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Application Note

Digital Image Correlation + Thermal Imaging

Updated infrared (IR) integration, analysis, and visualization with VIC-Snap & VIC-3D 10

VIC-3D 10

2025

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Measure with Confidence

Updated infrared (IR) integration, analysis, and visualization with VIC-Snap & VIC-3D 10

Introduction

This guide lays out the steps for combining 3D DIC data with temperature data from an IR camera. The basic parts of the procedure include:

- Camera Selection & Setup
- System & Test Setup
- VIC-Snap Settings
- Calibration (DIC & IR)
- Computing External Position
- Capturing Test Images
- Mapping IR Data
- IR Data Analysis & Visualization

Selecting a Camera

VIC-Snap supports the FLIR A700 thermal-imaging camera (as well as some older Flir cameras with GenICam over a GigE interface).

For 3D calibration, we recommend a camera with at least 640x480 resolution (although lower resolution cameras can be calibrated with special care).

Setting up the Cameras

The stereo camera setup for IR-combined testing will be exactly as with a normal test. Set up the cameras in a stereo rig, observing a proper minimum stereo angle, and adjust the focus, aperture, and exposure time as normal.

The IR camera should be mounted rigidly together with the stereo rig, if possible. Depending on the magnification of your camera, it may need to be closer to or farther from the specimen, as lens selection is usually limited; in this case, it should still be mounted securely to avoid relative motion.

IR readings can vary with angle of incidence; the best placement for the IR camera will be between the DIC cameras, pointing directly at the specimen.

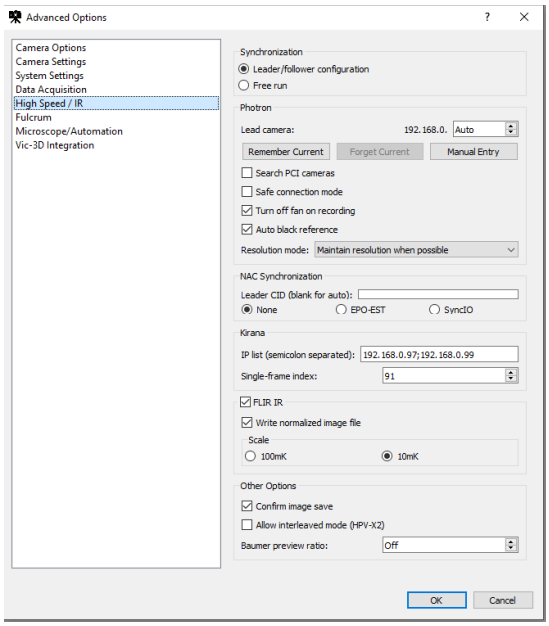
System Setup

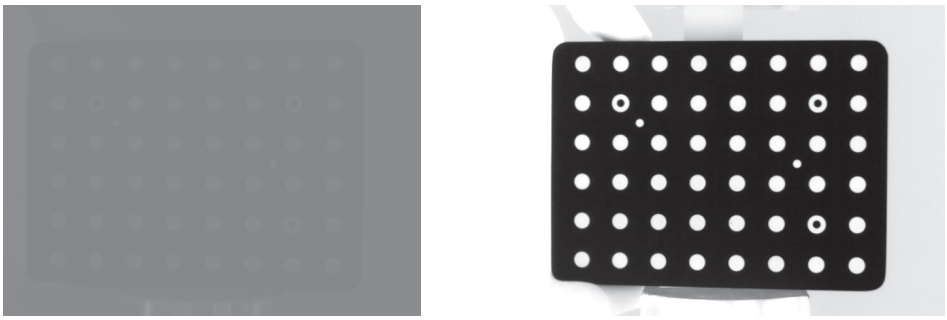
The VIC-3D system with the IR module comes pre-loaded with the necessary software to control FLIR cameras in VIC-Snap. If you have any issue with general connectivity, please contact our Support Team for assistance.

VIC-Snap Settings

Options for the FLIR cameras can be found under ***File... Advanced Options...High Speed / IR***.

- To allow VIC-Snap to search for FLIR cameras on opening, make sure that **FLIR IR** is checked.
- The images are written as 16-bit TIFFs which contain an absolute temperature. To also write a normalized file, which will be much more visible for working with and for calibration, check **Write normalized image file**.
- There are two scale options. Selecting **100mK** will result in a TIFF where each grey value is equal to the temperature, in K, multiplied by ten. Selecting **10mK** will cause a value of the temperature multiplied by 100.



