CaptaVision+ v3.0 Instruction Manual

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1. OVERVIEW

CaptaVision+™ is a powerful software that integrates the micro-imaging camera control, image calculation and management, image processing into a logical workflow for acquisition, processing, measuring and counting to give scientists and researchers a more intuitive operating experience.

CaptaVision+ drives and controls our Excelis™ portfolio of cameras, to give you the best performance in your microscopy imaging applications. Through its user-friendly and logical design, *CaptaVision*+ helps users maximize the potential of their microscope and camera system for their research, observation, documentation, measurement and reporting tasks.

CaptaVision+ allows users to customize their desktop within the application according to their application and need. Users can turn features on or off, and arrange the menus to follow your workflow. With such control, users are assured of completing their imaging work with more efficiency and efficacy, generating results faster and with greater confidence than ever before.

Thanks to its powerful real-time calculating engine, *CaptaVision*+ achieves superior quality images with less effort by the user. The real-time stitching feature allows the user to capture a super wide Field of View (an entire slide if desired) simply by translating a specimen on the mechanical stage of a microscope. In about 1 second, the real-time Extended Depth of Focus (“EDF”) feature can rapidly assemble in-focus features of a specimen as the focal plane passes through it, resulting in a 2-dimensional image containing all the detail of the 3-dimensional sample.

CaptaVision+ was developed from the user’s perspective, assuring the best operating procedures through the implementation of its all-new camera operating workflow with modular menus for efficient image acquisition → Image processing and editing → measurement and counting → reporting of findings. In conjunction with the latest image processing algorithms, the workflow saves time from the moment the imaging process begins to the delivery of a report at the end.

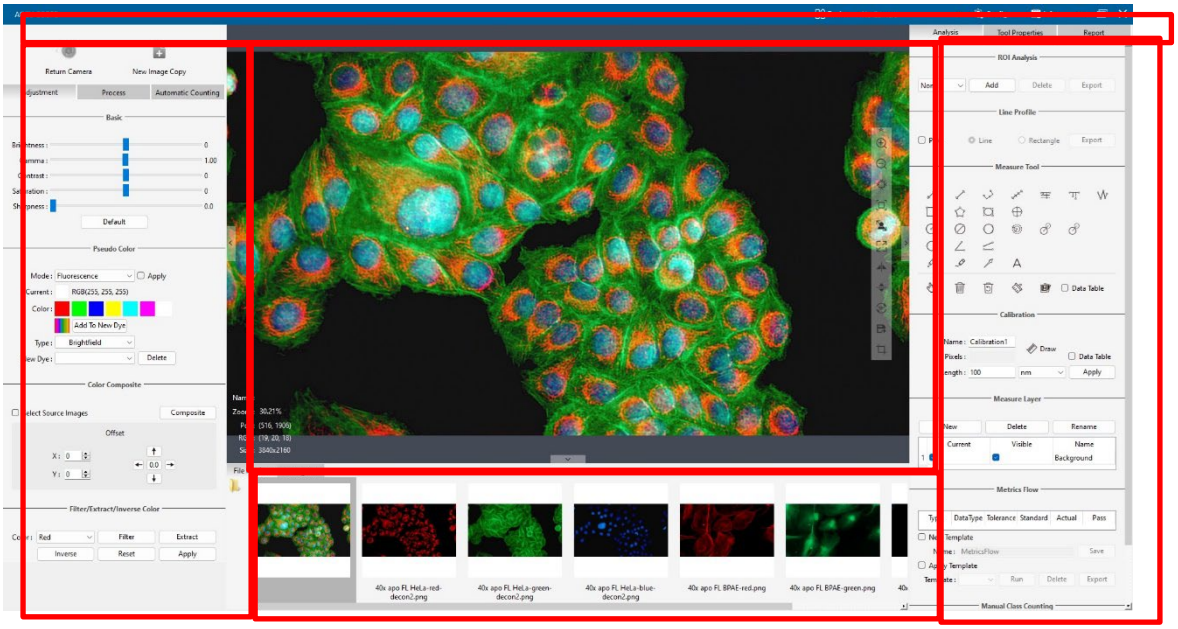
2. LOADING INTERFACE

While you configure the camera and open the software, the software data bar displays the histogram by default.

If the camera is not detected properly, the software will automatically display the file preview on data bar. You can load the image, and adjust, process, automatically count, analyze and measure the image.

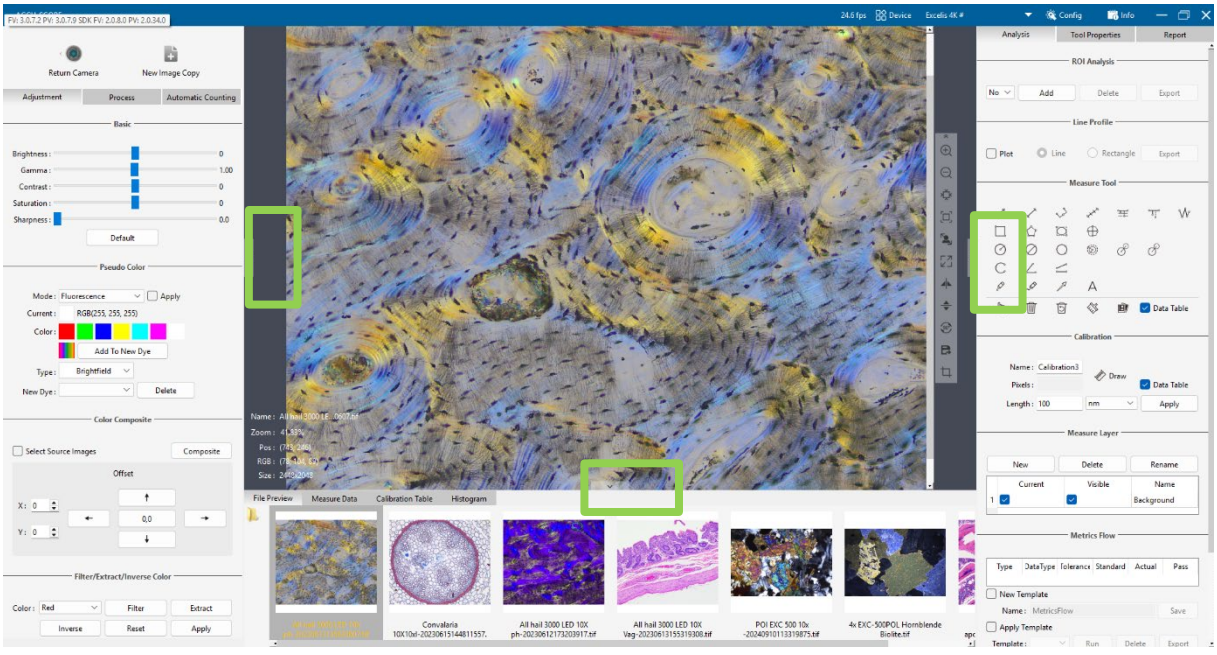
3. WINDOWS

The main interface of the software is mainly composed of five parts: ❶ status bar, ❷ menu bar, ❸ preview window, ❹ data bar, ❺ analysis bar:



3.1 Show/Hide Tool Bars

Click the arrowheads (green boxes) on the edge of the tool bar and the preview window to show or hide the tool bar.



3.2 Status Bar

The overall function of the software is divided into four modules: **Frame Rate, Device, Camera list, Config**

and **Info** modules. Click the relevant icon to switch to the corresponding display interface. The real-time frame rate module is only displayed when a camera is connected and functioning properly. If no camera is connected, the module will not be displayed.

Multi-camera connection and hot plugging are only supported by Windows systems and cameras with USB3.0 interfaces. Please note, do not unplug during the camera list refresh process.

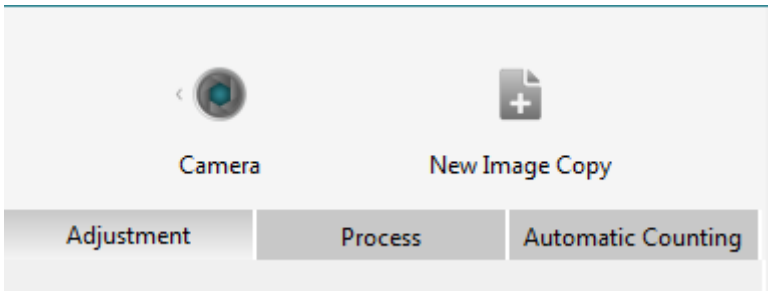
In the camera list, the recognized camera model is displayed. Click the camera name to switch the camera.

When the current camera is removed, it will automatically switch to another camera, or indicate no camera.

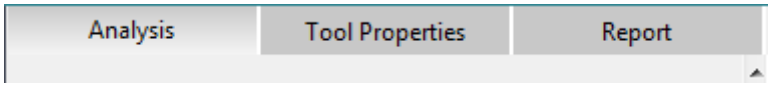
3.3 Menu Bar

When the camera is connected, the left menu provides all functional modules. Click the module title bar button to view the detailed functions.

When the camera is not detected, all the functional modules for image processing can be viewed by clicking the button in the title bar of the module.

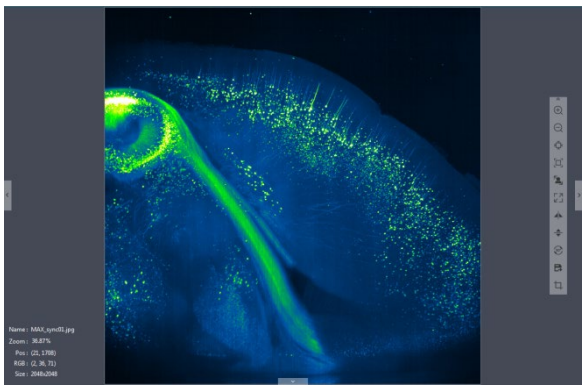


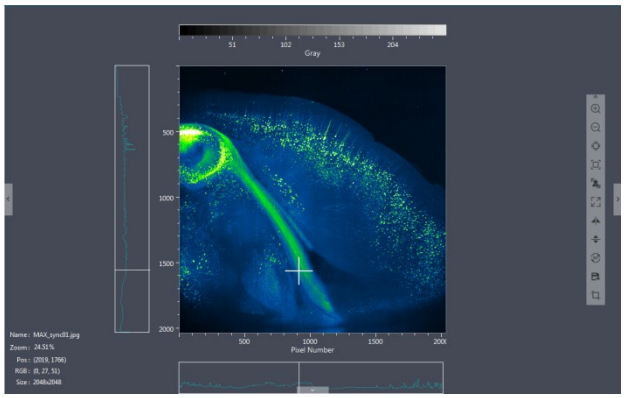
All the function modules on the right are available whether the camera is online or not. Click the button in the title bar of the module to view the details.



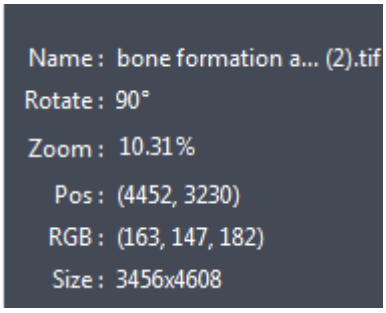
3.4 Preview Window

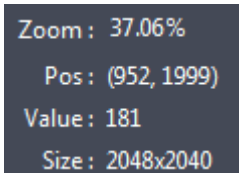
The configuration of preview window can be switched in according to different directions of applications.



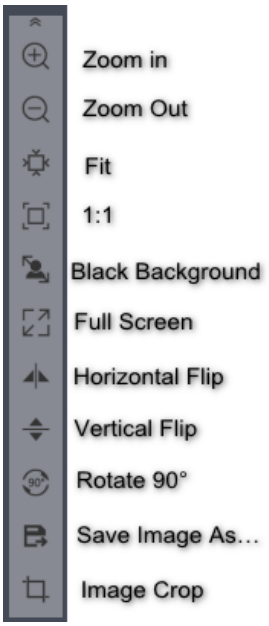


1) The middle of the software displays a live preview or an open image.
2) Through the mouse wheel can zoom in/out the image, the mouse position is always displayed in the center of the screen.
3) Hold the left mouse button, right mouse button or scroll wheel, you can drag the image display area.
4) Click the control button on the left edge, right edge the Analysis icon or the bottom edge of the display area to expand or contract the corresponding operation bar.
5) In the bottom left corner, the color camera displays editable scale, coordinates, RGB, size. As for mono cameras, it will show the editable scale, coordinates, gray value, size.





6) In order to meet the various needs of users, the software provides a series of quick operations, so that our users can obtain images more conveniently during usage.



➢ **Preview window shortcut key：** The default state is expanded, click to hide the shortcut key.

➢ Only the static image preview interface is supported:

Save Image As...: After clicking, the save window will pop out, you can save the current selected image. The function can support four image storage formats: JPEG, TIF, PNG, BMP, etc.

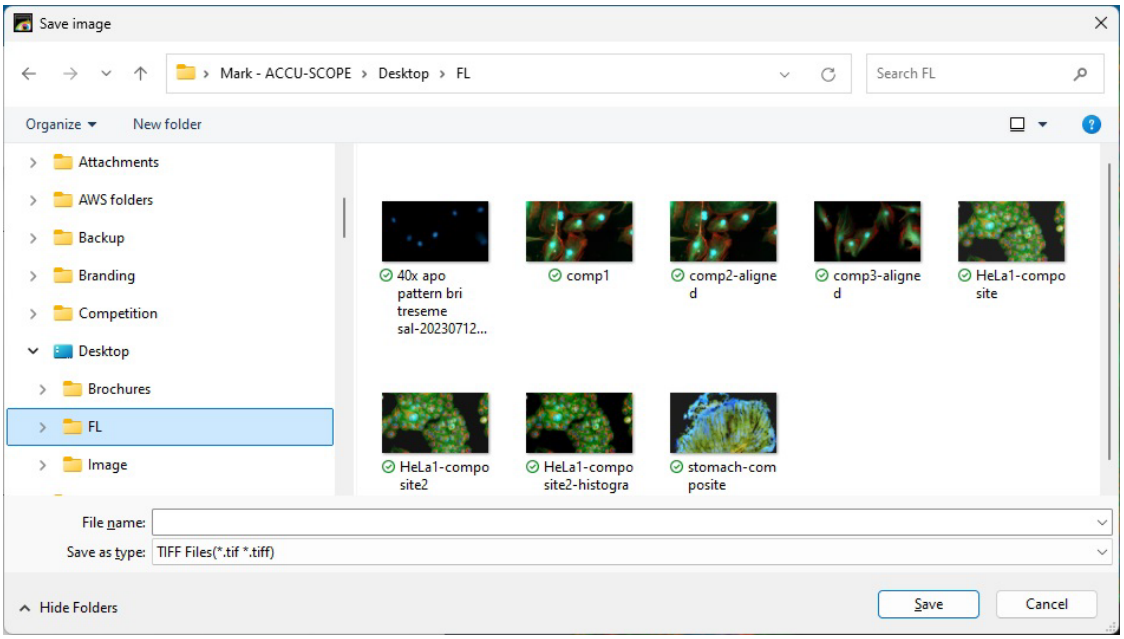


Image Crop: Click screenshot button on the right upper corner of the preview window to capture image, to select the interested area in preview image with mouse, then double left click or double right click the mouse to complete screenshot. The screenshot will appear on right image bar, click to save current screenshot. If there is no need to save the screenshot, right click to exit capture window.

Image Info: This function is the same as the "Image Info" function of the file preview after clicking right button. Only display SEN format images; this item is not displayed for other image formats.

➢ Camera Connection and Image Preview are both supported:

Zoom In: Magnify the current image and let it display larger than its original size.

Zoom Out: Reduces the current image and let it display smaller than its original size.

1:1: The current displaying image is in its 1:1 original size.

Fit: Adjust the showing size of the image to fit the software operating window.

Black Background: The image is in full screen and the background of the image is default to be black. Type the [Esc] button of the computer keyboard or click on the Back Arrow symbol on the right down corner of the screen to exit the black background mode.

Full Screen: Enable the image to be full screen. Type the [Esc] button of the computer keyboard or click on the Back Arrow symbol on the right down corner of the screen to exit the full screen mode.

Horizontal Flip: Horizontally mirrors the current image.

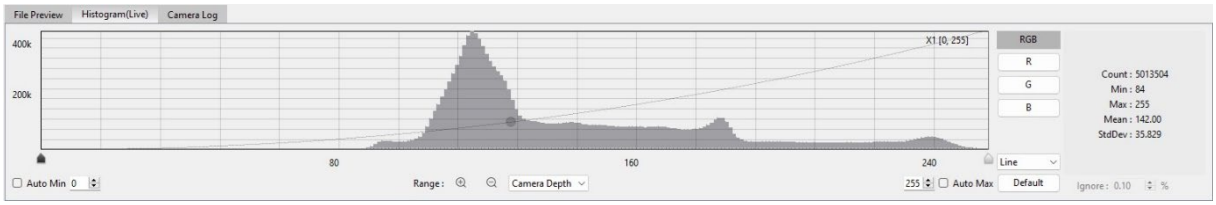
Vertical Flip: Perform a vertical mirror operation on the current image, and only supported cameras will be displayed during the dynamic preview.

Rotate 90°: Rotate the current image clockwise, which can be rotated continuously, each rotation is 90 degrees. The rotation angle will be prompted in the lower left corner, and only supported cameras will display the rotation button and the rotation angle during dynamic preview.

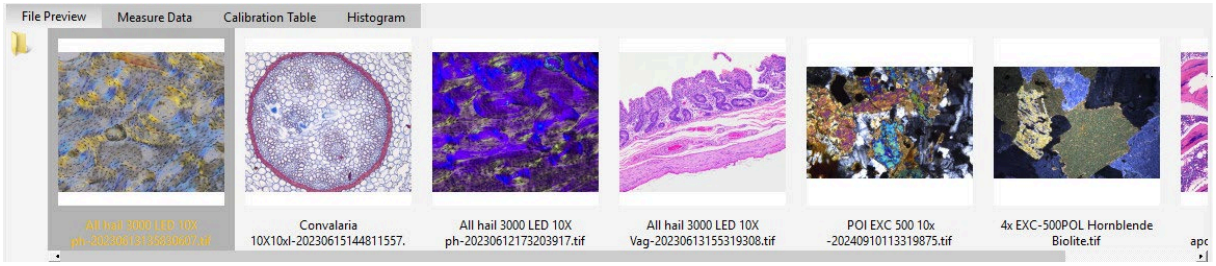
3.5 Data Bar

Including File Preview, Histogram, Temperature, Camera Log, Measure Table, Calibration Table, Class Counting, Automatic Counting Table, Automatic Counting Statistics. By default, the Camera Connection interface displays File Preview, Histogram, Log, and Temperature Monitoring (only for cooling cameras). The Image Processing interface, on the other hand, only displays File Preview and Histogram. Measure Table, Calibration Table, Class Counting, Automatic Counting Table and Automatic Counting Statistics are only displayed after configuration.

- Camera connection data bar interface:



- Image processing data bar interface:



3.6 Shortcut Key

In order to make clients' operation more convenient, the software provides shortcut key functions. Specific functions are as follow:

Function	Key	Remarks
Move image	Long-press mouse wheel for movement	Both preview interface and image processing interface are effective
Black background	Ctrl+B	Full screen display of preview window
Full Screen	Ctrl+S	Both preview interface and image processing interface are effective
Flip horizontally	Ctrl+H	Only effective when preview interface is enabled
Flip vertically	Ctrl+V	Only effective when preview interface is enabled
Zoom in	Ctrl+=、Ctrl++， mouse wheel forward	Both preview interface and image processing interface are effective
Zoom out	Ctr+-，mouse wheel backward	Both preview interface and image processing interface are effective
Images	Ctrl+P	Both preview interface and image processing interface are effective
Self-adaptive/original image switching	Ctrl+F	Both preview interface and image processing interface are effective
1:1	Ctrl+O	Both preview interface and image processing interface are effective
CCW	Ctrl+R	Both preview interface and image processing interface are effective
Back to menu	Ctrl+Q	Both the gallery interface and the image processing interface are in effect
Switch of LED	F2	Click software interface and press F2 to turn on or off the LED.
Switch of window heating	F3	Click software interface and press F3 to turn on or off the LED .
Capture	F10	Take images and automatically save the taken images.
Record videos	F11	Press once to record, press again to stop recording

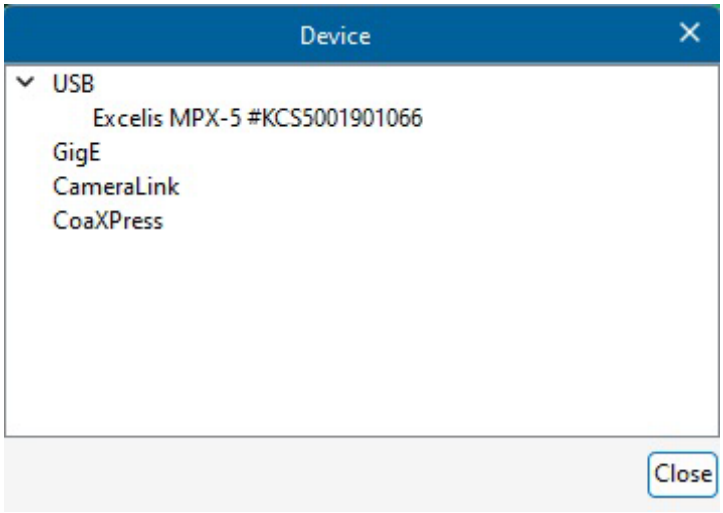
Close all	F9	Not to display right thumbnails. A prompt box will appear: whether to close all images, click Yes] to take effect.
Save image as	F8	Can change the image format or image saving position.
Pause	F7	Press once to pause the preview and again to resume the preview.
		When the preview is paused, the user cannot zoom in or out of the preview window.

4. MENU BAR

4.1 Frame Rate

Displaying the current real-time frame rate of the camera.

4.2 Device

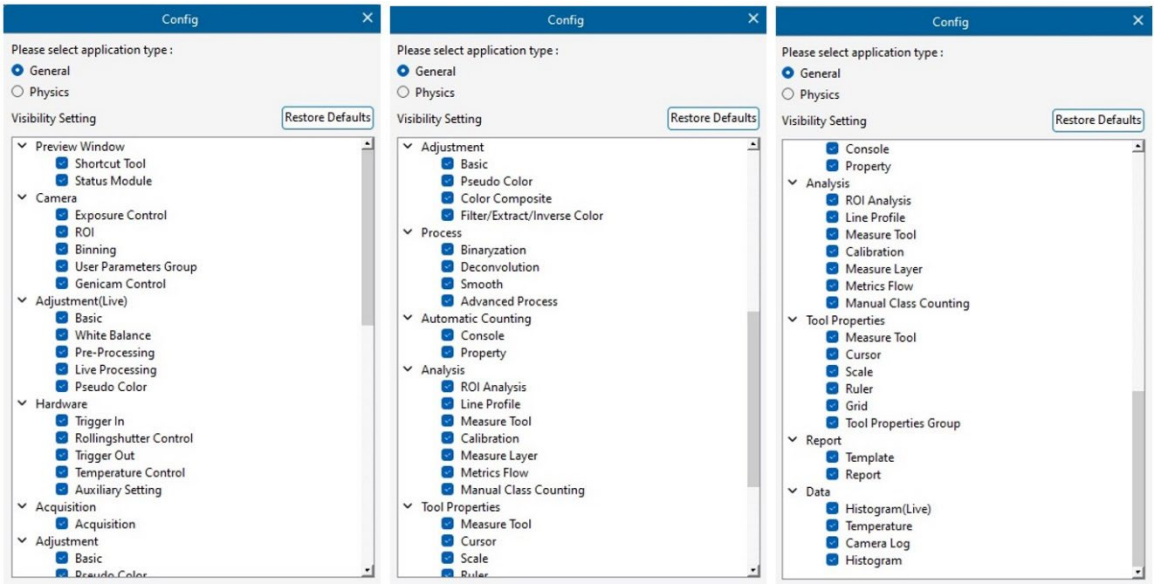


- **Device:** Select the device connection interface. Click to display device chosen window, and sort all available devices connected to the computer in order of the interface types like USB, GigE, CameraLink and CXP.

When connecting single camera, there is no need to select the device. The software can automatically detect the camera after connecting the camera. When multiple cameras are connected, cameras of the same type of interface can be switched directly in the drop-down list. While different interfaces need to be switched to after entering the device to select the specific interface

4.3 Config

The software can choose the application direction, and can customize the software interface and function array, mainly including 12 modules.

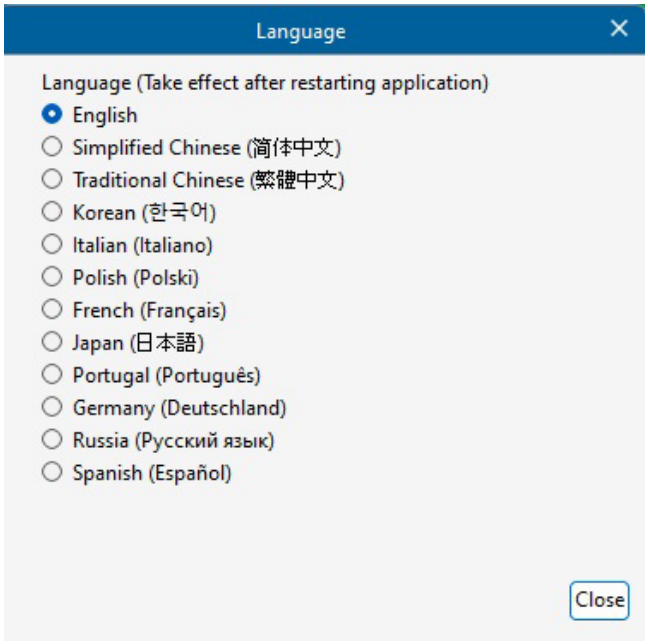


- **Application type:** Divided into **General** and **Physical**, the software starts with the general mode by default. Only sCMOS and USB3.0 black and white series cameras support selecting physical mode, while other cameras do not support physical mode. Restart the software after selection is determined. The software interface will change according to the selected application direction.When selecting the application type as "Physical," the preview window will display **coordinate axes**, **intensity curves**, and **color reference cards**. The camera and image processing menu bars will have a **Display Mode** option. The camera menu bar will disable image stitching, depth of field expansion, and masking functions. The image menu will disable advanced processing options.
- **Visibility Setting:** All are checked by default, support for unchecking to customize the display of the software interface.
- **Restore Defaults:** Resort and apply the default parameters in visibility settings.

4.4 Info

4.4.1 Language

You can select a software language. After you select a language, restart the software for the language to take effect.

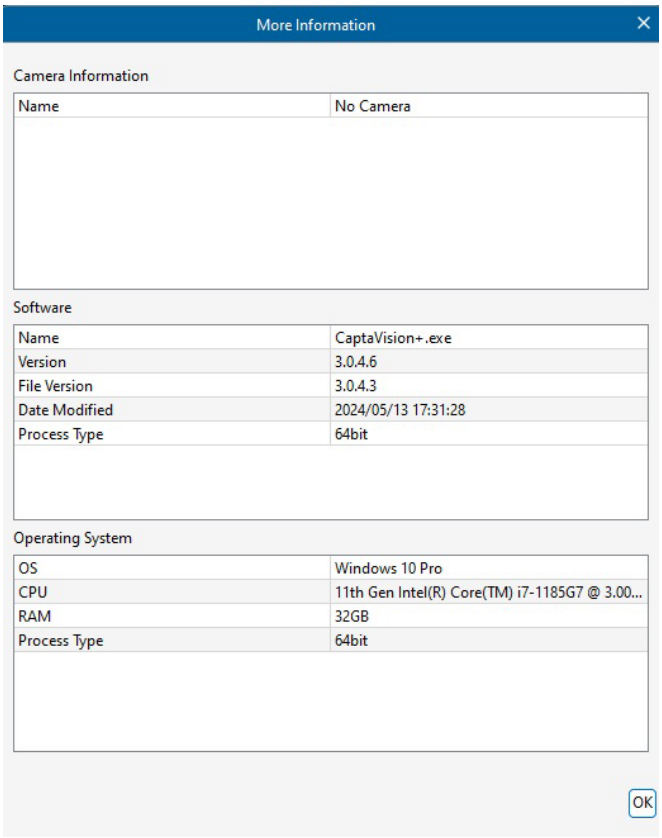


4.4.2 Help

Software operation instructions can be checked for users to learn and reference.

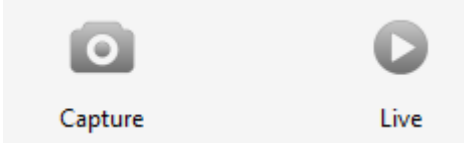
4.4.3 About

- **More Information:** Get the current information of the camera, the versions of the software and the information of the operating system.



