DAT/EM Stereo Viewer Operation Manual

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Contents

Introduction to DAT/EM Stereo Viewer

The DAT/EM Systems International Stereo Viewer is a product that was introduced in DAT/EM version 7.6 and remains in higher versions. Its purpose is to perform a relative-like orientation only, which produces good stereo viewing and establishes model coordinates.

Stereo Viewer allows stereo viewing and pseudo relative (model coordinates) comparisons only. It does not give ground coordinates. If your project requires ground coordinates, DAT/EM encourages you to try our Summit Evolution stereoplotter product instead.

Stereo Viewer does not require a camera definition file. Stereo Viewer will typically be used for historical imagery where the control and/or camera details are unknown.

For licensing and viewing:

- You will need to own a DAT/EM Stereo Viewer license and obtain an installation keycode in order to install this application.
- DAT/EM Stereo Viewer added to existing DAT/EM hardware locks will require a WriteLock program from DAT/EM Support.
- Stereo Viewer version 7.7 works with Windows 8.1 and 10 Professional and Enterprise.
- For help setting up your stereo hardware, please contact DAT/EM Support. The remainder of this document expects that your stereo hardware is working to display OpenGL stereo.

Additional notes for users who are familiar with the DAT/EM Summit Evolution stereoplotter:

- The DAT/EM Stereo Viewer project file is similar to – but not quite the same as – a Summit Evolution project that only has two images and relative tie point measurements. It does not require a camera file, so it will never be quite the same.
- In versions built 23 January 2019 or later, the Stereo Viewer project can be opened as read-only by Summit Evolution. Summit can't modify the project and can't create a new Stereo Viewer project.

Types of Stereo and Other Display Options

There are two stereo view types: Quad buffered stereo and anaglyph.
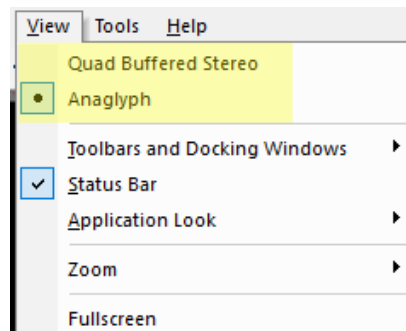

Two project types: Quad buffered stereo and anaglyph

Choose the type of stereo based on whether you have stereo viewing hardware installed. For example, set **Quad Buffered Stereo** if you have a Schneider Digital PluraView display system or nVidia 3DVision. Select **Anaglyph** if you have only colored film glasses or wish to take a screen shot demonstrating stereo.

Use the other View menu options as desired to set the appearance of the Stereo Viewer window.

Preparation

Select images with 50% to 90% overlap. The images should have similar scale and rotation.
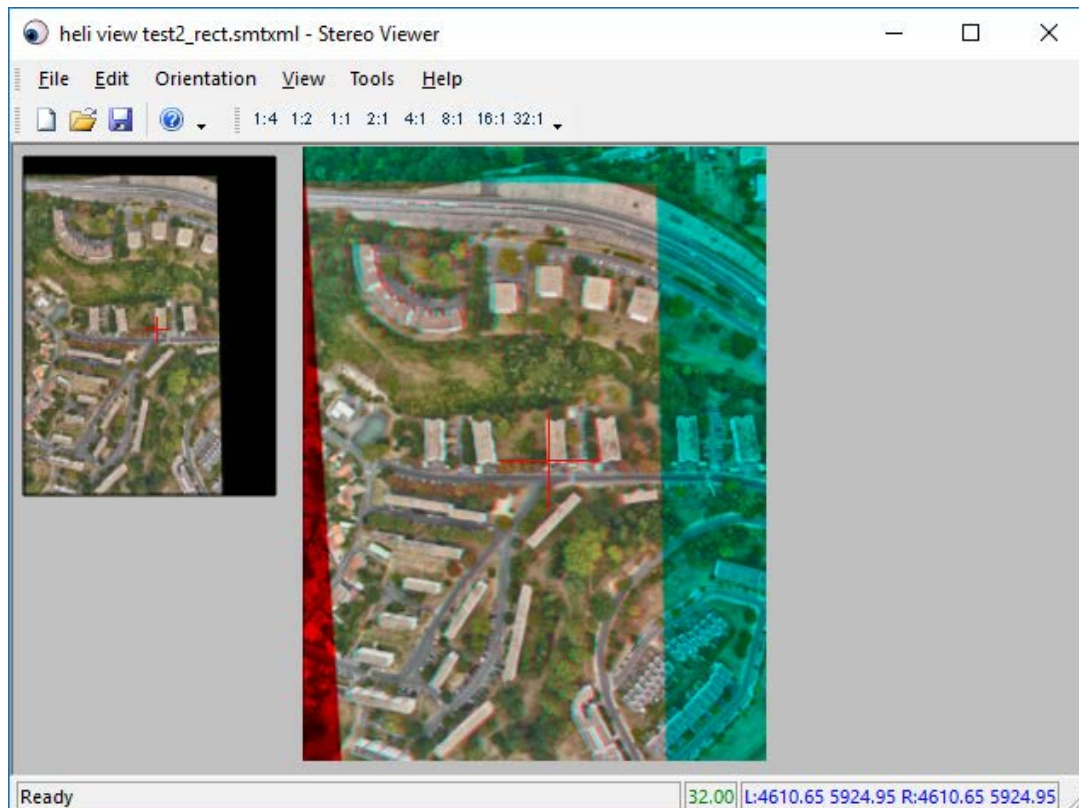
Example of Stereo Viewer Image Pair (in anaglyph stereo for demonstration purposes)

Stereo Viewer can use many different image formats. Some of the TIF-type formats may be used as they are without translating them to an optimized Stereo Viewer .smti format, but other formats must either be converted or used with generated .pyr zoom pyramid files. The DAT/EM Image Creator tool is used to create .smti or .pyr files. See the section below for instructions.