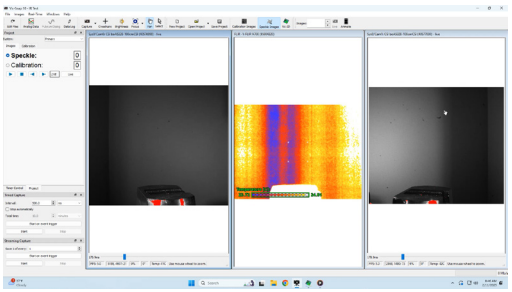


Standard **Normalized**

Flir Window in VIC-Snap

The FLIR window will appear as a camera window in VIC-Snap.

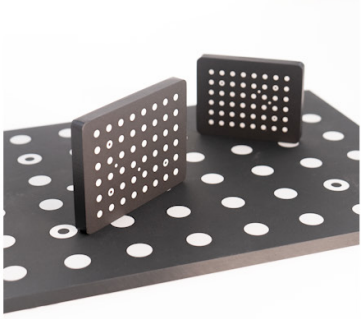
- Right-click in the window to select imaging options.
- The temperature at the cursor is displayed in the caption.
- Double-click in the window to lock the temperature display on a certain point; double-click again to clear.



Taking Calibration Images

In previous versions, the VIC-3D software required there to be a common target between the two white light cameras and the infrared camera to calibrate the system. This resulted in having to use a grid which was too large for the high-res cameras and too small for the low-res, so there was an inherent compromise in calibration effectiveness.

The latest version - VIC-3D 10 - features an updated method of aligning the coordinate system which is significantly more effective. Using the optimal target for the white light cameras and an optimal target for the IR camera results in a good intrinsic calibration for each camera and more flexibility for testing.

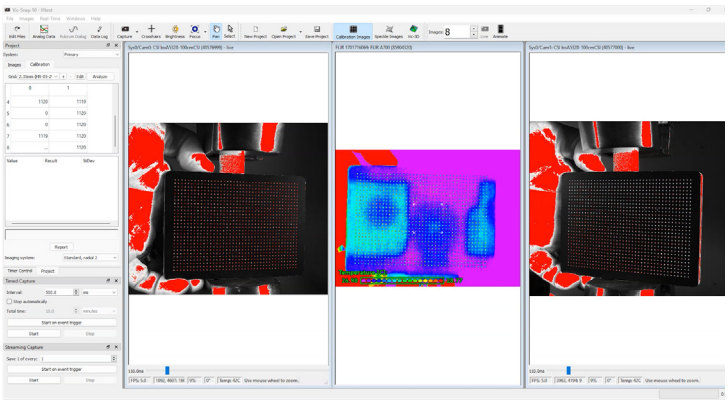


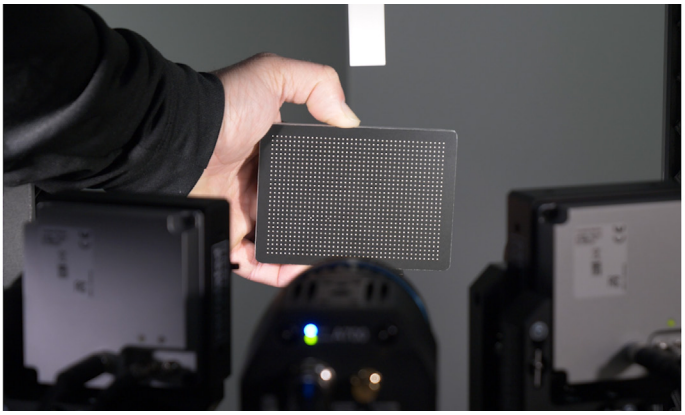
IR calibration targets are solid aluminum to allow for more efficient heating/cooling, and they are designed for the camera resolution of the FLIR A700.

The white light camera calibration targets may vary from 1Mp to 45Mp camera resolution depending on the camera and application.

Calibrating the Stereo Cameras

First, calibrate the white light cameras as usual with the optimal grid for your cameras. In this case, we used a 40 x 28 high resolution calibration target.

