GETTING STARTED

STEP-BY-STEP WALK-THROUGH

2026

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CONTENTS

1. GETTING STARTED STEPS

The following is a brief overview of the steps involved in getting started with the Mercury RT® contactless measuring system.

- First of all, it is necessary to connect the cameras to a computer. This is in general described in chapter 2.
- The next step is to install Mercury RT® software and obtain a valid license. This is described in chapters 3 and 4.
- After the installation, the first Mercury RT® run can be performed and an initial setup as well. This is described in chapter 5.1 Initial Setup within chapter 5. Running the Mercury RT® for the first time.
- After that, it is possible to create the first project. This is described in chapter 5.2.
- After the project creation, it is possible to run the measurement. This is described in chapter 5.3.
- After the measurement post-process analysis can be performed. This is described in chapter 5.4.
- Various scene-type settings according to your scene layout are described in chapter 6.
- Troubleshooting is described in chapter 7.

2. CAMERA CONNECTION

Cameras need to be properly connected to a computer before a Mercury RT® can be used for material testing. Mercury RT® supports various camera types that can be connected through an Ethernet cable or USB 3.0 cable.

Supported cameras are:

- **Regular cameras**: Basler, IDS, Teledyne FLIR, XIMEA, (Sapera, Camera Link).
- **High-speed cameras**: Chronos, Phantom, Photron, AOS
- **Thermal cameras**: FLIR, MICRO-EPSILON, Xenics, Infratec.

To get good results from digital image correlation use monochrome cameras with global shutter (rolling shutter will lead to distorted images during faster movements; rolling shutter can be used only for snapshot-based measurements).

2.1. Ethernet cameras

When connecting Ethernet cameras make sure that the network adapter is capable of 1000Mbit/s data flow and allows to set large Jumbo Packets of 9k MTU. This is done in the configuration window of the network adapter properties (Control Panel\Network and Internet\Network Connections, choose the Ethernet connection used for the camera connection, and in the properties window click on Configure…).

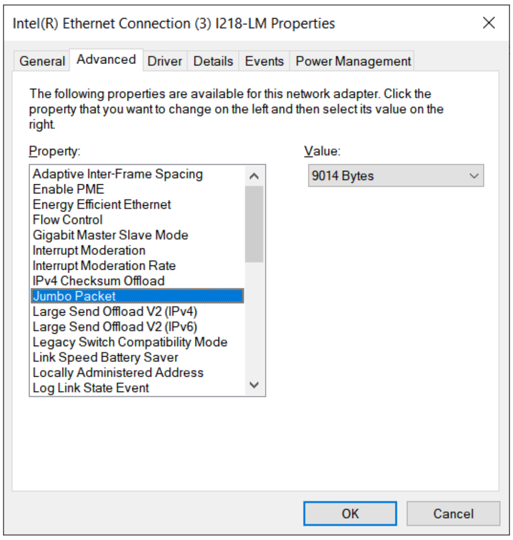


Figure 2.1: Setting Jumbo Packets in network adapter properties

Not setting this packet size may cause the camera not to use the whole capability and runs on a smaller FPS. Also, make sure that the used cable complies with CAT5e. Ethernet cameras need to be also powered as Ethernet cable does not carry a voltage. However, there are special network adaptors designed for Giga Ethernet Vision (Frame Grabbers) with the function of PoE (Power over Ethernet). These adaptors can power the camera through the Ethernet cable. If PoE is not available an external supply must be provided using the GPIO connector on the back side of the camera.

2.2. USB 3.0 cameras

USB 3.0 camera is powered through the USB bus and as such it does not need external power. Cameras on this kind of bus are generally faster than GigE cameras, but this speed brings some restrictions.

For the stable function of USB 3.0 cameras make sure that:

- A dedicated PCIe card for the camera connection is preferred before an integrated USB adaptor for higher speed.
- No other device (mouse, keyboard, printer) is plugged into the same bus as the camera (if the PCIe card is 2-port or 4-port, 2 or 4 cameras can be connected)
- Use only USB 3 Vision complied cables of length ≤5m. If possible, use rather shorter cables such as 3 or 4m
- Use ≤95% of maximal FPS

2.3. Camera Layout

Four camera layouts can be used with Mercury RT® for the measurement. Camera layouts are the following:

- Mono Cameras: used for 2D measurements. One or more cameras can be used, but they are treated separately.
- Stereo Cameras: used for 3D measurements. Cameras can be combined when creating stereo pairs.
- Stitched Mono Cameras: used for 2D measurements with an extended field of view. Used for measurements, where a measured point travels between the camera's field of view.
- Stitched Stereo Cameras: used for 3D measurements with an extended field of view. Used for measurements, where a measured point travels between the camera's field of view.

Stitching can be set in two ways:

- Overlapping FoV – Fields of View are overlapping each other so the measured point can travel between them. Used for high-elongating materials
- Separated FoV – Fields of View are separated and cameras only share the coordinate system. Used for long specimens with standard or lower elongation.

Additionally, when a stitched stereo scene is selected, the information on whether the cameras form a Partial or Full Circle around the measurement specimen needs to be provided to determine whether the last camera is neighbouring to the first camera or not.

A detailed description of the Mercury RT® setup for each layout is provided in chapter 6. SCENE TYPES SETTINGS.

3. INSTALLATION

After the decision about camera types and layout that will be used for contactless material testing, Mercury RT® can be installed.

Mercury RT® uses a Windows installer to copy the necessary files to the target machine file system and to install the necessary drivers for the cameras. Installation starts with executing the installation package: MercuryRT_x64_X.Y.Z.B.exe. The application requires at least 637 MB of free space. Follow the steps within the installation program to install the application.

During installation, you will be prompted to accept the license agreement. Once you have agreed that you have read and understood the license agreement and agree to be bound by it, you may proceed with the installation. Then you will be asked to select the destination location where the application will be installed. The application's default installation directory is C:\Program Files\ MercuryRT-vX.Y\.

Then you will be prompted to select a camera driver for your camera types. Select the camera drivers that will be supported in Mercury RT®.

3. CAMERA DRIVERS

Caution: Extreme care needs to be taken in order to provide just the right version of the camera drivers.

It is important to note that a very specific version of the driver might be needed and this can vary between versions of Mercury RT®. Do not just install the newest version of the drivers from the official camera manufacturer's web page!

If the user installs Mercury RT® from the supplied installation file, the correct drivers will be installed with the program if selected from the installation menu.

After selecting the camera drivers you will be asked to Select Additional Tasks. The choices are the following:

- Drivers: FTDI COM / USB CDM driver should be installed when you will use a testing machine that is connected through the serial USB communication to the computer. Install DigiGauge driver in cases when you will use accessories from DigiGauge.
- File extensions: If you would like to open Mercury RT® projects automatically when opening the file with an mpr file extension, leave the checkbox checked.
- Additional shortcuts: If you would like to open the Mercury RT® from the desktop shortcut. Leave the checkbox checked.

The installation can be cancelled anytime and the installation can be run repeatedly if necessary.

Mercury RT® can be uninstalled by running the uninstallation file (Uninstall_ Mercury RT-vX.Y.exe) from the C:\Program Files\ Mercury RT-vX.Y\ folder.

4. LICENSING

Mercury RT® is shipped in most cases with a hardware key (HASP) to be able to run the program on a user's computer. It is necessary to have the right hardware key inserted into a USB slot in your computer to run the program. The hardware key contains information about the purchased SW version and modules that you are allowed to use.

In case you have not obtained a HASP key, it is necessary to get a valid software license associated with the computer on which Mercury RT® software is installed to use Mercury RT® software. The procedure for obtaining a software license is described below.

- Run Mercury RT®
- The window for Requesting or Inserting a Licence File is displayed.

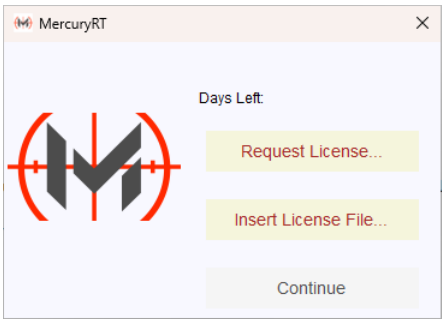


Figure 4.1: Request licence and Insert Licence File prompt

- Click on Request License... and a new window is displayed (this window can also be opened by clicking on the menu Help/Request License...).

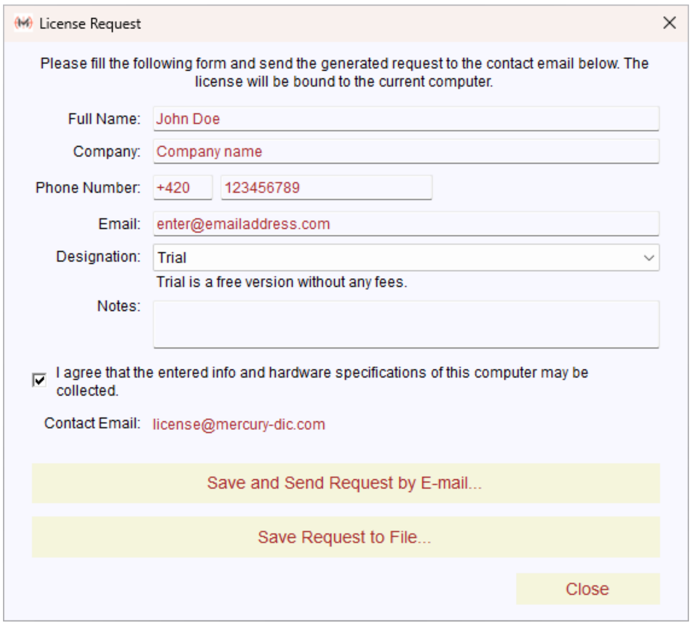


Figure 4.2: Licence Request window

- Fill in all the required fields.

Chose the required license. The following license types are available.

- "COMMERCIAL". This license can be used for commercial purposes (profitable activities).

- "TRIAL". This license can be legally used only for a free trial of the Mercury RT® for a period defined by Mercury MS. Free trial shall be understood as use for non-commercial purposes only and not for purposes of gaining profit in business, research, or other profitable activity. Further use of the Mercury RT® without obtaining the appropriate license after that period is in contradiction to the law as well as to the provisions hereof. Reinstalling the Trial Version of the Mercury RT® is not allowed by Mercury MS.
- "EDUCATION". This license can be legally used only by universities, educational institutions, and training centers and can be installed only on computers owned or in use by such entities. The Mercury RT® can be legally used solely for educational purposes and cannot be used for research purposes. Use for educational purposes shall be understood as use for non-commercial purposes only and not for purposes of gaining profit in business, grant-funded, or other profitable activity.
- "Not for Resale". This license can be used solely to present the Mercury RT® to third parties to mediate their further legal use. Mercury RT® may not be used for any other purposes.
- "Testing Only". This license can be used solely for internal testing of the Mercury RT® to verify the proper functionality of Mercury RT®. Mercury RT® may not be used for any other purposes.
- "Student". This license can be legally used only by students preparing a diploma thesis and can be installed only on a computer owned or in use by the student. Use for preparing diploma thesis shall be understood as use for non-commercial purposes only and not for purposes of gaining profit in business, grant-funded, or other profitable activity.

- Click Save request to file...
- Send generated license request file to license@mercury-dic.com

4.1 SW LICENSING

To get a software license bounded to a PC a license request has to be generated and sent to

license@mercury-dic.com

Caution: A software license request must be created on the same PC where the application is to be used and will not work on any other computer.

4.2 HW LICENSING

The licence can be attached to a USB HASP key. This is intended for use in industry where PC malfunctions need to be resolved quickly and therefore the licence can be carried on this HW key.

- A valid license file will be sent to the email address specified within the license request. If you do not receive the license file, please contact Mercury MS, s.r.o., at info@mercury-dic.com.

5. RUNNING THE MERCURY RT® FOR THE FIRST TIME

After the camera connection and Mercury RT® installation along with camera drivers and licensing the Mercury RT®, you will be able to run the Mercury RT®. The basic steps for working with the Mercury RT® are described in the following chapters.

5.1. INITIAL SETUP

While launching the application for the first time you will be asked to select the active camera libraries that you will actively use. This can be later changed in settings.

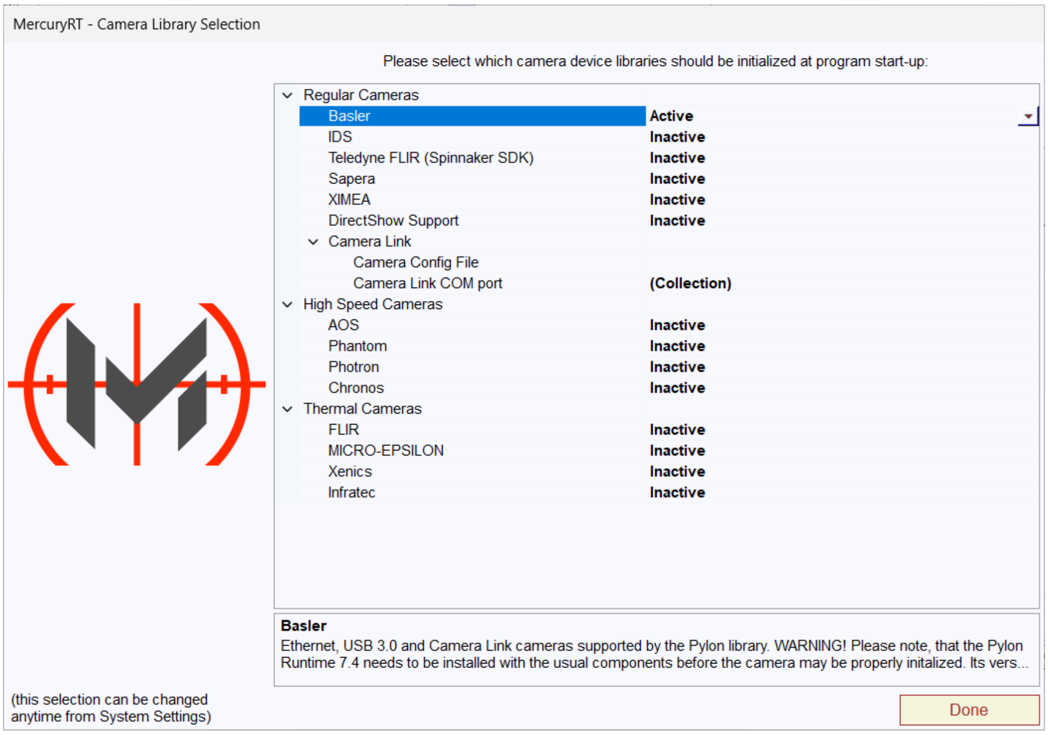


Figure 5.1: Camera Library selection – first run

The main Mercury RT® window is then opened.

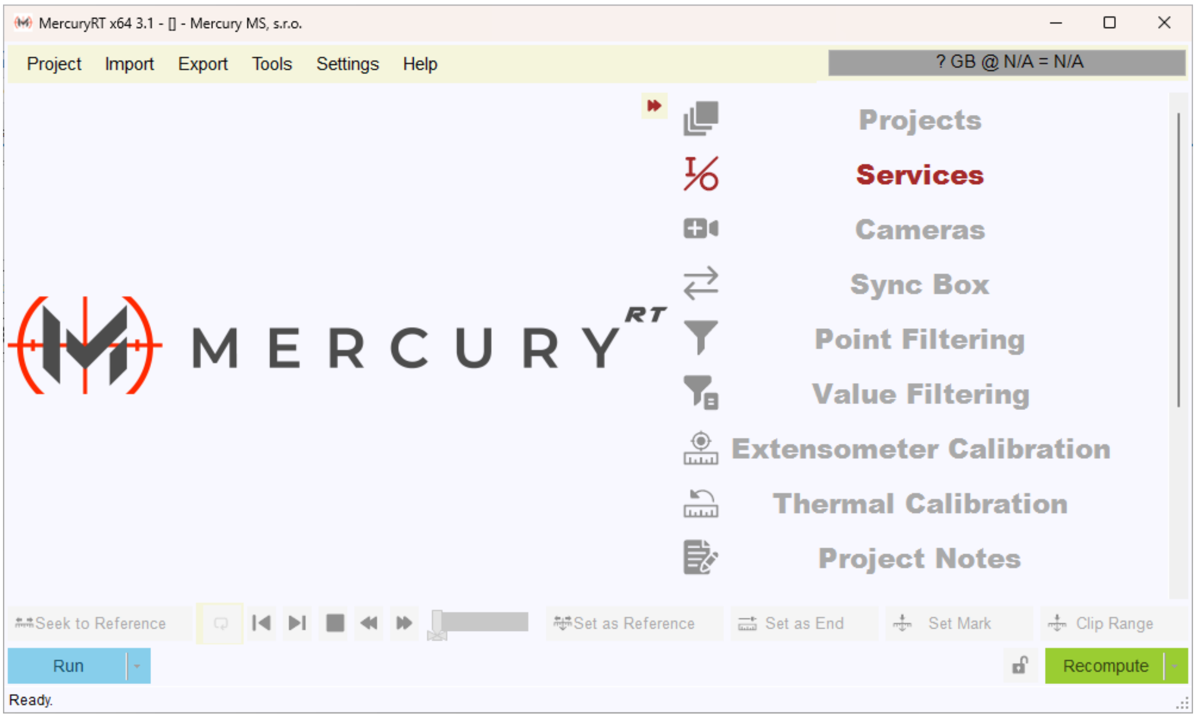


Figure 5.2: Mercury RT® main window

Next important thing is to set up output configuration. This is important if you require to send user defined values of measured quantities to a selected output. In that case you have to set I/O Services.

5.1.1. Camera Library Selection and Setup

Open the Settings/System... menu and choose Active Camera Libraries menu item. Set all camera libraries to be used with this system to Active. But remember that the more libraries are activated the more cameras have to be searched during the start of the program. So having all the libraries activated may lead to a longer Mercury RT® starting time.

5.1.2. Output Configuration

The configuration of services is handled by the I/O Services panel.

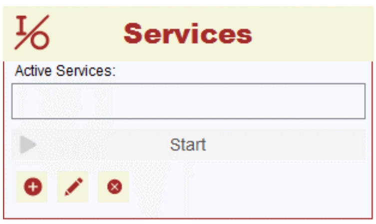


Figure 5.3: I/O Service panel

The new service can be added by clicking on plus sign icon in the I/O Services panel. The service parameters are adjusted using the Add I/O Service wizard.

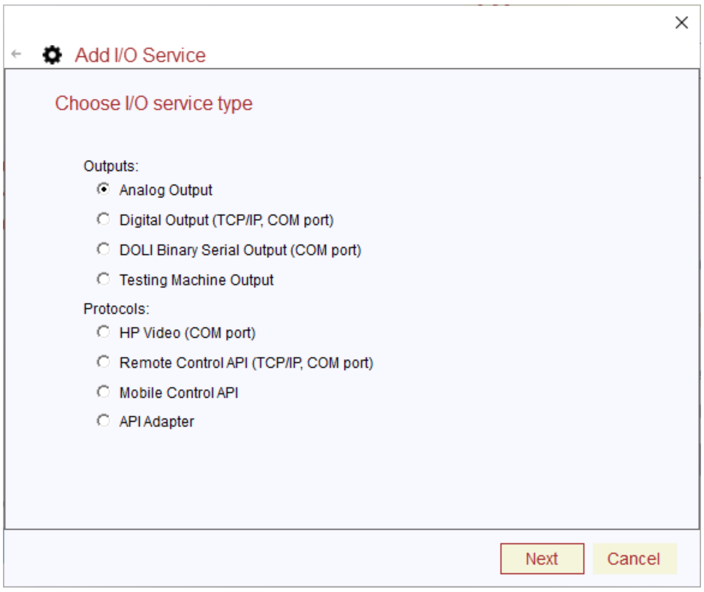


Figure 5.4: Add I/O Service wizard

The configuration options are the analog, digital, DOLI Binary Serial and Testing Machine outputs.

Caution: When using Analog Output Device, enter Name in format of COM#, not only #

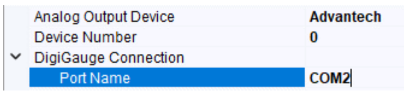


Figure 5.5: Specifying the Port Name

Caution: When using serial RS232 cable to connect PC and machine, use crossed cable.

To set which value is to be send to output see chapter 5.2.8 Setting the Output.

Detail information about Output configuration follow the Reference Handbook chapter 10. I/O Services. The handbook can be found in Help/View Help.

