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SOLUTIONS

VIC-EDU User Manual

Version 6
2021

VIC-EDU Testing Guide

Completing a test with the VIC-EDU system is streamlined to make the process as straight-forward as possible. This manual explains the procedure from start to finish, including:

Note: throughout this manual, we refer to the VIC-EDU system in two ways. The hardware (case, cameras, cords, calibration target) are referred to as "VIC-EDU" and the software (the special version of VIC-3D and VIC-Snap that are designed for this system) as "VIC-3D (EDU)" and "VIC-Snap (EDU)".

Prepare the Specimen with a Speckle Pattern

Prepare the region of interest of your test specimen with a speckle pattern. In order to provide good tracking information, the speckle pattern should consist of the following characteristics:

- **High contrast:** Either dark black dots on a bright white background or bright white dots on a dark black background.
- **50% coverage:** Ideally, there will be equal amounts of white and black on the surface. Therefore, it is important to make sure the pattern is dense enough, which typically requires 2-3 applications using the roller or the stamp.
- **Consistent speckle sizes:** Speckles should be ideally 3-5 pixels in size in order to optimize spatial resolution, but the most important thing is that the speckles are consistent in size and not too small (less than 3 pixels in size is too small and can cause aliased results).
- **Isotropic:** The speckle pattern should not exhibit a bias in any particular orientation.
- **Random:** While it is difficult to achieve a pattern regular enough to cause false matching, if you print repeating patterns it can occur.

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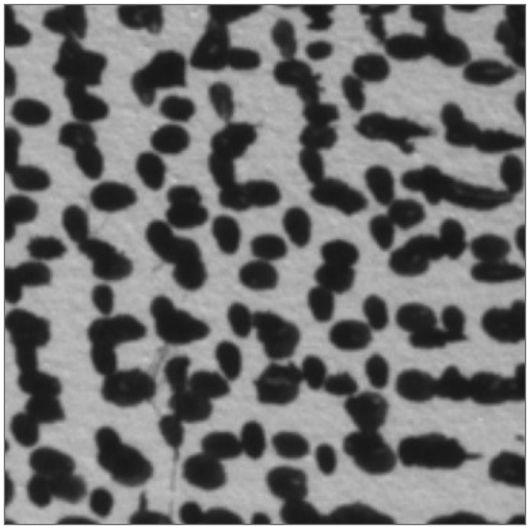
For the fixed-field of view of this system, perfectly sized individual speckles would be 0.6mm (0.025”) in size. Larger speckles can be okay, but they should not be any smaller. An easy way to create this pattern is by applying a white spray paint base coat to the specimen surface. Avoid paint applications that are too thick by using quick passes with the spray can - just enough to cover the surface. When the basecoat is adequately dry, use the speckle roller supplied with your system to apply ink speckles. Several passes with the roller may be needed to achieve a dense enough pattern of speckles.



Example of speckle pattern created using ink roller. High contrast, about 50% black/white, random.

A more thorough explanation of speckle patterns and commonly used techniques is provided in **Application Note: Speckle Pattern Fundamentals**, available through our online knowledgebase.

Physical Setup of the VIC-EDU System

Tripod

Begin by assembling the tripod. Screw the tripod head adjustment handles into the tripod head. Adjust the length of the tripod legs by releasing the levers on the legs, extending them to the desired length, and clamping the lever back down. Level the tripod head by turning the adjustment handles counter-clockwise to allow the head to rotate and then tighten them back to lock. There is a bubble level on both the tripod and tripod head to assist in leveling the system.

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Mounting System on Tripod Head

Next you will secure the system to the tripod. Screw the baseplate into the bottom of the system if not already installed. Open the locking mechanism on the tripod head by squeezing the small lever together and rotating it outwards. Align the baseplate with the tripod head and push it into place. The locking mechanism should snap shut when correctly secured.

Baseplate mounted to the bottom of the VIC-EDU system.

Cables

There are only two cables needed for the system. The first is the *USB 3.0 type A to type B* cable. Plug the type B end into the back of the system and the type A end into your computer's USB 3.0 port. The second cable is for the power supply which also plugs into the back of the system. Plug this in to supply power to the light and system fan.

Using VIC-Snap (EDU)

Once you have prepared the specimen with a speckle pattern and mounted the system on the tripod, open VIC-Snap (EDU). If you are prompted to select a camera system, choose *Point Grey*. This is the manufacturer of the cameras used in the system. You should see two live image feeds, one from each camera in the system. If you need to rotate the images so that they are in their correct orientation, right-click on the rotation angle below the image feed and select the appropriate orientation.

Placement of Specimen

The geometry and focal length of the system are set such that you should place your test specimen at about 0.5 meters from the system. To help center the specimen in the field of view, it may be useful to toggle the crosshair overlay from within VIC-Snap (EDU). When perfectly aligned, both the crosshair centers will be on the same location of the specimen surface.

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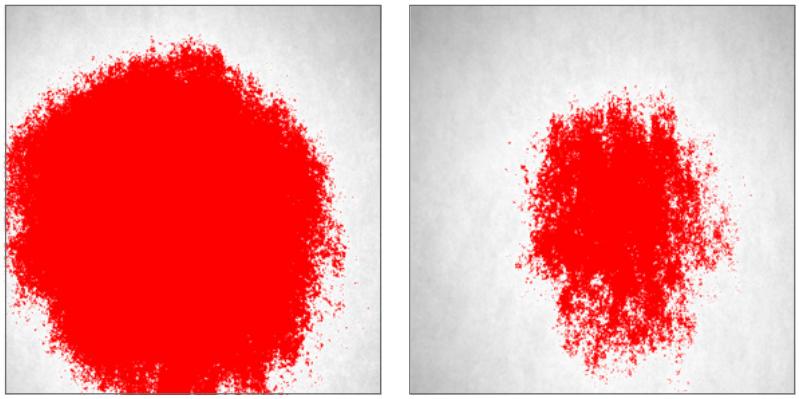
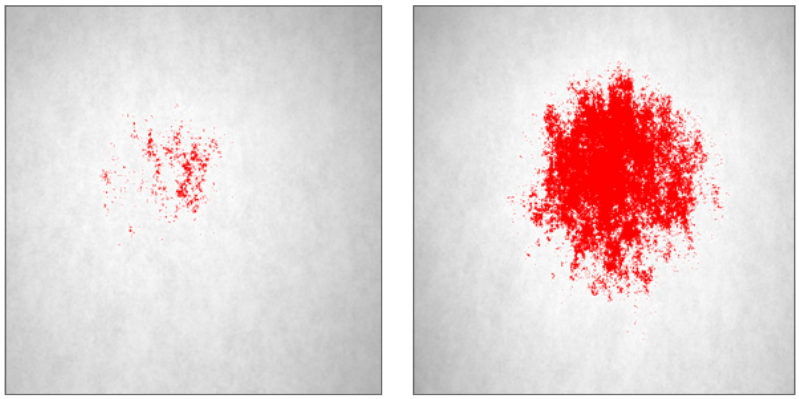
Polarizers

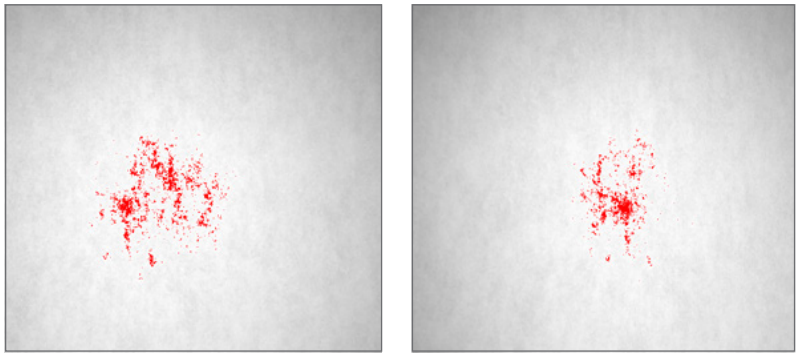
Polarizing lenses are used to minimize potential reflections from the specimen's surface that would cause problems in correlation. To be effective, the polarizers for both cameras should be positioned at the same orientation and the polarizer for the light should be rotated 90 degrees from the camera polarizers' orientation. One way to accomplish this is to point the system at a surface and adjust the exposure time in VIC-Snap (EDU) until some of the image is slightly overexposed, indicated by the red overlay. Rotate one camera's polarizer until the amount of overexposure is at a minimum. Then rotate the second camera's polarizer to also minimize overexposure. Successfully doing this will make the images appear darker.