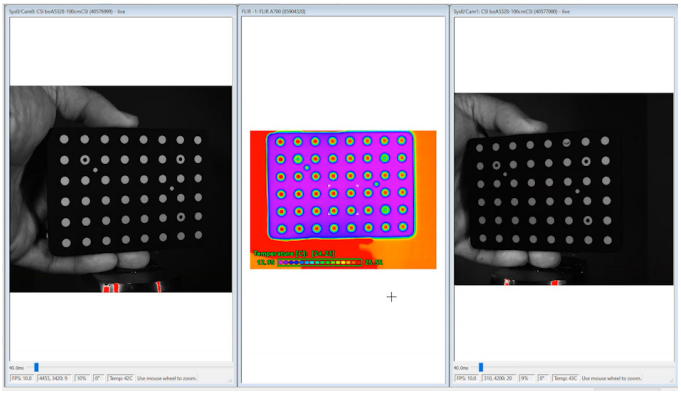




Calibrating the IR Camera

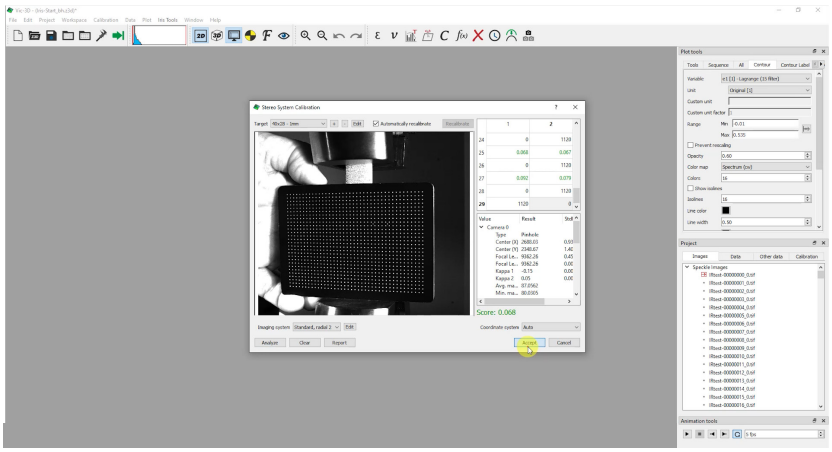
When calibrating an infrared camera for DIC, the target needs to be either cooled or (slightly) heated. As the target returns to ambient temperature, it will be less distinct and will need to be cooled/heated again.

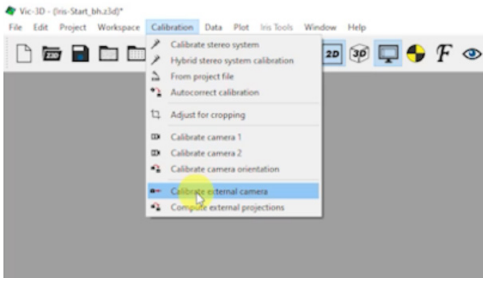
Using the IR target produced in-house at Correlated Solutions, we took a set of 20-30 calibration images in VIC-Snap.



Now, with two sets of calibration images - saved in the same folder to keep things organized - open VIC-3D 10.

Complete the white light camera calibration as normal in VIC-3D. When the calibration is complete and the score shown in green, click **Accept**.



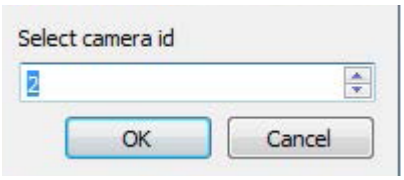


To calibrate the IR camera select **Calibrate external camera** from the Calibration menu.

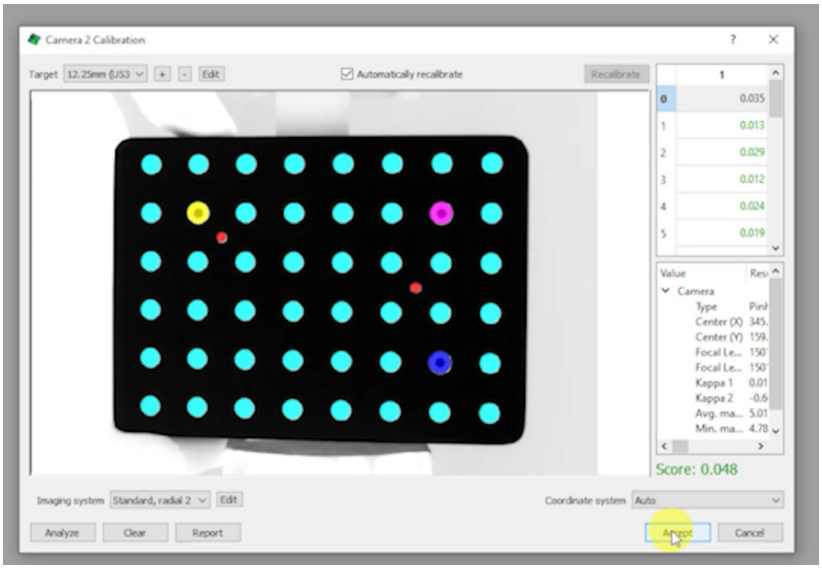
A file dialog will appear; select all of the IR calibration images and click **Open.**

A dialog will appear to allow you to select a camera ID (in the event that there are multiple IR cameras).

