



Seminar Series

Bringing Data Support and Training to You

Advanced Data Analysis

for Automotive Racers & Enthusiasts

May 2018



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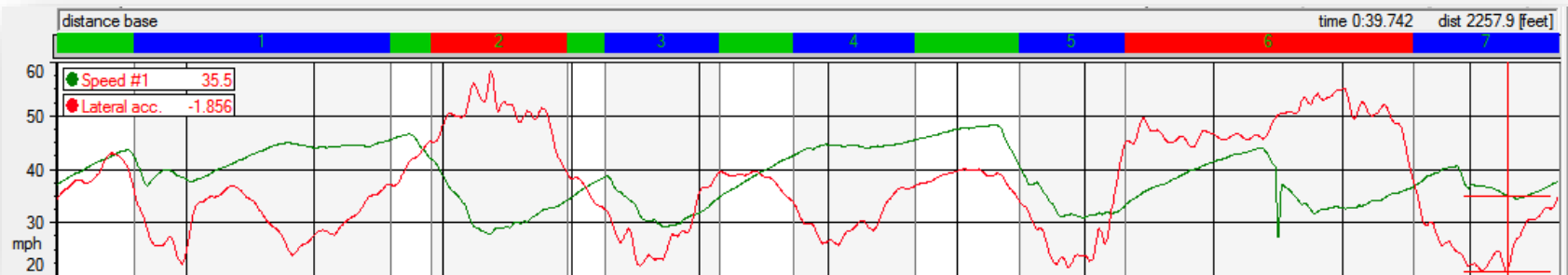
1.800.718.9090

- 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



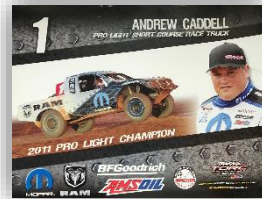


- My Father Started Racing in the '50's
- I Started Racing Off Road Racing in 1976
- I Started Driving in 1977
- Raced Desert and Short Course
- Last Race in Sept of 1996 – Crandon, WI
- No Gauges!!



All Spec Series/Classes

All With Data Systems



2010 - Current



1998



2002



2008



2007



2006



2004

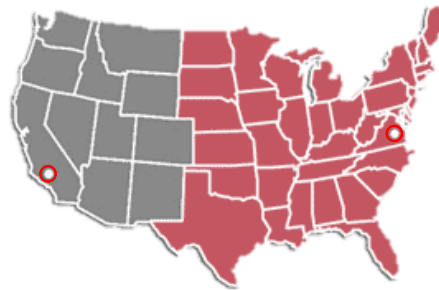


- **AiM Sports, LLC**

- 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

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Fax: 951.674.5699



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Tel: 540.342.9680
Fax: 540.342.9682

Toll Free: 1.800.718.9090
www.aimsports.com

Customer Support

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

Look for us at a track near you!



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Customer Support

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

Name	Date modified	Type	Size
AiM_Auto_Install_Templates	4/5/2018 5:32 PM	File folder	
AiM_Auto_Pinouts	4/5/2018 5:32 PM	File folder	
AiM_Auto_Sample_Data	4/5/2018 5:32 PM	File folder	
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	
AiM_Karting_Sample_Data	4/5/2018 5:32 PM	File folder	
AiM_Karting_Tech_Datasheets	4/5/2018 5:32 PM	File folder	
AiM_Karting_Tech_Pinouts	4/5/2018 5:32 PM	File folder	
AiM_Karting_User_Manuals	4/5/2018 5:32 PM	File folder	
AiM_LearnFast_Guides	4/5/2018 5:32 PM	File folder	
AiM_LearnFast_Presentations	4/5/2018 5:24 PM	File folder	
AiM_LearnFast_User_Profile	4/5/2018 5:32 PM	File folder	
AiM_Math_Channels	4/5/2018 5:32 PM	File folder	
AiM_OnTrack_Session_Documents	4/5/2018 5:32 PM	File folder	
AiM_Soft_Firmware	4/5/2018 5:32 PM	File folder	
2016_AiM_Seminar_BrownBook.pdf	2/5/2016 8:14 PM	Adobe Acrobat Document	78 KB
2016_AiM_Seminar_HPAcademy.pdf	2/4/2016 5:42 PM	Adobe Acrobat Document	211 KB
2016_AiM_Seminar_KnoxBook.pdf	11/23/2014 2:32 AM	Adobe Acrobat Document	70 KB
2017_AiM_Webinar_Auto-Ware_Block.pdf	2/17/2017 4:14 PM	Adobe Acrobat Document	1,269 KB
2018 AiM Racing Guide.pdf	1/17/2018 2:05 PM	Adobe Acrobat Document	11,164 KB
Data Sampling Rates.pdf	4/4/2018 6:30 PM	Adobe Acrobat Document	44 KB
IP_Rating_Info.pdf	2/3/2017 1:10 PM	Adobe Acrobat Document	212 KB
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!

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Additional Materials

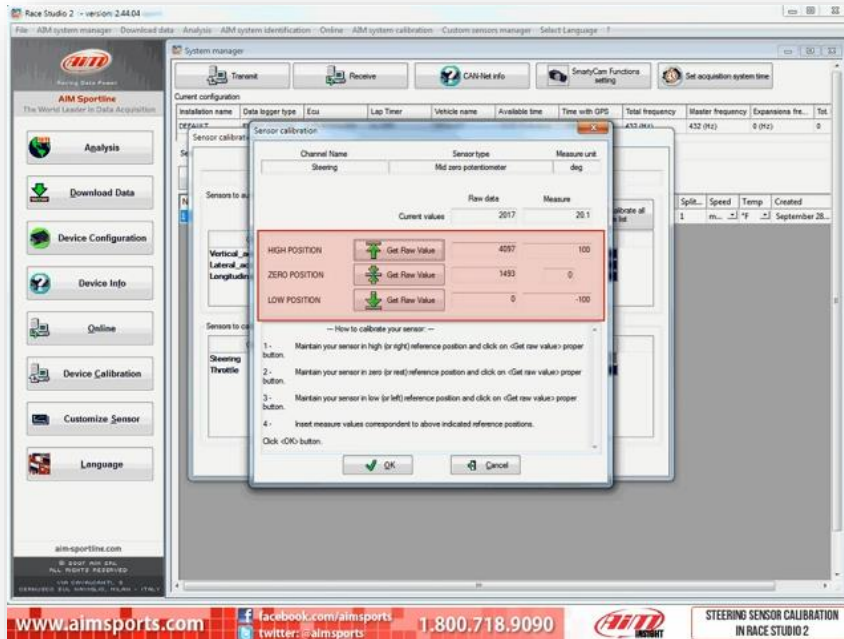
AiM Sports USB Drive



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



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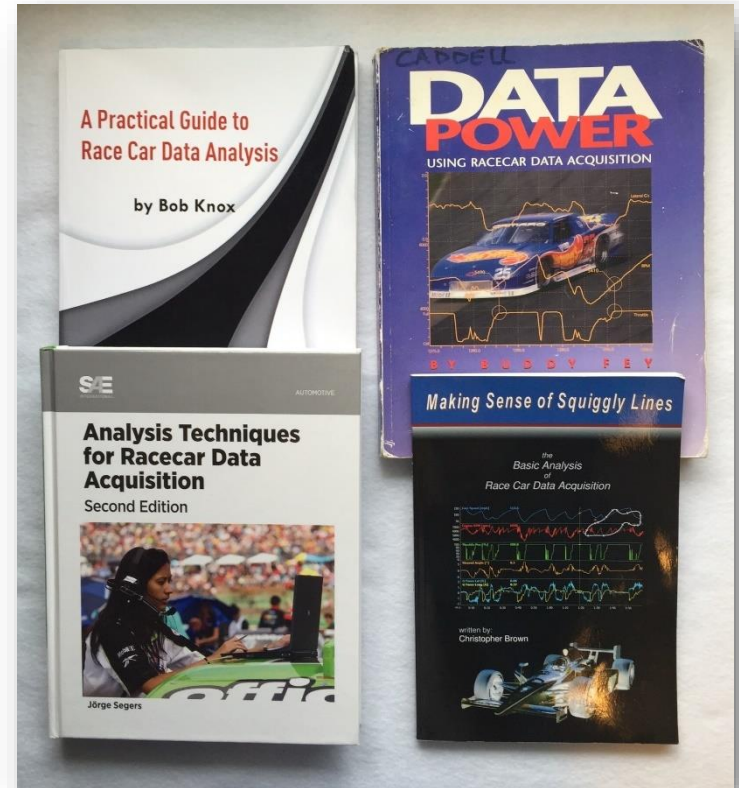
Additional Materials

LearnFast™ E-Training Video



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)

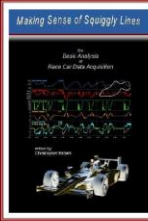


Just a few, many are available!

Additional Material Discounts

Making Sense of Squiggly Lines Chris Brown

"I must say that this is the Buddy Fey replacement that we've been waiting for!"
- Colin Harner, owner of Creative Motorsport



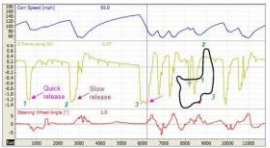
Making Sense of Squiggly Lines
Data points are just words, but when connected with a squiggly line they tell a story...

Starting with the basic channels of data, this book shows the reader how to extract information out of those squiggly lines seen in a graph. It discusses in great detail the following channels of information: Speed, Engine RPM, Throttle Position, Gear, G Force and Steering.

This book contains 144 pages with 166 figures and 15 tables.

The information discussed in the book is relevant to every data logger and is not brand specific. The book concentrates on interpreting the data and is more geared towards driver development than it is for chassis development.

"A very approachable tome that focuses on driver engineering through the intelligent use of data. Chris' explanations are wonderful and the premise of the book (as indicated by the title) is well executed. Probably the best single book for learning what to look at first for the Club and Track Day driver. Highly recommended!"
- Peter Krause, professional driver and data coach



"One of the real gems is Chris' analysis and explanation of using G data for driver improvement in braking and the different phases of a corner."
- Mark Dalek.

Order your copy today,
at a **discounted price** for 2016 AIM Training Seminar attendees!
\$35 paperback, \$37 hardback

Just visit www.cb-racing.com/aim.html

You can contact the author directly at info@cb-racing.com

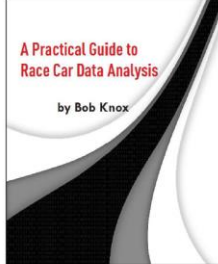
A Practical Guide to Race Car Data Analysis Bob Knox

SEMINAR SPECIAL!

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To receive this special price, go to www.createpace.com/3543378, add the book to your shopping cart, and enter this discount code: 8JDV8U9A.

Contact the author at bobknox@attglobal.net



Amazon reviews:


"Easy to read, simple to understand, immediate to apply. The topic isn't simple to explain, nonetheless the author has done a wonderful job taking the reader through all the main topics using as example the most common data logging softwares. You'll want to read it more than once and use it as a quick reference guide too."

"One of the best so far. Easy to read and a lot of questions answered and explained very clearly. Real life data, reasons, solutions, options, tips, etc..... Perfect for first timers, drivers or like me, technicians who run and prep cars on their own."

"I purchased this book on recommendation of a very successful and experienced race engineer. It is geared toward the beginner to somewhat experienced data analysis technician, but there is enough quality information to be useful to even experienced and professional data engineers. The book is well-illustrated and gives many clear, concise examples to improve understanding of concepts."

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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

Sales
505-890-8708

Fax: 505-890-5285
Tech help: 505-890-8708

email John@auto-ware.com

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Auto-Ware's WEB semINARs (webinars)

UPDATED We now have the Original Data Webinars and AdvancedData Webinars. Select the course below you wish to attend. After clicking the Purchase button below you will receive an acknowledgement email and we will follow up with the login info. Our virtual conference room is highly interactive with lots more features and it really is just like we are all sitting in one room looking at the same computer. Classes are limited to 8 people per class, so don't wait.

The Original Data Acquisition Webinars

NEXT SESSION STARTS June 4th. All sessions start 8pm Eastern - 7pm Central - 5pm Pacific unless other arrangements have been made.

How it works: Each class consisting of 5 sessions. Prior to each live session you will receive (via email) handouts to use for notes during the live session. Also, after each live session you will get a link to a recording of that session.

Data Acquisition session 1, the week of Jun 4th. Data displays; reading & understanding the different ways data can be displayed and placing different signals from the car in the display types.

Data Acquisition session 2, the week of Jun 11th. Working with data display appearances, manipulating and creating your own displays and creating typical pages/tabs/profiles for your own analysis.

Data Acquisition session 3, the week of Jun 18th. Tips and tricks prior to analyzing your data; math channels (understanding and creating). Understanding data quality, calibrating, sample rates, filtering & noise.

Data Acquisition session 4, the week of Jun 25th. Using your views to analyze and interpreting the data; first things first, lap/segment times, driver skill & performance and the secret tool of comparing drivers.

Data Acquisition session 5, the week of Jul 2nd. Part 2, Using your views to analyze and interpreting the data; steady state handling, transient handling, chassis platform movement, and shock absorber performance, tire loading and pre-failure diagnostics.

Note: You must have speakers to hear the seminar & high speed connection (DSL or cable, etc)

Your price only \$175.00 for all 5 sessions

Advanced Data Acquisition

NEXT SESSION STARTS June 5th. All sessions start 8pm Eastern - 7pm Central - 5pm Pacific unless other arrangements have been made.

Advanced DAQ session 1, Jun 5th. The secret to winning, Best Practices of using data acquisition, universal constants, quick check and targets, life cycle management, corner event management.

Advanced DAQ session 2, Jun 12th. Drivetrain like you've never seen before, health issues, gearing, driver input, and using a basic system as a rolling engine dyno.

Advanced DAQ session 3, Jun 19th. Tips and tricks for all things related to brakes, i.e. brake bias & predicting lockup, aggression, driver skill, total slowing, master cyl & pedal issues, caliper issues, all done with a basic system and 2 brake pressure sensors.

Advanced DAQ session 4, Jun 26th. A grab bag of goodies covering everything from dynamic load on tires, to measuring effective Anti-dive, to roll gradient comparisons, and using suspension frequencies to tune your suspension.

Advanced DAQ session 5, Jul 3. DRIVER, skills & development and conclude with aerodynamics.

Note: You must have speakers to hear the seminar & high speed connection (DSL or cable, etc)

You must take original webinar first. Only \$175.00 for all 5 sessions

[Buy Now](#)

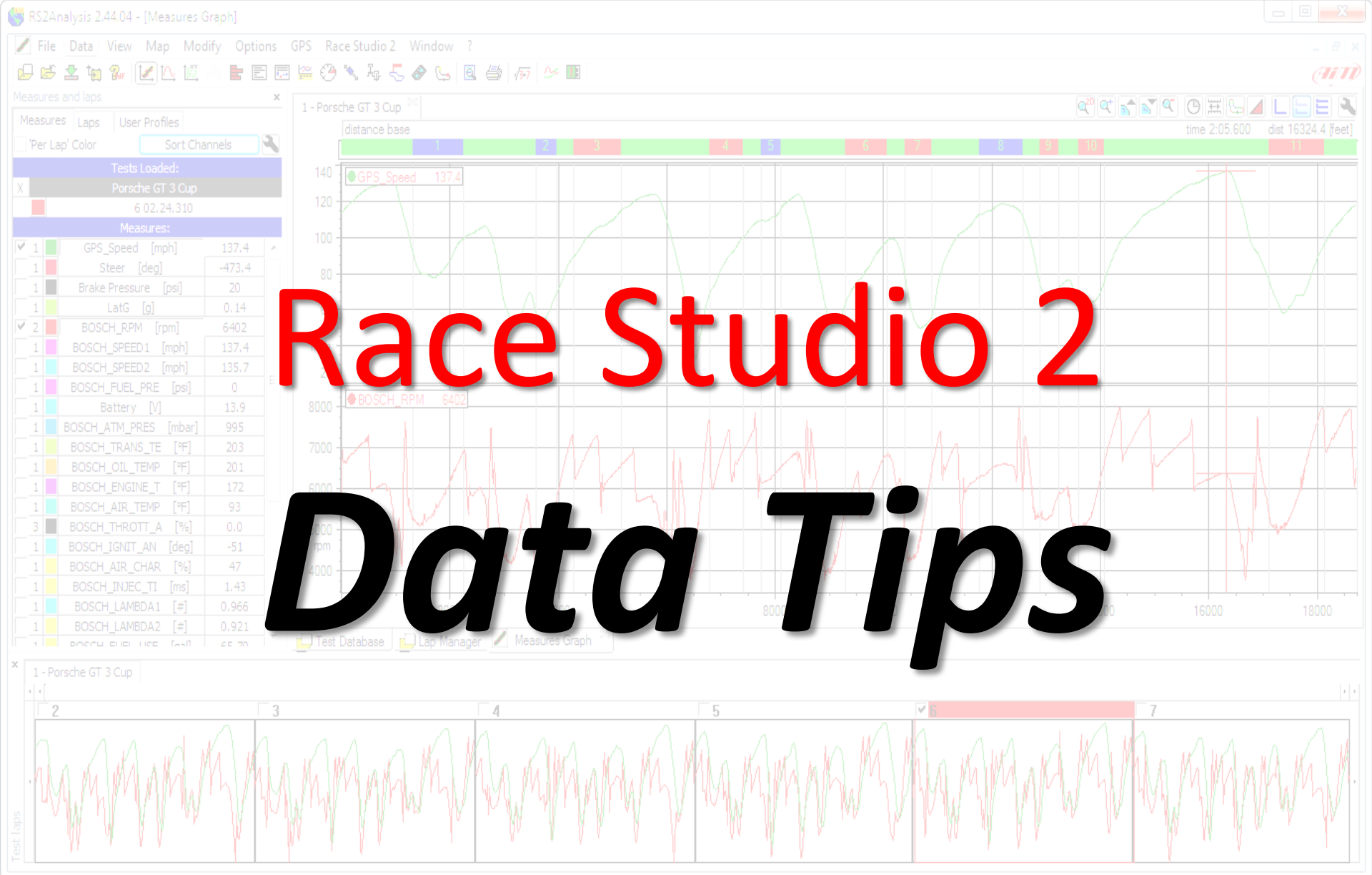
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Discounts

