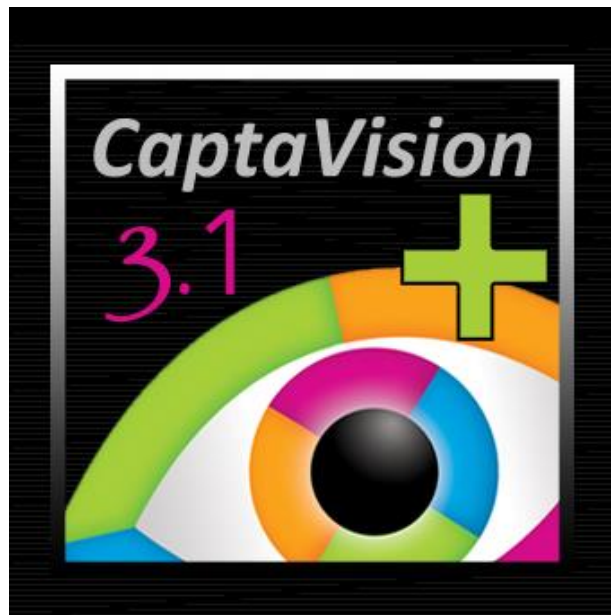




CaptaVision+ v3.1 Instruction Manual



ACCU-SCOPE, Inc. 73 Mall Drive, Commack, NY 11725
631-864-1000 (PH) • cameras@accu-scope.com
www.accu-scope.com

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Release Notes

Version	Date	Modifications	Compatibility (serial numbers)
V1.0.0	Nov 2025	Create document	2304xxx and up

1. Overview

CaptaVision+ v3.1 is a powerful, all-in-one software that integrates microscope camera control, computational imaging, modular processing, and measurement workflows to significantly enhance the user experience.

Working exclusively with Excelis™ microscope cameras, CaptaVision+ v3.1 enables camera control across a wide range of microscopes, bringing state-of-the-art performance to your system.

When you need to get the most out of your microscope and Excelis camera, CaptaVision+ v3.1 provides precise control over virtually all necessary parameters. Its user-friendly design helps you quickly identify and optimize the ideal configuration.

CaptaVision+ v3.1 allows you to create task-specific custom desktops. This guides your operators into a clear, function-oriented working environment, ensuring data reproducibility in multi-task or multi-user settings, and seamlessly integrates with custom measurement workflows.

Furthermore, CaptaVision+ v3.1's powerful real-time computational imaging engine unlocks advanced imaging capabilities. The real-time stitching feature allows you to acquire large field-of-view images while moving the stage. The real-time depth-of-field extension function can generate a single image with greatly extended depth of field in under a second.

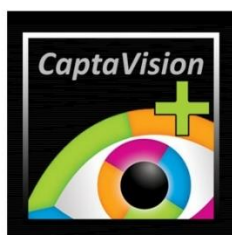
Designed from the user's perspective, CaptaVision+ v3.1 redefines the complete camera workflow—from efficient image acquisition and adjustment to measurement and report output—through a modular design. By integrating the latest image processing algorithms, it significantly reduces operation time and effectively improves productivity.

NOTE: CaptaVision+ v3.1 is compatible with Excelis cameras bearing serial numbers beginning 2304xxx (YYMMxxx) and up.

Minimum PC requirements

- Intel Core i5 processor (Dual Core or more)
- 16GB RAM or more
- USB 2.0 Hi-Speed port or higher
- Windows 7, 8, 10, 11 (64-bit recommended)

2. Loading Screen



Advanced Imaging Software
for Excelis™ Cameras

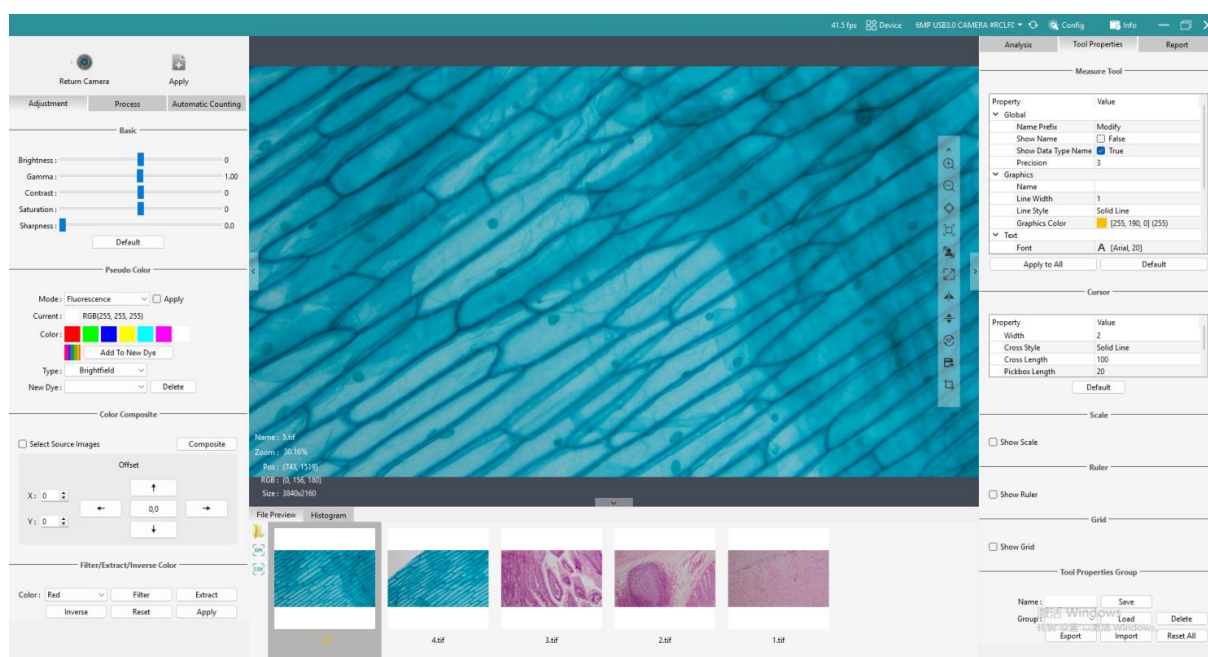


ACCU-SCOPE

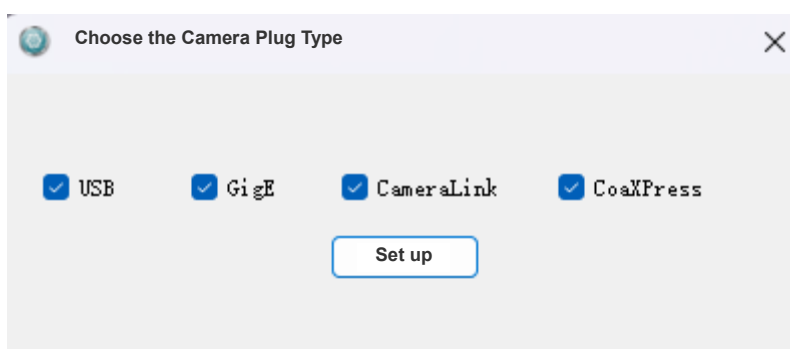
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When the software is launched with a camera connected, the data panel defaults to displaying the File Preview window. If no camera is connected upon startup, the data panel defaults to showing the File Preview.

When no camera is connected, after opening the software and loading an image, you can perform various operations on the image, including Adjustment, Processing, Auto-Counting, Analysis, and Measurement.

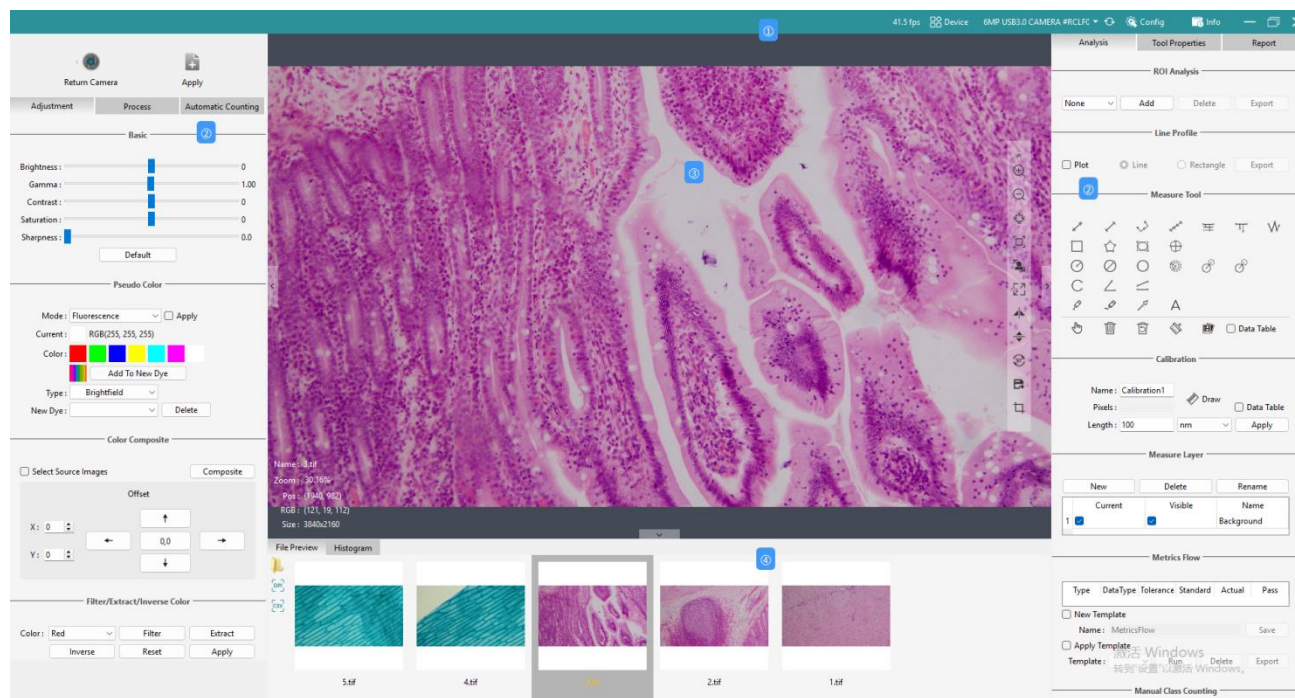


On first launch, you can select the recognized camera interface. Choosing the specific interface model can improve the software's startup speed:



3. Window Overview

The main interface of the software primarily consists of four sections: the Title Bar, Menu Bar, Preview Window, and Data Panel.



3.1. Title Bar

The software title bar is organized into several functional modules: Frame Rate, Device, Camera List, Configuration, and Information. Clicking the corresponding icon will switch the display to the associated interface.

The Real-time Frame Rate module is displayed only when a camera is connected and streaming images properly; it remains hidden if no camera is connected.

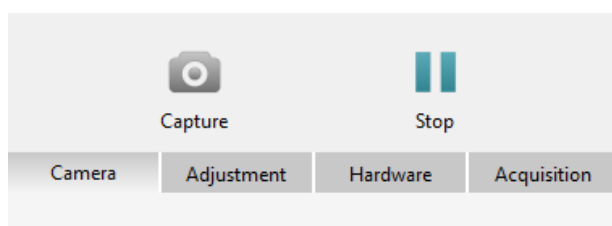


Multi-camera connectivity and hot-plugging are supported exclusively on Windows systems with USB 3.0 interface cameras. Please refrain from connecting or disconnecting cameras during the camera list refresh process.

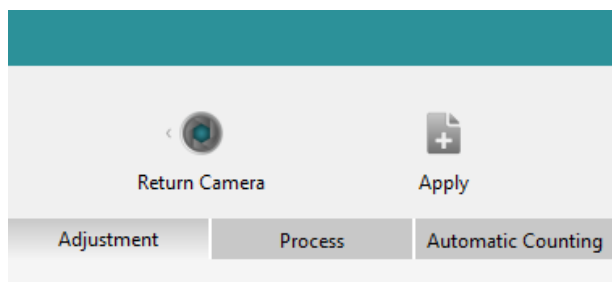
The camera list displays all currently recognized camera models. Click on the corresponding camera name to switch between connected cameras. If the currently previewed camera is disconnected, the system will automatically switch to another available camera or display a "No Camera" status.

3.2. Menu Bar

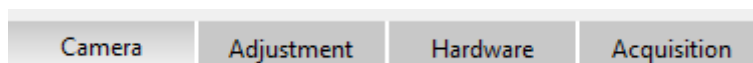
The left-side menu bar contains all functional modules when a camera is connected. Click on the module title buttons to view their detailed functions.



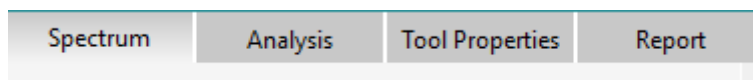
All functional modules for image processing are located on the left side. Click the module title buttons to view their detailed functions.



All functional modules on the right side are available during both camera connection and image processing. Click the module title buttons to view their detailed functions.

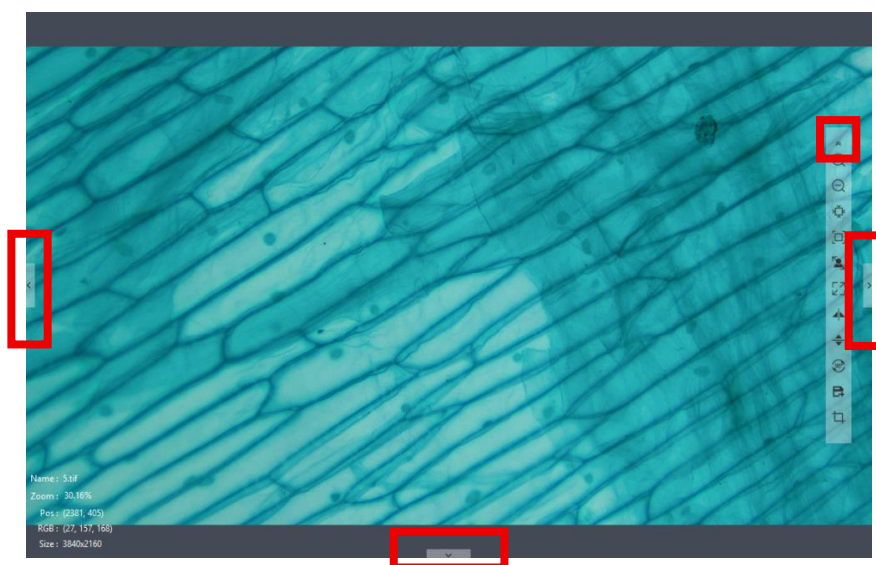


All functional modules on the right side in Physical Mode are accessible. Click the module title buttons to view detailed functions. (Note: This mode is supported only by select camera models.)



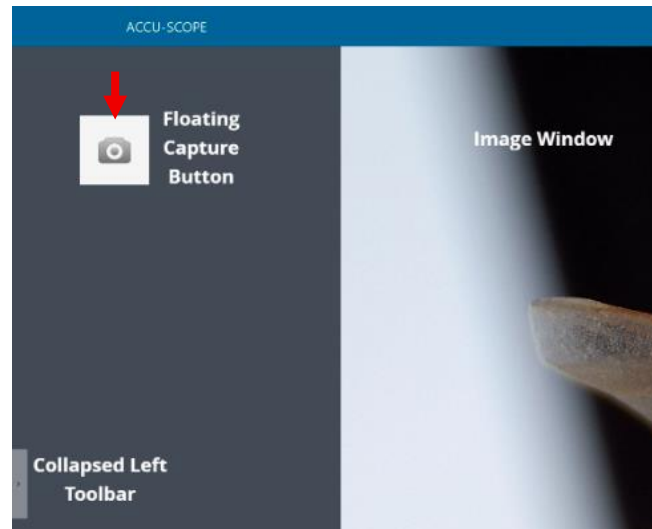
3.3. Preview Window

The preview window can be switched by selecting different application directions.

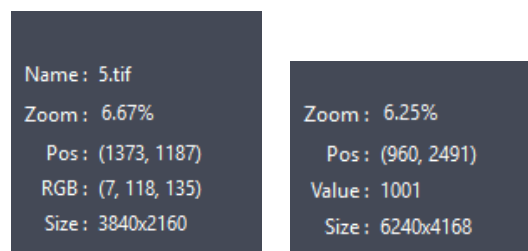


- 1) Click the left edge , right edge , Analysis icon , or bottom-edge  control buttons (see red boxes above) to expand or collapse the corresponding operation panels.
- 2) The preview window in the center of the software displays the live preview feed or opened images.
- 3) Use the mouse wheel to zoom in/out—the zoom centers on the cursor position.
- 4) Hold the left mouse button, right mouse button, or mouse wheel to drag and pan the image display area.

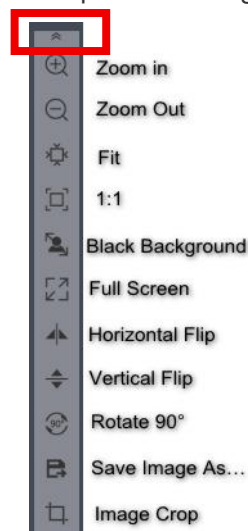
Collapsing the menu bars or operation panels allows the sample image to display larger in the software. New in CaptaVision+ v3.1 and after collapsing the left side operation panel, the Capture button is still visible and “floats” over the image preview window. This allows for easy capture of an image without needing to expand the left side operation panel again.



- 5) For color cameras, the lower-left corner shows an editable zoom ratio, coordinates, RGB values, and dimensions; for monochrome cameras, it displays an editable zoom ratio, coordinates, grayscale value, and dimensions.



- 6) To accommodate diverse user needs, the software provides a series of shortcut operations, enabling more convenient image acquisition and manipulation during use.



- **Shortcut Panel in the Preview Window:** By default, the shortcut panel is expanded. Click  to collapse it.
- The following functions are only supported in the static image preview interface:

Save Image As: Click to open a save dialog, allowing you to save the currently selected image. Supported formats include JPEG, TIF, PNG, and BMP. The default image type for saving is JPEG.

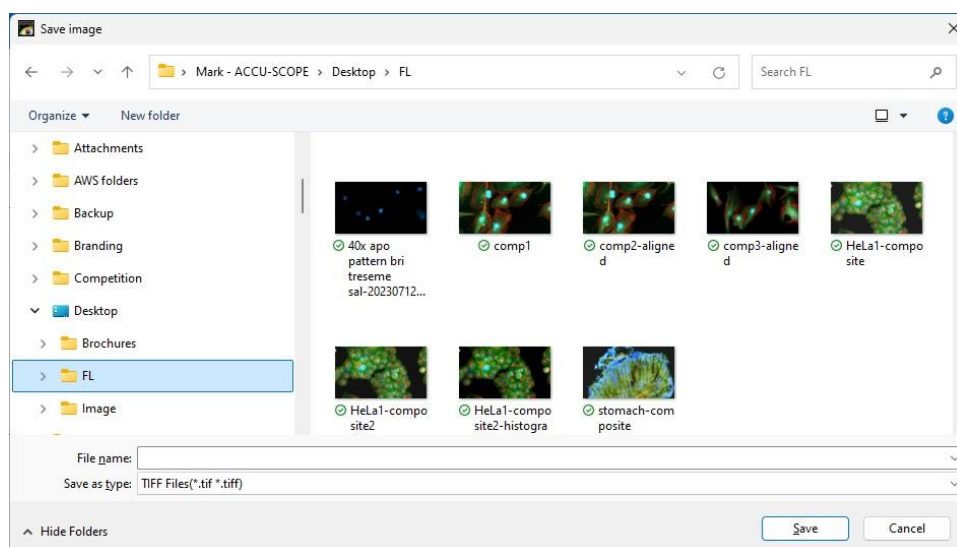


Image Crop: Click screenshot button on the upper right corner of the preview window to capture image, to select the interested area in preview image with mouse, then double left click or double right click  the mouse to complete screenshot. The screenshot will appear on right picture bar, click  to save 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. Each pixel in the image is mapped to a single pixel in the display.

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

Black Background: When the image is in full screen, the background of the image is set to be black. To exit the full screen mode, press the [Esc] button of the computer keyboard or click on the Back Arrow symbol on the lower right corner of the screen.

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 lower right 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.