Adjust exposure time so images are intentionally overexposed.



Adjusted left camera polarizer until overexposure is at a minimum (least number of red pixels).



Adjust right camera polarizer similarly; both match and have minimum red pixel overlay.

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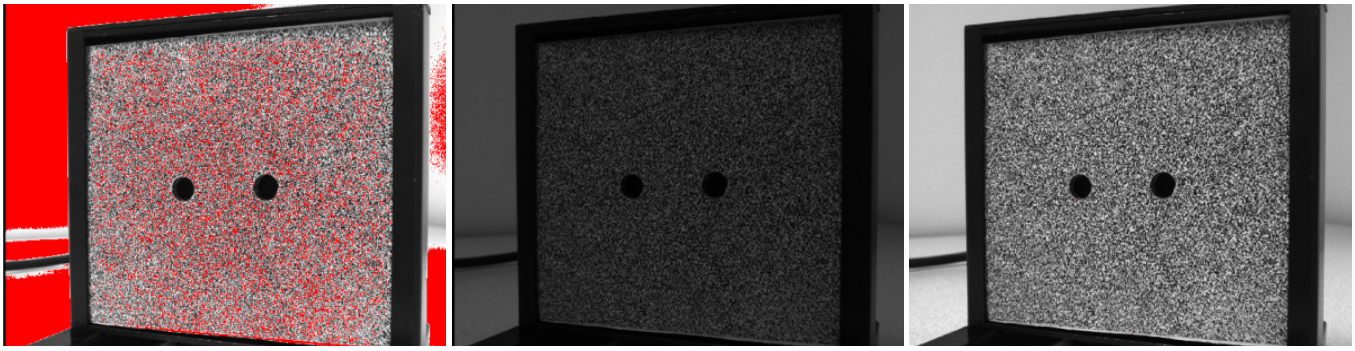
Exposure Time

Exposure time is the amount of time the camera sensors gather light before recording a new image. Longer exposure times make the image brighter but can also result in blur if significant motion happens during the exposure. For many tests, blur is not a concern for the specimen but can be an issue when acquiring images of a hand-held calibration grid.

Adjust the exposure time for each camera in VIC-Snap (EDU). This is done by using the slider bar below each image viewer or by using the bracket keys. The cameras are synchronized so that adjustments made to one camera impact both. The range of the slider can be adjusted by right-clicking the bar and selecting a new range. When acquiring images, the exposure time should be great enough that there is enough contrast between blacks and whites, but not too long that the image is overexposed or frame rate is limited. Overdriven pixels are indicated by the red overlay.



Exposure too long (overdriven) *Exposure too short (too dim)* *Correct exposure*

Capture Calibration Images

Before beginning calibration, make sure your tripod and system are fully secured so that they do not move during or after calibration. Even small movements of the system can disrupt the calibration and result in errors and measurement bias. Changing the exposure time, however, does not disrupt calibration and can actually help make sure all images have good brightness.

The goal of the calibration process is to take images of the calibration target in a range of orientations that include tilting the target forward, backwards, and rotating the target. Because the calibration target is rigid, these images can be used to perform shape measurements of the target and determine the camera models and system parameters.

Positioning Target

The calibration procedure calculates variables about the camera geometry and positions; it is not specific to a plane or volume in space. Therefore, it's not necessary to position the calibration target in the exact same location as the intended specimen. Still, it will be most convenient to place the target in roughly the intended plane. This will ensure that the cameras point correctly and the target is in focus.

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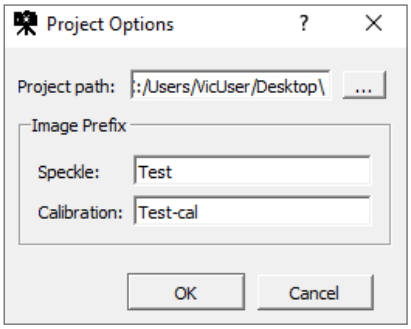
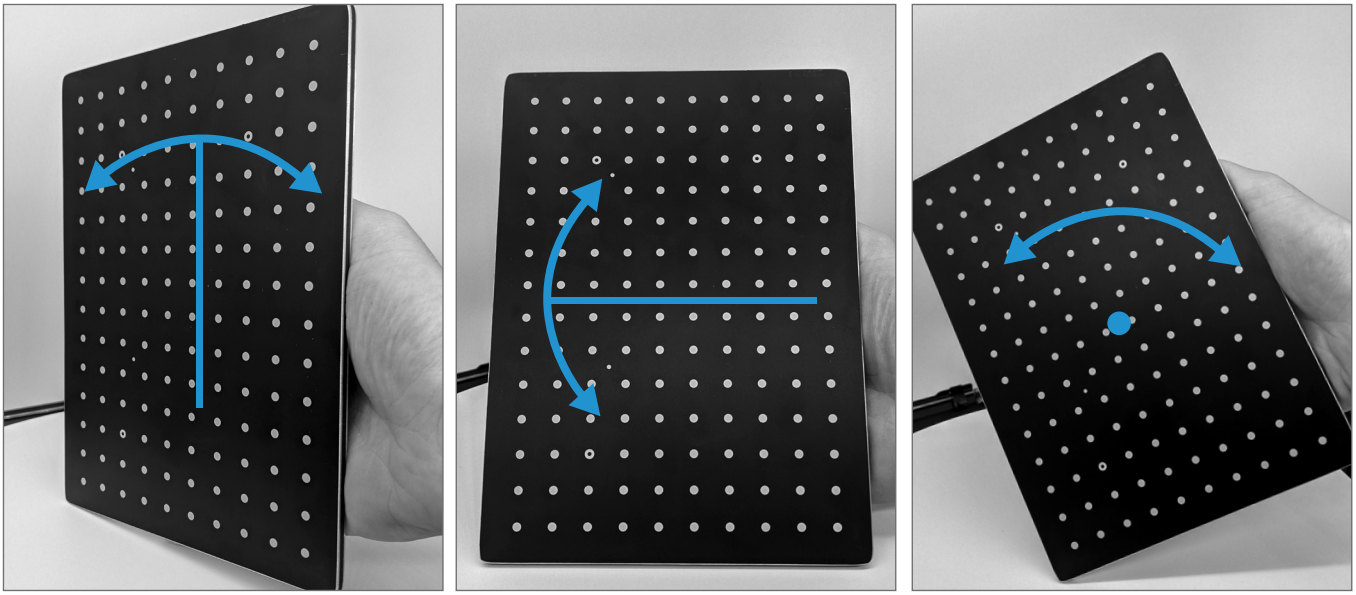
Optimally, the specimen can be moved and replaced with the target during the calibration. If this is not practical, it's often possible to calibrate directly in front of the specimen; this method does require some extra depth of field because the target will be in front of the focal plane rather than directly in it.

Acquiring Calibration Target Images

In VIC-Snap (EDU), select the directory and name for the images of this project by clicking *Edit Files* in the menu or toolbar. Select the *Calibration Images* button from the toolbar (shown below).

With the target in place, press the spacebar or the *Capture* button in the toolbar to acquire an image pair. Capture at least 15-20 image pairs that show the calibration target in both cameras, with a range of rotations of the target. To accurately estimate the camera parameters, capture images with the target rotated about all three axes. More calibration images will give a more accurate calibration and leaves more room to discard poor images (that may contain defocus, obstruction, etc). As you tilt the target away or towards the cameras, it may be necessary to adjust the exposure time in VIC-Snap (EDU) to make sure the images are sufficiently bright.