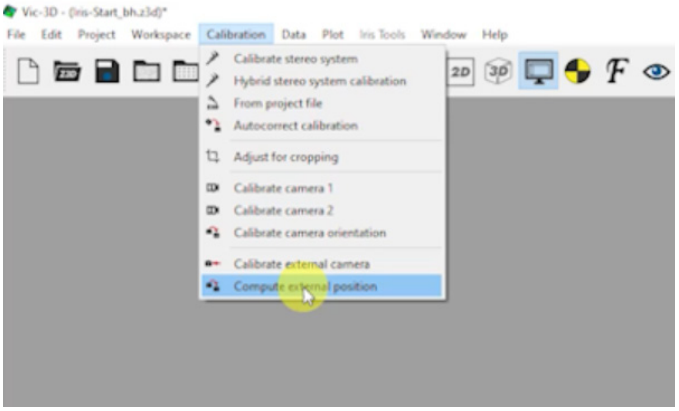
Click **OK**, and the external camera calibration will begin.



When the calibration is complete, click **Accept**.



Compute External Position



With both cameras calibrated, the next step is to determine the relative camera positions.

Under the Calibrations tab, click on **Compute External Position**

In nearly all cases a single image set from the IR calibration can be used to align the system in this step.

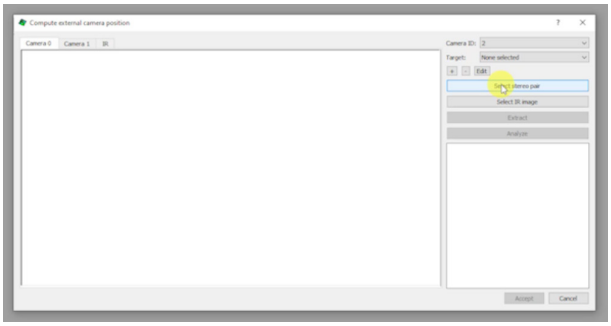
The set should include 3 images (--2 x white cameras and 1 x FLIR camera) in which we are certain the focus, position, and brightness are clear.

If you have an unconventional set-up and it's necessary, take a single additional image set which meets this qualification.

Select the first image in the set taken with the white light cameras.

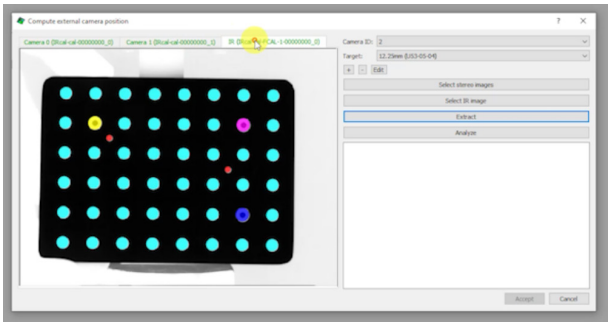
VIC-3D will auto-populate the corresponding stereo image from the second camera.

Now select the corresponding thermal image from that first set.



Click **Extract** and then **Analyze** to align the position of the three images.

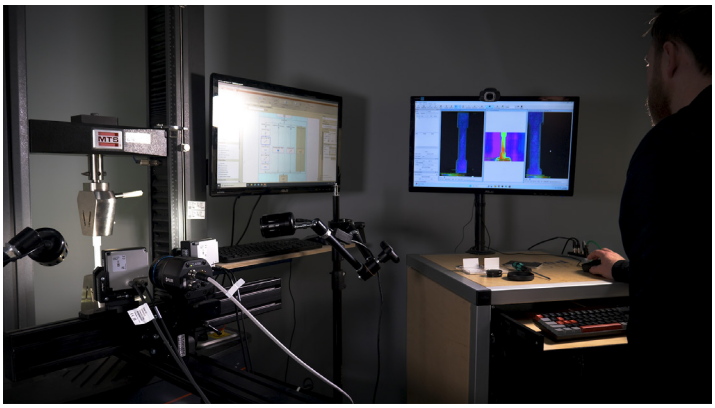
After clicking **Accept,** the three cameras are now calibrated, aligned, and ready to take test images.

