LearnFast™

Seminar Series

Bringing Data Support and Training to <u>You</u>

Advanced Data Analysis

for Automotive Racers & Enthusiasts

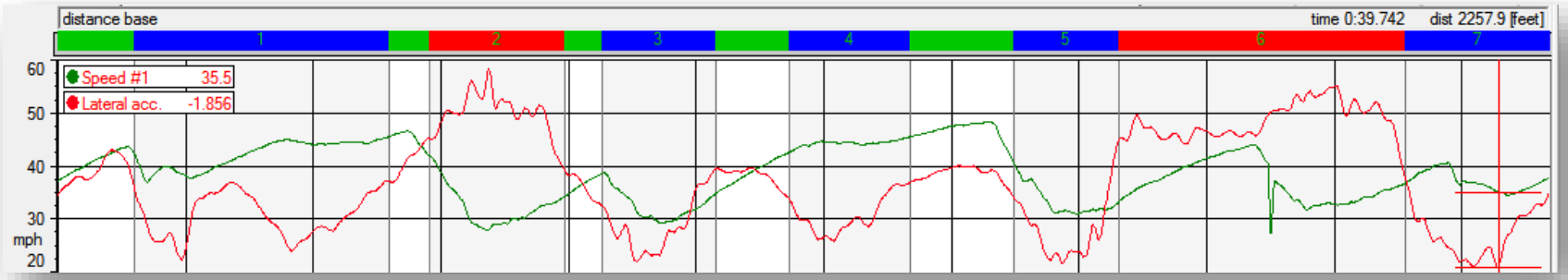
May 2018

KRAUSE & ASSOCIATES

- Introductions
- About *AiM Sports*
- Available Support, Training, Books
- Current *AiM Sports* Soft/Firmware
- Keyboard Shortcut List
- Data Analysis Concepts
- *Practical* Data Analysis
  - Early Steps Today (if needed)
    - Import Data
    - Import Track Map
    - Import User Profiles

- *Advanced* Data Analysis
  - 5 Tools You Need To Know
    - Per Lap Color
    - Sort Channels
    - Measures Graph Views
    - Snap Mode
    - Delta Function
  - Measures Graph is Boss
  - Post Data Collection Tools
    - GPS Lap Insert
    - Post Session Sensor Calibration
  - Track Location Tools
    - GPS Information
    - *AiM Sports* Track Maps
  - Advanced Data Analysis
    - Tire Temps
    - Comparing 2 Laps, 2 Tests
    - Deeply Analyze Your Data

- Your Name
- Racing Background\Experience
- Type of Vehicle(s) You Currently Run
- Data Acquisition Experience
- What Data System Do You Use
- Your Highest Expectation For Today's Seminar



Introductions

Comment on These questions

- My Father Started Racing in the ‘50’s
- I Started Racing Off Road Racing in 1976
- I Started Driving in 1977
- Raced Desert and Short Course
- Last Race in Sept of 1996 – Crandon, WI
- No Gauges!!

All Spec Series/Classes

All With Data Systems

2010 - Current

1998

2008

2002

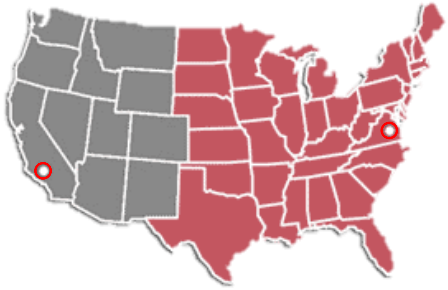
2007

2006

2004

- # AiM Sports, LLC
  - AiM Sports has been providing cutting-edge data and video solutions for the motorsports industry for over 21 years. From track-day users to top tier teams, when it comes to electronic instrumentation, data acquisition, and video, AiM Sports is the most trusted name in racing
  - Many AiM Sports products combine the functions of traditional tachometer, speedometer, temperature gauge, pressure gauge and lap timer all into one compact, high performance unit
  - Opened in 1996 in Lake Elsinore, CA and expanded to Roanoke, VA in 2002

AiM Sports, LLC
31889 Corydon, Suite 130
Lake Elsinore, CA 92530
Tel: 951.674.9090
Fax: 951.674.5699



Toll Free: 1.800.718.9090
www.aimsports.com

AiM Sports, LLC SE
1636 9th St SE #B
Roanoke, VA 24013
Tel: 540.342.9680
Fax: 540.342.9682

Customer Support

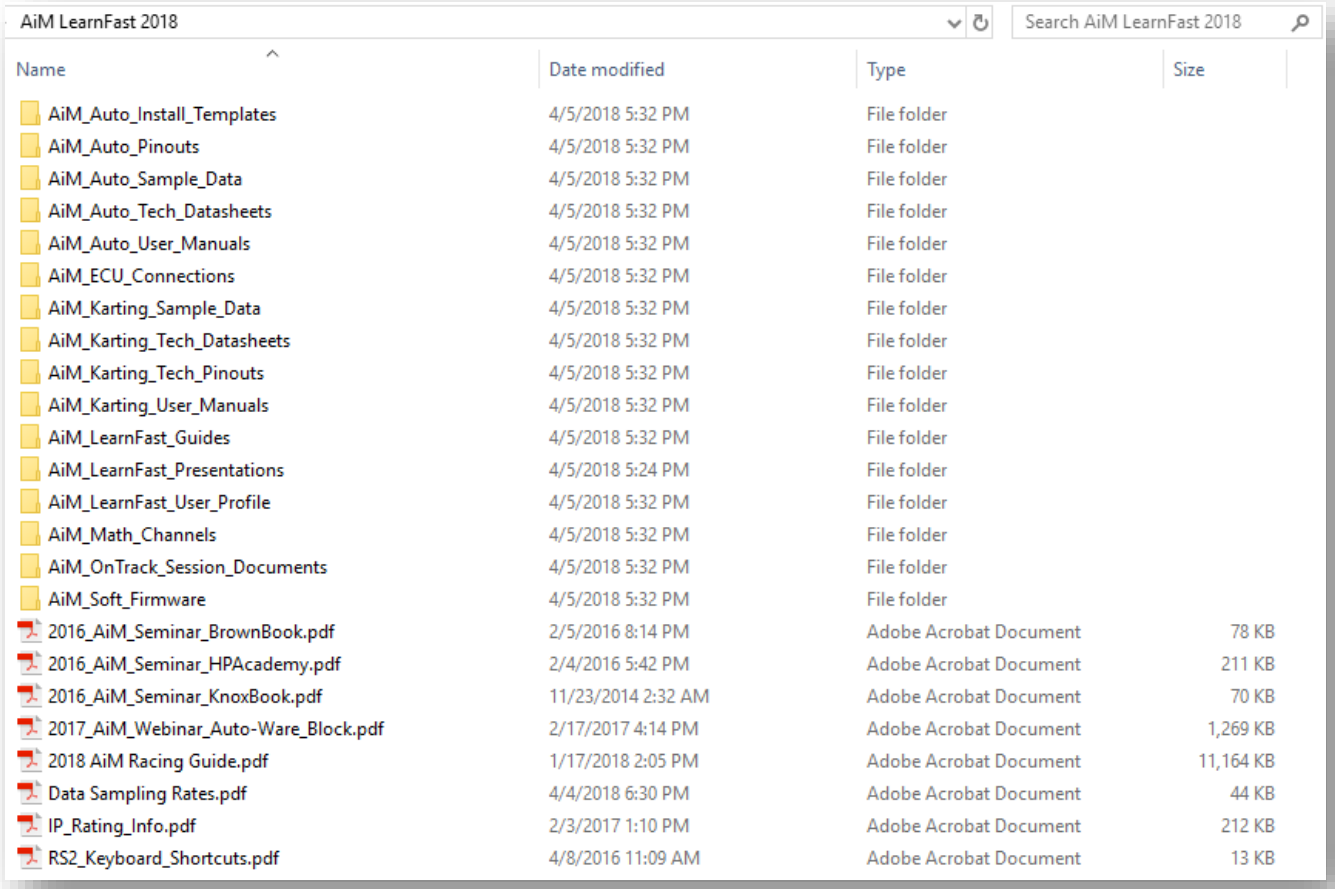
AiM Sports technical support staff regularly attend races and other events.

Look for us at a track near you!

LearnFast™ On-Site Data Training

- Jan 19 Peter Krause & Associates, Alton, VA (Driver Coaches)
- Jan 20 Peter Krause & Associates, Alton, VA (Practical Auto)
- Jan 21 Peter Krause & Associates, Alton, VA (Advanced Auto)
- Jan 26 APBA National Convention, Chicago, IL (Practical Boat)
- Feb 03 Kart O Rama, Sumner, WA (Practical Kart)
- Feb 10 Prairie City Kart Club, Prairie City, CA (Practical Kart)
- Feb 11 Prairie City Kart Club, Prairie City, CA (Trackside Support)
- Feb 24 Keller Racing, Chandler, AZ (Practical Off Road)
- Feb 25 Keller Racing, Chandler, AZ (Advanced Off Road)
- Mar 03 DiscoveryParts, Dawsonville, GA (Practical Auto)
- Mar 04 DiscoveryParts, Dawsonville, GA (Practical Kart)
- Mar 05 DiscoveryParts, Dawsonville, GA (Advanced Auto)
- Mar 10 TORC Off Road, Crandon, WI (Practical Off Road)
- Mar 11 TORC Off Road, Crandon, WI (Advanced Off Road)
- Mar 17 Pegasus Auto Racing, New Berlin, WI (Practical Auto)
- Mar 18 Franklin Karting, New Berlin, WI (Practical Kart)
- Mar 24 TrailBrake, Manchester, NH (Practical Auto)
- Mar 25 TrailBrake, Manchester, NH (Advanced Auto)
- Apr 07 NASA Great Lakes, Cincinnati, OH (Practical Auto)
- Apr 08 NASA Great Lakes, Cincinnati, OH (Advanced Auto)
- Apr 14 Britain West Motorsport, Toronto (Intro Data)
- Apr 15 Britain West Motorsport, Toronto (Practical Data)
- Apr 21 Wine Country Motor Sports, Denver, CO (Practical Auto)
- Apr 22 Wine Country Motor Sports, Denver, CO (Advanced Auto)
- Apr 28 Winding Road Racing, Austin, TX (Practical Auto)
- Apr 29 Winding Road Racing, Austin, TX, Denver, CO (Advanced Auto)
- May 05 Peter Krause & Associates, Alton, VA (Practical Auto)
- May 06 Peter Krause & Associates, Alton, VA (Advanced Auto)

AiM Sports USB Drive



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AiM_Auto_Tech_Datasheets	4/5/2018 5:32 PM	File folder	
AiM_Auto_User_Manuals	4/5/2018 5:32 PM	File folder	
AiM_ECU_Connections	4/5/2018 5:32 PM	File folder	
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AiM_Karting_Tech_Pinouts	4/5/2018 5:32 PM	File folder	
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RS2_Keyboard_Shortcuts.pdf	4/8/2016 11:09 AM	Adobe Acrobat Document	13 KB

4GB USB drive with over 520MB of AiM Sports information including today's presentation for you to take home!

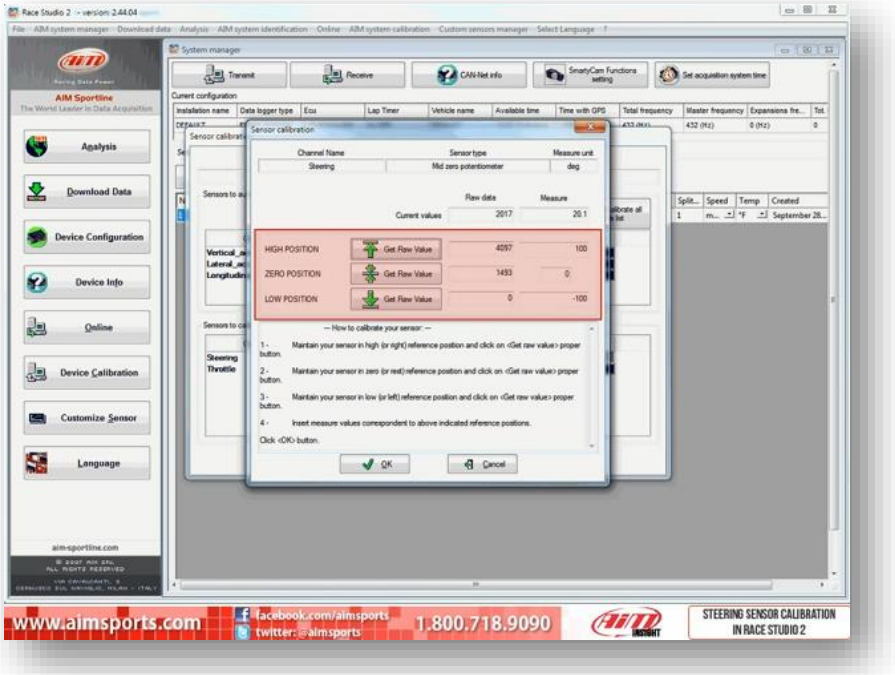
Additional Materials

AiM Sports USB Drive

LearnFast™ E-Training Video

Currently 60 Videos and Growing

www.youtube.com/aimdata

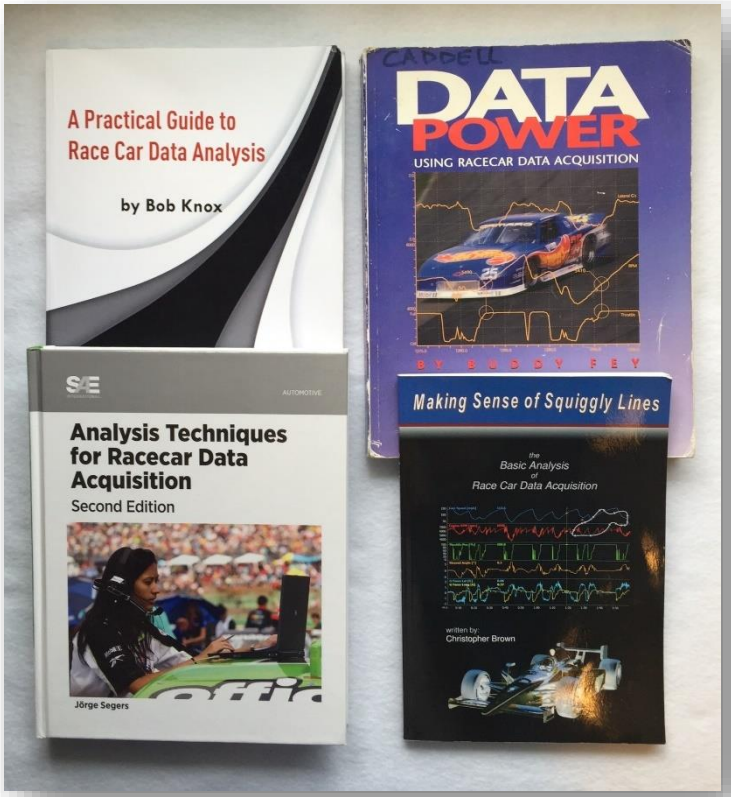


- 25 New 'Data Analysis' Videos in Late 2017!
- Software Updates with Race Studio 3
- Pre-Calculated Gear Position Function
- Configuring WiFi Communication
- Customizing AiM Device Logos
- Race Studio 3 Basic Configuration - Part 1
- Race Studio 3 Basic Configuration - Part 2
- **I Have Downloaded my Data, Now What - Part 1*
- **I Have Downloaded my Data, Now What - Part 2*
- GPS Lap Insert
- Data Views
- Measure Units
- Sort Channels
- Test Properties
- Per Lap Color
- Export Tests
- Channel Reports
- Setting Time
- Track Mapping
- Selection Criteria
- Sensor Calibration
- Conditional Alarms
- Gear Position
- Firmware Update
- Solo Configuration
- Transmit Tracks
- Gps Manager Overview
- New GPS Track
- Webinars

** Most Popular and Recommended*

Data Analysis Books

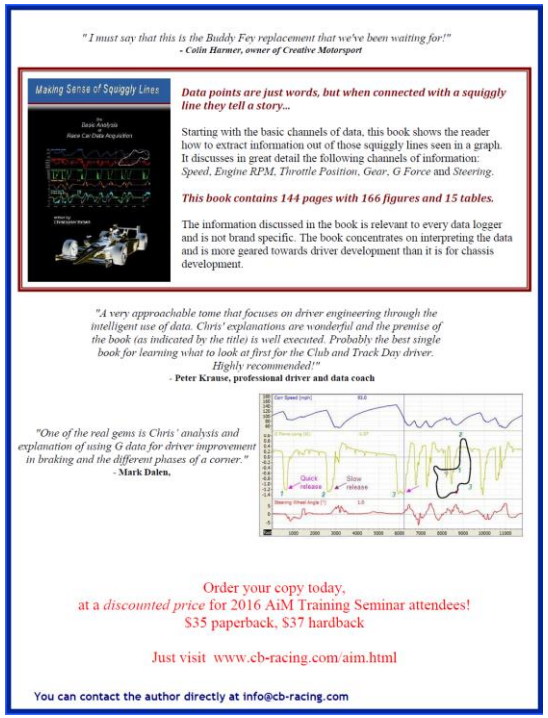
- Many Good Books are Available
  - Analysis Techniques for Racecar Data Acquisition
    Jorge Segers (2014)
  - A Practical Guide to Race Car Data Analysis
    Bob Knox (2011)
  - Making Sense of Squiggly Lines
    Chris Brown (2011)
  - Competition Car Data Logging: A Practical Handbook
    Simon Mcbeath (2009)
  - The Competition Car Data Logging Manual
    Graham Templeman (2008)
  - Data Power: Using Racecar Data Acquisition
    Buddy Fey (1993)



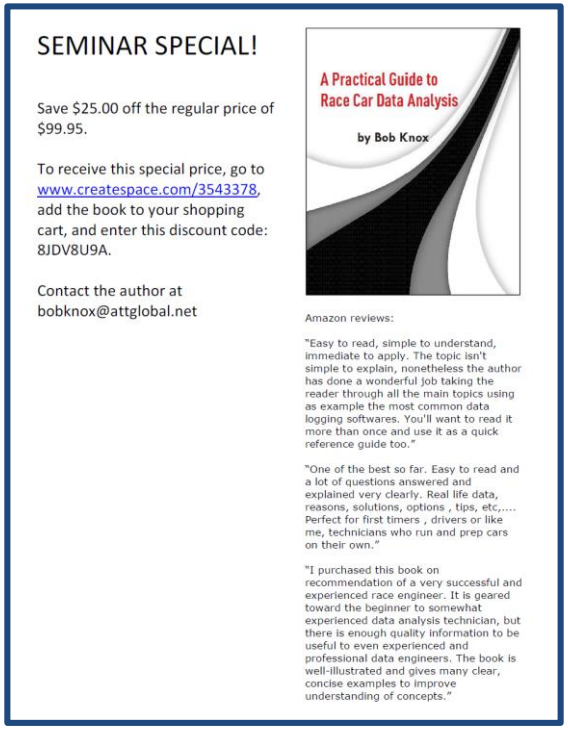
Just a few, many are available!

Additional Material Discounts

Making Sense of Squiggly Lines
Chris Brown



A Practical Guide to Race Car Data Analysis
Bob Knox



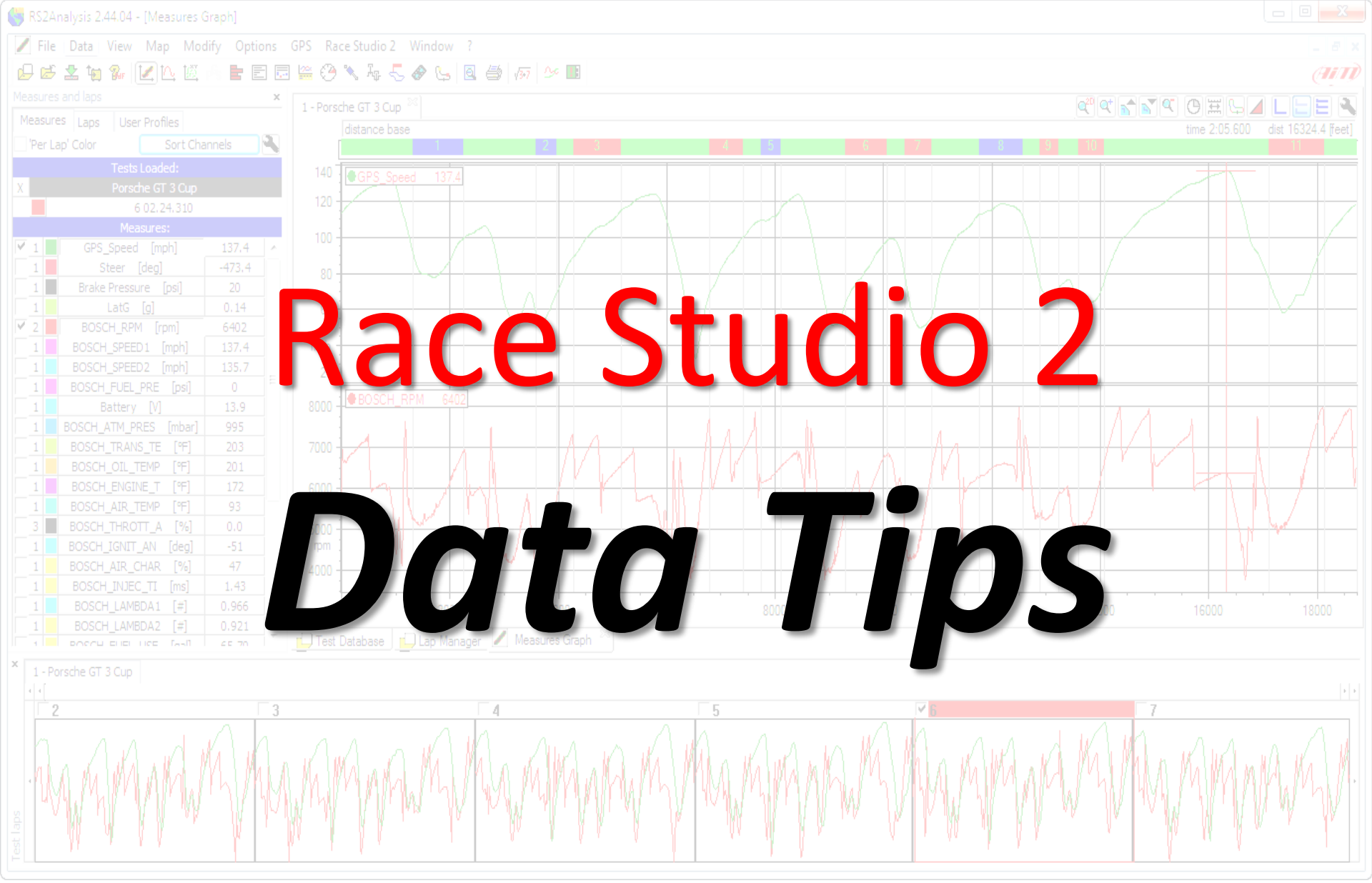
Learn to Tune Performance EFI
HP Academy

