

Contents

1. Install and Run Application.....	3
2. Maze Types.....	3
3. Video Service Connection.....	4
3. Experiment Configuration	5
3.1 New Experiment.....	5
3.2 Configure Parameters.....	7
3.2.1 Protocol Parameters.....	7
3.3 Area drawing	7
3.3.1 Drawing a Rectangle.....	8
3.3.2 Drawing a Polygon.....	8
3.4 Ruler	9
4. Experiment Run	10
4.1 Run Experiment	10
4.2 Result Tables.....	11
5. Behavior Measure	13
5.1 Temporal Move Measurement	13
5.2 Rotation Measurement	13
5.3 Activity Measurement	13
5.4 Heatmap	13
6. Maze Protocols.....	14
6.1 Y-Maze Spontaneous Alternation.....	14
6.1.1 Y-Maze Alternation Specification	14
6.1.2 Y-Maze Alternation Result.....	15
6.1.3 Y-Maze Alternation Calculation and Interpretation	16
7. Animal.....	17
8. Export Data.....	18
9. Troubleshooting	19
9.1 Log display	19

9.2 Database files and user data 19

1. Install and Run Application

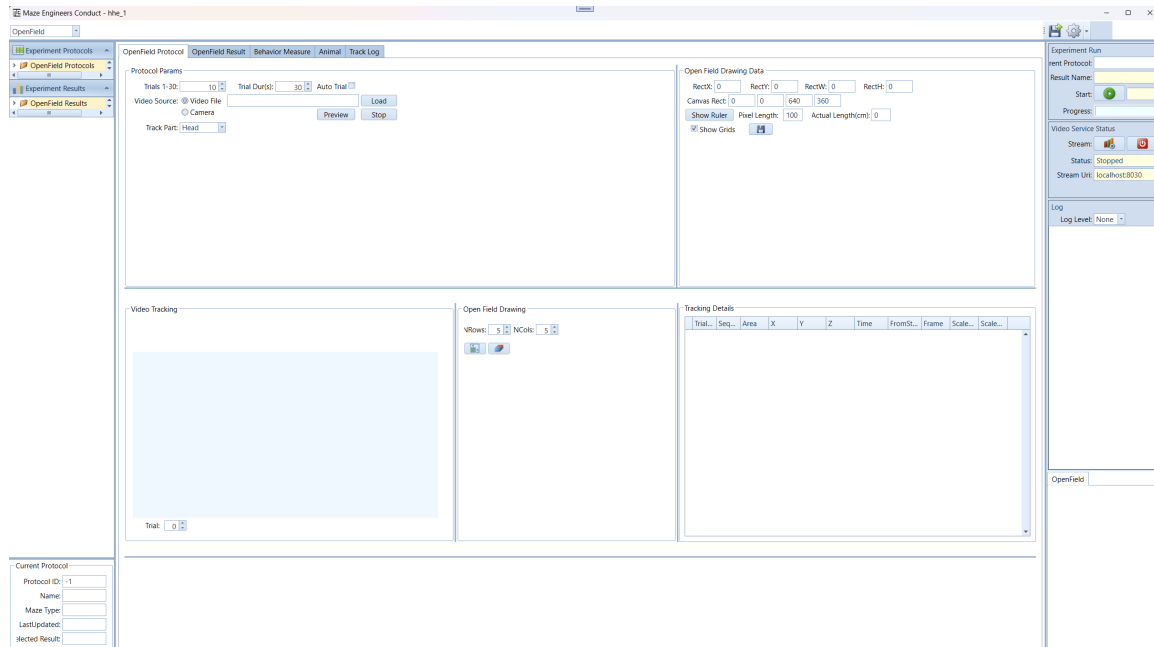
The application can be installed in folder C:\ConductScience. There are subfolders

ConductVisionF\ConductVisionPy

ConductVisionF\ConductVisionUI

The executable is ConductVisionUI\bin\ConductVisionUI.exe. Double click on the executable.

The application appears as below:

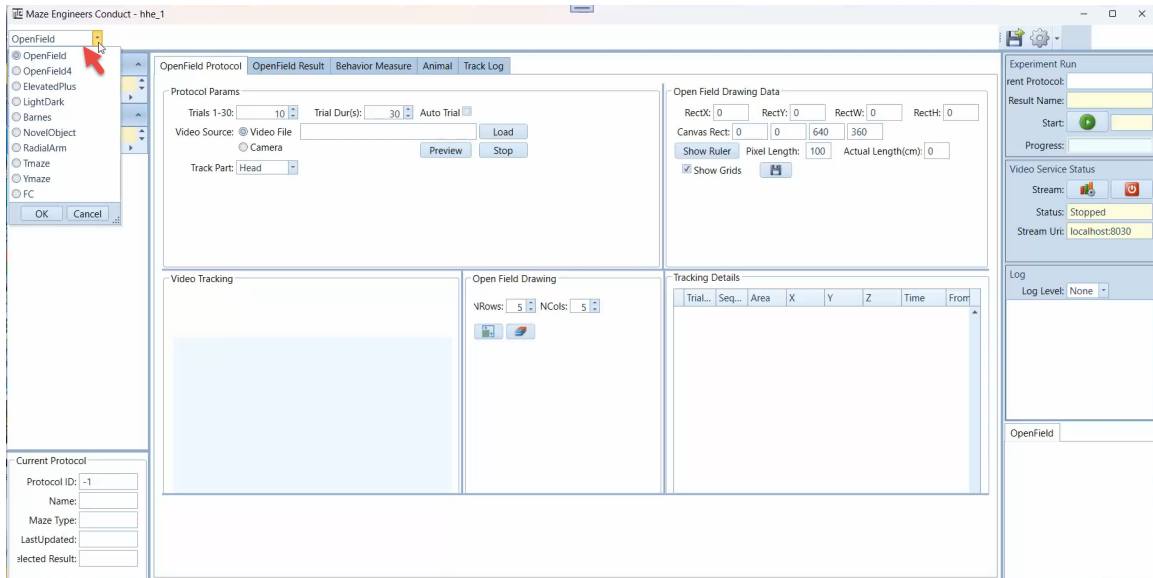


2. Maze Types

Click on the maze type field to view or select a maze type. You can switch to another maze without having to restart the application.

The maze types are defined in the package the user purchased. Pack1 is currently available.