Image Creator

If you know you need to process the images, or even if you are unsure of your image format, use **Stereo Viewer > Tools > Image Creator** to make optimized versions of your images.
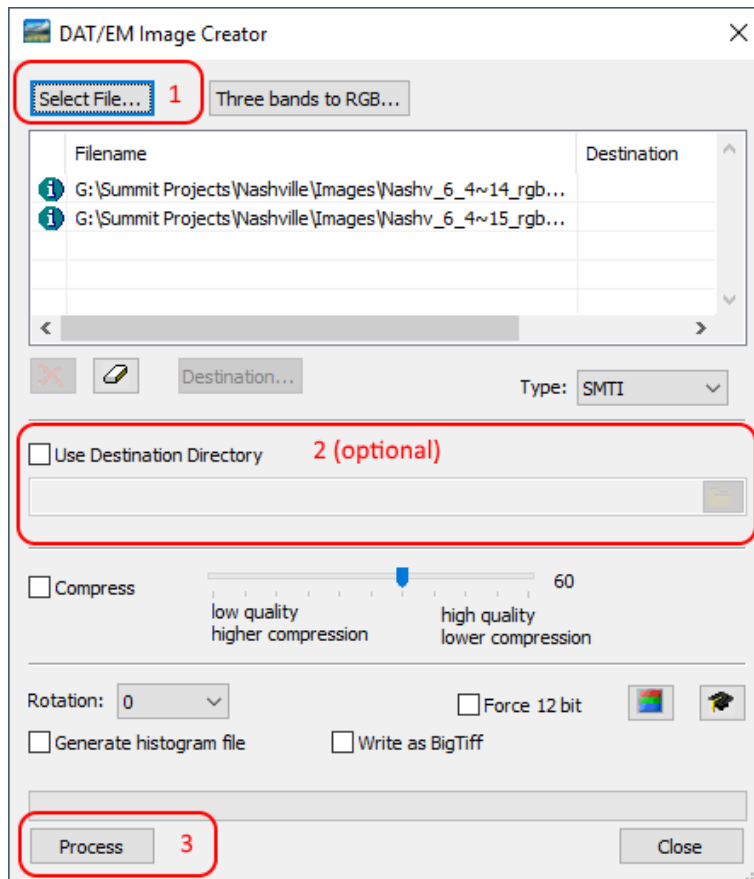

Image Creator

1. Select the images that you will use as input. A dialog containing a list of valid input image formats will appear. You will need at least two overlapping images to use the Stereo Viewer.

2. Select an output directory if you would like the images to be in a directory other than in their original location. The default file extension of **.smti** should prevent overwriting your existing images.

3. Press the Process button to begin processing. This will create images suitable for use in the Stereo Viewer.

4. You will probably not need the other options available in this tool. If you are not sure, please see the Image Creator training on www.datem.com in **Support** > **Training Videos**.

Create a Stereo Viewer Project

The Stereo Viewer needs a left and a right image to present stereo.

1. Start the Stereo Viewer application.

2. Use **Stereo Viewer > Edit > Project** to select the images you would like to view in stereo. These images must have an overlap region and must be of similar scale and rotation.

Use Project Edit to browse for the left and right image

3. Select File > Save or the save icon on the toolbar to name and save the project.
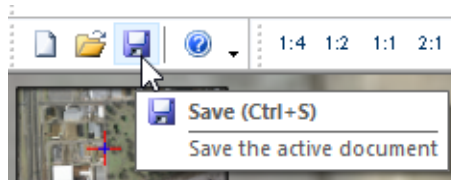
Save to name and save the project

Orientation for the Stereo Viewer

There are two tiers of orientation offered: **Tie Points** (also known as pseudo relative) and **Rectify**. DAT/EM recommends to do **Tie Points** first, then try **Rectify**. **Rectify** is the preferred method as long as it succeeds. For those image pairs where **Rectify** fails, the **Tie Points** method must be used as-is.

Always measure tie points first. Choose either manual or automatic measurement from the sections below.

Measure Tie Points Manually

This Tie Points method is really a "pseudo relative". It is very similar to a real relative orientation (RO), but in a real RO, the camera parameters are known. For convenience, we're going to call this pseudo relative either "relative orientation" or "RO" in the remainder of these instructions, but please keep in mind it is always a pseudo relative orientation in Stereo Viewer.

To measure tie points manually:

1. Select **Stereo Viewer** > **Orientation** > **Tie Points**. (For those who are familiar with it, this is similar to Summit Evolution's Relative Orientation dialog.)
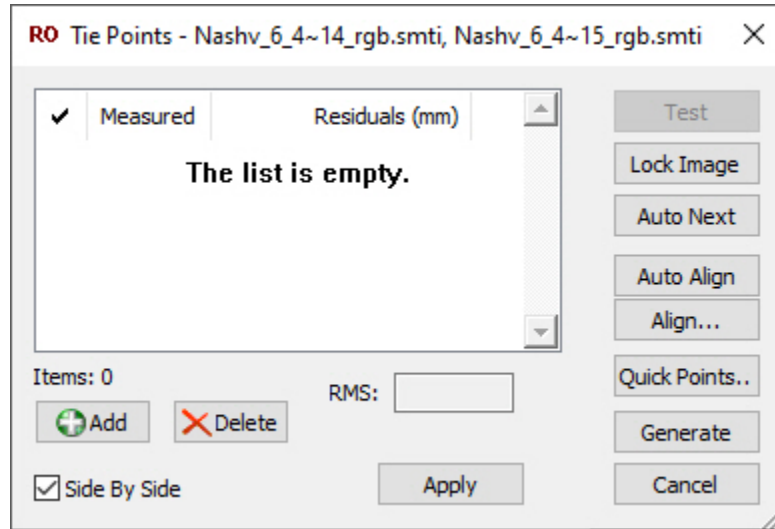
Stereo Viewer's [pseudo] Relative Orientation dialog

2. Perform an initial image alignment by selecting either the **Auto Align** or the **Align…** button. If **Auto Align** fails, **Align** must be used. Initial alignment will help set the overlap for the two images, making it easier for the **Quick Points** tool to estimate a stereo area and to make point measurement easier.