Acquire calibration images with target rotation about 3 axes

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- To acquire calibration images, capture several images of the target in various orientations. Include significant rotations about all 3 axes.
- To accurately estimate perspective information, the target should be tilted off-axis and/or moved closer/farther from the cameras for some images.
- To estimate aspect ratio accurately, the target should be also rotated in-plane in some images.
- To estimate distortion accurately, target points should cover the corners of the image field in some images. Note: If a smaller target other than what is provided is used, this will require specifically moving the target to each corner and acquiring images. If the target nearly fills the field, it will naturally fill in the corners. The provided calibration target should always be used.
- For each image pair, the target should be visible in both images. If calibration is performed in roughly the same plane as the specimen, this will happen naturally.
- If a target dot is partially off the edge of the image, it will be discarded. However, if it is partially blocked by, i.e., a thumb, VIC-3D (EDU) may estimate the center incorrectly. This should be visible as a high error for that particular image.
- Some overdrive/saturation is acceptable, as long as black target dots don't appear reflective or white.

VIC-Snap (EDU) Integrated Calibration

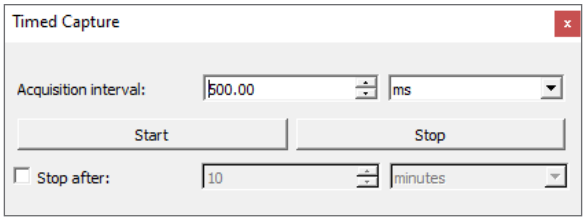
To calibrate in VIC-Snap (EDU), select the *Calibration Images* button from the toolbar. Once selected, calibration images can be acquired by pressing the spacebar or selecting the capture button from the toolbar. The images will appear under the calibration tab in the project bar once captured. Coded calibration targets will begin to extract immediately, showing a calibration score in real-time. Once all calibration images are acquired, select *Speckle Images* from the toolbar and a capture method to begin acquiring images for the test. Once the test is complete and the images have been acquired, selecting the *VIC-3D* button from the toolbar will auto-populate a VIC-3D (EDU) project with the calibration and speckle images, as well as the calibration score.

Capture Test Images

Once calibration is complete, you may run the test. Select *Speckle Images* button from the tool bar (shown above). There are two options available for how you capture images:

Manual Capture: You may manually capture images by pressing the spacebar or the *Capture* button.

Timed Capture: Timed capture can be used to acquire one image every two seconds. You may also choose to have image capture terminate after a certain length of time (maximum 200 seconds), otherwise you can stop the image acquisition by pressing *Stop*.



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Calibration in VIC-3D (EDU)

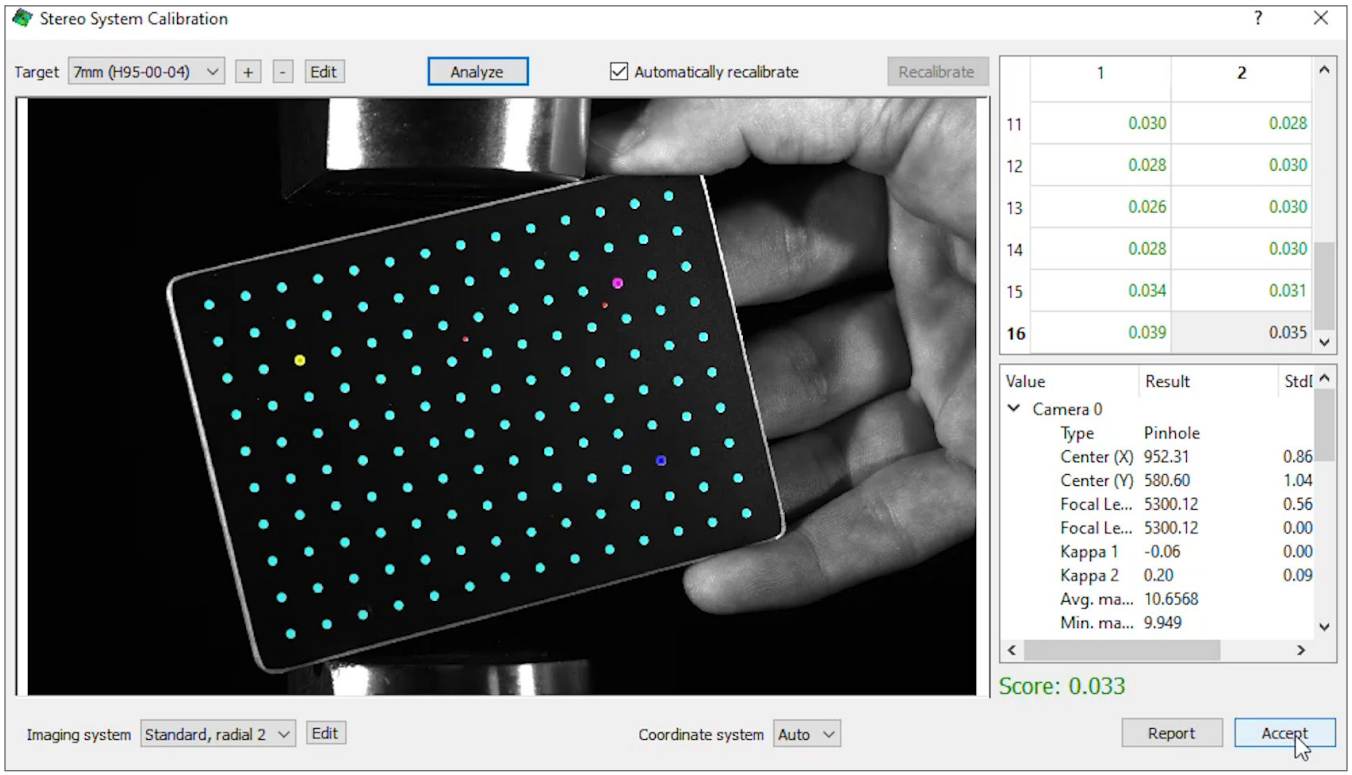
Import Images

Once you have acquired calibration and test images, open VIC-3D (EDU). Import the calibration images using the *Calibration Images* icon or from the *Project* menu. Navigate to the directory of your images and select them. Click *Open* to import the images to your project.

Calibrate

Open the system calibration dialog using the calibration icon or select from *Calibrate Stereo System* from the *Calibration* menu. With a coded target, extraction will begin automatically. If not, select the target you used from the *Target* drop-down menu. Click *Analyze* to start extracting grid points from the target.

After the calculation is complete, you will be presented with a report of calibration results and error scores. The errors will be displayed per image, as well as an overall error score.



The overall error (standard deviation of residuals for all views) should be displayed in green. If you have a good set of calibration images with good tilt and coverage of the image field, and the score is green, then the calibration is good and you can click *Accept* to finish.

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If the score is displayed in red, this indicates a potentially poor calibration. You may need to remove some images that have high individual scores or take new calibration images. VIC-EDU (EDU) will automatically remove very poor images, but you can remove additional images by right-clicking in the table of scores and selecting *Remove row*.

Below the calibration scores, the calibration results are listed. Each result is listed with a confidence interval; if the interval is very high, it may indicate a poor image sequence, even if the error score is low.

If the scores are uniformly high across all images and not due to just a few outliers, there may be a problem with the setup.

Check that:

- Each image has correctly extracted points and no partially covered points.
- There is enough data for the calibration to converge.
- The target images are in focus, evenly lit, and the grid points do not appear reflective.
- The exposure times are short enough to eliminate motion blur.
- The target is rigid.
- The cameras are synchronized.

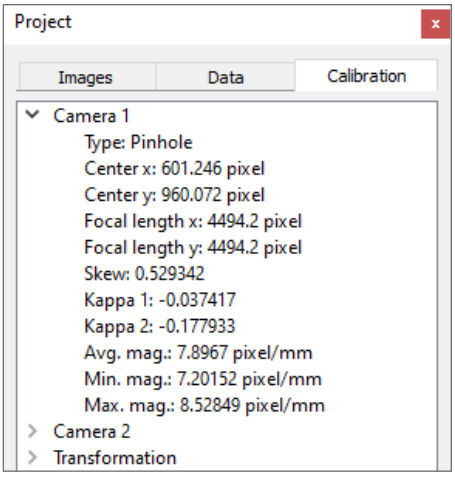
Correct any potential problems and recalibrate.