Additional Material Discounts

www.auto-ware.com

John Block

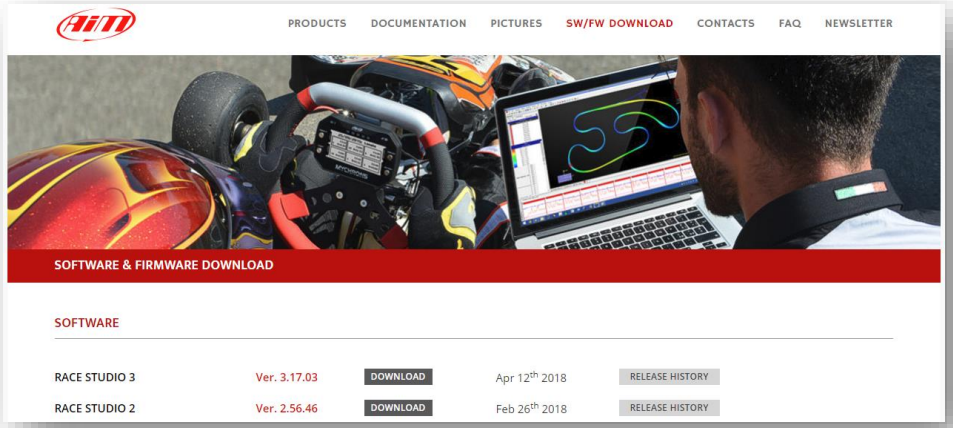
- The Auto-ware webinars are on-line seminars that address the RaceStudio Analysis part of the software
- They cover different ways of displaying data, how to arrange those displays in Profiles for specific tasks and math channels for analyzing the car and your driving
- The next round of Auto-Ware webinars starts on Monday, June 4th, 2018
- Each class consists of 5 live sessions
- Each session is Monday evenings at 8:00pm Eastern
- Cost is $175 for all 5 sessions
- AiM LearnFast seminar attendees get a $25 discount



Race Studio 2

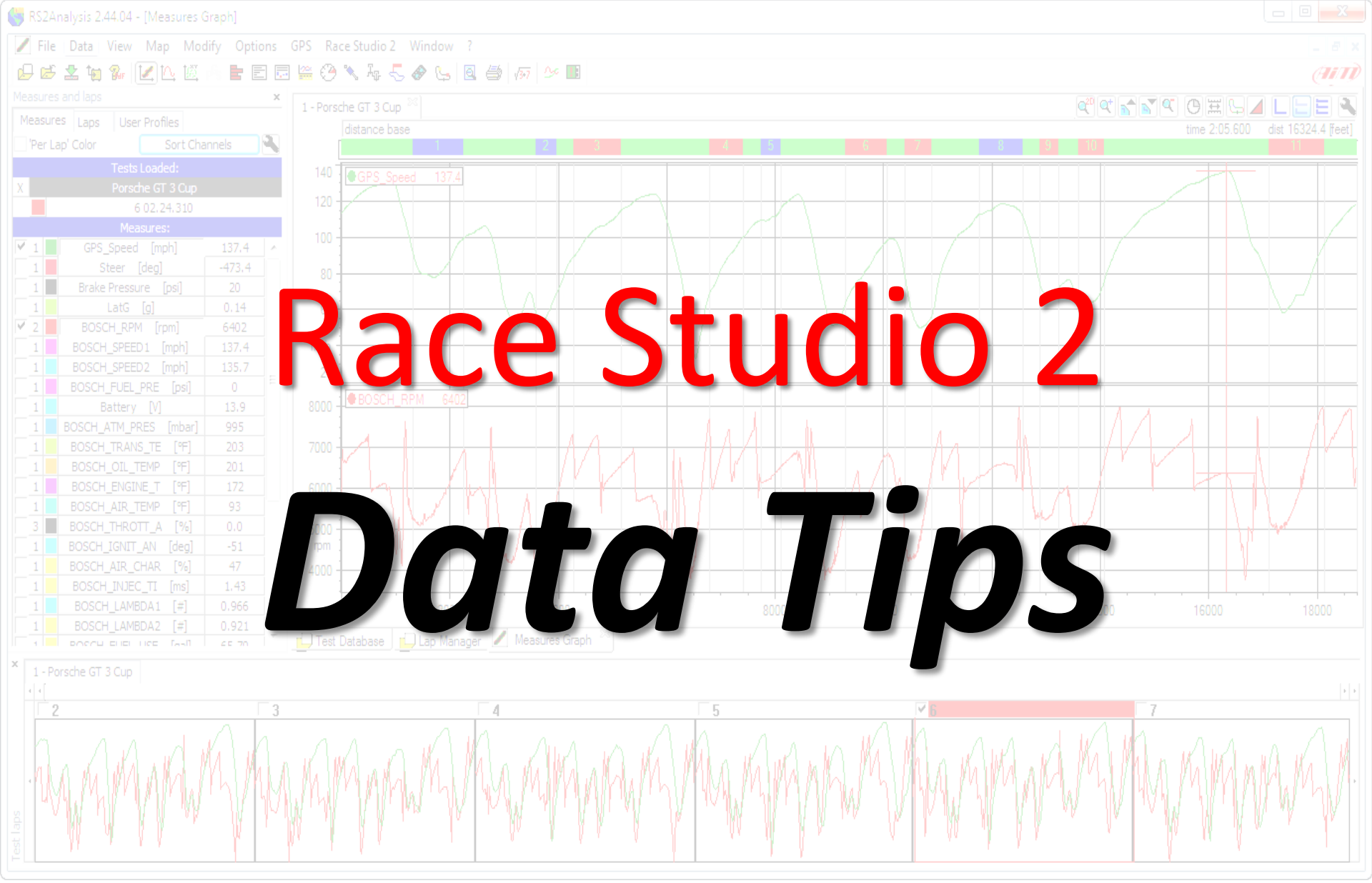
Data Tips

Current Software/Firmware



- Software
  - Race Studio 3 3.18.00 (04/17/18)
  - Race Studio 2 2.56.46 (02/26/18)
- Camera Firmware
  - SmartyCam HD 1.03.72 (12/04/17)

- Car/Bike Product Firmware
  - MXL2/MXG/MXS 1.26.28 (04/12/18)
    (Use Race Studio 3 to Update)
  - Solo2 2.22.34 (04/17/18)
    (Use Race Studio 3 to Update)
  - EVO5 1.26.28 (04/12/18)
    (Use Race Studio 3 to Update)
  - Other Car/Bike 170120 (01/20/17)
    - MXL 14.86.67 (09/03/13)
    - EVO4 43.05.22 (01/20/17)
    - ECU Bridge 45.02.06 (04/21/15)
    - Solo/Solo DL 46.03.24 (01/20/17)
    - MemoryKey 37.06.12 (06/11/13)
    - GPS Module 35.50 (04/21/15)
    - Channel Exp / TC Hub 40.15 (07/20/12)
    - Formula Wheel 38.20 (09/03/13)
    - MyChron3 Dash 15.23 (07/20/12)
    - MXL Dash 52.02.06 (02/26/13)
    - G-Dash / GT Wheel 57.01.28 (07/03/15)



Race Studio 2

Data Tips

Function	F Key	Shift+	Alt+	Control+	Other	Menu	Comments
Manual	F1					?=>Manual	
Race Studio 2	F5					Race Studio 2	
Data Animation	F12					View=>Animation	
Show Track Map		Shift+F1				Map=>Show Track Map	
Map Manager		Shift+F2				Map=>Map Manager	
New Map		Shift+F4				Map=>New	
Suspension Analysis		Shift+F5				View=>Suspension Analysis	
Preferences		Shift+F6				File=>Preferences	Only works when no tests are open
2D Zoom Enable		Shift+F7				None	
Zoom Enable		Shift+F9				Options=>Zoom Enable	
Zoom 1 Lap		Shift+F10				Options=>Zoom 1 Lap	
Print Preview		Shift+F11				File=>Print Preview	
Print		Shift+F12				File=>Print	
Unload Test			Alt+F3			Data=>Unload Test	
Exit			Alt+F4			File=>Exit	
Test Database			Alt+F7			None	
Math Channels			Alt+F8			Modify=>Math Channels	
Plot Settings			Alt+F9			Options=>Plot Settings	
Test Channels			Alt+F10			Modify=>Test Channels	
Hide/Show Measures Toolbar			Alt+F11			View=>Measures Toolbar	Also Spacebar
Measures Plot				Ctrl+F2		View=>Measures Plot	
Plot vs. Frequency				Ctrl+F3		View=>Plot vs. Frequency	
Channels Report				Ctrl+F4		View=>Channels Report	
X/Y Plot				Ctrl+F5		View=>X/Y Plot	
Split Times				Ctrl+F6		Split Times	
Lap Times				Ctrl+F7		View=>Lap Times	
Histogram				Ctrl+F8		View=>Histogram	
Car Setup Analysis				Ctrl+F9		View=>Car Setup Analysis	
Lap Replay				Ctrl+F10		View=>Lap Replay	
Dashboard				Ctrl+F11		View=>Dashboard	
Track Report				Ctrl+F12		View=>Track Report	
Delta				Ctrl+D		None	
Save User Profile				Ctrl+S		File=>Save User Profile	
Hide Test Laps Toolbar				Ctrl+Spacebar		View=>Test Laps Toolbar	
Hide Measures Toolbar					Spacebar	View=>Measures Toolbar	Also Alt+F11
Zoom In					Up Arrow	Options=>Zoom In	
Zoom Out					Down Arrow	Options=>Zoom Out	

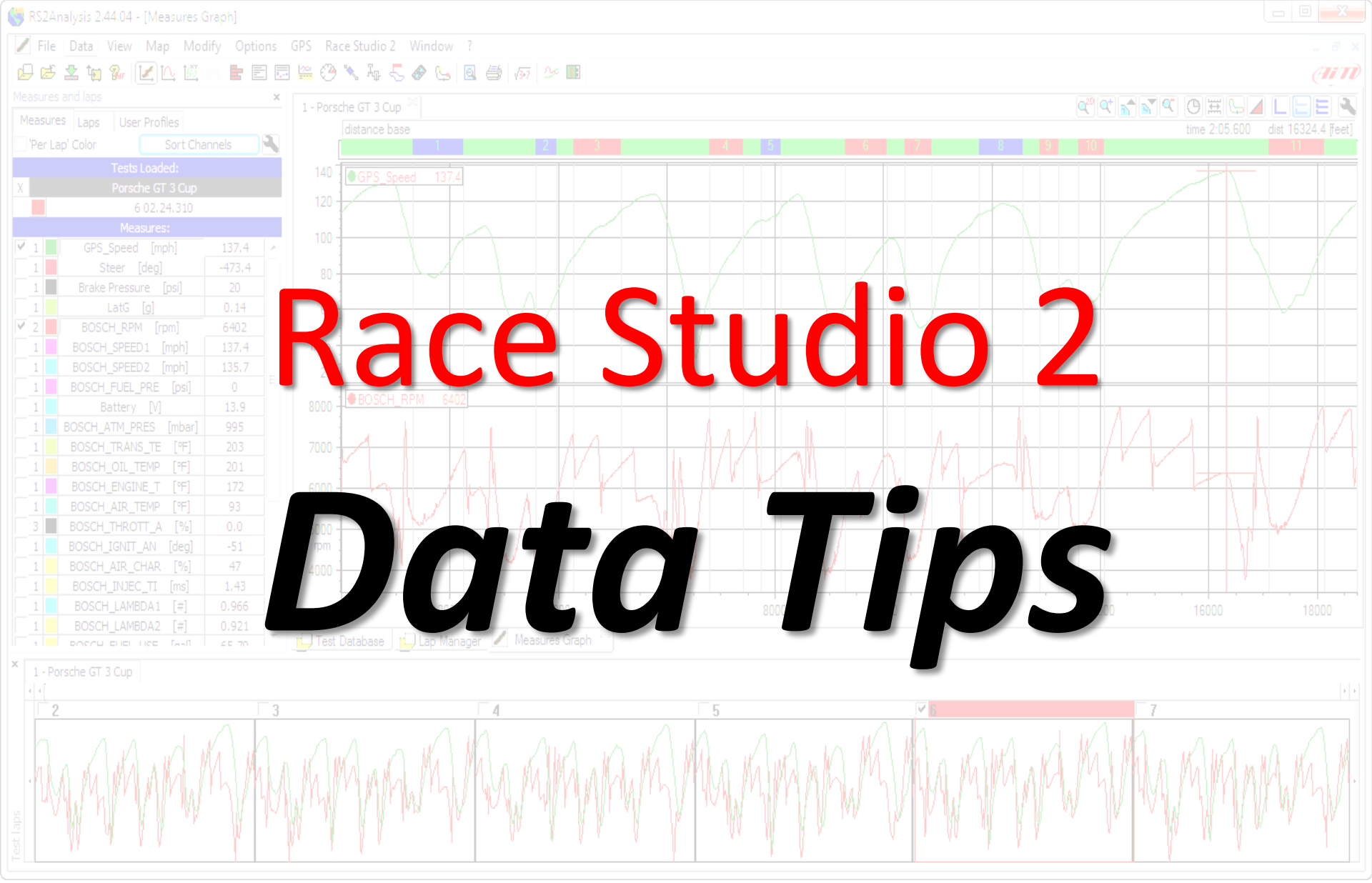
Function	F Key	Shift+	Alt+	Control+	Other	Menu	Comments
Download	F4					Download Data	
Race Studio 2 Analysis	F5					Analysis	
Exit	F10					File=>Exit	
Close Active Window			Alt+F4			None	If no open window, it closes Race Studio 2
Manual			Alt+F10			?=>Manual	
File			Alt+F			File	
Device Configuration			Alt+G			Device Configuration	
Download Data			Alt+D			Download Data	
Import SmartyCam Data			Alt+I			Import SmartyCam Data	
Analysis			Alt+N			Analysis	
Device Info			Alt+F			Device Info	
Online			Alt+O			Online	
Device Calibration			Alt+C			Device Calibration	
Customize Sensor			Alt+S			Customize Sensor	
Language			Alt+L			Language	
? (Help)			Alt+?			?=>Manual	
Exit Program				Ctrl+F4		None	Only when all windows are closed

A .pdf copy of the keyboard shortcuts is on your AiM Sports USB Drive

How to Use Data Acquisition

Data Analysis Concepts

- Basic Data Analysis Steps
  - What is Happening (many stop here!)
  - Where is it Happening
  - Why is it Happening
- Data Analysis Triangle
  - Driver Performance
  - Vehicle Performance
  - Vehicle Health
- Money Channels
  - Lap Times and Speed
  - All Other Channels Strongly Support the Money Channels
- Vehicle or Driver
  - Is the Driver Reacting to the Vehicle Movement
  - Or is the Driver Creating the Vehicles Movement
  - Critical Component of the Why is it Happening

