5324-K210 Super Depth of Field 3D Synthetic Measurement Microscope Operating Instructions

1. Starting interface

Double-tap to open the camera software.

2. Windows

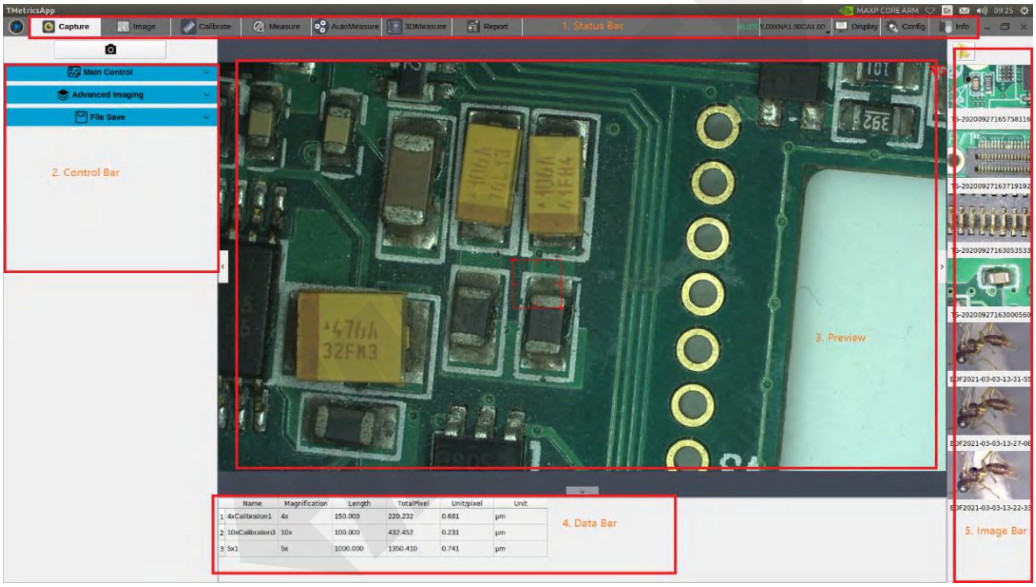


Figure 2- 1

The home screen of software is mainly consisted of five parts - Status Bar, Control Bar, Preview, Data Bar, Image Bar as shown in Figure 2- 1.

2.1 Status Bar

There are ten modules in the status bar: [Capture], [Image], [Calibration], [Image], [Auto Image], [3D], [Report], [Display], [Config], and [Info]. click them to switch the software windows.

In addition, the CPU temperature is also displayed in the status bar, it is used for monitoring CPU temperature:

When T＜68℃, the value is in green, it indicates that device is normal.

When 68℃≤T≤73℃, the value is in red, it indicates that device temperature is abnormal; it will pop up warning message

When T>73℃, the value is in red, it indicates that device temperature is abnormal, and device will shut down automatically, and it will pop up warning message, please click OK to shut down device.

Note: If you do not click the OK button, the protection mechanism will shut down device when the temperature reaches the system limit.

2.2 Control Bar

To display the available functions and controls within a module, click the button to expand the functions. Click the button to collapse the display of the functions.

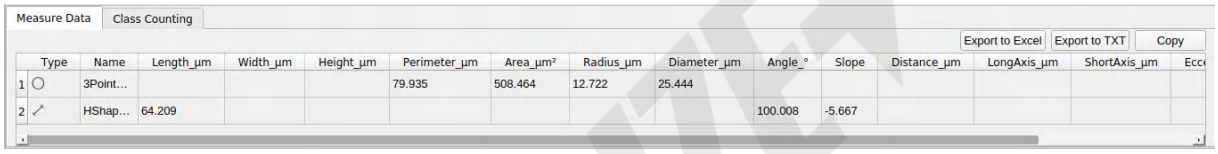
2.3 Preview

To display live and captured images.

With the cursor placed over the image, use the wheel of the mouse to zoom in and out of the image, show the magnified area around the cursor in the middle of the screen.

2.4 Data Bar

It displays 2 types of data, calibration and measurement. Click the name to switch the display content.



	Type	Name	Length_µm	Width_µm	Height_µm	Perimeter_µm	Area_µm²	Radius_µm	Diameter_µm	Angle_°	Slope	Distance_µm	LongAxis_µm	ShortAxis_µm	Ecc
1	○	3Point...				79.935	508.464	12.722	25.444						
2	⟋	HShap...	64.209							100.008	-5.667				

Figure 2- 2 Measurement

	Name	Magnification	Length	TotalPixel	Unit/pixel	Unit
1	4xCalibration1	4x	150.000	220.232	0.681	µm
2	10xCalibration3	10x	100.000	432.452	0.231	µm

Figure 2- 3 Calibration

2.5 Image Bar

The Image Bar displays thumbnails of all captured images and videos from all saving paths. Click on any thumbnail and the interface automatically switches to the [Imaging] window for image processing.

3. Capture

[Capture] module includes Main Control, Advanced Imaging, and File Save.

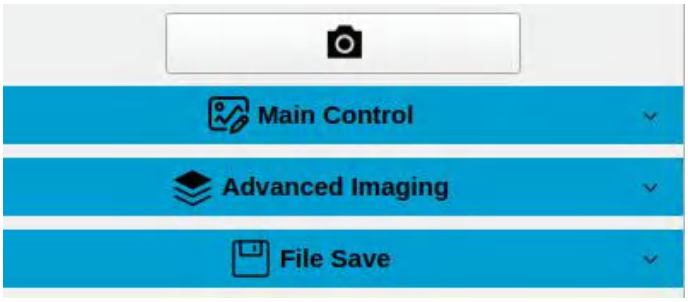


Figure 3- 1

3.1 Main

3.1.1 Exposure

Set the exposure time of camera and the real-time frame per second (fps) will be displayed.

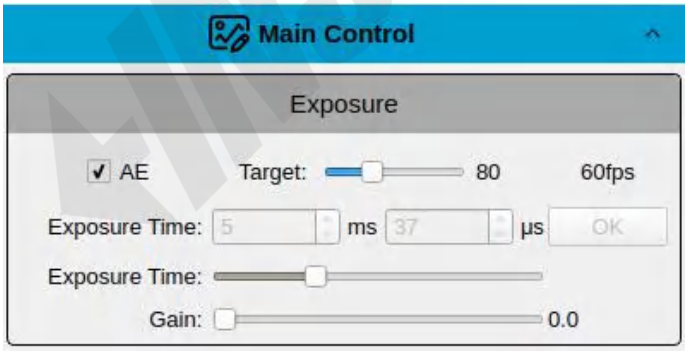


Figure 3- 2

Target Value: Adjusting the target value can change the automatic exposure brightness of the image.

Auto Exposure: Check the box of [Auto Exposure], the software will automatically adjusts the exposure time to achieve the appropriate brightness level (the maximum automatic exposure time 16.666ms). Exposure Time and Gain are not available to change in Auto Exposure mode.

Manual Exposure: Uncheck the [Auto Exposure], then the software enters [Manual Exposure] mode. Users can manually enter exposure time into the boxes, then click [OK] button to apply, or manually adjust the exposure time with the slider. The maximum manual exposure time is 1000ms.

Gain: User can select the most suitable gain setting depending on application and needs for generating a good image preview. Higher gain can brightens an image but may also produce increased noise.

3.1.2 Focus

The software provides two focusing methods, users can choose according to the situation, the setting interface is shown in Figure 3-3.

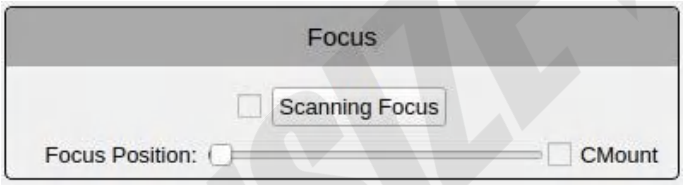


Figure 3-3

Scanning Focus: Check [Scanning Focus] to divide the entire preview screen into 112 windows of equal size, scan and focus the area in 112 windows respectively. Displaying the scanning results in numbers, the larger the number, the farther the area from the upper focal plane, that is, the greater the object distance. Uncheck [Scanning Focus], the digital grid is not visible, but the current scanning focus results can be kept when re-check [Scanning Focus], and the last result will be overwritten when the scan is executed again; the data will be cleared after the software is restarted, and the scan will be required again.

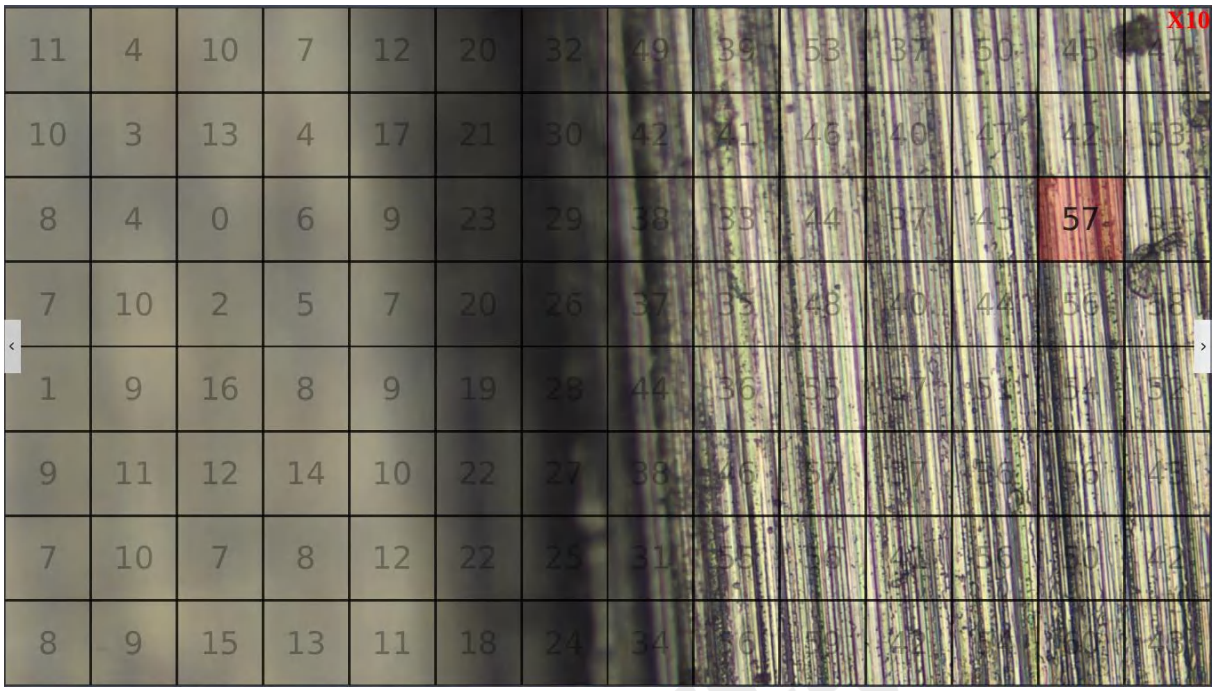


Figure 3-4

Manual: Focusing location can be manually positioned. The focus position (focal length) of camera will change according to location change.

C-Mount: Automatically moves to the C interface position.

Note: The analysis result of the scanning focus mode for the point light source and the transition area of the image may be different from the clarity judged by the human eye, and the final effect may not be clear.

3.1.3 Image Adjust

The user may perform real-time dynamic adjustment of images to achieve the desired image effect.

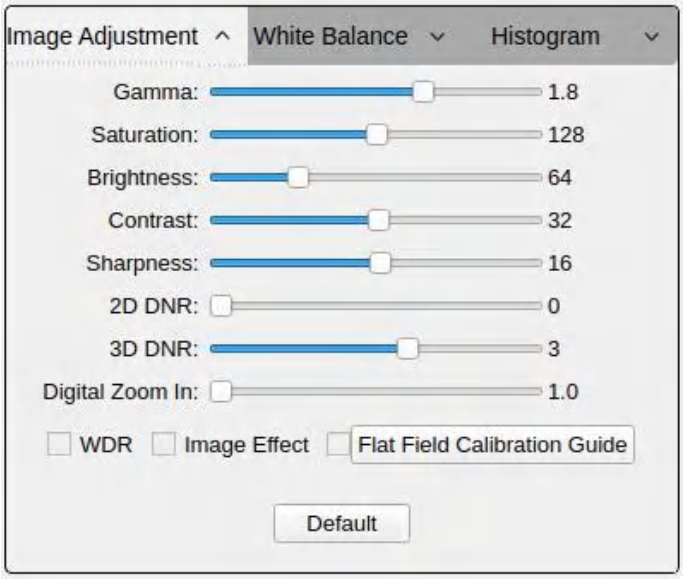


Figure 3- 5

Gamma: Non-linear adjustment of the median of the color level, often used to "stretch" darker areas in the image to see more detail.

Saturation: Adjusts the intensity of the color, the higher the setting, the more vivid the color. A setting of "0" is essentially monochromatic. Setting range is 0~255.

Light: The brightness and darkness of the image, setting range is 0~255

Contrast: The difference in brightness level between the brightest white and the darkest black in the light and dark areas of an image, setting range is 0~63. Default is 33.

Sharpness: Improves clarity of feature edges in the image.

2D noise reduction: noise reduction is performed on a frame of image, the larger the value, the more obvious the noise reduction effect.

3D noise reduction: Compare the images of the two frames before and after, find the position of the noise and reduce the gain. The larger the value, the more obvious the noise reduction effect.

Electronic zoom: User can zoom in or out the image by adjust slider according to their needs.

WDR: Click to stretch the dynamic range to reveal more image detail. Use as needed for the application. (The maximum frame rate in WDR mode is 30FPS)

Flat Field Calibration: In microscopy applications, live and captured images may contain uneven illumination, shading, vignetting, color patches or dirty spots due to microscope

illumination, microscope alignment, optical path systems and alignment or dirt in the optical system (objectives, camera couplers, camera window or sensor, internal lenses, etc.). Flat field correction compensates for these types of image defects in real-time through a reduction of repeatable and predictable artifacts to deliver an image with a more uniform, smoother and realistic background.

Operating Procedures:

1) Click [Flat Field Calibration Wizard] to initiate the process. Move the specimen out of the camera's field of view (FOV) to a blank background or put in a piece of A4 paper, as shown in below figure. It is recommended to move the sample/slide completely out of the FOV.

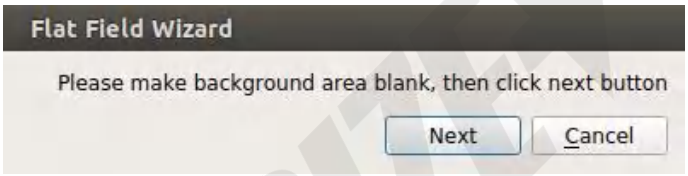


Figure 3- 6

2) Click [Next] then move the first background to another new blank background, click [OK] to apply the Flat Field Calibration function, as shown in below figure;

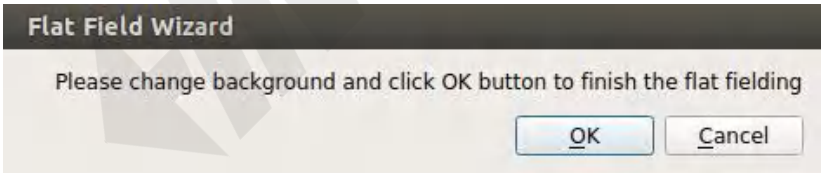


Figure 3- 7

3) Select [uncheck] to exit the flat field correction mode. If you need to apply it again, re-check it, no need for repeating the wizard procedures again.

Image Effect: Provides four image effects: [Normal], [Negative], [Black and White] and [Relief], and the default is [Normal].

Figure 3- 8

Default: Click the [Default] button to restore this module's parameters to the factory default.

3.1.4 White Balance

White Balance provides for more consistent images, accommodating for changes in light composition and its impact on the sample.

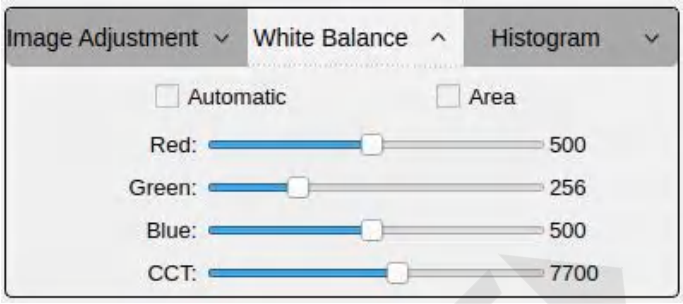


Figure 3- 9

Auto-White Balance: By adjusting the ratio of the three individual components of red, green and blue, the camera can reflect the true image color under various illuminating conditions. To manually set white balance, uncheck [Auto], move the sample out of the light path or place a white or neutral gray paper under the camera, then recheck [Auto] to lock the current white balance setting.

Area: When [Area White Balance] is selected, a region for measuring white balance opens on the preview image.

Red, Green, and Blue(Gain): Manually adjust the gain values of the red, green, and blue channels for suitable white balance effect, adjusting range is 0~1023.

