
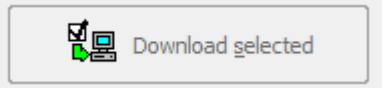
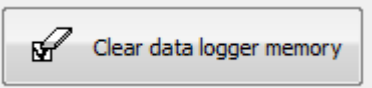


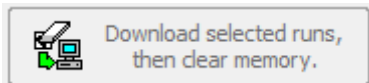
Data Logging & Analysis 101

Warning: motorsports, racing, HPDE, and other forms of high-speed driving events are extremely dangerous. The information, analysis and recommendations provided in this document are based on fictional data on a race track for illustration purposes only. Use this document at your own risk. Always consult a professional for driving instructions.

Chapter 0: Downloading Data from your AiM Device

Downloading Data

- Connect your AiM device to your computer via USB
- Turn on your AiM device
- Open Race Studio 2
- Click  (second button from top)
- Pick data to download
- Click 
- You can erase data on your device by clicking 



is not recommended.

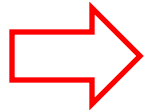
Chapter 1: Getting Familiar with RS2Analysis

What Kind of Data is Available?



	Solo	Solo DL	Evo4
Lap timing w/ predictive lap timing	Yes	Yes	Yes
Basic data (speed, position, Gs)	Yes	Yes	Yes
Gear Position	No	Yes	Yes
Advanced data (RPM, pedal position, wheel speeds, etc.)	No	Yes	Yes
Analog channels	No	No	Yes
Video Integration	No	Yes (SmartyCam HD)	Yes (SmartyCam HD)

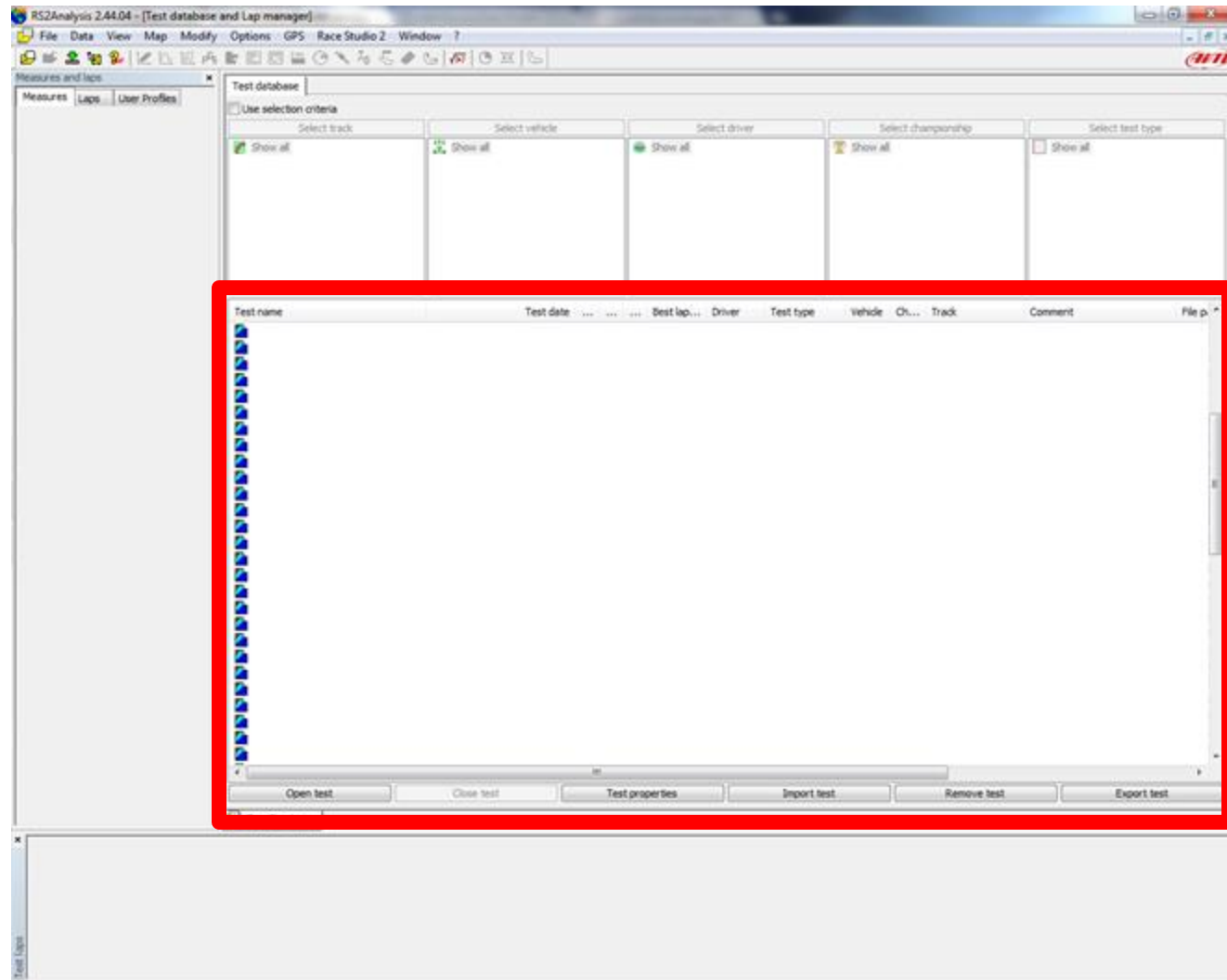
Opening RS2Analysis



RS2Analysis Opening Screen/Test Database

What's Here?

- All available data files are listed, most likely each track session has its own data file
- You can set *car, driver, track, and comments* for future references
- Modify by right click, then *Test Properties*
- Open a data file by double clicking



Main Analysis Window

- After you double click on a data file, this will be the screen you see. If not, make sure the button with purple arrow is selected.

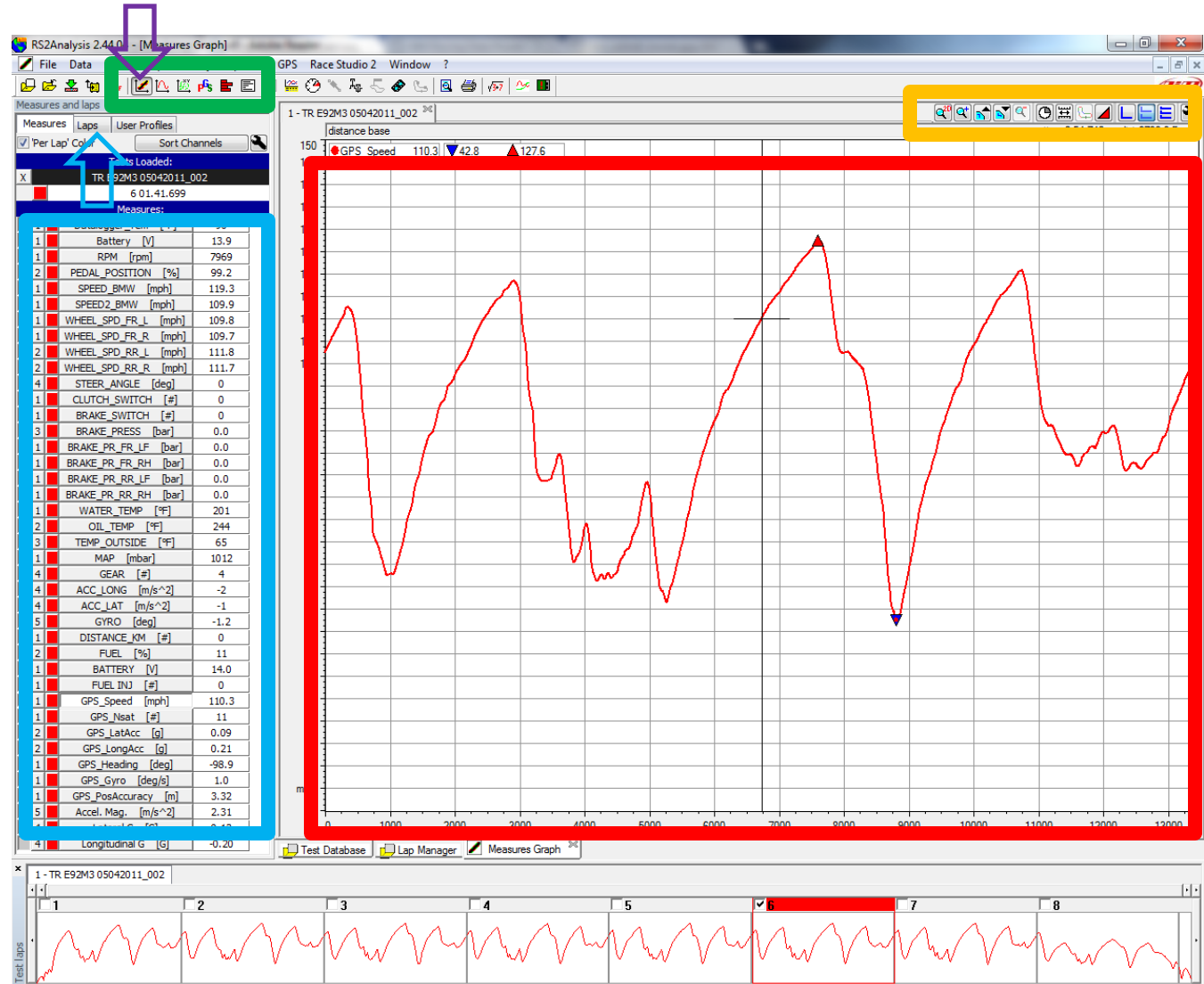
- Plot(s) of active channels.

