Condor Viewer Imaging System
User Guide

(Marc-Antoine Lalonde, 03/23/2018)

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2 Introduction

The Choi lab at the Gordon Center for Medical Imaging is actively developing fluorescent compounds with high metabolic specificity. The aim is to support disease identification for research and surgery assistance. This user guide describes the graphical user interface (GUI) for the mesoscale imaging system (MIS) in development at Choi Lab. As such, it provides essential features for real-time imaging and original functions integrated at the request of the users.

3 Scope

This user guide is focused on explaining the features supported by the GUI. Programming and engineering aspects are documented in a separate developer guide.

4 System components

Operation of the imaging system requires the following components:

- Desktop computer
- Camera link frame grabber
- Imaging device
- Power supply for the camera
- Camera link cable
- Laser sources
- White light source
- Fiber optics for the laser sources
- Fiber optics or LED for the white light source
- Fiber optics holder and camera mount assembly

5 Physical operation

5.1 Lens Adjustment

The lens has three separate adjustments available: aperture, zoom and focus.

5.1.1 Aperture

Turning the topmost knob will change the aperture of the lens. A bigger aperture means more light will come to the sensor, and thus produce brighter images. However, a bigger aperture means a smaller depth of field, which means that object sharpness degrades faster as the focal plane is moved (see focus).

5.1.2 Zoom

The middle knob on the lens adjusts the zoom of the camera. Like aperture, a higher zoom also reduces the depth of field and image sharpness.

5.1.3 Focus

The bottommost knob of the lens adjusts the focus distance of the camera. Objects in the focal plane of the camera will have the best sharpness/contrast. However, this lens also affects the zoom. It may therefore be necessary to adjust zoom and focus alternatively to attain the desired result.

6 Software Operation

The Graphic User Interface provides two major feature families: visualization enhancements and quantitative measurement. The two are fundamentally different because tracer uptake in biological

systems is linearly proportional to the fluorescence emission, while the human eye interprets intensity (brightness) in a logarithmic scale. The following sections expose the high-level dataflow to simultaneously support both features, list the visual enhancement features (qualitative image rendering) with their use model and then similarly detail quantitative measurement support tools.

6.1 High-level data flow

Figure *1*below shows the path followed by the images throughout the software. Images saved to disk are not modified, except for the cold / hot pixel removal for the IR channels, which only compensates for hardware defects in the camera, image transformations such as rotation and mirroring and white balance for the Visible channel (can be deactivated in Hardware Settings). The same goes for ROI analysis: only the raw data is analyzed and saved.

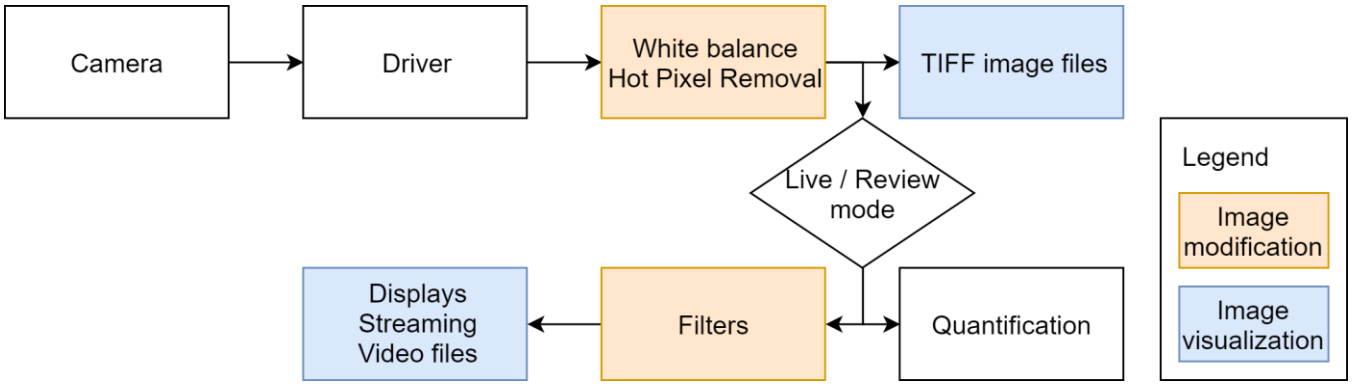


Figure 1: Data flow for the images

The Condor Viewer GUI is presented in **Figure *2***. On the left is a menu containing a series of sliders and settings, sorted according to their type. Below that menu is the laser control tabs, allowing the control of NIR700 and NIR800 lasers. At the top is an action bar with buttons that will prove useful to the user, such as changing the application settings, saving images and analyzing ROI. Finally, in the center are located the Visible, IR1, IR2 and Merged images, above which are a few image-specific action buttons, such as zooming out, recording video and clearing or replicating ROI.

