




















The Microscope Camera Software Help Manual











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







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



















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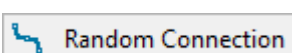
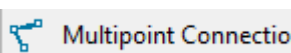






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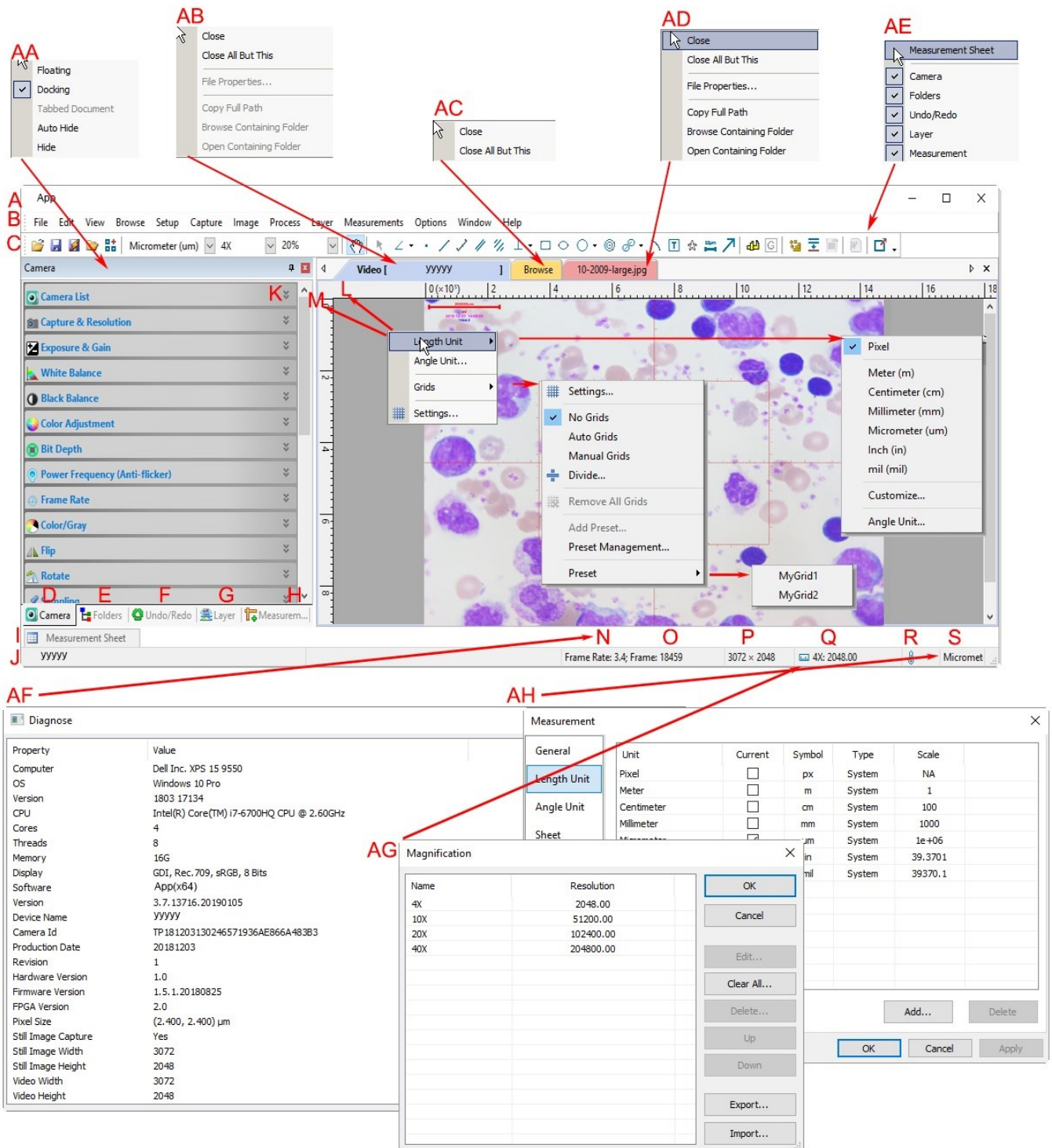
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1 Video window GUI

1.1 Video window GUI




- A: The App title bar
- B: Menu;
- C: App toolbar
- D: Camera Sidebar ;
- E: Folders Sidebar ;
- F: Undo/Redo Sidebar ;
- G: Layer Sidebar ;
- H: Measurement Sidebar ;
- I: Measurement Sheet;
- J: Statusbar;

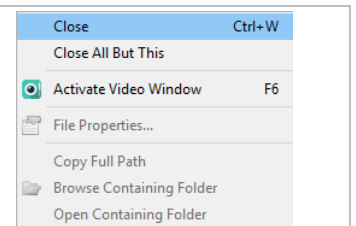
K: [Auto Hide](#) button
 L: [Horizontal](#) ruler;
 M: [Vertical](#) ruler
 N: [Frame Rate](#)
 O: [Frames](#) captured
 P: Current [Video](#) sizes
 Q: The selected microscope [Magnification](#)
 R: Cooling Temperature
 S: Current [Unit](#);

AA: [Sidebar](#) right mouse button context menu;
 AB: [Video](#) window right mouse button context menu;
 AC: [Browse](#) window right mouse button context menu;
 AD: [Image](#) window right mouse button context menu;
 AE: [Frame](#) window right mouse button context menu;
 AF: Double-click bring up [Diagnose](#) dialog;
 AG: Double-click bring up [Magnification](#) dialog;
 AH: Double-click bring up [Measurement](#) dialog;
 AI: [Horizontal Ruler](#) or [Vertical Ruler](#) right mouse button context menu

1.2 How to close the video window?

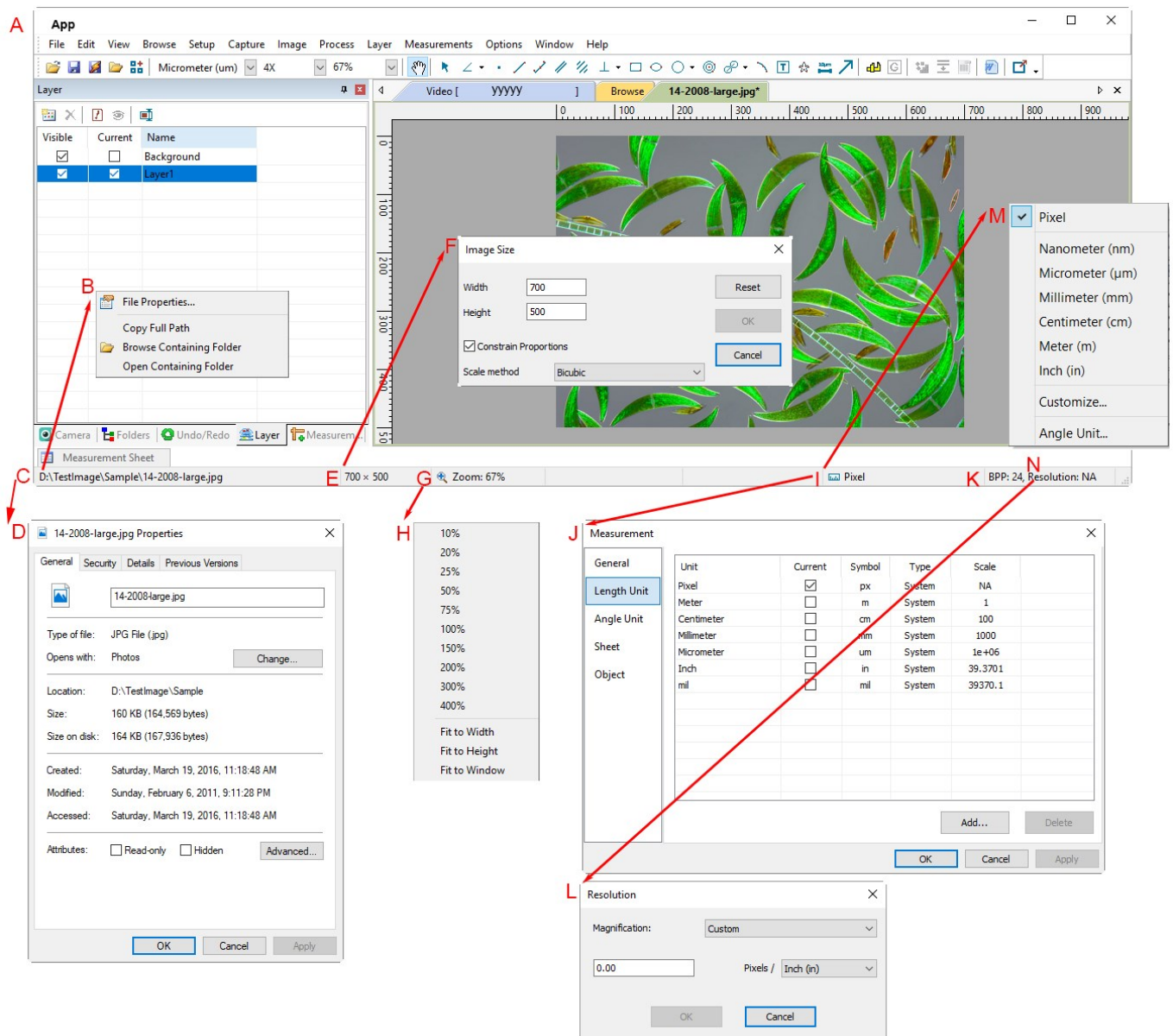
1 Double-clicking the tabbed video window title or clicking **x** on the title bar right side  will close the video window directly;

2. Choose [Windows>Close All](#) command to close the video window;
3. Click the right mouse button on the video window title to invoke the context menu and choose [Close](#) to close the video window;
4. Press [Ctrl+W](#) buttons.



2 Image window GUI


2.1 Image window GUI




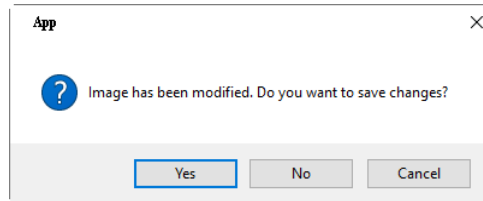
- A: The **App** title bar;
- B: The opened file right mouse button context menu on status bar;
- C: The opened file name and directory;
- D: Double-click bring up opened file **Properties** dialog;
- E: Current image width and height;
- F: Double-click bring up **Scale Image** dialog;
- G: Image **Zoom** ratio, double-clicking will zoom the image to 100%;
- H: **Zoom** ratio right mouse button context menu;
- I: Currently selected **Unit**;
- J: Double-click bring up **Measurement** dialog;
- K: Image **BPP** & **Resolution**;
- L: Double-click bring up **Resolution Setting** dialog;
- M: **Unit** right mouse button context menu;
- N: Calibrated Resolution.

2.2 How to close the image window?

1. If user has modified an image before attempting to close it, double-clicking the tabbed image window

title bar or clicking **x** button on the title bar right side  will bring up a warning dialog as shown below:

2. If the image window is snapped or pasted with number as its title, double-clicking the tabbed image window title bar or clicking **x** button on the title bar right side  will bring up a warning dialog as shown below:



3. Clicking **Yes** will save the changes with its old name and close the window quickly, **No** will close the file immediately with no changes and no warning, or **Cancel** will cancel the **Close** command and leave the window there with no changes;

4. If the image window is snapped from the video window or **Pasted as New File** from the clipboard, clicking **Yes** will bring up the **Save As** dialog (See Sec. 5.5 for details). In the **Save As** dialog, user can:

Save in: Select the driver and folder to which you want your image file saved in the **Save in** combobox and enter the file name in the **File name** edit box;

Save: Click **Save** to save the new image with the specified directory and file name;

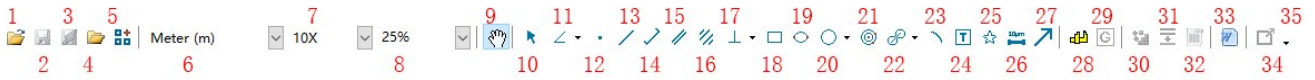
5. Click **No** on the warning dialog will close the file immediately with no changes and no warning;

6. Press **Ctrl+W** buttons.

Note: Choosing **Window>Close All** command can also close the tabbed image window. Please check the **Window>Close All** for details.

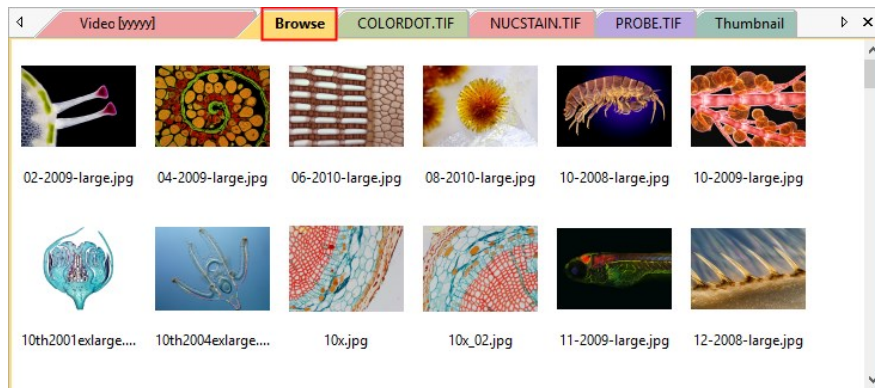
3 UI toolbar

When the camera is started, the image is opened (or captured) or the image window is setup with **Paste as New File**, most of the icons on the toolbar will be enabled for the quick operation of the video or image window.

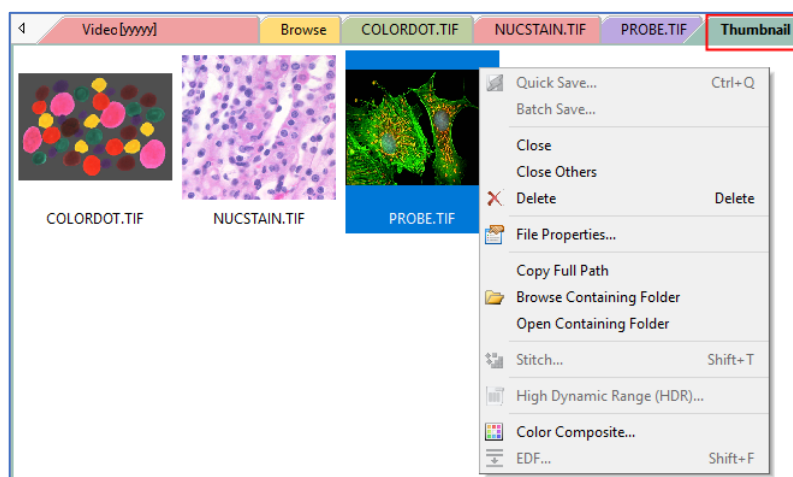


- 1: **Open** (Ctrl + O)
- 2: **Save** (Ctrl + S)
- 3: **Quick Save**
- 4: **Browse** (Ctrl + B)
- 5: **Thumbnail**(Ctl+T)

Folders is a browser to **Browse** all the image files on disk. It is also an important platform where users can perform operations easily, such as **Stitch**, **EDF**, **HDR**, **Color Composition** and so on. But user cannot find a temporary image files in **Folders** which are just captured from the software or pasted from the clipboard and have not been saved to the disk.



Thumbnail is also a browser that could manage all the opened files, including the opened files on disk and opened temporary files which are not on the disk yet. Many convenient operations can be done in **Thumbnail Browser**, besides the operations on the opened files on disk (**Stitch**, **EDF**, **HDR** and **Color Composite**), **Quick Save** and **Batch Save** could also be done for temporary files. Selection of multiple images exported to **Microsoft Word Report** can only be done in **Thumbnail Browser**.



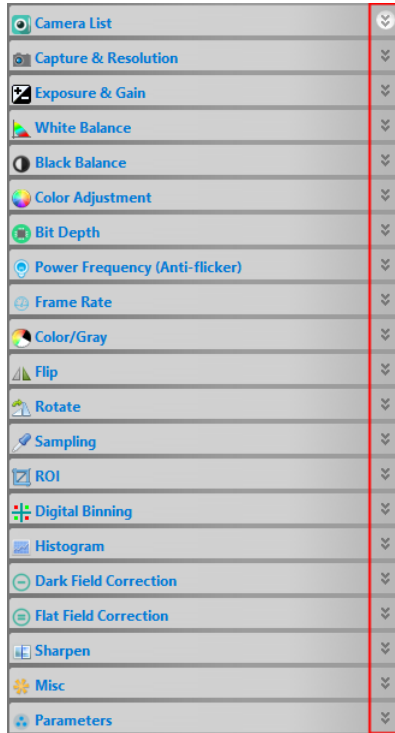
- 6: **Unit**
- 7: **Magnification**
- 8: **Zoom**
- 9: **Track**(enabled only when the image/video size is larger than the window size)
- 10: **Object Select**(will be enabled when an object is overlaid on the background layer)
- 11: **Angle**

- 12: [Point](#)
- 13: [Line](#)
- 14: [Line\(3 Points\)](#)
- 15: [Parallel](#)
- 16: [Two Parallel](#)
- 17: [Vertical](#)
- 18: [Rectangle](#)
- 19: [Ellipse](#)
- 20: [Circle](#)
- 21: [Annulus](#)
- 22: [Two Circles](#)
- 23: [Arc](#)
- 24: [Text](#)
- 25: [Polygon](#)
- 26: [Scale Bar](#)
- 27: [Arrow](#)
- 28: [Calibrate](#) (for both image/video window)
- 29: [Gray Calibration](#) (for video window)
- 30: [Stitch](#)(for image/video/[Browse/ Thumbnail](#) window)
- 31: [EDF](#)(for image/video/[Browse/ Thumbnail](#) window)
- 32: [High Dynamic Range\(HDR, for image/\[Browse/Thumbnail\]\(#\) window \)](#)
- 33: [Microsoft Word Report\(F10\)](#)
- 34: [External Application](#) (Open the current image with the [External Application](#))
- 35: [Customize Toolbar](#)

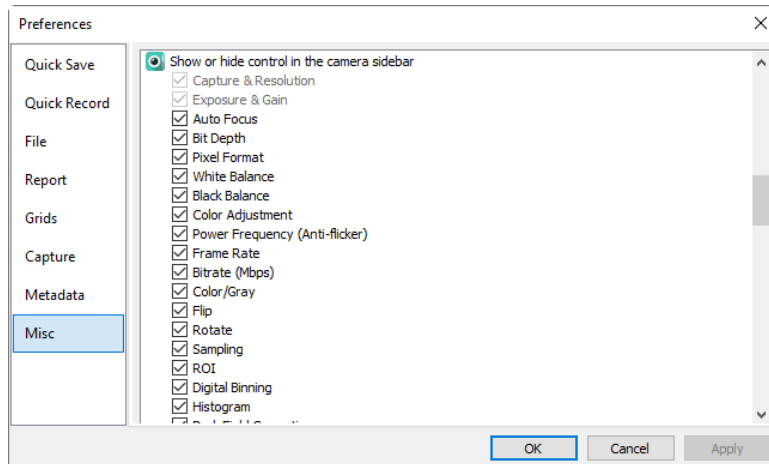


4 Camera Sidebar

The **Camera Sidebar** is used for the control of the camera, it includes many groups. The group can be expanded by a) clicking the group name or b) clicking the **Down Arrow** at the right end of the group name.



The camera **Sidebar** can be shown or hidden by **Option>Preference>Misc** page and find **Show or hide group in the camera sidebar** as shown below:



4.1 Camera List group

Camera List

yyyy

Camera List will list all of the cameras connected to the computer USB ports that support the App. Clicking the camera name **yyyy** will start the camera video window.

4.2 Capture & Resolution group

Capture & Resolution

Snap Record

Live: 5440 × 3648

Snap: 5440 × 3648

Format: RGB24

Snap: Click it to continuously **Snap** images;

Record: Record video feed in **mp4(H264)/mp4(H265)/wmv/avi(Deprecated)** format;

Live: Set the **Live** video resolution;

Snap: Set the **Snap** resolution for image capture;

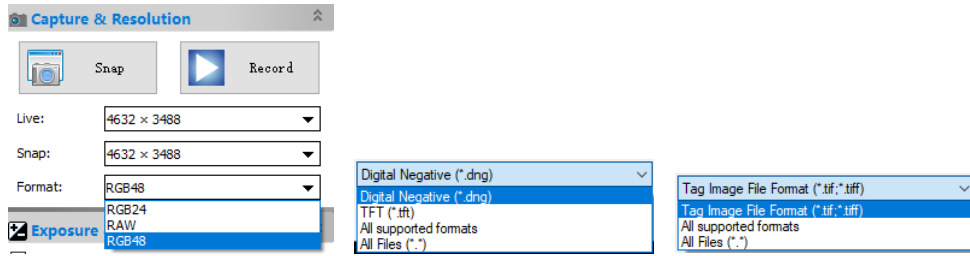
Format: Can be **RGB24/RAW/RGB48** Format depending on the camera model for **Snap**.

For cameras that support more than 8 bits, please set the camera **Bit Depth** to more than 8 bits (10/12/14 bits) first to capture a file with more than 8 bits. Click the **Format** list box's drop down arrow in **Capture & Resolution** group, you can find 3 options there, which are **RGB24**, **RAW** and **RGB48**. **RGB24** means **RGB888**, and you could only get an image with **8bits** per channel;

RAW is the original image data; RGB48 means RGB161616 and you could only get an image with 16bits per channel.

If RAW is selected, clicking Snap button will bring up a Save As dialog, the 10bits/12bits/14bits RAW data will be transferred to 16bits RAW data and will ask user directly to save the image into DNG or TIF file. No image window will be created.

If RGB48 is selected, for 10bit/12bit/14bit Bit Depth, clicking the Snap button will capture the corresponding Bit Depth into image window. Choosing File>Save As command will transfer the Bit Depth to RGB48 Format and save it with tiff format.



4.3 Exposure & Gain group

Rectangle for Auto Exposure

- When the Exposure & Gain group is expanded, a green rectangle marked with Exposure will be overlaid on the video window. This marked region is a ROI for judging if the image brightness reaches to the Exposure Target value or not. Drag the Exposure ROI to the darker area will increase the video brightness and drag it to the brighter area will decrease the video brightness;
- Uncheck the Auto Exposure box to switch the Auto Exposure mode to the Manual Exposure. The Exposure Target slider will be disabled in this mode;
- Turn the microscope light source to a brighter state, and then drag the Exposure Time slider left or right until the image brightness is normal;
- If and only if the microscope light intensity is too low to meet the Exposure Time's up limit, drag the Gain slider right until the video brightness is normal;
- The exact Exposure Time can also be entered by clicking the edit box at the up right side of the Exposure Time slider. This will bring up a dialog called Exposure Time. User can type the values in this edit box to set the exact Exposure Time;
- When the 50HZ or 60 HZ is selected on the Power Frequency group and the Auto Exposure is checked, the Exposure Time will be calculated automatically to eliminate the dark band effect for the video feed;
- There is an Auto Exposure Policy setup to customize the Auto Exposure process, please check Sec.15.1.8.4 for details.

4.4 White Balance group

The White Balance controls allow user to adjust the White Balance ratios for Color Temperature/Tint or each of the RGB color channels in a specified rectangle area.

- Click the White Balance bar to expand the White Balance group and a pink rectangular marked with White Balance will be overlaid on the video window;
- Drag or resize the red rectangle to a pure white or gray area and click the White Balance button to establish the video White Balance for future video feed process;
- If the automatic setting and the actual result still has deviation, drag the Temperature or Tint slider to left or right to manually correct the White Balance;

4. The White Balance group can be switched to RGB Gain mode in the Options>Preference--- property sheet at the Misc page under the White Balance item. A restart of the software is required when switching the White Balance adjustment mode. See Sec.15.1.8.3 for details.

4.5 Black Balance group

Video cameras can possess a function called Black Balance which calibrates the signal for no light, just as they have a White Balance function which gives reference to true white to the CCDs. Unlike White Balance, Black Balance is not adjusted every time. This function is found in higher end professional cameras rather than in cameras for amateurs.

The main purpose of Black Balance is to eliminate any residual current being output from the pixel sites under conditions of complete darkness, often referred to as thermal noise in different channel. This is why the camera automatically closes the iris completely when it does the Black Balance.

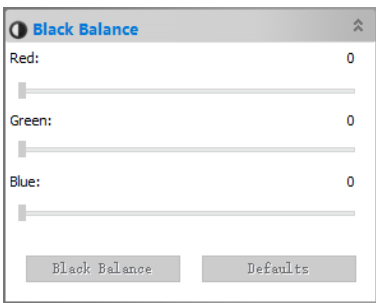
Conditions under which Black Balance are typically done are when the camera experiences a large change in operating temperature, especially from colder to warmer. Otherwise, it is a periodic thing to allow for other minor factors that could come into play.

With CMOS sensor technology, Black Balance may not be as necessary as it is with CCD type devices. It is common to talk about how clean and relatively noise free CMOS sensors are by design.

There is a lot of debate on whether it is necessary to do the Back Balance every time.

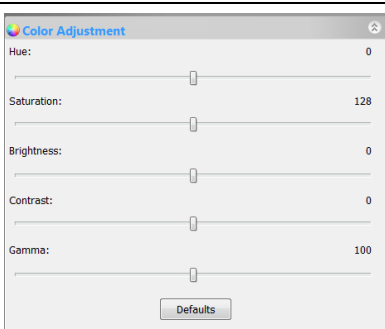
The App suggests that the **Back Balance** be performed when:

- The camera is used for the first time;
- The camera is first used after a long period of disuse;
- The ambient temperature changes greatly;
- When switching to normal shutter or slow shutter;
- When switching between progressive and interlaced modes;



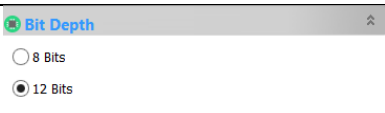
1. Click the **Back Balance** bar to expand the **Black Balance** group and a pink rectangular marked with **Black Balance** will be overlaid on the video window;
2. Turn off the microscope light;
2. Drag or resize the red rectangle to a black area and click the **Black Balance** button to establish the video **Black Balance** for future video feed process;
3. If the automatic setting and the actual result still has deviation, drag the **Red**, **Green** or **Blue** slider to left or right to manually correct the **Black Balance**.

4.6 Color Adjustment group



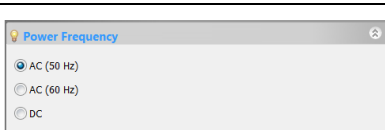
1. **Hue**: Adjusts the **Hue** of the video. Drag the slider to the right to increase or to the left to decrease **Hue**;
2. **Saturation**: Adjusts the **Saturation** of the video. Drag the slider to the right to increase or to the left to decrease video **Saturation**;
3. **Brightness**: Adjusts the video **Brightness**. Drag the slider to the right to increase or to the left to decrease the video **Brightness**;
4. **Contrast**: Adjusts the video **Contrast**. Drag the slider to the right to increase or to the left to decrease the video **Contrast**;
5. **Gamma**: Adjusts the video **Gamma**. Drag the slider to the right to increase or to the left to decrease the video **Gamma**;
6. **Defaults**: Click the **Defaults** to clear all the changes and reset them to default ones;
7. All of the settings will be saved for future applications.

4.7 Bit Depth group



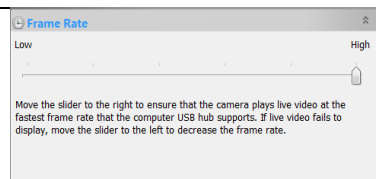
Switch among or between **8 bits/12 bits/14 bits**. **8 bits** is the basic windows image format. **12bits/14 bits** will have higher image quality but moderate FPS;
 The **Bit Depth (Bits Per Pixel)** is depending on the camera hardware.

4.8 Power Frequency group



1. A CMOS sensor captures each row of pixels (from top to bottom) in sequential order, creating a rolling effect, hence the name "Rolling Shutter". Instead of being relatively constant, so for example, as the commercial main frequency in Europe is **50Hz**, fluorescent lights in Europe flicker at 100 times per second and as the main frequency in US is **60Hz**, so in the USA they flicker at 120 times per second;
 2. This flickering problem is solved by capture row pixels in over the duration of integer number of n flicker periods;
 3. Selecting **50HZ** will delete the rolling dark band for the **50HZ** light fluctuation;
 4. Selecting **60HZ** will delete the rolling dark band for the **60HZ** light fluctuation;
 5. For **DC** power, no light fluctuation is existed and no compensation is needed.
- When **50HZ** or **60HZ** is selected and the **Auto Exposure** is checked on the **Exposure & Gain** group, the **Exposure Time** will be calculated automatically to eliminate the dark band effect for the video feed.

4.9 Frame Rate group



Drag the slider to the right (**High**) to ensure that the camera can run the video at the fastest **Frame Rate** that the computer USB hub supports. If the video fails to display, drag the slider to the left (**Low**) to reduce the **Frame Rate** and this will enable the video feed in a low speed state.

4.10 Color/Gray group



If you wish to preview **Color** video, select the **Color** button;
 If you wish to preview **Gray** video, select the **Gray** button.

4.11 Flip group



If the video on the screen appears in different directions from what is viewed under the microscope or direct view, check the **Horizontal** or **Vertical** box to set the video direction to the right one.

4.12 Rotate group



Select the right one (**0°**(Default), **90°**, **180°** or **270°**) to rotate the video to the desired angle.

4.13 Sampling group

Binning is a function that averages or adds multiple sensor pixels to obtain a single value:

If the pixel values are added, the image brightness increases; if the pixel values are averaged, the image noise is reduced.

This also reduces the amount of data to be transferred and enables higher camera frame rates. The captured image has a lower resolution but still the same field of view compared to the full-resolution image.



Color binning as performed by most color sensors, combines only pixels of the same color. For some monochrome sensors, the camera also performs color binning, resulting in slight artifacts.

Most monochrome sensors and some color sensors combine neighboring Bayer pattern pixels; in this case, the color information gets lost (mono binning).

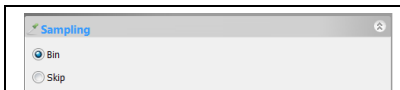
Subsampling skips multiple sensor pixels when reading out the image data. This reduces the amount of data to be transferred and enables higher camera frame rates. The captured image has a lower resolution but still the same field of view compared to the full-resolution image.



Color subsampling as performed by most color sensors, skips pixels while maintaining color. For some monochrome sensors, the camera also performs color subsampling, resulting in slight artifacts.

Monochrome sensors and some color sensors ignore the Bayer pattern and the color information gets lost (mono subsampling).

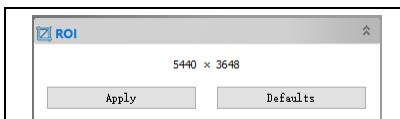
Subsampling can also be done in the pixel preprocessing on the camera. This process reduces the data volume per image, but does not increase the frame rate.



1. **Bin**: Pixel binning refers to the method of combining (averaging) pixels of blocks of neighboring same color pixels to resize the video to the lower resolution, but higher signal to noise ratio;

2. **Skip**: Also called **Decimation** (reduction of digital signal's sampling rate) means that a certain amount of pixels are not read out but skipped (horizontally, vertically or in both axes). This reduces resolution of the resulting video and introduces subsampling artifacts but higher frame rate;

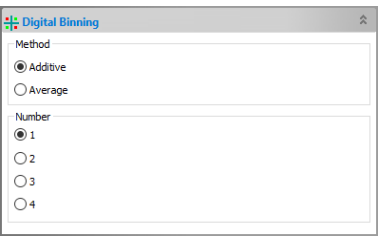
4.14 ROI group



ROI, Region of interest. This function can set the **ROI** on the video window. When the **ROI** group was expanded, a dotted rectangle with **Handles** will appear around the video window that will let user alter the **ROI**. Use mouse button to adjust the **ROI** size. If **ROI** is ok, click **Apply** will set the video to **ROI** size, **Defaults** will return to the original size;

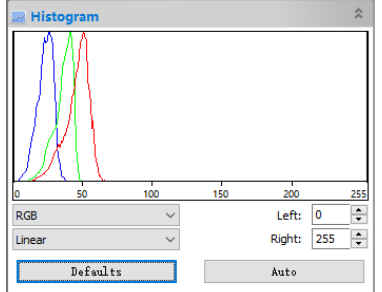
Click the left or right number edit box will invoke the ROI dialog to set the ROI with keyboard.

4.15 Digital Binning group



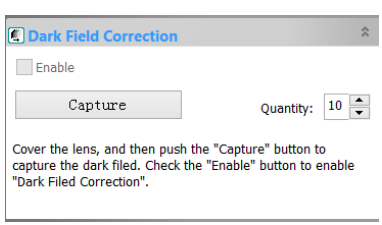
- Additive:** Additive Digital Binning refers to the method of combining (Adding the specified Number x Number of pixels) pixels of blocks of neighboring same color pixels to resize the video to the lower resolution, but the higher brightness. The new resolution will be (Width/n, Height/n, n is the Number);
- Average:** Average Digital Binning will add the specified Number x Number of neighborhood pixel values together and then divide it by Number x Number, means that a certain amount of pixels are averaged (horizontally, vertically or in both axes). This reduces resolution of the resulting video and introduces higher signal-to-noise ratio. The new resolution will be Width/n, Height/n, n is the Number;
- The Digital Binning is realized by the computer software not by camera hardware.

4.16 Histogram group



- A Histogram illustrates how pixels in an image are distributed by graphing the number of pixels at each color intensity level. The Histogram shows detail in the shadows (shown in the left part of the histogram), midtones (shown in the middle), and highlights (shown in the right part). A Histogram can help you determine whether an image has enough detail to make a good correction;
- This group shows the Histogram of current active video. Two vertical line markers show the upper and lower limits of the intensity levels. These markers can be dragged with mouse. If you are looking at a color image, the Histogram will reflect the RGB(red, green and blue channels histogram at the same time), R(red), G(green), and B(blue) values with lines of the same color;
- You can also enter directly the desired values in the Left or Right edit boxes below the Histogram chart for both Left and Right Histogram boundaries;
- Linear or Logarithmic can be chosen to make the video in a rational display mode;
- Clicking the Defaults button will return the Left and Right Histogram boundaries to its original ones;
- Click the Auto button to locate the two boundaries automatically to get the best video quality.

4.17 Dark Field Correction group



Dark Field Correction is normally used to remove the background noise or fixed pattern noise. Dark frames must be taken with no illumination.

For long time exposure application, dark current noise is obvious and users could remove the dark current noise by Dark Field Correction process. It could also help to remove the defect pixel when long exposure time is required.

To Enable the Dark Field Correction, one should capture the dark field images first. After the images are captured, the Enable button will be enabled. Check it will enable the Dark Field Correction. Uncheck it will disable the Dark Field Correction.

4.18 Flat Field Correction group

Flat Field Correction is used to correct the inhomogeneous background caused by the microscope or illuminations. Please remove the sample first and capture the inhomogeneous background images. Then put the samples on the microscope xy stage and enable the Flat Field Correction. Please be sure that the sample is removed when the background images are taking.

When condition is changed, including optical system, illumination, exposure time or gain, Flat Field Correction must be performed again in the new condition.

- Remove the sample first to get the inhomogeneous background;
- Set the Quantity of the background images and these inhomogeneous background images are going to be averaged and used as reference for Flat Field Correction;





- Click the Capture button and the App will capture the specified Quantity image. After the background images are captured, the Enable button will be enabled;
- Check Enable button and the Flat Field Correction will be effective, uncheck it will disable the Flat Field Correction;

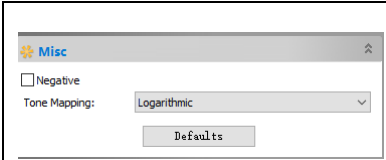
5. Put the sample back. Please check the results as show above for reference;
6. Click [Export](#) to export the current [Flat Field Correction](#) data to the ffc file for the future application;
7. Click [Import](#) to import the saved ffc file for the current video [Flat Field Correction](#).

4.19 Sharpen group



[Sharpness](#) determines the amount of detail an image can convey. Drag the slider to the right will increase the image [Sharpness](#) and to the left will decrease the image [Sharpness](#).

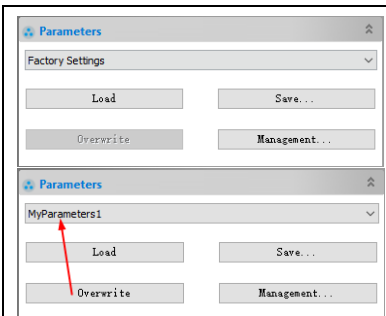
4.20 Misc group



[Negative](#) will reverse the pixel values of the video feed without going through the lookup table;

[Tone Mapping](#) is a technique used in image processing to map one set of colors to another to approximate the appearance of high-dynamic-range images in a medium that has a more limited dynamic range. In the [App](#), user can choose [Logarithmic](#) or [Polynomial](#).

4.21 Parameters group



[Parameters](#) group is used to save the camera control parameters adjusted for further application;

Click [Save](#) will save the current camera control parameters in new parameter file (For example [MyParameters1](#)), This file name will be attached to the end of the [Factory Setting](#) list box. Then the [Load](#) and [Overwrite](#) buttons will be enabled;

Click [Load](#) will load the current item in the [Factory Setting](#) list box;

If the user saved [Parameters](#) is loaded (such as [MyParameters1](#)) in the [Factory Setting](#) list box, the [Overwrite](#) button will be enabled. Clicking [Overwrite](#) will overwrite the current camera control parameters to the current loaded active camera control parameters file([MyParameters1](#));

Click [Management](#) will invoke a [Management](#) dialog and in this dialog, one can manage all of the saved [Parameter](#) files.

5 File

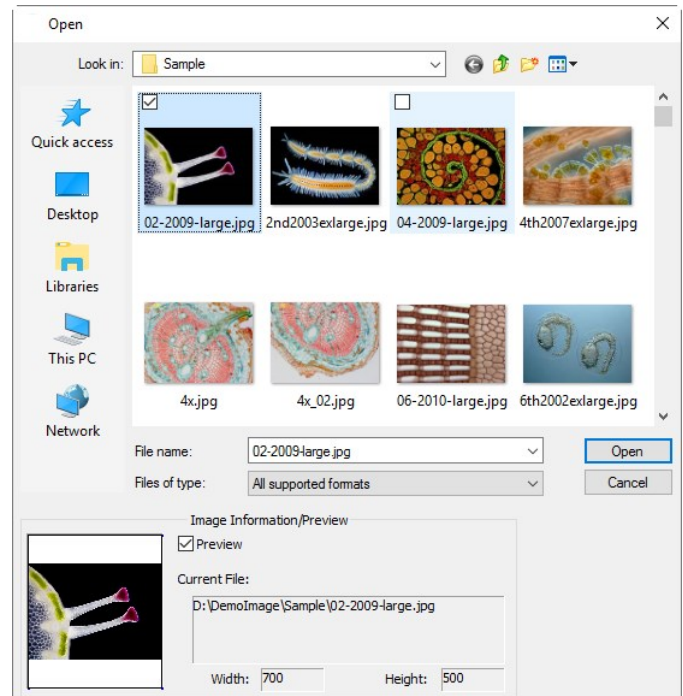
5.1 Open Image... Ctrl+O

Choose **File>Open Image...** command to open an existing image file. The **Open Image...** command can also be used to preview an image in small size, or to view image's statistics information without actually opening the image itself. These capabilities can be used to locate a particular image quickly.

The **App** supports and can open many image formats. These are identified in the **Files of type** list box. One may also open the **TFT (*.tft)** format image file which can save **Measurement Objects** (for simplicity, only **Object** or **Objects** will be used to represent **Measurement Object** or **Measurement Objects**) overlaid on the image.

More than one image can be opened with the **App** simultaneously by a) with **Ctrl + left mouse button**; b) **Shift + left mouse button**; c) Draw a rectangle with the left mouse button and d) **Ctrl+A** button to highlight the files to be opened. In this mode, the **Preview** window will be disabled.

When opening an image, the **App** places it into a new image window. It then becomes the active image.



Note: The **App** maintains, at **File>Recent Files** submenus, a list of the last 4 (Can be 1-8, see Sec.15.1.8.18 for details) opened files. Any of these files can be accessed by simply clicking the submenu. If no files are listed in **File>Recent Files** submenus, the **Open Image...** command must be used to open an image.

Also, the **View>Browse** can be used to view images in **Icon** mode under any selected directory. Brief information can be found in the **View>Browse** command (See Sec.7.1 for details).

File name: From this list box, select the name of the file want to open. Either the type of the file name (with its entire path, if it is not in the current folder), or selecting **Files of type** to obtain a list of file names. Double-clicking a file name in the large combobox (where both folder and file names are listed) will automatically open it;

Note: If user just type in the **File name**, be sure that the **Files of type** field correctly identify the format of the file to open. Otherwise error messages will bring up when the **App** tries to open the file.

Files of type: In this list box, select the image format of the file to open. If one selects **All supported formats**, the **App** uses the file's extension to identify its format. The **App** supported file formats are show above on the right side;

If the image file does not use the standard format-identifying extensions, the file in the **File name** field must be typed, and then select its format from the **Files of type** list box. Otherwise, the **App** will select a format based on the file name extension.

Preview: Check this button to preview image in small size. In **Preview** mode, statistics information about the image (i.e. image **Width**, **Height** and image location) will be displayed. The default is unchecked;

Current File: **Current File** location on your computer;

Windows Bitmap (*.bmp;*.dib;*.rie)
 JPEG (*.jpg;*.jpeg;*.jpe;*.jf;*.jif)
 Portable Network Graphics (*.png)
 Tag Image File Format (*.tif;*.tiff)
 CompuServe GIF (*.gif)
 PCX (*.pcx)
 Targa (*.tga)
 Photoshop (*.psd)
 Icon (*.ico)
 Enhanced Windows Metafile (*.emf)
 Windows Metafile (*.wmf)
 JBIG (*.jbg)
 Wireless Bitmap (*.wbmp)
 JPEG 2000 Standard (*.jp2)
 JPEG 2000 Codestream (*.j2k)
 Digital Imaging and Communications in Medicine (*.dcm)
 Digital Negative (*.dng)
 WebP (*.webp)
 TFT (*.tft)
 All supported formats
 All Files (*.*)

Width: Current File image Width;

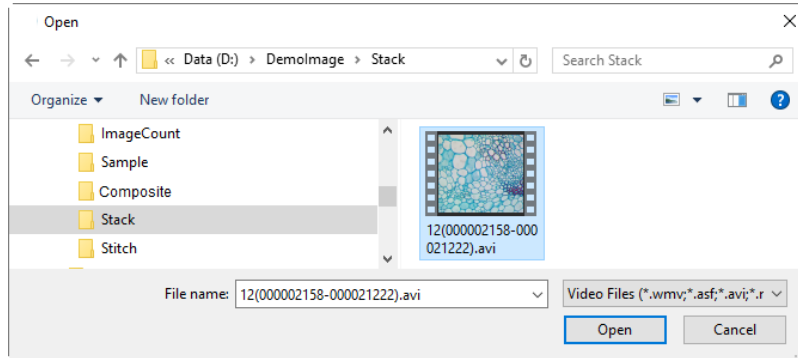
Height: Current File image Height.

5.2 Open Video...



The **File>Open Video...** menu will be enabled only when there is no video file opened in the **App** frame or no camera was opened with video feed.

1. Choose **File>Open Video...** command to open an existing video file;



2. Select the name of the file wish to open. If the file does not appear, select the option for showing all files from the **Files of Type** list box on the right side of the **File name** list box. The video **File of Type** can be:

Video Files (*.wmv;*.asf;*.avi;*.mp4;*.m4v;*.3gp;*.3g2;*.3gp2;*.3gpp;*.mov;*.mkv;*.flv;*.rm;*.rmvb;*.264;*.h264;*.265;*.h265)

3. Click **Open** to open a video file, this will create a video window and begin to start the video feed. The video window will be associated a name called **Video[yyy.ext]** (i.e., its title bar will display **Video [yyy.ext]**, here, **yyy.ext** is the video file name);

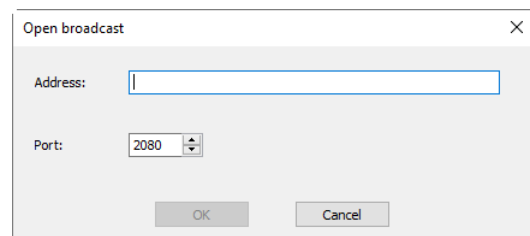
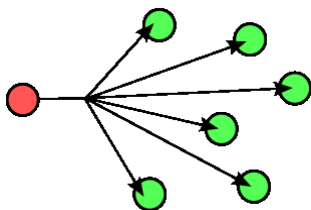
4. Click **Cancel** to return to the **App**.

Note: Only a single video window can be created at a time. The **App** takes camera as a special video file, if the camera is opened, the **File>Open Video...** menu will be disabled.

5.3 Open Broadcast...

In computer networking, telecommunication and information theory, **Broadcasting** is a method of transferring a message to all recipients simultaneously. **Broadcasting** can be performed as a high level operation in a program, for example broadcasting in **Message Passing Interface**, or it may be a low level networking operation, for example **Broadcasting** on Ethernet.

Users could receive the **Broadcasting** video with the **App** from the other user by specifying the **Address** and **Port**.



For example, if user starts a broadcasting service via **Address** 192.168.0.20 and **Port** 2080, the other users could receive the video that is broadcasted through 192.168.0.20 by inputting the right **Address** and **Port** in the **Open broadcast** dialog. If the receiver and the broadcaster are in the same intranet, the performance will be excellent. If not, the performance will depend on the network bandwidth.

About **Capture>Start Broadcast...**, please see Sec.10.4 for details.

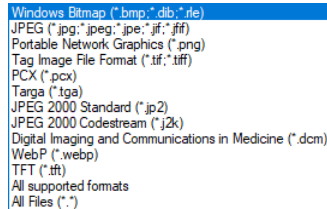
5.4 Save **Ctrl+S**

Choose **File>Save** command to immediately store the current window image to its file (the saved file name

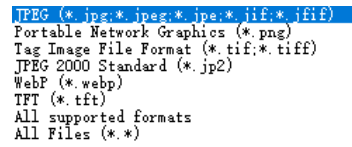
is listed on the window's title bar) while leaving the image still active in its window.

If the image is untitled or titled with a number and there are no **Calibrated Resolution** for the captured image, the **App** will issue the **File>Save As...** dialog automatically (See Sec.5.5). The default **Save as type** will be **Windows Bitmap (*.bmp,*.dib,*.rle)** as shown below on the left side.

If there are **Calibrated Resolution** for the captured image, the default **Save as types** are shown below on the right side:



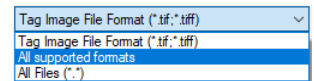
Save as Type without **Calibrated Resolution**



Save as Type without **Calibrated Resolution**

This means the **Objects** can be saved as an image file's separate layer in popular format, such as **JPG, TIF, PNG, WebP** and **TFT**. The **TFT(*.tft)** is a special format defined by the **App** for the **Layer Objects**. All of the formats allow for further editing of the **Objects** in the **App**.

If the captured image format is **RGB48**, the default **Save as type** is shown on the right side. This is because the **TIFF** supports several depths ranging from 2 BPP to 32 BPP.



The **File>Save** command can be used to save the most recent changes to disk. It is often performed as a precautionary measure during lengthy or involved processes to reduce the amount of reprocessing that might be required in the event of a system failure or operational error. When an image is closed and not to save its changes is chosen, the **App** discards all changes made since the last **File>Save** operation.

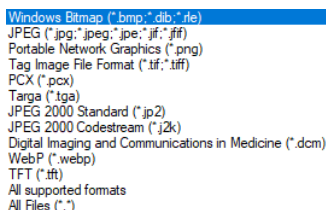
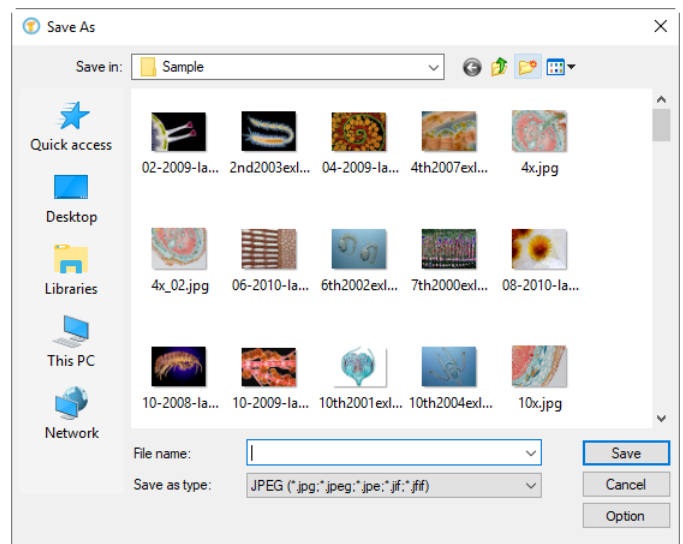
Note: a). The **File>Save** command always saves the contents of the entire window, even if there is an **AOI (Area of Interest)** defined on it;

b). The **File>Save** command will be disabled if the file is not changed or the changes have been saved.

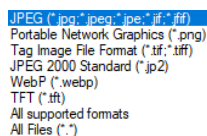
5.5 Save As...

Choose **File>Save As...** command to save the contents of the current window to a specified file format as show on the right side. At the end of a **File>Save As...** operation, the image window will be associated with the new file and the new format (i.e., its title bar will display the new file name).

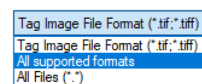
The **App** supported file save formats are shown as below. Different file information will list different **Save as type** in the list box. The **App** will arrange the **Save as type** format group according to the image information automatically. In the **App**, there are 4 groups for different image.



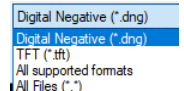
File format without **Calibration Resolution**




File format with **Calibration Resolution**



File format with **Bit Depth >8bit(RGB48)**



File format for **RAW data**

Save in: Find the folder where the file wishes to be saved. A new folder may be created using the [Create New Folder](#) button ;

File name: The file name to be saved. To specify the file's location, either enter its entire path (disk and folder), or specify its location using the [Save in](#) list box;

Save as type: In this list box, select the format where the image wants to be saved;

File>Save As... is also used to convert a single image from one format to another. For example, if a [TIFF](#) file needs to convert to [PCX](#) format, open the [TIFF](#) image first, then choose [Save As...](#) command with the [PCX](#) format to save it to a new file. The default [Save as type](#) will be [Window Bitmap \(*.bmp,*.dib,*.rle\)](#). If there are [Objects](#) overlaid on the image, the default [Save as type](#) will be [JPG](#), [TIF](#), [PNG](#), [WebP](#) and [TFT](#);

The [Save As](#) command has several important uses beyond simply saving an image to a new file name.

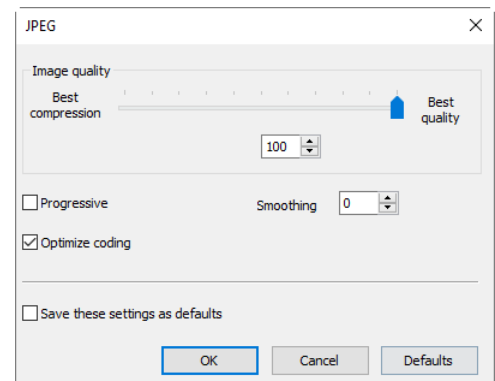
Option: Click [Option](#) to select the different parameters to encode the file. Details are described below.

5.5.1 Option for JPEG

For [JPEG \(*.jpg,*.jpeg,*.jpe,*.jif,*.jfif\)](#), [Option](#) has the following items:

Image quality: If one save an image in [JPEG format \(*.jpg\)](#), one may adjust image quality in the edit box or drag the slide bar. The values for [Image quality](#) range from [0](#) to [100](#). Defaults value: [75](#);

Progressive: The default is unchecked; Check this to save the file in what's called [Progressive](#) or [Interlaced](#) formats. This label changes depending on what file type you select. These image properties are only supported by certain file types, such as [GIF](#) or [JPG](#) formats. This property lets viewers see the file quickly, with more details appearing as the file is successively rendered. Commonly used for images on web pages, it's also generally used where the file must be viewed over a slow network connection. [GIF](#) supports [Interlaced](#), and [JPG](#) support [Progressive](#).



Optimize coding: The default is unchecked;

Smoothing: The values range between [0](#) and [100](#). Default value: [0](#);

Save these setting as defaults: When saving a file, if this item is checked, the current settings will be saved as defaults for the next file save operation.

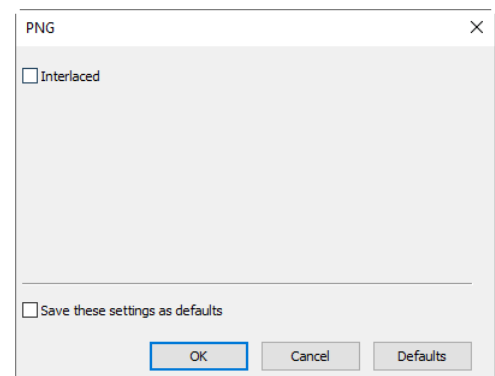
5.5.2 Option for PNG

For [Portable Network Graphics \(*.png\)](#), [Option](#) has the following items:

Interlaced: The default is unchecked; [Interlaced](#) image loads an early degraded version of the whole image as soon as possible and then progressively renders the image to clear state. [Interlaced](#) will always be a bit bigger in file size;

Non-interlaced image will load up in tiles showing clear image in each tile as it progresses to load in the image;

Save these setting as defaults: When saving a file, if this item is checked, the current settings will be saved as defaults for the next file save operation.



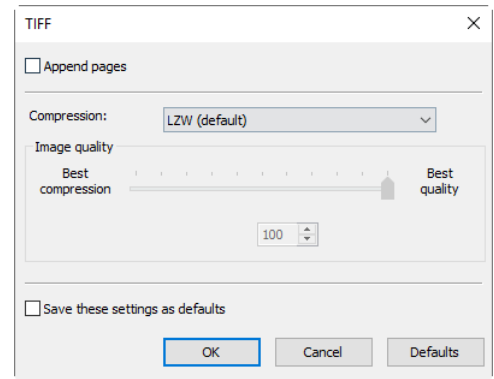
5.5.3 Option for TIF

For [Tag Image File Format \(*.tif, *.tiff\)](#), the [Option](#) has the following items:

Appended pages: Determine whether the current image will be saved in multiple pages style or not;

Compressions: Specifies a method for compressing the composite image data. For saving a 32-bit TIFF file, one can specify that the file be saved with predictor compression, but have no option to use JPEG compression. Predictor compression offers improved compression by rearranging floating point values, and works with both LZW and ZIP compression;

Image quality: If choosing Compressions as "JPEG", the Image quality can be adjusted by the slider bar. The values range between 0 and 100. Default value: 75;



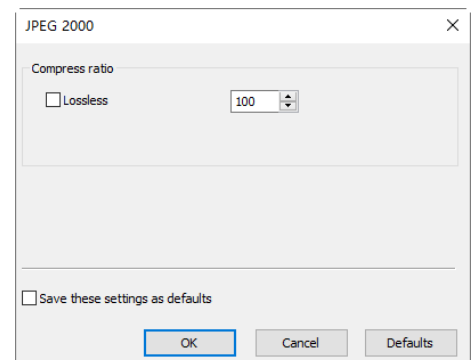
Save these setting as defaults: When saving a file, if this item is checked, the current settings will be saved as defaults for the next file save operation.

5.5.4 Option for JPEG 2000 Standard, JPEG 2000 Codestream

For JPEG 2000 Standard, JPEG 2000 Codestream, Option has the following items:

Lossless: Can check the Lossless or its right edit box with spin button to choose the wished compress ratio. The default value is 100(1~100);

Save these settings as defaults: When saving a file, if this item is checked, the current settings will be saved as defaults for the next file save operation.



