



RaceCTRL  
Race strategy

# RaceCTRL

(V2.30)

## User Guide

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# 1. Versions - Comparison chart

The **starter version** provides you with all the standard timing features on the standalone mode.

The **standard version** works either on the standalone mode or on the client/server mode.  
Some analysis is added as well as the possibility to record and replay synchronized video and audio.  
Access to the official Trackside software support is also available on this version.

In addition to the functionalities of the standard version, the **advanced version** allows you to design your own 'in house' strategy engine.

Standard timing features	Starter	Standard	Advanced
Leaderboard (6.3.1)	✓	✓	✓
Gaps (6.3.2)	✓	✓	✓
Live Track (0)	✓	✓	✓
Laptime Graph (6.3.4)	✓	✓	✓
Gaps Graph (6.3.5)	✓	✓	✓
Race messages (6.3.7)	✓	✓	✓
Lap history (0)	✓	✓	✓
Race planner (6.3.16)	✓	✓	✓
Advanced timing features	Starter	Standard	Advanced
Race time Manager (6.2.3)	✓	✓	✓
Timing analysis	✗	✓	✓
Instant Speed (0)	✗	✓	✓
Basic extrapolation	✗	✓	✓
Media features	Starter	Standard	Advanced
Video player (0)	✓	✓	✓
Audio player (0)	✗	✓	✓
Video recorded for replayer (0)	✗	1 stream	24 streams
Audio recorded for replayer (0)	✗	2 streams	32 streams
Audio to text (0)	✗	✗	✓
Custom features	Starter	Standard	Advanced
Custom layouts (10.1)	✓	✓	✓
Table configuration (5.3)	✓	✓	✓
Web API (8)	✗	✓	✓
Strategy engine (8.5)	✗	✗	✓
Custom displays (6.3.17)	✗	✗	✓
Working modes (4.2)	Starter	Standard	Advanced
Standalone	✓	✓	✓
Client/Server	✗	✓	✓
Support	Starter	Standard	Advanced
Official TS support	✗	✓	✓

## 2. Prerequisites

RaceCTRL requires the following libraries to be installed. You can download them from the Microsoft website:

**.Net Framework V8.0**

<https://dotnet.microsoft.com/en-us/download/dotnet/8.0>

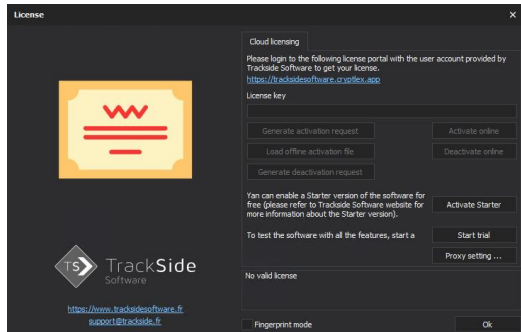
**Visual C++ Redistributable for Visual Studio 2015 to 2022.**

[https://aka.ms/vs/17/release/vc\\_redist.x64.exe](https://aka.ms/vs/17/release/vc_redist.x64.exe)

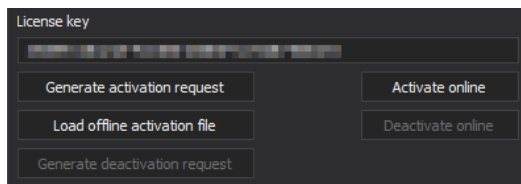
## 3. License

### 3.1. Activate a license online

#### 3.1.1. Enter license key



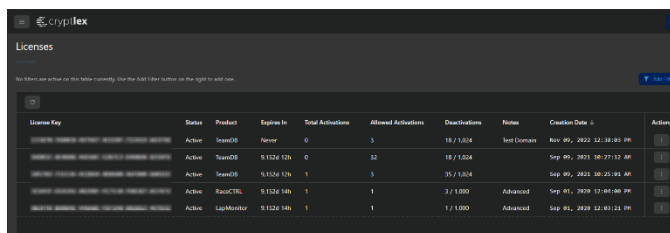
If you have no license yet, the first time you will launch RaceCTRL, this window will appear.



Enter a valid license key and click on “Activate online”.

#### Two solutions:

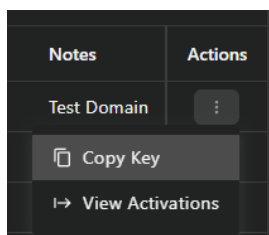
- If the Trackside Software team have provided you a license you can paste it and activate it here.
- Else, you will need to get it from the Cryptex portal (see below).



On a computer with an internet connection, navigate to the license portal.

<https://tracksideoftware.customer.cryptex.com/licenses>

Use the credential provided by Trackside Software to open a session.



In the Actions column, click on the three dots button of the line corresponding to the licence you want to activate.

Click Copy Key.

Then, paste the key in RaceCtrl “License key” windows.

Activate Starter

You can use a Starter license by clicking on “Activate Starter”.

Start trial

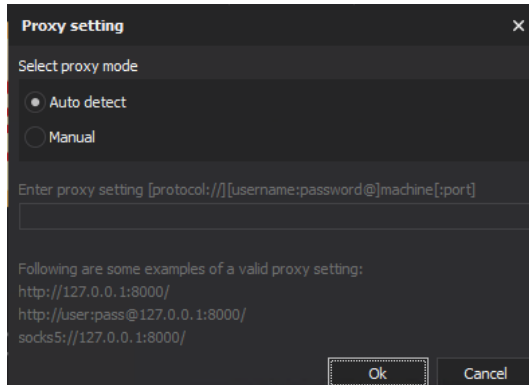
You can also start a trial period with “Start trial” (30 days).



*RaceCTRL need an internet access to check the license frequently. But after a successful validation, it can work for 30 days without internet.*

*Notice than a trial license always requires an internet access to start*

### 3.1.2. Proxy



RaceCTRL requires to access internet to activate the License. It uses the default proxy configuration of the system, but in some cases, you may need to specify another proxy server. This could be done from this window available by clicking on the button “Proxy setting ...” of the License window.

### 3.1.3. Firewall whitelisting

If your policy denies access to external websites, you will need to whitelist the URL below. A whitelist provides access to designated sites that would otherwise be prevented by your security policy.

<https://api.cryptlex.com:443>

### 3.2. Offline license

### 3.2.1. Activation

If the software is not allowed to access to internet, it is possible to activate the license in offline mode.

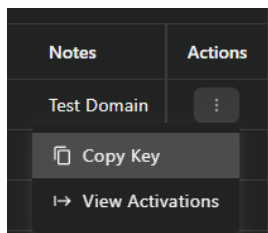
The screenshot shows the CryptiLix application interface. At the top, there's a navigation bar with the CryptiLix logo and a user profile icon. Below the navigation bar, the main heading is 'Licenses'. A message states: 'You have no active licenses currently. Use the Add (+) button on the right to add one.' To the right of this message is a blue button labeled '+ Add (+)'. Below this is a table titled 'Licenses' with the following columns: License Key, Status, Product, Expires In, Total Activations, Allowed Activations, Disactivations, Notes, Creation Date, and Actions. The table contains five rows of license data.

License Key	Status	Product	Expires In	Total Activations	Allowed Activations	Disactivations	Notes	Creation Date	Actions
00000000-00000000-00000000-00000000	Active	TeamOS	Never	0	3	10 / 1,024	Test Domain	Sep 09, 2022 12:38:28 PM	[Edit] [Delete]
00000000-00000000-00000000-00000000	Active	TeamOS	5,120 h 24	0	32	10 / 1,024		Sep 09, 2021 10:27:12 AM	[Edit] [Delete]
00000000-00000000-00000000-00000000	Active	TeamOS	5,120 h 24	1	3	35 / 1,024		Sep 09, 2021 10:25:38 AM	[Edit] [Delete]
00000000-00000000-00000000-00000000	Active	RooCTL	5,120 h 24	1	1	2 / 5,000	Advanced	Sep 01, 2020 12:01:00 AM	[Edit] [Delete]
00000000-00000000-00000000-00000000	Active	LapMonitor	5,120 h 24	1	1	1 / 5,000	Advanced	Sep 01, 2020 12:03:13 PM	[Edit] [Delete]

On a computer with an internet connection, navigate to the license portal.

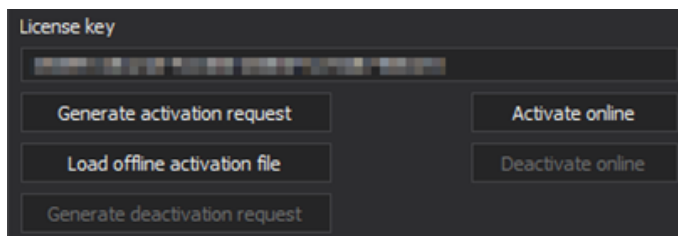
<https://tracksidesoftware.customer.cryptlex.com/licenses>

Use the credential provided by Trackside Software to open a session.



In the Actions column, click on the three dots button of the line corresponding to the licence you want to activate.

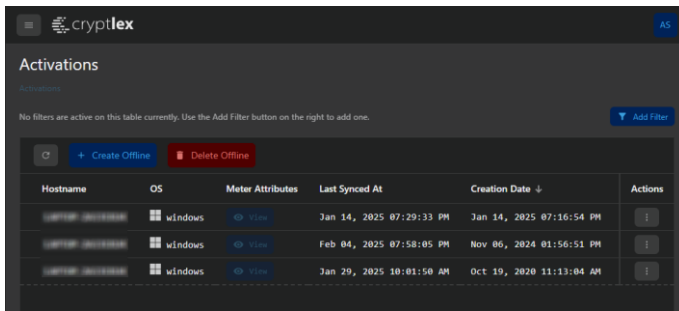
Click Copy Key.



On the “License” window of RaceCtrl.

Past the license key and click on “Generate activation request”. This will generate a file containing an activation request. Copy this file to a computer with an internet connection.

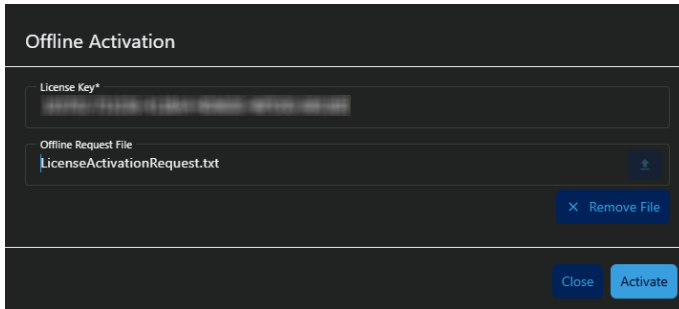




Navigate to the activations page:

<https://tracksidesoftware.customer.cryptlex.com/activations>

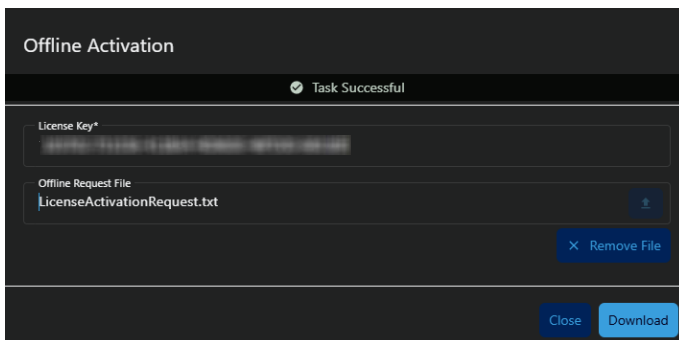
Click on Create Offline.



Past the license key in the appropriated field of the popup.

Select the generated offline activation request file.

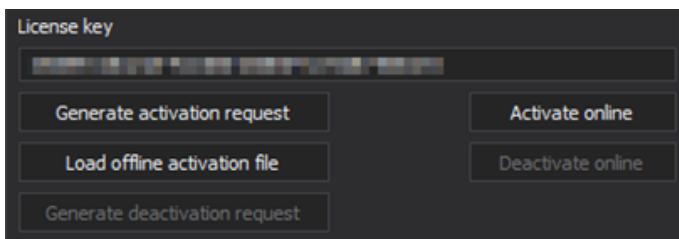
And click on Activate.



A message "Task Successful" will appear if the license key and activation request file match.

Download the offline activation response file (a .dat file).

Copy this file one the (offline) computer running RaceCtrl.



Get back on the "License" window of RaceCtrl.

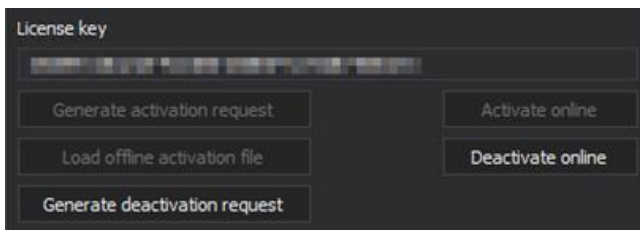
Click on "Load offline activation file" to activate the license on the computer without internet connection.

Select the offline activation response file.

⇒ The license should now be activated

### 3.2.2. Deactivation

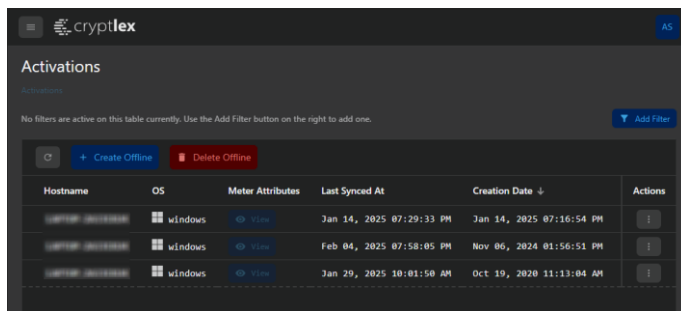
If you want to use license on another computer, it is possible to deactivate the license without internet connection on the computer using the software.



On the "License" windows of RaceCtrl.

Click on "Generate deactivation request" to deactivate the license on the computer.

Then copy the generated deactivation request file on another computer with an internet connection. Copy the license key too, you will need-it later.

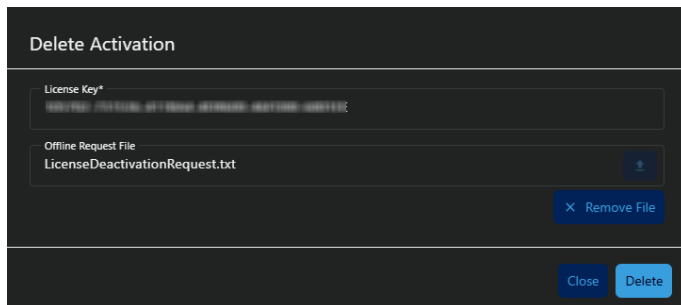


On a computer with an internet connection, navigate to the activation pages of the Cryptplex portal.

<https://tracksidesoftware.customer.cryptplex.com/activations>

Use the credential provided by Trackside Software to open a session.

Click on Delete Offline.



Past the license key you copied earlier into the appropriated field of the popup.

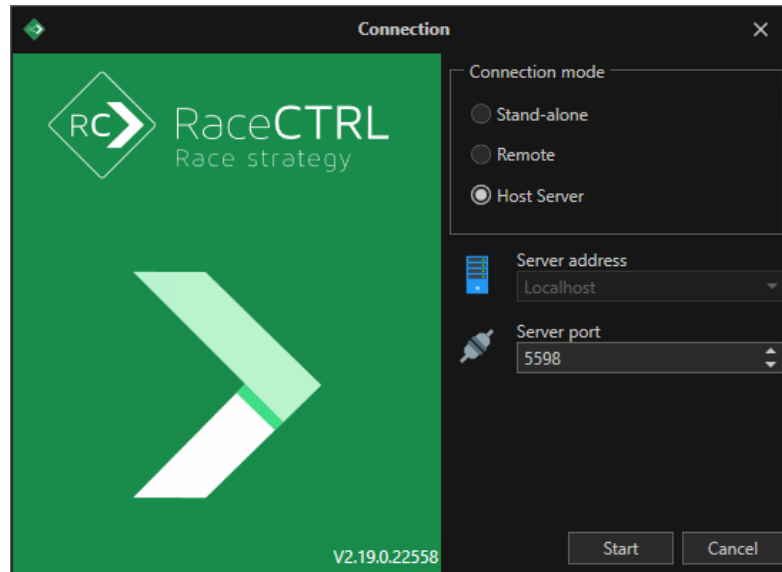
Select the generated offline deactivation request file.

And click on Delete.

⇒ The license should now be deactivated and can be use again on another computer.

## 4. Starting the application

### 4.1. Starting page



### 4.2. Working modes

RaceCTRL can be used on 2 different modes: Standalone or Client/Server.

To work alone choose the **Stand-alone** option on the connection starting page.

To share your work, use the **Host Server** option in order to set your computer as the Server or the **Remote** option to connect to another computer set as a Host Server.

On the **Stand-alone** option, no more option needed

On the **Host Server** option, a **Server port** must be set

On the **Remote** option, you need to choose the **Server address** and the **Server port** of the server

**Option:** On the **Remote** option it is possible to change the current session even during a live session (this feature is not available for the **Host Server** which record the session live). But you can enable the session following. When this option is activated, you cannot change the current session manually anymore. The session will change automatically depending on the **Host Server** session.

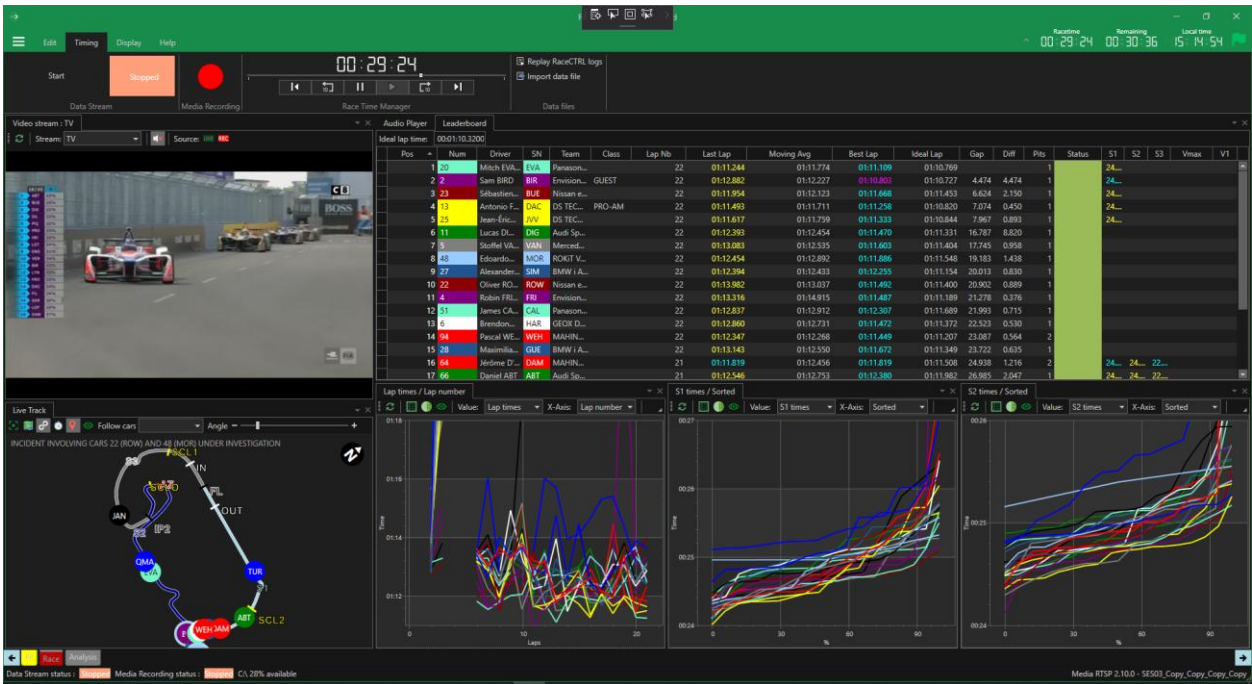
*Edit > Options*



**Info:** On the **Remote** option, if the server connection is lost, a reconnection popup will be displayed. This popup will try to reconnect every 20s. You can reconnect immediately by clicking "Try Now" button. Or close the application by clicking "Close" button.

## 5. RaceCTRL user's interface

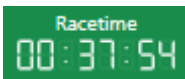
### 5.1. Working page



#### 5.1.1. Top bar



Show/hide the ribbon.



##### Session time

The session time is different to the race time displayed in the “race time manager”. If the session is stopped, for any reason, the session time will stop but not the race time which is the time from the green flag.



##### Remaining time

The remaining time is displayed only if the session duration type is set to “Duration” (Edit Session).



##### Local time

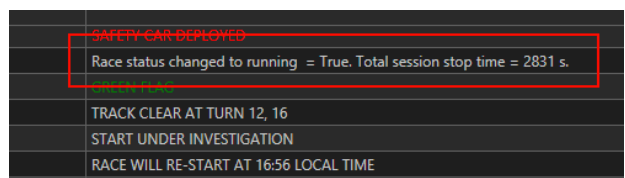
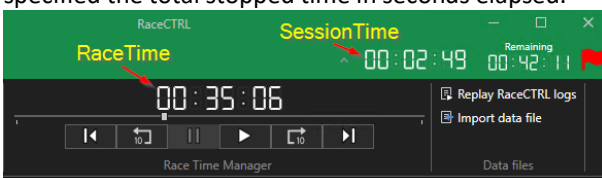
The current local time. The local time is recomputed in replay mode.



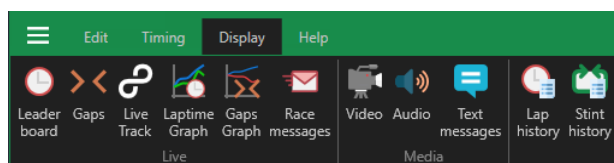
##### Session status

**Info:** In case of Red flag, the **session time**, is stopped and will restart at the end of the red flag. On the other hand, the **race time** does not stop and will be different from **session time**.

Moreover, an additional message generated by RaceCTRL will be displayed in the race messages view in order to specified the total stopped time in seconds elapsed.



### 5.1.2. Ribbon

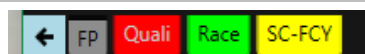


The menus are displayed as **ribbons**.

There are 4 different ribbons: **Edit**, **Timing**, **Display** and **Help** (more details in section 6).

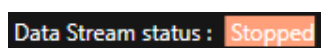
It is possible to hide the ribbon by using the arrow of the top bar (see above). When the ribbon is on the hide mode, it appears by clicking on the title.

### 5.1.3. Bottom bar



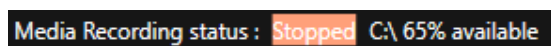
On the **bottom bar** you can use a right click to create and arrange layouts.

### 5.1.4. Status bar



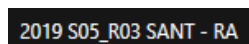
#### Data Stream status

Green when connected to a timing feed. (See section 6.2.1)



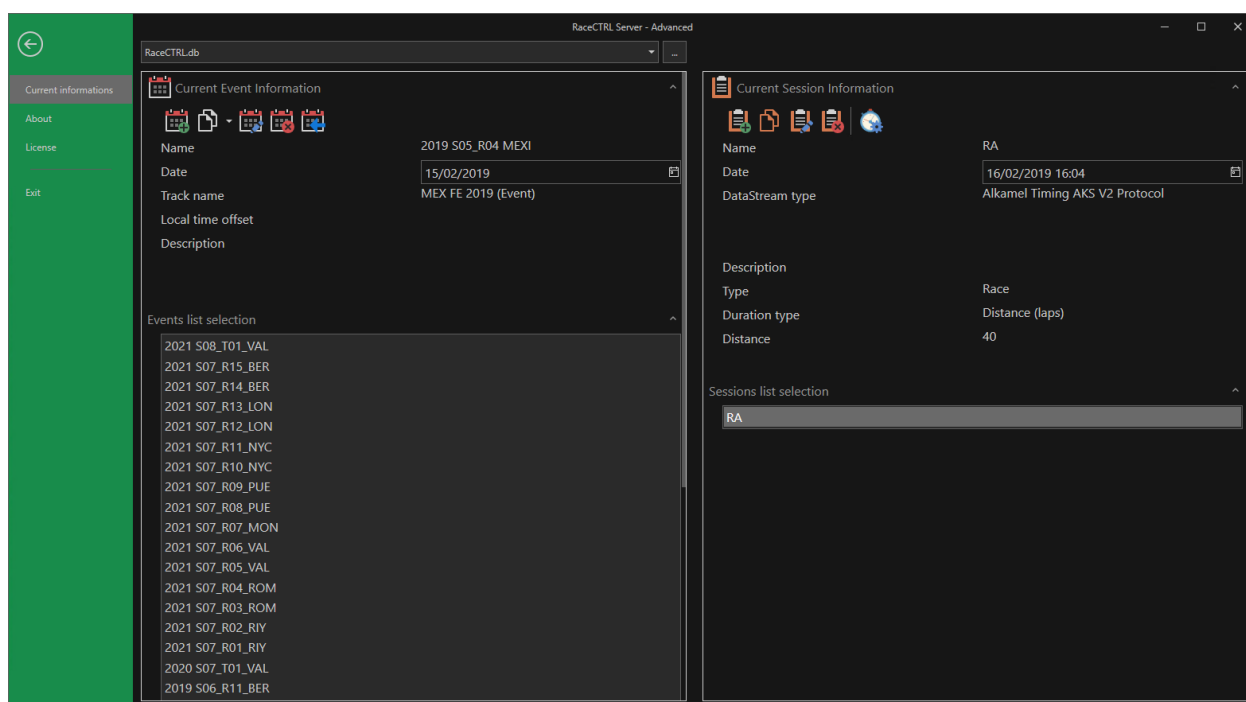
#### Media Recording status

Green when a media is recorded. The available space on the disk is also displayed.



In addition to the status the current event and session names are displayed on the RHS.

## 5.2. Selection page



Use this button to go from the working page to the selection page



Use this button from the selection page to come back to the working page

### 5.2.1. Current event information

Current Event Information

Add an event (see tutorial in section 10.2)

Duplicate the current event (The following data are duplicated: the event properties, the media streams, the cars and drivers)

Edit the current event

Delete the current event

Import an event from another database

Name2019 S05\_R03 SANT
Date25/01/2019
Track nameSCL FE 2019 (Event)
Description

**Information of the current event**

- Name
- Date
- Track name
- Description (optional)

Events list selection
2019 S05\_R04 MEXI
2019 S05\_R03 SANT
2019 S05\_R02 MARR
2018 S05\_R01 RIYA

**List of events** recorded in the database

### 5.2.2. Current session information

Current Session Information

Add a session (see tutorial in section 10.3)

Duplicate the current session (The following data are duplicated: the session properties, the timing stream properties)

Edit the current session

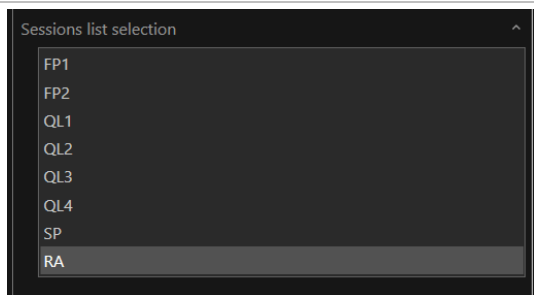
Delete the session event

Edit the timing feed for the current session (see tutorial in section 0)

NameRA
Date26/01/2019
Description
TypeRace
Duration modeDuration
Duration45
DataStream typeAlkamel Timing AKS V2 Protocol

**Information of the current session**

- Name
- Date
- Description (optional)
- Type: Practice, Qualification or Race
- Duration mode: Distance (laps), Duration (min) or Duration and distance (laps and min).
- Duration
- DataStream type (see section 11 for details on timing feeds)



List of sessions of the current event

### 5.2.3. Database selection

The dropdown at the top of the view allows to switch between database files. This could be useful if you are using RaceCTRL in several championship or if you want to split the data by season.

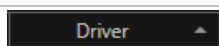


## 5.3. “Spreadsheet type” views

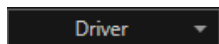
Example: Leaderboard

S. .		N...	Driver	Team	Lap...	Last Lap	Moving A...	Best Lap	Ideal Lap	Gap	Diff	Pits	S1	Best S1	S2	Best S2	S3	Best S3	225kW...	250k...
1	94	Pascal WEHRLEIN	MAHINDRA R...	16	01:01.998	01:01.810	01:01.112	01:01.021				1	14.725	14.405		28.018		18.598	✓	
2	22	Oliver ROWLAND	Nissan e.dams	16	01:01.855	01:01.782	01:01.206	01:01.100	0.511	0.511		1	14.455	14.213		28.193		18.694	✓	
3	11	Lucas DI GRASSI	Audi Sport Abt...	15	01:02.102	01:01.914	01:01.277	01:01.159	1.654	1.143		1	14.666	14.215	28.309	28.221	19.127	18.723	✓	
4	23	Sébastien BUEMI	Nissan e.dams	15	01:01.647	01:02.171	01:01.557	01:01.145	4.247	2.593		1	14.323	14.271	28.377	28.149	18.947	18.725	✓	
5	28	Antonio Felix DA CO...	BMW i ANDRE...	15	01:01.794	01:02.366	01:01.463	01:01.249	5.573	1.326		1	14.374	14.219	28.374	28.261	19.046	18.769	✓	
6	19	Felipe MASSA	Venturi Formul...	15	01:01.837	01:02.293	01:01.557	01:01.383	6.243	0.670		1	14.360	14.286	28.465	28.374	19.012	18.723	✓	
7	48	Edoardo MORTARA	Venturi Formul...	15	01:01.968	01:02.306	01:01.441	01:01.387	6.844	0.601		1	14.506	14.316	28.447	28.330	19.015	18.741	✓	
8	36	André LOTTERER	DS TECHETAH	15	01:02.281	01:02.466	01:01.603	01:01.251	8.224	1.380		1	14.601	14.177	28.650	28.360	19.030	18.714	✓	
9	64	Jérôme D'AMBROSIO	MAHINDRA R...	15	01:02.157	01:02.468	01:01.450	01:01.287	8.766	0.542		1	14.543	14.206	28.521	28.336	19.093	18.745	✓	
10	25	Jean-Eric VERGNE	DS TECHETAH	15	01:02.674	01:02.609	01:01.217	01:01.217	10.038	1.272		1	14.585	14.323	28.944	28.106	19.145	18.788	✓	
11	20	Mitch EVANS	Panasonic Jag...	15	01:02.253	01:02.599	01:01.397	01:01.377	10.367	0.329		1	14.499	14.168	28.565	28.354	19.189	18.855	✓	
12	16	Oliver TURVEY	NIO Formula E...	15	01:02.419	01:02.696	01:01.491	01:01.397	11.280	0.913		1	14.606	14.307	28.619	28.327	19.194	18.763	✓	
13	7	José Maria LOPEZ	GEOX DRAGON	15	01:02.370	01:02.564	01:01.577	01:01.443	11.613	0.333		1	14.574	14.153	28.748	28.511	19.048	18.779	✓	
14	4	Robin FRUNTS	Envision Virgin...	15	01:02.166	01:02.779	01:01.573	01:01.326	12.067	0.454		1	14.288	14.139	28.666	28.523	19.212	18.664	✓	
15	2	Sam BIRD	Envision Virgin...	15	01:02.296	01:02.644	01:01.522	01:01.508	12.458	0.391		1	14.487	14.279	28.524	28.457	19.285	18.772	✓	
16	66	Daniel ABT	Audi Sport Abt...	15	01:02.691	01:02.476	01:01.381	01:01.140	13.296	0.838		1	14.468	14.408	29.453	27.962	18.770	18.770	✓	
17	8	Tom DILLMANN	NIO Formula E...	15	01:02.397	01:02.779	01:01.514	01:01.364	14.369	1.073		1	14.563	14.367	28.683	28.277	19.151	18.720	✓	
18	27	Alexander SIMS	BMW i ANDRE...	15	01:02.761	01:02.424	01:01.233	01:00.950	16.022	1.653		3	14.055	14.055	28.394	28.114		18.781	✓	
19	5	Stoffel VANDORNE	HWA Racelab	15	01:02.060	01:02.407	01:01.154	01:01.074	18.064	2.042		2	14.644	14.371	28.596	28.123		18.580	✓	✓
20	6	Felipe NASR	GEOX DRAGON	15	01:03.280	01:03.117	01:01.518	01:01.500	19.300	1.236		1	14.756	14.274	28.801	28.525		18.701	✓	
21	17	Gary PAFETT	HWA Racelab	15	01:02.882	01:02.586	01:01.745	01:01.627	19.947	0.647		1	14.714	14.465	28.851	28.373		18.789	✓	
22	3	Nelson PIQUET	Panasonic Jag...	3	01:02.932	01:07.085	01:02.932	01:02.529	26.502	6.555		0	14.694	14.694	28.679	28.679		19.156	✓	

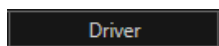
All the “spreadsheet type” views of RaceCTRL are highly customisable:



A right click on the title of a column will sort the data by this column ascending.