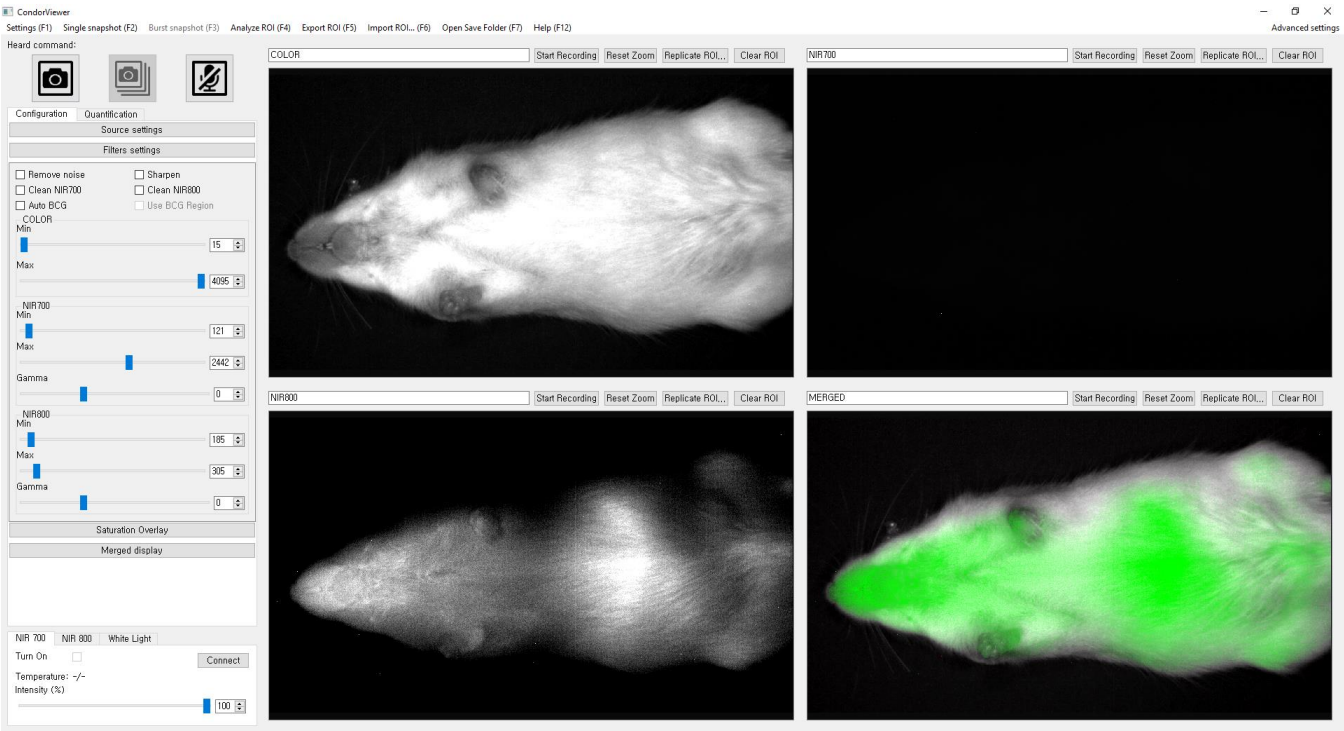


Figure 2: Condor Viewer main window

6.2 Profile Manager

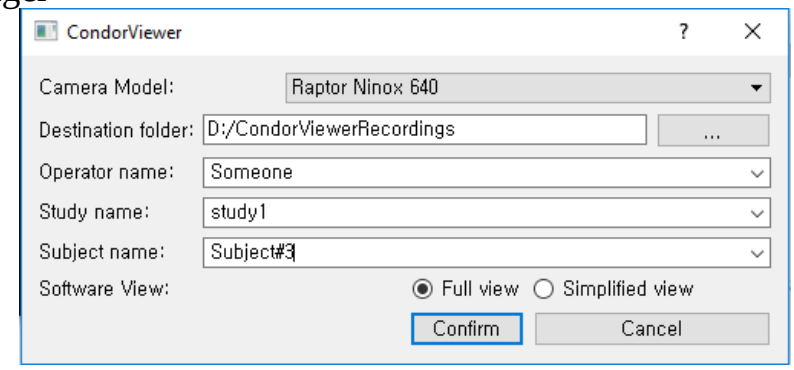


Figure 3: Profile information dialog

At application startup, the user is prompt to enter various information. It includes a dropdown to choose the camera model. The camera that is currently plugged in the computer should be selected.
Additionally, the destination folder, the operator name, the study name and the subject name should be specified. The operator, study and subject fields remember the last 10 entries and will autocomplete the entry when typing. Alternatively, the arrows on the right can be used to select one of the entries in memory. This information will all be used when saving data with the software as snapshots, videos, ROIs, etc. The folder in which the data is saved will be built as follow: [DestinationFolder]/[OperatorName]/[StudyName]/[Date]/[SubjectName]/.
These parameters can later be changed in the 'Profile' tab of the setting dialog.
Additionally, the user can choose between "Full view" and "Simplified View".

6.2.1 Full View:

Displays all the software functionalities

6.2.2 Simplified View

Only the bare minimum for image visualization, such as camera exposure, is displayed. Everything else like quantification or filtering is hidden from the user and set to default values.

6.3 Top menu bar

The **Figure *4*** shows the top left corner of the screen, where the "global" actions are located. The effect of these buttons is described in detail in the following sections. Also note the parenthesis in the button names. They are keyboard shortcuts. You can activate each button by pressed the corresponding F-key on the keyboard.

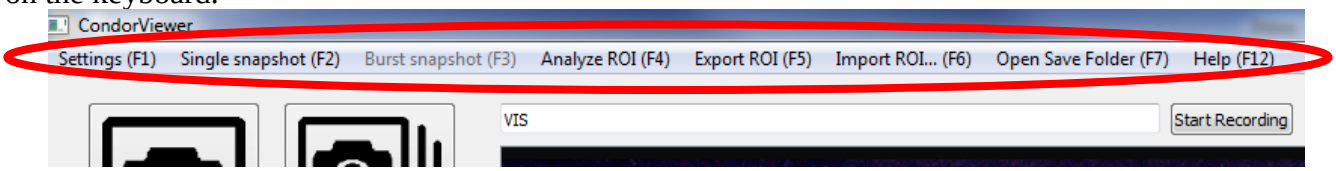


Figure 4: The top left corner of Condor Viewer and the available buttons.

Completely on the right side of this bar (not shown in the image) is a hardware setup menu. This menu should not be used by regular users, it is meant for advanced engineers that understand the consequences of changing these settings.

6.3.1 Settings button

In the top left corner of the application is located a “Settings” button. Clicking this button will show a Settings Dialog, which allows the user to change global application settings. When done, click the “Save” button at the bottom of the dialog to confirm changes, or the “Cancel” button to discard them and close the dialog. This dialog contains three tabs: “General”, “Profile”, “Metadata” and “Defaults”, each of them containing different settings described below.

6.3.1.1 Changing the watermark settings

When taking a snapshot, a watermark will be added to the png images. Here (**Figure *5***), you can choose the watermark size (large is good for small images in a power point, but small is generally big enough for full screen images) as well as the color.

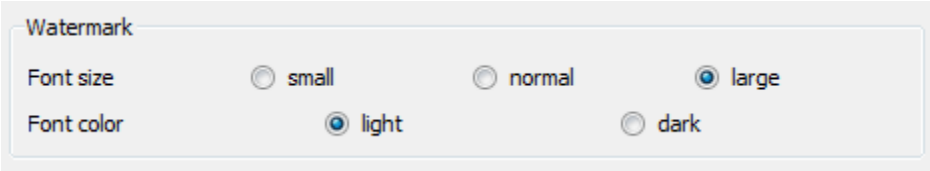


Figure 5: The watermark settings section

6.3.1.2 Changing the burst snapshot settings

In the burst settings section (**Figure *6***), the user can choose how many snapshots will be taken and what should be the exposure of every shot. The selected exposure will only change the IR1 and IR2 exposure. The color image exposure will remain the current value in every snapshot.

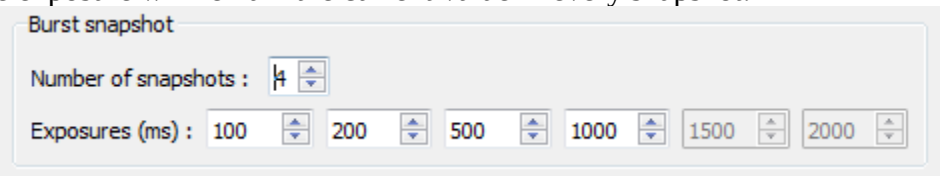


Figure 6: Burst snapshot settings section

6.3.1.3 Changing the video formats

In the video settings section (**Figure *7***), the user can change settings such as video size and recording frame rate (fps). Changing the fps is the most efficient way of reducing video file size without losing quality. For example, working with an exposure time of 200 ms on the camera corresponds to a frame rate of 5 fps. Recording a video at 15 fps would then use 3 times more space as required for the same playback quality. In the drop-down menu, the exposure time equivalent to each frame rate is shown, to help the user make a better choice. If changing the fps is not enough, or if the exposure time is very low, the image size can also be changed to save space. A size compression will impact the video quality.

