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DAT/EM Stereo Viewer Operation Manual

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Introduction to DAT/EM Stereo Viewer

The DAT/EM Systems International Stereo Viewer is a new product introduced with DAT/EM version 7.6. 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 stereoplottter 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:

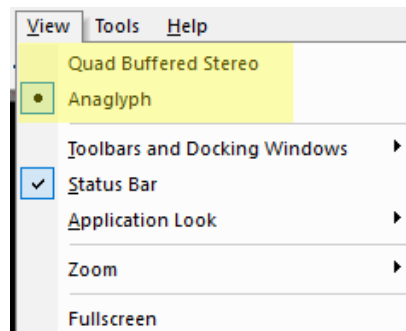
- You will need to own a DAT/EM Stereo Viewer license and obtain an installation keycode in order to install this application.
- DAT/EM Stereo Viewer added to existing DAT/EM hardware locks will require a WriteLock program from DAT/EM Support.
- Stereo Viewer works with Windows 7, 8.1, and 10 Professional and Enterprise. Note: DAT/EM will drop support for Windows 7 on January 14, 2020 and for Windows 8.1 on January 10, 2023.
- 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 stereoplottter:

- 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.
- As of DAT/EM v.7.6 beta of 23 January 2019, the Stereo Viewer project can be opened by Summit Evolution; however, 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.



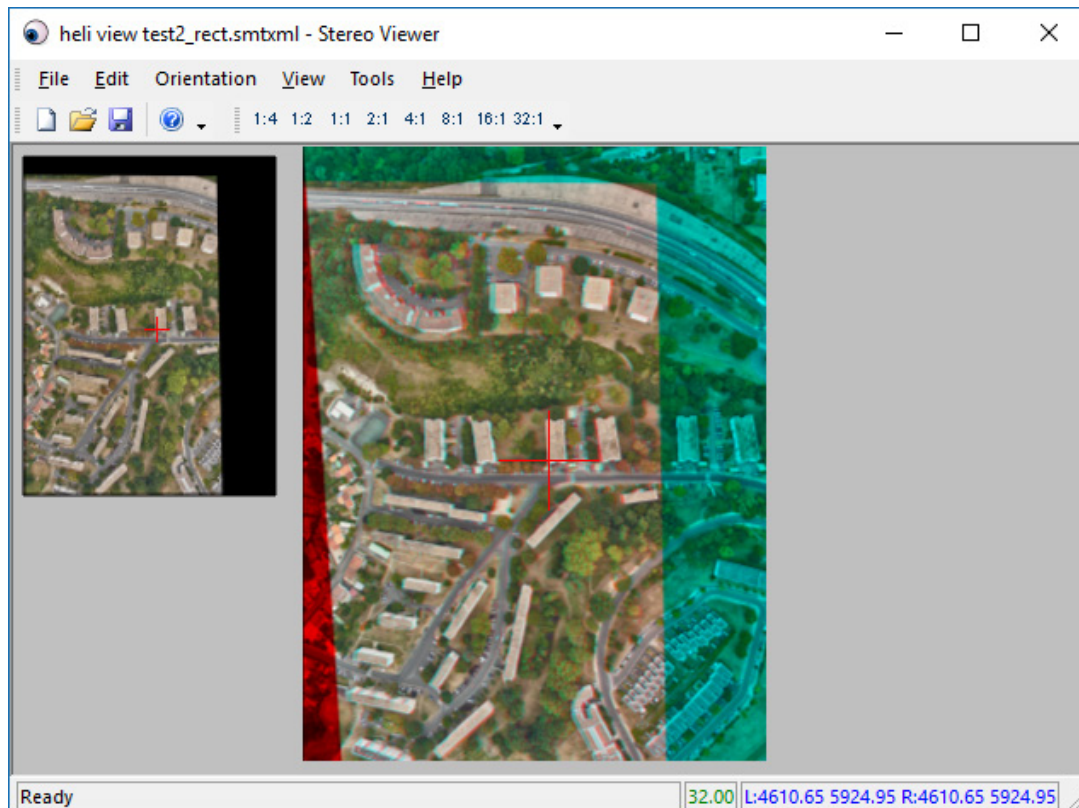
Two project types: Quad buffered stereo and anaglyph

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 3D Vision. 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.