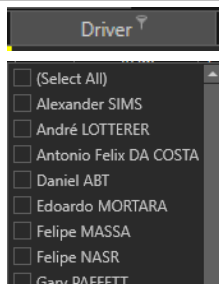


A second right click on the title of the same column will sort the data descending.



A right click on the title of another column will remove the sorting of the previous column and sort the data by the new column ascending.

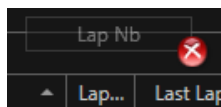
To remove all sorting, you need to use the menu, see below.



A right click on the “filter” icon opens a menu in order to filter the data.



A right click and hold allows to move a column to another position. The two arrows show where (in between which columns) the column will be positioned after releasing it.



If you release the title of the column outside the title bar, the column will be removed from the sheet.

A right click on the title of a column opens a menu to extend the possibilities:

Sort Ascending

Sort the data by this column ascending

Sort Descending

Sort the data by this column descending

Clear Sorting

Clear all sorting

It is possible to group the data by one (or more) column.

Group By This Column

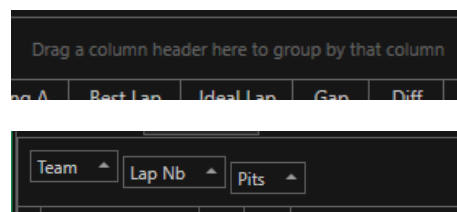
S...	N...	Driver	Team
1	94	Pascal WEHRLEIN	MAHINDRA
2	22	Oliver ROWLAND	Nissan e.d
3	11	Lucas DI GRASSI	Audi Sport
4	23	Sébastien BUEMI	Nissan e.d
5	28	Antonio Felix DA CO...	BMW i AN
6	19	Felipe MASSA	Venturi F

Show/hide the group panel.

You can group directly with a drag and drop of the column title in this panel. You can also clear a group by drag and drop the column title from the group panel to a position in the column title bar.

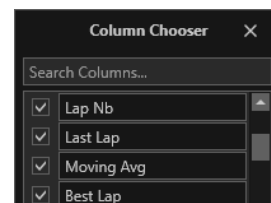
A right click in this panel opens a menu in order to directly expand / collapse the groups or clear all grouping.

Show Group Panel



Show Column Chooser

Show the column chooser where you can select the data you want to display in the spreadsheet.

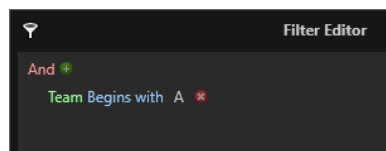


Best Fit  
Best Fit (all columns)

Adapt the width of the column (or all columns) to the content.

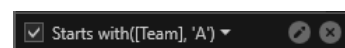
A powerful filter editor is available:

Filter Editor...



S...	N...	Driver	Team	La
3	11	Lucas DI GRASSI	Audi Sport Abt...	
16	66	Daniel ABT	Audi Sport Abt...	

When a filter is applied, a summary is displayed into the bottom bar. From here, you can edit, delete, disable a filter. You have also access to the list of the last filter used.



Clear Filter

You can clear all filters at once.

Show Search Panel

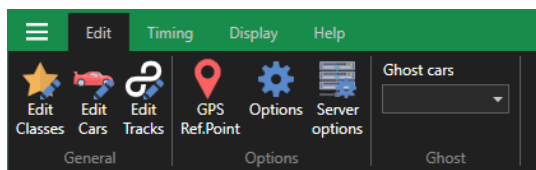
A search panel is also available:



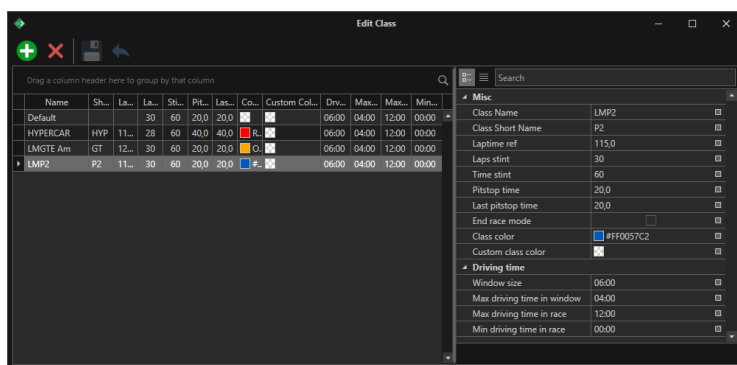


## 6. Ribbons & functionalities

### 6.1. Edit



#### 6.1.1. Edit Classes



Add a class



Delete a class



Save changes



Discard changes




	Name	LapTim...	Laps Stint	Stint du...	Pitstop...	Last Pits...
▶	Default	110.0	50	65	68.0	28.0
	ICGT_Pro	104.0	47	65	68.0	28.0

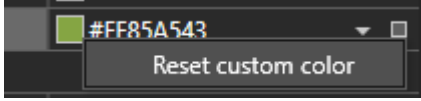
#### Class list

#### Class properties

- Class short name: short name used in the live track and live gap views to display the class leaders
- Laptime ref: Reference laptime for a car of this class (in seconds)
- Laps stint: Maximum number of laps possible for a full stint of a car of this class (range)
- Time stint: Maximum duration (in minutes) for a full stint of a car of this class (regulation).
- Pitstop time: Standard pitstop time (in seconds) for a car of this class (pitlane time excluded)
- Last pitstop time: Last pitstop time (in seconds) for a car of this class (pitlane time excluded)
- End race mode: Used to define the end in time of the last stint (for stint and driving times), On = end at the scheduled end of the race, Off = end at the end of the last lap.
- Class color: color of the class shared between all RaceCTRL users
- Custom class color: This color is only applied to the

Class Name	LMP2
Class Short Name	P2
Laptime ref	115,0
Laps stint	30
Time stint	60
Pitstop time	20,0
Last pitstop time	20,0
End race mode	<input type="checkbox"/>
Class color	<input checked="" type="checkbox"/> #FF0057C2
Custom class color	<input type="checkbox"/>

current RaceCTRL instance. It is not shared to all connected clients. You can reset the custom color to get back to the global color by clicking the square button on the right  and then click on the *command Reset custom color*.



**Note:** All the fields are mandatory except for Laptimes ref and custom color. If empty, the laptimes ref defined on the track will be used for the calculations.

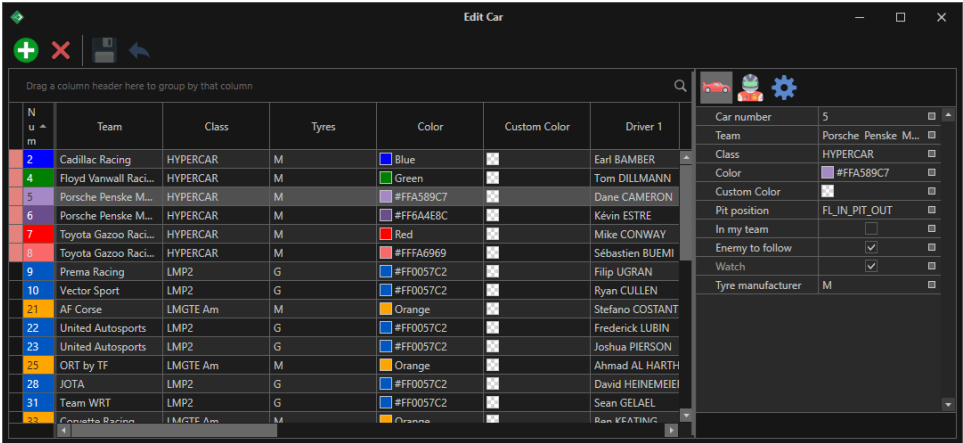
Driving time	
Window size	06:00
Max driving time in window	04:00
Max driving time in race	12:00
Min driving time in race	00:00


- Driving time limits:**
- Window wise: the wise of the moving window
  - Max driving time in window: the max time allowed to drive in the window
  - Max driving time in Race: the max time allowed to drive during the whole race
  - Min driving time in Race: the min driving time


**Note:** You can override these values for each driver in the Edit Car view.


**Note:** A default class is automatically created and cannot be deleted. This default class is used by default if there is no class assigned to the car.


6.1.2. Edit cars



 Add a car

 Delete a car

 Save changes






 Discard changes




Drag a column header here to group by that column					
	Team	Color	Driver 1	Pit Posit...	In my
2	Envision Virgin Racing	Purple	Sam Bl...	Pit betw...	
3	Panasonic Jaguar Racing	#FF2...	Nelson...	Pit betw...	
4	Envision Virgin Racing	Purple	Robin F...	Pit betw...	
5	HWA RACELAB	#FF3F...	Stoffel...	Pit betw...	
6	GEOX DRAGON	White	Maximil...	Pit betw...	
7	GEOX DRAGON	White	José M...	Pit betw...	
8	NIO Formula E Team	Light...	Tom D...	Pit betw...	

## Car list

**Info:** Most of the time, depending of the timekeeper, the list of cars and drivers is automatically uploaded from the timing feed. So, it is not necessary to enter manually the whole entry list. It is better to wait for the first connection to the feed in order to get the list and then adjust some parameters if needed. If a car already exists in the list, information will be updated by the feed but a car or a driver will never be deleted.

		
Car number	5	
Team	Porsche Penske M...	
Class	HYPERCAR	
Color	 #FFA589C7	
Custom Color		
Pit position	FL_IN_PIT_OUT	
In my team	<input type="checkbox"/>	
Enemy to follow	<input checked="" type="checkbox"/>	
Watch	<input checked="" type="checkbox"/>	
Tyre manufacturer	M	

## Car properties

- Car number
- Team
- Class: if the class name is recognised among the RaceCTRL class list, then the class parameters are applied to this car.
- Color
- Custom color: This color is only applied to the current RaceCTRL instance. It is not shared to all connected clients. You can reset the custom color to get back to the global color by clicking the square button on the right  and then click on the *command Reset custom car color*.
- Pit position: 2 options possible depending of the position of the pitbox in the pitlane: IN\_CH-PIT\_OUT (default) or IN\_PIT\_CH\_OUT (note that when IN and OUT are in the same lap, which is very rare, it is automatically detected and the option is no longer available).
- In my team: Add a blue arrow on highlighting this car on the track map
- Enemy to follow: Add a red arrow highlighting this car on the track map
- Watch: this tag is used to restrict the race projection calculation, only car tagged will be calculated.






## Drivers' properties

- Name
- Short name
- Class (category, not used yet)
- Order
- Is Used
- Color (default is the car color)




## Driving time limits:

- Window wise: the wise of the moving window
- Max driving time in window: the max time allowed to drive in the window
- Max driving time in Race: the max time allowed to drive during the whole race
- Min driving time in Race: the min driving time

		
Drivers	Drivers list	
[0]	Driver	
Name	Bruno SENNA	
Short Name	SEN	
Class		
Order	1	
Is Used	<input checked="" type="checkbox"/>	
Window size		
Max driving time in window		
Max driving time in race		
Min driving time in race		

## Car parameters (used for race projection)

- Laptime ref: Reference laptime (in seconds)
- Laps stint: Maximum number of laps possible for a full stint (range)
- Pitstop time: Standard pitstop time (in seconds pitlane time excluded)
- Last pitstop time: Last pitstop time (in seconds pitlane time excluded)

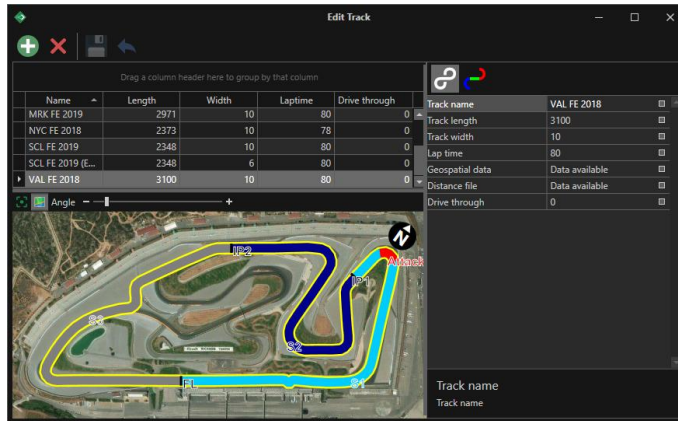
		
Laptime ref		<input type="checkbox"/>
Laps stint		<input type="checkbox"/>
Pitstop time		<input type="checkbox"/>
Last pitstop time		<input type="checkbox"/>

**Note:** If left empty, the value from the class will be used.  
If there is no class defined for that car, the default class value will be used. In the car list table, values displayed in grey are coming from the class:

110	38	88	28
105	47	68	28
104	47	68	28

**Info:** Cars properties are linked to the **event**. Any change during a session will change for the whole event.

### 6.1.3. Edit Tracks



Add a track



Delete a track



Save changes




Discard changes

Drag a column header here to group by				
Name	Length	Width	Laptime	Dr
MRK FE 2019	2971	10	80	
NYC FE 2018	2373	10	78	
SCL FE 2019	2348	10	80	
SCL FE 2019 (Event)	2348	6	80	
VAL FE 2018	3100	10	80	


#### Track list (with properties summary)

**Info:** The track followed by "Event" between brackets is the track that is used in the current event. This track could be different from the one "without brackets" because the track is saved in the event when creating it. If the track is changed later, it will not change the one stored in the event.

	
Track name	WEC Bahrain (Event) <input type="checkbox"/>
Track length	5412 <input type="checkbox"/>
Track width	10 <input type="checkbox"/>
Lap time	105 <input type="checkbox"/>
Geospatial data	Data available <input type="checkbox"/>
Distance file	Data available <input type="checkbox"/>
Distance file offset	20 <input type="checkbox"/>
IN	5372 <input type="checkbox"/>
OUT	400 <input type="checkbox"/>
Ratio Inlap	1 <input type="checkbox"/>
Ratio Outlap	1 <input type="checkbox"/>
Pitlane speed	60 <input type="checkbox"/>
Pitlane time	26,4 <input type="checkbox"/>
Pitlane IN time	2,4 <input type="checkbox"/>
Pitlane OUT time	24,0 <input type="checkbox"/>
Drive through	0,0 <input type="checkbox"/>
Track IN time	102,6 <input type="checkbox"/>
Track OUT time	81,0 <input type="checkbox"/>

### Track properties

- Name
- Track length
- Track width: minimum 2 m
- Lap time: Ref laptime used for the race projection
- Geospatial data: kml file (more detail in tutorials section 10.5)
- Distance data: .Dis file (more detail in tutorials section 10.5)
- Distance file offset: Offset (m) used to phase the .Dis file with the finish line.
- IN: Distance of the IN loop from the FL (start of the kml file)
- OUT: Distance of the OUT loop from the FL (start of the kml file)
- Ratio Inlap: Inlaptime / Laptime ratio
- Ratio Outlap: Outlaptime / Laptime ratio
- Pitlane speed: Pitlane speed limit
- Pitlane time\*: Time from IN to OUT in the pitlane
- Pitlane IN time\*: Time from IN to FL in the pitlane
- Pitlane OUT time\*: Time from OUT to FL in the pitlane
- Drive through\*: Time loss to drive through the pitlane (used to calculate the ghost position, see section 6.1.7)
- IN time\*: Time form FL to IN on track
- OUT time\*: Time from OUT to FL on track

	
Track sectors	<input type="checkbox"/>
[0]	<input type="checkbox"/>
Track Sector Name	FL <input type="checkbox"/>
Track Sector Type	Finish Line <input type="checkbox"/>
Track Sector Start	0 <input type="checkbox"/>
Track Sector Color	Black <input type="checkbox"/>
[1]	<input type="checkbox"/>
Track Sector Name	IP1 <input type="checkbox"/>
Track Sector Type	Intermediary <input type="checkbox"/>
Track Sector Start	1040 <input type="checkbox"/>
Track Sector Color	Black <input type="checkbox"/>

### Sector properties

- Track Sector Name
- Track Sector Type: Many types are possible
- Track Sector Start: Position of the sector in distance from the start of the kml file. For the "section" type, it is the start of the section.
- Track Sector End: Only for "section" type
- Track Sector Color

**Info:** You can add as many sectors as you wish by using the (+) at the top of the list. You can also remove a sector by using the red (x) of this sector.

**Note:** FL, IN and OUT are automatically created from track properties and are used for the race projection.

\* These values are automatically computed and displayed for verification purpose:

For cases A or B (see pitlane definition below):

Pitlane time = ( Distance OUT + Track length - distance IN ) / Pitlane speed

Pitlane IN time = ( Track length - distance IN ) / Pitlane speed

Pitlane OUT time = Distance / Pitlane speed

Drive through = ( Ratio Inlap + Ratio Outlap - 2 ) x Laptime

For case C (see pitlane definition below):

Pitlane time = ( Distance OUT - distance IN ) / Pitlane speed

Pitlane IN time = Pitlane time / 2

Pitlane OUT time = Pitlane time / 2

Drive through = ( Ratio Inlap + Ratio Outlap - 1 ) x Laptime

For Cases A, B or C (see pitlane definition below):

IN time = Ratio Inlap x Laptime - Pitlane IN time

OUT time = Ratio Outlap x Laptime - Pitlane OUT time

**Note:** It is more precise to use the distance IN and OUT measured in the pitlane. It could be sometime a bit different from the ones given by the timekeeper which are usually measured on track.

Pitlane definition:

#### Case A:

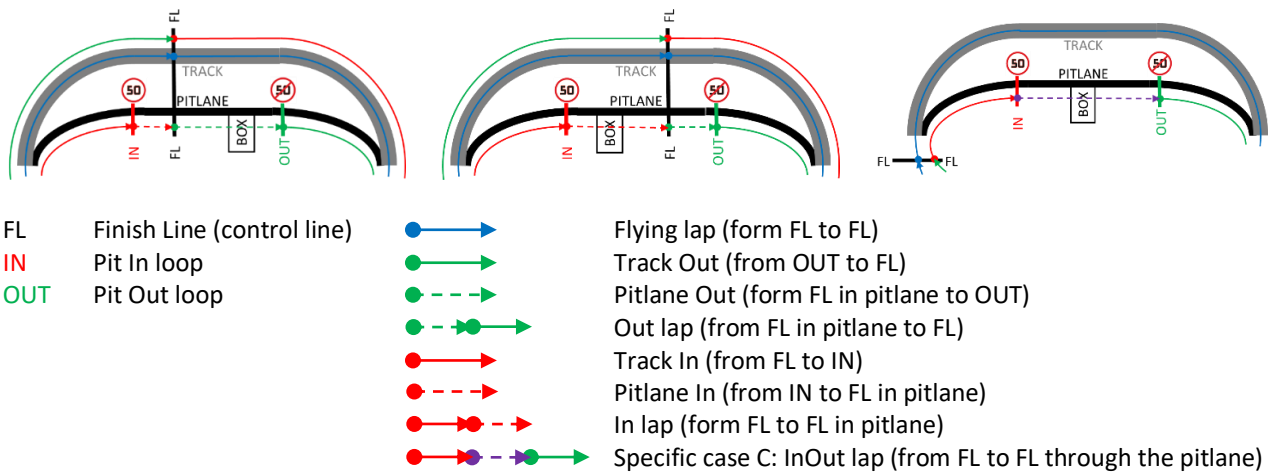
FL is between IN and OUT  
BOX is between FL and OUT

#### Case B:

FL is between IN and OUT  
BOX is between IN and FL

#### Case C:

FL is outside IN and OUT



**Note:** Case C is automatically detected in RaceCTRL

Distance IN > Distance OUT => Case A or B

Distance IN <= Distance OUT => Case C

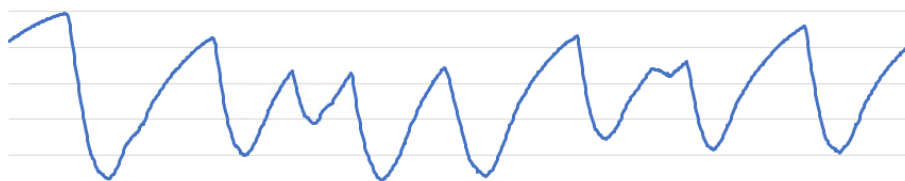
#### 6.1.4. Distance file (.dis)

A distance file (.dis) can be used with the definition of a track for a better estimation of the position and the speed of the cars on the track. The .dis file is a text file that contains the distance of the car on the track at a sampling rate of 10Hz.

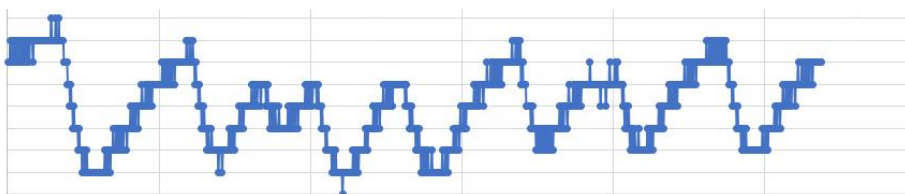
Here is an example of .dis file

```
1 0
2 7,17222222
3 14,37222222
4 21,59444444
5 28,84722222
6 36,125
7 43,41111111
8 50,73333333
9 58,075
```

The accuracy of the distance is important because RaceCTRL will calculate the speed of the car with the data contain in this file. You should check the distance derivative to make sure that the .dis file can be used in RaceCTRL.

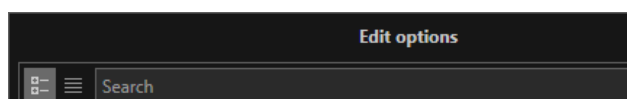


*The derivative is fine, the file can be used in RaceCTRL*



*The derivative shows a lack of precision, the file cannot be used in RaceCTRL*

#### 6.1.5. Options



Web API	
Web API host address	localhost
Web API host port	9000
Enabled web API	<input checked="" type="checkbox"/>

### Web API

More details in section 8

Strategy	
Strategy engine type	Not Defined <input type="checkbox"/>

### Strategy

More details in section 8

Messages	
Green keywords	green, open
Yellow keywords	yellow, safety car
Red keywords	red, closed
Checkered keywords	checkered flag
FCY keywords	full course yellow
SC keywords	safety car

### Messages

Keywords used by RaceCTRL to decode the messages received from the race director.

Export	
Timing data export	Timing data export config list (1)
[0]	Timing data export for car 23
Car number	23
Export file path	C:\Users\chris\Desktop\export.csv
Enable export	<input type="checkbox"/>

### Export for TeamDB

This function allows to export lap times as a lap report for each chosen car. These lap reports can be imported into TeamDB for automatic lap creation. Add a new export by using the (+) at the top of the list (you can delete an export by using the red (x)) Set the car number and the output file path. You can disable an export by unchecking Enable export without losing the setup.

Misc	
Follow current session	<input type="checkbox"/>
Use short name	<input checked="" type="checkbox"/>

### Follow current session

When connected to a server, it is possible to change the current session even during a live session. You can enable the session following. When this option is activated, you cannot change the current session manually anymore. The session will change automatically depending on the Host Server session.

### Use short name

You can display the drivers short name provided by the feed or enter manually from Edit Car. This short name will be displayed everywhere the car number appears: graphs legends, race planner, car selection... but also as a new column in the leaderboard or histo laps view.

Calculation parameters	
Moving average lap count	10
Moving average delta laptime (s)	15

### Calculation parameters

- Moving average lap count: Used for the race projection and displayed in the leaderboard.  
- Moving average delta laptime: Used to exclude automatically laps greater than laptime ref + delta laptime.

**Note:** Laptime ref is the ref of the car or the ref of the class or the ref of the circuit, in this order.

Reference GPS position	
Enable GPS receiver	<input type="checkbox"/>

### Reference GPS position

See section **Error! Reference source not found.** for more info on GPS correction.

## 6.1.6. Server options

Edit server options	
<input type="checkbox"/>	Search

Communication	
Port	5598
URI	RaceCTRLRemote
Max buffer pool size	536870912
Use raw messages	<input checked="" type="checkbox"/>
Max parallelism	4

### Communication

- Port: TCP Port used for client connection.
- URI: Server URI used for client connection.
- Max buffer pool size (bytes).
- Use raw messages: Allows raw message to clients.
- Max parallelism: For messages to clients.

Miscellaneous	
Minimum version	2.6.1

### Miscellaneous

- Minimum version: Minimum version for a client to be able to connect to the server.

Media recording	
Enable media recording	<input checked="" type="checkbox"/>
Silence detection threshold (dB)	-60
Minimum silence duration (s)	2
Minimum audio duration (s)	0.5
Records path	C:\Users\chris\AppData\Local\...
Analysis parallelism	4
Enable Speech-to-text	<input type="checkbox"/>
Speech-to-text sampling rate	8kHz

### Media recording

- Enable media recording
- Silence detection threshold: Level in db under which the audio is detected as a silence (must be negative).
- Minimum silence duration: Minimum time for a silence to be set as a silence.
- Minimum audio duration: Minimum time for a non-silence part to be set as non-silence.
- Record path: see section 7.3 for info on media folder.
- Analysis parallelism: For audio analysis.
- Enable Speech-to-text: See section 0
- Speech-to-text sampling rate: See section 0

Database	
Path	C:\Users\chris\AppData\Local\...

### Database

You can use several databases and change here.

Session	
Enable AutoSession	<input type="checkbox"/>

### Session

RaceCTRL can automatically create new sessions by detecting session change in the timing feed.

## 6.1.7. Ghost cars

**Ghost cars** are virtual cars displayed at a delayed time behind the real cars. You can add one or more ghosts per real car. The time delay is computed as the **drive through** value of the track plus a custom time offset for each ghost.

The base ghosts' definition is done on car classes, in the "ghost" tab:

The screenshot shows the 'ghost' tab in the RaceCTRL interface. On the left, there's a table of car classes with columns: Name, Short Name, La..., La..., Sti..., Pit..., La..., C..., C..., Dr..., M..., M..., M..., and M... The table lists 'Default', 'Hypercar', 'LMGT3', and 'LMP2'. On the right, the 'Class ghosts' configuration is shown. It has a list of ghosts with columns: Short Name, Icon, and Time offset. The first ghost is 'Fuel' with a time offset of 10. The second ghost is 'Tyres' with a time offset of 15. The third ghost is 'ABC' with a time offset of 30. There are buttons to add (+) and remove (X) ghosts.

Add a ghost with the button. Remove a ghost with the button. Give it a short name (5 characters max) and choose an icon.



Define the time offset, it is added to the “drive through time” of the track:

WEC Fuji (Event)	4563	10	80	29,22
WEC LeMans	13626	15	200	33,06
WEC LeMans (ss corner)	13626	10	200	33,06
WEC Monza	5793	10	80	25,08
WEC Portimao	4653	10	90	28,62
WEC Sebring	6019	10	100	33,48
WEC Spa Francorchamps	7004	10	120	26,16
WEC Spa Francorchamps (ss corner)	7004	10	120	26,1

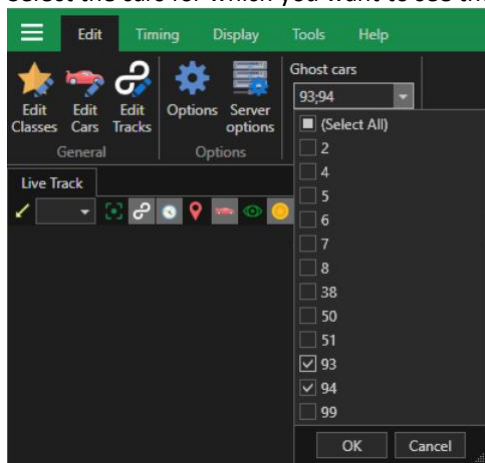
  


IN	4526	<input type="checkbox"/>
OUT	450	<input type="checkbox"/>
Ratio Inlap	1,05	<input type="checkbox"/>
Ratio Outlap	1,05	<input type="checkbox"/>
Pitlane speed	60	<input type="checkbox"/>
Pitlane time	29,22	<input type="checkbox"/>
Pitlane IN time	2,22	<input type="checkbox"/>
Pitlane OUT time	27,0	<input type="checkbox"/>
Drive through	8,0	<input type="checkbox"/>
Track IN time	81,78	<input type="checkbox"/>
Track OUT time	57,0	<input type="checkbox"/>

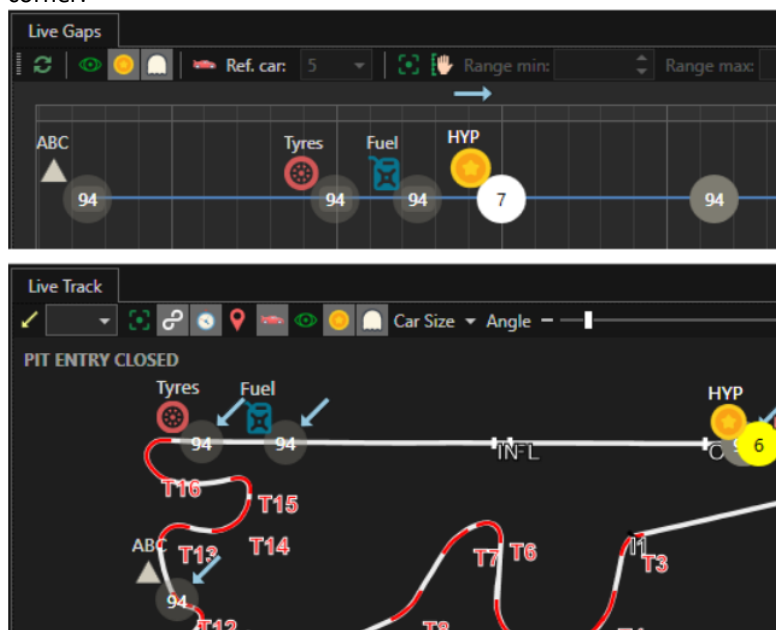
The time offset can be overridden for each car in the “ghost” tab if needed (an empty cell means no override, take the value defined on the class):

Ghosts times		<input type="checkbox"/>
[0]	Ghost Fuel	<input type="checkbox"/>
Time offset	5	<input type="checkbox"/>
[1]	Ghost Tyres	<input type="checkbox"/>
Time offset		<input type="checkbox"/>
[2]	Ghost ABC	<input type="checkbox"/>
Time offset	20	<input type="checkbox"/>

Select the cars for which you want to see the ghosts in the main toolbar:



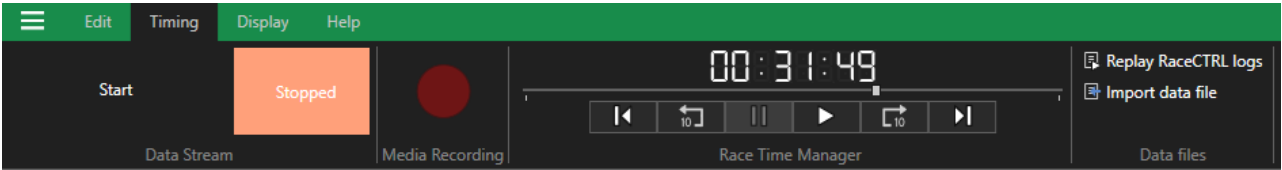
Enable the ghosts display on Live Gaps and Live Track with the  button on their toolbar. The ghosts are shown with the same color as the real car with transparency. The ghost name and icon are shown on the upper left corner:



Ghosts' positions are calculated like this:

- On the Live Gaps view, the time offset (including the drive through time) is subtracted to the real car position.
- On the Live Track view, 2 methods are used:
  - In "estimated position" mode, the ghosts' positions are estimated like the real car but with the time offset (including the drive through time) subtracted to the race time.
  - In "GPS" mode, a reference lap is used to set the GPS position of each ghost from the current position of the real car and going back in time the value of the time offset (including the drive through time). The reference lap is chosen from the 5 faster laps and with the most GPS positions to avoid the laps which may have had a loss of GPS data. The ghost's position in GPS mode isn't available on the first lap(s), until a suitable reference lap is found.