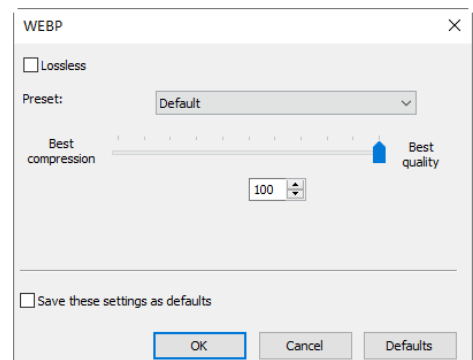
5.5.5 Option for WebP

For WebP, the Option has the following items:

Lossless: Check Lossless will set all the parameters to the values which can keep the image with the higher quality;

Preset: If Lossless is unchecked, the Preset item will be enabled. User can select Photo, Picture, Drawing, Icon or Text according to the image contents;

Image quality: If one save an image in WebP format (*.webp), one may adjust image quality in the edit box or drag the slide bar. The values range from 0 to 100. Default value: 75;



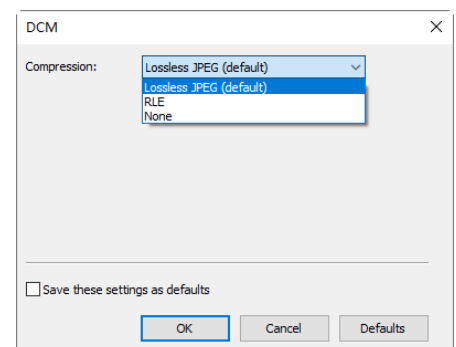
Save these settings as defaults: When saving a file, if this item is checked, the current settings will be saved as defaults for the next file save operation.

5.5.6 Option for Digital Imaging and Communication in Medicine(*.dcm)

For Digital Imaging and Communication in Medicine,(DCM format) Option has the following items:

Compression: There are 3 terms in the dropdown box, they are Lossless JPEG(default), RLE, None, The default is Lossless JPEG;

Save these settings as defaults: When saving a file, if this item is checked, the current settings will be saved as defaults for the next file save operation.



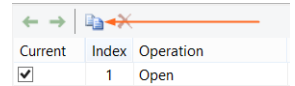
5.5.7 Option for the other formats

For PCX(*.pcx), Targa(*.tga), JBIG(*.jbg) and the App File Type(*.tft), there is no Option.

Note: a) Detailed information of the above academic terminologies can be found in books or internet about image processing and image compression; b) The file saved directory can be restored for future use. To keep the directory unchanged when the App is started again, choose **Options>Preferences...** command, click **Misc** page and check **Restore the current directory when startup** under the **Privacy** item.

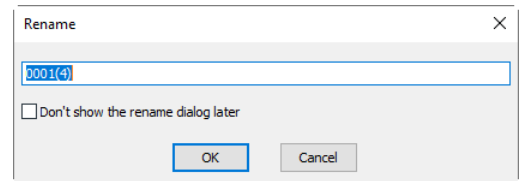
5.6 Quick Save CTRL+Q

The **File>Quick Save** menu will be enabled when a) a new image captured from the camera; b) an image window is created by choosing **File>Paste as New File** command; c) an image window is copied from the **Undo/Redo Sidebar** with the copy button as shown on the right side.



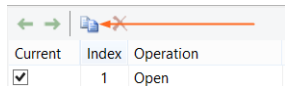
File>Quick Save can save the file at quick way with no need to specify the file directory, file name and file format. All those are specified in **Options> Preferences...**, **Quick Save** property page (See Sec.15.1.1 for details) If **Show the rename dialog** is checked in the **Quick Save** property page, choosing **File>Quick Save** will pop up a **Rename** dialog as shown below on the right side. Enter the name to save the image file.

If **Show the rename dialog** is unchecked, choosing **File>Quick Save** will save the file with the name specified in the **Options> Preferences...**, **Quick Save** property page's setting (See Sec.15.1.1 for details.).



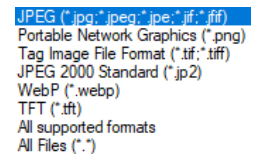
5.7 Batch Save...

The **File>Batch Save...** menu will be enabled when a) an image is opened and modified; b) an image is captured from the camera; c) an image window is created by choosing **File>Paste as New File** command; d) an image window is copied from the **Undo/Redo Sidebar** with the copy button as show below:



5.7.1 Batch Save for a) style image window

1. If the image is modified, choosing **File>Batch Save...** command will save the file with its opened file directory, including file name plus file extension;
2. If the image is modified because of the **Objects**, choosing **File>Batch Save...** menu will save the file with its opened file directory and name with the right side listed file extensions.

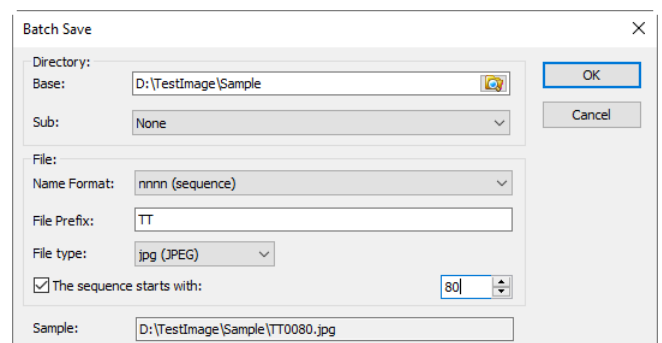



5.7.2 Batch Save for b), c) or d) style image window

If the image window has been created with b), c) or d) style, choosing **File>Save As...** command to save the multiple files one by one will be time-consuming. The **Batch Save...** command will runs **File>Save As...** command with the name automatically specified according to the paradigm specified in the **Batch Save** dialog as shown below on the right side.

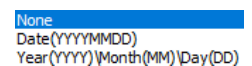
To start **File>Batch Save...** command for b) style image window, you have to

1. Start the camera;
2. Snap at least an image first;
3. Choosing **File>Batch Save...** command will bring up a **Batch Save** dialog shown on the right side.



Directory Base: Enter the name of the drive and directory where the new image will be saved. User may either type the path, or use the **Browse** button  to locate it from a standard **Browse Folder** dialog;

Directory Sub: The sub directory for the **Quick Save** under the **Base** directory. The **Sub** can be **None**, **Date(YYYYMMDD)** or **Year(YYYY)\Month(MM)\Day(DD)**.



The default is **None**;

Name Format: The **year**, **month**, **date**, **hour**, **minute** and **second** or **nnnn** (sequence) are used as part of the file name. If more files are saved with in a second, a **(xx)** suffix is attached to the end of **Name Format** to avoid the possible name confliction. For the **nnnn** (sequence) **Name Format**, no suffix is needed;

```
yyymmdd+HHMMSS
yyyyymmdd+HHMMSS
yy-mm-dd+HH-MM-SS
yyyy-mm-dd+HH-MM-SS
nnnn (sequence)
```

File Prefix: Enter a file name prefix for **Quick Save** when generating files names for a series of images. This prefix will be combined with **Name Format** to form a final file name naming paradigm;

File Type: In this list box, select the format in which you wish the image to be saved (can be **JPG**, **PNG**, **TIF**). If the image **Bit Depth** is larger than 8-bit, the **App** will transfer the **Bit Depth** to 16-bit(**RGB48**) format, the image will be always saved with **tif** format because only **tif** file could support **RGB48** format;

The sequence starts with: Check this to specify the start number for the **Batch Save** sequence file number. Unchecking will always start it with 1;

Sample: The final file name is shown at the right of the **Sample** item for reference;

4. If the setting in the **Batch Save** dialog was finished, click **OK** button to begin the file batch save process or **Cancel** to cancel the **Batch Save** command and return to the application;

For the c) or d) style image window, only step 3 and 4 are needed.

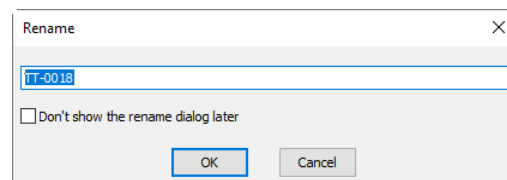
Note: a) In the process of the **File>Batch Save...** command, the title on the image tab or image window will be modified according to the file name paradigm defined in the **Batch Save** dialog. b) The **File>Batch Save...** command will perform no saving operation if the file is not modified or unchanged.

5.8 External Application (F7)

The **External Application** will allow the opened images or pre-processed images to be opened directly by the 3rd party software. Some standard program has this interface, such as **Photoshop** or **Paint**. The 3rd party application can be specified at **Option>Preferences...** property sheet, **Misc** page in the **External Application** item. The **External Application** command will be enabled only when the application is specified in the **External Application** item. See Sec.15.1.8.11 for details.

If the image is modified, newly captured or **Pasted as New File** created, choosing **External Application** command will pop up a **Rename** dialog and asked to save it first.

After the image is saved, then it will be opened by the **External Application** for further processing.



5.9 Paste as New File

The **File>Paste as New File** command will be enabled only when there is valid image data on the clipboard first (see the **Edit>Copy** and **Edit>Deep Copy** commands). If there is no image data on the clipboard, the **File>Paste as New File** menu will be disabled.

Choose **File>Paste as New File** command to paste the contents of the clipboard image into a new active image window.

The new image type will be the same as that of the original image. The **App** will accept image data from the other application via the clipboard as long as it is in **BMP/Windows Bitmap (DIB)** format.

Note: The **App** will assign a number to the **File>Paste as New File** command created window title bar.

5.10 Microsoft Word Report... (F10)

The **File>Microsoft Word Report...** function is designed to export the images and other useful information to a **Word** file according to the template format.

The report template is a **Word** format file that contains different type of placeholders and it uses placeholder to represent the content to be replaced.

Now 3 different type of placeholders are supported, which are [Time Placeholder](#), [Image Placeholder](#) and [Measurement Table Placeholder](#) respectively.

Time Placeholder: `{{YYYY}}``{{mm}}``{{DD}}``{{HH}}``{{MM}}``{{SS}}` are time placeholder that represent **Year**, **Month**, **Day**, **Hour**, **Minute** and **Second** respectively; User does not need to set the content for time placeholder because it will set to system by software automatically;

Image Placeholder: `{{IP}}` is the [Image Placeholder](#). The image in this template whose title item of alternative text property is `{{IP}}` will be regarded as the image placeholder; When users want to export images to the template, the images must be [Opened /Snapped/Pasted as New File](#); created image windows;



Measurement Table Placeholder: `{{MT}}` is a table with one row and one column filled with content of the [Measurement Sheet](#). The properties of the [Measurement Table](#) are the same as the placeholder, such as the border color, the alignment mode and so on. The width of every column is equal to the width of the placeholder divided by the number of the columns. The height of the [Measurement Table](#) is equal to the height of the placeholder; The [Measurement Table Placeholder](#) will be replaced by the measurement information of the exported images. Users could manage the exported measurement information before export in the [Options>Measurement...](#) command and click [Sheet](#) page. Please See [Sec.15.2.4](#) for details;

When the [Microsoft Word Report](#) is generated, different placeholder in the template will be replaced by corresponding content from the [App](#). Users could define their own template and rearrange the placeholders in their own template according to their requirement. Choosing [Options> Preferences...](#), clicking [Report](#) page to [Edit](#), [Clone](#), [Delete](#) or [Reset](#) the [Report Template](#). See [Sec. 15.1.4](#) for details.

When the template is finished, users could select the content in [App](#) to replace the placeholders in template.

You can export the [Word Report](#) on the image window (Only the active image can be export in this mode) /[Browse](#) window/[Thumbnail](#) window. The rear two methods are strongly recommended to generate the [Word Report](#);

The basic steps is described below:

1. Choose [View>Thumbnail](#) command or press the  button on the toolbar/Choose [View>Browse](#) command or press the  button on the toolbar to active the [Thumbnail/Browse](#) window;
2. Select the images you want to export in [Thumbnail/Browser](#) window and choose [File> Microsoft Word Report...](#) command to generate. The replacement of multiple pictures in template will depend on the image selection order in the [Thumbnail /Browser](#) UI.

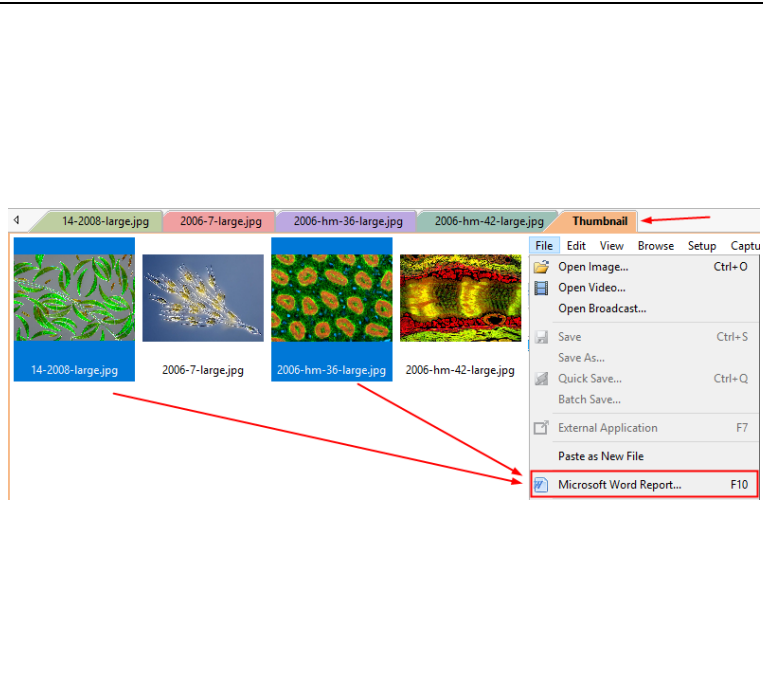
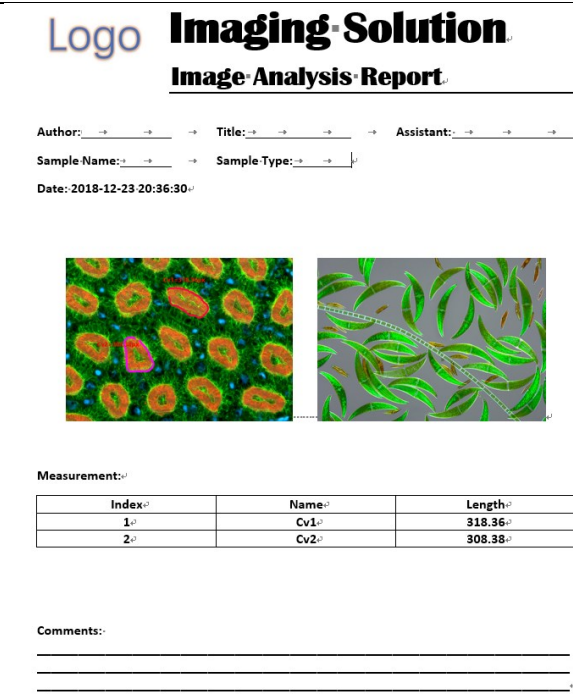
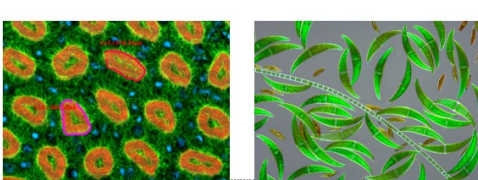


Image selection for the [Microsoft Word Report](#) in the [Thumbnail](#) window



Logo **Imaging Solution**
Image Analysis Report

Author: → → → → Title: → → → → Assistant: → → → →
Sample Name: → → → → Sample Type: → → → →
Date: 2018-12-23 20:36:30



Measurement:

Index	Name	Length
1	Cv1	318.36
2	Cv2	308.38

Comments:

Microsoft Word Report of the selected images

5.11 Print Setup...

Choose **File>Print Setup...** command to access the setup panel for the printer that has been selected. The **App** will present the standard setup panel for the particular printer (this is the same panel one would receive if one was setting up the printer from the **All Settings>Device>Printer**). Change printer's setup to satisfy the requirements, click **OK** button to return.

5.12 Print Preview... Ctrl+Shift+P

Choose **File>Print Preview...** command to see the real-time effect of the printer without actually printing it out.

5.13 Print... Ctrl+P

Choose **File>Print...** command to print one or more copies of the current image to the selected output device. The **File>Print...** command lets one take full advantage of the printer's capabilities. If the printer has built-in half-toning or color dithering capabilities, use them or instruct the **App** to perform these processes before sending the image to the device.

The **File>Print...** command also has facilities that let one adjust the size and position of the image on the printed page.

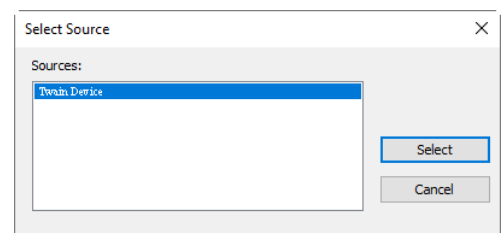
5.14 Twain: Select Device...

Twain is a cross-platform interface for acquiring images captured by certain scanners, digital cameras, or frame grabbers. The manufacturer of the **Twain Device** must provide a **Source Manager** and **Twain Data Source** to work with the **App**.

Select the active device for the **Twain: Acquire...** menu from all devices available in the device combobox which are enumerated by the **App**.

One must install the **Twain Device** hardware and its driver first. Please read the documents provided by the device manufacturer for the installation instructions.

Before begin to start the **Twain: Acquire** at the 1st time with the **App**, choosing **File>Twain: Select Device...** command will invoke a **Select Source** dialog as shown on the right side.



Source: Choose the right device from the **Source** window (Highlighted);

Select: Click the **Select** button to select the device. User does not need to repeat this step for subsequent choosing of the **Twain: Acquire...** command.

Note: All of the provided cameras are integrated into single **Source** called **Twain Camera**. This will greatly reduce the listed item and easy to choose for the user.

5.15 Twain: Acquire...

5.15.1 Introduction

There are basically two techniques used to capture the video images from video devices such as a PC camera, digital camera, and scanner. They are the **Twain: Acquire...** technique and the **DirectShow** technique (previously called **VFW**).

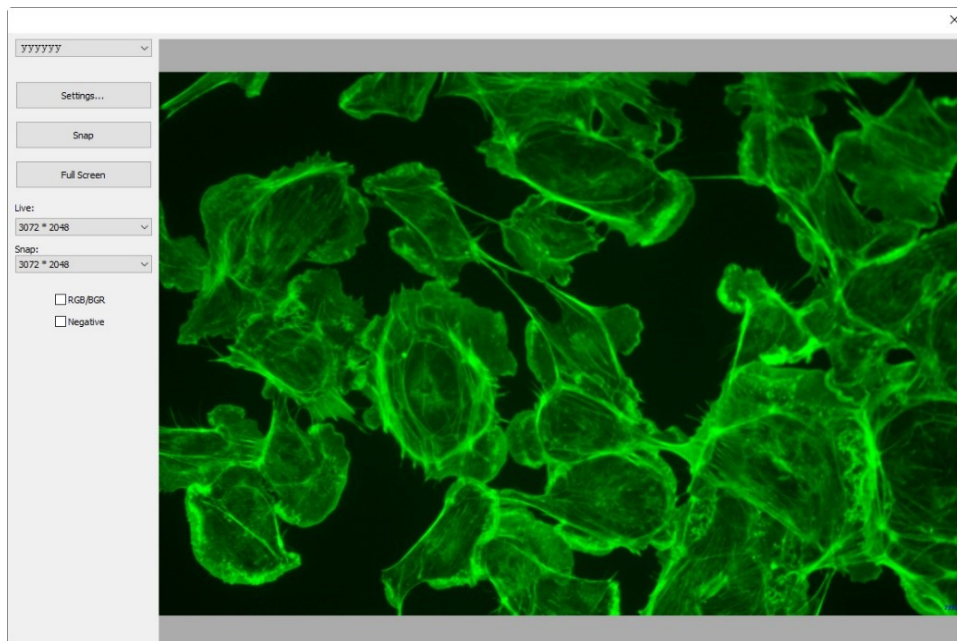
The most obvious characteristics of the **Twain** technique is that it previews the video in smaller resolution but captures the image with higher resolution. Most of the cameras we provided support all of these two video preview techniques.

5.15.2 Steps for Twain Acquire

Here we illustrate how to capture the image using **yyyyyy**(6M pixels, USB3.0) camera as an example.

1. Install the camera **Twain** driver provide by the supplier (for example driver for **yyyyyy** hardware);

2. Install the [App](#);
3. Plug the cameras [yyyyyy](#) (USB3.0) into the computer USB port;
4. Start the [App](#);
5. Choose [File>Twain: Select Device...](#) command to select the device from the [Select Source](#) dialog (If never selected before);
6. Choose [File>Twain: Acquire...](#) command and there should be a dialog box like below:



In this dialog, the [Video Source Property](#) can be set by clicking [Setting...](#) button and this will pop up a [Settings](#) property sheet as shown below. The [Settings...](#) property sheet has many property pages which are defined by the camera supplier. Please contact with your camera vendor for details.

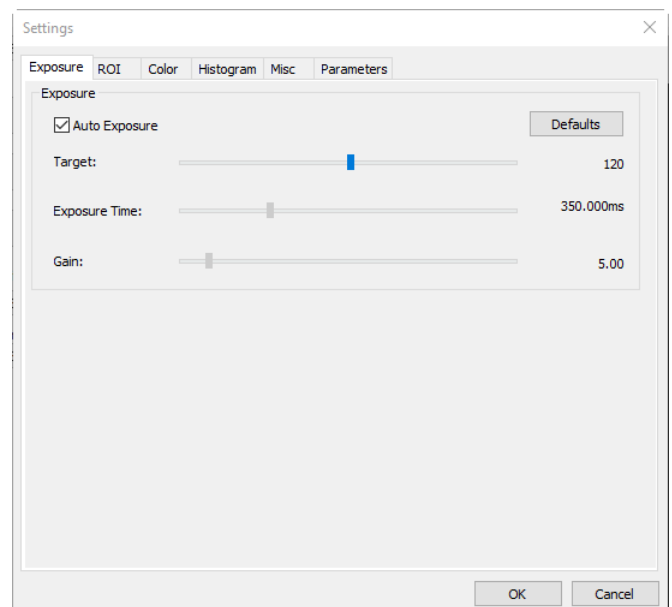
Snap: Click the [Snap](#) button to snap an image. This will create a new window and its title bar will be assigned a digital number as the image window name;

Full Screen: Click [Full Screen](#) will give user a total-screen view of video. Press [ESC](#) to cancel the full screen view;

Live or Snap: The video [Resolution](#) can be chosen in the [Live](#) list box and the captured image [Resolution](#) in the [Snap](#) list box;

RGB/BGR: Check the [RGB/BGR](#) box to ensure the correct color encoding format compatible with your camera;

Negative: [Negative](#) will reverse the pixel values of the active video without going through the lookup table.



Click [x](#) on the window's upright corner to close the [Twain: Acquire](#) dialog.

5.16 Recent Files

The [App](#) maintains 4 (Default) most recently opened document files under the [Recent Files](#) menu. Choosing one of these submenus will reopen that file immediately.

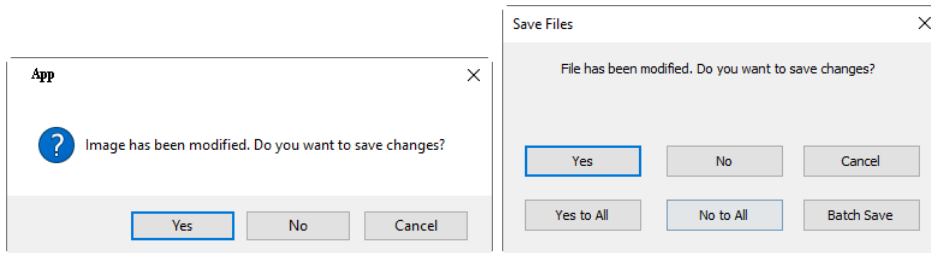
Note. a) The maximum number of Recent Files can be modified by choosing [Options>Preferences...](#) command and clicking the [Misc](#) page, locating the [Privacy](#) item (See [Sec.15.1.8.18](#) for details). Here, clicking the [4](#) (default) edit box will allow user to enter the number of the [Recent Files](#) submenus wanted. The value ranges from [0](#) to [8](#);

b) One can also check the [Clear the Recent Files when exit the application](#) to clear the [Recent Files](#) after exit the [App](#) application (See [Sec.15.1.8.18](#) for details).

5.17 Exit

Choosing [File>Exit](#) command will close video window, all of the image windows and [Browse/Thumbnail](#) window. After all of the windows are closed, the [App](#) will end itself.

Note: If an image has been modified before attempting to [Exit](#), the [App](#) will first issue a warning dialog to ask if user want to save the image or not.



If multiple images have been modified before attempting to [Exit](#), the [App](#) will issue [Save Files](#) dialog to direct the user to save changes in different ways.


See [Sec.16.2 Window>Close All](#) for details.

6 Edit

6.1 Cut Ctrl+X

The **Edit>Cut** command will be enabled only when a) an **Object** or **Objects** on the **Layer** over the image is or are selected; b) an image or images in the **Browse** window is or are selected.

6.1.1 Cut for Objects

Check the **Measurements>Object Select**  (Sec.14.1) and **Edit>Select All** menu (Sec.6.7) to find how to select **Layer Objects** for the **Edit>Cut** command.

Choose **Edit>Cut** command to a) copy the selected **Objects** to the clipboard and b) delete the selected **Objects** on the image window. Any data already exists on the clipboard will be replaced.

The **Objects** copied to the clipboard can be pasted into the active window or into another opened image/video window on the layer overlaid on the image using the **Edit>Paste** command (when there is no **Layer** overlaid on the **Background Layer**).

6.1.2 Cut for Browse window selected files

When the **Browse** window is active and the image files in the **Browse** window are selected, the **Edit>Cut** command will be enabled. Choosing **Edit>Cut** command will delete the selected files and copy them to the clipboard.

Note: The **Edit>Cut** command does not support **Background Layer** (image) **Cut** operation.

6.2 Copy Ctrl+C





Choose **Edit>Copy** command to **Copy** a) the highlighted **Objects** (on the **Measurement Layer**); b) an image's selected area on the **Background Layer**; c) The selected files in the **Browse** window to the clipboard.

Note: When a) the **Object(s)** is (are) highlighted; b) the **Current Layer** is the **Background Layer** and an image ROI is selected or c) The files in the **Browse** window are selected, the **Edit>Copy** menu will be enabled. Check the differences of **Edit>Copy** and **Edit>Deep Copy** commands

6.2.1 Copy the selected area on the Background layer to the clipboard

1. Select the image area using the **Edit>Image Select**  command/**Edit>Select All**/**Ctrl+A**. The **Edit>Copy** menu will be enabled;
2. Choose **Edit>Copy** command to copy the selected image area to the clipboard.

6.2.2 Copy Object(s) on the Measurement Layer to the clipboard

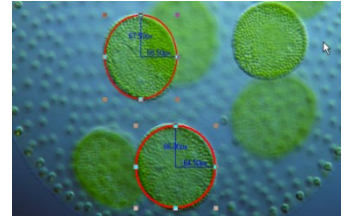
1. For the **Layer** operation, see the **View>Sidebar>Layer** menu in Sec.7.4.5 and the **Layer** menu in Sec.13 for details;
2. For the **Measurement** operation, see the **View>Sidebar>Measurement** menu in Sec.7.4.6 and the **Measurements** menu in Sec.14;
3. After the **Measurement** operations have been done, choose **Measurements>Object Select** command or press the **Object Select** button  on the toolbar, the cursor will change to  in the image/video window;
4. Move the mouse until the cursor becomes , this means the cursor is right on the **Object**. Clicking it will highlight the **Object** and the **Object** will be selected;
5. Option 1: Continue to move the mouse until the cursor becomes  again, this means the cursor is right on another **Object** again. Clicking it with **Ctrl+left mouse button** and the second **Object** will be selected and highlighted;
6. Option 2: a) Move the cursor over the image, click down the left mouse button; b) Drag the mouse to draw a rectangle on the image. A dotted rectangle will appear around the selected area; c) Release the mouse

and all of the **Objects** within the dotted rectangle will be highlighted and selected;

7. Option 3: **Ctrl+A/Select All** to select all the **Objects** on the **Current Layer**;

8. After the **Objects** are selected, the **Edit>Copy** menu will be enabled;

9. Choose **Edit>Copy** to **Copy** the **Object(s)** to the clipboard. Then the **Edit>Paste** menu will be enabled. One can then **Paste** the objects onto the **Current Layer** or onto the other **Measurement Layer** in the same image/video window. If one switches to the **Background Layer**, the **Edit>Paste** menu will be disabled, but if one returns to the **Measurement Layer** again, the **Edit>Paste** menu will be enabled again.



6.2.3 Copy for Browse window selected files

When the **Browse** window is active and the image files in the browse window are selected, the **Edit>Copy** command will be enabled. Choosing **Edit>Copy** command will copy the image files to the clipboard. After the **Edit>Copy** command, the **Edit>Paste** and the **Edit>Paste Shortcut** menus will be enabled.

1. The copied **Object(s)** can be pasted into the active window or into another opened window using the **Edit>Paste** command as long as the current window is not on the **Background Layer** (the **Edit>Paste** menu will be disabled if the **Background Layer** is active). See the **View>Sidebar>Layer** command in Sec.7.4.5 and the **Layer** menu in Sec.13 for details;

2. The copied files on the clipboard can be pasted into the **Browse** window by choosing **Edit>Paste** command.

Note: a) The **Edit>Copy** command will not delete the **Objects** over the image. Any data existing on the clipboard will be replaced with the new data;

b) Click the icon/**Ctrl+left mouse button/Shift+left mouse button/Draw a rectangle/Ctrl+A/Edit>Select All** on the **Browse** window to select file(s).

6.3 Paste



Ctrl+V

If a) there is (are) **Object(s)** on the clipboard and the **Current Layer** is not the **Background Layer**, or b) there is (are) image file(s) on the clipboard and the current active window is **Browse** window, the **Edit>Paste** menu will be enabled.

6.3.1 Paste for Objects

Choose **Edit>Paste** command to **Paste Objects** from the clipboard onto the active image's **Measurement Layer**. One can also choose **Edit>Paste** command to transfer a layer's **Objects** from one image/video window's **Measurement Layer** to another or current image/video window's **Measurement Layer**.

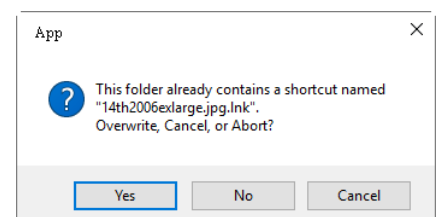
6.3.2 Paste files to Browse window

When the **Browse** window is active and there are the image files in the clipboard, the **Edit>Paste** command will be enabled. Choosing **Edit>Paste** command will paste the clipboard files to the **Browse** window.

Note: The **Edit>Paste** command does not support the image area **Paste** operation.

6.4 Paste Shortcut

This command is for **Browse** window only. This menu will be enabled when the files in the **Browse** window are selected and the **Edit>Copy** command is executed to copy the file shortcut to the clipboard. Choosing this command will create the selected files **Shortcut** (in ***.lnk** format) in the **Browse** window.



If the to be pasted ***.lnk** file has been existed in the current **Browse** window, the **App** will pop up a prompt dialog as shown on the above right side.

One can click **Yes**, **No** or **Cancel** to **Overwrite**, **Cancel** or **Abort** the command.

6.5 Delete Delete

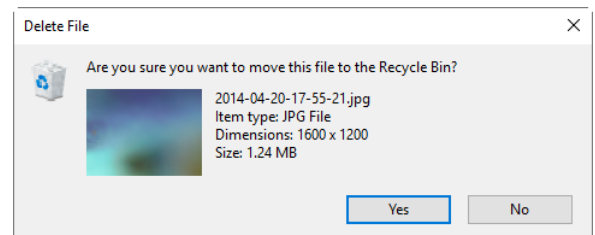
The **Edit>Delete** menu will be enabled if a) the file(s) is (are) highlighted in the **Browse/Thumbnail** window, b) the **Object(s)** on the image/video window are selected. This command is for **Browse/Thumbnail** /image/video window only.

User can **Delete** or remove one or more files from the **Browse** window. The steps are as follows:

6.5.1 For Browse/Thumbnail window file delete

1. Select one or more files by a) Clicking the displayed file icons, a single file will be highlighted; b) Clicking the file one by one with **Ctrl + left mouse button**, all of the clicked files will be highlighted; c) Clicking the displayed file icons, the first clicked file will be highlighted, clicking the end file with **Shift + left mouse button**, all of the files among the first and last will be highlighted. d) Dragging the mouse to draw a dotted line rectangle across the files you wish to delete, all of the files in the rectangle will be highlighted; e) **Ctrl+A /Edit>Select All** to select all files in the **Browse/Thumbnail** window;

2. a) Press the **Delete** key or choose **Edit>Delete** command to delete the selected files; b) Click the right mouse button to bring up a context menu, choose **Delete** command to delete the highlighted files. A confirm **Delete File** dialog will bring up as shown on the right side.



In the confirm **Delete File** dialog, click **Yes** to move the files to the desktop recycle bin, or **No** to cancel the **Delete** operation.

6.5.2 For image/video window Object(s) delete

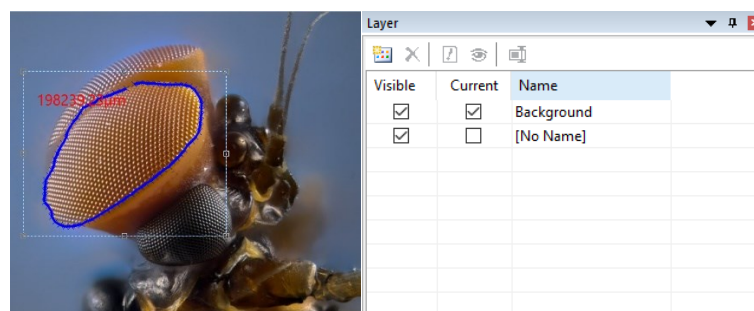
If the **Objects** on the image/video are selected, choosing **Edit>Delete** command or pressing **Delete** button will remove the **Objects** from the image/video window.

6.6 Image Select

The **Edit>Image Select** command can be used to mark **ROI** and **Copy** the selected **ROI** to the clipboard. This command is only used to select the **ROI** on the **Background Layer**.

Choosing **Edit>Image Select** command will check this menu and the cursor will turn into **+**. The **ROI** selection steps are described as below:

1. After the **Edit>Image Select** command is chosen, the **Background Layer** will be checked automatically regardless of if the other **Layer** is checked or not;
2. Drag the mouse cursor across the image with the left button held down until the area is selected;
3. Release the left button and the area will be marked. Handles will appear on the area that will allow altering the selection after it is marked;
4. **Ctrl+A/Edit>Select All** will select all the image area.



6.7 Select All **Ctrl+A**

6.7.1 Select all on the Background layer

When the image/video window is active and the **Background Layer** is checked, choosing **Edit>Select All** command will select all pixels on the **Background Layer** within the canvas (shortcut: **Ctrl+A**).

6.7.2 Select all Objects over the Background layer

When the image/video window is active and the **Background Layer** is not checked, choosing **Edit>Select All** command will select all of the **Objects** on the **Current Layer** (shortcut: **Ctrl+A**).

6.7.3 Select all files in the Browse/Thumbnail window

When the **Browse/Thumbnail** window is active, choosing **Edit>Select All** command will select all of the files or icons in the **Browse/Thumbnail** window.

6.8 Select None **Ctrl+D**

Deselect a) any selected area (**ROI**) on the image; b) the **Objects** on a **Layer**; c) the file listed in the **Browse/Thumbnail** window.

6.8.1 Select None for Background Layer


When the **Current Layer** is the **Background Layer** and an image area is selected, the **Select None** menu will be enabled. Choosing **Edit>Select None** command will delete the dotted rectangle representing the selected area (**ROI**).

6.8.2 Select None for Objects

When the **Current Layer** is not the **Background Layer** and the **Objects** are selected, the **Edit>Select None** command will be enabled. Choosing **Edit>Select None** command will deselect all of the selected **Objects**.

6.8.3 Select None for Browse/Thumbnail window

When the **Browse/Thumbnail** window is active and the image files in the browse window are selected, the **Edit>Select None** command will be enabled. Choosing **Edit>Select None** command will deselect all of the selected files in the **Browse/Thumbnail** window.

Note: See **Edit>Image Select**, **Edit>Select All** and **Measurements>Object Select**  commands to understand how to perform select operations.

6.9 Deep Copy **Ctrl+Z**

The **Edit>Deep Copy** function, which will allow the image and **Objects** copy to the clipboard and users can paste to word or other document directly with no need to execute **Layer>Merge to Image...** command to merge the **Layer Objects** to the image first.

If there are **Objects** on the image, **Edit>Deep Copy** function will pop up an **Export Options** dialog as below:

Label font size: Used for the **Object's** label font size, the default value is 7(1~28);

Label font weight: **Normal**, **Bold** or **Heavy**. The default is **Bold**;




Set the **Label font size** and **Label font weight** for the **Objects** over the image and click **Ok** to finish the **Deep Copy** command. The user can use **Paste** command in other application or **File>Paste as New File** command in the **App** with this **Deep Copy** data.

7 View

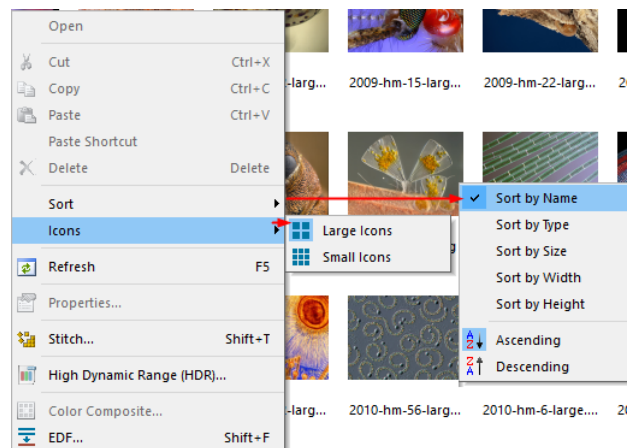
7.1 Browse Ctrl+B

7.1.1 Open the Browse window

1. Choose [View>Browse](#) menu or click the [Browse](#) toolbar button  to open or active [Browse](#) window under the specified directory in the [Folders Sidebar](#);
2. Click the [Folders Sidebar](#) to activate it and double-clicking the listed directory in the [Folders Sidebar](#) will create the [Browse](#) window.
3. After creating the [Browse](#) window, the [App](#) will display a [Browse](#) window that looks like windows explorer. The child window on the left part of the [Browse](#) window called [Folders Sidebar](#) is used to locate the directory on the hard disk. Images in the current directory are displayed in [Large Icons](#) or [Small Icons](#) mode on the right side of the [Browse](#) window.
4. Image file's order can be set in [Ascending](#) or [Descending](#) order according to [Sort by Name](#), [Type](#), [Size](#), [Width](#) or [Height](#) et al.

7.1.2 Browse window right mouse button context menu

Clicking the right mouse button on the listed [Icon](#) in the [Browse](#) window will bring up a right mouse button context menu as shown below:



These context menu functions are described in

- [Browse>Delete File](#)
- [Browse >Sort>Sort by Names](#)
- [Browse >Sort>Sort by Type](#)
- [Browse >Sort>Sort by Size](#)
- [Browse >Sort>Sort by Width](#)
- [Browse >Sort>Sort by Height](#)
- [Browse >Sort>Forward](#)
- [Browse >Sort>Reverse](#)
- [Browse >Icon>Large Icons](#)
- [Browse >Icon>Small Icons](#)
- [Browse >Refresh](#)
- [Browse >Properties](#)

menus. See Sec.8 for details.

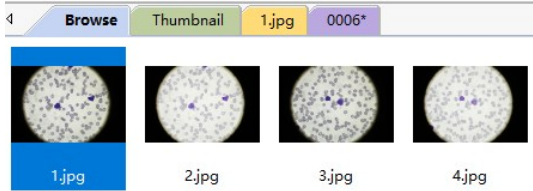
The other command can be found in the [Process](#) menu in Sec.12.

Note: The [Folders Sidebar](#) and the [Browse](#) window can be used to perform tasks such as creating new folders, renaming, moving, and deleting files. Individual file information and import data from digital cameras can also be displayed. Double-clicking the left mouse button on the icon will open the image as an

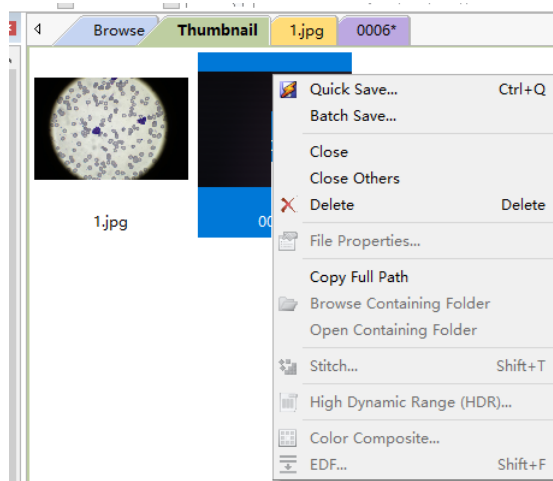
active image in full size. See [Image window GUI](#) in Sec.2 for more details.

7.2 Thumbnail (Ctrl+T)

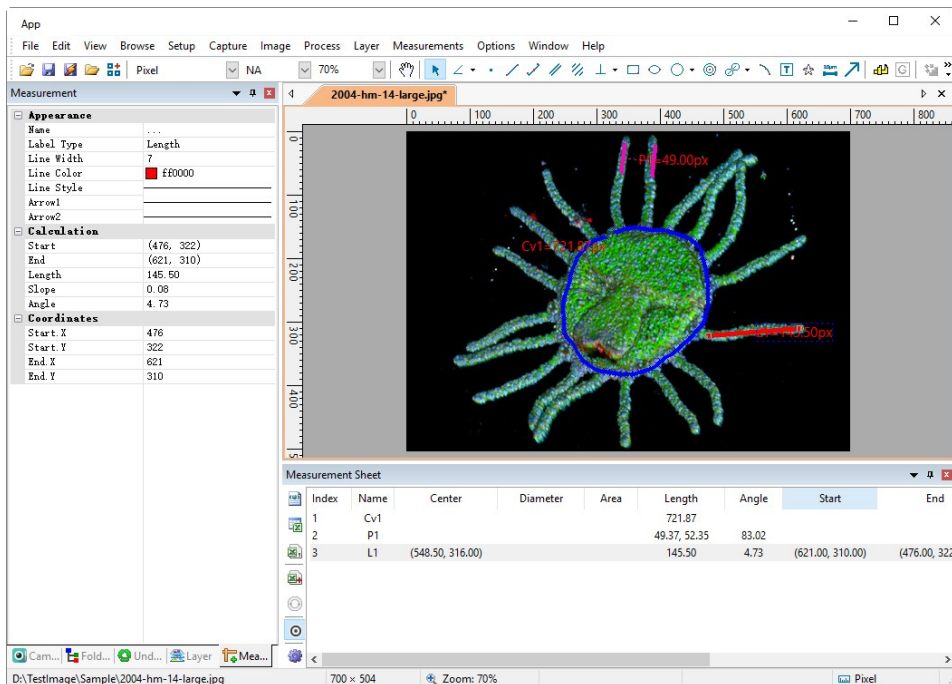
[Folders](#) is a browser to [Browse](#) all the image files on disk. It is also an important platform where users can perform file operations easily, such as [Stitch](#), [HDR](#), [Color Composition](#), and [EDF](#) ital. But user cannot find a temporary file in the [Folders](#) which has just captured from the camera and has not been saved to the disk. The [Browse](#) window is shown below:










[Thumbnail](#) is also a browser that could manage all the opened files, including the opened files on the disk and the captured image from the camera/[Edit](#)>[Paste as New File](#) created window image. Many convenient operations can be done in [Thumbnail](#) browser, besides the operations on the opened files on disk ([Stitch](#), [HDR](#), [Color Composition](#), [EDF](#)...), quick save and batch save could also be done for temporary files. Selection of multiple images exported to [Microsoft Word Report](#) can only be done in [Thumbnail/Browse](#) window (See Sec.5.10 for details).



7.3 Measurement Sheet



Choosing [View>Measurement Sheet](#) or clicking [Measurement Sheet](#) title under the [Sidebar](#) will active [Measurement Sheet](#). The [Measurement Sheet](#) shows the [Object's](#) possible features, such as [Name](#), [Center](#), [Diameter](#), [Area](#), [Length](#), [Angle](#), [Start Point](#), and [End Point](#) ital. overlaid on [Background Layer](#).

On the left of the [Measurement Sheet](#), there is a toolbar with 5 buttons called [Export to Html](#) , [Export to Excel](#) , [Export to CSV](#) , [Append to CSV](#) , [Reset](#) , [Auto Highlight](#)  and [Setting](#) . Their main functions are explained as follows:

7.3.1 Export to Html

Export all the [Layer Objects](#) to the [*.html](#) file in a tabbed format.

Layer Name	Index	Name	Center	Diameter	Area	Length	Angle	Start	End	Distance
Layer1	1		(124.86, 239.18)	218.54	37509.04	686.55				
	1		(578.19, 249.50)	205.15	33055.73	644.51				
Layer2	2		(350.50, 246.50)			457.13	178.62	(579.00, 252.00)	(122.00, 241.00)	

Length Unit:Pixel, Angle Unit:Pi

7.3.2 Export to Excel

Export the [Current Layer Objects](#) to the [*.xlsx](#) file in a tabbed format.




Note: This menu will be enabled only when there are [Objects](#) overlaid on the [Background Layer](#) (image/video).

7.3.3 Export to CSV

Export [Current Layer Objects](#) to the [*.csv](#) file in a tabbed format which can be opened by [Excel](#).

Note: This menu will be enabled only when there are [Objects](#) overlaid on the [Background Layer](#) (image/video). User could check [Options>Preference... Misc](#) page, [File Format](#) item's [Using UTF8 charset in CSV](#) to prevent the messy code in the [CSV](#) file (See Sec.15.1.8.5).

7.3.4 Append to CSV

[Append Current Layer Objects](#) to the [*.csv](#) file in a tabbed format which can be opened by [Excel](#). If it is the first time or the [Reset](#)  button is clicked, all the operation is just the same as [Export to CSV](#)  command. After that, [Append to CSV](#)  will append the [Current Layer Objects'](#) sheet parameters to the [CSV](#) file automatically. This command is commonly used for those who wish to post process the [Measurement](#) results on different image or on the video.

Note: This menu will be enabled only when there are [Objects](#) overlaid on the [Background Layer](#) (image/video). User could check [Options>Preference... Misc](#) page, [File Format](#) item's [Using UTF8 charset in CSV](#) to prevent the messy code in the [CSV](#) file (See Sec.15.1.8.5).

7.3.5 Reset to CSV

Begin a new [Append to CSV](#)  command;

Note: This menu will be enabled only when [Append to CSV](#)  command is excuted..

7.3.6 Auto Highlight

When the [Auto Highlight](#) button is pressed down, clicking the item in the [Measurement Sheet](#) will highlight the corresponding [Object](#) overlaid on the [Background Layer](#) (image/video window).

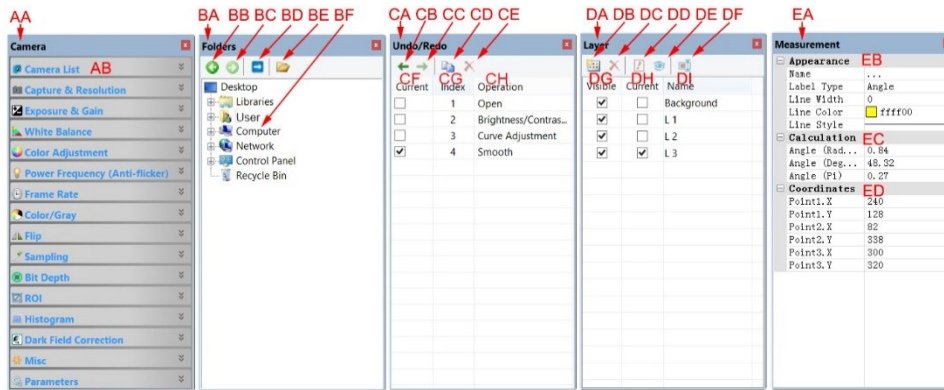
7.3.7 Settings... ([Options>Measurement>Object](#))

Click the **Setting** button will pop up a **Measurement** property sheet located at **Object** page. Detailed information can be found in **Options>Measurement...** command's **Objects** page (See Sec.15.2.5 for details).

7.4 Sidebar

There are 5 **Sidebar**s in the **App** frame window in tabbed style. They are **Camera Sidebar**, **Folders Sidebar**, **Undo/Redo Sidebar**, **Layer Sidebar** and **Measurement Sidebar**.

7.4.1 Sidebar Overview



AA: **Camera Sidebar**;

AB: **Camera Sidebar** groups for the control of the camera.

BA: **Folders Sidebar**;

BB: **Back** to the previous folder;

BC: **Forward** to the next folder;

BD: **Browsing** the pictures under the application's file directory;

BE: Open the **Browse** window if it is not opened (Double-clicking on the selected directory will perform the same functions.);

BF: **Folders** to locate the **Browse** window's file directory.

CA: **Undo/Redo Sidebar**;

CB: Forward to the previous step;

CC: Backward to the next step;

CD: **Operation Copy**: Copy the highlighted operation in the **Undo/Redo Sidebar** to a new image window; User can also drag the selected operation in the **Undo/Redo Sidebar** to the window area to create a new image window;

CE: **Remove** the highlighted operations from the **Undo/Redo** list (This button will be enabled only when the operation(s) is (are) selected, the opened image(the first operation) cannot be removed;

CF: Indicating the **Current** operation displayed in the image window;

CG: **Operation Index**;

CH: **Operation** name.

DA: **Layer Sidebar**;

DB: Make a **New** layer;

DC: **Remove** a layer;

DD: Set as the **Current** layer;

DE: **Show/Hide** a layer;

DF: **Rename** a layer;

DG: Visibility control of the layer items;

DH: The **Current** active layer for operations;

DI: The layer **Name**. The image layer is always named as **Background**.

EA: **Measurement Sidebar**;

EB: The **Appearance** of the highlighted **Object** on the **Current** layer; you can edit the **Appearance** by clicking its item and editing it;

EC: The [Calculation](#) of the highlighted item on the [Current](#) layer;

ED: The [Coordinate](#) of the highlighted item on the [Current](#) layer; you can edit the [Coordinate](#) by clicking the item.

7.4.2 Sidebar>Camera

The [Camera Sidebar](#) is mainly used for the control of the camera, it includes many groups. Each group can be expanded by clicking the group name or the arrow button at the right of the group name.

Checking the [Sidebar>Camera](#) menu will show/hide it on sidebar group.

Please check [Camera Sidebar](#) in Sec.4 for details.

7.4.3 Sidebar>Folders

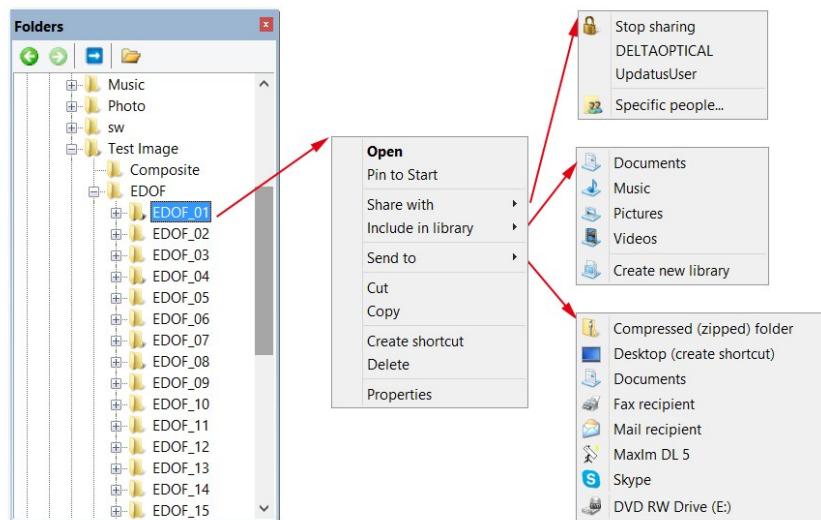
The [Folders Sidebar](#) is mainly used for the image [Browse](#) control.

Checking the [View >Sidebar>Folders](#) menu will show/hide the [Folders Sidebar](#). Clicking its tree can navigate the file directories.

Double-clicking the directory in the [Folders](#) will create the [Browse](#) window. If there are image files under the directory that the [App](#) supports to [Browse](#), the image files will be displayed in [Large](#) or [Small](#) icons mode.

Their orders can be set in [Ascending](#) or [Descending](#) styles according to [Sort](#) by [Name](#), [Type](#), [Size](#), [Width](#) or [Height](#) et al.

Clicking the right mouse button on the directory will bring up the right mouse context menu as shown below:



Folders directory right mouse button context menu

This is the basic window explorer menu and will not be explained further in this manual.

7.4.4 Sidebar>Undo/Redo

The [Undo/Redo Sidebar](#) is used to list the [Undo/Redo](#) operations for the [Image](#) and [Process](#) menus' command.

Checking the [View>Sidebar>Undo/Redo](#) menu will show/hide the [Undo/Redo Sidebar](#).

7.4.5 Sidebar>Layer

The [Layer Sidebar](#) is used for the management of [Layer](#) operations. These operations include making a [New Layer](#), [Removing](#) a [Layer](#) or [Renaming](#) a [Layer](#) and [Layer](#) visibility controlling et al.

Checking [View>Sidebar>Layer](#) will show/hide the [Layer Sidebar](#). See Sec.13 for detail.

7.4.6 Sidebar>Measurement

The **Measurement Sidebar** is used to check, set or edit the selected **Object** on the **Layer**.

Checking **View>Sidebar>Measurement** will activate/show the **Measurement Sidebar**.

In this **Sidebar**, the **Object Appearance**, **Calculation** and **Coordinates** characteristic are listed. The **Appearance** and **Coordinates** can be edited. See Sec.14 for detail.

7.5 Grid

The **Grid** menu has 5 submenus, they are:

7.5.1 Settings...



Choosing **View>Grid>Setting...** command, or choosing **Option>Preference>...** command and clicking the **Grids** page to realize the same function.

The **Grids** page can set the **Line Style**, **Line Color**, **Preset Management** for the **Grid** overlaid on the image/video window (See Sec.15.1.5 for detail).

7.5.2 Grids>No Grids

Choosing this command will remove both the **Manual Grids** and the **Auto Grids** overlaid on the image/video window.

7.5.3 Grids>Auto Grids

Choose **Grids>Auto Grids** command to overlay the **Grids** on the image/video automatically.