If you select **Align**, the two images will appear in a selection window. Click on the same recognizable feature in both the left and right image. This is a rough alignment and does not need to be pixel perfect!
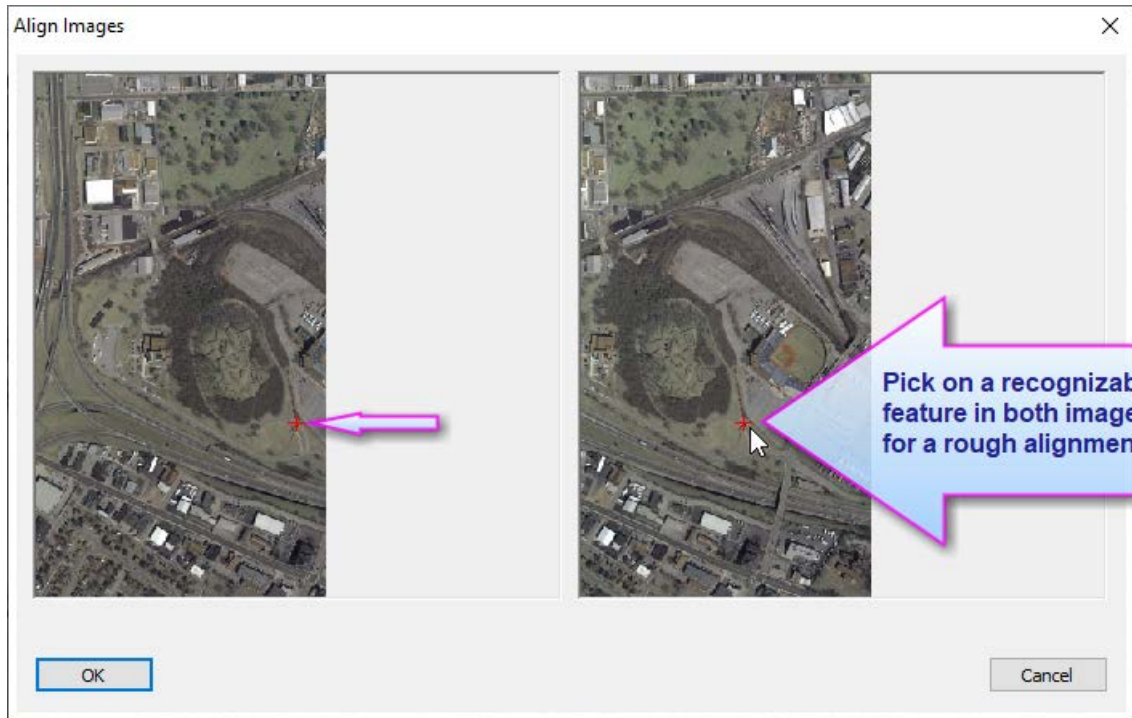
Align allows you to pick a rough alignment to help get started

3. Add at least six or eight point to the list. There are two choices for this:

- Press the **Add** button at least six or eight times to insert blank tie points into the list. Six are required for this process alone. Eight are required if you want to proceed to the **Rectify** step, which is recommended. More than eight points are optional.

- (Recommended) Select the **Quick Points** button Then select a number of points to add and a percentage from the edge value. Von Gruber points are added at even, calculated intervals along the right and left edges of the stereo area
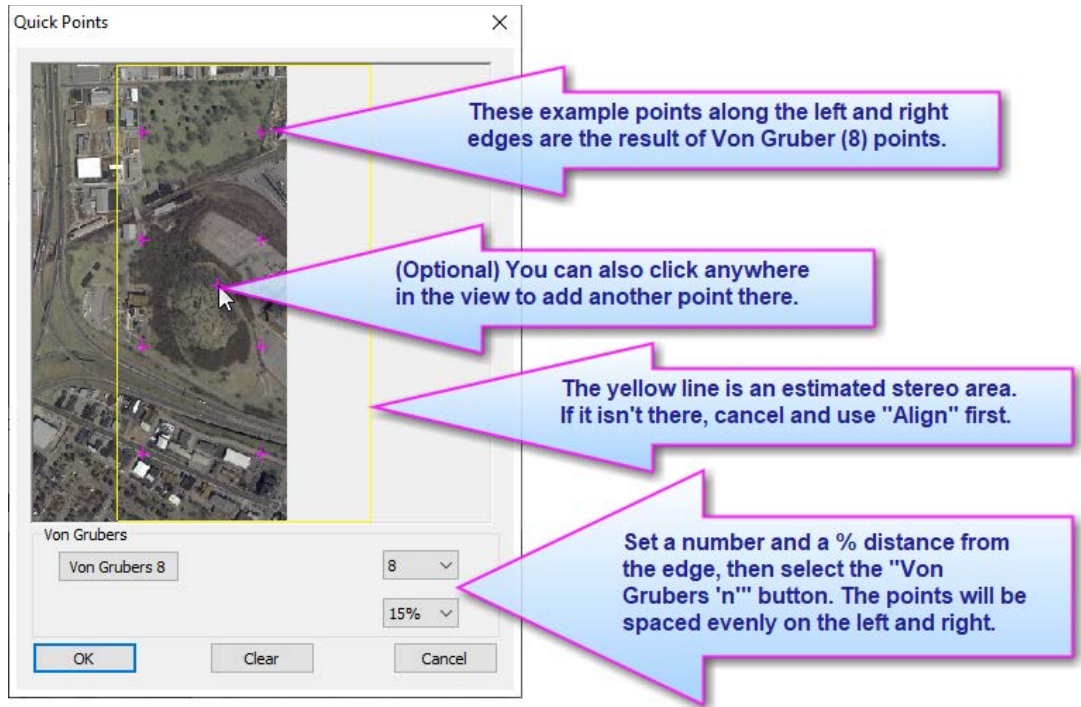
*Select the number of Von Gruber positions and press the **Von Grubers "n"** button*

Note: If you do not see a yellow rectangle around the estimated stereo area, it could be that **Auto Align** failed in the previous step. In this case, the Von Gruber points will be added to the left image area rather than the overlap area, and some of the points may be outside the stereo area. In this case, **Cancel** and return to **Align** (manual alignment) then repeat **Quick Points**. If the points still miss the stereo area, don't worry. The points are not locked to the magenta "+" mark locations; you may move them during measurement. Putting them in the stereo area is mostly for the convenience of not having to move them very far.

For the following steps, make sure that the **Auto Next** button is **not** checked (not blue)Having **Auto Next** off allows you to pick multiple times on the same feature to refine the measurement.

4. Click on the point in the list that you would like to measure. There are two options for measurement: The simple system mouse pick method (A. below, recommended) and the lock image method (B. below).

   A. **Simple system mouse pick method (recommended)**: This is the newer and more convenient method. Tie Points will open with **Side by Side** checked on by default. This places the left and right images in separate views for separate measurements.

      Click the left system mouse button on the same distinct feature in the left and right images.

      Note: It's best to select an object on the ground that has a distinct shape and does not move. Do not select points on the top of thin, high objects, such as sign posts. Do not select moving objects, such as cars and boats, even if they seem stationary. In general,

do not pick points on the tops of trees, in case the wind was moving the branches; the exception is if the entire model or Von Gruber area is covered with thick trees and no ground is visible, and even then, be careful to measure unique branches that you are sure are the same feature.

