



Seminar Series

Bringing Data Support and Training to You

Practical Data Analysis
for Racers & Enthusiasts

May 2018



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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	
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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

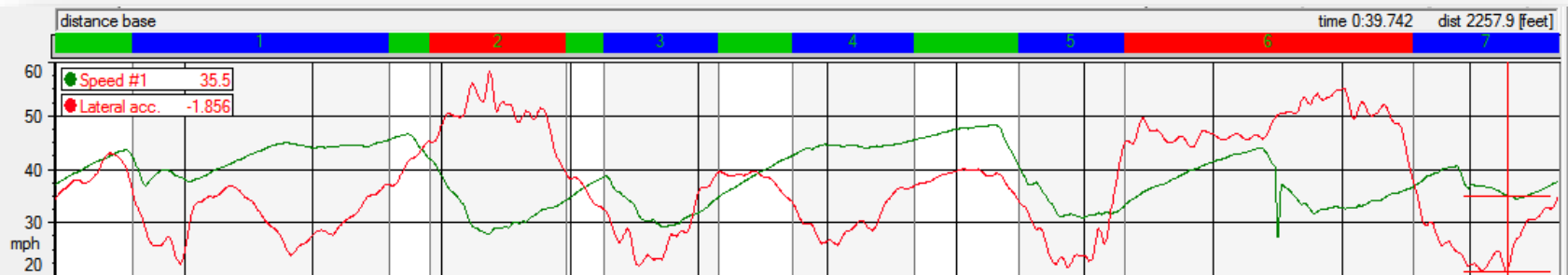
AiM Sports USB Drive



- **Introductions**
- **About AiM Sports**
 - Other Reference Materials
- **What is Data Acquisition**
- **Why Use Data Acquisition**
- **How to Use Data Acquisition**
 - Introducing Race Studio Software
 - Data Concepts
 - What Happened
 - Where Did It Happen
 - Why Did It Happen
 - Data Analysis - Data Triangle
 - Driver Performance
 - Vehicle Performance
 - Vehicle Health
 - Data Analysis Examples



- 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



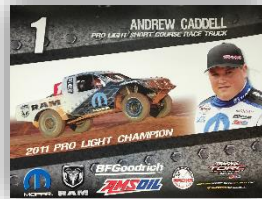


- My Father Started Racing in the '50's
- I Started Racing Off Road Racing in 1976
- I Started Driving in 1977
- Raced Desert and Short Course
- Last Race in Sept of 1996 – Crandon, WI
- No Gauges!!



All Spec Series/Classes

All With Data Systems



2010 - Current



1998



2002



2008



2007



2006



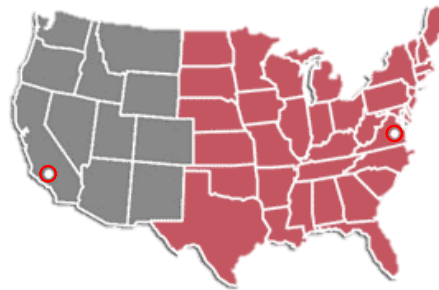
2004

- **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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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

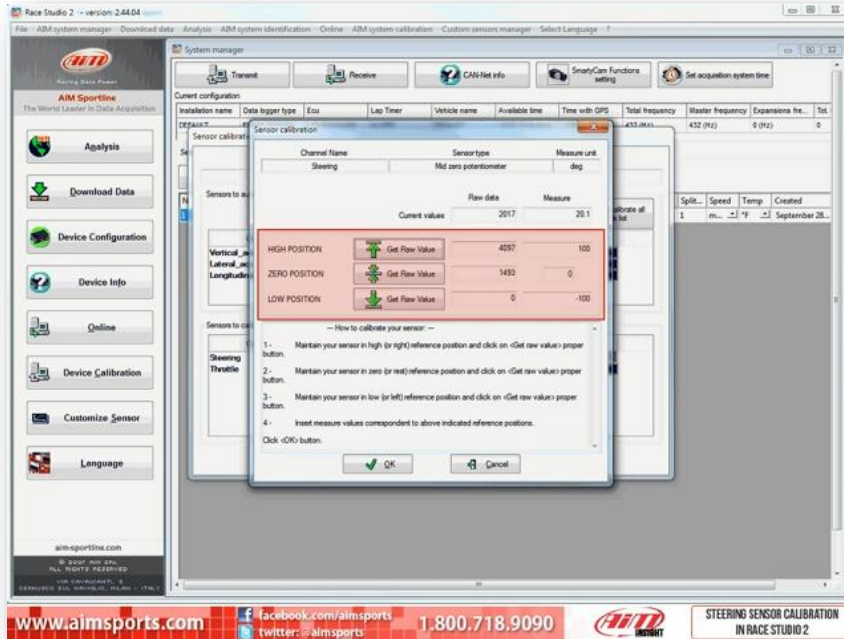
- Jan 19 Peter Krause & Associates, Alton, VA (Driver Coaches)
- Jan 20 Peter Krause & Associates, Alton, VA (Practical Auto)
- Jan 21 Peter Krause & Associates, Alton, VA (Advanced Auto)
- Jan 26 APBA National Convention, Chicago, IL (Practical Boat)
- Feb 03 Kart O Rama, Sumner, WA (Practical Kart)
- 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)



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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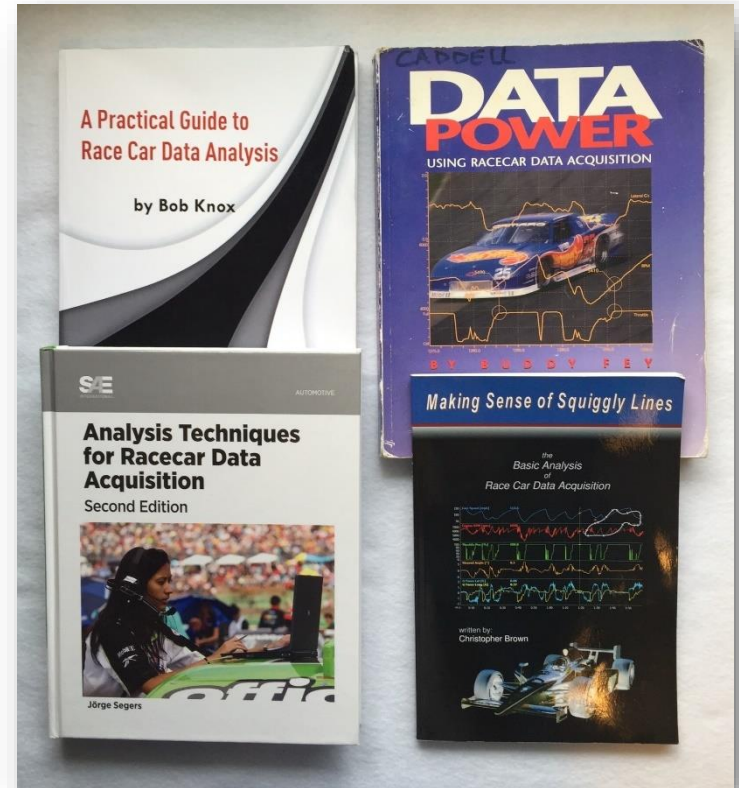
Additional Materials

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)

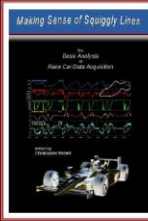


Just a few, many are available!

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



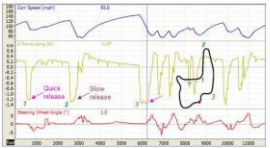
Making Sense of Squiggly Lines
Data points are just words, but when connected with a squiggly line they tell a story...

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.

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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

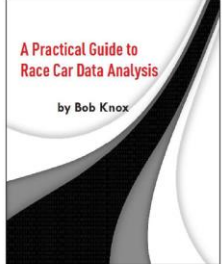
A Practical Guide to Race Car Data Analysis Bob Knox

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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For more information go to: <http://www.hpacademy.com>

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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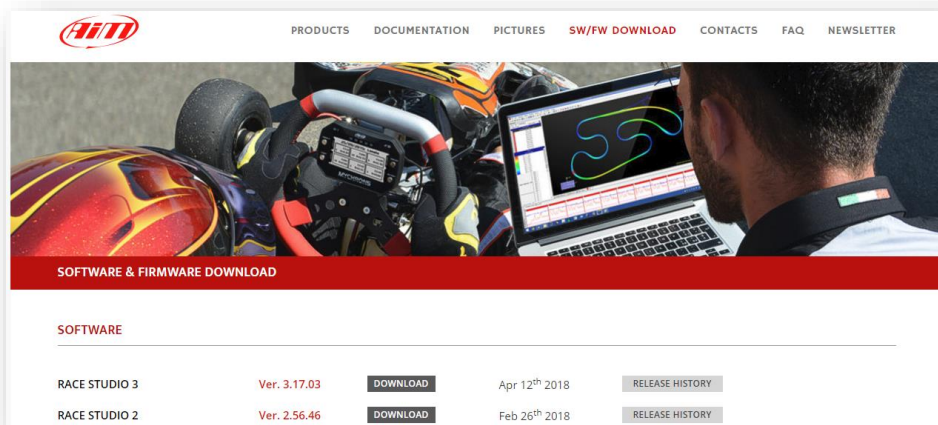
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Additional Materials

Discounts



Current Software/Firmware



• Software

- Race Studio 3 3.18.00 (04/17/18)
- Race Studio 2 2.56.46 (02/26/18)

• Camera Firmware

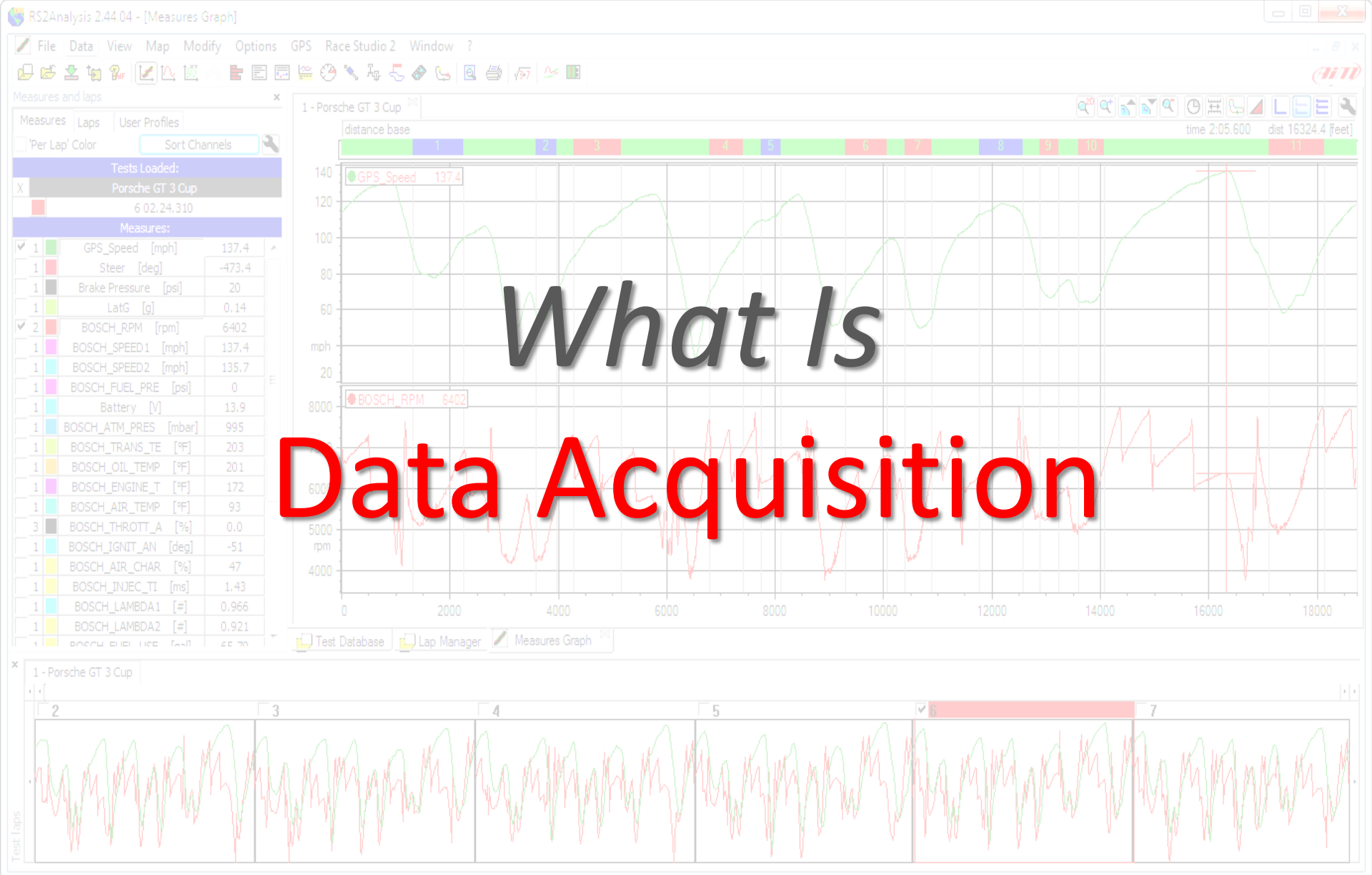
- SmartyCam HD 1.03.72 (12/04/17)

• 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)

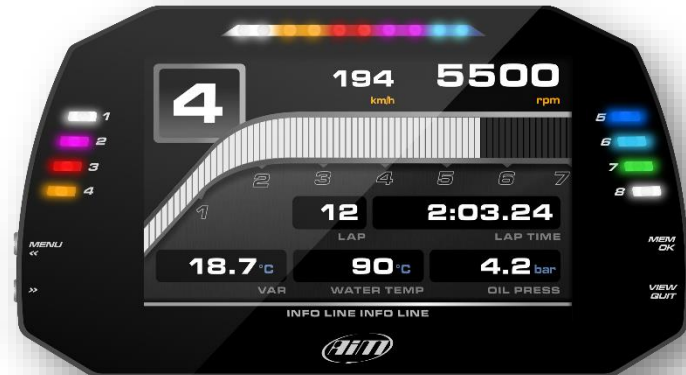
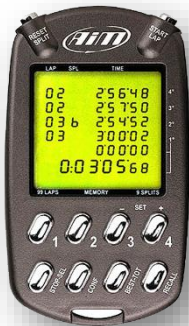


What Is Data Acquisition

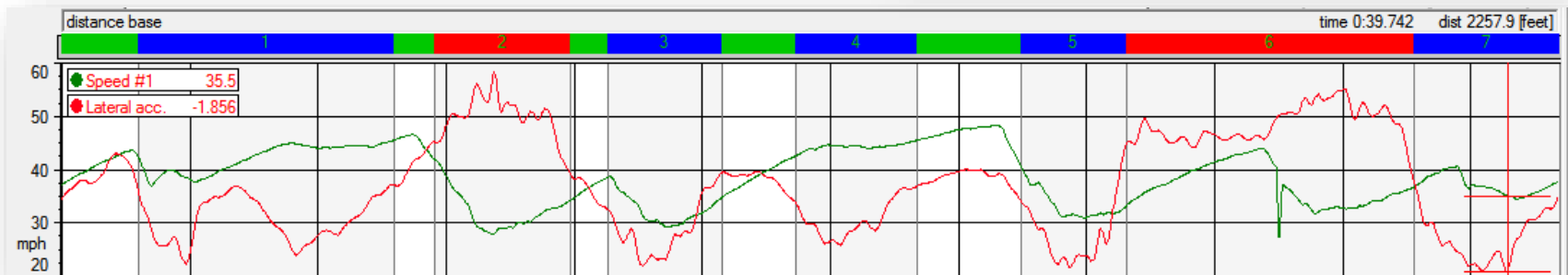
What is Data Acquisition

Different Methods

- Seat of the Pants
- Stopwatch
- Video, Especially 'SmartVideo'
- Data Acquisition Systems
 - Hardware and Software



- Just like an engine or shock dyno, the data system measures and records performance
- Not just *Vehicle* performance
- Not just *Driver* performance
- But *Overall* performance!
- Sensors gather values and hardware stores the data of the dynamics of what the vehicle is doing
- Software makes the detailed data analysis possible

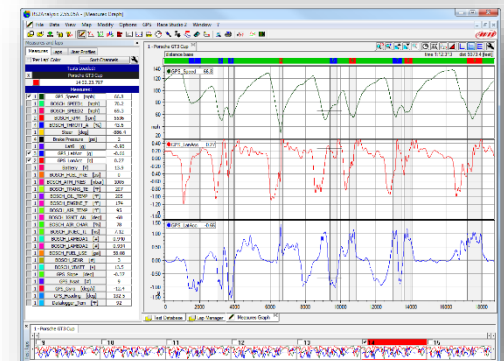
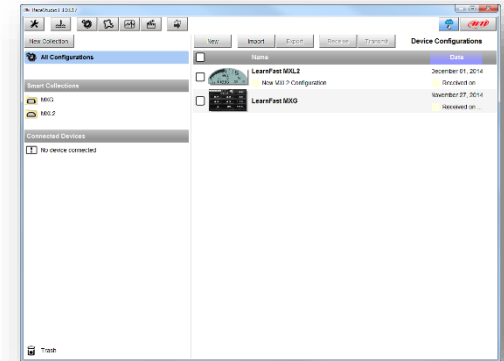


- **Configuration** (Pre Session)

- Race Studio has Powerful Functions for Configuring Your AiM Sports Data System
- Sensors
- Expansion Modules
- Sampling Rates
- Alarms
- Shift Lights

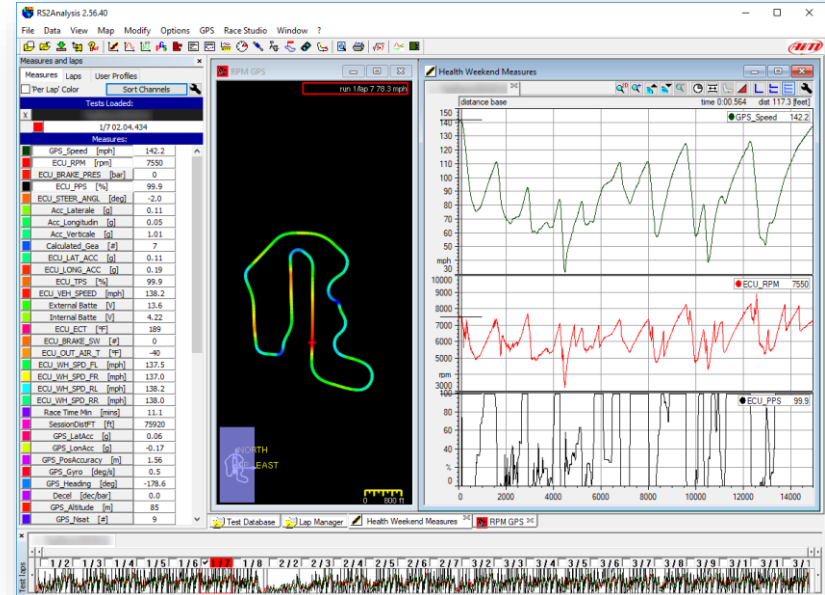
- **Data Analysis** (Post Session)

- Race Studio Features the Functions Needed to View, Analyze, and Understand Your Recorded Data
- Measure Plots
- X/Y Plots
- Channel Reports
- Suspension Analysis
- And Much More!

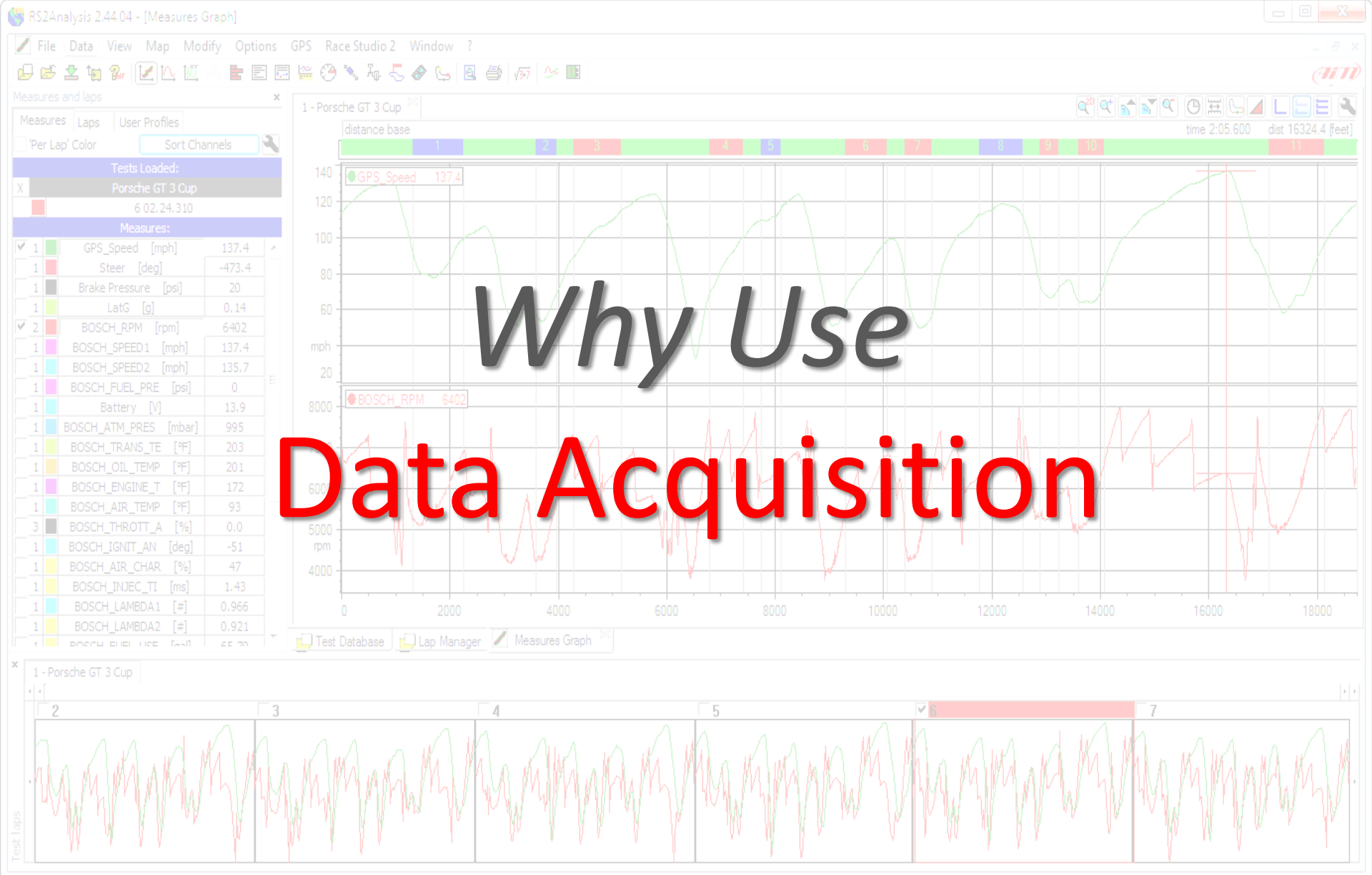


What is Data Acquisition

Data = Knowledge



Knowledge = Speed ... How **Fast** Do You Want to Go?



Why Use Data Acquisition

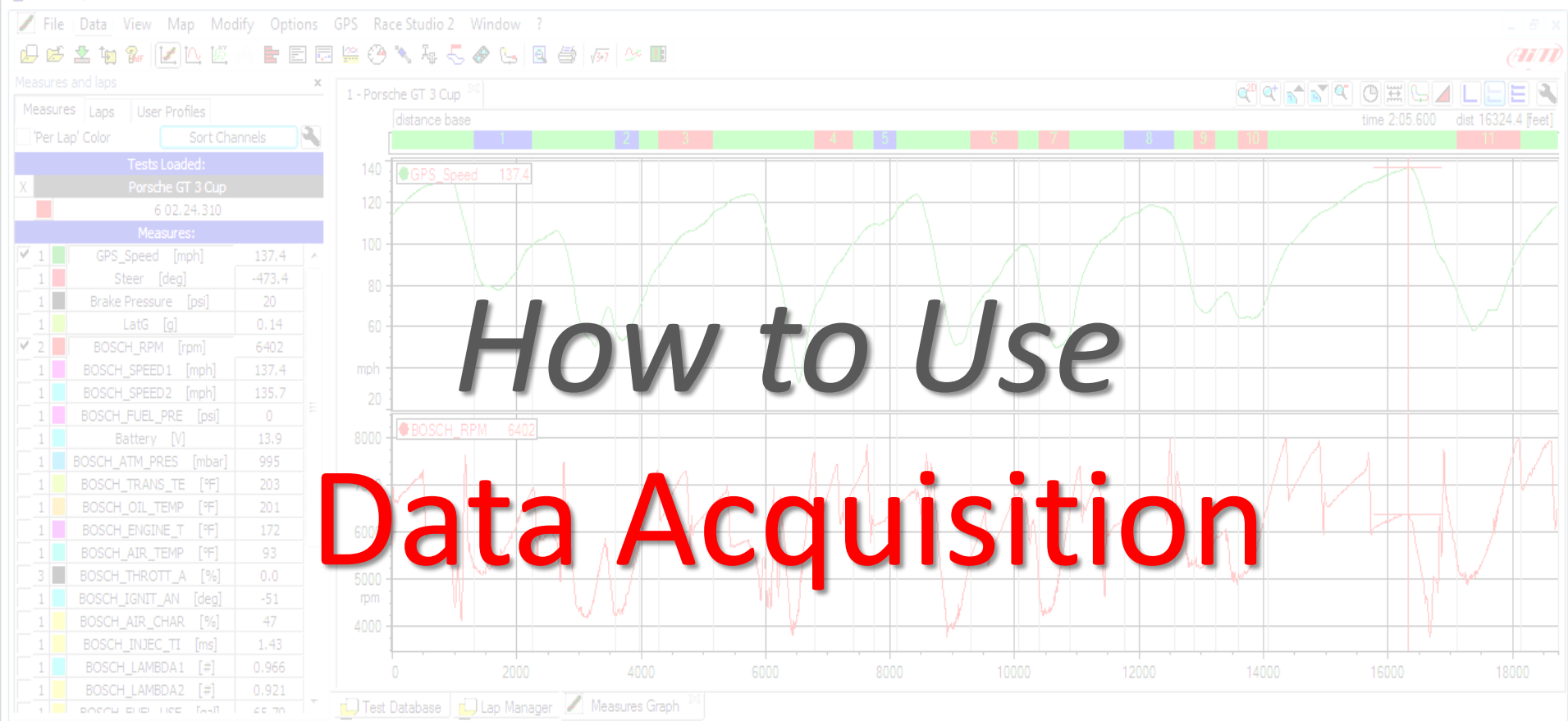
Why Use Data Acquisition

To Improve:

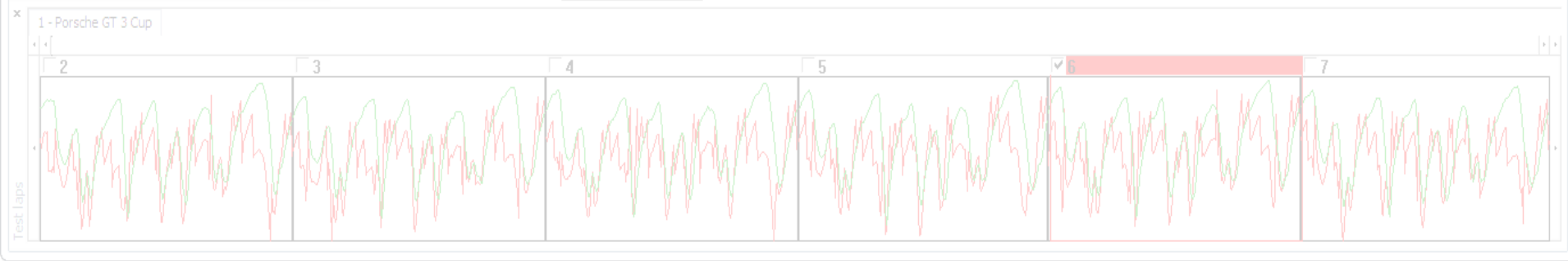
- Driver Performance
- Vehicle Performance
- Vehicle Health
- Results!