- All available data channels.

- Display mode controls.

- Plot type control.

- Blue arrow: choose which lap(s) to display.



Data Channels

- This is a list of all available channels
- Left click to activate channel(s) for plotting
- Modify the scale of each channel's graph by right click
- The number on the left side of each channel indicates sub-plot position in multi-plot mode (more on next two slides).
- Left click on the red square to modify the color of the plot of each channel.

RS2Analysis 2.44.04 - [Measures Graph]

File Data View Map Modify Options

Measures and laps

Measures Laps User Profiles

'Per Lap' Color Sort Channels

Tests Loaded:

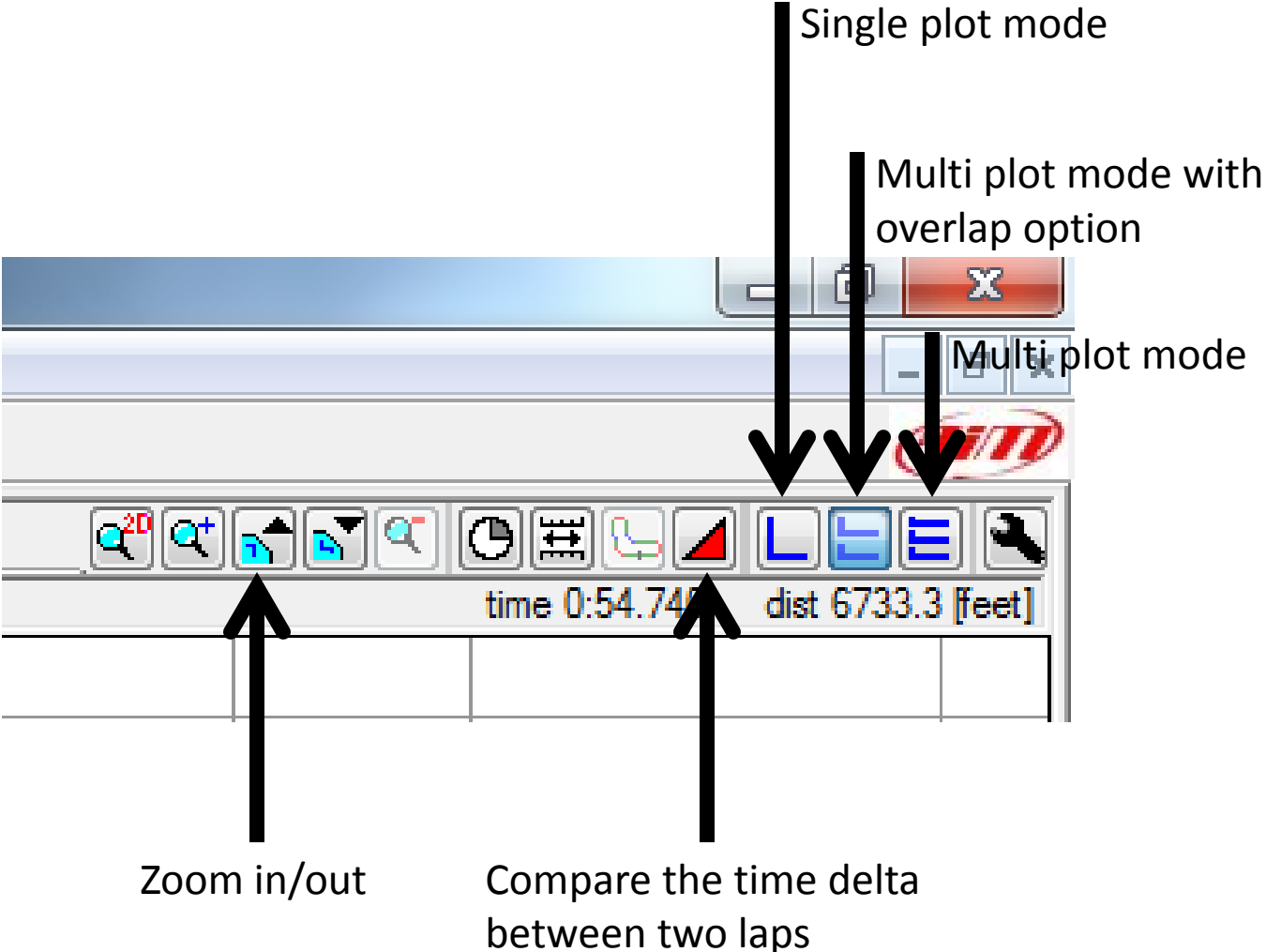
X TR E92M3 05042011_002

6 01.41.699

Measures:

1	<input type="checkbox"/>	Datalogger_Tem [°F]	90
1	<input type="checkbox"/>	Battery [V]	13.9
1	<input type="checkbox"/>	RPM [rpm]	7969
2	<input type="checkbox"/>	PEDAL_POSITION [%]	99.2
1	<input type="checkbox"/>	SPEED_BMW [mph]	119.3
1	<input type="checkbox"/>	SPEED2_BMW [mph]	109.9
1	<input type="checkbox"/>	WHEEL_SPD_FR_L [mph]	109.8
1	<input type="checkbox"/>	WHEEL_SPD_FR_R [mph]	109.7
2	<input type="checkbox"/>	WHEEL_SPD_RR_L [mph]	111.8
2	<input type="checkbox"/>	WHEEL_SPD_RR_R [mph]	111.7
4	<input type="checkbox"/>	STEER_ANGLE [deg]	0
1	<input type="checkbox"/>	CLUTCH_SWITCH [#]	0
1	<input type="checkbox"/>	BRAKE_SWITCH [#]	0
3	<input type="checkbox"/>	BRAKE_PRESS [bar]	0.0
1	<input type="checkbox"/>	BRAKE_PR_FR_LF [bar]	0.0
1	<input type="checkbox"/>	BRAKE_PR_FR_RH [bar]	0.0
1	<input type="checkbox"/>	BRAKE_PR_RR_LF [bar]	0.0
1	<input type="checkbox"/>	BRAKE_PR_RR_RH [bar]	0.0
1	<input type="checkbox"/>	WATER_TEMP [°F]	201
2	<input type="checkbox"/>	OIL_TEMP [°F]	244
3	<input type="checkbox"/>	TEMP_OUTSIDE [°F]	65
1	<input type="checkbox"/>	MAP [mbar]	1012
4	<input type="checkbox"/>	GEAR [#]	4
4	<input type="checkbox"/>	ACC_LONG [m/s^2]	-2
4	<input type="checkbox"/>	ACC_LAT [m/s^2]	-1
5	<input type="checkbox"/>	GYRO [deg]	-1.2
1	<input type="checkbox"/>	DISTANCE_KM [#]	0
2	<input type="checkbox"/>	FUEL [%]	11
1	<input type="checkbox"/>	BATTERY [V]	14.0
1	<input type="checkbox"/>	FUEL INJ [#]	0
<input checked="" type="checkbox"/>	<input type="checkbox"/>	GPS_Speed [mph]	110.3
1	<input type="checkbox"/>	GPS_Nsat [#]	11
2	<input type="checkbox"/>	GPS_LatAcc [g]	0.09
2	<input type="checkbox"/>	GPS_LongAcc [g]	0.21
1	<input type="checkbox"/>	GPS_Heading [deg]	-98.9
1	<input type="checkbox"/>	GPS_Gyro [deg/s]	1.0
1	<input type="checkbox"/>	GPS_PosAccuracy [m]	3.32
5	<input type="checkbox"/>	Accel. Mag. [m/s^2]	2.31
4	<input type="checkbox"/>	Lateral G [G]	0.13
4	<input type="checkbox"/>	Longitudinal G [G]	-0.20

Display Mode Controls



Display Modes



Single Plot Mode

Use this option to display one or more channels on **one single plot**.



