Processing GNSS Baselines

TRIMBLE BUSINESS CENTER TUTORIAL

Corporate office:

Trimble Navigation Limited
Engineering and Construction Division
5475 Kellenburger Road
Dayton, Ohio 45424-1099
USA

Phone: +1-937-233-8921
Toll free (in USA): +1-800-538-7800
Fax: +1-937-233-9441

www.trimble.com

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About this tutorial

In this tutorial, you will process baselines from GNSS data that has already been imported into the project.

Notes:

- For this tutorial, you will be processing baselines for data that includes both L1 and L2 signals. You can perform the procedures described in the tutorial while running **Trimble Business Center** software with the ***Survey Standard*** product license; however, only the L1 data will be processed. The ***Survey Advanced*** product license is required to process baselines for L1 and L2 data. To verify the product license for your installation, select **Help > About Trimble Business Center** and click the **License** button. Licensed features are displayed in the **Features** list.
- If you need additional help at any time you are using the software, press **F1** to display the online help.

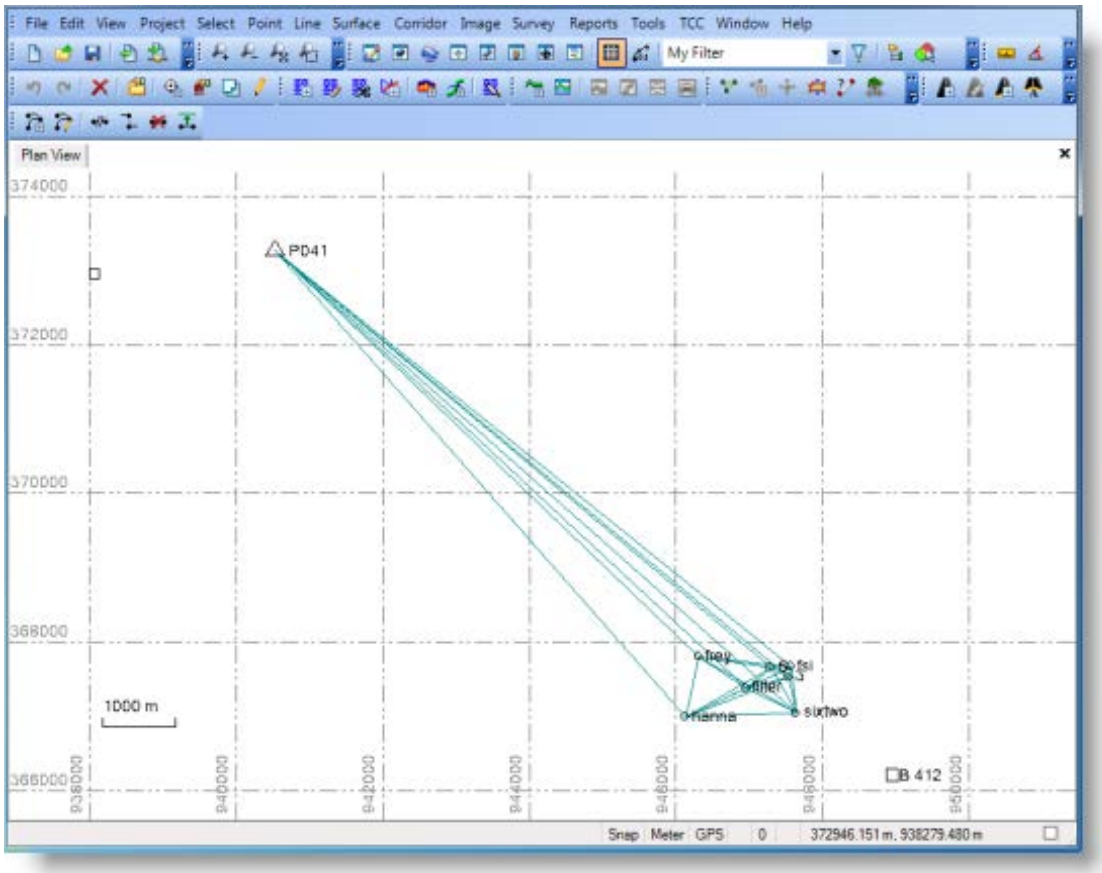
Step 1. Open the project

For this tutorial, you will use the project file *Processing GNSS Baselines.vce*. GNSS data has already been imported into the project, but baselines have not yet been processed.

1. On the **Trimble Business Center** menu bar, select **File > Open Project**. Or, click the **Open Project** icon on the toolbar.
2. In the **Open File** dialog, browse to ***C:\Trimble Tutorials\TBC\Projects\Processing GNSS Baselines.vce*** and click **Open**.

   If you installed the tutorial to a location other than the default location shown here, browse to that location.

