Ethotrack

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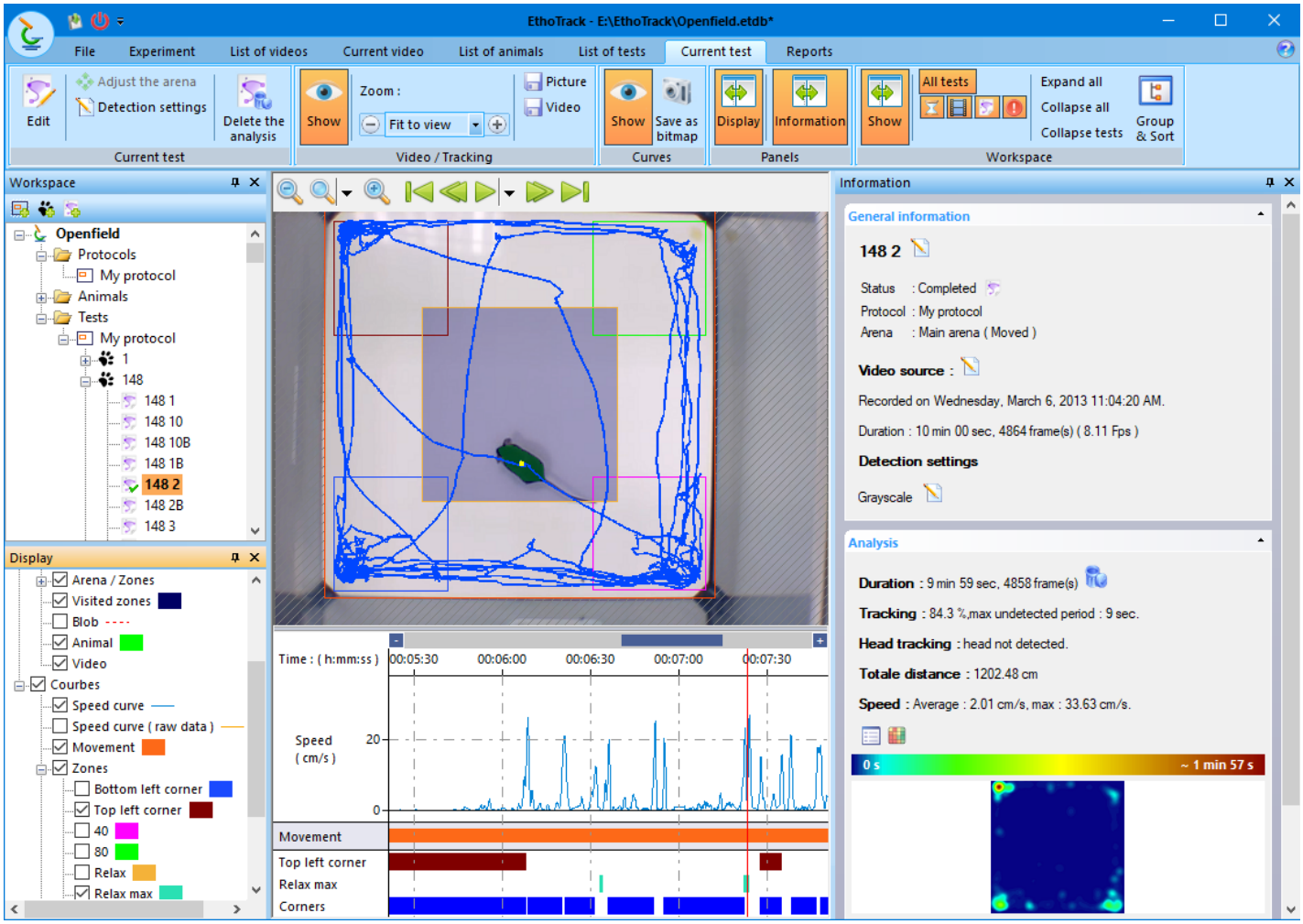
1. Introduction

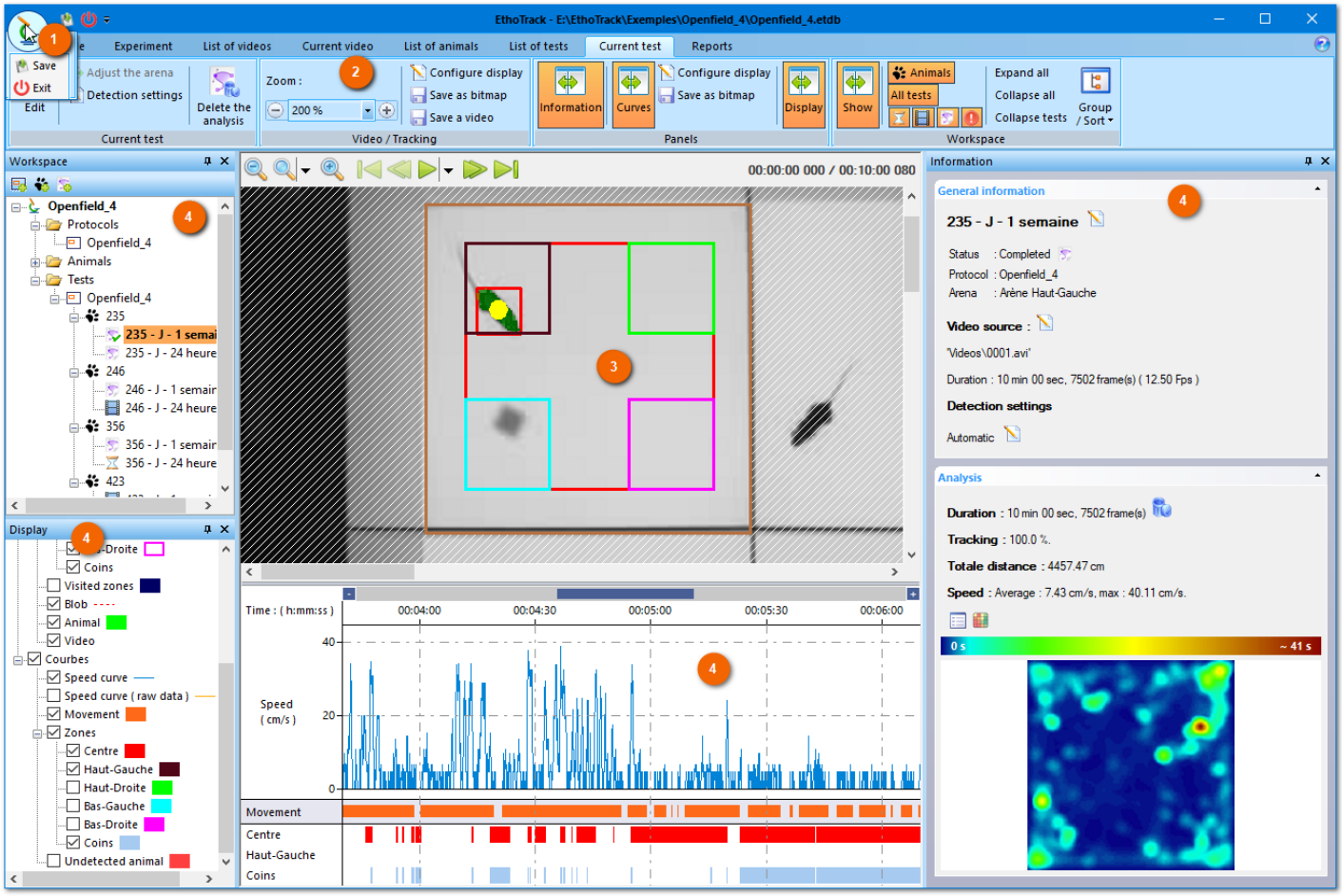
EthoTrack is a video tracking software intended for the study of animal behavior.



EthoTrack brings together all the tools essential to the smooth running of an experiment on animal behavior:

- Definition of all parameters of the experiment.
- Animal management.
- Definition and management of tests.
- Recording videos with a simple USB camera.
- Analysis of recorded videos.
- Creation of detailed reports and graphs.

2. User Interface Overview



1 Main button

The application's main button that allows you to save the current experiment or quit Ethotrack at any time.

2 Ribbon bar

Ribbon of commands organized in the form of 8 tabs. Each tab corresponding to a display mode :

- File
- Experiment
- List of videos
- Current video
- List of animals
- List of tests
- Current test
- Reports

3 Main part

The central part of the interface which varies according to the selected display mode .

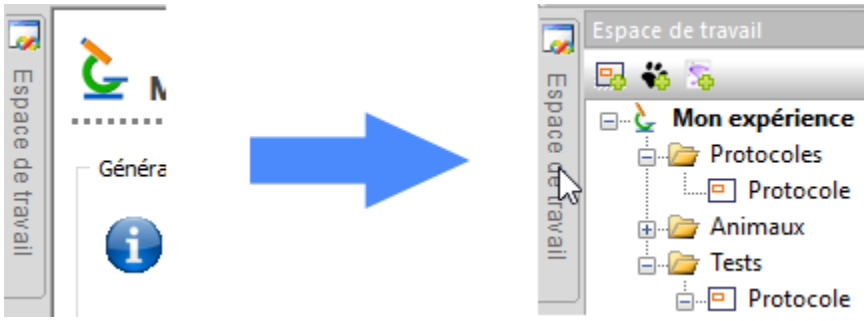
4 Tool windows

The tool windows (or side panels) which also depend on the display mode and whose layout can be customized:

- The workspace (in all the tabs except the "File" tab): displays in tree form all the elements of the current experiment (protocol, animals, tests, ...).
- Display panel (only in the "Current test" view): allows you to select the elements to display in the central part of the "Current test" view.
- Information panel (only in the "Current test" view) : displays important information on the current test.
- Curves panel (only in the "Current test" view) : displays analysis results in graphic form, such as the animal's movement speed, periods of immobility, the animal's presence in a zone of interest, etc.

A tool window can be:

- Anchored to an edge of the main Ethotrack window.
- Placed as an independent floating window.
- Hidden along the edge of the main Ethotrack window: in this case, only the name of the window appears along the edge and it suffices to point the mouse cursor on this name to make the window appear.

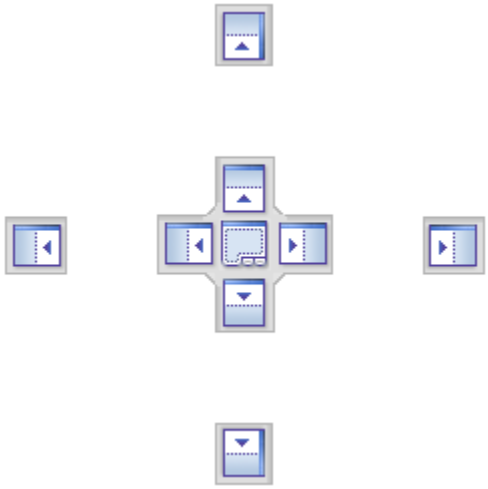


Arrange and dock tool windows:

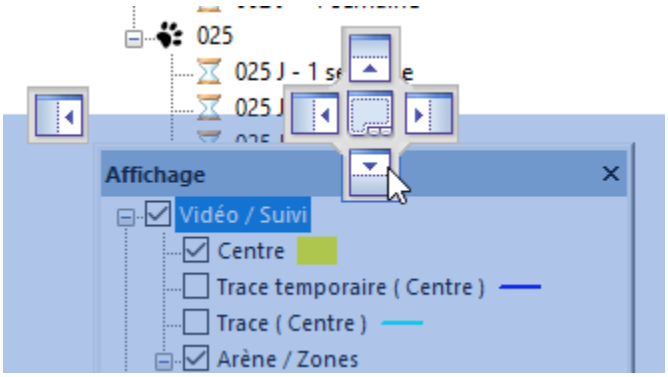
Method 1:

Click on the window title bar and drag it while holding down the left mouse button.

Several guides appear on the screen to indicate the positions to which you can dock the window.



Move the mouse cursor over one of the guides to reveal a blue shaded area that indicates the position where the window will be anchored.



If the position suits you, release the mouse button to dock the window.

You can also release the mouse button outside of a guide to make the window float and position it anywhere on the screen.

Method 2:

Click with the right mouse button on the title bar of the window to bring up the contextual menu then choose a command:

Floating: makes the window float and moves it to the last known floating position.

Dockable: Docks the window to the edge of the main window at the last known docked position.

Hide: hides the window. You can use the corresponding button on the command ribbon to make it reappear.

Auto-hide: only the window name appears along the edge, and hovering the mouse cursor over that name will bring up the window.

Method 3:

Double-click on the title bar of the window to switch from the "floating window" state to the "docked window" state and vice versa.

You can, at any time, restore the layout of the default windows as it was when Ethotrack was first launched. To do this: open the Ethotrack "Options" dialog box by clicking on the Options File menu command, then click on Restore default windows layout.

2.1. Workspace

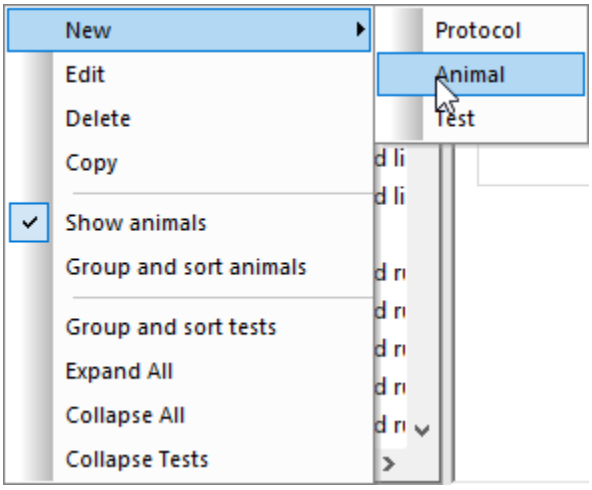
The side panel: "Workspace" displays in tree form all the elements of the current experiment (protocol, animals, tests, ...).

The icon displayed to the left of a test indicates its status:

- Waiting.
- Waiting , test created automatically by Ethotrack.
- Recorded.
- Recorded, contains period of behavior.
- Recorded, but video file not found.
- Analyzed.
- Analyzed, contains period of behavior.
- Excluded: the test is not taken into account in the reports.

Contextual menu :

Right-click in the workspace to bring up the context menu.



This menu allows you to:

- Add a protocol.
- Add an animal.
- Add a test.
- Edit the selected item.
- Delete the selected item.
- Copy the selected item.
- Show or hide animals;
- Open the "Group/ Sort animals" to organize the display of animals.
- Open the "Group/ Sort tests" dialog box to organize the display by grouping the tests according to different criteria (animal or user fields).

- Collapse or expand groups.

2.2. "Group and sort tests" dialog

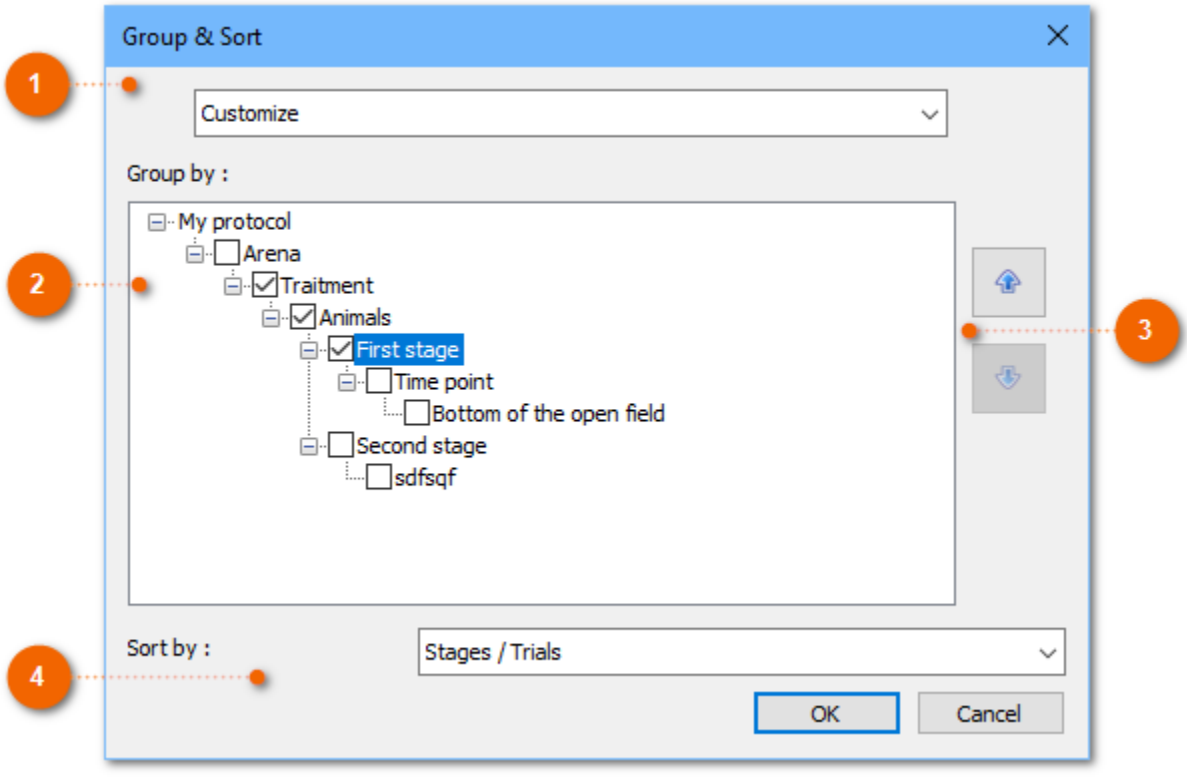
This dialog allows you to configure the grouping levels of a list of tests, as well as the order in which the tests are displayed.

This dialog is available for:

- the workspace.
- the list of tests.
- the reports.

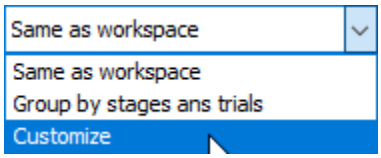
The possible grouping levels are:

- The protocols (only for the workspace and the list of tests).
- User fields of the "Animals" category of choice type.
- Animals.
- User fields of the "Tests" category of choice type.



1 **Choice :**

Choice of a pre-defined configuration :



- Same as workspace : the grouping levels and the display order of the tests are the same as those defined for the workspace (only for the list of tests and the reports).
- Group by stages and trials : tests are automatically grouped by stages and trials.
- Customize : you can choose the grouping levels.

2 **Grouping levels :**

Area used to choose the grouping levels of a list of tests. All you have to do is check the desired items.

3 **Order of grouping levels :**

Buttons for changing the order of grouping levels by moving the selected item.

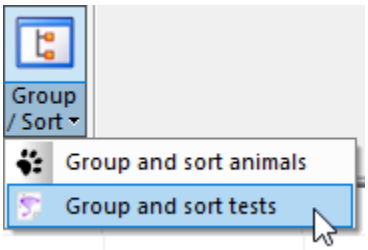
4 **Sort by :**

List allowing you to choose the display order of the tests within a group, as desired:

- Alphabetical order.
- Stages and trials.
- Registration Date.
- User fields of category "Tests".

Note: For the list of tests, this parameter concerns the display order when the sort is done on the first column. (Reminder: for the list of tests, sorting can be done on each column by clicking on the column header).

To open this dialog box:

- Click 

in the command ribbon.
- Use the "Group and Sort tests" context menu.

2.3. "Group and sort animals" dialog

This dialog allows you to configure the grouping levels of a list of animals, as well as the order in which the animals

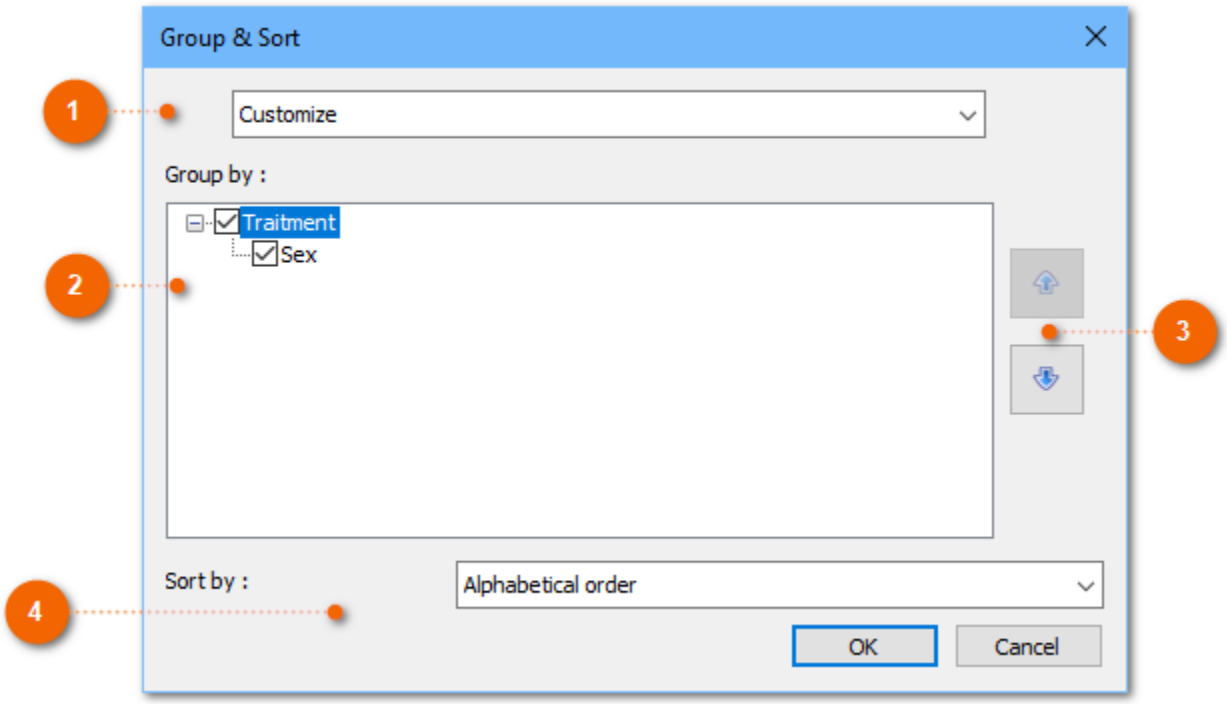
are displayed.

This dialog is available for:

- the workspace.
- the list of animals.

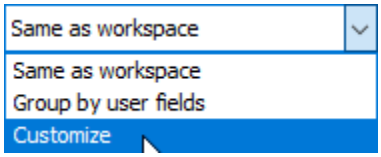
The possible grouping levels are:

- User fields of the "Animals" category of choice type.



1 **Choice :**

Choice of a pre-defined configuration :



- Same as workspace : the grouping levels and the display order of the tests are the same as those defined for the workspace (only for the list of tests and the reports).
- Group by user fields : animals are automatically grouped by user fields of "animals" category and "choice" type.
- Customize : you can choose the grouping levels.

2 **Grouping levels :**

Area used to choose the grouping levels of a list of tests. All you have to do is check the desired items.

3 **Order of grouping levels :**

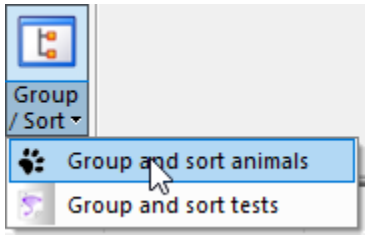
Buttons for changing the order of grouping levels by moving the selected item.

4 **Sort by :**

List allowing you to choose the display order of the animals within a group, as desired :

- Alphabetical order.
- Creation date order.

To open this dialog box:

- Click 

in the command ribbon.
- Use the "Group and Sort animals" context menu.

3. Experiment

Definition:
An experiment is a set of tests carried out on animals according to a specific protocol.

An experiment includes:

- all the parameters that define the tracking method (video source, arena, ...)
- Video recordings of animal behavior.
- information on the animals used.
- analysis parameters.
- The tests carried out.
- Different reports and filters to analyze the results obtained.

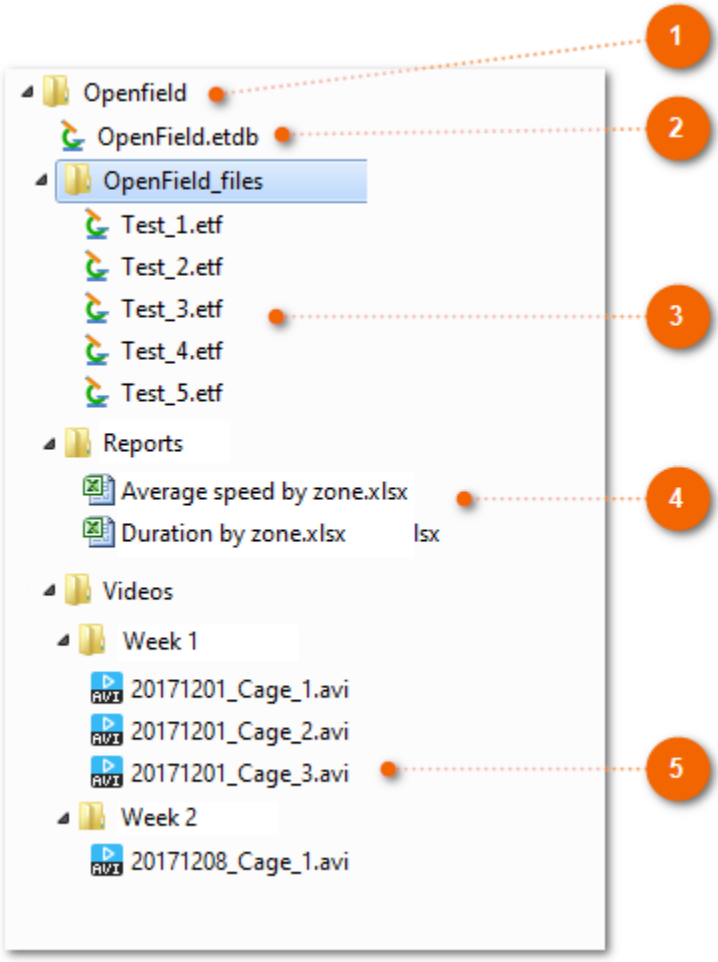
Files:

An experiment is made up of several files:

- The main experiment file (experiment_name.etdb).
- The video files of the various tests:
- If these files are saved with EthoTrack they are saved in a subfolder named "my_experiment_files" in the same folder as the main experiment file. These files are named "Test_nnn.etf" (where 'nnn' represents the test number).
- If these files are saved with other software, they may be located anywhere on your computer. **It is advisable to place all the video files in a subdirectory of the folder that contains the experiment file** (for example: a "Videos" folder) so that all the experiment files are located in the same location.
- Report export files:
  You can save these files anywhere on your computer, but again, **it is recommended to save them in a subfolder of the experiment folder** (for example in a "Reports" folder) .

It is advisable to create a specific folder (experiment folder) to contain all these elements.

Example of organization of experiment files:



1 **The experiment folder :**

The main folder that contains all the experiment files.

2 **The main experiment file :**

The main file created by Ethotrack.

3 **Video files recorded by Ethotrack :**

Video files recorded by Ethotrack. This folder must not be deleted or renamed.

4 **The report folder :**

Report files generated by Ethotrack

5 **Video files recorded by other software :**

Video files recorded by another software or directly by a camera and imported into Ethotrack.

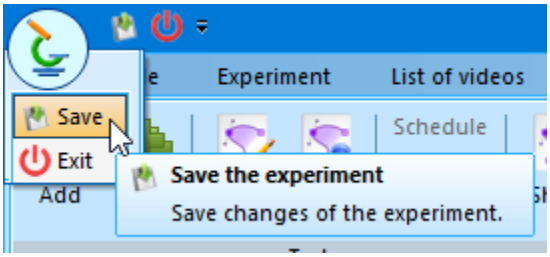
When a file used by Ethotrack is located in the experiment folder (or in a subfolder), Ethotrack uses the relative path of the file in relation to the experiment folder. This allows you to move or copy the experiment while keeping the link to the different files used. All you have to do is move or copy the entire experiment folder.

Saving changes to the experiment file:

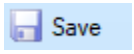
Ethotrack offers 2 modes for saving modifications in an experiment file:

1. Using a temporary file (default mode):

When opening an experiment, Ethotrack creates a copy of the experiment file and saves the modifications in this temporary file. This temporary file is automatically destroyed when the experiment is closed. To keep the changes you can, at any time:

- Click on the main button of the Command Ribbon 

then choose the "Save" command.
- Click on 

in the ribbon in the "Experiment" view.
- Click on 

in the "File" view.

When closing an experiment, if Ethotrack detects modifications that have not been saved, a dialog box will allow you to choose whether or not you want to keep these modifications.

2. Background recording:

In this mode, there is no ""Save" or "Save as..." command. All changes are automatically saved in the experiment file in the background:

- or, directly when modifying a parameter.
- or, when closing a dialog box by clicking on the "Ok" button.

Warning: this recording mode does not allow you to cancel a modification.

You can change how changes are saved on the Miscellaneous tab of the Options dialog.

Automatic data recovery:

Regardless of the recording mode chosen, your data is saved in the event of an untimely shutdown of the computer (for example in the event of a power failure):

- In the recording mode with a temporary file, it is enough to re-open the experiment file opened during the crash. A dialog box will allow you to choose whether or not you want to keep the changes saved in the temporary file.
- In background save mode, changes are saved in real time, and are therefore saved in the event of a crash.

Copy of an experiment, transfer to another computer:

If you have organized your experiment according to the recommendations above, just copy the experiment folder and all its contents.

When a test has been analyzed, the corresponding video file is no longer required (unless you want to redo an analysis). However, if this file is missing or has been moved, the test video will no longer be visible in

EthoTrack.

Opening an experiment file located on a network drive:

Normally, it is advisable to work with an experiment file located on a local hard disk of the computer on which Ethotrack is installed. However, it is possible to open an experiment located on another computer through a local network. In this case, the experiment is opened as read-only and changes to the experiment cannot be saved.

3.1. Settings

This dialog allows you to define the parameters of the current experiment. It has the following tabs:

- Animals .
- Units .
- Smoothing .

To open this dialog box:

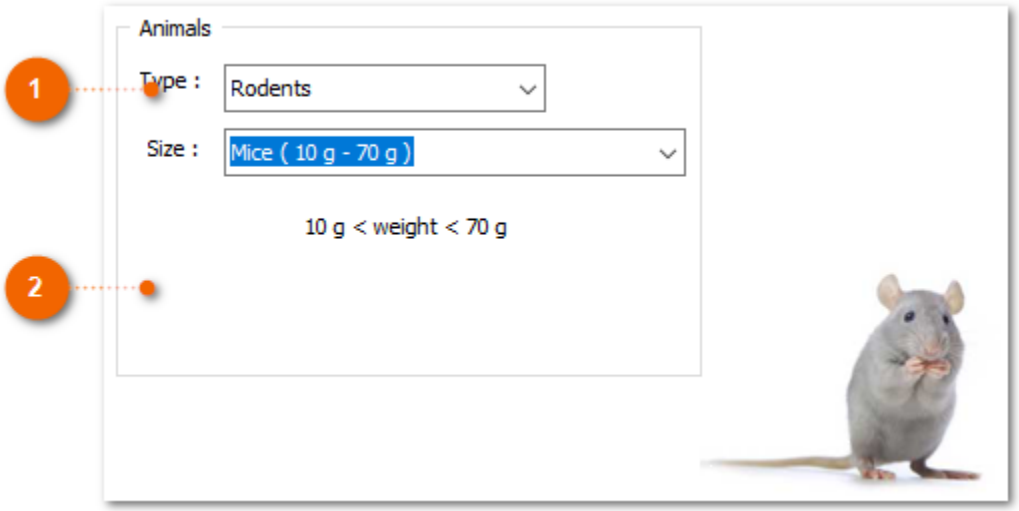
- Click on 

in the "Experiment" view.
- Click on 

in the ribbon of the "Experiment" view.

3.1.1. Animals

This tab is used to define the characteristics of the animals used for the experiment:



1 **Type :**

The type of animal. For the moment Ethotrack is planned to be able to detect rodents.

2 **Size :**

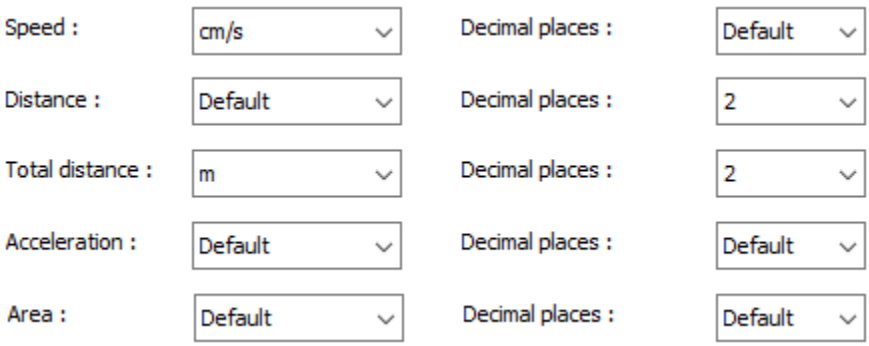
The approximate size of the animals. You can :

- Select a predefined size.
- Define a custom size.

These features are used by the detection module to eliminate artifacts. For more information on the use of the animal's size by the detection module, please consult the section: Detection parameters ▸ Filtering according to the size of the animal

3.1.2. Units

This tab allows you to choose the units and the display precision to use for displaying the data of the current experiment.

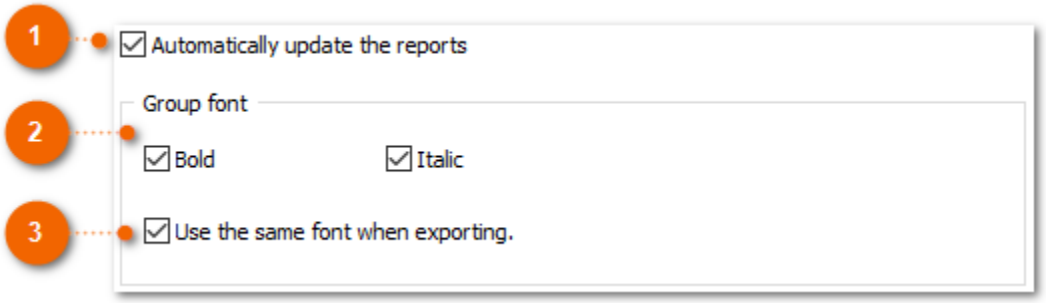


The choices made in this tab have priority over the choices made in the "Default units " tab of the Ethotrack general options dialog box .

- Choose "Default" to use the unit selected in Ethotrack's default unit options.
- Choose another value if you want to use a different unit for the current experiment.

3.1.3. Reports

This tab is used to modify the display format of groups (and calculated averages) in reports.



1 **Automatically update the reports:**

If this box is checked the reports will be automatically recalculated if needed when you made modifications in the experiment.
Otherwise you have to click the refresh button to update the report.

2 **Group display format:**

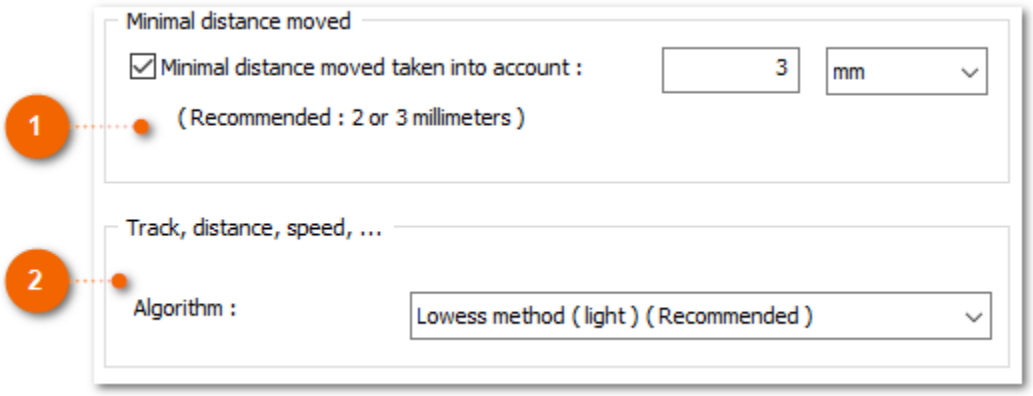
Characteristics of the character font used to display the lines representing groups of tests for which the values displayed represent the means of the values of all the tests making up the group.

3 **Group display format in an exported file:**

Check this box to have the format also applied when exporting the report to Microsoft © Excel format.

3.1.4. Smoothing

This tab is used to define the filtering options applied to the raw data of the position of the animal's center in order to remove noise and artefacts inherent to the acquisition method. For more information on these parameters, please see the " Calculation method " section.



1 **Minimumdistance taken into account**

You can specify the minimum distance between 2 successive points. All points "too close" to the previous point will be deleted. This prevents small apparent movements related to the definition of the webcam or to the noise of the system.

A value of 2 or 3 millimeters is recommended.

2 **Smoothing algorithm:**

The drop-down list lets you choose a smoothing algorithm that will be applied to the points of the trace before calculating the derived data: distance, speed, acceleration, ...

Several smoothing algorithms are available:

- No smoothing.
- 'Lowess' method (strong)
- Lowess method (lightweight) (Recommended)
- Weighted moving average
- Weighted Moving Average (Stavitsky-Golay)

The initial coordinates of the acquisition (raw data) are kept. You can return to the initial data at any time
These parameters are important because they influence all the results of the experiment. If you are not c recommended values.

3.1.4.1. Calculation method

Introduction:
The raw position data collected by Ethotrack (as by all video tracking systems) suffers from noise problems and artefacts inherent to the acquisition method. This noise and artifacts are due to several reasons, including:

- A video camera is made up of a finite number of pixels. The position of the animal is therefore of a discrete nature. Two distinct successive positions cannot be less than one pixel wide apart.
- The data calculated from the animal's position (distance travelled, speed, etc.) are calculated from the animal's center of gravity. A modification of the animal's posture can result in a displacement of the center of gravity of a few pixels, without this corresponding to a real displacement of the animal.

Even if the error between 2 images can be considered low, or even negligible, the sum of all these errors quickly becomes significant when calculating certain data, such as the total distance traveled. This is why it is necessary to "smooth" the position data before using it for calculations.

Ethotrack offers several configurable smoothing methods in the experiment options dialog . These methods are applied in order:

First step - Minimum distance taken into account:

This step consists in deleting the points considered too close to the previous point.

Consider the following example which represents the position of the animal (raw data) on frames 1 to 7:

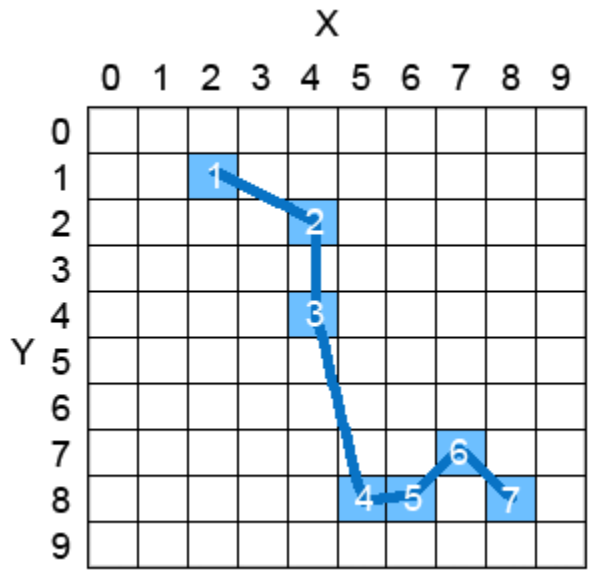


Image 1: X = 2, Y = 1
Image 2: X = 4, Y = 2 Image 3: X = 4, Y = 4
Image 4: X = 2, Y = 1 Image 5: X = 4, Y = 2 Image 6: X = 4, Y = 4Picture 7: X = 2, Y = 1

In our example, if the minimum distance taken into account is 3 pixels, points 2, 5 and 6 will be "deleted" because they are deemed too close to the previous point. The trace obtained will be as follows:

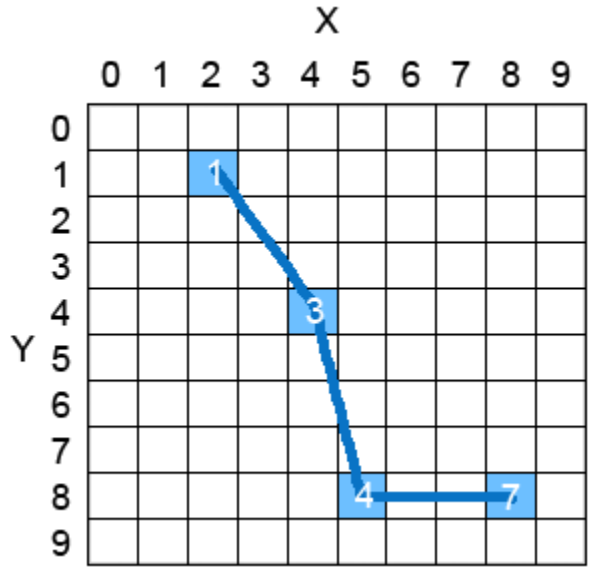


Image 1 and 2: X = 2, Y = 1

Image 3: X = 4, Y = 4 Image 4, 5 and 6: X = 2, Y = 1

Image 7: X = 2, Y = 1

This smoothing step has priority and influences **all the results of the experiment**:

- Immobility of the animal.
- Position within an area.
- Distance traveled, speed.
- etc

Step Two - Smoothing Algorithm:

For this step, the animal's position data (hitherto in pixels) is first converted to actual distances (in meters) from the upper left corner of the image, before applying a smoothing algorithm .

Several algorithms are available:

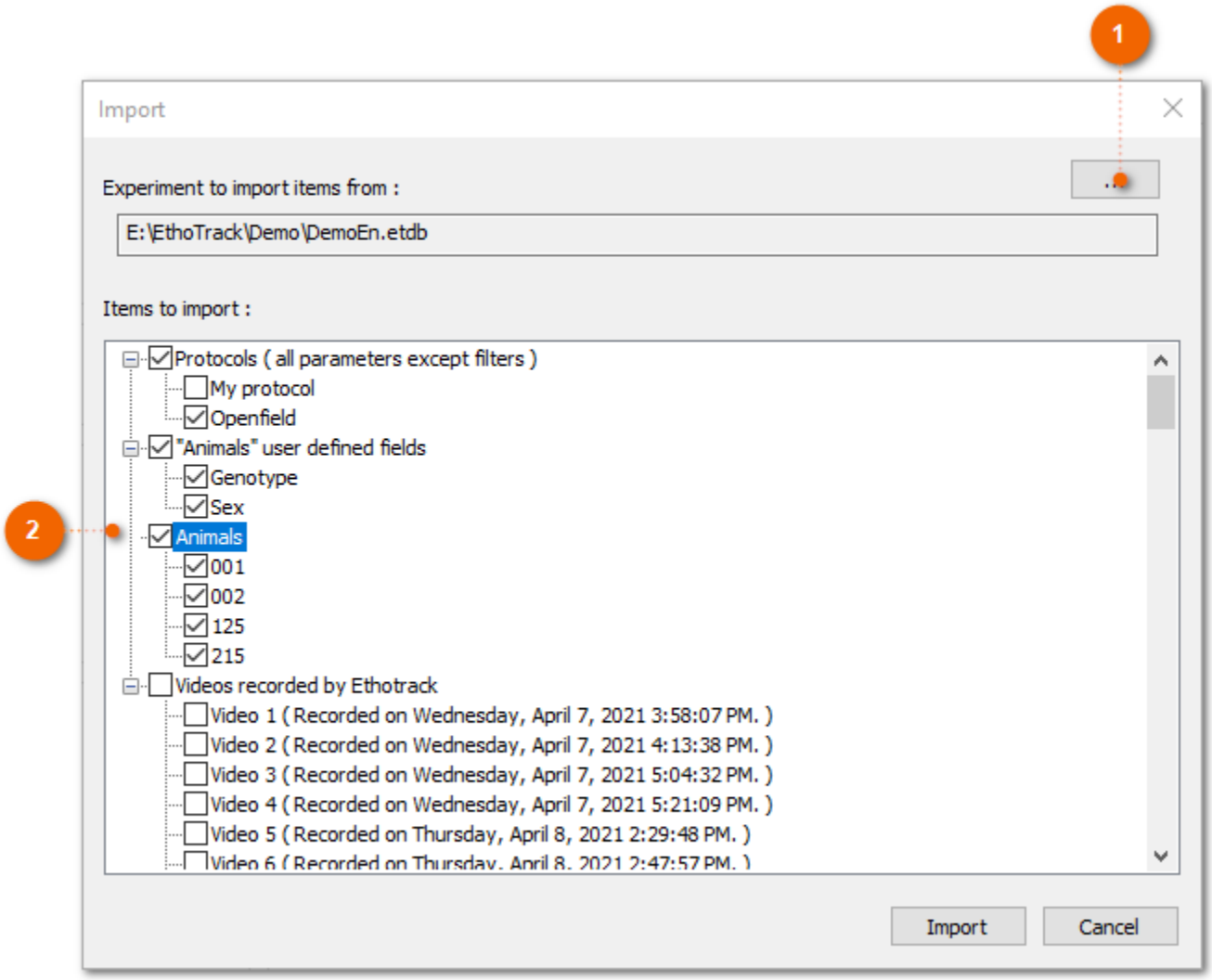
- No smoothing.
- "Lowess" (strong) method.
- "Lowess" method (light). (*recommended algorithm)*
- Weighted moving average.
- Weighted Moving Average (Stavisky-Golay)

This smoothing step influences **all the calculated physical quantities**:

- Distance traveled.
- Speed.
- etc

3.2. Import

This dialog allows you to import some elements (protocols, user fields, animals) from an existing experiment into the current experiment :



1 **Choice of the experiment containing the elements to import :**

Click this button to select the experiment containing the items to import

2 **Items to import :**

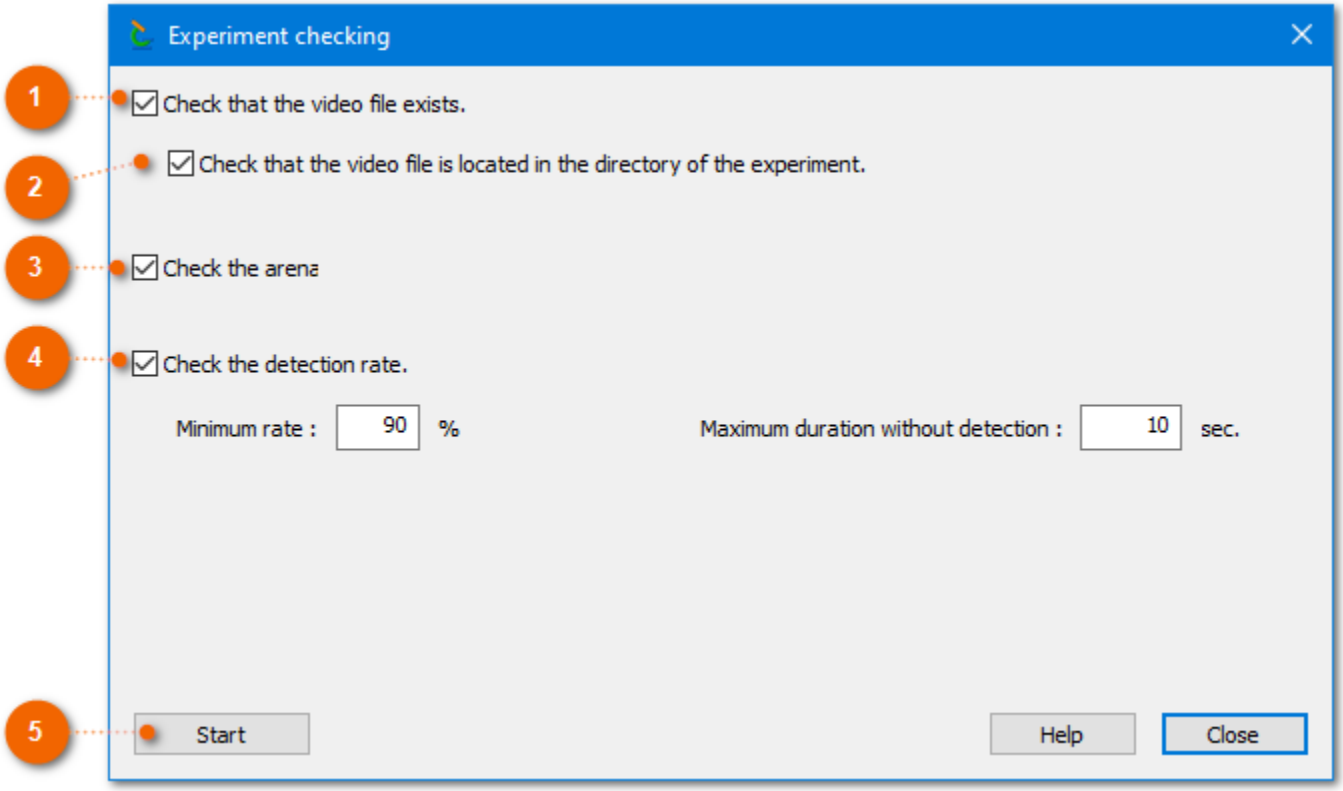
Check the boxes of the elements you want to import into the current experiment

To open this dialog box:

Click Import in the "Experiment" tab of the command ribbon.

3.3. Experiment check

This dialog allows you to check the consistency of the experiment:



1 **Check that the video file exists**

If this box is checked, an error message is displayed if the video file no longer exists on the hard disk or is not accessible.

2 **Check that the video file is located in the experiment directory**

It is advisable to place all the files used by Ethotrack in a sub-folder of the experiment folder.

3 **Check the arena**

If this box is checked, Ethotrack verifies:

1. that the test arena matches the animal's default arena. Indeed, in order to limit the risk of errors, i is advisable, when the experiment involves several arenas, to always place the animals in the same arena, even if it means leaving an empty place if the animal is excluded during the experiment.
2. that the arena of the video is not used by several tests.

4 **Check detection rate**

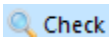
Allows you to check that the detection of the animal is correct. That is to say:

1. that the detection rate is greater than a certain value.
2. that the maximum duration without detecting the animal is less than a certain value.

5 **Start**

Click this button to start the check.

To open this dialog box:

Click 

in the "Experiment" tab of the command ribbon.

4. Protocol

Definition:

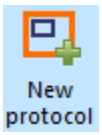
A protocol contains all the information that characterizes a set of tests:

- the acquisition parameters (video source, image format, recording frequency, etc.).
- The definition of the main arena and zones of interest.
- The definition of secondary arenas.
- The conditions for starting and stopping the analysis.
- User fields.
- Behaviors.
- Reports and filters.

An experiment must contain at least one protocol and can contain several.

Add a new protocol:

To add a protocol:

- Click the 

command ribbon button.
- Click  in the "Experiment" view.
- Click  in the toolbar of the "Workspace" panel.
- Use the contextual menu: ***New*** ***Protocol*** of the "Workspace" panel

Modify an existing protocol:

To edit a protocol:

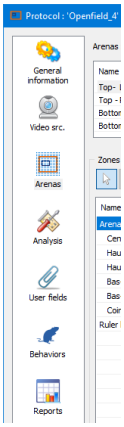
- Double click on the protocol name in the "Workspace" panel.
- Select the protocol in the panel: "Workspace", then use the contextual menu: ***Modify*** .

It is not recommended to modify a protocol when it is used in tests that have already been analyzed. Thi
results analyzed before and after the changes.

For example: if you modify the main arena or the rule you should, normally, redo the analysis of all the t

If you have changed a critical parameter, an alert message will be displayed when saving. You can ignore
negligible impact on the results. Otherwise it is preferable to cancel the modifications or redo the analy

The "Protocol" dialog box:

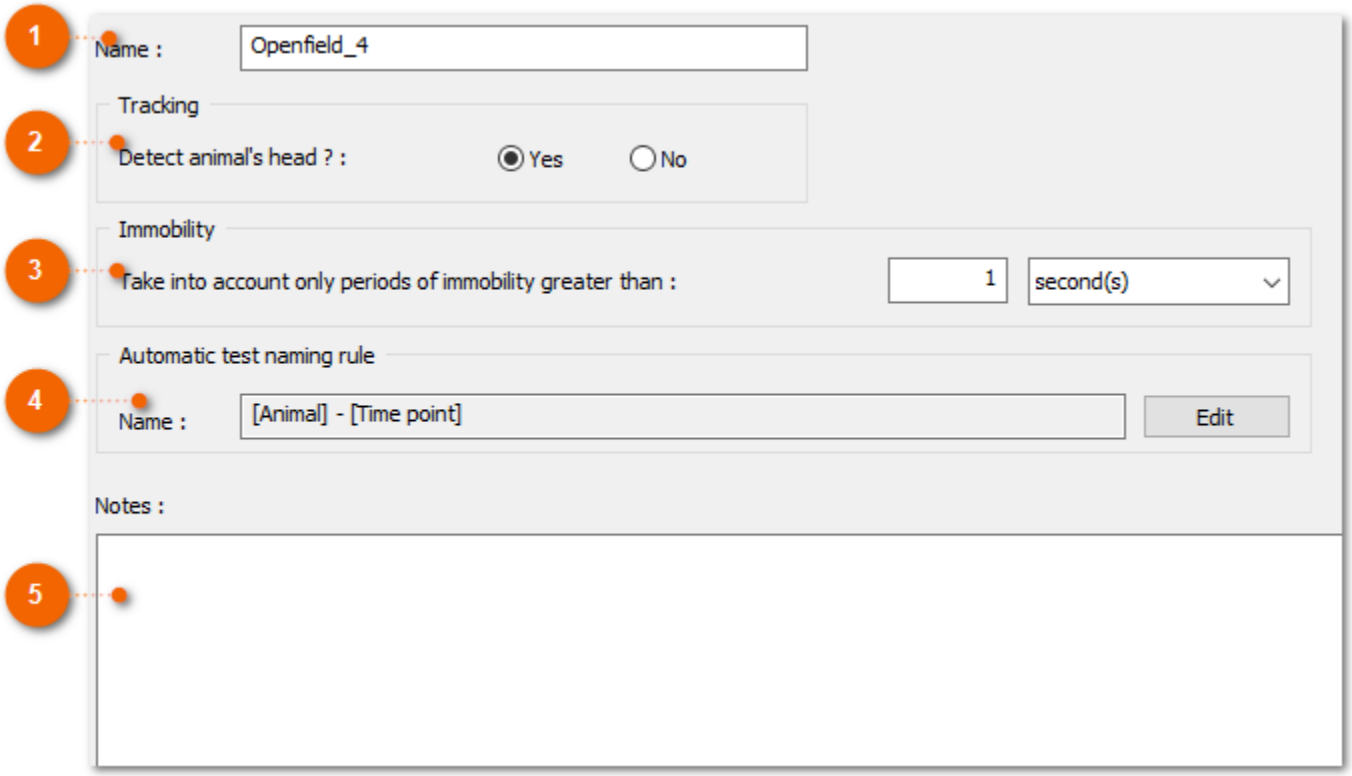


This dialog has 7 tabs:

- General information : The general parameters of the protocol.
- Video Source : Capture Settings
- Arenas : the definition of the main arena, secondary arenas and zones of interest.
- Analysis : the conditions for starting and stopping the analysis.
- User fields : user fields management.
- Behaviors : behavior management.
- Reports : the definition of reports and filters.

4.1. General information

This tab is used to define the general parameters of the protocol.



1 **Name :**

The name of the protocol

2 **Tracking: Detectthe animal's head :**

By default Ethotrack detects the position of the animal's center of gravity. All measurements of distances, speeds, ... are calculated from this position.

Ethotrack can also detect the position of the animal's head and use it as a criterion for entering or leaving an area.

If you want to use the position of the animal's head to detect the entry or exit of an area select the "Yes" option, otherwise select the "No" option to reduce the processing time during the 'analysis.

 Warning: if you modify this option and choose to detect the animal's head when certain tests have already been analyzed, you will have to redo the analysis of these tests.

3 **Immobility :**

This parameter allows you to specify the minimum time during which the animal must remain motionless for the period to be counted as a period of immobility.

4 **Test naming rule :**

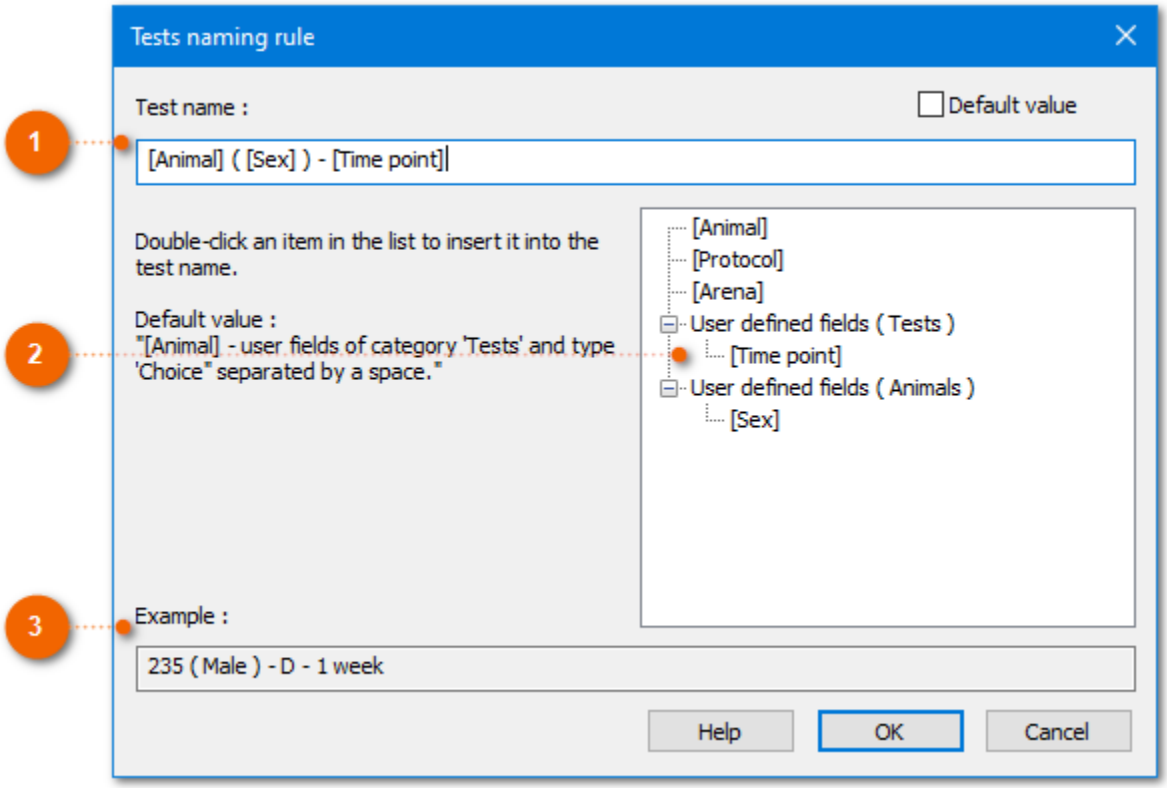
This parameter is used to customize the name of the automatically generated tests. Click on the "Edit" button to open the " Test naming rule " dialog box

5 **Notes :**

You can use this area to record comments or notes.

4.1.1. "Test naming rule" dialog box

This dialog box allows you to customize the name of the automatically generated tests.



Test name :

Input area used to customize the name of the tests. Each keyword will be replaced by the corresponding value.

Keywords :

The list of keywords that can be used to generate the test name. To insert a keyword in the name of the test, all you have to do is place the cursor at the desired location in the input area, then double-click on the chosen keyword.

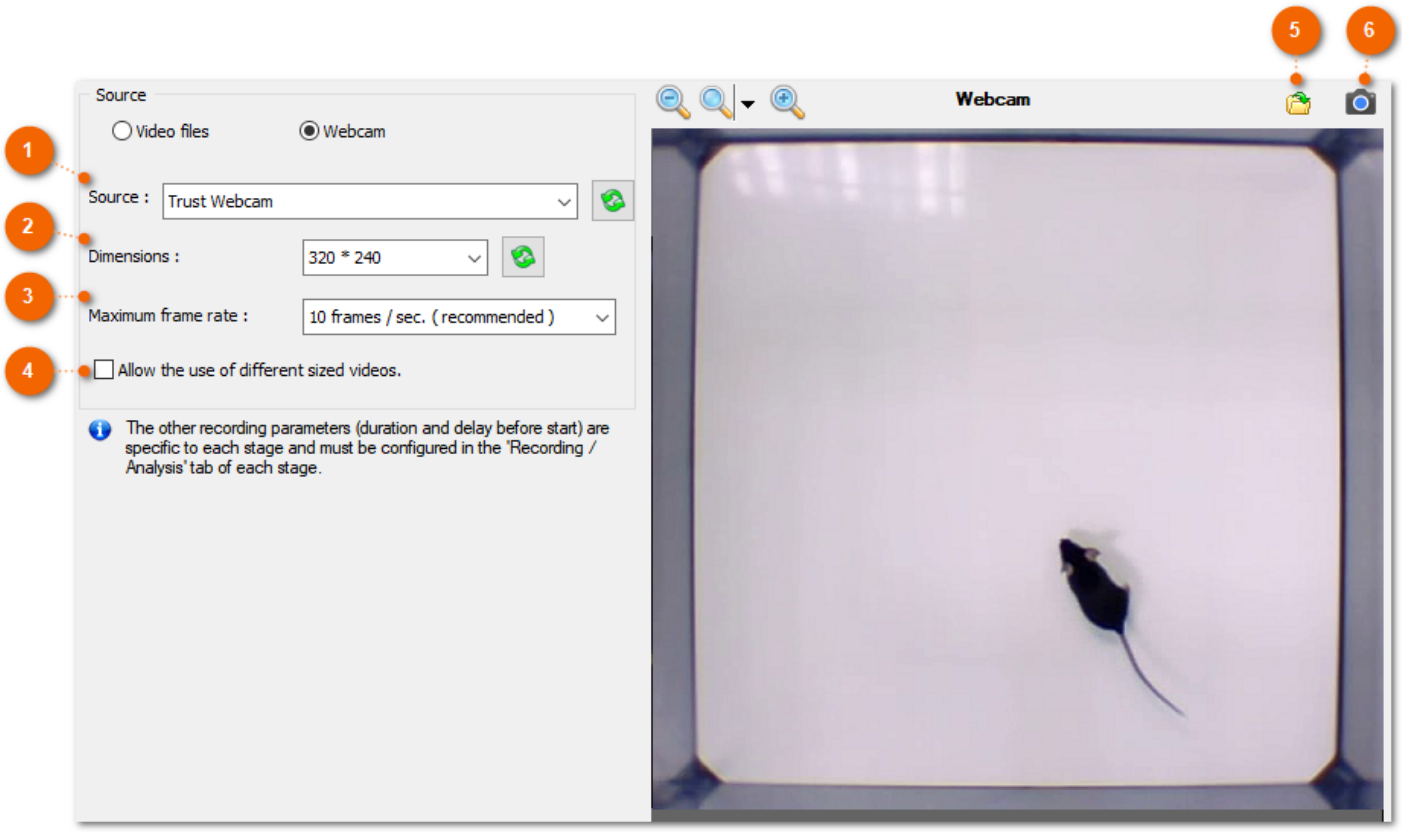
Example :

An example of a name that can be generated.

4.2. Video source

This tab is used to define the source of the videos used by the tests.
You can choose a webcam to record videos with Ethotrack or use video files present on your computer.

webcam:



1 **Source :**

The drop-down list allows you to choose the camera that will be used to record the videos.

This list displays the cameras connected to the computer, but also those known to Ethotrack, even if they are not physically connected to the computer.

Click  to refresh the list of available cameras.

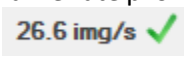
2 **Dimensions :**

This drop-down list allows you to choose the dimensions of the image. This list depends on the selected camera.

3 **Number of images / sec. max :**

This drop-down list allows you to choose the maximum recording frequency (ie the number of frames per second) of the video. Actual video recording rate may be lower as it depends on many parameters:

- The characteristics of the webcam : if the camera does not support the desired frequency, it will use the nearest supported value.
- The recording conditions (especially brightness) : if the brightness is too low, the camera will automatically reduce the frame rate to increase the exposure time.
- The characteristics of the computer used.

The actual frame rate provided by the camera is shown at the top right of the image before you start recording : 

A pictogram also indicates whether this value is correct or too low compared to the desired value :

- : the frame rate is less than half the desired value.
- : the frame rate is between half and 3/4 of the desired value.
- : the frame rate is greater than 3/4 of the desired value.

A frame rate of 10 images per second is, in general, sufficient to have good precision and makes it possible to limit the size of the video file.

4 **Allow the use of videos of different sizes :**

Normally, it is preferable that all the videos of the same protocol are recorded under the same conditions with identical characteristics. By default, Ethotrack does not allow to associate with a test, a video whose image does not have the same dimension as that of the protocol. If some videos were recorded by mistake with a different frame size and you still want to use them check this box to remove this limitation.

5 **Import an image :**

Click this button to create a " saved image " from a file.

For more details, please consult the " Saved image " section.

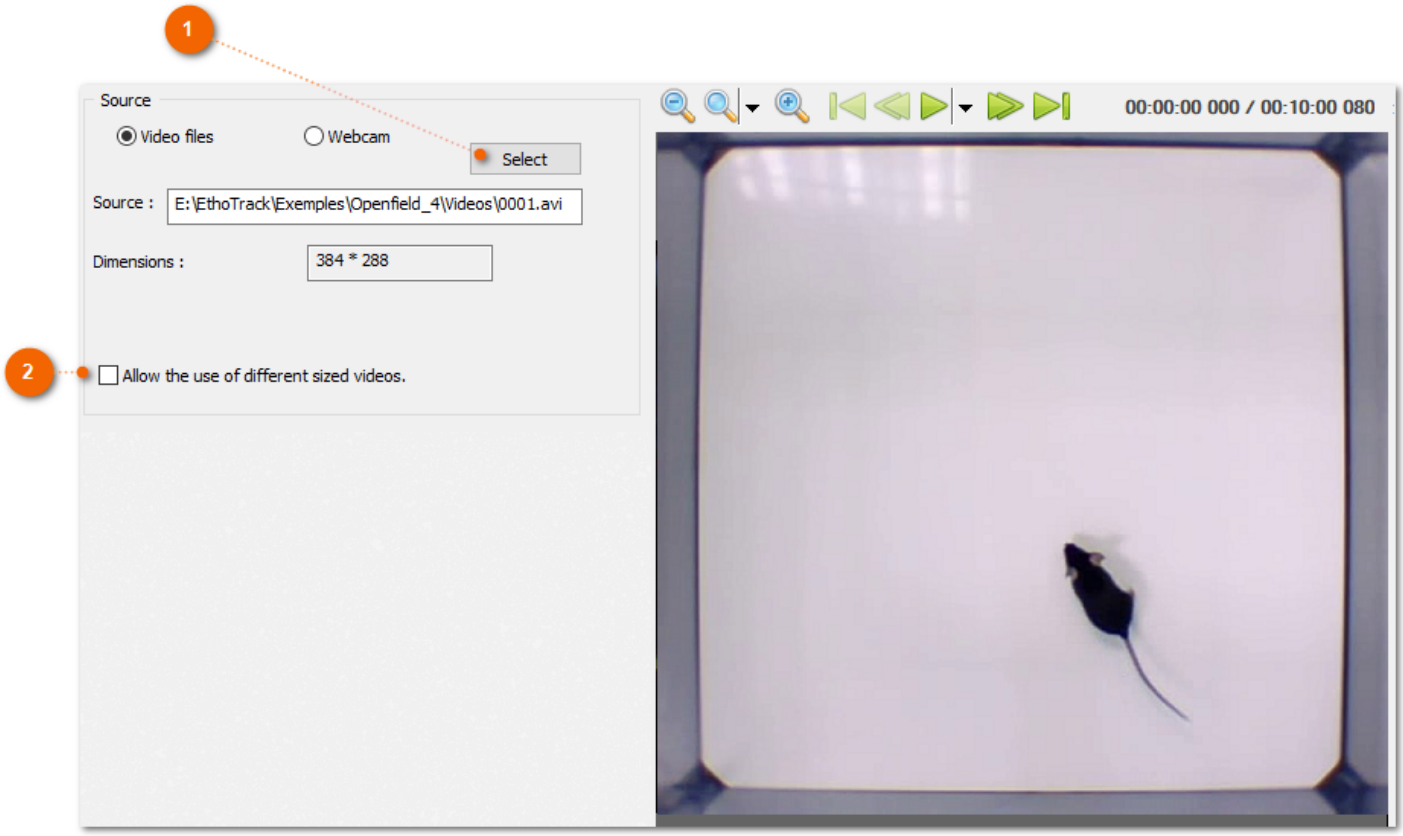
6 **Saved image :**

Click this button to record an image from the webcam or to view the image already recorded. This allows the protocol to be changed later, even if the webcam is no longer connected to the computer.

The larger the image size and the larger the recording frequency, the larger the video file size will be. Normally a recording frequency of 10 frames per second provides sufficient precision while limiting the size of the video file.

Even if you choose a webcam as the video source for the protocol, it is still possible to use a file recorded by another application as the video source for a test.

Video files:



1 **Select :**

Click this button to select a video file or an image file from your computer.

2 **Allow the use of videos of different sizes :**

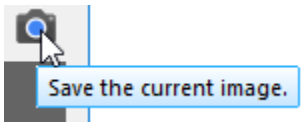
Normally, it is preferable that all the videos of the same protocol are recorded under the same conditions with identical characteristics. By default, Ethotrack does not allow to associate with a test, a video whose image does not have the same dimension as that of the protocol. If some videos were recorded by mistake with a different frame size and you still want to use them check this box to remove this limitation.

4.2.1. Saved image

When you use a camera as the video source for the experiment, you may need to create or modify the arena or the areas of interest without being able to view the image directly from the chosen webcam (for example if you are using a computer that is not the one that will be used to make the acquisitions). For this you can use a "saved image" to replace the camera image and allow you to draw your arena and zones of interest. The saved image can also be modified during the experiment, for example: to create a zone of interest around a new object if it was not present when the protocol was created.

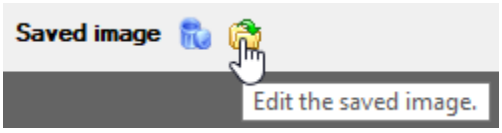
To create a saved image from the webcam :

Click on the corresponding button in the 'Video source' tab of the Protocol:



To create a saved image from an existing test or a file :

Click on the corresponding button in the 'Video source' tab of the Protocol to open the "saved image" dialog box :

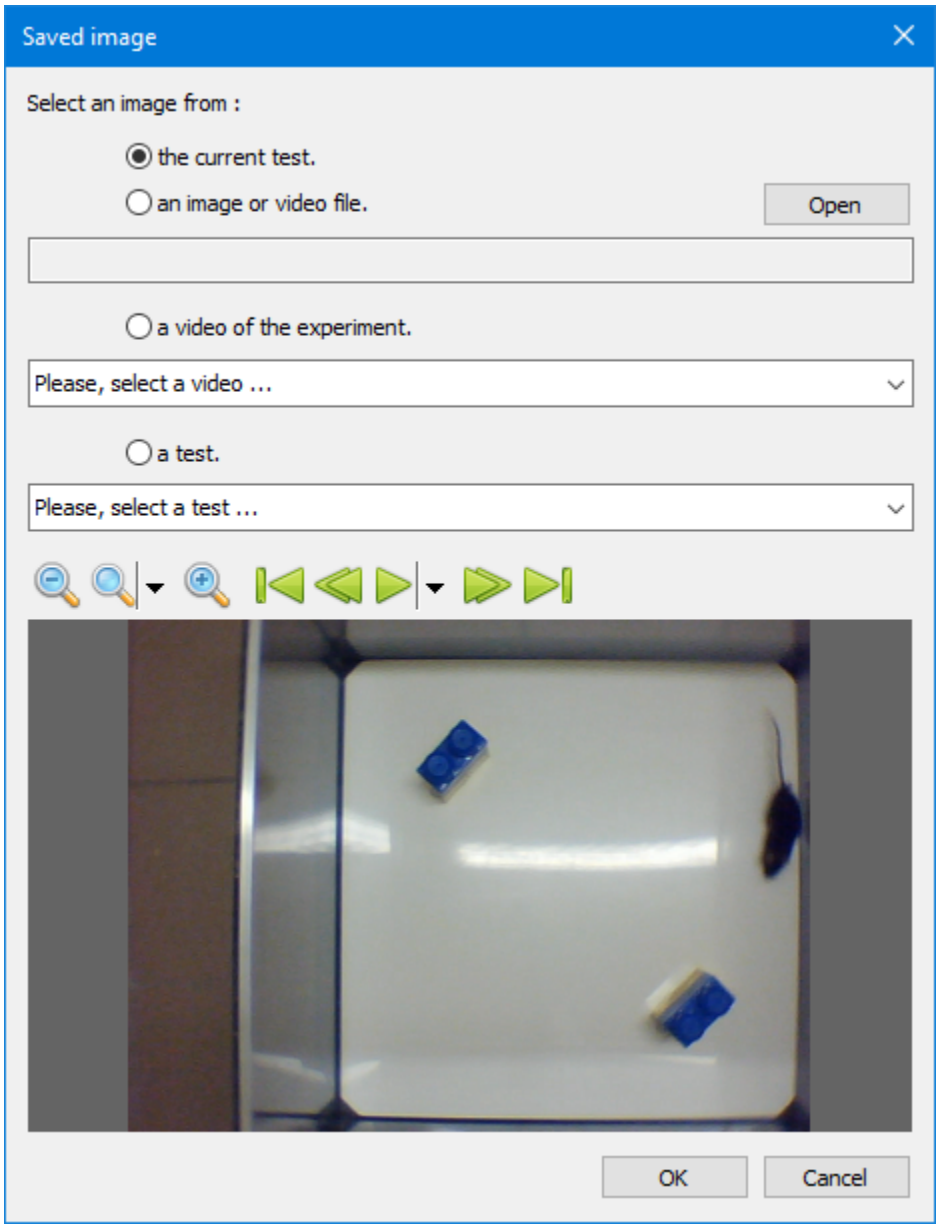


"Saved image" dialog box :

You can select an image from:

- the current test video.
- an image or video file on your computer.
- a video already recorded in the experiment.
- the video of a test already recorded.

If the image is from a video, you can use the navigation bar above the video to select the desired image before clicking the "Ok" button.

