QUICK GUIDE | LoliTrack 5 - 2D tracking 1.2 LOLIGO® SYSTEMS

INSTALLATION

Download the latest version of LoliTrack 5 from our website: <u>www.loligosystems.com/downloads</u> Follow the instructions on the screen and then restart the PC.

2 Connect the green (WiBu) copy protection dongle to a USB port on the PC (2).

RECORD VIDEO FOR 2D TRACKING

Open **Video Recording** from the main menu. Choose any of the available cameras for Cam 1 (3). Change frame rate or resolution in the Settings panel, if needed. **File frame rate:** The software will attempt to record at this frame rate. **File resolution:** The video will be scaled and saved to this resolution. You can also change the internal camera parameters.

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

2D TRACKING

Open **Tracking 2D** from the main menu. Click on **a** and choose a video file. Change the **File resolution**, if necessary. Click Next to continue (4).

In the **Calibration tab**, choose the desired Distance, Time and Angle units. Now drag the X/Yaxes to align with a known edge on the video preview (5). Input the actual length of the X-axis (or Y-axis), and then click the Calculate value from X-axis (or Y-axis) icon (5.1). Click OK to save the calibration. Click Next to continue.

5 Additional functions:

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- Hold cursor on video preview and scroll mouse wheel to zoom in/out.
- Drag the video preview around by right-clicking and dragging.
- Hold cursor on timeline and scroll mouse wheel to zoom in/out.
- Drag timeline from side to side by right-clicking and dragging.
- Use arrow keys for frame-by-frame control on timeline.

6 In the **Mask tab**, use masking tools in Settings panel (6) to mask out any unwanted areas by choosing tool and dragging on video preview to create shape. Adjust shape using anchor points. Objects in red areas will not be tracked. Every closed, non-masked area defines an arena (*i.e.* there are 97 arenas in the example (6.1)). Click OK to save mask and Next to continue.

In the **Filter tab**, change settings to create a filter that will threshold images into objects (yellow pixels), that you want to track, and irrelevant objects or background. First select filter mode A (color/contrast) or B (background subtraction). Then use one or more tools (1-3) for A or choose between the two options in B (7).

A. Threshold objects based on color contrast:

- Select an object by drawing a rectangle around it. Use mouse scroll while the rectangle is active to increase threshold pixels.
- 2. Indicate color of object by drawing rectangle inside object. Using this tool requires that you have indicated background pixel color (tool 3).
- **3.** Indicate color of background by drawing rectangle on background. *Using this tool requires that you have indicated object pixel color (tool 2).*

B. Threshold objects by subtracting static background pixels:

- 1. Auto: Calculates background automatically.
- **2.** Current frame: Uses current frame as background.

Fine tune the filter selection by adjusting filter strength and object size sliders (7.1 + 7.2). Scroll through video for a visual check of the yellow pixels and change settings, if needed. Click OK to save the filter. Click Next to continue.





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2D TRACKING

In the Tracking tab, select the best tracking method for your setup (11).

- Track a single or a few objects with no occlusions (when one object is hidden by another Α. object that passes between it and the observer).
- 11 Multiple objects with occlusions Β.

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С. Multiple arenas with no more than 1 object in each arena.

Move time cursor to a point on the timeline where all objects are easily identified (no occlusions or object fusing with background) to help start tracking.

In the Tracking tab, click Auto select all objects to add all visible objects (yellow pixelclusters) to your object list (12). Alternatively, left-click on each object to add it to the list.

12 Track entire video by clicking **Start tracking**. Alternatively, select an interval (hold shift + drag) on the timeline (12.1) and then click Start tracking to track only this interval. When the tracking is completed, click Next to continue.

In the Analysis tab, you can add Zones as a video overlay and select Parameters before exporting tracking data to Excel or as a media file (13).

- Position settings: Choose the position on the object that the tracking data will be based Α. on. Adjust the Activity-threshold to remove unwanted pixel-noise. Choose the number of frames over which data averaging is performed (Smoothing).
- View settings: Adjust which parameters are shown as overlay on the video preview. In Β. the heat map settings, Frames in heat map decides the number of frames that are used for calculating the heat map.
- Arenas and treatments: Edit the names of arenas and treatments, and apply a treatment С. to a given arena (13.1).
- D. **Export to Excel:** Choose the parameters that will be included in the Excel file for the entire video (or interval, if selected on the timeline). Selecting markers on the fish will include tracking data for the selected positions in the Excel file. Tracking data (the parameters you select in **Export parameters**) for arenas, zones and treatments can be exported as well.
- Export video: Export the entire video (or interval, if selected on timeline) with the overlay Ε. shown in the video preview window.
- F. **Export image:** Export the current frame with the overlay shown in the video preview window.

In the Analysis tab, tracking data for Speed, Acceleration, Distanced moved, Nearest Neighbor Distance (NND), Average Inter-Individual Distance (AIID) and Median Inter-Individual Distance (MIID) is shown in the graph tabs (upper left). You can export any of the graphs (14) by clicking the **Export to Excel** icon in the Settings panel. Additionally, you can change the color and style of the plotted data by clicking on the Style icon in the same panel (14.1).



