

Leica Infinity

Training materials - Advanced GNSS Processing



Version 1.0
English

- when it has to be **right**

Leica
Geosystems

Introduction

This is a step-by-step tutorial in which you learn how to import GNSS raw data, process baselines, analyse and improve your final results.

Multi-constellation (GPS, Glonass, Beidou, Galileo) static raw data has been acquired with the GS16 and GS15 receiver at 1 Hz sampling rate. The two receivers were placed on the field with 3 m inter-distance.

The functionality discussed in this guide requires the GNSS Processing license.

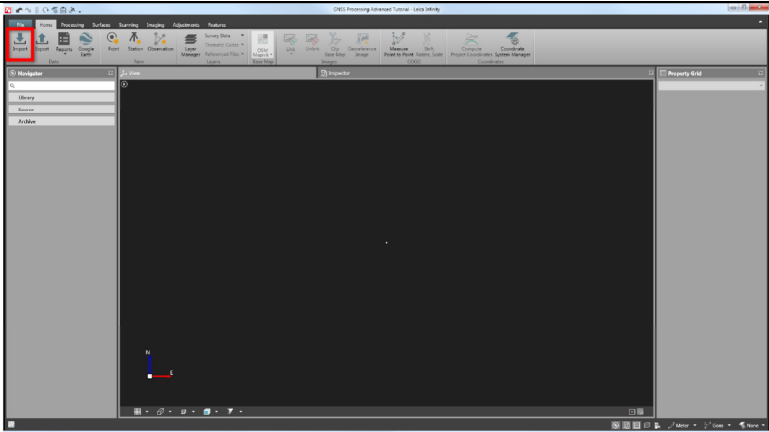
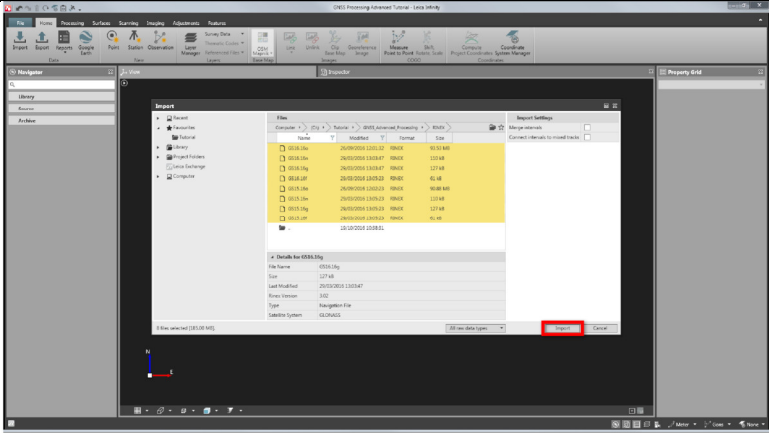
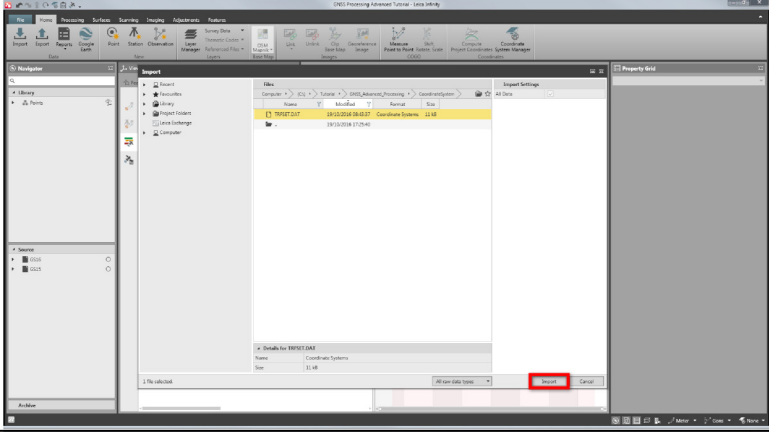
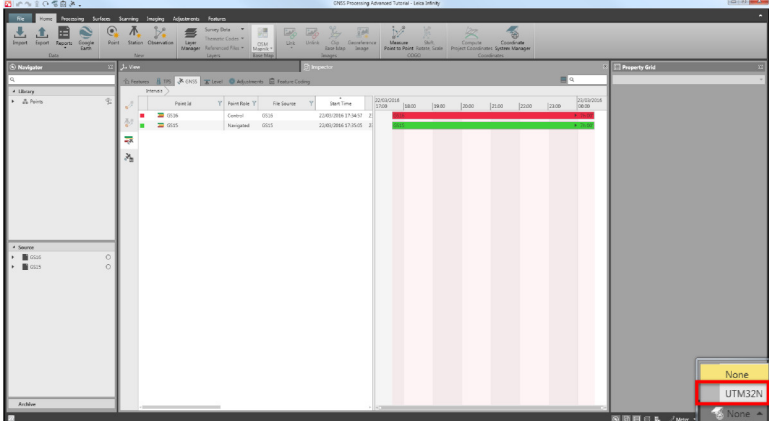
The data from the following folders will be used in this tutorial:

- RINEX contains all GNSS raw data
- CoordinateSystem\ contains the coordinate system and the geoid files.