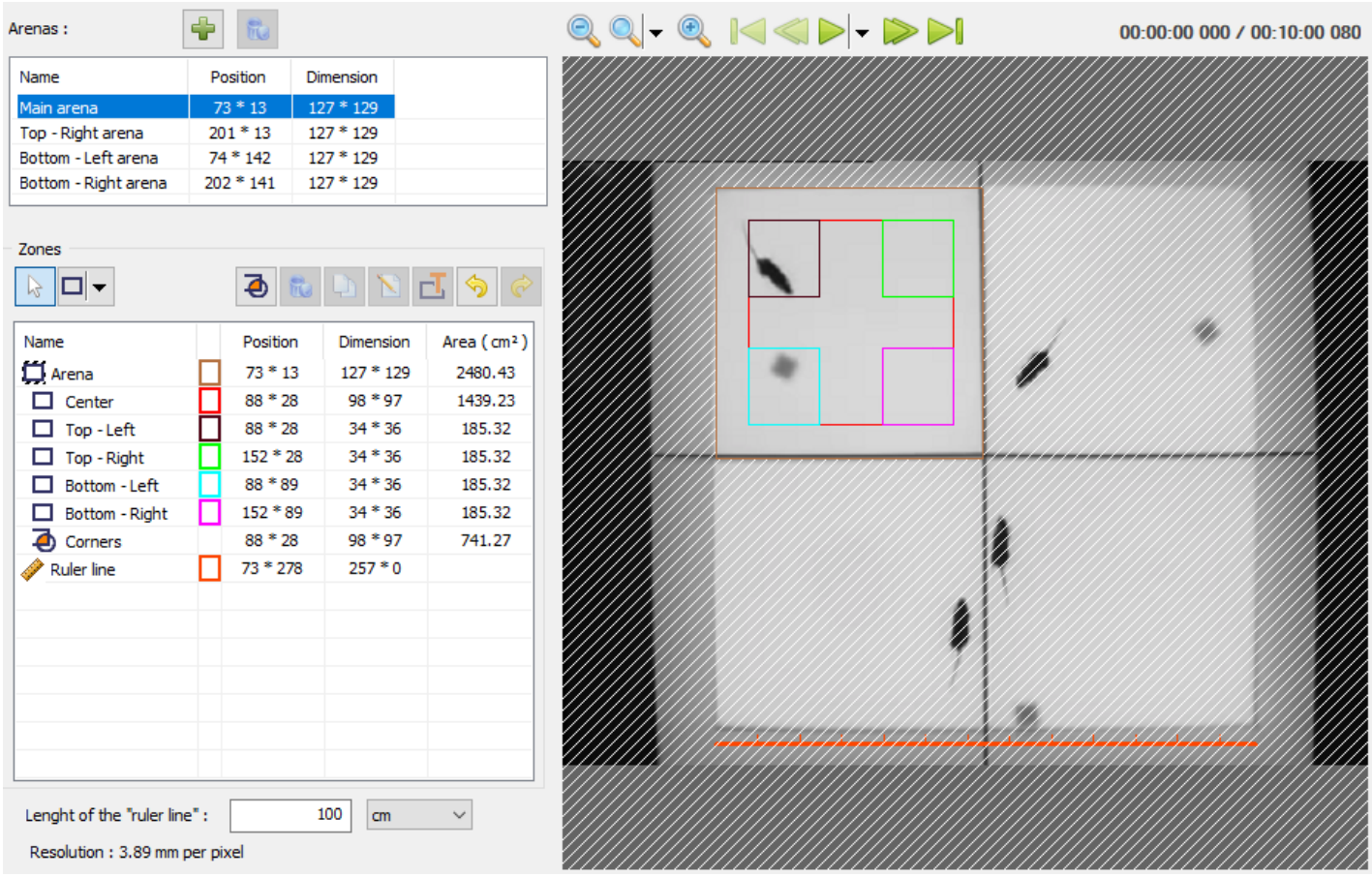


The format of the selected image must be compatible with that of the video source of the protocol. That is to say that the ratio width / height must be identical. If the dimensions of the chosen image are different from those of the video source, the image will be resized.

4.3. Arenas / Zones

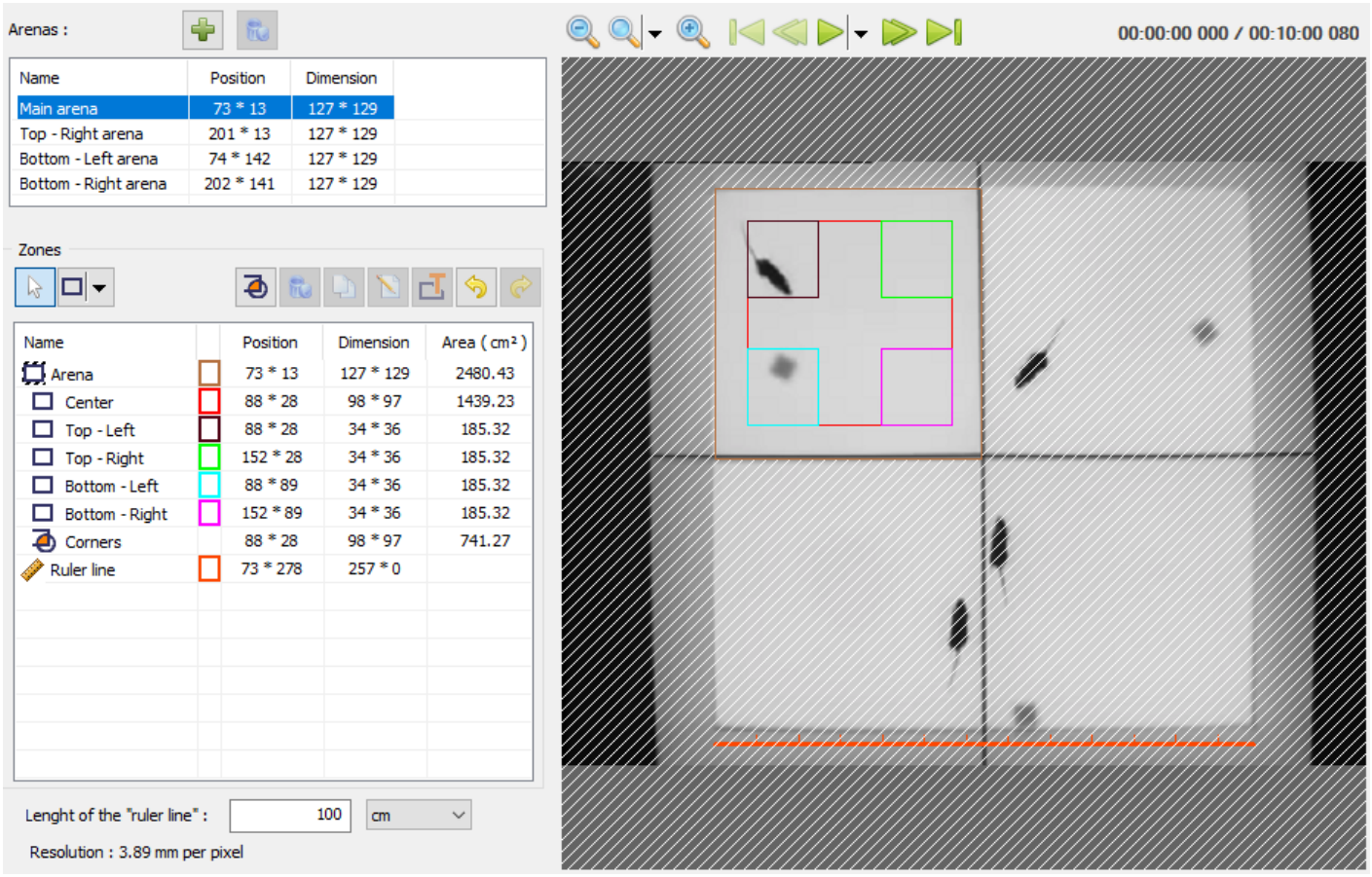
This tab is used to define :

- The **main arena**, i.e. the part of the image in wich the animal evolves and wich is used for analysis.
- The **ruler line** which is used to define the scale of the image.
- **Zones of interest** which define specific parts of the image in order to study animal's behavior.
- **Secondary arenas** if you record several animals on the same video.
- **Position adjustment marks** to automatically correct arena position errors that may occurs if video recording is done over several days or even weeks.



4.3.1. Main arena

This tab is used to define the main arena as well as the zones of interest of the image.



The arena:

The arena is the part of the image in wich the animal evolves and wich is used for analysis.

It could be :

- the main enclosure of an open-field if it contains a single animal.
- a part of an open-field if it is made up of several identical analysis areas allowing several animals to be recorded on a single video. To analyze the movement of an animal in another area of the open-field you can define secondary arenas.
- a maze of any shape (Y-maze, Barnes maze, Hamlet, ...).

Any areas of the image that are not included in the arena (represented by the hatched area) will not be analyzed.

To set the arena:

1. Draw a new zone of any shape or select an existing one (except a compound zone).
2. In the dialog box for editing zone parameters, check the box ☑ This zone is the main arena

- A protocol can only contain one main arena.
- If the arena is not defined, the whole image will be analyzed. This is not recommended, as it wil between 2 recordings. It will also be impossible to set secondary arenas.
- The arena must be defined before starting the analysis of the tests. Once analysis has started, th
- A compound zone cannot be the main arena.

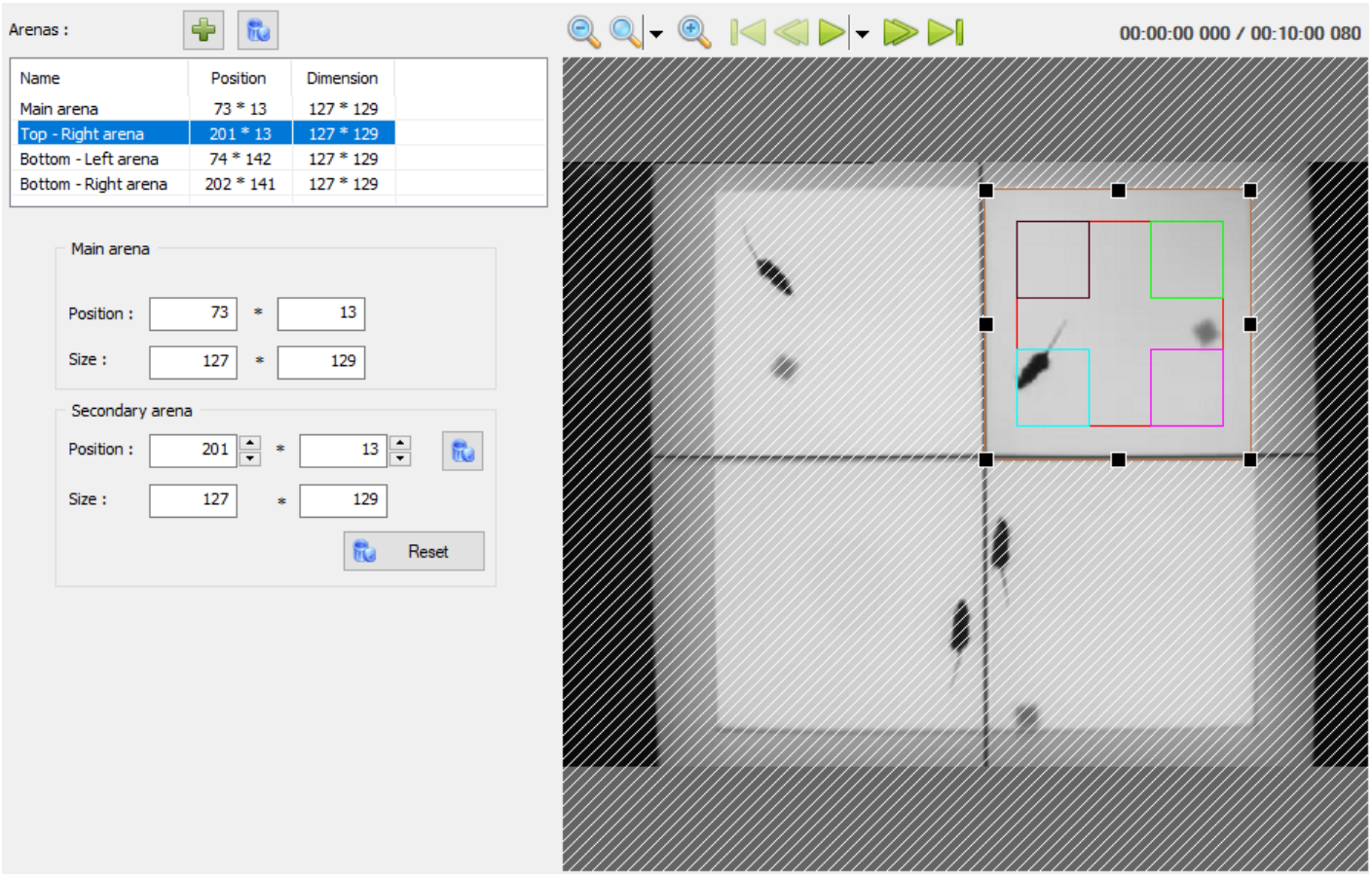
The ruler line :

The ruler line is used to define the ratio between a "virtual" distance (in number of pixels) on the image and the real distance (in millimeters, centimeters or meters) in the open-field. To do this, you must place the ruler along

an object whose dimensions are known (for example one side of the open-field) and indicate the actual length in the box: "Length of the ruler line").

4.3.2. Secondary arenas

Secondary arenas are used when multiple animals are recorded simultaneously on a single video. After creating the main arena on the area in which the first animal evolves, simply create a secondary arena for each additional animal . Each secondary arena actually corresponds to a move of the main arena. All zones defined in the main arena are also moved.



To create a secondary arena:

- Click on the button  located above the list of arenas.
- Change the name of the new arena.
- Move the arena using the mouse or the arrow keys.

 From the moment a secondary arena is created, it is no longer possible to delete the main arena, nor to modify its shape or size.

To move a secondary arena, you can:

- Use the mouse in the image part.

- Use the arrows (up, down, right, left) of the keyboard:
- Click on the arrows  in the "Secondary Arena" area

To rename a secondary arena:

- Click directly on its name in the first column of the Arenas table, then enter the new name.

4.3.3. Zones of interest

Zones of interest represent specific parts of the arena.
They can be used in reports (for example to calculate the time spent by the animal in an area) or to trigger events (for example to start the analysis when the animal leaves a zone).

There are several types of zones:

- Simple zones of rectangular, elliptical, pie or polygonal shape.
- Compound zones of union or intersection type formed by the union or intersection of several zones.
- Compound zones of choice type formed by choosing a single zone.

Move or resize an existing zone :

1. Select the zone on the image or in the table.
2. Move or resize the zone:
   - directly with the mouse in the image part.
   - using the arrow keys:
   - Arrows (up, down, right, left) to move the area.
   - [Shift key] + Arrows (up, down, right, left) to resize the zone.

Delete one or more zones:

1. Select one or more zones on the image or in the table.
2. Click the button  or press the "Delete" key

Copy one or more zones:

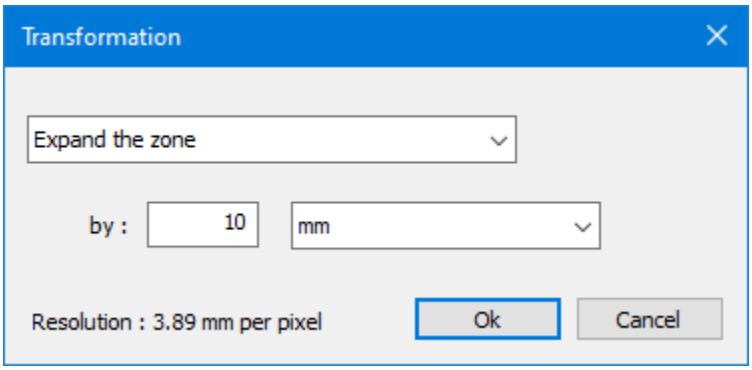
1. Select one or more zones on the image or in the table.
2. Click the button  .

Modify the parameters of a zone:

1. Double-click on a zone in the table or select a zone and click on the button  to open the zone parameters editing dialog box.

Transform (contract, expand or rotate) a single zone :

1. Select the zone on the image or in the table.
2. Click the button  to open the dialog box:



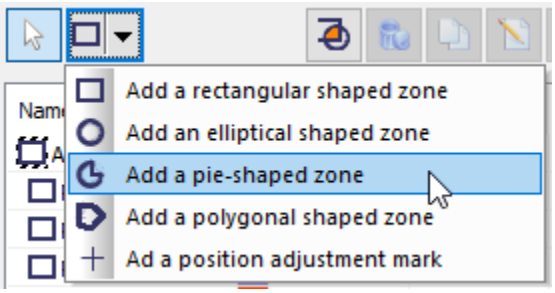
3. Choose the type of transformation to perform.

 It is possible to cancel or restore the modifications made to the zones (within the limit of the last 20 actions) by using the buttons  or the key combinations (Ctrl+Z) and (Ctrl+Y).

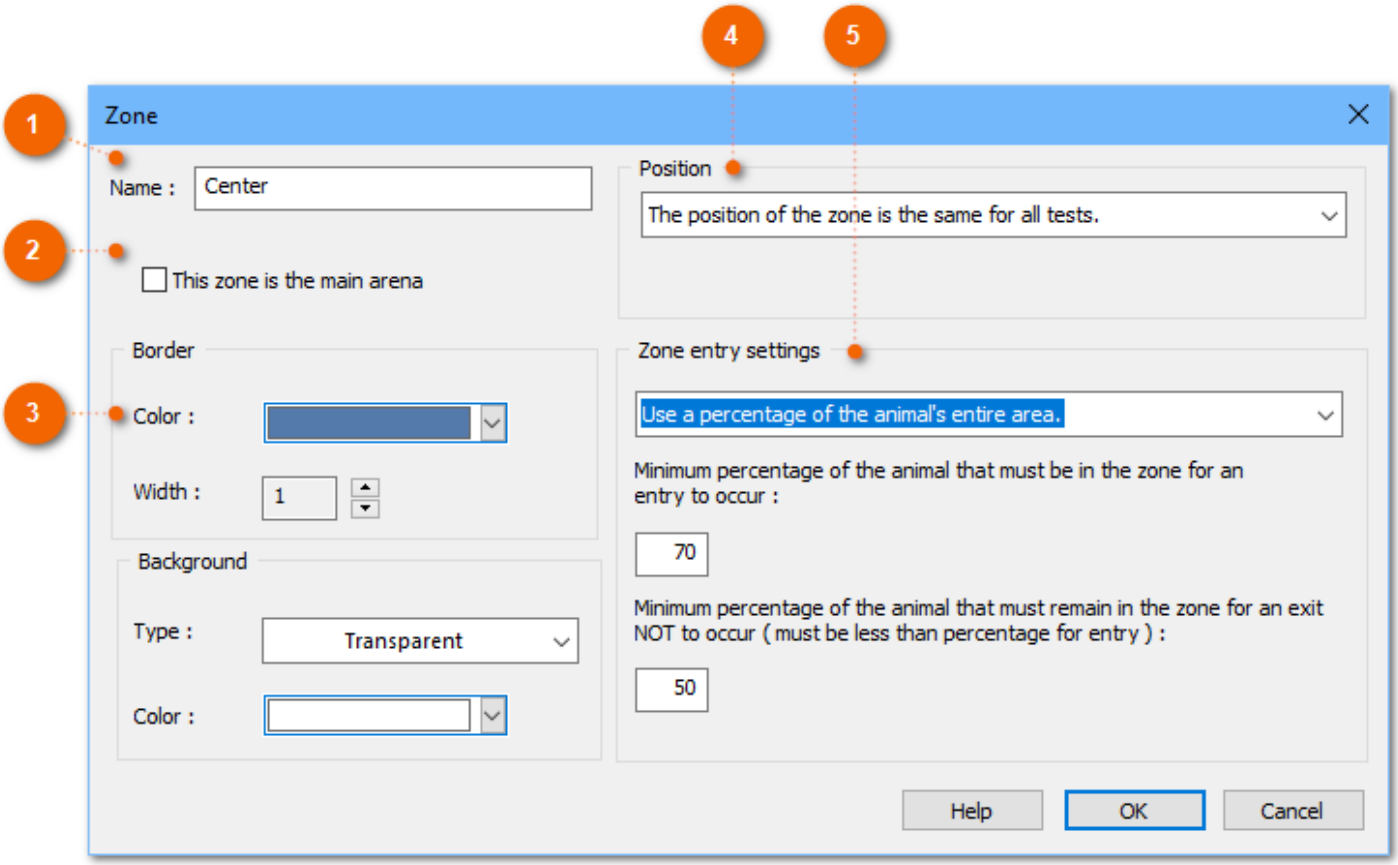
4.3.3.1. Simple zones

A simple zone is a rectangular, elliptical or polygonal shaped zone.

Create a single zone:

1. Click the arrow next to the shapes button 

to bring up the menu and select the shape of the zone to be created.
3. For a rectangle or an ellipse :
   - Click on the image of the open-field to position the first point of the zone.
   - While holding down the mouse button move the cursor to create the zone.
3. For a pie :
   - Click on the image of the open-field to position the first point of the zone.
   - While holding down the mouse button move the cursor to create the zone.
   - Click on the end of each segment and while holding down the mouse button move the points to adjust the opening angle of the sector.
4. For a polygon:
   - Each mouse click creates a point of the polygon.
   - A double-click creates the last point.
5. When the drawing of the zone is finished the dialog box for editing the parameters opens:



1 **Name :**

The name of the zone

2 **Main arena :**

Check the box if the zone is the main arena.

3 **Border / Background :**

The appearance of the zone:

Border : color and thickness of the outline of the zone.

Background : color and style of the background (For the arena, the fill pattern extends outside the area. For hidden zones the fill pattern extends to the edge of the detection zone).

4 **Position :**

The position of the zone :

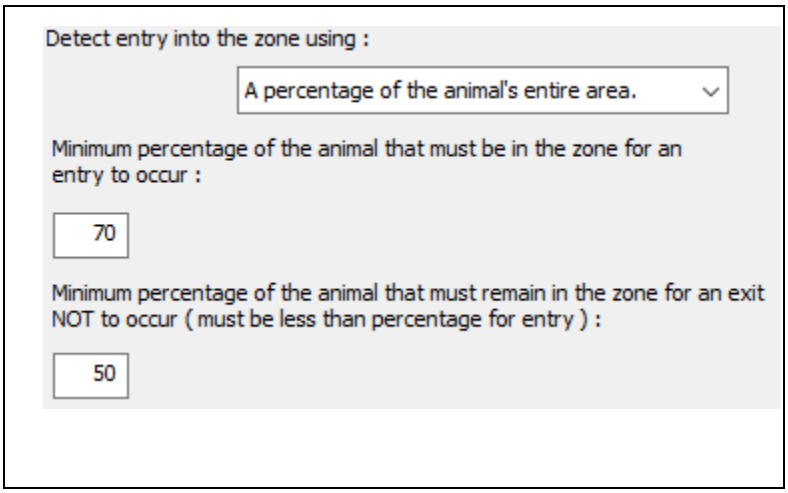
- **The position is the same for all tests.**
- **The position of the zone varies according to the tests :** the position of the zone may vary between tests. In this case the position of the zone can be adjusted for each test.
- **The position of the zone is linked with the position of another mobile zone :** the position of the zone may vary according to the position of another zone. You must choose the reference zone.

5 **Zone entry parameters:**

Allows you to configure the conditions that define the entry and exit of the zone:

- **Use the animal's center**: the animal is considered to be in the zone when its center of gravity is in

- **Use a percentage of the surface of the animal** : The entrance and the exit of the zone are determin



In the example opposite, t
it when there is less than 5

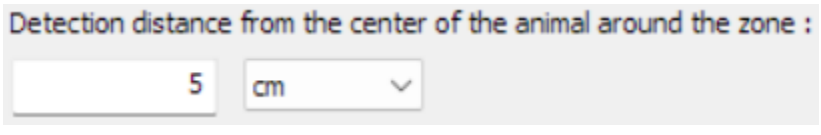
The output percentage valu

The difference between th
the zone.

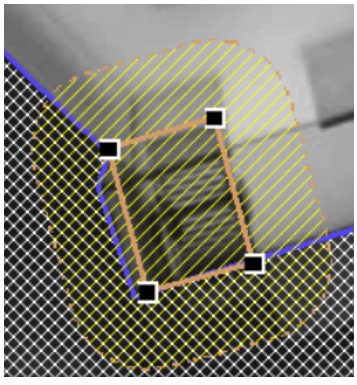
- **The position of the animal's head** : the animal is considered to be in the zone when its head is in t

To be able to use the position of the animal's head as an entry criterion in the zone, you must

- **The zone is a hidden or difficult detection zone :** A hidden or difficult detection zone is a zone whe
rung exercise wheel) .
When the animal is not detected for a period and it is in the vicinity of the zone before and after t
is considered to be in the area for the entire period. It is thus possible to count the time spent in t
At the beginning of the analysis, if the first detected position is in the vicinity of the hidden zone a
non-detection period. The same applies at the end of the analysis if the last known position is in t



In the example, the anim
before and after the peri



The detection area is delimited by a dotted line of the s

- **Exclude this zone from the arena and not detect the animal :** this part of the image will be masked
another animal.

Modify the parametersof a zone :

Double-click on a zone in the table or select a zone and click on the button  to open the zone parameters editing dialog box.

Move a point of a polygonal zone :

Click on the point to move.

While holding down the mouse button drag the point to its new position.

Delete a point from a polygonal zone :

Click on the point to be deleted while holding down the "CTRL" key.

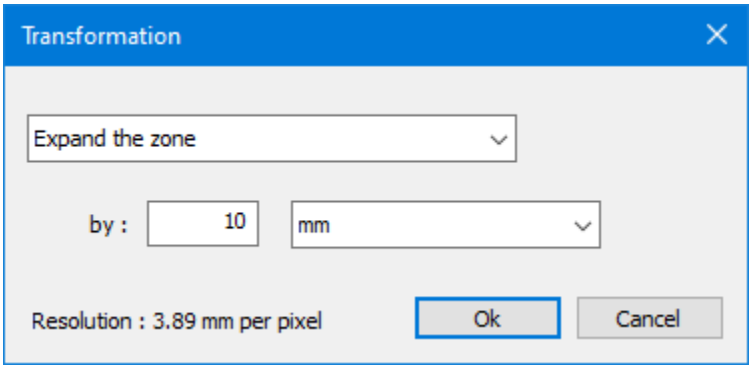
Add a point to a polygonal zone :

Click on a line connecting 2 points while holding down the "CTRL" key.

Transform (contract, expand or rotate) a zone :

Select the zone on the image or in the table.

Click the button  to open the dialog box:



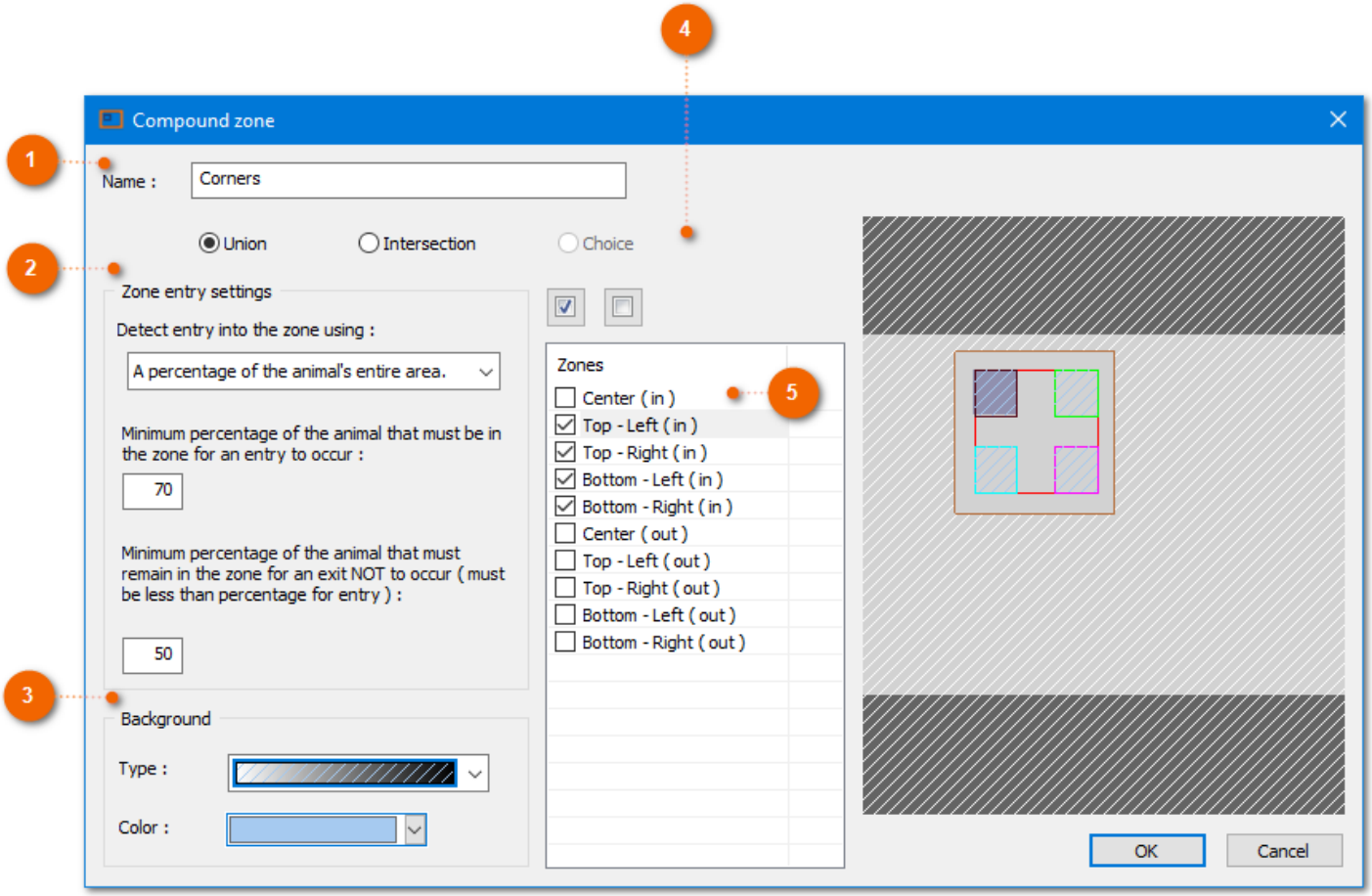
Choose the type of transformation to perform.

4.3.3.2. Compound zones of "union" or "intersection" type

A compound zone of "union" or "intersection" type is a zone formed by the union or intersection of several simple or compound zones.

Create a compound zone of the "union" or "intersection" type:

Click on the button  to open the editing window of a compound zone:
Choose the "Union" or "Intersection" type



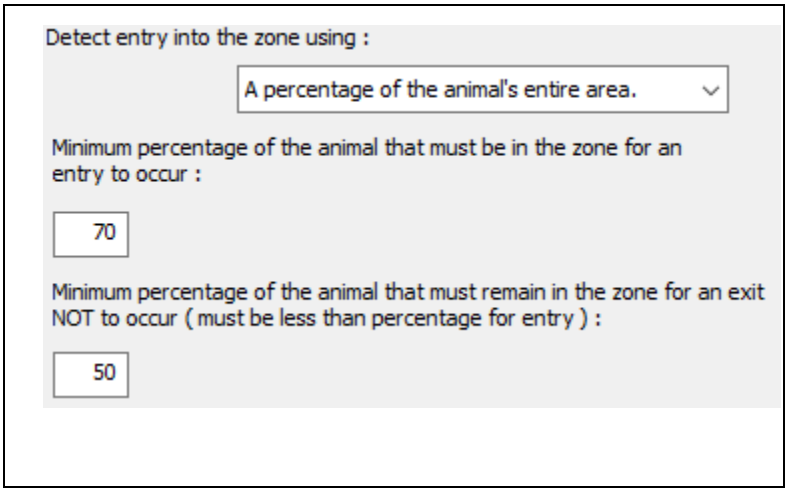
Name:

The name of the zone

Zone entry settings :

Allows you to configure the conditions that define the entry and exit of the zone:

- **The animal's center** : the animal is considered to be in the zone when its center of gravity is in the
- **A percentage of the surface of the animal** : The entrance and the exit of the zone are determined a



In the example opposite, the animal is it when there is less than 50% of its su

The output percentage value must be

The difference between the 2 values (the zone.

- **The position of the animal's head** : the animal is considered to be in the zone when its head is in th

To be able to use the position of the animal's head as an entry criterion in the zone, you must valida

3 **Background :**

Color and style of the background.

4 **Union / Intersection :**

The Boolean operation defining the combination of zones.

5 **List of zones :**

Click the checkboxes to select the zones forming the combination. For each zone, it is possible to choose either the inside or the outside of the zone.

4.3.3.3. Compound zones of "choice" type

A compound zone of the choice type is a virtual zone, associated with a stage or a user field, and which corresponds to the single choice of an element from a list of zones. For each test, the value of the user field determines the corresponding zone.

For each use (for example: to view the presence of the animal in the zone, in a report, as a trigger condition, etc.) the composite zone is replaced by the zone determined by the choice of the stage or the user field.

Use :

A compound field of choice type can be used, for example, for an object recognition test (NOR):

In an object recognition test, a rodent is habituated to being in contact with two objects (object 1 and object 2). We then replace object 2 with an object of a different shape (object 3).

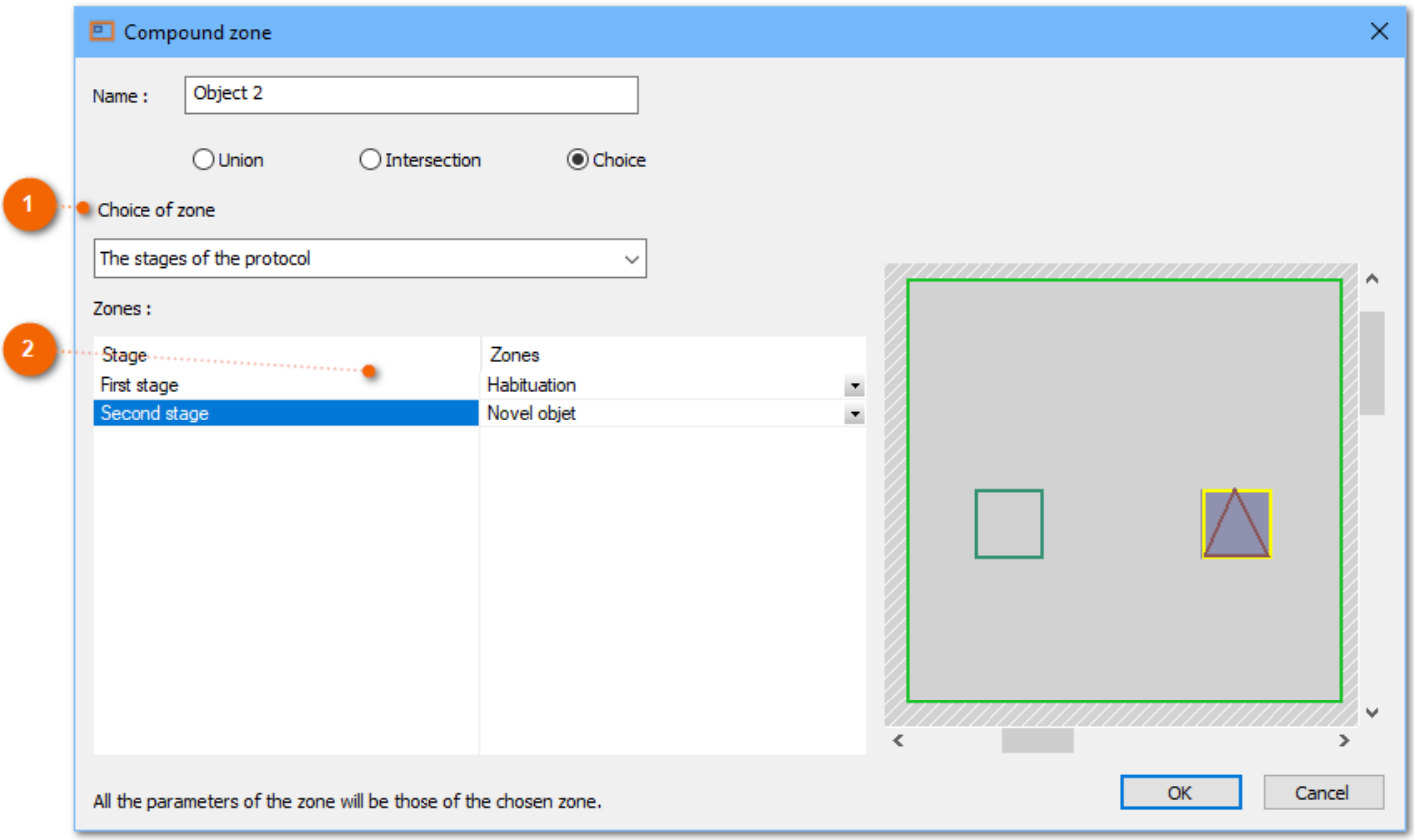
It is possible to create a zone of the choice type (eg: "Object 2 or 3") formed by "Object 2" and "Object 3" and to use this zone to visualize the presence of the animal in the zone on the "Current test" view or in a report. Depending on the test, Ethotrack will automatically select the corresponding zone ("Object 2" or "Object 3").

Create a compound zone of choice type:

1. Click on the button  to open the editing window of a compound zone.
2. Choose the "Choice" type

To select the zone according to the stages of the protocol:

3. Select "The stages of the protocol" from the list.
4. Then, for each stage select the correspondinf zone.



1 **Choice of zone :**

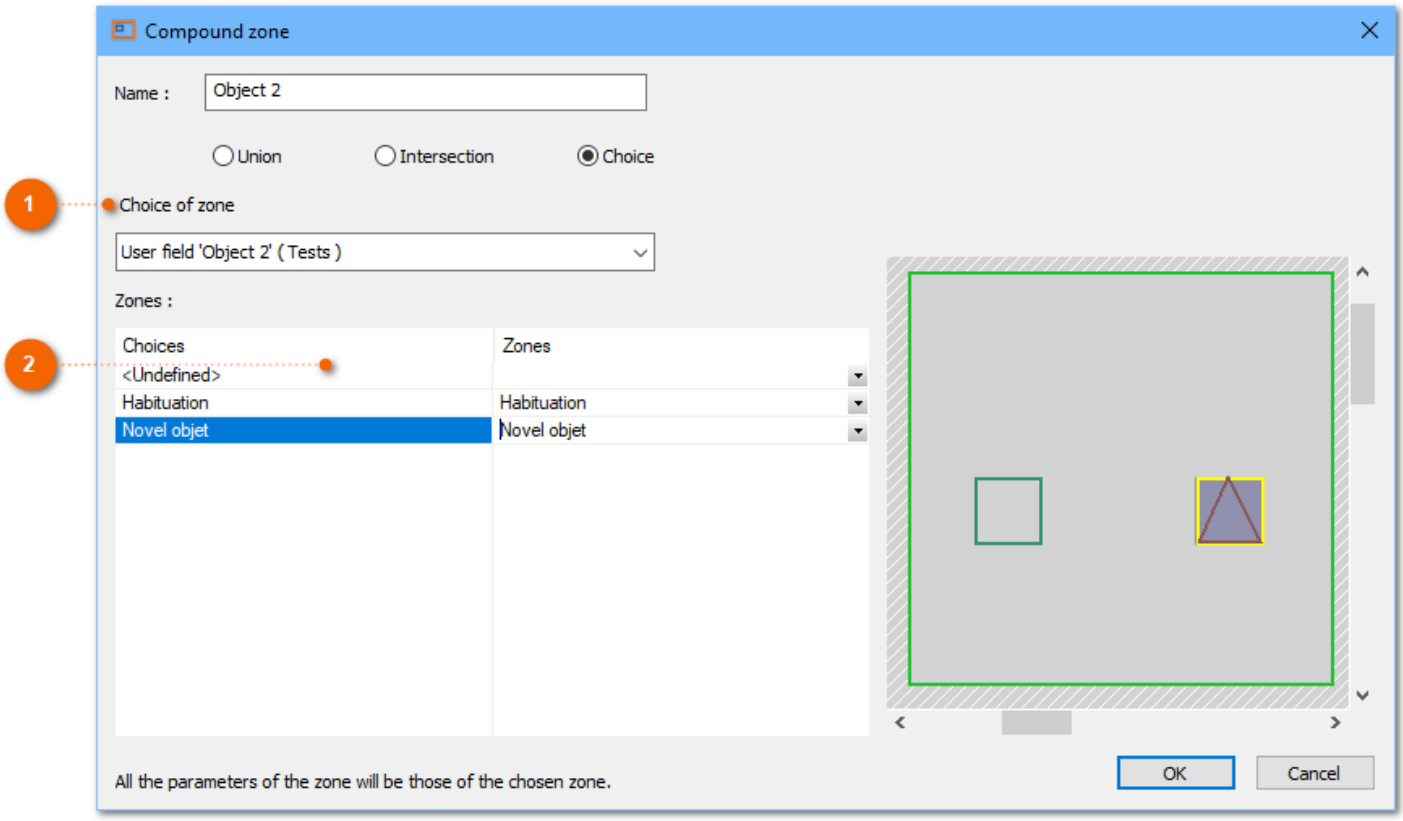
The choice of the associated item that will define the selected zone.

2 **Zones :**

This table is used to define the correspondences between the stages and the zones. All you hac=ve to do for each stage is to select the corresponding zone.

To select the zone according to a user field that already exists :

3. Select the user field from the list.
4. Then for each choice of the use field select the corresponding zone.



1 **Choice of zone :**

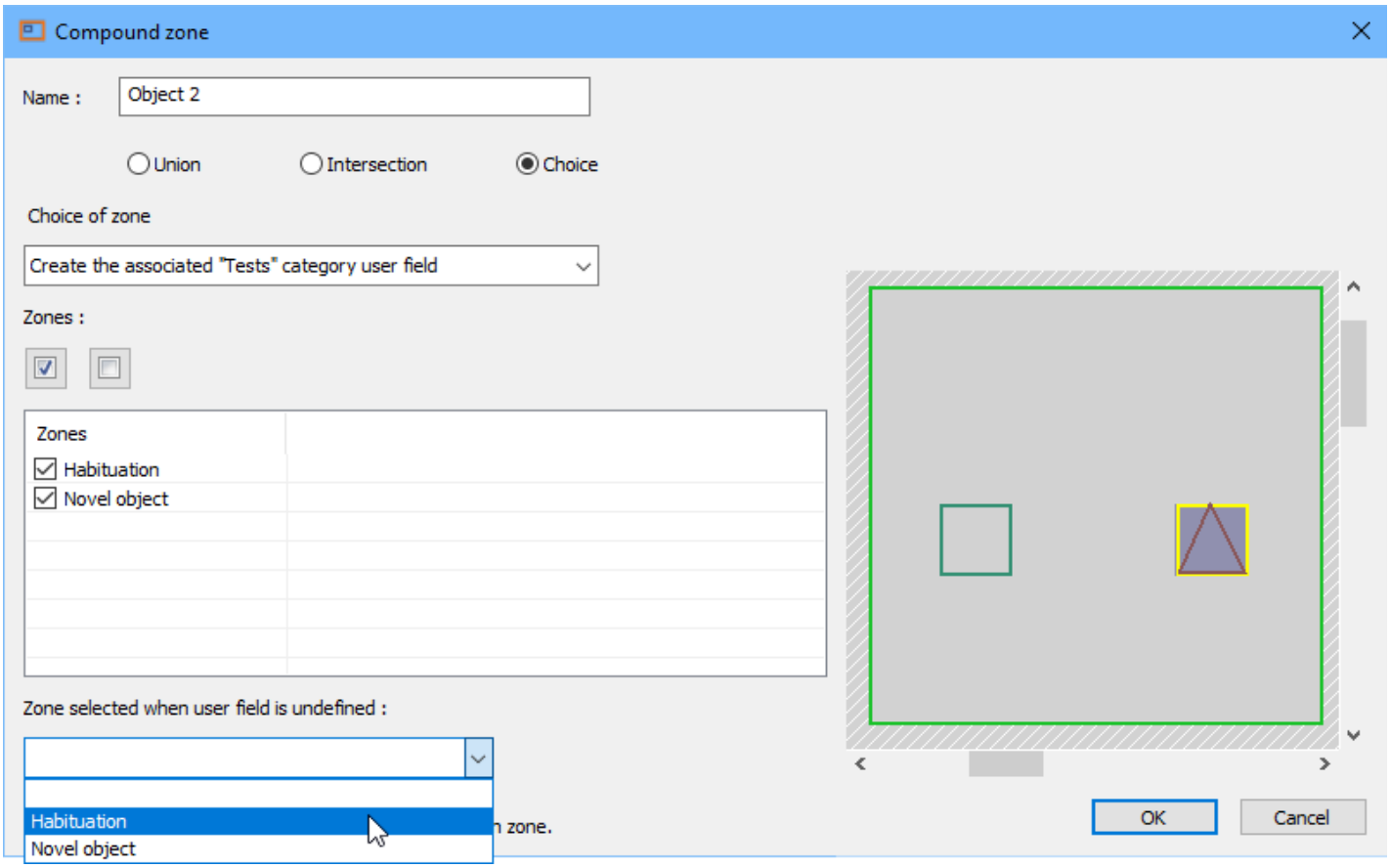
The choice of the associated item that will define the selected zone.

2 **Zones :**

This table is used to define the correspondance between the values of the use field and the zones. All you have to do for each value of the user field is to select the corresponding zone.

To select a user field that does not exist :

3. Select "Create the associated "Tests" (or Animals") category user field.
4. Check the box of the different zones that form the choice.
5. Select the zone corresponding to an undefined user field.



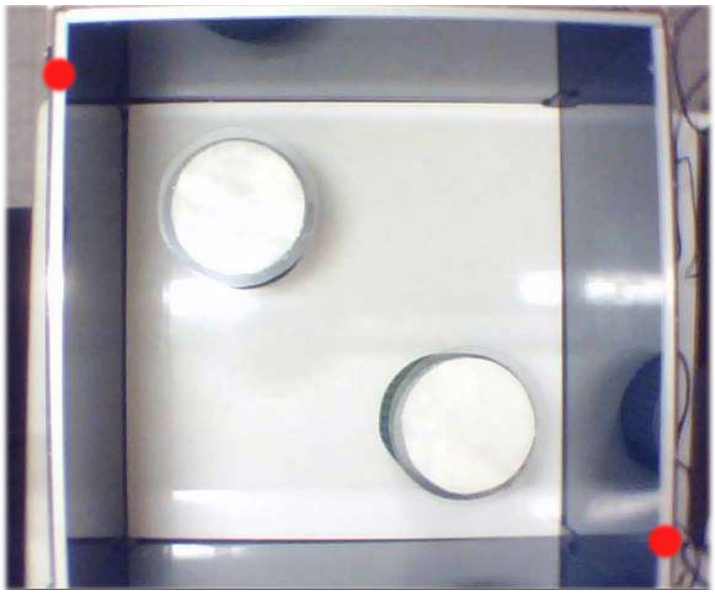
4.3.4. Position adjustment marks

When the experiment lasts several days, or even several weeks, it may happen that the camera or the workspace are accidentally moved. In this case, when recording a new test, it is possible to see that the position of the arena defined in the protocol no longer corresponds to the real position of the arena in which the animals are evolving.

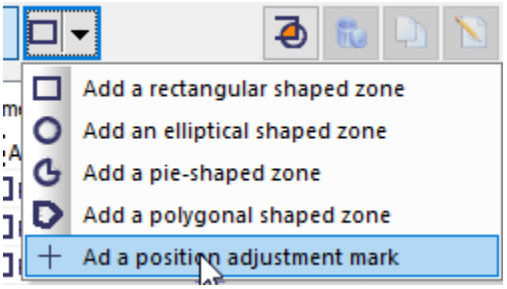
The position adjustment marks make it possible to correct this problem simply and automatically.

To do this, simply position 2 colored marks on the enclosure in which the animals are evolving. These 2 marks must respect the following constraints :

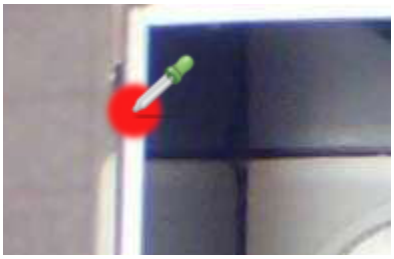
- be of a solid color that is neither found on the animals nor on the bottom of the enclosure.
- be of a sufficient size to be detected (approximately 1 or 2 cm on each side).
- be securely fixed to the enclosure in 2 opposite corners.
- be visible on the first image of the video.



To add the position adjustment marks:

1. Click the arrow next to the shapes button 

to bring up the menu and select "Add a position adjustment mark".

2. Click the image in the center of the first color mark 

3. Click the image in the center of the second color mark 

Even if you have set marks to use the automatic arena position adjustment feature, it is still possible to manually adjust the arena position in the current test view, or the video position.

4.4. Stages / Trials

Stages are used to organize the experiment.

For each stage, it is possible:

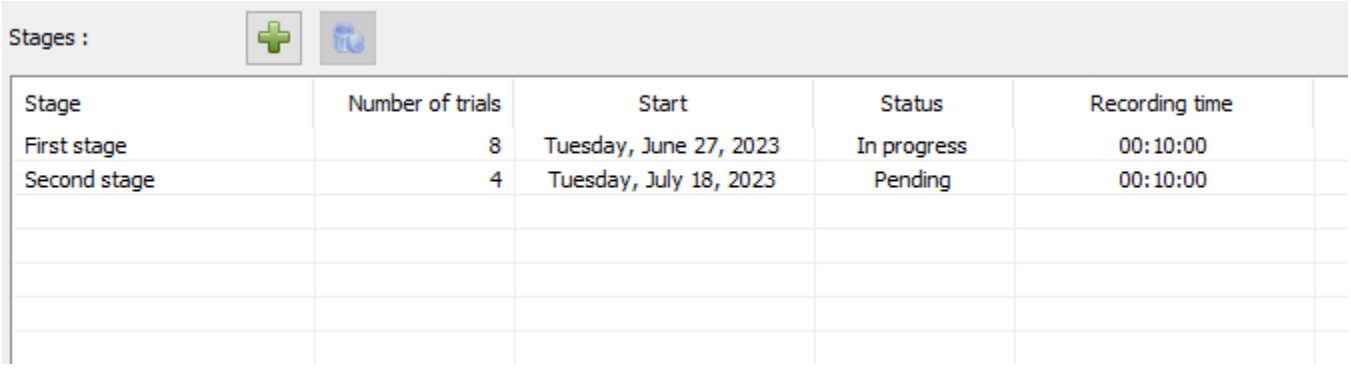
- to define a recording duration and a delay before the start of recording (when the videos are recorded by

Ethotrack).

- to define the start and end conditions of the analysis with the analysis sequencer.
- to organize the tests to be carried out according to several factors. For example, in an object recognition test, it is possible to have a “Training” stage consisting of 4 trials and a “New object” stage consisting of a single trial.
- to select the animals that must participate to the stage.
- to automatically create the tests (as a reminder: a test is a trial carried out by an animal).
- plan the tests in advance.

A protocol must have at least one stage.

This tab displays the list of stages and allows you to add or delete a stage.



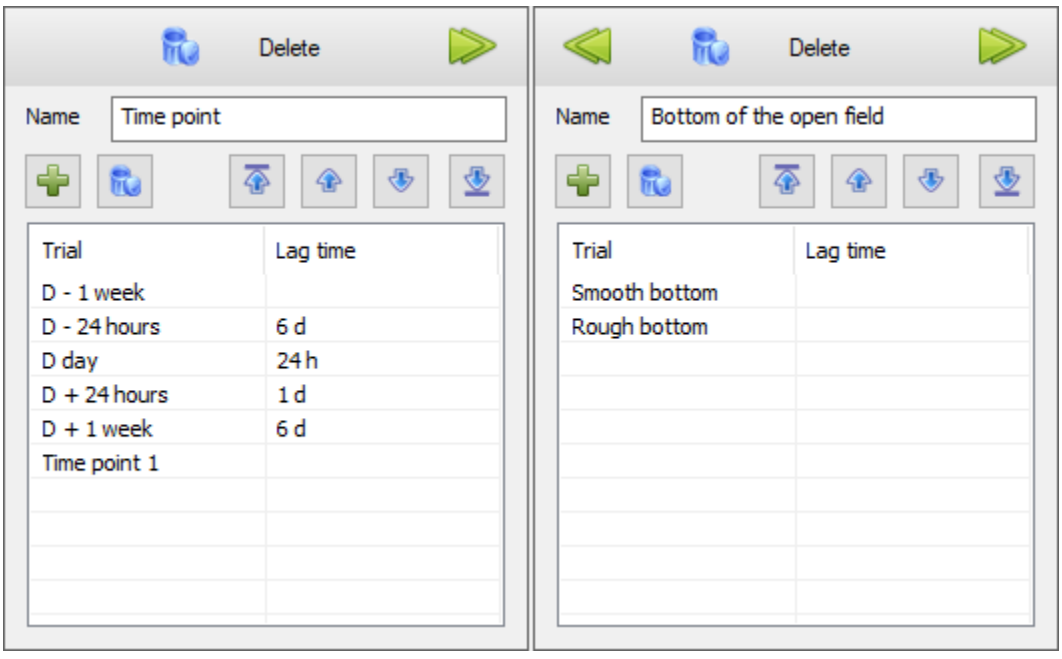
4.4.1. The progress of a stage

This tab is used to define and organize the different trials that will have to be carried out. It also makes it possible to choose the animals which will have to carry out these trials.

The trials :

For each stage, it is possible to define up to 3 independent factors (or parameters), each comprising a finite number of values. The trials correspond to the different possible combinations of the values of the factors.

For example the following configuration :



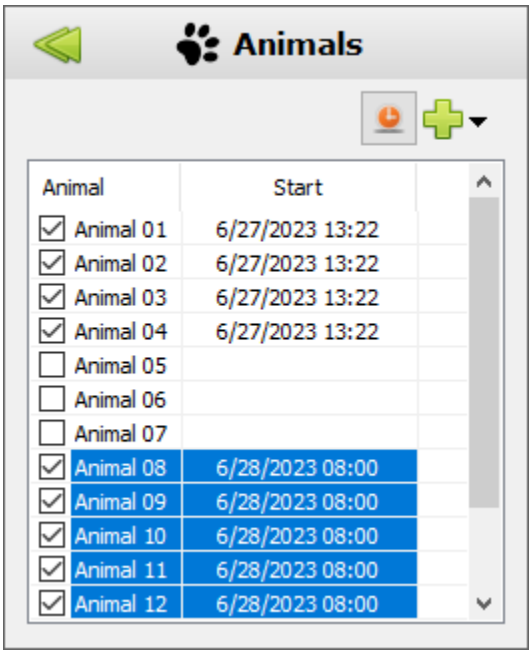
means that for each animal, 2 tests will be carried out (one on a smooth bottom and one on a rough bottom) on 5

different days: 2 tests at D - 1 week, then 2 tests at D - 24 hours (6 days more later), then 2 tests on "D-Day" (1 day later), etc.

The total number of trials for this step is 5 * 2 = 10 trials.

The delay column is used to specify the delay (in days, hours and minutes) to respect with respect to the previous element. For example 24 hours between "D - 24 hours" and "D day". Combined with the start date and time of the step, this data is used to plan the tests.

Animals selection :



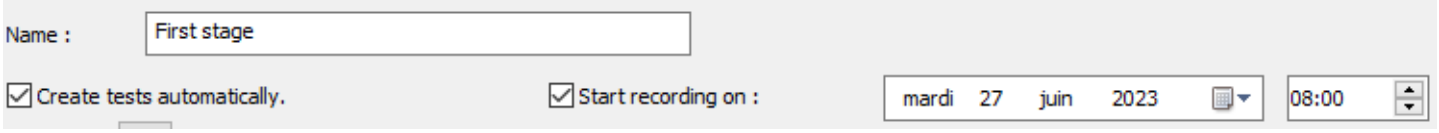
The "Animals" block is used to select the animals that must perform this stage. To exclude an animal, simply uncheck the corresponding box.

Notes on animal selection :

- Animals are assigned in the order in which they were created.
- Animals created later are automatically added to the end of the list and are selected to perform the stage.

If the stage is scheduled to start on a certain date, it is possible to specify a different start date and time for each animal. To do this, simply select the animals concerned by clicking on their name (you can use the CTRL and SHIFT keys to select several animals) and click on  .

Automatique test creation et planning :



If the "Create tests automatically" option is checked, Ethotrack automatically creates all the corresponding tests (ie one test for each trial and each animal). Tests are created dynamically based on changes in the experiment. For example if an animal is added later, all tests for this new animal will be created automatically. Similarly, if an animal is excluded, all tests that have not yet been recorded will be automatically deleted.

To plan the tests, it is possible to specify the date and time of the recording of the first test of the stage. Next tests will be scheduled based on this date and the delay value specified for the various factor items.

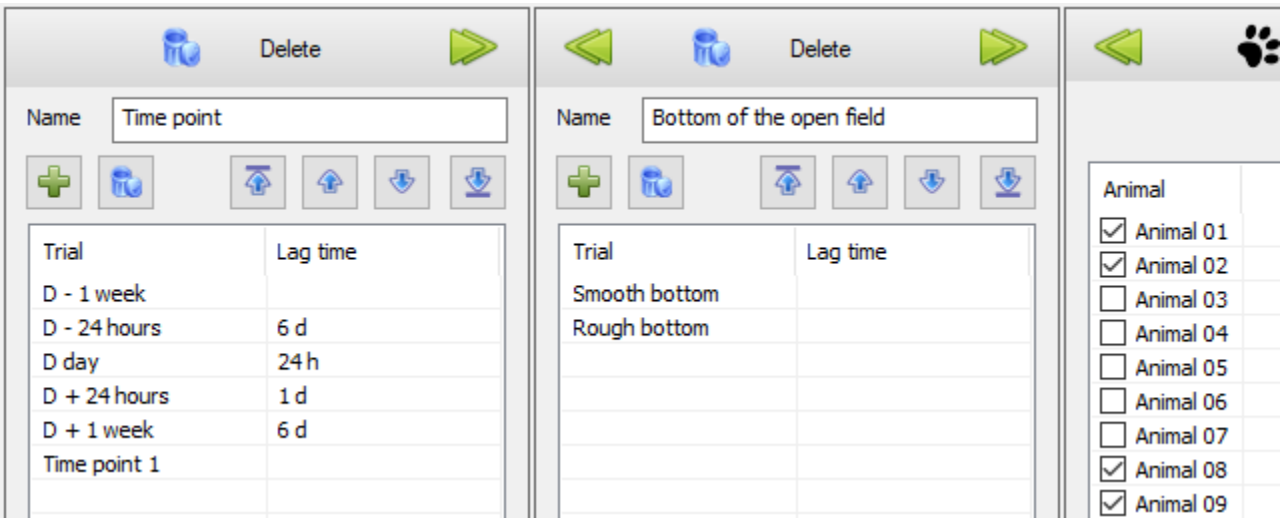
Test planning notes :

- If an animal is added after the start of a stage, the tests for this animal will be scheduled from the date the animal was created.
- If a test is recorded on a different date than scheduled, all subsequent tests of the animal will be automatically rescheduled based on the real date of recording to meet the time between trials.

Tests order :

The order of the factors and the animals selection block détermines the order of the tests.

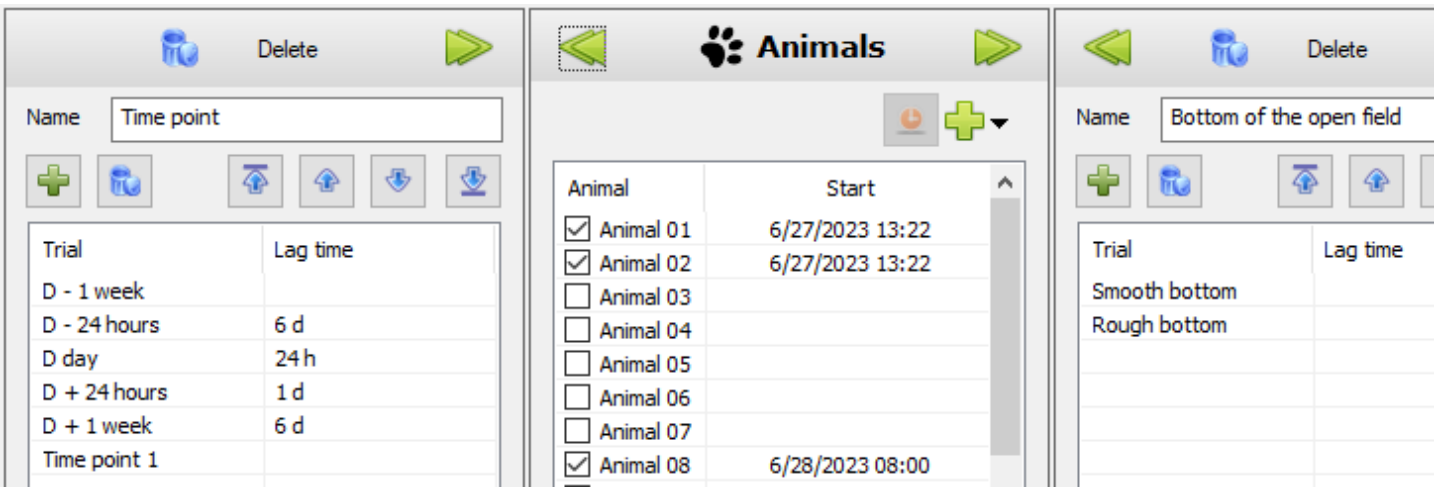
In the following example :



Tests will be created in the following order :

"D - 1 week", "Smooth bottom","Animal 001"
then : "D - 1 week", "Smooth bottom","Animal 002"
...
then : "D - 1 week", "Smooth bottom","Animal 009"
then : "D - 1 week", "Rough bottom","Animal 001"
then : "D - 1 week", "Rough bottom","Animal 002"
...

In the following example :

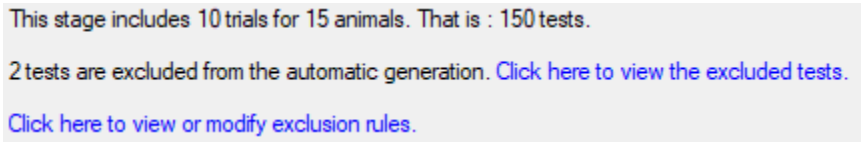


Tests will be created in the following order :

"D - 1 week","Animal 001","Smooth bottom"
next : "D - 1 week","Animal 001","Rough bottom"
next : "D - 1 week","Animal 002","Smooth bottom"
next : "D - 1 week","Animal 002","Rough bottom"
...
next : "D - 24 hours","Animal 001","Smooth bottom"
...

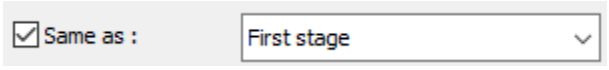
Selection of tests to create :

By default, Ethotrack generates one test per animal and per trial. It is possible to precisely control the tests to be generated by creating exclusion rules.



Stage copy :

From the second stage, you can easily create a stage similar to a previous one. To do this, you can either :

- Check the box 

: in this case the tests of the new step cannot be modified and any modification in the source step is automatically carried over to the new step. You can of course change the date and time of the start of the recording.
- Utse the button 

to make a copy of the source stage. You can the edit the copy.

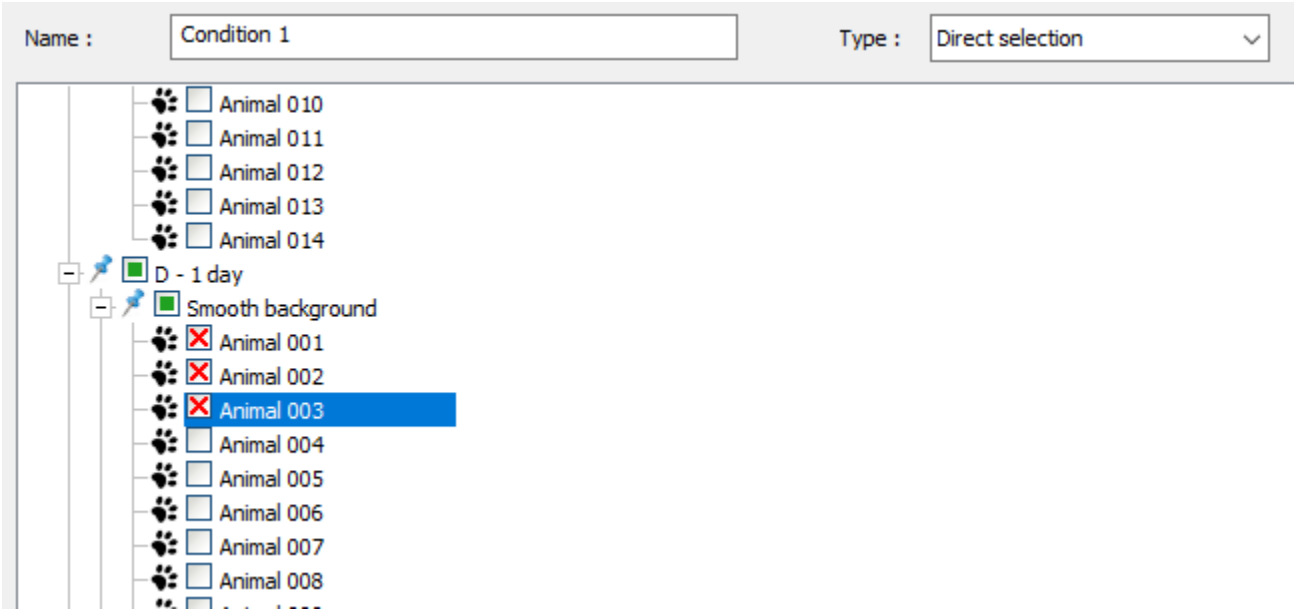
4.4.1.1. Exclusion of some tests

By default, Ethotrack generates one test per animal and per trial. This dialog box allows you to define rules to exclude somme tests form automatic generation.

A rule can be defined by a direct selection of tests to exclude or by a logical condition (simple or full)on the animals and by the selection of trials to exclude when the condition is verified.

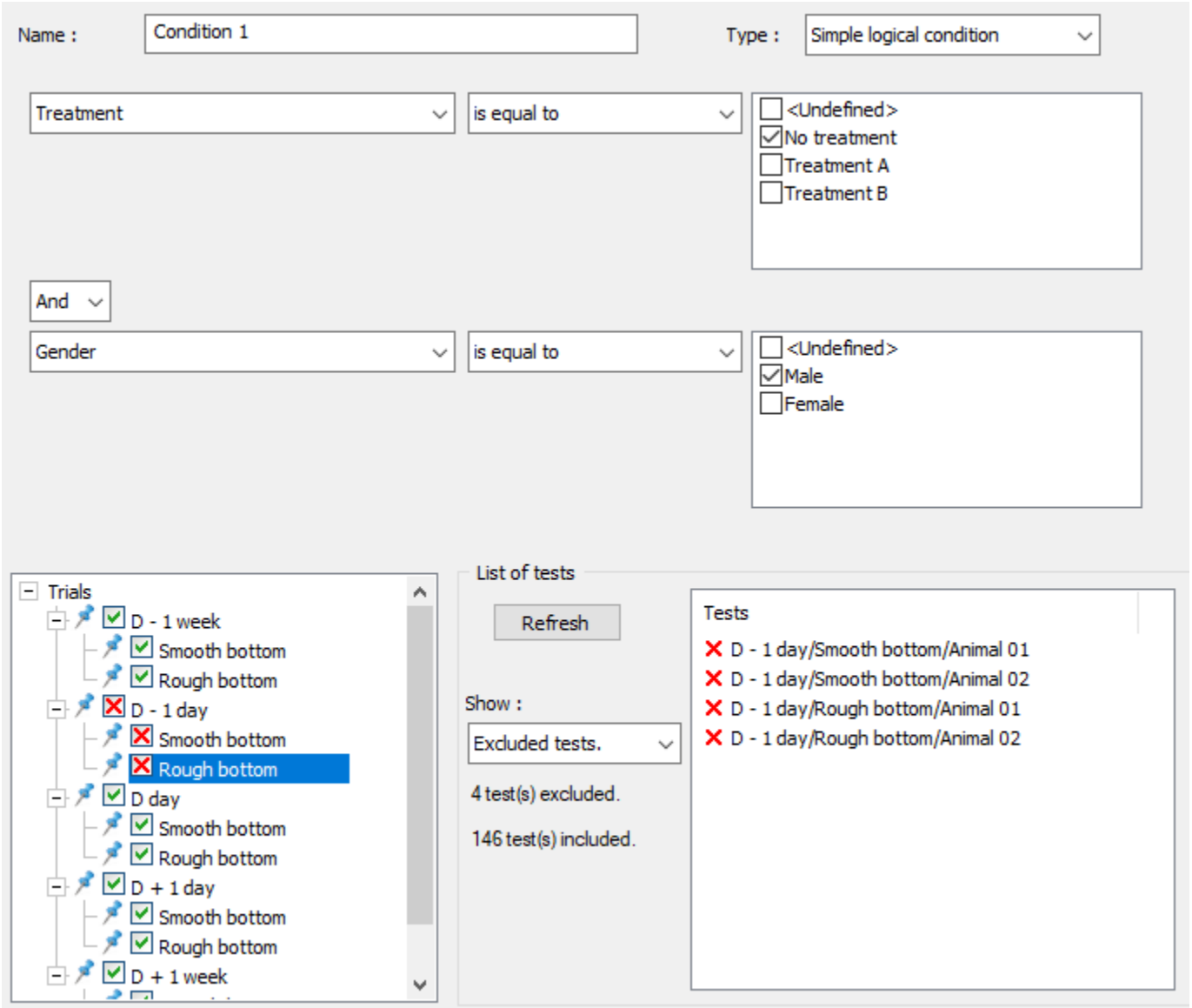
Direct selection of tests to exclude :

In the following example, animals 001,002 and 003 will not participate in the "D - dayt / Smooth background" trial.



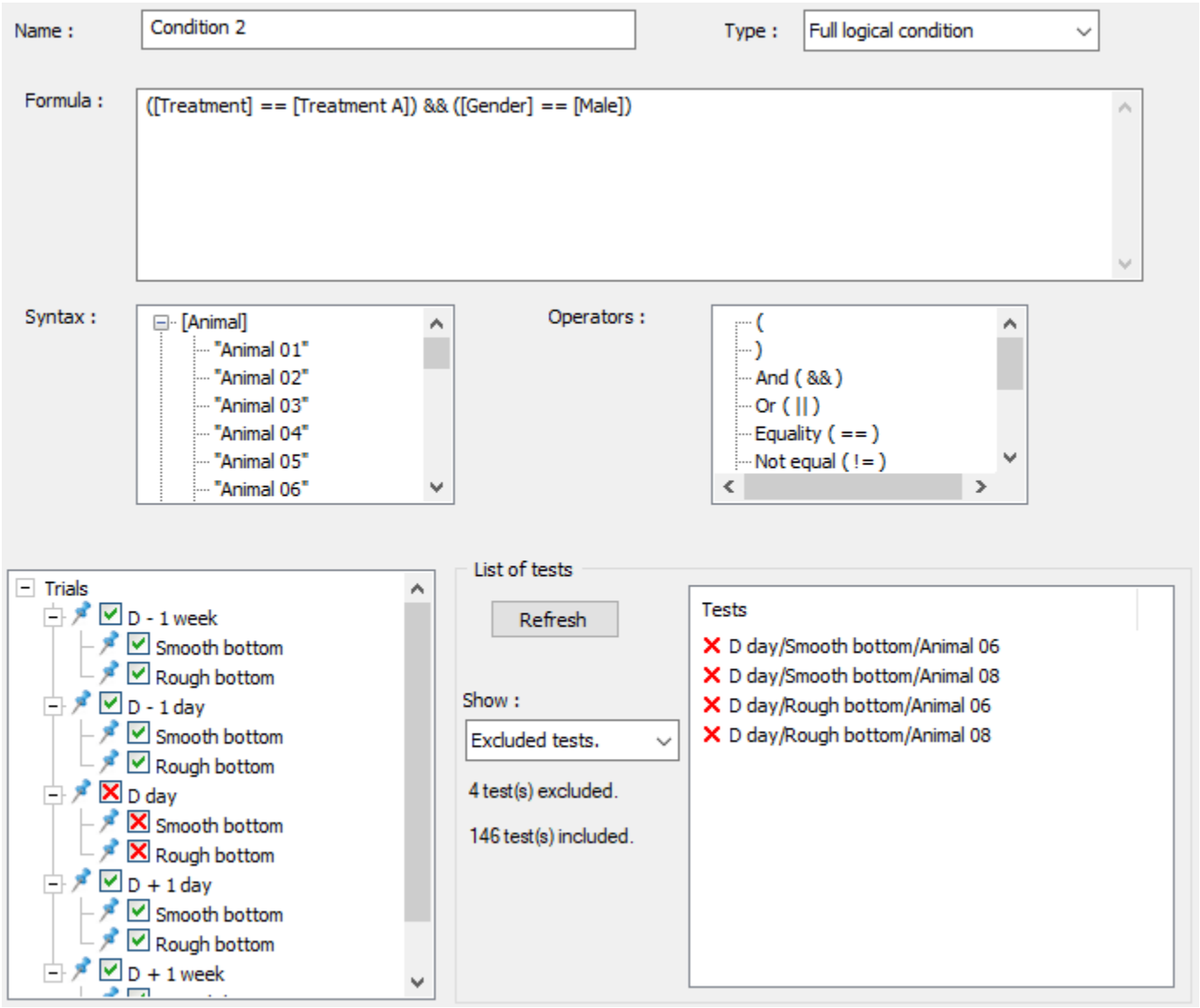
Simple logical condition :

In the following example, male animals which have not received any treatment will not participate in the "D - 1 day / Smooth bottom" and "D - 1 day / Rough bottom" trials.

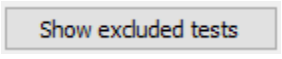


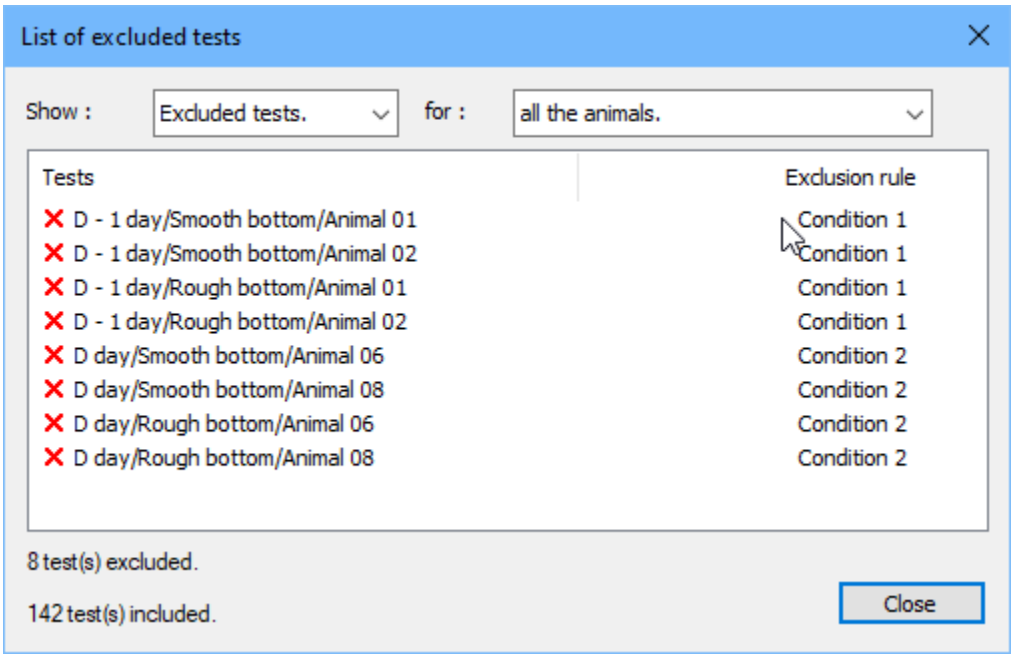
Full logical condition :

In the following example, male animals which have not received any treatment will not participate in the "D day / Smooth bottom" and "D day / Rough bottom" trials.