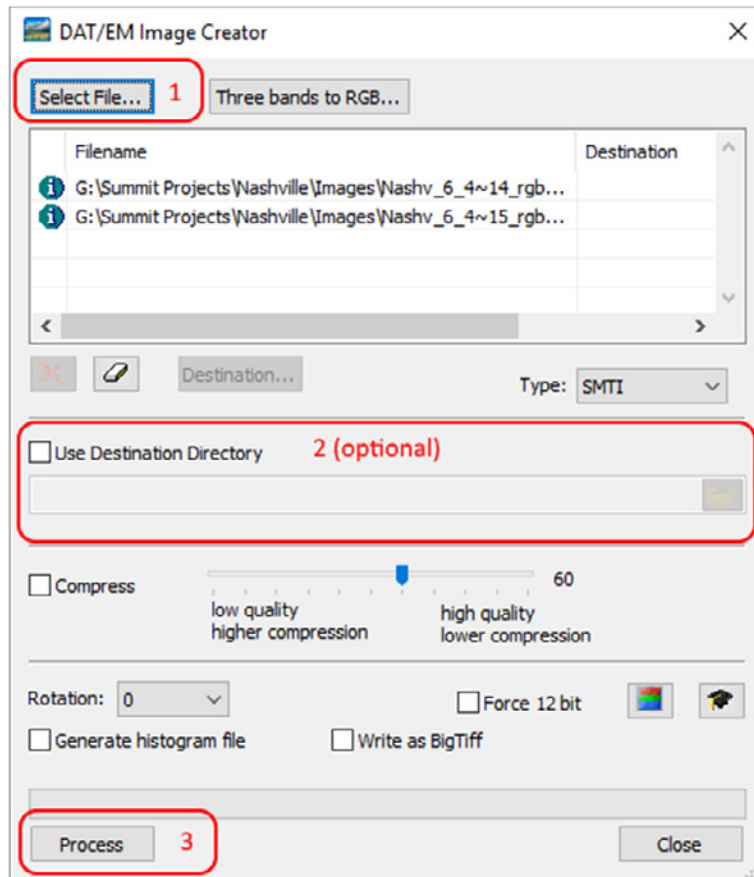
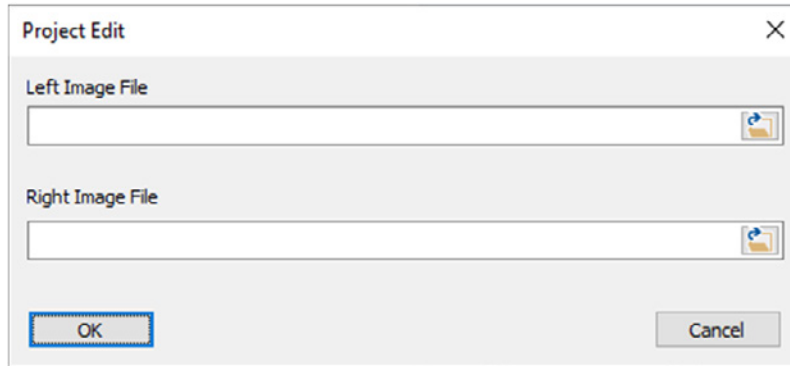


Image Creator

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 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. 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.



Project Edit

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.

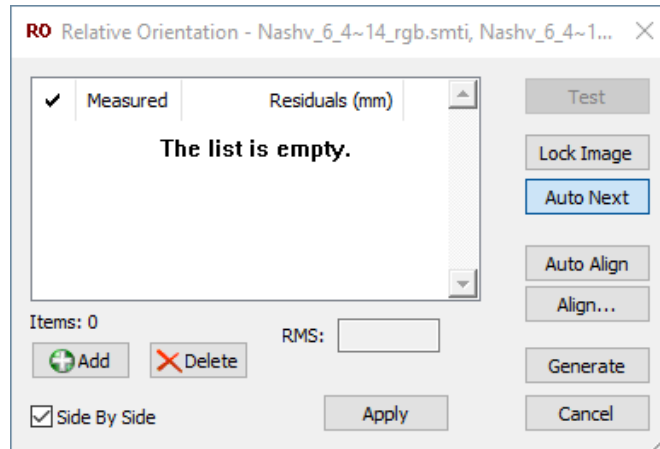
Always measure tie points first. Choose either manual or automatic measurement from the sections below.

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.)



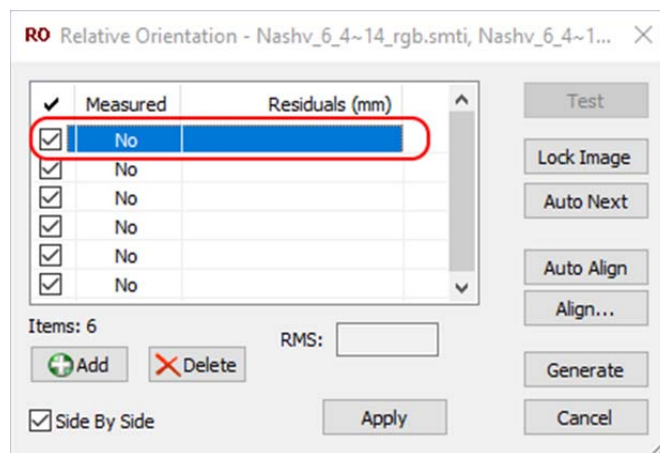
Stereo Viewer's [pseudo] Relative Orientation dialog

2. Press the  button at least six times to insert blank tie points into the list.
3. Perform an initial image alignment by selecting either the **Auto Align** or the **Align...** button. this will help set the overlap for the two images, making point selection easier.