Use the **Zoom 1:n** buttons on the toolbar or spin the system mouse wheel to zoom out if you need to see a bigger area to find a feature to match. This is a rough match if zoomed out. Following this measurement in the left and right images, the **Measured** column will show **Yes** for the point, but remember, it may be only a rough match at this time.

After clicking a rough match at a zoomed-out view, use the **Zoom 1:n** buttons on the toolbar or spin the system mouse wheel to zoom in. When zoomed in, click again on the feature to refine the measurement on the images, if necessary. Pick again any number of times until the match is acceptable.


Click on the next point in the list. Repeat zooming out, picking the left and right position, zooming in, and refining the measurement until all points are matched and measured.

B. **Lock Image Method**: This is the older and more difficult method, so it may be considered obsolete, although it is still available. This method may be measured in either **Side By Side** on or off (off is in stereo).

To begin measuring using the **Lock Image Method**, click the right system mouse button in the Stereo Viewer main view. This changes the system mouse to a full Stereo Viewer measurement/digitizer mode; it no longer behaves as a system mouse when in this mode. When you move the mouse, the images will shift under the cursor.

While in measurement mode, zoom in on the object you will be measuring. If you are in measure mode, you can do this by holding down the control button and spinning the mouse wheel. If you are not yet in measure mode, then spin the mouse wheel to zoom.

Make sure that the **Lock Image** button is **not** highlighted (it is gray). Move the red cursor in the **right** image to the object you have decided to measure. The cursor on the left image will probably not be perfectly aligned with the object at this time. That is expected.
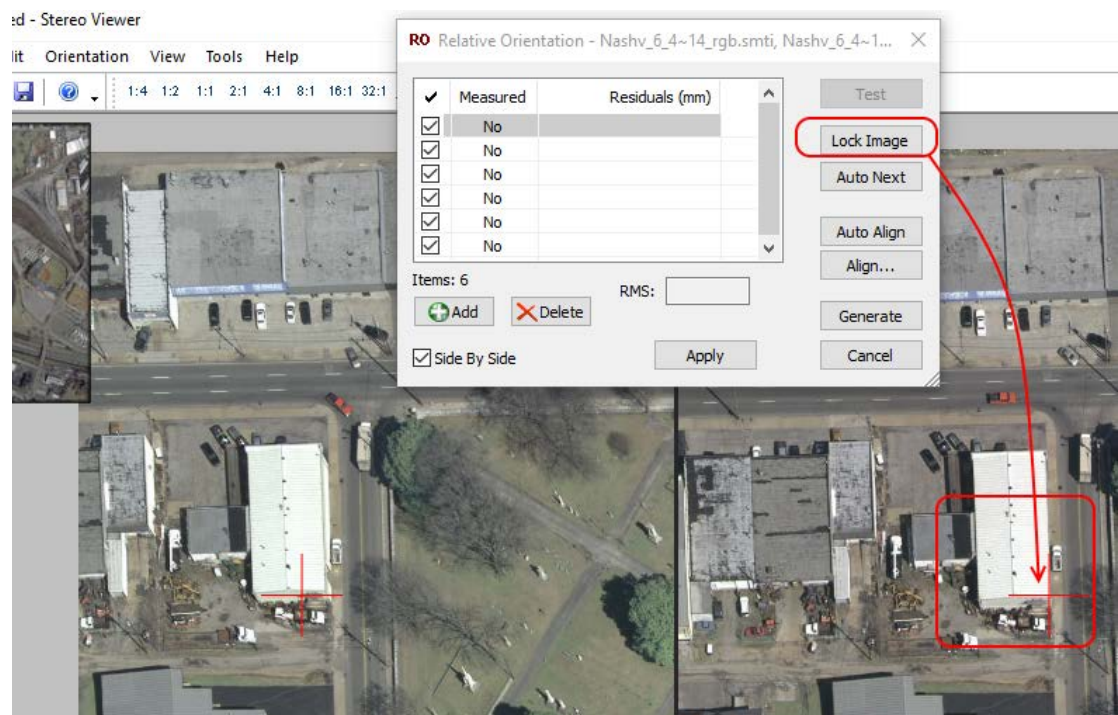

Example of Lock Image off (light gray color indicates off)

With the right image point selected, right-click the mouse or press Escape on the keyboard to exit Measure Mode.

Press the **Lock Image** button. This will lock in the measurement for the right image.

Now right-click the mouse to re-enter movement mode and move to the same object in the left image. If **Side By Side** is off, align the cursor on the object in stereo. When the cursor is on it, measure it by clicking the **left mouse button.**
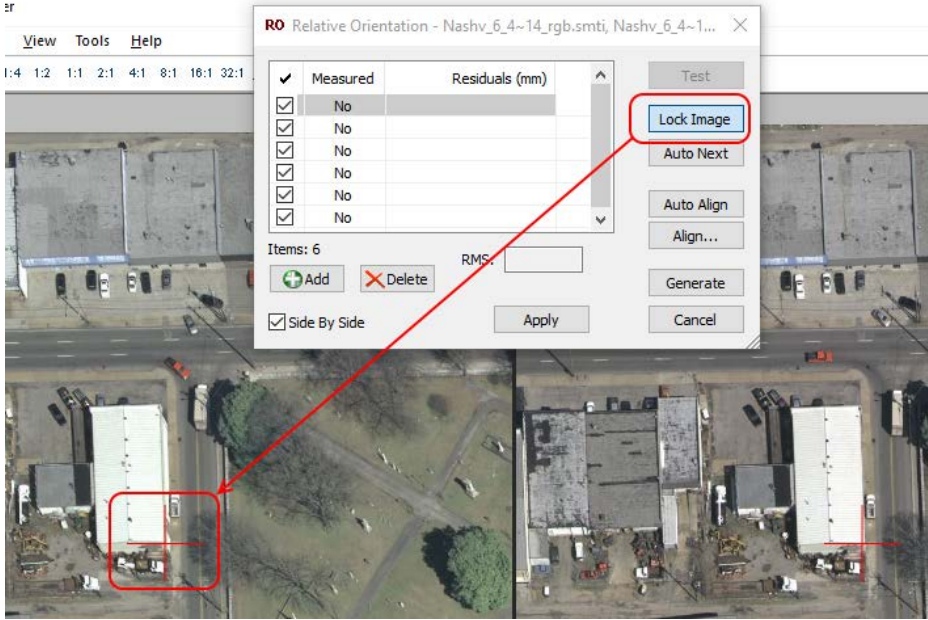
Example of Lock Image on (blue highlight indicates on)