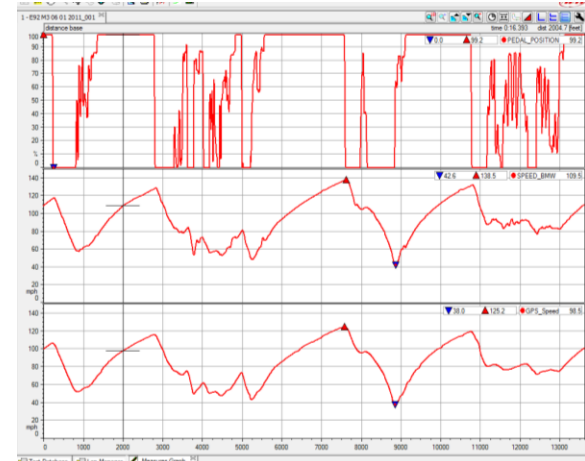
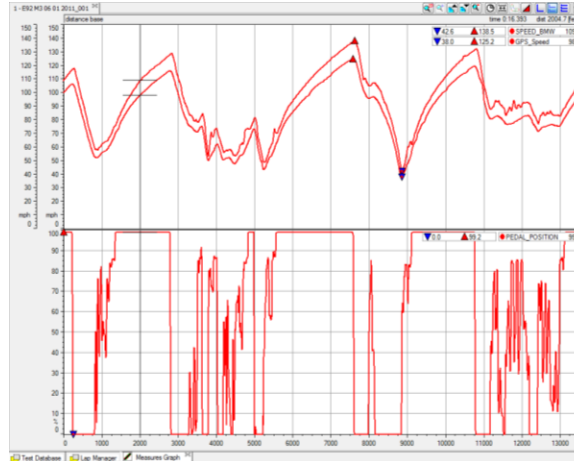
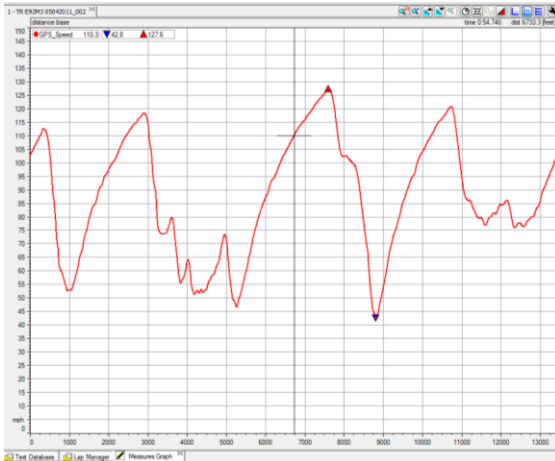
Multi Plot Mode with Overlap Option

Use this option to display multiple subplots but have the option to place **two or more channels in each subplot**. Use the number next to each channel to determine its subplot position.

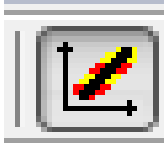


Multi Plot Mode

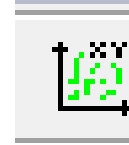
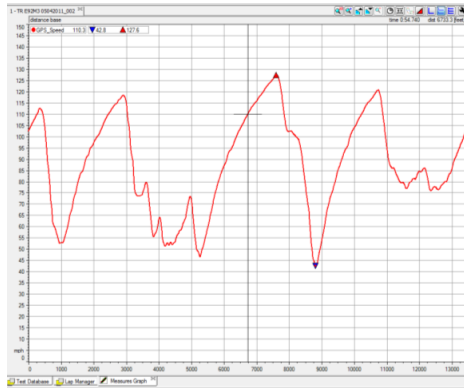
Use this option to display **one channel in each subplot**.



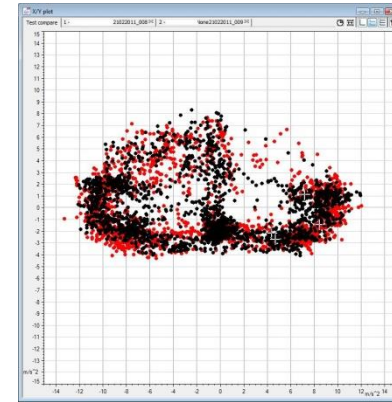
Plot Type Controls



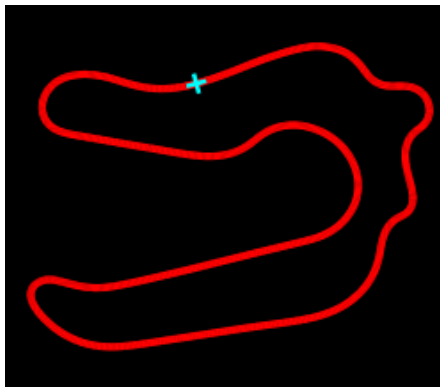
Plot data channel vs. distance/time plot – most widely used type



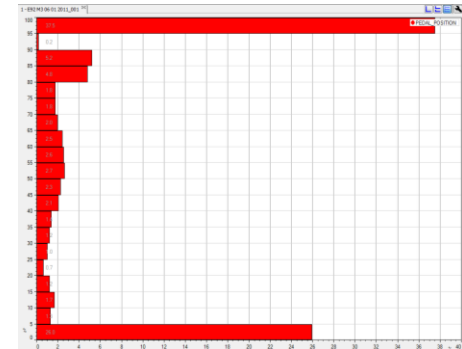
Plot channel vs. channel – i.e. plotting a traction circle



