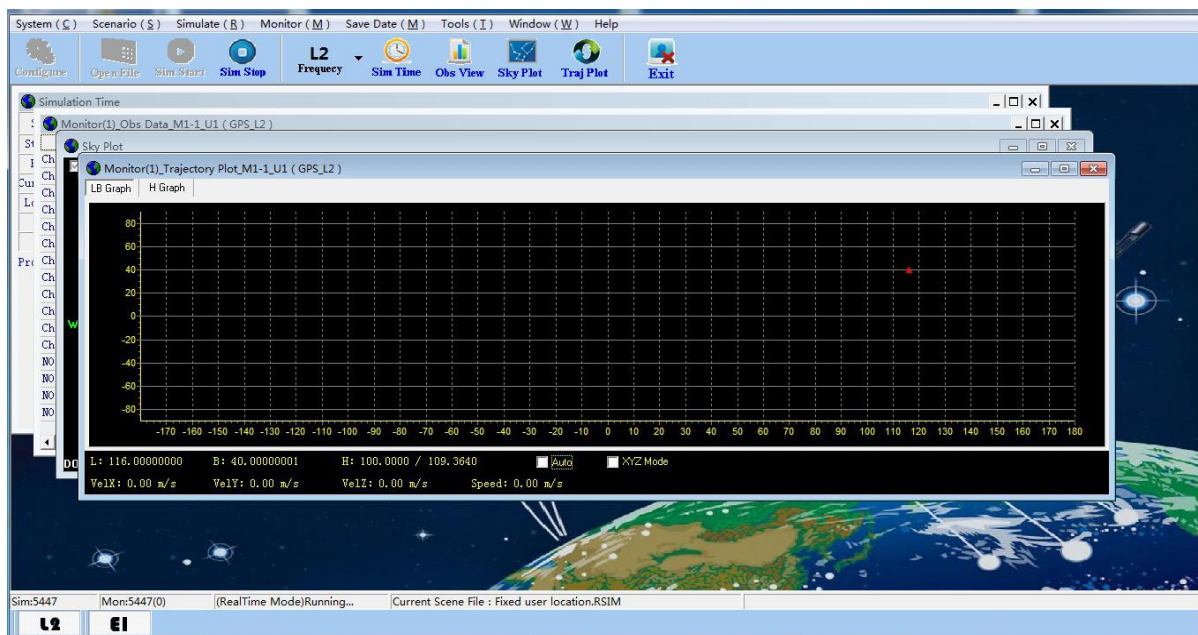
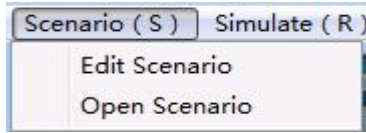


Figure 2-25 "Cascade Layout" Monitor Window Distribution Diagram

## 2.8. SYSEXIT

When complete, users need to click the "Stop Simulation" icon on the toolbar, and then click the "System Exit" icon to exit the control software.

### 3. Simulation Scenario Edit



While using the mathematical scenarios provided by us, users can also design moving scenario or edit existing scenario according to their own requirements. Click the simple scenario edit option in the scenario menu to enter the “Edit Scenario” dialog box:

The index menu is on the left of the editing window. There are four sub-editing window options, namely "Simulation Time", "Constellation Parameters", "Initial State" and "Carrier Trajectory". Users can click the right side of the window to pop up the corresponding parameter set window.

The underneath of the window shows as below picture:



Users can choose "New" digital simulation scenario, or click "Open" to open the existing scenario for editing, and click "Save" for saving the set digital simulation scenario.

#### 3.1. Simulation Time Parameter Setting

The start time and simulation time of required scenario can be put into the Simulation Parameters Editing frame. (The start time can be set as any time after January 1<sup>st</sup>. 2006, and it shall be input in the format of YYYY -- MM -- DD hh: MM; Start time is UTC time). According to the Start time and Duration, the Week Counting Number and Seconds of Week automatically calculated and generated by the software. Show as Figure 3-1:

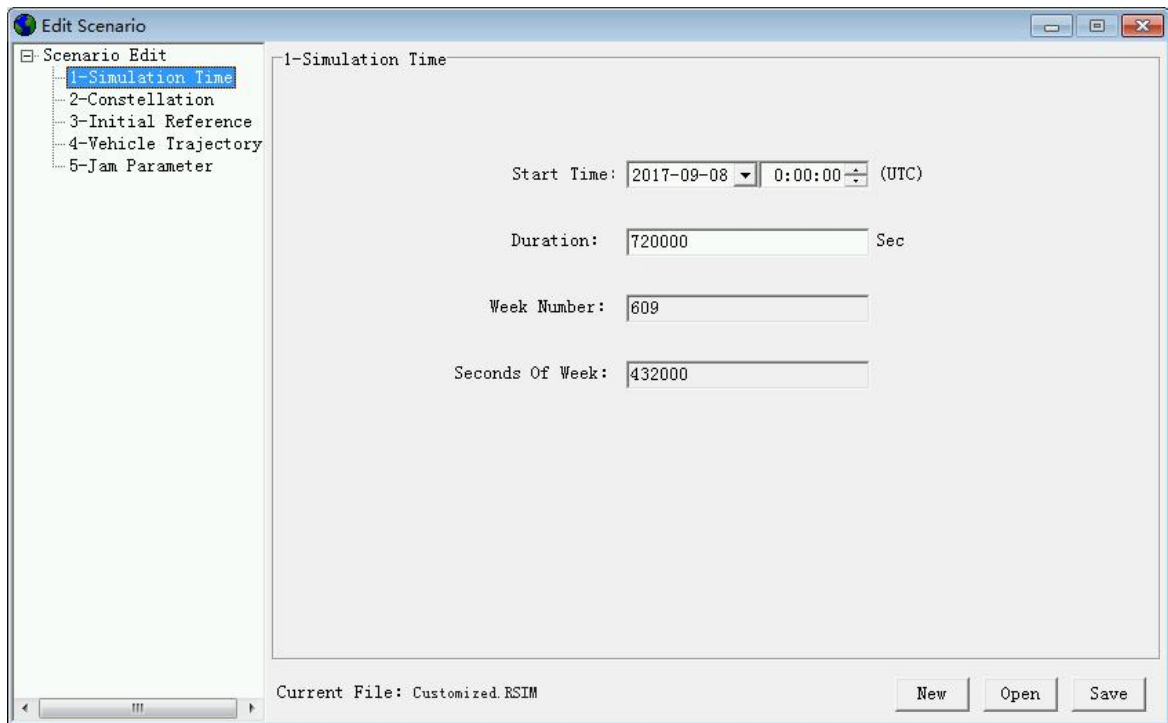


Figure 3-1 Simulation Time Parameter Setting Window

### 3.2. Constellation Parameter Editing

In Constellation Parameter Setting, customize select “Using System Ephemeris”, show as Figure 3-2.