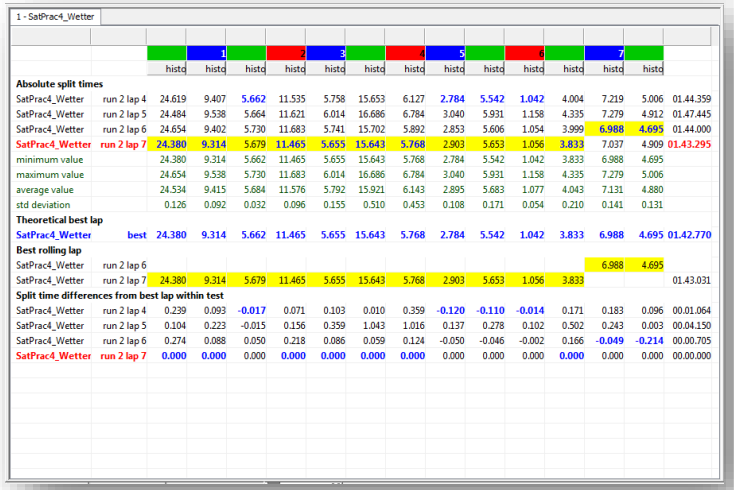


Race Studio 2

Data Tips

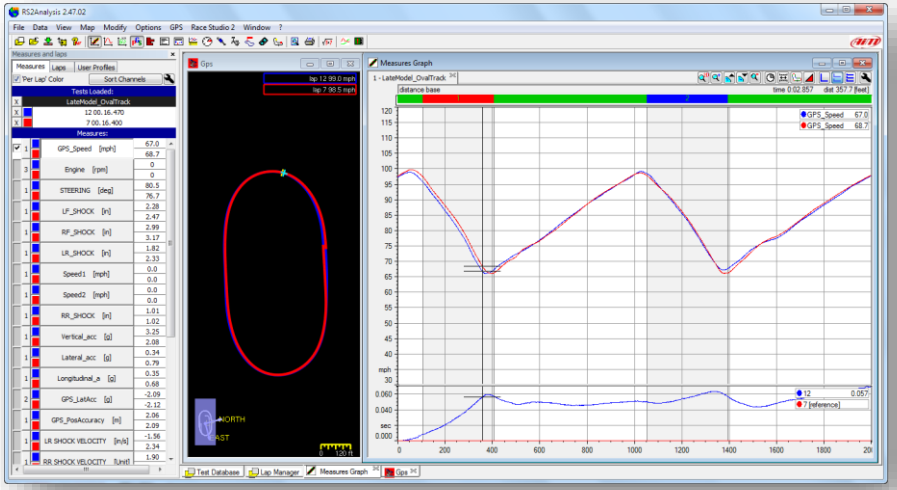
Tools You Need To Know

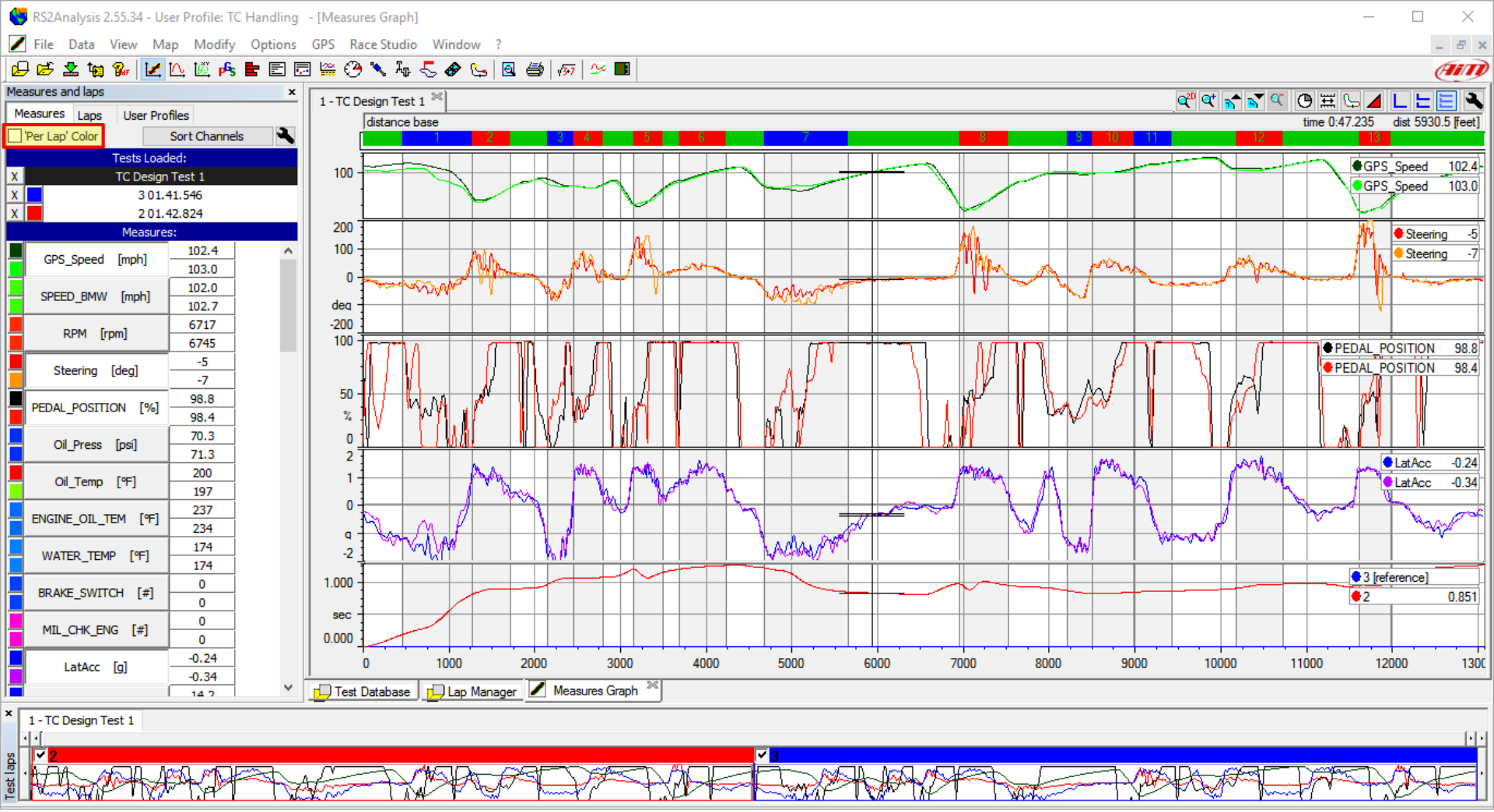
1 - Per Lap Color



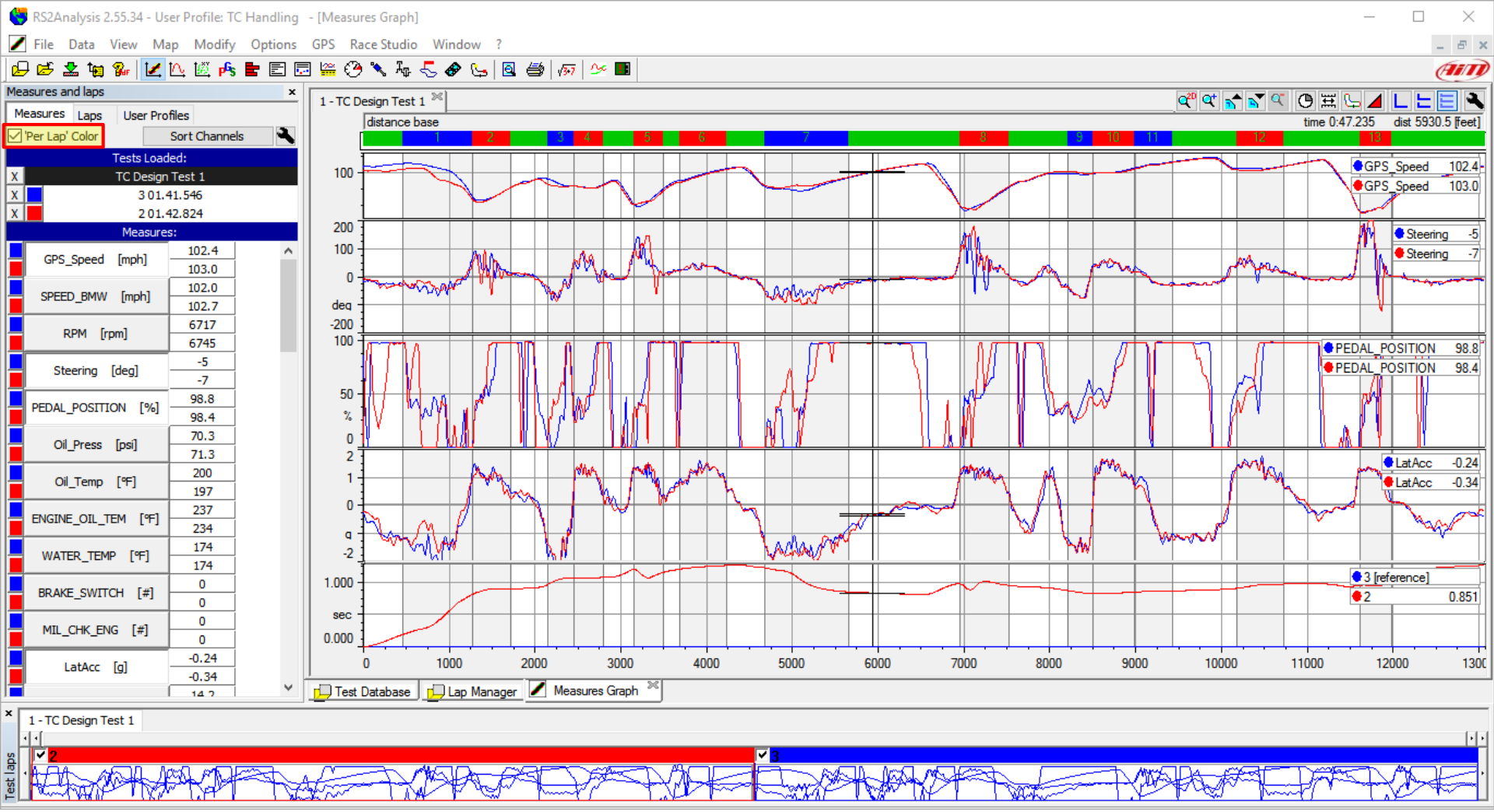
1 - SatPrac4_Wetter

			1		2	3		4	5		6		7		
			histo	histo	histo	histo	histo	histo	histo	histo	histo	histo	histo	histo	
Absolute split times															
SatPrac4_Wetter	run 2 lap 4		24.619	9.407	5.662	11.535	5.758	15.653	6.127	2.784	5.542	1.042	4.004	7.219	5.006	01.44.359
SatPrac4_Wetter	run 2 lap 5		24.484	9.538	5.664	11.621	6.014	16.686	6.784	3.040	5.931	1.158	4.335	7.279	4.912	01.47.445
SatPrac4_Wetter	run 2 lap 6		24.654	9.402	5.730	11.683	5.741	15.702	5.892	2.853	5.606	1.054	3.999	6.988	4.695	01.44.000
SatPrac4_Wetter	run 2 lap 7		24.380	9.314	5.679	11.465	5.655	15.643	5.768	2.903	5.653	1.056	3.833	7.037	4.909	01.43.295
minimum value			24.380	9.314	5.662	11.465	5.655	15.643	5.768	2.784	5.542	1.042	3.833	6.988	4.695	
maximum value			24.654	9.538	5.730	11.683	6.014	16.686	6.784	3.040	5.931	1.158	4.335	7.279	5.006	
average value			24.534	9.415	5.684	11.576	5.792	15.921	6.143	2.895	5.683	1.077	4.043	7.131	4.880	
std deviation			0.126	0.092	0.032	0.096	0.155	0.510	0.453	0.108	0.171	0.054	0.210	0.141	0.131	
Theoretical best lap															
SatPrac4_Wetter		best	24.380	9.314	5.662	11.465	5.655	15.643	5.768	2.784	5.542	1.042	3.833	6.988	4.695	01.42.770
Best rolling lap															
SatPrac4_Wetter	run 2 lap 6													6.988	4.695	
SatPrac4_Wetter	run 2 lap 7		24.380	9.314	5.679	11.465	5.655	15.643	5.768	2.903	5.653	1.056	3.833			01.43.031
Split time differences from best lap within test															
SatPrac4_Wetter	run 2 lap 4		0.239	0.093	-0.017	0.071	0.103	0.010	0.359	-0.120	-0.110	-0.014	0.171	0.183	0.096	00.01.064
SatPrac4_Wetter	run 2 lap 5		0.104	0.223	-0.015	0.156	0.359	1.043	1.016	0.137	0.278	0.102	0.502	0.243	0.003	00.04.150
SatPrac4_Wetter	run 2 lap 6		0.274	0.088	0.050	0.218	0.086	0.059	0.124	-0.050	-0.046	-0.002	0.166	-0.049	-0.214	00.00.705
SatPrac4_Wetter	run 2 lap 7		0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	00.00.000





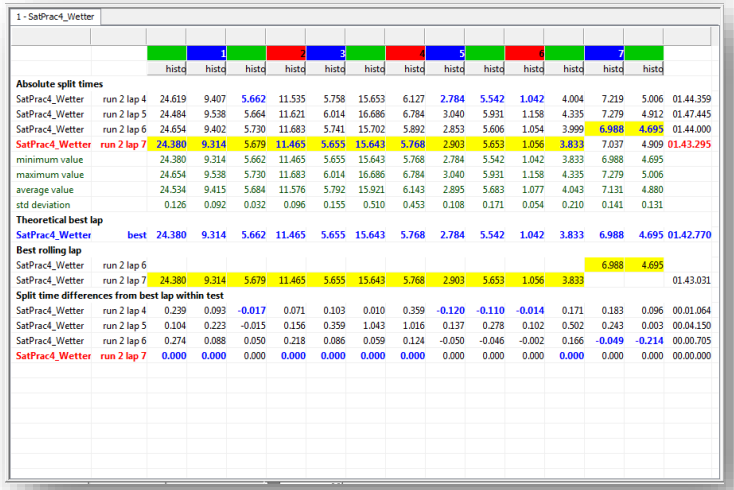
Per Lap Color This tool makes reading data from more than one lap much easier to understand. Here each data trace is a random color. By checking the 'Per Lap Color' checkbox, each data trace matches the overall color set for that lap.



Per Lap Color This tool makes reading data from more than one lap much easier to understand. Here each data trace is a random color. By checking the 'Per Lap Color' checkbox, each data trace matches the overall color set for that lap.

Tools You Need To Know

2 - Sort Channels



1 - SatPrac4_Wetter

		1	2	3	4	5	6	7		
		histo	histo	histo	histo	histo	histo	histo	histo	histo
Absolute split times										
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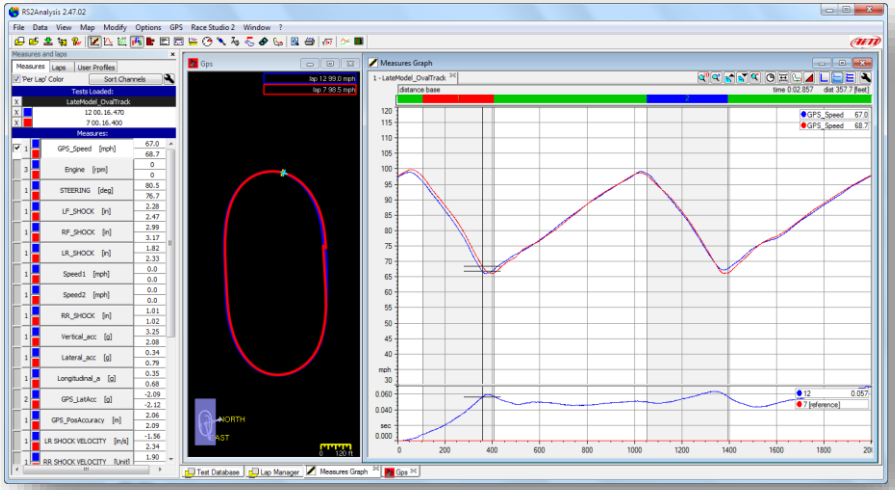
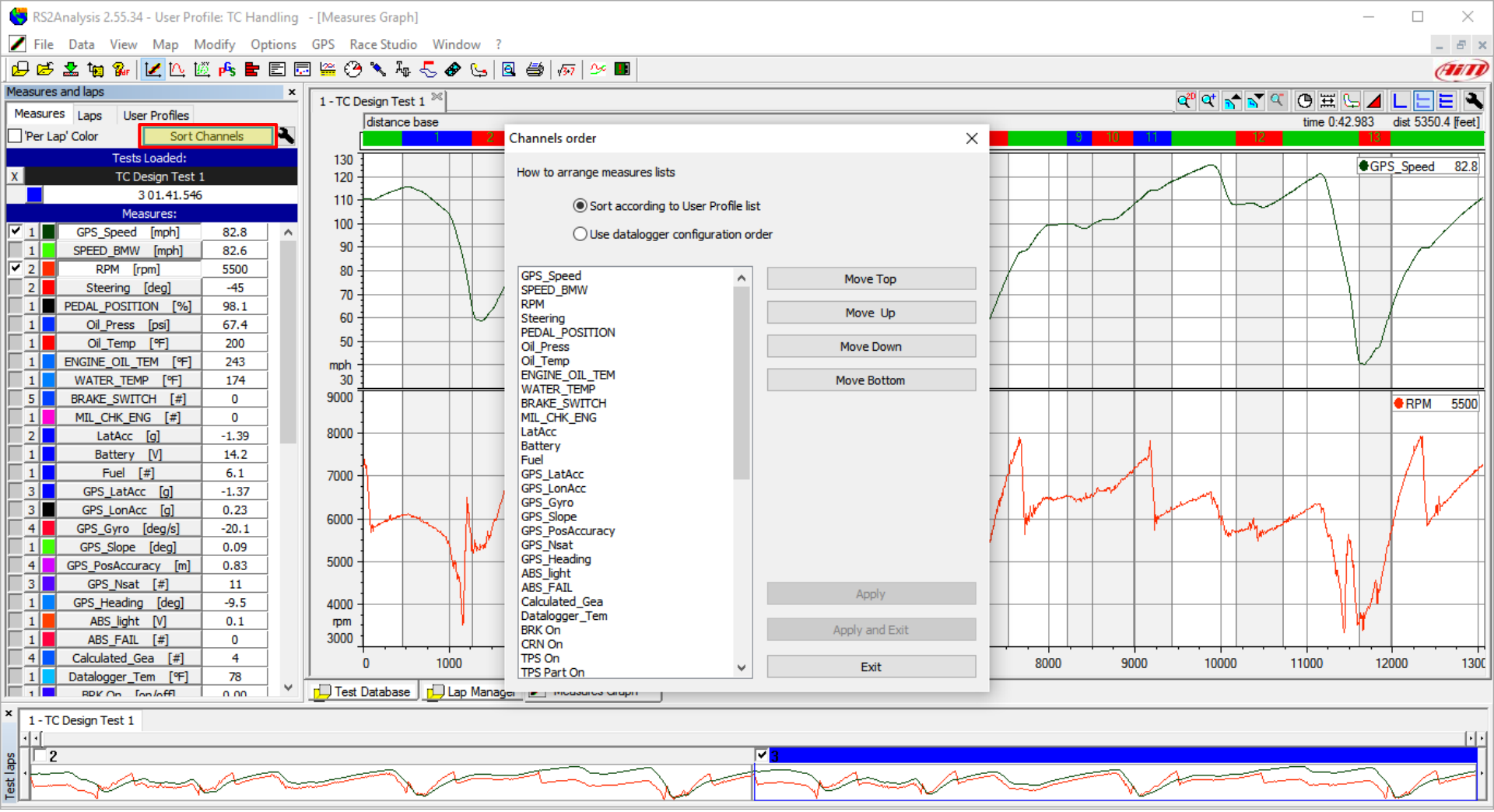
SatPrac4_Wetter	run 2 lap 7	24.380	9.314	5.679	11.465	5.655	15.643	5.768	2.903	5.653	1.056	3.833	7.037	4.909	01.43.295
minimum value		24.380	9.314	5.662	11.465	5.655	15.643	5.768	2.784	5.542	1.042	3.833	6.988	4.695	
maximum value		24.654	9.538	5.730	11.683	6.014	16.686	6.784	3.040	5.931	1.158	4.335	7.279	5.006	
average value		24.534	9.415	5.684	11.576	5.792	15.921	6.143	2.895	5.683	1.077	4.043	7.131	4.880	
std deviation		0.126	0.092	0.032	0.096	0.155	0.510	0.453	0.108	0.171	0.054	0.210	0.141	0.131	
Theoretical best lap															
SatPrac4_Wetter	best	24.380	9.314	5.662	11.465	5.655	15.643	5.768	2.784	5.542	1.042	3.833	6.988	4.695	01.42.770
Best rolling lap															
SatPrac4_Wetter	run 2 lap 6												6.988	4.695	
SatPrac4_Wetter	run 2 lap 7	24.380	9.314	5.679	11.465	5.655	15.643	5.768	2.903	5.653	1.056	3.833			01.43.031
Split time differences from best lap within test															
SatPrac4_Wetter	run 2 lap 4	0.239	0.093	-0.017	0.071	0.103	0.010	0.359	-0.120	-0.110	-0.014	0.171	0.183	0.096	00.01.064
SatPrac4_Wetter	run 2 lap 5	0.104	0.223	-0.015	0.156	0.359	1.043	1.016	0.137	0.278	0.102	0.502	0.243	0.003	00.04.150
SatPrac4_Wetter	run 2 lap 6	0.274	0.088	0.050	0.218	0.086	0.059	0.124	-0.050	-0.046	-0.002	0.166	-0.049	-0.214	00.00.705
SatPrac4_Wetter	run 2 lap 7	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	00.00.000

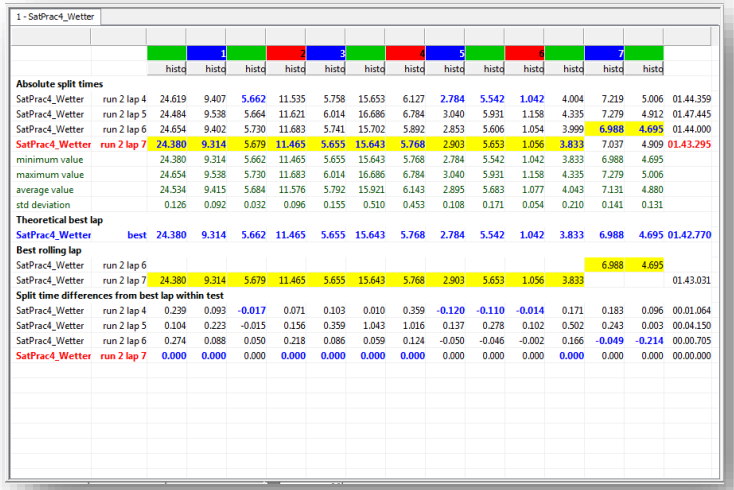




Sort Channels This tool allows you to re-order the channels in the 'Measures and Laps' toolbar. When you have a lot of channels, re-ordering them with the most used at the top of the list is very helpful.