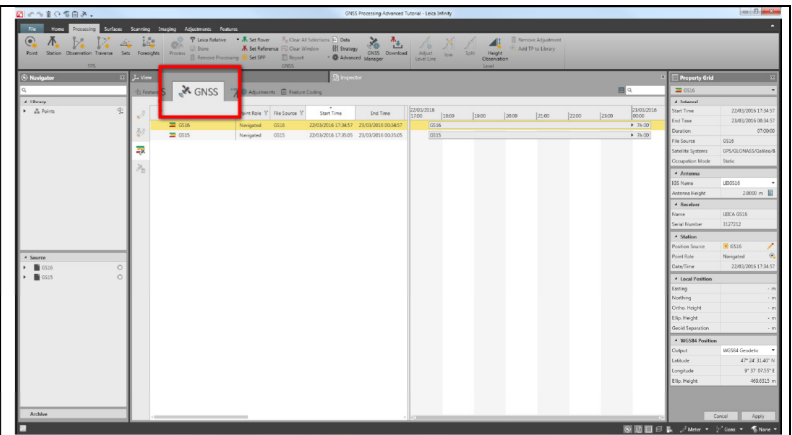



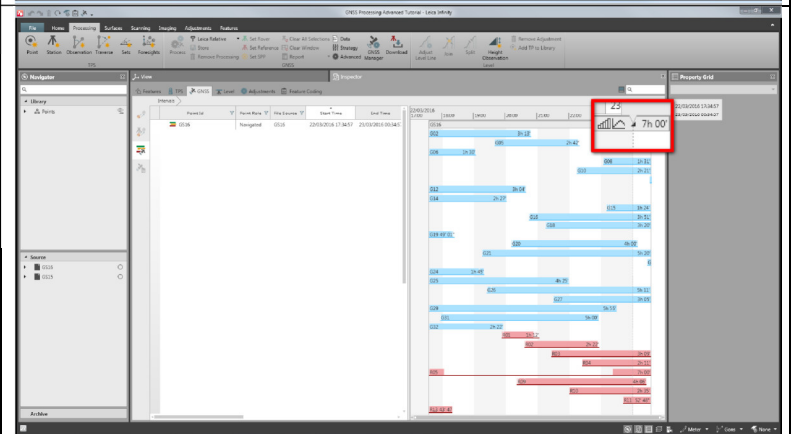
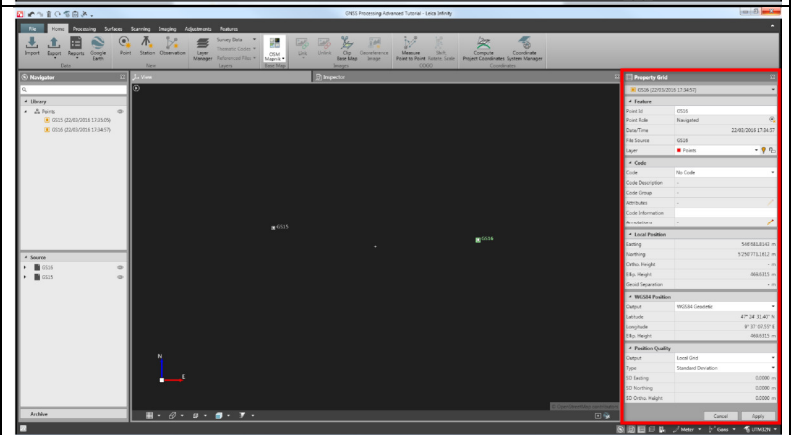
Table of Contents

| | | |
|----|--|----|
| 1. | Import data | 4 |
| 2. | View imported data | 5 |
| 3. | Create control point | 6 |
| 4. | Process baselines | 7 |
| 5. | Results analysis | 9 |
| 6. | Ephemeris download..... | 11 |
| 7. | Correct antenna height | 13 |
| 8. | Reprocessing and final results analysis..... | 14 |
| 9. | Store final Result | 18 |


1. Import data



| | |
|--|--|
| <p>1.1 Start Infinity and create a new project. Choose Home tab in the ribbon bar and select Import.</p> |  |
| <p>1.2 In the Import dialog navigate to directory RINEX, select all RINEX files and click Import.</p> <p>☞ Use Control+All or Shift to select all files.</p> |  |
| <p>1.3 To import the coordinate system, select Import from the ribbon bar and in the Import dialog navigate to directory CoordinateSystem, select file TRFSET.DAT and then Import.</p> |  |
| <p>Assign the imported Coordinate System to the project by clicking on the combo box None on the right side of the Status bar, then select UTM32N.</p> |  |

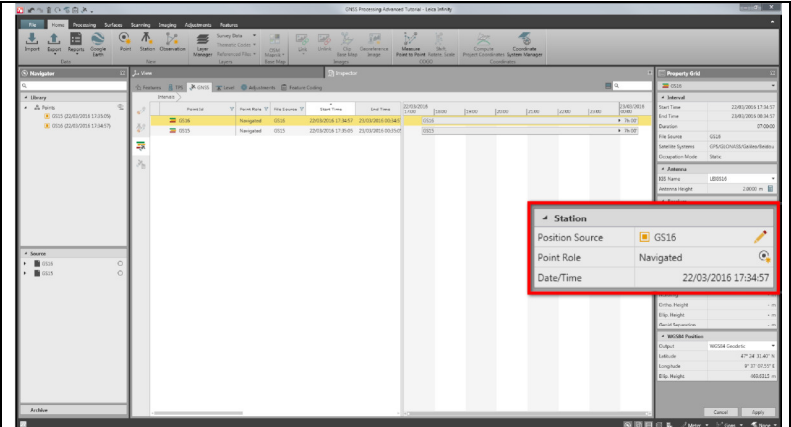
2. View imported data

| | | |
|------------|--|--|
| <p>2.1</p> | <p>In the data Inspector choose the GNSS tab.</p> <ul style="list-style-type: none"> If the GNSS Intervals view is not available, you can display it by selecting the toggle button  in the top right corner of the Inspector. |  |
| <p>2.2</p> | <p>Click on the arrow  on the right side of the interval to open/close the satellite view.</p> <ul style="list-style-type: none"> Click on the icon  to show/hide the satellites elevation. Click on the icon  to show/hide the strength of the signal . Move up and down the vertical bar in the middle of the Inspector to visualize all satellites. |  |
| <p>2.3</p> | <p>Visualize the point by selecting the View tab.</p> <ul style="list-style-type: none"> Select the point to get information on the Property Grid on the right. |  |

3. Create control point

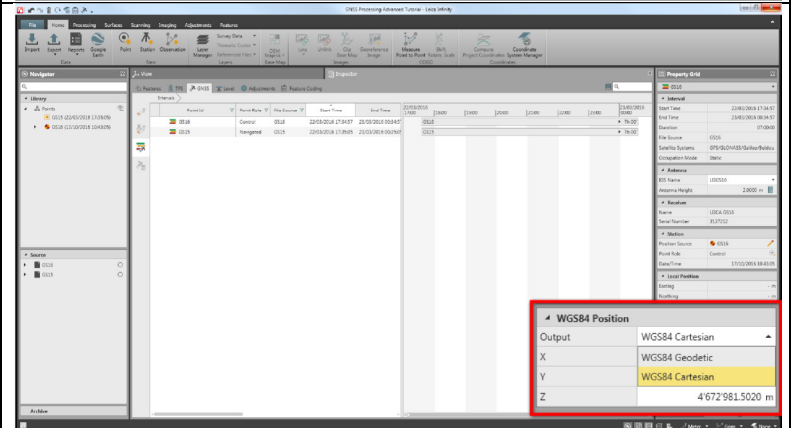
3.1 Select the GS16 in the Inspector GNSS Intervals view to display its Properties. In the Property Grid Change Point Role from Navigated to **Control Point** by clicking on the button  .

➔ After that you create the Control Point, the Position Source icon will change from  (Navigated) to  (Control).

