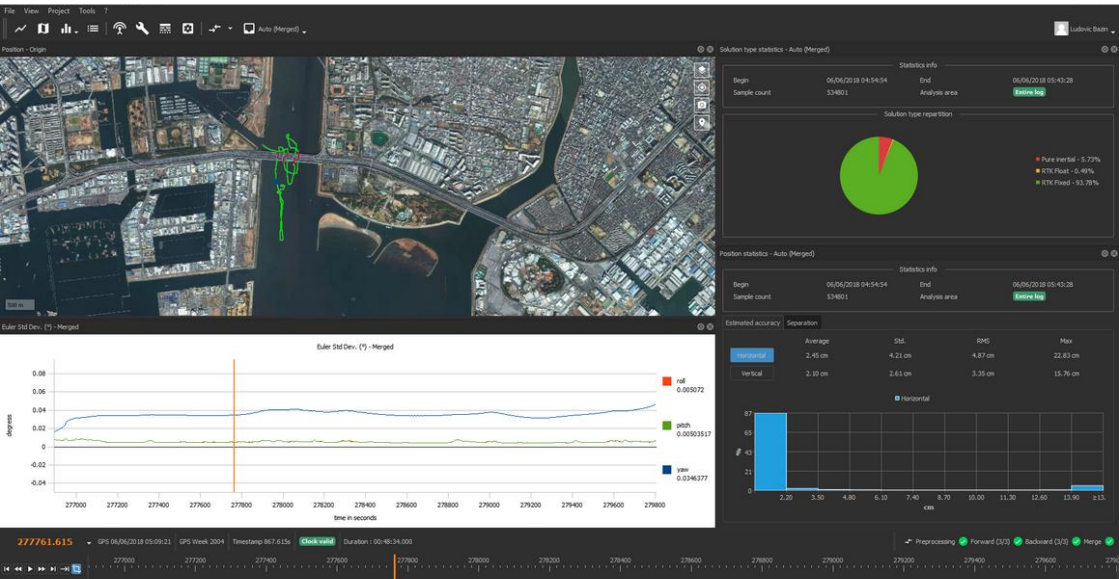


— High Performance INS

Post Processing guide

Operating handbook



Document
Revision

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Support

EMEA +33 1 80 88 43 70
support@sbg-systems.com

Americas: +1 (657) 549-5807
support@sbg-systems.com

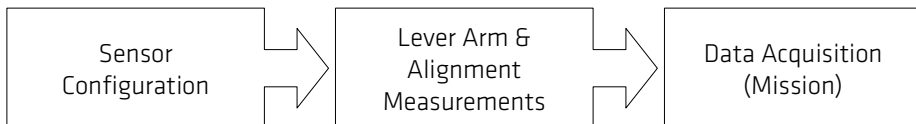
This brief document explains how to setup the INS for post processing with Qinertia and details the workflow from data acquisition to post processed results.

Post Processing Workflow

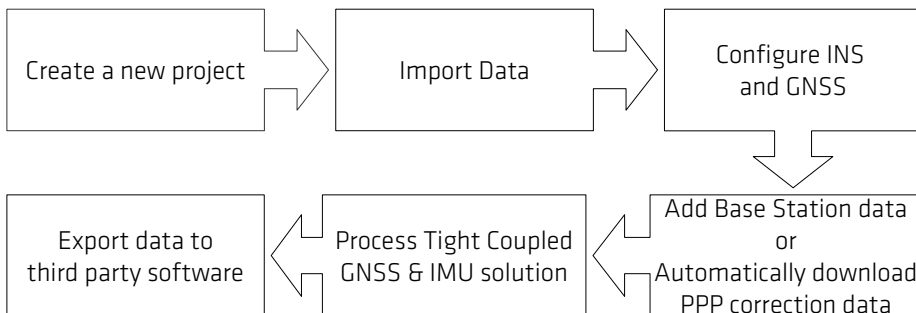
The processing workflow can be divided into two parts. The first one consists of configuring the sensor correctly and acquiring data thanks to the internal data-logger.