The project opens in the **Trimble Business Center** window.



Note: This figure shows the **Plan View** with a white background. Your background may be black. If you want to change it to white, select **Tools > Options** and select **Background color: White** in the **Options** dialog.

The project file is read-only. You can perform the tutorial steps without saving the project file. However, if you are interrupted while performing the tutorial, you can save it by selecting **File > Save Project As** and saving it to ***..\My Documents\Trimble Business Center***, which is the typical location for storing project files on your computer. Then, you can re-open the project to continue the tutorial at a later time.

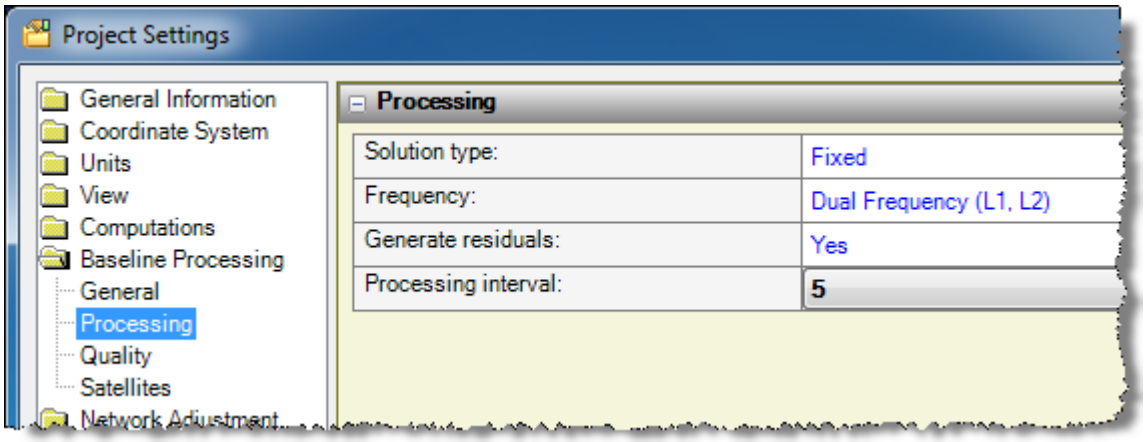
Before you process baselines for the project, you should check the baseline processing settings to ensure they are appropriate for your project.

Step 2. Specify the processing interval

Before processing baselines for your project, you can choose the interval (in seconds) at which you want to select field data to process, or you can choose to use the interval specified in the data file. The shorter the interval, the more data is processed, resulting in a longer processing time and higher precision. If you choose an interval that is shorter than the interval at which the data was collected, the interval at which the data was collected is used.

Ideally, you would choose to use the interval specified in the data file to ensure you are using the shortest intervals possible. However, for long occupation times with intervals (epochs) of 1 second or less, the processing time could be very long. In this case, you might choose to use a longer interval to shorten the processing time. For this tutorial, you will select a processing interval of 5 seconds to keep the processing time as short as possible.

1. Select **Project > Project Settings**. Or, click the **Project Settings** icon on the toolbar.
2. In the navigation (left) pane in the **Project Settings** dialog, select **Baseline Processing > Processing**.
3. In the **Processing interval** drop-down list, select **5** (seconds).



Note that you can select other options that affect baseline processing. Helpful tips are displayed in the lower portion of the dialog, or you can press **F1** at any time for additional online help. For this tutorial, you should not make any other changes.

4. Click **OK** to close the **Project Settings** dialog.

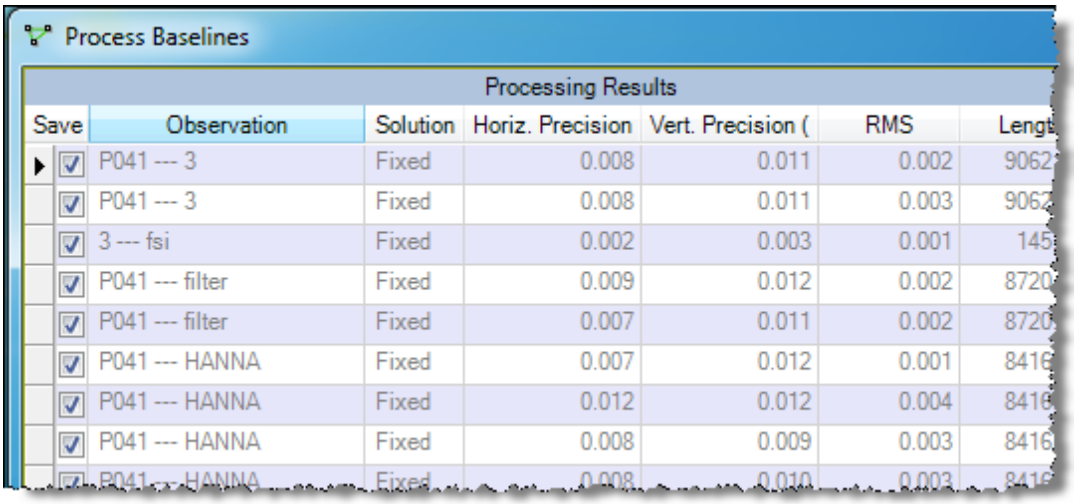
You are now ready to process baselines.