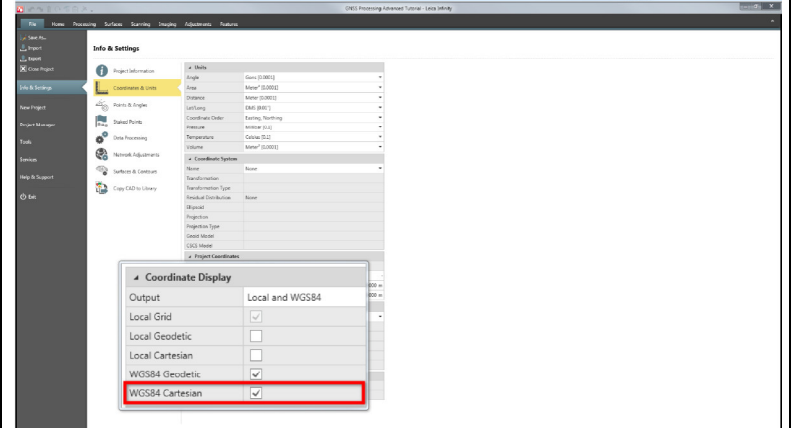


3.2 Change GS16 WGS84 Position Output from Geodetic to **Cartesian**

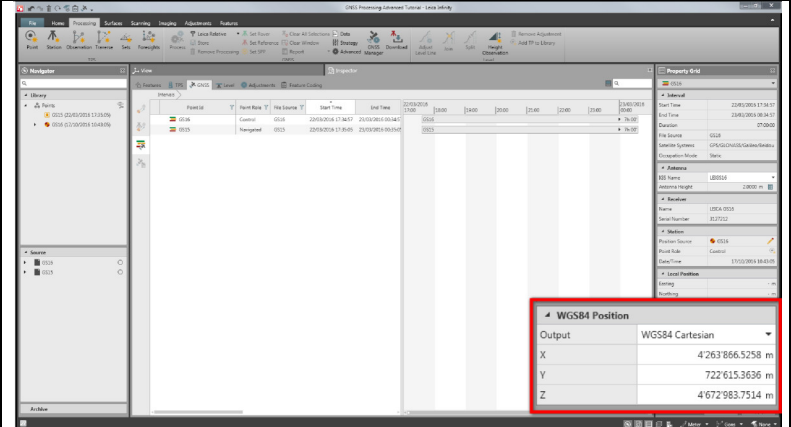
➔ To edit Cartesian coordinates for interval it is required to create a control point and select the WGS84 Cartesians output in the property grid



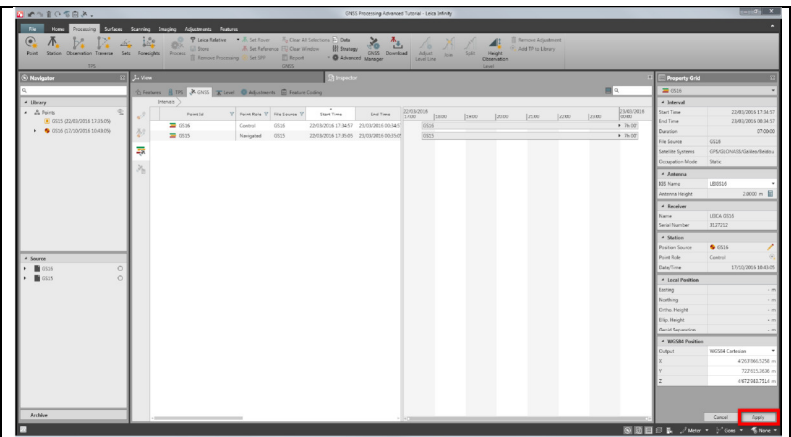
➔ If you cannot visualize the coordinates in Cartesian format, go to File→Info & Settings →Coordinates & Units. Make sure that **WGS84 Cartesian** in Coordinate Display is flagged.



3.3 Type the following known coordinates for point GS16:
 X: 4263866.5258 m
 Y: 722615.3636 m
 Z: 4672983.7514 m

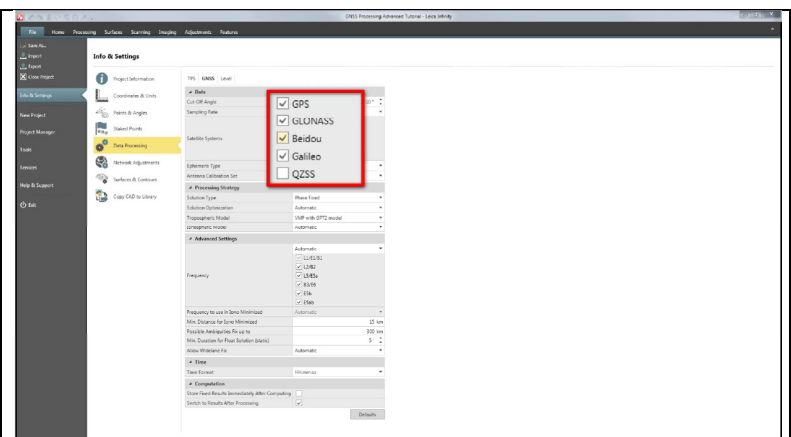


3.4 Save the changes selecting **Apply** in the Property Grid.

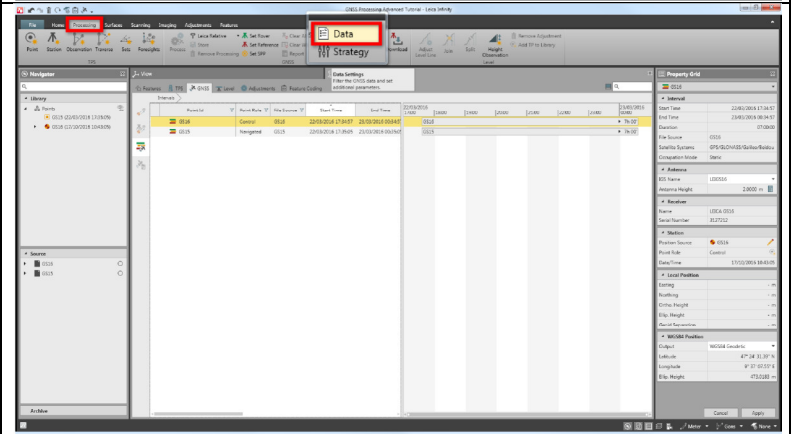


4. Process baselines

4.1 Go to File→Info & Settings→Data Processing and in the **GNSS** Tab make sure that the use of GPS, Glonass, Beidou, Galileo is enabled.

