

# ECUMASTER DATA MASTER

## User Manual



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## DATA MASTER software

DATA MASTER is an advanced software for data analysis intended for ECUMASTER devices. It has all the analytical features of the ADU software plus many new ones. It supports all ECUMASTER logging devices (ADU, PMU, EMU BLACK, EMU CLASSIC, EDL1,). In addition, it allows you to import video files and automatically synchronise them with your logged-in data.

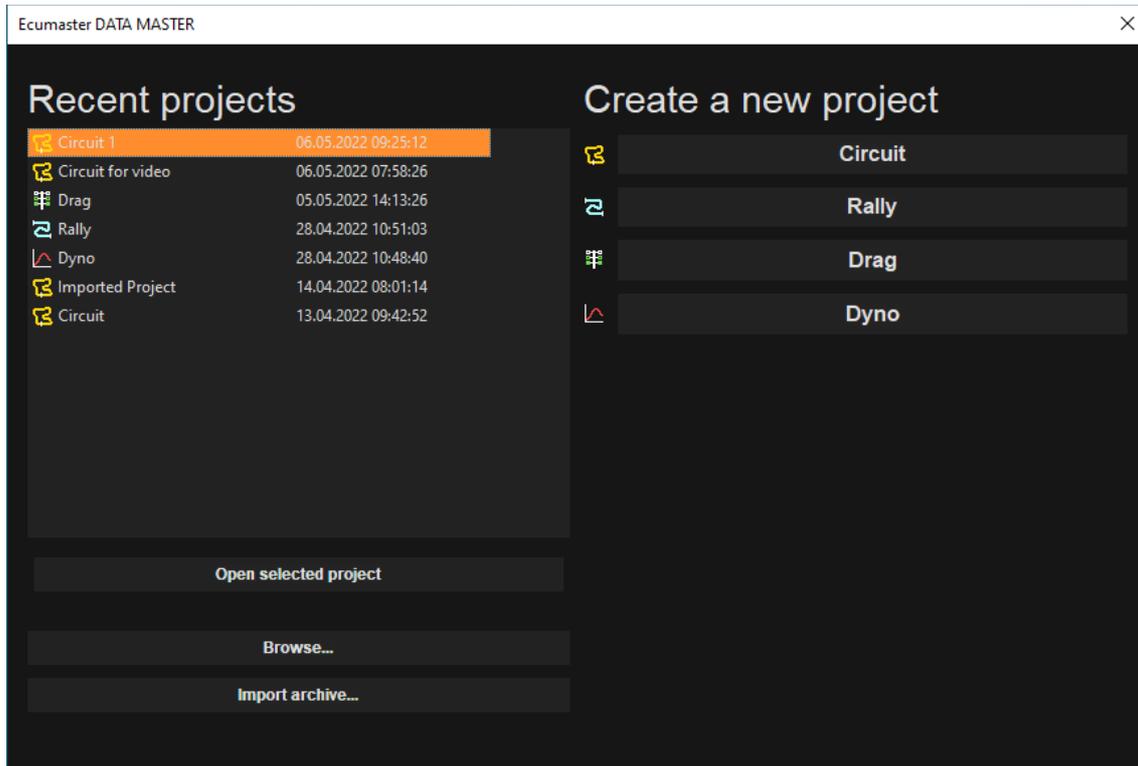
DATA MASTER allows you not only to analyse a driver's driving style, but also the car parameters. Using corresponding project types, it is easy to analyse the different categories of motorsport, i.e. circuit racing, rallying, drag racing, and to analyse the performance of a car on a dynamometer(*Dyno*).

### Key functionalities:

- Mathematical channels
- Video analysis with automatic synchronisation
- Lap management
- User channels support (a project file is no longer needed to load user defined channels)
- Many new/improved visualisations
- Greater integration between panels
- Global channel aliases ensuring versatility
- Support for ADU, PMU, EDL, EMU BLACK and EMU CLASSIC log files
- User-defined start/finish point for a lap or special stage
- Reference track (in-depth analysis per track segment)

## Projects

Projects help you to organise your handling of data. Logs, video files, reference track, math channels and desktop layout are stored within the project. The whole project can be packed into one file. There are four project types available for different motorsports. They have dedicated tabs for each type with corresponding types of data visualisation. In addition, they allow you to add your own tabs with visualisations, depending on your needs.



### Types of projects

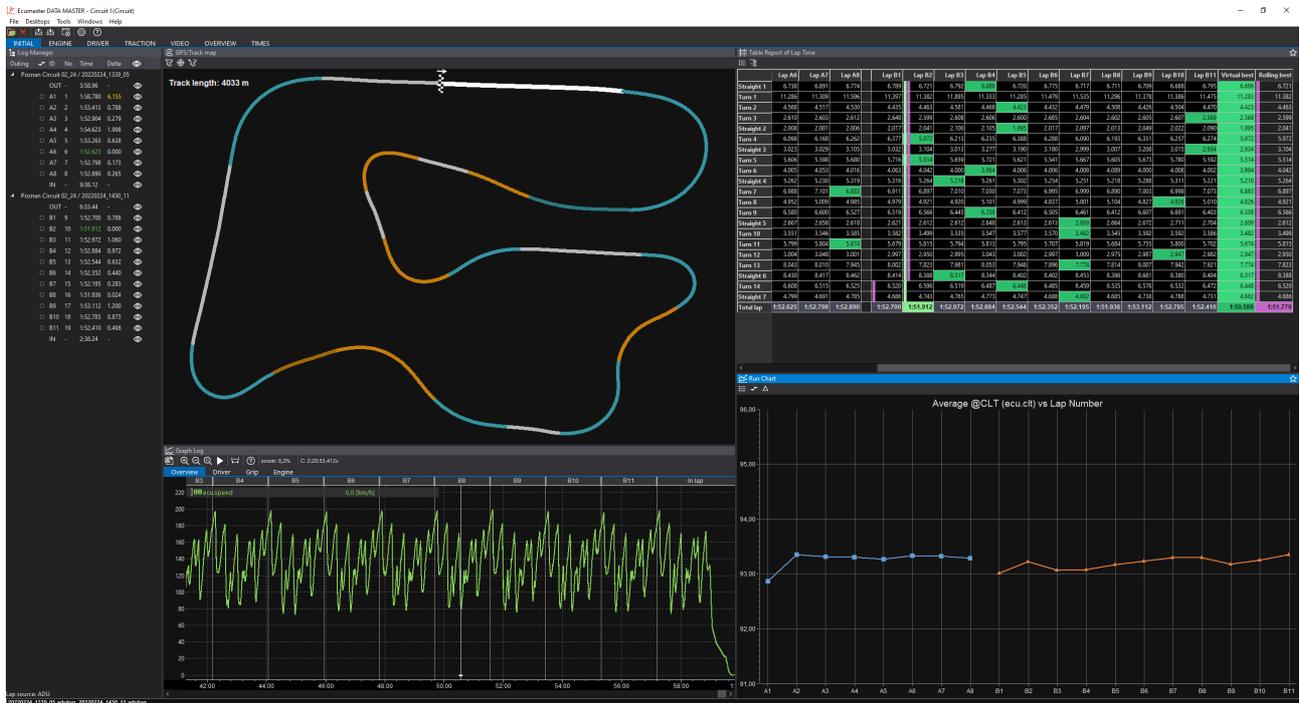
Type	Description	Log split
<b>Circuit</b>	Dedicated to circuit racing	Lap
<b>Rally</b>	Dedicated to rallies	Special stage
<b>Drag</b>	Dedicated to parallel racing	Run
<b>Dyno</b>	Dedicated to dynamometers	Pull

The project is saved automatically when the application closes.

Since most of the functions work similarly for all log splits, for simplicity a log split into laps will be used further in the manual. If any functionality differs depending on the project type, this will be indicated.

## Desktops / application layout

After installing and launching the application and creating a new project, the computer screen should look like the one below:



Below is a description of all available menu functions

File	
<b>Open log</b>	Opening a log ( <b>CTRL + O</b> )
<b>Clear logs</b>	Clearing all loaded logs ( <b>CTRL + X</b> )
<b>New/open project</b>	Opening a new or a different project ( <b>CTRL + N</b> )
<b>Save project</b>	Saving a project in the location last used ( <b>CTRL + S</b> )
<b>Save project as</b>	Saving a project to a new file ( <b>CTRL + SHIFT + S</b> )
<b>Pack project</b>	Packing a project into a file with the logs used in it. This option is useful for transferring and sending projects ( <b>CTRL + SHIFT + P</b> )
<b>Import project</b>	Importing a project from an archive ( <b>CTRL + SHIFT + I</b> )
<b>Show full screen</b>	Activating a full-screen mode. This increases the available screen space for applications ( <b>CTRL + F</b> )
<b>Exit</b>	Exiting the application. A project is saved on exit ( <b>ALT + X</b> )
Desktops	
<b>Import desktops template...</b>	Importing desktops
<b>Export desktops template...</b>	Exporting desktops
<b>Add new panel</b>	Adding a new window to the desktop ( <b>F9</b> )

<b>Replace panel</b>	Replacing a selected window with another one ( <b>SHIFT + F9</b> )
<b>Switch desktop to...</b>	This option allow you to switch to any selected desktop ( <b>CTRL + 1 -9</b> )
<b>Previous desktop</b>	Switching to the previous desktop ( <b>CTRL + TAB</b> )
<b>Next desktop</b>	Switching to the next desktop ( <b>CTRL + SHIFT + TAB</b> )
<b>Tools</b>	
<b>Lap Editor</b>	Opening the Lap Editor window ( <b>F5</b> )
<b>Maths Editor</b>	Opening the <b>Maths tree</b> window for editing mathematical channels, constants and aliases ( <b>F7</b> )
<b>Coach Mode</b>	Opening the sketching mode ( <b>F8</b> ) Exiting the mode using <b>F8</b> or <b>Esc</b>
<b>Options...</b>	Opening the options window ( <b>CTRL + SHIFT + O</b> )
<b>Windows</b>	
<b>Next panel</b>	Activating the next panel ( <b>Tab</b> )
<b>Previous panel</b>	Activating the previous panel ( <b>SHIFT + TAB</b> )
<b>Help</b>	
<b>About</b>	Opening a window with information about the software version

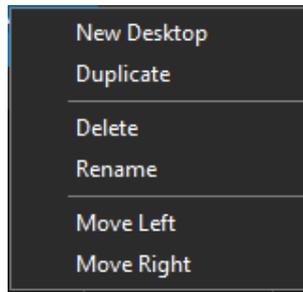
There are icons on the taskbar  indicating:

- **Open log** – opening a log
- **Clear log** - clearing all loaded logs
- **Restore project** - loading the last saved project
- **Store project** - saving the current project
- **Add panel** – adding a panel
- **Configuration** - opening the *General Options* configuration window

The *General Options* window contains the following settings:

Option	Description
<b>Auto-synchronize video and data</b>	Enabling automatic video synchronisation when opening a file
<b>Automatically generate reference track</b>	Enabling automatic reference track generation when opening a log
<b>Use mouse wheel to zoom on Graph Log</b>	Controlling the zoom in the <i>Graph Log</i> panel with the mouse wheel

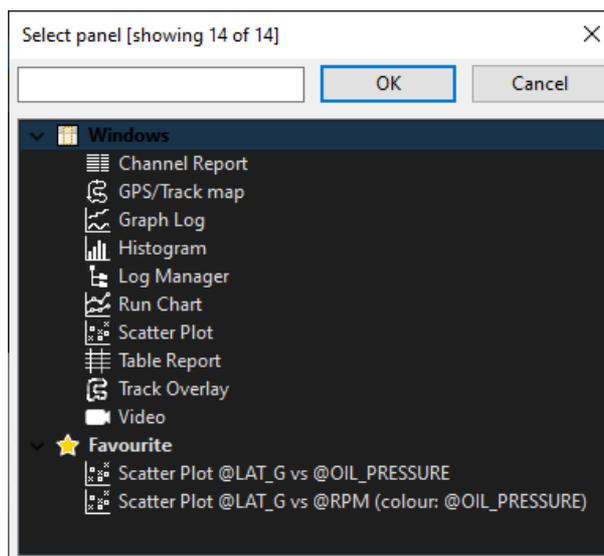
Tabs are an important part of the application. They allow you to create your own sets of windows (panels), which makes the software easier and quicker to use. After pressing the right mouse button on the tab the following menu appears:



Option	Description
<b>New desktop</b>	Create a new tab.
<b>Duplicate</b>	Duplicate a tab. This option creates a new tab and copies into it the contents of a selected one
<b>Delete</b>	Delete tab
<b>Rename</b>	This function makes it possible to change the name of a tab
<b>Move Left</b>	Moves a tab to the left
<b>Move Right</b>	Moves a tab to the right

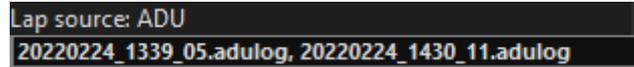
Tabs form part of a project. They can also be exported to a *.dmlayout* file and loaded in another project.

Another element of the interface are panels. To add a new panel, press **F9** (or click on the **Add panel** icon in the toolbar). A window with all available panels will open. For a quicker search, you can enter the panel you are looking for in the filter field.



Newly opened panel always show up on the right side of the desktop. You can move them by pressing the left mouse button on the *Title bar* and moving the mouse to a new position. To remove a panel from the desktop, press the right mouse button on its bar. A menu will appear from which you can delete it (*Close panel*).

The bottom left corner shows the name and source of the currently analysed log(s).

A screenshot of a software interface showing log source information. The text is displayed on a dark background with a light border. The first line reads "Lap source: ADU" and the second line lists two log files: "20220224\_1339\_05.adulog, 20220224\_1430\_11.adulog".

Lap source: ADU  
20220224\_1339\_05.adulog, 20220224\_1430\_11.adulog

When default-saving a project, the program remembers the path to the logs opened in the project. If you change the location in which these files are stored, the project will not find access to the logs.