The second one is the post-mission part that is basically, getting the data from the INS, creating a project in Qinertia, computing a post processed GNSS + IMU tight coupled solution and exporting data to the desired format.

Data acquisition



Post-Mission workflow



Before you start

Post processing is officially supported on all SBG INS when used with the internal GNSS receiver. To be used for post processing operations, the GNSS receiver connected to the INS should be able to output RAW data.

You can easily check if your internal receiver supports post processing by accessing the information panel on the embedded web interface. The Master GNSS should include the RAW option as you can see on the screenshot below:

The screenshot displays the 'Information' tab of the SBG Systems web interface. It is divided into three main sections:

- Information for Master GPS:** A table listing various parameters for the Master GPS. The 'RAW' feature is highlighted with a red box and is marked as 'Permitted'. Other features like Dual Antenna, RTK, PPP, RAIM, and NATO are also listed with their respective statuses.
- Firmware Details:** Shows the current firmware version as '3.0.7012-stable' and indicates that the firmware is up to date. There are buttons for 'Upload firmware' and 'Upload license'.
- Internal Data Logger:** Shows the data logger is ready with 1.47 GB free space. It includes a progress bar and buttons for 'Begin a new session' and 'Erase all logs'.



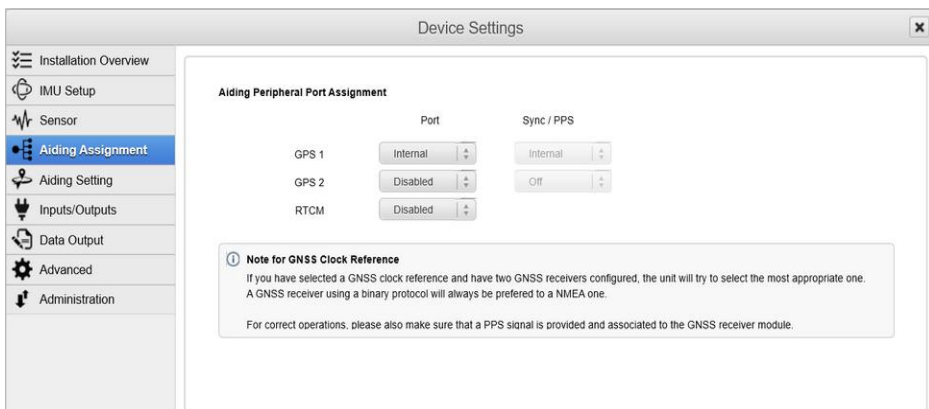
Note: If your GNSS doesn't support RAW GNSS data logging, please contact your sales representative to discuss available options.

Step 1: Sensor configuration

Set Aiding Assignment

Binary protocol from Novatel, Septentrio or Trimble are mandatory to be able to log raw GNSS observables. All products with an internal GNSS receiver are able to provide RAW data for post processing.

In this window, please make sure that the GNSS receiver is set properly as GPS 1 module (right protocol or internal selected):



You can also enable the odometer if you are planning to use a DMI.

Any differential corrections sent to the Device (RTCM data) will only improve the real time solution. They will not be used in the post processed solution (corrections should be logged on the base station).

Data-logger configuration

Device Settings

Port A Port B Port C Eth 0 Eth 1 Eth 2 Eth 3 Eth 4 CAN Data Logger

General configuration

Output monitoring point IMU location Start output after Power On

NMEA talker id GP

Datalogger configuration

Datalogger mode Start On Session name session

Log configuration

Preset selection You can choose a preset or configure manually all desired logs below

Post-Processing

All messages needed to compute a post processed solution can be logged into the sensor internal data-logger.

Please select the “Post-Processing” output preset for quick output configuration.

