

Pitside Console – A Wifilapper Database / Analysis Tool

Table of Contents

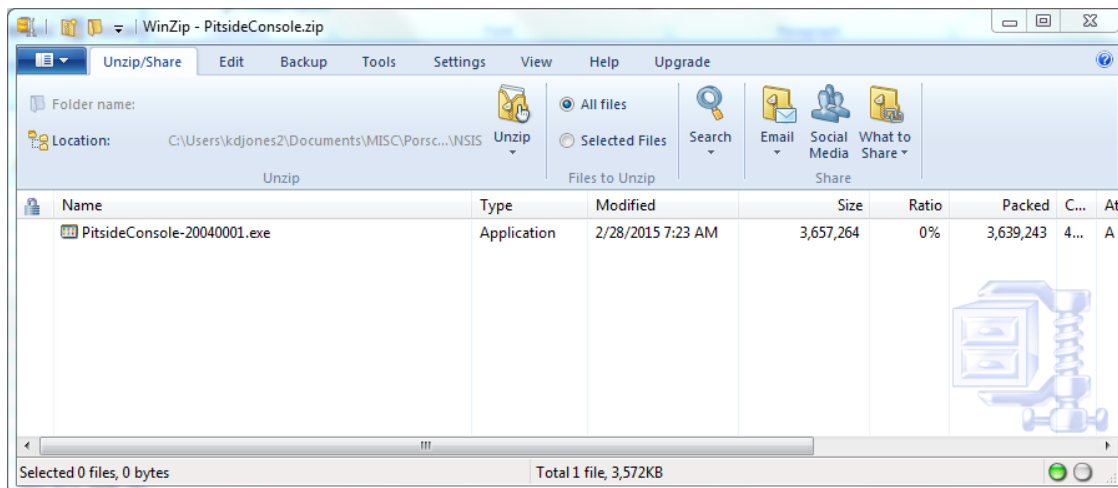
1	Getting Started with Pitside Console	2
1.1	Installation / Removal	2
1.2	Opening / Creating a database with Pitside Console	3
1.3	Selecting a Race Session	4
1.4	Changing Race Sessions	5
1.5	Displaying Lap Data	5
1.6	Choosing a Reference Lap	6
1.7	Choosing the X-axis	7
1.8	Choosing the Y-Axis data channels	8
1.9	Panning / Zooming	9
1.10	Displaying All of the Data for Selected Lap	9
1.11	Setting Comments	10
1.12	Display Views – Map vs. Data Plot	11
2	Advanced Options	12
2.1	Manipulating the SETTINGS.TXT file	12
2.2	The Graphing Menu	13
2.2.1	Km/h, Mph, m/s:	14
2.2.2	X-Axis in KM or LAT:	14
2.2.3	Set Split Points:	14
2.2.4	Show Traction Circle:	15
2.2.5	Show All-Time Bests:	17
2.2.6	Show Driver Bests:	17
2.2.7	Show Reference Lap:	17
2.2.8	Smooth Accelerometer Graphs:	18
2.2.9	Draw Lines Between Data Points:	18

2.2.10	Use Dark Background for Plots:	18
2.2.11	Plotting Options....:	18
2.3	Phone Orientation.....	18
2.4	Plotting Data as Graphs vs. Values / Alarms / Transformations	19
2.4.1	Graphs vs. Values Plot Options:	19
2.4.2	Setting Alarm Limits for Values Data Channels:	21
2.4.3	Transforming raw signals into real data:	23
2.5	Sending Messages to the Wifilapper Phone	25
2.6	Traction Circle.....	26
2.7	Using the Time X-Axis display to show long-term trends	28
2.8	Wifi Dots	28
2.9	Current Lap / Following your car around the track	29
2.10	Print / Save Image / Copy	30
3	Wifilapper Database Management	30
3.1	Switching Race Sessions / Changing Databases.....	30
3.2	Editing/Renaming Race Sessions	31
3.3	Merging Race Sessions.....	31
3.4	Exporting Data to .CSV format	32
4	Timing & Scoring	32
5	Contributors / Acknowledgements	38
6	Version Information	39

1 Getting Started with Pitside Console

1.1 Installation / Removal

Pitside console consists of a main EXE file with a collection of helper files. They are all contained in a compressed ZIP file located [here](#).



To install Pitside Console simply unzip the file to a temporary directory on your IA32/64 computer. Run the Installer file (EXE) and it will copy all necessary files to your computer. It will also place an icon onto the Desktop and your Start Menu that will run PitsideConsole.exe. You should also be able to run this in virtual machines with Linux or OSX operating systems.



PitsideConsole.exe runs a simple HTTP server, which requires access to your network. If you have a Firewall or Anti-virus it is likely that you will have a warning pop up when you first execute Pitside. You will need to allow access and possibly put an exception into your security program in order for Pitside to be able to connect to the Wifilapper phone.

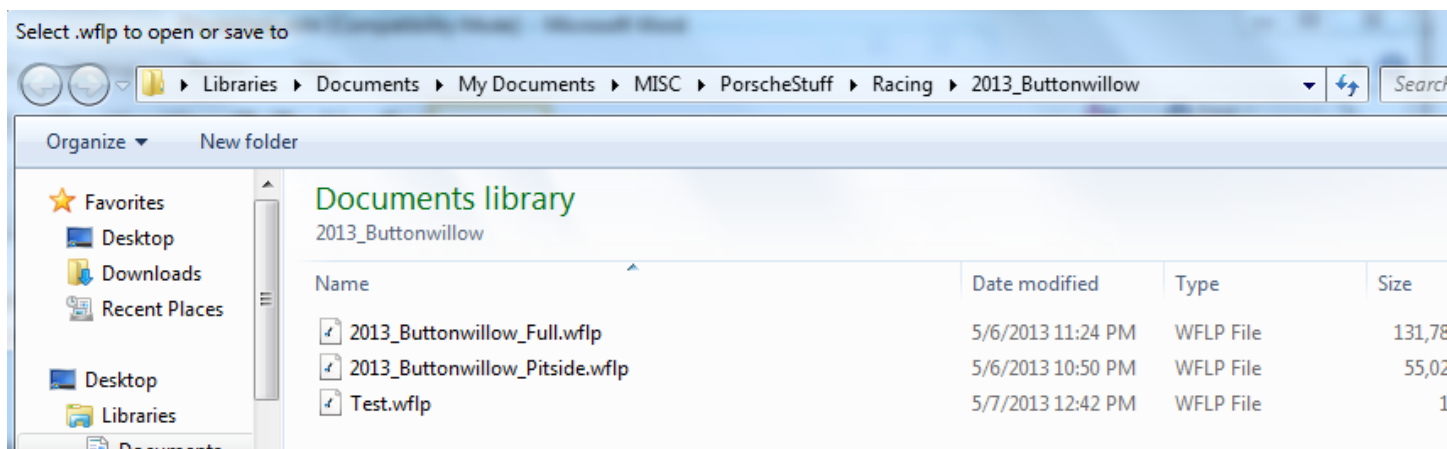
The Pitside Console program can be removed from your computer by running the "Uninstall" program located in the Start Menu, or through the Control Panel.

1.2 Opening / Creating a database with Pitside Console

To run Pitside Console simply double click on either the executable file PitsideConsole.exe or the Shortcut you created for it.

A splash screen will show up with some information about the Wifilapper project and how you can contribute to it. Click anywhere on this image and a window will pop up asking you to select a Wifilapper database. You have two options here:

- 1) Open an existing Wifilapper database: Browse to the folder where you saved an existing .wflp database and double click on that file. That will open the database up and display the next screen.
- 2) Create a new Wifilapper database: Browse to where you would like to save a new .wflp database and enter in the desired name into the dialog. That database will be created and you will be taken directly to the main Pitside program.

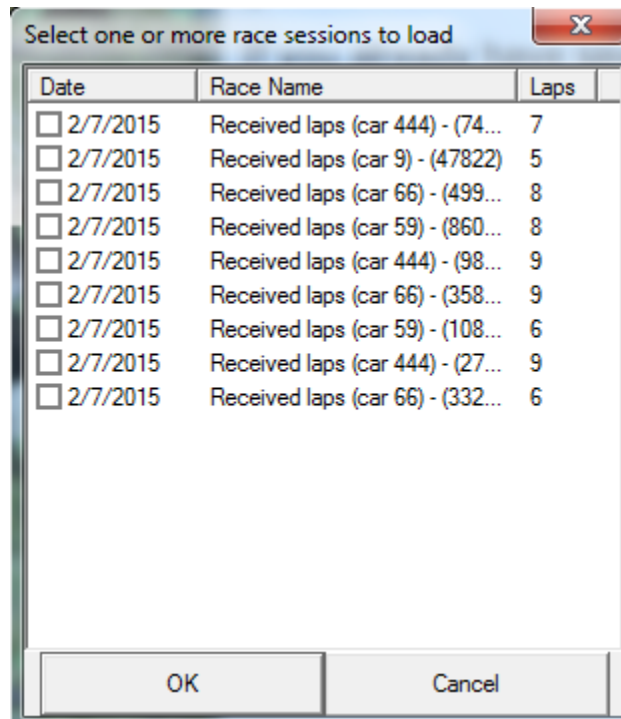


1.3 Selecting a Race Session

If you have opened up an existing database the Race Sessions screen will be displayed. If the database has no races saved, the dialog list will be blank. Simply click on the CANCEL button and you will be taken to the main Pitside program. If you save data during your session those races will be displayed the next time you load this database.

If you already have saved some race sessions in this database, those will be displayed. Click on one or more of the sessions that you want to view and hit the OK button. Click the checkboxes to select multiple sessions. If you just want to set up Pitside to collect a new Race Session, you can click CANCEL and a blank main Pitside program will display. You can also pick an existing

Race Session and load it, and as new race data is being received Pitside will collect that as a new Race Session and alert you.



1.4 Changing Race Sessions

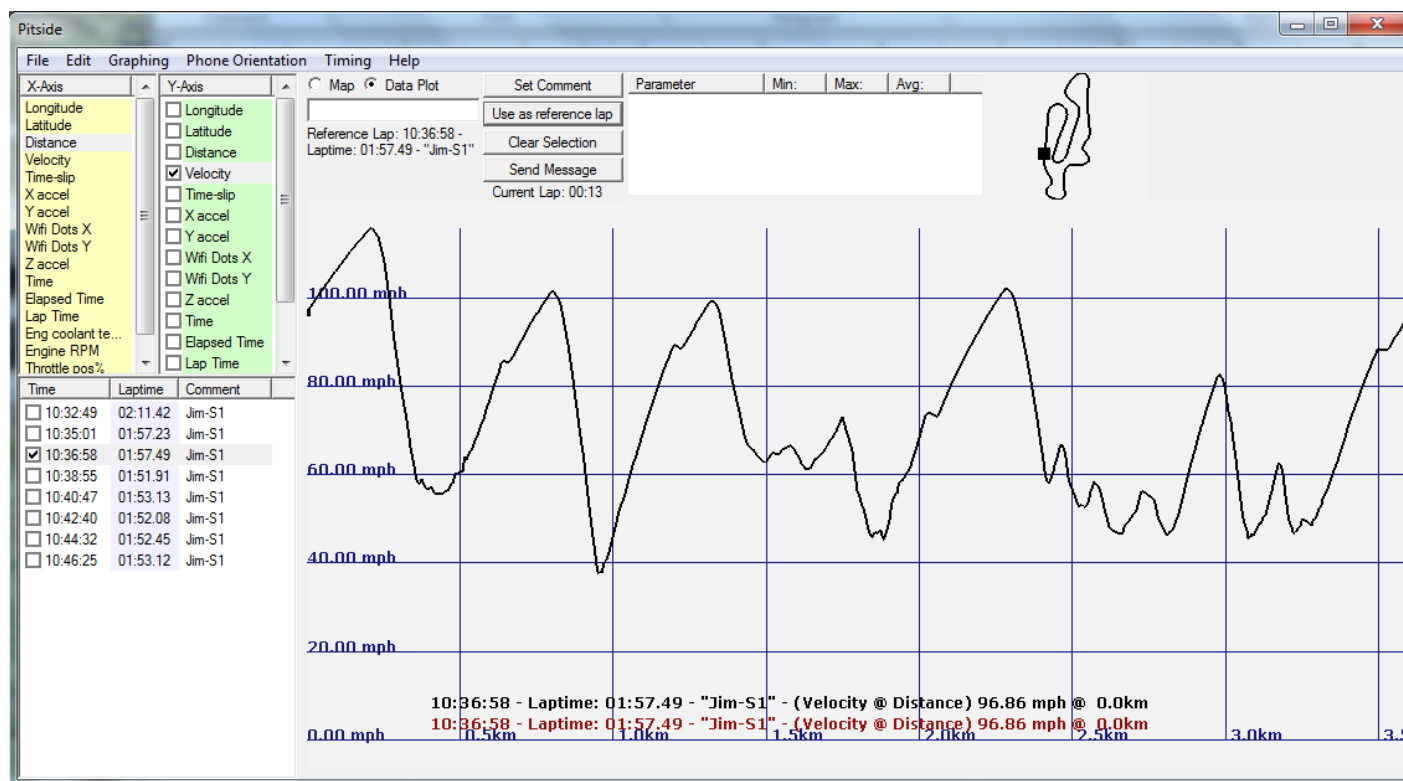
To change to a different Race Session, click on the DATA menu option and select SWITCH RACE SESSIONS. The same dialog for choosing your Race Session will show up. Follow the above procedure and load the desired Race.

1.5 Displaying Lap Data

Once either an existing Race Session is picked or some laps from a live Race Session have been recorded, some data should now show up in the main window of Pitside. Pitside functions very much like a UNIX program, where window sections update only when the mouse is hovering over them. Move your mouse over the main display area and one or more graphs will show up.

Likely the first lap of data is going to look quite unusual, as this is the "out lap" from the pits onto the racing surface. If more than 1 lap has been

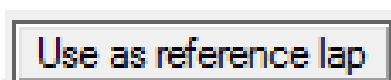
recorded (and shows up in the "Lap List" area at the lower left of the Pitside window), you can click on other laps to see their data.