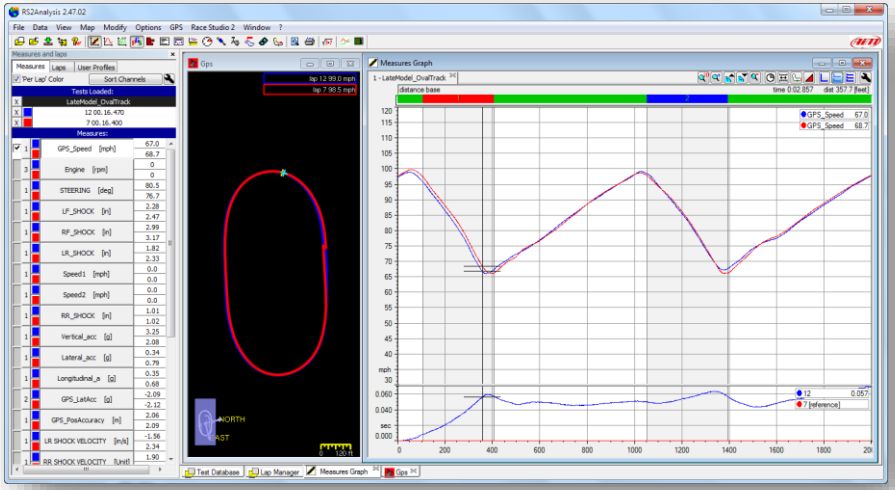
Tools You Need To Know

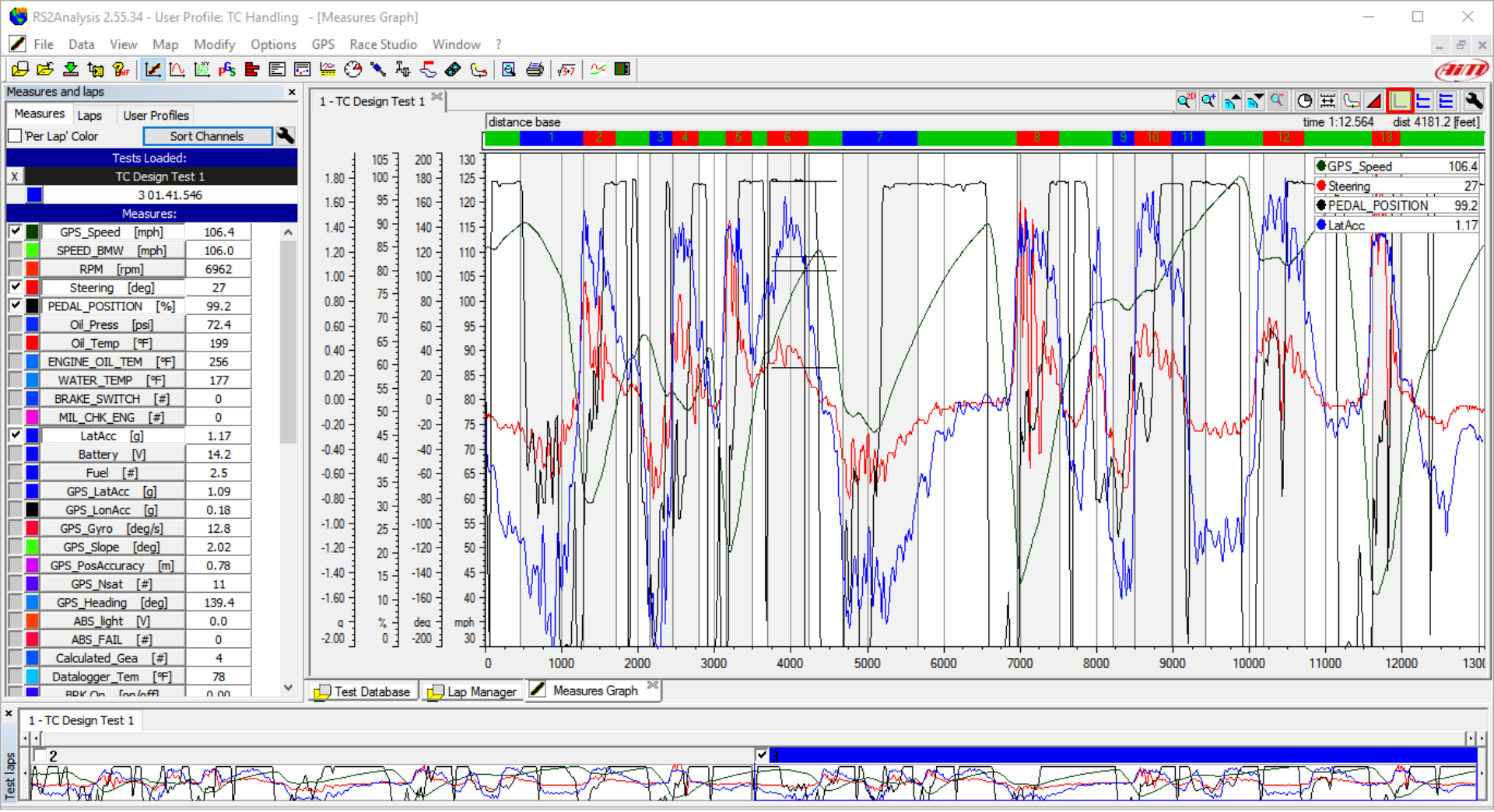
3 - Measures Graph Views



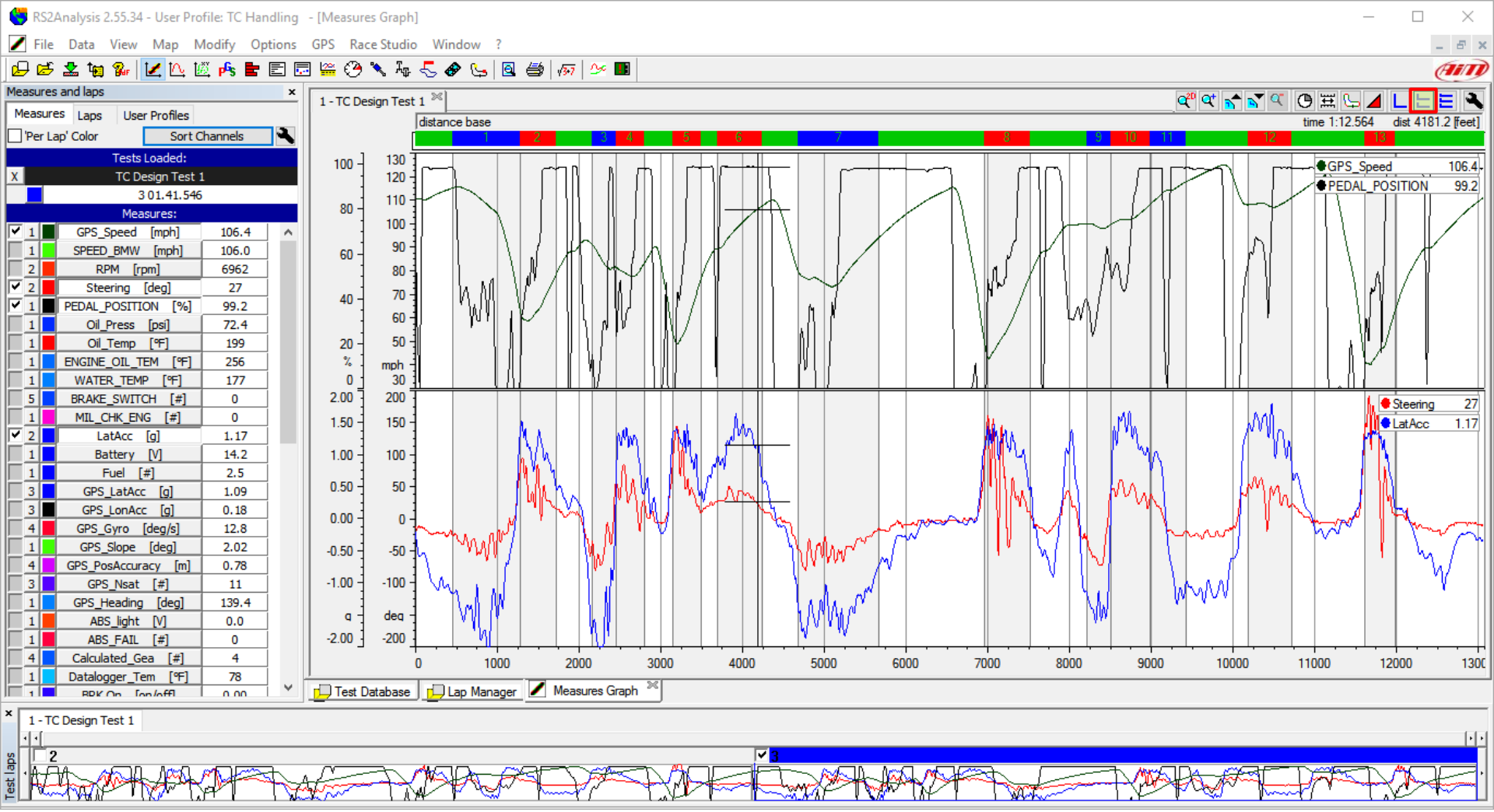
1 - SatPrac4_Wetter

			1		2	3		4	5		6		7		
			histo	histo	histo	histo	histo	histo	histo	histo	histo	histo	histo	histo	
Absolute split times															
SatPrac4_Wetter	run 2 lap 4		24.619	9.407	5.662	11.535	5.758	15.653	6.127	2.784	5.542	1.042	4.004	7.219	5.006	01.44.359
SatPrac4_Wetter	run 2 lap 5		24.484	9.538	5.664	11.621	6.014	16.686	6.784	3.040	5.931	1.158	4.335	7.279	4.912	01.47.445
SatPrac4_Wetter	run 2 lap 6		24.654	9.402	5.730	11.683	5.741	15.702	5.892	2.853	5.606	1.054	3.999	6.988	4.695	01.44.000
SatPrac4_Wetter	run 2 lap 7		24.380	9.314	5.679	11.465	5.655	15.643	5.768	2.903	5.653	1.056	3.833	7.037	4.909	01.43.295
minimum value			24.380	9.314	5.662	11.465	5.655	15.643	5.768	2.784	5.542	1.042	3.833	6.988	4.695	
maximum value			24.654	9.538	5.730	11.683	6.014	16.686	6.784	3.040	5.931	1.158	4.335	7.279	5.006	
average value			24.534	9.415	5.684	11.576	5.792	15.921	6.143	2.895	5.683	1.077	4.043	7.131	4.880	
std deviation			0.126	0.092	0.032	0.096	0.155	0.510	0.453	0.108	0.171	0.054	0.210	0.141	0.131	
Theoretical best lap															
SatPrac4_Wetter		best	24.380	9.314	5.662	11.465	5.655	15.643	5.768	2.784	5.542	1.042	3.833	6.988	4.695	01.42.770
Best rolling lap															
SatPrac4_Wetter	run 2 lap 6													6.988	4.695	
SatPrac4_Wetter	run 2 lap 7		24.380	9.314	5.679	11.465	5.655	15.643	5.768	2.903	5.653	1.056	3.833			01.43.031
Split time differences from best lap within test															
SatPrac4_Wetter	run 2 lap 4		0.239	0.093	-0.017	0.071	0.103	0.010	0.359	-0.120	-0.110	-0.014	0.171	0.183	0.096	00.01.064
SatPrac4_Wetter	run 2 lap 5		0.104	0.223	-0.015	0.156	0.359	1.043	1.016	0.137	0.278	0.102	0.502	0.243	0.003	00.04.150
SatPrac4_Wetter	run 2 lap 6		0.274	0.088	0.050	0.218	0.086	0.059	0.124	-0.050	-0.046	-0.002	0.166	-0.049	-0.214	00.00.705
SatPrac4_Wetter	run 2 lap 7		0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	00.00.000

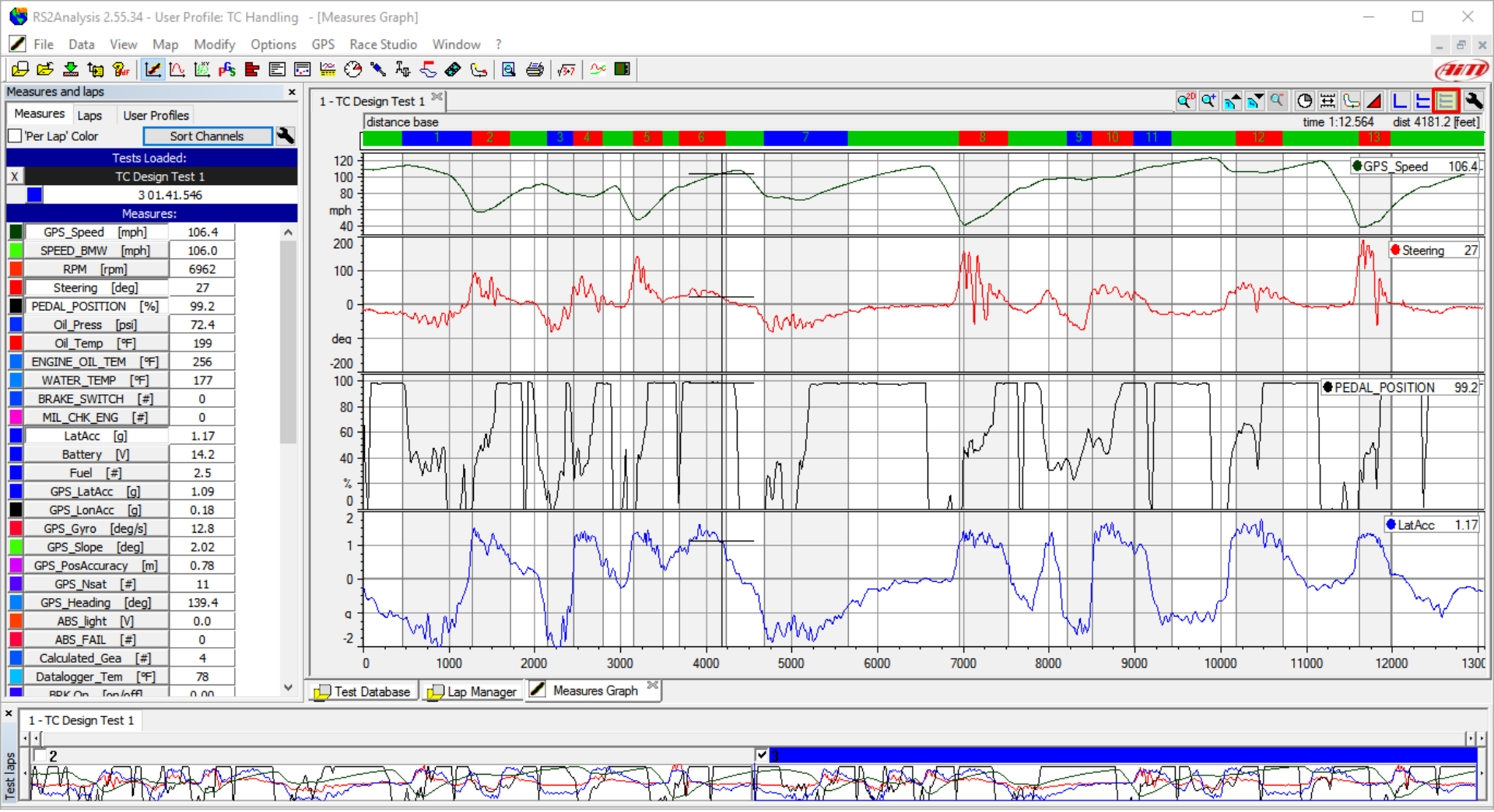




Measures Graph Views - Overlapped This function allows you to view your data in ways to make the data easier to read. This first mode is called 'Overlapped'. Each channel you have shown in the Measures Graph is placed in a single window.



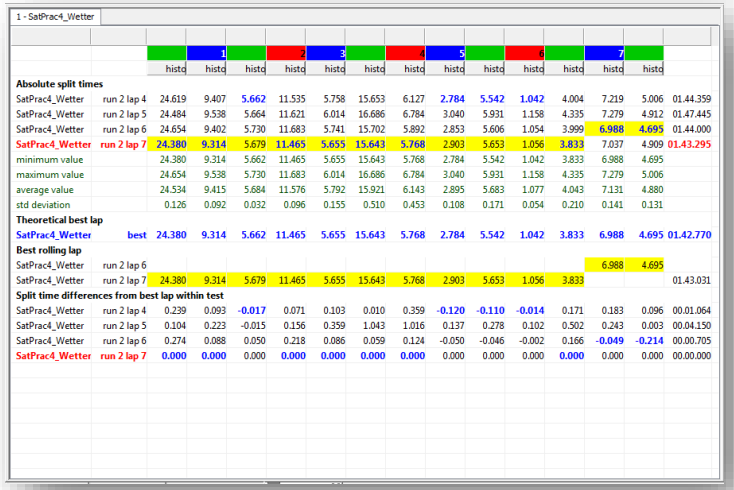
Measures Graph Views - Mixed This function allows you to view your data in ways to make the data easier to read. This second mode is called 'Mixed'. Each channel you have shown in the Measures Graph is placed in one of 6 user defined views. The Measures Graph gives you a numbered toggle box that allows you to mix your channel traces.



Measures Graph Views - Tiled This function allows you to view your data in ways to make the data easier to read. This third mode is called 'Tiled'. Each channel you have shown in the Measures Graph is placed in its own views. This view is not limited with the number of views available.

Tools You Need To Know

4 - Snap Mode



1 - SatPrac4_Wetter

			1		2	3		4	5		6		7		
			histo	histo	histo	histo	histo	histo	histo	histo	histo	histo	histo	histo	
Absolute split times															
SatPrac4_Wetter	run 2 lap 4		24.619	9.407	5.662	11.535	5.758	15.653	6.127	2.784	5.542	1.042	4.004	7.219	5.006	01.44.359
SatPrac4_Wetter	run 2 lap 5		24.484	9.538	5.664	11.621	6.014	16.686	6.784	3.040	5.931	1.158	4.335	7.279	4.912	01.47.445
SatPrac4_Wetter	run 2 lap 6		24.654	9.402	5.730	11.683	5.741	15.702	5.892	2.853	5.606	1.054	3.999	6.988	4.695	01.44.000
SatPrac4_Wetter	run 2 lap 7		24.380	9.314	5.679	11.465	5.655	15.643	5.768	2.903	5.653	1.056	3.833	7.037	4.909	01.43.295
minimum value			24.380	9.314	5.662	11.465	5.655	15.643	5.768	2.784	5.542	1.042	3.833	6.988	4.695	
maximum value			24.654	9.538	5.730	11.683	6.014	16.686	6.784	3.040	5.931	1.158	4.335	7.279	5.006	
average value			24.534	9.415	5.684	11.576	5.792	15.921	6.143	2.895	5.683	1.077	4.043	7.131	4.880	
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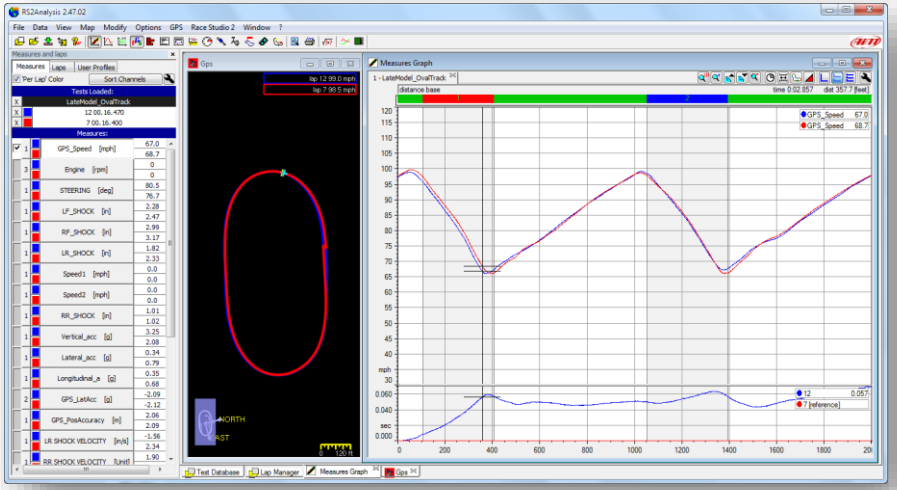
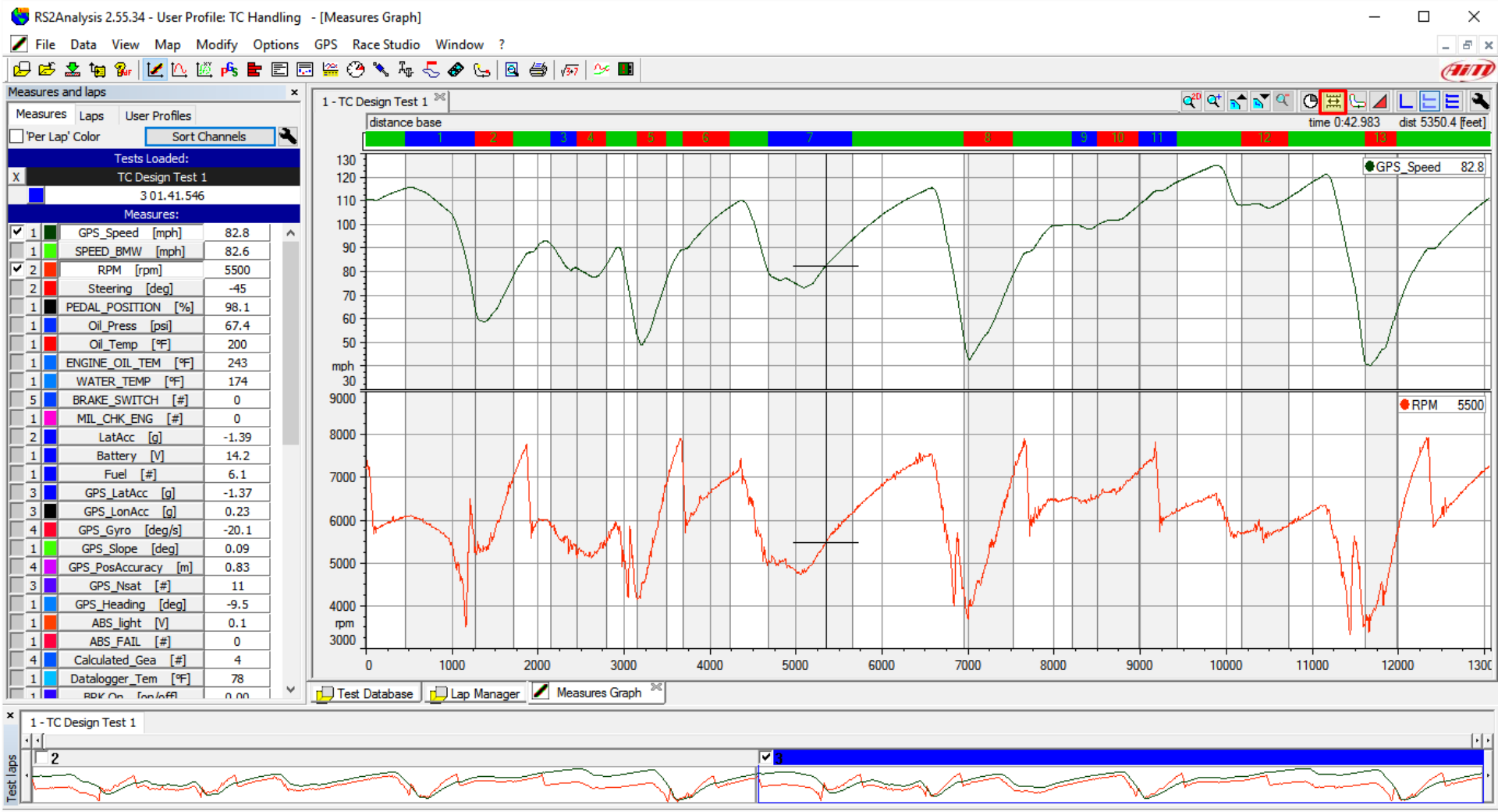
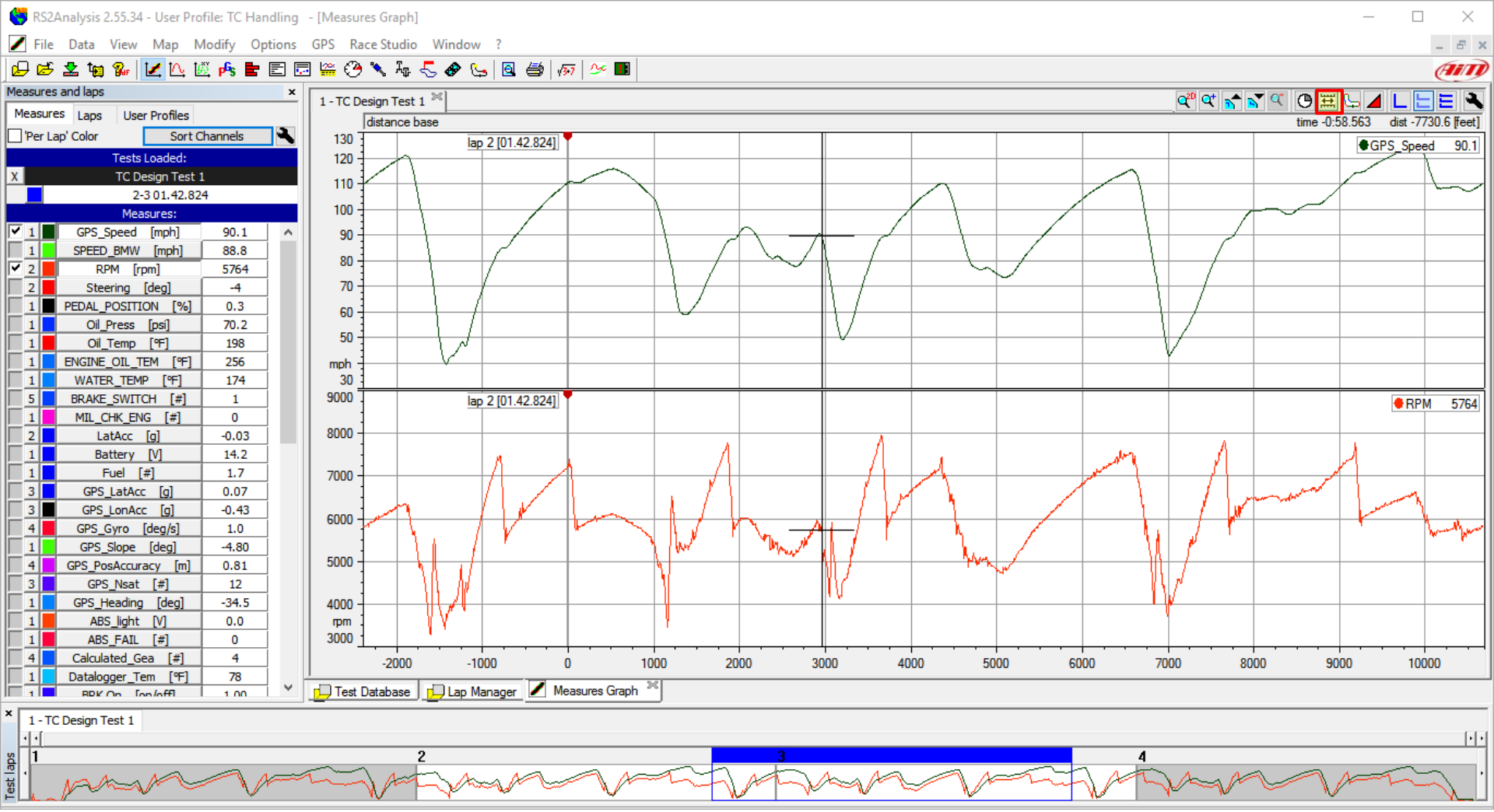
Theoretical best lap															
SatPrac4_Wetter		best	24.380	9.314	5.662	11.465	5.655	15.643	5.768	2.784	5.542	1.042	3.833	6.988	4.695	01.42.770
Best rolling lap															
SatPrac4_Wetter	run 2 lap 6													6.988	4.695	
SatPrac4_Wetter	run 2 lap 7		24.380	9.314	5.679	11.465	5.655	15.643	5.768	2.903	5.653	1.056	3.833			01.43.031
Split time differences from best lap within test															
SatPrac4_Wetter	run 2 lap 4		0.239	0.093	-0.017	0.071	0.103	0.010	0.359	-0.120	-0.110	-0.014	0.171	0.183	0.096	00.01.064
SatPrac4_Wetter	run 2 lap 5		0.104	0.223	-0.015	0.156	0.359	1.043	1.016	0.137	0.278	0.102	0.502	0.243	0.003	00.04.150
SatPrac4_Wetter	run 2 lap 6		0.274	0.088	0.050	0.218	0.086	0.059	0.124	-0.050	-0.046	-0.002	0.166	-0.049	-0.214	00.00.705
SatPrac4_Wetter	run 2 lap 7		0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	00.00.000





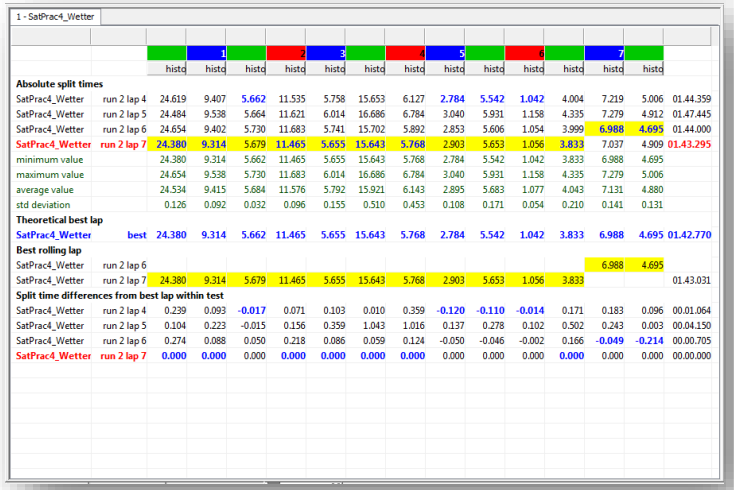
Snap Mode This function allows you to view your data and not have it locked to a single full lap. When this mode is active, you can view data across the start/finish line and is very useful when multiple laps are open for aligning shifted data.