Alternatively, and for reference, the following messages must be set to enable the post-processing capability:

- **System Status** @ 1 Hz
- **IMU Short** @ New Data
- **UTC** @ 1 Hz
- **GPS 1 Velocity** @ New Data
- **GPS 1 Position** @ New Data
- **GPS 1 True Heading** @ New Data (*)
- **GPS 1 Raw data** @ New Data
- **Odometer** @ New Data (*)
- **Heave** @ New Data (*)
- **Delayed Heave** @ New Data (*)



Note: All output logs marked with an * are not mandatory for correct post processing operations. You can freely enable or disable these logs according to your setup.

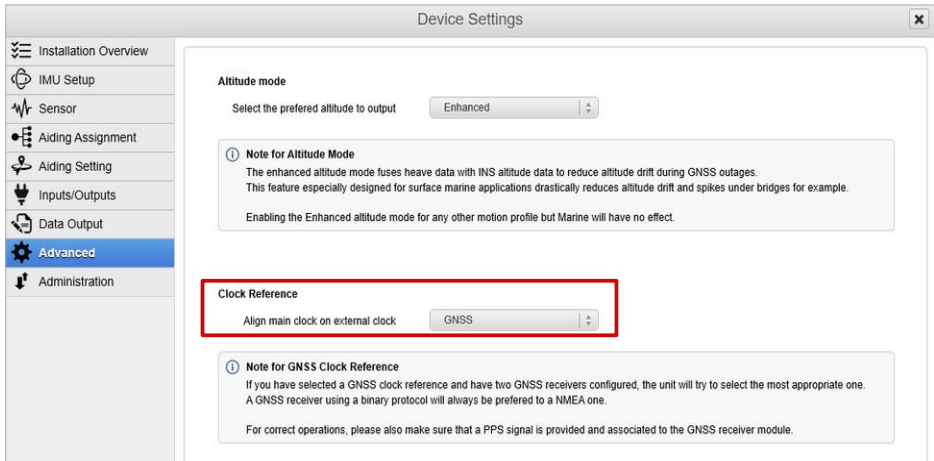


Note 2: If you have several GNSS receivers sending data to the INS, you should also set GPS 2 on New Data to allow Post Processing with one or with the other.

Set Clock alignment

Finally, you should make sure that the GPS 1 is used to align the internal clock and provide UTC time data.

The post-processed solution can only be computed if data are correctly aligned and time stamped to the GPS time.



The screenshot shows the 'Device Settings' application window. On the left is a navigation menu with the following items: Installation Overview, IMU Setup, Sensor, Aiding Assignment, Aiding Setting, Inputs/Outputs, Data Output, **Advanced** (highlighted in blue), and Administration. The main content area is titled 'Device Settings' and contains the following sections:

- Altitude mode**
 - Select the preferred altitude to output: Enhanced
 - Note for Altitude Mode**

The enhanced altitude mode fuses heave data with INS altitude data to reduce altitude drift during GNSS outages. This feature especially designed for surface marine applications drastically reduces altitude drift and spikes under bridges for example. Enabling the Enhanced altitude mode for any other motion profile but Marine will have no effect.
- Clock Reference** (highlighted with a red box)
 - Align main clock on external clock: GNSS
 - Note for GNSS Clock Reference**

If you have selected a GNSS clock reference and have two GNSS receivers configured, the unit will try to select the most appropriate one. A GNSS receiver using a binary protocol will always be preferred to a NMEA one. For correct operations, please also make sure that a PPS signal is provided and associated to the GNSS receiver module.