With the Proper and Consistent use of Data, Your Race Program Will Improve



How to Use Data Acquisition



How to Use Data Acquisition

- Hardware

- Design
- Install
- Configure
- Calibrate
- Use
- Download

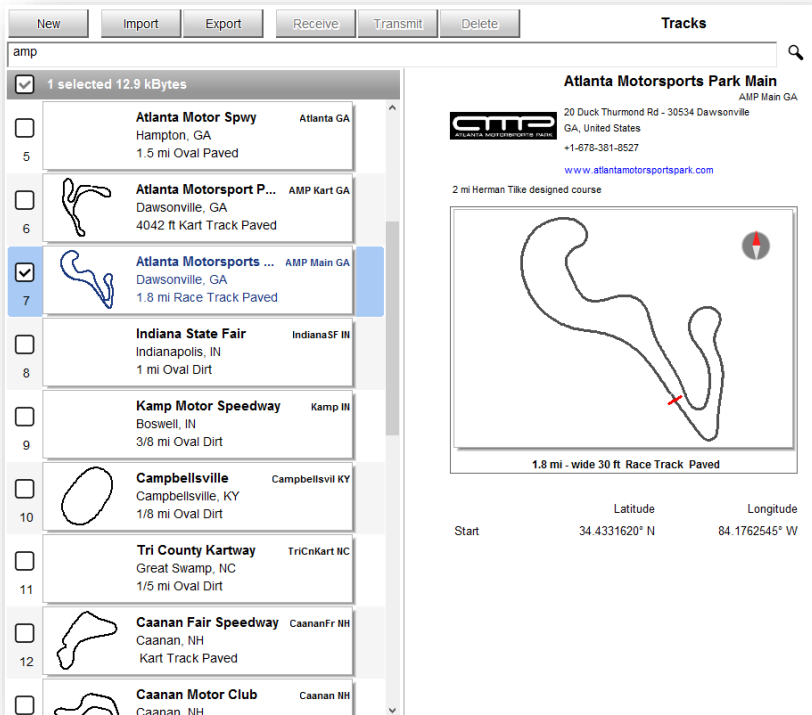
- Software

- Open
- Analyze
 - *What Happened?*
 - *Where Did it Happen?*
 - *Why Did it Happen?*

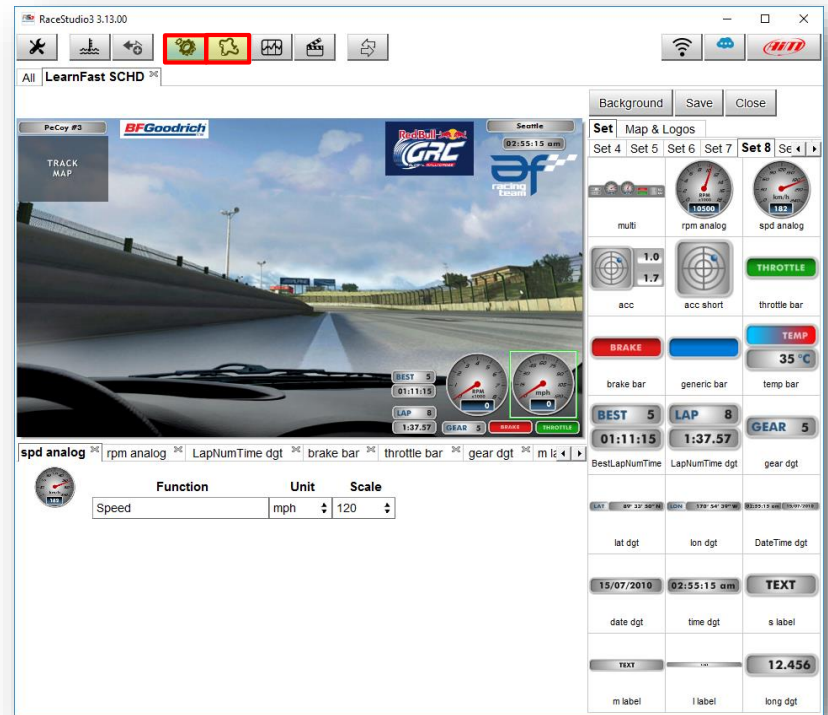
← Repeat



GPS Tracks



Video Configuration



GPS Tracks function allows you to take full advantage of the AiM Sports GPS technology with start/finish coordinates, split positions and the ability to import/export.

Video Configurations function is designed to help you configure your SmartyCamHD and allow customizing the data and video integration.

How to Use Data Acquisition

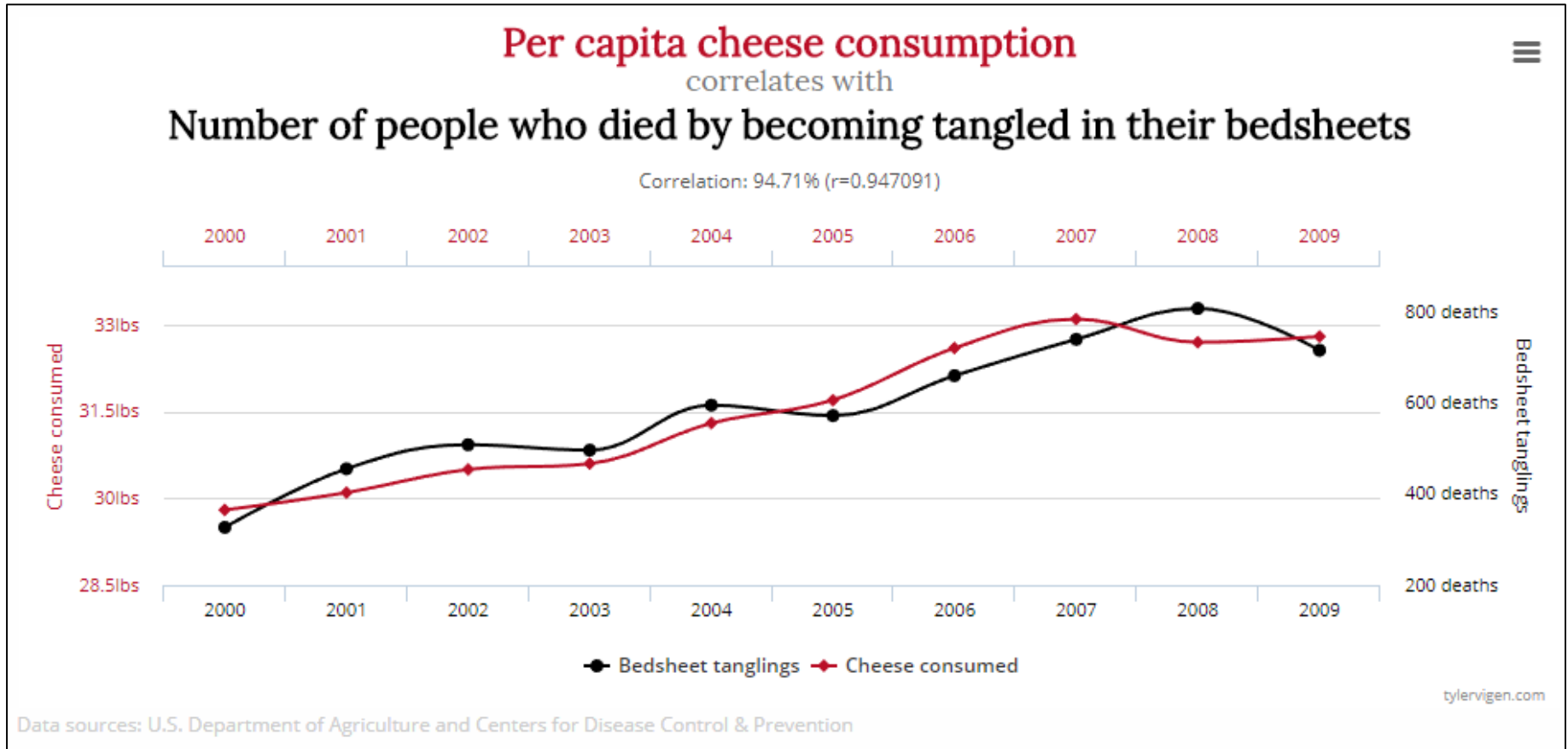
Data Analysis Concepts

- **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**



Data Correlation

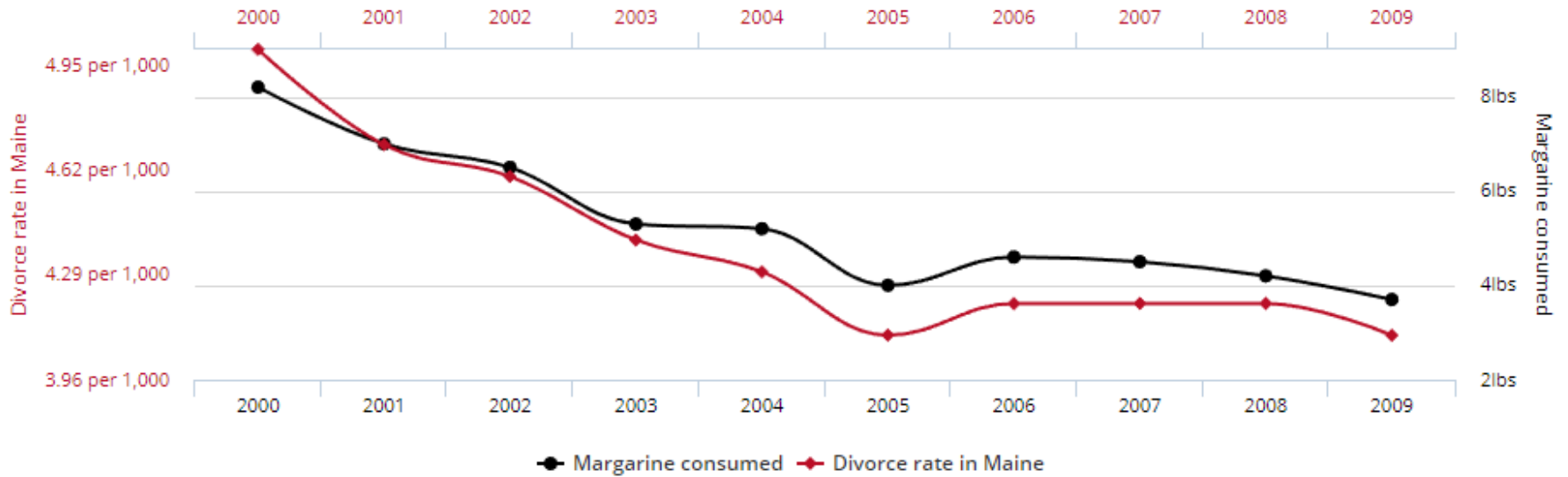
Here are some fun spurious data correlations to prove that while data does not lie, you still need 'Rational Thinking' to establish if there is an actual data correlation in the data.



Data Correlation

Divorce rate in Maine correlates with Per capita consumption of margarine

Correlation: 99.26% ($r=0.992558$)

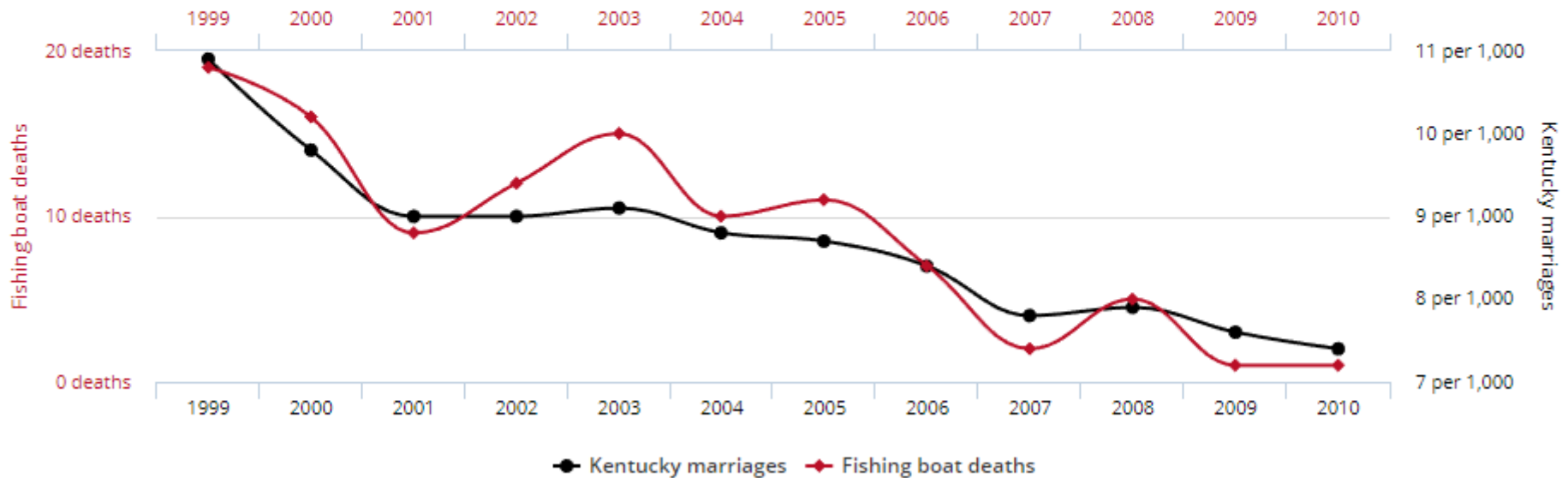


Data sources: National Vital Statistics Reports and U.S. Department of Agriculture

Data Correlation

People who drowned after falling out of a fishing boat
correlates with
Marriage rate in Kentucky

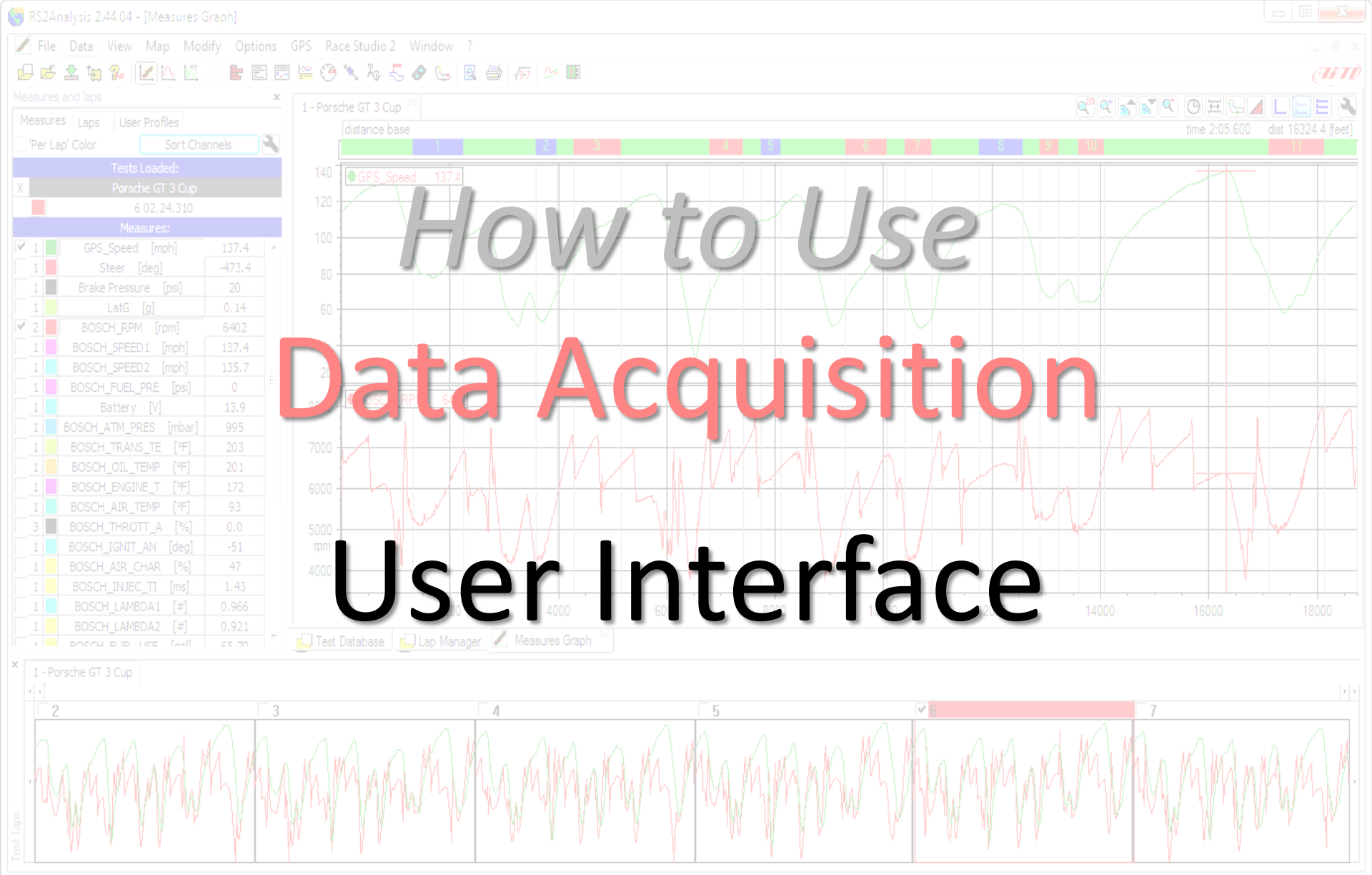
Correlation: 95.24% ($r=0.952407$)



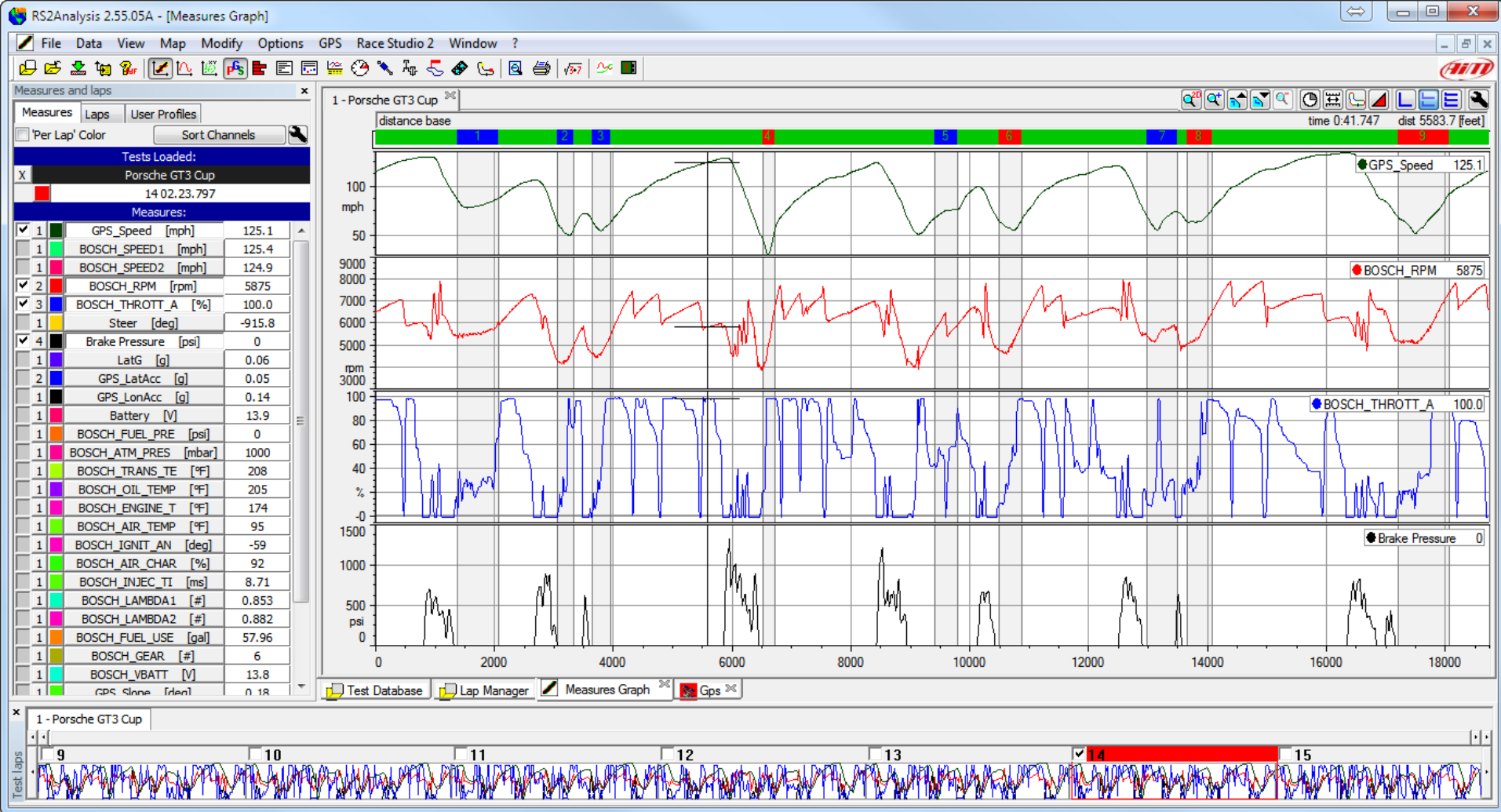
tylervigen.com

Data sources: Centers for Disease Control & Prevention and National Vital Statistics Reports

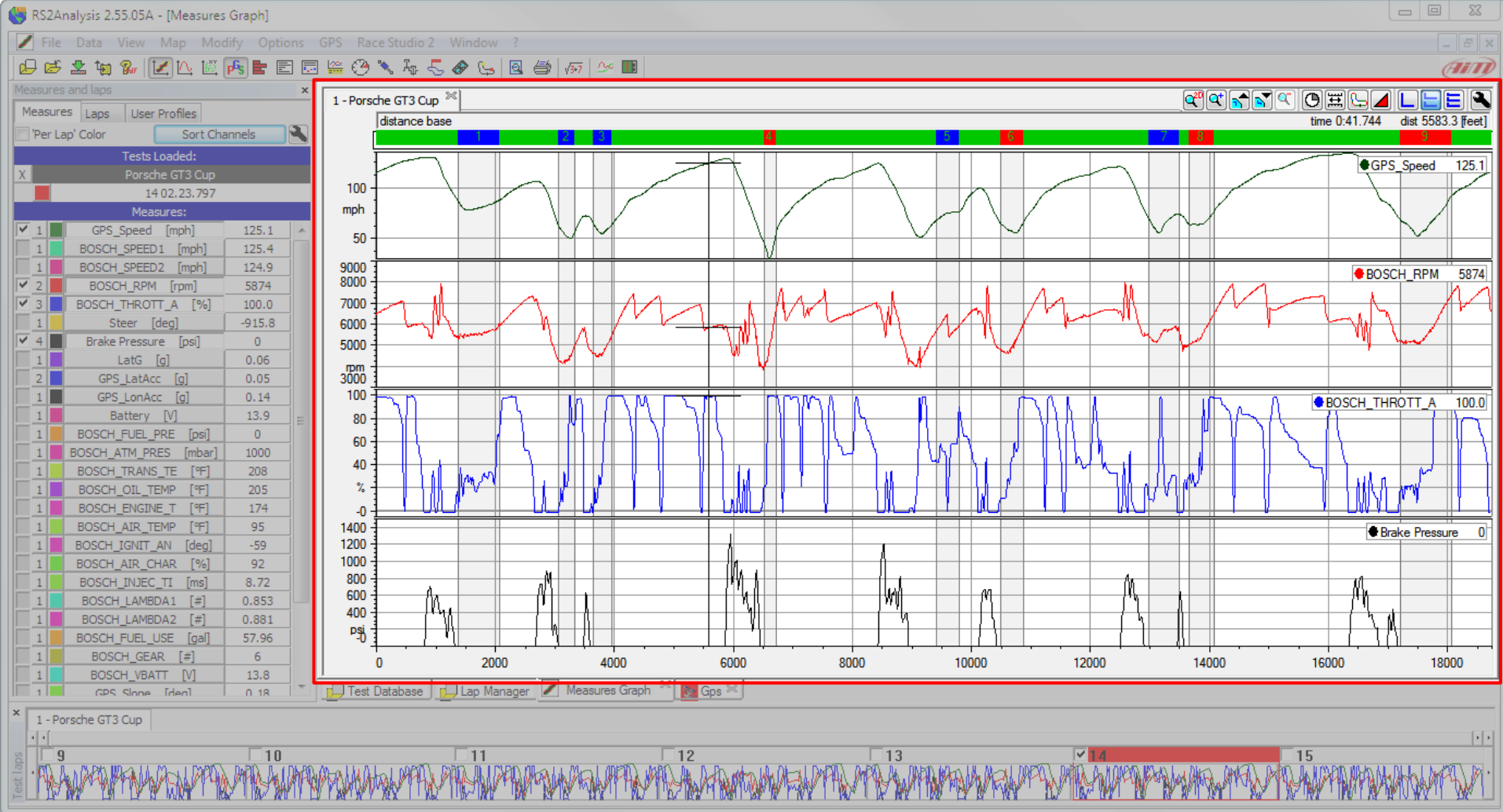
Even silly data can correlate but it is your racing judgment and common sense that allows data to be used correctly.



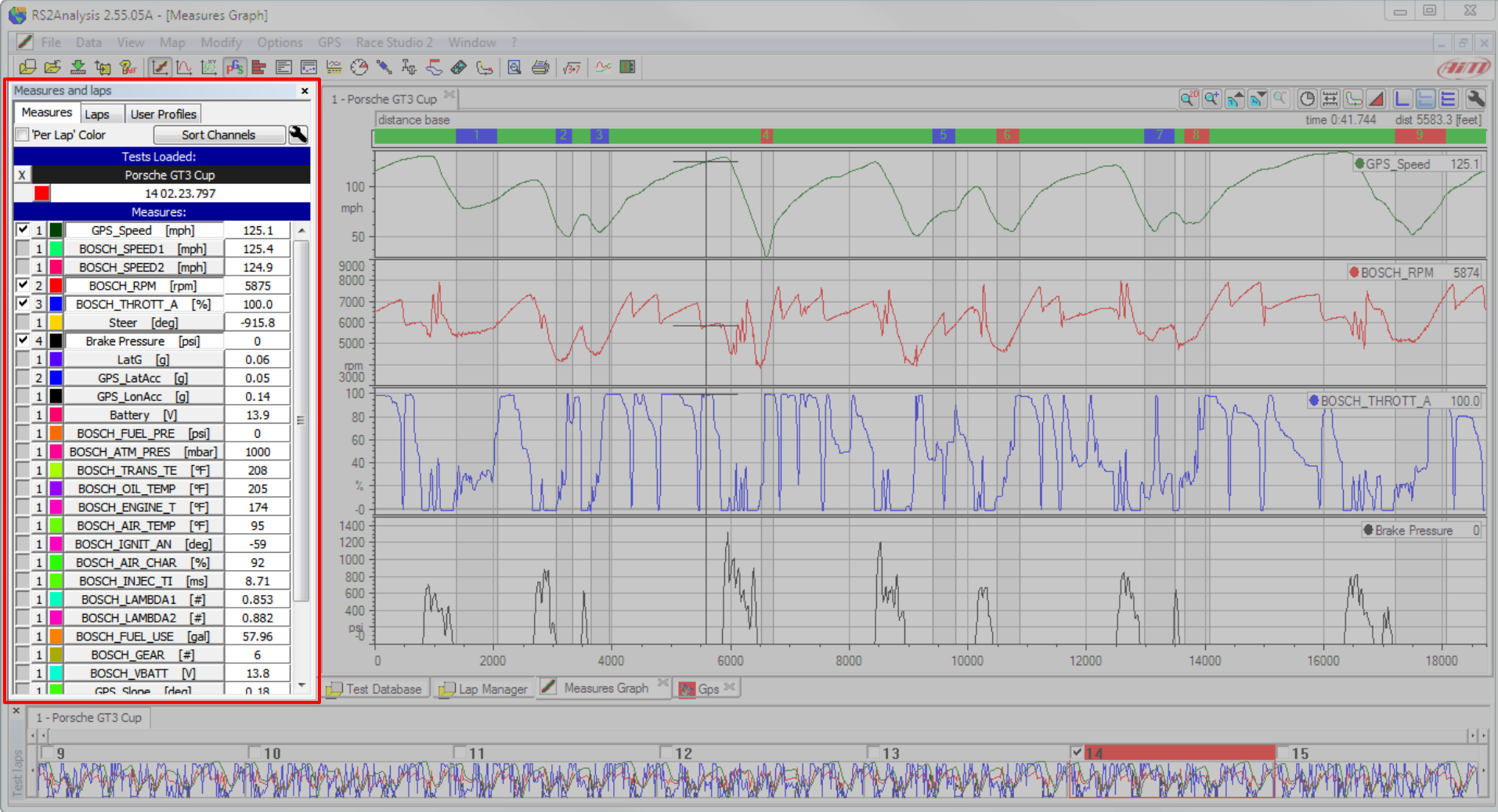
How to Use Data Acquisition User Interface



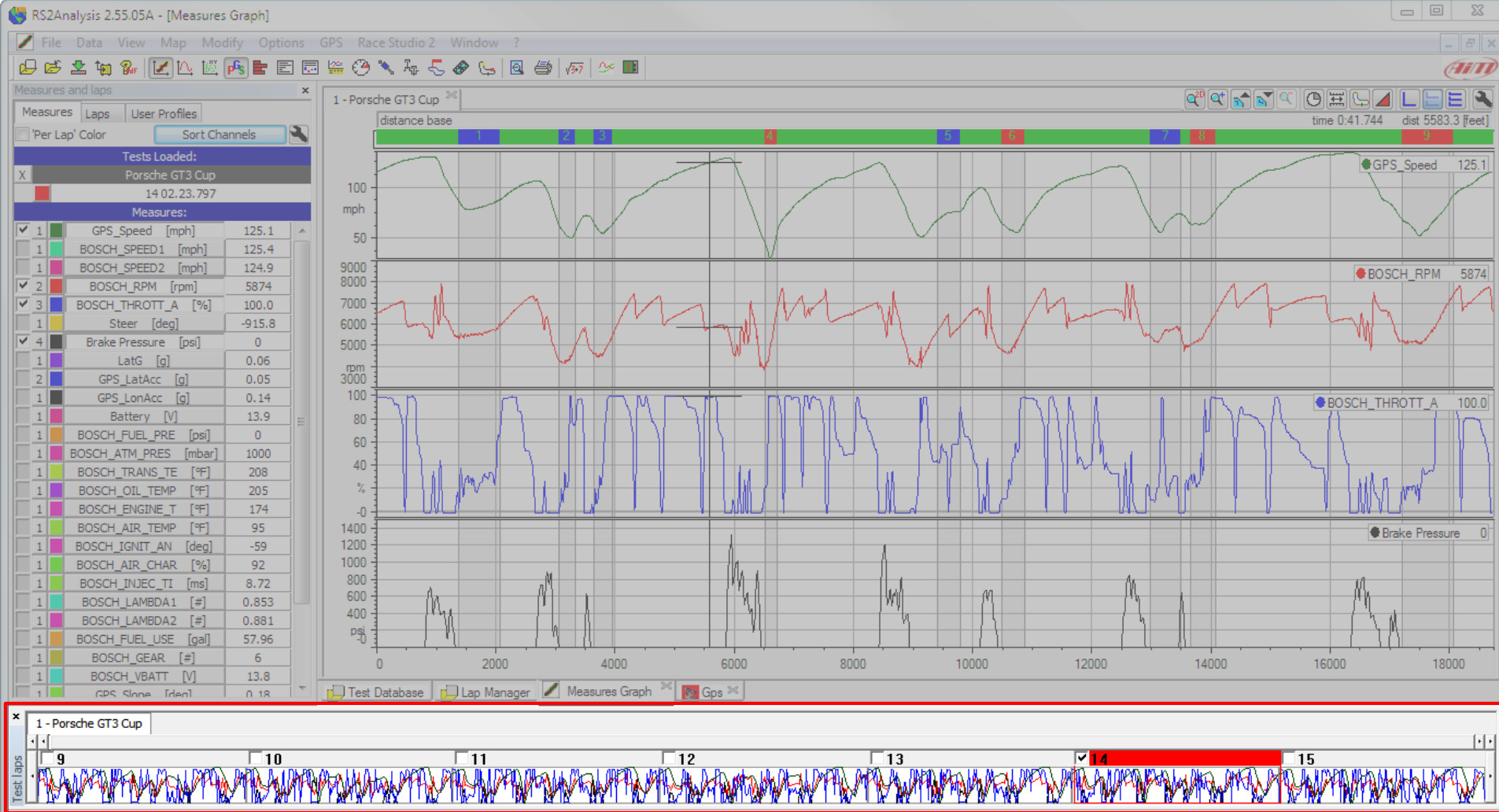
Graphical User Interface - Race Studio 2 Analysis This are 5 main parts to the Race Studio 2 Analysis software. Let's look at each one.