Following the left mouse button click, the **Measured** column will show a **Yes** for that point.
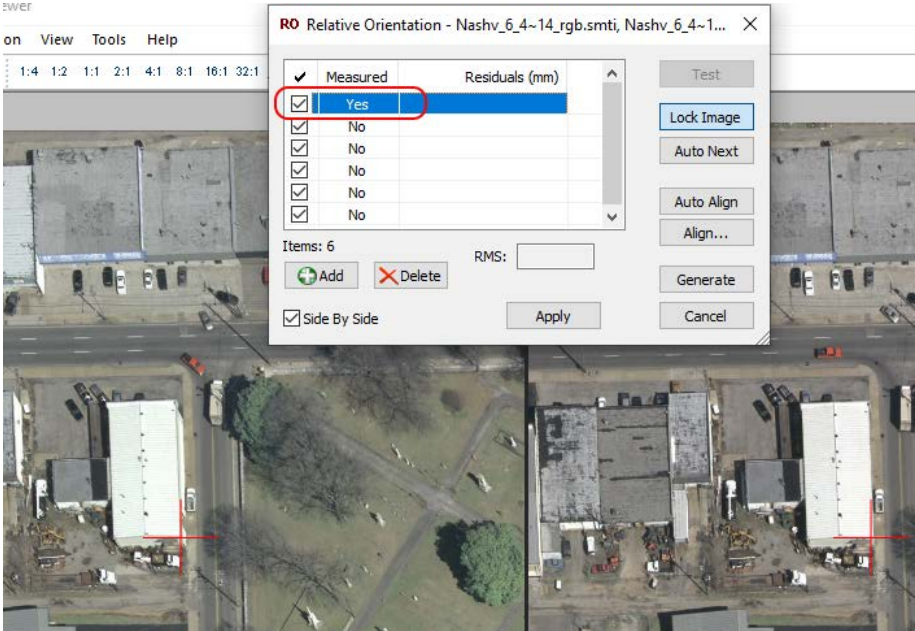
*Example of one point measured, showing **Yes** in the **Measured** column*

Note: It's best to select an object on the ground that has a distinct shape and does not move. Do not select points on the top of thin, high objects, such as sign posts. Do not select moving objects, such as cars and boats, even if they seem stationary. In general, do not pick points on the tops of trees, in case the wind was moving the branches; the exception is if the entire model or Von Gruber area is covered with thick trees and no ground is visible, and even then, be careful to measure the most unique branches that you are sure are the same feature.

Now that you have measured your first tie point in measurement/digitizer mode, zoom out, select the next unmeasured tie point in the dialog, and choose another object that appears in both images. Repeat to measure six, eight, or more tie points across the entire overlap region.

5. Once you have measured at least six or eight points, you will see residual values indicating the quality of the resulting orientation.

- If you see a large number in the **Residuals** column (greater than 1.0, depending on the quality of your images), it is particularly important to review the measurements to see if you can refine the measurements.

- If residuals are very large, search for gross errors. Click on each measured point in the dialog and make sure the same object was measured in both images. If not, remeasure the point.

- To generally improve any initial residuals, click on the **Residuals** column title once or twice to sort the highest residuals at the top. Click on the point with the highest residual, zoom in, and remeasure to try to improve the residuals. Repeat until the residuals are acceptable overall.
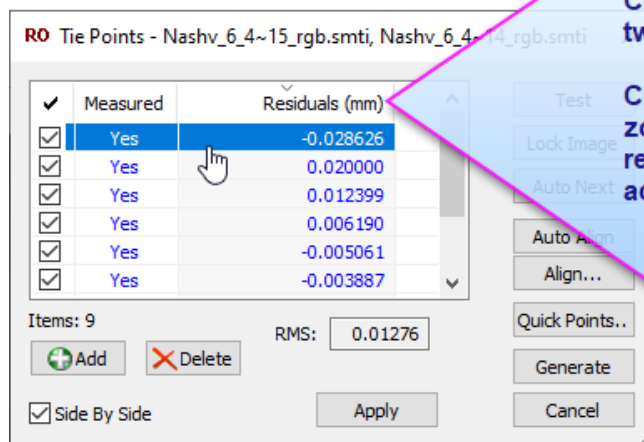
Click on the "Residuals" column title once or twice to sort the highest residuals at the top.

Click on the point with the highest residual, zoom in, and remeasure to try to improve the residuals. Repeat until the residuals are acceptable overall.

- You may also test your stereo solution using the **Test** button. This will allow the cursor to move around in the pseudo relative stereo view as defined by the currently measured points' solution. View the stereo results to see if they are acceptable. When finished, unselect **Test** to return to Relative Orientation measurement mode.

- If you hover the mouse cursor over the **Measured** column, it will display the pixel coordinates for each image.
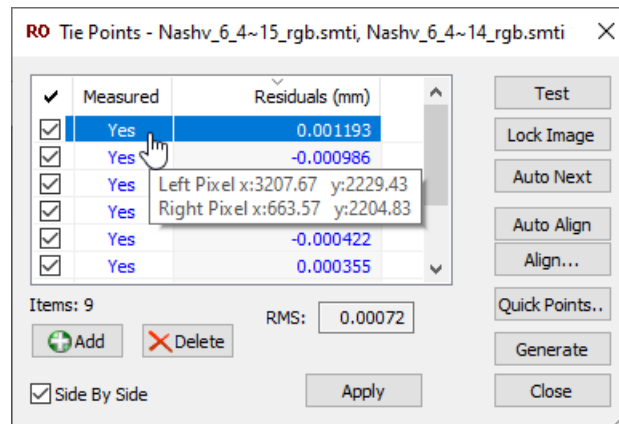

A tooltip shows the pixel coordinates of the measurement

6. When you are satisfied with the solution, press the **Apply** button to activate the results and then close the dialog.

Measure Tie Points Automatically

The manual method can be time consuming. Fortunately, there is a faster way. Tie points may be generated automatically using the **Generate** button. The setup is identical to the manual method, but rather than manually selecting and measuring each point, Stereo Viewer will generate tie points for you.