Snap Mode This function allows you to view your data and not have it locked to a single full lap. When this mode is active, you can view data across the start/finish line and is very useful when multiple laps are open for aligning shifted data.

Tools You Need To Know

5 - Delta Function



1 - SatPrac4_Wetter

			1		2	3		4	5		6		7		
			histo	histo	histo	histo	histo	histo	histo	histo	histo	histo	histo	histo	
Absolute split times															
SatPrac4_Wetter	run 2 lap 4		24.619	9.407	5.662	11.535	5.758	15.653	6.127	2.784	5.542	1.042	4.004	7.219	5.006	01.44.359
SatPrac4_Wetter	run 2 lap 5		24.484	9.538	5.664	11.621	6.014	16.686	6.784	3.040	5.931	1.158	4.335	7.279	4.912	01.47.445
SatPrac4_Wetter	run 2 lap 6		24.654	9.402	5.730	11.683	5.741	15.702	5.892	2.853	5.606	1.054	3.999	6.988	4.695	01.44.000
SatPrac4_Wetter	run 2 lap 7		24.380	9.314	5.679	11.465	5.655	15.643	5.768	2.903	5.653	1.056	3.833	7.037	4.909	01.43.295
minimum value			24.380	9.314	5.662	11.465	5.655	15.643	5.768	2.784	5.542	1.042	3.833	6.988	4.695	
maximum value			24.654	9.538	5.730	11.683	6.014	16.686	6.784	3.040	5.931	1.158	4.335	7.279	5.006	
average value			24.534	9.415	5.684	11.576	5.792	15.921	6.143	2.895	5.683	1.077	4.043	7.131	4.880	
std deviation			0.126	0.092	0.032	0.096	0.155	0.510	0.453	0.108	0.171	0.054	0.210	0.141	0.131	
Theoretical best lap															
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Best rolling lap															
SatPrac4_Wetter	run 2 lap 6													6.988	4.695	
SatPrac4_Wetter	run 2 lap 7		24.380	9.314	5.679	11.465	5.655	15.643	5.768	2.903	5.653	1.056	3.833			01.43.031
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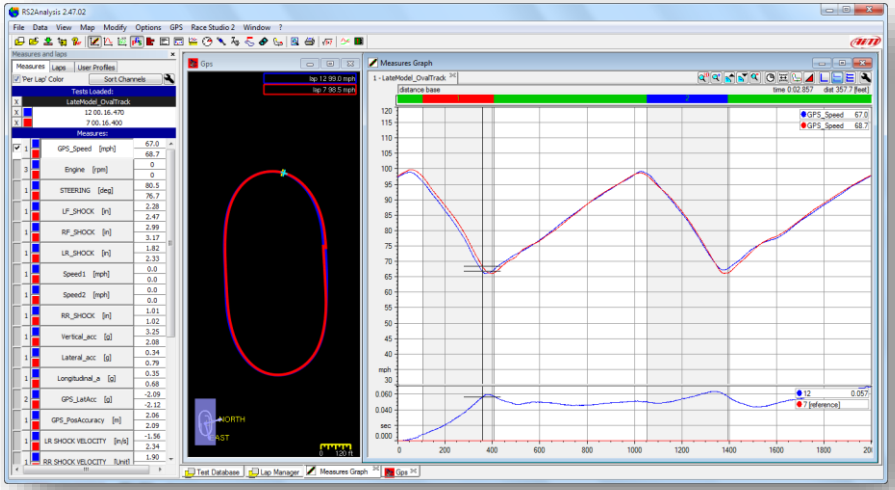
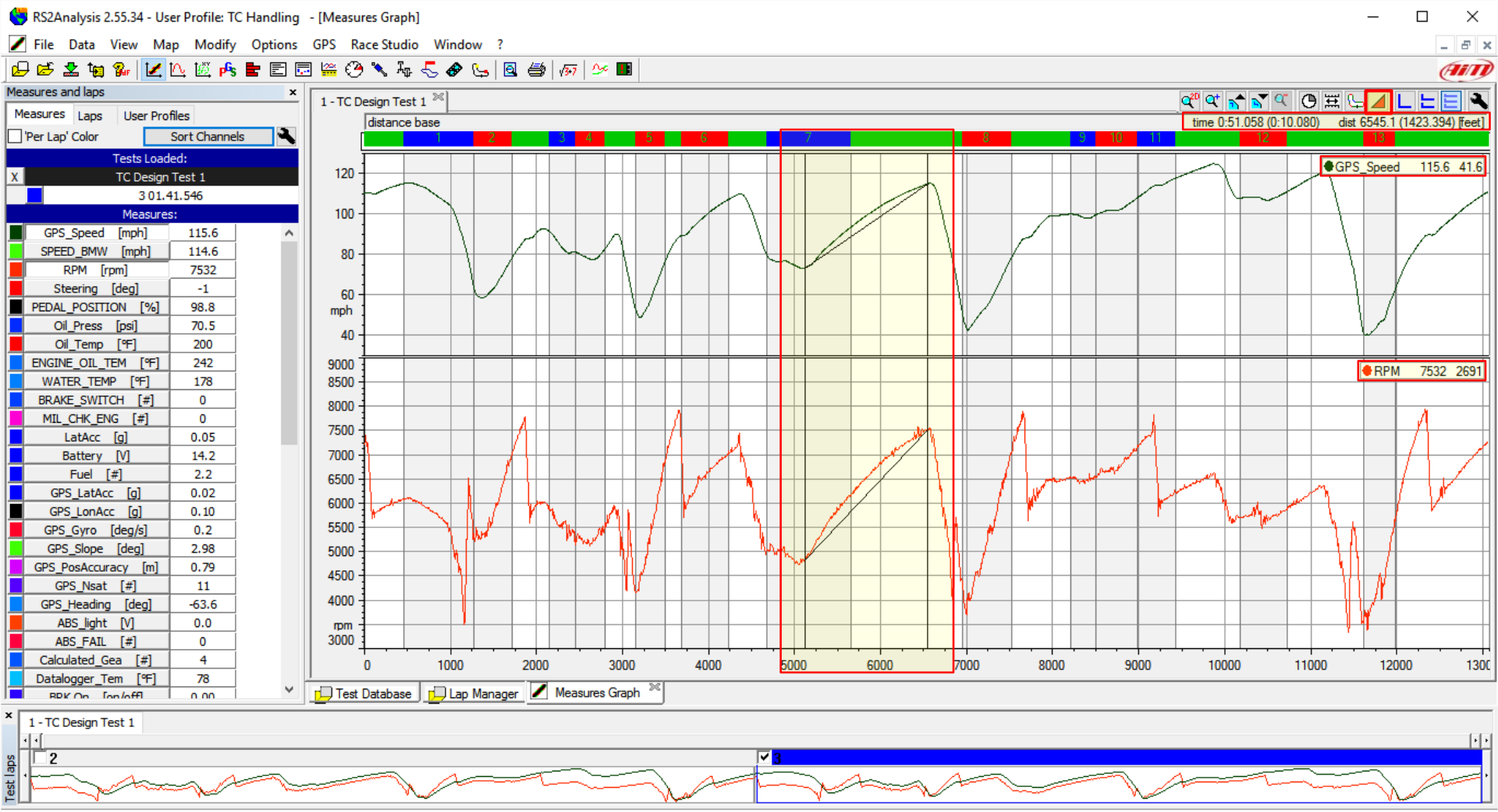
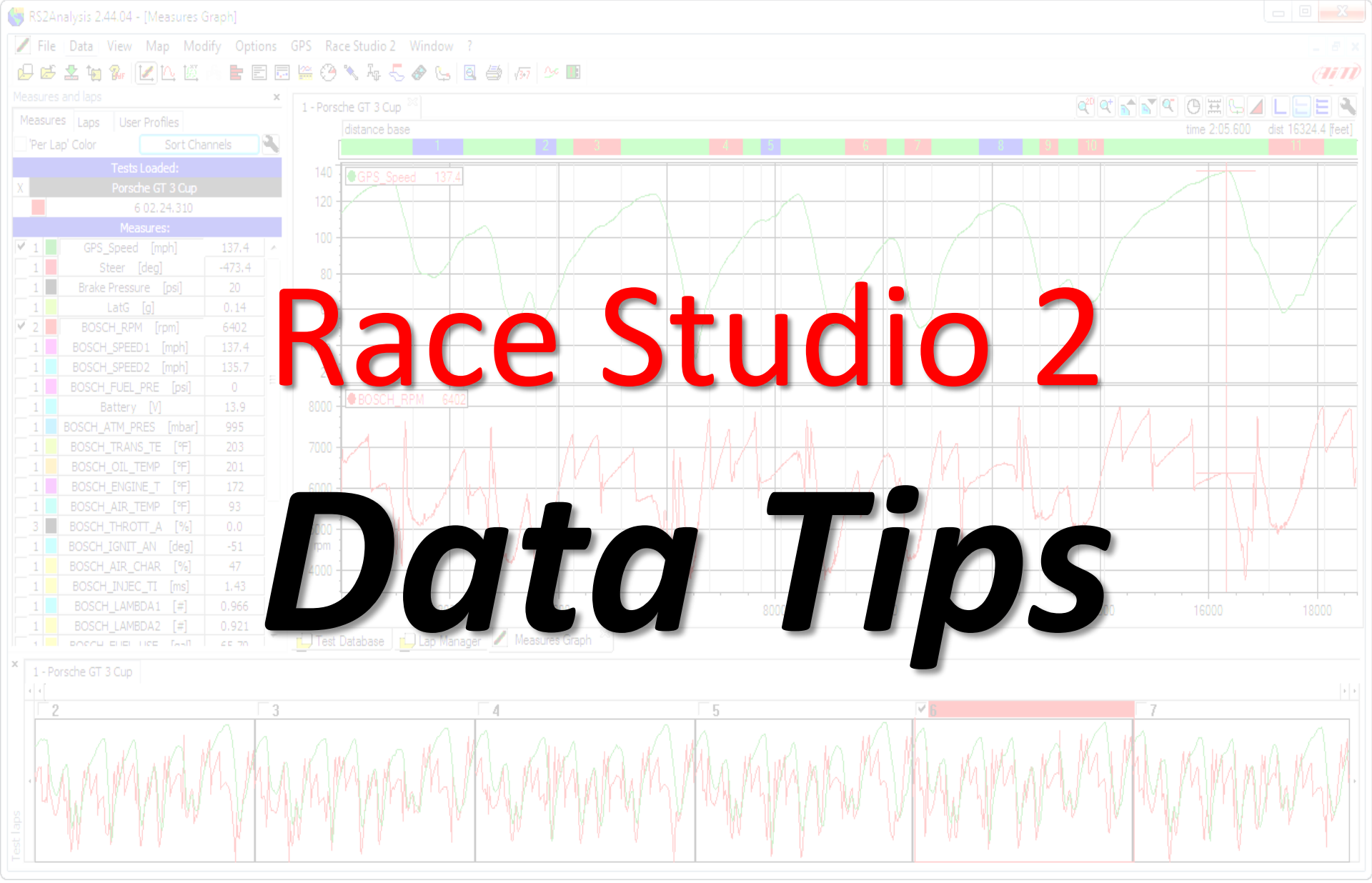
SatPrac4_Wetter	run 2 lap 5		0.104	0.223	-0.015	0.156	0.359	1.043	1.016	0.137	0.278	0.102	0.502	0.243	0.003	00.04.150
SatPrac4_Wetter	run 2 lap 6		0.274	0.088	0.050	0.218	0.086	0.059	0.124	-0.050	-0.046	-0.002	0.166	-0.049	-0.214	00.00.705
SatPrac4_Wetter	run 2 lap 7		0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	00.00.000



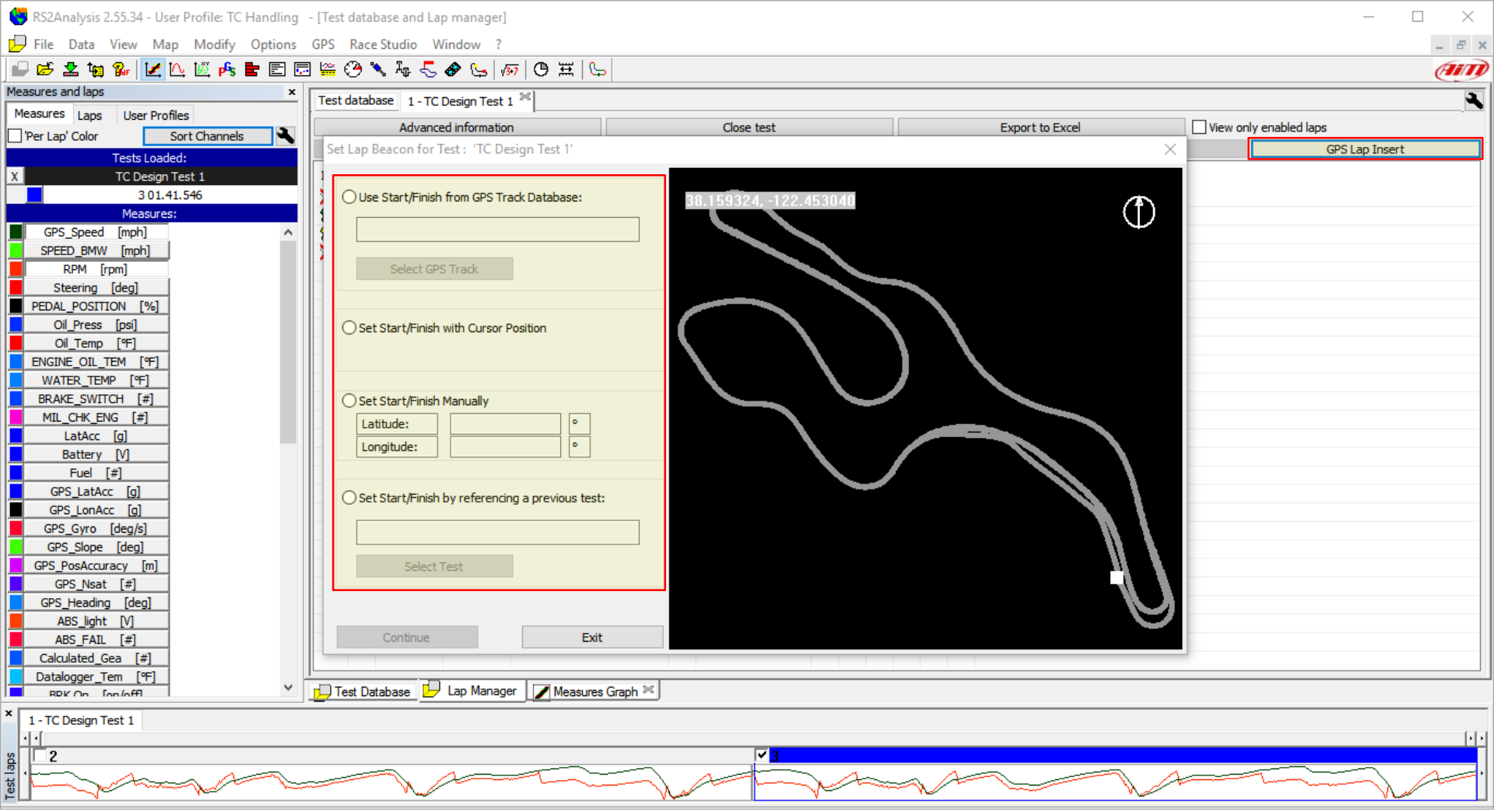


Delta Function This function allows you to measure the differences between 2 points anywhere in your data. Here we are measures the gain in MPH and RPM in an acceleration zone. Also shown is the time and distance measured.

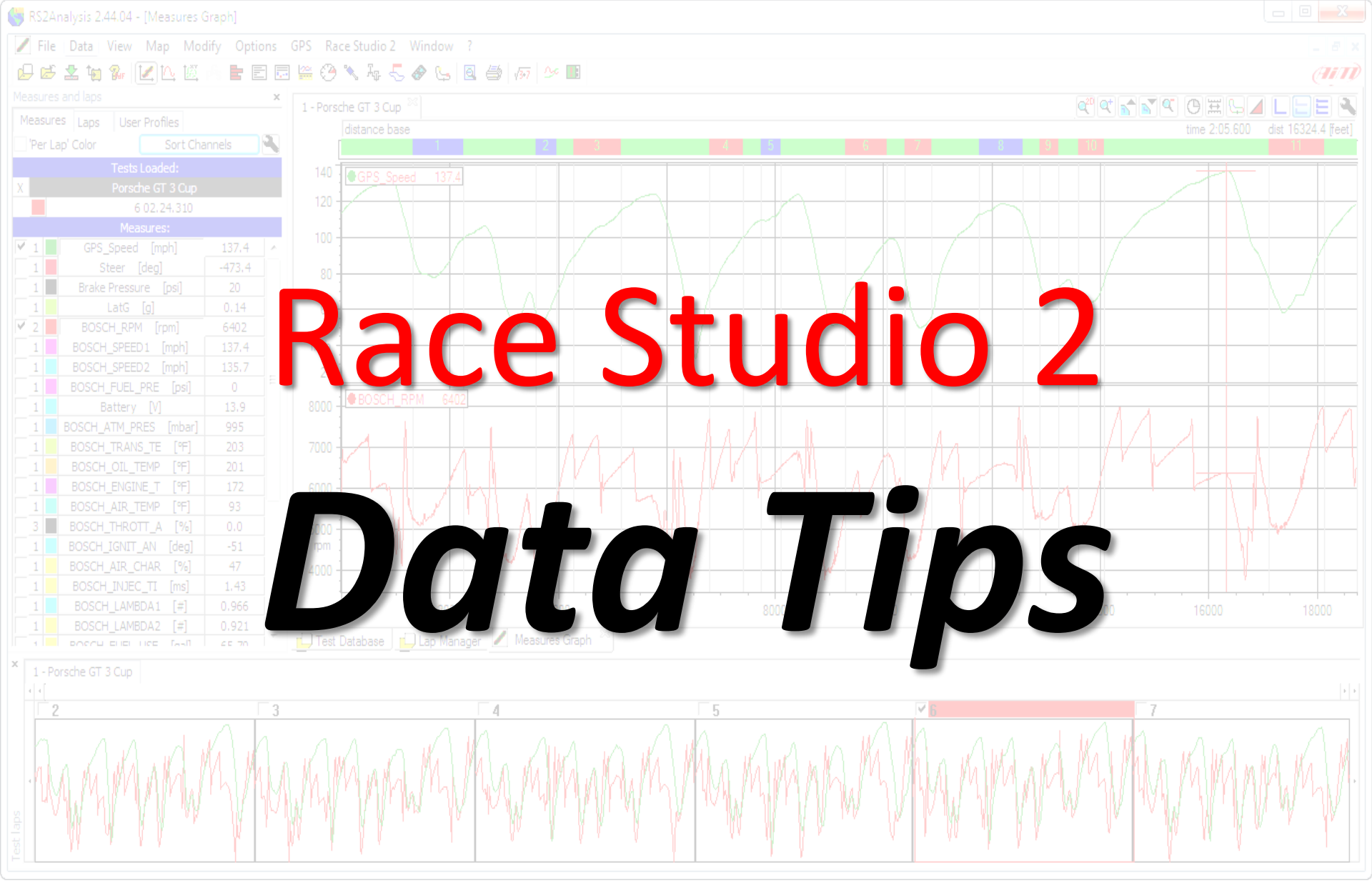


Race Studio 2

Data Tips

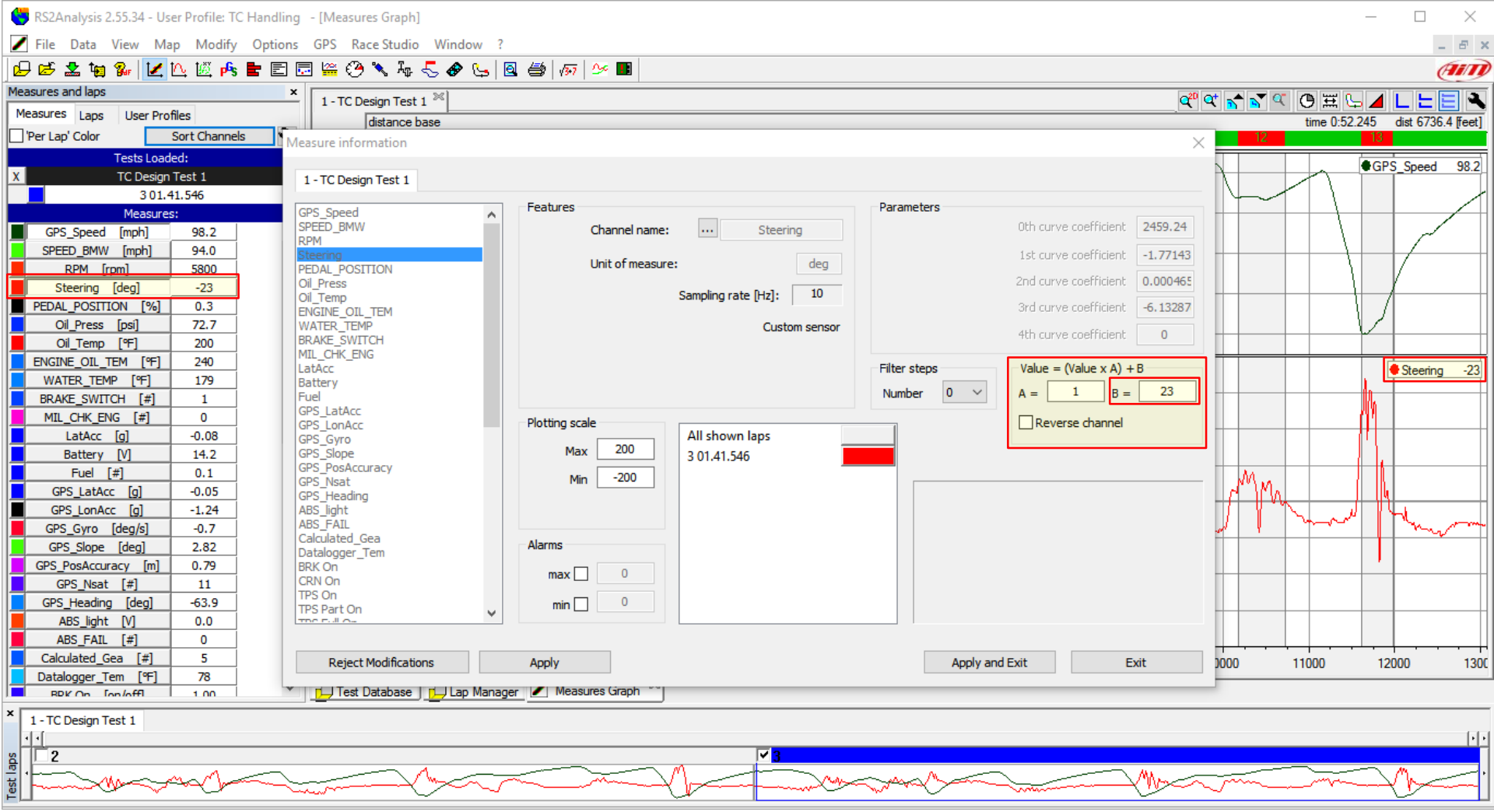


GPS Lap Insert: If you are running a GPS sensor and did not setup the S/F coords, incorrectly setup the S/F coords, or just want to change the S/F coords, the GPS Lap Insert function is where we do this.