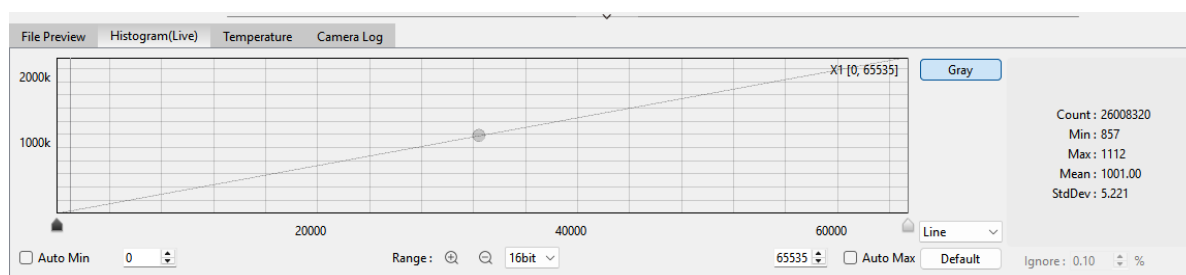
Rotate 90°: Rotate the current image clockwise, which can be rotated continuously, each rotation is 90 degrees. The rotation angle will be prompted in the lower left corner, and only supported cameras will display the rotation button and the rotation angle during dynamic preview.

3.4. Data Bar

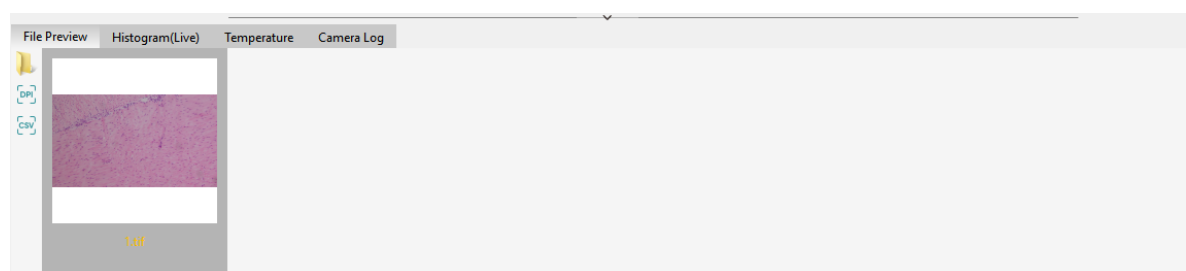
Including File Preview, Histogram, Temperature, Camera Log, Measure Table, Calibration Table, Class Counting, Automatic Counting Table, Automatic Counting Statistics. By default, the Camera Connection interface displays File Preview, Histogram, Log, and Temperature Monitoring (only for cooling cameras). 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:**



3.5. Shortcut Key

In order to make the users operation more convenient, the software provides shortcut key functions. Specific functions are as follows:

Function	Key Stroke	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	Ctrl+-, 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 (D400BSI V2/V3 & D95 V2 & D4040 & D4040BSI models only).

Switch off window heating	F3	Click software interface and press F3 to turn on or off the LED (D4040 & D4040BSI models only).
Capture	F10	Take pictures and automatically save the taken pictures.
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 pictures, click [Yes] to take effect.
Save image as	F8	Can change the picture format or picture 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. Software Usage

4.1. System Compatibility:

The current software version is officially compatible only with Windows 10/11. Testing and support for Windows 7 have been suspended, and full functionality on this platform is no longer guaranteed. MacOS and Linux systems are not currently supported for this software version.

4.2. Software Compatibility with Computer Specifications

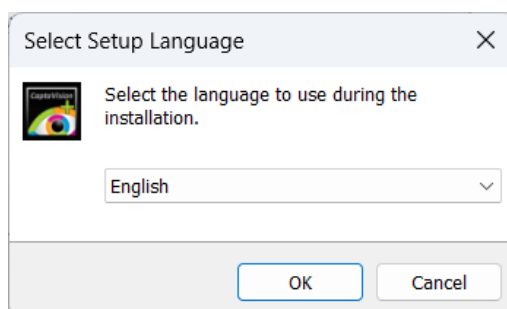
CPU	Intel Core i5 or higher, with a base clock speed of 2.6GHz or higher.
Operating System	Windows10/11 x64 PC
Memory	16GB and above
PCIe Specifications	PCIe4.0*8

4.3. Software Installation and Uninstallation

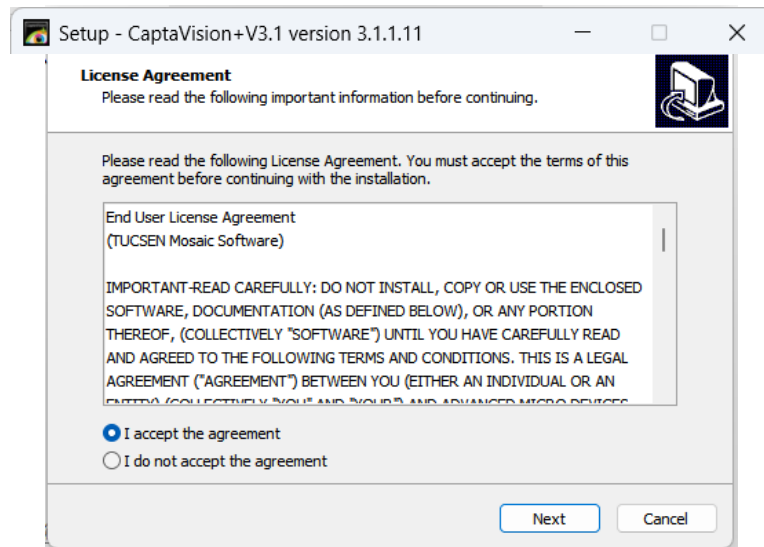
4.3.1. Installation

Procedure:

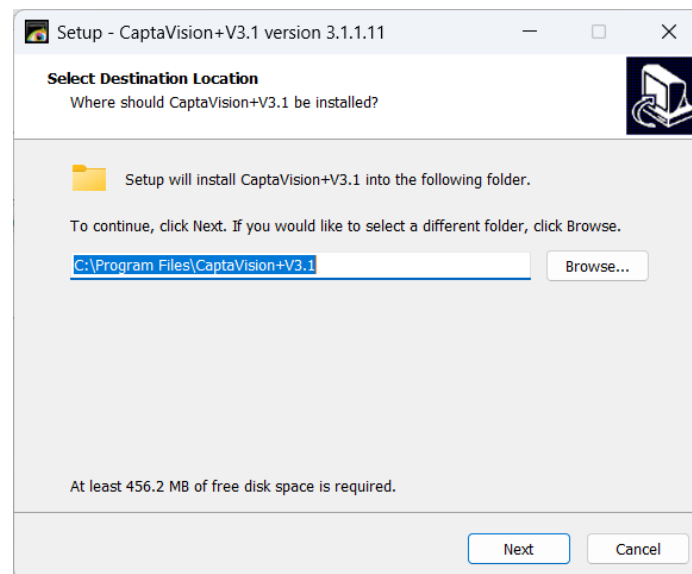
- (1) Open the provided USB drive and double-click to run the CaptaVision+ v3.1 installation file.
- (2) The installation language will be automatically selected based on your system language settings.



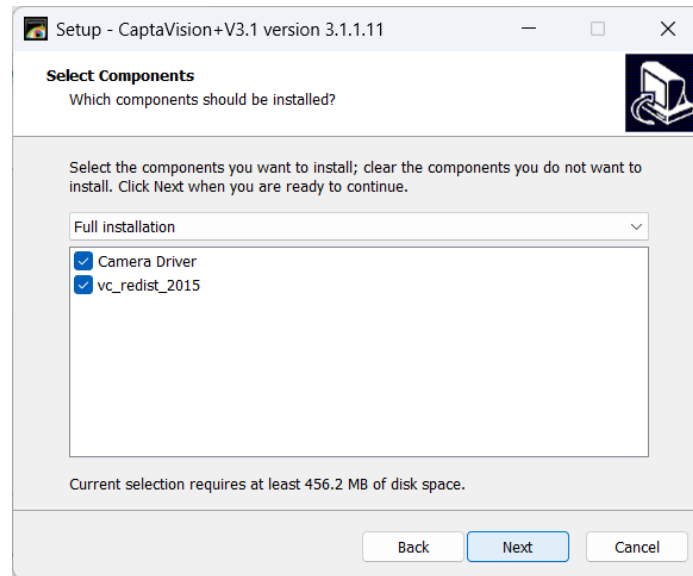
(3) Accept License Agreement Authentication



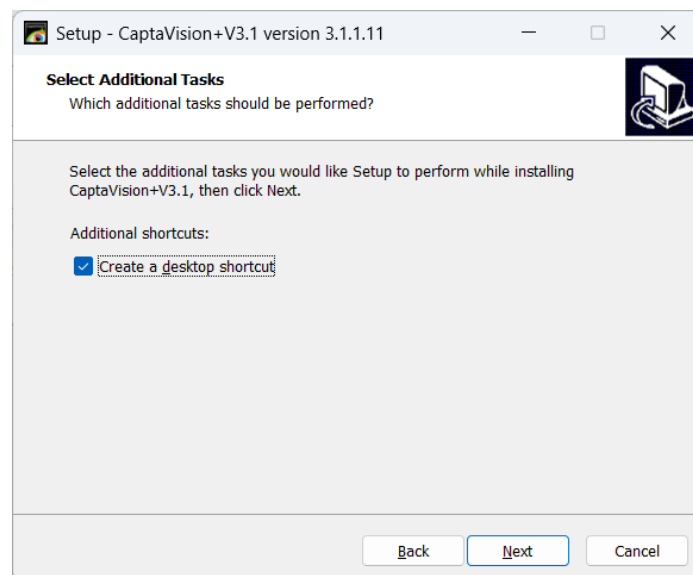
(4) Select the installation path. The default location is the C drive. Users may customize the installation directory based on their needs



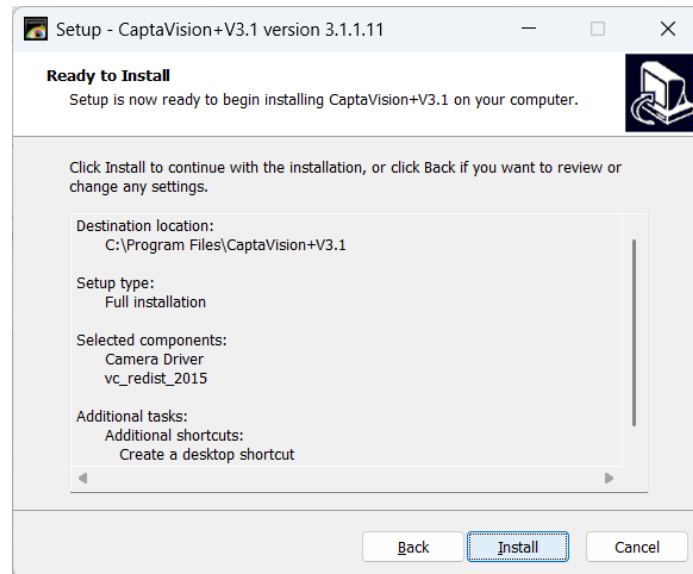
(5) Select the installation components. By default, both the driver and Microsoft runtime library (vc_redist_2015) are checked. Unchecking these may prevent the software from recognizing the camera.



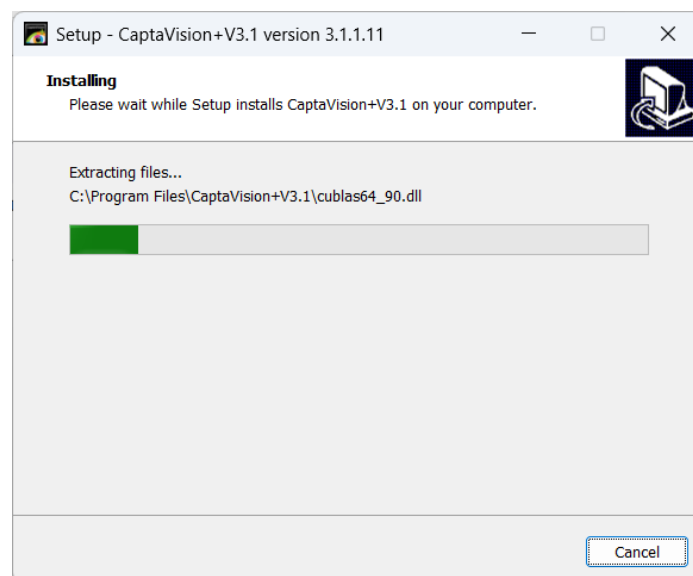
(6) Configure installation settings by selecting whether to create a desktop shortcut.



(7) After confirming all installation parameters, click "Install" to begin the installation process.



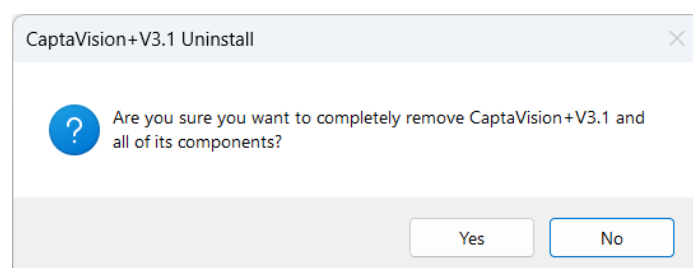
(8) Waiting for the installation to finish.



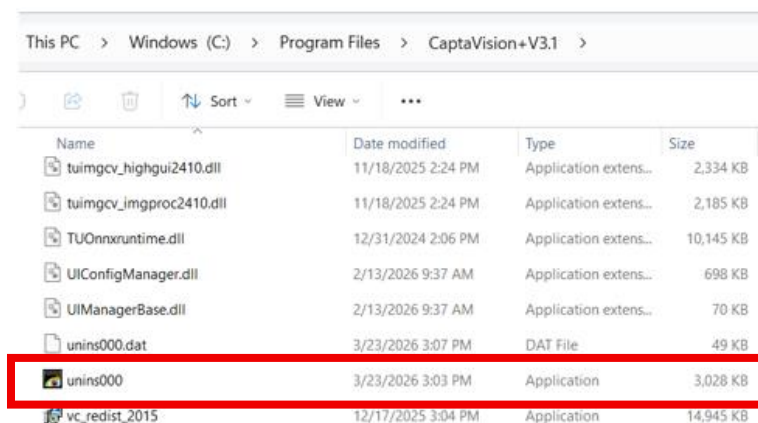
4.3.2. Uninstallation

CaptaVision+ v3.1 software can be uninstalled using the following three methods:

- (1) Via the installation package: Running the installation package will uninstall any existing version of the software on the computer. This method is applicable only to the default installation path on the C drive.



- (2) Locate the unins000.exe file in the installation directory and double-click it to uninstall the software.



- (3) Through the "Programs and Features" interface in your computer's settings.

Note:

After uninstalling or reinstalling the software, all software configuration information and calibration table data will be deleted.

5. Title Bar

5.1. Ctrl

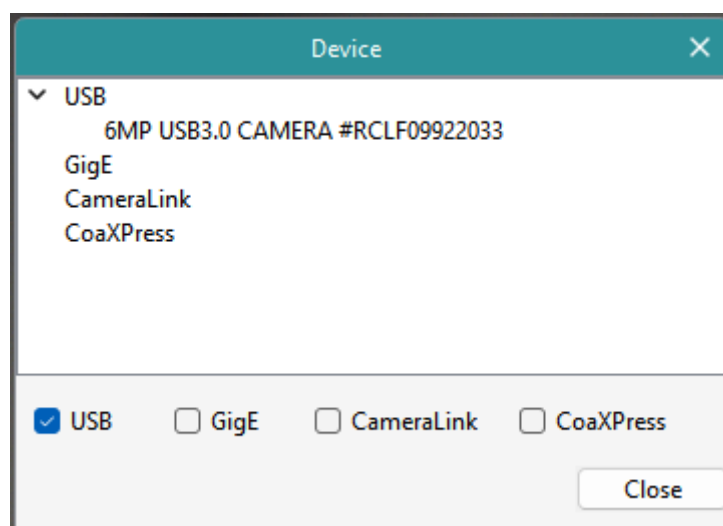
When Ctrl is displayed, the underline appears as a locked horizontal or vertical line. Press Ctrl to toggle it on or off.

5.2. Frame Rate

Displays the current camera's real-time frame rate.



5.3. Equipment



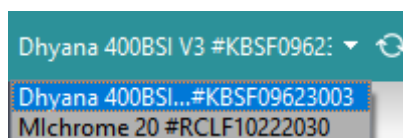


- **Device:** Select the device connection interface. Upon clicking, a pop-up window displays, sorting all available devices connected to the computer by interface type (USB, GigE, CameraLink, CXP).

When connecting a single Excelis camera, no device selection is required; the software automatically detects the camera upon connection. For multi-camera setups, cameras with the same interface can be switched directly via the dropdown list. Cameras with different interfaces require switching through the device selection interface.

- **Software Interface Detection:** Select the interface types to detect upon software startup. Reducing the number of interfaces to scan accelerates startup speed. Changes take effect upon the next launch.

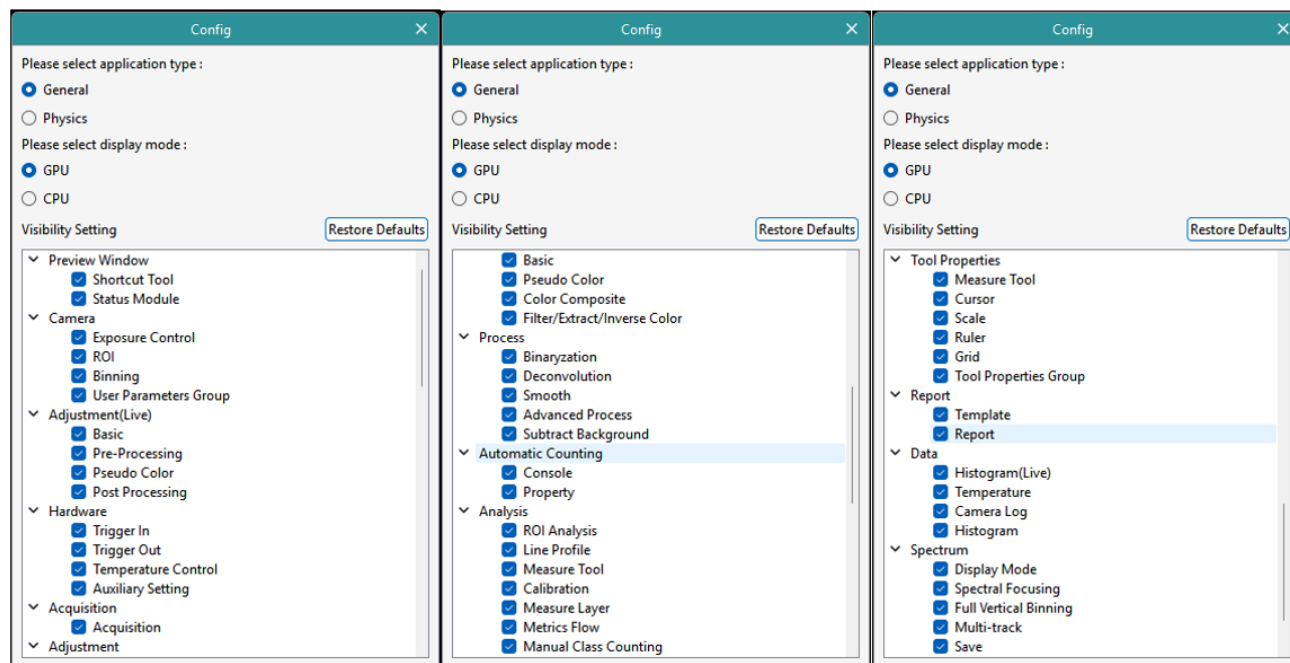
5.4. Camera List Display



- **Camera List:** Displays currently connected cameras. Information shown includes camera model and corresponding SN code. Switch cameras here.

5.5. Configuration

Users can select application directions while customizing the software interface and functional layout, primarily comprising 12 modules.



Application Type: Divided into "General" and "Physical". The software defaults to the General category upon startup. Only Dhyana and FL monochrome series cameras support selecting the Physical category; cameras that do not support the Physical orientation cannot select this option. After selection, the software must be restarted for the change to take effect. The software interface will adjust according to the selected application type. When the Physical application type is selected, the preview window will display coordinate axes, an intensity curve, and a color chart. The camera and image processing menu bars will show the display mode option, while the camera menu bar will disable image stitching, depth-of-field extension, and masking

functions. The image menu will disable advanced processing. The spectral function will appear in the right-side menu bar.