Sometimes this method fails and in general it will always provide some points that are not good. This section covers generating points as well as locating and removing bad points.
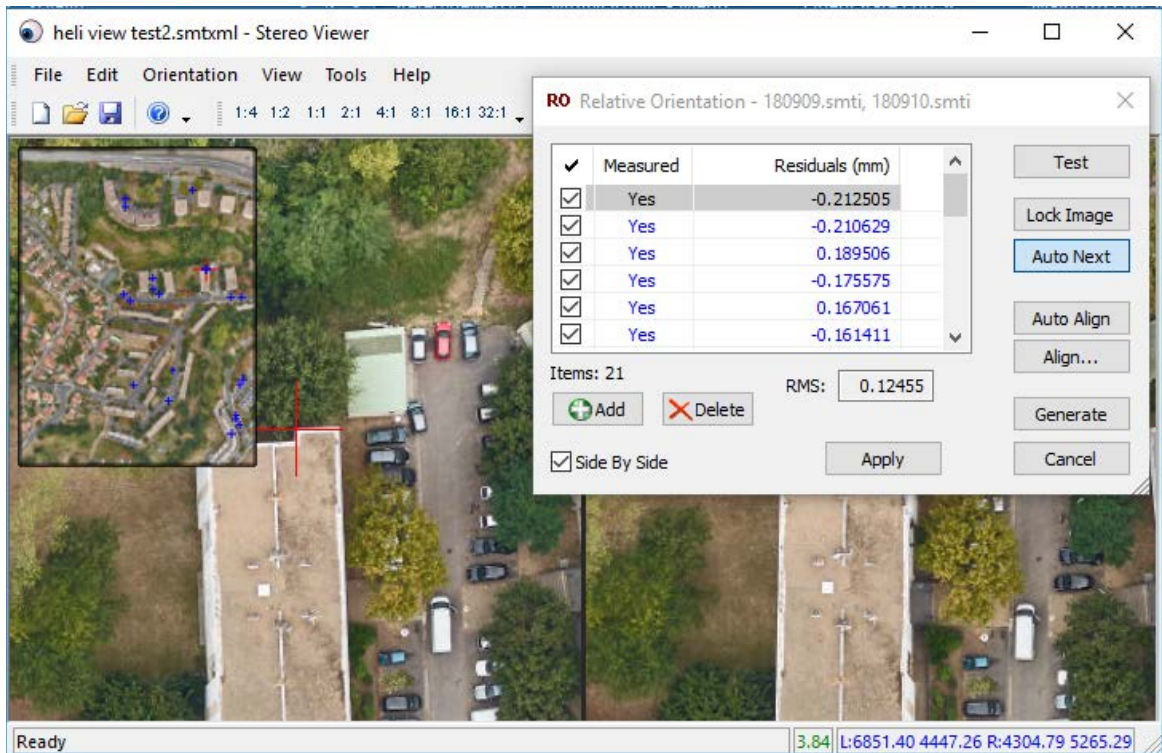
*Example of the results of automatic RO tie point generation*

To run the Automatic Tie Point method:

1. Select **Stereo Viewer** > **Orientation** > **Tie Points** > **Generate** button. This **Generate Tie Points** dialog will appear. Press the **Process** button. The Generate Tie Points tool will generate several **candidate** points.
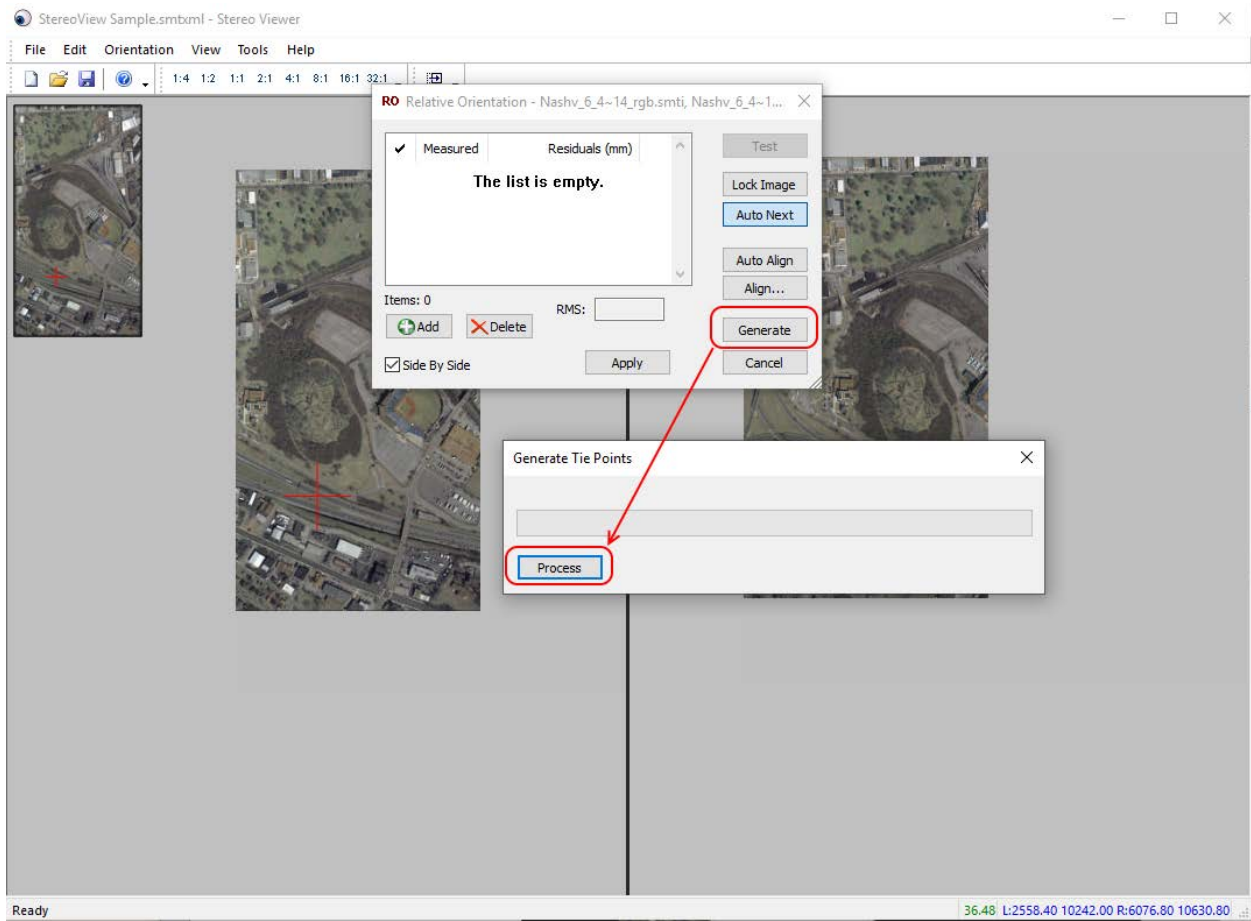
Generate and *Process* buttons for automatic tie point generation