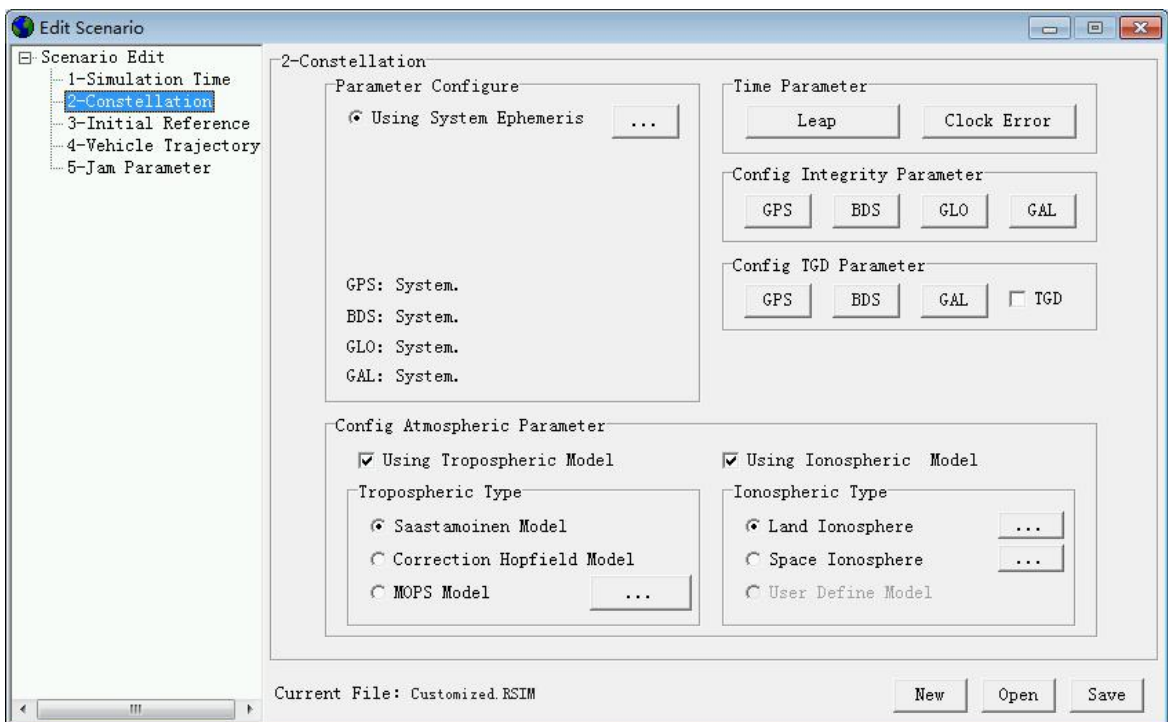



Figure 3-2 Constellation Parameter Editing Window



### 3.2.1. Ephemeris Parameter Setting

Click “” on the right picture to enter Ephemeris Parameter Setting, show as below picture (GPS Ephemeris):

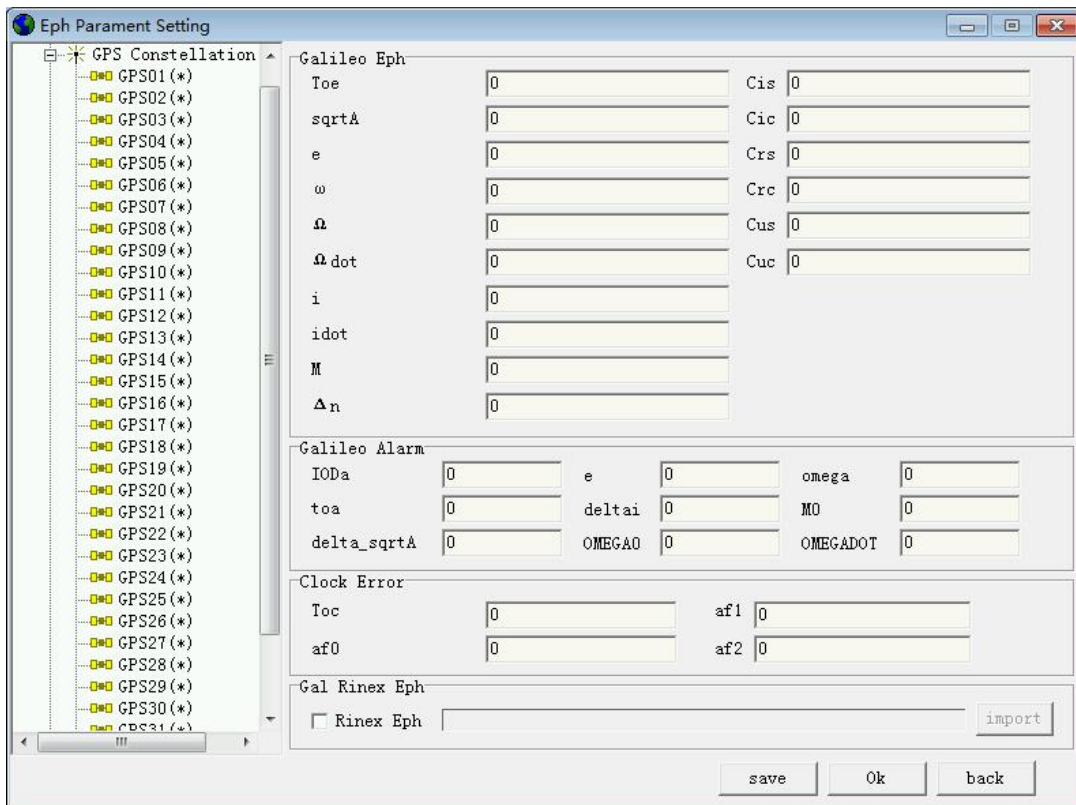
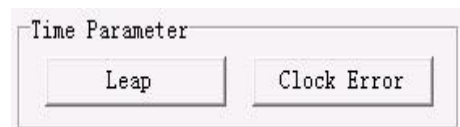


Figure 3-3 Ephemeris Parameter Setting Window

Users can edit and set TGD parameters and Clock Error parameters in GPS constellation by themselves.