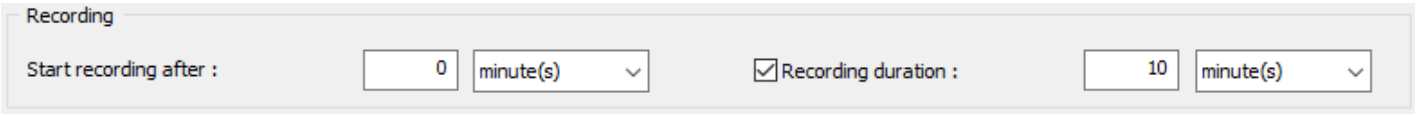
Displaying all excluded tests :

Click on  to display the list of all tests excluded by the different conditions :

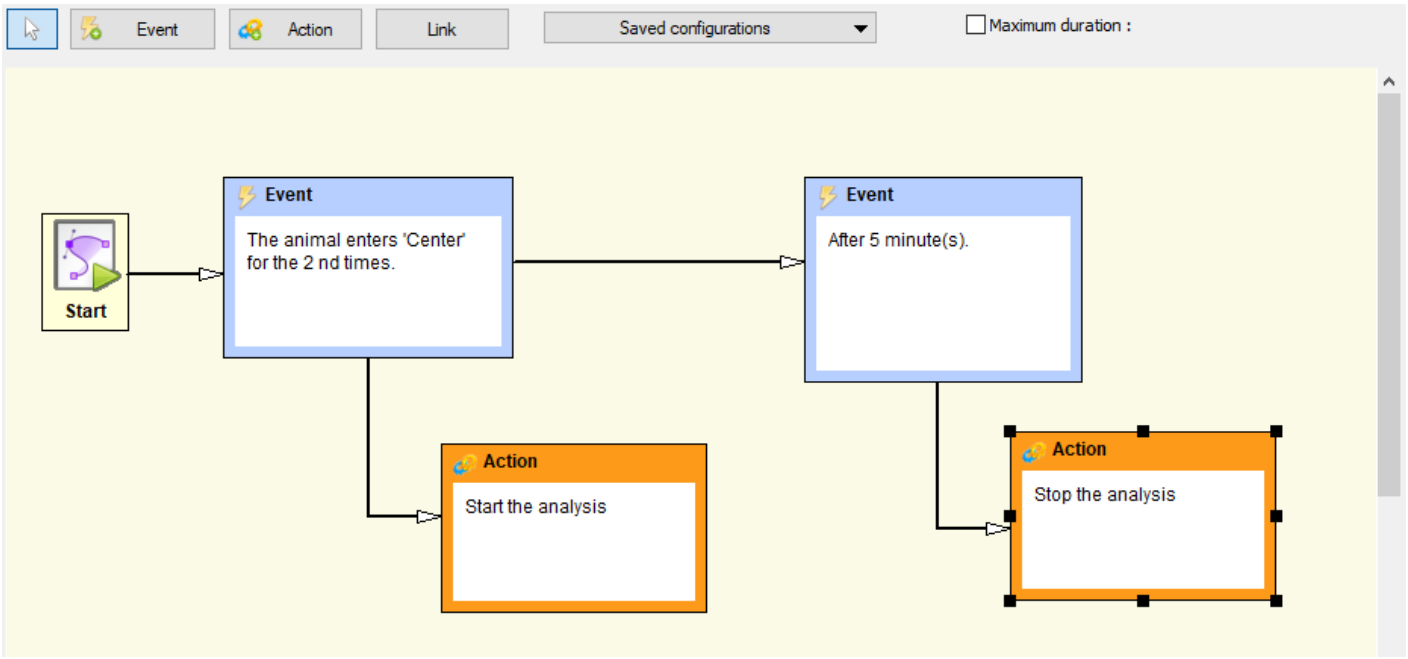


4.4.2. Recording / Analysis

This tab allows you to configure the recording of videos if this is done by Ethotrack with a webcam connected to the computer:



It also allows to program the sequencer which triggers the start and end of the analysis.



The sequencer is made up of events and actions connected by links. These links are represented by arrows, the direction of which indicates the chronological order of the progress of the various stages.

The events :

An event blocks the flow of the program until the condition defined in the event is true. When the condition is true, the sequencer can proceed to the next steps. The following steps which are actions are carried out and the following steps which are events are in turn tested until their condition is verified.

The event conditions are:

- Immediately.
- After a certain period.
- When the animal is in motion for a certain time. *Note: the animal is considered to be in motion if it remains motionless for less than the duration of immobility defined in the 'General'tab of the protocol.*
- When the animal is motionless for some time.
- When the animal enters a zone for a certain period of time.
- When the animal enters a zone one or more times. *Note: The presence of the animal in the zone during the first evaluation of the event is counted as an entry if the option "Consider the presence of the animal in the zone during the first evaluation as an entry" is selected.*
- When the animal leaves a zone for a certain period of time.
- When the animal leaves a zone one or more times. *Note: The presence of the animal outside the zone during the first evaluation of the event is counted as an exit if the option "Consider the presence of the animal outside the zone during the first evaluation as an exit" is selected.*

The actions :

actions are:

- Start analysis.
- Stop analysis.

In the example above the recording of the animal's position starts when it enters the zone 'Center' for the second time, and continues for a duration of 5 minutes.

Maximum duration:

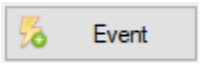
It is possible to set a maximum duration from the beginning of the video. When this duration is reached, the analysis is stopped, whether the stop condition defined by the sequencer is reached or not.

Pre-saved configurations:

Select an item from the list to recall a pre-stored standard configuration.

- **Immediate start**: The analysis starts immediately at the beginning of the video and continues until the end of the video.
- **Start after delay** : The analysis starts after a certain delay and continues until the end of the video.
- **Start after delay, end after delay** : The scan starts after a certain delay and ends automatically after a certain time.

To add an event or action:

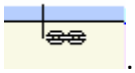
1. Click the button 

or the button 

to select the item to add.
2. Click in the sequencer edit area.
3. While holding down the left mouse button, move the cursor to size the element.
4. Double click the element you just added or use the "Properties" contextual menu to modify the properties of the element.

To add a link between 2 elements:

1. Click the button 

.
2. Click on the edge of the starting element when the cursor takes on the shape of a chain 
.
3. Move the mouse cursor. Click in a free part of the editing area to position an angle on the link and change direction.
4. Click the edge of the final element.

To select an element (event, action or link):

1. Click the select button 
.
2. Click on the item to select.

To select several elements (event, action or link):

1. Click the select button 
.
2. Click in a free part of the editing area.
3. While holding down the left mouse button, move the cursor to encompass the items to be selected.
4. You can also hold down the "Ctrl" key while clicking on an element to add it to the selection.

To delete one or more items:

1. Select one or more items.
2. Press the "Delete" key on your keyboard or use the contextual menu: "Cut", or use the keyboard shortcut "CTRL"+X

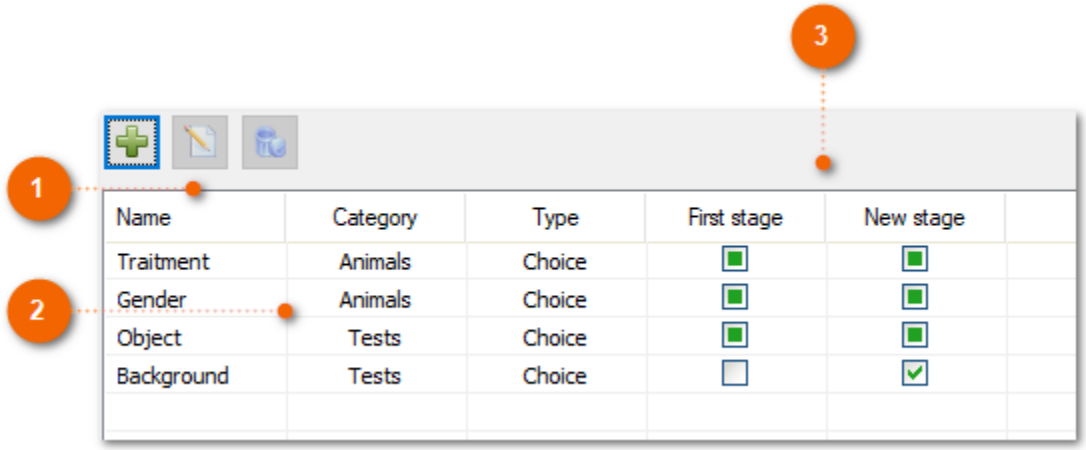
Keyboard shortcuts:

- You can use the arrow keys to move selected items.
- You can use the arrow keys while holding the "Shift" key (Shift) pressed to resize the selected elements.
- "Ctrl" + "Return": open the properties window of the selected element.
- "Ctrl" + A: select all elements.
- "Ctrl" + X: cut the selected elements.
- "Ctrl" + V: Paste selected items.
- "Ctrl" + C: copy the selected elements.

- "Ctrl" + Z: undo the last action (maximum: 10 actions).
- "Ctrl" + Y: redo the last undone action.
- "Next page": move the selected element back.
- "Previous page": advance the selected element.
- "Ctrl" + "Next page": put in the background.
- "Ctrl" + "Previous page": bring to the foreground.

4.5. User fields

This tab is used to manage user fields .



1 **Buttons**

Buttons to add, edit or delete a user field.

2 **List**

User fields list.

3 **Stages**

Selection of user fields from the "tests" category for each stage of the protocol :

- ☐ : the user field is not used for this stage and will not appear in the corresponding tests.
- ☑ : the user field is used for this stage.
- ■ : the user field is used for this stage and cannot be deselected ("Animals" category fiel, or field used in a choice type compound zone, or field used in a filter).

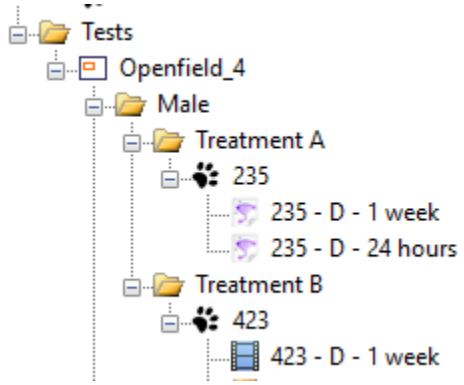
User fields are custom settings or additional information associated with an animal or test. This may be, for example, the weight of an animal, its sex, the group to which it belongs (control group, group having received treatment A, B, etc.), or the phase of the test (first training, second training, first test, second test, etc).

There are 4 types of user fields:

- **Choice** : an element of a list (for example the sex of the animal, the membership of a group, the delay before or after treatment, ...).
- **Text** : a free text.
- **Numeric**: a positive or negative numeric value, with or without a comma, with or without a unit (for example the weight of the animal)

User fields can be used to store information about an animal or a test, but also to create filters to select certain tests to include in a report (for example all tests performed on animals in the control group).

User fields of choice type (or zone choice) can also be used as grouping level in the "Workspace" panel, in the list of tests, as well as in reports.

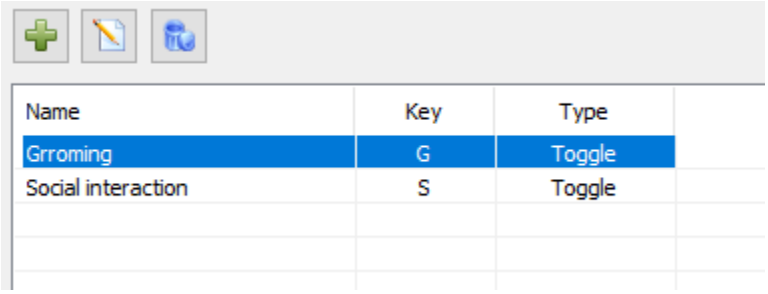


4.6. Behaviours

This tab is used to manage behaviors.

A behavior designates an action of the animal which cannot be detected automatically by Ethotrack (for example: grooming or standing) but which can be recorded manually (by simply pressing a key) during the viewing of the video.

To do this you must associate a key on the keyboard with a behavior.



Behaviors are recorded in the "Behaviors" side panel of the "Current test" view.

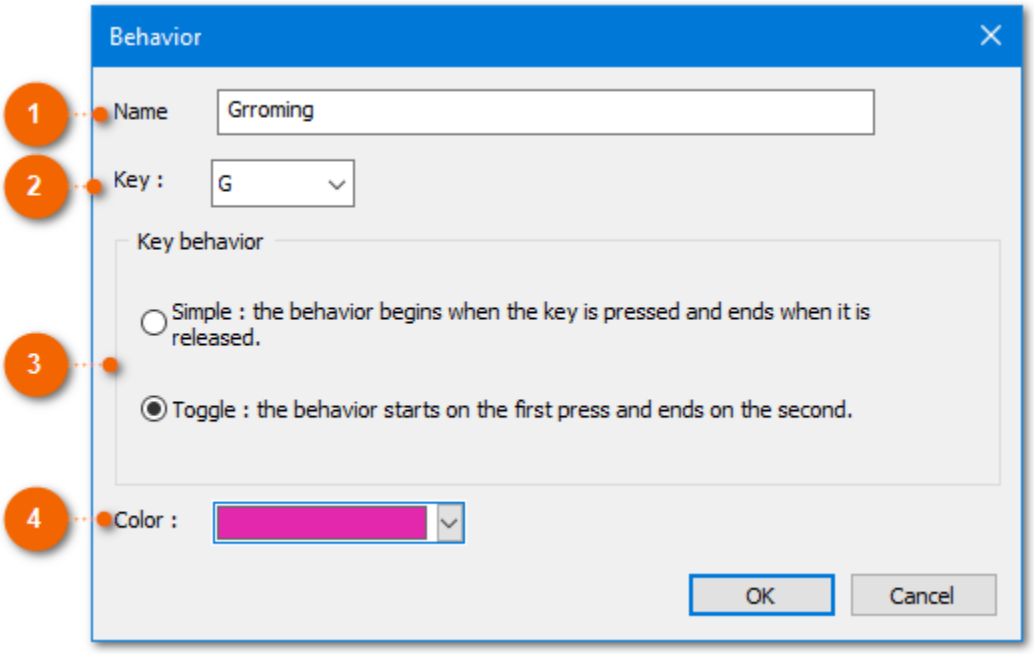
Once recorded, behavior periods can be viewed in the "Current Test" view, exported as raw data in spreadsheet software, or analyzed in a report.

Several types of reports can be generated:

- Total duration of a behavior.
- Longest duration of a behavior.
- Shortest duration of a behavior.
- Average duration of a behavior.
- Time to first behavior.
- Number of times a behavior has occurred.

4.6.1. Behavior Dialog

This dialog allows you to create or modify a behavior.



1 **Name :**

The name of the behavior

2 **Key :**

The keyboard key that triggers the start and end of the behavior

3 **Key behavior :**

The key used to record the behavior :

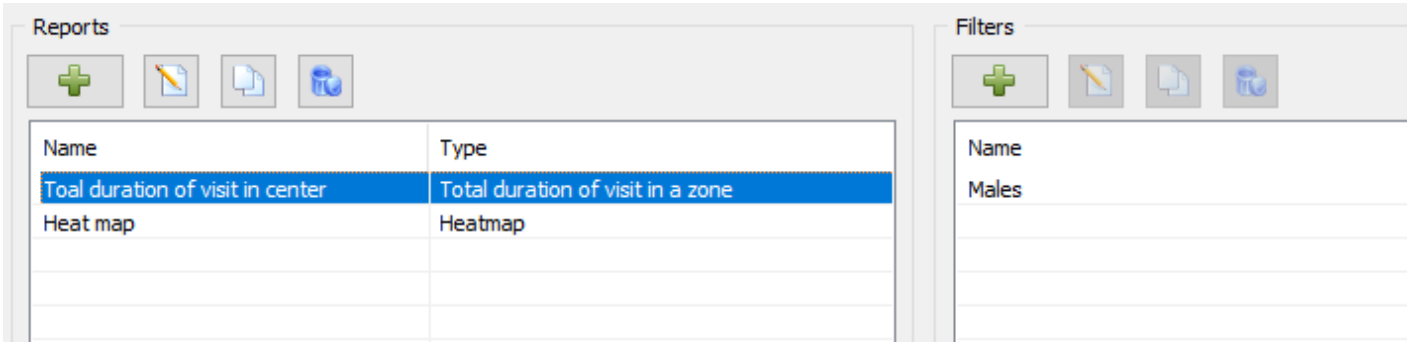
- Simple: the behavior starts when the key is pressed and ends when it is released.
- Toggle: the behavior begins on the first press and ends on the second.

4 **Color :**

The color of the behavior in the tracking curves area of the "Current test" view

4.7. Reports/Filters

This tab is used to manage reports and filters .



5. Videos

The videos used by the experiment can be recorded by Ethotrack or by another software. If the videos are recorded by another software, it is advisable to copy them to a subfolder of the experiment folder.

Once added to the list of videos, a video can be associated with a test, or with several tests if the image of the video encompasses several arenas.

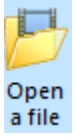
To record a video with Ethotrack:

1. select a webcam and configure the recording start and end conditions in the "Source" tab of the protocol dialog box.
2. To start recording, you can:
   - Click on 

in the " Current video " view or in the " List of videos " view.
   - Click on one of the buttons used to start recording in the "Current test" view:
     i)  : to start the recording according to the protocol (the beginning and the end of the recording will be in accordance with the parameters of the "Source" tab.
     ii)  : to start the recording immediately without taking into account the start and end conditions of the protocol (the recording will not stop automatically).

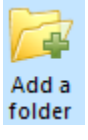
To add video recorded by other software:

- Click on 

in the " Current video " view or in the " List of videos " view.
- Click on 

in the " Current test " view.

To add multiple files recorded by other software:

- Click on 

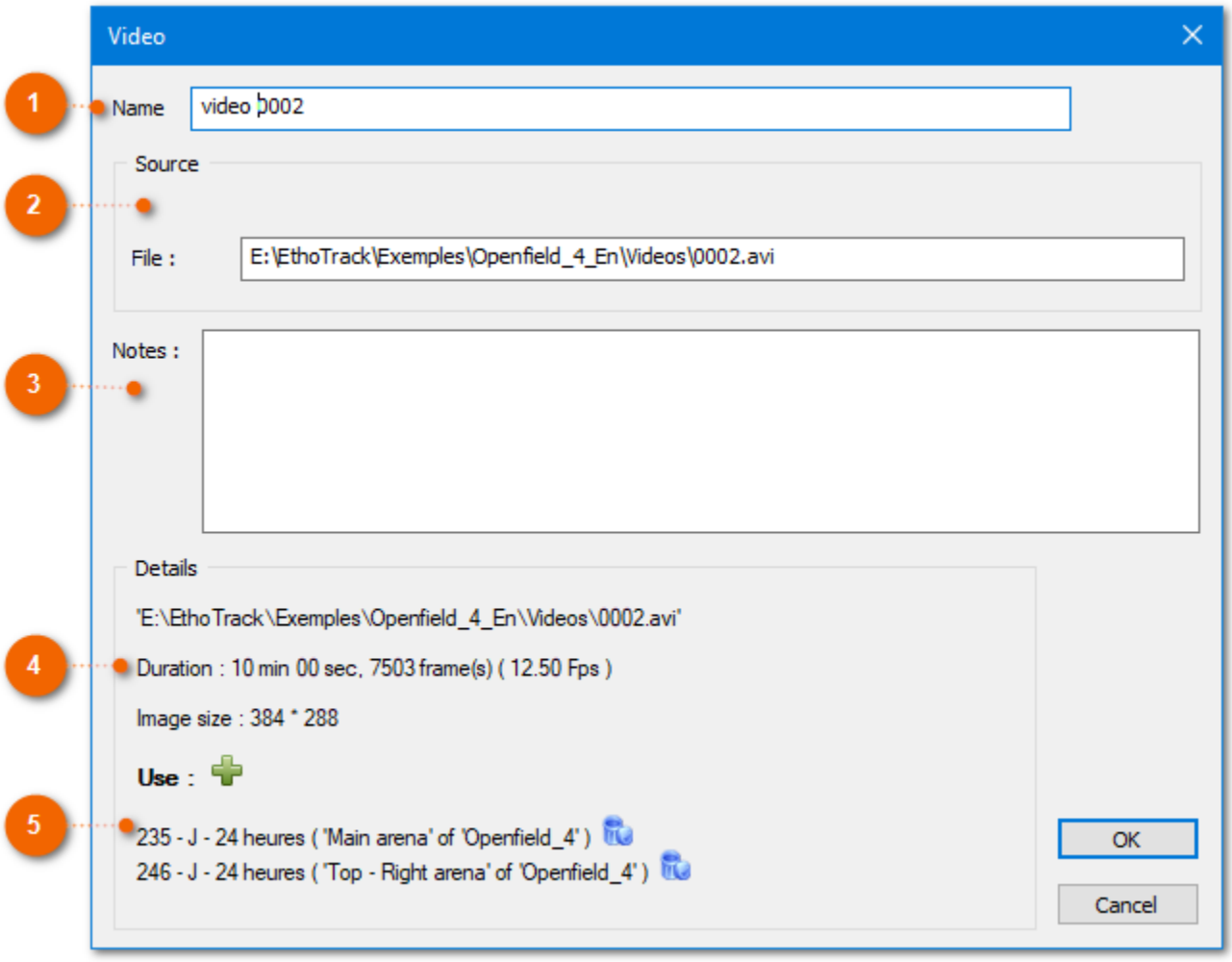
in the " Video List " view .

To add a video recorded by Ethotrack in an other experiment:

To use a video recorded by Ethotrack in an other experiment, you don't have to add it like a regular video file, but you have to use the "Import" function.

5.1. "Video" Dialog

This dialog box is used to modify the parameters of a video and in particular the list of tests that use it.



1 **Name:**

The name of the video (by default the name of the file)

2 **Source :**

The source of the video: either a file, or: recorded by Ethotrack.

3 **Notes :**

An area for entering information about the video (recording conditions, etc.)

4 **Details :**

Some information about the video; duration, image size, etc.

5 **Use :**

The list of tests that use video. The buttons  and  allow you to delete an item from the list or to add a new test by opening the " Using video " dialog box

5.2. "Use of video" Dialog

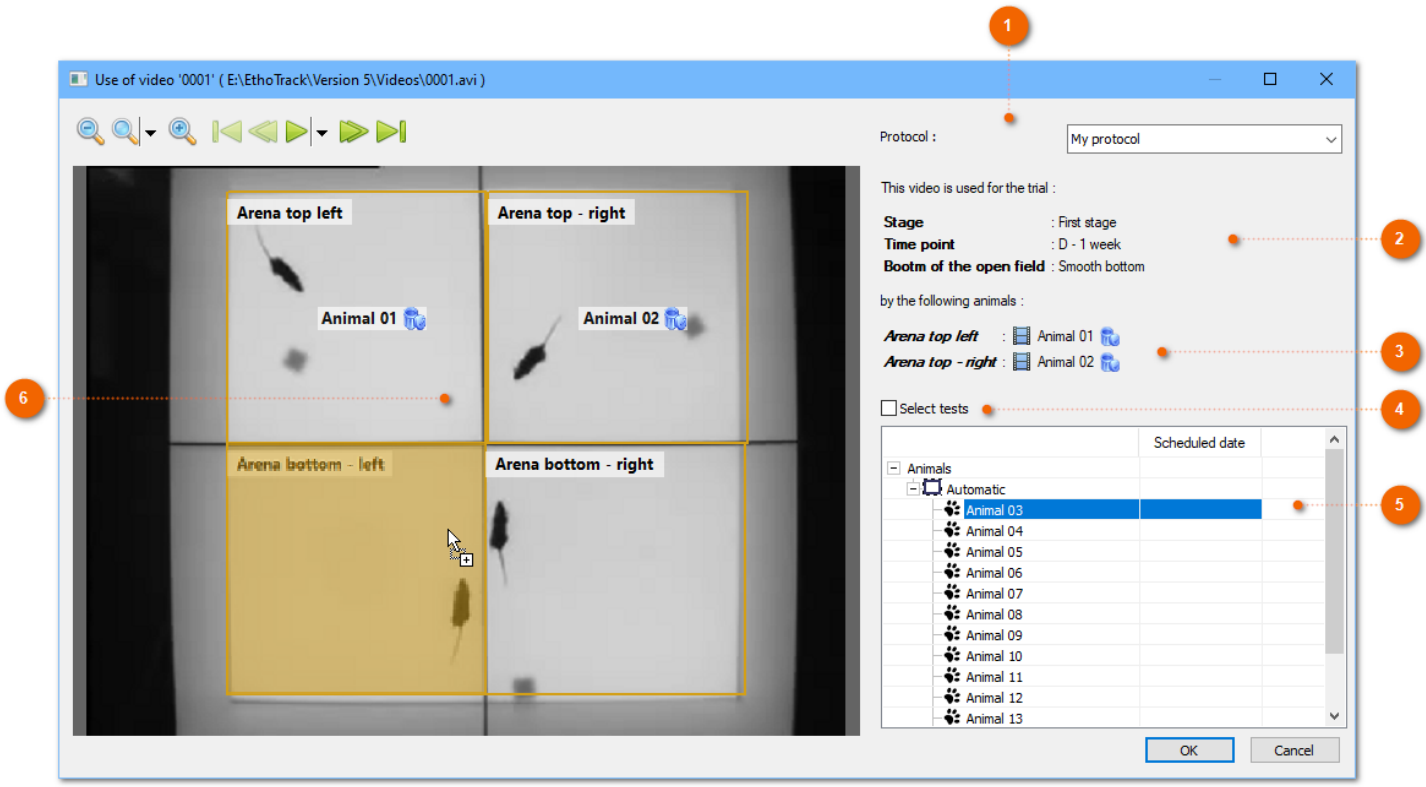
This dialog box allows you to make the link between a video and one or more tests. When the protocol includes secondary arenas it also makes it possible to indicate for each test the arena in which the animal was placed during recording.

Selection by animal :

To avoid the risk of error, it is advisable to organize your experimental plan to respect the following rules:

- an animal must perform a trial no more than once.
- if the protocol includes several arenas, the tests recorded on the same video must correspond to the same trial.

If these 2 conditions are met, it is possible to link the tests to a video by selecting a trial, then placing the animals participating in this trial in their respective arena.

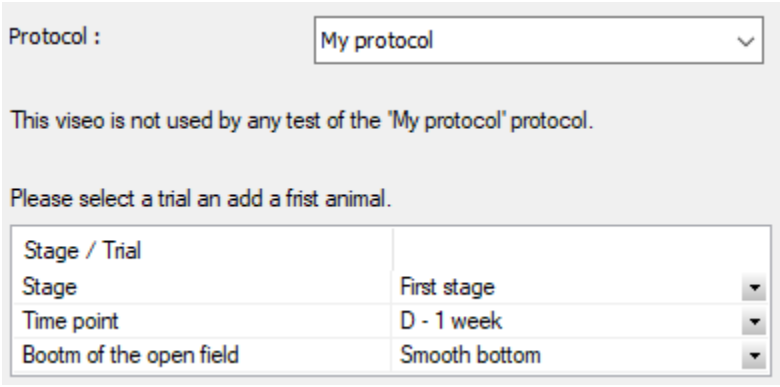


Protocol :

Choice of protocol. Only protocols compatible with the video size are offered.

Stage / Trials:

The description of the selected trial (when at least one animal is assigned to the video).
If no animal is assigned to the video, this area allows you to select a stage and a trial :



Use :

The list of animals linked to the video for the selected trial. Click to delete a link.

Select tests :

Allows you to choose the selection mode (Test if the box is checked, animal otherwise).

List of animals:

The list of animals for which the selected trial test is "Pending" grouped by arena by default.

Video :

The video superimposes the arenas and the animals in their respective arenas.

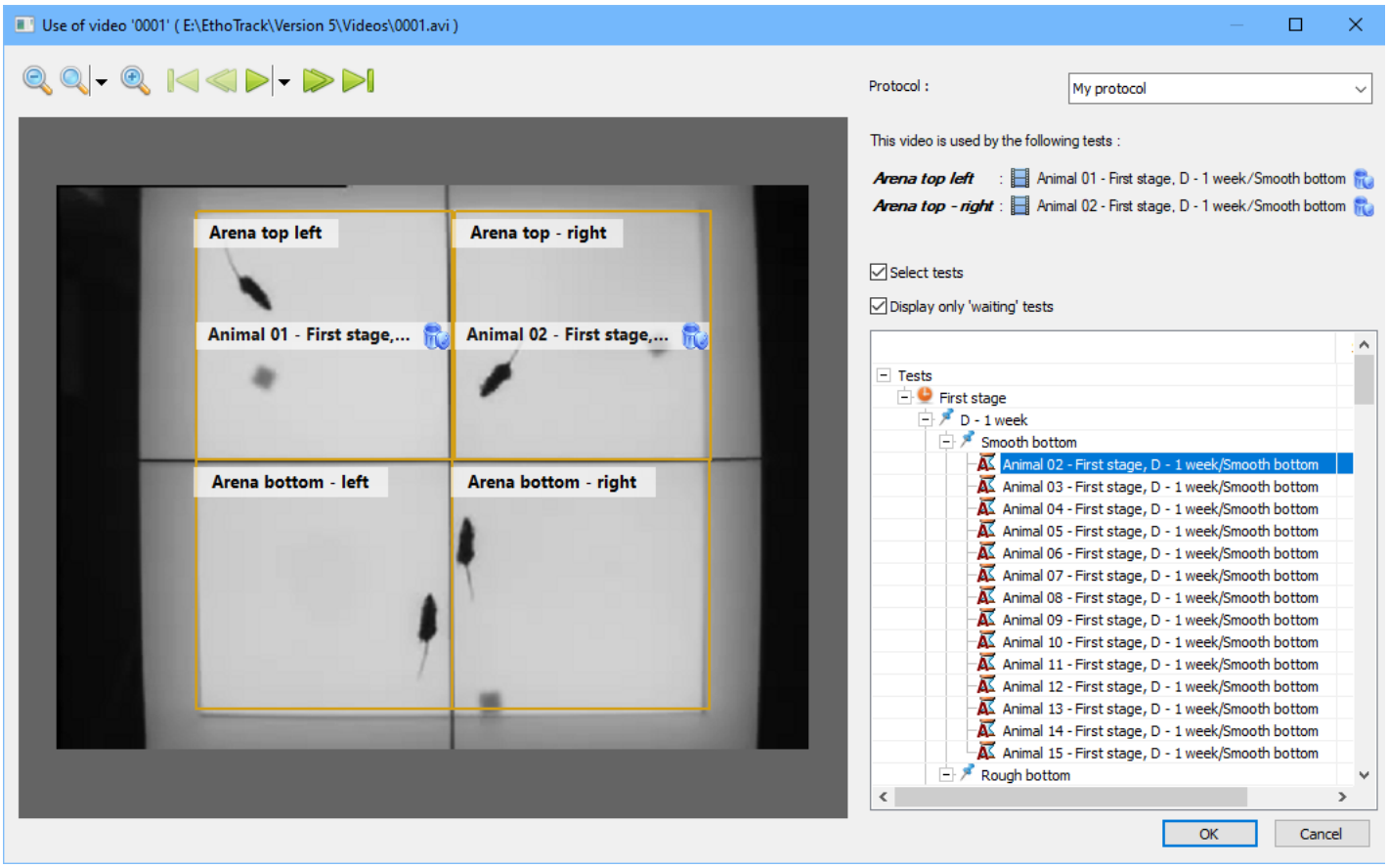
Click to delete a link.

To assign an animal to the video, simply click on the animal in the list, move the cursor to the video while holding down the mouse button, then release the mouse button when the cursor is over. is located above the chosen arena. It is also possible to "double click" on an animal to automatically assign it to the next available arena.

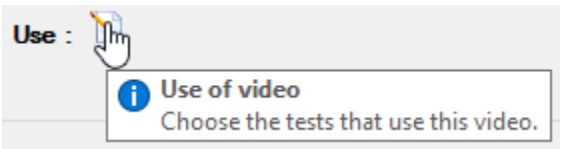
If the protocol includes several arenas, it is advisable to always place the animals in the same arena.

Selection by test :

If an animal must perform the same trial several times, or if the video contains test recordings corresponding to different trials, simply check the box Select tests to directly link the tests to the video.



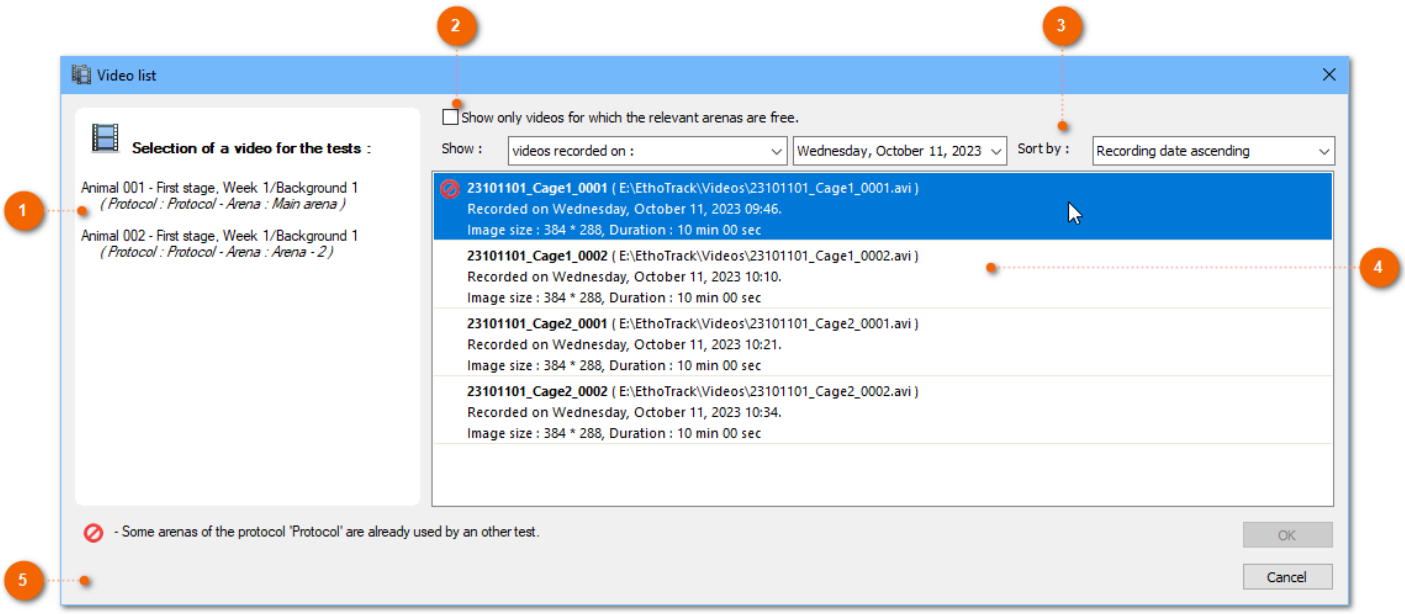
To open this dialog box :

This dialog box is accessible by clicking on the button 

in the video editing dialog box.

5.3. Video Selection Dialog

This dialog box allows, for a given test, to select the associated video.



1 **List of tests :**

The list of tests that must be associated with the video.

2 **Filters :**

Allows you to filter the videos diplayed in the list.

3 **Sort by :**

Allows you to change the display order of videos in the list.

4 **List of videos :**

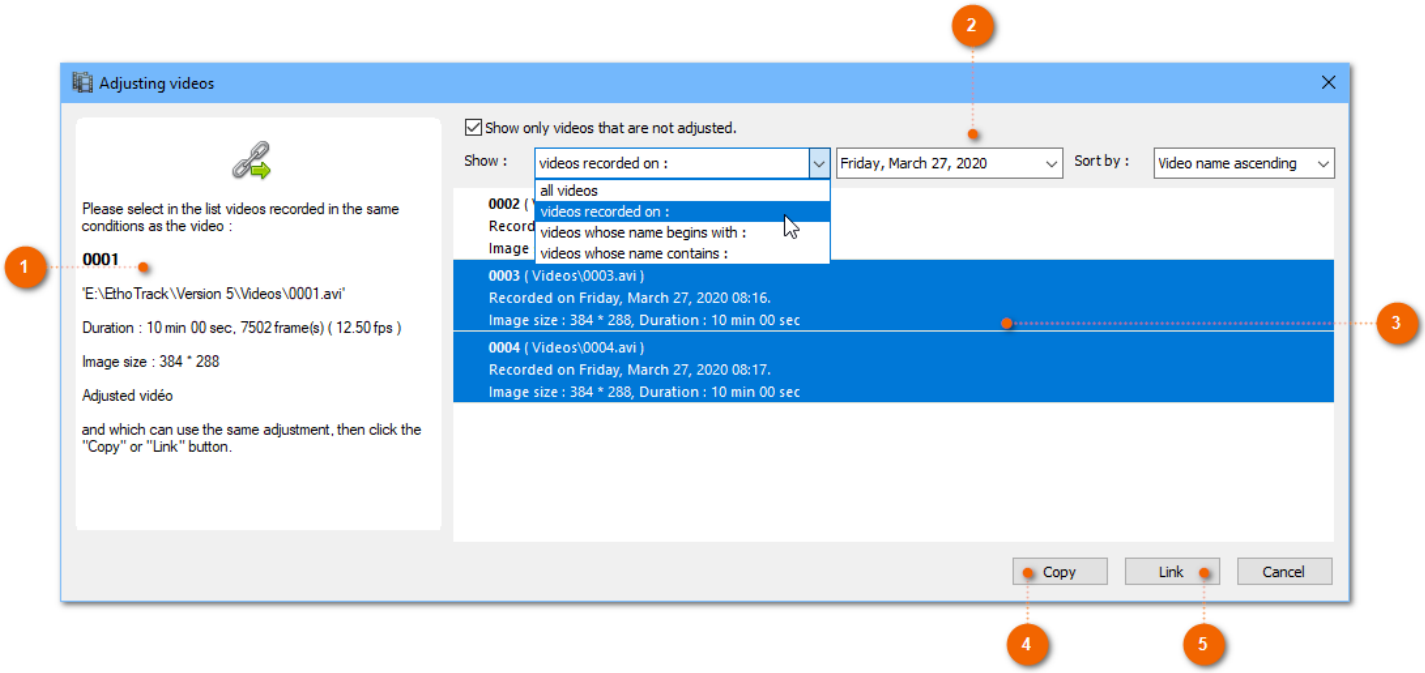
The list of videos.

5 **Warning messages :**

Warning messages if the selected video is not compatible or if one of the arena is already used.

5.4. "Copy video adjustment" Dialog

This dialog allows you to copy or link the adjustment of a video to other videos (for example all videos recorded on the same day under the same conditions).



1 Reference video :

Write description here...

2 Videos filtering and sorting options :

Write description here...

3 List of videos :

Write description here...

4 Copy :

Write description here...

5 Link :

Write description here...

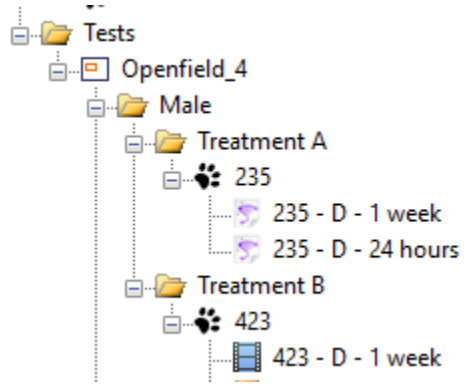
6. User fields

User fields are custom settings or additional information associated with an animal or test. This may be, for example, the weight of an animal, its sex, the group to which it belongs (control group, group having received treatment A, B, etc.), or the phase of the test (first training, second training, first test, second test, etc).
There are 3 types of user fields:

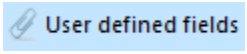
- **Choice** : an element of a list (for example the sex of the animal, the membership of a group, the delay before or after treatment, ...).
- **Text** : a free text.
- **Numeric**: a positive or negative numeric value, with or without a comma, with or without a unit (for example the weight of the animal.

User fields can be used to store information about an animal or a test, but also to create filters to select certain tests to include in a report (for example all tests performed on animals in the control group).

User fields of choice type can also be used as grouping level in the "Workspace" panel, in the list of tests, as well as in reports.



To add a user field, you can either:

- Open the " User Fields" tab of the protocol.
- Click on  in the command ribbon of the " Experiment " view.

- Click on the "Add" or "Manage" button  of the command ribbon, in the view " list of animals " or " list of tests ".

- In the view: "list of animals" or "list of tests", click with the right mouse button on the header of the table to bring up the contextual menu, then choose the command ***Add a user field*** .

To modify a user field, you can either:

- In the "User fields" tab of the protocol, select the user field to modify, then click on the button  or double-click on the user field.
- Click the "Manage" button on the command ribbon to open the user fields management dialog. Select the user field to modify, then click on the button  .
- In the view: "list of animals" or "list of tests", click with the right mouse button on the header of the column of the field to be modified to bring up the contextual menu, then choose the command ***Modify the user field*** .

Once the user field has been created, the category (animal or test) and type (choice, text or numeric)

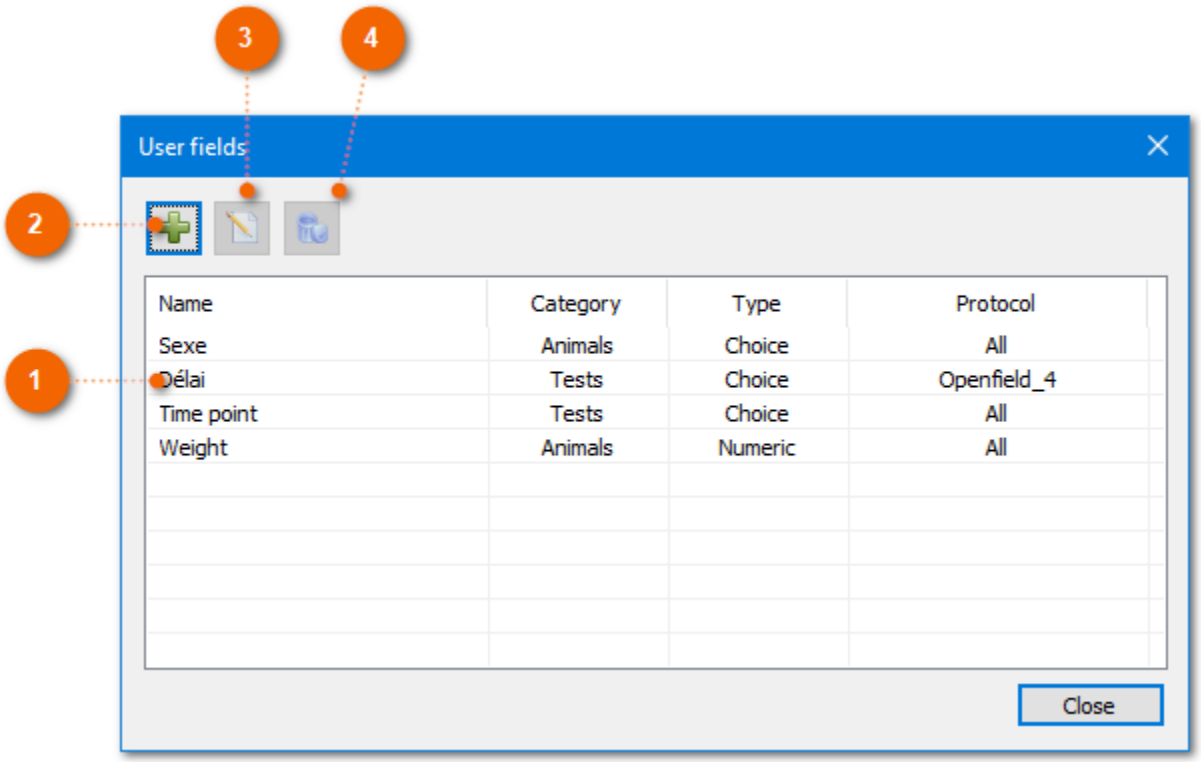
cannot be changed. To modify them, you must delete the user field and create a new one.

To delete a user field, you can either:

- In the "User fields" tab of the protocol, select the user field to modify, then click on the button  .
- Click the "Manage" button on the command ribbon to open the user fields management dialog. Select the user field to modify, then click on the button  .
- In the view: "list of animals" or "list of tests", click with the right mouse button on the header of the column of the field to be modified to bring up the contextual menu, then choose the ***Delete user field command***.

6.1. "User Fields" Dialog

This dialog allows you to manage user fields :



1 **List of user fields**

The list of all user fields in the experiment.

2 **Add User Field**

Click this button to add a new user field.

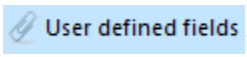
3 **Edit a user field**

Click this button to edit the selected user field.

4 **Delete a user field**

Click this button to delete the selected user field.

To open this dialog box:

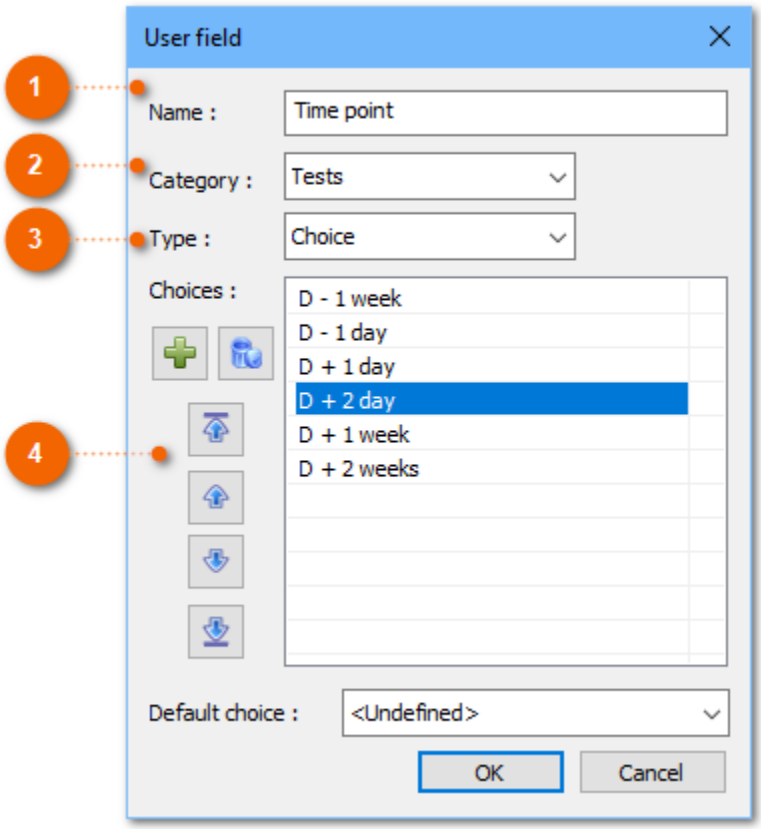
- Click on the button 

in the command ribbon of the " Experiment " view.
- Click on the "New" or "Manage" button 

of the command ribbon, in the view: " list of animals " or " list of tests ".

6.2. "User Field" Dialog

This dialog allows you to create or modify a user field :



1 **Name :**

The name of the user field.

2 **Category:**

The category of the user field:

- **Animals**: the user field is a characteristic related to an animal (for example: sex, weight, age, ...).
- **Tests**: the user field is a characteristic linked to a test (for example: the delay before or after processing, etc.)

3 **Type :**

The type of the user field:

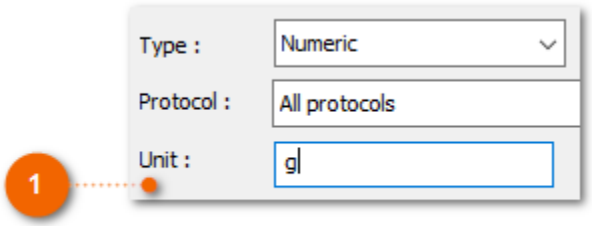
- **Choice** : an element of a list (for example the sex of the animal, the membership of a group, the delay before or after treatment, ...).
- **Text type** : a free text.
- **Numeric type** : a positive or negative numeric value, with or without a comma, with or without a unit (for example the weight of the animal)

4 **Additional parameters:**

Additional parameters depending on the type of user field (see below...)

Additional parameters:

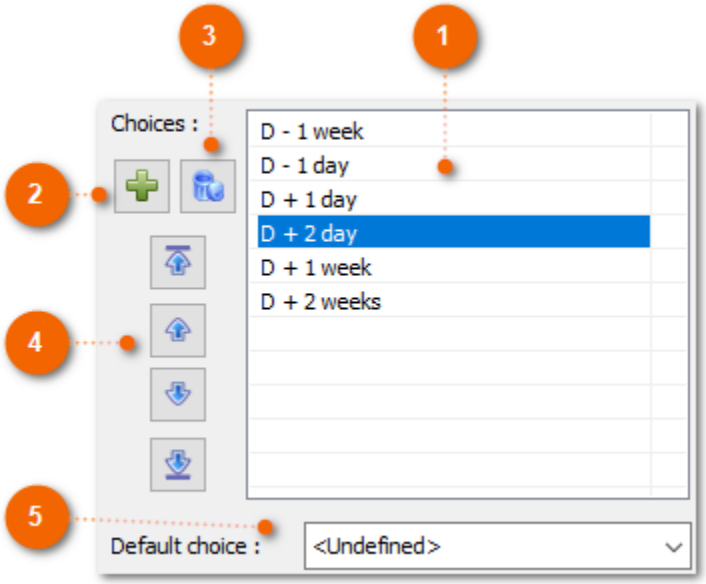
- **"Text" type :** no additional parameter.
- **"Numeric" type :**



1 **Unit:**

The unit of the numeric value of the user field (for example: grams for the weight of the animal).

- **"Choice" type :**



1 **List of choices :**

The list of possible choices for the user field.

2 **Add a choice :**

Button for adding a new choice.

3 **Delete a choice :**

Button used to delete the selected choice.

4 **Order of choices :**

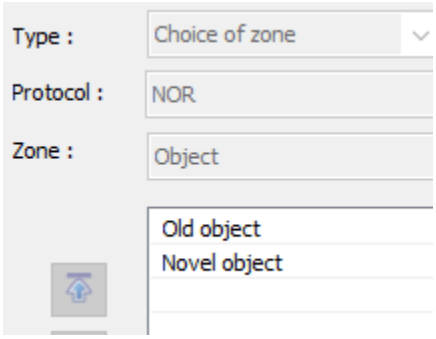
Buttons for changing the order of choices.

The order of choices defined here is used as a sorting criterion wherever possible (Workspace, list of tests, reports, etc.)

5 **Default choice :**

Default choice of the user field when creating the test or animal.

- **"Choice of zone" type :**


Type :
Choice of zone
Protocol :
NOR
Zone :
Object
Old object
Novel object

7. Animals

Before starting the tests, it is necessary to define the animals used for the experiment as well as their characteristics.
Each animal used for the experiment is identified by name.

You can define your own parameters (User Fields) to record additional information about each animal. For example: the sex of the animal, its weight, the treatment it receives, etc...

To add an animal:

- Click the button  on the main toolbar.
- Click the button  in the "Experiment" view.
- Click the button  in the toolbar of the "Workspace" panel.
- Use the contextual menu: ***New*** ***Animal*** of the "Workspace" panel.
- Click the button  in the animal list .

It is also possible to import animals from a file .

To edit an existing animal:

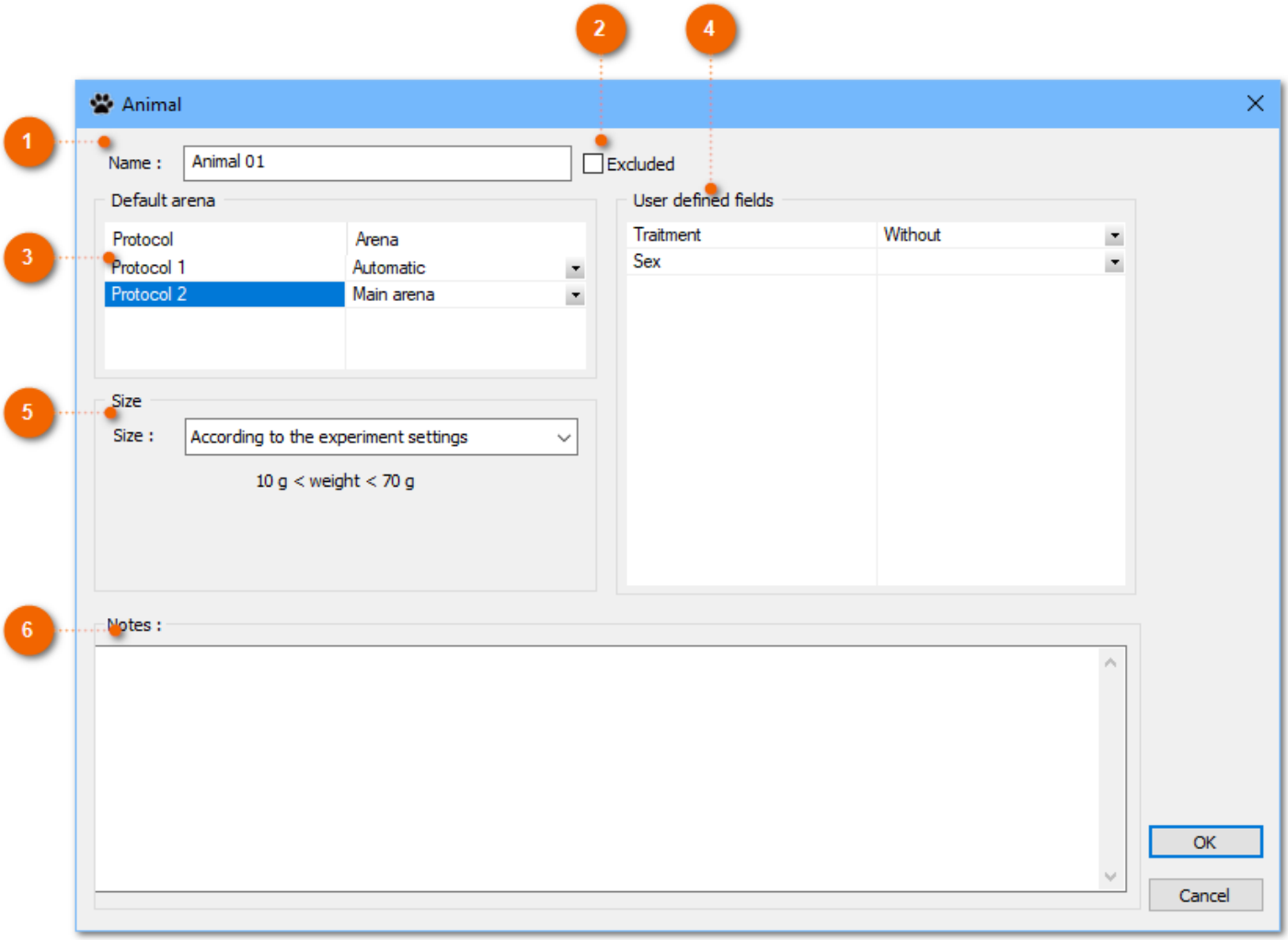
You can open the "Animal" dialog box by performing one of the following actions:

- Double click on the animal's name in the "Workspace" panel.
- Select the animal in the panel: "Workspace", then use the contextual menu: ***Modify*** .
- Select the animal in the animal list , then click the button  .

 An experiment must contain at least 1 animal.

7.1. "Animal" Dialog

This dialog box allows you to define the characteristics of an animal:



1 **Name :**

The animal's name.

2 **Excluded :**

An excluded animal can no longer be selected when creating a new test and is no longer taken into acco

3 **Default arena :**

Allows for each protocol containing several arenas, to indicate whether the animal must be placed in a particular arena.

4 **User fields :**

The values of the " User Fields " for the animal.

5 **Size :**

The size of the animal, to choose from:

- Animals " tab of the " Experiment settings dialog ".
- A pre-programmed value.
- Custom values.

This information is used to improve detection of the animal .

6 **Notes :**

You can use this area to record comments or notes about the animal.

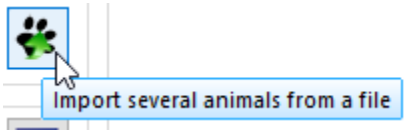
7.2. Importing multiple animals from a file

Introduction:

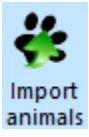
Instead of creating the animals one by one, it is possible to create several animals at the same time by importing all the data concerning them from a file created with spreadsheet software (Microsoft Excel, Open Office or other).

Import animals:

To import multiple animals from a file, you can:

Open the "Experiment" view and click on the button 

in the description of the experiment.

Open the "Experiment" view and click on the 

command ribbon button.

Open the "List of animals" view and click on the 

command ribbon button.

Open the "Animal List" view, right-click on the animal list table to bring up the context menu, then use the "Import Animals from File" menu

File format and syntax:

Ethotrack can import the list of animals from the following formats:

Microsoft Excel files, *.xlsx format (since Excel 2007) or *.xls format (Excel 97 - 2003).
*.cvs text files with semicolon as separator.

*.txt text file with tab character as separator.

The file must respect the following rules:

1/ the first line must include the column headers as in the animal list table. The keywords for the column headers are:

- "nom" or "name": the name of the animal.
- "notes" or "note": free text (if the file is in text format (csv or txt) the "notes" field must not include the separator character.
- "protocol" or "protocol": the name of the animal's default protocol. This protocol must exist and must be created before importing.
- "arèna" or "arene" or "arena": the default arena (Only if the experiment has a single protocol, otherwise you need to use the protocol name as header).
- "Protocol name" : the default arena.
- "Animals" category user fields. The fields must exist and must be created before importing. Possible values for choice type fields must also be created before importing.

Checking the header of columns or choice type values does not take into account upper and lower case letters (the name column can also be called Name or NAME).

2/ the following lines must contain the animal data with one line per animal. Blank lines are ignored.

3/ If a user field is of the "numeric value" type, the decimal separator can be a period or a comma, with no thousands separator.

If an animal already exists in the experiment, Ethotrack checks the data of the existing animal and possibly modifies the values which must be.

Sample file:

Name, Protocol, Arena, Gender, Treatment
001,Protocol1,Arena NW,Male,None
002,Protocol1,Arena NE,Female,Treatment A
003,Protocol1,Arena SW,Female,Treatment B

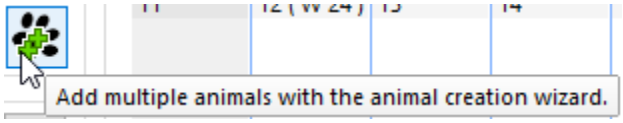
7.3. "Animals creation wizard" dialog box

Introduction:

This wizard allows to create several animals at the same time according to the user fields.

To open the wizard:

To create several animals with the wizard, you can:

- Open the"Experiment" view and click on 

in the description de the experiment.

- Open the"Experiment" view and click on 

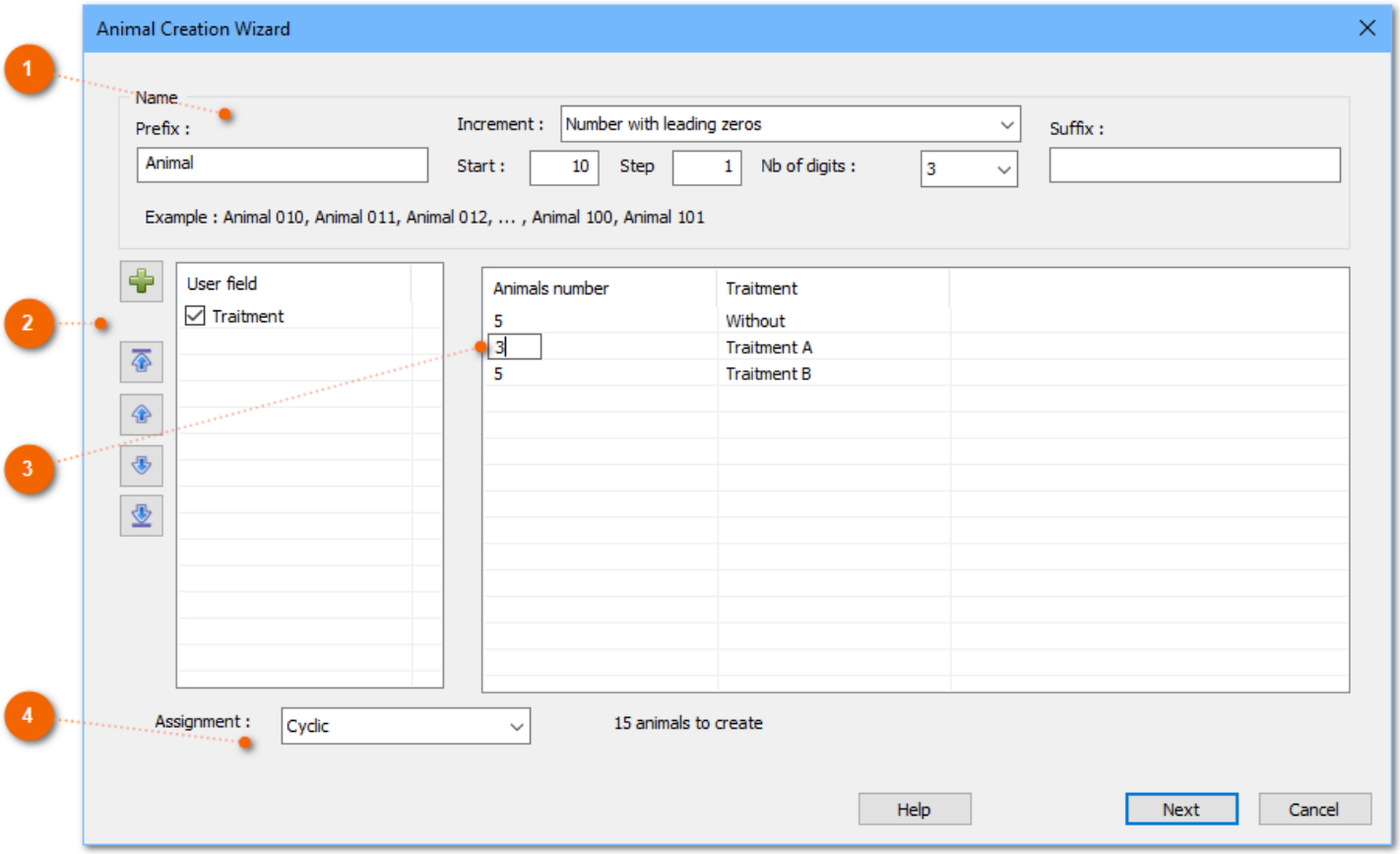
on the command ribbon.

- Open the"List of animals" view and click on 

on the command ribbon

The wizard has 2 steps :

First step :



1 **Animal's name :**

The name of the animal composed of 3 parts:

- a prefix (optional): an identical free text for all the animals.
- A different central part for the animals, which can be composed, as desired:
  - a number with leading zeros (for example: 001,002,003).
  - a number (for example 1,1,3,...)
  - uppercase letters (for example: A, B, C, ... AA, AB, ...)
  - lowercase letters (for example: a, b, c, ... aa, ab, ...)
- a suffix (optional): an identical free text for all the animals.

The name of each animal can be changed in step 2.

2 **User fields :**

The list of all user fields of category "animals" and type "choice".
Select the user fields for which you want to create animals by checking the corresponding box.

3 **Number of animals :**

This list displays all possible combinations of selected user fields. Click on the first column to specify the number of animals to create for each combination.

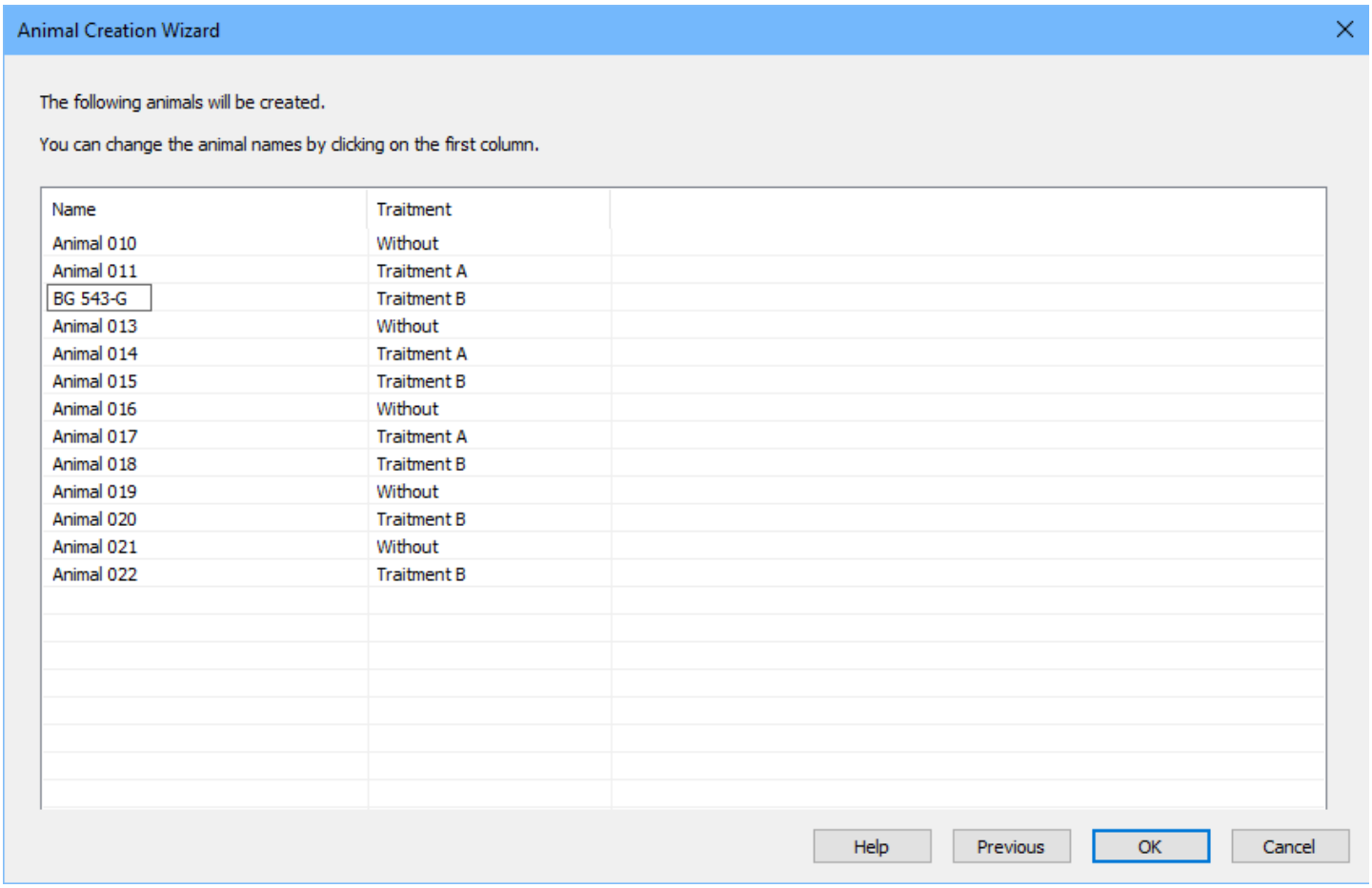
Assignment :

The order in which the animals will be created:

- Cyclic: 1 animal for each combination, then a second animal for each combination, etc., until the number of animals to be created for each combination is reached.
- By group: the number of animals to create for the first combination, then the number for the second combination, then ...

Once you are satisfied with the configuration clisk on "Next".

Second step :



This step presents the list of all the animals that will be created.
You can change the name of each animal individually if the naming rule specified in step 1 does not suit you.

8. Tests

Definition :

A test corresponds to **1** recording of the behavior of **1** animal.

A test takes place in 3 steps:

1. **Test definition :** this step allows you to define the main parameters of the test such as the protocol chosen or the animal used.
2. **Recording a video of the animal:** this step consists in recording a video of the animal according to the parameters defined in the protocol. Video can be recorded by Ethotrack or other software.
3. **Analysis of the recorded video :** this step consists of analyzing the video of the test to detect the position of the animal.

8.1. Test definition

This step makes it possible to define the main parameters of the test such as the chosen protocol or the animal used.

You can define your own settings (User Fields) to record additional information about each test. For example: the time elapsed after the treatment, the weight of the animal during the test, its state of health, etc...

You can also plan the next step by indicating the planned check-in date. In this case, the test will automatically appear a few days before the scheduled date in the list of tests to be performed in the main Experiment view .

Normally, it is advisable to let **Ethotrack** generate the tests automatically based on the stages and trials defined in the protocol. If your experience requires it, it is possible to add tests manually to those automatically generated by **Ethotrack**, or to disable the automatic generation function and create the tests manually.

To add a test:

- Click the button  on the main toolbar.
- Click the button  in the "Experiment" view.
- Click the button  in the toolbar of the "Workspace" panel.
- Use the contextual menu: ***New*** ▸ ***Test*** of the "Workspace" panel.
- Click the button  in the Tests list .

To modify an existing test:

open the "Test" dialog box by performing one of the following actions:

- Double click on the name of the test in the "Workspace" panel.
- Select the test in the panel: "Workspace", then use the contextual menu: ***Modify*** .
- Select the test from the Tests list , then click the button  .

To automatically create multiple tests:

- Click the button  in the "Experiment" view to open the test creation wizard.

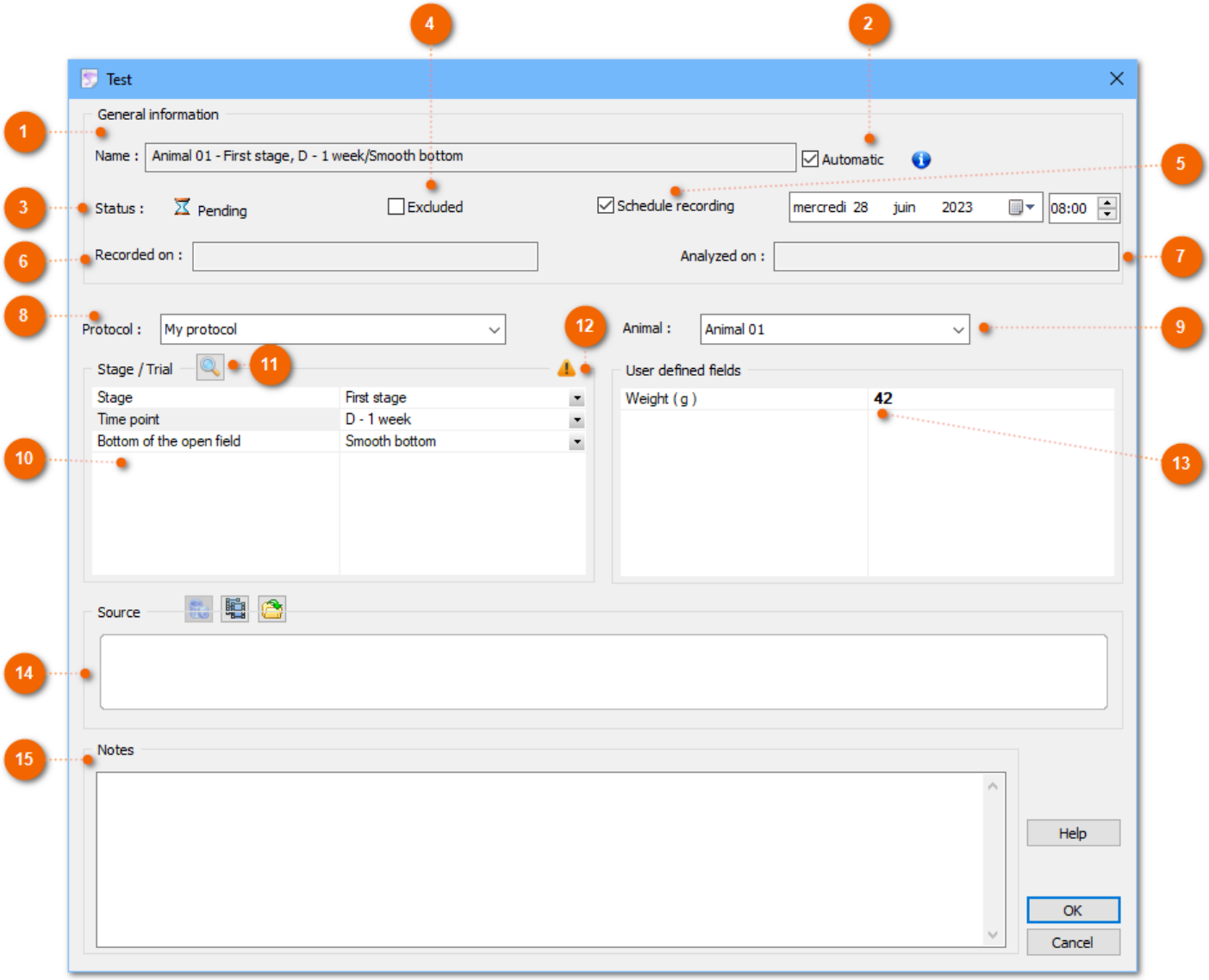
- Once created and as long as the video is not recorded, the status of the test is :  Pending.

- A test created automatically by Ethotrack is indicated by the icon  .

- If you modify an automatically created test it is excluded from automatic generation.

8.1.1. "Test" Dialog

This dialog box is used to define the parameters of a test.



Name :

The name of the test

2 **Automatic :**

Check this box to have the test name generated automatically. To modify the automatic name of the tests, please consult the " General " tab of the corresponding protocol.

3 **Status:**

The status of the test.

4 **Excluded :**

Check this box to exclude the test from all reports.

5 **Scheduled recordingdate :**

If you want to schedule the recording date for the video, check this box and specify the scheduled recording date. A few days before this date, a reminder will appear in the to-do list in the experiment view.

6 **Recordingdate :**

The actual recording date of the video.

7 **Analysis date :**

The date of analysis.

8 **Protocol:**

The protocol used for this test.

9 **Animal :**

The animal used for this test.

10 **Stage and trial :**

Selection of the test stage and trial.

11 **Trialselection button**

Opens a dialog box that allows you to select a trial from all the free trials for the selected animal.

12 **Error icon**

Normally there should be only one test per animal per trial. This icon indicates that a test already exists for this animal and this trial.