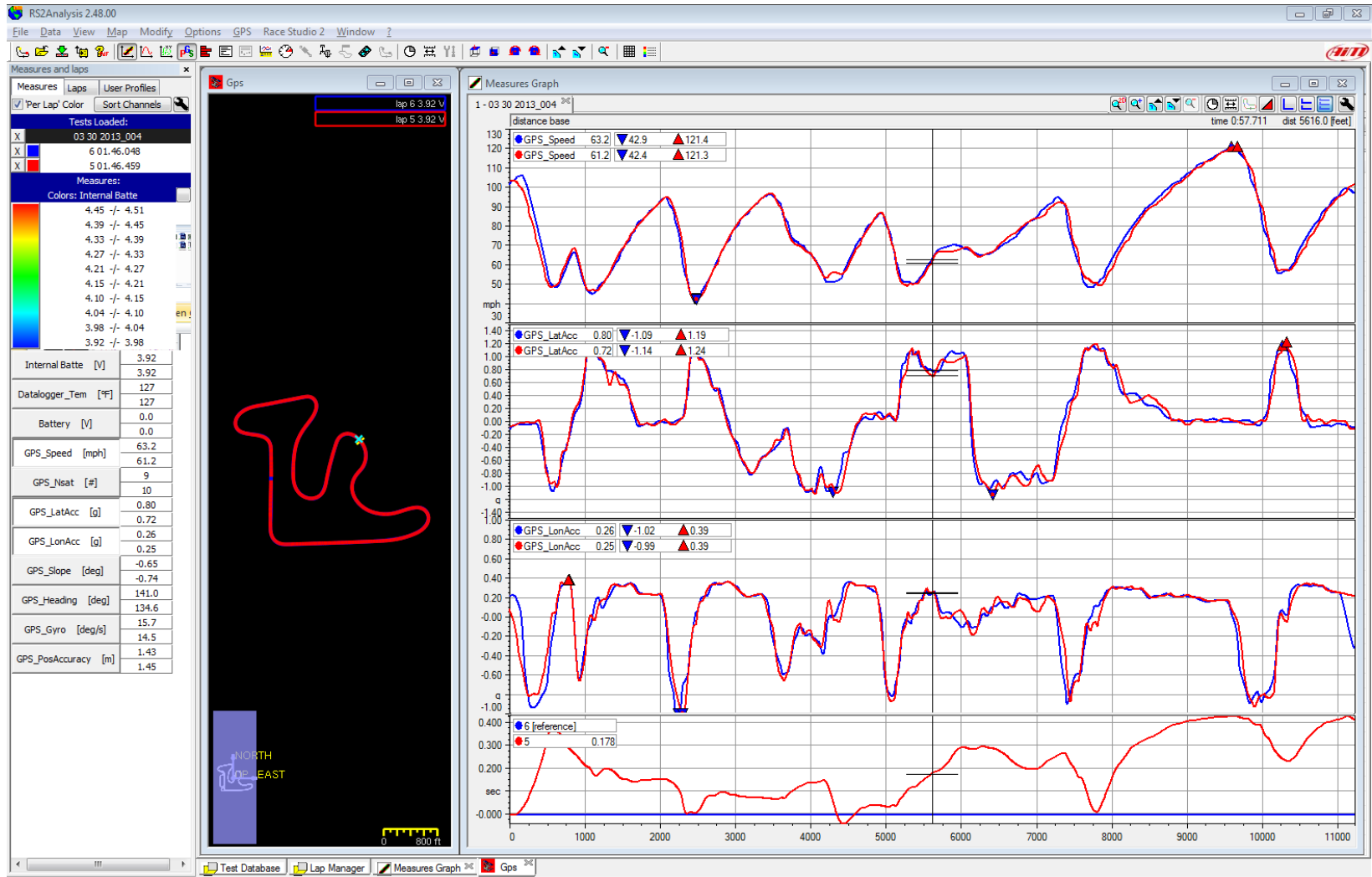
Display GPS location



Plot histogram – i.e. understand % of time at 100% throttle



Recommended Screen Layout



Chapter 2:

What Happens in a Corner?

(adapted from “Data Logger Secrets Revealed”)

Visualizing a Corner

The first step towards understanding data is being able to visualize the inputs of the driver. The following are the basic steps of driving through a corner. But please note that every corner is different and not all the steps below apply.

A – Brake Point

This is where you start to brake before a corner.

B – Turn in Point

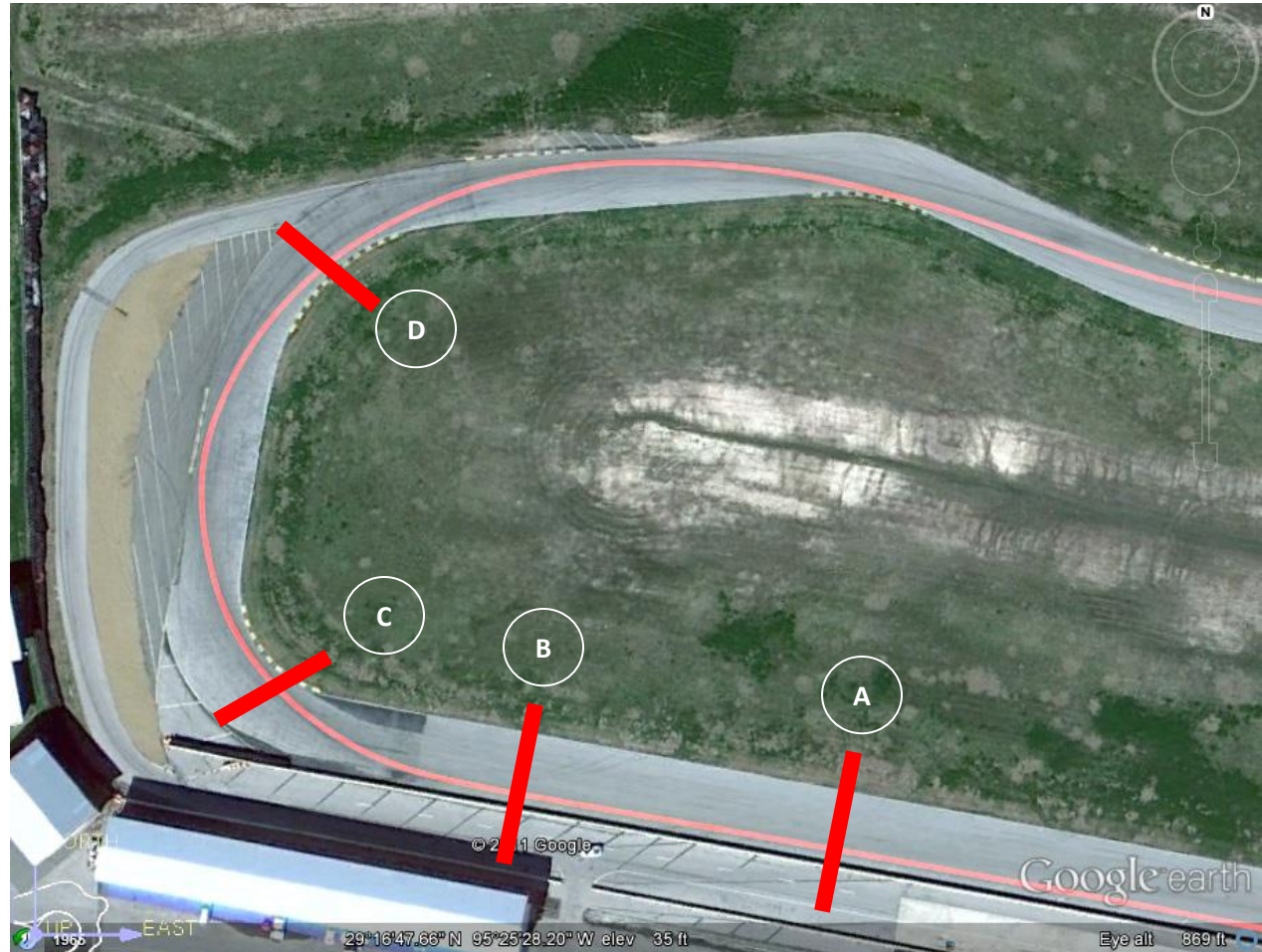
This is where you start to turn your steering wheel.

C – Brake-Gas Transition

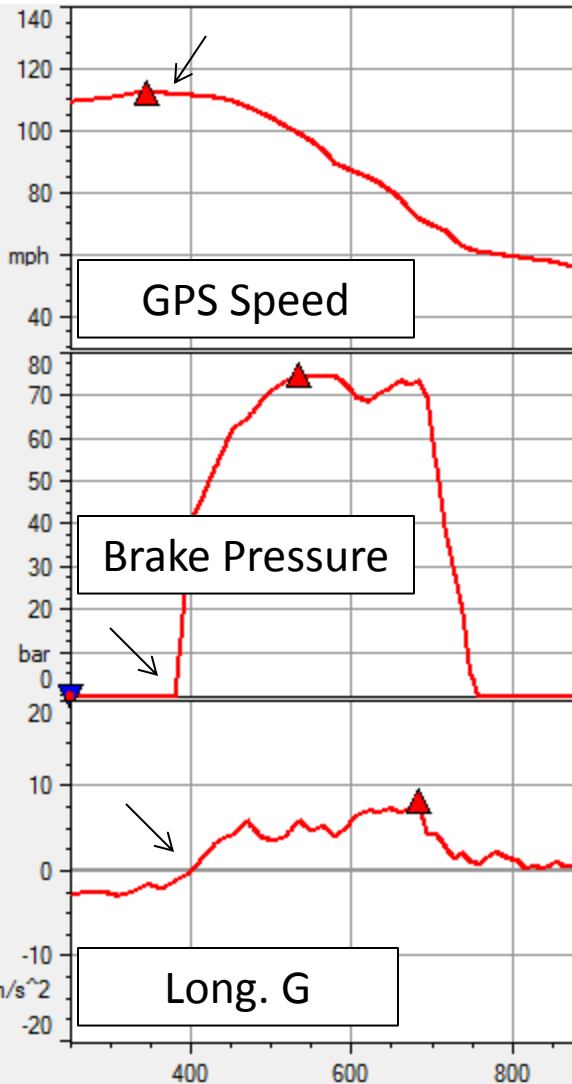
This is where you transition from brake to throttle.

D – Apex

Point(s) in a corner that is part of the optimal line.



Part A – Brake Point



GPS Speed

The GPS speed reaches a peak and starts to decrease. The steeper the slope the heavier the driver is braking.