Display Mode: Defaults to CPU. This setting is used to configure how the software allocates system resources.

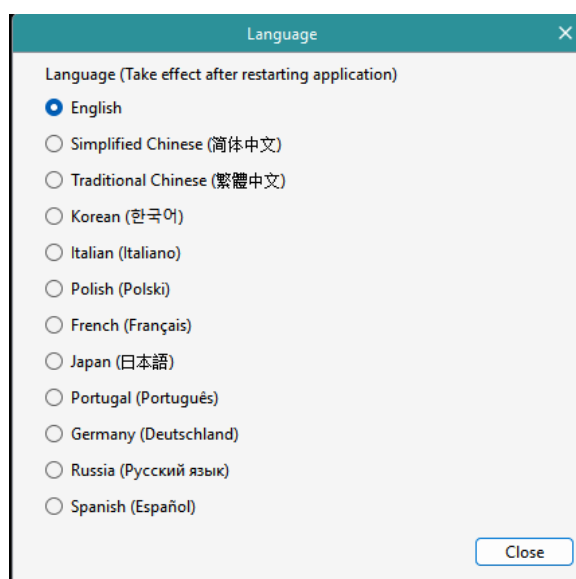
Visibility Settings: Defaults to all options selected. Users can deselect options to customize the display of the software interface.

Restore Default Settings: Resets the visibility settings to their default state.

5.6. Information

5.6.1. Language

Allows selection of the software interface language. The change will take effect after restarting the software.

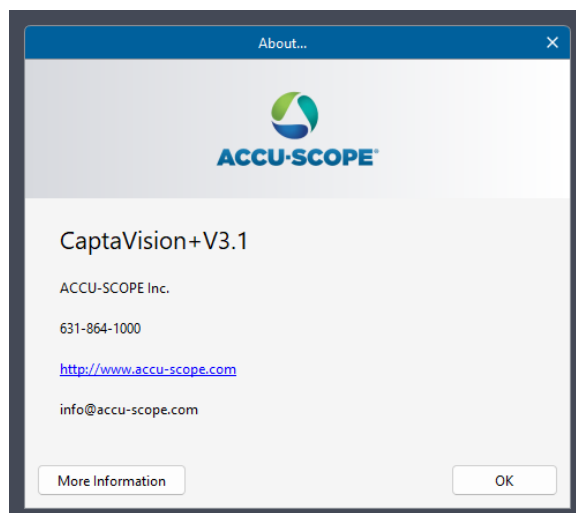


5.6.2. Help

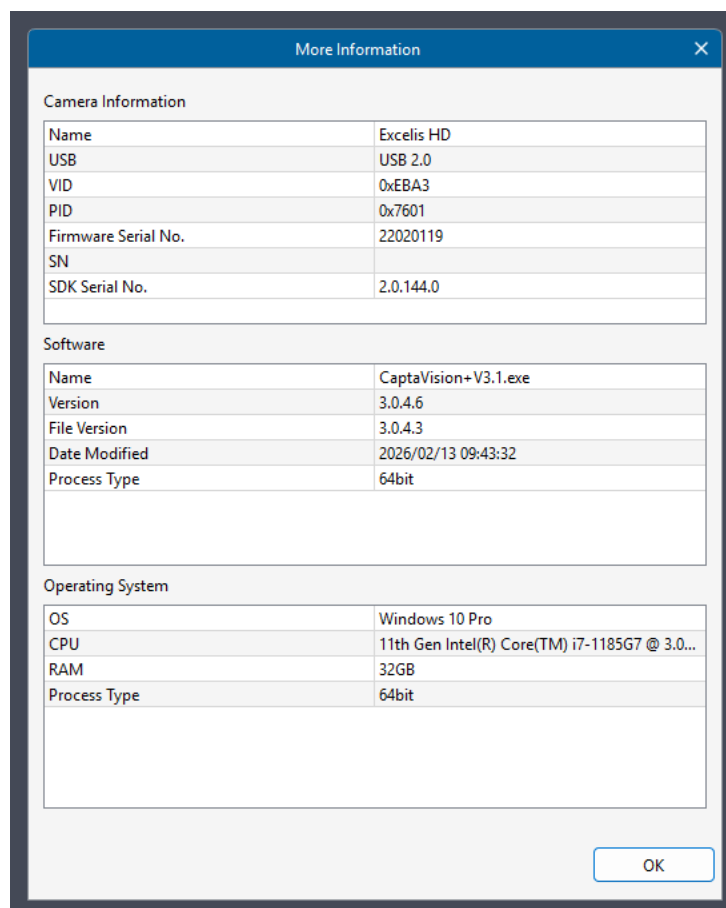
Provides access to the software operation manual for users to study and reference.

5.6.3. About

Displays the company's basic contact information.

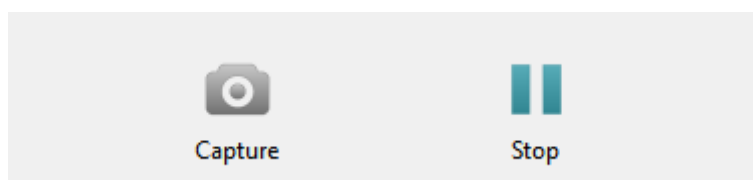


- **More Information:** You can view the currently connected camera information, software version details, and operating system information.



6. Dynamic Image Acquisition

6.1. Image Capture



- **Capture:** Click this button to capture an image of the current preview interface.
- **Preview/Stop:** Starts or stops the preview function, allowing real-time viewing of the live feed or halting the preview. If the Capture button is clicked while the preview is stopped, the camera will temporarily re-enter the preview mode to take a picture and then return to the stopped state after the capture is complete. While the preview is stopped, you can modify the camera's configuration parameters; these changes will take effect once the preview is restarted.

6.2. Camera

6.2.1. Basic Settings

Configures the fundamental operating state of the camera to ensure its normal functionality. (The specific interface of the basic settings varies depending on the camera model. Please use the options according to the actual display.)

Gain Mode: HighGain
 Exposure Mode: Manual AE Once
 Exposure Time: 0 s 8 ms 864 μs
 Resolution: 2048x2048 Depth: 16bit
 Frame Rate: 40.2 fps

Gain Mode: High Dynamic
 Exposure Mode: Manual
 Exposure Time: 0 s 0 ms 10 μs
 Resolution: 4096x4096 Depth: 16b
 Frame Rate: 16.556 fps 16.6 fps

Gain: 4
 Exposure Mode: Auto
 Target: 7
 Exposure Time: 0 s 39 ms 939 μs
 Resolution: 1920x1080 Depth: 8bit
 Frame Rate: 25.2 fps

Mode: Standard
 Gain: Gain 1(1.0e-/ADU)
 Exposure Mode: Manual
 Exposure Time: 0 s 0 ms 15 μs
 Resolution: 3000x3000 Depth: 14bit

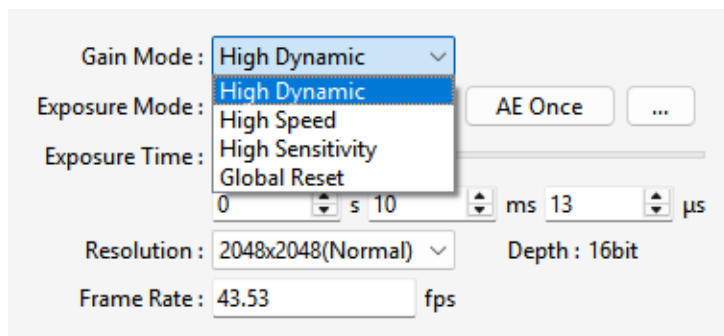
Gain: Gain 1
 Exposure Mode: Manual
 Exposure Time: 0 s 0 ms 34 μs
 Resolution: 6240x4168 Depth: 16bit
 Shutter: Rolling

Mode: HighGain
 Exposure Mode: Manual AE Once
 Exposure Time: 0 s 8 ms 864 μs
 Resolution: 2048x2048 Depth: 16bit

Mode: High Dynamic
 Exposure Mode: Manual
 Exposure Time: 0 s 0 ms 10 μs
 Resolution: 4096x4096 Depth: 16b
 Frame Rate: 16.556 fps

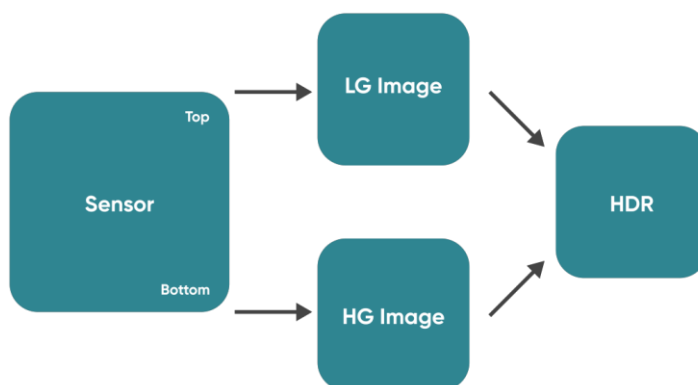
Gain: 4
 Exposure Mode: Auto
 Target: 7
 Exposure Time: 0 s 39 ms 939 μs
 Resolution: 1920x1080 Depth: 8bit

- **Mode:** During use, users can select the most appropriate gear for image preview based on the specific application scenario and requirements. This can enhance image brightness, but it will also increase noise.



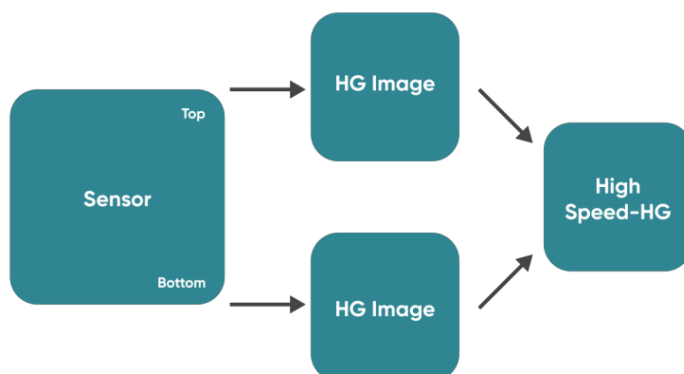
1) High Dynamic Range (HDR)

The synthesis schematic of the High Dynamic Range (HDR) image mode is shown in the figure below. The chip simultaneously outputs image signals from both the top and bottom readout chains. These two images have identical exposure times but different analog gains. The Low Gain (LG) mode offers a higher full-well capacity with higher noise, making it suitable for high-signal imaging scenarios. In contrast, the High Gain (HG) mode has a lower full-well capacity and reduced readout noise, making it ideal for low-signal imaging scenarios. By algorithmically combining the high-gain and low-gain images, an HDR image is generated. This mode is suitable for applications with significant variations in signal strength.



2) High Speed

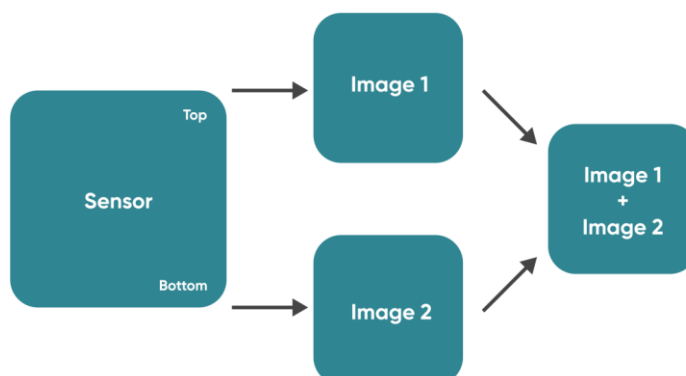
The synthesis schematic of the High Speed mode is shown in the figure below. The chip simultaneously outputs odd and even rows from the top and bottom readout chains, respectively. This parallel readout method increases the frame rate. The High Speed mode is generally suitable for dynamic observation applications that require a high frame rate.



3) High Sensitivity

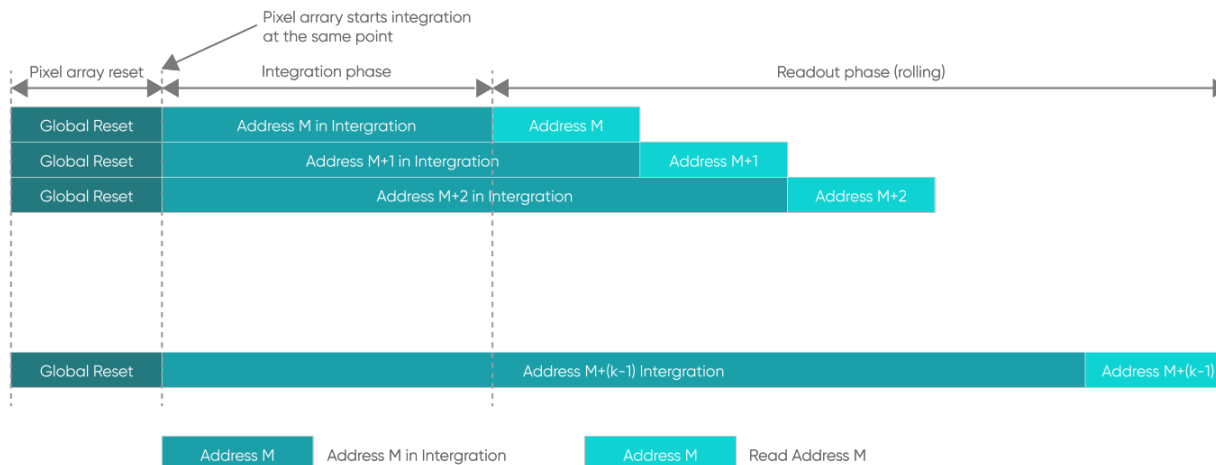
The High Sensitivity mode employs Correlated Multiple Sampling (CMS) technology, also referred to as CMS mode. It typically involves 2 sampling cycles, thereby reducing noise by a factor of $\sqrt{2}$. The principle is

illustrated in the figure below: data from each row is simultaneously acquired by dual channels (top and bottom). The two resulting images are then averaged to generate a final CMS-mode image. This mode is typically configured with higher gain and is suitable for low-signal applications.



4) Global Reset

The Global Reset function enables rolling shutter cameras to achieve effects similar to global shutter cameras. The Global Reset function first clears and resets the entire pixel array simultaneously. All rows then begin exposure at the same time, after which data is read out row by row. The effective exposure time increases progressively row by row. In ideal applications, the light source should be turned off immediately after the exposure of the first row ends to avoid uneven brightness in the image. This mode is suitable for applications requiring signal synchronization and can be used to capture transient events.



- **Gain:** Adjusts the gain value. In manual exposure mode, the gain can be modified by dragging the slider. In auto exposure mode, the gain is automatically set based on the current environment.
- **Exposure Mode:** Sets the camera's exposure time.

1) Auto Exposure: The software automatically adjusts the exposure time based on image brightness to achieve optimally exposed images. The available exposure time range varies by camera model; please refer to the actual interface for specific values.

2) One-shot Exposure: Clicking the One-shot Exposure button triggers the software to automatically adjust the exposure time for optimal brightness and then lock the final exposure time. (Supported only by some CMOS cameras)

3) Area Exposure: The software automatically adjusts the exposure time based on the brightness within a user-defined area to achieve optimal image brightness. (Supported only by some CMOS cameras)

4) Manual Exposure: Users manually input the exposure time according to their needs, or set it by dragging

the slider (non-linear). The available manual exposure time range varies by camera model; please refer to the actual interface for specific values.

5) **Target Value:** Adjustable only in Auto Exposure mode. Users can manually adjust the target brightness value, prompting the auto-exposure algorithm to adjust the exposure time accordingly to achieve the desired image brightness. (Supported only by some CMOS cameras)

➤ **Resolution:** Selects the operational resolution of the camera. The available resolutions depend on the camera model; please refer to the actual interface for specific options.

➤ **Note:**

b. For the TrueChrome series, selecting compress mode increases the frame rate but results in higher CPU usage.

➤ **Bit Depth:** Displays the bit depth supported by the current camera. The display shows 8-bit image data. CaptaVision+ v3.1 allows users to select either 8-bit or 16-bit data for preview according to their needs. However, some cameras only support either 8-bit or 16-bit output, which cannot be changed.

➤ **Frame Rate:** Optional for some cameras. Allows users to set a custom output frame rate as needed.

➤ **Shutter:** Optional for some cameras. Options include Rolling Shutter and Global Reset. Users can select the shutter type based on their requirements.

6.2.2. ROI

ROI (Region of Interest) allows defining a specific window area of interest within the full resolution of the camera sensor. Only the image data within this window is read out, enabling the acquisition of a localized image area. This optimizes processing speed and resource usage by focusing on the relevant region in the sample.

➤ **Preset:** By default, the setting is "Full Frame." The software provides four preset central ROI sizes (Full Frame, 1/2, 1/4, 1/8). Selecting a preset allows for quick configuration of the desired central ROI.

➤ **Manual:** Includes Single ROI and Multi-ROI modes. Multi-ROI (currently supported only by the 401D model) allows dividing the image into up to 256 ROI segments.

➤ **Fast ROI:** Use the mouse to select the region of interest. Check the "ROI" box, then left-click and drag on the preview image to define a window. The interface will display the starting coordinates and resolution of the selected area. Single ROI: Click the checkmark [✓] to apply the ROI. Alternatively, double-click or press the "ENTER" key to apply. Click the [×] to cancel the selection. Multi-ROI: Click "Continue" to proceed with selecting the second, third, and so on, up to the nth ROI. Click "Finish" to apply all ROIs.

➤ **Set ROI:**

1) Single ROI: Manually enter the starting coordinates and resolution dimensions to define the ROI. Input the offset coordinates of the top-left corner, along with the width and height of the rectangular area, then click "Set ROI" to apply.

After completing any of the above settings, the **Set ROI** button will change to **Set Full Frame**. Click this button to cancel the current ROI effect and return to the full-frame view.

2) Multi-ROI (currently supported only by the 401D model): After clicking "Set ROI," a dialog box will appear. Continue entering the coordinates and dimensions for the second ROI, then click "Set ROI"

again. Repeat this process until all ROIs (up to the n^{th}) are defined, then click "Finish" to apply. If more than 256 ROIs are attempted, the interface will display the message: "It can support to select no more than 256 ROIs." The interface will only display the boundaries of the ROI areas, not the entire field of view. Non-ROI areas will be set to a grayscale value of 0.

6.2.3. Binning

Binning is an image readout mode that combines adjacent pixels and reads them out as a single unit. This process enhances sensitivity but concurrently reduces image resolution. Binning may not be available with every camera.

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

The top screenshot shows the 'Binning' section with four radio button options: 1x1 (selected), 2x2, 3x3, and 4x4.

The bottom screenshot shows the 'Binning' section with manual settings: Horizontal: 1, Vertical: 1, a 'Square' checkbox, and a 'Binning Mode' dropdown menu set to 'Sum'.

- **Square Pixels:** When enabled, the "Vertical" setting is disabled. The "Vertical" value automatically follows the "Horizontal" setting, ensuring the number of pixels is identical in both horizontal and vertical directions.
- **Binning Mode:** Switch between "Sum" and "Average" modes. "Average" mode helps increase the saturation capacity.
- **Bit Depth Extension:** This option is only available in the Physical application orientation and when Sum mode is selected. When checked, the image data is extended to 32-bit to accommodate the total sum of pixels. Due to the large data size, preview is not possible; the preview image will display at full resolution.

Note:

- This function performs sum binning on the original data, so the frame rate remains unchanged.
- In Bit Depth Extension mode, images are saved in 32-bit .sen format.
- When opening a 32-bit image, the software uses a 16-bit display method. If the maximum grayscale value of the 32-bit image exceeds 65,535 DN, scaling is applied: the maximum value is mapped to 65,535 DN. The bit depth scaling factor is calculated as $(\text{Max Grayscale Value @32-bit} / 65,535)$, and all grayscale values are divided by this factor. If the maximum value is less than or equal to 65,535 DN, no scaling is applied (scaling factor = 1).
- When opening a static 32-bit image, the status information bar displays the 32-bit bit depth scaling factor with a precision of 5 decimal places.