Color temperature(CCT): The current close color temperature can be achieved by adjusting the three gains which are the above Red, Blue and Green. It can also be manually adjusted and matched to approximate the color temperature of the illuminating environment. Manually setting the white balance is more accurate at achieving the correct color temperature. Color temperature setting range is 2000 to 12000.

3.1.5 Histogram

Color level adjustment can lead to more realistic images for observation and analysis. Adjust the color level (gradation) to increase or decrease the range of the highlight area in the image. Alternatively, the color components of the individual RGB channels can be adjusted separately.

Each color channel of the histogram will overlap as illustrated in below figure.

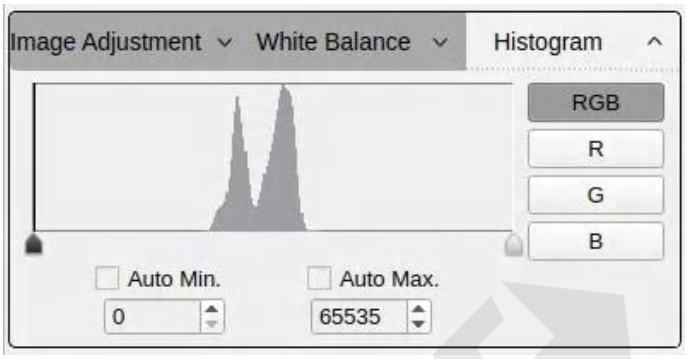


Figure 3- 10

Color/R/G/B: Red (R), green (G) and blue (B) color levels can be adjusted in each channel, and the associated pixel values distributed accordingly.

Auto Color Level: Check [Auto Min] and [Auto Max] to automatically adjust the brightest and darkest pixels in each channel as white and black, and then re-distribute the pixel values in proportion.

Manual Color Level: Manually adjust the image's dark tone (left gradation), the gamma and highlight brightness level (right gradation) on the histogram to regulate the image's tones.

Note: The histogram curve requires software to do real-time data statistics and display, which will take up some performance. When the module is expanded, the camera frame rate may be affected and slightly decreased.

3.2 Advanced Imaging

It provides real-time depth of field, 3D modeling displays and measurement (calibration is required before measurement):

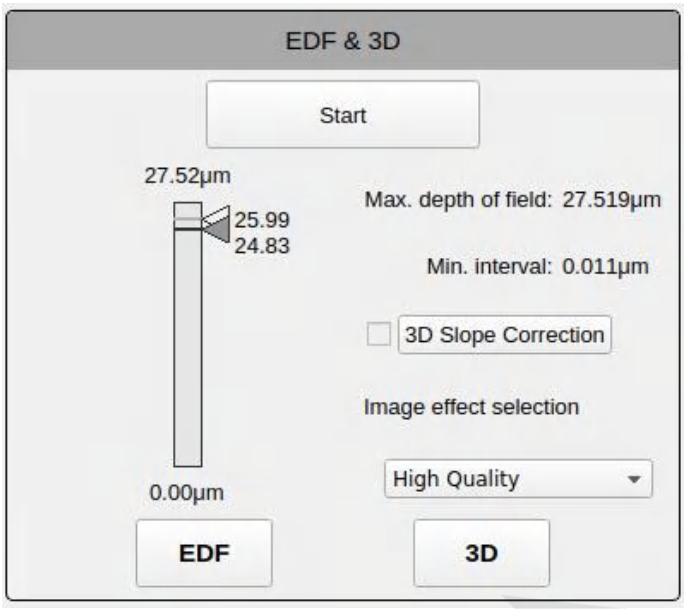


Figure 3- 11

- **Max. Depth of field:** The maximum depth of field of under the current objective lens

- **Minimum interval:** The distance moved by the focus motor in one-step.
- **3D Slope Correction:** used for correction when the microscope optical path is tilted.
- **Image effect:** Three options: high quality, fast mode and custom:
  1) **High quality:** High image accuracy, it is recommended to use for measuring;
  2) **Fast mode:** Quickly build 3D models, it is recommended to use for observing;
  3) **Custom:** Customization: 3D modeling according to the set Z step length or number of steps.
- **Z axis step length:** Set the Z accuracy, this setting can't be lower than the minimum interval.
- **Steps:** Walk through the selected depth of field with the set number of steps.
- **Z-axis ruler:** Display the range of the Z-axis under the current magnification, as well as the set upper and lower focal plane positions. As shown in Figure 3- 11:

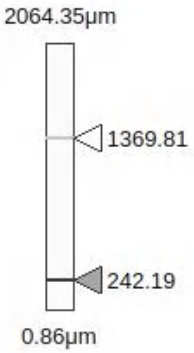


Figure 3- 12

3.2.1 Extended depth of field (Live)

EDF (Extended Depth of Focus) merges in-focus images across multiple focus planes to generate a two dimensional images with everything in focus. EDF is ideally suited for "thicker" specimens or samples (i.e. an insect as opposed to a thin tissue specimen). The EDF image allows for easy observation of sample detail all at once.

There are two modes to generate EDF images.

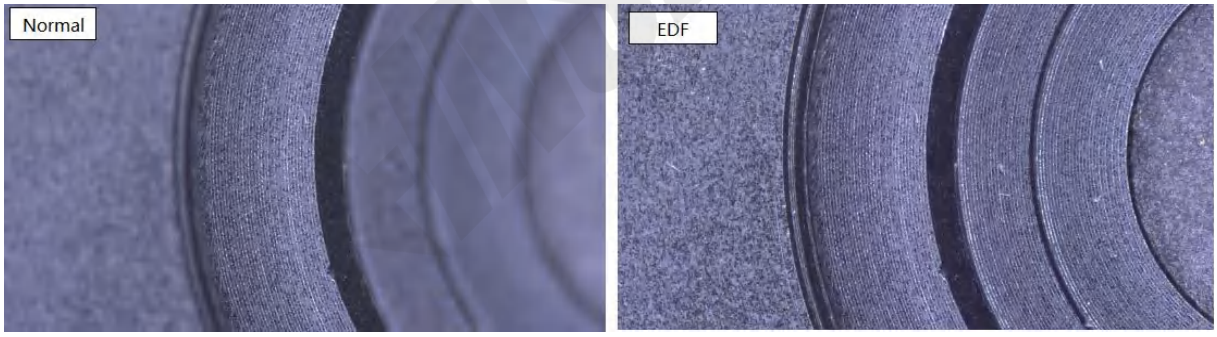


Figure 3- 13

- **Operating Procedures of Semi-automatic:**

1) Click [Start], and manually adjust the knob until the upper focal plane is clear, and click [OK];

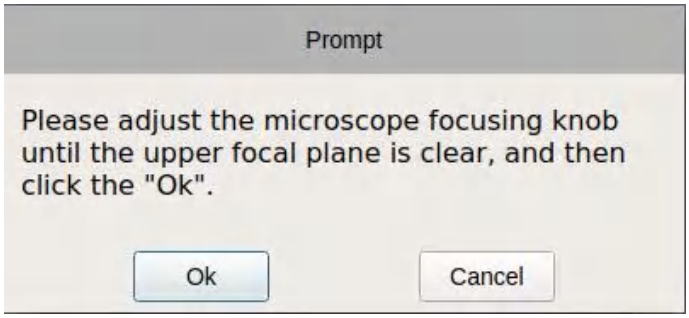


Figure 3-14

2) After the [scanning focus] is completed, select the lower focal plane in the digital grid;

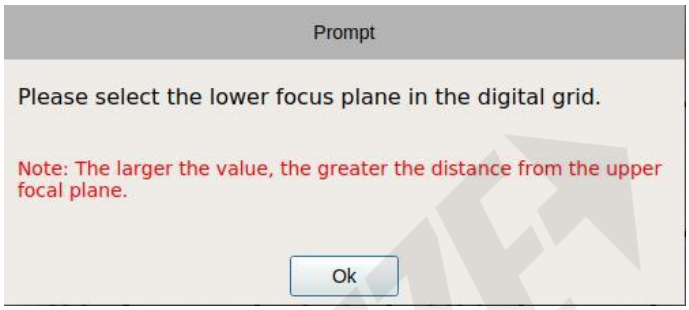


Figure 3-15

3) Click [EDF] to complete the real-time fusion of the depth of field from the selected lower focal plane to the upper focal plane, and generate a new image.

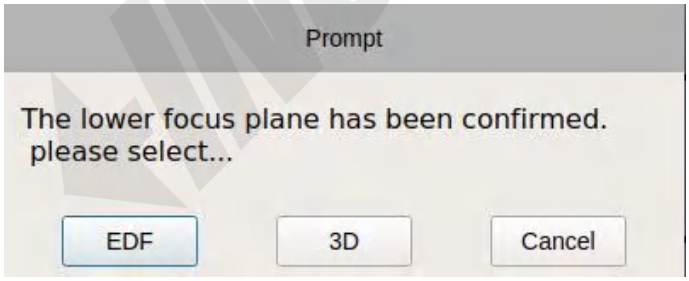


Figure 3-16

- **Operating Procedures of Manual**

1) Drag the upper and lower focal plane positions on the Z-axis ruler;
2) Click the [EDF] button to generate a new image;

3.2.2 3D Slope Correction

In the actual microscope environment, the reference plane and the optical imaging plane are

not parallel. At this time, the 3D modeling is sloped. [3D tilt correction] is to correct this non-parallel state.

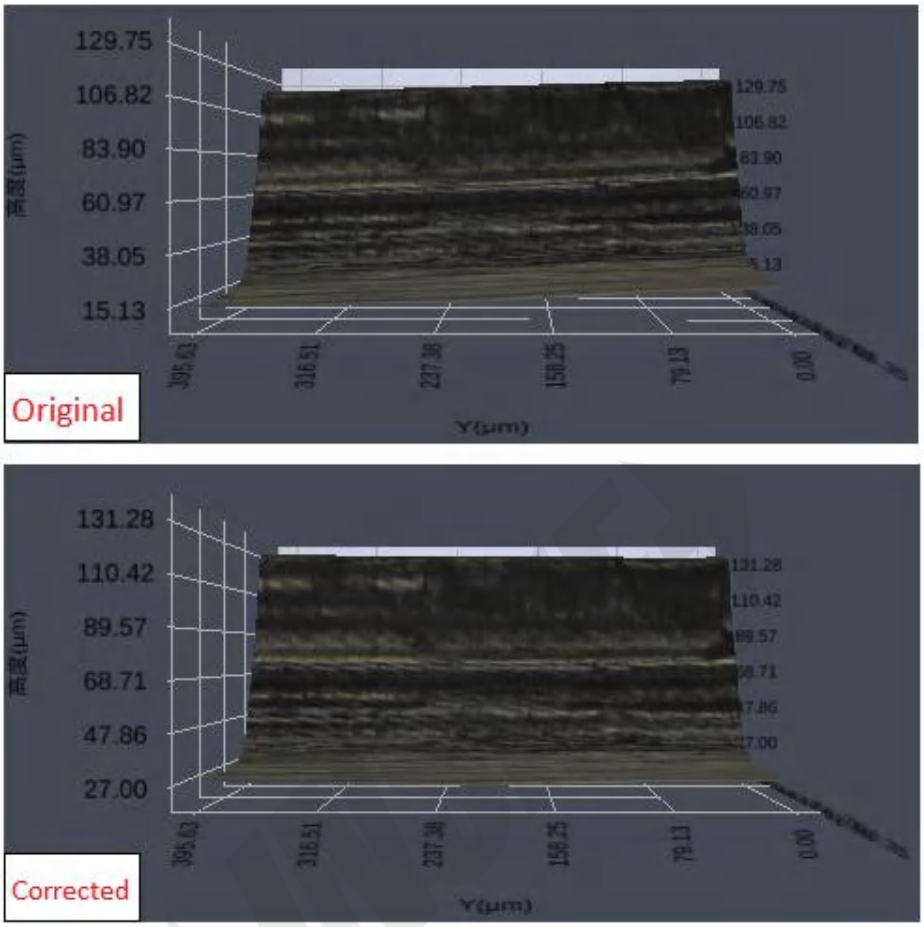


Figure 3-17

Operating procedures

1) Place a flat surface on the reference table (for example, the surface of the standard block);
2) Click [3D Slope Correction], follow the prompts to adjust the microscope focus knob until the preview is clear, click [OK], and wait for the 3D modeling to be completed;

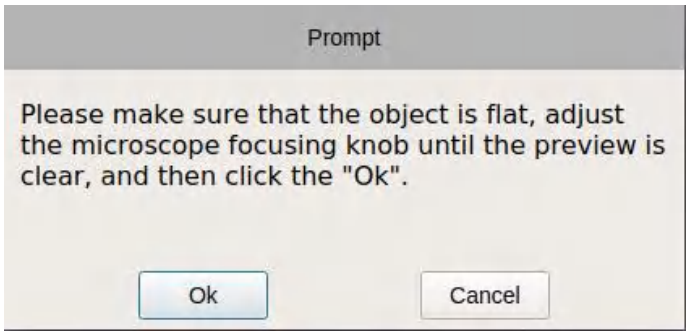


Figure 3-18

Note:

1) When the magnification and the reference plane have not changed, there is no need to re-calibrate, just check [3D tilt calibration]. If you change the objective lens or the reference plane, in order to ensure the accuracy of the results, you need to perform 3D tilt correction again.
2) It is recommended to calibrate the 3D Z axis firstly and then execute the [3D Slope Correction].

3.2.3 3D

3D uses optical imaging technology to obtain the size, position, height and other information of the target sample, and restores the 3D of the sample based on the obtained information through an algorithm. At the same time, the height, volume, area, etc. can be measured on the generated 3D image.

Like EDF operation, it supports automatic and manual modes. Click [3D] to synthesize 3D images. The 3D image supports three modes of [high quality], [fast] and [custom]. The [high quality] mode is used when the image quality and measurement accuracy are high, and the [fast] mode can be used to observe the overall outline of the object. In [Custom] mode, users can customize the number and step length of 3D image fusion.

Figure 3- 19

3.3 Files Save

Files save contains images and videos save settings.

3.3.1 Images Save

Capture the currently needed data from the real-time video data stream and record it into image format for later development and analysis. Click the [📷] button to capture a preview image. The setting interface as Figure 3- 14 shows:

Figure 3- 20

- **File Name:** The name of the file to be saved is [TS] by default and can be readily edited by the user. The software supports file name suffix format of [custom + time-stamp]. There are four formats of time-stamp naming available and numerical suffix

augmentation (nnnn).

- **Format:** Images may be saved as JPG\TIF\PNG\ files. The default format is TIF. The formats may be checked individually or in multiples. Captured images saved in multiple formats will be displayed together.
- **Path:** The destination path for saving images. User can click the [Browse] button to change the saving path. The default saving path is /home/nvidia/Desktop/Image.

3.3.2 Videos Save

Click on [Video Record], save the image data in a video format for play back to observe the sample/specimen movement or change over time. The setting interface as Figure 3- 15 shows.

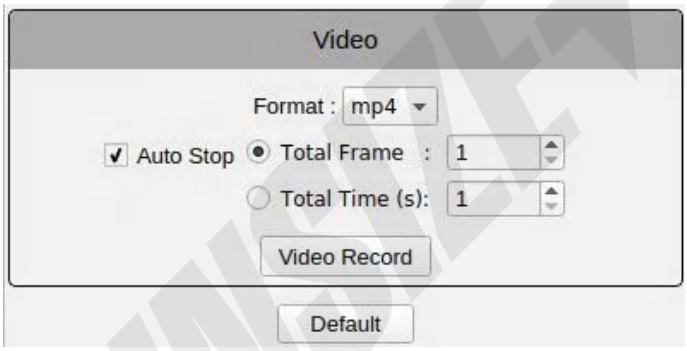


Figure 3- 21

- **Video Format:** AVI\MP4\ are supported, the default is AVI format.
- **Auto Stop:** Check the Auto Stop box to activate options for capturing a designated number of frames or for a specific time duration.
- **Total Frame:** Capture images according to how many frames are desired to be captured. Camera will operate at the frame rate shown in the Exposure Control menu.
- **Total Time(s):** The length of time of video capture at the frame rate shown in the Exposure Control menu.
- **Default:** Click the [Default] button to restore the module's parameters to the factory default.

4. Images

The following image processing functions are available: Image Adjust, Image Binarization, Image Histogram, Filter/Extract/Inverse Color, Image Smooth, Image Surface Inspection.

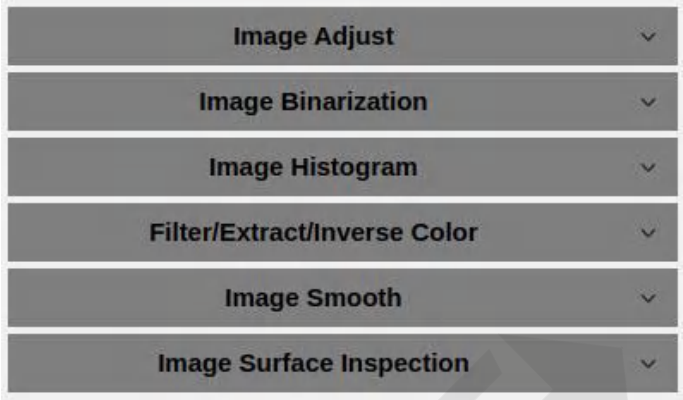


Figure 4- 1

4.1 Image Adjust

Adjust the image parameters to revise the effects of the captured images.