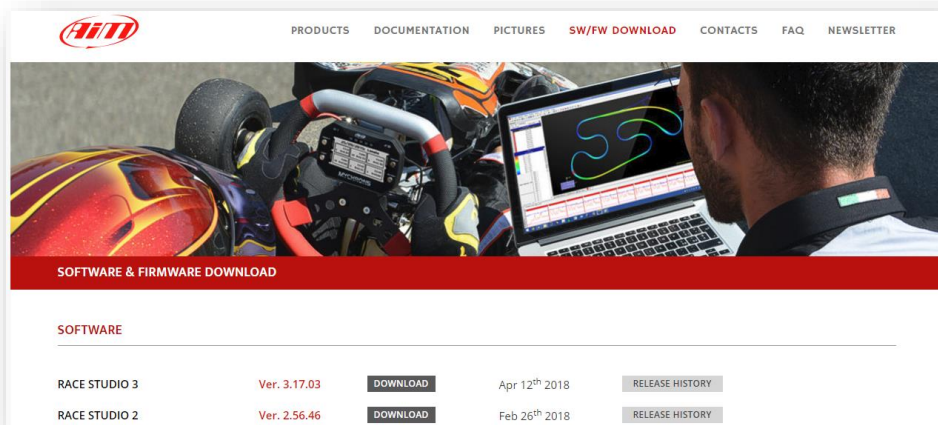




Race Studio 2

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

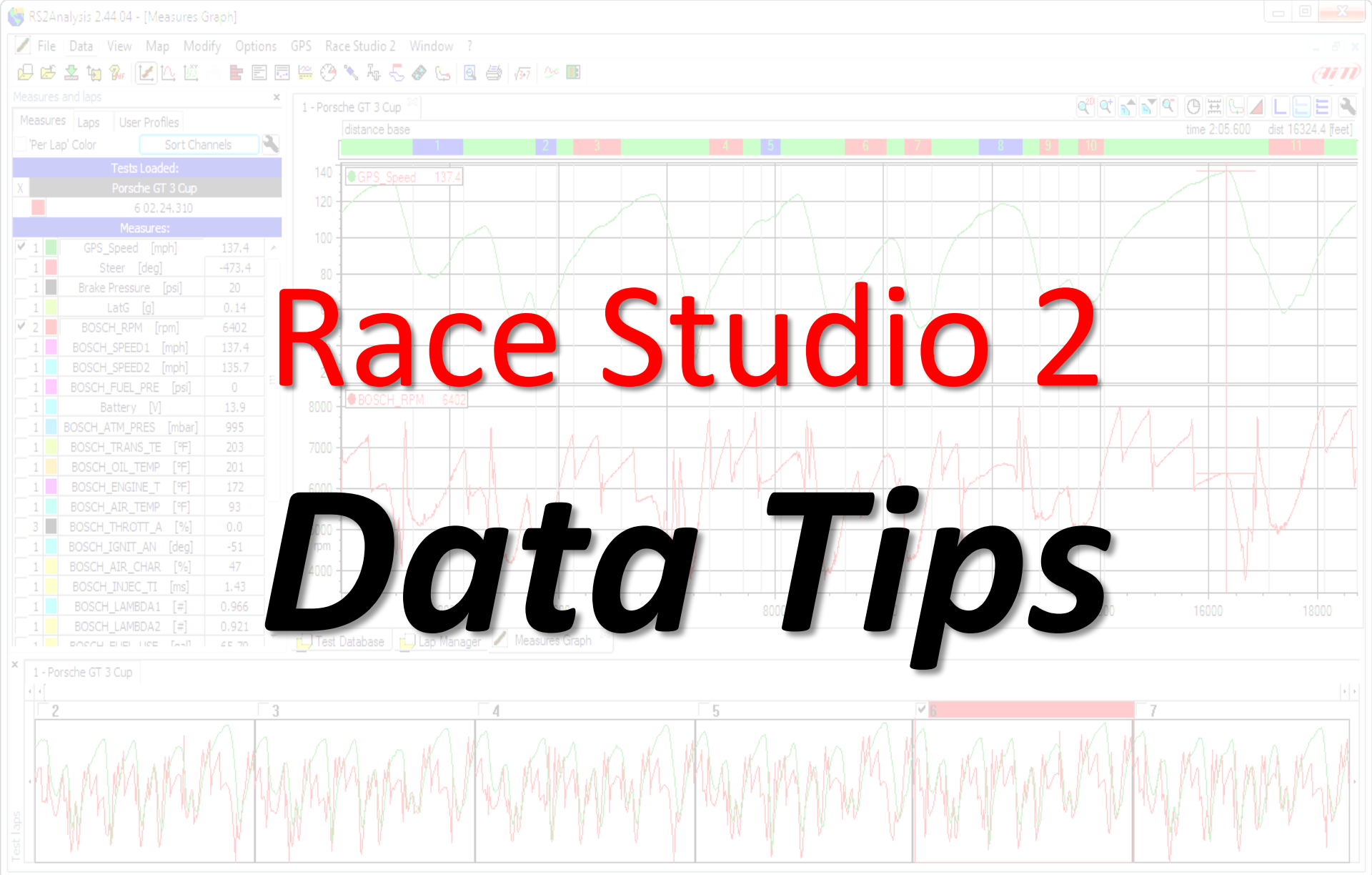
- SmartyCam HD 1.03.72 (12/04/17)

• 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

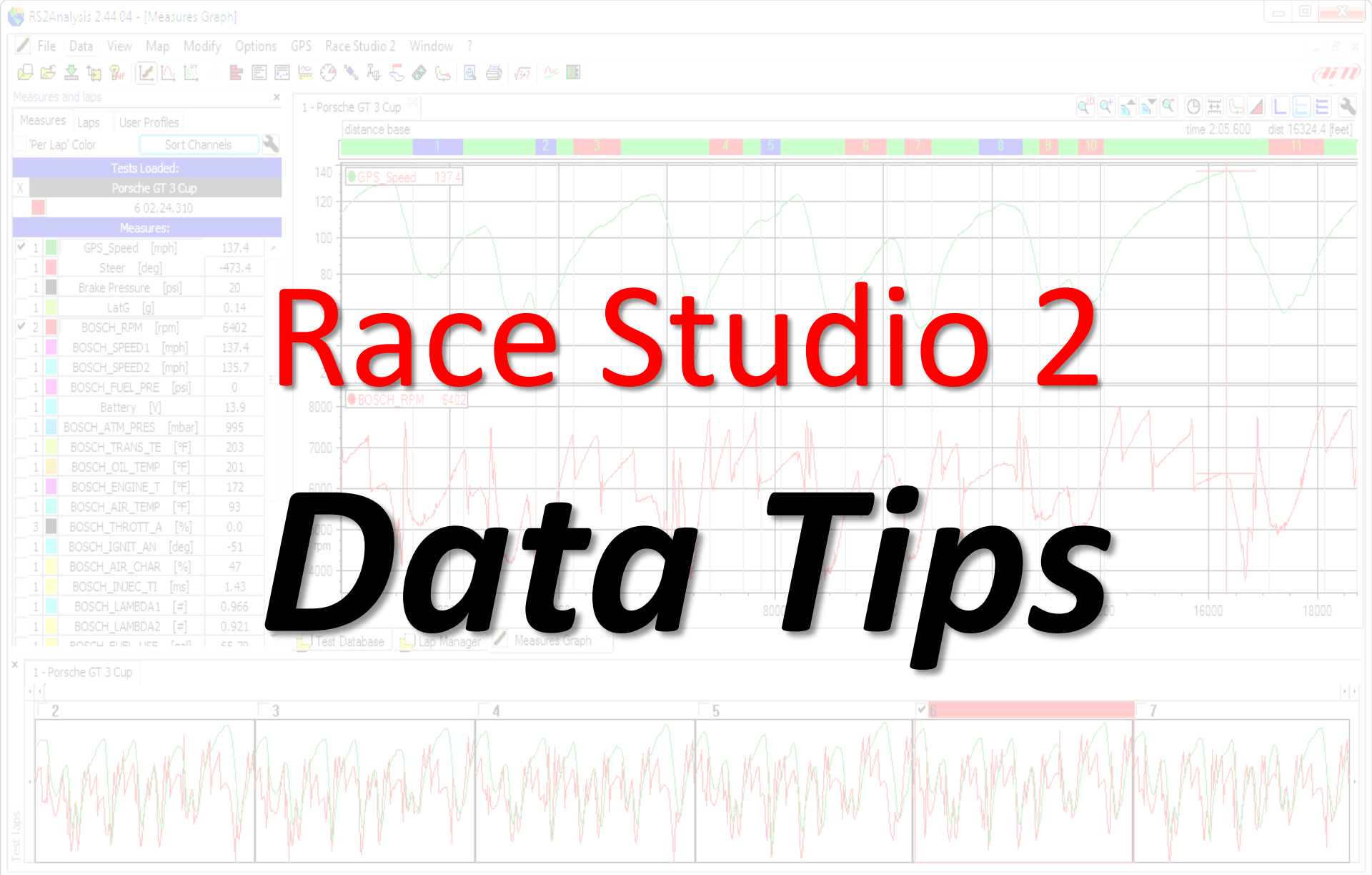


How to Use Data Acquisition

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

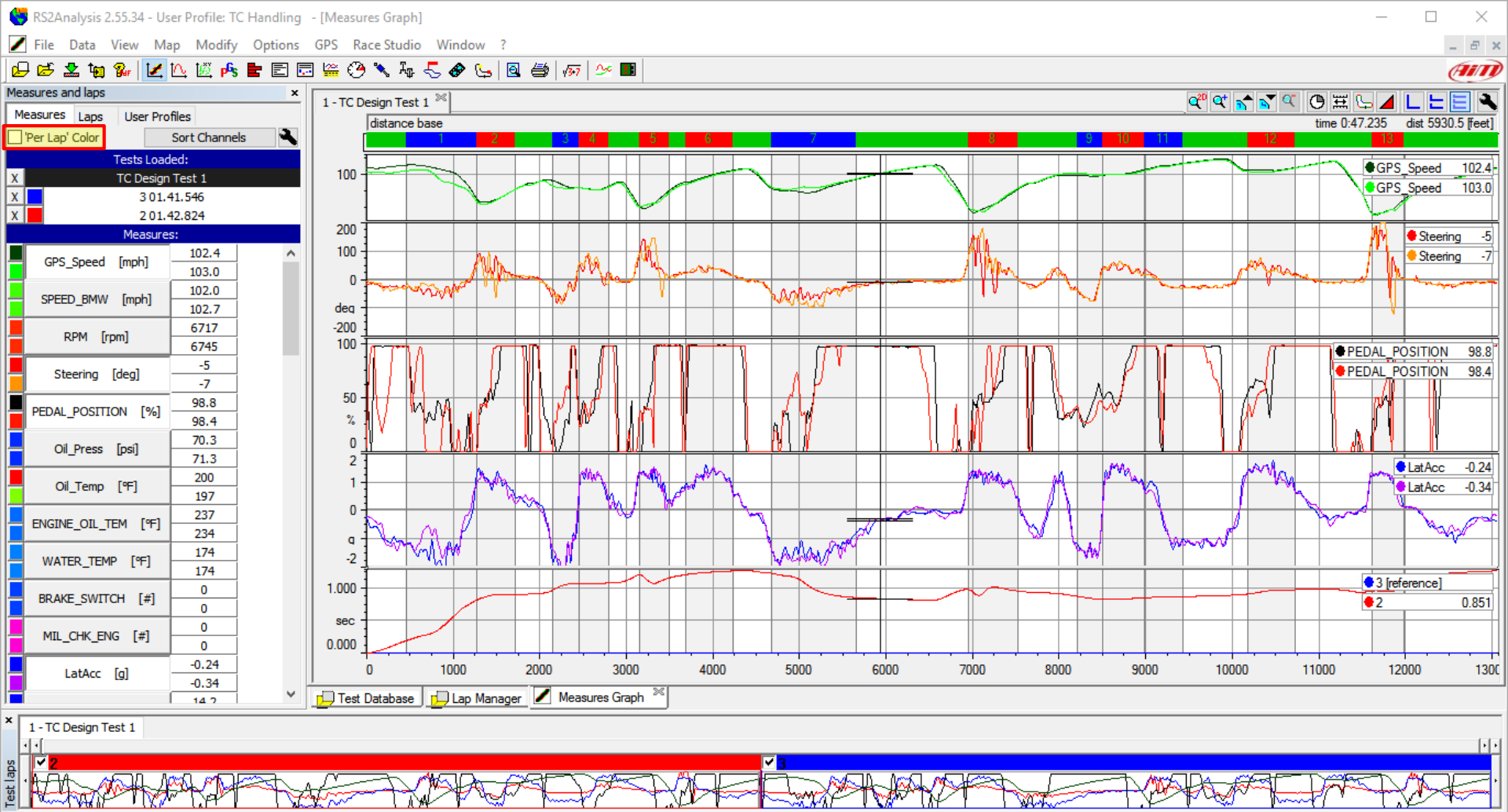
Data Tips

Tools You Need To Know

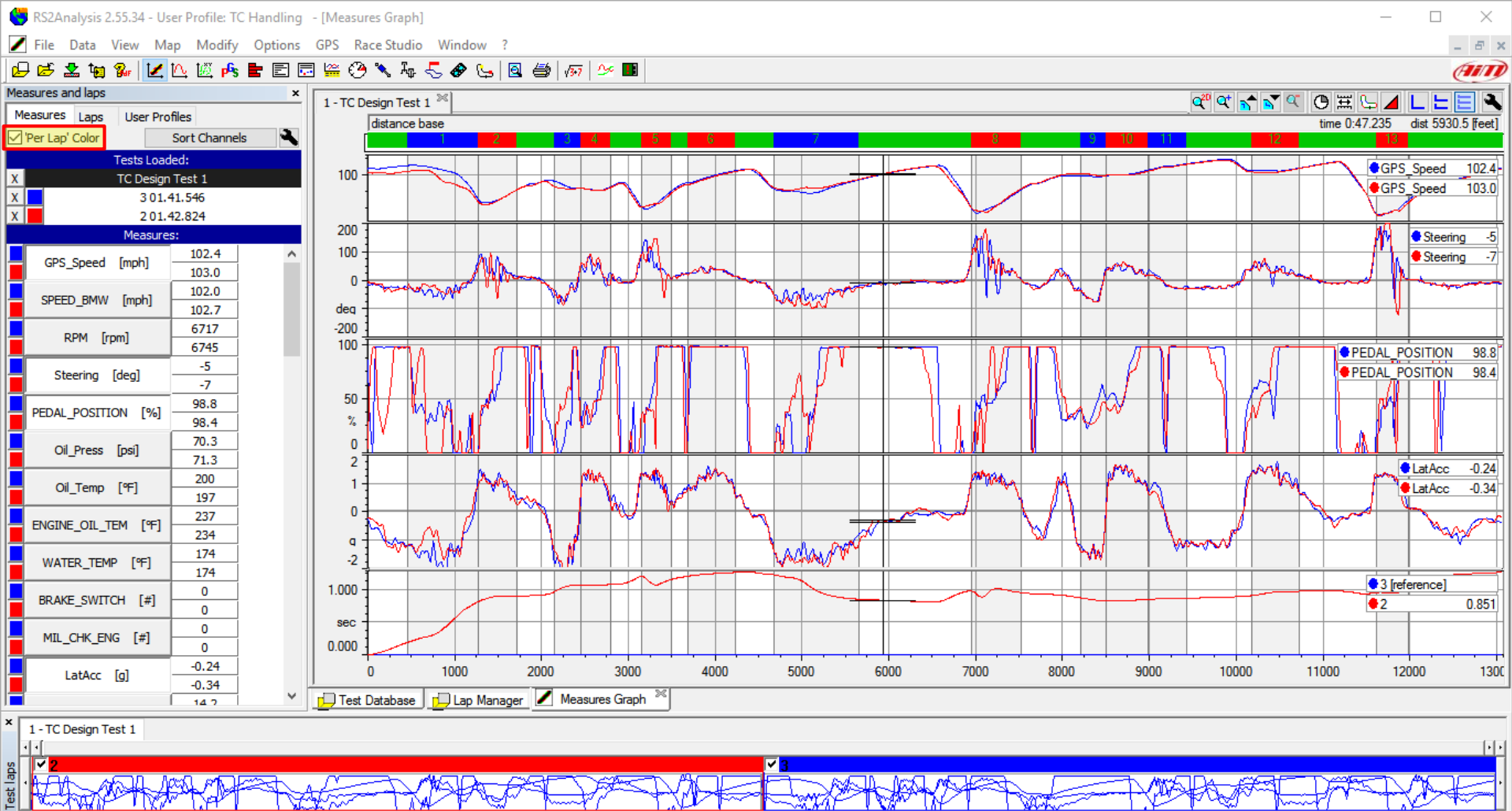
1 - Per Lap Color

1 - SatPrac4_Wetter															
	histq	histq	histq	histq	histq	histq	histq	histq	histq	histq	histq	histq			
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.