Name : TUC-202307030949...no32.sen	Name : TUC-202307031004...no32.sen
Zoom : 23.29%	Zoom : 46.58%
Pos : (257, 927)	Pos : (66, 908)
32bit Depth Scale : 1.00000	32bit Depth Scale : 4.00000
Value : 65535	Value : 65535
Size : 2048x2048	Size : 1024x1024

6.2.4. Parameter Save/Load

In practical applications, users often need to switch the camera between multiple scenarios or use it across different platforms. To simplify operation, the software provides a parameter group management function, allowing users to save and load configuration parameters for each specific scenario, thereby saving setup time.

Parameter files can be copied and loaded onto other computers, enabling cross-platform parameter transfer. This ensures maximum consistency in experimental conditions.

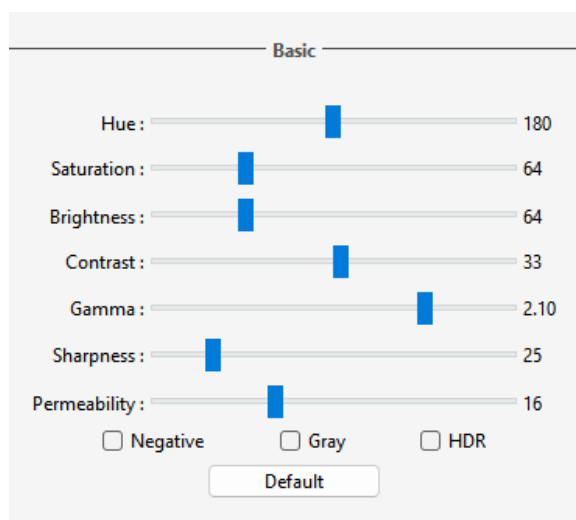
- **Parameter Group Name:** Assign a name to the parameter group for saving and loading. Users can also view and load saved parameter groups via the dropdown menu.
- **Save:** Saves the current software configuration parameters into a parameter group. A maximum of 50 parameter groups can be saved.
- **Parameter Group:** (This refers to a list or dropdown selector for choosing existing or previously saved parameter groups).
- **Load:** Applies the selected parameter group to the current scenario.
- **Delete:** Deletes the currently selected parameter group.
- **Export:** Saves the parameter group file to a specified folder.
- **Import:** Loads a parameter file from a specified folder.
- **Reset All:** Restoring factory settings will clear all user-defined parameters and revert the software to its original (factory settings).

6.3. Adjustment (Interface varies by camera model)

6.3.1. Basic

- **Hue:** Adjusts the color shade. Range: 0–360.
- **Saturation:** Adjusts color purity. Higher values result in more vivid colors, while lower values produce duller tones.
- **Brightness:** Adjusts the lightness/darkness of the image. Range: 0–255.
- **Contrast:** Higher contrast makes the image sharper and more distinct, with more vibrant colors. For

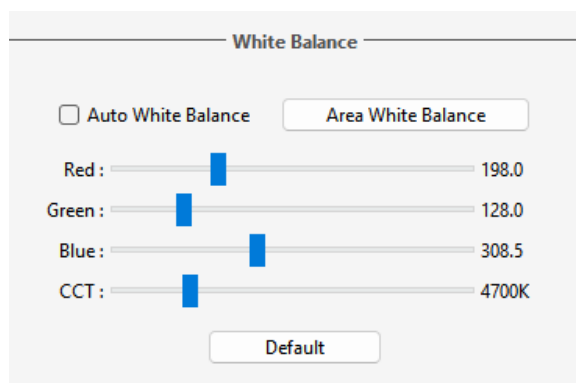
- Dhyana series monochrome cameras, the range is -128 to 127 (default: 0).
- **Gamma:** Corrects the display brightness of the image on the monitor.
- **Sharpness:** Affects the clarity of the image plane and the acuity of edges.
- **Transparency:** Enhances image quality. Range: 0–48 for MPX-5C Pro and MPX-6C; 0–63 for EC50 series.
- **Offset:** Adjusts the grayscale value of the dark field baseline. For 4040 and 4040BSI (CameraLink interface), default is 100, adjustable range 0–1023. For FL-20BW, default is 12, adjustable range 0–255.
- **Invert:** Displays the negative (color-inverted) version of the current image.
- **Grayscale:** Converts a color image to a black-and-white image.
- **High Dynamic Range (HDR):** Provides a wider dynamic range and more image details for improved image quality.
- **Default:** Restores all parameters in this module to their factory default settings.



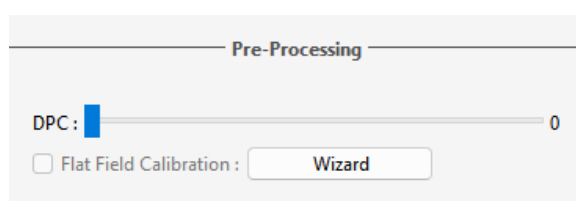
6.3.2. White Balance (Supported by Color Cameras)

Users can adjust the white balance parameters according to the actual light source to achieve image results that better suit their needs, as illustrated in the figure below.

- **White Balance:** Adjusts the proportional relationship of the R, G, and B components in the image to enable the camera to restore true colors under various lighting conditions. The camera defaults to Auto White Balance. In stable lighting environments, users can uncheck Auto White Balance to lock the current RGB gain values.
- **Area White Balance:** Click the Area White Balance option, and a selection frame will appear on the preview image. Under stable lighting conditions, users can move this frame to any white area within the image. The area white balance takes effect both during frame movement and when the stage is moved. Click "√" to lock the area white balance. The size of the white balance frame is adjustable.
- **Black Balance:** Locks the white balance and applies a predefined set of R/G/B gain values, allowing the camera to accurately reproduce image colors in low-light environments. This is typically used for imaging in biological fluorescence microscopy.
- **R, G, B Gain:** Manually adjusts the gain values for the R, G, and B channels.
- **Color Temperature:** Displays the approximate color temperature based on the current R/G/B values. It also allows manual adjustment to match the actual environmental color temperature for more accurate white balance calibration.



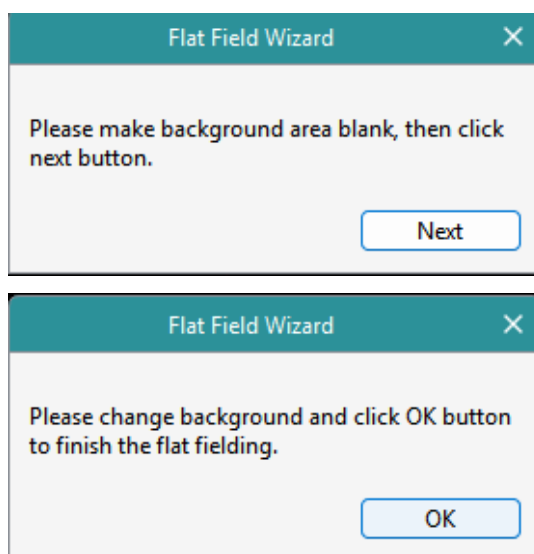
6.3.3. Preprocessing



- **DPC (Defective Pixel Correction):** Reduces image bad pixels. EC50 series: Range 0–1. Excelis 4K: Range 0–15, default 0. Other Excelis HDMI series: Range 1–7, default 5.
- **3D Denoising:** Averages several consecutive frames to filter out non-overlapping noise, preserving a cleaner and finer image. The number of frames can be customized.
- **Flat Field Correction:** In practical microscopy applications, uneven illumination caused by the microscope light source, optical system, or dirt on eyepieces/objectives may lead to non-uniform imaging or color patches. Flat field correction effectively reduces such defects, resulting in more uniform imaging and smoother, more realistic color reproduction.

Flat Field Correction Steps:

1. Click **【Wizard】** and move the camera's field of view to a blank background area.
2. Click **【Next】** to move the background to another blank area, then click **【Confirm】** to complete the flat field correction.



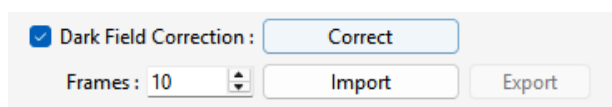
3. Uncheck the box to exit flat field correction. To reapply it later, simply check the box again; there is no need to run the setup wizard again.

Note:

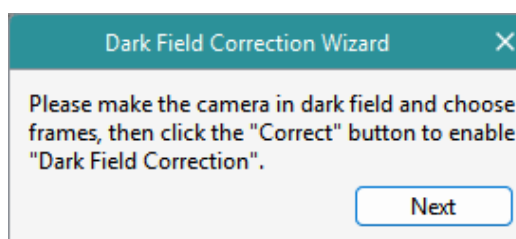
- a. During flat field correction, manually set the exposure time to avoid overexposure (clipping) or underexposure. All pixel values should be between 64 DN and 254 DN.
 - b. Except for any moved specks, the brightness of other areas in the two background images should be consistent. The two backgrounds must not appear as "visually inconsistent images".
 - c. For the flat field correction target, it is recommended to use plastic, ceramic, or professional white balance paper.
 - d. Ensure the background is a blank area and the illumination is uniform during correction. Re-calibration is required if the camera lens is changed, the microscope objective is swapped, or if focus/magnification is adjusted.
- **Dark Field Correction:** This function is used to address issues such as corner brightness and background non-uniformity on the sensor chip.

Instructions for using Dark Field Correction:

- (1) The correction checkbox is unchecked by default. After checking it, you can set the number of frames, and then click Correct or Import.

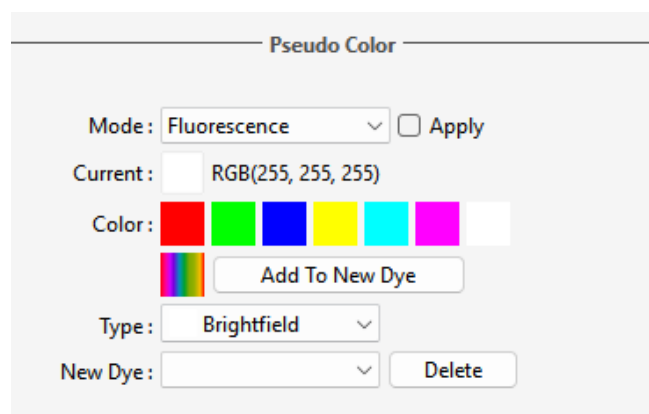


- (2) After clicking the Correct button, follow the prompts in the pop-up dialog box. Click Next to automatically calculate the correction coefficients.



- (3) The default number of frames is 10 (users can set a different value between 1 and 99 as needed).
- (4) Import and Export are used to import and export the correction coefficients, respectively.
- (5) Dark field correction must be performed separately for different exposure times and under different scenarios.
- (6) Closing the software or saving parameter groups will save the frame count setting, but it will clear the correction checkbox and the coefficients. The correction must be performed again the next time the software is started.

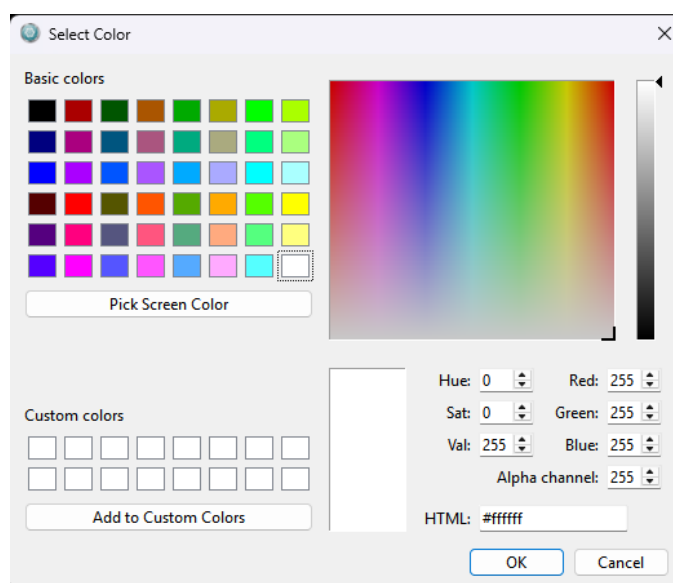
6.3.4. Pseudo Color



- **Fluorescence Staining:**

This is primarily used for fluorescence images captured by monochrome cameras. The software adds pseudo color to the image to achieve a fluorescence staining effect. Users can select a dye according to their needs. Check [Apply] to apply the selected color to the image; uncheck it to remove the staining. The pseudo-stained images can be used for later synthesis into complete fluorescence images. To save the pseudo-color with the image, ensure that the checkbox for **Save the Adjusted Image** is checked (section 6.4.1) before saving the image.

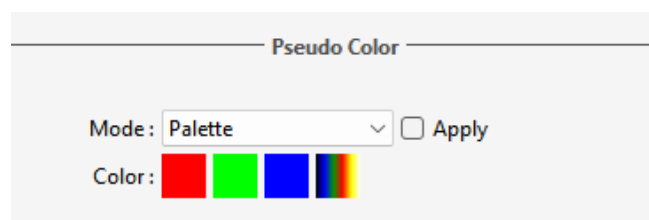
1. **Current:** Displays the currently selected dye type. Seven commonly used colors are provided.
2. Click  to bring up the complete color palette for a wider selection of colors. You can also define your desired color using the color parameters on the right, then click 'Add to Custom Colors' for future use.
3. **Add to New Dye:** Adds the color selected from the palette as a new dye.



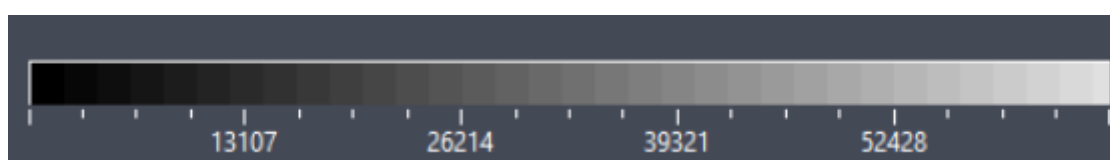
4. **Type:** Provides a wide range of colors for use.
5. **New Dye:** Displays the dye colors customized by the user.
6. **Delete:** Deletes a user-added custom dye.

➤ **Color Palette:**

Supports Monochrome, Red, Green, Blue, and Color modes. Select a color block with the mouse and check [Apply] to activate the corresponding color. If no color block is selected when [Apply] is checked, the Monochrome mode takes effect.



In Physical Mode, the display supports color pseudo-color bars in 5 modes, defaulting to Grayscale. Grayscale image data is mapped to the color range of the pseudo-color bar based on the histogram's minimum and maximum values. The pseudo-color mapping for pixels with different grayscale values changes according to the adjustment of the color levels. The pseudo-color bar automatically matches the changes in the left and right color levels.



6.3.5. Post-Processing

The screenshot shows the 'Post Processing' window with three sections:

- Stitching(Live)**: Speed is set to 'High Speed' (dropdown), Background Color is a black square, and a 'Start' button is present.
- EDF(Live)**: Quality is set to 'High' (dropdown), and a 'Start' button is present.
- Frame Integral/3D Denoise**: Mode is set to 'Frame Integral' (dropdown), with an unchecked 'Preview' checkbox. Under 'Frames', '1' is selected with a radio button. Under 'Time', '0' m '0' s '30' ms is selected with radio buttons.

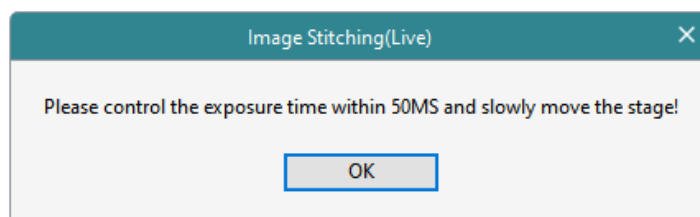
➤ **Image Stitching:**

Dynamic image stitching supports the real-time stitching of large-area samples under a biological microscope, completely presenting the sample morphology.

1. **Stitching Speed:** Supports two modes: Fast and High Quality. The default is Fast mode.
2. **Background Color:** Allows changing the background color of the invalid areas in the stitched composite image. Click  to switch the background color. Select the desired color from the pop-up palette. The change takes effect after stitching is complete. The software defaults to black.

Operating Steps:

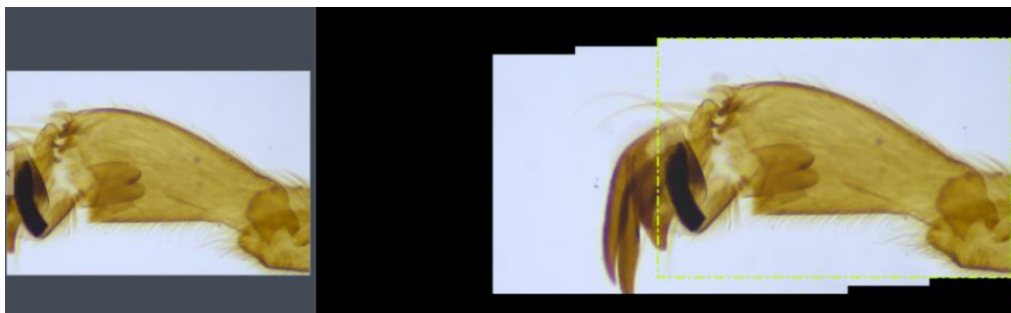
- (1) Click [Start]. If the exposure time is greater than 50ms, an operation prompt will pop up. Simultaneously, the current stitching data will be displayed in real-time below the stitching function: Size: The dimensions of the stitched image. Image Memory: The memory occupied by the image. Free Memory: The remaining available computer memory. Memory Usage: The overall memory usage of the computer.



The screenshot shows the 'Stitching(Live)' panel with the following information:

- Speed: 'High Speed' (dropdown) and a 'Stop' button.
- Background Color: A black square and a 'Save' button.
- Size: 6000 x 6000
- Memory: 0.52GB
- Free Memory: 1.36GB
- Memory Usage: 91%

- (2) Move the sample to another area via the stage (movement should not exceed 3/4 of the field of view) and then stop. The navigation display box in the stitching window will turn green, and the software will perform a stitching operation. Stop again after subsequent movement, and the software will stitch again.



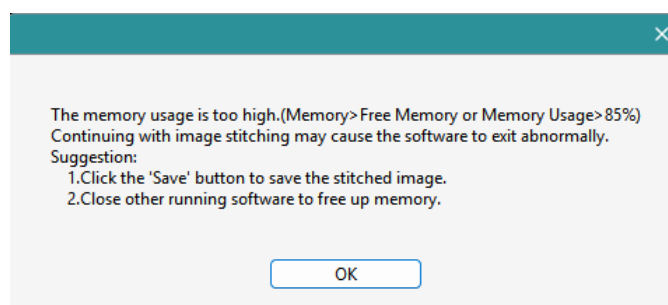
- (3) If the navigation display box turns red, it indicates the movement is beyond the stitchable area and stitching cannot be performed. The sample needs to be moved back near the last successful stitching position.



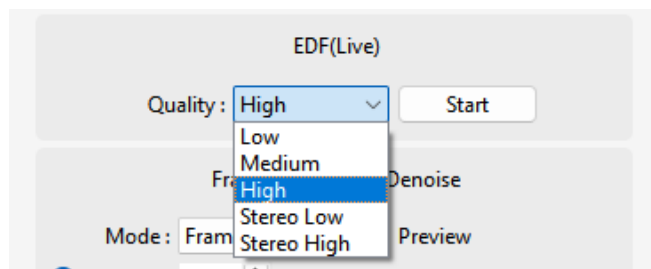
- (4) Click [Stop] to end the stitching process. The stitched image will pop up automatically.

Note:

- It is recommended to perform white balance correction and flat-field correction before starting stitching to achieve the optimal image quality.
- The stitching process will stop automatically when system memory is low. Therefore, it is recommended to perform this operation on a computer with sufficient memory.
- Dynamic image stitching is not supported on 32-bit computer operating systems.
- When the stitched image frame is very large and occupies significant memory, and the memory usage during stitching reaches 85%, a warning pop-up will appear. This indicates that the current computer's available memory no longer supports continuing the stitching process. Please promptly click the save control to save the image. The corresponding image will be saved in the following folder: Desktop\Image\stitching.



- **Extended Depth of Field (Real-time):** Dynamic EDF supports merging in-focus areas from different focal planes of thick specimens under biological microscopes into a single stereoscopic image, completely presenting the specimen morphology.