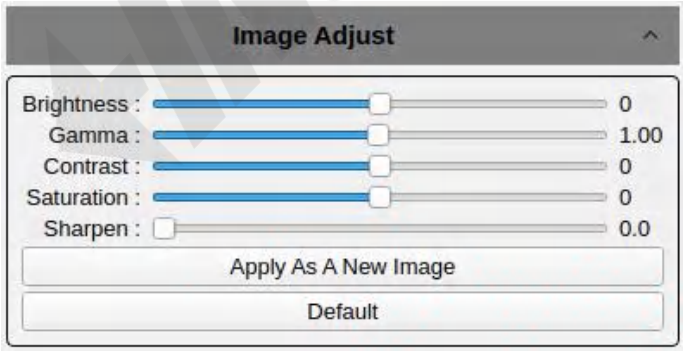


Figure 4- 2

- **Brightness:** Allows adjustment of the image brightness, the default value is 0.
- **Gamma:** Adjust the balance of darker and lighter regions on the monitor for bringing out details; the default value is 1.00.
- **Contrast:** The ratio between the darkest areas and brightest areas of the image, the default value is 0.

- **Saturation:** The intensity of color, the higher value of the saturation, the more intense the color, the default value is 0.
- **Sharpen:** Adjusts the appearance of edges in the image to appear more in focus, may result in more vivid color in a specific area of the image. The default value is 0.
- After completing the parameter adjustments for the image, Click [**Apply As A New Image**] to accept all new settings and apply them to a copy the original image – this preserves the original image. The new image should be saved with a different file name to preserve the original image (data).
- **Default:** Click the [default] button to restore the adjusted parameters to the factory default.

4.2 Binarization

T-Metrics C0 can perform image binarization in which a full color sample can be segmented and viewed as two classes.

The user moves the threshold slider until the desired segmentation is observed – other features are excluded. The grayscale value of the pixels of the image range from 0 to 255, and by adjusting the threshold to observe one feature, the image is presented with a distinctive black and white effect (based on the threshold, gray levels above the threshold will appear as white, and those below will appear as black). This is often used to observe and count particles or cells.

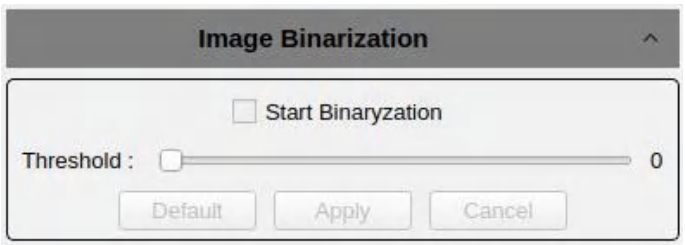


Figure 4- 3

- **Default:** Click the default button to restore the module's parameters to the factory default.

- **Apply:** After making adjustments, click [Apply] to generate a new image, the new image can be saved as desired.
- **Cancel:** Click the Cancel button to stop the process and exit the module.

4.3 Histogram

When handling with pictures, more realistic colorful pictures are usually needed to use for observation and analysis. Color scale adjustment can help users to obtain better picture effect, as shown in the following picture.

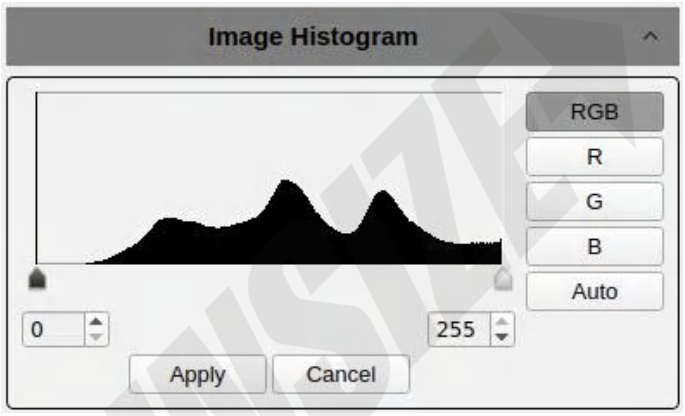


Figure 4- 4

- **Color Scale Adjustment:** Refine R/G/B color scales separately, then proportionally redistribute the pixel value among them. The adjustment of picture's color scale may highlight features and brighten the image – it may also darken an image. Each color channel can be adjusted separately to change the color of picture in corresponding path.
- **Manual Color Scale:** Users can manually adjust the dark shade (left color scale), gamma and highlight brightness level (right color scale) to calibrate picture shade tone, including contrast, shade and image hierarchy, and to balance the color of the picture.
- **Automatic Color Scale:** Check Automatic, customize the brightest and darkest pixel in each path as white and black, and then proportionally redistribute the pixel values between them.
- **Apply:** Apply current parameter setting in picture and generate a new picture. The new

picture can be saved as separately.

- **Cancel:** Click [Cancel] button to cancel parameter of the module.

4.4 Smooth

The software provides users three image-smoothing techniques for reducing the noise in images, often improving the observation of detail. These computation techniques, often called [blurring], include Gaussian Blur, Box Filter, and Median Blur.

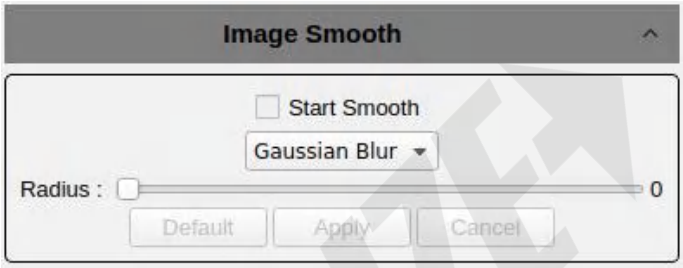


Figure 4- 5

- **Default:** Click the [default] button to restore the module's parameters to the factory default.
- **Apply:** After selecting the desired smoothing technique and adjusting the Radius, click [Apply] to generate a new image using those setting, and the new image can be saved as desired.
- **Cancel:** Click the [Cancel] button to stop the process and exit the module.

4.5 Filter/Extract/Inverse Color

Software allows users with methods to Filter/Extract/Inverse Color in previously acquired still images (not videos) as needed for the application.

- **Color:** Select Red/Green/Blue.
- **Filter Color:** Can be useful to check the color level information in each channel of a

color image and combine images with complementary colors. The combined image will always be brighter. The filter selectively removes the selected color from the image.

- **Extract Color:** Extract the certain of color from the RGB color group. Extract removes the other color channels from the image, keeping only the color that was selected.
- **Inverse Color:** Invert the colors in the RGB group to their complementary colors.

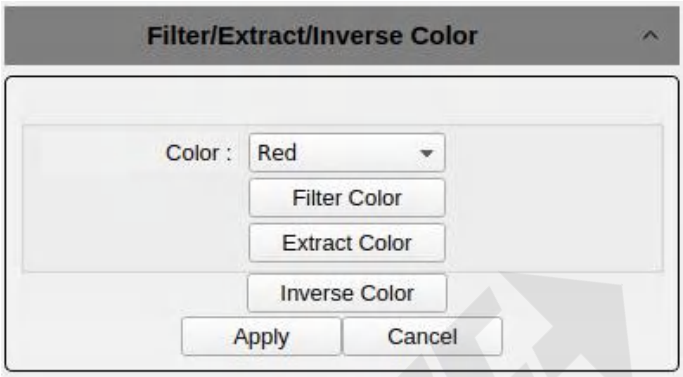


Figure 4- 6

- **Apply:** After choosing the settings, click [Apply] to apply those settings to a copy of the original image and generate a new image, then save the new image as desired.
- **Cancel:** Click the [Cancel] button to cancel process and exit the module.

4.6 Image surface inspection

There are two methods for surface inspection: [uniform inspection] and [scratch inspection].

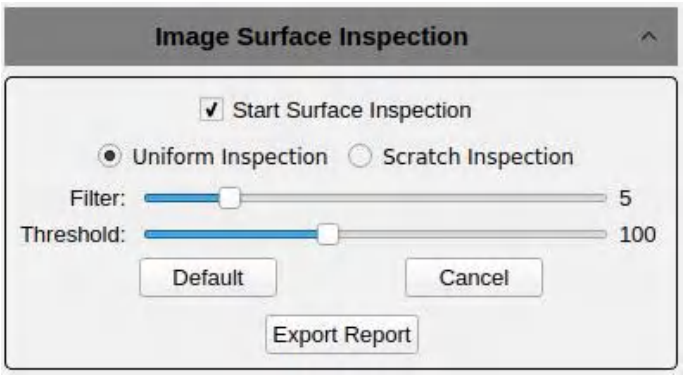


Figure 4- 7

4.6.1 Uniform Inspection

Uniform detection automatically generates detection results, as shown Figure 4- 8.

The lines and bright spots in the image indicate uneven parts. The size of the five detection windows in the image is 200pixel×200pixel. The first number indicates the proportion of bright spots in the window to the size of the window = Highlight pixels/40000, and the second number indicates the number of bright pixels in the window. Users can set the filter coefficient and threshold size to detect the uniformity of different ranges according to their needs.

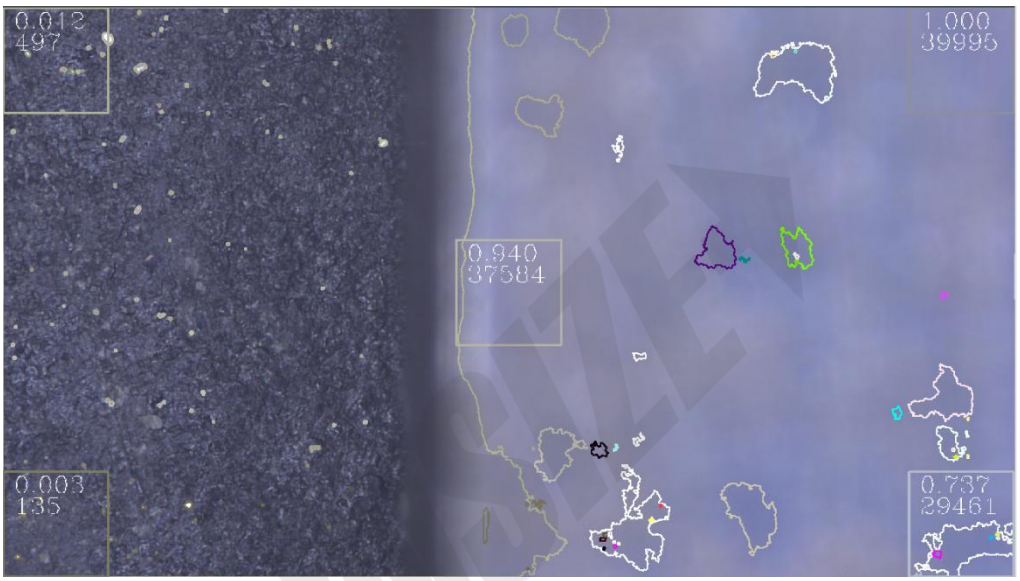


Figure 4- 8

4.6.2 Scratch Inspection

Scratch detection automatically generates detection results, as shown Figure 4- 9. The red lines are the detected scratches. Users can adjust the upper and lower thresholds and the minimum area threshold to detect scratches of different lengths according to their needs.

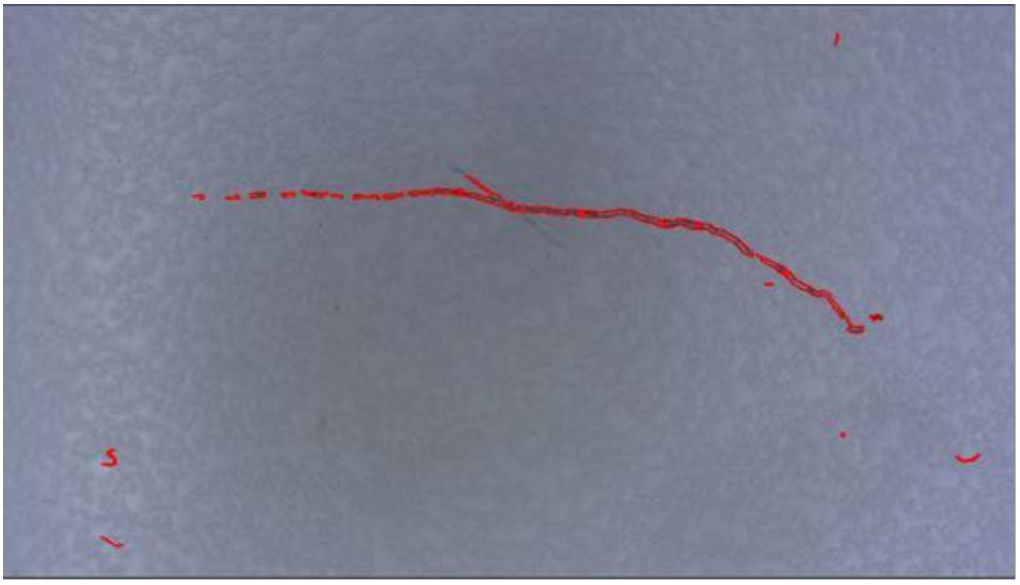


Figure 4- 9

4.7 Report

Surface inspection report can be exported for backup.

5. Calibrations

It is used for the calibration of 2D and 3D measurement. In order to ensure the accuracy of the measurement data, it is recommended to calibrate before performing the measurement.

5.1 Calibration Ruler

This module is used to calibrate the XY axis. It supports [Manual Drawing] and [Welt Drawing].

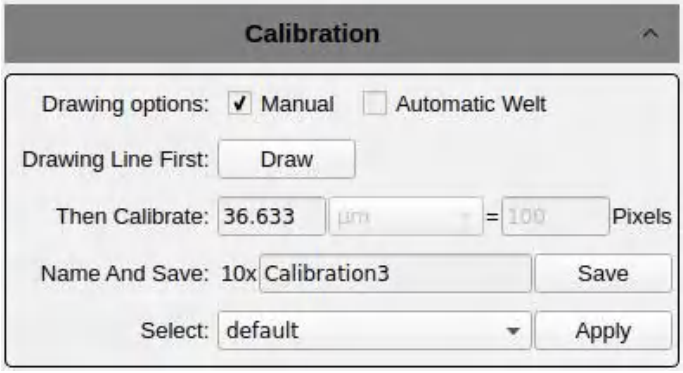


Figure 5- 1

Operating Procedures of [Manual Drawing]:

1) Click [Draw], draw a straight line on the image. If using a stage micrometer, begin on the left side of the micrometer, click on the left edge of a tick mark and, for maximum accuracy, drag the line to the far right of the images.
2) Specify the actual length of the object in the image. Create a logical name for the calibration measurement (i.e. “10x” for a measurement with a 10x objective), confirm the unit of measure, then finally, click [Apply] to accept the entries and save the calibration.

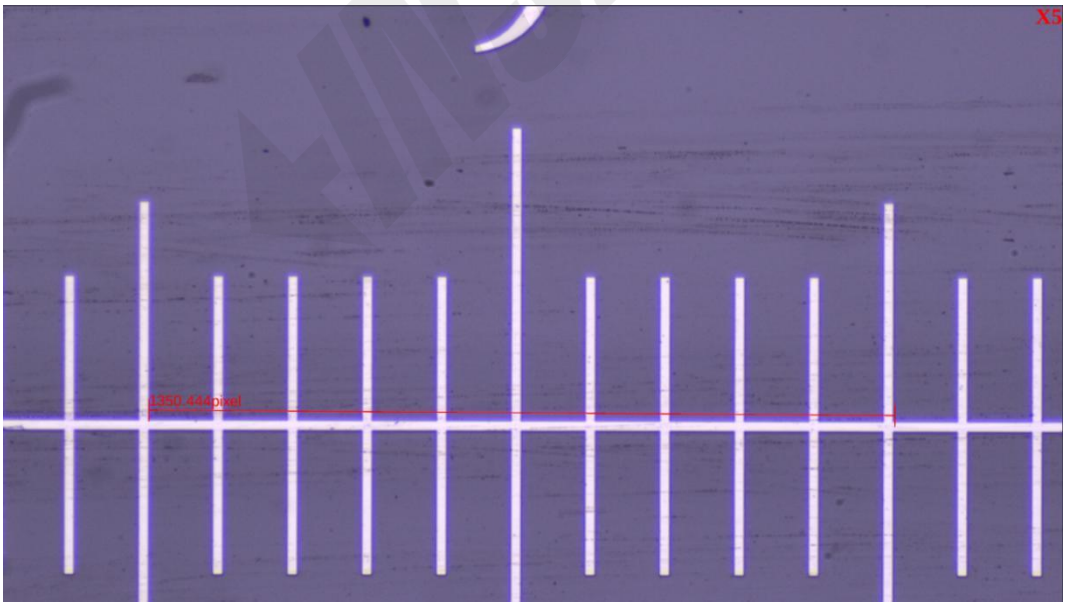
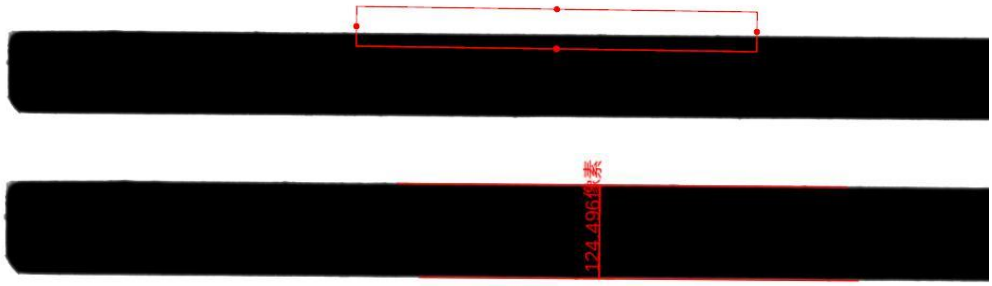


Figure 5- 2

Operating Procedures of [Welt Drawing]:

1) Select [Welt Drawing], and then draw a rectangular box to fit one side of the sample, double-click to end the drawing, use the same method to fit the other side of the sample;



2) Specify the actual length of the object in the image. Create a logical name for the calibration measurement (i.e. “10x” for a measurement with a 10x objective), click [Apply] to accept the entries and save the calibration.