- Pack1: Barnes, Light-Dark, Novel Object, OpenField, OpenField4 (Open Field Set of 4), Elevated Plus, Radial Arm, T-maze, Y-maze, U-maze (User defined maze)
- Pack2: Sociability, Phenotyping, Water Maze
- PackFish: Zebrafish
- PackFC: Fear Conditioning System
- PackAuto: Automated mazes

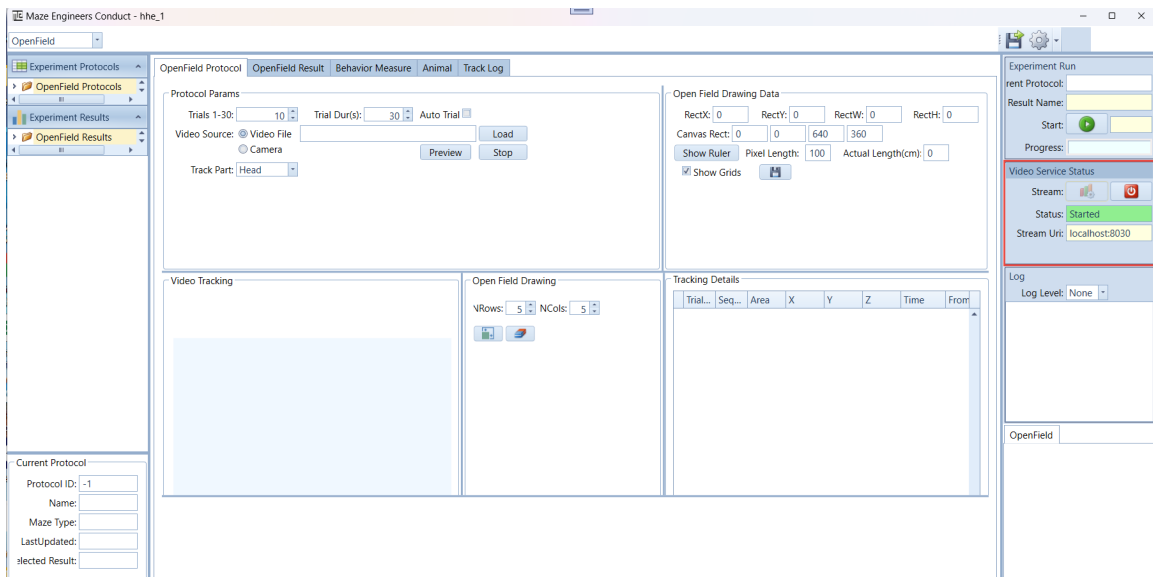


3. Video Service Connection

To use AI based video tracking service, the user needs to start the service stream. When the service stream is established, the status field shows text Started and color becomes green. If there is a need to stop the stream because of the exception, click on the stop button and then start again.

When the application starts, it is in the stop state.

The stream uses local machine port 8030. It is usually available for users. If the port is blocked, please contact your system administrator to open the port.

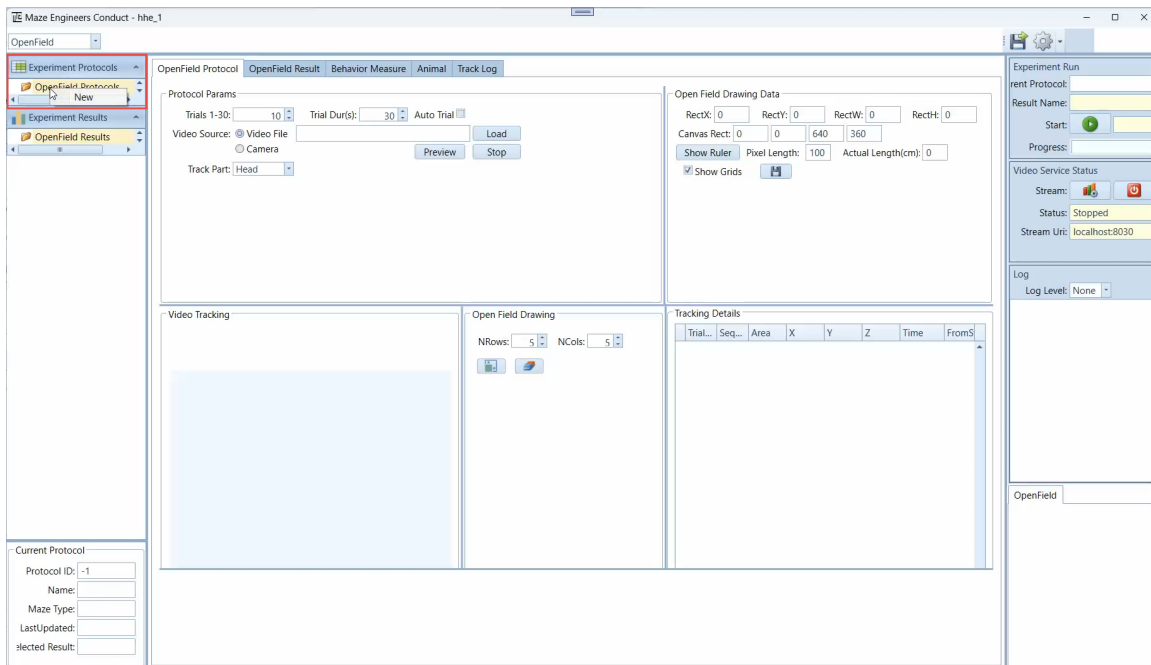


3. Experiment Configuration

The application provides a user interface to configure and execute experiments (protocols) and view execution results.

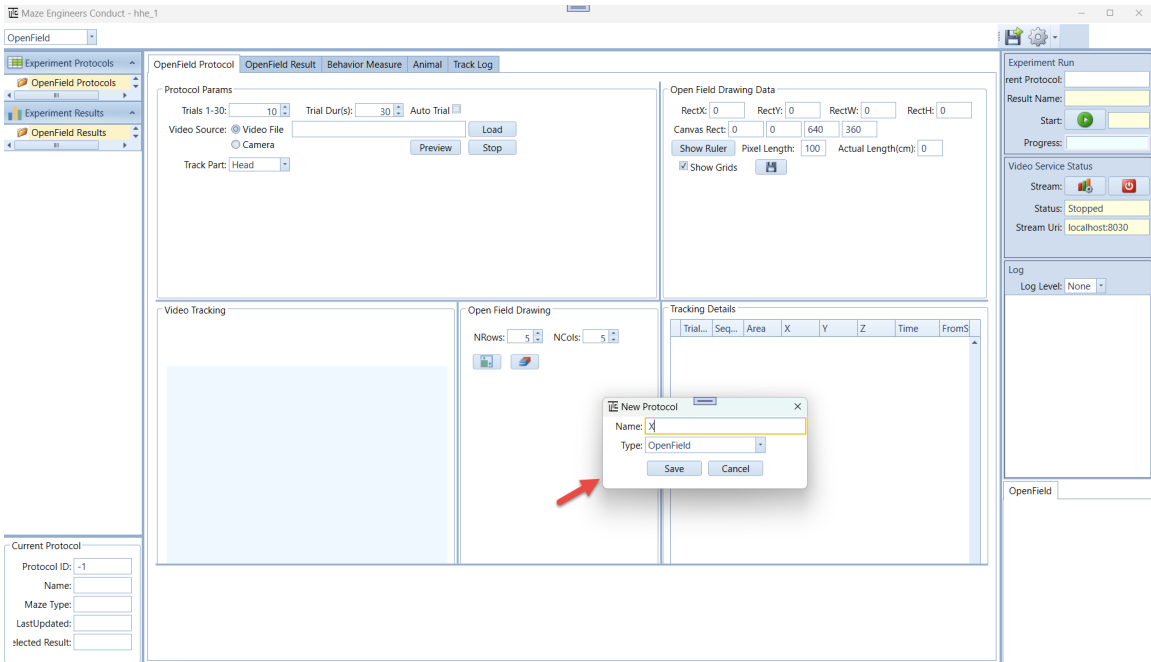
3.1 New Experiment

To create an experiment protocol, right click on "OpenField Protocols" on the left panel. A menu item **New** appears as shown below:

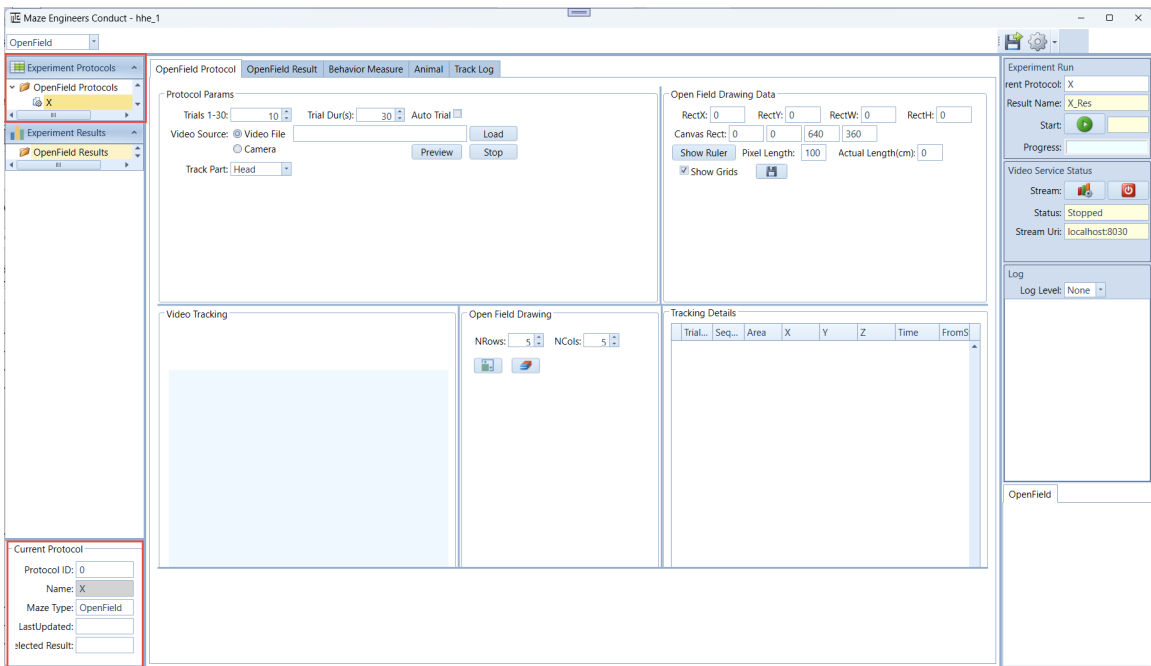


If a different maze like LightDark is selected, the protocols will be "LightDark Protocols".

Click on **New** menu item, a "New Experiment" window appears as shown below. Fill in an experiment name and click on **Save** button.



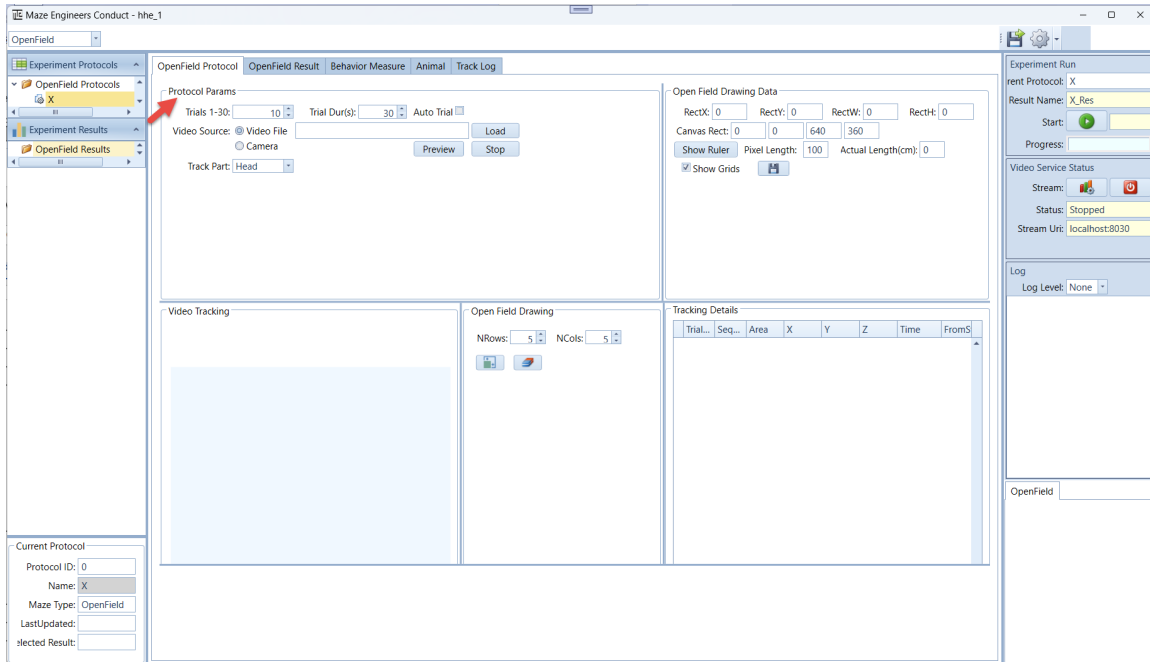
Once the experiment is created, it appears in the folder "OpenField Protocols" as shown below:



An experiment can be deleted by right click on the experiment. The current active protocol is indicated in the left bottom of the screen.

3.2 Configure Parameters

To configure an experiment, double click on the experiment under the folder "OpenField Protocols".



3.2.1 Protocol Parameters

- **Trials (1-30)** - represents number of the trials to continuously run in the session
- **Trial Dur(s)** - represents the trial duration in seconds
- **Auto Trial** – If selected, the next trial will automatically start after the completion of a trial. If not selected, a dialog will appear asking the user to place the animal in the starting position before starting.
- **Video Source Video file** - to track a video file, the user needs to load a video file.
- **Video Source camera** – this is to track rodent in real-time
- **Preview** – in living tracking mode, the user can preview the maze; stop preview will produce a thumbnail that can be used for drawing the tracking areas.
- **Track Part** – the user can choose the track part, either head or body. Some mazes only allow for head tracking.