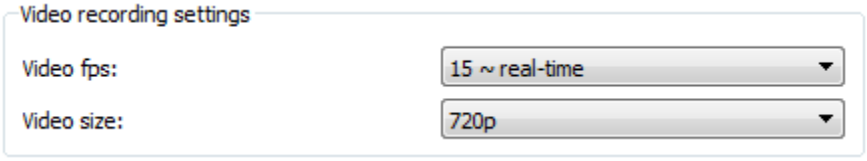


Figure 7: Video recording settings section

6.3.1.4 Changing the image orientation

The transform settings allow to user to flip or rotate the images. This is very useful for when the camera orientation is wrong or when the optics used produces a mirrored image.

6.3.1.5 Recovering ROIs from last session

The ROI are always saved in case of a crash. If you want to recover the ROI from the last session, click the Recover ROI button in the settings dialog.
*Note that only the ROI from last session are saved. Opening and closing the software will erase them.

6.3.1.6 Changing the profile information

By using the profile tab, the user can change the path where data is saved without closing the software.

6.3.1.7 Visualizing the metadata

The metadata tab allows the user to visualize the data that will be saved with the images as Xmp metadata.

6.3.1.8 Changing the default values

Various default values in the software can be modified in the settings. These values are used as initial value when starting the software. To modify such parameters, the user needs to click on the "Save Defaults" button in the "Defaults" tab, and not on the general "Save" button at the bottom.

6.3.2 Single Snapshot

Images can be captured with the "Single Snapshot" button. They are then saved in the save folder previously defined. The images will be saved in their own folder (described in the profile manager section) and will have names that follow the convention:
date_timeofday_[CHANNEL]_exposure_gain[INDEX].tif
The index will always be 1 for single snapshots and the snapshot will be taken instantly, in the current conditions.

6.3.3 Burst Snapshot

In burst mode, several snapshots will be taken at different exposures time. These exposures can be configured in the settings dialog. Each exposure time will have a different index in the file name. It is then easy to see which images were taken at the same burst sequence in the save folder. These multiple snapshots are saved in the same folder with the same name structure as the single snapshots.

6.3.4 Analyze ROI button

This button allows the user to perform ROI analysis, further described later in this document. When analyzing ROI, the three channels are saved to the save folder, as well as each ROI and a .csv file containing all the data.

6.3.5 Export ROI button

This button allows the user to export the ROI to csv files. It exports the ROI positions only, not the statistics like the Analyze ROI feature. All channels will have a separate ROI file in the save folder.

6.3.6 Import ROI button

This button allows the user to import ROIs from a csv file. It is important to use a file that was created with the "export ROI" feature to avoid any error. The ROIs will be imported on the channel in the file name. The user can then replicate those to the desired channel (see section 6.9.4).

6.3.7 Help menu

This menu contains contact email addresses and the version number. To report any bugs or request, use this email and include the version number in your request.

6.3.8 Hardware Settings (far right side)

*** For advanced users/engineers only, see developer guide for details**

6.4 Top-left corner information

In the top left corner, some information regarding the voice commands and the working distance can appear. They only appear if the underlying component is active. See the following subsections for details.

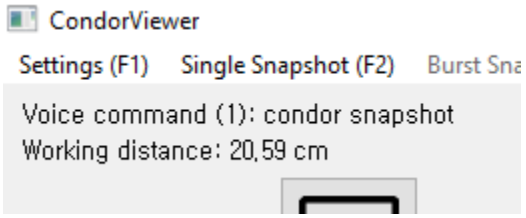


Figure 8: System information

6.4.1 Validating the voice commands

The text is updated and displays the last voice command recognized. There is also a number that will be incremented with each command, which helps if the same command is sent multiple times in a row. The text does not appear when the microphone is muted (see 6.5.3).

6.4.2 Monitoring the working distance

This field is updated with every distance reading from the sensor. The same value is also added to the metadata in real time. If no distance sensor is found, the working distance field will not appear,

6.5 Quick action menu

The **Figure *9*** shows the top left corner of the screen, where big icon buttons are located. These buttons are there for easy access to repetitive tasks.

Figure 9: Quick action menu

6.5.1 Snapshot button

The first button on the left is the single snapshot button and has the same function as 6.3.2.

6.5.2 Burst snapshot button

The second button from the left is the burst snapshot button, working the same way as 6.3.3.

6.5.3 Voice recognition button

The third button is used to activate or deactivate the voice recognition. The logo shows the status. Therefore, a line over the microphone means the recognition is muted (disabled).

6.6 Configuration tab

The Settings tab of the left menu contains various submenus that allow the user to control the camera and the display settings. The submenus are presented in the following sections.

6.6.1 Image source control

The **Figure *10*** shows a zoomed in image of the Source settings menu, which allows the user to modify the camera parameters and switch between live view and review modes.

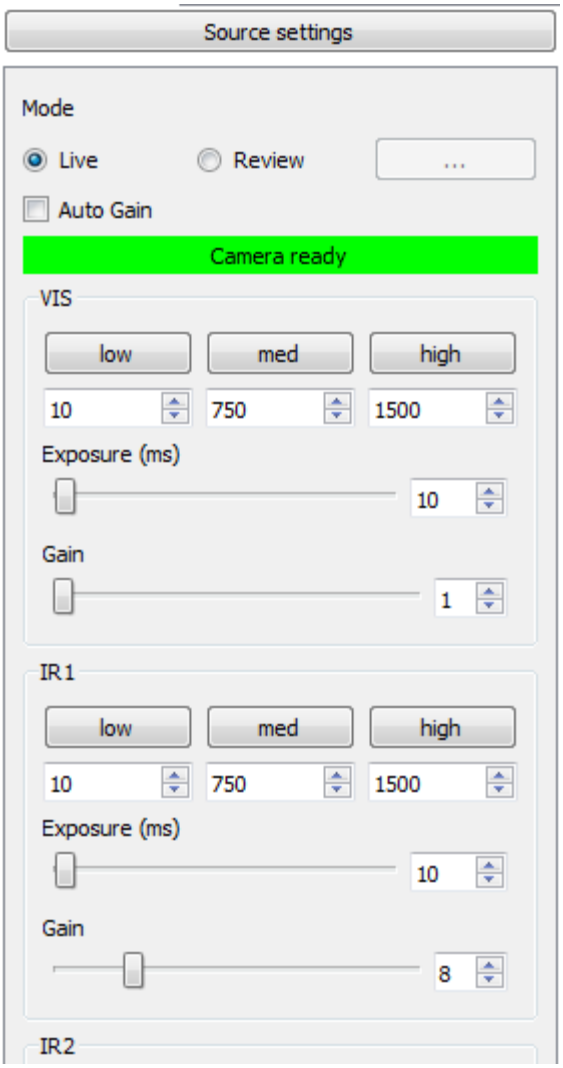


Figure 10: The Source settings menu, located on the left side of Condor Viewer

6.6.1.1 Reviewing images

Images previously captured with Condor Viewer can be reviewed and analyzed using the software. To do so, simply check the "Review" radio button as presented above and select one of the VIS, IR1 or IR2 .tif images in the file browser that will appear. The other corresponding channels will also be loaded to the interface. To select a different image, click on the "…" button beside the radio button.