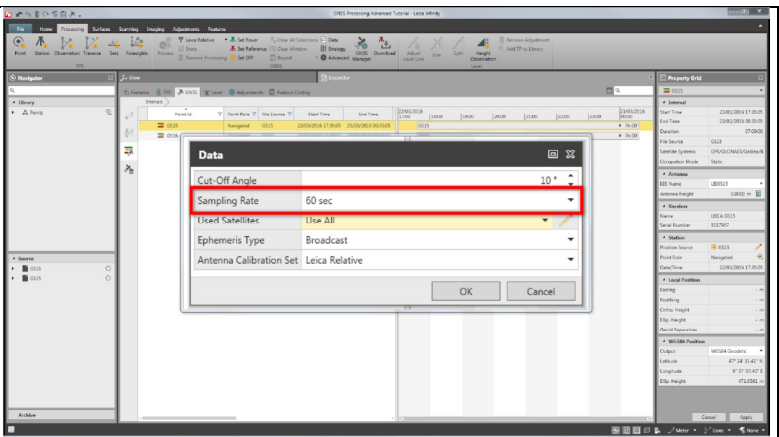


4.2 In the Processing Tab select the button **Data** from the ribbon bar.

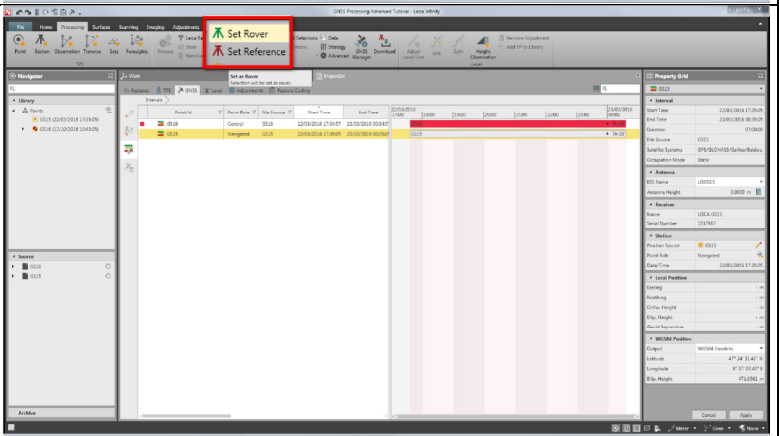


4.3 Change the **Sampling Rate** to 60 sec and select **OK**.

☞ From the same window it is possible to define other Data settings, such as Cut-Off Angle, Satellite to use/exclude, Ephemeris Type and Antenna Calibration Set.

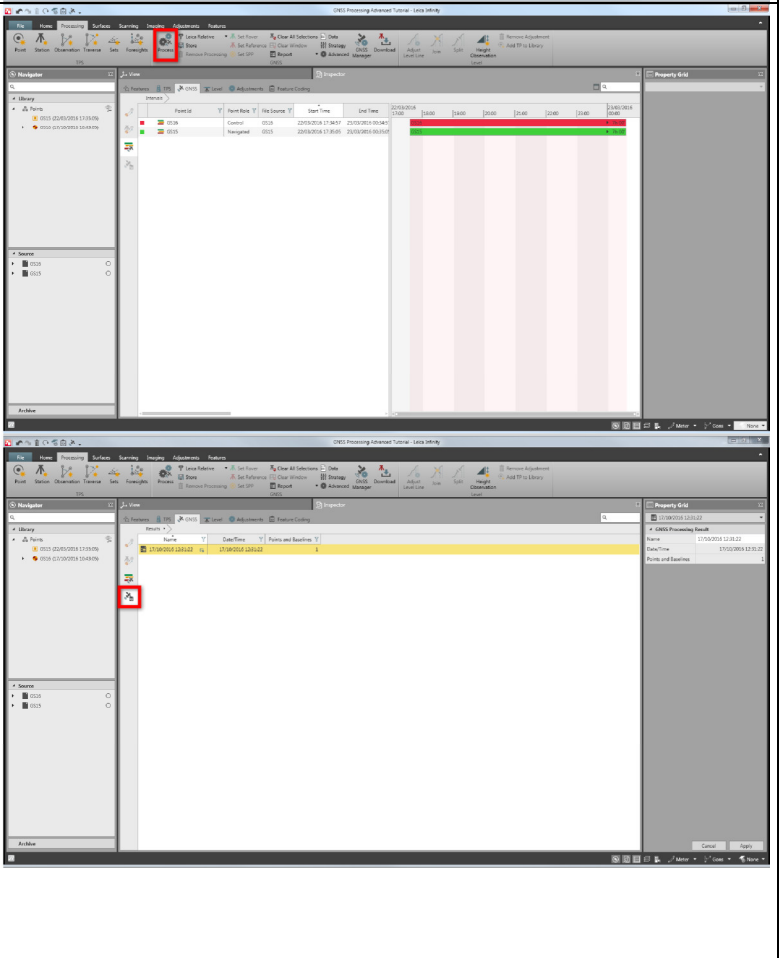


4.4 In the GNSS Intervals view highlight GS16 and select **Set Reference** from the Processing Ribbon Bar, then highlight GS15 and select **Set Rover**.

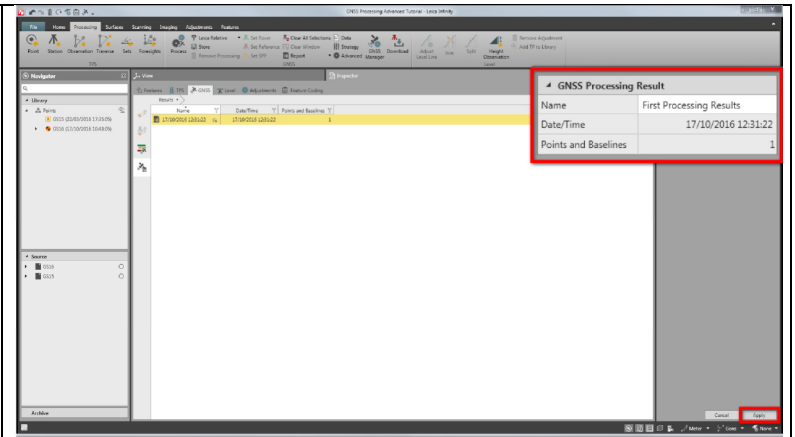


4.5 Select **Process** from the **Processing** Ribbon bar tab.

☞ As soon as the processing is complete, the **GNSS Processing Results** page opens automatically in the GNSS tab of the Inspector.

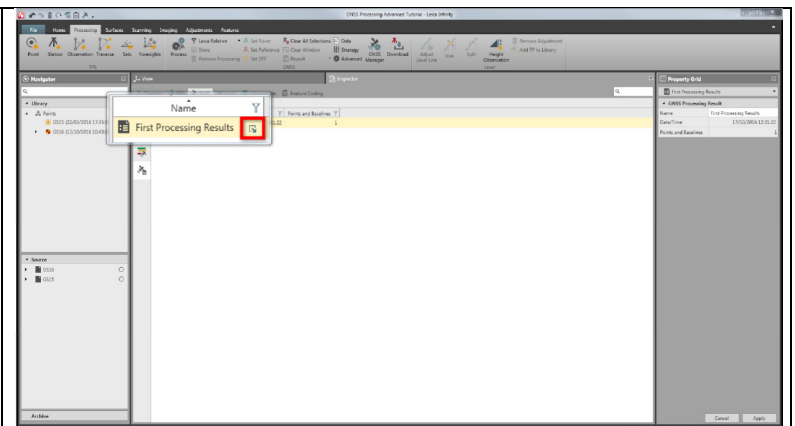



Results Name can be modified by selecting the result and typing a new name (e.g. First Processing Results) in the Property Grid on the right. Then select **Apply**.