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Arena 2

Edit Arena 3 Not set Treatment Select Edit Treatment 1 + × Name Treatment 1



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INSTALLATION

Download the latest version of LoliTrack 5 from our website: www.loligosystems.com/downloads Follow the instructions on the screen and then restart the PC.

Connect the green (WiBu) copy protection dongle to a USB port on the PC (2).

RECORD VIDEOS FOR 3D TRACKING

For accurate 3D tracking in LoliTrack 5, the two cameras must be set up similar to the illustrations specified in step 5, see 🕕

Open Video Recording from the main menu. Choose two of the available cameras for Cam 1 and Cam 2 (3). Change frame rate or resolution in the Settings panel for each camera, if needed. File frame rate: The software will attempt to record at this frame rate. File resolution: The video will be scaled and saved to this resolution. You can also change the internal camera parameters.

Click on the **Synchronized tab** to preview both cameras (3.1).

Press REC to open the file prompt and start synchronized recording. Note: A video file from each camera will be saved.

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

3D TRACKING

Open **Tracking 3D** from the main menu. Click on both **T** and choose a video file for each. Change the **File resolution**, if necessary. Note: 3D tracking is only available for a single object. Click Next to continue.

In the Calibration tab, choose the desired Distance and Time units (5). Specify the Refractive index of the medium that the object is in (typically water or air). In the Parameters section, fill out the parameter fields (L, W, D., etc.). Click on 🛄 to view illustrations of the camera setup. A blue square with dotted stroke will now appear on the video preview (5.1). Drag anchor points on each green square to the surface defined by L and W (see Setup 🛄), so that the anchor points mark the corners of the surface (5.2). If the tracked object is not in water, the green square can define the bottom of the chamber.

Click **Auto calibrate**. The blue square should now start to approximate the shape of the green square (5.3). As the auto calibration process is an appromixation, the progression status will move towards 100 % completion (5.3). It is acceptable to stop the auto calibration process, once the status is in the yellow or green area. If the progression status does not enter the vellow or green area, either change the parameters or verify that the blue square is actually on the surface. Click OK to save the calibration. Click Next to continue.

Additional functions:

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- Hold cursor on video preview and scroll mouse wheel to zoom in/out.
- Drag the video preview around by right-clicking and dragging.
- Hold cursor on timeline and scroll mouse wheel to zoom in/out.
- Drag timeline from side to side by right-clicking and dragging.
- Use arrow keys for frame-by-frame control on timeline.

In the Mask tab, select a masking tool (6) for each camera to mask out any pixels/areas that should not be processed by the software. Use mouse cursor to drag out masking shapes/ patterns on the video preview. Adjust the size and shape using anchor points. Areas marked with red color will not be tracked/analyzed. Click OK to save mask and Next to continue.





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3D TRACKING

In the **Filter tab**, change settings to create a filter **for each camera** that will threshold images into objects (yellow pixels), that you want to track, and irrelevant objects or background. First select filter mode A (color/contrast) or B (background subtraction). Then use one or more tools (1-3) for A or choose between the two options in B (7).

A. Threshold objects based on color contrast:

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- **1.** Select an object by drawing a rectangle around it. Use mouse scroll while the rectangle is active to increase threshold pixels.
- **2.** Indicate color of object by drawing rectangle inside object. Using this tool requires that you have indicated background pixel color (tool 3).
- **3.** Indicate color of background by drawing rectangle on background. *Using this tool requires that you have indicated object pixel color (tool 2).*

B. Threshold objects by subtracting static background pixels:

- 1. Auto: Calculates background automatically.
- 2. Current frame: Uses current frame as background.

Fine tune the filter selection by adjusting filter strength and object size sliders (7.1 + 7.2). Scroll through video for a visual check of the yellow pixels and change settings, if needed. Click OK to save the filter. Click Next to continue.

In the **Tracking tab**, click **Start tracking** to track entire video. Alternatively, select an interval (hold shift + drag) on the timeline (8) and then click Start tracking to track only this interval. When the tracking is completed, click Next to continue.

In the **Analysis tab**, you can view the 3D tracking and export tracking data to Excel, as a 3D model or as a media file (9).

- **A. Export image:** Export the current frame with the overlay shown in the video preview window.
- **B. Export video:** Export a 10 seconds video with the overlay shown in the video preview window. In the exported video, the camera will circle once around the 3D model, while the 3D position marker will move along the tracked positions in the selected interval on the timeline. To preview the exported video, click on **Orbit** in the 3D tools (9.1).
- C. Export to Excel: Export the tracked data to an Excel file for the entire video (or interval, if selected on the timeline).
- Export 3D model: Export a 3D model as either a .glb, .obj, .stl, .u3d file.
 .glb Can be viewed in most 3D apps on Windows, incl. Word, Excel and PowerPoint.
 .obj Standard 3D image format.
 .stl 3D image format widely used in 3D printing and modelling interfaces.

.u3d Standard 3D image format. Can be inserted and viewed in PDFs.

In the **Analysis tab**, tracking data for Speed, Acceleration and Distanced moved is shown in the graph tabs (upper left). You can export any of the graphs (10) by clicking the **Export to Excel** icon in the Settings panel. Additionally, you can change the color and style of the plotted data by clicking on the **Style** icon in the same panel (10.1).