6.6.1.2 Modifying camera settings

The camera settings can also be modified in this menu by moving the sliders. In general, increasing the exposure will improve the SBR, but if the subject moves the image will become blurry. Increasing the gain instead will increase pixel intensity but will not improve SBR due to the increase in electronic noise. For quantitative imaging, increase the exposure first, then the gain. For qualitative imaging, a balance of exposure and gain will give good results. If the NIR channels saturate, reduce the gain and exposure. Use the saturation overlay feature to evaluate this (section 6.6.3).

6.6.1.3 Exposure presets

For each channel, there are three text boxes with three buttons labeled ‘low’, ‘med’ and ‘high’. These are exposure presets. Pressing a button will set the camera channel to the corresponding exposure time. The user can edit the text boxes to make different presets.

6.6.1.4 Auto Gain

The Auto Gain feature automatically adjusts the gain of IR1 and IR2 channels so that the highest valued pixel on each of those channels is between 85% and 95% of the maximum pixel value. This can slightly increase image quality.

6.6.1.5 Camera status

This indicator tells the users if the latest settings were applied to the images currently displaying. If it is green, it means the images reflect the setting. If red, it means the settings did not take effect yet.

6.6.2 Filters control

The Filters menu (**Figure *11***) provides a series of check boxes and sliders designed to enhance image rendering, as seen by the user. Sliders in this menu do not affect the raw images saved to tiff file. Also, these filters are only applied to the IR channels, as the Visible channel is white balanced as soon as it is acquired from the camera, since no quantification operations are attempted on it.

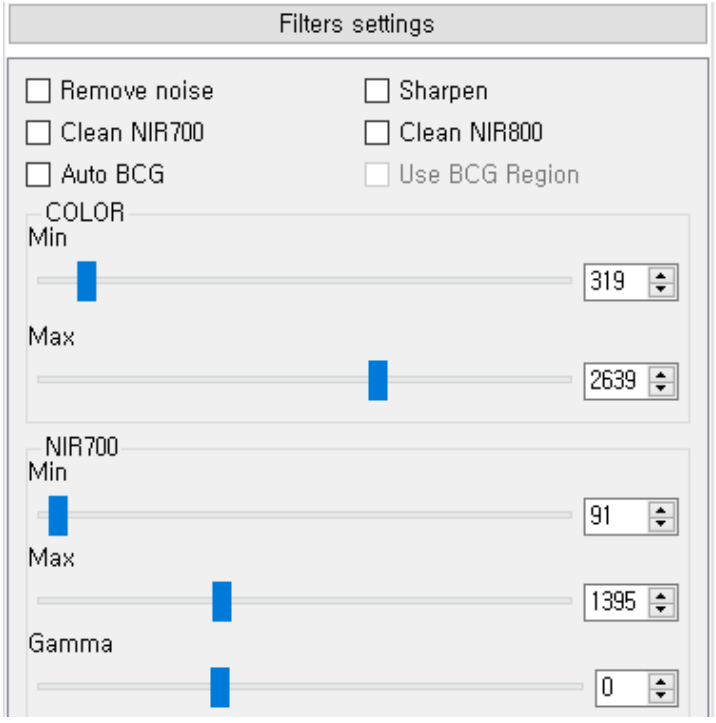


Figure 11: The Filters menu

6.6.2.1 Remove noise

Remove noise applies a simple blur to the image to make it look less grainy. The blur is applied through a 3x3 mean filter around each pixel of the image.

6.6.2.2 Sharpen

Sharpen makes the image, especially edges, look crispier. This function applies what is called an unsharp mask. First, a blurred version of the image is generated, and then the blurred version is subtracted from the original image with a weight. For example, ResultingImage = 1.5 * OriginalImage – 0.5 * BluredImage.

6.6.2.3 Clean IR1 and Clean IR2

The Clean IR1 function will darken pixels in the IR1 image if the corresponding pixel in IR2 is brighter. The opposite applies for Clean IR2

6.6.2.4 Auto BCG

This function will attempt to automatically correct Brightness and Contrast so that the IR images shown on screen have the best rendering possible (use the full dynamic range of the screen).
The user also has the option to use the BCG region or not for auto BCG computing. To draw this region on the channel, select the 'BCG Region' ROI shape in the quantification menu. If the option is selected, only the pixels inside the region will be used to adjust the brightness and contrast.

Gamma adjustment remains manual even with Auto BCG for IR channels currently, since gamma auto adjustment algorithms modify the shades of the image in a nonlinear way that makes the darker shades look similar to the brighter ones. This is a problem in this case, since we are trying to differentiate the signal (brighter shades) from background (darker shades). This feature will remain manually adjusted until a proper algorithm is worked on.

6.6.2.5 Min, Max, and Gamma

Those sliders allow the user to manually change the Brightness, Contrast and Gamma settings. In a desire of having more intuitive brightness and contrast control, they are controlled via the min and max sliders. Moving any of these sliders will affect brightness and contrast.
A higher minimum will tend to darken the image while a lower maximum will generally brighten the image.
Moving the sliders towards their optimal value will tend to increase the contrast. Once past the optimal value, the contrast will get worse.
Finally, a higher Gamma will increase the difference between white and dark pixels in a nonlinear fashion, therefore increasing the perceived signal to noise ratio for the user. On the opposite, a lower Gamma will decrease the difference dark and bright pixels in a nonlinear fashion, therefore reducing the perceived signal to noise ratio.

6.6.3 Saturation overlay control

The next menu is the saturation overlay menu (**Figure *12***). When enabled, the pixels with a value above the set threshold will be colored with the selected color. These pixels are found in the raw data, thus changing the filters settings won't have any effect on the saturation overlay.