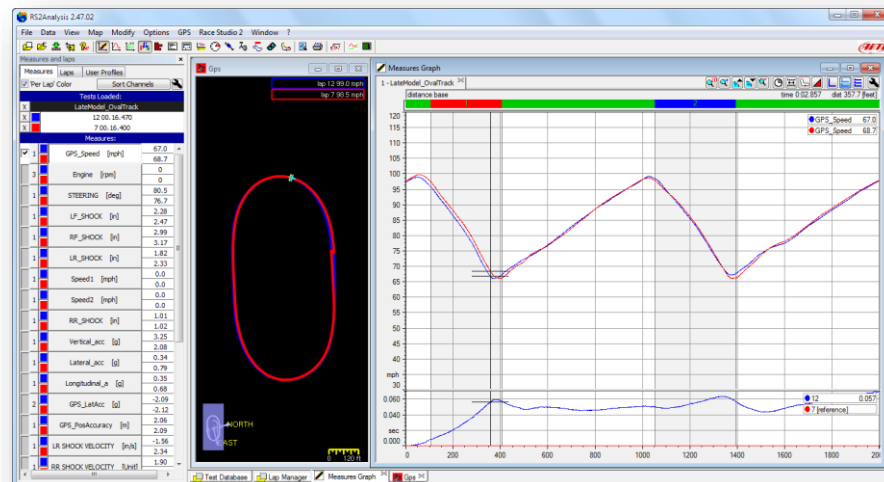


Per Lap Color This tool makes reading data from more than one lap much easier to understand. Here each data trace is a random color. By checking the 'Per Lap Color' checkbox, each data trace matches the overall color set for that lap.

Tools You Need To Know

2 - Sort Channels

1 - SatPrac4_Wetter															
	histd	histd	histd	histd	histd	histd	histd	histd	histd	histd	histd	histd			
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	01.43.270
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 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
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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



RS2Analysis 2.55.34 - User Profile: TC Handling - [Measures Graph]

File Data View Map Modify Options GPS Race Studio Window ?

Measures and laps

Measures Laps User Profiles

'Per Lap' Color Sort Channels

Tests Loaded:

X TC Design Test 1
3 01.41.546

Measures:

1	GPS_Speed [mph]	82.8
1	SPEED_BMW [mph]	82.6
2	RPM [rpm]	5500
2	Steering [deg]	-45
1	PEDAL_POSITION [%]	98.1
1	Oil_Press [psi]	67.4
1	Oil_Temp [°F]	200
1	ENGINE_OIL_TEM [°F]	243
1	WATER_TEMP [°F]	174
5	BRAKE_SWITCH [#]	0
1	MIL_CHK_ENG [#]	0
2	LatAcc [g]	-1.39
1	Battery [V]	14.2
1	Fuel [#]	6.1
3	GPS_LatAcc [g]	-1.37
3	GPS_LonAcc [g]	0.23
4	GPS_Gyro [deg/s]	-20.1
1	GPS_Slope [deg]	0.09
4	GPS_PosAccuracy [m]	0.83
3	GPS_Nsat [#]	11
1	GPS_Heading [deg]	-9.5
1	ABS_light [V]	0.1
1	ABS_FAIL [#]	0
4	Calculated_Gea [#]	4
1	Datalogger_Tem [°F]	78
1	BRK On [bool]	0.00

1 - TC Design Test 1

distance base

Channels order

How to arrange measures lists

Sort according to User Profile list

Use datalogger configuration order

GPS_Speed
SPEED_BMW
RPM
Steering
PEDAL_POSITION
Oil_Press
Oil_Temp
ENGINE_OIL_TEM
WATER_TEMP
BRAKE_SWITCH
MIL_CHK_ENG
LatAcc
Battery
Fuel
GPS_LatAcc
GPS_LonAcc
GPS_Gyro
GPS_PosAccuracy
GPS_Nsat
GPS_Heading
ABS_light
ABS_FAIL
Calculated_Gea
Datalogger_Tem
BRK On
CRN On
TPS On
TPS Part On

Move Top
Move Up
Move Down
Move Bottom

Apply
Apply and Exit
Exit

time 0:42.983 dist 5350.4 [feet]

GPS_Speed 82.8

RPM 5500

Test laps

1 - TC Design Test 1

2

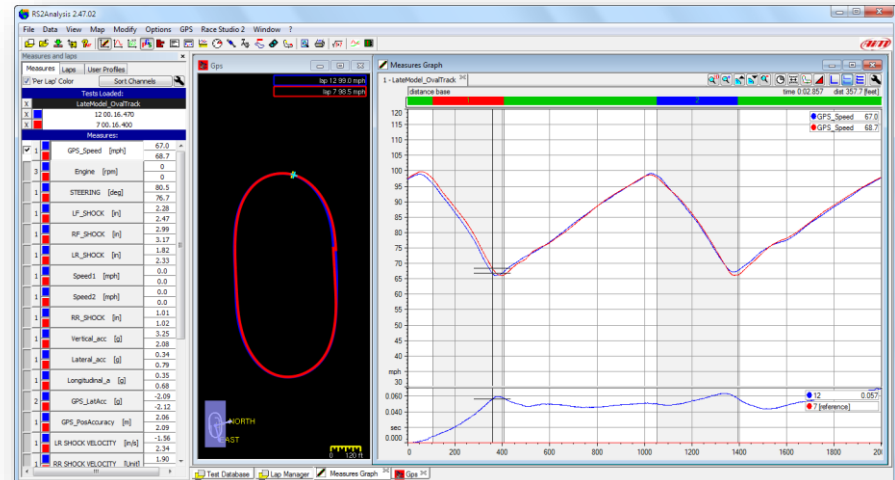
3

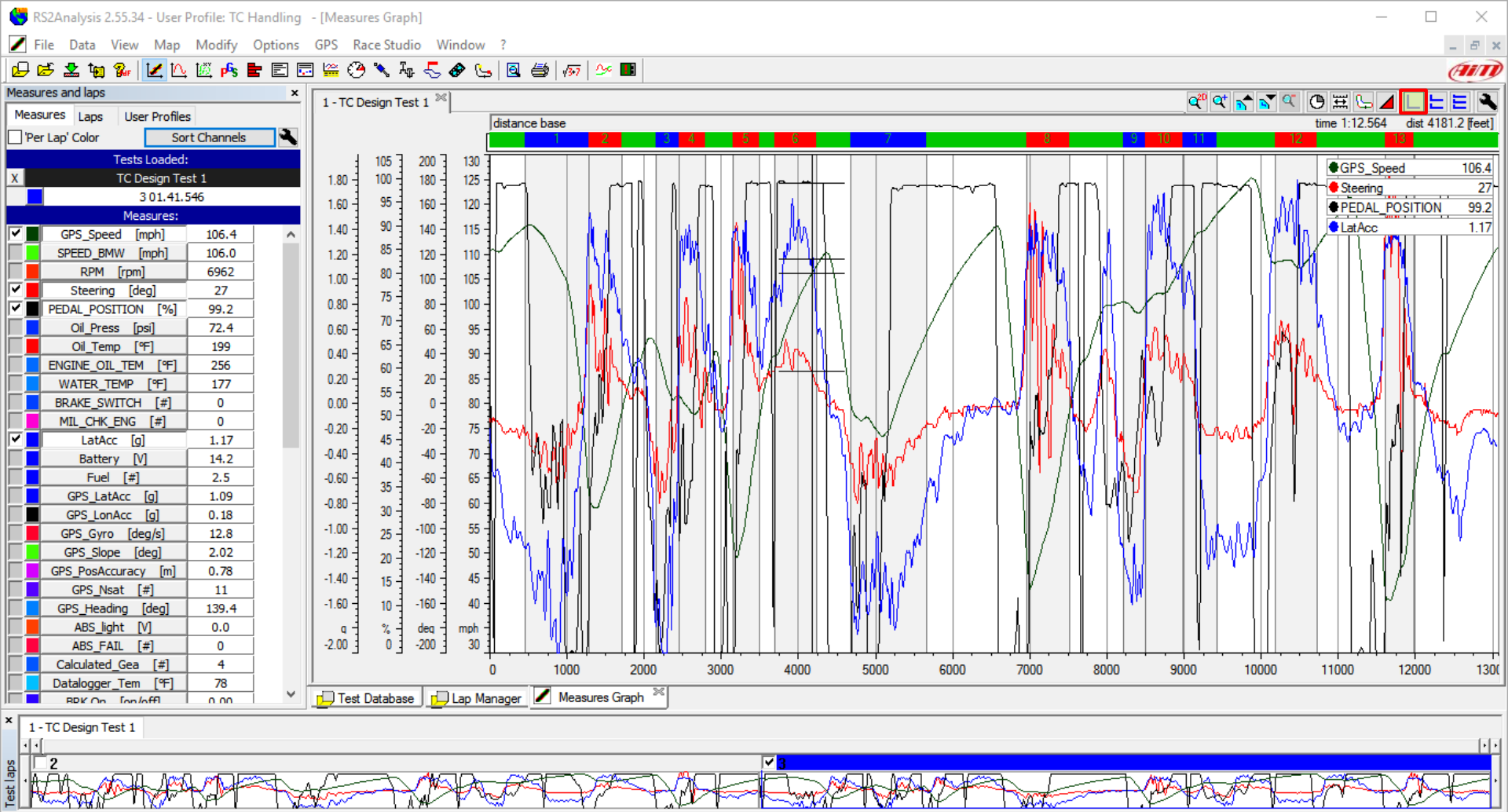
Sort Channels This tool allows you to re-order the channels in the 'Measures and Laps' toolbar. When you have a lot of channels, re-ordering them with the most used at the top of the list is very helpful.

Tools You Need To Know

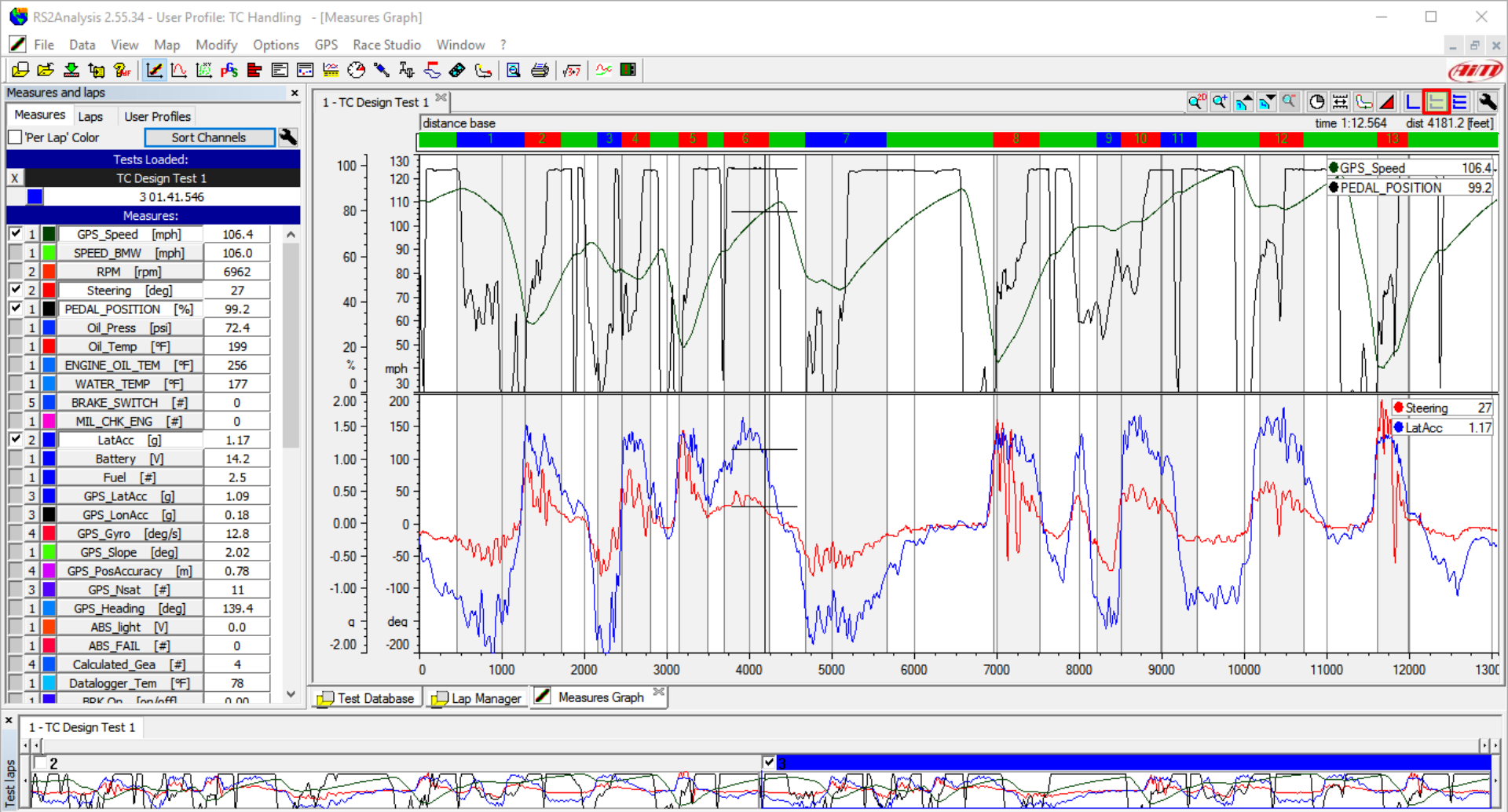
3 - Measures Graph Views

1 - SatPrac4_Wetter															
	histd	histd	histd	histd	histd	histd	histd	histd	histd	histd	histd	histd			
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	0.135	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

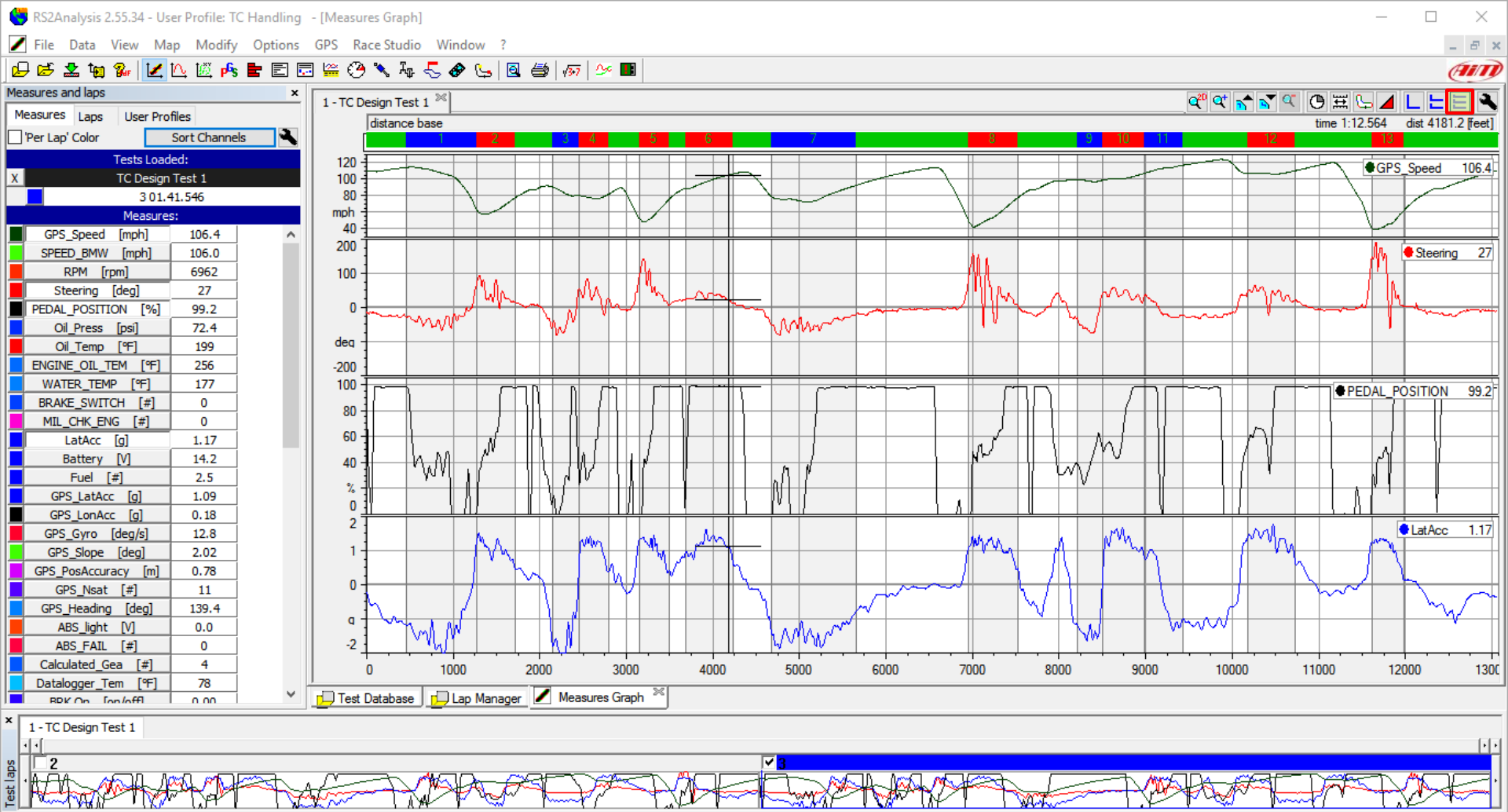




Measures Graph Views - Overlapped This function allows you to view your data in ways to make the data easier to read. This first mode is called 'Overlapped'. Each channel you have shown in the Measures Graph is placed in a single window.