## Working with logs - Log Manager

**Log Manager** is used to manage laps and loaded logs.

- It allows you to quickly view each lap.
- It indicates the path to the saved log (*Outing*)
- It allows you to select two laps for analysis, either by selecting the circle next to the lap name (red - base lap, white - compare lap) or from the lap pop-up menu (*Set base lap Ctrl+B, Set compare lap Ctrl+C*). To remove a lap from a comparison, click on the respective selection (when deleting the red base selection, the white lap being compared becomes the base selection and turns red).
- It indicates the lap name (*ID*).
- It indicates the lap number (*No*) (which is a continuation in the case of several logs).
- It indicates the lap time (*Time*) (best time is highlighted in green).
- It indicates the difference in time relative to the best lap (*Delta*) (if the difference is greater than 3% compared to the best time, it is marked in yellow).
- It allows you to exclude selected laps from the analysis by selecting the 'eye' icon or from the lap pop-up menu (*Exclude lap Ctrl+E*).

Outing	ID	No	Time	Delta	Eye Icon
Poznan Circuit 02_24 / 20220224_1339_05					
OUT	-	-	3:58.96	-	Eye
A1	1	1:58.780	6.155	Eye	
A2	2	1:53.413	0.788	Eye	
A3	3	1:52.904	0.279	Eye	
A4	4	1:54.623	1.998	Eye	
A5	5	1:53.263	0.638	Eye	
A6	6	1:52.625	0.000	Eye	
A7	7	1:52.798	0.173	Eye	
A8	8	1:52.890	0.265	Eye	
IN	-	9:38.12	-	Eye	
Poznan Circuit 02_24 / 20220224_1430_11					
OUT	-	-	6:33.44	-	Eye
B1	9	1:52.700	0.788	Eye	
B2	10	1:51.912	0.000	Eye	
B3	11	1:52.972	1.060	Eye	
B4	12	1:52.884	0.972	Eye	
B5	13	1:52.544	0.632	Eye	
B6	14	1:52.352	0.440	Eye	
B7	15	1:52.195	0.283	Eye	
B8	16	1:51.936	0.024	Eye	
B9	17	1:53.112	-	Eye	
B10	18	1:52.785	0.873	Eye	
B11	19	1:52.410	0.498	Eye	
IN	-	2:38.24	-	Eye	

Additionally, the following options are available from the log pop-up menu (right click on the bar with the name of the log):

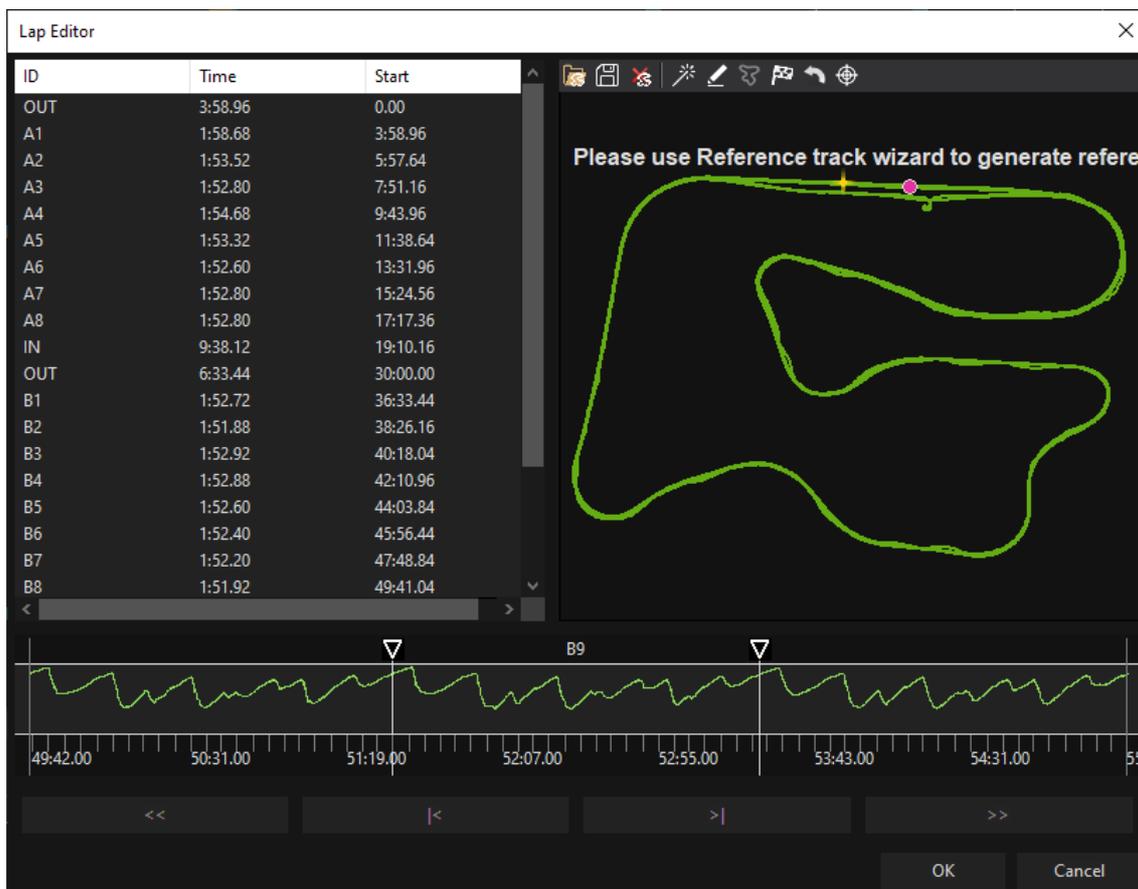
Parameter	Description
<b>Move file up</b>	Change the order of the log on the list (when more files are opened) by moving it one up ( <b>Ctrl+Up</b> )
<b>Move file down</b>	Change the order of the log on the list by moving it one down ( <b>Ctrl+Down</b> )
<b>Include log</b>	Include the entire log for analysis ( <b>Ctrl+Shift+I</b> )
<b>Exclude log</b>	Exclude the entire log from analysis ( <b>Ctrl+Shift+E</b> )
<b>Delete file</b>	Delete the selected log from the list ( <b>Ctrl+D</b> )

## Lap Editor

**Lap Editor** is used to edit the log split and handle the reference track. The *Lap Editor* window is opened using the **F5** key, from the main menu *Tools/Lap Editor* or from the panel *GPS/Track Map* using the *Lap Editor* icon.

The *Lap Editor* window is divided into three areas:

- Lap list
- GPS map
- A graph showing speed relative to time using the <<, |<, >|, >> keys



**The lap list** can be edited when there is no reference track generated. This edit shall be used to correct a wrongly split log. By right-clicking on the selected lap, a pop-up menu appears with the option to remove the selected lap (*Remove lap*) or split it into two with equal times (*Split lap*). When a lap is removed, it will be merged with the lap above. To correct the lap split, use the area displaying the **speed graph** of the split lap relative to time. It features two markers indicating the start and end point.

When a marker is active (selected) it can be moved:

- using the << / >> keys - one second back/forward
- using the |< / >| keys - two hundredths of a second back/ forward
- manually, with the mouse

The **GPS map** allows you to handle a reference track. It displays a track map and its length.

The taskbar icons allow you to:

- **Open reference track** - loading a reference track
- **Save reference track** – saving a reference track
- **Clear reference track** - removing a reference track
- **Create reference track** - generating a reference track divided into sectors and segments
- **Edit reference track** - editing reference track segments/sectors
- **Hide reference track** - hiding a track on the GPS map
- **Start point editor** - editing the start/finish point
- **Undo start edition** - undoing one change of position of the start/ finish point
- **Center on track** - displaying the track map over the entire available area

When loading the log, reference track is generated automatically. If you need to generate it from scratch (e.g. after clearing a reference track) press the wand icon (**Create reference track**).

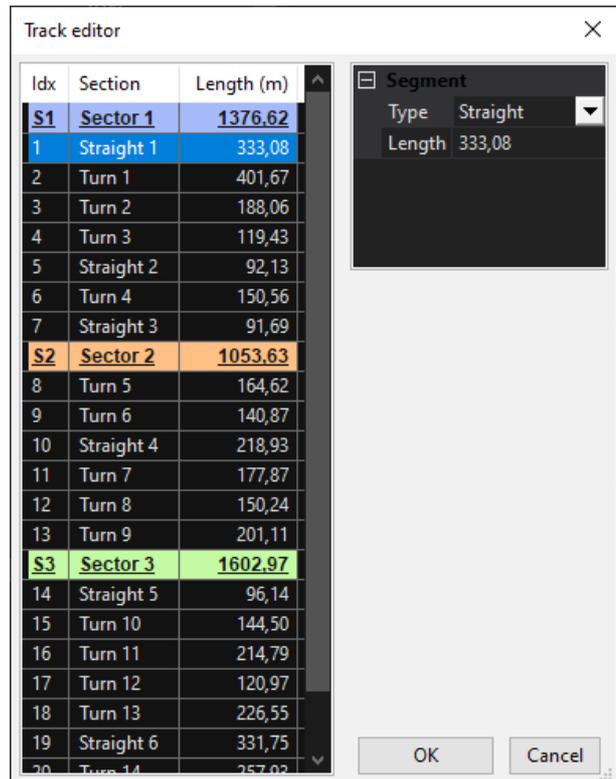
The following window should appear **Reference track wizard**.

Parameter	Description
<b>Reference lap</b>	Selecting a lap to create a reference track. (Depending on your lap selection, the track line drawn may vary). The lap with the best lap time is selected by default.
<b>Lateral G for corners</b>	A parameter defining over the lateral g-force above which a track section is treated as a turn. The default setting is 0.3 G.
<b>Min straight length</b>	A parameter defining the minimum driving distance with an g-force less than <i>Lateral G for corners</i> to be considered a straight segment. The default setting is 80 m.

After pressing OK, a reference track divided into segments (left turn, right turn, straight line) and their constituent sectors will be generated. By default the track is divided into three sectors. The start/finish line is displayed as a chequered flag, with an arrow indicating the direction of travel on the track. This line is also a fixed boundary of the first sector, i.e. it cannot be removed. Other sector boundaries can be created at any given point.

To edit segments and their constituent track sectors, select the pencil icon in the toolbar (**Edit reference track**). The **Track editor** window will appear.

You can use it to delete or split segments and sectors, as well as change the type and length of segments (in the window on the right where the type and length of the selected segment is displayed). When a segment or sector is selected, it is automatically highlighted on the preview screen. To edit the division of the reference track, click on the corresponding segment with the right mouse button. A context menu will appear with the following options:



Option	Description
<b>Remove segment</b>	Deletes the selected segment by attaching it to the segment immediately following it
<b>Split segment</b>	Divides the marked segment in the middle of its length
<b>Split sector</b>	Adds a sector border at the end of the selected segment
<b>Remove sector</b>	Deletes the sector in which the selected segment is located by attaching it to the following sector. The exception is the last sector (whose end is the start/finish line), deleting the last sector makes it join the preceding sector.
<b>Move current sector end</b>	Moves the end border of the sector in which the selected segment is located to the end of the selected segment. If the end of the selected sector is the start/finish line, an additional sector border will be added at the end of the selected segment (additional sector will be created)
<b>Move current sector start</b>	Moves the initial boundary of the sector in which the selected segment is located to the beginning of the selected segment. If the beginning of the selected sector is the start/finish line, an additional sector border will be added at the beginning of the selected segment (additional sector will be created)

The segments into which a track is divided are colour-coded (white, orange and blue), depending on the type of segment (straight, left turn, right turn). To facilitate the reading of the data, the same colours for the corresponding segments have been used in the table in the **Table Report** panel. The purple point on the track determines the position of the vehicle.

You can edit the position of the start/finish line. The chequered flag icon (**Start point editor**) is used for this purpose. After pressing the icon reference track is hidden and a green-white marker appears on the track line along with a yellow point indicating the current position of the track beginning. The green and white marker can be used to change the position of the start/finish point by moving it anywhere on the track with the mouse. If necessary, it is possible to undo one change of position of the start/finish point using the rounded arrow icon (**Undo start edition**).

In the rally-dedicated **Rally** project there are two markers: green for the starting point and red for the finish line. In this case, the log split and reference track is generated based on these points.

The resulting track can be recorded to disk using the floppy disk icon (**Save reference track**).

After finishing the editing in the *Lap Editor* window, press the *OK* button. The *Cancel* button rejects all changes made.