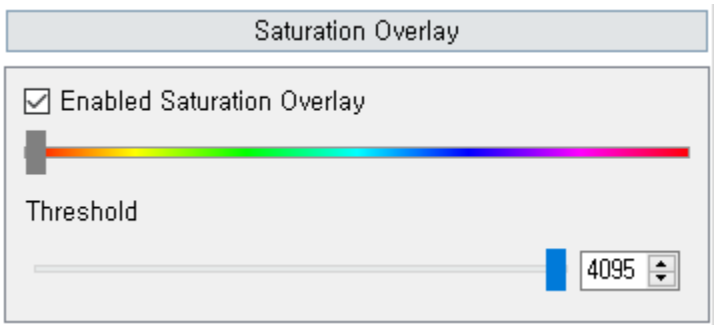


Figure 12: Saturation overlay control

6.6.4 Merged display control

The fourth display can be modified to the user's liking using the last menu, shown in **Figure *13***, by selecting which channels to show and what color to apply to the IR1 and IR2 channels. Increasing the threshold value will progressively hide the darkest pixels, so that only the brightest ones are visible. Additionally, the color channel can be displayed in gray values to help distinguish the NIR signal.

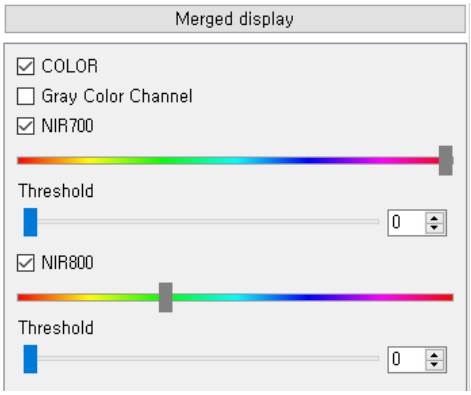


Figure 13: The Merged channel menu

6.7 Laser Control

The Condor software also allows the user to control many different lasers. In the lower left corner are tabs used to control the different laser and white light sources independently. The user must tell the software which laser system currently plugged in. To do so, the laser type should be changed in the hardware settings.

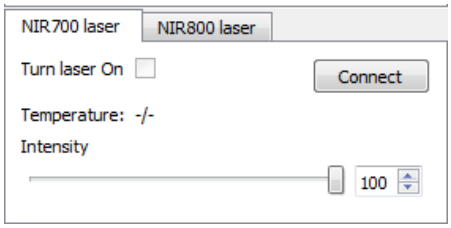


Figure 14: The lasers settings

6.7.1 Connecting the lasers

When pressing the connect button, the software will try to find an instrument matching the configuration. If it is unsuccessful, a message will be displayed briefly explaining the problem. If the

user does not understand or can't resolve the issue, a member from the engineering team should be contacted.
Upon successful connection, some laser systems will display the set temperature and the current temperature. Keeping a temperature around the set temperature is very important for the lifetime of the lasers. The laser system should take care of keeping the temperature around the desired target, but it is also part of the user's responsibility to monitor the temperature and report any large difference (more than 1C) to the engineering team.

6.7.2 Turning on the lasers

To turn on the laser, one simply needs to tick the tick box in the laser control tab. To turn them off, simply click on the same tick box again.

6.7.3 Adjusting laser intensity

The intensity slider can be used to control the laser intensity (in percentage of maximum current). As the slider controls current, the actual measured power will not change linearly with the intensity value.

6.7.4 Switching laser system

The software is compatible with different laser systems. To choose the type of laser to control, open the Hardware Settings on the top-right corner and choose the correct laser in the dropdown menu.

6.8 Quantification tab

The quantification tab contains all tools related to the measurement of the images. In this software, the data shown to the user is enhanced for better visibility, but the quantification features operate on the raw data from the camera.

6.8.1 Histograms

The histograms help the user estimate the distribution of brightness through the image.

- Above the histograms is a number corresponding to the pixel count (population) of the most populated bin of the histogram. At the time of writing, the bin size is equal to 1.
- Below the histogram are several statistics about the pixel distribution in the image.
- Further below are options for setting the histograms' X and Y scales to show data according to the preference of the user.
- Finally, on each histogram are horizontal lines. These lines are positioned on the Y scale at $1/10^{th}$, $1/100^{th}$ and $1/1000^{th}$ of the highest bin count (the number shown above the histogram). Only the $1/10^{th}$ line is visible when the Y scale is in "linear" mode, but in "log" mode, all three lines are usually present. For example, in the bottom right IR2 histogram, the maximum bin count is 2002, therefore the horizontal lines correspond to 200, 20, and 2 pixels.

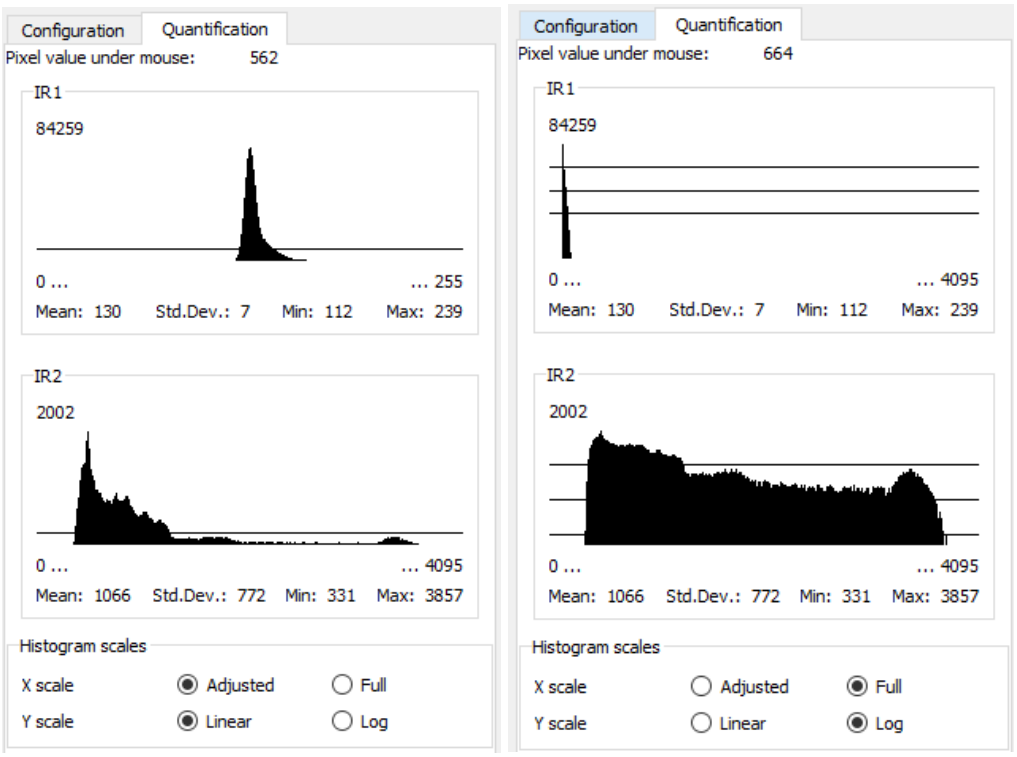


Figure 15: Histograms

6.8.2 Managing ROI

6.8.2.1 Drawing and ROIs

Regions Of Interest (ROI) are specific regions of the image that you may wish to quantify. The **Figure *16*** shows a typical set of ROI.