6.2. Timing



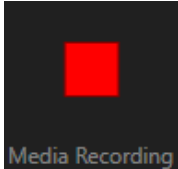


6.2.1. Data Stream

	Not connected. Press <b>start</b> to connect
	This message appears while trying to connect. If it is too long, you can click on the LHS to cancel.
	If the current session is not empty (no timing data), this message arises. You need to confirm that you want to override the current data. It could happen if you try to reconnect after a problem and the session is not finished.
	If some <b>media</b> are set and enable in the configuration of the event, this message appears. You need to confirm that you want to start the automatic recording of all the media of the event (more details in section 7).
	Connected! Press <b>stop</b> to disconnect
	You will be asked to confirm that you want to stop the data streaming. <b>Note:</b> Stream is automatically stopped when the session is finished.
	If some media is being recorded, when the data stream is stopped, a dialog box asks a confirmation to stop the recording.

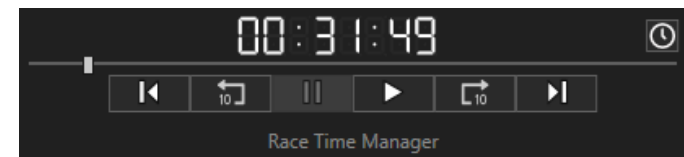
See section 11 for more info on Timing feeds.

6.2.2. Media Recording

	If there is no media set and enable in the event configuration, the button is inactive.
	<p>When at least one media is set and enable, the button is active.</p> <p>You can <b>start</b> recording manually by clicking on this record button. All the media of the event will be recorded.</p> <p><b>Note:</b> Media recording can also be started automatically when starting the data stream.</p>
	<p>The button turns square when recording.</p> <p>You can <b>stop</b> recording manually by clicking on the button.</p> <p><b>Note:</b> When the data stream is stopped, a dialog box asks a confirmation to stop the recording. Media recording is automatically stopped when the session is finished.</p>










See **Media Streams** in section 7 for more details.

6.2.3. Race Time Manager

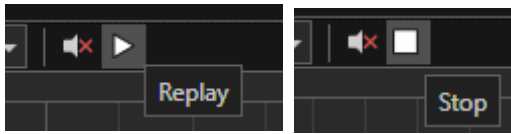


The **Race Time Manager** allows to move in time to see the timing data and the media at any point of the race. You can also replay a race from anytime using **Play** after having chosen the starting point with the **transport bar**.

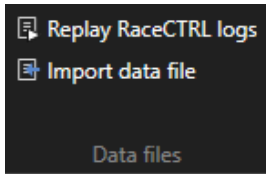
**Note:** All this is also possible during a live session but, in this case, using the **Play** button will put the session back to live.

	Race time
	Transport bar
	Back to start
	Back 10 seconds
	Pause
	Play
	Forward 10 seconds
	Forward to end
	Set the race time at a specific value

**Note:** While recording a live session, the video or audio players can replay the recorded media when session is paused. A “Replay” button appears on the toolbar of the players. Click on it to play the media from the transport bar position to the end of the record. Click again on the button to stop :

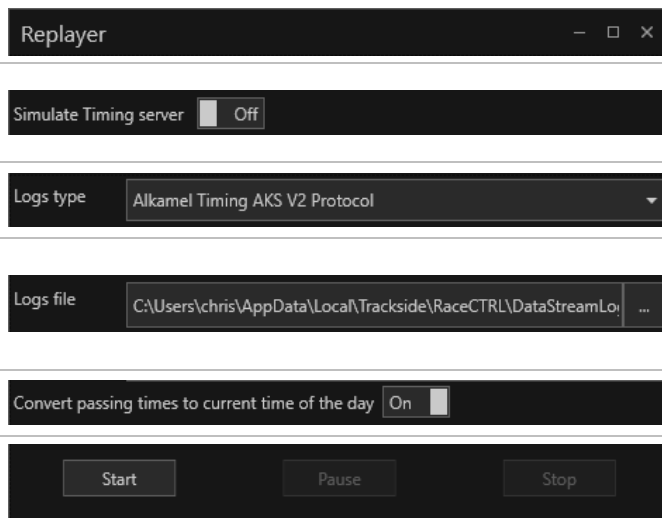


#### 6.2.4. Data files



##### Replay RaceCTRL logs

When RaceCTRL reads a data stream, it stores the feed in a file called a **RaceCTRL log**. This functionality allows you to replay a session with this log.



The replayer can be used to simulate an Alkamel server and replay the Alkamel V2 stream synchronously with all the other data of RaceCTRL.

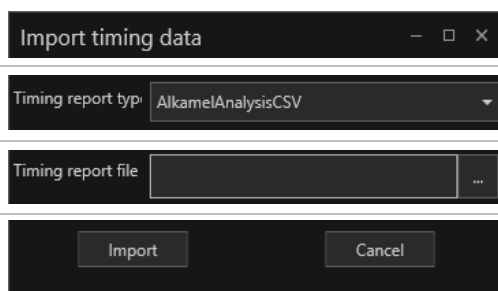
**Log type:** Timing protocol

**Log file:** location of the file  
Logs are stored in :  
C:\Users\youruser\AppData\Local\Trackside\RaceCTRL\DataStreamLogs\sessionname

This option has been added in order to replace all the passing times with the current date time.

##### Import data file

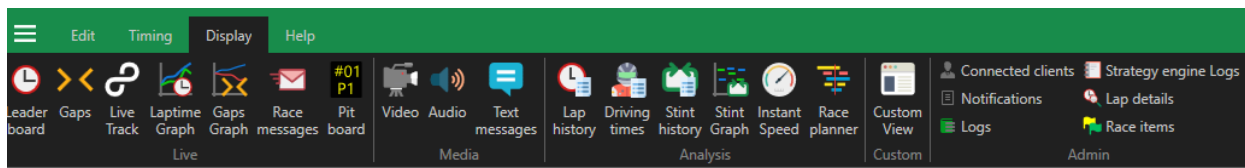
Allow to import a file in order to create the data for a session, instead of reading a data stream.



**Timing report type**  
Only Alkamel is providing this kind of reports for now.

**Timing report file:** location of the file

## 6.3. Display



### 6.3.1. Leaderboard

Leaderboard		Ideal lap time: 01:00.597																									
S.	N.	Driver	Team	Lap...	Last Lap	Moving A...	Best Lap	Ideal Lap	Gap	Diff	Pits	S1	Best S1	S2	Best S2	S3	Best S3	225kW...	250k...								
1	94	Pascal WEHRLEIN	MAHINDRA R...	16	01:01.998	01:01.810	01:01.112	01:01.021			1	14.725	14.405		28.018		18.598	✓									
2	22	Oliver ROWLAND	Nissan e.dams	16	01:01.855	01:01.782	01:01.206	01:01.100	0.511	0.511	1	14.455	14.213		28.193		18.694	✓									
3	11	Lucas DI GRASSI	Audi Sport Abt...	15	01:02.102	01:01.914	01:01.277	01:01.159	1.654	1.143	1	14.666	14.215	28.309	28.221	19.127	18.723	✓									
4	23	Sébastien BUEMI	Nissan e.dams	15	01:01.647	01:02.171	01:01.557	01:01.145	4.247	2.593	1	14.323	14.271	28.377	28.149	18.947	18.725	✓									
5	28	Antonio Felix DA CO...	BMW i ANDRE...	15	01:01.794	01:02.366	01:01.463	01:01.249	5.573	1.326	1	14.374	14.219	28.374	28.261	19.046	18.769	✓									
6	19	Felipe MASSA	Venturi Formul...	15	01:01.837	01:02.293	01:01.557	01:01.383	6.243	0.670	1	14.360	14.286	28.465	28.374	19.012	18.723	✓									
7	48	Edoardo MORTARA	Venturi Formul...	15	01:01.968	01:02.306	01:01.441	01:01.387	6.844	0.601	1	14.506	14.316	28.447	28.330	19.015	18.741	✓									
8	36	André LOTTERER	DS TECHEETAH	15	01:02.281	01:02.466	01:01.603	01:01.251	8.224	1.380	1	14.601	14.177	28.650	28.360	19.030	18.714	✓									
9	64	Jérôme D'AMBROSIO	MAHINDRA R...	15	01:02.157	01:02.468	01:01.450	01:01.287	8.766	0.542	1	14.543	14.206	28.521	28.336	19.093	18.745	✓									
10	25	Jean-Eric VERGNE	DS TECHEETAH	15	01:02.674	01:02.609	01:01.217	01:01.217	10.038	1.272	1	14.585	14.323	28.944	28.106	19.145	18.788	✓									
11	20	Mitch EVANS	Panasonic Jag...	15	01:02.253	01:02.599	01:01.397	01:01.377	10.367	0.329	1	14.499	14.168	28.565	28.354	19.189	18.855	✓									
12	16	Oliver TURVEY	NIO Formula E...	15	01:02.419	01:02.696	01:01.491	01:01.397	11.280	0.913	1	14.606	14.307	28.619	28.327	19.194	18.763	✓									
13	7	José Maria LOPEZ	GEOX DRAGON	15	01:02.370	01:02.564	01:01.577	01:01.443	11.613	0.333	1	14.574	14.153	28.748	28.511	19.048	18.779	✓									
14	4	Robin FRIJNS	Envision Virgin...	15	01:02.166	01:02.779	01:01.573	01:01.326	12.067	0.454	1	14.288	14.139	28.666	28.523	19.212	18.664	✓									
15	2	Sam BIRD	Envision Virgin...	15	01:02.296	01:02.644	01:01.522	01:01.508	12.458	0.391	1	14.487	14.279	28.524	28.457	19.285	18.772	✓									
16	66	Daniel ABT	Audi Sport Abt...	15	01:02.691	01:02.476	01:01.381	01:01.140	13.296	0.838	1	14.468	14.408	29.453	27.962	18.770	18.770	✓									
17	5	Tom DILLMANN	NIO Formula E...	15	01:02.397	01:02.779	01:01.514	01:01.364	14.369	1.073	1	14.563	14.367	28.683	28.277	19.151	18.720	✓									
18	27	Alexander SIMS	BMW i ANDRE...	15	01:02.761	01:02.424	01:01.233	01:00.950	16.022	1.653	3	14.055	14.055	28.394	28.114	18.781											
19	5	Stoffel VANDORNE	HWA Racelab	15	01:02.060	01:02.407	01:01.154	01:01.074	18.064	2.042	2	14.644	14.371	28.596	28.123	18.580	✓	✓									
20	6	Felipe NASR	GEOX DRAGON	15	01:03.280	01:03.117	01:01.518	01:01.500	19.300	1.236	1	14.756	14.274	28.801	28.525	18.701											
21	17	Gary PAFETT	HWA Racelab	15	01:02.882	01:02.586	01:01.745	01:01.627	19.947	0.647	1	14.714	14.465	28.851	28.373	18.789											
22	3	Nelson PIQUET	Panasonic Jag...	3	01:02.932	01:07.085	01:02.932	01:02.529	26.502	6.555	0	14.694	14.694	28.679	28.679	19.156											

This classic **Leaderboard** is highly customisable as all the “spreadsheet type” views of RaceCTRL (see section 5.3 for more details).

Formatting rules:

White	Default
Yellow	Last lap or sector
Blue	Personal best
Purple	Overall best

Sector analysis:

**Best sector** times are calculated for each car and sector, they can be displayed in the **leaderboard**.

From this info, RaceCTRL calculate the **ideal lap** time of each car = sum of the best sectors of that car.

And the **overall ideal lap** time = sum of the overall best sectors.

Moving average:

A **moving average** is calculated for each car and can be displayed in the **leaderboard**.

The number of laps used for this calculation can be set in *Edit > Options*



**Note:** Only laps with the “is used” properties are used (see “lap history” in section 0).

**Note:** You can access to this information from the Web API when calling CarResult or CarResults methods (see “Web API” in section 8).

Specific Formula E (Alkamel protocol):

You can display **power modes** the **leaderboard** (see “Alkamel feed” in section 11.1).

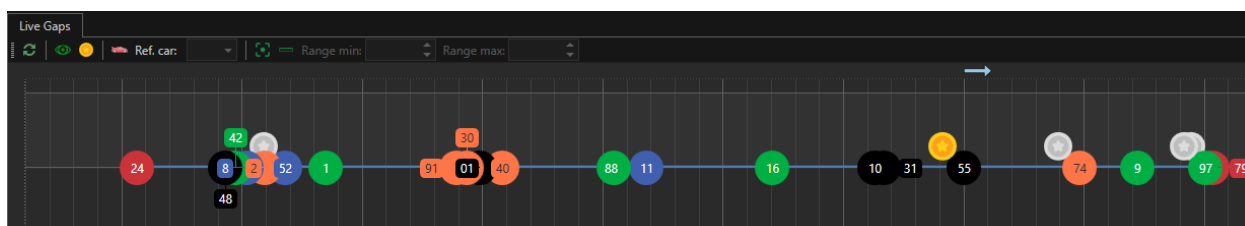
Ideal lap time: 01:00.597																			
S...	N...	Driver	Lap...	Last Lap	Best Lap	Moving Avg	Ideal Lap	Gap	Diff	Pits	S1	Best S1	S2	Best S2	S3	Best S3	225kW...	250k...	
	94	Pascal WEHRLEIN	24	01:02.353	01:01.112	01:02.255	01:01.021				1	14.876	14.405	28.406	28.018	19.071	18.598	<input checked="" type="checkbox"/>	<input type="checkbox"/>
	22	Oliver ROWLAND	24	01:02.099	01:01.206	01:02.251	01:01.100	0.709	0.709	1	14.519	14.213	28.503	28.193	19.077	18.694	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
	11	Lucas DI GRASSI	24	01:02.134	01:01.277	01:02.203	01:01.159	1.277	0.568	1	14.601	14.215	28.462	28.221	19.071	18.723	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
	23	Sébastien BUEMI	24	01:02.037	01:01.557	01:01.997	01:01.145	2.765	1.488	1	14.464	14.271	28.420	28.149	19.153	18.725	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
	28	Antonio Felix DA C...	24	01:02.169	01:01.463	01:02.043	01:01.249	3.893	1.128	1	14.428	14.219	28.656	28.261	19.085	18.769	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
	19	Felipe MASSA	24	01:01.818	01:01.557	01:02.055	01:01.383	5.519	1.626	1	14.401	14.286	28.401	28.374	19.016	18.723	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
	48	Edoardo MORTARA	24	01:03.019	01:01.441	01:02.204	01:01.387	7.224	1.705	1	14.434	14.316	29.413	28.330	19.172	18.741	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
	36	André LOTTERER	24	01:01.962	01:01.603	01:02.107	01:01.251	8.518	1.294	1	14.492	14.177	28.524	28.360		18.714	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
	64	Jérôme DAMBROS	24	01:02.098	01:01.458	01:02.087	01:01.387	0.124	0.516	1	14.411	14.206	28.565	28.226		18.745	<input checked="" type="checkbox"/>	<input type="checkbox"/>	

**Warning:** You can play with the sorting but, if you want to get the current classification, you need to sort the column "Pos" ascending.

Depending on the data provided by the feed, you can also display the micro sectors and best micro sectors.

SCL2	TV1	IP1	TV2	IP2	TV3	Best SCL2	Best TV1	Best IP1	Best TV2	Best IP2	Best TV3
9.897	6.741	7.396				9.828	6.606	7.374	13.067	10.998	11.558
10.947	6.926					9.962	6.524	7.380	13.253	11.112	11.588
10.150	6.693	7.603				10.085	6.510	7.507	13.127	11.197	11.580
10.097	6.698					10.009	6.646	7.457	13.170	11.105	11.713
10.201						9.977	6.545	7.419	13.012	11.228	11.598
10.360						9.907	6.525	6.995	12.937	11.063	11.650
10.140	6.906	7.840	13.351	11.280	11.713	9.921	6.698	7.491	12.899	11.058	11.598

### 6.3.2. Gaps

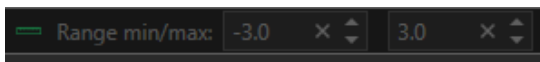


Displays the relative position of cars in line. This is an alternative, more precise, to the live track. Positions are computed with timing loops (Finish line and sectors).

A picto is displayed on each car class leader for the Live Track and Live Gap views. The race leader is flagged with a gold star while the other car class leaders are flagged with a silver star.

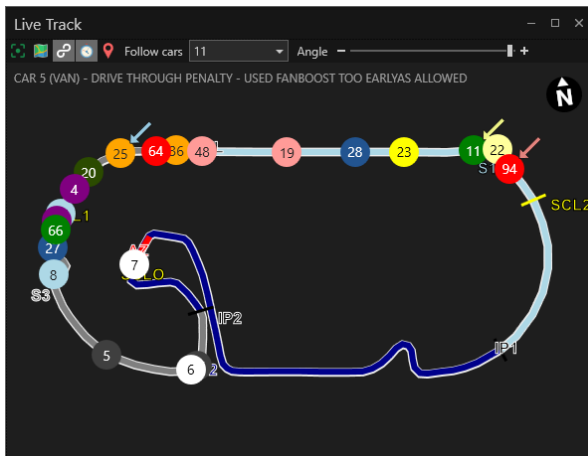
For a clearer reading, we display the car class short name. This short name can be configured from the Edit Classes view.

Live Gaps	
	Refresh
	Shows only watched cars.
	Displays the race leader, the class leader concerning my team, the cars flagged in my team and the safety cars (if available).
Ref. car: 7	<b>Ref. car</b> In order to define which car will be at the "0" position. If no car is set RaceCTRL uses the leader.
	After a dynamic zoom (shift + mouse) you can reset the zoom to come back to, or the overall range, or the <b>manual range</b> , depending which one is in use.
Range min/max: -3.0 x 3.0	<b>Manual range</b> enable.



**Manual range** disable. When the **manual range** is disable, the zoom is automatic to display the whole data.

### 6.3.3. Live Track



#### Live Track



Best fit of the track map in the view.  
**Note:** You can zoom/unzoom with the mouse wheel.



Show/hide the cartographical background:



Show/hide the trace of the circuit layout.



Position of cars on track = calculated position (loops + speed profile).



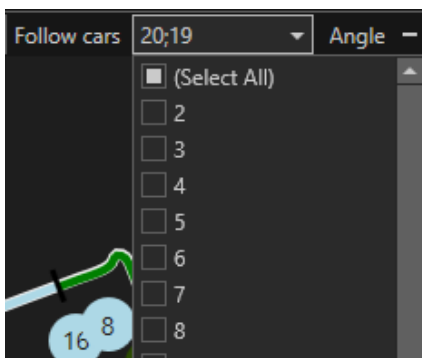
Position of cars on track = GPS positions (when available).



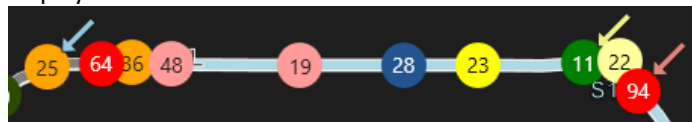
Shows only watched cars.



Displays the race leader, the class leader concerning my team, the cars flagged in my team and the safety cars (if available).



It is possible to follow some cars on track. The cars to follow will be displayed with a coloured arrow on the track:



= "In my team"
 = "Enemy"
 = "Temporary" car  
 "In my team" and "Enemy" cars are setup in *Edit > Edit Cars* (see section 6.1.1).

"Temporary" cars are selected directly on the live track view. These cars will always be shown, even if "Show only watched cars" or "Display the leader(s)" are checked.





Use the angle bar to adjust the map rotation. The rotation angle is saved in the current layout. The compass will display the North:

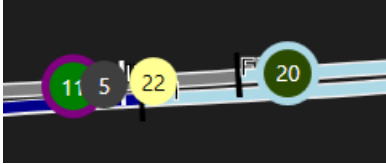


CAR 5 (VAN) - DRIVE THROUGH PENALTY - U

The last message from the race director is displayed top left.

Retired cars are not displayed on the Live Track.

Specific **Formula E** (Alkamel protocol):



The current power mode of the cars is displayed with a halo of colour around the car number.

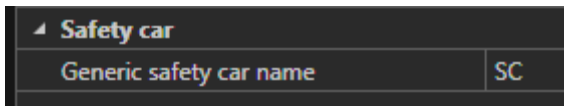
Cyan for "attack mode" and magenta for "fanboost".

**Note:** In the Alkamel data stream, the information of "attack mode" or "fanboost" is only available when full throttle. The display follows this.

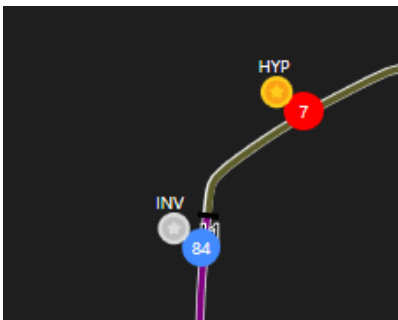
Safety cars:



When available in the data stream, the safety cars are shown on the Live Track while the "SC" status is active. They're shown in red with a yellow halo around them.



You can set a "generic" safety car name in the data stream config if it doesn't include the full name of the safety cars (usually when only one safety car is present). You must set it to the exact name used in the data stream.



A picto is displayed on each car class. The race leader is flagged with a gold star while the other car class leaders are flagged with a silver star.

For a clearer reading, we display the car class short name. This short name can be configured from the Edit Classes view.






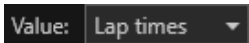
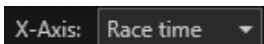
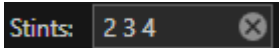


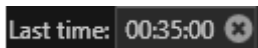


### 6.3.4. Laptime Graph



Shows laptimes, sector times or speeds of all cars. X-axis can be laps, sorted or racetime.

Lap times / Race time

Title depending on the value and axis type selected.

	Refresh
	Show/hide the caption (list of cars).
	<p>Enable/disable <b>global selection</b>.</p> <p>The <b>global selection</b> is a common selection of cars used by all the <b>laptime graphs, gaps graph or stints graphs</b> with this option enabled. There is only one <b>global selection</b> in the whole application for the cars, and another one for the drivers.</p> <p>When the <b>global selection</b> is used, "Global selection:" is shown above the caption.</p>
	Shows only watched cars.
	<p>Switches between "cars" and "drivers" selection modes. In "drivers" mode, the selection shows all drivers for each car as "Car number - Driver short name". The drivers' selection is saved independently from the car's selection. By default, the drivers have the same color as their car but you can set a specific color for each driver in the "Edit car" window.</p>
	<p><b>Value</b></p> <p>Selection of the value to display. The values available depend on the timing feed but the most common are: Lap times, Sector times, Micro sector times and Speeds.</p>
	<p><b>X-Axis</b></p> <p>Race time, Lap number, Sorted or Raising average. With the "Raising average" option, the times (or speeds) are sorted and an average of the "N" better laps is computed, "N" being the number of laps shown on the X axis.</p>
	<p><b>Stints</b></p> <p>Stints numbers to show. The laps who belong to other stints will be hidden (and ignored in "sorted" or "raising average" modes). Clear this filter to show all laps.</p>
	After a dynamic zoom (wheel mouse or shift + mouse) you can reset the zoom to come back to, or the overall range, or the <b>manual range</b> , depending on which one is in use.
	<p><b>Manual range</b></p> <p>On/off button.</p>
	<p><b>Manual range</b></p> <p>X axis: shows the last 35 min (for example)</p>
	<p><b>Manual range</b></p> <p>Y axis min/max: scale from 1:10 to 1:30 (min/s) (for example)</p> <p><b>Note:</b> Manual range values can be changed with up/down arrows and cleared with the x button.</p>
	<p><b>Set default scale</b></p> <p>Sets a default Y scale in manual range mode. It is computed from the reference lap time of the slower and faster classes in the event. If no reference lap time is found, the one from the track is used. A +/-2% margin is applied on the results.</p>

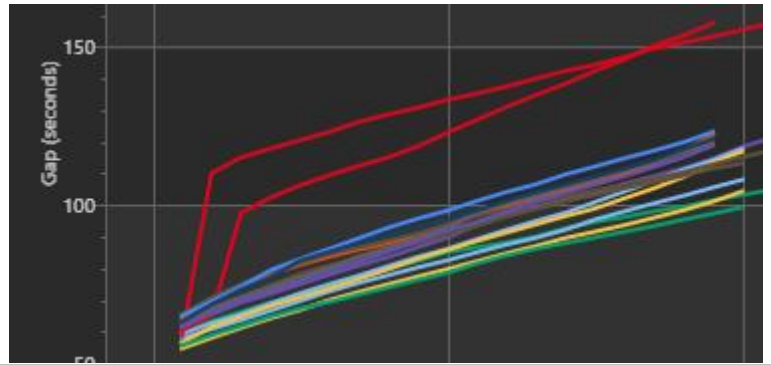
**Note:** A car or driver can be selected in the graphs by clicking on the trace or in the caption. The trace will then be shown in bold. Click anywhere else to unselect the car or driver.

6.3.5. Gaps Graph



Shows gaps between cars, for the whole race.

	Refresh
	Show/hide the caption (list of cars).
	Enable/disable <b>global selection</b> . The <b>global selection</b> is a common selection of cars used by all the <b>laptime graphs, gaps graph or stints graphs</b> with this option enabled. There is only one <b>global selection</b> in the whole application. When the <b>global selection</b> is used, "Global selection:" is shown above the caption.
	Shows only watched cars.
	Show or hide the extrapolation.
	<b>Reference car</b> The reference car is the car form which the gaps are calculated. It can be the leader or any cat in the list.
	<b>Reference time</b> In place of a reference car, it is possible to set a reference time (a virtual car with a constant laptime). Select "time" from the drop-down list, this will enable the time edit box.



After a dynamic zoom (mouse wheel or shift + mouse) you can reset the zoom to come back to, or the overall range, or the **manual range**, depending which one is in use.



#### Manual range

On/off button.



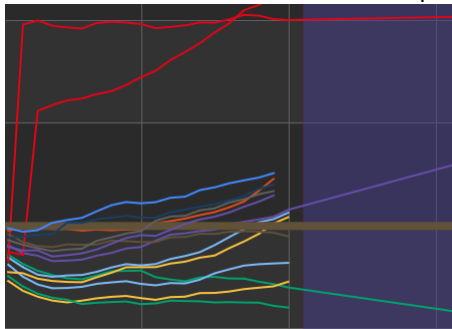
#### Manual range

Y axis min/max: scale from 01:00:00 to 03:23:20 (for example)

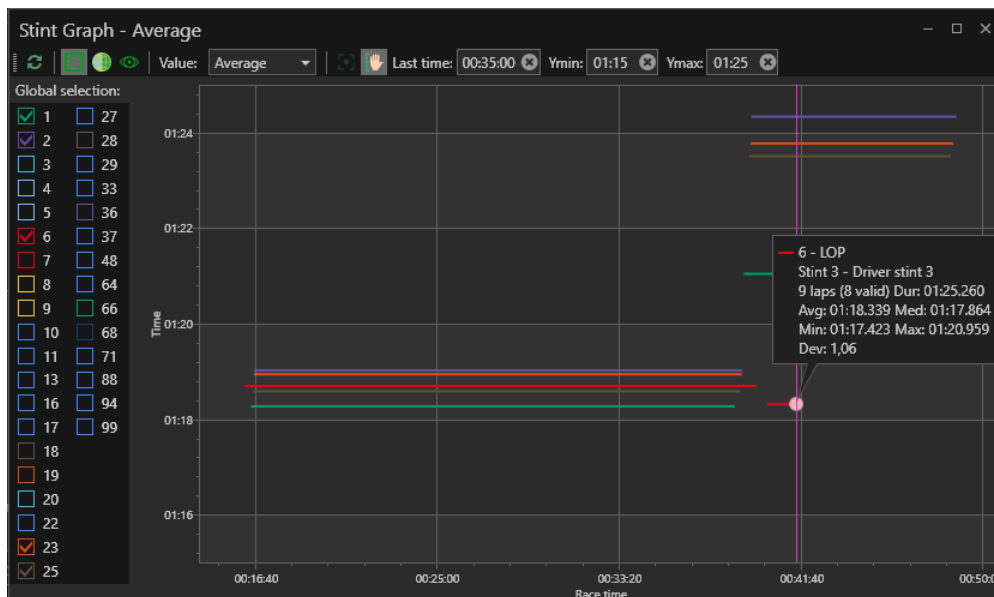
**Note:** Manual range values can be cleared with the x button.

**Note:** A car can be selected in the graphs by clicking on the trace or in the caption. The trace will then be shown in bold. Click anywhere else to unselect the car.








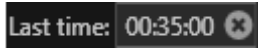

**Note:** The gaps graph displays a blue background starting at the first extrapolated lap of the reference car (if any) to show that values are from the race prediction calculation, so not real data:



### 6.3.6. Stints Graph



Shows the stints for each car with values computed from the laptimes.

<b>Stint Graph - Average</b>	Title depending on the value type selected.
	Refresh
	Show/hide the caption (list of cars).
	<p>Enable/disable <b>global selection</b>.</p> <p>The <b>global selection</b> is a common selection of cars used by all the <b>laptime graphs, gaps graph or stints graphs</b> with this option enabled. There is only one <b>global selection</b> in the whole application.</p> <p>When the <b>global selection</b> is used, "Global selection:" is shown above the caption.</p>
	Shows only watched cars.
	<p><b>Value type</b></p> <p>The value shown in the graph can be selected from:</p> <ul style="list-style-type: none"> <li>- The average of laptimes,</li> <li>- The median laptime,</li> <li>- The minimum laptime,</li> <li>- The maximum laptime,</li> <li>- The standard deviation of laptimes.</li> </ul>
	After a dynamic zoom (mouse wheel or shift + mouse) you can reset the zoom to come back to, or the overall range, or the <b>manual range</b> , depending which one is in use.
	<p><b>Manual range</b></p> <p>On/off button.</p>
	<p><b>Manual range</b></p> <p>X axis: shows the last 35 min (for example)</p>
	<p><b>Manual range</b></p> <p>Y axis min/max: scale from 1:15 to 1:25 (min/s) (for example)</p> <p><b>Note:</b> Manual range values can be changed with up/down arrows and cleared with the x button.</p>

**Note:** A car can be selected in the graphs by clicking on the trace or in the caption. The trace will then be shown in bold. Click anywhere else to unselect the car.

### 6.3.7. Race messages

Race messages	
00:00:23 CAR 7 (LOP) - UNDER INVESTIGATION - PIT ENTRY LINE CROSSING	
Received time	Message
22:11:32	JAGUAR RACING RADIO CHECK
23:03:47	GREEN FLAG
23:07:05	YELLOW AT TURN 14
23:07:34	FULL COURSE YELLOW
23:08:06	RED FLAG
23:24:00	CARS 7 (LOP), 6 (NAS) AND 16 (TUR) - UNDER INVESTIGATION - CUTTING CHICANE
23:26:02	CARS 36 (LOT), 64 (DAM) AND 48 (MOR) UNDER INVESTIGATION - OVERTOOK UNDER FCY
23:26:23	RACE WILL RE-START AT 16:34:30
23:31:41	ESTIMATED END OF THE RACE 17:15

Shows the race messages.

## Race messages



It is possible to print or export the race messages list.



Allows to set the race time on the timing bar to the race time of the selected message.

00:00:23

CAR 7 (LOP) - UNDE

The last race message is displayed bigger at the top of the view.

Received time	
22:11:32	JAGUAR RACING RADIO CHECK
23:03:47	GREEN FLAG
23:07:05	YELLOW AT TURN 14
23:07:34	FULL COURSE YELLOW
23:08:06	RED FLAG
23:24:00	CARS 7 (LOP) 6 (NAS) AND 16 (TUR)

Like all the “spreadsheet type” views of RaceCTRL, the race message table is highly configurable (see section 5.3 for more details). For example, it is possible to sort the data, apply powerful filters or make a search.