For each camera, the following values are displayed:

- **Type:** the type of camera model used in calibration.
- **Center (x, y):** the position on the sensor where the lens is centered. It should be roughly in the physical center of the sensor.
- **Focal length (x, y):** the focal length of the lens, in pixels.
- **Skew:** indicates out-of-square conditions for sensor grid.
- **Kappa (1, 2):** radial distortion coefficients of the lens.
- **Magnification:** the pixels/mm scale.

For the rig as a whole, the following values are given:

- **Angles (alpha, beta, gamma):** the three angles between each camera. In general, two angles will be small and one (the stereo angle) will be larger.
- **Distances (Tx, Ty, Tz):** the distance between centers of *Camera 1* and *Camera 2*, measured from *Camera 1*.



When the error score and confidence intervals are acceptable, click *Accept* to finish. The calibration data will be displayed in the *Calibration* tab of your project.

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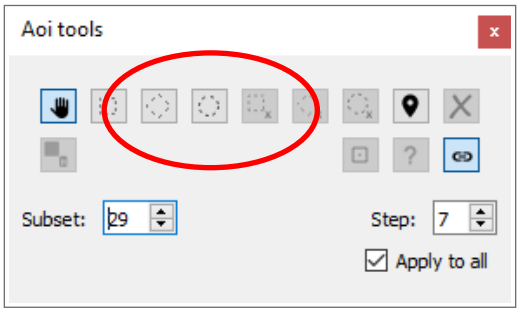
Analysis in VIC-3D (EDU)

Import Speckle Images

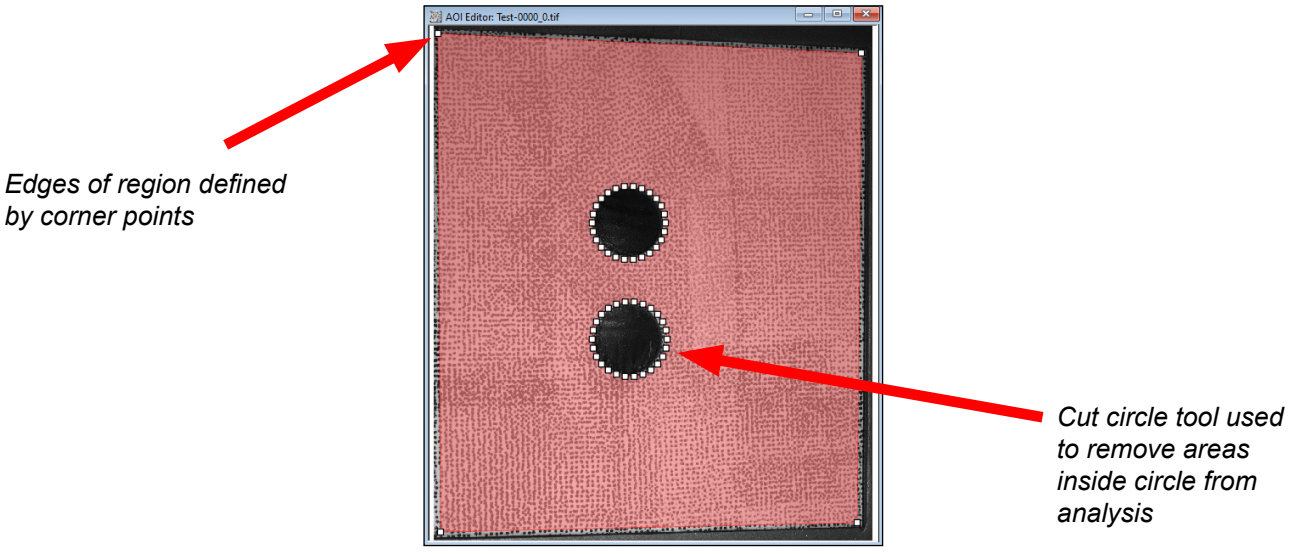
Import the test images into your project using the *Speckle Images* icon or from the *Project* menu.

Define Area of Interest (AOI), Subset, Step

Next you must define the area of interest (AOI) on your specimen. This is the portion of the image that contains the speckle pattern and which will be analyzed for specimen shape and displacements. To begin, double-click on the reference image file name in the *Images* tab to open the AOI Editor. The reference image will be displayed. You may change the reference image by right-clicking a speckle image name and selecting *Set Reference Image*. Use the *Create rectangle, Create polygon,* or *Create circle* tools to select the desired AOI. Sections can be removed from the AOI using any of the *Cut* tools. You can define multiple AOIs in one project if necessary.



With the tool selected, clicking on the image will create a control point for the shape. Using the *Rectangle* and *Circle* tools, the region will be defined after the necessary endpoints are defined. With the *Polygon* tool, double-click to finish defining the region. VIC-3D (EDU) has undo and redo functionality for changes to the AOI.



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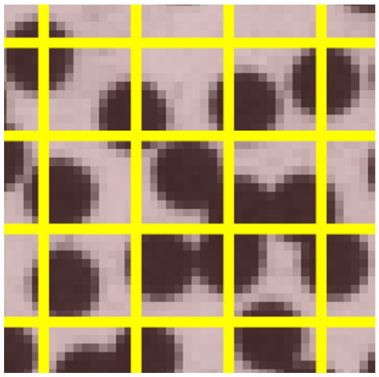
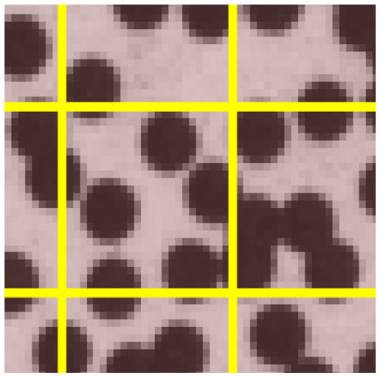
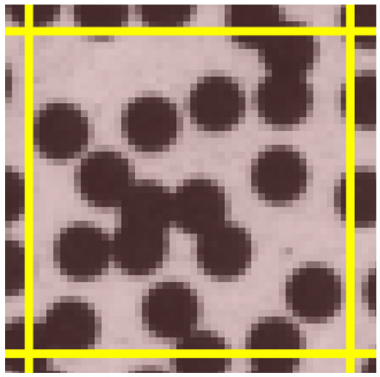
Next, set the *Subset* size for this AOI. The subset should be large enough that it contains enough pattern information that it is unique from nearby areas. A coarse speckle pattern with large speckles will require a larger subset size than a fine pattern with small speckles. In general, larger subset sizes will provide higher measurement confidence at the cost of lower spatial resolution.



Subset too small, not enough information per subset



Good subset size



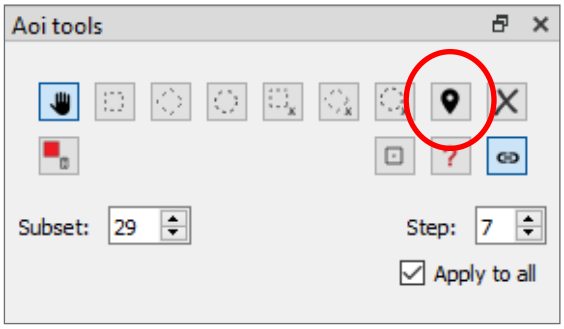
Subset unnecessarily large, results in loss of spatial resolution

Select the *Step* size for the AOI. The step size controls how many pixels apart each data point is. Lower step sizes will result in more data points and longer analysis times. Because small step sizes result in more overlap between neighboring subsets, they will not be independent of each other and therefore do not provide much gain. A good default is to use a step size ¼ of the size of the subset.

You may apply subset and step sizes to all subsets by checking *Apply to all* or individually by unchecking this option.

Initial Guess

Prior to running the analysis, VIC-3D (EDU) will attempt to automatically determine a start point and initial guess. If the calibration and speckle pattern are good, this generally works well, but in certain cases it will be necessary to provide a manual start point. Large motions between images will likely require a start point. To start this procedure, select the *Create Start Point* tool from the AOI tools.