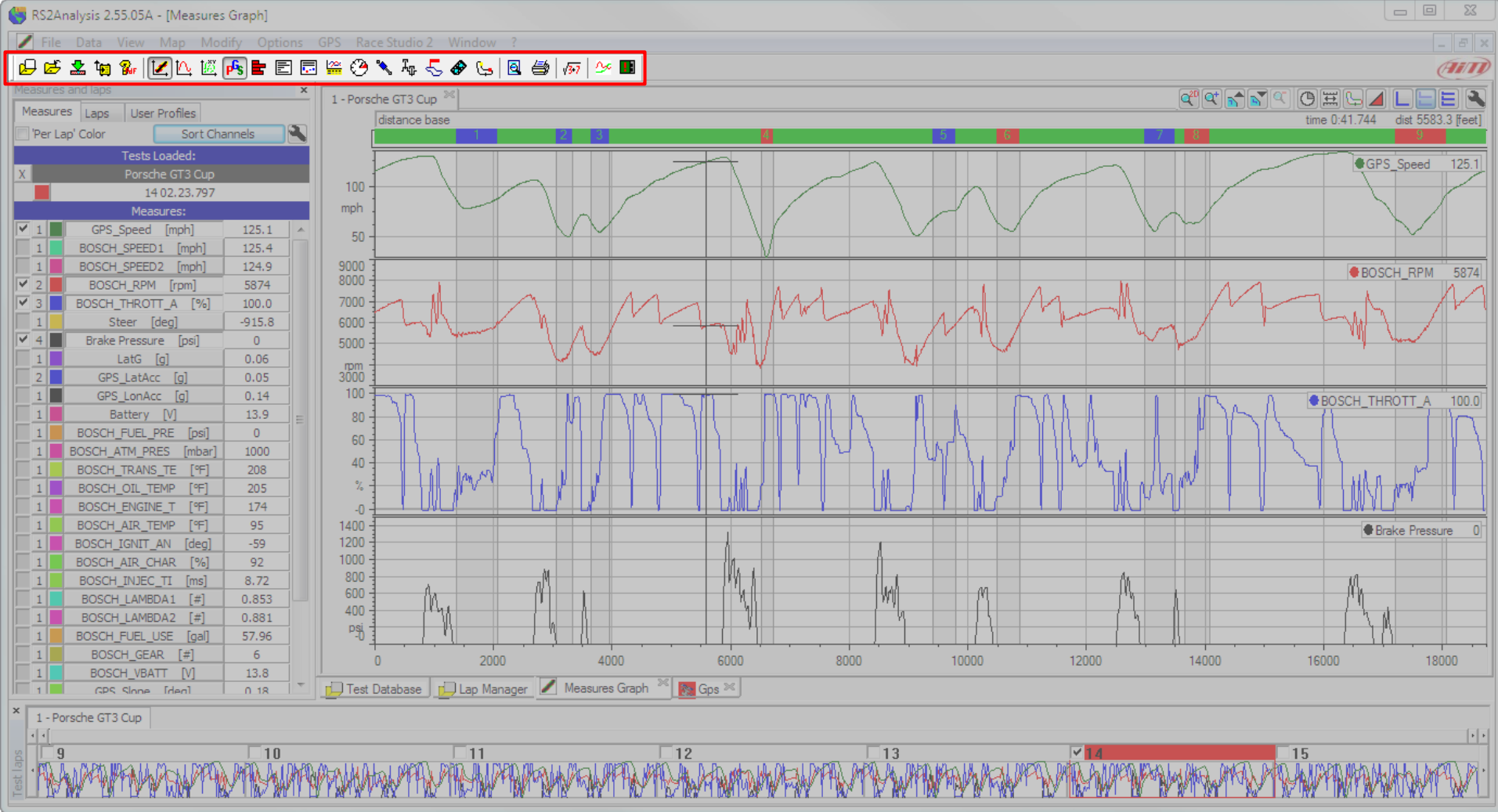
Graphical User Interface - Race Studio 2 Analysis This is the Main Window and where all of the data analysis will be done. This is currently showing a Measures Graph.



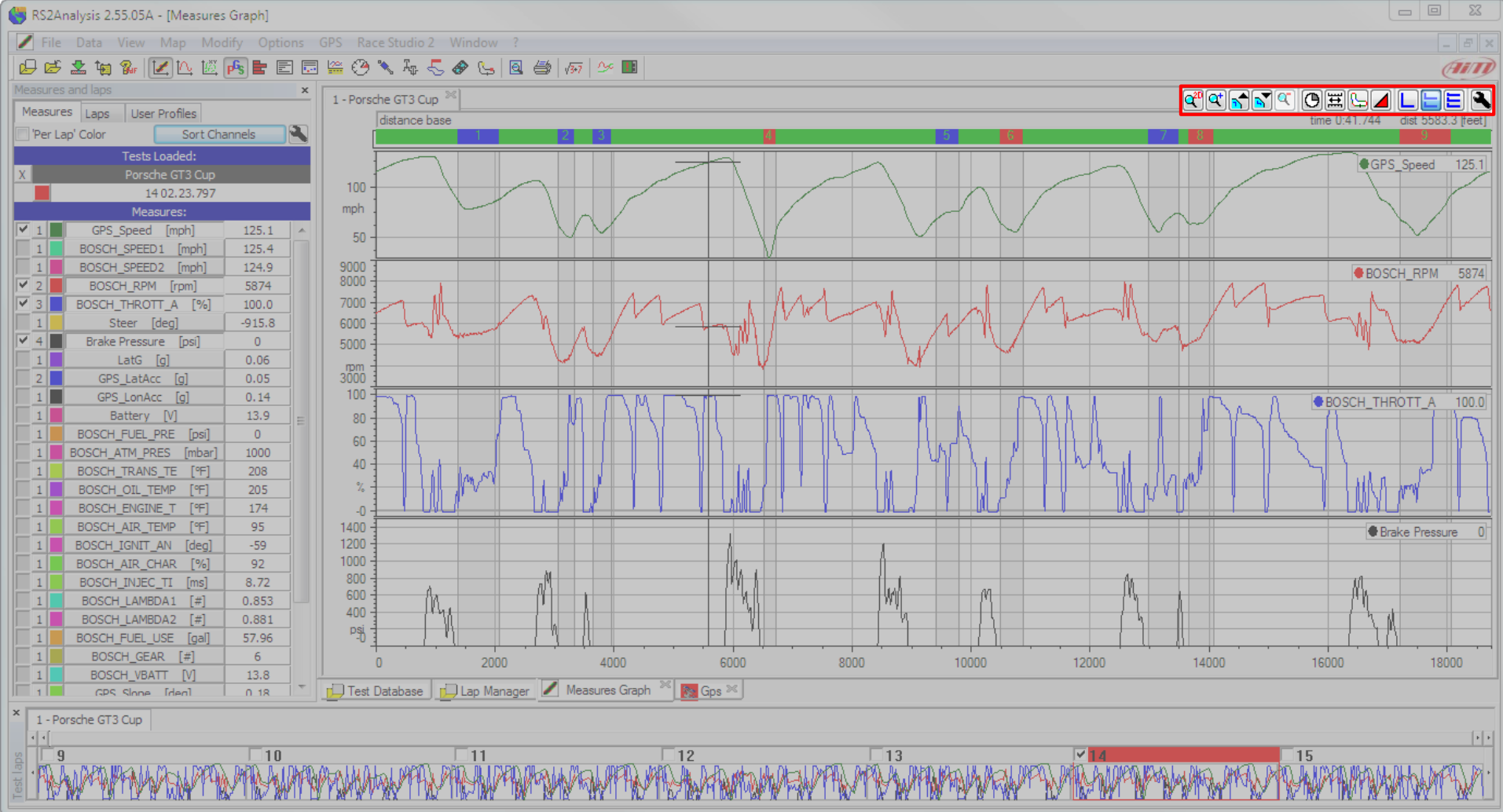
Graphical User Interface - Race Studio 2 Analysis This is the Measures and Laps Toolbar where we have 3 tabs; Measures, Laps, and User Profiles.



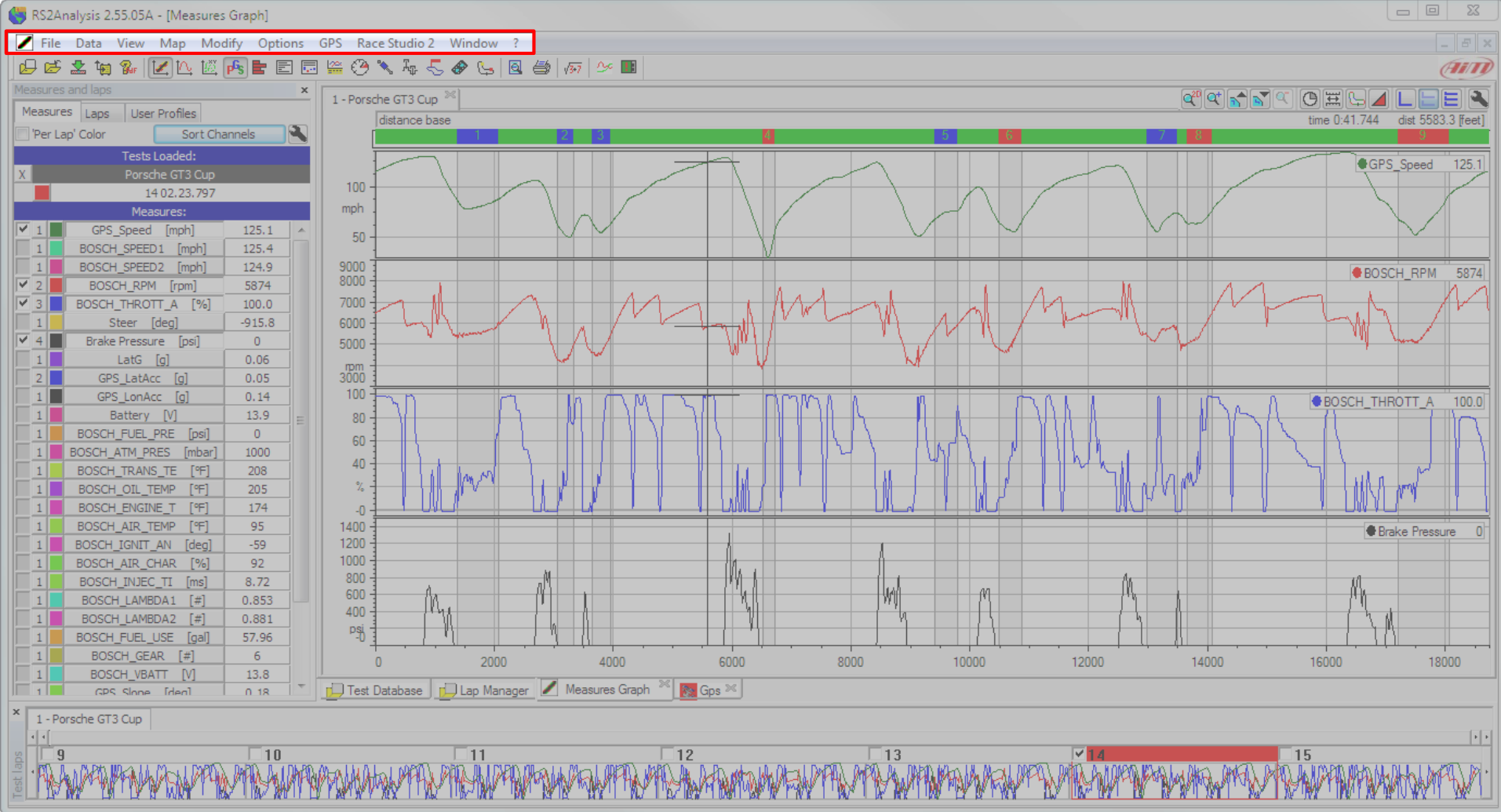
Graphical User Interface - Race Studio 2 Analysis This is the Test Laps Toolbar and shows all of the enabled laps and active channels.



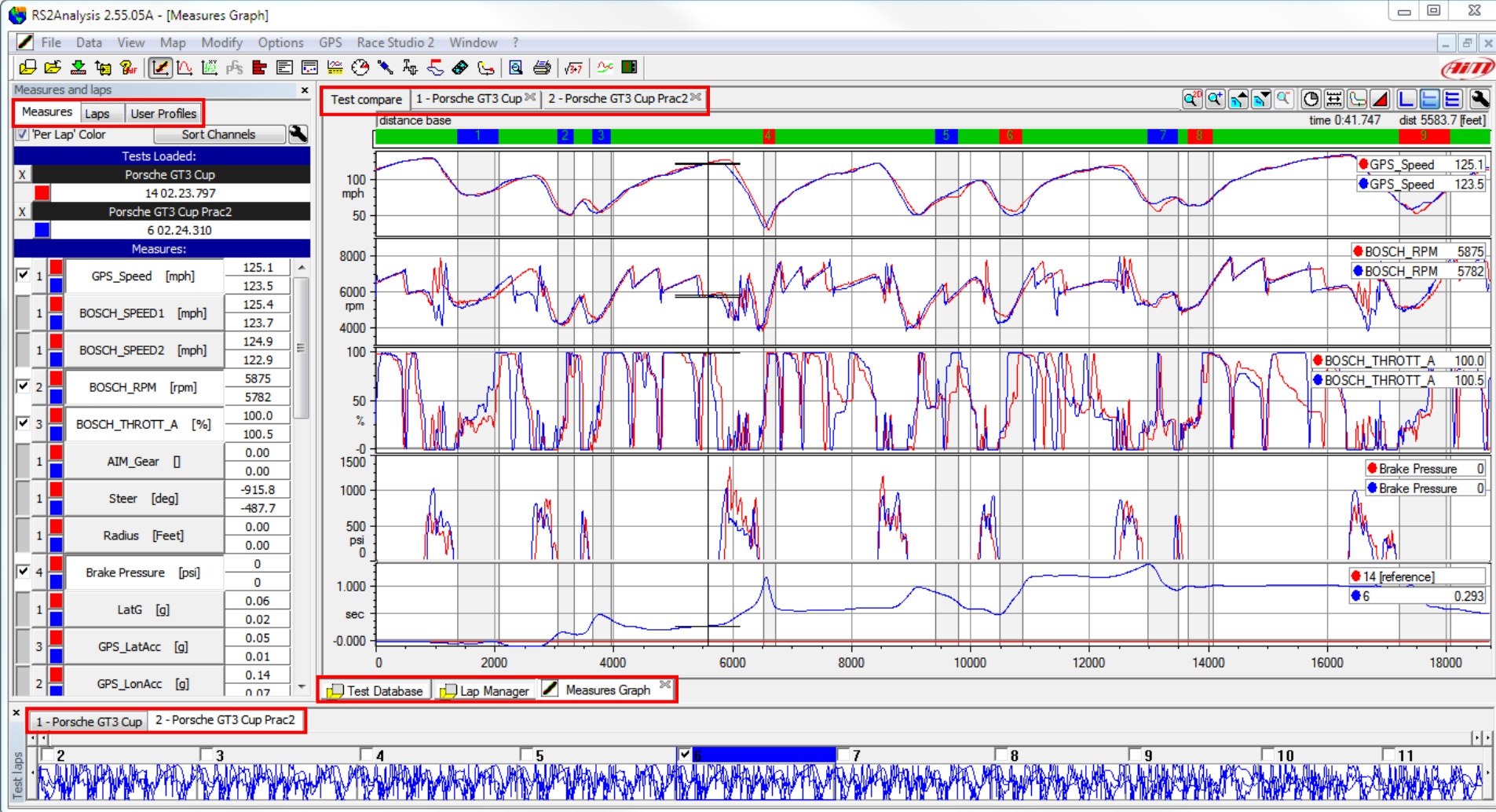
Graphical User Interface - Race Studio 2 Analysis This is Primary Icon Toolbar and this is where you find shortcuts for turning on and off popular functions.



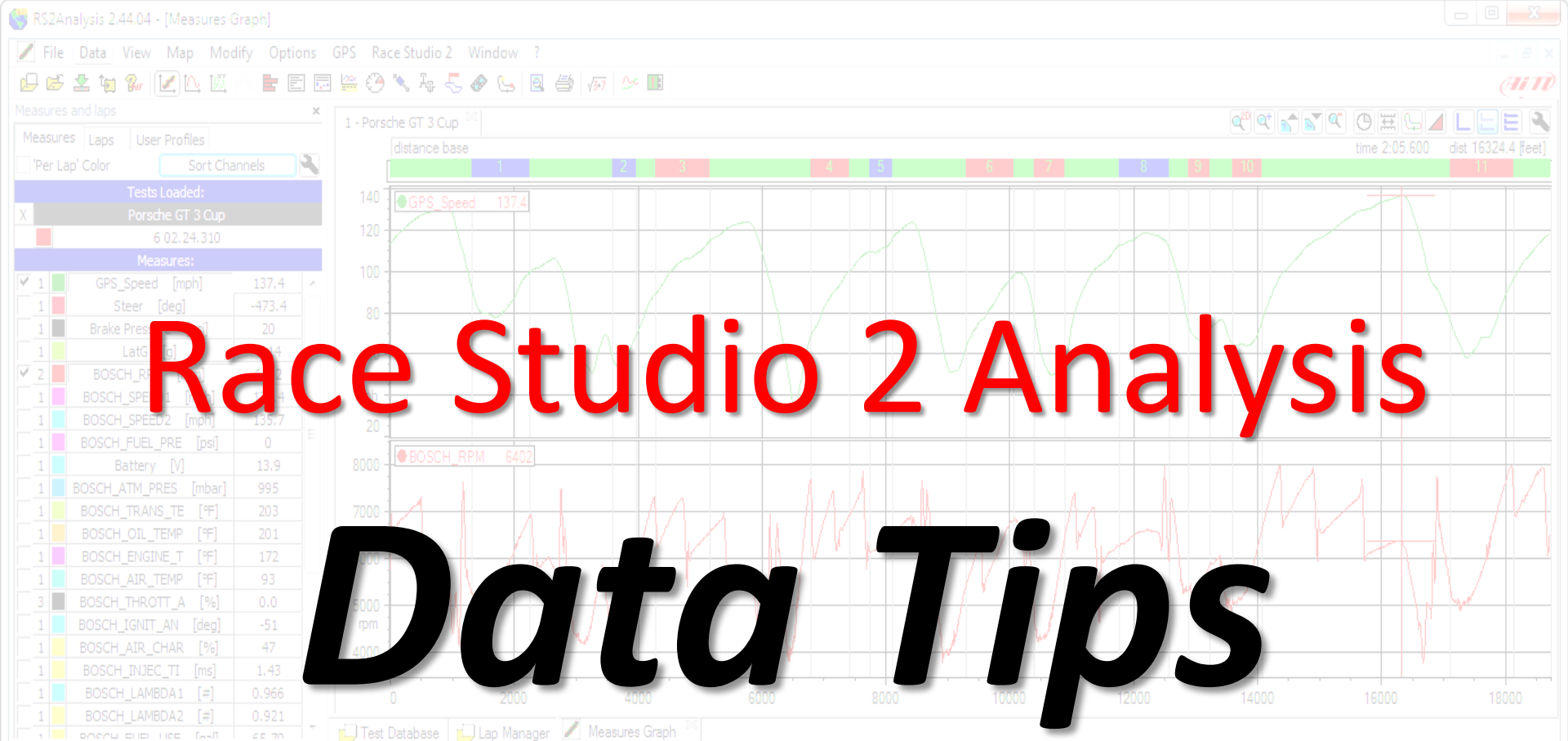
Graphical User Interface - Race Studio 2 Analysis This is the Secondary Icon Toolbar and where you find shortcuts for modifying the data in the Main Window. (Zooming, Measuring, Views, etc.)



Graphical User Interface - Race Studio 2 Analysis This is the Windows pulldown menu. All of the deeper functions are available here.

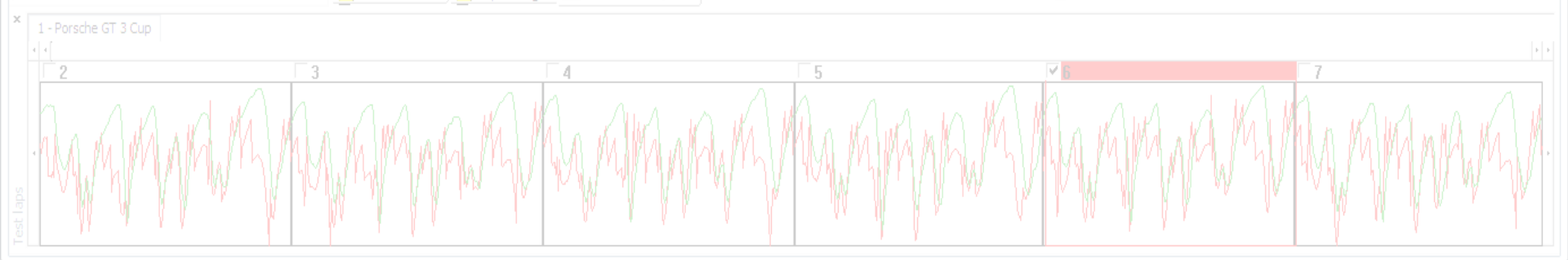


Graphical User Interface - Race Studio 2 Analysis has several places that feature tabs. These tabs make the software much easier to use and allow several functions to share the same workspace.



Race Studio 2 Analysis

Data Tips

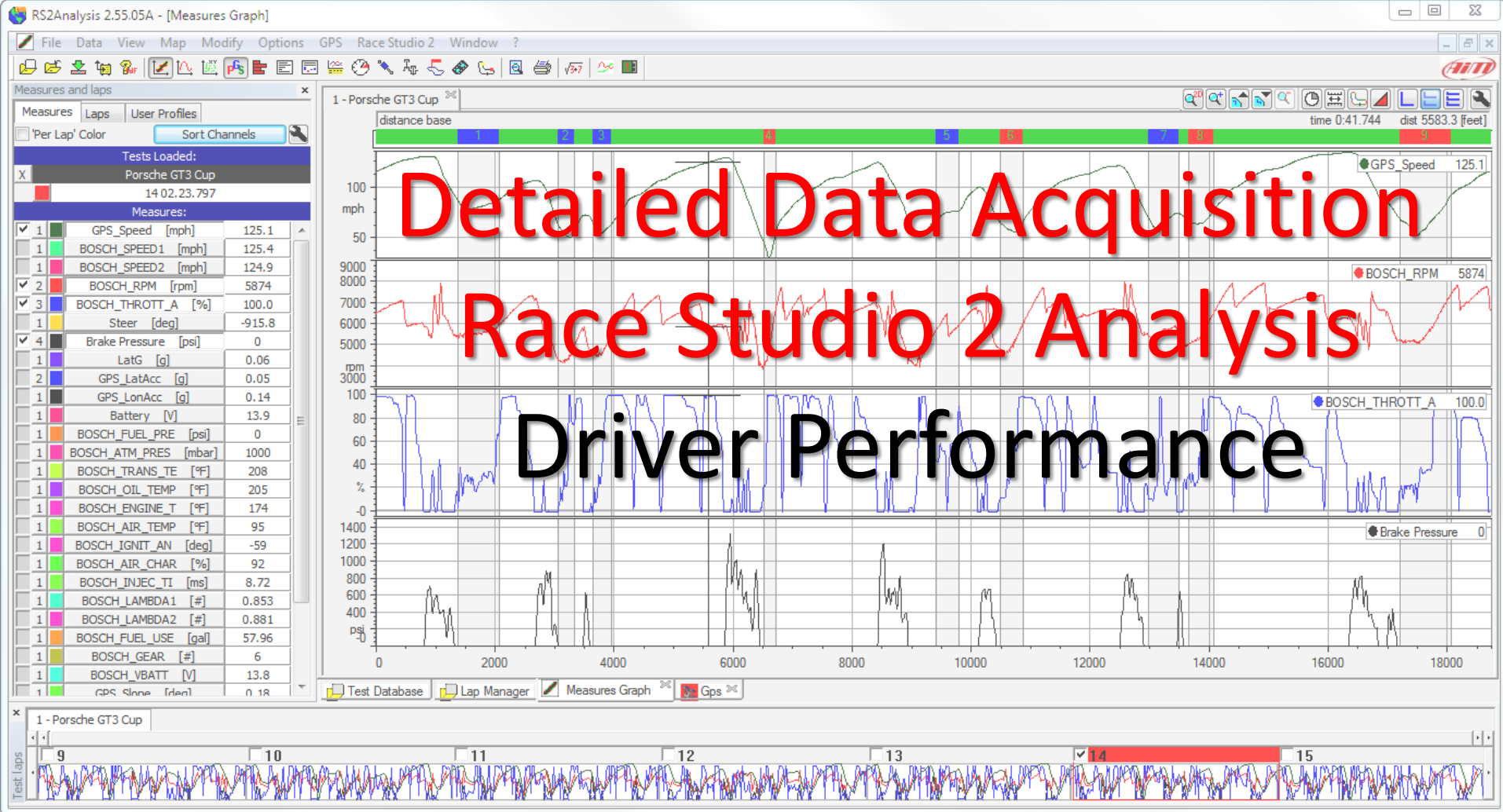


Function	F Key	Shift+	Alt+	Control+	Other	Menu	Comments
Manual	F1					?=>Manual	
Race Studio 2	F5					Race Studio 2	
Data Animation	F12					View=>Animation	
Show Track Map		Shift+F1				Map=>Show Track Map	
Map Manager		Shift+F2				Map=>Map Manager	
New Map		Shift+F4				Map=>New	
Suspension Analysis		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	

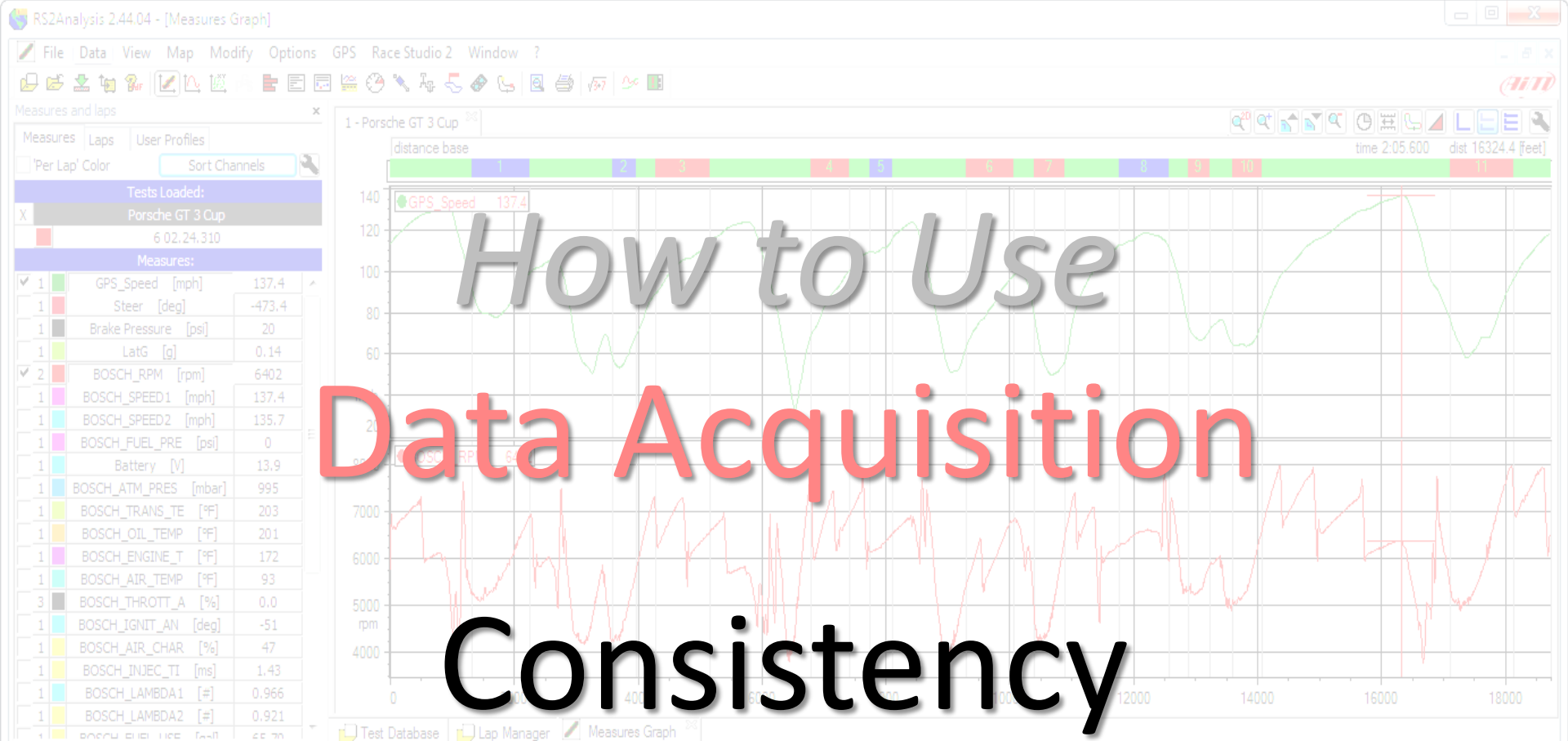
Function	F Key	Shift+	Alt+	Control+	Other	Menu	Comments
Download	F4					Download Data	
Race Studio 2 Analysis	F5					Analysis	
Exit	F10					File=>Exit	
Close Active Window			Alt+F4			None	If no open window, it closes Race Studio 2
Manual			Alt+F10			?=>Manual	
File			Alt+F			File	
Device Configuration			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