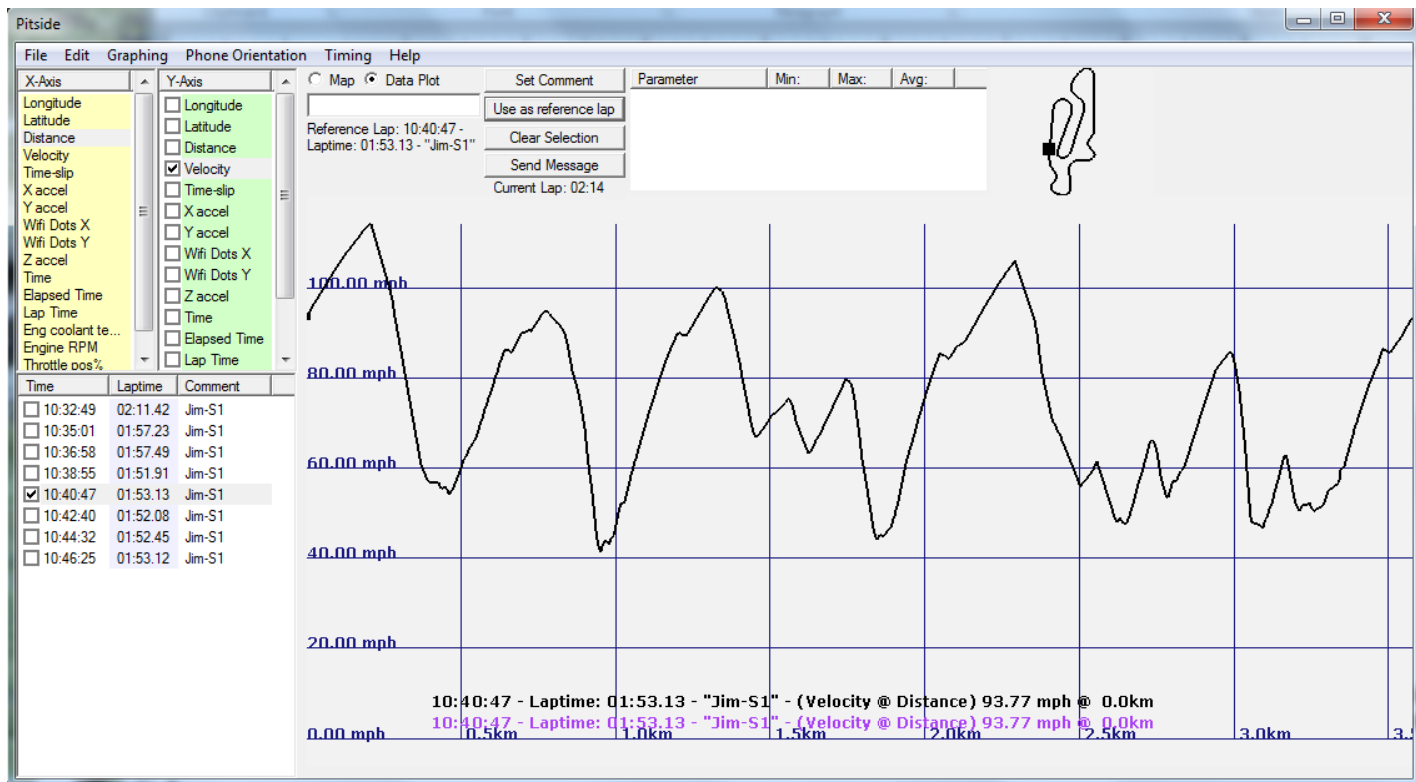


Once you have multiple laps showing up in the Lap List you can select a single lap or you can click the checkboxes to select multiple laps. Each lap will be color coded in the graph displayed.

1.6 Choosing a Reference Lap

Pitside translates speed/positional/acceleration data collected over time and converts these data into the desired graphical display (eg: Velocity vs. Distance). To do this transformation effectively, Pitside requires the user to identify a typical **Reference Lap**, which other laps will be compared against. To set or change the Reference Lap, highlight in the Lap List a single lap that is typical for this Race Session. Once this lap is chosen, click the "Use as Reference Lap" button.





Frequently the user will want to use the Reference Lap to compare exit speeds, brake points and such against either the fastest lap or that driver's fastest lap. This can be achieved by highlighting the desired fast lap and then clicking on the "Use as Reference Lap" button. All other laps will now be compared against this Reference Lap.

In the Lap List area of the screen in the lower left of the window you can sort the Lap List in either Chronological Order or by Laptime (lowest first). This is done by simply left-clicking on the column header to sort it. Sorting by Laptime can help determine the fastest lap to set for the Reference Lap.

1.7 Choosing the X-axis

By default Pitside chooses the Distance channel as the default when you open up the application. You can choose any other data channel to be used for the x-axis, simply by clicking on the desired channel in the X-Axis list box.

Only a SINGLE CHANNEL can be chosen for the X-Axis at any one time. Of the default channels available with Wifilapper the following will be most useful for X-Axis displays:

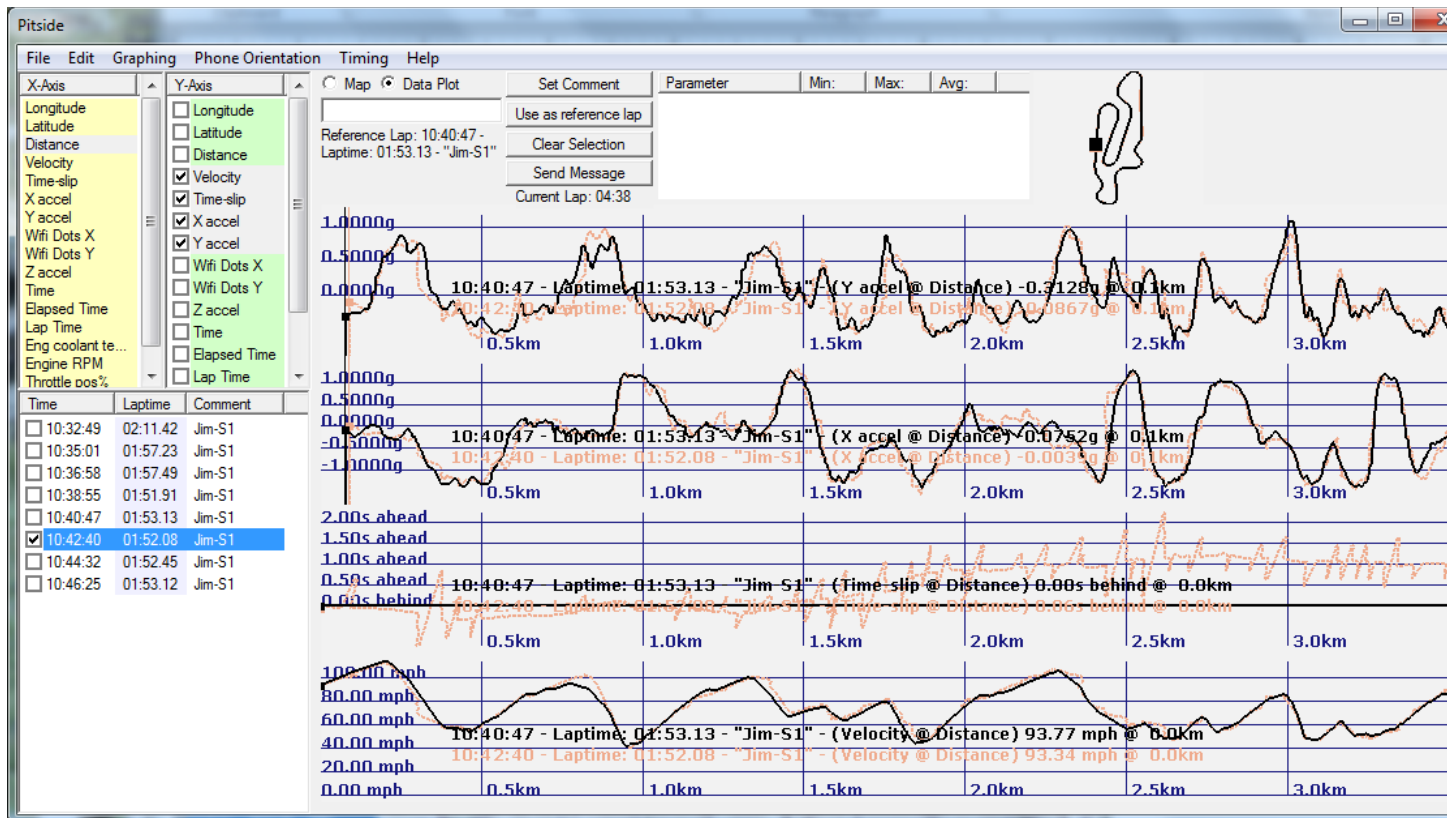
- 1) **Distance:** This will find the closest points by distance across all laps displayed. This is the most common X-Axis display channel.
- 2) **Time:** This is useful for displaying long-term trends in mostly constant data such as engine monitors. It is also used for the Laptime Summary display.
- 3) **Lap Time:** You can compare car locations for different laps at the same moment during a lap.

1.8 Choosing the Y-Axis data channels

Pitside default for display on the Y-Axis is Velocity. You can use this graph to compare top speeds, exit speeds and other driver aids. This is a powerful tool when the proper Reference Lap is chosen. For each highlighted lap the details are shown as text in the graph.

Multiple Y-Axis channels can be chosen, unlike for the X-axis. Use Shift-Click, Ctrl-Click or drag the mouse over the desired channels to display. Below are listed some of the most useful default channels for Y-Axis display:

- 1) **Velocity:** The default and most useful.
- 2) **Time-Slip:** This will show how much ahead or behind the current lap is compared to the Reference Lap at the closest distance from where the mouse arrow is. This is the most useful tool to determine where time is gained or lost when comparing laps and drivers.
- 3) **Laptime Summary:** This is used to display a graph of multiple laps, showing their lap times. This can be used to determine how consistent a driver is or if they are improving lap over lap.
- 4) **X/Y Acceleration:** While vibration from the phone can make this less useful, it can still be a driver aid.
- 5) **Custom Channels:** If you have an OBD2 scanner or IOIO board connected to your phone and are recording driver input/car management data, there will be additional data channels showing up. You can view these as simple graphs, or they can be displayed in more compact Value Only fashion. This is discussed further in the Advanced Options section.



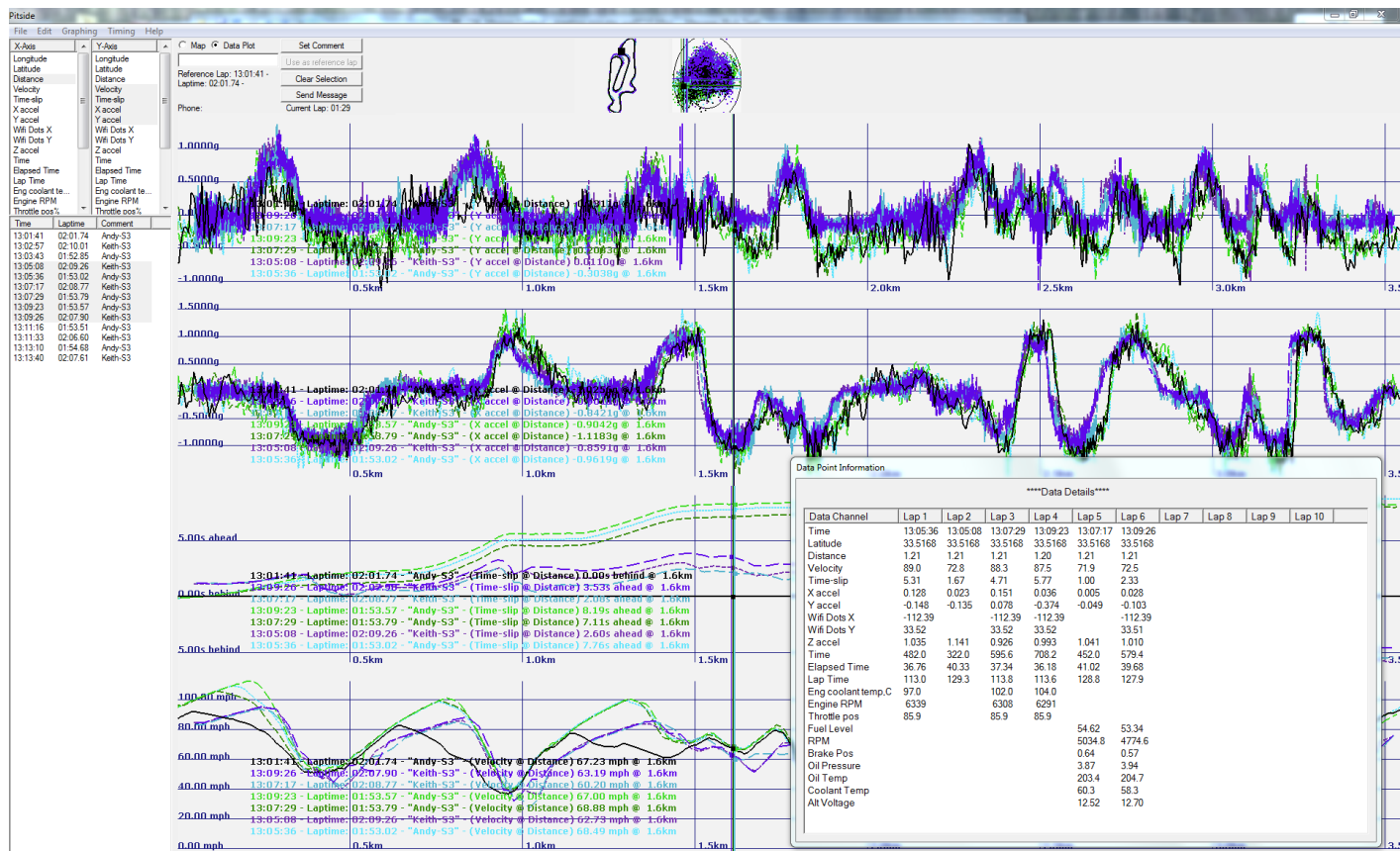
1.9 Panning / Zooming

The graphs can be moved around as well as zoomed in or out, if the user desires. Click on the graph display area to make it the active display, and then you can pan by holding down the Left Mouse button and moving your mouse. The Zoom wheel can be used to zoom in or out for a particular area.