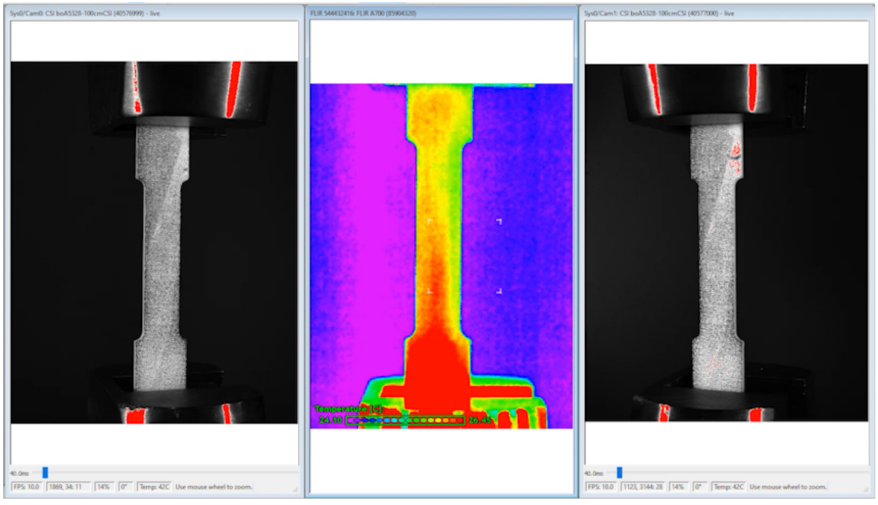


Please note, the previous external camera calibration procedure which involves using a single calibration target with all three cameras for the entirety of the calibration procedure can still be effective with some cameras and test scenarios.

Capturing Test Images

When conducting the test, images from the white light cameras and the IR camera will be automatically synchronized if captured using the VIC-Snap software.

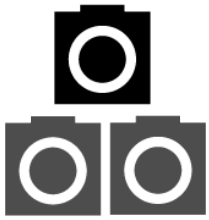




With the test complete, begin the analysis as normal by creating an AOI, selecting options, and running the DIC analysis.

When the analysis is complete, you should have a complete set of output data with the usual DIC contour variables X/Y/Z/U/V/W/etc.

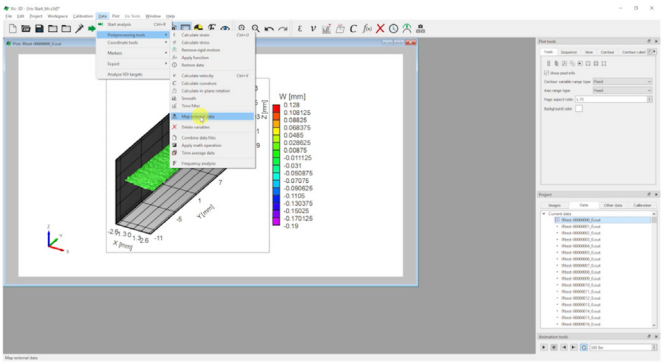
Mapping IR Data



To combine the DIC data just produced with the IR data from the FLIR camera, click on the Map External Data icon:

Or go to **Data....Postprocessing tools....Map external data**.

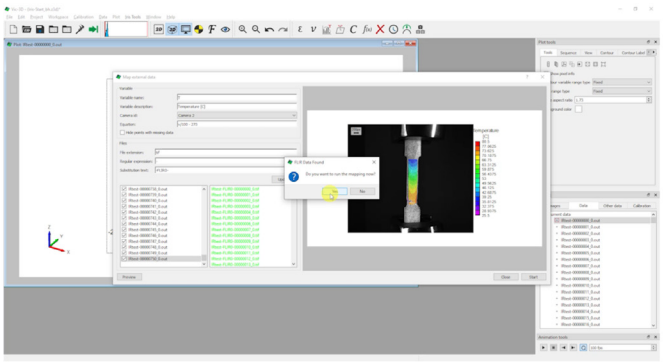
Here, we see that temperature has been mapped to the object as a new contour variable.