Step 2: Checking status

General
Status
Calibration
Information
Raw Values

General					Solution		Aiding Inputs				
Main Power				✓	Solution mode	Vertical Gyro	Velocity Heading Position UTC				
Imu Power				✓	Alignment status	Not Aligned	GPS 1	✓	✓	✓	✓
GPS Power				✓	Quality		GPS 2	✓	✓	✓	✓
Settings				✓	Attitude	✓	DVL	✗	✗	✓	✓
Temperature				✓	Heading	✗	RTCM			✗	
Data Logger				✓	Velocity	✗	Interfaces				
CPU Load				✓	Position	✗					
IMU					Used for solution						
General					Vertical Reference	✓	Com A	✗			
Communication				✓	GPS1 Position	✗	Com B	✓	✓	✓	
Built In Test				✓	GPS1 Velocity	✗	Com C	✗			
Sensors					GPS1 True Head.	✗	Com D	✓	✓		
	x	y	z	In Range	GPS2 Position	✗	Com E	✗			
Accelero	✓	✓	✓	✓	GPS2 Velocity	✗	Eth 0	✓			
Gyro	✓	✓	✓	✓	GPS2 True Head.	✗	Eth 1	✗			
GPS 1					DVL Bottom Tracking	✗	Eth 2	✗			
Position				Single point	DVL Water Layer	✗	Eth 3	✗			
Velocity				Doppler	Clock						
Dual antenna				Insufficient Obs.	Position	Single point	Input Clock			✓	
GPS				L1 L2 L5	Velocity	Doppler	Clock Alignment			Valid	
GLONASS				L1 L2 L3	Dual antenna	Insufficient Obs.	UTC synchro			✓	
GALILEO				E1 E5A E5B	GPS	L1 L2 L5	UTC info			Valid	
BEIDOU				B1 B2 B3	GLONASS	L1 L2 L3	Heave				
QZSS				L1 L2 L5	GALILEO	E1 E5A E5B	Real-Time valid			✓	
Diff. correction age				-	BEIDOU	B1 B2 B3	INS aided			✗	
Nb of sat. used				16	QZSS	L1 L2 L5	Swell Mode			✗	
GPS 2					Diff. correction age	-	Delayed valid			✓	
Position				Single point	Nb of sat. used	13					
Velocity				Doppler							
Dual antenna				Insufficient Obs.							

Once fully configured, the global status must be checked:

1. GPS 1 line in “Aiding Inputs” section must show that valid data are being received from the internal GNSS. The Heading status can be in red if your are not using a dual antenna unit.
2. You should then check if a valid GNSS solution has been calculated. If you are using a dual antenna system, the heading status should also be checked.
3. Finally, make sure that the internal clock is aligned and valid UTC time information is being received by the INS.

Step 3: Lever arms, alignments & data acquisition

Lever arms

Configuring lever arms on the INS web page will not impact post-processed results. Indeed, this configuration is only used by the product to compute the real time solution.

You will have to re-enter the lever arms setup in Qinertia to compute a correct post processed solution.

You should thus measure them accurately and keep this information for later post-processing.

Alignments

Unlike for lever arms, if you configure a specific alignment between the INS and the vehicle, it will affect directly the IMU data used by the post processing software. You will obviously have to enter alignment correction only once; either in the INS or Qinertia.

SBG Systems recommend that you enter the alignment corrections on the INS rather than in Qinertia so you can use the same workflow for both real time and post-processed operations.



Note: Even if you enter an incorrect miss-alignment in the INS configuration, you can still fix this issue in the post processing software.

Data acquisition

As for real time operations, you will get better results if you can perform good calibration runs with vehicle dynamics at the beginning and ideally at the end of the log.

These calibration runs help the Kalman filter (either real time or post processed one) to observe and correct for mechanical installation parameters (lever arms) and sensors errors.

Please also make sure that the first and last parts of the log are in a **clear view of sky** to ensure correct and easy initial alignment procedure.

Finally, it's only possible to re-process ONE session as the logged data should be contiguous so don't split your run into multiple sessions or you will not be able to post process the data. You can't combine different sessions as you will have missing data between two different sessions.



Caution: Don't split logged data into multiple sessions or you will not be able to post-process the data correctly.