3.3 Area drawing

There are two styles of drawing: rectangular area and polygon.

Rectangular area drawings include

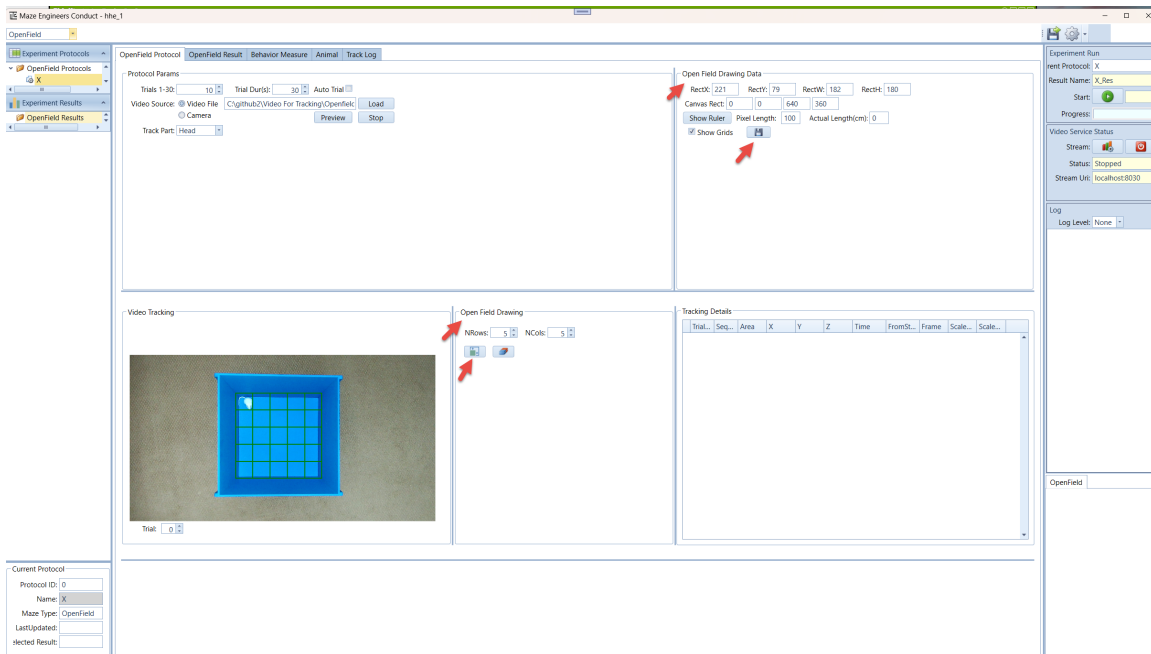
- Barnes
- Light-Dark
- Novel Object
- OpenField
- OpenField4 (Open Field Set of 4)

Polygon area drawings include

- Elevated Plus
- Radial Arm
- T-maze
- Y-maze
- User defined maze

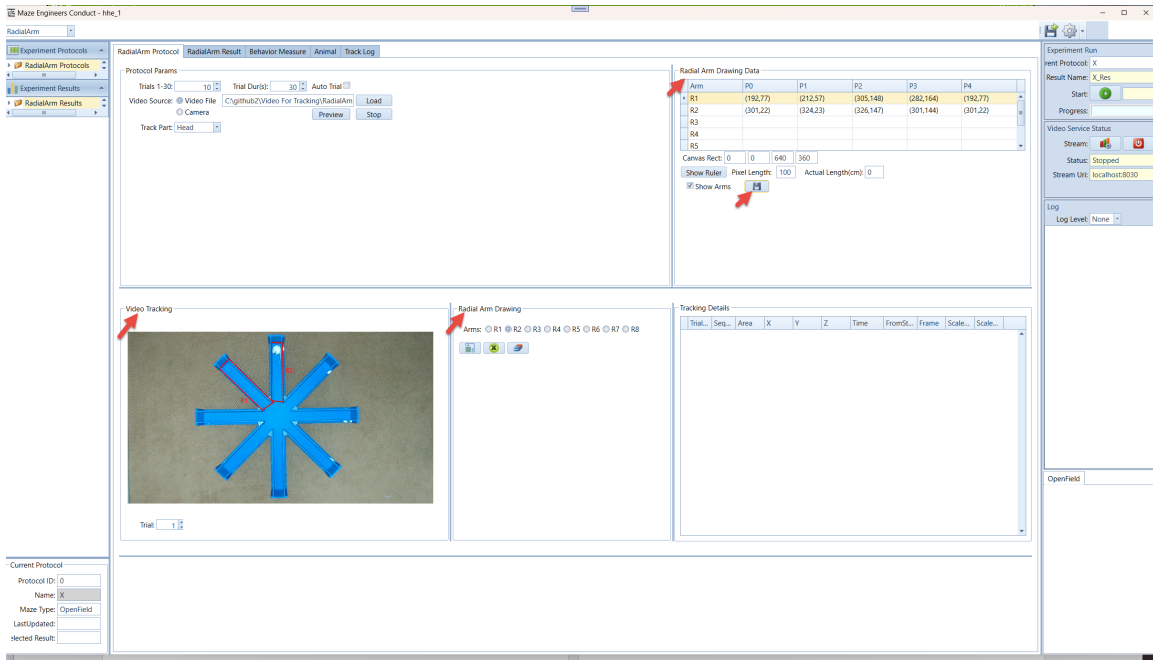
3.3.1 Drawing a Rectangle

- Click Button in the Open Field Drawing group to enable the drawing mode.
- Select NRow and NCol
- On the maze, select the point on the left up corner and drag to the right bottom inside the maze
- After the drawing, click Save button on Drawing Data group.