2. In order to identify inaccurate points in the solution, sort the points by their residuals. This can be done by clicking once or twice on the **Residuals (mm)** column to sort the highest residuals to the top of the list.
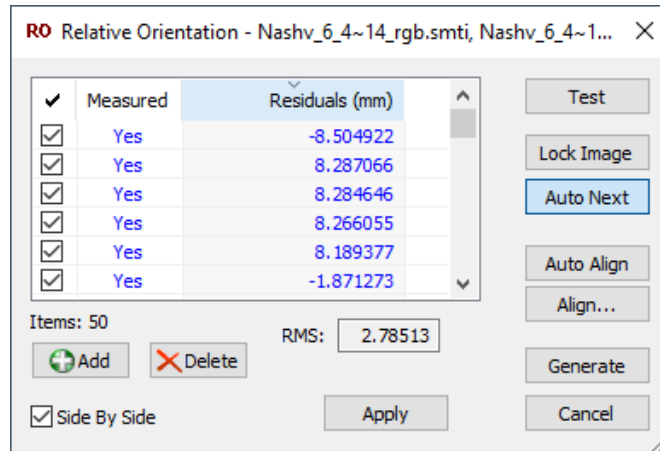

Example of Residuals sorted with the highest at the top of the list

3. Pick the point with the highest residual value. Stereo Viewer will drive the cursor to that point. In some cases, the point will be obviously incorrect. In others it may be more difficult to tell whether it is wrong. Look for objects that are similar, but not the same, such as a row of similar painted marks on a parking lot or a row of guard rail posts. Also look for moving objects such as cars, trucks, or boats; they make poor tie points.

4. To delete poor tie points, select them and press the **Delete** button. Examples:

- Below is an example of a car on a freeway. It is the same car, but since the car is moving, it may not be used as a tie point. Press the **Delete** button to remove bad tie points.
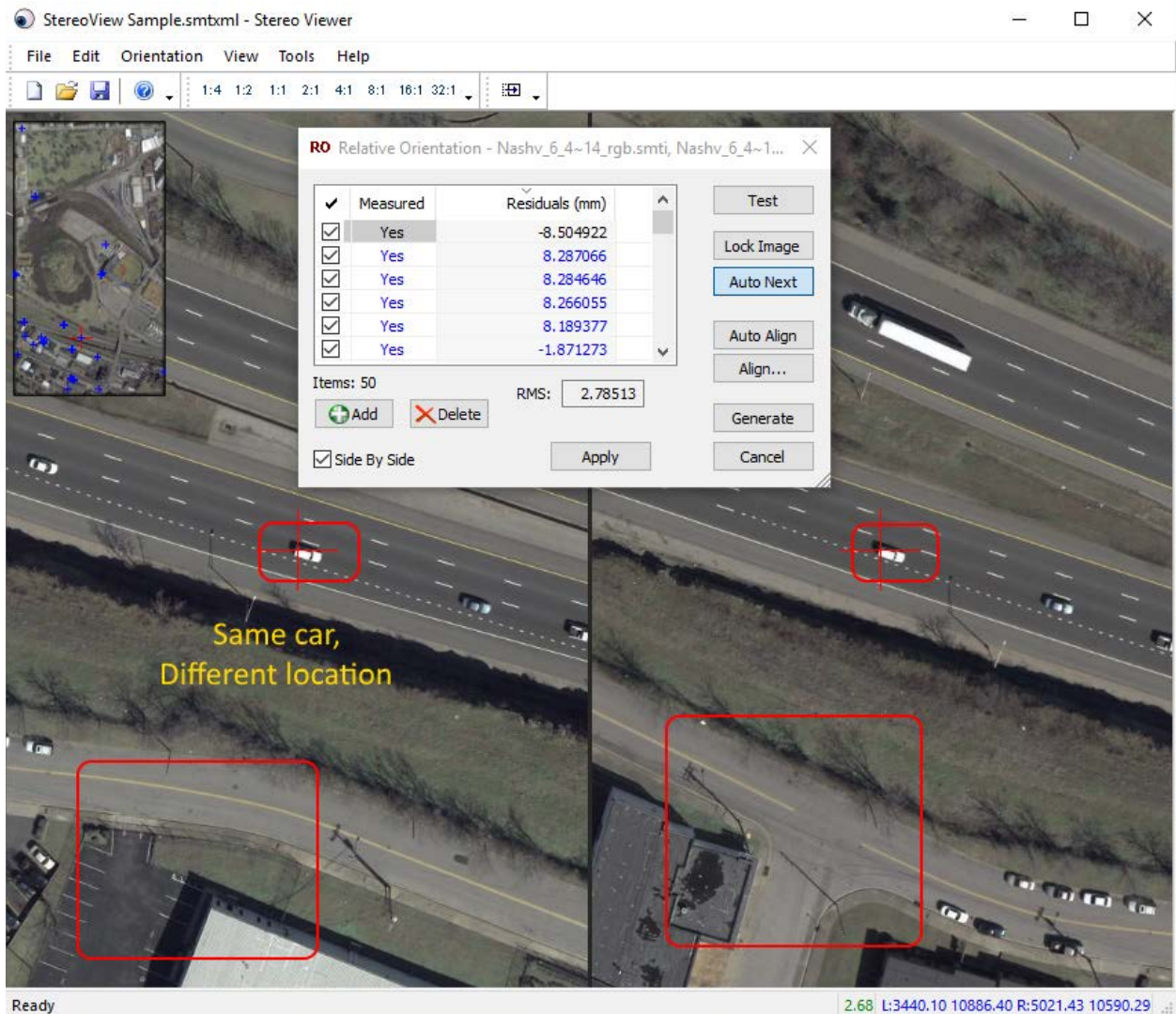
Example of the same object that has moved between images (delete)