Step 3. Process baselines

1. Select **Survey > Process Baselines.** Or, click the **Process Baselines** icon on the toolbar.

Note: If no baselines are selected in the various views when you select the **Process Baselines** command (as in this case), all baselines in your project are processed. If any baselines are selected, only those baselines are processed.

The **Process Baselines** dialog displays showing the progress of the process.



Save	Observation	Solution	Horiz. Precision	Vert. Precision (	RMS	Lengt
☑	P041 --- 3	Fixed	0.008	0.011	0.002	9062
☑	P041 --- 3	Fixed	0.008	0.011	0.003	9062
☑	3 --- fsi	Fixed	0.002	0.003	0.001	145
☑	P041 --- filter	Fixed	0.009	0.012	0.002	8720
☑	P041 --- filter	Fixed	0.007	0.011	0.002	8720
☑	P041 --- HANNA	Fixed	0.007	0.012	0.001	8416
☑	P041 --- HANNA	Fixed	0.012	0.012	0.004	8416
☑	P041 --- HANNA	Fixed	0.008	0.009	0.003	8416
☑	P041 --- HANNA	Fixed	0.008	0.010	0.003	8416

When processing is complete, the processed baselines are listed in the table. You can sort the baselines as necessary by clicking any of the column headings. For example, you can sort baselines to verify that desired accuracy has been met by clicking the **Horiz. Precision** and **Vert. Precision** column headings.

To see more information about any specific baseline, select the row and click the **Report** button to display the **Baseline Processing Report** in HTML format in your browser window.

Note: When you select to open a *Baseline Processing Report* from anywhere else in **Trimble Business Center**, the report opens on a viewing tab in RDLC (Report Definition Language Client-side) format, which can then be saved in PDF format.

2. In the **Process Baselines** dialog, click the **Save** button to save the processed baselines.

   The project is re-computed with the newly created baselines.

   You can view the **Point Derivation Report** for any point to see the resultant coordinates.

3. Select the point *fsi* in the **Plan View**. Then right-click and select **Point Derivation Report** in the context menu.

   The **Point Derivation Report** displays in your browser window.

If an error flag had displayed for a baseline in the **Process Baselines** dialog, you would need to ensure all the information about that baseline is correct (for example, antenna type, antenna height, and point name). In some cases, reprocessing the baseline by itself will clear a flag by using a different coordinate seeding. Depending on the underlying problem, there are a number of actions you could take, including possibly editing the associated session.

In the next step, you will edit a session and reprocess a baseline as if an error flag had been displayed in the **Process Baselines** dialog, even though one did not. This will help familiarize you with the **Session Editor**.

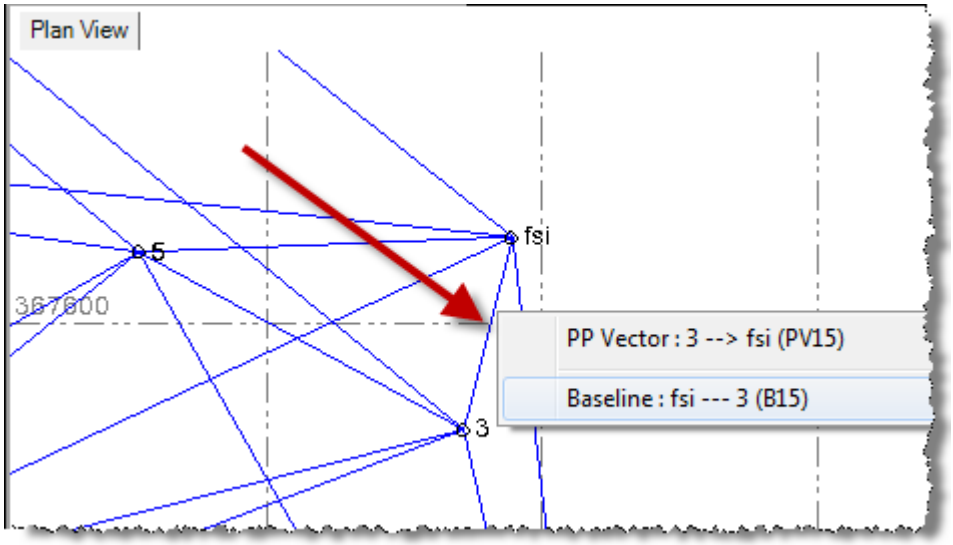
Step 4. Edit a session and reprocess a baseline

The **Session Editor** allows you to visually analyze the quality of the raw satellite data collected for the selected session. Gaps in satellite data can indicate satellite signal cycle slips, invalid range errors, and other signal loss problems. To improve the quality of a processed baseline, you can use the **Session Editor** to disable unhealthy satellites, mask bad sections of satellite data, and adjust occupation times.