5. IMAGE ACQUISITION

5.1 Capture

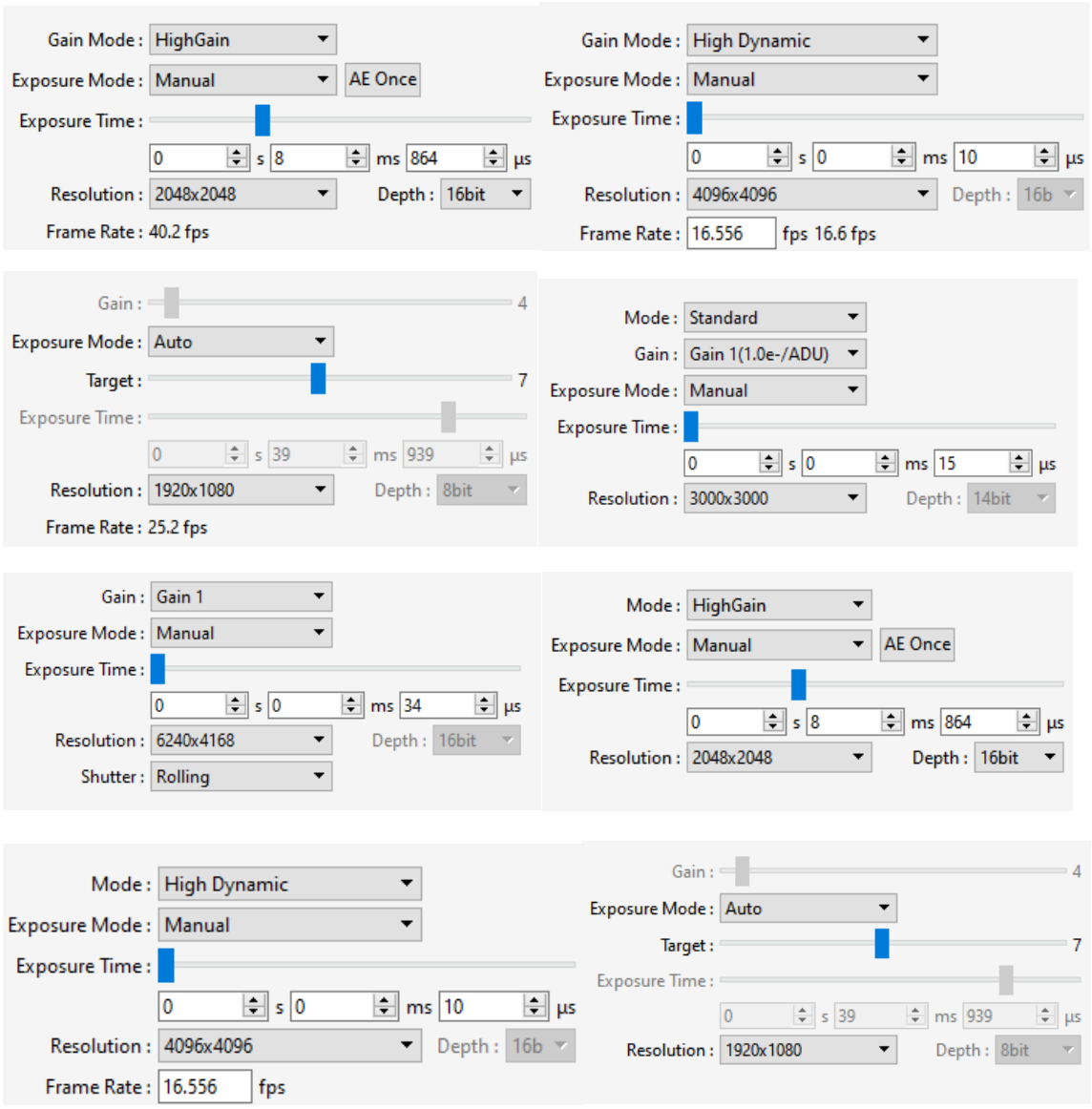


- **Capture:** Click the button to capture the image of the preview interface, support continuous click.
- **Live/Stop:** On/Off the preview, you can preview the image in real time or stop the preview. In the stop state, if you click the shooting button, the camera will re-enter the preview state. When the shooting is over, it will return to the static state. In the stop preview state, you can change the camera configuration parameters, the changed configuration parameters will enable after preview restarting.

5.2 Camera

5.2.1 Basic Configuration

Configure the basic state of the camera to ensure the normal operation of the camera.



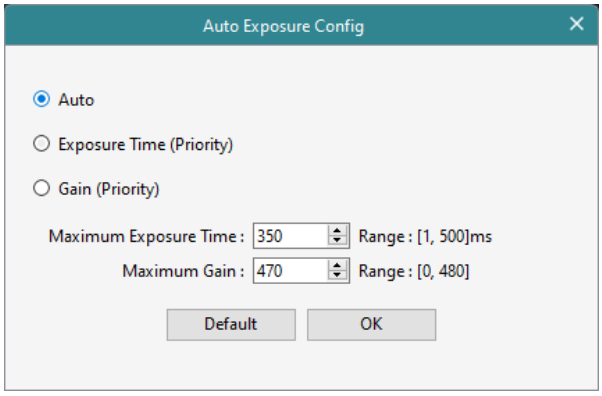
- **Mode:** User can select the most suitable gear of gain according to his specific applications and needs on images previewing. Greater gain brings the improvement of the brightness, but with the increasing noise.
- **Gain:** Adjustable gain value. In the case of manual exposure, drag the slider to modify the gain. In the case of automatic exposure, the gain is automatically set according to the current environment.

- **Exposure Mode:** Set the camera's exposure time.

➢ **Auto Exposure:** The software automatically adjusts the exposure time according to the image brightness to obtain the right brightness image. The software provides different automatic exposure time ranges according to different camera models. For more details, please refer to the actual interface.

- Auto Exposure Config: Users can set “Auto”, “Exposure time (priority)”, “Gain (priority)”; The default value is “Auto”.

➢



- Auto: When performing automatic exposure adjustment, the exposure is automatically adjusted first, and the automatic gain adjustment is only performed when the exposure reaches the set maximum value;
- Exposure time (priority) : When performing automatic exposure, only adjust the exposure time and fix the gain;
- Gain (priority) : When performing automatic exposure, only adjust the gain and fix the exposure time;

➢ **AE Once:** Click the AE once button, the software automatically adjusts the exposure time to obtain the right brightness image, then determine the exposure time. (Only supported by some CMOS cameras)

➢ **Area Exposure:** The software automatically adjusts the exposure time according to the brightness of the image in the area to obtain the image with appropriate brightness. (Only supported by some CMOS cameras)

➢ **Manual Exposure:** The user manually enters the exposure time according to the actual needs, or setting by dragging the slider (non-linear). The software will provide different manual exposure time ranges according to different models of cameras, please refer to the actual interface for specific values.

➢ **Target Value:** Adjustable only in automatic exposure mode, the user can manually adjust the target value according to the image brightness, adjust the exposure time to obtain the appropriate brightness of the image automatic exposure. (Only supported by some CMOS cameras)

- **Resolution:** Select a resolution for the camera. The software provides different resolutions for different camera types. For more details, see the specific interface.

➢ Note:

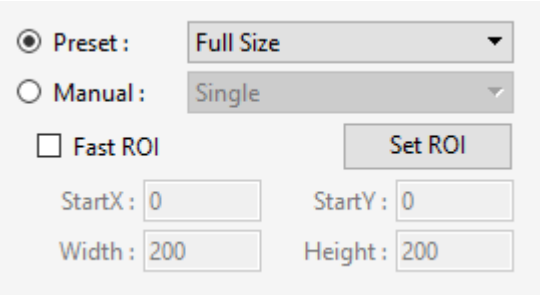
a. When 20MP USB3.0 CAMERA resolution is selected, only in High Speed mode can binning improve the frame rate.

b. When the TrueChrome series selects compress mode, the frame rate is increased, but the CPU utilization is higher.

- **Depth:** CaptaVision+ allows users to select the required 8/16bit for display preview according to the actual needs. But some cameras only support 8bit or 16bit images, which cannot be modified.
- **Frame Rate:** The camera output frame rate can be customed according to your needs.
- **Shutter:** In some cameras, there are options to choose between rolling shutter and global reset, allowing users to select the desired shutter type based on their needs.

5.2.2 ROI

ROI (Region of interest) is an application that user runs the software to define a window area of interest within the effective and sensitive detecting area of the camera sensor and just allow the image information within this defined window to be read out and then show out a localized area of image. A smaller ROI area reduces the amount of information and tasks of image transferring and computer processing, which results in increased frame rate of the camera.



- **Preset:** The default state is "Full Size". The software provides four kinds of central ROI areas (full width, 1/2, 1/4, 1/8). Select different presets to quickly set the required central ROI.
- **Manual:** Divided into single ROI and multi-ROI, multi-ROI can be divided into a maximum of 256 ROI images in the screen.
- **Fast ROI:** move the computer mouse to the previewing image to define the window area you would like it to be your ROI, this window area will display the coordinate value and resolution of the current running point. Single ROI, click [√] below the mouse to apply ROI, or double-click the mouse or

press "ENTER" to apply ROI, click [x] to cancel ROI. For multiple ROIs, click Continue to continue to select the second, third……until the nth ROI, then click End to apply the ROI.

- Set ROI:

1) **Single ROI:** Manually input the coordinate value of starting point and resolution size to set the area of ROI. Enter the actual starting point offset position, width and height of the rectangular area, and then click Set ROI to apply ROI. For multiple ROIs, a pop-up box will appear after clicking Set ROI. After choosing to continue to enter the second coordinates and width and height information, you need to click the Set ROI button until the nth one, and click Finish to apply the ROI.

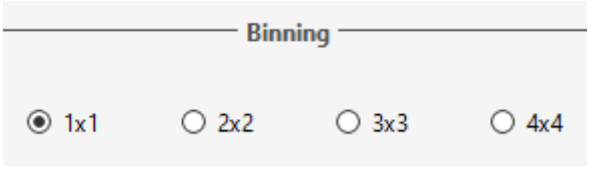
- After the above Settings are completed, the [Set ROI] button will change to [Set Full Size]. Click this button to cancel the current ROI.

2) **Multiple ROI:** When there are more than 256 ROIs, the interface will prompt "It can support to select no more than 256 ROIs". The interface does not display the entire field of view size, but only the boundary size corresponding to the ROI area, and the gray value of the rest area is all set to 0

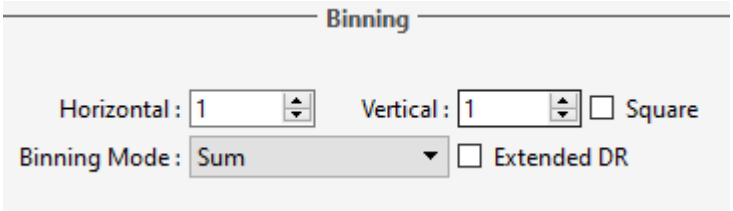
5.2.3 Binning

Binning is an image readout model, that considers the adjacent pixel combining together as one pixel. Binning can improve the sensitivity, nonetheless, it also decrease the resolution of image.

- **Preset Binning:** Color cameras only provide Binning(1x1/2x2/3x3/4x4) as preset.



- **Free Binning:** SCMOS and USB3.0 mono series cameras support software to achieve any combination of Binning. Customers can set any Binning according to their needs, then the preview image is the image after Binning, but the image data width will not change. The image resolution, m x n, m, n can be set as Any integer other than 0.

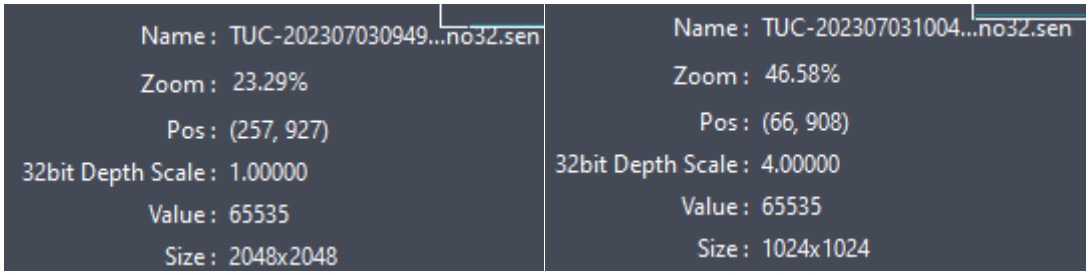


- **Binning Mode:** Switch between the "sum" and "average" modes, the "average" mode can increase the saturation capacity.
- **Square:** After checking, "Vertical" is disabled, and after "Horizontal" is set, the value of "Vertical"

follows. The number of pixels in the horizontal and vertical directions is the same.

- **Extended DR:** Only the physical application sum mode can be checked. After checking, the image is expanded to 32-bit data to provide space for the sum of pixels. The image data cannot be previewed because the image data is too large, and the preview image is a full-resolution image.

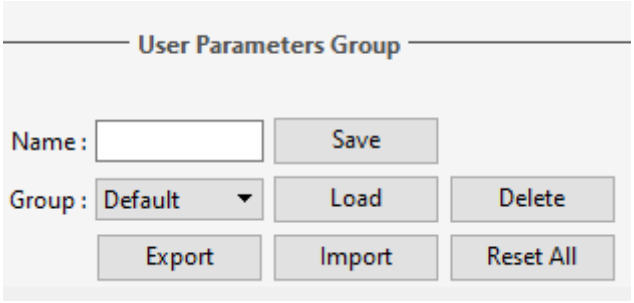
- Note:
  - This function implements sum binning on the basis of raw data, so the frame rate does not change;
  - In Extended DR mode, the image storage format is 32-bit .sen format image.
  - The software opens a 32-bit image in 16-bit mode. When the maximum gray value of the 32-bit image is greater than 65535 DN, scaling is used, that is, the maximum gray value of the currently opened image is mapped to 65535 DN. The maximum gray value is divided by @32bit Use 65535= bit depth scaling, and divide all gray values by the "bit depth scaling". While the maximum gray value of a 32bit image is less than or equal to 65535 DN, the image will not be scaled, that is, at this time Bit depth scaling=1.
  - Only when opening a 32-bit static image, add 32-bit bit depth scaling information in the status information column, and the precision is 5 digits after the decimal point.



5.2.4 User Parameters Group

In actual applications, the camera is usually used in multiple scenes to switch back and forth, or cross-platform usage, in order to facilitate user operation, the software provides the parameter group management function, users can save and load the setting parameters in each scene.

Copying the parameter file to another computer and loading it allows for the transfer and application of parameters across platforms, ensuring maximum consistency in user experimental conditions.

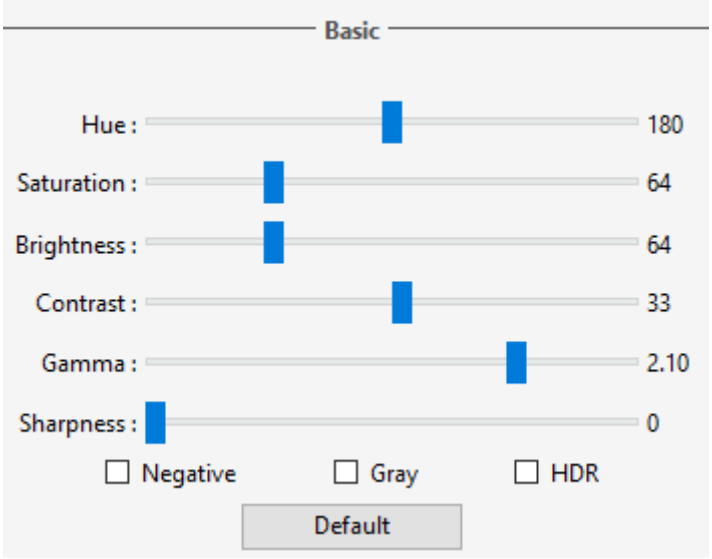


- **Name:** To name the parameter group, input the name you desired and load it. the window's context menu will display those parameter groups which have been saved or loaded.
- **Save:** To save the current parameters into a named parameter group file. up to 50 sets of parameters can be saved.
- **Load:** Load the parameter group to current working state.
- **Delete:** Delete the currently selected files of parameter group.
- **Export:** Save the files of the parameter groups to specified folder documents; Reset all: Restore to the factory default settings will delete all the files of parameter groups set and saved by the users before.
- **Import:** Load the selected files of parameter group from the selected folder.
- **Reset All:** Restore to the factory default settings will delete all the files of parameter groups set saved by the users before.
- **Fluorescence:** After Load " fluorescence", the exposure mode is switched to manual exposure, the exposure time is 100ms, and the automatic level is automatically checked.
- **Industry:** The default color temperature is 6500K, and the software sets regional white balance. The gamma value keeps 1.80, and the exposure method is center exposure.

- Note: Fluorescence and Industrial parameter sets are only supported for CMOS cameras and cannot be deleted.

5.3 Adjustment

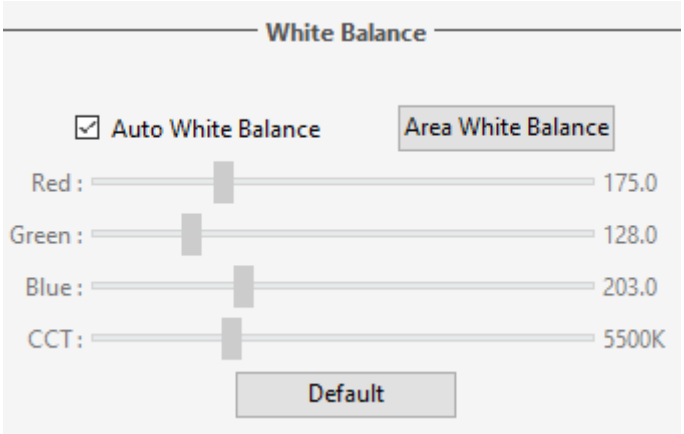
5.3.1 Basic



- **Hue:** The shade of the color, adjusting ranges from 0 to 360.
- **Saturation:** The purity of the color, the higher the purity, the more vivid the performance, and the lower the purity, the duller the performance.
- **Brightness:** Used to set the brightness of image, the range is 0~255..
- **Contrast:** Ratio between maximum darkness and maximum brightness, sCMOS series mono camera contrast -128~127, the default is 0.
- **Gamma：** adjust the median of the color level.
- **Sharpness:** To improve clarity of image edges.
- **Permeability:** Image enhancement.
- **Offset:** Adjust the gray value of the dark field background.
- **Negative:** Inverse color of the current image
- **Gray:** Convert color image to mono image
- **HDR:** Provide broader dynamic range and image details, so that the image has a better effect.
- **Default:** Restore the parameters of the module to the factory default parameters.

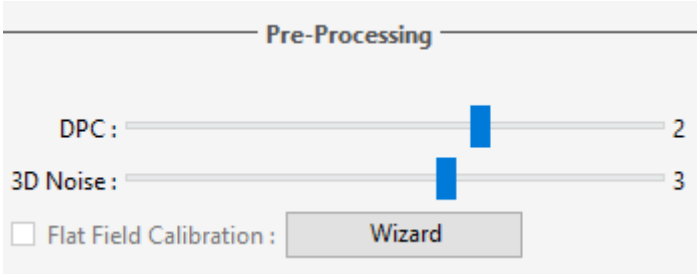
5.3.2 White Balance

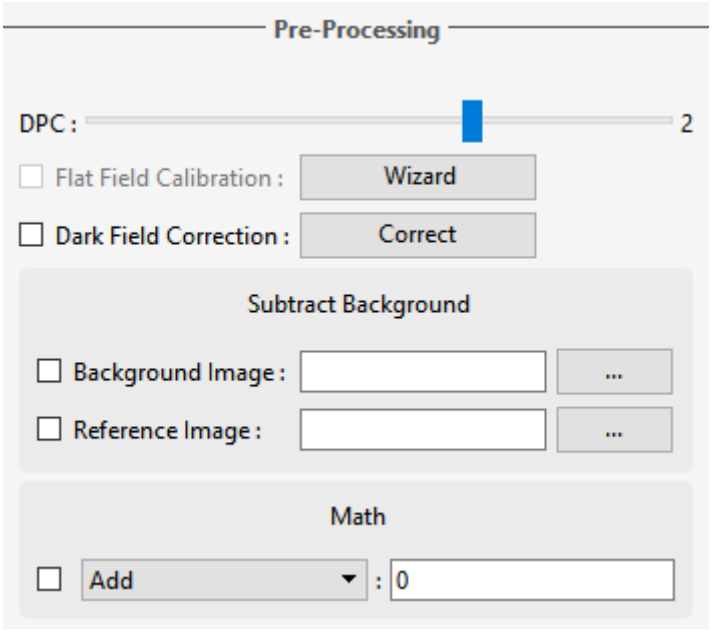
The user adjusts the white balance parameters of the image according to the actual light source to obtain an image that is more in line with the user's needs. As shown below.



- **White Balance:** By adjusting the proportional relationship of the three components of the image R, G, and B, the camera can restore the true image color under various light conditions. The camera defaults to automatic white balance. In an environment with stable lighting conditions, the user can uncheck the automatic white balance to fix the RGB gain value of the current white balance.
- **Area white balance:** Click the regional white balance option, and the preview screen will prompt out of the regional white balance frame. In an environment with stable light conditions, the user can move the regional white balance frame to any white area of the screen. During the moving process of the regional white balance frame or the movement of the stage, the regional white balance is effective, click "√" to fix the regional white balance. The size of the white balance frame is adjustable.
- **Black Balance：** Fix the white balance, and set a group of defined R/G/B gain values, so that the camera can correctly restore the image color in low-light environments. This function is generally used for imaging under bioluminescent microscopes.
- **Red, Green, and Blue(Gain):** Manually adjust the gain value of the R/G/B channel.
- **Color Temp：** 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 the close color temperature according to illuminating environment. By the way of calibrating the white balance will be more accurately to achieve the correct color temperature.
- **Default:** The white balance can be restored to the factory default parameters, and the automatic white balance is turned on by default.

5.3.3 Pre-Processing

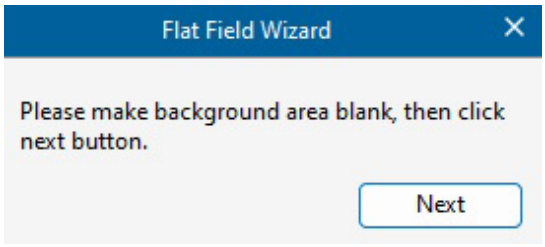


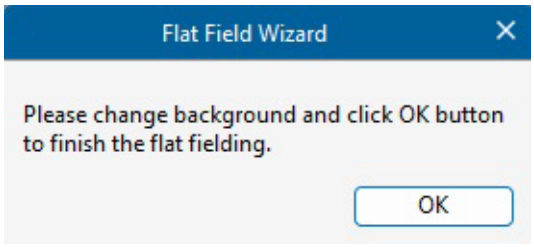


- **DPC：** Reduce image bad pixels.
- **3D Noise :** Take the average adjacent frames of images, automatically filter out the non-overlapping information, so as to obtain a purer and delicate image. The number of frames can be customized.
- **Flat field correction:** In actual microscope applications, the images captured by the camera may be uneven or carry color patches, due to the problems of microscopes' light sources, optical path systems, or the dirty spots on the microscope eyepieces and objectives. With flat field correction, those types of defects could be effectively reduced, the imaging effects will be more uniform, and the color reproduction of the images is smoother and more realistic.
- Flat field correction operation steps:

  1) Click [Flat Field Correction Wizard] to move the camera field of view to the background of the blank area.

2) Click [Next] to move the background to another blank area, and click [OK] to complete the flat field correction.





3) Click ☑ to cancel the check to exit the flat-field correction. If you need to apply it again, just check it again, and there is no need to operate the wizard again.

➢ Note:

a. The Flat Field Calibration requires the manually setting of the exposure time, so that the image brightness will not overflow up or down, and all the pixel values are range from 64DN to 254DN.

b. The brightness of other areas of the two backgrounds which are used for references of correction should be almost the same except that there are some moving spots on the two backgrounds. These two background should not be those of "significantly inconsistent".

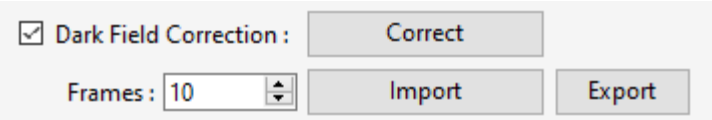
c. To standardize the background for the flat field correction, it is recommended to use plastic, ceramic or professional white balance paper as the standard samples.

d. Flat Field Correction requires that the background it use as reference to be a blank one and the light illumination on it is uniform. The correction should be conducted again if the camera or the microscope changed their lens or objective.

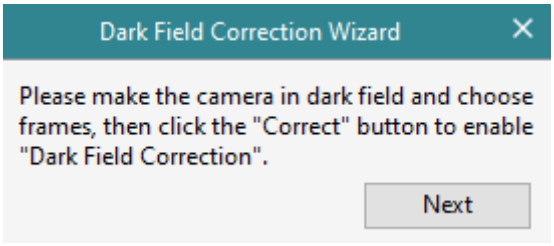
➢ **Dark Field Correction:** In order to solve the problem of bright light at the corner of the chip and uneven background, the dark field correction function is adopted.

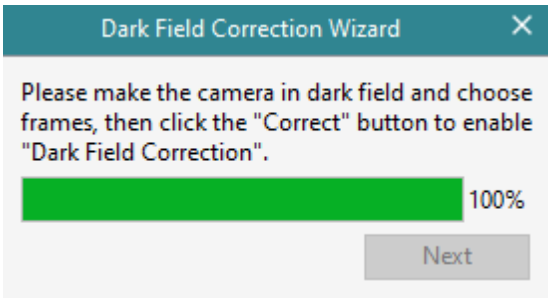
➢ Instructions for Dark Field Correction

1) The default correction enable is disabled and cannot be checked. It lights up only after the coefficients are imported and set. It is automatically checked, that is, to enable the dark field correction. At this time, the check status can be selected to be removed, that is, to turn off the dark field correction.



2) Click the correction button and follow the pop-up prompt. Click next to calculate the correction coefficient automatically.





3) The default frame number is 10 frames (users can set different frames according to their needs, and the range supports 1-99).

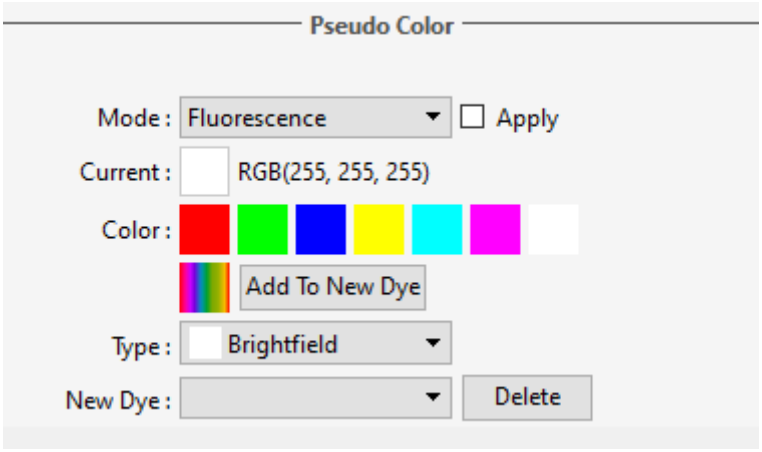
4) Import and export are import and export correction factors respectively.

5) In different exposure time and scene, dark field correction should be done respectively.

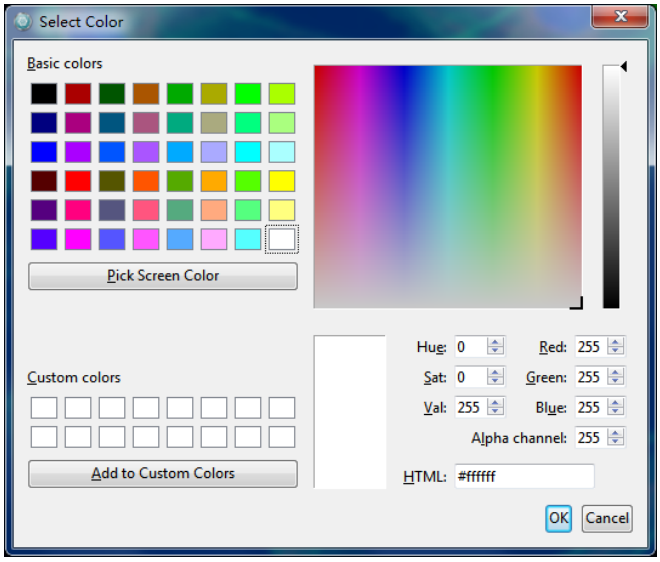
6) Close the software and parameter group to save the frame number, close the software to clear the correction enable and coefficient, and restart the software for correction next time.

- **Subtract Background:**(Only some cameras of sCMOS and USB3.0 mono series are available and displayed) Select the file path corresponding to the background/reference Image. When it is checked, the path selection is disabled, the corresponding background/reference data file under the selected path loads to the memory for real-time subtraction of the background/reference;
- **Math:** "Add", "Subtract", "Multiply" and "Divide" are performed on the gray value of the original image (Only some cameras of sCMOS and USB3.0 mono series are available and displayed). Check it to take effect, and the range is 0~65535.