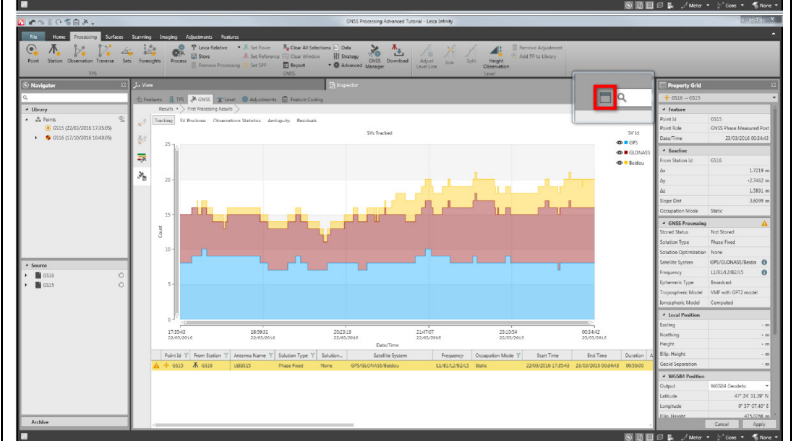


5. Results analysis

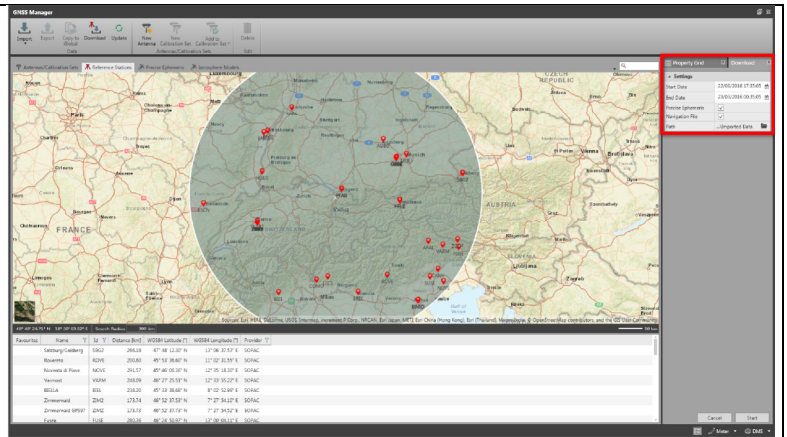
5.1 Click the button that is on the right side of the **Name** column in the **GNS3** tab of the **Inspector**, to drill in the results.



If the Result Analysis Viewer is not available, you can display it by selecting the toggle button  in the top right corner of the Inspector.

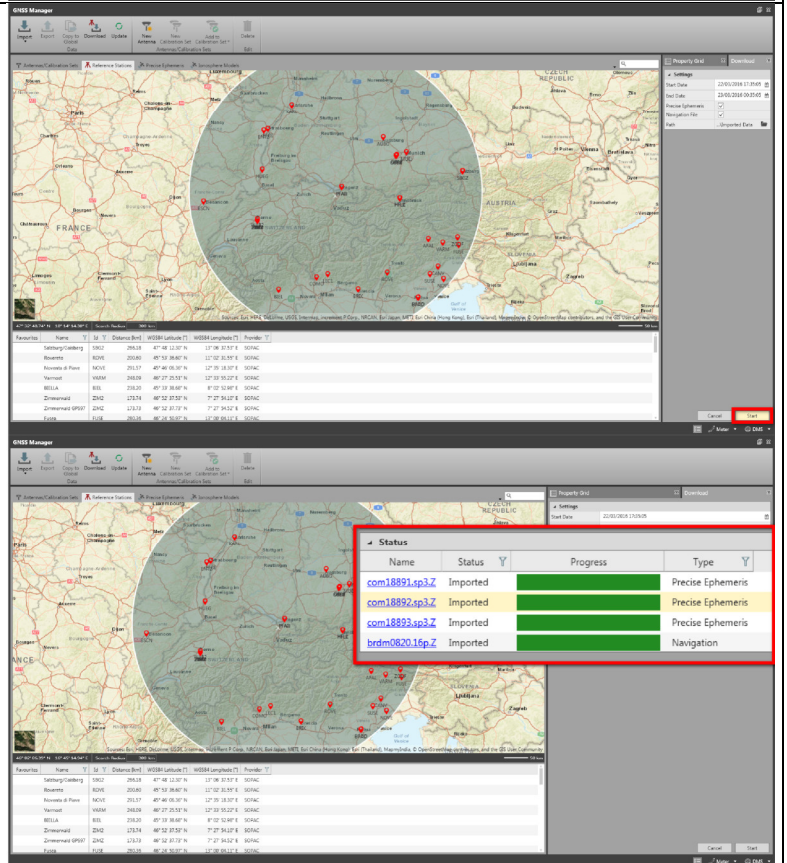


- 👉 A new tab dedicated to the download Settings opens on the right side of the Property Grid.
- 👉 Start/End date is automatically available from the data imported in the project; in this case no changes are needed.


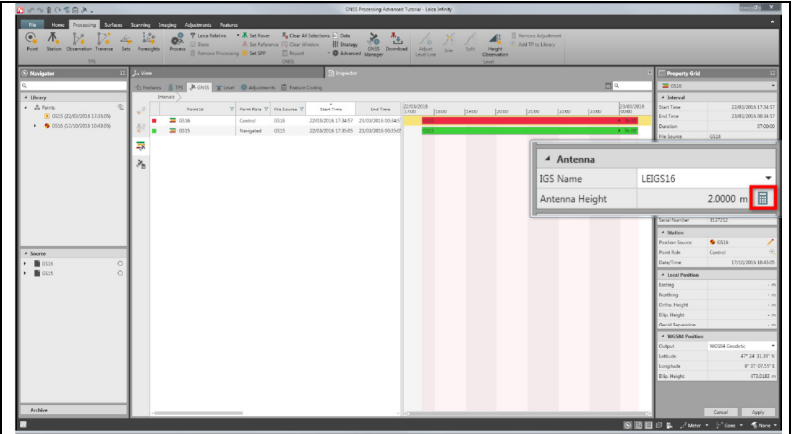
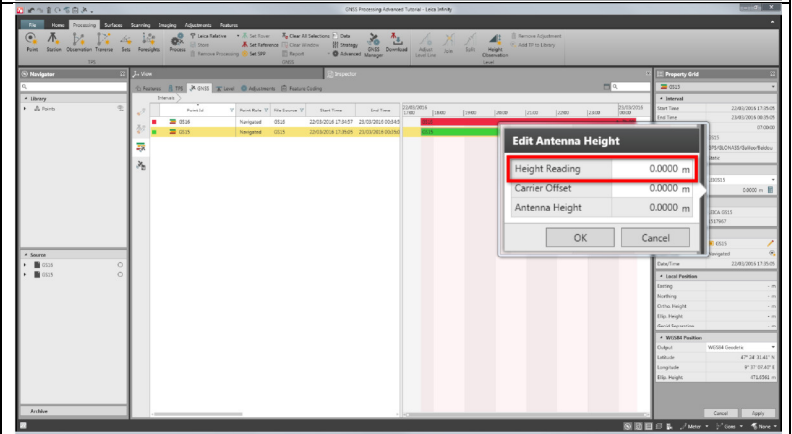
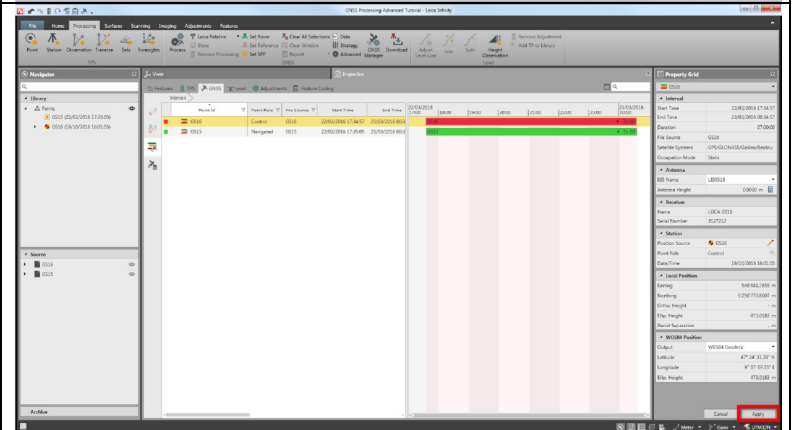