In this step, you will edit a session associated with a baseline to correct for gaps in the satellite signal. Then you will reprocess the baseline.

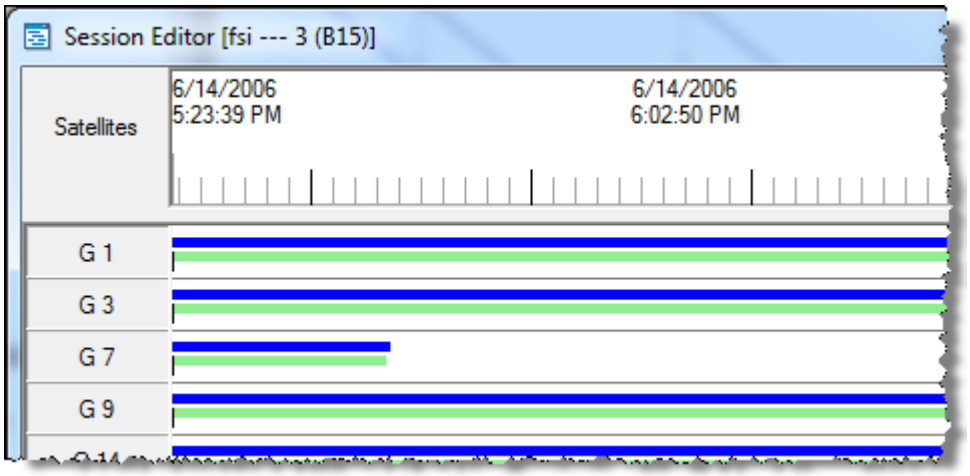
Note: This procedure is intended to familiarize you with the **Session Editor**. If this were a real project, there would be no need to reprocess the specified baseline since it is within the acceptance criteria specified for the project.

1. Click on the **Plan View** and use your mouse wheel to zoom in so that you can distinguish the baseline between the points *fsi* and *3.* Then, click on the baseline and select *Baseline fsi --- 3 (B15)* in the context menu.



2. Right-click anywhere on the **Plan View** and select **Session Editor** in the context menu.

The **Session Editor** dialog displays.



Satellites that provided data for the session include blue and/or green lines on the timeline. Each blue line represents data collected for the first point in the baseline (*fsi)*. Each green line represents data collected for the second point in the baseline (*3*).

Each satellite is represented by a letter and number in the left column:

- G = GPS satellite
- R = GLONASS satellite
- E = Galileo satellite

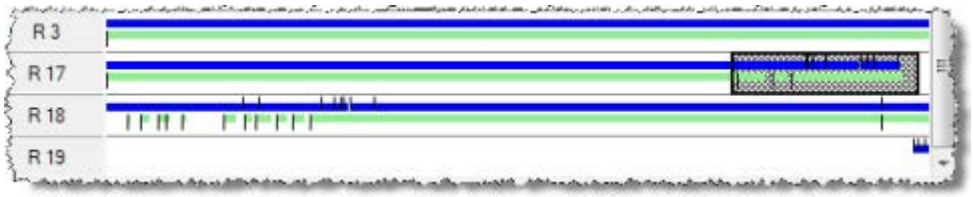
Note that the signal for the satellite G7 ends early in the session. The satellite probably moved beyond the horizon at that point. Although it is not necessary in this case, you will disable the satellite G7 data for this tutorial.

3. In the left column, click **G7**.

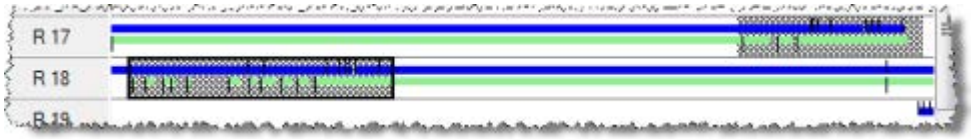
   The entire row is shaded to show the satellite data will be disabled (that is, the data will not be used for processing) when you click **OK**.

   Next, you will disable part of the R17 and R18 satellite data in which there are cycles slips as indicated by breaks in the blue and green lines.

