

FIRST TIME USE

- 1 Download the latest version of **DPTV 2** from our website: www.loligosystems.com/downloads. Follow the installation instructions on the screen and then restart the PC.

SWIM TUNNEL SETUP

Set up and prepare the 170 or 1500 mL swim tunnel according to the **Quick guide for mini swim tunnel setup**, but skip step 3. Also, in step 6, mount the **light guide** (2) - not the oxygen dipping probe.

Place the light guide so that its tip is aligned with the edge of the honeycomb (170 mL swim tunnel) or as far into the swim tunnel chamber as possible (1500 mL swim tunnel) (2.1). Connect the light guide to the **green laser pointer** (6).

IMPORTANT: Wear safety glasses whenever the laser is on!

- 2 Neutral density green fluorescent **microspheres** can be used to visualize the water flow. Generally, a concentration of 10 mg/L (e.g., ~2 mg for the 170 mL swim tunnel) will provide an optimal density of spheres. We recommend using a plastic syringe to add the spheres to avoid introducing air bubbles into the chamber (2.2). Weigh the spheres directly in the syringe. Add 2-3 drops of detergent into a 500 mL beaker filled with water from the ambient water bath. Now, slowly fill the syringe with ~10 mL of detergent water. Turn the syringe upside-down to remove excess air or foam.

Add the spheres carefully into the swim tunnel chamber via the flush inlet. Then close off the flush outlet (e.g., by tying a knot on a small piece of tubing). The swim tunnel is ready for DPTV.

DEVICE SETUP (AUTOMATED DPTV)

Power the DAQ-BT (using its DC adapter and USB power cable) from a wall outlet or from a USB port on your PC. Press and hold the power button (3) on the front of the DAQ-BT until the POWER and STATUS LED flash green rapidly. Pairing mode is now enabled. To pair the DAQ-BT:

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 1. (On Windows 10): Go to Settings > Devices > Add Bluetooth or other device > Choose Bluetooth > Look for BTH-1208LS-XXXX and choose Pair.
 2. If Windows asks for a pairing code, use "0000" (four zeros).
 3. Verify that the DAQ-BT is paired with your PC (under Devices in Other devices list).
 4. The DAQ-BT is now ready to use in DPTV 2.

- 4 Connect a uEye camera to a USB 3.0 port on the PC. Let the camera initialize until the LED on the back lights green.

CAMERA PLACEMENT (AUTOMATED DPTV)

- 5 Connect the green (WiBu) copy protection dongle to a USB port on the PC.

Start DPTV 2. Open **Devices** and select your uEye camera and (if available) DAQ-BT device. From the main menu, open **Video Recording** or **Flow Analysis > Camera**. Use the live preview to adjust the camera's placement in step (7).

- 6 We recommend setting image dimensions to 800 x 256 for optimal performance on most modern PCs. Lowering the image width/height will increase performance (higher frame rate). Adjust the AOI-sliders to fine tune the field of view.

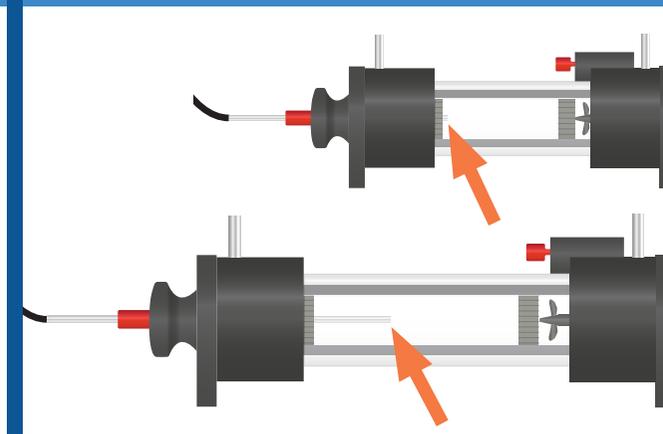
- 7 Place the uEye camera so that the field of view covers a section of the swim tunnel chamber inside which the water velocity is to be measured (7). Adjust the camera lens' focus ring until the center of the chamber is in focus. The live preview should look like in figure (7.1).

IMPORTANT: Once the camera is in place, the camera must not be moved! Otherwise, a new pixel-calibration is necessary.