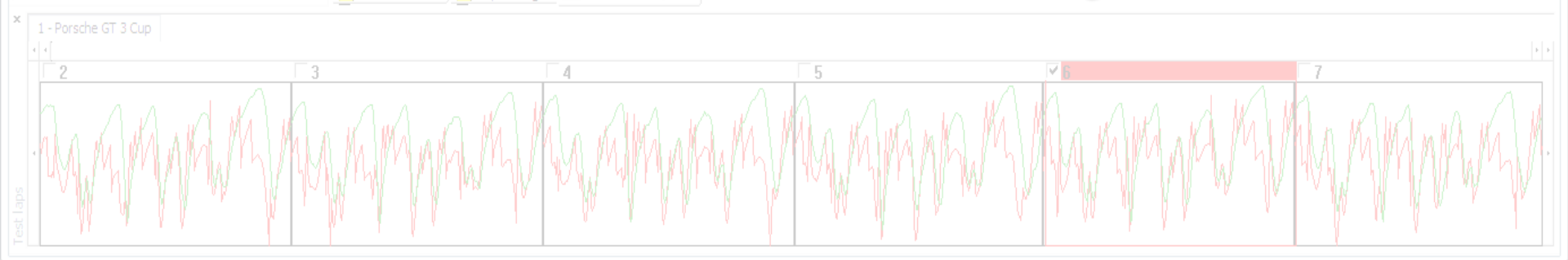


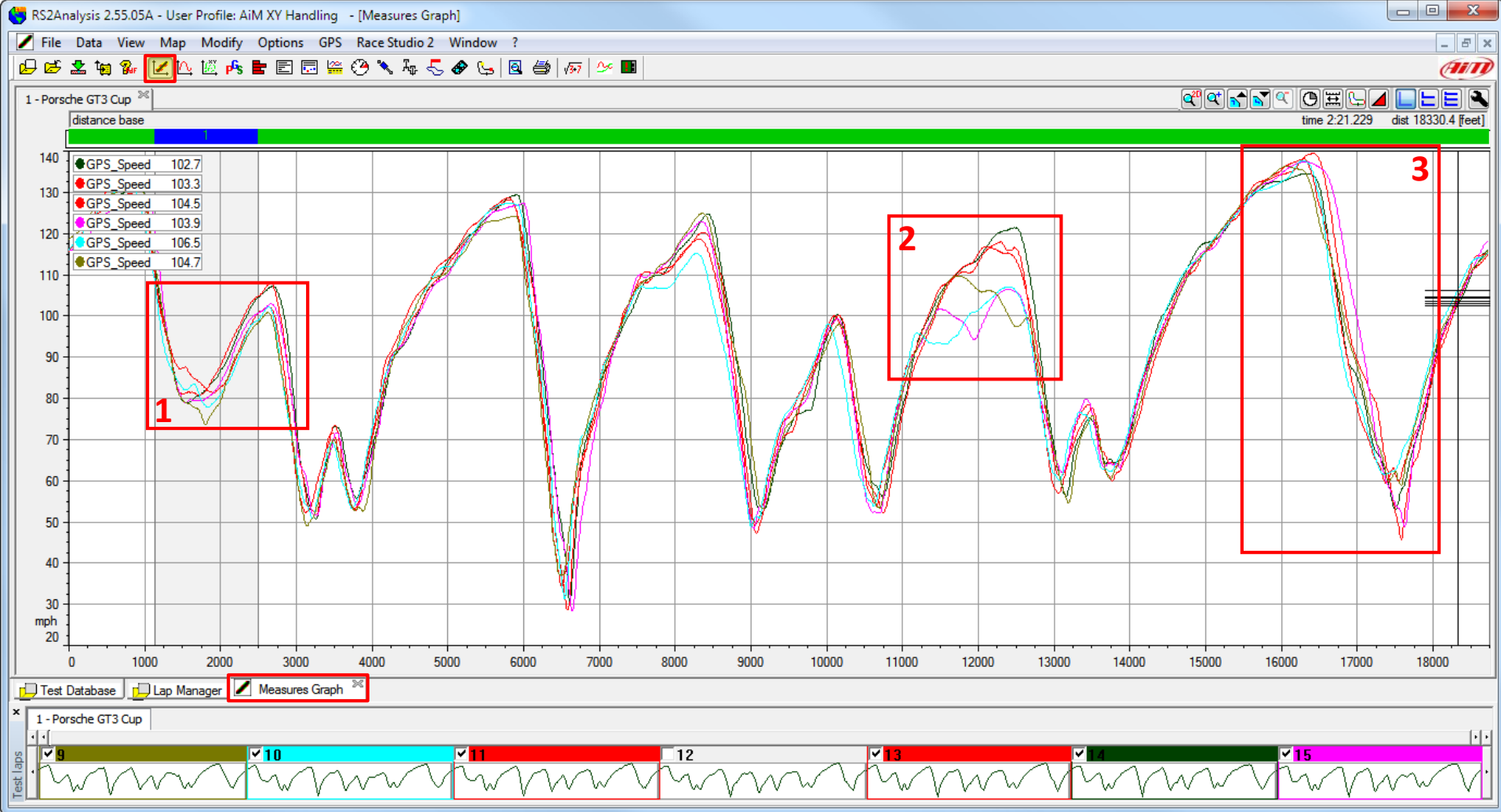


Let's look at several detailed Race Studio 2 Analysis examples to help you with Driver Performance.

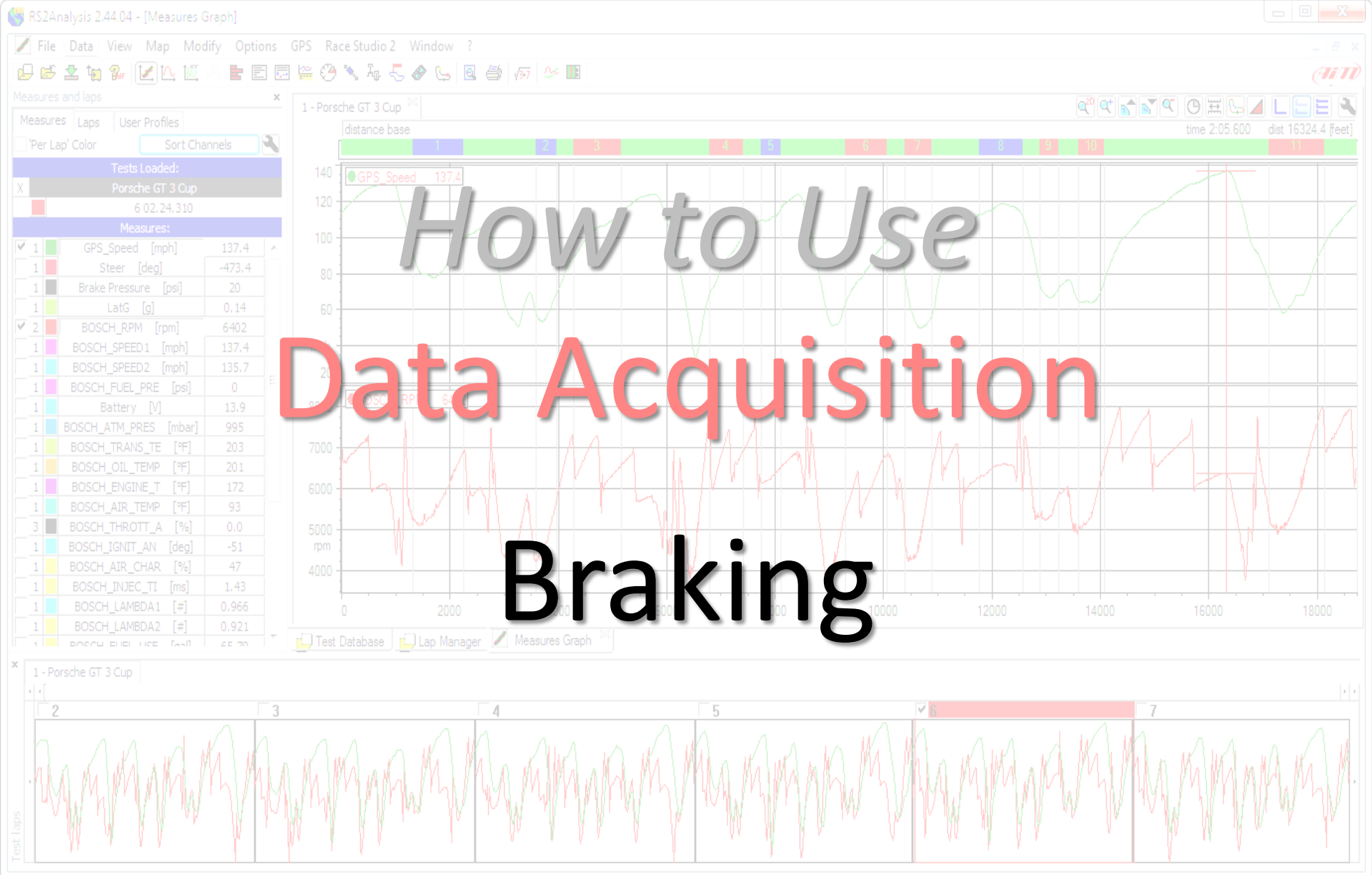


How to Use Data Acquisition Consistency





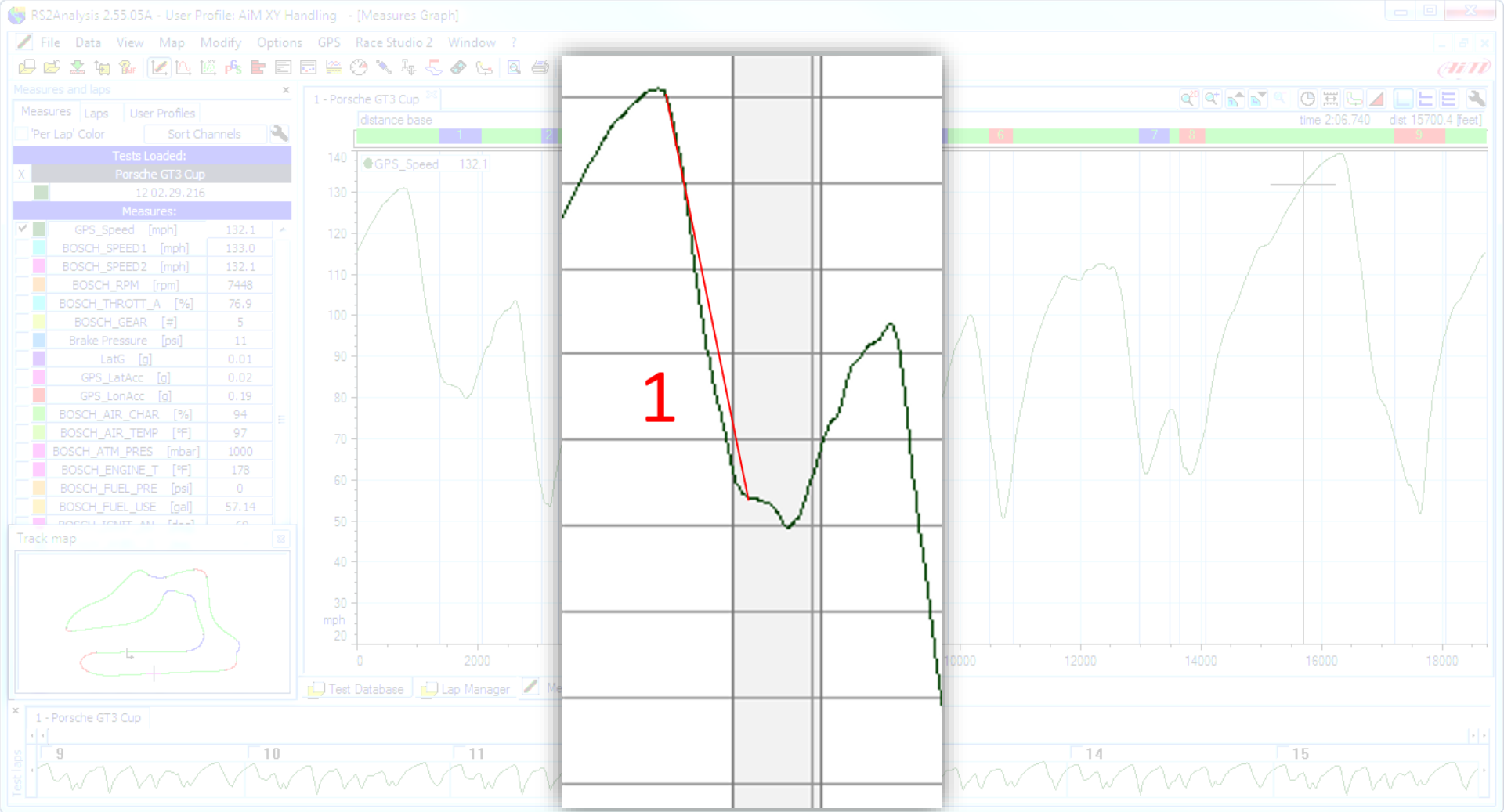
Multiple speed traces can be used to point out inconsistency and point to areas for improvement. In this sample, three areas stand out. In area #1, the inconsistency begins at the end of braking and clearly affects exit speed until the next braking zone. In area #2, the inconsistency is through a high speed kink and may be traffic related. In area #3, the inconsistency starts just before braking and continues through braking.



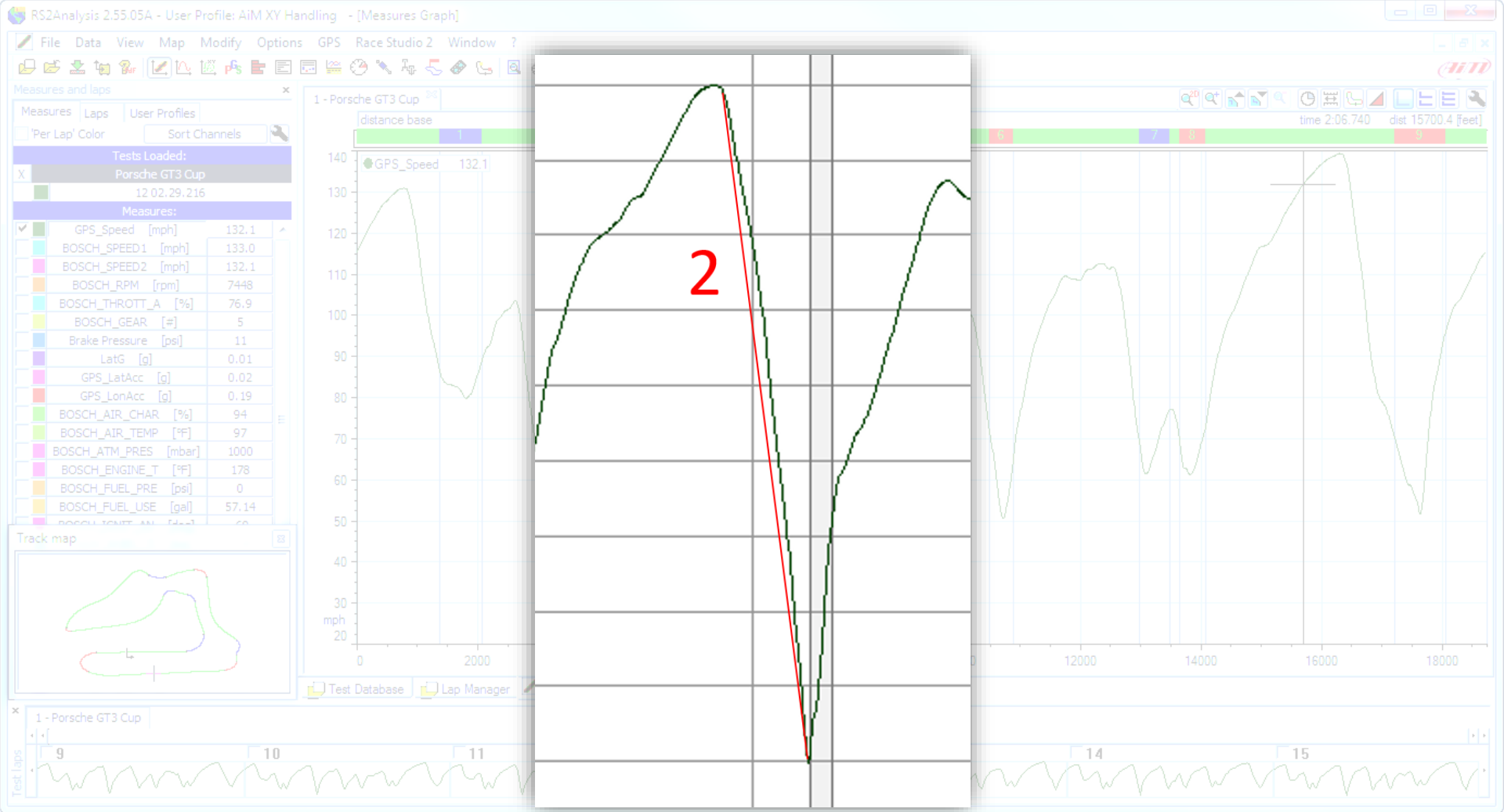
How to Use Data Acquisition Braking



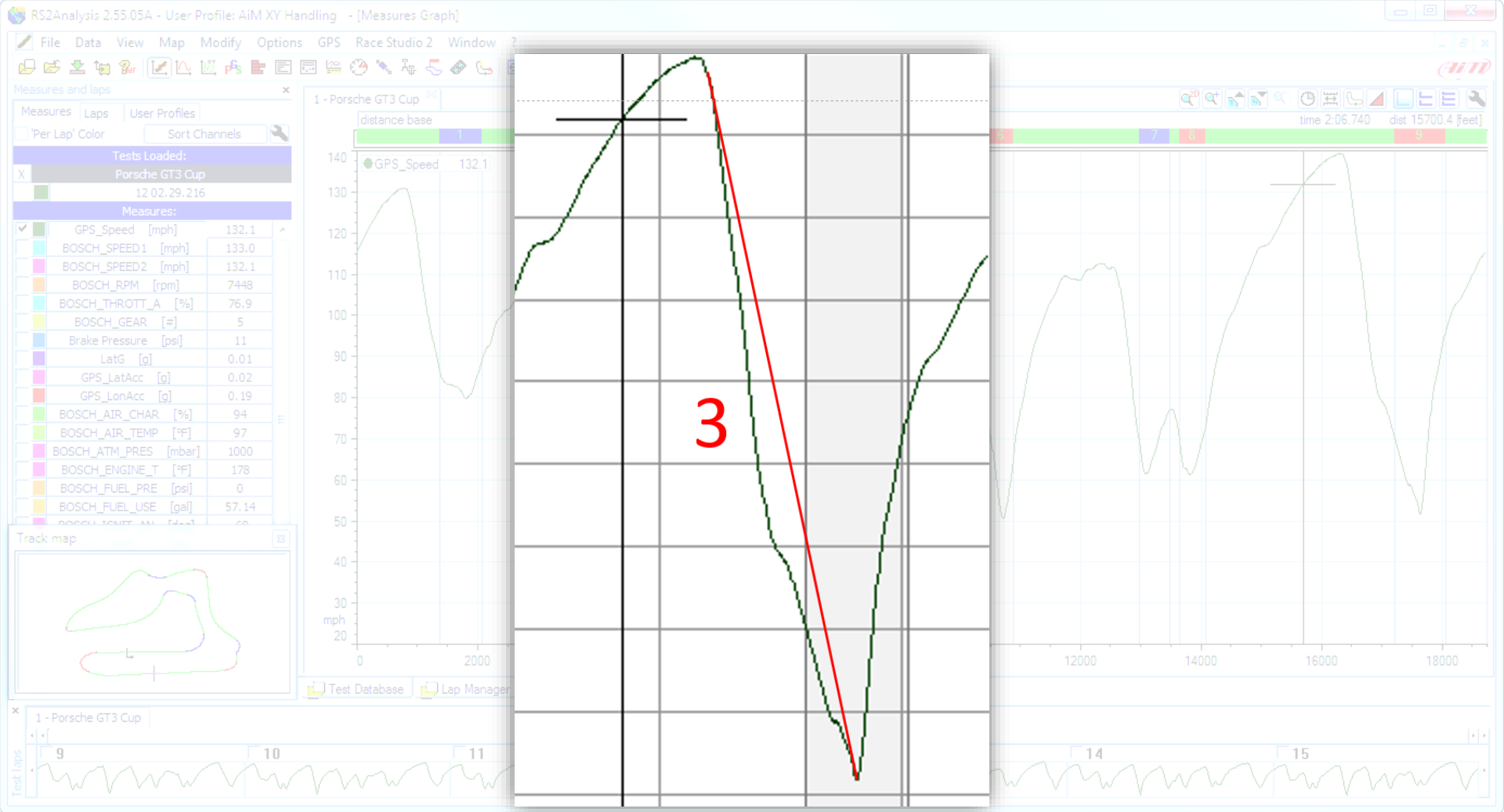
Speed traces can be used to point out areas for **Improvement in Braking**. In this sample, three areas stand out. In area #1, the issue is that the driver is releasing brake for the last 25% or so of the braking zone. In area #2 the issue is light braking early and then using maximum braking late in the braking zone. Area #3 is a series of issues but overall braking to early.



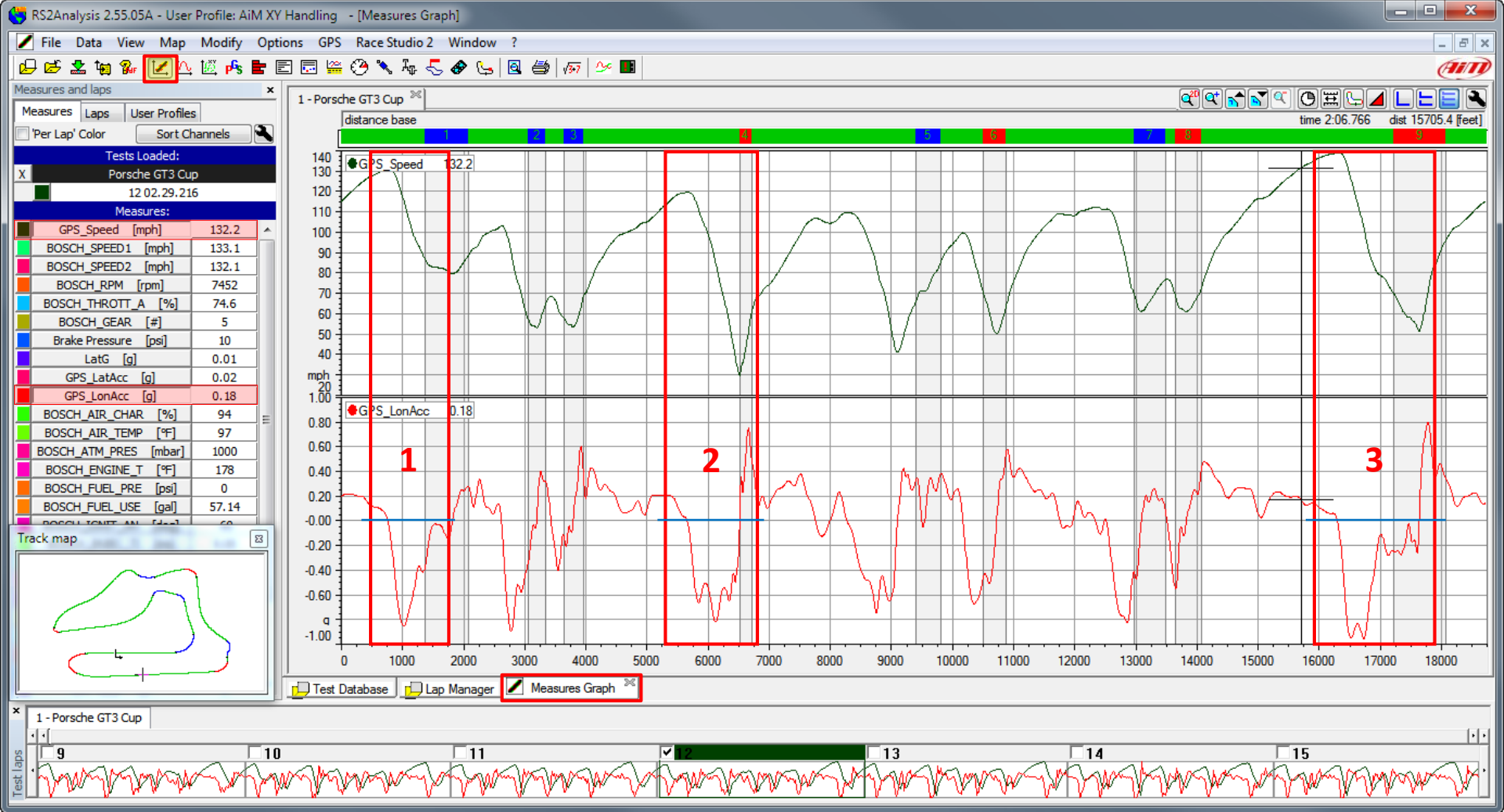
Brake Zone Example 1 - Zoomed In this example, the issue is that the driver is releasing brake for the last 25% or so of the braking zone. Let's call it a 'Hockey Stick' shape. It could also be a classic sign of 'trailbraking'.



Brake Zone Example 2 - Zoomed In this example, the issue is light braking early and then using maximum braking late in the braking zone.



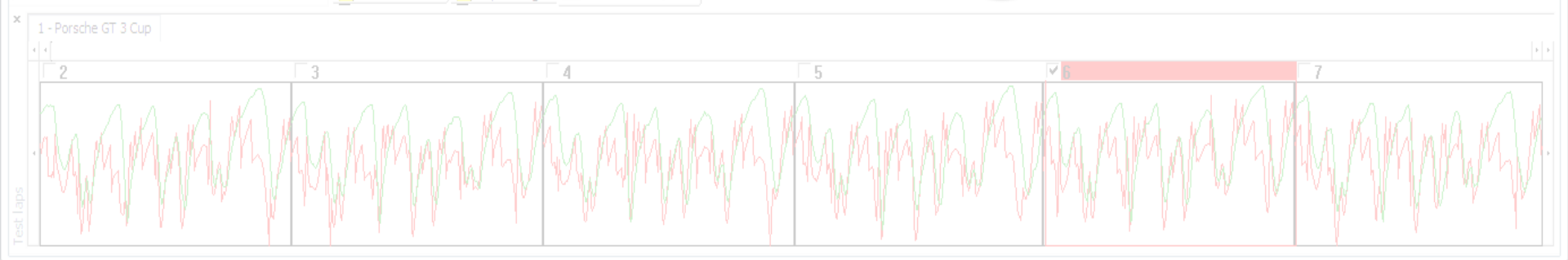
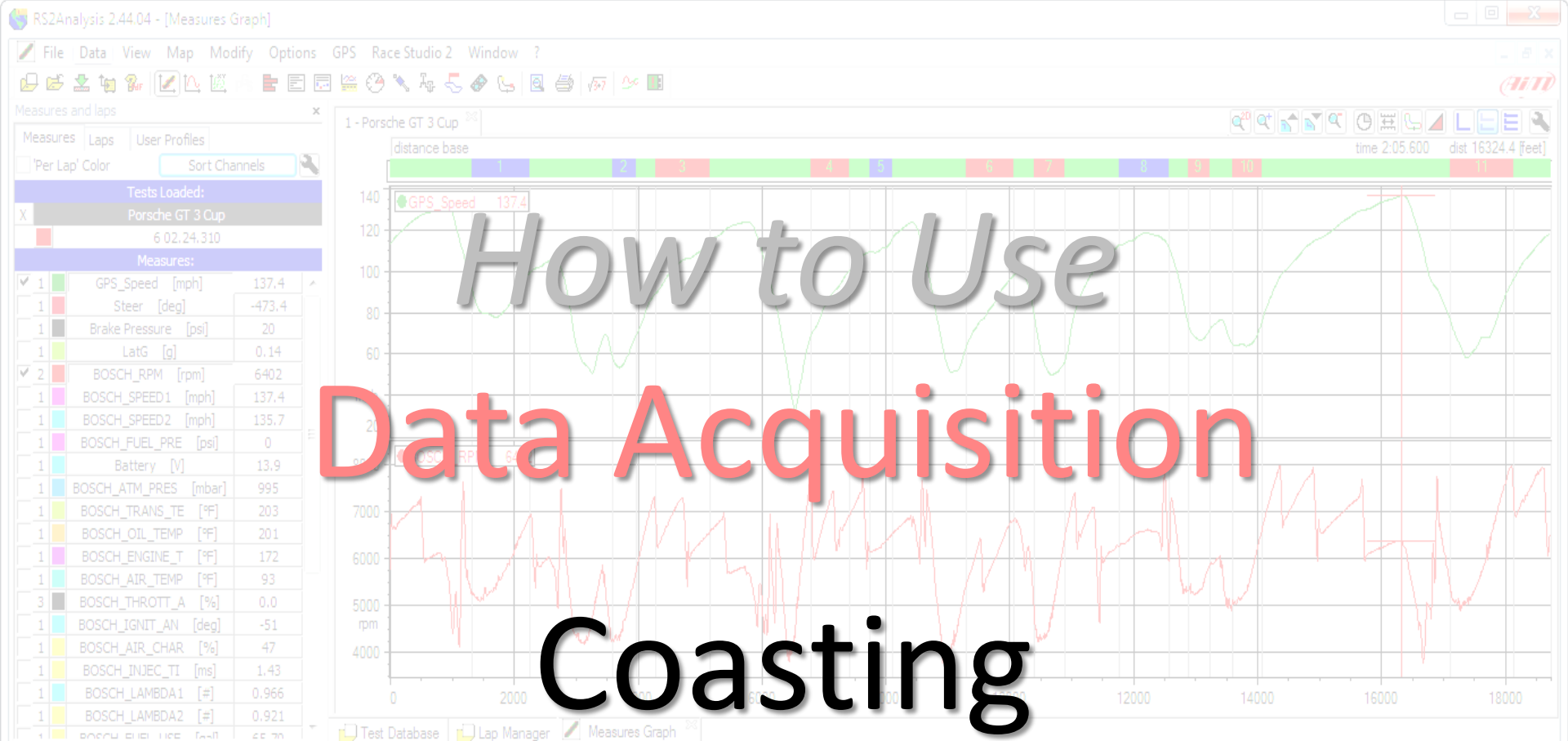
Brake Zone Example 3 - Zoomed In this example, the issue is light braking early and then using maximum braking late in the braking zone. Example 3 is a series of issues but overall braking to early.