### 3.2.2. Time Parameter Editing

Click the leap second parameter to enter the Time Parameter Editing Window, show as Figure 3-4:

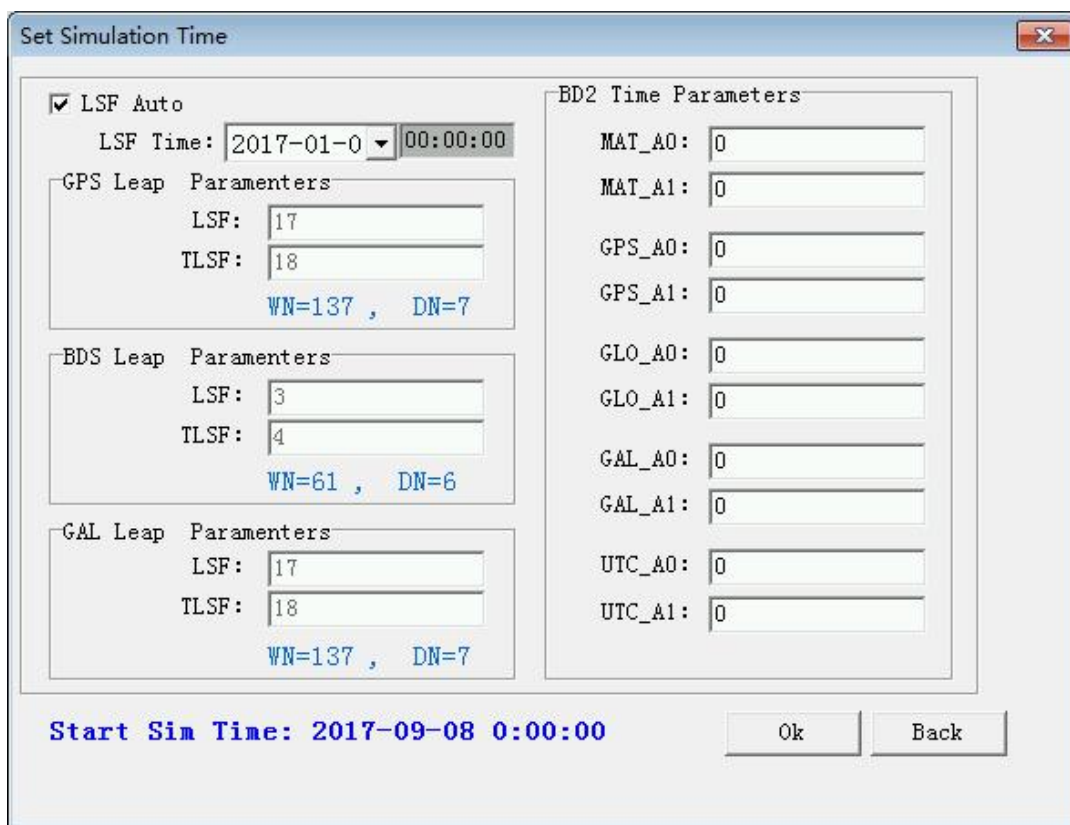

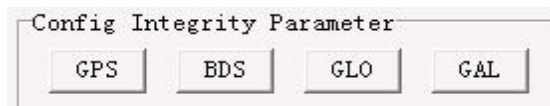


Figure 3-4 Time Paameter Setting Window

Users can edit GPS/ BDS/ GLONASS Leap Parameters.

### 3.2.3. Satellite Health Information and Distance Accuracy Setting

Click  icon in below picture to enter Parameter Editing window, show as Figure 3-5.



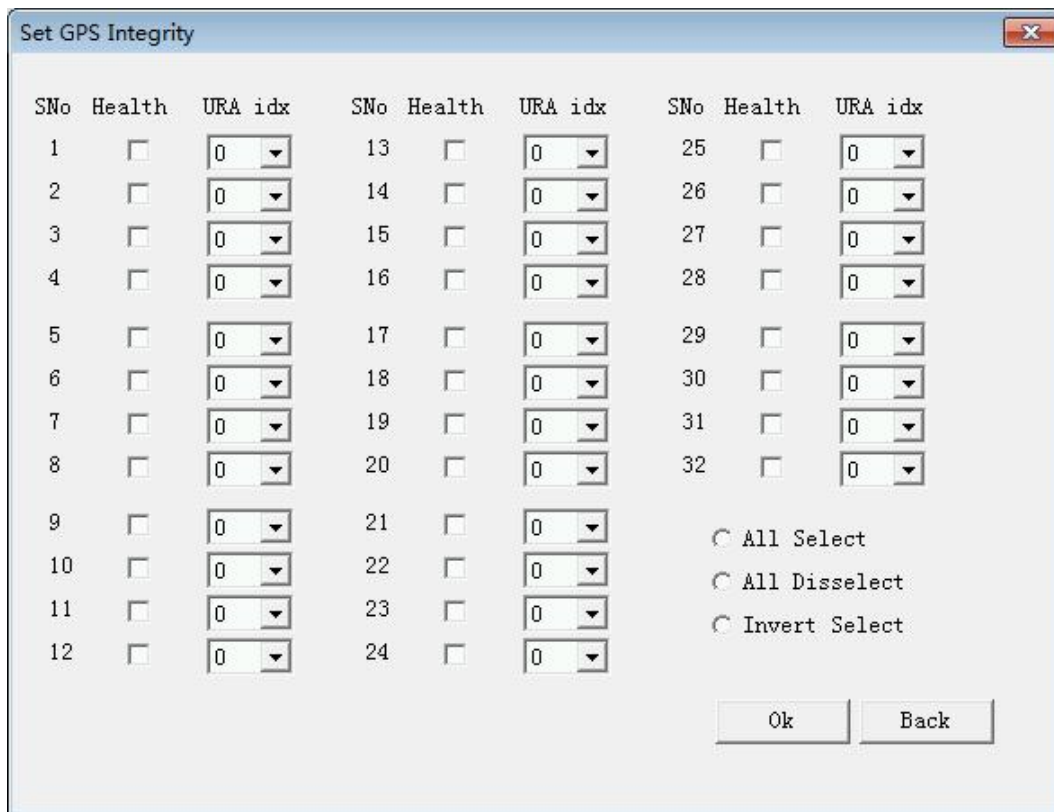


Figure 3-5 GPS Health Information and Distance Accuracy Setting Window

In the edit window, users can customize the fault status of each satellite and the ranging accuracy. At the bottom of the window, users can easily edit the "Current Set" and "All Set".

### 3.2.4. Atmosphere Environment Parameters Editing

In the editing box of Atmospheric Environment Parameters, users can add and modify Troposphere or Ionosphere Model Parameters in the edited numerical simulation scenario. Show as Figure 3-6:

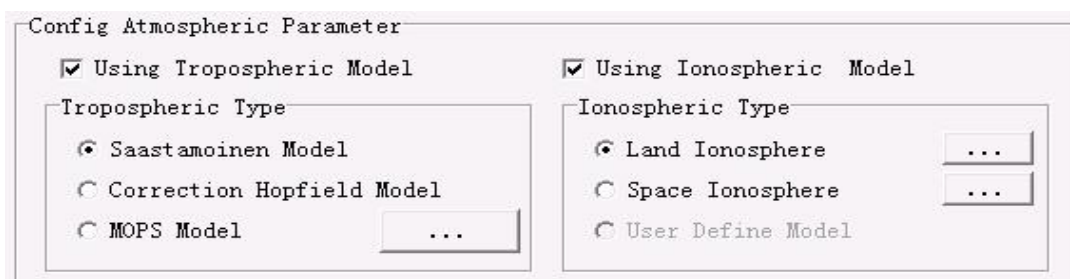


Figure 3-6 Atmosphere Environment Parameter Editing Window

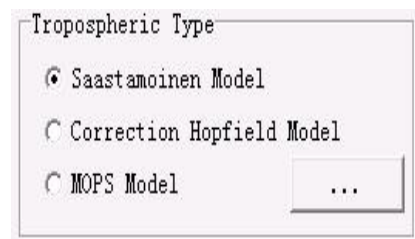
Select “  Using Tropospheric Model  Using Ionospheric Model ” to

add Tropospheric or Ionospheric Model Parameters in the edited scenario. If no selection, it means that these atmospheric environment models not be added in the current numerical simulation scenario.