5.2. CREATING A NEW PROJECT AND ITS SETTING

To create a new project, go to Project/New/Realtime Measurement (or press Ctrl+N) and select the directory to save the project file.

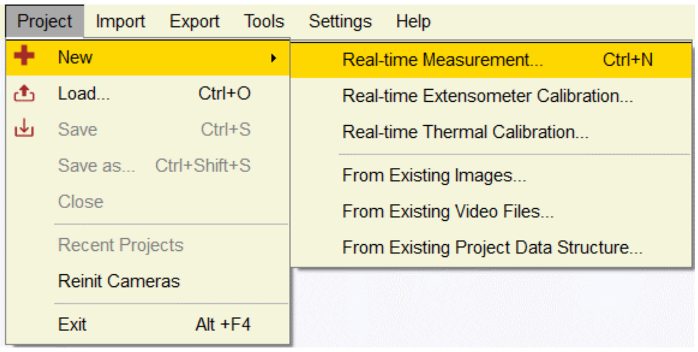


Figure 5.6: Creating a new project

Caution: Project consists of one file like MyPoject.mpr and folder with calibration and image data that is called Data_MyProject. This means that when copying the project, both file and folder need to be copied.

5.2.1. Camera Selection

When a project for New Realtime Measurement is saved, camera selection window with a list of connected cameras will pop up. Here the camera configuration can be set. To select the camera, use drag and drop to move the camera view to the right side of the selector.

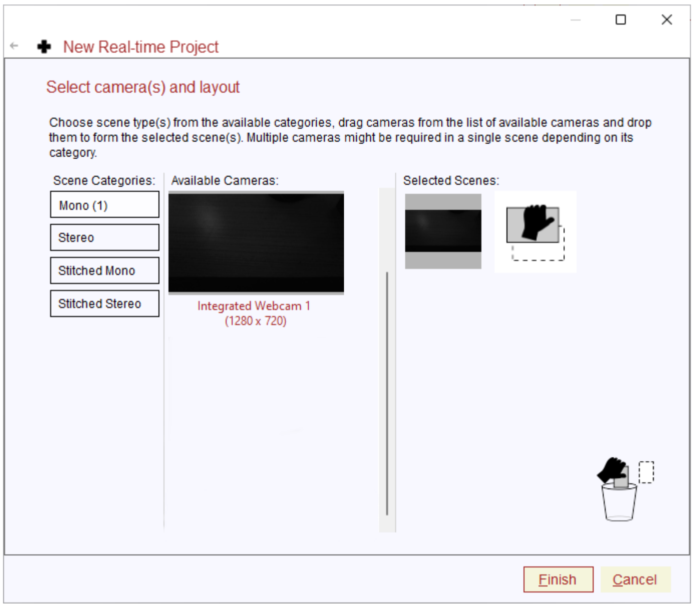


Figure 5.7: Mono Camera selection

Mono Camera – used for 2D measurements. One or more cameras can be used.

Stereo Camera – To create a camera stereo pair drag two individual cameras and assign them as Left and Right Camera.

Note: The easiest way of recognizing the left and right cameras is to cover or wave in front of the left camera to recognize it in the selector.

Cameras can be combined. With three cameras three stereo pairs can be created. (CAM1 - CAM2; CAM2-CAM3; CAM1-CAM3)

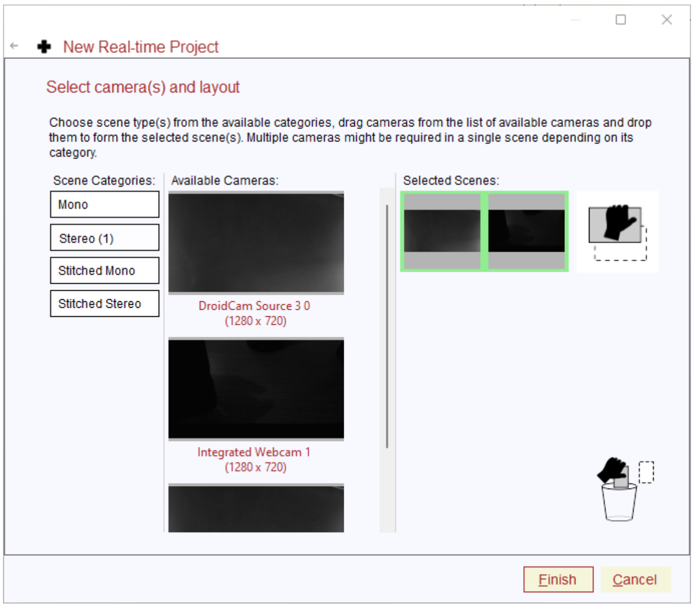


Figure 5.8: Stereo Camera Selection

Stitched Mono Cameras – used for 2D measurements with extended field of view. Used for measurements where a measured point travels from CAM1 to CAM2 or for cases where there is a gap between both fields of view.

Stitched Stereo Cameras – used for 3D measurements with an extended field of view. Used for measurements, where a measured point travels between the camera's field of view.

After selection press **Finish** to open the Camera Window.

Caution: Make sure that GAIN of the camera is set to 0.

The following sections assume the use of one camera (monoscopic system). Mercury RT® setup for other types of camera layouts is described in Chapter 6 SCENE TYPES SETTINGS.

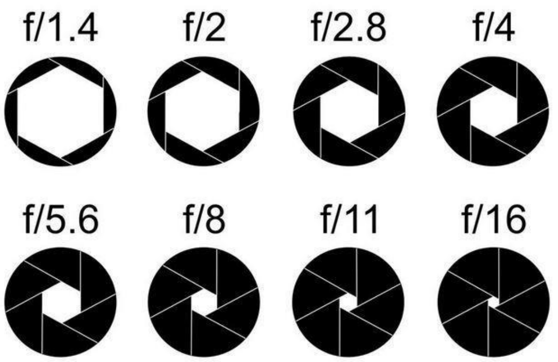
5.2.2. Setting the Scene

To set the scene and prepare the system for calibration following steps have to be performed:

Light Setup – turn on the light and point it towards the measured area. The brightness of the picture can be modified in two ways.

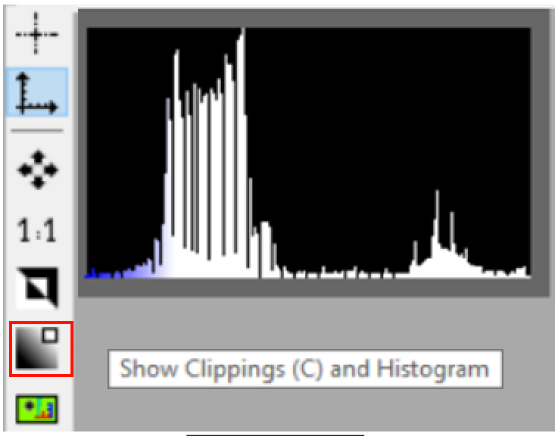
IRIS APERTURE ON THE LENS

The aperture controls the amount of light falling on the surface of the camera sensor. More light brings the possibility of a short shutter speed, which is desirable; a small aperture causes a shallow depth of field. In addition, the best optical properties of lenses are usually found in the middle of the range. The recommended setting is therefore between 4 and 11.



SHUTTER TIME

Setting the exposure time should be the second step after setting the aperture. This value should be as low as possible to minimize the risk of motion blur that would lead to degradation of the system resolution. Set the shutter speed so that no blue or red pixels appear on the sample if you have the Show Clippings and Histogram feature turned on. (Reference Handbook chapter 3.2)



Focus the camera – To focus the camera the easiest way is to use our Focus Tool which marks the highest contrast with the green color in the image which is sufficiently sharp. Simply turn the focus ring on the lens and look for the green color in the measured area.

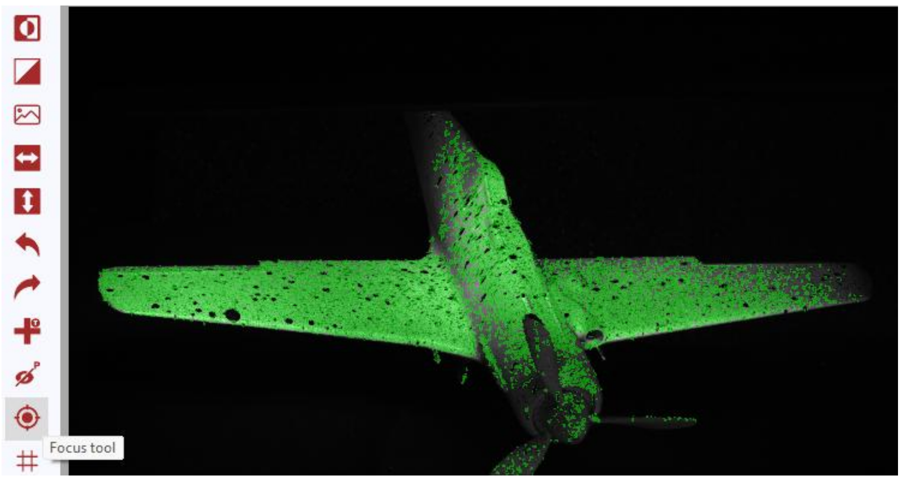


Figure 5.9: Focus tool

5.2.3. Camera Calibration

Camera calibration, also called **distortion compensation**, is done for two reasons. **The first reason** is to compensate for camera lens distortion, which is spherical. The following figure shows the reason for the need for distortion correction.

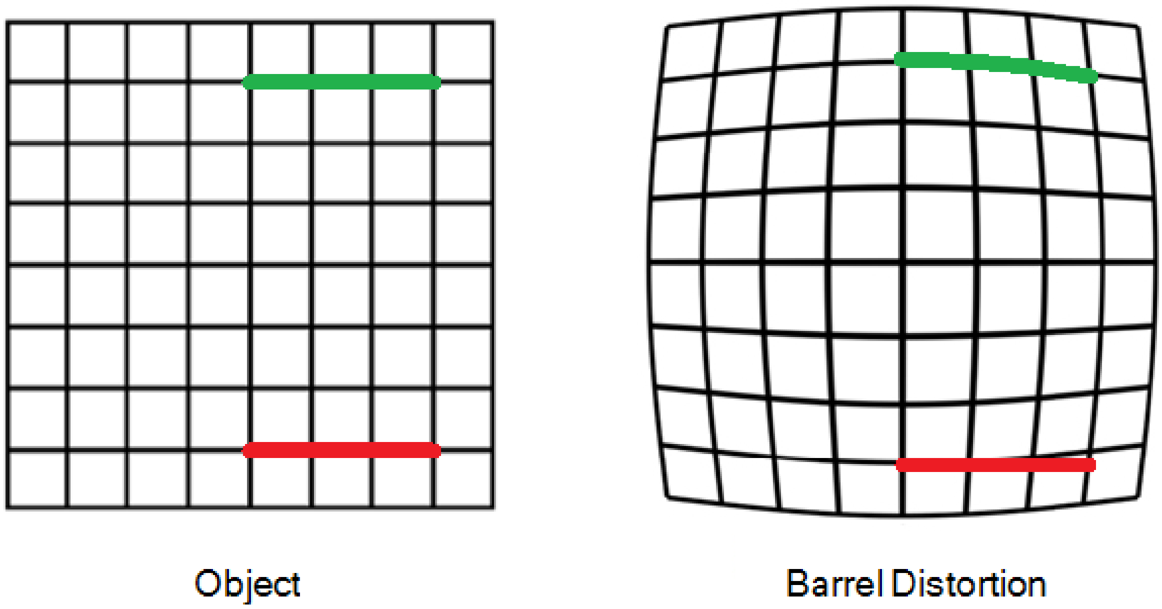


Figure 5.10: The lens distortion

Let the horizontal direction be the X-axis and the vertical direction be the Y-axis. And let the lines represent the movement of a point from the center to the side of the grid. You can see that both trajectories run only in the X direction. When the correction is applied, the system calculates the actual position and keeps the motion as uniaxial. When the correction is not applied, even if the point was moving only along the X axis, the system would evaluate the motion as an X and Y displacement.

The second reason is that the system calculates a mathematical model of the lens and allows perspective compensation so that a plane offset can be applied. This is a very useful feature for creating measurement templates for different sample widths.

Caution: Note that some features require or depend on camera calibration, so it is recommended to perform this calibration as the first step after opening the scene window. In addition, calibration must be performed at full camera resolution.

To perform the calibration, press the **Camera Calibration** button within Scene Setup panel in the Camera Window.

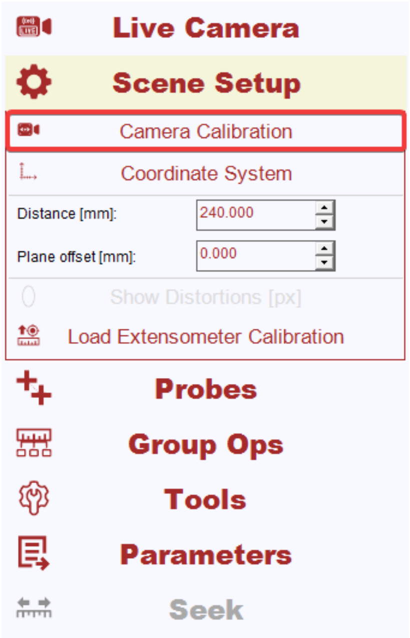


Figure 5.11: Camera calibration button

A **camera Calibration dialog window** will appear. Then select **Start New**.

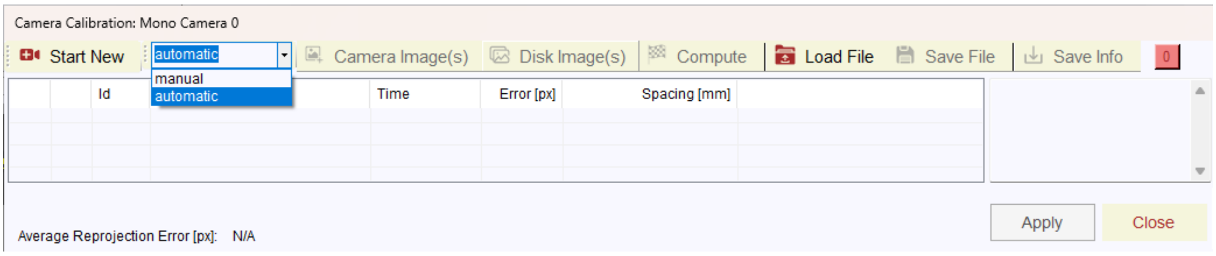


Figure 5.12: Camera calibration window

Now **Unit Distance** have to be specified. Unit Distance specify the unit distance (distance between squares or circle centers) of the used calibration grid. When using the Enhanced circle grid a Unit Distance is labelled on the grid. Other parameters can be left at their default values.

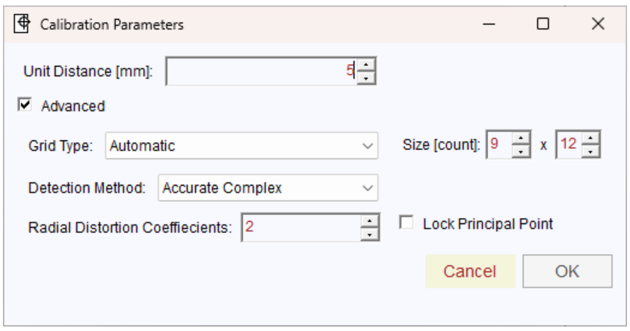


Figure 5.13: Calibration parameters

Caution: Holes in the corner of the grid are due to manufacturing reasons and in some cases may lead to incorrect operation of the detection algorithm. In this case, position the grid so that the hole is not visible or cover it.

Select the image capture mode. If you select Automatic, images will be taken automatically at 1-second intervals. To stop capturing images in Automatic mode, you must press the Stop Capturing button. If you select Manual, you must capture images of the grid by pressing the **Camera Image(s)** button.

Now start capturing images of the grid by pressing the **Camera Image(s)** button. Eventually, the images should cover the entire frame and **also different angles**. Keep changing the angle of the grid slightly as you take pictures. Capture between 15 and 30 images.

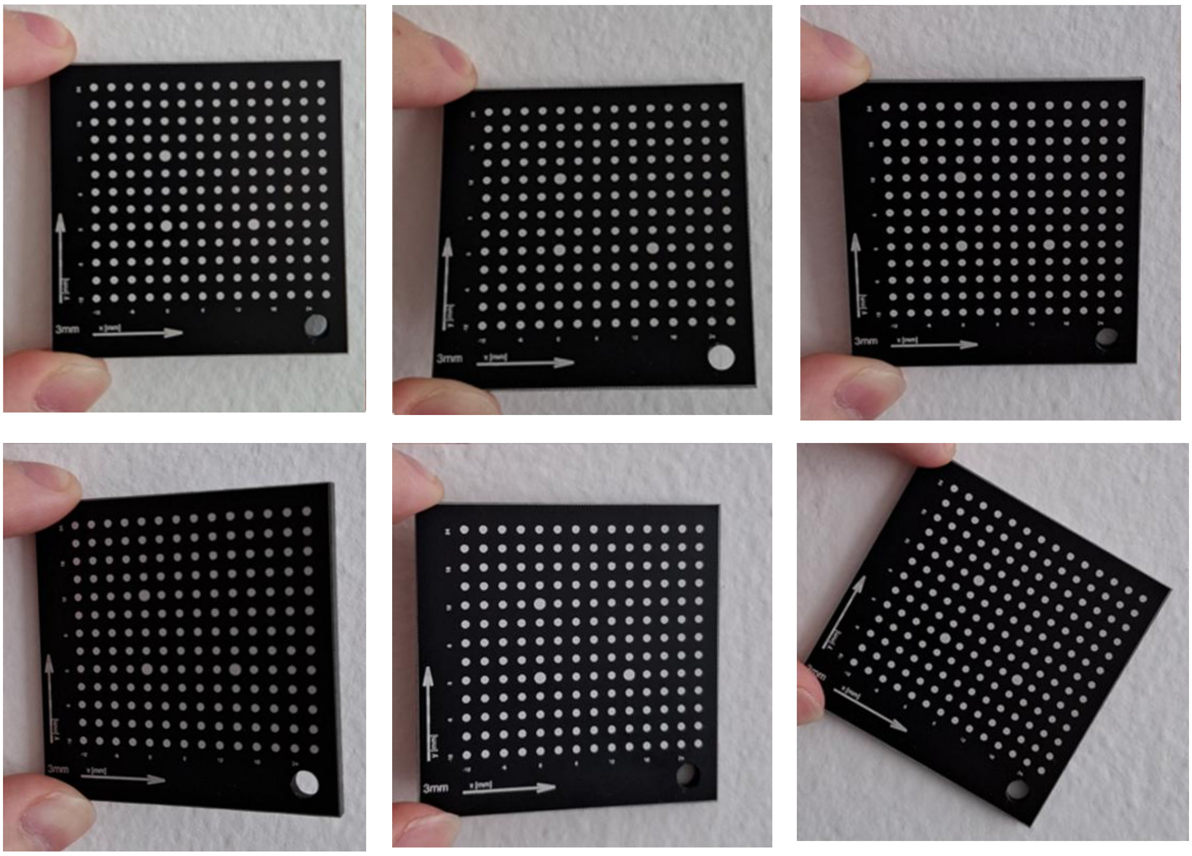


Figure 5.14: Camera Calibration with calibration grid

Caution: It is very important to capture the grid at different angles, not just parallel to the camera sensor. Based on these images, the system calculates the perspective and focal length of the lens and can perform a plane offset.

Hint: When calibrating Stereo Cameras you can follow the calibration guide by clicking on the Guide icon.

A red icon is shown in the upper right corner, when you press the Camera Image(s) and the grid is not recognized. This indicates that detection of the calibration grid in the captured image failed. This can occur if the grid does not appear in its entirety in the camera's field of view or if incorrect calibration grid parameters have been entered. Press the Start New button to start the calibration process again.

Hint: If the detection fails, try setting the Shutter Time about 1 or 2 ms higher to increase the contrast of the grid.

After capturing at least **15 images** press **Compute** button at the top of the window to start computing the reprojection error.