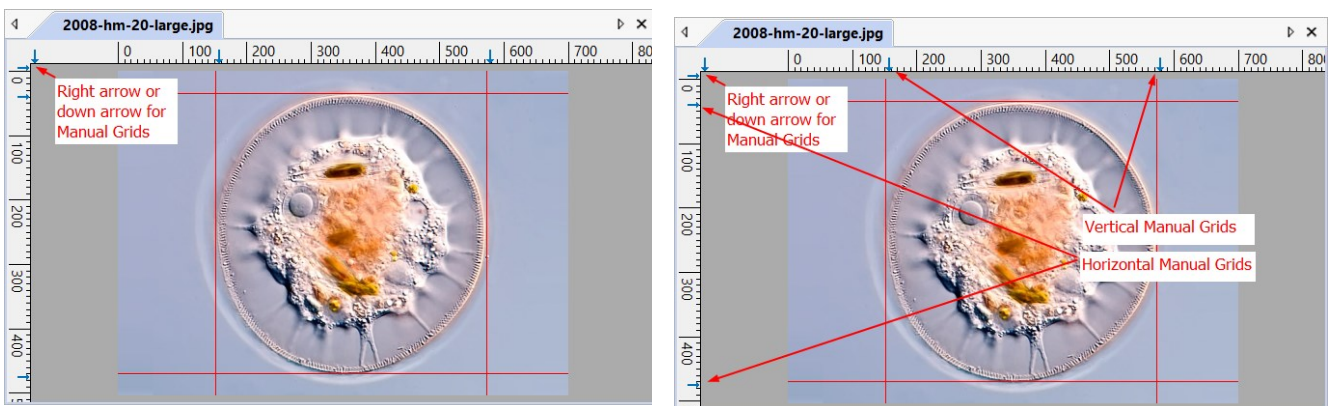
The **Auto Grids** can be set in the **View>Grids>Setting...** menu.

7.5.4 Grids>Manual Grids

Choosing this command will display two small **Right** and **Down Arrows** overlaid on the top of the **Vertical Ruler** and on the left of the **Horizontal Ruler** as shown below:

Down Arrow: Move the mouse over the **Down Arrow** will show a horizontal drag icon. Drag the **Down Arrow** along the **Horizontal Ruler** to where ever you want. When it is dragging over the image/video, there will be a **Vertical** line appeared to let you judge where to release this line on the image/video. User can drag any lines to overlay them on the image/video. The overlaid lines can be adjusted by dragging the specific **Down Arrow** again on **Horizontal Ruler**.

Right Arrow: Move the mouse over the **Right Arrow** will show a vertical drag icon. Drag the **Right Arrow** along the **Horizontal Ruler** to where ever you want. When it is dragging over the image/video, there will be a **Horizontal** line appeared to let you judge where to release this line on the image/video. You can drag any lines to overlay them on the image/video window.



The overlaid lines can be adjusted by dragging the specific **Right Arrow** again on the **Vertical Ruler**.

Choose **Grids>No Grid** command to remove the **Manual Grids** overlaid on the image/video window. The menu will be checked.

Choose **Grids>Manual Grids** command again (If it is unchecked) to display all the previous **Manual Grids**

overlaid on the image/video window. The menu will be checked.

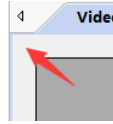
7.5.5 Grids>Remove All Grids

Choosing **Grids>Remove All Grids** will **Remove (Delete)** all of the **Manual Grids** or **Auto Grids** overlaid on the image/video window.

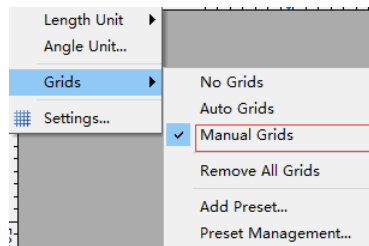
7.5.6 Grids>Add Preset...

The **Manual grids** could be saved into **Preset** items for later use. Please follow the following steps:

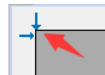
1. Right click the mouse in the upright region in the image/video window as shown below:



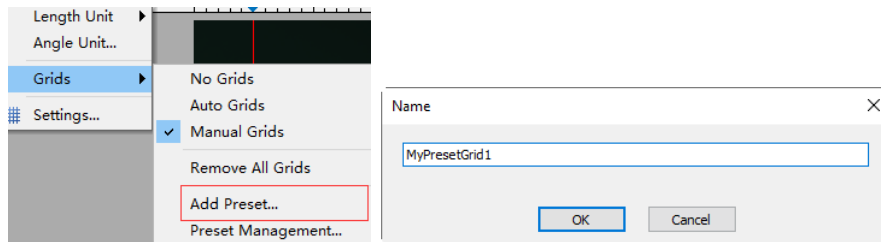
2. Select the right mouse context menu's **Grids>Manual Grids**;



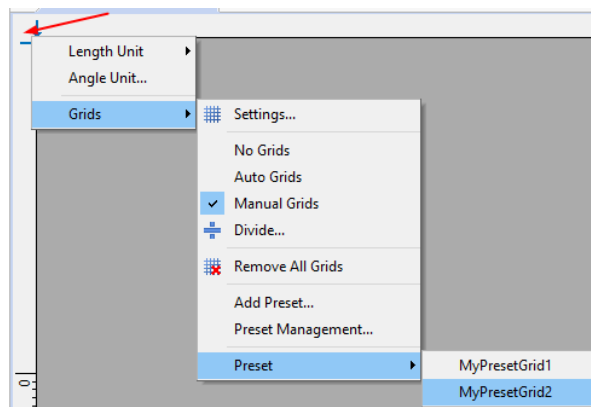
3. Drag the blue arrow to image/video window (vertically or horizontally) to set the position of **Grids**;



4. Choose **Add Preset** command and input the name to add the current **Grids** to the **Preset** list or submenu;

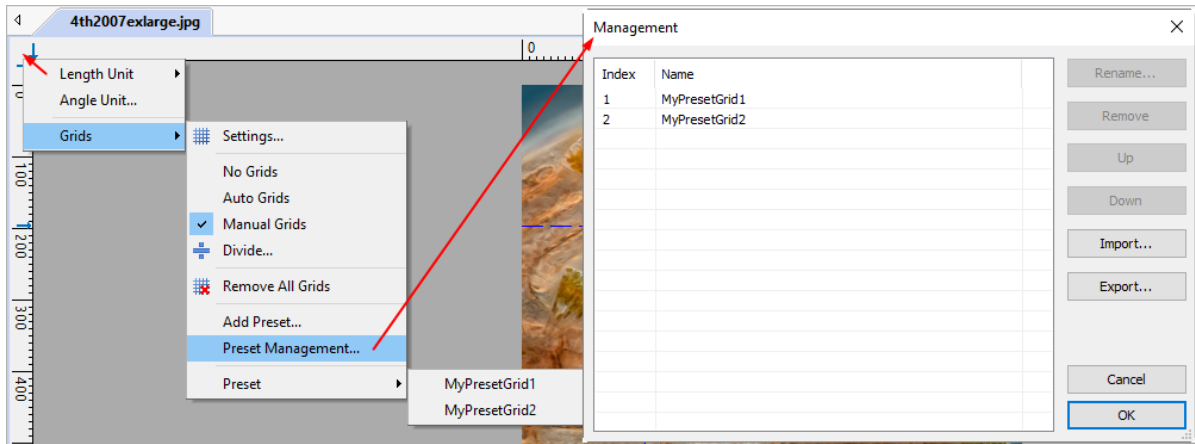


5. Users could select the **Preset Grids** in the right mouse context menu item under **Preset**;



7.5.7 Grids>Preset Management...

To manage the saved **Preset** items, such as **Rename**, **Remove**, **Up**, **Down**, **Import** or **Export**, choose **View>Grids>Preset Management** command and a dialog called **Management** will pop up:



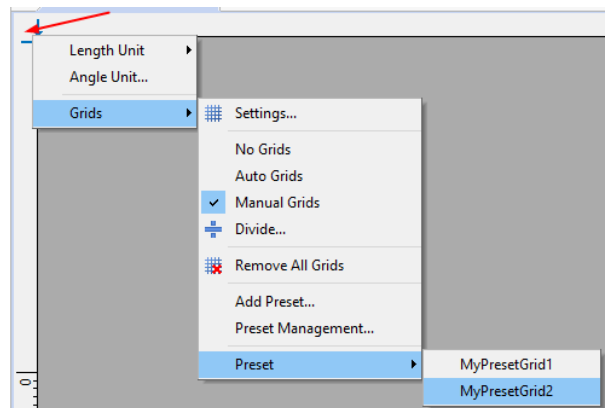
The **Rename**, **Remove**, **Up** and **Down** will be enabled only when the item is selected. If the **Preset** item order is changed or the item is deleted, the submenu under the **View>Preset** will also be modified. The **Preset** items can **Export** to or **Import** from a file in the **View>Grid>Preset Management••** menu.

7.5.8 Preset

If there are items in the **Preset Management**, the items will be added to **View>Grids>Preset** submenu and user can load the **Presettted Manual Grids** directly by simply clicking the submenu.

User can also right clicking the mouse button on the image/video window at up left corner and a content menu will pop up as shown on the right side

Choose the right one under the **Preset** menu to load it.



7.6 Best Fit Num *

Choose **View>Best Fit** command to automatically resize the image/video to fit in the window.

Note: Choosing this command will enable **View>Actual Size** menu.

7.7 Actual Size Num /

Choose **View>Actual Size** command to set the active image to its **Actual Size** (e.g. 100%).

Note: This option will be disabled if the image is currently viewed at 100%. At any other **Zoom** ratio, **View>Actual Size** will be enabled.

7.8 Full Screen



Choosing **View>Full Screen** command will display the video window in full screen style. It should be noted that this command is only for video window.

7.9 Pipette





Pipette is used for the display image pixel color (**RGB**) values. Choosing **View>Pipette** and move mouse over the image, the image **RGB** values will be shown on the **Status Bar** for reference.

7.10 Track



If the image/video's actual size is larger than the image/video's window size, choose this command to position the image/video that does not fit entirely within in the image/video window. Its function is similar to the scroll bars. It is an alternative to using the arrows on the scroll bars for positioning the image/video within the window.

Choosing the [View>Track](#) menu or pressing  button on the toolbar will change the cursor to  and the button on the toolbar will be checked.

Then keep down the left mouse button to drag the region of interest on the image/video to any position wanted.

Note: If the image/video size is smaller than the window size. The [Track](#) operation will be disabled.

8 Browse

8.1 Sort

8.1.1 Sort>Sort by Names

This command is for the [Browse](#) window only.

[Sort](#) the image files in order of names in the [Browse](#) window.

8.1.2 Sort>Sort by Type

This command is for the [Browse](#) window only.

[Sort](#) the image files in order of file type in the [Browse](#) window.

8.1.3 Sort>Sort by Size

This command is for the [Browse](#) window only.

[Sort](#) the image files in order of file size in the [Browse](#) window.

8.1.4 Sort>Sort by Width

This command is for the [Browse](#) window only.

[Sort](#) the image files in order of image file width in the [Browse](#) window.

8.1.5 Sort>Sort by Height

This command is for the [Browse](#) window only.

[Sort](#) the image files in order of image file height in the [Browse](#) window.

8.1.6 Sort>Ascending

This command is for the [Browse](#) window only.

[Sort](#) the image files in order of the [Ascending](#) mode (i.e. 1, 2, 3 and 4) in the [Browse](#) window.

8.1.7 Sort>Descending

This command is for the [Browse](#) window only.

[Sort](#) the image files in order of the [Descending](#) mode (i.e. 4, 3, 2 and 1) in the [Browse](#) window.

The [Sort](#) settings are saved until they are changed. For example, if you sort images in the [Browse](#) window according to the [Type](#), the images will remain sorted according to [Type](#) until the [Sort](#) settings are changed.

8.2 Icon

8.2.1 Icon>Large Icons

This command is for the [Browse](#) window only.

The [Thumbnail](#) mode displays small preview images; you can select different view modes in the [Browse](#) window.

Choosing [Icons>Large Icons](#) will display the image files in [Large Icon](#) mode in the [Browse](#) window.

8.2.2 Icon>Small Icons

This command is for the [Browse](#) window only.

The [Thumbnail](#) mode displays small preview images; you can select different view modes in the [Browse](#) window.

Choosing [Icons>Small Icons](#) will display the image files in [Small Icon](#) mode in the [Browse](#) window.

8.3 Refresh F5

This command is for the [Browse](#) window only.

If the files under the [Folders Sidebar](#)'s directory are altered outside of the [App](#), after switch back to the [App](#), one can [Refresh](#) the image files in the current directory to update the [Thumbnails](#) with [Browse>Refresh](#) command.

8.4 Properties...



If an image file listed in the [Browse](#) window is highlighted. Choosing [Browse>Properties](#) command or clicking the selected file in the [Browse](#) window with the right mouse button, a right mouse button context menus will pop up, clicking context menu's [Properties](#) command will bring up a [Properties](#) sheet with 4 [Properties](#) pages. They are [General](#), [Security](#), [Details](#) and [Previous Versions](#) pages. These [Property](#) pages may depend on the operating system and it will not be discussed in this help manual.

9 Setup

9.1 Start/Pause Pause

If the video in video window is playing, one can choose **Setup>Start/Pause** command to pause the video and choose **Setup>Start/Pause** command again to start the video continuously.

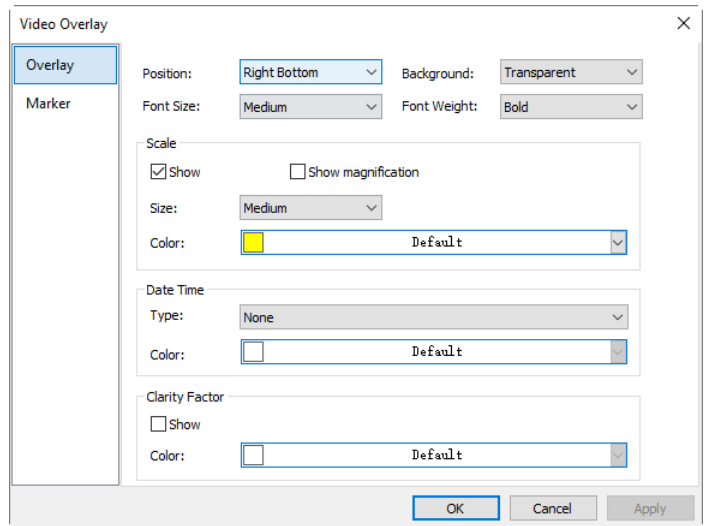
9.2 Video Overlay...

9.2.1 Video Overlay>Overlay...

Choosing **Setup>Video Overlay...** command will invoke a **Video Overlay** property sheet. Clicking the **Overlay** page on the **Video Overlay** property sheet can set **Scale**, **Magnification**, **Date Time** and **Clarity Factor** to overlay them on the video window.

The **Position**, **Background**, **Font Size**, **Font Weight** of the **Scale**, **Magnification**, **Date Time**, and **Clarity Factor** can be defined in this page. Their **Size**, **Type** and **Colors** can be defined separately.

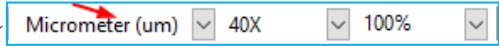
Clicking **OK** button and the **Scale**, **Magnification**, **Date Time**, and **Clarity Factor** will be overlaid on the **Video** window.



The **Clarity Factor** can tell if the sample is in good focused state or not. The larger the **Clarity Factor**, the better the sample focused.



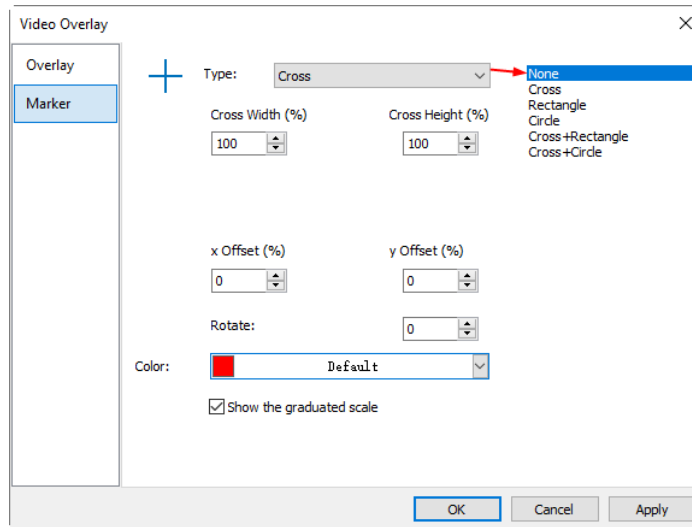
Note: To enable the **Scale Bar**, the **Magnification** or **Resolution** must be defined and chosen first in the **Unit** combobox on the toolbar. The **Unit** can be any unit except **Pixel**. There are two methods to set the **Unit**, they are:

- Choosing **Unit** in the **Unit** dropdown list box () on the toolbar which is just on the left side of the **Magnification** dropdown list box;
- Choosing **Option>Measurement...** command, a property sheet called **Measurement** will bring up, click the **Length Unit** page and check the **Unit** in the **Current** to set the **Unit**. (See Sec.15.2.2 for details).

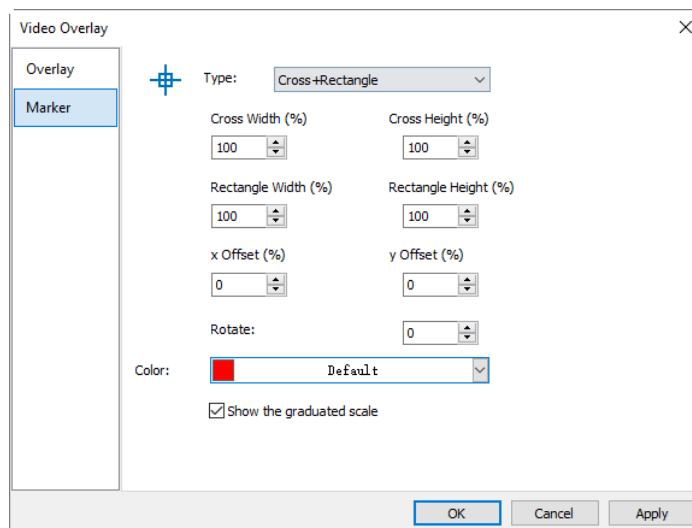
9.2.2 Video Overlay>Marker...

Choose **Setup>Video Overlay...** command, this will invoke a **Video Overlay** property sheet. Click the **Marker** page on the **Video Overlay** property sheet to set the **Marker** on the video window.

The **Video Marker** type can be **None**, **Cross**, **Rectangle**, **Circle**, **Cross+Rectangle**, or **Cross+Circle**. The **Video Marker** page is shown as below:

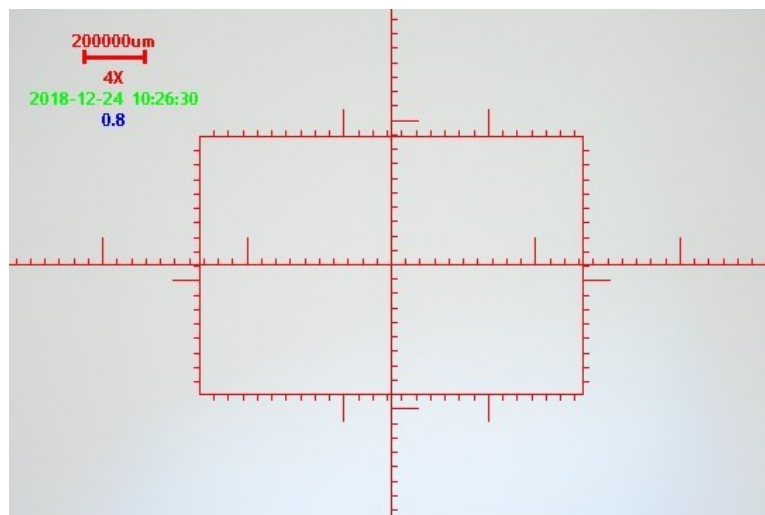


Choosing **Cross+Rectangle** in the **Type** list box and **Video Overlay> Marker** property sheet will change to the following style:



Edit the **Cross Width(%)** and **Cross Height(%)**, **Rectangle Width(%)** and **Rectangle Height(%)**, **x Offset(%)** and **y Offset(%)**, plus **Rotate** angle in their specific fields. Click **Color** to define the **Video Marker** color. Check **Show the graduated scale** will show the graduate scale on the marker.

Click **OK** to end the **Video Marker** setup page and a **Cross+Rectangle Marker** will be overlaid on the video window as shown below:




Click **Cancel** to cancel the **Video>Overlay>Marker** page setup and return to the application area, or **Apply**

to overlay the **Marker** on the video window and keep the **Video Overlay** dialog there for further setup.

9.3 Video Watermark...

Fig.1 shows a **micro ruler**. The dark lines can be extracted as **Video Watermark** and overlaid on the video window. The steps are as follows:

1. Choose **Capture>Capture Image** command or click  to capture the **micro ruler** image as shown in Fig.1;
2. Choose **Process>Binary...** command to binarize the image as shown in Fig.2;
3. Choose **Image>Adjust>Invert** command to invert the image and choose **Image>Color Quantize...** command to convert the image to 24 bits as shown in Fig.3. Choose **File>Save As...** command to save the image in **24 bit BMP** format;

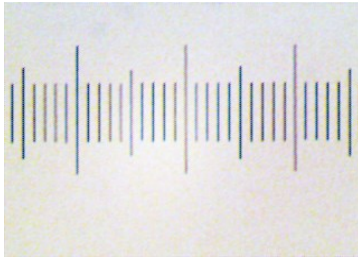


Fig.1 Captured **Micro Ruler**

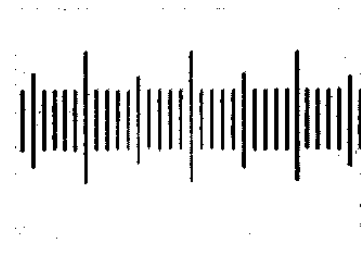


Fig.2 **Micro ruler** after being binarized

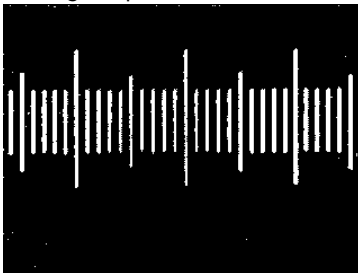


Fig.3 Inverted 24 bits image

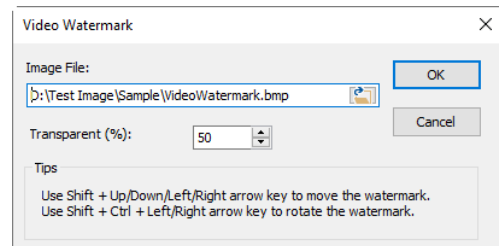



Fig.4 **Video Watermark** setup dialog

4. Choosing **Setup>Video Watermark...** command and a dialog called **Video Watermark** will bring up as shown in Fig.4. Click the  button to locate the image saved in step 3. Use the defaults **Transparent (%)**(50). If everything is ok, click **OK** button. The final **Video Watermark** overlaid on the video window is shown in Fig.5.

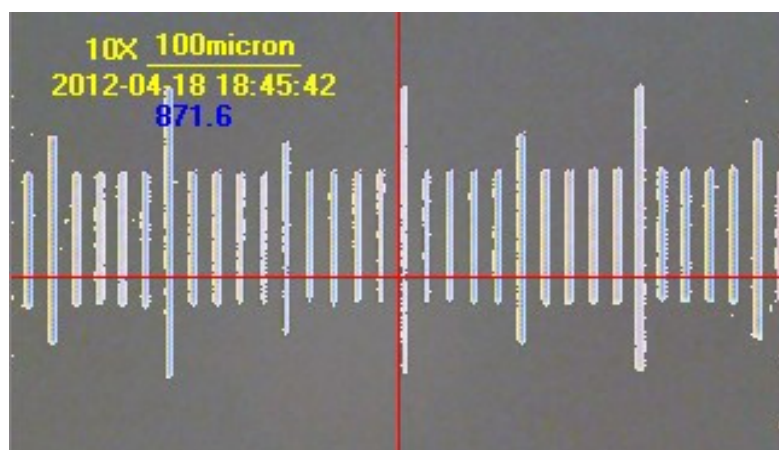


Fig.5 **Video Window** with **Video Watermark** overlaid

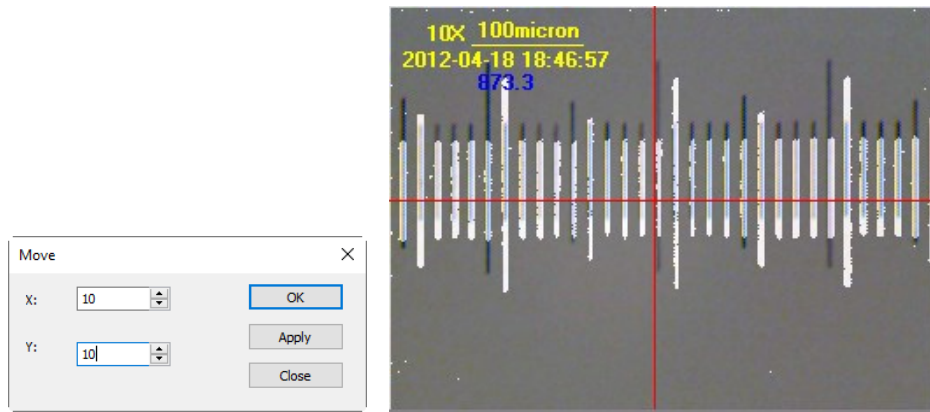
9.4 Move Watermark

9.4.1 Move to...

If there is **Watermark** overlaid on the video window, this menu will be enabled.

Choosing **Setup>Move Watermark...** command will bring up a **Move** dialog. Where one can enter the **X**:

and **Y**: offset value in their fields for the desired pixel move distances. The default **X** and **Y** offsets are 0.



9.4.2 Move to zero

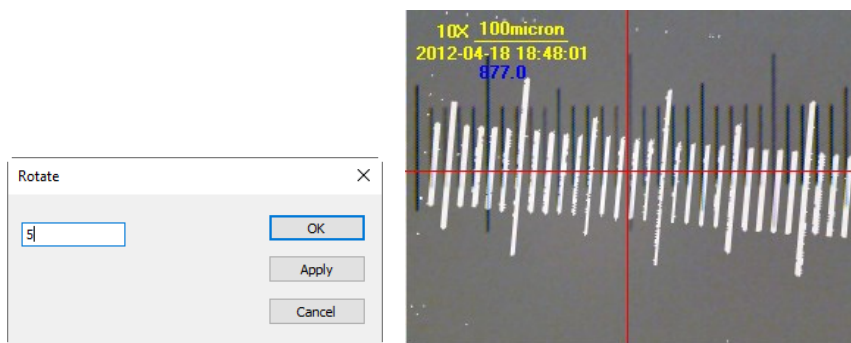
If the **Watermark** on the video window was moved, this menu will be enabled. Choosing this menu will move the **Video Watermark** to its original coordinates (0, 0).

9.5 Rotate Watermark

9.5.1 Rotate to...

If there is **Watermark** overlaid on the video window, this menu will be enabled.

Choosing **Setup>Rotate Watermark>Rotate to...** command will bring up a **Rotate** dialog, user can define an **Angle** to **Rotate** the **Video Watermark** around the video center (0, 0).



9.5.2 Rotate to zero

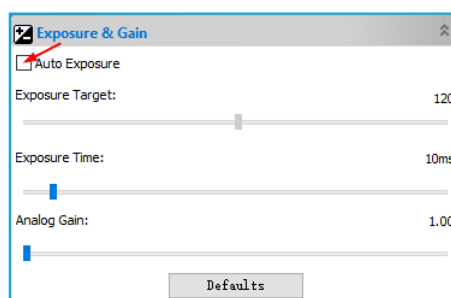
If the **Video Watermark** was rotated, the **Rotate to zero** menu will be enabled. Choosing this menu will rotate the **Video Watermark** to zero degree.

9.6 Gray Calibration...

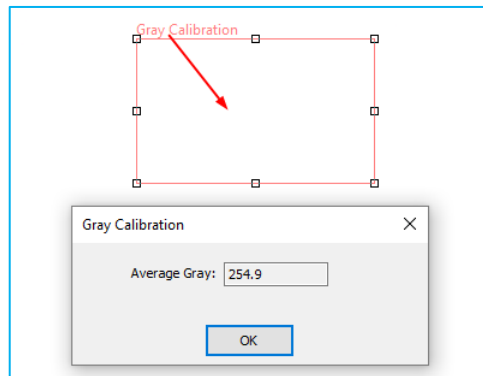


This function can make the image brightness to a desired value among various scenarios in a specified area, achieving the continuity requirement of the observation. The **Gray Calibration** steps are summarized as follows:

1. Click the **Exposure & Gain** group on the **Camera Sidebar** to expand the **Exposure & Gain** group, uncheck the **Auto Exposure** box (If it is checked) as shown below:



2. Choose **Setup>Gray Calibration...** command and a dialog called **Gray Calibration** will be brought up to display the current **ROI Average Gray**, there will be a red rectangle called **Gray Calibration** overlaid on the video window;
3. This rectangle is adjustable and moveable with mouse. Now the brightness of the microscope or the **Exposure Time** on **Exposure & Gain** group can be adjusted until the **Average Gray** reaches to the desired value;
4. Click **OK** to finish the calibration and return to the application area. The current gray value here is around 254.9.



10 Capture

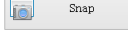
10.1 Capture Image



F8

During the video preview, user can always choose **Capture> Capture Image** command to capture the video image.

After the image is captured, the captured image created window will become the current active window, but the **Capture>Capture Image** menu is still enabled, user can choose it again to continue the capture operation.

Note: a) The **Snap** button  on the **Camera Sidebar** can continuously snap the image even if the video window is not activated. User can click this button on the **Camera Sidebar** to capture image in a quick and continuous style;

b) If the **Live** and **Snap** resolutions are different, the **App** need to switch the resolution from **Live** to **Snap** resolution first to capture an image with **Snap** resolution. After the **Snap** is finished, the **App** will switch back to the **Live** resolution to continus the video stream process. This will take more time to capture a still image;

c) If many images are captured, user can choose **Windows>Activate Video Window (F6)** to return back to the video window in a quick way (See Sec.16.1 for details).

d) If **RAW** in the **Format** list box is selected on the **Capture & Resolution** group, the 10bit/12bit/14bit **RAW** data will be transferred to 16bits **RAW** data and saved in **DNG** or **TFT** file format. In the **RAW Format**, clicking the **Snap** button will bring up a **Save As** dialog and ask user directly save the image into **DNG** or **TFT** file directly, no image window will be created.

10.2 Start Time-lapse (Auto Capture)...



Choosing **Capture>Start Time-lapse (Auto Capture)...** command will bring up **Time-lapse (Auto Capture)** dialog as shown below:

Time-lapse (Auto Capture)

Directory:

Base: D:\TestImage\Sample

Sub: None

File:

Name Format: nnnn (sequence)

File Prefix: TT

File type: jpg (JPEG)

The sequence starts with: 80

Sample: D:\TestImage\Sample\TT0080.jpg

Capture Mode


Capture every frame

Time slot(second) 6

Total Images 100

OK Cancel

This command can capture a sequence of pictures with the specified time interval; user can precisely set the **Time slot** (2 to 3600 seconds) and the **Total Images** (1 to 9999).

Directory>Base: Enter the driver name and directory where the new image will be saved. User may either type the path information, or use the **Browse** button  to locate it from a standard **Browse Folder** dialog;

Directory>Sub: The sub directory for the **Time-Lapse(Auto Capture)** under the **Base** directory. The **Sub** can be **None**, **Date(YYYYMMDD)** or **Year(YYYY)\Month(MM)\ Day(DD)**. The default is **None**;

None
Date(YYYYMMDD)
Year(YYYY)\Month(MM)\Day(DD)

File: The **File** name including **Name Format**, **File Prefix** and **File type**. It can be a combination of **File Prefix**, **Name Format** and **File Type** and is shown in the **Sample** string;

The sequence starts with: Check this to specify the start number for the **Batch Save** sequence file number. Unchecking will always start it with 1;

Sample: The final file name is shown at the right of the **Sample** label for reference;

Capture Mode>Capture every frame: Select this item will capture every video frame to the specified file;

Capture Mode>Time slot(second): **Time slot(second,1-3600S)** is a time segment to capture an image;

Total Images: Checking **Total Images** will enable its edit box. User can enter the **Total Images** (1-9999) to be captured. The **App** will stop the **Time-lapse** capture automatically when the **Total Images** are reached;


If **Total Images** is unchecked, the **App** will capture the images continuously until user choose **Capture>Stop Time-lapse (Auto capture)** command again to stop the **Time-lapse** capture.

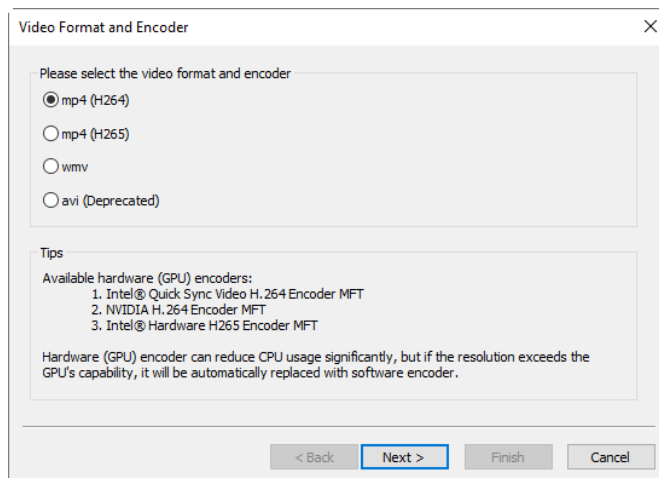
Click **OK** to begin the **Time-lapse** capture, or **Cancel** to cancel the **Start Time-lapse(Auto Capture)...** command.

After the **Time-lapse** capture is started, the **Capture>Start Time-lapse (Auto Capture)...** menu will be changed to the **Capture>Stop Time-lapse (Auto capture)** menu. Choosing this command will stop the **Time-lapse** capture.

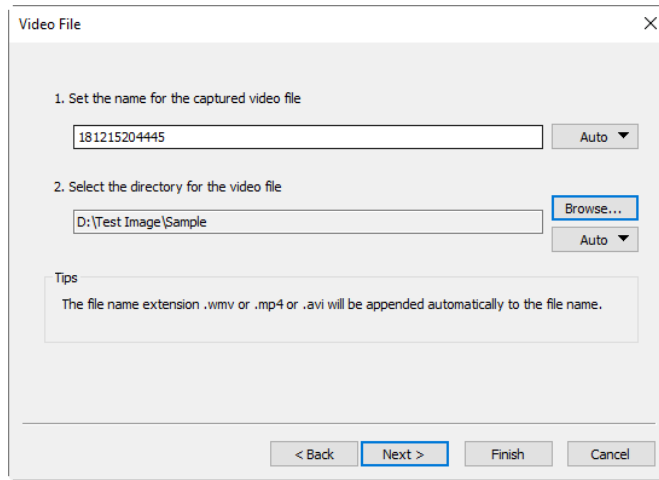
There are a variety of image formats available (they are **bmp**, **jpg**, **png** and **tif**) to save the captured image. For example, when choosing **jpg** format, user can set the parameters of **Option** to adjust its compression quality or encoding method. Please check the **File>Save As...** menu for details (See Sec.5.5).

10.3 Start Record... F9

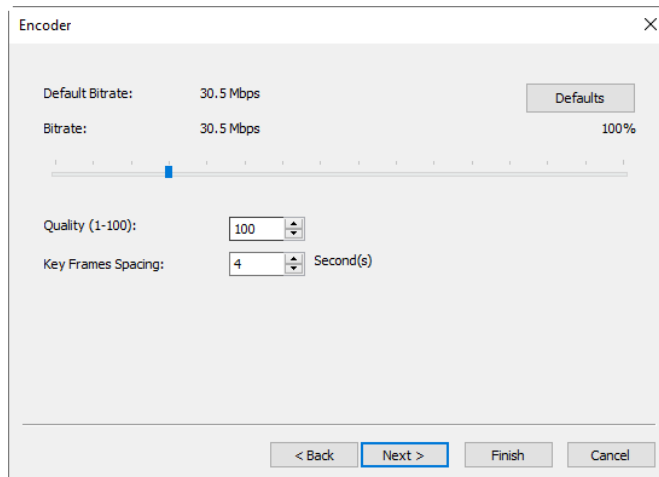
1. User can a) choose **Capture>Start Record...** command; b) click **Record** button  on the **Camera Sidebar**; c) use the shortcut key **F9** to start recording video. This will bring up a **Video Format and Encoder** dialog as shown below:



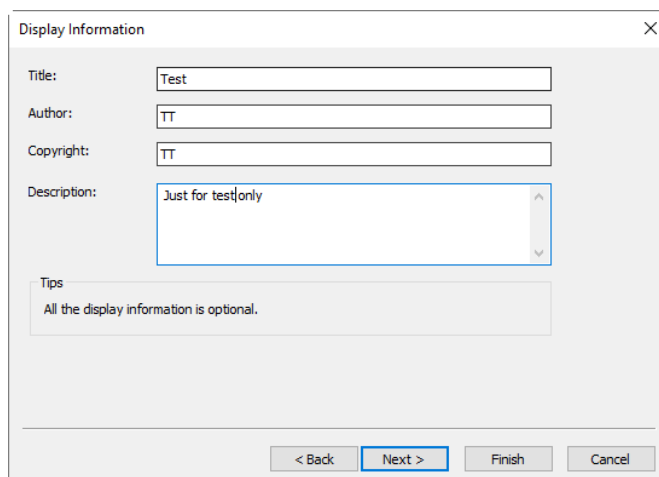
2. The video format can be **mp4(H264)**, **mp4(H265)**, **wmv** or **avi**; Click **Next** to the next step, This will bring up a **Video File** dialog as shown below:



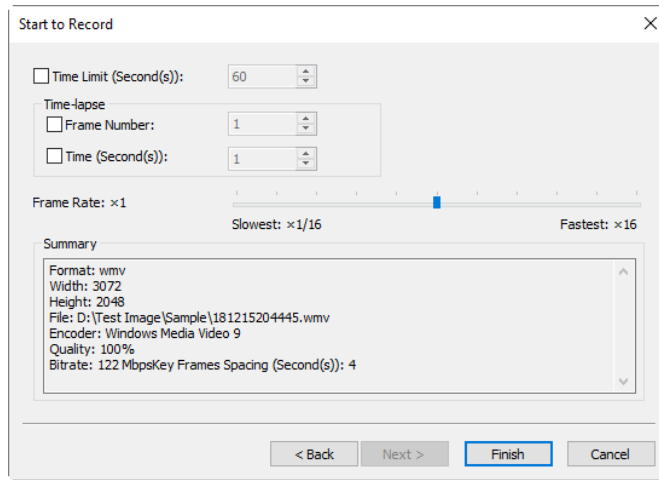
3. Enter the video file name under **1. Set the name for the captured video file** field and click the **Browse...** button under **2. Select the directory for the video file** item to locate the video file directory. Click **<Back** button to the previous dialog, click **Next>** button to the next step, this will bring up an **Encoder** dialog as shown below:



4. Here user can select the **Encoder** format, set the **Bitrate** (Default 30.5Mbps, 7.63Mbps-122Mbps), **Quality** (Default 100, 1-100) and **Key Frames Spacing** (4, 1-30). Click **<Back** to return to the **Video File** dialog, or **Next>** to the **Display Information** dialog as shown below:



4. In this dialog, user can enter **Title**, **Author**, **Copyright**, and **Description** about the record information into the edit box. All the information is optional. Click **<Back** to return to the **Encoder** dialog, or **Next>** to the **Start to Record** dialog as shown below:



5. Here user can check **Time Limit(Second(s))** (1-86400) and enter recording time; Input **Time-lapse>Frame Number**(1-100) or **Time-lapse>Time(Second(s))** (1-600). There is a **Summary** text to display what user has been defined. Click **Back** to return to the **Encoder** dialog, or **Finish** to end the setup;

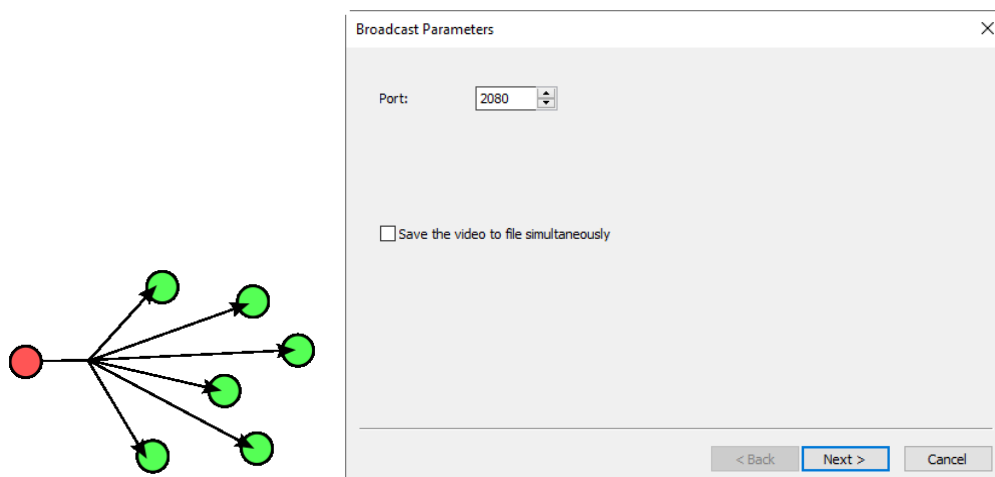
6. After the **Video** capture is started. The **Record** button on the **Camera Sidebar>Capture and Resolution** group will become **Record** (Also the **Capture>Start Record...** menu will change to **Stop Record**). Clicking will stop the capture process, otherwise, it will stop until the **Time Limit** is reached. After the **Video Record** process is finished. The button on the **Camera Sidebar>Capture & Resolution** group will become for the future **Record** process(The menu will be the same);

7. User can choose **File>Open Video...** command to display the recorded video file in the video window; this command will be effective only when the camera video window is closed.

10.4 Start Broadcast...

Start a network broadcasting service. The **App** will start broadcasting the video that is opened by the **App** locally via the specified **Port** and **Encoder**. The other users could share the video by **File>Open Broadcast...** command.

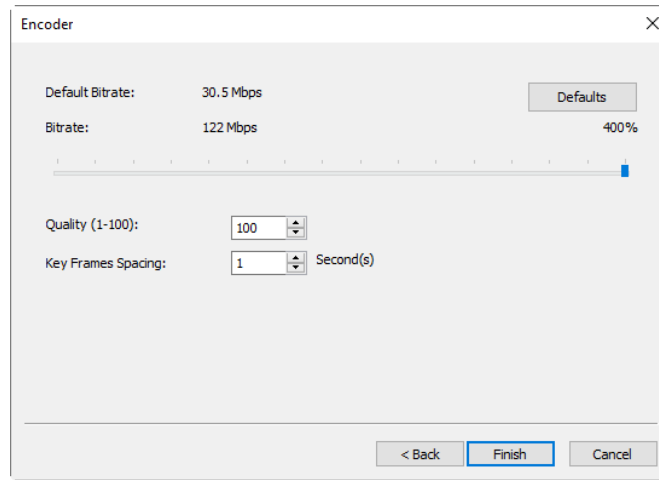
Choosing **Capture>Start Broadcast...** will invoke a **Broadcast Parameters** dialog as shown below:



Port: Set the **Port** for broadcasting;

Save the video to file simultaneously: Check to save the video to file at the same time;

Next>: Clicking the **Next>** button will invoke an **Encoder** dialog as shown below:



The **Encoder** dialog is used for the setup of video **Encoder** parameters for broadcasting. This setup dialog is just the same as those of **Capture>Start Record...**'s **Encoder** dialog. Here user can set the **Bitrate**(Default: 30.5Mbps, 7.63Mbps-122Mbps), **Quality** (Default: 100, 1-100) and **Key Frames Spacing** (1, 1-30).

<Back: Clicking the **<Back** button will return to the previous **Broadcast Parameters** dialog;

Cancel: Clicking the **Cancel** button will cancel the **Start Broadcast...** command and return to the video window;

Finish: Clicking the **Finish** button will start the broadcasting process and it will end up the process when it reaches to the **Time Limit**. After the broadcast begin, the **Start Broadcast...** menu will change to **Stop Broadcast menu...**. Choosing it will stop the broadcasting process.

See **File>Open Broadcast...** to understand the **Start Broadcast** function in more detail (Sec.5.3).

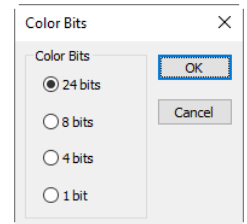
11 Image

11.1 Mode

11.1.1 Color Quantize...

The **Color Quantize...** command is widely used to change the image bit. The **App** supports the mutual transfers among **24 bits**, **8 bits**, **4 bits** or **1 bit** images.

When the **Color Bits** dialog is opened, the default selected **Color Bits** is the current image's **Color Bits**. Select the desired bit item and click **OK** to end the command. The image will be converted to the selected **Color Bits** in the image window.

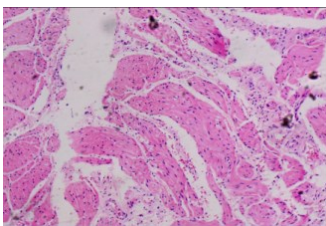


11.1.2 Gray Scale

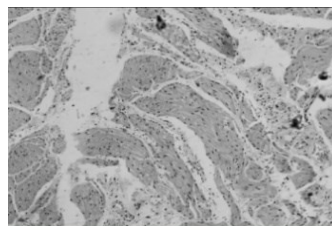
Choose **Gray Scale** command to convert a color image (true color image or index color image) to a **Gray Scale** image. If the original image is 24 bits, the new image will be 8 bits. Otherwise the bits of the image will not be modified.

11.1.3 Contrast Preserving Decolorization

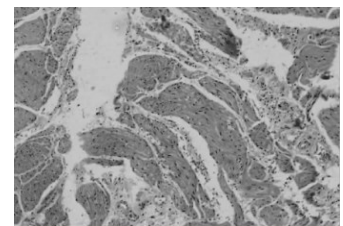
Choose **Image>mode>Contrast Preserving Decolorization** command can convert the color image into gray image with contrast preserved. The following pictures (a) is the original microscopic image, (b) is the gray image produced by traditional method, (c) is the gray image produced by **Contrast Preserving Decolorization**.



(a) Original microscopic image



(b) Traditional **Gray Scale** method



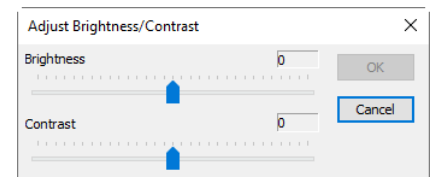
(c) **Contrast Preserving Decolorization**

11.2 Adjust

11.2.1 Brightness/Contrast...

The **Image>Adjustment>Brightness/Contrast...** command offers simple adjustments to the tonal range of an image. This command makes the same adjustment to every pixel in the image. The **Brightness/Contrast...** command does not work with individual channels and is not recommended for high-end output because it can result in the loss of image details.

Brightness: Dragging the slider to the left decreases the level and dragging it to the right increases the level. The number on the right of the slider displays the **Brightness** value. Value can be in range of **-100** to **+100**. Default is **0**;



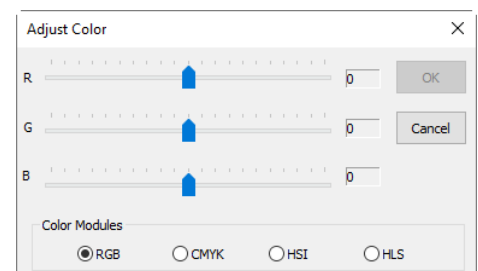
Contrast: Dragging the slider to the left decreases the level and dragging it to the right increases the level. The number on the right of the slider displays the **Contrast** value. Values can be in range of **-100** to **+100**. Default is **0**.

11.2.2 Color...



Choose **Image>Adjustment>Color...** command to modify the overall mixture of the colors in an image.

The command supports 4 color modules: **RGB**, **CMYK**, **HIS** and **HLS**.

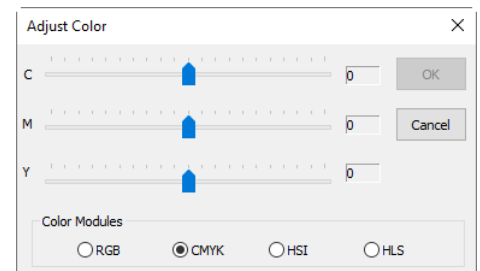


RGB: The App uses the RGB model. It assigns an intensity value to each pixel ranging from 0 (black) to 255 (white) for each of the RGB components in a color image. For example, a bright red color might have an R value of 246, a G value of 20, and a B value of 50. When the values of all three components are equal, the result is a shade of neutral gray. When the value of all components is 255, the result is pure white; when the value is 0, pure black;

RGB images use 3 channels to reproduce up to 16.7 million colors on-screen. In addition to being the default mode for the new App images, the RGB mode is used by computer monitors to display colors. This means that when working in color modes other than RGB, such as CMYK, the App uses RGB mode for display on-screen. Although RGB is a standard color mode, the exact range of colors represented can vary, depending on the application or display device.

CMYK: The CMYK mode is based on the light-absorbing quality of ink printed on papers. As white light strikes translucent inks, certain visible wavelengths are absorbed while others are reflected back to the eyes;

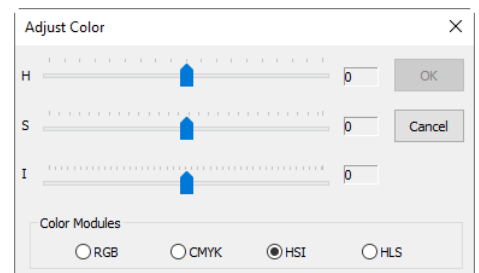
In theory, pure cyan (C), magenta (M), and yellow (Y) pigments should combine to absorb all light and produce black. For this reason these colors are called subtractive colors.



Because all printing inks contain some impurities, these three inks actually produce a muddy brown and must be combined with black (K) ink to produce a true black. (K is used instead of B to avoid confusion with blue.) Combining these inks to reproduce color is called four-color process printing.

The subtractive (CMY) and additive (RGB) colors are complementary colors. Each pair of subtractive colors creates an additive color, and vice versa.

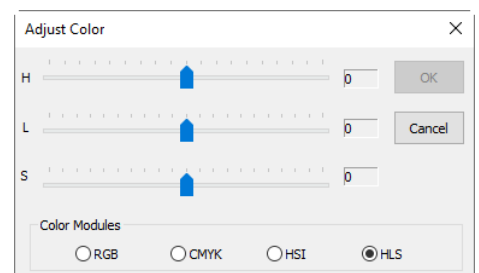
HSI: Based on the human perception of color, the HSI model describes 3 fundamental characteristics of colors:



Saturation, sometimes called chroma, is the strength or purity of the color. Saturation represents the amount of gray in proportion to the hue, measured as a percentage from 0% (gray) to 100% (fully saturated). On the standard color wheel, Saturation increases from the center to the edge;

Intensity is the relative lightness or darkness of the color, usually measured as a percentage from 0% (black) to 100% (white);

HLS: The HLS model is very similar to the HSI color model. The main difference between them is the calculation used to produce the brightness value. In the HSI model, a pixel's brightness (I) is derived from its three (R, G and B) color values $I=(r+g+b)/3$. In the HLS model, a pixel's brightness (L) is determined by the minimum and maximum values of its three color values. $L=(\text{maximum of } r,g,b - \text{minimum of } r,g,b)/2$;



The values beside the slider bar show the color changes in various color channels.

For RGB channel values, they are range from -100 to +100. Default is 0;

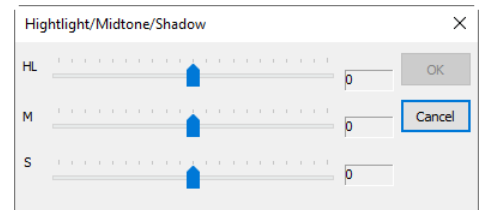
For CMYK channel values, they are range from -100 to +100. Default is 0;

For HSI channel values, the H value can range from -180 to 180, the S value range from -275 to 275, and the I value is range from -442 to 442. Default is 0;

For HLS channel values, the H value is range from -180 to 180, the L value is range from -100 to 100, and the S value is range from -100 to 100. Default is 0.

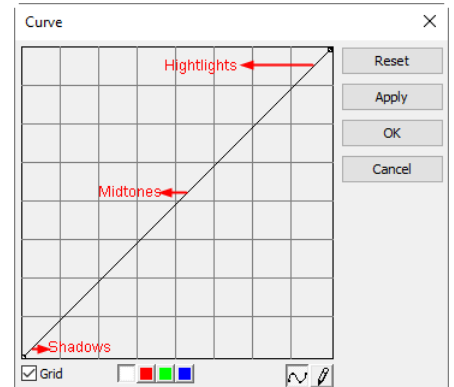
11.2.3 HMS...

Choose **Image>Adjustment>HMS...** command to adjust the **HL** (Highlight), **M** (Midtone), and **S**(Shadow) parts of the image. Each part's value ranges from **-100** to **100**. This command is only available for 24 bits true color image.



11.2.4 Curve...

Choose **Image>Adjust>Curve...** to adjust the entire tonal range of an image. But instead of making adjustments using only 3 variables (**Highlight**, **Midtone**, **Shadow**), one can adjust any point on the curve along a 0-255 scale while keeping up to any other values constant. One can also use **Curve** to make precise adjustments for individual color channels on an image. The **Curve** dialog is shown on the right side:

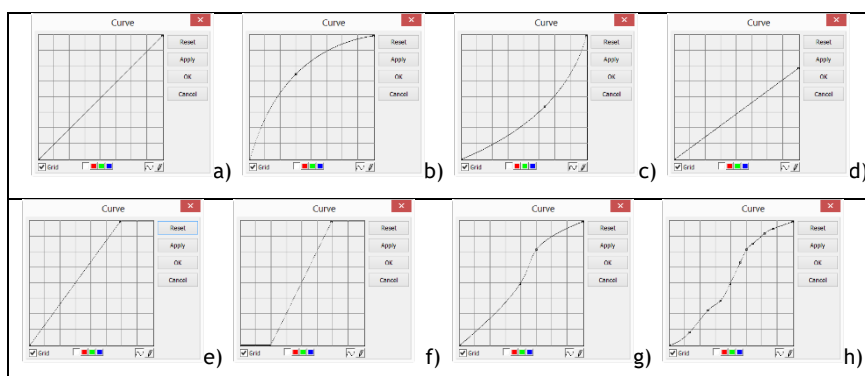


Horizontal Axis: The horizontal axis of the graph represents the original intensity values of the pixels (**Input** levels);


Vertical Axis: The vertical axis represents the new color values (**Output** levels). In the default diagonal line, all of the pixels have identical **Input** and **Output** values;


Curve area: Area to setup a map between input and output;


- When the **Curve** dialog is opened, perhaps surprisingly, not a curve but a straight line. As a default, the input values are the same as the output, so there's no change;
- By clicking in the center of the line and dragging upwards, we make our first curve. Raising the curve increases the overall brightness of the scene.
- Conversely, clicking in the center and dragging downwards lowers the brightness, producing an image that's darker overall;
- As well as clicking in the center, one can also adjust the endpoints. Clicking the top right point and dragging down will limit the image's brightest, reducing contrast;
- If we drag that top right point to the left rather than down, we produce the opposite effect—increasing the contrast of the image. This is a very useful and controllable quick fix;
- By dragging the top and bottom points towards the center, we create a stylized, posturized effect that turns any photograph into more of a graphic object;
- Click once in the center of the **RGB** curve to "pin" that midpoint; now drag just the top half of the curve to make this **S** shape, and the result is to increase the overall contrast;
- User can add up to any control points to the curve, locking those values. To remove a control point, 1) drag it off the graph or 2) click the right mouse button on that point. User cannot delete the endpoints of the curve.



