



USB3.0 Behavior Tracking Camera

User Manual

Version 1.2.0

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Overview

1.1 System Overview

The camera system is comprised of the camera itself, the objective lens, and a Trig cable. The system is shown with the microscope system (Fig. 1.1) and with the electrophysiology console (Fig. 1.2).

1.1.1 USB3.0 Behavior Camera

The behavior camera is used to observe experimental subject. It has the following elements.

- One **USB3.0 Micro-B** port (Fig. 1.3b).
- One **12-pin Hirose** port (Fig. 1.3b).
- One **Assembly Base** with 2 M6 screw-holes and one 1/4-20 screw-hole (Fig. 1.3c). These can be used to secure the camera on a tripod, or inside an optical setup.
- One **Objective**, with a **Focus Adjustment Ring** and **Iris Adjustment Ring** (Fig 1.3a).
- The **CLCS Mount** connects the **Camera** and the **Objective Lens**.



Figure 1.3: USB3.0 Behavior Camera Layout

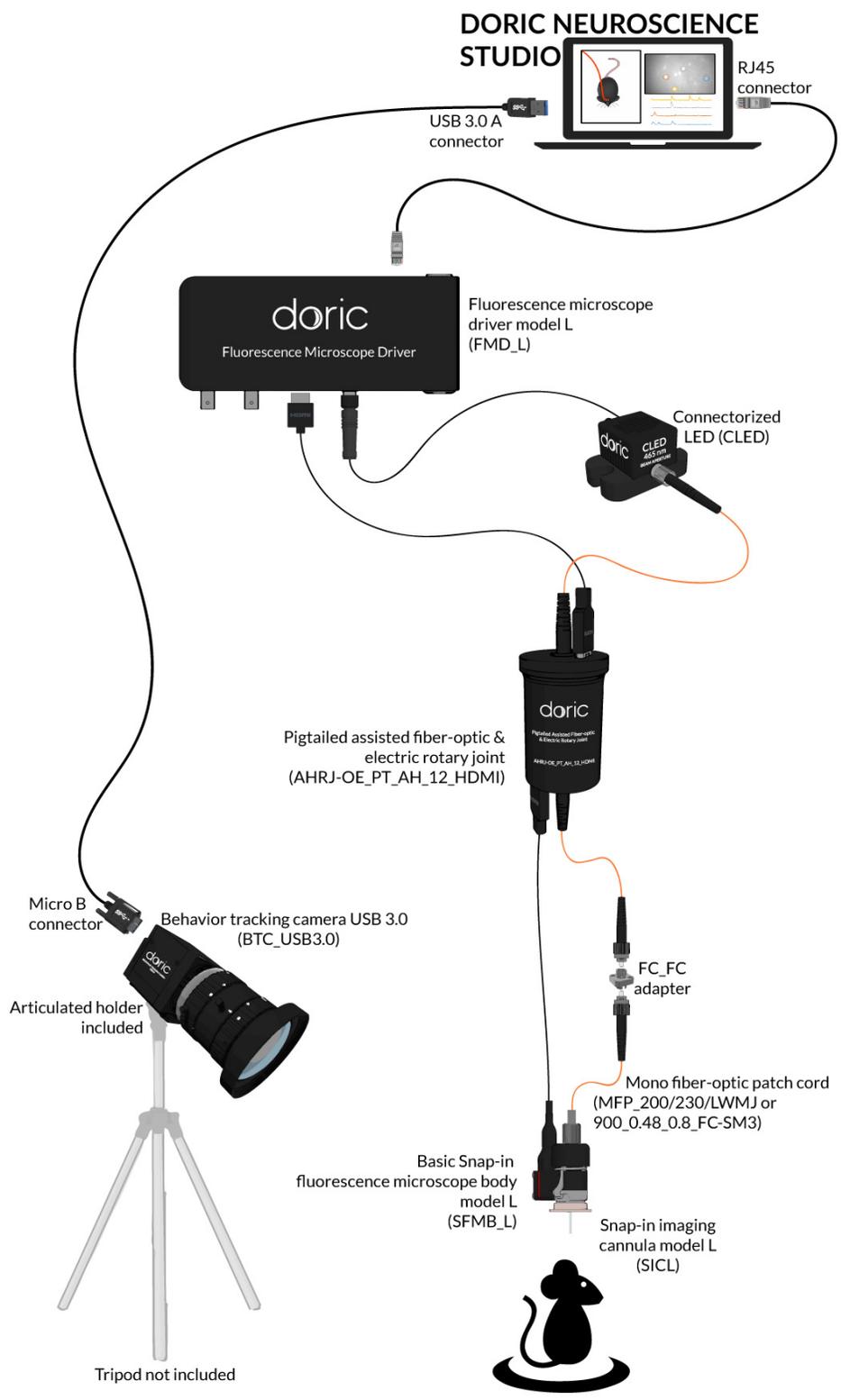