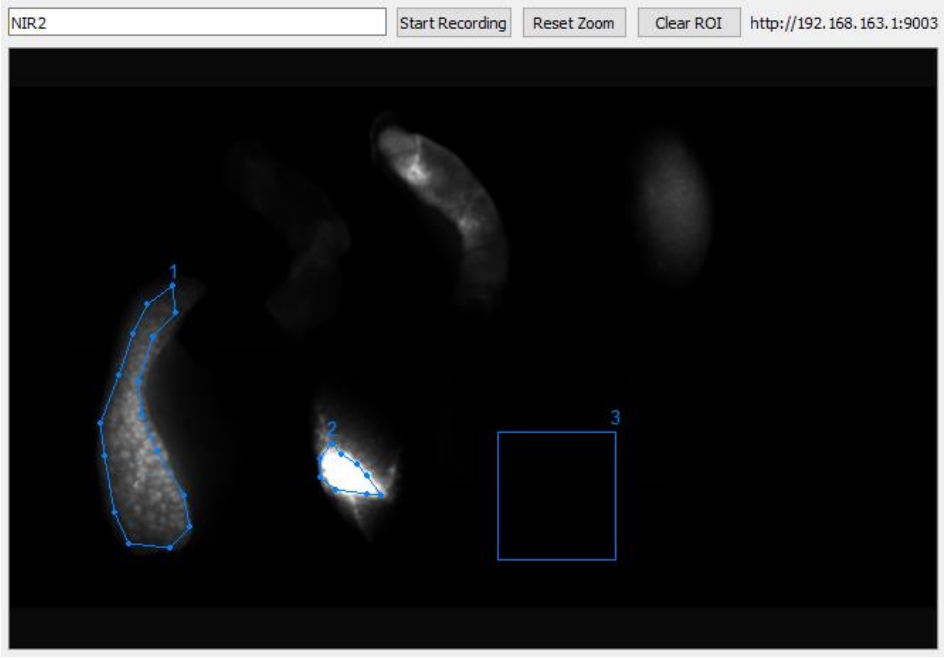


Figure 16: One of the four channels displayed in Condor Viewer. In this case, channel IR2

ROI mode can be switched from free form to rectangle or ellipse by selecting the corresponding radio button on the left of the screen, below the histograms.

A free form ROI can be drawn by left-clicking on the displays. Additional points can be placed by left-clicking where desired. To finish and close a ROI, simply right-click anywhere on the image.

A rectangle ROI can be drawn by left-clicking anywhere on the display to place the first corner, and then clicking again anywhere to place the second corner.

An ellipse ROI can be drawn the same way as a rectangle.

To cancel a ROI placement, simply move the mouse cursor out of the current display. For free form ROI, you can also right-click before placing the 3rd point. For rectangle and ellipse ROI, you can right-click before placing the second corner.

6.8.2.2 Moving ROIs

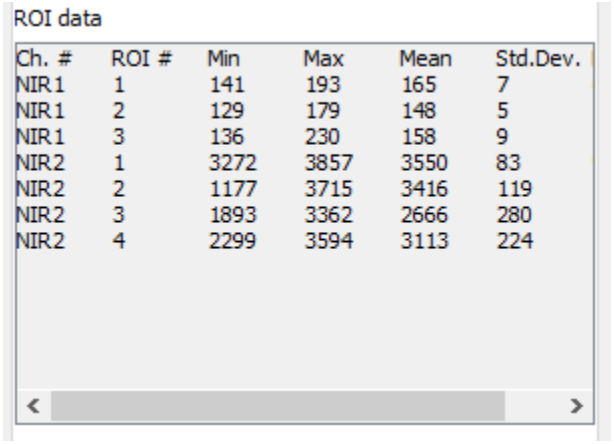
Once an ROI is drawn, the user can move them around with a simple mouse drag-and-drop. Additionally, the keyboard arrow keys will move the currently selected ROIs.

6.8.2.3 Deleting ROIs

It is also possible to remove one or more ROI(s). To do so, the user must select the unwanted ROIs by holding the control key (ctrl) of the keyboard and clicking on the ROIs. Once selected, hit the delete key on the keyboard to delete the selected ROIs.

6.8.3 ROI analysis

ROI data is updated in real time in the Quantification tab of the left menu.


ROI data

Ch. #	ROI #	Min	Max	Mean	Std.Dev.
NIR1	1	141	193	165	7
NIR1	2	129	179	148	5
NIR1	3	136	230	158	9
NIR2	1	3272	3857	3550	83
NIR2	2	1177	3715	3416	119
NIR2	3	1893	3362	2666	280
NIR2	4	2299	3594	3113	224

Figure 17: Live ROI data

When clicking on the “Analyze ROI” button at the top of the GUI, a deeper analysis will be performed on the current ROI and the results will be saved in the save folder. The save path will be shown on screen as a reminder. The results of the analysis include each channel, a .csv file as well as each individual ROI in TIFF format.

Figure 18: Example of a ROI analysis report.

Various statistics will be shown on screen. Those statistics will be saved in .csv format along with the corresponding pictures to the save folder defined in the *Settings* menu. **Figure *19*** shows an example of a .csv file when opened in Excel.

Channel	ROI number	x1	y1	x2	y2	width	height	pixels count	min	max	mean	std. dev.
IR2	1	156	130	268	242	112	112	12544	320	571	437.384	34.2939
IR2	2	411	138	498	214	87	76	6612	370	595	456.075	34.2129
IR2	3	565	102	658	238	93	136	12648	287	3276	1509.75	738.453
IR2	4	830	133	942	294	112	161	18032	385	819	577.829	112.866
IR2	5	135	442	202	557	67	115	7705	1216	2455	1969.89	222.364
IR2	6	426	454	482	528	56	74	4144	496	1153	808.111	118.58
IR2	7	656	385	694	422	38	37	1406	440	595	508.161	31.3173

Figure 19: ROI analysis CSV file viewed in Excel

6.9 Individual display functionalities

Above each display are various buttons that allow the user to perform actions that are specific to that display (see **Figure *20***).

Figure 20: The buttons above each display

6.9.1 Changing the display name

Changing the display name will change the histograms titles, the video file names and the metadata "channel" field. It will not change the snapshots file names, they will remain as "COLOR", "NIR700", "NIR800" and "MERGED" no matter what the channel has been renamed to.