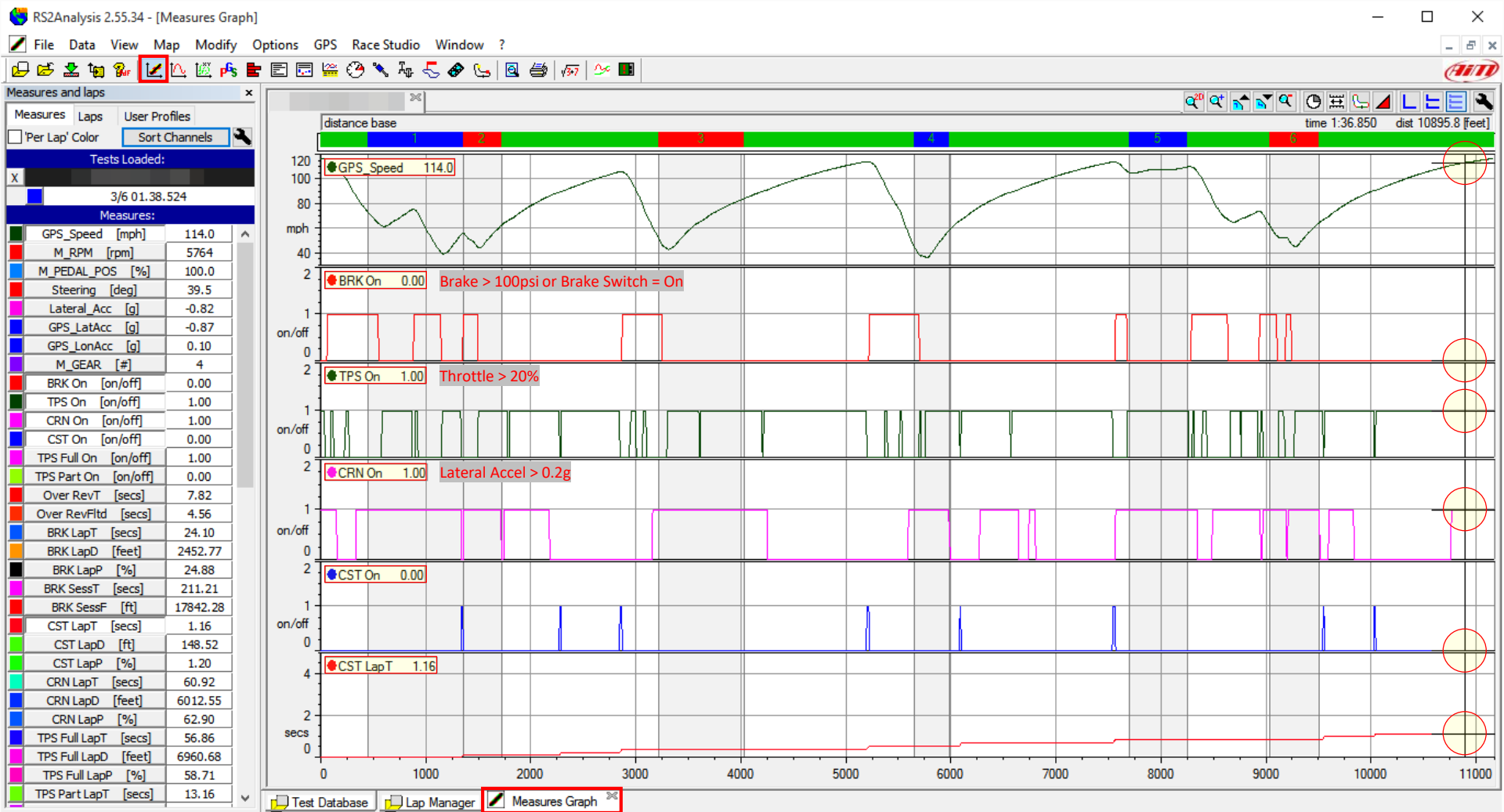


This is the same lap as the prior slide but we have added **Longitudinal G's**. This is another way to see the same issue. In area #1, the issue is that the driver is releasing brake for the last 25% or so of the braking zone. Typically this is from braking too early and then realizing it. In area #2 and 3, the issue is under braking early and then using maximum braking late in the braking zone.

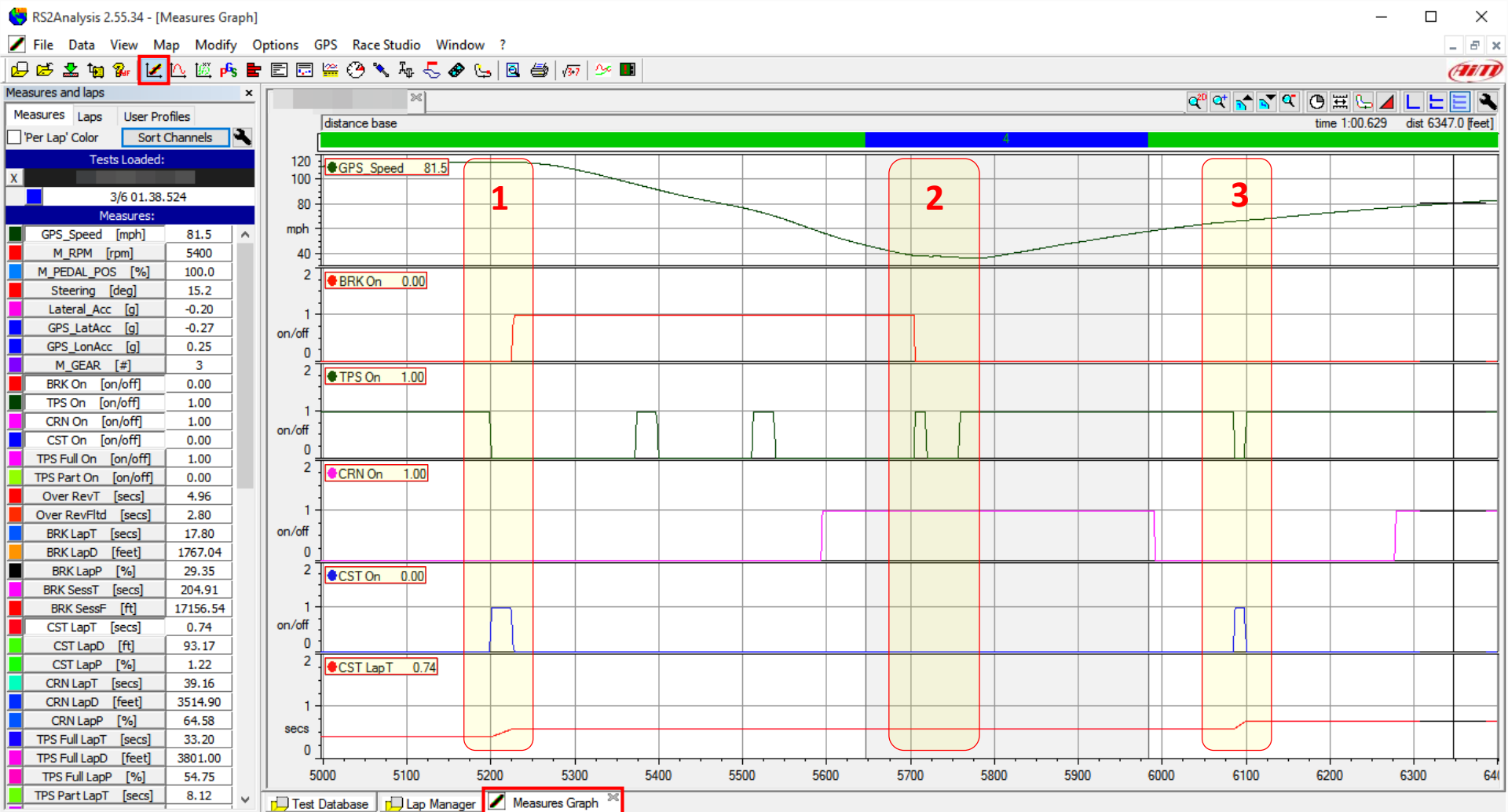


This is another example of **Braking** being analyzed with a **Speed** trace and a **GPS_LonAcc** trace. This is a better example than the prior slide.





Math Channels are powerful tools. They use existing data and manipulate it to view the existing data in other ways. The limit is your imagination. Here is an example of a **Coasting Time/Lap** channel. Taking the Throttle, Brake, and Cornering values (sensor or GPS based data), then build **BRK on**, **TPS On** and **CST On** Math Channels, then when none of these are active, the driver is "Coasting" and we add up that time and display it.



Here we are zoomed in on an area and the BRK on, TPS On, and CRN On channels are shown. There are 3 areas we need to focus on. #1 is a true area of coasting, #2 is where the driver is not on the TPS or BRK but in a corner, and #3 is a shift point that is shown as coasting. The Coasting Time per Lap (CST LapT) is increasing in #1 and #3.

RS2Analysis 2.55.34 - [Channels report]

File Data View Map Modify Options GPS Race Studio Window ?

Lap	GPS_Speed			CST LapT	CST LapD	TPS Full LapT	TPS Full LapD	Add / Remove	
	Num	Time	Dist	min	avg	max	max		max
run 3 / lap 3	01.39.545	11150	35.0	77.8	117.7	1.02	124.35	58.24	7141.53
run 3 / lap 4	01.38.656	11162	36.7	78.5	117.7	1.12	146.01	58.10	7287.80
run 3 / lap 5	01.38.622	11171	35.9	78.6	117.4	0.98	129.03	59.56	7399.32
run 3 / lap 6	01.38.524	11172	37.0	78.7	117.5	1.16	148.52	58.50	7237.18
run 3 / lap 7	01.39.114	11162	33.6	78.2	117.6	0.74	92.99	58.88	7194.39
run 3 / lap 8	01.39.100	11167	34.7	78.2	117.4	0.88	119.64	60.20	7375.13
run 3 / lap 9	01.39.397	11181	35.2	78.0	117.2	0.76	94.40	61.46	7538.35
run 3 / lap 10	01.38.911	11178	36.7	78.4	116.9	0.88	113.49	58.94	7308.97
run 3 / lap 11	01.39.439	11198	36.0	78.0	117.0	0.72	88.19	58.28	7217.02
run 3 / lap 12	01.39.194	11181	35.1	78.1	117.4	0.68	86.85	58.32	7190.02
run 3 / lap 13	01.40.029	11222	34.2	77.6	117.4	0.70	88.16	60.22	7314.03
run 3 / lap 14	01.39.532	11175	35.2	77.8	116.9	0.74	95.90	59.98	7365.26
run 3 / lap 15	01.40.233	11193	36.9	77.4	117.0	0.76	102.05	59.00	7273.31
run 3 / lap 16	01.39.722	11177	34.7	77.7	117.4	0.90	122.17	59.24	7269.00
run 3 / lap 17	01.39.804	11178	34.3	77.7	117.7	0.64	76.74	57.92	7156.41
run 3 / lap 18	01.40.216	11209	34.8	77.4	117.7	0.48	64.21	58.50	7170.91
run 3 / lap 19	01.39.992	11179	36.4	77.5	117.2	0.86	103.14	58.50	7253.93
run 3 / lap 20	01.40.032	11195	34.4	77.5	116.8	0.48	68.62	59.82	7325.30
run 3 / lap 21	01.40.729	11177	34.2	77.0	116.8	0.52	64.94	58.82	7236.58
run 3 / lap 22	01.40.568	11192	34.7	77.0	116.6	0.84	100.92	60.66	7410.38
run 3 / lap 23	01.40.712	11203	33.7	77.1	116.8	0.70	84.65	58.86	7253.83
run 3 / lap 24	01.40.380	11184	34.7	77.2	117.2	0.56	76.04	59.90	7350.97
run 3 / lap 25	01.40.283	11188	34.1	77.2	117.3	0.60	83.39	57.78	7148.07
run 3 / lap 26	01.40.146	11191	34.9	77.4	117.3	0.42	53.77	59.76	7359.98
run 3 / lap 27	01.40.950	11189	34.4	76.8	116.8	0.44	54.80	60.48	7366.83
run 3 / lap 28	01.40.286	11204	34.8	77.3	116.7	0.52	69.86	60.32	7438.84
run 3 / lap 29	01.40.308	11210	33.7	77.3	116.8	0.72	84.17	57.24	6975.27

Test Database Lap Manager Measures Graph Channels report

Here we are looking at the same 27 laps of data but in a **Channel Report**. We are looking at all enabled laps for this session. The values we have configured the report to show are: the **GPS_Speed**, **CST LapT**, **CST LapD**, **TPS Full LapT**, and **TPS Full LapD** and values. Clearly, lower **CST LapT** max values are desired but not a guarantee of better lap times. Better lap times are always created by doing many things right.

Math Channels Examples

Here are some “Switch” Math Channels:

BRK On: $\text{IF}(\text{LT}(\text{GPS_LonAcc}, -0.05), 1, 0)$ or $\text{IF}(\text{GT}(\text{Brake}, 200), 1, 0)$

CRN On: $\text{IF}(\text{GT}(\text{abs}(\text{GPS_LatAcc}), 0.20), 1, 0)$

TPS On: $\text{IF}(\text{GT}(\text{GPS_LonAcc}, 0.05), 1, 0)$ or $\text{IF}(\text{GT}(\text{Throttle}, 15), 1, 0)$

TPS Full On: $\text{IF}(\text{GT}(\text{Throttle}, 85), 1, 0)$

CST On: $\text{IF}(\text{GT}(\text{BRK On}, 0.5), 0, \text{IF}(\text{GT}(\text{CRN On}, 0.5), 0, \text{IF}(\text{GT}(\text{TPS On}, 0.5), 0, 1)))$

Here are some “Driver Performance” Math Channels:

CST LapT: $\text{lap_integ}(\text{CST On})$

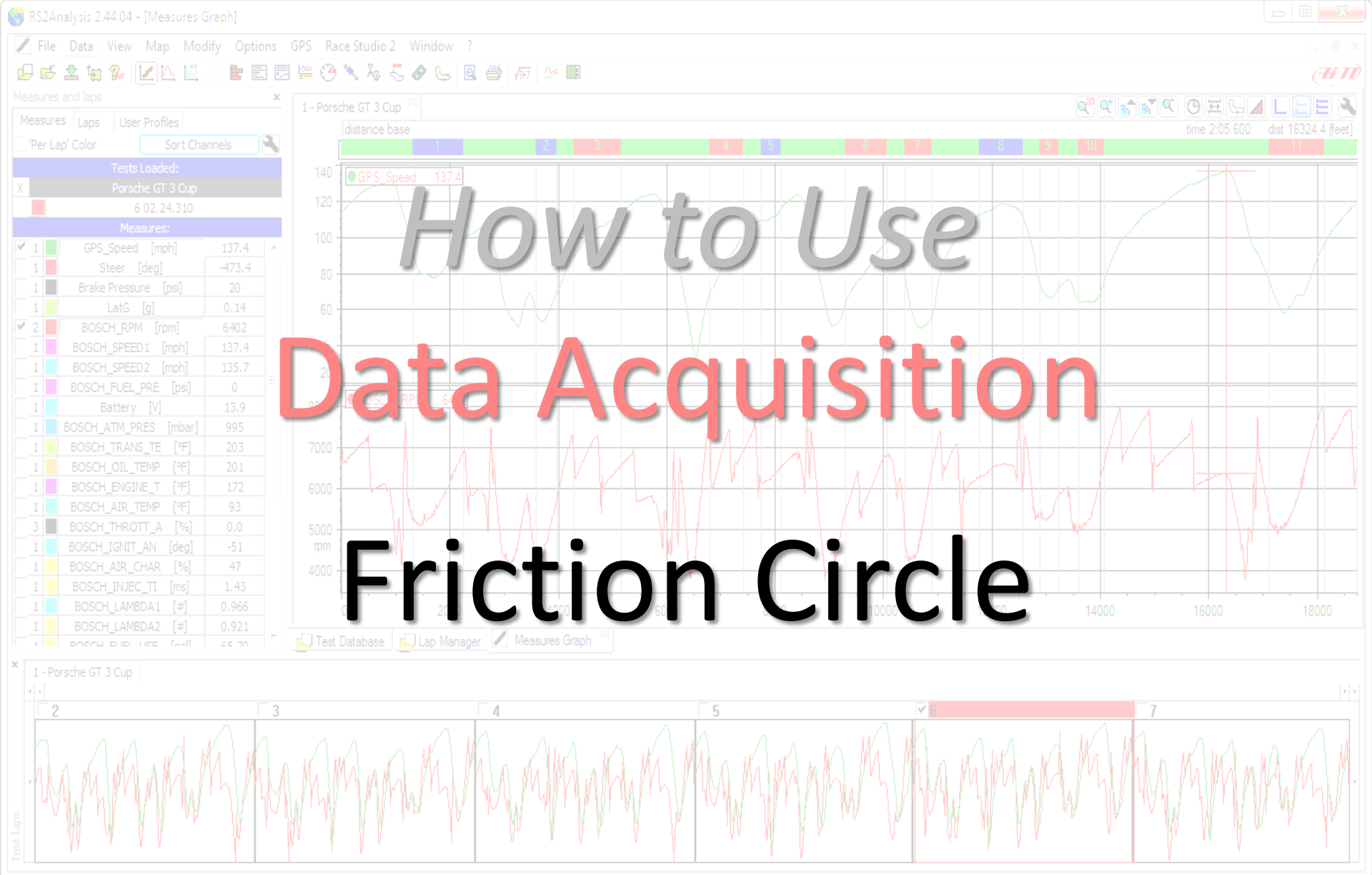
BRK LapT: $\text{lap_integ}(\text{BRK On})$

BRK LapD: $\text{lap_integ}(\text{BRK On} * \text{Speed} * \text{MPH2FTS}), 0$

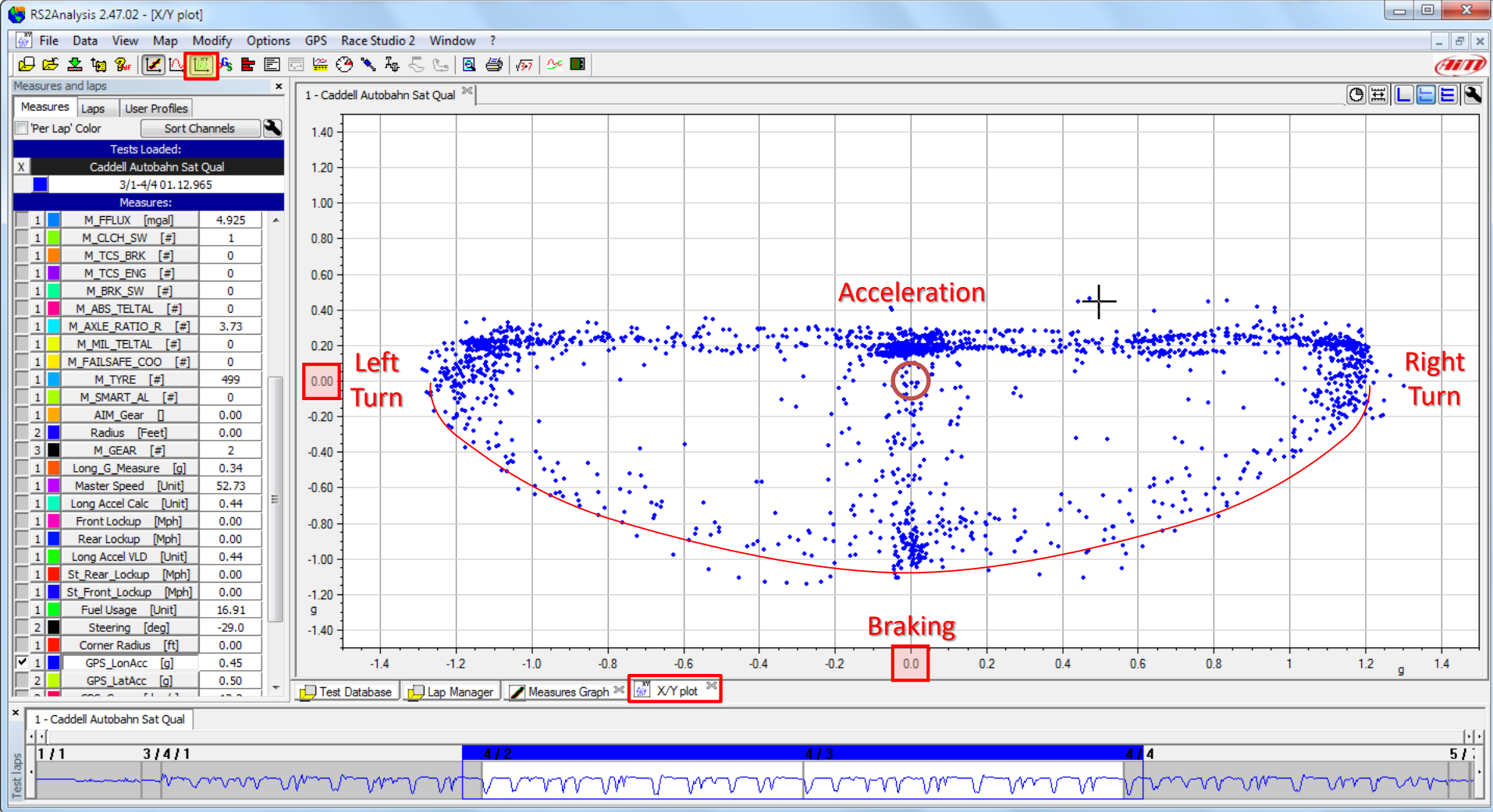
TPS Full LapT: $\text{lap_integ}(\text{TPS Full On})$

TPS Full LapD: $\text{lap_integ}(\text{TPS Full On} * \text{Speed} * \text{MPH2FTS}), 0$

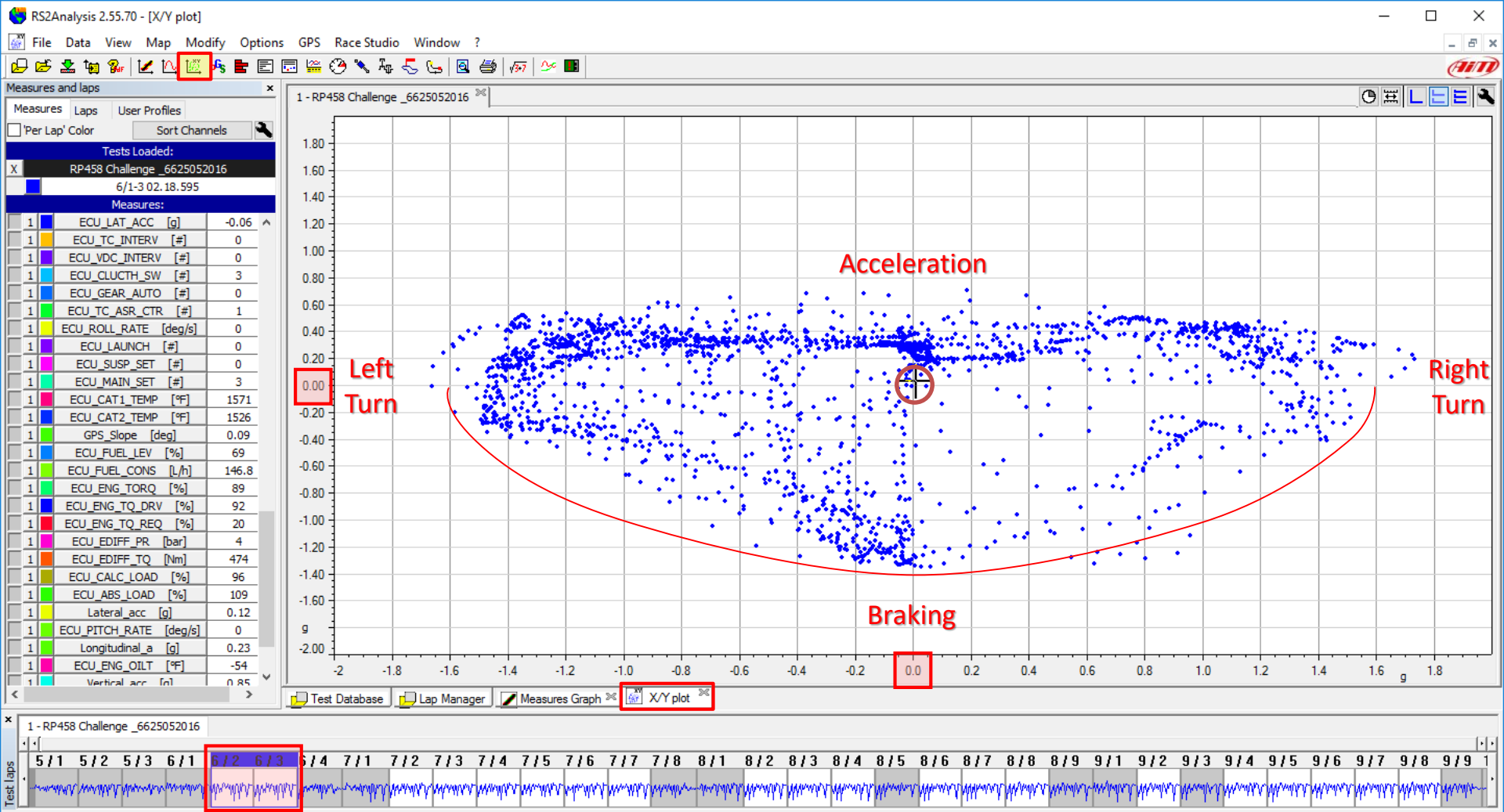
Here are some **Math Channels** examples. All of these plus many more are available to you in the electronic handouts (on the AiM USB thumb drive) at this seminar.