**Note:** The keywords used to colorize the messages can be customized into the *Edit > Options*

Messages	
Green keywords	green
Yellow keywords	yellow
Red keywords	red flag
Checkered keywords	checkered flag
FCY keywords	full course yellow
SC keywords	safety car
Car highlight keywords	car,penalty,investigation,limit

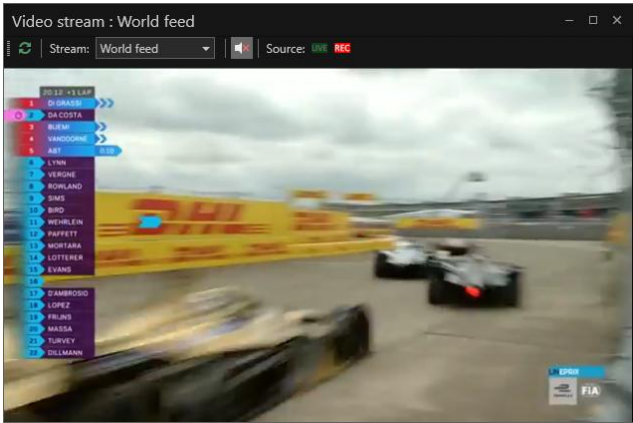
The parameter “Car highlight keywords” is used to find car numbers inside the race messages and display a colored cell on the message line: blue if a car “in my team” has been found or red for a car “enemy to follow”:

11:53:23	WARNING FLAG CAR 60 DRIVER
11:55:52	WARNING FLAG CAR 61 DRIVER

This parameter contains some words which may be found in messages intended for an individual car, by default they are: “car, penalty, investigation, limit” (for track limits violation). You can add or remove keywords as needed. If you remove all of them, all messages will be checked for car numbers (more false detections can be seen in this case).

Note that if several car numbers are found in a message, the blue color (in my team) will take over the red color (enemy to follow).

6.3.8. Video



The media have a type, Audio or Video, defined in the media streams list of the event. When opening a **video player** window, the streams list will show only videos. You can open as many **video players** as needed.

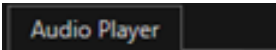
	The name of the stream is displayed in the title.
	Refresh (allow to quickly restart the stream in case of freeze)
	Drop-down list of the streams available (those set and enable in the event configuration, see media in section 7).
	Mute
	Shows the source of the video, “live” or “rec” when it comes from a record.

**Note:** The videos are synchronised with the data. Moving in time in the timing data with the transport bar will also move in time in the recorded videos.

6.3.9. Audio



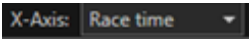
The media have a type, Audio or Video, defined in the media streams list of the event. You can open only one **audio player** window; it shows all the audio streams defined in the event (see media in section 7).



Refresh



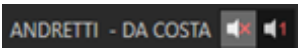
After a dynamic zoom (mouse wheel) you can reset the zoom to come back to the overall range.



You can change the horizontal axis from “Race time” to “Time of the day”.



Mute all channels.



Mute this channel.



Set this channel as “solo”. This will mute all the other channels. Click again on this button to remove the solo and get back to the previous state.

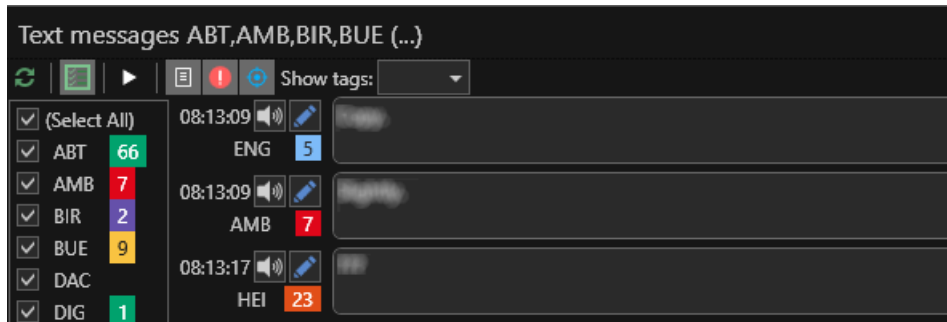


If a stream has been recorded and analysed by RaceCTRL, the line showing the audio stream has line segments with round markers at the beginning and at the end, this is where there is something to hear.  
If no record is available, the line has no marker and its length is the same as the race length.  
In both cases, the line colour is the same as the car colour (if the car as a defined colour and if the car number has been defined the audio stream configuration).  
**Note:** A red vertical line shows the current race time when playing.

**Note:** The audios are synchronised with the data. Moving in time in the timing data with the transport bar will also move in time in the recorded audios.

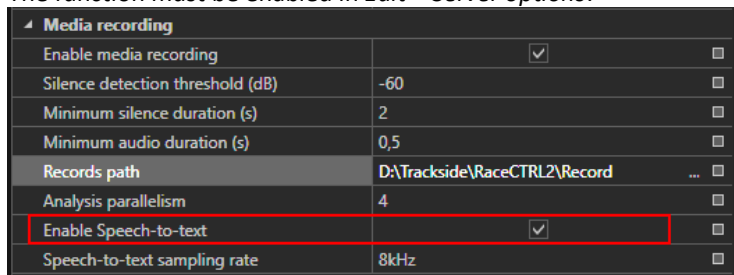


### 6.3.10. Text messages



A “speech-to-text” function analyses the audio records and extracts the corresponding texts.

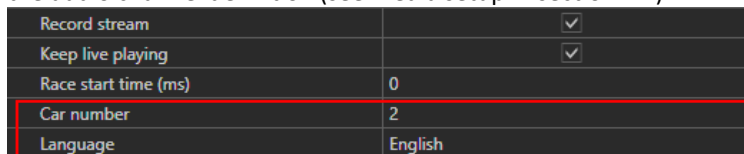
The function must be enabled in *Edit > Server options*:



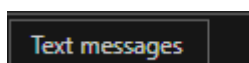
You can also, from there, adjust:

- the analysis parallelism (beware that a high number will use a lot of CPU power and internet bandwidth).
- the sampling rate between 8kHz or 16kHz (use 16Hz if the text recognition seems to be bad but beware that, in this case the internet bandwidth used will be doubled).

You must setup each audio stream options with the corresponding car number (if any) and the spoken language in the audio channel definition (see media setup in section 7.1):



When recording, audio parts are analysed and the resulting text, if any, is stored in a text message associated with the car. You can see them in the “Text messages” view:



Refresh



Show/hide the caption (list of cars).



Follow the current racetime.



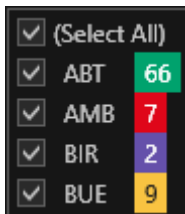
Show normal messages (not urgent and not follow)



Show urgent messages





Show follow messages

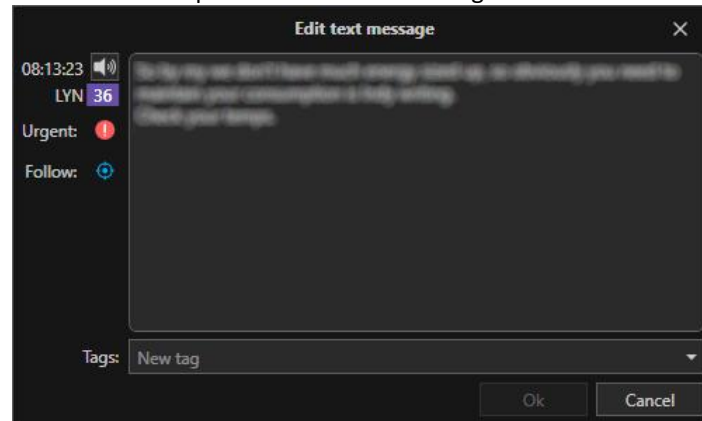
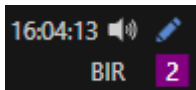


The cars can be filtered with the selector on the right.

Each text message is shown with the time, the audio stream name and the car number.

The  button can be used to play the corresponding audio part.

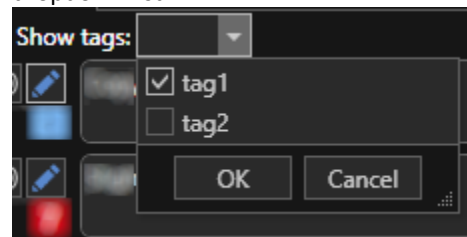
The  button opens the “Edit text message” window:



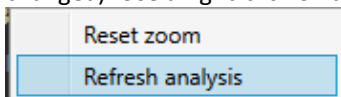
The text can be edited and saved.

You can check “urgent” and “follow” to filter the messages by type.

You can add tags to the messages to further filter the messages with the “Show tags” dropdown list:



**Note:** After the recording is over, you may restart the analysis manually (for example after some settings has been changed). Use a right-click on an audio stream in the audio player and choose “Refresh analysis”:



6.3.11. Lap history

Laps history [1]

Grid config: None

Drag a column header here to group by that column

Is Used	Lap Nb	Num	Driver	Team	Lap time	S1	S2	S3	RaceTime	PitStops	IN	OUT	PitTime	235kW %	250kW %
<input checked="" type="checkbox"/>	12	6	Maximilian GÜNTHER	GEOR DRAGON	01:16.529	25.467	18.674	32.387	14:56.664	0				0%	0%
<input checked="" type="checkbox"/>	12	64	Jérôme D'AMBROSIO	MAHINDRA RACING	01:13.161	24.264	18.359	30.538	15:05.688	0				0%	0%
<input checked="" type="checkbox"/>	12	66	Daniel ABT	Audi Sport Abt Schaeffler Formula E Team	01:12.971	24.385	17.815	30.771	14:48.787	0				100%	0%
<input checked="" type="checkbox"/>	12	7	José Maria LOPEZ	GEOR DRAGON	01:13.570	24.143	18.126	31.301	14:58.600	0				91%	0%
<input checked="" type="checkbox"/>	12	94	Pascal WEHRLEIN	MAHINDRA RACING	01:12.433	23.923	18.140	30.370	14:46.074	0				99%	0%
<input checked="" type="checkbox"/>	13	23	Sébastien BUEMI	Nissan e.dams	01:13.114	24.182	18.311	30.621	15:56.478	0				0%	0%
<input checked="" type="checkbox"/>	13	11	Lucas DI GRASSI	Audi Sport Abt Schaeffler Formula E Team	01:14.125	25.802	17.835	30.488	16:15.963	0				100%	0%
<input checked="" type="checkbox"/>	13	16	Oliver TURVEY	NIO Formula E Team	01:13.663	24.337	18.412	30.914	16:18.117	0				97%	0%
<input checked="" type="checkbox"/>	13	17	Gary PAFETT	HWA RACELAB	01:14.344	24.605	18.498	31.241	16:18.060	0				0%	0%
<input checked="" type="checkbox"/>	13	19	Felipe MASSA	Venturi Formula E Team	26.532	19.747			16:18.609	1				0%	0%
<input checked="" type="checkbox"/>	13	2	Sam BIRD	Envision Virgin Racing	01:13.082	24.056	18.283	30.743	15:57.122	0				0%	0%
<input checked="" type="checkbox"/>	13	20	Mitch EVANS	Panasonic Jaguar Racing	01:13.680	24.807	17.940	30.933	16:11.611	0				100%	0%
<input checked="" type="checkbox"/>	13	22	Oliver ROWLAND	Nissan e.dams	01:13.279	24.634	18.285	30.360	16:10.542	0				0%	0%
<input checked="" type="checkbox"/>	13	25	Jean-Eric VERGNE	DS TECHEETAH	01:12.411	23.969	18.119	30.523	16:21.018	0				0%	0%
<input checked="" type="checkbox"/>	13	27	Alexander SIMS	BMW i ANDRETTI MOTORSPORT	01:12.214	24.217	17.615	30.382	16:07.751	0				100%	0%
<input checked="" type="checkbox"/>	13	28	Antonio Felix DA COSTA	BMW i ANDRETTI MOTORSPORT	01:12.308	24.089	17.919	30.300	17:04.090	1				100%	0%
<input checked="" type="checkbox"/>	13	3	Nelson PIQUET	Panasonic Jaguar Racing	01:14.526	24.964	18.565	30.997	16:14.792	0				97%	0%
<input checked="" type="checkbox"/>	13	36	André LOTTERER	DS TECHEETAH	01:14.474	24.568	18.915	30.991	16:14.585	0				0%	0%
<input checked="" type="checkbox"/>	13	4	Robin FRUNS	Envision Virgin Racing	01:13.713	24.596	18.160	30.957	16:11.455	0				27%	0%
<input checked="" type="checkbox"/>	13	48	Edoardo MORTARA	Venturi Formula E Team	01:13.648	24.350	18.352	30.946	16:06.210	0				0%	0%
<input checked="" type="checkbox"/>	13	5	Stoffel VANDORNE	HWA RACELAB	01:13.654	24.442	18.183	31.029	16:07.533	0				0%	0%
<input checked="" type="checkbox"/>	13	6	Maximilian GÜNTHER	GEOR DRAGON	24.130	18.227			22:16.020	1				0%	0%
<input checked="" type="checkbox"/>	13	64	Jérôme D'AMBROSIO	MAHINDRA RACING	01:13.386	24.242	18.251	30.893	16:19.074	0				0%	0%
<input checked="" type="checkbox"/>	13	66	Daniel ABT	Audi Sport Abt Schaeffler Formula E Team	01:13.334	24.272	18.233	30.829	16:02.121	0				26%	0%
<input checked="" type="checkbox"/>	13	7	José Maria LOPEZ	GEOR DRAGON	01:13.799	25.003	17.939	30.857	16:12.399	0				97%	0%
<input checked="" type="checkbox"/>	13	94	Pascal WEHRLEIN	MAHINDRA RACING	01:12.883	23.998	18.369	30.516	15:58.957	0				100%	0%
<input checked="" type="checkbox"/>	14	23	Sébastien BUEMI	Nissan e.dams	01:13.317	24.353	18.319	30.645	17:09.795	0				0%	0%
<input checked="" type="checkbox"/>	14	11	Lucas DI GRASSI	Audi Sport Abt Schaeffler Formula E Team	01:12.827	24.307	18.318	30.202	17:28.790	0				100%	0%
<input checked="" type="checkbox"/>	14	16	Oliver TURVEY	NIO Formula E Team	01:13.034	24.306	18.181	30.547	17:31.151	0				100%	0%
<input checked="" type="checkbox"/>	14	17	Gary PAFETT	HWA RACELAB	01:16.122	25.073	18.808	32.241	17:34.182	0				0%	0%
<input checked="" type="checkbox"/>	14	2	Sam BIRD	Envision Virgin Racing	01:13.287	24.233	18.252	30.802	17:10.409	0				0%	0%
<input checked="" type="checkbox"/>	14	20	Mitch EVANS	Panasonic Jaguar Racing	01:14.628	25.320	18.308	31.000	17:26.239	0				100%	0%
<input checked="" type="checkbox"/>	14	22	Oliver ROWLAND	Nissan e.dams	01:15.526	26.091	18.404	31.031	17:26.068	0				0%	0%

This view gathers all the info and properties of all the laps of the session.  
This chart is highly customisable as all the “spreadsheet type” views of RaceCTRL (see section 5.3 for more details).

Laps history



It is possible to print or export the data with the current properties of the chart (columns, filters, etc...).

Export, into .csv files, the instant speeds and GPS positions of all the laps of the grid, taking into account the filters.

Export instant speeds and GPS

Export path	C:\Users\chris\Desktop\Report Race( ...	<input type="checkbox"/>
Filter level	3	<input type="checkbox"/>
Use corrected GPS	<input checked="" type="checkbox"/>	<input type="checkbox"/>

In the dialog window, set the mandatory options:  
- folder path where to create the files (one per lap),  
- filter level,  
- corrected GPS or not (see GPS Ref.Point section **Error! Reference source not found.**).  
See Instant Speed (section 0) for more info about the exported files.



Allows to set the race time on the timing bar to the race time of the selected lap.



Opens the “Edit lap” window for the selected lap. You can also use a double-click on a lap.

The grid configuration (columns, sort order, filters, etc...) can be saved and restored:

Grid config: None

- Click on the “save” button to save the current configuration.  
You can either enter a new config name to create a new config or keep the same name to save the grid into the select config.  
- Click on the “delete” button to remove the selected

configuration.

- The “None” config is the default one. It’s saved automatically when it’s selected and can’t be deleted. Each layout has an independent default config.
- Except for the “None” config, don’t forget to save your changes with the “save” button.
- The saved configurations are global and shared between all layouts.

#### “Is Used” property:

It is possible to enable or disable laps with a right click on the lap line:

Is Used	Lap Nb	Num	Driver	Lap time	Racetime
<input type="checkbox"/>	1	19	Felip...	13:43.544	13:43.544
<input checked="" type="checkbox"/>	2	19	Felip...	01:41.713	15:25.257
<input checked="" type="checkbox"/>	3	19	Felip...	01:18.050	16:43.307
<input checked="" type="checkbox"/>	4	19	Felip...	01:49.233	18:32.540
<input checked="" type="checkbox"/>	5	19	Felip...	01:44.003	20:16.542
<input checked="" type="checkbox"/>	6	19	Felip...	01:44.003	21:35.626
<input checked="" type="checkbox"/>	7	19	Felip...	01:44.003	23:19.373
<input checked="" type="checkbox"/>	8	19	Felip...	01:20.399	24:39.772

It is also possible to enable or disable a lap using shortcuts: enable (E) or disable (D). Select the lap you want to enable or disable and press the key E or D.

A column “Is Used” show if a lap is enable or disable.

When a lap is disabled, this lap is no longer displayed in any Laptime graph and is excluded from the calculations (best laptime, best sector time, moving average, etc...)

Laps number 1, IN/OUT laps and extrapolated laps are automatically ignored by default.

#### “Retired” property:

It is possible to add a “retired” property to a car. Right click on any rows belonging to the car you want to retire and then click on *car retired*. You can revert the changes by clicking on *car running*.

<input checked="" type="checkbox"/>	8	01:12.709	Sam BIRD	09:53.066	13:10:30.0...	Enable lap	E
<input checked="" type="checkbox"/>	9	01:13.219	Sam BIRD	11:06.285	13:11:43.2...	Disable lap	D
<input checked="" type="checkbox"/>	10	01:12.596	Sam BIRD	12:18.881	13:12:55.8...	Car running	
<input checked="" type="checkbox"/>	11	01:12.337	Sam BIRD	13:31.218	13:14:08.1...	Car retired	
<input checked="" type="checkbox"/>	12	01:12.822	Sam BIRD	14:44.040	13:15:20.9...		

The Status column of the leaderboard view will be displayed in gray when a car is retired:

20	6	Maximilian GÜNTHER	13	01:16.529	01:12.552	01:1...
----	---	--------------------	----	-----------	-----------	---------

You can access to the retired information from the Web API (see section 8). The data is available inside GetCompletedLaps, CarResult and CarResults methodes. A completed lap object contains a IsRetired property and a IsRetiredLapNumber that corresponds to the lap where the car is really retired. This can be the current not finished lap, or the last completed lap if the car stopped the race in pits after crossing the CH.

#### Text color:

White	Default
Blue	Personal best
Purple	Overall best

**Note:** For these formatting rules, the calculation used only previous laps, not all laps, so you can see the progressive improvements over the session.

#### Other formatting rules:

IN/OUT laps are highlighted with a green background.

8	1	OGI	Sébastien OGIER	LMP2	2	03:41.282	1	29:12.427	8	34.469	01:22...	01:44...	
9	1	W...	Lilo WADOUX	LMP2	1	04:41.386	1	30:28.282	01:15.855	1	01:39.328	01:23...	01:38...

Laps not used are displayed in light gray with an italic font.

3	3	Nelson PIQUET	14.694	28.679	0	0%	0%
---	---	---------------	--------	--------	---	----	----

Laps with a blue background are coming from the race prediction calculation, so not real data.

32	2	Sam BIRD	01:02.204	39:49.337	23:03:36.057	0	0%	0%
33	2	Sam BIRD	01:02.204	01:00:51.542	23:04:38.261	0	0%	0%

Some cells of the power mode laps are highlighted (Specific Formula E / Alkamel protocol). See below.

	Is Used	Lap...	N...	SN	Lap time	235kW duration	250kW duration
	<input type="checkbox"/>						
	<input checked="" type="checkbox"/>	13	13	DAC	01:20.383		
	<input checked="" type="checkbox"/>	14	13	DAC	01:21.768	14.929	
	<input checked="" type="checkbox"/>	15	13	DAC	01:17.925	22.869	
	<input checked="" type="checkbox"/>	16	13	DAC	01:18.520	21.789	
	<input checked="" type="checkbox"/>	17	13	DAC	01:18.981	7.451	
	<input checked="" type="checkbox"/>	18	13	DAC	01:19.499		
	<input checked="" type="checkbox"/>	19	13	DAC	01:19.492		
	<input checked="" type="checkbox"/>	20	13	DAC	01:19.779		
	<input checked="" type="checkbox"/>	21	13	DAC	01:20.323		1.995
	<input checked="" type="checkbox"/>	22	13	DAC	01:19.012		

The “Edit lap” window can be used to make manual changes on the selected lap:

- Enabled: check/uncheck to enable/disable this lap.
- Car retired: check/uncheck to set this car as retired/running.
- Pit: check to create a pit stop, uncheck to remove the pit stop. When adding a pit stop, the selected lap will become an IN and the next one will be an OUT.
- Pit Time: enter the pit stop duration. Note that some checks are done to avoid overlapping but this will not guarantee that the times are correct.
- Driver: you can change the driver on a pit stop or on the first lap of the session.
- Tyres changed: as default, when the driver is changed, the tyres are changed too (this is shown as “auto”).
  - o If the driver has changed but not the tyres, uncheck it (it’ll show “manual”).
  - o If the driver is the same but the tyres has been changed, check it (it’ll show “manual”).
- After a driver change or when removing a pit stop, RaceCTRL may ask you if you want to change the driver on all laps up to the next pit stop.

6.3.12. Stint history

Stints history

Grid config: None

Car Number

	Driver	ShortName	Team	Category	Tyres	Drv Stint Num	Stint Number	Racetime	PassingTime	PassingTime (UTC)	Lap count	Valid lap count	Average	Median	Min laptime	Max laptime	Deviation	Duration	Track cond.	Brightness
+ Car Number: 1																				
+ Car Number: 2																				
	Timo BERNHARD	BER	Porsche LMP Team Porsche	LMP1_H		1	1	00:00.000	15:32:22.775	14:32:22.775	12	12	03:27.276	03:21.702	03:19.783	04:21.793	16.69	41:26.308		
	Timo BERNHARD	BER	Porsche LMP Team Porsche	LMP1_H		2	2	42:31.563	16:14:54.338	15:14:56.338	13	13	03:36.625	03:26.023	03:21.794	04:18.894	19.51	45:48.865		
	Timo BERNHARD	BER	Porsche LMP Team Porsche	LMP1_H		3	3	01:29:26.385	17:01:53.160	16:01:53.160	13	13	03:49.209	03:37.700	03:20.084	04:54.770	25.19	48:31.786		
	Earl BAMBER	BAM	Porsche LMP Team Porsche	LMP1_H		1	4	02:19:27.420	17:51:50.325	16:51:50.325	13	13	03:27.862	03:21.893	03:20.334	04:37.469	20.14	43:36.907		
	Earl BAMBER	BAM	Porsche LMP Team Porsche	LMP1_H		2	5	03:04:11.612	18:36:34.387	17:36:34.387	7	7	03:53.794	03:53.207	03:22.203	04:34.507	28.73	26:08.671		
	Brendon HARTLEY	HAR	Porsche LMP Team Porsche	LMP1_H		1	6	04:35:31.391	20:07:54.166	19:07:54.166	14	12	04:05.323	03:57.096	03:20.266	05:04.772	40.62	57:59.534		
	Brendon HARTLEY	HAR	Porsche LMP Team Porsche	LMP1_H		2	7	05:34:39.052	21:07:01.827	20:07:01.827	14	12	03:45.416	03:27.024	03:19.782	04:39.633	31.16	55:20.248		
	Timo BERNHARD	BER	Porsche LMP Team Porsche	LMP1_H		4	8	06:31:22.728	22:03:45.503	21:03:45.503	12	12	03:37.433	03:28.626	03:21.564	04:35.443	23.31	42:05.762		
	Timo BERNHARD	BER	Porsche LMP Team Porsche	LMP1_H		5	9	07:14:33.832	22:46:56.607	21:46:56.607	13	12	03:35.773	03:24.318	03:20.886	04:38.127	25.78	47:44.568		
	Timo BERNHARD	BER	Porsche LMP Team Porsche	LMP1_H		6	10	08:03:37.442	23:36:02.217	22:36:02.217	13	13	03:30.322	03:24.922	03:22.680	04:33.024	18.22	44:14.839		
	Earl BAMBER	BAM	Porsche LMP Team Porsche	LMP1_H		3	11	08:49:15.573	00:21:38.348	23:21:38.348	14	11	03:51.220	03:25.297	03:22.447	04:39.007	34.27	01:02:47.108	60	20
	Earl BAMBER	BAM	Porsche LMP Team Porsche	LMP1_H		4	12	09:52:35.957	01:24:58.732	00:24:58.732	1	1	03:56.596	03:56.596	03:56.596	03:56.596	0	03:23.320	60	20
	Earl BAMBER	BAM	Porsche LMP Team Porsche	LMP1_H		5	13	09:57:07.470	01:29:30.245	00:29:30.245	15	11	03:45.058	03:27.346	03:21.876	04:42.106	31.17	01:09:36.258	60	20
	Earl BAMBER	BAM	Porsche LMP Team Porsche	LMP1_H		6	14	11:07:50.344	02:40:13.119	01:40:13.119	13	13	03:33.524	03:24.673	03:21.043	04:18.547	17.94	45:09.202	60	20
	Brendon HARTLEY	HAR	Porsche LMP Team Porsche	LMP1_H		3	15	11:54:23.504	03:26:46.279	02:26:46.279	13	13	03:29.876	03:23.211	03:20.581	04:41.223	20.7	44:04.428	60	20
	Brendon HARTLEY	HAR	Porsche LMP Team Porsche	LMP1_H		4	16	12:39:35.703	04:11:58.478	03:11:58.478	13	13	03:44.572	03:29.145	03:22.169	04:30.002	26.23	47:31.666	60	20
	Brendon HARTLEY	HAR	Porsche LMP Team Porsche	LMP1_H		5	17	13:28:14.440	05:00:37.223	04:00:37.223	13	13	03:38.824	03:27.890	03:21.825	04:21.305	15.48	44:08.934	60	20

This view gathers all the info and properties of all the stints of the session.  
This grid is highly customisable as all the “spreadsheet type” views of RaceCTRL (see section 5.3 for more details).

Stints history



It is possible to print or export the data with the current properties of the chart (columns, filters, etc...).



Export, into .xlsx files, the grid data taking into account the filters.

You have to select the folder path where to create the files  
The grid configuration (columns, sort order, filters, etc...) can be saved and restored:

- Click on the “save” button to save the current configuration. You can either enter a new config name to create a new config or keep the same name to save the grid into the select config.
- Click on the “delete” button to remove the selected configuration.
- The “None” config is the default one. It’s saved automatically when it’s selected and can’t be deleted. Each layout has an independent default config.
- Except for the “None” config, don’t forget to save your changes with the “save” button.
- The saved configurations are global and shared between all layouts.

Grid config: None

ShortName	Drv Stint Num	Stint Number
BER	1	1
BER		2
BER	3	3
BAM	1	4
BAM	2	5
HAR	1	6
HAR	2	7
BER	4	8
BER	5	9

You will find the driver stint number as well as the car stint number

Lap count	Valid lap count
12	12
13	13
13	13
13	13
7	7
14	12
14	12

The view displays the number of laps in the stint and the number of valid laps. Those valid laps are used for calculation and depend on their status (IN/OUT) or the delta time with the average lap time.

Average	Median	Min laptime	Max laptime	Deviation	Duration
03:27.276	03:21.702	03:19.783	04:21.793	16,69	41:26.308
03:36.625	03:26.023	03:21.794	04:18.884	19,51	45:48.865
03:49.209	03:57.700	03:20.084	04:54.770	25,19	48:31.766
03:27.862	03:21.893	03:20.334	04:37.469	20,14	43:36.907
03:53.704	03:53.207	03:22.203	04:34.507	28,73	26:08.671

Finally, some interesting calculation are available like:

- Average stint time
- Median time
- Min lap time
- Max lap time
- Deviation
- Stint duration

### 6.3.13. Race Statistics

Race Statistics													
Grid config: None													
Drag a column header here to group by that column													
Num	Team	Class	Rank	Race time	Stint count	Avg Laptime	Lap count	Driving time	Stop time	Pit count	Min pit	Avg Track time IN	Avg Track time OUT
10	Vector Sport	LMP2	17	06:01:24.513	8	01:37.239	217	05:52:17.449	09:07.064	7	01:11.497	01:40.134	01:36.378
2	Cadillac Ra...	HYPERCAR	10	06:01:37.897	9	01:33.969	219	05:44:24.614	17:13.283	8	29.298	01:42.976	01:34.462
21	AF Corse	LMGTE Am	34	06:01:50.085	8	01:41.882	208	05:54:08.903	07:41.182	7	29.417	01:44.729	01:42.186
22	United Aut...	LMP2	12	06:01:24.989	8	01:36.727	218	05:51:53.031	09:31.958	7	01:14.652	01:39.232	01:35.649
23	United Aut...	LMP2	14	06:01:40.908	8	01:36.715	218	05:51:51.077	09:49.531	7	01:14.384	01:39.107	01:35.598
15	ORF by T2	LMGTE Am	35	06:00:59.020	11	01:41.843	202	05:48:55.104	12:01.916	10	29.351	01:44.982	01:42.020
28	IGTA	LMP2	16	06:00:49.195	9	01:36.772	217	05:50:31.578	10:17.617	8	01:05.110	01:39.589	01:35.253
31	Team WRT	LMP2	13	06:01:26.023	8	01:36.758	218	05:52:00.411	09:25.612	7	01:12.999	01:39.148	01:35.596
13	Corvette R...	LMGTE Am	25	06:01:55.080	6	01:40.981	210	05:54:09.360	07:45.720	5	01:04.973	01:43.866	01:42.550
14	Inter Europ...	LMP2	19	06:01:53.083	9	01:37.150	217	05:52:08.130	09:44.933	8	58.206	01:40.136	01:36.683
15	Alpine Elf T...	LMP2	21	06:00:49.833	9	01:37.573	215	05:50:25.806	10:24.027	8	01:00.603	01:40.380	01:37.772
16	Alpine Elf T...	LMP2	15	06:01:39.031	8	01:36.910	218	05:52:34.669	09:24.362	7	01:12.746	01:39.124	01:35.731
13	North Te...	HYPERCAR	6	06:00:45.480	7	01:33.275	227	05:52:26.211	07:19.282	6	29.350	01:55.571	01:33.587
16	Northw...	LMGTE Am	29	06:01:13.024	6	01:41.485	209	05:54:23.588	06:49.436	5	01:08.878	01:43.262	01:42.417

The race statistics view displays some statistics available in the Race planner summary section:

- Total race time
- Total driving time
- Total stop time
- Average lap time
- Stint count
- Pit stop count
- Lap count
- Minimum pit stop time
- Average track time for IN laps
- Average track time for OUT laps

## 6.3.14. Driving Statistics

Num	Driver	SN	Team	Class	Total race	Total window	Final race	Max time window	Avg laptime	Avg Tracktime IN	Avg Tracktime OUT	Avg Best 20%
21	Hiroshi KOZUMI	KOI	AF Corse	LMGTE Am	01:52:55	01:50:49		01:54:19	01:43:516	01:47:570	01:44:610	01:41:083
21	Nen COZZOLINO	COL	AF Corse	LMGTE Am	02:06:23	02:06:23		02:08:58	01:41:099	01:43:175	01:41:165	01:39:607
22	Eliseo ALBUQUERQUE	ALB	United Autosports	LMP2	02:55:08	02:53:03		02:59:08	01:37:166	01:38:901	01:35:498	01:34:770
23	Ben HANLEY	HAN	United Autosports	LMP2	02:58:44	02:58:44		03:04:21	01:36:564	01:39:219	01:36:007	01:35:082
56	PJ HYETT	HYE	Project 1 - AD	LMGTE Am	01:45:24	01:43:19		01:46:54	01:42:871	01:46:466	01:41:491	01:41:023
56	Gunnar JEANNETTE	JEJ	Project 1 - AD	LMGTE Am	02:01:04	02:01:04		02:03:47	01:40:726	01:45:534	01:41:300	01:40:027
57	Itomo MIYATA	MIY	Kessel Racing	LMGTE Am	02:03:56	02:03:56		02:06:45	01:40:373	01:41:929	01:42:069	01:39:123
63	Andrea CALDARELLI	CAL	Prema Racing	LMP2	01:23:49	01:23:49		01:26:15	01:36:584	01:40:649	01:35:894	01:35:415
9	Juan Manuel CORREA	COR	Prema Racing	LMP2	01:27:28	01:25:23		01:28:46	01:38:652	01:40:736	01:35:271	01:35:796
94	Shaun VANDOOIJNE	VAN	Progres TotalEnergies	HYPERCAR	01:55:57	01:55:57	01:59:57	01:58:46	01:32:591	01:36:508	01:35:544	01:31:564
98	Ian JAMES	JAM	Northwest AMR	LMGTE Am	01:48:29	01:46:24		01:49:57	01:42:433	01:46:987	01:41:728	01:40:771
98	Daniel MANCINELLI	MAN	Northwest AMR	LMGTE Am	02:00:57	02:00:57		02:03:33	01:40:675	01:43:931	01:41:608	01:40:039
98	Alex RIBERAS	RIB	Northwest AMR	LMGTE Am	02:04:56	02:04:56		02:07:42	01:41:180	01:44:474	01:43:572	01:39:562

This view displays the driving time for each driver.