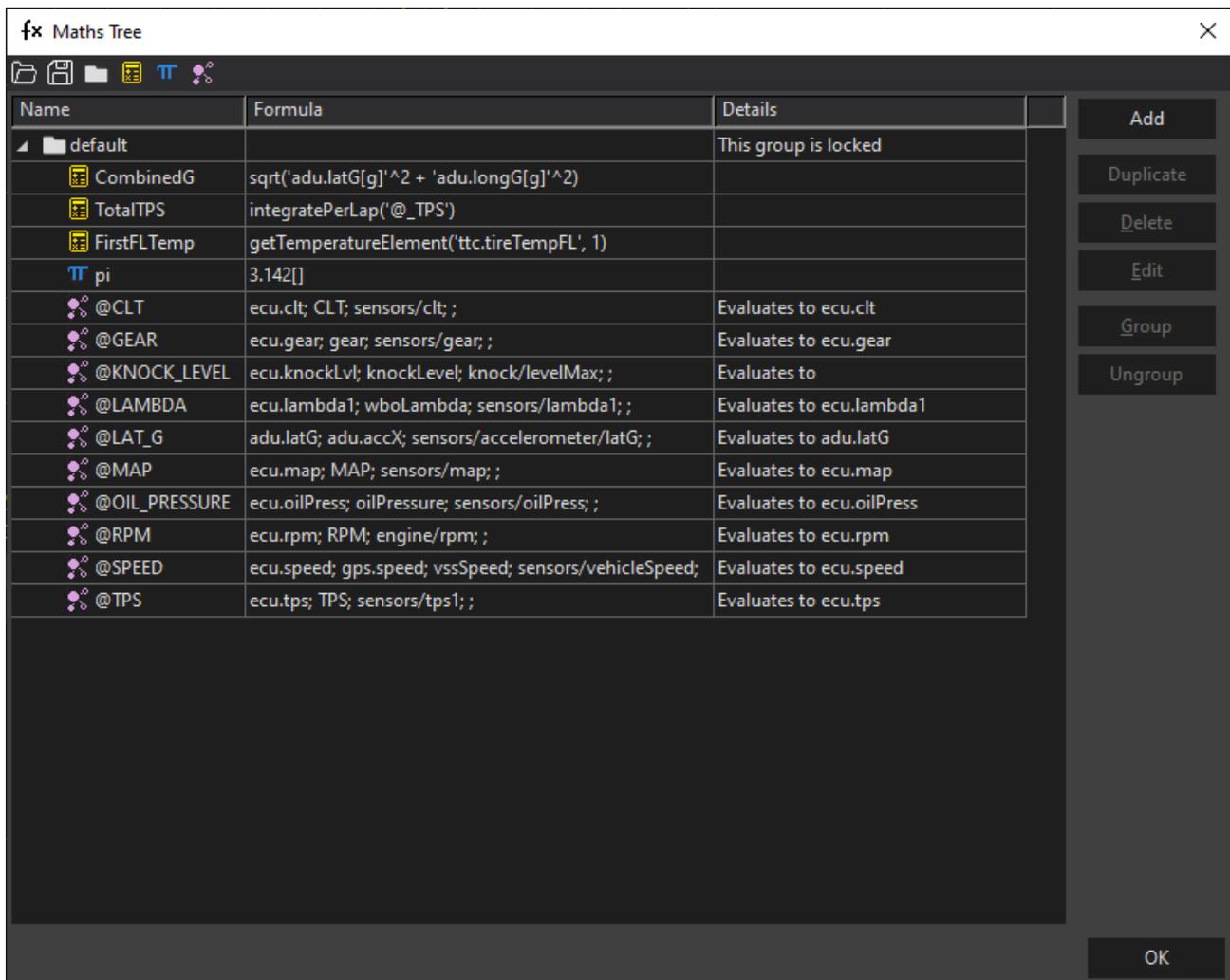
After closing a project the currently used reference track is saved automatically. It will load reference track next time you open this project.

## Maths Tree

**Maths Tree** allows you to create and organise maths channels, constants and aliases.

- It allows you to perform mathematical operations on recorded data.
- It allows you to define your own constants, such as car dimensions, coefficient of friction, etc., to be used in calculations.
- It allows you to add an alias, which is a special channel type that selects the first available channel from a defined list.
- It gives you the possibility to group channels, constants and aliases.

The **Maths Tree** is opened via the keyboard shortcut **F7** or *Tools/ Maths Tree*. It provides an overview of mathematical channels, constants and aliases. You can add, duplicate, group, edit or delete them. It is also possible to import or export a mathematical file.



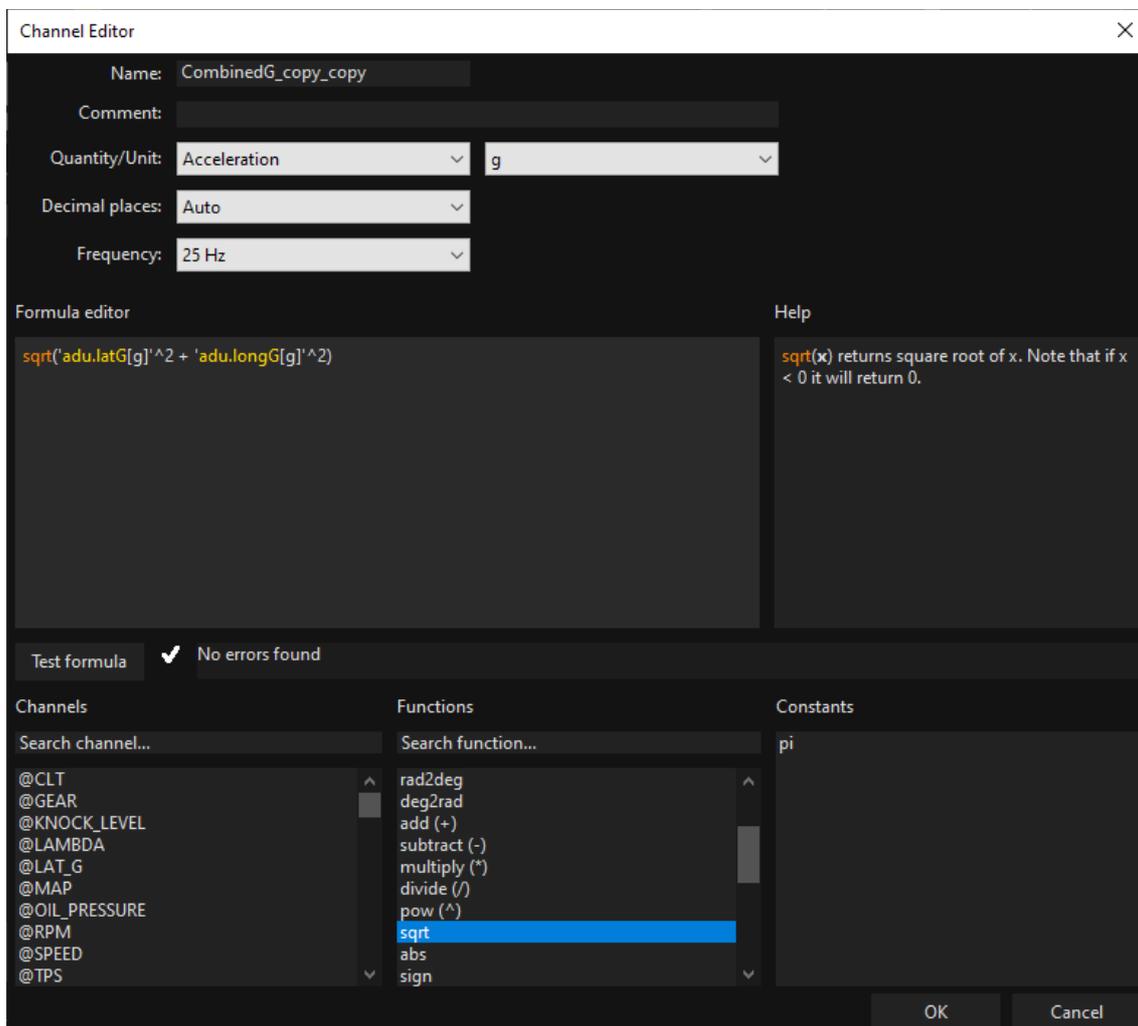
The screenshot shows the 'Maths Tree' dialog box with a table of mathematical channels and constants. The table has three columns: Name, Formula, and Details. The 'default' group is locked. The table lists various channels like CombinedG, TotalTPS, FirstFLTemp, pi, and several @ aliases (e.g., @CLT, @GEAR, @KNOCK\_LEVEL, @LAMBDA, @LAT\_G, @MAP, @OIL\_PRESSURE, @RPM, @SPEED, @TPS) with their respective formulas and evaluation details. On the right side, there are buttons for Add, Duplicate, Delete, Edit, Group, and Ungroup. An OK button is at the bottom right.

Name	Formula	Details
default		This group is locked
CombinedG	$\sqrt{\text{adu.latG}[g]^2 + \text{adu.longG}[g]^2}$	
TotalTPS	$\text{integratePerLap}('@\_TPS')$	
FirstFLTemp	$\text{getTemperatureElement}('ttc.tireTempFL', 1)$	
pi	3.142[]	
@CLT	$\text{ecu.clt}; \text{CLT}; \text{sensors/clt};$	Evaluates to ecu.clt
@GEAR	$\text{ecu.gear}; \text{gear}; \text{sensors/gear};$	Evaluates to ecu.gear
@KNOCK_LEVEL	$\text{ecu.knockLvl}; \text{knockLevel}; \text{knock/levelMax};$	Evaluates to
@LAMBDA	$\text{ecu.lambda1}; \text{wboLambda}; \text{sensors/lambda1};$	Evaluates to ecu.lambda1
@LAT_G	$\text{adu.latG}; \text{adu.accX}; \text{sensors/accelerometer/latG};$	Evaluates to adu.latG
@MAP	$\text{ecu.map}; \text{MAP}; \text{sensors/map};$	Evaluates to ecu.map
@OIL_PRESSURE	$\text{ecu.oilPress}; \text{oilPressure}; \text{sensors/oilPress};$	Evaluates to ecu.oilPress
@RPM	$\text{ecu.rpm}; \text{RPM}; \text{engine/rpm};$	Evaluates to ecu.rpm
@SPEED	$\text{ecu.speed}; \text{gps.speed}; \text{vssSpeed}; \text{sensors/vehicleSpeed};$	Evaluates to ecu.speed
@TPS	$\text{ecu.tps}; \text{TPS}; \text{sensors/tps1};$	Evaluates to ecu.tps

## Mathematical channels

A software function that allows a new channel to be created by applying mathematical operations to the recorded data. When you create a new channel, you must give it an appropriate name (*Name*) and for easier understanding of the channel, you can write a comment (*Comment*). A physical quantity is also defined (*Quantity*), unit (*Unit*), the number of decimal places of the measured value (*Decimal places*) and the frequency at which the channel will be calculated (*Frequency*).

In addition to simple numerical operators (+, -, \*, /, ^) and logical operations (and, or, negation), functions such as the derivative, integration, moving average, trigonometric functions and many others are available.



All operations can be written manually or selected from the menu. The syntax is straightforward and a check tool guides the user through the process of creating a mathematical channel. The *Test formula* button is used to check the correctness of the formula and indicates errors.

## Elements of syntax

Element	Description
' ' apostrophes	Any channel used in the calculation must be preceded and followed by an apostrophe ' <i>channel</i> '. The channels in the syntax are highlighted in yellow.
[ ] square brackets	If you need to use a unit other than the default channel unit, type it in square brackets next to the channel used in the syntax ' <i>channel</i> [ <i>unit</i> ]
( ) round brackets	The arguments of the function must be written in round brackets. Functions in the syntax are coloured orange. <i>function</i> ( <i>argument</i> )
, comma	Function arguments in brackets must be separated by a comma <i>function</i> ( <i>argument</i> , <i>argument</i> , <i>argument</i> )

In addition to the **channels** and **functions** described above, the syntax may also include **constants** marked blue. The following can be used for calculations: logged channels, predefined mathematical channels, aliases and constants. Defining units other than the default units for a channel is necessary to get the correct unit in the result. The unit set in place of *Unit* is only used to display information e.g. on the log.

## Functions available for calculation

Position	Description
<i>sin</i>	<i>sin</i> (angle[°])
<i>cos</i>	<i>cos</i> (angle[°])
<i>tan</i>	<i>tan</i> (angle[°])
<i>arcsin</i>	<i>arcsin</i> (x) inverse sine function, returns the angle in degrees.
<i>arccos</i>	<i>arccos</i> (x) inverse cosine function, returns the angle in degrees.
<i>arctan</i>	<i>arctan</i> (x) inverse tangent function, returns the angle in degrees. Note: may not identify the correct quadrant.
<i>rad2deg</i>	<i>rad2deg</i> (angle[rad]) converts the angle in radians to degrees.
<i>deg2rad</i>	<i>deg2rad</i> (angle[°]) converts the angle in degrees to radians.
<i>add (+)</i>	<i>add</i> (x,y) = x+y
<i>subtract (-)</i>	<i>subtract</i> (x,y) = x-y
<i>multiply (*)</i>	<i>multiply</i> (x,y) = x*y
<i>divide (/)</i>	<i>divide</i> (x,y) = x/y Note: in case y = 0 it will return 0.
<i>pow (^)</i>	<i>pow</i> (x,y) = x^y
<i>sqrt</i>	<i>sqrt</i> (x,y) returns the square root of x. Note: if x < 0 it will return 0.
<i>abs</i>	<i>abs</i> (x) returns the absolute value of x.
<i>sign</i>	<i>sign</i> (x) returns the sign of x.
<i>and</i>	<i>and</i> (x,y) returns true if both x and y are true. Otherwise false.
<i>or</i>	<i>or</i> (x,y) returns true if at least one value of x or y is true. Otherwise false
<i>not</i>	<i>not</i> (x) logical negation of x

<b>getTemperatureElement</b>	<b>GetTemperatureElement</b> (brake disc or tyre temperature channel, index <1-16>)
<b>derivative</b>	<b>derivative</b> (x) returns the derivative of x in respect to time.
<b>integratePerLap</b>	<b>integratePerLap</b> (x) integration in the time domain. The rectangular method is used. After each lap, the value of the integral will be reset. Note that a higher frequency yields more accurate results.
<b>integratePerFile</b>	<b>integratePerFile</b> (x) integration in the time domain. The rectangular method is used. After each file (log) the value of the integral will be reset. Note that a higher frequency yields more accurate results.
<b>integratePerTotal</b>	<b>integratePerTotal</b> (x) integration in the time domain. The rectangular method is used. The value will not be reset. Note that a higher frequency yields more accurate results.
<b>choose</b>	<b>choose</b> (condition, value if true, value if false) if a condition obtains any positive value, the value if true is returned. Example: <b>choose</b> ('ecu.speed[km/h]' > 30, 1, 0) takes the value 1 if the vehicle speed exceeds 30 km/h at a given time.
<b>smooth</b>	<b>smooth</b> (value, number of samples) returns the value averaged from the given number of samples.
<b>gate</b>	<b>gate</b> (value, minimum value, maximum value) ensures that the value does not exceed the minimum and maximum values.

## Channel aliases

DATA MASTER has been designed to be highly versatile. When the user creates a visualisation or maths channel, in some situations the channels used may not be available. DATA MASTER allows to avoid this problem by using aliases.

For example, the user wants to display the speed of the vehicle on a graph. They decide on "ecu.speed". If for some reason the channel is not available in the other log being analysed, the user would have to change the displayed channel to "gps.speed," for example. This requires a manual change of the channel or desktop depending on the log.