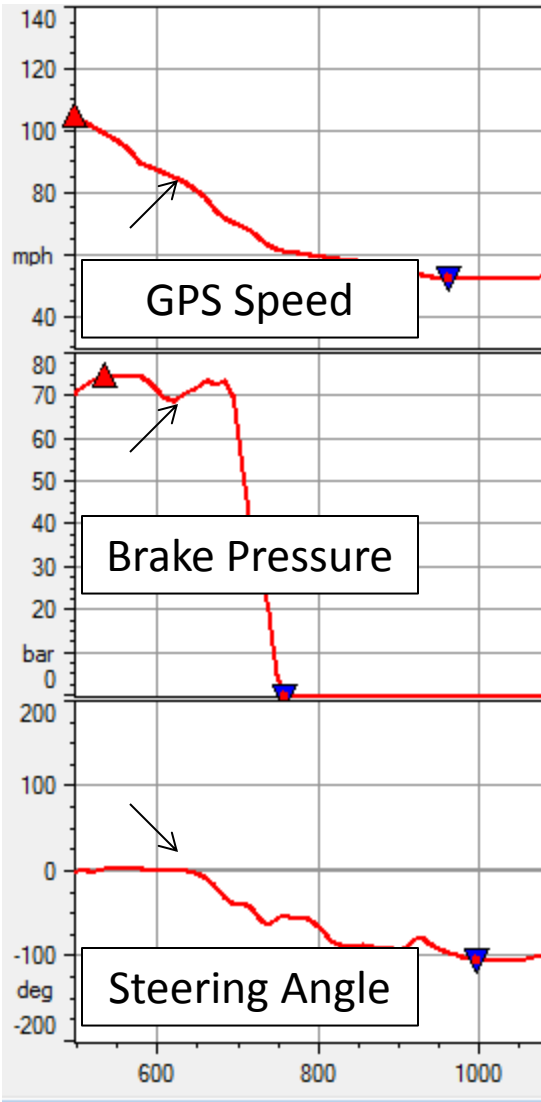
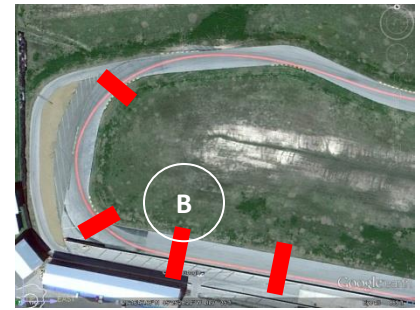
Brake Pressure

Brake pressure spikes up as the driver depresses the pedal.

Longitudinal G

As the driver starts to brake, longitudinal acceleration changes sign (from negative to positive in this case). Your data could go from positive to negative depending on how it is set up.

Part B – Turn in Point



GPS Speed

The driver continues to scrub speed as the car goes through point B.

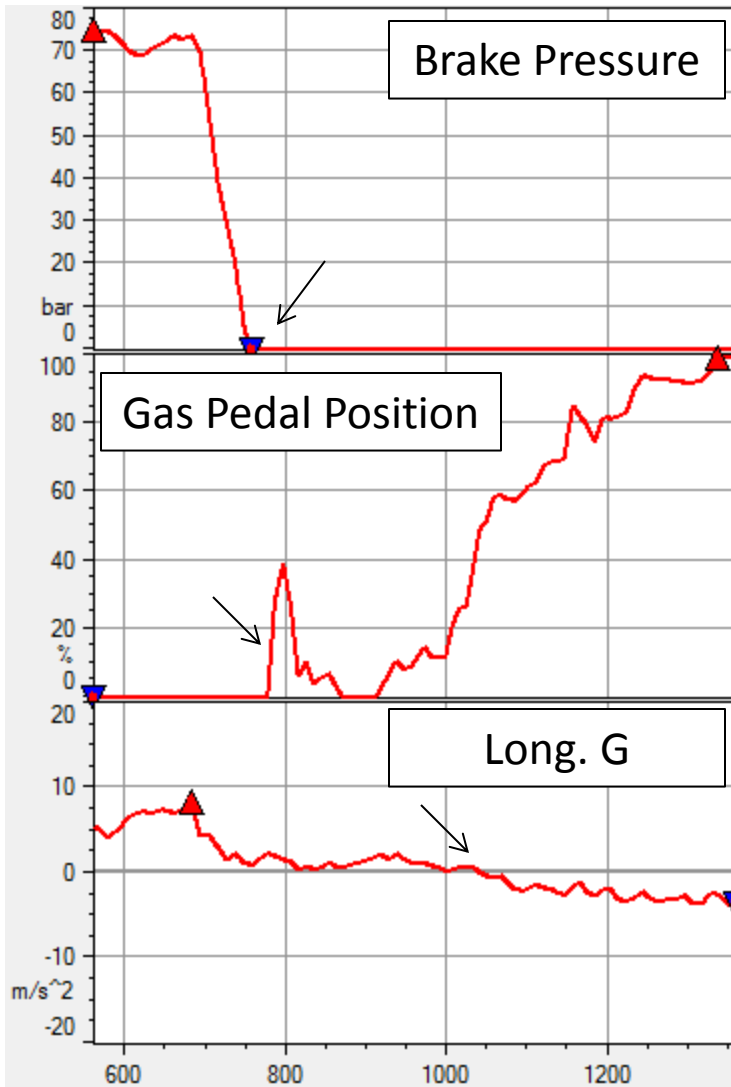
Brake Pressure

Braking continues as indicated by the brake pressure.

Steering Angle

Steering angle increases in magnitude. Driver starts to turn in before he's completely off the brakes. AKA trail braking. This is an advanced skill and should not be attempted without a professional instructions.

Part C – Brake-Gas Transition



Brake Pressure

Driver is off the brake pedal.

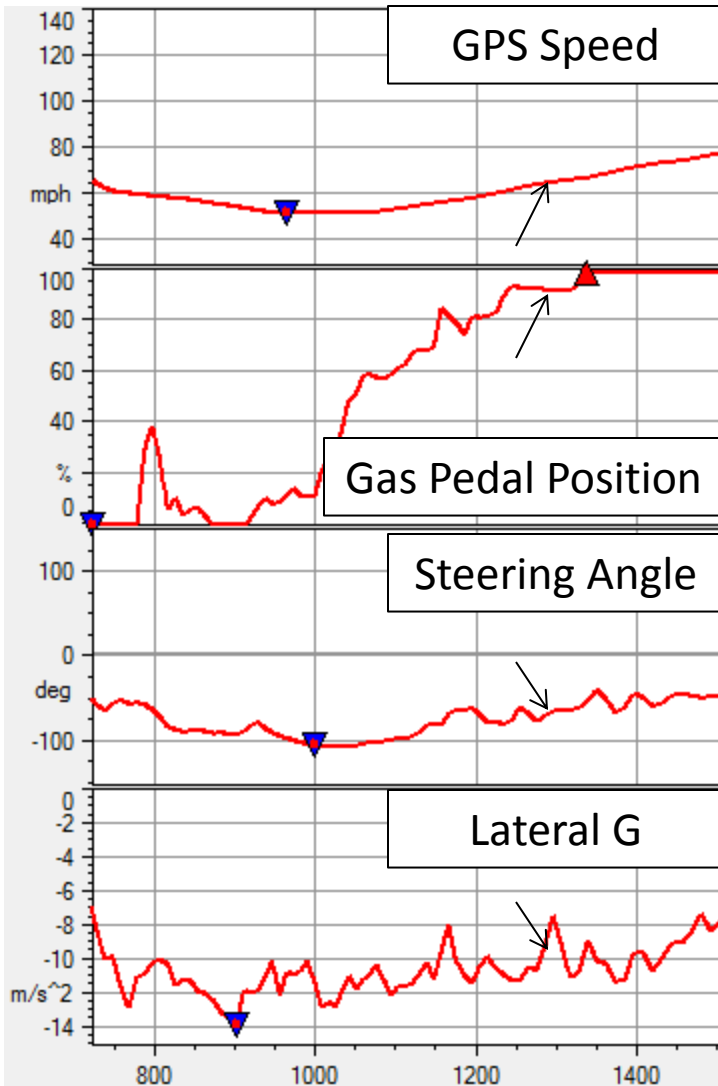
Gas Pedal Position

Driver transitions to the gas pedal and gradually applies the throttle. Driver modulates the throttle to control the front-rear weight transfer to fine-tune the rotation of the car.

Longitudinal G

Due to the transient motion of the car, longitudinal G may lag slightly behind the gas pedal position.