Note:

1) The software provides a default calibration ruler, and the unit pixel changes in real time with the magnification.
2) It needs to be re-calibrated when the magnification changes.

5.2 Z Axis Calibration

The Z-axis needs to be calibrated when performing 3D measurement. The software provides two modes: default and custom. When the user does not calibrate, the system default calibration parameters are used. The default parameters will be overwritten after custom calibration.

Calibration: The principle is the same as the 2D calibration ruler. The height of the known object is used for calibration, and the altimeter of the entire depth of field is obtained.

Operating Procedures of [Z Axis Calibration]:

1) Please confirm that the magnification is consistent with the objective lens;
2) Place standard blocks;

3) Enter the height of the standard block;

4) Draw a low plane rectangular area in the image;

5) Draw a high plane rectangular area in the image;

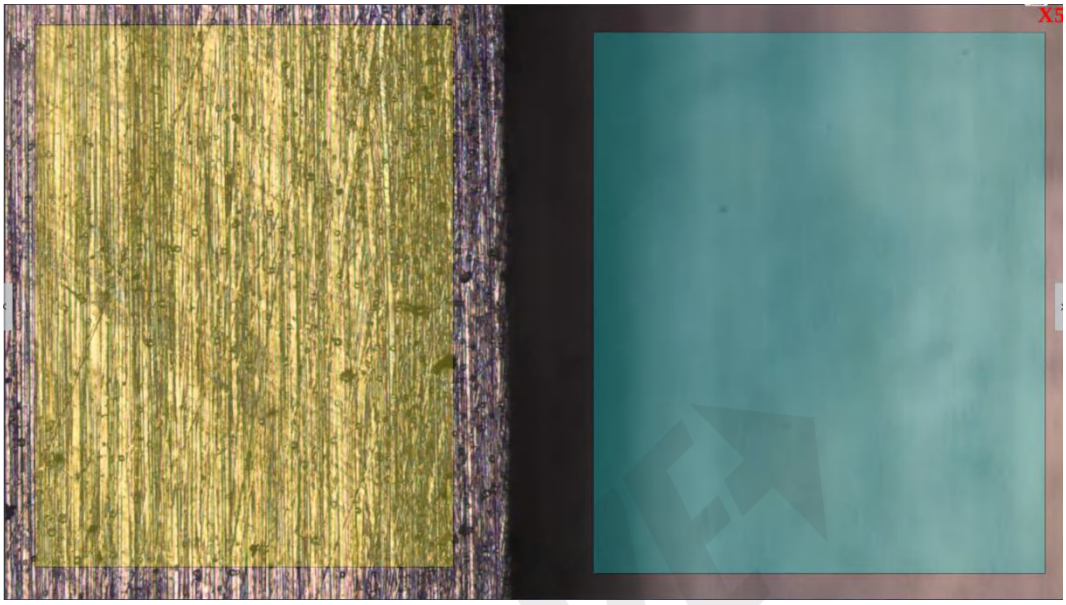


Figure 5- 3

6) Click [Start Calibration] and wait for the calibration to be completed. After the calibration is completed, the calibration data will be automatically saved and applied; recalibration will overwrite the last calibration data.

Note:

1) When calibrating, ensure that the high and low areas can be focused clearly.

2) Each magnification needs to be calibrated separately and independent of each other. After calibration, you can directly select and use it, and the calibration data can be retained after power off;

3) The default calibration ruler cannot be deleted, but it can be re-calibrated to overwrite the default data;

5.3 Scale Property

T-Metrics C20 allows users to set the scale properties based on need or application, the setting

interface shown in Figure 5- 4.

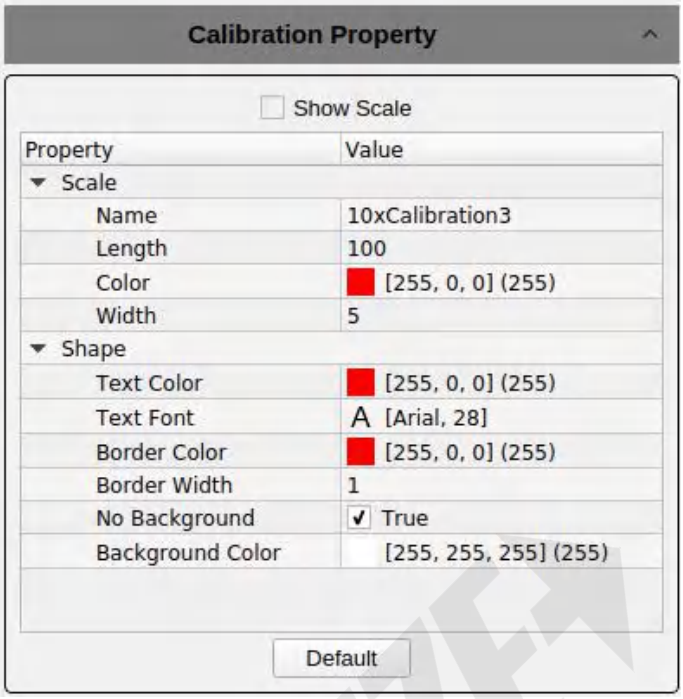


Figure 5- 4

- **Show Scale:** Click the checkbox to display the scale bar on the image. The default setting is NOT to display the scale bar.
- **Name:** Create name for the scale in the current image. The default setting is blank.
- **Length:** The default value is 100 units, according to the calibration file selected. The value can be modified by entering new value.
- **Color:** Choose the line color for the current scale bar on the image. The default color is red, other colors can be chosen by clicking the color box.
- **Width:** Adjust the width of scale bar on the image. The default is value 2, the range is 1~5.
- **Text Color:** Choose the color for the current scale bar on the image. The default color is red, other colors can be chosen by clicking the color box.
- **Text Font:** Choose the text font and set font size for the current scale bar.
- **Border Color:** Choose the color for border of the scale currently displayed on the image. The default color is red, other colors can be chosen by clicking the color box.
- **Border Width:** Adjust the width of the border surrounding the scale. The default value is

5, range 1~5.

- **No Background:** Check or uncheck the checkbox next to True. Checked box = transparent (no) background; unchecked box = with background. Transparent background is the default setting.
- **Background Color:** Select the background color for the scale on the image. The default color is white; click the color box to choose another background color.
- **Default:** Revert to and apply the default settings for the scale on the image.

6. Measure

Software provides tools for measuring features in images. It contains a rich set of measurements for image analysis. The principle of the measurement functions is based on image pixels as the basic execution unit, and with calibration. The resulting measurements can be very accurate and repeatable.

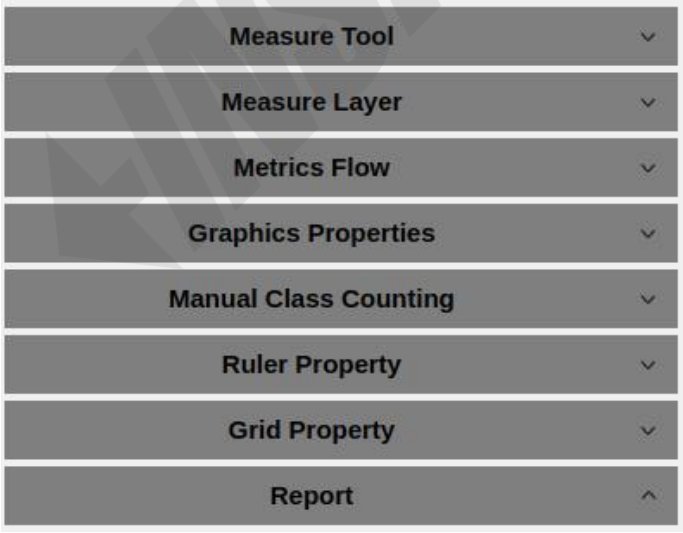


Figure 6- 1

6.1 Measure Tool

Begin all measurements by clicking the desired measure tool in the module window.

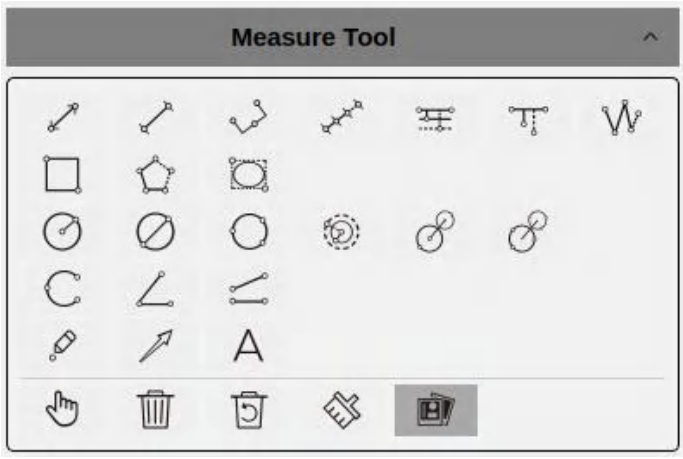


Figure 6- 2

- **Line:** Click in the image to draw a line segment graphic and complete the drawing with another click. Arrows are displayed at the endpoints.
- **H Shape Straight Line:** Draw a line segment graphic and then finish drawing with one more click, vertical lines at endpoint.
- **Three Dots Line Segment:** Draw graphic with three dots line segment, finish drawing when click for the third time.
- **Multiple Dots Line Segment:** Draw graphic with multiple dots at the same direction, single click to draw and double click to end drawing.
- **Parallel Line:** Click in the image to draw a line segment, left click again to draw its parallel lines, then double-left-click to finish drawing.
- **Vertical Line:** Click in the image to draw a line segment, left click again to draw its vertical line, then double-left-click to finish drawing.
- **Polyline:** Click in the image and draw a line segment, left click again to add a new line segment to the existing polyline, then double-left-click to finish drawing.
- **Rectangle:** Click in the image to start drawing, drag the shape down and to the right, then double-left-click to complete the drawing. Measurements include length, width, perimeter and area.

-  **Polygon:** Click in the image to start drawing the shape, left click to draw each additional face, then double-left-click to finish drawing.
-  **Ellipse:** Click in the image, drag the shape down and to the right, then double-left-click to finish. Measurements include perimeter, area, major axis, short axis, and eccentricity.
-  **Radius Circle:** Click in the image to select the center of the circle, click again to define the radius length, then click again to finish drawing.
-  **Diameter Circle:** Click in the image, drag to enlarge the circle, then click again to finish drawing.
-  **3Point Circle:** Click in the image to define one point on the perimeter, move and click to set another point, then move and click a third time to finish drawing.
-  **Concentric Circles:** Click in the image to draw the first circle with its radius, in or out and click to define the next circle, then double-click to finish drawing.
-  **4Point Double Circle:** (like drawing two radius circles) Click to position the center of the first circle, then click to define the radius of the first circle. Click again to position the center of the second circle, then click again to define the radius of the second circle.
-  **6Point Double Circle:** (like drawing two 3point circles) Click three times to select three points on the first circle, and click another three times to select the three points of the second circle, then end the drawing.
-  **Arc:** Click in the image to select the starting point, drag and click again to set the second point on the arc, then click again to finish the drawing. All 3 points will be on the arc.
- **3Point Angle:** Click to set the end point of one arm of the angle, click to set the vertex (inflection point), then click again after drawing the second arm and to finish drawing.
-  **4Point Angle:** Click in the image the angle between two unconnected lines. Click to

draw the endpoints of the first line, then click to draw the endpoints of the second line. The software will extrapolate and determine the smallest angle between the two lines.

- **Dot:** Click in the image where you want to place a dot i.e. for counting or to mark a feature.
- **Arrow:** Click in the image to start the arrow, click again to end the drawing.
- **Text:** Click in the image and type to add a text note.
- **Select:** Click in the image window to select an object or annotation. The mouse cursor changes to , use the to move the object or annotation.
- **Delete:** To delete the drawing, measurement or annotation.
- **Undelete:** Undo the last delete operation.
- **Clear All:** Delete all the drawn and measured graphics or texts on the current layers.
- **Combine:** When saving the image, the drawings, measurements and annotations will be permanently added ("burned into") the image. By default, Combine is active.

Note:

All drawing and measurement graphic data will be added to the measurement table. Click [Export to Excel] or [Export to TXT] to transfer the data information to EXCEL form format or TXT document format. Click [Copy] to copy the entire table for pasting into another document.

6.2 Measure Layer

Multiple layers can be created on the image allowing multiple measurement approaches to be created, applied or shown individually or in multiples.

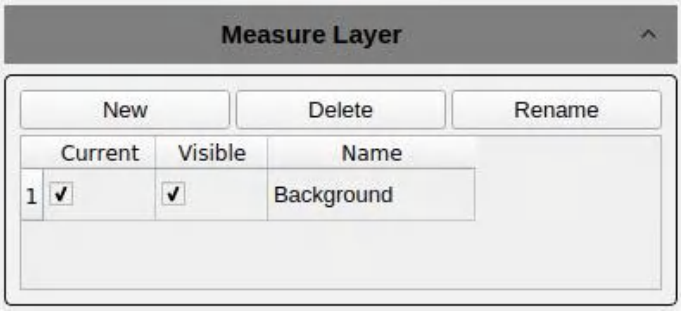


Figure 6- 3

- **New:** Click [New] to create a new layer. The default layer naming convention is to augment the suffix of the layer by 1 as “Layer 01”, “Layer 02”, “Layer 03”, and so on.
- **Delete:** Click [Delete] to delete the selected (checked) layer.
- **Rename:** Click [Rename] to rename the selected (checked) layer or selected layer name.
- **Current:** Click the checkbox in the [Current] column to activate a layer for measurement. Measurements made on that layer will be associated with that layer.
- **Visible:** Measurement data from different layers may be displayed individually by layer or by multiple layers. Click the checkboxes in the [Visible] column of the layers you wish to display.

6.3 Metrics Flow

The Metrics Flow feature provides powerful, semi-automated measurements especially for pass-fail quality inspection of devices or parts in industrial manufacturing environments. Metrics Flow adds convenience and improves speed and accuracy of inspection.

Operating Procedures

1) Open a group of device or part images saved in the image gallery.
2) Click [Start Building A Metrics Flow] checkbox to create a new metrics template. Select the image of the standard sample to measure and set the tolerances for later measurements and observations; after recording the reference measurements and annotations on the

template, assign a name to the template and click [Save].

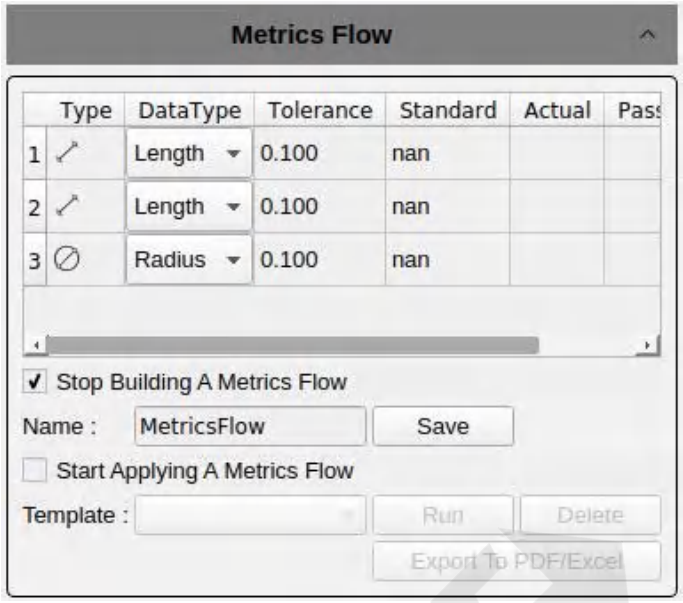


Figure 6- 4

3) Click [Start Applying A Metrics Flow], select the created template, click the [Run] button to apply the template, click [Delete] to delete the template.
4) Select the image for inspection/observation and follow the steps as when creating the template, draw the first measurement, the Metrics Flow will automatically advance to the next measurement tool, continuing until every measurement in the flow has been made.
5) After the software applies the template, the [Run] button will be released and a window showing the results is displayed.
6) Click [Export to PDF/Excel] to save the results in PDF format or export in Excel format with the detecting results.
7) Continue to click [Run] and select other images for inspection/observation, then repeat steps 3 and 4 as above. After finished analyzing all the images, click [Stop Applying A Metrics Flow] to stop the Metrics Flow process.