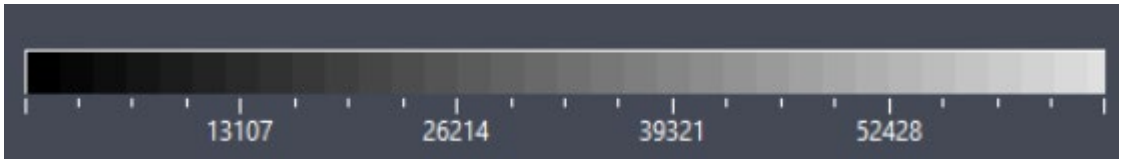
5.3.4 Pseudo Color



- **Fluorescence :**It is generally used for mono cameras to take fluorescent images, and add pseudo colors to the images through software to achieve fluorescent coloring. The user selects a dye according to the needs, check [Apply] to apply the selected color to the image, and uncheck to remove color. The stained image obtained by taking images can be used to synthesize a complete fluorescence image in the later stage.
- **Current:** Displays the currently selected dye type, providing seven commonly used colors.
- Click  to call up the full color palette and richer colors can be chosen. You can set the desired color by yourself through the color parameters on the right and add to custom colors for future use.
- **Add to New Dyes:** To add selected colors to the palette as a new dyes.

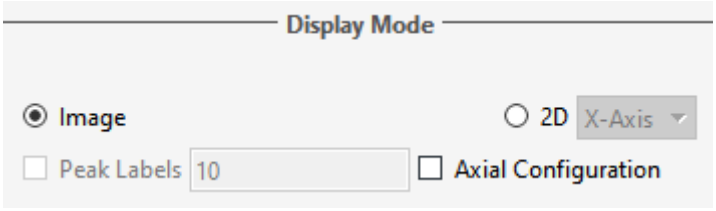


- **Dye Type:** Display various commonly colors.
- **New Dye:** Displays user-defined dye colors.
- **Delete:** Delete the selected user-defined dye color.
- **Palette:** Black, white, red, green, blue, and other colors are provided. After selecting the color with the mouse, check [Apply],then the corresponding color to take effect. If the color block is not selected with the mouse, check [Apply] to take effect in mono.

- In physical mode, it supports displaying pseudo-color bars in 5 modes, and the default is grayscale. The grayscale image data is mapped to the color range of the pseudo-color bar according to the minimum and maximum values of the histogram. And the pseudo-color mapping of pixels with different grayscale values changes with the variety of the color scale.The pseudo-color bar automatically matches with the changes of the left and right color levels.
- 

5.3.5 Display Mode

In physical mode, it is used to perform grayscale statistics on images collected in a specific scene. Only some of sCMOS and USB3.0 mono series cameras support the function.



- **Image:** Analyze intensity in the mouse position X and Y. If the position of the mouse is at [255, 255], the gray value distribution of 255 rows and columns will be counted. The mouse is at the top middle position of the image by default. Image scale is Pixel Number or Wavelength, and the scale is the resolution of the corresponding image. The calculation formula of the image scale is as follows:

  1) Take the upper left corner of the image as the coordinate origin and do not display the value of the origin, that is, do not display 0;

  2) By default, according to the longest side of the image, it is divided into 5 complete large scales. And a interval between each large scale is divided into 5 complete small scales.

formula:

① After the length is divided by 5, it is rounded up.

② Calculate the length of the value in step①.

③ Calculate the corresponding length of 10 to the power of "② -1".

④ Divide the value of step ① by the value of step ③, round up, and multiply by the value of step ③ to calculate the maximum scale;

⑤ Calculate the value of the small scale according to the steps of ①~④;

⑥ Divide the value of step ④ by the value of step ⑤, round up, and calculate the actual number of small scales;

⑦ Calculate the final maximum scale by multiplying the value in step ⑤ by the value in step ⑥.

Units: pixels/tick.

Example: Resolution 2048 x 1152

2048 / 5 = 409.6 ≈ 410;

② 410 is 3 digits;

③ Calculate 10 to the power of (3-1) to be 100;

④ 410 / 100 = 4.1 ≈ 5 ； 5 * 100 = 500；

⑤ According to the steps of (1) ~ (4), calculate the small scale value as 100;

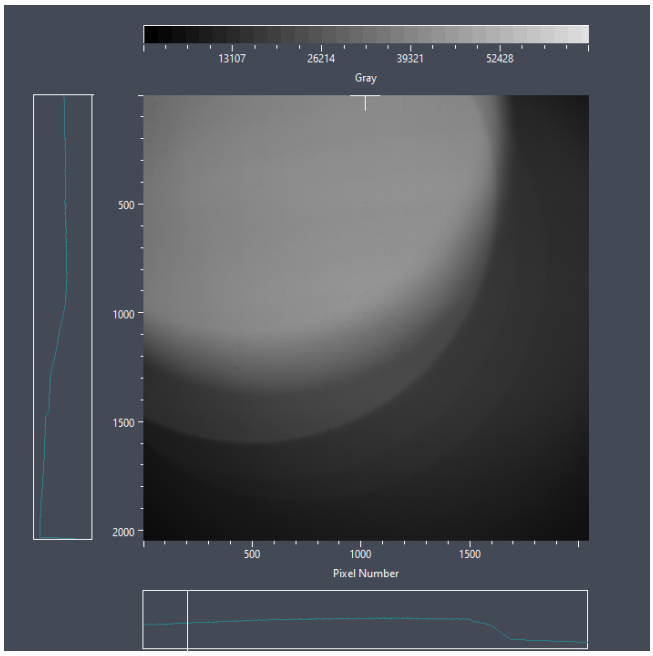
⑥ 500 / 100 = 5；

100 * 5 = 500. That is, large scale = 500; small scale = 100.

Image supports zooming in and out, and the corresponding scale will also be enlarged and reduced.

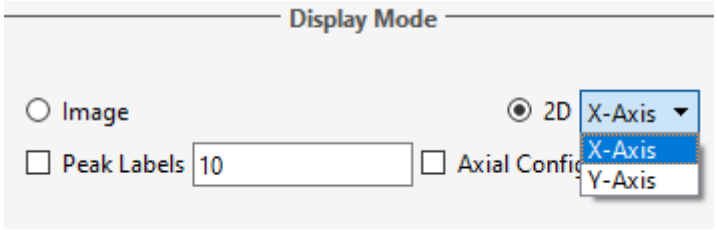
The current intensity distribution is shown above the image, the grayscale image data is mapped to the color range of the pseudocolor bar according to the minimum and maximum values of the histogram. And the pseudocolor mapping of pixels with different grayscale values changes with color levels.

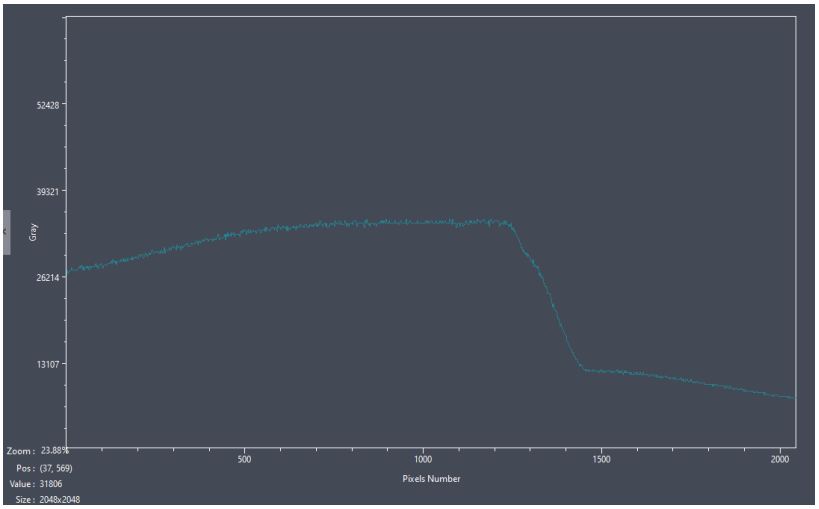
The lower-left corner of the image displays the coordinates and grayscale values of the cursor position in real time.



➢ 2D

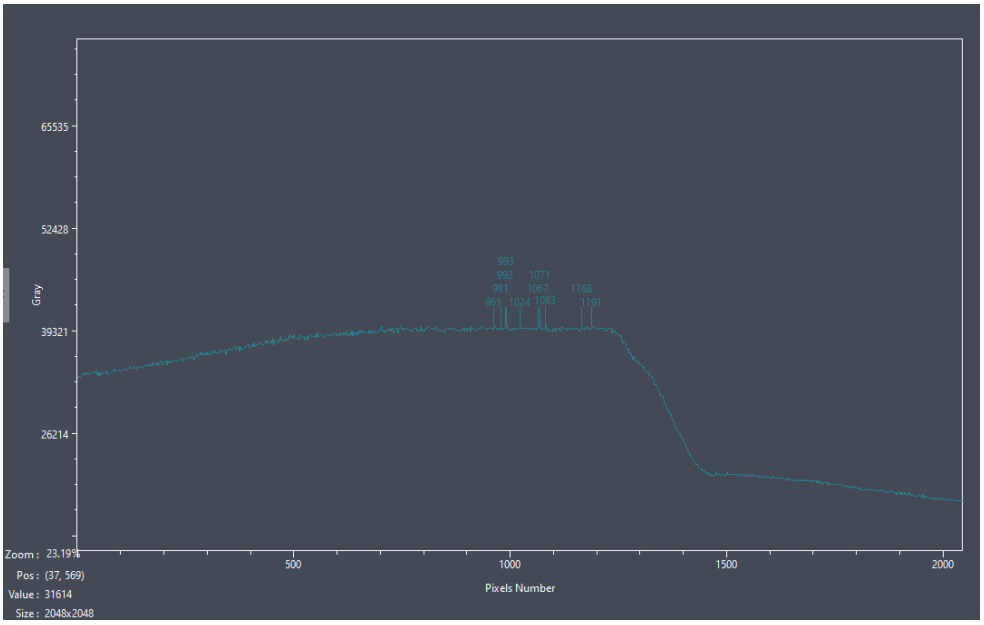
Analyze the single row or column of the current mouse coordinate position, which can better analyze the strength in one direction. In the above diagram, the abscissa is Pixel Number or Wavelength, and the ordinate is grayscale.By adjusting the color levels, you can alter the vertical coordinates of a 2D image.





- Peak Labels

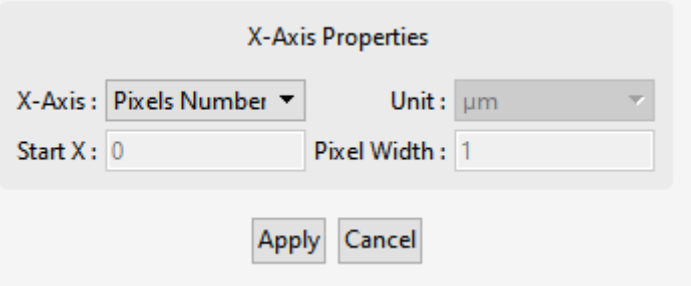
The maximum value mark of the waveform is available in 2D mode, and the peak value label is not supported in the image mode. The maximum value mark is marked based on the automatic multi-scale peak search algorithm. The final result will be sorted from highest to lowest based on the grayscale value corresponding to the marked maximum value. The number of tags can be set, the default value is 10, and the range is 1-200.



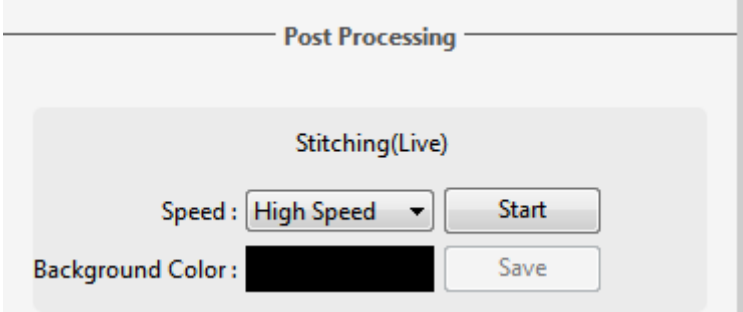
- **X-Axis Properties:** The abscissa supports switching between pixel number and wavelength unit. When the unit is the number of pixels, the unit, X-axis start value and pixel width cannot be adjusted. When the unit is wavelength, the start value of X-axis and pixel width are available to adjust.

Start X: The initial position of the X-axis, the input range is 0~4096.

Pixel width: X-axis interval, the input range is 1~2048.

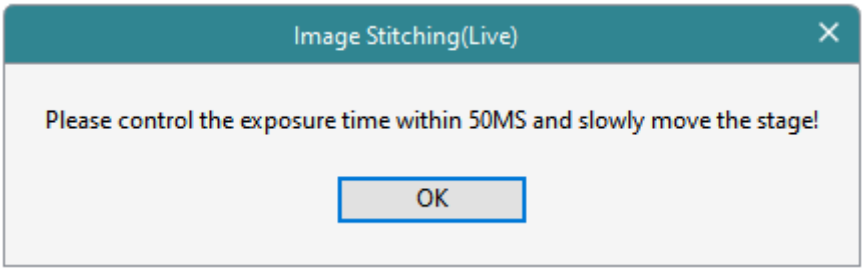


5.3.6 Post Processing

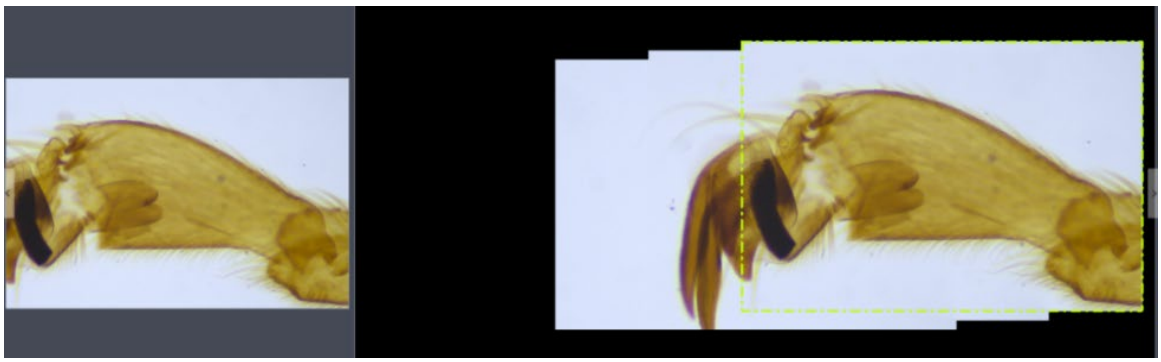


- **Stitching(Live):** The model of real-time image stitching supports to acquire several individual images with adjoining positions on the specimen or sample, and to have them combined into a stitched image which present the whole form of the specimen.
- **Speed:** High Speed and High Quality. the default is High Speed.
- **Background color:** The default background color of the invalid area on the stitched-to-composed image is black, but you can change it.
- Click on  to select the desired color in the palette. And it will effective after stitching is completed..
- Steps

1) Click [Start], if the exposure time is greater than 50Ms, an operation prompt will pop up.



2) Move the sample to other areas through the stage, and move no more than 3/4. The navigation display frame in the stitching window is green, and the software will perform one stitching; each time the sample is moved, the software will perform one stitching.

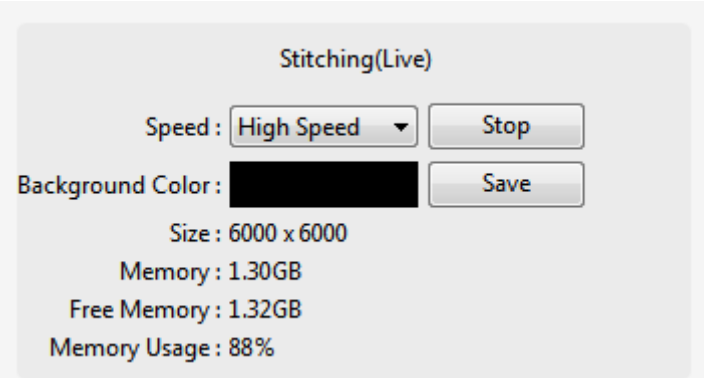


3) If the navigation display frame is red, it means that the stitching area is exceeded and stitching cannot be performed, and the sample needs to be moved back to the location near the last stitching area.

4) Click [Stop] to end the stitching, and the image will be saved in the "stitching" folder under the storage path.

5) In the process of stitching, the user can click the "Save" button to save the currently stitched image.

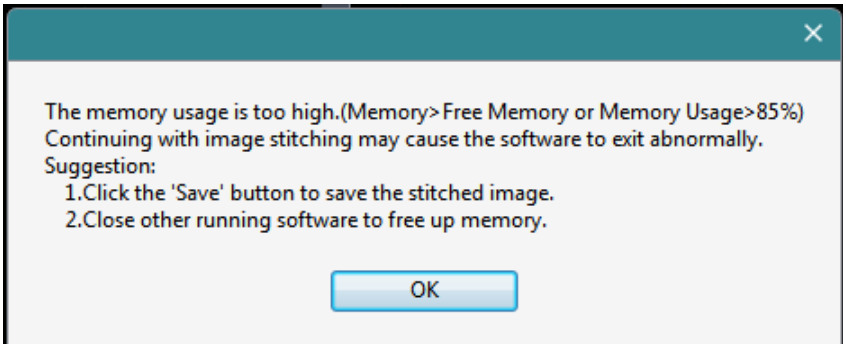
6) When stitching, the memory usage of the current stitching will be displayed in the lower left corner, which can be previewed in real time.



Notice:

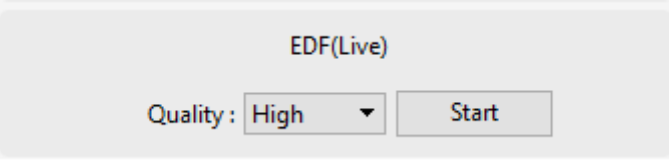
a. It is recommended to conduct a white balance correction and flat field correction before starting the stitching to ensure to achieve the best quality images.

b. b. When the Mosaic image size is too large and occupies a lot of memory, the "The memory usage is too high" dialog box will be displayed. If the stitching continues, the software will crash, and users are advised to save the image in advance.



c. The result of the concatenation will be displayed directly in the window and will not be displayed in the file preview.

➢ **EDF(Live)：** EDF makes it possible to stack and merge the images acquired by microscope with different focused panels or positions on a certain thick specimen or sample. The new stacked and merged image is able to present the clear full forms and information of the specimen or sample.



➢ **Quality:** The higher quality level of the new image requires, the slower speed in its merging, but results in coming out of image with better quality.

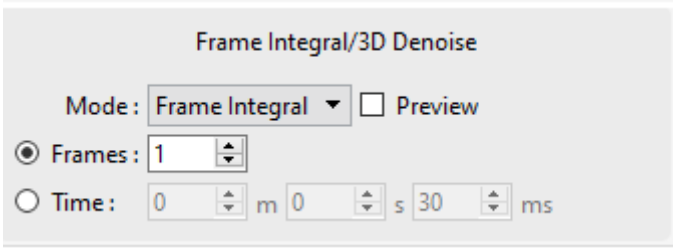
➢ Operating Procedures

a. Click the [Start] button to start the depth of field expansion operation.

b. Continuously turn the fine knob of the microscope to focus on one plane to next other, the software is able to merge the obtained plane images instantly and show out a live and clearest image.

c. Click the [Stop] button to end the stacking and merging application, a new merged image including all the depth focusing information will be generated at the same time.

Frame Integral/3D Denoise:



➢ **Frame Integral:** Capture multiple-frame image frames continuously as setting conditions, then accumulate multiple frames of data into one image in real time.

1) Integral by frame number:

➢ Take the continuous preset frame number and add it up to a image. The range is 1~99, the default set to 1.

2) **Integral by time length:** all frame data within the preset time are accumulated into one image, and the number of frames is the integral time divided by the exposure time. The available range is 1ms~59m59s999ms, and the default is 30ms.

3) **Integral Preview:** display the integral effect in real time in advance on the screen according to the preset parameters, adjust to the best effect, and then take the image.

➢ Integral imaging can enhance the weak signal, improving the overall brightness of the image, and obtain better imaging effect.

Note:

a. The appropriate number of accumulated frames shall be set for integral photographing, otherwise the image brightness will be too high and distortion will occur.

b. "Integration frame number" and "integration time length" cannot be enabled at the same time. Only one method can be selected at a time.

➢ **3D Denoise:** Through obtaining and comparing several adjacent images, it is possible to filter out nonoverlapping information automatically.

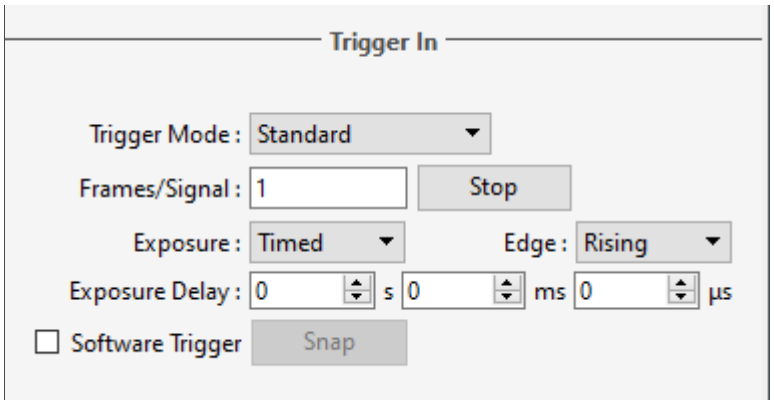
➢ The function can customize the number of frames used, so as to acquire low noise image. The range of frame number is 1~99, the default set is 10.

➢ Note:

To capture images processed with 3D denoise, we need to take multiple-frame image data continuously. Therefore, it takes a longer time for imaging by taking multiple-frame image data continuously to filter out noise. If it is used for photographing dynamic scenes, this will cause blur or smear images. In addition, 3D noise reduction is not effective for video recording.

5.4 Hardware

5.4.1 Trigger In (sCMOS cameras only)



There are two output modes for image output: frame mode and flow mode

➢ **Frame mode:** External trigger mode, which is to output images by triggering in units of frames, divided into hardware trigger (standard, CC1, synchronous and global) and software trigger. When the standard, synchronous, and global modes are selected, the camera will switch to the trigger waiting mode, and will not take images, and will only shoot when it receives a trigger signal.

➢ **Flow mode:** Data flow is the real-time output mode. Embed image data in the stream. The image is output circularly like flowing water.

➢ **Trigger mode:** Internal, Standard, CC1 (CameraLink standard trigger mode), Synchronization, Global

1) **Internal:** This means that the trigger mode is in the Off status; the camera is always capturing images.

2) **Standard:** The Standard mode comprises several configuration modules.

A. Exposure:

➢ **Timed:** If enabled, exposure time will be set by the software.

➢ **Width:** If enabled, exposure time will be set by the width of input pulse.

B. Edge

- Rising: Trigger by the rising edge.
- Falling: Trigger by the falling edge.

C. **Delay:** User can set a specific delay time before camera is triggered for exposure after a trigger signal is received.

D. **Frames / Signal**: This mode can control the number of triggered images. After receiving the trigger signal, it will continue to acquire images according to the set number of images. This mode contains [Total Frame] option and [Stop] button.

- **Frames / Signal**: You can set the total number of sheets for automatic continuous image acquisition, the default is 1 sheet, and the range is 1~65535. After setting the parameters, you need to press the Enter key on the keyboard to take effect;
- **Stop**: You can end the image acquisition after the frame acquisition is completed.

Note:

[Total Frame] = 1, send a trigger signal, one image will be captured.

[Total Frame] = 65535, send a trigger signal, the camera will produce 65535 images continuously. You can click [Stop] to stop the process.

3) CC1(Cameralink standard trigger mode)

- This mode is the same as Standard mode, but the difference is that only sCMOS cameras support CameraLink. It can be triggered directly through the acquisition card CC1, and the trigger signal is transmitted to the camera through the CameraLink line without SMA interface.

4) Synchronization:

A. Exposure

- Width: If enabled, exposure time will be set by the width of input pulse.

B. Edge: Configure the type of trigger response level edge to start the exposure operation.

- Rising: Trigger by the rising edge.
- Falling: Trigger by the falling edge.

5) **Global:** Global mode is emulation of a global shutter in rolling shutter mode by simultaneous exposure of all rows through pre-triggering and external light source coordination.

A. Exposure

- **Timed:** If enabled, exposure time will be set by the software.

- **Width:** If enabled, exposure time will be set by the width of input pulse.

B. Edge

- **Rising:** Trigger by the rising edge.
- **Falling:** Trigger by the falling edge.

- Software Trigger

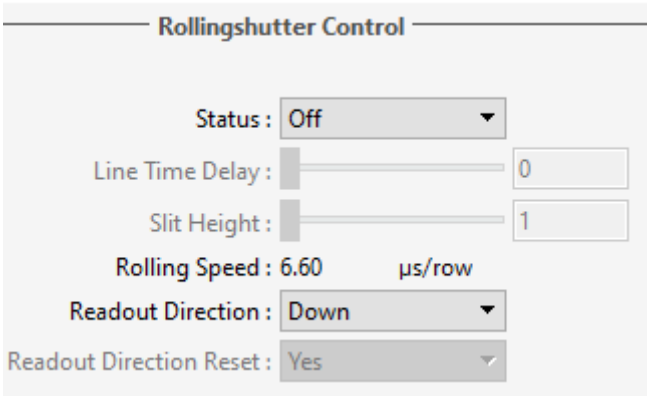
- Under software trigger mode, by ticking Software Trigger and clicking [**Capture**] entering the trigger waiting status, and click [**Snap**], an image acquisition command will be issued to the camera. One image can be captured each time when [**Snap**] is clicked.

Note:

1) When trigger mode selection, exposure mode selection, boundary selection, and delay setting are performed, cancel the process of clicking Apply button after selection and take effect directly.
2) Shield resolution, ROI, AVI storage format, bit depth, video recording and other functions when entering the external trigger.
3) Disable the software support for saving parameters. The next time you start the software, the external trigger mode is still used.
4) In trigger mode, real-time preview, frame rate update and parameter modification are supported, but no image is saved, which needs to be clicked after setting parameters such as number and name in the [image acquisition] module
5) After selecting the trigger mode, the interface has stopped drawing, but there is still a stream mode signal in the trigger output. Only after clicking to shoot, it really enters the trigger frame mode and the output signal stops. Rolling Shutter Control

5.4.2 Rolling Shutter Control (sCMOS cameras only)

Only partially supported by sCMOS cameras. The Rolling shutter feature allows the camera to seamlessly synchronize with the movements of the LightSheet imaging system, exposing the sample from top to bottom or bottom to top repeatedly, line by line, thus significantly improving the signal-to-noise ratio. The main applications are in imaging in the life sciences, particularly in applications requiring LightSheet imaging, such as neurodevelopmental microscopy.



Status: Three modes of operation are supported:

Off (**Default)**: When "Rollingshutter Control" is set to **[Off]** mode, the line time of Sensor is 1 line time by default. Line time is the inherent (minimum) line cycle time of the Sensor. For example, the Line time in High Sensitivity mode is 11.2us, and the Rollingshutter Control function is off.

Line Time Delay: When "Rollingshutter Control" is set to "Line Time Delay" mode, add the number of "Line Time Delay" between "Reset" and "Readout" signal (range: 1 to 100ms/Line time (unit: number of Line times) to increase the value of Rolling Speed (range: 2 * Line time to 100ms, unit: us/row). The software automatically calculates and displays the value of Rolling Speed.

- Rolling Speed = Line time$_{(sensor)}$ +（Line time$_{(sensor)}$ × Line Time Delay）

The frame rate of imaging in this mode depends on the number of lines to be imaged and the line cycle time, which can be calculated by the following formula:

Readout time$_{(image)}$ = Rolling Speed×N_{rows}

Frame rate = 1/ (Readout time$_{(image)}$ + Exposure time)

N_{rows} is the total number of rows of pixels to image.

Note:

1) When the exposure time is less than frame period (Line time *2048), camera has the highest frame rate;
2) The calculation formula of Readout time is slightly inaccurate, and the actual Readout time of rolling shutter is = Rolling Speed * (N-1) +Line Time (because Rolling Speed is not added to the last Line).
3) When the scanning direction is down-cycle, the line scanning order is 1->2048, 2048->1. "Rolling Speed" in the last line can be added or not.

Slit Height: When Status is set to **[Slit Height]** (line width) mode, the scan line width can be set, that is, the

scan line width can be directly changed to set the size of the active pixel area. Slit Height = Number of pixel rows between "reset" signal and "readout" signal. The range of **[Slit Height]** is 1~2048.