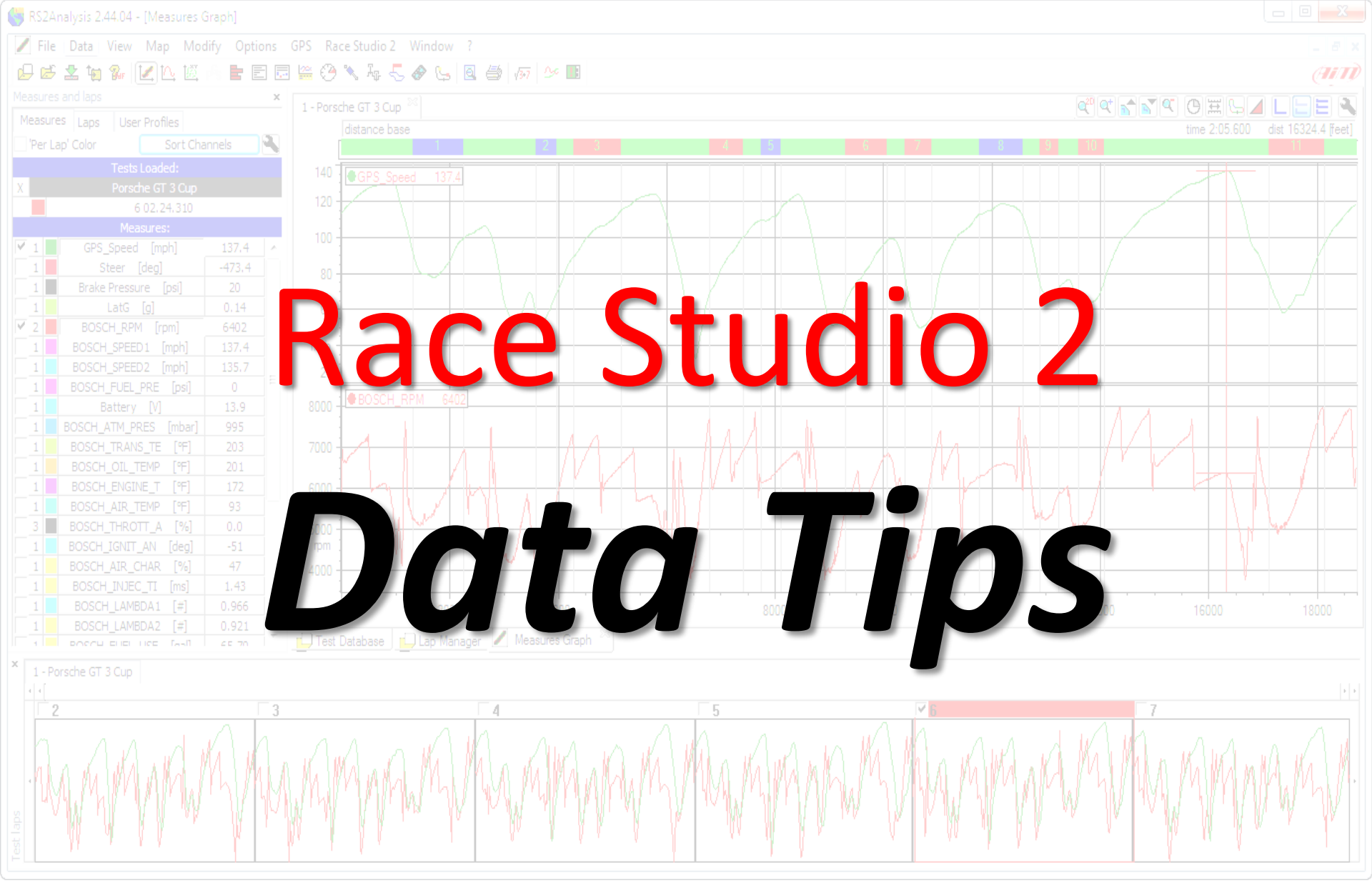


Race Studio 2

Data Tips



Post Session Sensor Calibration: To adjust (or scale) the value of a sensor, change the value in the “A=“ box.
To adjust(or shift) the value of a sensor, change the value in the “B=“ box. You can also fully reverse the channel. To perform a shift, find the value and place it into the “B=“ input box, in this case a positive value of 23. Then click on apply and exit.

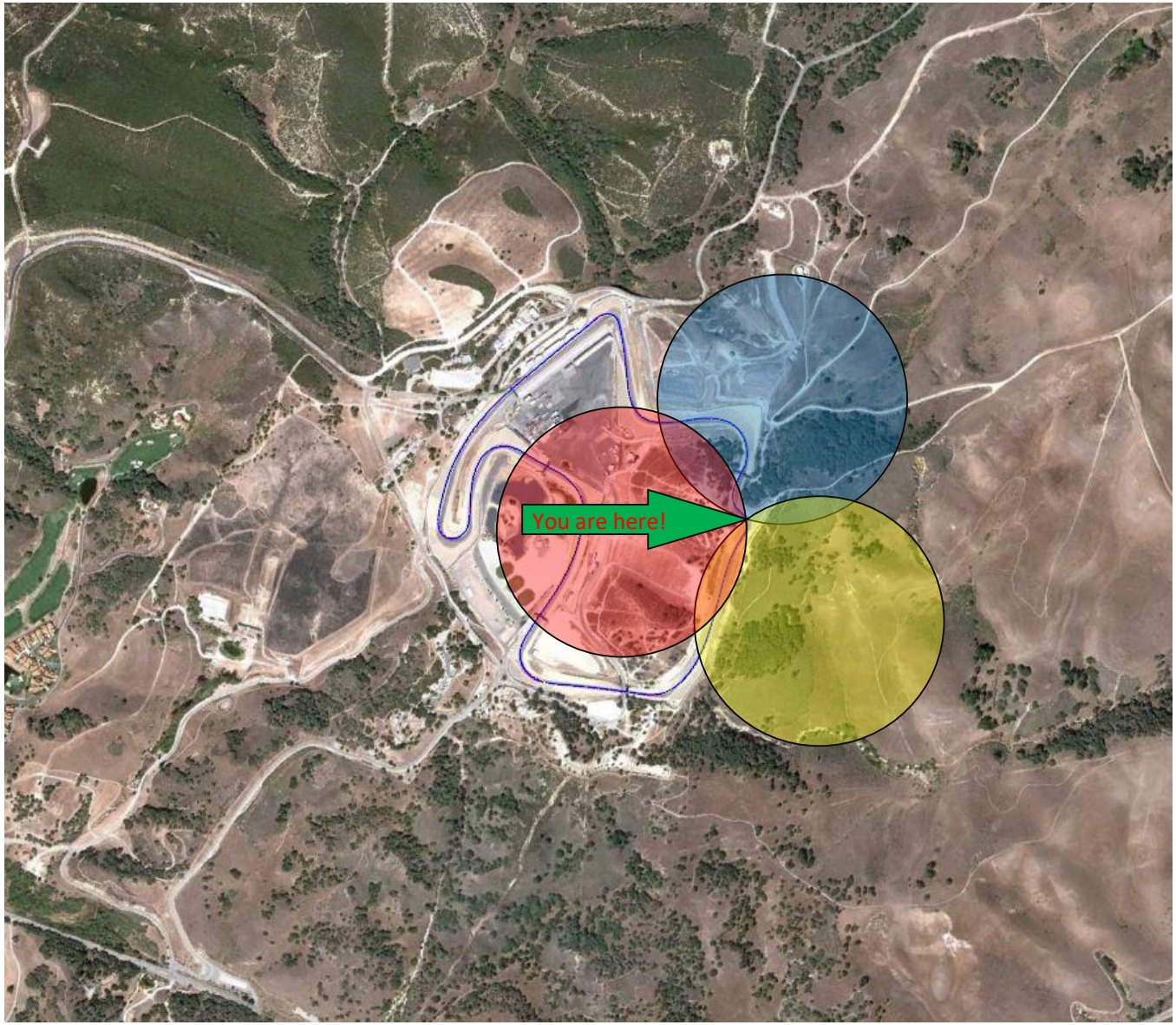


Race Studio 2

Data Tips

GPS System Information:

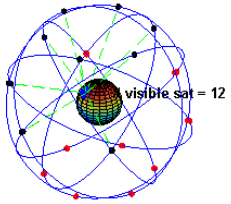
- 31 Sats Currently orbiting
- 6 different orbital planes
- Each orbit is 11hrs 58min
- Moving at about 7000mph
- Designed to have 9 Sats visible worldwide
- Min 4 Sats needed for good 3d location, more is always better
- Orbiting at about 10,988mi above Earth
- Early L1 GPS Sats output power is about 25.6 watts! Newer Sats have more power



Trilateration:

The process of calculating location by the measuring of distances.

- GPS receivers constantly receive and analyze radio signals
- Calculate the precise distance to each satellite
- 1 satellite determines position to a large area on earth
- 2 satellites narrows the position to where they overlap
- 3 satellites provides a fairly accurate position
- 4 satellites is better and give elevation



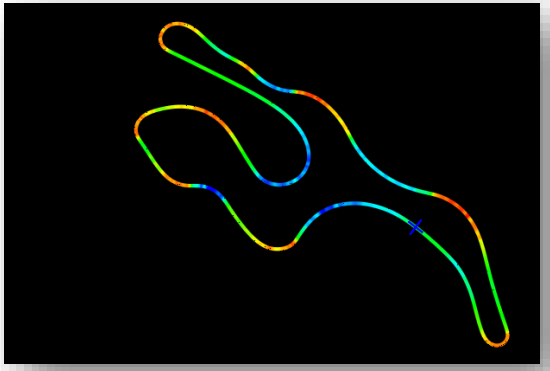
GPS Accuracy Types

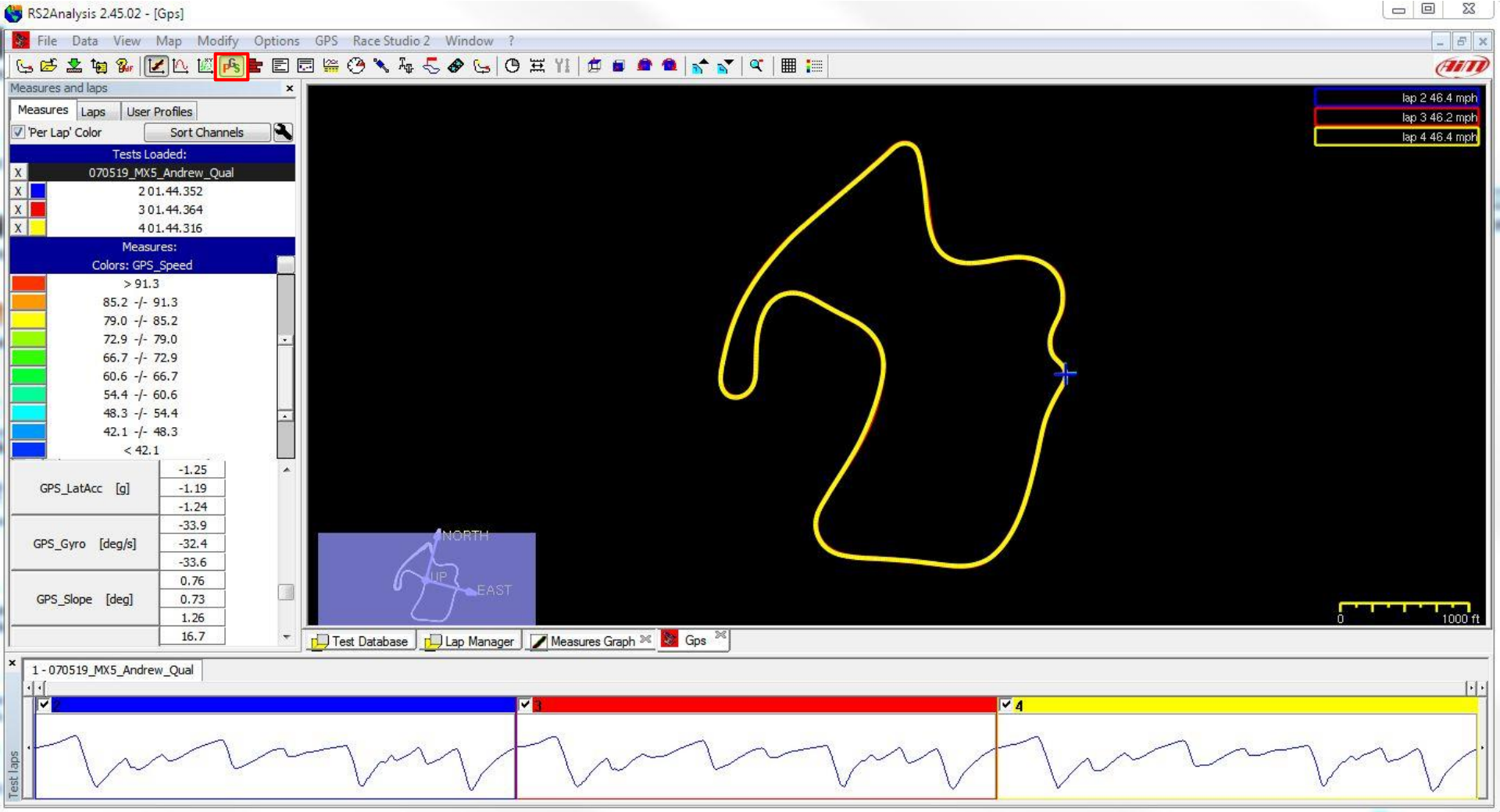
When Considering GPS Accuracy, There are 2 Types:

- **Positional Accuracy**
  - The Accuracy When Comparing the Position of Your Driven Line to any Other Data Gathered at any Other Time
  - This is Reported in Your Data as 'GPS_PosAccuracy'
  - The Positional Accuracy of Your AiM Sports GPS System (or any other GPS Device) can Vary at Times

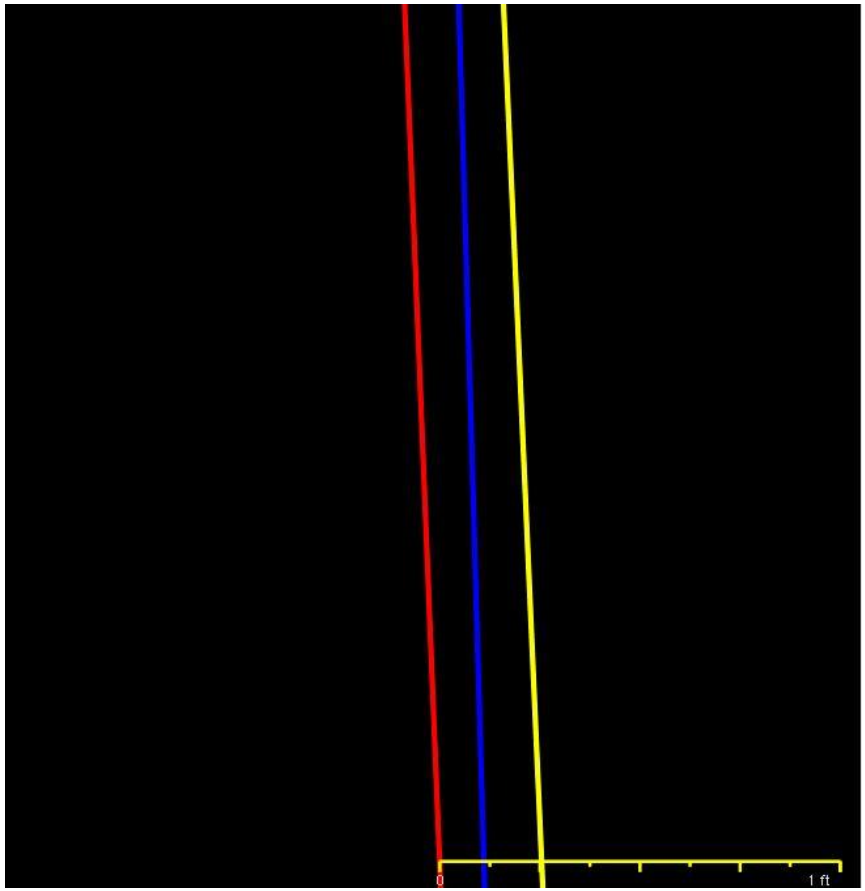
GPS_Speed [mph]	24.4
GPS_LatAcc [g]	-0.39
GPS_LonAcc [g]	-0.19
GPS_Gyro [deg/s]	-19.3
GPS_PosAccuracy [m]	0.76
GPS_Nsat [#]	18
GPS_Heading [deg]	-37.8
GPS_Altitude [m]	5
GPS_Slope [deg]	-0.39

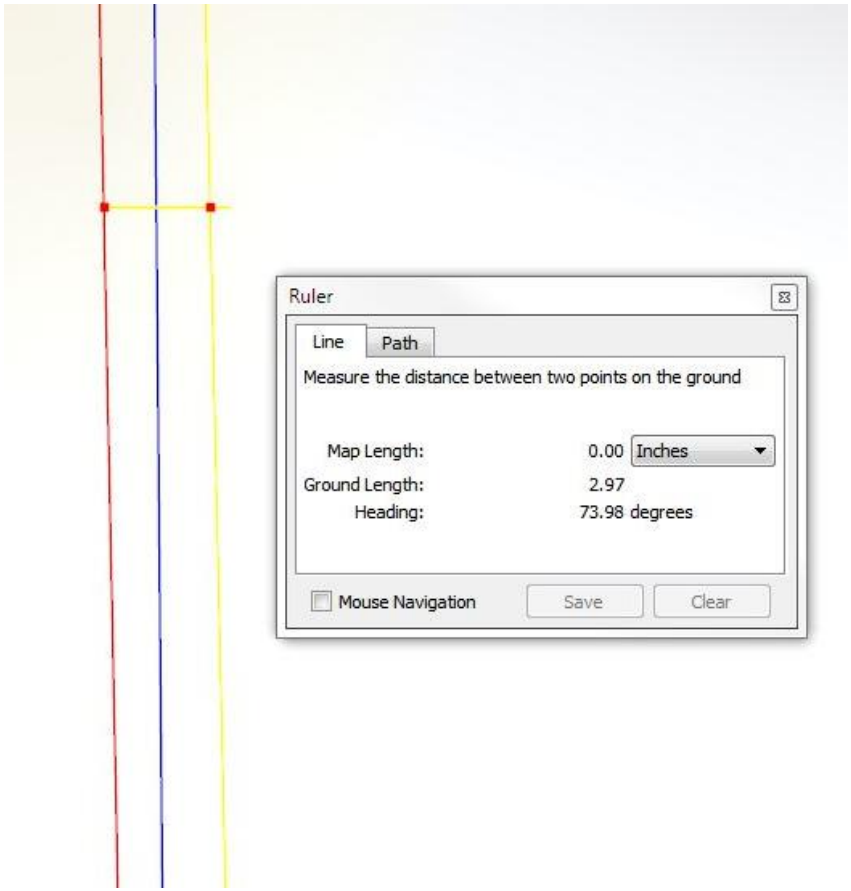
- **Relative Accuracy**
  - The Accuracy When Comparing Each Data Point Against the Previous Data Point
  - This is the Process Used to Calculate GPS_Speed, GPS_LatAcc, GPS_Heading, and Other Very Accurate Values
  - The Relative Accuracy of your AiM Sports GPS System is Very Good



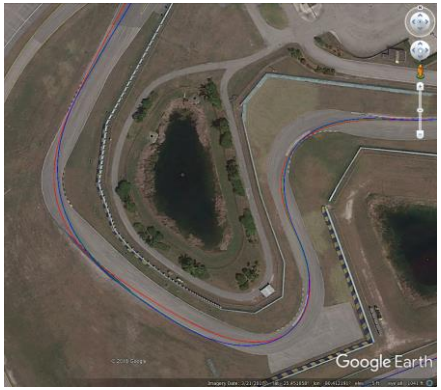


This is the default view of GPS data in the Race Studio 2 Analysis software. This data is a qualifying session with 3 laps of data. You only see the yellow lap as it was the last lap ran and they appear right on top of each other at this zoom level. On the next slide we zoom in to see the accuracy/repeatability of the GPS driven line on a slow corner where the driver should be placing the car at the same location.