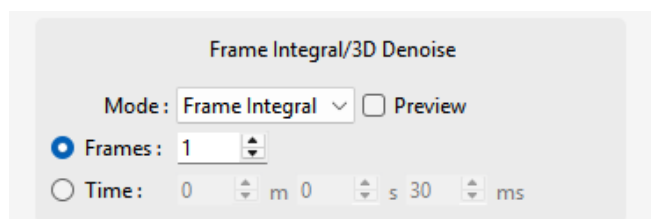


Quality: The quality level of the composite image. A higher value results in slower composition speed but better image quality. The "Stereo" option uses an algorithm adapted for stereomicroscopes. "Stereo-High" adds an image shift correction algorithm on top of the EDF function, meaning it can automatically correct for deviations in the X and Y axes (parallax) that occurs when focusing on the sample.

Operating Steps:

- 1) Click the **【Start】** button to begin the EDF operation.
- 2) Continuously fine-tune the microscope's focus point. The software will merge the sharpest parts from the current view in real time.
- 3) Click the **【Stop】** button to end the process. A composite EDF image will be generated in the file preview panel.

➤ Frame Integration / 3D Denoising:



Frame Integration: Captures a continuous sequence of frames based on preset conditions and integrates them into a single image, allowing real-time preview of the integrated result.

- 1) **Integration by Frame Count:** Integrates a consecutive preset number of frames into one image. Range: 1~99 frames. Default: 1 frame.
- 2) **Integration by Time:** Integrates all frames captured within a preset duration. The number of frames integrated equals the integration time divided by the exposure time. Range: 1ms ~ 59m 59s 999ms. Default: 30ms.
- 3) **Integration Preview:** Previews the integration effect on the screen in real time based on the preset parameters, allowing adjustment to the optimal effect before final image capture. Frame integration can enhance the brightness of low-light images for better imaging results.

Note:

- a. An appropriate number of frames should be set for integration; otherwise, excessive brightness may cause distortion.
- b. "Integration by Frame Count" and "Integration by Time" cannot be enabled simultaneously; only one method can be selected at a time.

3D Denoising: Obtains low-noise images by acquiring and comparing image data from several consecutive frames, automatically filtering out non-overlapping information. The number of frames can be customized. Range: 1~99 frames. Default: 10 frames.

Note:

Saving a 3D denoised image requires capturing multiple consecutive frames, so the capture time is longer than usual. Since 3D denoising filters noise by processing multiple consecutive frames, it is only suitable for static scenes. Using it on dynamic scenes will cause blurring or smearing. 3D Denoising is not effective for video recording.

6.4. Acquisition

6.4.1. Acquisition Settings

➤ Pop-up Saving (Use Dialog Select Path):

When this option is selected, clicking the capture button will trigger a save dialog window. Users can set the corresponding storage path and customize the file name. Only a single image can be saved at a time. The total number of frames and total duration cannot be configured.

➤ File Name Saving (Use Fixed Path):

- 1) **Path:** Saves image files to a folder at a predefined path. Users can click the [...] button to modify the save path. The default save path is C:/Users/Administrator/Desktop/Image. Files can also be saved to a shared drive.

Note:

- a. If a single image is captured, it will be stored directly in the predefined folder path after capture.
 - b. If multiple images are captured, a new folder named with the date and time will be created under the predefined path. All images from that capture session will be stored in this folder. The timestamp precision supports display up to milliseconds.
- 2) **File Name:** The default file name is "TUC". Custom naming is supported, including "custom name + timestamp". File names must not contain the following half-width special characters: \:.*? "<>|. If such characters are entered, an error message will appear.

The file name cannot contain any of the following characters:\:.*? "<>|

The file name can be customized with a maximum length of 64 bytes. The timestamp supports five display formats, with the default being yyyymmddHHMMSS. The timestamp precision supports display up to milliseconds.

➤ Total Frame: Take pictures according to the set frame number.

When saving to the internal memory for shooting, check how many pictures can be stored in the remaining memory. If the number of pictures taken exceeds the maximum number that can be opened, the number of pictures 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 units options: minutes, seconds and milliseconds, the default is 0 minutes, and the range is 0ms-120min.
- **Save the Adjusted Image:** After checking, all adjustments will be automatically saved with images and video. Parameters include adjusted coloring (pseudo-color), gamma, contrast, color scale, 3D noise reduction, integral effect, flat field correction, dark field correction effect, subtraction Background and

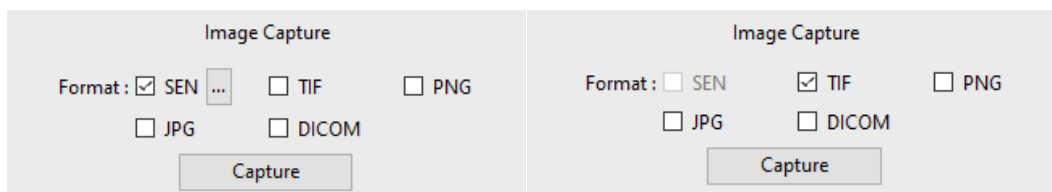
reference subtraction, etc. If unchecked, the saved image is the original image, without coloring, gamma, contrast, color scale, 3D noise reduction, integral effect, flat field correction, dark field correction effect, background subtraction and reference subtraction, etc. (Mono cameras support this 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.
- **Image Metadata:** Timestamp Information.

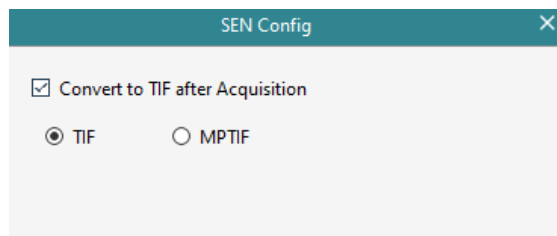
When enabled, timestamp information is stored in the header of each frame.

- **Bit Depth Conversion:** The Windows system displays images in 8-bit or 16-bit, but the camera's actual bit depth is often less than 16 bits. This function maps the actual bit depth image data to a 16-bit range for display, ensuring consistent brightness between the software preview and the image when opened in Windows.

6.4.2. Image Capture



- **File Format:** Supports SEN\JPEG \TIFF\PNG\DICOM, Monochrome cameras default to SEN, while color cameras default to JPG. Multiple selection is available.
- 1) **SEN:** Custom file format, including file header information. (Monochrome cameras only; 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.

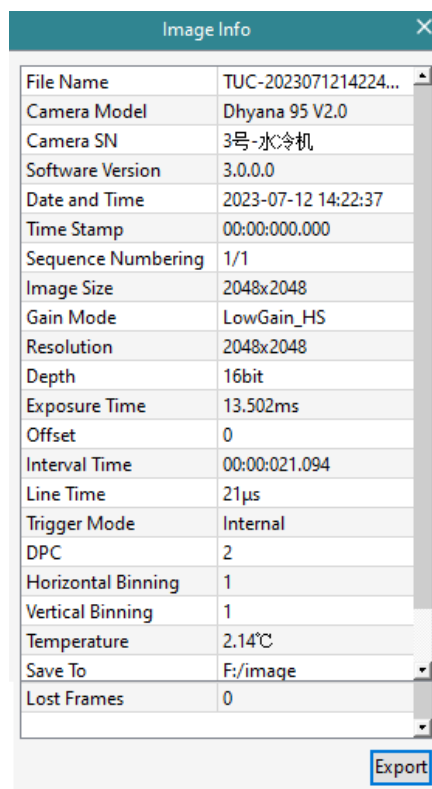
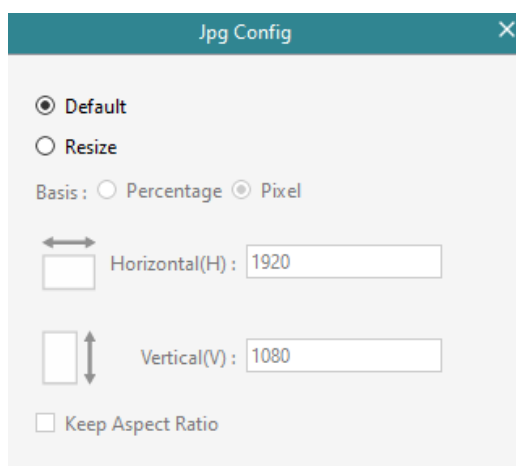


Image Info	
File Name	TUC-2023071214224...
Camera Model	Dhyana 95 V2.0
Camera SN	3号-水冷机
Software Version	3.0.0.0
Date and Time	2023-07-12 14:22:37
Time Stamp	00:00:000.000
Sequence Numbering	1/1
Image Size	2048x2048
Gain Mode	LowGain_HS
Resolution	2048x2048
Depth	16bit
Exposure Time	13.502ms
Offset	0
Interval Time	00:00:021.094
Line Time	21μs
Trigger Mode	Internal
DPC	2
Horizontal Binning	1
Vertical Binning	1
Temperature	2.14°C
Save To	F:/image
Lost Frames	0

Export

- 2) **JPG:** Lossy compressed image format, the size of the image is small, and the quality of the original image data is reduced.

JPG Configuration: 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.



Jpg Config

☒ Default
☐ Resize

Basis: ☐ Percentage ☒ Pixel

Horizontal(H): 1920

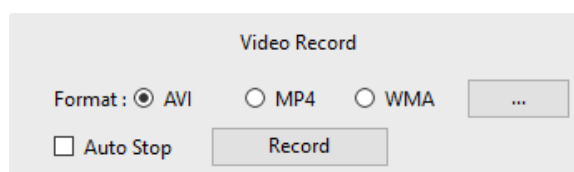
Vertical(V): 1080

☐ Keep Aspect Ratio

- Default: When the default is selected, the generated image keeps the current camera image resolution.
- Resize: Check the resize to adjust the image size. The input must be higher than 0 and less than 10000. 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.
- Percentage/pixel: Adjust pictures 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.

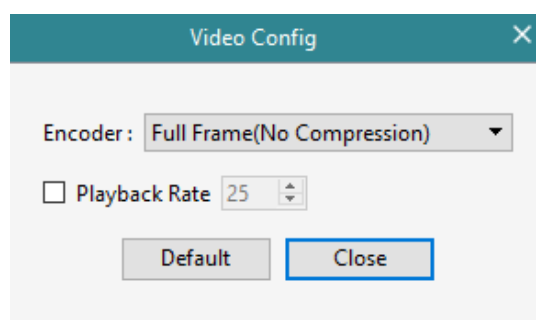
- d. **Horizontal:** Set the size of the image in the horizontal direction.
- e. **Vertical:** Set the size of the image in the vertical direction.
- f. **Keep Aspect Ratio:** Check it to keep the image aspect ratio to prevent image distortion.
- 3) **TIF:** The lossless image format can save all the 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 pictures. Using software such as Windows Photo Viewer will cause the color of the picture to be inconsistent with the actual color.
- 4) **PNG:** Lossy compressed image format, the size of the image is small, and the quality of the original image data is reduced.
- 5) **DICOM:** Digital Imaging and Communications in Medicine 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.

6.4.3. 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 MP4. When the image width or height exceeds 4096 pixels, try to output image in AVI.
- **Video config:**



Click the [...] button to open the **Video Config** dialog.

- 1) **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.
- 2) **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.
- 3) **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 (see below in Section 6.4.4). You can click [Stop Record] at any time to stop the video recording, even if the total frames or total time have not been reached.

6.4.4. Time-Lapse Photography

☐ Use Fixed Path ☒ Use Dialog Select Path
 Path : C:/Users/Administrator/Desktop//Image ...
 File Name : TUC + yyyymmddHHMMSS
☒ Total Frame : 1
☐ Total Time : 0 m 1 s 0 ms
 Delay Time : 0 m 0 s 0 ms
☐ Save the Adjusted Image
☒ Keep Live Preview

Time-Lapse Photography
 Interval Time : 0 m 0 s 0 ms
 Capture as Frames Record as Video

Before starting a time-lapse photography experiment, you should first choose the **Video Playback Rate** (see Section 6.4.3 above) and set the **Video Format** to **MP4** (smaller size, more universal playback). The default playback rate is 25 frames per second (fps). When capturing hundreds of time-lapse images, 25 fps may be suitable to see the changes in the sample. For example, 200 time-lapse images with a video playback rate of 25 fps would show an 8-second video. However for shorter time-lapse acquisitions or fewer captured images, a slower playback rate may be desirable to better visualize any changes. The video playback rate is applied to the time-lapse experiment.

There are several options for applying time-lapse photography. After setting the **Interval Time** (or time between image capture), you have the option to capture a total number of frames (**Total Frame**) or a total time of acquisition (**Total Time**). Enter either the number of Total Frames or Total Time in the dialog at the top of the Acquisition menu. Note: **Delay Time** specifies the delay before the first image is acquired, whereas **Interval Time** is the time between image acquisition.

After your acquisition parameters have been set and to initiate acquisition, you may choose **Capture as Frames** (capture all time-lapse images as separate frames; this option is best for post-acquisition analysis or measurement) or **Record as Video** to compile all the images into a video that will be played back at your specified playback rate.

- **Interval Time:** The interval time of each picture 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 pictures. 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.

Example Experiments:

Total Time of Acquisition: Capture time-lapse images with 10-second interval between images, for a **total time of 2 minutes**.

1. Set the **Video Playback Rate** to 2. This will play 2 images per second and the total video duration will be 6 seconds.
2. Set the Interval Time for Time-Lapse Photography to 10s.
3. Set the **Total Time** for Acquisition to 2m.
4. Click **Record as Video** in the Time-Lapse Photography dialog to start acquisition. Acquisition will stop automatically after 2 minutes, and the video will appear in the **File Preview** gallery.

Total Number of Images: Capture time-lapse images with 5-second interval between images, for a **total of 60**

images.

1. Set the **Video Playback Rate** to 6. This will play 6 images per second and the total video duration will be 10 seconds.
2. Set the **Interval Time** for Time-Lapse Photography to 5s.
3. Set the **Total Frame** for Acquisition to 60.
4. Click **Record as Video** in the Time-Lapse Photography dialog to start acquisition. Acquisition will stop automatically after 60 images have been acquired (about 5 minutes), and the video will appear in the **File Preview** gallery.

6.4.5. Save To

During the shooting process and when the disk space is less than 1GB, the shooting will stop automatically, and a reminder of "Disk space not enough" will be displayed; If the disk space is less than 1GB before recording, the "Disk space not enough" reminder will pop up, and the shooting will not be performed.

Disk space not enough.

- **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 imaging.
- **Frames Per Stack:** It can only be set when saving SEN and TIF images, and the default is 1 frame. If the setting value is not 1, MPSEN or MPTIF will be generated.

Note:

As the number of frames increases, memory usage will also rise, which may lead to frame loss. For SEN and TIF file formats, this number can be set to the same value as in the "Acquisition Frame Count" 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 disk. If the output is in MPSEN format, it can be decompressed into individual SEN or TIF files. If the output is an MPTIF file, it can be imported into ImageJ as a single "virtual stack."

- **RAM Buffer:** There are two options available for selection: Automatic and Manual. The default option is Manual.

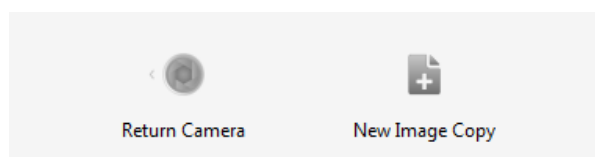
Auto: When selecting "auto" mode, the capacity of the acquisition buffer for memory configuration is set to match the frame rate.

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.

7. Static Image Processing

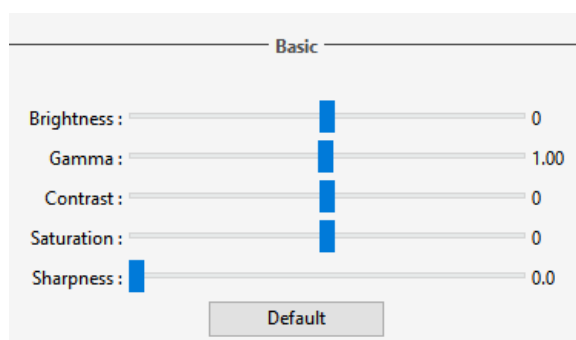
7.1. Hot Key



- **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.

7.2. Adjustment

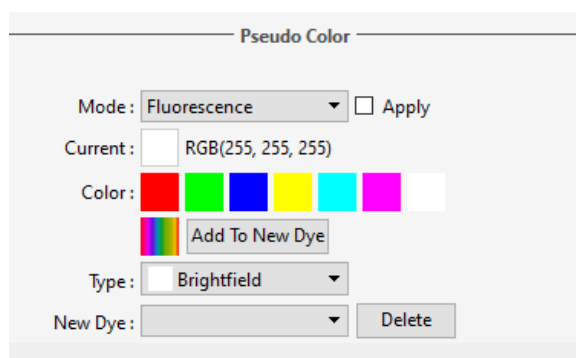
7.2.1. Basic



- **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.

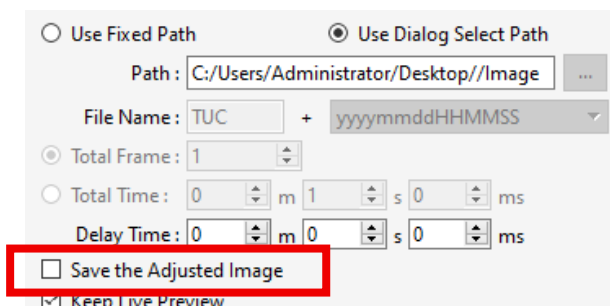
7.2.2. Pseudo Color



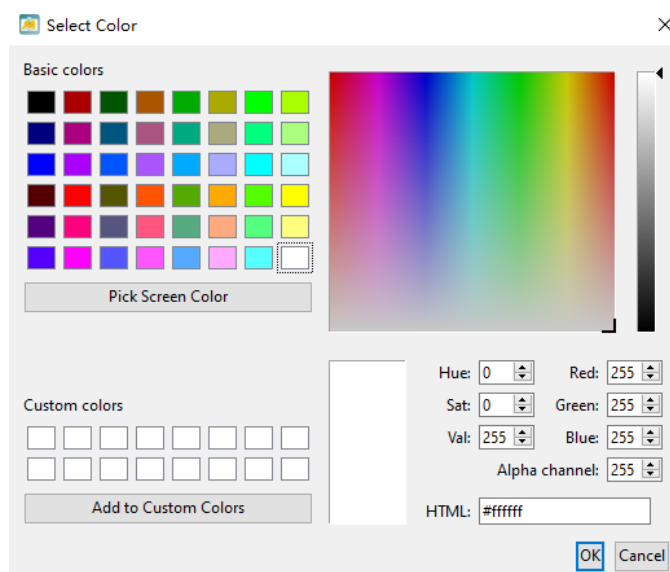
- **Fluorescence:** It is generally used for black-and-white cameras to take fluorescence images, and add pseudo colors to the images through software to achieve the effect of fluorescence coloring. The user selects a dye according to the needs, checks [Apply] to apply the selected color to the image, then you can uncheck to remove coloring. The pseudo-colored image obtained by taking pictures can be used to synthesize a complete fluorescence image in the later stage.

Note: Colors are assigned to dyes, but the user is free to choose any color/dye when adding a pseudo-color to the image. Other colors may enhance the observation of details.

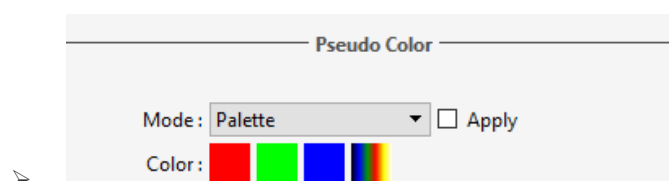
Note: To save any changes (i.e., pseudo color) to an image, ensure that the box next to **Save the Adjusted Image** is checked.



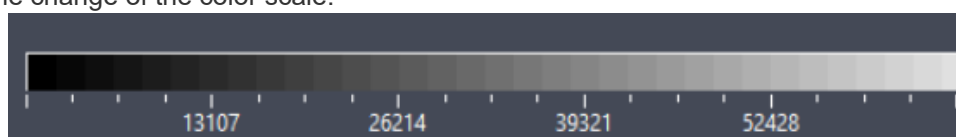
- 1) **Current:** Display the currently selected dye type, providing seven commonly used colors.
- 2) Click  to call up the full color palette and choose richer colors. You can set the desired color by yourself through the color parameters on the right and click Add to Custom Colors for future use.
- 3) **Add to New Dyes:** To add selected colors on the palette into the new dyes.