Step 4: Retrieve data from the INS

The INS will log all data needed for post processing operations within its internal data-logger.

To access the files stored in the internal data-logger, please use a dedicated FTP client such as FileZilla, Transmit or Cyberduck.

To read the INS ip address, connect to the embedded webpage and browse to the information page as shown on the screenshot.

No password is required for the anonymous FTP access.

The window on the right shows the data-logger files tree structure. You will typically retrieve a whole session (session_0002 in this case).

To find more information on the FTP and on the internal data-logger, please refer to the Technical Reference Manual.

Network	
FTP access	ftp://10.10.0.230:21
MAC Address	98:5C:93:00:03:14
IP	10.10.0.230
Mask	255.255.0.0
Gateway	10.10.0.254

The screenshot shows a web browser window with the address bar displaying 'ftp://10.10.0.230/dataLogger/session_0002/'. The page title is 'Index de /dataLogger/session_0002/'. Below the title, there is a directory listing table with columns for 'Nom', 'Taille', and 'Date de modification'. The table lists various session files, including a configuration file 'session_0002.json' and several data files named '20200422_14h_session_001' through '20200423_06h_session_017'.

Nom	Taille	Date de modification
session.000	645 kB	01.01.2019 01:00:00
session_0002.json	1.1 kB	01.01.2019 01:00:00
20200422_14h_session_001	38.0 MB	01.01.2019 01:00:00
20200422_15h_session_002	59.0 MB	01.01.2019 01:00:00
20200422_16h_session_003	59.2 MB	01.01.2019 01:00:00
20200422_17h_session_004	59.2 MB	01.01.2019 01:00:00
20200422_18h_session_005	59.2 MB	01.01.2019 01:00:00
20200422_19h_session_006	59.2 MB	01.01.2019 01:00:00
20200422_20h_session_007	59.2 MB	01.01.2019 01:00:00
20200422_21h_session_008	59.1 MB	01.01.2019 01:00:00
20200422_22h_session_009	58.9 MB	01.01.2019 01:00:00
20200422_23h_session_010	58.7 MB	01.01.2019 01:00:00
20200423_00h_session_011	58.7 MB	01.01.2019 01:00:00
20200423_01h_session_012	58.8 MB	01.01.2019 01:00:00
20200423_02h_session_013	58.7 MB	01.01.2019 01:00:00
20200423_03h_session_014	58.7 MB	01.01.2019 01:00:00
20200423_04h_session_015	58.9 MB	01.01.2019 01:00:00
20200423_05h_session_016	58.9 MB	01.01.2019 01:00:00
20200423_06h_session_017	58.9 MB	01.01.2019 01:00:00





Note: Data-logger directory contains a *.json file that is the configuration file generated during acquisition (feature available from version 3.0 for High Performance INS products). If this file is kept in the same directory as raw data *.bin files, Qinertia will then automatically load configuration as configured during real time acquisition.


Step 5: Configure your Qinertia Project


Start up Qinertia, then select New Project from the Dashboard.


Create a new project

 Airplane

 Automotive

 Helicopter

 Marine

 UAV

Project name
Post Processing on UAV

Organization name
SBG Systems


User name
Anne O. Nymes

Save project to
C:\Users\Nicolas\Documents\Demo\UAV Tests - Ekinox 2

Import from directory
C:\Users\Nicolas\Documents\Demo\UAV Tests - Ekinox 2\Logs\rover

SBG Systems INS detected

Qinertia has detected in the selected import directory INS project.
Please select which files you would like to import to make sure data are contiguous.



File name	UTC Begin	UTC End	Data rate
log_11h00.bin	05/12/2017 11:36:12	05/12/2017 11:59:21	200 Hz



Caution: Qinertia will merge data from multiple binary logs, but you should make sure they are continuous in time with no data gap.

Select the data to be Post-Processed, configure the IMU model, import base station data, then enter the GNSS lever arms.