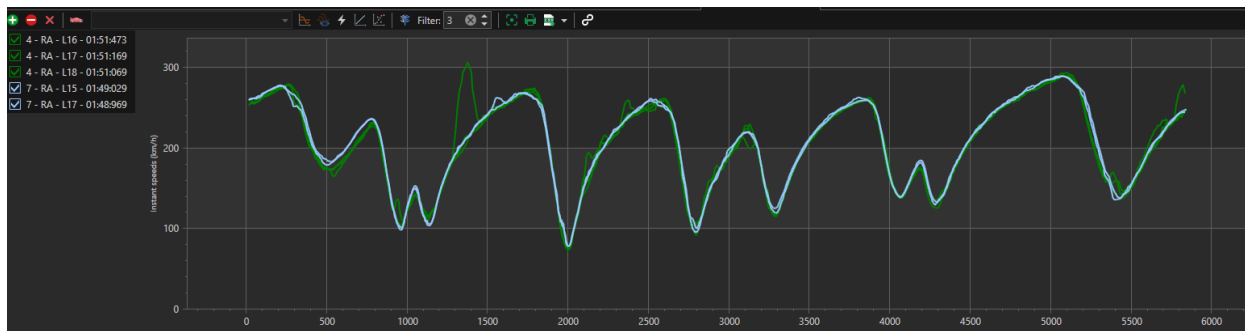
You have to specify for each car class the driving time limits allowed. You can override these values for each driver from the Edit Cars view.

Driving time	
Window size	06:00 <input type="checkbox"/>
Max driving time in window	04:00 <input type="checkbox"/>
Max driving time in race	12:00 <input type="checkbox"/>
Min driving time in race	00:00 <input type="checkbox"/>

The Total time in Race or in the Window will be displayed in orange 1 hour before reaching the limit or in red if the limit is exceeded.



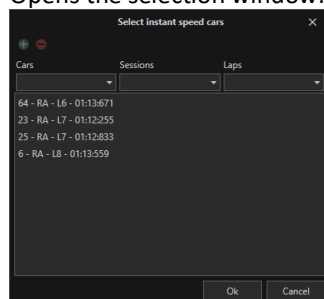
### 6.3.15. Instant Speed



When the GPS data is available, these views allow to display and compare the speed trace of selected laps (speed calculated from the GPS position).

#### Instant Speed Compare

Opens the selection window:



From here you can update the list of laps to compare:

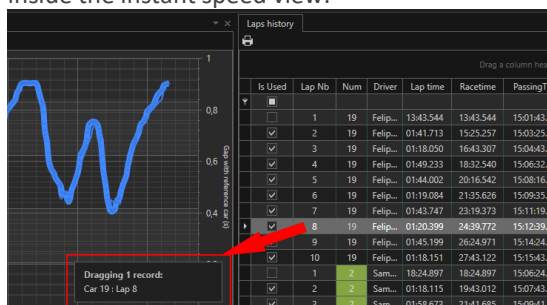
Select a Car/Session/Lap from the drop-down lists.

Use (+) to add the selected lap.

**Note:** If a lap is selected in the list, you can choose to update this line or add a new line (popup window).

Use (x) to remove the selected lap from the list.

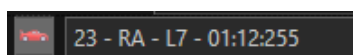
**Note:** It's also possible to drag a line from the laps history view and drop it inside the instant speed view.



Remove the selected lap.



Remove all laps.



Enable the reference car in order to calculate and display the time difference between laps. Use the button to show/hide these additional curves. Use the dropdown list to choose the reference car.



Enable the display of the **power modes** (Specific Formula E / Alkamel protocol).

**Note:** Power modes are also shown in the "Trajectories" window as bigger dots.

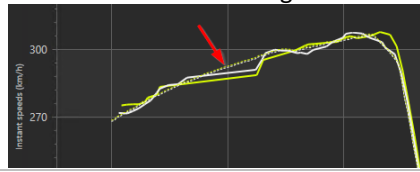


Displays the average speed curve by car. When enabled, this option replaces the lap speed items by a new curve *Avg speed car N* for each car. The average speed calculation only uses the select lap speeds items in the legend for each car.

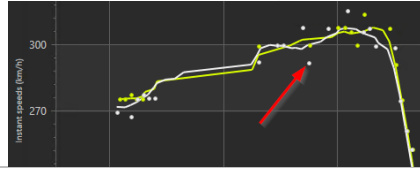


A second option allows you to display the average speeds + the lap speeds used for the calculation. This allows you to select the laps to use to calculate the average speed of a car.

Enable / disable the display of the **reference speed** used by the “guided” algorithm. The reference speed is calculated from the distance file (.Dis) defined in the track configuration.

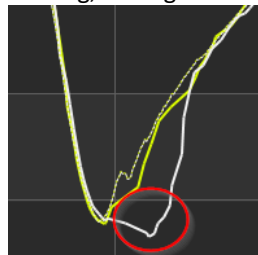


Enable / disable the display of the **raw speed** points. This is the speed calculated from the GPS positions without any processing.

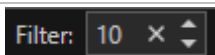
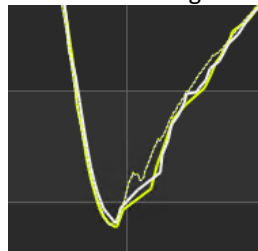


Enable / disable the “**guided**” algorithm. This algorithm uses the distance file (.Dis) defined in the track configuration to improve the speed recognition.

When the accuracy of the GPS position is too low or when GPS points are missing, the algorithm may not auto-detect the speed properly.



In this case the “guided” algorithm could help.



Filter level, from 0 to 10.



After a dynamic zoom (mouse wheel or shift + mouse) you can reset the zoom to come back to the overall range.



Print the graph.



Export the selected lap as a .csv file.

6 columns in the .csv file:

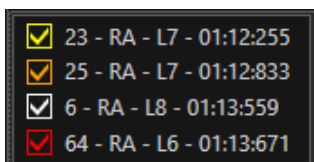
Distance, Speed,  
Latitude, Longitude,

X, Y (calculated from a Lambert II projection)

It is also possible to export multiple laps at once from the Lap history (see section 0).



Opens the “Trajectories” window.







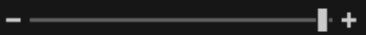
You can show/hide a trace by ticking the according box in the caption.

You can also select a trace by clicking on the line. The trace will then be shown in bold.

The “Trajectories” window shows all visible traces from the “Instant Speed Compare” window. You can check/uncheck the traces to show/hide them.

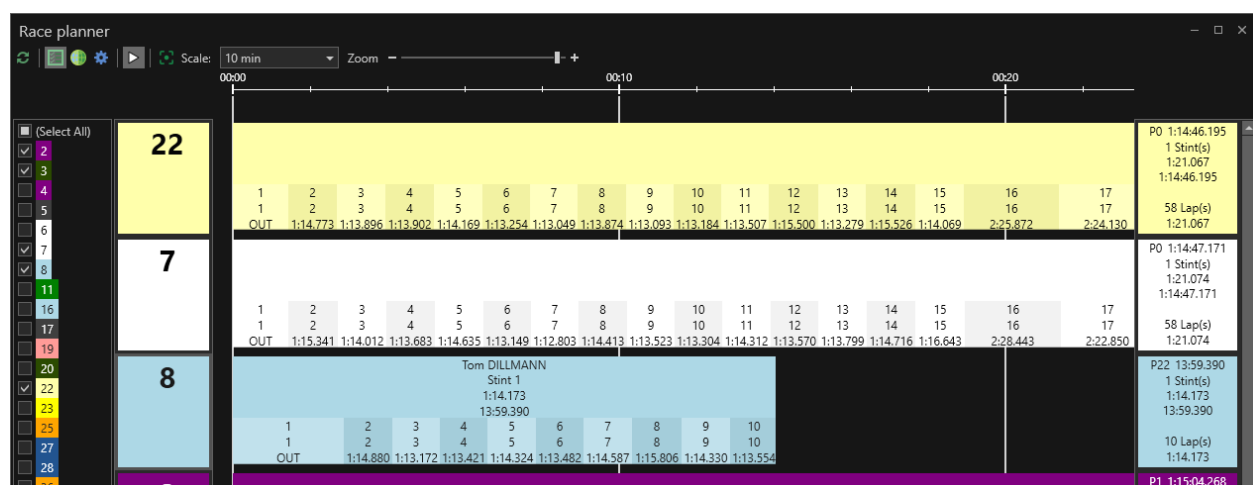
Each trajectory uses the same colour as the speed trace in the graph. Its luminosity is changed a bit depending on speed (lighter when speed increases).




When selecting a trace in the “Instant Speed Compare” view, it’s also selected in the “Trajectories” view (thick line). The point under the cursor is also highlighted on the trajectory as a transparent white dot.

Trajectories	
	Best fit of the track map in the view. <b>Note:</b> You can zoom/unzoom with the mouse wheel.
	Show/hide the cartographical background.
	Show/hide the trace of the circuit layout.
	You can check this “auto-center” toggle button to automatically move the “Trajectories” view if the point selected in the “Instant speed compare” is not visible.
Angle 	Use the angle bar to adjust the map rotation. The rotation angle is saved in the current layout. The compass will display the North.

**Note:** The “Trajectories” window is automatically closed when the “Instant Speed Compare” window is closed.

## 6.3.16. Race planner



Race planner	
	Refresh
	Show/hide the caption (list of cars).
	Enable/disable <b>global selection</b> . The <b>global selection</b> is a common selection of cars used by all the <b>laptime graphs</b> or <b>Driving Time</b> with this option enable. There is only one <b>global selection</b> in the whole application.

Planner options:

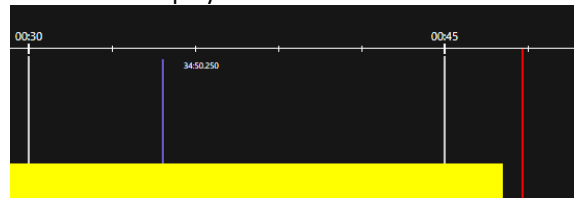


Here you can choose what kind of information you want to be displayed in the planner.

**Note:** Displaying a lot of information could lead to an overload of the CPU.



You can show/hide the **current race time**. When enable the current race time is displayed as a red line:



**Note:** A blue line is displayed when you move the mouse over the time scale.



Best fit of the time scale.

Scale: 10 min

Time scale.

Zoom - +

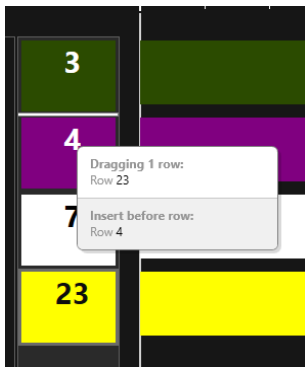
Zoom around the time scale.

P22	27:31.866
1 Stint(s)	
1:11.529	
23 Lap(s)	
27:31.866	
23 Lap(s)	
1:11.529	
P13	47:23.674
1 Stint(s)	
1:16.592	
37 Lap(s)	
47:23.674	
37 Lap(s)	
1:16.592	

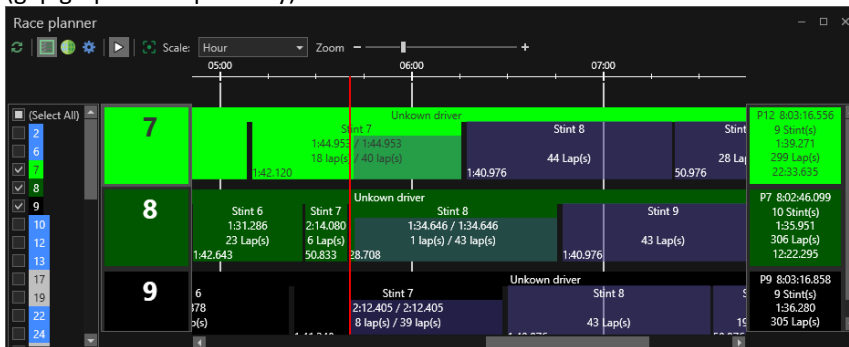
### Summary:

On the LHS you can find a summary of the information for each car. This list can be shown/hidden via the options. The information displayed inside the summary is synchronized with the selected options.

**Note:** You can sort the cars in the planner as you wish via drag and drop in the list displaying the car numbers.



**Note:** The race planner shows the extrapolated part with the same blue background color as the other windows (gap graph and lap history).



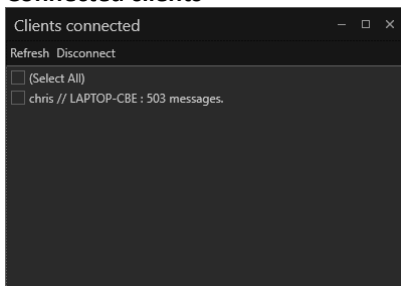
### 6.3.17. Custom View

Views	Pace	Cars	Lap
Avg	Theo 62.2	Real 62.1	
2	-0.7	-0.6	
3	-0.7	-0.6	
4	-0.7	-0.6	
5	Retired		
6	Retired		
7	-0.7	-0.6	
8	Retired		
11	-0.7	-0.6	
16	-0.7	-0.6	
17	-0.7	-0.6	
19	Retired		
20	-0.7	-0.6	
22	-0.7	-0.6	

With the Web API (see section 8) it is possible to create **custom views**. To display these views in RaceCTRL, opens a “custom view” window and choose the **custom view** from the drop-down list.

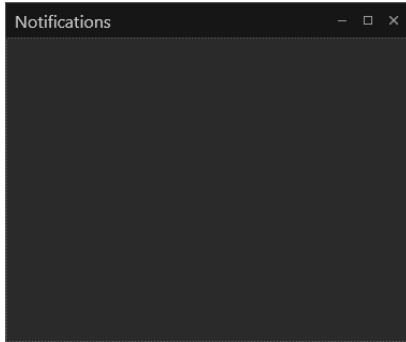
### 6.3.18. Admin

#### Connected clients



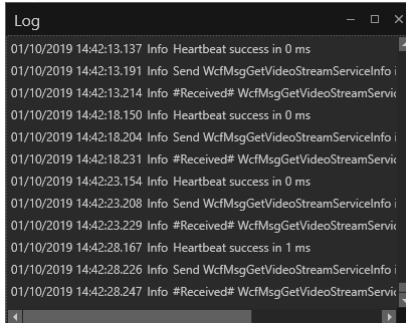
When on the **Host Server** mode, you can find here the list of the clients connected.

## Notifications



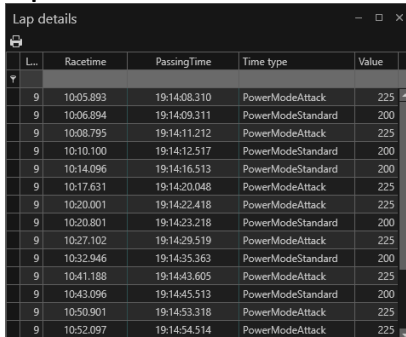
Not used yet.

## Log



Application log.

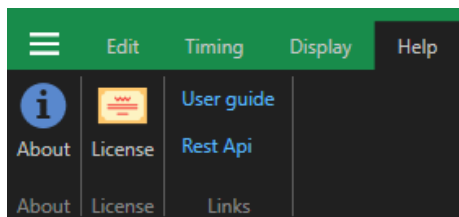
## Lap details



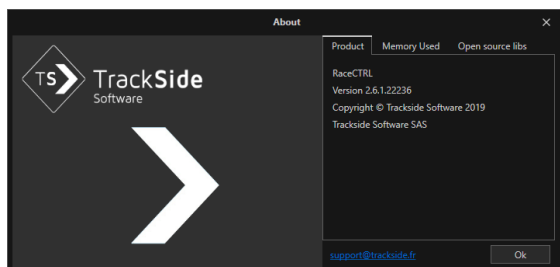
L...	Racetime	PassingTime	Time type	Value
9	10:05.893	19:14:08.310	PowerModeAttack	225
9	10:06.894	19:14:09.311	PowerModeStandard	200
9	10:08.795	19:14:11.212	PowerModeAttack	225
9	10:10.100	19:14:12.517	PowerModeStandard	200
9	10:14.096	19:14:16.513	PowerModeStandard	200
9	10:17.631	19:14:20.048	PowerModeAttack	225
9	10:20.001	19:14:22.418	PowerModeAttack	225
9	10:20.801	19:14:23.218	PowerModeStandard	200
9	10:27.102	19:14:29.519	PowerModeAttack	225
9	10:32.946	19:14:35.363	PowerModeStandard	200
9	10:41.188	19:14:43.605	PowerModeAttack	225
9	10:43.096	19:14:45.513	PowerModeStandard	200
9	10:50.901	19:14:53.318	PowerModeAttack	225
9	10:52.087	19:14:54.514	PowerModeAttack	225

Display the time (race time and passing time) of the power mode changes during a lap (the one currently selected in “Laps history”).  
Specific Formula E / Alkamel protocol

## 6.4. Help

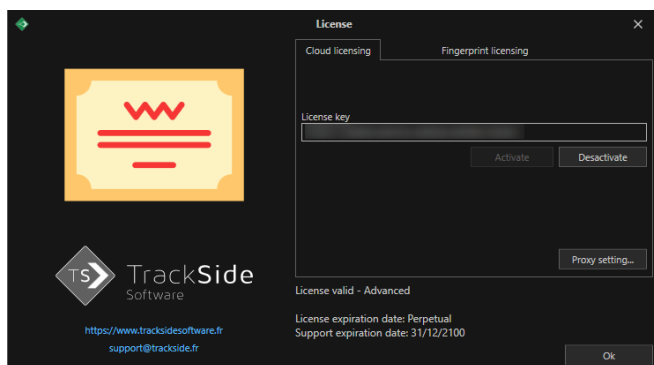


### 6.4.1. About



Information about the product, the memory used and the open source libraries.

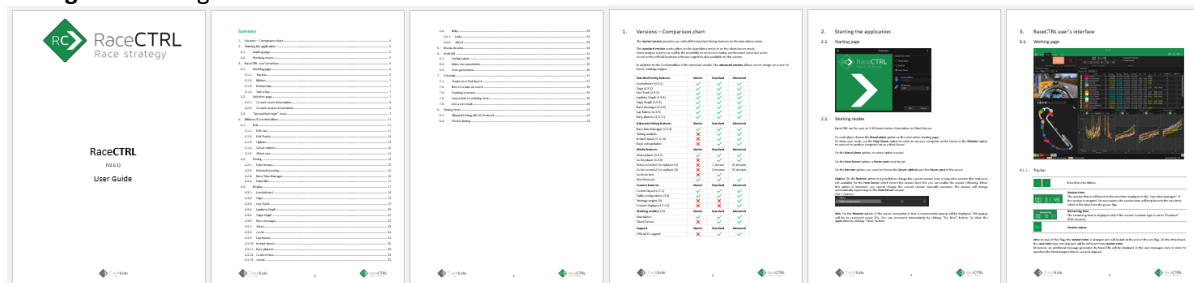
### 6.4.2. License



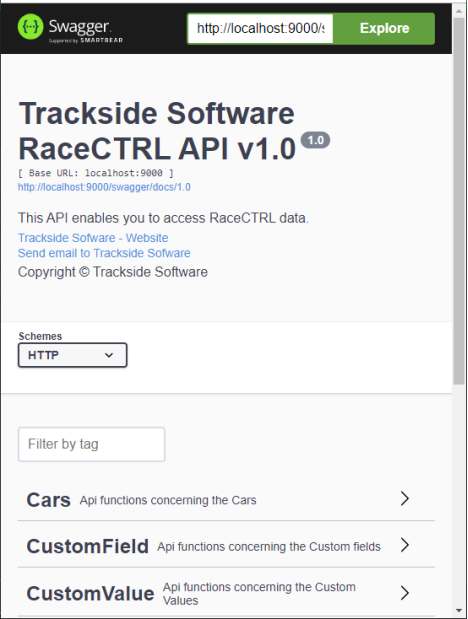
The license view allows you to enter a license key or license file. But you can also configure the proxy settings depending on your network policy.

### 6.4.3. Links

**User guide = this guide**



Rest Api = API documentation (see Web API in section 8)



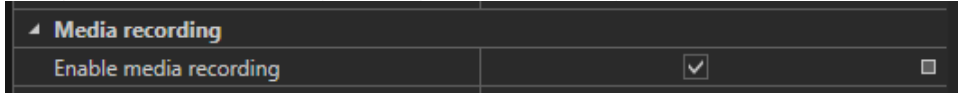


## 7. Media streams

It is possible to record audio/video media with RaceCTRL.

### 7.1. Setup

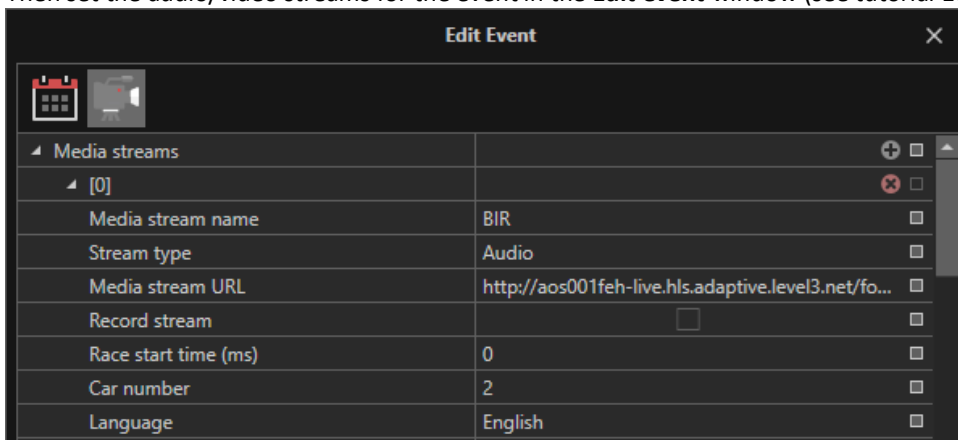
First you need to enable this possibility in *Edit > Server options*



You must restart RaceCTRL to apply this new setting.

**Note:** to allow the replay of the recordings on a remote RaceCTRL client, you should check that your firewall allows the connection to the TCP port 7303 on the RaceCTRL server.

Then set the audio/video streams for the event in the **Edit event** window (see tutorial 10.2):



Click on (+) to create a new media and set the properties of the media stream:

- set a **Media stream name**,
- set the **Stream type** (Video or Audio),
- set the **Media stream URL**,
- tick the **Record stream** box to enable the record of this media,
- for replays, you can set a time offset to synchronise the media with the timing data (**Race start time**). The easiest way to synchronise a media with the timing is to use the race start. Set the value **Race start time** to the time (in milliseconds) on the media when the race start occurs. The value should be positive if the recording has started BEFORE the actual race start and negative if the recording has started AFTER the actual race start.
- set a **Car number** if this media is linked to a car (car radio for example).
- set a **Language** used for the Speech-to-text function.

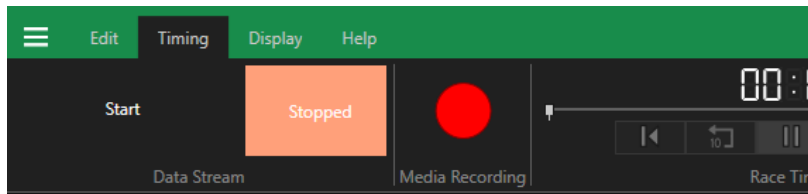
**i** **Youtube** URL are not supported, but you can download a video and use it in RaceCTRL. Use the following URL: file:///C:/Video/MyFile.mp4

**i** **Note:** The live video is shown automatically when:

- a new session is not started yet,
- the session is "live" and not "paused",
- the session is finished.

### 7.2. Record

When at least one media is set and enable, the **Media Recording** button is active in the Timing ribbon:

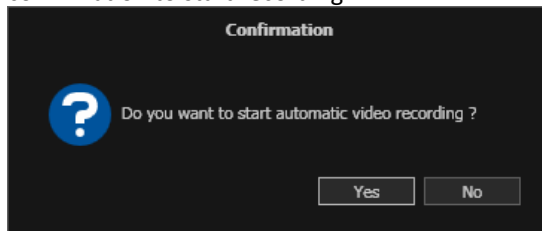


**Note:** In the status bar, you can find the recording status with the remaining available space on the recording drive:

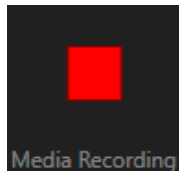
Data Stream status : **Stopped** Video Recording status : **Stopped** C:\ 41% available

You can **start** recording manually by clicking on this record button.

Media recording can also be started automatically when starting the data stream. In this case a dialog box asks a confirmation to start recording:



With both methods, all the media streams checked as **Record stream** will be recorded at the same time. The button turns square when recording.



You can **stop** recording manually by clicking on the button.

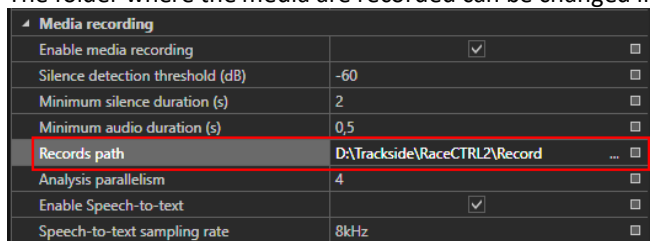
**Note:** When the data stream is stopped, a dialog box asks a confirmation to stop the recording. Media recording is automatically stopped when the race is finished. Pausing the data stream won't pause the recording.

You can use the audio/video player to listen/see the live media while recording.

After the media have been recorded, you can play them back into the audio or video player, **RaceCTRL** will find the recorded sequence corresponding to the session date and time.

## 7.3. Media folder change

The folder where the media are recorded can be changed in *Edit > Server Options*:



When changing the path, the media recording service must be restarted, a confirmation dialog is shown to ask for this:



**Note:** The existing files aren't copied to the new folder. If needed you must do that manually.

## 7.4. Media control

The window “Media Control” is used to monitor each stream status while recording. You can open this window on the “Timing” tab. It’s available only on the server (or in standalone mode).

Media control											
	Name	Type	Car	Status	Sequences	Files	Errors	Last message	Analysis status	Detected (s)	Transcribed (s)
▶	ABT	Audio	66	Recording	4	21	4	Recording in progress	...	35	34
	AMB	Audio	7	Recording	4	21	4	Recording in progress	Set Text Messa...	29	20
	BIR	Audio	2	Recording	4	21	4	Recording in progress		51	51
	BUE	Audio	9	Retrying	4	20	7	Connecting to stream		16	16
	DAC	Audio		Recording	4	21	4	Recording in progress		93	82
	DIG	Audio	1	Recording	4	21	4	Recording in progress	Set Text Messa...	38	38
	ENG	Audio	5	Recording	4	21	4	Recording in progress		93	92
	EVA	Audio	20	Recording	4	21	4	Recording in progress		0	0
	FIL	Audio	68	Recording	4	21	4	Recording in progress		23	17
	Full race	Video		Recording	4	24	8	Recording in progress		0	0
	HEI	Audio	23	Recording	4	21	4	Recording in progress		17	16
	LOP	Audio	6	Recording	4	21	4	Recording in progress	Get Audio Lev...	41	33
	LOT	Audio	18	Recording	4	21	4	Recording in progress		66	66
	LYN	Audio	36	Recording	4	21	4	Recording in progress		50	50
	PIQ	Audio	3	Error	2	15	13	VLC has closed unexpectedly, retryin...		49	49
	ROS	Audio	19	Recording	4	21	4	Recording in progress	Get Audio Lev...	37	27
	SAR	Audio	27	Recording	4	21	4	Recording in progress		75	71
	TUR	Audio		Recording	4	21	4	Recording in progress	Get Audio Lev...	0	0
	TV	Video		Recording	4	21	6	Recording in progress		0	0
	VER	Audio	25	Recording	4	21	4	Recording in progress		44	29

The grid shows all the known media streams for the event. Note that it’s refreshed no more often than every ~2s to avoid high loads on the server.

### Status

- Stopped: the stream isn’t recording (either the whole recording is stopped or its “Record stream” option isn’t checked).
- Starting: the record is starting, but not confirmed yet.
- Recording: the stream is confirmed to be recording, that is after at least 15s.
- Error: an error occurred, see the “Last message” column. The recording will retry after a delay.
- Retrying: the recording is retrying after an error

<b>Sequences</b>	The number of recordings for the current session (every time you start the media recording a new sequence is started for each media stream).
<b>Files</b>	The number of files for all sequences in the session, each file is ~15s of record.
<b>Errors</b>	The number of errors, for all sequences in the session.
<b>Last message</b>	The last message for the stream. Click on the “...” button to see all messages.
<b>Analysis status</b>	<ul style="list-style-type: none"> <li>• Can't Open File: the analyzed file may be locked (it'll be retried later).</li> <li>• Get Audio Level: audio level is analyzed.</li> <li>• Get Audio Level Edges: audio level edges are detected.</li> <li>• GetText From Speech: the audio sample is sent to the speech-to-text Microsoft server.</li> <li>• SetText Message: the text has been returned from the Microsoft server and is saved to the database.</li> <li>• Error: an error occurred while getting the text from the Microsoft server, see the “Last message” column.</li> </ul>
<b>Detected (s)</b>	The number of detected non-silence audio seconds for all sequences in the session.
<b>Transcribed (s)</b>	The number of non-silence audio seconds which has been transcribed as text messages. Note that this number can be different from the “detected” counter because of rounding and/or errors or unrecognized speech.

## 8. Web API

A Web API is available to access RaceCTRL data.

### 8.1. Configuration

By default, the Web API is enabled, this can be changed in *Edit > Options*:

Web API		
Web API host address	localhost	<input type="checkbox"/>
Web API host port	9000	<input type="checkbox"/>
Enabled web API	<input checked="" type="checkbox"/>	<input type="checkbox"/>

### 8.2. External access

It is possible to access the API from another computers. The computer hosting the API must allow the connexion from the other machines.

Step 1/3 : Set the properties "Web API host address" to \*

Web API		
Web API host address	*	<input type="checkbox"/>
Web API host port	9000	<input type="checkbox"/>
Enabled web API	<input checked="" type="checkbox"/>	<input type="checkbox"/>

Step 2/3

Run the following command in a DOS cmd running in administrator mode:

```
netsh http add urlacl url=http://*:9000/ sddl=D:(A;;GX;;;S-1-1-0)
```

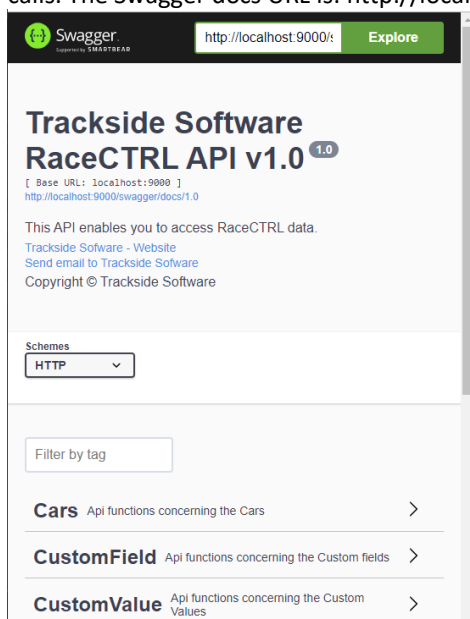
Step 3/3

Open the firewall port 9000 in TCP.