In addition: the HighSpeed mode is two-line read-out, so the range of HighSpeed mode **[Slit Height]** is from 2 to 2048, and can only be set to even number.

The software will automatically calculate the required [**Line Time Delay]** and Rolling Speed, the formula is as follows:

- HighSpeed mode:
  - Line Time Delay = Exposure time $_{(Lines)}$ ÷（Slit Height $_{(Lines)}$ ÷2）
- Modes other than Highspeed mode:
  - Line Time Delay = Exposure time $_{(Lines)}$ ÷ Slit Height $_{(Lines)}$
  - Rolling Speed = Line time$_{(sensor)}$ +（Line time$_{(sensor)}$×Line Time Delay）

Note：

1) When Status is set to [Off], [Line Time Delay] and [Slit Height] cannot be set; [Rolling Speed] is not gray, [Readout Direction] is optional;
2) When Status is set to **[Line Time Delay]**, the value of Rolling Speed is increased or decreased by changing the value of this parameter. **[Slit Height]** is read-only and cannot be set. The display value is the value obtained by the following formula：

- HighSpeed mode:

Slit Height = （Exposure time $_{(Lines)}$ ÷ Line Time Delay）×2

- Modes other than Highspeed mode:

Slit Height = Exposure time $_{(Lines)}$ ÷ Line Time Delay

3) When Status is set to **[Slit Height]** and **[Line Time Delay]** is read-only, it cannot be set. The displayed value is the value obtained by the following formula:

- HighSpeed mode:

Line Time Delay = Exposure time $_{(Lines)}$ ÷ （Slit Height $_{(Lines)}$ ÷2）

- Modes other than Highspeed mode:

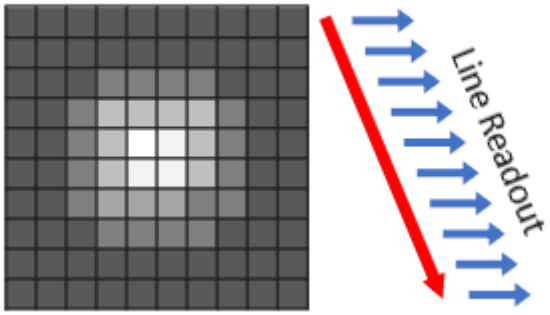
Line Time Delay = Exposure time $_{(Lines)}$ ÷ Slit Height $_{(Lines)}$

4) *Line Time Delay , Exposure time* $_{(Lines)}$ and *Slit Height* $_{(Lines)}$ must maintain the correlation of the above formula. When two parameters are determined, the value of the third parameter should be

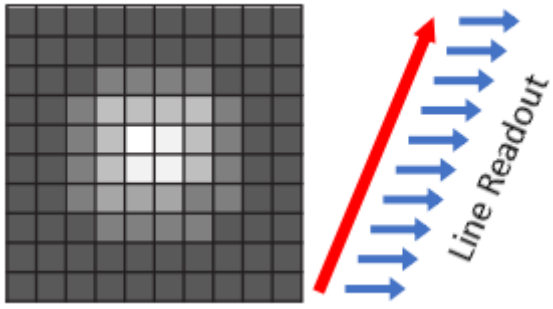
automatically re-given.

- **Readout Direction:** Scanning Direction. It supports the control of the Readout Direction of the rolling shutter. When Status = Off, it also supports the control of the scanning Direction, and the frame rate in the Down-Up cycle Direction decreases accordingly.

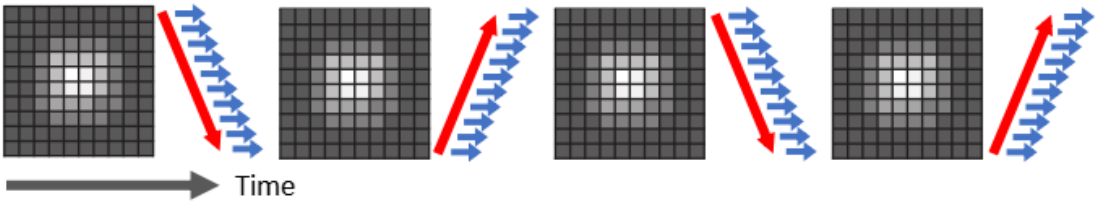
  1) Down: The downward scan direction is the default scan direction for sCMOS cameras. The shutter starts from the first row at the top of the Sensor and scans down to the last row at the bottom. Each subsequent frame capture starts with the first row at the top.



  2) Up: The upward scanning direction. The shutter starts to scan from the bottom row to the top row. Each subsequent frame is captured starting from the bottom row. The direction of the image acquired in this mode will not be reversed, which is consistent with the image in the downward scan mode.



  3) Down-up Cycle: When scanning Up and Down alternately, the shutter starts from the first row at the top and goes Down to the last row at the bottom. For the next frame, the shutter will start at the bottom row and scan up to the top row, and so on. The direction of the image captured in this mode is consistent with the downward scanning direction.



- **Readout Direction Reset:** This function is only available in Down-up Cycle mode and affects the direction of the first graph in each set.

The default setting is Yes, which ensures that the first frame of each new collection sequence starts at the top line and scans down.

When set to No, the first frame of Each New Collection Sequence starts at the position of the last frame in the Previous Sequence. If the last frame ends at the bottom row, the first frame of the subsequent collection starts at the bottom row and exposures upward.

The example validates the following: sequence mechanism for each set of graphs:

1) Every trigger only sends one signal, and output one image
2) **Readout Direction Reset = Yes,** the scanning Direction of each image is from top to bottom: Down-Down-Down-Down;
3) **Readout Direction Reset = NO,** the scanning Direction of each image is: Down-Up-Down-Up;
4) (One graph at a time is a set of independent sequences)
5) Trigger each time to send multiple signals or send a signal of Standard mode through Total Frame to set multiple graphs, can be a group of sequence of graphs :

Readout Direction Reset = Yes

The first sequence is Down-Up-Down

The second series is Down-Up-Down

The third sequence is Down-Up-Down

Readout Direction Reset = NO, only when the number of outgoing images is odd, the Direction difference is available

The first sequence is Down-Up-Down

The second series is UP-Down-Up

The third sequence is Down-Up-Down

When the number of images is even, the scanning direction of each image is the same:

The first sequence is Down-Up

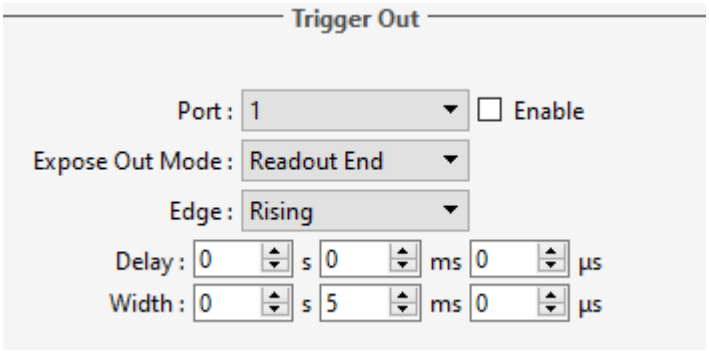
The second series is Down-Up

The third sequence is Down-Up

Note:

1) Rollingshutter Control：Both Cameralink and USB3.0 are supported, and both stream and trigger modes are supported. The Global Reset mode does not support the function.
2) When the Rollingshutter Control is turned on **[Live]**, the parameters can be adjusted and real-time preview can be achieved.
3) Support Rollingshutter Control in ROI;
4) The parameters under **[Line Time Delay]**, **[Slit Height]** and "Image Ajustment" all support manual input in text box.
5) In Standard/Width mode, Total Frame is not supported, because the second image cannot copy the first one. When the second image is generated, the software or camera cannot remember the pulse width of external signals, so the exposure time is equivalent to no high level signals. In Time mode, the exposure time is taken from the software every time.
6) In the continuous saving images process of Standard/Time Total Frame, setting exposure, setting gain mode, setting ROI, switching horizontal mirroring, setting trigger output parameters, setting rollingshutter parameters, these operations (involving live/stop operations) will lead to the drawing directly stop; Switching on and off the DSNU, PRNU, LED, fan adjustment, vertical mirroring, color levels, and capturing does not affect the images of saving.

5.4.3 Trigger Out (sCMOS cameras only)



The trigger output signal has 3 ports, that are TRIG.OUT1, TRIG.OUT2, TRIG.OUT3 corresponding to Port1, Port2, Port3.

The three output signals are disabled by default and controlled by the software.

The camera outputs a level signal to a third-party device as its input signal. The three signals can work

independently and output to different devices at the same time.

- Port

The hardware interface of trigger output has three pins, which can be configured for three ports. The trigger output is always on, and the signals of the three ports do not interfere with each other, and can be independently configured.

- **Enable**：Only partially supported by sCMOS cameras, it is allowed to turn off/on the trigger output signal in stream mode and trigger mode, and at the same time, the signal is only output when Live is previewed, and no signal is output when it is Stopped.
- Kind (The configuration of the output level)

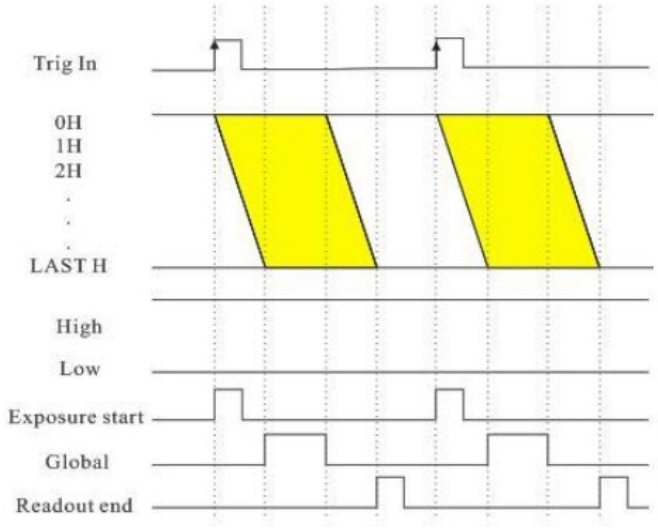
High: Output high level signal.

Low: Output low level signal.

Readout End: The signal output by the Readout End interface will be the level signal from the last line starts to readout. Readout End is the default mode of Port 1.

Global Exposure: The signal output by the Global Exposure will be the level signal from the last line starts to be exposure to the end of the first line starts to readout. Global Exposure is the default mode of Port 2.

Exposure Start: The signal output by the Exposure Start will be the level signal from the first line starts to exposure. Exposure Start is the default mode of Port 3.



- **Edge:** Configuration of the output signal polarity

Rising: The rising edge of the trigger signal is valid.

Falling: The falling edge of the trigger signal is valid.

- **Delay:** Delay time for configuring the output level signal and the default time is 0.

- **Width:** Configure the level width of the pulse and the default width is 5ms.

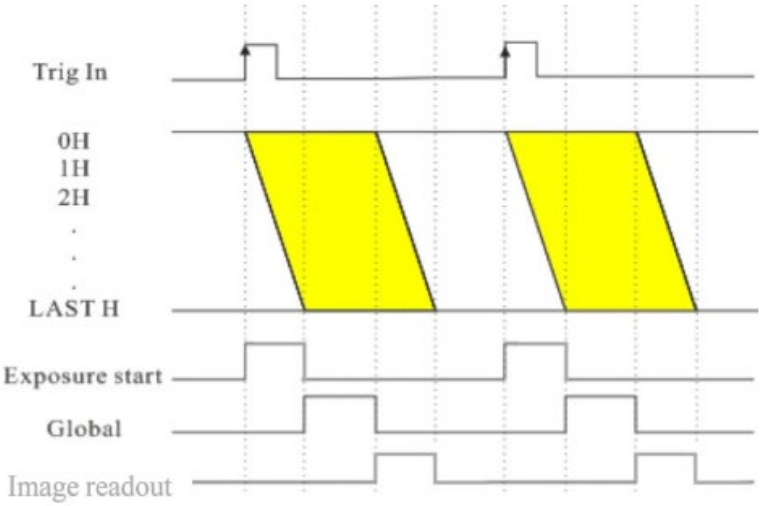
Note:

a. When the Global Exposure signal output is selected, the pulse width configuration is invalid and its output according to the actual pulse width.

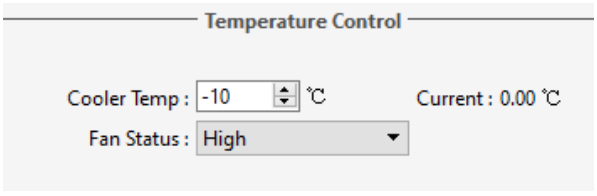
b. When High or Low signal output is selected, other configurations are invalid.

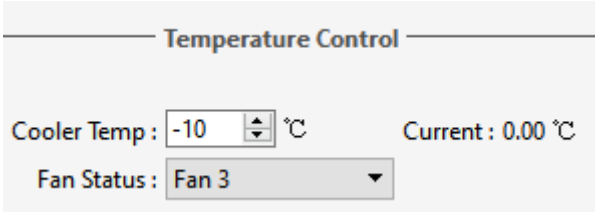
c. The Delay and Width signals in the streaming mode cannot be too long, otherwise the next frame signal will be lost;

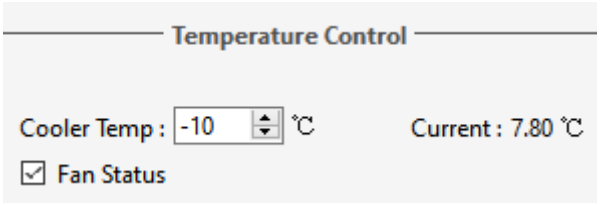
d. The configuration precision of Delay and Width signals is up to us, the setting range of Delay is 0~10s, and the setting range of Width is 1us~10s;

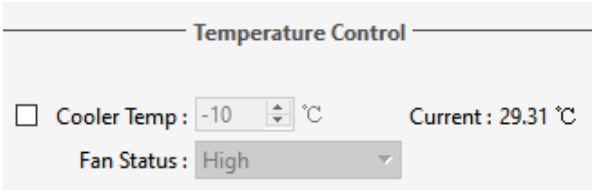


5.4.4 Temperature Control (sCMOS cameras only)



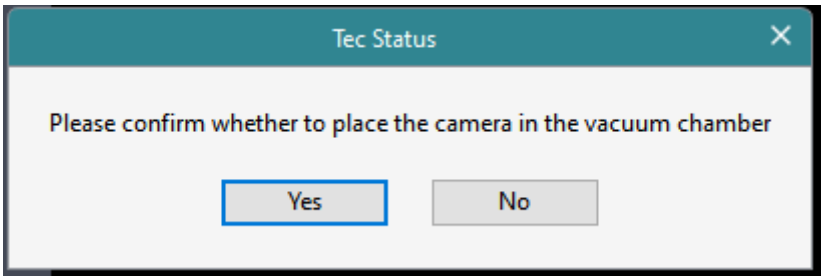






The camera is equipped with a semiconductor cooling chip, and the cooling temperature of the camera is controlled by software to reduce the working temperature of the image sensor, thereby achieving the effect of reducing noise.

- **Cooling:** The soft X ray camera is unchecked by default, that is, the cooling film is turned off. When check the option, the software will prompt operator the cooling start. The cooling temperature can be modified, and the cooling temperature range is from -50°C to 10°C.

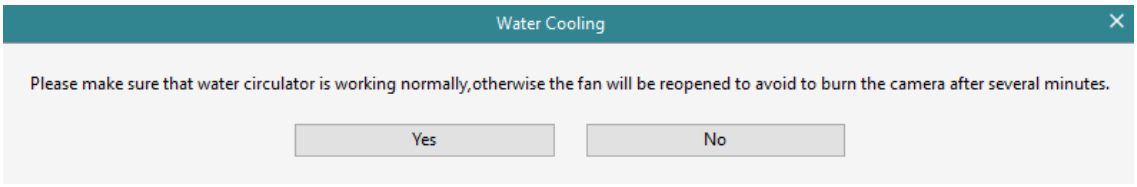


- Fan :

Fixed-speed fan: Once the camera is turned on, the fan is always running at the maximum wind speed, and the fan speed cannot be adjusted.

Adjustable speed fan: The fan speed can be adjusted by software.

1) The cooling temperature of different fan speed is -10°C by default. The difference between the three levels is the time cost of cooling to -10°C. The cooling temperature of each gear has a difference of about 1°C.
2) Once the Off is selected or untick the check box for fan status, the following prompt will pop up, and the fan can only be turned off after clicking OK.



3) If you have not used water cooling after selecting the Off option or untick the check box for fan, the camera will implement a protection mechanism. Once the current temperature reaches 0°C and above, the highest-grade fan will be automatically turned on to prevent the camera from overheating and burning out the chip. If the software is turned off, the protection mechanism will not take effect.

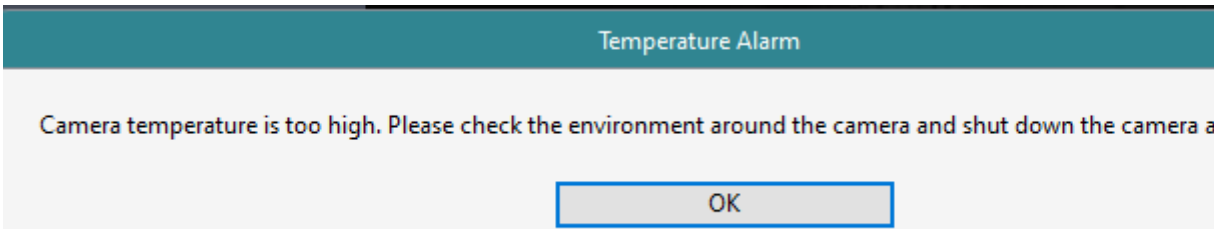
4) The set fan parameters will be reset after restarting the camera, and the original configuration needs to be resolved by restarting the software.

- Water cooling

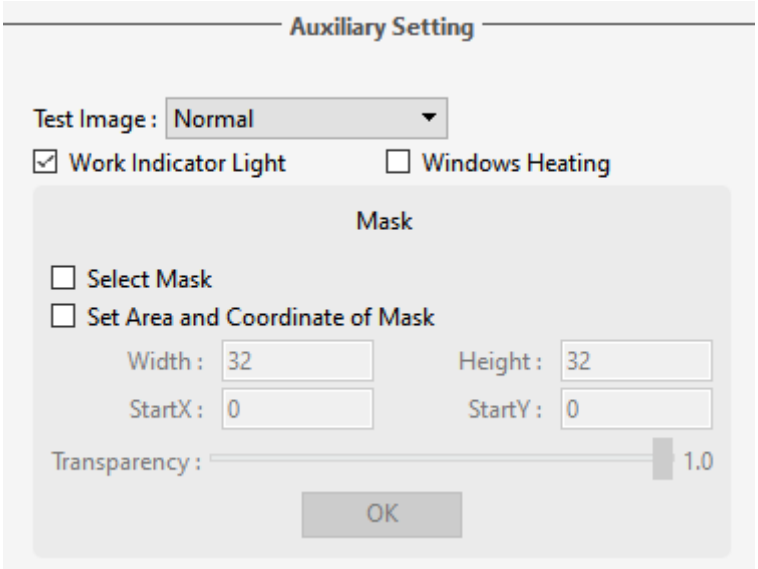
The camera that supports water cooling is equipped with an adjustable speed fan. It needs to be connected with an external water cooler. See the Instructions of Water Cooling Camera.

- Temperature alarm

The camera supports the high temperature warning function. When the external ambient temperature is too high, the software will prompt the temperature alarm prompt message, and the camera indicator will turn red flashing.



5.4.5 Auxiliary settings



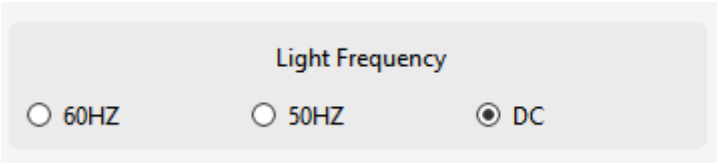
- **Test image:** Several sets of fixed images are provided to detect whether the image readout is normal, including horizontal bevel, vertical bevel, static bevel, and rolling bevel.
- **Work indication light:** Control the LED light switch;
- **Window heating:** Control the window heating switch;
- Mask

Select Mask: Move the computer mouse to frame an area of the previewing image to define the mask, this window area will display the coordinate value and resolution of the current running point. Click on the [√] below the cursor to apply the cover settings into effect.

Set Area and Coordinate of Mask: Manually entering the starting point coordinate value and the resolution size to define the exact cover area. Enter the actual point position of the rectangular area as well as the width and height, then click [OK] to apply the mask configuration into effect.

Transparency: Manually select the brightness of the unselected area.

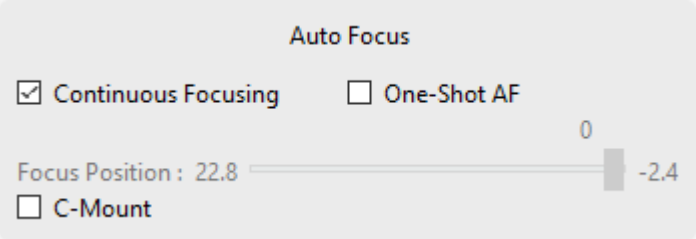
- Light Frequency



Users can select the suitable light source frequency according to the scenarios. Suitable frequency of light

source is good for the normality of the image and excludes the phenomenon of stroboscopic on the image. The default light source frequency is the frequency of direct current.

- Auto Focus (only available with autofocus camera)



This function is only available for auto focus cameras.

Continuous Focusing: Select the area to be focused in the preview screen, then, the camera will conduct continuous focusing on selected area until the image subject become sharp. When the focal length is changed due to movement of sample or camera, camera will automatically modify the focal length to ensure the clear image.

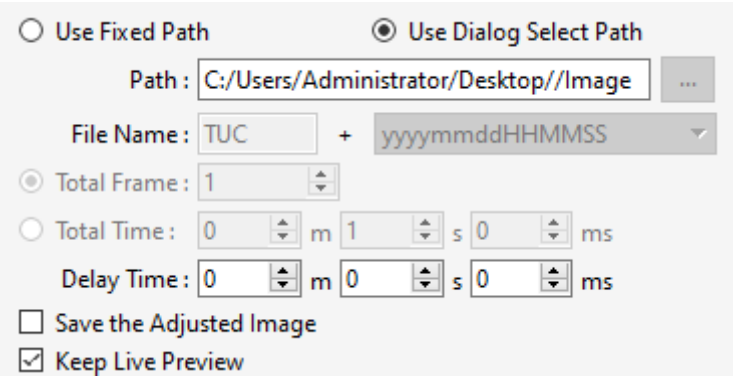
One-Shot AF: Select the area to be focused in the preview screen, camera will conduct focusing on selected area at one time. After procedure is completed, the focal length will stay unchanged even the sample or camera moves.

Focusing Position: Focusing location can be manually modified, the focal length of camera will change according to configuration.

C-Mount: Can be automatically moved to the C-Mount position.

5.5 Acquisition

5.5.1 Collection Settings



- **Use Dialog Select Path:** When selecting the pop-up save option, clicking the capture button will

trigger a save window to appear. Only one image can be saved at a time, and it is not possible to set the total number of frames or the total duration.

- Use Fixed Path:

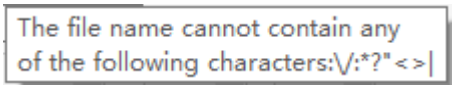
1) **Path:** Save the image file to the folder indicated by the defined path. Users can click the [Browse] button to modify the save path. The default save path is C:/Users/Administrator/Desktop//Image. Files can be saved to a shared disk.

Note:

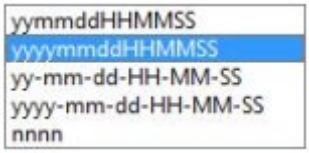
a. If a single image is taken, it will be directly stored in the defined folder path after shooting.

b. If multiple images are taken, create a new folder named after the date and time under the defined folder path, store the multiple images taken this time under this file, and the timestamp accuracy supports displaying to millisecond.

2) **File Name:** The saved file is named "TUC" by default, and it can also be customized. It supports "custom + timestamp" naming; the file name cannot contain special characters like \/:*?"<>|, special Characters cannot be entered, and an error message will pop up, and the maximum number of bytes can be customized to 64 bytes.



The timestamp supports five display formats, the default is yyyymmddHHMMSS; the timestamp precision supports display to milliseconds.



- **Total Frame:** Take images according to the set frame number.

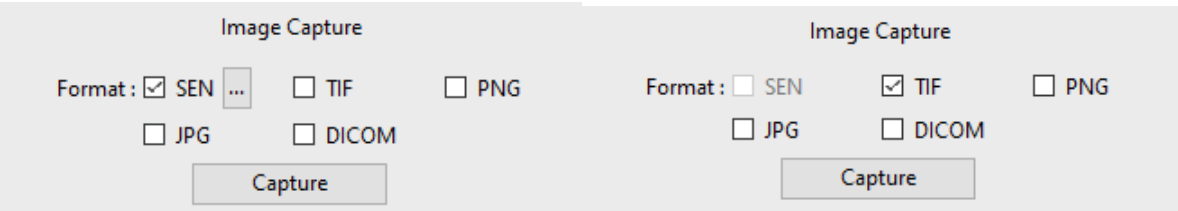
When saving to the internal memory for shooting, check how many images can be stored in the remaining memory. If the number of images taken exceeds the maximum number that can be opened, the number of images will be changed to the maximum number that can be opened.

- **Total Time:** Capture images according to set time. The range is 0ms~120min.
- **Delay time:** There will be a delay in capturing images based on the setting period; three time unit options: minutes, seconds and milliseconds, the default is 0 minutes, and the range is 0ms-120min.
- **Save the Adjusted Image：** After checking, all images and video data will have the parameters which include adjusted coloring, gamma, contrast, color scale, 3D noise reduction, integral effect, flat field correction, dark field correction effect, subtraction Background and reference subtraction, etc. if unchecked, the saved image is the original image, without coloring, gamma, contrast, color scale, 3D

noise reduction, integral effect, flat field correction, dark field correction effect, background subtraction and reference subtraction, etc. (Mono cameras support this function, and the default set is disable. Color cameras do not support this function and the default set is checked)

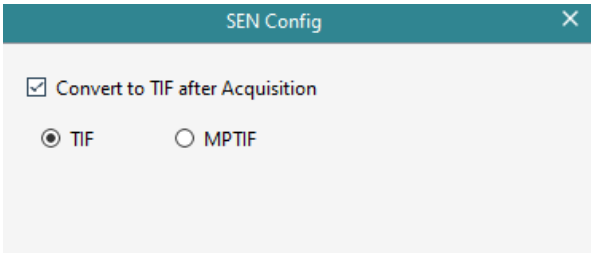
- **Keep Live Preview:** It is checked by default, if it is unchecked, the update of the main window will be prohibited, as well as the CPU and memory consumption during the acquisition process will be reduced. You can check it when you need short exposure and fast imaging.

5.5.2 Image Capture



- **File Format：** Support SEN\JPG \TIF\PNG\DICOM, mono camera defaults to SEN, while color camera defaults to TIF. Multiple selection is available.

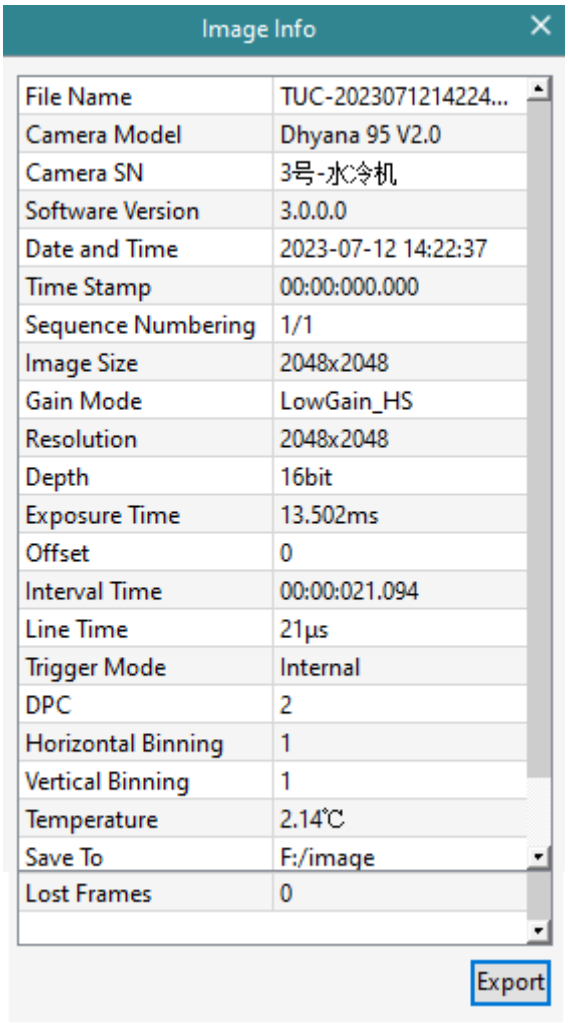
1) **SEN：** Custom file format, including file header information. (Color cameras do not support SEN output)



SEN configuration: Check the "Converting to TIF " option (unchecked by default) to automatically convert captured images to TIF format while retaining the original SEN format.