6.4 Graphics Properties

Allows users to manage and adjust graphics properties for their application.

- **Name:** Create or change a name in the blank text field in the Value column next to the Name row.
- **Show Name:** Check the False checkbox if you do NOT want the Name to be displayed.
- **Precision:** Choose the precision (characters after the decimal point) of any values being displayed. The default value is 3, the range is 0~6.
- **Graphics Width:** Adjust the width of the current measurement tools on the image. The default is value 1, the range is 1~5.
- **Graphics Style:** Select the line style of the current measurement tools on the image. The default style is a solid line, other available styles are dashed lines, dotted lines, and double dotted lines.

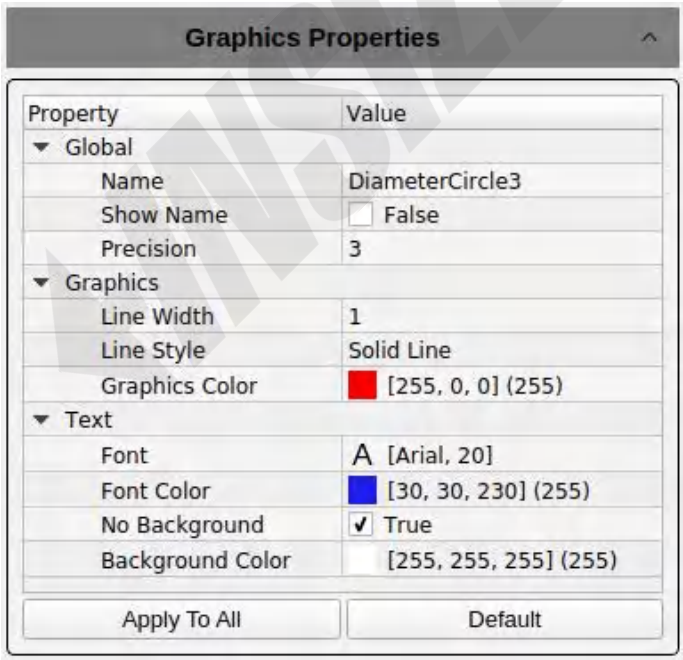


Figure 6- 5

- **Graphics Color:** Select the color of the lines of the measurement tools on the image. The default color is red, other colors can be chosen by clicking the color box and then the button.

- **Font:** Choose the text font for the current measurement data. The default format is [Arial, 20]. Click the "A" in the Font: Value field to select another font and/or size.
- **Font color:** Choose the color for the current measurement data on the image. The default color is blue, other colors can be chosen by clicking the color box and then the button.
- **No Background:** Check or uncheck the checkbox next to True. Checked box = transparent (no) background, unchecked box = with background. Transparent background is the default setting.
- **Background Color:** Select the background color for the current measurement data on the image. Click the color area and then the button to choose the desired background color, the default background color is white.
- **Apply to All:** Apply all the graphics properties to the measurement graphics.
- **Default:** Revert to and apply the default graphics settings.

6.5 Manual Class Counting

The Manual Class Counting function allows the user to manually count objects in the sample based on a feature or detail. Multiple features may be specified based on color, morphology, etc. as needed for the user's application. Up to seven classes are possible.

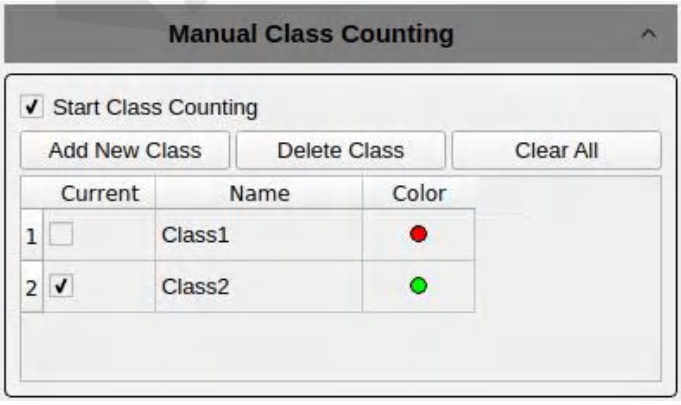


Figure 6- 6

- Start Class Counting: Enable this function.
- Add New Class: Create a new class.

- Delete Class: Remove selected class from the lists.
- Clear All: Remove all classes in the table.
- Current: Check to indicate the class being used.
- Name: Double-click the category button (i.e. Class1) to name the category.
- Color: Click the radio button in the Color column to select another color for the class.

Operating Procedures

1) Click the [Start Class Counting] checkbox to select a class to use;
2) Left-click the mouse on targets in the image to count;
3) After counting is finished with one or more classes, the counting results are displayed in the counting table. Export the data by selecting [Export to Excel], then choose the destination in which to save the file.

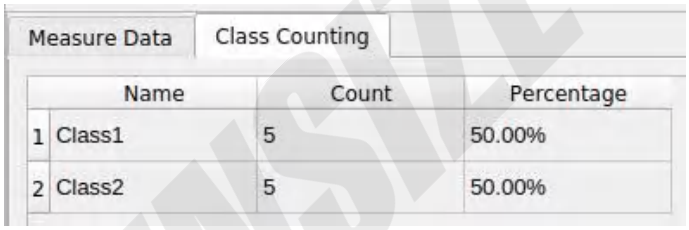


Figure 6- 7

6.6 Ruler Property

Software allows users to set the ruler properties according to need or application.

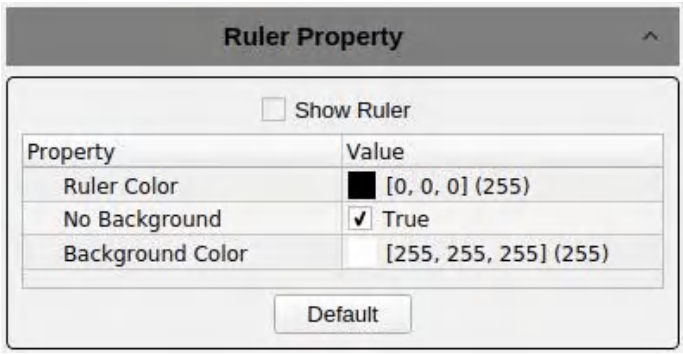


Figure 6- 8

- **Show Ruler:** Click the checkbox to display the crosshair-style ruler on the image. The default setting is unchecked to not display the crosshair.
- **Ruler Color:** Choose the color for the current crosshair on the image. The default color is black; other color options are available by clicking the color box.
- **No Background:** Uncheck the checkbox for a transparent background. Check the checkbox to apply a background to the ruler. The default setting is a transparent background.
- **Background Color:** Select the background color for the current ruler displayed on the image. Click the color box to choose another background color. The default background color is white.
- **Default:** Revert to and apply the default ruler settings.

6.7 Grid Property

Software allows users to set the grid properties on the image according to need or application. The grid is simply a series of vertical and horizontal lines dividing the image into rows and columns.

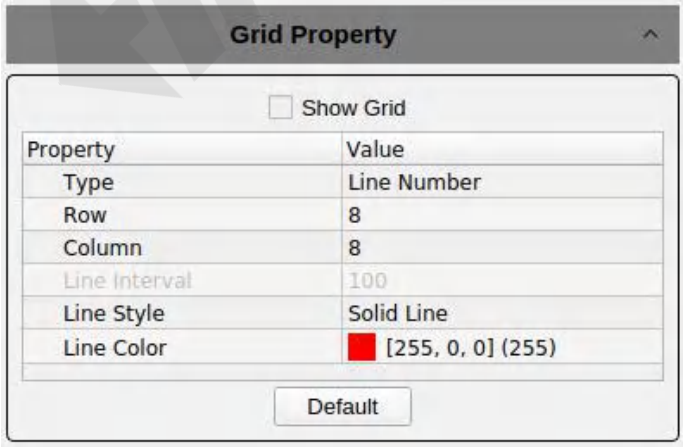


Figure 6- 9

- **Show Grid:** Check the Show Grid checkbox to display the grid on the image. The default setting is to NOT show the grid.

- **Type:** Select the way to define the grid to apply to the current image, either by Line Number or Line Interval.
- **Row/Column:** When Type is defined as Line Number, enter the number of horizontal (row) lines and vertical (column) lines to show on the image.
- **Line Interval:** If you choose to define the grid by the line interval, you can enter the number of grids you need into the blank of Line Interval, the default number of line interval is 100.
- **Line style:** Choose the line style for the grid to apply on the image there are 5 styles of grid could be chosen from, the solid lines, dashed lines, dotted lines, dotted lines, and two dotted lines.
- **Line Color:** Choose the color for the grid to apply on the image, the default color is red, Click on […] to choose the desired grid color.
- **Default:** Resort and apply the default parameters settings to the grid on the image.

6.8 Report

The measured data can be exported by the user to form a measurement report. The setting interface is as shown Figure 6- 10.

Figure 6- 10

7. Automatic Measurement

Automatic measurement can be used for batch measurement of small workpieces (studs, gears, etc.) and rice in a backlight environment.

Figure 7- 1

In order to ensure the accuracy of measurement matching, please binarize the image in a backlight environment. The parameter settings of the binarized image are shown in Figure 7- 2, and the result after the binarization is shown in Figure 7- 3

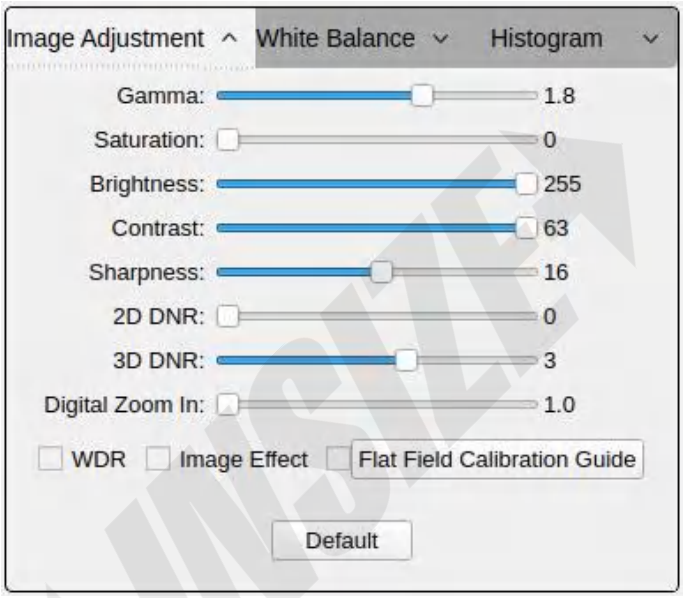


Figure 7- 2

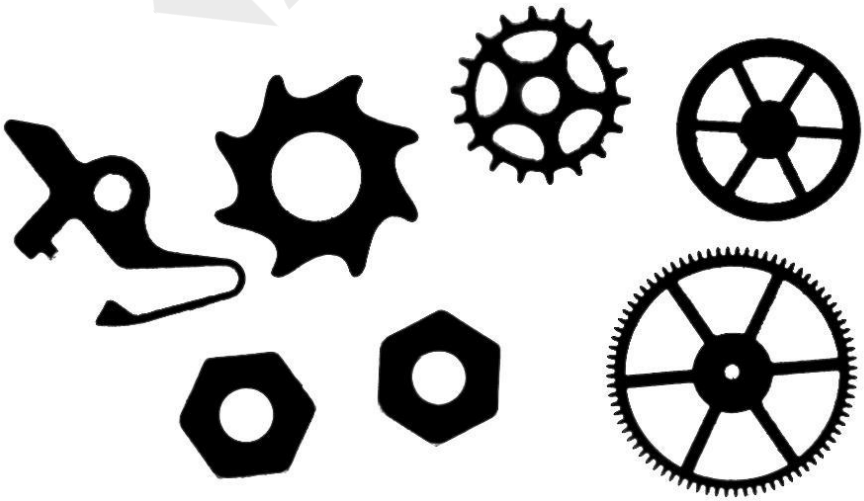


Figure 7- 3

For the measurement of transparent types such as rice (Figure 7-4), the gamma can be adjusted to 1.5 on the basis of the above parameters, and the brightness value can be appropriately increased.

Figure 7-4

Note:

It is recommended to isolate the objects by a certain distance. When the objects are too close to each other during batch measurement, measurement errors will occur.

7.1 New standard template

Create a template based on a single sample for the measurement of the same sample. The tolerance range can be set during the template creation process.

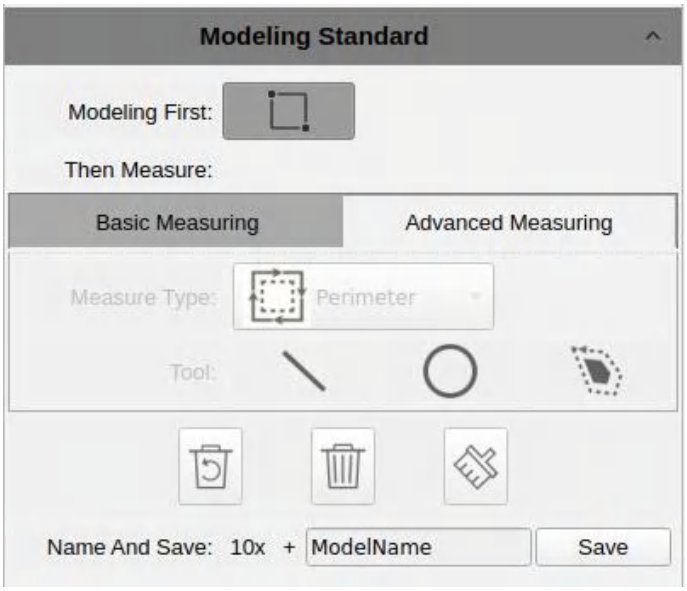


Figure 7- 5

Operating Procedures

1) Place the sample in the middle of the screen, after the focus is clear, click  to model;
2) According to the prompt of the pop-up window, use the rectangle to select the sample and draw the measurement graph (such as the distance between two points, area, perimeter, etc.);
3) Name and save the template, as Figure 7- 6 shows:

Figure 7- 6

7.1.1 Measuring Tools

Basic

-  **Point-to-point:** Measure the distance between two selected points. Left-click to select the starting point, and click again to select the end.

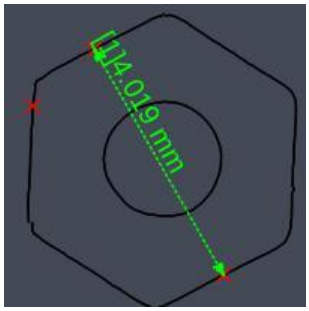


Figure 7- 7

- **Point-to-Line:** Measure the distance from the point to the line. Select the point first, draw a straight line on the edge, and double-click to display the data.

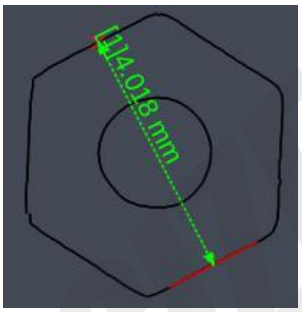


Figure 7- 8

- **Line-to-line:** Measure the distance between two selected lines. Left-click to select the starting point of the straight line, and double-click to select the end of the straight line. The same operation to draw a second straight line, display the distance between the two parallel lines (when the two straight lines do not meet the parallel judgment, it will remind, "the angle between the two lines is too large ").

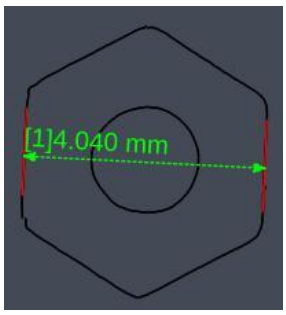


Figure 7- 9

- **Point to circle:** Measure the distance between point to circle. Left-click to select the

starting point, draw a three-point circle again, and double-click to complete. The distance can be selected from center, maximum, minimum, horizontal and vertical.

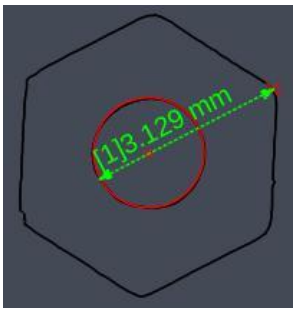


Figure 7- 10

- **Line to circle:** Measure the distance between line to circle. Left-click to select the starting point of the line, double-click to select the end of the line, draw a three-point circle again, and double-click to complete. The distance can be selected from center, maximum, minimum, horizontal and vertical.

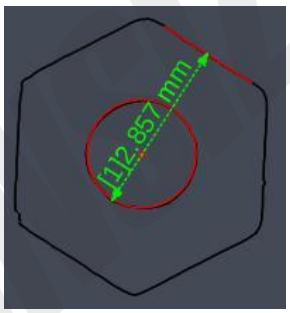


Figure 7- 11

- **Circle to circle:** Measure the distance between two circles. The distance can be selected from center, maximum, minimum, horizontal and vertical.