By using the alias "@SPEED" which has the channels "ecu.speed" and "gps.speed" assigned, if it possible, the former will be used. However, if "ecu.speed" is not available, "gps.speed" will be selected automatically.

Users can use aliases not only in graphs but also in mathematical channels.

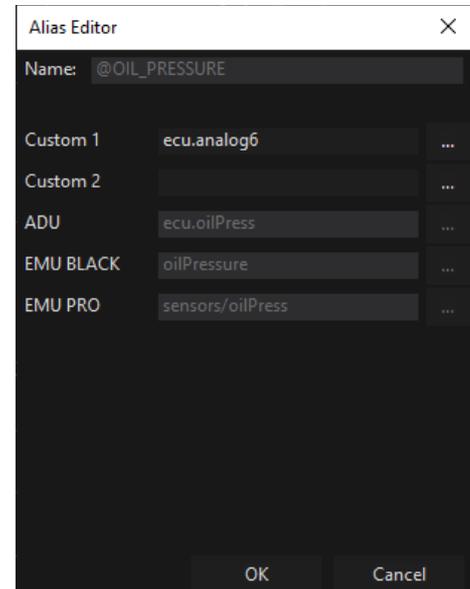
Up to five channels can be assigned to each alias. The alias uses the currently available channel with the highest priority (the first available in the list). You can assign channels to **Custom 1** and **Custom 2** from any source (i.e. channels from any ECUMASTER device, math channels, and more). The next three items: **ADU**, **EMU BLACK**, **EMU PRO** can be edited depending on

the device from which the uploaded log comes from. Only channels registered from ADU can be connected to *ADU*, channels from EMU BLACK, EMU CLASSIC or EDL can be connected to *EMU BLACK*, and channels from EMU PRO to *EMU PRO*.

In addition to creating and editing new aliases, you can also edit the default aliases.

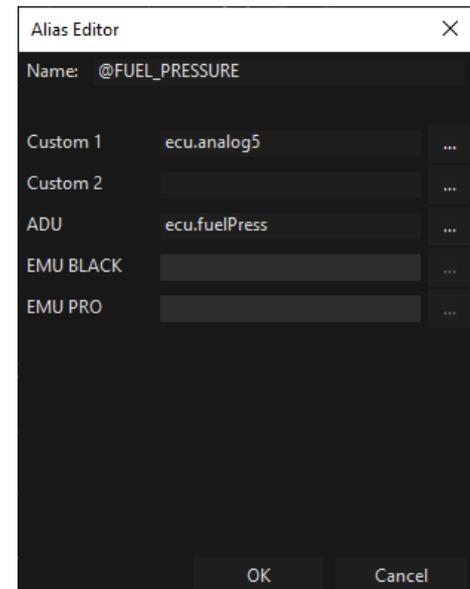
### Example of editing the default alias @OIL\_PRESSURE

By default, the oil pressure is logged in the ADU device to the channel named *ecu.oilPress*, in EMU BLACK *oilPressure*, and in EMU PRO *sensors / oilPress*. If the user uses an external oil sensor connected to the selected analog input on the device, then they can assign it to the default @OIL\_PRESSURE alias in the Custom 1 item. This channel will have the highest priority. If another log is uploaded to this project (in which the external sensor was not used), the remaining channels will be checked. If any of the default assigned channels contain data, it will be used.



### Example of creating new alias

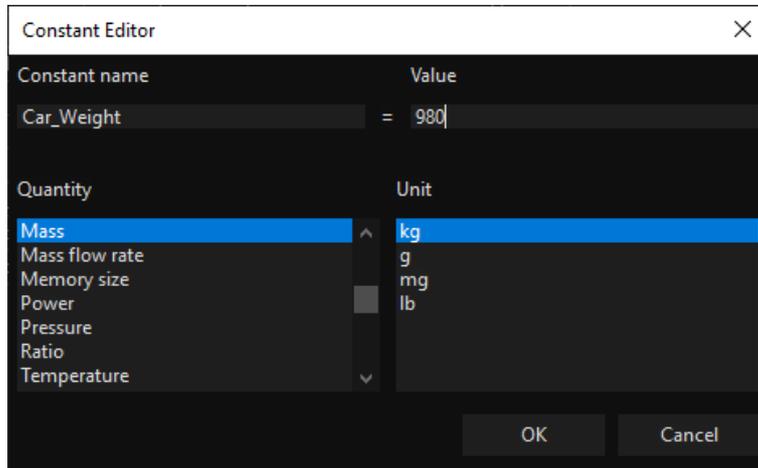
Start by naming the alias you are creating, @FUEL\_PRESSURE in this example. The currently uploaded log comes from the ADU, which also used an external fuel pressure sensor connected to the input No. 5. In ADU position, connect the ADU *ecu.fuelPress* channel, and in Custom 1, the external sensor *ecu.analog5* channel. When creating this alias, if you want to add a channel in the EMU BLAK position, you must upload the logs from the EMU BLACK device (or CLASSIC, EDL).



## Constants

To improve clarity and versatility, users can define their own constants, such as car dimensions, friction coefficient, etc., to be used in calculations.

When defining a constant, you should give it a name and specify the physical quantity and unit.



## Panels

Panels present data in the form of various visualisations such as tables, charts or maps.

To facilitate simultaneous data analysis across multiple visualisations, most panels feature a moving marker as a common indicator for each visualisation. This means that if a particular point (on the time/distance axis) is marked with the cursor in one window, the marker will move to the same place in other visualisations.

In the lap comparison mode there are two cursors: red for the base lap and white for the lap to be compared.

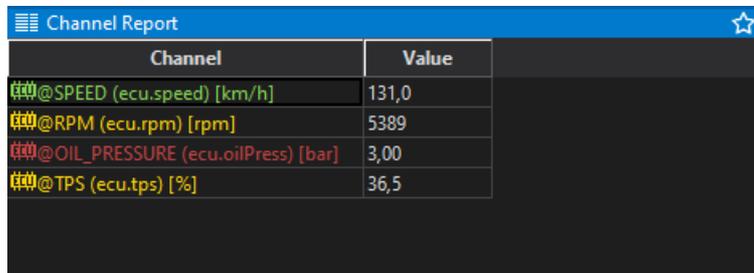
Each panel has a taskbar with dedicated icons. Same options are also available in the context menu displayed by right-clicking in the panel field.

Right-clicking on the panel bar opens a menu with the following options:

Option	Key shortcut	Description
<b>Add panel above</b>	<b>Tab+Shift+Up</b>	Adding a panel above
<b>Add panel below</b>	<b>Tab+Shift+Down</b>	Adding a panel below
<b>Add panel on left</b>	<b>Tab+Shift+Left</b>	Adding a panel on the left
<b>Add panel on right</b>	<b>Tab+Shift+Right</b>	Adding a panel on the right
<b>Duplicate panels</b>	<b>Tab+Shift+D</b>	Duplicating a panel. This option adds a new panel on the right side with the copied settings of the selected
<b>Replace panel</b>	<b>Shift+F9</b>	Replacing a panel
<b>Close panel</b>	<b>Ctrl+F4</b>	Closing a panel

## Channel Report

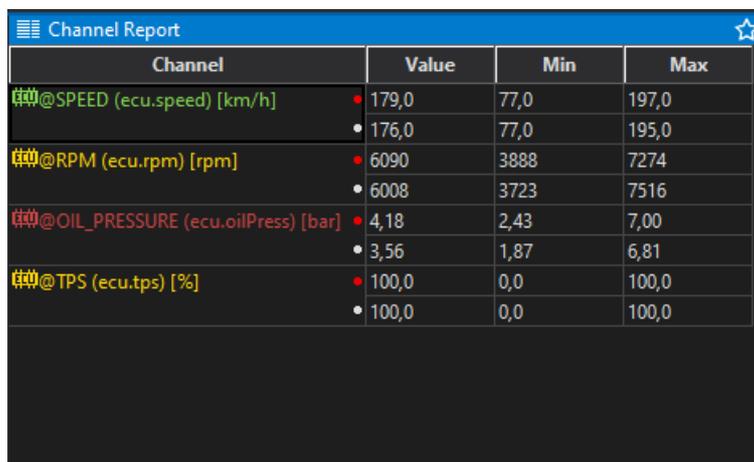
The **Channel Report** panel presents the values of the selected channels as a table. Those values are corresponding to a specific point (on the distance / time axis) indicated by the cursor in other panels (e.g. in the Graph Log panel).



Channel	Value
🏎️@SPEED (ecu.speed) [km/h]	131,0
🏎️@RPM (ecu.rpm) [rpm]	5389
🏎️@OIL_PRESSURE (ecu.oilPress) [bar]	3,00
🏎️@TPS (ecu.tps) [%]	36,5

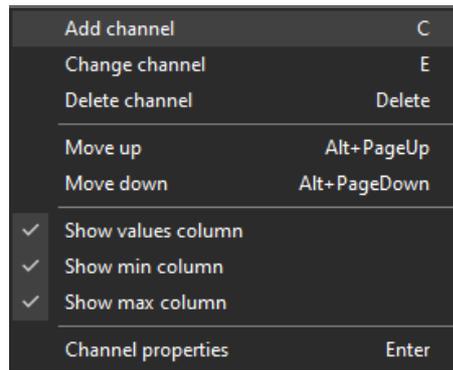
You can also display the minimum and maximum value within:

- all uploaded logs
- the selected area on the Graph Log
- laps indicated in the comparison mode - separately for each of the compared laps (the red dot is the base lap, the white dot - the compared lap).



Channel	Value	Min	Max
🏎️@SPEED (ecu.speed) [km/h]	• 179,0	77,0	197,0
	• 176,0	77,0	195,0
🏎️@RPM (ecu.rpm) [rpm]	• 6090	3888	7274
	• 6008	3723	7516
🏎️@OIL_PRESSURE (ecu.oilPress) [bar]	• 4,18	2,43	7,00
	• 3,56	1,87	6,81
🏎️@TPS (ecu.tps) [%]	• 100,0	0,0	100,0
	• 100,0	0,0	100,0

Pressing the right mouse button in the panel area displays the context menu:

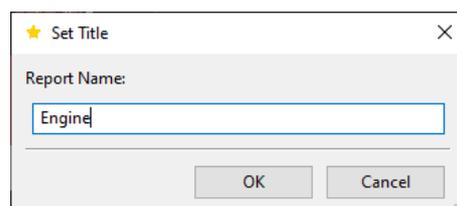


Option	Key shortcut	Description
<b>Add channel</b>	<b>C</b>	Adding a channel / channels to the table
<b>Change channel</b>	<b>E</b>	Replacing the selected channel
<b>Delete channel</b>	<b>Delete</b>	Deleting the selected channel / channels from the table
<b>Move up</b>	<b>Alt + PageUp</b>	Moving the selected row up
<b>Move down</b>	<b>Alt + PageDown</b>	Moving the selected row down
<b>Show values column</b>		Display the column with a value pointed by a cursor for the selected channels. In the lap comparison mode, the cursor value is displayed separately for each compared lap.
<b>Show min column</b>		Display the column with the minimum value for selected channels within all uploaded logs, or within the selected range on the <i>Graph Log</i> . In the lap comparison mode, the range for searching the minimal value is a selected lap or the range selected on the <i>Graph Log</i>
<b>Show max column</b>		Display the column with the maximum value. It works as described above.
<b>Channel properties</b>	<b>Enter</b>	Shows properties window for the channel

The channel display settings are available by selecting the following option from the menu **Channel properties**.

Option	Description
<b>Log channel</b>	Name of the edited channel
<b>Graph colour</b>	Select the line display colour of the channel
<b>Autoscale</b>	This option causes the range of values to be calculated automatically based on the logged data
<b>Min value</b>	Selection of the value range for a given channel
<b>Max value</b>	
<b>Filter samples [0=off]</b>	Filtering of the waveform, i.e. how many samples the value at a given point is to be determined from. A value of 0 means no filtering.
<b>Enable alarm</b>	Checking the box will activate the alarm (displayed on the application toolbar) if the condition defined in the <b>Condition</b> and <b>Alarm value</b> fields is met at the cursor position
<b>Condition</b>	Condition specifying alarm activation for values: <b>Greater</b> - greater than <b>Alarm value</b> <b>Lower</b> - smaller than <b>Alarm value</b>
<b>Alarm value</b>	Alarm value

When adding a Channel Report panel to your favorites, by clicking the star icon in the upper right corner of the panel toolbar, the *Set Title* window will appear, where you can name your favorite panel.