6.3 Initiate the download by clicking on the **Start** button.

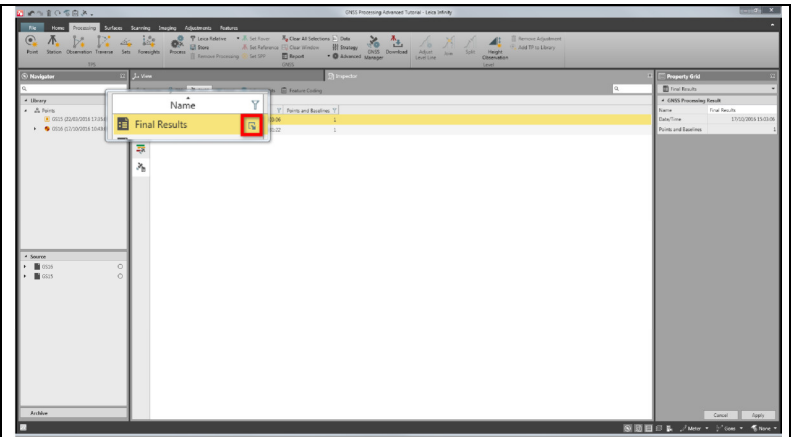
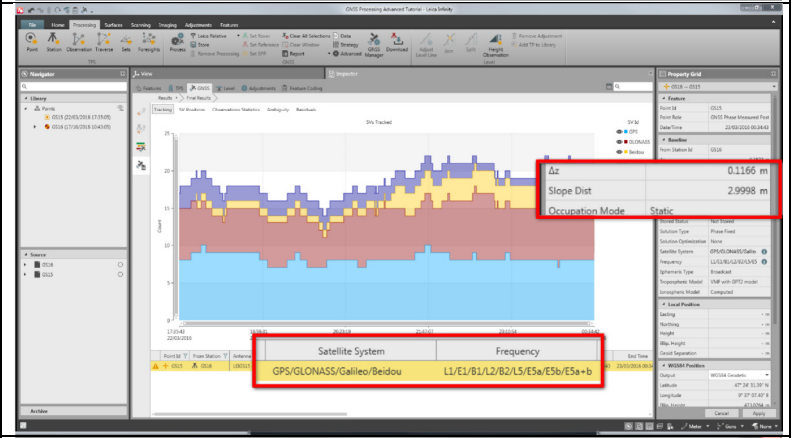
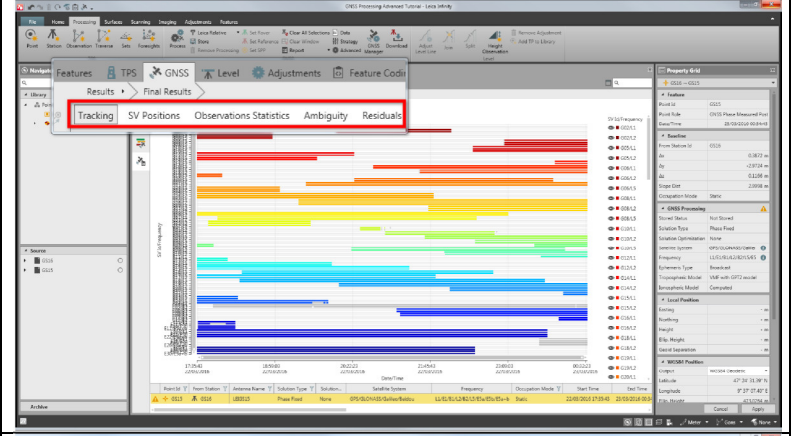
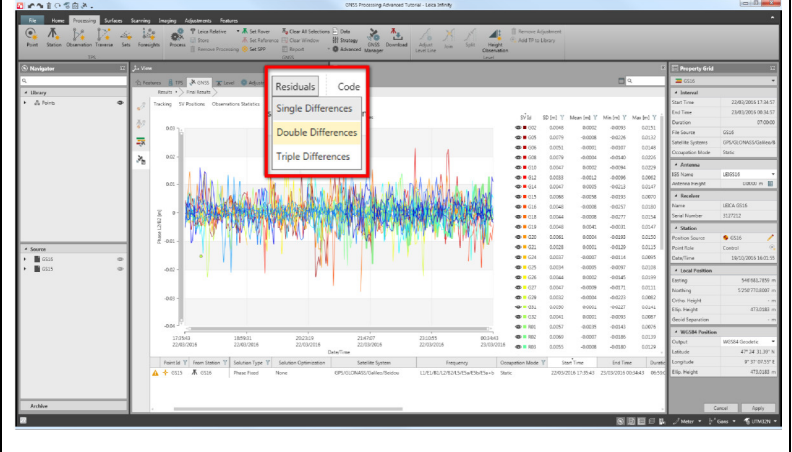
- 👉 Keep the download of **Precise Ephemeris** enabled even if it is not strictly necessary to complete the Tutorial. You may try to process with precise ephemeris yourself.
- 👉 Availability can comfortably be checked by clicking the hyperlink on the file name.
- 👉 The green **Progress** bar informs that data have been downloaded and imported into the project.
- 👉 comXXXXX.sp3 files contain precise orbits for all satellites and all constellations.
- 👉 brdmXXXX.16p file contains broadcast ephemeris for all satellites and all constellations.