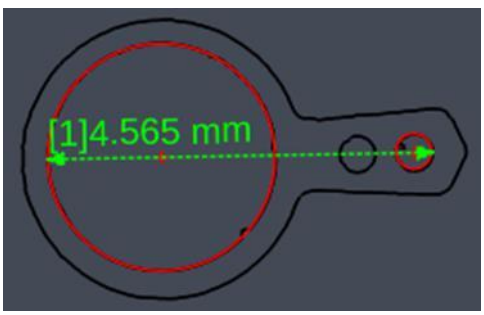


Figure 7- 12

- **Circle:** Draw a three-point circle again, and double-click to complete. The least square circle, the largest circumscribed circle, the smallest inscribed circle, and the smallest area circle can be selected; the diameter and radius can be selected for data display.

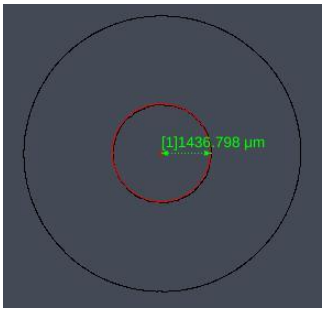


Figure 7- 13

- **Arc radius:** Draw a three-point arc, and double click to complete. Arc radius for data display.

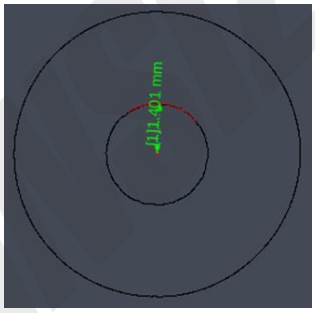
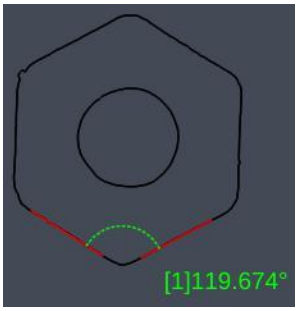


Figure 7- 14

- **Angle:** Measure the angle. Left click to select the start point of the line, double click to select the end point of the line. Draw two lines according to this method. The angle between the two straight lines, the group angle, the supplementary angle, and the group angle of the supplementary angle can be selected.



- Figure 7- 15

- **R angle:** Measure the central angle of the arc. Left click to select the start point of the line, double click to select the end point of the line. Draw two lines according to this method.

Figure 7- 16

- **C-Surface:** Under the same contour, the line segment sandwiched by two straight lines is called C surface.

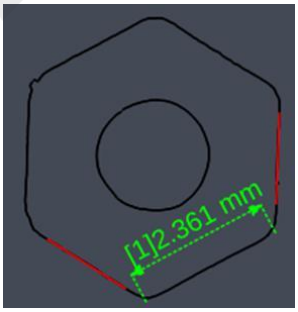


Figure 7- 17

- **Note:** All drawn line segments, rectangles and circles can be dragged to adjust the size before the end of drawing.

Advanced

-  **Line:** Measure straightness, parallelism, and perpendicularity. Left click to select the start point of the line, double click to select the end point of the line.
-  **Circle:** Measure roundness and concentricity. Draw a three-point circle again, and double-click to complete.
-  **Contour:** Measure perimeter and area. Click to select the contour to be displayed.
-  **Perimeter:** Measure the perimeter of the selected contour.

Figure 7- 18

-  **Area:** Measure the area of the selected contour (the contour to be measured must be closed, otherwise the area cannot be measured).

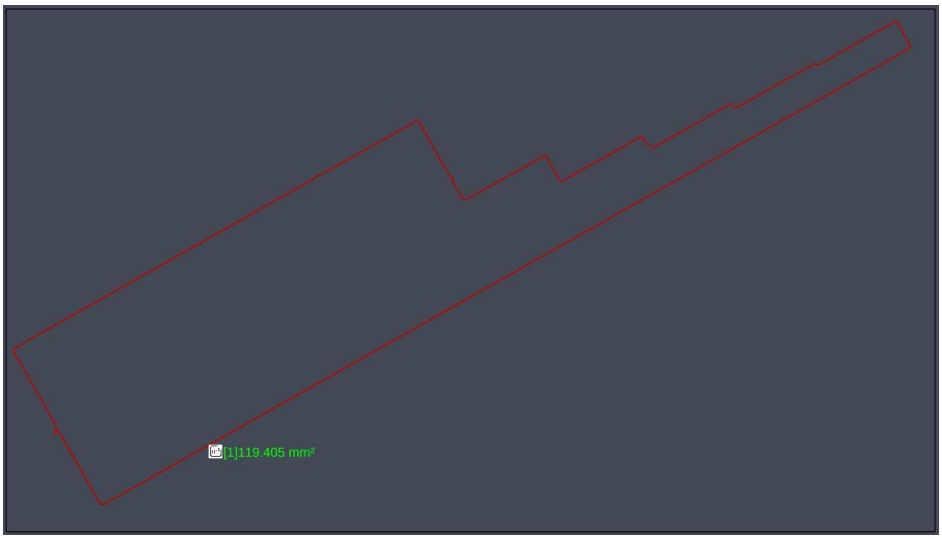


Figure 7- 19

-  Straightness: Measure the straightness of the line. The smaller the value, the closer it is to a straight line.

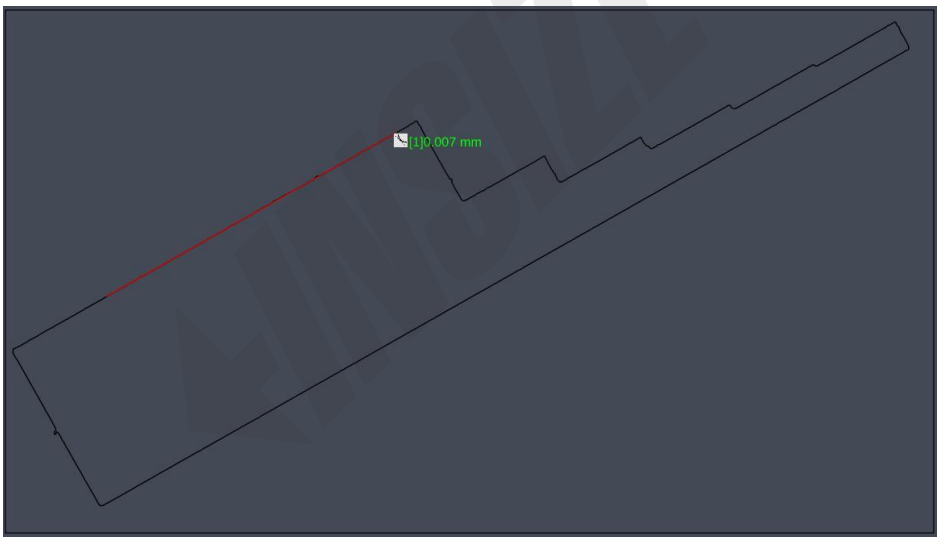


Figure 7- 20

-  **Parallelism:** Measure the parallelism of two straight lines, the smaller the value, the closer the two straight lines are parallel.

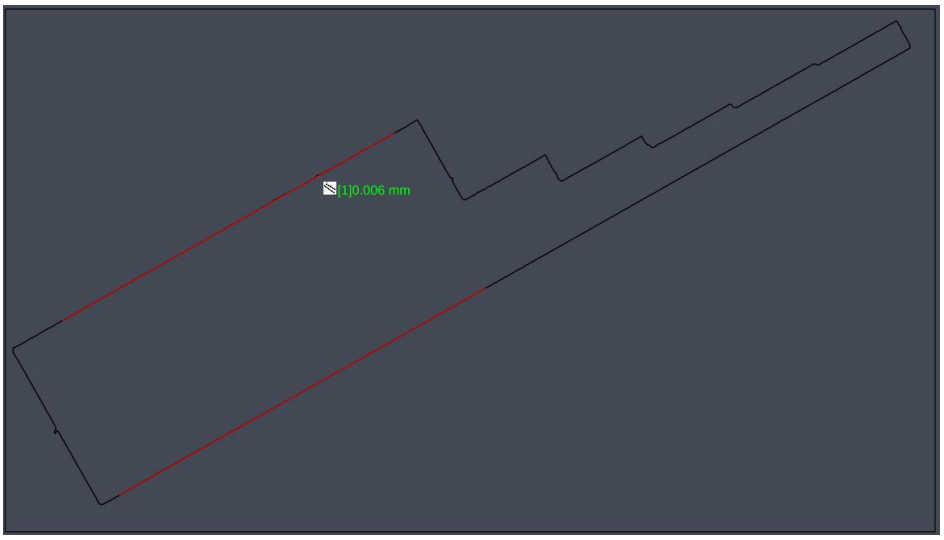


Figure 7- 21

- **Concentricity:** Measure the concentricity of two circles, the smaller the value, the closer the two circles are to concentric circles.

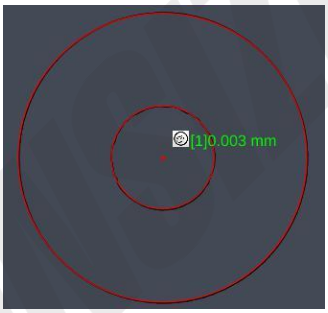


Figure 7- 22

- **Roundness:** Measure the roundness of circle, the smaller the value, the closer to the circle.

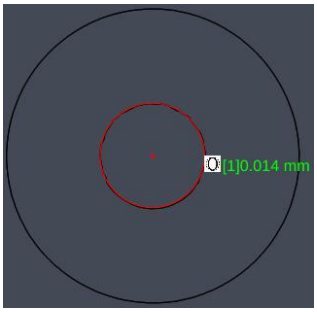


Figure 7- 23

- **Verticality:** Measure the perpendicularity of two straight lines, the smaller the value, the closer to vertical.

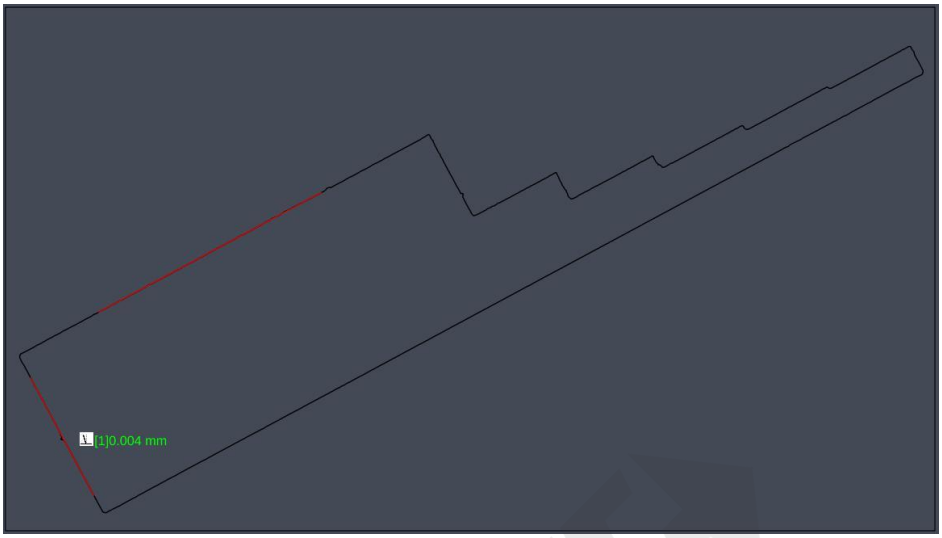


Figure 7- 24

7.1.2 CAD

The CAD displays the contour information and the shape and data of the objects measured in batches.

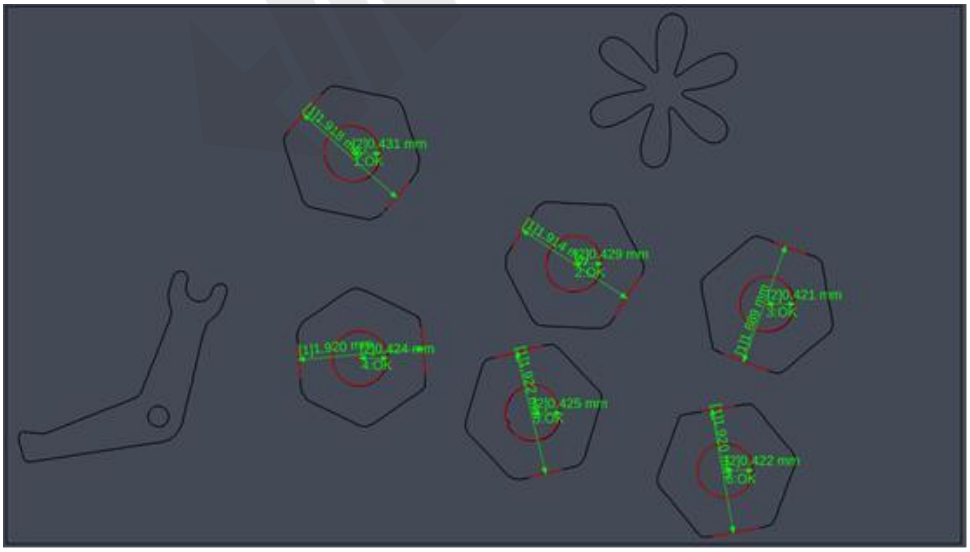


Figure 7- 25

7.1.3 Analysis and Report

When the batch measurement is completed, the detailed data can be viewed. Click Statistical Analysis to view the statistical information of the measurement items.

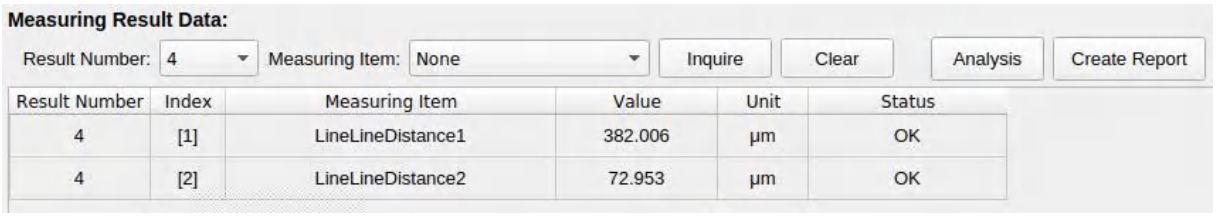


Figure 7- 26

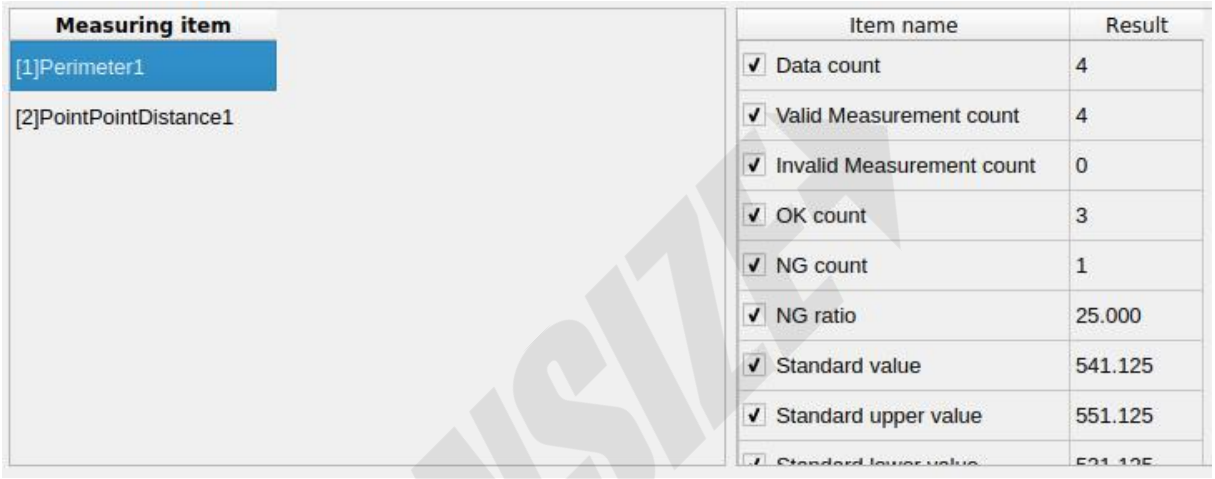


Figure 7- 27

Statistical analysis of measurement elements can be viewed:

- σ is (process standard deviation) the quality distribution of quality characteristics, which measures the amount of difference between the observation data and the average.
- CP (Accuracy) Process capability: CP=tolerance margin T / 6σ, T=(Upper Specification Limit-Lower Specification Limit).
- CPK (Precision) Process Capability Index: CPK = MIN(|Upper Specification Limit-Average|/3σ, |Average- Lower Specification Limit |/3σ).