13 **User defined fields :**

The values of the " User Fields " for the test.

14 **Source :**

The source of the test video and the arena in which the animal is placed during the test. The video source can be recorded from the webcam defined in the protocol, or be a video file present on the computer.

 : remove the link with the video.

 : select a video from the list of videos in the experiment.

 : select a video file on the computer. The file will be automatically added to the video list.

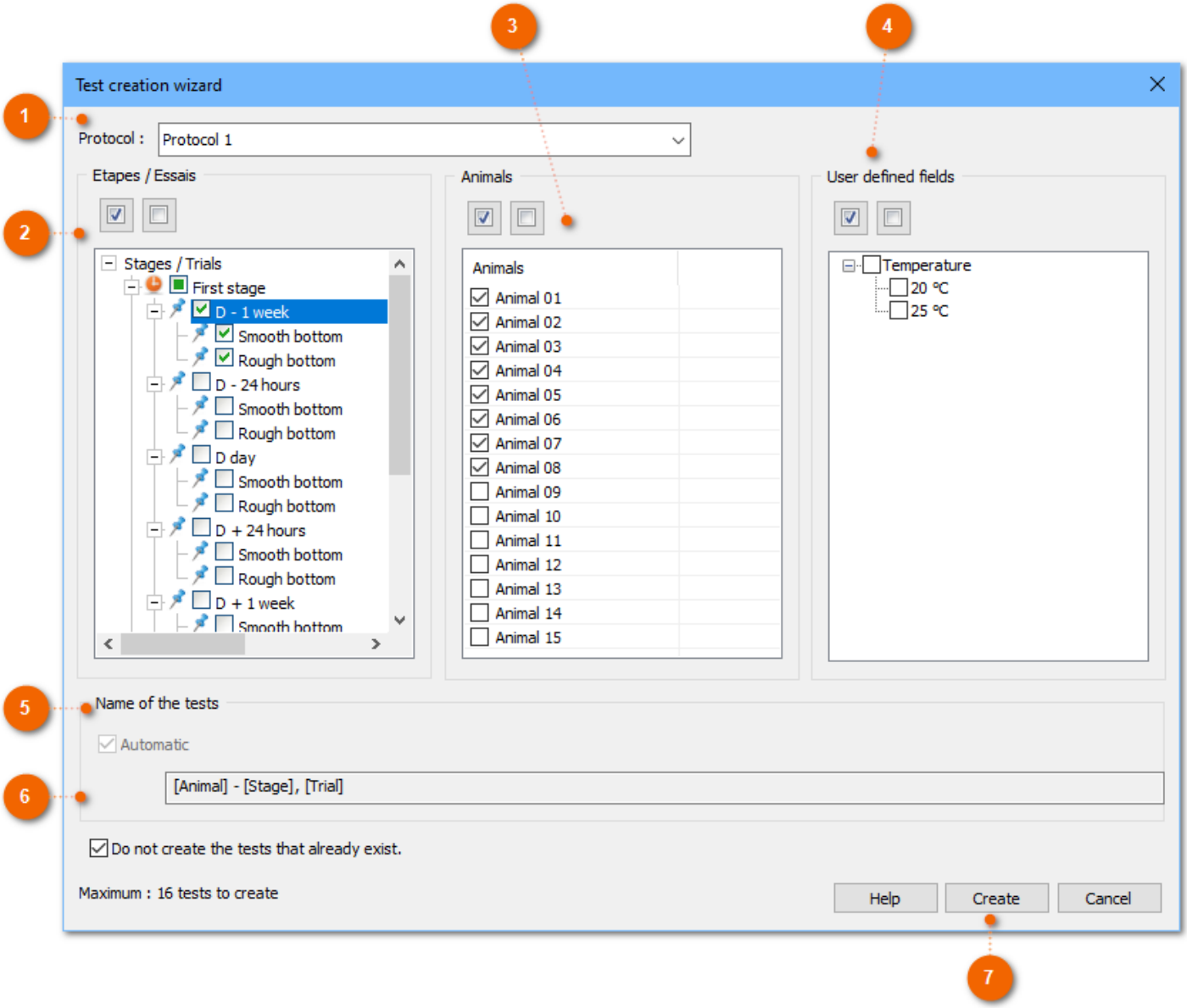
15 **Notes :**

You can use this area to record comments or notes about the test.

8.1.2. "Test creation wizard" dialog box

This wizard allows to automatically create all the tests of a protocol according to the user fields.

Important note : since version 5, it is preferable to use the function of automatic creation of tests from the "Stage" tab of the configuration dialog of a protocol rather than this wizard.



1 **Protocol :**

Selection of the protocol for which the wizard must create the tests.

2 **Animals :**

Selection of the animals for which the assistant must create the tests.

3 **Stages / Trials :**

Selection of the trials for which the assistant must create the tests.

4 **User definde fields**

Selection of the user fields (of "tests" category and of "choice" type) for which the wizard must create the tests.

5 **Name of the tests :**

The name of each test is created automatically.

6 **Do not create tests that already exist**

If this box is checked, tests that already exist (ie with the same animal and the same user field values) are not created by the wizard.

7 **Create :**

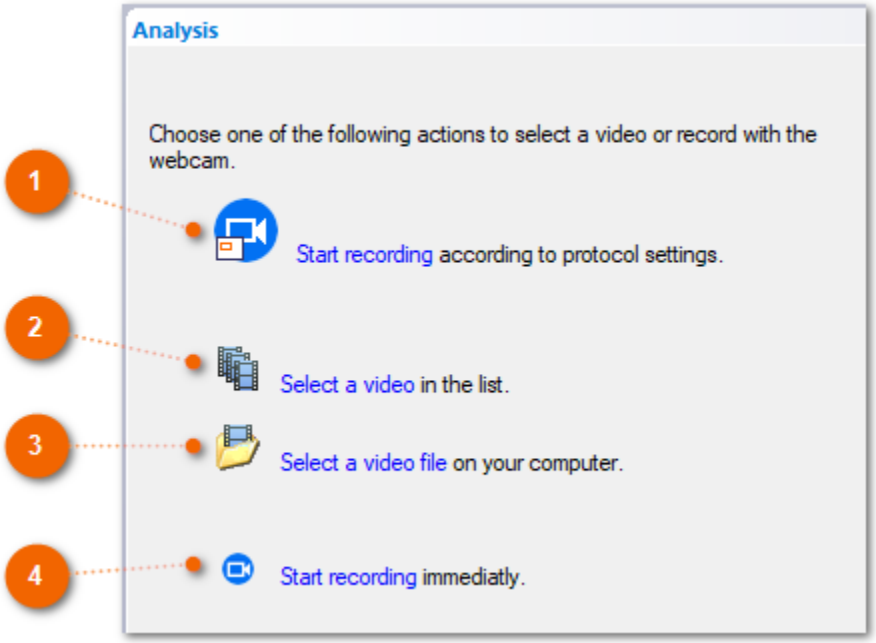
Click this button to start the test creation procedure.

8.2. Selecting a video

This step consists of selecting the test video.

To select a video:

Click on one of the buttons in the "Analysis" side panel.



1 **Start recording according to protocol settings:**

Start recording according to protocol settings.The start and end of the recording will be done in accordance with the protocol.

2 **Select a video in the liste :**

Open "Video Selection " dialog box to select a video from the video list.

3 **Select a video file on your computer :**

Select a video file on the computer and add it to the video list.

4 **Start recording immediatly:**

Start recording immediately regardless of the start and end conditions of protocol recording (recording will not stop automatically

Once the video has been selected, the test status becomes:

- Saved: The video is saved, but has not been analyzed.

Where

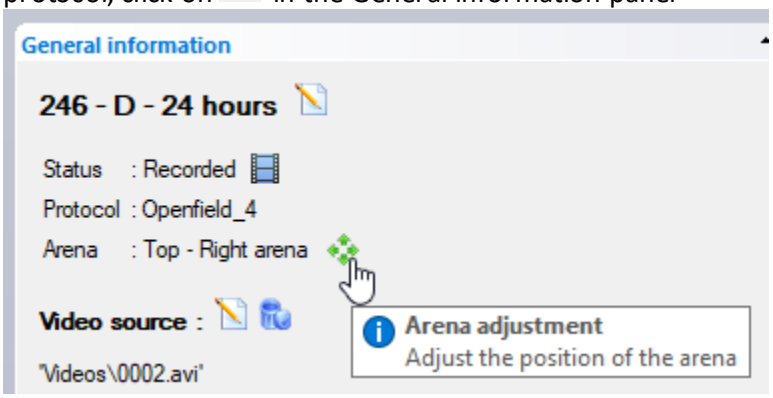
- Recorded (video missing): video is recorded, but the file is not found

8.3. Video analysis

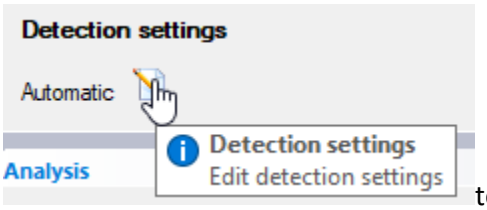
This step consists of analyzing the video of the test to detect the position of the animal.

To start the analysis :

1. Click on the test name in the Workspace to select the test as the current test.
2. If the actual arena where the animals are located is not correctly aligned with the arena defined in the protocol, click on in the General information panel



to " Adjust the arena ".

3. Optionally, Click the button near the detection mode 

to change the detection settings .
4. Click the button in the analysis part of the "Information" pane to start analyzing the video.

The status of the test becomes:

Analyzed: The video is recorded and analyzed.

8.3.1. Arena Adjustment

When the experiment lasts several days, even several weeks, it can happen that the camera or the workspace are accidentally moved. In this case, when recording a new test, you may find that the arena defined in the protocol no longer corresponds to the real arena where the animals evolve.

If this case occurs, you must not modify the arena in the protocol because it would disturb all the tests already carried out.

To correct arena misalignment, you can :

- use the automatic adjustment function with position ajdustment marks in the "Arena / Zones" tab of the protocol.
- manually adjust the position of the arena in the current test view.
- adjust the video position in the current video view.

Using the automatic adjustment function is recommended, but requires a hardware modification of the enclosure in which the recordings are made. If such a modification is impossible or if videos have already been made without adjustment marks, it is always possible to perform a manual adjustment before analyzing the video.

In case of manual adjustment :

- If the protocol includes secondary arenas, it is advisable to adjust the video (because the adjustment of the main arena is automatically carried over to the secondary arenas) and then copy this adjustment to the videos recorded under the same conditions.

- If the protocol includes only one arena, you can choose to adjust the video or adjust the arena of the test and copy this adjustment to the tests recorded under the same conditions.

The arena adjustment defines the transformation rules (moving, resizing and rotation) to be applied to the image coming from the camera to match the arena defined in the protocol and the real arena.

For an unanalyzed test :

the position of the arena is determined according to the following rules :

1. If the arena has been adjusted in the "current test" view, this adjustment takes priority and the arena position is the one defined manually.

2. Otherwise, and if the video position is adjusted, the arena position is recalculated according to the video adjustment.

Otherwise, and if position adjustment marks are defined in the "Arena / Zones" tab of the protocol, the psoition of the arena is automatically recalculated based on the position of the marks.

3. Otherwise, the arena position is the one defined in the protocol.

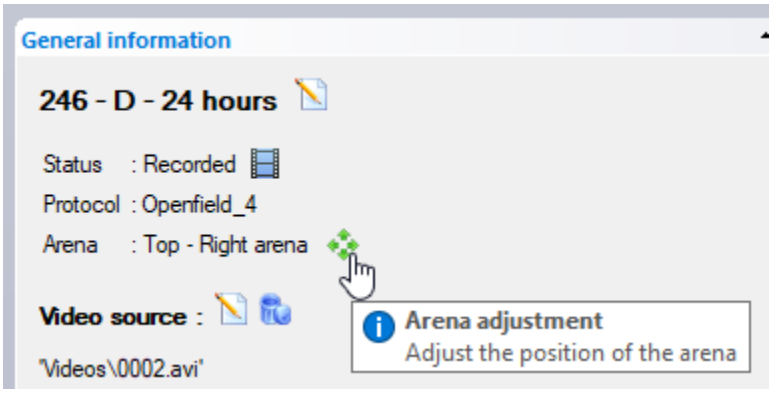
When the test is analyzed :

The arena position is memorized during analysis so that it can be used for display and reports even if the video position is adjusted later.

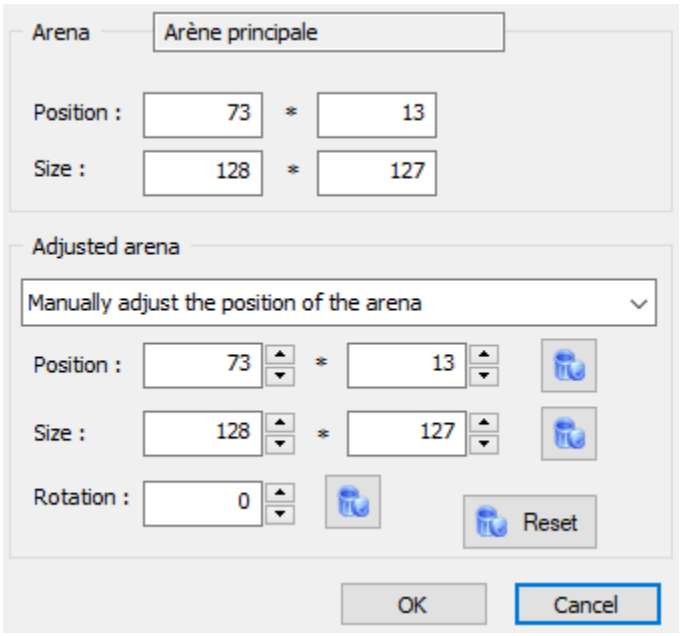
Note : Before Ethotrack version 5.3, the arena position was not memorized during analysis and the video position was not adjustable. For tests analyzed with a version prior to version 5.3, the arena position used for display and reports is therefore either the position manually adjusted before analysis or the position defined in the protocol.

To adjust the arena for a test :

1. Open the relevant test.
2. In the "Information / General" side panel, click on the button located on the "Arena" line



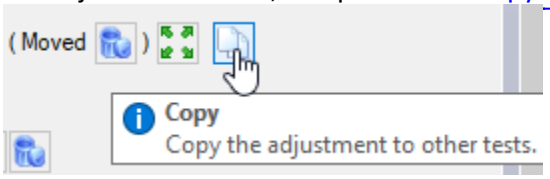
to open the "Adjust arena" panel :



3. Select "Manually adjust the position of the arena".
4. Adjust the arena to match the real arena :
   - using the buttons .
   - or, by moving the arena directly with the mouse on the test image.
   - or, using the arrow keys :arrow alone to move the arena; [Shift key]+arrow to resize.

Arena adjustment is possible only if the test has not yet been analyzed.

When the arena position has been adjusted for a test, it is possible to copy this adjustment to other tests. To do this, simply click on the button



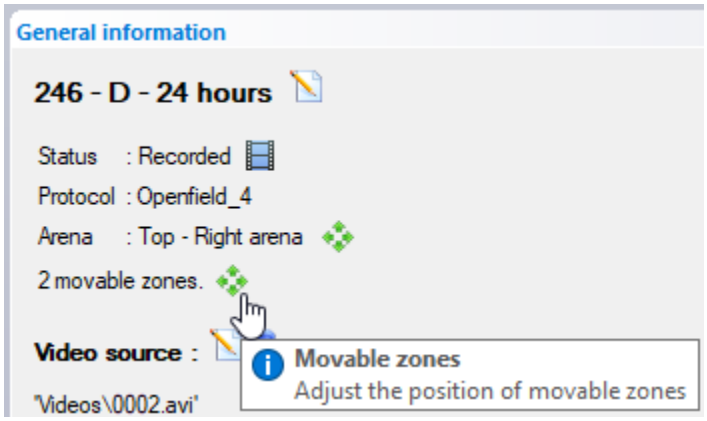
8.3.2. Adjusting the position of a movable zone

Definition :

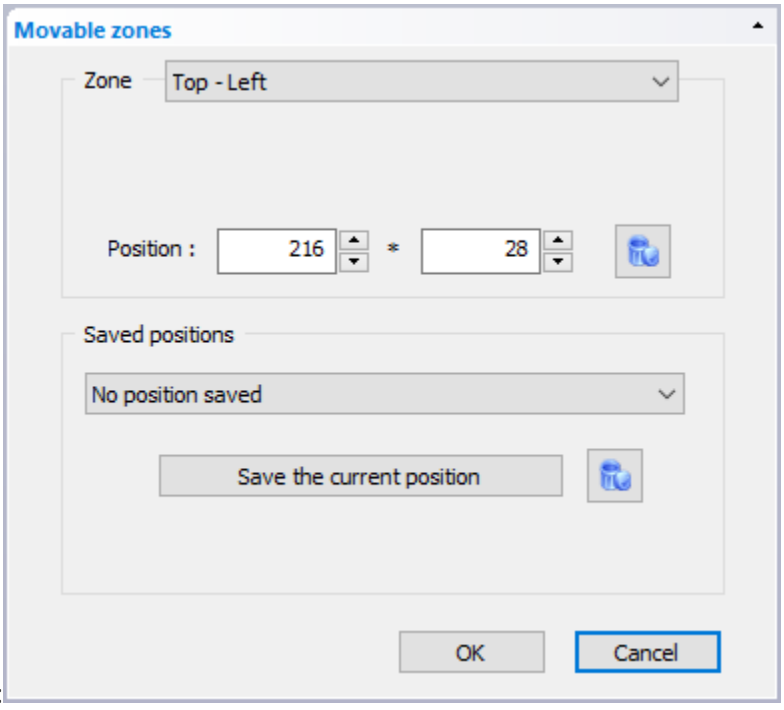
a movable zone is a zone whose position can vary according to the tests.

To adjust the position of a movable zone:

1. Open the relevant test.
2. In the "Information / General" side panel, click on the button located on the line indicating the number of movable zones



to open the panel: "Movable zones":



3. Select the zone to move from the list.
4. Move the zone :
   - using the buttons .
   - or by moving the zone with the mouse over the test image.

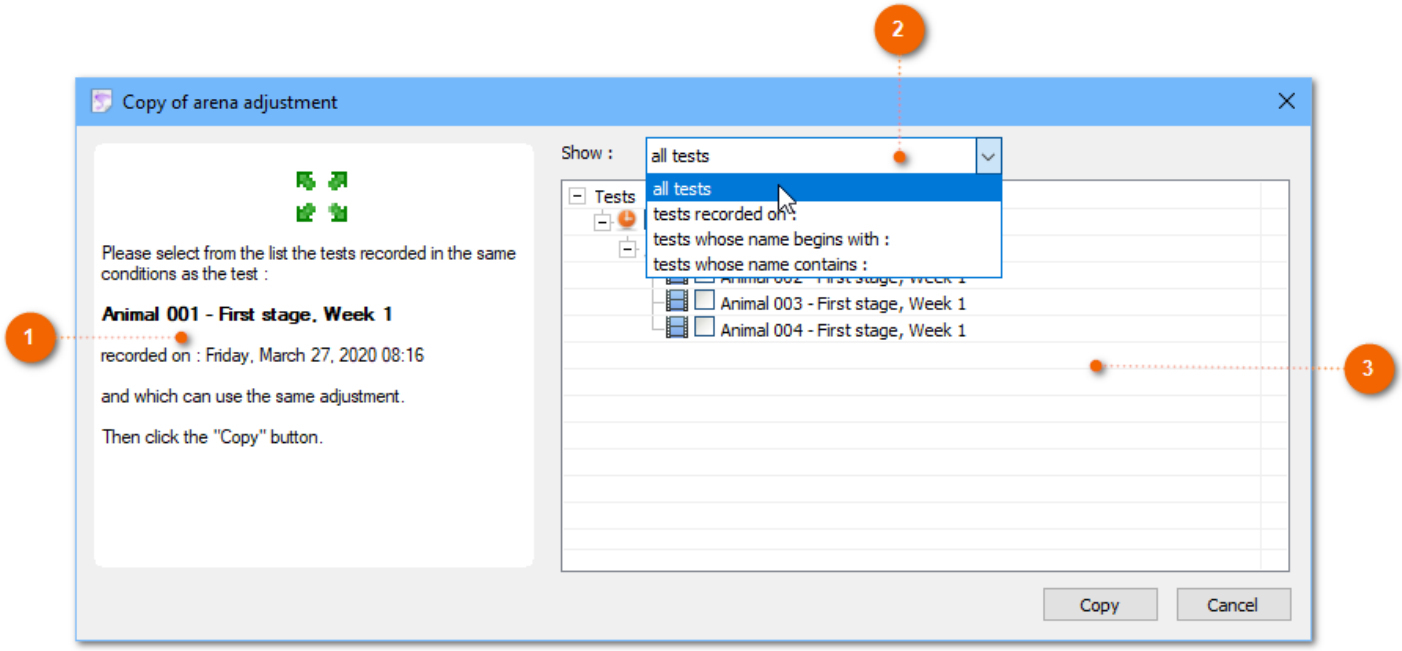
- or, by using the arrows of the keyboard.

If the test is analyzed, the adjustment is not possible if the zone is used by the analysis sequencer of the protocol.

You can save the position of a zone so that you can reuse it in other tests.

8.3.3. Copy of arena or movable zones adjustment

This dialog box allows you to copy the arena adjustment or the position of the moving zones from one test to other tests.



1 **Reference test :**

The original test on which the arena position is adjusted.

2 **Test filtering options :**

Options to filter the tests displayed in the list according to recording date or name.

3 **List of tests :**

The list of tests that match the filter options.

only tests with the same protocol and arena as the reference test are displayed.

8.3.4. Detection settings

The Ethotrack detection module has several algorithms in order to allow a good detection of the animal whatever the conditions of the experiment. Automatic mode (default mode) does not require any adjustment and gives good results in most cases . If the detection conditions are more difficult (low contrast between the animal and the background of the image, variation in brightness, etc.) and if the automatic mode does not provide a sufficient detection rate, you can use the one of the following 5 manual modes in order to find the best settings adapted to the situation:

- Grayscale : In this mode the original image is converted to grayscale. All pixels whose value falls within a given interval are detected.
  This mode gives very good results when the image background is uniform and the contrast between the animal and the image background is high.

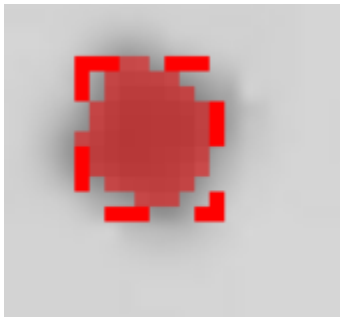
- Image Subtraction : This mode uses a black and white reference image of the experimental area recorded in the absence of any animals.
  During the test, the current image is transformed into black and white and compared to the reference image. The differences between the 2 images indicate the position of the animal.
  This method is effective when the recording conditions (and in particular the light conditions) do not vary during the experiment.

- Image Subtraction (advanced) : This mode uses a color reference image of the experiment area recorded in the absence of any animals.
  During the test, the comparison of the current image with the reference image can be made on a single color layer (red, green or blue) or on the combination of the 3 color layers.
  This method is effective when the arena background is in color and there is low contrast between the background and the animal.

- Color (simplified) : In this mode the color information of the image is analyzed. This mode is called: "simplified" because it only requires setting a tolerance value around the reference color.

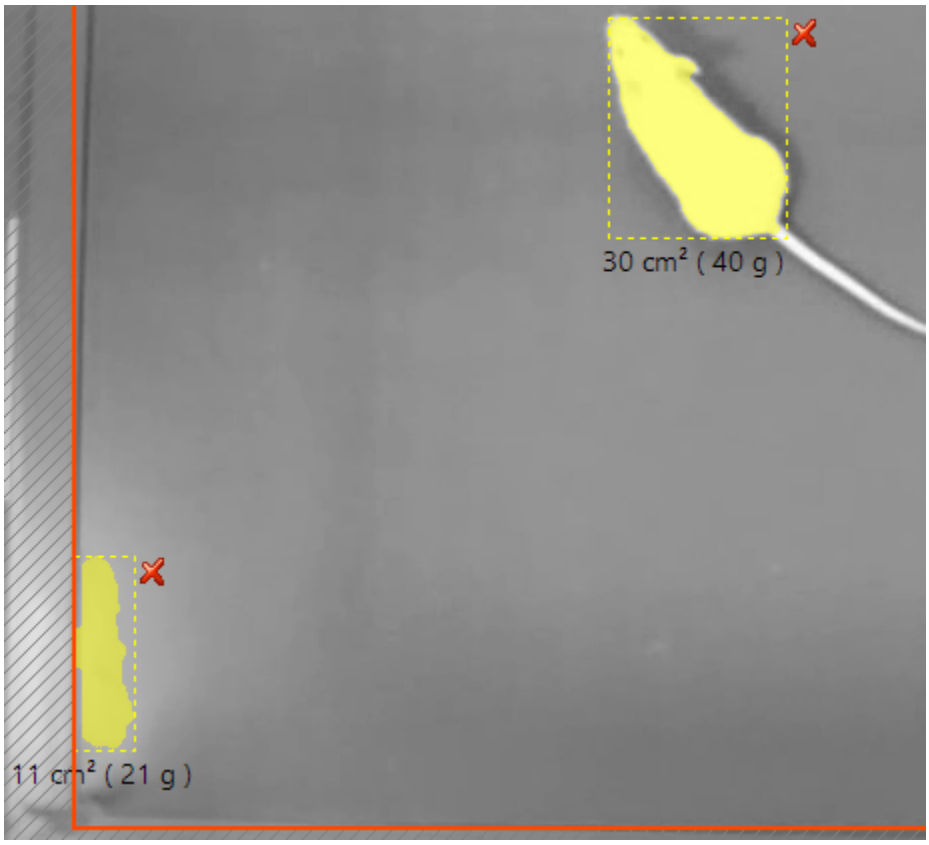
- Color (advanced) : In this mode the color information of the image is analyzed. The representation of the colors of the image uses the model TSV (Hue Saturation Value), also called HSV (Hue Saturation Value) or HSB (Hue Saturation Brightness) in English. In this mode it is possible to fine tune the detection range for each color component. This mode allows finer adjustment than the "Color (simplified)" mode for a user who is familiar with the HSV color management model.

In detection parameter settings mode, each detected area of the image is clearly marked with a color and a bounding box. By default, detected areas are indicated as follows :

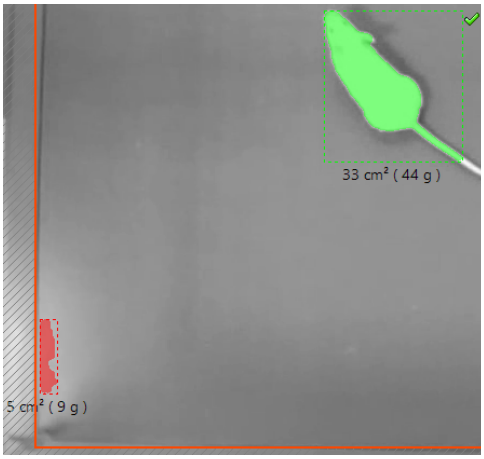
		
This area is detected, but cannot correspond to an animal because of its shape or size.	This area could correspond to an animal, but it's not the only one. There is another area in the arena that could also correspond to an animal.	This area can correspond to an animal and it is the only one.

Note : the appearance of detected areas can be configures using the display panel.

In order to allow a precise adjustment, each modification of a parameter is immediately taken into account and its effects visible on the current image of the video :

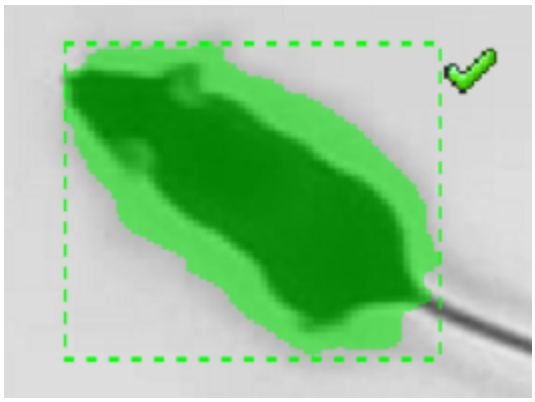


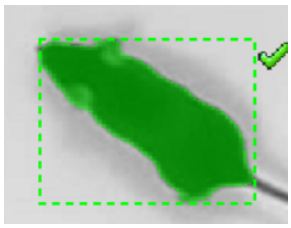
Several zones are detected, and at least two meet the size criteria : **detection is poor**.
To improve detection, you can modify the detection threshold or reduce the size filter range.



Several zones are detected, but only one matches the size criterion. The animal's tail is detected : **the detection is correct, but can be improved**.
To improve detection, it is recommended to adjust the detection threshold.

The detection parameters must be adjusted so that the detected area corresponds as closely as possible to the surface area of the animal :





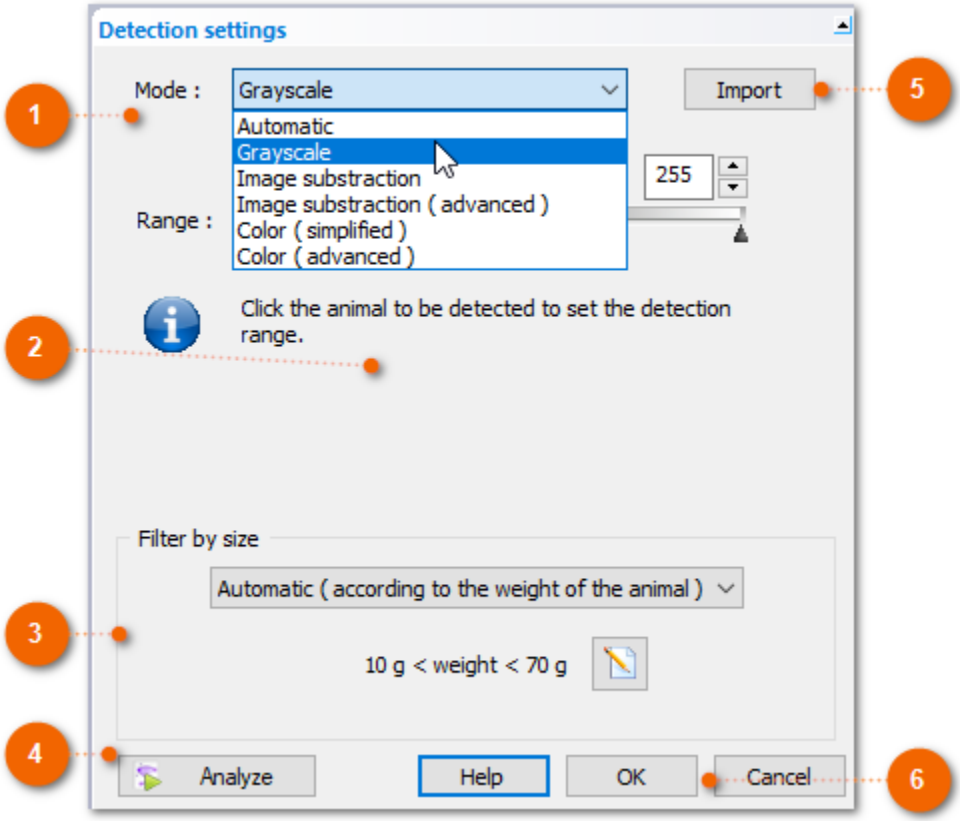
Incorrect setting.	Incorrect setting.	Correct setting.
Threshold too low : the animal is not fully detected.	Threshold too high : the shadow around the animal is detected.	

When adjusting detection settings, it's best to choose an image where the animal isn't on the edge of the arena. The edge can cast unwanted shadows that make detection more difficult. The animal might also climb onto the edge and appear smaller.

Once the detection settings seem correct, it's necessary to check them on several images, and then on the entire video.

Regardless of the detection mode chosen, filtering according to the size of the animal improves detection.

Description of the "Detection Settings" side panel :



Mode :

Selection of the algorithm used for detection:

- Automatic
- Grayscale
- Image Subtraction
- Image subtraction (advanced)
- Color (simplified)
- Color (Full)

2 **Mode settings:**

Central part which varies according to the choice of the detection algorithm.

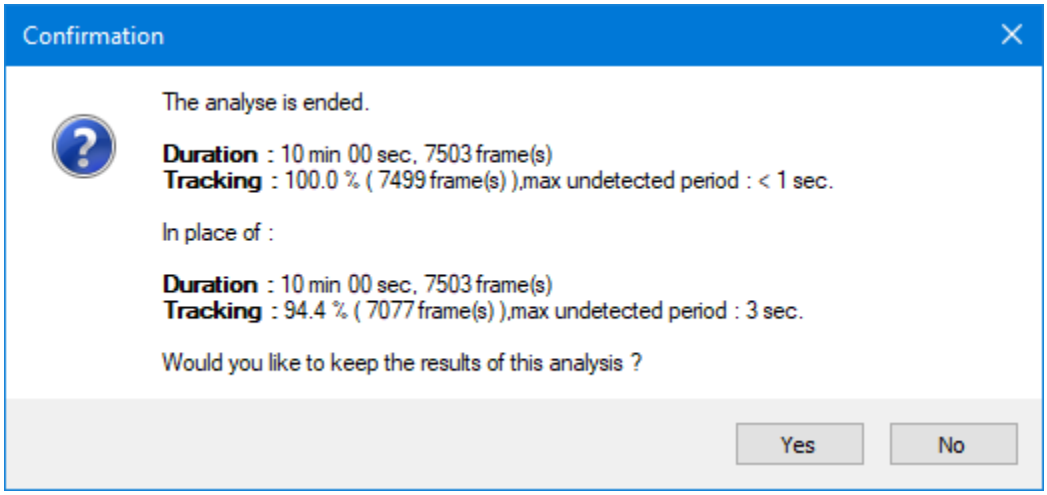
3 **Filter by animal size :**

Choice of filtering parameters according to the size of the animal. For more information, see the section: Filtering according to the size of the animal.

4 **Analyze :**

When the adjustment looks good on an image, click this button to run a full analysis and check that the animal detection is correct on the whole video.

Once the analysis is finished, you can choose to keep these results, or to return to the previous analysis.



- Click "Yes" to save the detection settings and analysis results.
- Click "No" to keep the results of the previous analysis.

5 **Import :**

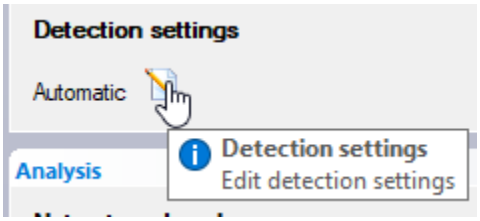
Click this button if you want to import detection settings from another test.

6 **Ok / Cancel :**

Use one of these buttons to close the detection settings modification panel. "Ok" to save the new detection settings or "Cancel" to return to the previous configuration.

To open this panel:

- Click the button in the "Detection Settings" area of the test information side panel



8.3.4.1. Automatic

Automatic mode is the default detection mode and requires no adjustment.

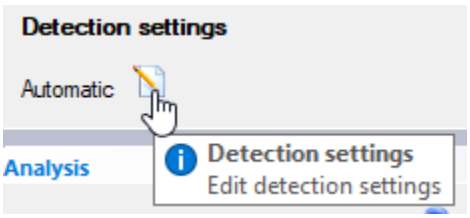
This mode generally gives good results. However, if the detection conditions are difficult (low contrast between the animal and the background of the image, variation in brightness, parasitic shadows, etc.) it is sometimes possible to obtain a better detection rate with a manual mode correctly set.

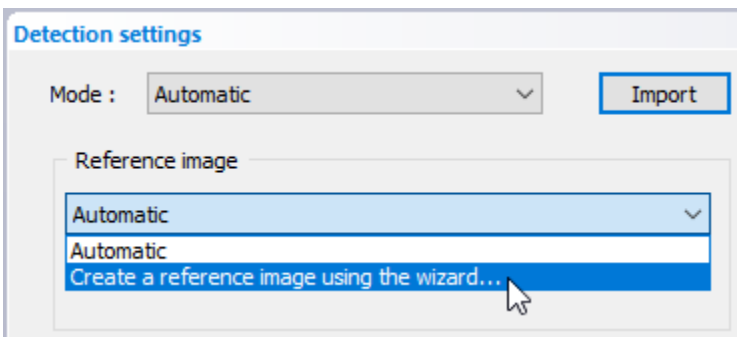
Automatic mode needs a reference image to detect the animal. Normally, this image is created automatically by Ethotrack at the start of the analysis. In some cases, it may happen that Ethotrack fails to create the reference image (especially if the animal moves very little). In this case, Ethotrack will offer you to use the reference image creation wizard to create an image manually.

If the detection rate obtained with the automatically created image is too low, you can help Ethotrack by defining the reference image yourself using the reference image creation wizard .

For it :

Click the button in the test information area
In the tab corresponding to automatic mode :



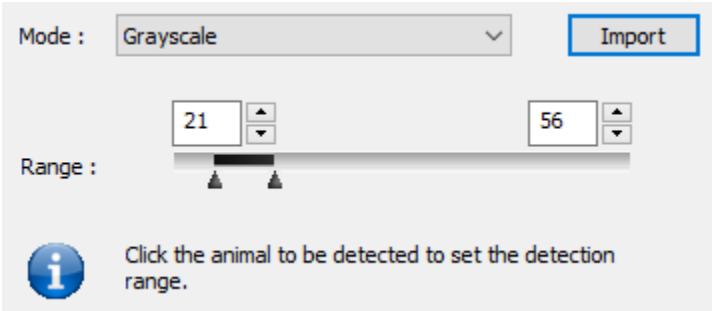


Choose "Create reference image using wizard..."

8.3.4.2. Grayscale

In this mode the original image is converted to grayscale.
All pixels whose gray level is included in the given interval are detected.

This mode gives very good results when the contrast between the animal and the background of the image is high.



To set the detection interval, you can either:

- Use arrows 
- Move the cursor with the mouse.
- Click on the animal to detect

8.3.4.3. Image Subtraction

This mode uses a reference image of the experiment area recorded in the absence of any animal. During analysis, the current image is compared to the reference image. The differences make it possible to locate the animal.

Simplified mode uses a black and white reference image and requires less adjustment. This mode is sufficient in most cases and is to be preferred because it requires fewer resources.

The advanced mode uses a color reference image and in some cases allows better detection thanks to more precise settings.

The reference image is an image of the arena in which there are no animals. This image can be created from the current test video, even if the animal is visible throughout the recording.

The same reference image can be used for several tests if it is saved in the image library .

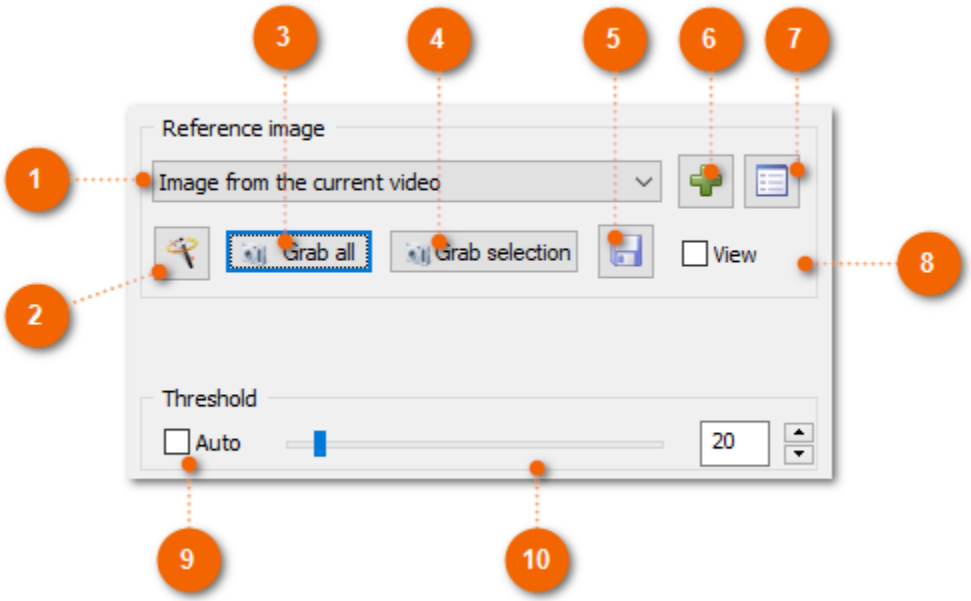
8.3.4.3.1. Simplified mode

This mode uses a black and white reference image of the experimental area recorded in the absence of any animals.

During the test, the current image is compared to the reference image. The differences between the 2 images indicate the position of the animal.

This method is effective when the recording conditions (and in particular the light conditions) do not vary during

the experiment.



1 **Image :**

Selection of the reference image among the images of the image library, or creation of a new image from the video of the current test.

2 **Reference Image Creation Wizard :**

Open the wizard for creating a reference image .

3 **Grab All :**

Creation of a new reference image : selection of the entire image.

4 **Grab selection :**

Creation of a new reference image : the current selection replaces the corresponding part of the reference image.

5 **Save :**

Save the reference image in the image library so that it can be reused in another test.

6 **Add :**

Creation of a new image from the video of the current test.

7 **Image Library :**

Open the Image Library.

8 **View :**

Open of a window to view the reference image.

9 **Threshold : Auto**

Check this box to let Ethotrack automatically adjust the detection threshold.

10 **Threshold :**

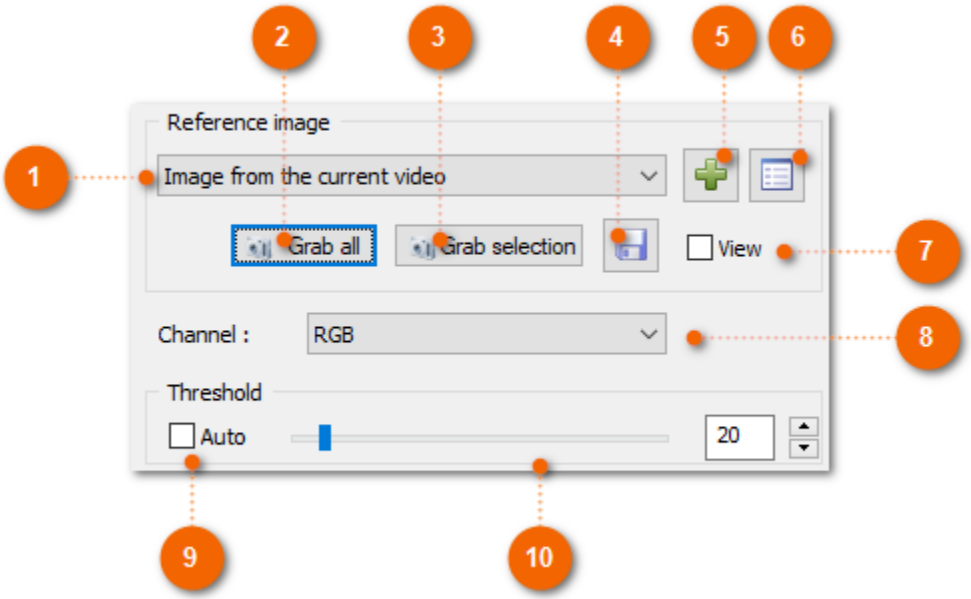
Detection threshold if manual.

8.3.4.3.2. Advanced mode

This mode uses a color reference image of the experiment area recorded in the absence of any animals.

During the test, the comparison of the current image with the reference image can be made on a single color layer (red, green or blue) or on the combination of the 3 color layers.

This method is effective when the arena background is in color and there is low contrast between the background and the animal.



1 **Image :**

Selection of the reference image among the images of the image library, or creation of a new image from the video of the current test.

2 **Grab all :**

Creation of a new reference image : selection of the entire image.

3 **Grab selection :**

Creation of a new reference image : the current selection replaces the corresponding part of the reference image.

4 **Save :**

Save the reference image in the image library so that it can be reused in another test.

5 **Add :**

Creation of a new image from the video of the current test.

6 **Image Library:**

Open the Image Library .

7 **View :**

Open of a window to view the reference image.

8 **Channel :**

Selecting the color channel.

9 **Threshold, Auto :**

Check this box to let Ethotrack automatically adjust the detection threshold.

10 **Threshold**

Detection threshold if manual.

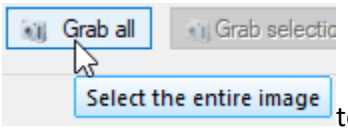
8.3.4.3.3. Creating a reference image

A reference image is an image of the arena that does not contain any animals.

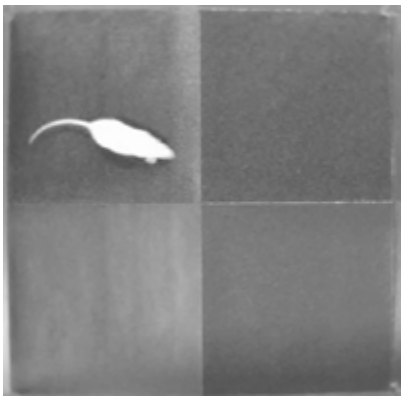
To create a reference image:

1. Choose "Image created from current video" from the drop-down list or click the button 
2. Select an image from the current video using the buttons on the playback control panel:

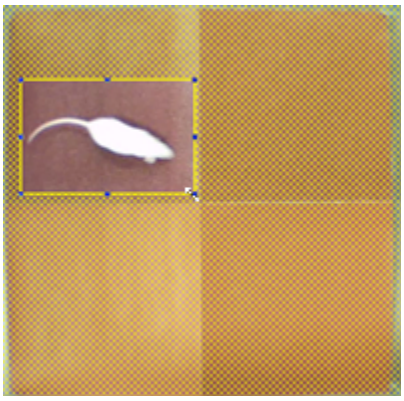
   - If possible choose an image containing no animal.
   - Otherwise choose an image where the animal is located in a corner of the arena.

3. Click on 

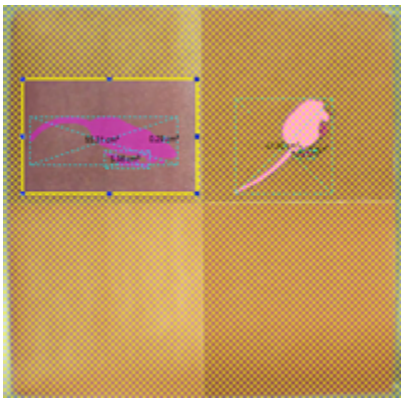
to memorize the entire image.
4. If the stored image contains an animal:

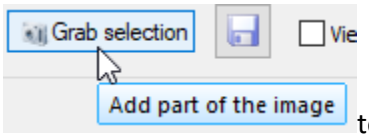


1.1. Using the mouse, draw a selection box around the animal, directly in the video playback area :



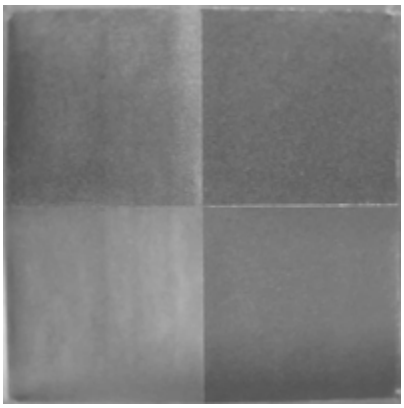
1.2. Using the buttons on the playback control panel,  select a new image of the video where the animal has moved and left the selection area :



1.3. Click on 

to replace, in the reference image, the part delimited by the selection by that of the current image.

1.4. The reference image thus created no longer contains an animal:



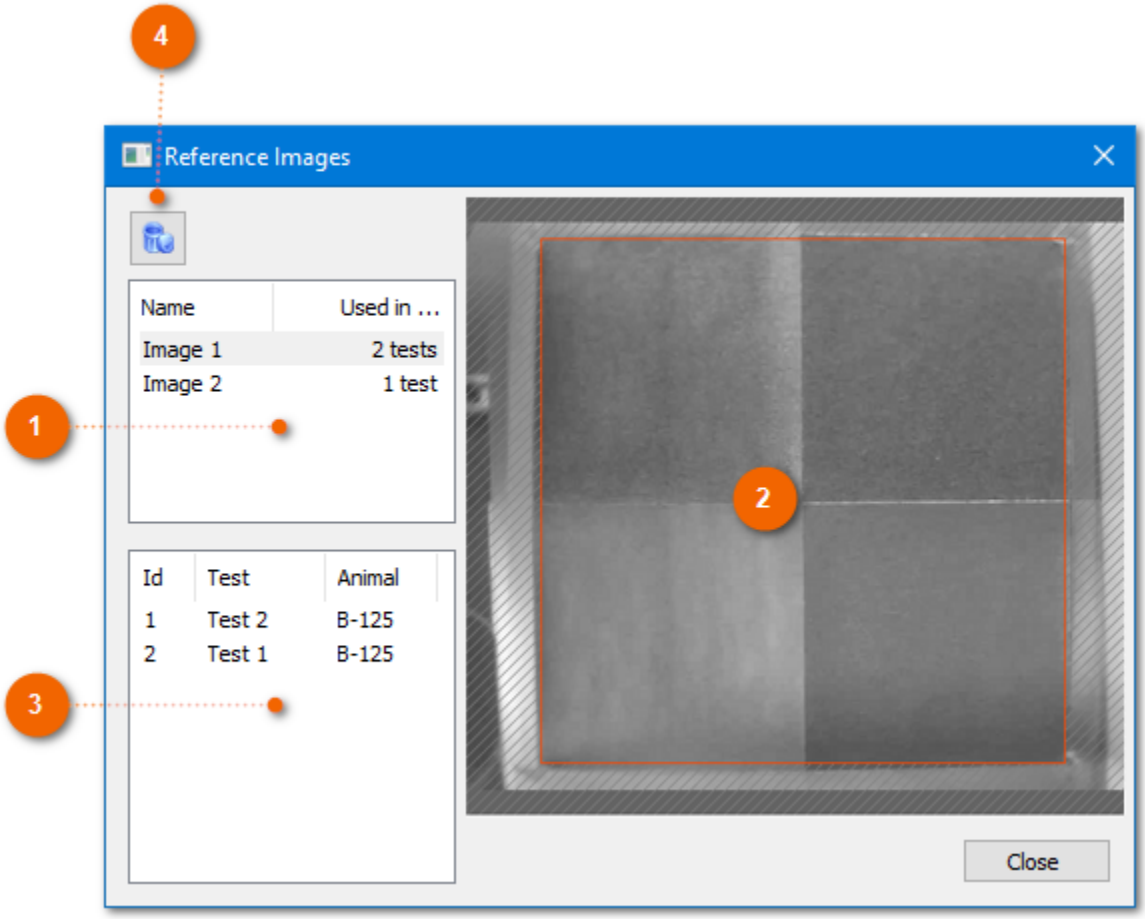
In image substraction mode (simplified) you can also use the reference image creation wizard by clicking on  .

If you want to use this reference image for several tests you must save it in the image library . To do this, simply click on the button  .

8.3.4.3.4. Image Library

To be able to use the same reference image for several tests, it must be saved in the image library.

Image LibraryDialog:



1 **List of images :**

The list of saved images with the number of tests in which each image is used.

2 **Image :**

The selected image.

3 **Tests :**

The list of tests that use the selected image.

4 **Delete :**

Button for deleting the selected image.

To open the Picture Library:

- Click the button Refference images of the command ribbon of the "Experiment" view.
- Click the button  in the detection settings edit panel.

To save an image to the Image Library:

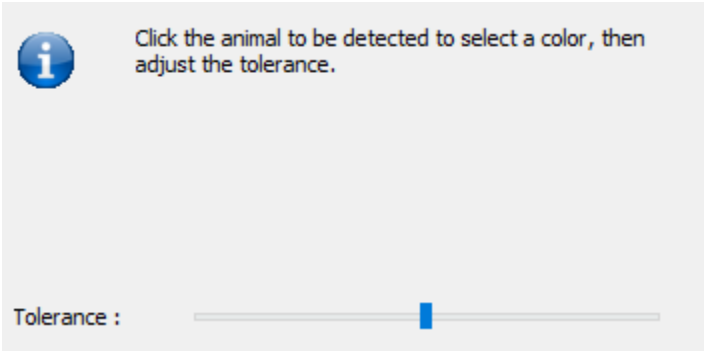
- Click the button  in the detection settings edit panel.

Saving an image to the library uses a lot of space in the experiment file. In order to limit the file size, it is advisable to save only the images used in **several tests**.

When a reference image is not saved in the image library, it is automatically recreated from the video when necessary. For this, only the information allowing to recreate the image is saved. This limits the size of the experiment file.

8.3.4.4. Color (Simplified)

In this mode the color information of the image is analyzed.
This mode is called: "simplified" because it only requires setting a tolerance value around the reference color.

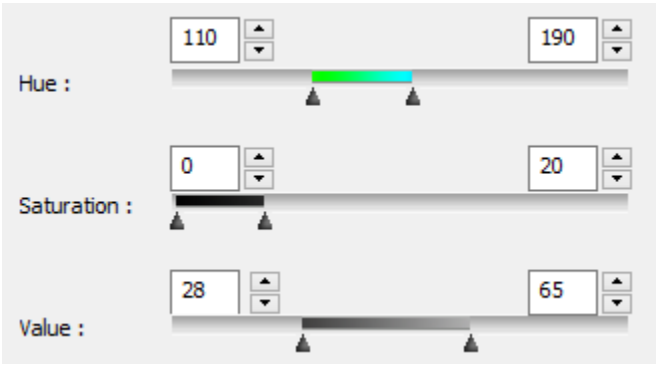


Click on the animal to detect, then adjust the "Tolerance" slider.

8.3.4.5. Color (Full)

In this mode the color information of the image is analyzed.

The representation of the colors of the image uses the model TSV (Hue Saturation Value), also called HSV (Hue Saturation Value) or HSB (Hue Saturation Brightness) in English.



Click on the animal to detect, then adjust the values by:

- Using the arrows 
- Moving the cursors with the mouse.

This mode allows finer adjustment than the "Color (simplified)" mode for a user who is familiar with the HSV color management model.

8.3.4.6. Filtering by animal size

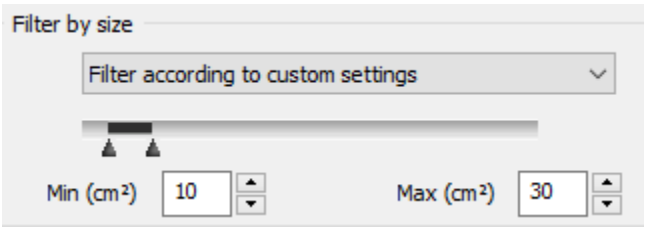
Filtering according to the size of the animal improves detection by eliminating certain areas detected incorrectly.

By default, the filtering uses the characteristics of the animal as defined in the "Animal" dialog box.

The min and max surfaces are calculated according to the following correspondence table:

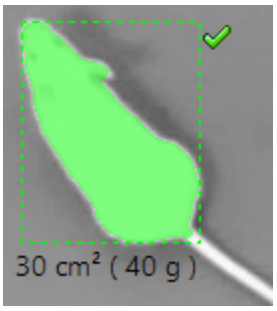
Weight (g)	Surface (cm^2)
10	5
20	10
30	20
40	30
70	50
80	55
170	100
240	125
360	185

You can also, for each test, choose not to filter by the size of the animal, or to use custom parameters. If you want to use custom settings, you must specify a minimum size and a maximum size for the animal:



The size to take into account is the surface of the animal (without the tail) when it is fully visible and it is not on an edge of the arena. When the animal is detected on an edge of the arena, a coefficient of 0.5 is applied to the minimum size to take into account the fact that the animal can climb on the walls of the arena.

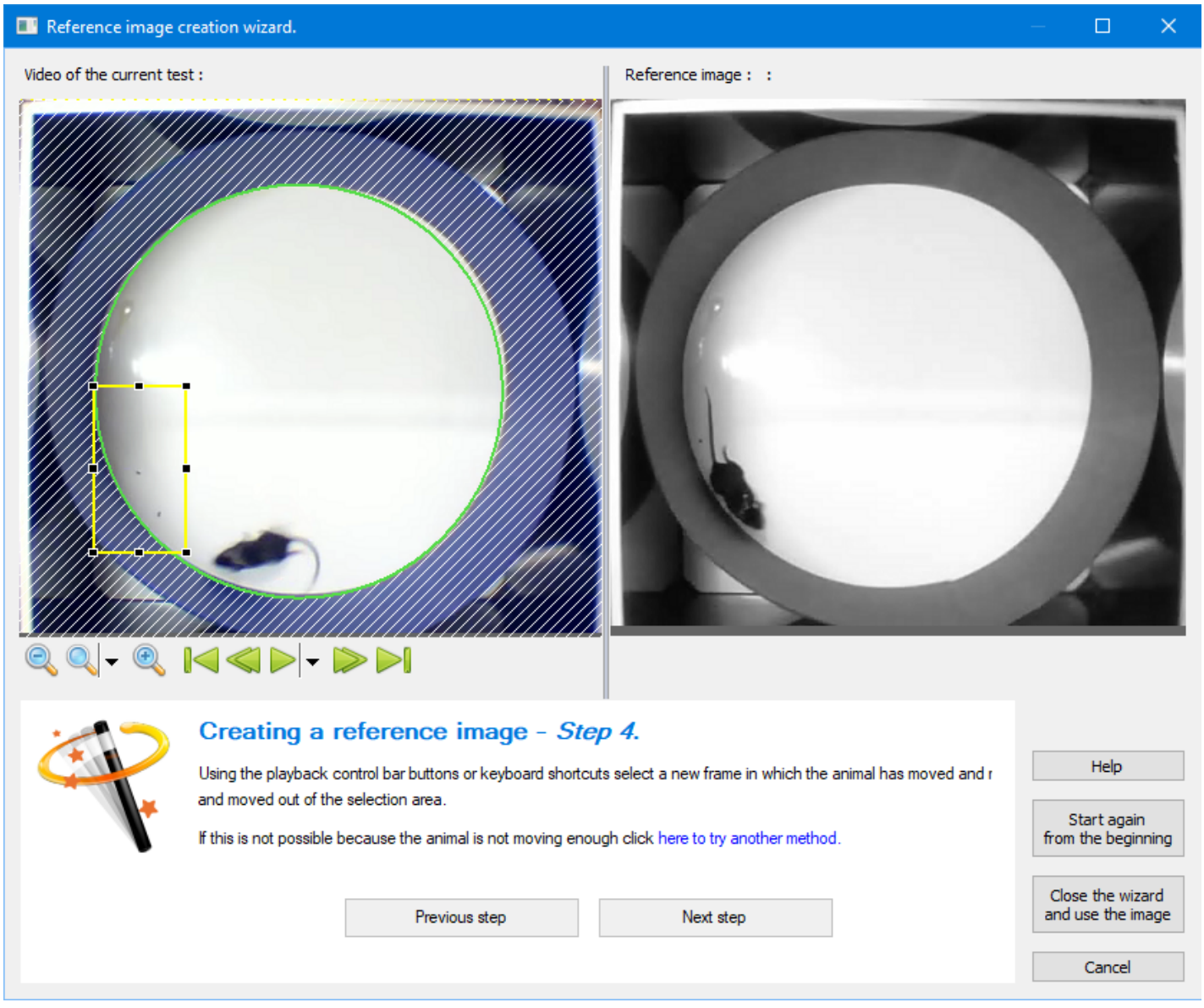
The parameters are immediately applied to the video image, and each part of the image corresponding to the detection criteria is clearly identified:



For the filtering according to the size of the animal to work correctly, it is imperative that the length of the ruler is correctly entered in the "Arenas" tab of the "protocol" .

8.3.4.7. Reference Image Creation Wizard

The wizard helps you create a reference image using a series of simple steps.



The dialog box is separated into 3 parts:

Top left: the video of the current test with the control bar that allows you to play the video or zoom.
Top right: the reference image under construction.
Bottom: the operations to be performed on the different steps.

At any time, if the reference image looks correct, you can click the "Close wizard and use image" button to return to the detection settings panel.

To open the wizard:

In the "automatic mode" tab of the detection settings side panel: open the Reference Image drop-down list and select "Create a reference image with the wizard...".

In the "image subtraction mode" tab, click on the button  .

8.3.4.8. Troubleshooting detection

If possible, follow these guidelines for recording videos :

- Install the open-field in a sufficiently bright place, with uniform and constant lighting. Give preference to constant artificial lighting located above the open-field in order to avoid shadows.
- Avoid placing the open-field near a window, especially if the experiment is to take place over several days. Otherwise, block out the light from the window if possible.
- Install the open-field in a quiet place, away from a traffic area to avoid any risk of the camera moving. Especially if the experiment is to take place over several days.
- Position the camera in the center of the arena (to avoid perspective errors), at a height that captures the entire area to be analyzed. Leave enough space around the area to allow for arena adjustments if the camera moves between tests.
- If possible, choose a background color that maximizes the contrast between the arena background and the animal you are trying to detect.

If the detection rate is too low or the longest period without detection is too long, it is advisable to first check the following points:

1/ Check the position and length of the rule in the protocol : To improve detection, Ethotrack filters out areas whose size or shape does not correspond to an animal. To convert a number of pixels into actual dimensions, Ethotrack uses the rule defined in the protocol. If the rule is incorrectly positioned, or if the rule length is incorrect, the calculation of the animal's size will be inaccurate and the filter will not function correctly.

2/ Check the animal's size : By default, all animals in the experiment are assumed to have a size within the range specified in the experiment parameters. If an animal is larger or smaller, the area occupied by the animal may be ignored due to the filtering based on animal size. If this is the case, you can change the animal's size in the "Animal" dialog box. If all animals are in the same situation, you can modify the experiment parameters. You can also choose a custom size range for each test.

3/ Check the arena position : If the arena defined in the protocol is not correctly aligned with the actual arena in which the animal is moving, it will not be correctly detected when it is on an edge of the arena. If necessary, you can adjust the arena position.

If the problem persists, try choosing a different detection mode and manually fine-tune the parameters until you

obtain the best possible detection. You can also modify the filtering parameters according to size.

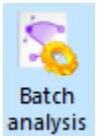
8.3.5. Batch Analysis

Instead of analyzing each test one by one, it is possible to do a batch analysis of all tests that are not yet analyzed.

For each selected test Ethotrack can seek to obtain the best possible detection rate by carrying out several analyzes with different detection parameters. In order :

Current detection settings of the test.
Automatic mode if different from the current detection settings of the test.
Parameters of a test using the same video that has already been analyzed.

To initiate a batch scan:

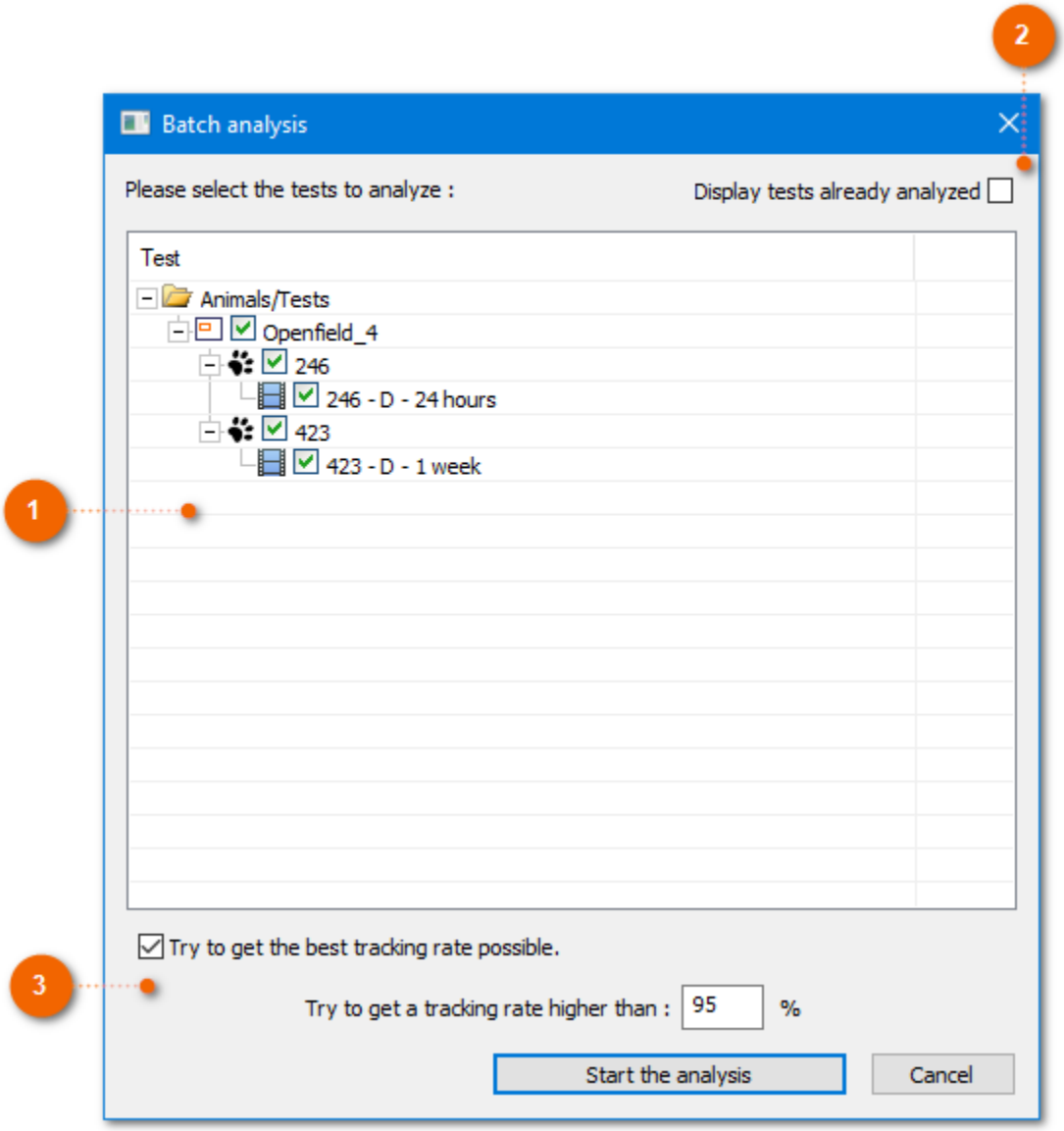
Click on 

in the " Experiment " view to open the "Batch analysis dialog box".

It is advisable to save the experiment before doing a batch analysis.

8.3.5.1. "Batch analysis" dialog box

This dialog box is used to launch the analysis of several tests automatically.



1 **Tests :**

The list of tests that are not analyzed. Check the box of the tests you want to analyze.

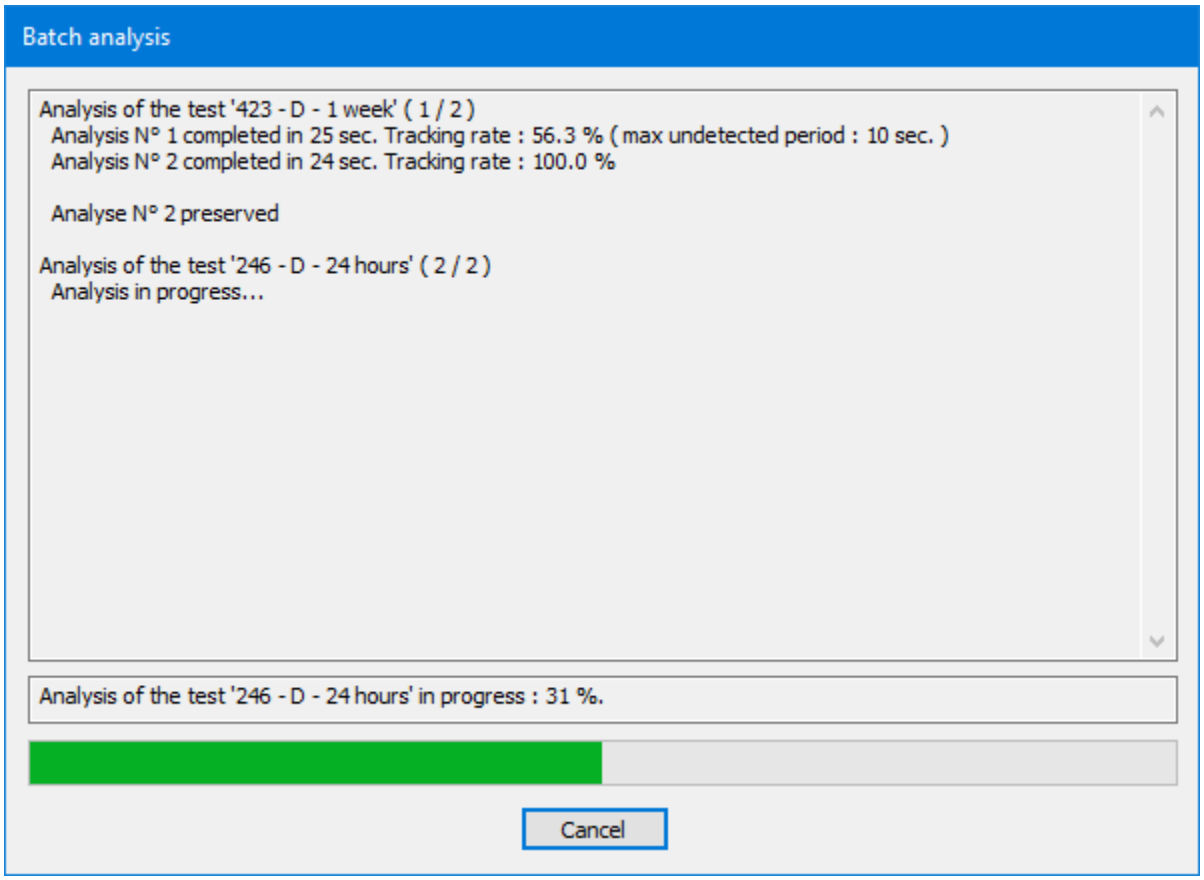
2 **Display tests already analyzed**

By default, the tests list only displays tests that are not yet analyzed. Check this bosx to also display already analyzed tests if you wish to re-analyze some.

3 **Detection rate :**

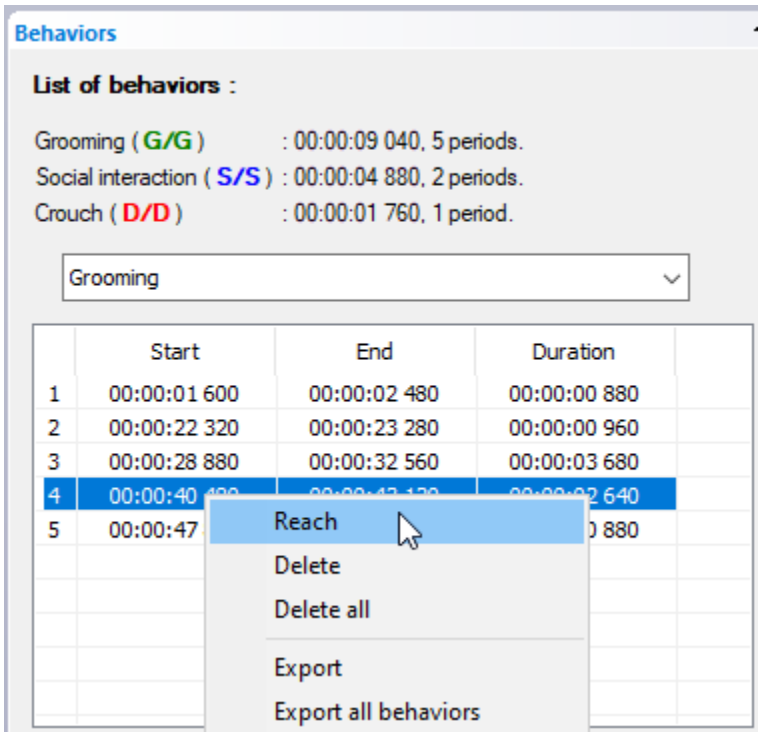
If the box is checked, Ethotrack will perform several analyzes to try to obtain a detection rate higher than the value entered.
If the box is not checked, Ethotrack will only perform an analysis with the current detection parameters of the test.

During the treatment the progress window displays the progress of the treatment.



8.4. Behaviours

This side panel allows you to view and manage (add or delete) all behavior periods.



To recorda new behavior period :

1. Scroll through the video to view the frame where the animal begins to exhibit the behavior.
2. Press the behavior key.
3. Scroll through the video to view the frame where the animal stops exhibiting the behavior.
4. Release the key (or press a second time)

If the new period overlaps one or more existing periods, these are deleted.
It is possible to record several behaviors at the same time.

To delete one or more periods :

1. Select the behavior from the drop-down list.
2. Select periods from the list of periods.
3. Click the right mouse button to bring up the context menu.
4. Use the "Delete" menu.

To position video playback at the beginning of a behavior period:

1. Select a period from the list of periods.
2. Click the right mouse button to bring up the context menu.
3. Use the "Reach" menu.

Keyboard shortcuts:

The keys that control the start and end of a behavior, as well as their operation, are shown in the list of behaviors.

In the screenshot above:

The 'Grooming' behavior is controlled by the 'G' key: the behavior starts when the key is pressed and ends when the key is released.
The 'Social interaction' behavior is controlled by the 'S' key: the behavior starts on the first press and ends on the second.

The following keyboard shortcuts are used to manage the progress of the video:

'Space' key: pause the video or resume playback.
'N' key: go to the next image (when the video is paused).
'B' key: go to the previous image (when the video is paused).
'X' key: slower speed.
'C' key: normal speed.
'V' key: faster speed.

The following keyboard shortcuts allow you to manage the zoom and move the visible part of the video:

'+' key: zoom in.
'-' key: zoom out.
Arrow keys (left, right, up, down): movement of the part of the video displayed on the screen.

To open this panel:

Click the button  in the test analysis area

9. Reports

Introduction:

The reports allow you to analyze the results of an experiment by presenting in the form of tables or graphs the behavioral data (duration, distance traveled, average speed, etc.) calculated from the raw monitoring data of each test (position, time).

The analysis can cover the entire arena or only certain zones of interest , and can be limited to certain time periods .

The different lines of a report can be grouped by animal or by "user fields "

To create a report:

You can choose to:

- Open the protocol dialog box , select the "Reports / Filters " tab, then click the button  in the reports column.
- Select the "Reports" display mode, then click on 

in the Report panel of the command ribbon.

To edit a report:

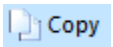
You can choose to:

- Open the protocol dialog box , select the "Reports / Filters " tab, then click the button  in the reports column.
- Select the "Reports" display mode, then click on 

in the Report panel of the command ribbon.

To copy a report:

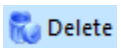
You can choose to:

- Open the protocol dialog box , select the "Reports / Filters " tab, then click the button  in the reports column.
- Select the "Reports" display mode, then click on 

in the Report panel of the command ribbon.