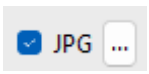
a. When selecting "TIF" (default selection), both MPSEN and SEN images captured by SEN will be converted to TIF format.

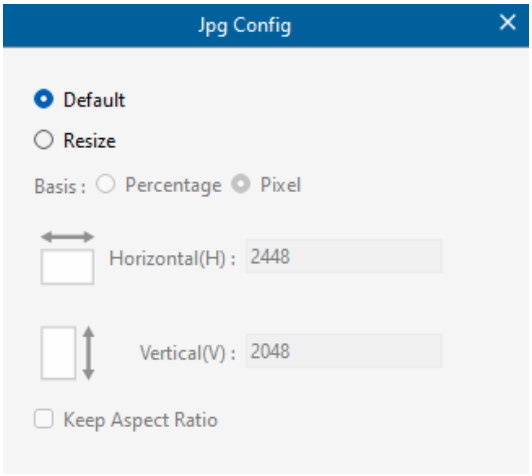
b. When selecting "MPTIF," if an MPSEN image is captured, it will be converted to MPTIF format. If a SEN image is captured, it will still be converted to TIF format.



JPG： Lossy compressed image format, the size of the image is small, but the quality of the original image data is reduced.

- **JPG Config：** Click the ... to provide Jpg format size setting. It can be found in the settings. When Jpg is selected to capture the image, the image size will be generated according to the settings.





1) **Default:** When the default is selected, the generated image keeps the current camera image resolution;
2) **Resize:** Check the resize to adjust the image size. The input is limited to more than 10000, and the input is limited to lager than 0. Closing the Jpg configuration pop-up window will refresh the minimum value. When the aspect ratio of the image is not checked, the horizontal and vertical ranges are 8-10000. While the aspect ratio of the image is checked, the minimum value of the larger pixel in the horizontal and vertical is 8, and the smaller pixel can be smaller than 8 in proportion. Smaller pixels have a maximum value of 10000 horizontally and vertically, larger pixels can be proportionally larger than 10000.
3) **Percentage/pixel:** Adjust images according to percentage/pixel. When a percentage is selected, the adjustment range is 1-200%. When pixel is selected, the adjustment range is 4-maximum resolution*2;
4) **Horizontal:** Set the size of the image in the horizontal direction;
5) **Vertical:** Set the size of the image in the vertical direction;
6) **Keep Aspect Ratio:** Check it to keep the image aspect ratio to prevent image distortion;

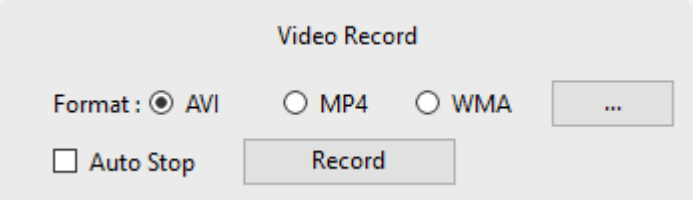
TIF： The lossless image format can save all the data transmitted by the camera without loss, and is suitable for the storage and conversion of images with high image quality requirements. It is recommended to use ImageJ professional image processing software to view TIF format images. Using software such as Windows Photo Viewer will cause the color of the image to be inconsistent with the actual color.

PNG: Lossy compressed image format, the size of the image is small, but the quality of the original image data is reduced.

DICOM： That is, medical digital imaging and communication, which is an international standard for medical images and related information. It defines a medical image format that can be used for data exchange with a quality that qualifies clinical needs.

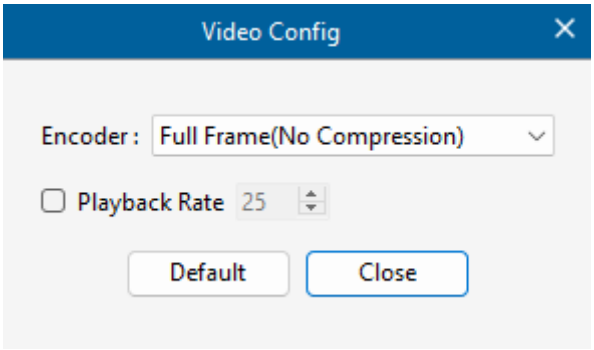
- **Capture:** Click this button to capture the image of the preview image, and click to stop during the shooting process to terminate the continuous capture in advance.

5.5.3 Video Record



Click [Record] to save the image data in the form of video, which is used to replay the dynamic changes of the observed sample process.

- **Format:** The video format supports AVI\MP4\WMA, does not support multiple selection, the default format is AVI. When the image width or height exceeds 4096 pixels, try to output image in AVI.
- Video config:



Encoder: The software provides two video recording modes. One is the uncompressed mode and the other is MPEG-4 compressed mode. Different formats generate different video sizes, and users can choose according to actual needs.

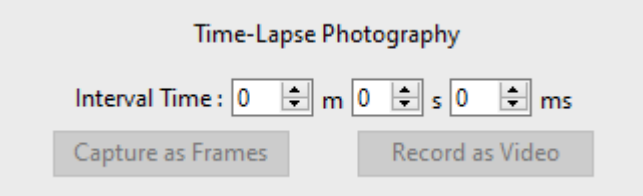
Playback Rate: That is, the number of frames played per second during playback, which is set by the user. If the function is checked, it means playback at the frame rate which defaults to 25 and ranges from 1 to 1000 frames.

Default: Restore the parameters of this module to the factory default parameters. The default compression encoding is full frame (uncompressed), and the video playback frame rate is 25 frames.

- **Manual stop:** Click [Record] to start shooting video. The video recording is not limited by the number of frames and time, therefore you can keep recording until you manually click [Stop Record] to end.
- **Auto Stop:** Check the automatic stop option to start recording video, then the automatic video recording will stop according to the number of frames and time set by the acquisition collection

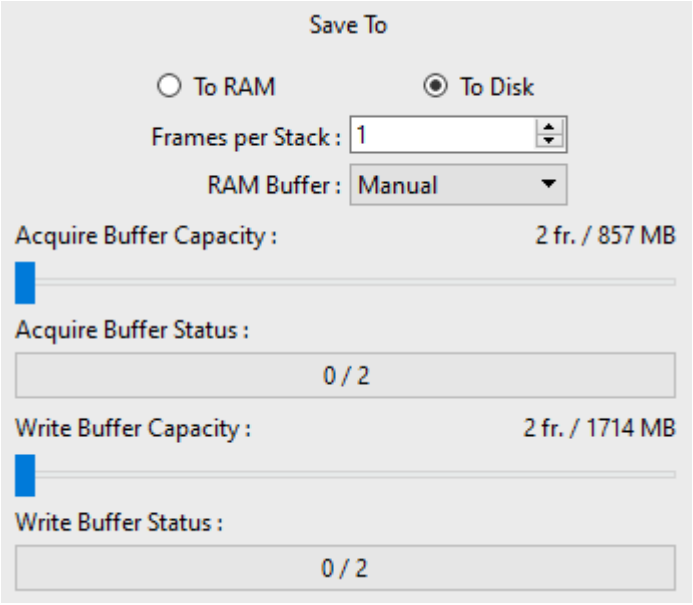
module.

5.5.4 Time-Lapse Photography



- **Interval Time:** The interval time of each image can be selected from time units of minutes, seconds and milliseconds. The default is 0 minutes, and the range is 0ms~120min.
- **Capture as Frames:** Capture multiple frames of continuous image data according to the preset conditions, then save as multiple images. You can click Stop to terminate the continuous shooting before the shooting is over.
- **Record as Video:** Capture multiple frames of image data according to the preset conditions and directly synthesize the video. If the shooting is not over, you can click [Stop] to terminate the continuous shooting in advance.

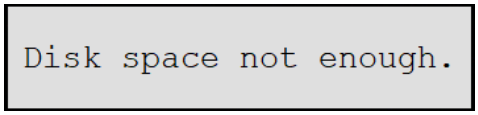
5.5.5 Save To



During the shooting process, when the disk space is less than 1G, the shooting will stop automatically, and a reminder of "Disk space not enough" will be displayed;

If the disk space is less than 1G before shooting, the "Disk space not enough" reminder will pop up, and the

shooting will not be performed.



- **To RAM:** First save the data in the computer memory, and then write the data to the ROM after the image is captured. In default configuration, the data would be stored to computer memory.
- **To Disk:** Instant read and write, directly write data to the rom during image acquisition. When taking images in this way, the frame rate of the camera will be reduced due to reading and writing data files, which is not suitable for rapidly changing scene requirements, and is suitable for long-term shooting.
- **Frames Per Stack:** It can only be set when selecting to save SEN and TIF images, and the default is 1fr. If the setting value is not 1, MPSEN or MPTIF will be generated.
- **RAM Buffer:** There are two options available for selection: Automatic and Manual. The default option is Manual.

Auto: When selecting "auto" mode, the capacity of the acquisition buffer for memory configuration is set to match the frame rate.

Manual: RAM buffer capacity can be manually configured.

- **Acquire Buffer Capacity:** Manually adjust the progress bar to configure the memory size, where the total progress bar represents the maximum available configuration of the current system. When the acquisition buffer is set to manual, the default is 2 frames. When the acquisition buffer is set to automatic, it defaults to the same number of frames as the frame rate. When conducting high-speed acquisition, it is advisable to increase the buffer size appropriately to prevent frame drops.
- **Acquire Buffer Status:** Display the buffer occupancy status in real-time during file transmission.
- **Write Buffer Capacity:** When saving to disk, the available settings correspond to the overall progress bar, which represents the maximum configuration currently supported by the system. When the write buffer is set to manual, the default value is 2 frames. When it is set to automatic, the default value is half of the total capacity in terms of frame count. Increasing the buffer size appropriately during high-speed disk capture helps prevent frame drops.

Write Buffer Status: When saving to disk, the available settings are displayed in real-time to show the occupancy status of the configured write buffer during the file transfer process. When the buffer occupancy reaches 90% of the set value, the progress bar turns red.

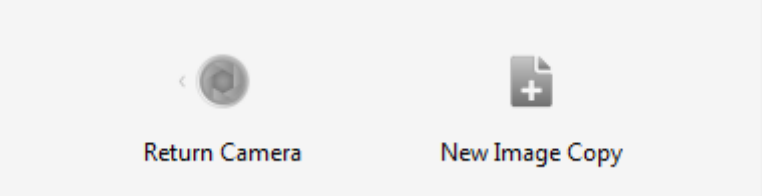
Note :

As the number of frames increases, the memory usage will also increase, which can cause frame drops. For SEN and TIF file formats, this number can be set to the same quantity as in the “Acquire Frames” box. For example, when acquiring 10,000 frames, if the stack size is also set to 10,000, only one large file will be

created on the disk. If it is generated as an MPSEN, it can be decompressed into individual SEN or TIF files. Or if it is generated as an MPTIF file, it can be imported into ImageJ as a single “virtual stack”.

6. STATIC IMAGE PROCESSING

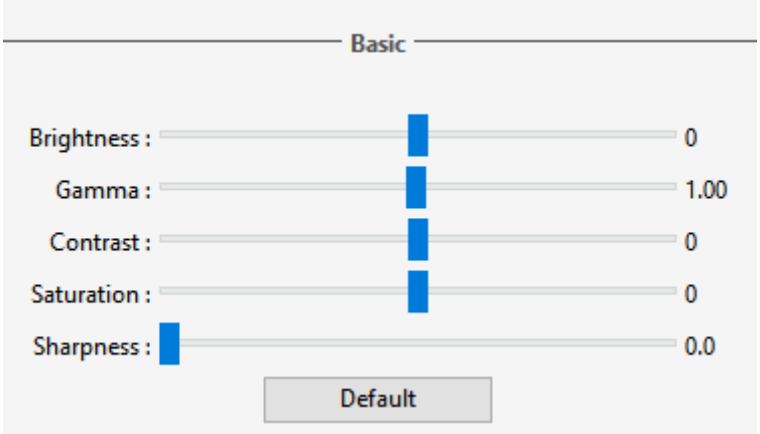
6.1 Hot Key



- **Return Camera:** Return to the image shooting interface from the image processing interface. When the camera is not connected, this shortcut key is disabled.
- **New Image Copy:** Generate a processed image, and generate a new image, which can be saved as a separate file.

6.2 Adjustment

6.2.1 Basic

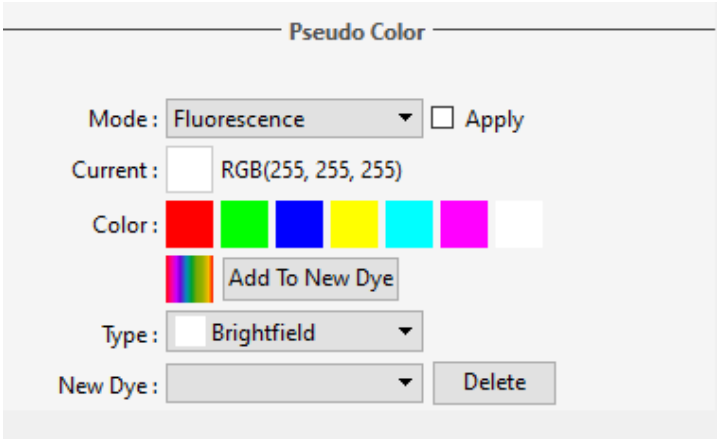


- **Brightness:** The brightness of the image, the default is 0, and the range is -255~255.
- **Gamma :** Correct the display brightness of the image on the monitor, the default is 1.00, and the range is 0.01~2.00.
- **Contrast:** The ratio between the darkest and brightest areas of the image, the default is 0, and the

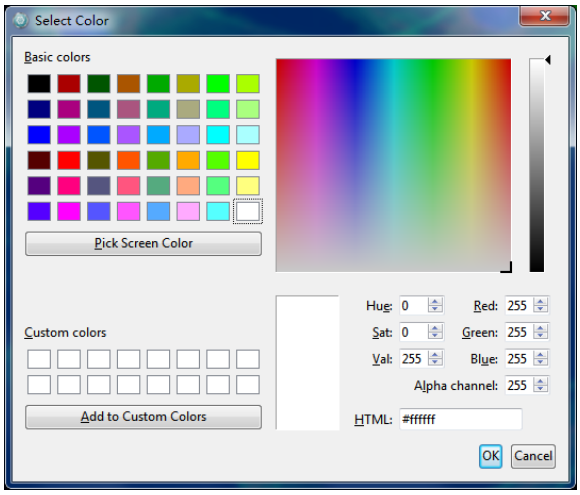
range is -80~80.

- **Saturation:** The purity of the color, the higher the saturation, the more vivid the color. The default is 0, and the range is -180~180.
- **Sharpness:** Focus on blurred edges, improve the clarity or focus of a certain part of the image, and make the color of a specific area of the image more vivid. The default is 0, and the range is 0~3.
- **Default:** Restore the parameters of the module to the factory default parameters.

6.2.2 Pseudo Color



- **Fluorescence:** It is generally used for monochrome cameras to take fluorescent images, and add pseudo colors to the images through software to achieve the effect of fluorescent coloring. The user selects a dye according to the needs, tick [Apply] to apply the selected color to the image, then you can uncheck to remove coloring. The stained image obtained by taking images can be used to synthesize a composite fluorescence image in the later stage.
- **Current:** Display the currently selected dye type, providing seven commonly used colors.
- Click  to call up the full color palette and choose richer colors. You can set the desired color by yourself through the color parameters on the right and click Add to Custom Colors for future use.
- **Add to New Dyes:** To add selected colors on the palette into the new dyes.



- **Dye Type:** Display seven common colors.
- **New Dye:** Displays user-defined dye colors.
- **Delete:** Delete the selected user-defined dye color.
- **Palette:** mono, red, green, blue, and color are supported. After selecting the color block with the mouse, check [Apply] and click the corresponding color to take effect. If the color block is not selected with the mouse, check [Apply] to take effect in mono.

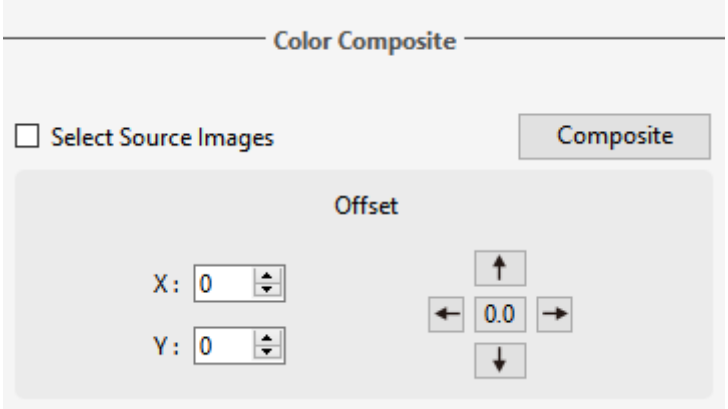
- In physical mode, it supports displaying pseudo-color bars in 5 modes, and the default is grayscale. The grayscale image data is mapped to the color range of the pseudo-color bar according to the minimum and maximum values of the histogram, and the pseudo-color mapping of pixels with different grayscale values changes with the change of the color scale.

6.2.3 Color Composite

In the research fields of biological related sciences, different fluorochromes are used to label different cell structures. On the applications of micro-fluorescent observations, a complete fluorescent cell image

contains multiple fluorescent areas which belong to different cell structure who has its own special affinity to certain of fluorochromes.

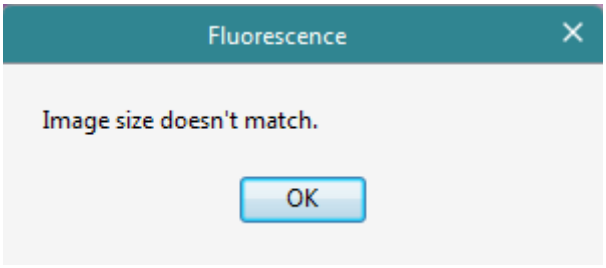
Due to the limitation to the wavelength of the emission fluorescence in the microscope turret, user can only observe one color of image each time. The specific operation is as follows:



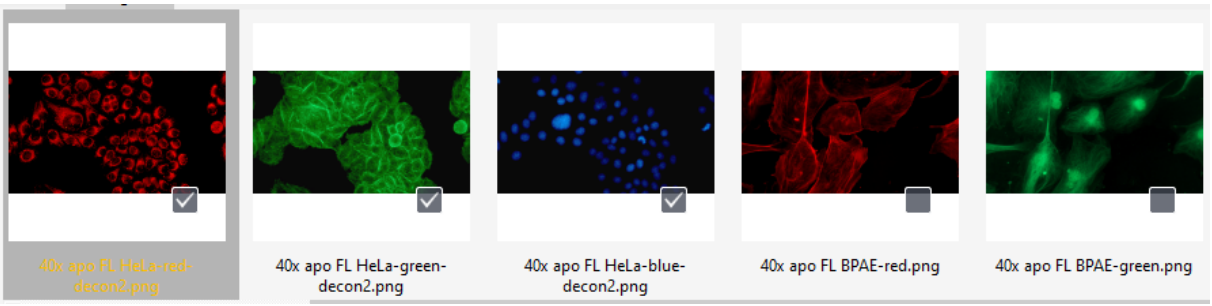
Under a fluorescence microscope, capture each fluorescence channel separately, and use the Composite function to merge the images of the camera under multiple fluorescent bands into a complete image.

1) Select the path to open any image that needs to be synthesized by fluorescence. Select the image which needs fluorescent channels combing from its path and open onto the window.

2) Click on [Start Color Composite] to select a group of images with the same observation field as the one opened before. There is no maximum number of images to select to combine into the composite image. The operating directions window will pop-up, as shown below.



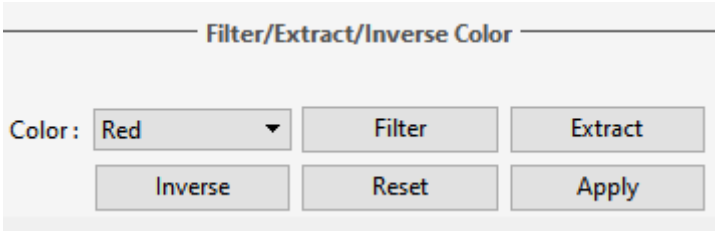
3) Use the check box in the file preview to select the original images desired for fluorescent synthesis on File Preview data bar, the synthesized image will be displayed on preview windows, as shown below.



4) Offset: When the fluorescence microscope switches the filter wheel, it may cause certain mechanical jitters, which will cause tiny pixel deviations when the images captured by the camera are superimposed. The currently selected original image can be slightly moved and adjusted to correct pixel deviation. A numerical unit represents a pixel, click 0.0 to return to the original point.

X/Y offset ±200, when the image resolution is less than 200, the X/Y offset setting cannot exceed the width and height of the image.

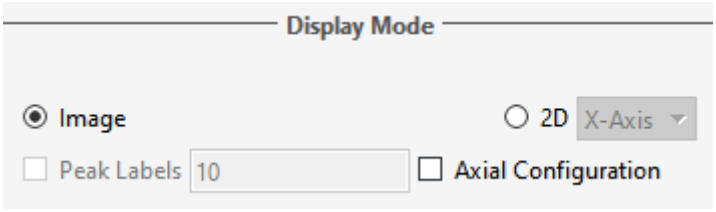
6.2.4 Filter/Extract/Inverse Color



- **Color:** Choose Red/Green/Blue channel.
- **Filter color:** Look at the color information in each channel, and combine the complementary color of the mixed color with the base color, and the result color is always the brighter color.
- **Extract Color:** Separate a certain color in RGB.
- **Inverted color:** Take the complementary color of the three channels of RGB.
- **Apply:** Apply the current parameter settings to the image, and generate a new image, which can be saved as a new image.
- **Reset:** Reset the parameters of the module.

6.2.5 Display Mode

In physical mode, it is used to perform grayscale statistics on images collected in a specific scene. Only some cameras in the sCMOS and USB3.0 black and white series support display.



- **Image:** Analyze the X and Y intensity of the image according to the position of the mouse. For example, the position of the mouse is at [255, 255], the gray value distribution of 255 rows and columns will be counted. The mouse is at the top middle position of the image by default. It is Pixel Number or Wavelength, and the scale is the resolution of the corresponding image. The calculation formula of the image scale is as follows:

  1) Take the upper left corner of the image as the coordinate origin and do not display the value of the origin, that is, do not display 0.

  2) By default, according to the longest side of the image, it is divided into 5 complete large scales, and between each large scale is divided into 5 complete small scales.

formula:

① After the length is divided by 5, it is rounded up;

② Calculate the length of the value in step ;

③ Calculate the corresponding length of 10 to the power of -1;

④ Divide the value of step ① by the value of step ③, round up, and multiply by the value of step ③ to calculate the maximum scale;

⑤ Calculate the value of the small scale according to the steps of ①~④;

⑥ Divide the value of step ④ by the value of step ⑤, round up, and calculate the actual number of small scales;

⑦ Calculate the final maximum scale by multiplying the value in step ⑤ by the value in step ⑥.

Units: pixels/tick.

Example: Resolution 2048 x 1152

2048 / 5 = 409.6 ≈ 410;

② 410 is 3 digits;

③ Calculate 10 to the power of (3-1) to be 100;

④ 410 / 100 = 4.1 ≈ 5 ; 5 * 100 = 500;

⑤ According to the steps of (1) ~ (4), calculate the small scale value as 100;

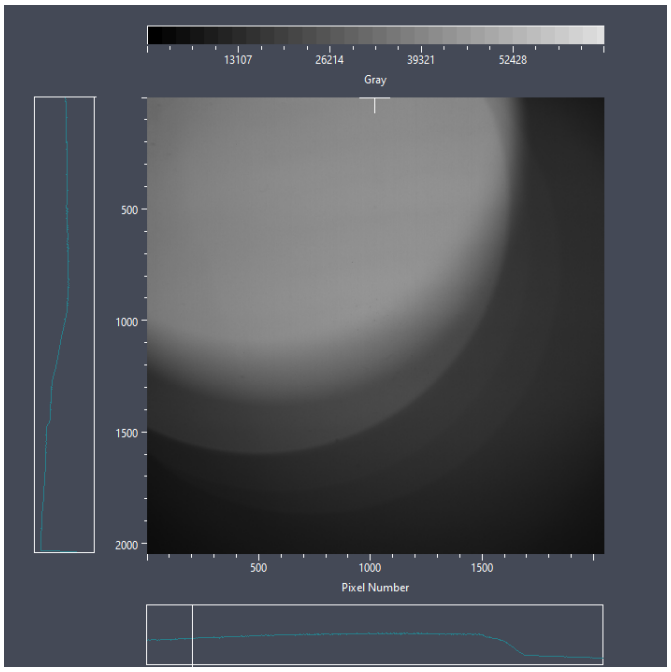
⑥ 500 / 100 = 5;

100 * 5 = 500. That is, large scale = 500; small scale = 100.

Image supports zooming in and out, and the corresponding scale will also be enlarged and reduced.

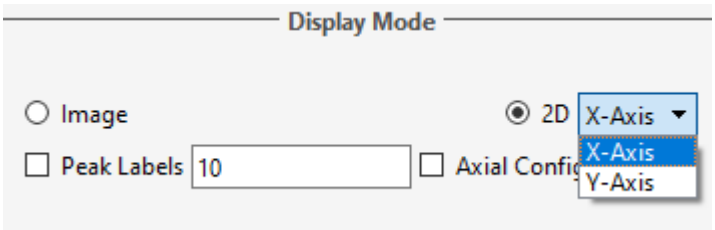
The current intensity distribution is shown above the image. The grayscale image data is mapped to the color range of the pseudo color bar according to the minimum and maximum values of the histogram, and the pseudo color mapping of pixels with different grayscale values changes with color levels.

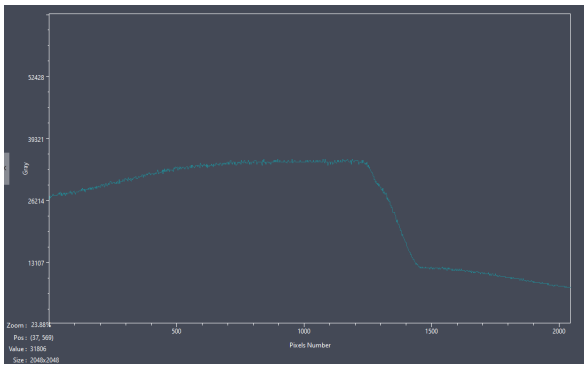
The lower-left corner of the image displays the coordinates and grayscale values of the current cursor position in real time.



➢ 2D

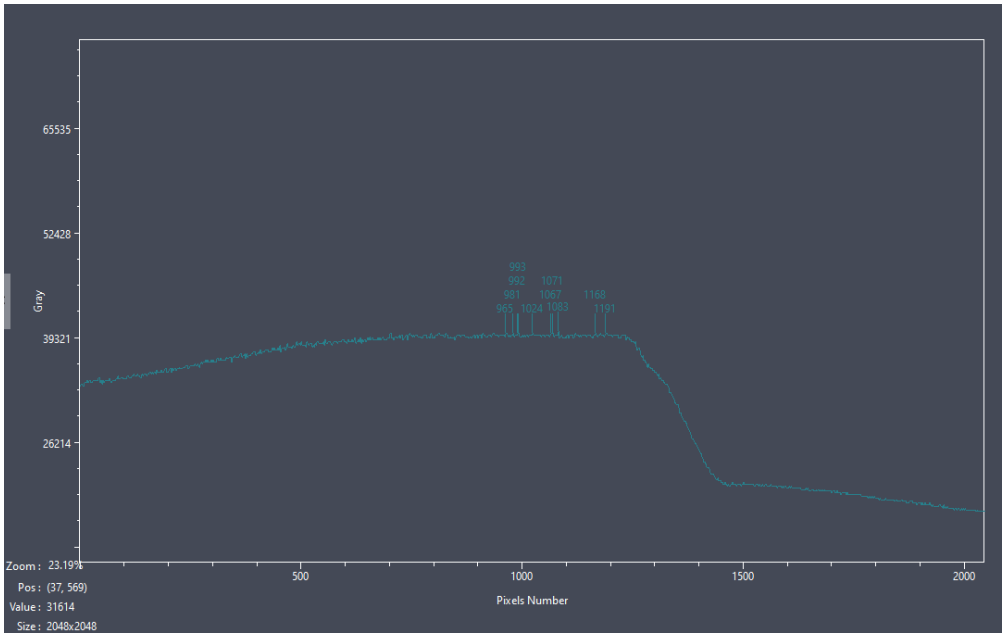
Analyze the single direction of the current mouse coordinate position, which can better analyze the strength of the current row or column. X-Axis and Y-Axis switching is available. The abscissa is Pixel Number or Wavelength, and the ordinate is Gray.