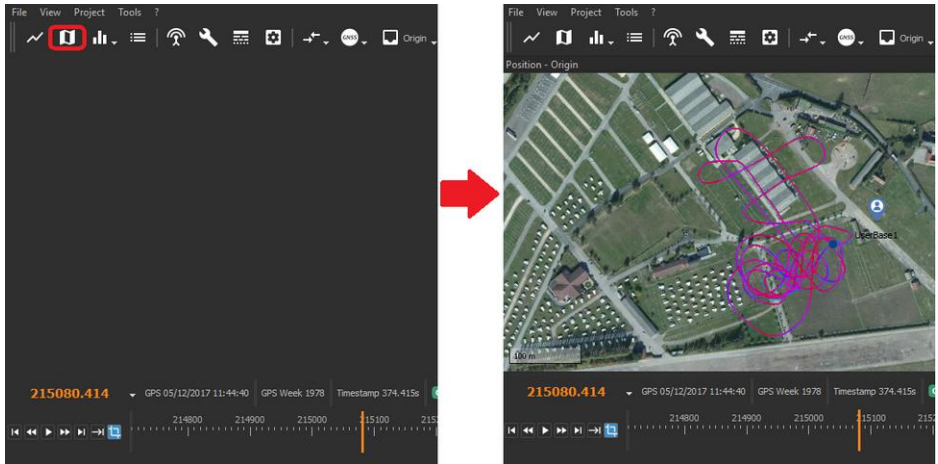


Caution: If the IMU alignment setting were already applied in the INS configuration, make sure to leave it to default (zero) in Qinertia, otherwise you will apply twice the alignment setting.

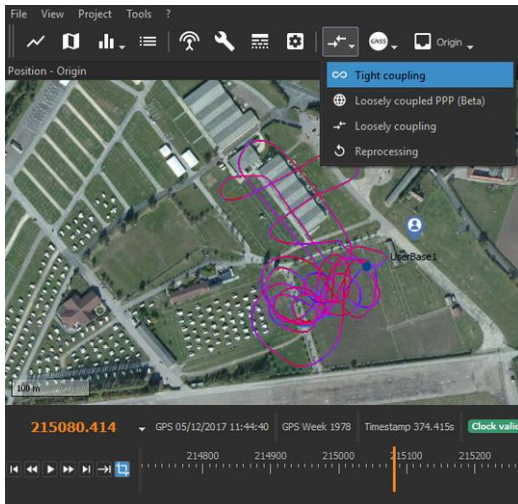
If *.json configuration file is in the directory together with corresponding raw data (feature available from version 3.0 for High Performance INS products), then configuration described above is done automatically by Qinertia.

Step 6: Process the tightly coupled solution

Now you finished creating your project you may start by displaying the 2D plot, this will show you the GNSS and real time fused trajectory on the map.



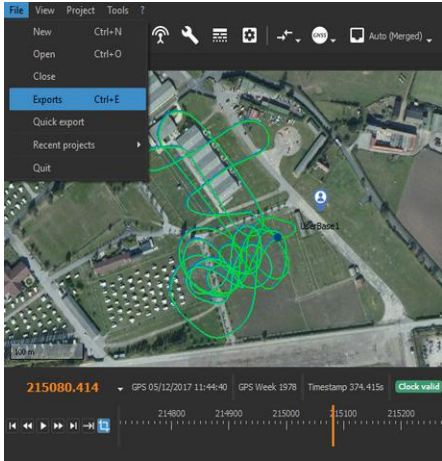
You can then press the Tight coupling option to launch the post-processing:



You will see on the time bar the forward and backward computation being realized at the same time, then the merge.

Step 7: Export Data

When the Post-Processing is done, you may export the data in a customizable text format, in SBET compatible file or Google Earth KMZ file.



The export window will give you the option to create your own export profile, and export presets.

The export preset menu is extremely versatile and give you a true customizable export format.