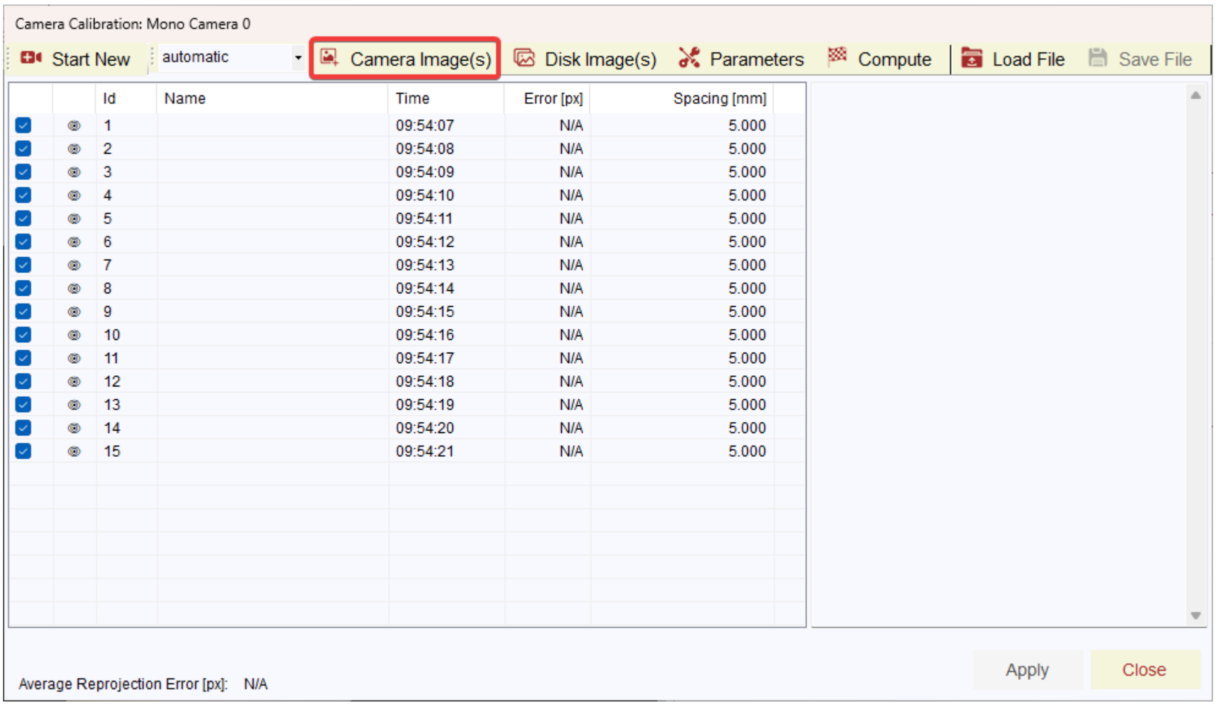


Figure 5.15: Capturing Camera Image(s) with a calibration grid

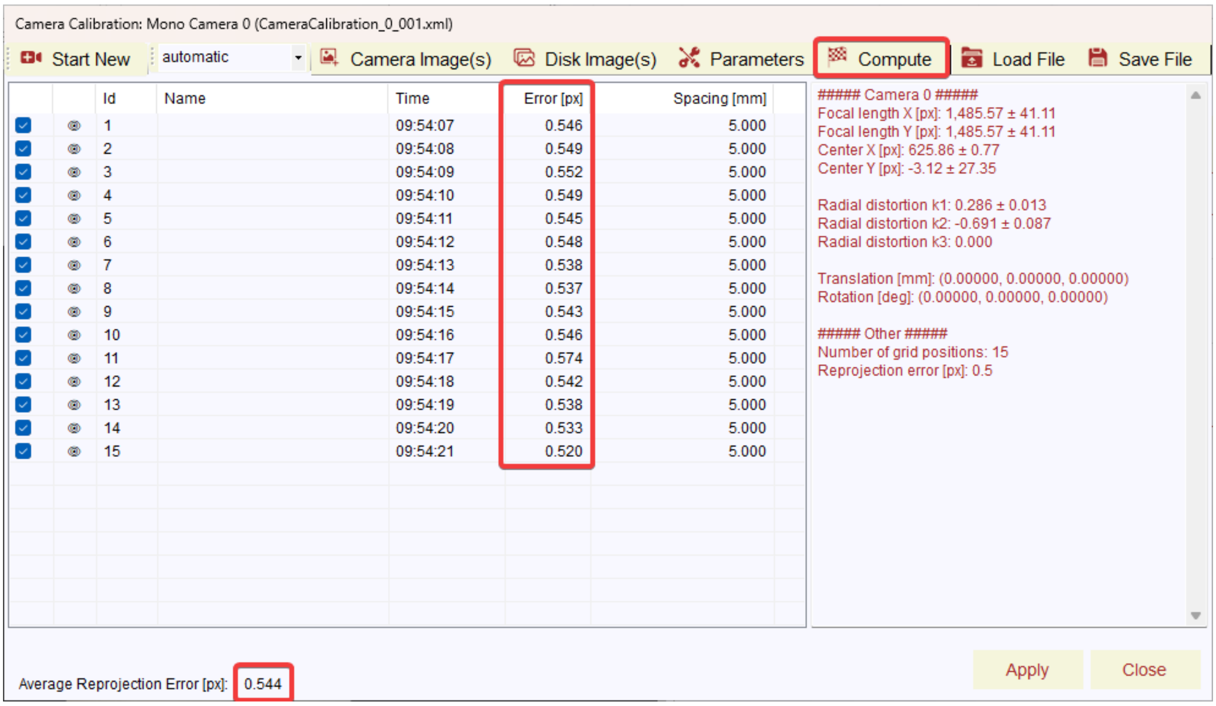


Figure 5.16: Computing Reprojection error

After the calculation is complete, the **Error** value is displayed for each image. This represents an error in re-projecting the centers of the dots in the grid. This value can lie in the range from 0.05 to 0.6px. This does not mean that the system will have an error of 0.544px (the value from the image). This value is more or less meaningless to the user. It's only good for checking that one doesn't greatly exceed the other, which may be due to the motion blur of this single image.

Caution: Do not remove images with slightly higher errors. These images may be images with a sharper angle and carry more perspective information. Remove images with errors greater than 1px (for standard measurements). It is better to have multiple images (even if worse) within the calibration than just a few "nice" ones.

When Apply button is pressed a previously red bar 

in the Camera Window becomes green bar 

and the calibration is done.

5.2.4. Setting the Coordinate System

The coordinate system defines the relation between the pixel and the physical unit millimeter and defines the measurement plane.

There are two ways to set up the coordination system for a mono scene. The first way is to use the ScaleCaliper tool, which you can use to set the Scale Factor for a mono scene if the camera sensor plane is parallel to the measurement plane.

The second way is to use the Calibration Grid, which allows the adjustment of the coordinating system even in cases where the camera sensor plane may not be parallel to the measurement plane and also for stereo scenes.

5.2.4.1. Setting the Scale Factor with Scale Caliper

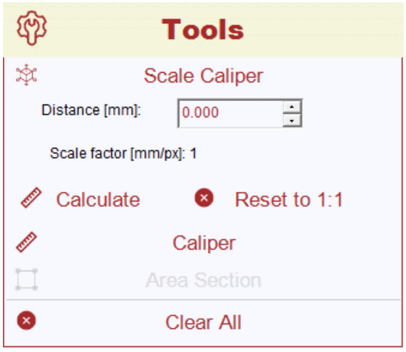


Figure 5.17: Scale Caliper tool

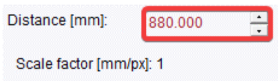


Figure 5.18: Scale Caliper distance

A tool called Scale Caliper is available for setting the scale factor for a mono scene. This tool allows you to specify a known distance within the scene. In this way, it is possible to define a relationship between a pixel and a physical unit in millimeters.

In the toolbar, select the Scale Caliper tool. Use the Scale Caliper tool to draw a line between two points in a mono scene where the distance is known. Then manually measure the real distance between the two points and enter that distance in the distance field (you can also enter the distance in the context menu, which can be displayed by right-clicking on the ScaleCaliper).

ScaleCaliper can only be used on a project that is not locked  and where the coordinate system position is not locked.

By specifying the Scale Caliper distance in mm, the Scale Factor is recalculated in unit [mm/px]. So Scale Factor specify how much mm equals one pixel.

5.2.4.2. Setting the Coordination system with Calibration Grid

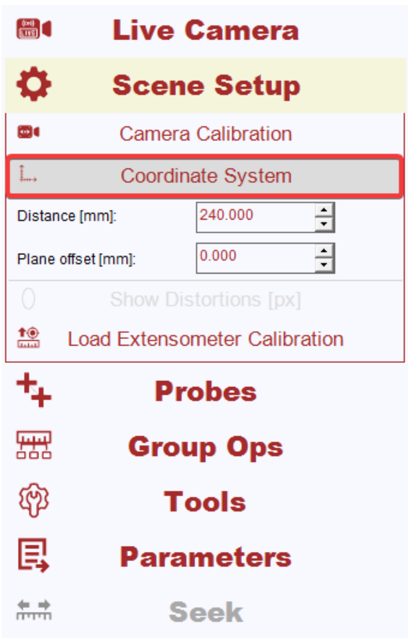


Figure 5.19: Coordinate System button

To start the Coordinate System setting, press the Coordinate System button to open the corresponding dialog box. If the calibration parameters were set during camera calibration, the parameters are automatically filled in. If this is not the case or if a different grid is used, these parameters must be filled in (see chap. 5.2.3).

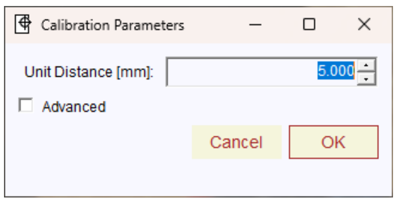


Figure 5.20: Calibration parameters

To set the Coordinate System properly place the grid into the measured plane. This can be done by placing the grid into the grips of the test machine or pressing the grid towards the specimen clamped in the grips.

When the grid is in the correct position, press the **Detect** or **Refresh & Detect** button. After successful detection, green crosses will be placed over the detected dots on the grid.

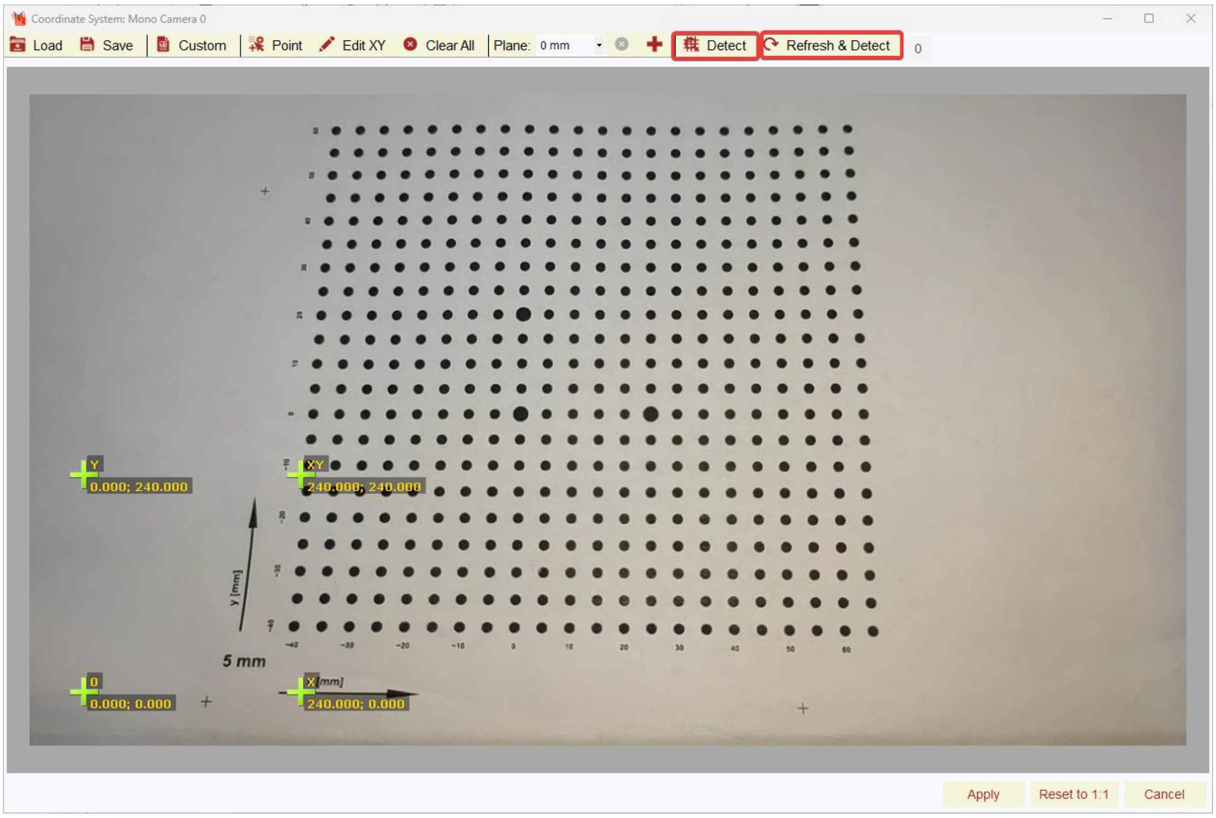


Figure 5.21: Coordinate system detection

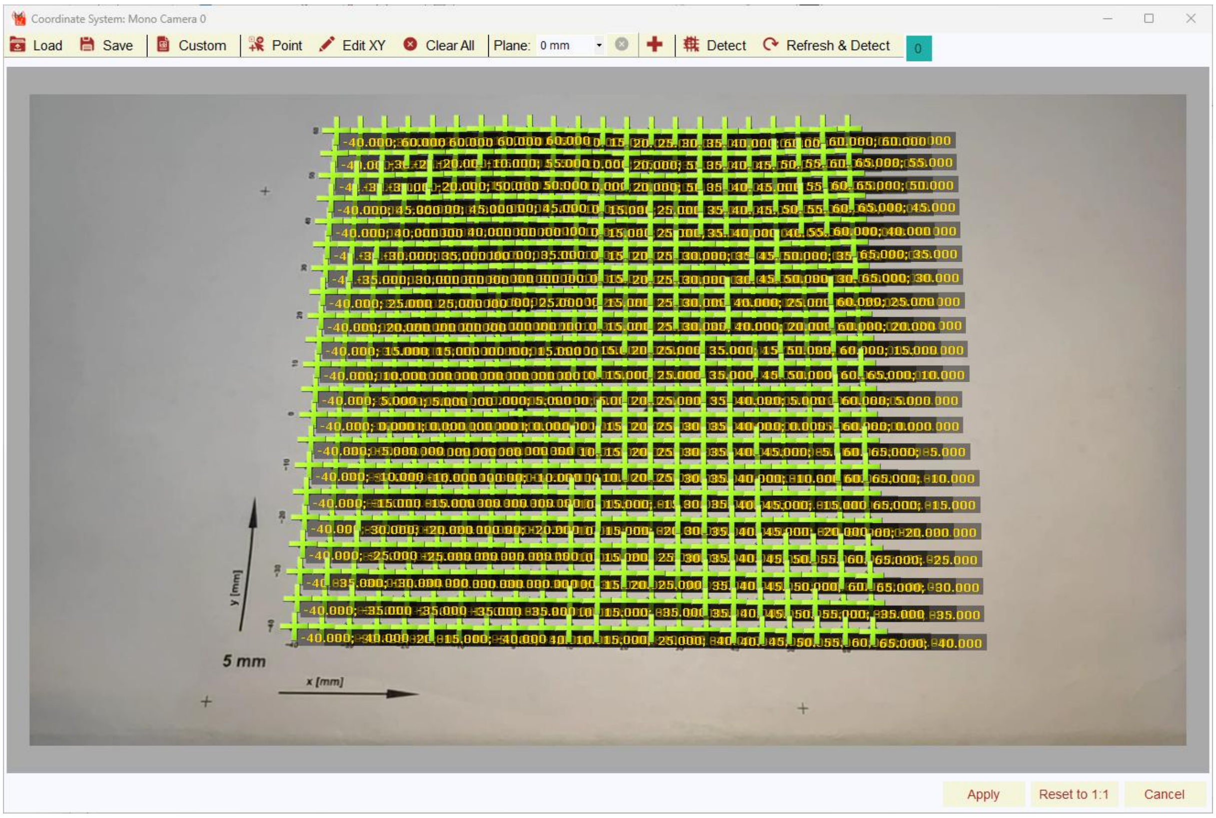


Figure 5.22: Properly detected coordination system

After detection, the Coordinate System is set, but in the wrong plane. The coordinate system is now "lying" on the grid and not on the sample.

The measurement plane can be moved closer or further away from the camera after establishing calibration and perspective. Click the plus button  to initiate the addition of a coordinate system. Specify the Plane Offsets for which you intend to create a coordinate system. Positive and negative numerical values are allowed.

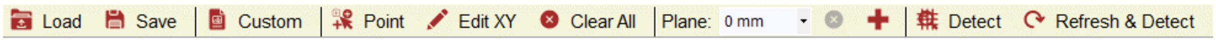


Figure 5.23: Plane Offset settings

Throughout the measurement process, you can then dynamically set a desired plane offset by specifying its value. The software will intelligently interpolate the plane offset to align with the nearest coordinate system. The more plane offsets are created in the measurement range, the more accurate the actual measurement will be if the correct plane offset is selected, as interpolation errors are eliminated.

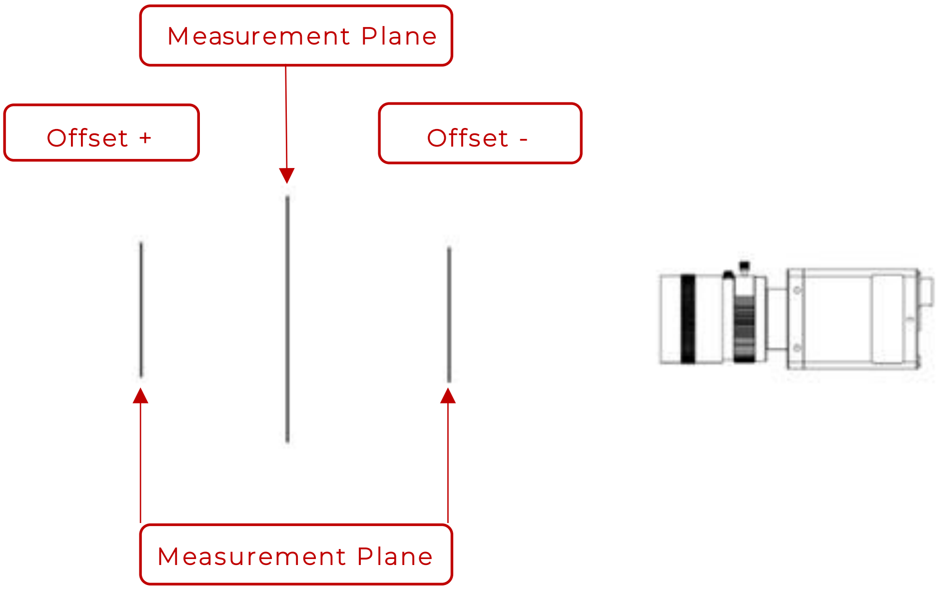


Figure 5.24: Plane Offset description

If the grid is pressed towards the specimen, enter the grid thickness to get to the surface of the specimen:

- Mercury RT® black aluminium grid thickness 3mm.
- Mercury RT® white glass grid thickness 4mm.

Hint: The recommended procedure is to set the coordinate system to the machine axis for the first project and create measurement templates for different sample thicknesses by copying the first setup.

When setting the Coordinate System for different templates, the type of used grips has to be considered.

For wedge grips only half of the specimen thickness will be entered.	For vise it is beneficial to measure from the fixed side as the measurement plane will not change.
	

After Applying the Coordinate System it can be adjusted in the Camera Window. Move it by dragging by ZERO, rotate it by dragging point X and flip the Y direction by dragging point Y.

The coordination system can be hidden to prevent unwanted change by clicking on  icon.

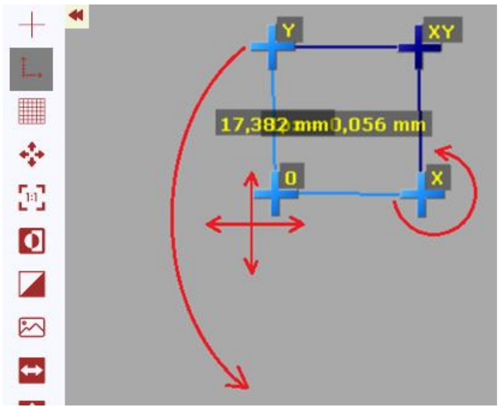


Figure 5.25: Coordination System adjustment

5.2.5. Applying Area of Interest

Area of Interest (AOI) is a feature that lowers the read-out number of pixels of the camera sensor. This feature is used for two reasons.