Report

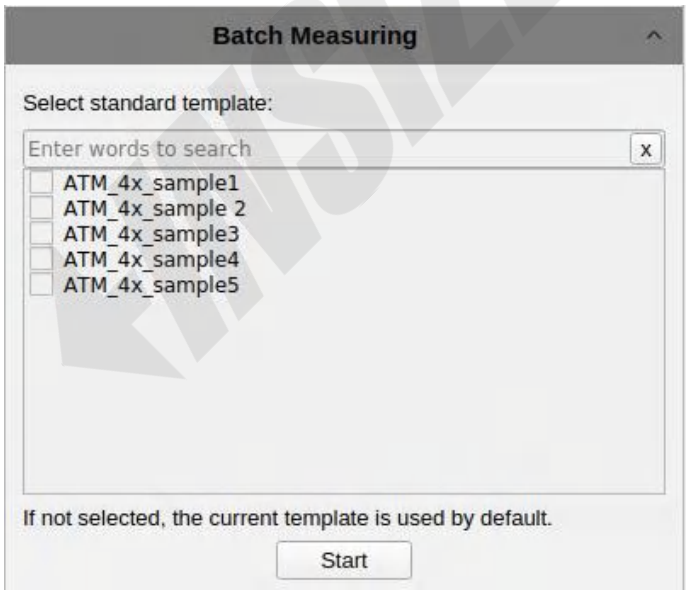
Users can choose to export the report according to their needs.

7.1.4 Operations

- **Undo:** click the  to undo the last operation.
- **Delete:** Click the  to delete the selected item.
- **Clear:** Click the  to clear current matching information, click twice to clear template information, and click three times to clear modeling.

7.2 Batch measurement

After the creation of the standard template is completed, select the standard template (by character index), and click [Start] to perform batch measurement of the same workpiece. If not selected, the currently created template will be used by default.



Operating Procedures

1) Create a template or open a saved template;

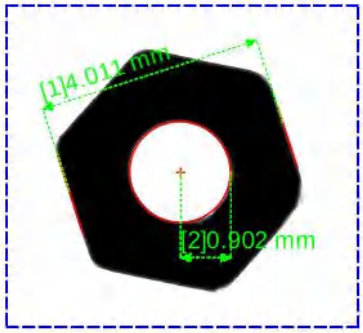


Figure 7- 28

2) Place the workpiece to be measured completely and without overlapping in the field of view, and focus clearly;

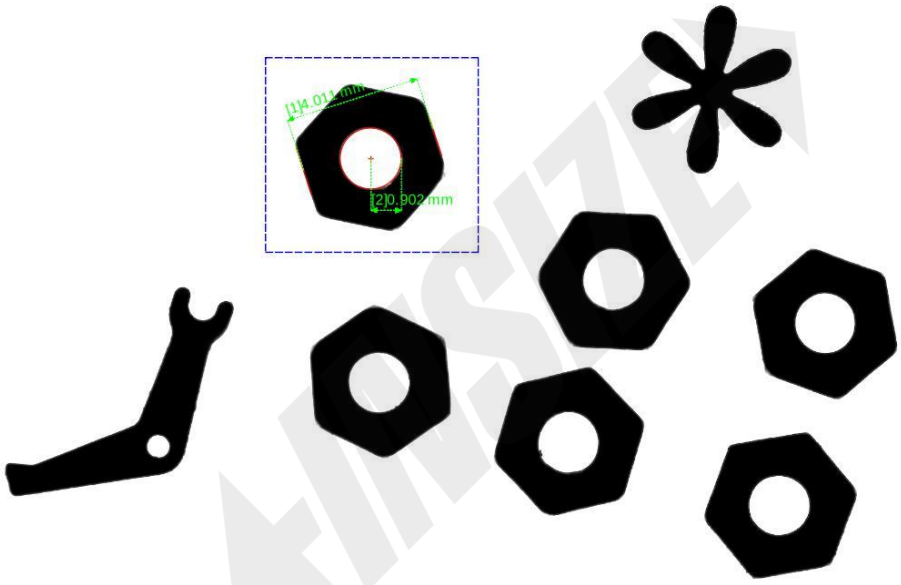


Figure 7- 29

3) Click [Start] to perform batch measurement. After the measurement is completed, the results of batch measurement are displayed in the image. Those within the template setting range are judged as qualified and displayed as OK, and those exceeding the set range are judged as unqualified and displayed as NG.

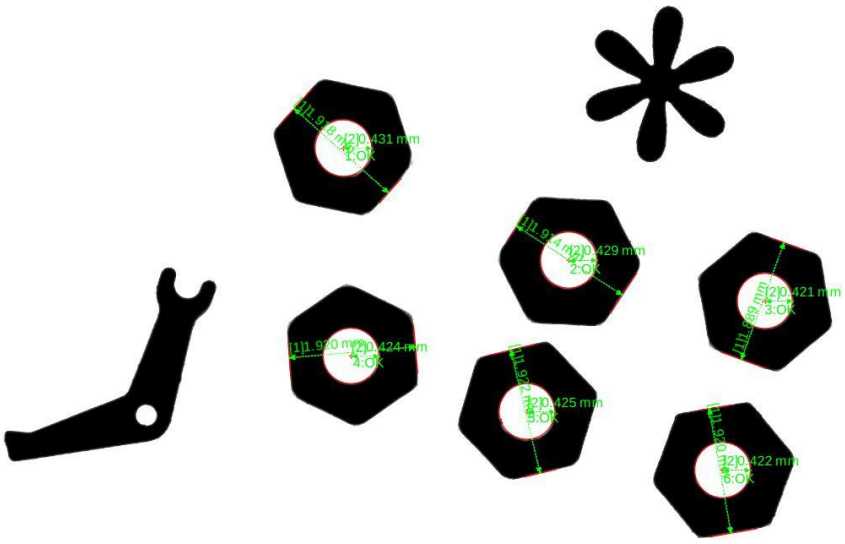


Figure 7- 30

7.3 Graphics Properties

Allows the user to adjust the graphics properties according to actual needs to achieve the user's needs. The measurement attribute setting interface is shown in Figure 7- 31.

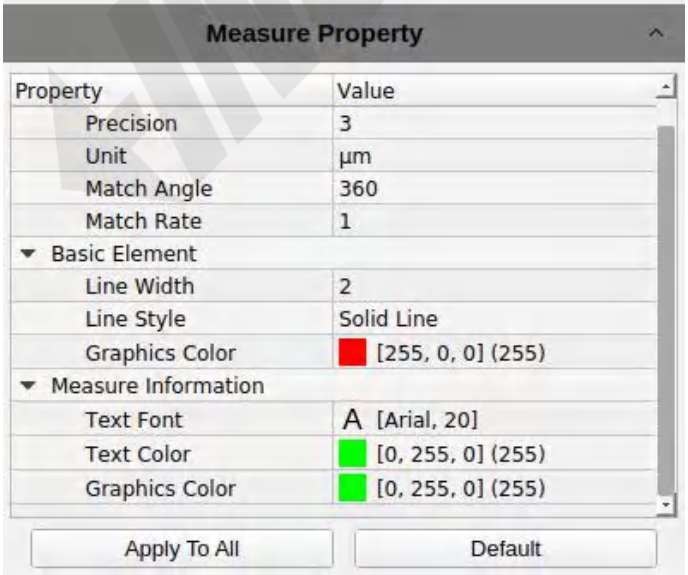


Figure 7- 31

- **Precision:** Choose the precision (characters after the decimal point) of any values being displayed. The default value is 3, the range is 0~6.

- **Unit:** Measurement unit, support mm, um, inch, 1/10inch, 1/100inch.
- **Match Angle:** The rotation angle that can be matched. The image can also be matched after being rotated. The angle range is 0-360 degrees, and the default is 360 degrees.
- **Match Rate:** The larger the setting value, the lower the requirement for object similarity and the easier it is to match. The default is 1, and the maximum is 100. It is recommended that the default setting is 1 to batch measure of small structural parts (such as gears, studs, etc.), and for batch measure of rice and other objects when the setting is 2 or more.
- **Line Width:** Adjust the width of the current measurement tools on the image. The default is value 1, the range is 1~5.
- **Line Style:** Select the line style of the current measurement tools on the image. The default style is a solid line, other available styles are dashed lines, dotted lines, and double dotted lines.
- **Graphics Color:** Select the color of the lines of the measurement tools on the image. The default color is red, other colors can be chosen by clicking the color box and then the button.
- **Text Font:** Choose the text font for the current measurement data. The default format is [Arial, 20]. Click the “A” in the Font: Value field to select another font and/or size.
- **Text color:** Choose the color for the current measurement data on the image. The default color is blue; other colors can be chosen by clicking the color box and then the button.
- **Default:** Revert to and apply the default graphics settings.

8. 3D measurement

When the 3D modeling is completed, the software automatically switches to the 3D measurement window, and the user can perform 3D observation and sample data measurement.

8.1 Display

The top, left, right, front, and back perspectives are provided, and the default is [Front], the surface texture can be checked; under the display function, the slider can be dragged to smooth the 3D image. Support pseudo color, image rotation display and ROI.

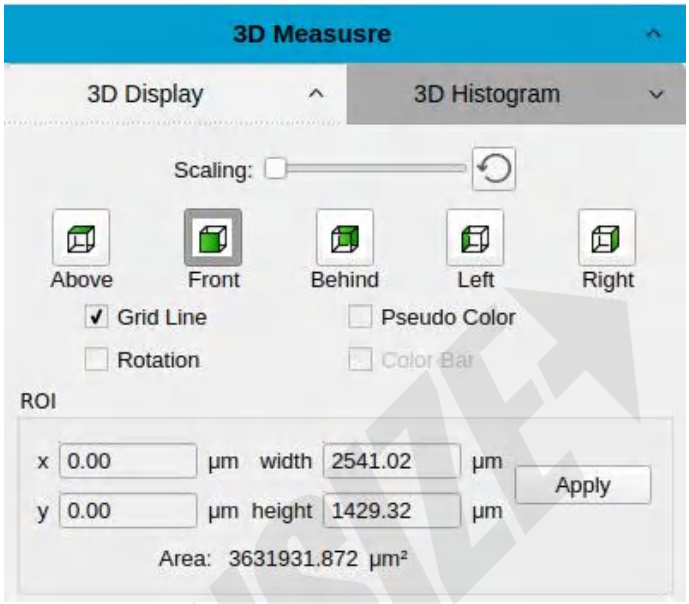


Figure 8- 1

8.2 Histogram

The 3D histogram shows the height distribution of the selected ROI area, the abscissa represents the height value, and the ordinate represents the percentage. The histogram shows the height distribution of the image, and the red graph shows the proportion of the height to the left of the sum of the coordinates. For a distribution, the value corresponding to the height of the rightmost coordinate is always 100%. For example, the percentage corresponding to the height of 0.73mm is 65%, which means that 65% of the height in the image is less than or equal to 0.73mm.

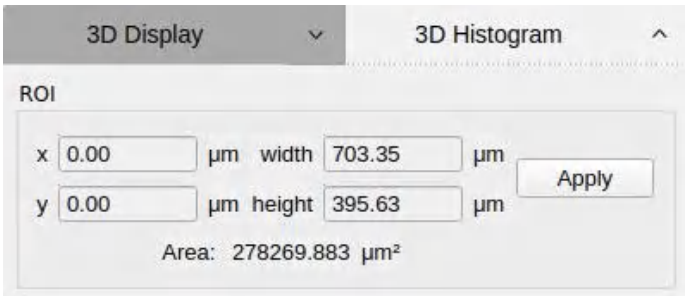


Figure 8- 2

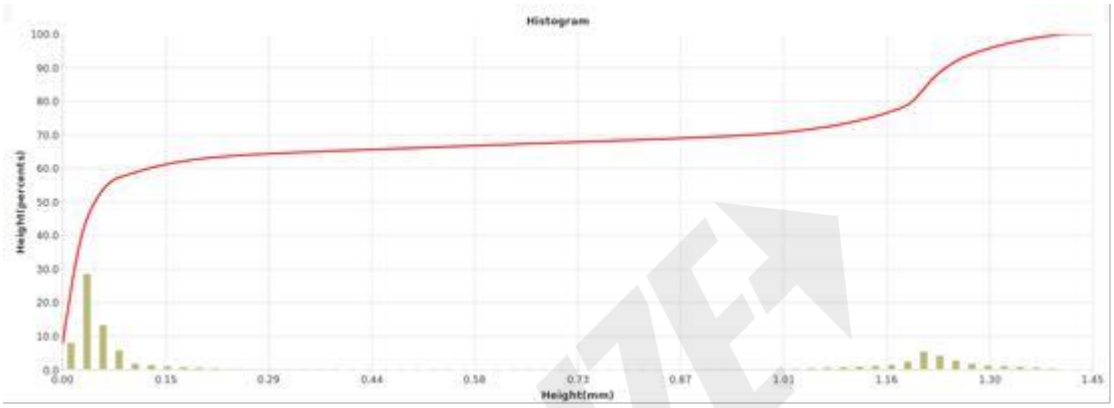


Figure 8- 3

8.3 Profile

Profile shows the shape outline of the selected section. Supports measurement of height, curvature, area, and roughness.

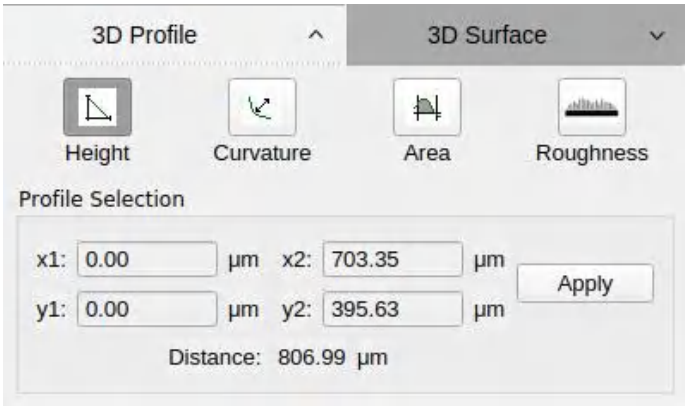


Figure 8- 4

- **Height:** Select the start and end points in the 2D image, and drag the blue line to adjust

the measurement position.

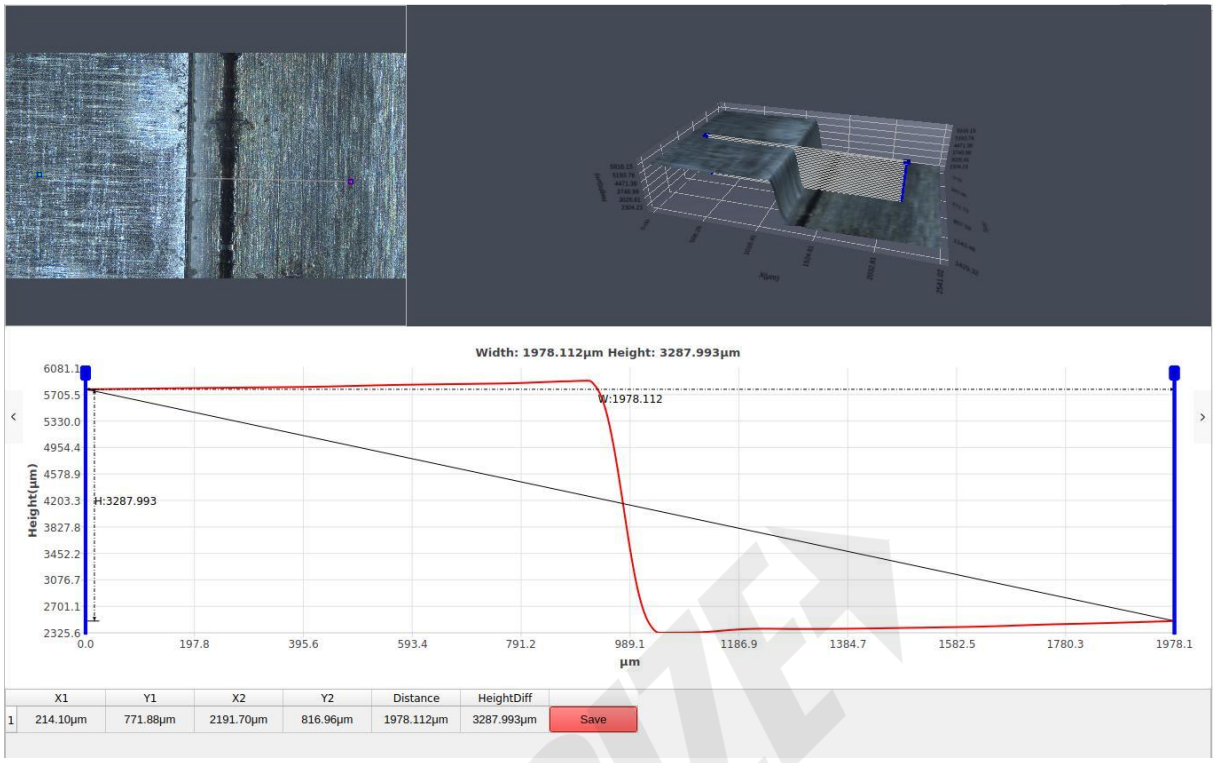


Figure 8- 5

- **Curvature:** Fit the arc of the selected section.