Figure 1.1: USB3.0 Behavior Tracking Camera + Miniature Fluorescence Microscope

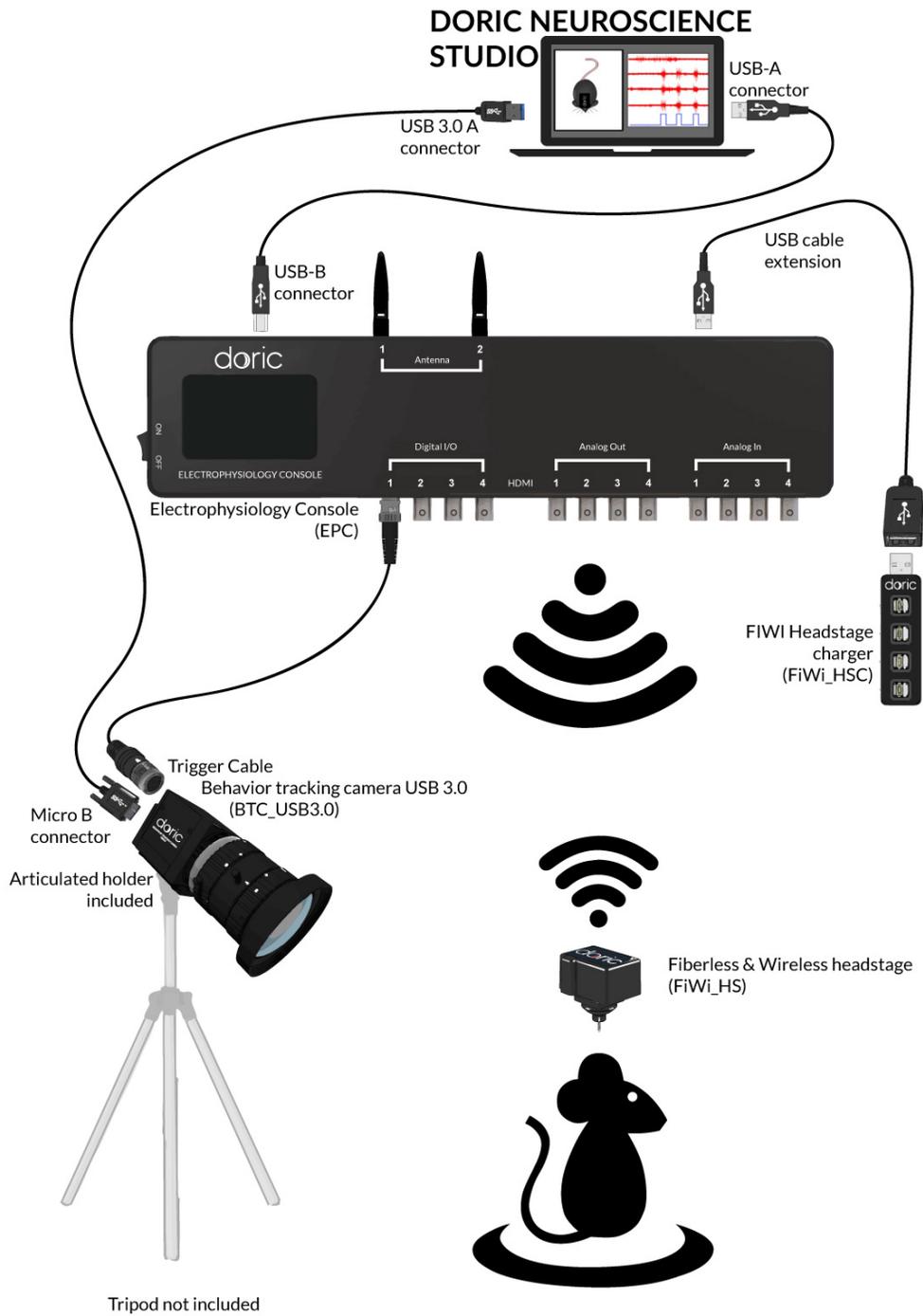


Figure 1.2: USB3.0 Behavior Tracking Camera + Electrophysiology Console

1.1.2 Trig Cable

The *Trig Cable* assembly allows the use of external triggers. The cable connects to the **12-pin Hirose output** of the camera. On the opposite side of the cable there is a **BNC Input** which allows digital signals to be sent to the camera.

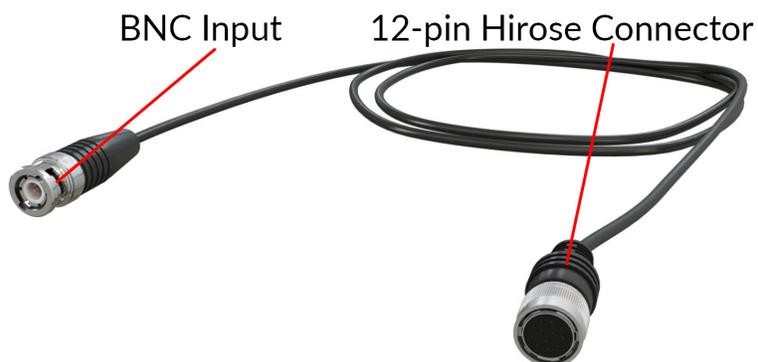


Figure 1.4: *Trig Cable*

Operations Guide

2.1 Getting Started

The USB key contains 2 pieces of software: 1) the *Doric Neuroscience Studio* to control Doric hardware, and 2) the Cam33U setup software. Instructions to install and maintain the *Doric Neuroscience Studio* can be found in the appropriate manual.

2.2 Installing the camera driver

- Select the **Cam33U_setup_4.2.0.1262.exe** file. This will open the **Installation Wizard**.

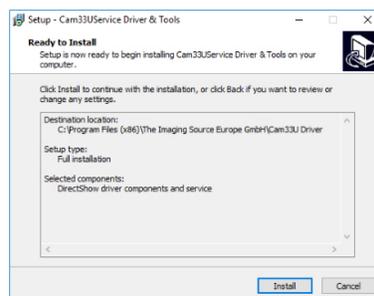


Figure 2.1: Installation Wizard, Installation Window

- In the **Installation Wizard**, select **Install**. Once complete, select **Finish**.

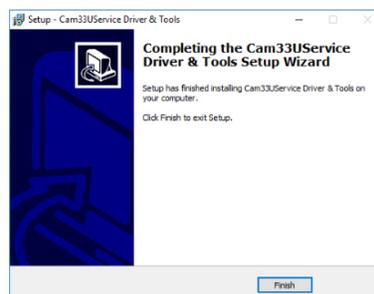


Figure 2.2: Installation Wizard, Installation End Window

- Connect the USB-A/USB Micro-B cable to the computer and camera. The camera **MUST BE CONNECTED TO A USB 3.0 PORT**.
- When connected, open the *Doric Neuroscience Studio*. The camera should be detected immediately, and the **Camera Tabs** will open. See section 3 for more information.

Doric Neuroscience Studio Software

3.1 Behavior Tracking Camera

Our Behavior Tracking Camera is a great addition to any experiment. The filming of the animal is complementary information needed to establish a correlation between the neuronal activity of a specific brain region and animal behavior. The interface from the software (Fig. 3.1) provides a framework for streaming high-speed video and related control data over computer networks.