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.

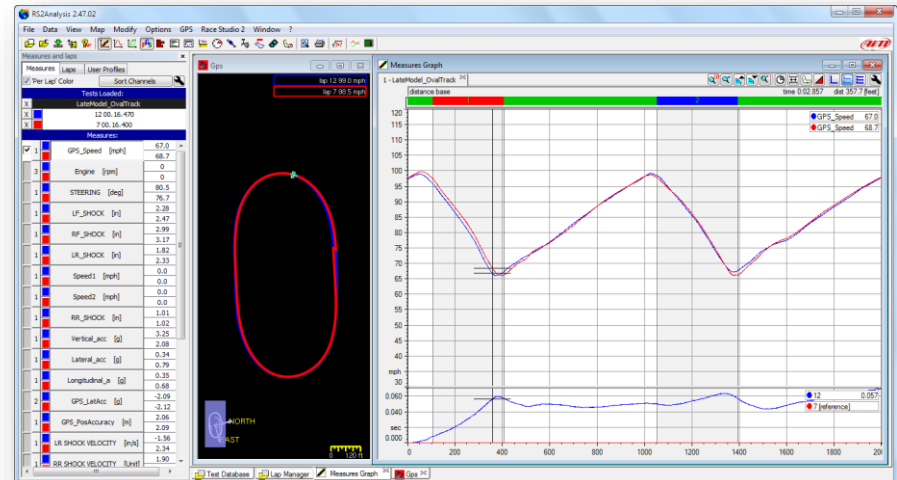


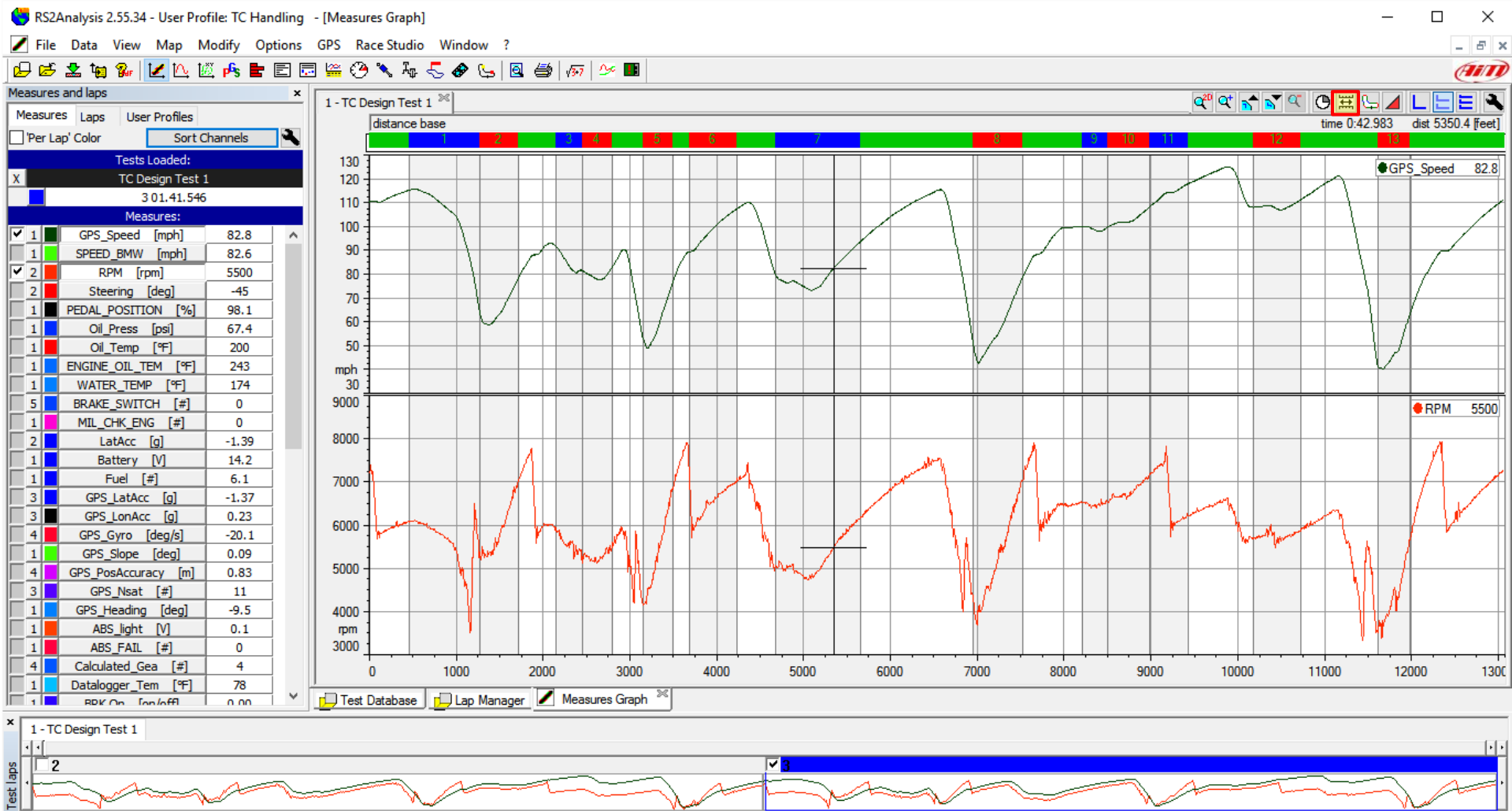
Measures Graph Views - Tiled This function allows you to view your data in ways to make the data easier to read. This third mode is called 'Tiled'. Each channel you have shown in the Measures Graph is placed in its own views. This view is not limited with the number of views available.

Tools You Need To Know

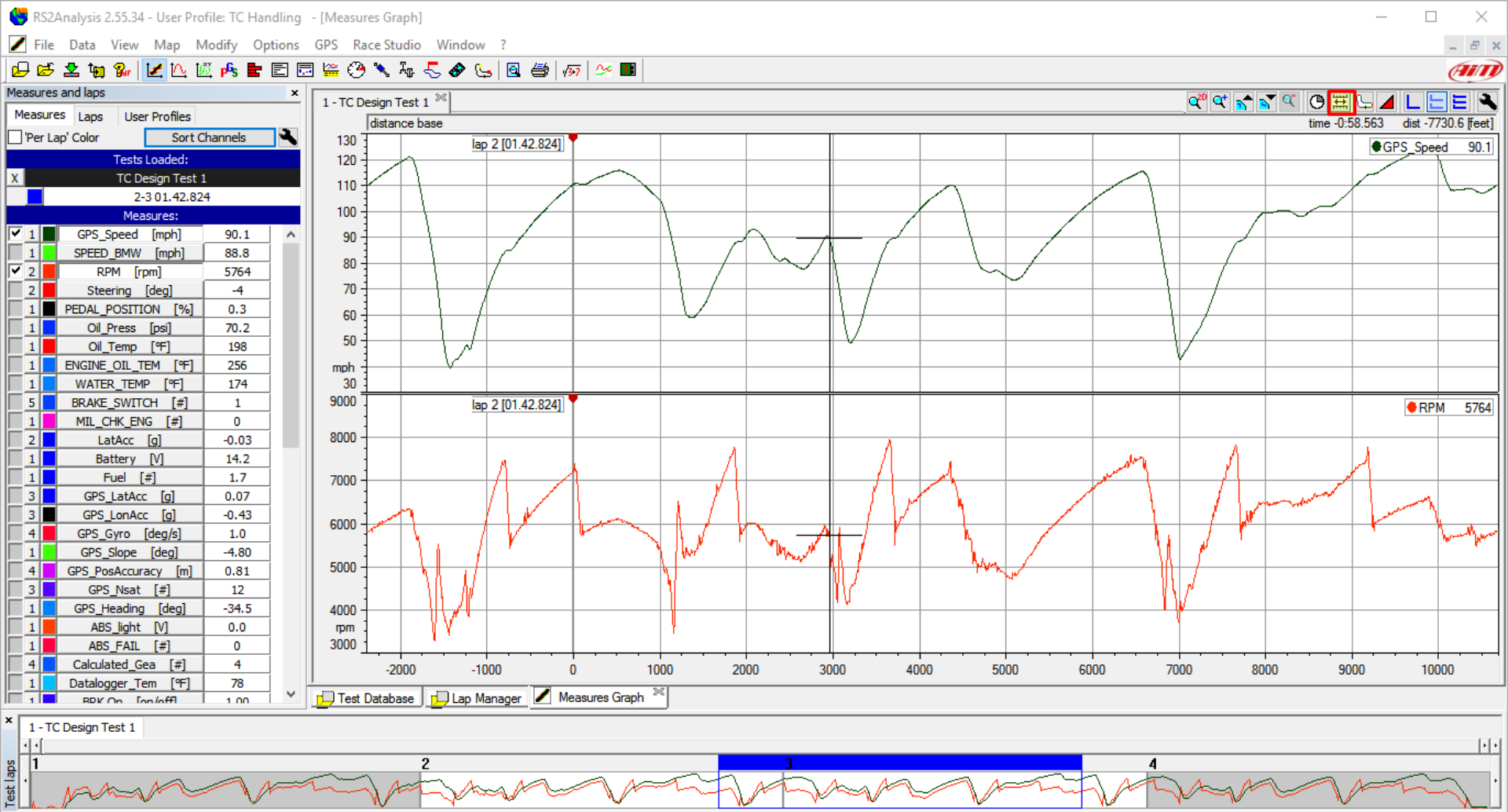
4 - Snap Mode

1 - SatPrac4_Wetter															
	histd	histd	histd	histd	histd	histd	histd	histd	histd	histd	histd	histd			
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
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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	
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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
Split time differences from best lap within test															
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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.

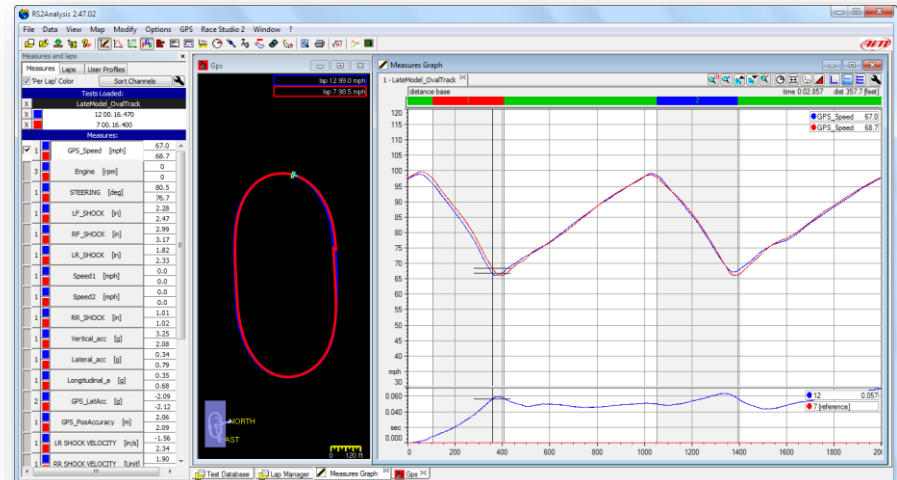


Snap Mode This allows you to view your data and not have it locked to a single full lap. When this mode is active, you can view data across the start/finish line and is very useful when multiple laps are open for aligning shifted data.

Tools You Need To Know

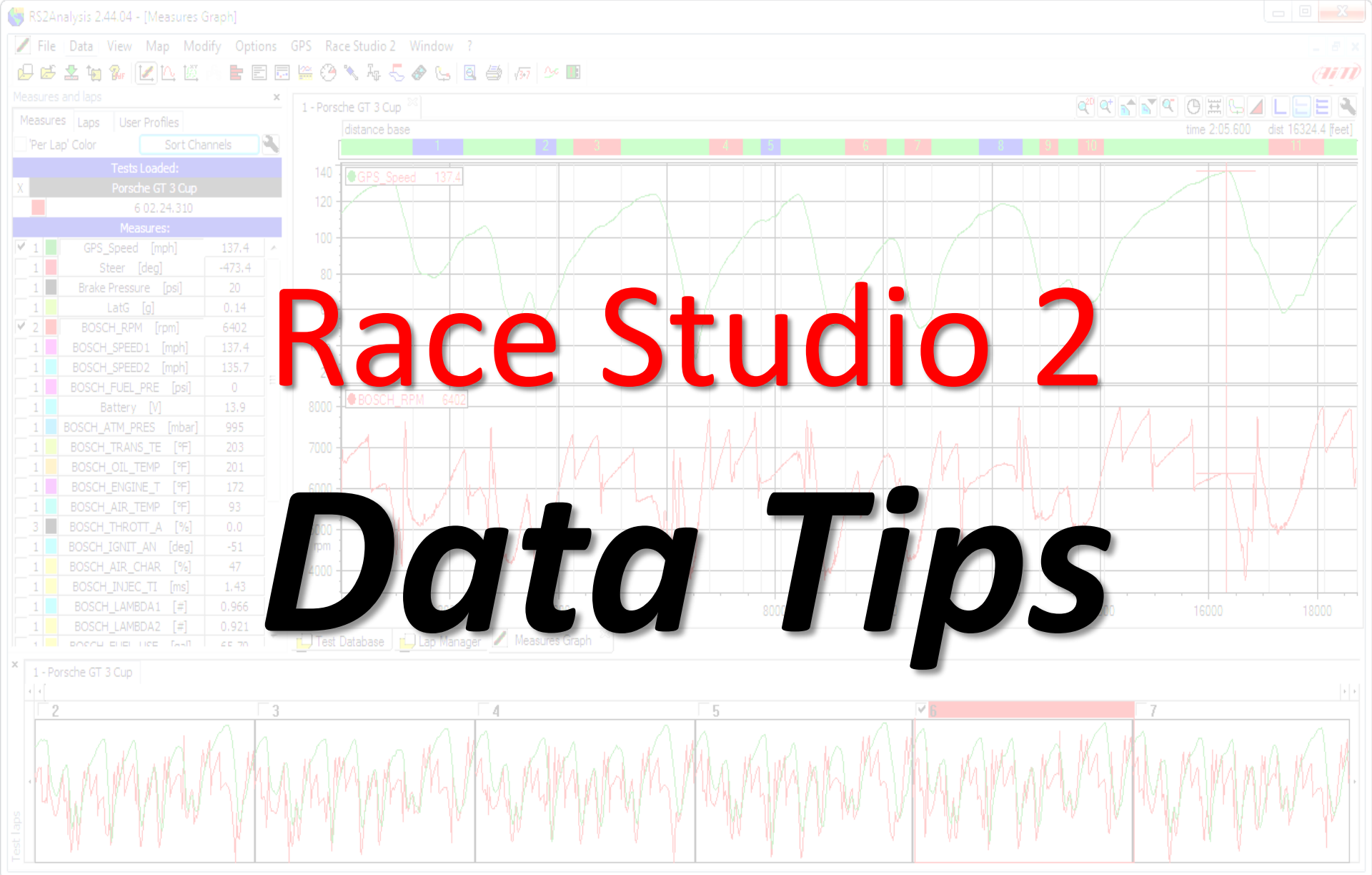
5 - Delta Function

1 - SatPrac4_Wetter															
	histd	histd	histd	histd	histd	histd	histd	histd	histd	histd	histd	histd			
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
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	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	0.135	0.510	0.453	0.108	0.171	0.054	0.210	0.141	0.131	
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Best rolling lap															
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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