- Peak Labels

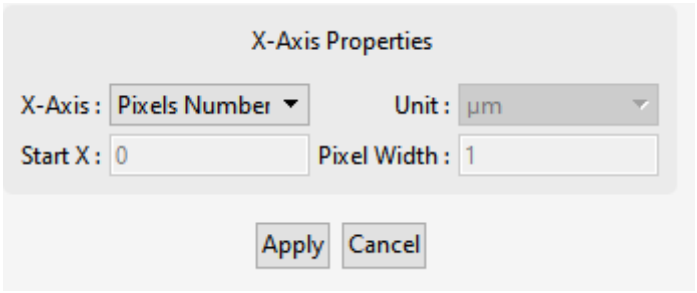
The maximum value mark of the waveform is supported in 2D mode, and the peak value label is not supported in the image mode. The maximum value mark is marked based on the automatic multi-scale peak search algorithm, and the final result will be sorted from large to large according to the gray value order. The number of tags can be set, the default value is 10, and the range is 1-200.



- **Axis configuration:** The abscissa supports switching between pixel number and wavelength unit. After the adjustment is completed, click Apply to take effect, and click Cancel to cancel the adjustment effect. When the unit is the number of pixels, the unit, X-axis start value and pixel width are grayed out and cannot be adjusted. When the unit is wavelength, the unit, X-axis start value and pixel width are lighted and can be adjusted.

X-axis initial value: the initial position of the X-axis, the input range is 0~4096;

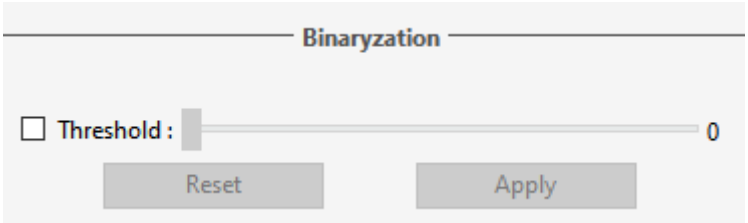
Pixel width: X-axis stepping, the input range is 1~2048;



6.3 Process

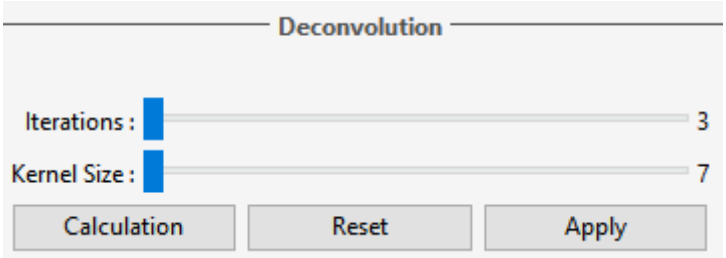
6.3.1 Binaryzation

CaptaVision+ software provides user with image binaryzation, which is to set the grayscale value of the pixels on the image from 0 to 255, it is the process of presenting the whole image with a distinct mono effect (A binary image, which is a digital image that has only two possible values for each pixel).



- **Threshold:** After checking, it can be adjusted from 0 to 255, reset and enabled by application.
- **Reset:** Click the reset button to cancel the parameters of the module.
- **Apply:** When the threshold parameter adjustment is complete, click [Apply] to apply the parameter settings to the image.

6.3.2 Deconvolution

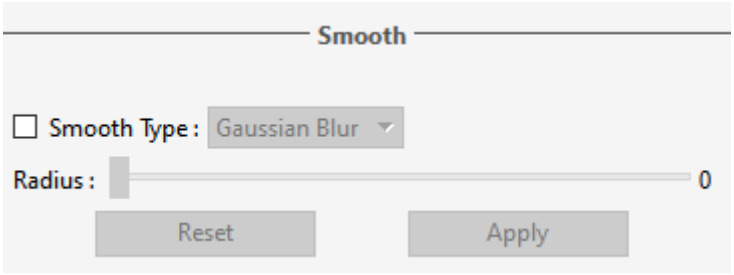


- **Iterations:** Number of iterations of the calculation.

- **Kernel size:** Deconvolution kernel window size.
- **Note:** Mac system and windows 32-bit system do not support this function. While Windows 64-bit system and the image is less than or equal to 5M pixels can be used.

6.3.3 Smooth

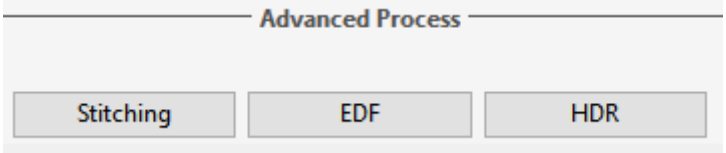
CaptaVision+ provides users with three image smoothing techniques, Gaussian blur, box filter and median filter, for image blurring. In order to reduce image noise and reduce the level of detail. The range is 1~30.



- **Smoothing type:** Gaussian Blur, Box Filter and Median Filter.
- **Radius:** Similar to Photoshop, the larger the radius, the stronger the image processing ability and the smoother the image.
- **Reset:** The parameters of the module can be restored to the factory default parameters.
- **Apply:** Apply the current parameter settings to the image, and generate a new image, which can be saved as a new image.

6.3.4 Advanced Process

CaptaVision+ provides users with three batch image post-processing technologies to merge a batch of captured images.

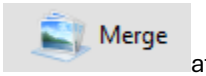


- **Stitching:** Stitch several images which have overlapping parts to one and other into a large, seamless, high-resolution image.
- **EDF:** Extract and synthesize a complete and clear image from a series of images of the same object with different focal lengths that are in focus. Pick up those images which were captured from the same observation field but not on the same focused planes, use those clear focused areas of each captured

image together to merge a new image which carries all clear focused areas in whole image. The EDF results are saved in the stitching folder under the file save path.

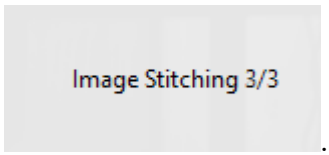
- **HDR:** Take a group of images with different exposure times, and then combine the three underexposed, moderate, and overexposed images to obtain a high dynamic range image. Take a batch of images with different exposure times, merge the three images which are the insufficient exposure one, the moderate exposure one and the excessive exposure one into new image with high dynamic range.

1) Choose a compositing method according to the user's needs, and select multiple images according to the prompt information. Take the depth of field expansion as an example, as shown in the figure below.

2) Then click on the [Combination] 

at the bottom of the interface.

3) The synthesis process needs to wait for a period of time, and there will be a progress prompt on the interface



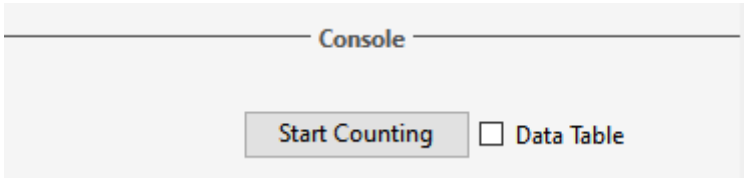
.

4) When the stitching is completed, a thumbnail of the combined image will be generated and present in the left menu bar as below.

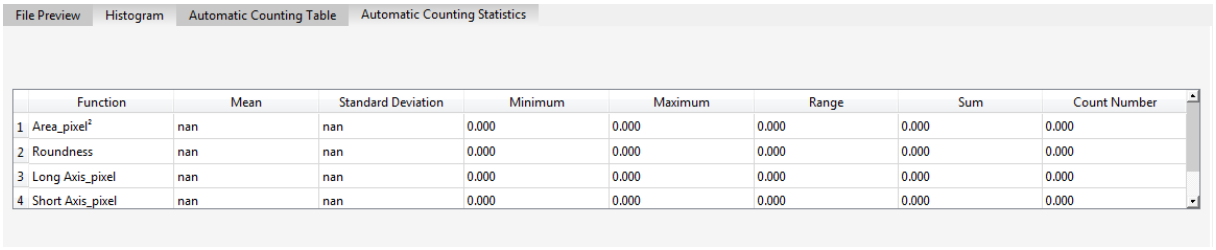
6.4 Automatic counting

6.4.1 Console

Automatic Counting setting interface as below show.

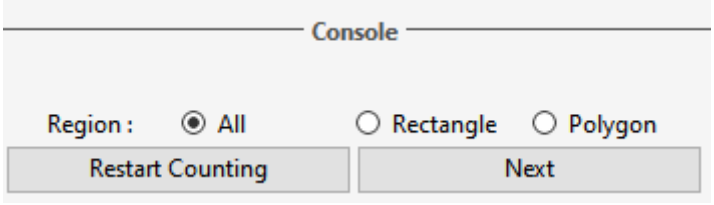


- **Data Table:** When checked the [data table] option, the "Automatic Counting Table" and "Automatic Counting Statistics Table" will be displayed in the data column. When the automatic counting is completed, the data will be displayed in the automatic counting table and the automatic counting statistics table. The automatic counting table shows the area, roundness, major axis and minor axis of each cell.

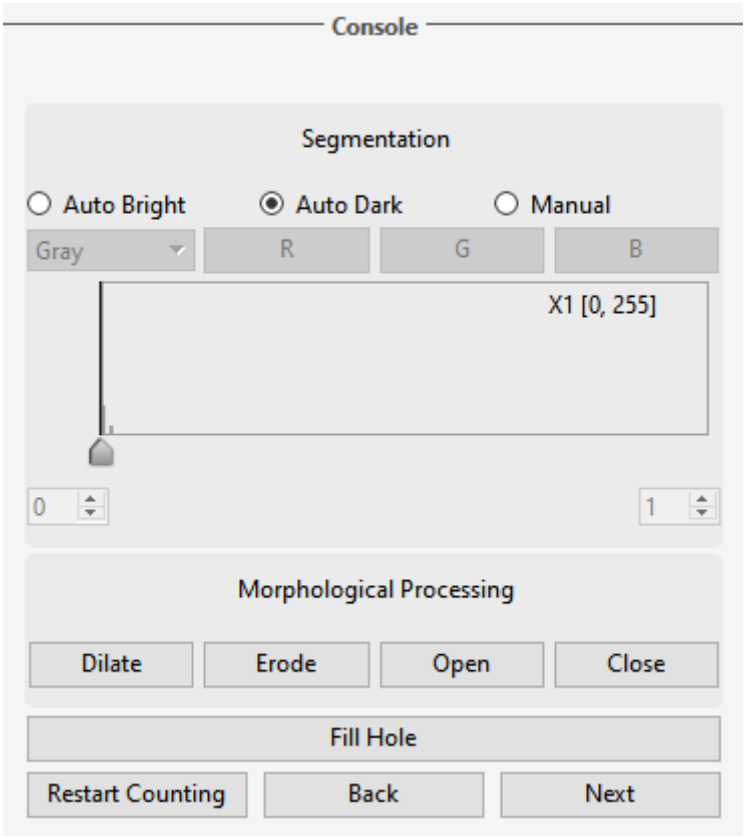


	Function	Mean	Standard Deviation	Minimum	Maximum	Range	Sum	Count Number
1	Area_pixel²	nan	nan	0.000	0.000	0.000	0.000	0.000
2	Roundness	nan	nan	0.000	0.000	0.000	0.000	0.000
3	Long Axis_pixel	nan	nan	0.000	0.000	0.000	0.000	0.000
4	Short Axis_pixel	nan	nan	0.000	0.000	0.000	0.000	0.000

- **Start Counting:** Click it to enter the counting process.

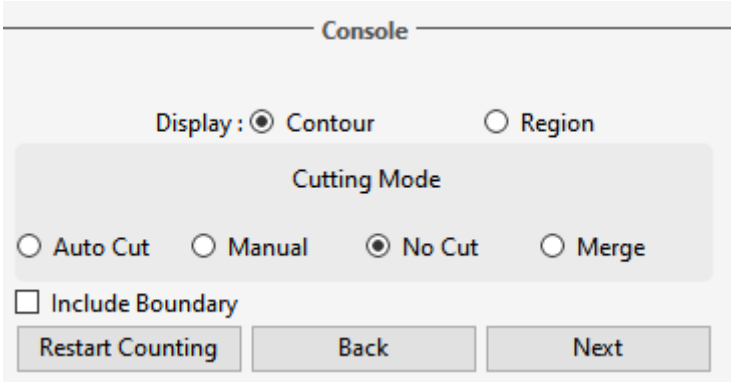


- **All:** The counting area is the full image.
- **Rectangle:** Left-click to select two endpoints to draw a rectangular image, and the counting area is the selected rectangular.
- **Polygon:** Left-click multiple times to draw a polygon, double-click to end the drawing, and the count area is the selected polygon area.
- **Restart Counting:** Back to the start counting interface.
- **Next:** Go to next step.

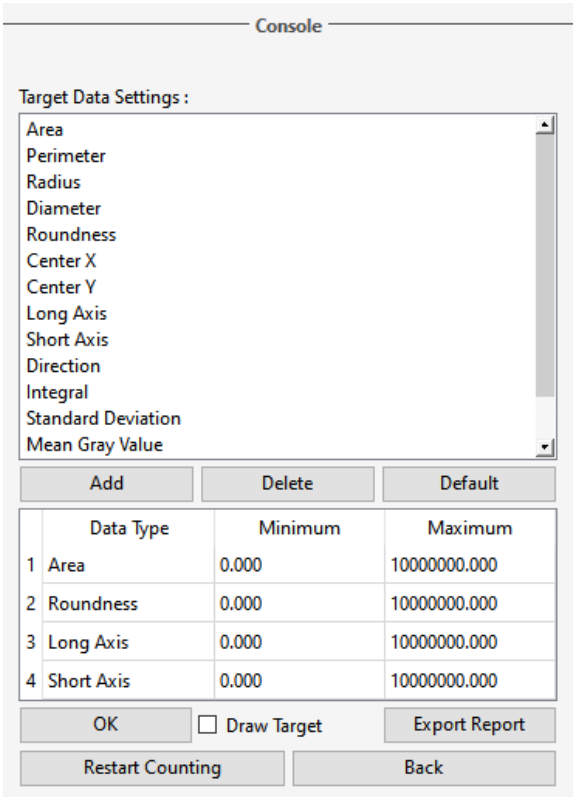


- **Auto Bright:** Use algorithms to automatically segment bright objects from the dark background;
- **Auto Dark:** Use algorithms to automatically segment dark objects from bright backgrounds;
- **Manual:** Manual segmentation is based on the histogram distribution of the image, which can be adjusted by the two vertical lines on the left and right in the histogram, or can be adjusted directly by inputting values in the upper and lower limit edit boxes of the histogram;
- **Dilate:** Change the size of the cells in the image to expand the borders of bright cells and shrink the borders of dark cells;
- **Erode:** Change the size of the cells in the image to expand the borders of dark cells and shrink the borders of bright cells;
- **Open:** Change the shape of image cells. Assuming that the image is a bright cell on a dark background, clicking this item will smooth the cell boundary, separate connected cells, and remove small black holes in the cell;
- **Close:** Change the shape of image cells. Assuming that the image is a bright cell on a dark background, clicking this item will fill in the gap of the cell, and at the same time stretch and highlight the cell that is close to it;
- **Fill Holes:** Fill holes in image cells

- **Restart Counting:** Back to the start counting interface;
- **Back:** Back to the previous operation process;
- **Next:** Go to next step;

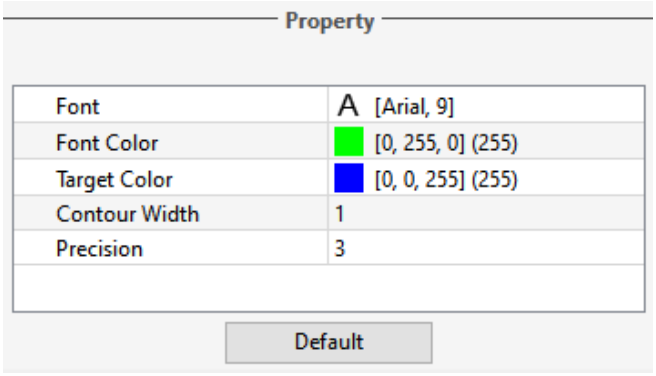


- **Contour:** Use contour lines to represent the divided cells;
- **Area:** Use padding to represent divided cells;
- **Auto Cut:** draw the boundary directly according to the actual contour of the divided cell;
- **Manual:** Manually select multiple points on the interface, and divide cells according to the selected points;
- **No Cut:** Do not divide the cell;
- **Merge:** Merge separate cells into one cell;
- **Bound Process:** When calculating the number of cells, cells with incomplete boundaries in the image will not be counted;
- **Restart Counting:** Back to the start counting interface;
- **Back:** Back to the previous operation process;
- **Next:** Go to next step;



- **Add:** Add the type of calculation to the statistical result;
- **Delete:** Delete type of calculation;
- **Minimum:** Set the minimum value for dividing cells, that is, cells smaller than the minimum value will not be counted;
- **Maximum:** Set the maximum value for dividing cells, that is, cells greater than the maximum value will not be counted;
- **OK:** Start counting cell data;
- **Draw Target:** Check this option after the automatic counting is completed, and you can manually draw the missed cells on the interface;
- **Export Report:** Export statistical cell data to Excel file;
- **Restart Counting:** Back to the start counting interface;
- **Back:** Back to the previous operation process;

6.4.2 Property



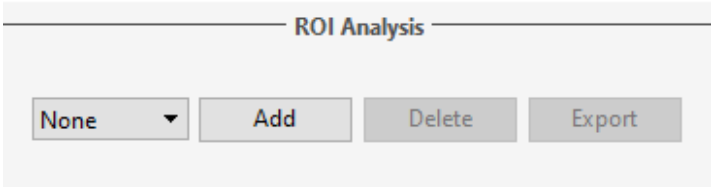
- **Font:** Set font and size, default is Arial, 9, click to bring up the font board to select the desired font;
- **Font Color:** Set font color, default is green, click to bring up the color palette to select the desired color;
- **Target Color:** Set cell display target color, the default is blue, select it and click to bring up the color palette to select the desired color;
- **Contour Width:** Adjust the cell display outline width, default is 1, range 1~5;
- **Precision:** Set the number of decimal places for the maximum and minimum values. By default, 3 decimal places are reserved. The range is 0~6.

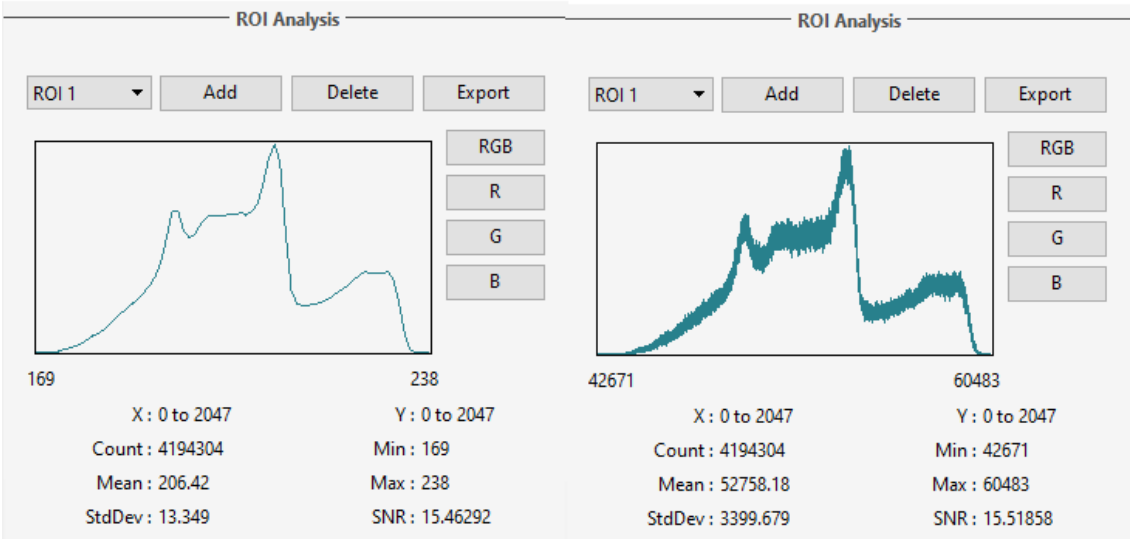
7. ANALYSIS

7.1 Analysis

7.1.1 ROI Analysis

Statistical histogram distribution of the ROI area, color images can be selected for the channel.





- **List:** When there is no ROI or none is selected, the histogram data analysis will not be performed. Display histogram and analysis data when adding or selecting ROI.
- **Add:** Click once, a new ROI area will be added in the drop-down box, and the software interface can be customized for box selection;
- When the mouse cursor hovers over the border of the ROI analysis, the cursor switches to a cross with four arrows  and can be moved. While the mouse cursor hovers over the four vertices of the border of the ROI analysis, the cursor switches to a two-way arrow  for stretching area;
- **Delete:** Delete the currently selected ROI area and the corresponding ROI area name in the

drop-down box.

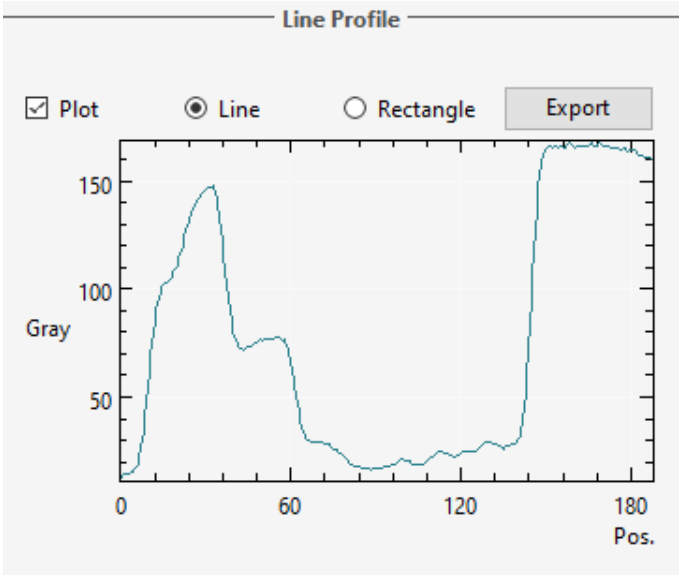
- **Export:** Support the export of currently selected ROI statistical information, and the export file type is ".csv".
- **Statistic Information:** The start and end coordinates of the ROI area, the number of pixels, the average gray value, the minimum gray value, the maximum gray value, the standard deviation, and the signal-to-noise ratio.

7.1.2 Line Profile

Measure the grayscale value of images, supporting two methods: straight and rectangular analysis.

- Operating Procedures:

1) Check the box to turn on;
2) Draw a line segment or a rectangle to measure the fluorescence intensity of the drawn area;
3) Save the current measurement data in. csv format locally.

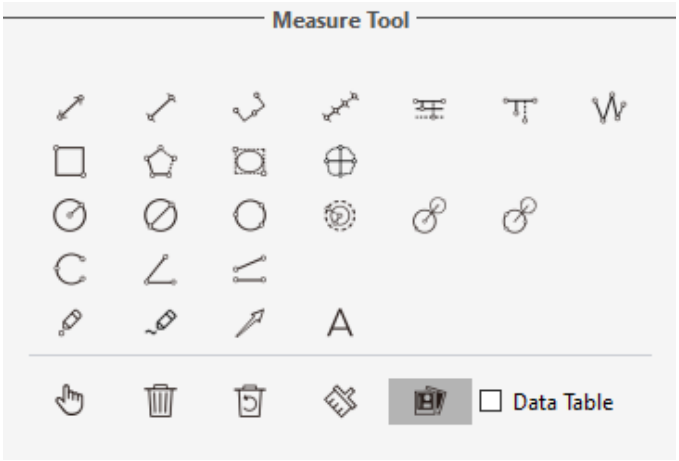


- Note：

a. line analysis, complete the drawing on the second click, and measure the fluorescence intensity data on the straight line.
b. Rectangle analysis, left click to select two endpoints to draw a rectangular graph, which can measure the average fluorescence intensity data of each column of pixels within the rectangular range.

7.1.3 Measure Tool

CaptaVision+ provides tools for images measuring. For example, if you want to know the distance between two points in the image, using the measurement tools, you can simply draw a line between the two points and get real-time measurement data.

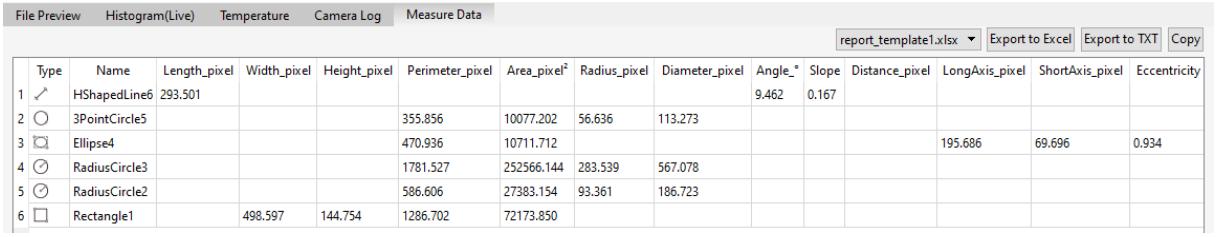


Measurement operations in the software are performed based on image pixels, for example, the length of a line feature is determined by the number of pixels along the line. Pixel-level measurements can be converted to more meaningful units such as millimeters or inches using measurement calibration.

- **Straight Line:** Draw a line segment graphic and then finish drawing with one more click, arrows at endpoints. Press [ctrl] to draw horizontal or vertical lines.
- **H Shape Straight Line:** Draw a line segment graphic and then finish drawing with one more click, vertical lines at endpoints.
- **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:** Draw a line segment, then left click again to draw its parallel lines, double- left-click to finish drawing.
- **Vertical Line:** Draw a line segment, then left click again, draw its vertical line, double- left-click to finish drawing.
- **Polyline:** Left click, add a new line segment to the existing polyline, double- left-click to finish drawing.
- **Rectangle:** Left click to select two endpoints to draw a rectangular, the length, width, perimeter and area of the rectangular can be measured,

- **Polygon:** Left click to draw the polygon multiple times, double click to finish drawing.
- **Ellipse:** Left-click to select two endpoints to draw an elliptical graph the perimeter, area, major axis, short axis, and eccentricity of the ellipse can be measured.
- **Roundness:** Select the first and second segment passing through the center of the circle on the contour of the measured circle. After drawing, the value of the degree to which the cross section is close to the theoretical circle is obtained. The value is equal to two. The difference of the secondary line segment is divided by two.
- **Radius Circle:** Left-click to select the center of the circle, and click again to define the radius length, then click to finish drawing.
- **Diameter Circle:** Click two times to define the two diameter endpoints separately to draw the circle, then one more click to finish drawing.
- **3Point Circle:** Click three times separately on the selected circle, and then one more click to finish drawing.
- **Concentric Circles:** Draw a circle with its radius, Click the position to be the center of the circle, then double click finish drawing.
- 4Point Double Circle: First click to position the center of the first circle, second click to define the radius length of the first circle. The third click to position the center of the second circle, the fourth click to define the radius length of the second circle.
- **6Point Double Circle:** 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:** Draw a curved line by taking three points on the circle, finish the drawing with the third click.
- **3Point Angle:** the angle between two connected lines. Click to draw the endpoint and intersection point of the two lines, take the third click to finish drawing.
- **4Point Angle:** the angle between two unconnected lines. Click to draw the endpoints of the two lines, position the intersection point and take the fourth click to finish drawing.
- **Dot:** Dot marking or dot counting, manually count the quantity of targets or mark them. And record the XY coordinate value of the point.
- **Paintbrush:** After clicking, you can draw any curve on the preview screen.
- **Arrow:** The arrow mark is made by two times of clicks.
- **Text:** Add a text note to the image.
- **Select:** The measured graphics or text notes on the image are able to be selected. When the mouse moved to the vicinity of the graphics or texts, the mouse symbol changes  to  , you can drag or use the [Delete] button on the keyboard to delete the selected graphics and text.

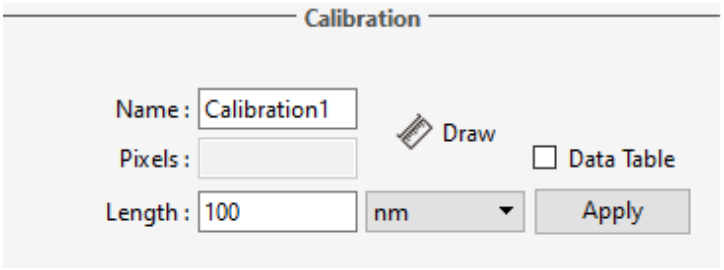
- **Delete:** To delete the drawn or measured graphs.
- **Back Undelete:** Undo the last delete operation.
- **Clear All:** Delete all the drawn and measured graphics or texts on the current layers.
- **Combined:** When saving an image, the drawn measurement graphics will be blended into the image. By default, this feature is disabled, but once enabled, the settings will be saved.
- **Data Property:** Each graphic has corresponding data type, such as length, angle, slope, diameter, perimeter, area and etc. Draw graphics after checking and the information will appear on images at the same time. If you don't want to display certain data information, you can uncheck the corresponding data types. This setting will be saved once applied.
- Click the right mouse button in the process of drawing graphics to exit the drawing directly and stay in the "drawing  " state, and click the right mouse button again to resume the drawing state.
- When the measurement is in the "unselected  " state, you can zoom in on the image, hold down the mouse and drag the image.
- When the measurement is in the "selection  " state, the image can be enlarged, and the graph can be changed by pressing and holding the endpoint  of the drawn graph.
- All the drawn measurement graphic information will be saved in the measurement table, click [Export to Excel] or [Export TXT file] to export and save the data, click [Copy] to copy the entire table to other places and paste it.