Part D – Apex



GPS Speed

Speed increases as driver powers out of the corner.

Gas Pedal Position

Driver is well into the throttle as he hits the apex. Apex of other corners could see completely different pedal positions.

Steering Angle

Driver begins to unwind the steering wheel (less negative from peak as indicated by blue triangle).

Lateral G

Similar to the steering angle, lateral G magnitude decreases as driver unwinds the steering wheel.

Summary

GPS Speed

- Indicates your speed and whether you are braking or accelerating.

Lateral Acceleration/G

- Indicates how many Gs you are pulling in a corner. Lateral acceleration is speed squared divided by the radius of the corner.

Longitudinal Acceleration/G

- Indicates how hard your car is braking or accelerating.

If you have Evo4 or Solo DL, you can also look at the following:

Steering Angle

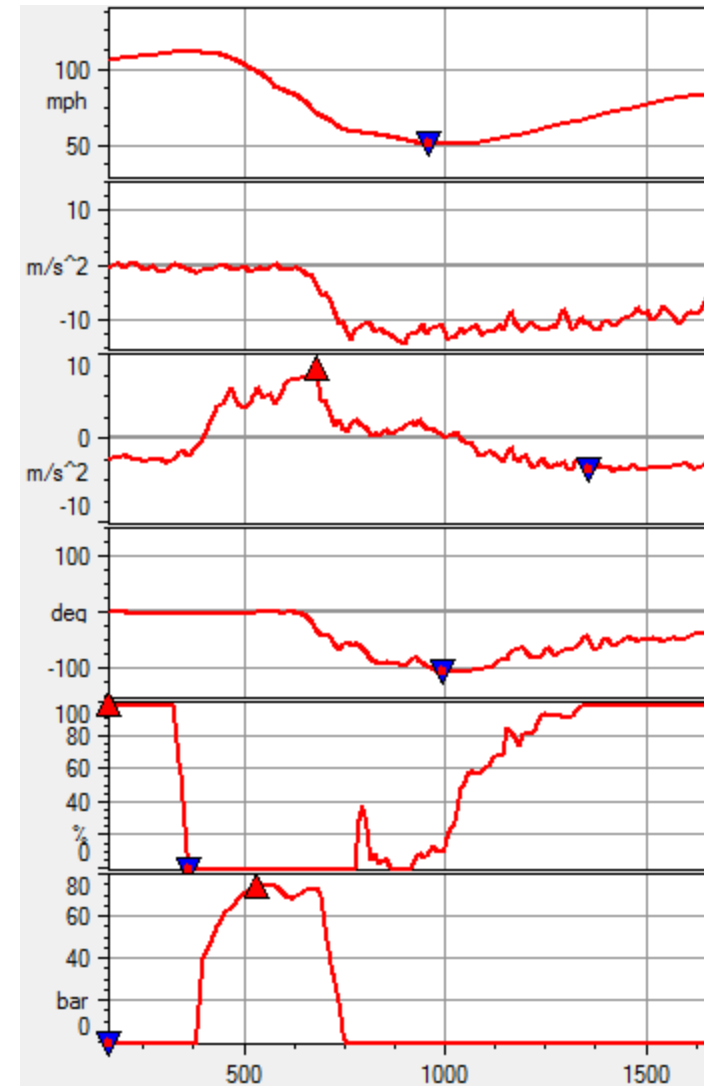
- Accurately indicates your steering to show turn in, etc.

Gas Pedal Position

- Are you really flat out through that corner?

Brake Pressure

- Pretty self-explanatory



Chapter 3: Comparing Two Laps

Corner

1

GPS Speed

Red carried more speed into the corner.

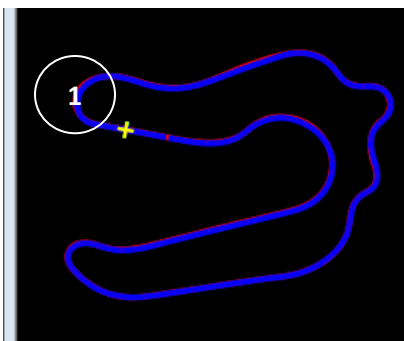
Blue carried less speed but accelerated out of the corner sooner. Having a throttle position channel would allow us to know precisely when each driver got back onto the throttle.

Lateral G

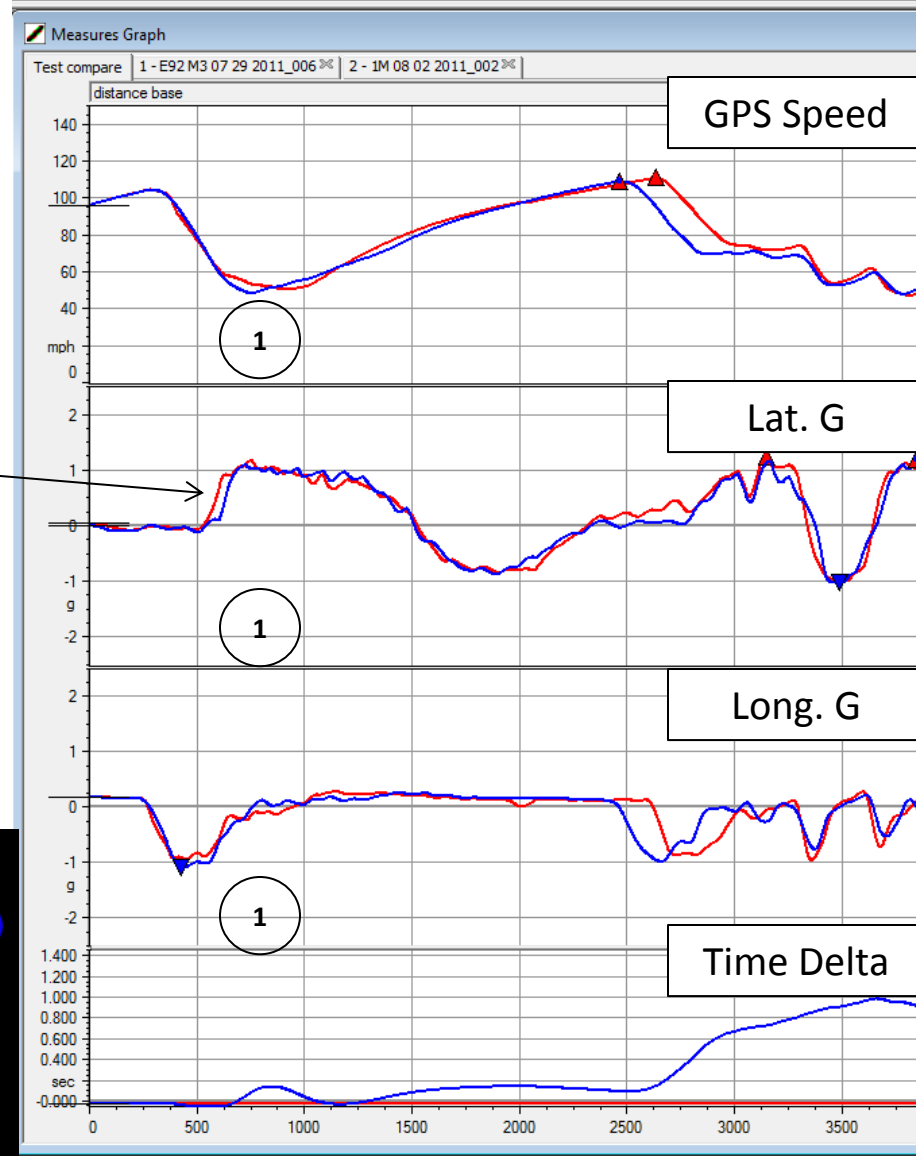
Red turned in earlier compared to blue. Steering angle sensor can give us a more accurate turn in point indication.

Time Delta

Blue lost time compared to red going into the corner. However, because red slowed down mid corner, the net time delta is zero.



Red: Faster Lap
Blue: Slower Lap



Corner

2

GPS Speed

Red braked significantly later than blue.

It also carried more speed through the turn.