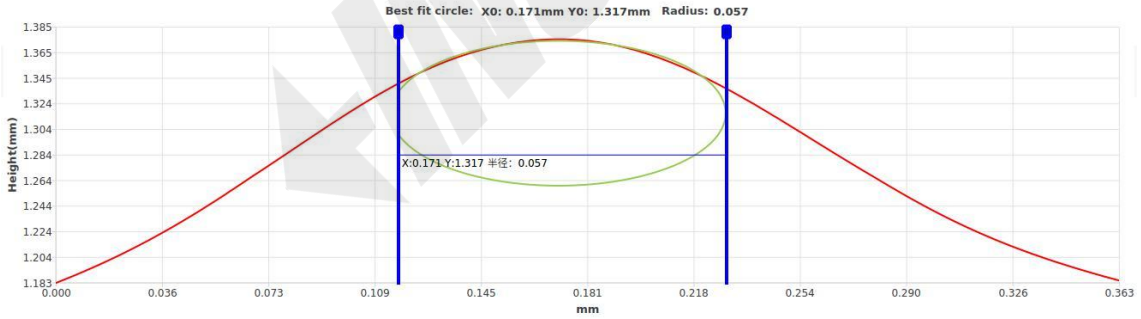


Figure 8- 6

- **Area:** measure the cross-sectional area.

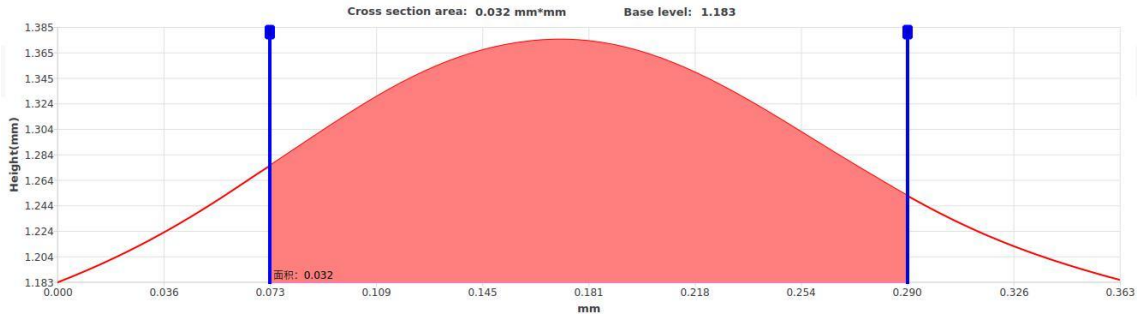


Figure 8- 7

- **Roughness:** Observe the roughness of the object profile, configure λ according to different materials

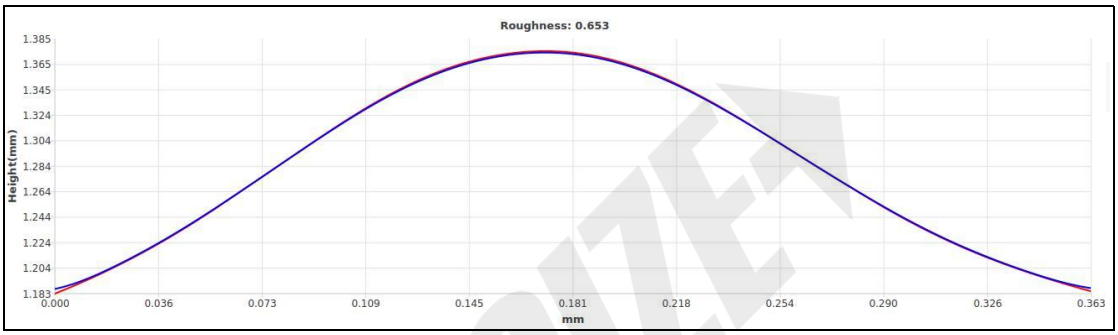


Figure 8- 8

8.4 Surface

It supports height, volume, roughness measurement, and the average value of the selected area height is used as the benchmark for measurement.

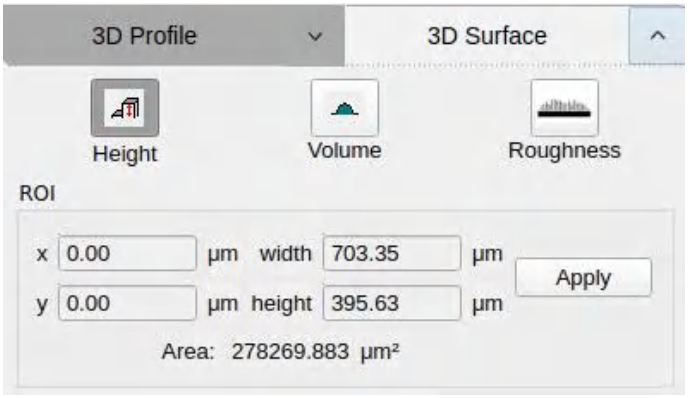


Figure 8- 9

Draw R1, R2...R9, R10, two by two as a group, up to 5 groups can be displayed at the same time, and can be drawn repeatedly, before the area is selected, you can right-click to cancel the redraw. The measurement data is automatically generated and saved in the table below, invalid data can be deleted manually.

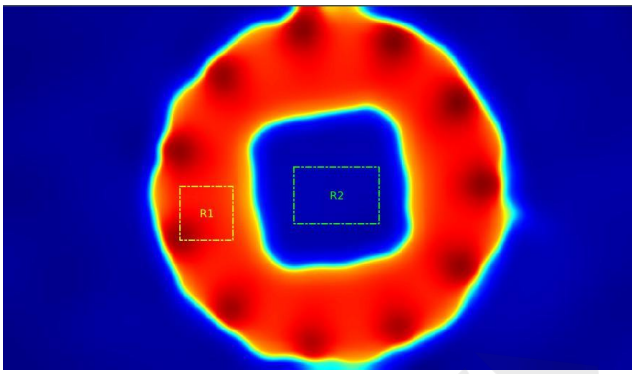


Figure 8- 10

8.5 Report

The 3D measurement data can be exported as report by the user. The setting interface is as shown Figure 8- 11:

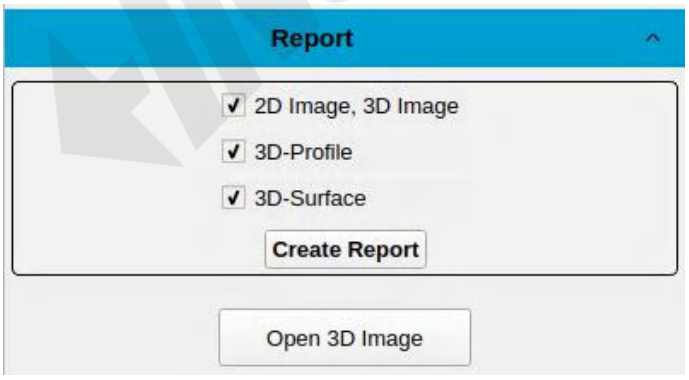


Figure 8- 11

9. Data Bar

Displays the measurement and statistics tables. This is where measurements, calibrations and

counts will be collected and available to apply (e.g. calibrations) or export.

9.1 Measurements

It displays the measured length, width, circumference and other data information. Users can export Excel tables or TXT files for saving, or copy data.

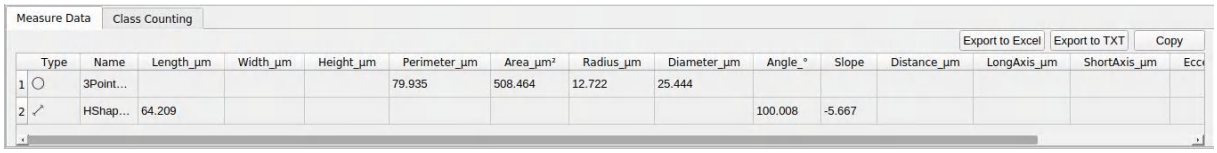


Figure 9- 1

9.2 Calibrations

It displays calibration information and the currently used calibration ruler.

	Name	Magnification	Length	TotalPixel	Unit/pixel	Unit
1	4xCalibration1	4x	150.000	220.232	0.681	µm
2	10xCalibration3	10x	100.000	432.452	0.231	µm

Figure 9- 2

9.3 Count table

It displays technical information, the total number and percentage of each category. Users can export to an Excel table for saving.

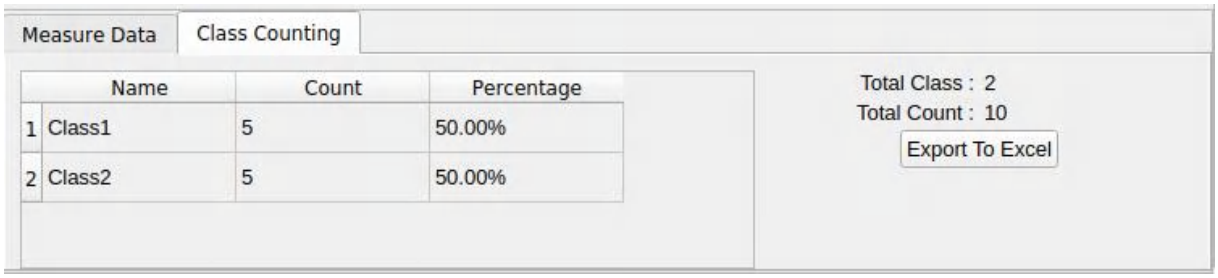


Figure 9- 3

9.4 Template information

When creating a template, the value, unit, upper and lower limits of each item of the template are displayed. After the measurement is completed, the actual measurement is displayed and whether it matches ("OK" for successful matching, "NG" for failed matching).

Template Data:

Index	Measuring Item	Value	Unit	Tolerance_upper	Tolerance_lower
[1]	LineLineDistance1	382.137	μm	1.000	-1.000
[2]	LineLineDistance2	73.119	μm	1.000	-1.000

Figure 9- 4

Measuring Result Data:

Result Number: 1 Measuring Item: None Inquire Clear Analysis Create Report

Result Number	Index	Measuring Item	Value	Unit	Status
4	[1]	Perimeter1	545.461	μm	OK
4	[2]	PointPointDistance1	58.498	μm	NG

Figure 9- 5

10. Image Bar

The Image Bar displays thumbnails of all captured images and videos from all saving paths. Click on any thumbnail and the interface automatically switches to the [Imaging] window for image processing.

Click the button to locate the saving path of the file, select the desired directory from

which the image will be opened, and the interface changes to the following view.

Right click on an image or on the blank area of the interface to display the operation menu, and choose from the operations to perform: [Select All], [Deselect All], [Open], [New Folder], [Copy], [Paste], [Delete] and [Rename]. Click the button to close the window.

- **Rename:** Select the image in the thumbnail, right-click to select rename or double-click the file name to edit, the user can customize the name.
- **Close:** Close the selected thumbnail.
- **Close all:** Close all thumbnails.
- **Delete:** Delete the image and thumbnail.
- **Compare:** Right-click and choose Compare, the currently selected image is on the left. When the image needs to be switched for comparison, check the file name above and click on the thumbnail to be compared on the right to switch.

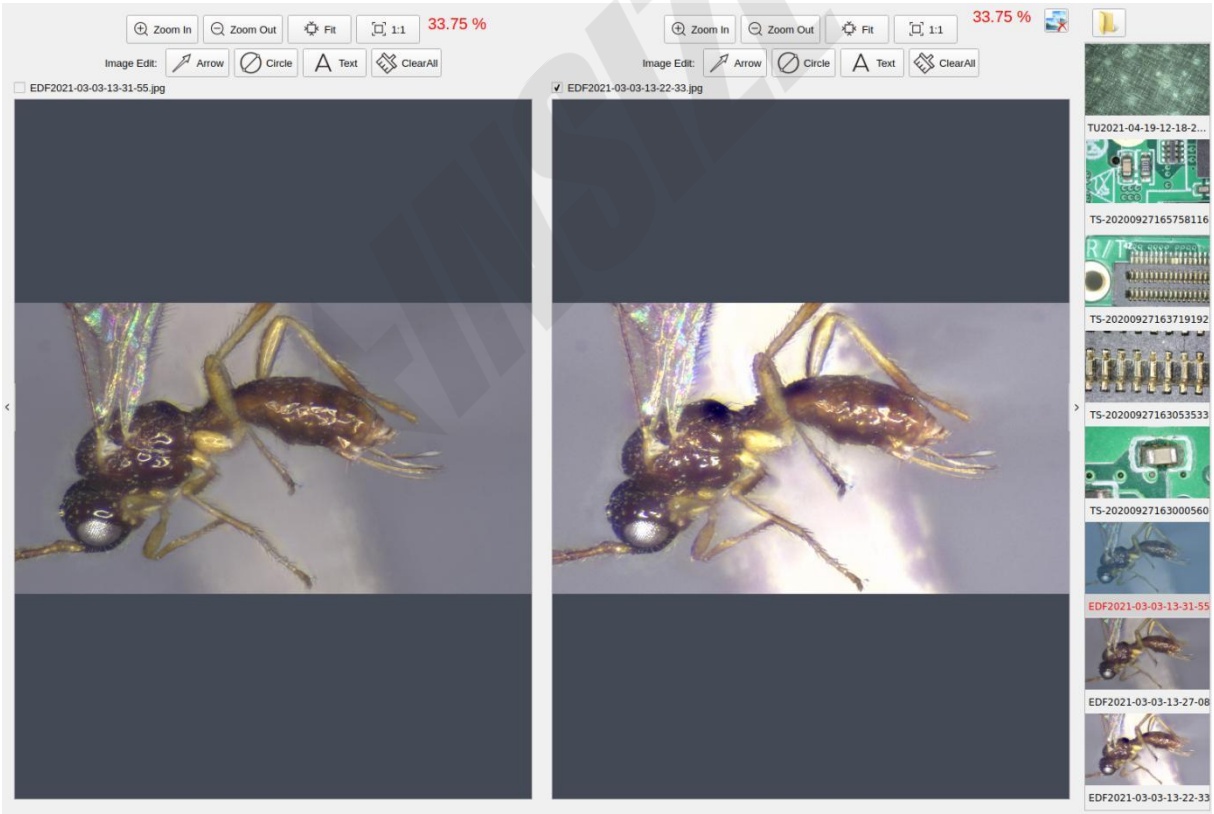


Figure 10- 1

The image can be zoomed in and out separately, and the image display ratio can be adjusted at the same time through the mouse wheel.

Support image editing, mark arrows, circles, input text, etc. After the comparison is complete, you can right-click on the thumbnail to save the comparison result. When the comparison is over, the user can click the icon on the upper right to close the comparison window.

11. Display

The display menu is to adjust the display of the preview window.

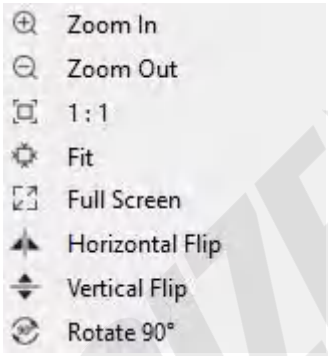


Figure 11- 1

- **Zoom In:** Magnify the current image and display it larger than its original size.
- **Zoom Out:** Reduces the current image and displays it smaller than its original size.
- **1:1:** Displays the image in its 1:1 original size.
- **Fit:** Adjusts the display size of the image to fit the software operating window.
- **Full Screen:** Displays the image in a full screen. Press the [Esc] button of the computer keyboard to exit the full screen mode.
- **Horizontal Flip:** Flips the current image horizontally, like a mirror (not rotation).
- **Vertical Flip:** Flips the current image vertically, like a mirror (not rotation).
- **Rotate 90°:** Rotates the current image clockwise 90°degrees with each click.

12. Config

Supports sorting the visibility and order of the menu bar. Click " ↑ " and " ↓ " to sort the selected items in ascending or descending order, uncheck the visibility of the menu to hide the module. It can edit the measurement template, calibration ruler and objective lens information.

13. Info

Software language switching, firmware online upgrade, software manuals, company and software version information are supported in this module.

13.1 Preferences

Select the preferred software language. The software must be restarted to take the language setting into effect.

Figure 13- 1

13.2 Firmware Upgrade

It is used to update the firmware of the camera.

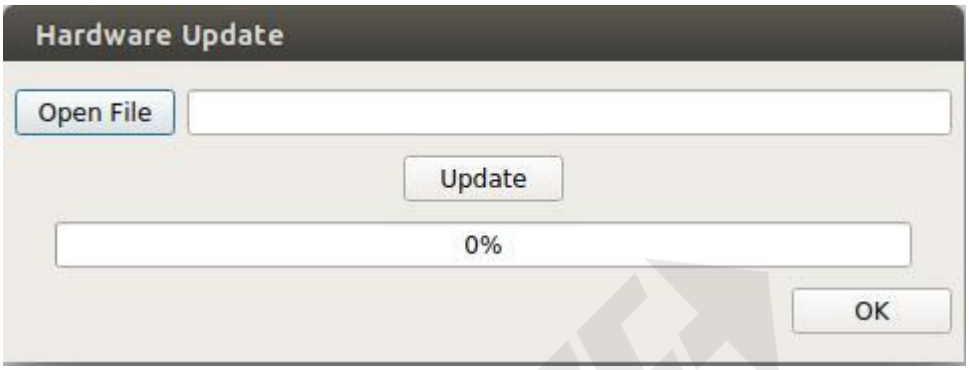


Figure 13- 2

Operating Procedures

1) Click [Open File], and select the firmware file;

2) Click [Update] to perform the upgrade operation.