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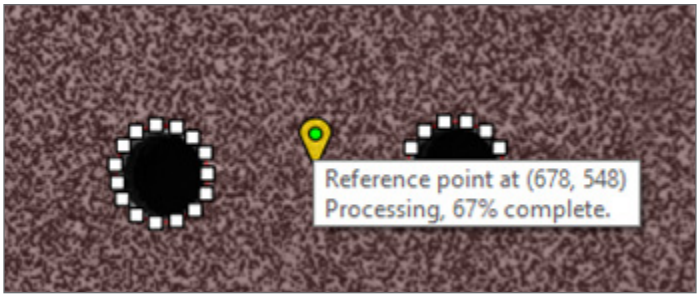
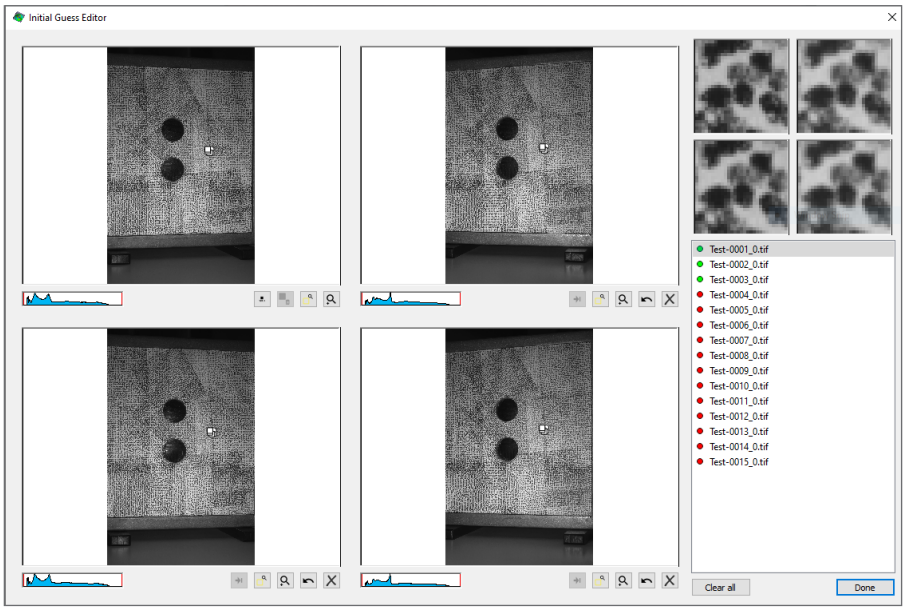
Click in the AOI to place the start point. Ideally, the start point will be in a position of low motion (i.e., near a fixed grip), but anywhere on the AOI will generally work. Mouse over the start point to view the tracking progress.



When the start point finishes tracking or becomes idle, double-click on it to open the *Initial Guess Editor.*



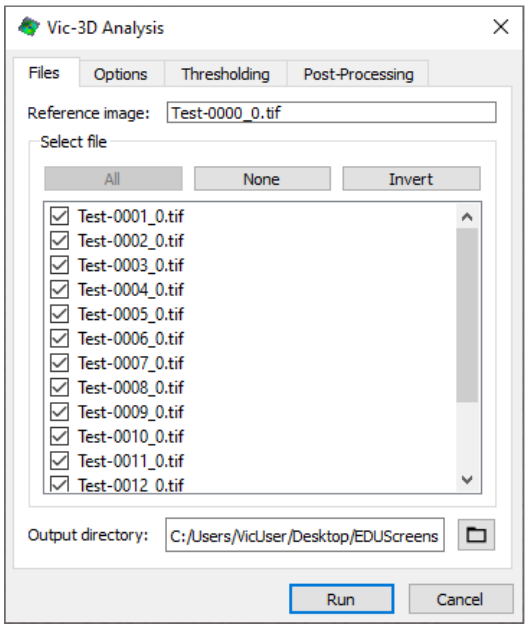
In this case, the initial guess has been automatically found – the areas at the top right match, and the indicator next to each image is green. Click through the images to make sure the matches found are correct. At this point, you can click *Done* and continue to the analysis.

If the start point is not automatically found, indicated by a yellow or red dot, or is incorrectly matched, manually position the subset location and shape in the lower two images so that they match the reference images on top. Right-click the subset when it is in position and confirm it is correctly matched.

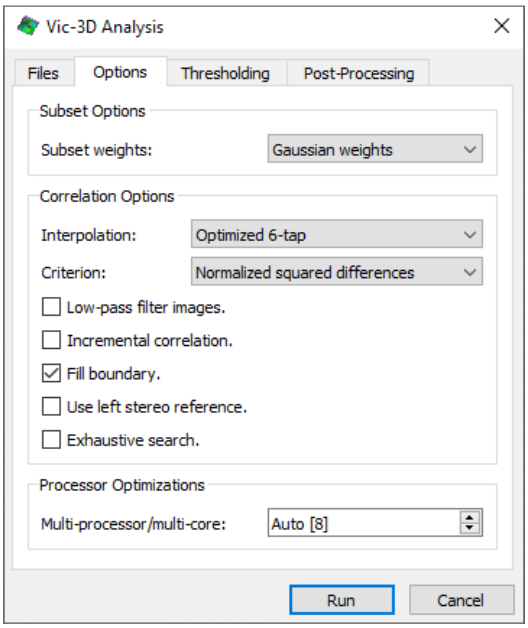
You may place multiple start points in the same or multiple AOIs as needed.

Analysis Options

To start correlation, click the green *Start Analysis* button in the toolbar or select *Start Analysis* from the *Data* menu. This will open a window which will allow you to control correlation options.



The Files tab



The Options tab

In the *Files* tab, you can select files to analyze and the directory that data files will be saved to (note: the reference image is always analyzed).

In the *Options* tab, you can fine-tune correlation options.

Subset Weights: This controls the way pixels within the subset are weighted. With *Uniform weights*, each pixel within the subset is considered equally. Selecting *Gaussian weights* causes the subset matching to be center-weighted. Gaussian weights provide a better combination of spatial resolution and displacement resolution.

Interpolation: To achieve sub-pixel accuracy, the correlation algorithms use gray value interpolation, representing a field of discrete gray levels as a continuous spline. Either 4-, 6-, or 8-tap splines may be selected here.

Generally, more accurate displacement information can be obtained with higher-order splines. Lower-order splines offer faster correlation at the expense of some accuracy.

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Criterion: There are three correlation-criteria to choose from:

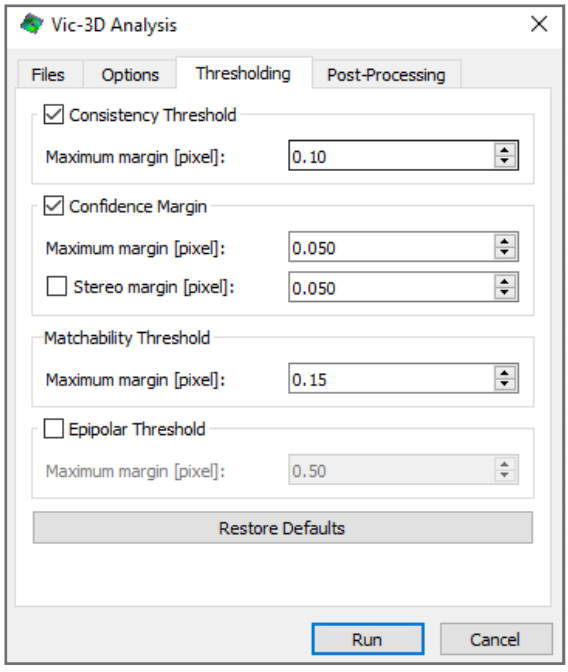
- **Squared Differences (SD):** Affected by any lighting changes; not generally recommended.
- **Normalized Squared Differences (NSSD):** Unaffected by scale in lighting (i.e., deformed subset is 50% brighter than reference.) This is the default and usually offers the best combination of flexibility and results.
- **Zero-normalized squared differences (ZNSSD):** Unaffected by both offset and scale in lighting (i.e., deformed subset is 10% brighter plus 10 gray levels.) This may be necessary in special situations. However, it may also fail to converge (produce a result) in more cases than the NSSD option.

The *Low-Pass Filter Images* option removes some high-frequency information from the input images. This can reduce aliasing effects in images where the speckle pattern is overly fine and cannot be well represented in the image (these aliasing effects are often visible as a moiré pattern in the output data.)

Multi-Processor controls the number of processors/cores used for analysis. In most cases this is automatically determined for your computer.