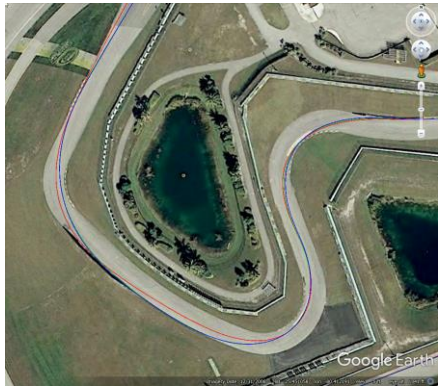


The same GPS data in the same location, a slow corner where the driver should be hitting the same spot . The image on the left is in Race Studio 2 Analysis/GPS, zoomed in and with the data right on top of the scale bar showing a difference of about 3" The image on the right is from Google Earth after a .kml export and using their "Ruler" tool shows a difference of 2.96", a good check.



March 2017

April 2011



December 2008

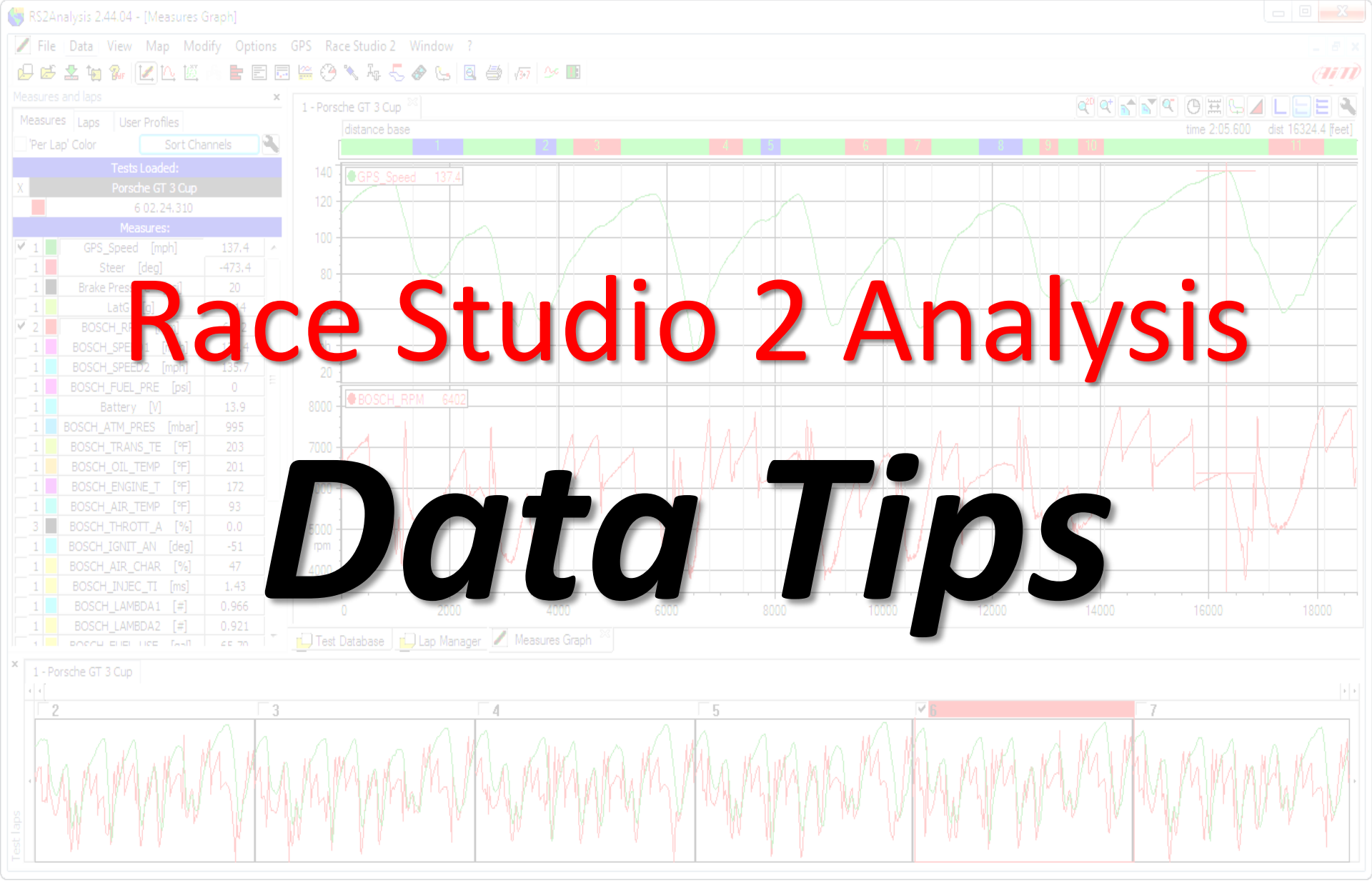
February 2005

Google Earth Image Accuracy: Using the Timeline Function in Google Earth, here are 3 laps of exported AiM Sports Race Studio data, opened and viewed on 4 different Google Earth images from February 2005 thru March 2017.

Keep in mind the AiM Sports data is exactly the same data from image to image.

As you can see here even in just this one series of corners at the Homestead Florida track, the accuracy of the Google provided imagery varies based on the quality of the images Google Earth is using.

If your exported AiM Sports data does not 'fit' well on the latest imagery in Google Earth, use the 'Historical Imagery' function in Google Earth to see if better imagery is available.



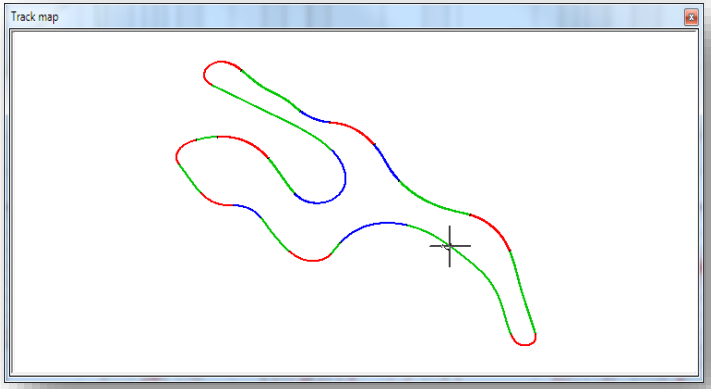
Race Studio 2 Analysis

Data Tips

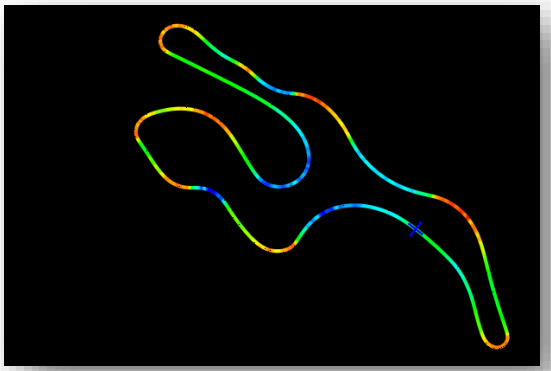
Track Map Differences

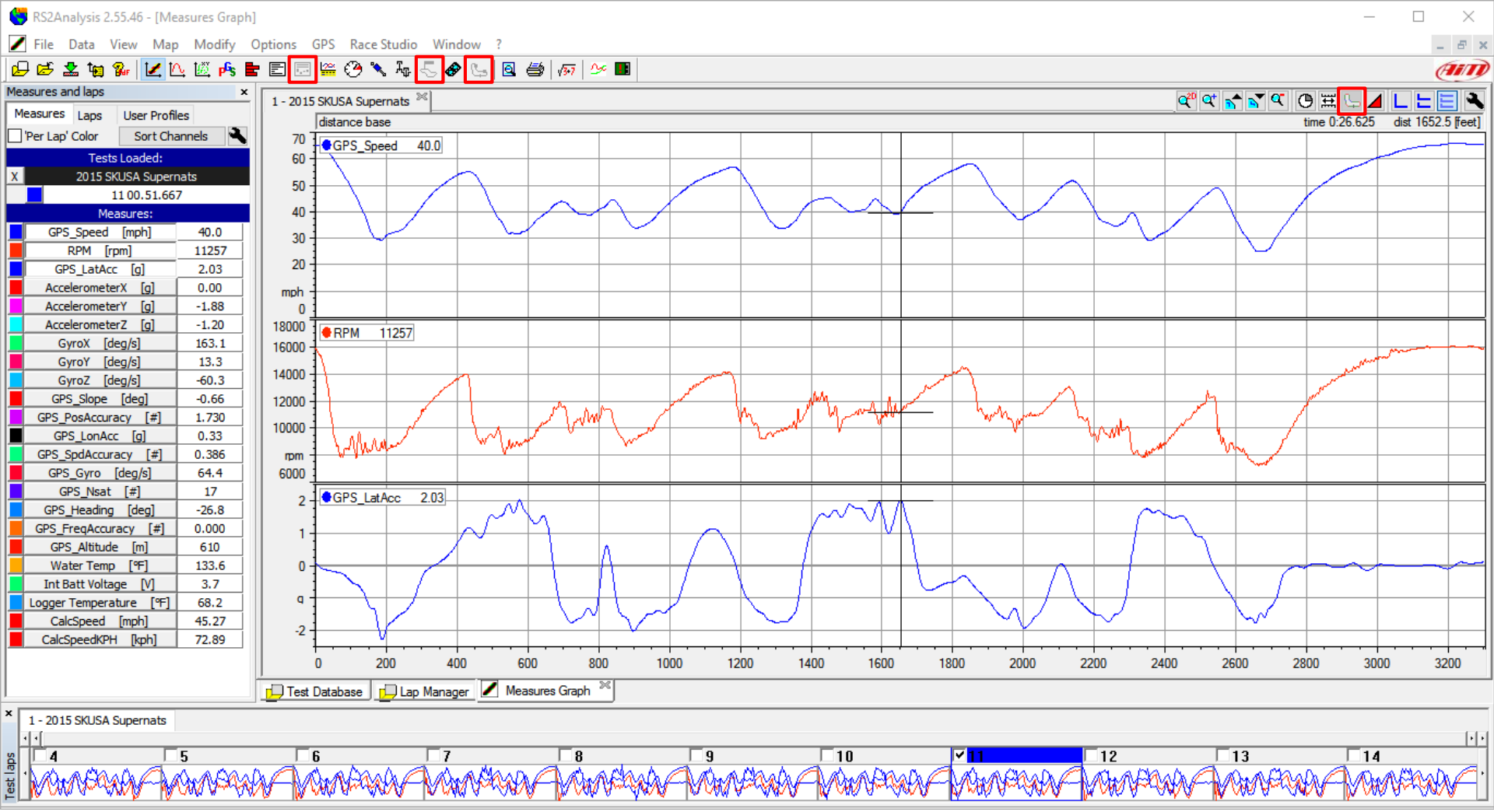
Race Studio 2 Creates two Different Types of 'Track Maps'. Both Have Value for Your Data Analysis. Here are the Differences and Where you Will use Them Both.

- 'Standard' Track Map
  - Generated by the Roll Out Distance and Lateral Acceleration Values
  - Used in the Split Report, Track Report, and Lap Replay Functions
  - Just for General Track Location, not the Actual Driven Line

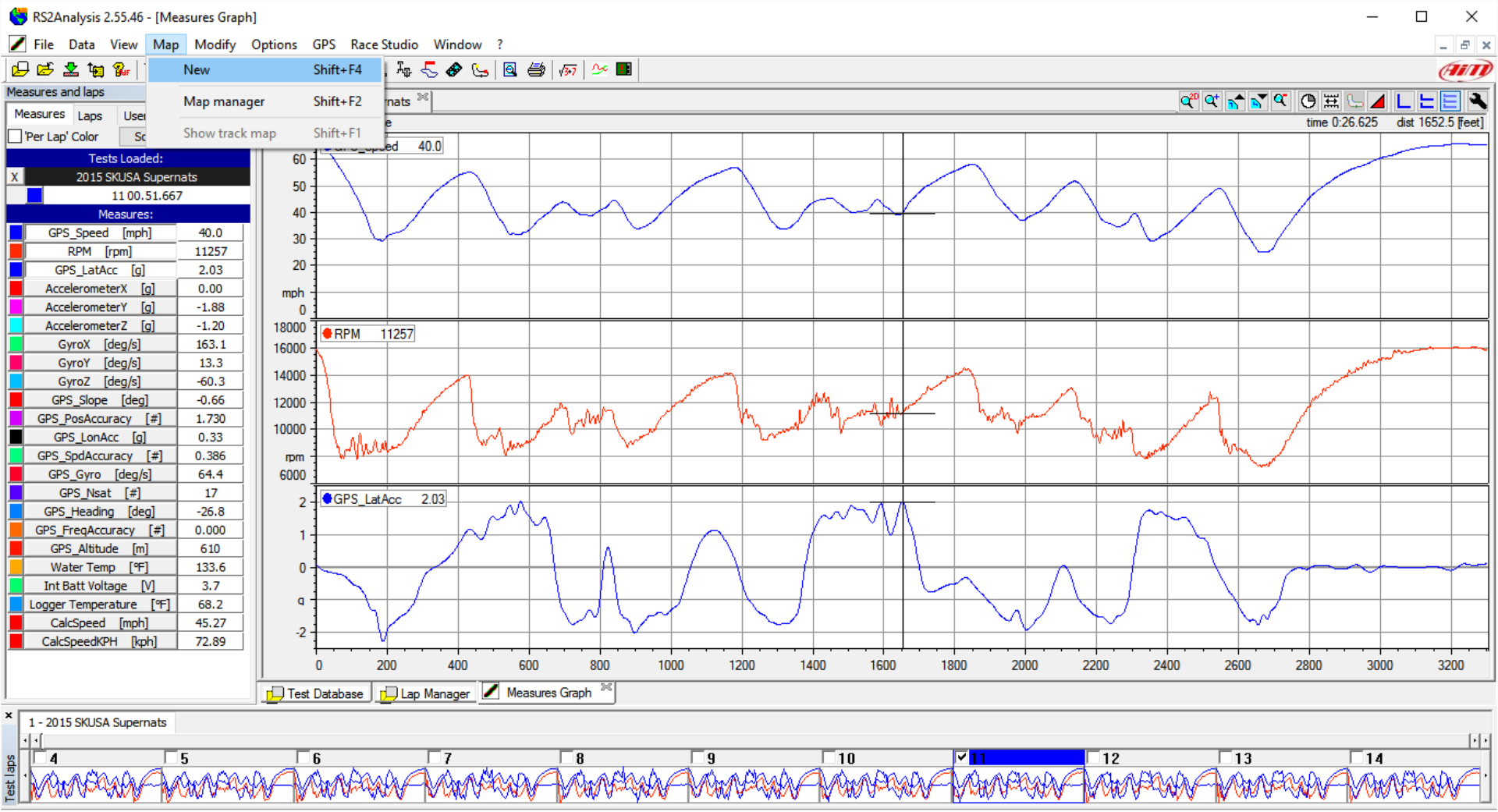


- GPS 'Driven Line' Track Map
  - Generated by the GPS Sensor
  - Actual Driven Line
  - Can be Colorized Based on any Channel

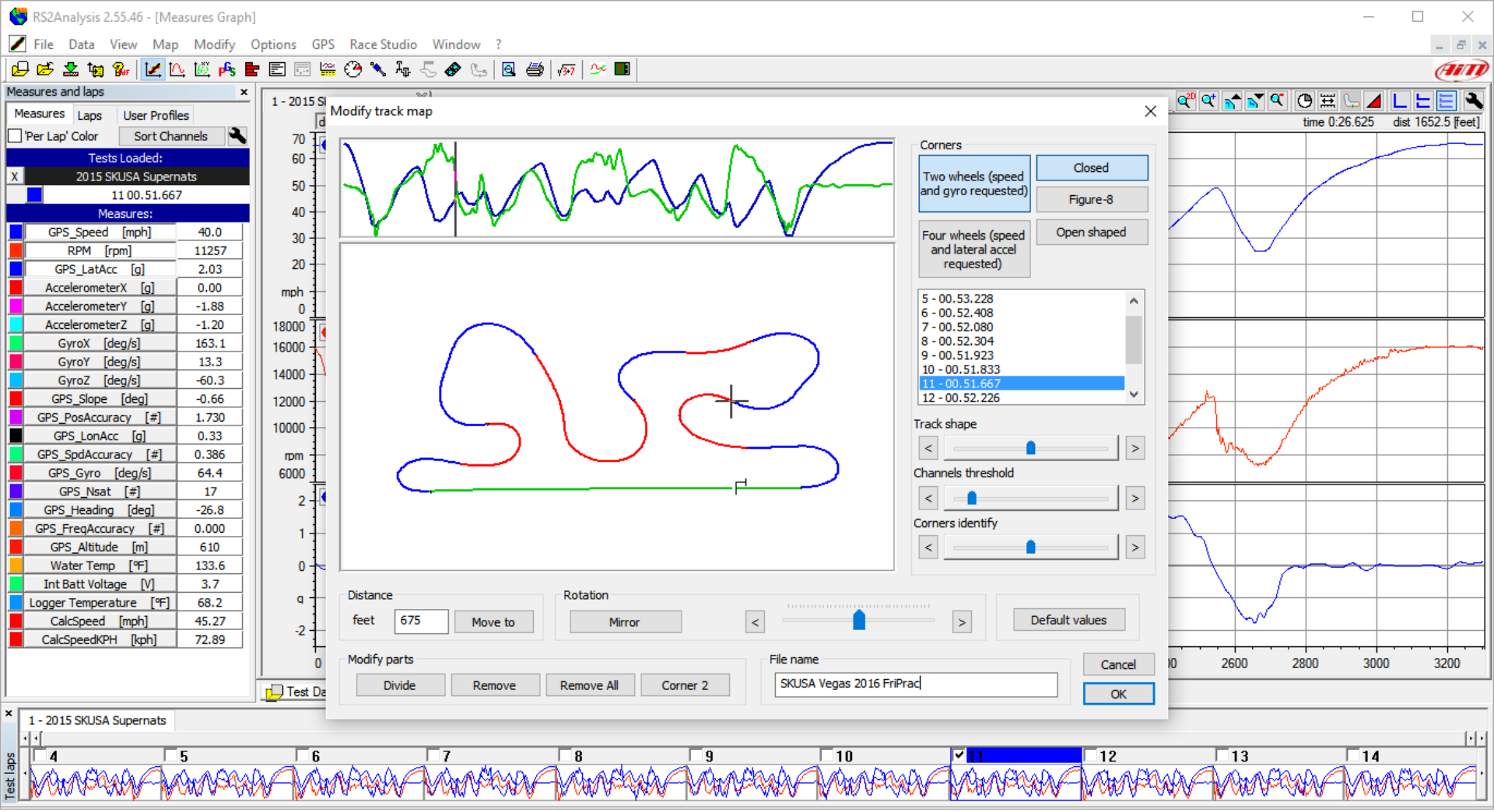




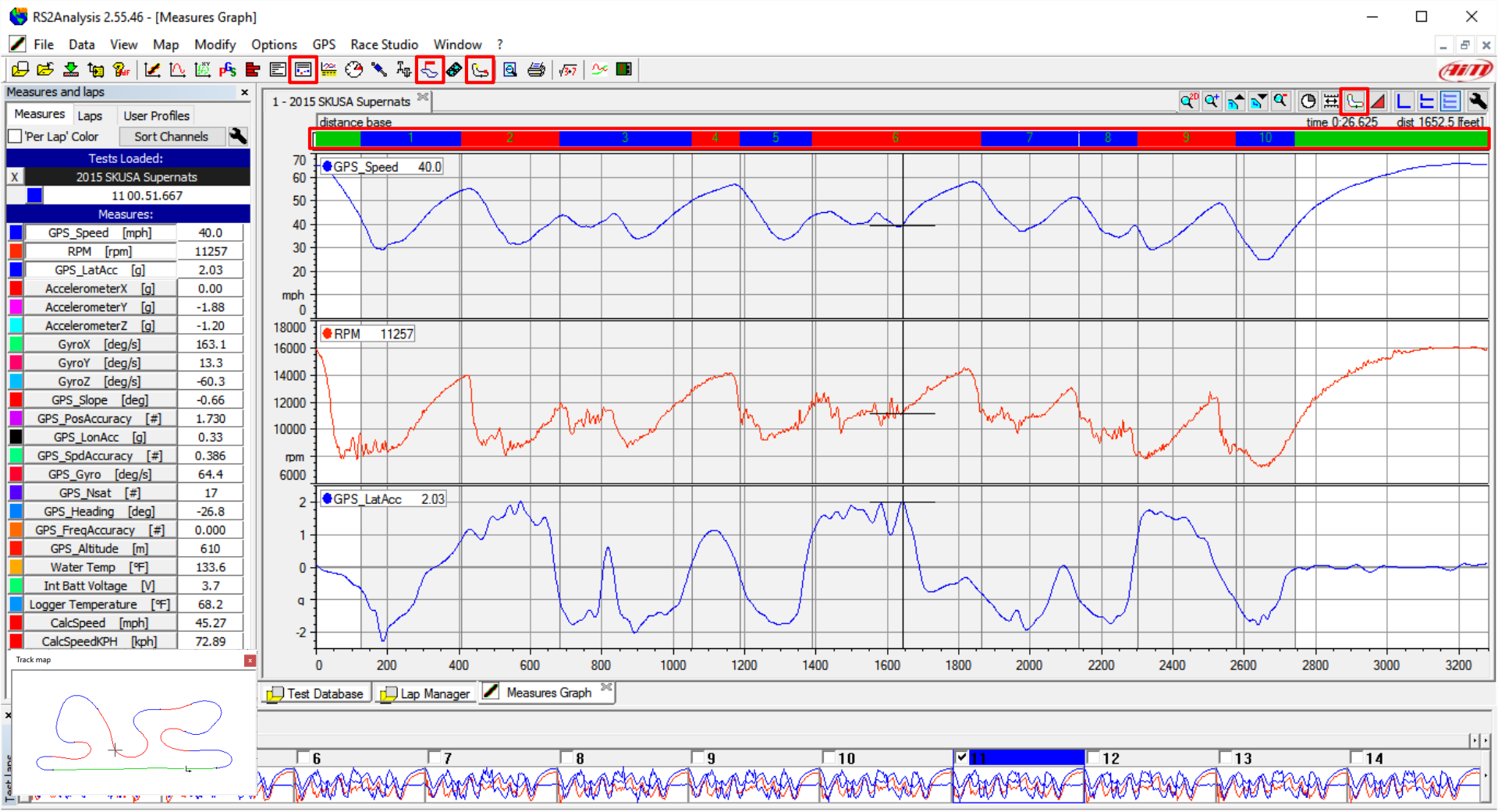
Track Maps, are required for several different functions in the Race Studio 2 Analysis software, these are: Split Report, Track Report, and Lap Replay functions. Prior to creating a Track Map, these function icons plus the Track Map icon are not active.