6.9.2 Saving video

Video can be recorded by clicking the "Start recording" button above each display. The video is only recorded for the selected display, and the image recorded is the same one that is shown on screen. As such, the video format does not support quantitative analysis. The video will be in the save folder. For performance reasons, videos are saved in the MJPEG format in AVI files. The video size and fps can be changed in the settings menu to allow for smaller file sizes. However, to compress the video without losing quality, it is possible to convert it to H.264 or MPEG format using VLC or other video processing software.

6.9.3 Zooming and moving the displays

The middle mouse button can be used to zoom in/out, and when zoomed in, to move the displayed field of view. Rolling the wheel will zoom in on the cursor location, while click-dragging the wheel will move the screen around. To reset the image to its original size, click the "Reset zoom" button above each display.

6.9.4 Replicating ROI

The ROI can be replicated on other channels. When pressing the replicate button, a dialog will ask the user on which channel to replicate the ROIs. See **Figure *21***.

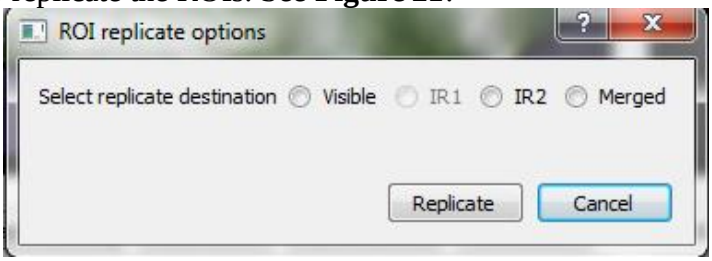


Figure 21: Replicate options

6.9.5 Clearing ROI

ROI can be removed for the display by clicking the "Clear ROI" button.

6.9.6 Streaming*

*** Disabled at the moment**

The video shown on screen can be viewed from any other device using a regular web browser or a video player such as VLC. Simple enter the URL displayed above any display in the URL box of the browser or as a stream source to connect to the video feed.

7 Resizing the display

Between the left menu and the four displays is a resize handle. By grabbing this handle, it is possible to resize the left menu and the displays as desired. The **Figure *22*** demonstrates the cursor change on the handle.

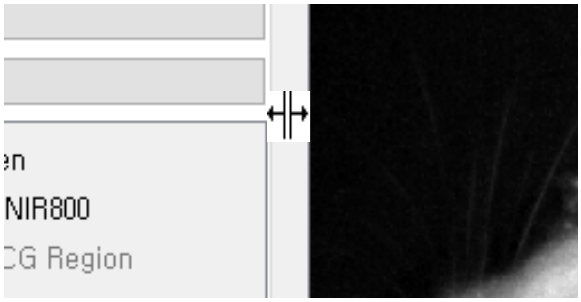


Figure 22: Resize handle cursor change

It is useful to adapt the software to different images aspect ratios. Furthermore, when the settings menu gets large enough, the settings and configuration tabs are displayed side by side like on the **Figure *23*** allowing the user to view the configuration and the histograms at the same time.

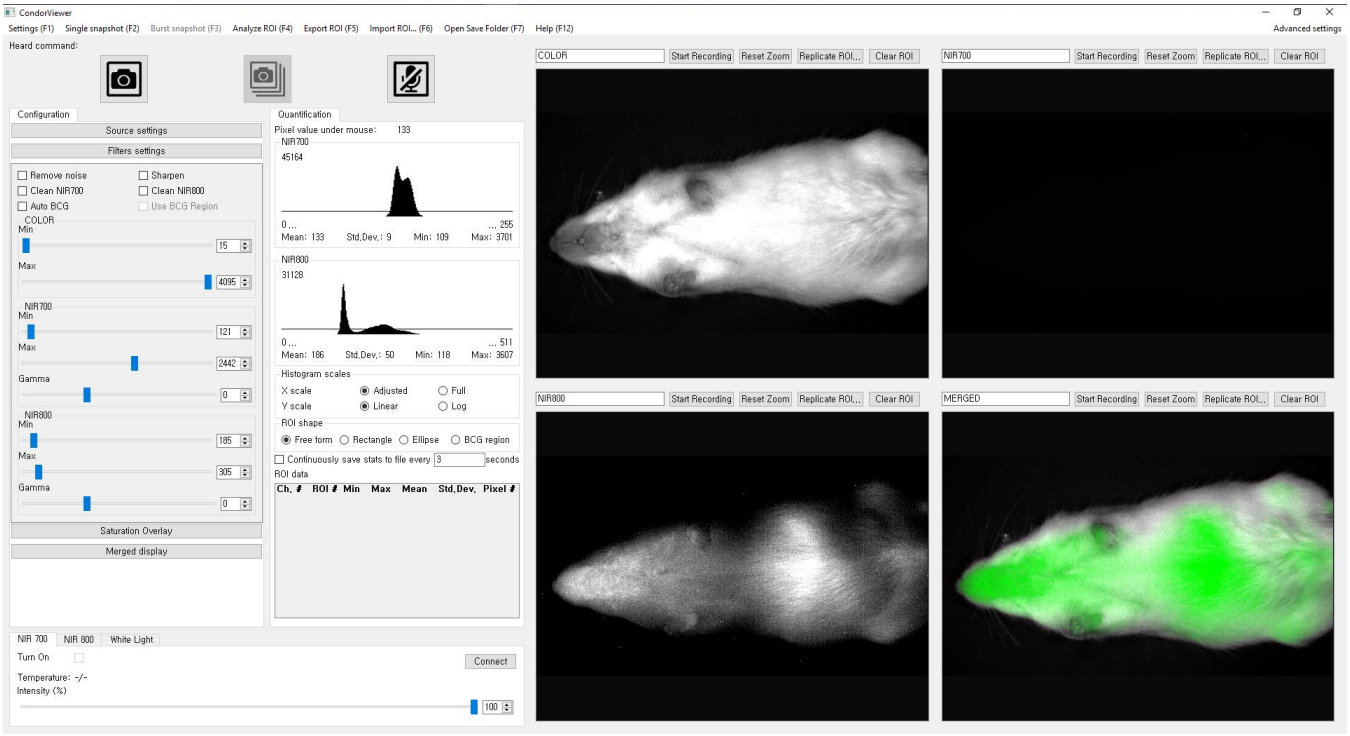


Figure 23: Side by side menu example

8 Voice recognition

The voice recognition allows the user to do some trivial software task without the use of the mouse. All commands should be preceded by "Condor" to be recognized, just like Siri's "Hey Siri", or Google's "Ok Google". An audio signal is played when the recognizer is ready after activation, and every time a command is recognized. The supported commands are:

Command	Effect
Snapshot	Takes a snapshot
Burst	Takes a burst shot
Color/700/800/Merged Video	Start or stop the recording on the specified channel. It acts as a toggle. Channels can be combined in a single call.
Light On/Off	Turns the white light on or off
700/800 Laser On/Off	Turns the 700 or 800 lasers on or off
Exposure Low/Medium/High	Sets the exposure of both NIR channel to the Low, Medium, or High preset.