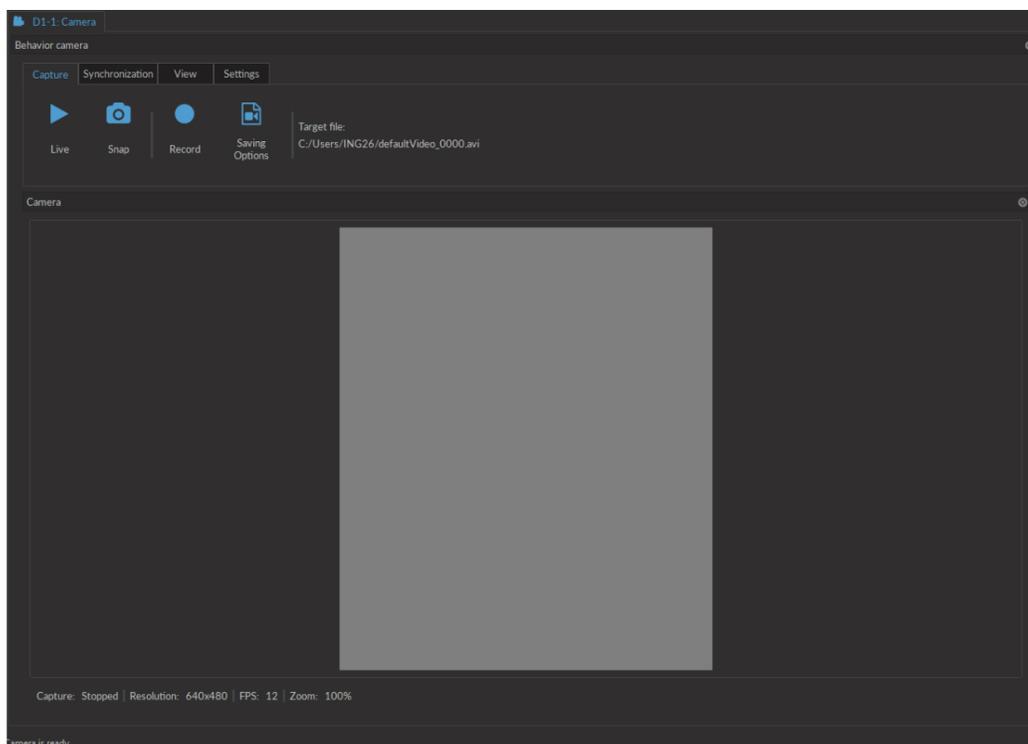


Figure 3.1: Camera Module

The constant live feed allows the status of the camera to be followed. On the bottom left are shown **Resolution** (in X by Y pixels), **FPS** (in Frames Per Second) and **Zoom** (in %). In addition to the constant live feed, the module contains four tabs allowing the configuration and control of the camera.