### 1) Set Tropospheric Model Parameter

After select “Using Tropospheric Model”, users can use or edit Troposphere Model. There have three models: “Saastamoinen Model”, “Correction Hopfield Model” and “MOPS Model”. “Saastamoinen Model” and “Correction Hopfield Model” open the editing window to users, users can customize the parameters in the model.

For example, click “  ” icon on the right picture to enter the corresponding parameter model set window. Show as Figure 3-7.



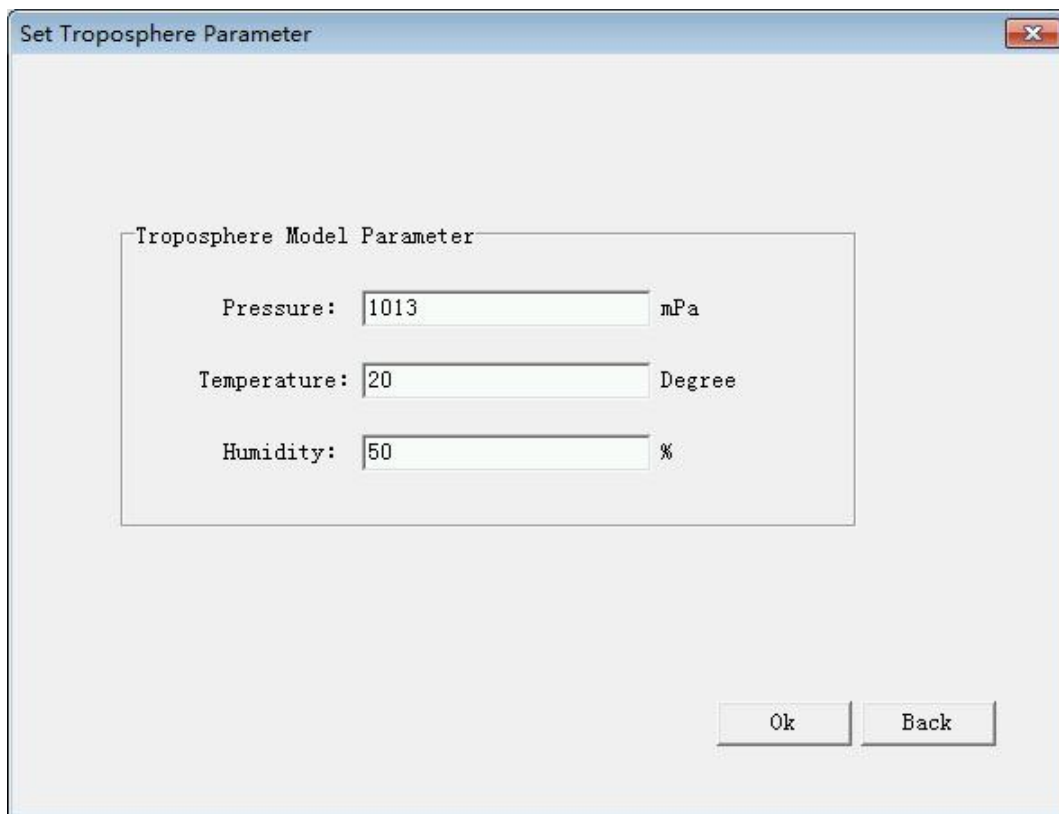


Figure 3-7 Troposphere Model Parameter Window

Users can set the “Pressure”, “Temperature” and “Humidity” parameters in the Troposphere Model.

## 2) Set Ionosphere Model Parameter

After select "Using Ionospheric Model", users can use or edit the Ionosphere Model. We provide two models for users: Land Ionosphere Model and Space Ionosphere Model. At the same time, the two models open editing window for users, users can customize the parameters of the model.

Click the “...” icon in the “ Land Ionosphere ...” to enter Land Ionosphere Model Parameter Window. Show as Figure 3-8:

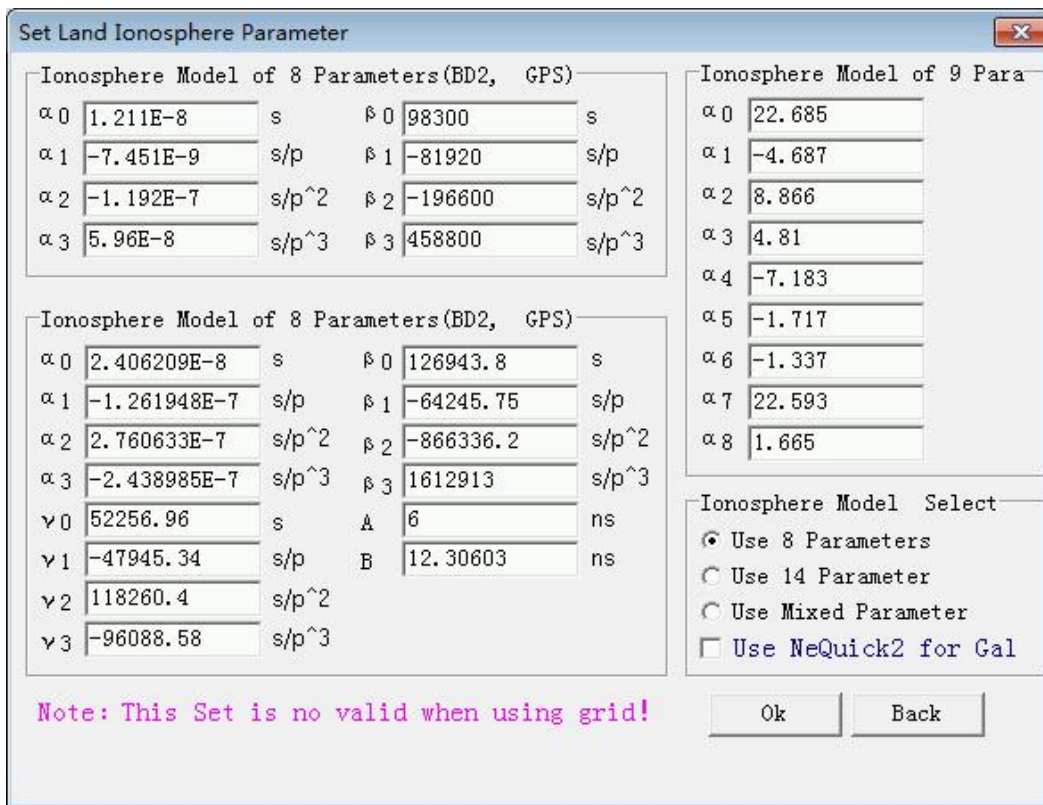


Figure 3-8 Land Ionosphere Model Parameter Set Window

In this window, users can choose to use 8 Parameters Model, 9 Parameters Model or Galileo Parameter Model. And users can also edit the parameters in each Parameter Model.