## GPS/Track map

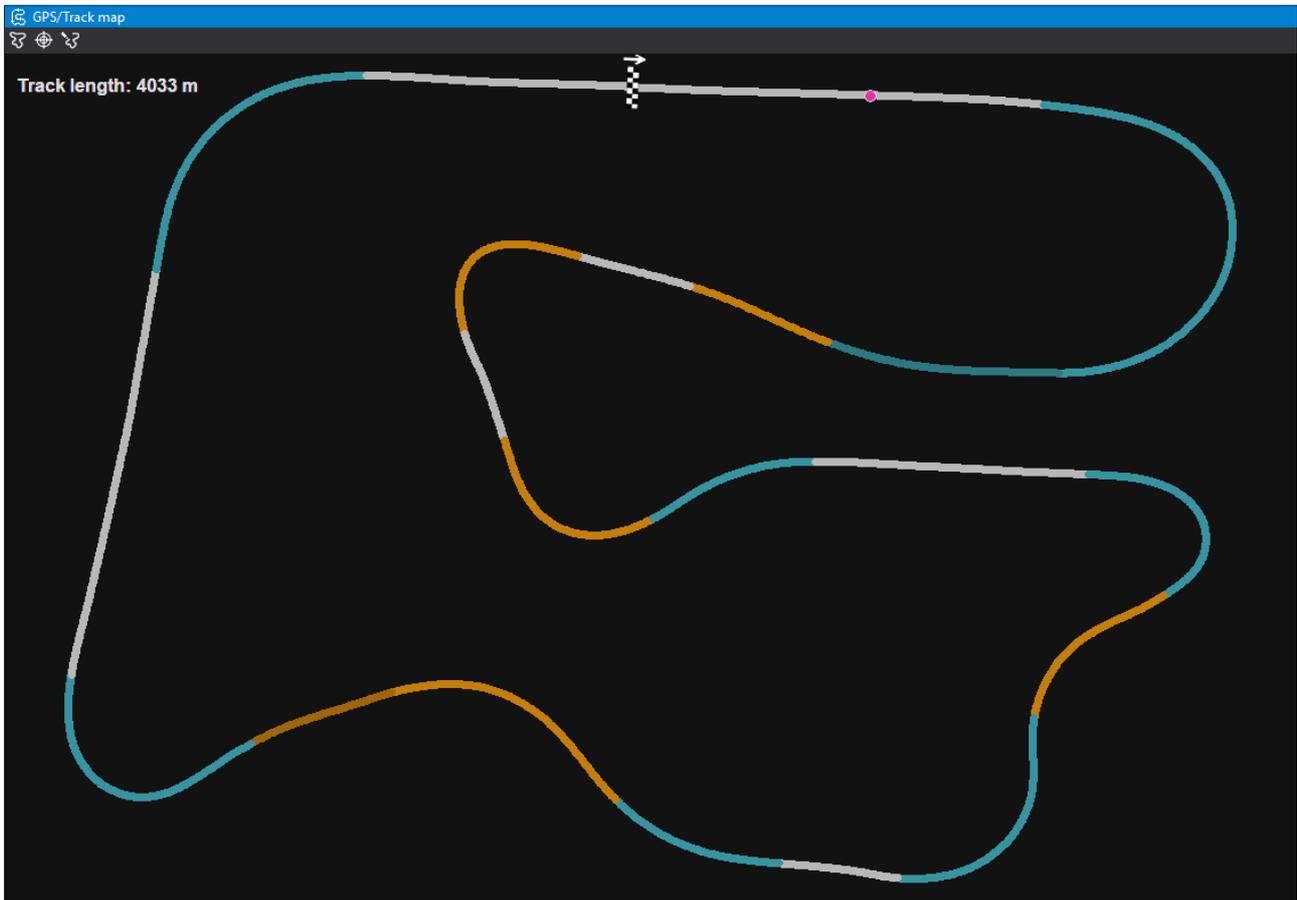
The **GPS/Track map** panel displays data from the GPS module.

When reference track has not been generated or is hidden, the track map shows all the raw GPS data (drawn with green lines).

In the lap comparison mode, two GPS tracks are plotted: red (for the base lap) and white (for the lap being compared), allowing you to see the difference in the trajectory between the two.

Once the reference track has been generated, the division of the track into sectors and segments is obtained. The segments into which a track is divided are colour-coded (white, orange and blue), depending on the type of segment (straight, left turn, right turn).

The purple point on the track, determines the position of the cursor. The start/finish point is marked with a yellow marker for raw GPS data, or with chequered flag, with an arrow pointing in the direction of the track when the reference track is generated.



On the panel's taskbar there are icons respectively indicating:

- *Hide reference track*
- *Center on track* - displaying the track map on the entire panel screen
- *Lap Editor* - lap editing described in the *Lap Editor* chapter

With Ctrl+ keys ↑/↓ or the mouse wheel you can zoom the image in or out (*zoom*). Use the arrows ↑/↓/→/← or the left mouse button to move the image on the screen.

## Graph Log

**Graph log** is the basic panel showing channel graphs as a function of time/road.

The panel toolbar contains icons allowing:

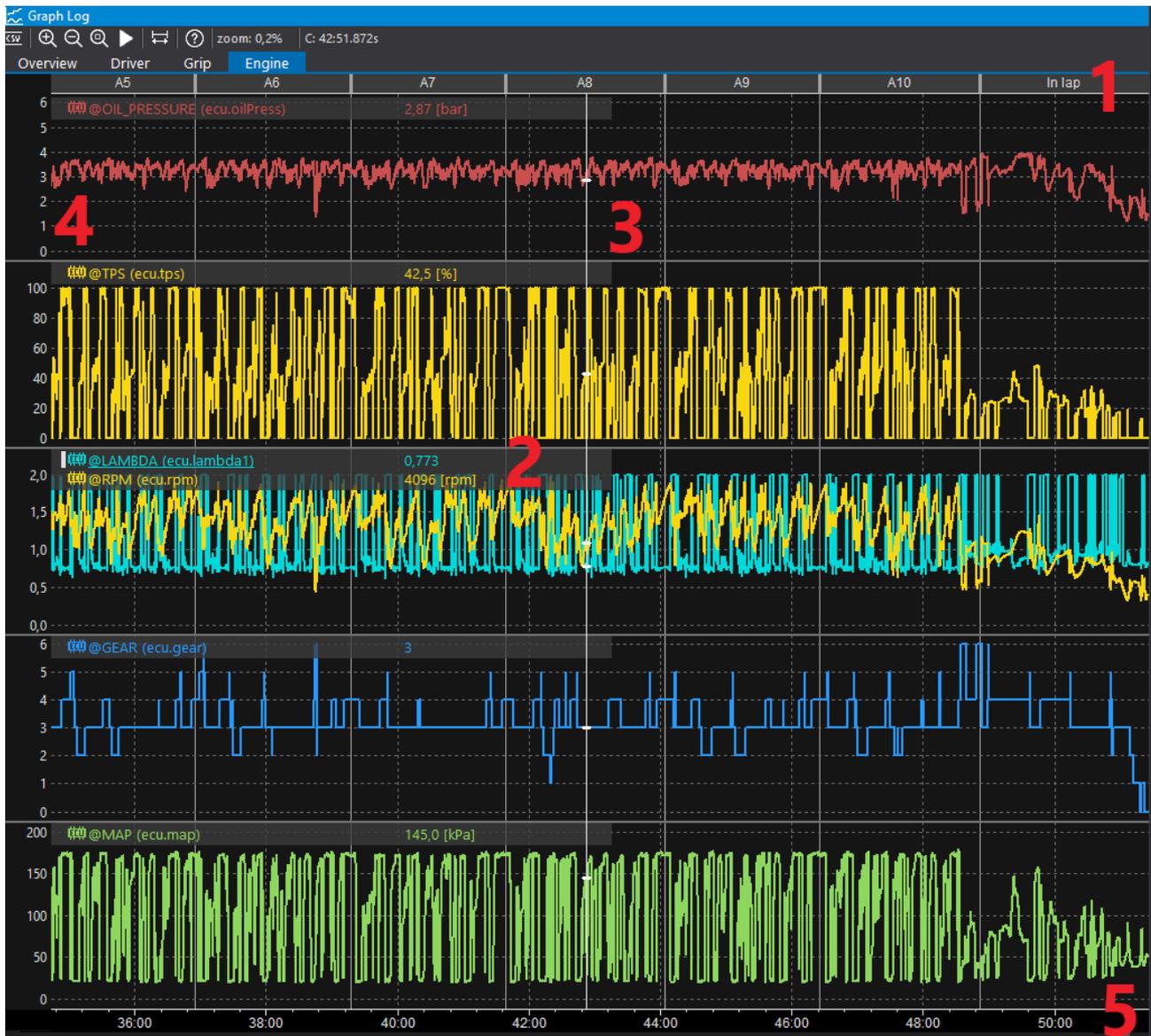


- **Export to CSV** - exporting to CSV file with the possibility of changing the settings:

<b>Export frequency</b>	<b>Same as channel</b>	Export frequency including actual logging frequency for individual channels
	<b>1Hz, 5Hz, 10Hz, 25Hz, 50Hz, 100Hz, 125Hz, 250Hz, 500Hz</b>	Selection of export frequency, the same for all exported channels
<b>Interpolate</b>		If the export frequency is higher than the logging frequency of the individual channels, the missing data will be completed by the previous value or by interpolation
<b>Separator Decimal/Column</b>	<b>system / ","</b>	The decimal separator is either a comma or a dot (depending on system settings), the column separator is a semicolon
	<b>"." / ","</b>	The decimal separator is a dot, the column separator is a comma
<b>Preview</b>		A window for previewing the resulting file
<b>Tables</b>		Presentation of data in table form
<b>Raw output</b>		Presentation of the contents of the resulting .csv file

- **Zoom in, Zoom out, Zoom extents** - change of scale.
- **Playback** – start/stop playback - after enabling playback, the cursor moves in real time.
- **Axis properties** - change of the X axis setting in lap comparison mode. It is possible to select the distance/time axis and the speed channel used to determine the lap distance.
- **zoom:** - the current zoom rate is displayed on the taskbar.
- **c:** - information about the current position of the cursor is displayed on the taskbar.

The **Graph Log** panel, just like the main application dashboard, has tabs that can be used to organise the displayed channels (e.g. engine, track, etc.). The handling of the tabs is no different to that of the main application desktop.



### Elements of the Graph Log panel

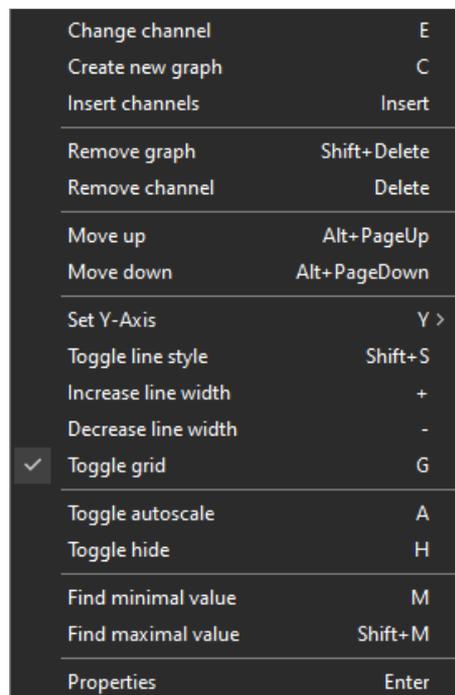
1. Lap axis - Clicking on the selected lap on the axis makes it fit the screen. In the Lap Comparison mode, the track segment axis is displayed instead of the lap axis when a reference track is generated. Clicking on the segment makes it fit the screen. You can zoom in on the part of the track by clicking on two segments when holding shift.
2. Channel panel - displays the channels presented on a given chart along with the values of these channels indicated by the cursor. The following is displayed in the lap comparison mode values for both laps. The active channel is indicated by a vertical white line next to the name. The active channel can be changed with the Page Up/Down keys or by left clicking on the channel name. It is also possible to select a channel by right-clicking on the chart.

3. Cursor
4. Value axis - if two or more channels are superimposed on one chart, the value axis has two modes of operation. The **Y** key is used to switch between these modes. In the *Overlaid* axis mode, each channel is drawn with its own value axis (the axis for the underlined channel is visible). This is useful where the channels showing different quantities are superimposed (as in the attached figure the engine revolutions and the lambda parameter value). In the *Common axis* mode, the maximum and minimum values of all channels within the chart are searched for. This setting should be used when overlaying channels showing the same quantities (e.g. longitudinal and transverse overloads).
5. Time/distance axis - if Graph Log is used in a *Dyno*-type project, two time axes are displayed when comparing *pulls*. The upper axis can be moved, causing the *pull* being compared to move.

### Navigation in the *Graph Log* panel

Clicking the left mouse button on the chart causes the cursor to move. Double-clicking with the left mouse button starts edition of the selection. The selection can be confirmed by clicking the left mouse button again, in which case the selected fragment will be zoomed in. If you hold down the Shift key when confirming a selection, the selected area remains selected without zooming in.

By pressing the right mouse button in the log area, the context menu is called up:

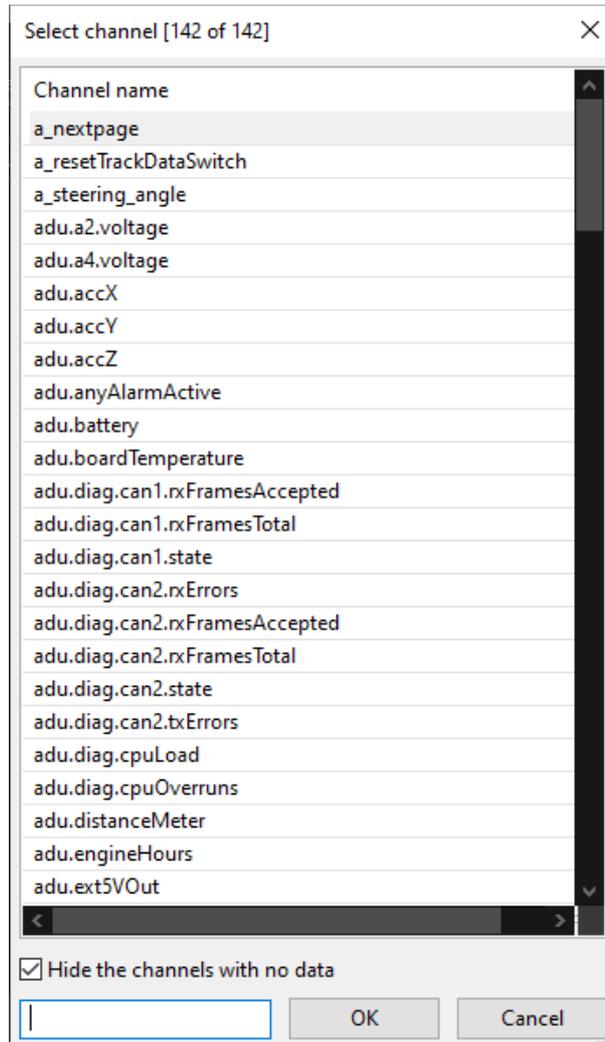


Option	Key shortcut	Description
<b>Change channel</b>	<b>E</b>	Replacing the selected channel
<b>Create new graph</b>	<b>C</b>	Adding a channel on a new graph
<b>Insert channels</b>	<b>Insert</b>	Adding a channel on the currently active graph
<b>Remove graph</b>	<b>Shift+Delete</b>	Deleting a graph
<b>Remove channel</b>	<b>Delete</b>	Removing a selected channel from the graph
<b>Move up</b>	<b>Alt + PageUp</b>	Moving a graph up
<b>Move down</b>	<b>Alt + PageDown</b>	Moving agraph down
<b>Set Y-Axis</b>	<b>Y</b>	Changing the axis mode for graphs with several channels: <b>Overlaid axis</b> <b>Common axis</b>
<b>Toggle line style</b>	<b>Shift + S</b>	Changing the display mode: line / dots / connected dots
<b>Increase line width</b>	<b>+</b>	Increase the thickness of lines/dots on the graph
<b>Decrease line width</b>	<b>-</b>	Reduce the thickness of the lines/dots on the graph
<b>Toggle grid</b>	<b>G</b>	Turns the grid on/off
<b>Toggle autoscale</b>	<b>A</b>	Enables/disables auto-scaling of the selected channel
<b>Toggle hide</b>	<b>H</b>	Hides the active channel without deleting it
<b>Find minimal value</b>	<b>M</b>	Moves the cursor to the minimum value of the selected channel
<b>Find maximal value</b>	<b>Shift+M</b>	Moves the cursor to the maximum value of the selected channel
<b>Properties</b>	<b>Enter</b>	Enables the display properties window for the channel (described in the <i>Channel Report</i> chapter - <i>Channel properties</i> )