1. The **Capture** tab (Fig. 3.2) contains the controls related to image and movie capture, and saving.

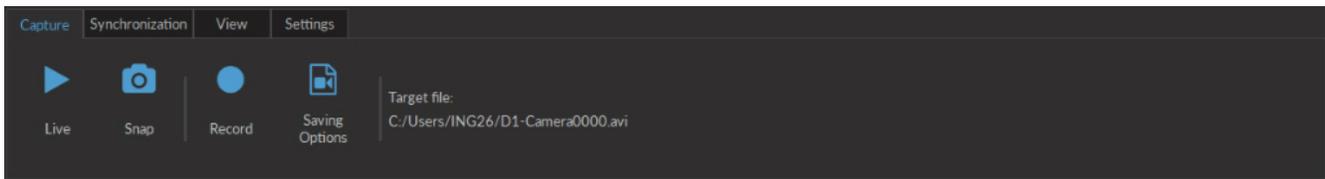
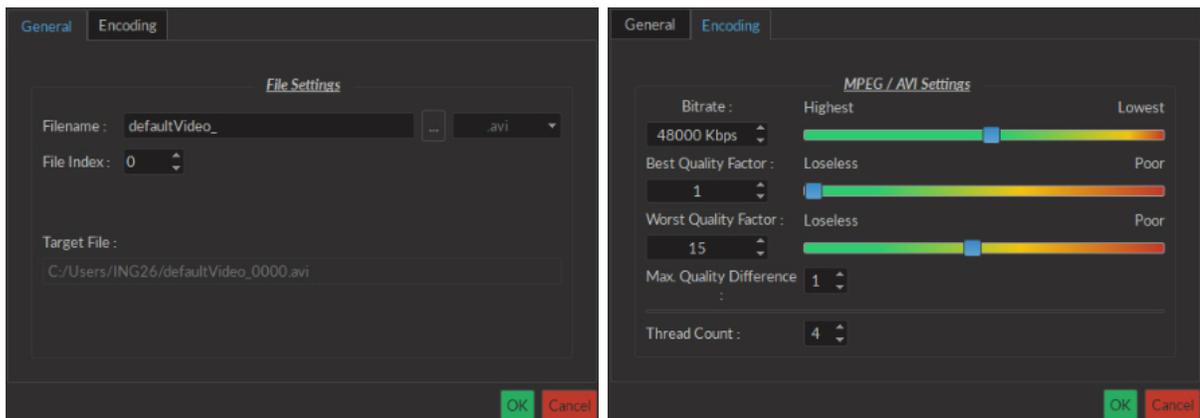


Figure 3.2: Camera Module - Capture Tab

- The **Live** button acquires images and displays them. These images are for display only and cannot be saved.
- The **Snap** button saves one image to a user-defined file. Live mode must be active to acquire images.
- The **Record** button acquires a continuous image stream, and saves it to a user-defined file as one .AVI file.
- The target file for recording is defined by the **Saving Options** window and shown in the **Target File** label.



(a) Saving Options Window-General

(b) Saving Options Window-Encoding

Figure 3.3: Saving Options Window

- The **General** tab is used to define basic file setting.
 - The **Filename** box is used to define the name of the recorded video file. Currently, all videos are saved in .avi format.
 - The ... button is used to define the target directory where the video will be saved.
 - The **File Index** box is used to choose the index that follows the **Filename**.
 - The **Encoding** tab is used to choose video encoding quality. Most elements can be changed either using the appropriate **Text Box** or **Slider**.
 - The **Bitrate** sets the number of bits recorded per second. Larger, and larger-resolution images require a higher **Bitrate**.
 - The **Best Quality Factor** and **Worst Quality Factor** are used to define the compression of saved video, with a factor of 1 implying no compression, and a factor of 31 for maximal compression. The **Best Quality Factor** indicates the lowest-compression frames accepted, while the **Worst Quality Factor** indicated the highest-compression frames accepted.
 - The **Max Quality Difference** box indicated the maximal compression difference between two subsequent video frames.
 - The **Thread Count** defines the number of processing threads (real and virtual) used on the CPU. There is a maximum of 16 threads. Using more threads can provide better resolution and FPS though is more demanding on the CPU.
- The **Synchronization** tab (Fig. 3.4) contains the controls related to synchronization with other Doric devices. The software will allow for the synchronized triggering of the experiment. To synchronize the frame acquisition between the camera and the microscope, it is important to set the same frame rate in both devices (e.g. Camera FPS: 20 and Microscope exposure: 50 ms).