For the following steps, make sure that the **Auto Next** button is **not** checked.

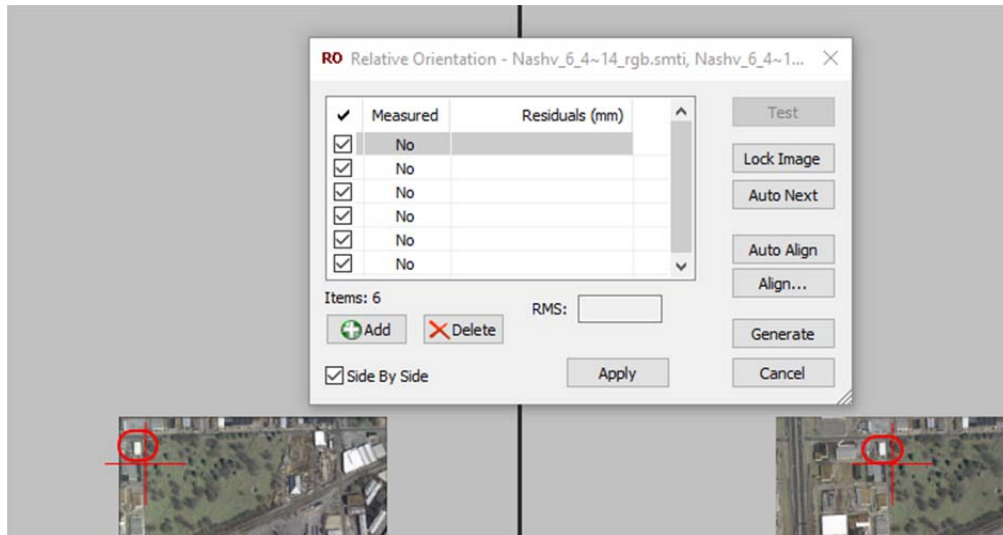
4. You will be using the red cursor in the center of the screen to measure the tie points.
 - To begin measuring, click the right system mouse button in the Stereo Viewer main view.
 - Note that when you move, the images will shift under the cursor.
 - To exit measurement mode, either click the right system mouse again or press the Escape button on the keyboard.

Highlight the point you would like to measure.



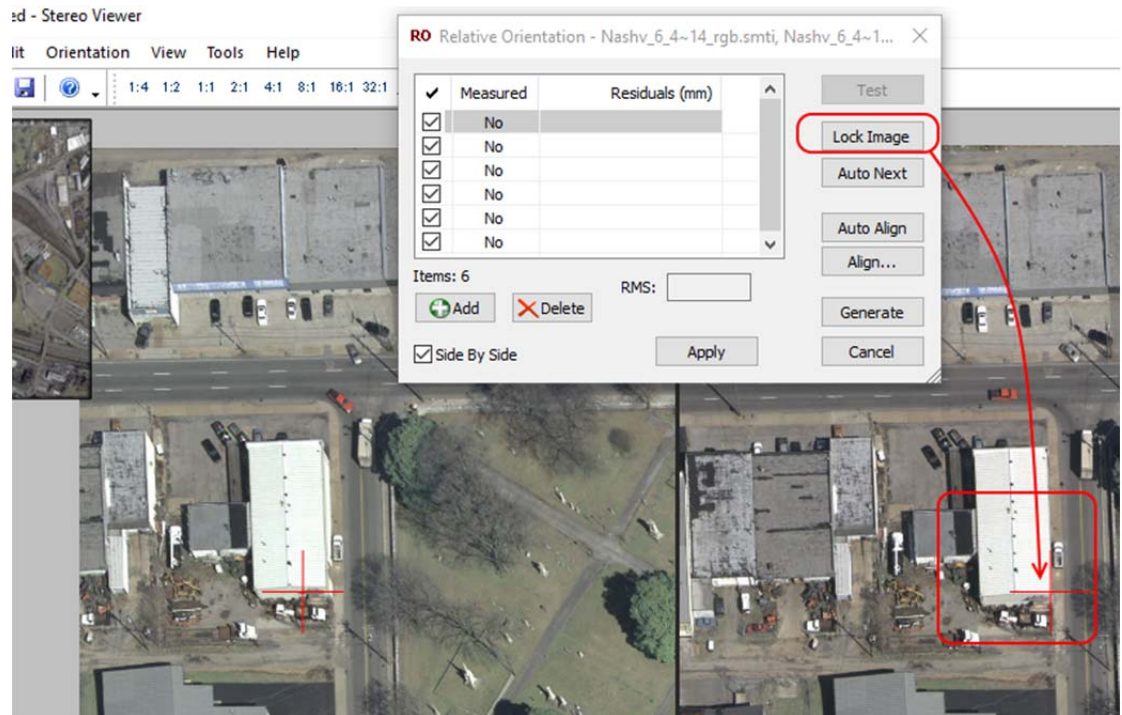
Example of a highlighted point that does not yet have a measurement