	Type	Name	Length_pixel	Width_pixel	Height_pixel	Perimeter_pixel	Area_pixel²	Radius_pixel	Diameter_pixel	Angle_°	Slope	Distance_pixel	LongAxis_pixel	ShortAxis_pixel	Eccentricity
1		HShapedLine6	293.501							9.462	0.167				
2		3PointCircle5				355.856	10077.202	56.636	113.273						
3		Ellipse4				470.936	10711.712						195.686	69.696	0.934
4		RadiusCircle3				1781.527	252566.144	283.539	567.078						
5		RadiusCircle2				586.606	27383.154	93.361	186.723						
6		Rectangle1		498.597	144.754	1286.702	72173.850								

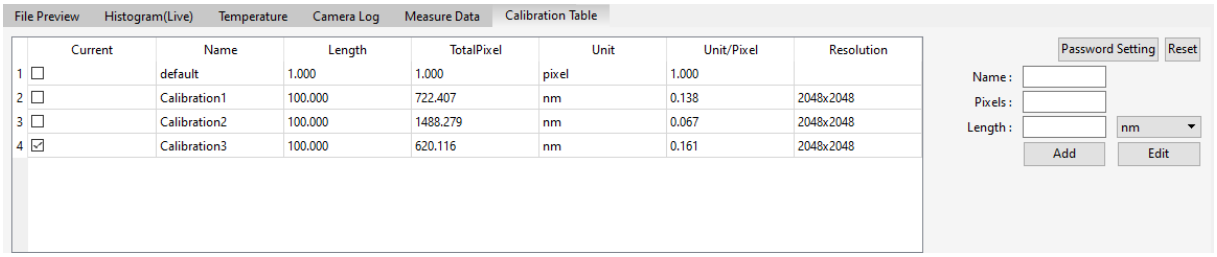
7.1.4 Calibration

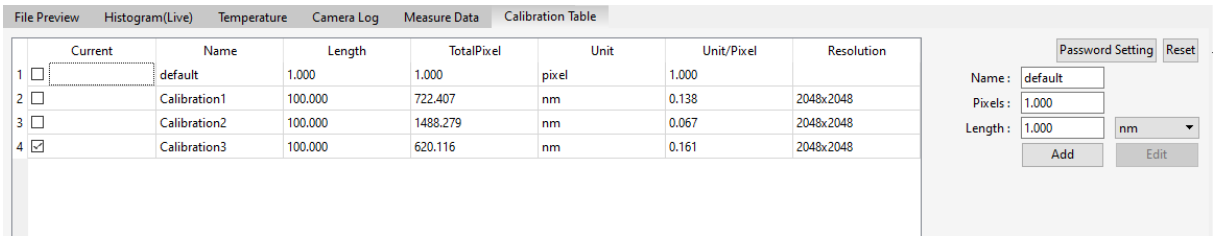
The calibration ruler converts the number of pixels into meaningful measurement units, and supports conversion units of nm, um, mm, inch, 1/10inch, 1/100inch, and 1/1000mil.



Operating Procedures

1) Click [Draw], and draw a straight line on the image, press [ctrl] to draw horizontal or vertical lines;
2) Enter the length and unit represented by the number of pixels of the straight line;
3) Enter a name for the calibration scale;
4) Click [Apply] to save and use the calibration ruler;
5) Check "Calibration Table" to view/edit: the user can create multiple sets of calibration scales at the same time for switching in multiple scenarios. Calibration scales can be viewed or edited in the calibration table.

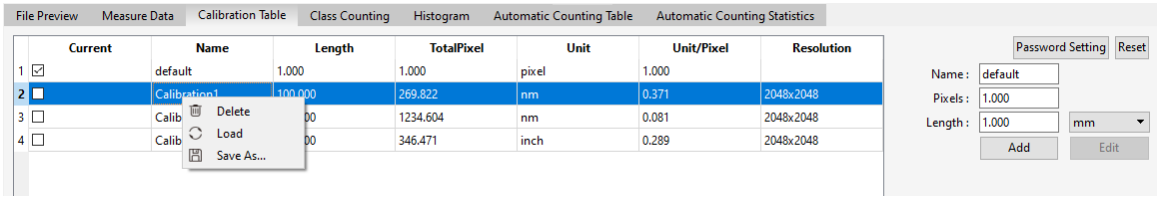




➢ Select a calibration scale and click to check the box under the current column to switch the calibration scale and apply it to all measurement items.

➢ Calibration table deletion, backup and loading steps

1) Open the calibration table at the bottom of the preview interface;
2) Select a calibration ruler with the mouse, and right-click to bring up the menu, as shown in the figure



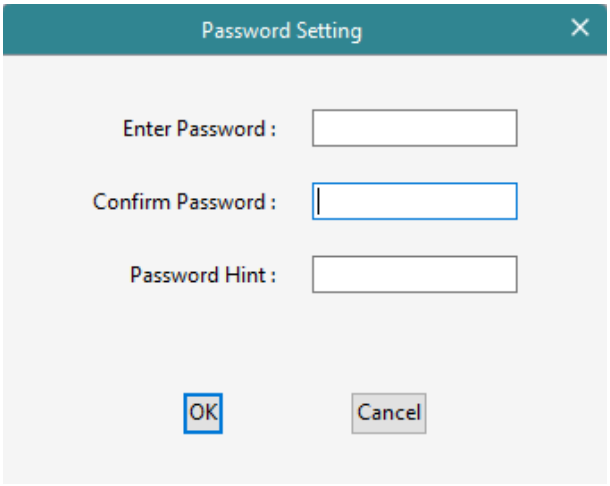
3) Click [Delete] to delete the selected calibration ruler that is not currently in use.

4) Click [Save As] to save the calibration.ini file in the pop-up dialog box.

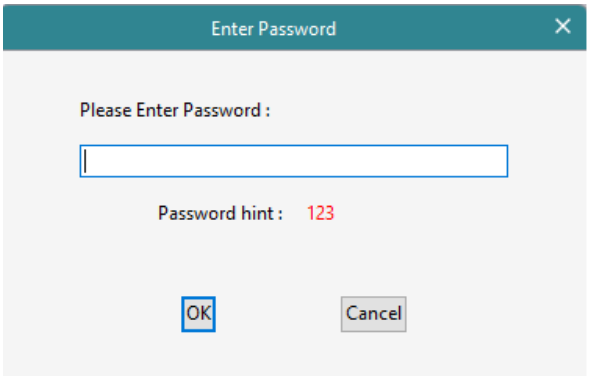
5) Click [Load], and select the calibration.ini file in the computer to import the backup calibration ruler.

➢ Calibration Table Encryption Settings

1) Set the password for calibration table encryption settings.



2) After the password setting is completed, password verification is required when performing operations such as creating a new calibration scale, deleting, loading, saving, adding, and editing.



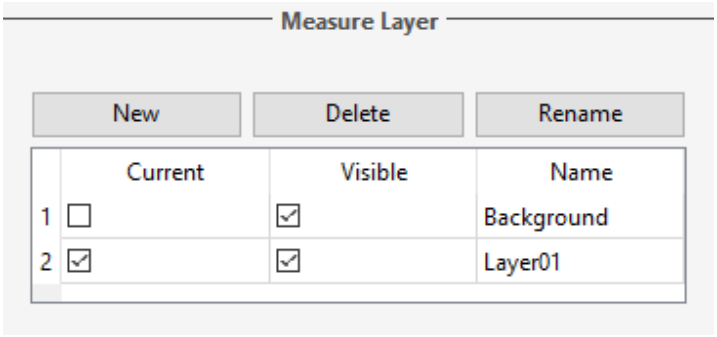
3) If you want to delete the password, you need to click the reset button. Then, enter the correct password, to finish the reset operation.

➢ Note:

a. Calibration can be performed more accurately with micrometer. Choosing the unproper calibration table can completely err the measurement results. When taking measurements on images, special care needs to be taken to select the correct correction table.

b. The default scale and the scale in use cannot be deleted.

7.1.5 Measure Layer



Measure Layer: Creating multiple layers on the image, user can make different measurements on different layers of the image. This layer creating module meet the needs of a large number of image measuring and image further processing applications.

Operating Procedures

If some targets on the current image have already been measured, the layer creating function will automatically create a [Background] and named it as [Layer 01], the current measurement results will be automatically displayed in [Layer 01].

You can choose to display the measurement data from different layers or choose to view the different layers.

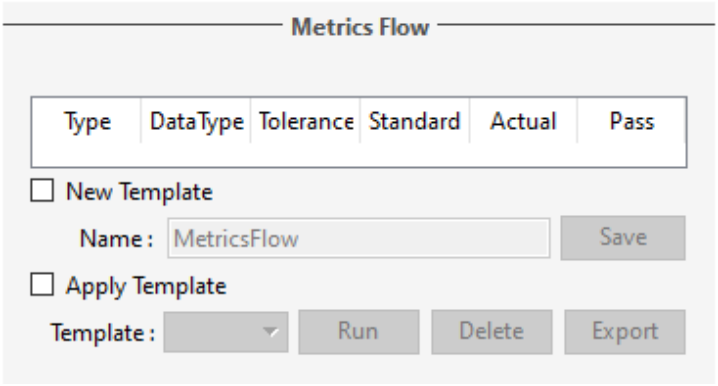
Check the box which the related layer belongs to under the defined window of [Current] to display the layer you want to preview. Check on different box to switch to different layer you want to display.

Check on the box under the defined window of [Visible] to display the measurement results of the corresponding layer.

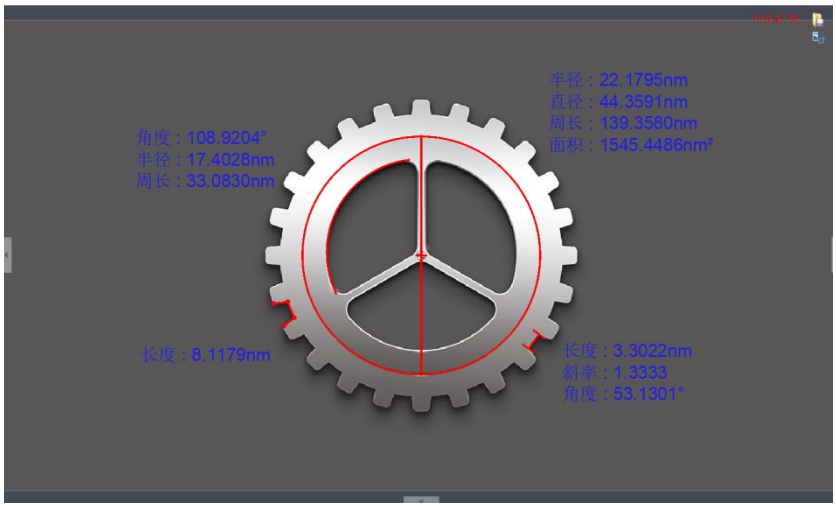
- **New:** Click [New] to create a new layer, you can customize the new layer name. The default layer naming principle is by [Layer 01], [Layer 02], [Layer 03], it means that the layer name with increased number, which related from early to later by the time the layer was created.
- **Delete:** Click [Delete] to delete the selected layer.
- **Rename:** Click [Rename] to rename the selected layer name.

7.1.6 Metrics Flow

CaptaVision+ provides powerful metrics flow function for convenient and semi-automatic measurements in the passing-rate detection of batches of industrial devices or parts.



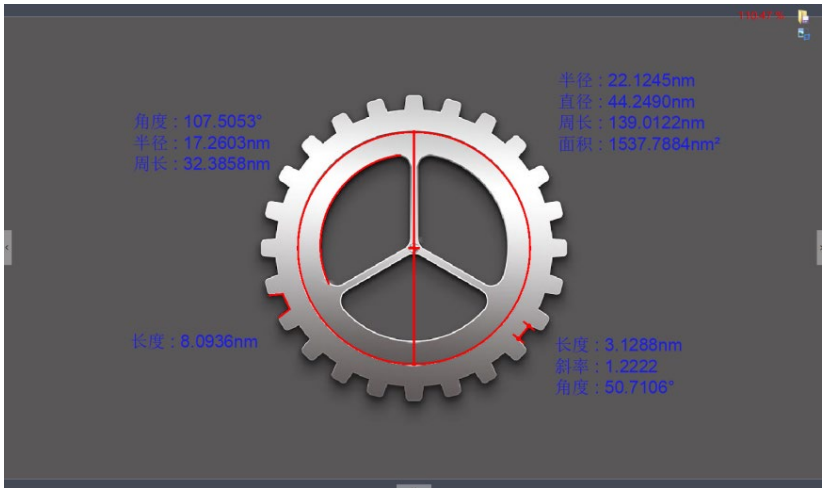
1) Open a group of the devices or parts images saved in the image gallery.
2) Select the image of the standardized sample (or we call this image as the reference image) to calibrate and set the tolerances for later measurements and detection;
3) Click [New Template] to create a new metrics template;
4) Use the different measurement tools to measure or draw any of the desired shapes on the reference image opened before. The running template will record the whole measuring or drawing process and save the measuring results or drawing graphics as the reference specifications.



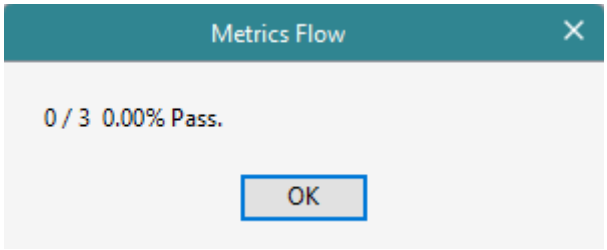
5) After setting the referencing information on the template, user can name the template personally, click **[Save]** to complete the setting and saving of the measurement flow template.
6) Click **[Apply Template]**, select the created template, click [Run] button to apply the template, click

[Delete] to delete the template created and saved before.

7) Select the image to be detected and operate as the procedure as that on creating template.



8) After the operating of the software on the image to be detected, [Run] button will be released and a window showing the detecting results will pop up automatically.



	Type	DataType	Tolerance	Standard	Actual	Pass
1		Area	0.100	1751.270	1535.325	No
2		Radius	0.100	21.011	21.532	No
3		Length	0.100	96.758	59.347	No

9) Click **[Export]**, to save as PDF format or export to in Excel format with the detecting results.

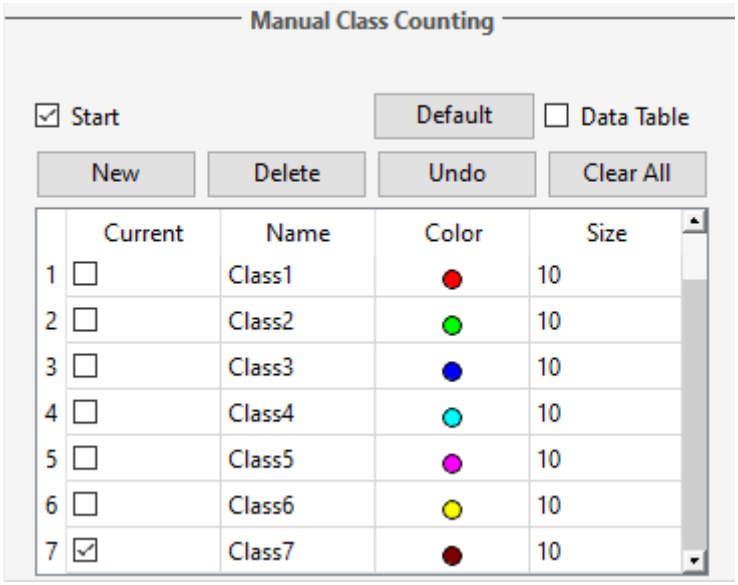
10) Continue to click **[Run]** to select the next image need to be detected, repeat the procedures of steps 7, 8, and 9 directed above;

11) After all the device detection is completed, click to check it to stop the measurement flow.

7.1.7 Manual Class Counting

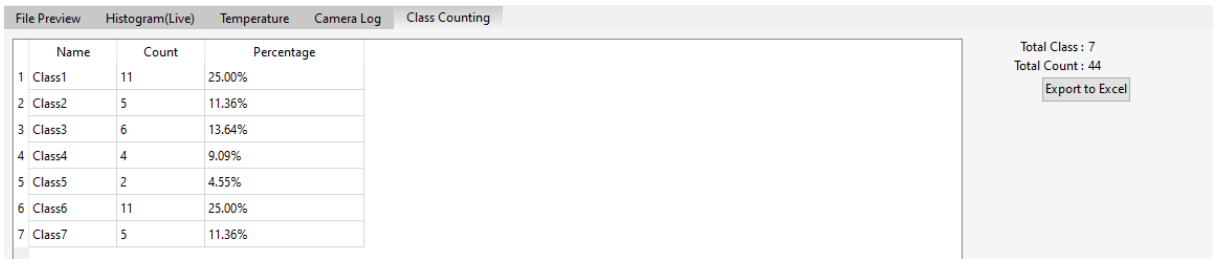
User can classify and count different categories of cells with the manual counter from the CaptaVision+

software, there are 7 different categories available.



- **Class Name:** Double-click the category button to name the category personally.
- **Color:** Click  to display the palette to choose the desired color.
- **Size:** Double-click the number to set the size of points, the default is 10, the range is 5-100.
- **Add New Class:** Click [New] to create a new category.
- **Delete Class:** Click [Delete Class] to delete the selected category.
- **Undo:** Click to undo the last operation.
- **Clear All:** Click [Clear All] to clear all categories .Restore category 1 to default and clear the whole counter table simultaneously.
- **Default:** After clicking, the class will not be cleared, but the size of all classes will return to the default 10;
- **Start Class Counting:** Click **[Start Class Counting]** to select a certain category, click the left mouse button on the targets on image to count. The counted results will be automatically display on the counting table.

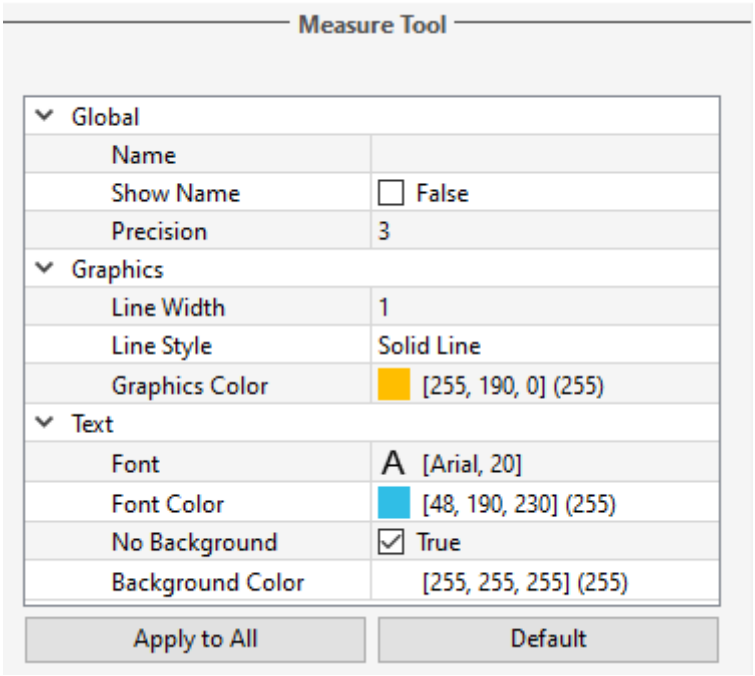
After the counting with one or different categories, all the counting results data will be displayed on the counting table, select **[Export to Excel]**, and export the data to the Excel forms.



7.2 Tool Properties

7.2.1 Measure Tool

This function is utilized for modifying the properties of all measurement tools. As shown below.



- Global:
  1) **Name:** Select the measurement information on the image to edit.
  2) **Show Name:** If checked, it will be displayed, or displayed.
  3) **Precision:** Adjust the display accuracy after the decimal point, the default is 3, and the range is 0~6.
- Graphics:
  1) **Line Width:** To display line width of the measurement tool currently applied on the image. The

default is value 1, the range is 1~5.

2) **Line Style:** Select the styles of measurement tools currently applied on the image. The default style is the solid line, and the software also supporting solid lines, dashed lines, dotted lines, dotted lines, and two dotted lines.

3) **Graphics Color:** choose the colors for the measurement tools applied on the image. The default color is yellow, colors could be chosen from [...].

- Text:

1) **Font:** Choose the font format for the currently applied measurement data, the default format is A [Arial, 20], click on ... to choose the desired format.

2) **Font color:** Choose the color for the currently applied measurement data, the default color is blue. Click on ... to select the desired color.

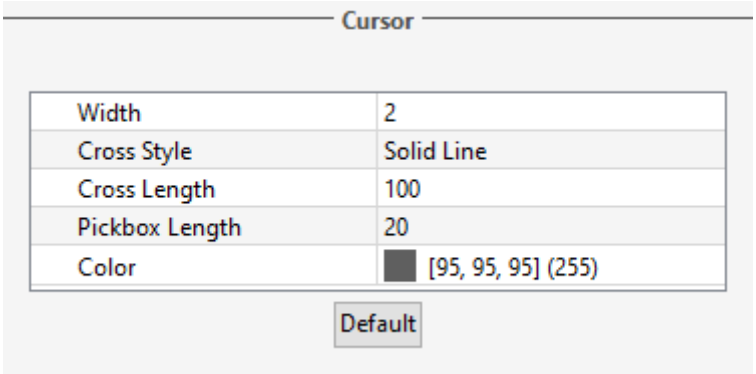
3) **No Background:** Check or uncheck the blank of True to set the background as transparent background, or with background, transparent background is the default setting.

4) **Background Color:** Select the background color for the current measurement data on the image. Click out ... to choose the desired background color, the default background color is white.

- **Apply to All:** Apply the current set parameters above to the all measured graphs.
- **Default:** Resort and apply the default parameters settings to the measured graphs.

7.2.2 Cursor

The user can adjust the properties of the measurement cursor according to actual needs. The setting interface is shown in the figure.



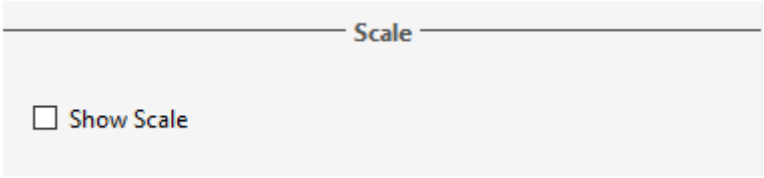
- **Width:** Used to set the thickness of the cross cursor line segment, the setting range is 1~5, and the

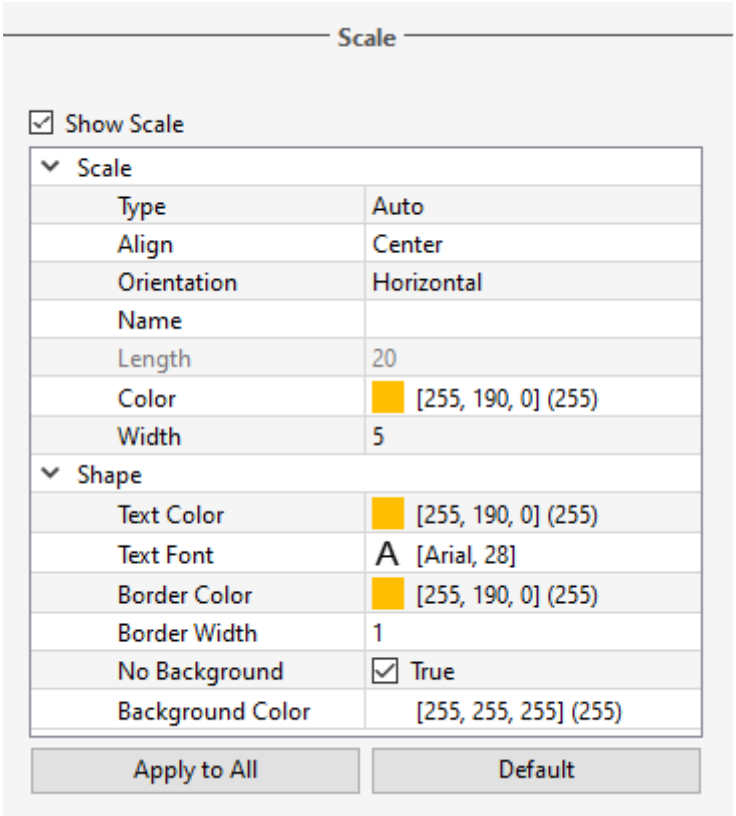
default value is 2.

- **Cross style:** Set the line style of the cross cursor, the default is solid line, and dotted line can be selected;
- **Cross length:** Select the length of the cross cursor currently displayed on the image, the default is 100; 50, 80, 100, 150, 200 are optional.
- **Pickbox length:** Select the width and length of the cross cursor that is currently displayed on the image, the default is 20; 0, 10, 20, 30, 40 are optional.
- **Color:** Select the currently applied cross cursor on the image to adjust the line color, select it and click the color palette to select the desired color;

7.2.3 Scale

CaptaVision+ allows users to adjust the scale property of the image for actual needs. As shown below.





- **Show Scale:** Check the box to display the scale on the measured image or not; the default setting is not showing the scale, if check to show the scale, the scale will automatically be shown on the left top of the image, use can use the mouse to drag the scale to the position he desires.

1) **Type:** select the display type of the current scale, support manual and automatic, the default is automatic;
2) **Align:** Set the alignment between the current scale and the value. It supports left, center, and right alignment, and the default is center;
3) **Orientation:** Set the display direction of the current scale, support horizontal and vertical, the default is horizontal;
4) **Name:** Create name for the scale applied o the current, the default setting is blank.
5) **Length:** Select the currently applied scale length on the image.
6) **Color:** Choose the color for the current applied scale on the image, the default color is yellow, click on  to choose the desired scale color.
7) **Width:** enter the value of width for the scale on applied the image, the default value is 5, range 1~5.

- Shape:

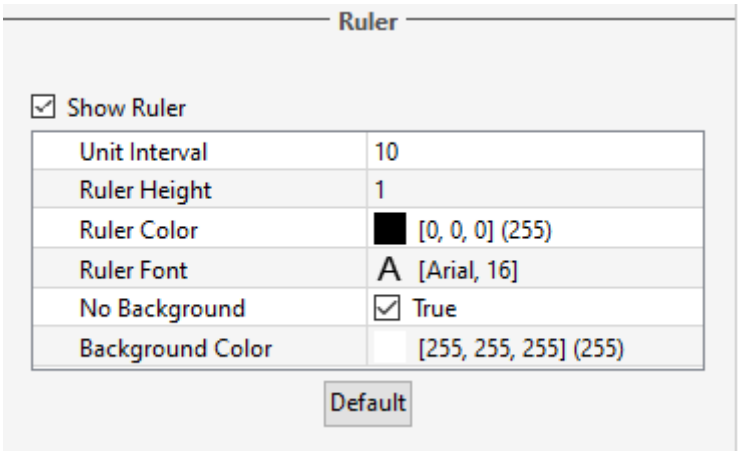
1) **Text Color:** Choose the color for text of the scale currently applied on the image, the default color is yellow, click on  to select the desired color.
2) **Text Font:** Choose the font format for scale currently applied on the image, the default format is [Arial 28], click on  to choose the desired format.
3) **Border Color:** Choose the color for border of the scale currently applied on the image, the default color is yellow, click on  to select the desired color.
4) **Border Width:** enter the value of width of the scale currently applied on the image, the default value is 5, range 1~5.
5) **No Background:** check or uncheck the blank of True to set the background as transparent background, or with background for the scale currently applied on the image, transparent background on the scale is the default setting.
6) **Background Color:** Select the background color for scale currently applied on the image. Click on  to choose the desired background color, the default background color is white.

- **Apply to All:** Apply settings to all scales.

- **Default:** Resort and apply the default parameters settings to the scale on the image.

7.2.4 Ruler

CaptaVision+ allows users to adjust the crosshair properties of the image according to actual needs. As shown below.



- **Show Ruler:** Check the box to display the crosshair on the image or not; the default setting is not showing the crosshair. When the function is turned on, it is centered by default, and the position of the crosshair can be dragged freely.