To generate an AiM Sports Race Studio 2 Track Map, select the Map pull-down menu and then the New command.



The Modify Track Map dialog box will appear. Typically it will display your best lap time, however you can select any of your laps. You have options to modify the default settings; track shape, channels threshold, corners identify, and rotation. When you have the map the way you want it, input a file name and click on the OK button. This now becomes the default Track Map for this test.



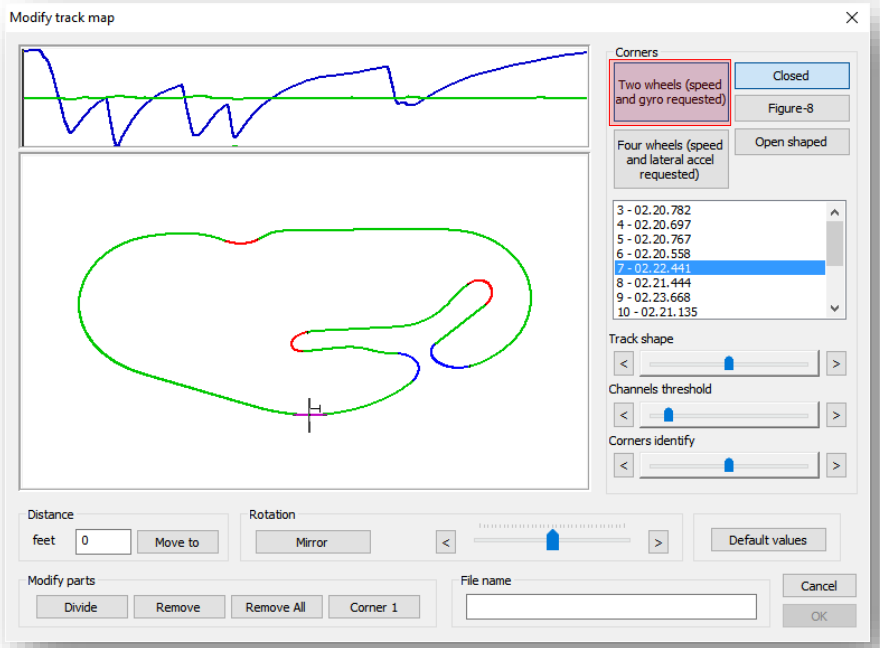
After creating or attaching an existing Track Map, you now see the track segments across the top and the function icons that were not active before (Split Report, Track Report, and Lap Replay functions) are now active.

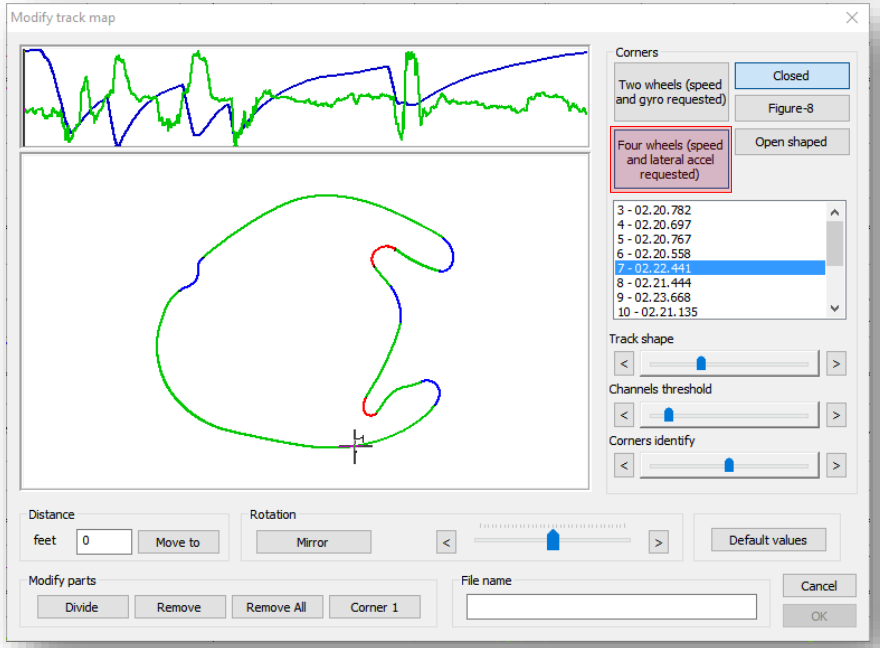
Track Map Differences

Race Studio 2 can use two different methods to calculate the track map corners and straights.

'Two Wheels' (speed and gyro) uses your GPS data (if included)

'Four Wheels' (speed and lateral accelerometer) does not.





Using the same lap from the high banked corners of Daytona, standard track maps can be difficult to accurately create with so much banking in the corners, the data logger 'sees' much less lateral acceleration than it would normally take to turn as much as the car is doing there. Using the 'Two Wheels' corners selection forces the software to use the GPS data (if included) and gives much more accurate standard track maps.

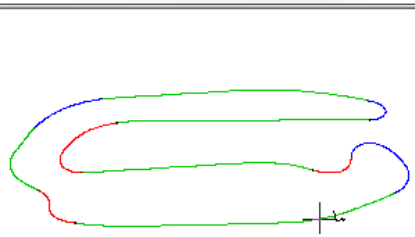
RS2Analysis 2.55.05F - User Profile: AiM Vehicle Health - [Split report]

File Data View Map Modify Options GPS Race Studio 2 Window ?

1 - Homestead Sun Final

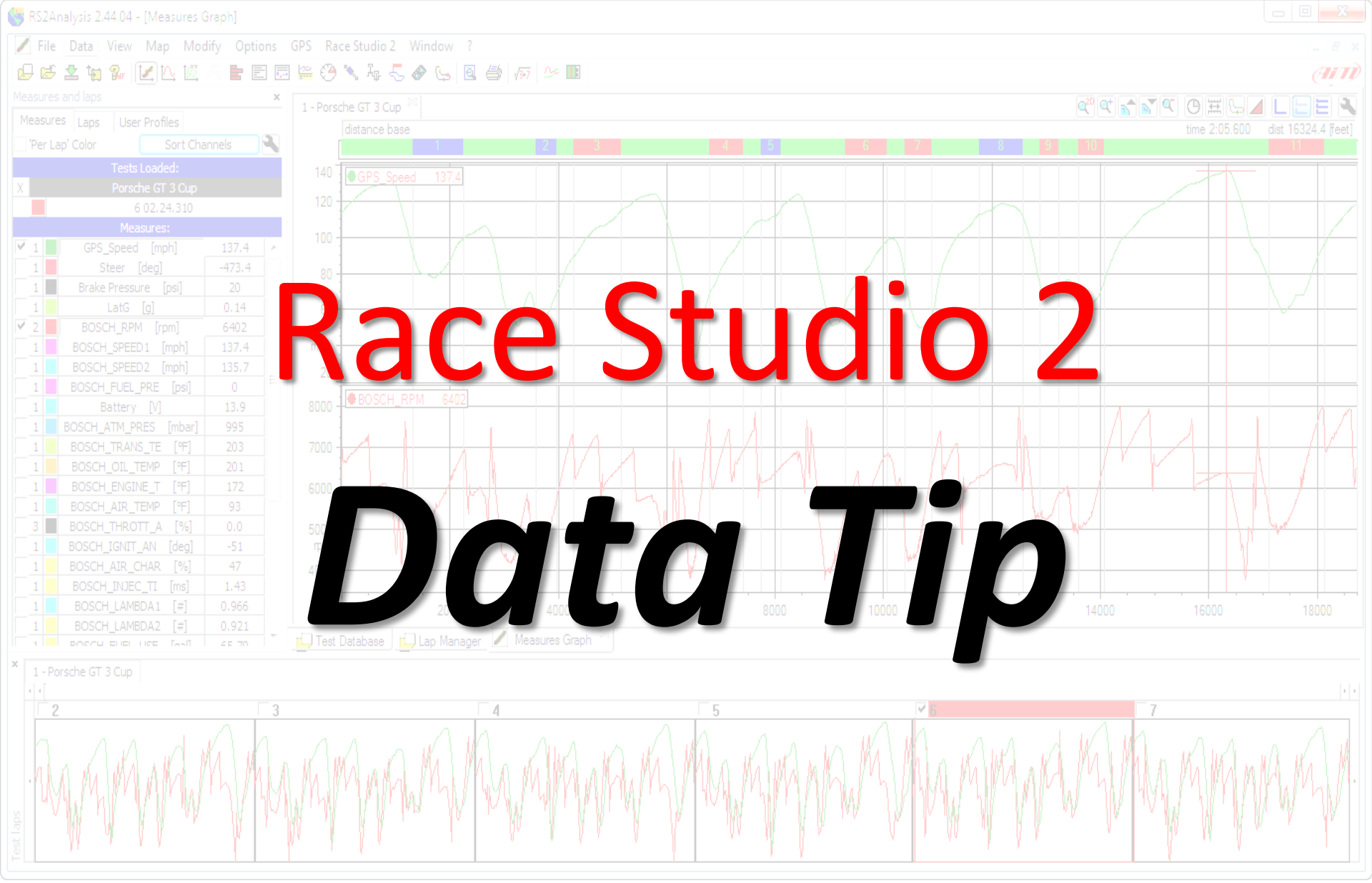
			1	2	3	4	5	6				
		histo	histo	histo	histo	histo	histo	histo	histo	histo	histo	histo	histo
Absolute split times													
Homestead Sun F	run 3 lap 3	3.506	11.371	4.867	12.100	8.976	11.871	5.315	12.860	3.566	7.116	5.951	12.044	01.39.545
Homestead Sun F	run 3 lap 4	3.389	10.703	4.824	12.331	8.854	12.054	5.103	12.817	3.520	7.052	5.912	12.096	01.38.656
Homestead Sun F	run 3 lap 5	3.297	10.700	4.781	12.263	8.861	11.931	5.214	12.827	3.484	7.074	6.031	12.159	01.38.622
Homestead Sun I	run 3 lap 6	3.271	10.757	4.762	12.259	8.891	11.956	5.221	12.793	3.497	7.028	5.998	12.091	01.38.524
Homestead Sun F	run 3 lap 7	3.247	10.916	4.792	12.250	8.959	11.973	5.343	12.830	3.502	7.116	6.051	12.135	01.39.114
Homestead Sun F	run 3 lap 8	3.247	10.931	4.794	12.255	8.980	12.032	5.253	12.782	3.524	7.179	5.988	12.134	01.39.100
Homestead Sun F	run 3 lap 9	3.265	10.851	4.858	12.360	8.918	11.958	5.263	12.771	3.577	7.373	5.898	12.305	01.39.397
Homestead Sun F	run 3 lap 10	3.243	10.837	4.787	12.318	8.950	11.921	5.162	12.852	3.485	7.139	6.065	12.151	01.38.911
Homestead Sun F	run 3 lap 11	3.296	10.841	4.938	12.409	8.934	11.968	5.283	12.906	3.507	7.152	5.955	12.249	01.39.439
Homestead Sun F	run 3 lap 12	3.278	10.849	4.833	12.321	8.949	11.965	5.279	12.872	3.506	7.162	5.973	12.206	01.39.194
Homestead Sun F	run 3 lap 13	3.239	11.164	4.837	12.537	9.073	11.943	5.253	12.952	3.557	7.058	6.084	12.332	01.40.029
Homestead Sun F	run 3 lap 14	3.297	10.845	4.924	12.271	8.984	12.044	5.359	12.930	3.506	7.193	6.032	12.146	01.39.532
Homestead Sun F	run 3 lap 15	3.296	10.932	4.901	12.556	9.030	12.163	5.171	13.081	3.554	7.301	6.035	12.211	01.40.233
Homestead Sun F	run 3 lap 16	3.309	10.933	4.871	12.379	9.029	12.015	5.349	12.910	3.507	7.163	6.081	12.176	01.39.722
Homestead Sun F	run 3 lap 17	3.307	10.942	4.876	12.400	9.119	11.968	5.354	12.927	3.542	7.135	6.105	12.129	01.39.804
Homestead Sun F	run 3 lap 18	3.277	11.107	4.935	12.401	9.160	11.954	5.263	13.008	3.528	7.195	6.117	12.272	01.40.216
Homestead Sun F	run 3 lap 19	3.308	11.035	4.947	12.384	8.979	12.109	5.298	12.900	3.536	7.146	6.124	12.227	01.39.992
minimum value		3.239	10.700	4.762	12.100	8.854	11.871	5.103	12.771	3.484	7.028	5.898	12.044	
maximum value		3.506	11.371	4.947	12.556	9.160	12.163	5.359	13.081	3.577	7.373	6.124	12.332	
average value		3.298	10.924	4.855	12.341	8.979	11.990	5.264	12.883	3.523	7.152	6.024	12.180	
std deviation		0.064	0.170	0.060	0.110	0.084	0.072	0.073	0.082	0.028	0.086	0.070	0.078	
Theoretical best lap														
Homestead Sun I	best	3.239	10.700	4.762	12.100	8.854	11.871	5.103	12.771	3.484	7.028	5.898	12.044	01.37.855
Best rolling lap														
Homestead Sun F	run 3 lap 4							5.103	12.817	3.520	7.052	5.912	12.096	
Homestead Sun F	run 3 lap 5	3.297	10.700	4.781	12.263	8.861	11.931							01.38.333
Split time differences from best lap within test														
Homestead Sun F	run 3 lap 3	0.236	0.614	0.105	-0.159	0.085	-0.085	0.094	0.068	0.069	0.088	-0.047	-0.047	00.01.021

Track map



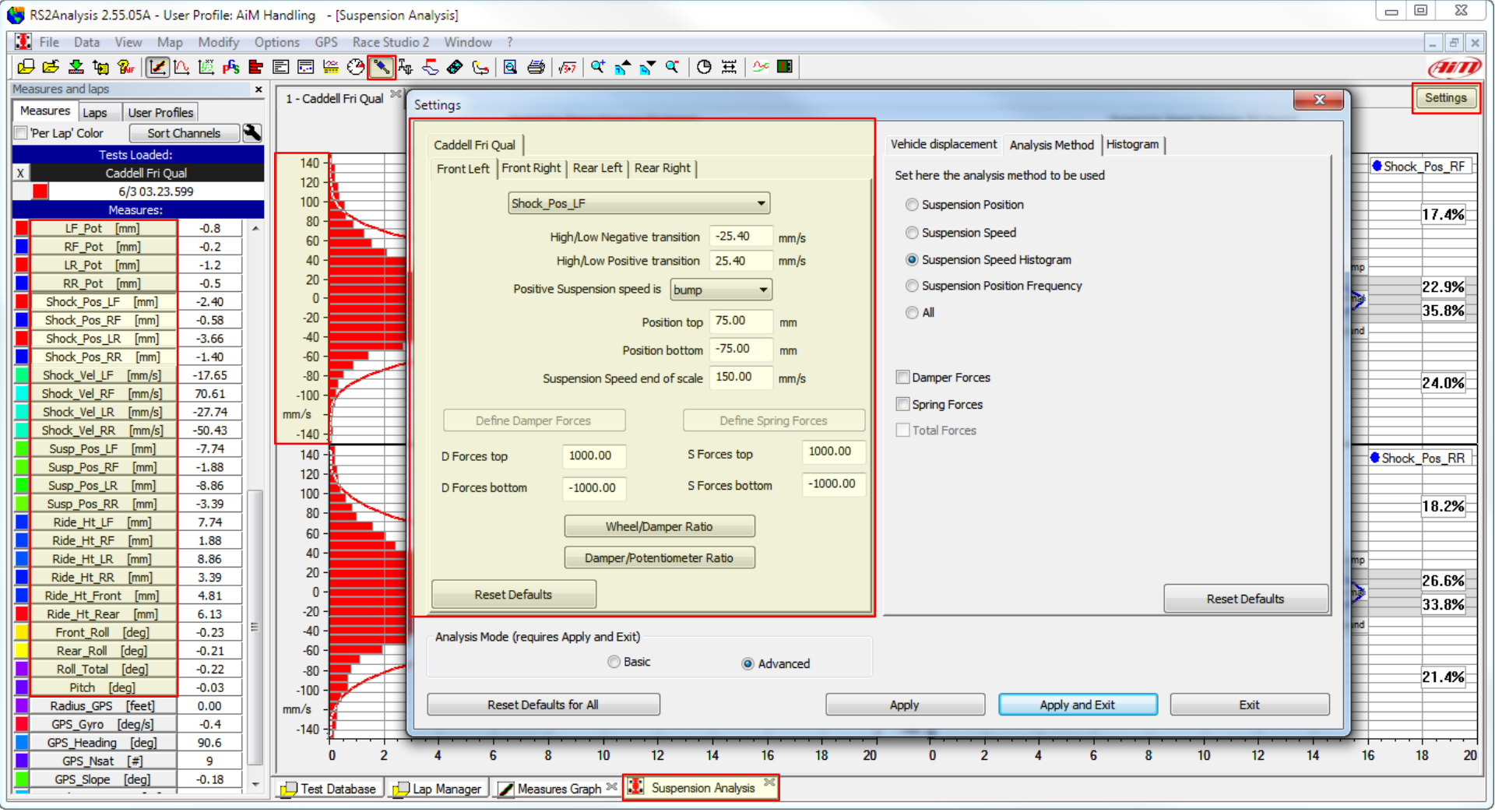
Test Database | Lap Manager | Split report

Split Reports are a very valuable tool. They calculate segment times for each lap based on the segments of the active track map. Also provided are the "Best Rolling Lap" and the "Theoretical Best Lap". The blue segment times are the best times in that segment for the entire test.
Pay attention to the "Std Deviation" value 0.0 to 0.1 is the goal, the lower the better.

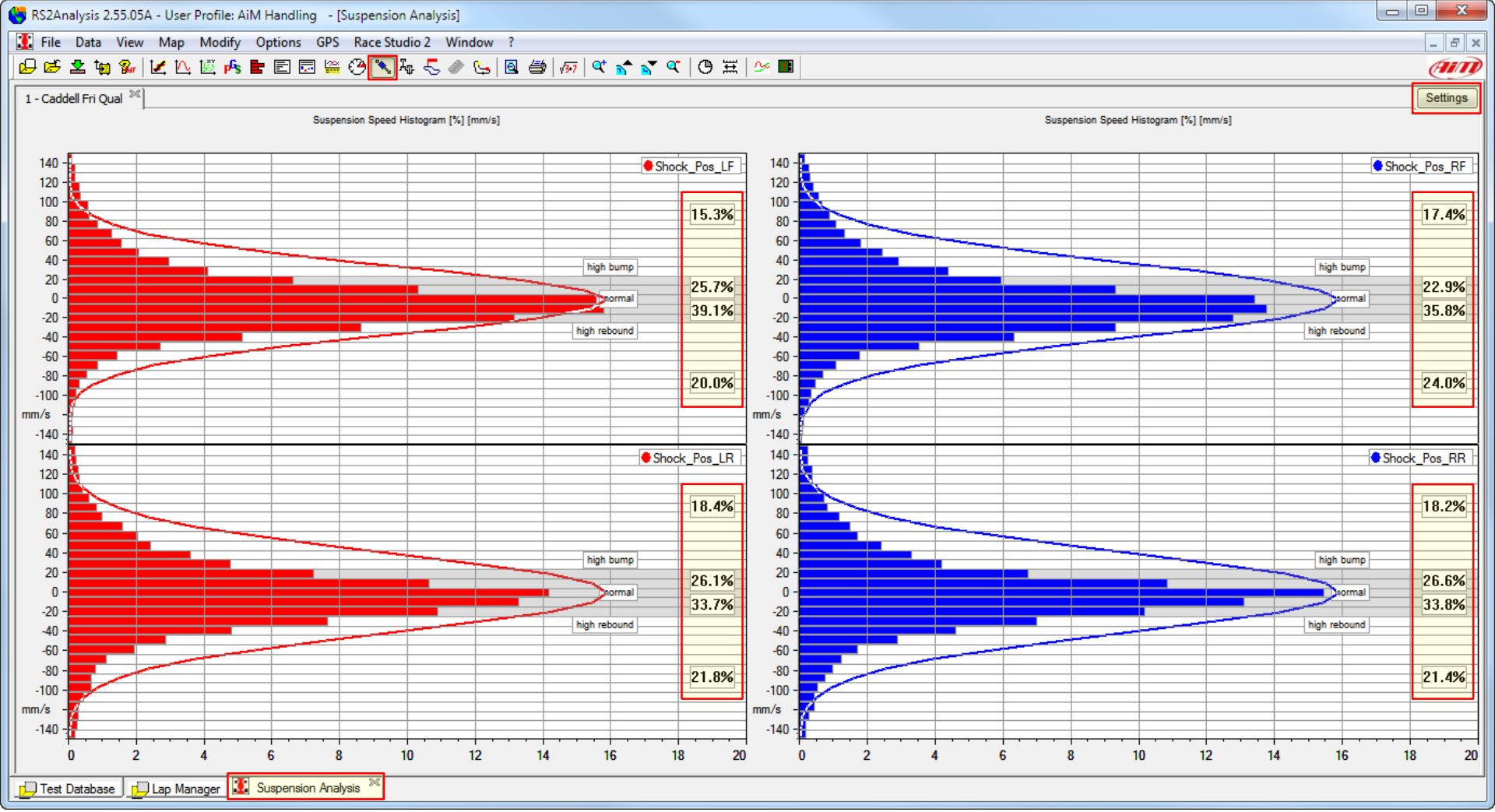


Race Studio 2

Data Tip



Suspension Analysis is a powerful tool that displays the suspension data in a way to easily allow you to adjust the shock settings for optimum grip. First like most other functions, we must open the settings panel and set up the function.



Suspension Analysis is a powerful tool that displays the suspension data in a way to easily allow you to adjust the shock settings for optimum grip. The group calculations and shape of the histograms are the main tools.

- Data is great… but you still need to understand and interpret the data correctly

- Always look for trends… never make a decision based on one section of one lap

- There is not a button that tells you what shocks or springs to run or where to set the tire pressures

- YOU are still in charge

- YOU still make all of the decisions, just with more accurate information and data

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May 2018