3.3.2 Drawing a Polygon

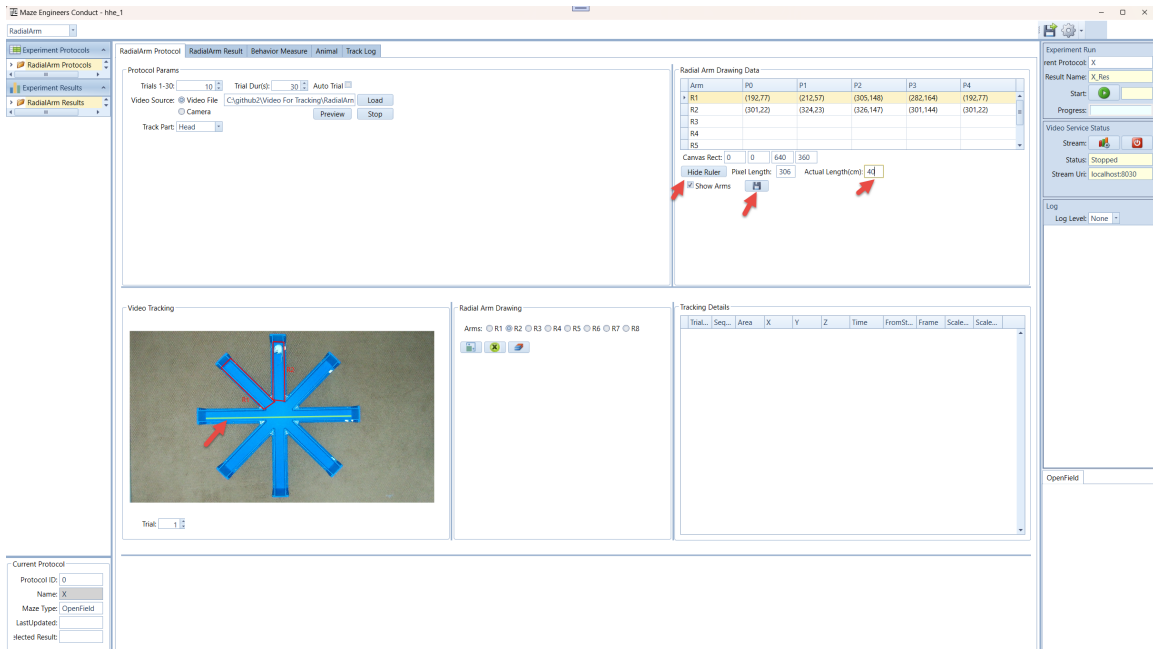
- Enable Button in Radial Arm Drawing group to enable drawing mode
- Select a radial arm
- Click four points of an arm to form a polygon
- After the drawing, click Save button on Drawing Data group.



3.4 Ruler

In software, the camera image distance is defined as pixels. We are interested in reporting the distance meters like cm. So, we need to know the pixels distance on screen maps to meter distance cm.

- Click on the Show Ruler button, and a line appears on the maze
- Draw the ends of the line to two end points of the maze
- Enter the real distance in the field.
- Click Save button the save the data

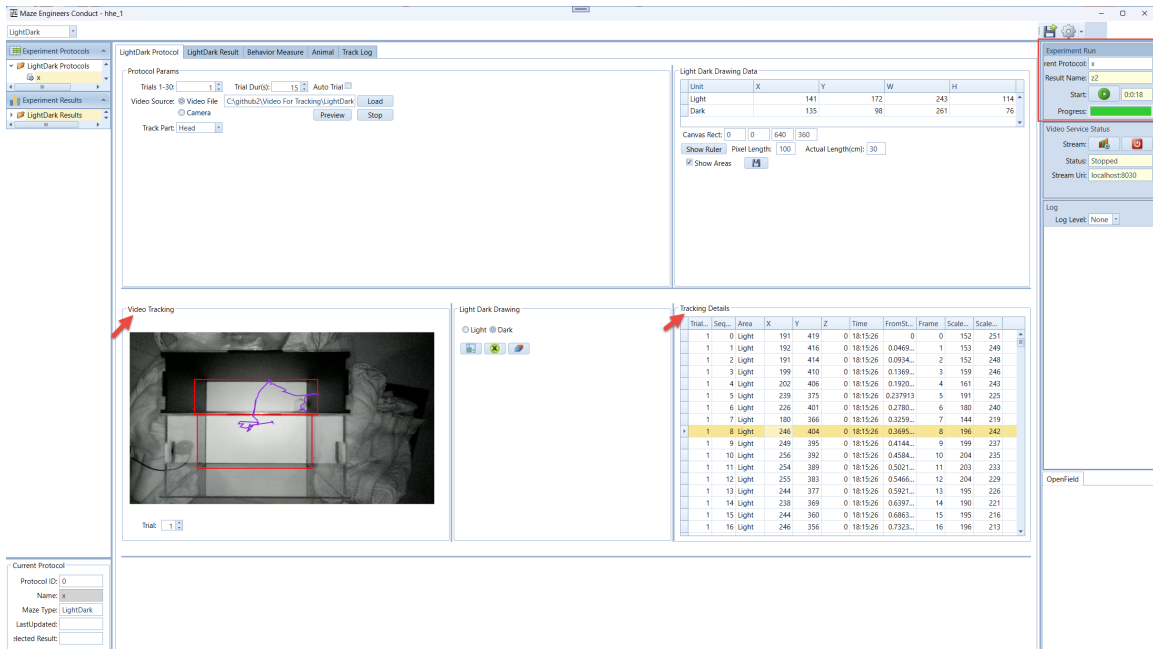


4. Experiment Run

To execute an experiment, select the protocol under "Protocols" on the left navigation panel and double click on it. Make sure the service stream is connected.

4.1 Run Experiment

Enter a name for the experiment run and click **Start** button. This will set system in the running state.



When the start button is clicked, the button state becomes stop. User can click on a stop button to stop the session run.

The experiment will stop when total time reaches, or all trials are completed, or the user stops it.

In the Video Tracking group, the animal moves are tracked.

In the Tracking Details group, the track details are recorded. The data grid only should the latest trial. When a trial completes, the tracking data is saved.

4.2 Result Tables

Select the result from the left Experiment Result. The results are shown on the Result tab. There are five grids.

The screenshot displays the Maze Engineers Conduct software interface for the 'LightDark' protocol. The main window is divided into several sections:

- Current Result Status:** Shows Job Name: 'x', Result Name: 'x_Res', Start Time: '20240717 18:23:10', Complete Time: '20240717 18:23:29', and Run Status: 'Complete'.
- Summary Result:** A table with columns: TrialID, Area, EnterCnt, DurSec, JumpCnt, DurPct, Distance cm, Distance Pixel, Animal.

TrialID	Area	EnterCnt	DurSec	JumpCnt	DurPct	Distance cm	Distance Pixel	Animal
1	Light	2	5	0	0.3	216.66	722.2	
1	Dark	2	11	0	0.7	408.93	1363.1	
- Light Dark Areas:** A table with columns: Area, X, Y, W, H.

Area	X	Y	W	H
Light	141	172	243	114
Dark	135	98	261	76
- Replay:** A video frame showing a maze environment with a red bounding box around a central area.
- Replay Details:** A table with columns: Trial ID, Seq ID, GridID, X, Y, Z, Time, FromStartSec, FrameCount, ScaledX, ScaledY.