To delete a report:

You can choose to:

- Open the protocol dialog box , select the "Reports / Filters " tab, then click the button  in the reports column.
- Select the "Reports" display mode, then click on 

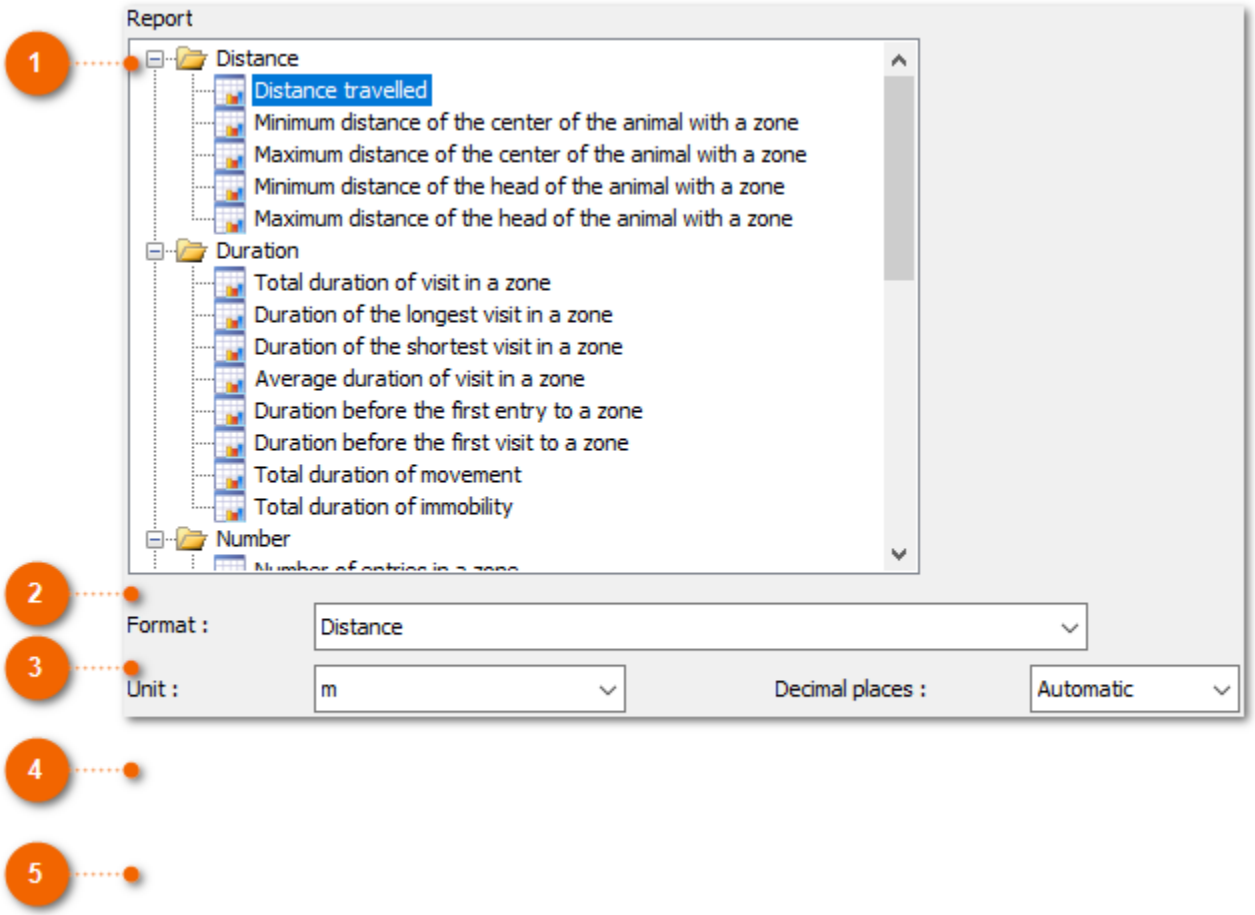
in the Report panel of the command ribbon.

To view report results:

1. Select the "Reports" display mode.
2. Select the report to view from the report drop-down list.
3. Optionally, select a filter from the list of filters.

9.1. Type

This tab allows you to select the type of report and the data display format:



1 **Report :**

The type of report:

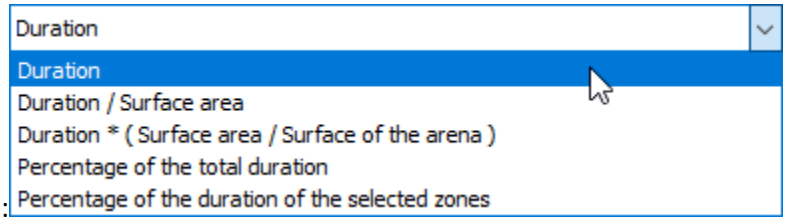
1. Distance :
   - Distance traveled .
   - Minimum distance from the center of the animal with a zone .
   - Maximum distance from the center of the animal with a zone .
   - Minimum distance from the animal's head to a zone .
   - Maximum distance from the animal's head with a zone .
2. Duration :
   - Total duration of visits in a zone.
   - Average duration of visits in a zone .
   - Duration of the longest visit to a zone .
   - Duration of the shortest visit to a zone .
   - Duration before first entry into a zone .
   - Duration before the first visit to a zone .
   - Total movement time .
   - Total period of immobility .
3. Number:
   - Number of entries in a zone .
   - Number of visits to a zone .
   - Number of exits from a zone .
   - Number of periods of immobility .
   - Number of periods of head immobility .
4. Speed :
   - Average speed .
5. Behaviours :
   - Longest duration of a behavior .
   - Shortest duration of a behavior .
   - Average duration of a behavior .
   - Total duration of a behavior .
   - Time to first behavior .
   - Number of times a behavior has occurred.
6. Plots
   - Heatmap .
   - Trace of the animal's center .
   - Trace of the animal's head .
7. Various :
   - List of visited zones .
8. Distribution / histogram:
   - Average speed, grouped by intervals .

2 **Format :**

The data display format.

This parameter depends on the type of report.

For example for a duration report :



3 **Unit :**

The unit (and optionally the precision) to use for displaying the data.

This parameter depends on the type of report and the display format.

4 **Average of groups :**

Check this box to calculate and display the average of the groups in the report.

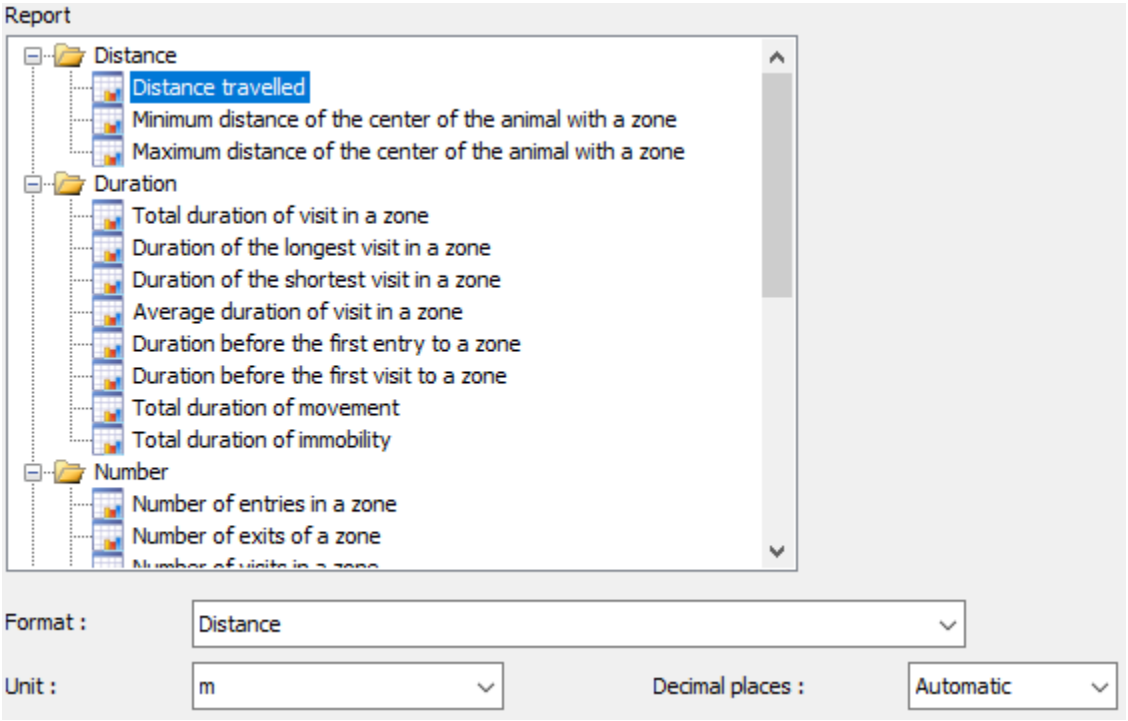
5 **Default filter :**

The filter to apply when the report is selected. Otherwise, the last filter used for this report is selected.

9.1.1. Distance traveled

Description:

This report calculates the distance an animal has traveled inside or outside an area.



Calculation method :

Sum of the distance between each point of the track.

Settings :

Size:

The data display format:

- Distance: the distance covered in the zone.
- Distance / Zone area: the distance traveled in the zone / zone surface.
- Distance * (Zone area / Arena area): the distance covered in the area * (Zone area / Arena area)
- Percentage of total distance: the distance covered in the zone / Total distance covered during the test.
- Percentage of distance in selected areas: the distance traveled in the area / (total distance traveled in all selected areas.

Unit :

The choice depends on the format.

Number of decimals:

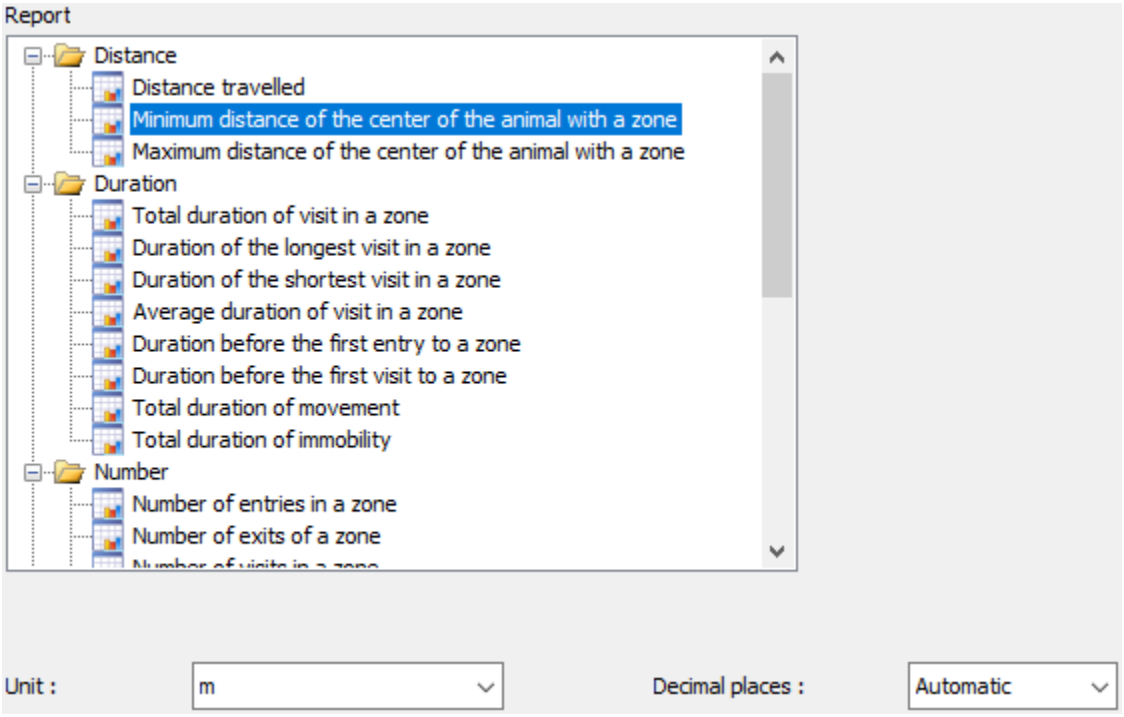
The precision of display of the results:

- 0 to 6 digits after the decimal point.
- Automatic: 2 **significant digits** after the decimal point.

9.1.2. Minimum distance from the center of the animal to a zone

Description:

This report calculates the minimum distance between the center of the animal and the edge of a zone.



Calculation method :

For each position of the animal, calculate the minimum distance between the center of the animal and the edge of the zone, and keep the smallest of these values.

Settings:

Unit :

millimeters, centimeters or meters.

Number of decimals:

The precision of display of the results:

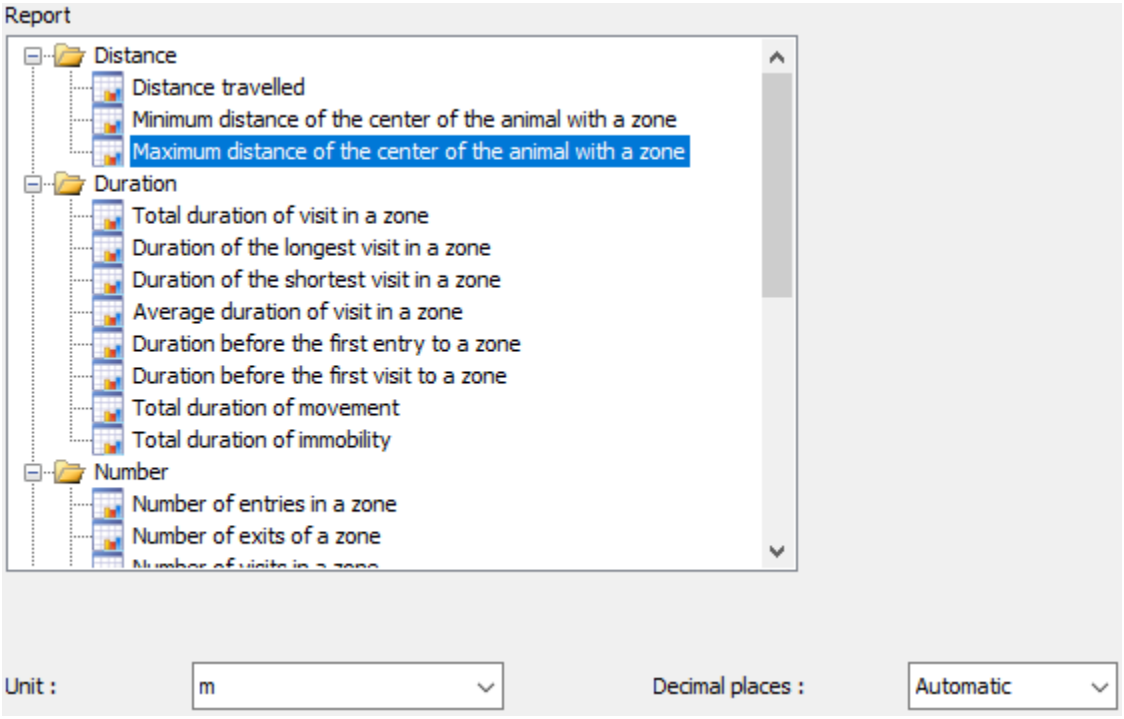
- 0 to 6 digits after the decimal point.
- Automatic: 2 **significant digits** after the decimal point.

If the animal enters the zone, this value is equal to zero.

9.1.3. Maximum distance from the center of the animal with a zone

Description:

This report calculates the maximum distance between the center of the animal and the edge of a zone.



Calculation method :

For each position of the animal, calculate the minimum distance between the center of the animal and the edge of the zone, and keep the greater of these values.

Settings :

Unit :

millimeters, centimeters or meters.

Number of decimals:

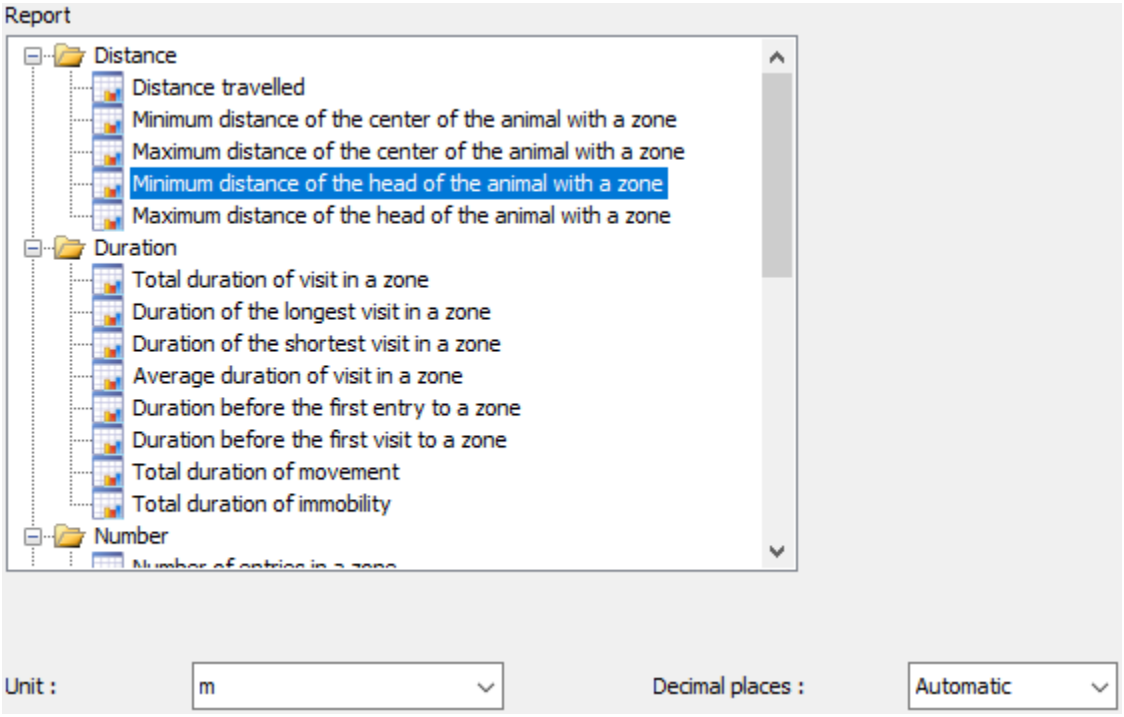
The precision of display of the results:

- 0 to 6 digits after the decimal point.
- Automatic: 2 **significant digits** after the decimal point.

9.1.4. Minimum distance from the animal's head to a zone

Description:

This report calculates the minimum distance between the animal's head and the edge of a zone.



Calculation method :

For each position of the animal, calculate the minimum distance between the head of the animal and the edge of the zone, and keep the smallest of these values.

Settings:

Unit :

millimeters, centimeters or meters.

Number of decimals:

The precision of display of the results:

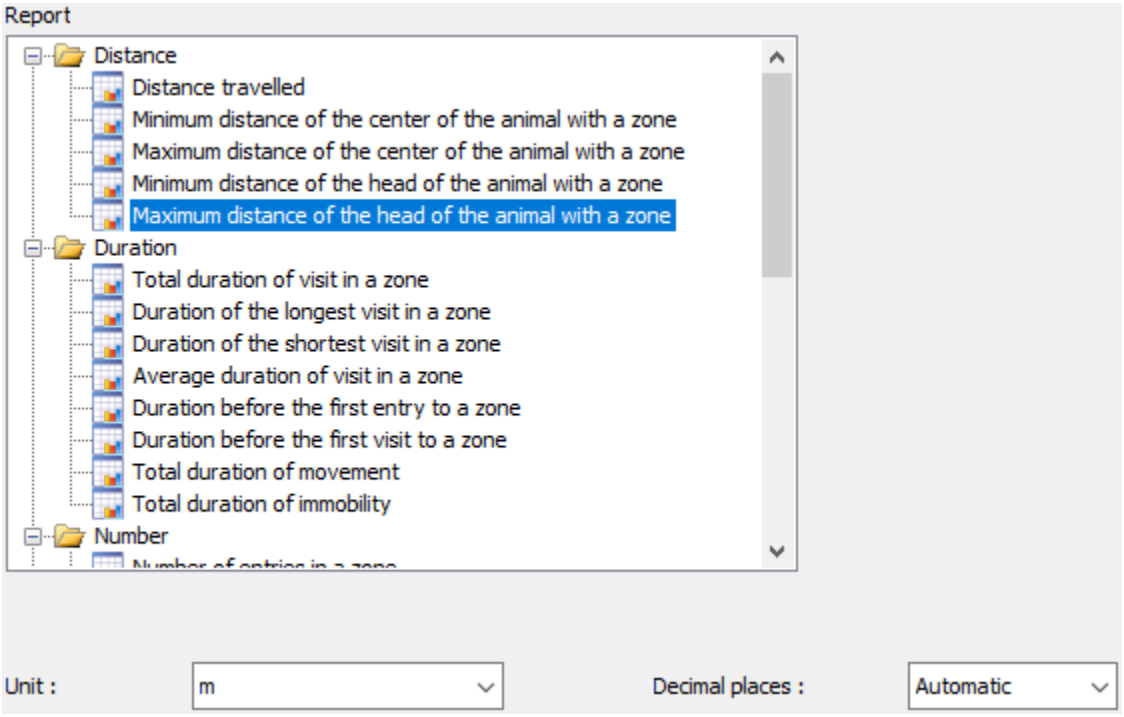
- 0 to 6 digits after the decimal point.
- Automatic: 2 **significant digits** after the decimal point.

This report is only available if the "Head detection" option is activated in the protocol.
If the animal's head enters the zone, this value is zero.

9.1.5. Maximum distance of the animal's head to a zone

Description:

This report calculates the maximum distance between the animal's head and the edge of a zone.



Calculation method :

For each position of the animal, calculate the minimum distance between the head of the animal and the edge of the zone, and keep the greater of these values.

Settings:

Unit :

millimeters, centimeters or meters.

Number of decimals:

The precision of display of the results:

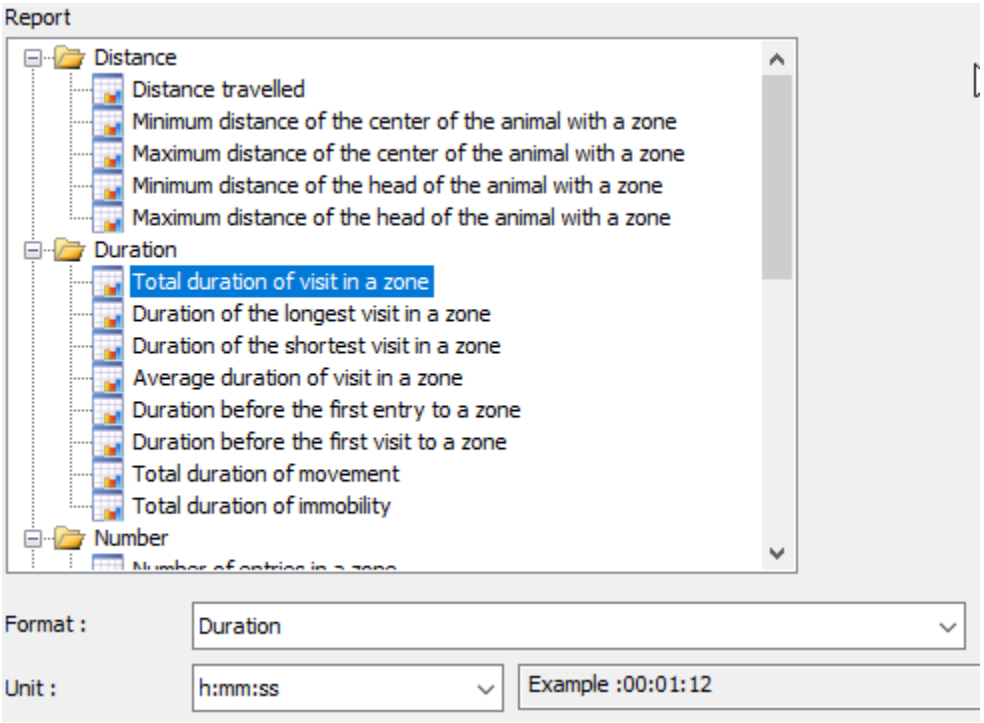
- 0 to 6 digits after the decimal point.
- Automatic: 2 **significant digits** after the decimal point.

This report is only available if the "Head detection" option is activated in the protocol.

9.1.6. Total duration of visits in a zone

Description:

This report calculates the total time spent by the animal in a zone.



Calculation method :

Calculates the duration of each visit of the animal in the zone (according to the criterion chosen in the zone parameters dialog box) , then sums it up.

Settings:

Size:

The data display format:

- Duration: time spent in the zone.
- Duration / Zone area: time spent in the zone / zone surface.
- Duration * (Area of the zone / Area of the arena): time spent in the zone * (Area of the zone / Area of the arena)
- Percentage of Total Time: Time Spent in Zone / Total Test Time.
- Percentage of duration of selected zones: time spent in zone / total time spent in all selected zones.

Unit :

The choice depends on the format:

For "Duration" or "Duration * (Area area / Arena area)":

- h:mm:ss: hours:minutes:seconds
- h:mm:ss ms: hours:minutes:seconds milliseconds
- Seconds: seconds
- Seconds.mSec: seconds.milliseconds

For "Duration / Area of the zone":

- h:mm:ss ms / mm ^{2} : hours:minutes:seconds milliseconds / square millimeters

- h:mm:ss ms / cm ^{2} : hours:minutes:seconds milliseconds / square centimeters
- h:mm:ss ms / m ^{2} : hours:minutes:seconds milliseconds / square meters
- Seconds / mm ^{2} : seconds / square millimeters
- Seconds / cm ^{2} : seconds / square centimeters
- Seconds/m2 : seconds/square ^{meters}
- Seconds.mSec / mm ^{2} : seconds.milliseconds / square millimeters
- Seconds.mSec / cm ^{2} : seconds.milliseconds / square centimeters
- Seconds.mSec / m ^{2} : seconds.milliseconds / square meters

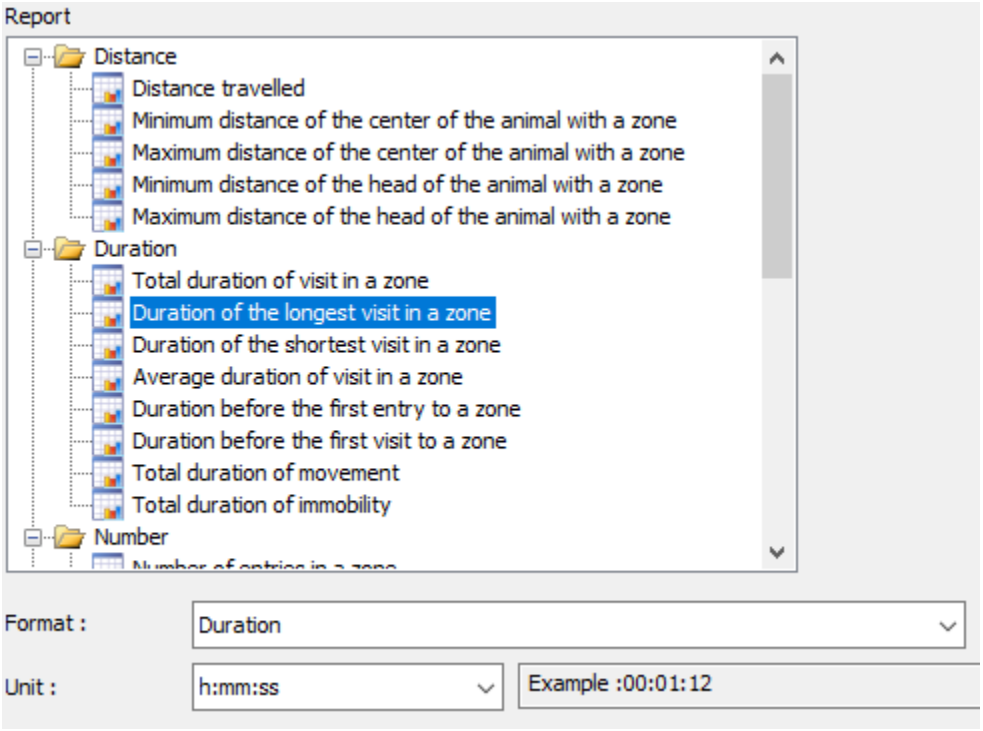
For "Percentage of total duration" and "Percentage of duration of selected zones":

- %

9.1.7. Duration of the longest visit in a zone

Description:

This report calculates the duration of the longest animal visit in a zone.



Calculation method :

Calculates the duration of each visit of the animal in the zone (according to the criterion chosen in the zone parameters dialog box), then selects the longest one.

Size:

The data display format:

- Duration: time spent in the zone.
- Duration / Zone area: time spent in the zone / zone surface.
- Duration * (Area of the zone / Area of the arena): time spent in the zone * (Area of the zone / Area of the

arena)

- Percentage of Total Time: Time Spent in Zone / Total Test Time.
- Percentage of duration of selected zones: time spent in zone / (total time spent in all selected zones.

Unit :

The choice depends on the format:

For "Duration" or "Duration * (Area area / Arena area)":

- h:mm:ss: hours:minutes:seconds
- h:mm:ss ms: hours:minutes:seconds milliseconds
- Seconds: seconds
- Seconds.mSec: seconds.milliseconds

For "Duration / Area of the zone":

- h:mm:ss ms / mm^2 : hours:minutes:seconds milliseconds / square millimeters
- h:mm:ss ms / cm^2 : hours:minutes:seconds milliseconds / square centimeters
- h:mm:ss ms / m^2 : hours:minutes:seconds milliseconds / square meters
- Seconds / mm^2 : seconds / square millimeters
- Seconds / cm^2 : seconds / square centimeters
- Seconds/m2 : seconds/square ^{meters}
- Seconds.mSec / mm^2 : seconds.milliseconds / square millimeters
- Seconds.mSec / cm^2 : seconds.milliseconds / square centimeters
- Seconds.mSec / m^2 : seconds.milliseconds / square meters

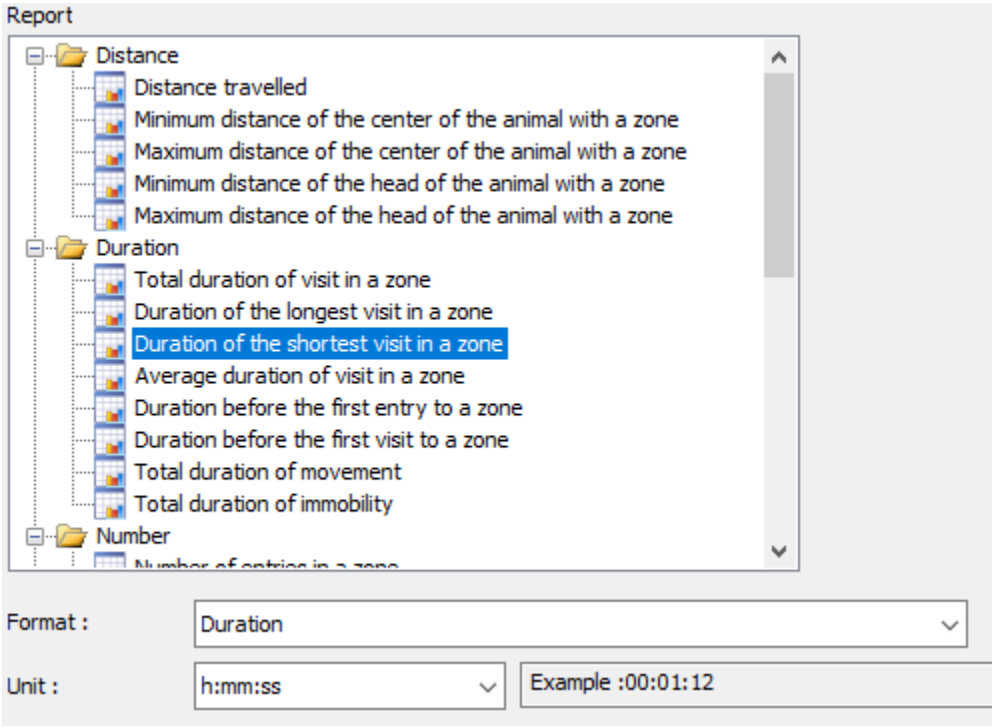
For "Percentage of total duration" and "Percentage of duration of selected zones":

- %

9.1.8. Duration of the shortest visit in a zone

Description:

This report calculates the duration of the animal's shortest visit in a zone.



Calculation method :

Calculates the duration of each visit of the animal in the zone (according to the criterion chosen in the zone parameters dialog box), then selects the shortest one.

Size:

The data display format:

- Duration: time spent in the zone.
- Duration / Zone area: time spent in the zone / zone surface.
- Duration * (Area of the zone / Area of the arena): time spent in the zone * (Area of the zone / Area of the arena)
- Percentage of Total Time: Time Spent in Zone / Total Test Time.
- Percentage of duration of selected zones: time spent in zone / (total time spent in all selected zones.

Unit :

The choice depends on the format:

For "Duration" or "Duration * (Area area / Arena area)":

- h:mm:ss: hours:minutes:seconds
- h:mm:ss ms: hours:minutes:seconds milliseconds
- Seconds: seconds
- Seconds.mSec: seconds.milliseconds

For "Duration / Area of the zone":

- h:mm:ss ms / mm^2 : hours:minutes:seconds milliseconds / square millimeters
- h:mm:ss ms / cm^2 : hours:minutes:seconds milliseconds / square centimeters

- h:mm:ss ms / m ^{2} : hours:minutes:seconds milliseconds / square meters
- Seconds / mm ^{2} : seconds / square millimeters
- Seconds / cm ^{2} : seconds / square centimeters
- Seconds/m2 : seconds/square ^{meters}
- Seconds.mSec / mm ^{2} : seconds.milliseconds / square millimeters
- Seconds.mSec / cm ^{2} : seconds.milliseconds / square centimeters
- Seconds.mSec / m ^{2} : seconds.milliseconds / square meters

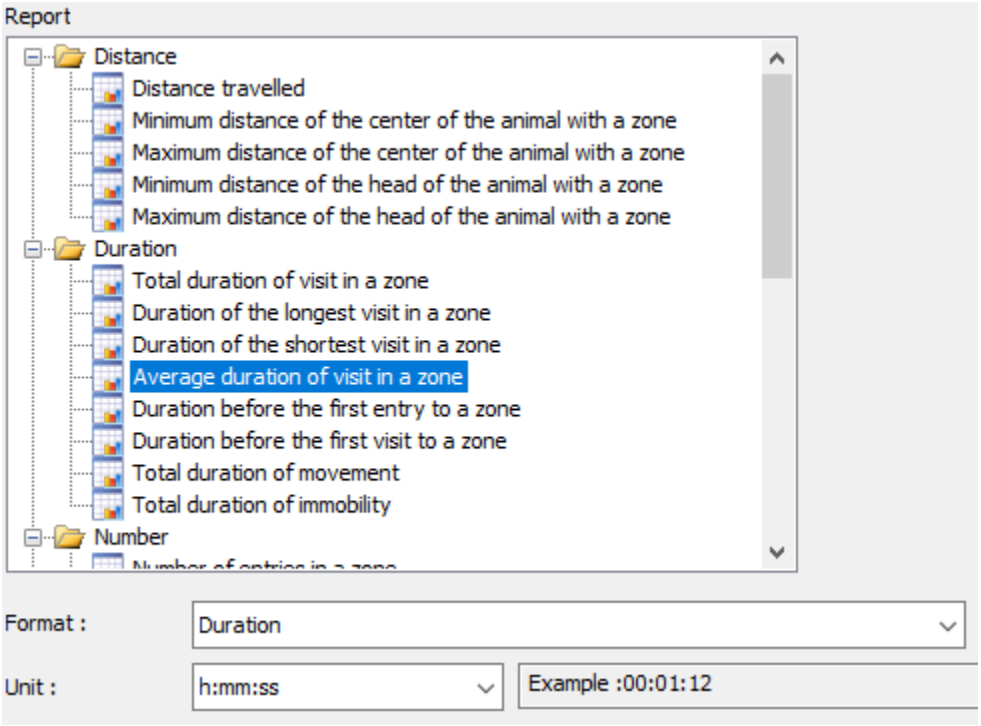
For "Percentage of total duration" and "Percentage of duration of selected zones":

- %

9.1.9. Average duration of visits in a zone

Description:

This report calculates the average duration of the animal's visits in a zone.



Calculation method :

Calculates the duration of each visit of the animal in the zone (according to the criterion chosen in the zone parameters dialog box) , then averages it.

Size:

The data display format:

- Duration: time spent in the zone.
- Duration / Zone area: time spent in the zone / zone surface.
- Duration * (Area of the zone / Area of the arena): time spent in the zone * (Area of the zone / Area of the arena)

- Percentage of Total Time: Time Spent in Zone / Total Test Time.
- Percentage of duration of selected zones: time spent in zone / (total time spent in all selected zones.

Unit :

The choice depends on the format:

For "Duration" or "Duration * (Area area / Arena area)":

- h:mm:ss: hours:minutes:seconds
- h:mm:ss ms: hours:minutes:seconds milliseconds
- Seconds: seconds
- Seconds.mSec: seconds.milliseconds

For "Duration / Area of the zone":

- h:mm:ss ms / mm^2 : hours:minutes:seconds milliseconds / square millimeters
- h:mm:ss ms / cm^2 : hours:minutes:seconds milliseconds / square centimeters
- h:mm:ss ms / m^2 : hours:minutes:seconds milliseconds / square meters
- Seconds / mm^2 : seconds / square millimeters
- Seconds / cm^2 : seconds / square centimeters
- Seconds/m2 : seconds/square meters
- Seconds.mSec / mm^2 : seconds.milliseconds / square millimeters
- Seconds.mSec / cm^2 : seconds.milliseconds / square centimeters
- Seconds.mSec / m^2 : seconds.milliseconds / square meters

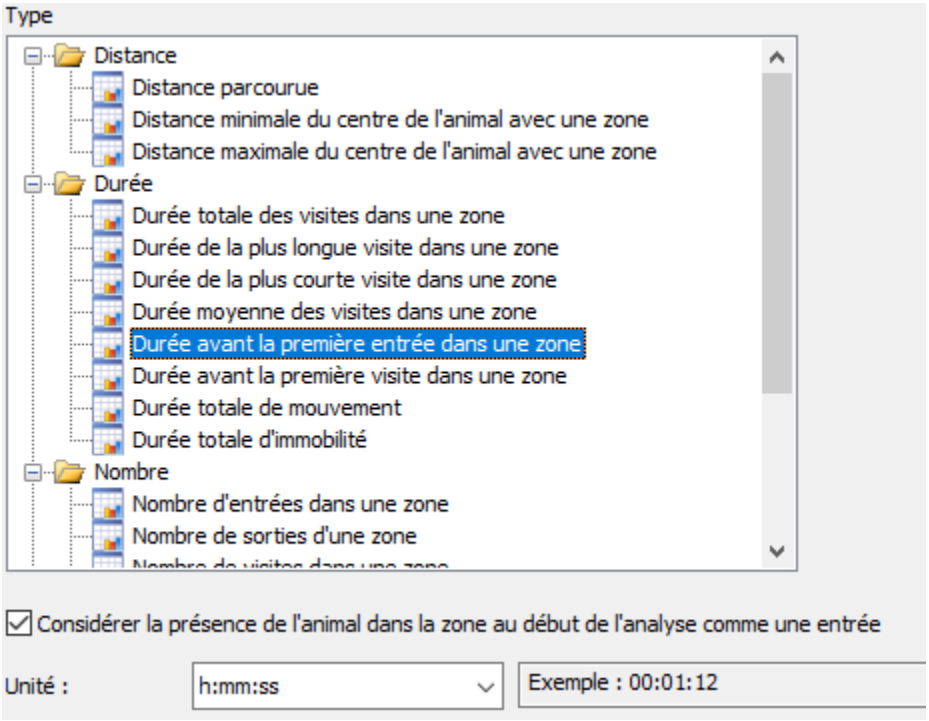
For "Percentage of total duration" and "Percentage of duration of selected zones":

- %

9.1.10. Duration before first entry into a zone

Description:

This report calculates the time elapsed between the start of the period and the animal's first entry into a zone.



Calculation method :

Calculates the time elapsed between the start of the period and the first time the animal enters the zone (according to the criterion chosen in the zone parameters dialog).

Settings:

Consider the presence of the animal in the area at the start of the analysis period as an entry:

On the first image of the analysis, the animal may already be present in the area:

- Check this box so that this presence is taken into account (The duration before the first entry into the zone will then be zero).
- Uncheck the box to wait for the first "true" entry into the zone.

This parameter is only relevant if the time period of the report **starts at the same time as the analysis** . If the animal is present in the area at the beginning of a time period that begins later, this presence is considered a "visit" and not an entry and is not taken into account. To take this presence into account, please use the " Duration before the first visit to a zone " report.

Unit :

A choice :

- h:mm:ss: hours:minutes:seconds
- h:mm:ss ms: hours:minutes:seconds milliseconds
- Seconds: seconds
- Seconds.mSec: seconds.milliseconds

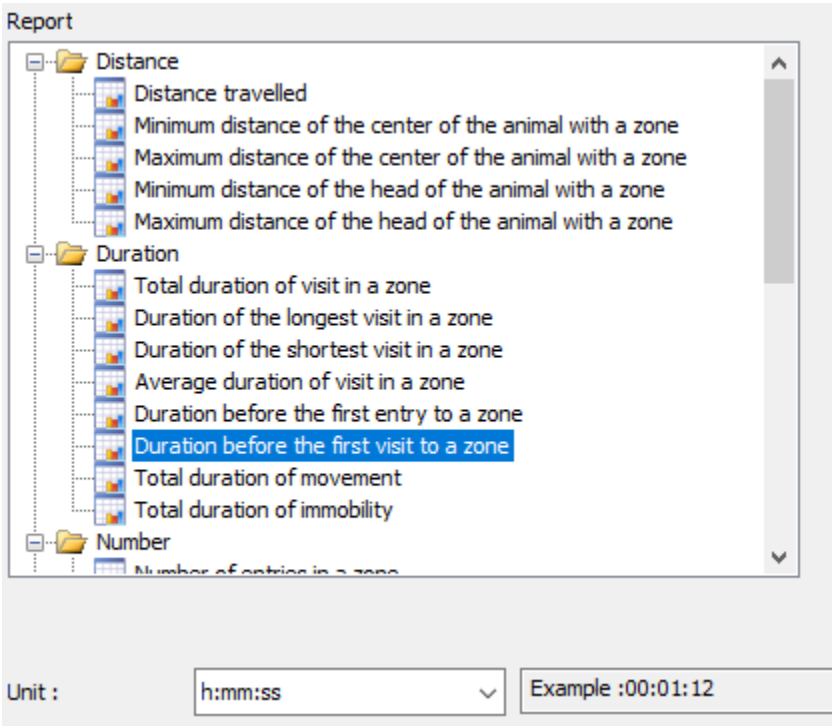
Difference between "entry" and "visit":

- An "entry" is a **transition** between the 2 states: "animal is out of the zone" and "animal is in the zone"
- A "visit" corresponds to the state: "the animal is in the zone".

9.1.11. Duration to first visit to a zone

Description:

This report calculates the time elapsed between the start of the period and the first time the animal is present in a zone



Calculation method :

Calculates the time elapsed between the start of the period and the first time the animal is detected in the zone (according to the criterion chosen in the zone parameters dialog box).

Settings:

Unit :

A choice :

- h:mm:ss: hours:minutes:seconds
- h:mm:ss ms: hours:minutes:seconds milliseconds
- Seconds: seconds
- Seconds.mSec: seconds.milliseconds

The presence of the animal in the zone at the beginning of the period is considered as a visit and is taken into account. If you want to take into account only the first "true" entry into the zone, use the " Time before first entry into a zone " report.

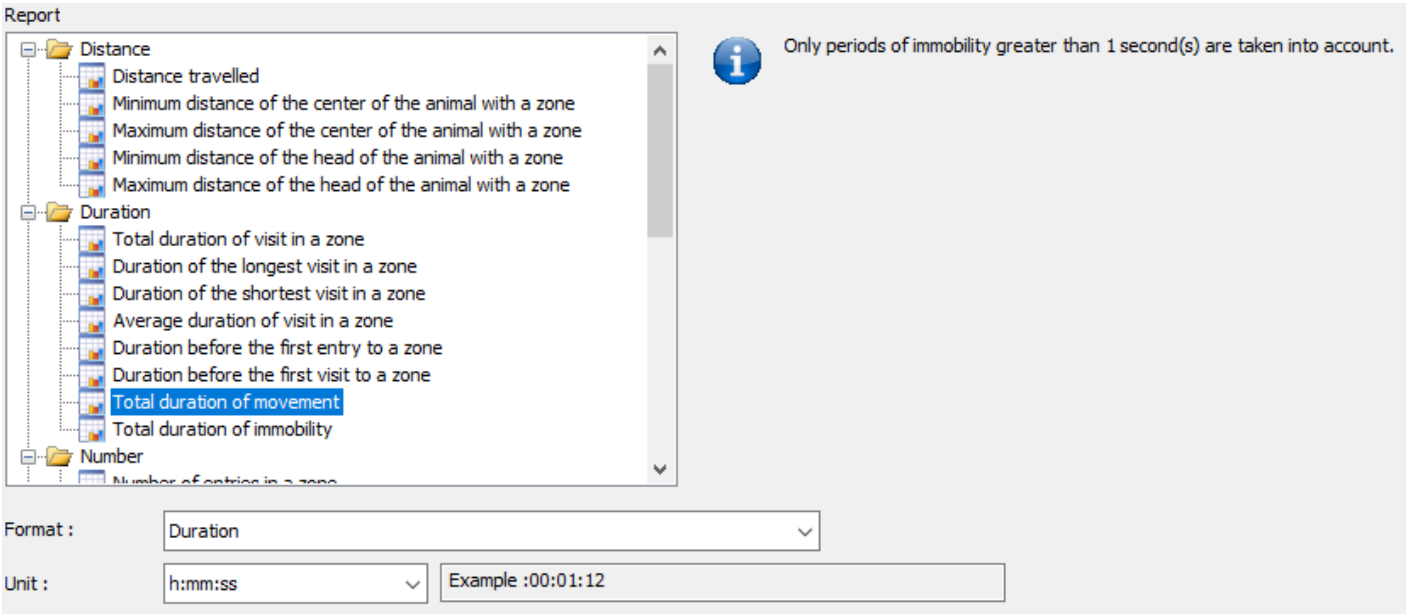
Difference between "entry" and "visit":

- An "entry" is a **transition** between the 2 states: "animal is out of the zone" and "animal is in the zone"
- A "visit" corresponds to the state: "the animal is in the zone".

9.1.12. Total duration of movement

Description:

This report calculates the total time the animal is moving inside or outside a zone.



Calculation method:

Total time spent in the zone - the sum of the periods when the animal is stationary inside the zone.

Settings:

Size:

The data display format:

- Duration: total time the animal is moving in the area.
- Percentage of total duration: time the animal is moving in the zone / Total duration of the test.
- Percentage of time spent in the zone: time the animal is moving in the zone / time spent in the zone.

Unit :

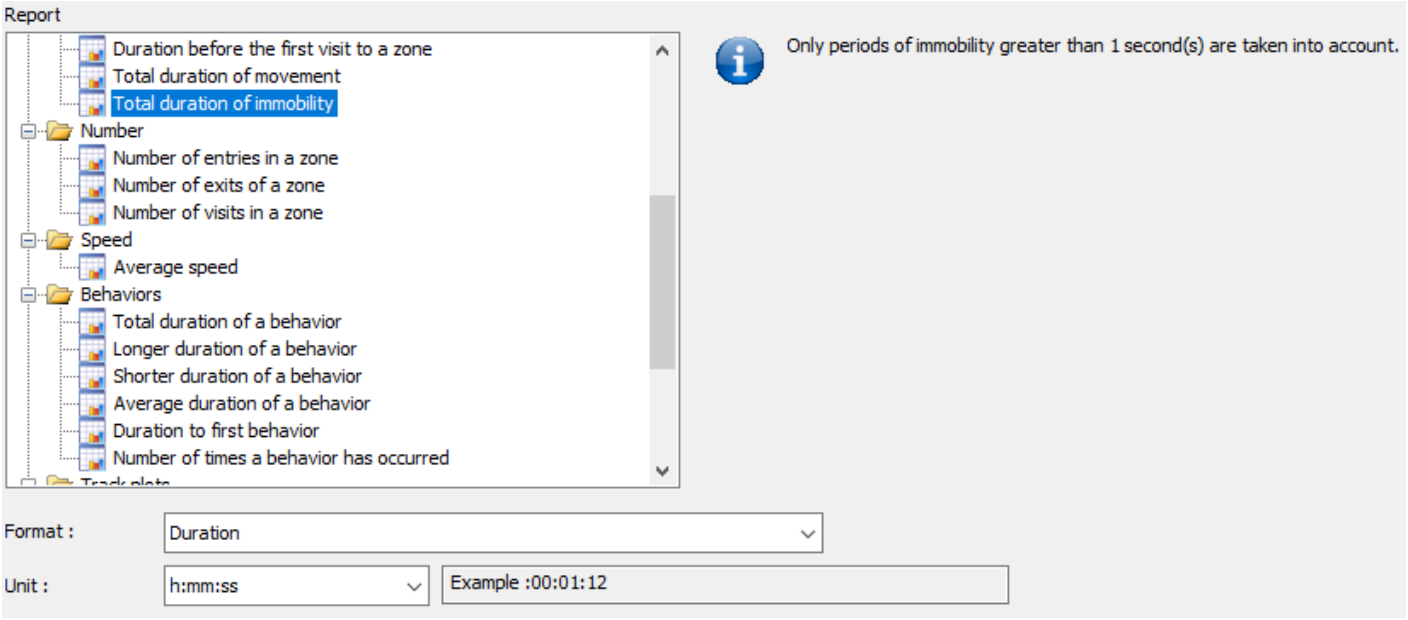
The choice depends on the format.

Only sufficiently long periods of immobility are counted in accordance with the duration specified in the 'General' tab of the protocol.

9.1.13. Total duration of immobility

Description:

This report calculates the total time the animal is stationary inside or outside a zone.



Calculation method:

The sum of the periods when the animal is immobile inside the zone.

Settings:

Size:

The data display format:

- Duration: total time the animal is immobile in the zone.
- Percentage of total duration: time the animal is immobile in the zone / Total duration of the test.
- Percentage of time spent in the zone: time the animal is immobile in the zone / time spent in the zone.

Unit :

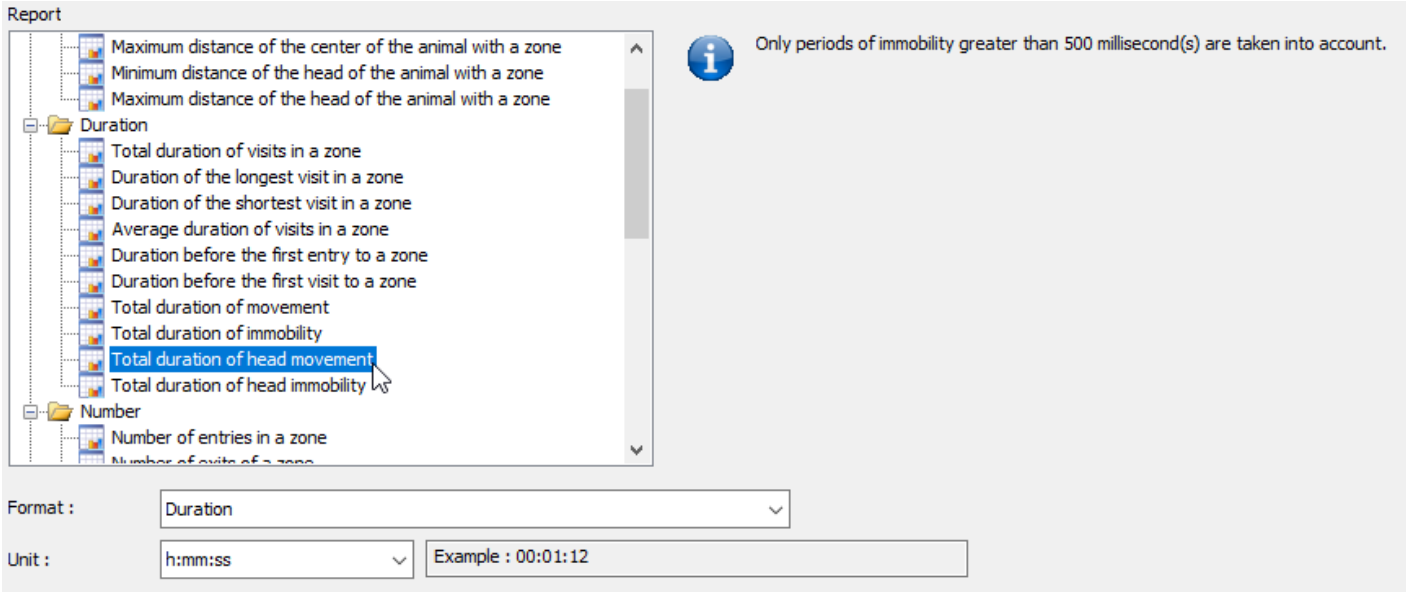
The choice depends on the format.

Only sufficiently long periods of immobility are counted in accordance with the duration specified in the 'General' tab of the protocol.

9.1.14. Total duration of head movement

Description:

This report calculates the total time the animal's head is moving inside or outside a zone.



Calculation method:

Total time spent in the zone - the sum of the periods when the animal's head is immobile inside the zone.

Settings:

Size:

The data display format:

- Duration: total time the animal head's is moving in the area.
- Percentage of total duration: time the animal's head is moving in the zone / Total duration of the test.
- Percentage of time spent in the zone: time the animal's head is moving in the zone / time spent in the zone.

Unit :

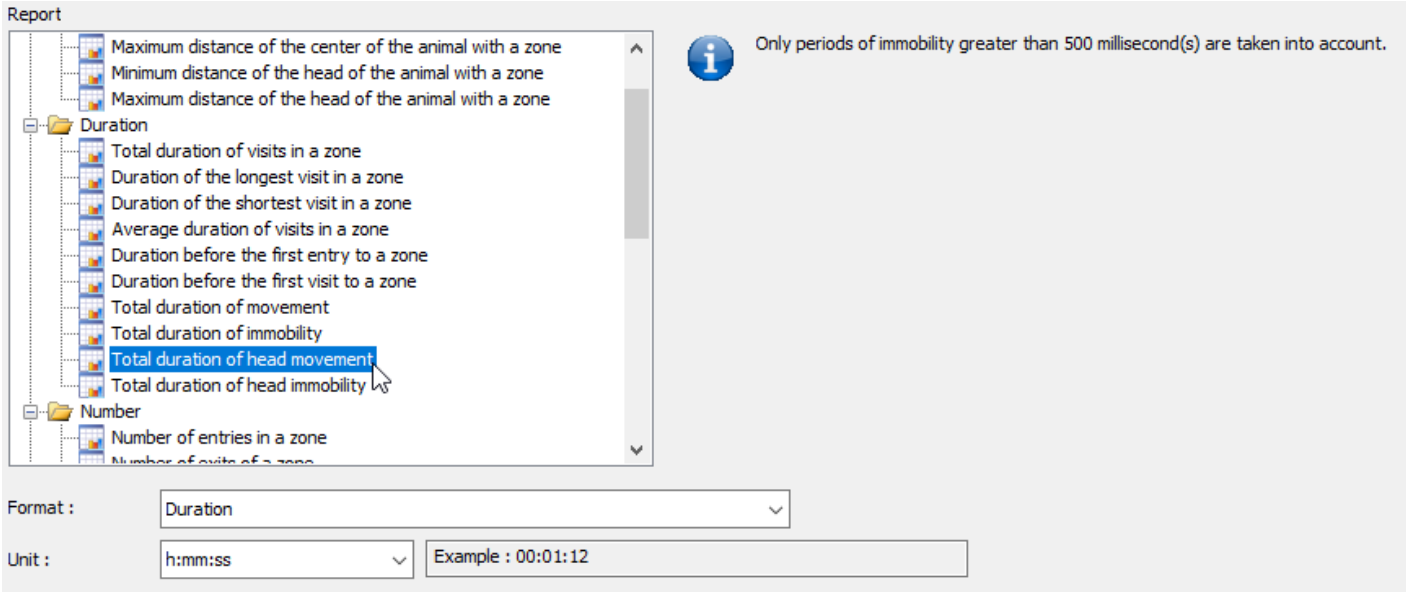
The choice depends on the format.

Only sufficiently long periods of immobility are counted in accordance with the duration specified in the 'General' tab of the protocol.

9.1.15. Total duration of head immobility

Description:

This report calculates the total time the animal's head is stationary inside or outside an area.



Calculation method:

The sum of the periods when the animal's head is immobile inside the zone.

Settings:

Size:

The data display format:

- Duration: total time the animal's head is immobile in the zone.
- Percentage of total duration: time the animal's head is immobile in the zone / Total duration of the test.
- Percentage of time spent in the zone: time the animal's head is immobile in the zone / time spent in the zone.

Unit :

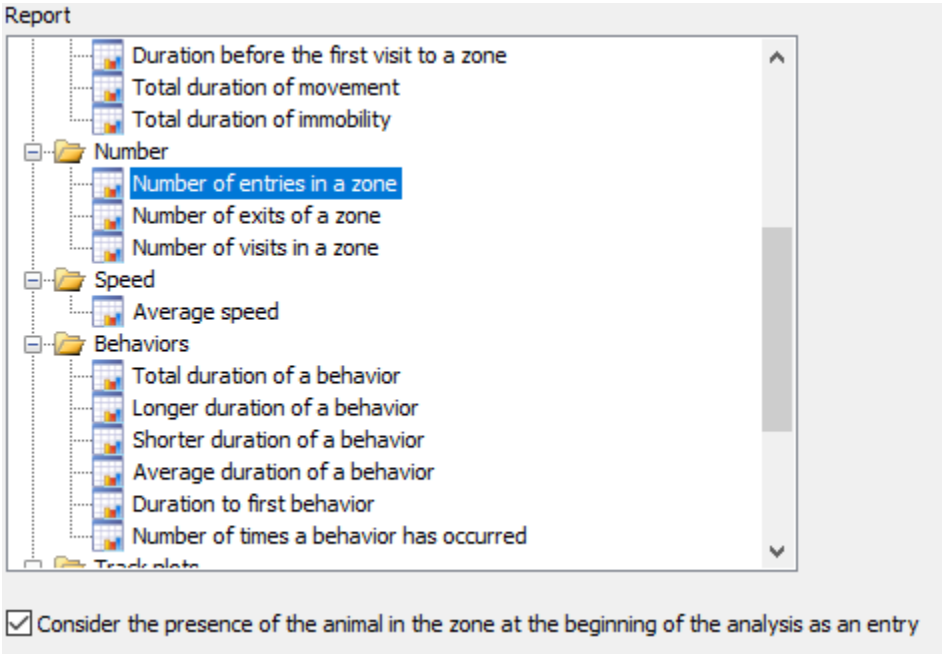
The choice depends on the format.

Only sufficiently long periods of immobility are counted in accordance with the duration specified in the 'General' tab of the protocol.

9.1.16. Number of entries in a zone

Description:

This report calculates the number of times the animal enters a zone.



Calculation method :

The number of times the animal enters the zone, according to the criteria chosen in the zone settings dialog .

Settings:

Consider the presence of the animal in the zone at the start of the analysis period as an entry:

On the first image of the analysis, the animal may already be present in the zone:

- Check this box for this presence to be counted as an additional entry.
- Uncheck the box so that this presence is not counted as an entry.

This parameter is only relevant if the time period of the report **starts at the same time as the analysis** . If the animal is present in the zone at the beginning of a period of time which starts later, this presence is considered as a "visit" and not as an "entry" and is not counted. To count this presence, please use the " Number of visits in a zone " report.

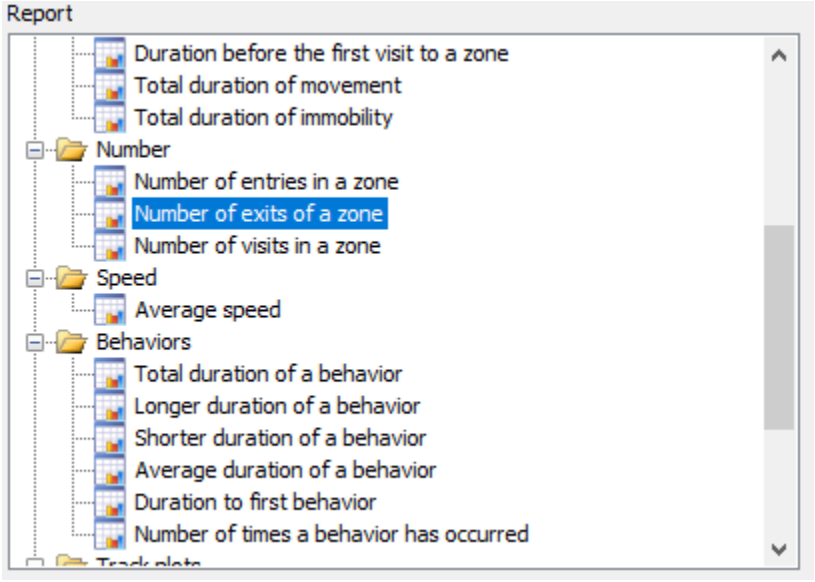
Difference between "entry" and "visit":

- An "entry" is a **transition** between the 2 states: "animal is out of the zone" and "animal is in the zone"
- A "visit" corresponds to the state: "the animal is in the zone".

9.1.17. Number of exits from a zone

Description:

This report calculates the number of times the animal leaves a zone.



Calculation method:

The number of times the animal leaves the zone, according to the criteria chosen in the zone settings dialog .

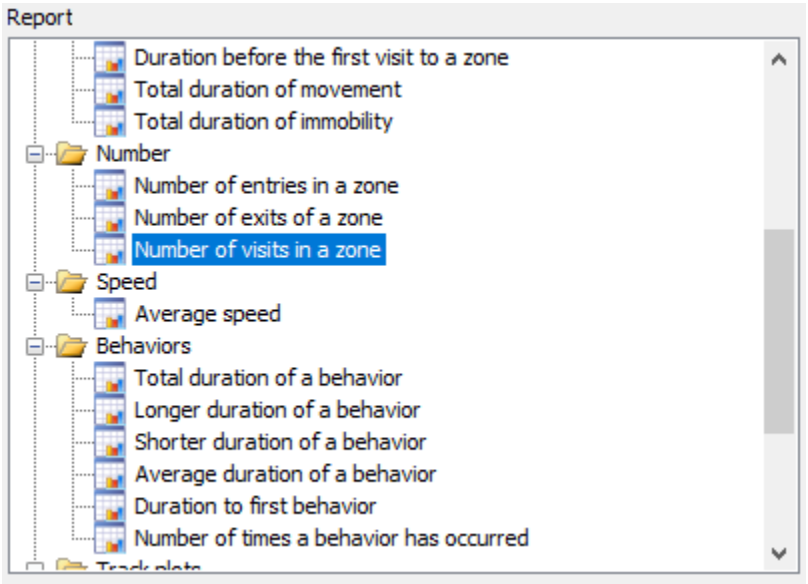
Settings:

None

9.1.18. Number of visits to a zone

Description:

This report calculates the number of times the animal visits a zone.



Calculation method :

The number of times the animal visits the zone, according to the criteria chosen in the zone settings dialog .

Settings:

None

The presence of the animal in the zone at the beginning of the period is considered as a visit and is counted. If you want to count the number of "true" entries, use the " Number of entries in a zone " report.

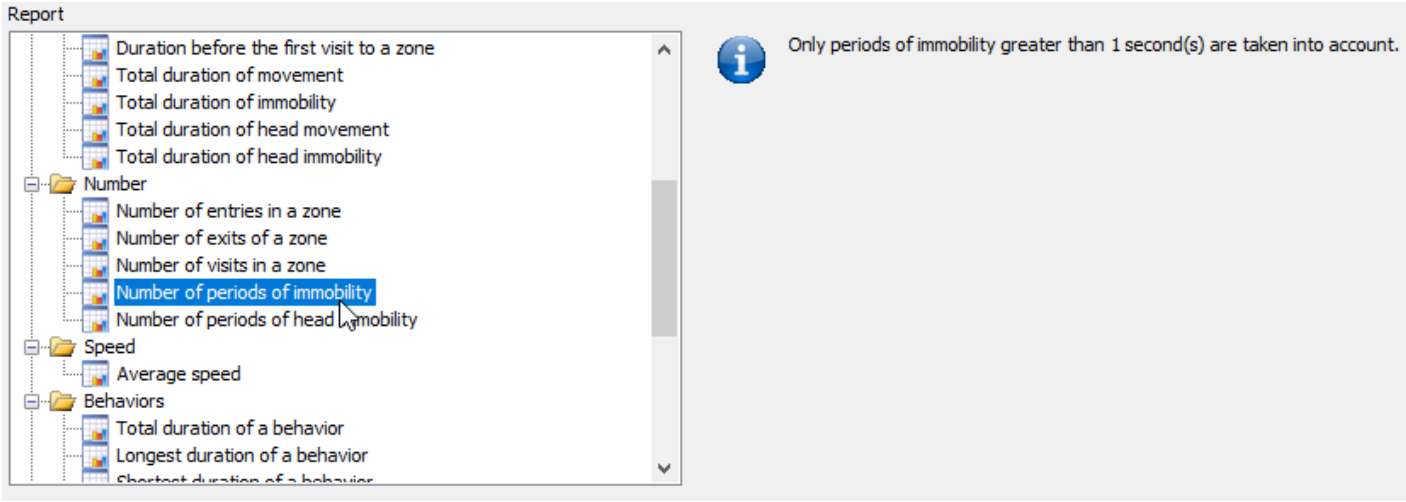
Difference between "entry" and "visit":

- An "entry" is a **transition** between the 2 states: "animal is out of the zone" and "animal is in the zone
- A "visit" corresponds to the state: "the animal is in the zone".

9.1.19. Number of periods of immobility

Description:

This report calculates the number of times the animal is immobile inside or outside a zone..



Calculation method :

The number of times the animal is immobile in the zone.

Settings:

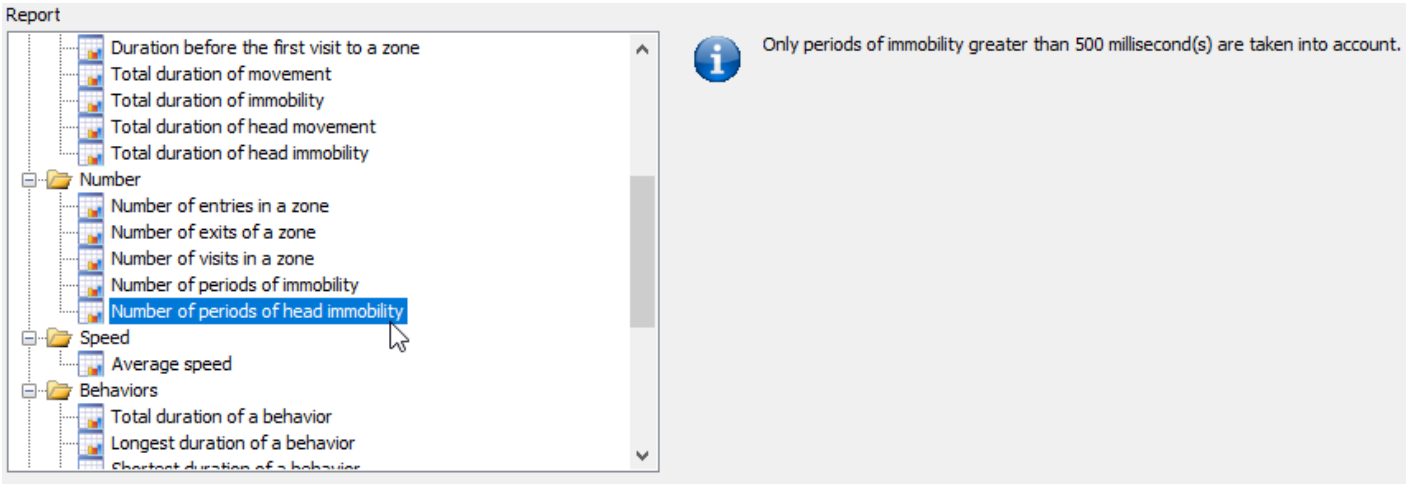
None

Only sufficiently long periods of immobility are counted in accordance with the duration specified in the 'General' tab of the protocol .

9.1.20. Number of periods of head immobility

Description:

This report calculates the number of times the animal's head is immobile inside or outside a zone..



Calculation method :

The number of times the animal's head is immobile in the zone.

Settings:

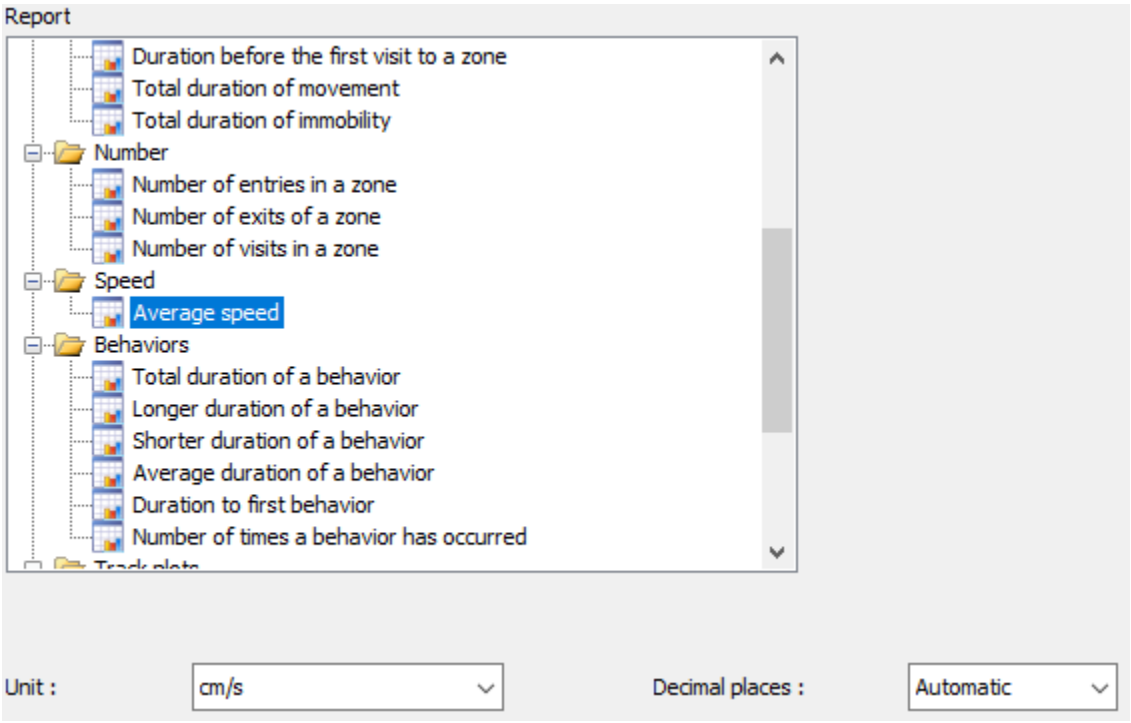
None

Only sufficiently long periods of immobility are counted in accordance with the duration specified in the 'General' tab of the protocol.

9.1.21. Average speed

Description:

This report calculates the average speed of the animal in a zone.



Calculation method :

Total distance traveled in the zone divided by time spent in the zone.

Settings :

Unit :

unit of speed, selectable: mm/s, cm/s or m/s.

Number of decimals:

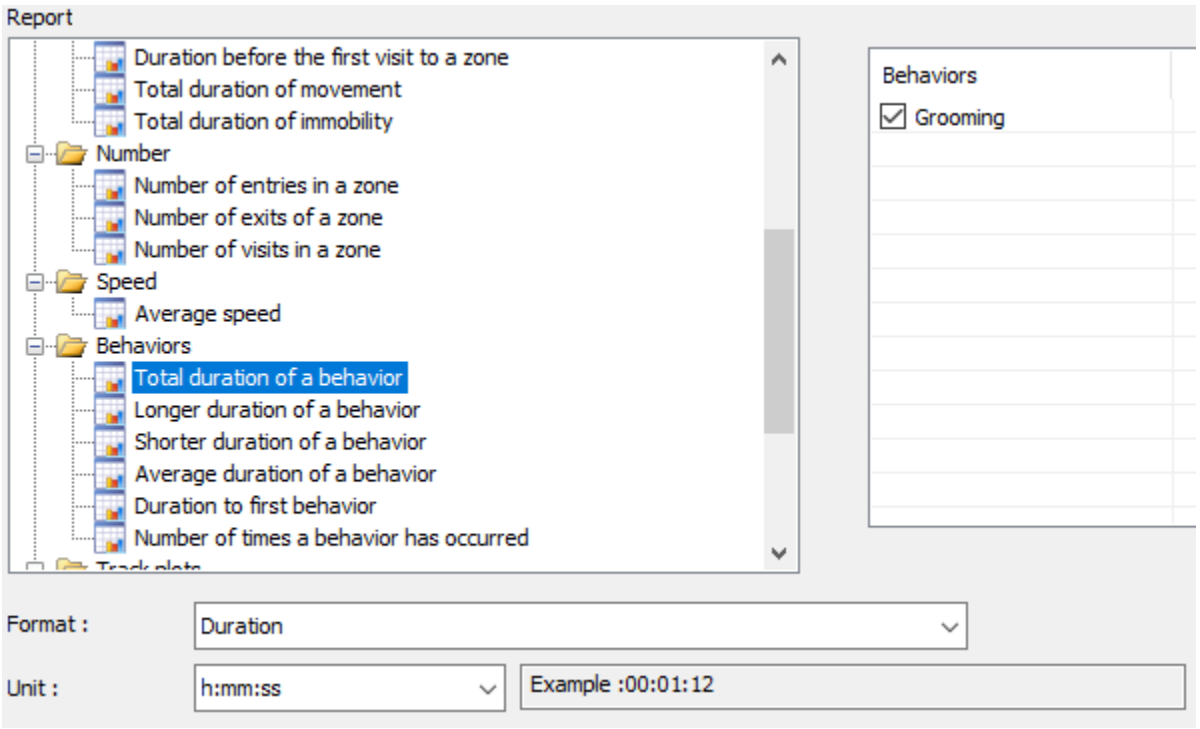
The precision of display of the results:

- 0 to 6 digits after the decimal point.
- Automatic: 2 **significant digits** after the decimal point.

9.1.22. Total duration of a behavior

Description:

This report calculates the total time that a behavior occurs.



Calculation method :

Calculates the duration of each period during which the behavior occurred, then sums them.

Settings :

Size:

The data display format:

- Duration: Time during which the behavior occurred.
- Percentage of total duration: time the behavior occurred / Total duration of the period.