You can reset panning/zooming by clicking the Right Mouse button.

1.10 Displaying All of the Data for Selected Lap

Pitside Console now has the option of displaying in tabular form all of the data available for up to 10 of the selected laps. Double click on the data graph at the point you want to retrieve all of the data from, using either the Left or Middle mouse button. A window will appear:



The data present in the window is the information for the current mouse position on the graphs. If you single-click on the Middle Button at a different point, the information about that point will be displayed.

For dynamic display of the data in the table, click and hold down the middle button. As you move the mouse around the information in the table will update in real time.

Double click the left or middle mouse button to close the window. You may also move the window by grabbing the title bar with your mouse. This is great when using dual displays in extended screen mode.

1.11 Setting Comments

Comments can be added to existing or newly acquired laps. Use the Comment dialog to enter in the information you want (Driver name is common). Once some text is entered into the Comment dialog, highlight one or more laps in the Lap List and click on the "Set Comment" button. The comment will appear in the Lap List for all selected laps.

<input type="radio"/> Map <input checked="" type="radio"/> Data Plot	Set Comment
<input type="text" value="Add comment here"/>	Use as reference lap
Reference Lap: 18:21:51 - Laptime: 03:06.82 - "Keith"	Clear Selection
	Send Message

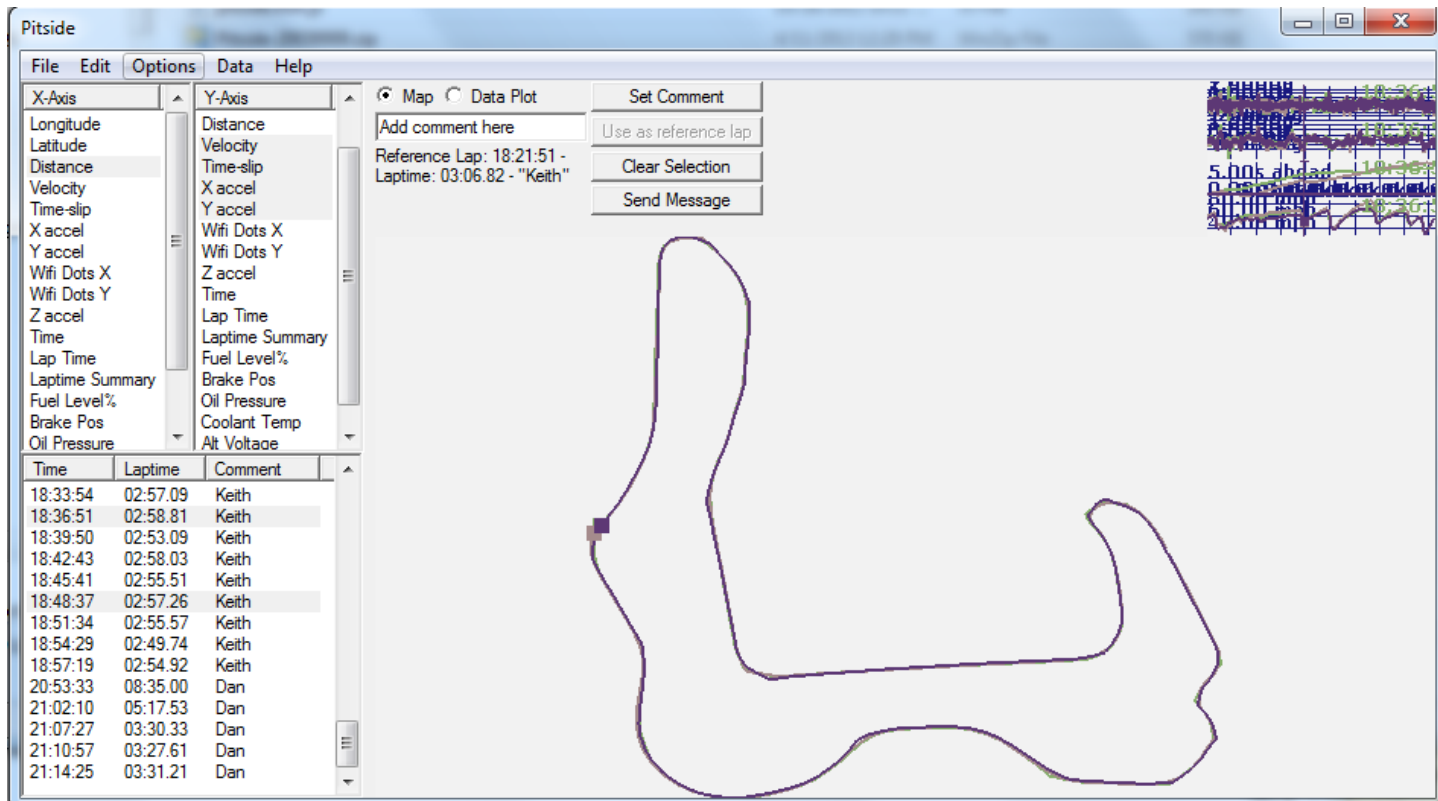
Once there is text in the Comment dialog, all subsequent laps received will have that comment added to them. Thus, if you wanted to mark the first race session as "Bob", enter in Bob into the Comment dialog and all received laps will have "Bob" added to them. Don't forget to change the name when the next driver gets in the car.

1.12 Display Views – Map vs. Data Plot

There are 2 radio button options at the top of the main Pitside screen, one for "Map" and the other for "Data Plot". These toggle what is shown on the Main Display and the Subdisplay.

<input type="radio"/> Map <input checked="" type="radio"/> Data Plot
--

The "Map" button moves the track map to the main display area. You can pan/zoom this track map in order to view a specific corner or track area and see how drivers entered/exited it.



The "Data Plot" button displays all of the data graphs for the selected laps. You can pan/zoom these graphs in the same manner.

2 Advanced Options

2.1 Manipulating the SETTINGS.TXT file

Several Pitside settings are set to their default values inside of the "Settings.txt" file. This file is located in the same folder as the PitsideConsole.exe application. If you want to have a different start up behavior for Pitside than what is currently the default, you can change it by using a text editor (Notepad or Wordpad will work just fine) and making changes to the "1's" and "0's" file.

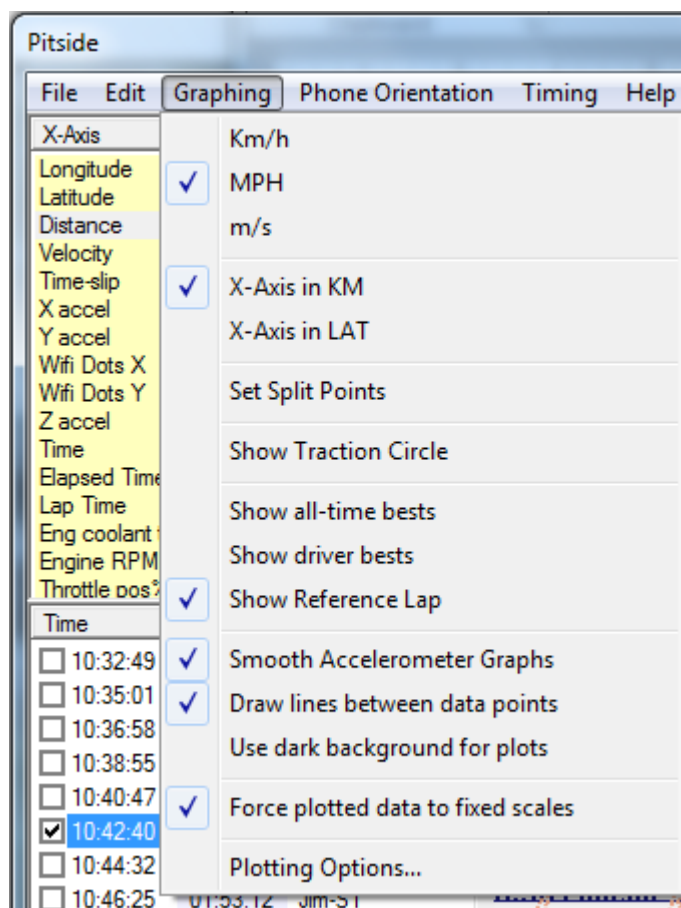
Here are the settings that are changeable in order:

- 1) **Whether to run the http server** (0 = don't. 1 = do) Pitside communicates to the Web UI using this server. This must be enabled to view content using the Web UI.

- 2) -**HTTP server port** (port 80 makes for easiest use. Big port numbers like 63938 are less likely to be blocked)
- 3) -**Velocity Units** (0 = KMH, 1 = MPH, 2 = M/S)
- 4) -**Draw graph points or lines** (0 = points, 1 = lines)
- 5) -**Graph plot color scheme** (0 = grey background, 1 = black background)
- 6) -**Smooth accelerometer channels** (0 = no smoothing, 1 = smoothing enabled)
- 7) -**X-Axis display in Latitudinal degrees, or KM** (0 = Latitudinal degrees, 1 = KM)

2.2 The Graphing Menu

The default options set up in the Settings.txt can be overridden by changing items in the Graphing menu. There are additional display option choices here as well.



2.2.1 Km/h, Mph, m/s:

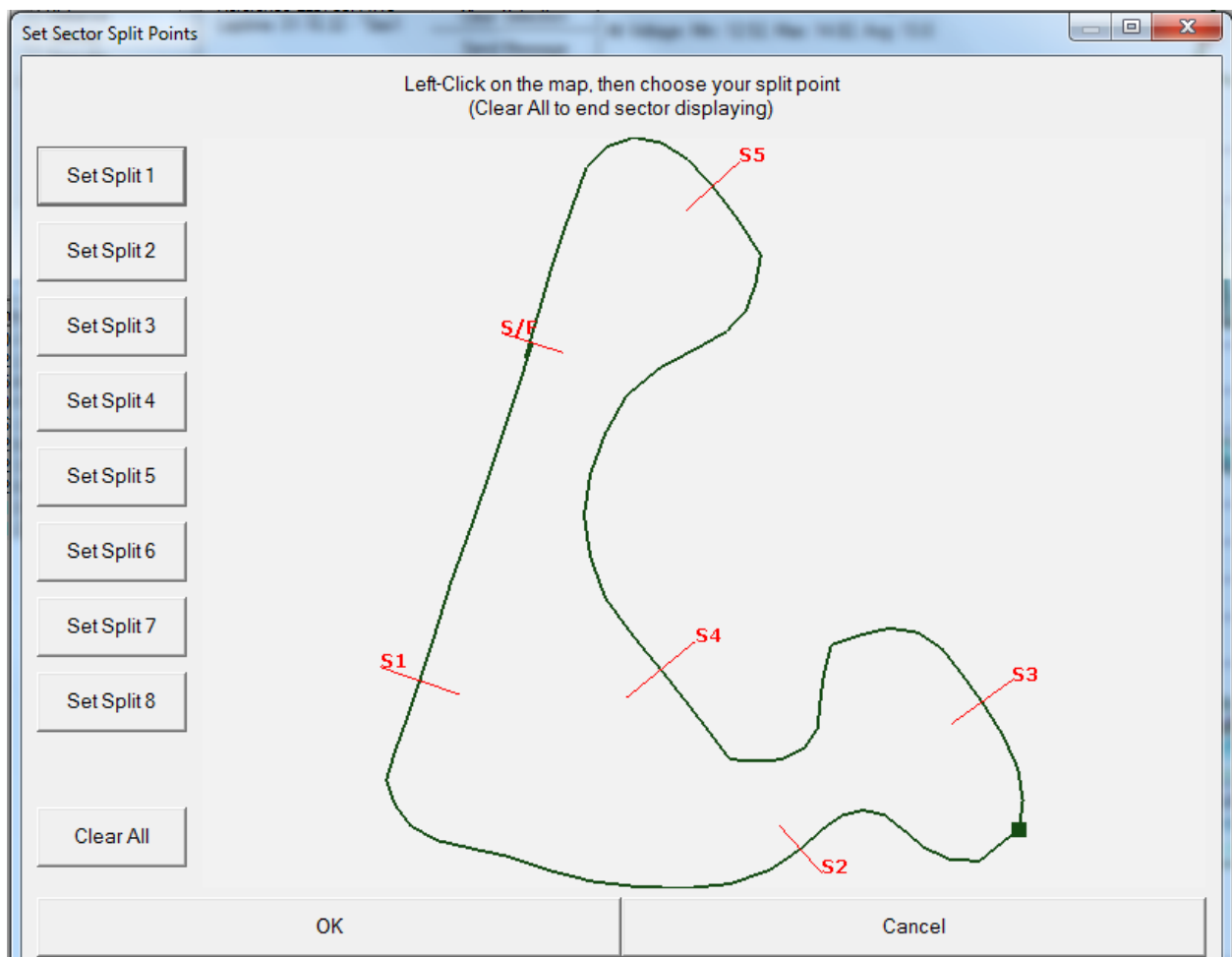
Toggle between these 3 options to set your speed units. Only one option can be chosen at a time.

2.2.2 X-Axis in KM or LAT:

Toggling between these options changes the X-Axis display units from KM (default) to Latitude/Longitude degrees. **The Web UI requires you choose the LAT option in order to work properly at this time.** You can change the default option for this in the Settings.txt file.