- 4) **Dye Type:** Display seven commonly used colors.
- 5) **New Dye:** Displays user-defined dye colors.
- 6) **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.

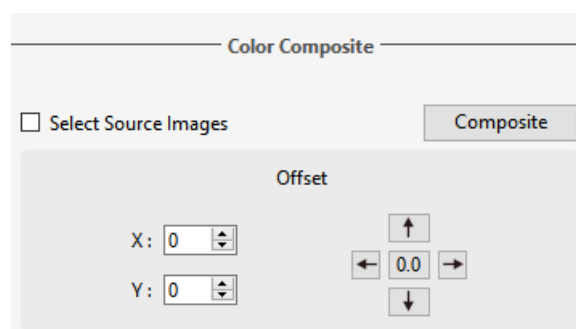


- In physical mode, it supports displaying pseudo-color bars in 5 modes, and the default is grayscale. The grayscale image data is mapped to the color range of the pseudo-color bar according to the minimum and maximum values of the histogram, and the pseudo-color mapping of pixels with different grayscale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



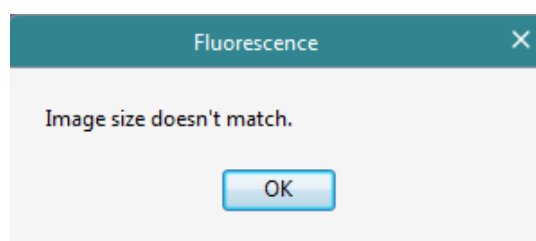
7.2.3. Color Composite

In the research applications of biological related sciences, different fluorochromes are used to label different cell structures. On the applications of micro-fluorescence observations, a complete fluorescence cell image contains multiple fluorescence areas which belong to different cell structures that have their own special affinity to certain fluorochromes.

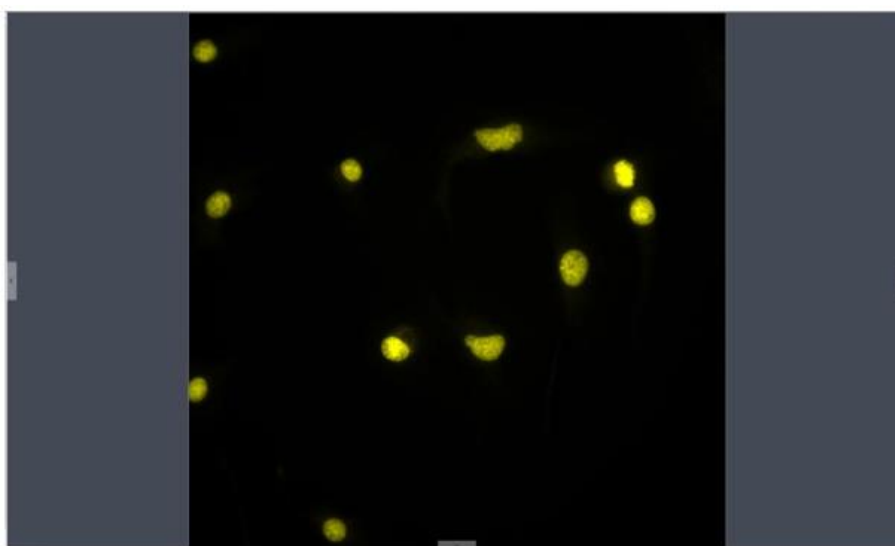


Under a fluorescence microscope, a complete cell map usually consists of multiple fluorescent channels, and the synthesis function is used to merge the images of the camera under multiple fluorescence channels into a single image.

- 1) Select the path to open any picture that needs to be synthesized by fluorescence. Select the image which needs fluorescence channels combining from its path and open into the window.
- 2) Monochrome images should first be pseudo-colored and saved prior to selecting for merging into a color composite.
- 3) Check the box Select Source Images, then check the box in the thumbnails of the images to be merged.
- 4) Click on [Start Color Composite] to select two or more images with the same observation field and image dimensions as the one opened before. The maximum number of images to select and combine together is not limited. The operating directions window will pop-up, as shown below.



- 5) Select the original picture needs fluorescence synthesis on right data bar, the synthesized picture will be displayed on preview windows, as shown below.



- 6) 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 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.

7.2.4. 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

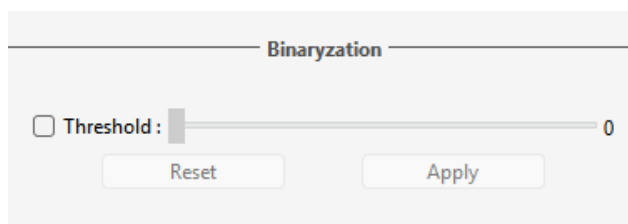
mixed color with the base color, and the result color is always the brighter color.

- **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 picture, and generate a new image, which can be saved as a new image.
- **Reset:** Reset the parameters of the module.

7.3. Processing

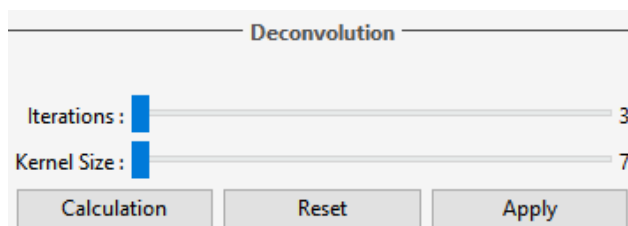
7.3.1. Binarization

CaptaVision+ v3.1 provides image binarization, which sets pixel grayscale values to 0 to 255, transforming the entire image into a distinct black-and-white effect.



- **Threshold:** Check to enable adjustment between 0 and 255. Reset and Apply are activated.
- **Reset:** Click the Reset button to clear all parameters for this module.
- **Apply:** After adjusting the threshold parameter, click Apply to implement the settings to the image.

7.3.2. Deconvolution



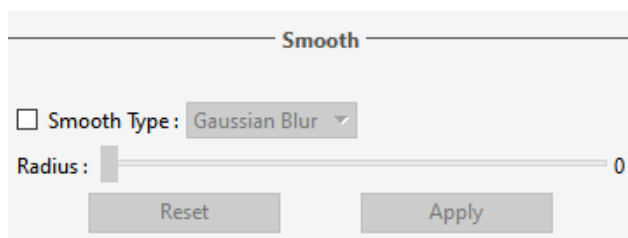
- **Iterations:** Number of iterations of the calculation.
- **Kernel size:** Deconvolution kernel window size.

Note:

Mac system and windows 32-bit system do not support this function. While Windows 64-bit system and the picture is less than or equal to 500w pixels can be used.

7.3.3. Smooth

CaptaVision+ v3.1 provides users with three image smoothing techniques, Gaussian blur, box filter and median filter, for image blurring. These methods reduce image noise and reduce the level of detail. The range is 1~30.

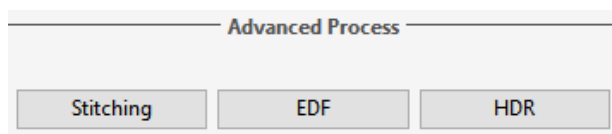


- **Smoothing type:** Gaussian Blur, Box Filter and Median Filter.
- **Radius:** Similar to Photoshop, the larger the radius, the stronger the image processing ability and the smoother the image.

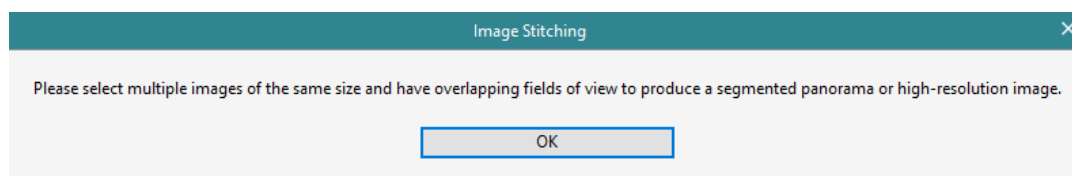
- **Reset:** The parameters of the module can be restored to the factory default parameters.
- **Apply:** Apply the current parameter settings to the picture, and generate a new image, which can be saved as a new image.

7.3.4. Advanced Process

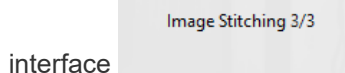
CaptaVision+ v3.1 provides users with three batch image post-processing technologies to merge a batch of captured images.



- **Stitching:** Stitch several images which have overlapping parts to one another into a large, seamless, high-resolution image.
- 1) Choose a compositing method according to the user's need, 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

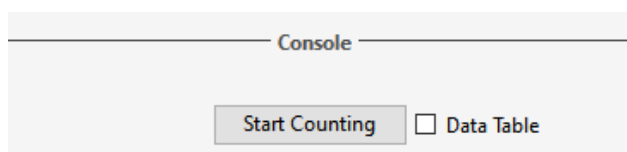


- 4) When the combining is completed, a thumbnail of the combined image will be generated and present in the left menu bar as below.
- **EDF:** Extract and synthesize a complete and clear image from a series of images of the same object with different focal lengths that are in focus. Pick up those images 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.
 - **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.

7.4. Automatic counting

7.4.1. Console

Automatic Counting setting interface is as shown below.



- **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 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.

File Preview Histogram Automatic Counting Table Automatic Counting Statistics								
	Function	Mean	Standard Deviation	Minimum	Maximum	Range	Sum	Count Number
1	Area_pixel ²	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.

Console

Region : ☒ All ☐ Rectangle ☐ Polygon

- **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 area.
- **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.

Console

Segmentation

☐ Auto Bright ☒ Auto Dark ☐ Manual

Gray

X1 [0, 255]

Morphological Processing

- **Auto Bright:** Use algorithms to automatically segment bright objects from a dark background.
- **Auto Dark:** Use algorithms to automatically segment dark objects from a bright background.
- **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.

Console

Display : ☒ Contour ☐ Region

Cutting Mode

☐ Auto Cut ☐ Manual ☒ No Cut ☐ Merge

☐ Include Boundary

- **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.
- **Include Boundary:** 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.

Console

Target Data Settings :

- Area
- Perimeter
- Radius
- Diameter
- Roundness
- Center X
- Center Y
- Long Axis
- Short Axis
- Direction
- Integral
- Standard Deviation
- Mean Gray Value

	Data Type	Minimum	Maximum
1	Area	0.000	10000000.000
2	Roundness	0.000	10000000.000
3	Long Axis	0.000	10000000.000
4	Short Axis	0.000	10000000.000

☐ Draw Target

- **Add:** Add the type of calculation to the statistical result.
- **Delete:** Delete a data type.
- **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.

7.4.2. Property

Property	
Font	A [Arial, 9]
Font Color	■ [0, 255, 0] (255)
Target Color	■ [0, 0, 255] (255)
Contour Width	1
Precision	3
Default	

- **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 another 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 specified. The range is 0~6.

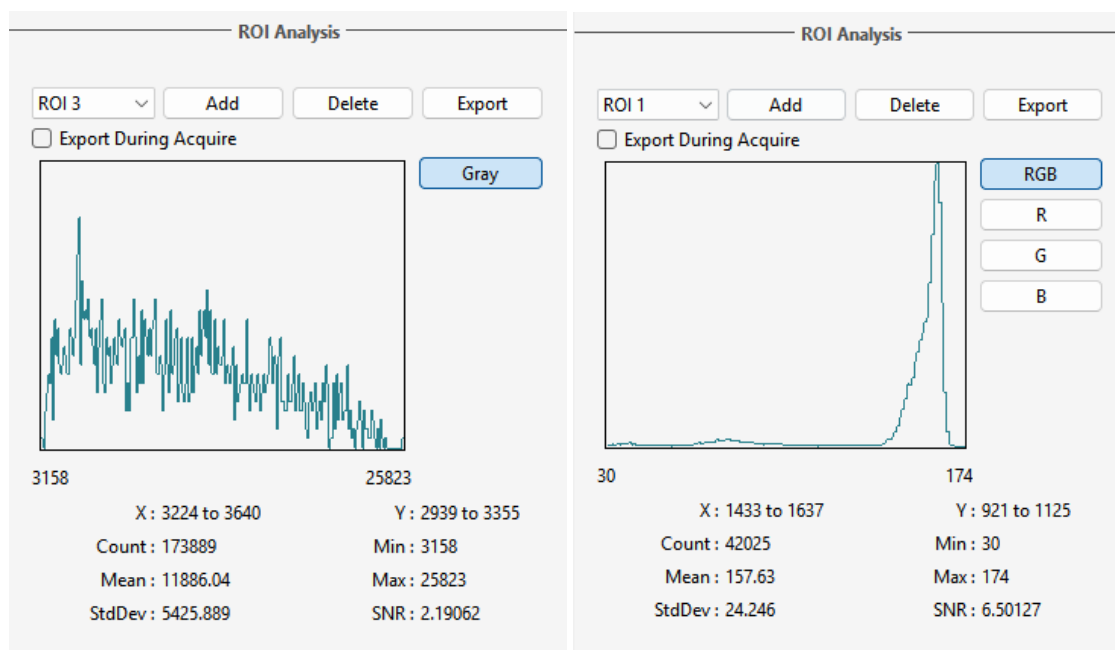
8. Analysis Panel

8.1. Data Analysis

8.1.1. ROI Analysis

Statistically analyze the histogram distribution of ROI regions; color images allow channel selection.

ROI Analysis	
None ▼ Add Delete Export	☐ Export During Acquire



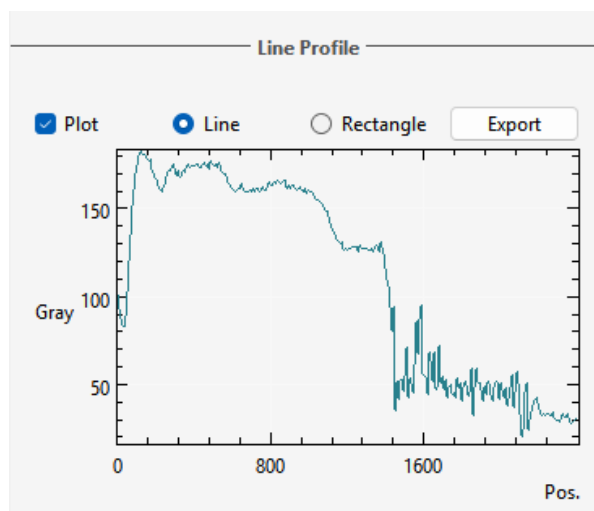
- **List:** No histogram data analysis is performed when no ROI is selected or none exists; histograms and analysis data are not displayed. Histograms and analysis data appear when an ROI is added or selected.
- **Add:** Click once to add a new ROI region to the dropdown list; the software interface allows custom selection; When the mouse cursor hovers over the ROI analysis border, it changes to a crosshair with four arrows , enabling click and drag to reposition the ROI; when hovering over the four corners of the ROI analysis border, it changes to a double-headed arrow , enabling stretching;
- **Delete:** Removes the currently selected ROI region and its corresponding name from the dropdown menu.
- **Export:** Supports exporting statistics for the selected ROI region. Exported file format: ".csv".
- **Statistical Information:** Start/end coordinates of the ROI region, number of pixels, average gray value, minimum gray value, maximum gray value, standard deviation, signal-to-noise ratio.

8.1.2. Line Profile Analysis

Used to measure grayscale values in images, supporting both line and rectangle modes.

Operating Steps:

- 1) Enable the function by checking the [Marking] option.
- 2) Draw a line segment or rectangle to measure the fluorescence intensity within the selected area.



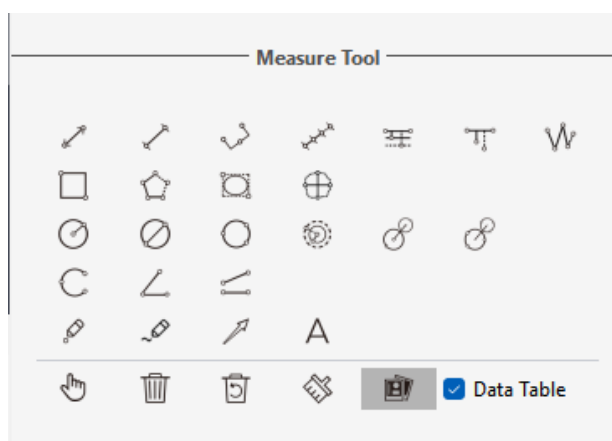
3) Click [Export] to save the current measurement data locally in .csv format.

Note:

- When drawing a line segment, the measurement is completed upon the second click, allowing measurement of fluorescence intensity data along the straight line.
- For rectangle drawing, left-click to select two endpoints and draw a rectangle, enabling measurement of the average fluorescence intensity data for each column of pixels within the rectangle.

8.1.3. Measurement Tools

The software provides tools for measuring images. For example, if you wish to determine the distance between two points in an image, using the measurement tool allows you to simply draw a straight line between the points and obtain instant measurement data. CaptaVision+ v3.1 offers users a wide range of measurement types to aid image analysis.



Measurement operations in the software are executed at the image pixel level. For instance, 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 like millimeters or inches using measurement calibration.

- **Line:** Draw a line segment. Clicking a second time completes the drawing, with arrowheads at the endpoints. Hold Ctrl to draw horizontal or vertical lines.
- **H-shaped Line:** Draw a line segment. Click a second time to complete the drawing, with endpoints as perpendicular lines.
- **Three-Point Line Segment:** Draw a line segment. Click a third time to complete the drawing.
- **Multi-Point Line Segment:** Draw a line segment. Click again to draw additional segments continuously. Double-click to finish drawing.
- **Parallel Line:** Draw a line segment, then left-click again to draw its parallel line. Double-click to finish drawing.

- **Perpendicular Line:** Draw a line segment, then left-click again to draw its perpendicular line. Double-click to finish drawing.
- **Polylines:** Left-click once to add a new segment to an existing polyline. Double-click to finish drawing.
- **Rectangle:** Left-click to select two endpoints and draw a rectangle. Measurements include length, width, perimeter, and area.
- **Polygon:** Left-click multiple times to draw a polygon. Double-click to finish drawing.
- **Ellipse:** Left-click to select two endpoints and draw an ellipse. Measurements include perimeter, area, major axis, minor axis, and eccentricity.
- **Circularity:** Select the first segment passing through the center on the measured circle's outline. Select the second segment passing through the same center on the measured circle's outline. Upon completion, the numerical value representing the degree of approximation to a theoretical circle is obtained. This value equals the difference between the two segment lengths divided by two.
- **Radius Circle:** Click to select the center point, then click again to select the radius distance to complete drawing.
- **Diameter Circle:** Click twice to select the diameter endpoints and draw a circle, then click again to finish drawing.
- **Three-Point Circle:** Click three times to select three points on the circumference, then click again to complete drawing.
- **Concentric Circles:** Draw a circle using radius. First click selects the center; double-click completes drawing.
- **Four-Point Double Circles:** First click selects the first center; second click selects the radius distance; third click selects the second center; fourth click selects the radius distance, completing drawing.
- **Six-Point Double Circles:** Click three times to select three points on the first circle's circumference, then click three more times to select three points on the second circle's circumference to complete drawing.
- **Arc:** Select three points on a circle to draw an arc segment; the third click completes drawing.
- **Three-Point Angle:** Angle between two connected line segments. Click to draw endpoints, then click a third time to finish drawing.
- **Four-Point Angle:** Angle between two non-connected line segments. Click to draw endpoints, then click a fourth time to finish drawing.
- **Point:** Mark points or count points. Manually tally quantities or make markings while recording the XY coordinate values of points.
- **Pen:** After clicking, freely draw curves on the preview screen.
- **Arrow:** The arrow shape completes drawing upon the second click.
- **A:** Add text annotations to the image.
- **Select:** Select measurement shapes and text information on the image. When the mouse hovers near a shape or text, the cursor changes from  to . You can then drag or use the keyboard's [Delete] key to remove the selected measurement shapes and text.
- **Delete:** Delete drawn measurement shapes.
- **Undo:** Reverse the last deletion operation.
- **Delete All:** Remove measurement shapes from all current layers.
- **Merge Measurements:** When saving the image, merged measurement shapes will be integrated into the image. This feature is disabled by default but will be saved once enabled.
- **Measurement Table:** Check to display the "Measurement Table" in the data bar.
- **Data Type:** Each shape corresponds to a data type (e.g., length, angle, slope, diameter, circumference, area). Checking this displays the corresponding information on the image when the shape is drawn. To hide specific data types, uncheck them. This setting persists after saving.