5. Choose an object that appears in both images. Measure it as described below.



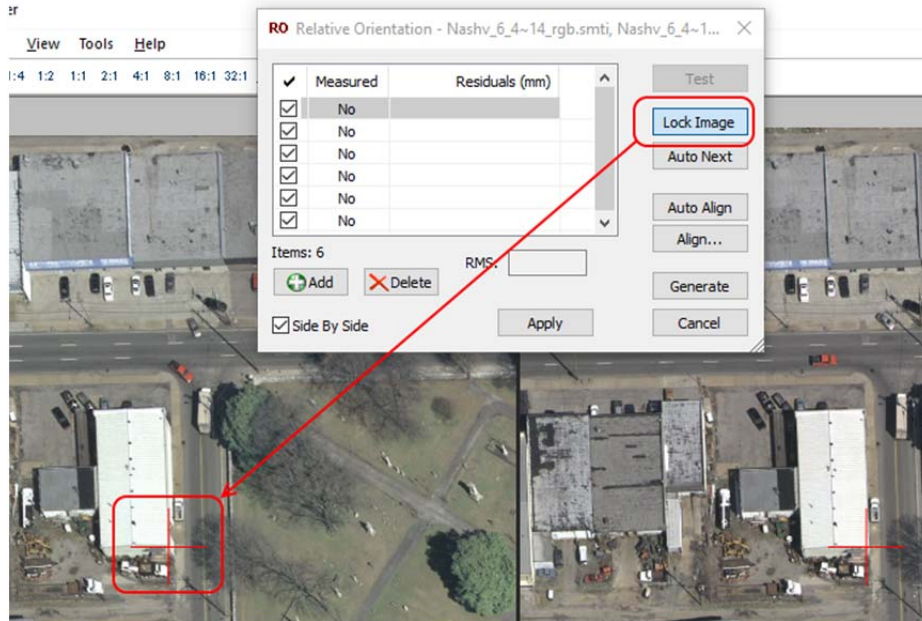
Example of an object that can be found on both the left and right images

- ✓ 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 just spin the mouse wheel to zoom.
- ✓ Make sure that the **Lock Image** button is **not** highlighted. 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.



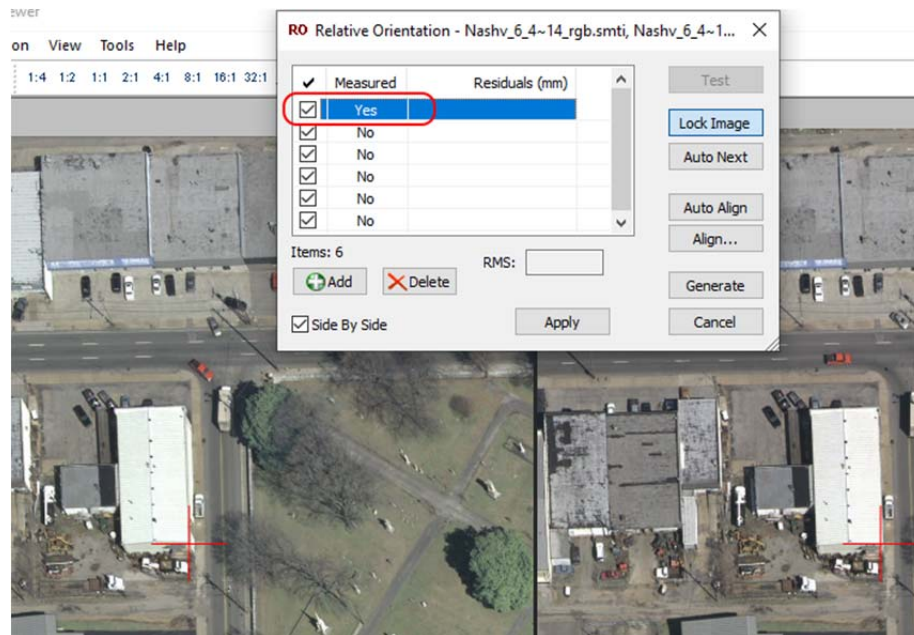
Example of Lock Image off (light gray color indicates off)

- ✓ 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. When the cursor is on it, measure it by clicking the **left mouse button**.