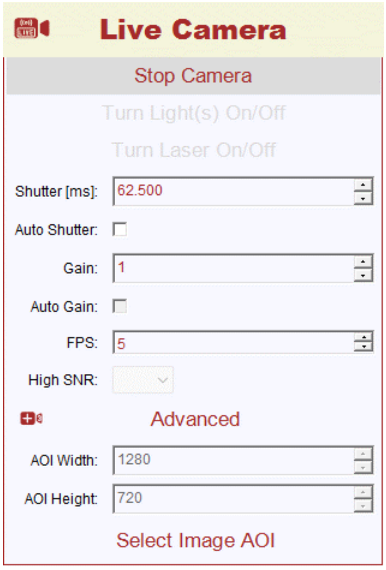
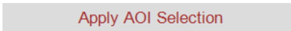


Figure 5.26: Select Image AOI

Higher FPS - the frame rate of the camera is usually limited by the bus. More data simply cannot be pushed through. But with AoI, each frame can be scaled down and therefore more frames per second can be pushed.

Drive Space and Performance Saving – even if a high frame rate is not needed, a smaller image can save disk space and also save some computer performance because the algorithm does not have to process larger images.

To set the AOI, press the Select Image AOI button in the Live Camera section of the camera window. When the green lines appear, drag them to set the optimal area of interest. When the width is not measured, it is not necessary to see the edge of the specimen and a higher FPS can be achieved. When the selection is complete, confirm it by pressing the Apply AOI Selection button 

. The same procedure can be used to reset the AOI.

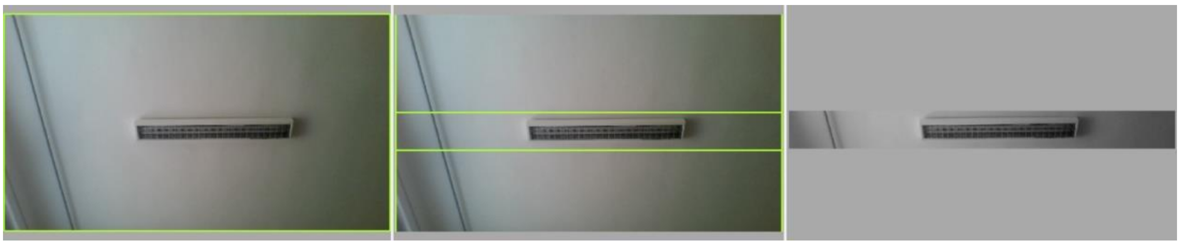


Figure 5.27: AOI function

5.2.6. Specimen Preparation

Many samples can be measured without the use of an additional pattern, but the application of a pattern is sometimes unavoidable. Especially for materials without a distinctive texture, such as polished metals or polymers. These materials have no or almost no pattern and therefore carry no information suitable for the DIC algorithm.

Figure 5.28: Polished metal and polymer samples

The most basic way of marking a sample is to use a marking pen such as the Schneider MAXX 130. **There is no need to create an exact mark, just anything that will create contrast on the surface and will deform with the sample**. However, creating a cross or speckled pattern is the best choice as it removes all degrees of freedom (DoF).

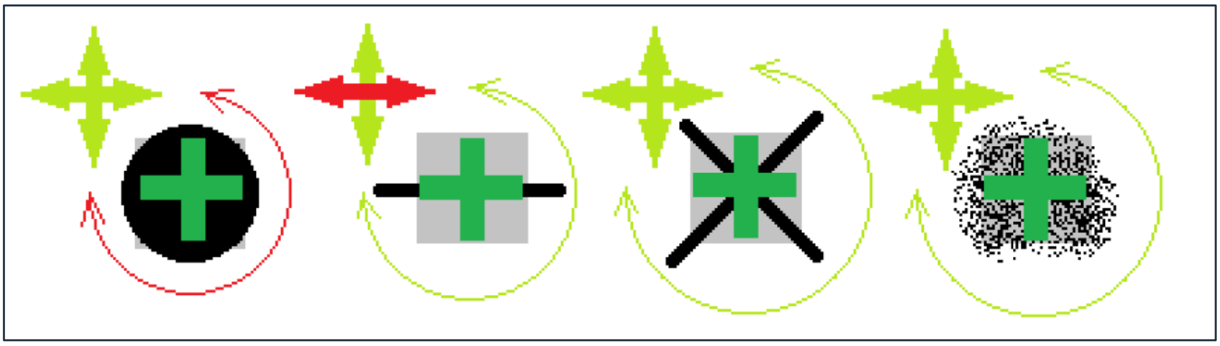


Figure 5.29: Marking of specimens

Following chart shows which DoF are constrained with a different marking methods.

Table 1: DoF constrains for different marking methods

	DOT	LINE	CROSS	SPECKLE
Horizontal Translation	YES	NO	YES	YES
Vertical Translation	YES	YES	YES	YES
Rotation	NO	YES	YES	YES

The marks need not be made exactly at the Gauge Length distance, just close to it. Mercury RT® allows the user to set the exact Gauge Length manually and all that is needed is some contrast in the dark area around the measured points (Correlation Template).

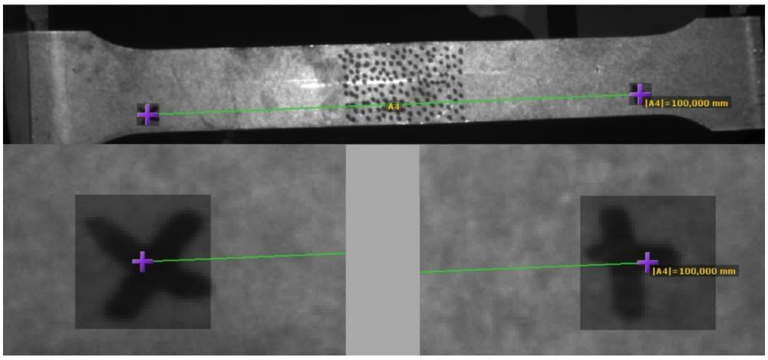


Figure 5.30: Making marks close to Gauge Length

The most common method of applying a speckle pattern is to use spray paint. We recommend using matte white paint to apply a thin layer of base color and a dark red primer for the dots.

Note: The layer of base colour should be as thin as possible. Just to prevent reflections. This is essential at high deformations. A thick layer of paint can create a crust that can crack and invalidate the measurement.

To create fine dots (small-sized specimens) use quick motion over the area of interest or spray through some very fine metallic mesh.

To create larger dots (medium-sized specimen) throttle the spray (pressing the throttle just a little until larger blobs start to come out.

5.2.7. Setting the Measurement

Once the calibration and coordinate system setup are complete, it's time to set up the measurements using the different types of measurement probes. Probes can be inserted into the scene by selecting them from the Probes menu and clicking on the scene. Right-clicking on the inserted probe point opens the probe context menu from which the measurement values can be selected. For length and width measurements, see the following chapters.

5.2.7.1. Probes

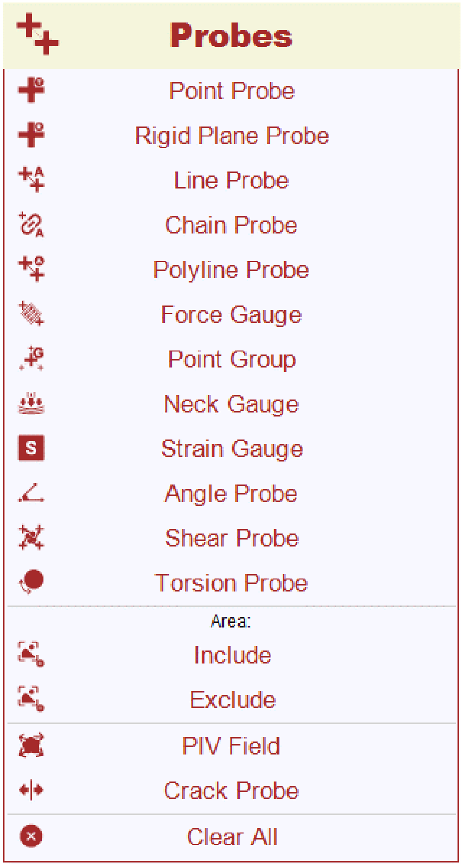


Figure 5.31: Probes

Point Probe – tracks movement at the selected point. Measures displacement, velocity or acceleration. Euclidean or directional.

Figure 5.32: Point probe

Rigid Plane Probe – sets the rigid points in the field of view such as stable parts of a machine. They are used to compute the movement of the coordinate system over time. It is helpful to use rigid plane probes in combination with Crack Probe.

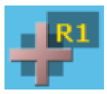


Figure 5.33: Rigid point probe

Line Probe – basic extensometer. Measures change of distance between two points. Can measure total length as well as a delta of this length. Measures in a physical unit or in percent. Allows width measurement in one point that keeps its relative position along the line (e.g. 28% from the start point). Length and orientation can be set manually.

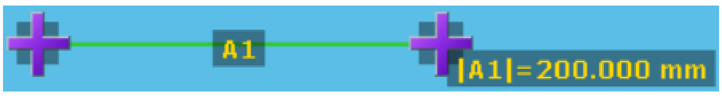


Figure 5.34: Line probe

Chain Probe – finds its place when measuring longer prismatic samples with small measured lengths. It detects the greatest elongation along the specimen and allows measurement over the neck.

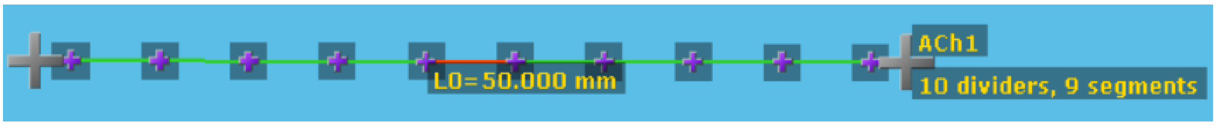


Figure 5.35: Chain probe

Polyline Probe – useful in bending tests. It measures elongation as a baseline, but the polyline is divided into sub-sections with internal points that are tracked so that it can follow the curvature of the specimen during measurement.

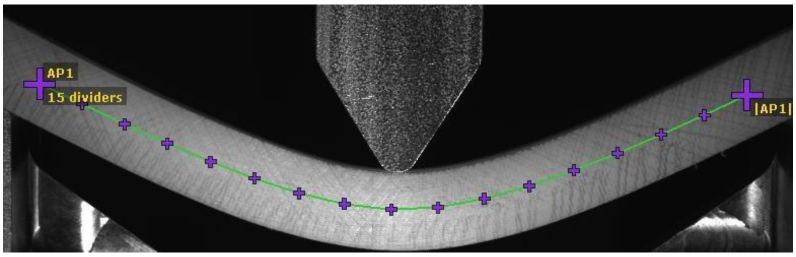


Figure 5.36: Polyline probe

Force Gauge – used for the computation (Hooke's law) of a simulated tear force. This simulation works as a transducer, complementing the values measured by a connected testing machine or replacing them if no such device is present. The resulting force is computed from the extension of the force gauge over time and a specified stiffness.

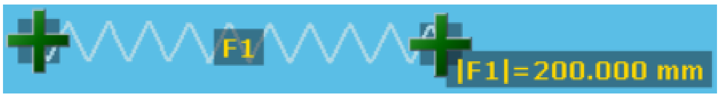


Figure 5.37: Force Gauge

Point group – is the extension of a point probe, which consists of multiple arrow-shaped markers. This probe is useful to observe the behavior even in the places of the image, which do not contain a suitable correlation template or to compute values related to the entire group of points, such as the changes in the rotation of the measured specimen.

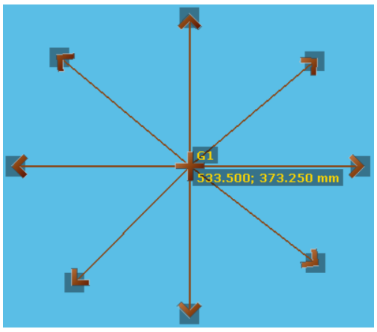


Figure 5.38: Point group

Neck Gauge – recommended probe for width measurements. Can be divided into subsections. The neck gauge automatically detects an edge of the specimen and searches for the highest gradient of deformation (transverse contraction).

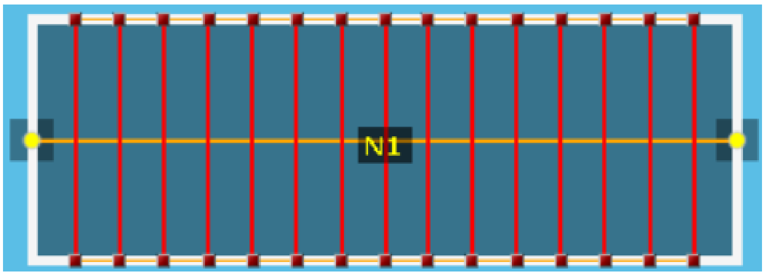


Figure 5.39: Neck Gauge

Strain Gauge – simulates a foil strain gauge and allows strain measurement. Can visualize the direction of major and minor strain and **is always aligned with the Coordinate System**.

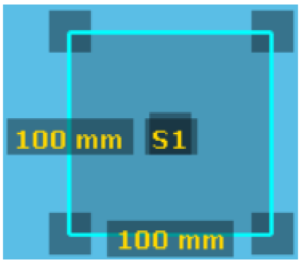


Figure 5.40: Strain Gauge

Angle Probe – consists of two lines, which share a common starting point. Angle probe is used to measure the angle between two lines based on correlation on all three points of angle probe.

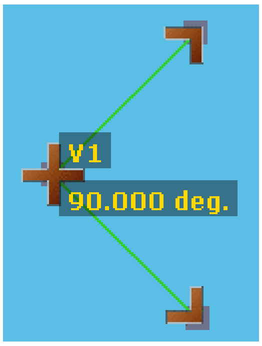


Figure 5.41: Angle Probe

Shear Probe – consists of two lines. Shear probe is used to measure the angle between two lines, as well as the shear strain computed as the sum of the absolute values of their relative elongations. The computation is performed by correlating the endpoints of these lines (four points in total), which makes it suitable for lattice-like materials.

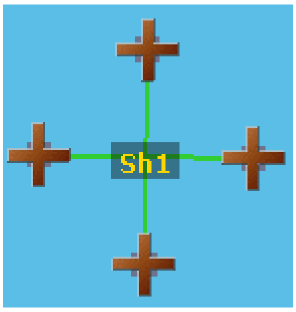


Figure 5.42: Shear Probe

Torsion Probe – consists of one line, with start point and end point. It is used to measure angular twist on cylindrical specimens by measuring the angle between start and end point by performing correlation on these points. In order to get results, it is necessary to specify a diameter of the cylindrical specimen from the context menu of the probe.

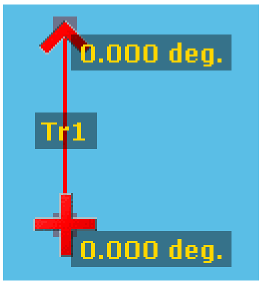


Figure 5.43: Shear Probe

Area Include – sets boundary points for Full Field measurement and defines the area of interest. The area inside of these points is uniformly filled with the measurement points. Even if the area is split into more isolated areas it is computed as one.

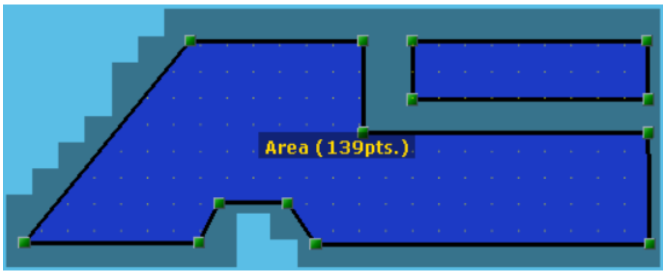


Figure 5.44: Area include

Area Exclude – sets boundary point for the area that should be excluded from the measured area.

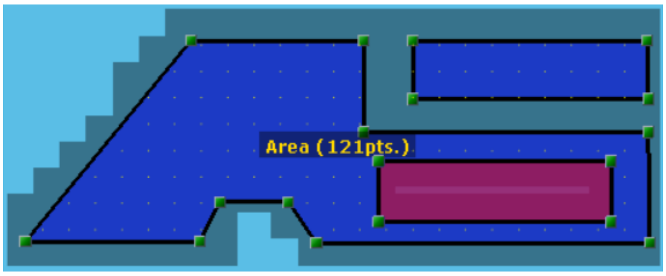


Figure 5.45: Area exclude

Note: SHIFT + Left Mouse Click can delete Probes.
Middle Button Click can move Areas

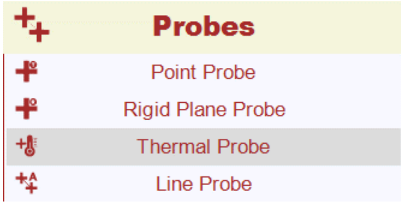


Figure 5.46: Thermal Probe item

Figure 5.47: Thermal Area items

When a thermal camera is connected, it is possible to use Thermal Probe and Thermal Area. Temperature measurements can only be performed in monoscene, but a combination with an optical camera is possible.

Thermal Probe – measures temperatures (including temperature changes) at a specific point.

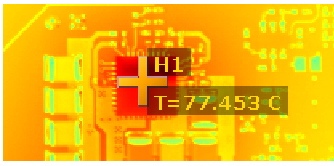


Figure 5.48: Thermal Probe

Thermal Area – used for a full-field analysis based on Temperature field. Measurements in the thermal area work the same way as measurements using the normal area, except that in the normal area the deformation is measured at the given points, in the thermal area the temperature is measured at the given points. The area can measure a temperature variable or temperature difference and can display, mean, minimum, maximum, median, or standard deviation. Measurements and outputs are displayed in graphs. Outputs can also be exported to CSV or HDF5 from the graph or area data.

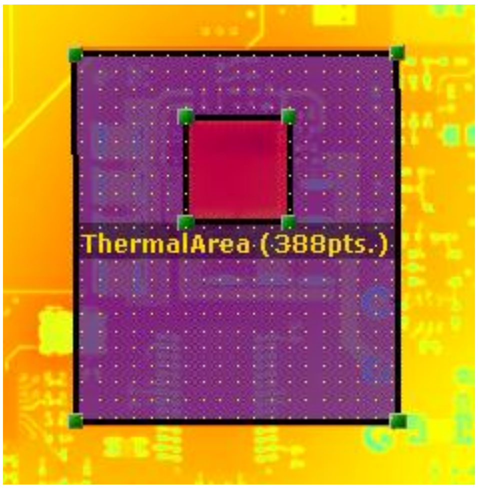


Figure 5.49: Thermal Area

5.2.7.2. Length Measurement

To measure the length or longitudinal elongation the **Line** or **Chain Probe** is commonly used.

Line Probe – applicable for most of the basic measurements. Just place the line on the specimen in the measurement direction and by right-clicking on the line select a desired value in the opened context menu.

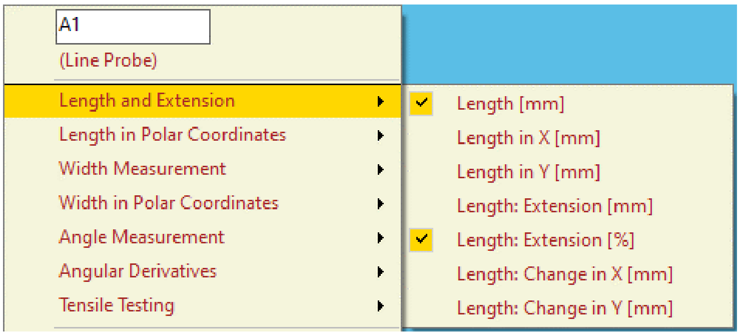


Figure 5.50: Line Probe - Length and Extensions values

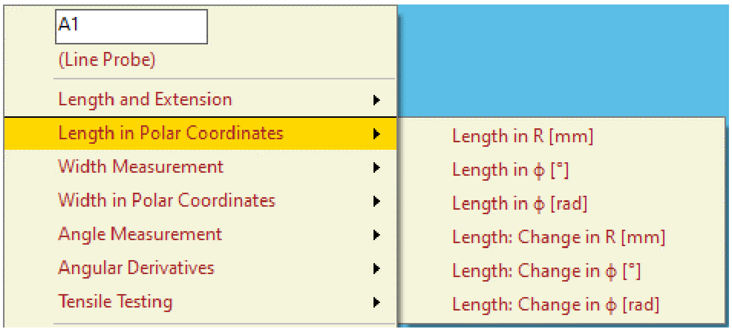


Figure 5.51: Line Probe - Length in Polar Coordinates values

Then set the **Length** as the initial Gauge Length.