To exit drawing mode during graphic creation, simply right-click the mouse. While in "Drawing"  mode, right-clicking again will resume drawing.

When measurements are in "Unselected"  mode, you can zoom in on the image by holding down the mouse button and dragging the image.

When measurements are in "Selected"  mode, you can zoom in on the image and modify the graphic by

holding down the endpoint of the drawn shape .

All drawn measurement information is saved in the measurement table. Click **[Export to Excel]** or **[Export to TXT]** to save data. Click **[Copy]** to copy the entire table for pasting elsewhere.

File Preview Histogram(Live) Camera Log Measure Data															
☐ Real-time Save report_template1.xlsx Export to Excel Export to TXT Copy															
Type	Name	Length_pixel	Width_pixel	Height_pixel	Perimeter_pixel	Area_pixel ²	Radius_pixel	Diameter_pixel	Angle_°	Slope	Distance_pixel	LongAxis_pixel	ShortAxis_pixel	Eccentricity	
1	Rectangle6		670.366	492.012	2324.757	329828.305									
2	Polygon5				2017.841	265772.773									
3	DiameterCircle4				2044.495	332630.930	325.392	650.784							
4	3PointCircle3				2870.389	655650.136	456.837	913.674							
5	Line2	916.372							0.000	0.000					
6	Line1	1279.231							0.000	0.000					

Note:

- Double-click the mouse to end a single measurement; add clicking the End button to complete the drawing of the graph.

8.1.4. Calibration Ruler

The calibration ruler converts pixel counts into meaningful measurement units, supporting conversions between nm, μm, mm, inch, 1/10 inch, 1/100 inch, and mil.

➤ **Steps to Create a Calibration Table (Requires use of a micrometer)**

- 1) Click **[Draw Line]** to draw a straight line on the image. Holding Ctrl while drawing automatically adjusts the line to a horizontal/vertical calibration ruler.
- 2) Enter the actual length and unit represented by the line's pixel count.
- 3) Specify the calibration ruler name.
- 4) Click **[Apply]** to save and use the calibration ruler.
- 5) Check "Calibration Table" to view/edit: Users can create multiple calibration rulers for switching between different scenarios. Calibration rulers can be viewed or edited within the calibration table.

File Preview Histogram(Live) Camera Log Measure Data Calibration Table							
	Current	Name	Length	TotalPixel	Unit	Unit/Pixel	Resolution
1	☒	default	1.000	1.000	pixel	1.000	

Password Setting **Reset**
 Name :
 Pixels :
 Length : nm

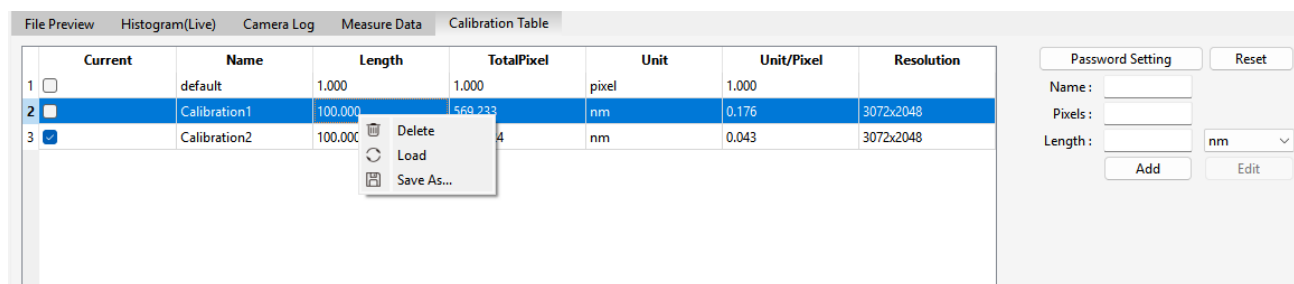
Select a calibration scale by checking the box under the current column to switch scales and apply it to all measurement items.

Note:

- Switching resolutions or using the camera with different magnification objectives requires separate calibration.

➤ **Calibration Table Deletion, Backup/Export, and Load Steps**

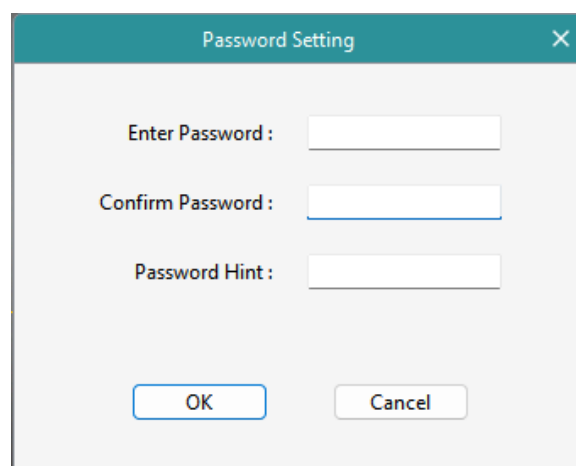
- 1) Open the calibration table at the bottom of the preview interface.
- 2) Select a calibration ruler with the mouse and right-click to bring up the menu, as shown in the figure.



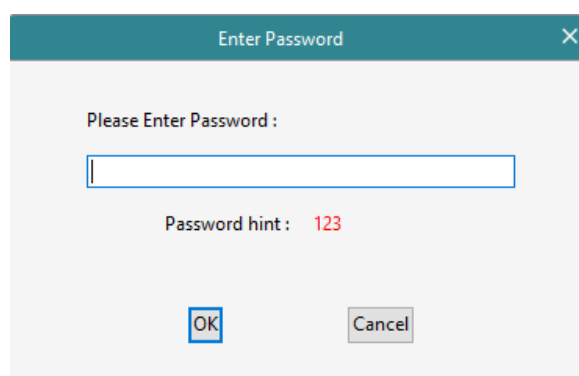
- 1) Click [Save As] and save the calibration.ini file in the dialog box.
- 2) Click [Load], then select the calibration.ini file on your computer to import the backed-up calibration rulers.
- 3) Click [Delete] to remove the currently selected calibration ruler that is not in use (a checked box indicates active status).

➤ Calibration Scale Encryption Settings

- 1) Click Password Settings, enter the password, confirm the password, and enter the password hint. Then click OK.



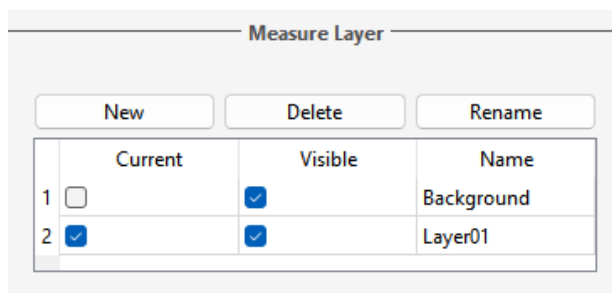
- 2) After setting the password, password verification is required for operations such as creating new calibration scales, deleting, loading, saving as, adding, and editing.
- 3) To remove the password, click Reset, enter the correct password, then click OK to execute the reset.



Notes:

- a. Using a micrometer ensures more accurate calibration. Selecting an incorrect calibration table will yield completely erroneous measurement results. Exercise caution when selecting the correct calibration table for image measurements.
- b. The default scale and currently active scale cannot be deleted.

8.1.5. Layers



- **Layers:** Create multiple layers to perform different measurements on separate layers. The layer function facilitates extensive measurement requirements and image processing for diverse applications. Specific operations are illustrated below.

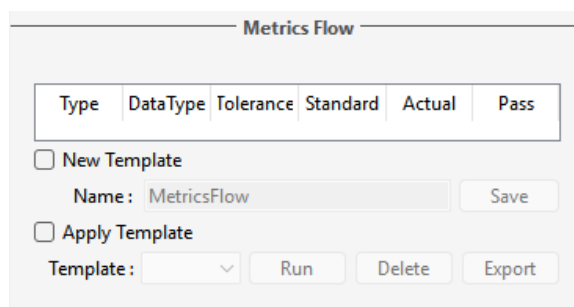
If the current image has undergone prior measurement operations, the layer function will automatically create “Background” and “Layer 01,” with current measurements automatically displayed on “Layer 01.”

You can choose to display measurement data from different layers and preview specific layers. Check the box corresponding to the layer you wish to preview. Switch the currently displayed layer in the software by checking different layers. The checkbox selects the measurement information from the corresponding layer to display in the current layer.

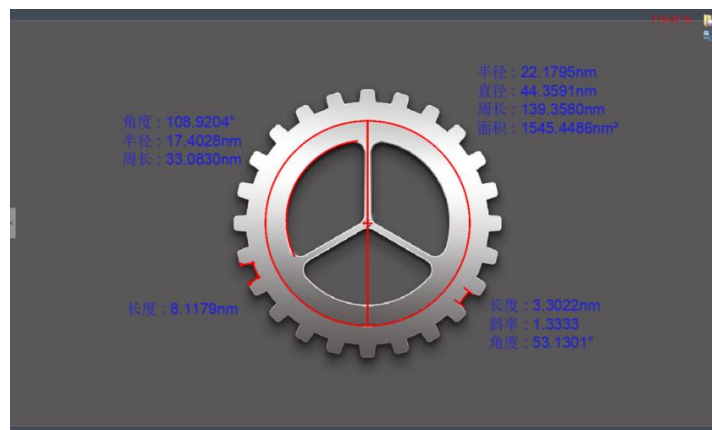
- **New:** Click [New] to create a new layer. You can customize the new layer name. Default layers are named “Layer 01,” “Layer 02,” “Layer 03,” etc.
- **Delete:** Click [Delete] to remove the selected layer.
- **Rename:** Click [Rename] to change the name of the selected layer.

8.1.6. Metrics Flow (Macro for Measurements)

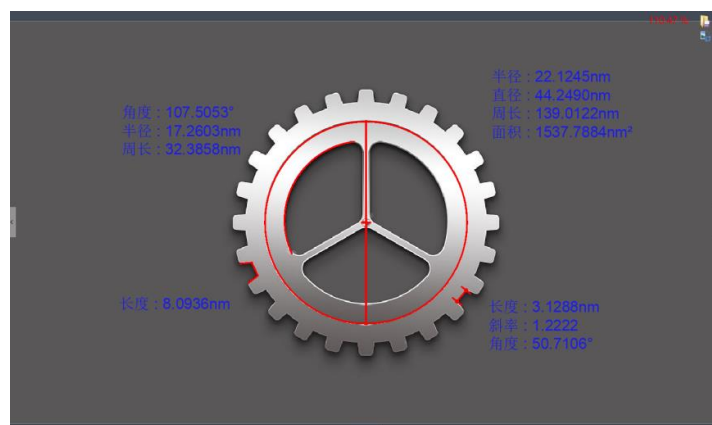
CaptaVision+ v3.1 offers powerful measurement flow capabilities for semi-automated, convenient measurement. This feature enables rapid batch inspection of industrial components or parts for qualification, as illustrated below.



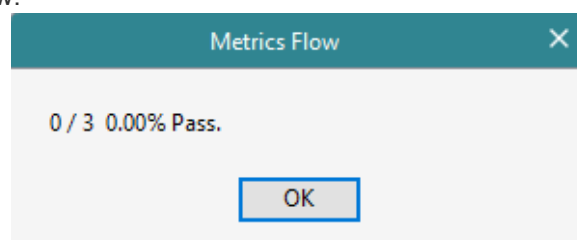
- 1) Open a set of captured component images.
- 2) Select a reference part image for calibration and tolerance setup.
- 3) Click [New Template] to create a measurement flow template.
- 4) Select corresponding shapes from the measurement tool menu to draw. The template creation process records the entire drawing sequence, allowing you to set data types, tolerances, and modification criteria for each shape. As shown below:



- 5) After completing template settings, customize the template name and click [Save] to finalize the measurement flow template.
- 6) Click [Apply Template], select the established template, then click [Run]. To delete an established template, click [Delete].
- 7) Select the device image to be inspected and directly draw corresponding shapes on the image following the established template process. As shown below:



- 8) Upon template execution completion, the Run button status releases. A pop-up window automatically displays measurement results, while actual data and pass/fail status are recorded in the measurement flow table. As shown below:

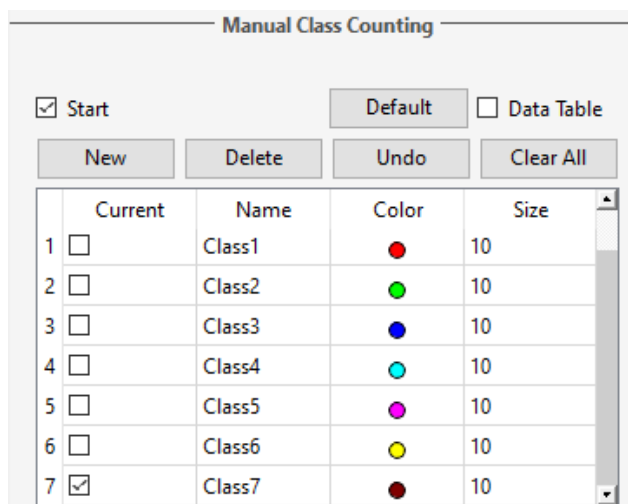


	Type	DataType	Tolerance	Standard	Actual	Pass
1		Area	0.100	1751.270	1535.325	No
2		Radius	0.100	21.011	21.532	No
3		Length	0.100	96.758	59.347	No

- 9) Click [Export] to save the inspection data for this device;
- 10) Continue clicking [Run], select the next image, and repeat steps 7, 8, and 9 of the inspection process;
- 11) After inspecting all devices, click [Stop] to terminate the measurement flow template and halt the measurement process.

8.1.7. Manual Class Counting

A user can classify and count different categories of cells with the manual counter from the CaptaVision+ v3.1 software, specifying up to 7 different categories.



The 'Manual Class Counting' dialog box contains the following elements:

- Buttons: ☒ Start, Default, ☐ Data Table, New, Delete, Undo, Clear All.
- Table with 4 columns: Current, Name, Color, Size.

	Current	Name	Color	Size
1	☐	Class1		10
2	☐	Class2		10
3	☐	Class3		10
4	☐	Class4		10
5	☐	Class5		10
6	☐	Class6		10
7	☒	Class7		10

- **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 displayed 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.

File Preview Histogram(Live) Temperature Camera Log Class Counting			
	Name	Count	Percentage
1	Class1	11	25.00%
2	Class2	5	11.36%
3	Class3	6	13.64%
4	Class4	4	9.09%
5	Class5	2	4.55%
6	Class6	11	25.00%
7	Class7	5	11.36%

Total Class : 7
Total Count : 44

[Export to Excel](#)

8.2. Tool Properties

8.2.1. Measure Tool

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

Analysis		Tool Properties		Report	
Measure Tool					
Property		Value			
▼ Global					
Name Prefix		Modifv			
Show Name		☐ False			
Show Data Type Name		☒ True			
Precision		3			
▼ Graphics					
Name					
Line Width		1			
Line Style		Solid Line			
Graphics Color		[255, 190, 0] (255)			
▼ Text					
Font		A [Arial, 20]			
Apply to All			Default		

Graphics Name Prefix			Data Type Name Prefix		
	Name	Prefix		Name	Prefix
1	Calibration	Calibration	1	Length	Length
2	Dot	Dot	2	Width	Width
3	Line	Line	3	Height	Height
4	Parallel	Parallel	4	Perimeter	Perimeter
5	Perpendicular	Perpendicular	5	Area	Area
6	Polyline	Polyline	6	Radius	Radius
7	Rectangle	Rectangle	7	Diameter	Diameter
8	Polygon	Polygon	8	Angle	Angle
9	RadiusCircle	RadiusCircle	9	Slope	Slope
10	3PointCircle	3PointCircle	10	Distance	Distance
11	DiameterCircle	DiameterCircle	11	LongAxis	LongAxis
12	ConcentricCircles	ConcentricCircles	12	ShortAxis	ShortAxis
13	Arc	Arc	13	Eccentricity	Eccentricity
14	3PointAngle	3PointAngle	14	XCoordinate	XCoordinate
15	4PointAngle	4PointAngle	15	YCoordinate	YCoordinate
16	4PointDoubleCircle	4PointDoubleCircle	16	Roundness	Roundness

➤ **Global:**

- 1) **Name:** Select the measurement information on the image to edit.
- 2) **Show Name:** If checked, it will be displayed, or uncheck to hide.
- 3) **Show data type names:** Check to display, uncheck to hide.
- 4) **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 supports dashed 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.

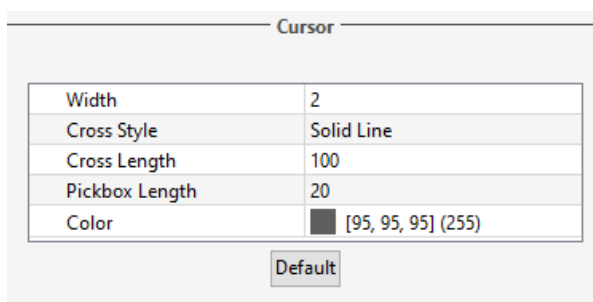
Click on  to choose the desired background color, the default background color is white.

➤ **Apply to All:** Apply the current set parameters to all measurement graphics.

➤ **Default:** Return to and apply the default parameters settings to the measurement graphs.

8.2.2. Cursor

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



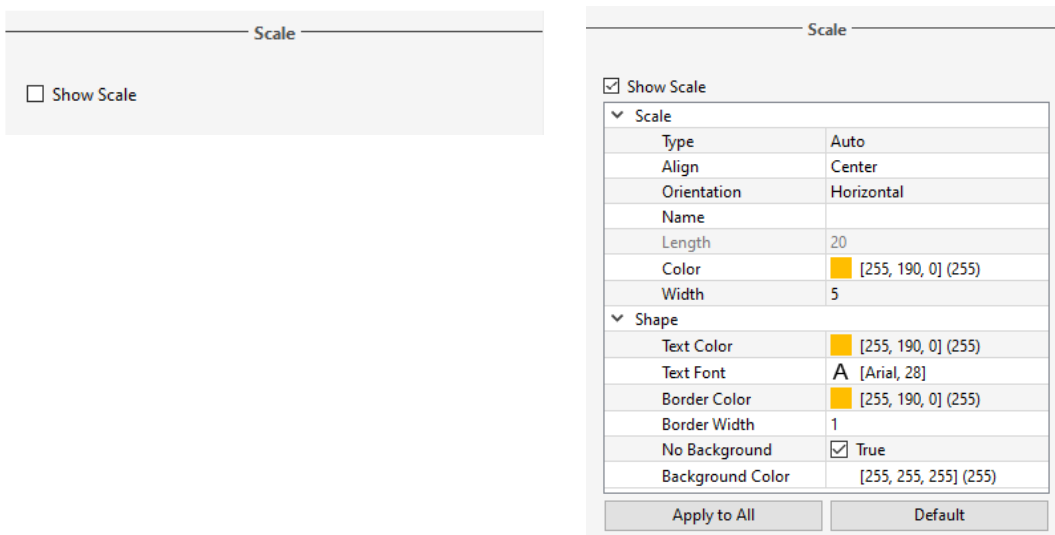
Cursor	
Width	2
Cross Style	Solid Line
Cross Length	100
Pickbox Length	20
Color	 [95, 95, 95] (255)

Default

- **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.

8.2.3. Scale

CaptaVision+ v3.1 allows users to adjust the scale property of the image for actual needs. As shown below.



Scale

☐ Show Scale

Scale

☒ Show Scale

▼ Scale	
Type	Auto
Align	Center
Orientation	Horizontal
Name	
Length	20
Color	 [255, 190, 0] (255)
Width	5
▼ Shape	
Text Color	 [255, 190, 0] (255)
Text Font	A [Arial, 28]
Border Color	 [255, 190, 0] (255)
Border Width	1
No Background	☒ True
Background Color	[255, 255, 255] (255)

- **Show Scale:** Check the box to select to display the scale on the measured image, uncheck to hide the scale; the default setting is to not show the scale. If checked to show the scale, the scale will automatically be shown on the left top of the image. The user can use the mouse to drag the scale to the desired position.
 - 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 to 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.
 - 8) **Accuracy:** Select the scale on the image and adjust the number of decimal places displayed for the scale. Default is 3, range is 0 to 6.
- **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) **Transparent 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:** Reset to and apply the default parameters settings to the scale on the image.