Trial ID	Seq ID	GridID	X	Y	Z	Time	FromStartSec	FrameCount	ScaledX	ScaledY
1	1	Light	192	416	0	182312	0.045246	1	153	249
1	2	Light	191	414	0	182312	0.095151	2	152	248
1	3	Light	199	410	0	182312	0.1415848	3	159	246
1	4	Light	202	406	0	182312	0.2020447	4	161	243
1	5	Light	239	375	0	182312	0.2430383	5	191	225
1	6	Light	226	401	0	182313	0.2844157	6	180	240
1	7	Light	180	366	0	182313	0.3286603	7	144	219
1	8	Light	246	404	0	182313	0.3716789	8	196	242
1	9	Light	249	395	0	182313	0.413636	9	199	237
1	10	Light	256	392	0	182313	0.4620501	10	204	235
1	11	Light	254	389	0	182313	0.509788	11	203	233
1	12	Light	255	383	0	182313	0.5549336	12	204	229
1	13	Light	244	377	0	182313	0.6040922	13	195	226
1	14	Light	238	369	0	182313	0.6517776	14	190	221
1	15	Light	244	360	0	182313	0.699962	15	195	216
1	16	Light	246	356	0	182313	0.7578428	16	196	213
1	17	Light	244	341	0	182313	0.7964271	17	195	204

Current Result Status: show the protocol name, result name, protocol run start time, complete time and run status

Replay Group: it allows user to replay the video at a user defined speed (frame per second)

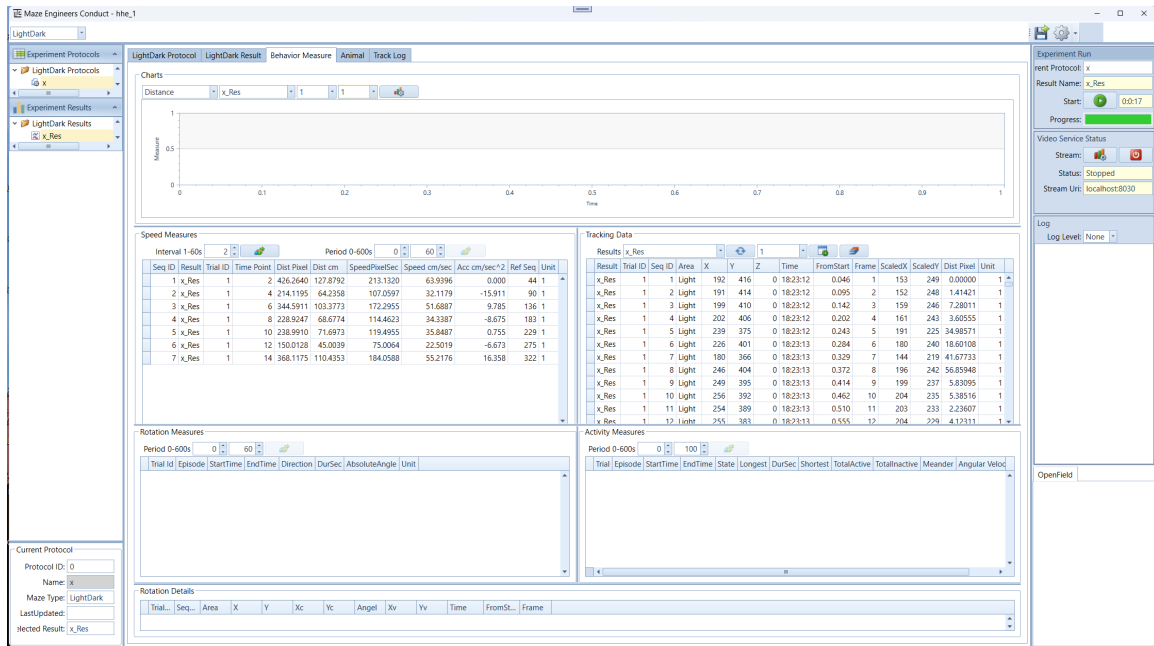
Replay Details: it contains all tracking data of the session (multiple trials)

Summary Result: shows the statistics of each area including the enter count, duration and distances.

Area Group: shows area drawing information. The data are not important for the user at this point.

5. Behavior Measure

5.1 Temporal Move Measurement



The Behavior Measure tab provides calculations of the animal motor measurements.

It allows calculation of any number of results (multiple results), trials (multiple trials) or units (open field set of 4 has 4 units).

Charting provides drawing of the measurements (single trial or cross trial comparison).

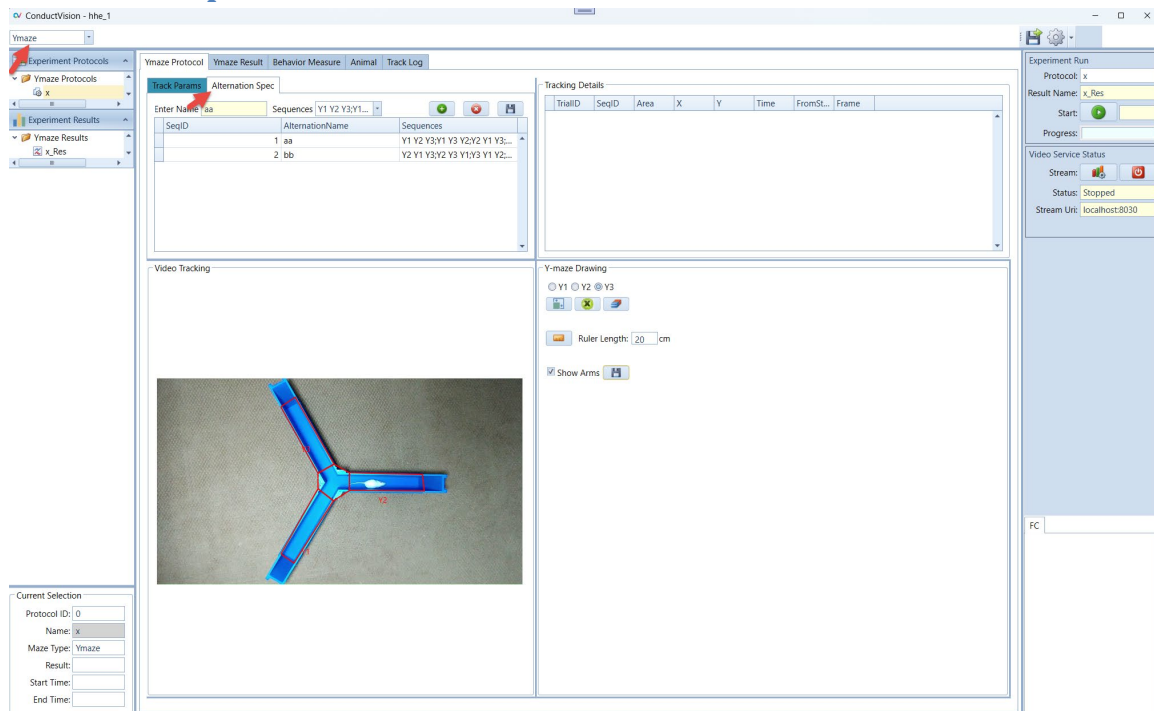
5.2 Rotation Measurement

5.3 Activity Measurement

5.4 Heatmap

6. Maze Protocols

6.1 Y-Maze Spontaneous Alternation



The Y-maze spontaneous alternation test is a behavioral test often used in research, particularly in neuroscience and psychology, to assess spatial memory and exploratory behavior in rodents.

The Conduct Vision software provides spontaneous alternation analysis using tracking data.