2.2.3 Set Split Points (Sector Times):

You can set up to 8 split points on the track map, giving you a total of up to 9 Sector Times that you can use to analyze your team's driving. Click on the menu option and a dialog will pop up:

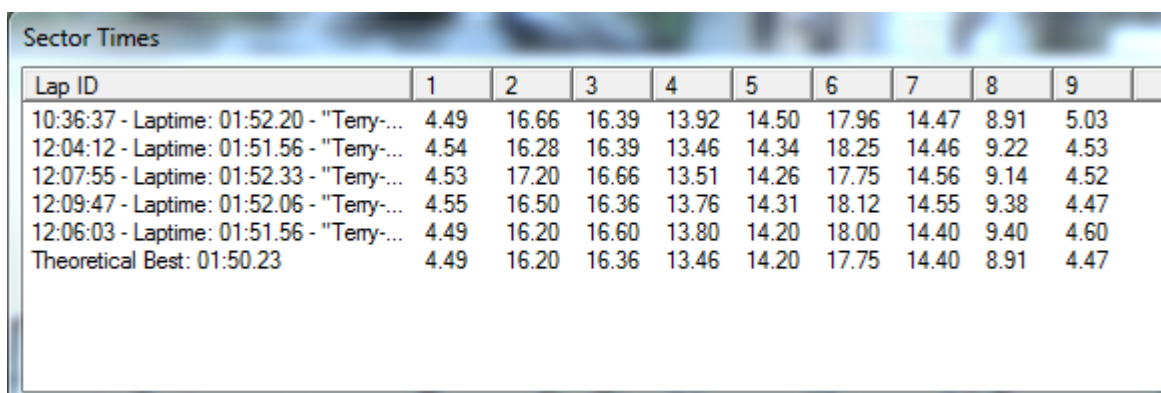


This displays the current Reference lap, showing the Start/Finish line location. You your mouse to highlight a location on the lap that you want to

choose for a Split Point, and click the left mouse button. Next, assign that Split Point to a "Set Split x" button, keeping in mind that you need to set these sequentially around the track map. You do not have to assign a location for all 6 split points – just choose the ones you want.

Once you have set all of your split points hit the "OK" button. The currently selected laps will now have their Sector Times displayed in a separate window on top of the main Pitside Console window. Drag this window to a location that is least obtrusive. The final sector time will always show up in the "Sect 7" column, independent of how many split points you have chosen.

You can select and display up to 7 different laps and their sector times in this window. If you have "Show Reference Lap", "Show All-Time Best" or "Show Driver Bests" options chosen, these will show up in the window as well, identified by their individual timestamps.



Lap ID	1	2	3	4	5	6	7	8	9	
10:36:37 - Laptime: 01:52.20 - "Terry-..."	4.49	16.66	16.39	13.92	14.50	17.96	14.47	8.91	5.03	
12:04:12 - Laptime: 01:51.56 - "Terry-..."	4.54	16.28	16.39	13.46	14.34	18.25	14.46	9.22	4.53	
12:07:55 - Laptime: 01:52.33 - "Terry-..."	4.53	17.20	16.66	13.51	14.26	17.75	14.56	9.14	4.52	
12:09:47 - Laptime: 01:52.06 - "Terry-..."	4.55	16.50	16.36	13.76	14.31	18.12	14.55	9.38	4.47	
12:06:03 - Laptime: 01:51.56 - "Terry-..."	4.49	16.20	16.60	13.80	14.20	18.00	14.40	9.40	4.60	
Theoretical Best: 01:50.23	4.49	16.20	16.36	13.46	14.20	17.75	14.40	8.91	4.47	

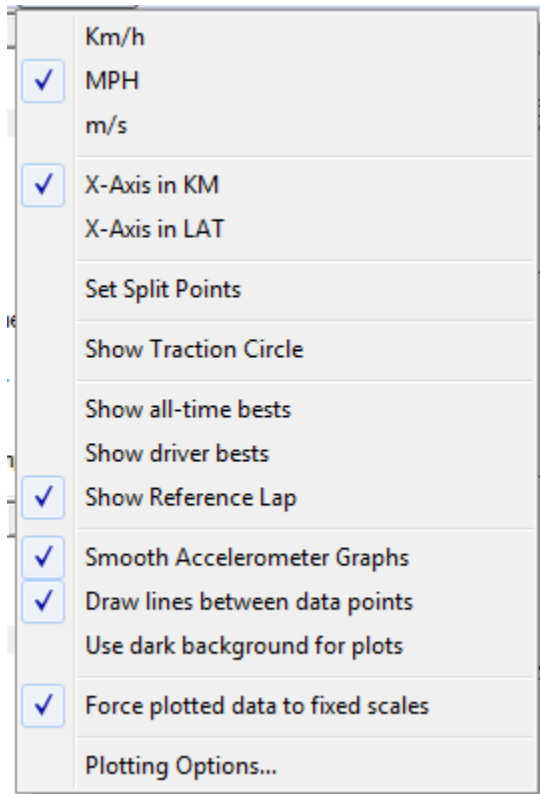
In addition to sector times for each individual lap, a "Theoretical Best Lap" is also calculated. This is the fastest lap calculated from each Sector's lowest time, so should give an indication of what time you could achieve if you had a clear track and were able to drive each sector optimally.

To close this window, go back to the Options/Set Split Points menu and choose "Clear All" and hit "OK". All split points will be cleared and the Sector Times window will close. If you change the Reference Lap or load a new Race Session or database the split points will also be lost and have to be recreated.

2.2.4 Show Traction Circle:

Pitside has the ability to display the Traction Circle in a separate display at the same time you are viewing your Data Plot and Track Map. Checking the "Show Traction Circle" option will activate a 3rd display, right next to the

small display in the upper part of the screen. If you have chosen to collect accelerometer data, and the X and Y-Accel data channels are showing up in the Y-Axis list you should be able to display the Traction Circle graph.



When you first choose to display the Traction Circle graph, you will get only a white box with a message "Click X-Accel to display" in it.



You need to load the X-Accel data from the database by clicking on the X-Accel channel in the Y-Axis window, and then the graph should display. You can then change back to displaying whatever Y-Axis channels you want and the Traction Circle display will still update properly. Multiple laps will display in their respective colors, similar to how the Data Plots are shown.



If you switch to another Race Session or change your Reference Lap, you will have to reload the X-Accel data with the above procedure. Once you have done that, however, changing to other laps will update the Traction Circle graph without any further user action required. This graph assumed that you have set up your phone running WFL in your car such that the screen is facing towards the rear, and your phone is in landscape mode. Future enhancements may become available to choose different orientations.

The circles in the Traction Circle graph are displayed in increments of 0.5G. You typically will see circles out to 1.5G for HPDE runs, maybe out to 2.0G if it is a high HP car running Hoosiers or slicks.

2.2.5 Show All-Time Bests:

Checking this option will add the Best Lap to all graphs displayed. This can be used as a driver aid in addition to the Reference Lap. One problem currently with using this option is that the responsiveness of Pitside becomes significantly affected with large databases. For long endurance races it is recommended to keep this option unchecked.

2.2.6 Show Driver Bests:

This will show the Best Lap for each driver, assuming that there are different Comments added to Lap List. This can help determine who is the better driver on the team, but may lead to fights ☺. One problem currently with using this option is that the responsiveness of Pitside becomes significantly affected with large databases. For long endurance races it is recommended to keep this option unchecked.

2.2.7 Show Reference Lap:

This option toggles displaying the Reference Lap on all graphs. There are some displays (Traction Circle, Laptime Summary, Acceleration) where showing the Reference Lap only adds confusion, so this option was added.

2.2.8 Smooth Accelerometer Graphs:

This toggles between displaying the raw accelerometer data (X/Y/Z) or a smoothed set of lines. You can set the default for this in the Settings.txt file if you want.

2.2.9 Draw Lines Between Data Points:

This toggles between data points for each graph and a connected line for each dataset. This is useful if you want to see all of the data points that were collected.

2.2.10 Use Dark Background for Plots:

Toggles between a light grey & a black background for data graphs. Use whichever option that shows the data best for you.

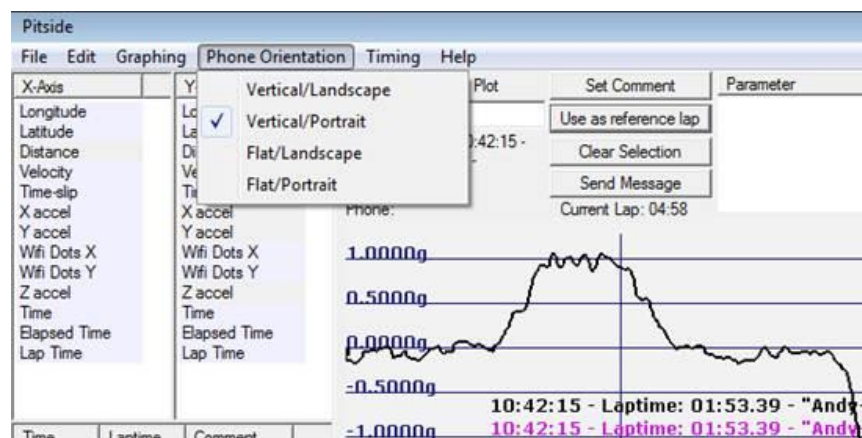
2.2.11 Plotting Options....:

Detailed out in Section 2.3 "Plotting Data as Graphs vs. Values / Alarms / Transformations"

2.3 Phone Orientation

Pitside has a feature to allow you to set which orientation your phone is in while it is collecting data. This is important for Accelerometer data, so that braking, acceleration and turning are captured correctly and displayed in the Traction Circle (See 2.2.4) properly.

Four options are available, with the default being the Vertical/Landscape mode. This assumes that you have your phone positioned so that the screen is facing rearward in the car, and that the screen is in Landscape orientation. If you choose to have your phone in Portrait mode, change the selection to Vertical/Portrait.



If you are using an external GPS device such as the QStarz, and you have the phone laying flat in your car, choose either Flat/Landscape or Flat/Portrait to get the Traction Circle to display correctly. You may have to select one of the accelerometer channels (Y/X/Z) to have the Traction Circle graph show up.

2.4 Plotting Data as Graphs vs. Values / Alarms / Transformations

2.4.1 Graphs vs. Values Plot Options:

The Plotting Options menu allows the user to choose how to display the various data channels available for a given Race. Choose OPTIONS / PLOTTING OPTIONS... and the following window will appear.

All unique Data Channels that are available for the loaded Race Session will be displayed. Base and derived Data Channels (Distance, Velocity, Time, Laptime, Laptime Summary, Time-Slip) are not displayed. The user can then choose which data channels that, if chosen, will display as Graphs or as Values Only by clicking the appropriate radio button:

Choose plotting preferences

Data Channel	Display Type		Low Limit	High Limit	Trans?	A	+	Bx	+ Cx^2
X accel	<input checked="" type="radio"/> Graph	<input type="radio"/> Value	-3.00	1000000.00	<input type="checkbox"/>	0.0000		1.0000	0.0000
Y accel	<input checked="" type="radio"/> Graph	<input type="radio"/> Value	-3.00	1000000.00	<input type="checkbox"/>	0.0000		1.0000	0.0000
Wifi Dots X	<input checked="" type="radio"/> Graph	<input type="radio"/> Value	-3.00	1000000.00	<input type="checkbox"/>	0.0000		1.0000	0.0000
Wifi Dots Y	<input checked="" type="radio"/> Graph	<input type="radio"/> Value	-3.00	1000000.00	<input type="checkbox"/>	0.0000		1.0000	0.0000
Z accel	<input checked="" type="radio"/> Graph	<input type="radio"/> Value	-3.00	1000000.00	<input type="checkbox"/>	0.0000		1.0000	0.0000
Fuel Level%	<input type="radio"/> Graph	<input checked="" type="radio"/> Value	50.00	1000000.00	<input checked="" type="checkbox"/>	116.0000		-40.0000	0.0000
RPM	<input checked="" type="radio"/> Graph	<input type="radio"/> Value	-3.00	6000.00	<input checked="" type="checkbox"/>	0.0000		32.0000	0.0000
Brake Pos	<input checked="" type="radio"/> Graph	<input type="radio"/> Value	-3.00	1000000.00	<input type="checkbox"/>	0.0000		1.0000	0.0000
Oil Pressure	<input type="radio"/> Graph	<input checked="" type="radio"/> Value	2.00	1000000.00	<input checked="" type="checkbox"/>	-4.5000		3.2500	0.0000
Coolant Temp	<input type="radio"/> Graph	<input checked="" type="radio"/> Value	-3.00	110.00	<input checked="" type="checkbox"/>	167.0000		-44.0000	0.0000
Alt Voltage	<input type="radio"/> Graph	<input checked="" type="radio"/> Value	12.00	1000000.00	<input checked="" type="checkbox"/>	0.0000		5.1000	0.0000
12:	<input type="radio"/> Graph	<input type="radio"/> Value			<input type="checkbox"/>				
13:	<input type="radio"/> Graph	<input type="radio"/> Value			<input type="checkbox"/>				
14:	<input type="radio"/> Graph	<input type="radio"/> Value			<input type="checkbox"/>				
15:	<input type="radio"/> Graph	<input type="radio"/> Value			<input type="checkbox"/>				
16:	<input type="radio"/> Graph	<input type="radio"/> Value			<input type="checkbox"/>				
17:	<input type="radio"/> Graph	<input type="radio"/> Value			<input type="checkbox"/>				
18:	<input type="radio"/> Graph	<input type="radio"/> Value			<input type="checkbox"/>				
19:	<input type="radio"/> Graph	<input type="radio"/> Value			<input type="checkbox"/>				
20:	<input type="radio"/> Graph	<input type="radio"/> Value			<input type="checkbox"/>				