The *Thresholding* tab allows you to set the limits beyond which data will be discarded (leaving 'holes' in the plot). Raising a threshold will always allow more data. If you are unsure, try using the default thresholds.

- **Consistency Threshold:** discards points that are inconsistent with neighbors. This is the most useful threshold for limiting false matches.
- **Confidence Margin:** discards matches which have a high uncertainty due to defocus, highlights, pattern degradation, etc. This option can be very useful for discarding data around cracks that grow during the test. The *Stereo Margin* option applies only to the left-right match
- **Matchability Threshold:** discards matches which have poor contrast.
- **Epipolar Threshold:** discards matches which seem unrealistic with regards to the calibration.



The Threshholding tab

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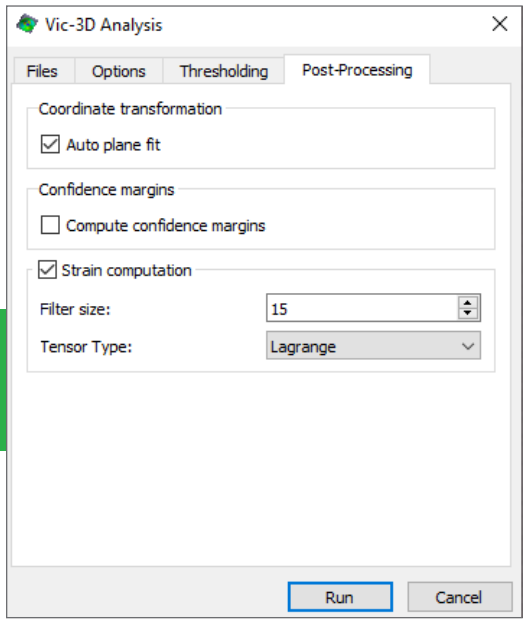
The *Post-Processing* tab allows you to control how the data is processed immediately after calculating. The *Auto Plane Fit* option will create a coordinate system based on the reference shape. The origin will be at the centroid of all measured points, with the Z-axis normal to the best-fit plane of the data field. Leaving this option cleared will leave the system in camera coordinates.

To calculate strain during the correlation, rather than after, check the *Strain Computation* box.

Note: unless you know that you need to change correlation options or thresholds, the default values often do not need to be changed.

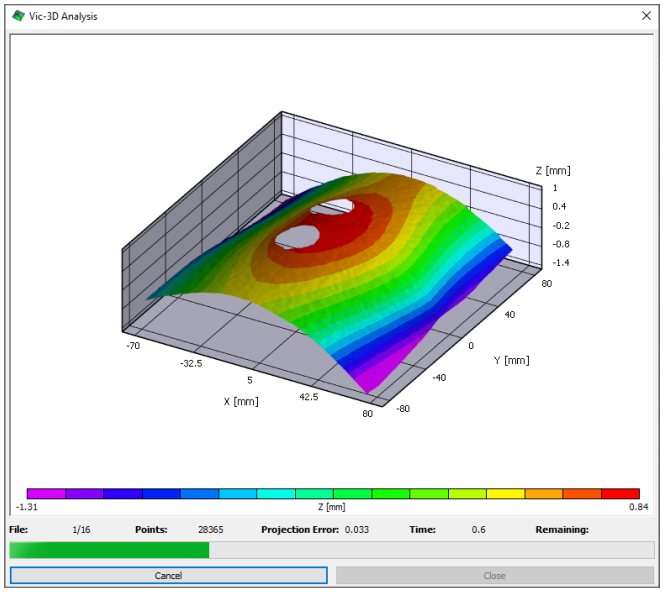


The Post-Processing tab

Run the Analysis

Click *Run* to begin the analysis.

VIC-3D (EDU) calculates the surface geometry (X, Y, and Z coordinates for each analyzed point) as well as the displacement for each point (U, V, and W, indicating displacement in the X, Y, and Z directions, respectively). By default, the Z value is displayed; other values can be selected by right-clicking in the plot and selecting *Contour Variable*.



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The file number, data points, projection error, and analysis time are displayed at the bottom edge of this plot. The projection error is of special interest because it will indicate potential problems with calibration or analysis. In short, projection error is the difference between where a point is expected to be based on the calibration and where it is actually found in the image. If the plot looks correct but the projection error is high (high errors will be displayed in red), check the calibration; it may be erroneous or the cameras may have been disturbed.

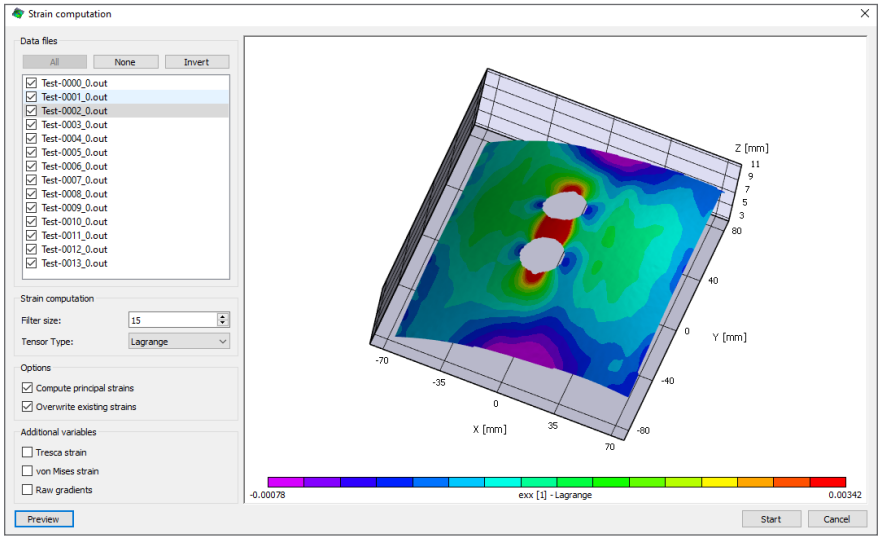
Alternately, if the error is high and the plot shows obviously erroneous data in one region (spikes/noise), there may be a problem with the analysis in that region; check the images and AOI boundaries. If necessary, reduce the analysis area or use threshold settings to eliminate the bad data.

If no points can be analyzed, an error will be shown. The most common reason for this condition would be that the software could not determine an automatic initial guess. In this case, a manual start point may be needed.

When the analysis is complete, click *Close*.

Strain Computation

To calculate strain after running the correlation, select *Data… Postprocessing Tools… Calculate Strain*.



One of the computation options is the strain filter size. Since strain values are calculated in a very local manner, they are inherently noisy. To counteract this, a smoothing filter is applied. By increasing the size of the filter, strain contours will be smoother and smaller strain values can be resolved. However, this comes at the cost of reduced spatial resolution. To see more local strain values, a smaller filter is required. If you are unsure, the default value is a good starting point. Note that the filter diameter is the filter size times the step size, so increasing step size will also increase the smoothing diameter (unless filter size is accordingly reduced).

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You may also select the strain tensor type. By default, the *Lagrange Tensor* is used. The other tensors available are *Hencky* (logarithmic), *Euler-Almansi*, *Log. Euler-Almansi*, *Biot*, and *Engineering*. The *Engineering Strain* will provide a measure that can be directly compared to strain gauges, clip extensometers, etc. At low strains, these tensors will give similar results, but they can diverge at large strains.

Select *Tresca Strain, von Mises Strain,* and/or *Raw Gradients* to compute these additional values.

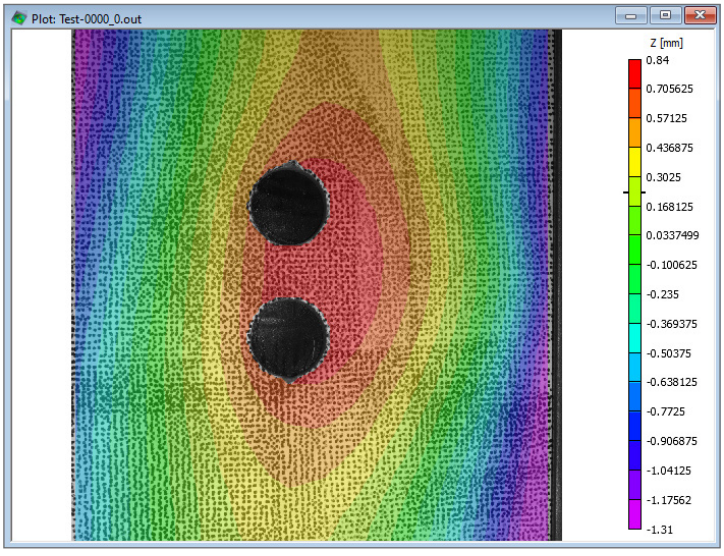
You can calculate strain for all files by clicking *Start*. Alternately, you can adjust settings and see the effect on a single file by clicking *Preview*.