Grid: Check to overlay the grid on the **Curve** window;

Channel : To adjust the color balance of the image, click the channel (R, G or B) from the **Channel** button. Click the white button to select **RGB** channels at the same time, which is located on the left of the **R** (Red), **G** (Green) and **B** (Blue) buttons;

Curve : Click the **Curve** with your left mouse button, a spline curve (straight line) will setup the initial input-output relation. Click on the **Curve** will mark the **Curve** with a point. The point number can be any as long as it can be inserted on the **Curve**. Drag the **marked point** until the image looks satisfactory. The point can be deleted by move the mouse on it and click the right mouse button on it;

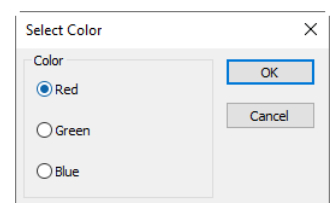
Pencil : Click the pencil button at the bottom of the dialog, and use your left mouse button to draw a new arbitrary **Curve** in the **Curve** area;

Reset: Click the **Reset** button will reset the **Curve** to the initial straight line;

Apply: Apply current **Curve** map on the image.

11.2.5 Filter Color...

Choose **Image>Adjustment>Filter Color** command to filter a special color channel from a color image. Select either **Red**, or **Green**, or **Blue** color to filter. For every pixel, if select **Red** color to filter, only information about the **Red** channel will be discarded, the **Green** and **Blue** information will remain there.

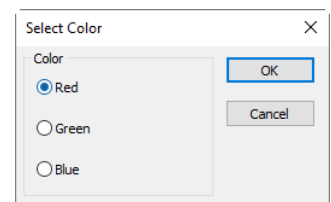


See **Image>Extract Color...** for another color operation.

11.2.6 Extract Color...

Choose **Image>Adjustment>Extract Color...** command to extract a special color channel from a color image. Select either **Red** or **Green**, or **Blue** color to extract.

For every pixel, if selecting **Red** color to extract, only information about the **Red** channel will be kept, the **Green** and **Blue** information will be discarded.



See **Image>Filter Color...** for another color operation.

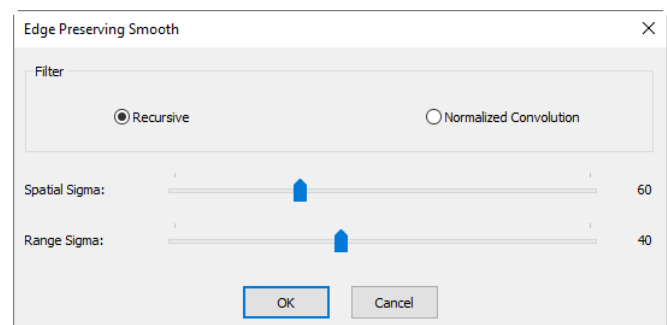
11.2.7 Invert

Choose **Image>Adjustment>Invert** command to reverse the pixel values of the active image without going through the lookup table.

11.2.8 Edge Preserving Smooth...

Edge Preserving Smooth is an image processing technique that smooth away textures whilst retaining sharp edges. Examples are the **Bilateral filter**, the **Guided filter** and **Anisotropic diffusion**.

Choose **Image>Adjust>Edge Preserving Smooth ...** command can smooth the entire image and preserve the edge of image, as shown on the right side.



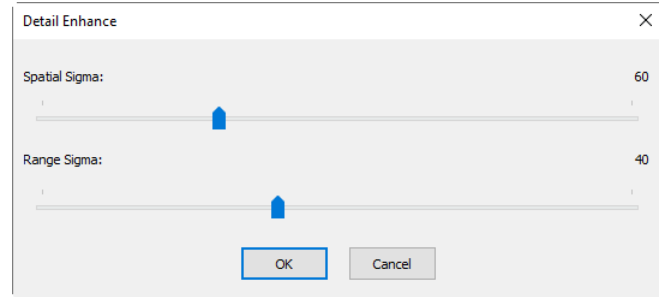
Edge Preserving Smooth function provide two kinds of filters including **Recursive** and **Normalized Convolution** filters, and the default filter is **Recursive**.

The **App** uses **Spatial Sigma** and **Range Sigma** to define the filter kernel size. The bigger the two parameters, the stronger the image smoothed, vice versa.

11.2.9 Detail Enhance...

Choose **Image>Adjust>Detail Enhance...** command to enhance the detail in the image, its dialog is shown on the right side.

The **App** chooses **Spatial Sigma** and **Range Sigma** to define the kernel size for **Detail Enhance** algorithm. The bigger the 2 parameters, the stronger the enhanced image and vice versa.



The following picture is the detail enhanced image for reference with default parameter.



a)Original image and

b)Enhanced image

11.2.10 Auto Level

The **Image>Adjustment>Auto Level** command moves the level's sliders automatically to set highlight and shadow. It defines the lightest and darkest pixels in each color channel as white and black and then redistributes the pixels' color values proportionately. Since **Auto Level** adjusts each color channel individually, it may remove or introduce color casts. The **Auto Level** command moves the level's sliders automatically to set highlight and shadow. It defines the lightest and darkest pixels in each color channel as white and black and then redistributes the pixels' color values proportionately. Since **Auto Level** adjusts each color channel individually, it may remove or introduce color casts.

By default, this feature clips the white and black pixels by **0.5%**--that is, it ignores **0.5%** of the lightest pixels and **0.5%** of the darkest pixels when identifying the lightest and darkest pixels on the image. Choose **Options>Auto Correction...** command to modify this default setting. This ensures that white and black values are representative without being determined by extreme pixel values. The **Auto>Correction...** setup dialog can be find in Sec.15.6.

The **Image>Adjustment>Auto Level** command gives good results when an image with an average distribution of pixel values needs a simple contrast adjustment or when an image has an overall color cast. However, adjusting the **Curves** manually is more precise.

See **Image>Adjustment>Auto Contrast** for another auto adjust command.

11.2.11 Auto Contrast

The **Image>Adjustment>Auto Contrast** command automatically adjusts the overall contrast and mixture of colors in an RGB image. Since it does not adjust channels individually, **Auto Contrast** does not introduce or remove color casts. It maps the lightest and darkest pixels in the image to white and black, which makes highlights appear lighter and shadows appear darker.

When identifying the lightest and darkest pixels on an image, **Auto Contrast** clips the white and black pixels by **0.5%**--that is, it ignores the first **0.5%** of either extreme.

Choose **Options>Auto Correction...** command to modify this default setting. This ensures that white and black values are representative without being determined by extreme pixel values. The **Auto Correction...** setup dialog can be find in Sec.15.6.

The **Auto Contrast** command can improve the appearance of many photographic or continuous-tone images. It does not improve flat-color images.

See **Image>Adjustment>Auto Level** for another auto operation.

11.3 Rotate(R)

Choose **Image>Rotate** command to rotate the entire image. One has the following submenus:

11.3.1 90(CW)

Rotate the image clockwise by a quarter-turn.

11.3.2 180(CW)

Rotate the image clockwise by 180 degrees.

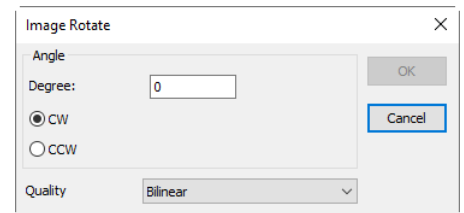
11.3.3 270(CW)

Rotate the image clockwise by 270 degrees.

11.3.4 Arbitrary...

Rotate the image by a specified angle. For the **Arbitrary...** operation, it will invoke an **Image Rotate** dialog as shown on the right side.

Enter an angle between 0 and 360 degrees in the **Degree** edit box, and select **CW** or **CCW** to rotate clockwise or counterclockwise.



Degree: The degree that the image to be rotated;

CW: **Rotate** the image clockwise;

CCW: **Rotate** the image counterclockwise;

Quality: One can select one of the 2 methods for the image rotation, **Bilinear** or **Bicubic**. The default is **Bilinear**.

11.3.5 Flip Horizontal



Reverses the image so that the top right corner of the original image is now the top left, and the top left corner of the original image is now the top right corner.

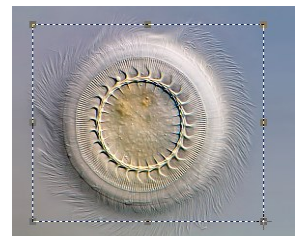
11.3.6 Flip Vertical

Reverses the image so that the top right corner of the original image is now the bottom right corner, and the top left corner of the original image is now the bottom left corner.

11.4 Crop Shift+C

Choose **Image>Crop** command to remove the portions of an image that does not want so that the focus is on the part of the image that is left.

1. Choose **Open Image...** command to open an image to **Crop**;
2. Choose **Edit>Image Select** command, the cursor will change to a small cross;
3. Move the cursor over the image to the desired location, click the left mouse button and hold it down to mark the first position;
4. Drag the mouse over the part of the image to be kept, a dotted rectangle appears around the selection and release the left mouse button;
5. **Optional 1:** To move the rectangle: a) Move the mouse over the selected area and when it becomes a move cursor , click and hold the left mouse button; b) Drag the selected area to the desired position;
6. **Optional 2:** To change the size of the rectangle: a) Put the mouse cursor on one of the handles that appear on the edges of the selected area ; b) Click and hold the mouse button; c) Drag the box to size it;
7. To **Crop** the image, choose **Image>Crop** command or press **Shift+C** buttons.



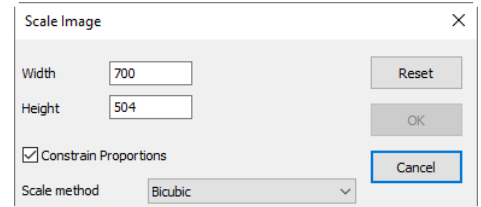
Note: a) Each of the handles that appear on the edges of the box sizes the box differently; b) When there are **Objects** overlaid on the image, the **Crop** operation will delete the **Objects** located totally outside of the kept region.

11.5 Image Size



Choose **Image>Image Size** command to change the image to specified size. This process actually changes spatial resolution by adding (replicating) or removing (decimating) pixels to achieve the specified dimensions.

Width & Height: When choosing **Image Size** command; the dialog displays the dimensions of the original image in pixels. The **Width** & **Height** can be set on the new image by adding or removing pixels. If **Constrain Proportions** is checked, the **Width** & **Height** will stay proportionate to each other. If **Constrain Proportions** is unchecked, the **Width** & **Height** can be set independently, but this will distort the image;



Reset: Reset the image **Width** and **Height** to the original ones;

Constrain Proportions: To maintain the current proportions of pixel **Width** and **Height**, check **Constrain Proportions**. This option automatically updates the **Width** as the **Height** is modified, and vice versa. Otherwise, uncheck the **Constrain Proportions** button;

Scale method: There are 2 options for the **Scale method**, **Bilinear** or **Bicubic**. The default is **Bilinear**.

Note: **Image Size** operation will not modify the **Calibrated Resolution**. The **Measurement** results will be wrong after the **Image Size** command.

11.6 Histogram



Shift+H

A **Histogram** illustrates how pixels in an image are distributed by graphing the number of pixels at each color intensity level. The **Histogram** shows whether the image contains enough detail in the **Shadows** (shown in the left part of the **Histogram**), **Midtones** (shown in the middle), and **Highlights** (shown in the right part) in order to make a good correction.

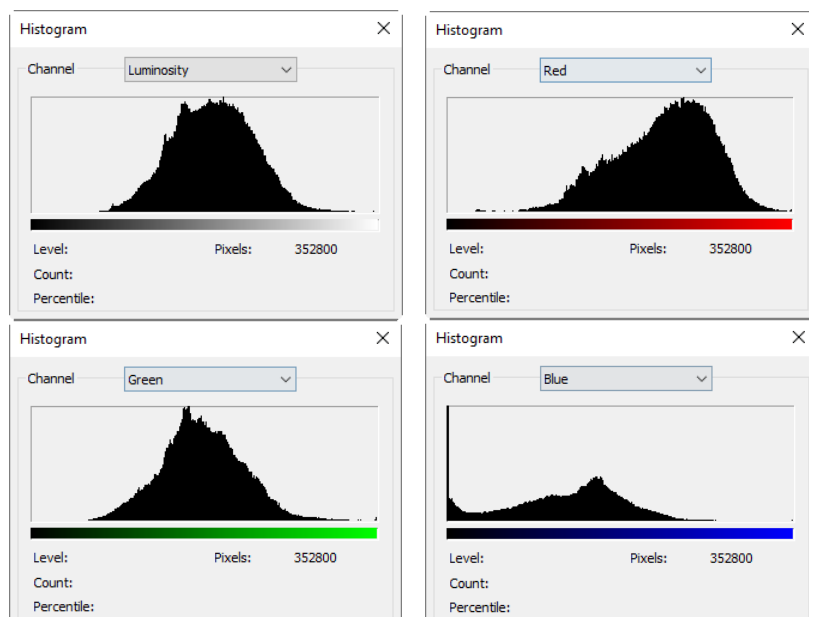
The **Histogram** also gives a quick picture of the tonal range of the image, or the image key type. A low-key image has detail concentrated in the shadows, a high-key image has detail concentrated in the highlights, and an average-key image has detail concentrated in the **Midtones**. An image with a full tonal range has a number of pixels in all areas. Identifying the tonal range helps determine the appropriate tonal corrections.

Choose **Image>Histogram** command to open the **Histogram** dialog as shown on the right.

Depending on the image's color mode, choose **R**, **G** and **B**, or **Luminosity** to view a composite **Histogram** of all the channels.

If the image is **RGB** true color, choose **Luminosity** to display a **Histogram** representing the luminance or intensity values of the composite channel.

If the image is **RGB** true color, choose **R**, **G** and **B** to display a composite **Histogram** of the individual color channels in color.



Do one of the following:

To view information about a specific pixel value, place the mouse pointer in the [Histogram](#);

To view information about a range of values, click down the left mouse button and drag it in the [Histogram](#) to highlight the range;

The dialog displays the following statistical information below the [Histogram](#).

Pixels: Represents the total number of pixels used to calculate the [Histogram](#);

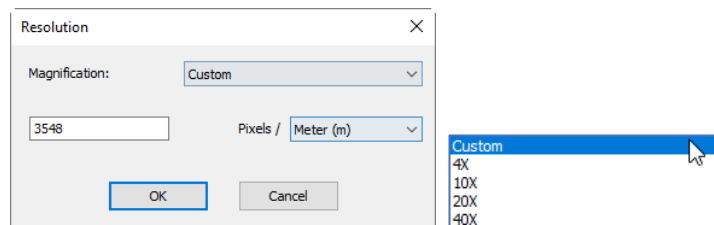
Level: Displays the intensity level of the area underneath the pointer;

Count: Shows the total number of pixels corresponding to the intensity level underneath the pointer;

Percentile: Displays the cumulative number of pixels at or below the level underneath the pointer. This value is expressed as a percentage of all of the pixels in the image, from **0%** at the far left to **100%** at the far right.

11.7 Resolution...

Choose [Image>Resolution...](#) command to set the image [Resolution](#) to calibrate the spatial scale. By default, the [App](#) expresses image measurements in terms of pixels. This [Resolution](#) (The better name should be [Calibrated Resolution](#)) command is used to change the terms in which the [App](#) reports such measurements. This command should be run first in order to measure [Objects](#) in terms of units other than pixels.



The resolution can be [Custom](#) or set it according to the [Magnifications](#) defined by the microscope calibration command. The [Resolution](#) will list all of the [Magnifications](#) in the [Magnification](#) dropdown box. If [Custom](#) is selected, user has to enter the [Resolution](#) according to the real value, otherwise, just select the corresponding [Magnification](#) and the [Resolution](#) value will be filled into the edit box automatically.

After the new [Resolution](#) is set, all of the [Measurements](#) will be calculated according to the new [Resolution](#). (See more in the [Measurements](#) (Sec.14) and [Options> Measurement...](#) menu (Sec.15.2)).

11.8 DPI...

In printing, [DPI](#) (dots per inch) refers to the output resolution of a printer or image setter, and [PPI](#) (pixels per inch) refers to the input resolution of a photograph or image. [DPI](#) refers to the physical dot density of an image when it is reproduced as a real physical entity, for example printed onto paper.

A digitally stored image has no inherent physical dimensions, measured in inches or centimeters. Some digital file formats record a [DPI](#) value, or more commonly a [PPI](#) (pixels per inch) value, which is to be used when printing the image. This number lets the printer or software know the intended size of the image, or in the case of scanned images, the size of the original scanned object.

For example, a bitmap image may measure 1,000 × 1,000 pixels, a resolution of 1 megapixel. If it is labeled as 250 [PPI](#), that is an instruction to the printer to print it at a size of 4 × 4 inches. Changing the [PPI](#) to 100 in an image editing program would tell the printer to print it at a size of 10 × 10 inches. However, changing the [PPI](#) value would not change the size of the image in pixels which would still be 1,000 × 1,000. An image may also be resampled to change the number of pixels and therefore the size or resolution of the image, but this is quite different from simply setting a new [PPI](#) for the file.

[DPI](#) menu can be used to change the [DPI](#) of the captured image for the display and print operation because if one keep using resolution of the microscope image captured from the camera. The [Calibrated Resolution](#) will make the image in small size in the [Word](#) file or on the printed paper.

The value in the **DPI** dialog can be set to 150, 300,600 or 1200 for the print or display application.

11.9 Mosaic•••

Mosaic is a process that can combine the images opened into a new image. This will open **Mosaic Property** sheet as shown below. It has two pages, they are is **Image List** and **Parameters** pages.

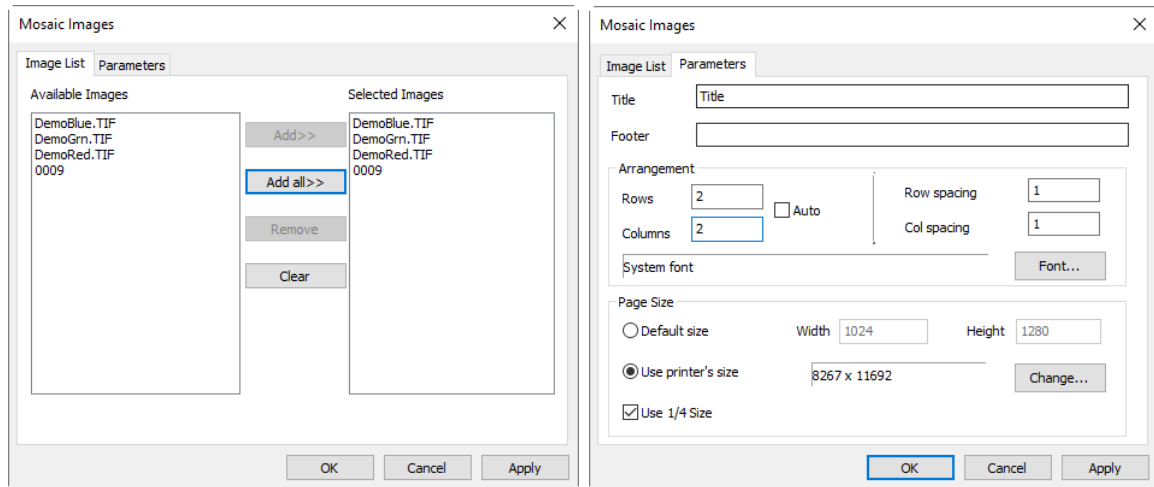


Image List page:

Available Images: Images opened with the **App**;

Add>>: Add the opened images to the **Selected Images** list view;

Add All>>> Add all the opened images to the **Selected Images** list view;

Remove: Select the images and remove them from the **Selected Images** list view;

Clear: Remove all the images from the **Selected Images** list view.

Parameter page:

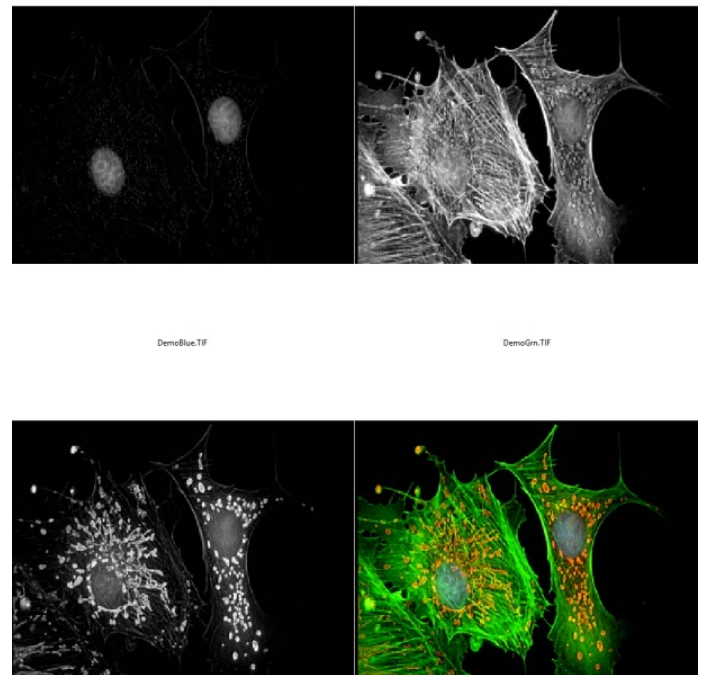
Title: The title wanted;

Footer: The footer wanted;

Arrangement: The **Mosaic Images** distribution on the page;

Page Size: The page size for the **Mosaic Images**;

If everything is set, click **OK** to end the **Mosaic Images** operations and a new image window will be displayed and the final results should look like that on the right side.



12 Process

12.1 Stitch...



Shift+T

Image stitching is the process of combining multiple photographic images with overlapping fields of view to produce a segmented panorama or high-resolution image. Commonly performed through the use of computer software, most approaches to image/video stitching require nearly exact overlaps between images and identical exposures to produce seamless results. Some digital cameras can [Stitch](#) photos internally. Image stitching is widely used in today's world in applications such as Image Stabilization feature in camcorders which use frame-rate image alignment, high resolution photo mosaics in digital maps and satellite photos, medical imaging, multiple image super-resolution, live stitching and object insertion.

The App also integrated [Live Stitch](#), [Image Stitch](#) and [Browse Window Stitch](#) into it.

12.1.1 Live Stitch (Video)


[Live Stitch](#) allows real time stitching in video mode. Users could get an overview of the stitching area and the stitching results could be updated immediately when frames in video mode is updating. Automatic alignment and blend is applied during operation to achieve the best quality.

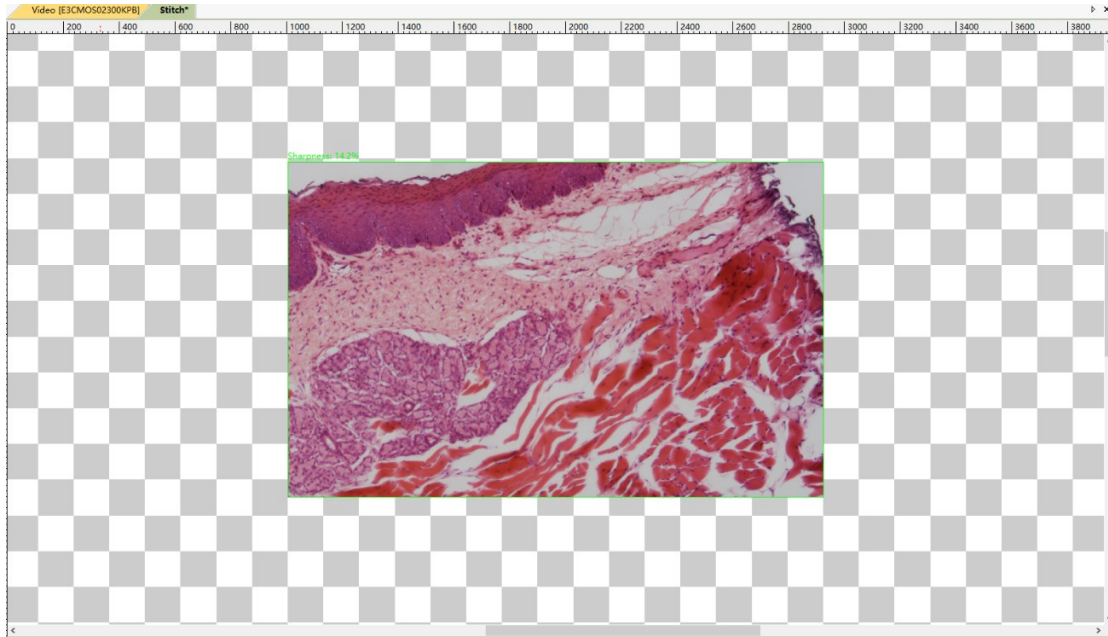
Before begin the [Live Stitch \(Video\)](#), the following preparations should be made first:

1. **Good quality specimen:** For [Live Stitch](#) imaging, it is important, that the specimen is of good quality. Avoiding higher thickness variations of the specimen will speed up the stitching process by reducing the need to refocus while scanning;
2. **Structured scanning:** Don't lose orientation while scanning a specimen. Look at the sample with low magnification and memorize its contour or shape. When scanning in horizontal stripes from top to bottom, locate the uppermost edge of the specimen and use it as starting point. For difficult specimens with disjointed sample areas, simply take a picture of the whole slide with a smartphone first. This helps you to remember all areas that have to be scanned;
3. **Warm up the microscope light source first:** Warming up the illumination is a crucial step especially for the halogen light source, because the color and intensity of the lamp is changing significantly in the first few minutes of operation. If the brightness and color keeps changing after a few minutes, this might be a hint to replace the bulb;
4. **Free resources of your computer:** [Live Stitch](#) is hard work for computer. Close all other applications before starting the App's [Live Stitch](#) command. This ensures that everything works smooth;
5. A camera with global shutter sensor is preferred to get the best performance. The distortion of the image taken with rolling shutter may result in failure or unsatisfied results;
- 6 It is strongly recommended that the [Auto Exposure](#) function in [Exposure & Gain](#) group on the [Camera Sidebar](#) is unchecked during the stitching operation to guarantee the unique lightness;
7. High speed camera is preferred to achieve the best experience. Shorten the exposure time to guarantee the high frame rate if the illumination is strong enough;
8. Users should move the slides in proper speed and guarantee that the camera is in focus. When the rectangle in the stitching window is getting **red** or **yellow**, users should stop or move back a little bit until the rectangle is **green**. The **red** or **yellow** rectangle during stitching operation means failure or warning on the stitching or alignment. The reasons may result from the fact that the slides is moving too fast, in which case the computer is not quick enough to finish the calculating, or the details of the content is not very clear for alignment;
9. Stop the stitching window first before closing it;

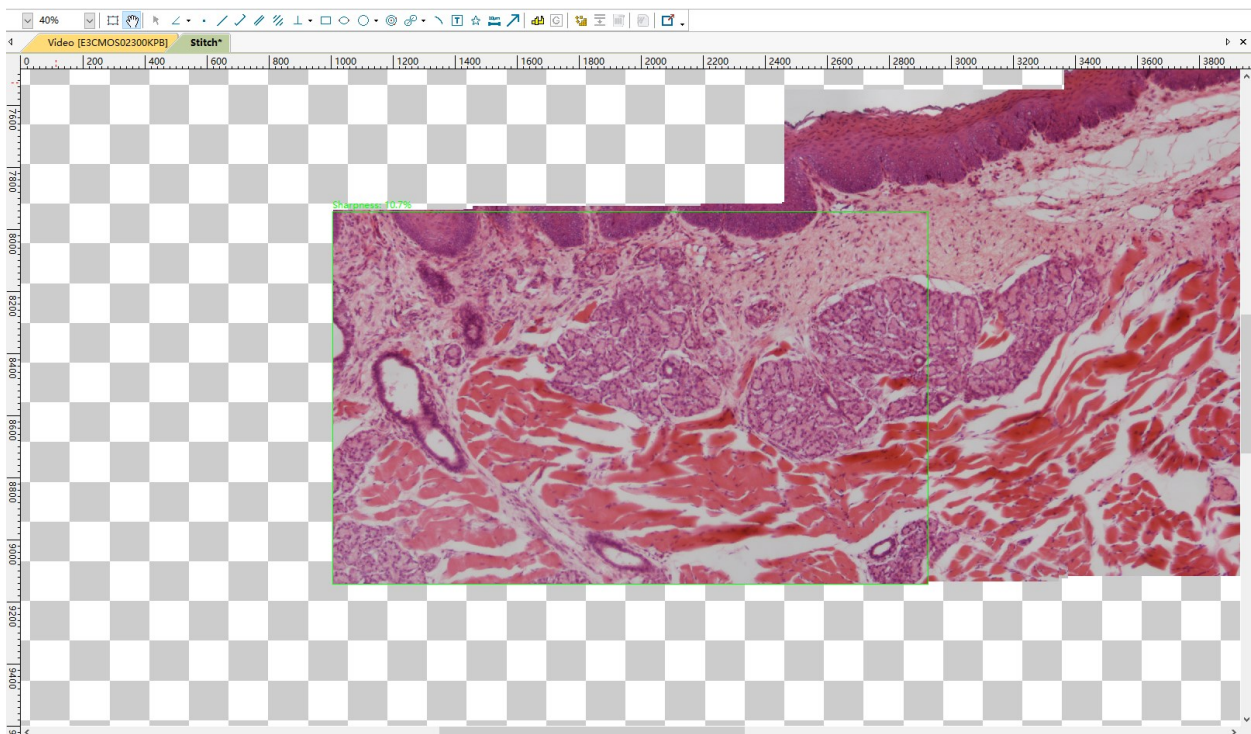
Now user can begin the [Live Stitch \(Video\)](#) step by step as listed below:

1. Click the camera name in the [Camera List](#) group on the [Camera Sidebar](#) to begin the video feed;
2. Adjust the microscope and camera control parameter to get the best image quality;

3. Choosing **Process>Stitch...** command or clicking down the **Stitch** button  on the toolbar (**Shift+T**) will invoke the **Live Stitch (Video)**;
4. A stitching window will be shown as below. The border around the video turns green to show that the scanning is active and working. The grids area is the background;



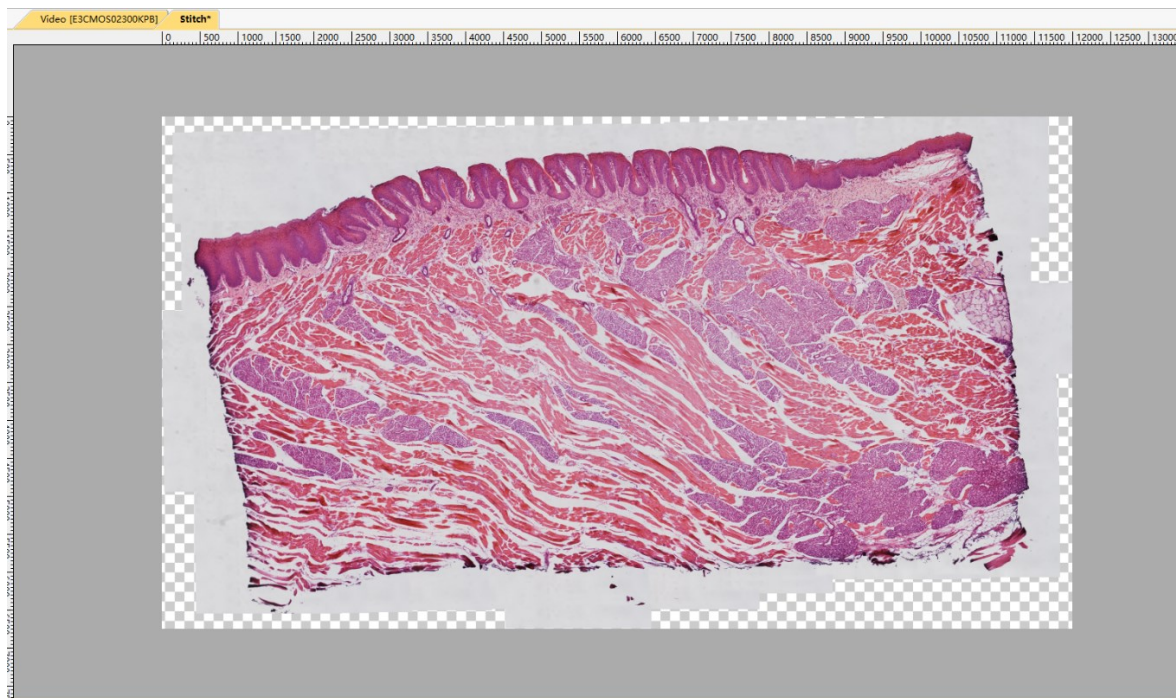
5. Move the slides with the microscope **X-Y translational control knobs** and user will see the stitching results simultaneously. Move the slide to acquire horizontal or vertical stripes. If your camera has a very wide aspect ratio (e.g. 16:10) it is recommended to scan vertical stripes. For standard aspect ratios (5:4 or 4:3) vertical and horizontal stripes are equally efficient. Make sure that adjacent stripes are overlapping by at least to rows (or columns) of grids.



6. The area marked with **Green Rectangle** shows the real time video and the other area is the stitching results. Please pay attention to the **Green Rectangle**. When the rectangle is green, the stitching function is working as expected and users could move the slides continuously. If the scanner loses track (usually because you are accidentally moving into an empty area of the slide that cannot be stitched or you are

moving/accelerating the slide too fast for the camera), the border of the video turns to **red** or **yellow** and you can slowly return back to the last known position where the rectangle turns into **green**. After the rectangle is **green**, users could continue the operation;

7. Click the **Stitch (Shift+T)** button again to stop the live stitching function. The stitching results will be cropped from the background and the result image will be generated automatically;

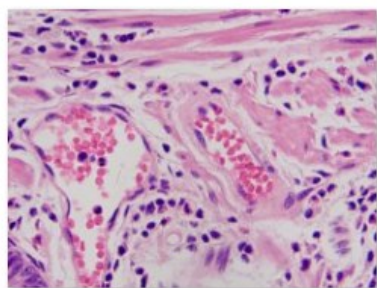


8. The stitching image could be saved or edited.

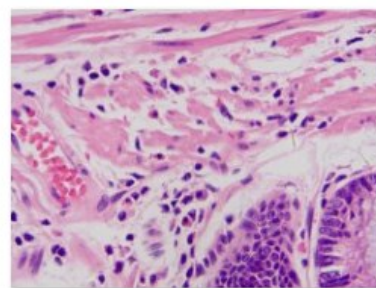
Some default setups about the **Live Stitch** can be found in **Options>Preference...**, **Misc** page's **Stitch(Video)** item in Sec.15.1.8.8.

12.1.2 Image Stitch

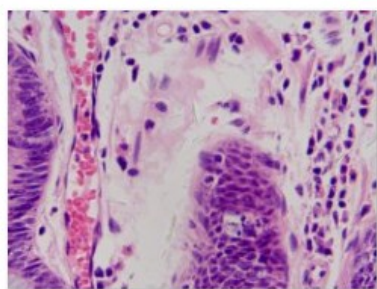
If images are opened in the **App**, for example 0001.jpg, 0002.jpg, 0003.jpg, 0004.jpg are opened as shown below:



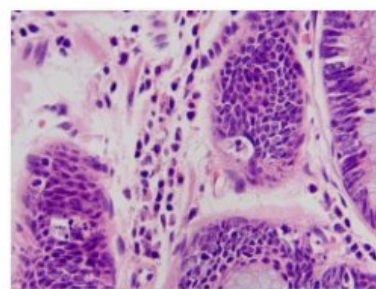
0001.jpg



0002.jpg



0003.jpg

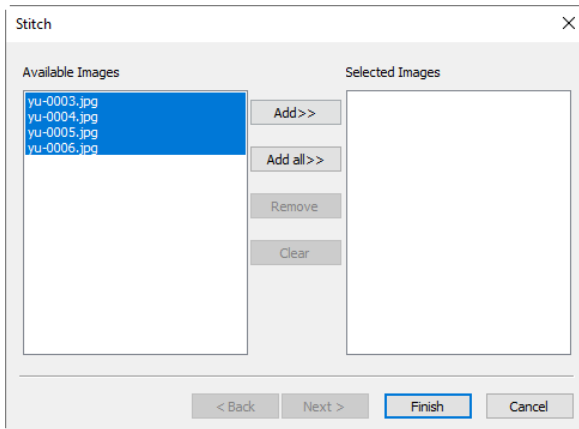


0004.jpg

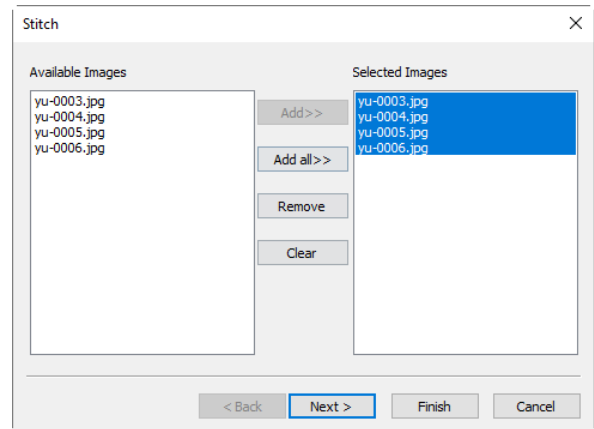
1. Choosing **Process>Stitch** command or clicking down the **Stitch** button  on the toolbar (**Shift+T**) will

invoke the image **Stitch** dialog as shown below. Each item in the **Stitch** is described below:

Available Images: The images opened by the **App**; Here, 4 images are listed in the list box. One can click the image file name to select the files to be added to the **Selected Images**;



a) Available Images



b) Selected Images

Selected Images: The images selected for stitching; Using **Add >>** or **Add All >>** to add **Available Images** to this list box;

Add >>: When an image or images is or are selected and highlighted in the **Available Images** window, the **Add >>** will be enabled. Clicking **Add >>** will add it or them into the **Selected Images** list box ;

Add All >>: Clicking **Add All >>** will add all of the **Available Images** into the **Selected Images** list box;

Remove: When an image or images is or are selected and highlighted in the **Selected Images** list box, the **Remove** button will be enabled, click **Remove** button will remove it or them from the **Selected Images** list box;

Clear: Used to clear all of the images in the **Selected Images** list box. When no image in the **Selected Images** list box, it will be disabled;

Cancel: Click to cancel the current stitching process;

Finish: Click the **Finish** button will accept the other **Default** setup and begin to stitch the captured images according to the above setup;

2. **Next >:** Clicking **Next >** will step to the **Stitch** method setup dialog;

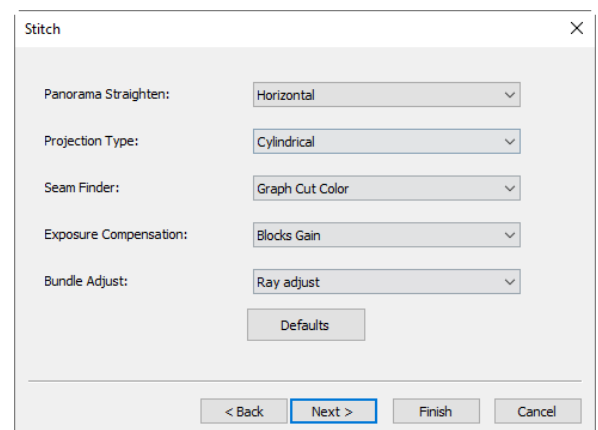
Panorama Straighten: The image stitching direction. It can be **Horizontal**, **Vertical** and **None**. Default is **Horizontal**;

Projection Type: For image segments that have been taken from the same point in space, stitched images can be arranged using one of various map projections. **BMS_pix3** including **Plane**, **Cylindrical**, **Spherical**, **Fisheye**, **Stereographic**, **Mercator** or **Transverse Mercator** map projections. The Default is **Cylindrical**;

Seam Finder: Seam Finder method, **BMS_pix3** including **None**, **Voronoi Diagram**, **Graph Cut Color** or **Graph Cut Color Grad**. Default is **Graph Cut Color**;

Exposure Compensation: **Exposure Compensation** is required between images to minimize exposure differences. **BMS_pix3** including **None**, **Gain** or **Blocks Gain Exposure Compensation** method. Default is **Blocks Gain**;

Bundle Adjust: Bundle Adjustment can be defined as the problem of simultaneously refining the 3D coordinates describing the scene geometry as well as the parameters of the relative motion and the optical characteristics of the camera(s) employed to acquire the images, according to an optimality criterion



involving the corresponding image projections of all points. [BMS_pix3](#) including [Ray adjust](#) or [Reprojection error adjust](#) method. Default is [Ray adjust](#);

[<Back](#): Click [<Back](#) will return to the previous setup page;

[Finish](#): Click [Finish](#) will accept the other Default setup and begin to stitch images according to the above setup;

[Cancel](#): Click to cancel the stitching process.

3. [Next>](#): Click [Next>](#) will step to the [Stitch](#) parameter dialog:

[Match Confidence](#): 1~100, Default is 65;

[Panorama Confidence](#): 1~100, Default is 100;

[Match Strength](#): 0~100, Default is 25;

[Blend Strength](#): 0~100, Defaults is 5;

[Defaults](#): Click [Defaults](#) will set all the parameters to the [Default](#) ones;

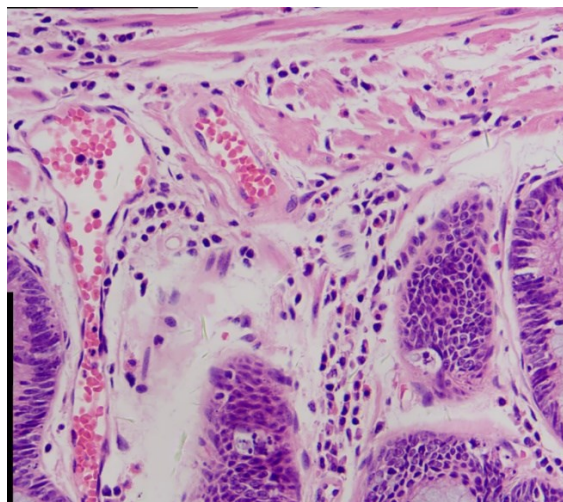
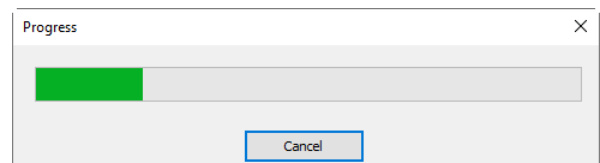
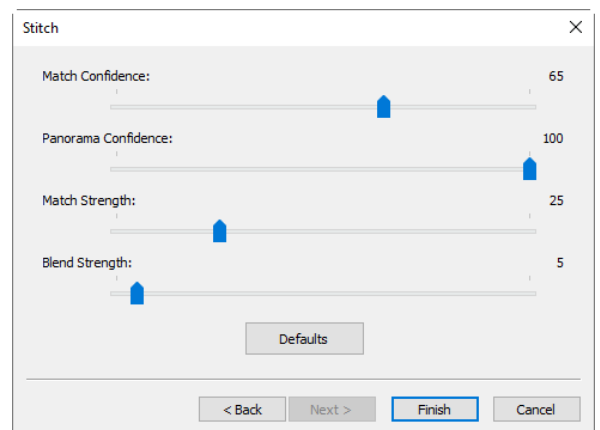
[<Back](#): Click [<Back](#) will return to the previous [Stitch](#) dialog;

[Finish](#): Click [Finish](#) will begin to [Stitch](#) images according to the above setup. After the [Finish](#) button is clicked, the [App](#) will start to stitch and a progress dialog will be shown to indicate the [Stitch](#) state;

[Cancel](#): Click to cancel the stitching process.

The final stitched image will be created in a new image window as shown below.

In the stitched image, there are some black areas, these are happened when there are translations among the edge images in both directions.



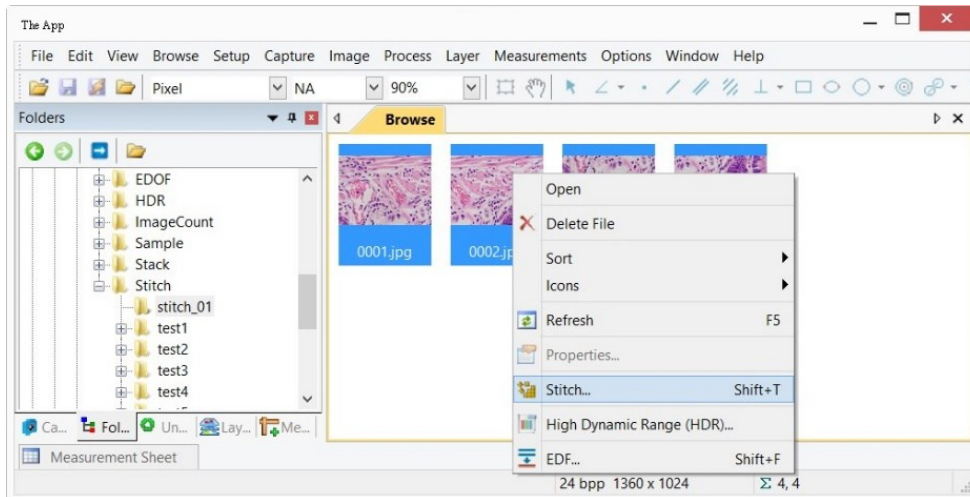
The Stitched image

12.1.3 Browse/Thumbnail window Stitch

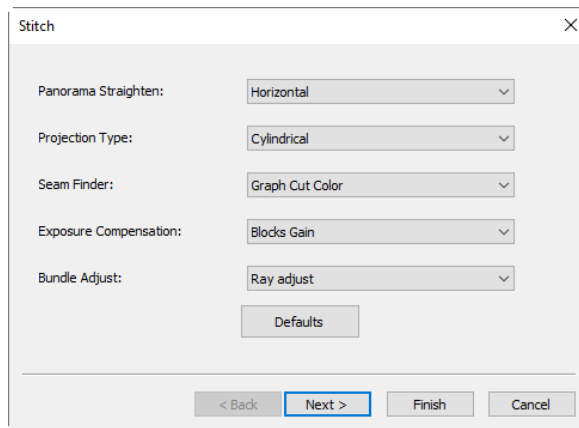
Click the [Folders Sidebar](#) to activate it. Double-click the right directory to show the images under the directory in the [Browse](#) window.

For [Thumbnail](#) window, choose [View>Thumbnail](#) command or click the [Thumbnail](#) button  on the toolbar, all the images captured/opened/[Paste as New File](#) created will be displayed in icon mode.

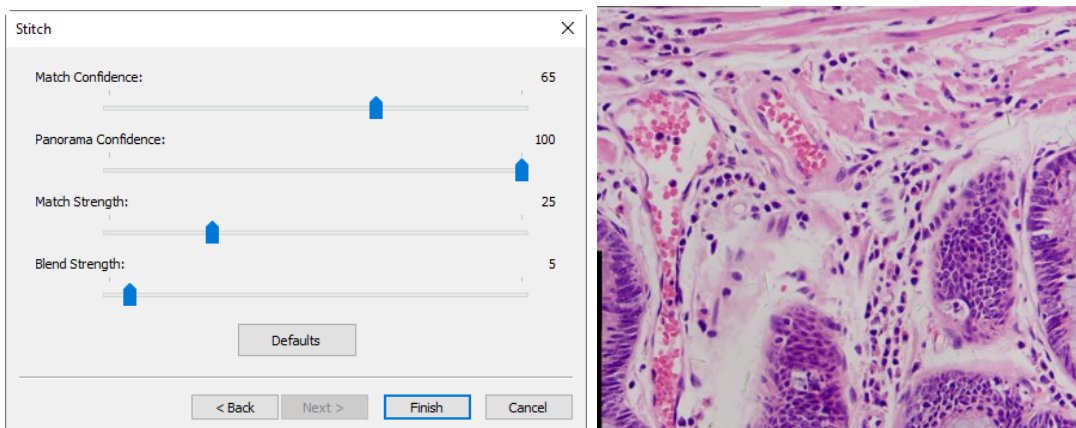
Choosing the image files to be stitched and then clicking the right mouse button will display the context menu, choose **Stitch** submenu to start the image stitch operation (One can also choosing **Process>Stitch** to do the same operation after the images are selected in the **Browse/Thumbnail** window)



After the **Stitch** command is selected, a **Stitch** dialog will be popped up as shown below:



The **Stitch** dialog and the other **Next>** steps dialog are just the same as those of **Image Stitch** in Sec.12.1.2.



The final stitched image will look like the above right side one:

In the stitched image, there are some black areas; these are happened when there are translations among the edge images in both directions.

12.2 High Dynamic Range (HDR)...

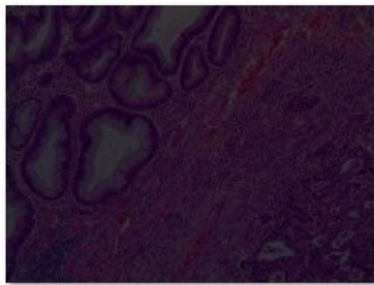


High Dynamic Range can fuse a sequence of multi-exposure images into a high dynamic range image. The user can capture the multi-exposure images by adjust the aperture of microscope or the **Exposure Time** and the **Analog Gain** in the **Exposure & Gain** group on the **Camera Sidebar**.

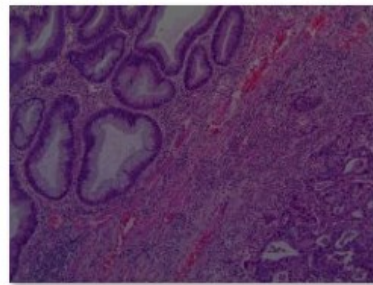
The **App** supports **High Dynamic Range** function in 2 modes, which is shown below.

12.2.1 Image window High Dynamic Range operation

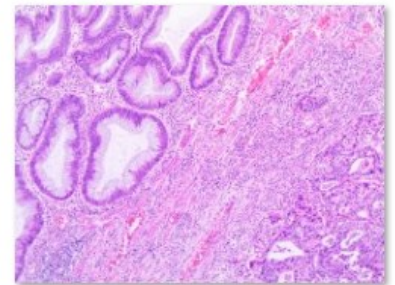
When the image window is active, the user can choose images from opened window to generate high dynamic range image. This mode will lead the system to overhead when many images were opened



(1).png



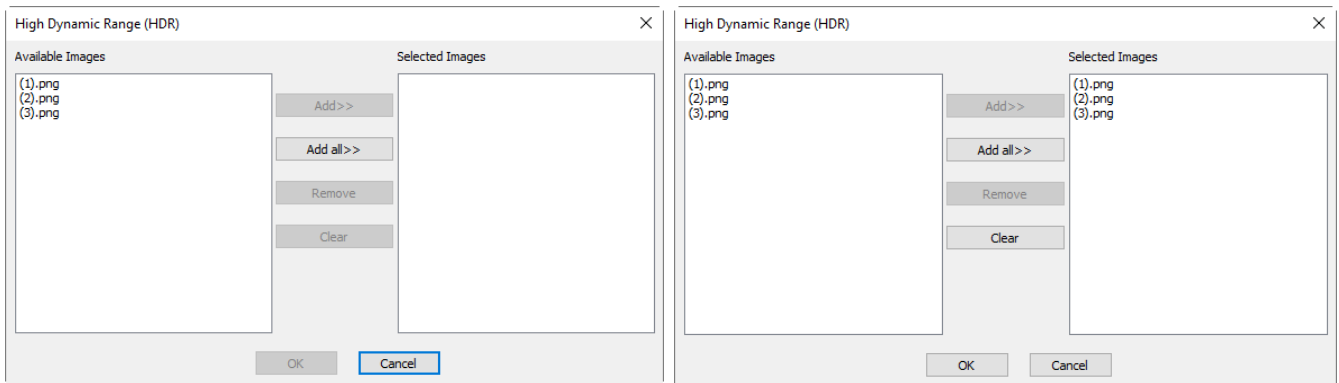
(2).png



(3).png

Opened image for HDR operation

Choose **Process>High Dynamic Range...** command to fuse captured or opened images to **High Dynamic Range** image, a dialog called **High Dynamic Range(HDR)** will be shown as below:



a) Available Images and b) Selected Images

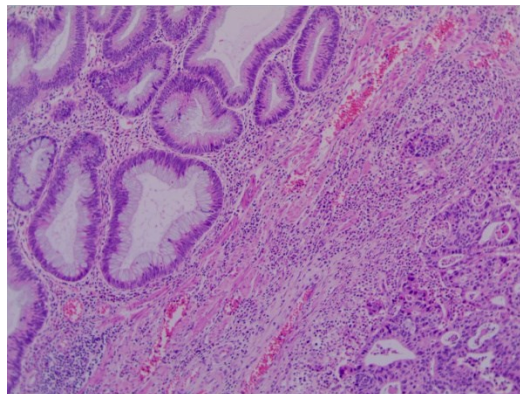
We assumed that (1).jpg, (2).jpg, (3).jpg 3 images have been opened.

Available Images: The images opened by the **App**; Here, 3 images are listed in the list box. One can click the image file names to select them and added them to the **Selected Images** list box

Selected Images: The images selected for stitching; Using **Add>>** to add the **Available Images** to this list box;

Add>>: When an image or images is or are selected and highlighted in the **Available Images** window, the **Add>>** will be enabled. Clicking **Add>>** will add it or them into the **Selected Images** list box;

Add All>>: Clicking **Add All>>** will add all of the **Available Images** into the **Selected Images** list box;



Remove: When an image or images is or are selected and highlighted in the **Selected Images** list box, the **Remove** button will be enabled, clicking **Remove** will remove it or them from the **Selected Images** list box;

Clear: Used to clear all of the images in the **Selected Images** list box. When no image in the **Selected Images** list box, it will be disabled;

Cancel: Click to cancel the stitching process;

OK: Click **OK** will begin to fuse the selected images according to the above setup. The final result is shown above.

12.2.2 Browse/Thumbnail window High Dynamic Range operation

In **Browse/Thumbnail** window, the user can choose images to be fused directly and there is no need to open any image to save the system cost.

When the **Browse/Thumbnail** window is active, the user can choose low dynamic range images by:

- a) Clicking the displayed file icons, a single file will be highlighted;
- b) Clicking the file one by one with **Ctrl + left mouse button**, all of the clicked files will be highlighted;
- c) Clicking the displayed file icons, the first clicked file will be highlighted, clicking the end file with **Shift + left mouse button**, all the files among the first and last will be highlighted.
- d) Dragging the mouse to draw a dotted line rectangle across the files you wish to delete, all of the files in the rectangle will be highlighted;
- e) **Ctrl+A /Edit>Select All** to select all files in the **Browse/Thumbnail** window;

Clicking the right mouse button on the **Browse/Thumbnail** window will invoke the context menu. Choosing **High Dynamic Range** (or choose **Process>High Dynamic Range...** command), the **App** will begin to calculate according to the selected images. The high dynamic range image will be displayed in a new image window when the progress bar reaches to the end.