Additional operations on the *Graph Log* panel are possible using the following keyboard shortcuts:

Option	Key shortcut	Description
Cursor movement	←/→	Moves the cursor forward/backward by one unit
Move the cursor by a bigger distance	<b>Ctrl + ←/→</b>	Moves the cursor forward/backward by ten units
Screen offset	<b>Shift + ←/→</b>	Moves the screen without changing the cursor position
Marking the area	<b>Ctrl + Shift + ←/→</b>	Marks the area between the start and end positions of the cursor
Zoom in/out	↑/↓	Zoom in/out view
Positioning the cursor at the beginning	<b>Home</b>	Moves to the start of the log/ lap in lap comparison mode
Positioning the cursor at the end	<b>End</b>	Moves to the end of the log/ lap in lap comparison mode
Changing the active channel	<b>PageUp</b> <b>/PageDown</b>	Changes the active channel to the channel above/below
X-axis domain change	<b>T</b>	Changes the X axis, in lap comparison mode, between the time and the distance axis

If you change or add a new channel to the chart, the channel selection window appears. For easier searching, the channel name can be entered in the lower field of the window, which will filter the available channels. For example, if you enter the word **gps**, only channels containing the word **gps** will be displayed. Using the Shift or Ctrl keys, it is possible to select multiple channels to be added to one chart. If the **Hide the channels with no data** box is selected, the list will display only channels with logged data.



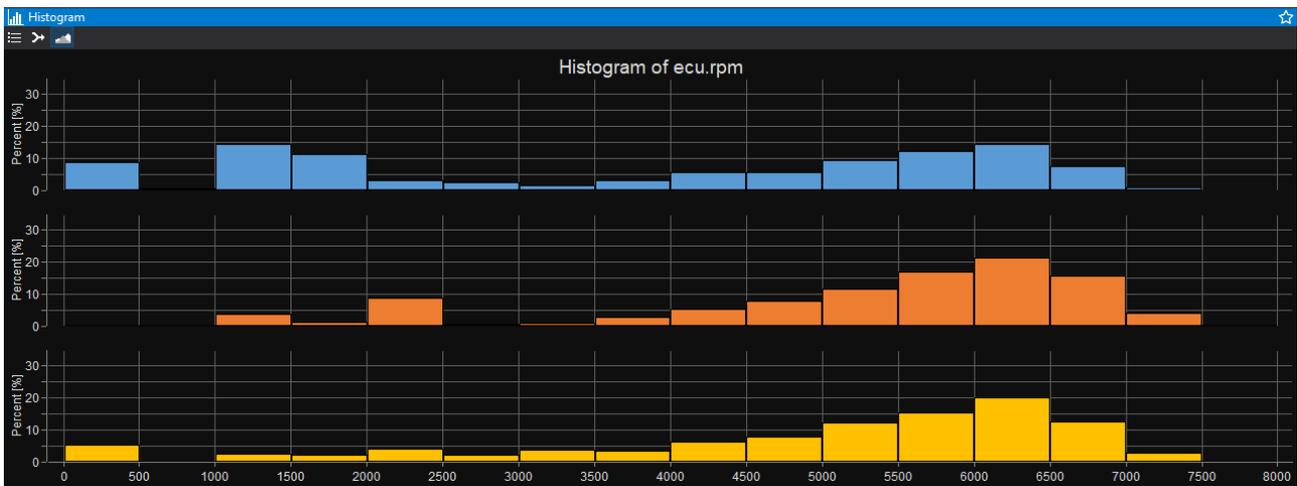
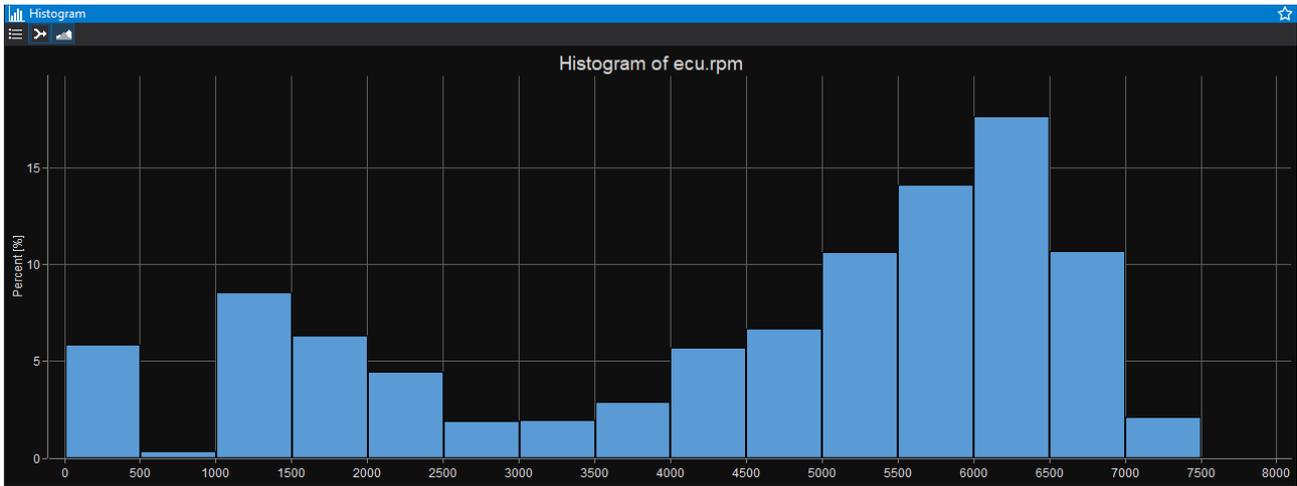
## Histogram

The **Histogram** visualisation is used to analyse the frequency of occurrence of the channel values.

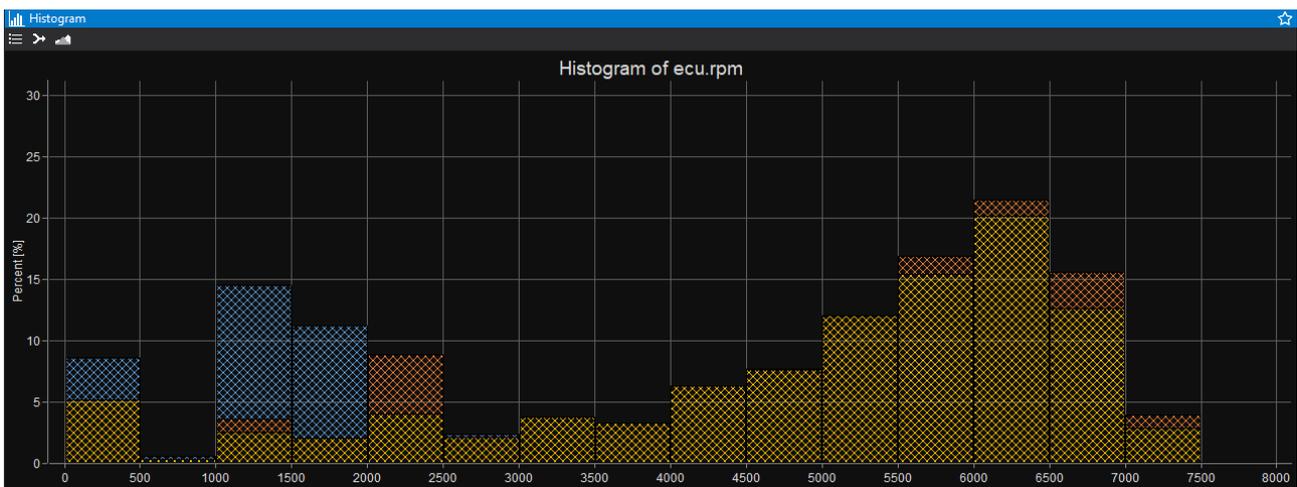
To configure the panel, click on the **Panel properties** icon on the **Histogram** panel's taskbar or press the right mouse button.

Option	Description
<b>Channel X</b>	The channel defining the X axis
<b>Filter channel</b>	The filter channel introduces an additional condition on a separate channel, the fulfilment of which determines whether (at a particular point in time) data from channel X will be collected for analysis or rejected
<b>Discard samples above</b>	Rejecting samples above the set value for the filter channel
<b>above value</b>	Upper limit value for the filter channel
<b>Discard samples below</b>	Rejecting samples below the set value for the filter channel
<b>below value</b>	Lower limit value for the filter channel
<b>Autoscale X axis and Y bins</b>	Automatic scaling of the X axis range and the number of bins
<b>Autoscale X axis</b>	Automatic scaling of the X axis range
<b>Min</b>	Initial value of the X axis
<b>Max</b>	Final value of the X axis
<b>Set bin width</b>	Setting the bin width
<b>Bin width</b>	Width of a bin
<b>Bin count</b>	Number of bins
<b>Exclude outliers</b>	Rejection of outliers (deviating from normal distribution)
<b>Y axis channel</b>	Y-axis unit defining the frequency of occurrence of the defined phenomenon <b>Percent</b> - percentage <b>Time</b> - time frame
<b>Centered bins</b>	Sets the description of the X axis values at the centre of the bins

In the panel **Histogram** panel you can analyse data from several logs at the same time. They can be analysed merged into one long log on one histogram (default setting), or separately on separate axes (one below the other). Use the arrow icon to switch between these views **Compare/Append Mode**.



In the split log mode we can plot the logs onto a single histogram, where each log will be marked with a different colour. The **Tiled/Overlay** icon is used for this purpose.



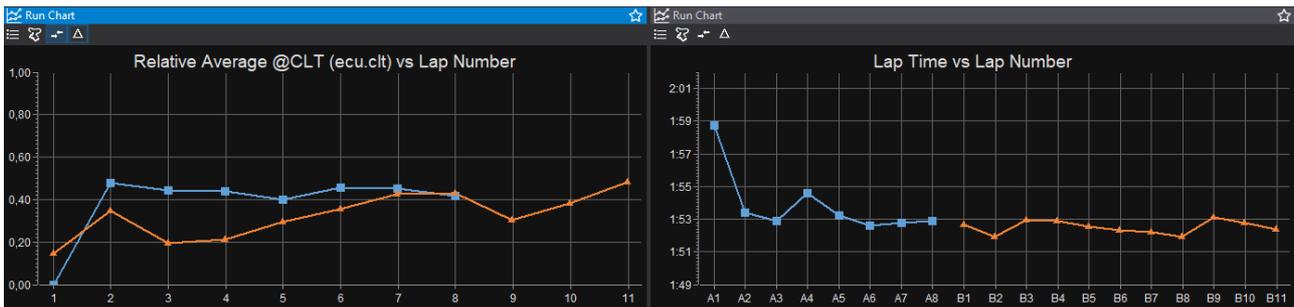
## Log Manager

The **Log Manager** panel is described in the chapter *Working with logs - Log Manager*.

## Run Chart

The **Run Chart** panel shows each lap as one point on the graph. The point value can be a lap time or a selected metric. Metrics allow the user to select the maximum/ minimum /average value of a given channel.

The **Run Chart** panel can also operate in sector mode. Each point on the graph shows the value for the selected sector (instead of the entire lap). The **Run Chart** panel operation mode can be changed to a sector by clicking **Focus on...** icon or by selecting the sector mode in the Table Report panel and choosing the selected sector.



On the graph: the X axis represents the lap numbers, the Y axis is defined by selecting the **Panel properties** icon.