Stress can be calculated if a force signal is acquired.

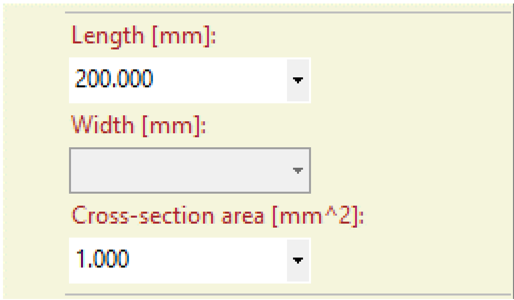


Figure 5.52: Line Probe parameters

Chain Probe – the origin of this probe is in concrete steel strain measurement. Typical use is for long specimens with small Gauge Lengths (e.g. 400mm sample size, 70mm gauge length) and the standard says that the measurement must be performed over the crack otherwise the test is invalid.

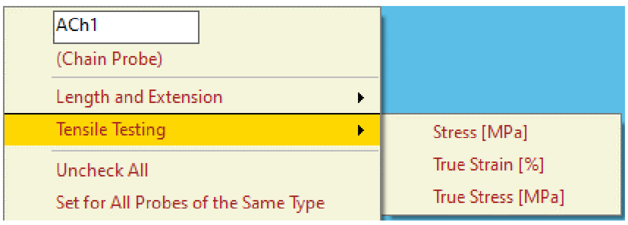


Figure 5.53: Chain Probe – Tensile Testing values

Apply the probe over the whole length of the specimen and then open the dialog. Divide the probe into a higher number of sections in the **Dividers** box and set the **Original Gauge Length**. **Recommended number of dividers is 19** because when one point is lost it is more than 5% of points and the reference image is refreshed (description later within Incremental Step).

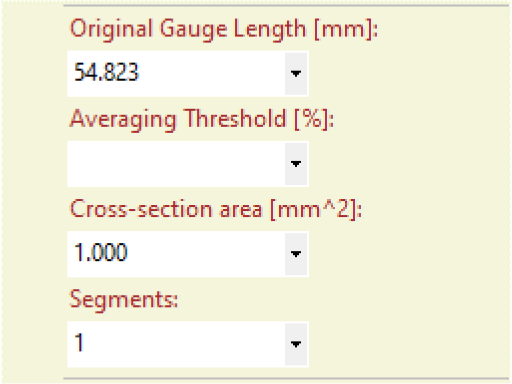


Figure 5.54: Chain Probe - parameters

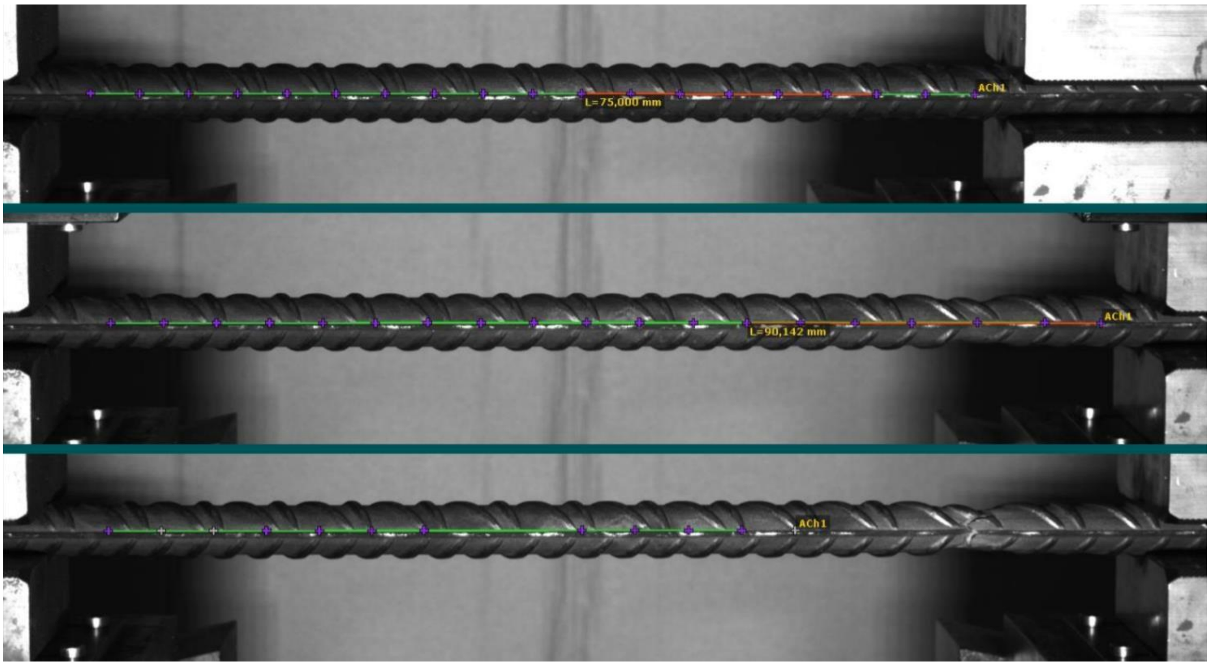


Figure 5.55: Chain Probe measurument

5.2.7.3. Width Measurement

To measure the width or transversal contraction the **Line Probe** or **Neck Gauge** is used.

Caution: To measure the width successfully good contrast between the sample and background is essential. Put some uniform contrast plate behind the specimen.

Caution: Width measurement is like using a line for marking. It is constrained in one direction only. Moreover, remember that the longer side of the sensor is always set as horizontal. That is why a proper Transformation Type needs to be set. Choose Vertical or Horizontal translation.

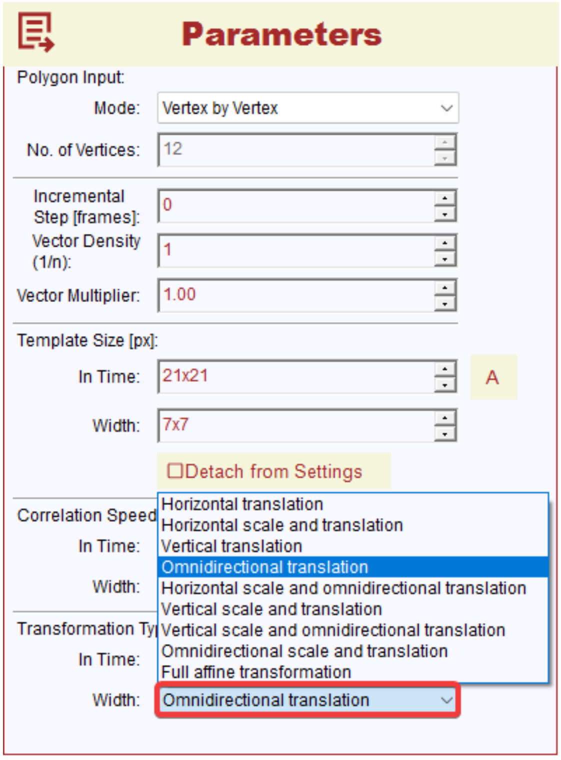


Figure 5.56: Computation parameters

Line Probe – measures width or width change in a single point and can be set in line probe context menu as **Width** or **Width: Extension.**

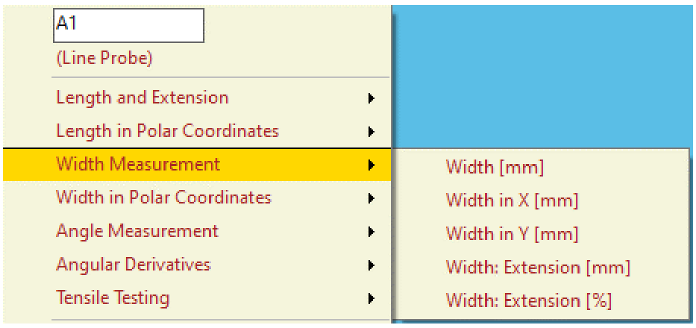


Figure 5.57: Line Probe – Width Measurement values

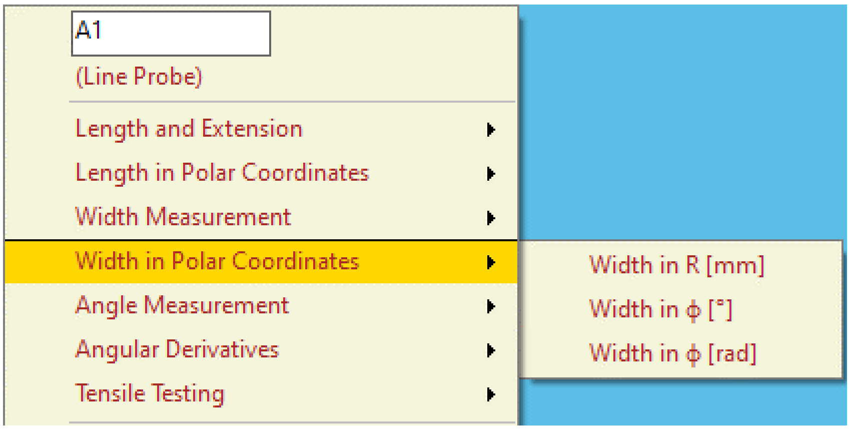


Figure 5.58: Line Probe - Width in Polar Coordinates values

Neck Gauge – enables a user to measure the width or width change in multiple positions and automatically finds the biggest gradient of strain. Insert the Neck Gauge into a picture. If the orientation does not fit rotate it. Then adjust the size and position of the gauge.

Note: Neck Gauge can measure length as well.

Caution: The yellow points of the Neck Gauge are tracked as well, therefore some contrast must be present under these points.

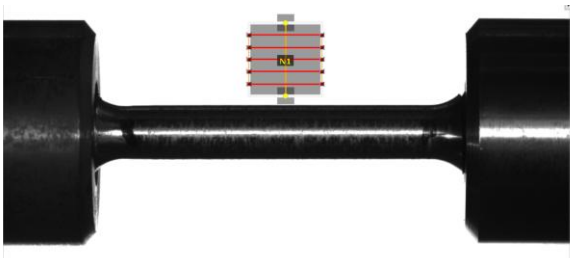


Figure 5.59: Neck gauge insertion

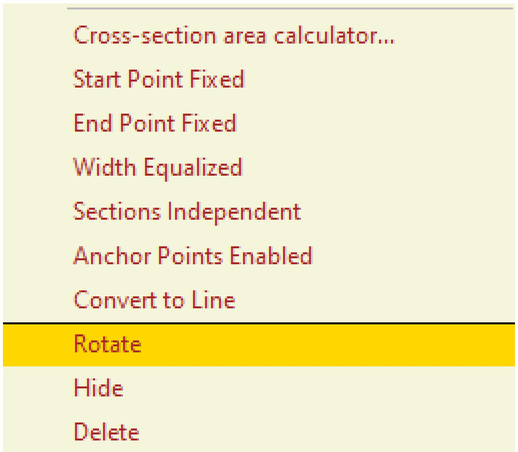


Figure 5.60: Neck gauge rotation

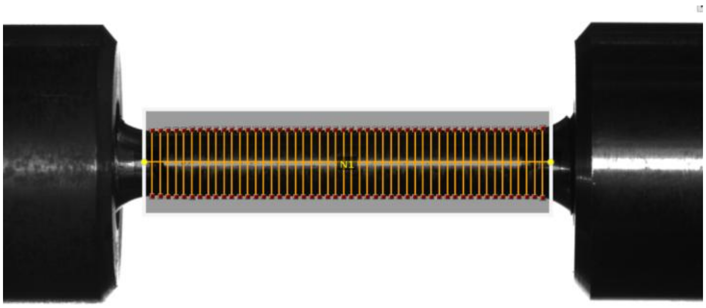


Figure 5.61: Neck Gauge

5.2.7.4. Area Measurement

The area measurement often called "DIC measurement" (all of Mercury RT® measurements are based on DIC but a lot of people have linked DIC with colourful maps) is in most cases set with **Include** and **Exclude** tools. But the **Area can also be set discretely by selecting individual points**. This feature finds its use with the measurement of large surfaces where the application of speckle pattern is difficult or not wanted. An example can be the wing of an aeroplane. To do so insert the points and afterwards press **Group Probes – Full-field**.

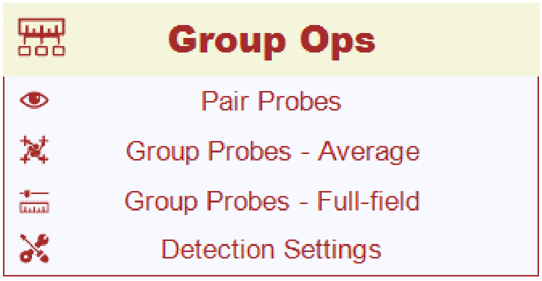


Figure 5.62: Group operations

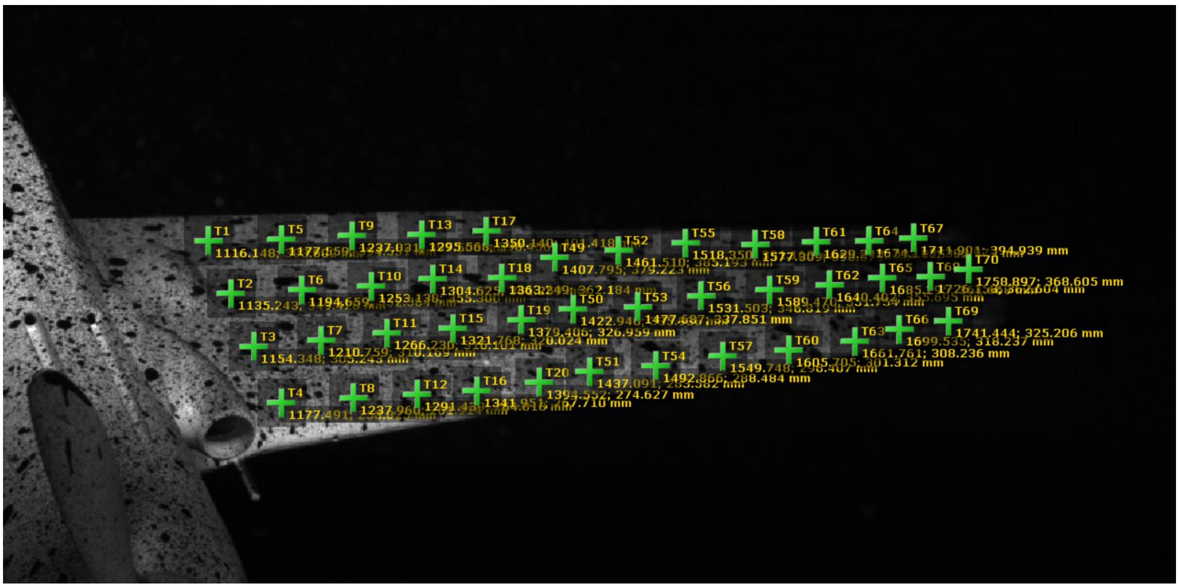


Figure 5.63: Points forming an area

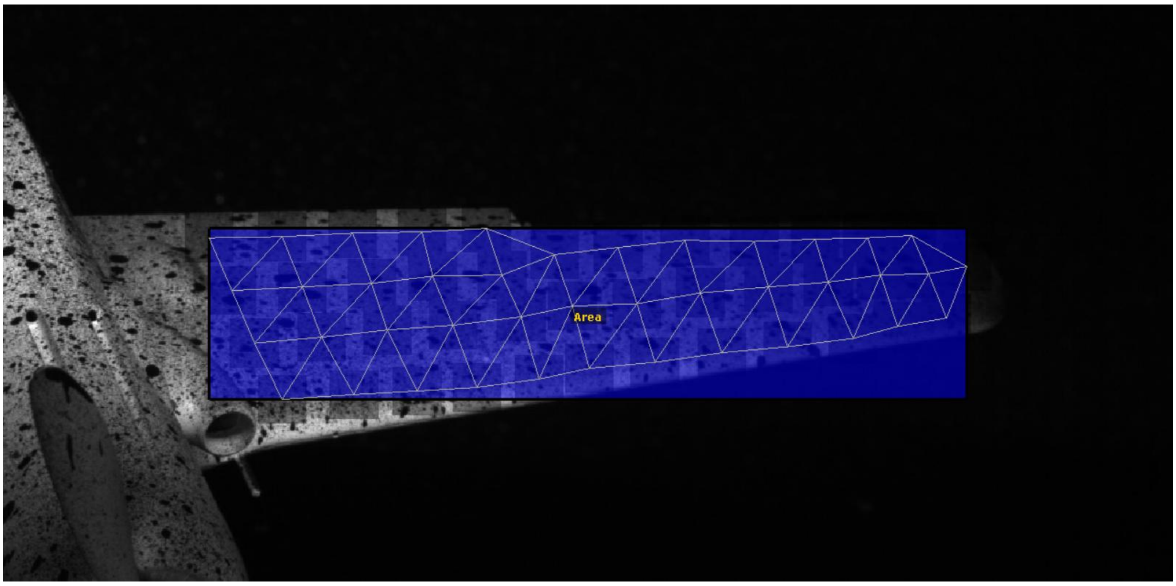


Figure 5.64: Area with a mesh

The area can measure **displacement, velocity, acceleration** and **strain**. All of these values can be measured as **Euclidean or directional. E1 computes the major principal strain and E2 minor principal strain. In stereo mode E1-major; E2-intermadiate and E3-minor principal strain.**

> **Note:** Due to big PC performance demand, it is recommended to measure FullField measurements as post-process.

The density of the calculation points (like mesh with FEA) can be adjusted in Area Dialog as **Grid Spacing**, which is the distance between the points in pixels.

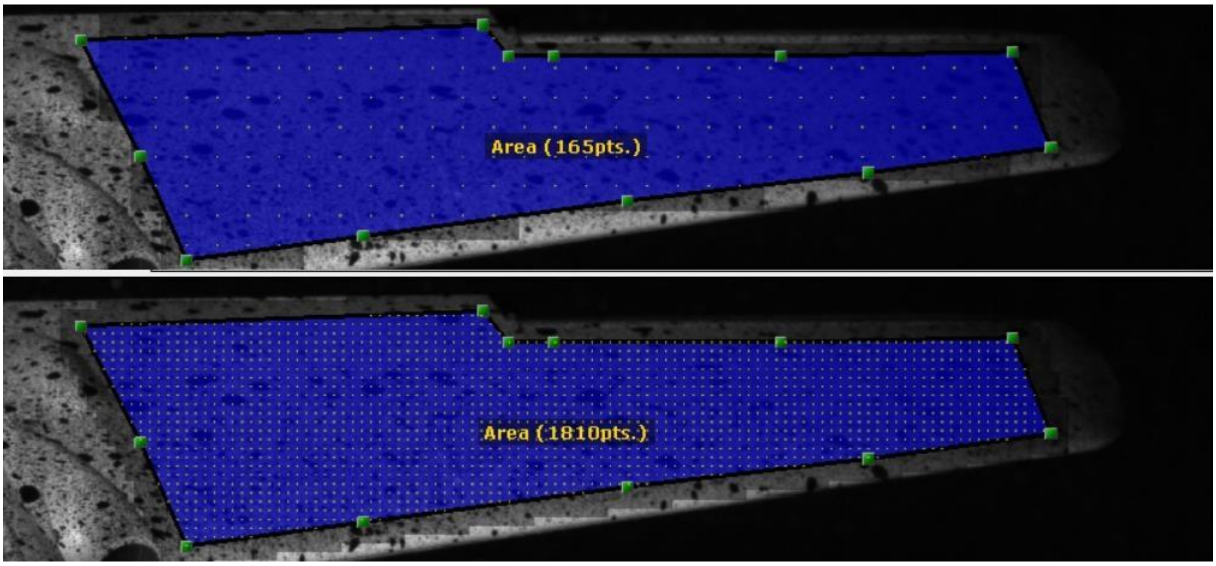


Figure 5.65: Area - adjusting grid spacing

In the default setting only the average value from the whole area is plotted in the graph. However **local values can be plotted by clicking on the area in the Camera Window**. See the following image. The orange curve represents the average value, red is at the tip of the wing and green is on the left of the wing.