### 8.3. Inline documentation

You can access the API documentation at the following URL: <http://localhost:9000/swagger/ui/index>

You can use the Swagger UI to look at the API functions and parameters, look at the object model and test the API calls. The Swagger docs URL is: <http://localhost:9000/swagger/docs/1.0>



## 8.4. Code generation

You can use the URL of the documentation for various OpenAPI compatible code generation tools like Swagger CodeGen, AutoRest, or others... These tools can help generate some code in many languages to simplify the access to the API but you can of course use code written from scratch. If you decide to use CodeGen, we recommend to download the 2.4.x version of Swagger CodeGen for a better result.

Swagger CodeGen documentation is available here: <https://github.com/swagger-api/swagger-codegen>

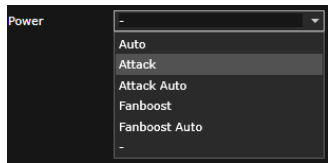
### Custom field and custom views:



You can edit custom field values directly from a custom view. By default, the current custom view is locked. To be able to enter new value you must unlock the view by clicking on this button. Then enter a value and press Enter key or leave the field to validate the changes. Press Esc to cancel changes.



By default, the custom view displays the values from the select car and the last completed lap. But you can click on this button and select a row in the Laps History grid. This will actualize the custom view with the values of the current row.



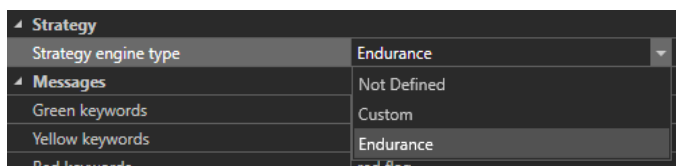
A new type of custom fields has been added in order to create Enumeration. Select the Enumeration value type and add values in the EnumValues list of string. If you want to display an Enumeration value in a custom view, you can create a DisplayFieldInformation with the ViewItemTypeEnum Combobox.

### Miscellaneous:

GetCompletedLap	The GetCompletedLap method contains for each lap returned a PitInfo object named InOuts that gathers information corresponding to the Pit stops but also the power modes. Moreover, a TrackStatus object named TrackStatus has been added on the Lap objects in order to know if the lap was completed under yellow, FCY, safety car... but also the percentage of time the lap was under each state.
LapController	GetCurrentCarResult and GetCurrentCarResults to get the content of the leaderboard for a given car via its Id or for all the cars. These methods return CarResult objects.
clearAllExistingLaps	A new boolean parameter named clearAllExistingLaps has been added in the SetExtrapolatedLaps in order to clear all the extrapolated laps already in cache before to set the new list. This can help to remove extrapolated laps if the number of laps changed between to calculation.
UpdateSession	UpdateSession has been added in SessionController in order to update an existing session.
Gps	Get the list of GPS positions for a car identified by its id and a lap number.

## 8.5. Strategy engine

The strategy engine supports 3 modes:



- **Not defined:** no strategy
- **Endurance:** embedded strategy engine dedicated to endurance championships.
- **Custom:** in house strategy engine using Web API to communicate with RaceCTRL

When Custom mode is selecting, the **strategy engine** runs outside RaceCTRL. It's a simple custom program using the **Web API**, in order to compute your own strategy (race prediction or other). You have to enter the path to your strategy engine program and optionally some arguments.

The **strategy engine** can be automatically launched with RaceCTRL. Just set the path and the arguments (if any) here:

*Edit > Options*

▲ Strategy	
Strategy program path	C:\Program Files\TrackSide\RaceCTRL\Rac... <input type="checkbox"/>
Strategy program arguments	<input type="checkbox"/>

## 9. PitBoard

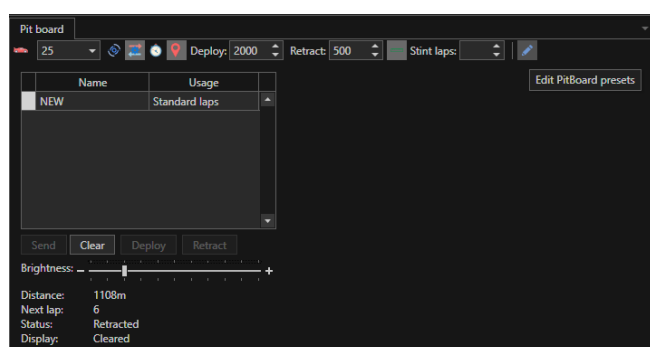
A PitBoard connected to the network can be managed by RaceCTRL. You can connect a PitBoard to each RaceCTRL client.

The Soda Racing Equipement Electronic LED PitBoard and the CASELINER LED PIT BOARD CL-15 are supported.

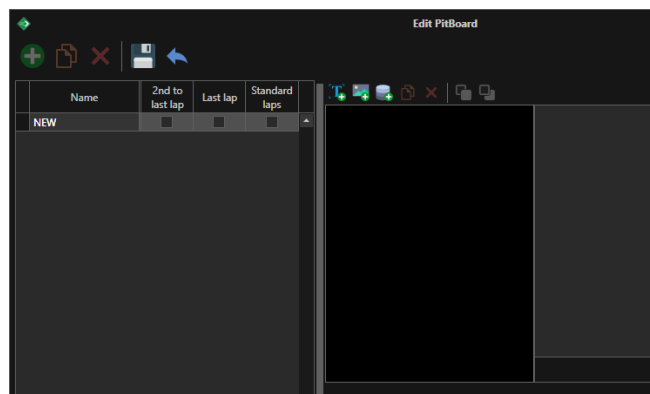
▲ PitBoard	
PitBoard type	Soda Racing Equipement
▲ PitBoard config	PitBoardSodaConfig
PitBoard Width	60
PitBoard Height	80
PitBoard Address	localhost
PitBoard Port	10080
Send Timeout (ms)	5000
Receive Timeout (ms)	5000

Set the PitBoard in the client options:

- Select the PitBoard type
- Set the width/height of the PitBoard (number of LEDs),
- Set the PitBoard address and port on the network,
- The timeouts can be adjusted if asked by the support.

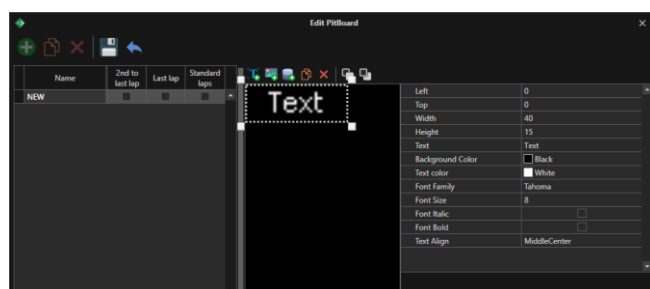


Open the “PitBoard” window from the “Display” tab.

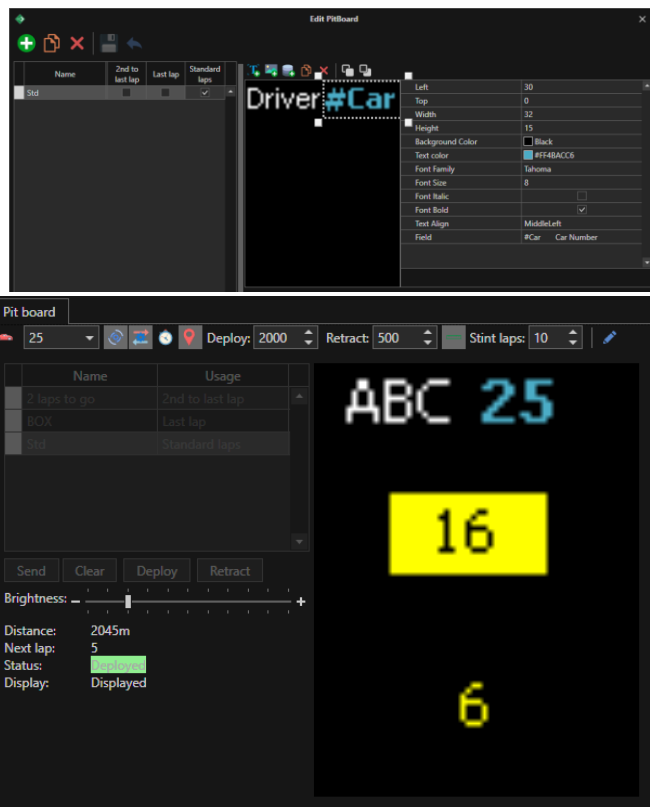


Open the “Edit PitBoard” window to define the informations you’ll display on the PitBoard:

- Create a new preset and give it a name,
- Check the usage of this preset in auto mode:
  - 2nd to last lap: it’ll be used for 2nd to last lap,
  - Last lap: it’ll be used for the last lap,
  - Standard laps: it’ll be used for all other laps.
- You can check more than one usage per preset, but only one preset can be checked for a given usage at a time. You have to check at least “Standard”, if the other usages aren’t defined, the “Standard” one will be used.
- Add some text, images and fields to the display preview












- For each element you can set its location, size, colors, font, etc.
- For the fields choose the data to display in the “Field” property.
- When you designed and saved the presets, close the “Edit PitBoard” window.

The PitBoard operation is managed from the “PitBoard” window.

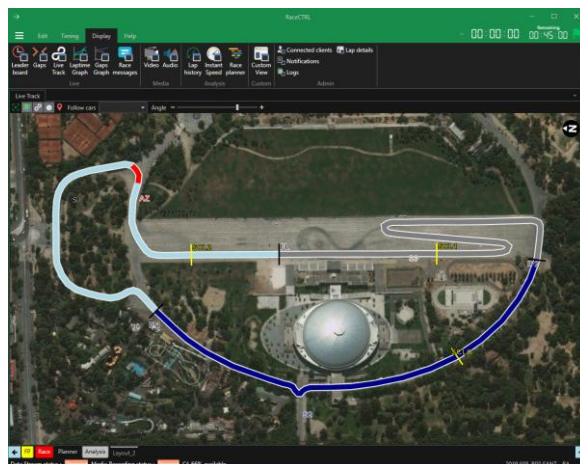
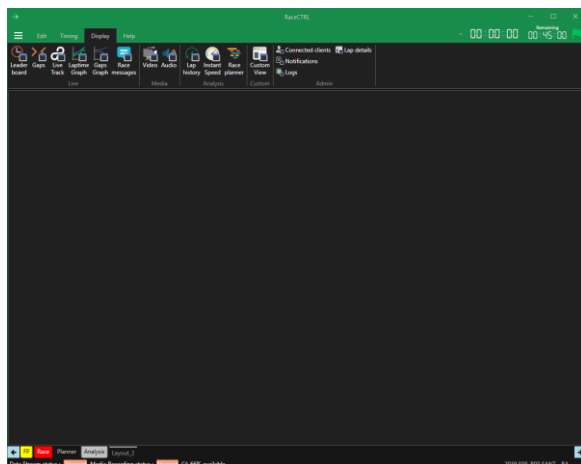
- Select the car for which you want to display the PitBoard. The current car distance on the track and the next lap number to do are displayed at the bottom of the window.
- Select the car distance mode:
  -  use the estimated position (if GPS data isn’t available).
  -  use the GPS position.

- The preset to display can be selected automatically or manually and the deploy/retract can also be done automatically or manually. To choose the modes, check the buttons on the toolbar:
  -  sets the automatic preset selection mode: the preset will be selected automatically and sent to the PitBoard before deploying it. In manual mode, you have to select the preset to use and click on the “Send” button to display it. Use the “Clear” button to clear the display in manual mode.
  -  set the automatic deploy/retract mode: the PitBoard will be deployed automatically when the car distance on track is after the “Deploy” value (track distance in meters) on the toolbar, and it is retracted when the car distance on track is after the “Retract” value (track distance in meters). If the “Retract” value is lower than the “Deploy” value that means the Finish Line is between them. Note that you must account for the deploy/retract delay when defining these values.
- To be able to automatically calculate the number of remaining laps (either for the “Laps to do” display field and for the “second to last/last lap” selection):
  - Use the Strategy Engine to calculate the current stint lap count,
  - Or check the  button and enter the current stint lap count manually in the “Stint laps” field on the toolbar.
- The PitBoard preview shown in the window displays current data. If the display has not been sent yet to the PitBoard, the “Display” status shows “Not updated”:
  - In manual selection mode you have to click on “Send” to update the display.
  - In automatic selection mode, the display will be updated just before deploy, and cleared after retract.
- The “Status” shows “Deployed” or “Retracted” depending on the known position of the PitBoard.

## 10. Tutorials

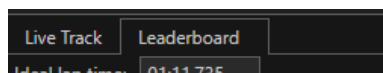
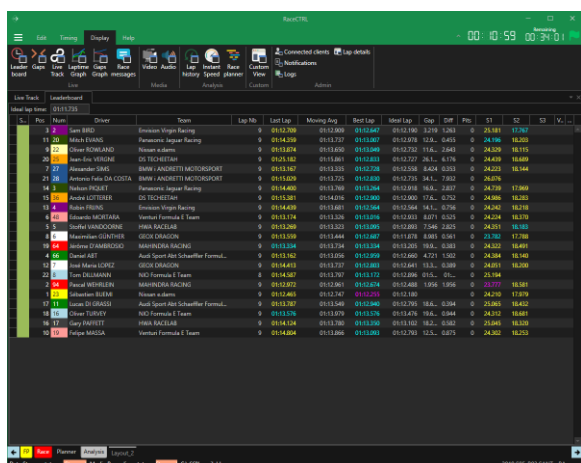
### 10.1. Create your first layout

- 1 Add a view in an empty layout, for example the track map: *Display > Live Track*

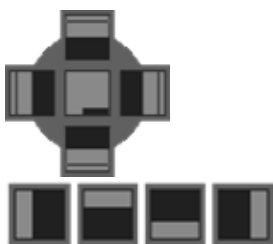


- 2 Add a second view, for example the Leaderboard: *Display > Leaderboard*

The 2 views are arranged in tabs:



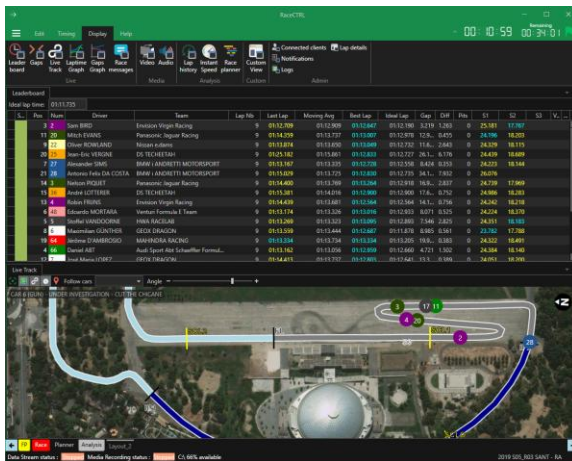
- 3 It is possible to move this second view to another area with a left click on the title of the view



Releasing the left mouse button on one of the parts of this pictogram will divide the area where it is and place the view on the wanted side (left, up, right, down). If you release on the center, the view will be placed as a layer in the area.

You can also place the view on the sides of the layout using these pictograms.

For example, releasing the left mouse button on the top of the pictogram will divide the area in 2 equal parts and will place the view on the top side.



You can create a layout with as many views as you need and arrange them as you want.

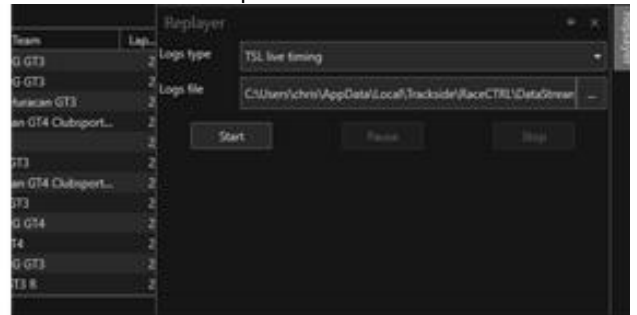
- It is possible to add an autohide function on some views attached on the side.



You can activate the autohide function with this icon.

Once activated, the view is hidden, and appears when the mouse pointer is over.

Lap...	Last Lap	Best Lap	Gap	Diff	P...	S1	S2	S...	V1
28	02:11.9...	02:09.6...	53.482	11.710	0	48.876	53.773	18...	
28	02:10.0...	02:09.0...	41.772	3.620	0	46.815	53.769	14...	
28	02:08.9...	02:07.3...	4.566	3.503	0	52.781	59.080	15...	
26	02:25.1...	02:20.9...	06:28.5...	1.265	0	53.473	59.430	18...	
26	02:23.3...	02:20.5...	05:38.4...	11.212	0	52.138	57.990	19...	
28	02:09.5...	02:07.9...	0.404	0.404	0	52.720	01:03.5...	15...	
26	02:24.9...	02:20.8...	06:15.2...	34.365	0	58.345	01:03.0...	18...	
28	02:09.2...	02:07.9...	1.063	0.659	0	51.202	58.836	16...	
26	02:22.5...	02:21.4...	05:40.8...	2.486	0	51.896	57.205	17...	
26	02:25.2...	02:23.8...	06:36.3...	7.846	0	54.785	56.703	20...	
28	02:10.0...	02:08.3...	18.408	10.267	0	51.124	54.789	17...	
28	02:11.1...	02:08.3...	7.142	2.348	0	50.682	55.626	13...	



## 10.2. Creating an event

- Use the 3 dashes to go to the **selection page**



- In **Current Event Information** click on (+)



Edit Event

Event name

New Event

Event date

02/10/2019

Event description

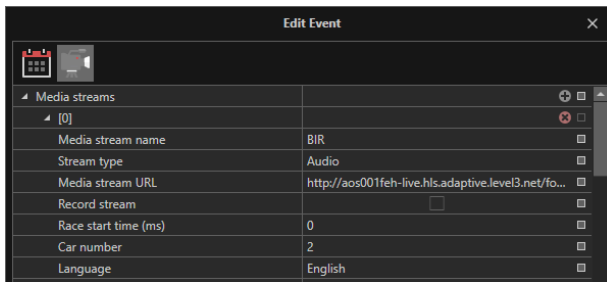
Event track

- Set the event properties:

- set the **Event name**,
- set the starting date of the event in **Event date**,
- if needed you can set a description in **Event description**,
- choose a track in the list **Event track**.

- On the second tab of this window you can define your **Media streams**





5 Click on (+) to create a new media and set the properties of the media stream:



- set a **Media stream name**,
  - set the **Stream type** (Video or Audio),
  - set the **Media stream URL**,
  - tick **Record stream** to enable the record of this media,
  - set a time offset to synchronise with the timing data (**Race start time**),
  - set a **Car number** if this media is linked to a car (car radio for example).
  - set a **Language** used for the Speech-to-text **function**.
- (more details on media streams in section 7)

**Note:** Once created, an event can be edited or deleted. It is also possible to duplicate an existing event in order to create an event faster (The following data are duplicated: the event properties, the media streams, the cars and drivers).

More details in section 0

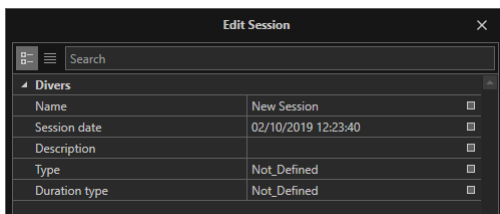
### 10.3. Creating a session

1 Use the 3 dashes to go to the **selection page**



2 Choose the event in the **Events list selection**

3 In **Current Session Information** click on (+)






4 Set the session properties:

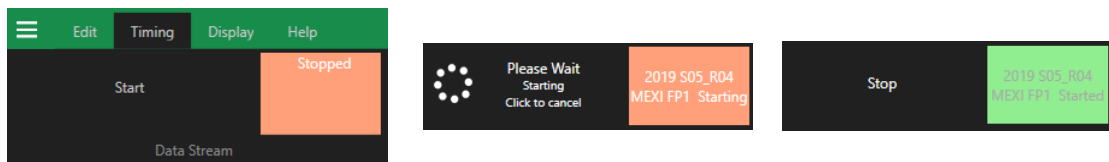
- set the session name in **Name**,
- set the session date and time in **Session date**,
- if needed you can set a description in **Description**,
- choose a **Type** in the list (practice, qualification or race),
- choose a **Duration Type** in the list + the duration (laps, distance or both).

**Note:** Once created, a session can be edited or deleted. It is also possible to duplicate an existing session in order to create a session faster (The following data are duplicated: the session properties, the timing stream properties).

More details in section 5.2.2

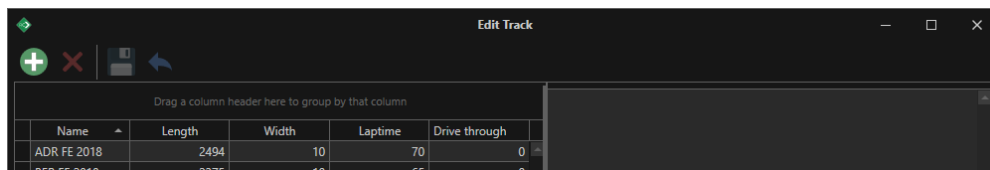
## 10.4. Connection to a timing feed


- 1 Use the 3 dashes to go to the **selection page** 
- 2 Choose the event in the **Events list selection**
- 3 Choose the session in **Sessions list selection**
- 4 Click on the **Configure DataStream** button at the top 
- 5 Choose a **DataStream Type**
- 6 Set all the parameters needed to define the **DataStream** (more details on timing feeds in section 11)
- 7 Back on the **working page** 
- 8 *Timing > Start*



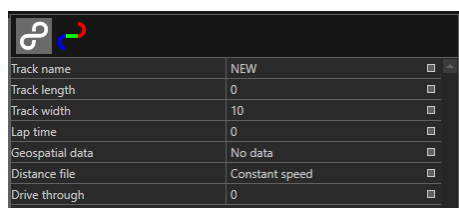
## 10.5. Add a new track

- 1 From the **working page** *Edit > Edit Track*



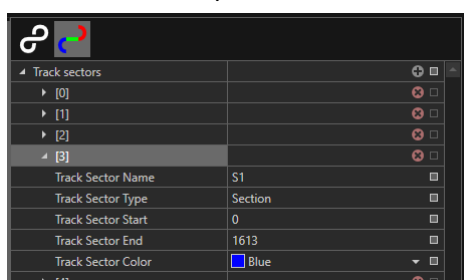
- 2 Click on (+) to create a new track 

- 3 On the first tab set the track properties:



- set the **Track name**,
- set the **Track length**,
- set the **Track width**,
- set a default **Lap time** (for the race prediction purpose),
- set a **Drive through** time (used for Ghost cars, see section 6.1.7),
- and the 2 files that define the track (see below for more details).

- 4 On the second tab you can customize the track by adding sector loops, sections with colours, markers...





This part is optional but Finish line, IN and OUT are used for the race projection.

**Note:** If the path defined in the Geospatial data doesn't start at the timing line, you can set an offset on Finish line.

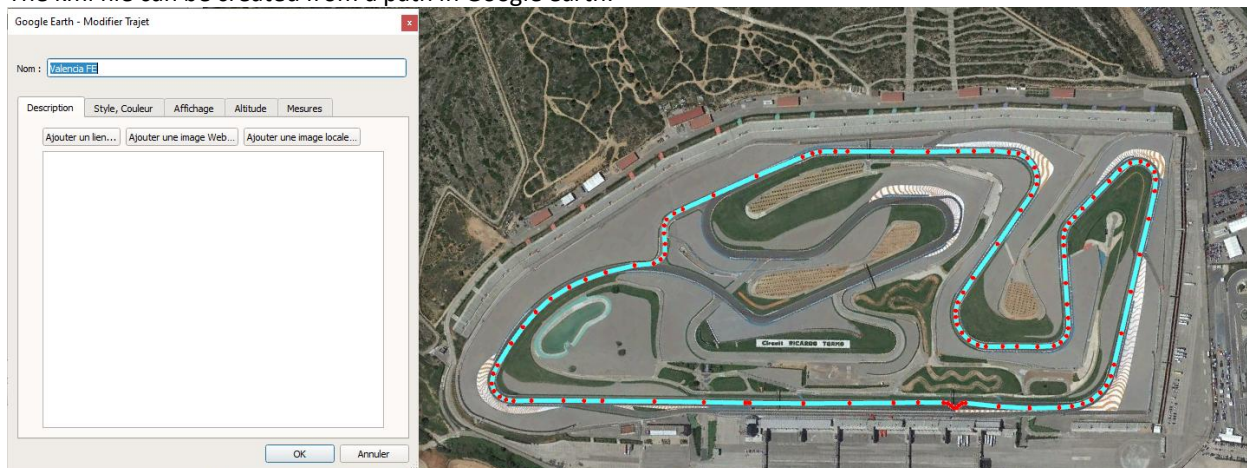
- 5 Do not forget to save before closing the window



More details on **Edit Tracks** in section 6.1.3

### Geospatial data (.kml):

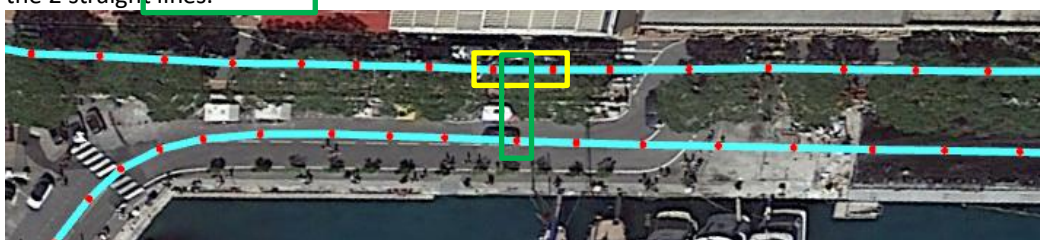
The kml file can be created from a path in Google earth:



The path must start at the Timing/Finish Line (FL) and must not be closed. Also, it must be created in the same direction as the cars on the track or the cars will run in the wrong direction.



This path is used to create the track but also for the “instant speed” calculation with GPS data (see section 0). In order to have a good accuracy it is important that 2 consecutive points are close enough. For example, when you have 2 parallel straight lines the distance between 2 consecutive points must be less than the distance between the 2 straight lines.



Once your path is finished save it as a kml file with a right click on its name on the lateral bar.

### Distance file (.dis) :

the distance file (.dis) is a csv file with one column containing the distance every 10th of a second. It is used to have a better position of cars on the live track when no GPS is available. A track can be saved without a distance file, the result will be a constant speed.

	A	B
1	3.3	
2	8.8	
3	14.4	
4	20	
5	25.6	
6	31.3	
7	36.9	
8	42.6	
9	48.4	
10	54.1	

## 11. Timing feeds (Data streams)

To edit a timing feed :

- 1 Use the 3 dashes to go to the **selection page**
- 2 Choose the event in the **Events list selection**
- 3 Choose the session in **Sessions list selection**
- 4 Click on the **Configure DataStream** button at the top



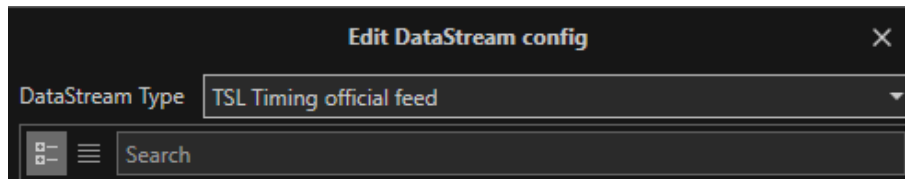
### 11.1. Alkamel Timing AKS V2 Protocol

Al Kamel Systems <http://www.alkamelsystems.com/en>

<b>Logs</b>		Location of the <b>feed record</b> (log) on your computer (default is: C:\Users\your user\AppData\Local\Trackside\RaceCTRL\DataStreamLogs)
Log path	.\DataStreamLogs	
<b>Connection</b>		
Server host		Name of the Alkamel server
Server port	11001	Port of the Alkamel server
Login		Your login to access the Alkamel server
Password		Your password to access the Alkamel server
Retry (s)	1800	Amount of time RaceCTRL try to connect to the timing server. Default is 1800 = 30 min.
Disable SSL	<input type="checkbox"/>	Option used for certain applications which emulate the Alkamel timing feed without SSL.
<b>Formula E</b>		Specific for <b>Formula E</b> : Power modes are supported. There are 3 different modes called Standard, Attack and Fanboost. For each you need to set the value coming from the timing feed (ex: 200 for Standard) and the text you want to use in RaceCTRL (ex: 200kW for Standard). RaceCTRL will calculate the total duration of each mode for a lap. If you want to have a % of use instead of time you can set a <b>Full load mean time</b> . These data are then available in the leaderboard and the laps history views.
Power mode Standard	200	
Power mode Standard display name	200kW	
Power mode Attack	225	
Power mode Attack display name	225kW	
Power mode Fan boost	250	
Power mode Fan boost display name	250kW	
Full load mean time	30	

## 11.2. TSL live timing (official)

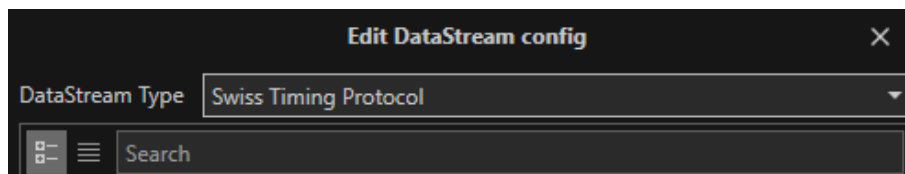
Timing Solution Ltd official feed.



Connection		
Server host		Name of the TSL server
Server port	5100	Port of the TSL server
Login		Login and password if needed to connect to the server. Or empty elsewhere.
Password		
API key		The API Key provided by TSL (mandatory)
Secret Shared key		The secret shared key provided by TSL (mandatory)
Log path	.\DataStreamLogs	Location of the <b>feed record</b> (log) on your computer (default is: C:\Users\your user\AppData\Local\Trackside\RaceCTRL\DataStreamLogs)

## 11.3. Swiss Timing Protocol

Swiss timing <https://www.swisstiming.com/>



▲ Logs		Location of the <b>feed record</b> (log) on your computer (default is: C:\Users\your user\AppData\Local\Trackside\RaceCTRL\DataStreamLogs)
Log path	.\DataStreamLogs	
▲ Connection		
Ftp server host		Name of the ftp server
Ftp server port	21	Port of the ftp server
Login		Your login to access the ftp server
Password		Your password to access the ftp server
Ftp folder		Path to the ftp folder to read
Ftp read interval	10000	Read file frequency in ms
Local files directory	C:\Users\	The local directory where the files are downloaded
Retry (s)	1800	Amount of time RaceCTRL try to connect to the timing server. Default is 1800 = 30 min.



## 12. Strategy engines

### 12.1. Strategy engine “Endurance” (SEE)

**blue** = parameters coming from RaceCTRL or calculated from other parameters

**red** = variables

#### 12.1.1. Parameters from RaceCTRL

Session parameters used (section 5.2.2)

<b>RaceType</b>	(-)	Type of race: “distance” or “duration” or “distance and duration”
<b>RaceLapCount</b>	(-)	When RaceType = “distance”, race length in number of laps
<b>RaceDuration</b>	(s)	When RaceType = “duration”, race length in time

When **RaceDuration** or **RaceLapCount** are not known (for example, in case of a distance race, **RaceDuration** is not known) , they are set to a high value to not interfere in the calculations.