Example of Lock Image on (blue highlight indicates on)

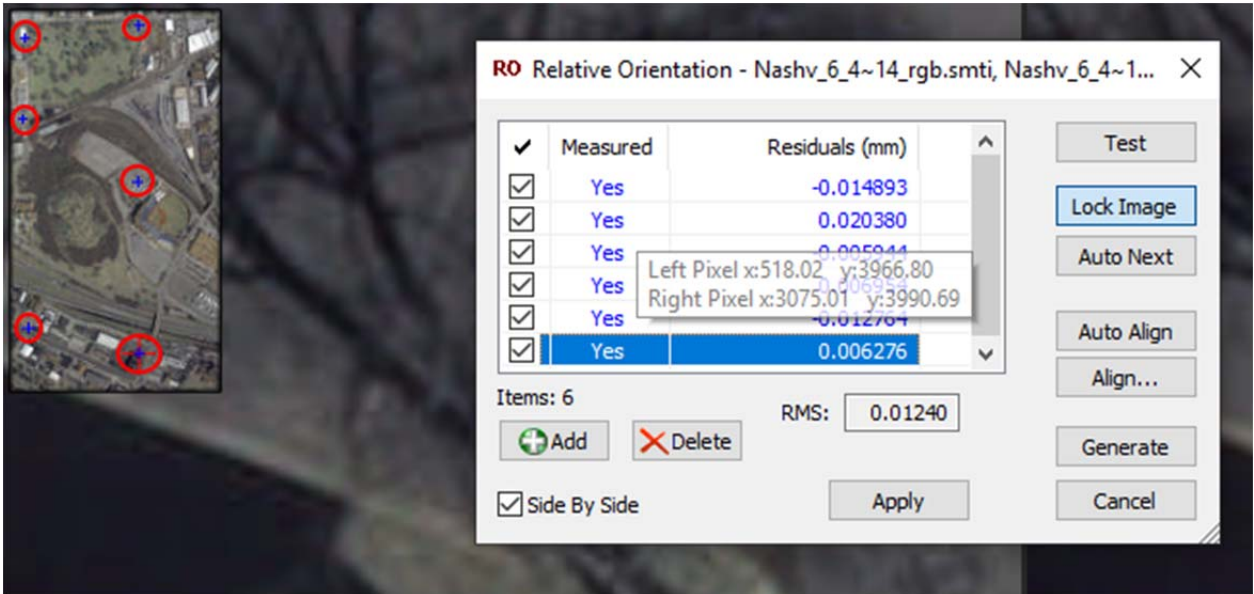
Following the left mouse button click, the **Measured** column will show a **Yes** for that point.



Example of one point measured, showing **Yes** in the **Measured** column

- Now that you have measured your first tie point, 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. 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.

7. Once you have measured at least six 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), review the measurements by clicking on each measured line in the dialog and make sure the same object was measured in both images.
 - If a point is not measured on the same object in both images, repeat the measurement steps for the highlighted line/object to replace the measurement.
 - 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.

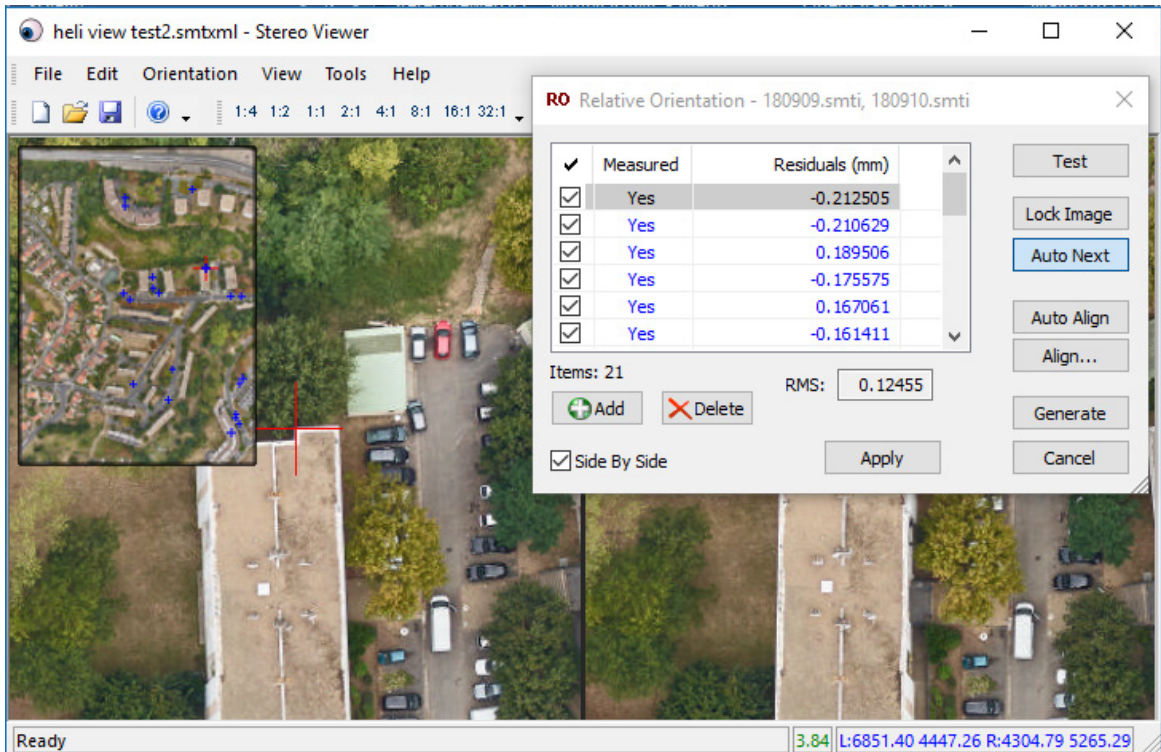


Example of hovering the mouse cursor over the Measured column to show the pixel coordinates

