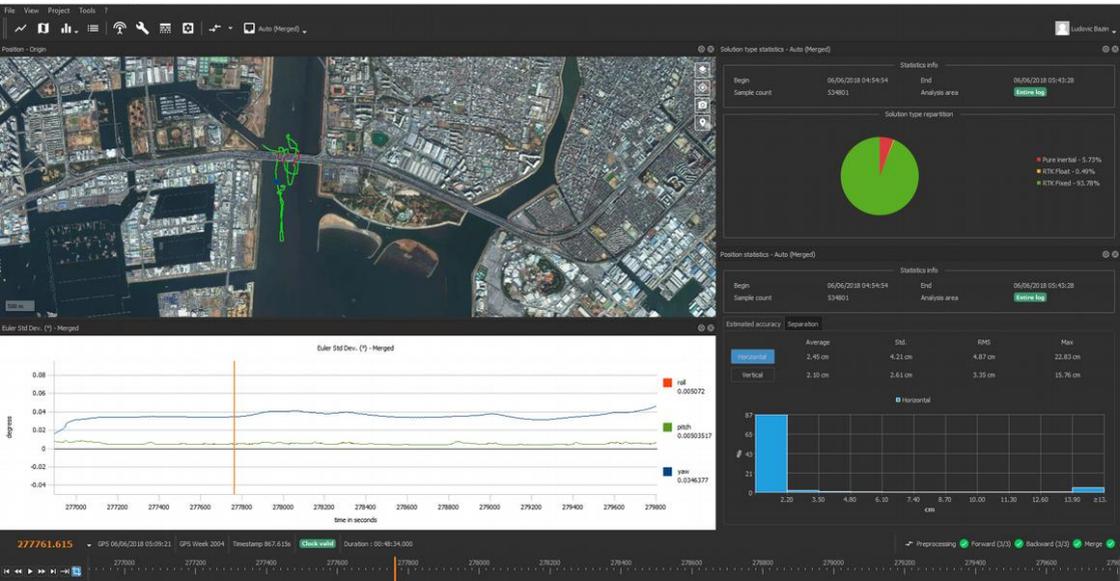


— Survey Grade INS

Post Processing guide

Operating handbook



Document
Revision

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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

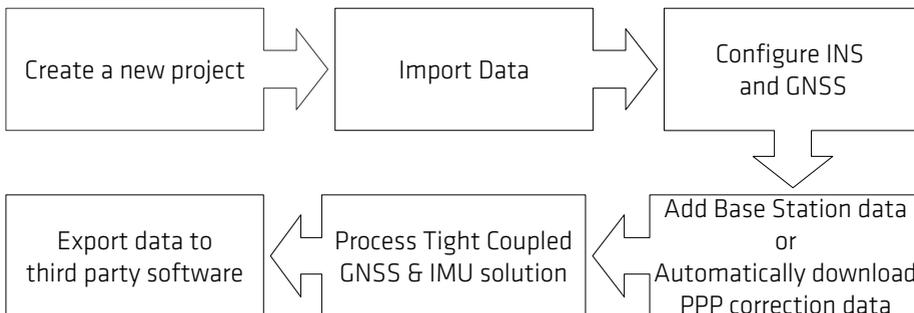
The processing workflow can be divided into two parts. The first one consists of configuring the sensor correctly and acquiring data thanks to the internal data-logger.

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 shows a web interface with tabs for General, Status, Calibration, Information, and Raw Values. The 'Information' tab is active, displaying 'Firmware Details' and 'Information for Master GPS'.

Firmware Details

Firmware version
 Current version: 2.0.297-stable Upload firmware

✓ Firmware up to date

GNSS options Upload license

Detected Master GPS Show Details

Information for Master GPS

Identification	
Product Code	CDSW0G550
Serial Number	BMES16251293F
Hardware Version	OEM617D-1.00
Firmware Version	OEM060600SN0056
Signals	
GPS	L1/L2
GLONASS	L1/L2
BEIDOU	B1/B2
Galileo	Not Permitted
QZSS	Not Permitted
SBAS	Permitted
L-Band	Not Permitted
Features	
Dual Antenna	Permitted
RTK	Permitted
PPP	Not Permitted
RAW	Permitted
RAIM	Not Permitted
NATO	Not Permitted
Output Rate	5 Hz
L-Band decoder	
Activation Code	N/A
User ID	N/A

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):

The screenshot shows the 'Aiding Setting' configuration window for 'GPS 1'. On the left is a navigation menu with options: Setup Overview, Sensor, Aiding Assignment, Aiding Setting (highlighted), Inputs/Outputs, Data Output, Advanced, and Administration. The main content area is titled 'GPS 1' and contains the following sections:

- GNSS Setup:** Includes a note about receiver models and antenna mode. It features two dropdown menus: 'Receiver Model' set to 'Internal' and 'GNSS Heading Mode' set to 'Dual antenna (known lever arm)'.
- GNSS Lever Arms:** Includes a note about lever arm accuracy. It features two sets of input fields: 'Primary Antenna (X,Y,Z)' with values -0.372, -0.817, -0.163 m, and 'Secondary Antenna (X,Y,Z)' with values -0.372, 0.613, -0.169 m.
- Aiding Use and Rejection:** Includes a note about rejection filters. It features two dropdown menus: 'Position/Velocity' set to 'Auto rejection' and 'True Heading' set to 'Auto rejection'.