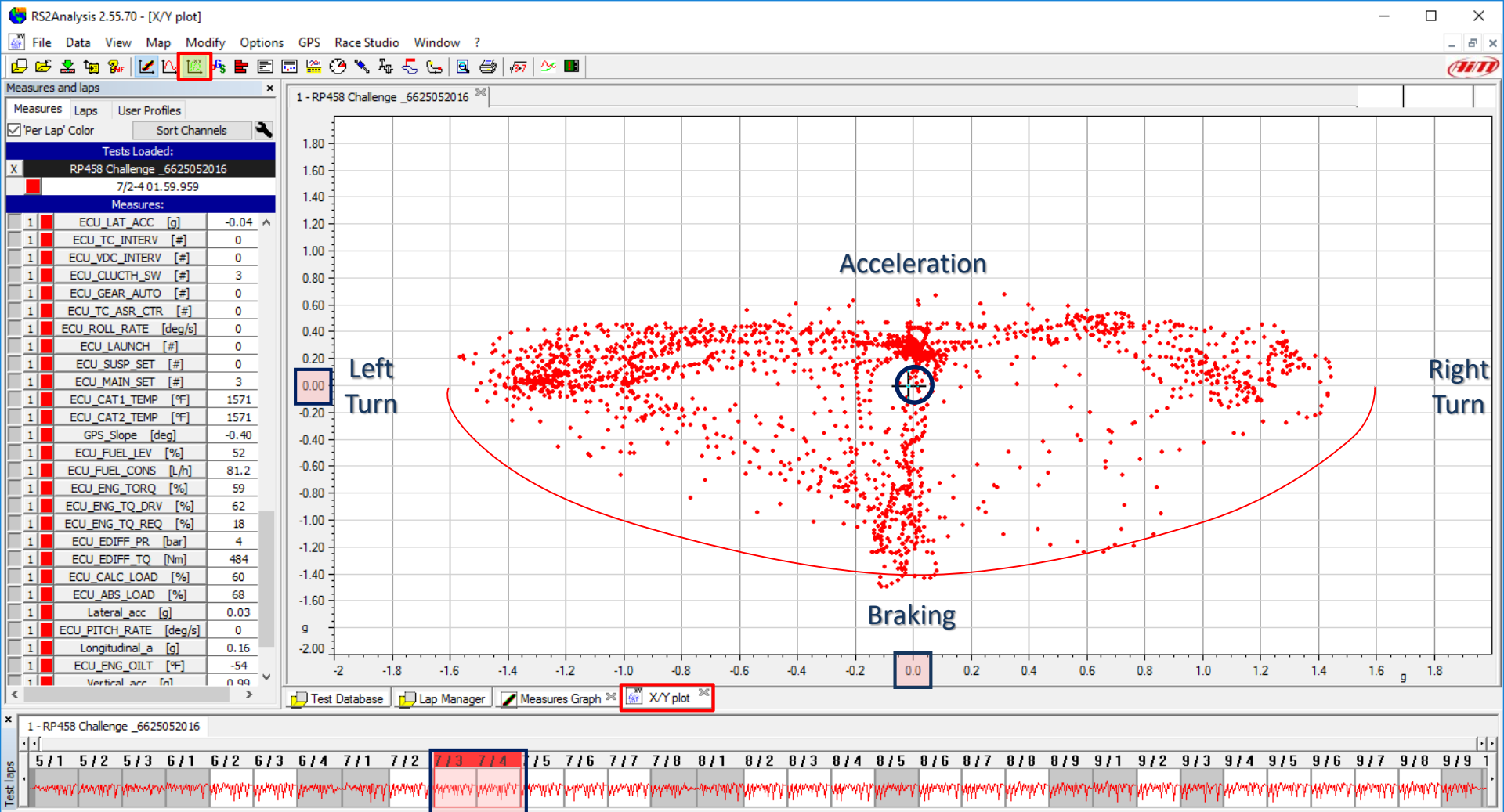
How to Use Data Acquisition Friction Circle



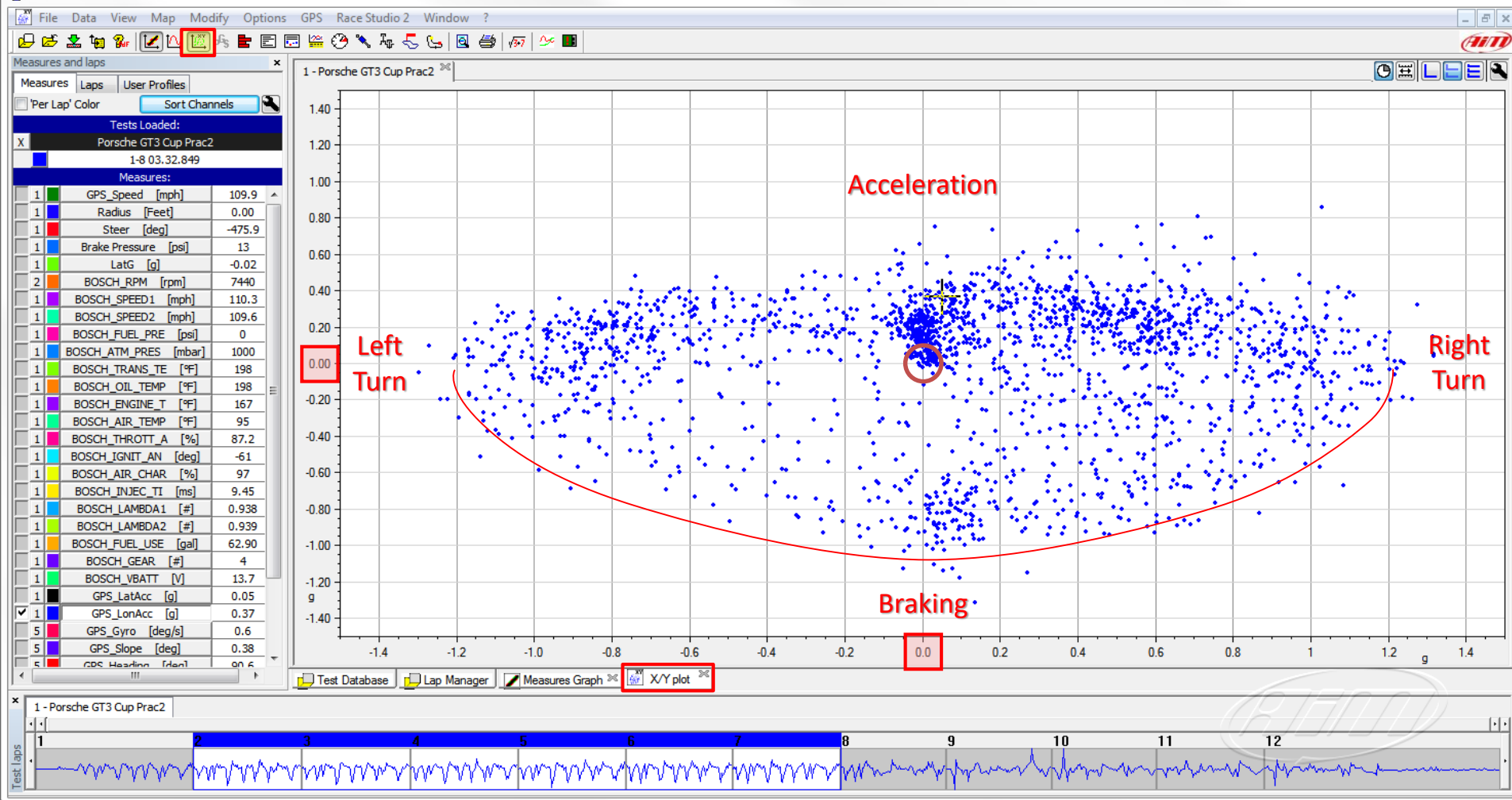
X/Y Graph or G/G Diagram You can plot 2 channels against another. Here we have plotted GPS_LateralAcc vs. GPS LongitudinalAcc to determine if the driver is using maximum grip while transitioning from Long G's to Lat g's, commonly known as a GG Diagram. This driver is good at running the car near the performance envelope. Here we have also labeled the directions of force and the "zero" point.



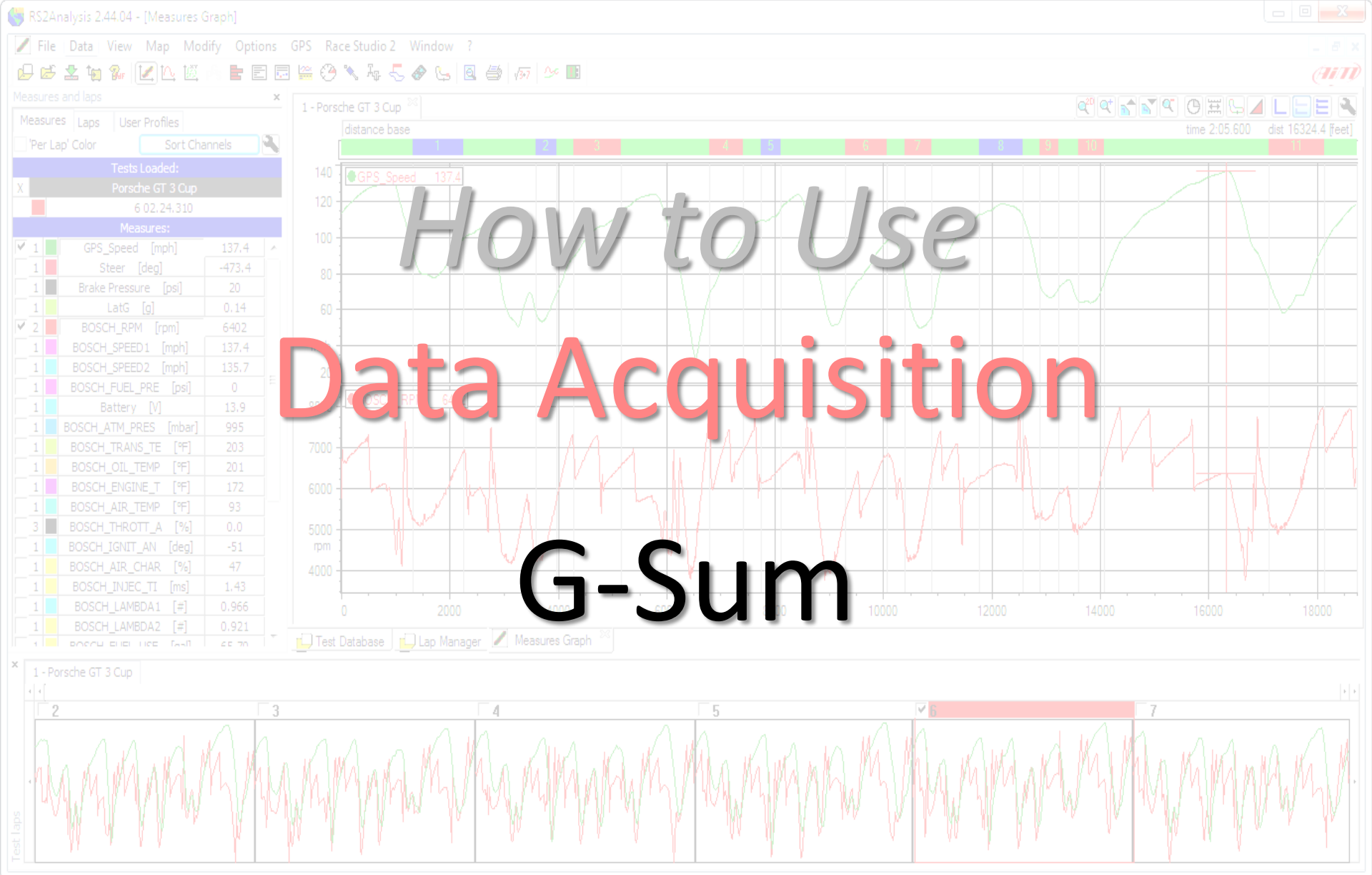
X/Y Graph or G/G Diagram Here we have a driver that was fairly efficient but was not fully using the vehicles performance envelope.



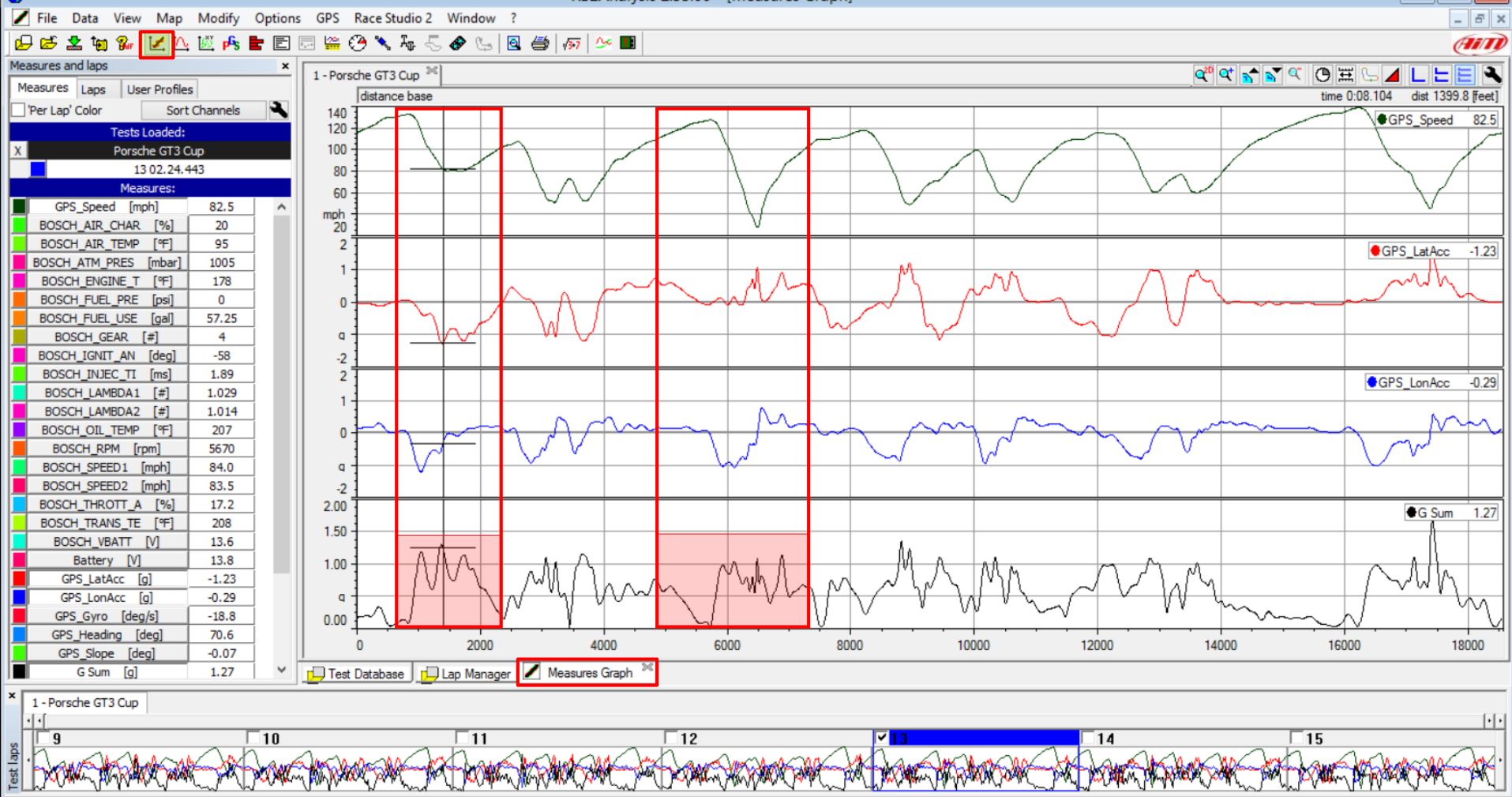
X/Y Graph or G/G Diagram Here we have a driver that was fairly efficient but was not fully using the vehicles performance envelope.



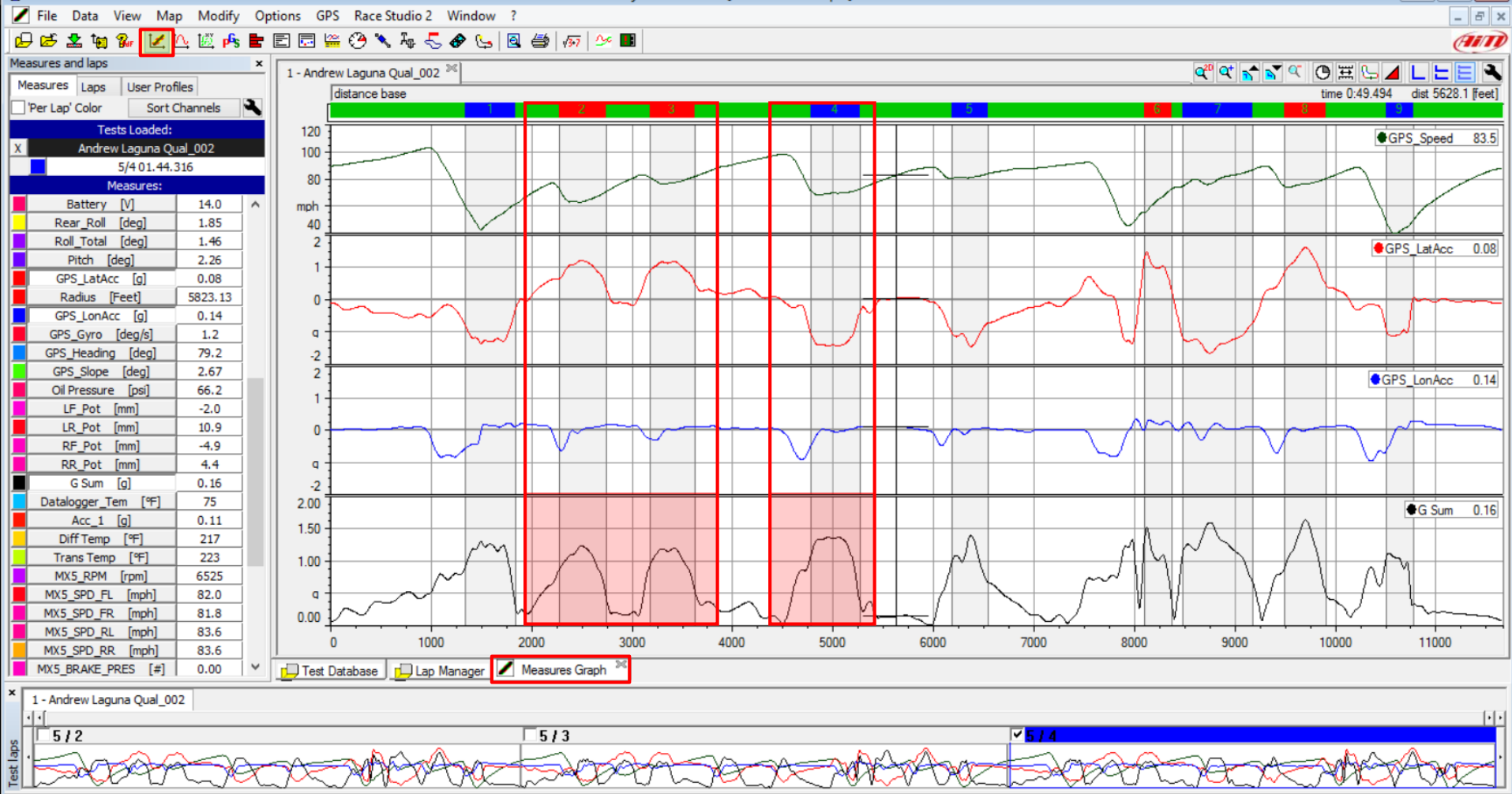
X/Y Graph or G/G Diagram Here we have the same driver that we looked at the **G-Sum** data earlier. This driver was not efficient at fully using the vehicles performance envelope.



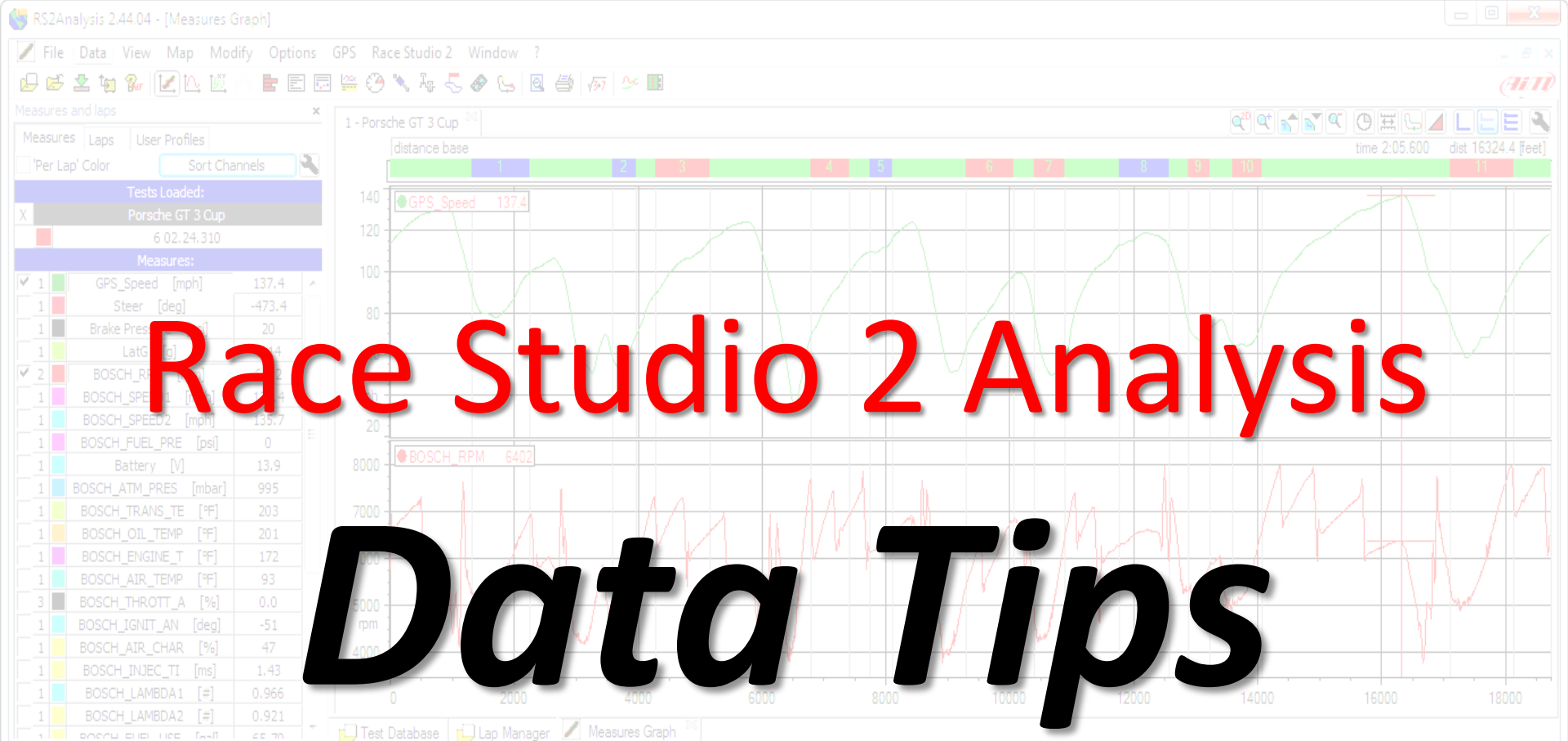
How to Use Data Acquisition G-Sum



G-Sum Another fairly simple math channel is the 'G sum' channel. This shows if the driver is driving the car at or near the limit especially when transitioning between braking and lateral acceleration. Here is a poor example of G-sum data, the smoother and nearer the limit the better. The G Sum Math Channel is: $\text{sqrt}((\text{GPS_LatAcc}^2)+(\text{GPS_LonAcc}^2))$

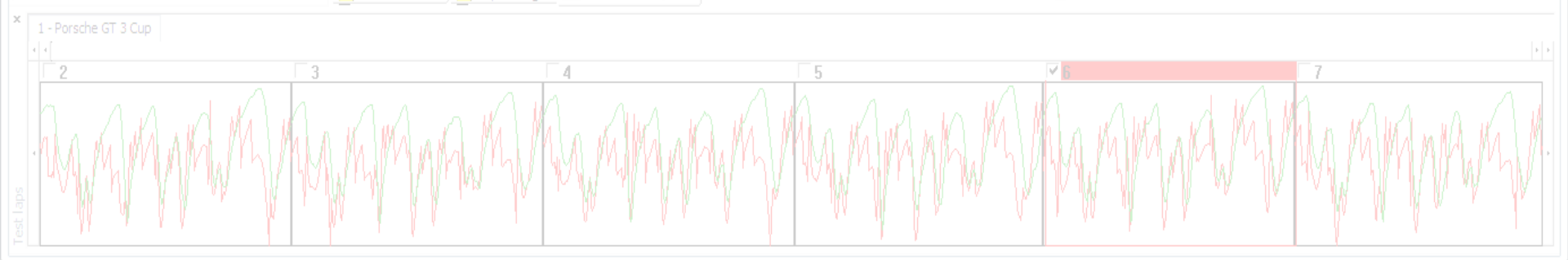


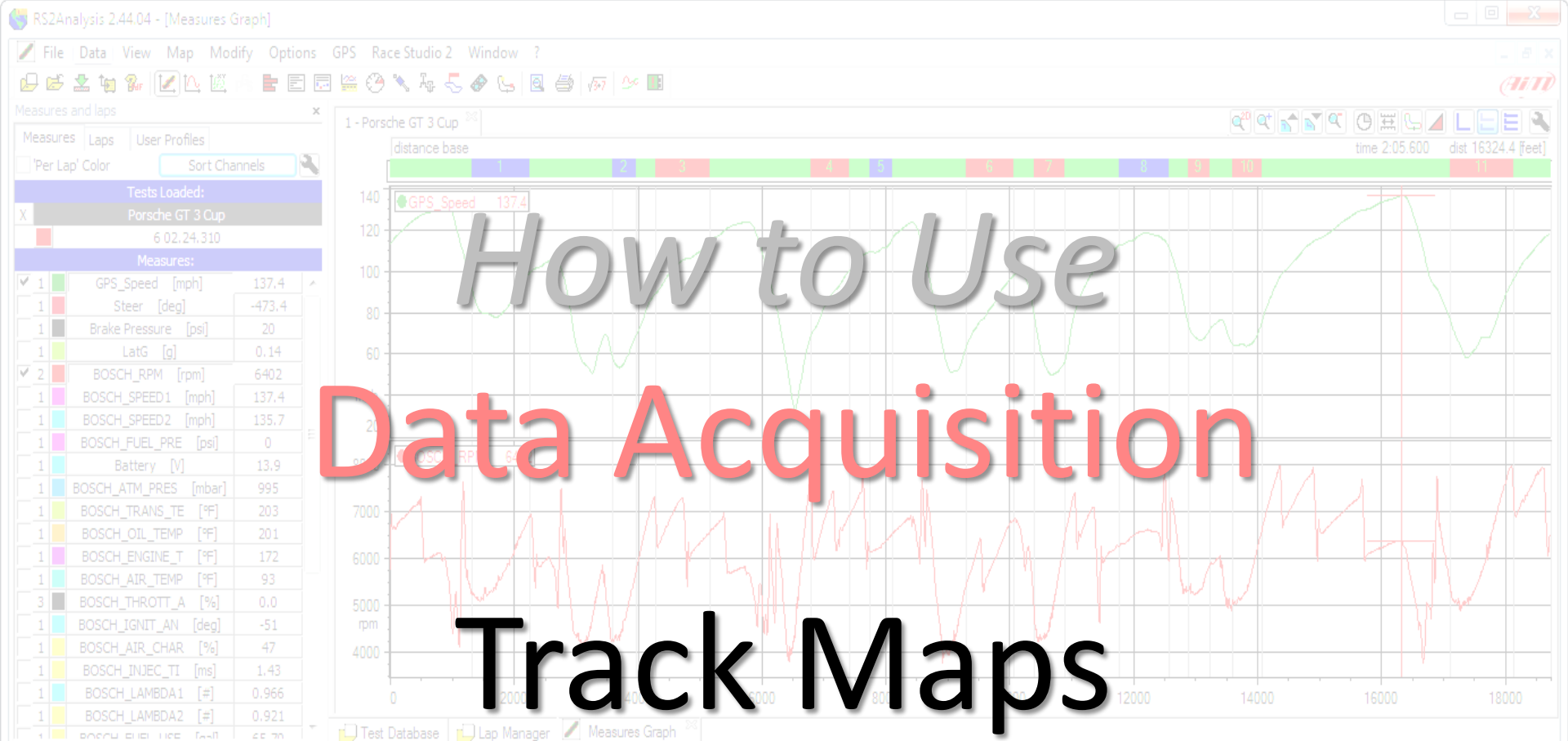
G-Sum This slide shows a better example of G-sum data, the smoother and nearer the limit the better. The highlighted areas show sections that are good. The G Sum Math Channel is: $\text{sqr}t((\text{GPS_LatAcc}^2)+(\text{GPS_LonAcc}^2))$



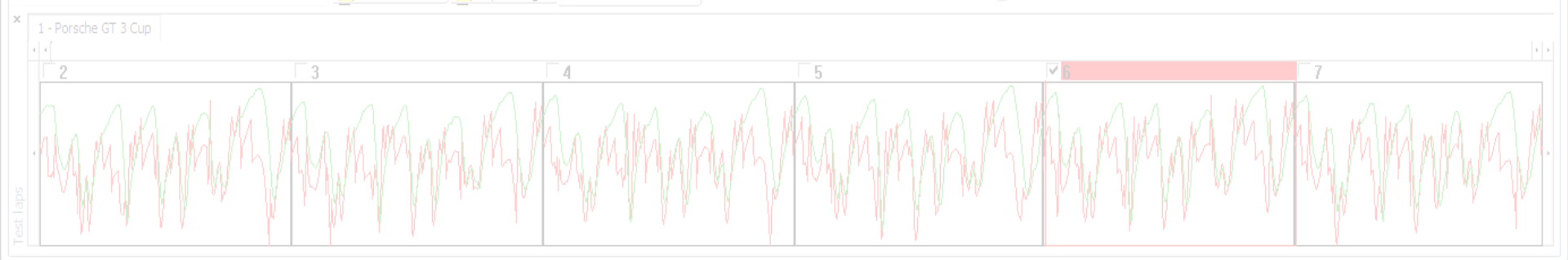
Race Studio 2 Analysis

Data Tips





How to Use Data Acquisition Track Maps

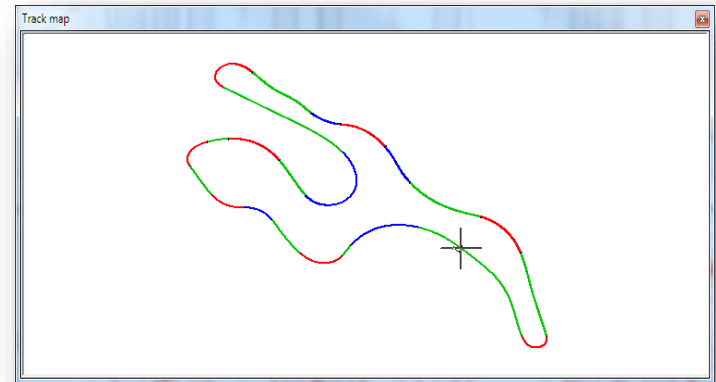


Track Map Differences

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.