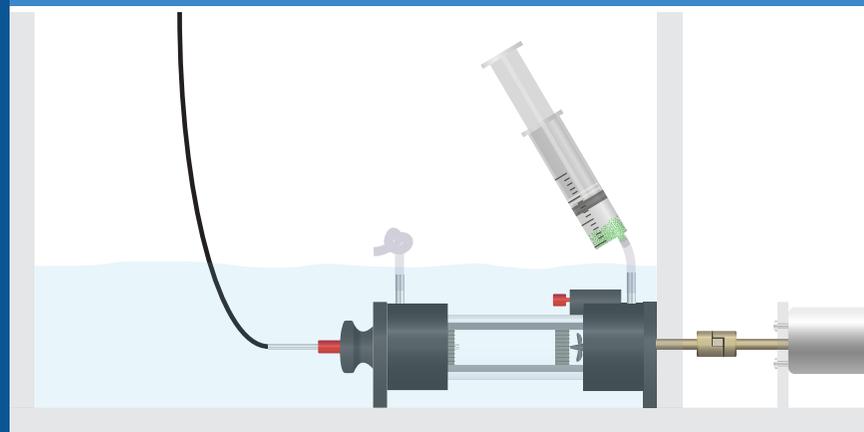
2



2.1



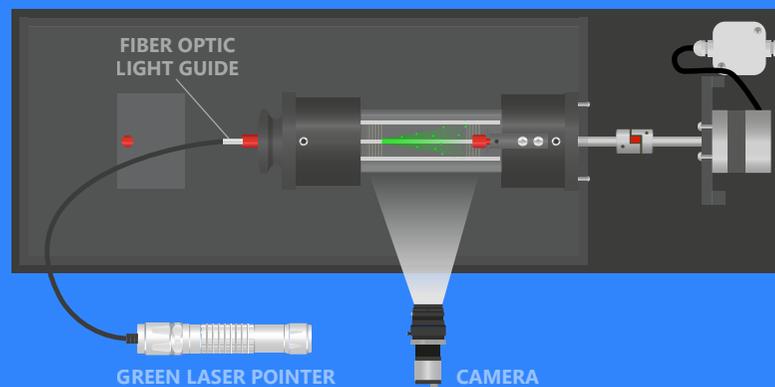
2.2



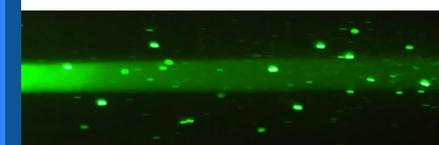
3



7



7.1



FLOW ANALYSIS (AUTOMATED DPTV)

Open **Flow Analysis > Camera**. Start by performing a **pixel-calibration** to enable correct velocity measurements. Drag the **blue ruler endpoints** to define a known length (e.g., by placing a ruler in the background) on the live preview (8). Use mouse-scroll to zoom in/out on the image, an right-click+drag to move the image. Input the defined length in the **Ruler length** field.

The optimal **Frame rate** is 100-150 FPS. This will result in optimal tracking performance throughout the automated flow analysis. You can increase the performance by lowering the image height and width (and adjusting AOI, if needed). It is highly recommended to close all other Windows applications and not to use the PC, while the tracking analysis is running.

Start the motor by inputting 1 V in the **Control signal** field. Wait for a steady flow, and then adjust the **Filter strength**, **Minimum object size** or **Maximum object size** sliders to threshold the live preview image into tracked spheres (yellow pixels) that you want to track. An optimal number of objects is shown in figure (8.1) *.

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Now press **AUTO**. DPTV 2 will now perform an automated flow analysis. The motor will automatically increase the **Control signal** from 1.0 to 1.5, 2.0, 2.5 and to 3.0 V. At any time during the process, the flow analysis (and motor) can be stopped by pressing:

STOP AUTO or **STOP MOTOR!**

The flow analysis data is displayed at the bottom of the screen in a **speed histogram** (data per video) and **speed and motor unit graph** (data for all videos) (8.3). *NB: The histogram may show two peaks. This is normal and can happen if the computer skips video frames during the analysis.*

Click **SAVE** to export data as an Excel file (12) and a **calibration file** (named "filename for AutoResp 3"). The calibration file can be loaded directly into AutoResp 3.

- **Track individual objects:** Enable to track each pixel-cluster separately rather than the overall movement resolving in a longer tracking process.
- **Show velocity vector:** Enable to show the velocity vector for overall movement or for each pixel-cluster (if *Track individual objects* is enabled).

FLOW ANALYSIS (MANUAL DPTV)

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Open **Flow Analysis > Camera**. Follow the instructions in step (8) until the *. Input a **Control signal** value (e.g., 1 V) as the first step in your flow calibration. Press **TRACK**. DPTV 2 will now track the moving spheres for some seconds, and analyze the tracked data. The tracked data, for the chosen **Control signal** value, will appear in the data histogram and graph. Repeat this procedure for at least two other **Control signal** values. Click **SAVE** to export the data as an Excel file and a calibration file.