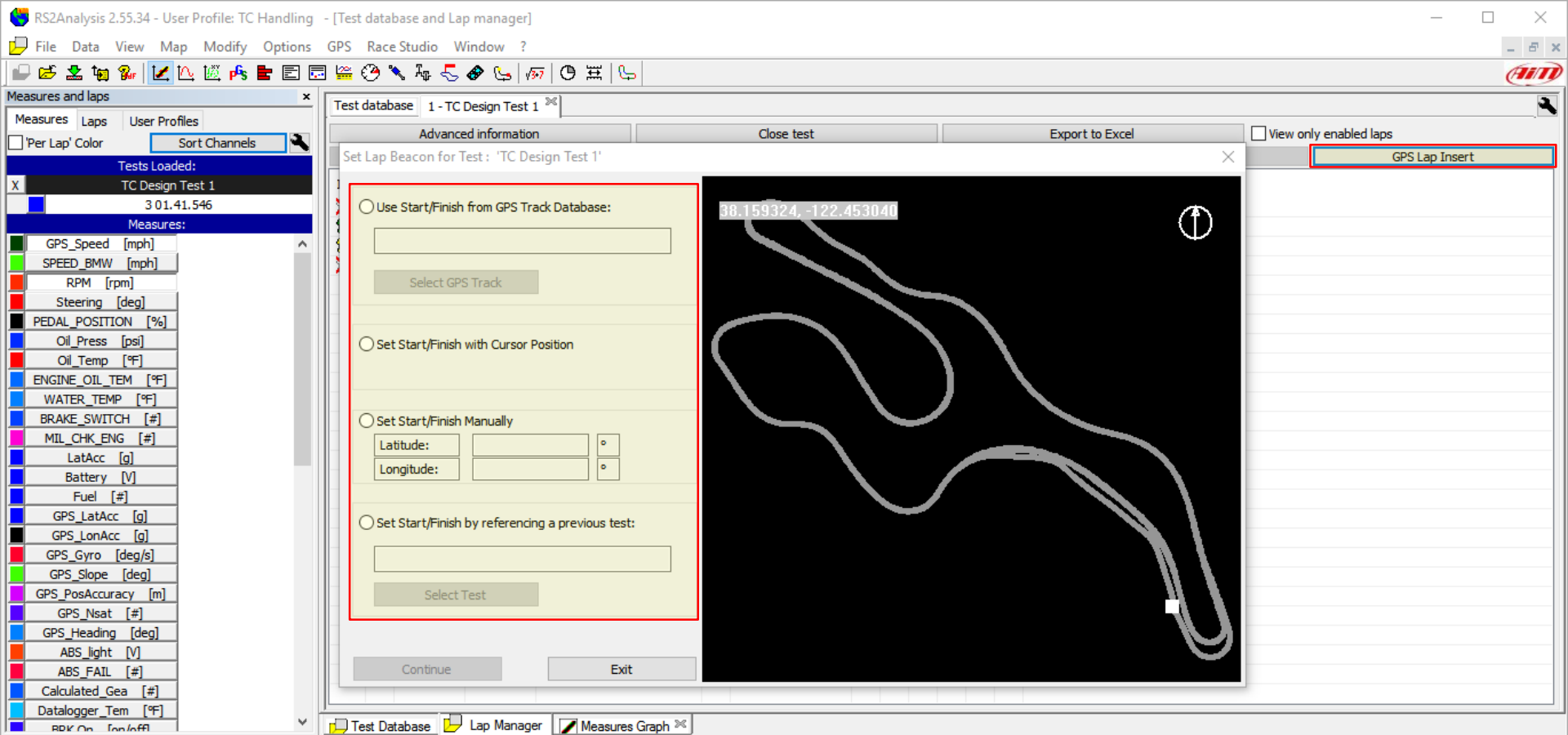


Delta Function This function allows you to measure the differences between 2 points anywhere in your data. Here we are measuring the gain in MPH and RPM in an acceleration zone. Also shown is the time and distance measured.

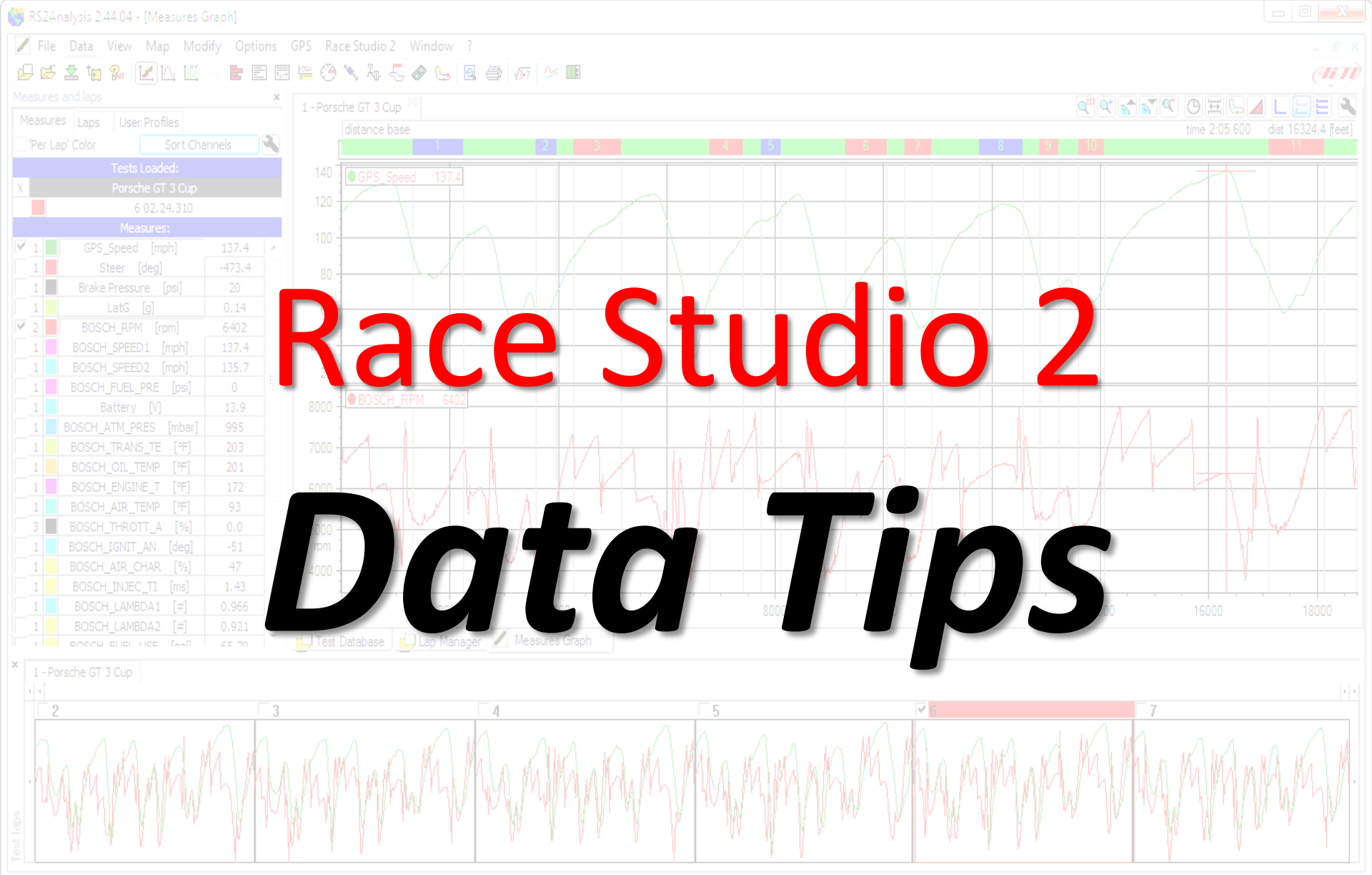


Race Studio 2

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

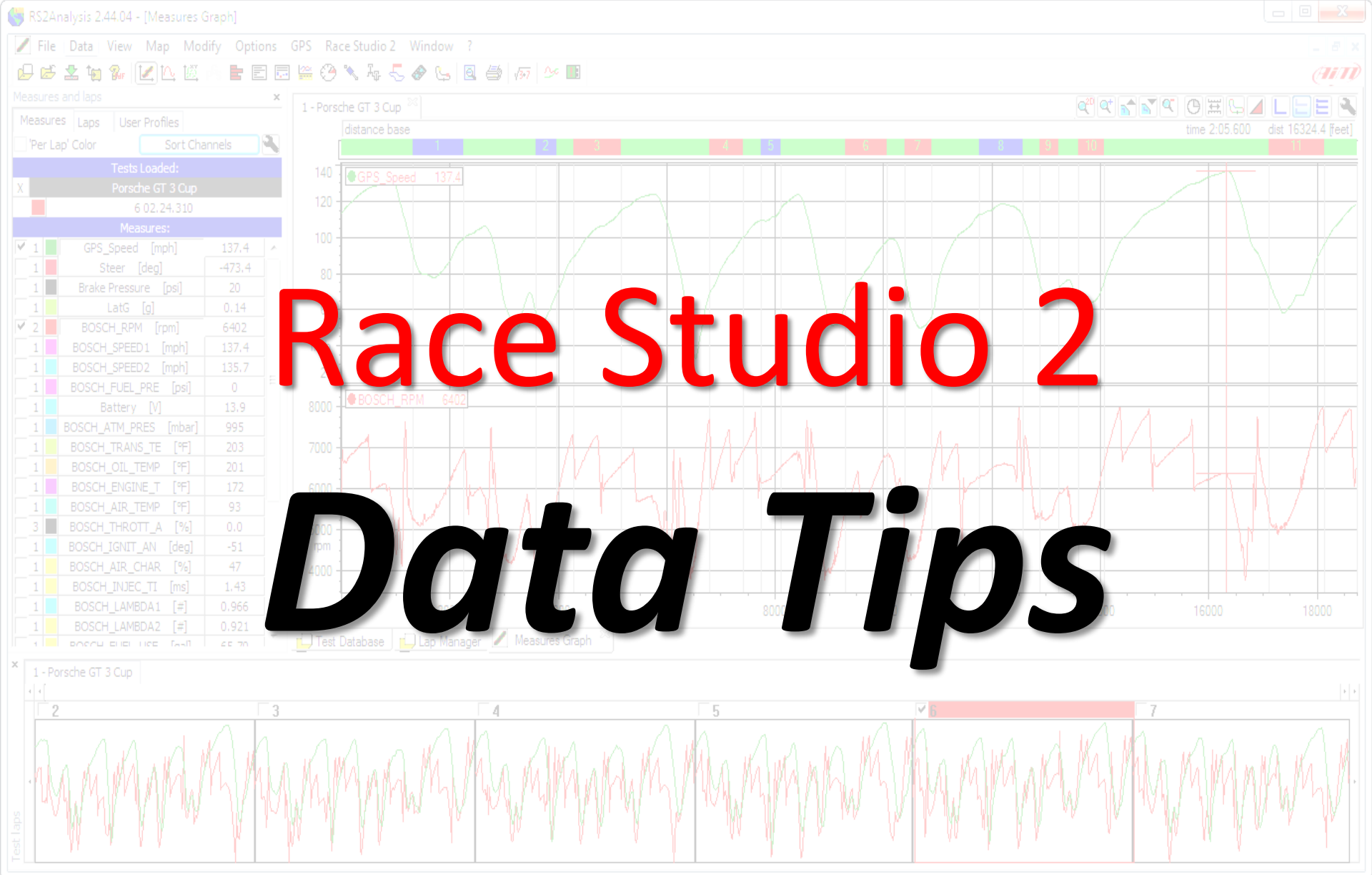
Data Tips

The screenshot displays the AIM software interface for sensor calibration. The 'Measures' list on the left shows 'Steering [deg]' with a value of -23. The 'Parameters' window for 'Steering' shows the formula $Value = (Value \times A) + B$ with 'A' set to 1 and 'B' set to 23. The 'Steering' graph on the right shows a sharp spike at approximately 12000 feet, labeled 'Steering -23'.

Measures:	Value
GPS_Speed [mph]	98.2
SPEED_BMW [mph]	94.0
RPM [rpm]	5800
Steering [deg]	-23
PEDAL_POSITION [%]	0.3
Oil_Press [psi]	72.7
Oil_Temp [°F]	200
ENGINE_OIL_TEM [°F]	240
WATER_TEMP [°F]	179
BRAKE_SWITCH [#]	1
MIL_CHK_ENG [#]	0
LatAcc [g]	-0.08
Battery [V]	14.2
Fuel [#]	0.1
GPS_LatAcc [g]	-0.05
GPS_LonAcc [g]	-1.24
GPS_Gyro [deg/s]	-0.7
GPS_Slope [deg]	2.82
GPS_PosAccuracy [m]	0.79
GPS_Nsat [#]	11
GPS_Heading [deg]	-63.9
ABS_light [V]	0.0
ABS_FAIL [#]	0
Calculated_Gea [#]	5
Datalogger_Tem [°F]	78
BRK On [On/Off]	1.00

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

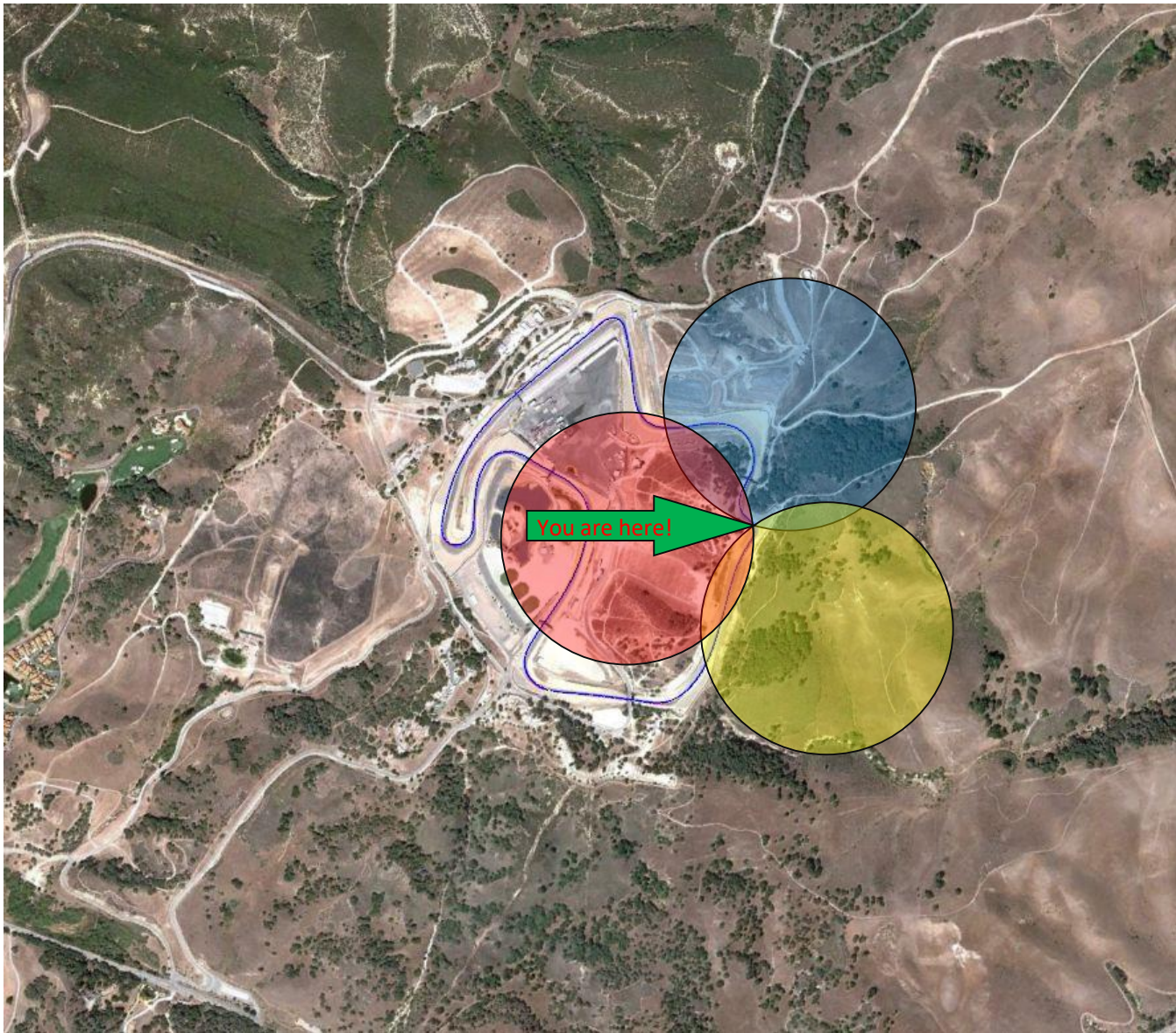
Data Tips



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

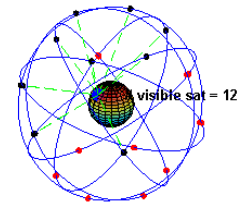




Trilateration:

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:

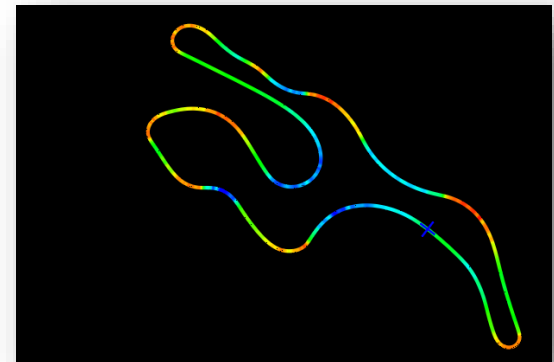
- **Positional Accuracy**

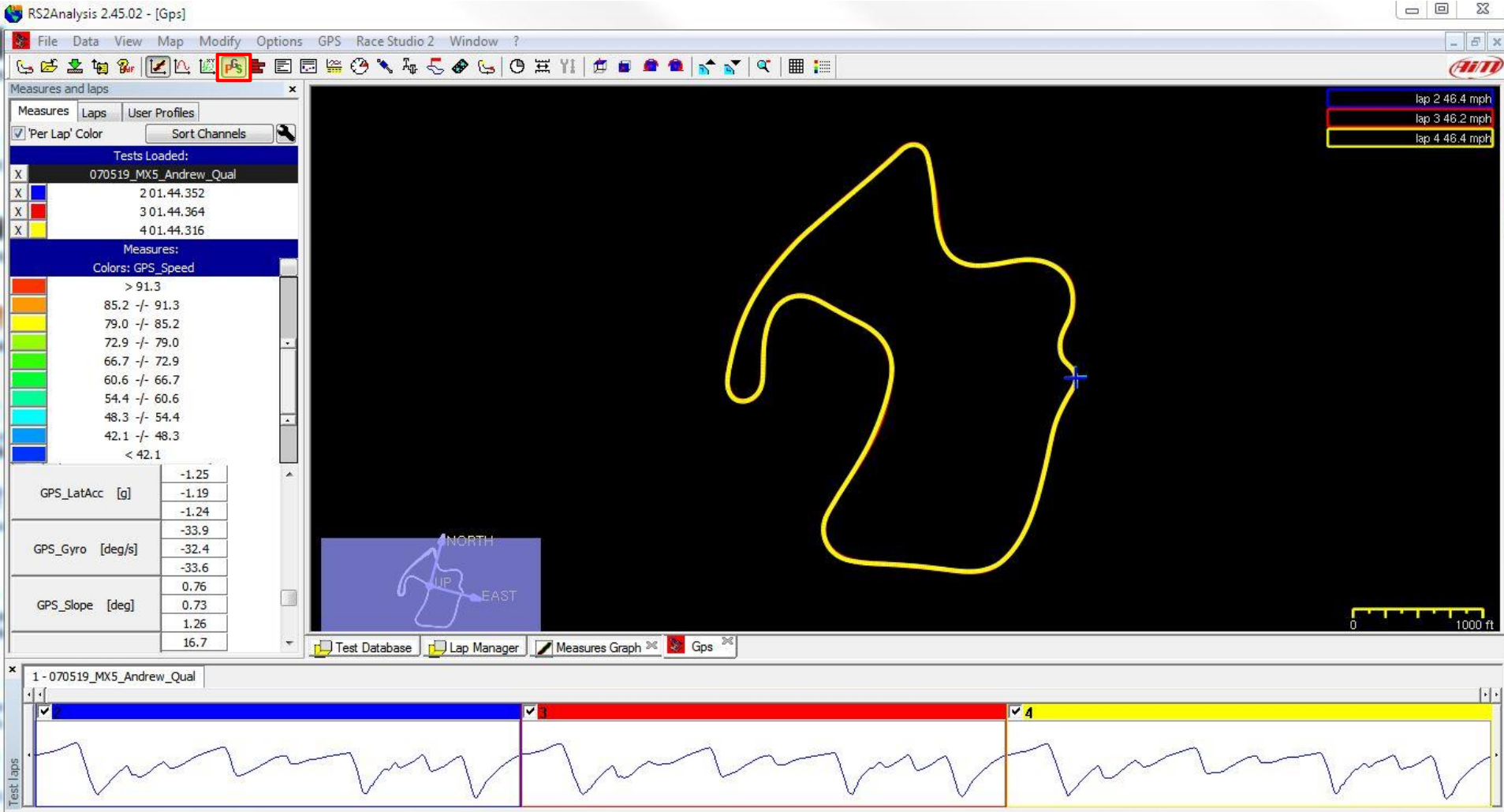
- The Accuracy When Comparing the Position of Your Driven Line to any Other Data Gathered at any Other Time
- This is Reported in Your Data as 'GPS_PosAccuracy'
- The Positional Accuracy of Your AiM Sports GPS System (or any other GPS Device) can Vary at Times

- **Relative Accuracy**

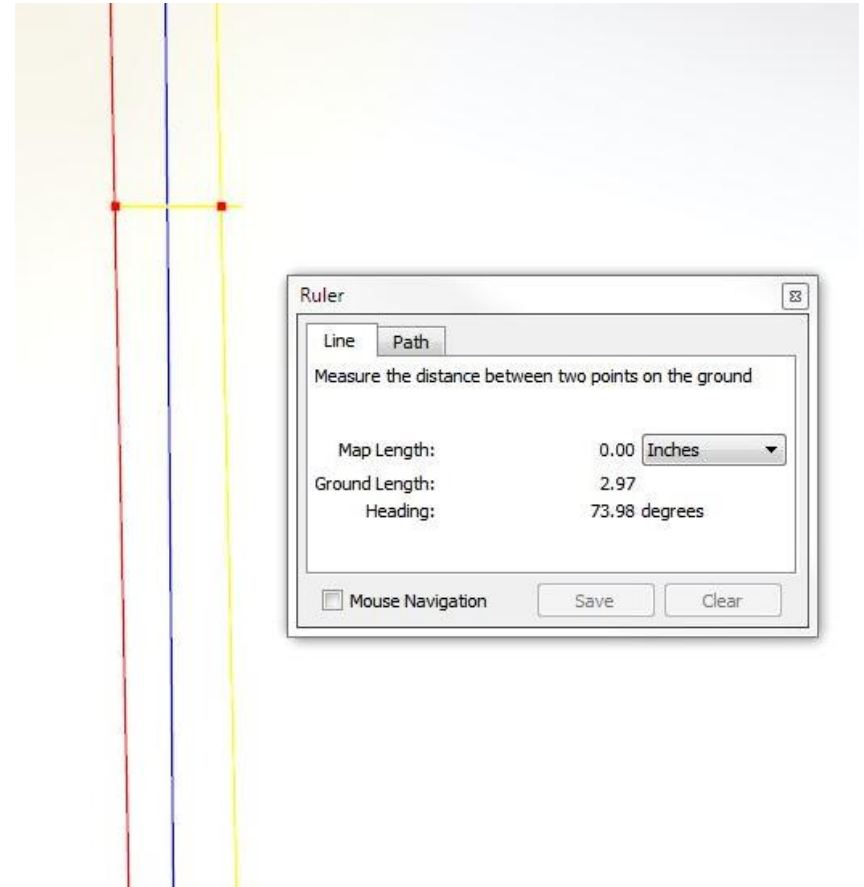
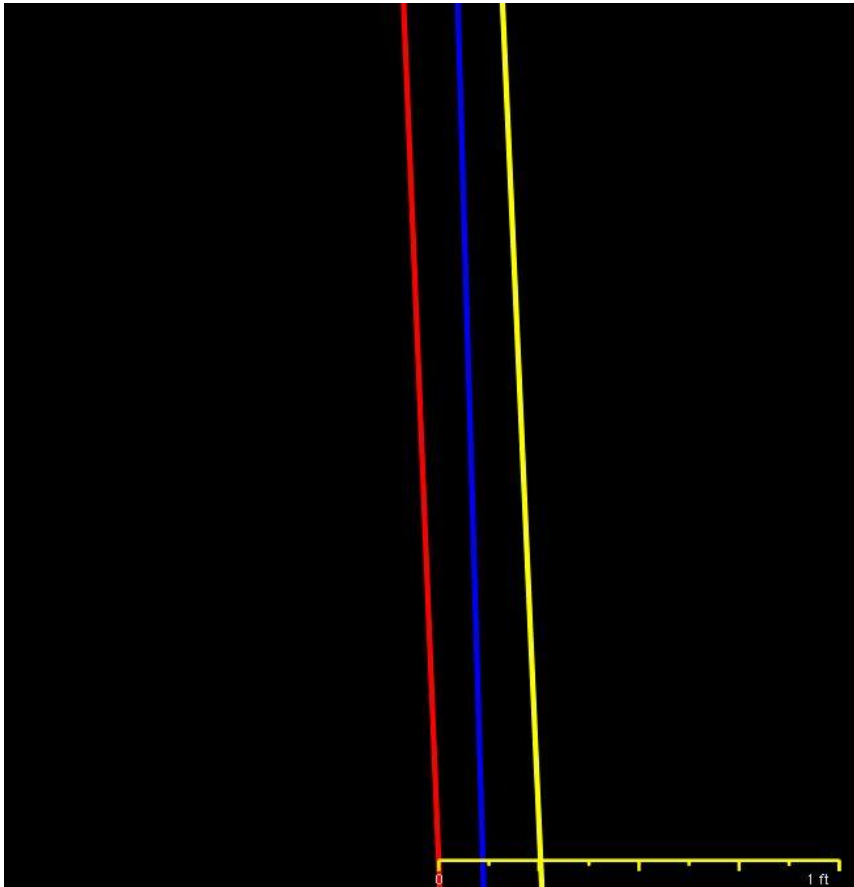
- The Accuracy When Comparing Each Data Point Against the Previous Data Point
- This is the Process Used to Calculate GPS_Speed, GPS_LatAcc, GPS_Heading, and Other Very Accurate Values
- The Relative Accuracy of your AiM Sports GPS System is Very Good

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

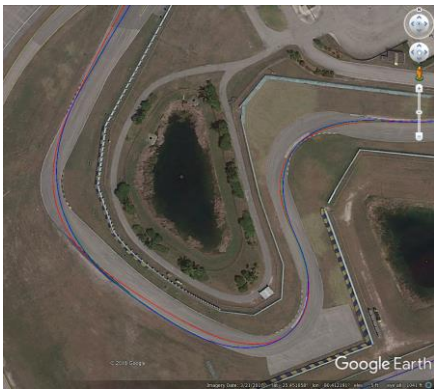




This is the default view of **GPS data** in the **Race Studio 2 Analysis** software. This data is a qualifying session with 3 laps of data. You only see the yellow lap as it was the last lap ran and they appear right on top of each other at this zoom level. On the next slide we zoom in to see the accuracy/repeatability 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



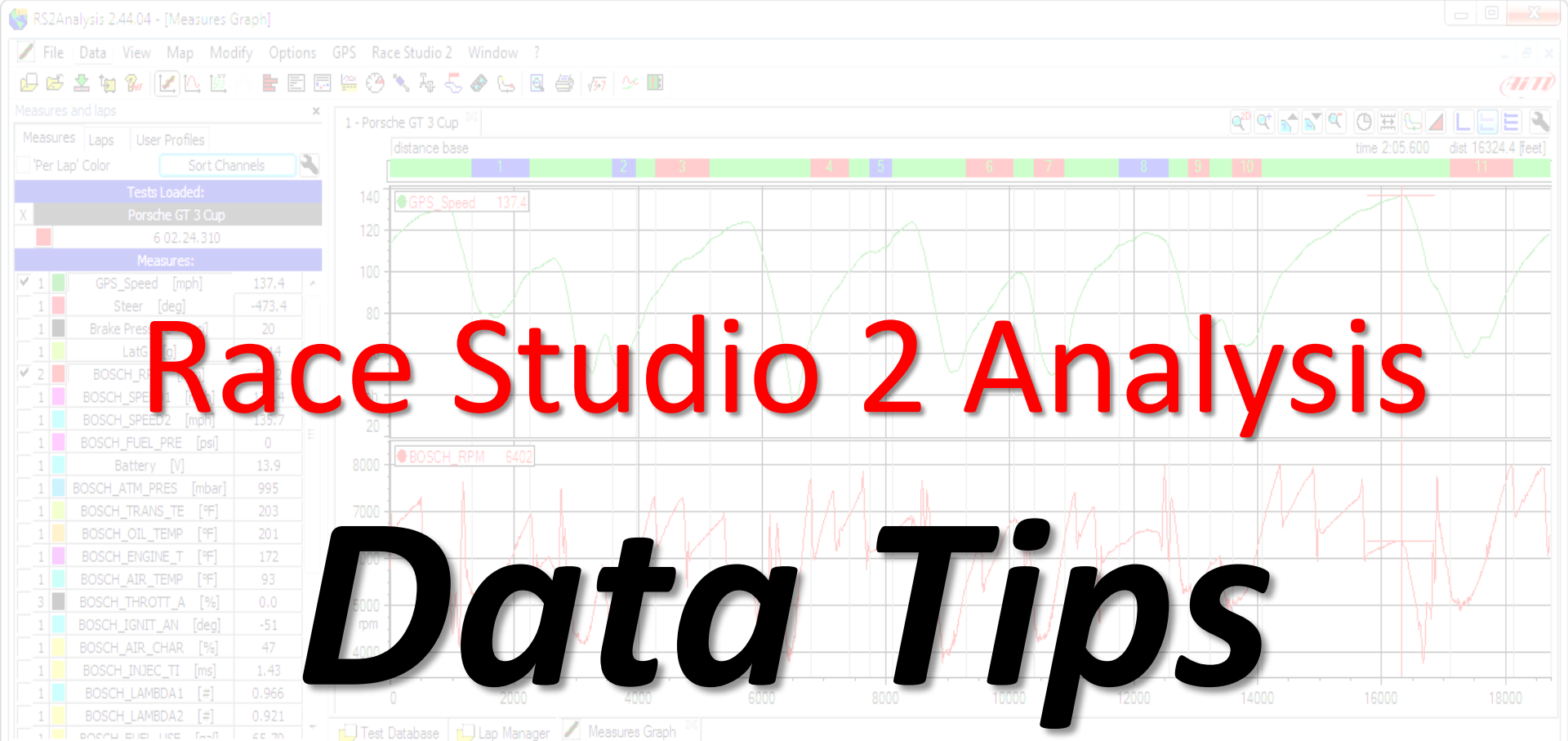
February 2005

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.

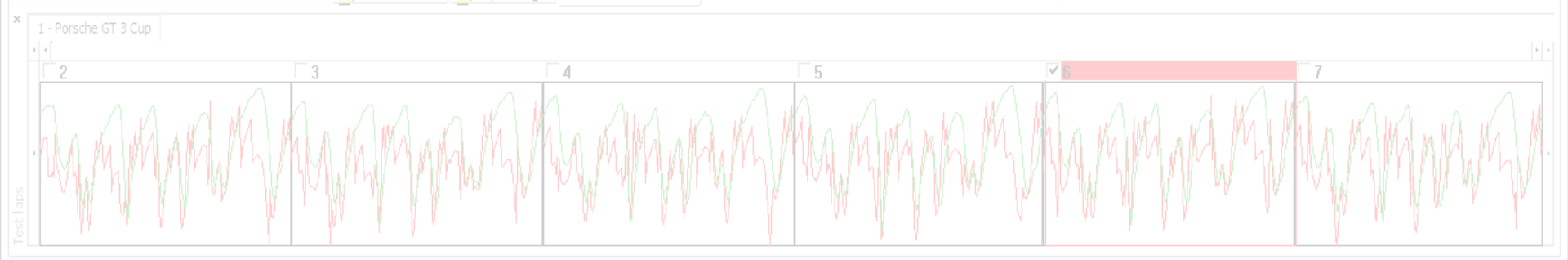
As you can see here even in just this one series of corners at the Homestead Florida track, the accuracy of the Google provided imagery varies based on the quality of the images Google Earth is using.

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

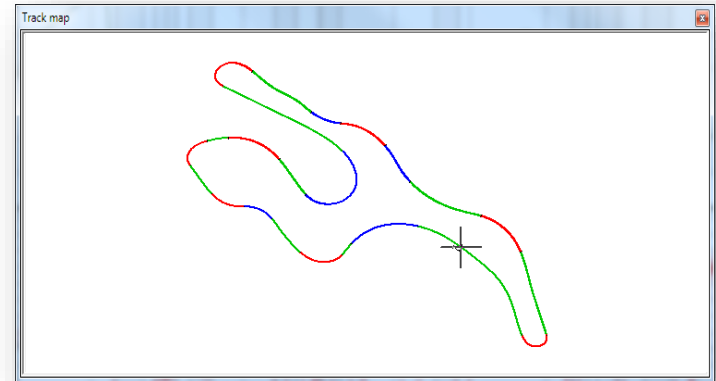


Track Map Differences

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.