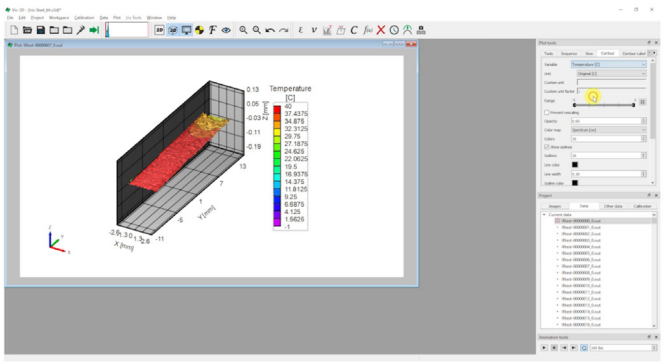


The preview window gives the opportunity to identify any obvious problems with the mapping before starting the process.

Click **Yes** to start the mapping.

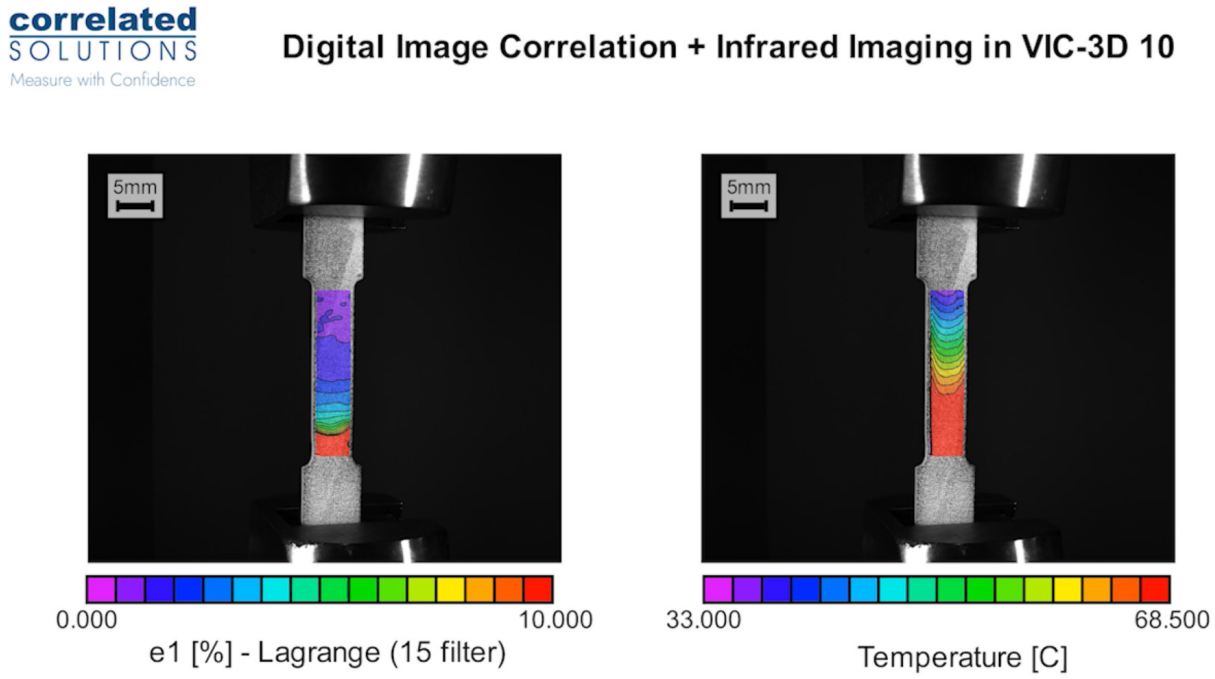
When the mapping is complete, find Temperature [C] as a new option under the Contour Label tab in the Plot Tools in the panel on the right.





Working with IR Data

IR data is now a contour variable and can be treated like other data. For instance, we used the iris visualization engine to juxtapose major strain against temperature below.



Keep in Mind

Whenever working with high temperature testing, please be mindful of personal safety and the melting potential of ancillary objects (lens, mounting rigs, etc.).

When working with IR data, temperature differentials are likely to be present. This means we need to be very cautious about refractive heat waves. Use fans or insulation to make sure that the air in your optical path is either well mixed or at a steady state temperature.

If your test involves capturing images through glass (a window in a test furnace, for example), double check that all windows are IR transparent.

The most common error in this process is a mismatch of the images resulting from incorrect naming conventions or user error (selecting the wrong image).

Support

The data for this test can be found under Example Data in the Downloads section of the Correlated Solutions website.

If you have any questions about this document or any other questions, comments, or concerns about our software, please contact us at support@correlatedsolutions.com, or visit our website at support.correlatedsolutions.com.