FLOW ANALYSIS (FILE)

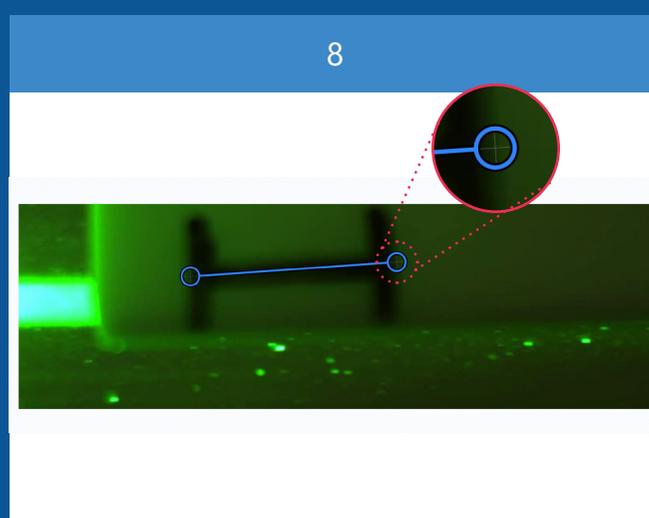
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Open **Flow Analysis > File**. Press **LOAD VIDEO** to add a video file. It is recommended to load your "pixel-calibration video" (see step (8)) first to input the **Ruler length** value. Load next video, i.e., the video recorded at the lowest input value. Input the control signal value that the motor ran at in the **Input value** field (e.g., 1 V) (10). Press **TRACK** to analyze the entire video. Alternatively, Shift+drag on the timeline to select an interval. DPTV 2 will now track the spheres, and analyze the tracked data. The tracked data will appear in the data histogram and graph. Load remaining DPTV videos and repeat the tracking procedure. *NB: You do not need to pixel-calibrate between videos.* Click **SAVE** to export data as an Excel file and a calibration file.

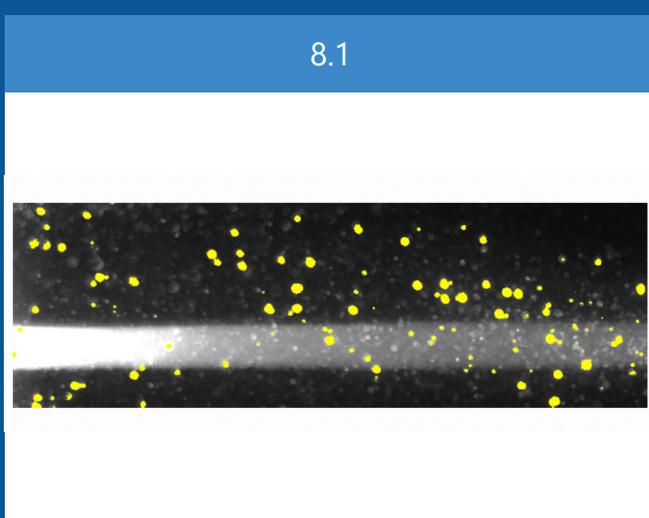
VIDEO RECORDING

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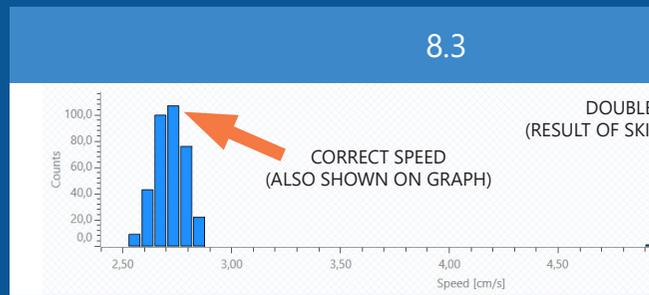
Set up your uEye camera according to step (4-7). Open **Video Recording** from the main menu. Choose any available camera. Change frame rate or resolution in the **Settings panel** (11), if needed. For optimal settings, see step (6). *NB: The frame rate may be lower than the set value, if your PC has performance issues (i.e. many skipped frames).* Press **REC** to open the file prompt and start recording. During recording, four parameters are shown at the bottom of the screen: **Recorded time:** The length of the recorded file (number of captured frames / file frame rate). **Frame rate:** The actual frame rate during recording. **Captured frames:** The number of captured frames. **Skipped frames:** The number of skipped frames.



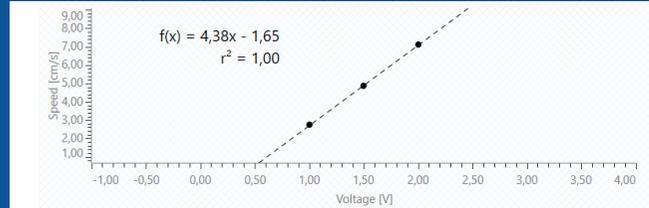
8



8.1



8.3



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Flow calibration

Show velocity vector

* Input value

Unit

TRACK

Flow calibration

Show velocity vector

Input value

Unit

TRACK

11

Settings

Camera

Frame rate [fps]

Resolution

12

EXCEL EXPORT EXAMPLE

Speed calibration

$y = 9,2234x - 3,4511$
 $R^2 = 0,9998$

Speed [cm/s]

Voltage [V]

• Data
— Linear (Data)