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

Any differential corrections sent to the Device (RTCM data) will only improves 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

The screenshot shows the 'Data Logger' configuration page. On the left, a sidebar contains menu items: Setup Overview, Sensor, Aiding Assignment, Aiding Setting, Inputs/Outputs, **Data Output**, Advanced, and Administration. The main area has tabs for Port A, Port C, Eth 0, Eth 1, Eth 2, Eth 3, Eth 4, CAN, and **Data Logger**. The 'General configuration' section includes 'Output monitoring point' (IMU location) and 'Log data' (ON/OFF). The 'Log configuration' section has a 'Preset selection' dropdown menu with 'Post-Processing' selected and highlighted by a red box.

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.

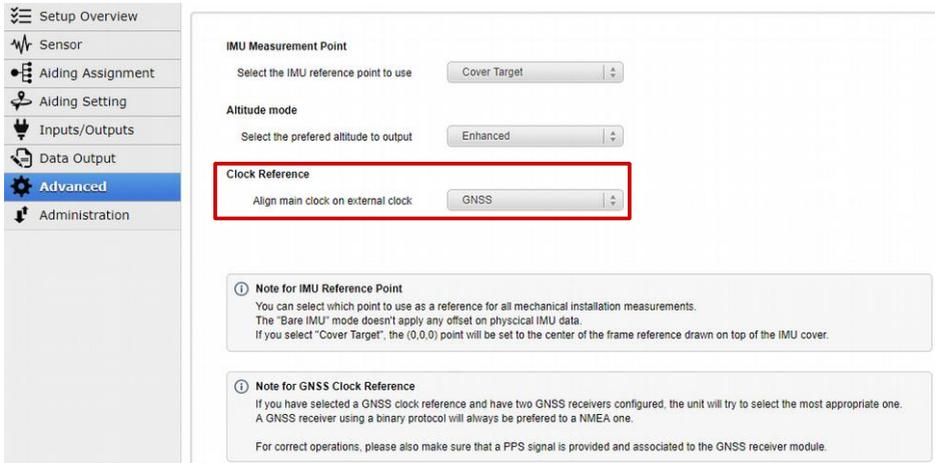


Note 2: If you have several GNSS receivers sending data to the INS, you should also set GPS 2 on New Data to allow Post Processing with one or with the other.

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.



Advanced

IMU Measurement Point

Select the IMU reference point to use

Altitude mode

Select the preferred altitude to output

Clock Reference

Align main clock on external clock

Note for IMU Reference Point

You can select which point to use as a reference for all mechanical installation measurements. The "Bare IMU" mode doesn't apply any offset on physical IMU data. If you select "Cover Target", the (0,0,0) point will be set to the center of the frame reference drawn on top of the IMU cover.

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

Main Power	✓
Imu Power	✓
GPS Power	✓
Settings	✓
Temperature	✓
Data Logger	✓
CPU Load	✓

Solution

Solution mode	Vertical Gyro
Alignment status	Not Aligned
Quality	
Attitude	✓
Heading	✗
Velocity	✗
Position	✗
Used for solution	
Vertical Reference	✓
GPS1 Position	✗
GPS1 Velocity	✗
GPS1 True Head.	✗
GPS2 Position	✗
GPS2 Velocity	✗
GPS2 True Head.	✗
DVL Bottom Tracking	✗
DVL Water Layer	✗

Aiding Inputs

	Velocity	Heading	Position	UTC
GPS 1	✓	✓	✓	✓
GPS 2	✓	✗	✓	✓
DVL	✗			
RTCM			✗	

IMU

General

Communication	✓
Built In Test	✓

Sensors

	x	y	z	In Range
Accelero	✓	✓	✓	✓
Gyro	✓	✓	✓	✓

GPS 1

Position	Single point
Velocity	Doppler
Dual antenna	Insufficient Obs.
GPS	L1 L2 L5
GLONASS	L1 L2 L3
GALILEO	E1 E5A E5B
BEIDOU	B1 B2 B3
QZSS	L1 L2 L5
Diff. correction age	-
Nb of sat. used	16

GPS 2

Position	Single point
Velocity	Doppler
Dual antenna	Insufficient Obs.
GPS	L1 L2 L5
GLONASS	L1 L2 L3
GALILEO	E1 E5A E5B
BEIDOU	B1 B2 B3
QZSS	L1 L2 L5
Diff. correction age	-
Nb of sat. used	13

Clock

Input Clock	✓
Clock Alignment	Valid
UTC synchro	✓
UTC info	Valid

Heave

Real-Time valid	✓
INS aided	✗
Swell Mode	✗
Delayed valid	✓

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.