4. In the **R17** row, click in front of the first slip and drag your cursor to the end of the row.



5. In the **R18** row, click and drag across the cycle slips in the earlier part of the session.



In this procedure you are disabling satellites data only for the selected baseline. If you want to disable a satellite for all baselines in your project, select **Project > Project Settings**. Then select **Baseline Processing > Satellites** and remove the checkmark from the satellite you want to disable. This is also where you could raise or lower the elevation mask to try and improve baseline results.

6. Click **OK** to close the **Session Editor** dialog.

   You are now ready to reprocess the baseline.

7. With *Baseline fsi --- 3 (B15)* still selected, select **Survey > Process Baselines**. Or, click the **Process Baselines** icon on the toolbar.

   The **Process Baselines** dialog displays and the selected baseline is reprocessed.

8. When processing is complete, click the **Save** button.

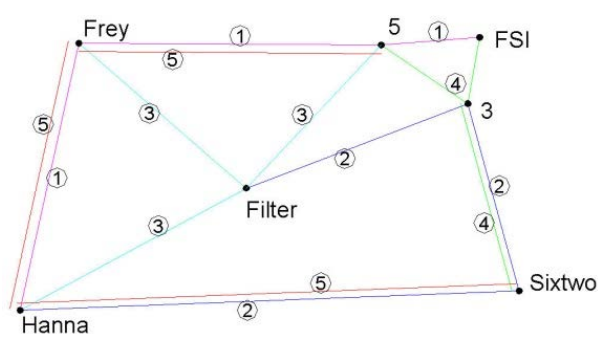
You are done processing GNSS baselines. In the next step, you will identify and disable dependent baselines in your project.

Step 5. Identify and disable dependant baselines

If you plan to use only independent baselines in the network adjustment, you can use the **Time-Based View** to identify dependent baselines and disable them.

Note: Disabling a baseline deletes the associated vector. If you want to retain a vector you must disable it, not the baseline. Instructions for disabling vectors are not included in this tutorial.

Following is a diagram of the survey data used in this project.



Session	Surveyor 1	Surveyor 2	Surveyor 3	Surveyor 4
1	FSI	5	Frey	Hanna
2	Filter	3	Sixtwo	Hanna
3	Hanna	Frey	Filter	5
4	3	5	FSI	Sixtwo
5	Sixtwo	Hanna	Frey	5

The circled numbers indicate the session in which each baseline was measured. In the session 1, points *fsi*, *5*, *frey*, and *hanna* were occupied. The total number of baselines that can be observed during a session is equal to

$$\frac{n(n-1)}{2}$$

where *n* equals the number of receivers used during the session.

For example, if four receivers were used in a session, six baselines can be observed (4 times 3, divided by 2).

The number of independent baselines for a given session is equal to $n-1$.

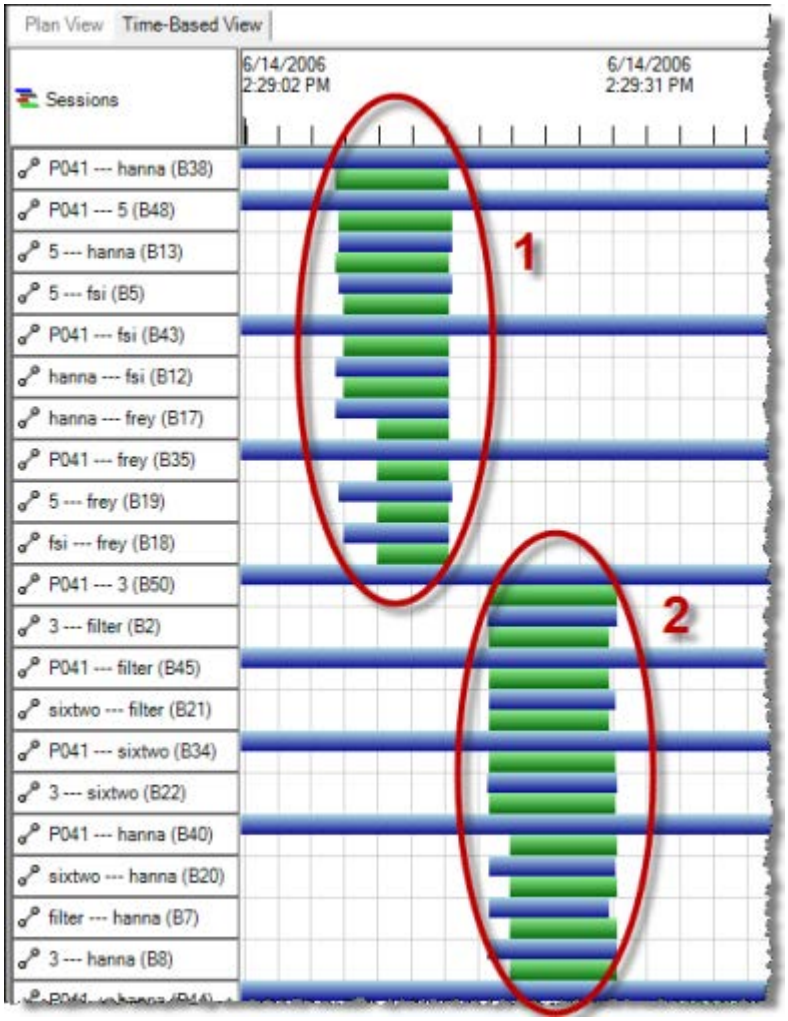
For this project, three independent baselines were measured for each session. In the five sessions observed, 30 baselines were measured, but only 15 are independent.