Unit :

The choice depends on the format:

For "Duration":

- h:mm:ss: hours:minutes:seconds
- h:mm:ss ms: hours:minutes:seconds milliseconds
- Seconds: seconds
- Seconds.mSec: seconds.milliseconds

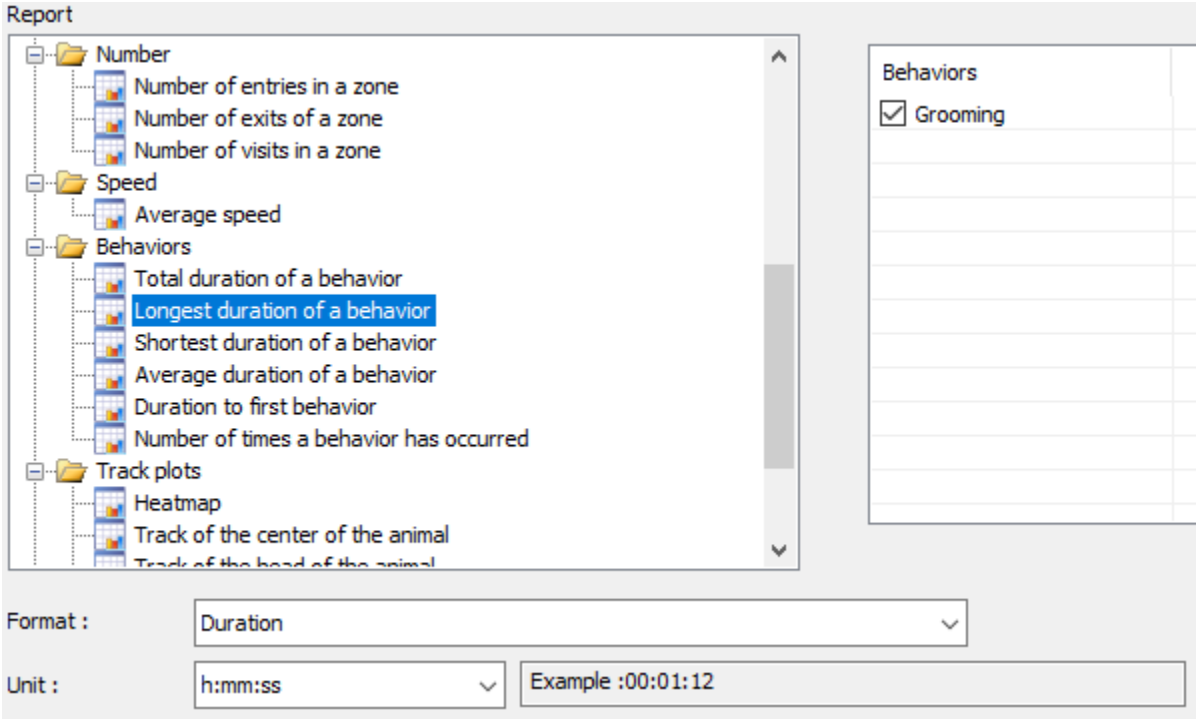
For "Percentage of total duration":

- %

9.1.23. Longest duration of a behavior

Description:

This report calculates the duration of the longest period during which a behavior occurred.



Calculation method :

Calculates the duration of each period during which the behavior occurred, then selects the longest.

Settings:

Size:

The data display format:

- Duration: Time during which the behavior occurred.

- Percentage of total duration: time the behavior occurred / Total duration of the period.

Unit :

The choice depends on the format:

For "Duration":

- h:mm:ss: hours:minutes:seconds
- h:mm:ss ms: hours:minutes:seconds milliseconds
- Seconds: seconds
- Seconds.mSec: seconds.milliseconds

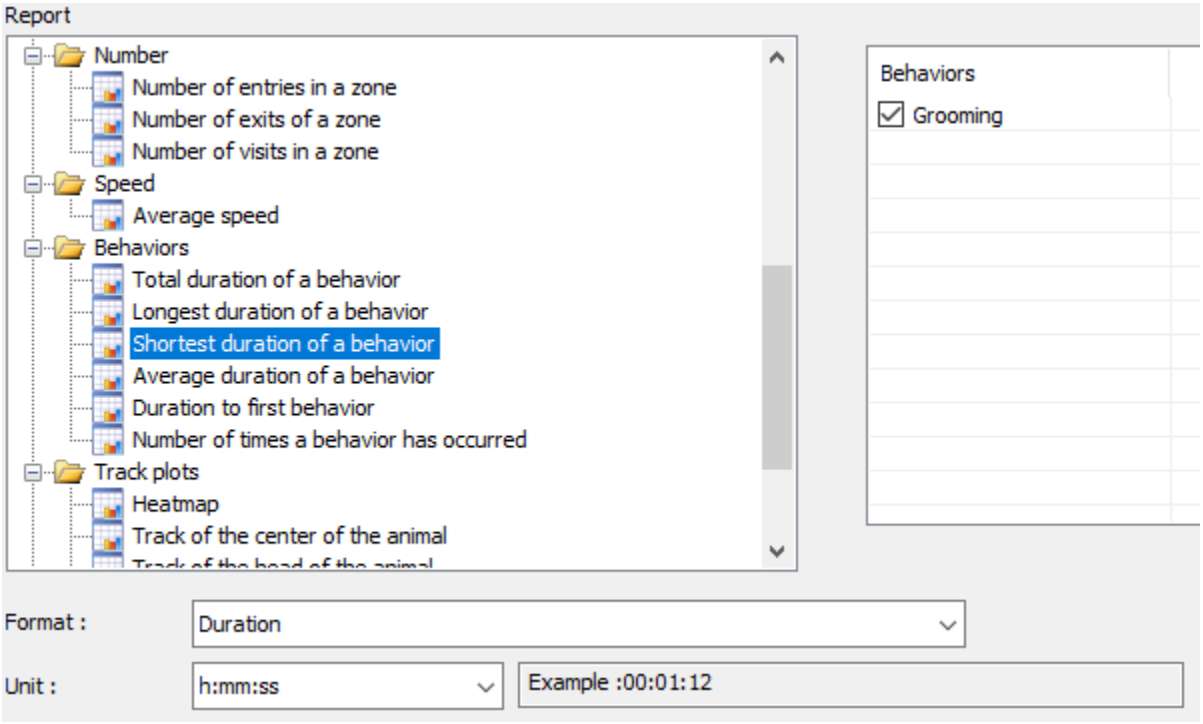
For "Percentage of total duration":

- %

9.1.24. Shortest duration of a behavior

Description:

This report calculates the duration of the shortest period during which a behavior occurred.



Calculation method :

Calculates the duration of each period during which the behavior occurred, then selects the shortest.

Settings:

Size:

The data display format:

- Duration: Time during which the behavior occurred.
- Percentage of total duration: time the behavior occurred / Total duration of the period.

Unity :

The choice depends on the format:

For "Duration":

- h:mm:ss: hours:minutes:seconds
- h:mm:ss ms: hours:minutes:seconds milliseconds
- Seconds: seconds
- Seconds.mSec: seconds.milliseconds

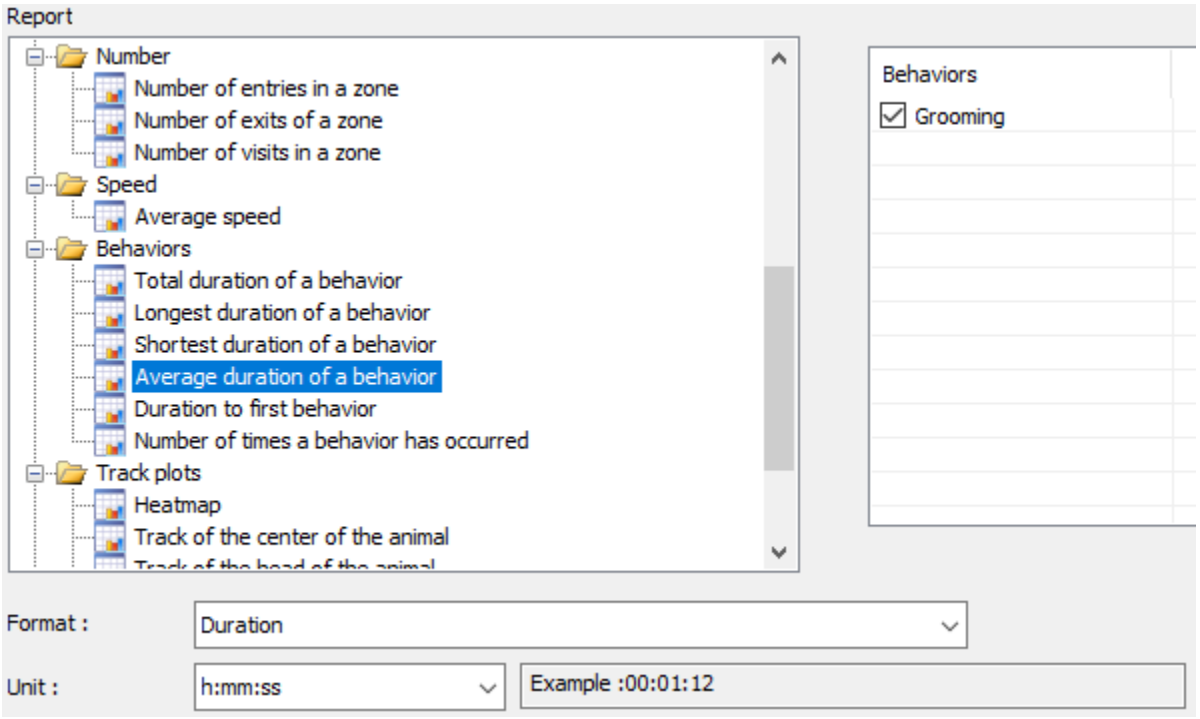
For "Percentage of total duration":

- %

9.1.25. Average duration of a behavior

Description:

This report calculates the average duration of periods during which a behavior occurred.



Calculation method :

Calculates the duration of each period during which the behavior occurred, then averages it.

Settings:

Size:

The data display format:

- Duration: Time during which the behavior occurred.
- Percentage of total duration: time the behavior occurred / Total duration of the period.

Unit :

The choice depends on the format:

For "Duration":

- h:mm:ss: hours:minutes:seconds
- h:mm:ss ms: hours:minutes:seconds milliseconds
- Seconds: seconds
- Seconds.mSec: seconds.milliseconds

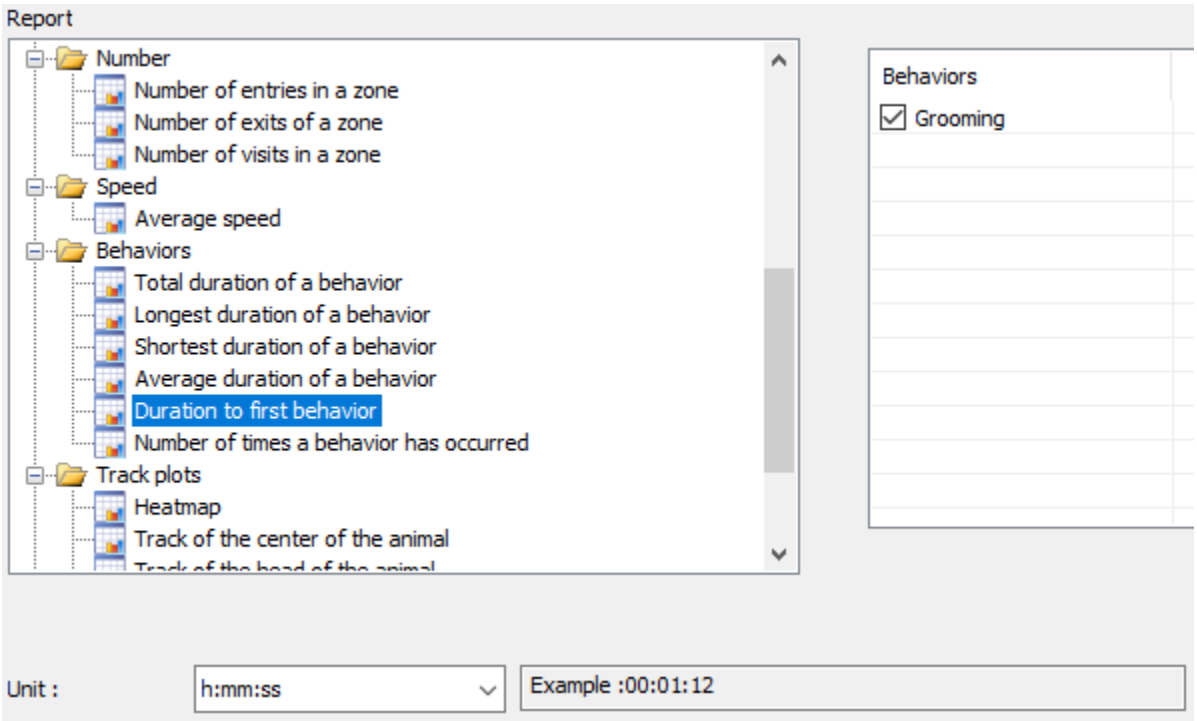
For "Percentage of total duration":

- %

9.1.26. Duration to first behavior

Description:

This report calculates the elapsed time between the start of the period and the first time a behavior occurred.



Calculation method :

Calculates the elapsed time between the start of the period and the first time a behavior occurred.

Settings:

Unity :

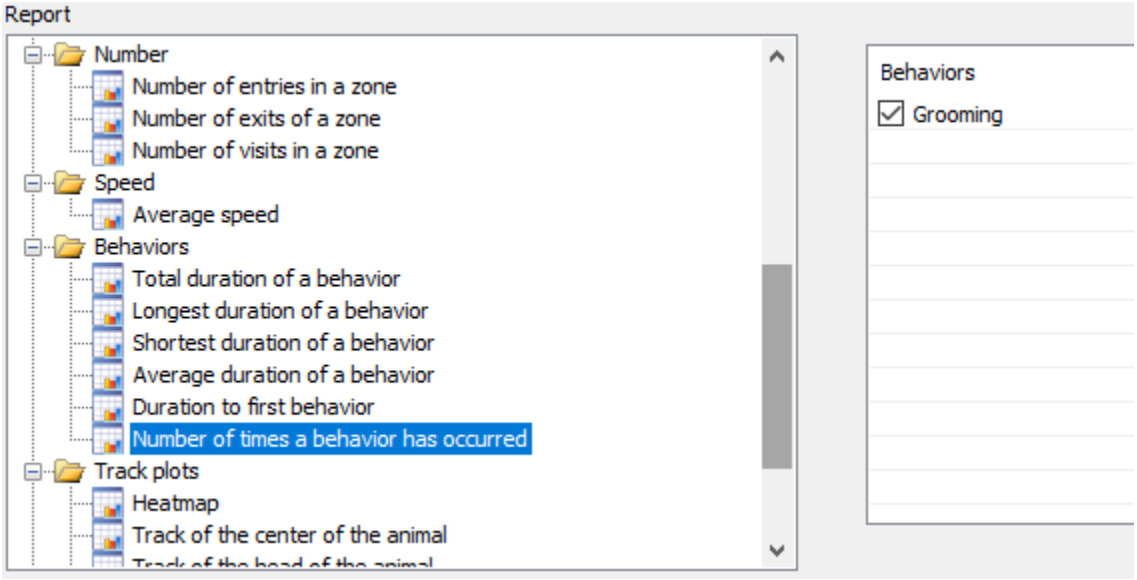
A choice :

- h:mm:ss: hours:minutes:seconds
- h:mm:ss ms: hours:minutes:seconds milliseconds
- Seconds: seconds
- Seconds.mSec: seconds.milliseconds

9.1.27. Number of times a behavior occurred

Description:

This report calculates the number of times a behavior has occurred.



Calculation method :

The number of times a behavior has occurred.

Settings:

None

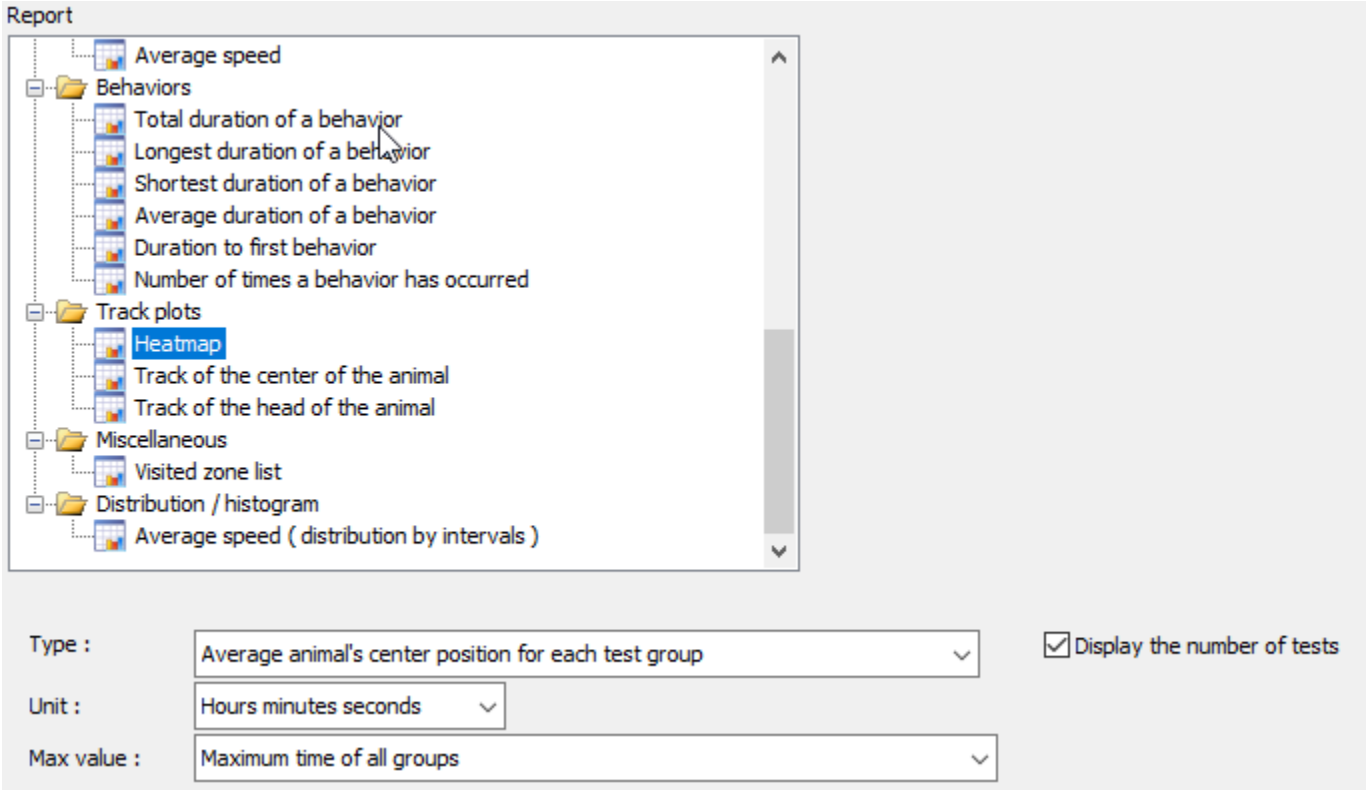
9.1.28. Heatmap

Description:

This report displays as thumbnails a visual representation of the time spent by animals in different parts of the arena.

heat maps can be plotted using the animal's center or head position.

Is it possible to display, either one heat map for each test, or heat maps of averaged data for each group of tests.



Calculation method :

A heatmap uses a range of colors to provide a visual representation of the time the animal spends in different parts of the arena during a test, with blue representing the shortest time and red the longest time.

The algorithm uses the position of the center of the animal in each image, the time between each detected position and the size of the animal to perform the calculation.

Settings:

Type :

The type of heat map :

- The position of the animal's center.
- The average of the animal's center position for each test group.
- The position of the animal's head.
- The average of the animal's head position for each test group.

Display the number of tests:

In the case of average heat maps for the groups, display or hide the number of tests in the group.

Unity :

Maximum time display format: hours minutes seconds (example: ~12 min 5 s) or seconds (example: ~725s).

Max value:

In order to be able to compare several tests, the longest time (corresponding to the color red) must be the same for all the tests.

This option allows you to choose how the longest time will be calculated :

When the report display an heat map for each test :

- Maximum time of all tests: the maximum time spent in any part of the arena for all animals of all tests in the report.
  Advantage: this is the "true" maximum time. Disadvantage: if an animal remains motionless for a long time, the other "heat maps" will only use a reduced range of the color range.
- Average of the maximum time of all tests.
  Advantage: allows a wider range of color gamut to be used for tests where animals are always in motion . Disadvantage: Masksdifferences between animals that have remained motionless for a long time in certain areas.
- Fixed value: chosen time value that does not depend on the tests included in the report.
  Advantages: makes it possible to compare the results between 2 r contributions, including if the reports depend on different protocols or different experiments.

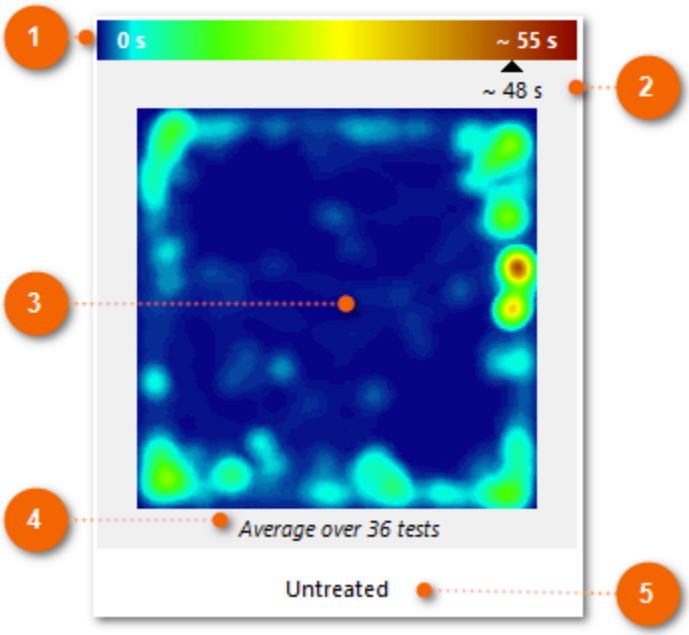
When the report display an average heat map for each group of tests :

- Maximum time of all groups: the maximum of the averages.
- Average of the maximum time of all groups.
- Fixed value.

Analysis over time:

The heat map can be calculated over the entire analysis period or only over part of the analysis period depending on the options chosen in the " Period " tab.

Thumbnail display description:



1 **color gradient :**

The color gradient used to generate the map, as well as the minimum and maximum values of the time spent (in seconds) corresponding to the extreme colors of the gradient. As indicated by the symbol ~, the calculated maximum value is an approximate value because it is calculated from the average value of a number of points around the animal's center position and not on the animal's position. a single point.

2 **Maximumvalue of time spent in a part of the arena for the test :**

The maximum value calculated for the test (or the group) as well as the position of the maximum on the color gradient (if this value is lower than the maximum value of the report). This value can be lower or higher than the maximum value of the report.

Note: *As indicated by the symbol ~, the calculated maximum value is an approximate value because it is calculated from the average value of a number of points around the position of the animal's center and not on the position from a single point.*

3 **heat map**

The heat map of the test or group.

4 **Numberof tests in the group**

The number of tests in the group (only for average heat maps for groups).

5 **Name**

The name of the test or group.

Grouping:

Tests can be grouped by stage, trial, user fields or by animals (see "Group / Sort").

Exportof results:

The report can be exported in different formats to use the results in other software.

The complete report can be saved as a file in html format to be opened in any internet browser, or in rtf format to be opened by a text editor (Microsoft Word, Microsoft Wordpad, Libre Office writer, Open Office Writer, ...).

To do this, simply click on the 

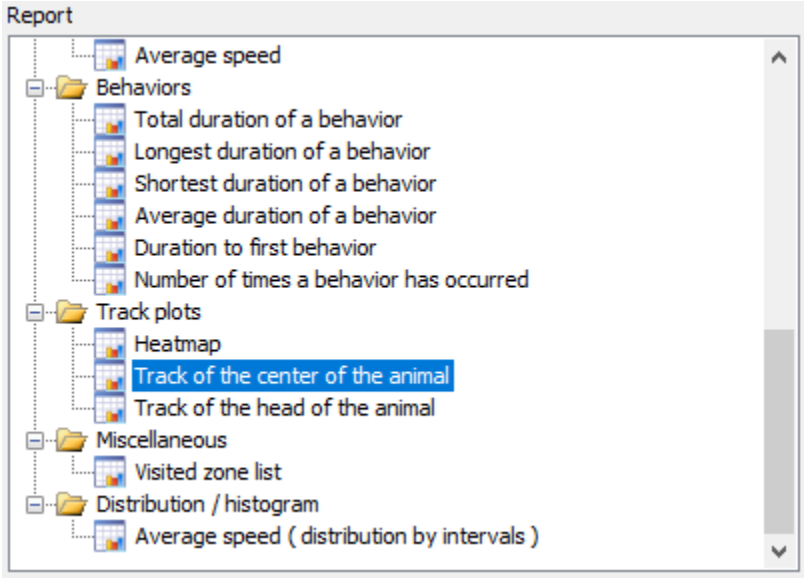
command ribbon button or click on the right mouse button in the report to bring up the contextual menu and select the "Save to file" menu.

It is also possible to export each thumbnail independently, either by copying it to the clipboard or by saving it as an image file. To do this, simply position the cursor on a thumbnail, click on the right mouse button to bring up the contextual menu and select the corresponding menu "Copy the plot" or "Save the plot".

9.1.29. Track of the center of the animal

Description:

This report displays the track of the center of the animal in the form of thumbnails.



Settings:

None

Analysis over time:

The trace displayed can be limited to part of the analysis period according to the options chosen in the " Period " tab.

Grouping:

Tests can be grouped by user fields or by animals.

Export of results:

The report can be exported in different formats to use the results in other software.

The full report can be saved as a file either in "html" format to be opened in any internet browser, or in "rtf" format to be opened by a text editor (Microsoft Word, Microsoft Wordpad, Libre Office writer, Open Office Writer, ...). To do this, simply click on the 

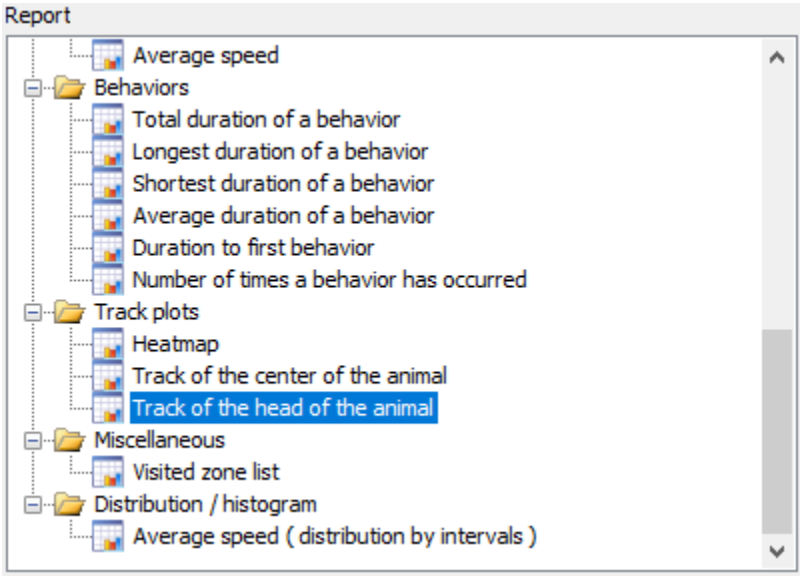
command ribbon button or click on the right mouse button in the report to bring up the contextual menu and select the "Save to file" menu.

It is also possible to export each thumbnail independently, either by copying it to the clipbloard or by saving it as an image file. To do this, simply position the cursor on a thumbnail, click on the right mouse button to bring up the contextual menu and select the corresponding menu "Copy the plot" or "Save the plot".

9.1.30. Track of the head of the animal

Description:

This report displays the trace of the animal's head in the form of thumbnails.



Settings:

None

Analysis over time:

The trace displayed can be limited to part of the analysis period according to the options chosen in the " Period " tab.

Grouping:

Tests can be grouped by user fields or by animals.

Export of results:

The report can be exported in different formats to use the results in other software.

The full report can be saved as a file either in "html" format to be opened in any internet browser, or in "rtf" format to be opened by a text editor (Microsoft Word, Microsoft Wordpad, Libre Office writer, Open Office Writer, ...). To do this, simply click on the 

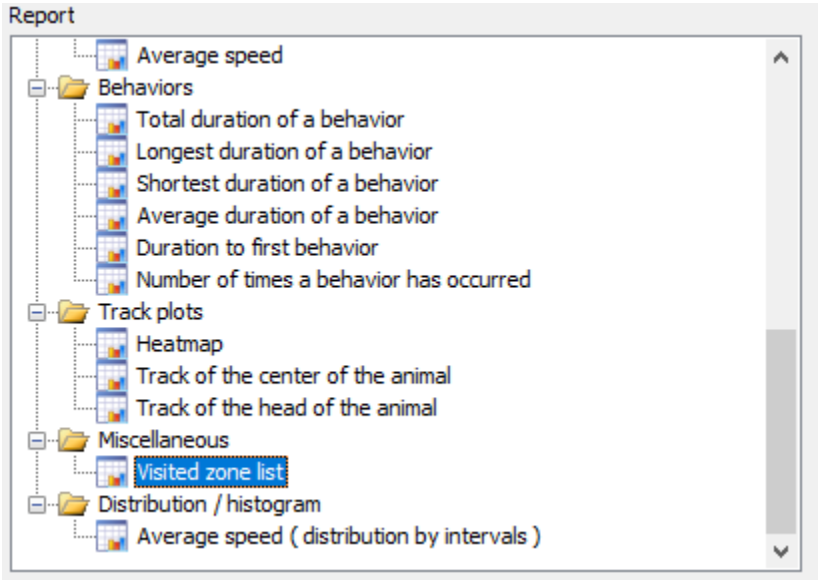
command ribbon button or click on the right mouse button in the report to bring up the contextual menu and select the "Save to file" menu.

It is also possible to export each thumbnail independently, either by copying it to the clipboard or by saving it as an image file. To do this, simply position the cursor on a thumbnail, click on the right mouse button to bring up the contextual menu and select the corresponding menu "Copy the plot" or "Save the plot".

9.1.31. List of visited zones

Description:

This report displays the list of zones visited during the period.



Calculation method:

The list of visited zones separated by a comma

Settings:

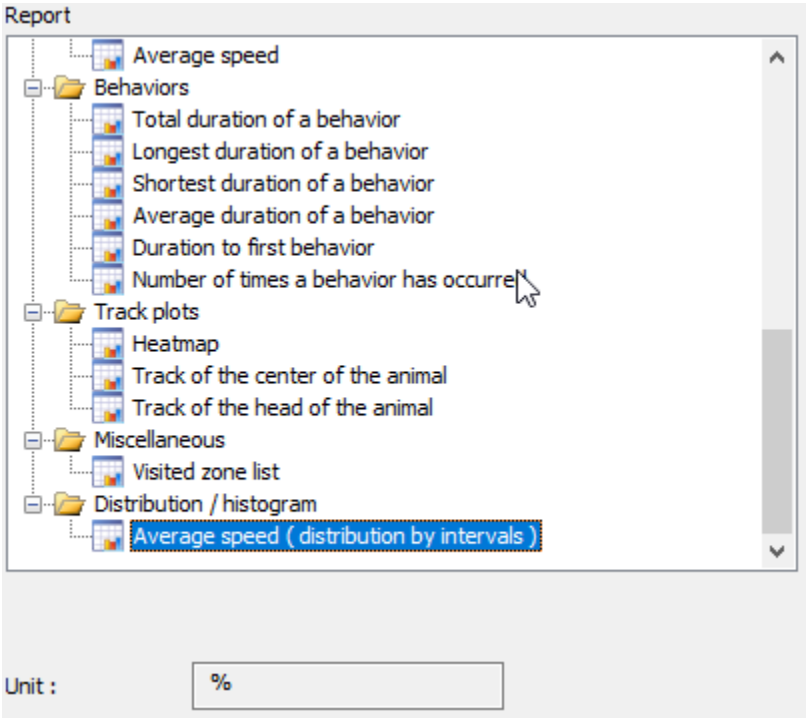
None

Only the zones selected in the "Zones of interest" tab are included in the list.

9.1.32. Average speed (distribution by intervals)

Description:

This report calculates the percentage of time an animal moved at an average speed within different intervals.



Calculation method :

The calculation takes place in 2 steps:

- ***Step 1:*** EthoTrack calculates the average speed of the animal over each averaging period.
- ***Step 2:*** EthoTrack groups the periods during which the average speed belongs to the same speed interval and calculates the percentage of the total time.

Example :

Analysis time: 10 minutes.
Averaging time: 1 minute. Equal intervals: width = 5 mm/s.

Step 1: EthoTrack calculates the average speed of the animal over each period: 0 to 1 min, 1 to 2 min, 2 to 3 min, ..., 9 to 10 min.

For example :

period	average speed	speed interval
0 - 1	0.3mm/s	0 - 5
1 - 2	2.3mm/s	0 - 5
2 - 3	10.2mm/s	10 - 15
3 - 4	24.3mm/s	20 - 25
4 - 5	11.3mm/s	10 - 15
5 - 6	1.1mm/s	0 - 5
6 - 7	1.9mm/s	0 - 5

7 - 8	14.6mm/s	10 - 15
8 - 9	22.5mm/s	20 - 25
9 - 10	23.6mm/s	20 - 25

Step 2: EthoTrack groups the periods during which the average speed belongs to the same speed interval and calculates the percentage of the total time.

For example :

speed interval	periods	Duration	% Test duration
0 - 5	0 - 1 1 - 2 5 - 6 6 - 7	4 minutes	4 / 10 = 40%
10 - 15	2 - 3 4 - 5 7 - 8	3 minutes	3 / 10 = 30%
20 - 25	3 - 4 8 - 9 9 - 10	3 minutes	3 / 10 = 30%

Settings:

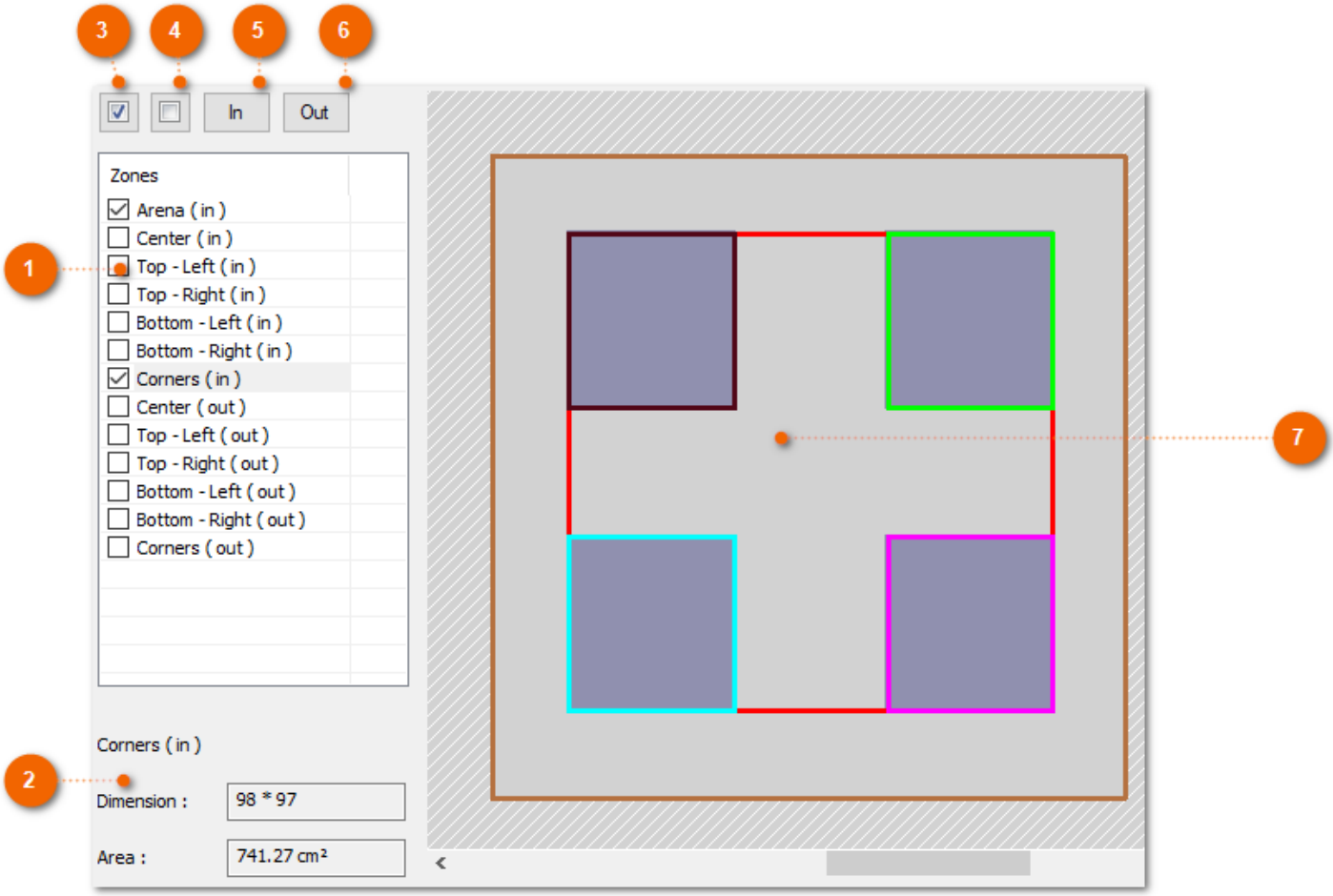
None

9.2. Zones of interest

Each report can be linked to one or more zones of interest.

A zone of interest can be:

- the whole arena.
- inside a zone defined in the protocol.
- outside a zone defined in the protocol.



Selection of zones of interest

Click the checkboxes to select or deselect the report's zones of interest (inside or or outside).

Information

Some information about the highlighted area in the list (name, dimension, area).

Select all

Click to select all zones.

Deselect all

Click to deselect all zones

Select inside zones

Click to select only the inside of the zones.

Select outside zones

Click to select only the outside zones.

Display

Representation of the arena and the zones defined in the protocol.

the area highlighted in the list also appears highlighted in the display part.

You must select at least one zone.

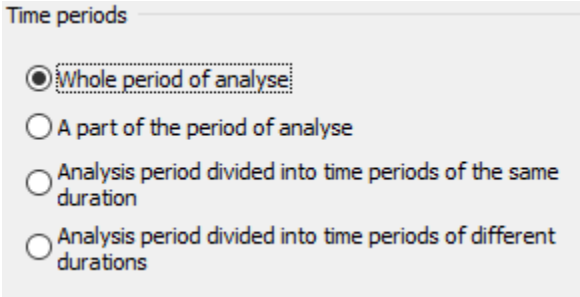
9.3. Analysis over time

Sometimes it can be interesting to analyze the behavior of the animals over one or more specific time periods and not over the total analysis time. For example, to compare animal behavior before and after a stimulus.

This tab is used to define the time period(s) of the report.

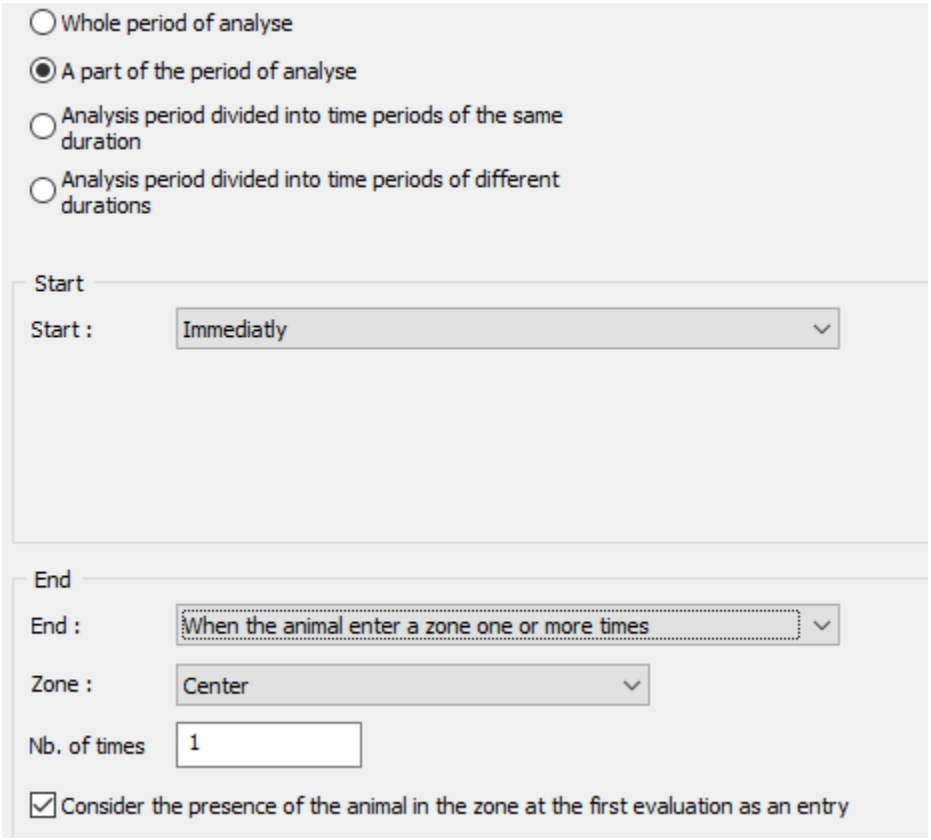
You can analyze data on:

- **The entire analysis period:**



The entire analysis period as defined in the "Analysis" tab of the "Protocol" dialog box will be taken into account.

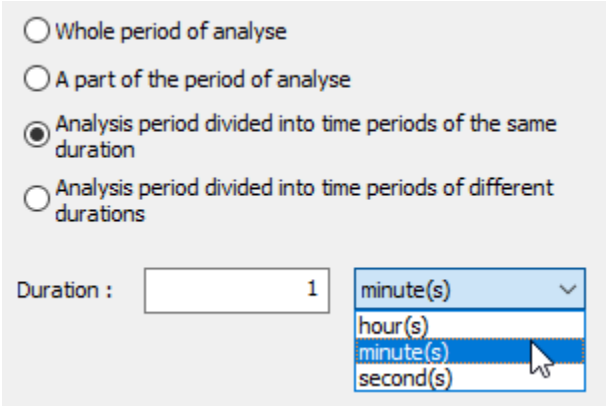
- **Part of the analysis period**



This option allows you to choose the start and end of the report time period according to one of the following conditions:

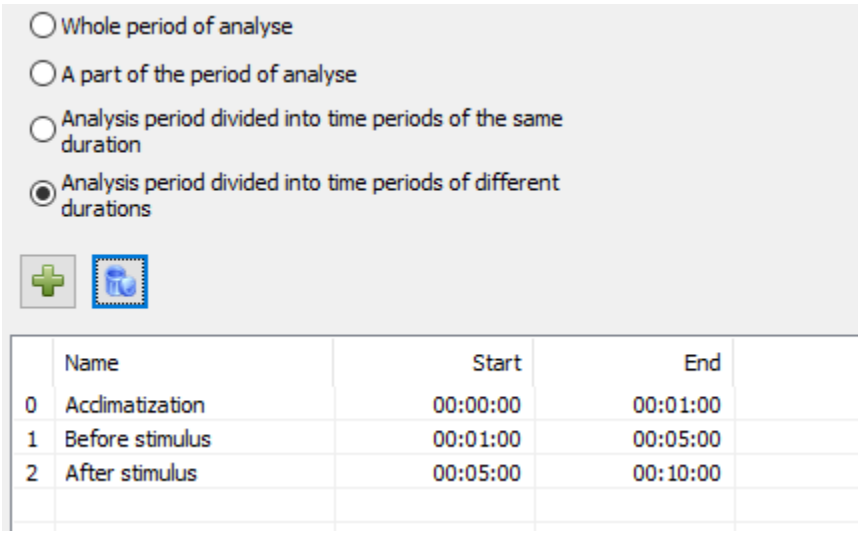
- Immediately for the beginning) or at the end of the analysis (for the end).
- After a specific duration.
- When the animal moves for a certain amount of time.
  Note: the animal is considered to be in motion if it remains motionless for less than the duration of immobility defined in the 'General'tab of the protocol.
- When the animal is motionless for a certain amount of time.
- When the animal enters a zone for a certain amount of time.
- When the animal enters a zone one or more times.
  Note: The presence of the animal in the zone during the first evaluation of the event is counted as an entry if the option "Consider the presence of the animal in the zone during the first evaluation as an entry" is selected.
- When the animal leaves a zone for a certain amount of time.
- When the animal leaves a zone one or more times.
  Note: The presence of the animal outside the zone during the first evaluation of the event is counted as an exit if the option "Consider the presence of the animal outside the zone during the first evaluation as an exit" is selected.

- **Time periods of the same duration:**



Simply indicate the duration of a period and let Ethotrack create several consecutive periods according to the total analysis duration.

- **Time periods of different lengths:**



In this case, you can create as many periods as you want by simply specifying the start and end of each period.

To add a new period:

- Click on the button  , then click directly in the list on the new period, to modify the name, the beginning or the end.
- Click directly in the list on the first empty line.

To delete a period:

- Click in the list to select the period to delete, then click on the button 

9.4. Distribution by intervals

Averaging period :

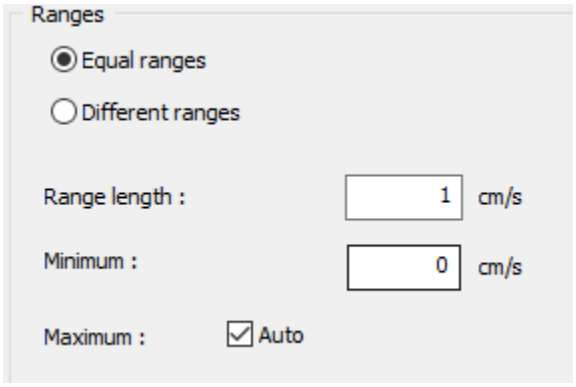
Duration over which the average speed will be calculated.

Ranges :

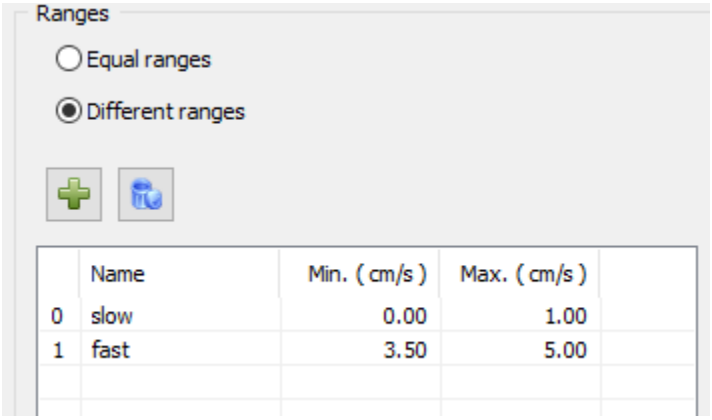
Definitions of speed "ranges".

ranges can be:

- of equal width: In this case, the width of the interval must be defined, as well as the minimum and maximum speeds to be taken into account.



- variable width: In this case, each interval must be defined.



Example :

Analysis time: 10 minutes.
Averaging time: 1 minute. Equal intervals: width = 5 mm/s.

Step 1: EthoTrack calculates the average speed of the animal over each period: 0 to 1 min, 1 to 2 min, 2 to 3 min, ..., 9 to 10 min.

For example :

period	average speed	speed interval
0 - 1	0.3mm/s	0 - 5
1 - 2	2.3mm/s	0 - 5
2 - 3	10.2mm/s	10 - 15
3 - 4	24.3mm/s	20 - 25

4 - 5	11.3mm/s	10 - 15
5 - 6	1.1mm/s	0 - 5
6 - 7	1.9mm/s	0 - 5
7 - 8	14.6mm/s	10 - 15
8 - 9	22.5mm/s	20 - 25
9 - 10	23.6mm/s	20 - 25

Step 2: EthoTrack groups the periods during which the average speed belongs to the same speed interval and calculates the percentage of the total time.

For example :

speed interval	periods	Duration	% Test duration
0 - 5	0 - 1 1 - 2 5 - 6 6 - 7	4 minutes	4 / 10 = 40%
10 - 15	2 - 3 4 - 5 7 - 8	3 minutes	3 / 10 = 30%
20 - 25	3 - 4 8 - 9 9 - 10	3 minutes	3 / 10 = 30%


This tab is only available for "Average speed, grouped by intervals" reports.

10. Filters

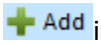
A filter allows you to select the tests to include in a report.

A filter can be described in 3 ways:

- By direct selection of the tests to be included.
- By a simple logical condition entered graphically. In this case, all tests for which the logical condition is true are included in the report.
- By a complex logical condition . In this case, all tests for which the logical condition is true are included in the report.

To create a filter:

You can choose to:

- Open the protocol dialog box , select the " Report " tab , then click the button  in the filters column.
- Select the "Reports" display mode, then click on  in the Filter panel of the command ribbon.

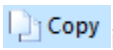
To modify a filter:

You can choose to:

- Open the protocol dialog box , select the "Reports / Filters " tab, then click the button  in the filters column.
- Select the "Reports" display mode,, then click on  in the Filter panel of the command ribbon.

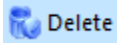
To Copy a filter:

You can choose to:

- Open the protocol dialog box , select the "Reports / Filters " tab, then click the button  in the filters column.
- Select the "Reports" display mode, then click on  in the Filter panel of the command ribbon.

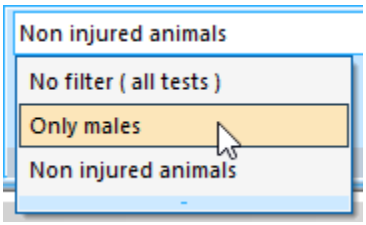
To remove a filter:

You can choose to:

- Open the protocol dialog box , select the "Reports / Filters " tab, then click the button  in the filters column.
- Select the "Reports" display mode, then click on  in the Filter panel of the command ribbon.

To filter items to include in a report:

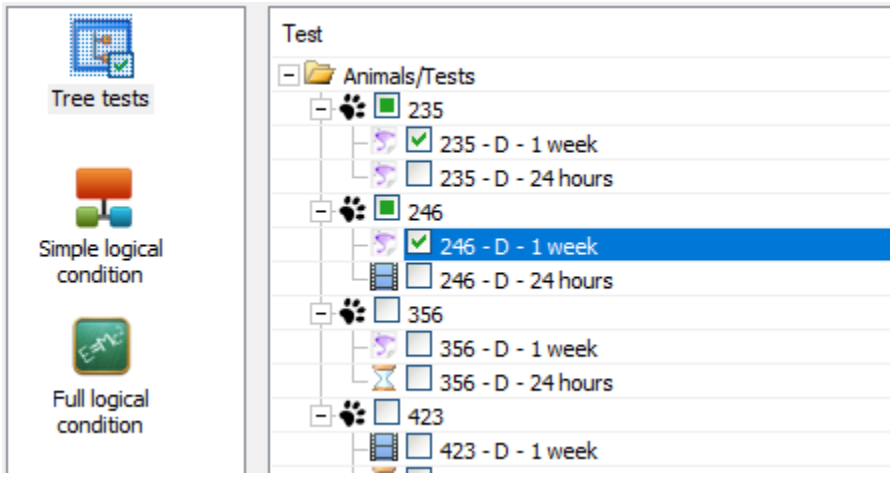
Select a filter from the list of filters :



10.1. Selection of tests

This tab allows you to define a filter by directly selecting the tests. To do this, simply check the boxes of the tests you want to include in your reports.

Grouping levels and display ordrer are those defined in the workspace.

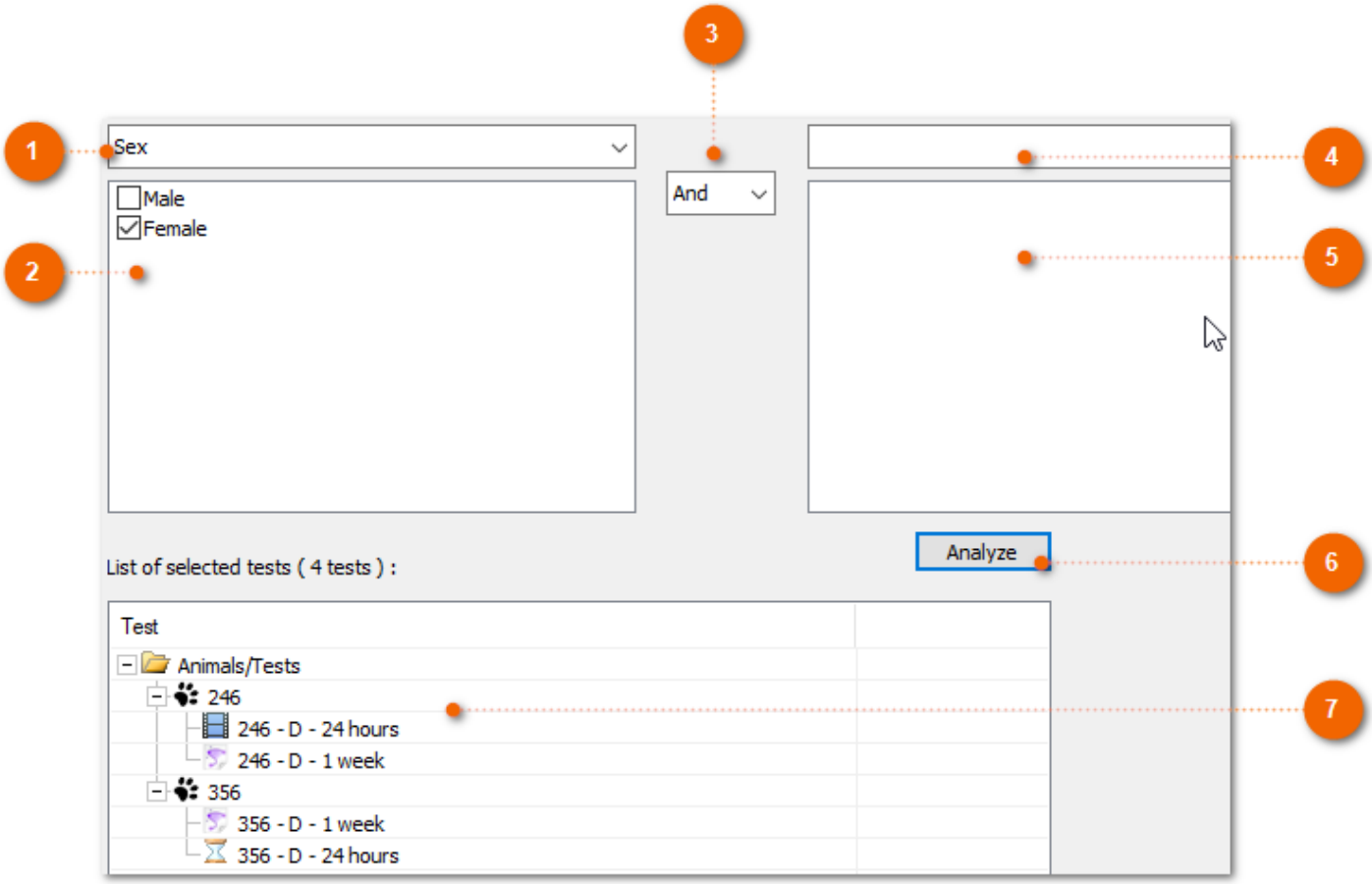


10.2. Simple logical condition

This tab allows you to precisely select the tests to be included in a report by defining a simple logical condition defined by a graphical interface. This logical condition can relate to 2 parameters among the following elements:

- The animal's name.
- The "choice" type user fields .

In the example below: only female animals will be selected.



1 **Parameterof condition 1 :**

Choice of parameter to test for condition 1.

2 **Possible choices for condition 1 :**

All possible values of the parameter 1. Check the box of the choices to be selected.

3 **Logical operator between the 2 conditions :**

Either "And" operator or "Or" operator

4 **Parameterof condition 2 :**

Choice of parameter to test for condition 2.

5 **Possible choices for condition 2 :**

All possible values of the parameter 2. Check the box of the choices to be selected.

6 **Analyze :**

Button used to refresh the list of selected tests.

7 **List of selected tests:**

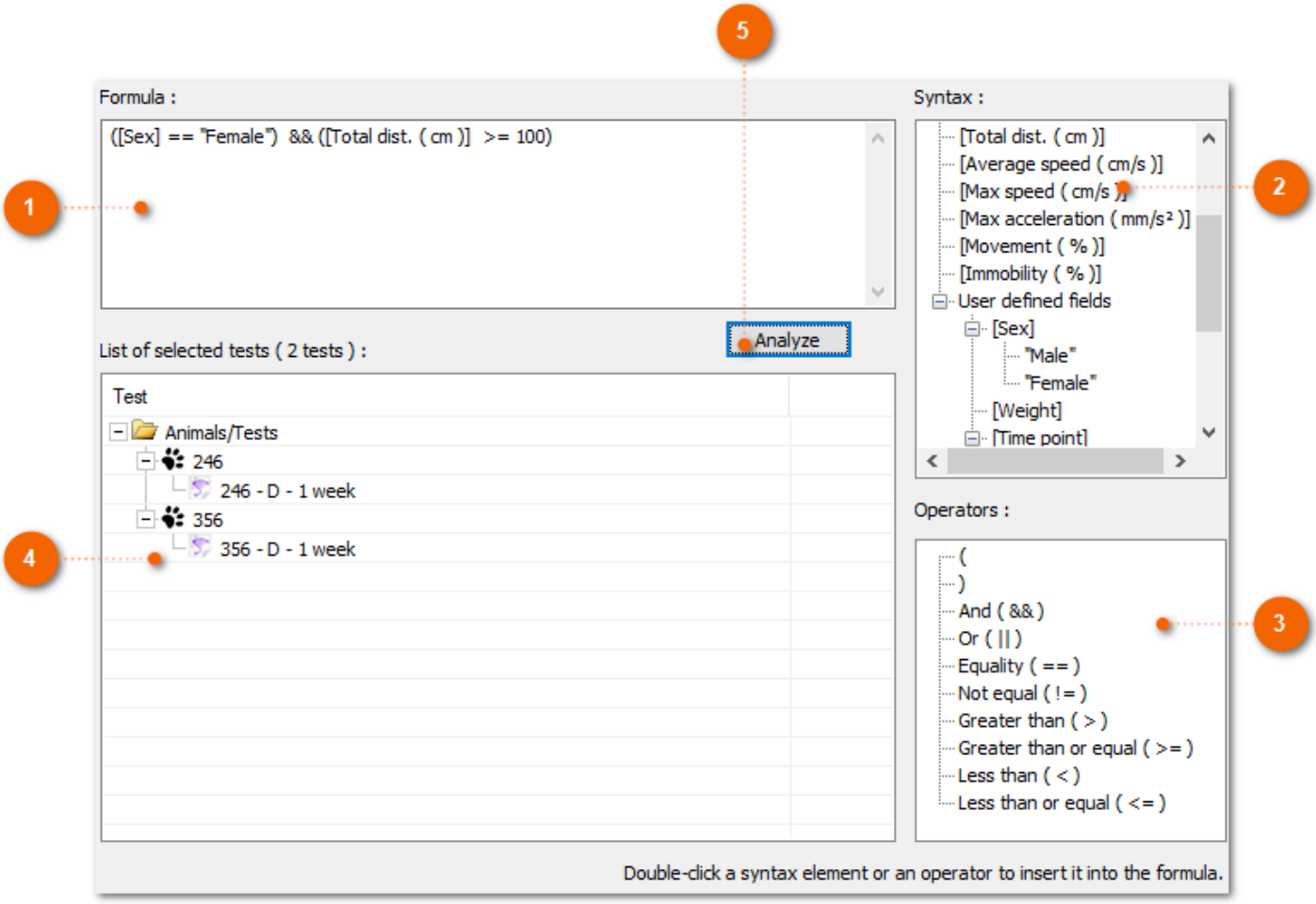
List of tests for which the logical condition is true.

10.3. Full logical condition

This tab allows you to precisely select the tests to be included in a report by defining a more or less complex logical condition. This logical condition can incorporate the following parameters:

- The animal's name.
- Some results calculated during the analysis (total distance covered, average speed, etc.).
- User fields of the "choice" or "numeric" type.

In the example below: only the female animals having traveled more than 100cm during the test will be selected (the unit used is that defined in the options of the experiment).



1 **Formula:**

Input box for the logical condition.

2 **Syntax :**

List of keywords that can be used in the formula defining the logical condition. Double-click an item in this list to insert it into the formula at the cursor position.

3 **Operators:**

List of operators that can be used in the formula defining the logical condition. Double-click an item in this list to insert it into the formula at the cursor position.

4 **List of selected tests:**

List of tests for which the logical condition defined by the formula is true.

5 **Analyze :**

Button used to check the syntax of the formula and refresh the list of selected tests.

 For criteria based on a calculated numeric value, the comparison is made on the actual calculated value and not on the rounded value as displayed in the "list of tests" or in the "current test" view (for example: if the calculated distance traveled is 99.997cm, the value rounded to 2 decimal places displayed is 100.00cm and the condition "distance traveled greater than or equal to 100will be considered false).

11. Display Modes

The Ethotrack interface is organized in several display modes which correspond to the different stages of the experiment

- File
- Experiment
- List of videos
- Current video
- List of animals
- List of tests
- Current test
- Reports

To change display mode:

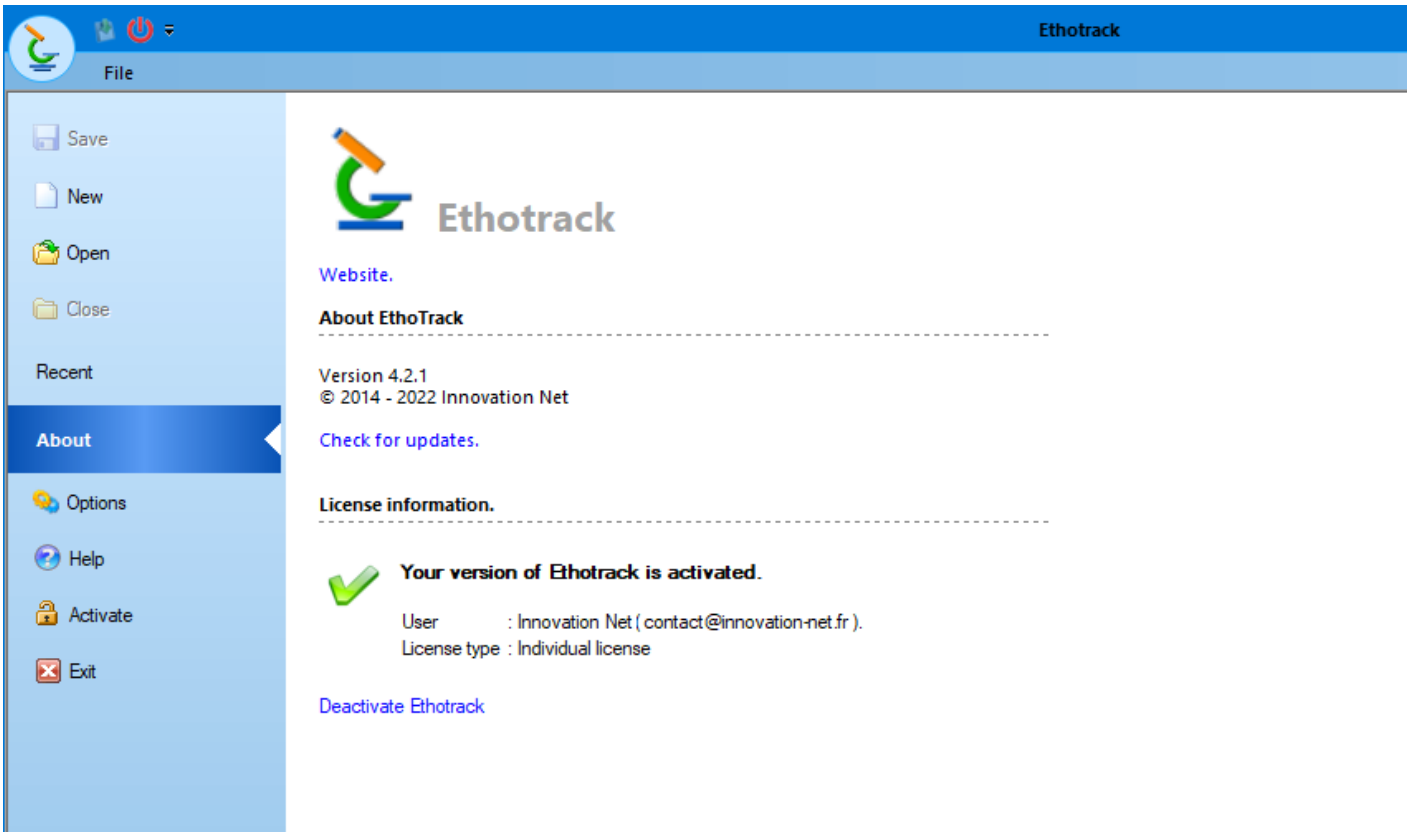
- Select the corresponding tab in the command ribbon.

11.1. File

This view is used to manage experiment files:

- Save the current experiment.
- Create a new experiment.
- Open an existing experiment.
- Close the current experiment.
- Open an experiment from the list of recent experiments.

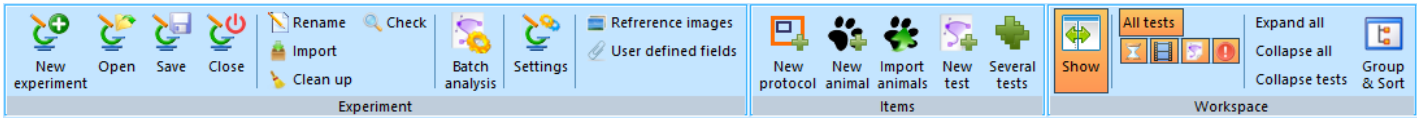
It also allows you to change program options and activate your version of Ethotrack.



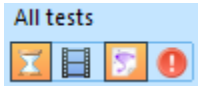
11.2. Experiment

This view presents the main information of the current experiment.

Ribbon commands:

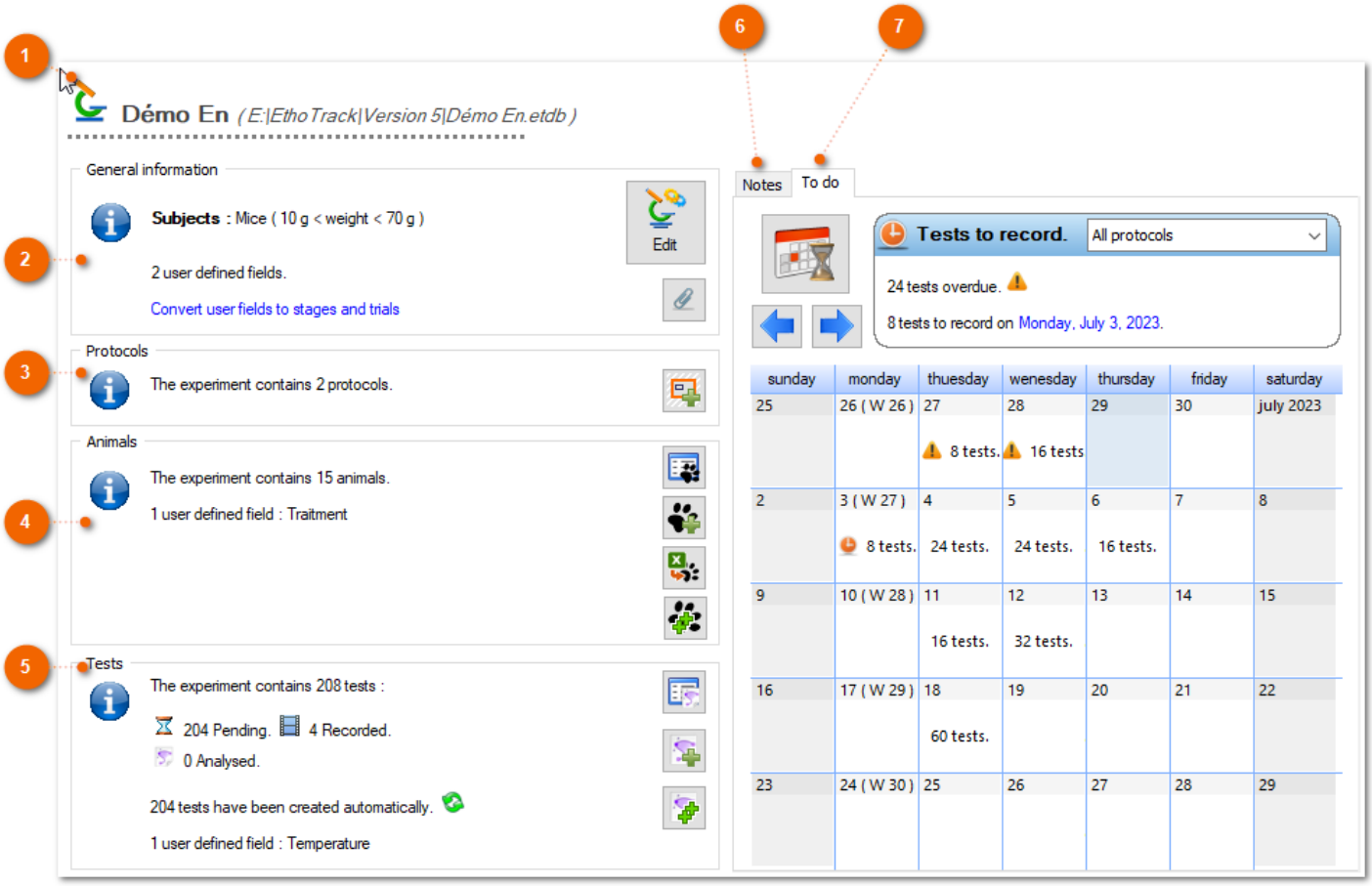


- **Experiment** :
  - **New experiment** : Create a new experiment.
  - **Open** : Open an existing experiment.
  - **Save** : Save changes to the current experiment.
  - **Close** : Close the current experiment.
  - **Rename** : Rename the current experiment.
  - **Import** : Import elements (protocols or user fields) from another Ethotrack experiment.
  - **Clean up** : Reduces the size of the experiment file by compacting the database.
  - **Check** : Verifies the consistency of the experiment and allows certain errors to be detected (choice of arena, detection rate, etc.).
  - **Batch analysis : Open the "** Batch analysis **"** dialog box to start the analysis of several tests.
  - **Settings :** Open the **"** Experiment Settings **"** dialog
  - **Reference images** : Open the dialog box for managing reference images.
  - **User Fields** : Open the dialog for managing user fields .

- **Items** :
  - **New protocol** : Add a new protocol.
  - **New animal** : Add an animal.
  - **New test** : Add a test.
  - **Several tests** : Add multiple tests with the test creation wizard.
- **Workspace** :
  - **Show** : Show or hide the workspace.
  - 

: Allows you to display or hide the tests in the workspace according to their status (Pending, saved, analyzed, excluded).
  - **Expand all** : fully expand the tree structure of the "Animals / Tests" node of the workspace.
  - **Collapse all** : collapse the tree structure of the "Animals / Tests" node of the workspace.
  - **Collapse Tests** : Collapse the workspace tree to the parent nodes of the tests.
  - **Group / Sort** : open the dialog box for configuring the tree structure of the "Animals" or "Tests" node of the workspace.

Main part :



1 **Title :**

The name of the experiment and the location of the experiment file.

2 **General information :**

The summary of the parameters of the experiment.

- Click the button to open the " 

Experiment Settings " dialog box
- Click the button  to open the dialog for editing user fields .

3 **Protocols:**

The number of protocols.

- Click the button  to add a new protocol.

4 **Animals :**

The number of animals as well as the details of the "animal user fields".

- Click on the button  to display the list of animals.
- Click the button  to add an animal.

5 **Tests :**

The number of tests, as well as the distribution of tests according to their status. Details of "test user fields".

- Click on the button  to display the list of tests.
- Click the button  to add a test.
- Click the button  to add multiple tests with the test creation wizard .

6 **Notes :**

This area allows you to enter notes or comments on the experiment.

To do :

The list of pending tests presents the list of scheduled tests in chronological form. The tests are grouped into 3 categories:

- Overdue tests.
- Tests scheduled today.
- The tests planned in the next few days.

You can click directly on the title of a test to select it as the current test and open the "Current test" mode.

11.2.1. Schedule of tests to record

The to-do list allows you to quickly view the list of tests to be recorded over a given period :

- Either in calendar form for a period of one month.
- Or in the form of a list for one day.

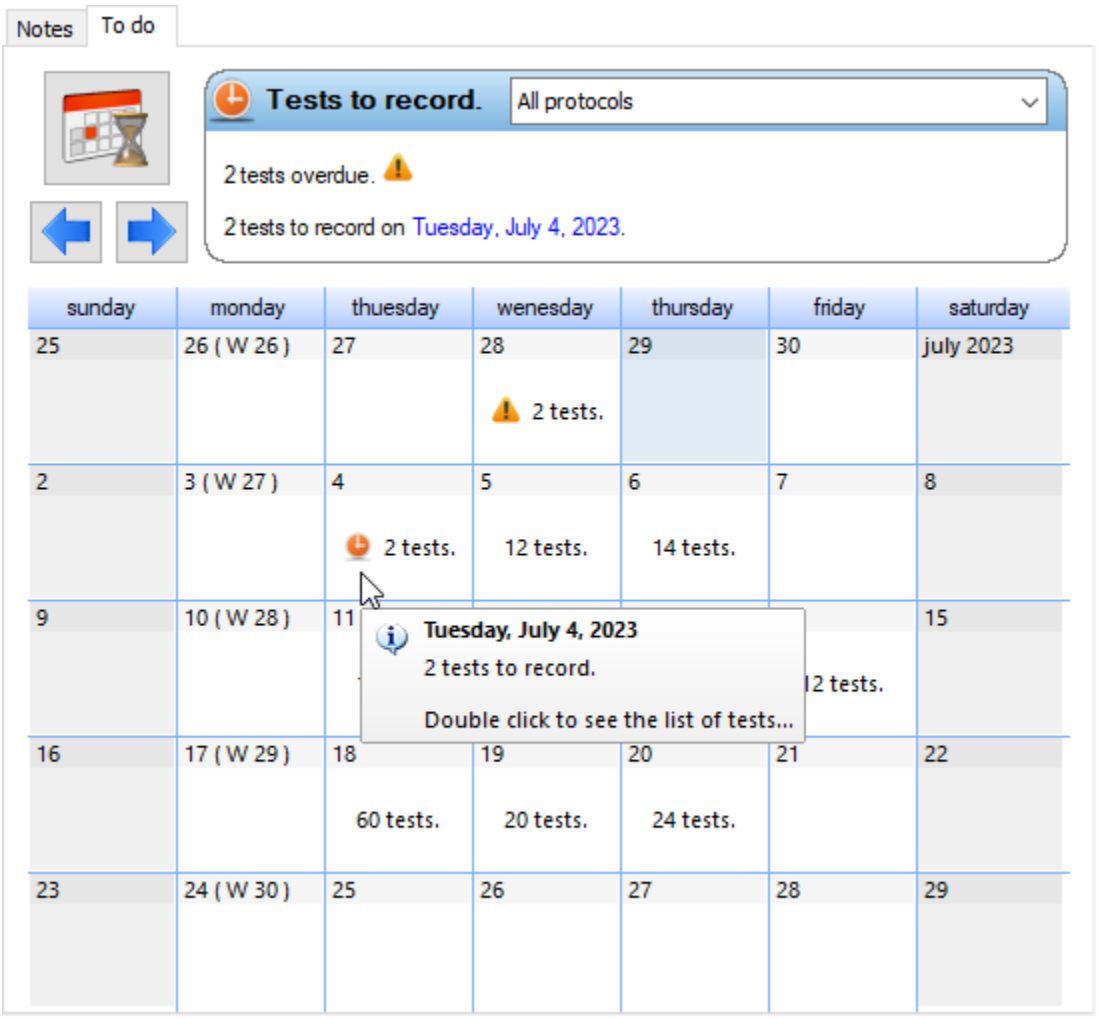
To switch from the monthly calendar to the daily display, simply double click on a day containing tests to be recorded.