Click the “...” icon in the “Space Ionosphere ...” to enter Space Ionosphere Model Parameter Window. Show as Figure 3-9:

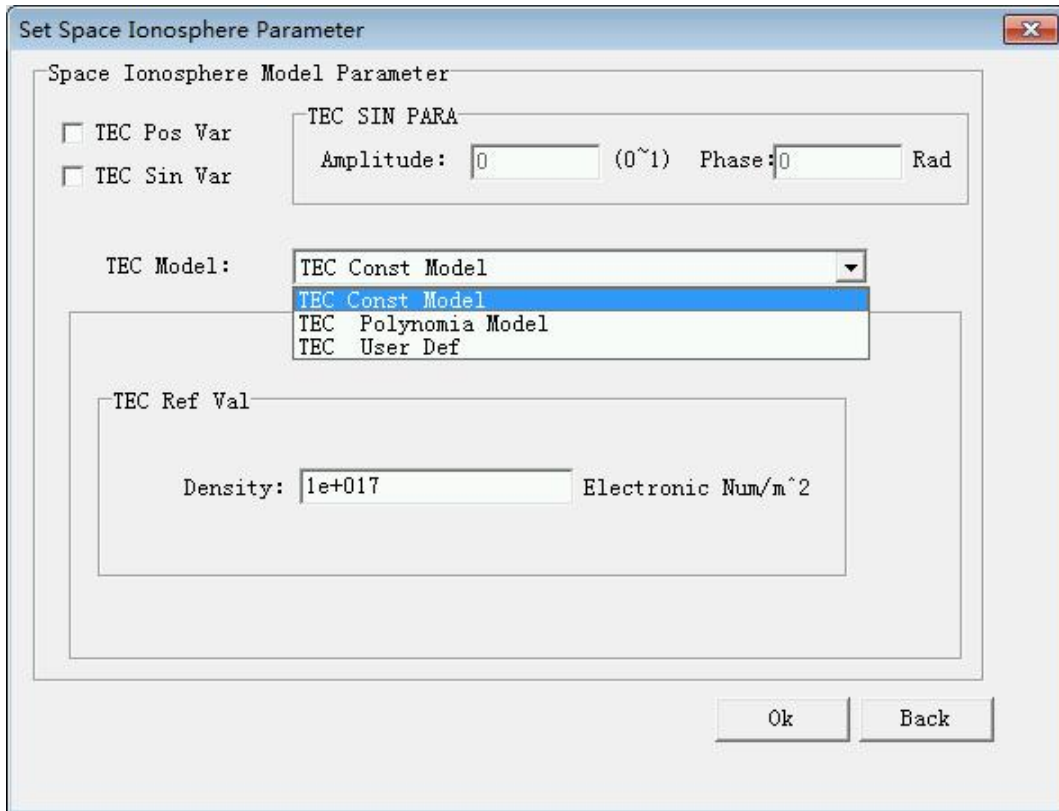


Figure 3-9 Space Ionosphere Model Parameter Set Window

In this window, the user can edit and select the TEC change type, TEC parameter model and TEC reference value.

### 3.3. Initial Reference Editing

In “Initial Reference” Window, users can set User Trajectory Initial Position, Initial Speed and Initial Acceleration Value. Show as Figure 3-10.

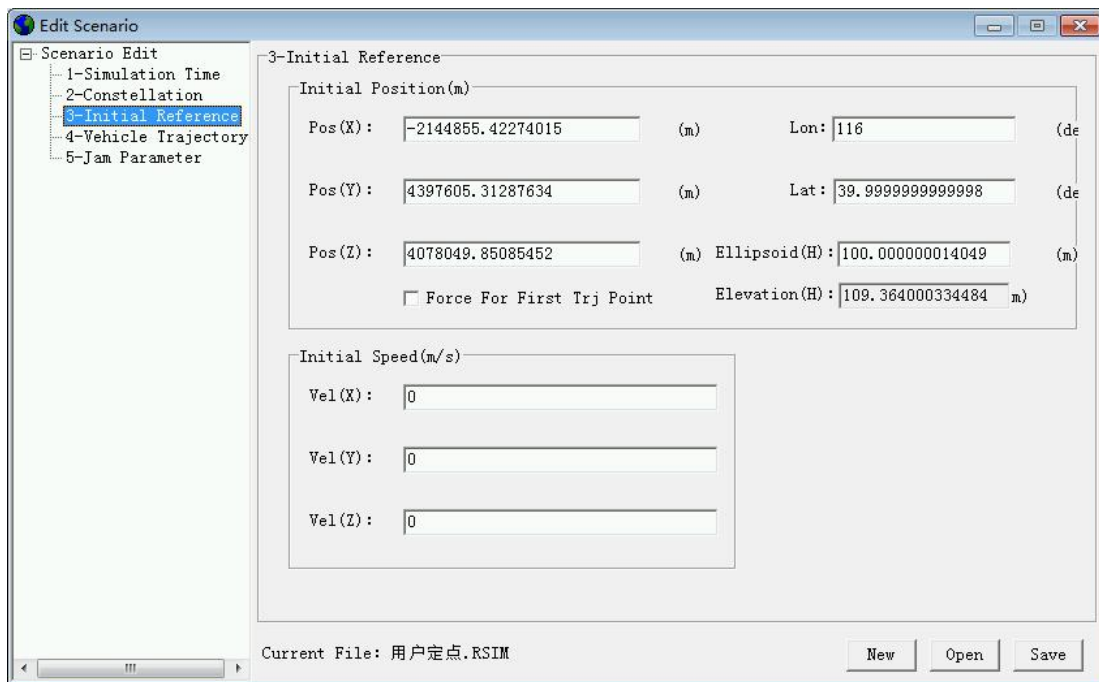
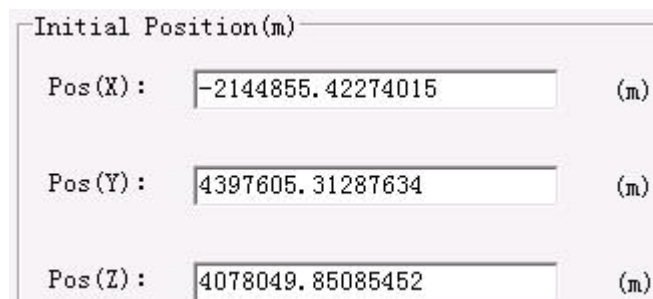


Figure 3-10 Initial Reference Editing Window

### 1) Initial Position

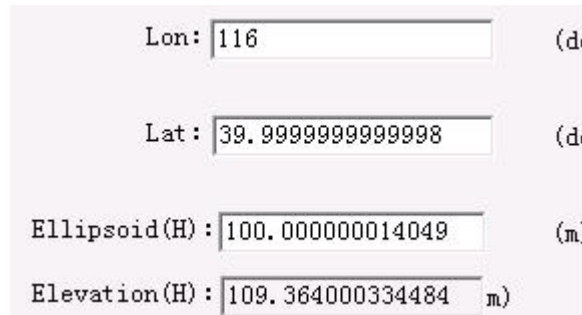
The Initial Position is set according to the Rectangular Coordinate System, users can set the initial position of the simulated scenario according to the demand, the unit is m.