Using the CORS station, you must add another receiver into the count. This increases the total baselines per session to 10 and the number of independent baselines to four. There are 50 total baselines and 20 independent baselines for all sessions.

To disable dependent baselines, follow these steps:

1. Select **View > New Time-Based View**. Or, click the **New Time-Based View** icon on the toolbar.

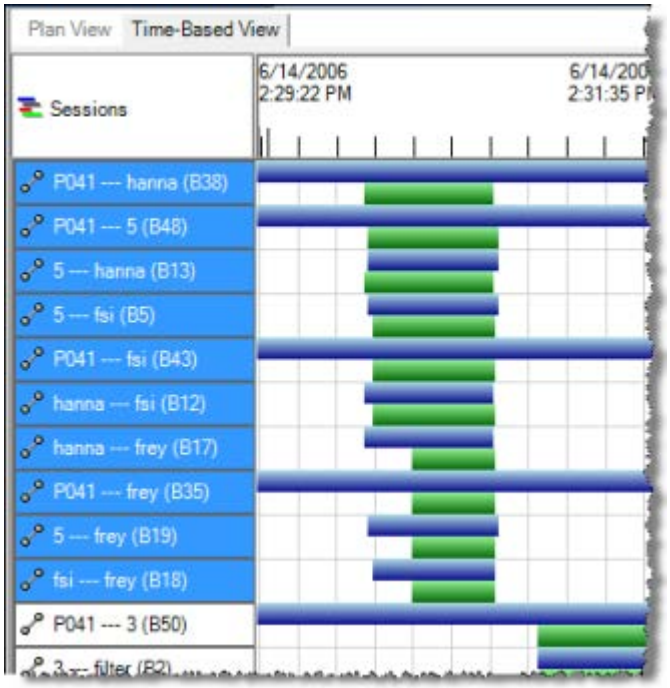
   The **Time-Based View** displays. The following figure identifies sessions 1 and 2. (The other sessions are not shown in this figure.)



   You can use your mouse to navigate the **Time-Based View** as follows:

   - Place you cursor over the sessions, press your mouse wheel, and move the mouse back and forth to pan the view horizontally.
   - Use the mouse wheel to scroll the view vertically up and down.
   - Place you cursor over the sessions, press and hold the left mouse button, and move the mouse up to zoom in, or move it down to zoom out.
   - Right-click to see other zoom options.

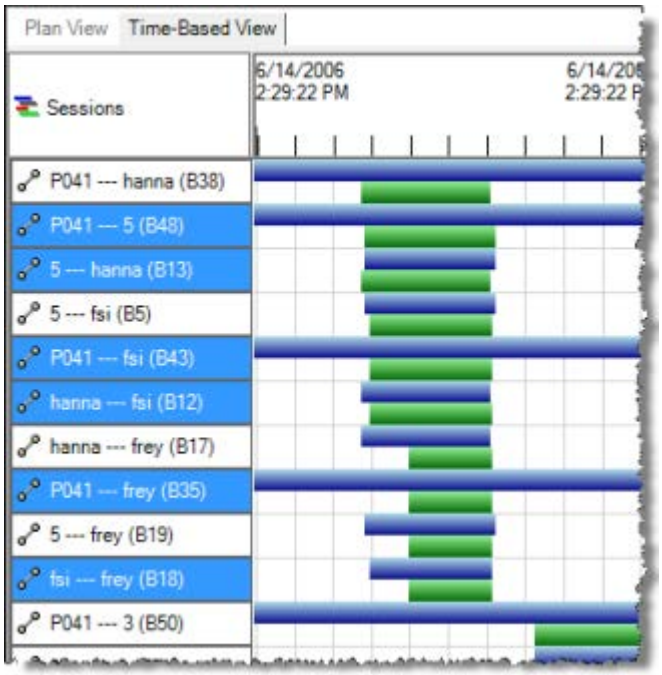
2. To ensure you are working with the correct session, use **Shift + click** in the left column to select all of the baselines in session 1.



3. Using **Ctrl + click**, deselect the independent baselines in session 1. These are the baselines **you do not want to disable**.