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

Measure Tie Points Automatically

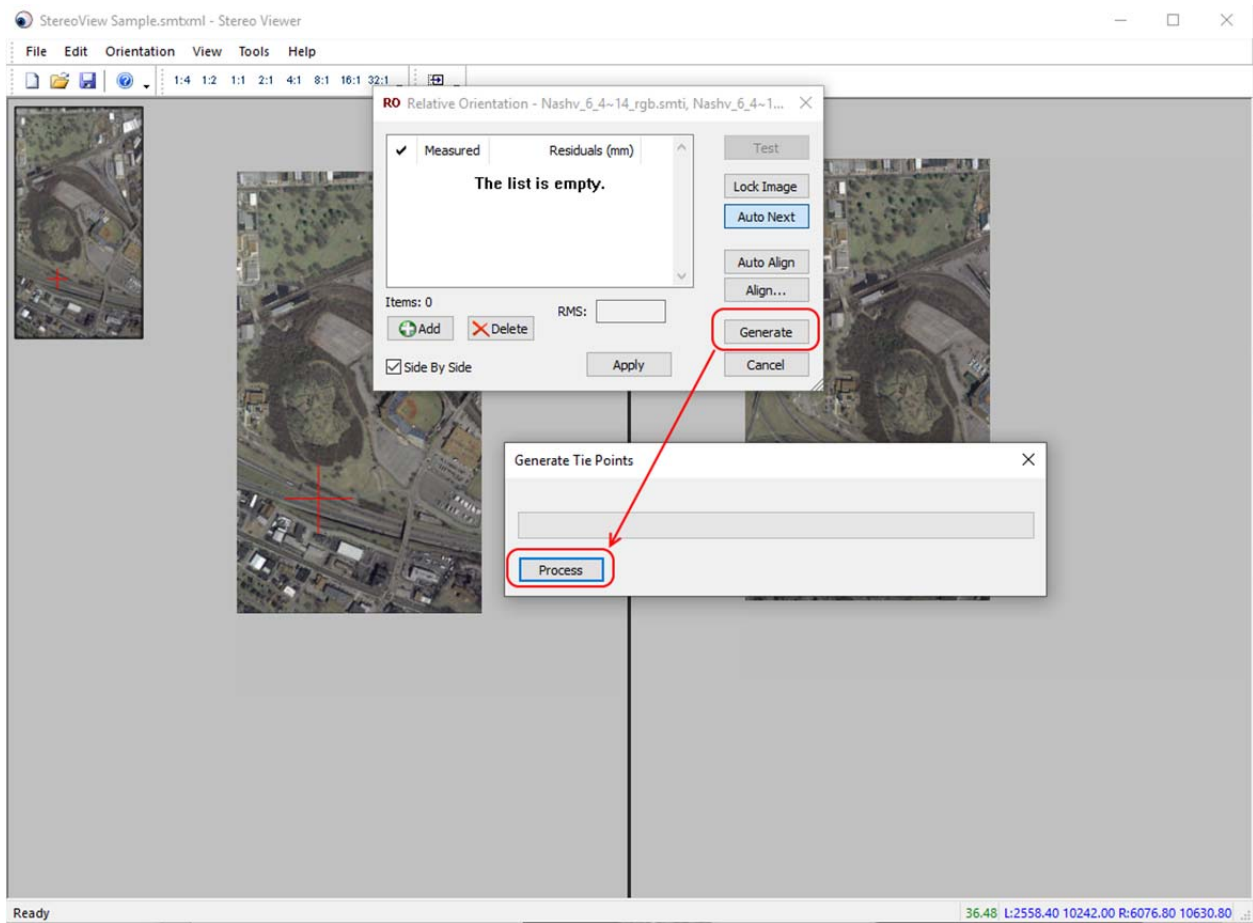
The manual method can be time consuming. Fortunately, there is a faster way. Tie points may be generated automatically using the **Generate** button. The setup is identical to the manual method, but rather than manually selecting and measuring each point, Stereo Viewer will generate tie points for you.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

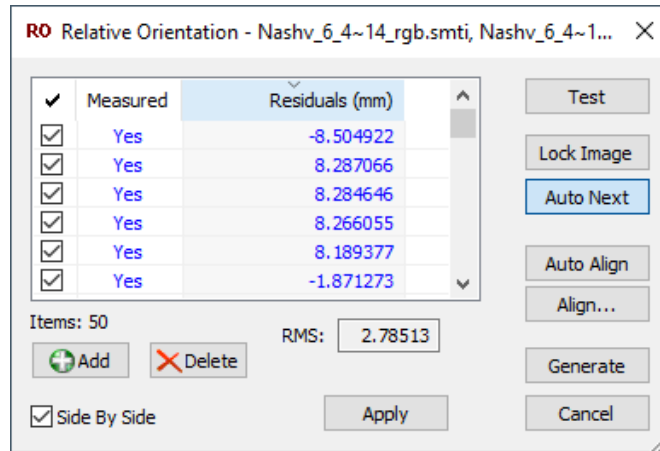
To run the Automatic Tie Point method:

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

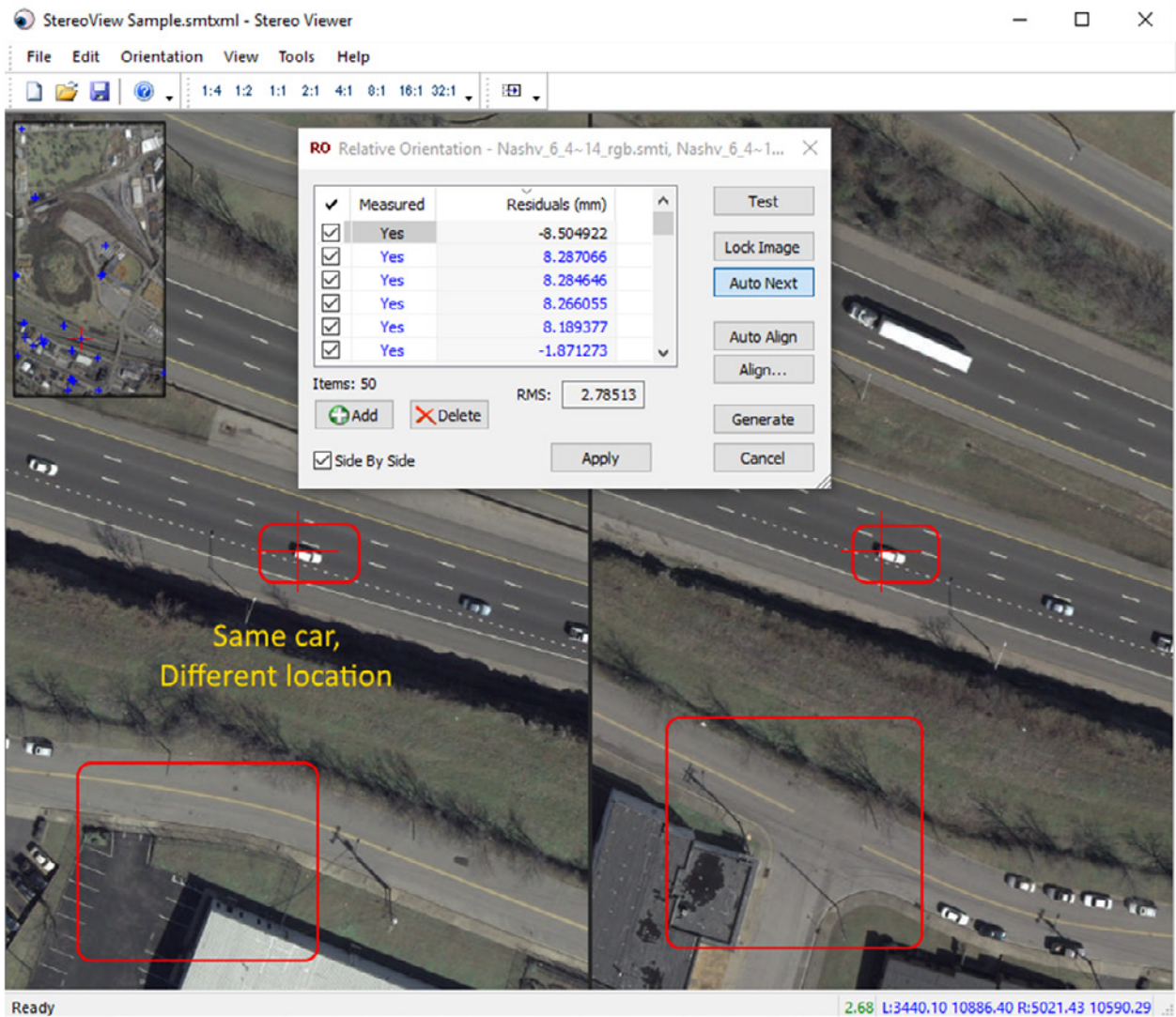
- In order to identify inaccurate points in the solution, sort the points by their residuals. This can be done by clicking on the **Residuals (mm)** column. You may need to click twice to sort the highest residuals to the top of the list.