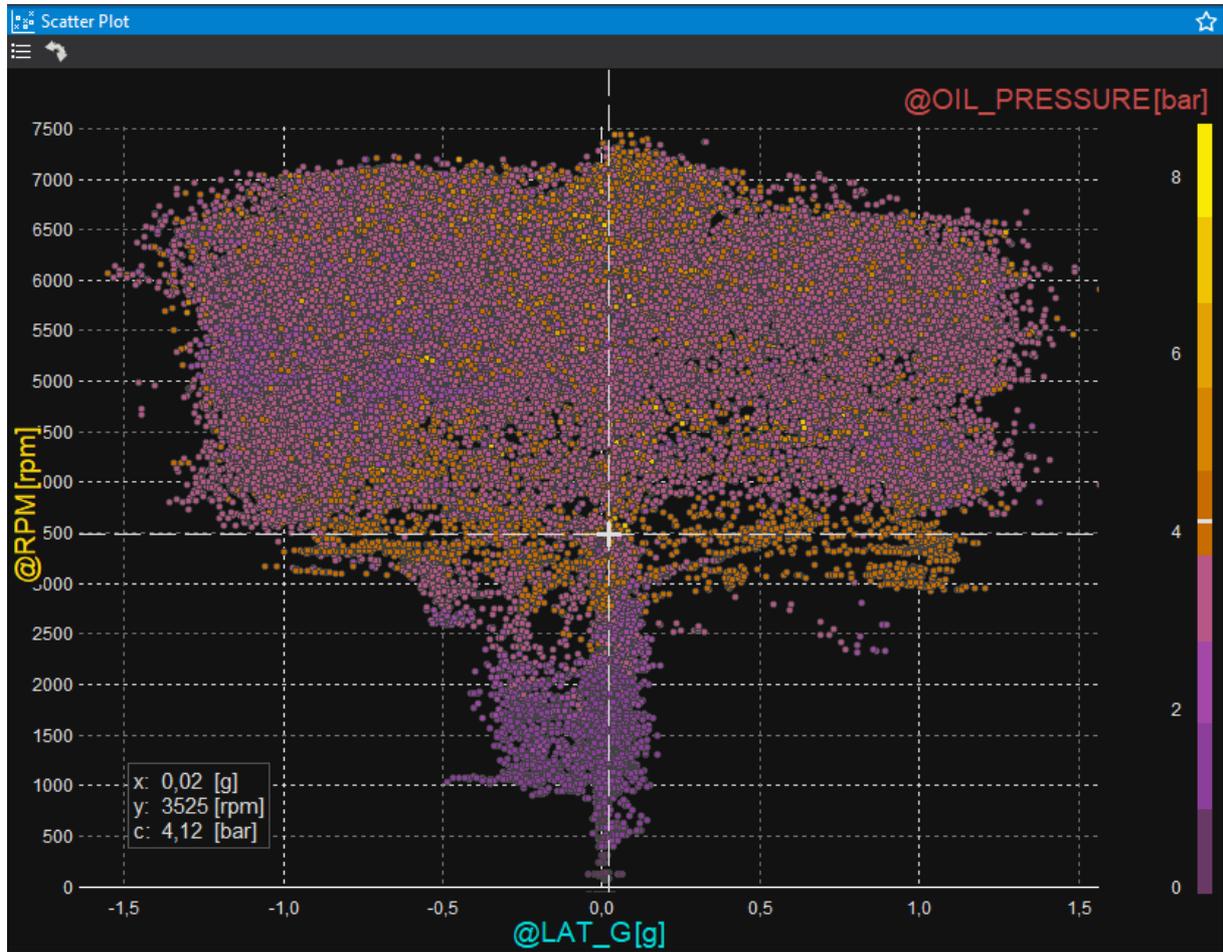
Option	Description
<b>Use lap time as y-axis</b>	When this field is activated, the y-axis is defined by the lap times
<b>Channel</b>	Channel defining the y-axis (in case the field <b>Use lap time as y-axis</b> is inactive)
<b>Summary parameter</b>	A type of metric that specifies values for a given lap: <b>Min</b> - minimum value <b>Max</b> - maximum value <b>Average</b>

When analysing several logs simultaneously, by default the graphs from both logs are plotted side by side, so that one is a continuation of the other. In this case, laps are described on the X axis by lap name (i.e. the letter denoting the log in question and the number of the lap in that log e.g. A1, A2, B1, B2, etc.). Using the arrow icon **Compare/Append Mode** you can overlay the logs on top of each other. Then the lap numbers are marked on the X axis. By clicking again on the **Compare/Append Mode** icon, you return to the previous view.

In addition, for clarity of the graph, the Y axis can be scaled using the icon with the delta symbol **Absolute/Relative Mode**. In the mode **Relative Mode**, the values on the Y axis are shown with reference to the lowest value.

## Scatter Plot

Another way of visualising data is **Scatter Plot** (with three axes: X, Y and colour axes).



To define axes, click the icon **Panel properties** icon.

Option	Description
<b>Channel X</b>	The channel defining the X axis
<b>Channel Y</b>	Channel defining the Y axis
<b>Color channel</b>	Channel defining the colour axis
<b>Discard colour samples above</b>	Rejecting samples above the set value for the <i>Color channel</i>
<b>above value</b>	upper limit value for the <i>Color channel</i>
<b>Discard colour samples below</b>	Rejecting samples below the set value for the <i>Color channel</i>
<b>below value</b>	lower limit value for the <i>Color channel</i>

The **Swap X/Y** icon allows you to swap the X axis with the Y axis, causing the graph to rotate. If laps are selected for comparison in the *Log Manager* panel, the *Scatter Plot* chart will include only the points belonging to the laps being compared. The points from the base lap are coloured according to the legend, while points from the comparison lap are white. With the + and - keys you can change the size of the points on the graph.

The next element of the graph is the cursor (or two cursors in lap comparison mode) which indicates the coordinates of the point currently marked on the time/road axis. The position of the cursor can be changed by double-clicking a point on the graph.

There is also a legend in the corner of the graph describing the values of the x, y and colour axes of the point indicated by the cursor. The position of the legend on the chart can be changed (or turned off) by right-clicking on the legend window.



## Table Report

The **Table Report** panel shows times or aggregated values from the selected channel by lap in the form of a table. With the reference track generated these values are shown separately for each segment or sector of the track.

Table Report of average @SPEED (ecu.speed)																				
	Lap A1	Lap A2	Lap A3	Lap A4	Lap A5	Lap A6	Lap A7	Lap A8	Lap B1	Lap B2	Lap B3	Lap B4	Lap B5	Lap B6	Lap B7	Lap B8	Lap B9	Lap B10	Lap B11	
Straight 1	186,5	187,5	187,8	187,3	184,2	188,4	186,2	188,6	187,7	189,3	186,8	189,0	189,3	188,1	189,4	189,7	190,2	188,7	186,4	
Turn 1	131,7	131,7	132,9	132,7	131,3	132,5	132,5	131,0	132,1	133,2	126,9	133,0	133,0	131,5	130,9	132,6	132,3	132,6	131,7	
Turn 2	160,2	161,1	160,8	161,0	160,7	161,5	161,9	160,6	162,4	163,4	160,4	162,6	163,3	162,4	161,8	162,7	162,8	162,3	162,3	
Turn 3	173,7	174,8	174,4	174,8	175,4	175,5	176,4	174,6	176,1	177,3	175,7	176,7	177,6	175,8	177,0	177,0	176,6	176,3	175,4	
Straight 2	159,2	160,3	158,4	157,0	161,1	160,6	165,4	165,7	158,7	162,9	159,5	155,0	164,8	159,0	157,1	159,1	157,6	157,5	160,8	
Turn 4	88,3	90,4	89,0	90,1	91,7	92,2	90,6	88,5	88,9	92,7	89,9	88,9	86,8	87,2	92,6	90,4	87,6	89,9	91,6	
Straight 3	117,8	119,0	117,9	120,5	119,9	119,7	118,9	119,5	119,2	119,9	120,4	113,0	116,3	117,5	122,1	121,4	115,2	120,2	122,8	
Turn 5	110,0	108,4	106,6	110,6	108,6	110,6	109,1	106,9	108,9	110,8	109,5	111,0	110,5	111,4	108,6	109,5	109,4	106,9	112,1	
Turn 6	138,2	131,7	138,4	138,0	138,8	138,1	137,3	136,8	136,8	138,4	138,2	138,3	138,2	138,4	138,2	138,3	139,1	138,0	137,7	
Straight 4	156,7	153,1	155,8	157,0	158,2	157,3	156,3	155,8	156,8	157,0	157,7	157,3	157,0	157,9	158,2	157,3	158,1	156,3	157,2	
Turn 7	92,2	92,0	92,6	93,3	90,9	92,2	91,6	93,7	92,3	94,3	92,4	91,5	91,4	92,5	92,4	94,6	93,0	94,2	91,8	
Turn 8	121,4	119,3	121,1	117,5	118,1	120,5	119,8	120,7	121,5	122,4	123,0	118,9	120,7	122,4	118,6	118,1	123,0	123,4	118,7	
Turn 9	110,2	119,6	119,1	118,7	118,4	118,5	118,2	119,1	119,1	119,7	119,3	120,8	120,7	120,2	121,0	119,9	117,4	114,6	120,6	
Straight 5	99,2	143,0	141,5	141,3	141,8	141,7	142,8	142,7	142,7	143,2	143,6	143,8	143,8	143,9	144,2	142,2	141,8	141,1	141,9	
Turn 10	93,5	157,7	156,1	156,3	156,6	157,0	157,9	157,7	158,2	158,6	158,9	158,1	159,3	159,5	160,3	157,6	156,8	156,6	157,8	
Turn 11	123,2	141,5	141,4	139,1	139,3	140,0	139,4	143,0	143,4	142,2	140,8	139,8	140,8	141,2	141,5	143,6	142,3	141,2	141,9	
Turn 12	148,5	153,4	155,4	134,8	152,5	153,9	153,8	154,9	155,4	156,4	156,0	155,4	155,8	155,4	153,9	157,8	156,6	156,0	157,2	
Turn 13	103,9	106,3	107,4	96,3	107,2	106,5	107,1	107,5	107,1	109,6	108,2	108,0	107,9	109,1	109,0	108,3	106,8	107,9	108,6	
Straight 6	152,0	152,8	153,9	149,2	152,7	153,2	153,5	153,3	154,4	154,9	154,6	154,6	154,6	154,9	154,5	155,7	150,8	155,6	154,7	
Turn 14	149,9	152,5	150,7	150,0	151,0	148,8	151,8	150,8	151,4	148,5	151,0	150,9	153,1	150,8	152,3	150,4	150,3	150,4	152,1	
Straight 7	168,6	169,3	167,8	166,8	169,8	167,8	170,3	169,1	170,8	169,2	170,8	170,0	169,0	170,8	171,4	170,9	169,8	168,6	170,4	
Total lap	129,6	135,7	136,0	134,0	135,6	136,3	136,1	136,1	136,5	137,6	136,0	136,4	136,7	136,8	137,1	137,1	136,0	136,3	137,0	

To change the view between segments or sectors use the **Sectors/Segments** icon on the taskbar of the panel. If the Table Report panel is set to sector mode and a sector is marked in the table, it will be highlighted in the GPS / Track map panel and will change the Run Chart panel operating mode to the sector summary.

In the two lap comparison mode, a red (for the base lap) and a white (for the lap being compared) dot appears next to the lap number in the table. If any laps have been excluded from analysis in the **Log Manager panel**, it will be greyed out in the table. To configure the panel press the **Panel properties** icon **Properties** icon on the taskbar.

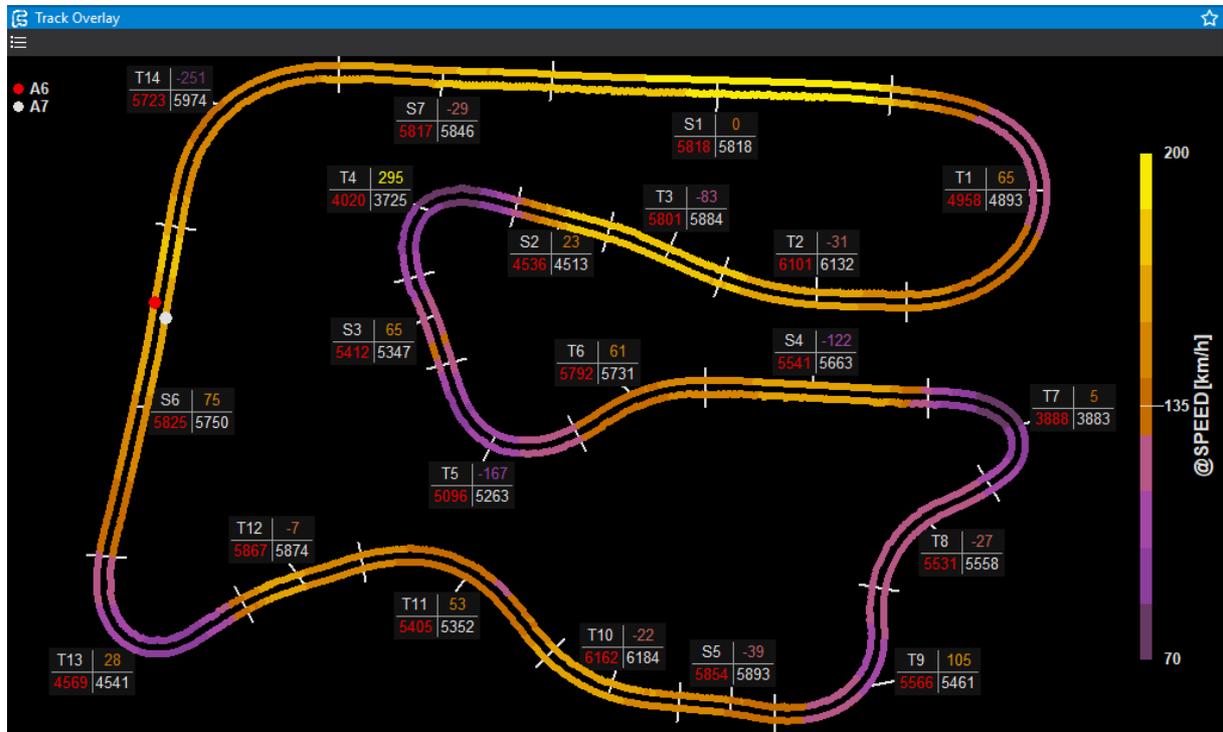
Option	Description
<b>Use time as cell value</b>	Activation of this field has priority over the other settings ( <b>Channel</b> and <b>Summary parameter</b> ). Provides a table with lap times <b>Table Report of Lap Time</b> .
<b>Channel</b>	Channel defining the values in the table
<b>Summary parameter</b>	A parameter specifying which value within a segment is to be displayed: <b>Min</b> - minimum <b>Max</b> - maximum <b>Average</b>
<b>Conditional formatting</b>	Conditional formatting within a segment, applies a cell fill colour (on a scale from strong colour to no colour at all) depending on the numerical value.

**Table Report of Lap Time** shows the times in each segment for all laps. The best times achieved in each segment/sector are highlighted in green. They form the **Virtual best** column showing the theoretical best lap time. The purple line indicates the **Rolling best** time. It indicates the best time achieved during a run, but which did not necessarily start at the physical start of the lap. The green line indicates the best time achieved in one lap.