   - *P041 --- hanna*
     Note that since you are using the observation from P041 to the points on the exterior of your network, you must deselect this baseline.
   - *5 --- fsi*
   - *hanna --- frey*

- *5 --- frey*

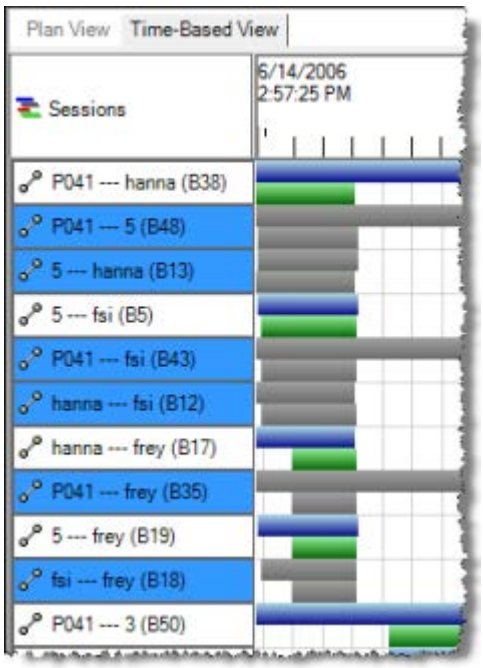


4. Right-click on any of the remaining selected baselines in session 1 and select **Disable Baselines** in the context menu.

   A message is displayed alerting you that associated vectors will be deleted.

5. In the **Delete Vectors** message dialog, click **Yes**.

6. In the **Time-Based View**, the disabled baselines are displayed with a dark gray bar.



7. Repeat this procedure for sessions 2 through 5, ensuring all dependent baselines are disabled.

The independent baselines for each session are as follows. ***These baselines should not be selected to be disabled.*** All other baselines should be selected to be disabled.

Session 2:

- *3 --- filter*
- *P041 --- sixtwo*
- *3 --- sixtwo*
- *sixtwo --- hanna*

Session 3:

- *hanna --- filter*
- *filter --- 5*
- *filter --- frey*
- *P041 --- frey*

Session 4:

- *P041 --- fsi*
- *fsi --- 3*
- *3 --- sixtwo*
- *3 --- 5*

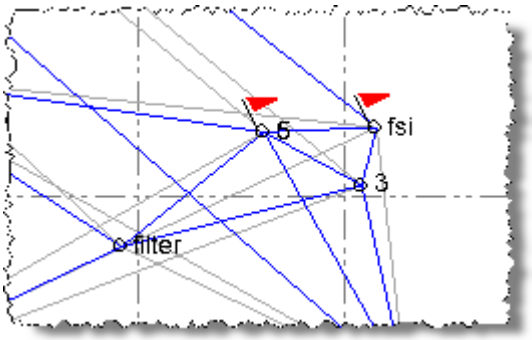
Session 5:

- *P041 --- sixtwo*
- *frey --- hanna*
- *frey --- 5*
- *sixtwo --- hanna*

Now that you have disabled baselines, you must recompute the project.

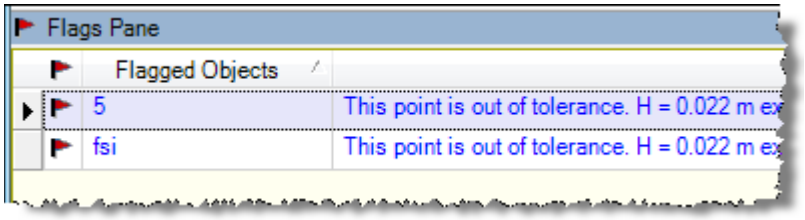
8. Select **Project > Compute Project**. Or, press the **F4** key.

   Note that flags now display on points *5* and *fsi* in the **Plan View**.



9. Select **View > Flags Pane**.

In the **Flags Pane**, you can see that the two points exceed horizontal points tolerances that have been specified for the project.



For this tutorial, you will change the tolerance to be less restrictive so the flags no longer display.

10. To change the horizontal and vertical tolerancs for points in the project, do the following:

    a. Select **Project > Project Settings**. Or, click the **Project Settings** icon on the toolbar.

    b. In the **Project Settings** dialog, select **Computations > Point Tolerances** in the navigation pane located on the left side of the dialog.

    c. In the **Survey Quality** section, change the **Horizontal tolerance (Survey)** field to *0.025 m*. Change the **Vertical tolerance (Survey)** field to *0.055 m*.

    d. Click **OK**.