- Below is an example of objects that are similar, but not the same. In this case you may either re-measure the object manually or just delete the measurement. It is not recommended to use cars as tie points, even if they appear to be parked.
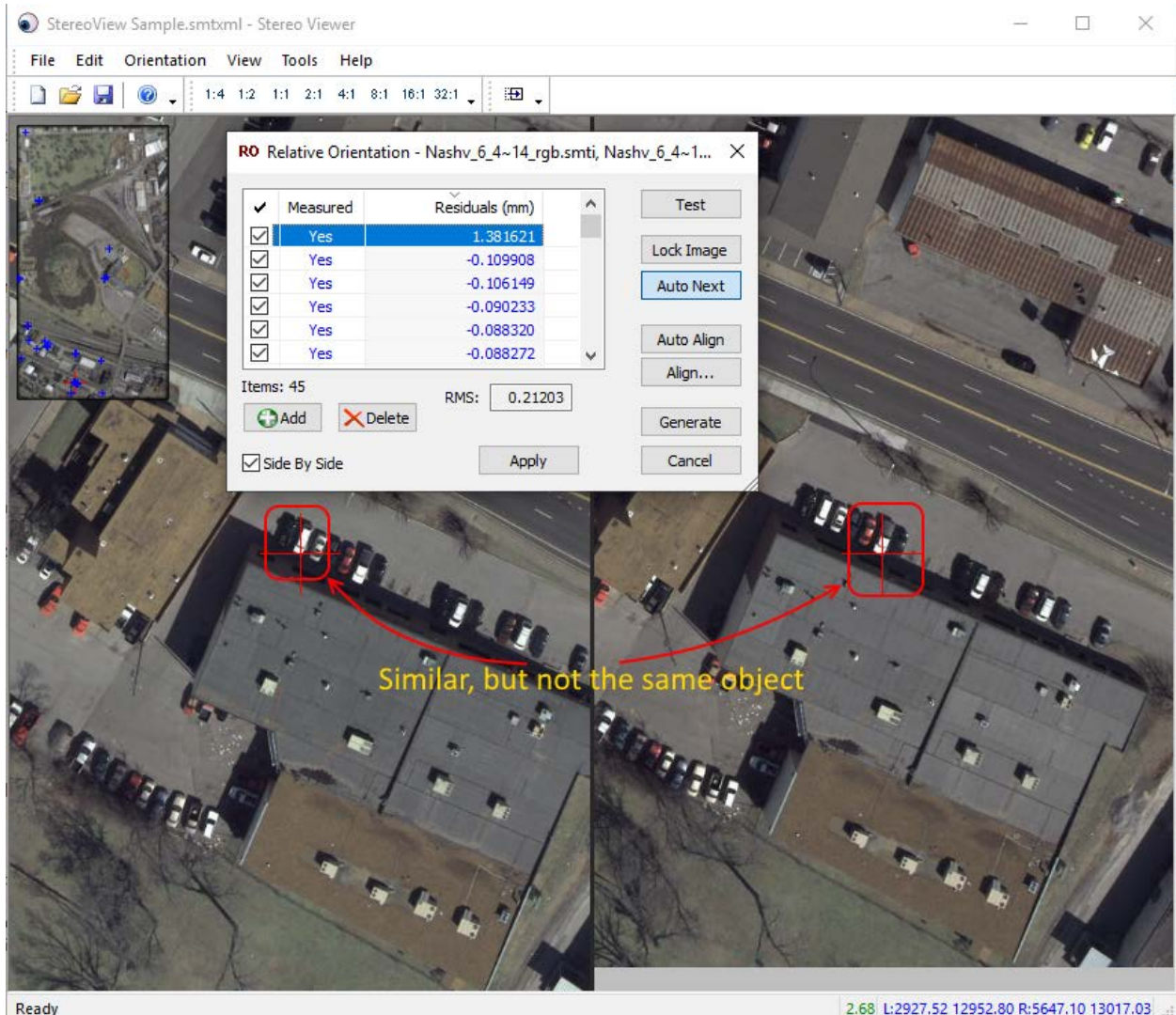
Example of different objects that are similar enough to create a false match (remeasure or delete)

5. While you are deleting and remeasuring objects, keep an eye on the **Overview** window in the upper left. Make sure that you have a fairly even distribution of measured points across the entire overlap area.

For best results, ensure there are points in at least the six Von Gruber locations (Von Gruber points are traditional for photogrammetry: Upper left, center left, lower left, upper right, center right, and lower right, all somewhat inside the edge of the stereo area). It is acceptable to have many more points than in the Von Gruber locations, but if it misses the general area of one or

more Von Gruber locations, you should manually measure a point in each missing area, if possible. It may not be possible if the area shows a lake or the ocean.

Manually add points to areas that do not currently have points.

Find any areas that lack points and manually measure more

6. Make sure that you have at least six points that cover most of the overlap area to obtain a high-quality stereo view. If you intend to try **Rectify** later, you should have at least eight points. Press **Apply** and then close the dialog when you are finished.
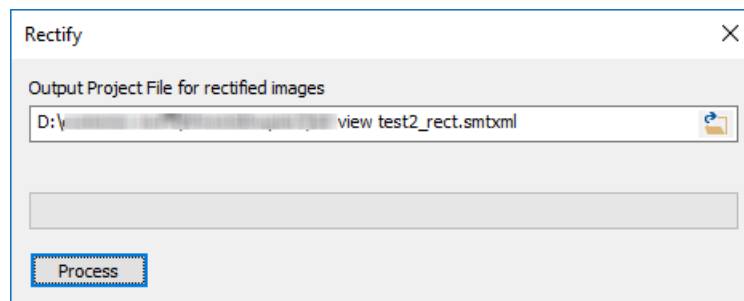
Rectified Orientation

Rectify is the preferred method to get the best stereo, but only if it gives good results. It is optional.

Try **Rectify** only after the project has at least eight manually or automatically measured tie points (see sections above).

**Rectify** uses computer vision methods to generate new rectified imagery. To use:

1. Select **Stereo Viewer** > **Orientation** > **Rectify**. This dialog will generate two rectified images and a project file containing those images.
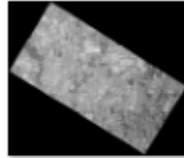

***Rectify** asks for the .smtxml that contains eight or more tie points*

2. To check out the orientation, load the new project (**Stereo Viewer** > **File** > **Open** the resulting .smtxml).

Potential Failure of Rectified Orientation: The Rectified Orientation is the preferred method, but it does not always work. On typical image pairs, DAT/EM testing did very well; however, the following images with a 55 degree rotation had problems during beta testing:
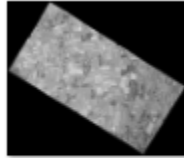
1944-08-03_US7-2623_5040.tif   1944-08-03_US7-2623_5041.tif

These were the images supplied courtesy of Schneider Digital, makers of PluraView monitors. The DAT/EM Stereo Viewer rectification had inconsistent results on such images. In cases like this, the pseudo relative (RO Tie Points alone) will have to suffice.