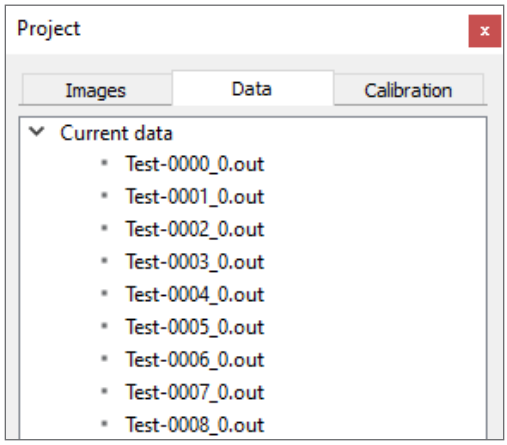
After strain calculation is complete, there will be new strain variables in the data set; right-click on the contour plot to view them. By default, you will see strain in the x- and y-axes (*exx, eyy*) and shear strain (*exy*), as well as first and second principal strain (*e1, e2*) and principal strain angle (*gamma*).

Viewing Data

Viewing Full-Field Data

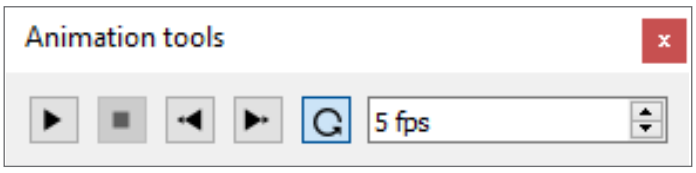
The new data will be displayed in the *Data* tab shown to the right; double-click on a file to view.





You can click and drag to rotate the data set and use the mouse wheel to zoom in and out. Right-click to select different contour variables. You may also right-click and select *Show 2D Plot* to see a contour overlay as shown to the left.

To animate through the images, use the *Animation* toolbar.



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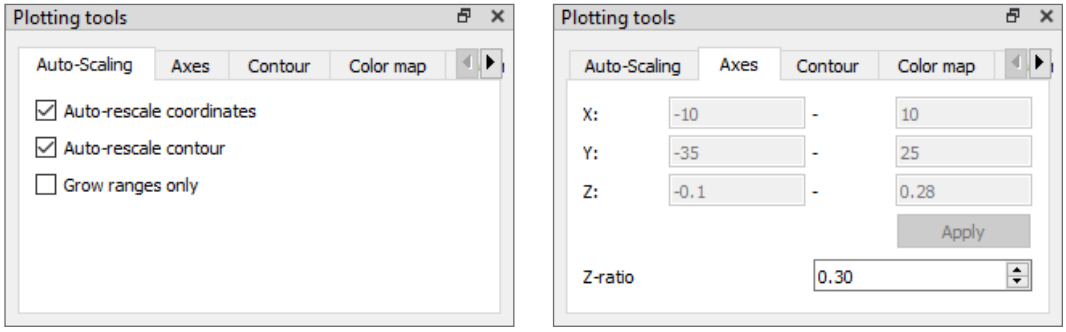
Videos can be exported by right-clicking in the plot and selecting *Export Video*. To save plots as images, right-click on the plot and select *Save* or you can right-click on any plot in VIC-3D (EDU) and select *Copy* to copy the plot to the clipboard.

Axis and Contour Limits

By default, both axis and contour limits will auto-scale to the measured minimum and maximum values. For the shape, this means that very flat shapes will appear very noisy, as the limits will be very close together. The same applies to contours. For example, if the strain is close to constant, the strain contour plot will have a small range and noise will be exaggerated.

To edit axis and contour limits, use the *Plotting Tools*, at the left.



You may either auto-scale the axis and contour limits or clear the *Auto-rescale* box and manually enter limits.

Data Inspection

VIC-3D (EDU) provides a number of facilities to reduce data from the initial point cloud.

To extract data over time, open a 2D contour plot. Select from the *Inspector* toolbar one of the *Inspect Point* tools, the *Inspect Rectangle, Inspect Circle,* or the *Inspect Polygon* tool.

Points:
The *Inspect Point* tool places an extraction at a single data point. Simply select the tool and click the desired location. You may remove a point by clicking on it with the *Delete* tool.

Area Average:
To observe data averaged over a region, use the *Rectangle, Circle,* or *Polygon* inspector tools. Define a rectangle by its center and one corner, a circle by its center and radius, or a polygon by clicking to place vertices and double-clicking to finish.

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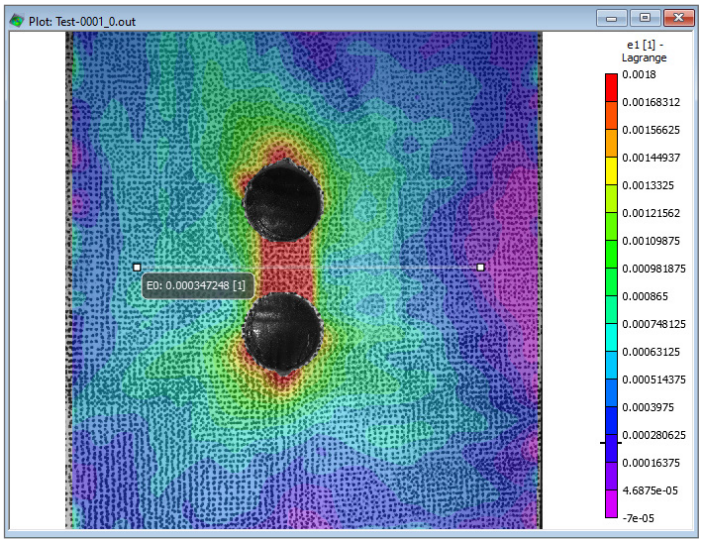
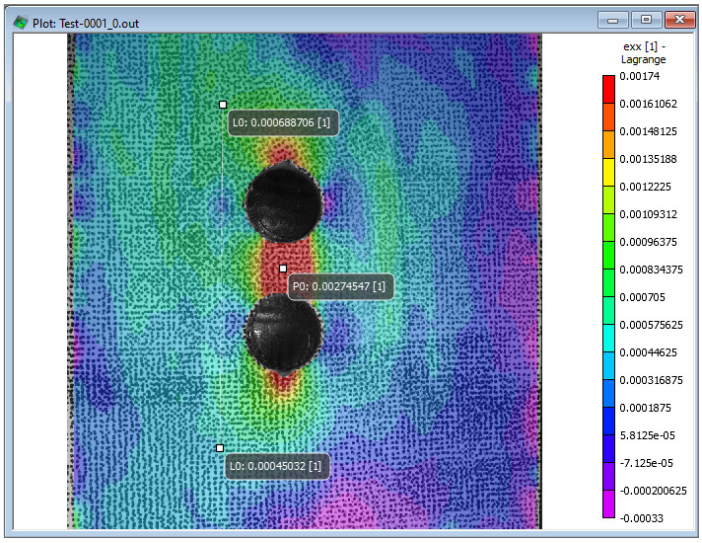
Extensometers:
The *Extensometer* tool can be used to emulate the behavior of placing an extensometer on the surface of the specimen. It measures the extensometer length and total extension. Click to place the two endpoints. Open an extraction plot to view the measurements from the extensometer.

An extensometer can report ΔL/L0 (similar to engineering strain), ΔL (difference in length), L1 (deformed length), and L1 (initial length). Note that this tool gives simple end-to-end distances, which may not always be the same thing as strain – the tool ignores bending, etc.