For example:



This coordinate is the Rectangular Coordinate System of Beijing.



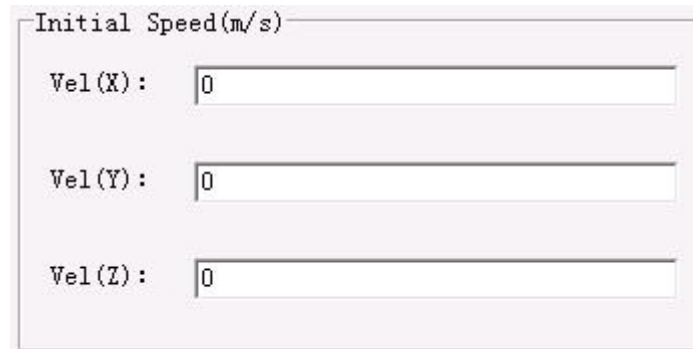


Lon:  (de  
 Lat:  (de  
 Ellipsoid(H):  (m)  
 Elevation(H):  m)

This is the corresponding Geodetic Coordinate of the figure above.

## 2) Initial Speed

Users can edit three directions of Coordinate to set the Initial Speed and Acceleration of the scenario, the unit is m/s and  $m/s^2$  respectively.



Initial Speed(m/s)  
 Vel(X):   
 Vel(Y):   
 Vel(Z):

Figure 3-11 Initial Speed Editing Window

## 3.4. Vehicle Trajectory Parameters Editing

Trajectory Parameters Editing includes three formats: “Test Trajectory Simulation”, “Out Trajectory Simulation” and “Navigation Trajectory Simulation”. Show as Figure 3-12, use the Radio button to select.

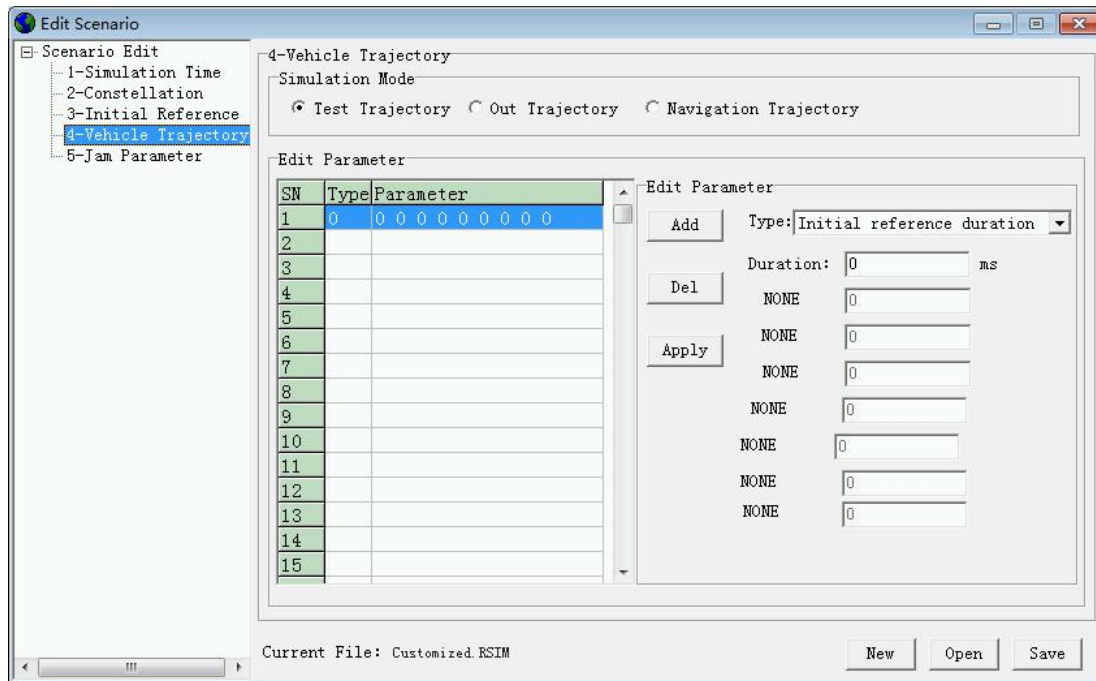


Figure 3-12 Vehicle Trajectory Parameters Editing Window

### 3.4.1. Test Trajectory Simulation

Select “Test Trajectory Simulation”, user can use the various trajectory provided by the software to edit the scenarios they need.

We provide 14 types of trajectory parameters for users, including: Initial Reference Duration, Vehicle Same Speed Motion, Vehicle Acceleration Motion, Vehicle Jerk Motion and other nine kinds of Special Motion Trajectory. Show as Figure 3-13.

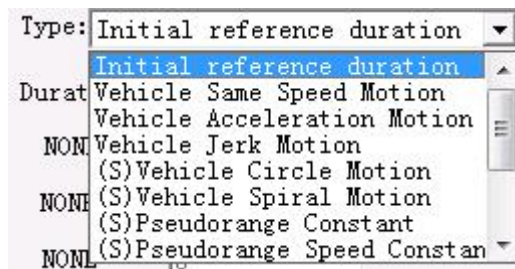
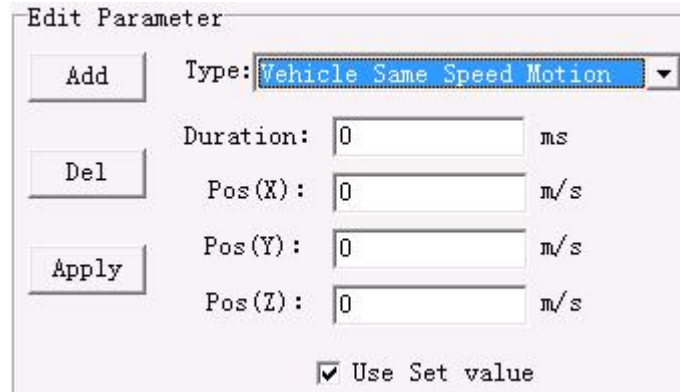



Figure 3-13 Parameter Model Selection Window

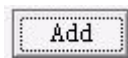
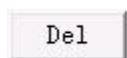
For each motion trajectory, we can set the corresponding parameters. Such

as Vehicle Same Speed Motion, we can set the Duration and speed parameters in the three directions of the Rectangular Coordinate. Show as below picture:



Click “  ” after set parameters, the corresponding trajectory parameters will appear in the track list on the left, show as the picture:

SN	Type	Parameter
1	1	1 0 50 100 60 0 0 0 0


Users can add and delete each group of trajectory parameters at will by using the button “  ” and “  ” in the edit parameters edit box.