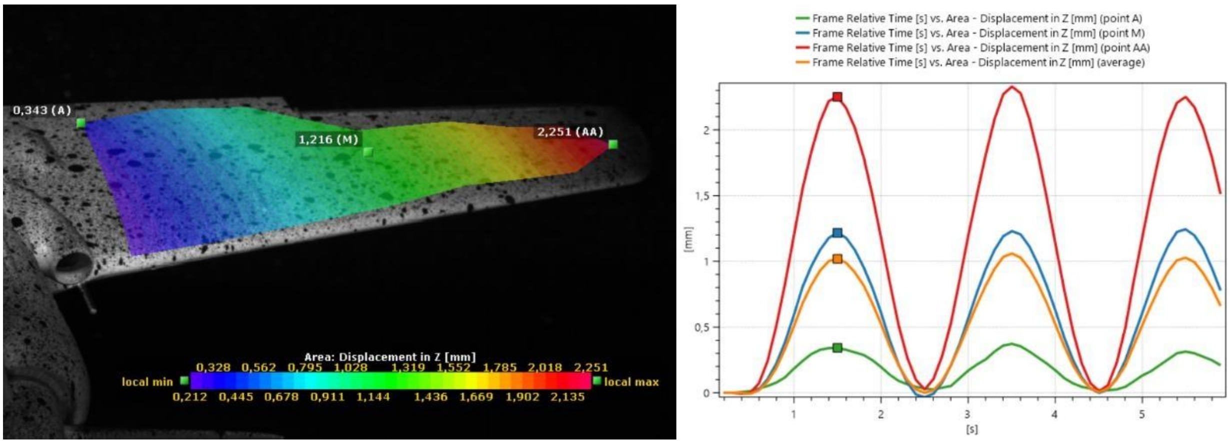


Figure 5.66: Graph of the area local values

For Euclidean Displacement, E1, E2 and E3 vectors can be shown. To enable this feature open Area Dialog and uncheck the **Vectors Hidden.**

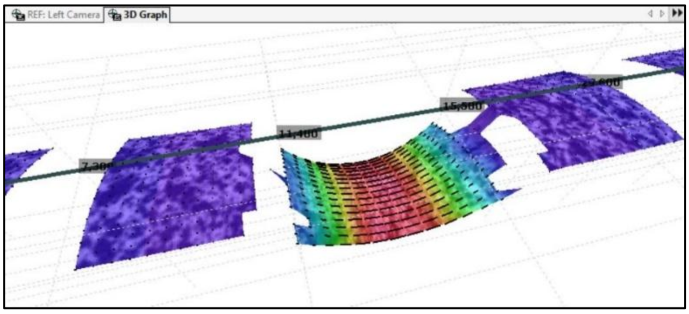


Figure 5.67: E1, E2 and E3 vectors

Choosing the Area Section tool from the Tool panel and dragging over computed area a **section line** is inserted. Major and minor principal strains can be read out along this line.

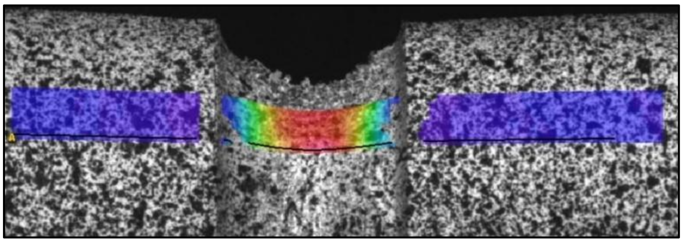


Figure 5.68: Area section tool

Strain distribution along the line is plotted in **Area Cross** Section tab in Main Window. The number of the lines is adjusted in Settings/ Presentation/ Post Processing/ Section Segment Count.

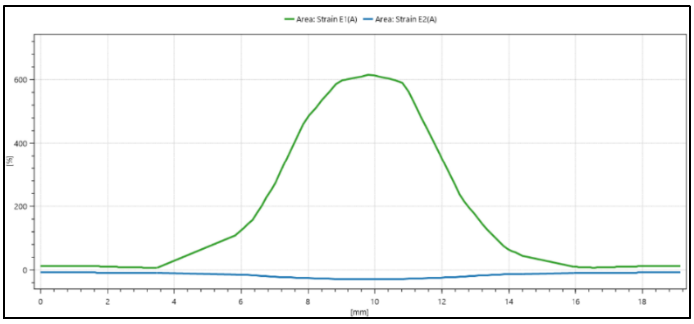


Figure 5.69: Area cross section graph

The color scale can be switched between Global, Local and Custom ranges. Scale is changed by clicking on the square next to max or min.

Global – uses the max and min value from the whole measurement.

Local – uses the max and min value from the individual image. The range is changing with every image.

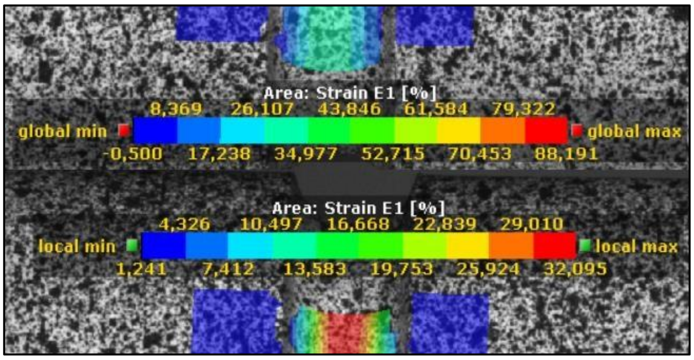
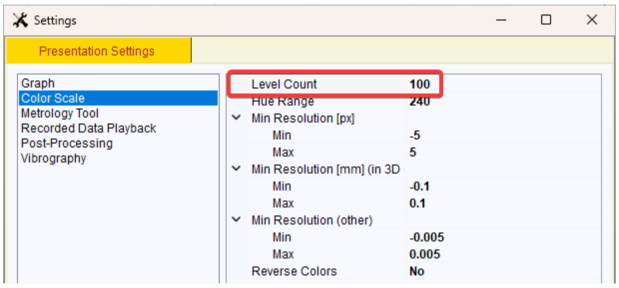
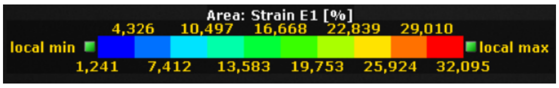


Figure 5.70: Color scales

Custom – user-defined range. Dragging the square next to the max or min sets the range. Number of color levels is set in Settings/ Presentation/ Color Scale/ Level Count.





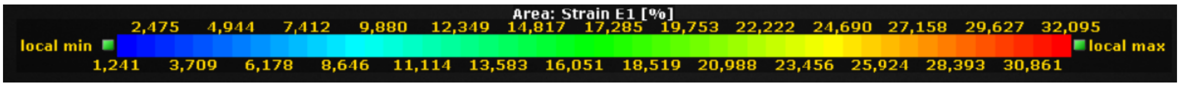


Figure 5.71: User defined scale range

5.2.8. Setting the Output

If an output has been configured within Active Services (chap. 5.1.2), the output values can be set. This is done in Main Window next to measured values in Graph Data. Press the button with wrench and screwdriver next to the value that is to be sent to output to open the dialog window.

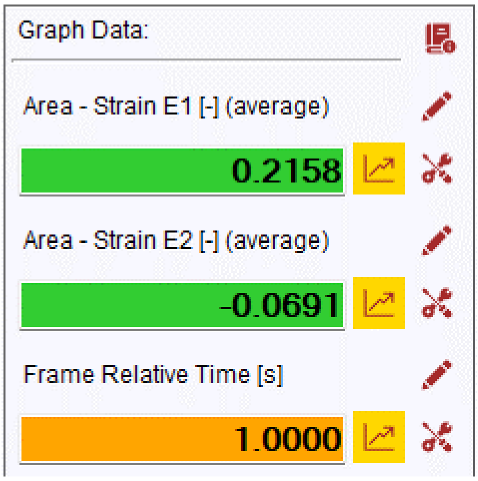


Figure 5.72: Output settings in Graph Data panel

Value A, B, C... are channels of the output and in this dialog, the measured value for each channel can be set.

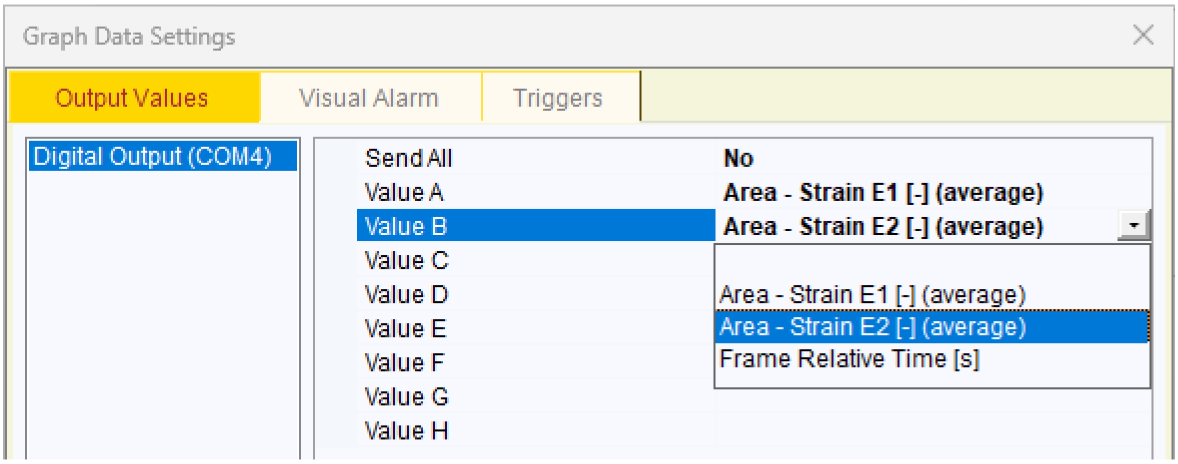


Figure 5.73: Output settings

5.2.9. Filtering the Data

Two kinds of filtering can be applied.

Point Filtering – performs filtering of the image data. Graph data is already filtered.

Value Filtering – perform filtering of the graph data. Creates new data series with applied filter.

5.2.9.1. Point Filtering

Six types of point filters are available. **Averaging**, **Gaussian Smoothing**, **Batch Averaging**, **Batch Averaging**, Linear Polynomial Fit, Quadratic Polynomial Fit, Cubic Polynomial Fit. Filtering is performed in a defined time window, except for batch averaging, where Run with Snap Mode and Run with Timer are used (described in chapter 5.3 RUNNING THE MEASUREMENT)

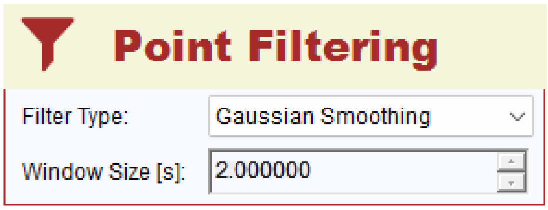


Figure 5.74: Point Filtering

Caution: Use Batch Averaging only with Snap Mode and Timer otherwise the system will run but all data points would be charted as one in the graph.

5.2.9.2. Value Filtering

Different user-defined value filters can be set up and also set as active or inactive.

To create a new filter  press the button to open **the Value Filter Setting** dialog window.

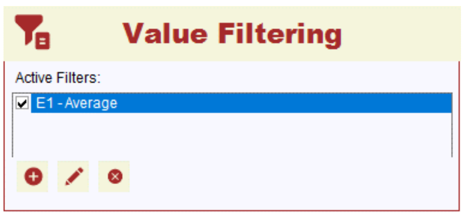


Figure 5.75: Value Filtering

Define the **Name** of the filter and set desired **Function** (Averaging, minimum, maximum, median, standard deviation). Set the time **Window Size** and choose from Active Values.

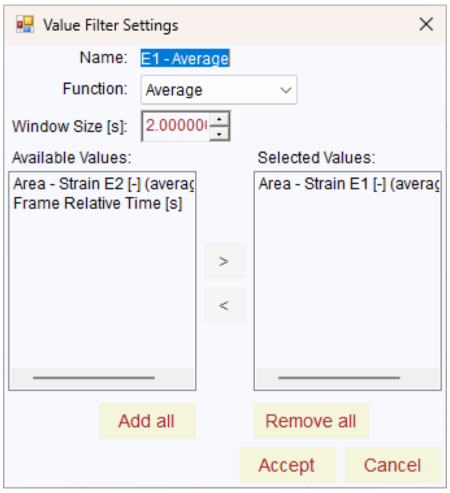


Figure 5.76: Value Filter Settings

5.2.10. Copying the Project

If you need to create a new template for a similar type of test, this can be done very easily without having to repeat the calibration or coordinate system setup. The Projects panel in the main window is used for this operation.

Figure 5.77: Project panel

Activate the project whose settings are to be copied and press the button  to open the **Copy Project** dialog window.

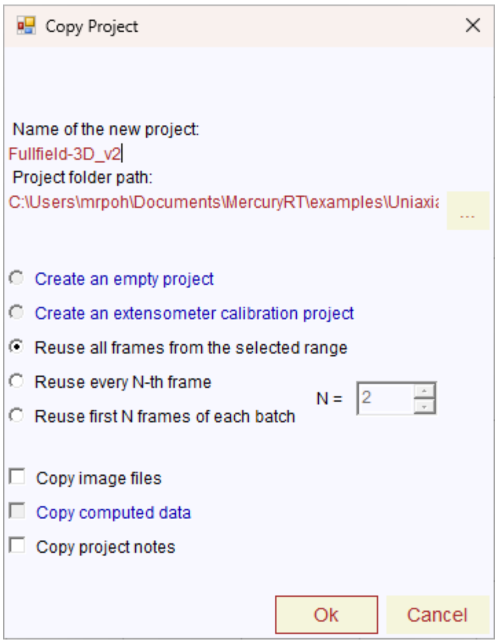


Figure 5.78: Copy Project

Enter the name of the new project and select one of these options:

Create an empty measurement – copies all settings and probe layout but does not copy graph and image data.

Reuse all frames from the selected range – when recorded image data is present it copies the setting, probe layout and image data from the selected range to perform new analysis with the same image data.

Reuse every N-th Frame – when recorded image data is present it copies the setting, probe layout and every N-th image from the selected range.

Reuse first N frames of each batch – copies the setting, probe layout and first N images from each batch.

5.3. RUNNING THE MEASUREMENT

After all setup, it is finally time for the first Run of the measurement. Four different Run regimes are available together with two additional options.

Frames Saved – image data is saved for later post-process or video export.

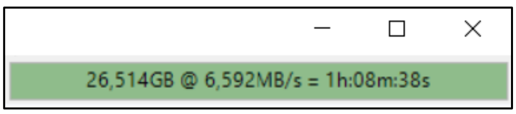


Figure 5.79: Available disk space and recording time indication

Caution: When saving images, you need to set the frame rate carefully as the disk may run out of space. The available recording time can be checked in the upper right corner of the Main Window.

Data Computed – data are computed during recording. If unchecked image data is only recorded for post-processing.

Run – default run mode. The system runs on a selected frame rate (if possible). Frame Saved and Data Computed option is available. After stopping keeps the data in a graph.

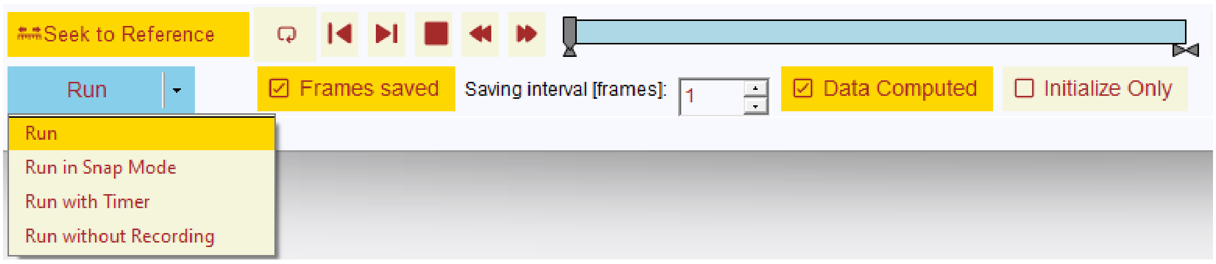


Figure 5.80: Running modes

Run in Snap Mode – batch of images is captured only on a manual trigger (pressing Snap Frame, using wireless presenter or remote-control command). Frame Saved and Data Computed option is available. Bath size can be set (one trigger pulse – multiple images). Used during measurements with manual control of loading – wagon measurement, bridge measurements.

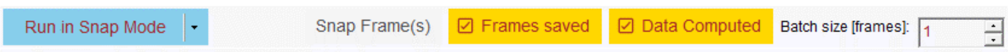


Figure 5.81: Snap Mode

Run with Timer – defined batch size is captured in the defined time interval. Frame Saved and Data Computed option is available.

Used during long-term measurements – 24-hour test of thermal behavior of structure during the climatic change.

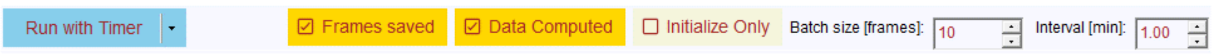


Figure 5.82: Run with Timer mode

Run without Recording – processes the image data online. Does not record the image data. After stopping the measurement, all graph data is erased.

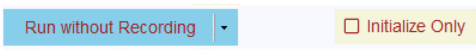


Figure 5.83: Run without recording mode

Note: Mode created for industrial use, without the need for post-processing. Erasing the graph data is performed at the start of the measurement and can take up to a few seconds when tens of thousands of data points are captured. In Run without Recording mode, Mercury RT® responds the fastest.

5.3.1. Tuning the Correlation (Losing the Points)

Loss of points is the biggest issue during the video measurements. A lot of tuning can be done in **Parameters Panel** in Camera Window.

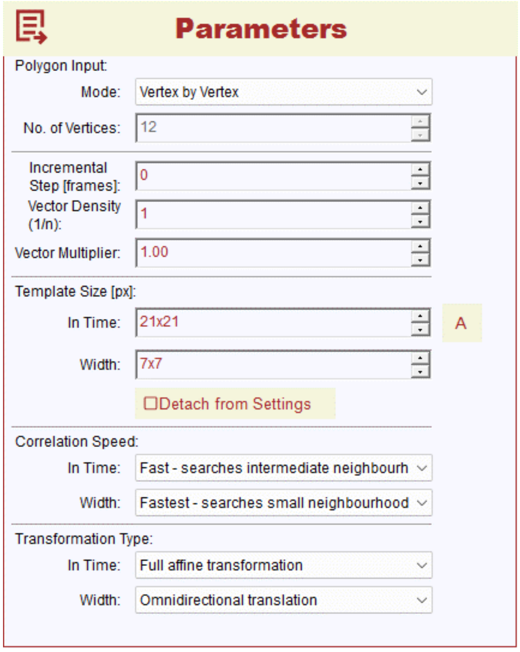


Figure 5.84: Correlation parameters

In general, there are only a few reasons for this to happen.

Too little information in the Correlation Template – too little Template

Hint: enlarge the Template Size.

The following image shows the difference between template size 20x20px and 53x53px.

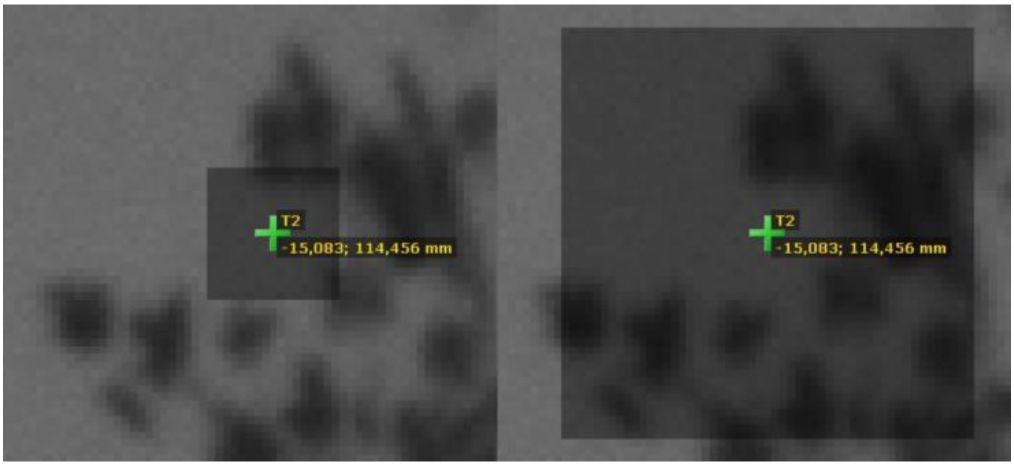


Figure 5.85: Template size

Note: Bigger Template Size carries more information but also more time is needed to be calculated and negatively affects the maximum possible calculated FPS.