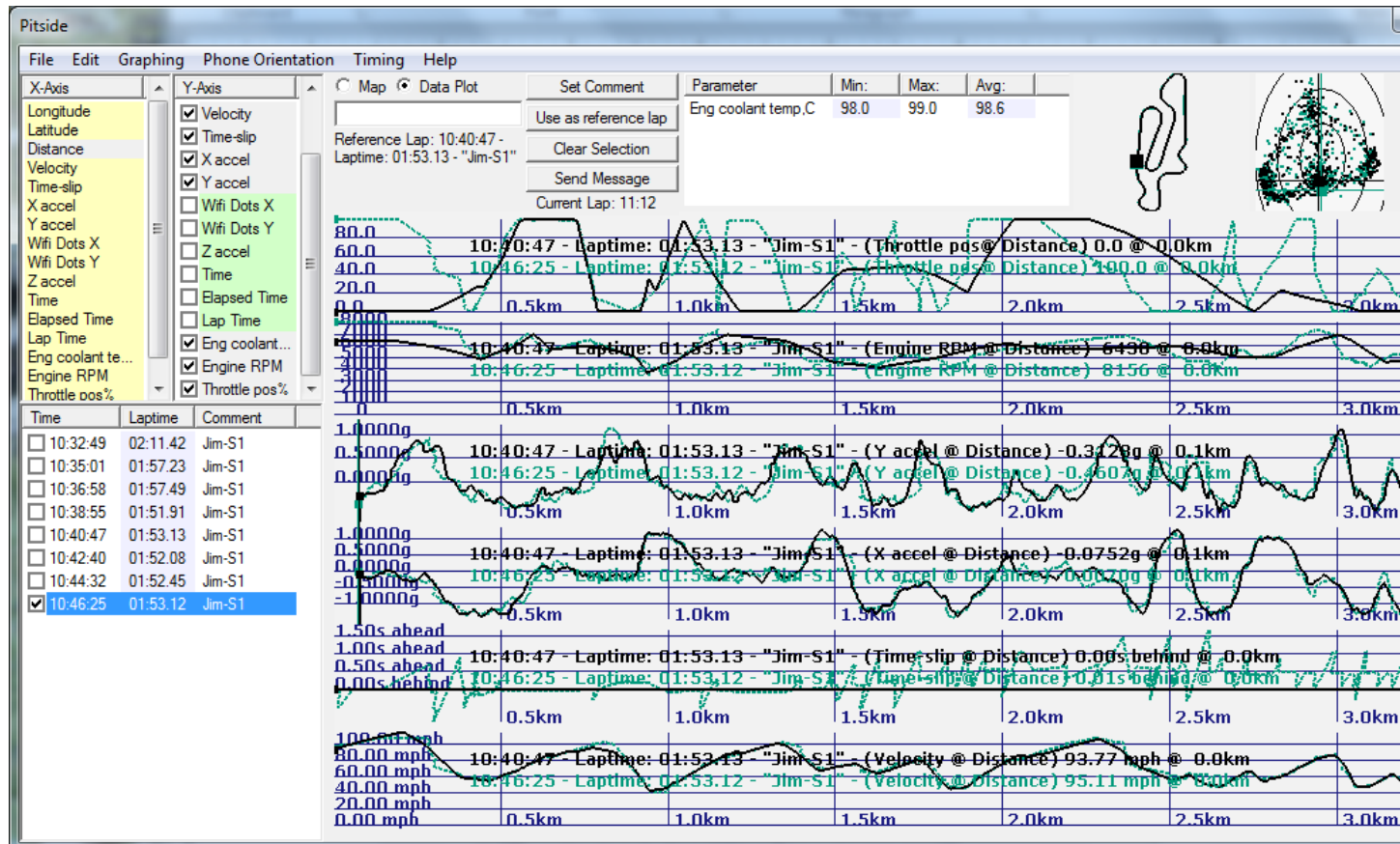
Rescan/Reset

OK Cancel

The Values display is where key statistics from up to 5 Data Channels can be displayed. Typically the Values Only display area is used to show the key statistics for Data Channels that are tracking key parameters that do not change significantly over time. Engine management (Alt, Oil Pressure, Coolant Temp, Oil Temp, Fuel Level) are typical parameters chosen.

Set Comment	Fuel Level%: Min: 0.41, Max: 0.92, Mean: 0.4
Use as reference lap	Brake Pos: Min: 0.44, Max: 2.86, Mean: 1.9
Clear Selection	Oil Pressure: Min: 2.52, Max: 2.67, Mean: 2.6
Send Message	Coolant Temp: Min: 1.6, Max: 1.9, Mean: 1.7
	Alt Voltage: Min: 2.47, Max: 2.93, Mean: 2.8

Note that the Data Channels need to be selected in the Y-Axis list in order to be displayed, just like for graphical displays.



2.4.2 Setting Alarm Limits for Values Data Channels:

Once Data Values channels are selected the user has the option of setting Alarm Limits for each. This is done by entering appropriate limits (high, low or both) into the Low Limit and High Limit columns of the Plot Options... dialog.

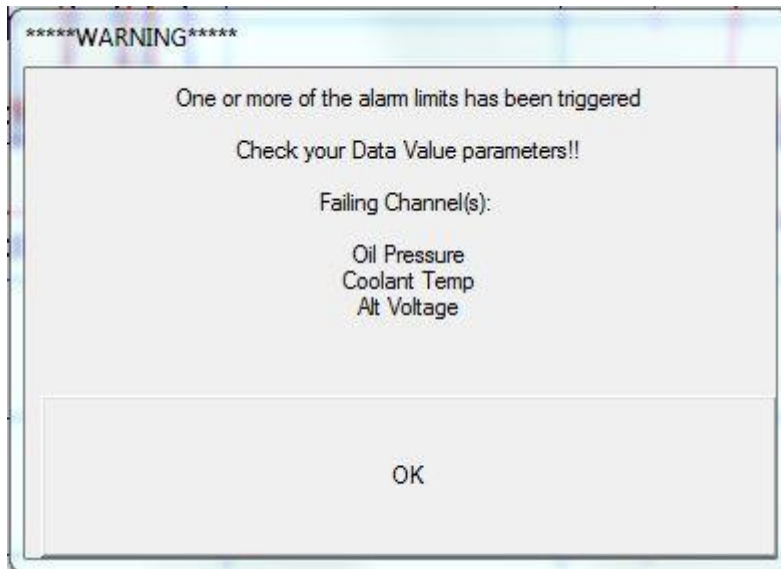
Choose plotting preferences

Data Channel	Display Type		Low Limit	High Limit	Trans?	A	+ Bx	+ Cx ²
X accel	<input checked="" type="radio"/> Graph	<input type="radio"/> Value	-3.00	1000000.00	<input type="checkbox"/>	0.0000	1.0000	0.0000
Y accel	<input checked="" type="radio"/> Graph	<input type="radio"/> Value	-3.00	1000000.00	<input type="checkbox"/>	0.0000	1.0000	0.0000
Wifi Dots X	<input checked="" type="radio"/> Graph	<input type="radio"/> Value	-3.00	1000000.00	<input type="checkbox"/>	0.0000	1.0000	0.0000
Wifi Dots Y	<input checked="" type="radio"/> Graph	<input type="radio"/> Value	-3.00	1000000.00	<input type="checkbox"/>	0.0000	1.0000	0.0000
Z accel	<input checked="" type="radio"/> Graph	<input type="radio"/> Value	-3.00	1000000.00	<input type="checkbox"/>	0.0000	1.0000	0.0000
Fuel Level%	<input type="radio"/> Graph	<input checked="" type="radio"/> Value	50.00	1000000.00	<input checked="" type="checkbox"/>	116.0000	-40.0000	0.0000
RPM	<input checked="" type="radio"/> Graph	<input type="radio"/> Value	-3.00	6000.00	<input checked="" type="checkbox"/>	0.0000	32.0000	0.0000
Brake Pos	<input checked="" type="radio"/> Graph	<input type="radio"/> Value	-3.00	1000000.00	<input type="checkbox"/>	0.0000	1.0000	0.0000
Oil Pressure	<input type="radio"/> Graph	<input checked="" type="radio"/> Value	2.00	1000000.00	<input checked="" type="checkbox"/>	-4.5000	3.2500	0.0000
Coolant Temp	<input type="radio"/> Graph	<input checked="" type="radio"/> Value	-3.00	110.00	<input checked="" type="checkbox"/>	167.0000	-44.0000	0.0000
Alt Voltage	<input type="radio"/> Graph	<input checked="" type="radio"/> Value	12.00	1000000.00	<input checked="" type="checkbox"/>	0.0000	5.1000	0.0000
12:	<input type="radio"/> Graph	<input type="radio"/> Value			<input type="checkbox"/>			
13:	<input type="radio"/> Graph	<input type="radio"/> Value			<input type="checkbox"/>			
14:	<input type="radio"/> Graph	<input type="radio"/> Value			<input type="checkbox"/>			
15:	<input type="radio"/> Graph	<input type="radio"/> Value			<input type="checkbox"/>			
16:	<input type="radio"/> Graph	<input type="radio"/> Value			<input type="checkbox"/>			
17:	<input type="radio"/> Graph	<input type="radio"/> Value			<input type="checkbox"/>			
18:	<input type="radio"/> Graph	<input type="radio"/> Value			<input type="checkbox"/>			
19:	<input type="radio"/> Graph	<input type="radio"/> Value			<input type="checkbox"/>			
20:	<input type="radio"/> Graph	<input type="radio"/> Value			<input type="checkbox"/>			

Rescan/Reset

OK Cancel

If the Minimum or Maximum value for one or more Data Channels exceeds the Low/High Limit chosen by the user, a warning notification box will appear on the Pitside screen. The message indicates which data channels have points outside of the alarm limits.



2.4.3 Transforming raw signals into real data:

The final option available in the Plotting Options dialog is whether or not to transform incoming raw data inputs into more meaningful numbers. If you have connected a data acquisition board (Such as an IOIO board) to Wifilapper, you need to convert those raw signals into actual units such as Temperature, Pressure, etc. You will need to use a curve fitting program such as <http://www.curveexpert.net/> (free evaluation version) and fit a quadratic polynomial ($y = A + B*x + C*x^2$) to your calibration data.

One option is to enter all of these conversions directly into the Wifilapper application on your phone, and all data received by Pitside will already be converted. You can also choose to enter the conversions directly into Pitside, which will allow you to change these transformations at a later date or during the race if needed. However, the downside to this is that these conversions are not outputted to the .CSV export file, if you are going to use an overlay tool such as Dashware or RaceRender. You will also have to re-enter these every time you open up the database. This is made easier by having pre-sets available inside of the Plot Preferences dialog: Click the down arrow in the "Load Transform" column for the Data Channel you wish to transform and select the desired pre-set transformation, and the A, B and C coefficients will be filled in. If desired, you can manually edit these values, or put in entirely new values for your sensor.

Finally, check the "Trans?" box to enable it:

Choose plotting preferences

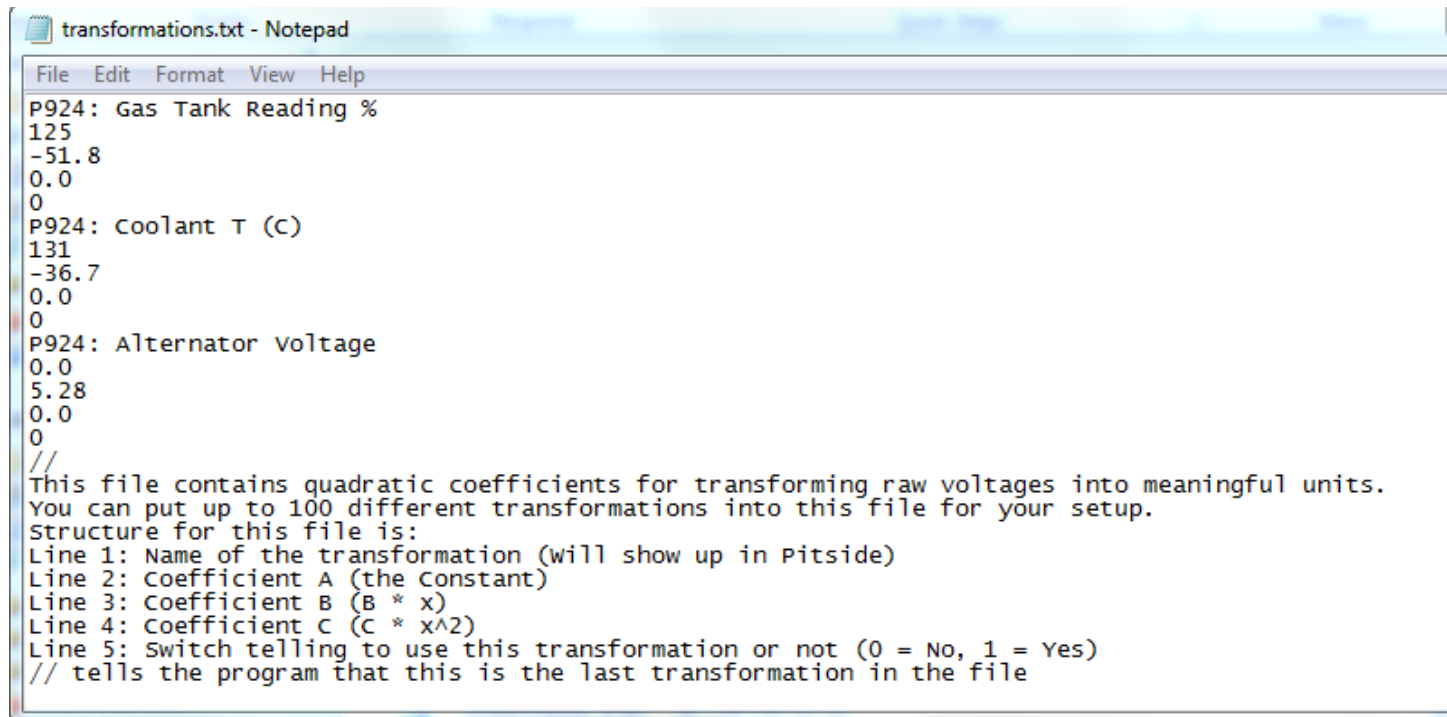
Data Channel	Display Type	Low Limit	High Limit	Trans?	A	B x	C x ²	Load Transform
X accel	<input checked="" type="radio"/> Graph <input type="radio"/> Value	-3.00	1000000.00	<input type="checkbox"/>	0.0000	1.0000	0.0000	
Y accel	<input checked="" type="radio"/> Graph <input type="radio"/> Value	-3.00	1000000.00	<input type="checkbox"/>	0.0000	1.0000	0.0000	
Wifi Dots X	<input checked="" type="radio"/> Graph <input type="radio"/> Value	-3.00	1000000.00	<input type="checkbox"/>	0.0000	1.0000	0.0000	
Wifi Dots Y	<input checked="" type="radio"/> Graph <input type="radio"/> Value	-3.00	1000000.00	<input type="checkbox"/>	0.0000	1.0000	0.0000	
Z accel	<input checked="" type="radio"/> Graph <input type="radio"/> Value	-3.00	1000000.00	<input type="checkbox"/>	0.0000	1.0000	0.0000	
Fuel Level%	<input checked="" type="radio"/> Graph <input type="radio"/> Value	-3.00	1000000.00	<input checked="" type="checkbox"/>	115.6000	-40.1000	0.0000	P951: Fuel Level
RPM	<input checked="" type="radio"/> Graph <input type="radio"/> Value	-3.00	1000000.00	<input checked="" type="checkbox"/>	0.0000	31.8000	0.0000	P951: Tachometer RPM
Brake Pos	<input checked="" type="radio"/> Graph <input type="radio"/> Value	-3.00	1000000.00	<input checked="" type="checkbox"/>	4.1400	3.5700	0.0000	P951: Alternator Voltage
Oil Pressure	<input checked="" type="radio"/> Graph <input type="radio"/> Value	-3.00	1000000.00	<input checked="" type="checkbox"/>	-4.4800	3.2600	0.0000	P951: Oil Pressure (Bars)
Coolant Temp	<input checked="" type="radio"/> Graph <input type="radio"/> Value	-3.00	1000000.00	<input checked="" type="checkbox"/>	167.2000	-44.0000	0.0000	P951: Coolant T (C)
Alt Voltage	<input checked="" type="radio"/> Graph <input type="radio"/> Value	-3.00	1000000.00	<input checked="" type="checkbox"/>	4.1400	3.5700	0.0000	P951: Alternator Voltage
12:	<input type="radio"/> Graph <input type="radio"/> Value			<input type="checkbox"/>				P951: Oil Pressure (Bars)
13:	<input type="radio"/> Graph <input type="radio"/> Value			<input type="checkbox"/>				P951: Fuel Level
14:	<input type="radio"/> Graph <input type="radio"/> Value			<input type="checkbox"/>				P951: Coolant T (C)
15:	<input type="radio"/> Graph <input type="radio"/> Value			<input type="checkbox"/>				P951: Alternator Voltage
16:	<input type="radio"/> Graph <input type="radio"/> Value			<input type="checkbox"/>				P951: Tachometer RPM
17:	<input type="radio"/> Graph <input type="radio"/> Value			<input type="checkbox"/>				P924: Oil Pressure (Bars)
18:	<input type="radio"/> Graph <input type="radio"/> Value			<input type="checkbox"/>				P924: Gas Tank Reading
19:	<input type="radio"/> Graph <input type="radio"/> Value			<input type="checkbox"/>				P924: Coolant T (C)
20:	<input type="radio"/> Graph <input type="radio"/> Value			<input type="checkbox"/>				P924: Alternator Voltage