To switch from the daily display to the monthly calendar, click on :  .

The contextual menu accessible by a right mouse click allows you to export the calendar to a file or to send it by email to the person in charge of carrying out the tests. It also allows you to reschedule some tests.

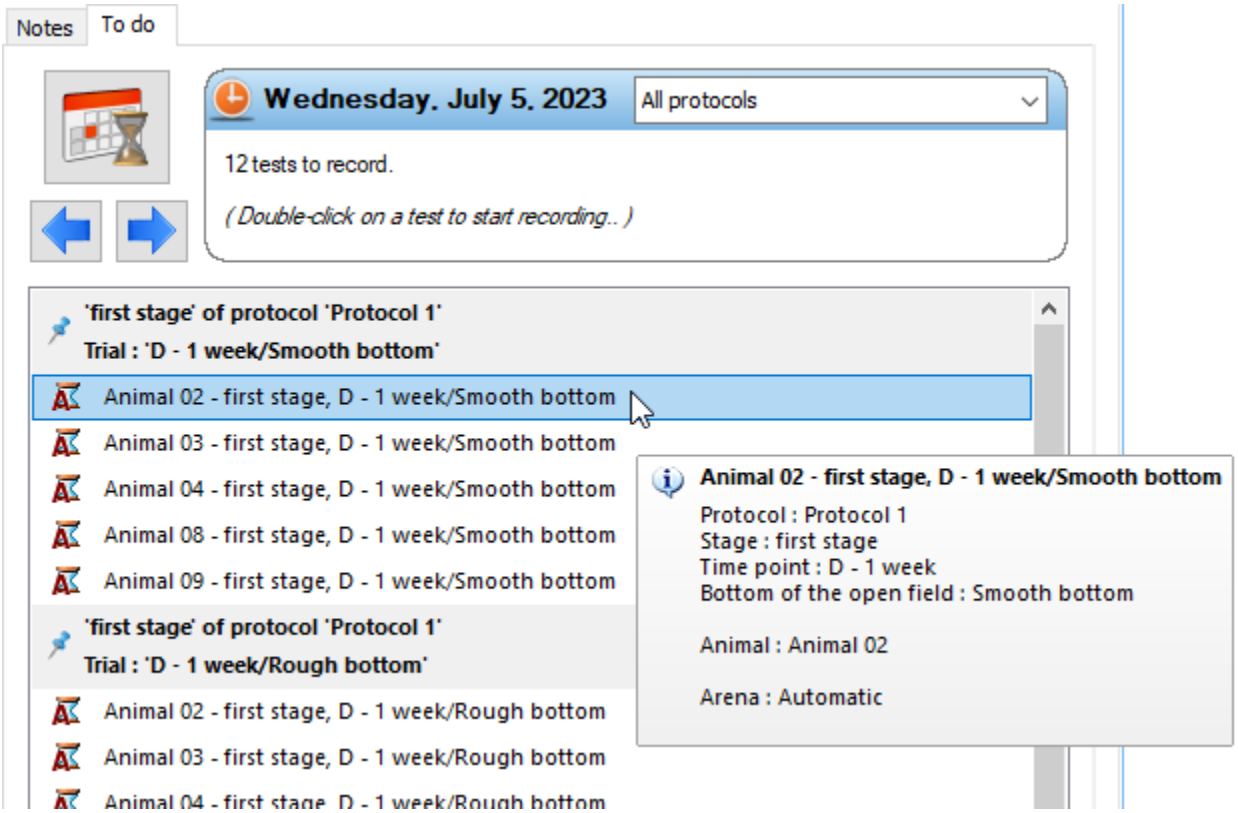
Calendar :

Display of tests to be recorded over a period of one month. .



List of tests to record on a day :

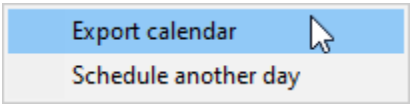
Detailed display of the tests to be recorded over a day classified by test.



You can double click on an item in the list to start recording the test.

Contextual menu :

The contextual menu is accessible by clicking on the right mouse button.



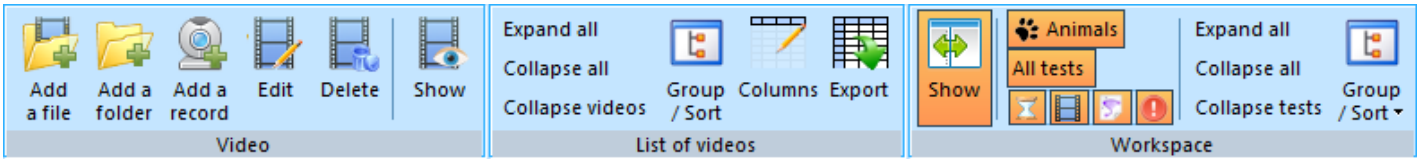
It allows the following actions:

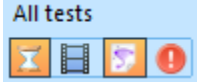
- **Export calendar :** Create a file containing the list of tests to save. The file can be in text format, in rtf format (to open it in word processing software such as Word), or in html format (for display in a web browser).
- **Schedule another day :** Change the scheduled date of the selected tests.

11.3. List of videos

This view displays and manages the list of videos used in the experiment.

Ribbon commands :

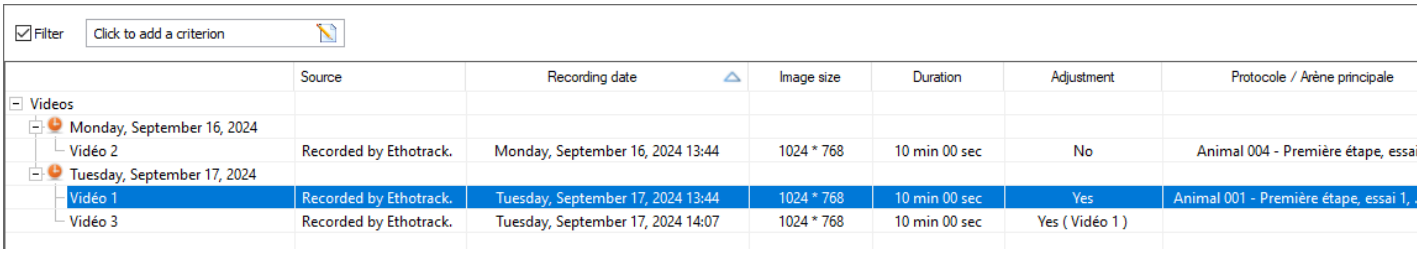


- **Video** :
  - **Add a file** : Add an existing video to the list.
  - **Add a directory**: Add all the videos present in a directory.
  - **Add a record**: Record a new video and add it to the list.
  - **Edit** : Edit the settings of the selected video.
  - **Delete** : Delete the selected videos.
  - **Show** : Open the selected video in the " Current video " view.
- **List of videos** :
  - **Expand all** : fully expand the tree structure of the "Videos" node of the list.
  - **Collapse all** : collapse the tree structure of the "Videos" node of the list.
  - **Collapse Videos** : Collapse the workspace tree to the parent nodes of the videos.
  - **Group / Sort**: open the dialog box for configuring the tree structure of the video list.
  - **Columns:** Select the table columns.
  - **Export**: Export the list of videos in a Microsoft© Excel or text file with separator (CSV).
- **Workspace** :
  - **Show** : Show or hide the workspace.
  - 

: Allows you to display or hide the tests in the workspace according to their status (Pending, saved, analyzed, excluded).
  - **Expand all** : fully expand the tree structure of the "Animals / Tests" node of the workspace.

- **Collapse all** : collapse the tree structure of the "Animals / Tests" node of the workspace.
- **Collapse Tests** : Collapse the workspace tree to the parent nodes of the tests.
- **Group / Sort** : open the dialog box for configuring the tree structure of the "Animals" or "Tests" node of the workspace.

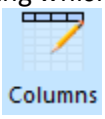
Main part :



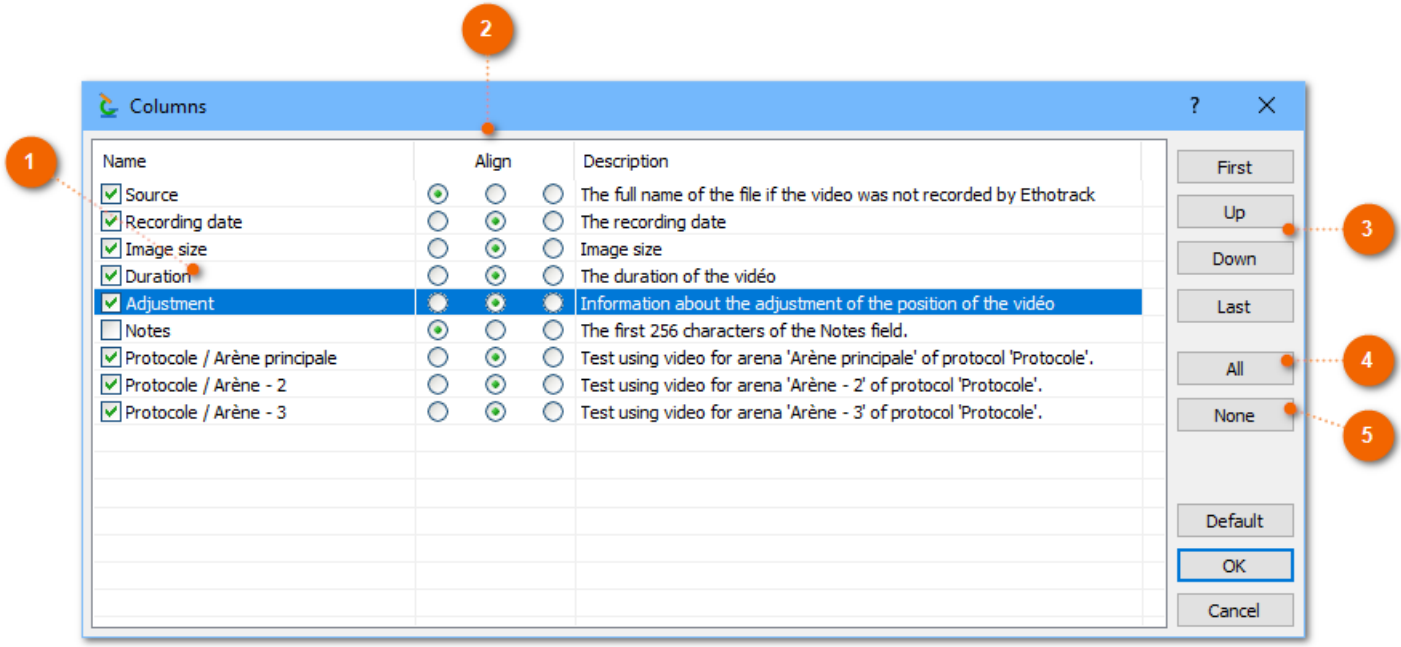
The central part displays the list of videos with the following information:

- The name of the video.
- The source of the video (file or recorded by Ethotrack).
- The date of recordings.
- The size of the image.
- The duration of the video.
- Information about video position adjustment and possible links. In the example above "video 1" and "video 3" are adjusted and "video 3" use the same adjustment as "Video 1".
- The list of tests that use video with the corresponding arena.

Choozing and organizing colums :

You can customize the table by choosing which columns to display and the order in which these columns are displayed. To do this, click the button 

of the command ribbon or use the "**Column**" context menu to open the dialog box :



1 **List of columns**

The list of columns that can be displayed in the table. Check the box to display a column.

2 **Align**

Text alignment in the column : right, left or center alignment.

3 **Position of columns**

Buttons to change the position of the selected column. You can also change the position of a column by simply "drag and drop". To do this: click on the corresponding line, then while holding down the mouse button, move the line. Finally, release the mouse button when you have reached the new desired position.

4 **All**

Show all columns.

5 **None**

Hide all columns.

You can also change the position of a column by simply "drag and drop". To do this: click on the column header, then while holding down the mouse button, move the header. Finally, release the mouse button when you have reached the new desired position.

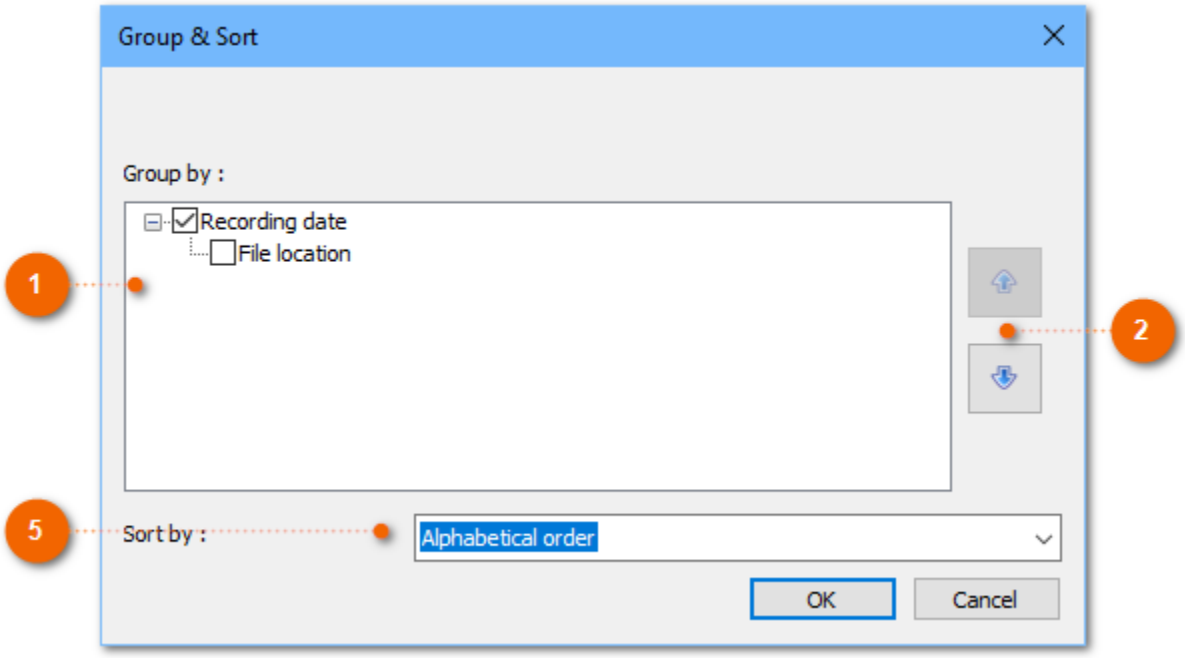
Sorting data :

You can sort the data in the table in ascending or descending order of a column. To do this, simply click on the column header. The sorting and sort order in indicated by an arrow: Recording date

Organizing the video tree :

To organize the display of videos it is possible to define grouping levels, such as the date the video was recorded or the location of the file. To do this, click the button Grouper / Trier on the command ribbon or use the "**Group / Sort**"

context menu to open the "Group/ Sort Videos" dialog box :



1 **Grouping levels :**

Area for choosing the grouping levels of the video list. To do this, simply check the desired items.

2 **Order of grouping levels :**

Buttons to change the order of grouping levels by moving the selected item.

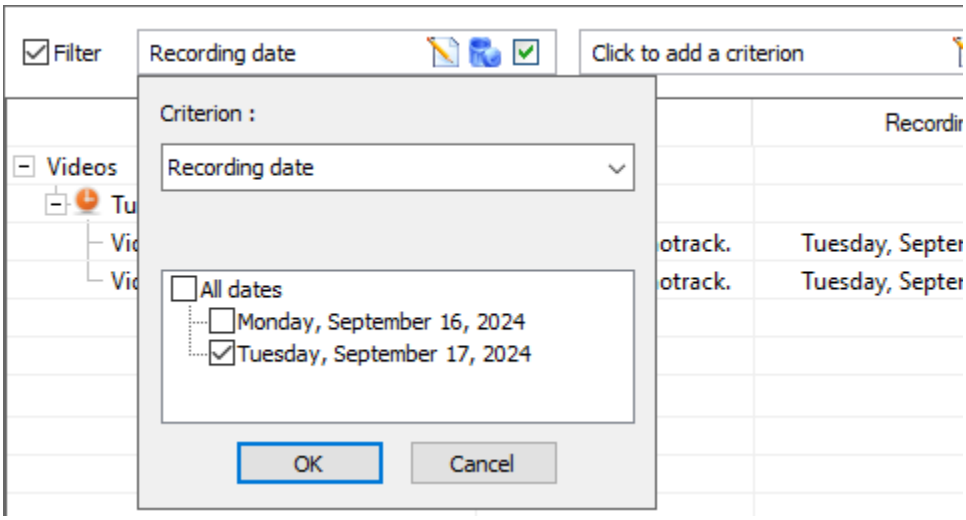
5 **Sort by :**

List allowing you to choose the order in which videos are displayed within a group when the table is sorted on the first column, with the choice:

- Alphabetical order.
- Recording date of the video.

Selecting videos to display :

You can create a filter to select the videos to display in the list, for example videos recorded on certain days, or videos whose name begins with a certain text. To do this, click on "Click to add a criterion" in the area at the top of the table, then select a criterion and configure the criterion settings (the settings area depends on the selected criterion).



You can add a maximum of 3 filter criteria. Only videos that meet all the criteria are displayed.

You can temporarily disable a filter criterion by unchecking the corresponding checkbox  . You can also temporarily disable all criteria by unchecking the "Filter" box  .

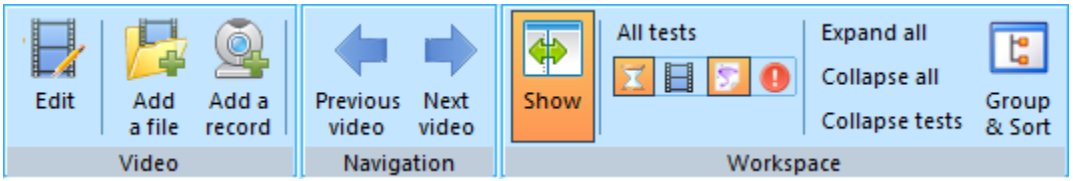
11.4. Current video

This view lets you record a new video or view a video that has already been recorded.

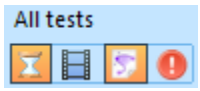
It also allows to :

- Record a new video using a webcam.
- Adjust the position of the video relative to arenas.
- Select tests that use this video.

Ribbon commands:



- **Video** :
  - **Edit** : Open the current test parameters dialog box.
  - **Add a file** : Add a new video to the list from a file on the computer.
  - **Add record**: Record a video with a webcam and add it to the list.
- **Navigation:**
  - **Previous video** : select the previous video (according to the order of creation of the videos) as the current video.
  - **Next video** : select the next video (according to the order of creation of the videos) as the current video.
- **Workspace** :
  - **Show** : Show or hide the workspace.

- 

: Allows you to display or hide the tests in the workspace according to their status (Pending, saved, analyzed, excluded).
- **Expand all** : fully expand the tree structure of the "Animals / Tests" node of the workspace.
- **Collapse all** : collapse the tree structure of the "Animals / Tests" node of the workspace.
- **Collapse Tests** : Collapse the workspace tree to the parent nodes of the tests.
- **Group / Sort** : open the dialog box for configuring the tree structure of the "Animals" or "Tests" node of the workspace.

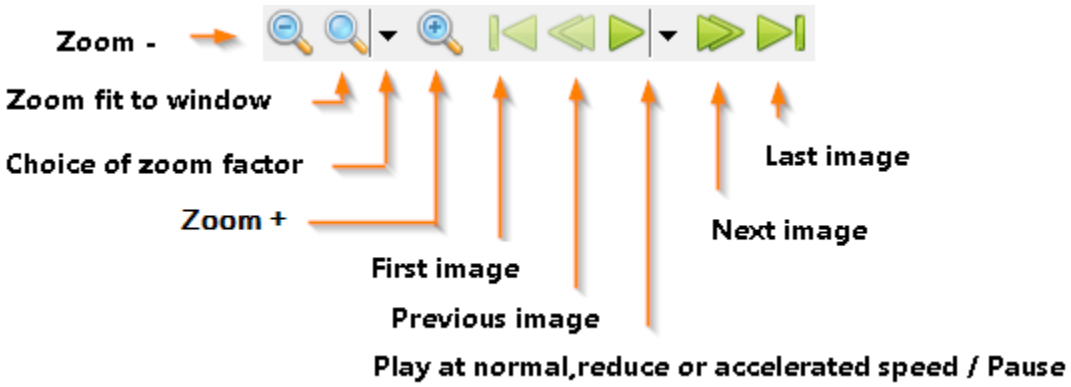
Main part:

1 **Video :**

The central part displays either the recorded video, or the webcam image if the video has not yet been recorded.

2 **Commandbar :**

Video zoom and playback control buttons



3 **Current image information :**

Some information about the image being played.

4 **Information**

This area displays information about the current video

5 **Adjustment**

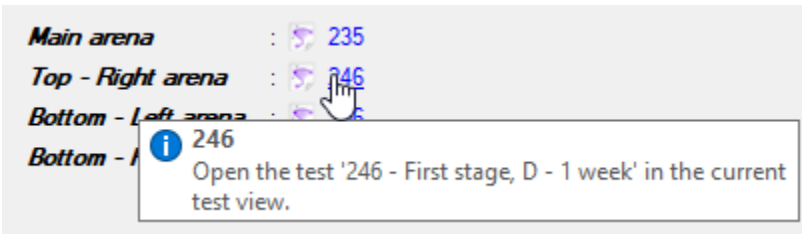
This area indicates whether the video is adjusted or not and allows you to control the adjustment of the video position.

- click  to change the video position adjustment.
- click  to delete the video position adjustment (Warning : adjustment is removed for all protocols).
- click  to copy (ou link) the adjustment of the current video to other videos.

6 **Use :**

The list of tests that use the current video.

- click  to edit the list of tests that use the video.
- click  to show or hide the arenas of the indicated protocol on the video.
- click on the test or animal name to open the corresponding test in the "Current test" view.

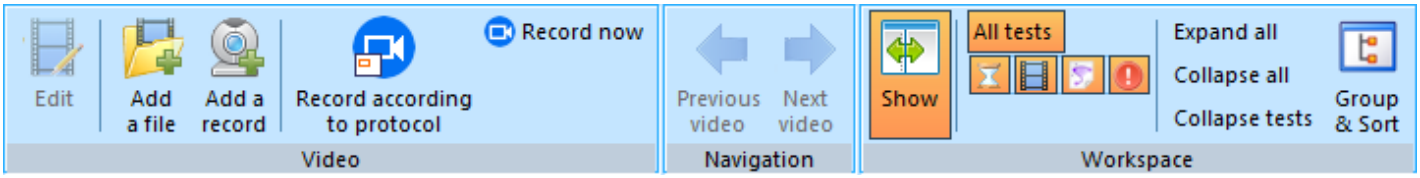


11.4.1. Record a video

When the video source defined in the protocol is a webcam, the “Current video” view allows you to record a new video.

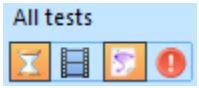
In this mode, the operator can start recording and view the webcam image in real time. He can interrupt the recording at any time if he wishes. At the end of the recording, he can replay the video before deciding whether or not to keep the recording.

Ribbon commands:



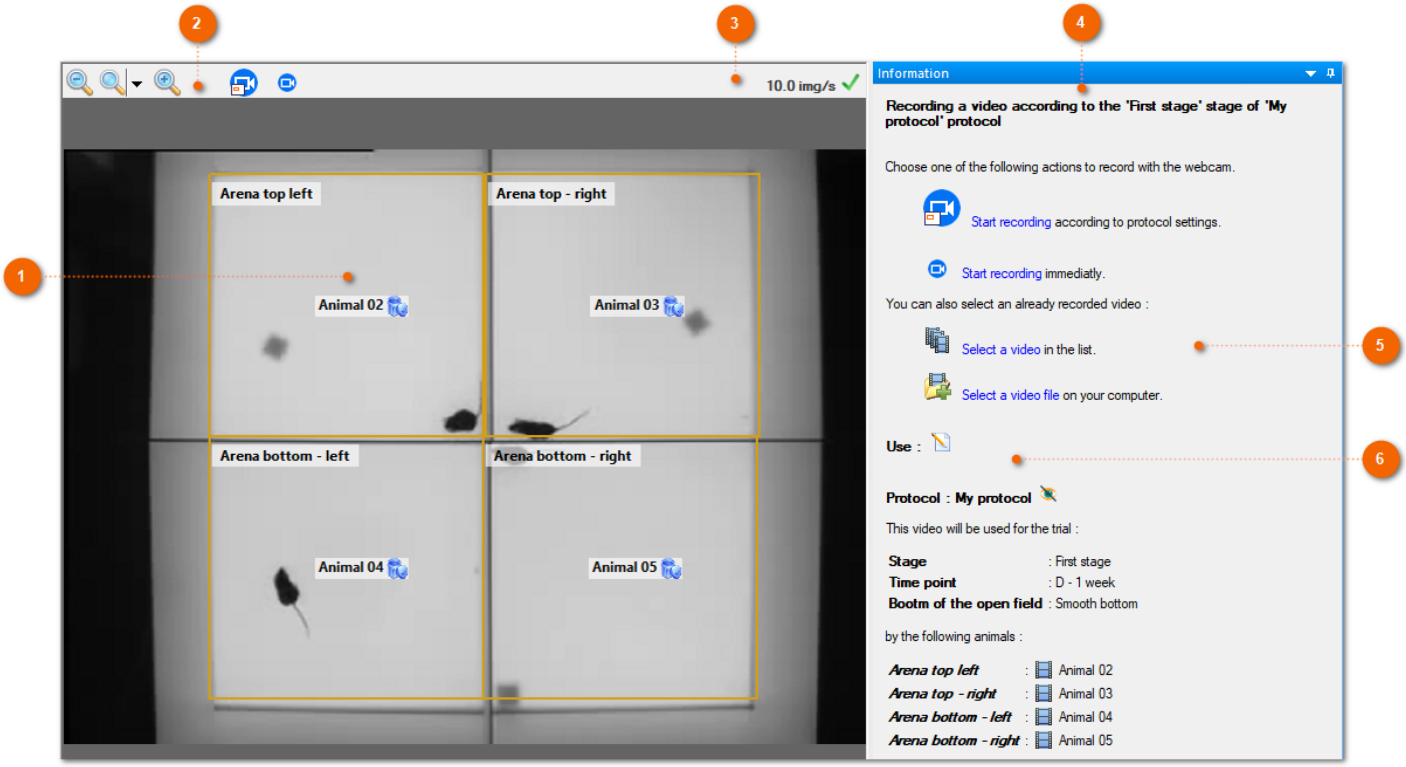
- **Video** :
  - **Edit** : Open the current test parameters dialog box.
  - **Add a file** : Add a new video to the list from a file on the computer.
  - **Add record**: Record a video with a webcam and add it to the list.
  - **Record according to protocol : S**tart recording a video according to the protocol (the beginning and the end of the recording will be in accordance with the parameters of the "Source" tab).
  - **Record now** : Start recording a video immediately without taking into account the start and end conditions of the protocol (the recording will not stop automatically).

- **Navigation**:
  - **Previous video** : Select the previous video (according to order in which the video were cerated) as the current video.
  - **Next video :** Select the next video (according to order in which the video were cerated) as the current video.

- **Workspace** :
  - **Show** : Show or hide the workspace.
  - 

: Allows you to display or hide the tests in the workspace according to their status (Pending, saved, analyzed, excluded).
  - **Expand all** : fully expand the tree structure of the "Animals / Tests" node of the workspace.
  - **Collapse all** : collapse the tree structure of the "Animals / Tests" node of the workspace.
  - **Collapse Tests** : Collapse the workspace tree to the parent nodes of the tests.
  - **Group / Sort** : open the dialog box for configuring the tree structure of the "Animals / Tests" node of the workspace.

Main part:



1 **Video :**

The central part displays the image of the camera.

Superimposed, the arenas as well as the animals present in the video in their respective arenas can be displayed. (click on to show or hide this information).

2 **Command bar :**

Video zoom and record control buttons :

: Record a video according to the protocol (the beginning and the end of the recording will be in accordance with the parameters of the "Source" tab of the protocol).

: Start recording a video immediately without taking into account the start and end conditions of the protocol (the recording will not stop automatically).

3 **Frame rate :**

Actual camera frame rate.

4 **Information :**

This protocol and the stage.

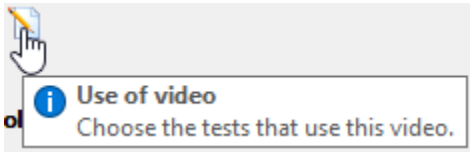
5 **Actions:**

: Record a video according to the protocol (the beginning and the end of the recording will be in accordance with the parameters of the "Source" tab of the protocol).

: Start recording a video immediately without taking into account the start and end conditions of the protocol (the recording will not stop automatically).

6 **Use :**

The list of tests linked to this video.

Click the button 

to edit this list.

11.4.2. Edit the list of tests that use a video

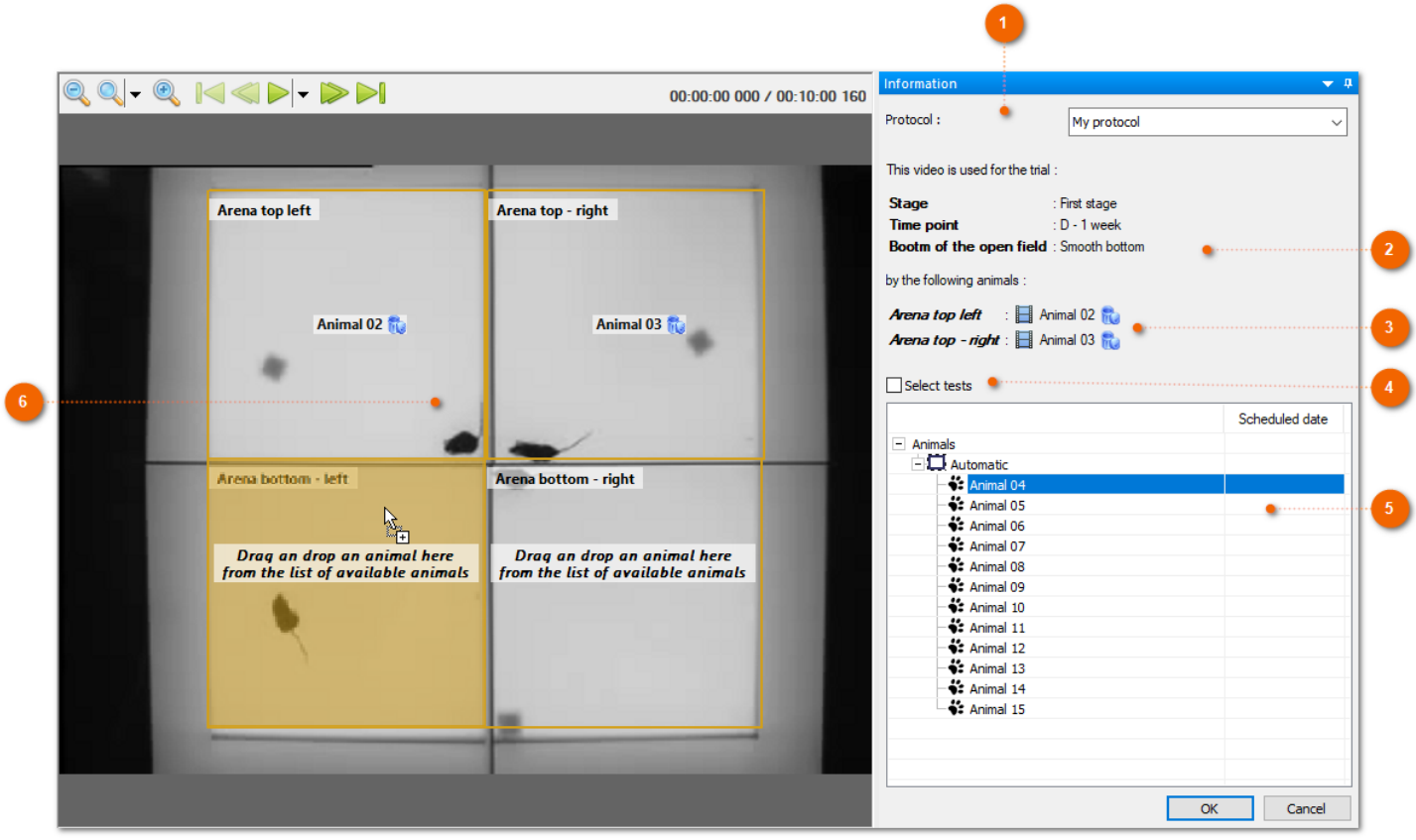
In this mode, the "Current video" view allows you to make the link between a video and one or more tests. When the protocol includes secondary arenas it also makes it possible to indicate for each test the arena in which the animal was placed during recording.

Selection by animal :

To avoid the risk of error, it is advisable to organize your experimental plan to respect the following rules:

- an animal must perform a trial no more than once.
- if the protocol includes several arenas, the tests recorded on the same video must correspond to the same trial.

If these 2 conditions are met, it is possible to link the tests to a video by selecting a trial, then placing the animals participating in this trial in their respective arena.

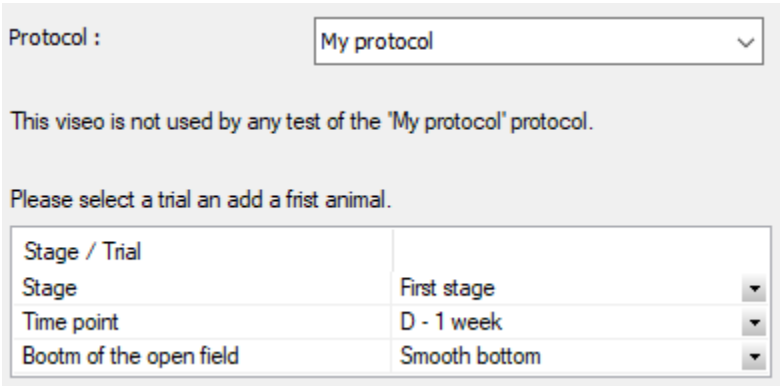


1 **Protocol :**

Choice of protocol. Only protocols compatible with the video size are offered.

2 **Stage / Trials:**

The description of the selected trial (when at least one animal is assigned to the video).
If no animal is assigned to the video, this area allows you to select a stage and a trial :



3 **Use :**

The list of animals linked to the video for the selected trial. Click to delete a link.

4 **Select tests :**

Allows you to choose the selection mode (Test if the box is checked, animal otherwise).

5 **List of animals:**

The list of animals for which the selected trial test is "Pending" grouped by arena by default.

6 **Video :**

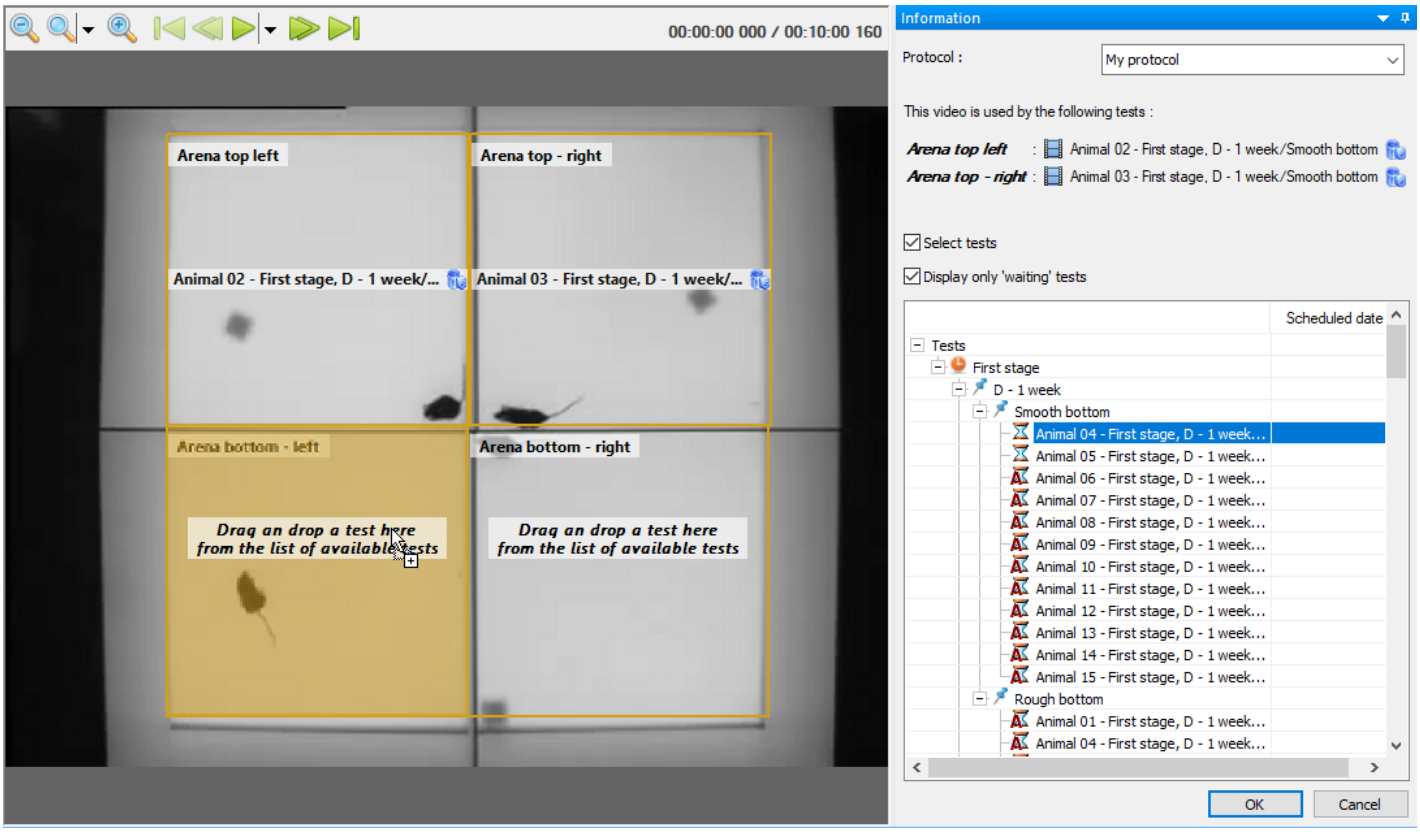
The video superimposes the arenas and the animals in their respective arenas.
Click to delete a link.

To assign an animal to the video, simply click on the animal in the list, move the cursor to the video while holding down the mouse button, then release the mouse button when the cursor is over. is located above the chosen arena. It is also possible to "double click" on an animal to automatically assign it to the next available arena.

If the protocol includes several arenas, it is advisable to always place the animals in the same arena.

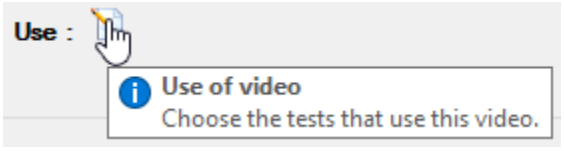
Selection by test:

If an animal must perform the same trial several times, or if the video contains test recordings corresponding to different trials, simply check the box Select tests to directly link the tests to the video.



To open this view :

Simply click on the “Use” button in the information side panel of the “Current video” view :



in the video editing dialog box.

11.4.3. Adjust the video position

In this mode, the "Current video" view allows you to adjust the position of the current video for each compatible protocol.

When the experiment lasts several days or even several weeks, it may happen that the camera or the workspace are accidentally moved. In this case, when recording a new video, you may notice that the arena defined in the protocol no longer corresponds to the real arena where the animals are evolving.

To correct this, it is possible to adjust the position of the arena for each test in the "current test" view.

It is also possible to adjust the position of the video. The adjustment defined for a video will be automatically used for all tests that use this video and that have not been adjusted manually.

Arena adjustment allows you to define the transformation rules (movement, resizing and rotation) to be applied to the image from the camera to match the arena defined in the protocol and the real arena. If the video is compatible with several protocols, you can define an adjustment for each protocol.

Once a video has been adjusted, it is possible to carryover this adjustment to other videos (for example all videos recorded on the same day).

To enter the adjustment mode :

Select a video in the "Current video" view then click on  in the side information panel:

Manual video adjustment :

To adjust a video :

1/ Select the protocol. The main view displays the main arena of the selected protocol.

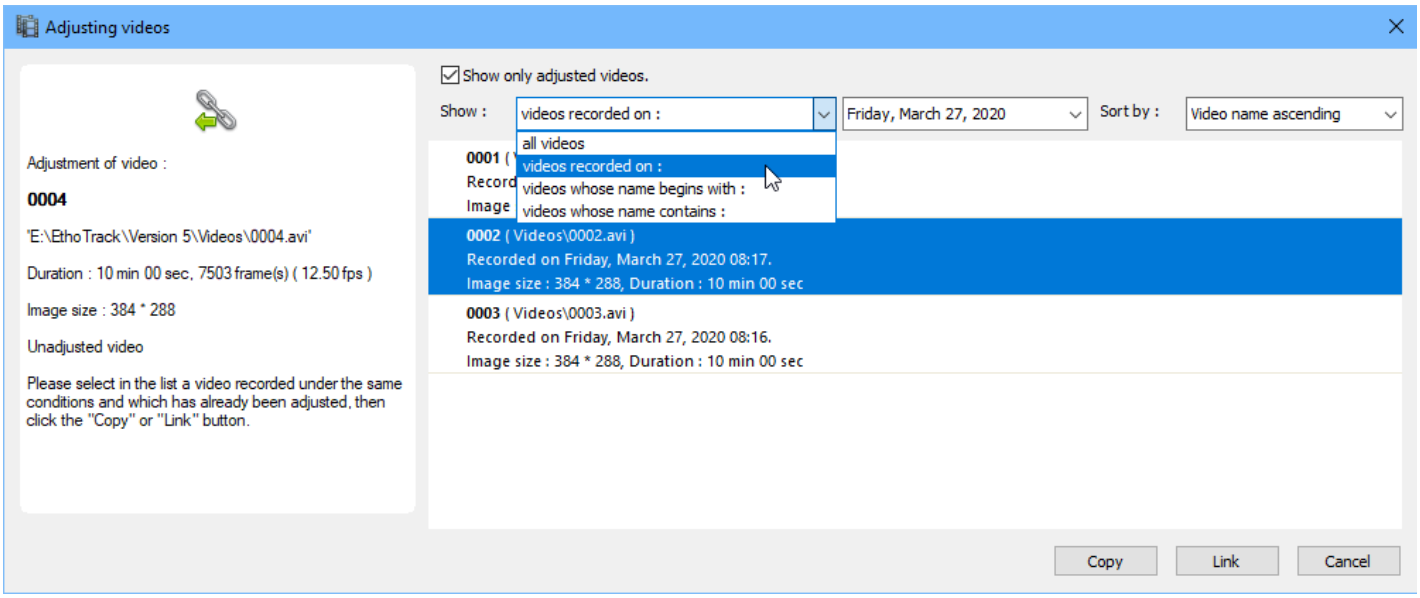
2/ adjust the position of the arena to make it coincide with the real arena:

- either, by using the buttons.
- or, by moving the arena directly with the mouse on the video image.
- either, using the keyboard arrows (arrow alone to move the arena; [Shift key]+arrow to resize.

3/ repeat the operation for all compatible protocols.

Use the adjustment of another video :

1/ Click on the "Use the adjustment of another video" link in the side information panel. to open the selection dialog box :



2/ Select a video in the list.

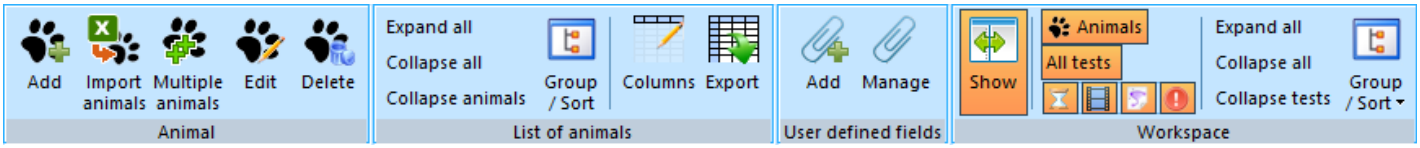
3/Click the "Copy" button or the "Link" button.

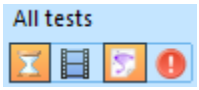
 If you create a link, any change to the source video's adjustment will be automatically taken into account and will change the linked video's adjustment.

11.5. List of animals

This view displays and manages the list of animals used in the experiment.

Ribbon commands :

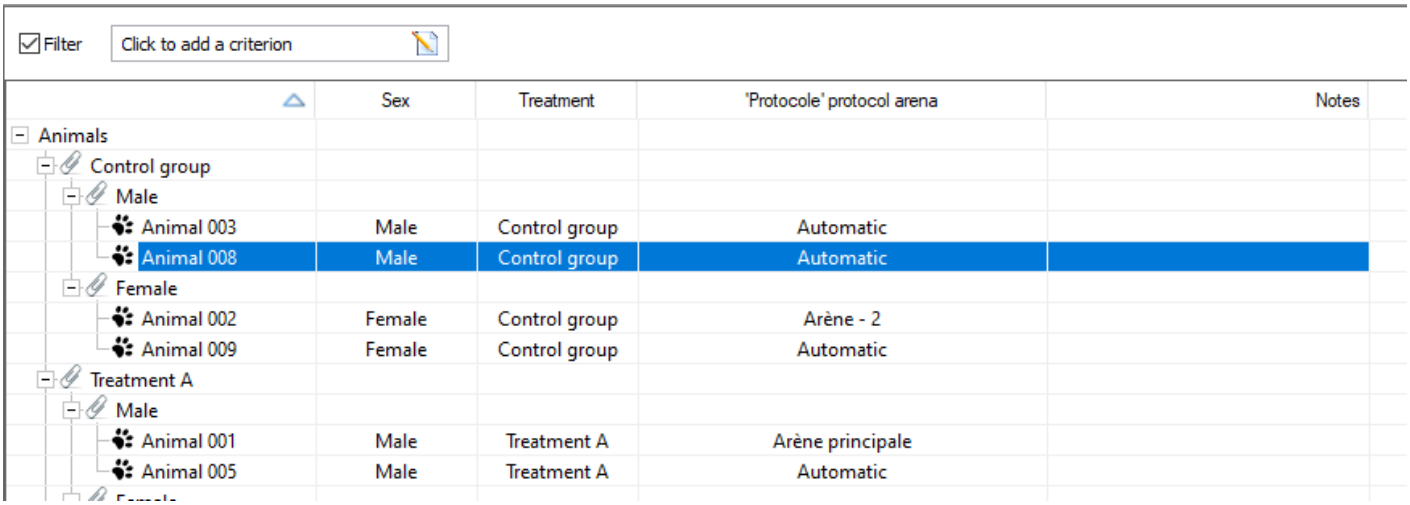


- **Animal**:
  - **Add** : Add an animal.
  - **Import animals :** Import multiples animals from a file
  - **Multiple animals :** Add multiple animals using the Animal Creation Wizard.
  - **Edit** : Modify the selected animal.
  - **Delete** : Delete the selected animal.
- **List of animals** :
  - **Expand all** : fully expand the tree structure of the "Animals" node of the list.
  - **Collapse all** : collapse the tree structure of the "Animals" node of the list.
  - **Collapse Videos** : Collapse the workspace tree to the parent nodes of the animals.
  - **Group / Sort** : open the dialog box for configuring the tree structure of the animal list.
  - **Columns** : Modify table columns.
  - **Export** : Export the list in a Microsoft© Excel or text file with separator (CSV).
- **User fields** :
  - **New** : Add an animal type user field.
  - **Manage** : Opens the dialog for managing user fields .
- **Workspace** :
  - **Show** : Show or hide the workspace.
  - 

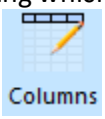
: Allows you to display or hide the tests in the workspace according to their status (Pending, saved, analyzed, excluded).
  - **Expand all** : fully expand the tree structure of the "Animals / Tests" node of the workspace.
  - **Collapse all** : collapse the tree structure of the "Animals / Tests" node of the workspace.
  - **Collapse Tests** : Collapse the workspace tree to the parent nodes of the tests.
  - **Group / Sort** : open the dialog box for configuring the tree structure of the "Animals" or "Tests" node of the workspace.

Main part:

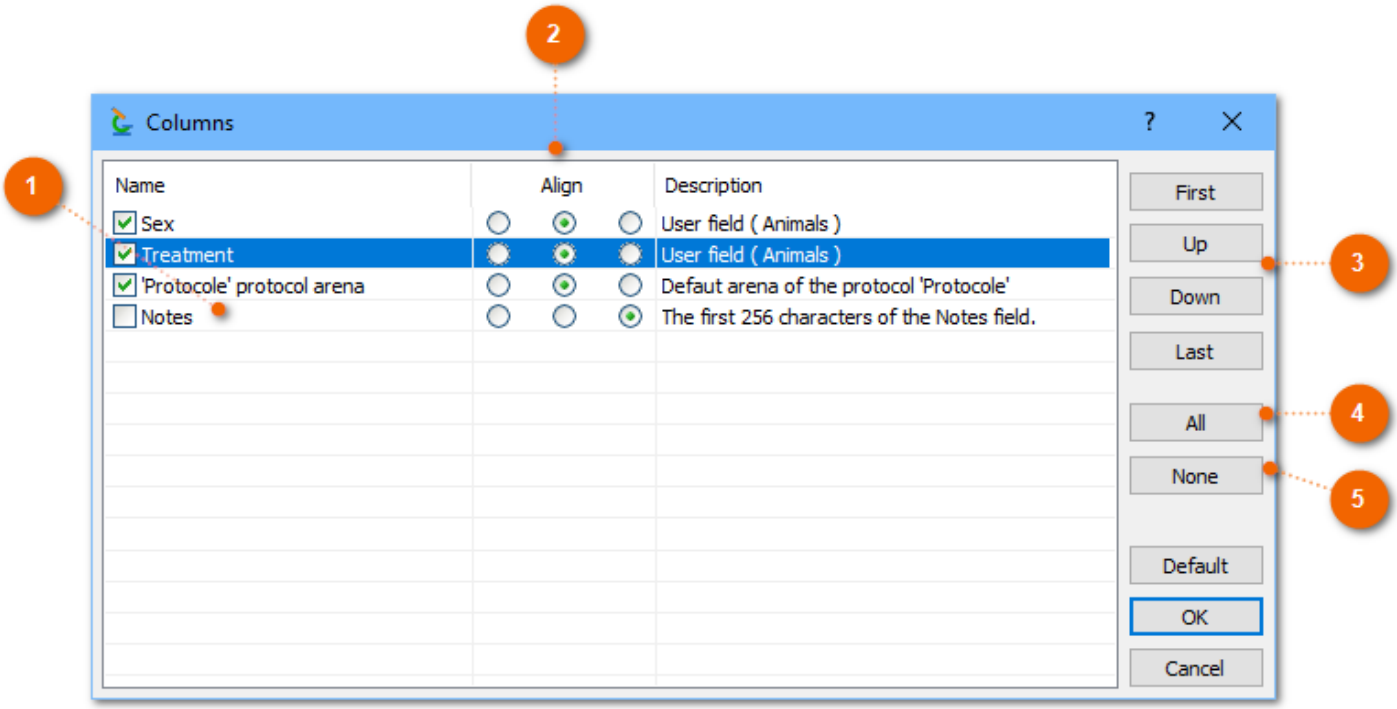
The central part displays the list of animals and information about each animal.



Choozing and organizing colums :

You can customize the table by choosing which columns to display and the order in which these columns are displayed. To do this, click the button 

of the command ribbon or use the "**Column**" context menu to open the dialog box :



1 **List of columns**

The list of columns that can be displayed in the table. Check the box to display a column.

2 **Align**

Text alignment in the column : right, left or center alignment.

3 **Position of columns**

Buttons to change the position of the selected column. You can also change the position of a column by simply "drag and drop". To do this: click on the corresponding line, then while holding down the mouse button, move the line. Finally, release the mouse button when you have reached the new desired position.

4 **All**

Show all columns.

5 **None**

Hide all columns.

You can also change the position of a column by simply "drag and drop". To do this: click on the column header, then while holding down the mouse button, move the header. Finally, release the mouse button when you have reached the new desired position.

Sorting data :

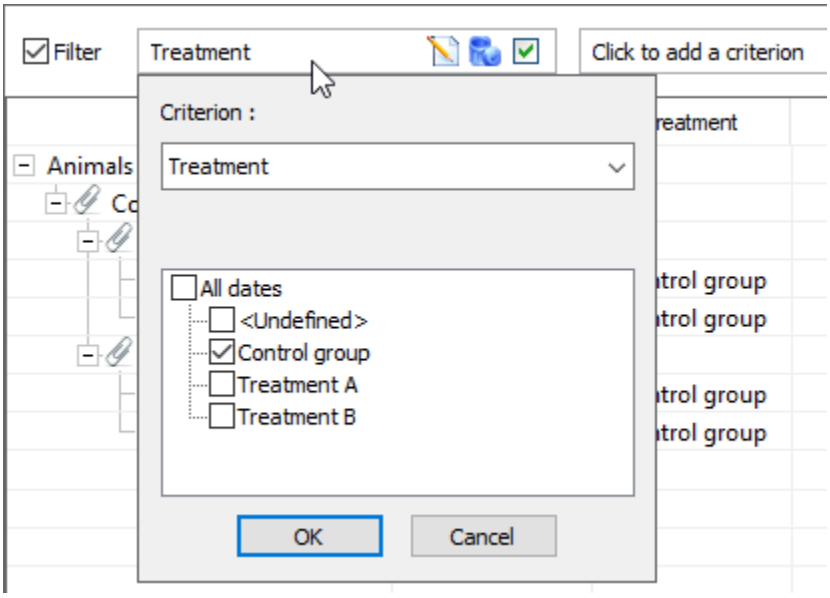
You can sort the data in the table in ascending or descending order of a column. To do this, simply click on the column header. The sorting and sort order in indicated by an arrow: Recording date

Organizing the animal tree :

To organize the display of animals it is possible to define grouping levels, such as the userfields. To do this, click the button Grouper / Trier on the command ribbon or use the "**Group / Sort**" context menu to open the "Group / Sort Animals" dialog box.

Selecting animals to display :

You can create a filter to select the animals to display in the list, for example only animals of the control group. To do this, click on "Click to add a criterion" in the area at the top of the table, then select a criterion and configure the criterion settings (the settings area depends on the selected criterion).



You can add a maximum of 3 filter criteria. Only animals that meet all the criteria are displayed.

You can temporarily disable a filter criterion by unchecking the corresponding checkbox  . You can also temporarily disable all criteria by unchecking the "Filter" box 

.

Contextual menu :

Click on the header of the table with the right button of the mouse to bring up the contextual menu allowing you to manage the user fields.

Right-click an animal to bring up the context menu to manage animals.

Changing an animal's parameters:

To change an animal's settings, you can open the "Animal" dialog box , either :

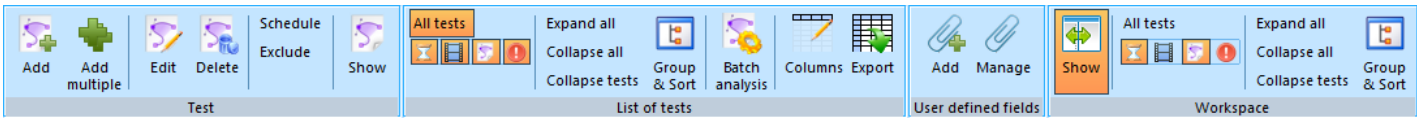
- by selecting the animal in the list, then clicking on the "Edit" button on the command ribbon.
- by double clicking on the animal.
- by selecting the "Edit" command from the popup menu.

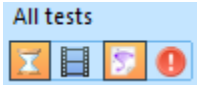
If you want to delete an animal that has already performed one or more tests, you must first delete all tests performed by this animal.

11.6. List of tests

This view displays and manages the list of experiment tests.

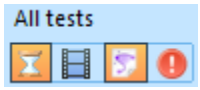
Ribbon commands :



- **Test** :
  - **Add** : Add a new test.
  - **Add multiple** : Add multiple tests with the test creation wizard .
  - **Edit** : Modify the selected test.
  - **Delete** : Delete the selected tests.
  - **Schedule** : Schedule the acquisition date for the selected tests.
  - **Exclude** : Exclude the selected tests.
- **List of tests** :
  - 

: Allows you to display or hide the tests in the list according to their status (Pending, saved, analyzed, excluded).
  - **Expand all ;** expand the tree structure of the "Animals / Tests" node of the list.
  - **Collapse all** : Collapse the tree structure of the "Animals / Tests" node of the list.
  - **Collapse Tests** : Collapse the list tree to the parent nodes of the tests.
  - **Group / Sort** : Opens the dialog box for configuring the tree structure of the "Animals / Tests" node .

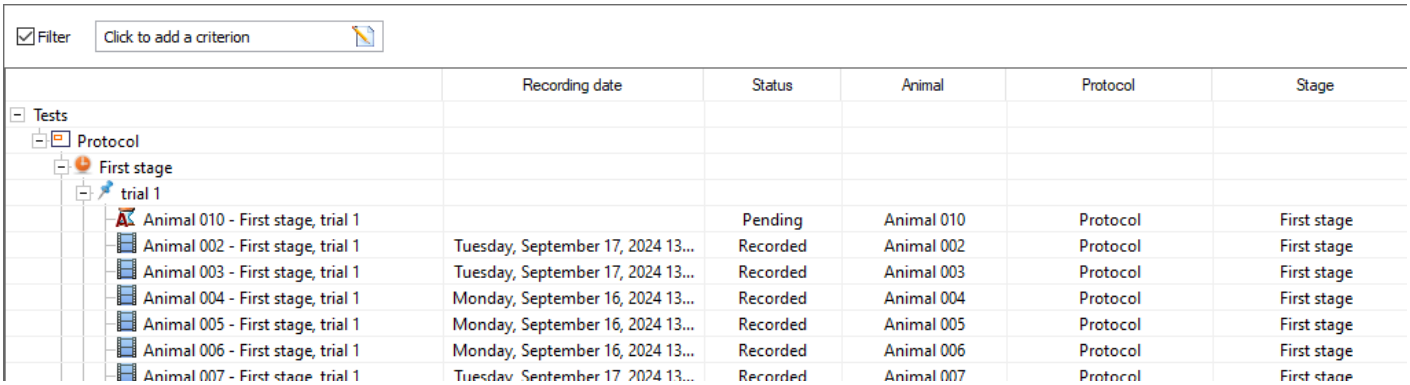
- **Batch analysis : Open the "** Batch analysis **"** dialog box to start the analysis of several tests.
- **Columns** : Select the table columns.
- **Export** : Export the list of tests in a Microsoft© Excel or text file with separator (CSV).

- **User fields** :
  - **Add** : Add a Test type user field.
  - **Manage** : Opens the dialog for managing user fields .
- **Workspace** :
  - **Show** : Show or hide the workspace.
  - 

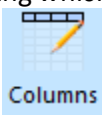
: Allows you to display or hide the tests in the workspace according to their status (Pending, saved, analyzed, excluded).
  - **Expand all** : fully expand the tree structure of the "Animals / Tests" node of the workspace.
  - **Collapse all** : collapse the tree structure of the "Animals / Tests" node of the workspace.
  - **Collapse Tests** : Collapse the workspace tree to the parent nodes of the tests.
  - **Group / Sort** : open the dialog box for configuring the tree structure of the "Animals " or "Tests" node of the workspace.

Main part:

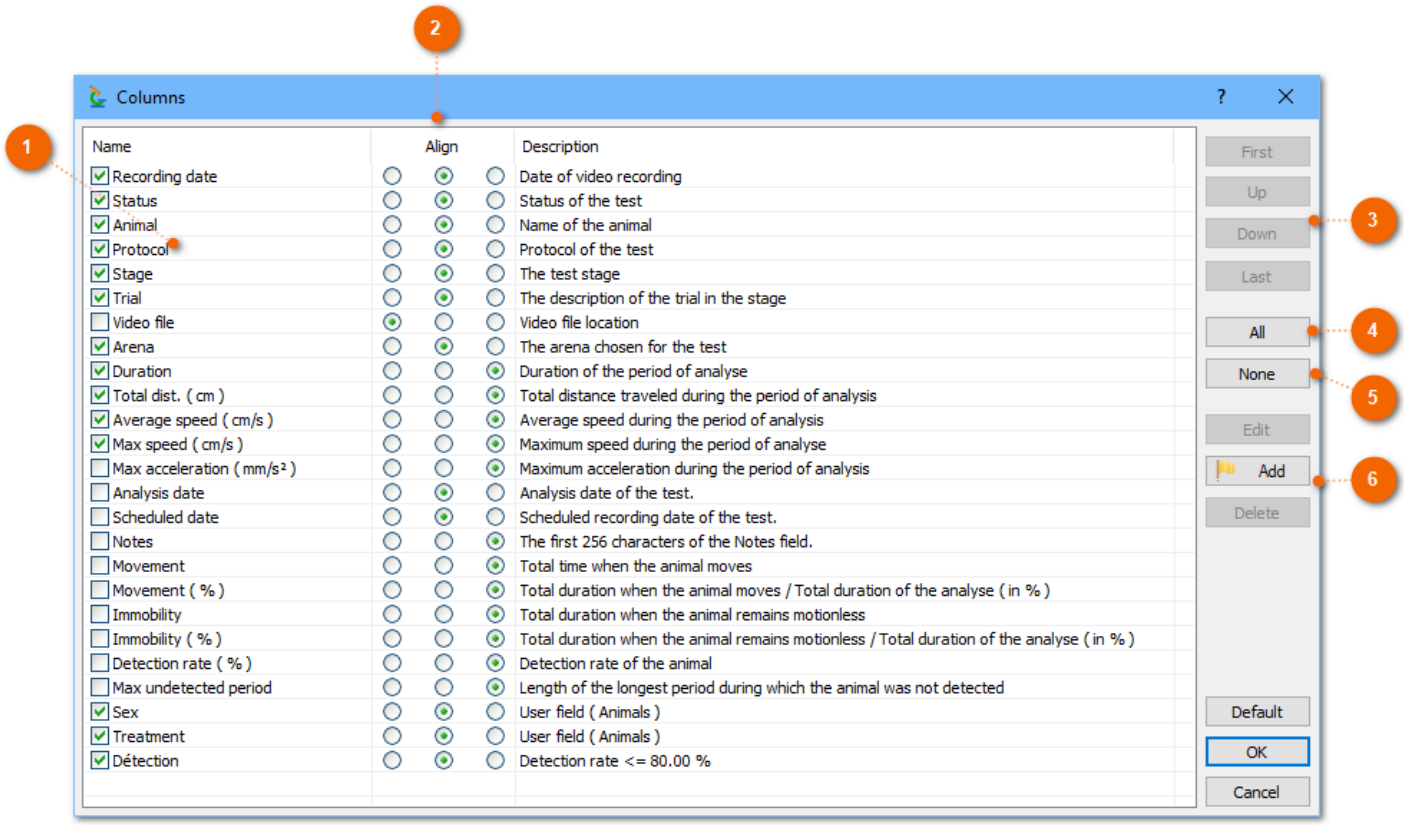
The central part displays the list of tests.



Choozing and organizing colums :

You can customize the table by choosing which columns to display and the order in which these columns are displayed. To do this, click the button 

of the command ribbon or use the "**Column**" context menu to open the dialog box :



1 List of columns

The list of columns that can be displayed in the table. Check the box to display a column.

2 Align

Text alignment in the column : right, left or center alignment.

3 Position of columns

Buttons to change the position of the selected column. You can also change the position of a column by simply "drag and drop". To do this: click on the corresponding line, then while holding down the mouse button, move the line. Finally, release the mouse button when you have reached the new desired position.

4 All

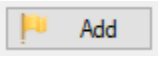
Show all columns.

5 None

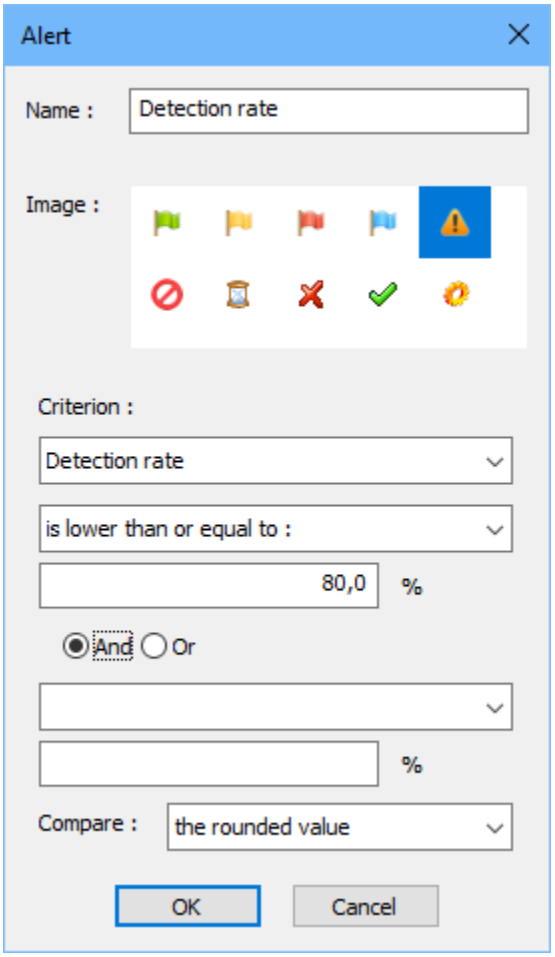
Hide all columns.

6 **Alert columns**

You can create additional alert columns to display an icon when a test meets a specific condition, such as if the detection rate is below a certain value, or if the animal has traveled a certain distance.

To add an alert column, click the button 

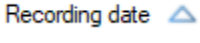
to open the alert configuration dialog :



The comparison of a numeric value can be made either on the rounded value as displayed or on the actual calculated value. For example: if the calculated detection rate is 79.997%,the value rounded to 1 decimal place displayed is 80.0%.The condition "Detection rate is equal to 80%"is true if the comparison is made on the rounded value and false if the comparison is made on the actual calculated value.

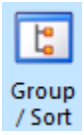
You can also change the position of a column by simply "drag and drop". To do this: click on the column header, then while holding down the mouse button, move the header. Finally, release the mouse button when you have reached the new desired position.

Sorting data :

You can sort the data in the table in ascending or descending order of a column. To do this, simply click on the column header. The sorting and sort order in indicated by an arrow : 

Organizing the test tree :

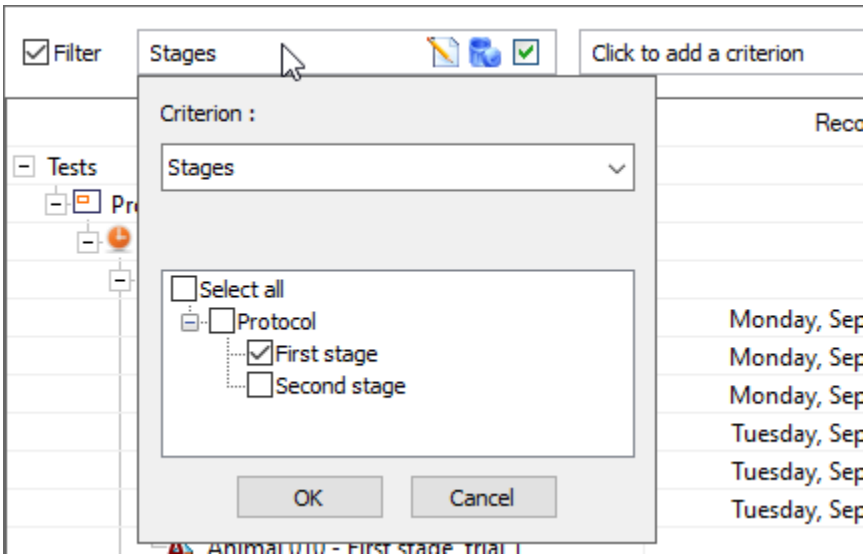
To organize the display of animals it is possible to define grouping levels, such as the userfields. To do this, click

the button 

on the command ribbon or use the "**Group / Sort**" context menu to open the "Group / Sort Tests" dialog box.

Selecting tests to display :

You can create a filter to select the tests to display in the list, for example the tests performed by a particular animal, or all the tests of a particular stage . To do this, click on "Click to add a criterion" in the area at the top of the table, then select a criterion and configure the criterion settings (the settings area depends on the selected criterion).



You can add a maximum of 3 filter criteria. Only tests that meet all the criteria are displayed.

You can temporarily disable a filter criterion by unchecking the corresponding checkbox  . You can also temporarily disable all criteria by unchecking the "Filter" box 

.

The comparison of a numeric value can be made either on the rounded value as displayed or on the actual calculated value. For example: if the calculated detection rate is 79.997%,the value rounded to 1 decimal place displayed is 80.0%.The condition "Detection rate is equal to 80%"is true if the comparison is made on the rounded value and false if the comparison is made on the actual calculated value.

Contextual menu :

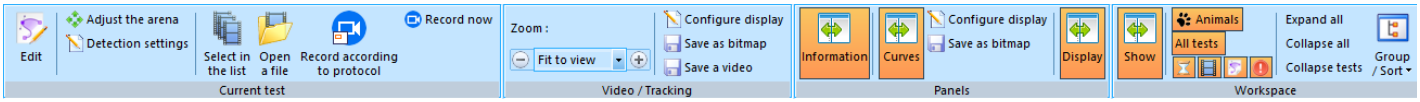
Click on the header of the table with the right button of the mouse to bring up the contextual menu allowing you to manage the user fields.

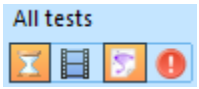
Right-click on the central part of the table to bring up the context menu for managing the display of the table or modifying a test.

11.7. Current test

This view presents all the information relating to a test.

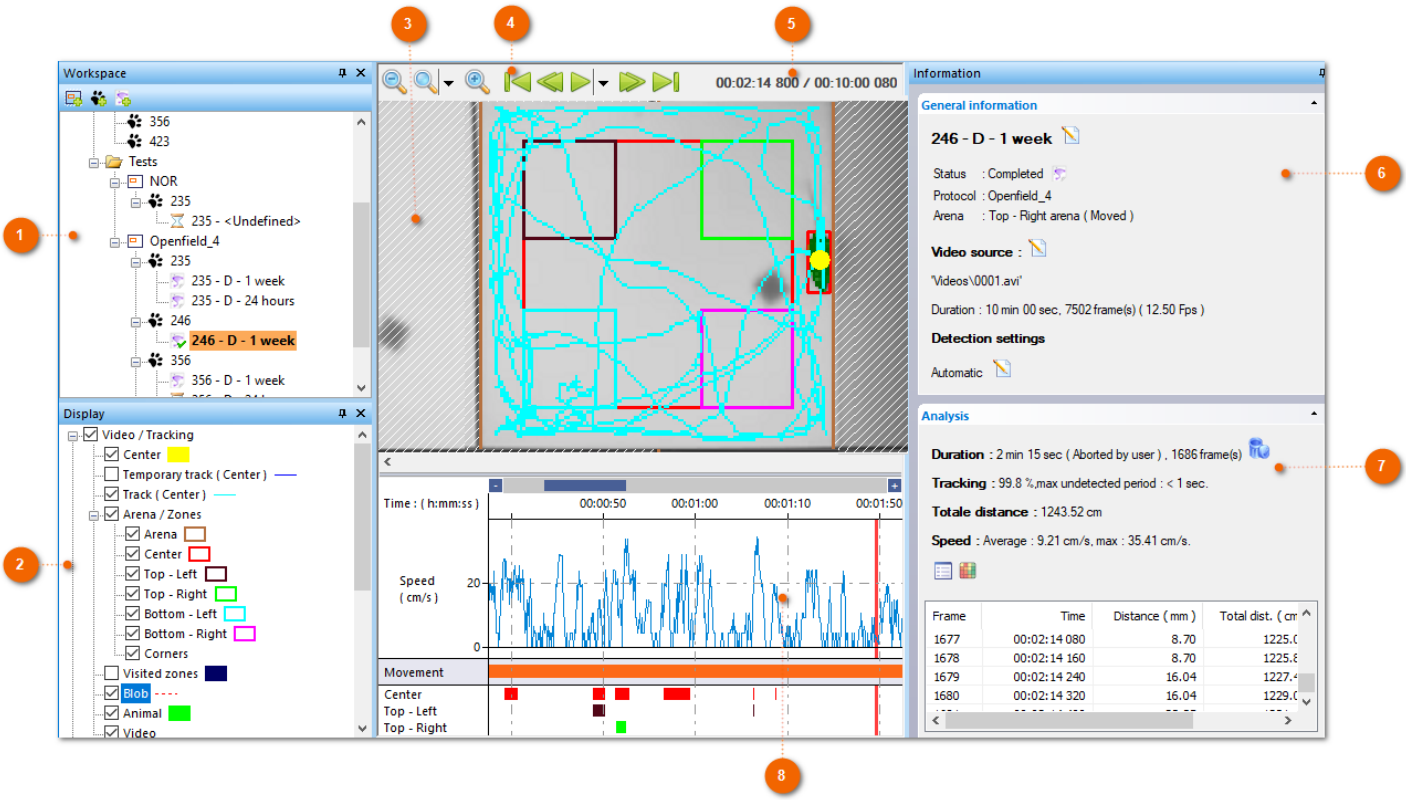
Ribbon commands:



- **Current test** :
  - **Edit** : Open the current test parameters dialog box.
  - **Adjust Arena** : Open the arena adjustment side panel.
  - **Detection settings**: Open the side panel for modifying detection parameters.
  - **Select in the list** : Select a video from the video list.
  - **Open a file** : Select a file on the computer and add it to the video list.
  - **Record according to the protocol** : Start recording the video according to the parameters (start and duration) defined in the protocol.
  - **Record Now** : Start video recording immediately regardless of protocol start and end conditions (recording will not stop automatically).
- **Video / Tracking**:
  - **Show** : Show or hide the video.
  - **Zoom** : Modification of the zoom factor of the video display.
  - **Configure display** : Open the display configuration dialog to select what to display.
  - **Save as bitmap** : Save the current frame of video and animal tracking to an image file.
  - **Save a video** : Save part of the video and tracking information (track, animal position, etc.) to a video file.
- **Curves** :
  - **Show** : Show or hide tracking curves (speed, presence in zones, etc.)
  - **Save as bitmap**: Save tracking curves to an image file.
- **Panels** :
  - **Information** : Show or hide the "Information" side panel.
  - **Curves** : Show or hide the "Curves" panel.
  - **Configure display** : Open the display configuration dialog to select what to display.
  - **Save as bitmap** : save the curves as an image file.
  - **Display** : Show or hide the "Display" side panel allowing you to select the elements to display.
- **Workspace** :
  - **Show** : Show or hide the workspace.
  - 

: Allows you to display or hide the tests in the workspace according to their status (Pending, saved, analyzed, excluded).
  - **Expand all** : fully expand the tree structure of the "Animals / Tests" node of the workspace.
  - **Collapse all** : collapse the tree structure of the "Animals / Tests" node of the workspace.
  - **Collapse Tests** : Collapse the workspace tree to the parent nodes of the tests.
  - **Group / Sort** : open the dialog box for configuring the tree structure of the "Animals" or "Tests" node of the workspace.