12.3 EDF... Shift+F

12.3.1 Video Window EDF Shift+F

Live EDF allows you to capture a fully-focused image for specimens whose thickness exceeds the microscope depth of field. Available for any manual microscope, **Live EDF** solves the depth of field issues that often plague Entomologist, Botanists, and Parts and Material manufacturers. Automatic alignment is applied during operation to achieve the best performance in case there is a slightly FOV (field of view) shift. The characteristics of Live EDF is listed below:

- ✓ No motor stage or focus drive needed
- ✓ Works with any camera
- ✓ Users need not be concerned about;
 - Specimen Thickness
 - Focus direction or evenness
 - Starting or ending focus point
 - Z thickness
 - # of Z planes required
 - Camera/Stage orientation
 - Stereomicroscope image shift
- ✓ Prevents damage caused by specimen flattening
- ✓ Works in Fluorescence applications

Live EDF is not designed to:

- Retain Z axis information

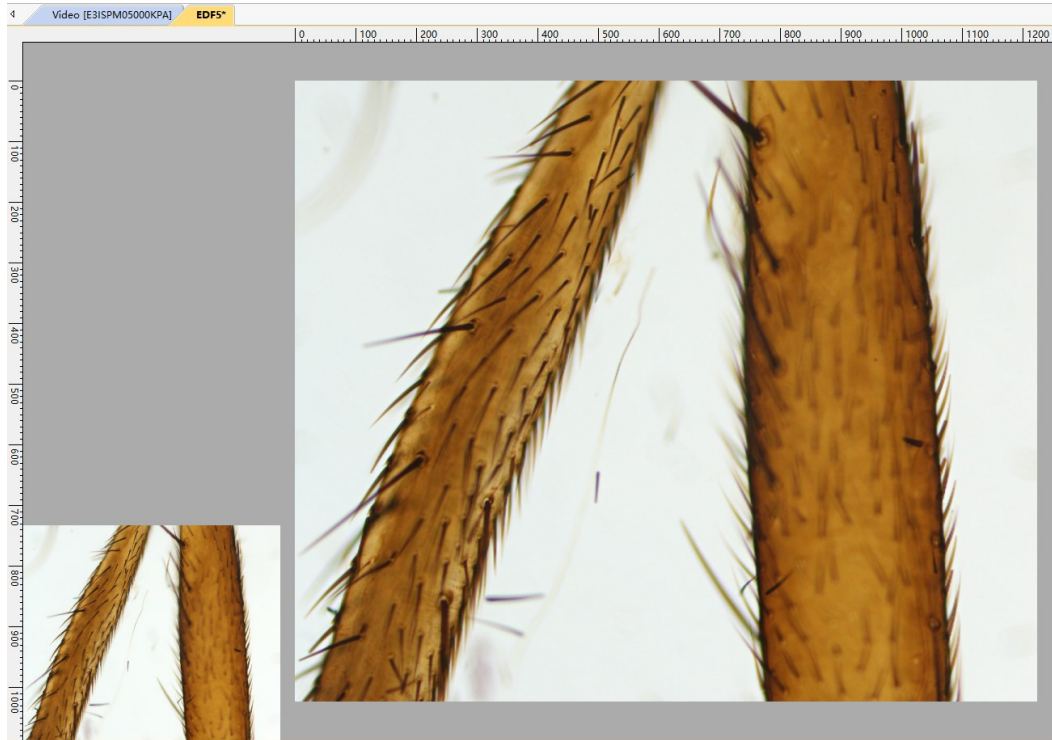
- Produce a 3D image

The basic Live EDF steps are listed as below:

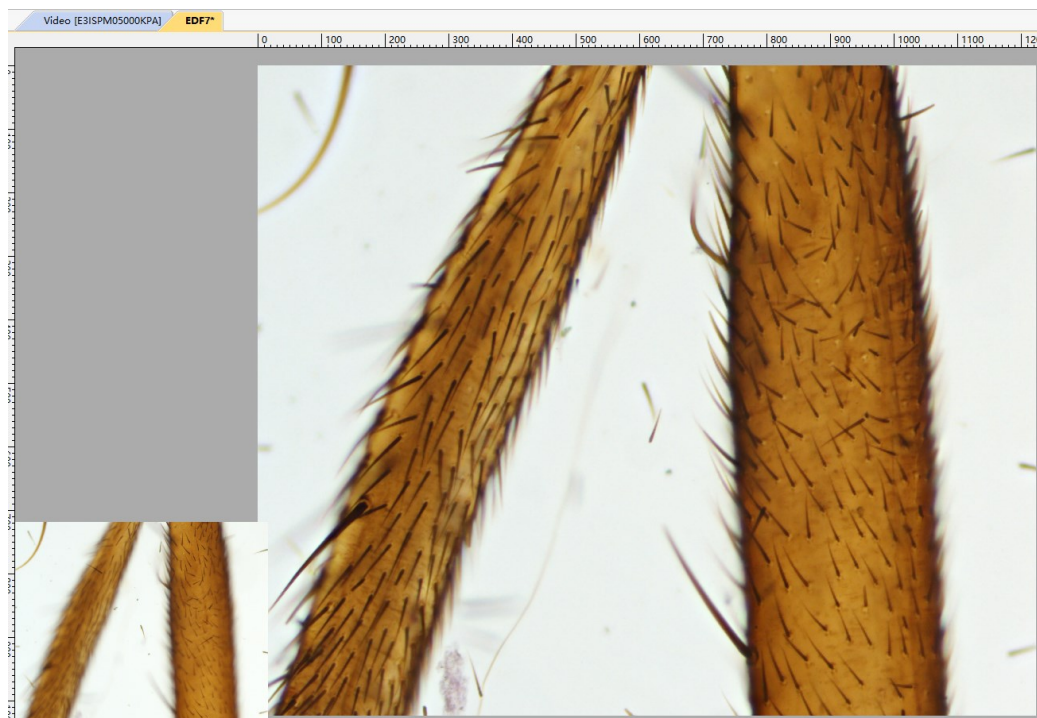
1. Click the camera name in the **Camera List** group on the **Camera Sidebar** to begin the video;
2. Choose **Process>EDF** command or click the **EDF** button in the toolbar to open the live **EDF** window;



A live **EDF** window will show as below. The left bottom window is the video preview window of the camera and the right main window is the **EDF** results in real time.



3. Rotate the microscope fine adjustment knob. The live preview of the specimen will be shown in the left bottom small video window. The **EDF** results will be updated in the right large window in real time;



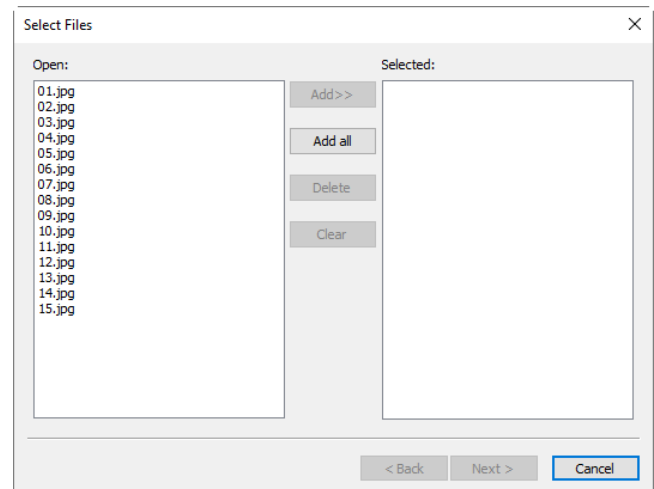
4. Click the **EDF** button again to stop the live **EDF** function.

Notes: Settings related to **Live EDF** is integrated in the **Option>Preferences>Misc...** page, **EDF (Video)** item (See Sec.15.1.8.9 for details).

12.3.2 Image Window EDF Shift+F

Image window EDF is also a very useful tool to generate a clear image by combining a sequence of previously captured or opened multi-focus images. Choosing **Process>EDF...** command, the following dialog will be brought up (assume 01.jpg 02.jpg ... 15.jpg are already opened in the **App**):

Clicking on the image file name in the **Open** list box will highlight the image, and then the **Add>>** button is enabled (Clicking on the selected images will deselect them). Clicking the **Add>>** button, the highlighted images will be added into the **Selected** list box, which will be fused later.

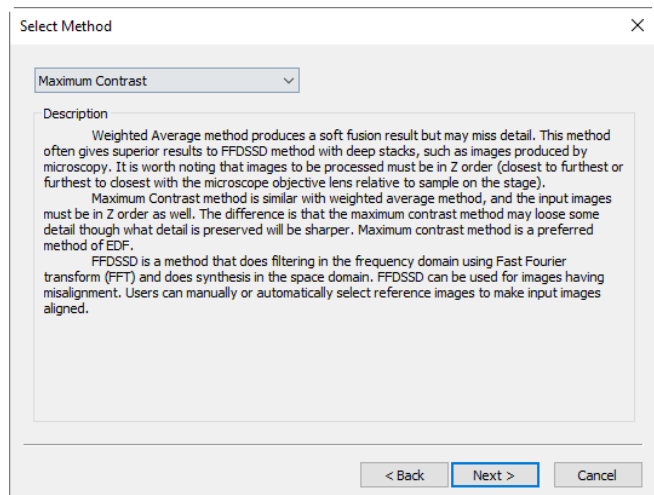


Clicking the **Add all** button will add all images in the **Open** list box into the **Selected** list box.

If images in the **Selected** list box are highlighted, the **Delete** button will be enabled. Clicking the **Delete** button, the highlighted images in the **Selected** list box will be removed.

Clicking the **Clear** button will remove all the images in the **Selected** list box, including the unselected ones. The button will be disabled if there is no image in the **Selected** list box.

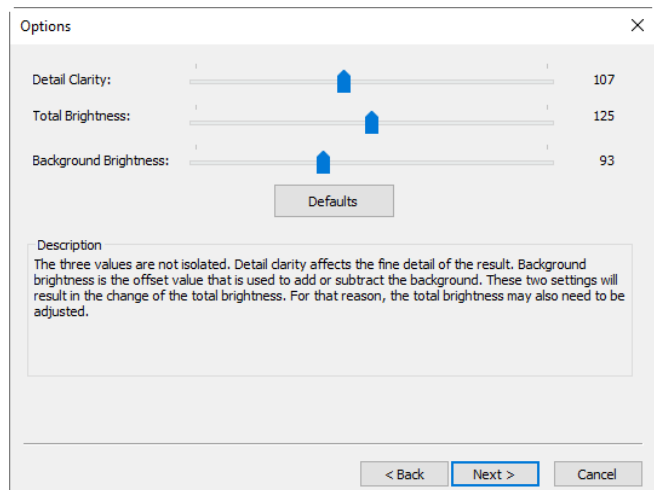
When the desired images are all selected (If more than 2 images are added in the **Selected** list box, the **Next>** button will be enabled), clicking on the **Next>** button, a dialog called **Select Method** is popped up as shown on the right side.



There are 3 **EDF** methods in the **App**, they are:

Maximum Contrast: **Maximum Contrast** method is similar with weighted average method, and the input images must be in **Z** order as well. The difference is that the maximum contrast method may lose some detail however the preserved details will be sharper. **Maximum Contrast** method is a preferred method in these three **EDF** methods.

Weighted Average: **Weighted Average** method produces a soft fusion result but may lose detail. This method often gives superior results to **FFDSSD** method with deep stacks, such as images produced by microscopy. It is worth noting that images to be processed must be in **Z** order (**Capture** a series images in closest to furthest or furthest to closest order);



Choosing **Maximum Contrast** and **Weighted Average** in the **Select Method** dialog will pop up an **Options** dialog as shown above.

Detail Clarity: **Detail Clarity** affects the fine detail of the result. Default: 107, Range: 10~240;

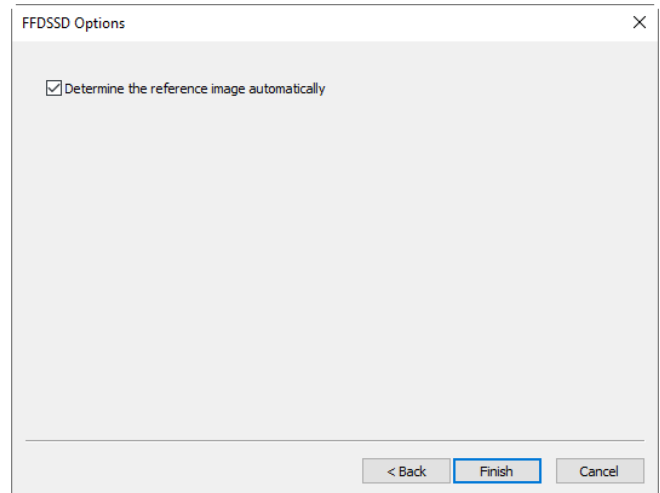
Total Brightness: **Total Brightness** is the overall brightness. The **Detail Clarity** and **Background Brightness** will result in the change of the **Total Brightness**. For this reason, the **Total Brightness** may also need to be adjusted. Default: 125, Range: 10~240;

Background Brightness: **Background Brightness** is the offset value that is used to add or subtract the background. Default: 93; Range: 10~240;

Default: This will set all 3 values to the **Default** ones;

FFDSSD: **FFDSSD** is a method that does filtering in the frequency domain using Fast Fourier Transform (FFT) and does synthesis in the space domain. **FFDSSD** can be used for images having misalignment. Users can manually or automatically select reference images to make images aligned.

FFDSSD related dialog is shown on the right side.



Determine the reference image automatically: If this item is checked, the **APP** will determine the reference image automatically. Otherwise, the first one will be the reference image.

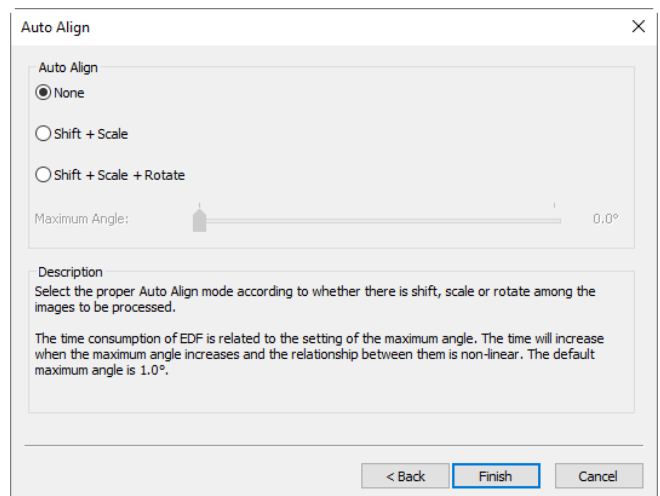
Clicking **Next>** button will pop up an **Auto Align** dialog as shown below:

None: Considering no **Shift+Scale+Rotate** among the selected images in the fusion process;

Shift+Scale: Considering **Shift+Scale** among the selected images in the fusion process; **Rotation** is not considered in this option;

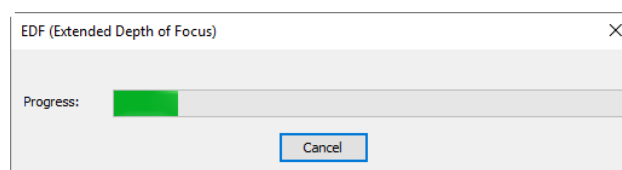
Shift+Scale+Rotate: Considering **Shift+Scale+Rotate** among the selected images in the fusion process; If this mode is selected, The **Maximum Angle** slide bar will be enabled;

Maximum Angle: The **Maximum Angle** is used to set the upper limit in **Rotate** alignment. The **Default** is 1 degree. Range: 0.1~10;



User can select the proper **Auto Align** mode according to whether there is shift, scale or rotation among the images to be processed or not. The time consumption of **EDF** is related to the setting of the **Maximum Angle**. The time will increase when the **Maximum Angle** increases and the relationship between them is non-linear. The default is 1.0°;

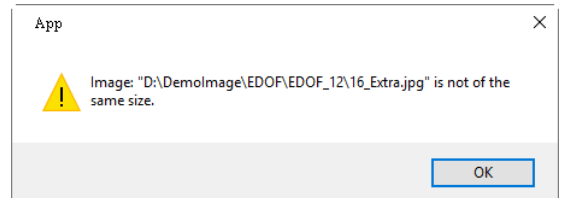
Clicking **<Back** will return to **Option** dialog and clicking **Finish** will begin the **EDF** operating according to the previous setup. The **App** will display the **EDF (Extended Depth of Focus)** progress bar as follow:



The final **EDF** result is shown as below:



Note: Images used for fusing must be the same size; otherwise there will be a prompt when adding different sizes of image to perform the EDF operation. The prompt dialog indicates which image is not the same size with the others.



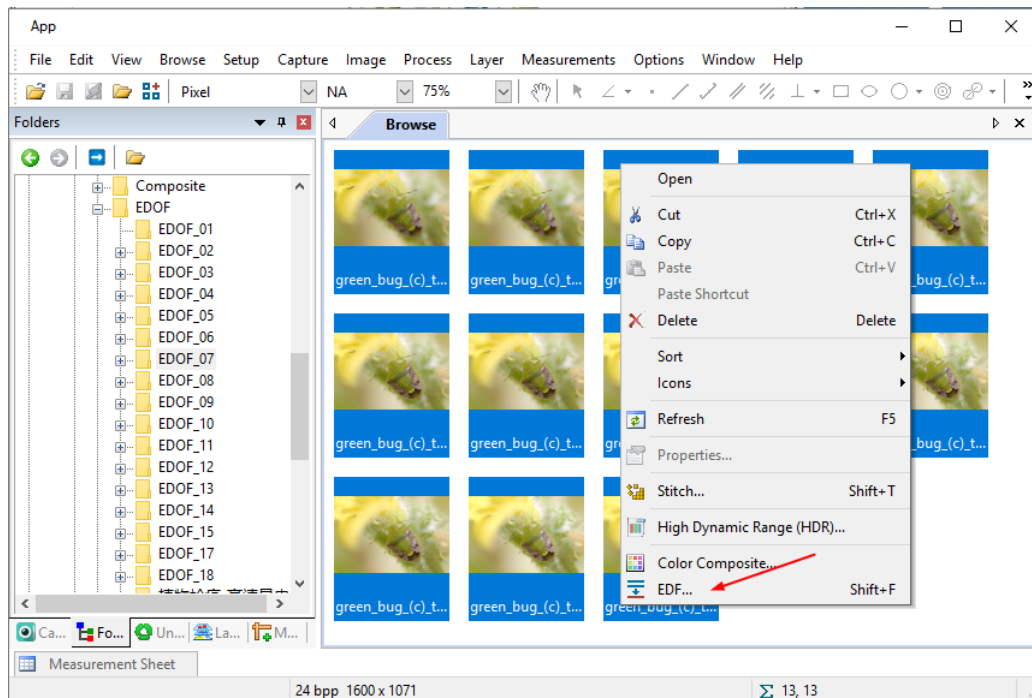
12.3.3 Browse/Thumbnail Window EDF



Shift+F

Click the **Folders Sidebar** to activate the **Browse** window/Click the **Browse** button on the toolbar or choose **View>Browse** to activate the **Browse** window. Double-click the directory to display the images in the **Browse** window in **Icon** mode.

Choose **View>Thumbnail** command or click the **Thumbnail** button  on the toolbar, all the images captured/opened/**Paste as New File** created will be displayed in **Icon** mode.



- Clicking the displayed file icons, a single file will be highlighted;
- Clicking the file one by one with **Ctrl + left mouse button**, all of the clicked files will be highlighted;
- Clicking the displayed file icons, the first clicked file will be highlighted, clicking the end file with **Shift + left mouse button**, all the files among the first and last will be highlighted.
- Dragging the mouse to draw a dotted line rectangle across the files you wish to delete, all of the files in the rectangle will be highlighted;
- Ctrl+A /Edit>Select All** to select all files in the **Browse/Thumbnail** window;

Clicking the right mouse button will display a context menu, choosing **EDF** submenu to start the image fusion process (One can also choose **Process>EDF...** command to do the same operation after the image files are selected in the **Browse/Thumbnail** window).

After the **Process>EDF** command is chosen, a dialog called **Select Method** is popped up which is just the same as in the **Image Window EDF** operations. Please refer it in the previous section (Sec.12.3.2) for detail. The final **EDF** result is shown on the right side.



12.4 Deinterlace

When interlaced cameras is used to take the images, a complete images is divided into 2, 3 or more fields. Since different fields are exposed and output at different time, there is no problem for a still object. But you will see an image with interlaced content when the object is moving. **Deinterlace** algorithm is used to resolve this problem. This function could find the difference between different fields automatically, correct the location difference as much as possible and **Deinterlace** the image. But vertical resolution will be lost to some extent and there will be some small shift.

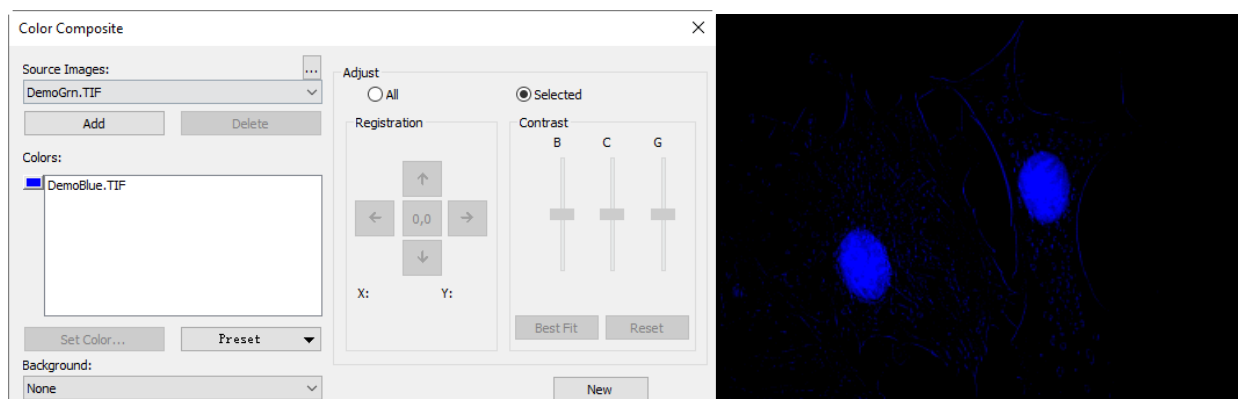
12.5 Color Composite...



Use the **Process>Color Composite...** dialog box to create and configure color composites using gray-scale source images. You can access the **Color Composite** dialog box through the **Color Composite** menu item from the **Process** menu.

You can combine gray-scale images into a color composite. Any group of gray-scale images that are of the same size can be mixed in a color composite. Images of 8-, 12-, 16-bit integer or floating point format are combined into a 24-bit color composite. Each input channel will have individual LUT adjustments, as well as a registration offset to line it up with the rest of the images.

You can also combine individual channels from a single image. Each channel will be listed separately, as shown here:

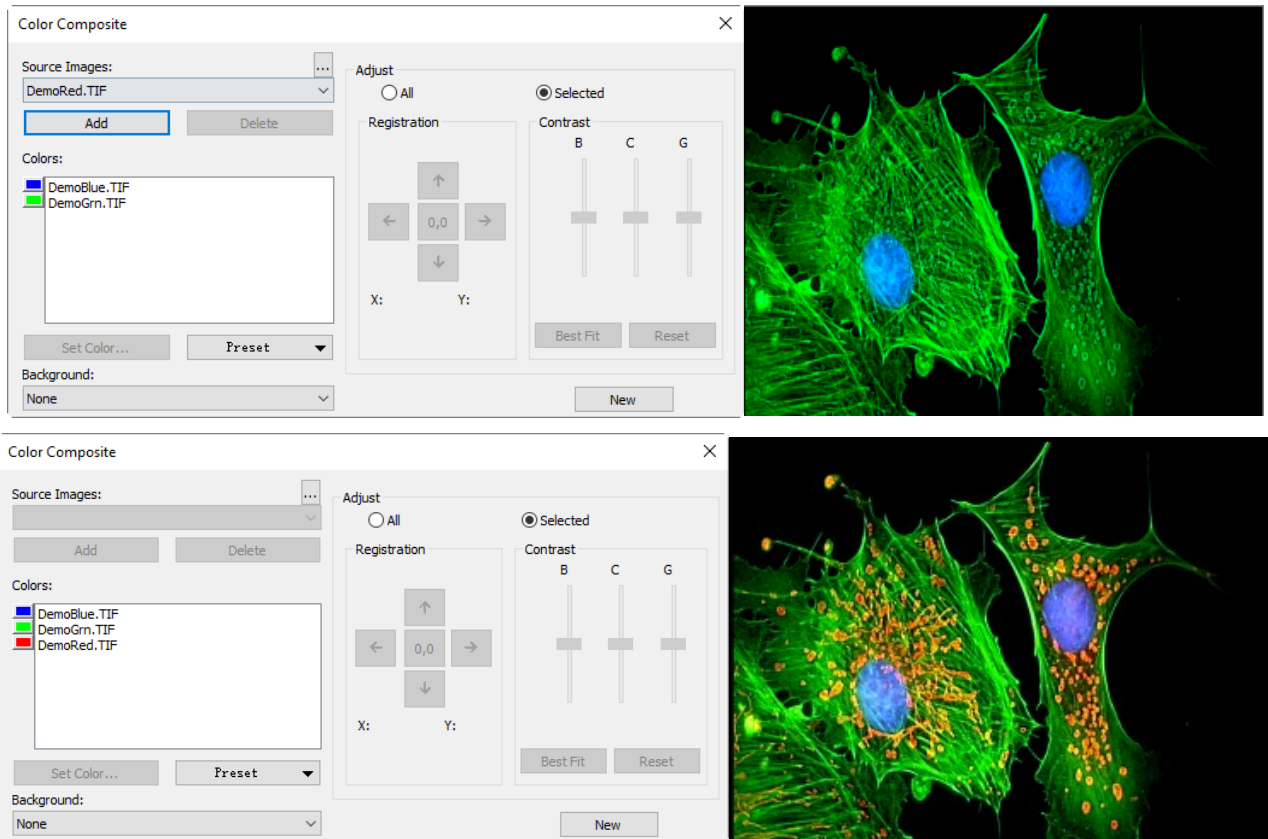


Source Images: The **Source Images** combo box displays the images available for color mixing. The **Source Image** list is initially filled with a list of the gray scale images that are currently open. The size of the color composite is determined by the first input image selected. Once this is entered, the list is filtered to contain only images of the same size as the initial selection;

Add: Click the **Add** button to add an image to the mix. You will be prompted for the color to be assigned to that image from the **Set Color** dialog;

Delete: Use this button to delete the selected image from the list;

Colors: The **Colors** combobox displays the images selected for color mixing;

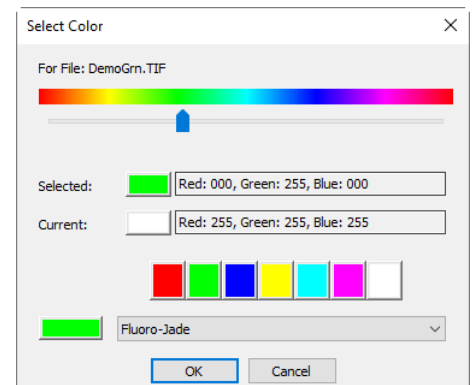


To change the color within the list box, double-click to select the image name (the **Select Color** dialog box appears) or highlight the name and click the **Set Color** button.

To delete colors/images from the **Colors** list box, first click on the color/image to highlight it then press the **Delete** button within the **Color Composite** dialog box.

Color Bar: The picture item box on the left side of the **Colors** list indicates the color associated with each image in the composite. The **Color Bar** will scroll with the contents of the **Colors** list box;

Set Color: This option determines the **Color** used for the selected channel in the final image display. Clicking on the **Set Color** button brings up the **Select Color** dialog box.



Directly select a color by:

- 1) Dragging the **Color Value Slider** to the desired color on the **Color Bar** (range of 0 to 359°): or
- 2) Clicking the appropriate **Color** button on the **Color Palette**. The **Color Bar** represents **Color** degrees in the standard color wheel representation, and the **Color Palette** contains a subset of possible **Colors** (pure red, green, blue, cyan, magenta, and white) or
- 3) Select a dye in the dye list, and click the **Select Dye** button.

Note: You can navigate through the **Select Color** dialog box by using the **<Tab>** and **<Shift + Tab>** keys to cycle through the items in the dialog box.

Intensity is determined by the image the **Color** is applied to, and **saturation** will always be 100%.

The only exception to this is the white **Color**, which has by definition a saturation of 0%. Selecting a value greater than or equal to 360 (dragging the **Color Value** slider over to the far right) is a choice of white, which results in a non-tinted (gray) image.

The elements of the **Select Color** dialog box are:

Color Bar: The **Color Bar** shows a rainbow displaying the **Colors** underneath the appropriate point of the

Color Value slider.

Note: If **Color Value Slider** is the selected (highlighted) selected control, then you can also control the slider with keyboard strokes: a) Use the left/right arrow <-> or <->keys to move the slider incrementally; b) Press the <Page Up> and <Page Down> to move the slider in chunk sections along the **Color Bar**; c) Use the <Home> and <End> keys to move the slider to the beginning and end of the **Color Bar**.

Selected: This color block displays the new **Color** selected by the **Color Value** slider bar or the **Color Palette**.

Selected Color: The **Selected Color** text field displays the corresponding numeric **Color** value of the **Selected Color** block described above. The **Selected Color** value is expressed as an **HSV** color, with the red value first, followed by the green and blue values. If the color corresponds to a dye color, the dye name will be displayed. If the dye color corresponds to a color palette color, the name of the color will also be displayed.

Current: The **Current** color block displays the starting **Color** of the channel.

Color Palette: The **Color Palette** provides an alternate method of selecting a **Color**. Clicking on an item in the **Color Palette** will set the **Color Value** slider to the correct value and update the displays in both the **Selected** color block and **Selected Color** text field.

For example, clicking on the white button on the **Color Palette** will set the **Color Value** slider to the right, change the **Selected** color block to white, and cause the **Selected Color** text box to display **White**.

Adjust: The controls in this section are used to adjust the color composite contribution from each image, or for the color composite preview itself. You can adjust the input image that is currently selected in the **Colors** list by clicking the selected button. When you want to adjust the color composite preview, or you want no image is selected in the **Colors** list, use the **All** button.

Registration: **Registration** allows you to correct for mis-registrations of images caused by filter-induced optical shifts. Use the directional keys to shift the selected image in the *x*- and/or *y*- direction, with respect to the rest of the input images. One click moves that channel one pixel in the direction indicated. Blank areas are filled with black. The key labeled 0,0 will re-center the selected image.

The registration shift for the selected channel or the overall image is displayed in the static text box below the directional keys.

Contrast: Use the **BCG sliders** along with the **Best Fit** and **Reset** buttons to adjust the contrast of the selected image or the composite;

BCG sliders: The **Brightness**, **Contrast**, and **Gamma** sliders are the similar to the **Contrast Enhancement** feature in the **App**. You can also adjust each channel individually or collectively by using the **Selected** or **All** radio buttons (to the left of the **BCG** sliders in the **Adjust** group box);

Best Fit: Click this button to perform a **Best-Fit** contrast stretch on the selected input, automatically setting the **Brightness** and **Contrast** settings accordingly (**Gamma** will be reset to 50.). This method is identical to the **Best Fit** contrast adjustment under the standard **Contrast Enhancement** feature of the **App**. **Best Fit** is useful for first pass adjustments;

Reset: Pressing the **Reset** button automatically resets the **BCG** settings. If the **Adjust** radio button is set on **All**, the **BCG** settings for the overall color image will be reset;

Frame: Use the frame slider to adjust the frame of the selected image that is used for the preview, or the active frame of the composite. (Please see the discussion of **Color Composite** and **Image Sequences** that follows this section.)

Background: Select one of the available images to be the background color in this combo box. The rest of the image planes are subtracted from the background image — effectively punching holes into it and allowing the foreground colors to show without mixing with the background. This is most effective where the background covers large areas and the other images have smaller objects within the background objects;

Background allows the other inputs to be displayed in front of the background inputs, minimizing color

mixing. For example, the **App** can display a red dot on a blue background without turning the dot to magenta. Selecting **None** causes all images to be equally mixed.

New: Click the **New** button to discard the current color composite image, and start over;

The **Source Images** combo box will reset to include all gray scale images (including floating point images). Selecting an image from the list will create a new composite the same size as the initial selection. As mentioned previously, the source images list will be filtered to contain only images of the same size as the initial selection.

12.6 Segmentation & Count...

Choose **Process>Segmentation & Count** command to realize the segmentation and count of the interested image. The arrangement of **Segmentation & Count** is very special and some explanations are needed here to clarify it in details:

1. The function provides users with five methods which are **Watershed (W)**, **OTSU Dark**, **OTSU Bright**, **RGB Histogram**, **HSV Histogram** and **Color Cube**. Users can select any one of those 5 methods, but after selecting any one of them, the others will be disabled;
2. After segmentation, there may exist adhesions. Then what we should do is segment connected object manually by choosing **Split Objects** function;
3. When the users get the expected results, they can choose **Counting Results** menu and get the statistics and analysis results.

According to the counting result, you can go back from step 2 or 3 to step 1 or 2 to repeat segmentation or split objects operation.

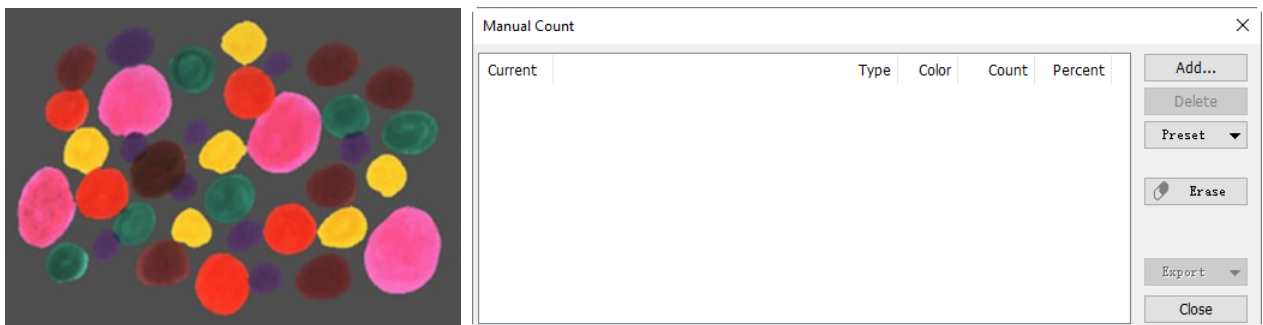
Note: If the users choose **None** in the **Label** button at the **Count Options** dialog, then regardless of the type of **Method** set, there is no **Label** for **Index**, **Area** or **Perimeter** on the image. But the **None**, **Circle** and **Ellipse** will show the segmentation results. That's why the **App** name the menu as **Segmentation & Count**. That is, this function can achieve either the image **Segmentation** or **Count**. In this regard, please refer to the **Process>Segmentation & Count > Watershed** in the **Count Options** dialog.

12.6.1 Manual...

Manual cell counting is still the golden standard method of cell counting in many labs but the time at the microscope counting cells is both laborious and time-consuming.

The **App**'s **Manual** counting method is a "touch count" method. As a fact, the user "touches", e.g. clicking with the mouse every single object to be counted on the image. It is possible to count different object categories and label them with different **Types** and **Colors**, in order to separate them in a proper way.

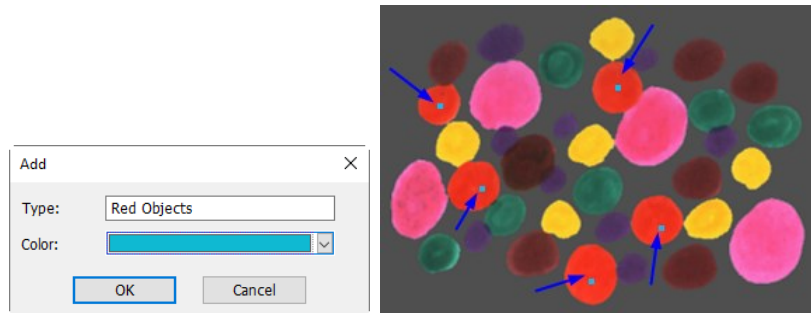
Open or capture an image and choosing **Process>Segmentation & Count>Manual...** command will invoke the **Manual Count** dialog as shown below:



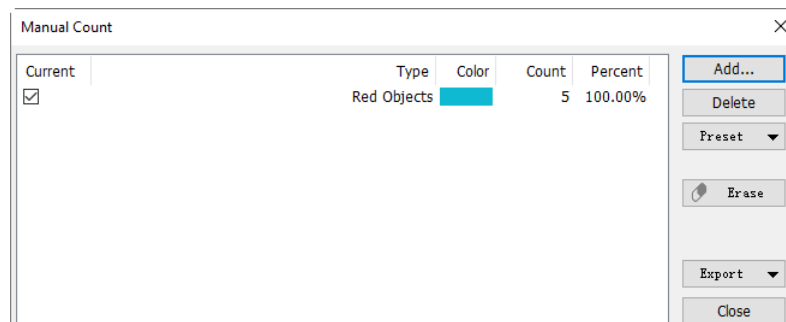
The current list box has no items. It means no count is performed. There are 5 red to be counted red object on the above left image.

Add...: Clicking **Add...** button will pop up the **Add** dialog as shown below on the left side, define the name in the **Type** edit box and **Color** in the list box. Here, the name is **Red Objects** and the color is █. Click

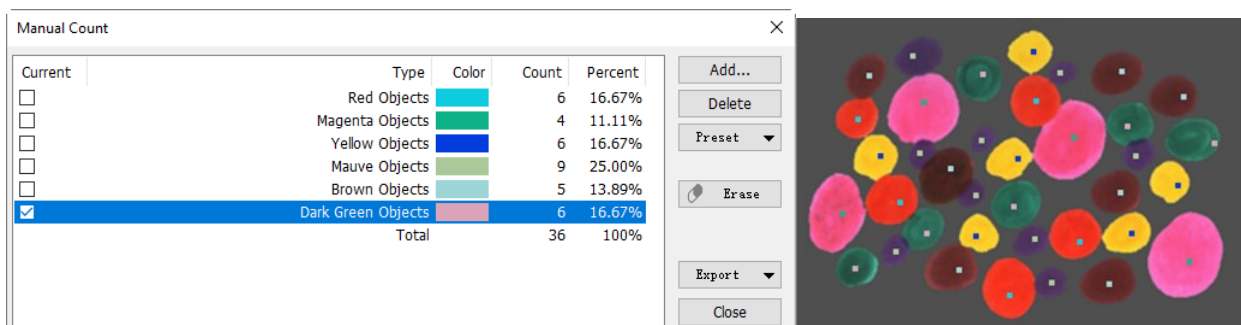
Ok to return to the **Manual Count** dialog. Move the mouse to the on the image and click it on the to be counted objects continuously to mark the object with the defined **Color**.



The final manual count results for the **Red Objects** are shown below at the first row in the list box. One can find that the **Count** number is 5, the **Percent** is 100%.



Continue the above process and count all the objects with different color. The final results on the **Manual Count** dialog are list as below:



Delete: Delete the unwanted items(Always be the **Current** checked one);

Preset:

Save•••: Save the current **Manual Count** results with the preferred name such as **ColorDot_en**. The saved. The name will be attachment to the end of the **Preset** list box;

Management•••: Choosing **Management** can **Rename** and **Delete** the saved items;

Erase: Becomes active only when the **Objects** inside the images have been “touched”. By activating the **Erase** key, mouse cursor changes its shape and clicking every single object will **Erase** it from the image and from the **Count** sheet.

Export: Once the counting is finished it is possible to click on **Export**: all the count results will be directly exported to an **Excel** sheet or clipboard by choosing **Export to Microsoft Excel** or **Export to Clipboard**.

Current: The active label for the object to be counted; Click on the checkbox beside the object to be counted in **Current** and move the mouse in the image: the cursor will change its shape, allowing to “touch” every single object belonging to that category.

Type: Definition or name for the object to be counted;

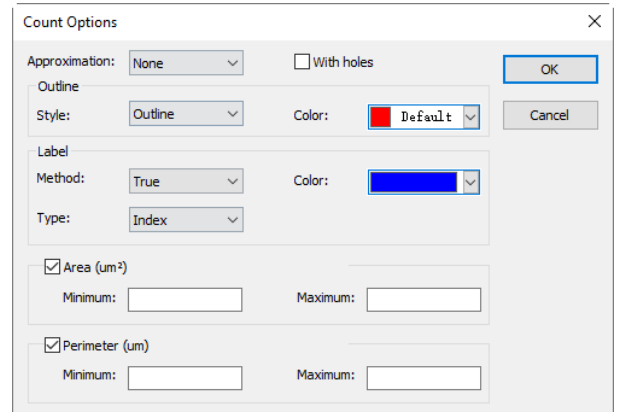
Color: Label **Color** assigned to the object;

Count: The counting number made for that object;

Percent: Percentual calculation of that category (if more than one category has to be counted).

12.6.2 Watershed ●●

Watershed segmentation method is a mathematical morphology segmentation method, which based on topological theory. The basic idea is taking the image as a topological geomorphology on geodesy, and each image pixel gray value indicates the altitude, boundaries of each local minimum value and its impact area called catchment basins and the formation of watershed catchment basins. So the formation of the watershed concept can be illustrated by simulating the immersion process. In each local minimum value of the surface, piercing a hole, then the entire model slowly immersed in water, with the immersion of the deepening impact of the domain of each local minima slowly expands outward in two catchments basin at the confluence build dams that form the watershed.



Watershed is suitable for relatively simple background target object or target object with a relatively large difference between the background images instead of the more complex application.

Choose **Process>Segmentation & Count> Watershed●●**, there will pop up the following dialog:

Note: **Segmentation & Count** function only works for 24 bits, otherwise all the sub-menu items will be disabled. Users can change the **Color Bits** to 24 bits by choosing **Image>Mode>Color Quantize●●**.

Approximation: **Approximation** including 3 options: 1)**None**: drawn the actual outline of the segmented object; 2)**Circle**: The actual outline fitting into a perfect circle, users can get fit **Radius** of each object in the **Count Result** dialog; 3)**Ellipse**: The actual outline fitting into an ellipse, users can get fit Axis of each object in the **Count Result** dialog;

With Holes: When checking **With Holes** function, the segmented object's **Outline** will be marked with **Color**. Meanwhile the holes are also marked with **Color** and its parameters will be output in the image (**Hole** is defined as the target grayscale or the color close to the background pixels). The left figure below is the segmentation result without checking **With Holes**; the right below is on the contrary. **With Holes** option is usually used to get hole parameters;

Outline>Style: Including 3 options: 1)**Outline**: objects are marked by outline, the color can be user-defined; 2)**Filled**: the segmented objects will be filled with custom colors; 3)**None**: no marked outline for the segmented object;



Color: Custom colors used to mark the **Style**;

Label: Method: Including 3 options: 1)**XOR**: with the current pixel's **XOR** color to mark the current object segmentation; 2)**True**: marked with the specified **Color**; 3)**False**: no mark for the objects;

Note: If users choose **False** in the **Label** group box, then regardless of the type of **Method**, there is no display for **Index**, **Area** or **Perimeter**. But the **None**, **Circle** and **Ellipse** will displayed on the segmented image. That's why the **App** call it **Segmentation & Count**;

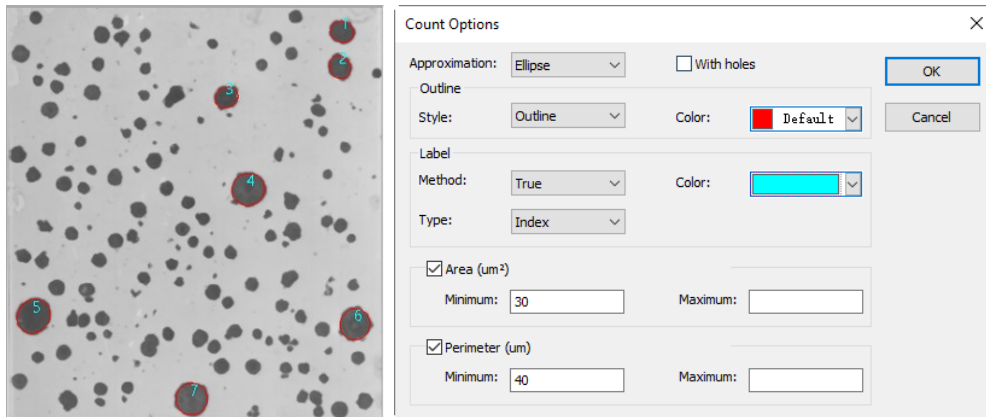
Color: Custom **Color** used to represent the color of **Label**. When selecting **XOR** in the **Method**, the **Color** selection will be disabled, but the **App** will automatically mark the segmented image with the current pixel's **XOR** color;

Type: Including 3 options: 1) **Index**: use numbers to mark the segmented object. 2) **Area**: the object area is marked by outline area size. 3) **Perimeter**: the object perimeter is marked by the outline perimeter;

Area:

Minimum: determine the lower limit of the area, that is, if the object area is less than the lower limit, it will not be included;

Maximum: determine the upper limit of the area, that is, if the object area is greater than the upper limit, it will not be included;

**Perimeter:**

Minimum: determine the lower limit of the perimeter, that is, if the object perimeter is less than the lower limit, it will not be included;

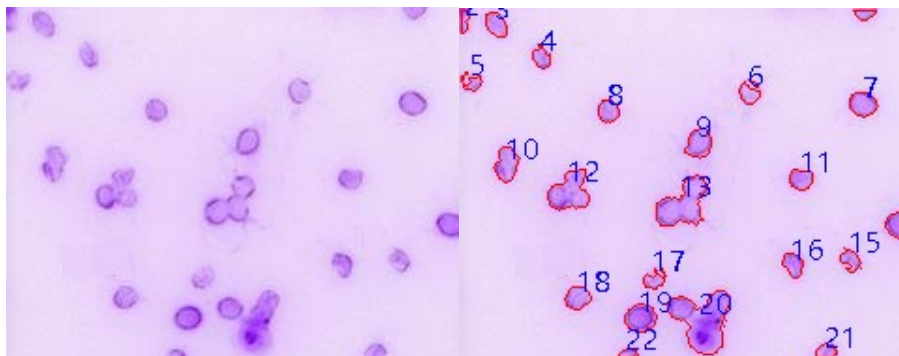
Maximum: determine the upper limit of the perimeter, that is, if the object perimeter is greater than the upper limit, it will not be included;

The figure above shows image **Segmentation & Count** results with **Watershed** method with setting in **Count Option** dialog.

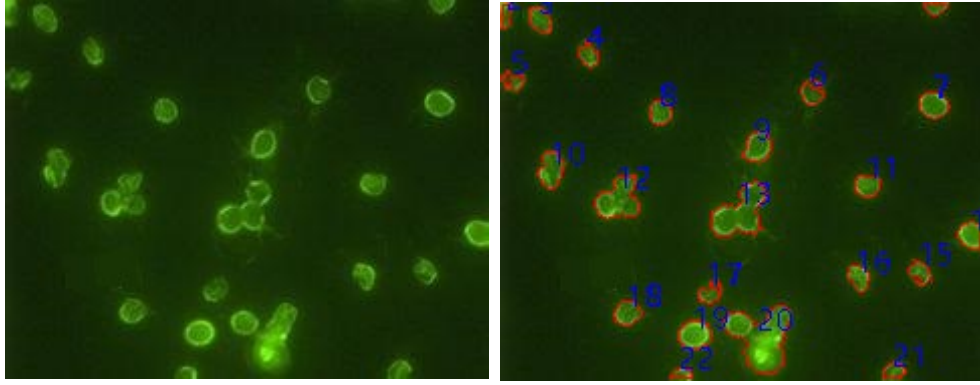
12.6.3 OTSU Dark...

OTSU is proposed in 1979 by Japanese scholars, which is a method to determine the threshold of an adaptive, also known as **OTSU** method, referred to as **OTSU**. It is based on the gradation characteristic of the image, and divided the image into the background and the target. The bigger the **OTSU** is between background and the target, the larger difference between the two parts images. The wrong part of the background or the wrong part of the target will lead to smaller differences between the two parts. Therefore, the maximum **OTSU** means the minimum probability of misclassification.

OTSU Dark segmentation method means segment the dark object from the bright background using **OTSU** algorithm. Its **Count Options** dialog is exactly the same with the **Watershed Count Options**. Below are bright background with dark object (bottom left) and its segmentation result (bottom right) for reference:

**12.6.4 OTSU Bright...**

OTSU Bright segmentation method means segment the bright object from the dark background using **OTSU** algorithm. Its **Count Options** dialog is exactly the same with the **Watershed Count Options**. Below are dark background with bright object (bottom left) and its segmentation result (bottom right) for reference:



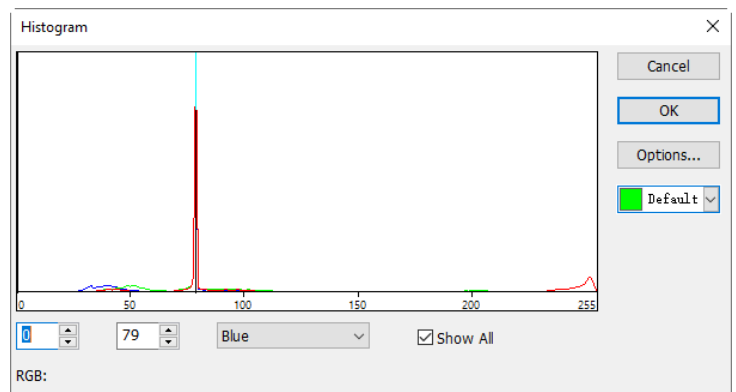
12.6.5 RGB Histogram***

RGB Histogram segmentation is based on image histogram where image pixels between a specified histogram upper and lower range will be color processed. The segmented area can be adjusted by mouse to drag two vertical lines in histogram, or by inputting precise value in **RGB** upper and lower edit box directly and clicking Enter to make it effective. The **Color** representing the segmentation area can be customized by system palette. For a 24-bit true color image, segmentation can be realized by **R**, **G**, **B** channels respectively.

Choose **Process>Segmentation & Count>RGB Histogram***** shows **Histogram** dialog, each function is specified as below:

: **Left Value** in the currently selected region of histogram segmentation, corresponding to **Left Vertical Line** position in histogram. Users can segment the pixels bigger than the **Left value** by inputting a value in this edit box or dragging the **Left Vertical Line** in histogram. When input a **Left Value** in this edit box, users should click enter to make the value effective. Meanwhile, the **Left Vertical Line** will move to the place the **Left Value** represents. **Left Value** range: 0~current **Right Value**. The current **Left Value** is 0;

: **Right Value** in the currently selected region of histogram segmentation, corresponding to **Right Vertical Line** position in histogram. Users can segment the pixels, bigger than the **Left Value** and smaller than **Right Value**, by inputting a value in this edit box or dragging the **Right Vertical Line** in histogram. When input a value in this edit box, users should click enter to make the value effective. Meanwhile, the **Right Vertical Line** will move to the place the **Right Value** represents. Range: The current **Left Value** ~255;



: A histogram channel of the currently **RGB** histogram. It can be **R** histogram, **G** histogram or **B** histogram;

Show All : Show all channel **RGB** histogram. When uncheck **Show All**, only a selected histogram channel will be shown;

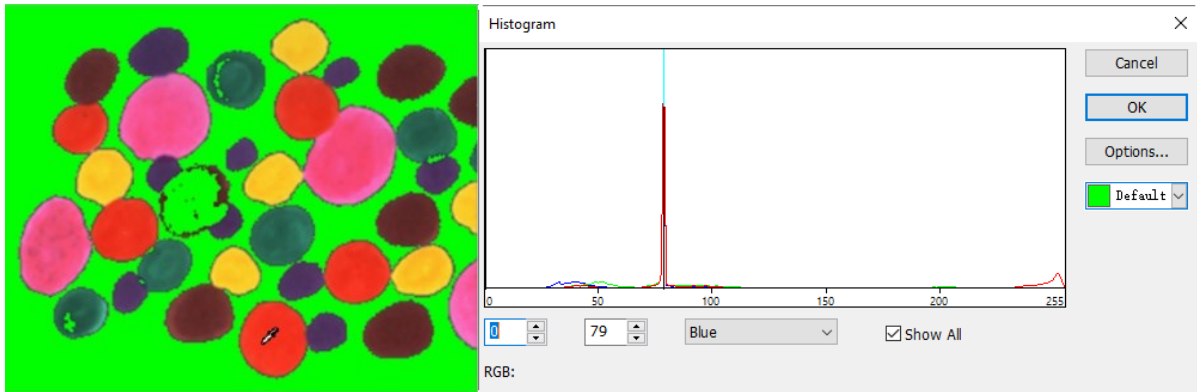
: Used to identify the **Color** of the segmented pixels; the default is green;

Options... : When users click **Options...** button, a **Count Options** dialog pops up as below. The setting of **Count Options** dialog is the same as that of **Watershed's Count Options** dialog, details can be referred to **Process>Segmentation & Count>Watershed(W) ...**;



Example of **RGB Histogram** is as follows:

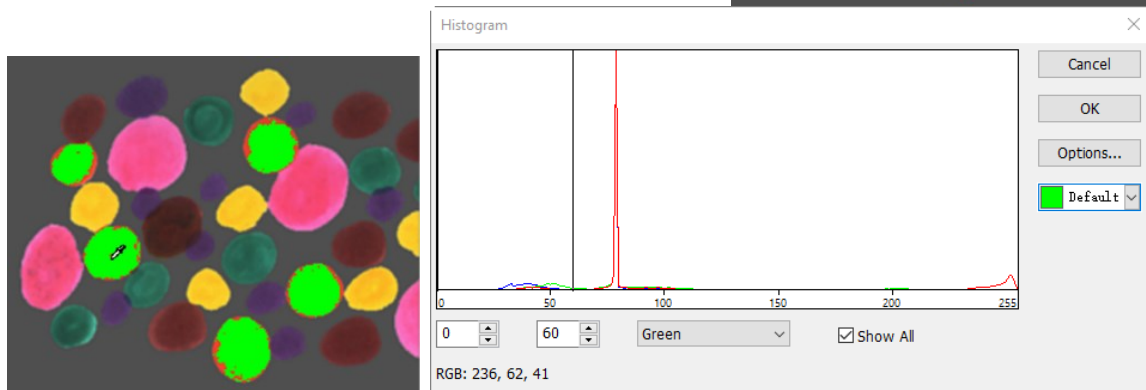
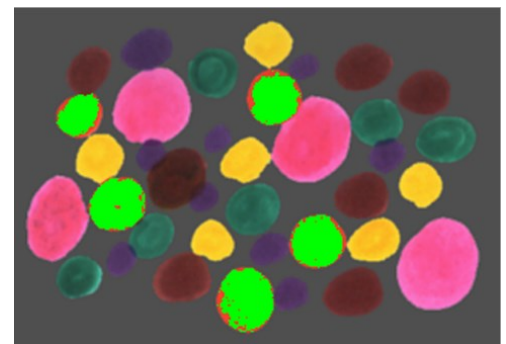
1. Open an image and then choose **Process>Segmentation & Counting>RGB Histogram...** menu, a **Histogram** dialog shows as below. When the mouse moves in the image area, the cursor will be displayed as **Color Picker Cursor**;



2. Move **Color Picker Cursor** to any pixel of the image, shown as above, **RGB** value of the current pixel will be displayed in the bottom **Histogram** window. Here **R** is 249, **G** is 51, **B** is 31, showing the **RGB** value of the ideal segmentation area, record the three values.
3. Move the mouse to the background area, the **RGB** value of **Color Picker Cursor** is 79, 79, 79. In order to accurately segment out the target, users can set **RGB** values of the segmented pixels in the initial interval, and those of background out of the initial interval. For example, the **RGB** values can be set to the initial interval as follows: **R** is set to the initial interval: 200~255; **G** is set to the initial interval: 0~60; **B** is set to the initial interval: 0 ~ 60;

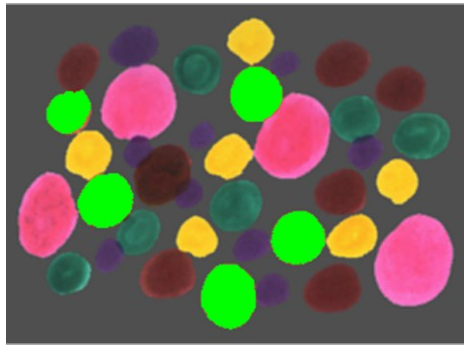
When setting completed, the segmentation effect is shown on the right side.