Rescan/Reset

OK Cancel

Pitside will now display all graphs and values using these transformations.

If you wish to add your own pre-set transformation values into Pitside you can do it by editing the "transformations.txt" text file using a text editor such as Notepad. Up to 100 different pre-set transformations can be added to this file. The format is described in detail at the bottom of the file:



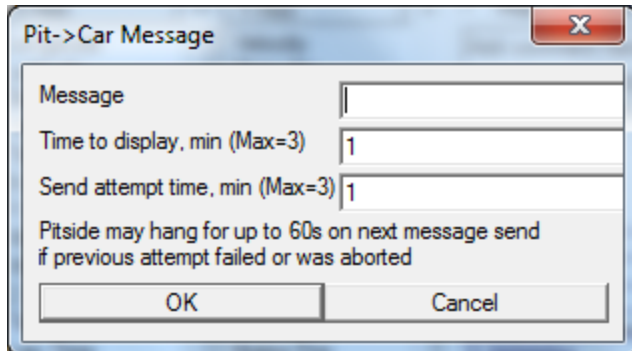
```
transformations.txt - Notepad
File Edit Format View Help
P924: Gas Tank Reading %
125
-51.8
0.0
0
P924: Coolant T (C)
131
-36.7
0.0
0
P924: Alternator Voltage
0.0
5.28
0.0
0
//
This file contains quadratic coefficients for transforming raw voltages into meaningful units.
You can put up to 100 different transformations into this file for your setup.
Structure for this file is:
Line 1: Name of the transformation (will show up in Pitside)
Line 2: Coefficient A (the Constant)
Line 3: Coefficient B (B * x)
Line 4: Coefficient C (C * x^2)
Line 5: Switch telling to use this transformation or not (0 = No, 1 = Yes)
// tells the program that this is the last transformation in the file
```

2.5 Sending Messages to the Wifilapper Phone

It is possible to send brief messages from Pitside to the Wifilapper application in the car. Several conditions need to be met to ensure success. Firstly, the phone needs to be able to connect to the Wifi network while on the track. Secondly, the Wifilapper application needs to be running on the phone and collecting lap data.

A more preferred method of sending messages to the phone, providing that the phone has Text message capability, is to send a Text message to its number, using the prefix string set in the phone. This method allows for a confirmation message to be sent back from Wifilapper to the phone in the pits. No confirmation is possible when sending messages directly through Pitside.

If it is still desired to send a message via Pitside, click on the "Send Message" button, and the following dialog box will appear.

A screenshot of a Windows-style dialog box titled "Pit->Car Message". It has a standard title bar with a close button (X). The dialog contains three input fields: "Message" (a text box), "Time to display, min (Max=3)" (a numeric box with "1" entered), and "Send attempt time, min (Max=3)" (a numeric box with "1" entered). Below these fields is a warning message: "Pitside may hang for up to 60s on next message send if previous attempt failed or was aborted". At the bottom are "OK" and "Cancel" buttons.

Type in your desired message on the top "Message" line. The "Time to Display" field allows you to choose how long IN MINUTES the message should appear on the phone screen inside the car. The default setting is for 1 minute. "Send Attempt Time" is a setting telling Pitside how long to try to send the message, again in minutes, to the phone.

Make sure that the car is already connected to the Wifi network before hitting the OK button to actually send the message. If the phone is not connected when the message is sent then it is unlikely that the phone will successfully receive the message. You can tell when the car has successfully connected to the network when Pitside displays the "Phone IP: xxx.xxx.xxx.xxx" underneath the Comments input area.

It is recommended that the user test the messaging feature out before a race in order to familiarize themselves with it.

2.6 Traction Circle

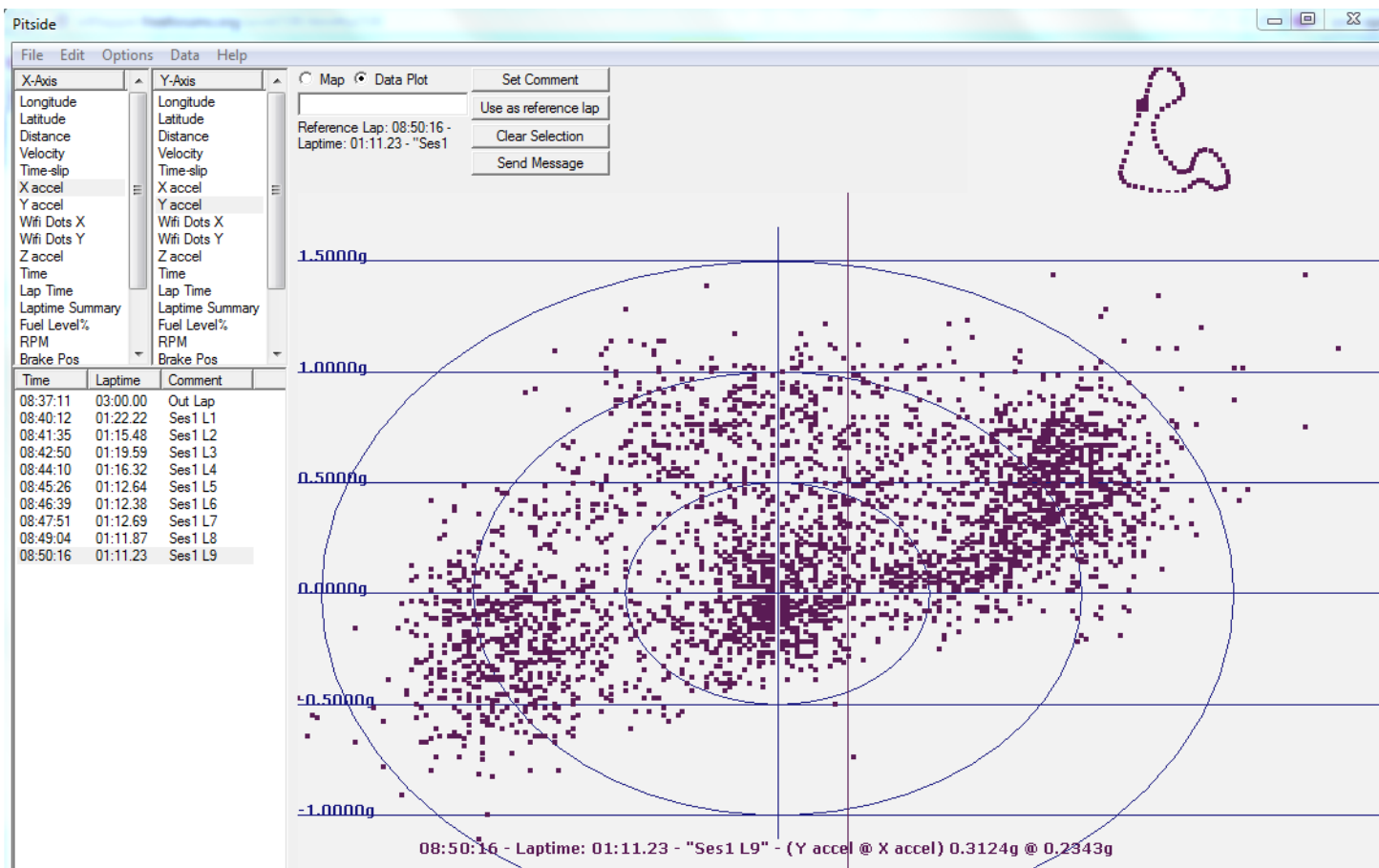
The Traction Circle graph is a specialized graph to display within Pitside Console, which requires certain display settings in Pitside to work. Keep in mind that a small version of this display can be shown by using "Options/Show Traction Circle".

Following is the procedure the user needs to follow in order to successfully display the traction circle for a lap, assuming that Pitside is displaying a default Distance/Velocity data plot:

- 1) Uncheck "Show Reference Lap" inside of the Options menu.
- 2) Choose the "Y-Accel" data channel in the Y-Axis select box. You should see the Y-Accel data displayed in the graph.
- 3) Choose the "X-Accel" data channel in the Y-Axis select box. You should see the Y-Accel data displayed in the graph. You have now loaded both the Y and X data channels into memory.
- 4) Choose the "X-Accel" data channel in the **X-Axis** select box. A line of data should show up as a graph.
- 5) Choose the "Y-Accel" data channel in the Y-Axis select box. The Traction Circle graph should now successfully be displayed.

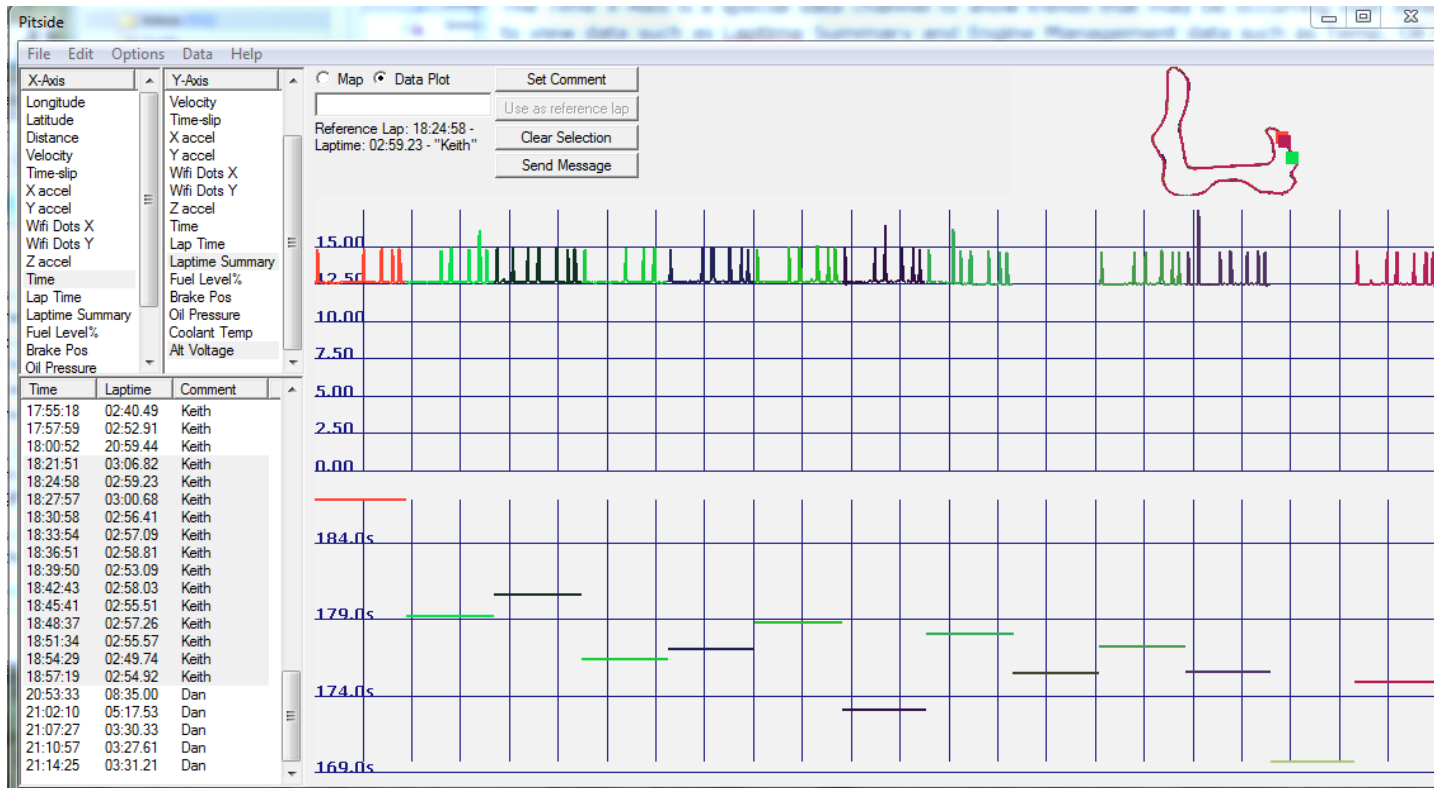
You will need to switch the X-Axis back to Distance and repeat steps 3-7 whenever you choose to display a different lap.