6.1.1 Y-Maze Alternation Specification

- There are six possible sequences for Y-maze:

Y1 Y2 Y3

Y1 Y3 Y2

Y2 Y1 Y3

Y2 Y3 Y1

Y3 Y1 Y2

Y3 Y2 Y1

- For a specification definition, the user can specify all sequences or a subset of the sequences and give a name. The screenshot below shows two definitions of alternation sequences aa and bb. Each protocol can have its specification of the sequences.
- To add a definition, give a name and choose a set of sequences and then click on Add button
- To remove a definition, select the data row in the grid and click the Remove button
- To save the specification, click the Save button.

- Once the specification is saved, it will appear on the result tab when a trial run is completed.

Ymaze Protocol | Ymaze Result | Behavior Measure | Animal | Track Log

Track Params | Alternation Spec

Enter Name Sequences

SeqID	AlternationName	Sequences
1	aa	Y1 Y2 Y3;Y1 Y3 Y2;Y2 Y1 Y3;...
2	bb	Y2 Y1 Y3;Y2 Y3 Y1;Y3 Y1 Y2;...

6.1.2 Y-Maze Alternation Result

Summary Result

TrialID	Area	EnterCnt	DurSec	DurPct	DistancePixel	DistanceCm	Animal
1	Y1	3	26	0.21	753.6	85.15	Black35
1	Y2	2	17	0.14	607.4	68.63	Black35
1	Y3	2	29	0.24	550.1	62.16	Black35
1	SO	7	50	0.41	1431.3	161.79	Black35
2	Y1	3	25	0.21	753.6	85.15	Black35
2	Y2	3	17	0.14	618.1	69.84	Black35
2	Y3	2	28	0.23	550.1	62.16	Black35
2	SO	7	51	0.42	1539	173.9	Black35


Spontaneous Alternation

VisitID	ID	FromArea	ToArea	EnterSec	ExitSec	VisitDurSec	Sequence	Status	Percent	Animal
1	1	Y1	SO	0.000	9.482	9.482				
2	1	SO	Y2	9.482	12.600	3.118	Y1 Y2			
3	1	Y2	SO	12.600	21.558	8.958				
4	1	SO	Y3	21.558	29.091	7.533	Y1 Y2 Y3	Alternation		
5	1	Y3	SO	29.091	55.916	26.824				
6	1	SO	Y2	55.916	65.146	9.230	Y2 Y3 Y2			
7	1	Y2	SO	65.146	73.116	7.970				
8	1	SO	Y1	73.116	76.789	3.674	Y3 Y2 Y1	Alternation		
9	1	Y1	SO	76.789	91.634	14.845				
10	1	SO	Y1	91.634	101.830	10.195	Y2 Y1 Y1			
11	1	Y1	SO	101.830	103.375	1.545				
12	1	SO	Y3	103.375	113.136	9.761	Y1 Y1 Y3			
13	1	Y3	SO	113.136						
14	1	NA	NA				Total 2		40	Black35
15	2	Y1	SO	0.000	9.472	9.472				

Replay

Replay Details

TrialID	SeqID	GridID	X	Y	Time	FromStart
1	1	Y1	396	185	23:19:39.873	0.000
1	2	Y1	402	186	23:19:39.920	0.047
1	3	Y1	404	186	23:19:39.991	0.118
1	4	Y1	407	184	23:19:40.043	0.170
1	5	Y1	413	184	23:19:40.090	0.218
1	6	Y1	415	183	23:19:40.148	0.275
1	7	Y1	419	185	23:19:40.253	0.380
1	8	Y1	421	185	23:19:40.274	0.402
1	9	Y1	425	186	23:19:40.304	0.432
1	10	Y1	427	186	23:19:40.358	0.485
1	11	Y1	430	184	23:19:40.408	0.535
1	12	Y1	433	184	23:19:40.470	0.598
1	13	Y1	437	184	23:19:40.522	0.650
1	14	Y1	439	185	23:19:40.589	0.717
1	15	Y1	443	186	23:19:40.635	0.762
1	16	Y1	445	186	23:19:40.695	0.823
1	17	Y1	446	185	23:19:40.748	0.876
1	18	Y1	449	183	23:19:40.797	0.924

- On the result tab, the Spontaneous Alternation panel displays the result of alternation analysis.
- Choose the alternation specification name and the specification definition is displayed in the next field.
- Press button the calculation button , the alternation result is calculated and saved automatically.

- The calculation is done for each trial. At the end of the result of the trial, a summary line is displayed with number of alternations and the alternation percentage.
- Examples
 - Example 1: the first four rows shows arm entry sequence Y1Y2Y3. Since Y1Y2Y3 is in the definition, the sequence makes an alternation.

VisitId	TrialID	FromArea	ToArea	Enter(s)	Exit(s)	VisitDurSec	Sequence	Status	Percent	Animal
1	1	Y1	S0	0.000	9.482	9.482				
2	1	S0	Y2	9.482	12.600	3.118	Y1 Y2			
3	1	Y2	S0	12.600	21.558	8.958				
4	1	S0	Y3	21.558	29.091	7.533	Y1 Y2 Y3	Alternation		

- Example 2: the following four rows shows arm entry sequence Y3Y2Y1. Since Y3Y2Y1 is in the definition, the sequence makes an alternation.

VisitId	TrialID	FromArea	ToArea	Enter(s)	Exit(s)	VisitDurSec	Sequence	Status	Percent	Animal
5	1	Y3	S0	29.091	55.916	26.824				
6	1	S0	Y2	55.916	65.146	9.230	Y2 Y3 Y2			
7	1	Y2	S0	65.146	73.116	7.970				
8	1	S0	Y1	73.116	76.789	3.674	Y3 Y2 Y1	Alternation		

- Example 2: the following four rows shows arm entry sequence Y2Y3Y2. Since Y2Y3Y2 goes back to Y2 after Y2Y3, it is not a spontaneous alternation.

VisitId	TrialID	FromArea	ToArea	Enter(s)	Exit(s)	VisitDurSec	Sequence	Status	Percent	Animal
3	1	Y2	S0	12.600	21.558	8.958				
4	1	S0	Y3	21.558	29.091	7.533	Y1 Y2 Y3	Alternation		
5	1	Y3	S0	29.091	55.916	26.824				
6	1	S0	Y2	55.916	65.146	9.230	Y2 Y3 Y2			

- Total alternations
The last row of the entries for a trial shows the total alternations and alternation percentage

6.1.3 Y-Maze Alternation Calculation and Interpretation

- Alternation Percentage

$$\text{Spontaneous Alternation Percentage} = \left(\frac{\text{Number of Alternations Made}}{\text{Possible Alternations}} \right) \times 100$$

$$= \frac{\text{Number of alternations Made}}{(\text{Y1 entries} + \text{Y2 entries} + \text{Y3 entries} - 2)} \times 100$$

- A high spontaneous alternation percentage indicates good working memory and spatial awareness, whereas a lower percentage may suggest memory impairment or cognitive deficits. This measure is especially useful in studies on neurodegenerative disease, pharmacological interventions, and genetic modifications affecting memory and cognition.