4. Move again the **Color Picker Cursor** to any other unshaded pixels, then the **RGB** value shown in left bottom of histogram is 236, 60, 41 as below:



It's easily found that here **G** channel, defined 60, is too small to get the pixel segmented. Then initial interval for **G** channel can be adjusted from 0~60 to 0~80 to segment the pixels nearby. (**Note**: If the background

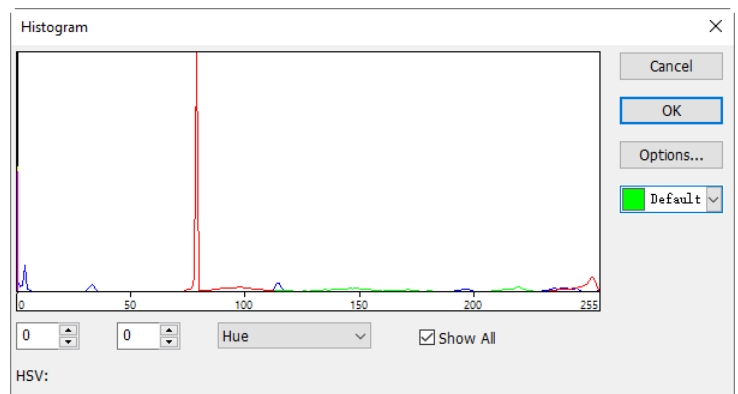
pixels of a single channel is within the initial interval, no segmentation change will take place. Only all three channels of the background pixels are within the initial intervals can the pixels be segmented) The segmentation effect by readjusting **G** initial interval is shown as below:



5. Repeat step 4 and readjust initial interval of each **RGB** channel to achieve perfect segmentation.

12.6.6 HSV Histogram***

HSV Histogram segmentation is based on image histogram where image pixels between a specified histogram upper and lower range will be color processed. The segmented area can be adjusted by mouse to drag two vertical lines in histogram, or by inputting precise value in **HSV** upper and lower edit box directly and clicking Enter to make it effective. The **Color** representing the segmentation area can be customized by system palette.



For a 24 bits true color image, segmentation can be realized by **H**, **S**, **V** channels respectively.

Choose **Process>Segmentation & Count>HSV Histogram***** command shows **Histogram** dialog as above, each function is specified as below:

: **Left Value** in the currently selected region of histogram segmentation, corresponding to **Left Vertical Line** position in histogram. Users can segment the pixels bigger than the **Left value** by inputting a value in this edit box or dragging the **Left Vertical Line** in histogram. When input a **Left Value** in this edit box, users should click enter to make the value effective. Meanwhile, the **Left Vertical Line** will move to the place the **Left Value** represents. **Left Value** range: 0~current **Right Value**. The current **Left Value** is 0;

: **Right Value** in the currently selected region of histogram segmentation, corresponding to **Right Vertical Line** position in histogram. Users can segment the pixels, bigger than the **Left Value** and smaller than **Right Value**, by inputting a value in this edit box or dragging the **Right Vertical Line** in histogram. When input a value in this edit box, users should click enter to make the value effective. Meanwhile, the **Right Vertical Line** will move to the place the **Right Value** represents. **Right Value** range: current **Left Value** ~255. The current **Right Value** is 79;

Hue : A histogram channel of the currently **HSV** histogram. It can be **H** histogram, **S** histogram or **V** histogram;

Show All : Show all channel **HSV** histogram. When uncheck **Show All**, only a selected histogram channel will be shown;

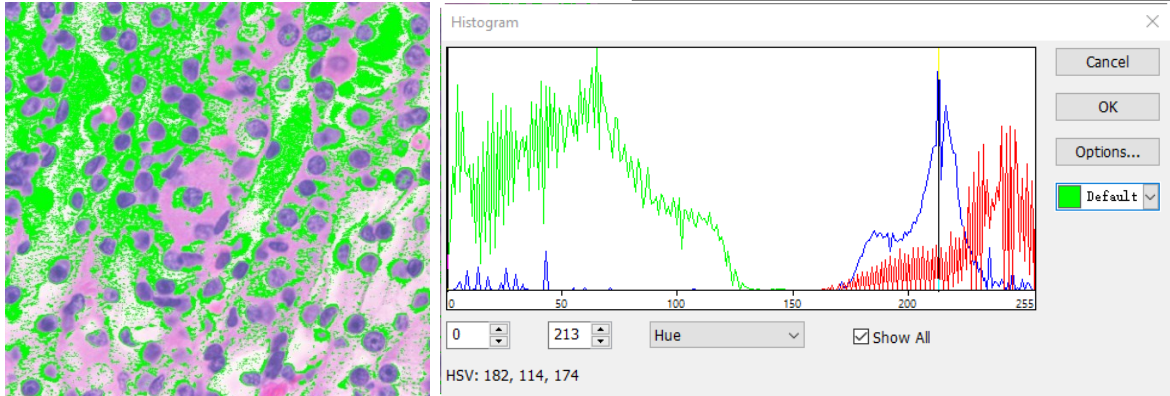
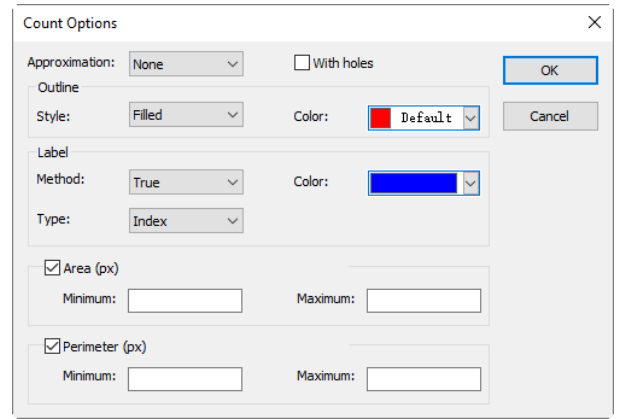
: Used to identify the **Color** of the segmented pixels; The default is green;

Options... : When users click **Options***** button, a **Count Options** dialog pops up as below. The setting of **Count Options** dialog is the same as that of **Watershed's Count Options** dialog, details can be referred to

Process>Segmentation & Count>Watershed...

Example of HSV Histogram is as follows:

1. Open an image and then choose Process>Segmentation & Counting>HSV Histogram... menu, a Histogram dialog shows as below. When the mouse moves in the image area, the cursor will be displayed as Color Picker Cursor;

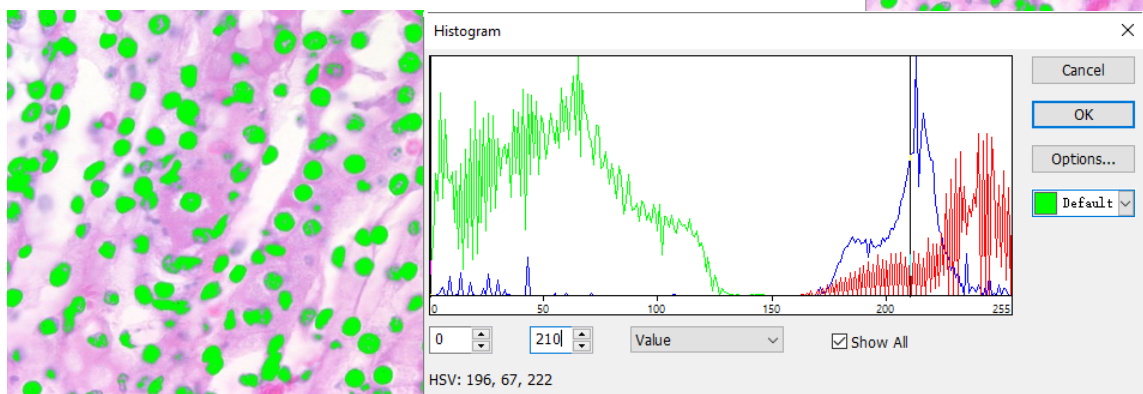
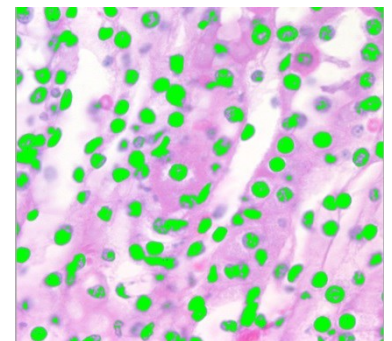


2. Move Color Picker Cursor to any pixel of the image, shown as above, HSV value of the current pixel will be displayed in the bottom Histogram window. Here H is 182, S is 114, V is 174, showing the HSV value of the ideal segmentation area, record the three values;
3. Move the mouse to the background area, the HSV value of Color Picker Cursor is 214, 87, 228. In order to accurately segment out the target, users can set HSV values of the segmented pixels in the initial interval, and those of background out of the initial interval. For example, the HSV values can be set to the initial interval as follows:

- H is set to the initial interval: 60~200;
- S is set to the initial interval: 90~130;
- V is set to the initial interval: 0~210;

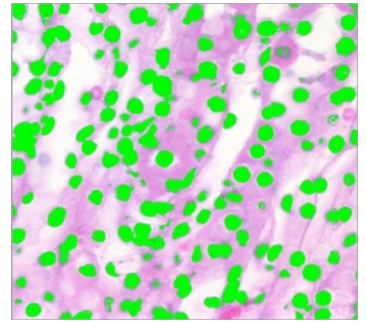
When setting completed, the segmentation effect is shown as below:

4. Move again the Color Picker Cursor to any other unshaded pixels, then the HSV value shown in left bottom of histogram is 196, 67, 222 as below:



It's easily found that here **S** channel, defined 90~130, its lower limit is too big to get the pixel segmented. Then initial interval for **S** channel can be adjusted from 90~130 to 60~130 to segment the pixels nearby.

Note: If the background pixels of a single channel is within the initial interval, no segmentation change will take place. Only all three channels of the background pixels are within the initial intervals can the pixels be segmented) The segmentation effect by readjusting **S** initial interval is shown on the right side.

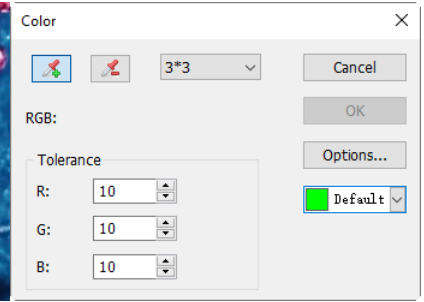
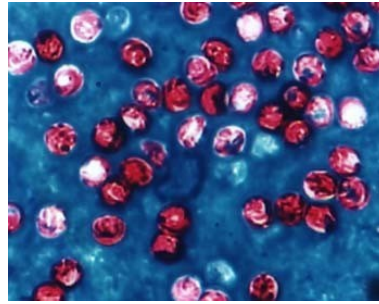


5.Repeat step 4 and readjust initial interval of each **HSV** channel to achieve perfect segmentation.

12.6.7 Color Cubic...


Open an image and choose **Process>Segmentation & Count>Color Cube...**, a dialog called **Color** will pop up as shown on the right side;


At this moment, the **Colorizing Pipette** is checked by default. Click the image will set the average color value in the masked area as **Basic Value**.




The **App** will segment the image by choosing the pixel within **Basic Value±Tolerance** color range and mark it with current selected **Color**. By clicking the target pixel repeatedly, the **App** can continuously add new pixels within the **Basic Value±Tolerance** color range into the target and thus acquiring continuous segmentation colorizing.

When some undesirable pixels have been added into the segmentation data, the **De-Colorizing Pipette** can be used to wipe off the undesirable pixels. This operation process is the same as **Colorizing Pipette**, that is, to set the average color value of the clicked-pixel's **Mask Area** as **Basic Value** and wipe off the segmentation data, which is within the **Basic Value±Tolerance** color range.

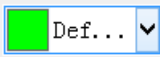
 **Colorizing Pipette:** Collect average color value of the clicked-pixel's **Mask Area** as **Basic Value** and add pixels which are within **Basic Value±Tolerance** color range into the segmentation data;

 **De-Colorizing Pipette:** Collect average color value of the clicked-pixel's **Mask Area** as **Basic Value** and wipe off the segmentation data, which is within the **Basic Value±Tolerance** color range;

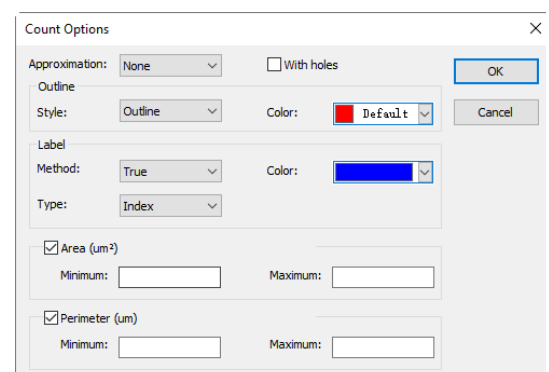
3*3  **Mask Area:** When **Colorizing Pipette** or **De-Colorizing Pipette** is used to click the image, a **Mask Area** is also needed to calculate the average color value of the clicked pixel. The **Mask Area**'s color value will be used as **Basic Value**. Color values within the **Basic Value±Tolerance** range can be added to or wiped off from the segmentation data. The default **Mask Area** is 3*3, other options are 1*1, 5*5, 7*7;

RGB: The average **RGB** values of the **Mask Area**;

Tolerance: There are 3 **Tolerance** values, they are **R**, **G** and **B**. User can make fast and accurate object segmentation by selecting a proper **Tolerance** value according to their experience. The default **R**, **G** and **B** Tolerance values are 10;

 **Def... :** Used to mark the color of the segmentation area; The default **Color** is green;

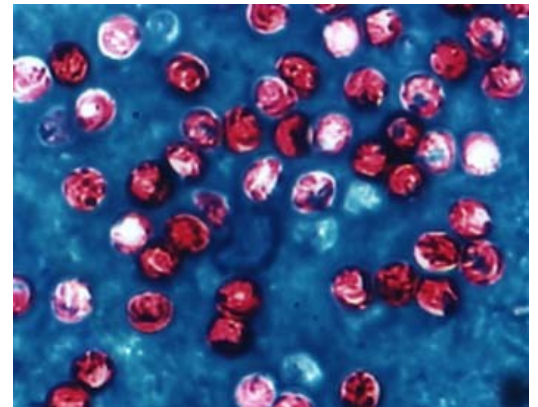
 **Options...** : When clicking the **Options** button, a **Count Options** dialog as below will pop up. This dialog



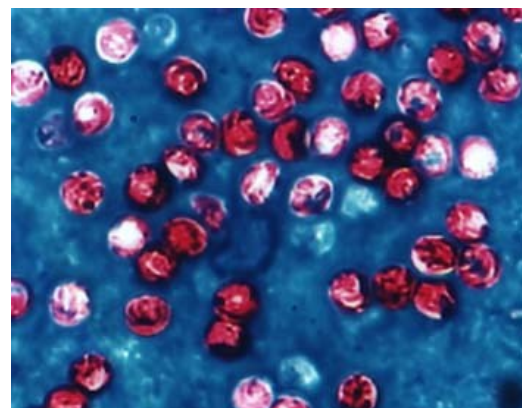
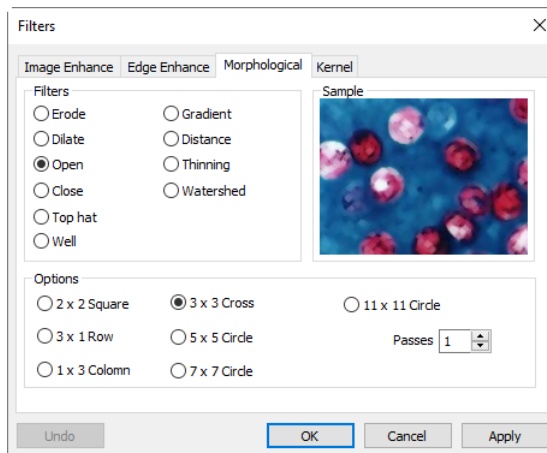
is the same as that in [Process>Segmentation & Count>Watershed...](#). Please refer to [Process>Segmentation & Count> Watershed...](#) for the detailed operation of this dialog;

Here is an example to demonstrate the [Color Cubic](#) segmentation process:

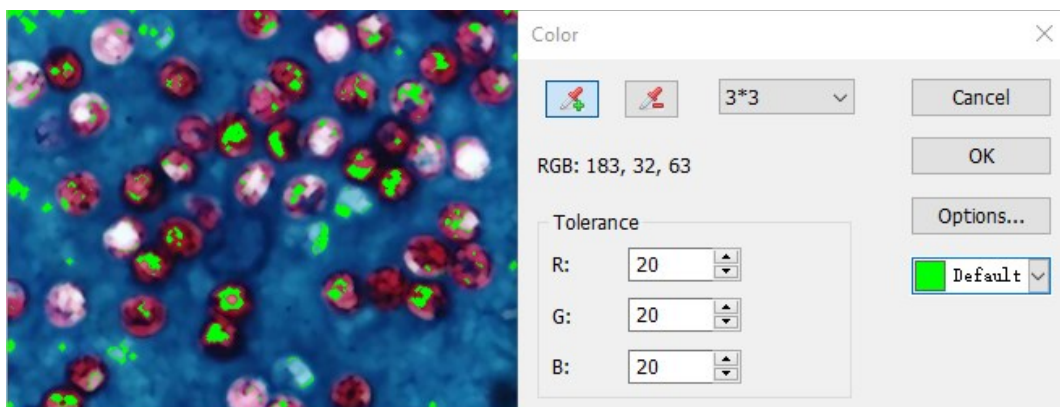
1. [Open](#) an image as shown on the right side;



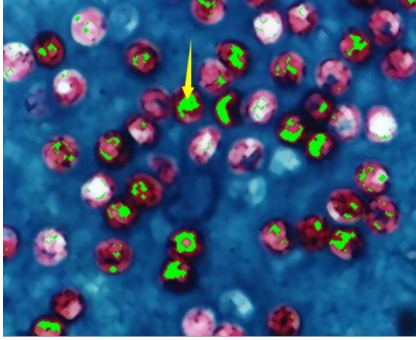
2. Because of the inevitable noise in the image, an image smooth operation should be done first. There are many algorithms to perform the image smooth operation and here we are to process it as follows: choose [Process>Filter](#) menu and click [Morphological](#) property page and a dialog will pop up with parameters as shown in the figure below on the left side. Click [OK](#) and the final smoothed image is shown below on the right side;



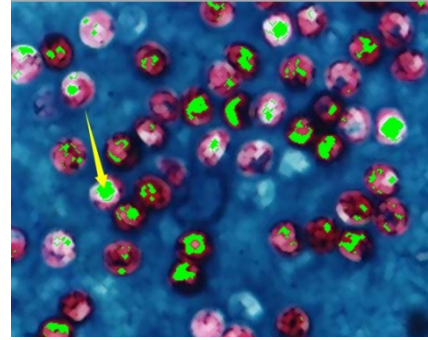
3. Choose [Process>Segmentation & Count> Color Cube...](#), a [Color](#) dialog will pop up as shown below;



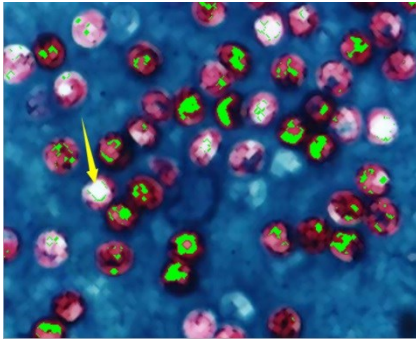
4. At this moment, the [Colorizing Pipette](#) is checked. Click the pixel wish to segment. That is to say, select the color area which is interested in. If some undesirable color area is included in the segmentation area, just check the [De-Colorizing Pipette](#) and click the undesirable pixels, thus the undesirable pixels will be wiped off. When the segmentation process is completed, click [OK](#) and the [Segmentation & Count](#) operation will be carried out;



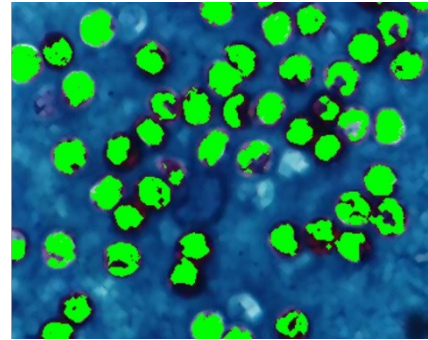
The result of segmentation after the first clicking at the pointed area with [Colorizing Pipette](#)



The result of segmentation after the second clicking at the pointed area with [Colorizing Pipette](#)

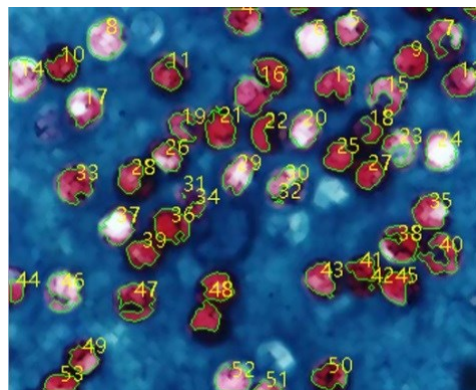


The result of segmentation after the second with the [De-Colorizing Pipette](#) (slight difference exists as inaccuracy in position)



The result of segmentation after countless clicking with [Colorizing Pipette](#)

5. Click [Options](#) to set [Outline](#), [Label](#) and etc., the final results is shown below. So far the primary segmentation is completed.

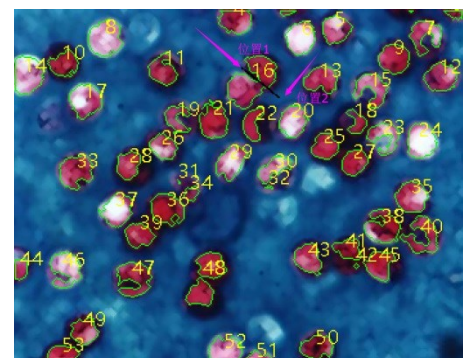


12.6.8 Split Objects

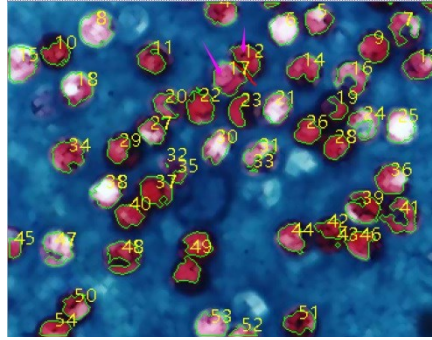
It can be found out in this segmentation, particle #16 (located in the upper middle of the image) is not a single object but actually two separate one. However they have been calculated as a single object. Choosing [Split Objects](#) will correct this problem. Object splitting with [Split Objects](#) is discussed below.

As is shown in the image below, move the cursor onto target #16. Click the left mouse button and draw a straight line.

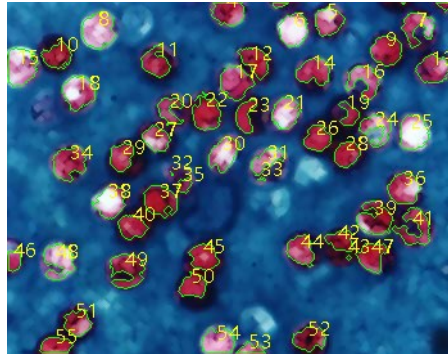
When pressing down the left mouse button, the cursor should not touch the target — the starting point of the split line should be off the target that is to be separated. Move the cursor to the bottom right of the target — the ending point of the split line should also be off the target that is to be separated. Release the left mouse button when this operation is completed. A split line is shown between the two adhesive objects as shown below:



After the left mouse button is released, the [App](#) will re-count the whole image. The result of re-counting is shown as below. The previous #16 turns out to be #12 and #17 now:



Unchecking or choosing **Split Objects** menu again will hide the split line. The final result of hiding the split line is shown as below. The whole **Split Objects** process is completed when the split line is hidden.



12.6.9 Count Result...

Count Result is a way to show count statistical result of the current image. **Count Result** dialog includes **Index**、**Center**、**Radius**(major-minor axis or non), **Area** and **Perimeter**, as is shown below. The unit of statistical result is the same as what the user selects in the Unit for the displayed image. Click **Index**、**Center**、**Radius** (major-minor axis or none), **Area** and **Perimeter** and the statistical result will be automatically sorted according to their data. Choosing a certain item can check the split object in the image. In the meanwhile, **Index** (or **Area** and **Perimeter**) of the other targets will be hidden automatically.

The **Center** column in **Result** is relevant to the **Approximation** option in the **Options** dialog. When selecting **Circle**, radius of the circle will be listed as **Radius** column and when choosing **Ellipse**, major-minor **Axis** of the **Ellipse** will be listed as **Axis** column; when selecting **None**, no column shows up.

Click **Export** and then the statistical result, together with the image of **Segmentation & Count**, will be exported to an **Excel** sheet for further analysis and processing.

Index	Center	Area	Perimeter
1	(435045.34, 510105.56)	262971304.25	96385.44
2	(588321.65, 510550.62)	285897725.69	88308.52
3	(198188.79, 503401.51)	380718604.60	129547.81
4	(162126.44, 497422.19)	438507187.50	114939.31
5	(338798.96, 485907.29)	392794353.30	110010.81
6	(98292.71, 477705.21)	10115627.17	38881.40
7	(635766.04, 482307.67)	394649468.32	103853.40
8	(77787.50, 471619.79)	466823943.14	135443.85
9	(248046.87, 471487.50)	449777886.28	133444.57
10	(46657.18, 471369.13)	466893947.48	215270.13
11	(218678.12, 457200.00)	3640225.69	24711.28
12	(359436.46, 463946.87)	430631699.22	133198.79
13	(203580.40, 462205.22)	434271924.91	118616.89
14	(146314.58, 451379.17)	3850238.72	31189.68
15	(127264.58, 462491.67)	502281141.49	129596.43
16	(184414.58, 449130.21)	13545839.84	21434.48
17	(320220.70, 451830.08)	596681994.36	135224.66
18	(200540.15, 451530.08)	46734935.00	120403.61

12.7 Denoise

The **App** provides 3 types of noise removal methods, **Adaptive Wiener Filter**, **Bilateral Filter** and **Non Local Means**. The processing speed of the 3 methods is from fast to slow, and the denoising quality is getting

better and better. Each method is described in detail in the following:

12.7.1 Adaptive Wiener Filter

The **Adaptive Wiener Filter** can preserve more image details than those of median filter, mean filter, Gauss filter. The effect is more remarkable for additive noise (such as Gaussian noise) and multiplicative noise (such as Poisson noise).

For the **Adaptive Wiener Filter** algorithm, please find its details in the relevant literatures, here only to illustrate the improvement of **Adaptive Wiener Filter** over the classical **Wiener Filter**.

In the classical **Wiener Filter**, the image noise intensity requires the user to manually input, but it is difficult to accurately enter the accurate value even for experienced users, because the value is usually very small, such as 0.0036781. Therefore in the development of the **Adaptive Wiener Filter**, the noise level is automatically calculated according to the image mean variance.

The process is quite simple, open an image, choose **Process>Denoise>Adaptive Wiener Filter** command to denoise the image.

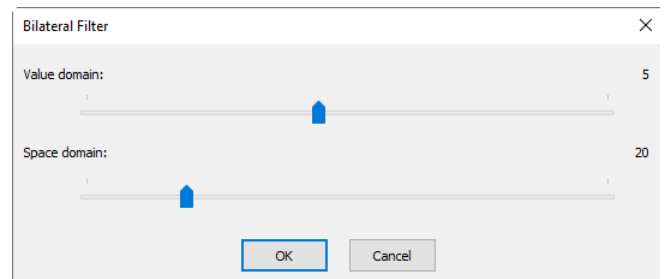
12.7.2 Bilateral Filter

The **Bilateral Filter** is a nonlinear filtering method that considers image spatial proximity, pixel value similarity, image spatial information and gray level similarity to achieve the purpose of edge preserving denoising. The **Bilateral Filter** has the simple, non-iterative, local characteristics. The **Bilateral Filter** is good to preserve image edge compare with **Wiener Filter** or Gauss filter.

Choosing **Process>Denoise>Bilateral Filter** will pop-up a dialog called **Bilateral Filter** shown on the right side:

Value domain: the range of neighborhood pixel in radius for considering, the greater the value, the slower the processing speed.

Space domain: Sigma value, the higher the value, the more effective the denoising effect.



12.7.3 Non Local Means

The traditional local mean filter is a pixels average method around the target pixel, but the **Non Local Means** is a weighted average method to average all of the image patches over the search window. The weight is determined according to the similarity between the target patch and neighborhood patches in the search window.

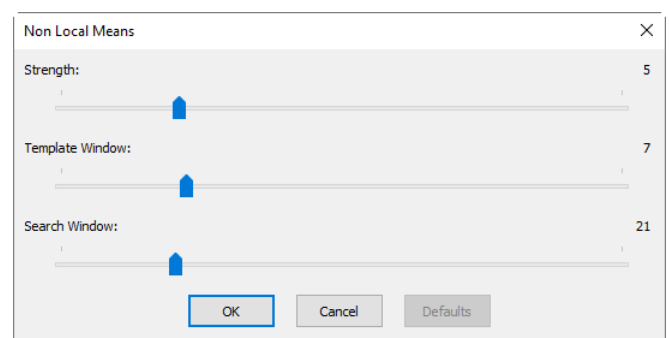
Compared to other famous denoising algorithms, such as Gaussian, **Wiener Filter**, total variation and wavelet denoising, The **Non Local Means** method can get better effect.

Choosing **Process>Denoise>Non Local Means** will pop-up a dialog called **Non Local Means** as shown on the right side.

Strength: The denoising strength, the greater the value, the more removal the image noise, but will lose more details;

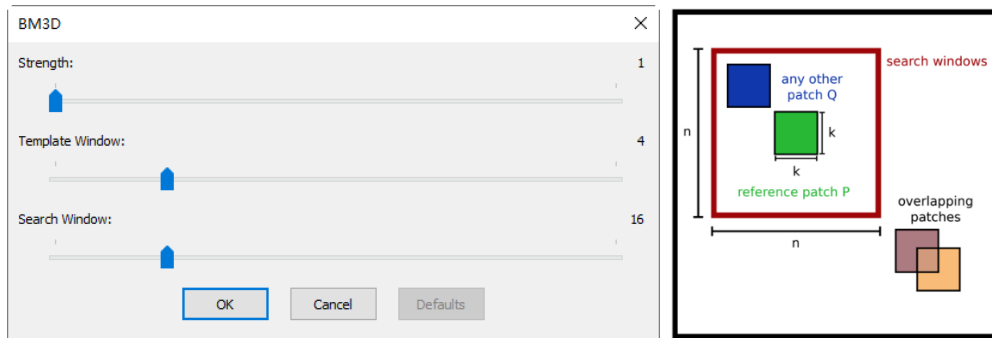
Template Window: The template block size, used to calculate the weight, the recommended default value is 7;

Search Window: The template patch search window size, used to calculate the weighted average value among image patches. Large value will increase the processing time. The recommended default value is 21.



12.7.4 BM3D

Block-matching and 3D filtering (**BM3D**) is a 3-D block-matching algorithm used primarily for noise reduction in images



Strength: The denoising strength, the greater the value, the more removal the image noise, but will lose more details, the defaults is 1;

Template Window: The template block size $k \times k$, used to calculate the weight, the recommended default value is 4×4 ; range: $1 \times 1 \sim 16 \times 16$;

Search Window: The template patch search window size $n \times n$, used to calculate the weighted average value among image patches. Large value will increase the processing time. The recommended default value is 16×16 ; range: $4 \times 4 \sim 64 \times 64$.

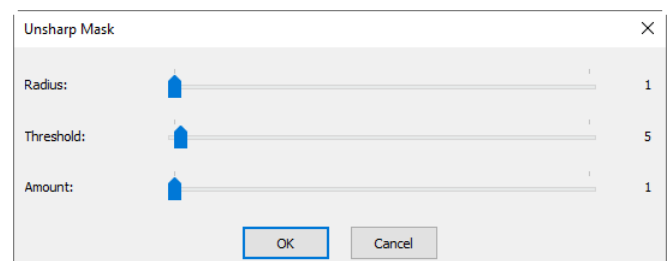
12.8 Sharpen

12.8.1 USM...

Unsharp Masking (USM) is an image sharpening technique, often available in digital image processing software. The "unsharp" of the name derives from the fact that the technique uses a blurred, or "unsharp", positive image to create a mask of the original image. The unsharped mask is then combined with the negative image, creating an image that is less blurry than the original one.

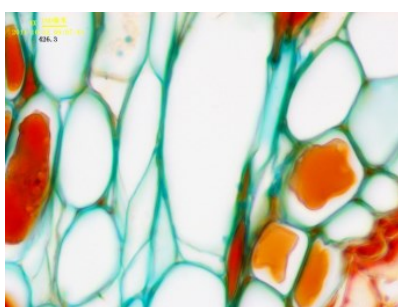
Open an image and then choose **Process>Sharpen>USM...** command, a dialog will pop up as shown below:

Radius: Affect the size of the edges to be enhanced, so a smaller radius enhances smaller-scale detail. Higher **Radius** values can cause halos at the edges. As a result, fine detail needs a smaller **Radius**. In addition, **Radius** and **Amount** interact; reducing one allows more of the other.

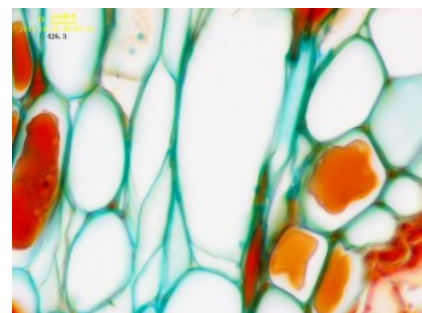


Threshold: Controls the minimum brightness change that will be sharpened. This parameter is important to prevent smooth areas from becoming speckled. The **Threshold** setting can be used to sharpen more-pronounced edges, while leaving subtler edges untouched. Low values should sharpen more because fewer areas are excluded. Higher threshold values exclude areas of lower contrast.

Amount: is listed as a percentage, and controls the magnitude of each overshoot (how much darker and how much lighter the edge borders become). This can also be thought of as how much contrast is added at the edges. It does not affect the width of the edge rims.



a) Original image

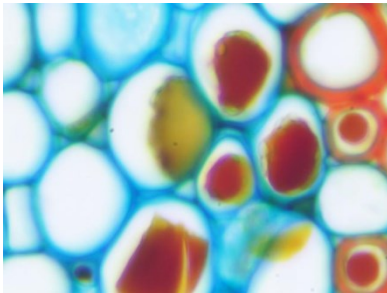


b) Sharpened image

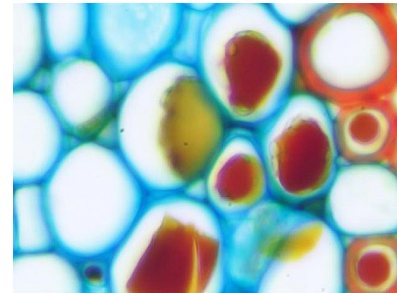
12.8.2 Laplacian Sharpen

The **Laplacian** operator is an example of a second derivative method of enhancement. It is particularly good at finding the fine detail in an image. Any feature with a sharp discontinuity (like noise, unfortunately) will be enhanced by a **Laplacian** operator. Thus, one application of a **Laplacian** operator is to restore fine detail to an image which has been smoothed to remove noise.

Open an image and then choose **Process>Sharpen>Laplacian Sharpen**, no parameter is required for this method.



a) Original image;



b) Sharpened image

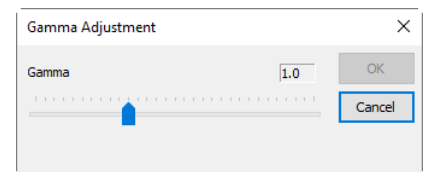
12.9 Color Toning

12.9.1 Gamma...



The **Process>Color Toning>Gamma...** measures the brightness of midtone values produced by a device (often a monitor). A higher gamma value yields an overall darker image.

Gamma: Dragging the slider bar to the left decreases the level, while moving it to the right increases the level. Values can range from 0 to 3.0. Default is 1.0.

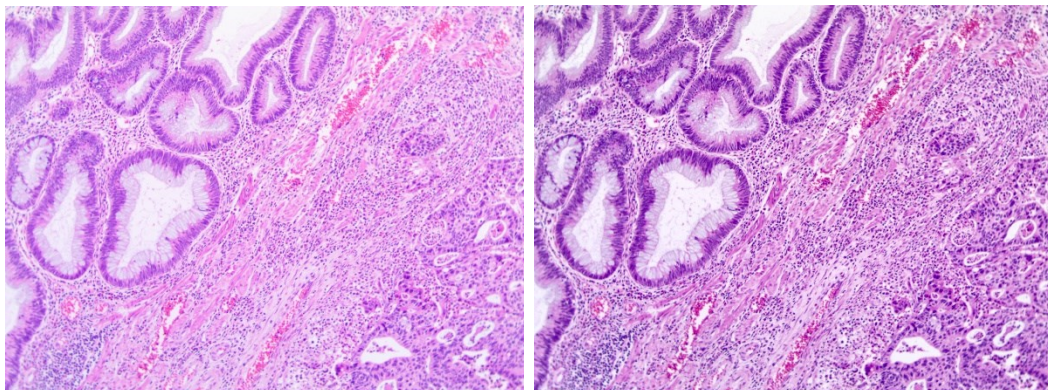
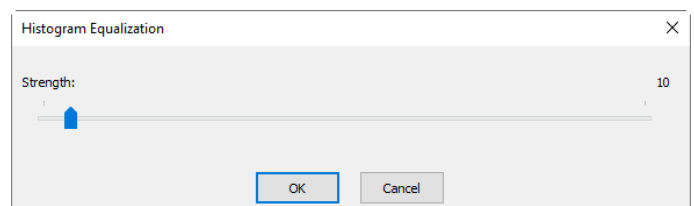


12.9.2 Histogram Equalization... Shift+Q

Adaptive histogram equalization (**AHE**) is a computer image processing technique used to improve contrast in images. It differs from ordinary histogram equalization (**HE**) in the respect that the adaptive method computes several histograms, each corresponding to a distinct section of the image, and uses them to redistribute the lightness values of the image. It is therefore suitable for improving the local contrast. However, **AHE** has a tendency to over amplify noise in relatively homogeneous regions of an image. A variant of adaptive histogram equalization called contrast limited adaptive histogram equalization (**CLAHE**) prevents this by limiting the amplification.

Open an image and then choose **Process>Color Toning>Histogram Equalization...**, a dialog should pop up as shown on the right side.

Strength: The **Strength** will affect the enhancement effect. The larger the **Strength**, the more obvious the effect.



a) Original image; b) Enhanced image

12.9.3 LCC...

The **Local Color Correction** algorithm is calculated in 2 steps:

A mask image is calculated from the input image.

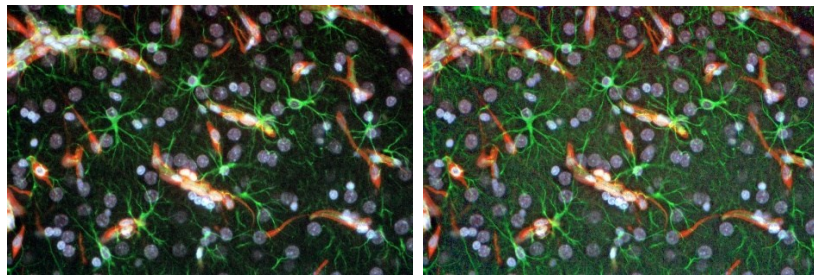
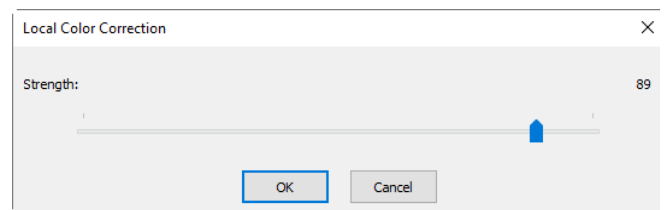
The mask image is calculated from the intensity component of the color image, defined as the average of R, G and B values i.e. $I=(R+G+B)/3$. The use of intensity information avoids distortions of the chroma. The mask image is obtained by inverting and then blurring the intensity component of the input image.

The input and mask images are combined to get the result.

The combination operation consists of a power function, where the exponent is calculated using the mask value previously found. If the mask value is greater than 128, it will result in an exponent less than 1, while if the mask value is lower than 128, it will result in an exponent greater than 1. Moreover, if the mask value is precisely 128, the exponent will be 1, and it will have no effect on the input image. The operation is equivalent to a pixel-wise gamma correction.

Please open an image and then choose **Process>Color Toning>LCC...**, a dialog should pop up as shown on the right side.

Strength: The strength will affect the enhancement effect. The larger the value, the more obvious the effect. Range: 1~100, default is 50.

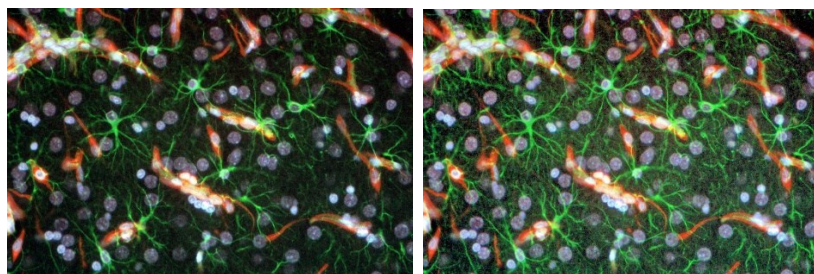


a) Original image; b) Enhanced image

12.9.4 AMSR

There are limited dynamic range problems when real world scenes are captured from a digital camera and displayed on monitors. Tone mapping algorithms are applied to image processing to reduce the dynamic range of an image to be displayed on low dynamic range devices. **Multi-scale Retinex** is one of the most popular methods for dynamic range compression, color constancy and color rendition. Here, we improve its performance by adopting the adaptive weight functions, named **Adaptive Multi-scale Retinex (AMSR)**.

Choosing **Process>Color Toning>AMSR**, the a) Original image; b) Enhanced image are shown as below:



a) Original image; b) Enhanced image

12.10 Filter... Shift+I

Choose **Process>Filter...** command to apply one of the App's numerous filters on the active image. If you are not familiar with the process and effects of filtering, some discussions about spatial filtering should be reviewed. The App provides an extensive set of convolution and no convolution (morphological) filters.

You can also create custom filter kernels and apply them with the **Filter** commands.

Choosing **Process>Filter...** command will open the **Filter** dialog. Each group of filters has its own property page or tab, where the **Filter** type and size can be selected. The filtered results are almost always written to the active image. The **Edit>Undo** command can be used to remove **Filter** operations that have been applied.

12.10.1 Image Enhance

Low Pass: Select this filter to soften an image by eliminating high-frequency information (this has the effect of blurring sharp edges). The **Low Pass** filter replaces the center pixel with the mean value in its neighborhood. The **Low Pass** filter can also be used to remove noise;

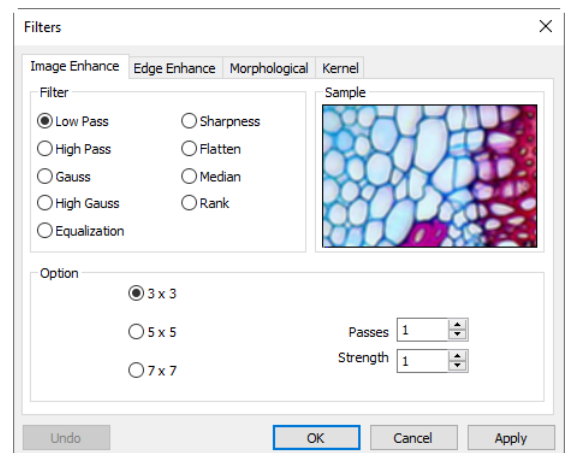
High Pass: Select this filter to enhance high-frequency information. The **High Pass** filter replaces the center pixel with a convolved value that significantly increases its contrast from its neighbors. The **High Pass** filter leaves only elements of high contrast;

Gauss: Select this filter to soften an image by eliminating high-frequency information using a **Gauss** function. This has the effect of blurring sharp edges. The operation of the **Gauss** filter is similar to the **Low Pass** filter, but it degrades the image less than the **Low Pass** filter;

High Gauss: Select this filter to enhance fine details. This operation is similar to the unsharp masking technique (see the **Sharpness** filter), but it introduces less noise into the image. It uses a Gaussian curve type of kernel. Available in 7x7 and 9x9 kernel sizes;

Equalization: This filter is used to enhance the contrast based on the histogram of the local neighborhood (See **Option** below);

Sharpness: Select this filter to enhance fine details, or refocus an image that is blurred. The sharpen filter sharpens the image using the unsharp masking technique;



Median: Select this filter to remove impulse noise from an image. The **Median** filter replaces the center pixel with the **Median** value in its neighborhood. It will also blur the image;

Rank: Select this filter to remove impulse noise from an image. The pixels in the kernel are ranked by order of intensity, and the pixel in that range at the rank percentage is chosen for comparison. For example, in a 5x5 kernel, there are 25 pixels. A rank percentage of 95% would choose second-brightest pixel for comparison. If the difference between the selected pixel and the center pixel is greater than the threshold value, the **Rank** filter replaces the value of the center pixel with the value of the selected pixel;

Option: 1. If one of the **Enhancement** filters is checked, the following options will be displayed:

3 x 3: Select 3 x 3 kernel will produce a more subtle filtering effect;

5 x 5: Select 5 x 5 kernel will produce a moderate filtering effect;

7 x 7: Select 7 x 7 kernel will produces a more extreme filtering effect;

Passes: Set the filter applied times on the image. When a filter is applied multiple times, its effect is amplified by each pass. An image that has been softened by one pass of the **Low Pass** filter will be softened further by a second pass;

Strength: Enter an applied value from 1-10 that reflects how much of the filtering effect on the image. A value of 10 specifies the full strength (100%) of the filtered result applied to each pixel. Values less than 10 cut the full weight of the filter. A value of 1 indicates that only 10% of the difference between the filtered pixel value and the original pixel value should be applied, a value of 2 indicates that 20% of the difference should be applied, and so forth.

Rank: This value specifies which pixel in the sorted array will be used to replace the center pixel. Pixels in the array will be sorted in ascending order. The pixels are indexed from 0 to **Kernel Size** x **Kernel Size**-1. In the pixel index 0 corresponds to the lowest pixel value;

The **Rank** will be specified in terms of a percentage of the indexes (**Kernel Size** x **Kernel Size**-1). A 50% **Rank** means the middle of the array. 0% rank means the lowest index (lowest gray value), and 100% rank means the highest index (highest gray value);

Option: 2. If the **Equalization** filter is checked, the options will relate to the histogram equalization. **Local Histogram Equalization** modifies the contrast of an image based on the pixel values in a small window surrounding each pixel;

Window: Image pixels statistics (min, max, histogram, mean, standard deviation, etc.) will be calculated on a small **Window** of the image. These measurements are then used to derive the local contrast for that area of the image. In short, an area of **Window** x **Window** around each pixel is all that is considered when modifying the intensities in the image. Larger **Window** produces smoother results, while small **Window** track small details more closely;

Best Fit: Choose **Best Fit** button to optimize the values for the particular image. The results are achieved by stretching the local histogram to maximize the contrast between the brightest and darkest pixels in the local window region;

Linear: This option distributes the histogram linearly across the intensity scale. This function produces a high contrast image with the highest possible dynamic range;

Logarithmic: This option concentrates the histogram at the low end of the scale. This function produces a high contrast image with little dynamic image. It will tend to darken the image overall. It is useful for increasing the contrast in a very light image

Exponential: This option concentrates the histogram at the high end of the scale. This function produces a high contrast image with little dynamic image. It will tend to lighten the image overall. It is useful for increasing the contrast in a very dark image.

12.10.2 Edge Enhance

Sobel: Select this filter to enhance just the principal edges in an image. The **Sobel** applies a mathematical formula to a 3x3 neighborhood to locate and highlight its edges.

Roberts: Select this filter to enhance fine edges in an image. The **Roberts** filter is not a convolution filter. It applies a mathematical formula upon a 4 x 4 neighborhood to produce its effect. The upper left pixel in the neighborhood is the one that is replaced.

Sculpt: Select this filter to apply a sculpted effect on the image;

Horizontal: Select this filter to detect and emphasize horizontal edges;

Vertical: Select this filter to detect and emphasize vertical edges;

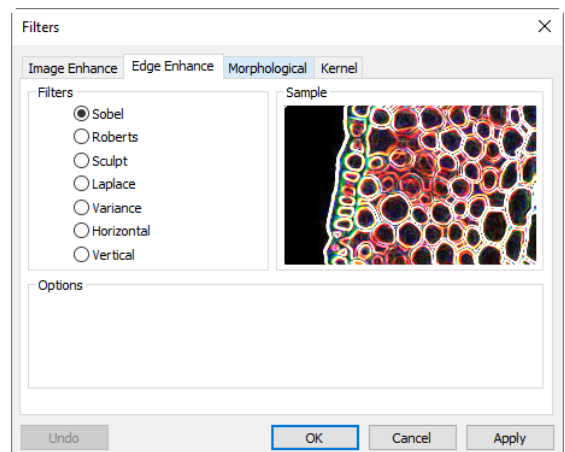
Options 1. If one of the **Edge** filters has been selected, the options will relate to kernel size and filtering strength. The following options will be displayed:

3 x 3: Select 3x3 kernels to produce a more subtle filtering effect;

5 x 5: Select 5x5 kernels to produce a moderate filtering effect;

7 x 7: Select 7x7 kernels to produce a more extreme filtering effect.

Passes: Enter the number of times that the filter will be applied to the image. When a filter is applied multiple times, its effect is amplified by each pass. An image that has been softened by one pass of the **Image Enhancement Filter**, will be softened further by a second pass;



Strength: Enter a value from 1-10 that reflects how much of the filtering effect to apply to the image. A value of 10 specifies that the full strength (100%) of the filtered result will be applied to each pixel. Values less than 10 cut the full weight of the filter - a value of 1 indicates that only 10% of the difference between the filtered pixel value and the original pixel value should be applied, a value of 2 indicates that 20% of the difference should be applied, and so forth.

Option 2. If **Sobel** or **Roberts** is selected, no options are available.

12.10.3 Morphological

Erode: Select this morphological filter if one wants to modify the size of objects in the image. The **Erode** filter erodes the edges of bright objects and enlarges the edges of dark ones;

Dilate: Select this morphological filter if one wants to modify the size of objects in the image. The **Dilation** filter dilates bright objects and erodes dark ones;

Open: Select this morphological filter if one wants to modify the shape of objects in the image. Assuming the image contains bright objects on a dark field, the **Open** filter will smooth object contours, separate narrowly connected objects, and remove small dark holes;

Close: Select this morphological filter if one wants to modify the shape of the objects in the image. Assuming the image contains bright objects on a dark field; the **Close** filter will fill gaps and enlarge protrusions to connect objects that are close together;

Tophat: Select this filter to detect and emphasize points, or grains, that are brighter than the background. There are 3 kernel sizes for this processing. Click the radio button to change the kernel size to the value that most closely matches the size of the grains to detect;

Well: Select this filter to detect and emphasize points, or grains, that are darker than the background. There are 3 kernel sizes for this processing. Click the radio button to change the kernel size to the value that most closely matches the size of the grains to detect;

Gradient: Select this filter to enhance edges in an image;

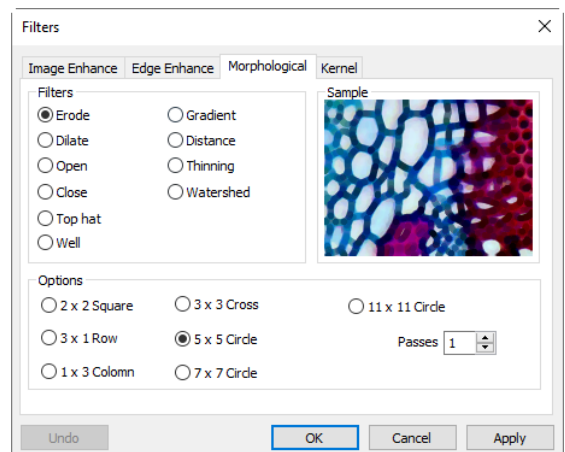
Distance: The **Distance** filter is used to show the distances of pixels within blobs to the outer boundaries of those blobs. After applying the distance filter, the background will be black (i.e. pixels with value 0). Only the area within the blobs will have non-zero values (will be white). The values of each pixel within the blob will be a count of the shortest distance from that pixel to the edge of the blob. Thus, all pixels along the blob's border will have a value of 1 (since they are one pixel away from the edge of the blob); pixels that are a distance of 2 from the border will have the value 2, and so on. This creates a distance map of the image. The **Distance** filter will not operate upon **True Color** images. If one wants to use the **Distance** filter with a **True Color** image, he must first convert it to **Gray Scale**;

Thinning: Select this filter to reduce an image to its skeleton. When choosing this filter, one must set the threshold that determines whether a pixel is part of the subject or part of the background (see Options below). The Thinning filter will not operate upon **True Color** images. If one wants to thin a **True Color** image, he must first convert it to **Gray Scale**;

Watershed: Select this filter to separate objects that are touching. The **Watershed** filter erodes objects until they disappear, then dilates them again, but will not allow them to touch. The **Watershed** filter will not operate upon true color images. If one wants to separate objects in a true color image, he must first convert it to **Gray Scale** (see **Process Frame: Image>Gray Scale**);

Options 1. If **Erode**, **Dilate**, **Open**, or **Close** filters is checked, the options will relate to the kernel size and shape. The following options will be presented:

2 x 2 Square: Select to use the 2x2 square kernel configurations.



3 x 1 Row: Select to use the 3x1 row kernel configuration.

1 x 3 Column: Select to use the 1x3 column kernel configuration.

3 x 3 Cross: Select to use the 3x3 cross kernel configuration.

5 x 5 Circle: Select to use the 5x5 circular kernel configurations.

7 x 7 Circle: Select to use the 7x7 circular kernel configurations. This is a two-pass filter, accomplished using a 5 x 5 circle followed by a 3x3 cross.

11 x 11 Circle: Select to use the 11 x 11 circular kernel configurations. This is a three-pass filter, accomplished using a 5 x 5 circle followed by another 5 x 5 circle, followed by a 3 x 3 cross.

Passes: Set the number of times iterate the filter.

Note: The circular kernels are especially effective on round objects (cells, grains and so on) because their circular configuration preserves the circular shape of the objects better than square configurations.

Option 2. If the **Tophat**, **Well**, or **Gradient** filter is selected, the options will relate to kernel size and shape. The following options will be presented:

3 x 3: Select to use the 3x3 square kernel configurations.

5 x 5: Select to use the 5x5 square kernel configurations.

7 x 7: Select to use the 7x7 square kernel configurations.

Option 3. If **Watershed**, **Thinning**, or **Distance** filter is selected, the options will relate to the threshold. The following option will be presented:

Threshold: Enter a percentage value from 1-100 that specifies the intensity value to binarize the image. For example, a Threshold of 50% on a **Gray Scale** image would set all values ≤ 127 to 0 (black) and all values ≥ 128 to the maximum value for that image class (white).

12.10.4 Kernel

The **Kernel** page allows edit the kernel files for morphological & convolution filters.