Track parameters used (section 6.1.3)

<b>TrackLength</b>	(m)	Track length
<b>DistanceIn</b>	(m)	Position of the IN loop from the 0 of the kml file
<b>DistanceOut</b>	(m)	Position of the OUT loop from the 0 of the kml file
<b>TrackLapTime</b>	(s)	Reference laptime for the track layout
<b>RatioOut</b>	(-)	Ratio Out lap / Flying lap (no pitstop)
<b>RatioIn</b>	(-)	Ratio In lap / Flying lap (no pitstop)
<b>PitlaneSpeed</b>	(m/s)	Pitlane speed
<b>TimePitlane</b>	(s)	Pitlane time, time from In to Out at pitlane speed $= ( \text{DistanceOut} + \text{DistanceTrack} - \text{DistanceIn} ) / \text{PitlaneSpeed}$ Case C* = $(\text{DistanceOut} - \text{DistanceIn}) / \text{PitlaneSpeed}$
<b>TimeInPitlane</b>	(s)	Time from In to Finish Line in pitlane $= (\text{DistanceTrack} - \text{DistanceIn}) / \text{PitlaneSpeed}$ Case C* = $\text{TimePitlane} / 2$
<b>TimeOutPitlane</b>	(s)	Time from Finish Line to Out in pitlane $= \text{DistanceOut} / \text{PitlaneSpeed}$ Case C* = $\text{TimePitlane} / 2$

Class and car parameters used (sections 6.1.1 and 6.1.2)

<b>LapTimeRef</b>	(s)	Reference laptime for this car (coming from car parameters or, if N/A, class parameter)
<b>StintLapCount</b>	(-)	Max number of laps of a stint (fuel or regulation)
<b>StintDuration</b>	(s)	Max time of a stint (regulation)
<b>EndRaceMode</b>	(-)	Option to define the driving time for the last stint True = ends at the end of the race duration False = ends when crossing the Finish Line
<b>PitstopTime</b>	(s)	Time of standard pitstops for this car

<b>LastPitstopTime</b>	(s)	Time of the last pitstop of race for this car

\*Case C = when Finish Line is outside the pitlane (see pitlane definition in section 6.1.3)

### 12.1.2. Car analysis

<b>LapTimeAvg</b>	(s)	Moving average for this car (calculated in RaceCTRL)
<b>LapTime</b>	(s)	Reference laptime used for this car = <b>LapTimeAvg</b> or, if N/A, <b>LapTimeRef</b>
<b>TrackInTime</b>	(s)	Time from Finish Line to In = <b>RatioIn</b> x <b>LapTime</b> - <b>PitlaneInTime</b>
<b>TrackOutTime</b>	(s)	Time from Out to Finish Line = <b>RatioOut</b> x <b>LapTime</b> - <b>PitlaneOutTime</b>
<b>FullStintLapCount</b>	(-)	Number of laps for a full stint of this car = Min { Floor [ ( <b>StintDuration</b> - <b>TrackInTime</b> - <b>TrackOutTime</b> ) / <b>LapTime</b> ] + 2 ; <b>StintLapCount</b> } Case C = Min { Floor [ ( <b>StintDuration</b> - <b>TrackInTime</b> - <b>TrackOutTime</b> ) / <b>LapTime</b> ] + 1 ; <b>StintLapCount</b> }
<b>FullStintTime</b>	(s)	Time for a full stint of this car = ( <b>FullStintLapCount</b> - 2 ) x <b>LapTime</b> + <b>TrackOutTime</b> + <b>TrackInTime</b> Case C = ( <b>FullStintLapCount</b> - 1 ) x <b>LapTime</b> + <b>TrackOutTime</b> + <b>TrackInTime</b>

### 12.1.3. Calculation / 1<sup>st</sup> pass

A new calculation is done every 30 seconds only for car tagged "watch" in RaceCTRL.

The goal of this 1<sup>st</sup> pass is to find which car (among those tagged "watch") will win the race (the one doing the more laps in less time).

Laptime analysis (laps coming from RaceCTRL through the API)

<b>LastOutRacetime</b>	(s)	Racetime of the last Out loop crossing <b>Note</b> : For the first stint, <b>LastOutRacetime</b> = 00:00:00.000 (start)
<b>LastOutLapNumber</b>	(-)	Lap number of the last Out lap <b>Note</b> : for the first stint, <b>LastOutLapNumber</b> = 1 (start lap)
<b>LastLapRaceTime</b>	(s)	Racetime of the last lap of the car (end of the lap)
<b>LastLapNumber</b>	(-)	Lap number of the last lap of the car
<b>CurrentStintLapDoneCount</b>	(-)	Number of laps done in car current stint IF <b>LastLapNumber</b> = 0 & <b>LastOutLapNumber</b> = 0 = 0 // The race is not started or the car is in the first lap ELSE IF <b>LastLapNumber</b> > 0 & <b>LastOutLapNumber</b> = 0 = <b>LastLapNumber</b> // First stint ELSE = <b>LastLapNumber</b> - <b>LastOutLapNumber</b> + 1 // others stints
<b>CurrentStintTimeElapsed</b>	(s)	Time elapsed in car current stint = <b>LastLapRaceTime</b> - <b>LastOutRacetime</b>

Current stint analysis

<b>CurrentStintTotalLapCount</b>	(-)	Estimated total number of laps for car current stint = Min { Int [ ( <b>StintDuration</b> - <b>CurrentStintTimeElapsed</b> - <b>TrackInTime</b> ) / <b>LapTime</b> ] + <b>CurrentStintLapDoneCount</b> + 1 ; <b>StintLapCount</b> }
<b>CurrentStintEndRacetime</b>	(s)	Estimated racetime of the end of the current stint (In loop) = <b>LastLapRaceTime</b> + ( <b>CurrentStintTotalLapCount</b> - <b>CurrentStintLapDoneCount</b> - 1 ) x <b>LapTime</b> + <b>TrackInTime</b>

		Case C = $\text{Min} \{ \text{Int} [ (\text{StintDuration} - \text{CurrentStintTimeElapsed} - \text{TrackInTime}) / \text{LapTime} ] + \text{CurrentStintLapDoneCount}; \text{StintLapCount} \}$
<b>CurrentStintDuration</b>	(s)	Duration of the car current stint = $\text{CurrentStintEndRacetime} - \text{LastOutRacetime}$
<b>CurrentStintEndLapNumber</b>	(-)	Lap number of the last lap of the car current stint = $\text{LastLapNumber} + \text{CurrentStintTotalLapCount} - \text{CurrentStintLapDoneCount}$

#### Remaining stints

<b>LastInRacetime</b>	(s)	Earliest racetime possible for the last In of the car IF $\text{EndRaceMode} = \text{false}$ = $\text{RaceDuration} - \text{FullStintTime} - \text{LastPitstopTime} - \text{PitlaneTime}$ IF $\text{EndRaceMode} = \text{true}$ = $\text{RaceDuration} - \text{Min} \{ \text{StintDuration}; (\text{StintLapCount} - 1) \times \text{LapTime} + \text{TrackOutTime} \} - \text{LastPitstopTime} - \text{PitlaneTime}$
<b>RemainingFullStintCount</b>	(-)	Number of full stints remaining for the car = $\text{Min} \{ \text{Int} [ (\text{LastInRacetime} - \text{CurrentStintEndRacetime}) / (\text{PitstopTime} + \text{PitlaneTime} + \text{FullStintTime}) ] + 1; \text{Int} [ (\text{RaceLapCount} - \text{CurrentStintEndLapNumber}) / \text{FullStintLapCount} ] \}$

#### Last stint

<b>LastStintLeftTime</b>	(s)	Remaining time for the last stint of the car = $\text{RaceDuration} - \text{CurrentStintEndRacetime} - \text{RemainingFullStintCount} \times (\text{PitstopTime} + \text{PitlaneTime} + \text{FullStintTime}) - \text{LastPitstopTime} - \text{PitlaneTime}$
<b>LastStintLapCount</b>	(-)	Number of laps for the last stint of the car IF $\text{RemainingFullStintCount} \geq 0$ = $\text{Max} \{ \text{Min} \{ \text{Int} [ (\text{LastStintLeftTime} - \text{TrackOutTime}) / \text{LapTime} + 2 ]; \text{RaceLapCount} - \text{CurrentStintEndLapNumber} - \text{RemainingFullStintCount} \times \text{StintLapCount} \}; 1 \}$ ELSE = $\text{Min} \{ \text{Int} [ (\text{RaceDuration} - \text{LastLapRaceTime}) / \text{LapTime} ] + \text{CurrentStintLapDoneCount} + 1; \text{RaceLapCount} - \text{CurrentStintEndLapNumber} \}$
<b>LastStintTime</b>	(s)	Duration of the last stint of the car ( > $\text{LastStintLeftTime}$ ) = $(\text{LastStintLapCount} - 1) \times \text{LapTime} + \text{TrackOutTime}$
<b>SlackTime</b>	(s)	Margin to a full stint in duration = $\text{FullStintTime} - \text{LastStintTime}$
<b>EndLapCount</b>	(-)	Total number of laps for the car IF $\text{RemainingFullStintCount} \geq 0$ = $\text{CurrentStintEndLapNumber} + \text{RemainingFullStintCount} \times \text{FullStintLapCount} + \text{LastStintLapCount}$ ELSE = $\text{LastLapNumber} - \text{CurrentStintLapDoneCount} + \text{LastStintLapCount}$
<b>EndRacetime</b>	(s)	Racetime of the end of the race for the car (crossing Finish Line) IF $\text{RemainingFullStintCount} \geq 0$ = $\text{CurrentStintEndRacetime} + \text{RemainingFullStintCount} \times (\text{PitstopTime} + \text{PitlaneTime} + \text{FullStintTime}) + \text{LastPitstopTime} + \text{PitlaneTime} + \text{LastStintTime}$ ELSE = $\text{LastLapRaceTime} - \text{CurrentStintTimeElapsed} + \text{LastStintTime}$

The winning car is the one with the highest **EndLapCount** and the lowest **EndRacetime**.

**WinnerEndLapCount** = **EndLapCount** of this car

**WinnerEndRacetime** = **EndRacetime** of this car

When **RaceType** = distance and duration, we need to define if the end of the race is distance or duration:

IF **WinnerEndLapCount** < **RaceLapCount** & **WinnerEndRacetime** > **RaceDuration**  
 THEN **RaceType** = duration  
 IF **WinnerEndLapCount** > **RaceLapCount** & **WinnerEndRacetime** < **RaceDuration**  
 THEN **RaceType** = distance

#### 12.1.4. Calculation / 2<sup>nd</sup> pass

Now that we know which car wins and if the race ends by time or distance, **EndRacetime** and **EndLapCount** of some cars must be adjusted.

For carXX      IF **RaceType** = duration  
                   IF      **EndLapCount** < **WinnerEndLapCount** & **EndRacetime** < **WinnerEndRacetime**  
                             THEN      **EndLapCount** = **EndLapCount** + 1  
   **EndRacetime** = **EndRacetime** + **LapTime**  
  
                   IF **RaceType** = distance  
                     **EndLapCount** = first lap when Racetime > **WinnerEndRacetime**

#### 12.1.5. Creation of laps for the RaceCTRL database

From here it is possible to create laps and import them in RaceCTRL database in order to have them in Lap History and Gap Graph.

Cas A

	Outlaptime = <b>TrackOutTime</b> + <b>TimeOutPitlane</b> + <b>PitstopTime</b>
	Inlaptime = <b>TrackInTime</b> + <b>TimeInPitlane</b>

Cas B

	Outlaptime = <b>TrackOutTime</b> + <b>TimeOutPitlane</b>
	Inlaptime = <b>TrackInTime</b> + <b>TimeInPitlane</b> + <b>PitstopTime</b>

Cas C

	InOutlaptime = <b>TrackOutTime</b> + <b>TrackInTime</b> + <b>TimePitlane</b> + <b>PitstopTime</b> Le InOut lap is set as the first lap of a stint
---	--

## 12.2. Strategy engine “WEC” (SEWEC)

**blue** = parameters coming from RaceCTRL or calculated from other parameters

**red** = variables

**green** = manually filled variables

**(black)** = variable name in RaceCTRL or in the Strategy Engine, if different

### 12.2.1. Parameters from RaceCTRL

Session parameters used (section 5.2.2)

<b>RaceType</b> (Type)	(-)	Type of race: “distance” or “duration” or “distance and duration”	Editable in Current information -> Edit current session
<b>RaceLapCount</b> (Distance)	(-)	When RaceType = “distance”, race length in number of laps	Editable in Current information -> Edit current session
<b>RaceDuration</b> (Duration)	(s)	When RaceType = “duration”, race length in time	Editable in Current information -> Edit current session

When **RaceDuration** or **RaceLapCount** are not known (for example, in case of a distance race, **RaceDuration** is not known), they are set to a high value to not interfere in the calculations.

Track parameters used (section 6.1.3)

<b>TrackLength</b>	(m)	Track length	Editable in Edit -> Edit Tracks
<b>DistanceIn</b> (IN)	(m)	Position of the IN loop from the 0 of the kml file	Editable in Edit -> Edit Tracks
<b>DistanceOut</b> (OUT)	(m)	Position of the OUT loop from the 0 of the kml file	Editable in Edit -> Edit Tracks
<b>TrackLapTime</b> (Lap time)	(s)	Reference laptime for the track layout	Editable in Edit -> Edit Tracks
<b>RatioOut</b> (Ratio Outlap)	(-)	Ratio Out lap / Flying lap (no pitstop)	Editable in Edit -> Edit Tracks
<b>RatioIn</b> (Ratio Inlap)	(-)	Ratio In lap / Flying lap (no pitstop)	Editable in Edit -> Edit Tracks
<b>PitlaneSpeed</b>	(m/s)	Pitlane speed	Editable in Edit -> Edit Tracks
<b>TimePitlane</b>	(s)	Pitlane time, time from In to Out at pitlane speed = ( <b>DistanceOut</b> + <b>DistanceTrack</b> - <b>DistanceIn</b> ) / <b>PitlaneSpeed</b> Case C* = ( <b>DistanceOut</b> - <b>DistanceIn</b> ) / <b>PitlaneSpeed</b>	
<b>TimeInPitlane</b>	(s)	Time from In to Finish Line in pitlane = ( <b>DistanceTrack</b> - <b>DistanceIn</b> ) / <b>PitlaneSpeed</b> Case C* = <b>TimePitlane</b> / 2	
<b>TimeOutPitlane</b>	(s)	Time form Finish Line to Out in pitlane = <b>DistanceOut</b> / <b>PitlaneSpeed</b> Case C* = <b>TimePitlane</b> / 2	

Class and car parameters used (sections 6.1.1 and 6.1.2)

<b>LapTimeRef</b>	(s)	Reference laptime for this car (coming from car parameters or, if N/A, class parameter)	Editable in Edit -> Edit Class (for the all class) or Edit -> Edit Cars
<b>FuelStintLapCountRef</b> (Laps Stint)	(-)	Max number of laps of a stint (fuel or regulation)	Editable in Edit -> Edit Class (for the all class) or Edit -> Edit Cars
<b>FuelPitstopRef</b> (Pitstop time)	(s)	Time of standard pitstops for this car	Editable in Edit -> Edit Class (for the all class) or Edit -> Edit Cars
<b>LastPitstopRef</b> (Last pitstop time)	(s)	Time of the last pitstop of race for this car	Editable in Edit -> Edit Class (for the all class) or Edit -> Edit Cars

\*Case C = when Finish Line is outside the pitlane (see pitlane definition in section 6.1.3)

### 12.2.2. Car analysis

(laps coming from RaceCTRL through the API)

<b>TotalAvg</b>	(s)	Average of all laps of the car
<b>LastLapRaceTime</b>	(s)	Racetime of the last lap of the car (end of the lap)
<b>LastLapNumber</b>	(-)	Lap number of the last lap of the car
<b>LastLapPassingTimeMs</b>	(ms)	Time of the day of the last lap of the car
<b>LastInRacetime</b>	(s)	Racetime of the last In loop crossing <b>Note</b> : For the first stint, <b>LastInRacetime</b> = 00:00:00.000 (start)
<b>LastInLapNumber</b>	(-)	Lap number of the last In lap <b>Note</b> : for the first stint, <b>LastInLapNumber</b> = 0
<b>LastOutRacetime</b>	(s)	Racetime of the last Out loop crossing <b>Note</b> : For the first stint, <b>LastOutRacetime</b> = 00:00:00.000 (start)
<b>LastOutLapNumber</b>	(-)	Lap number of the last Out lap <b>Note</b> : for the first stint, <b>LastOutLapNumber</b> = 0
<b>PitstopDoneCount</b>	(-)	Count of Pitstops done
<b>RetiredLapNumber</b>	(-)	If the car is retired, the lap number of the retirement
<b>CurrentStintLapDoneCount</b>	(-)	Number of laps done in car current stint IF <b>LastLapNumber</b> = 0 & <b>LastOutLapNumber</b> = 0 = 0 // The race is not started or the car is in the first lap ELSE IF <b>LastLapNumber</b> > 0 & <b>LastOutLapNumber</b> = 0 = <b>LastLapNumber</b> // First stint ELSE = <b>LastLapNumber</b> - <b>LastOutLapNumber</b> + 1 // others stints
<b>CurrentStintTimeElapsed</b>	(s)	Time elapsed in car current stint = <b>LastLapRaceTime</b> - <b>LastOutRacetime</b>
<b>RemainingTime</b>	(s)	= <b>RaceDuration</b> - <b>LastLapRaceTime</b>

### 12.2.3. TrackAnalysis

(laps coming from RaceCTRL through the API)

<b>LapTime(Cat,Car,Driv)</b>	(s)	Lap time of all cars taking into account and as parameter the Category, Car and the Driver
<b>FiltredLapTime(Cat)</b>	(s)	We only take the significant lap time, i.e., we don't take into account the INLAP, OUTLAP
<b>LapTimeRefCat(Cat)</b>	(s)	The reference laptime for each category (or mean of reference laptime of all cars of the category)
<b>TimeWindow(Cat)</b>	(s)	= <b>LapTimeRefCat(Cat)</b> x 5
<b>MeanCatLaps(Cat)</b>	(s)	Moving average for a category on <b>TimeWindow(Cat)</b> , considering de 5 fastest laps
<b>RatioTrackEvo(Cat)</b>	(s)	= <b>MeanCatLaps(Cat)</b> / <b>LapTimeRefCat(Cat)</b> is a ratio to normalize the track at time to a reference laptime per category

#### 12.2.4. Driver Analysis

<b>NormalizedLapTime(Cat)</b>	(s)	= <b>FiltredLapTime(Cat)/RatioTrackEvo(Cat)</b>
<b>AvgNormLapTime(Car)</b>	(s)	=Mean( <b>NormalizedLapTime(Cat)(Car)</b> ) Average laptime of a car (from the beginning) for each car if <b>NormalizedLapTime(Cat)</b> is lower than the reference time + a delta (20" currently)
<b>MeanDriverLaps(Driver)</b>	(s)	=Mean( <b>NormalizedLapTime(Cat)(Driver)</b> ) Average laptime of a driver (from the beginning) for each car if <b>NormalizedLapTime(Cat)</b> is lower than the reference time + a delta (20" currently)
<b>DriverPaceAuto(Driver)</b>	(s)	= <b>MeanDriverLaps – MeanCarLaps</b> is the pace of the driver compared to the car pace
<b>ActualDrivingTime(Drvier)</b>	(s)	Driving time of the driver since the beginning of the race
<b>TotalDrivingTime(Driver)</b>	(s)	Driving time of the driver for the whole race with extrapolated laps (after the calculation 1.2.7)
<b>TotalLapCount(Driver)</b>	(-)	Lap count made by the driver
<b>TotalStintCount(Driver)</b>	(-)	Stint count made by the driver
<b>ConsecutiveStintNbAuto(Driver)</b>	(-)	If a driver has made enough stints (more than 2) we get the max of the most frequent fuel stints per driver stint Else, we get the max of the most frequent fuel stints between two driver swaps or <b>TyresStintsCountRef</b> (see in 1.2.6 later)

#### 12.2.5. Stints and PitStops Analysis

<b>FuelStintLapCountAuto</b>	(-)	Get the max of the most frequent lap count of all stints
<b>ListPitFuelTime</b>	(s)	= List of shorter PitStop times coming from a k-means algorithm List of <b>FuelPitStopElement</b>
<b>ListPitTyresTime</b>	(s)	= List of longer PitStop times coming from a k-means algorithm List of <b>TyresPitStopElement</b>
<b>RefuelTime</b>	(s)	= Mean( <b>FuelPitStopElement / CorrespondingStintLapCount</b> ) Give the average Refueling time per laps done in the previous stint
<b>TyresChangeAuto</b>	(s)	= Mean( <b>TyresPitStopElement – RefuelTime x CorrespondingStintLapCount</b> ) Give the average TyresChange time during a tyres pitstop
<b>FuelPitStopAuto</b>	(s)	= <b>FuelStintLapCount x RefuelTime</b>
<b>TyresPitStopAuto</b>	(s)	= <b>FuelStintLapCount x RefuelTime + TyresChange</b>
<b>TyresStintsAuto</b>	(-)	Get the max of the most frequent stint count between two TyresPitStops
<b>TyresStintLapCountAuto</b>	(-)	= <b>TyresStintsNb x FuelStintLapCount</b>
<b>FuelStintDurationAuto</b>	(s)	Time for a fuel stint of this car = ( <b>FullStintLapCount - 2</b> ) x <b>LapTime</b> + <b>TrackOutTime</b> + <b>TrackInTime</b> Case C* = ( <b>FullStintLapCount - 1</b> ) x <b>LapTime</b> + <b>TrackOutTime</b> + <b>TrackInTime</b>
<b>TyresStintDurationAuto</b>	(s)	Time for a tyres stint of this car = <b>TyresStintsNb</b> x (( <b>FuelStintLapCount - 2</b> ) x <b>LapTime</b> + <b>TrackOutTime</b> + <b>TrackInTime</b> ) + ( <b>TyresStintsNb - 1</b> ) * ( <b>FuelPitStop</b> + <b>PitlaneTime</b> ) Case C* = <b>TyresStintsNb</b> x (( <b>FuelStintLapCount - 1</b> ) x <b>LapTime</b> + <b>TrackOutTime</b> + <b>TrackInTime</b> ) + ( <b>TyresStintsNb - 1</b> ) * ( <b>FuelPitStop</b> + <b>PitlaneTime</b> )

\*Case C = when Finish Line is outside the pitlane (see pitlane definition in section 6.1.3)

### 12.2.6. Calculation / 1<sup>st</sup> pass

A new calculation is done for car tagged “watch” in RaceCTRL.

The goal of this 1<sup>st</sup> pass is to find which car (among those tagged “watch”) will win the race (the one doing the more laps in less time).

Drivers information

<b>DrivePace(Driver)</b>	(s)	Depending on the combobox choice, we take <b>DrivePaceAuto(Driver)</b> or <b>DrivePaceManual(Driver)</b>	Editable in Custom View -> Driver Analysis
<b>ConsecutiveStintsNb(Driver)</b>	(-)	Depending on the combobox choice, we take, <b>ConsecutiveStintsNbAuto(Driver)</b> or <b>ConsecutiveStintsNbManual(Driver)</b>	Editable in Custom View -> Driver Analysis

Laptime analysis (laps coming from RaceCTRL through the API)

<b>LapsForTimeWindow</b>	(-)	Is the number of lap to compute the time window (= <b>LapsForTimeWindow</b> x <b>LapTimeRef</b> ) for the moving average	Editable in Custom View -> Global
<b>DeltaOfLapTimeRef</b>	(-)	Is the delta to determine the valid laptime interval ((1 +/- <b>DeltaOfLapTimeRef</b> ) x <b>LapTimeRef</b> ) for the moving average	Editable in Custom View -> Global
<b>MovingAvg</b>	(s)	Is the moving average of the car considering a <b>TimeWindow</b> and for each lap we subtract the <b>DriverPace</b> of the lap	
<b>LapTimeAuto</b>	(s)	Reference laptime used for this car = <b>LapTimeAvg</b> or, if N/A, <b>LapTimeRef</b> If a lap is not in the interval formed by <b>DeltaOfLapTimeRef</b> we consider it as <b>LapTimeRef</b>	

Extrapolation parameter choice and computation for extrapolation

<b>LapTime</b>	(s)	Depending on the combobox choice, we take <b>LapTimeRef</b> , <b>LapTimeAuto</b> or <b>LapTimeManual</b>	Editable in Custom View -> Car Analysis
<b>FullStintLapCount</b>	(-)	Depending on the combobox choice, we take <b>FuelStintLapCountRef</b> , <b>FuelStintLapCountAuto</b> or <b>FuelStintLapCountManual</b>	Editable in Custom View -> Car Analysis
<b>FullStintDuration</b>	(s)	= ( <b>FullStintLapCount</b> - 2) x <b>LapTime</b> + <b>TrackOutTime</b> + <b>TrackInTime</b> Case C* = ( <b>FullStintLapCount</b> - 1) x <b>LapTime</b> + <b>TrackOutTime</b> + <b>TrackInTime</b>	
<b>FuelPitStop</b>	(s)	Depending on the combobox choice, we take <b>FuelPitStopRef</b> , <b>FuelPitStopAuto</b> or <b>TyresStintsManual</b>	Editable in Custom View -> Car Analysis
<b>TyresStintsCountRef</b>	(-)	Is the reference value for the number of fuel stint per tyres stint. It's global for all cars.	Editable in Custom View -> Car Analysis
<b>TyresStintsCount</b>	(-)	Depending on the combobox choice, we take <b>TyresStintsCountRef</b> , <b>TyresStintsCountAuto</b> or <b>TyresStintCountManual</b>	Editable in Custom View -> Car Analysis
<b>TyresStintLapCount</b>	(-)	= <b>FullStintLapCount</b> x <b>TyresStintsCount</b>	
<b>TyresChangeTimeRef</b>	(s)	Is the reference value for tyres change time. It's global for all cars.	Editable in Custom View -> Car Analysis
<b>TyresChangeTime</b>	(s)	Depending on the combobox choice, we take <b>TyresChangeTimeRef</b> , <b>TyresChangeTimeAuto</b> or <b>TyresChangeTimeManual</b>	Editable in Custom View -> Car Analysis
<b>TyresPitStop</b>	(s)	= <b>FuelPitStop</b> + <b>TyresChangeTime</b>	



<b>LastPitStop</b>	(s)	Depending on the combobox choice, we take <b>LastPitStopRef</b> , <b>LastPitStopAuto</b> (depending on <b>LastStintLapCount</b> ) or <b>LastPitStopManual</b>	Editable in Custom View -> Car Analysis
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#### IN/OUT Laps

<b>TrackInTime</b>	(s)	Time from Finish Line to In = <b>RatioIn</b> x <b>LapTime</b> - <b>PitLaneInTime</b>
<b>TrackOutTime</b>	(s)	Time from Out to Finish Line = <b>RatioOut</b> x <b>LapTime</b> - <b>PitLaneOutTime</b>
<b>(Fuel)(Tyres)InLaptime</b>	(s)	Case A* = <b>TrackInTime</b> + <b>PitLaneInTime</b> Case B* = <b>TrackInTime</b> + <b>PitLaneInTime</b> + <b>pitstopTime</b> Case C* = <b>TrackInTime</b> + <b>PitlaneTime</b> + <b>TrackOutTime</b> + <b>pitstopTime</b> Where <b>pitstopTime</b> = <b>FuelPitStop</b> or <b>TyresPitStop</b>
<b>(Fuel)(Tyres)OutLaptime</b>	(s)	Case A* = <b>pitstopTime</b> + <b>PitLaneOutTime</b> + <b>TrackOutTime</b> Case B* = <b>PitLaneOutTime</b> + <b>TrackOutTime</b> Case C* = <b>TrackInTime</b> + <b>PitlaneTime</b> + <b>TrackOutTime</b> + <b>pitstopTime</b> Where <b>pitstopTime</b> = <b>FuelPitStop</b> or <b>TyresPitStop</b>

#### Current stint analysis

<b>CurrentStintLostedTime</b>	(s)	Give the time elapsed in the last lap if the car hasn't finished it = Max (0, <b>CurrentRaceTime</b> - <b>LastLapRaceTime</b> - <b>LapTime</b> )
<b>RemainingLaps</b>	(-)	= Floor(( <b>RemainingTime</b> - <b>CurrentStintLostedTime</b> ) / <b>LapTime</b> ) + 1
<b>CurrentStintTotalLapCount</b>	(-)	Estimated total number of laps for car current stint = Min( <b>RemainingLaps</b> + <b>CurrentStintLapDoneCount</b> , <b>FullStintLapCount</b> )
<b>CurrentStintRemainingLaps</b>	(-)	Estimated remaining number of laps for car current stint = Max(0, <b>CurrentStintTotalLapCount</b> - <b>CurrentStintLapDoneCount</b> )
<b>CurrentStintDuration</b>	(s)	Duration of the car current stint = ( <b>CurrentStintTotalLapCount</b> - 1) x <b>LapTime</b> + <b>TrackOutTime</b> + <b>CurrentStintLostedTime</b> //if is last stint = ( <b>CurrentStintTotalLapCount</b> - 2) x <b>LapTime</b> + <b>TrackOutTime</b> + <b>TrackInTime</b> + <b>CurrentStintLostedTime</b> Case C* = ( <b>CurrentStintTotalLapCount</b> - 1) x <b>LapTime</b> + <b>TrackOutTime</b> + <b>TrackInTime</b> + <b>CurrentStintLostedTime</b>
<b>CurrentStintEndLapNumber</b>	(-)	Lap number of the last lap of the car current stint = <b>LastLapNumber</b> + <b>CurrentStintTotalLapCount</b> - <b>CurrentStintLapDoneCount</b>
<b>CurrentStintRemainingTime</b>	(s)	Estimated remaining time for car current stint = <b>CurrentStintDuration</b> - <b>CurrentStintTimeElapsed</b> - <b>CurrentStintLostedTime</b>
<b>CurrentStintEndRacetime</b>	(s)	Estimated racetime of the end of the current stint (In loop) = <b>LastLapRacetime</b> + <b>CurrentStintDuration</b> - <b>CurrentStintTimeElapsed</b>
<b>CurrentStintEndLapNumber</b>	(-)	Estimated lap number of the end of the current stint (In loop) = <b>LastLapNumber</b> + <b>CurrentStintRemainingLaps</b>

\*Case A = when the box is between the Finish Line and the Out (see pitlane definition in section 6.1.3)

\*Case B = when the box is between the Finish Line and the In (see pitlane definition in section 6.1.3)

\*Case C = when Finish Line is outside the pitlane (see pitlane definition in section 6.1.3)

#### Remaining stints

<b>RemainingFullStintCount</b>	(-)	Number of full stints remaining for the car = Floor(( <b>MinFinalInRacetime</b> - <b>CurrentStintEndRacetime</b> ) / ( <b>pitstopTime</b> + <b>PitlaneTime</b> + <b>FullStintDuration</b> )) + 1 Where <b>pitstopTime</b> = <b>FuelPitStop</b> or <b>TyresPitStop</b>
<b>RemainingTyresPitStops</b>	(-)	= Floor(( <b>PitstopDoneCount</b> - <b>LastTyresPitStopStint</b> + <b>RemainingFullStintCount</b> ) / <b>TyresStintsNb</b> )

If InCurrentStint >= LastInRacetime

Then => Last stint

Else => Not last stint

Last stint

<b>MinFinalOutRacetime</b>	(s)	Earliest racetime possible for the last Out of the car = <b>RaceDuration</b> - <b>FullStintDuration</b>
<b>MinFinalInRacetime</b>	(s)	Earliest racetime possible for the last In of the car = <b>MinFinalOutRacetime</b> - <b>FuelPitStop</b> - <b>PitlaneTime</b>
<b>LastStintLeftTime</b>	(s)	Remaining time for the last stint of the car = Max ( <b>RaceDuration</b> - <b>CurrentStintEndRacetime</b> - <b>RemainingFullStintCount</b> x ( <b>PitlaneTime</b> + <b>FullStintDuration</b> ) - <b>RemainingTyresStintCount</b> x <b>TyresPitStop</b> - ( <b>RemainingFullStintCount</b> - <b>RemainingTyresStintCount</b> ) * <b>FuelPitStop</b> - <b>LastPitStop</b> - <b>PitlaneTime</b> , 0)
<b>LastStintLapCount</b>	(-)	Number of laps for the last stint of the car IF <b>IsLastStint</b> = <b>CurrentStintTotalLapCount</b> ELSE = Floor(( <b>LastStintLeftTime</b> - <b>TrackOutTime</b> ) / <b>LapTime</b> ) + 1
<b>LastStintDuration</b>	(s)	Duration of the last stint of the car ( > <b>LastStintLeftTime</b> ) = ( <b>LastStintLapCount</b> - 1 ) x <b>LapTime</b> + <b>TrackOutTime</b>
<b>SlackTime</b>	(s)	Margin to a full stint in duration = <b>FullStintTime</b> - <b>LastStintTime</b>
<b>EndLapCount</b>	(-)	Total number of laps for the car IF <b>IsLastStintStarted</b> = <b>LastLapNumber</b> - <b>CurrentStintLapDoneCount</b> + <b>LastStintLapCount</b> ELSE = <b>CurrentStintEndLapNumber</b> + <b>RemainingFullStintCount</b> * <b>FullStintLapCount</b> + <b>LastStintLapCount</b>
<b>EndRacetime</b>	(s)	Racetime of the end of the race for the car (crossing Finish Line) IF <b>IsLastStintStarted</b> = <b>LastOutRacetime</b> + <b>LastStintDuration</b> ELSE = <b>CurrentStintEndRacetime</b> + <b>RemainingFullStintCount</b> * ( <b>PitlaneTime</b> + <b>FullStintDuration</b> ) + <b>RemainingTyresStintCount</b> * <b>TyresPitStop</b> + ( <b>RemainingFullStintCount</b> - <b>RemainingTyresStintCount</b> ) * <b>FuelPitStop</b> + <b>LastPitStop</b> + <b>PitlaneTime</b> + <b>LastStintDuration</b>

The winning car is the one with the highest **EndLapCount** and the lowest **EndRacetime**.