Too big deformation – the measured surface is simply deformed beyond the recognition of the system.

Hint 1: Try to high the frame rate. The system is capable of measuring very large deformation, but this deformation must not be a step change. A higher frame rate may help to capture the deformation fluently.

Hint 2: Check if the **Incremental Step** is set to **-1**. In case of point loss, this feature sets the previous image as a new reference. Otherwise, the system keeps the first image as a reference until the end.

Hint 3: Set a more fitting Transformation Type – sometimes the **Full Affine Transformation** is an unnecessarily complex method of computation. For planar tests with longitudinal elongation and transverse contraction, **Omnidirectional Scale and Translation** is more than enough. For longitudinal direction only even **Horizontal / Vertical Translation** only.

Hint 4: Loosen the correlation limits in Settings/Computation. High the **Maximum square residual per pixel** to 800 (or higher if needed) and the **Confidence interval** to 0.25 (0.4)

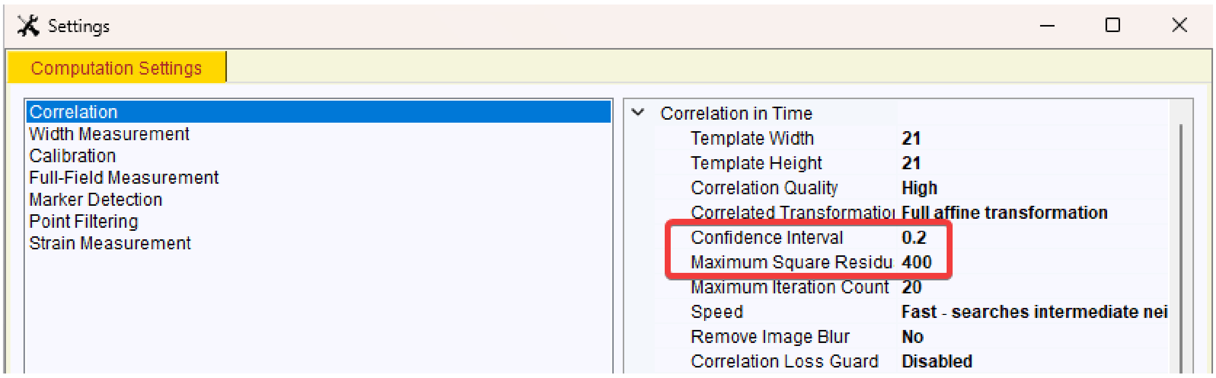


Figure 5.86: Correlation parameters

The measured point gets off the Field of View – some samples rotated during the test and the point can get into cover or out of sight.

Note: Mercury RT® is not able to handle this situation.

5.4. POST-PROCESS ANALYSIS

Mercury RT® allows users to perform as many analyses as needed. Simply unlock the measurement by clicking on the red lock in the camera window. Then rearrange the probes or change the correlation parameters and press the Recompute button in the main window.

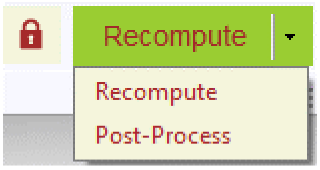


Figure 5.87: Recompute modes

6. SCENE TYPES SETTINGS

When preparing a new measurement, a new project needs to be created first. After the project is properly saved the choice of different camera layouts is displayed. It is possible to choose from Mono Cameras, Stereo Cameras, Stitched Mono Cameras and Stitched Stereo Cameras.

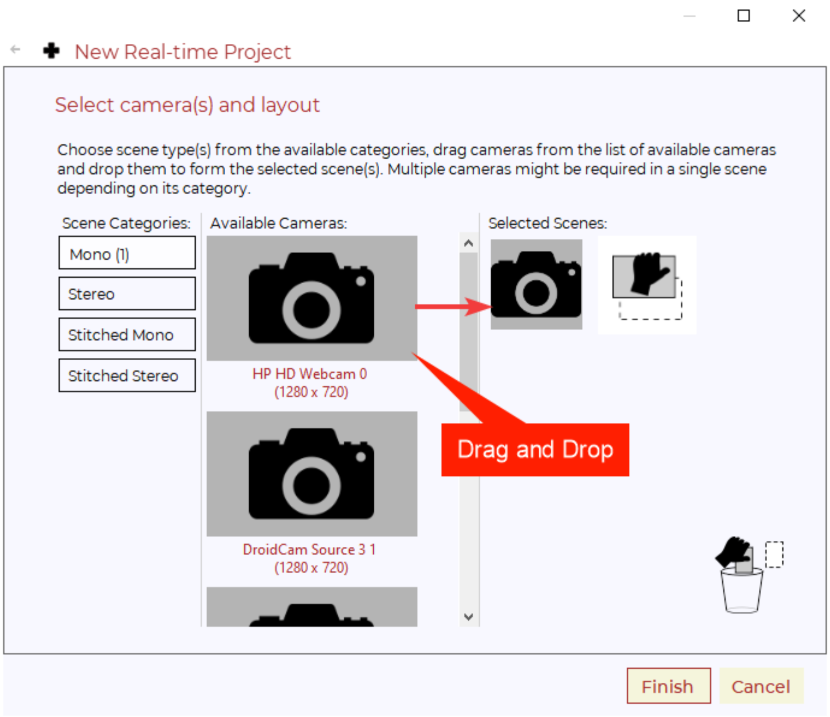


Figure 6.1: Camera selection and layout

This chapter provides a detailed description of the steps that are necessary for setting up the Mercury RT® for each camera layout.

6.1. Single camera - MONOSCOPIC SYSTEM

The monoscopic system is designed for 2D measurements. One or more cameras can be used, but each camera only within a separate scene.

When multiple cameras are selected and thus more scenes in Mono Scene Category is created, an additional page appears in the wizard. This dialogue is used for choosing blocking cameras. All blocking cameras run at the FPS of the slowest blocking camera and faster cameras may drop images if not synchronized. This option is typically used for measurements when all cameras have similar FPS. Unchecked (non-blocking) cameras do not slow down any other blocking or non-blocking cameras. Images from slower cameras may be repeated to keep consistency. This option is useful for non-measurement purposes.

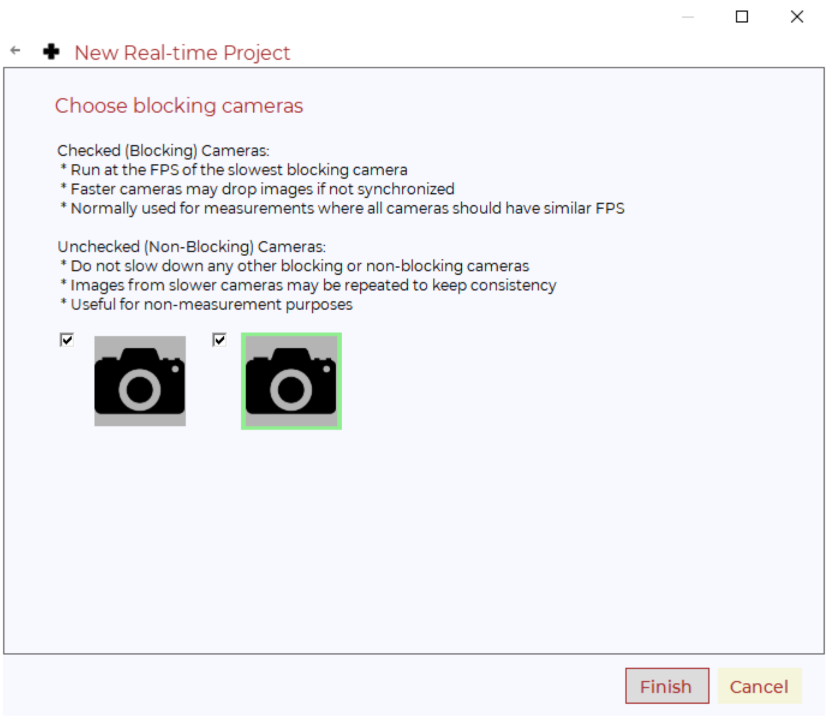


Figure 6.2: Choosing blocking cameras

All the necessary steps for measurements with a single camera were described in detail in chapter 5 RUNNING THE MERCURY RT® FOR THE FIRST TIME.

6.2. Multiple cameras - STITCHED MONOSCOPIC SYSTEM

Stitching is used when a long Gauge Length is required or very high elongation is expected. Using multiple lower resolution cameras instead of a single high resolution camera is often more economical and can also be an option for achieving a higher frame rate.

Stitching can be set in two ways:

- **Overlapping FoV** – Fields of View are overlapping each other so the measured point can travel between them. Used for high-elongating materials.
- **Separated FoV** – Fields of View are separated and cameras only share the coordinate system. Used for long specimens with standard or lower elongation.

Create a new project following chapter 5.2.1 and select **Stitched Mono** when creating New Real-time Project. When Stitched Mono layout is selected you are allowed to add more mono cameras to single scene.

Figure 6.3: Stitched Mono Layout

6.2.1. Calibration of the Stitched Cameras

Stitched camera calibration is very similar to Mono camera calibration only with the difference of the presence of multiple cameras. Each camera is calibrated separately.

6.2.2. Setting of Stitched Coordinate System

The process of adjusting the coordinate system in a stitched mono scene is different from a stereo or mono scene.

A special calibration grid is used for the stitched coordinate system. This calibration grid differs in the way that it includes two origins of the coordinate system marked with thicker dots. One coordinate system for each camera.

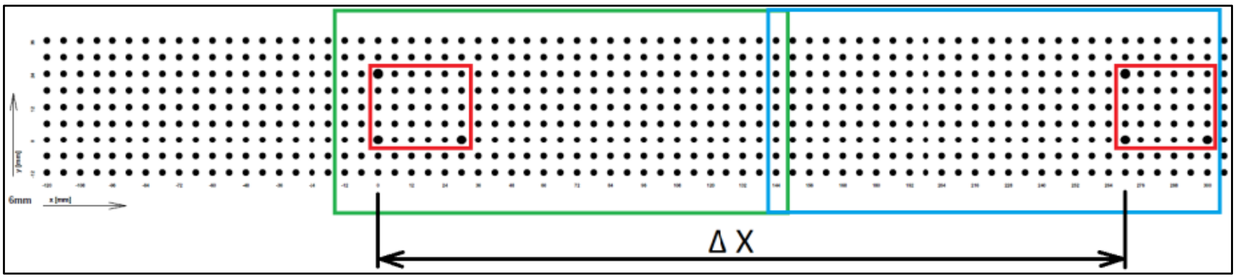


Figure 6.4: Calibration grid for stitched coordinate systems

One coordinate system must be visible in each camera (only one). Switch between cameras in the **Coordinate System** dialog window by selecting 0,1 in the top-right corner. When ready press **Refresh & Detect** for each camera individually.

Afterwards, as highlighted in red in Figure 6.5 and green in Figure 6.4, it is necessary to specify the location of the origin of the coordinate system (origin position). In the most common case, only the ΔX value should be entered as the X-coordinate, leaving the Y-coordinate at 0. The plus or minus sign depends on the relative positions of the cameras

Hint: It is highly recommended to compare a distance between two points in two cameras using the caliper tool with the real distance to ensure that the calibration is correct.

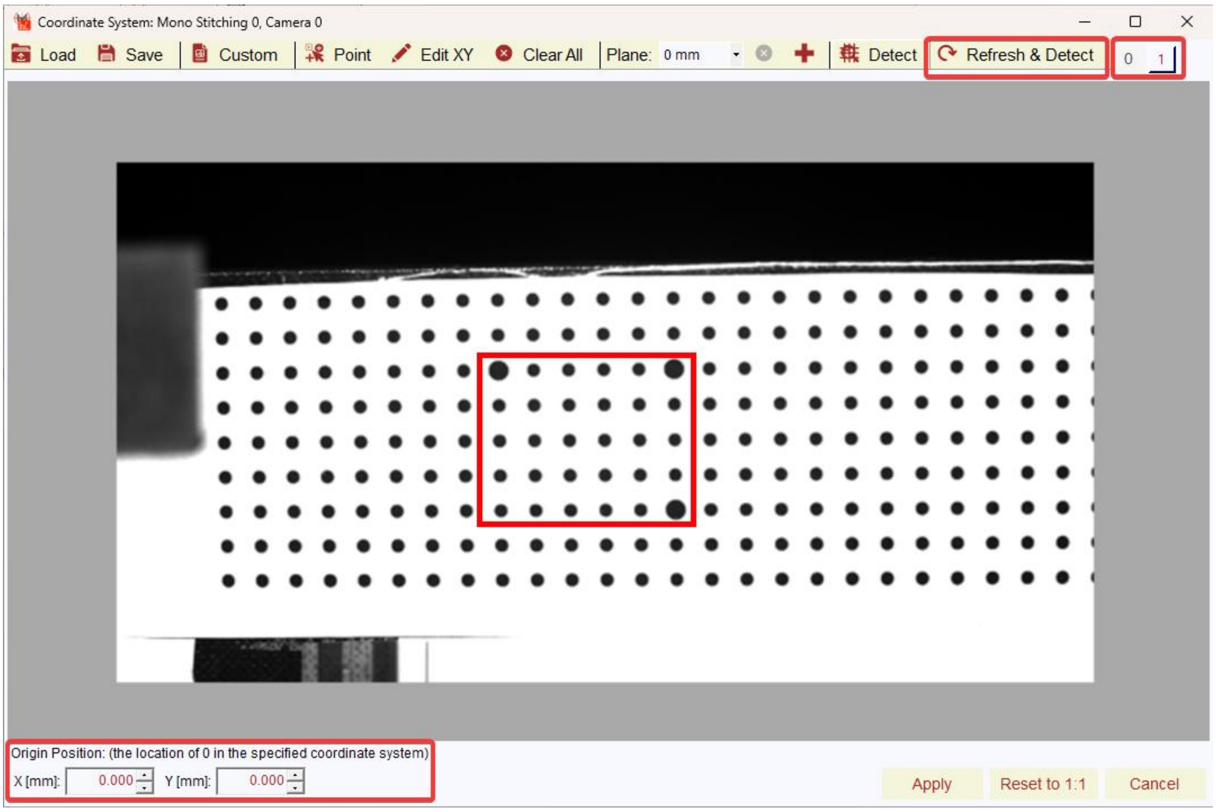


Figure 6.5: Stiched Mono Camera coordination system setting

Caution: For successful point transfer between the cameras an overlap of at least twice as big as the size of the correlation template.

6.3. Two cameras - STEREOSCOPIC SYSTEM (STEREO-3D)

Create a new project following chapter 5.2.1 and select **Stereo** when creating New Real-time Project. When Stereo layout is selected you can create a camera stereo pair and assign them as Left and Right Camera.

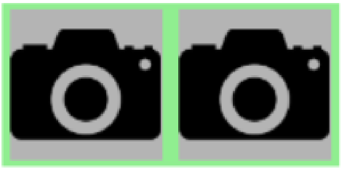


Figure 6.6: Stereo Layout

6.3.1. Setting the Cameras

The cameras should be mounted in a way that does not allow relative movement between them. When done so, the whole system can be moved as a rigid thing as long as cameras do not change their relative position.

The out-of-plane resolution of a stereo measurement depends on the angle between the cameras. The following chart shows the dependency of resolution on the camera angle.

The vertical axis shows a multiple of a single camera resolution for in-plane or out-of-plane measurement with a certain camera angle.

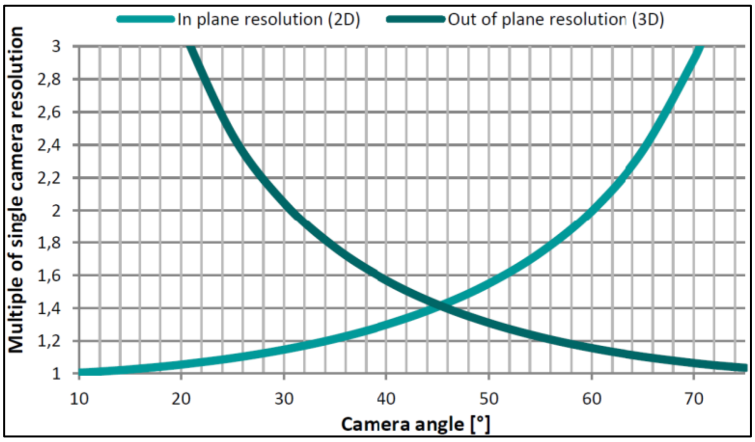


Figure 6.7: Dependency of out-of-plane resolution on the camera angle

Example: If the single camera resolution is 1 µm, for 30° angle the in-plane resolution is 1.14 times = 1.14 µm and the out-of-plane resolution is 2 times = 2 µm in comparison to single camera resolution.

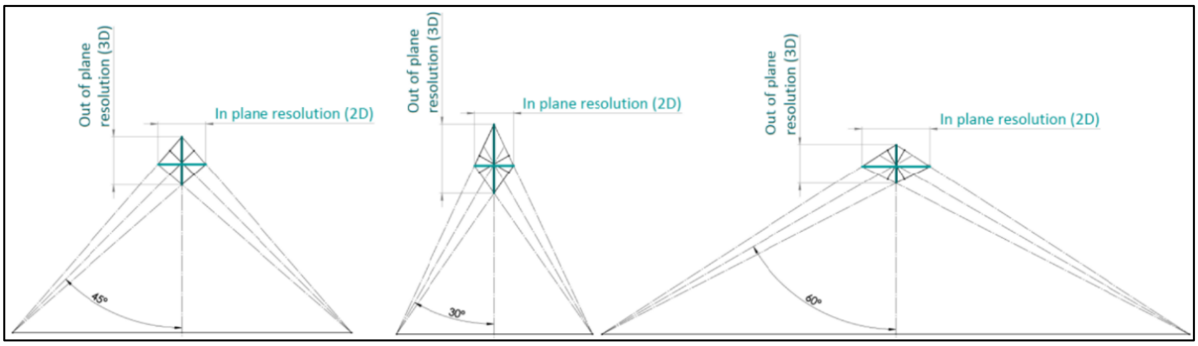


Figure 6.8: In-plane resolution (2D) vs Out-of-plane resolution (3D)

6.3.1. Stereo Camera Synchronization

Cameras of the Stereo System should be synchronized to capture the images at the very same moment. Enable sync in **Cameras** panel in Main Window. Three modes of sync can be set.

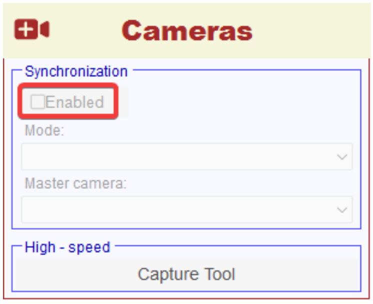


Figure 6.9: Stereo camera synchronization

Master / Slave – the first camera becomes Master that triggers the Slave camera. (master camera broadcasts a pulse at the very moment the camera started to capture its images). This mode does not require an external device, only a synchronization cable that is used to connect master and slave camera(s).

External Trigger – used when the cameras are connected to SyncBox or another trigger impulse-generating device.

FireWire Bus Synchronization – Valid only for FireWire cameras. Requires that all cameras are daisy-chained on a single FireWire adapter. The advantage is that no additional devices or cables are needed.

Caution: Use synchronization cable if possible. Run the stereo system without sync only in the most critical case; more critical with low FPS as the time gap between left and right camera is more significant.

A more detailed description of camera synchronization is described in Reference Handbook chapter 13. HW synchronization. The handbook can be found in Help/View Help.

6.3.2. Stereo Camera Calibration

Stereo Camera Calibration is performed in the very same way as Mono Camera Calibration with only one difference; **the grid has to be visible in both of the cameras**. The calibration of a stereo camera pair is necessary before performing any measurements.

To start a new camera calibration, click on the **Start New** button. A dialogue window appears, containing the Calibration Grid Unit Distance parameter. Specify this parameter. When the OK button is clicked, the calibration is ready to start. Then capture (**Camera Image(s)** button) between 15 and 30 images. After that click **Compute** button and verify if there are some significantly higher error values than others. If so, uncheck these higher error values and click Compute button again. If not, click **Apply**.