Main part :



Workspace :

The workspace displays in tree form all the elements of the experiment (protocol, animals, tests, etc.).

Display :

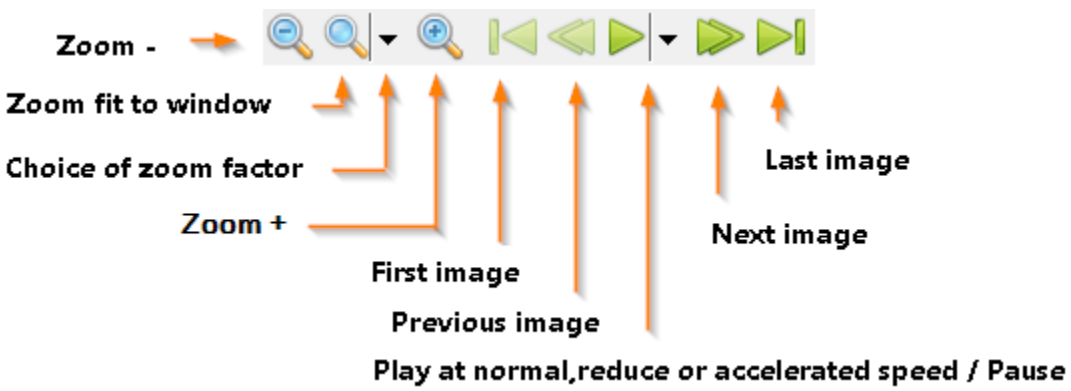
"Display" panel that allows you to select the elements to display. For more information, see the " Current test - Display " page.

Video :

The central part displays either the recorded video, or the webcam image if the video has not yet been recorded.

Video control bar :

Video zoom and playback control buttons



5 **Current image information :**

Some information about the image being played.

6 **Information : General information :**

This area displays the main information on the current test and allows you to quickly perform important actions related to the test. For more information, see the " Running test - Information / General " page.

7 **Information : Analysis :**

This area displays information about the analysis as well as the list of analysis points. For more information, see the " Test - Analysis " page.

8 **Curves :**

This zone presents in graphic form some results of the analysis (depending on the options of the "Display" panel) :

- The velocity curve after filtering.
- The speed curve on the raw data.
- The periods when the animal is moving or stationary.
- The periods during which the animal is inside the different zones.
- The periods during which the animal was not detected.
- Period of behaviors.

11.7.1. Information panel

The "Information" panel displays information about the current test and allows to perform all actions related to a test :

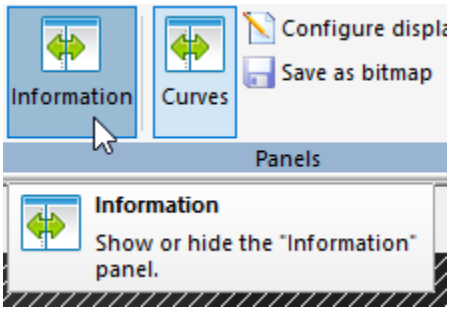
- record the video or associate an existing video.
- check the position of the arena an if necessary adjust it.
- analyze the video.
- check the analysis and view the results.
- record behaviors.

This pane is composed of 2 parts :

- General information : information about the test (protocol, arena, stage, trial, ...)
- Analysis : the results of the analysis.

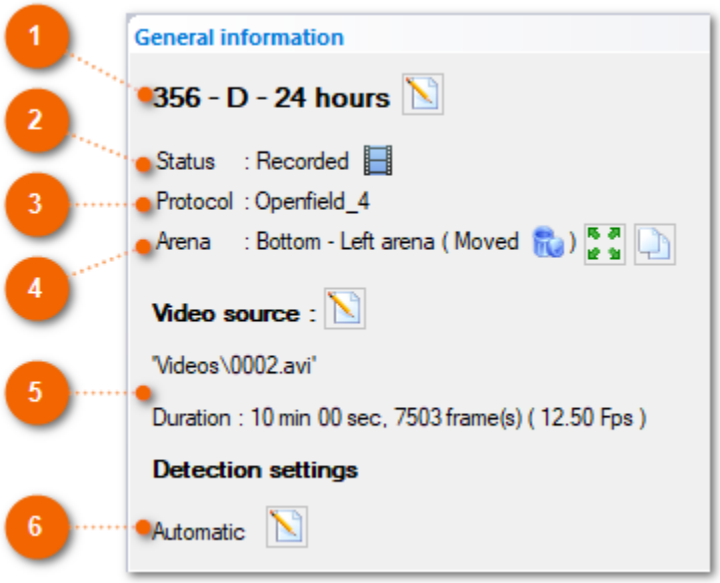
The display is dynamic and depends on the status of the test.

To display this pane :

1. Open the "current test" mode by clicking on a test in the workspace or by using the command ribbon.
2. If the Information panel is hidden click on 

in the command ribbon.

11.7.1.1. General information



1 **Name :**

The name of the test. Click the icon to open the test configuration dialog.

2 **Status**

The status of the test:

- Pending : The video has not yet been recorded.
- Recorded : The video is saved, but has not been analyzed.
- Recorded (video missing) : The video is saved, but the file cannot be found.
- Analyzed: The video is recorded and analyzed.
- Excluded: the test is not taken into account in the reports.

3 **Protocol :**

The name of the protocol associated with the test.

4 **Arena :**

The arena in which the test takes place and information regarding the arena adjustment .

Click the button  to remove the arena adjustment.

Click the button  ,  or  to change the arena adjustment.

 indicates that the arena position is automatically adjusted using the position adjustment marks.

 indicate that the arena position is adjusted according to the video position adjustment.

Click on  to copy the adjustment to other tests.

 : For all tests analyzed with version 5.3 or later, the arena position used during the analysis is memorized. The icon  is displayed if the arena position was adjusted during the analysis. If this position differs from the current position, the icon  is displayed to indicate the change. It is then advisable to check the arena position and possibly re-run the analysis.

5 **Video source :**

Video file information:

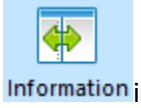
- The origin of the file and the date of acquisition.
- The duration of the file, the number of frames and the number of frames per second.

6 **Detection settings:**

The detection mode used for analysis. Click the button  to change the detection settings.

 The content of this page is dynamic. Some information and some buttons may be hidden depending on the test settings.

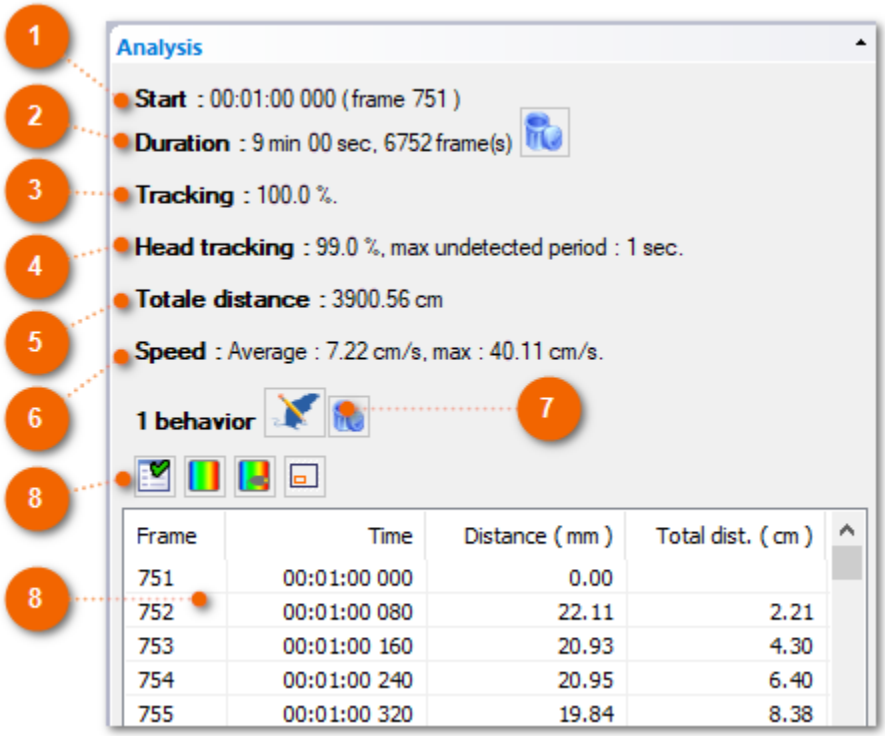
To display this panel :

1. Select the "Current Test" view by clicking on a test in the workspace, or by using the Command Ribbon.
2. Click the button 

in the command ribbon.

11.7.1.2. Analysis

The "Analysis" side panel displays the analysis results for the current test.



Start :

The start of tracking (time and frame number) according to the analysis sequencer defined in the protocol.

Duration :

The duration of the follow-up (time and number of images) and possibly the reason for the end of the follow-up (for example in the event of cancellation by the user). Click on to clear the results of the analysis.

Tracking:

The detection rate, as well as the maximum time during which the animal was not detected.

Head's tracking :

The detection rate, as well as the maximum time during which the animal's head was not detected.

Total distance :

The total distance traveled by the animal.

Speed :

Speed information (average speed and maximum speed).

7 **Behaviours :**

Click  to save or edit a behavior . (Only if the protocol contains at least one behavior).

Click  to delete all periods of all behaviors.

8 **Choice of display**

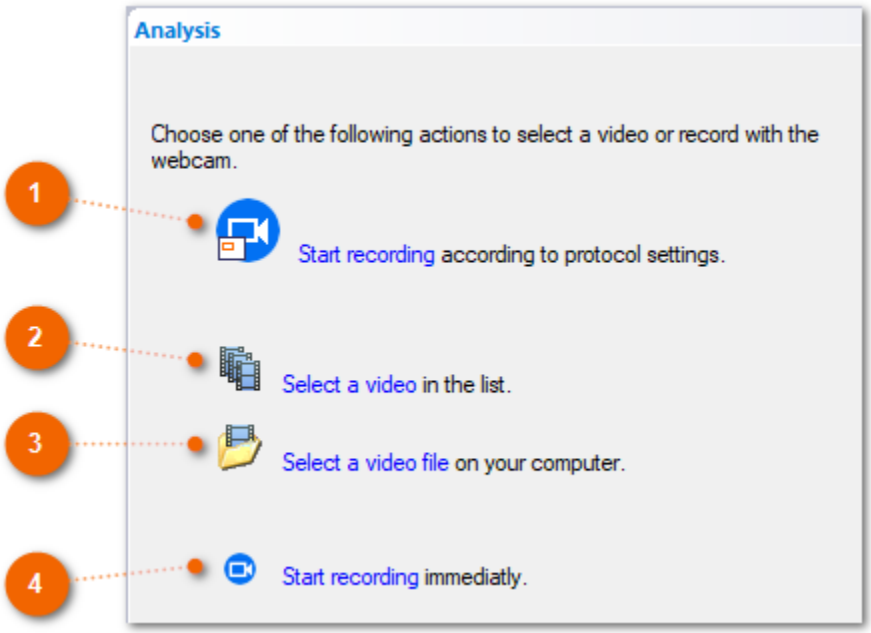
The choice of display in the lower part of the panel:

- The list of analysis points.
- The heat map of the position of the animal's center.
- The heat map of the position of the animal's head.
- Visiting periods in zones of interest.

8 **List of points or heatmap :**

The list of points of the analysis, the heat map of the animal, or the list of visiting periods in zones of interest.

When the test is "Pending", this panel displays buttons that allow you to select a video or start recording:



1 **Start recording according to protocol settings :**

Start recording according to protocol conditions. The start and end of the recording will be done in accordance with the protocol.

2 **Select a video from the list :**

Open the "Video Selection " dialog box to select a video from the video list.

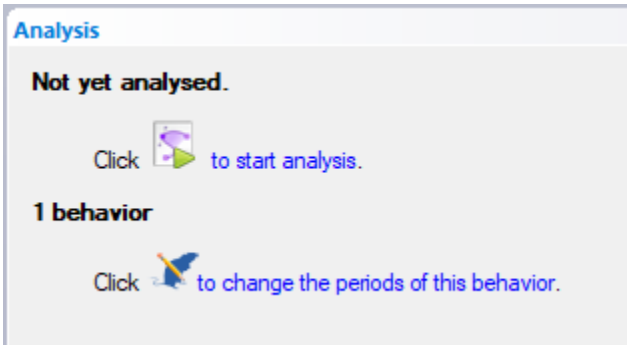
3 **Select a video file on your computer :**

Select a video file on the computer and add it to the video list.

4 **Start recording immediatly:**

Start recording immediately, without respecting the waiting and duration conditions defined in the "Recording" tab of the Protocol. Recording will not stop automatically.

When the test has not yet been analyzed, this panel displays a button to start the analysis and a button to save or modify a behavior (if the protocol contains at least one behavior):



11.7.1.2.1. List of points

The table contains the list of images on which the animal was detected. For each image it is possible to display the following information:

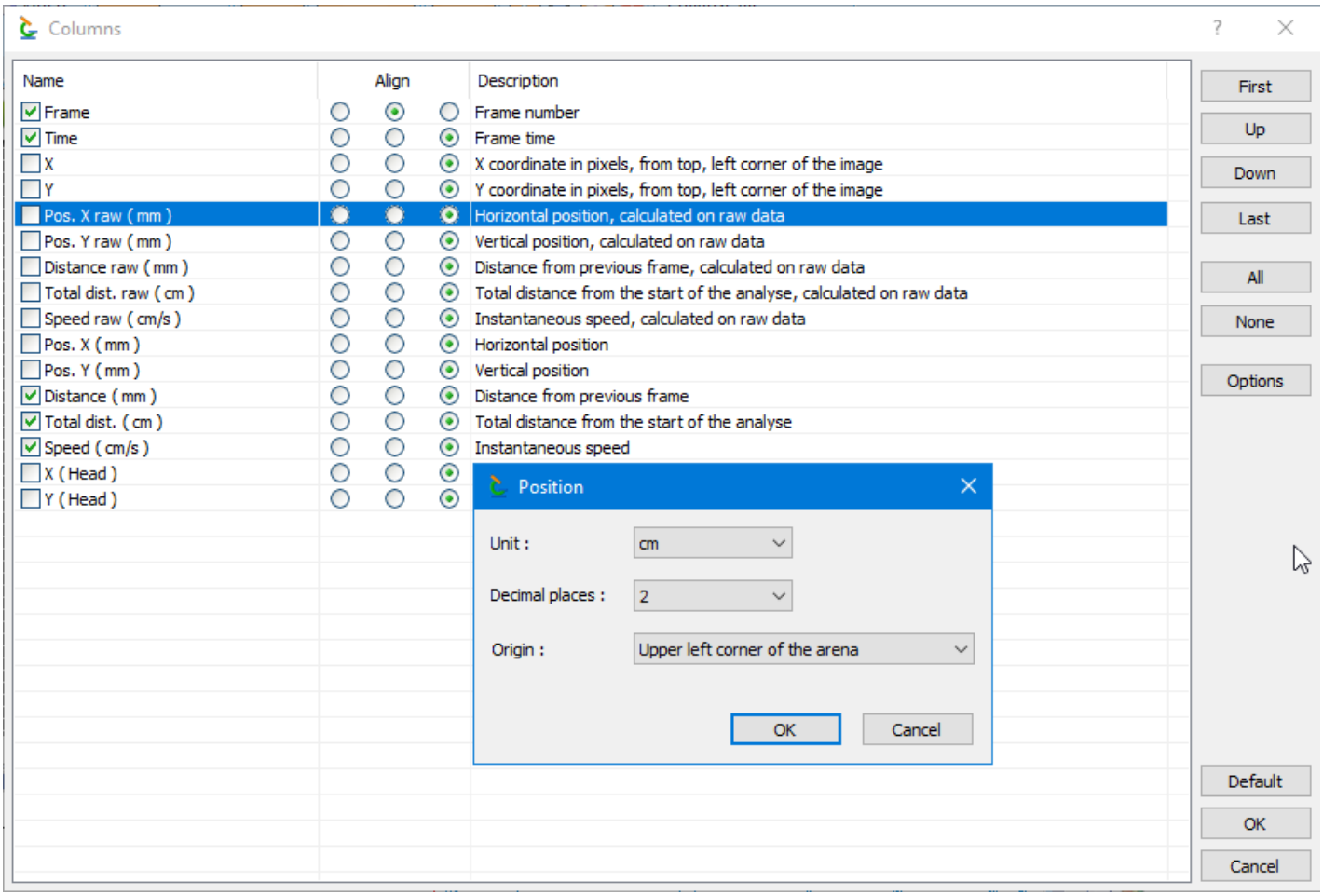
- Frame : the frame number.
- Time : the time since the start of the video file in the format: hours:minutes:seconds milliseconds.
- X : the horizontal position (abscissa) of the center of the animal from the upper left corner of the image.
- Y : the vertical (ordinate) position of the center of the animal from the top left corner of the image.
- pos. X,raw, Pos Y, raw : The horizontal and vertical position of the animal (in meters, centimeters or millimeters) calculated on the raw data (before filtering). This position can be calculated as desired in relation to:
  - the upper left corner of the image.
  - the center of the picture.
  - the upper left corner of the arena.
  - the center of the arena.
- Pos X, Pos Y: The horizontal and vertical position of the animal (in meters, centimeters or millimeters) after filtering. This position can be calculated as desired in relation to:
  - the upper left corner of the image.
  - the center of the image.
  - the upper left corner of the arena.
  - the center of the arena.
- Raw distance: The distance traveled by the animal between the current position and the previous position, calculated on the raw data (before filtering).
- Total raw distance: The total distance traveled by the animal between the current position and the start of

the tracking, calculated on the raw data (before filtering).

- Raw Speed: The average speed of the animal between the current position and the previous position, calculated on the filtered data.
- Distance: The distance traveled by the animal between the current position and the previous position, calculated on the filtered data.
- Total distance: The total distance traveled by the animal between the current position and the start of the tracking, calculated on the raw data (before filtering).
- Speed: The average speed of the animal between the current position and the previous position, calculated on the filtered data.
- X (head): the horizontal position (abscissa) of the animal's head from the upper left corner of the image.
- Y (head): The vertical position (ordered) of the animal's head from the top left corner of the image.

To modify the columns of the points list table:

1. Place the mouse cursor inside the table and click the right mouse button to bring up the context menu.
2. Choose the "Columns" command to bring up the column selection dialog box:



1. Select the elements to display by checking the corresponding box in the "Name" column.
2. Choose the alignment (left, center or right) of the text in the column.
3. Choose the column order by selecting an item and then using the "First", "Up", "Down" and "Last" buttons. You can also move an element directly with the mouse by holding down the left mouse button while moving the cursor.
4. Click on the "Default" button to return to the default display.
5. Some columns are configurable. To modify one of these parameters, select the corresponding column, then click on the "Options" button. You can also "double click" directly on the column name.

To export the table :

The table can be exported in "Microsoft© Excel" format or text with separator (CSV). For it :

1. Place the mouse cursor inside the table and click the right mouse button to bring up the context menu.
2. Choose the "Export" command.

To exclude a point from analysis :

It may happen on some images that the position of the animal found by the detection algorithm is wrong. If the choice of another algorithm or the modification of the parameters does not ensure correct detection of the animal on this image, it is possible to manually delete this image, so as not to distort the results of the analysis. . For it :

1. Place the mouse cursor inside the table and click the right mouse button to bring up the context menu.
2. Choose the "Exclude" command.

To delete the head position :

It may happen on some images that the position of the animal's head found by the detection algorithm is erroneous. In order not to falsify the results of the analysis, it is possible to manually suppress this detection. For it :

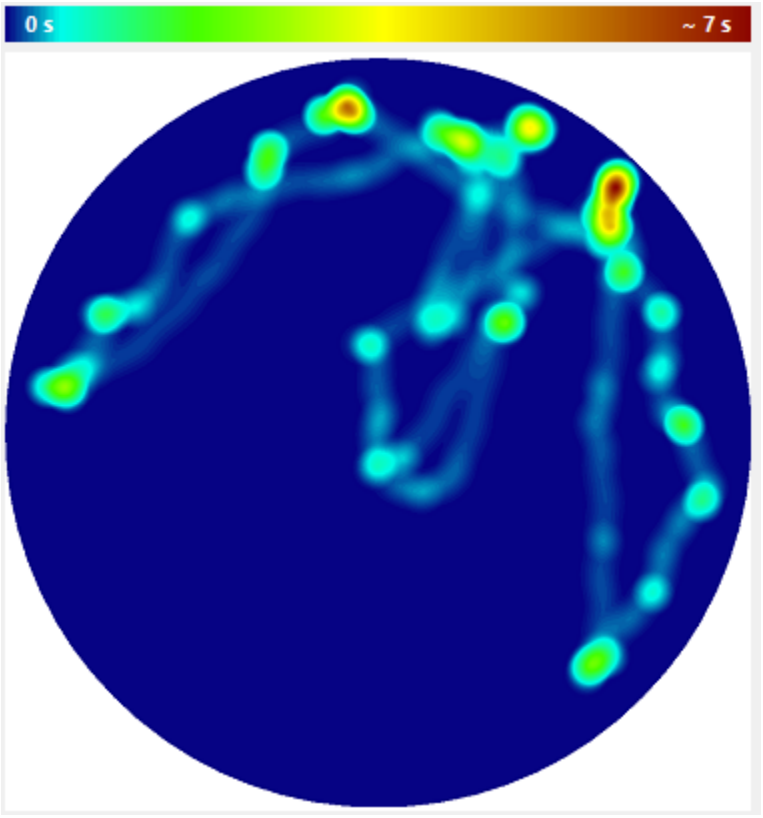
1. Place the mouse cursor inside the table and click the right mouse button to bring up the context menu.
2. Choose the "Delete Head Position" command.

 Note: It is possible to select several images using the "Shift" or "Ctrl" keys.

11.7.1.2.2. Heatmap

The heatmap represents, using a color gradient, the time spent by the animal in the different parts of the arena.

This map can be plotted using data from the position of the animal's center or head.



The color gradient used to generate the map, as well as the minimum and maximum values of the time spent (in seconds) corresponding to the extreme colors of the gradient are displayed. As indicated by the symbol ~, the calculated maximum value is an approximate value because it is calculated from the average value of a number of points around the animal's center position and not on the animal's position. a single point.

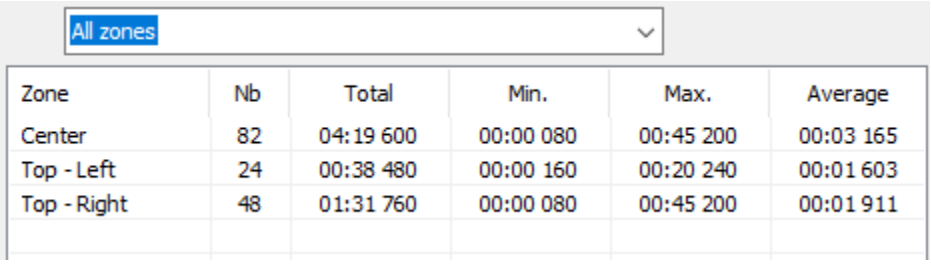
The contextual menu (accessible by a right mouse click) allows you to export the map as an image file to be able to use it in a presentation or a publication. It also allows you to choose the color gradient as well as the maximum display format.

11.7.1.2.3. List of visiting periods in zones of interest

This table displays the periods during which the animal was detected present in the different zones of interest selected in the "Display" panel.

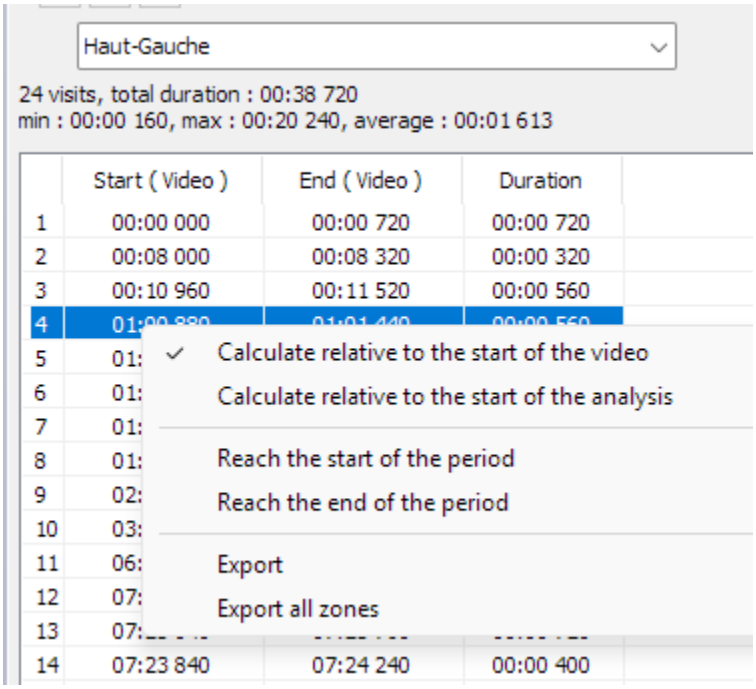
It is possible to display:

- the summary of visits in all zones of interest.



Zone	Nb	Total	Min.	Max.	Average
Center	82	04:19 600	00:00 080	00:45 200	00:03 165
Top - Left	24	00:38 480	00:00 160	00:20 240	00:01 603
Top - Right	48	01:31 760	00:00 080	00:45 200	00:01 911

- details of all visits for a particular zone :



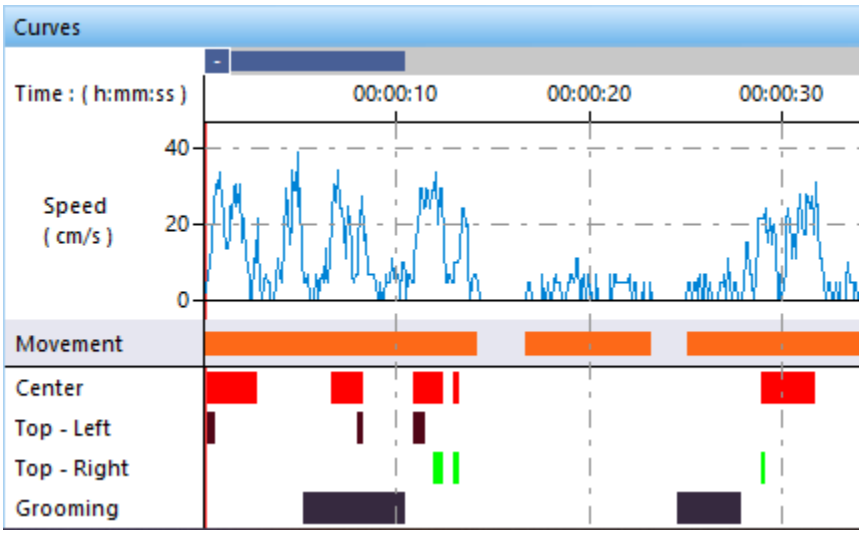
The context menu accessible by right-clicking in the table allows you to perform the following actions:

- **Calculate relative to the start of the video :** The time displayed in the start and end columns is calculated from the start of the video.
- **Calculate relative to the start of the analysis :** The time displayed in the start and end columns is calculated from the start of the analysis.
- **Reach the start of the period :** positions the video playback at the beginning of the selected visit period.
- **Reach the end of the period :** positions the video playback at the end of the selected visit period.
- **Export :** Exports the list to a file in "Microsoft© Excel" format or text with separator (CSV).
- **Export all zones :** Exports all zones (1 sheet per zone) to a file in "Microsoft© Excel" format or text with separator (CSV).

11.7.2. Curves panel

The "Curves" pane allows you to view the following elements in graphic form :

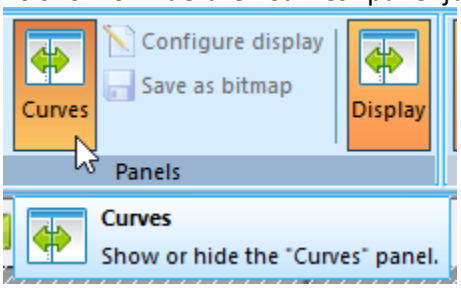
- The animal's movement speed (smoothed or raw data).
- The periods during which the animal is moving.
- The periods during which the animal is motionless.
- The periods during which the animal's head is moving.
- The periods during which the animal's head is motionless.
- The periods during which the animal is present in an area.
- The periods during which the animal could not be detected.



The curve area can be saved as an image file using the "Save Image" command from the context menu.

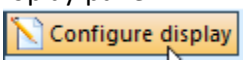
Show or hide the "Curves" panel :

To show or hide the "Curves" panel just click on the "Curves" button in the ribbon command bar :



Display configuration:

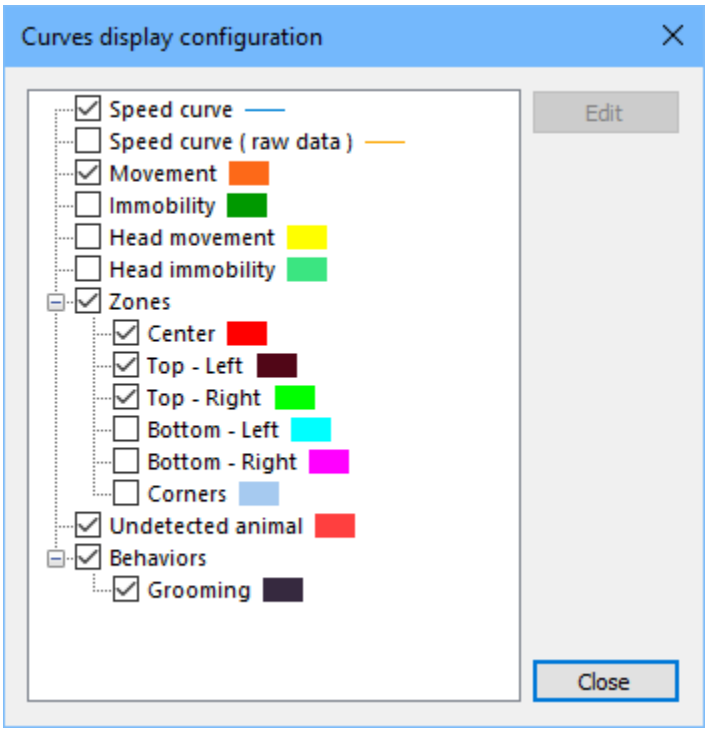
To configure the display you can either :

- Use the display pane.
- Click the 

button on the command ribbon to open the display configuration box.
- Use the "Configure the view" command from the context menu that appears when you right-click in the curves display area.

Display configuration dialog box :

This dialog box allows you to select the elements to be dispalyed in the curves area.



To change the style of an element, you can double-click on the element name, or click on the element name to select it, then click the edit button.

some elements (for example zones or behaviors) are not editable. Their color is necessarily the one defined in the protocol.

11.7.3. Display panel

The "Display" panel is used to select the elements to display in the central part of the "Current test" view:

- Video / Tracking:
  - Center: the point identified as the center of the detected animal. The point corresponds to the position of the animal.
  - Head : The position of the animal's head (if the " Detect animal's head " option is selected in the protocol)
  - Temporary track (Center or Head) : the part of the path traveled by the animal around the current image (15 points before, 15 points after).
  - Track (Center or Head) : The path taken by the animal throughout the analysis.
  - Partial Track (Center or Head) : The path traveled by the animal between the start of the analysis and the current video frame.
  - Direction/Speed : Vector indicating the direction in which the animal is moving and its speed.
  - Behaviors : The position of the periods of the behaviors (only if the test is analyzed and the period is located during the analysis period).
  - Arena / Zones : The arena and the different zones defined in the protocol.
  - Areas visited : the areas visited by the animal are highlighted.
  - Blob : square box that delimits the area where the animal has been detected.
  - Animal : area that corresponds to the part of the image where the animal was detected.
  - Countdown and recording icon : countdown before the start and the end of the recording and flashing icon during video recording (This option only appears for tests waiting to record with a webcam).

- Video : the video in the background.

- Curves:
  - Speed: speed of the animal calculated on the position data after applying the smoothing algorithm chosen in the smoothing options of the experiment .
  - Speed (raw data): animal speed calculated based on raw position data (before smoothing).
  - Movement: periods when the animal is moving (according to the criterion defined in the General tab of the Protocol).
  - Zones: periods when the animal is present in a zone.
  - Undetected animal: periods when the animal is not detected.
  - Behaviors : periods of behavior

When adjusting detection parameters, the following elements can be displayed on the video :

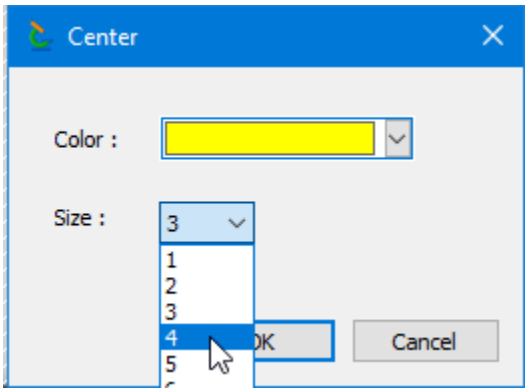
- Video / Tracking:
  - Arena: The arena defined in the protocol.
  - Size of detected areas : For each detected area, the area's surface value.
  - Areas that could correspond to an animal : The areas of the image detected by the detection module that could correspond (by size and shape) to an animal.
  - Areas that could not correspond to an animal : The areas of the image detected by the detection module but that cannot correspond to an animal due to their size or shape.
  - Video : The background video.

Note: The selection of elements to display is specific to each protocol.

Some display elements are configurable (color, line width, etc.). To do this, double click on the element in the "Display" panel or use the popup menu to open the corresponding dialog box:

Head, center:

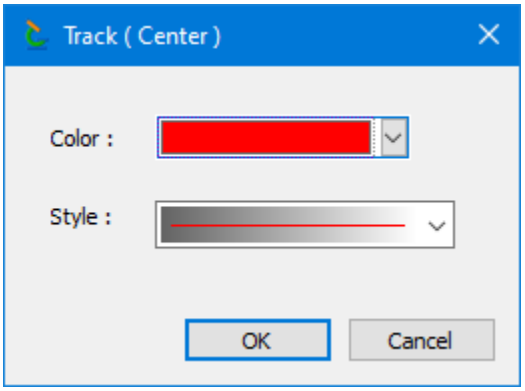
This dialog box allows you to choose the color and size of the point that marks the position of the center or the head.



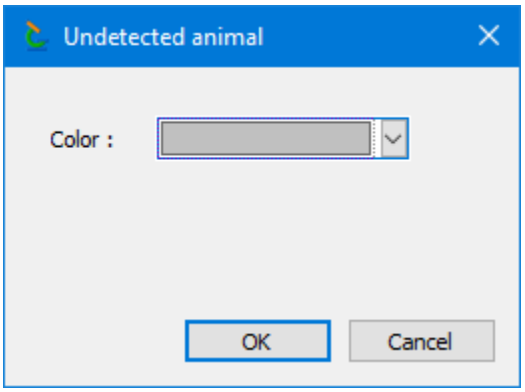
.

Track, contour, speed:

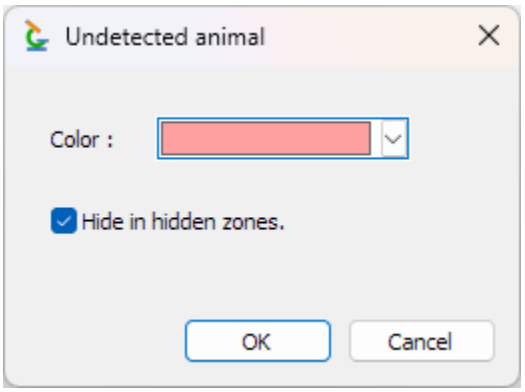
This dialog box lets you choose the color and style of a track, animal outline or velocity curve.



Animal, movement, undetected head :



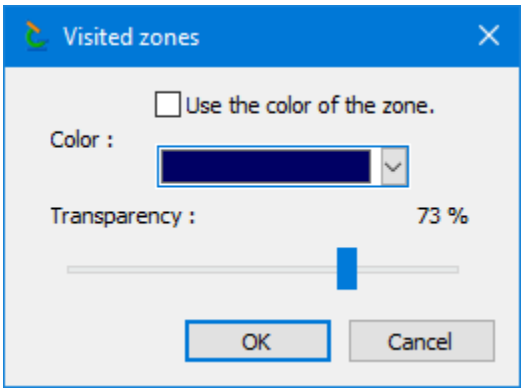
Undetected animal :



On principle, the animal is not detected in hidden areas. These periods of non-detection are not displayed in the graph area by default. To display these periods, simply uncheck the "Hide in hidden areas" box.

Visited zones :

This dialog box allows you to configure the display of the zones visited by the animal.

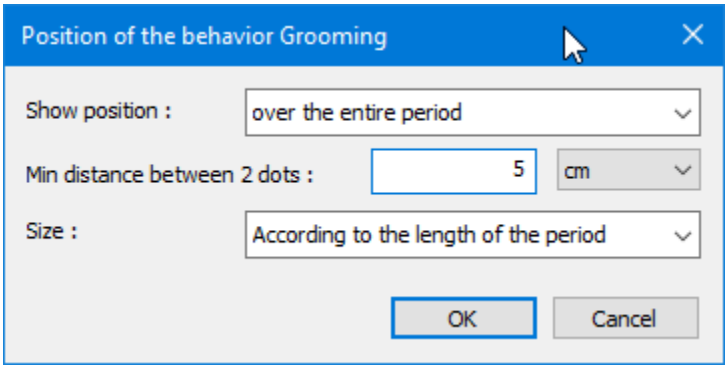


Color: the color applied to the area. You can use the color of the zone defined in the protocol or choose another color.

Transparency: the transparency rate of the color. 0 = opaque. 100%= totally transparent.

Behaviours:

This dialog box is used to configure the display of the position of the behavior periods (only the periods that are located during the analysis period).



You can choose to display the positions:

- from the beginning of the period.
- from the end of the period.
- from the middle of the period.
- over the entire period. In this case Ethotrack displays several markers over the entire period between the start and the end of the behavior. The markers are separated by the specified distance (5 centimeters in the example).

You can also configure the size of the position marker. In the case of a size "according to the duration of the period", the size of the marker varies according to the duration of the period:

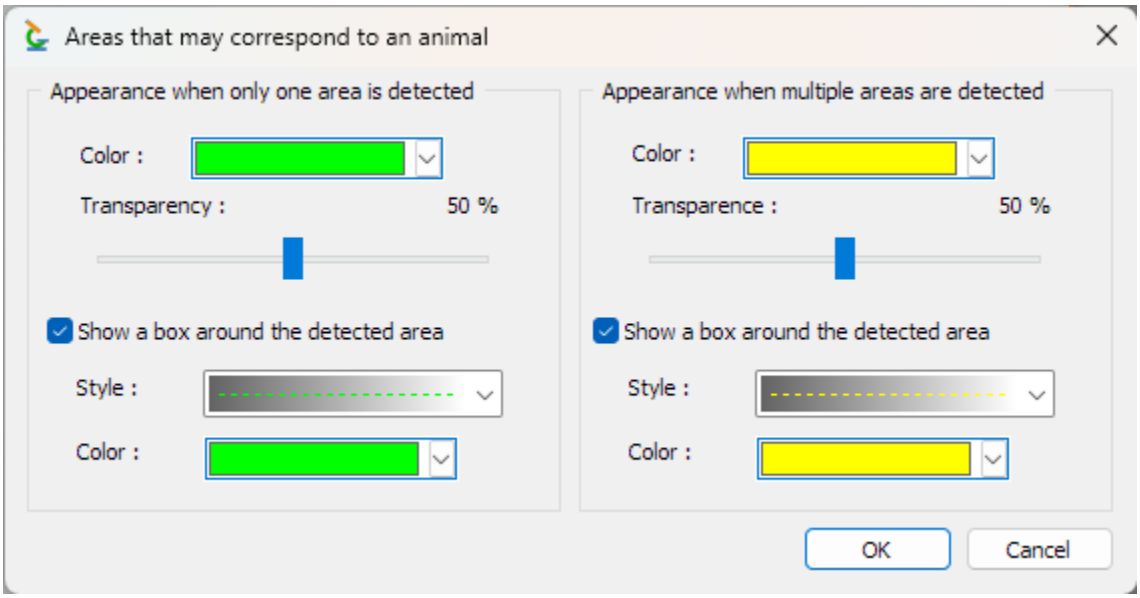
- very small if the duration is less than 1 second.
- small if the duration is between 1 and 2 seconds.
- medium if the duration is between 2 and 5 seconds.
- big if the duration is between 5 and 10 seconds.

- very big if the duration is greater than 10 seconds.

Areas that could correspond to an animal :

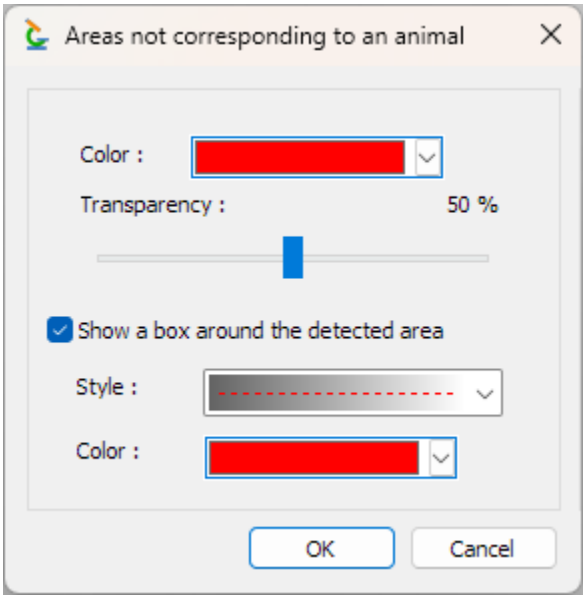
This dialog box allows you to configure the appearance of detected areas when their size and shape could correspond to an animal.

For detection to be accurate, only one area should be able to correspond to an animal.



Areas not corresponding to an animal :

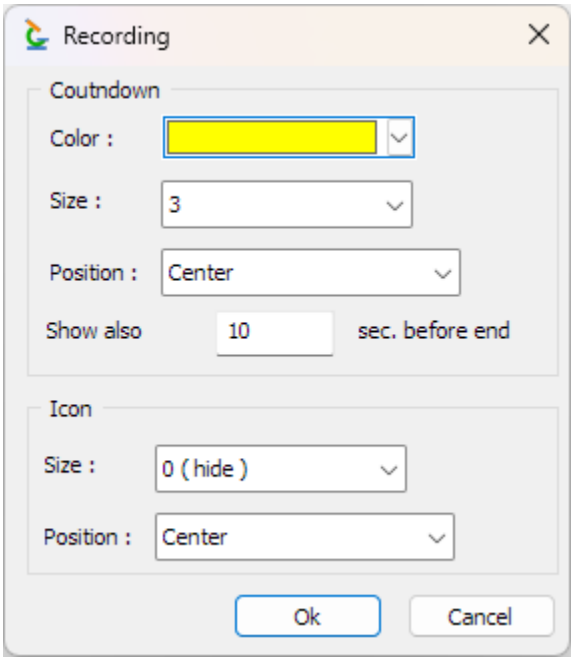
This dialog box allows you to configure the appearance of detected areas that cannot correspond to an animal due to their shape or size.



Countdown and recording icon :

This dialog box allows you to configure the display of informations during video recording :

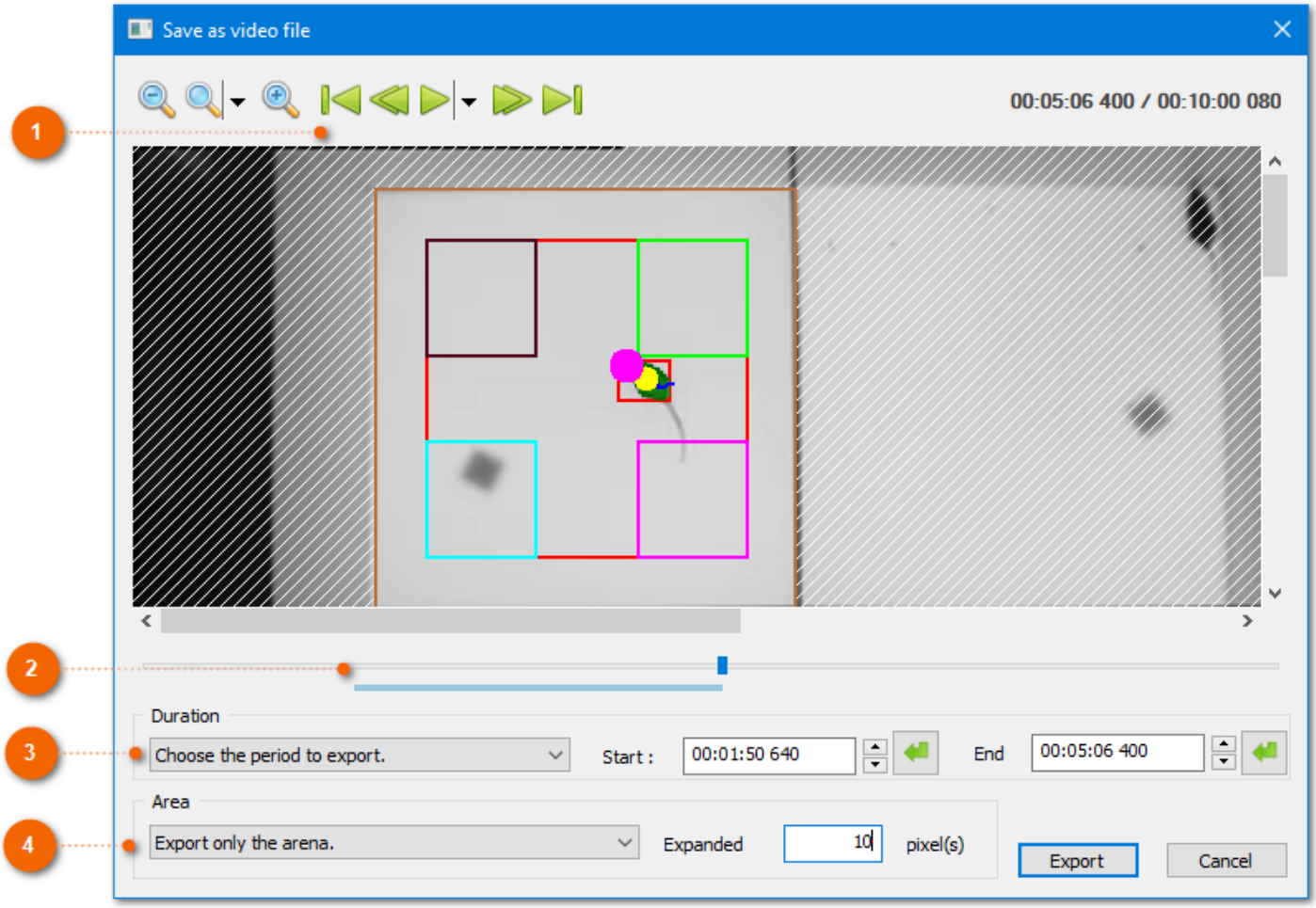
- Countdown timer before recording (as defined in the protocol) and programmable countdown timer before recording ends.
- Flashing icon during recording  .



Notes : these settings are also used for display in the "current video" view.

11.7.4. Export analysis results as video

This dialog box allows you to create a video file with the outline of the zones and the tracking information (track, position of the animal, etc.).



1 **Commandbar :**

Video zoom and playback control buttons.

2 **Cursor :**

Slider to quickly reach a video playback position.

3 **Duration to export :**

The export period can be set in several ways:

- By choosing a pre-defined period from the list.
- By manually adjusting the start and end using the buttons
- Using the current playing position of the video as the start or end of the period thanks to the buttons .

4 **Area to export :**

The export surface can be defined in several ways:

- All recorded area.
- The surface of the arena (possibly extended by a few pixels).
- The surface visible on the screen (possibly extended by a few pixels). Use the zoom functions to adjust the visible area on the screen.
- The selected area. Use the mouse to define the area to export directly on the video frame.

Choice of elements to include in the video:

The elements (tracks, temporary tracks, zones, animal positions, etc.) included in the video are those visible in the main view of the current test. You can select the elements or modify the display characteristics (color or line width) using the " Display " side panel of the current test view.

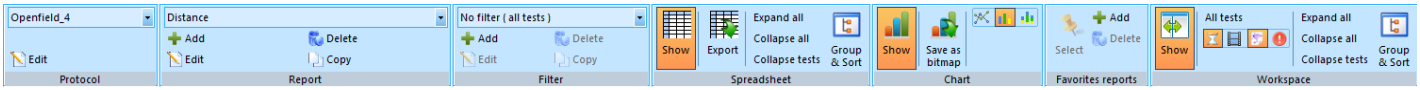
To open this dialog box:

- Use the "Save as video file" context menu of the current test view.
- Click on the Video command ribbon button of the "Current test" tab.

11.8. Reports

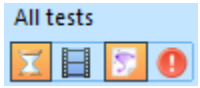
This view displays the result of the reports in the form of a table and/or a graph:

Ribbon commands:



- **Protocol**: Protocol selection.
  - **Edit** : Modification of the selected protocol.
- **Report**: Report selection
  - **Add**: Creation of a new report.
  - **Edit** : Modification of the selected report.
  - **Copy** : Creation of a new report from the selected report.
  - **Delete** : deletion of the selected report.
- **Filter: Filter selection**
  - **Add**: Creation of a new filter.
  - **Edit** : Modification of the selected filter.
  - **Copy** : Creation of a new filter from the selected filter.
  - **Delete** : deletion of the selected filter.
- **Spreadsheet :**
  - **Show** : Show or hide the table view of the report.
  - **Export :** Export the report to a Microsoft© Excel document or a text file with separator (CSV).
  - **Expand all** : fully expand the tree structure of the "Animals / Tests" node of the table.

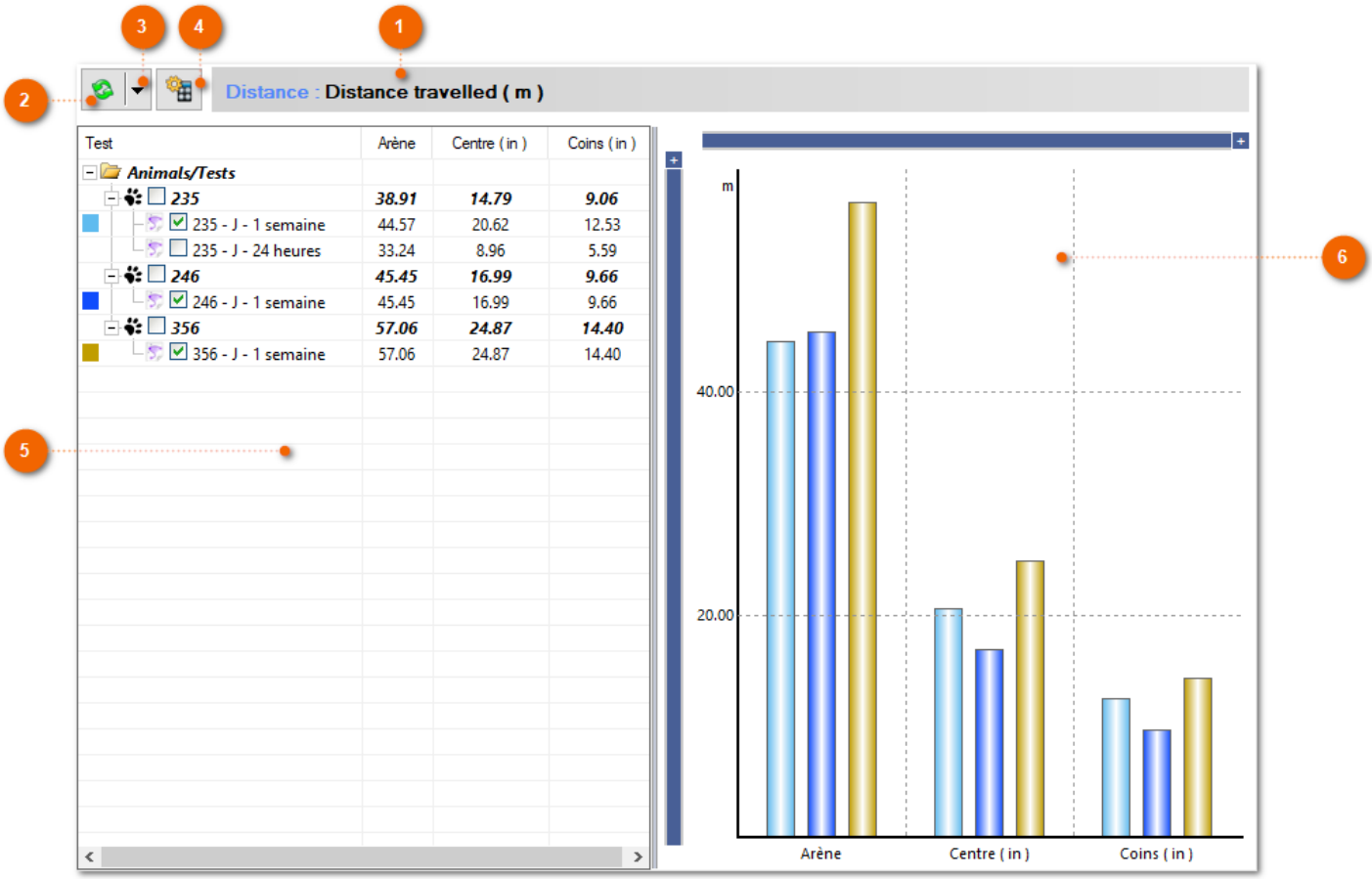
- **Collapse all** : collapse the tree structure of the "Animals / Tests" node of the table.
- **Collapse Tests** : Collapse the table tree to the levels of the parent nodes of the tests.
- **Group / Sort** : open the dialog box for configuring the tree structure of the "Animals / Tests" node of the report.

- **Chart :**
  - **Show :** Show or hide the graphical view of the report.
  - **Save as bitmap :** Save the graphical view of the report to an image file.
  -  : Selection of the type of graphic representation (curve of points, histogram, or stacked histogram).
- **Favorite reports** :
  - **Select** : Select and generate a report from the list of favorite reports.
  - **Add** : Create a new favorite report from the current configuration (report, filter, display, ...). Or modify an existing favorite report with the current configuration.
  - **Delete** : Delete a favorite report.
- **Workspace :**
  - **Show** : Show or hide the workspace.
  - 

: Allows you to display or hide the tests in the workspace according to their status (Pending, saved, analyzed, excluded).
  - **Expand all** : fully expand the tree structure of the "Animals / Tests" node of the workspace.
  - **Collapse all** : collapse the tree structure of the "Animals / Tests" node of the workspace.
  - **Collapse Tests** : Collapse the workspace tree to the parent nodes of the tests.
  - **Group / Sort** : open the dialog box for configuring the tree structure of the "Animals" or "Tests" node of the workspace.

Main part:

The central part displays the result of the reports in the form of a table and/or a graph:



1 **Title :**

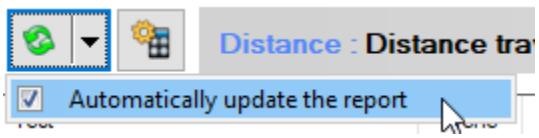
General report information: Name, Report type, Unit.

2 **'Refresh' button :**

Button to refresh the report. Only tests that have been added, modified or analyzed are recalculated.

3 **Choosing the Automatic Report Refresh Option :**

Click the arrow to open a menu to choose whether the report should be refreshed automatically each time a report parameter is changed or not.



When this option is selected, the report is automatically updated each time it is necessary (modification of a parameter of the report, modification of the analysis of a test, etc.). Otherwise, the report must be refreshed by clicking on the button  .

4 **'Recalculate' button :**

Button to recalculate the whole report. All tests are recalculated.

5 **Spreadsheet:**

The report results in tabular form.

6 **Chart:**

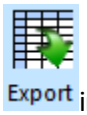
Report results (only the checked items) as a graph (lines, bars, or stacked bars)

11.8.1. Export to Microsoft© Excel

Report results can easily be exported to spreadsheet software. Either directly in Microsoft © Excel format, or in a text format with separator (csv format).

To export report results:

Once the report is generated :

- Click the button 

in the command ribbon.
- Use the "Export" command from the context menu.

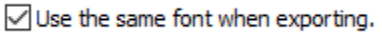
Selection of exported data:

All report rows are exported. To add or remove rows you must use a filter .

Calculation and display of the group average:

If you have chosen to display the average of the groups in the report (see the "Type" tab of the "Report" dialog box), the calculated averages will also be exported.

The font used for displaying the groups (see the "Reports" tab of the "Experiment Settings" dialog box) can be applied to the corresponding cells when exporting to Microsoft © Excel format.

To do this: check the box in the 

"Reports" tab of the "Experiment settings" dialog box .

Export file update:

When exporting a report in Microsoft © Excel format, if the file already exists, it is possible to "update the file". In this case, only the first columns of the first sheet of the file are modified. This function is useful if you have modified the file, for example, by adding calculations to the raw data of the report. By updating the file, all added calculation cells will not be modified.

Rules to respect to allow the update of a Microsoft© Excel file :

- Do not insert a new sheet **before** the sheet containing the raw report data. Report data is always inserted on the first sheet of the workbook regardless of its name.
- **Do not modify the first columns that contain the raw data of the report.** Additional calculation cells must be created after the last column of raw data or on another sheet. Note: the columns modified by Ethotrack can be identified by the gray background color of the table header cells.
- If the new report contains more columns than the old one: the additional columns are inserted at the end of the raw data table.
- If the new report contains fewer columns than the old one, unused columns are removed only if all cells in subsequent columns are empty. Otherwise, unused columns are cleared but not dropped.
- Ethotrack uses a hidden cell (A2) to record useful information for the update. **Do not modify or delete this cell.**

12. Options

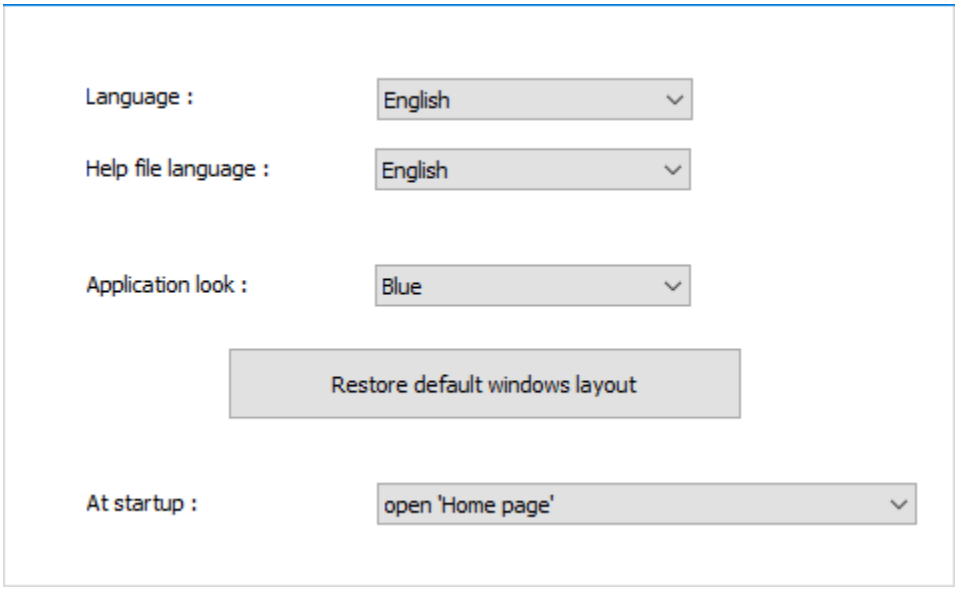
This dialog box allows you to define the general options of Ethotrack. It has the following tabs:

- General .
- Default units .
- Miscellaneous .

To open this dialog box:

- Use the menu: ***Tools*** ***Options*** .

12.1. General



Language :

The display language of the Ethotrack interface.

Help file language :

The language of the help file.

To open the help file:

- ***Help*** ***Help*** menu .
- Press the **F1 key** .
- Click a " **Help** " button in a dialog box.

Application look :

Allows you to choose the style of the Ethotrack interface.

Restore default window layout :

Allows you to restore the position of the various side panels (Workspace, Information on a test or a video, etc.)

as when Ethotrack was first launched.

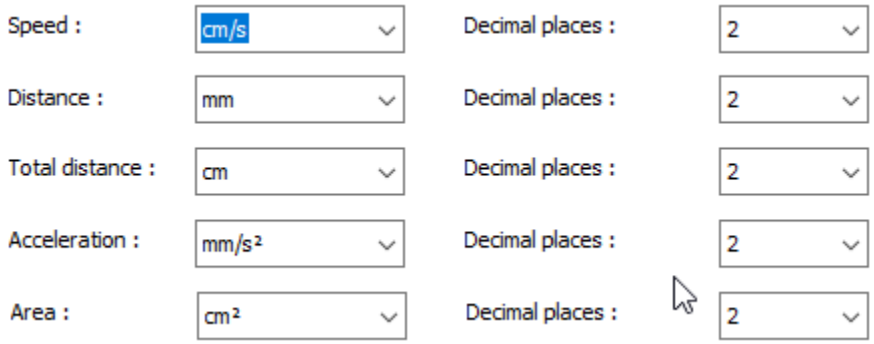
At startup:

Allows you to choose an action to perform when launching Ethotrack:

- Open home page.
- Open the last experiment.

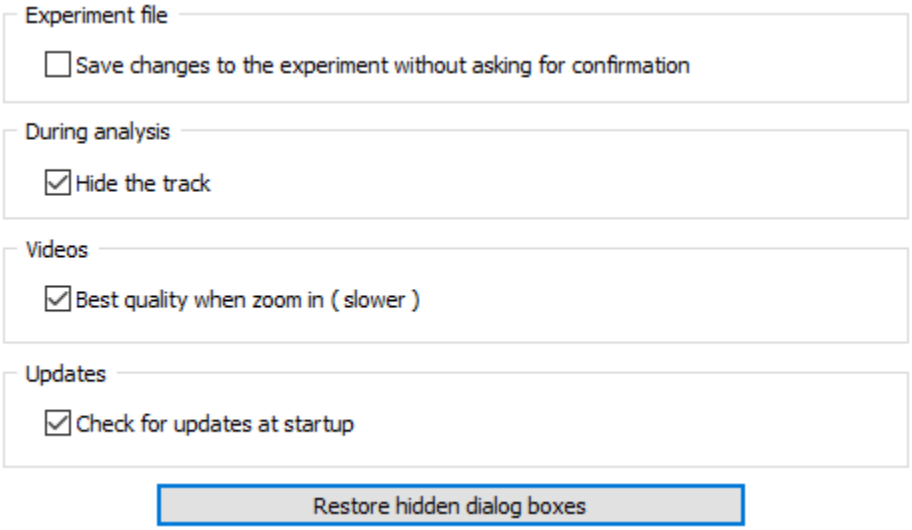
12.2. Default units

This tab allows you to choose the default display units and precision, for all Ethotrack experiments.



If you want to make different choices in a particular experiment, use the "Units" tab of the experiment's options dialog .

12.3. Miscellaneous



Experiment file - Save changes to the experiment without asking for confirmation:

Allows you to choose the mode for saving changes to the experiment. Check this box to not use a temporary file and to have changes to the experiment saved immediately to the experiment file. For more information on how changes are saved, see the "Saving changes in the experiment file" paragraph of the "Experiment" section .

During Analysis - Hide Track :

Check this box to temporarily hide the animal track in the test view when analyzing the video. This makes it possible to reduce the analysis time by reducing the display time of each image.

Videos - Best quality when zoomed in :

Check this box to have a better image quality of the video and tracking elements when zooming in.

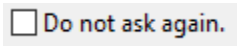
Depending on the performance of your computer, the display, with a large zoom factor, may become slower if this option is checked.

Updates - Check for updates on startup :

If this box is checked, Ethotrack checks for the availability of an update each time it is started (Requires an internet connection).

Restore hidden dialogs :

To make the interface more fluid, some confirmation or information dialog boxes can be hidden by checking the box provided for this purpose:



You can click this button to restore the display of all hidden dialog boxes.

13. Rules and tips

Ethotrack was designed to work with readily available hardware at an affordable price. To make the most of this material, it is important to respect certain rules:

Installation of the open field :

- Install the open-field in a sufficiently bright place, with uniform and constant lighting. Give preference to constant artificial lighting located above the open-field in order to avoid shadows.
- Avoid placing the open-field near a window, especially if the experiment is to take place over several days. Otherwise, block out the light from the window if possible.
- Install the open-field in a quiet place, away from a traffic area to avoid any risk of the camera moving. Especially if the experiment is to take place over several days.

Choice and installation of the camera :

- If the lighting conditions are good, any recent USB camera may be suitable.
- When installing the camera, check on the manufacturer's website that you have the latest drivers available.
- Position the camera in the center of the open-field (to avoid perspective errors), at a height that encompasses the entire area to be analyzed. Keep enough margin around the area to be analyzed to be able to adjust the arena if the camera moves between 2 tests.

Choice of bottom of the open-field :

- If possible choose the background color to have the maximum contrast between the background and the animal to be detected.

Choice of computer :

- Image processing uses a lot of resources. It is preferable to use a recent computer with at least 4 Giga Bytes of RAM, and a hard disk of sufficient size to record video files.
- For reasons of speed, it is preferable to save the experiment file and the video files on an internal hard disk of the computer, and not on a removable disk, or a USB key.
- When recording or analyzing it is best to close all unnecessary programs.
- It is best to avoid using the computer while recording.

14. End User License Agreement

This End User License Agreement (EULA) constitutes a contract between you and the author of Ethotrack. If you do not agree to the terms of this contract please do not install, copy or use Ethotrack.

This software and accompanying documentation are protected by copyright laws and international treaties, as well as other intellectual property laws and treaties.

Trial version :

To allow you to try out EthoTrack, a trial version is available at www.ethotrack.com. This trial version has some limitations.
On request, it is possible to obtain a demonstration license key which allows these limitations to be lifted for a period of 30 days.
Unless explicitly agreed by Innovation Net, the results obtained with a demo version (with or without a demo license key) cannot be used for publication in an article or a review.

Individual license :

An individual license is linked to a computer and allows, after activation, to use Ethotrack on this computer only. If you want to transfer this license to another computer, you must first deactivate the license on the first computer before you can activate it on the second. The activation or deactivation procedure requires an internet connection.

Floating license by USB key :

You are allowed to install EthoTrack on multiple computers, but in order to use it on one computer, you must connect the USB license key provided. To be able to use Ethotrack on several computers **simultaneously**, you must purchase several USB license keys.

Server Managed Floating License :

EthoTrack can be installed on several computers. Licenses are managed by a license server installed on a computer on your network. On startup Ethotrack contacts the server to obtain an available license token. When Ethotrack is closed, the token is returned and can be made available to another user. Without a token, Ethotrack operates in demonstration mode.

Restrictions:

You may not reconstruct the logic of the software, decompile it or disassemble it.

Limit of liability :

This software and accompanying documentation are provided "as is" without warranty of any kind. The author of EthoTrack cannot be held liable for damages of any kind whatsoever suffered by the user or third parties and resulting directly or indirectly from its use, in particular the loss of data, or any financial loss resulting its use or the impossibility of using it, even if the author has been warned of the possibility of such damages.

Third-party libraries :

Ethotrack uses the following third-party libraries :

* OpenCV under BSD license (Click here for more information).

* Sqlite dedicated to the public domain.
* FFmpeg under LGPLV2.1 license.

14.1. OpenCV license

By downloading, copying, installing or using the software you agree to this license. If you do not agree to this license, do not download, install, copy or use the software.

License Agreement
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15. Activation

By default, the version of EthoTrack available on the site www.ethotrack.com works in demonstration mode and has certain limitations. To use all features of EthoTrack, you must have a valid license and activate the software.

The activation procedure depends on the license type:

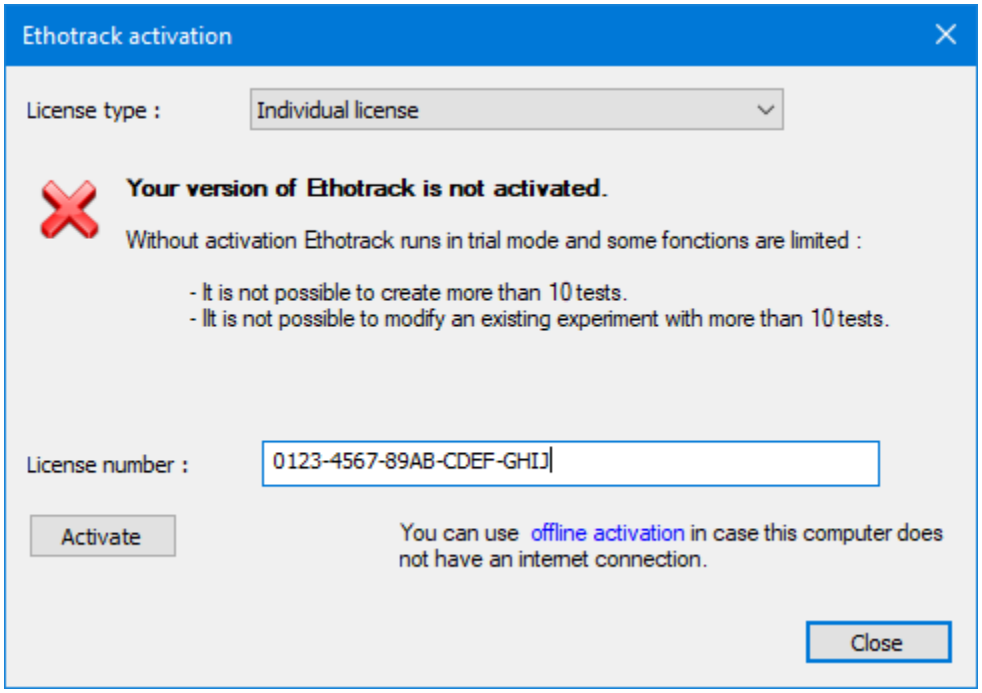
Floating license by USB key :

Simply connect the USB license key to your computer.

The USB key must remain permanently connected to the computer as long as you wish to use all the functionalities of EthoTrack. If you remove the USB key, you will no longer be able to make any changes, nor save the changes already made.

Individual license :

1. Start EthoTrack.
2. In the window that tells you that your version of EthoTrack is not activated, click on the "Activate Ethotrack" button to open the activation window.



3. Choose the type of license: "Individual license", then enter the license number that was provided to you during your order.
4. If your computer is connected to the internet, click on the "Activate" button. Otherwise, click on the "Activate Ethotrack offline" link, then follow the instructions in the offline activation window.

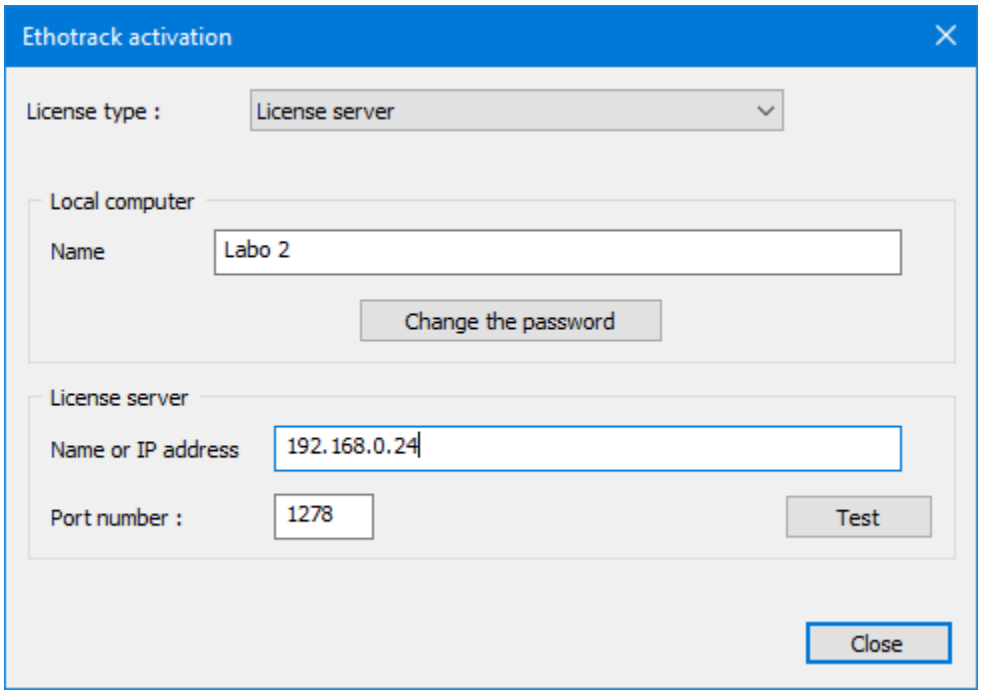
If you want to transfer this license to another computer, you must first deactivate the license on the first computer before you can activate it on the second.

Server Managed Floating License :

1. Make sure that the license server is installed on a computer accessible on the network and that it is

correctly configured and started.

2. Start EthoTrack.
3. In the window that tells you that your version of EthoTrack is not activated, click on the "Activate Ethotrack" b window.



4. Choose the type of license: "License Server", then enter the information of the local computer, as well as the address of the license server and the port number.
5. Click on the "Test" button to test the link with the license server.
6. If the test fails:
   - Check the parameters entered.
   - Check that the server is correctly installed and configured, and that it is started (see the server help).
   - Verify that the server and local computer firewalls allow communication on the specified port.

- A license token must be renewed regularly. If the connection with the server is interrupted and the token cannot be renewed, it is automatically lost after 30 minutes. When a license token is lost, it is no longer possible to make changes in the experiment; on the other hand, it is always possible to save the modifications already carried out.
- Remember to leave Ethotrack when you have finished your work, to release the token and allow another user to obtain a license.
- If no experiment is opened in Ethotrack for more than 30 minutes, the token is automatically returned to allow another user to work.