The 3 circles drawn on the graph represent 0.5G, 1.0G and 1.5G respectively.



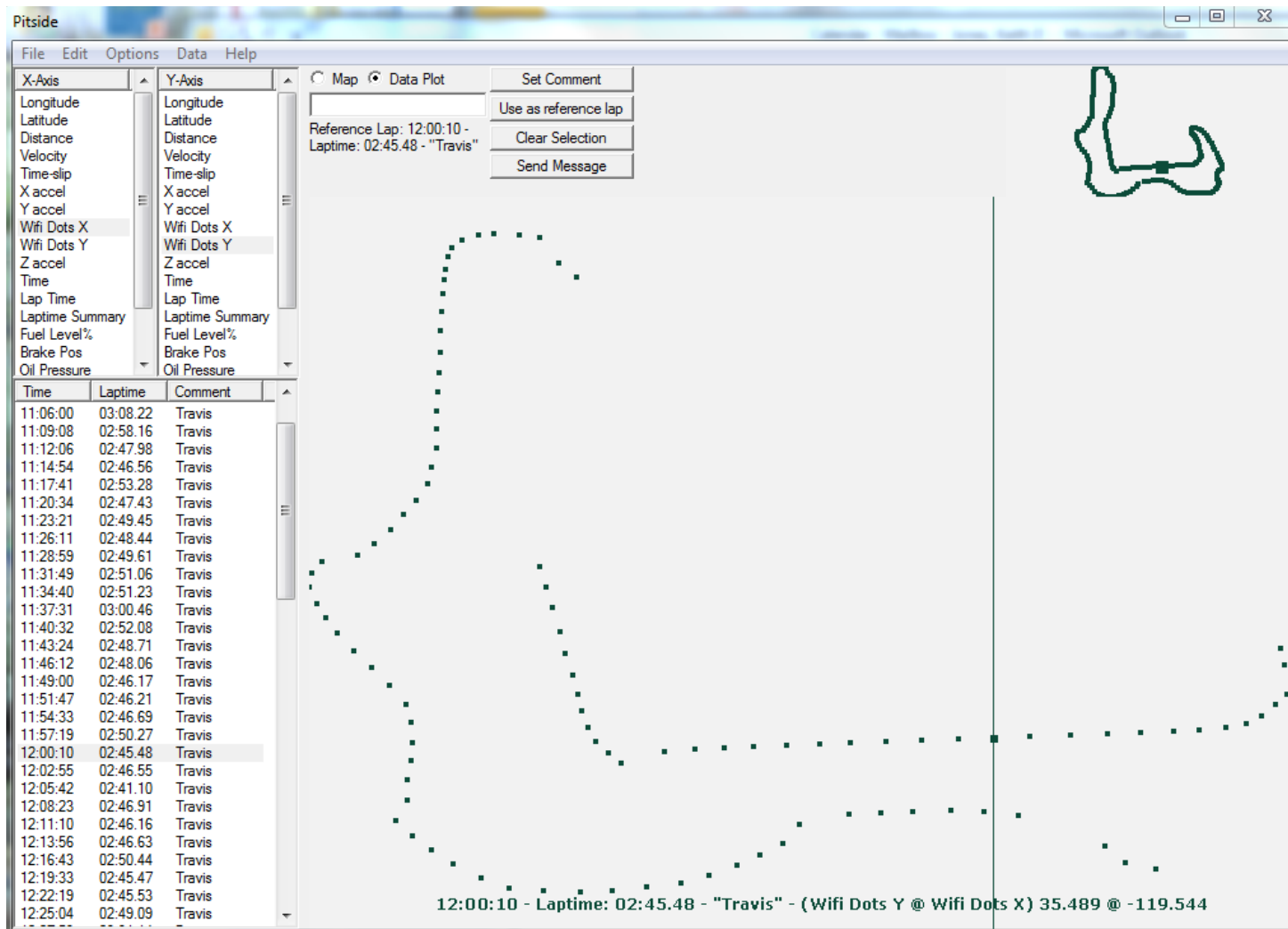
2.7 Using the Time X-Axis display to show long-term trends

The Time X-Axis is a special data channel to show trends that may be occurring over timeframes longer than a single lap. This is useful to view data such as Laptime Summary and Engine Management data such as Temp, Oil Pressure, Alt, etc. You must select more than one lap from the Lap List for the graph to be displayed.



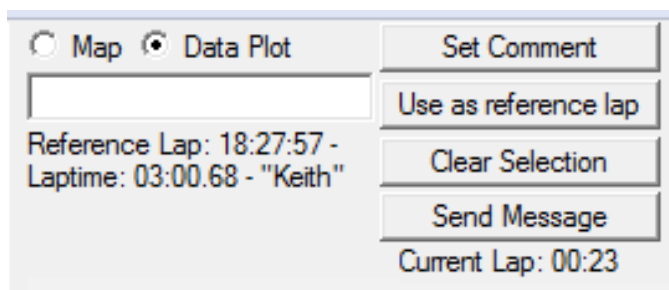
2.8 Wifi Dots

Wifi Dots is a display used to show where on the track the Wifi signal strength is strong enough that the phone is connected to the network. You can tell where on the track the car is successfully connecting to the Wifi network by displaying Wifi Dots X vs. Wifi Dots Y as a data graph. You may have to go through the same procedure as for displaying the Traction Circle graph to show Wifi Dots successfully, especially after changing laps.



2.9 Current Lap / Following your car around the track

Pitside now displays the time since the last data packet was received, just below the "Send Message" button on the main display.



You can use this time to estimate where on the track your car is, and whether or not you have been missing Phone – Pitside connects.

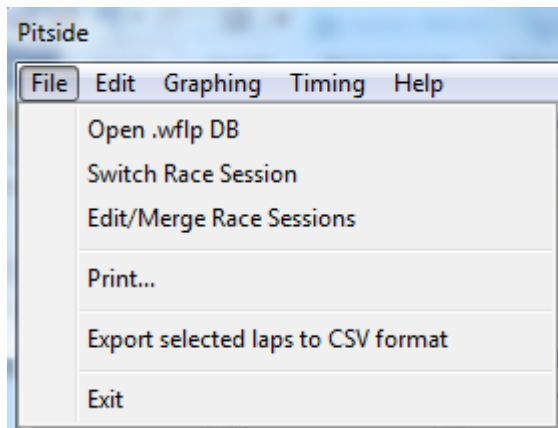
2.10 Print / Save Image / Copy

Choosing File / Print or File / Save Image will allow you to make a hardcopy print or save a JPEG image file of Pitside to disk. For best results it is recommended that change your Printer Options to Landscape mode.

Currently the Edit / Copy function within Pitside is still awaiting development time in order to become active. This will likely be included in future Pitside Console releases, but right now choosing Copy will not cause any problems, but also will not do anything.

3 Wiflapper Database Management

The "File" menu option inside of Pitside contains several operations to help you manage Race Sessions and .wflp databases.



3.1 Switching Race Sessions / Changing Databases

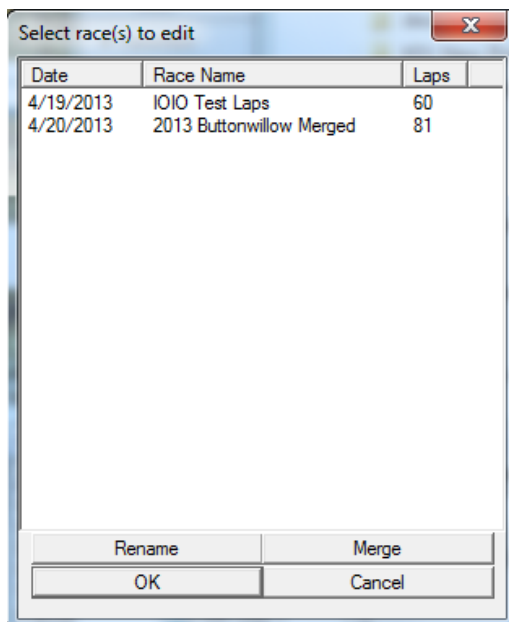
This choice is used to switch to a different race session than the one currently active. The same window displaying all available Race Sessions will come up; pick your desired Race Session and it will become the active dataset for analysis.

If you wish to choose a different .wflp database to analyze, choose the "Open .wflp DB" option. Browse and pick your desired database and Race Session for analysis.

3.2 Editing/Renaming Race Sessions

Race Session names are initially set from within the Wiflapper application on your Android phone. Frequently however multiple race sessions will be recorded and saved using the same Race Name, making identification from within Pitside difficult.

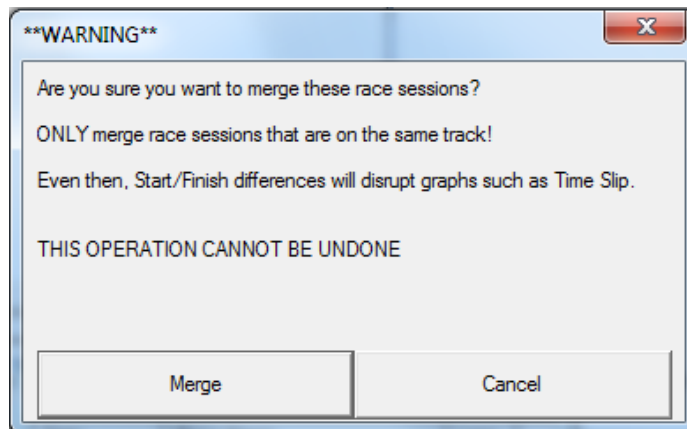
You can change the name of one or more Race Sessions from within Pitside, by using the Data / "Edit/Merge Race Sessions" menu choice. All Race Sessions contained within the current .wflp database will be displayed. Choose one or more of the Race Sessions that you wish to change the name of (Shift-click or Ctrl-Click will work here), and click on the "Rename" button. Enter in your new name and confirm. Use the "Switch Race Sessions" choice to view or load the Race Sessions list with your changed names.



3.3 Merging Race Sessions

You can merge one or more Race Sessions into a single Race Session from within Pitside, by using the Data / "Edit/Merge Race Sessions" menu choice. All Race Sessions contained within the current .wflp database will be displayed. Database Merging operations cannot be undone, so it is recommended that you make a copy of the .wflp database before you perform your Merge.

Choose two or more of the Race Sessions that you wish to merge into a single session (Shift-click or Ctrl-Click will work here), and click on the "Merge" button. A warning confirmation box will show up, giving you some guidelines on when merging sessions makes sense and when not to. After you choose to confirm the merge Pitside automatically loads the merged session and makes it active.



3.4 Exporting Data to .CSV format

Race Session data can be exported from Wifilapper into a comma separated variable (.CSV) format, which can be used by other analysis and display applications. Pitside does support the DASHWARE application in terms of the data output format. This allows the user to overlay the track map and other things like gauges onto video streams collected for a given race.

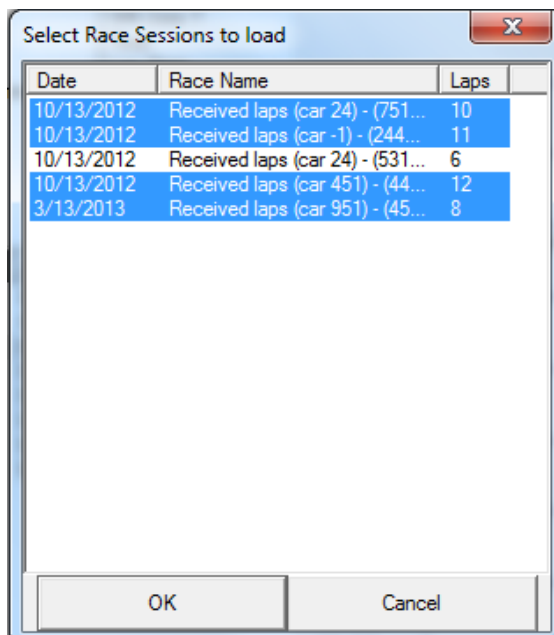
To export your data, first select the lap(s) that you wish to export to a .CSV file. Next choose Data / "Export Selected Laps to .CSV Format". Choose the name of your output file (.CSV will be appended automatically) and click OK. Pitside will work for a time, depending on how many laps were selected. Once complete the file is available for other programs to utilize.

4 Timing & Scoring

Starting with Pitside Version 2.003.0025 the WFL / Pitside lap timer setup can be used as a "Poor man's timing and scoring system" for events like HPDE's and Track Days. If multiple cars are sending lapping information to a single Pitside instance, a "Hot Laps" summary of the top 40 lap times can be viewed using Pitside. It should be able to handle up to 25 separate cars/phones feeding into a single Pitside instance at a time.

To most effectively set things up for this, make sure that each car / phone setup has a different Car Number (Inside of the WFL phone application, choose "Options" / "Set Car Number". The most accurate data would be attained if all cars used the same Start/Finish location, but since this is set by each racer individually it is unlikely for to it be exact. However, since the lap time should be approximately the same no matter where the S/F line is, it should be good enough for our purposes.

Have each car/racer try to set their S/F at approximately the same location, and wait for WFL to start collecting and transmitting lap times to Pitside. Once each car has registered at least one lap in Pitside, click on the "Timing" option on the menu bar, and choose "Timing and scoring". Select the desired Race Sessions that you want displayed and hit OK. You can use "CTRL-Click and Shift-click" to select multiple sessions.



A list of the top 40 lap times will then show up. Hit the "Refresh" button whenever you want to update the list.