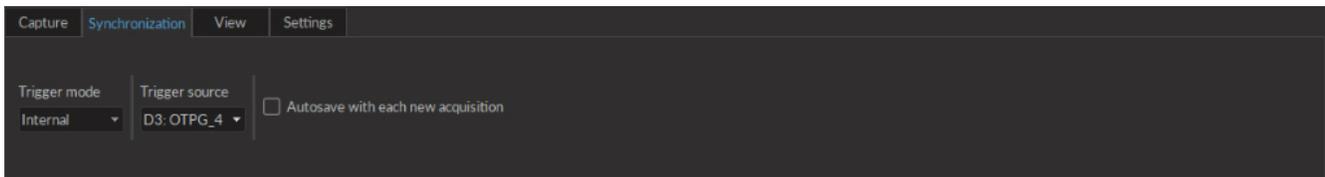


Figure 3.4: Camera Module - Synchronization Tab

- The **Trigger Mode** drop-down list allows the **Manual**, **Internal** or **External** modes to be chosen. In **Manual** mode, the camera controls are used to acquire the images. In **Internal** mode, the camera follows a signal coming from the program. In **External** mode, the camera follows an outside signal, with each pulse corresponding to a frame taken.
- **Trigger Source** is used to select the master device when the **Internal** trigger mode is selected.
- While using **Autosave**, every video started by the acquisition of the master device will be automatically saved to the target file determined in the **Capture** tab.

3. The **View** tab (Fig. 3.5) allows the zoom of the video to be modified.

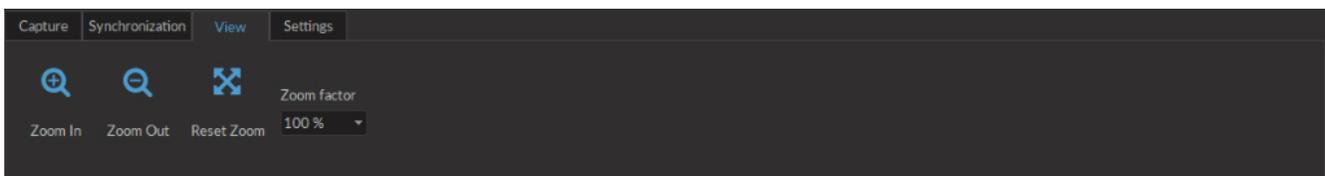


Figure 3.5: Camera Module - View Tab

- The **Zoom In** button increases the zoom factor for the image display.
- The **Zoom Out** button decreases the zoom factor for the image display.
- The **Reset Zoom** button resets the zoom factor to 100%.
- The **Zoom factor** button selects the zoom factor directly.

4. The **Settings** tab (Fig. 3.6) contains the controls related to the camera functions.

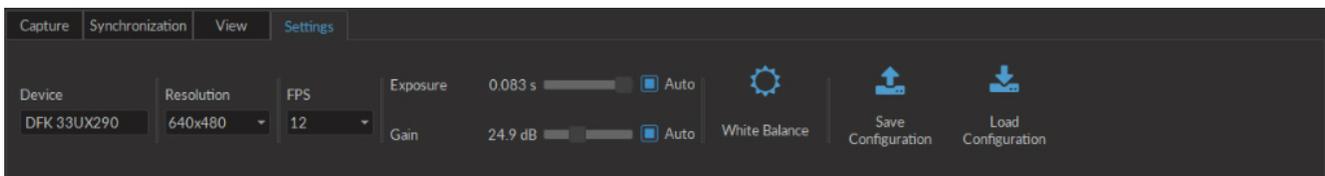


Figure 3.6: Camera Module - Settings Tab

- The **Device** box displays the camera serial number.
- The **Resolution** drop-down list selects the resolution of the camera.
- The **FPS** drop-down list selects the frame per second value of the camera. The FPS is dependent on the resolution.
- The **Exposure** (in ms) slider adjusts the exposure time of the pixels. If **Auto** is checked, the exposure time is calculated automatically.
- The **Gain** (in dB) slider adjusts the gain of the pixels. If **Auto** is checked, the gain is calculated automatically.
- The **White balance** button automatically adjusts the white balance for 5 seconds.
- The **Save Configuration** button is used to save the setting configuration in .doric format for future use.
- The **Load Configuration** button is used to load setting configurations in .doric format.

3.2 Behavioral Tracking Analyser

This module allows the observation of behavior video with traces from experimental measurements. Video data is taken in **.avi** format, while trace data is received in **.csv** format.