Example: To start recording on the color channel, the 700 channel and the merged channel, one could say "Condor Color Seven Hundred Merged Video". To stop the recording, simply repeat the same command.

9 Camera-Specific notes

9.1 Condor 3 camera

9.1.1 Specifications

- 3 CCD camera; Visible light, 700 nm NIR and 800 nm NIR
- Image resolution of 1280x720

- Pixel depth of 12 bits, maximum intensity of 4095
- Gain ranging from 0 to 36 dB
- Exposure ranging from 1 ms to 2000 ms

9.2 Ninox 640 camera

9.2.1 Specifications

- Single channel InGaAs NIR II camera, imaging from 900 nm to 1700 nm (also sensitive in the visible spectrum)
- Image resolution of 640x512
- Pixel depth of 14 bits, maximum intensity of 16383
- Gain ranging from 0 to 48 dB
- Exposure ranging from 1 ms to 26800 ms
- High gain or low gain mode

9.2.2 Usage Tips

- When changing the filter, you can update the display title to reflect the change. This way, the "channel" metadata field will be updated to the new title, documenting the filter type automatically in the images metadata.
- To change the CCD temperature, proceed as follow: The hardware settings has a place to send commands to the camera. Simply use the command "ninox:temperature", and use the temperature as the value (typically between -15 and -20) and then press send. You can validate the temperature change by looking at the metadata in the settings.

9.3 Blue Vision BV C8300 camera

9.3.1 Specifications

- 3 CCD camera, Visible light, 700 nm NIR and 800 nm NIR
- Image resolution of 640x480
- Pixel depth of 8 bits, maximum intensity of 255
- Gain ranging from 0 to 12 dB
- Exposure ranging from 1 ms to 1000 ms

9.4 Blue Vision BV C8220 camera

9.4.1 Specifications

- 2 CMOS camera, Visible light and 800 nm NIR
- Image resolution of 1440x1080
- Pixel depth of 8 bits, maximum intensity of 255
- Gain ranging from 0 to 12 dB
- Exposure ranging from 1 ms to 1000 ms

10 Visualizing images outside the software

Images captured with the software can be visualized and analyzed using either ImageJ or Fiji, the second of which is an evolution of ImageJ (**F**iji **I**s **J**ust **I**mageJ). In the special case of color TIFF images, the

Bio-formats plugin is required, installed by default in Fiji. The menu in this case is at Plugins > Bio-Formats > Bio-Formats Importer (see **Figure *24***).

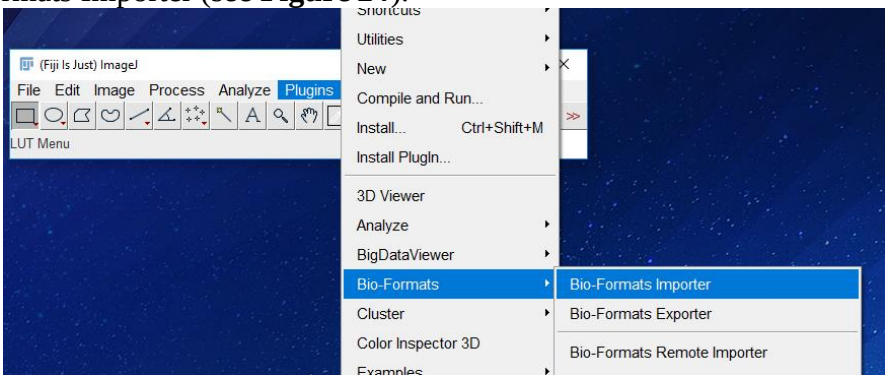


Figure 24: ImageJ BioFormats plugin

11 Visualizing the images metadata

When taking snapshots, metadata containing several useful fields (see **Figure *25***) is added to the files. It is then possible to visualize this metadata using the Xmp Reader ImageJ plugin or the standalone Xmp Reader tool. Details on how to install and use these two tools are in the CondorSuite installation guide.

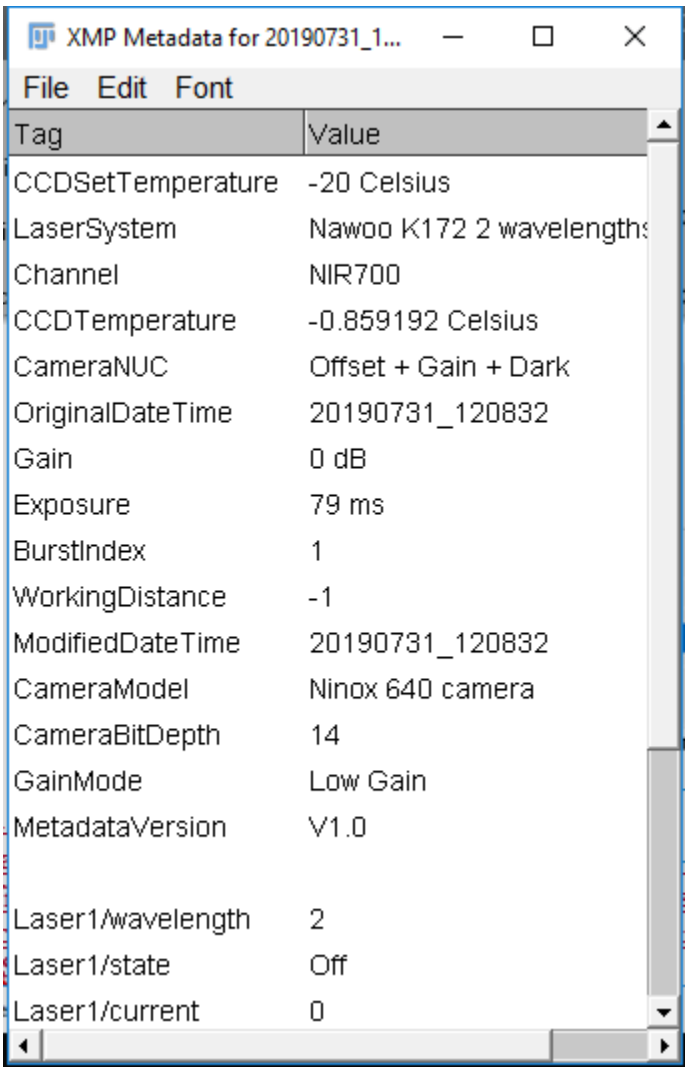


Figure 25: Metadata fields

12 Support

If you find a bug in the software, or would like to submit a feature request, please send a message to incoming+Bloodae/CondorSuite@gitlab.com. Briefly describe the issue / bug / feature request as the email's subject, and fill the email's content with the following template:

Description: <More details / how to reproduce bug>
Urgency: <How quickly does your issue need to be solved / implemented? When do you need it?>