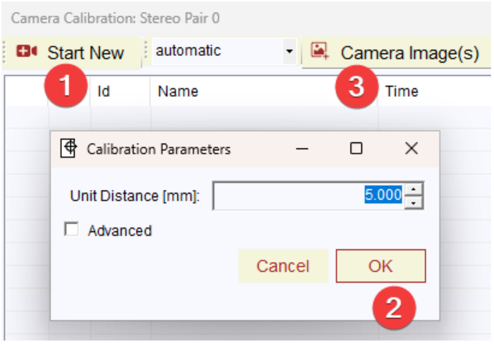


Figure 6.10: Stere Scene Calibration

6.3.3. Setting a Coordinate System

The setting of the Coordinate System is optional with 3D measurement. Due to the need of computing the relative position between the cameras during the calibration, the system sets the default Coordinate System as – X-axis aligned with the Left Camera horizontal and Y-axis aligned with the Left Camera vertical. The origin of the Coordinate System is in the center of the Left Camera.

This default coordinate system can be user defined by applying **Custom Coordinate System**. This feature adds a blue coordinate system that can be set by defining the X-axis and XY plane rotation. The points of the coordinate system must be visible in both cameras and must be correlated. X-axis direction and XY plane rotation can be split into separate lines.

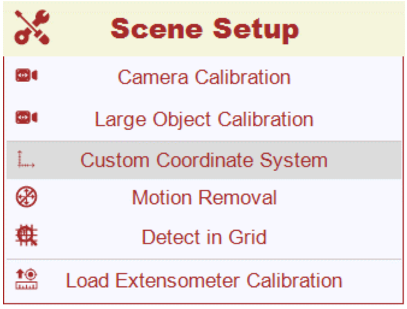


Figure 6.11: Scene Setup - Custom Coordinate System

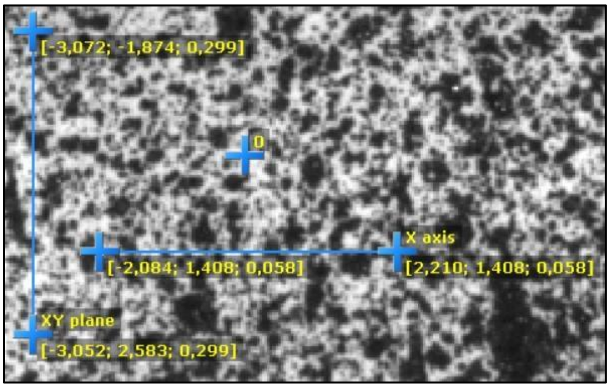


Figure 6.12: X-axis and XY plane rotation splitting

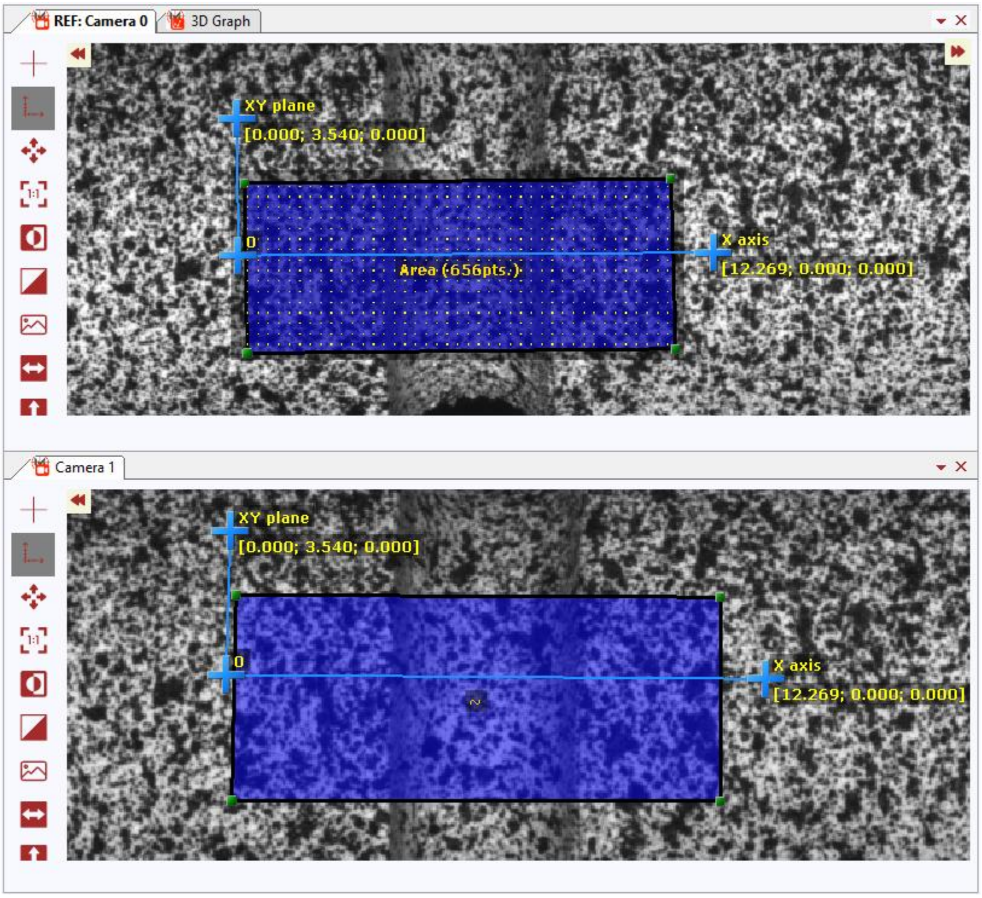


Figure 6.13: Custom Coordinate System

A Custom Coordinate System can be set as well by detecting the calibration grid in the image. To do so, press the **Detect in Grid** button. Then set the grid parameters and detection method and press Ok button when the grid is in the right position.

When the Custom Coordinate System is set, the **Motion Removal** feature is enabled. This sets the origin of the Coordinate System as a point of reference (like a floating Coordinate System).

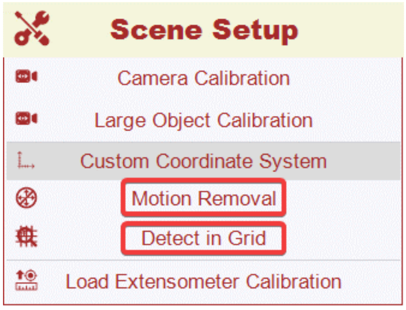


Figure 6.14: Detect Coordination System in the Grid and Motion Removal option

6.3.4. Applying Probes

Application of the measurement probes in Stereo mode demands more preparation. The system needs to find the match between the left and the right camera.

When the point is **red**, the match was not found; **green** means ready to go.

Points can be inserted only in the Left camera into the reference frame. If the point is not green immediately after inserting, try to move with it a little, however, it is recommended to set the **Correlation Speed** for Stereo to **Normal**. When doing so the system searches for the point in the whole image and not only the close region.

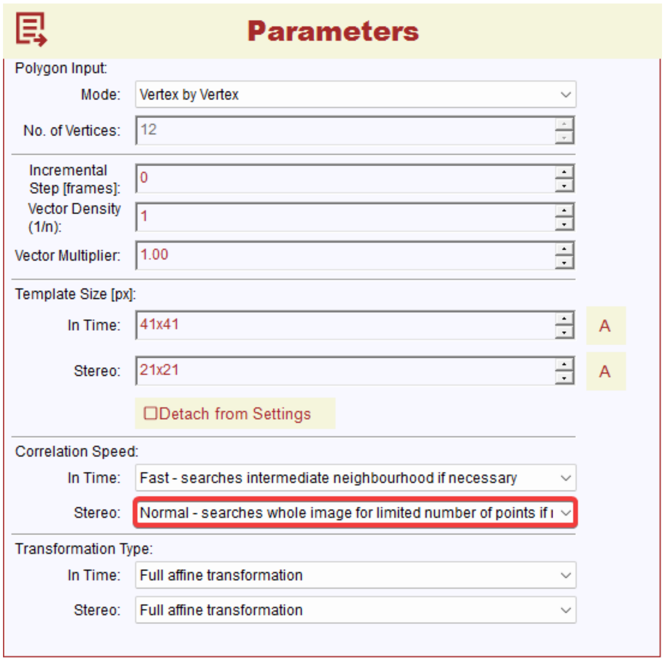


Figure 6.15: Parameters of Stereo Scene

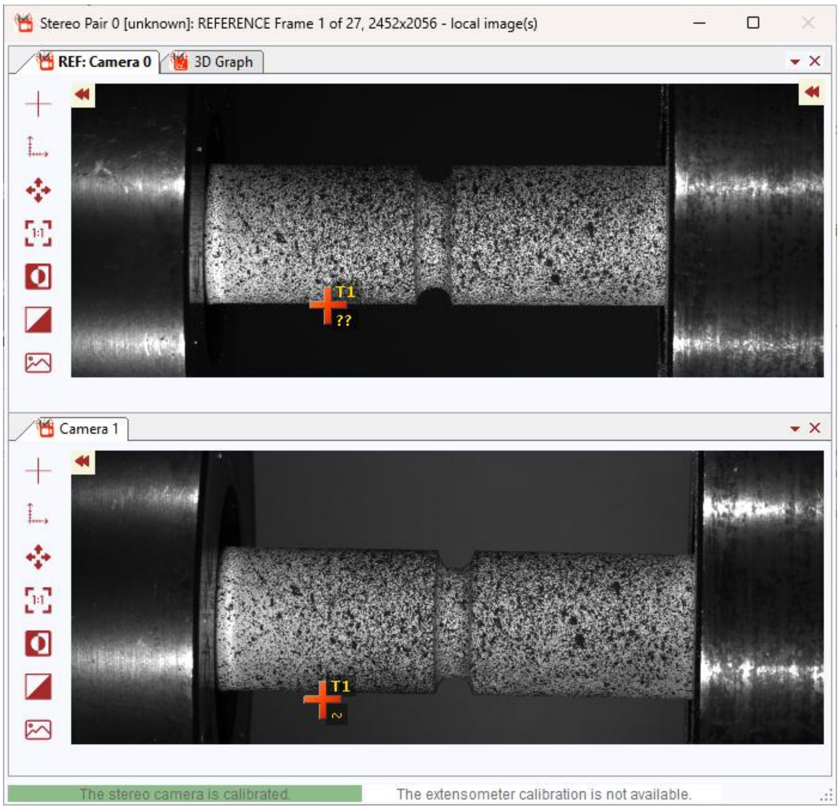


Figure 6.16: A match for probe was not found

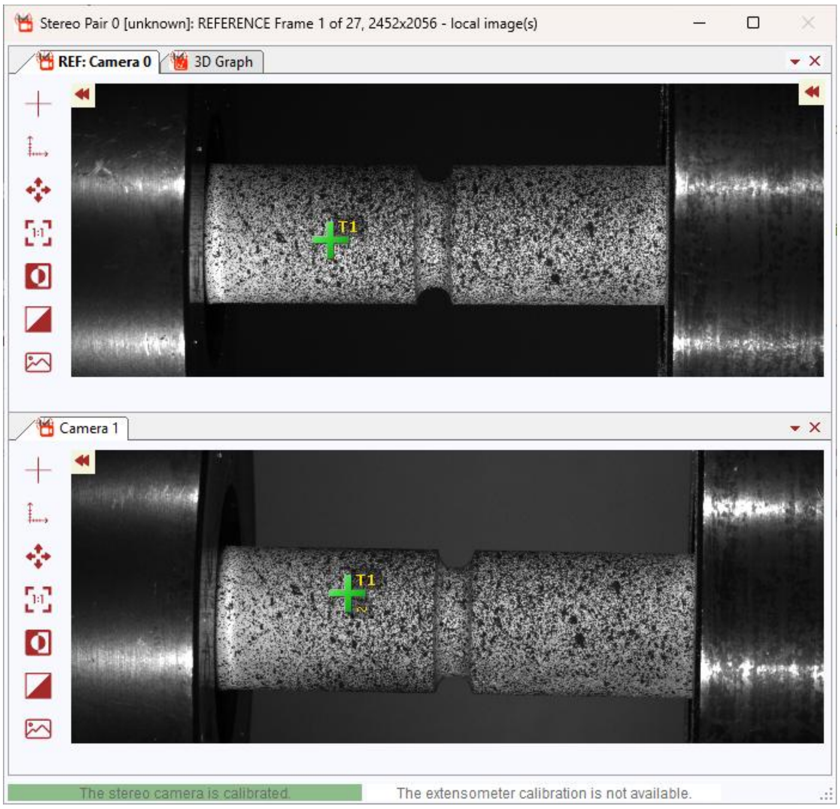


Figure 6.17: A match for probe was found

Note: If the pattern is not good (blurred, repetitive...), it is better to zoom in and check the match by eye.

6.4. Multiple cameras – STITCHED STEREOSCOPIC SYSTEM

To create a new stitched stereo scene follow chapter 5.2.1 section **Stitched Stereo Cameras**.

- The order in which you put the cameras in the scene matters.
- The cameras should be connected in an order from left to right.
- To make it easier, select one camera as a „primary" camera, cover the lens so the image is blacked out and put it in the scene, remove the cover and continue with the next camera on the right until all cameras are in the scene. This is necessary because the cameras in the Available Cameras column are not in the correct order and we need to be sure of the order in which the cameras are placed in the scene.

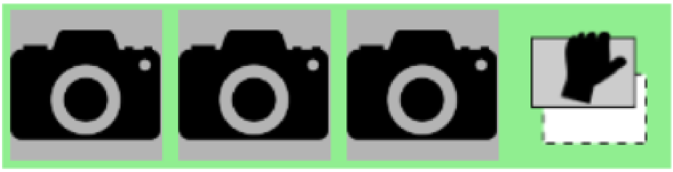


Figure 6.18: Stitched Stereo Layout

When creating a measurement project and a stitched stereo scene is selected, another page appears at the end of the wizard, where the field of view of these cameras must be specified. Further information is displayed right on the page itself. Connected cameras do not have to be of the same arrangement as presented in the images shown in Figure 6.19. It is only important that there should be pairs of neighboring cameras, which share a field of view and may, therefore, be calibrated together. The setting of whether the cameras form a Partial or Full Circle is only important to specify to determine whether the last camera is neighboring to the first or not.

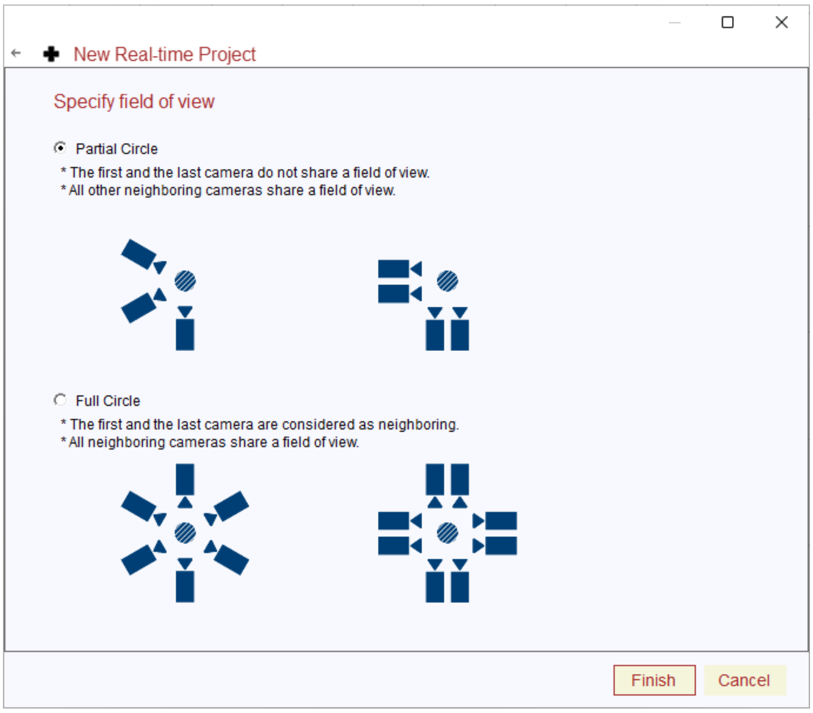


Figure 6.19: Stereoscopic system field of view specification

Other settings are similar to the stereoscopic system. The necessary steps can be found in chapter 6.3 Two cameras - STEREOSCOPIC SYSTEM (STEREO-3D).

7. TROUBLESHOOTING

This section describes the process of configuring cameras from different vendors and other issues that could arise when setting up the system.

7.1. IDS Cameras

IDS USB 3.0 cameras allow using of one custom feature that comes in handy. It is called an Optimal Pixel Clock. This tries out the capability of the adapter and searches for the maximal stable speed. This feature can be activated in Settings.

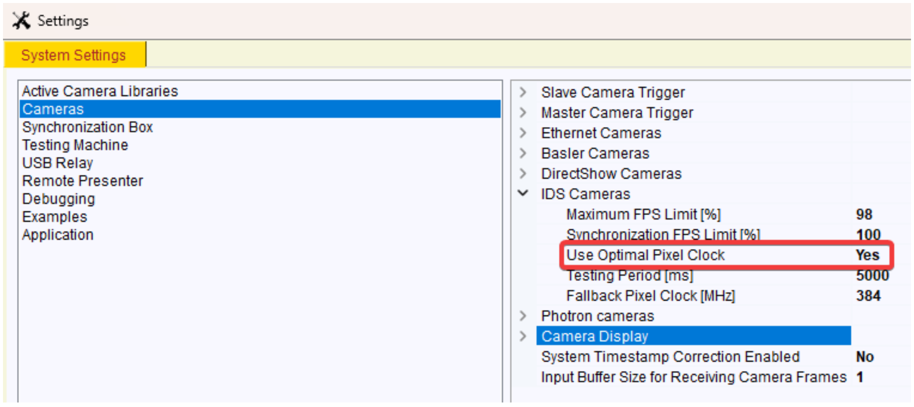


Figure 7.1: IDS Camera Settings

Caution: This feature can only be used when the camera's internal memory is disabled. Otherwise, the Mercury RT® may crash. Here is the message from log.txt

```
FATAL: Unhandled exception on domain thread. Mercury RT.Domain.Cameras.
Devices.IDSCameraException: IDSCamera: Optimal() failed! (NOT_SUPPORTED) by
Mercury RT.Domain.Cameras.Devices.IDSCamera.InitPixelClock()
```

In such a case the internal camera memory can be disabled by running the IDS CAMERA MANAGER. Select the camera and press Advanced Functions. And uncheck the Camera Memory.

The second option is to set the parameter Use optimal clock to NO and set the Fallback Pixel Clock manually.

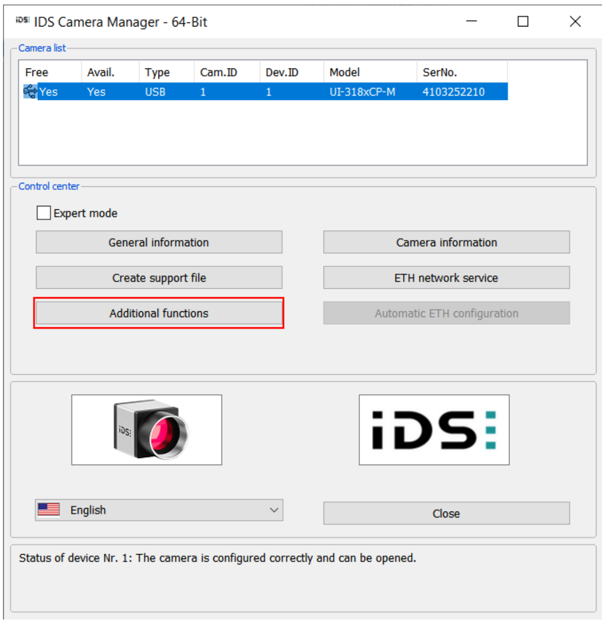


Figure 7.2: IDS Camera Manager

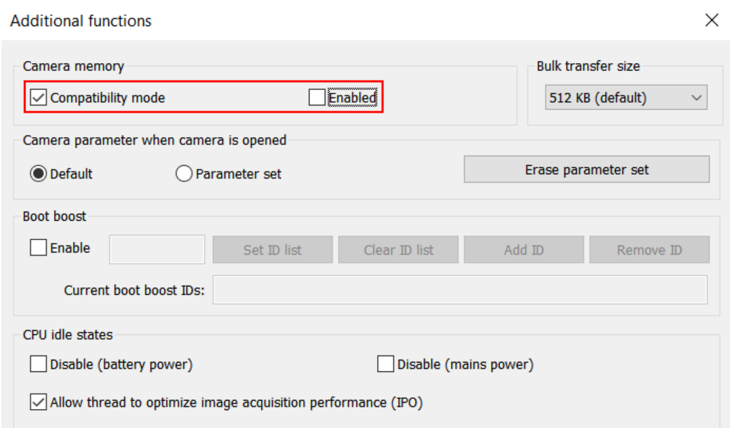


Figure 7.3: IDS Camera additional functions