**Remarks: Nine special motion trajectories cannot coexist with other trajectories.**

### 3.4.2. Out Trajectory Simulation

Select “Out Trajectory Simulation”, users can edit their desired User Motion Trajectory into the scenario.



Select “Out Trajectory File” button, then click “  ” on the right to pop up Out Trajectory File Slection Frame, the file format for Out Trajectory File is “\*.trk”.

### 3.4.3. Navigation Trajectory Simulation

Select “Navigation Trajectory Simulation”, users can set navigation

trajectory by self. Show as Figure 3-14.

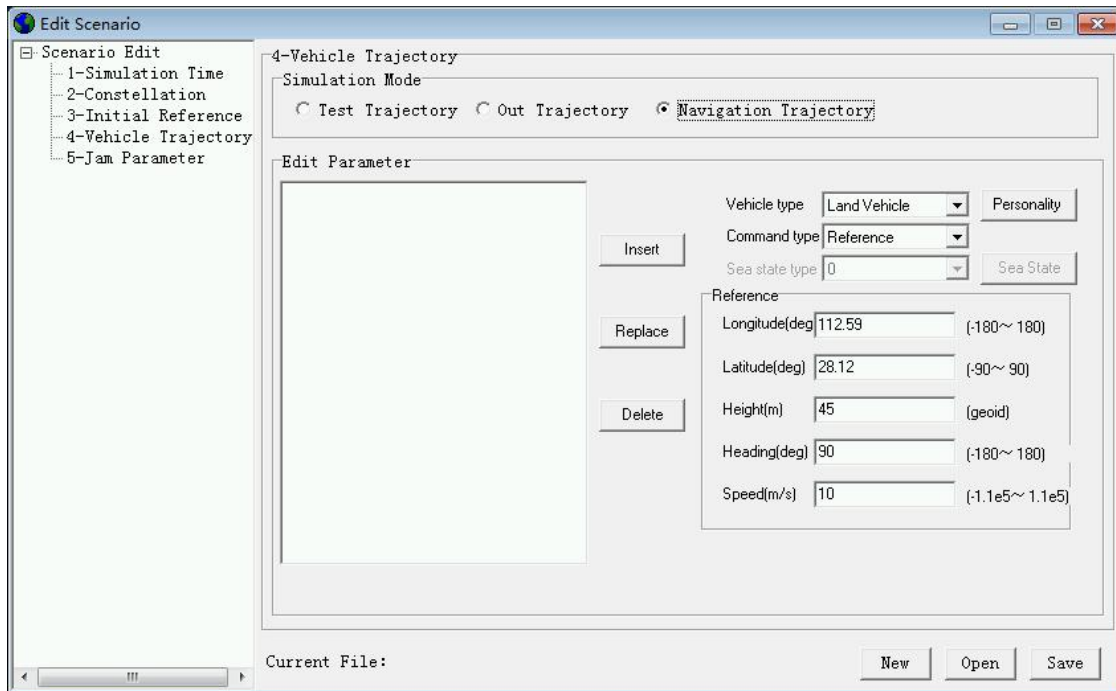


Figure 3-14 Navigation Trajectory Simulation Parameter Setting Window

In the track command toolbar “Vehicle Type”, user can select different track commands. Show as Figure 3-15.



Figure 3-15 Vehicle Track Type Selection Window

### 3.5. Jamming Parameter

When doing the anti-interference test in the navigation terminal, it is necessary to add corresponding Jamming Signals into navigation signals, such as Multipath Interference, Single Frequency Interference and Broadband Interference, etc. Then the interference parameters should be added into the simulation scenario parameters, “Jamming Parameter” window is interference parameters setting window, show as Figure 3-16.

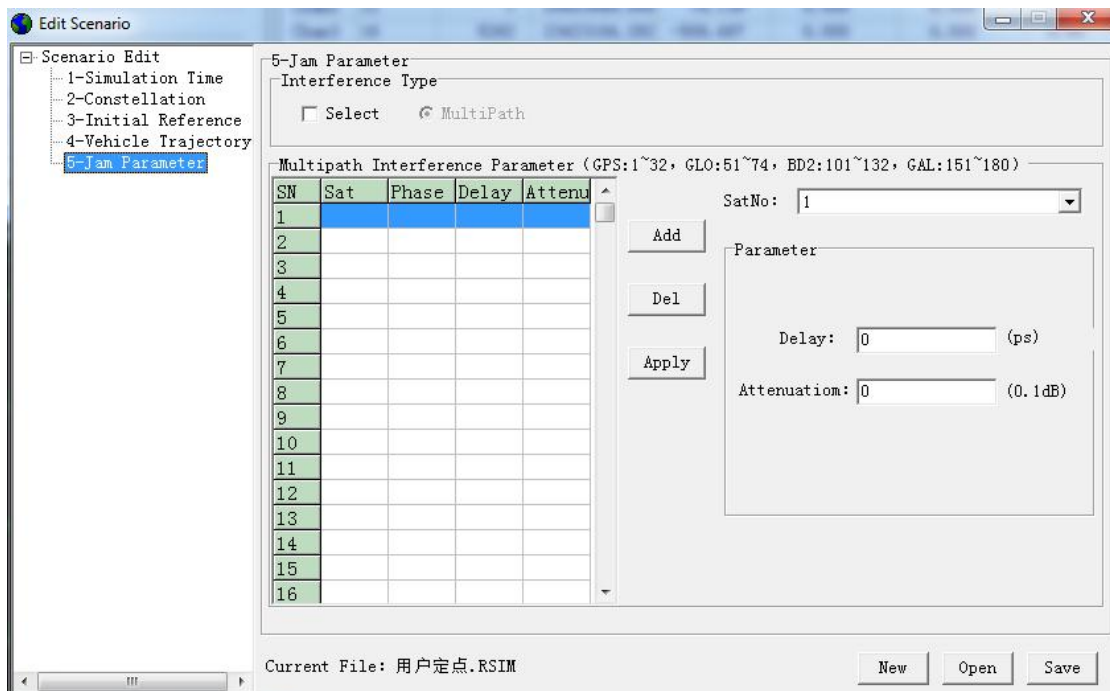



Figure 3-16 Interference Parameters Setting Window

Select the radio box before “Interference Set”, user can edit the Forwarding Interference, Spoofing Interference, Multipath Interference and Customize Interference. Among them, the Customize Interference divided into Single-frequency Interference, Spread Spectrum Interference, Sweep Interference and FM Interference.