For further detail, search chatgpt message “Y-maze spontaneous alternation percentage”

7. Animal

The tab provides a place for user to enter the animal information. The animal information then is applied to the results.

The screenshot shows the 'Maze Engineers Conduct' software interface. The main window is titled 'LightDark' and has several tabs: 'LightDark Protocol', 'LightDark Result', 'Behavior Measure', 'Animal', and 'Track Log'. The 'Animal' tab is active, displaying a table of animals. The table has the following data:

SeqID	Unit	AnimalName	MazeType	Active
1	1	a1	OpenField4	<input checked="" type="checkbox"/>
2	2	a2	OpenField4	<input checked="" type="checkbox"/>
3	3	a3	OpenField4	<input checked="" type="checkbox"/>
4	4	a4	OpenField4	<input checked="" type="checkbox"/>

A dropdown menu is open for the 'MazeType' of the selected animal (a4), showing the following options: OpenField, OpenField4, ElevatedPlus, LightDark, Barnes, NovelObject, RadialArm, Tmaze, Ymaze, and FC. The right sidebar contains controls for 'Experiment Run' (Start, Stop, Progress), 'Video Service Status' (Stream, Status, Stream Uri), and 'Log' (Log Level). The bottom left shows 'Current Protocol' details:

Current Protocol
 Protocol ID: 0
 Name: x
 Maze Type: LightDark
 Last Updated:
 Selected Result: x_Res

8. Export Data

LightDark

Experiment Protocols

- LightDark Protocols
- Experiment Results
- LightDark Results
- x_Ris

LightDark Protocol | LightDark Result | Behavior Measure | Animal | Track Log

Current Result Status

Job Name: x | Result Name: x_Ris | Run Status: Complete

Start Time: 20240717 18:23:10 | Complete Time: 20240717 18:23:29

Summary Result

TrialID	Area	EnterCnt	DurSec	JumpCnt
1	Light	2	5	0
1	Dark	2	11	0

Light Dark Areas

Area	X	Y	W	H
Light	141	172	243	114
Dark	135	98	261	76

Replay

Replay Details

Trial	Seq	GridID	X	Y	Z	Time	FromStar	Fram	Scale	
1	1	Light	192	416	0	18:23:12	0.04030445	1	153	249
1	2	Light	191	414	0	18:23:12	0.0991151	2	152	248
1	3	Light	199	410	0	18:23:12	0.1415848	3	159	246
1	4	Light	202	406	0	18:23:12	0.2030447	4	161	243
1	5	Light	239	375	0	18:23:12	0.2430383	5	191	225
1	6	Light	226	407	0	18:23:13	0.2844157	6	180	240
1	7	Light	180	366	0	18:23:13	0.3286603	7	144	219
1	8	Light	246	404	0	18:23:13	0.3716789	8	196	242
1	9	Light	249	395	0	18:23:13	0.413626	9	199	237
1	10	Light	256	392	0	18:23:13	0.4620501	10	204	235
1	11	Light	254	389	0	18:23:13	0.509788	11	203	233
1	12	Light	255	383	0	18:23:13	0.5549336	12	204	229
1	13	Light	244	377	0	18:23:13	0.6049032	13	195	226
1	14	Light	238	369	0	18:23:13	0.6517776	14	190	221
1	15	Light	244	360	0	18:23:13	0.699962	15	195	216
1	16	Light	246	356	0	18:23:13	0.7537828	16	196	213
1	17	Light	244	341	0	18:23:13	0.7904371	17	195	204

Current Protocol

Protocol ID: -1

Name:

Maze Type:

Last Updated:

Selected Result: x_Ris

Experiment Run

Experiment Protocol:

Result Name:

Start:

Progress:

Video Service Status

Stream:

Status: Stopped

Stream URL: localhost:8030

Log

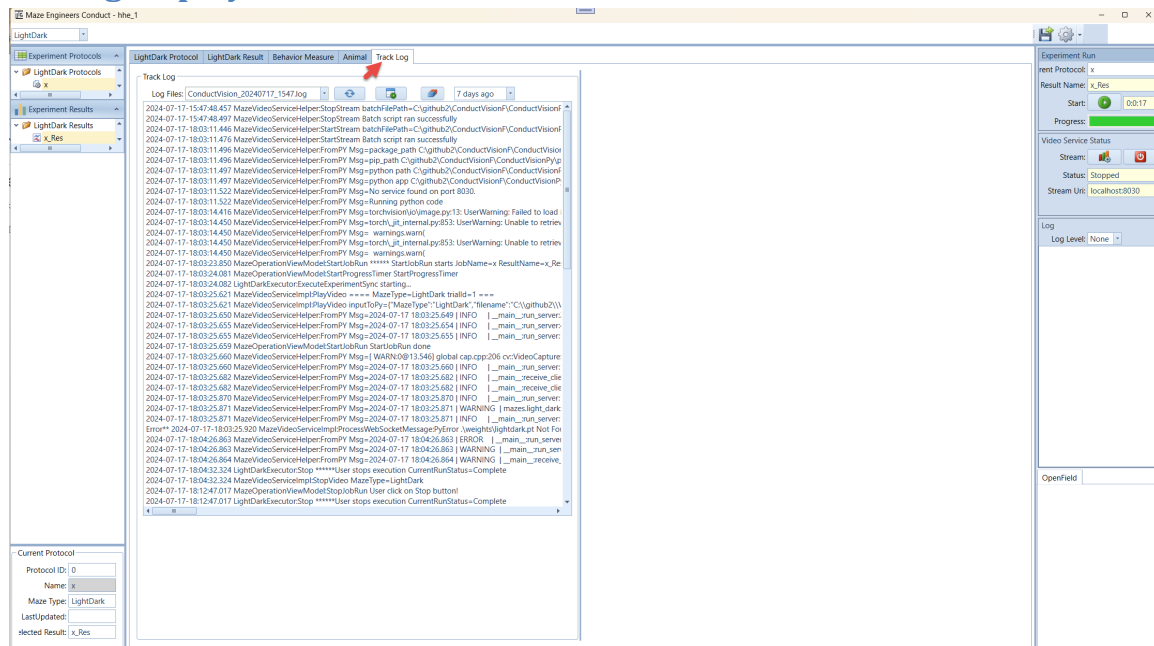
Log Level: None

OpenField

- Select a result
- Click the Export button
- The out is .csv file

9. Troubleshooting

9.1 Log display



- The log content can be displayed on the screen.
- The log file is in the Log folder under your deployment folder
C:\ConductScience\bin\Log

9.2 Database files and user data

The database file contains the protocols and results. There is a separate folder containing database files and video data for each maze under bin.