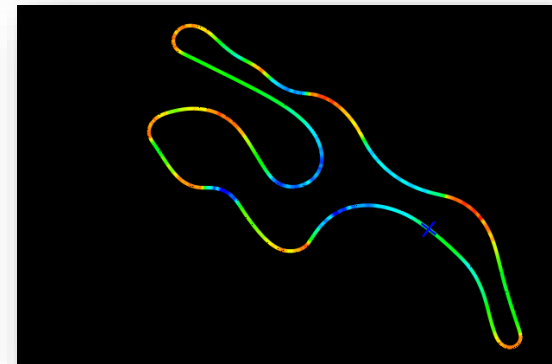
- **'Standard' Track Map**

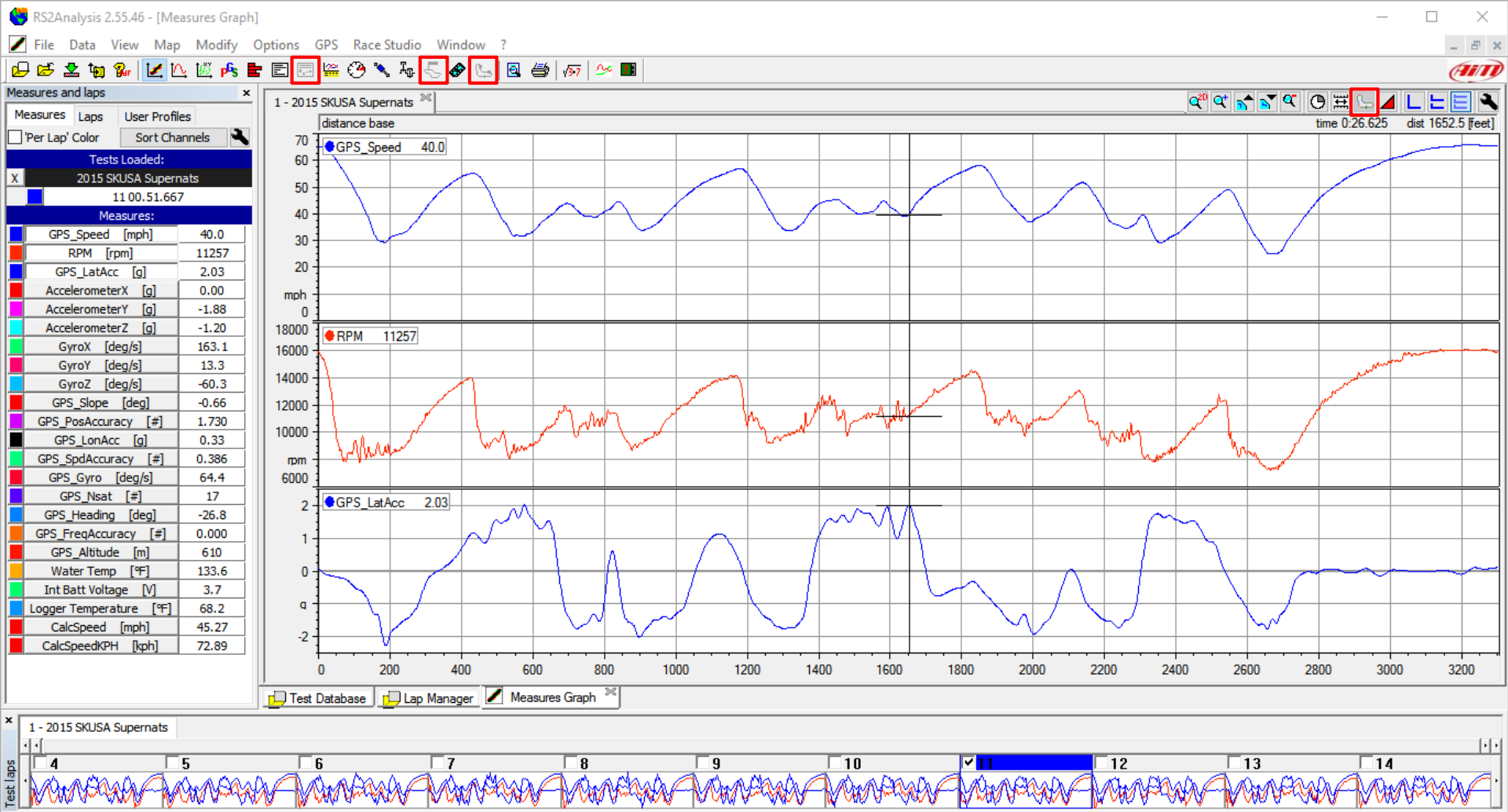
- Generated by the Roll Out Distance and Lateral Acceleration Values
- Used in the Split Report, Track Report, and Lap Replay Functions
- Just for General Track Location, not the Actual Driven Line



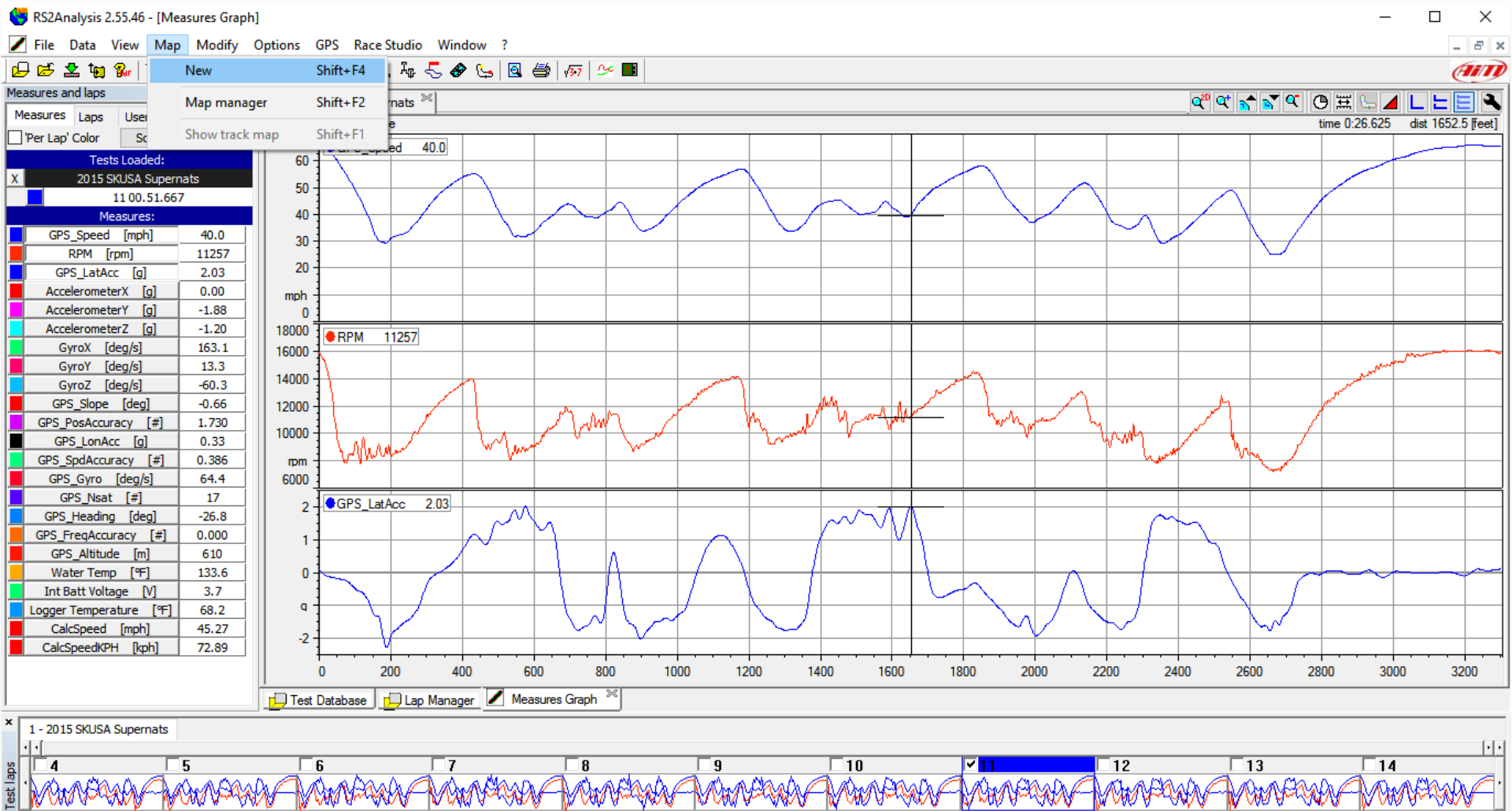
- **GPS 'Driven Line' Track Map**

- 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.

RS2 Analysis 2.55.46 - [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	2015 SKUSA Supernats
	11 00.51.667

Measures:

GPS_Speed [mph]	40.0
RPM [rpm]	11257
GPS_LatAcc [g]	2.03
AccelerometerX [g]	0.00
AccelerometerY [g]	-1.88
AccelerometerZ [g]	-1.20
GyroX [deg/s]	163.1
GyroY [deg/s]	13.3
GyroZ [deg/s]	-60.3
GPS_Slope [deg]	-0.66
GPS_PosAccuracy [#]	1.730
GPS_LonAcc [g]	0.33
GPS_SpdAccuracy [#]	0.386
GPS_Gyro [deg/s]	64.4
GPS_Nsat [#]	17
GPS_Heading [deg]	-26.8
GPS_FreqAccuracy [#]	0.000
GPS_Altitude [m]	610
Water Temp [°F]	133.6
Int Batt Voltage [V]	3.7
Logger Temperature [°F]	68.2
CalcSpeed [mph]	45.27
CalcSpeedKPH [kph]	72.89

1 - 2015 SKUSA Supernats

Modify track map

Distance: feet 675 Move to

Rotation: Mirror

Modify parts: Divide Remove Remove All Corner 2

File name: SKUSA Vegas 2016 FriPra

Cancel OK

Corners:

- Two wheels (speed and gyro requested) Closed
- Figure-8
- Four wheels (speed and lateral accel requested) Open shaped

5 - 00.53.228
6 - 00.52.408
7 - 00.52.080
8 - 00.52.304
9 - 00.51.923
10 - 00.51.833
11 - 00.51.667
12 - 00.52.226

Track shape: < [Slider] >

Channels threshold: < [Slider] >

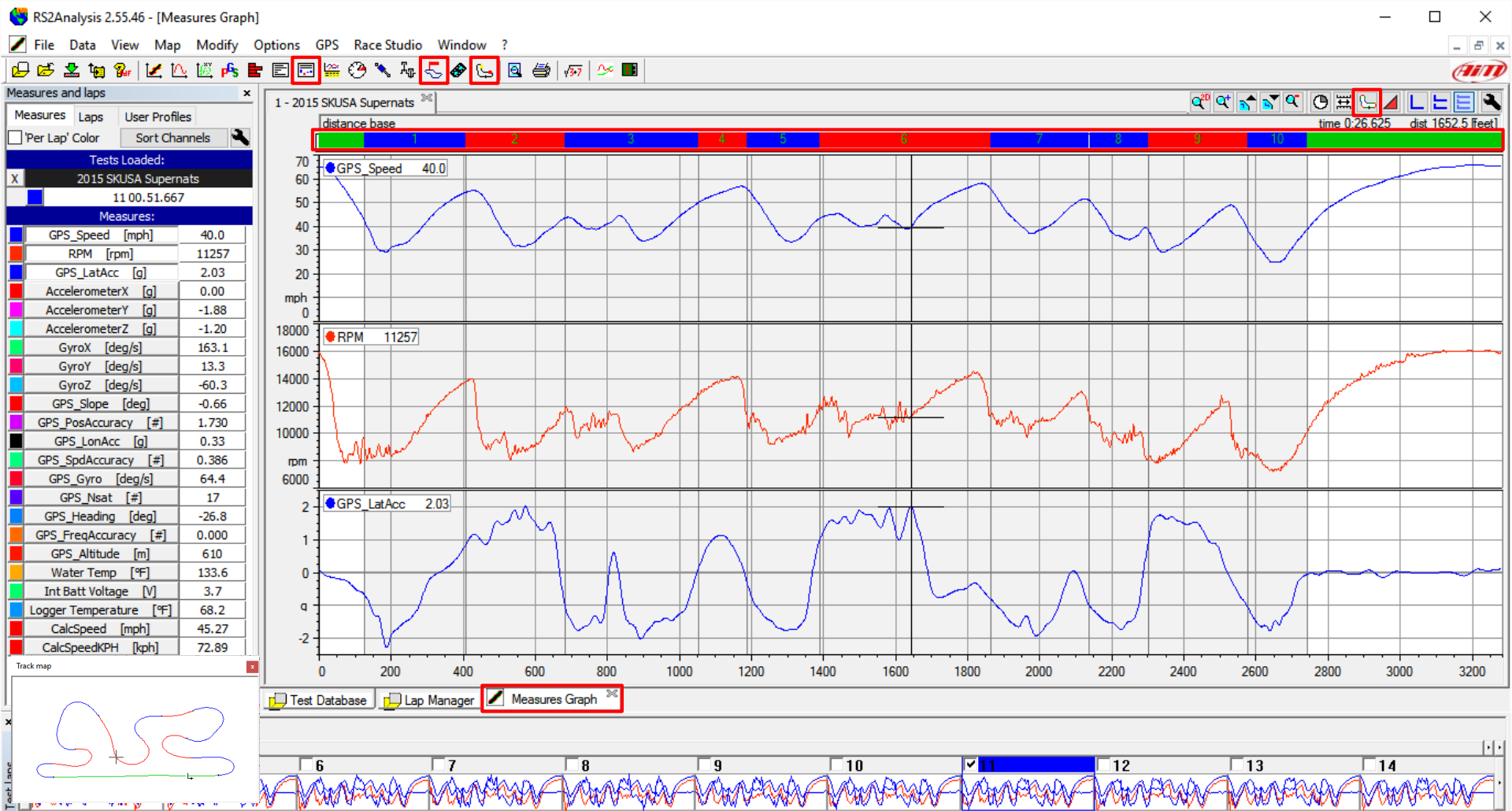
Corners identify: < [Slider] >

Default values

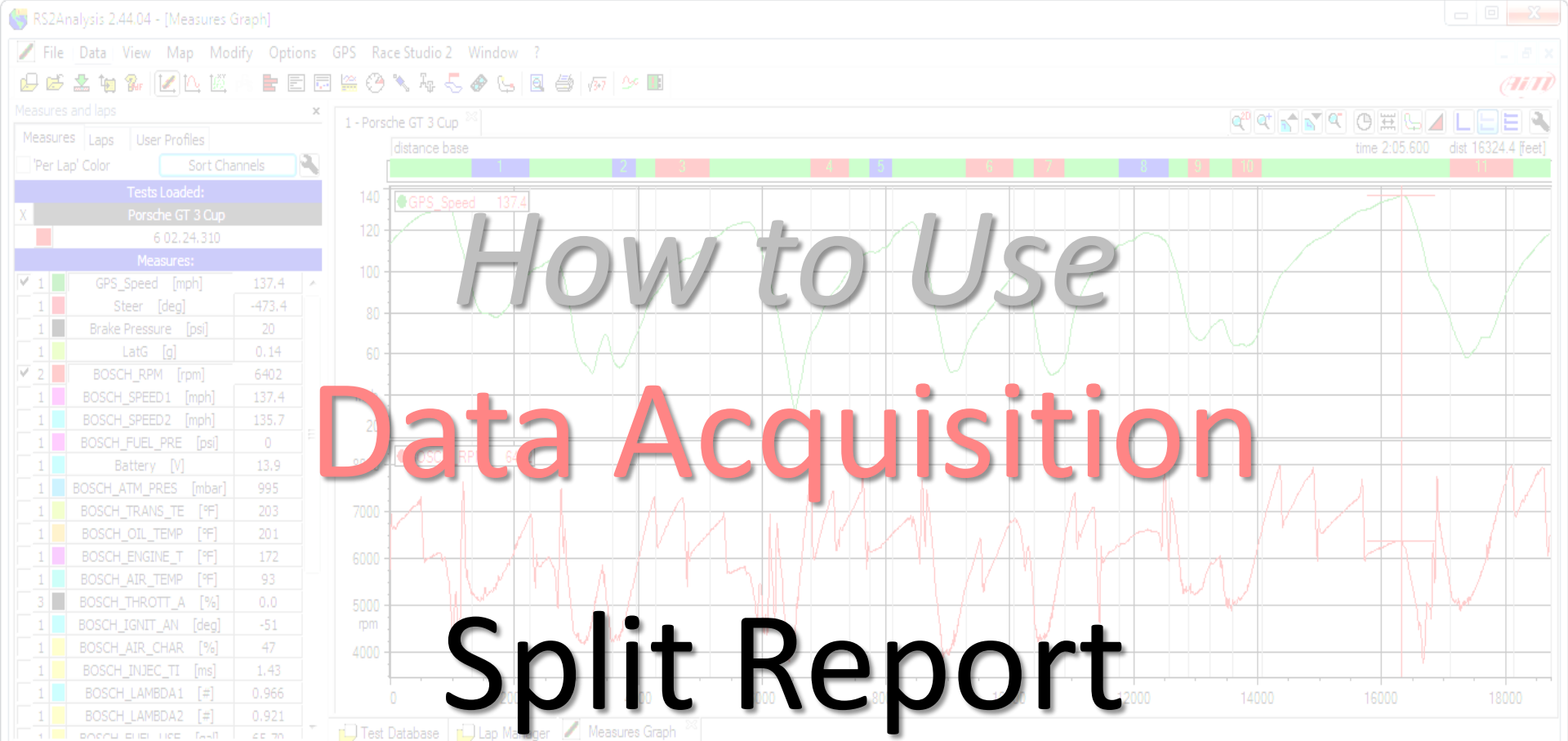
time 0:26.625 dist 1652.5 [feet]

Test laps: 4 5 6 7 8 9 10 11 12 13 14

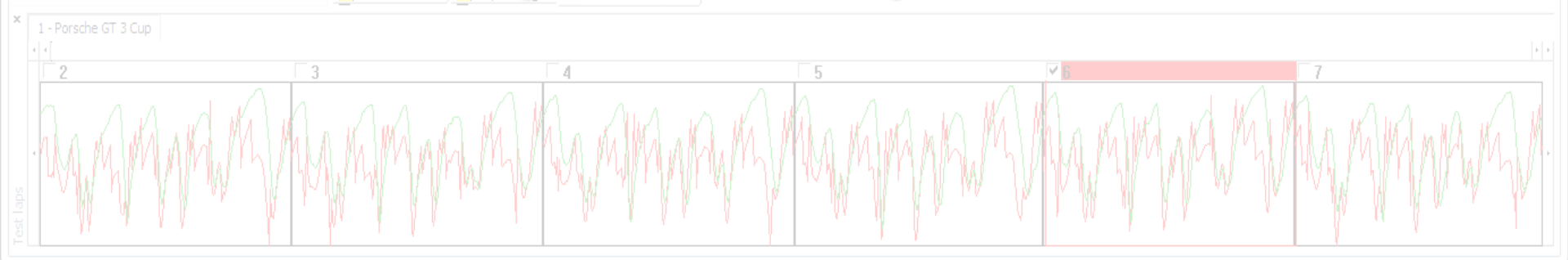
The **Modify Track Map** dialog box will appear. Typically it will display your best lap time, however you can select any of your laps. You have options to modify the default settings; track shape, channels threshold, corners identify, and rotation. When you have the map the way you want it, input a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

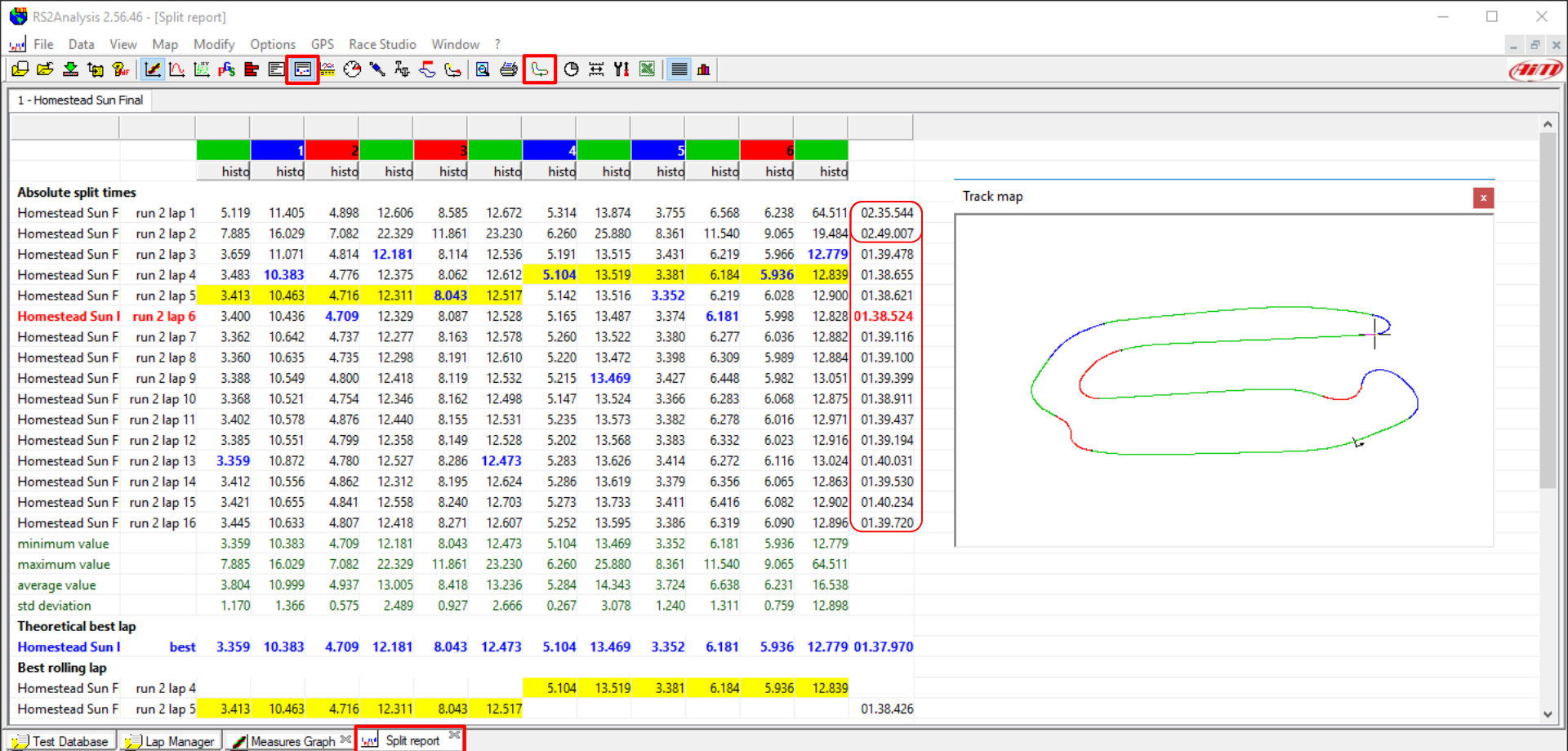


After creating or attaching an existing **Track Map**, you now see the track segments across the top and the function icons that were not active before (Split Report, Track Report, and Lap Replay functions) are now active.

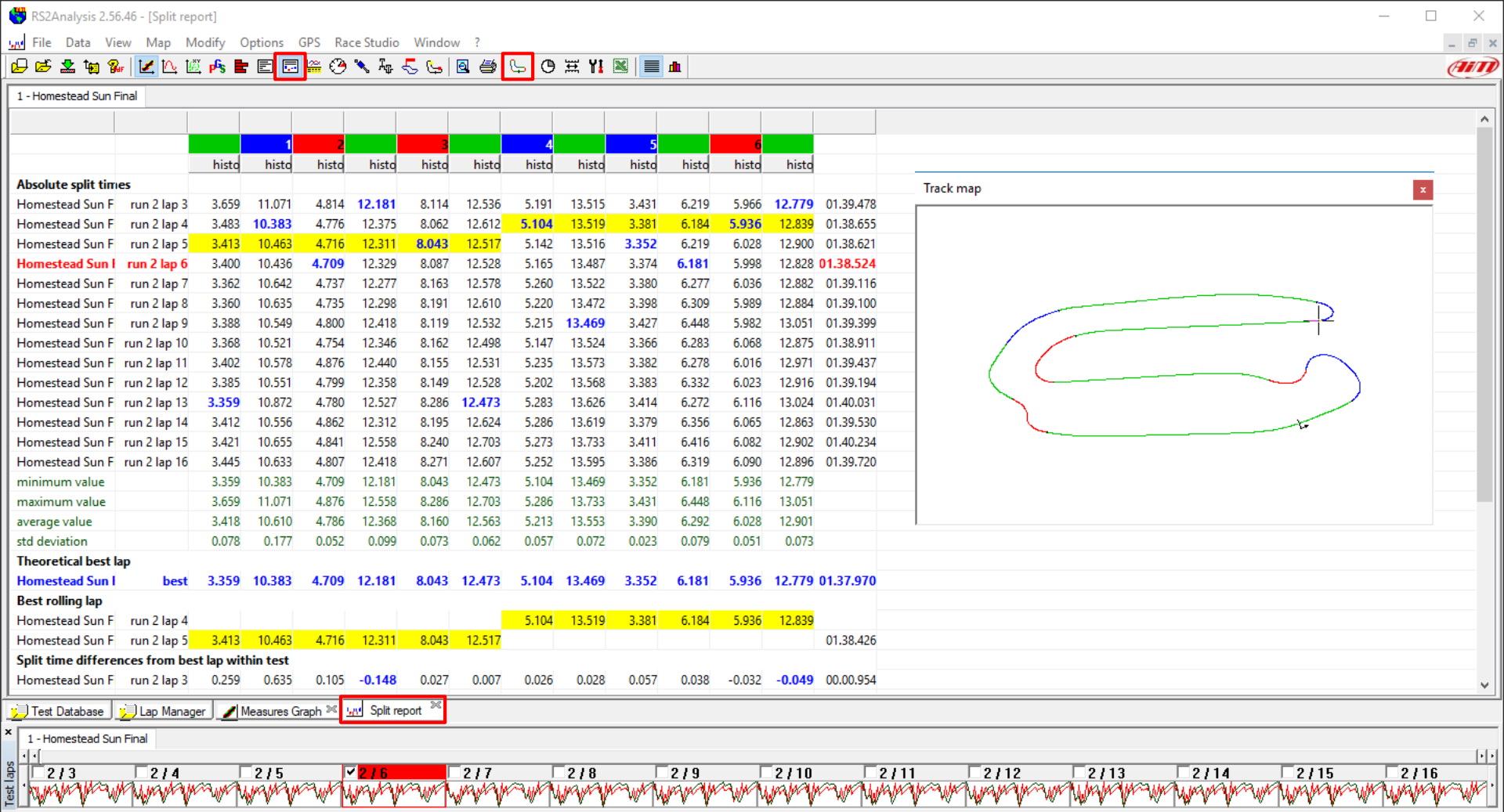


How to Use Data Acquisition Split Report

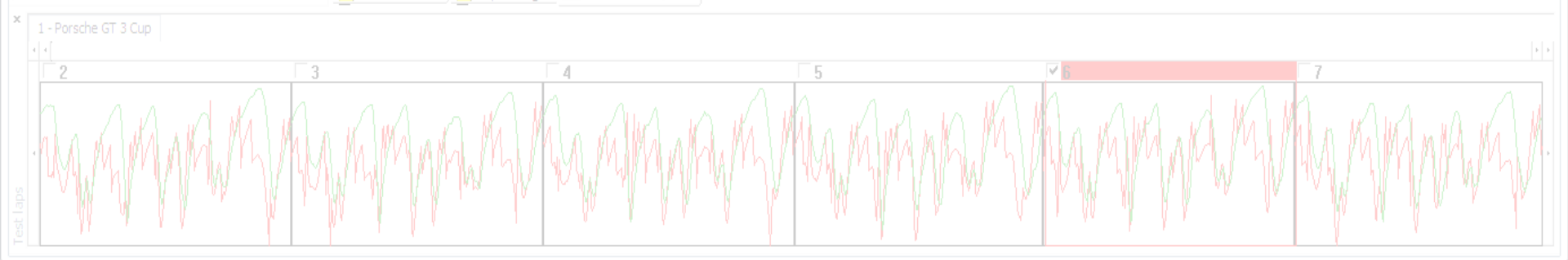
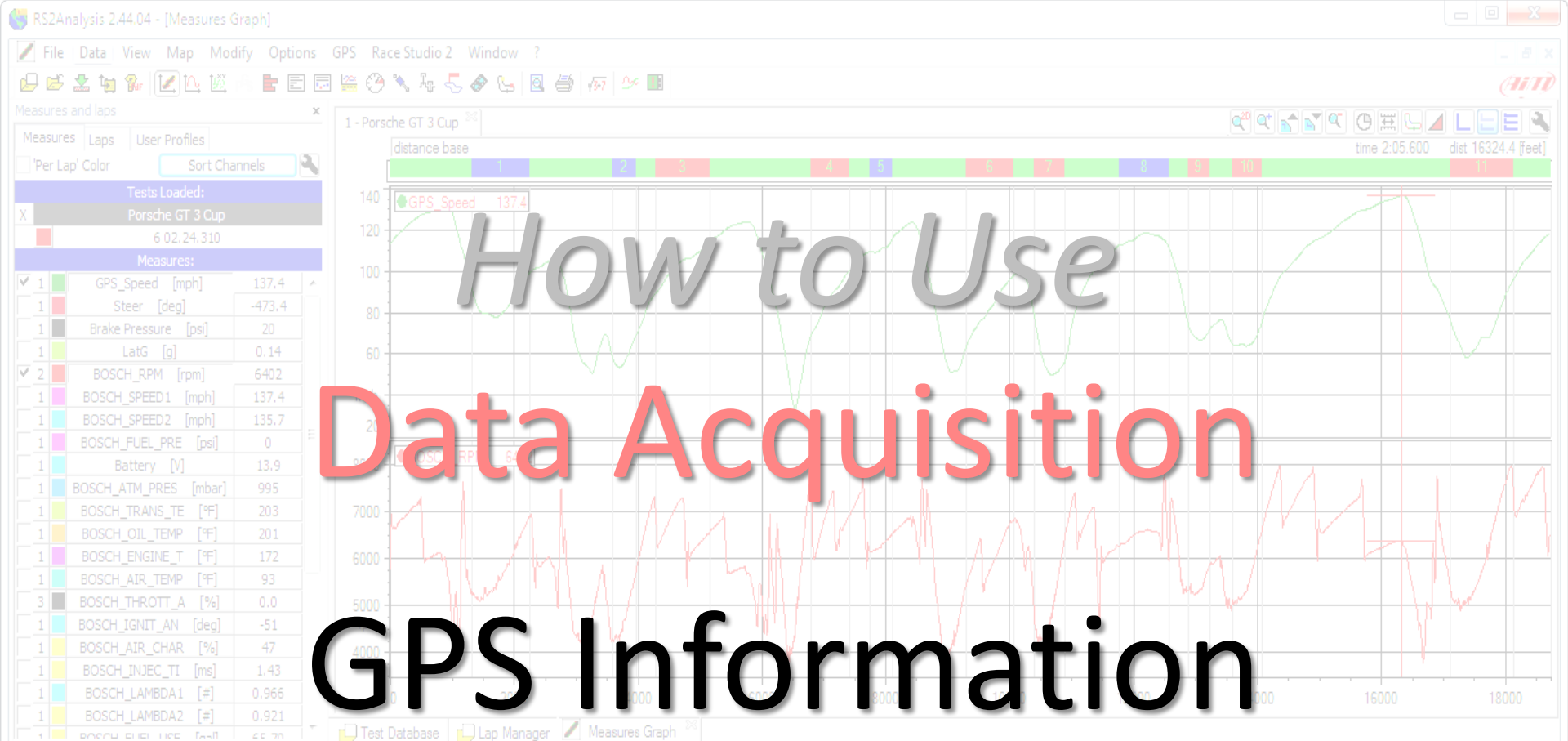




Split Reports are a valuable tool. They calculate segment times for each lap based on the segments of the active track map. But as we can see here, there are incomplete and slow laps included in our Split Report that cause incorrect or misleading data. To get the best and most useful information from a Split Report, it is best to Disable your 'Out' and 'In' laps plus any yellow flag or super slow laps (like laps 1 and 2 in this example)



Now that we have Disabled the suspect laps we have a more useful report. Beyond the actual Split Times, we are also provided are the "Best Rolling Lap" and the "Theoretical Best Lap". The "Blue Split Times" are the best times in that segment for the entire test. Pay attention to the Green "Std Deviation" values, 0.0 to 0.1 should be the goal. The lower, the more consistent/better.