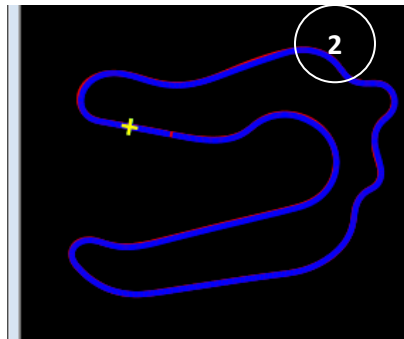
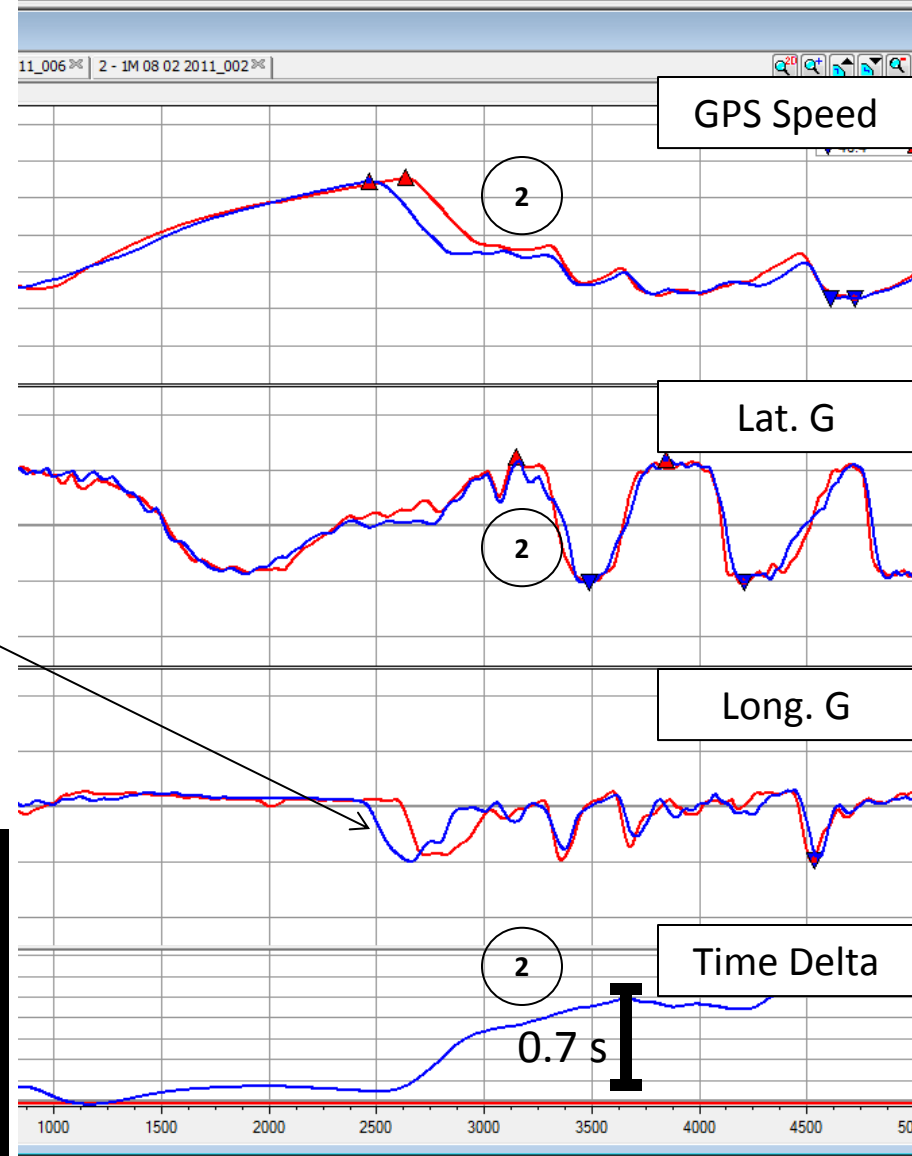
Longitudinal G

Blue's brake point too early.

Time Delta

Blue lost about 0.7 seconds in corner 2.

Red: Faster Lap
Blue: Slower Lap



Corner

3

Red: Faster Lap
Blue: Slower Lap

GPS Speed

Red carried more speed through high-speed turn 3.

Lateral G

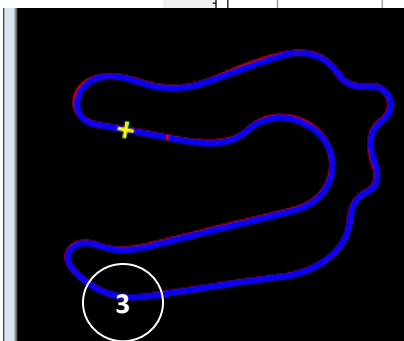
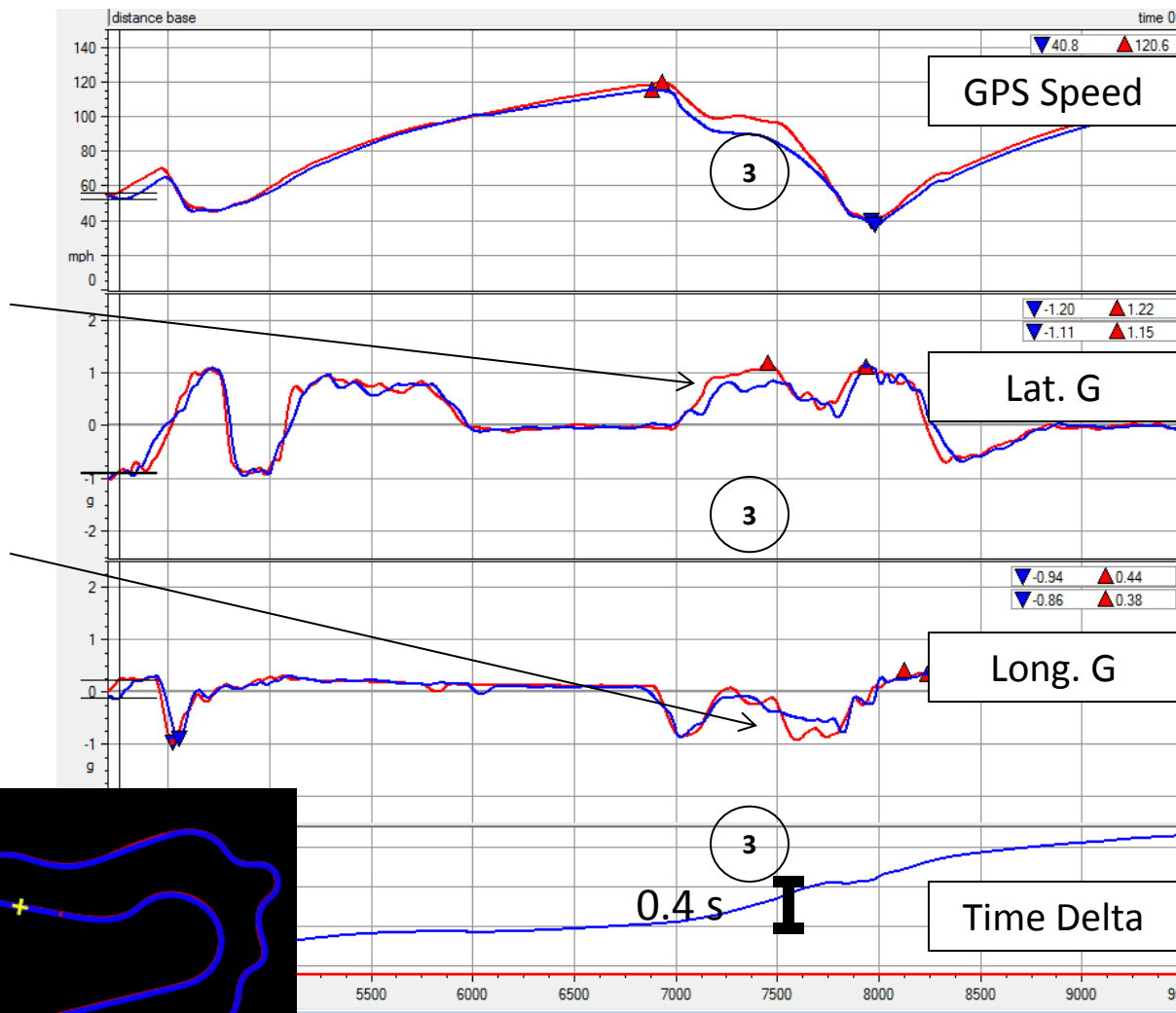
Red pulled a **consistent 1G** through corner 3. Blue pulled less than 1G.