	Lap A1	Lap A2	Lap A3	Lap A4	Lap A5	Lap A6	Lap A7	Lap A8	Lap B1	Lap B2	Lap B3	Lap B4	Lap B5	Lap B6	Lap B7	Lap B8	Lap B9	Lap B10	Lap B11	Virtual best	Rolling best
Straight 1	6.784	6.911	6.785	6.793	6.877	6.738	6.891	6.774	6.789	6.721	6.792	6.686	6.720	6.775	6.717	6.711	6.704	6.688	6.795	6.686	6.795
Turn 1	11.418	11.357	11.333	11.283	11.509	11.286	11.309	11.596	11.397	11.382	11.895	11.333	11.285	11.479	11.535	11.296	11.376	11.386	11.475	11.283	11.475
Turn 2	4.581	4.528	4.491	4.529	4.493	4.568	4.517	4.530	4.435	4.463	4.581	4.468	4.423	4.432	4.479	4.508	4.426	4.504	4.470	4.423	4.470
Turn 3	2.661	2.613	2.695	2.614	2.610	2.610	2.603	2.612	2.648	2.599	2.608	2.606	2.600	2.685	2.604	2.602	2.600	2.607	2.569	2.569	2.569
Straight 2	2.058	2.058	2.064	2.065	2.096	2.008	2.001	2.006	2.017	2.041	2.100	2.105	1.995	2.017	2.097	2.013	2.049	2.022	2.090	1.995	2.090
Turn 4	6.341	6.251	6.226	6.259	6.126	6.098	6.168	6.262	6.377	5.972	6.213	6.235	6.388	6.288	6.090	6.193	6.381	6.257	6.274	5.972	6.274
Straight 3	3.127	3.028	3.124	3.072	2.978	3.023	3.029	3.105	3.032	3.104	3.013	3.277	3.190	3.180	2.999	3.007	3.208	3.015	2.934	2.934	2.934
Turn 5	5.638	5.658	5.677	5.614	5.706	5.606	5.598	5.680	5.716	5.514	5.659	5.721	5.621	5.541	5.667	5.605	5.675	5.780	5.592	5.514	5.592
Turn 6	3.999	4.219	4.008	4.001	4.002	4.005	4.053	4.016	4.063	4.042	4.000	3.994	4.006	4.006	4.008	4.089	4.000	4.008	4.002	3.994	4.002
Straight 4	5.317	5.404	5.315	5.274	5.258	5.262	5.230	5.319	5.316	5.264	5.218	5.261	5.302	5.254	5.251	5.218	5.268	5.311	5.221	5.218	5.221
Turn 7	7.068	7.085	7.000	6.928	7.129	6.988	7.101	6.883	6.911	6.897	7.010	7.030	7.073	6.995	6.999	6.890	7.005	6.998	7.073	6.883	7.073
Turn 8	4.920	5.018	4.981	4.989	5.006	4.952	5.009	4.985	4.979	4.921	4.920	5.101	4.999	4.837	5.001	5.104	4.827	4.826	5.010	4.826	5.010
Turn 9	6.808	6.512	6.437	6.593	6.599	6.580	6.600	6.527	6.519	6.566	6.445	6.359	6.412	6.505	6.461	6.412	6.607	6.691	6.403	6.359	6.403
Straight 5	3.778	2.618	2.708	2.707	2.667	2.667	2.658	2.618	2.621	2.612	2.612	2.648	2.613	2.613	2.608	2.664	2.672	2.711	2.704	2.609	2.704
Turn 10	5.884	3.547	3.599	3.603	3.596	3.551	3.546	3.585	3.582	3.499	3.535	3.547	3.577	3.570	3.482	3.545	3.592	3.592	3.586	3.482	3.586
Turn 11	7.111	5.742	5.745	5.774	5.809	5.799	5.804	5.674	5.679	5.815	5.794	5.813	5.795	5.707	5.819	5.684	5.738	5.800	5.702	5.674	5.702
Turn 12	3.097	3.059	2.998	3.299	3.020	3.004	3.048	3.001	2.997	2.950	2.995	3.043	3.002	2.997	3.009	2.975	2.987	2.947	2.982	2.947	2.982
Turn 13	8.335	8.126	7.940	9.110	7.996	8.043	8.010	7.945	8.002	7.823	7.981	8.053	7.946	7.896	7.774	7.814	8.007	7.942	7.921	7.774	7.921
Straight 6	8.521	8.514	8.407	8.767	8.524	8.430	8.417	8.462	8.414	8.388	8.317	8.344	8.402	8.402	8.453	8.386	8.661	8.380	8.404	8.317	8.404
Turn 14	6.545	6.462	6.568	6.536	6.482	6.608	6.515	6.525	6.520	6.596	6.519	6.487	6.448	6.485	6.459	6.535	6.576	6.532	6.472	6.448	6.472
Straight 7	4.789	4.703	4.803	4.813	4.780	4.799	4.691	4.785	4.686	4.743	4.765	4.773	4.747	4.688	4.682	4.685	4.738	4.788	4.731	4.682	4.731
Total lap	1:58.780	1:53.413	1:52.904	1:54.623	1:53.263	1:52.625	1:52.798	1:52.890	1:52.700	1:51.912	1:52.972	1:52.884	1:52.544	1:52.352	1:52.195	1:51.936	1:53.112	1:52.785	1:52.410	1:50.588	1:52.410

## Track Overlay

If the reference track is generated **Track Overlay** shows a map of the track with the selected channel highlighted in colour.



The visualisation shows data from one lap (marked as baseline). The cursor only moves when operating within the selected lap in other panels, or when the cursor is moved in the *Track Overlay* panel (using the Ctrl + → / ← keys or the left mouse button).

It is also possible to compare two laps (the outer lap with the red cursor is the base lap and the inner lap with the white cursor is the lap being compared).

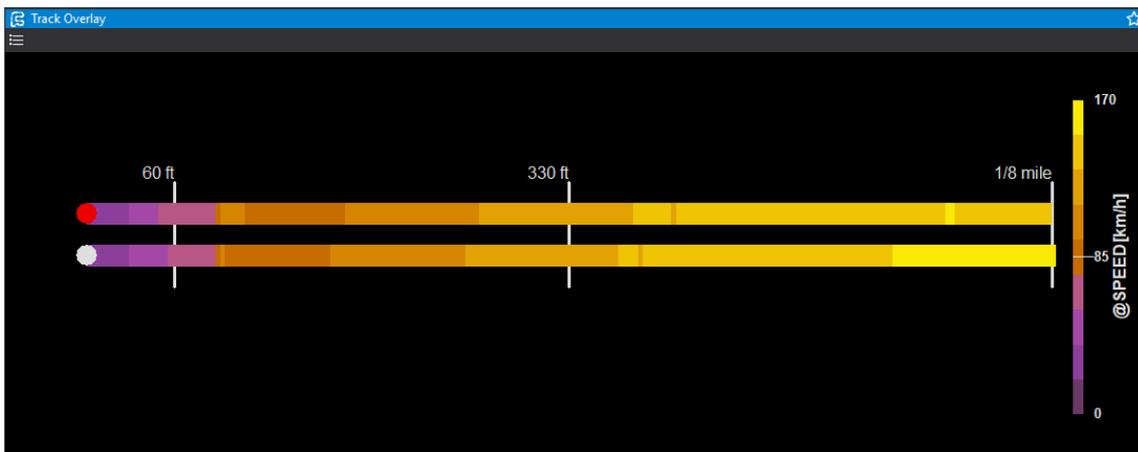
With Ctrl+↑/↓ keys or the mouse wheel you can zoom the in and out. Use the arrows ↑/↓/→/← or the left mouse button to move the view on the screen.

The following settings are available in the *Track Overlay* panel of the **Panel properties** window

Option	Description
<b>Show labels</b>	<p>Displaying <i>labels</i> for each track segment in the visualisation.</p> <p>The labels contain the name of the segment and may additionally represent values from the selected <i>turn/straight</i> channels for the given lap. The lap comparison mode shows the values for each lap and the difference between them (<i>delta</i>)</p>

	<table border="1"> <tr> <td>Segment no.</td> <td>Delta</td> </tr> <tr> <td>Value for the base lap</td> <td>Value for the lap to be compared</td> </tr> </table> <p>(These labels can be moved with the left mouse button to improve the clarity of the visualisation).</p>	Segment no.	Delta	Value for the base lap	Value for the lap to be compared
Segment no.	Delta				
Value for the base lap	Value for the lap to be compared				
<b>Colour channel</b>	Channel plotted on a track map.				
<b>Turn summary channel</b>	A channel that defines the value shown in the <i>labels</i> within each turn of the selected lap.				
<b>Turn parameter</b>	A parameter specifying which value within a turn is to be displayed: <b>Min</b> - minimum <b>Max</b> - maximum <b>Average</b>				
<b>Turn and straight summary channels equal</b>	When this field is activated, the configuration for displaying values for straight sections of the track will be the same as for curves. (Otherwise, the display parameters for straight and curve may be different)				
<b>Straight summary channel</b>	A channel that defines the value that is set in <i>labels</i> within each straight of the selected lap.				
<b>Straight parameter</b>	Parameter specifying which value within the straight section of the track is to be displayed: <b>Min</b> - minimum <b>Max</b> - maximum <b>Average</b>				

For a **Drag**-type project, the **Track Overlay** panel works without the need to generate a reference track. Then, the colour specified in the *Colour channel* is applied to the drag strip generated by the distance from the start.



## Video

It is possible to load video files for analysis from the **Video** panel.

Log synchronisation with the video file can be:

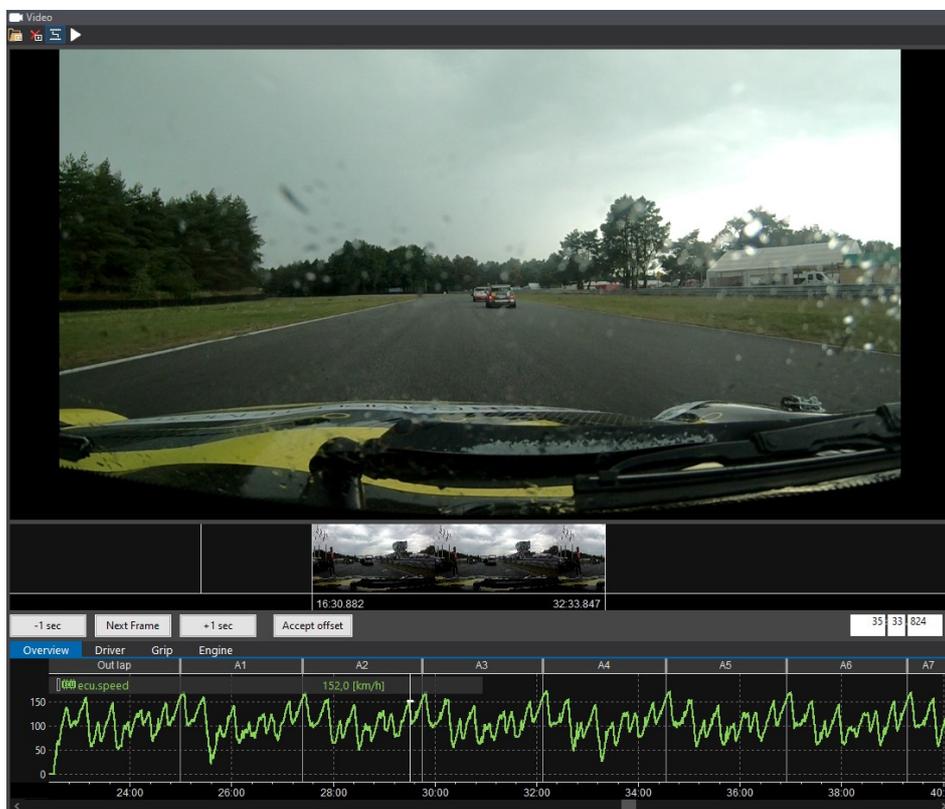
- automatic (to be activated in the *General Options* window), available when the following conditions are met: the log contains GPS data, the video file is from a GoPro camera (model higher or equivalent to Hero5 Black) and the camera has GPS enabled;
- manual (icon *Synchronize video* on the taskbar), in case automatic synchronisation is not possible or the result is incorrect.

In manual sync mode, the log window appears below the video window and the cursors for the video and log windows are disconnected.

Select a characteristic point (preferably the start, leaving the pits, etc.) and position the cursor in the log at the bottom of the panel as precisely as possible. You can use the zoom option to improve the accuracy of the cursor positioning.

Then, set the video position at the corresponding point. To facilitate precise video panning in manual sync mode, you can use the '-1 sec'/'+1 sec' buttons to pan the image by one second or the 'Next Frame' button to pan the image by one frame.

After correct positioning of the cursor and the video, accept the synchronization with the *Accept offset* button. Current cursor offset is displayed in the box on the right-hand side. Once the synchronisation is accepted, the cursors merge back into one common pointer for all panels.



It is possible to load several video files within the same log. In this situation, one of the files is synchronised and the rest are appended sequentially as a continuation. The video files will appear in the order in which they were opened, but it is possible to manually set the order of the files and choose the one to be synchronised via a pop-up menu (right-click).

When comparing two laps, two windows will appear showing both laps. The top for the base lap and the bottom for the comparison lap.



In the Video panel, you can also turn on the controls displaying data over video. This is done by selecting the *Overlay* icon from the taskbar. It allows you to select from two layouts: *Track* or *Simple*. The layout is not editable, which means the controls cannot be moved or modified. However, the change can be made by editing the default aliases attached to individual controls (see the aliases section).



## Favourite

Once you have configured a panel, you can add it to your favourites by pressing the star icon in the top right corner. This will enable you to quickly select pre-configured panels from the window selector.

To remove a panel from favourites, deselect the filled star icon or in the *Select panel* window, right-click the favorite panel, and then select *Delete favorite panel*.

When you make any changes to your favourite panel, it is treated as a different panel. To remember these changes in your favourite window, uncheck and recheck the star icon.