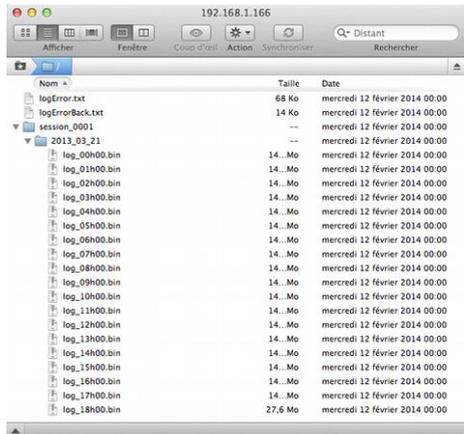
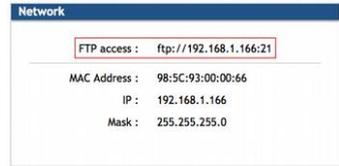
To access the files stored in the internal data-logger, please use a dedicated FTP client such as FileZilla, Transmit or Cyberduck.

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_0001 in this case).

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



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.

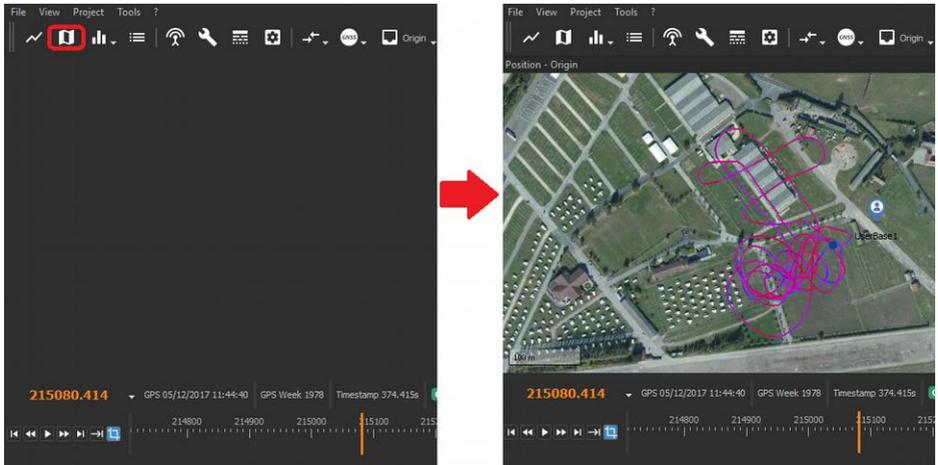
Select the data to be Post-Processed, configure the IMU model, import base station data, then enter the GNSS lever arms.



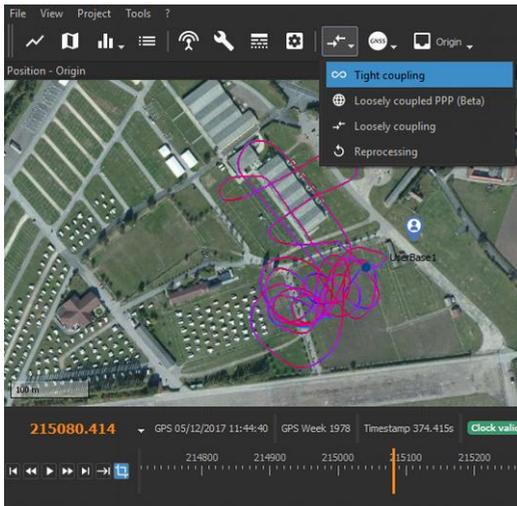
Caution: If the IMU alignment setting were already applied in the INS configuration, make sure to leave it to default (zero) in Qinertia, otherwise you will apply twice the alignment setting.

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.



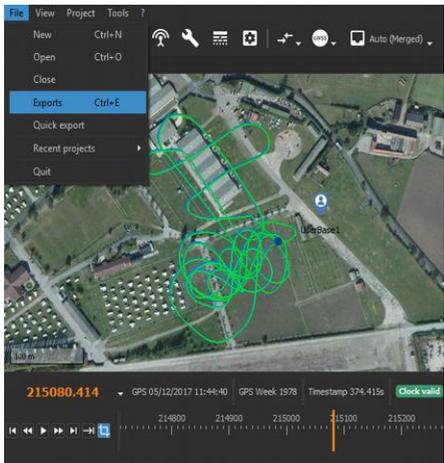
You can then press the Tight coupling option to launch the post-processing:



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.