Longitudinal G

While red braked in a deliberate manner, blue dragged on the brakes. The former is generally preferred as it reduces the total braking time.

Time Delta

Blue lost about 0.4 seconds in corner 3.



Corner

4

Straight

5

GPS Speed

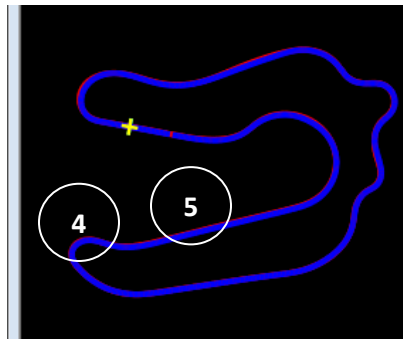
Red carried slightly more speed through corner 4. Moreover, it got back on the throttle earlier, which allowed it to gain significantly more time over the long straight 5.

Lateral G

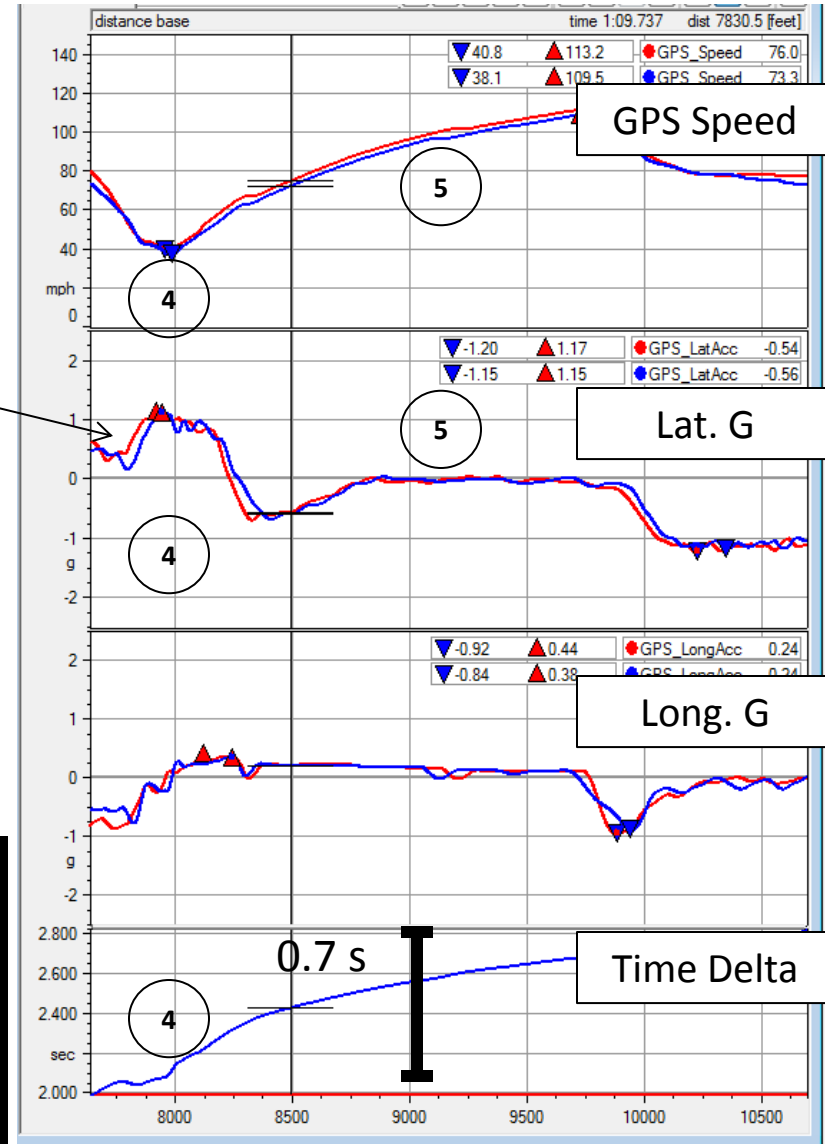
Red turned in earlier and reached peak G sooner, and it was able to unwind the steering wheel and get back on power quicker than blue.

Time Delta

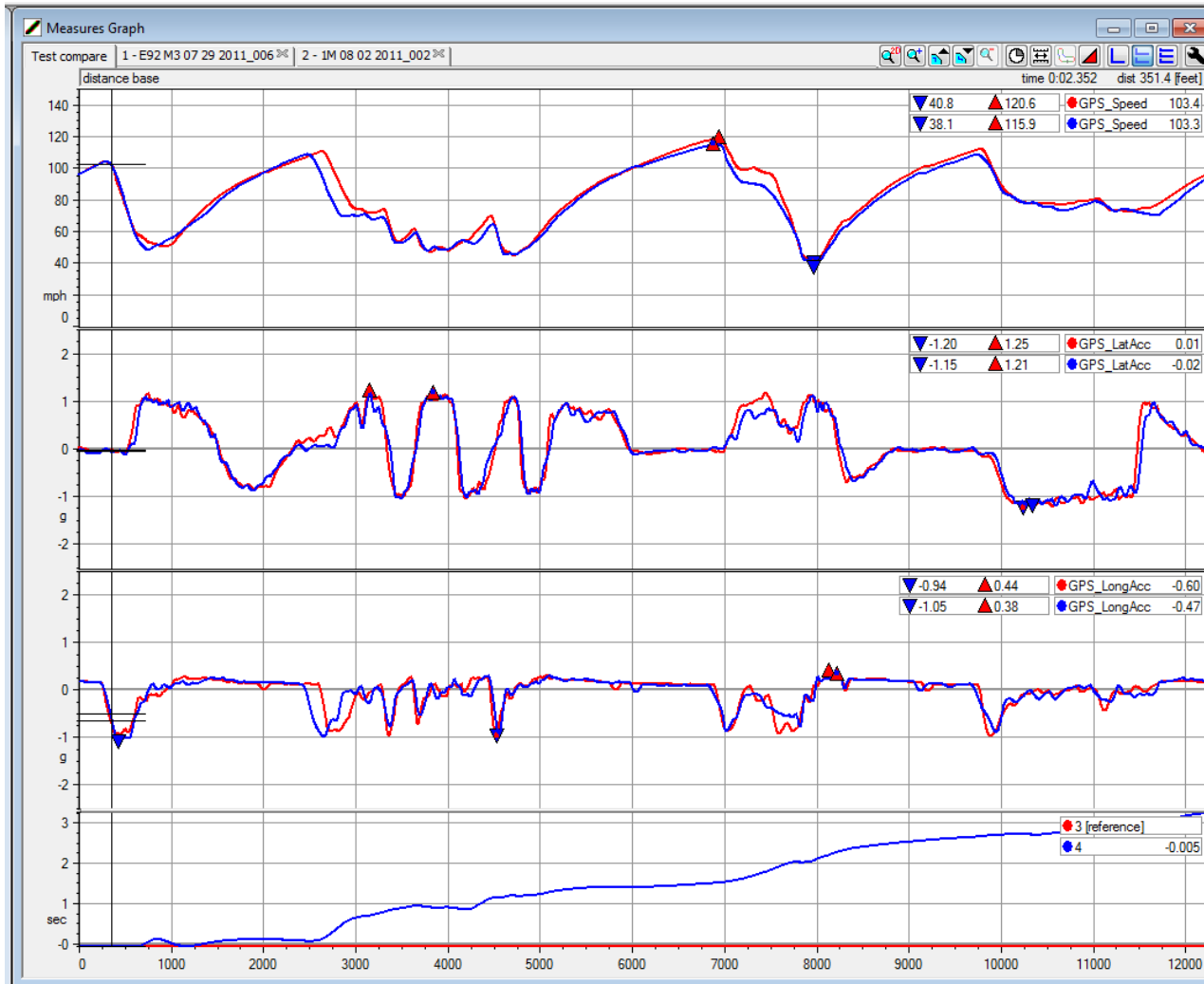
Red gained over **0.7 seconds** at the corner plus the long straight afterwards. **This is why corners before long straights are very critical.**



Red: Faster Lap
Blue: Slower Lap



Summary



GPS Speed: remember, area under speed is distance, therefore the higher the speed, the sooner you cover the same distance.

Lateral G shows the amount of G force your car pulls through corners.

Longitudinal G indicates when you are braking and when you are accelerating. Obviously having brake pressure sensors would be ideal.

Time Delta shows the time difference between two or more laps.