Best Laps & Race Standings from Selected Sessions

Pos	Name	Comment	Laptime
1	Received laps (car 24) - (70477)	Session 2	02:22.38
2	Received laps (car 24) - (70477)	Session 2	02:25.42
3	Received laps (car 24) - (70477)	Session 2	02:28.30
4	Received laps (car 24) - (70477)	Session 2	02:28.83
5	Received laps (car 24) - (18737)	Lap1	02:29.25
6	Received laps (car 24) - (70477)	In Lap	02:29.30
7	Received laps (car 24) - (70477)	Session 2	02:29.42
8	Received laps (car 24) - (18737)	Lap1	02:30.94
9	Received laps (car 24) - (22336)	Lap1	02:32.32
10	Received laps (car 9) - (33290)		04:04.00
11	Received laps (car 24) - (70477)	Out Lap	04:10.00
12	Received laps (car 24) - (22336)	Out Lap	05:28.00

****RACE STANDINGS****

Pos	Name	Lap/Time Ahead
-----	------	----------------

Save Results

Re-Run Race Scenario

Enter race information below

Start Race

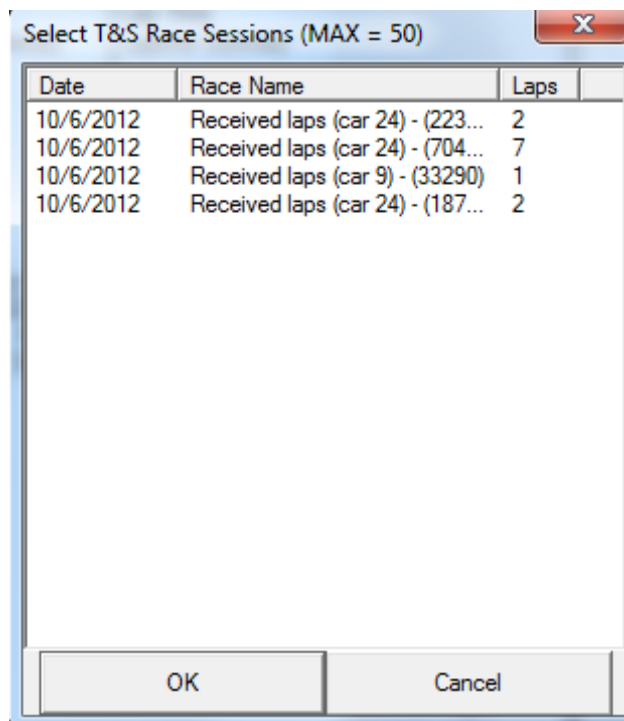
End Race

Refresh

Close

This list can be put behind the main Pitside window or even minimized while using the main Pitside application, and user can refresh it as desired. However, be sure to close this window before loading a new .WFLP database or this can cause Pitside to crash unexpectedly.

The user can also use WFL to count the number of laps for each racer during a track session. Once all cars have registered at least one lap into Pitside, which can be found by pulling up the Race Sessions selection dialog, choose the race sessions you want to be scoring. This process is the same as for the Hot Laps described above.



Date	Race Name	Laps
10/6/2012	Received laps (car 24) - (223...	2
10/6/2012	Received laps (car 24) - (704...	7
10/6/2012	Received laps (car 9) - (33290)	1
10/6/2012	Received laps (car 24) - (187...	2

OK Cancel

Once all racers have shown up in Pitside, click on the "Start Race" button. A message will pop up indicating that race scoring has started. Hit the refresh button whenever you want an update on the number of laps posted for each car. The "Time Ahead" value will show as "TBD" while the race is in progress.

Best Laps & Race Standings from Selected Sessions

Pos	Name	Comment	Laptime
1	Received laps (car 24) - (70477)	Session 2	02:22.38
2	Received laps (car 24) - (70477)	Session 2	02:25.42
3	Received laps (car 24) - (70477)	Session 2	02:28.30
4	Received laps (car 24) - (70477)	Session 2	02:28.83
5	Received laps (car 24) - (18737)	Lap 1	02:29.25
6	Received laps (car 24) - (70477)	In Lap	02:29.30
7	Received laps (car 24) - (70477)	Session 2	02:29.42
8	Received laps (car 24) - (18737)	Lap 1	02:30.94
9	Received laps (car 24) - (22336)	Lap 1	02:32.32
10	Received laps (car 9) - (33290)		04:04.00
11	Received laps (car 24) - (70477)	Out Lap	04:10.00
12	Received laps (car 24) - (22336)	Out Lap	05:28.00

****RACE STANDINGS****

Pos	Name	Lap/Time Ahead
1	Received laps (car 24) - (...)	2 / TBD
2	Received laps (car 24) - (...)	7 / TBD
3	Received laps (car 9) - (3...	1 / TBD
4	Received laps (car 24) - (...)	2 / TBD

Save Results

Re-Run Race Scenario

Enter race information below

Test Race #1

Start Race

End Race

Refresh

Close

The race is ended by clicking on the "End Race" button. This can be done at any time during the race session, and can be clicked again if you want to extend the window of time to be included in the scoring.

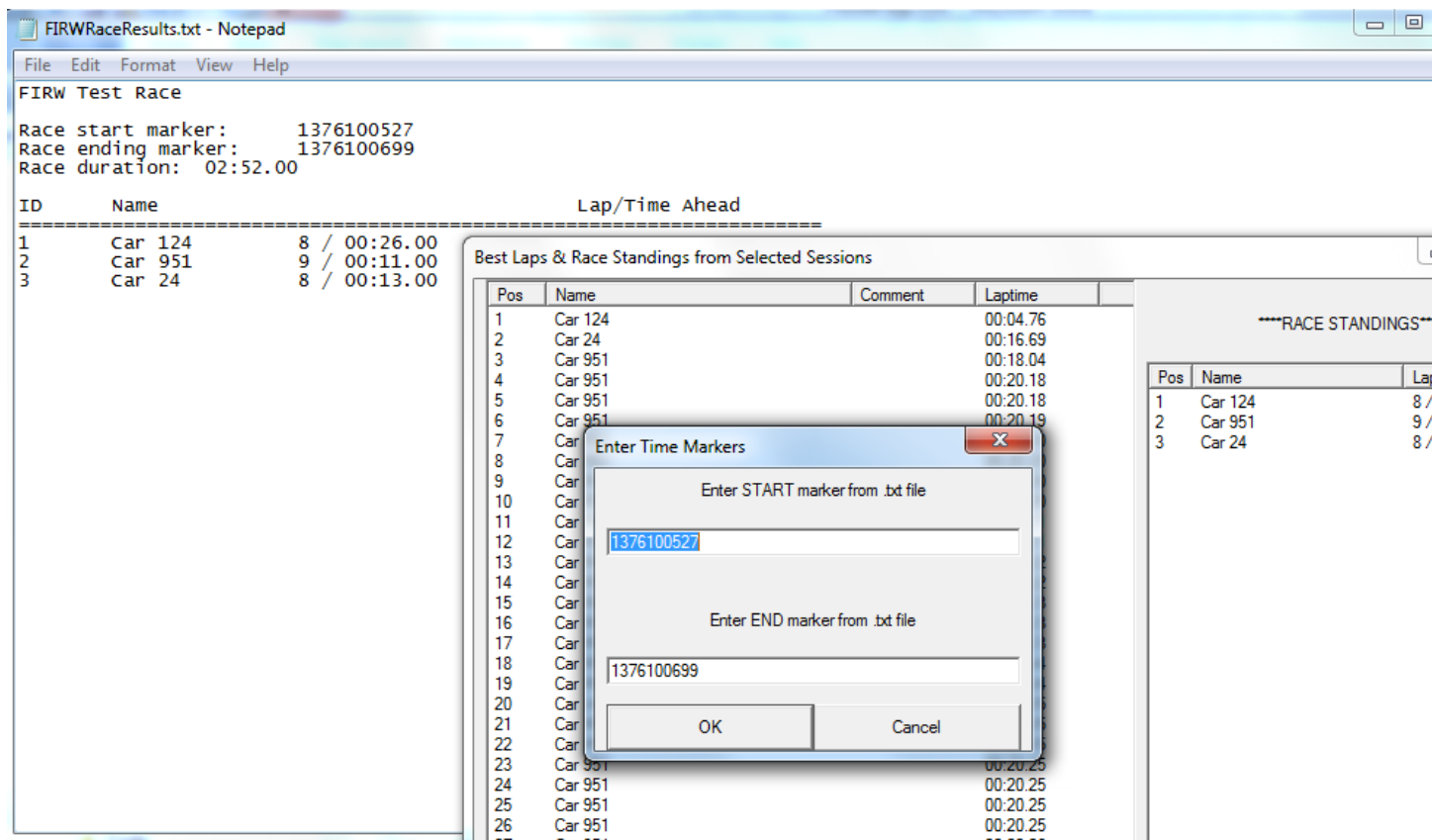
Once the race is ended the "Time Ahead" values are updated. This value is the summed time for each car for both before the first lap was registered and after the last lap registered within the time window chosen for "Start Race" and "End Race". This number can be anywhere from 0 seconds up to almost 2 times the lap time. If 2 racers have the same number of laps, it is

the racer with the HIGHER "Time Ahead" value that has a faster average track speed throughout that race session.

This should give the racer an indication of both how many completed laps they did as well as how far along on the next lap they traveled in the given time window. Information for the race can be typed into the "Race Information Field", and the results saved into a TXT file. Simply click the "Save Race" button and choose a folder and file name. The starting and ending time markers are saved in this TXT file along with the race information and the lapping results.

Sometimes it is desirable to either add some additional race sessions, or possibly change the starting or ending time markers for a given race. This may be required since each phone posts results based upon its individual time stamp, so if you are using phones on different cellular networks, or if the phone has been taken off of the cell network there will be discrepancies in the absolute times for laps across racers.

Pitside allows you to do this via the "Re-Run Race Scenario" button. Click on that and you can enter in any desired time markers for the start/end of a race. You can pull this information from the race results you saved in the TXT file.



You can adjust the times in order to get the best overall race results. Once you are happy with the outcome, save the results (and the respective time stamps) to a TXT file.

5 Contributors / Acknowledgements

Several people have been instrumental in making the Wifilapper and Pitside applications what they currently are. First and foremost would be Art Hare, who created this whole thing from nothing, and then decided to put it up as an Open Source project. Next would be Jason Willis who helped with the SQL database code and created the Web UI underpinnings. Keith Jones also helped to improve the Pitside Console application coding.

Finally, there are many in the Wifilapper community who have provided suggestions for improvements and found various bugs in the code. These

include Enduroracer, Cgorton, as well as several others that I cannot name at this moment.

6 Version Information

2.001.0001: Initial Version tracking of Pitside initiated, significant graphing improvements.

2.002.0001: Y-axis guideline improvements, panning/zooming enabled for data plots, grey background added, Time data channel added for long-term trend display.

2.002.0002: Significant improvement in lap display coding routines, x-axis guidelines added, Lap Time data channel added, added haversine coding for distance (KM).

2.002.0004: Pitside graphical layout improved, removed KM distance coding to prevent breaking WebUI.

2.002.0006: Significant improvement in lap display coding routines.

2.003.0003: Plot Preferences display options added,

2.003.0004: Laptime Summary plots enabled.

2.003.0006: Value Display enabled, OBDII Values display improved

2.003.0008: Guideline improvements in data plots, improved appearance of Laptime Summary plots.

2.003.0009: Default display options set with SETTINGS.TXT file.

2.003.0011: Added black background option for viewing data plots.

2.003.0012: Improved robustness of "Send Message" coding so it no longer locks up Pitside.

2.003.0013: Race Session merging enabled for database management.

2.003.0014: Enabled Race Session renaming in database.

2.003.0015: Sort Lap List by Laptime feature added.

2.003.0016: Help File added.

- 2.003.0017: Added constant G circles to Traction Circle graphs.
- 2.003.0018: Value Data Averaging coding fixed, Failing Data Channel information added, Printing enabled, Save Image enabled, improvements to CSV Exporting, Traction Circle graphing improvements, increased button sizes for Win8 tablet uses, minor performance improvements.
- 2.003.0019: Multi-threaded data reception coding added, "HTML Thread" coding incorporated into project, but not active.
- 2.003.0020: Up to 6 Split Points / Sector Times display feature added. Minor crash at startup bug fixed.
- 2.003.0021: Display improvements for Sector Times and X-axis / Distance, help file updated.
- 2.003.0022: Live lap timing feature added, up to 8 Split Points enabled, improved Traction Circle graphing.
- 2.003.0023: Polynomial transformations added for raw IOIO inputs, pre-sets added inside of transformations.txt file, zoom function now follows the mouse location for data plots, vertical guidelines now follow zoom function.
- 2.003.0024: Fixed bug causing lockup when out lap has very few data points, added guidelines for OBD2 data plots.
- 2.003.0025: Changed lap time sorting to key off of column headers instead of using menu choices, Timing & Scoring summary view added, help file updated.
- 2.003.0026: Track day scoring added, with text file output of the race summary, option to adjust starting/ending times for race scoring sessions, updated help file, ability to select and analyze multiple race sessions at once added.
- 2.003.0027: Fixed Point-to-Point as well as 1st lap IOIO/OBD2 data displaying, minor bug in Race Session selection fixed.
- 2.003.0028: Improved "Set Comment" performance, renamed Lap Time and Laptime Summary data channels for improved clarity.

2.003.0029: Additional Traction circle additional view added on main page, smoothing added to accelerometer data, fixed "Copy" crashing bug.

2.003.0030: Smoothing added to accelerometer data, corrected IOIO data graphing issues.

2.003.0031: Added option for smoothing accelerometer graphs, prevented duplicate windows from appearing.

2.003.0032: Reconfigured menu options, added option for X-axis display in kilometers or latitude/longitude.

2.003.0033: Smoothing option for Traction Circle sub-display, menu name change, fixed data plot point highlighting so it works on all graphs.

2.003.0034: Activated X-axis display option for KM or Latitude/Longitude. All Data window option added using middle mouse button.

2.004.0001: Added color painting of X and Y-Axis data channels, added Theoretical Best Lap to Sector Times display.

2.004.0002: Added Heart Rate Monitor capability.