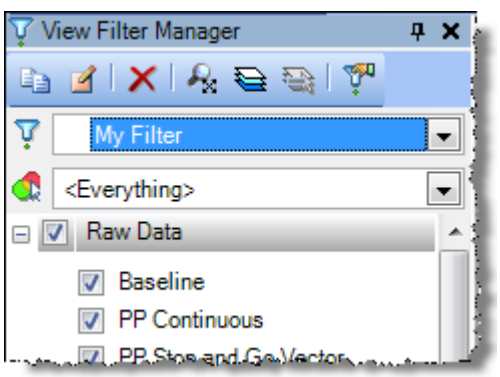
    The flags no longer display in the **Plan View** or **Flags Pane**.

11. To view only the enabled observations and baselines (for postprocessing) in the **Plan View**, do the following:

    a. Select **Plan View**.

    b. Select **View > View Filter Manager**.

    The **View Filter Manager** pane displays.

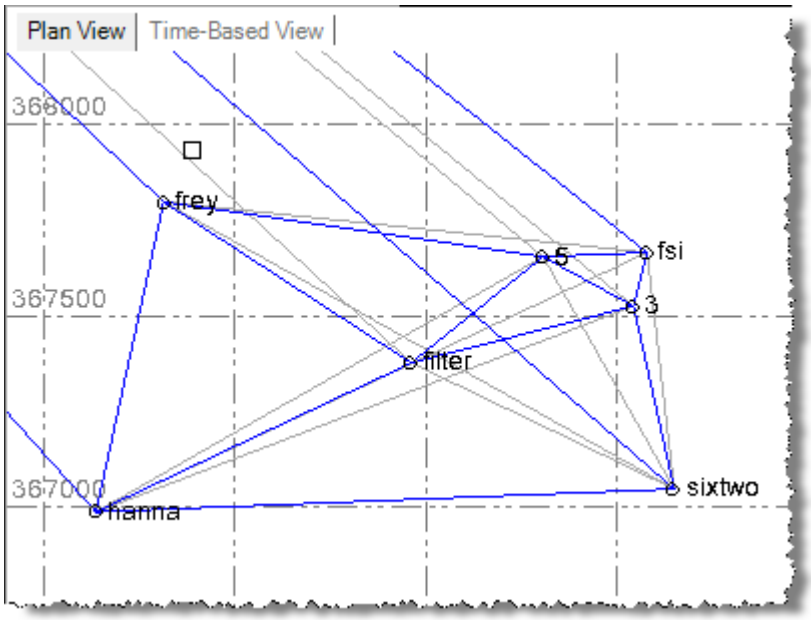


    c. Select the **Observations** tab in the bottom area of the pane, and select the **Enabled observations only** option.

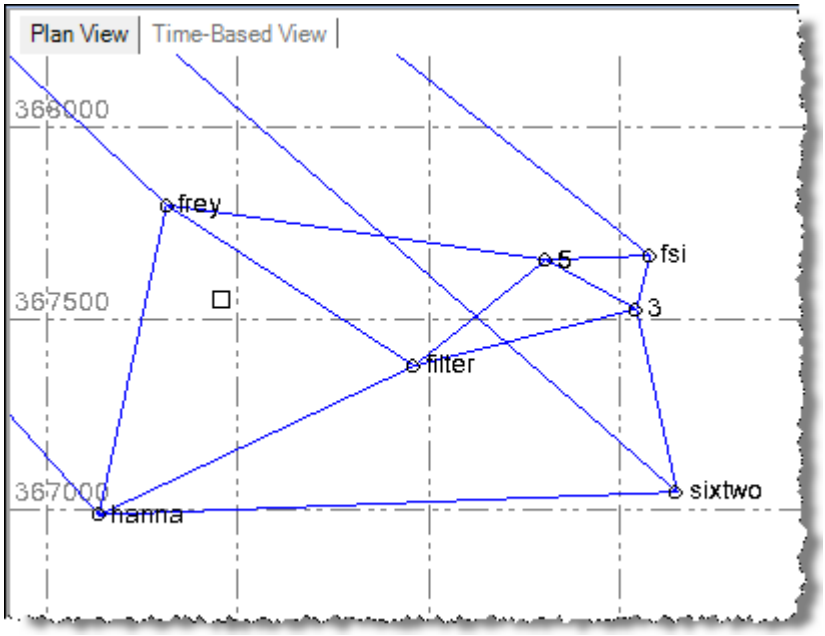
    d. Select the **GNSS Data Types** tab in the bottom area of the pane, and select the **Enabled baselines only (for postprocessing)** option.

    e. Click on the **Plan View** and use your mouse wheel to zoom in. Press the mouse wheel and move the mouse to center the points as shown in the second figure.

Plan View before filtering the view:



Plan View after filtering the view:



You are done disabling dependent baselines in your project.

12. Select **File > Close Project**.

    The **Save Changes** dialog displays. If you saved the project to a new location or with a new name, you can click **Yes**. Otherwise, click **No**.