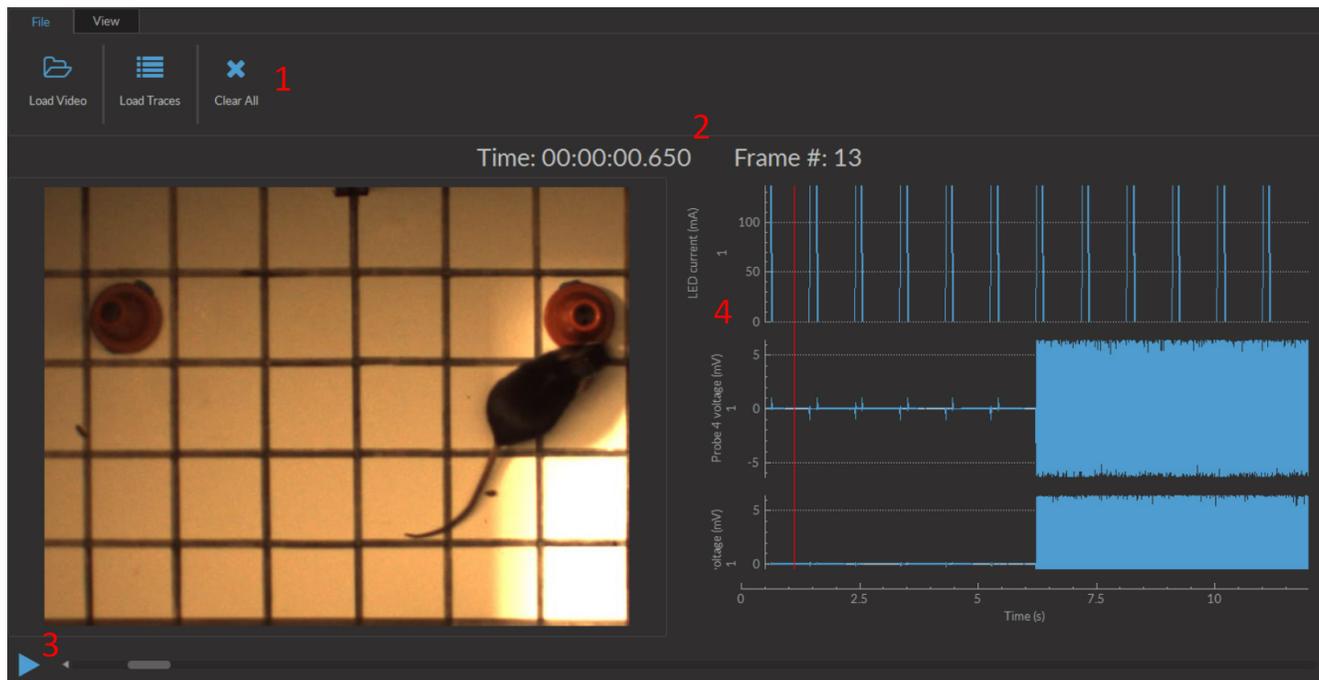


Figure 3.7: Behavioral Tracking Analysis Module Interface

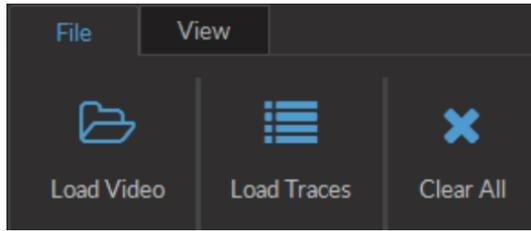
The interface can be separated into 4 major sections (Fig 3.7).

1. The **Tabs** are used to access the functions of the module.
2. The **Time** counters show the timestamp of a given frame in the video. As video is taken at a low frequency (50 Hz), while photometry data can be taken at very high frequency (> 10 kHz), the timestamp displayed is that of the data point nearest to that of the frame.
3. The **Video** box is used to show video and control the frames displayed. The **Play** button on the bottom left runs the video. The scrollbar beside it can be used to choose a frame while the video is paused.
4. The **Traces** box shows the various traces associated with the video. The red bar over the traces corresponds to the timestamp of the associated frame of the video.