### 3.5.1. Multipath Interference

When Multipath Interference is set, select simulating multipath signal satellite at first (consistent with Spoofing Interference).

To set the phase reversal, signal delay and power attenuation values of the multipath signal relative to the main path signal in the “Multipath Interference Parameter Set”. After set, click “  ” to add into Multipath Interference Parameter Set. Show as Figure 3-17.

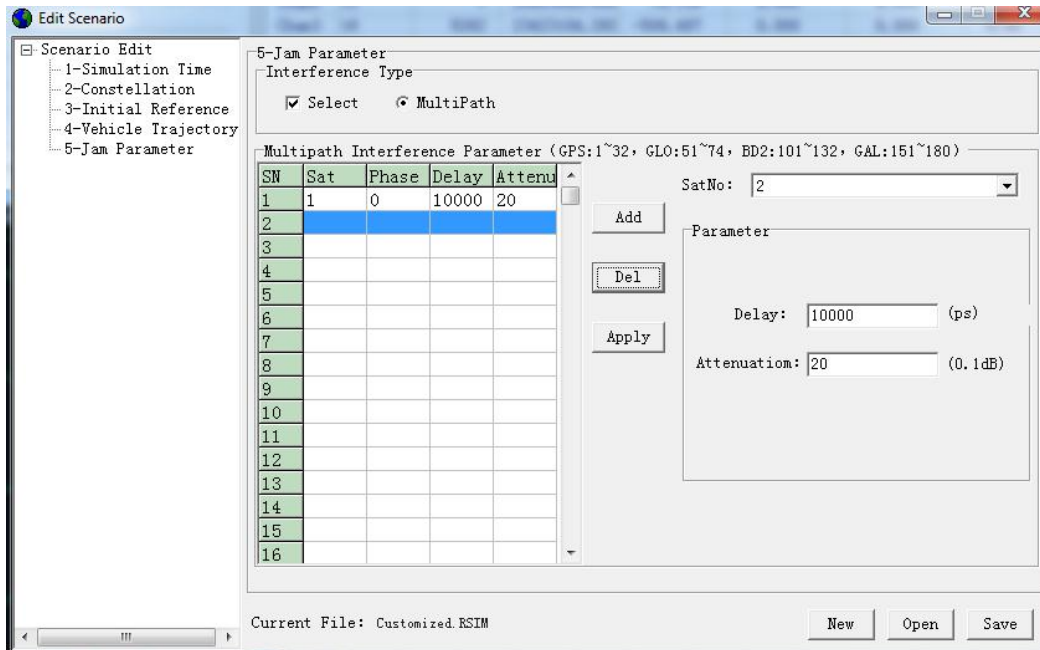



Figure 3-17 Multipath Interference Set Window

### 3.6. Save Scenario


After the scenario editing is completed, click the “  ” in the lower right corner of the window to pop up save dialog box, and the user can edit the generated scenario name, save type and save path.

**Remarks: The saved scenario format are all “Sim” files(\*.rsim).**

## 4. Maintenance

### 4.1. System Automatic Check

The Automatic Check mainly used for automatically detecting the hardware state of the simulator when the simulator starts. Double-click the program icon to enter the configuration window of the automatic detection hardware, and check whether the automatic detection fails. Show as Figure 4-1.

If not found the module, the automatic check hardware will always be in the detection state, the icon “  ” in control software interface will be

grey.

- 1) In such situation, user shall first confirm whether the simulator be powered on or not;
- 2) Whether the network connection between the simulator and the control computer is normal, whether the IP address is in network segment “10.129.41.X” (X is figure among 20 - 254).

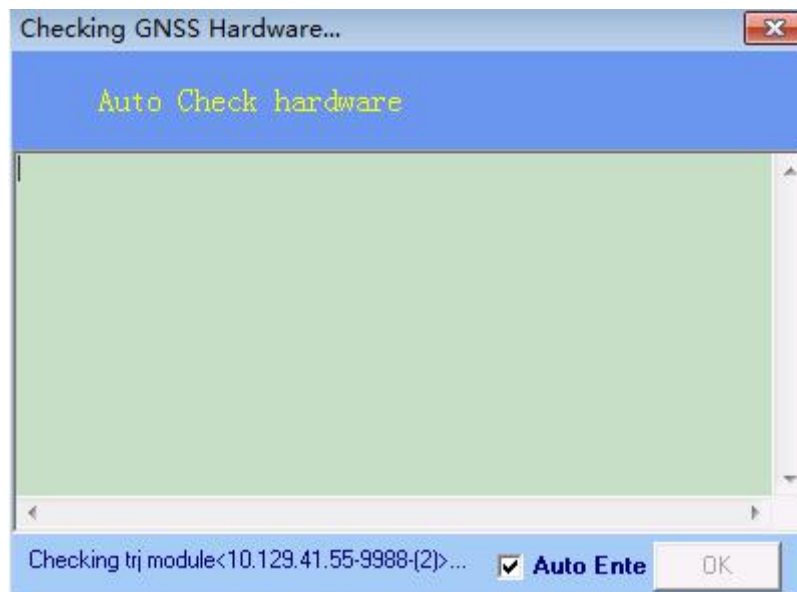


Figure 4-1 Automatic Check Hardware Configuration Window

## 4.2. Abnormal Signal Output

- 1) Handling method for abnormal signal output under normal operation of the simulator;
- 2) Check whether the power setting and modulation mode setting of the control software are correct, the power setting is according to the user terminal demand, system can adjust in the range of -60dBm to -150 dBm;
- 3) Check whether the RF cables connected by the simulator to the user terminal or other external devices are properly connected;

If there has evaluation software, first check whether the control software

responds to the instructions of the evaluation software;

Please contact our technical personnel in time when you encounter below issue: the system fails to power up or fails to start up when exclusive of abnormal external conditions and operational errors.

### **4.3. Daily Equipment Maintenance**

- 1) Please use within the environment specified in the operating manual to ensure the normal use of the device;
- 2) Avoid switch on and off the machine continuously in a short time;
- 3) To do ventilation and heat dissipation during the use of the device, and do not let the heat dissipation hole be blocked;
- 4) To do regular calibration, so the equipment can be timely found the existing problems and effectively reduce the measurement error caused by the environment. The recommended calibration cycle is 12 months;
- 5) To wipe the outer surface of the device regularly and to prevent moisture erosion; to be regularly powered on for 1-2 hours in wet and mildew days for unused status of the device; to use the body heat of the device for dissipating moisture. In the humid South of our country, to use the equipment regularly once a month, once every half a month during the rainy season.