**WinnerEndLapCount** = **EndLapCount** of this car

**WinnerEndRacetime** = **EndRacetime** of this car

When **RaceType** = distance and duration, we need to define if the end of the race is distance or duration:

IF **WinnerEndLapCount** < **RaceLapCount** & **WinnerEndRacetime** > **RaceDuration**

THEN **RaceType** = duration

IF **WinnerEndLapCount** > **RaceLapCount** & **WinnerEndRacetime** < **RaceDuration**

THEN **RaceType** = distance

#### 12.2.7. Calculation / 2<sup>nd</sup> pass

Now that we know which car wins and if the race ends by time or distance, **EndRacetime** and **EndLapCount** of some cars must be adjusted.

For carXX IF **LastStintLapCount** < 1 & **IsLastStintStarted** = Flase  
THEN **RemainingFullStintCount** = Max(**RemainingFullStintCount** - 1, 0)

Recompute :

**RemainingTyresStintCount**, **LastStintLeftTime**, **LastStintLapCount**, **LastPitStop**,  
**LastInLaptime**, **LastOutLaptime**, **LastStintDuration**, **SlackTime**, **EndLapCount**,  
**EndRacetime**

IF **EndLapCount** < **WinnerEndLapCount** & **EndRacetime** < **WinnerEndRacetime**

OR **RaceDuration** > **EndRacetime** & **RaceLapCount** > **EndLapCount**  
 THEN **EndLapCount** = **EndLapCount** + 1  
**LastStintLapCount** = **LastStintLapCount** + 1  
**EndRacetime** = **EndRacetime** + **LapTime**  
**LastStintDuration** = **LastStintDuration** + **LapTime**  
**MinFinalInRaceTime** = **MinFinalInRaceTime** + **LapTime**  
**MinFinalOutRaceTime** = **MinFinalOutRaceTime** + **LapTime**

IF **IsLastStintStarted**  
 THEN **CurrentStintTotalLapCount** = **CurrentStintTotalLapCount** + 1  
**CurrentStintEndLapNumber** = **CurrentStintEndLapNumber** + 1  
**CurrentStintDuration** = **CurrentStintDuration** + **LapTime**  
**CurrentStintEndRacetime** = **CurrentStintEndRacetime** + **LapTime**

ELSE IF **LastStintLapCount** > **FullStintLapCount**  
 THEN **RemainingFullStintCount** = **RemainingFullStintCount** + 1  
**LastStintLapCount** = **LastStintLapCount** - **FullStintLapCount**

Recompute :  
**RemainingTyresStintCount**, **LastStintLeftTime**, **LastPitStop**, **LastInLaptime**,  
**LastOutLaptime**, **LastStintDuration**, **SlackTime**, **EndRacetime**

#### 12.2.8. Creation of laps for the RaceCTRL database

From here it is possible to create laps and import them in RaceCTRL database in order to have them in Lap History and Gap Graph.

Cas A

	Outlaptime = <b>TrackOutTime</b> + <b>TimeOutPitlane</b> + <b>PitstopTime</b>
	Inlaptime = <b>TrackInTime</b> + <b>TimeInPitlane</b>

Cas B

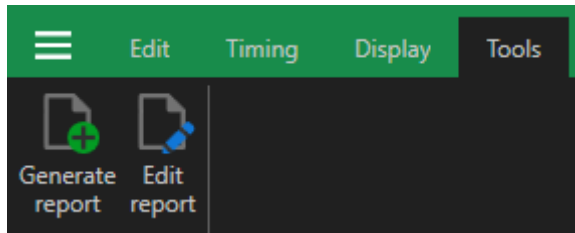
	Outlaptime = <b>TrackOutTime</b> + <b>TimeOutPitlane</b>
	Inlaptime = <b>TrackInTime</b> + <b>TimeInPitlane</b> + <b>PitstopTime</b>

Cas C

	InOutlaptime = <b>TrackOutTime</b> + <b>TrackInTime</b> + <b>TimePitlane</b> + <b>PitstopTime</b> Le InOut lap is set as the first lap of a stint
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## 13. Reports

You can generate or edit a report from the Tools Menu:



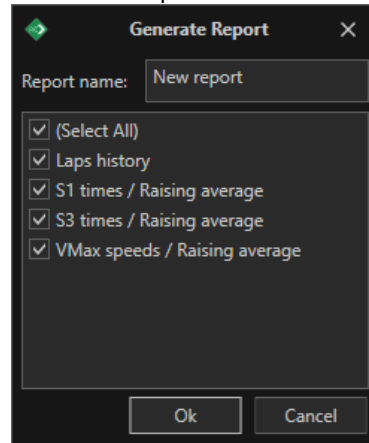
### 13.1. Generate a report

You can generate a report from the current layout base on the opened views. To do that, select a layout then navigate to the menu Tools and click on Generate report.

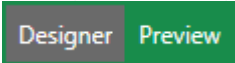
The views supported are the following:

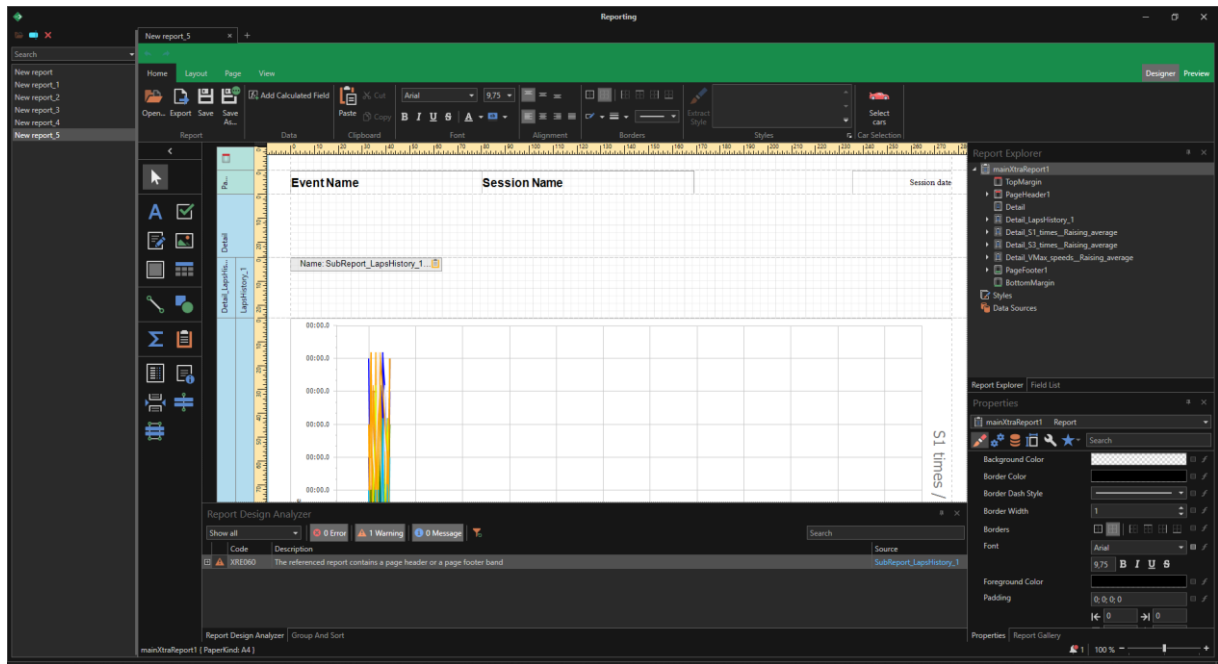
- Laptime graph
- Gap graph
- Stint graph
- Instant speed graph
- Leaderboard
- Lap history
- Stint history
- Driving times

A popup will be displayed to prompt you to select a report name and choose the items to add to the report.



After clicking on Ok button, the report will be generated and the result will be displayed inside the Report Editor view in design mode. You can see the generated report as a template. It does not contain any data. To obtain a

report with data, click on the Preview button . The preview mode will fill the report with the data from the current session. Then, you will be able to export the result in pdf or excel... depending on your needs.



Generated report opened in design mode

Is Used	Lap Nb	Num	Driver	Team	Class	Lap time	RaceTime	IN	OUT	PitTime	Pitane time	Track time	S1	S2	S3	Vmax	Comment
<input checked="" type="checkbox"/>	32	1	Lilou WADOUX	Richard Mille Racing Team	LMP2	1:35.934	52:00.040						23.409	29.781	42.744	292,7	
<input checked="" type="checkbox"/>	31	1	Lilou WADOUX	Richard Mille Racing Team	LMP2	1:35.203	50:24.106						23.531	30.032	41.640	291,1	
<input checked="" type="checkbox"/>	30	1	Lilou WADOUX	Richard Mille Racing Team	LMP2	1:35.186	48:48.903						23.569	29.973	41.644	291,9	
<input checked="" type="checkbox"/>	29	1	Lilou WADOUX	Richard Mille Racing Team	LMP2	1:35.928	47:13.717						23.581	30.235	42.112	291,1	
<input checked="" type="checkbox"/>	28	1	Lilou WADOUX	Richard Mille Racing Team	LMP2	1:35.779	45:37.789						23.631	30.233	41.915	290,3	
<input type="checkbox"/>	27	1	Lilou WADOUX	Richard Mille Racing Team	LMP2	2:40.898	44:02.010		42:28.357	01:09.469	01:07.244	01:33.653	1:28.602	30.454	41.842	149,0	
<input type="checkbox"/>	26	1	Lilou WADOUX	Richard Mille Racing Team	LMP2	1:40.222	41:21.112	41:18.888				2:224	01:37.997	23.358	29.796	47.068	292,7
<input checked="" type="checkbox"/>	25	1	Lilou WADOUX	Richard Mille Racing Team	LMP2	1:34.261	39:40.890						23.234	29.473	41.554	293,5	
<input checked="" type="checkbox"/>	24	1	Lilou WADOUX	Richard Mille Racing Team	LMP2	1:34.973	38:06.629						23.360	30.024	41.589	291,9	
<input checked="" type="checkbox"/>	23	1	Lilou WADOUX	Richard Mille Racing Team	LMP2	1:34.424	36:31.656						23.301	29.640	41.483	291,1	
<input checked="" type="checkbox"/>	22	1	Lilou WADOUX	Richard Mille Racing Team	LMP2	1:34.556	34:57.232						23.464	29.741	41.351	285,7	
<input checked="" type="checkbox"/>	21	1	Lilou WADOUX	Richard Mille Racing Team	LMP2	1:35.340	33:22.676						23.339	30.099	41.902	292,7	
<input checked="" type="checkbox"/>	20	1	Lilou WADOUX	Richard Mille Racing Team	LMP2	1:34.946	31:47.336						23.535	29.784	41.627	282,0	
<input checked="" type="checkbox"/>	19	1	Lilou WADOUX	Richard Mille Racing Team	LMP2	1:35.452	30:12.390						23.330	29.961	42.161	291,9	

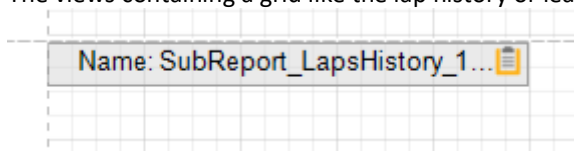
Report preview filled with the session data

**Notices:** During the generation, you will see the different views get activate. To be correctly generated in the report, a view needs to be rendered at least one time.

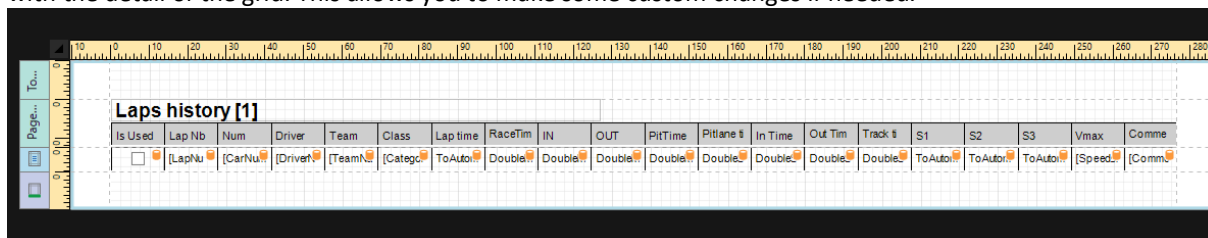
The generated report is automatically saved in database. If the name already exists, an auto increment algorithm will rename the report.

### 13.1.1. Grid type reports

The views containing a grid like the lap history or leaderboard are rendered inside a sub-report:



You can open the content of a sub-report by double clicking on it. This will open a new view inside the designer with the detail of the grid. This allows you to make some custom changes if needed.



Is Used	Lap Nb	Num	Driver	Team	Class	Lap time	RaceTim	IN	OUT	PitTime	Pitlane t	In Time	Out Tim	Track t	S1	S2	S3	Vmax	Comme
<input type="checkbox"/>	[LapNu]	[CarNu]	[Driver]	[TeamN]	[Categ]	ToAuto	Double	Double	Double	Double	Double	Double	Double	Double	ToAuto	ToAuto	ToAuto	[Speed]	[Comm]

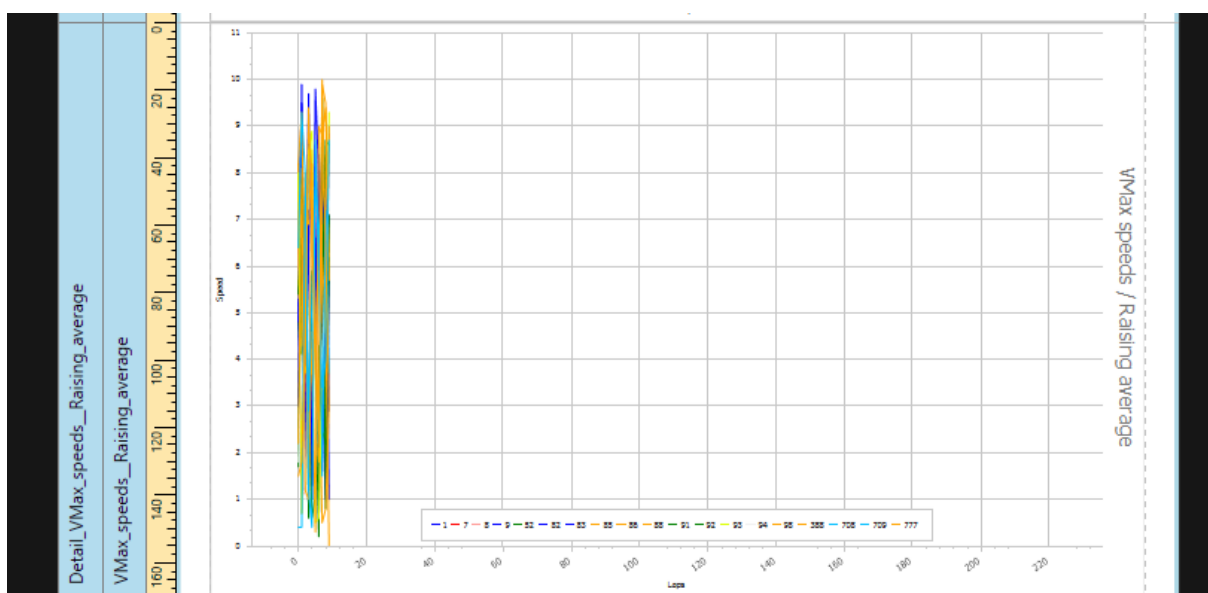
**Notice:** you do not need to save changes of the sub-report even if a popup prompts you. The modifications will be taken into account in the parent report.

The sub-report will memorize the grouping, filtering and sorting options currently applied in the view when the report was generated.

The columns size and font size are automatically resized in order to fit the paper format.

### 13.1.2. Chart type reports

The views containing a chart like the Gap graph or the Laptime graph are rendered inside a chart item:



The chart will display the cars currently selected in the view when the report was generated. But we will see later that it is possible to change the cars selection directly from the designer.

The chart name corresponding to the source view name is displayed on the right.


The colors, legends labels and range currently used in the view when the report was generated are memorized in the report. But you can edit all these properties.

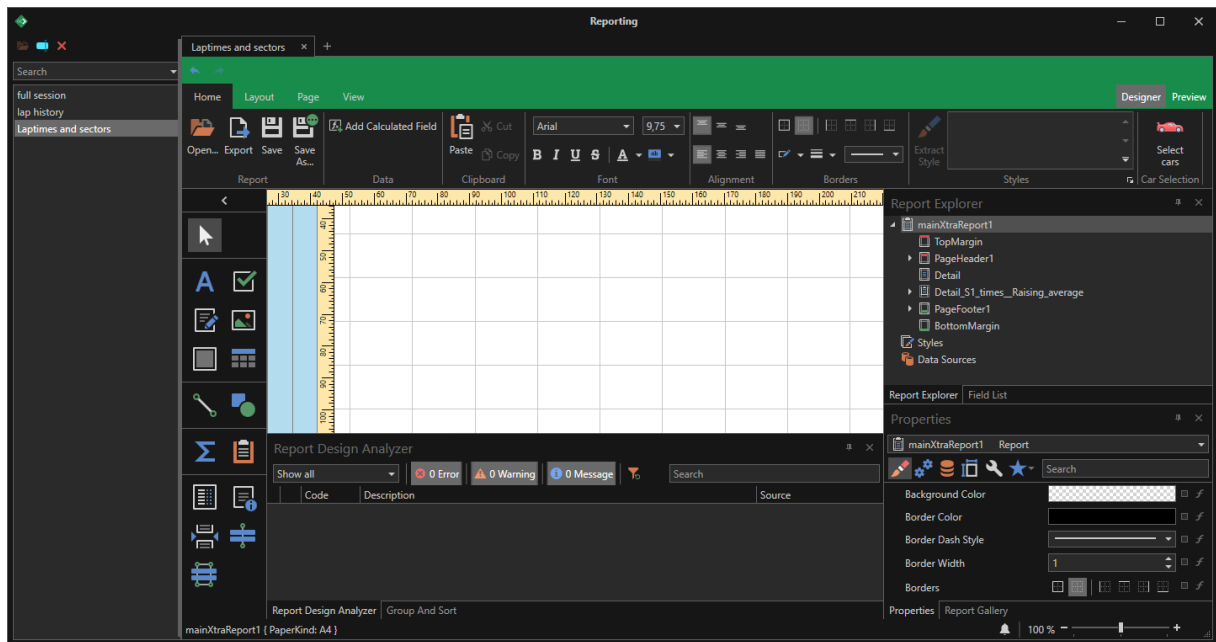
That also the case for the Y axis value or X axis type selected or last N option... but these options are not editable once the report generated.

## 13.2. Open a report

You can open a report from the menu Tools. Then click on Edit Report.

The reports available in database are displayed on the left pan. Double click on a report to open it in the designer.

Or select a report in the list and click the  button.

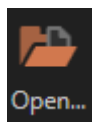


The full documentation concerning the designer is available here:

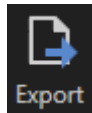
<https://docs.devexpress.com/XtraReports/114104/wpf-reporting/end-user-report-designer-for-wpf>

**Notice:** Some features has been intentionally disabled to make the designer easier to use for the end user. You can't add new data source, and some controls has been disabled.

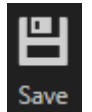
### 13.2.1. Main features



Open an external report saved in a file



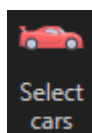
Export the report in a file



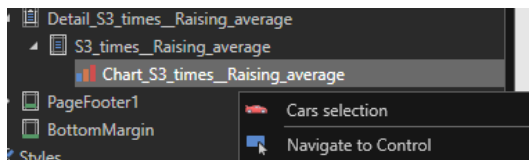
Save the current report in database



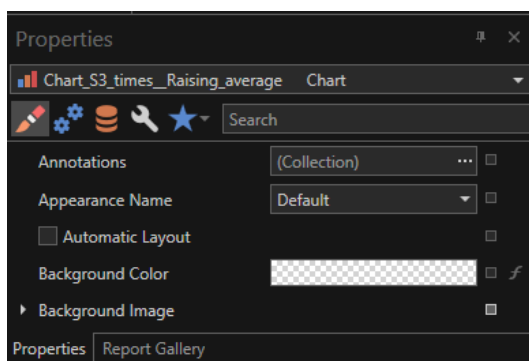
Save a new copy of the current report in the database



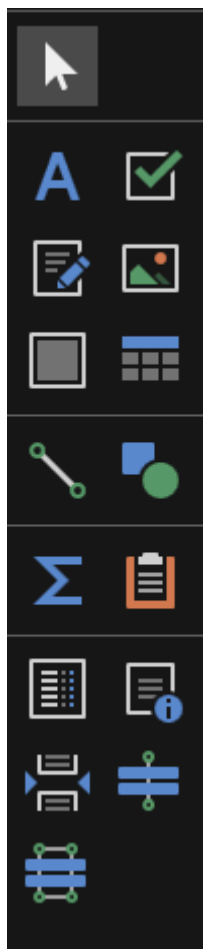
When the report contains charts, this feature allows you can select the cars to display. The cars selection will be applied on all the charts.



- Detail
- Detail\_LapsHistory\_1
- Detail\_S1\_times\_Raising\_average
- Detail\_S3\_times\_Raising\_average
  - S3\_time DetailVMMax\_speeds\_Raising\_average
- Detail\_VMMax\_speeds\_Raising\_average
- PageFooter1

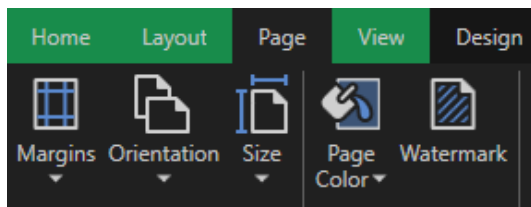


The properties pan give you access to all the properties corresponding to the current selected item in the designer. Or the report itself.



The controls pan contains all the items you can add to the report. For example, you can add labels, images, rich text...



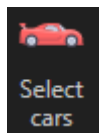


The page menu allows you to change the paper format, orientation, margin size...

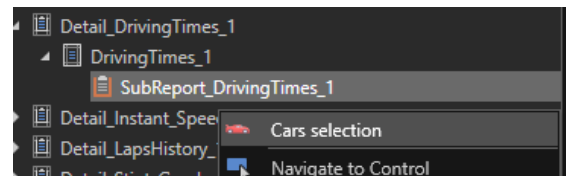
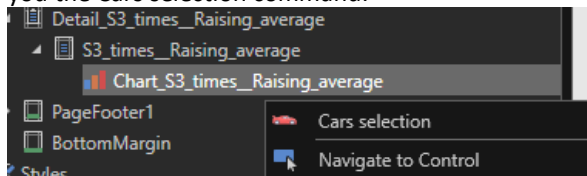
### 13.2.2. Cars selection

You can change the cars displayed in the charts and grids (except for the instant speeds) after the report has been generated or saved.

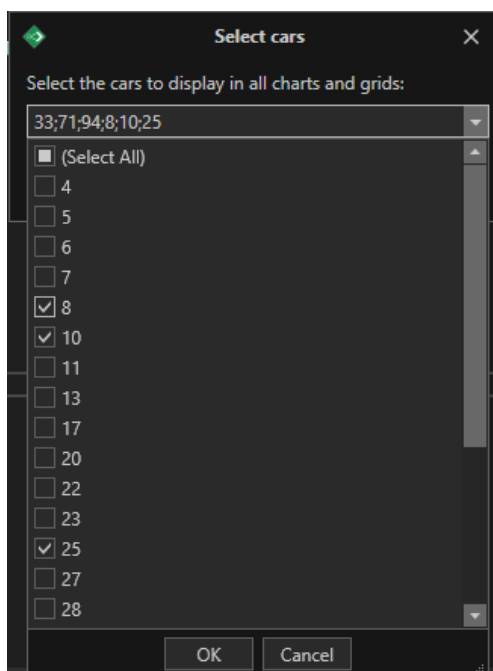
To edit the cars for all the charts and grids, you can use the menu Select Car:



To edit the cars for a single chart or grid, right click on the chart or sub report from the Report explorer pan and you the Cars selection command:



In both cases, a popup will prompt you to select the cars you want to display.

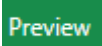


#### Notices:


The cars selection is not available for the Instant speeds chart.

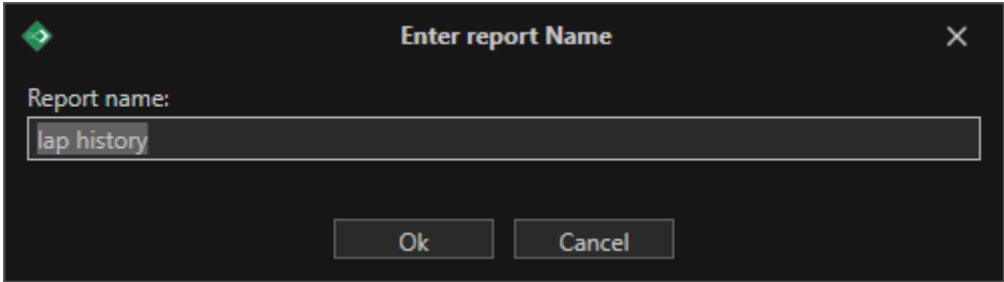
When the Driver mode option is used to display the data by driver, the cars selection doesn't allow you to select each driver independently. When a car is selected from a report, all the car drivers will be automatically selected.

## 13.3. Preview a Report

The report saved in database does not contain any data. When you click on the  button, the report is filled with the current session data. That means, you can change of current session and re-open an existing report to preview the result with the data of the new session.


## 13.4. Rename a report

You can rename a report. Select a report in the list and click the  button. A popup prompts you to enter the new report name.

A screenshot of a dialog box titled "Enter report Name" with a close button (X) in the top right corner. Inside the dialog, there is a label "Report name:" followed by a text input field containing the text "lap history". At the bottom of the dialog, there are two buttons: "Ok" and "Cancel".

If the name already exists, an autoincrement algorithm will rename the report to preserve the unicity.

### Delete a report

To delete a report, select a report in the list and click the  button.

## 14. Add-in Excel

It is possible to access some RaceCTRL data directly from Excel. To do that, you have to install the new Excel Add-in released with RaceCTRL.

### 14.1. Installation and Requirements

You have to select the add-in corresponding to your Excel version from the RaceCTRL installation directory C:\Program Files\Trackside\RaceCTRL\ExcelAddin\:

- x64 \ RaceCTRL.Addin-AddIn64.xll for Excel 64 bits
- x86 \ RaceCTRL.Addin-AddIn.xll for Excel 32 bits

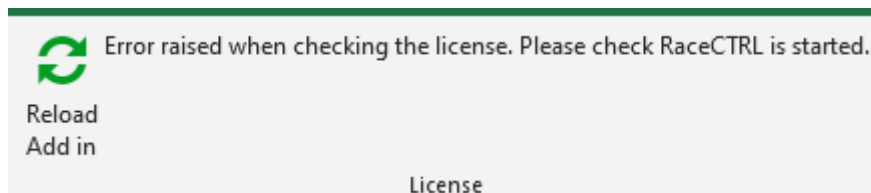
Then, you can double click on the add-in to perform the installation. This will open Excel and a popup will prompt you to confirm the installation.

Or you can open Excel and follow the instructions provided here <https://support.microsoft.com/en-us/topic/0af570c4-5cf3-4fa9-9b88-403625a0b460>

#### Requirements

The RaceCTRL Excel Add-in doesn't work with the Starter License. If you need this feature, please contact Trackside Software.

If RaceCTRL is not started or if your license level is not valid, the following message will be visible in the Excel RaceCTRL Ribbon menu:



You can retry to connect to RaceCTRL with the button Reload Add in.

The RaceCTRL Excel Add-in communicates with RaceCTRL through the Web API. You have to ensure that the Web API is enabled on RaceCTRL before using the Excel Add-in. For this, navigate to RaceCTRL menu Edit / Options / Web API section:

Web API	
Web API host address	localhost
Web API host port	9000
Enabled web API	<input checked="" type="checkbox"/>

### 14.2. Configuration

Once the add-in installed and RaceCTRL started, the new RaceCTRL Excel menu will be visible in Excel. Add a new workbook to start working.

Then you can configure the Web API port to connect to the RaceCTRL Web API. You can do this via the ribbon menu RaceCTRL / Config:

## 14.3. RaceCTRL Excel Menu

The RaceCTRL menu is made on the following entries:

Config menu:

- Port Number allows you to configure the web API port number
- Auto Update enables or disables the auto refresh of the data in the workbook
- Refresh the data contained in the current sheet depending on the current event and session selected in the RaceCTRL instance.

Cars data menu:

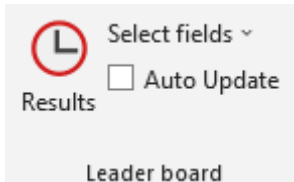
Allows you to get the cars collection from the current event and session selected on the RaceCTRL instance. The table created will start at the current selected Excel cell position.

- Select fields: allows you to select the columns you want to retrieve and display in the table
- Auto Update enables or disables the periodic refresh of the data contained in the table
- Cars button: creates the table with the selected columns and the data from RaceCTRL at the current Excel cell position.

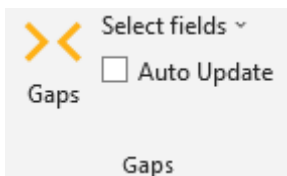
Laps data menu:

Allows you to get the laps collection for a specific car number. The data corresponds to the current event and session selected on the RaceCTRL instance. The table created will start at the current selected Excel cell position.

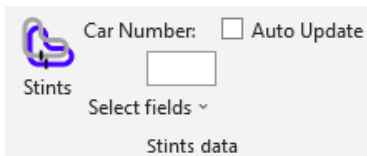
- Select fields: allows you to select the columns you want to retrieve and display in the table
- Car Number: allows you to enter the car number for which you want to get the laps.
- Auto Update enables or disables the periodic refresh of the data contained in the table
- Laps button: creates the table with the selected columns and the data from RaceCTRL at the current Excel cell position.



- Leader board menu:
- Allows you to get the leaderboard data (rank, last laptime, best laptime, gaps...). The data corresponds to the current event and session selected on the RaceCTRL instance. The table created will start at the current selected Excel cell position.



- Select fields: allows you to select the columns you want to retrieve and display in the table
- Auto Update enables or disables the periodic refresh of the data contained in the table
- Results button: creates the table with the selected columns and the data from RaceCTRL at the current Excel cell position.



- Gaps menu:
- Allows you to get the gaps information. The data corresponds to the current event and session selected on the RaceCTRL instance. The table created will start at the current selected Excel cell position.

- Select fields: allows you to select the columns you want to retrieve and display in the table
- Auto Update enables or disables the periodic refresh of the data contained in the table
- Gaps button: creates the table with the selected columns and the data from RaceCTRL at the current Excel cell position.

- Stints data menu:
- Allows you to get the stints collection for a specific car number. The data corresponds to the current event and session selected on the RaceCTRL instance. The table created will start at the current selected Excel cell position.

- Select fields: allows you to select the columns you want to retrieve and display in the table
- Car Number: allows you to enter the car number for which you want to get the stints.
- Auto Update enables or disables the periodic refresh of the data contained in the table
- Stints button: creates the table with the selected columns and the data from RaceCTRL at the current Excel cell position.

## 14.4. Auto update

- The data contained in the tables can be automatically updated periodically. To do that, you need to:
- enable Auto Update feature for each table
- enable Auto Update feature from the config menu to activate the mechanism

## 14.5. Table selection

When you select any cell contained in a table, the corresponding menu will update its content with the parameters selected when the table was created. This allows you to enable or disable the auto update, change the selected fields, or the car number...

## 14.6. Session data management

The session Id used to get the data is memorized for each table. The auto update feature will stop updating the data when the current session selected in RaceCTRL changes. You can click on the Refresh sheet button to force the tables to update with the data from the current session.

When you re-open a file containing data, the automatic update is disabled. Moreover, the data will still be there even if RaceCTRL is not started.



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