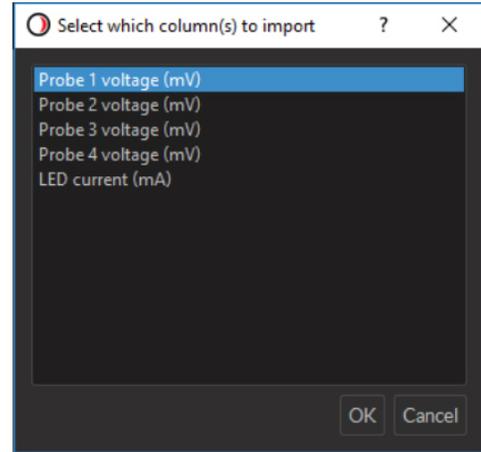
3.2.1 Tabs

Two tabs are found in this module.

1. The **File** tab (Fig. 3.8a) is used to load and remove data. The **Load Video** buttons allows the loading of **.avi** video files. The **Load Traces** button allows you to choose a **.csv** file and then opens the trace selection window (Fig. 3.8b). From this window, the desired traces can be selected. The **Clear All** button clear all experimental data from the module.
2. The **View** tab (Fig. 3.9) allows the modification of the video display. The **Zoom In/Zoom Out** buttons zoom the video display in and out. The **Reset Zoom** button resets the zoom to **100%**. The **Zoom Factor** drop-down list allows the choice of a specific zoom factor, from 10% to 500%.



(a) Behavioral Tracking Analysis Module, File Tab View



(b) Behavioral Tracking Analysis Module, Trace Import Window

Figure 3.8: Behavioral Tracking Analysis Module, File Tab

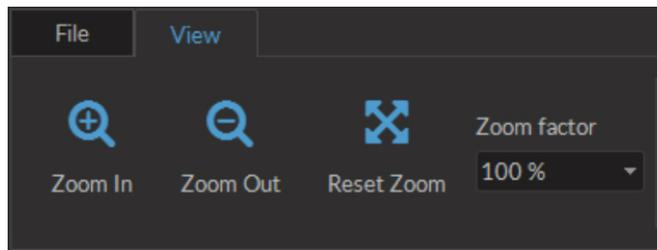


Figure 3.9: Behavioral Tracking Analysis Module, View Tab

Specifications

4.1 Specifications

Table 4.1: *USB3.0 Behavior Tracking Camera Specifications*

SPECIFICATION	VALUE
Video formats	B&W 1920 x 1080 Y800 Color 1920 x 1080 RGB32
Frame rate @ full resolution	60
Resolution	H: 1920, V: 1080
Format	1/2.8"
Pixel size	2.9 μm x 2.9 μm
Lens mount	C/CS
Interface	USB3.0
Supply voltage	4.5 to 5.5 VDC
Exposure	20 μs to 30 s
Gain	0 to 72 dB
Dimension	H: 29 mm, W: 29 mm, L: 43 mm
Mass (camera)	61 g
Mass (objective lens)	106 g

Table 4.2: *Behavior Tracking Camera Lens Specifications*

Focal Length (mm)	Aperture (F)	MOD¹ (m)	FOV @ 1 m
5	1.4 - 16C ²	0.10	1.0 x 1.0

Table 4.3: *Environmental Specifications*

DESCRIPTION	OPERATION	STORAGE
Use	Indoor	-
Temperature	-5-45 ° C	-20-60 ° C
Humidity	20-80% RH, non condensing	20-95% RH, non condensing

¹Minimum object distance

²Circular Iris

Support

5.1 Maintenance

The product does not require any maintenance. Do not open the enclosure. Contact Doric Lenses for return instructions if the unit does not work properly and needs to be repaired.

5.2 Warranty

This product is under warranty for a period of 12 months. Contact Doric Lenses for return instructions. This warranty will not be applicable if the unit is damaged or needs to be repaired as a result of improper use or operation outside the conditions stated in this manual. For more information, see our [Website](#).

5.3 Contact us

For any questions or comments, do not hesitate to contact us by:

Phone 1-418-877-5600

Email sales@doriclenses.com



© 2019 DORIC LENSES INC

357 rue Franquet - Quebec, (Quebec)
G1P 4N7, Canada

Phone: 1-418-877-5600 - Fax: 1-418-877-1008

www.doriclenses.com