7. Correct antenna height

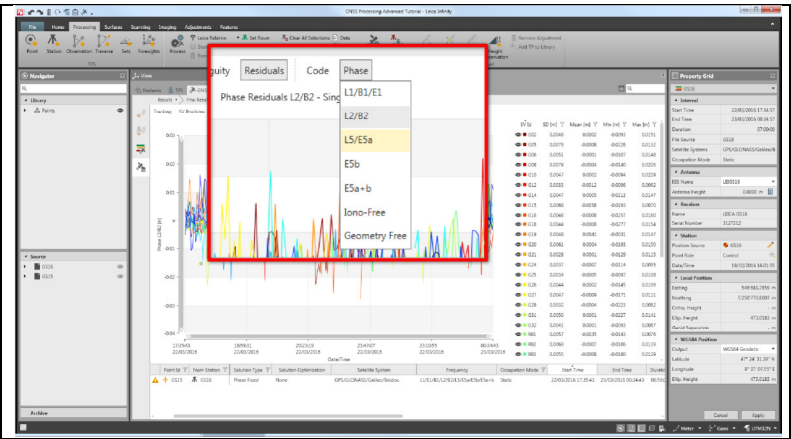
| | | |
|-----|---|--|
| 7.1 | Highlight the GS16 in the Inspector GNSS Intervals view and in the Property Grid select the button Edit Antenna Height  . |  |
| 7.2 | Edit the Height Reading from 2.000 m to 0.000 m and then select OK to close the fly out. |  |
| 7.3 | Select Apply to save the changes |  |

8. Reprocessing and final results analysis

| | | |
|------------|--|--|
| <p>8.1</p> | <p>Process the data and drill in into the new results.</p> |  |
| <p>8.2</p> | <p>In the Result Analysis Viewer check the final processing output. The expected GNSS results have been achieved.</p> <ul style="list-style-type: none"> ☞ Slope Distance is 3 m. ☞ All constellations and frequencies have been used in the final results: <ul style="list-style-type: none"> - GPS L1, L2, L5 - Glonass L1, L2 - Beidou B1, B2 - Galileo E1, E5a, E5b, E5ab. |  |
| <p>8.3</p> | <p>In the Inspector GNSS Processing results, Navigate the buttons on the top of the Result Analysis Viewer to get more detailed information about Tracking Status, Satellite position, Observation Statistics, Ambiguity Statistics, Residuals Plot.</p> <ul style="list-style-type: none"> ☞ Use the mouse wheel to zoom in/out on each plot to get more details. |  |
| <p>8.4</p> | <p>Select Residual and switch between Single Differences, Double Differences, and Triple Differences to visualize the plots.</p> |  |

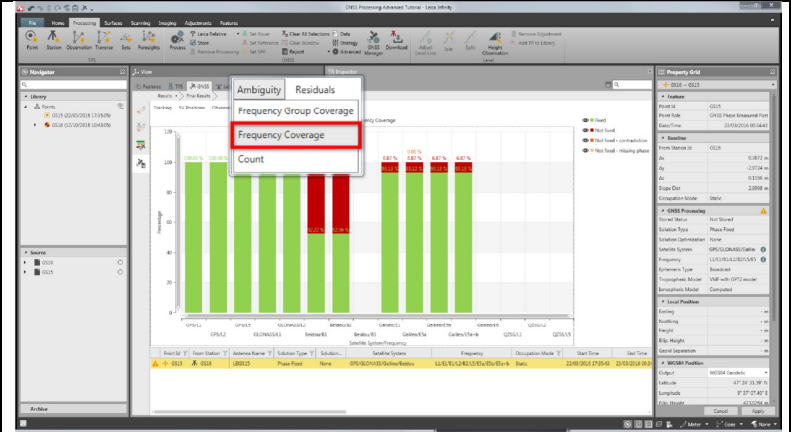
Residuals plots are applicable for Code and Phase observations, all frequencies are available.

- In the specific dataset phase residuals presents low dispersion and no jumps, suggesting a good quality of the raw data and a good reliability of the achieved results.

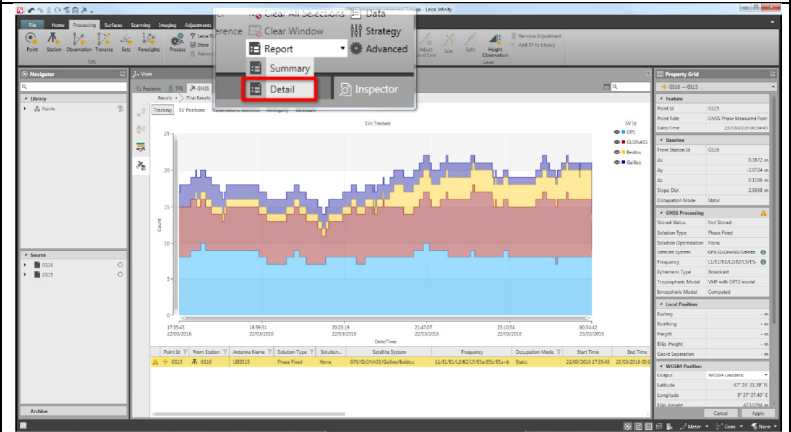


8.5 Select **Frequency Coverage** from the **Ambiguity** button in the GNSS Results Analysis view.

- The chart shows the % of epochs with fixed ambiguities over the total number of epochs for each Frequency of each constellation.
- It is possible to note that almost half of the total Beidou observations are not fixed (both B1 and B2 frequency).




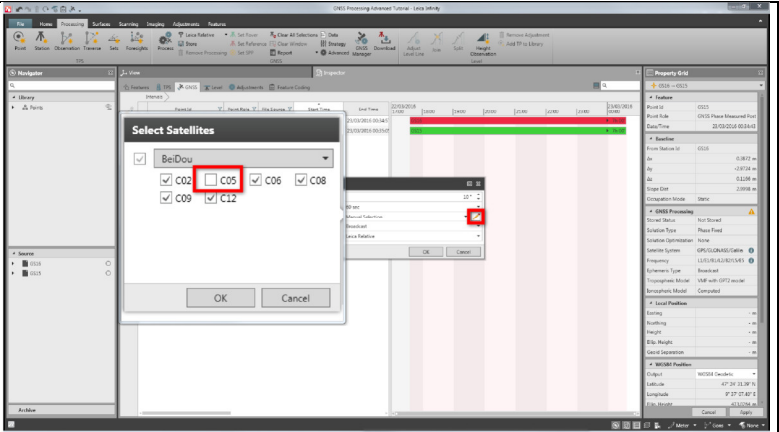
8.6 Open the GNSS Processing Result report by highlighting the results and selecting the button **Report** in the Processing ribbon bar, then select **Detail** from the list.