Filter type: Select to modify the kernel for a selected **Filter type**, either **Convolution** or **Morphological** filters;

Edit...: Invoke the **Edit Kernel** dialog to modify the selected filter kernel;

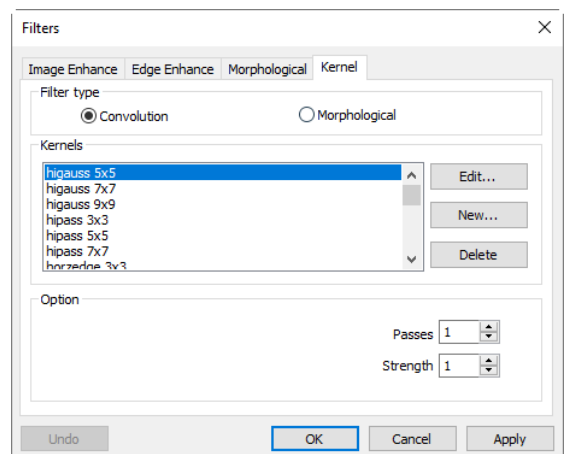
Name...: This combobox contains the name of the selected kernel file. If one wants to save the modified kernel file to the same file, leave it as it is. If one wants to save the file to a new location, enter the new filename here;

Kernel Size: Click the spin buttons or enter the number to change the size of the kernel. Either direction may take into account one to nine pixels. As one modifies the **Kernel Size**, the shape of the kernel representation changes accordingly. In the center of the dialog, there are white boxes containing coefficients that will be multiplied with each pixel that will be taken into account by the filter kernel. One can change any coefficient by clicking on it and adjust it as desired;

Fill: Click this button to **Fill** every element of the kernel with a particular value. The **Fill kernel** dialog appears. One may enter a value between 0 and 10. Using the **Fill** button is useful for setting all coefficients to the same value. One may then change the coefficients that require a different value;

Offset: The pixel whose value is being modified is usually the center-most pixel. One may, however, designate any pixel. The **App** signals the pixel to be changed by putting a box around it. Choose **X** and **Y Offset** spin buttons to apply;

New...: Click to create a new filter kernel. The **Edit Kernel** dialog will appear. The functions of the dialog are the same way as the dialog for **Edit...** described above), with the exception that the file name for the new kernel file must be provided;



Delete: Click to delete the selected filter kernel file;

Options: The choices in this group box will vary depending upon the kind of selected filter.

Note: The **HiPass**, **LowPass**, **Laplacian** and **Unsharp** kernel files are used by the **HiPass**, **LowPass**, **Laplacian**, and **Sharpen** options listed in the **Image Enhancement Filters** page dialog window (i.e. there is no difference between selecting one of these kernel files and selecting its **Option** button in the **Filter** window -- the 2 methods ultimately do the same thing). Because these kernel files are essential to the operation of these filtering options, they must not be deleted or renamed.

12.11 Image Stacking...

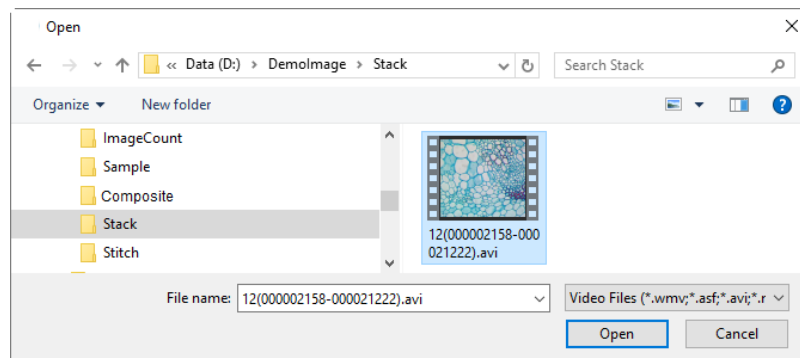


The **Image Stacking** method is a form of speckle imaging commonly used for obtaining high quality images from a number of short exposures with varying image shifts or rotations. It has been used in astronomy for several decades, and is the basis for the image stabilization feature on some cameras. The method involves calculation of the differential shifts of the images. This is easily accomplished in astronomical images since they can be aligned with the stars. Once the images have aligned, they are averaged together. It is a basic principle of statistics that variation in a sample can be reduced by averaging together the individual values. In fact, when using an average, the signal-to-noise ratio should be increased by a factor of the square root of the number of images.

Image Stacking can also be used for biological microscope image and florescent microscope image to increase the image SNR and dynamical ranges; this is why the **App** introduces **Image Stacking** function in the **Process** menu.

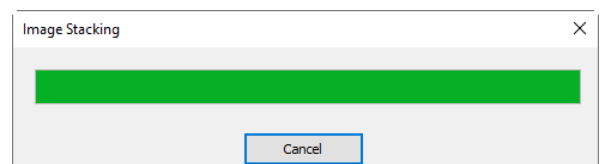
The **App**'s **Image Stacking** introduced advanced image matching techniques for rotated, shifted and scaled images. The user can record a short video to get a high quality stacked image at ease without considering the image rotation, shifting and scaling between a series of images in the video. The steps of **Image Stacking** are described as below:

1. Choose **Processing>Image Stacking...** command, an **Open** dialog will pop up as shown below;



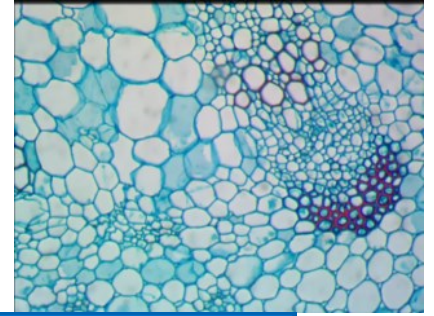
2. Choose right video file recorded before in the **Open** dialog, here we can open avi file for demonstration, click **Open** to open the avi file;

3. Then an **Image Stacking** dialog will pop up to show the progress of the each image's stacking progress.



4. If **Cancel** is pressed, the **Image Stacking** will be canceled. After the stacking is finished, a stacked image will be displayed in a new window for further application. The final image is shown on the right side. One can find the stacked image signal to noise ratio is greatly improved. The stacked image has some black edges, this is because the images in the video is moved and in the stacking process, the **App** will added 0 to the image area that has no corresponding pixel in the reference image (The first image is chosen in the video file as the reference image).

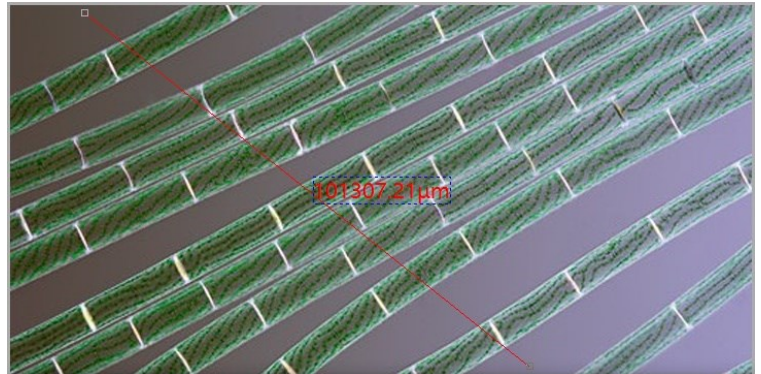
Note: a) The App supports wmv, asf, avi, mp4, m4v, 3gp, 3g2, 3gp2, 3gpp, mov, mkv, flv, rm, rmvb for Image Stacking operation; b) In the Image Stacking process, the App takes the first frame as the reference image, this means the first frame is very important and should be assure the first frame to be the right image scene and the subsequent frames have a greater overlap region with the first frame.



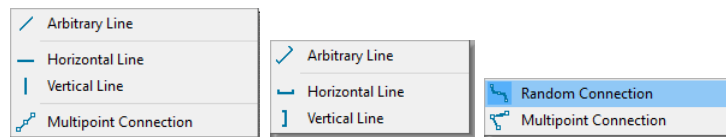
Video Files (*.wmv;*.asf;*.avi;*.mp4;*.m4v;*.3gp;*.3g2;*.3gp2;*.3gpp;*.mov;*.mkv;*.flv;*.rm;*.rmvb;*.264;*.h264;*.265;*.h265)
All Files (*.*)

12.12 Line Profile...


Choose Process>Line Profile... command to illustrate how pixels along a selected line or curve are distributed by graphing the number of pixels at each color intensity level. Both video and image windows support the Line Profile function. For video window, the profiles will be updated dynamically.

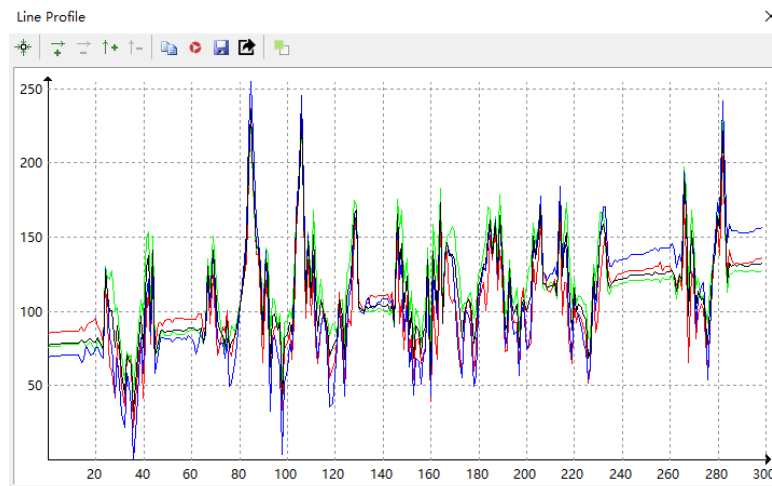


Choose Measurements>Line>Arbitrary Line, Line Horizontal Line, Vertical Line, Multipoint Connection, Line(3 Points)>Arbitrary Line, Line Horizontal Line, Vertical Line , Curve>Random Connection, Multipoint Connection command (shown below) to draw a line or curve on the image.













Choosing Process>Line Profile will bring up a Line Profile dialog as shown below (The procedure can be inverted):

In a Line Profile dialog, the horizontal axis represents the spatial scale, and the vertical axis represents the intensity values range from 0 to 255. If the image is a gray scale image, only the gray value will be profiled. If the image is a HSV color image, the R, G, B and the brightness values will be profiled separately with the corresponding R, G, B and black colors. Its toolbar  button functions are described as follows:



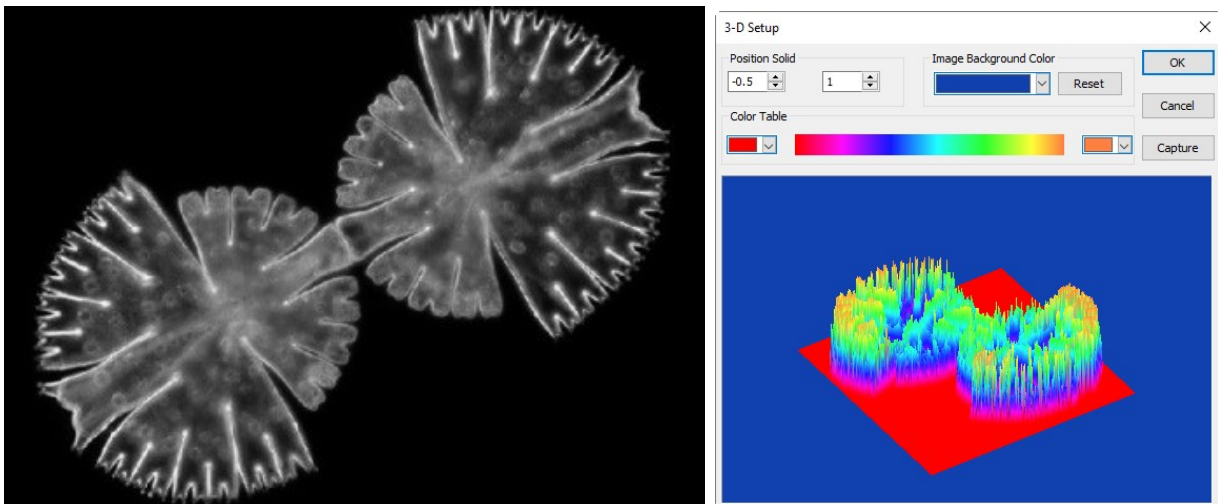
 : Fit the current Line Profile window to the best scale;

-  : Zoom in the current horizontal axis;
-  : Zoom out the current horizontal axis;
-  : Zoom in the current vertical axis;
-  : Zoom out the current vertical axis;
-  : Copy the **Line Profile** window's content to the clipboard;
-  : Capture the image in the **Line Profile** window as a new numbered image;
-  : Save the **Line Profile** image in png or bmp format;
-  : Export the current Y axis values of R,G,B and brightness to the *.txt file(check to select).
-  : Open the windows color dialog to set the background color of the profile window;

Only when the line is selected, the **Line Profile** can be painted in the window. Using **Object Select** button  on the toolbar to select the line over the image or video window.

12.13 Surface Plot***

The **Process>Surface Plot***** (or 3-D Plot) tool creates a 3-D representation of the intensity of an image. When choosing **Surface Plot** command, keep in mind that X=image width and Y=image height, and Z=pixel gray value.



In the viewpoint window, the **elevation** and **rotation** of the image can be adjusted by dragging the mouse on the image.

Position Solid: The left edit control indicates the relative position of the entire image in the viewpoint window, whose default value is 0.5. The right edit control indicates the relative height of the display of the Z scale, whose default value is 1;

Reset: Set the **Position Solid**'s two edit controls to their default values;

Image Background Color: Choose this command to display a color dialog where one can adjust the background color of the viewpoint window;

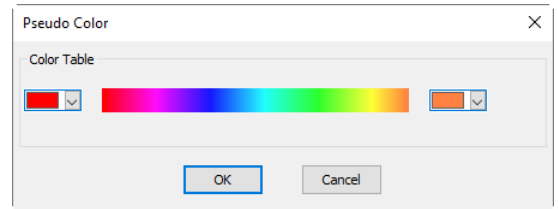
Capture: **Capture** the active image in the viewpoint window as a new image;

Color Table: Select the colors to map the gray values found in the surface plot. The button at each end of the **Color Table** brings up the color dialog, which allows select the start and end colors of the range. (Please refer to **Pseudo Color** for more information)

12.14 Pseudo Color***



Note: Image must be in **Gray Scale**.

Choose **Pseudo Color** command to "colorize" the active monochromatic image. This is used to highlight certain features in a **Gray Scale** image such as display all densities above a certain point in red, or, the imaging device recorded thermal information, all temperatures below a certain point can be revealed in blue color.



When **Pseudo Color** a monochromatic image, a special palette needs to be built with which the monochromatic image is displayed. **Pseudo Coloring** an image does not modify the pixels' values in image bitmap (it does not convert image to true color or palette). It simply associates a **Pseudo Color** palette with the image that interprets the gray-level values in the image as color.

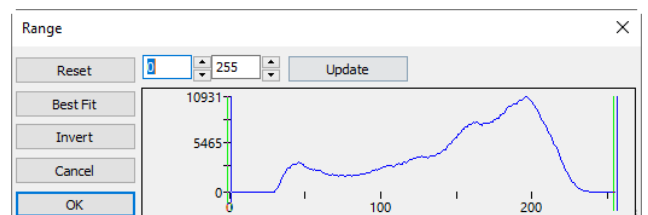
The **Pseudo Color** images are very similar in structure to palette class images, but they differ in a couple of important ways. First, the pixels' values in a **Pseudo Color** image actually represent continuous-tone intensity information, whereas a palette image's pixels carry no intensity significance. Secondly, a palette image includes a palette table that is actually part of the image file.

The colors used to map the gray values can be selected. The buttons at each end of the color strips ( or ) will bring up the color dialog separately, which allows select the start and end colors of the range.



12.15 Range... Shift+R

The **Process>Range...** command allows set the intensity levels of the image to increase the contrast and enhance the display in low-light situations. Choose **Range** command to open the **Range** dialog as shown on the right side.



Two **vertical markers** show the **upper** and **lower** limits of the intensity levels. These markers can be moved with mouse through the drag and drop method. For a color image, the histogram will reflect the **red**, **green**, and **blue** values with corresponding colors lines.

Two **Edit** controls indicate the values of the intensity levels. Choose the spin buttons to increase or decrease these values. All values between 0 and the lower limit will be black and all values between the upper limit and the upper end of the scale will be white. These two edit control values corresponding to the two **vertical markers** show the **upper** and **lower** limits of the intensity levels. Defaults are 0 and 255 respectively.

Reset: The **Reset** button allows **Reset** the black and white levels to the high and low ends of the dynamic **Range**;

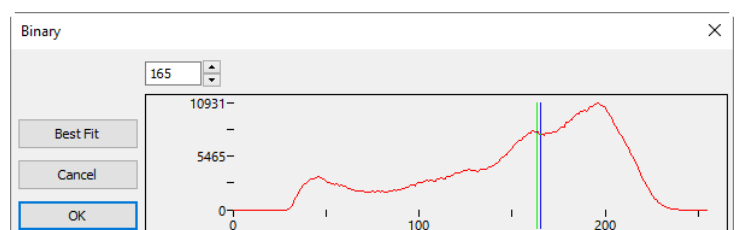
Best Fit: The **Best Fit** button automatically sets the intensity levels to the **Best Fit**. **Best Fit** instructs the **App** to optimize the brightness and contrast values for the particular image;

Invert: The **Invert** button reverses the color of the image;

Update: **Update** will refresh the display **Range** with the most current image information.

12.16 Binary... Shift+B

Binary is a kind of gray level process. If the gray of the pixel is greater than the given threshold, the pixel's color will be changed into white. Otherwise, the pixel's color will be changed into black. Although the process may lose some information, it is an important step of other processes.



The curve on the [Binary](#) dialog shows the gray distribution of the image.

The [Line](#) in the dialog indicates the threshold value. Drag the line to change the threshold, or change the value in the [Line](#) position [edit](#) box (in the top left corner of the dialog) to move the [Line](#).

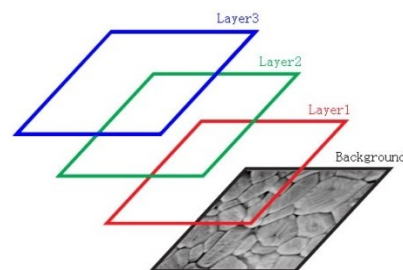
The [Line](#) position [Edit](#) box shows the current position value of the [Line](#); Modify the value will move the [Line](#) at the same time;

Click the "[Best Fit](#)" button to apply the auto threshold process to the image. It uses an automatic threshold to make the image [Binary](#).

13 Layer

13.1 About Layer

The App's Layer is like sheets of stacked acetate. You can see through transparent areas of a Layer to the Layers below. You add a Layer to position the Objects content on the Layer, like sliding a sheet of acetate in a stack. You can also hide/show a layer to make content invisible/visible.



You use layers to perform tasks such as perform the Measurement on the image without polluting the image and save it for the future adjustment or further analysis.

13.2 Organizing Layers

A new image has a single Layer called Background layer. The number of additional layers you can add to an image is limited only by your computer performance.

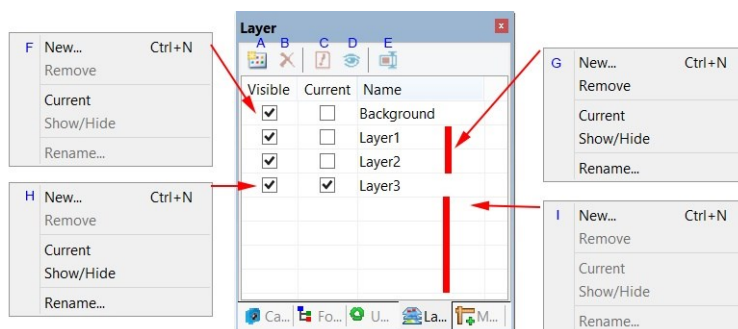
You work with layers in the Layers Sidebar. The Layer Sidebar help you organize and manage layers just like the Layer menu.

13.3 Layers for non-destructive Measurement and label

Rather than edit image pixels directly, you can label the image with text and measure the image and leave the underlying pixels unchanged. Because of the non-destructively to images, you can later tweak or remove the label and the Objects.

13.4 Layer Sidebar

- A: Make a New layer;
- B: Remove a layer;
- C: Set the Current layer;
- D: Show/Hide a layer;
- E:Rename a layer;
- F: Right mouse button context menu for the Background layer;
- G: Right mouse button context menu for the Current not checked layer;

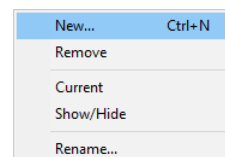


- H: Right mouse button context menu for the Current checked layer;
- I : Right mouse button context menu in the blank area;

Note: a) Only one layer can be checked as Current Layer. If a layer's Current is checked, the Visible will be checked automatically; b). The Current and Background layers cannot be removed. Only the non-current and non- background layers can be removed; c). All the Objects on the Current Layer can be selected, edited or exported; d). The non-current Layer can be Visible (checked) or invisible (unchecked).

13.5 Layer menu and Layer Sidebar page context menu

The function of the Layer menu and Layer Sidebar right mouse button context menu are the same. They are described in the following section.



13.6 New...



Ctrl+N

Setup a new layer. After the new layer is setup, it will be added to the end of the Layer Sidebar's items and the Visible and Current items will be checked. The first Layer will be created automatically when user perform the Measurement operation.

13.7 Remove...



Remove the non-current Layer.

Note: the Background and Current Layer cannot be removed.

13.8 Current...



Set the selected Layer as the Current Layer. User then can edit the Object on the Current Layer or added new Object to the Current Layer. The Current Layer will be always Visible.

13.9 Show/Hide...



Set the non-current Layer visible or invisible. The Current Layer cannot be toggled between Visible and invisible state. It is always Visible.

The Layer>Show/Hide... will be enabled only when there is a Layer over the Background Layer.

13.10 Rename...



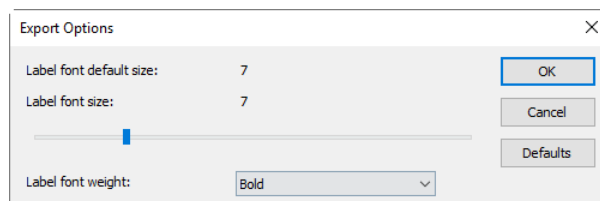
Rename a Layer.

The Layer>Rename... will be enabled only when there is a Layer on the Background Layer.

13.11 Export to Image... F2

Export all the Layers' Objects to the image, this will pollute the image and the image cannot be recovered anymore.

The Layer>Export to Image... will be enabled only when there is (are) Object(s) on the Layer(s)



13.12 Export to Microsoft Excel... F3

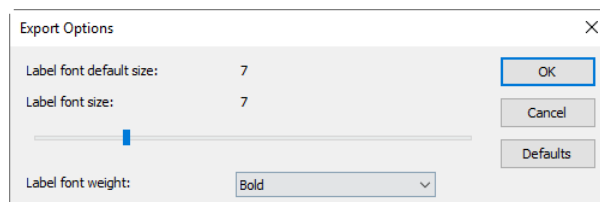


Export the image plus all the Objects on different Layers to the Excel file.

Label font size: Used for the Object's label font size, the default value is 7(1~28);

Label font weight: Normal, Bold, and Heavy. The default is Bold.

The Layer>Export to Microsoft Excel... will be enabled only when there is Layer on the image.



13.13 Export all to Microsoft Excel... F4



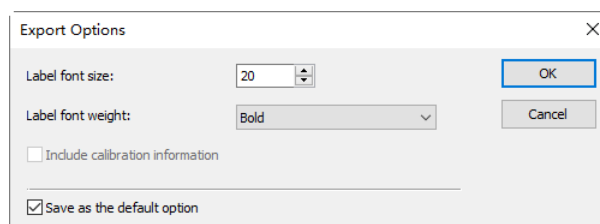
Export the current opened different images which have Objects on their Layer to a single Excel file. This function can be used to capture images with Objects from different video frames who may have the same characteristics. The output in the Excel file then can be processed to get the statistic properties.

Choosing Layer> Export all to Microsoft Excel... will bring up an Export dialog shown on the right side.

Label font size: Used for the Object's label font size, the default value is 20(8~72);

Label font weight: Normal, Bold, and Heavy. The default is Bold;

Include calibration information: If the images are calibrated, check this item will output the calibration information to the Excel file;



Save as the default option: If this item is checked, the current setting will be saved for the future application.

The Layer> Export all to Microsoft Excel... will be active only when there is Layer on the Background Layer.

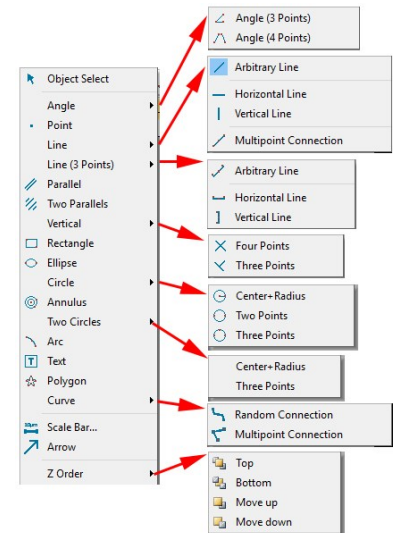
14 Measurements

The **Measurements** menu is mainly used for the image measurement. With this menu, you can measure the image with many geometrical shape at ease. The **App** uses **Layer** technique to manage the measurement object. This will never pollute the image pixels. The **Measurements** menus and its submenus are shown below.

About the **Layer** technique, please check the **Layer** menu and **Layer Sidebar** in Sec 13.


About the **Measurements** setup, please check **Options>Measurement•••** and **Measurement Sidebar** in **View>Sidebar** menu in Sec.7.4.6

About the **Measurements** menu's toolbar buttons, please check the **App's** toolbar in Sec.3: UI toolbar.



Note: a) To check or modify the parameters of the selected **Object**, just select a single **Object** and the **Measurement Sidebar** will be activated and extended automatically. Here user can edit the corresponding **Object** parameters to modify its properties; b) The **Appearance**, **Coordinates** on **Measurement Sidebar** will be enabled only when a single **Object** is selected. The **Calculation** will be effective for a single selected **Object** or multiple selected **Objects**. Its calculated items will depend on the selected **Object** type (The type could be the same or different).

14.1 Object Select

The **Measurements>Object Select** menu or the toolbar button  will be enabled only when a new **Measurement** is made over the **Background Layer**.

After the **Measurement** is done on the specific layer, choose this menu to select the **Objects**.

1. The **Object** can be selected by clicking on it;
2. Select a group of **Objects** by including them in a rectangular area with **Object Select** command or by press down the **Shift** key and clicking the **Object** with left mouse button until all the desired **Objects** are selected.

14.2 Angle

14.2.1 Angle (3 Points)

1. Move the mouse on the image to point 1, mark it by clicking the left mouse button;
2. Move the mouse to point 2, mark it by clicking the left mouse button;
3. Move the mouse to point 3, mark the final point by clicking the left mouse button. A label 50.26° will be shown near point 2.

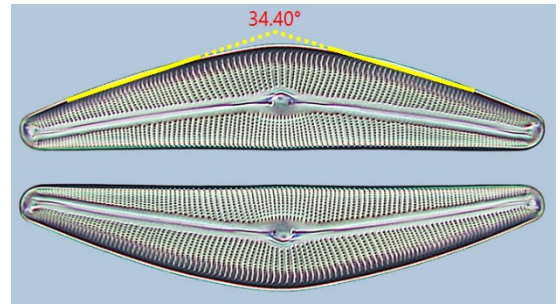


14.2.2 Angle (4 Points)

1. Move the mouse on the image to point 1, mark it by clicking the left mouse button;
2. Move the mouse to point 2, mark it by clicking the left mouse button; Point 1 and point 2 will be connected automatically to form L12;

3. Move the mouse to point 3, mark the first point of the second line;
4. Move the mouse to point 4, mark it by clicking the left mouse button; Point 3 and point 4 will be connected automatically to form L34;
5. After the above process, L12 and L34 will be extended to form an angle between L12 and L34.

A label 34.40° will be shown near vertex.



14.3 Point



Move mouse to the point; click the left mouse to mark it. It will show the point **Label Ptn** and its position x and y over the image.



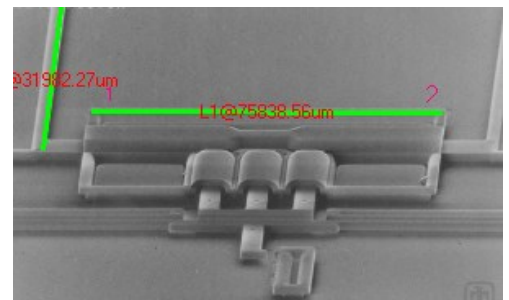
14.4 Line

14.4.1 Line>Arbitrary Line



Draw **Arbitrary Line** between the two points on the specified layer.

1. Choose **Measurements>Line> Arbitrary Line** command;
2. Move mouse to the 1st point; click the left mouse button to mark it;
3. Move mouse to the 2nd point, click the left mouse button to mark it again, a line with L1 and its length will be shown.



14.4.2 Line> Horizontal Line



Ctrl+Left mouse button

Draw a **Horizontal Line** between the two points on the specified layer. When the 1st point is marked, the 2nd point's y coordinate will be restricted to equal to the first point's y coordinate automatically.

14.4.3 Line> Vertical Line



Shift+Left mouse button

Draw a **Vertical Line** between the two points on the specified layer. When the first point is marked, the second point's x coordinate will be restricted to equal to the first point's x coordinate automatically.

14.4.4 Line>Multipoint Connection



Connect the left mouse button clicked points to form a straight line.

Ctrl+Left mouse button will draw a horizontal **Multipoint Connection**.

Shift+Left mouse button will draw a vertical **Multipoint Connection**.

14.5 Line(3 Points)

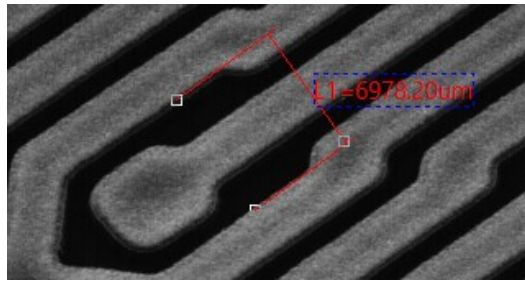
14.5.1 Line(3 Points)>Arbitrary Line

14.5.2 Line(3 Points)>Horizontal Line (Ctrl+Left mouse button)

14.5.3 Line(3 Points)>Vertical Line (Shift+Left mouse button)

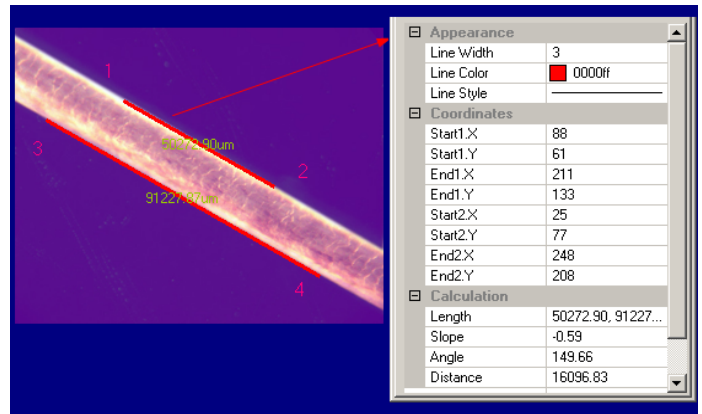
All of these are just as **Line>Arbitrary Line**, **Line>Horizontal Line** **Line>Vertical Line** function, but the 3rd

point is used to locate the label position.



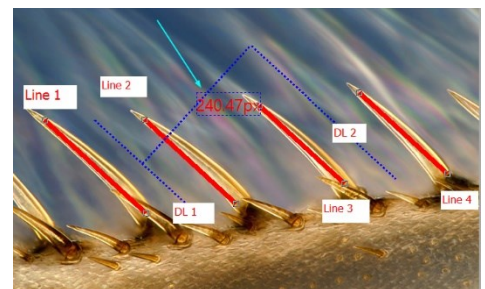
14.6 Parallel

1. Choose **Measurements>Parallel** command;
2. Move mouse and click to mark the 1st point;
3. Move mouse and click to mark the 2nd point;
4. Move mouse and click to mark the 3rd point;
5. Move mouse again, one will find the 4th point is always restricted to parallel to the line connecting point 1 and point 2. Click to mark the 4th point. Two parallel lines will be labeled and numbered.



14.7 Two Parallels

1. Move mouse and click its left button to mark the 1st point;
2. Move mouse and click its left button to mark the 2nd point. Line 1 (the 1st line) connect these two points will be overlaid on the image;
3. Move mouse and click its left button to mark the 3rd point;
4. Move mouse again, one will find the 4th point is always restricted to parallel to the Line 1 connecting point 1 and point 2. Click to mark the 4th point. Line 2 will be drawn which is parallel to Line 1. A dot line DL 1 located at the center of Line 1 and Line 2 will also be marked. Thus the 1st parallel is finished;
5. Repeated step 1~4 will draw Line 3 and Line 4. A dot line DL 2 located between the center of Line 3 and Line 4 will also be marked. Thus the 2nd parallel is finished;
6. The **App** will label the distance between DL1 and DL2 in with **Unit** specified in the **Unit** combo box. The final result is shown on the right side.



14.8 Vertical

14.8.1 Vertical>Four Points.

1. Move mouse and click its left button to mark the 1st point;
2. Move mouse and click its left button to mark the 2nd point. A line (the 1st line) connect these two point be overlaid on the image;
3. Move mouse and click its left button to mark the 3rd point;
4. Move mouse again, one will find the 4th point is always restricted to perpendicular to the line of point 1 and point 2. Click to mark the 4th point. Two vertical lines will be labeled and numbered.



14.8.2 Vertical>Three Points

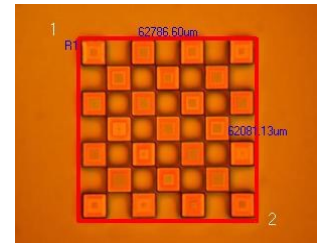


1. Move mouse and click its left button to mark the 1st point;
2. Move mouse and click its left button to mark the 2nd point. A line (the 1st line) connecting these two points will be overlaid on the image;
3. Move mouse and click its left button to mark the 3rd point. The 2nd line will be overlaid on the image which is perpendicular to the 1st one.

14.9 Rectangle



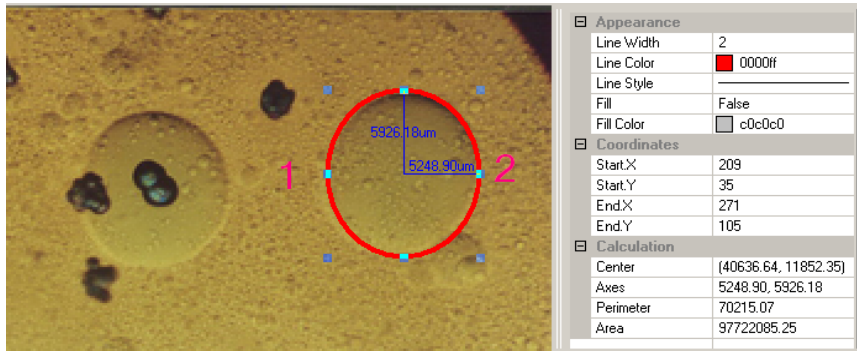
1. Move mouse to the 1st point; click its left mouse button to mark it;
2. Move mouse to the 2ed point; click its left mouse button to mark it. A **Rectangle** will be overlaid on the image according these two diagonal points.



14.10 Ellipse



1. Choose **Measurements>Ellipse** command;
2. Move mouse to mark the 1st point;
3. Move mouse to mark the 2nd point;
4. If it is not superposing with the shape on the image, choose **Measurements>Object Select** command to adjust the position to adjust the **Ellipse** in order to coincide with the image shape.



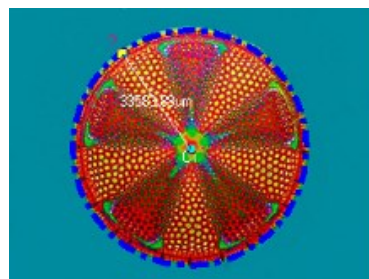
14.11 Circle



14.11.1 Circle>Center+Radius



Choose **Measurements>Circle>Center+Radius** command to draw a circle with **Center+Radius** method on the specified **Layer**. Here, the circle is [C1@33583.88um](#).



14.11.2 Circle>Two Points



Choose **Measurements>Circle>Two Points** command to draw a circle with **Two Points** method on the specified layer.

14.11.3 Circle>Three Points

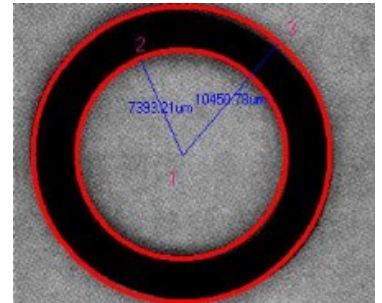


Choose **Measurements>Circle>Three Points** command to draw a circle with **Three Points** method on the specified layer.

14.12 Annulus



1. Find the **Annulus** center 1 and click mouse button to mark the **Annulus** center;
2. Move mouse to let the 1st circle superpose with the image circle, clicking the mouse left button;
3. Move mouse to let the 2nd circle superpose the image circle, clicking the left mouse button. Two radiuses with number and units will be labeled on the **Annulus**.



14.13 Two Circles



14.13.1 Two Circle>Center+Radius(R)

Draw **Two Circles** with **Center+Radius** method on the specified layer. After the **Two Circles** are drawn, a line connecting these two circle centers will be drawn.

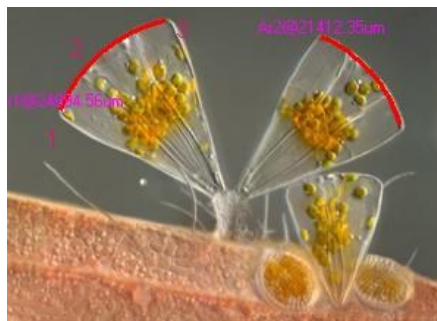
14.13.2 Two Circle>Three Points(3)

Draw **Two Circles** with **Three Points** method on the specified layer. After the **Two Circles** are drawn, a line connecting these two circle centers will be drawn.

14.14 Arc



1. Move mouse to mark the 1st point;
2. Move mouse to mark the 2nd point;
3. Move mouse to mark the 3rd point, then an **Arc** with **Label** and its **Length** will be drawn connecting these three points.

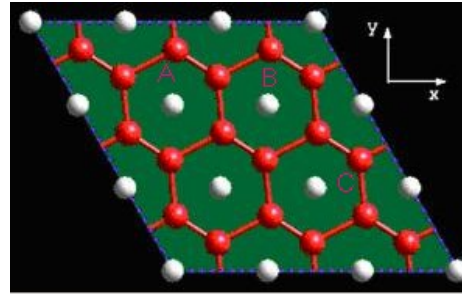
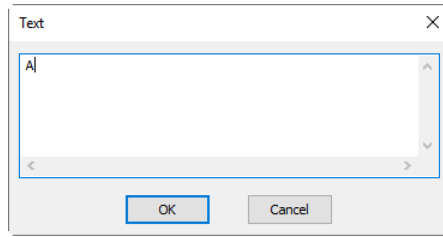


14.15 Text



1. Choose **Measurements>Text** command;
2. Move mouse to mark the 1st point;
3. Move mouse to mark the 2nd point, a rectangle with dash line restrict the **Text** window size. After the mouse button is released, a dialog called **Text** will bring up for you to enter the **Text**;
4. Enter the **Text** and click the right mouse button to end the **Text** object.

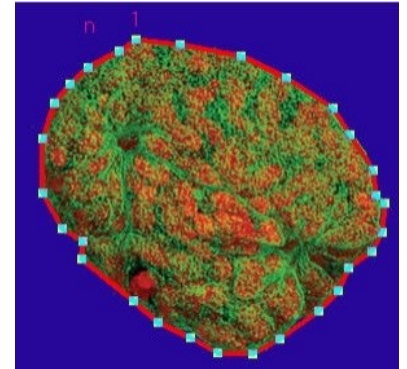
Note: The **Text**, **Text** frame styles, and **Text** positions can be modified on the **Measurement Sidebar**.



14.16 Polygon

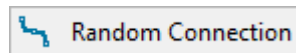


1. Choose **Measurements>Polygon** command;
2. Move mouse and click the left mouse button to mark the 1st point;
3. Move mouse and click the left mouse button to mark the 2nd point;
- ;
- n. Move mouse and click the left mouse button to mark the nth point;
- n+1. Click the right mouse button to end the **Polygon** command and the nth point will be connected with the 1st point.

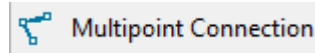


If only 2 points are marked and the 3rd action is the clicking of right mouse button, then nothing will be done.

14.17 Curve



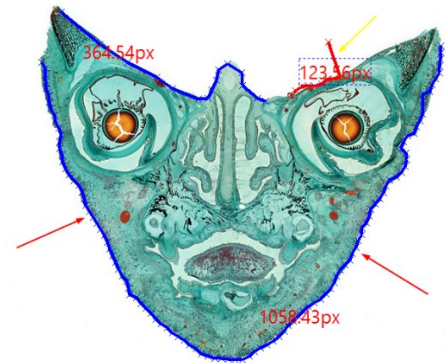
&



14.17.1 Curve>Random Connection



1. Press down the left mouse button and move mouse according to the requirement to draw any curve in **Random Connection** format;
2. If the left mouse button is released and move the it to a new position and then click the left mouse button again will draw a line to connect the last point;
3. Release the left mouse button and click the right mouse button to end **Random Connection**.



14.17.2 Curve>Multipoint Connection




The **Model 2 Curve** operation is almost the same as that of the **Polygon**.

1. Choose **Measurements>Curve> Multipoint Connection** command;
2. Move mouse to a point and click the left mouse button to mark the 1st point;
3. Move mouse to a point and click the left mouse button to mark the 2nd point;
4. •••;
- n-1. Move mouse to a point and click the left mouse button to mark the (n-1)th point;
- n. Move mouse to the final point and click the left mouse button to mark the nth point, then click the right



mouse button to end the current **Multipoint Connection** process.

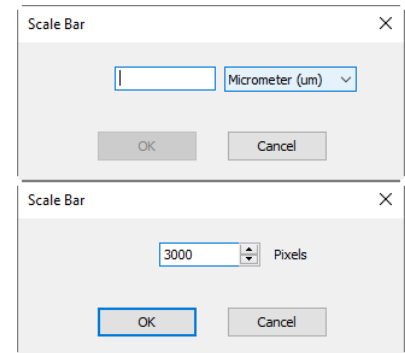
Choosing  button can adjust the finished **Multipoint Connection**.

14.18 Scale Bar

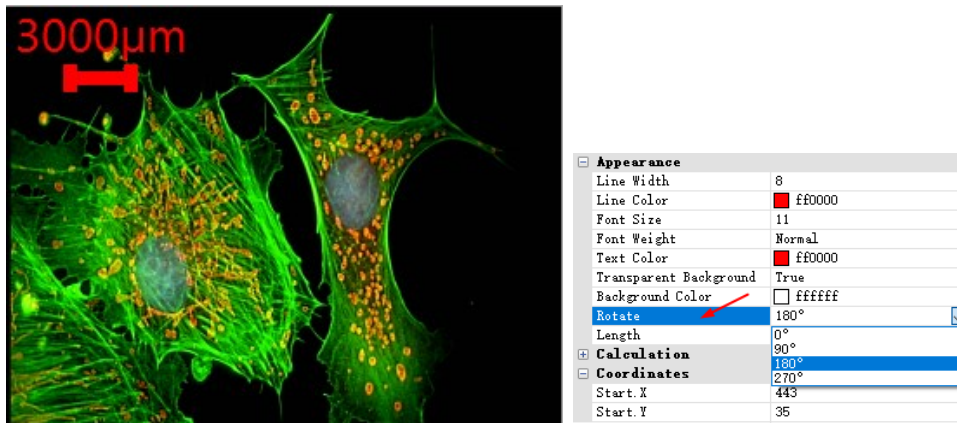
Choose **Measurements>Scale Bar** command will bring up a **Scale Bar** dialog as shown on the right up figure.

Input the number in the length edit box to determine the **Scale Bar** length. The **Unit** is chosen according to the current **Unit** in the **Options>Measurement>Length Unit** page. If the **Unit** is pixel, then **Scale Bar** dialog will be change to the right bottom figure.

Change the default value (3000) to the desired length and directly click **OK**, a **Scale Bar** will be displayed on the image in **Measurement** style.



One can move the **Scale Bar** to where ever he wants(Choosing **Measurements>Object Select** after the **Scale Bar** is displayed on the image/video window and move the mouse to the **Scale Bar** and click down the left mouse button). The final result should be:



The **Scale Bar** can be rotated on the **Measurement Sidebar** as shown above.

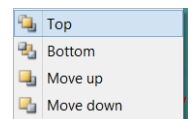
14.19 Arrow

Draw an **Arrow** on the image to specify the key or interest point on the image or video.

14.20 Z Order

The **Z Order** submenu is shown on the right side.

Top: Modify the selected **Object's** relative position to the uppermost place of all **Objects** on the **Current** layer;



Bottom: Modify the selected **Object's** relative position to the lowest place of all **Objects** on the **Current** layer;

Move Up: Modify the selected **Object's** relative position to the higher place of the two on the **Current** layer;

Move Down: Modify the selected **Object's** relative position to the lower place of the two on the **Current** layer.

15 Options

15.1 Preferences



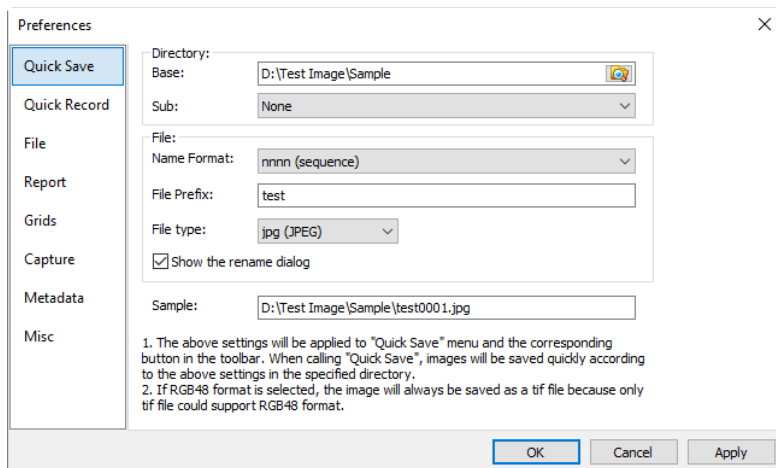
Shift+P

There are 8 pages for the Preference dialog, they are Quick Save, Quick Record, File, Report, Grids, Capture, Metadata and Misc pages.

15.1.1 Quick Save page

The File>Quick Save menu or the Quick Save icon on the toolbar will be enabled when a) a new image window snapped from the camera; b) an image window by choosing File>Paste as New File command created.

The File>Quick Save command can save the file at quick way with no need to specify file directory, name & format. All are specified in Options> Preferences, Quick Save property page as shown below:



None
Date(YYYYMMDD)
Year(YYYY)\Month(MM)\Day(DD)

Directory: Enter the name of the drive and directory where the new image will be saved. User may either type the path information, or use the Browse button to locate it from a standard Browse Folder dialog;

Sub: The sub directory for the Quick Save under the Base directory. The Sub can be None, Date(YYYYMMDD) or Year(YYYY)\Month(MM)\Day(DD). The default is None;

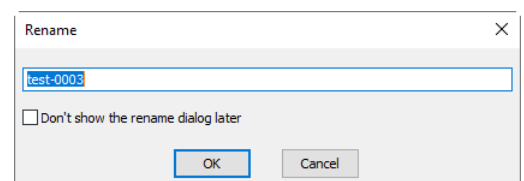
Name Format: The year, month, date, hour, minute and second or nnnn (sequence) are used as part of the file name. If more files are saved with in a second, a nnnn suffix is attached to the end of Name Format to avoid the possible name confliction. For the nnnn (sequence) Name Format, no suffix is needed;

File Prefix: Enter a file name prefix for Quick Save when generating files names for a series of images. This Prefix will be combined with Name Format to form a final file name naming paradigm;

File Type: In this list box, select the format in which you want the image to be saved (can be JPG, PNG, TIF or BMP). If RGB48 format is selected, the image will be saved as a tif file because only tif file supports RGB48 format; About the BMP format, it will be available only when the item in Options>Preference... Misc page, File Format's Add BMP... item is checked. See Sec.15.1.8.5 for details.

Sample: The final file name is shown at the right of the Sample label for reference;

Show the rename file dialog: The file name can be renamed according to this item. When this item is checked, a Rename dialog will pop up after choosing File>Quick Save command or click the Quick Save icon on the toolbar. The new name can be specified again according to the requirement.



15.1.2 Quick Record page

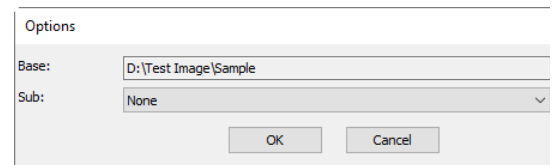
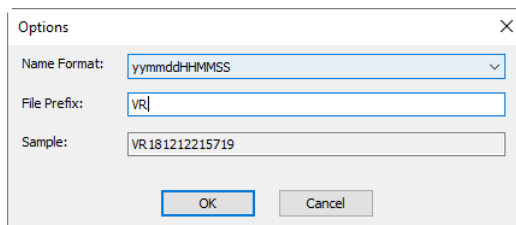
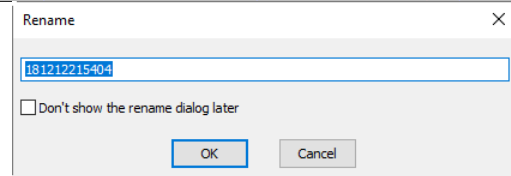
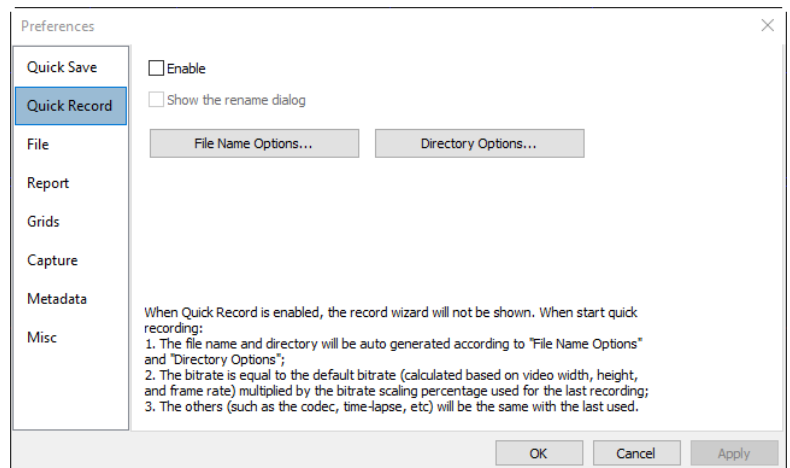
Quick Record is a method that allow users to take video records with the preset options, including the codec method, video records names, etc. With Quick Record enabled, users do not have to input the recording

related options every time.

Choose **Options>Preference** menu will invoke the **Preferences** property page, Click the **Quick Record** item in the **Preferences** property page and the **Quick Record** page is shown as on the right side.

Enable: When **Enable** is checked, the record wizard will not be shown;

Show the rename dialog: If this item is checked, and the **Record** button on the **Capture & Resolution** group is clicked, the **Rename** dialog will be invoked as shown on the right side. User can enter the name wanted in this dialog;

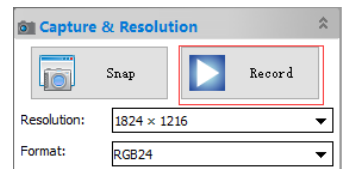


File Name Options...: It including the **Name Format**, **File Prefix** and the name **Sample** for reference;

Directory Options...: The **Directory Options** including **Base** and **Sub** directory defined by the user. The **Sub** directory can be **None**, **Date (YYYYMMDD)** or **Year(YYYY)\Month(MM)\Day(DD)**. The default is **None**;

When **Quick Record** is started, the file name and directory will be generated automatically according to the **File Name Options** and **Directory Options**. The **Bitrate** is equal to the default **Bitrate** (calculated based on video width, height, and frame rate) multiplied by the **Bitrate** scaling percentage used for the last recording; The others (such as the codec, time-lapse, etc.) will be the same with the last one used.

Click **Record** on the **Capture & Resolution** group to start quick recording.



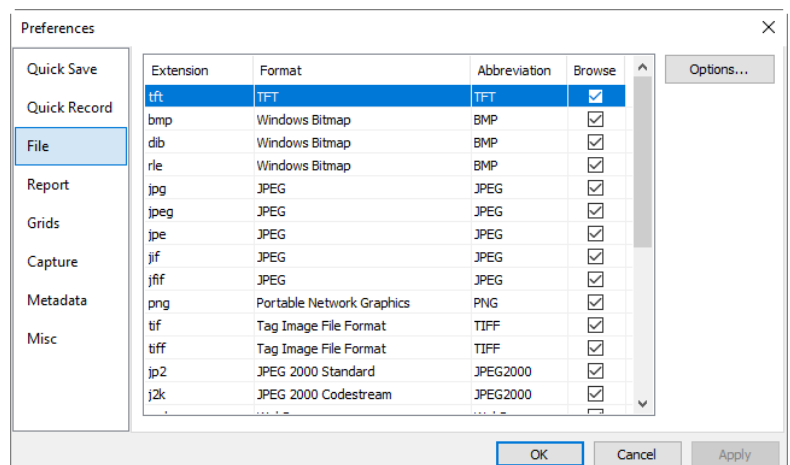
15.1.3 File page

One can check a file **Extension** for the specified file **Format** and its **Abbreviation**, to determine whether or not it will be displayed in the **Browse** window (The checked **Format** can be displayed in the **Browse** window).

Extension: Used to identify the file extension;

Format: English full name of file formats;

Abbreviation: File **Format**'s abbreviation;



Browse: Check/uncheck to determine whether or not the file **Format** can be displayed in the **Browse** window;

Options•••: To configure the image file **Save As Option** for tft, jpg, jpeg, jpe, jif, jfif, png, tif, tiff, jp2, j2k, webp, gif and dng. For details, please refer to the **Option** button explanation in the **File>Save As** dialog(See Sec.5.5 for details).

15.1.4 Report page

Choosing **Options>Preference**••• menu will invoke the **Preferences** property page, Clicking the **Report** item in the **Preferences** property page, the **Report** page is shown as below:

Template: The report template use placeholders to represent various content to be replaced;

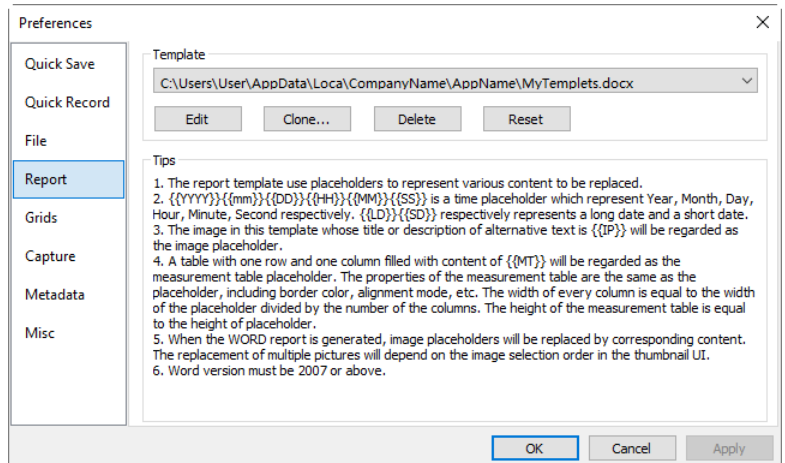
Edit: Click the **Edit** button to open the **Template** to edit;

Clone: Click **Clone** button to clone the current **Template**;

Delete: Click **Delete** button to delete the current **Template**;

Reset: Click **Reset** button to erase the content of the selected template and replaced it with the default **Template**.