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

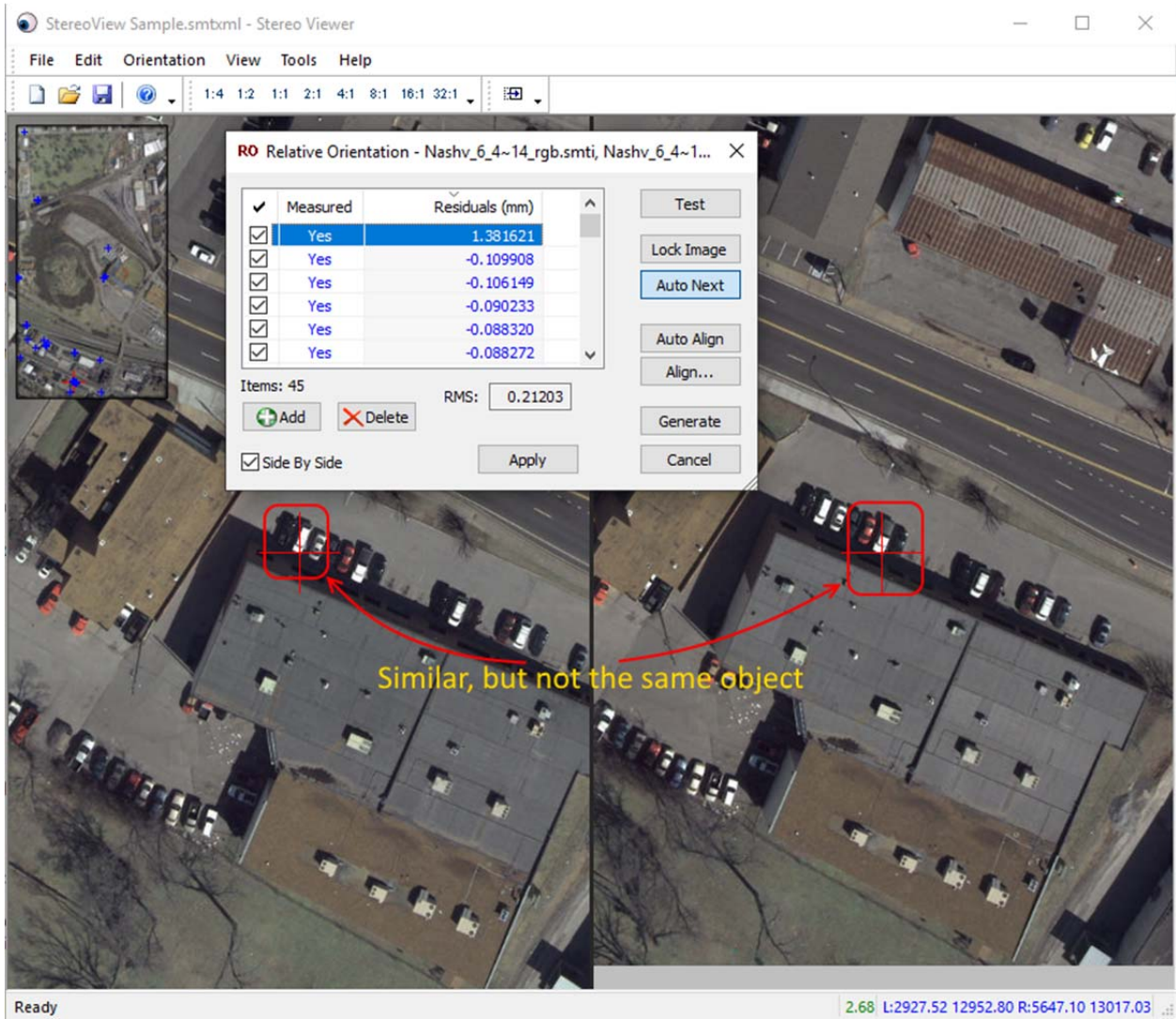
- Pick the point with the highest residual value. Stereo Viewer will drive the cursor to that point. In some cases, the point will be obviously incorrect. In others it may be more difficult to tell whether it is wrong. Look for objects that are similar, but not the same, such as a row of similar painted 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.
- 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 poor 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.



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.

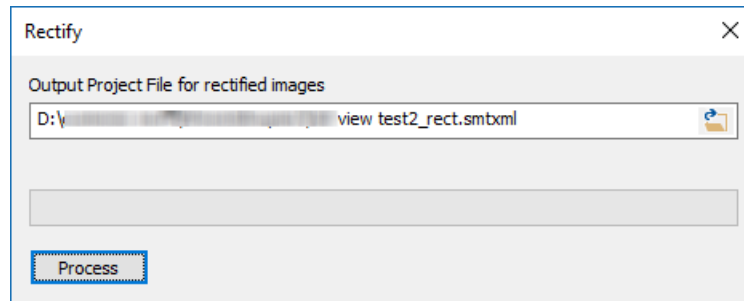
Rectified Orientation

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:

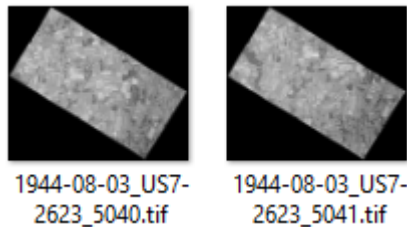
1. Select **Stereo Viewer > Orientation > Rectify**. This dialog will generate two rectified images and a project file containing those images.



***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:



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.