8.7 In the **GNSS Processing Report** move to the session **Signals Tracked**



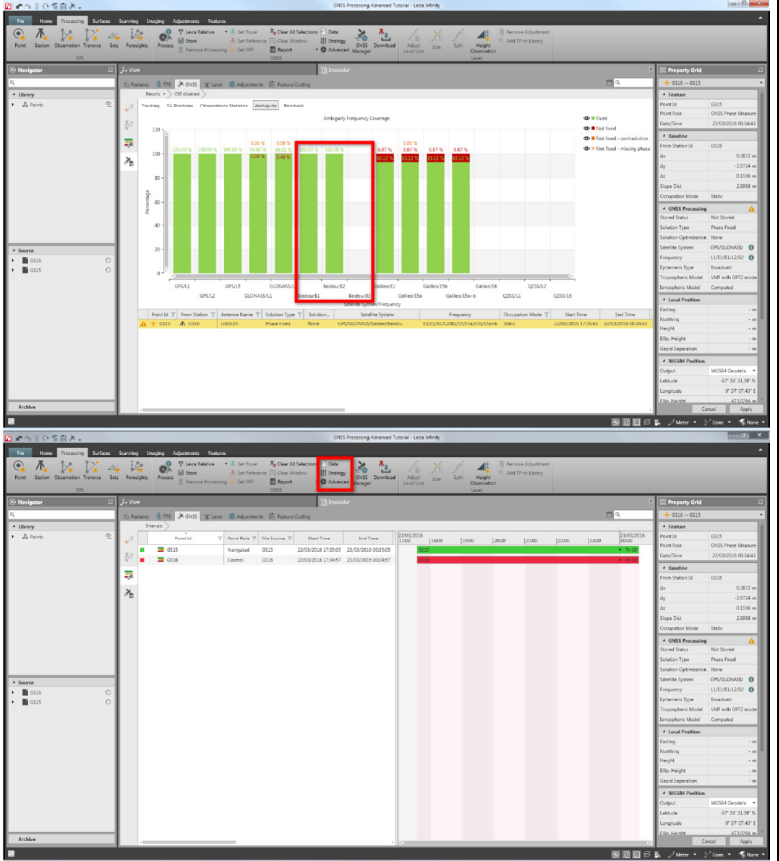
8.10 Select the **Edit** pencil  and disable the use of Satellite C05 from the Beidou constellation. **Process** the data again.



8.11 Open the Ambiguity Plot for **Frequency Coverage** in the GNSS tab of the Inspector.

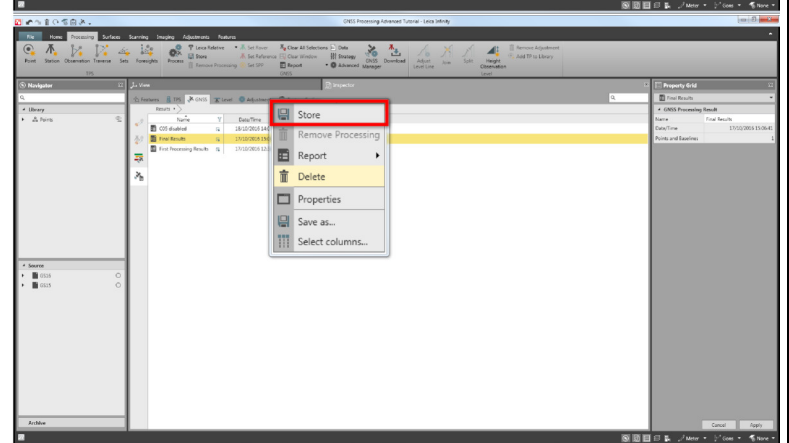
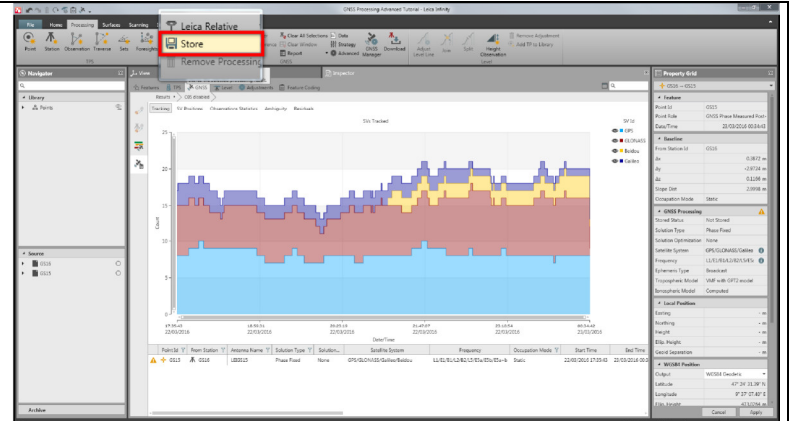
- Now Beidou ambiguities are 100% fixed.
- Compare the coordinates you get in this step (C05 disabled) with the coordinates you got in the previous step (C05 enabled). They are the same!

In most of the cases, you get the best results using the Default Processing Settings through which Infinity automatically rejects low quality data from the final results computation. However, there are special cases and exceptions in which it is required to “tune” your processing by acting on the parameters available in **Data**, **Settings** and **Advanced** in the GNSS Processing Ribbon.

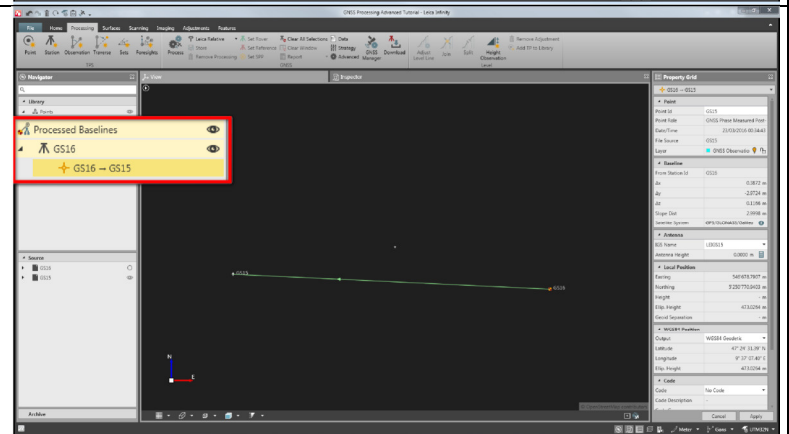


9. Store final Result

- 9.1 Store the Results by highlighting the results and selecting the button **Store** in the Processing ribbon bar.
- ☞ Results can also be stored from the results list in GNSS tab. In this case all contained processed baselines will be stored.
 - ☞ You can also store the results opening the context menu with a right click with the mouse over the results and by selecting **Store**.



- 9.2 After storing, the baseline is added in the **Navigator** within the Processed Baselines list. Visualize the baseline by moving to the **View** tab.



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