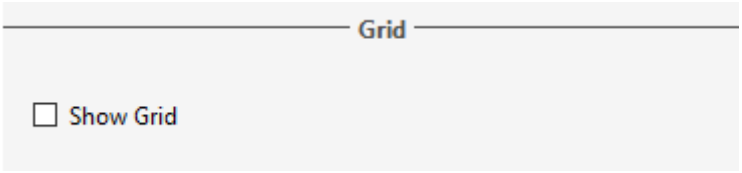
1) **Unit Interval:** Set current applied cross ruler interval distance on the image. The default is 10, and the range is 2~200.
2) **Ruler Height:** Set height of the currently applied cross ruler on the image. The default is 1, and the range is 1~10.
3) **Ruler Color:** Choose the color for the current applied cross ruler on the image, the default color is black, click on  to choose the desired cross ruler color.
4) **Ruler Font:** Sets the font size on crosshair;
5) **No Background:** check or uncheck the blank of True to set the background as transparent background, or with background for the cross ruler currently applied on the image, transparent background on the cross ruler is the default setting.
6) **Background Color:** Select the background color for cross ruler currently applied on the image. Click

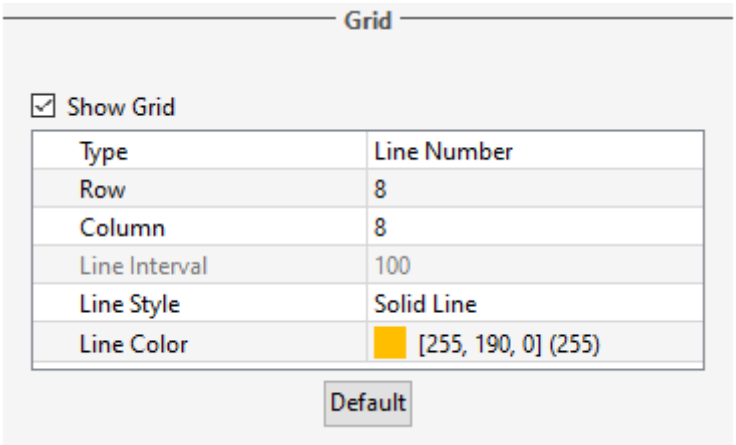
on  to choose the desired background color, the default background color is white.

- **Default:** Resort and apply the default parameters settings to the crosshair on the image.

7.2.5 Grid

CaptaVision+ allows the user to set the grid properties of the image according to his actual needs.





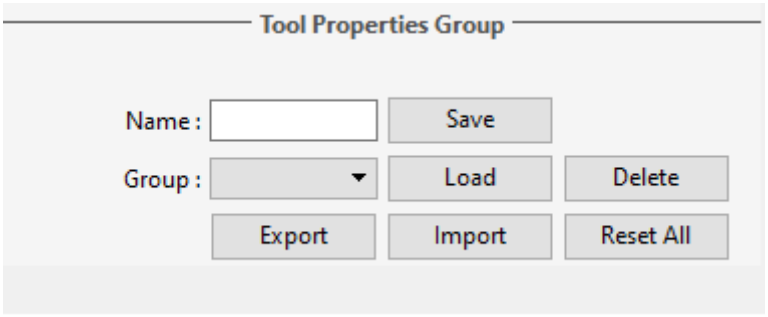
- **Show Grid:** check on the blank to select to display the grid on the image or not; the default setting is not showing the grid.
- Property:

1) **Type:** Select the way to set the grid to apply to the current image.
2) **Row/Column:** If you choose to define the line number, you can enter the numbers of the line on rows and columns applied on the image. The default numbers of row grid and column grid are both 8. The range is 2~500.
3) **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.The range is 2~500.
4) **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.
5) **Line Color:** Choose the color for the grid to apply on the image, the default color is yellow, click on  to choose the desired grid color.

- **Default:** Resort and apply the default parameters settings to the grid on the image.

7.2.6 Tool Properties Group

Copying and loading the files of parameter group to other computer platforms can realize the cross-platform applications of these parameters, so the user's experimental conditions are ensured to be as uniform as possible.



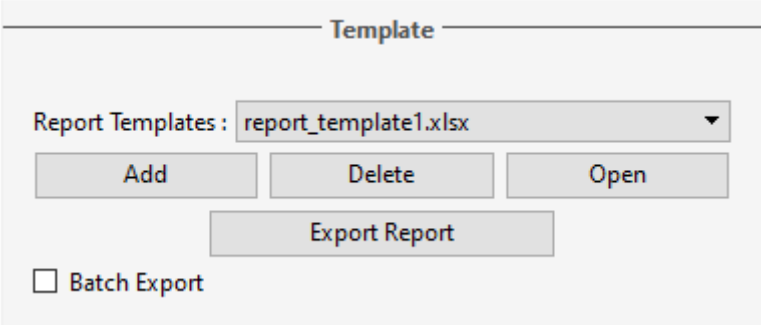
- **Name:** Set the parameter name, it can also be viewed and loaded through the drop-down menu.
- **Save:** To save the current parameters into a named parameter group file,
- **Load:** Load the parameter group to current working status.
- **Delete:** Delete selected settings;
- **Export:** Export selected settings;
- **Import:** Import settings file from drop-down menu;
- **Reset All:** Clear all parameters set by the user and restore to default settings of the software.

7.3 Report

CaptaVision+ provides exporting of measurement data information to generate working report documents. You can also export the report in real time when you in preview window. In addition to the default templates, custom templates are also available, and users can modify the report according to actual needs. Custom template, only supports excel format.

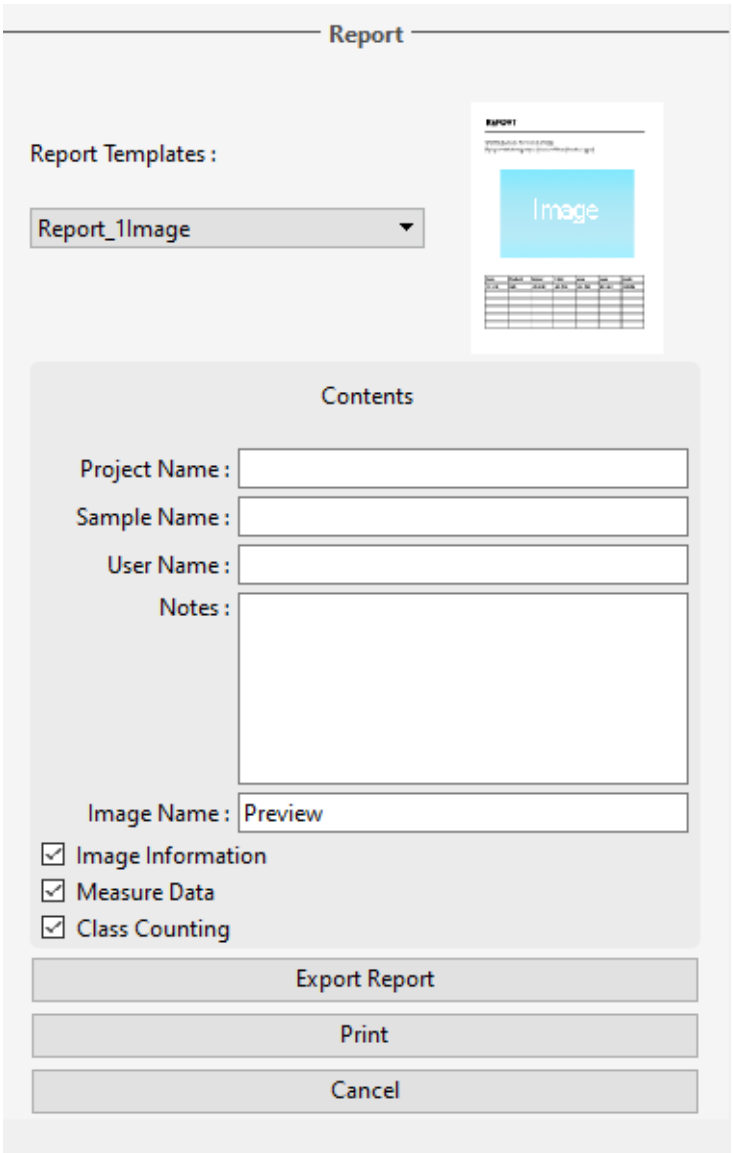
7.3.1 Template

The software provides the functions of exporting custom measurement templates, measurement data modules and batch export reports.



- **Report template:** Select a report template, you can choose a custom template name, and the default is a software template.
- **Add:** Add a custom template. The custom template must be modified on the software default template. The image size and data information can be modified. The template format is Excel. The default template is [templates] under the software installation path. Use the # identifier to indicate the content to be displayed. When the ## identifier appears, it means that the header of the data table is hidden.
- **Delete:** Delete the currently selected template.
- **Open:** Preview the selected template.
- **Export Report:** Export the current report information, the format is Excel.
- **Batch Export:** Check [Batch Export], the user can check the names of the images to be exported, and click [Batch Export] to export the report. The image name supports query.

7.3.2 Report



- **Report Templates:** Choose your desired format of report template.
- **Project Name:** Enter your personal name for the project you are working on, this name will show up on your working report,
- **Sample Name:** Enter the name of your sample in this project, this name will show up on your working report,
- **User Name:** Enter the name of the user, or conductor, or worker, or reporter,
- **Notes:** Enter the notes, supplement information or any or the comments you need to record down

from reference for this job in this working report,

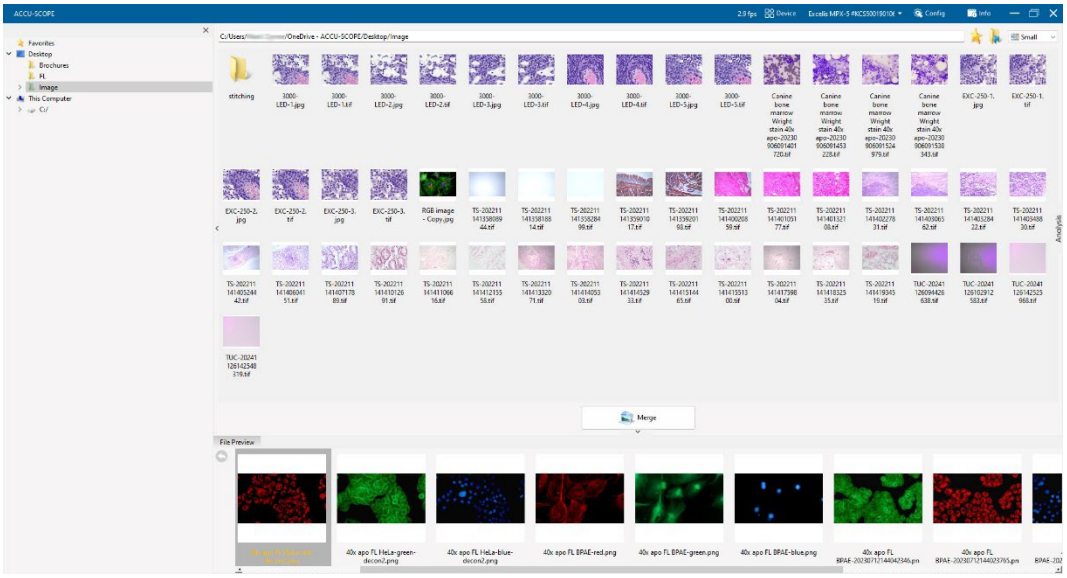
- **Image Name:** Enter the name of the image you captured before, then the image can automatically be loaded on the report.
- **Image information:** Check on the blank to show the information of the image you just pulled out, un-check to vanish the information, the default setting is showing out the information of the image on the report.
- **Measure Data:** In the report, display/do not display the current image measure data, default checked.
- **Count Table:** In the report, display/do not display the current image count table, default checked.
- **Export Report:** Export current report into a document of with PDF format.
- **Print:** Print the current report.
- **Cancel:** Cancels this operation, it means clearing out all the report information just entered or loaded in.

8. DATA

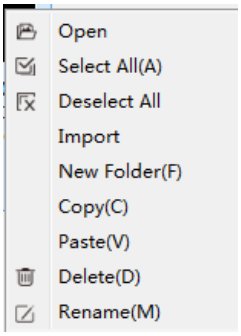
8.1 File preview

The bottom part of the software displays the captured images, videos, and thumbnails of images and videos opened by other paths. Image shows emission reduction by time from left to right. To click any image to switch to the [Static Image Processing] interface in order to adjust the parameter settings. The specific operation is as follows:

1) Click the button  to open the file path window, and the button changes  , as shown in the figure below. Select the image path to import and open, select the photo and double-click to add it to the file preview window below, it will also be displayed in the main interface. Right clicking [import] would only display the image file in the file preview window. Click  to exit the file path window.



2) Select an image in the file path window or right click on any blank area of the interface to call up the operation menu, as shown in the figure below.



a) Support Open, Select All, Deselect All, Import, New Folder, Copy, Paste, Delete and Rename. Click to open a file, and the thumbnail of the image will be displayed in the data column, and displayed on the preview interface at the same time. Click Import, and the thumbnail of the image will be displayed in the data column, but not on the preview interface.

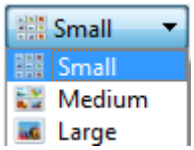
b) You can use the ctrl+c shortcut key to copy the image, and use ctrl+v to paste it in the current folder.

c) Select the folder path on the left, click the button X on the upper right corner to close the current window and return to the main interface of the software.

d) The path bar and all images under the current path are displayed below.

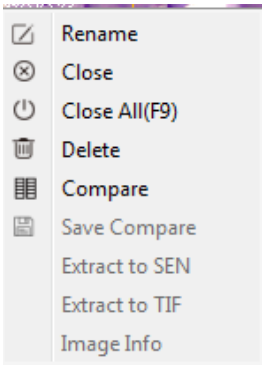
e) Click the button to add the current path to the favorites, and you can directly enter this path next time. Click the button to return to the previous directory.

f) Click the button in the image below to choose the way to view images.

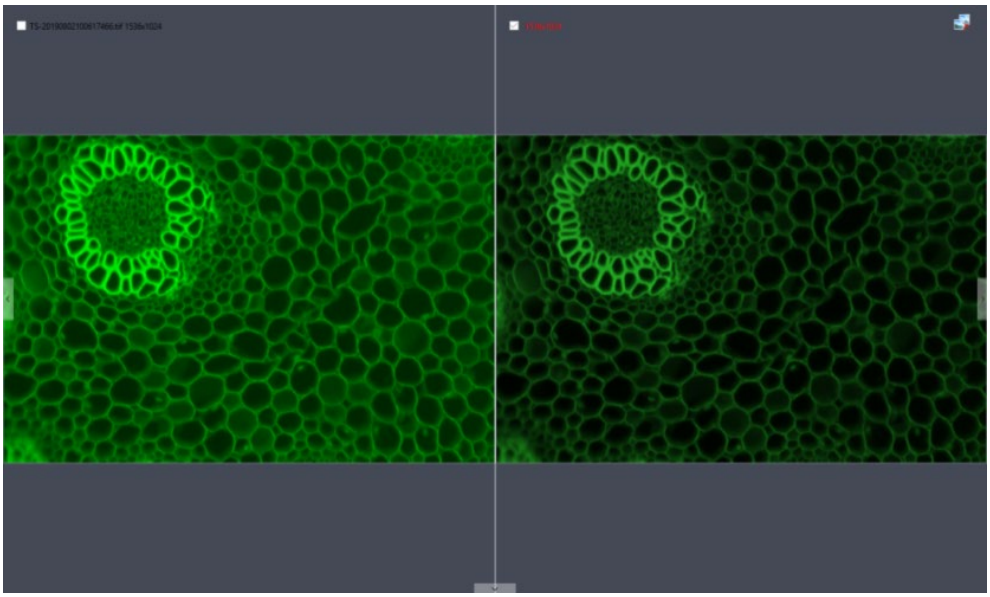


3) Select a image or click the right mouse button on the blank area of the thumbnail interface to pop up the operation menu, under which, rename, close, close all, delete, compare, save and compare, decompress to SEN, decompress to TIF, image information (only .SEN file format support) operations are able to performed.

➢ Only MPSEN supports decompression to TIF and SEN.



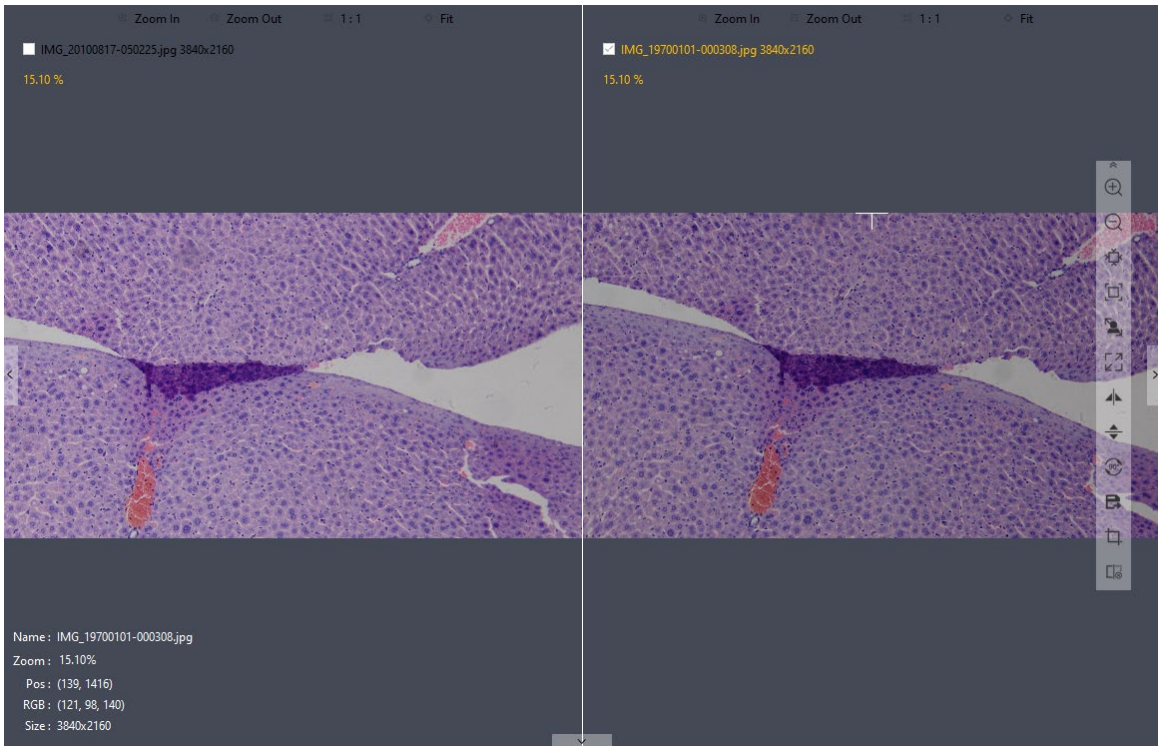
4) There are two contrast mode: dynamic contrast and static contrast.



- Dynamic contrast: The contrast between preview image and saved image. In preview status, right

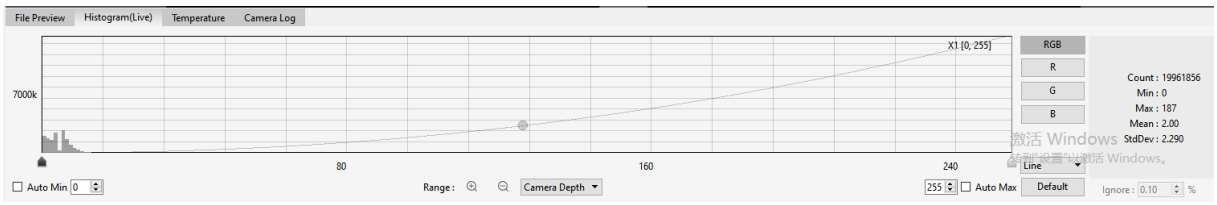
click image bar will eject operation menu, then select [Contrast]. Dynamic preview image will appear on the left side of the page, any saved image selected on image bar will appear on the right side, and the images on the right side can be replaced at anytime. Click  on the right upper corner to exit contrast.

- Static contrast: Contrast between two saved images. Selecting an image, and by right clicking image bar, the operation menu is popped out; then selecting [Contrast], the selected image will appear on the left side of the page. Clicking another image on the right side of image bar, it will appear on the right side. During static contrast, images on both sides can be replaced at anytime: firstly, click the image which needs to be replaced, and then click the image to replace; the process will be completed.
- When the physical direction is compared and counted automatically, the coordinate system, intensity curve, and color card are not displayed.

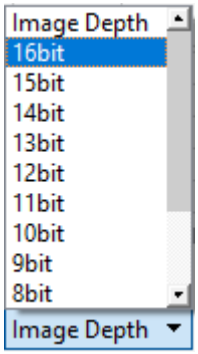


8.2 Histogram

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



- **Levels Adjustment:** Redefine R/G/B in each path, and then proportionally redistribute the pixel value among them. The adjustment of image's color scale can enlarge highlight area of the image and brighten image, as well as to darken the brighter image; RGB three paths can be adjusted separately to change the color of image in corresponding path.
- **Manual level:** Users, with histogram, can manually adjust the dark shade (left color scale), gamma and highlight brightness level (right color scale) to calibrate image shade tone, including contrast, shade and image hierarchy, and to balance the color of the image.
- **The histogram shows:** The histogram display mode is optional, and the options are linear and logarithmic.
- **Default:** Click the default button to restore the parameters of the module to the factory default parameters, and the default manual color scale.
- **Ignore:** Set the automatic color scale according to the current image gray value to improve the image contrast. When the ignored value is 0, the automatic color scale will not be turned on. The larger the ignored value (up to 49.9%), the smaller the difference between the left and right color scales, and the higher the image contrast. The smaller the ignore value (minimum 0%), the bigger the difference of the color scale between the left and right levels, and the lower the image contrast. Set the ignore value to take effect after checking, and the left and right color scale is checked to automatically enable.
- **Histogram bit depth:** As shown in the figure, the current image display bit depth can be set under the histogram to observe the histogram as a whole, or realizing a partial observation through zoom in the histogram. Users can customize and select the required bit depth;



Note:

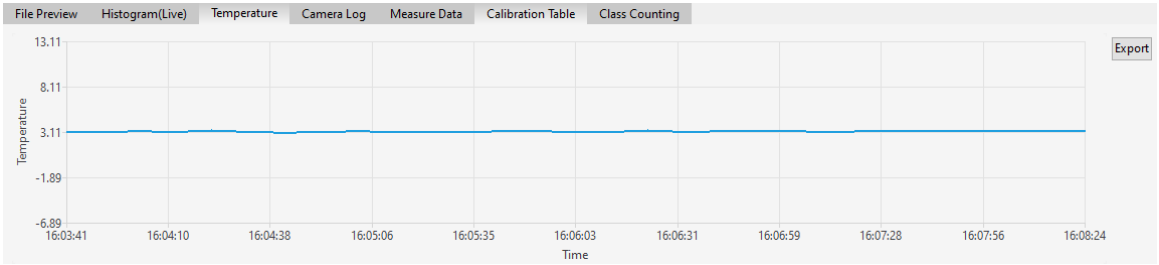
a. The camera bit depth is not the original data bit depth of the camera sensor, but the software preview bit depth;

b. When the bit depth of the histogram is greater than the bit depth of the camera, there will be no extended bit depth effect when switching, and the histogram will still display the bit depth of the camera;

c. When the bit depth of the histogram is less than or equal to the bit depth of the camera, the histogram will only display partial data when switching, and the histogram data is still the data of the camera bit depth. For example, the bit depth of the camera is 16bit, and the average gray value is 4096DN. The bit depth of the histogram is 8bit. At this time, the histogram will only display the data distribution of the first 8bit and the average gray value 4096DN remains unchanged.

8.3 Temperature

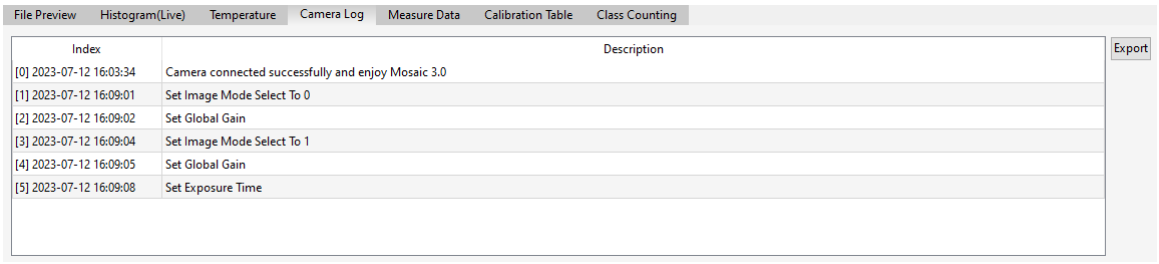
Display the current real-time temperature of the camera, monitor the temperature information, and support exporting data



- **Temperature:** Real-time temperature of the camera;
- **Time:** The total time length of the abscissa is 20min, and the time interval of obtaining temperature is 10s.
- **Export:** Support temperature data export as .csv file, the maximum export time is 12H, and some part of the data exceeding 12H will be overwritten

8.4 Camera Log

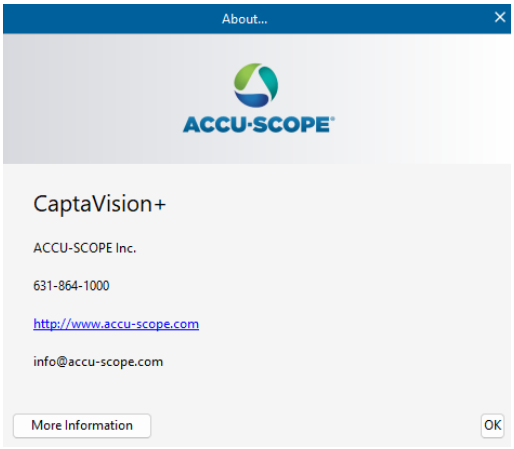
The software exports the information of the commands issued by the camera, and the pure software function does not export LOG information. The LOG does not take effect when processing static images

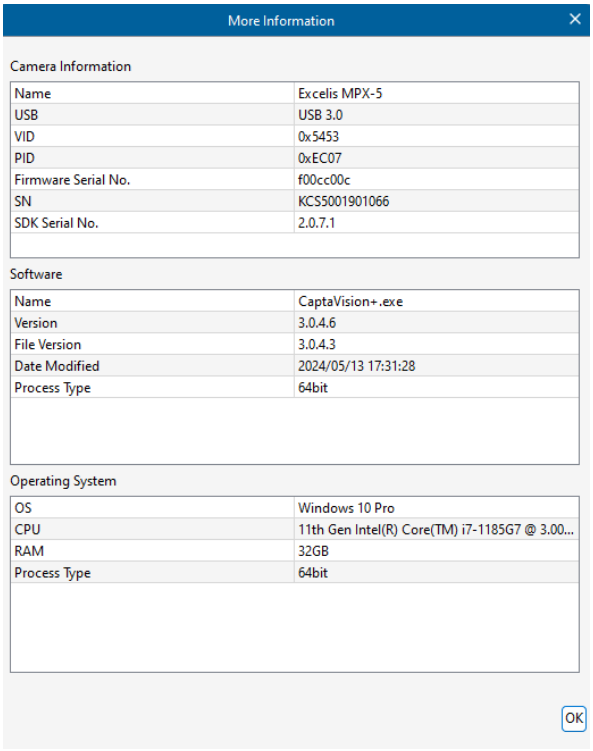


➢ Support log export as .csv file.

9. INFO

9.1 About





The About dialog displays more information about the software and operating environment. Information may include the connected camera model and operating status, the software version and operating system information.

10. LIMITED WARRANTY

10.1 Digital Cameras for Microscopy

This digital camera is warranted to be free from defects in material and workmanship for a period of one (1) year from the date of invoice to the original (end user) purchaser.

This warranty does not cover damage caused in-transit, damage caused by misuse, neglect, abuse or damage resulting from either improper servicing or modification by other than ACCU-SCOPE or UNITRON approved service personnel. This warranty does not cover any routine maintenance work or any other work that is reasonably expected to be performed by the purchaser. No responsibility is assumed for unsatisfactory operating performance due to environmental conditions such as humidity, dust, corrosive chemicals, deposition of oil or other foreign matter, spillage or other conditions beyond the control of ACCU-SCOPE Inc. This warranty expressly excludes any liability by ACCU-SCOPE INC. and UNITRON Ltd for consequential loss or damage on only grounds, such as (but not limited to) the non-availability to the End User of the product(s) under warranty or the need to repair work processes.

All items returned for warranty repair must be sent freight prepaid and insured to ACCU-SCOPE INC., or UNITRON Ltd., 73 Mall Drive, Commack, NY 11725 – USA. All warranty repairs will be returned freight prepaid to any destination within the Continental United States of America. Charges for repairs shipped back outside this region are the responsibility of the individual/company returning the merchandise for repair.

To save your time and expedite service, please prepare the following information in advance:

- Camera model and S/N (product serial number).
- Software version number and computer system configuration information.
- As much detail as possible including a description of the problem(s) and any images help to illustrate the issue.