8.2.4. Ruler

CaptaVision+ v3.1 allows users to adjust the crosshair properties of the image according to actual needs. As shown below.

Ruler

☐ Show Ruler

Ruler

☒ Show Ruler

Unit Interval	10
Ruler Height	1
Ruler Color	 [0, 0, 0] (255)
Ruler Font	A [Arial, 16]
No Background	☒ True
Background Color	[255, 255, 255] (255)

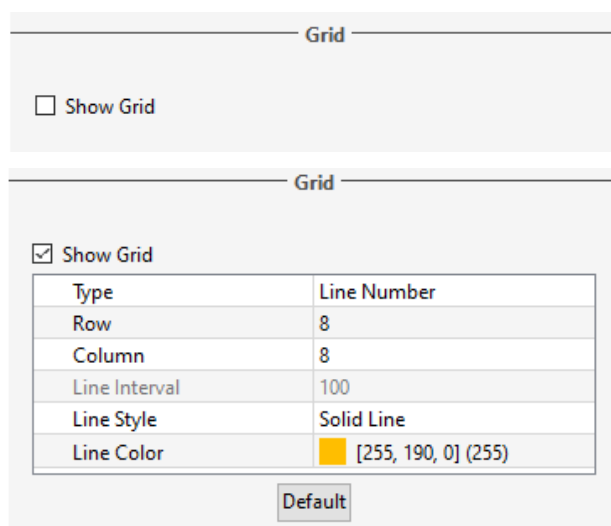
- **Show Ruler:** Check on the blank to select to display the crosshair on the image or not; the default setting is not showing the crosshair. When the function is turned on, it is centered by default, and the position of

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) **Transparent 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:** Reset to and apply the default parameters settings to the crosshair on the image.

8.2.5. Grid

CaptaVision+ v3.1 allows the user to set the grid properties of the image according to his actual needs.



Type	Line Number
Row	8
Column	8
Line Interval	100
Line Style	Solid Line
Line Color	 [255, 190, 0] (255)

- **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 that can be chosen: 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:** Reset to and apply the default parameters settings to the grid on the image.

8.2.6. 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.

The screenshot shows a dialog box titled "Tool Properties Group". It has a "Name" label followed by a text input field and a "Save" button. Below that is a "Group" label followed by a dropdown menu, and buttons for "Load" and "Delete". At the bottom are buttons for "Export", "Import", and "Reset All".

- **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.

8.3. Report

CaptaVision+ v3.1 provides exporting of measurement data information to generate working report documents. You can also export the report in real time when you are in the preview window. In addition to the default templates, custom templates are also available, and users can modify the report according to actual needs. Custom templates only support Excel format.

8.3.1. Template

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

The screenshot shows a dialog box titled "Template". It features a "Report Templates" label followed by a dropdown menu showing "report_template1.xlsx". Below this are buttons for "Add", "Delete", and "Open". A larger "Export Report" button is centered below these. At the bottom left is a checkbox labeled "Batch Export".

- **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 pictures to be exported, then click [Batch Export] to export the report. The image name supports query.

8.3.2. Report

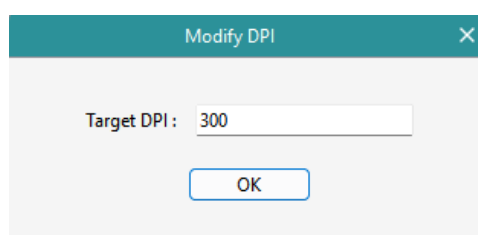
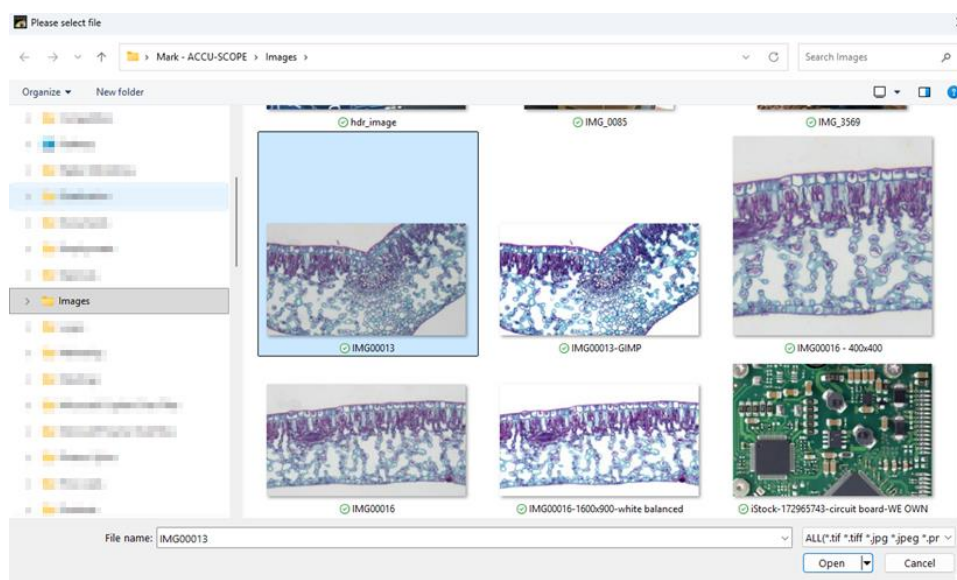
- **Report Templates:** Choose your desired format of report template.
- **Project Name:** Enter your personal name for the project you are working on, this name will show up on your working report,
- **Sample Name:** Enter the name of your sample in this project, this name will show up on your working 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.

9. Data Configuration

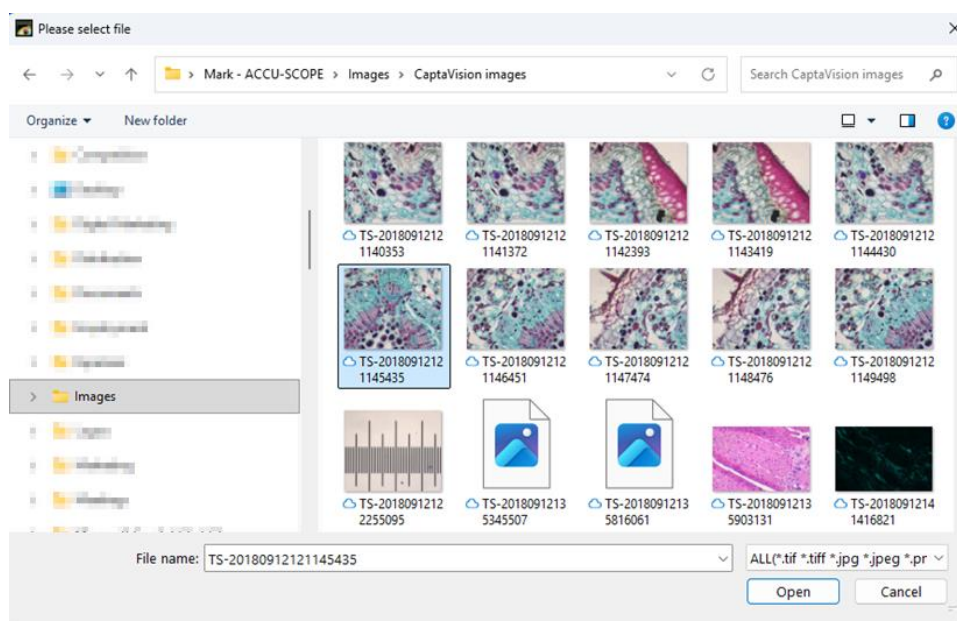
9.1. Format Settings



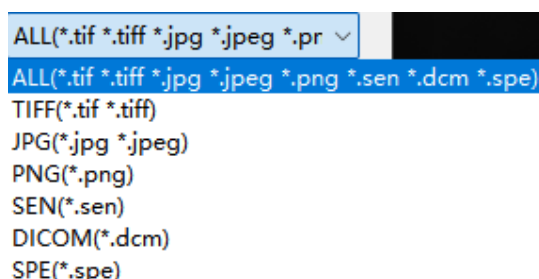
- **Adjust DPI:** DPI (Dots Per Inch) determines the “sharpness” when printing or displaying on screen. You can adjust the image's DPI parameter. Default is 300, range 0-600.



- **Convert to CSV Format:** Images can be converted to CSV format. This generates corresponding CSV data files in the image's call path directory. For color images, R, G, and B channels are displayed separately.



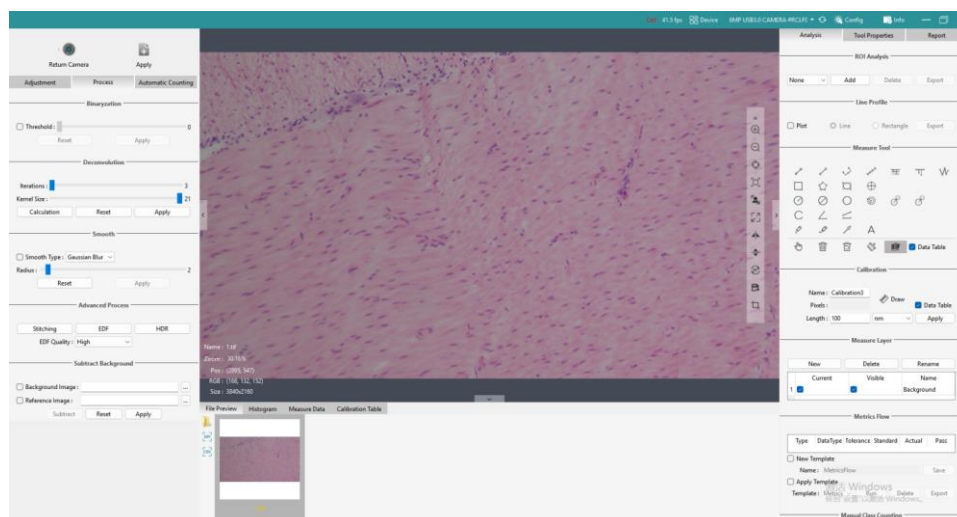
The following formats are supported for conversion:



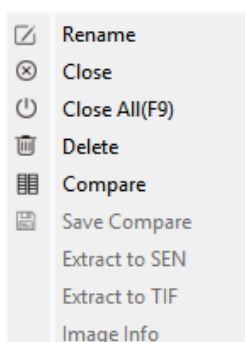
9.2. File preview

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

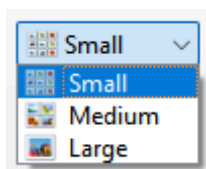
- 1) Click the button  to open the file path window, and the button changes , as shown in the figure below. Select the image path to import and open, select the photo and double-click to add it to the file preview window below, it will also be displayed in the main interface. Right clicking [import]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



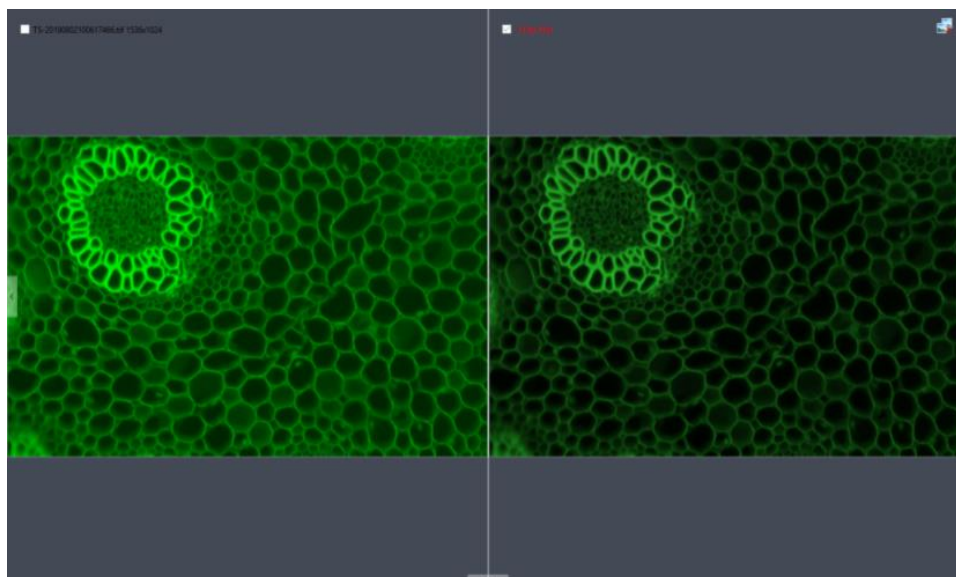
- a. Select an image in the file path window or right-click anywhere on the interface to display the context menu, as shown below.



- b. Supports Open, Select All, Deselect All, Import, New Folder, Copy, Paste, Delete, and Rename. Clicking Open displays the image thumbnail in the data pane and preview pane simultaneously; clicking Import displays the thumbnail only in the data pane, not the preview pane.
- c. Use Ctrl+C to copy images and Ctrl+V to paste them within the current folder.
- d. Select a folder path on the left. Click the button in the upper-right corner to close the current window and return to the software's main interface.
- e. The bottom section displays the path bar and all images within the current path.
- f. Click the button to add the current path to Favorites for quick access next time; click the button to return to the parent directory.
- g. Click the button below to select your preferred image viewing mode.



- 2) Right-click on an image or the blank area of the thumbnail interface to open the context menu, which supports renaming, closing, closing all, deleting, comparing, saving comparisons, extracting to SEN, extracting to TIF, and viewing image information (only supported for .SEN file format).
 - Only MPSEN supports extraction to TIF and SEN.
- 3) Comparison includes dynamic comparison and static comparison.

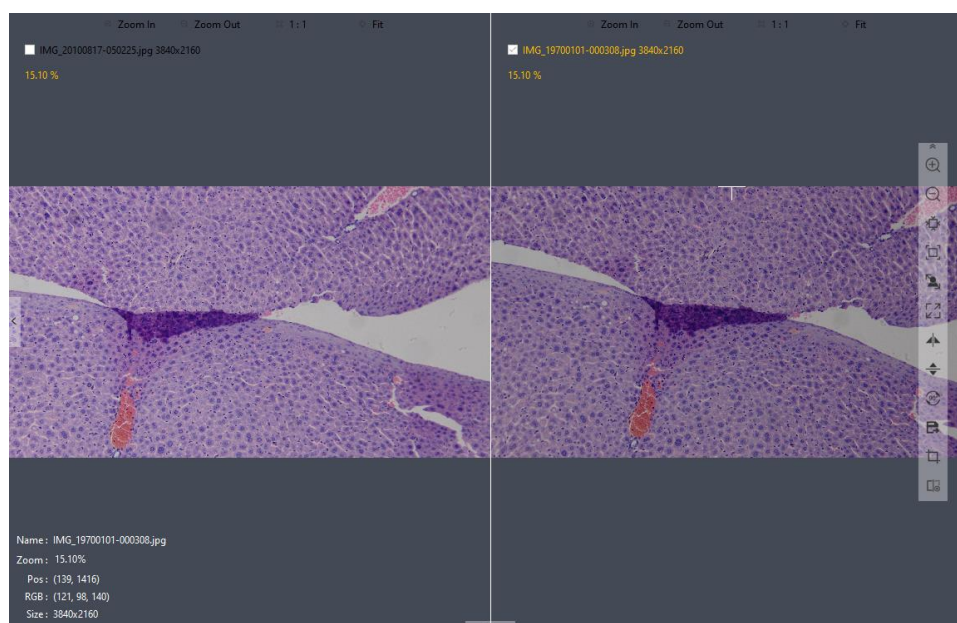


Dynamic comparison can be initiated by right-clicking an image in the image panel module of the preview interface to open the context menu, then selecting “Compare.” The dynamic preview will appear on the left side of the interface. On the right, you can select any image from the image panel for comparison, and images can be freely swapped. Click the button  to exit comparison mode.

Static comparison allows you to select any image, right-click to open the context menu, and choose “Compare.” The selected image will appear on the left side of the interface. Both sides of the static comparison can be freely swapped. To swap, click the image you wish to replace, then click the replacement image. Save Comparison allows you to save the current comparison image. The comparison effect is shown in the figure below.

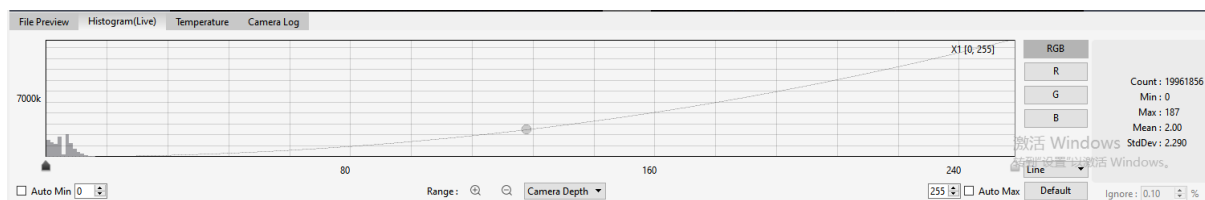
Note:

When performing physical direction comparisons or automatic counting, the coordinate system, intensity curve, and color chart are not displayed.

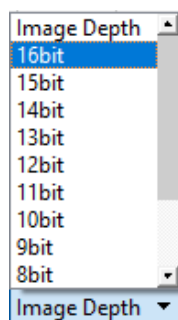


9.3. Histogram

With images, more realistic colorful images are often needed to improve observation and analysis. Color scale adjustment can help users to obtain an enhanced image, as shown in the following screenshot.



- **Levels Adjustment:** Redefine R/G/B in each path, and then proportionally redistribute the pixel value among them. The adjustment of picture's color scale can enlarge highlight area of the picture and brighten picture, as well as to darken the brighter picture; RGB three paths can be adjusted separately to change the color of picture in corresponding path.
- **Manual level:** Users, with histogram, can manually adjust the dark shade (left color scale; arrow on left side of histogram scale), gamma and highlight brightness level (right color scale; arrow on right side of histogram scale) to adjust picture shade tone, including contrast, shade and image hierarchy, and to balance the color of the picture.
 - **Check the Auto Min and/or Auto Max boxes to automatically adjust the image shade and brightness.** Uncheck these and click Default to return to the original settings
- **Gamma:** Click and drag the dot in the center of the histogram plot to adjust the gamma. Gamma can help reveal detail in dark or bright areas of the image.
- **The histogram shows:** The histogram display mode is optional, and the options are Line (linear) and Log (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 enable automatically.
- **Histogram bit depth:** As shown in the figure, the current image display bit depth can be set under the histogram to observe the entire histogram as a whole, or realizing a partial observation through zoom in of the histogram. Users can customize and select the required bit depth;



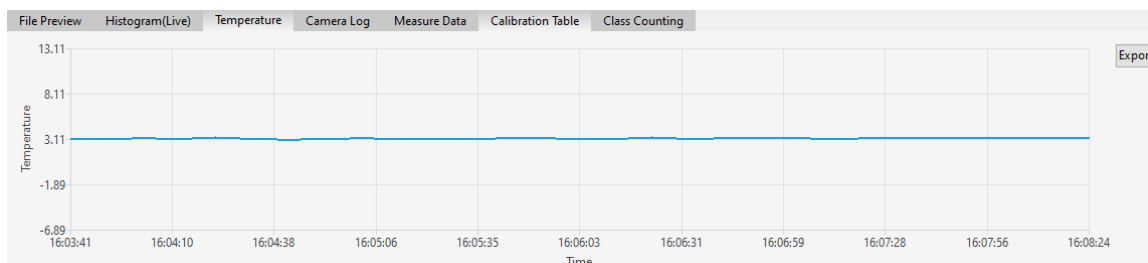
Note:

- 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.

9.4. Temperature (only for cooled cameras)

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.

9.5. 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

File Preview Histogram(Live) Camera Log	
Index	Description
[0] 2025-11-11 13:43:41	Set Target
[1] 2025-11-11 13:43:42	Camera connected successfully and enjoy Capture3.1

- Support log export as .csv file.

Note:

- 1) Measurement tables for measurements, calibration tables for calibrations, count tables for manual counting, as well as automatic count tables and automatic count statistics will all be displayed in the data column. You can choose whether to display these data tables on the corresponding interface.

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.