In the **Template**, there are following items described below:



{{YYYY}}{{mm}}{{DD}}{{HH}}{{MM}}{{SS}} is a time placeholder which represent **Year**, **Month**, **Day**, **Hour**, **Minute** and **Second** respectively;

{{LD}} {{SD}}: {{LD}}, {{SD}} represents long and short date respectively, **DD** can be **LD** or **SD**;

{{IP}}: The image in this template whose title or description of alternative text is {{IP}} which will be regarded as the image placeholder;

{{MT}}: A table with one row and one column filled with content of {{MT}} will be regarded as the **Measurement** table placeholder. The properties of the **Measurement** table are the same as the placeholder, including border color, alignment mode, etc. The width of every column is equal to the width of the placeholder divided by the number of the columns. The height of the **Measurement** table is equal to the height of placeholder.

When the **Word Report** is generated, the image placeholders will be replaced by corresponding content. The replacement of multiple pictures will depend on the image selection order in the **Thumbnail** window.

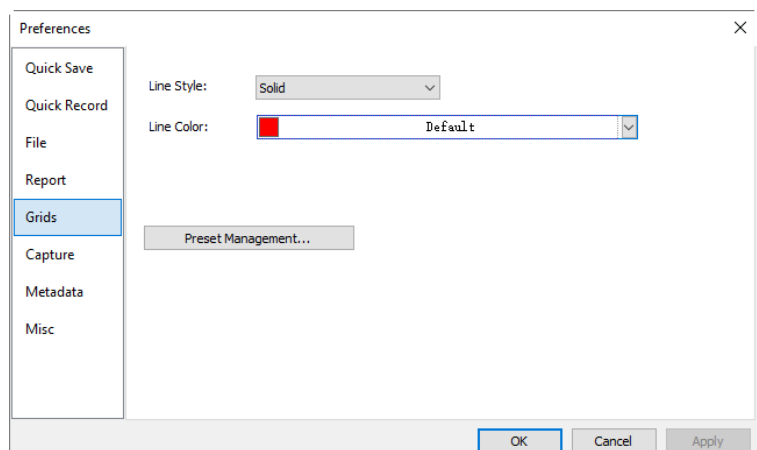
The **Word** version must be 2007 or above. See **File> Microsoft Word Report**••• (F10) for how to use the **Word Report** function.

15.1.5 Grids page

Choosing **View>Grid> Setting**••• command, or choosing **Preference**••• command and clicking the **Grids** page can set the **Grid line Style**, and **Line Color** for the **Grid** overlaid on the video and image window can also be set.

Grid Line Style: The **Line Style** for the grid can be **Solid**, **Dash**, **Dot** or **DashDot** et al. Default is **Solid**;

Grid Line Color: The color of the grid line. Default is **Red (255,0,0)**;

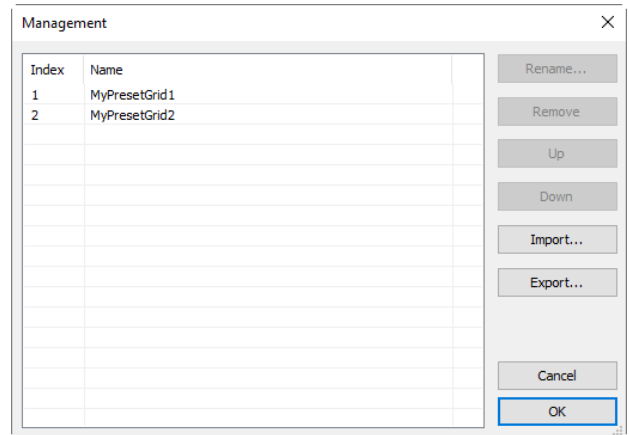


Preset Management: Click the **Preset Management** button will invoke the **Management** dialog to manager

[Manual Grids](#) items that have been set before.

To manage the saved [Preset](#) options, [Export](#) or [Import](#) the grids to or from file, click the [Preset Management](#) button will pop up a [Management](#) dialog to manage the saved [Manual Grids](#). The [Rename](#), [Remove](#), [Up](#) and [Down](#) button will be enabled only when a item is selected.

If the item order is changed or the item is deleted, the submenu under the [View>Grids>Preset](#) will also be modified.



15.1.6 Capture page

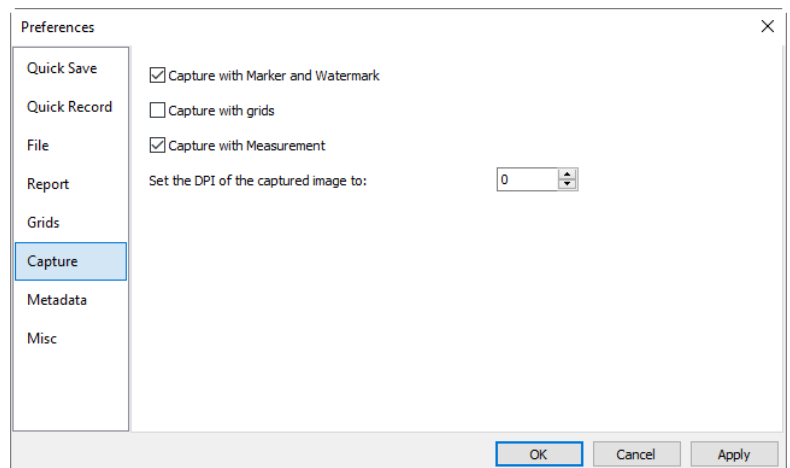
If one wish to capture an image with many [Objects](#) overlaid on the video window, the following settings should be defined first.

Choosing [Options>Preferences...](#) command and clicking [Capture](#) page, the [Capture](#) page will be shown as below:

[Capture with Marker and Watermark](#): Checking [Capture with Marker and Watermark](#) will capture image with [Marker](#) and [Watermark](#) on the video window;

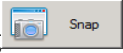
[Capture with Grids](#): Checking [Capture with Grids](#) will capture image with [Grids](#) on the video window;

[Capture with Measurement](#): Checking [Capture with Measurement](#) will capture image with [Measurement Objects](#) on the video window;



[Set the DPI of the captured image to](#): The [DPI](#) can be used to the display or print operation, if one keep using the [Calibrated Resolution](#) of the microscope image captured with the camera, the large [Calibrated Resolution](#) will make the image in small size in the [Word](#) file or on the paper printed. The value in the [DPI](#) dialog can be set to 150, 300,600 or 1200 for the print or display application.

Click [Ok](#) to end the setup, the [Apply](#) to apply the setup, or [Cancel](#) to cancel the setup.

After the above steps are finished, if there are [Marker](#), [Watermark](#), [Grids](#) or [Objects](#) overlaid above the video, choosing [Capture>Capture Image](#) or clicking  on the [Camera Sidebar](#) will capture the image with [Marker](#), [Watermark](#), [Grids](#) or [Objects](#) overlaid on the video.

15.1.7 Metadata page

Choosing [Options>Preferences...](#) command, and clicking [Metadata](#) page, a dialog called [Preferences](#) will be brought up as shown below;

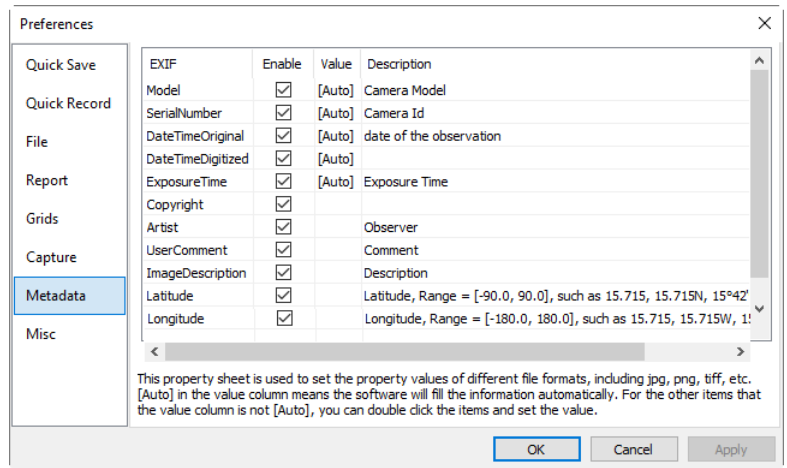
This [Metadata](#) property page is used to set the property values of different file formats, including jpg, png or tiff format after the image is captured.

[EXIF](#): Exchangeable image file format (officially [EXIF](#), according to JEIDA/JEITA/CIPA specifications) is a standard that specifies the formats for images, sound, and ancillary tags used by digital cameras (including smartphones), scanners and other systems handling image and sound files;

Enable: Check the corresponding items will save the items in the image file;

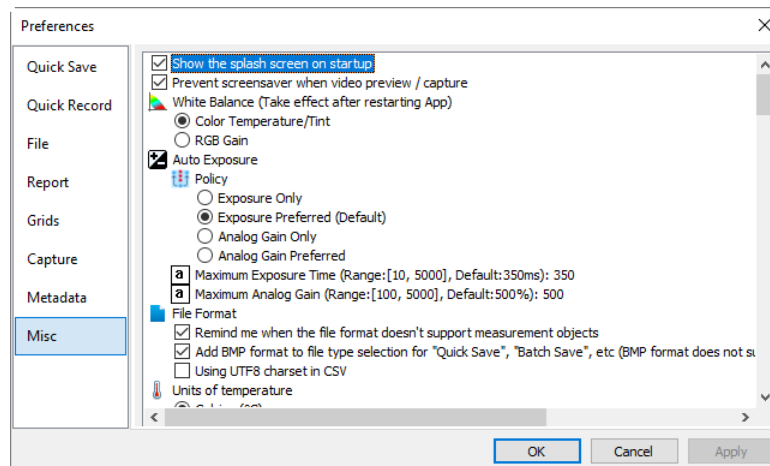
Value: [Auto] in the value column means the software will fill the value automatically. For the other items that the value column is blank, User can double click the items and set the value in the pop up dialog;

Descriptions: The explanations of the EXIF items.



15.1.8 Misc page

The **Misc** page is mainly used for the control of the **App**'s basic setup as shown below:



All of the **Misc** page functions are described in the following subsection.

15.1.8.1 Show the splash window on startup

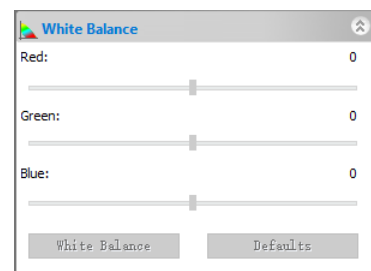
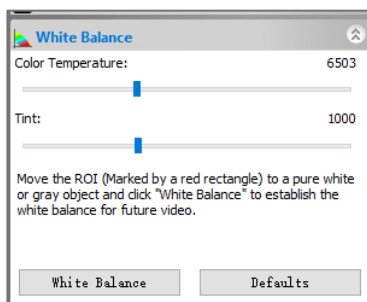
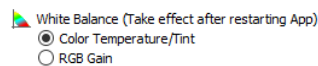
Check **Show the splash screen on startup** will show the splash screen at the start up of the **App**.

15.1.8.2 Prevent screensaver when video preview / capture

When camera video is started/recorded or the the capture is in the process, check this item will prevent the computer screensaver operation(**Prevent screensaver when video preview / capture**).

15.1.8.3 White Balance(Take effect after restarting the App)

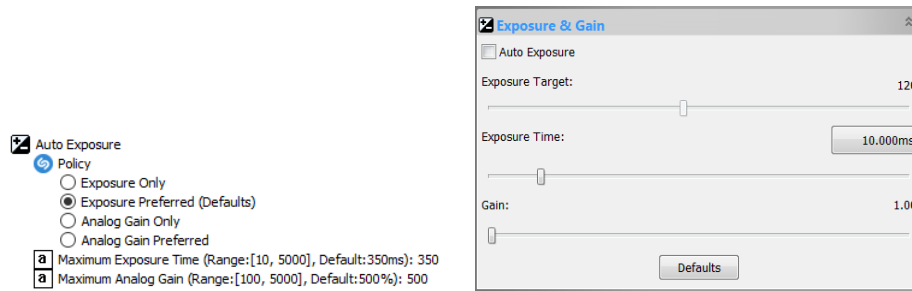
User can select **Color Temperature/Tint** or **RGB gain** for **White Balance** operation in the **White Balance** group on the **Camera Sidebar** according to his requirement or personal interest.



15.1.8.4 Auto Exposure

User can set the **Auto Exposure Policy** for the camera to optimize the camera **Auto Exposure** performance

in the **Exposure & Gain** group on the **Camera Sidebar**.



Policy>Exposure Only: If this item is selected, the **App** will only adjust the **Exposure Time** automatically, no **Analog Gain** adjustment will be considered. But user can adjust the **Analog Gain** manually;

Policy>Exposure Preferred (Defaults): If this item is selected, the **App** will adjust the **Exposure Time** at first. If the **Exposure Time** reaches to its **Maximum Exposure Time** value, but the video still does not reach to the **Exposure Target** value, then the **Analog Gain** adjustment will be performed along with the **Exposure Time** automatically;

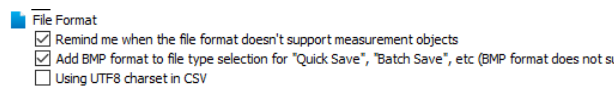
Policy>Analog Gain Only: If this item is selected, the **App** will only adjust the **Analog Gain** automatically, no **Exposure Time** adjustment will be considered. But user can adjust the **Exposure Time** manually;

Policy>Analog Gain Preferred: If this item is selected, the **App** will adjust the **Analog Gain** at first. If the **Analog Gain** reaches to its **Maximum Analog Gain** value, but the video still does not reach to **Exposure Target** value, then the **Exposure Time** adjustment will be performed along with the **Analog Gain** automatically;

Maximum Exposure Time (range: [10, 5000], Default: 350ms):350: Click to enter the **Maximum Exposure Time** wanted in the range of [10, 5000];

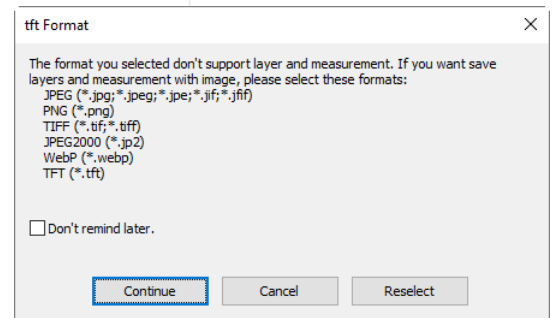
Maximum Analog Gain (range: [100, 5000], Default: 500%):500: Click to enter the **Maximum Analog Gain** wanted in the range of [100, 5000].

15.1.8.5 File Format



Remind me when the file format doesn't support measurement object: Check this button will remind the user that the selected format doesn't support **Measurement Objects** save operation. The remind dialog is shown on the right side.

The current formats supporting **Layer Objects** are **JPEG**, **PNG**, **TIFF**, **JPEG2000**, **WebP** and **TFT**.



Add BMP format to file type selection for “Quick Save”, “Batch Save”, etc (BMP format does not support calibration and measurement): Check this item will allow the **BMP** format available in the **File> Quick Save** and **File> Batch Save** commands' format list box (See Sec.5.6, 5.7, 15.1.1 for details).

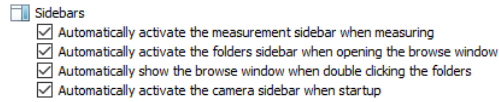
Using UTF8 charset in CSV: Check this item to prevent the messy code in the **CSV** file (See Sec.7.3.3 and 7.3.4 for details).

15.1.8.6 Units of temperature

User can select either **Celsius(°C)** or **Fahrenheit(°F)** unit  for the cooling camera.

15.1.8.7 Sidebars

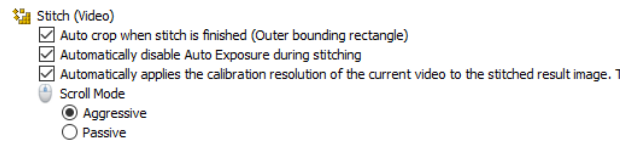
Used to ensure the corresponding action will activate the corresponding **Sidebar**



15.1.8.8 Stitch(Video)

This item is used for the [Live Stitch\(Video\)](#) only.

[Auto crop when stitch is finished\(Outer bounding rectangle\)](#): Checking this item will crop the stitched image including its maximum effective pixel size;



[Automatically disable Automatic Exposure during stitching](#): When [Live Stitch](#) starts, to ensure the image consistency at different position, [Auto Exposure](#) on the [Exposure & Gain](#) group will be unchecked if this item is checked;

[Automatically applies the calibration resolution of the current video to the stitched result image. The accuracy of this value depends on many factors](#): Checking this item will added the video window's [Calibration Resolution](#) to the current stitched image for the [Measurement](#) application. The [App](#) can not ensure the accuracy of this [Calibration Resolution](#).

[Scroll Mode: Aggressive](#) and [Passive](#) describe the behaviors of the scroll bars (vertical and horizontal) during stitching;

For [Aggressive](#) mode, the scroll bars are adjusted automatically to make the video frame always lying in the center of the window while the stitched result moving in the reverse direction;

For [Passive](#) mode, the video frame moves along the direction of the moving stage until it reaches to the edge of the window and at that time the corresponded scroll bar will be adjusted to let the video frame scroll to the center;

15.1.8.9 EDF(Video)

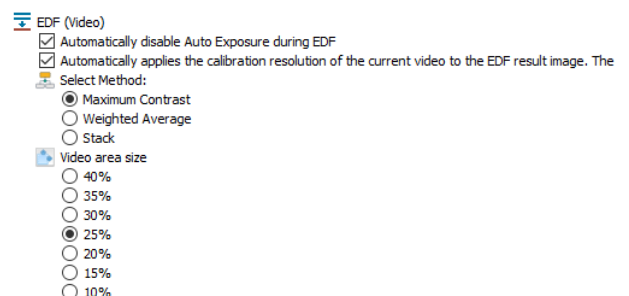
The [Options>Preference>Misc...](#) page's [EDF\(Video\)](#) items are used to setup for the video [Process>EDF...](#) command.

[Automatically disable automatic exposure during EDF](#): When [EDF\(Video\)](#) starts, to ensure the image consistency at different position, [Auto Exposure](#) on the [Exposure & Gain](#) group will be unchecked if this item is checked;

[Automatically applies the calibration resolution of the current video to the EDF result image. The accuracy of this value depends on many factors](#): Checking this item will added the video window's [Calibration Resolution](#) to the current stitched image for the [Measurement](#) application. The [App](#) can not ensure the accuracy of this [Calibration Resolution](#).

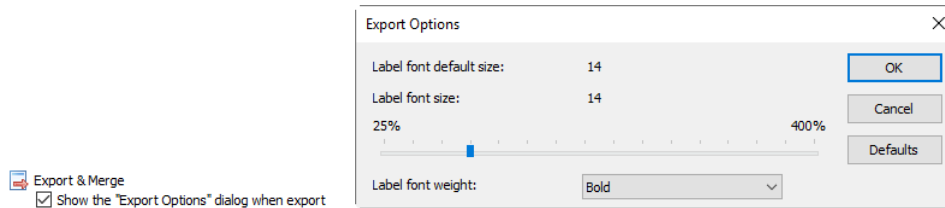
Three methods are provided for [EDF\(Video\)](#), including [Maximum Contrast](#), [Weighted Average](#) and [Stack](#) method. The [Maximum Contract](#) method is the default one.

The [Video area size](#) could be changed from 10% to 40% and the [EDF](#) results window size could be adjusted easily by middle mouse button or the zoom list box on the toolbar.

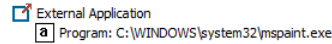


15.1.8.10 Export & Merge

If this item is checked, a dialog called [Export Options](#) will be pup up to set the [Label font size](#) and [Label font weight](#). This setup is mainly used to adjust the font size and weight and let it keeping a nice ratio between the image and the [Measurement Object Labels](#) in [Word](#), [Print](#) and other application.



15.1.8.11 External Application



This item is used to specify the 3rd party software for the **File>External Application** command to open the current window image. Some standard program has this interface, such as **Photoshop** or **mspaint**.

15.1.8.12 Show or hide control in the camera sidebar

Check/uncheck to customize(Show/hide) the **Camera Sidebar**'s group.

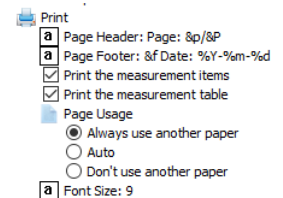
15.1.8.13 Print

The **Options>Preference>Misc** page's **print** items are used to setup the print format for the **File>Print...** or **File Print Preview...** command. When printing the image and the measurement results, one can set the **Page Header** and **Page Footer** in following format:

Page Header: Page:&p/&P: The page header, click to define the new format;

Page Footer: &f Date:%Y-%m-%d: The page footer format, click to define the new format;

Print the measurement table: If there are measurement item overlaid on the image, check it will print these objects' **Measurement Sheet** on the page with;



Page Usage>Always use another paper: Print the **Measurement Sheet** data on a separate page;

Page Usage>Auto: Print the **Measurement Sheet** data just behind the image (if the image and data can be arrange in a single page) of on a separate page (if not);

Page Usage>Do not use another paper: Print the **Measurement Sheet** data just behind the image page;

For example:

Choosing **&f Date:%Y-%m-%d** will print the file name and **Date** with yyyy-mm-dd format on the page header.

Choosing **Page: &p/&P** will print **Page: 01/11** on the page footer (Suppose the current page is page 1 and the total pages is 11).

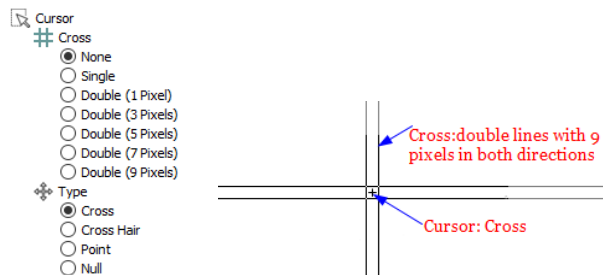
The following options can be used for reference:

- &f** File Name
- &p** Current Page
- &P** Total Pages
- %A** Full weekday name
- %b** Abbreviated month name
- %B** Full month name
- %c** Date and time representation appropriate for locale
- %d** Day of month as decimal number (01 - 31)
- %H** Hour in 24-hour format (00 - 23)
- %I** Hour in 12-hour format (01 - 12)
- %j** Day of year as decimal number (001 - 366)
- %m** Month as decimal number (01 - 12)
- %M** Minute as decimal number (00 - 59)
- %p** Current local times A.M./P.M. indicator for 12-hour clock

- %S** Second as decimal number (00 - 59)
- %U** Week of year as decimal number, with Sunday as first day of week(00-53)
- %w** Weekday as decimal number (0 - 6; Sunday is 0)
- %W** Week of year as decimal number, with Monday as first day of week(00-53)
- %x** Date representation for current locale
- %X** Time representation for current locale
- %y** Year without century, as decimal number (00 - 99)
- %Y** Year with century, as decimal number
- %z %Z** Time-zone name or abbreviation; no characters if time zone is unknown
- %%** Percent sign

15.1.8.14 Cursor

This command will set the mouse **Cursor** for the video and image window operations.



Select the **Cross** in:

None (window default), **Single** (single line), **Double(1 Pixel)**, **Double(3 Pixels)**, **Double(5 Pixels)**, **Double(7 Pixels)**, and **Double(9 Pixels)** formats.

Single means single line. **Double** means two parallel lines. **1 Pixel** means the line space between the two lines is 1 pixel in distance. The other size also has the same meaning.

Select the cursor shape from **Cross**, **Cross Hair**, **Point**, and **Null**.

In the figure above on the right side, a cursor with **Double horizontal and vertical lines with 9 Pixels cross** (for the alignment application, the longer one) and the **Cursor** as a **Cross** was defined.

15.1.8.15 UI Style

Select the favorite **UI style** for the application.



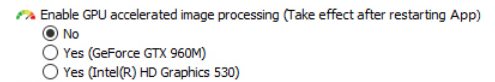
15.1.8.16 Language (Take effect after restarting the App)

Select the **Language** for the application. The **App** now supports 15 languages.



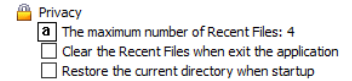
15.1.8.17 Enable GPU accelerated image processing(Take effect after restarting the App)

Select the GPU of the display card to accelerate the video or image processing. The **App** will list the possible display cards according to the computer and user can select different display card according to his requirement. Default is **No**.



15.1.8.18 Privacy

The maximum number of Recent Files can be modified by choosing **Options>Preferences** command and clicking the **Misc** page as shown on the right side.



Here, clicking the **4** (default) edit box will allow you to enter the number of the **Recent Files** submenus that you want. The value ranges from **0** to **8**, the default is **4**;

One can also check the **Clear the Recent Files when exit the application** to clear the **Recent Files** after exit the **App**.

Restore the current directory when startup: Check this item will save the current directory and restore it after the next startup.

15.2 Measurements **Shift+M**

This sheet has many pages, they are:

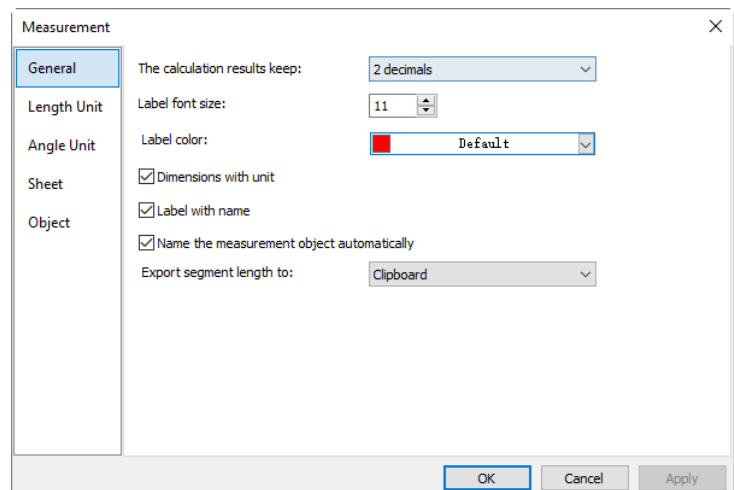
15.2.1 General page

The **General** page is shown below:

The calculation results keep: The list box allows you to set the calculation results accuracy among 1 decimal and 6 decimals. Default is **2 decimals**;

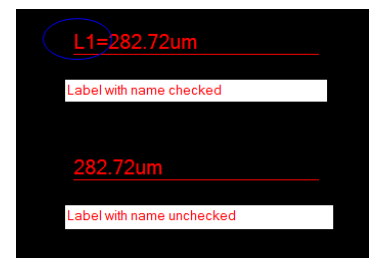
Label font size: The **Label** is used to display the **Objects** dimensions. the **Label font size** is among 5 and 15; Default is 15;

Label Color: The **Label Color** for the **Objects** dimensions; Default is red;



Dimensions with unit: If this box is checked, the **Dimension** will be displayed together with the **unit** for the **Objects**. If unchecked, only the **Dimension** will be displayed with the **Objects**.

Label with name: Checking **Label with name** will add a **Prefix** before the **Objects** number. The **Prefix** for the different **Object** can be specified in the Measurement Sidebar where there is an item called: **Name**. Here, we show an example for **Line Object** with and without **Prefix L1** as shown on the right side.



Export segment length to: Clipboard, CSV file or Microsoft Excel.

15.2.2 Length Unit page

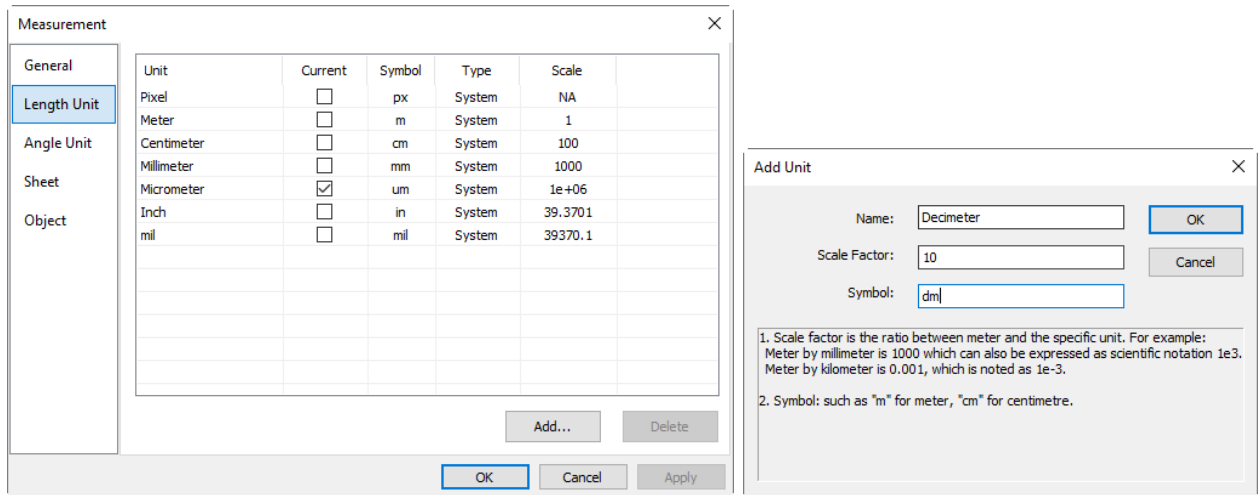
Length Unit page: One can select the **Length Unit** for the **Measurements** menu's **Objects** on the **Layer Measurement** operation;

Unit: The system unit defined by the **App**. It cannot be deleted;

Current: The **Unit** selected or checked;

Type: Type of unit. It can be **System** (Defined by the App) or **User** (Defined by the user) type;

Scale: Represents the ratio of "Meter by unit". For example, if the unit is μm , then "Meter by μm " should be 1000000, the **Scale** should be $1\text{e}+6$;

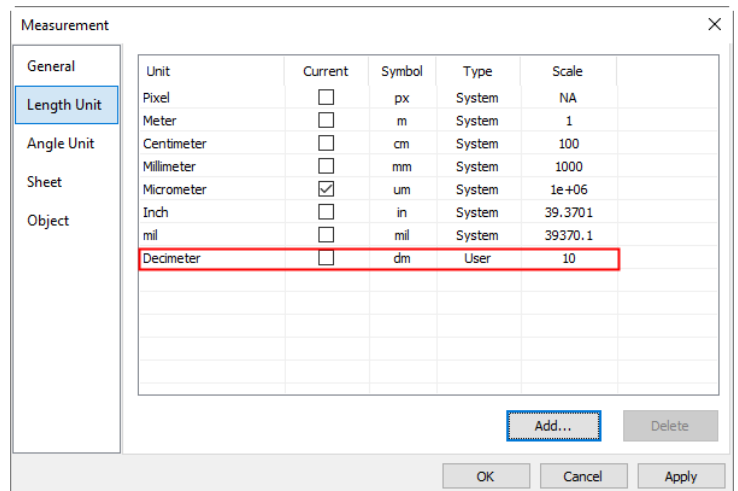


Add...: User can also define his own **Unit**. Clicking **Add...** button and the **Add Unit** dialog will be brought up as above on the right side;

User can enter the **Unit Name** and **Symbol** in their fields. Here, we enter a name called **Decimeter** and its **Symbol** is **dm**, its **Scale** for **Meter** by **Decimeter** is 10. Click **OK** to end the **Add Unit** operation, or **Cancel** to cancel the **Add Unit** operation.

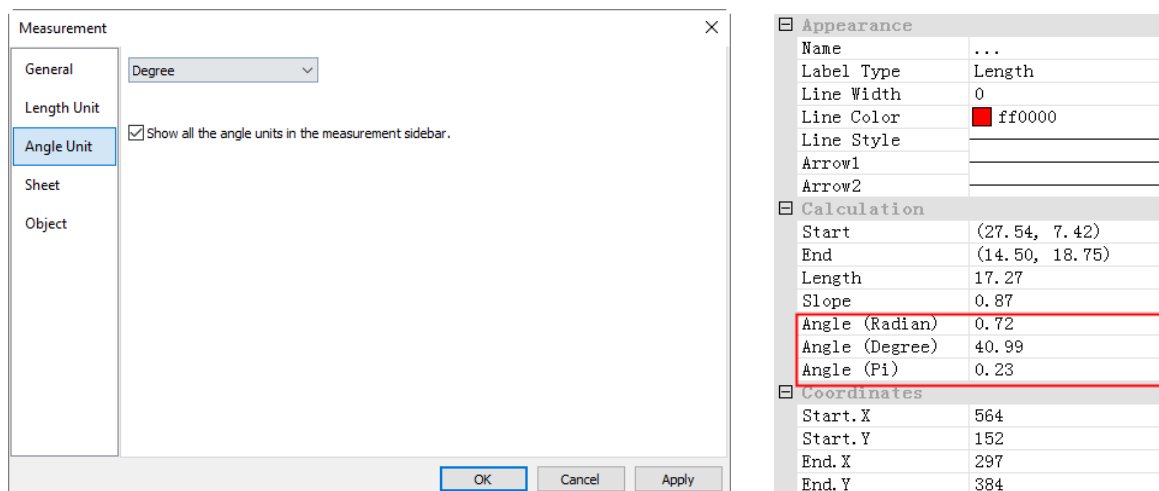
The final **Length Unit** list looks like the figure shown on the right side.

You can find the **Type** is now named **User**. This means that this **Unit** is not defined by the **System**, but by the **User** and can be deleted.



15.2.3 Angle Unit page

On the **Angle Unit** page, one can select **Radian**, **Degree**, or **PI** as the **Angle Unit**.



Show all the angle units in the measurement sidebar will list all the **Object Units** in the **Measurement Sidebar** as shown above on the right side for reference.

15.2.4 Sheet page

See the [View>Measurement Sheet...](#) menu to understand its functions.

1. To modify the [Measurement Sheet](#)'s item order, click the item to highlight it, the [Up](#) or [Down](#) buttons will be enabled (If the item is in the third position, the [Up](#) button will be disabled, if the item is in the last position, the [Down](#) button will be disabled). Click the [Up](#) or [Down](#) buttons to modify the item position;

Note: The item [Index](#) and [Name](#) are always in grayed states, this means these two items cannot be modified (Both their hide/show states and their positions).

2. Checking/unchecking the item will show/hide the item in the [Measurement Sheet](#);

3. Clicking [Default](#) will return to the App's default settings;

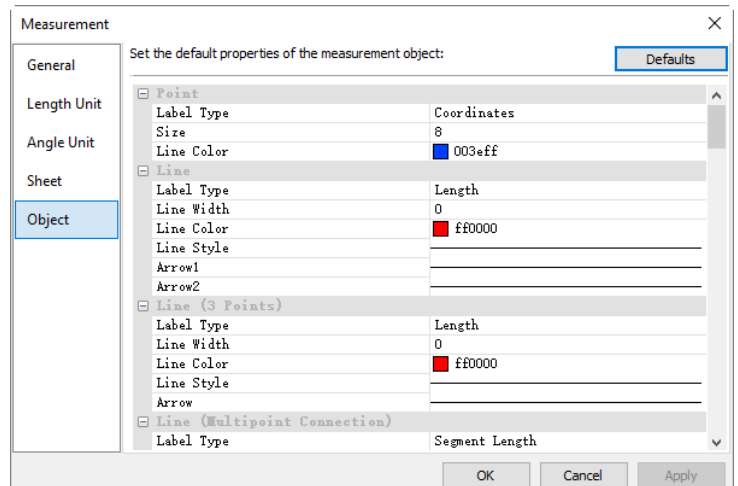
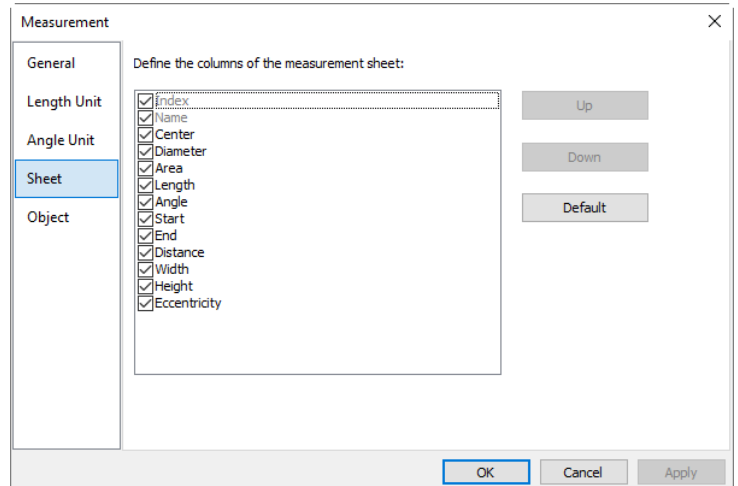
4. Both the name and order for Item 1([Index](#)) and item 2([Name](#)) cannot be changed.

15.2.5 Object page

The [Object](#) page list all of the [Objects](#)' characteristics. Their characteristics can be modified in this page according to the requirement. Different [Object](#) has different characteristics.

The setups for the [Objects](#) are global. User can still modify the setup for the specific in the [Measurement Sidebar](#)'s [Appearance](#) items.

Click [Defaults](#) can return the all the modifications to the [Default](#) one.



15.3 Magnifications... Ctrl+M

Choose [Options>Magnification...](#) command to manage the calibrated [Magnification](#).

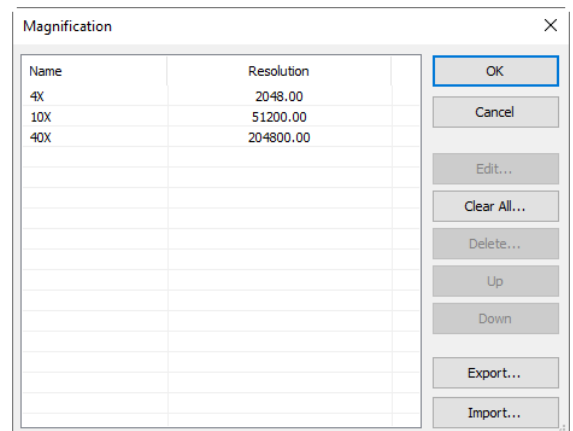
If one has defined the 4X, 10X and 40X [Magnifications](#), the [Magnification](#) dialog should look like the figure on the right side.

1. Highlight the [Magnification](#) item and the [Delete...](#) button will be enabled. Click [Delete...](#) to delete the selected item;

2. Highlight the [Magnification](#) item, click the [Up](#) or [Down](#) button to modify the [Magnification](#) list order; The [Up](#) or [Down](#) button will be disabled when the highlight item is at the first or last position;

3. Click [Clear All...](#) to delete all of the [Magnification](#) items; If one wishes to use the [Magnification](#) late, a backup should be made first;

4. Click [Export...](#) to back up the [Magnification](#) in a safe media. The file extension is [*.magn](#);



- After the new installation is finished, the **Magnification** can be import by choosing **Options>Magnification...** command and click **Import...** to load the previously saved *.magn file;
- If everything is ok, press **OK** to end the **Magnification** dialog.

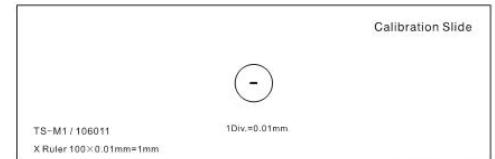
15.4 Calibrate...




The detailed calibration steps are as follows:

- Run the **App**;
- Connect the camera to the computer and microscope;
- Start the camera (Here, it is **yyyyy**);
- Switch the microscope object to 10X and put the TS-M1 micrometer in the middle of the microscope field and try to adjust the ruler clearly. Set the **Unit** to **Pixel** and the video **Resolution** to the maximum one (2048X1534 for **yyyyy**) and **Zoom** ratio to 100%.

(see);



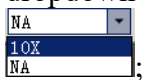
- Choosing **Options>Calibrate...** command or clicking  on the toolbar, a red line with pixels number and 0.000um length is overlaid on the video window. At the same time, a dialog called **Calibrate** will be displayed over the video window;

6. Try to align the two ends of the red line with the video ruler scale (Try to pull the red line as long as possible to keep the calibration accuracy);

7. Enter or select the current microscope objective lens **Magnification** in the **Magnification** field. The current **Magnification** is 10X;

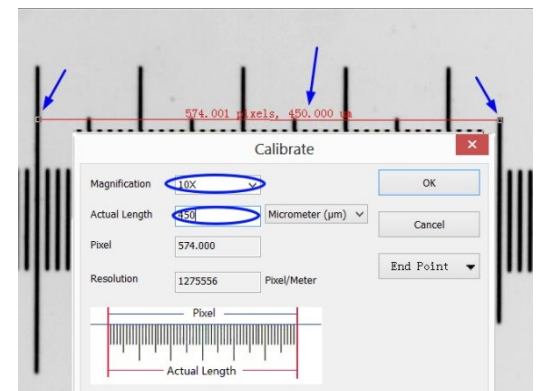
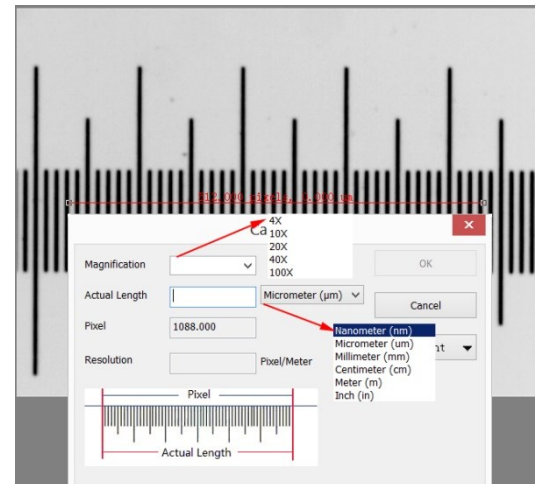
8. Read the overlaid (by the red line) micro-ruler actual length and fill it in the **Actual Length** field, the current **Actual Length** is 450um. This **Actual Length** will also be displayed in the middle of the red line just behind the pixel number. At the same time, the **Calibration Resolution** will be calculated and displayed simultaneously in the **Resolution** field;

9. If everything is ok, click **Ok** to end the calibration. The **Magnification** 10X (This is the number you entered in the **Magnification** edit box) will be available in the **Magnification** dropdown combobox on the video window toolbar



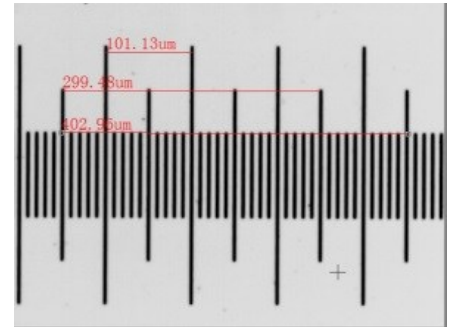
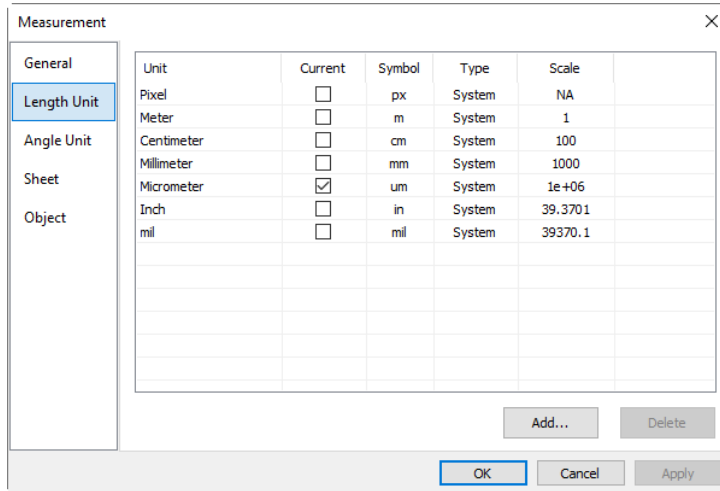
10. If one wishes to make the **Measurement** under this **Magnification**, choose 10X in the above **Magnification** list box first and then choose **Unit** in the **Unit** dropdown list box () which is just in the left of the **Magnification**'s list box (User can also choose **Unit** through the **Option>Measurements...** menu, a dialog called **Measurement** will be brought up. Click **Length Unit** page to display the **Length Unit** page and checking **Unit** in the **Current** item;

Now, you can measure the objects with the selected **Unit** at ease.



11. The selected **Resolution** can be saved for the future image **Measurement** operations. If the **Measurements** are performed on the video, the **Objects** and **Resolution** can be saved in the image with the jpg , png,tif,jp2,webp or tft files for the future applications (See Sec.5.5 for details);

12.The other microscope **Magnification** such as 4X, 40X,100X can also be defined just as the above steps. Thus when you switch the microscope objective lens, you just need to select the **Magnification** (40X for example) on the toolbar to perform the **Measurement** operations.



15.5 Edit Dye List...

The **Dye List** can be used for the **Process>Color Composite** operation. The new **Dye List** feature in the **App** allows you to select from a list of dyes, or add your custom dyes to the list. The list of dyes (**App.dye**) is stored under **C:\Program Files\Company\App** directory.


When you choose **Options>Edit Dye List...** command, you will see the **Edit Dye List** dialog box:

The list includes any dye definitions found in the current location. When this feature is used to prompt for a specific dye, the list indicates the currently selected dye, or you may select a dye from the drop-down list.

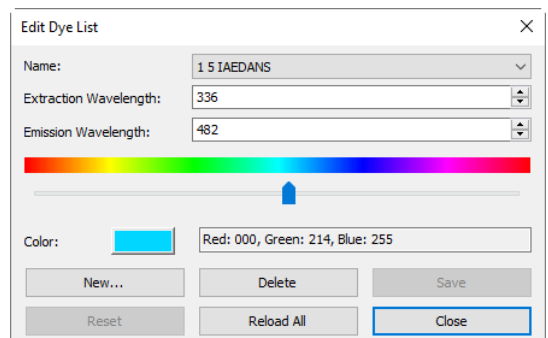
Name: This list includes all dye definitions found in the current dye file. You may select a different dye from the drop-down list, and all the remaining controls will be updated to show the characteristics of the new dye;

Emissions Wavelength: This field displays the emissions wavelength for the dye you have chosen. You can adjust the emissions wavelength by entering a new value. The default color will change in response to changes in the emissions wavelength;

Excitation wavelength: The default wavelength for your dye is displayed here. You can adjust the wavelength by entering a new value;

Color: Use the slider to adjust the emissions wavelength for your dye, which also sets the default display color. (You can also use the **Color** button  to select a specific color using a standard Windows color selection dialog) The color will change in response to changes in the emissions wavelength. Here you can change the color associated with the selected dye, or define a custom color. The color default is linked to the selection of a wavelength for your dye. If you change the **Emissions Wavelength**, the color displayed will be the standard color for that wavelength. To set a custom color, first you should set the wavelength and then edit the color;

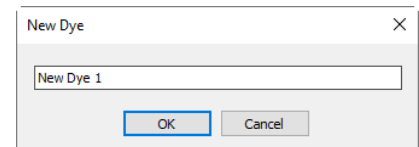
New: Clicking **New** will setup a new dye, this will invoke a dialog called **New Dye**. Input your **New Dye** name and click **Ok** to end the dialog and click **Cancel** to cancel the input. This will return to the **Edit Dye List** again and the new name will be the default on in the Name list box. Try to set the **Emissions wavelength**,



Excitation wavelength, Color for your new dye;

Save: Click **Save** on **Edit Dye List** to save your dye selection;

Close: Click the **Close** button to end the **Edit Dye List** dialog.



15.6 Auto Correction••

Set the low and high ranges for the **Image>Adjust>Auto Level** and **Image>Adjust>Auto Contrast** menus. The default value is 0.5% for both, but the **App** suggests this value be smaller than 1%.

See **Image>Adjust>Auto Level** and **Image>Adjust>Auto Contrast** for details (Sec.11.2.10 and Sec.11.2.11).

16 Window

16.1 Activate Video Window



F6

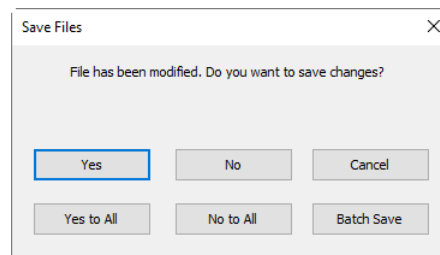
A video window activating function, which could help to switch to the video window immediately when it is not easy to find it among all the opened image windows.

16.2 Close All

Choosing **Closes All** command to close all of the pictures opened or captured inside the **App** frame. If user has made any modifications to the pictures or if you have captured some pictures from the camera, choosing **Close All** will let you finish the saving operations quickly.



If the above image windows exist, choosing **Window>Close All** command will bring up a **Save Files** dialog as below:



1. Clicking **Yes** on the **Save Files** dialog will close the **Video** , **Browse**, **Image** windows directly that are not changed without ask anything. If there are newly created **Image** windows, the **App** will bring up a **Save As** dialog to prompt user to enter the **File name** to save file (See Sec.5.5 for detail).

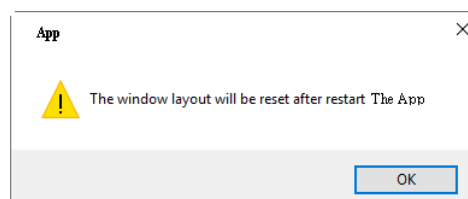
If **Save** or **Cancel** is clicked in the **Save As** dialog, the **App** will return to the **Save Files** dialog to continue the next file close operation;

2. Clicking **No** on **Save Files** dialog will close the current image window without saving operation and return to the **Save Files** dialog to continue the next file operation;
3. Clicking **Cancel** will cancel the **Save Files** dialog without doing anything;
4. Clicking **Yes to All** on **Save Files** dialog will always bring up a **Save As** dialog to let you enter the **File name** to save files one by one until all of the files are saved;
5. Clicking **No to All** on **Save Files** dialog will close all of the image windows without saving them;
6. Clicking **Batch Save** on **Save Files** dialog will transfer the save process to **File>Batch Save...** command. Please check the **File>Batch Save...** menu for details.

Note: If you have a lot of images opened and have made some modifications on them and want to close them quickly without saving anything, you may uses this command and choose Step 5. All the images will be closed instantly, no warning will be given.

16.3 Reset Window Layout

Choosing **Window>Reset Window Layout** will reset the **App** window layout to the original one. The reset will be effective after restart.

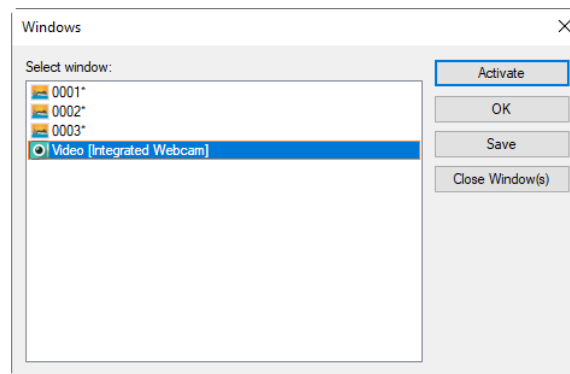


16.4 Windows...



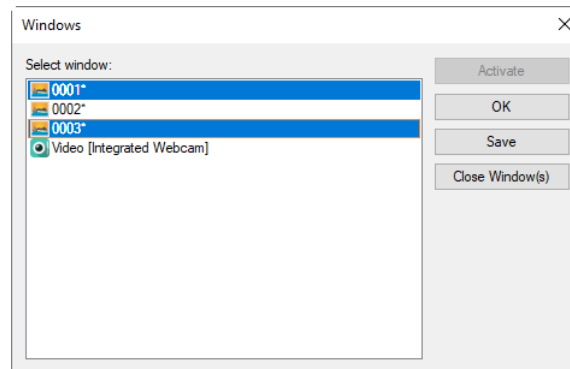
Choosing **Window>Windows...** will open a dialog that lets user manage the currently opened windows.

The **Windows** dialog allows user to manage large lists of open windows by assigning them into groups. Let us say user has 4 windows opened, but want to close 2 of them scattered through the list.



1. Choose **Window>Windows...** command;

2. Select the windows you want to close. Hold **Ctrl** or **Shift** key to select more than one at a time. Here, 2 items are selected;



3. Click **Close Window(s)** button, those 2 selected windows will be closed, leaving the other files or captures available for editing;

4. User can use this command to switch to the selected window on a list by hitting **Activate** (or "bring up" from multiple an icon windows).

17 Help

17.1 Help Contents



F1

Choose **Help>Help Contents** command to load the **App** help file. The help file is in Portable Document Format (PDF).

PDF is a file format used to represent documents in a manner independent of application software, hardware, and operating systems. Each PDF file encapsulates a complete description of a fixed-layout flat document, including the text, fonts, graphics, and other information needed to display it. In 1991, Adobe Systems co-founder John Warnock outlined a system called "Camelot" that evolved into PDF.

While the PDF specification has been available free of charge since at least 2001, PDF was originally a proprietary format controlled by Adobe. It was officially released as an open standard on July 1, 2008, and published by the International Organization for Standardization as ISO 32000-1:2008. In 2008, Adobe published a Public Patent License to ISO 32000-1 granting royalty-free rights for all patents owned by Adobe that are necessary to make, use, sell and distribute PDF compliant implementations.

If your computer still does not install the PDF reader, please try to download it from:

<http://www.adobe.com/downloads/>

17.2 Diagnose



The **Diagnose** command is used to diagnose the user's computer configuration for the analysis of the compatibility of the OS, the **App** version, and the installed camera characteristics.

Property	Value	
Computer	Dell Inc. XPS 15 9550	Computer Characteristics
OS	Windows 10 Pro	
Version	1803 17134	
CPU	Intel(R) Core(TM) i7-6700HQ CPU @ 2.60GHz	
Cores	4	
Threads	8	
Memory	16G	
Display	GDI, Rec.709, sRGB, 8 Bits	
Software	App	Application Name and Its Version
Version	3.7.13593.20181216	
Device Name	YYYYY	Camera Characteristics
Camera Id	TP18082308413447CCF24B3F13435DC	
Production Date	20180823	
Revision	1	
Hardware Version	1.0	
Firmware Version	1.4.1.20161129	
FPGA Version	1.1	
Pixel Size	(2.400, 2.400) μm	
Still Image Capture	Yes	
Still Image Width	5440	
Still Image Height	3648	
Video Width	5440	
Video Height	3648	
Frame	87	
Frame Rate	2.9	
Exposure Time	350.000ms	
Analog Gain	5.00	
Pixel Format	RAW8	
ROI	No	
Auto Exposure	Yes	
Exposure Target	120	
White Balance	6503, 1000	
Black Balance	0, 0, 0	
Hue	0, [-180, 0, 180]	
Saturation	128, [0, 128, 255]	
Brightness	0, [-64, 0, 64]	
Gamma	100, [20, 100, 180]	
Contrast	0, [-100, 0, 100]	
Frame Speed	2, [0, 2]	
Power Frequency (Anti-flicker)	DC	
Flat Field Correction	No	
Dark Field Correction	No	
Sharpen	0%	

OK Copy

Click the **Copy** button to copy the **Diagnose** items to the clipboard for further application such as send it to the supplier for analysis ital.

17.3 About...

Display the related information about the [App](#), including the [App version](#), [Compatible OS](#), [Built](#) date and its developer's [www](#) etc. Clicking on the [URL](#) link will direct user to the [www](#) address of the camera supplier. If user has any problem with the camera or application, please feel free to contact your supplier.