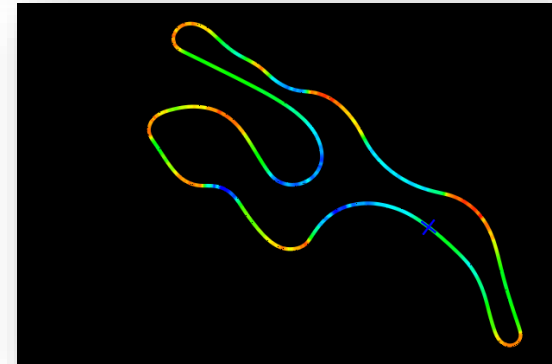
- **'Standard' Track Map**

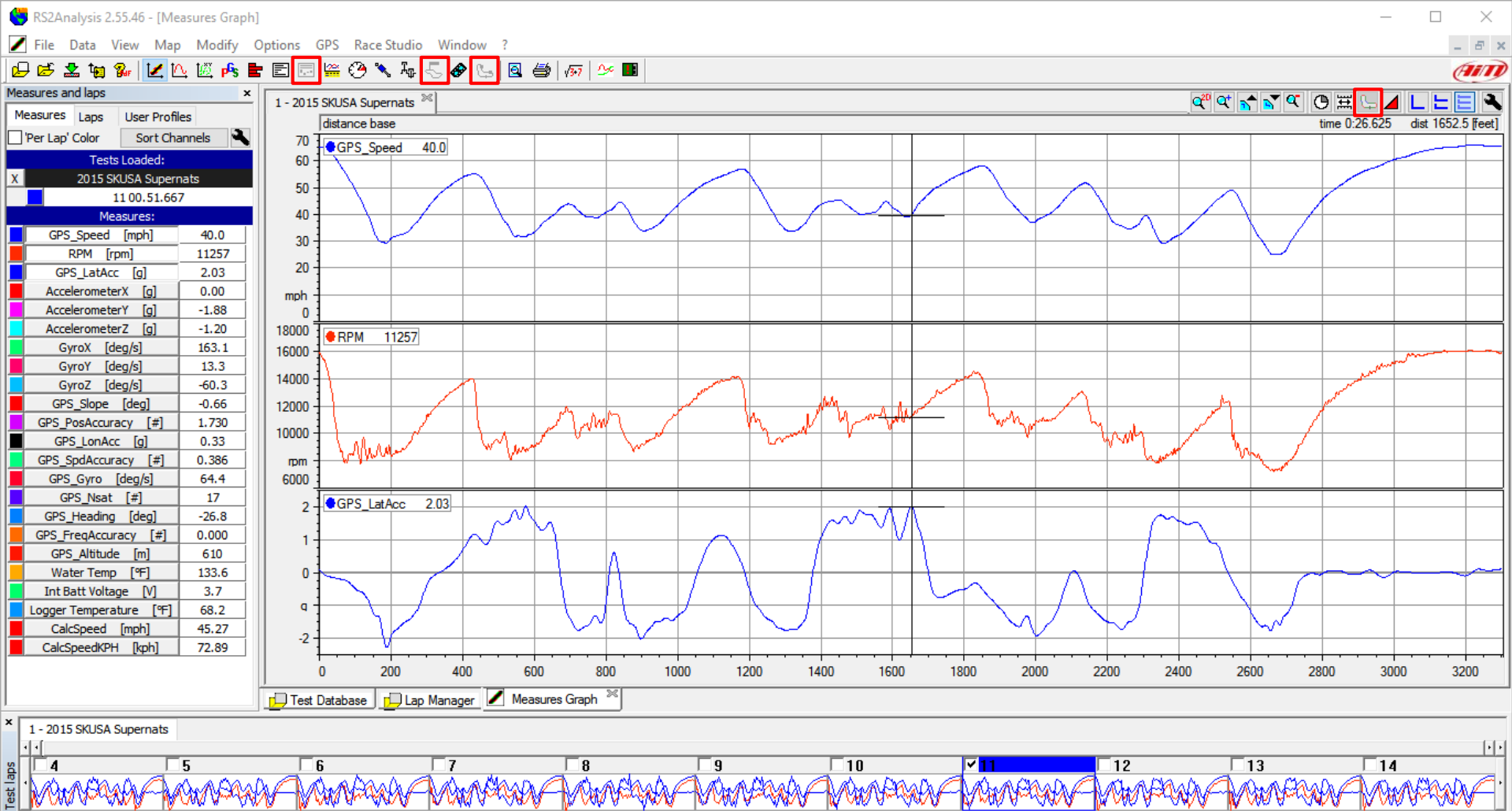
- Generated by the Roll Out Distance and Lateral Acceleration Values
- Used in the Split Report, Track Report, and Lap Replay Functions
- Just for General Track Location, not the Actual Driven Line



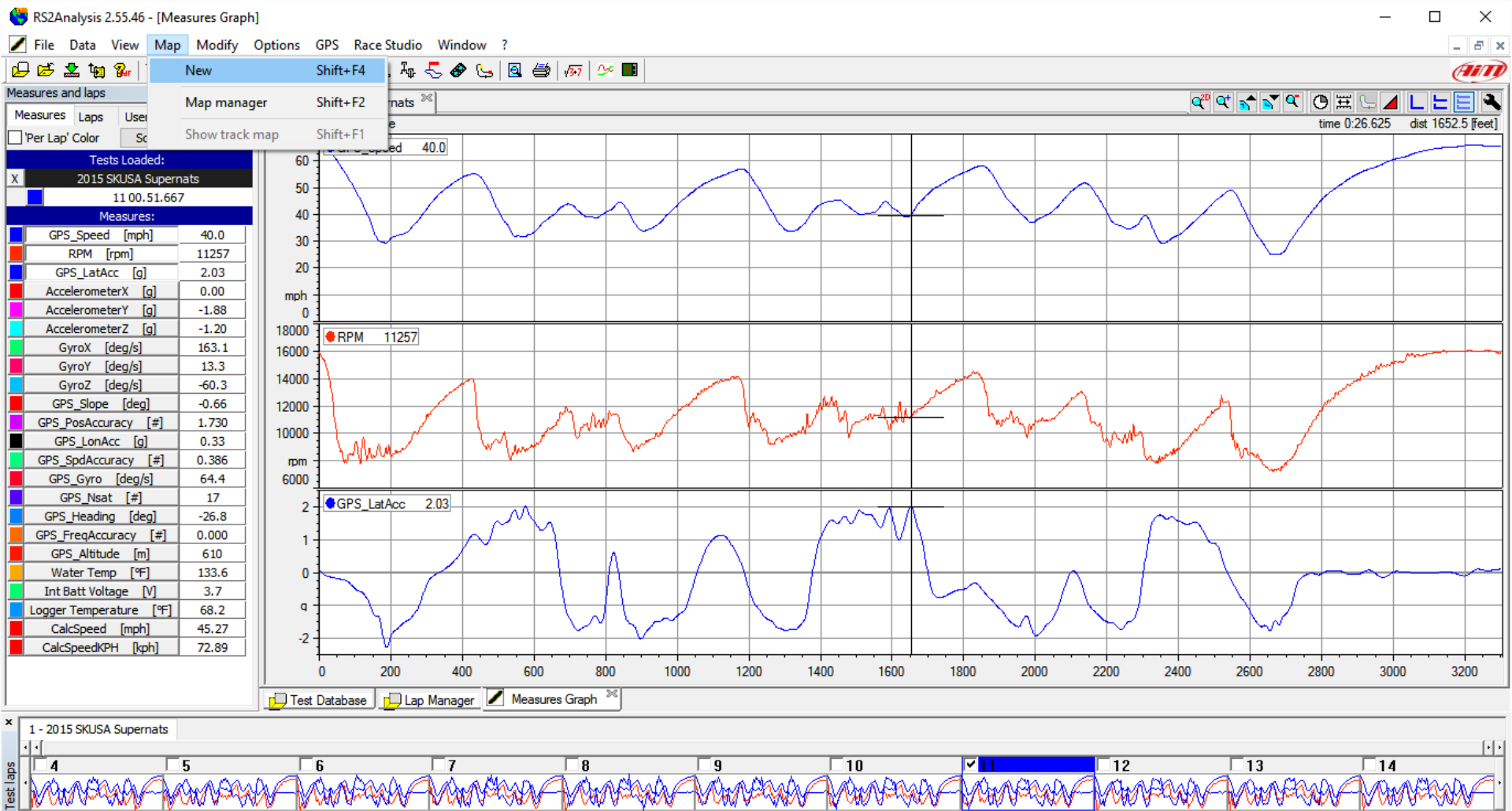
- **GPS 'Driven Line' Track Map**

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

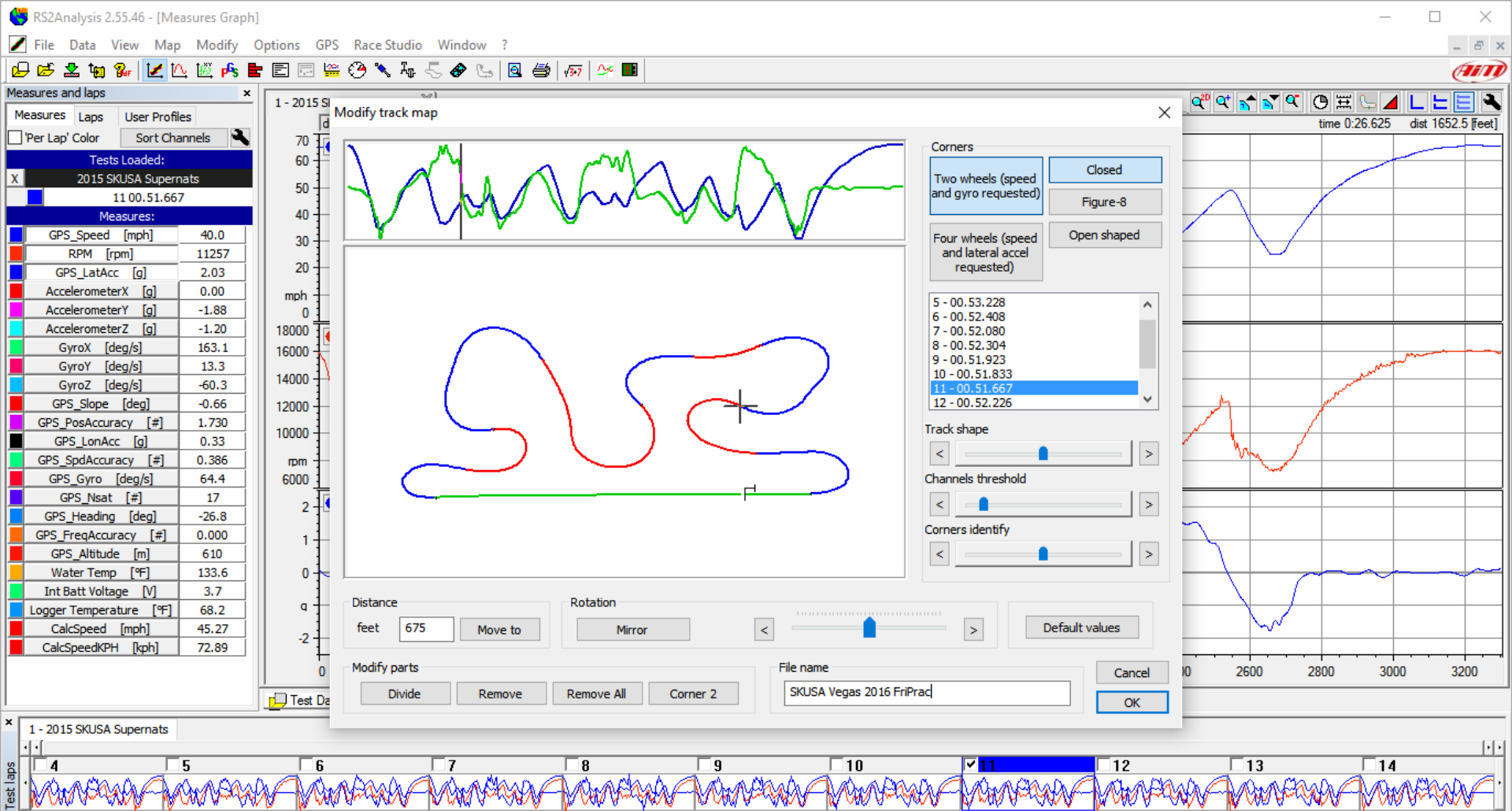




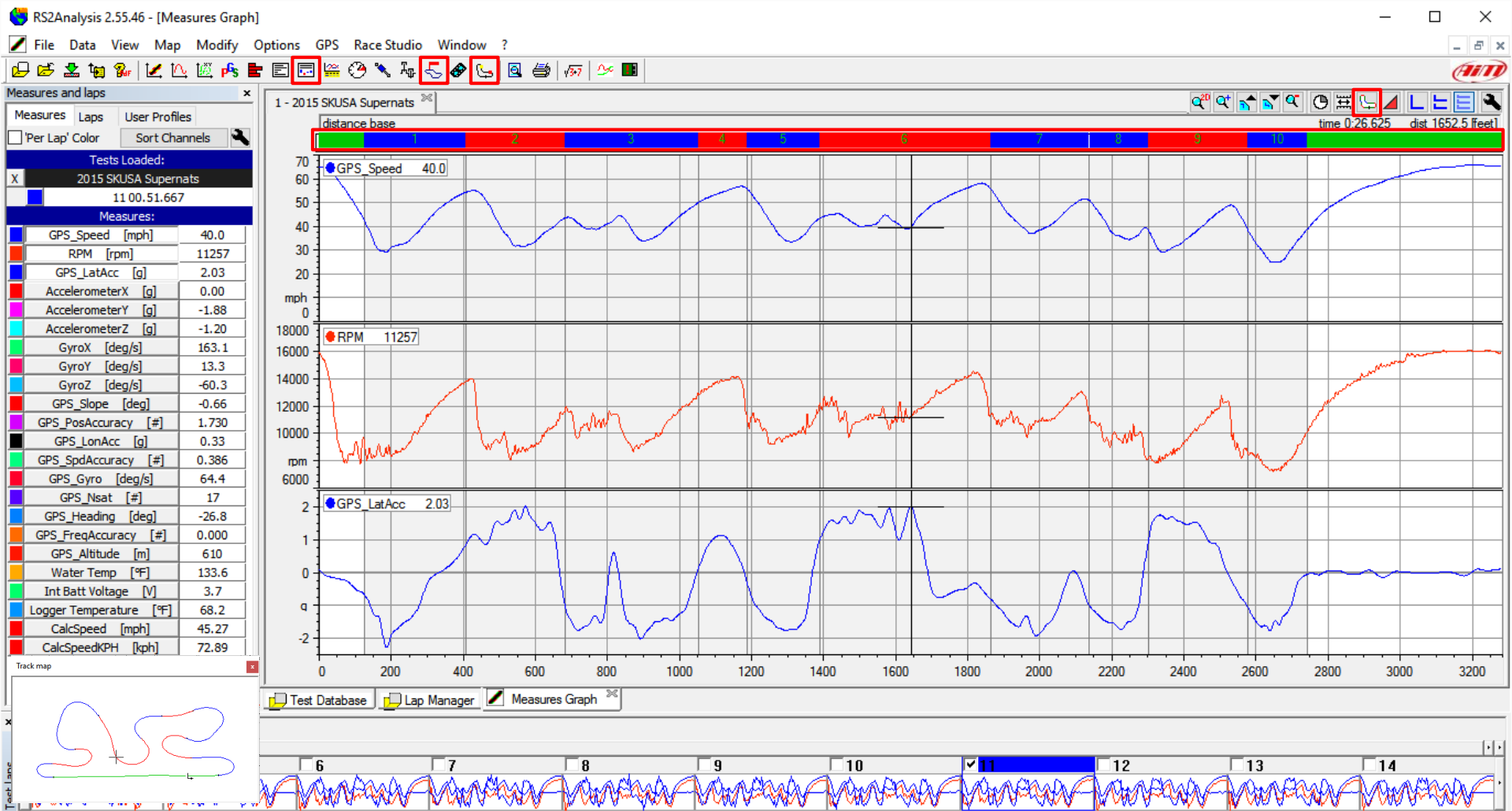
Track Maps, are required for several different functions in the Race Studio 2 Analysis software, these are: Split Report, Track Report, and Lap Replay functions. Prior to creating a Track Map, these function icons plus the Track Map icon are not active.



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.



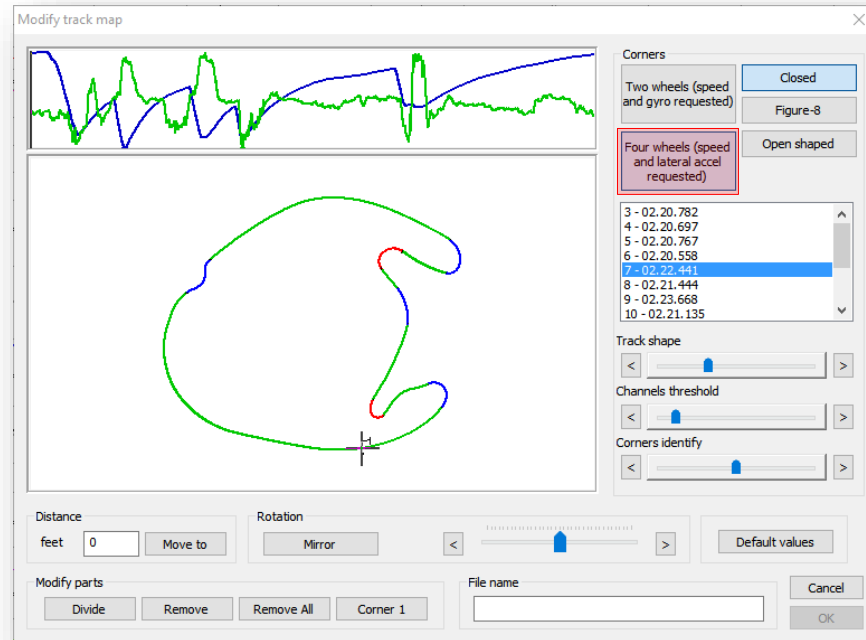
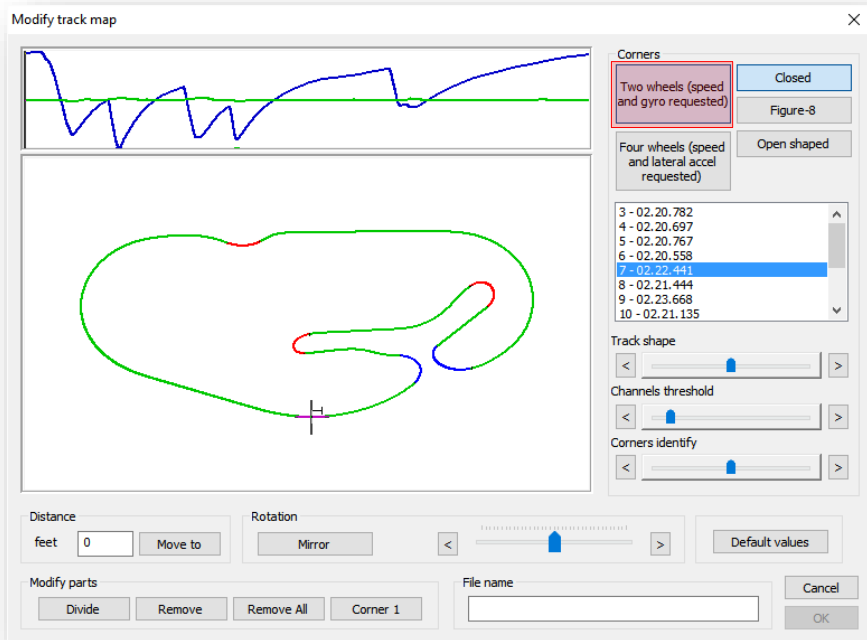
After creating or attaching an existing **Track Map**, you now see the track segments across the top and the function icons that were not active before (Split Report, Track Report, and Lap Replay functions) are now active.