Line Slices:
As shown to the right, you may also extract a slice of data with the *Extract Line* tool on the toolbar. Click the tool and then click two endpoints to define a line. Here, E0 is the normal strain along the vertical line shown.



Plot Extractions:
Plot Extractions can be used to display the data from any inspector tool or global averages. Click the *Plot Extractions* icon to create a new plot window or right-click the contour plot and select *Extraction*. By default, a line will be created for the average, and another for each placed point, circle, rectangle, or extensometer. To add, remove, or change a line, you can use the *Extraction* tools at the top left. Shown here are three selected points with the values of *exx* at each point. Also shown is the line L0 between two of the points.



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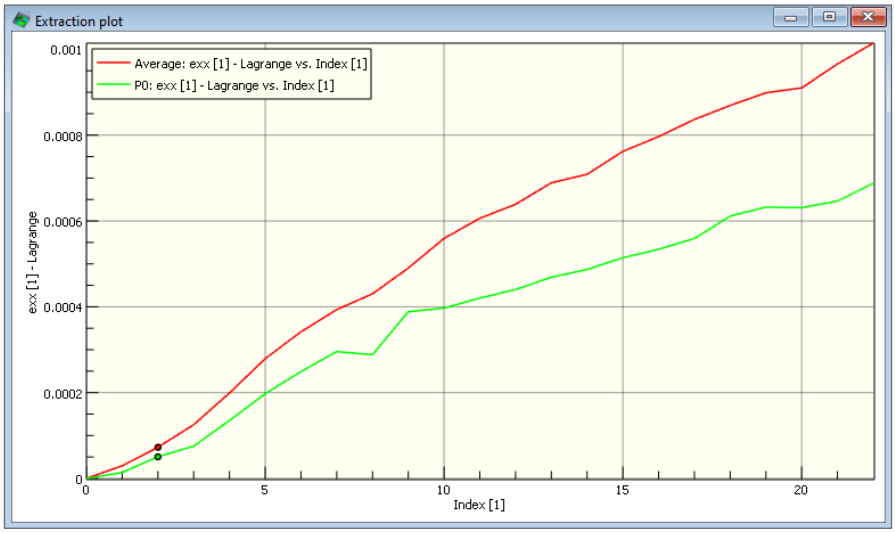
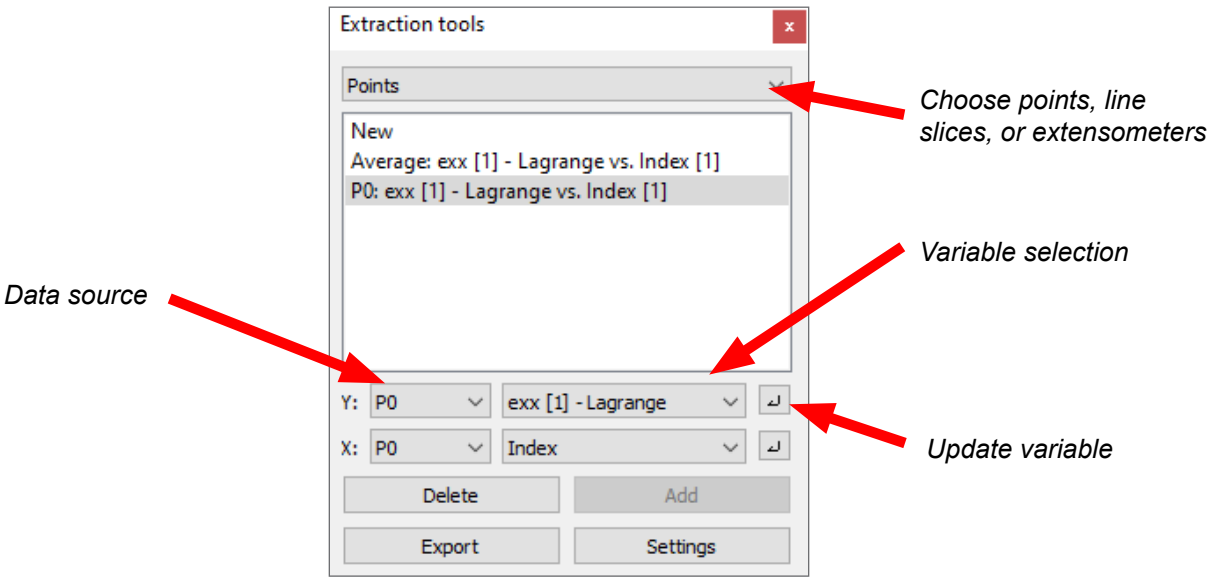


To modify a line's variables, you can change both the variables and the data source for the Y and X axes. Once you make a change, click the *Update* button to the right of the axis controls to apply. To delete a selected line, click the line and then click the *Delete* button. To add a new plot, click the "New" item in the line list at the top. Make your selections and click *Add* to add the extraction to the current plot. Below, a new point, P0, is selected and the plot of exx versus and index is shown above.

If you are using line slices, select *Line Slices* from the dropdown menu at the top of the *Extraction Tools* window.

This will display the data along the line for each image.



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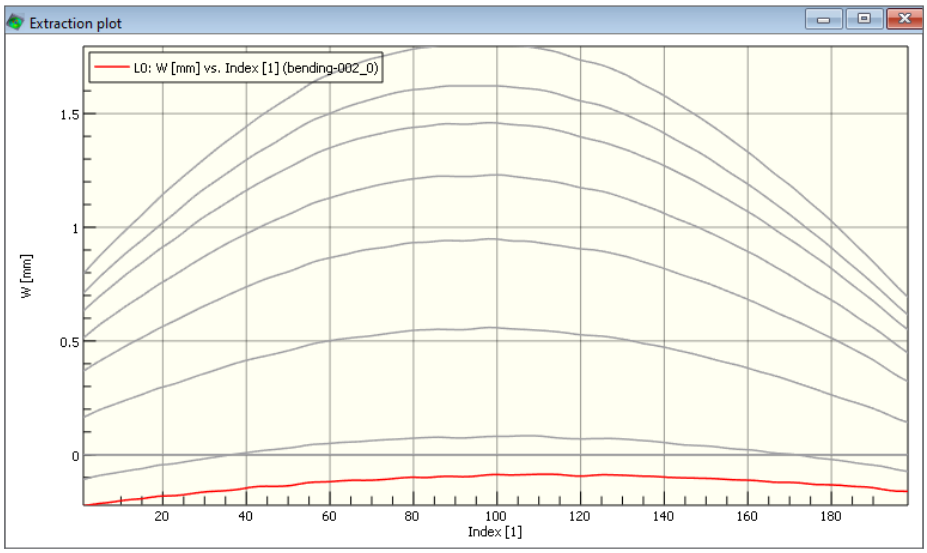

By default, several data files are shown, and the currently selected file is plotted as red. You can right-click and access the *Settings* dialog to change to plot only the selected file, or only certain files. Here, the displacement, W, is shown for points along a line L0.

Navigating the Plot:
Use the mouse wheel to zoom in or out on the plot. Click and drag to pan; double-click to fit the plot to the window. To adjust a single axis scale, mouse over that axis; the cursor will change to indicate the axis is active. Then, use the mouse wheel to zoom only that axis. To zoom to a selected box, hold the shift key and drag to indicate the zoom area. Right-clicking on the extraction plot will allow you to save/copy as an image or adjust the plot settings further.

VIC-EDU Labs & Support

The VIC-EDU system comes with a specially-designed test frame and four laboratory experiment manuals for students. These labs can be completed individually or as a series and come complete with instructor versions. These lab manuals may be requested by emailing support@correlatedsolutions.com at any time.

For more details about specific features of VIC-Snap (EDU) and VIC-3D (EDU), we suggest consulting the *User Manuals* which can be found under the *Help* tab in the software. Please note that these manuals are written for the full versions of the software and will therefore contain documentation for features that may not be available in the EDU versions.You may also visit our online DIC knowledgebase containing application notes on DIC and procedures specific to the VIC software suite. https://correlated.kayako.com/

We hope you enjoy the VIC-EDU system. Our team is dedicated to continually improving, so we ask that you please provide us with feedback by emailing sales@correlatedsolutions.com. Thank you.

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SOLUTIONS

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