Track Map Differences

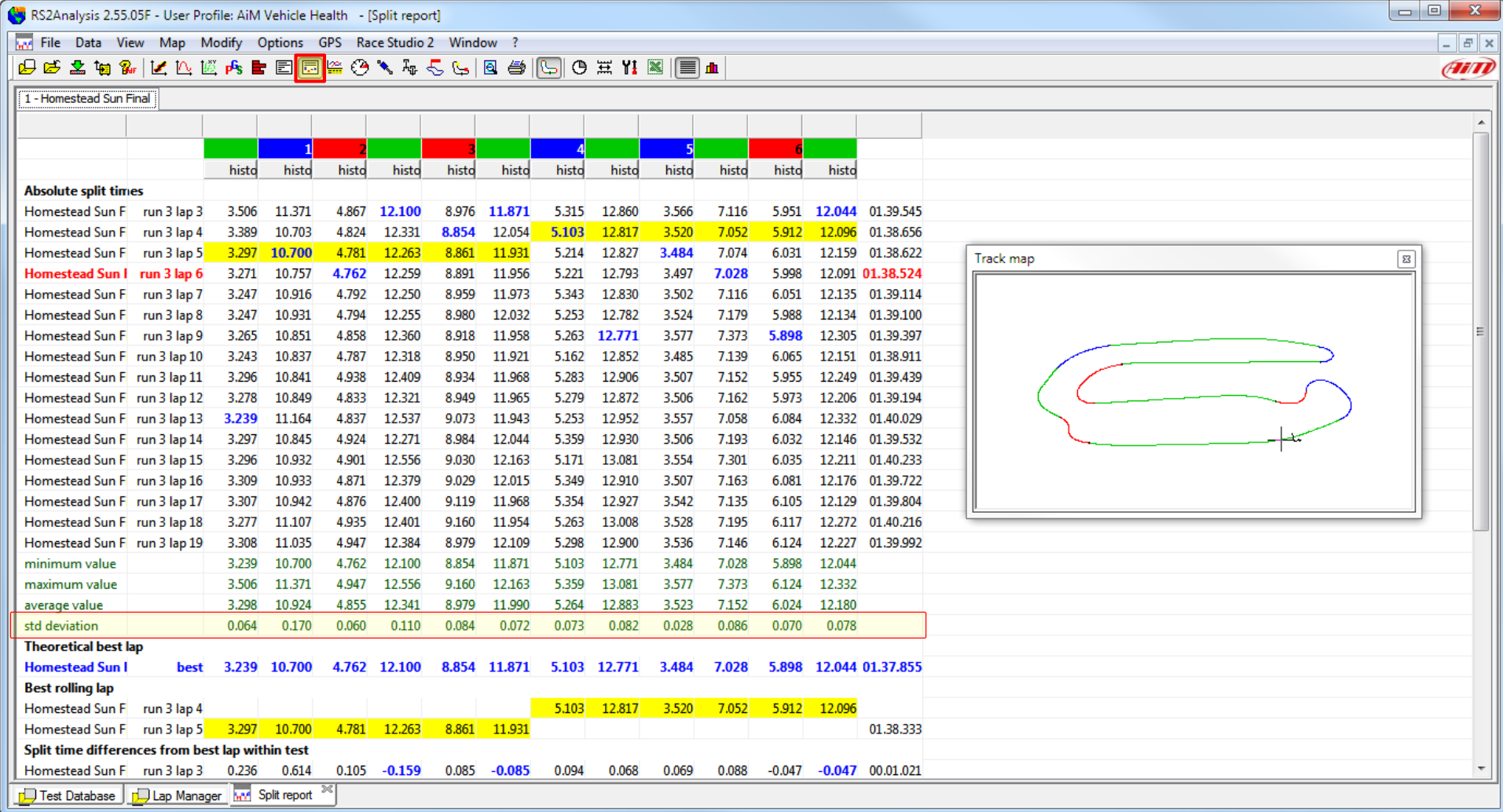
Race Studio 2 can use two different methods to calculate the track map corners and straights.

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

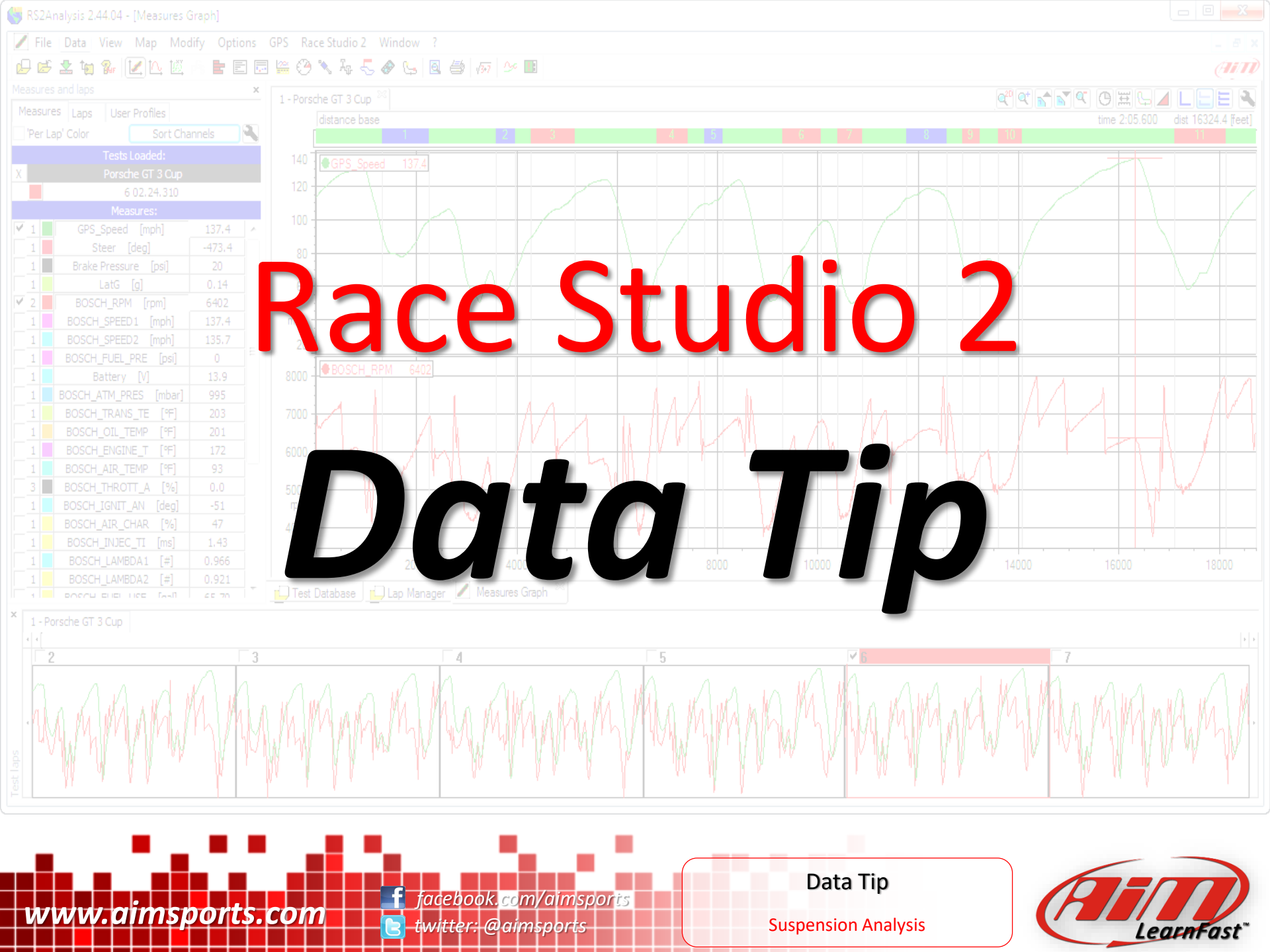
‘Four Wheels’ (speed and lateral accelerometer) does not.



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.

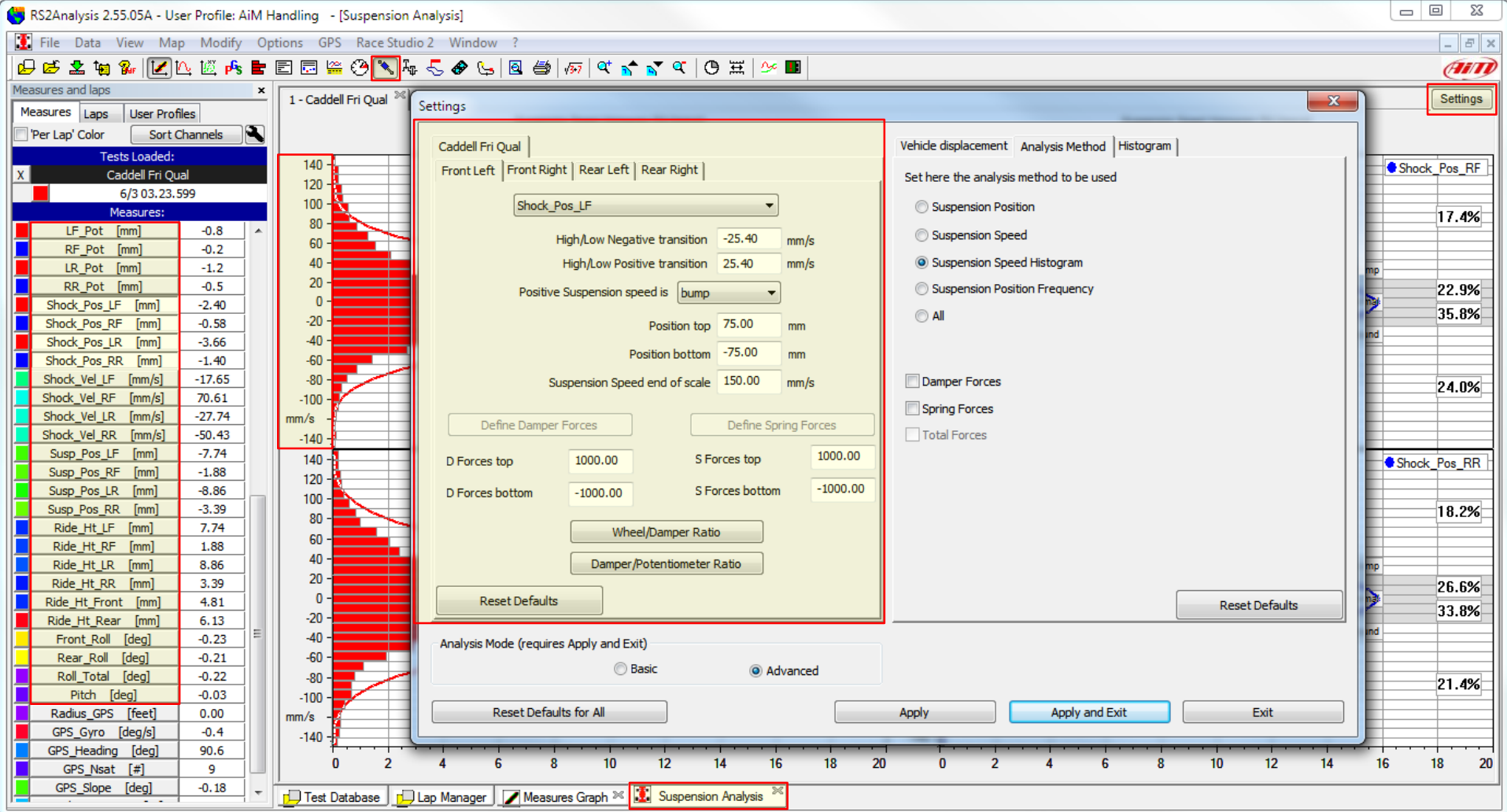


Split Reports are a very valuable tool. They calculate segment times for each lap based on the segments of the active track map. Also provided are the "Best Rolling Lap" and the "Theoretical Best Lap". The blue segment times are the best times in that segment for the entire test. Pay attention to the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

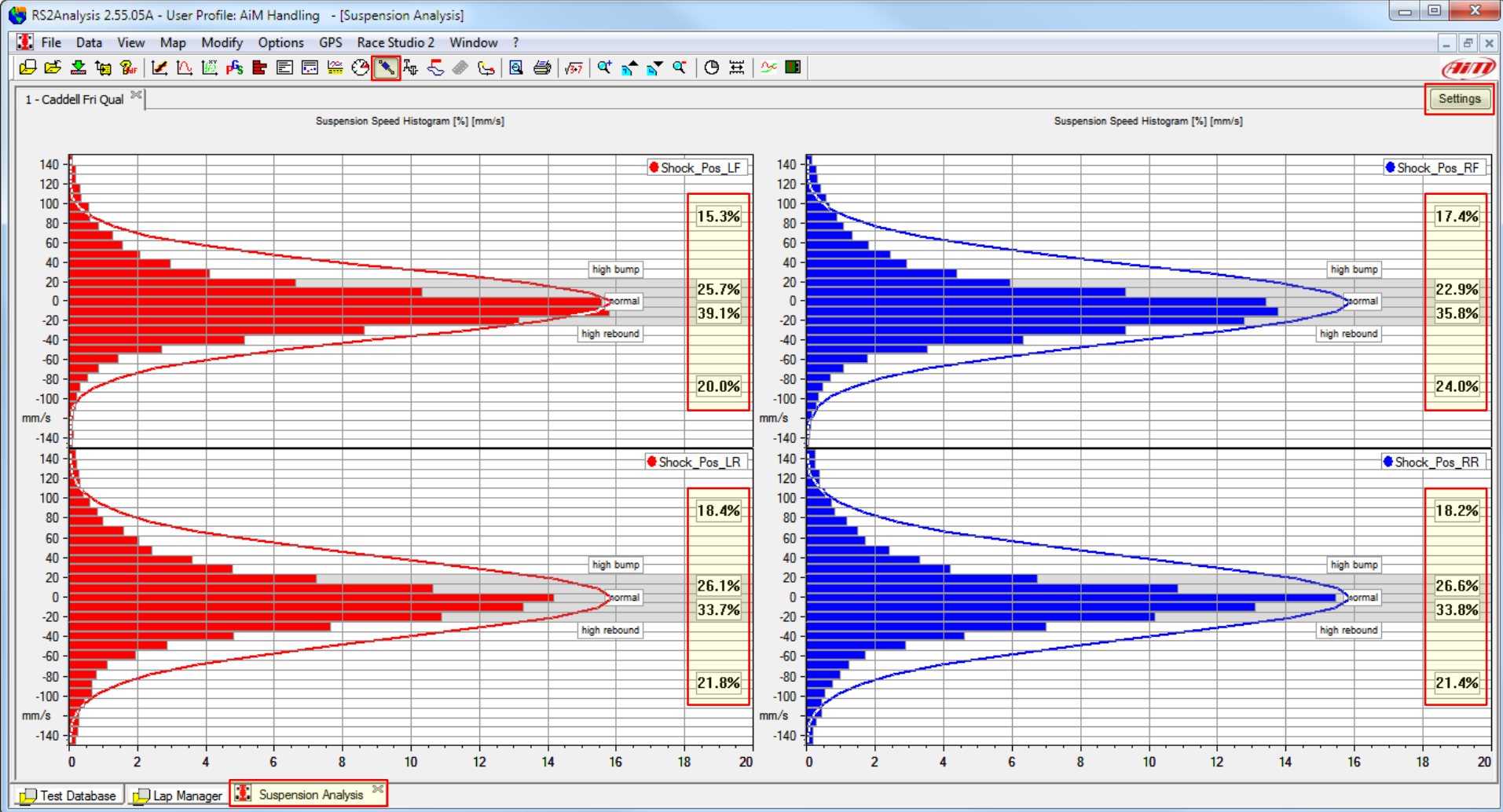


Race Studio 2

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



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