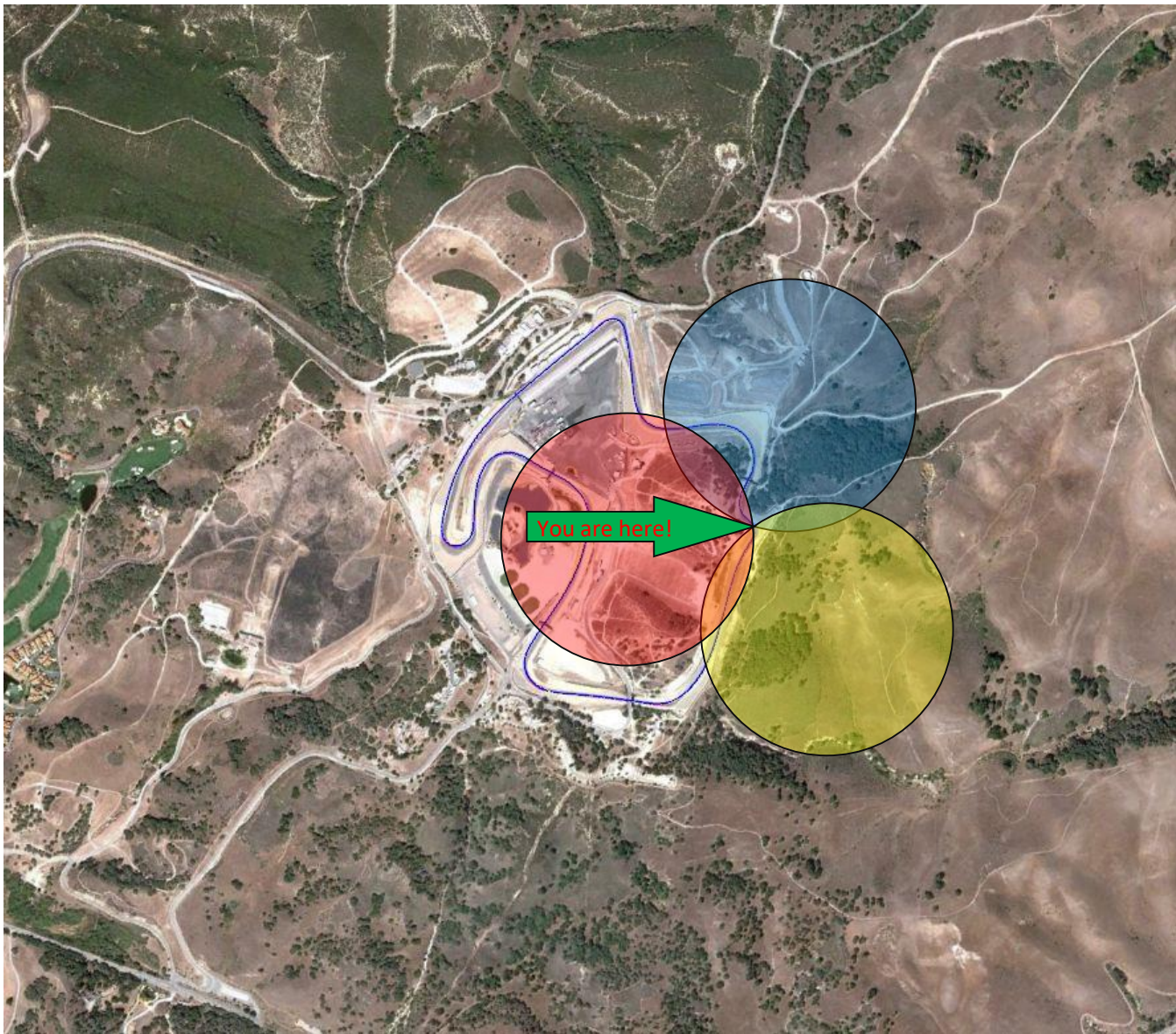




GPS System Information:

- 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

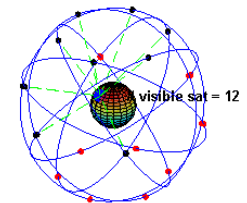




Trilateration:

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:

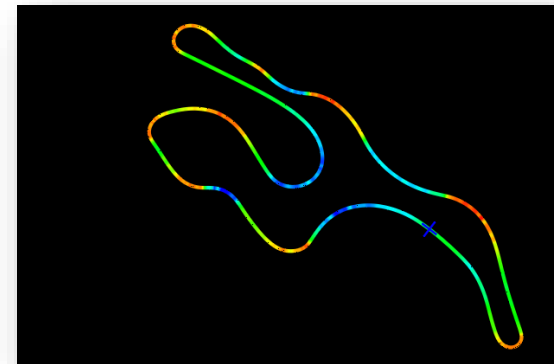
- **Positional Accuracy**

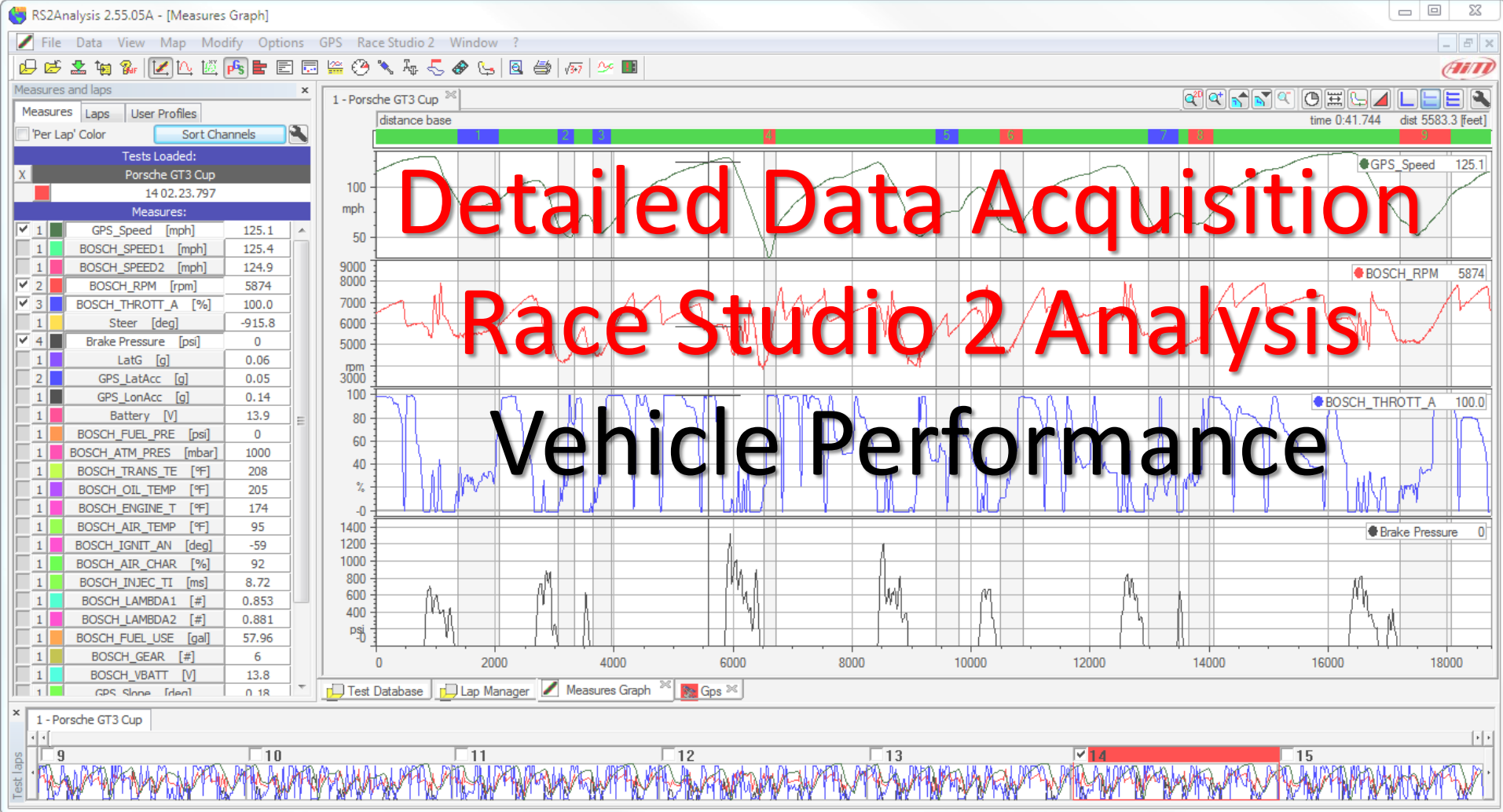
- The Accuracy When Comparing the Position of Your Driven Line to any Other Data Gathered at any Other Time
- This is Reported in Your Data as 'GPS_PosAccuracy'
- The Positional Accuracy of Your AiM Sports GPS System (or any other GPS Device) can Vary at Times

GPS_Gyro [deg/s]	-0.8
GPS_Slope [deg]	2.79
GPS_PosAccuracy [m]	0.79
GPS_Nsat [#]	11
GPS_Heading [deg]	-63.4

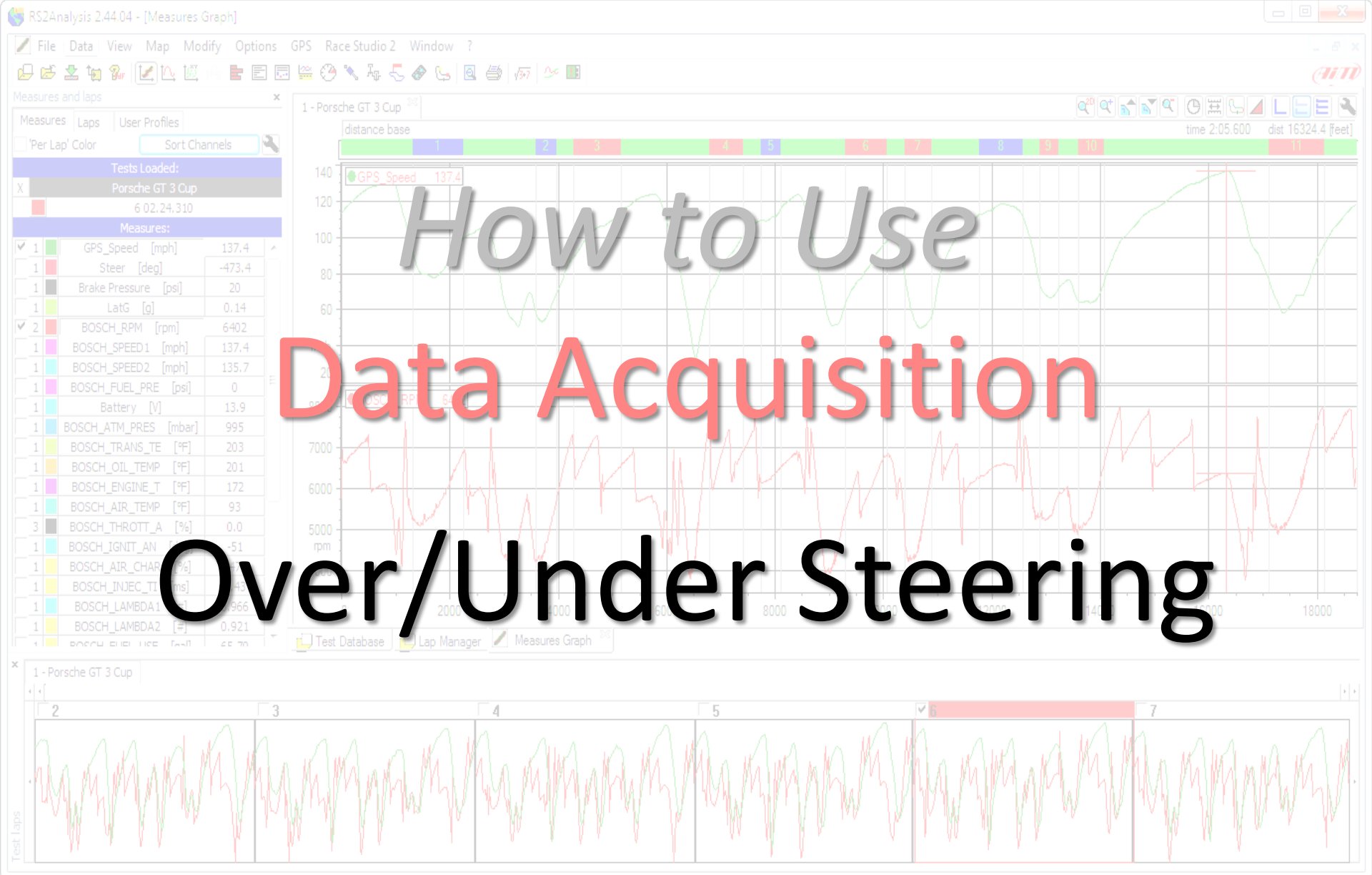
- **Relative Accuracy**

- 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

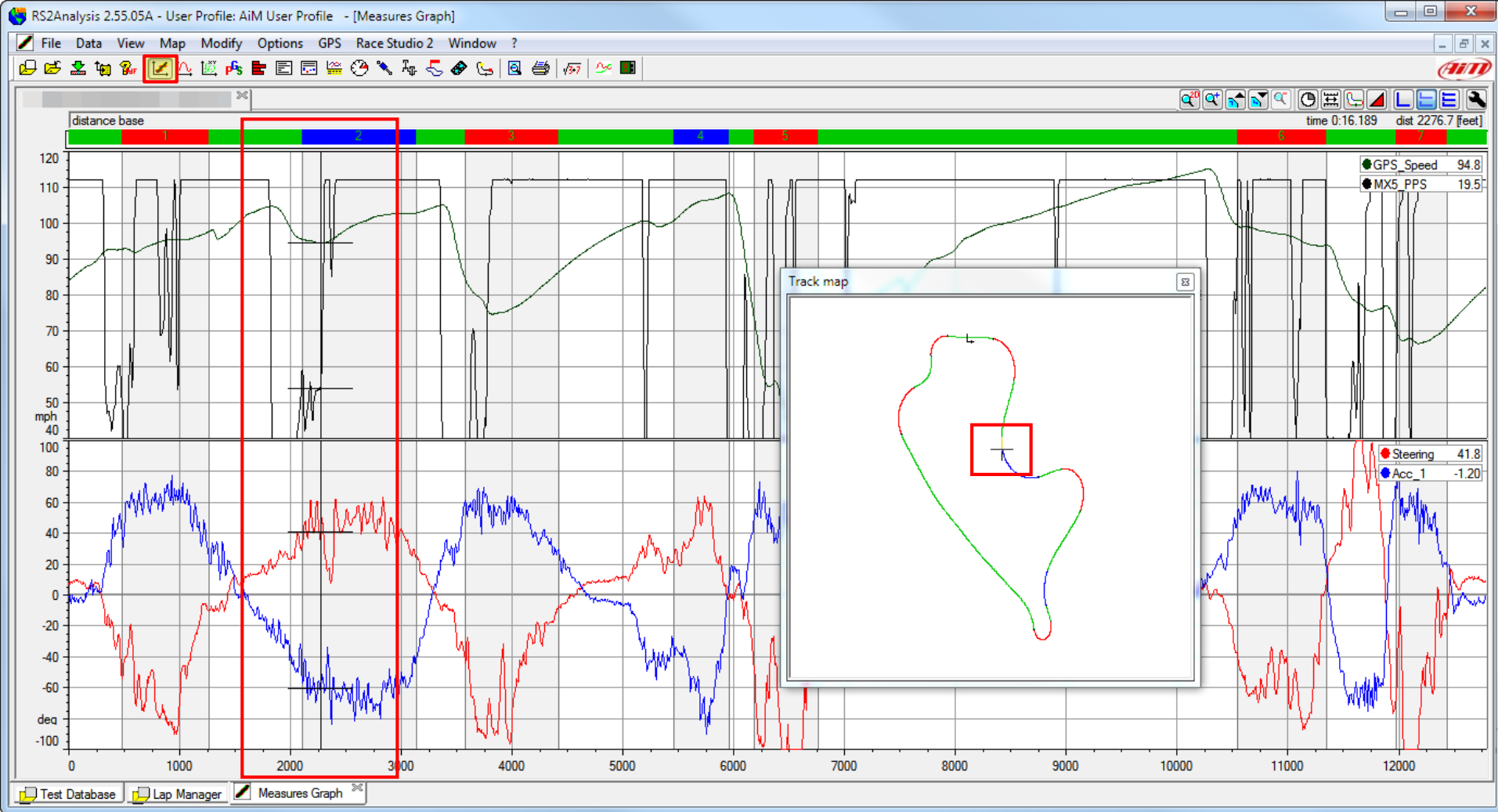




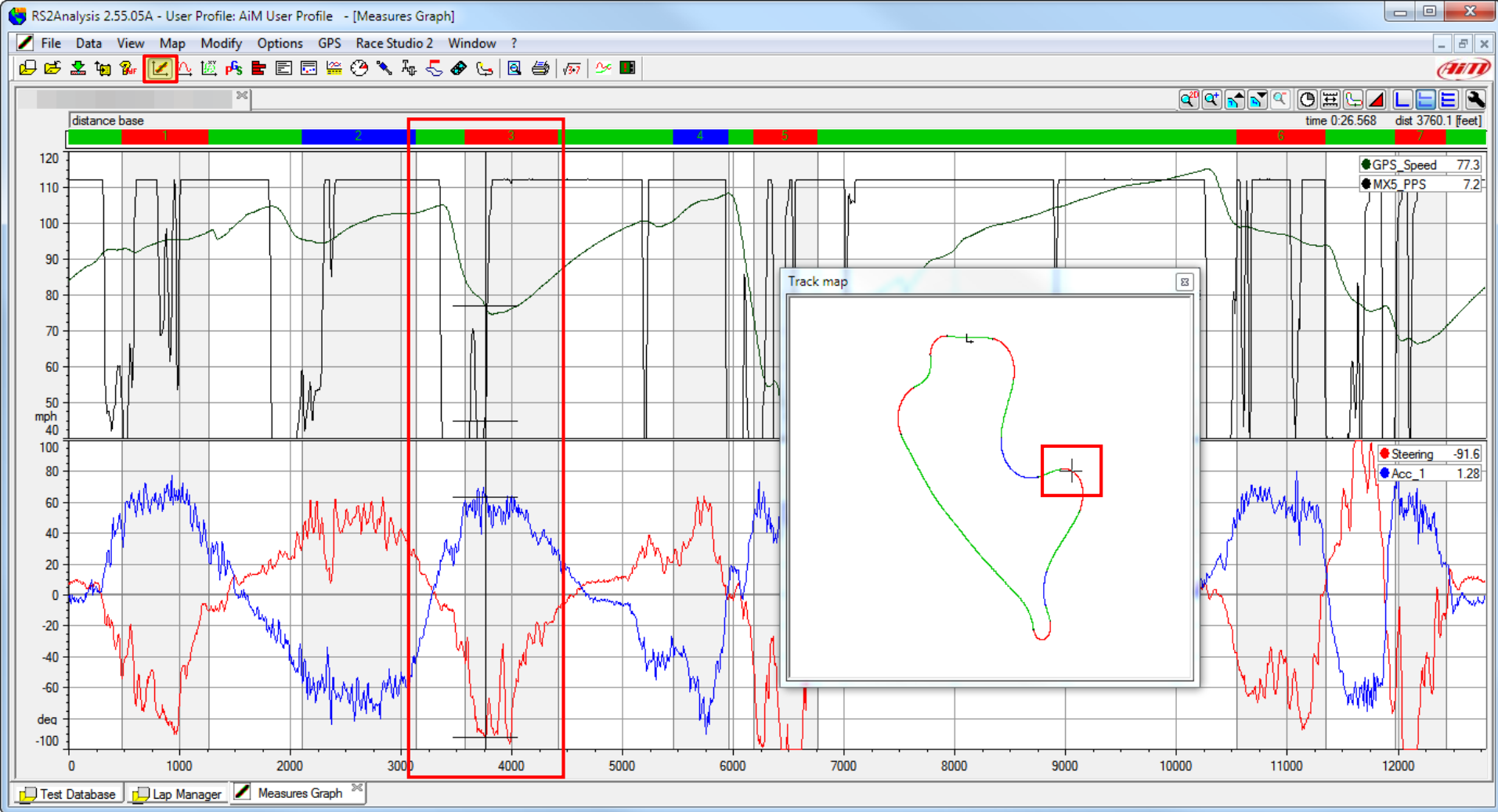
Let's look at several detailed **Race Studio 2 Analysis** examples to help you with **Vehicle Performance**.



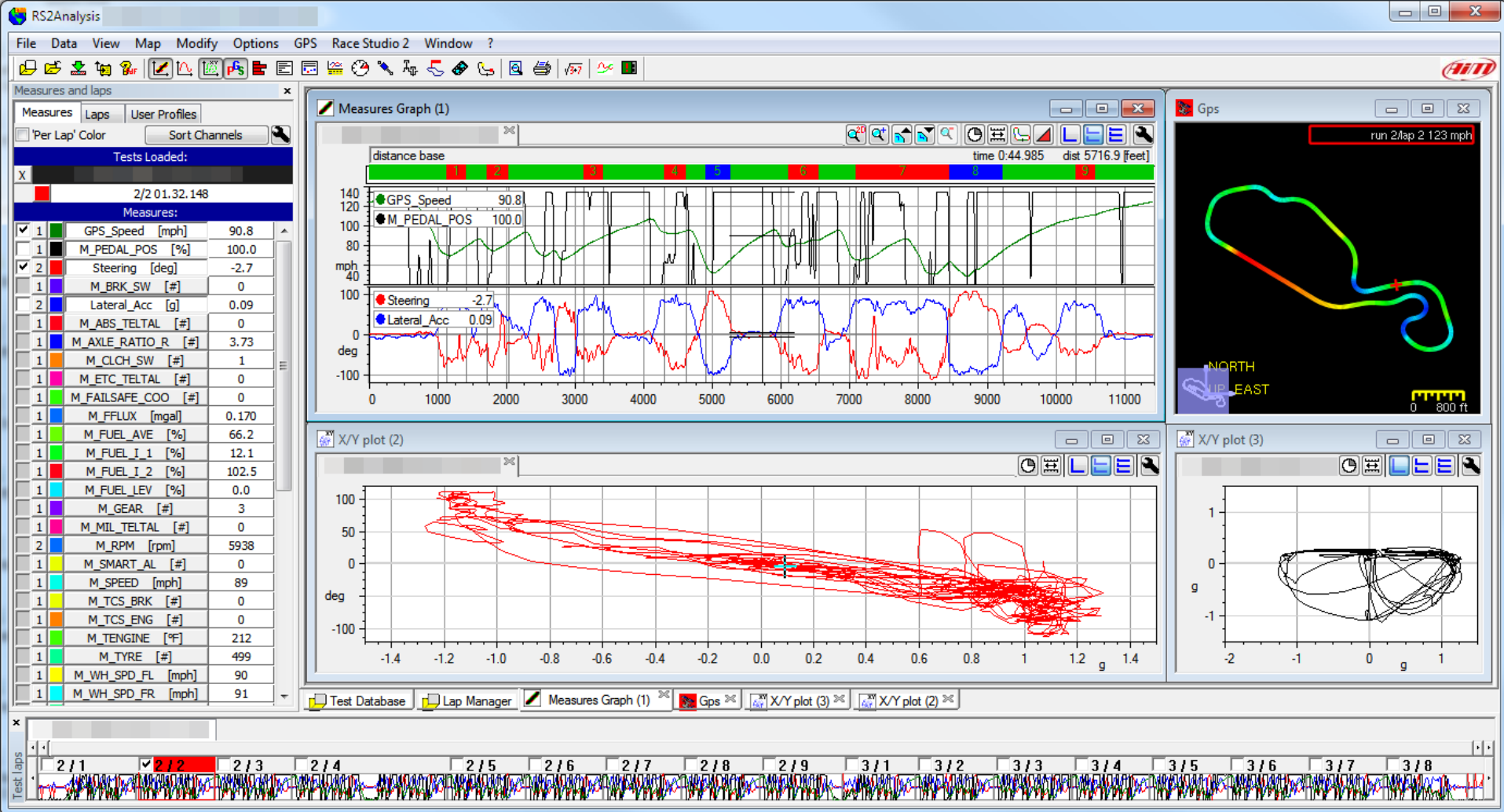
How to Use Data Acquisition Over/Under Steering



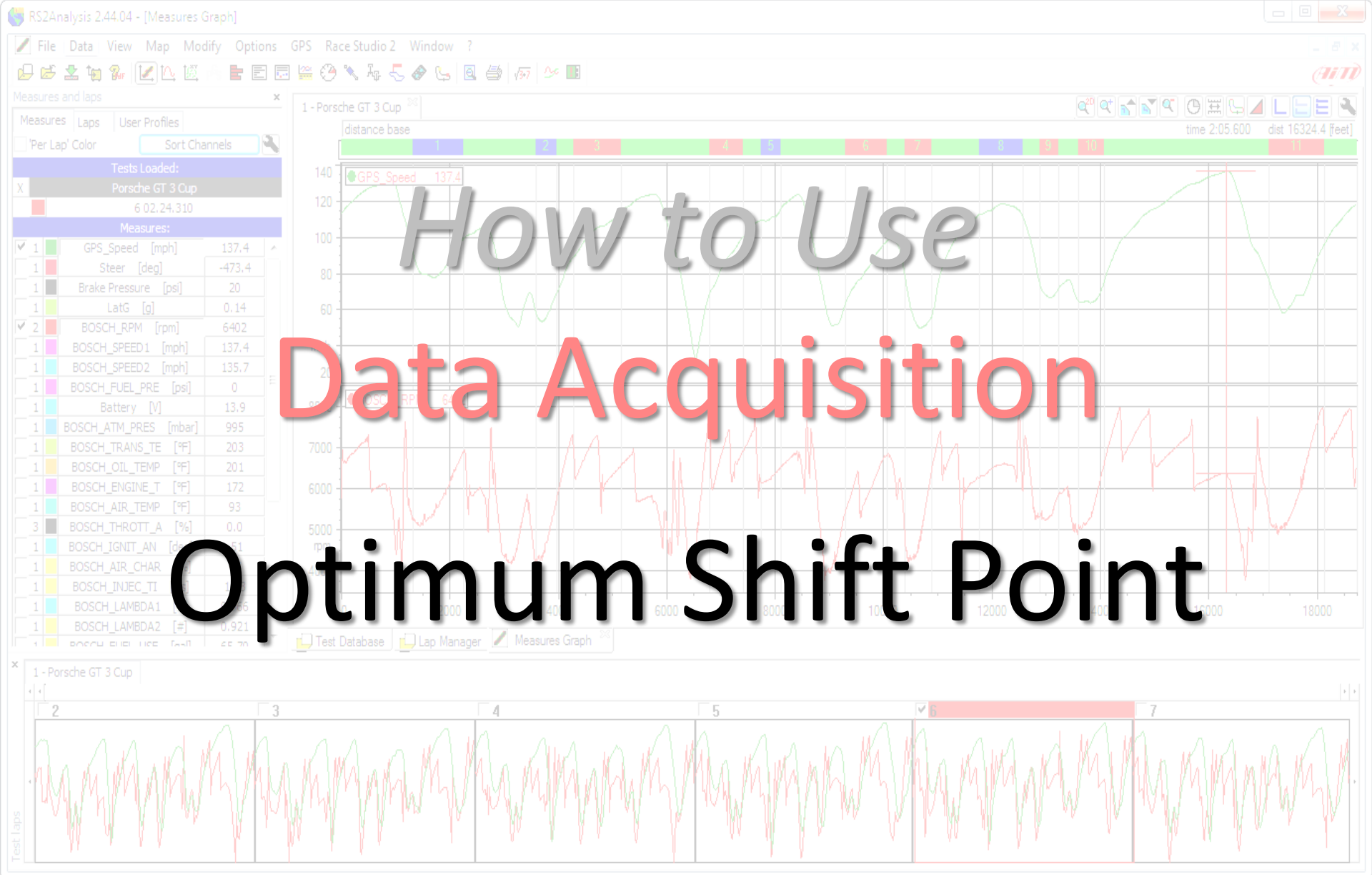
With **Steering** and **Lateral Acceleration** sensors, identifying **Under/Oversteering** areas can be seen. Here we also have a **Throttle Position** to help understand 'WHY' the **Under/Oversteer** happened. Inside the red highlighted area; the corner entry is OK but as soon as he went to full throttle, **snap oversteer**.



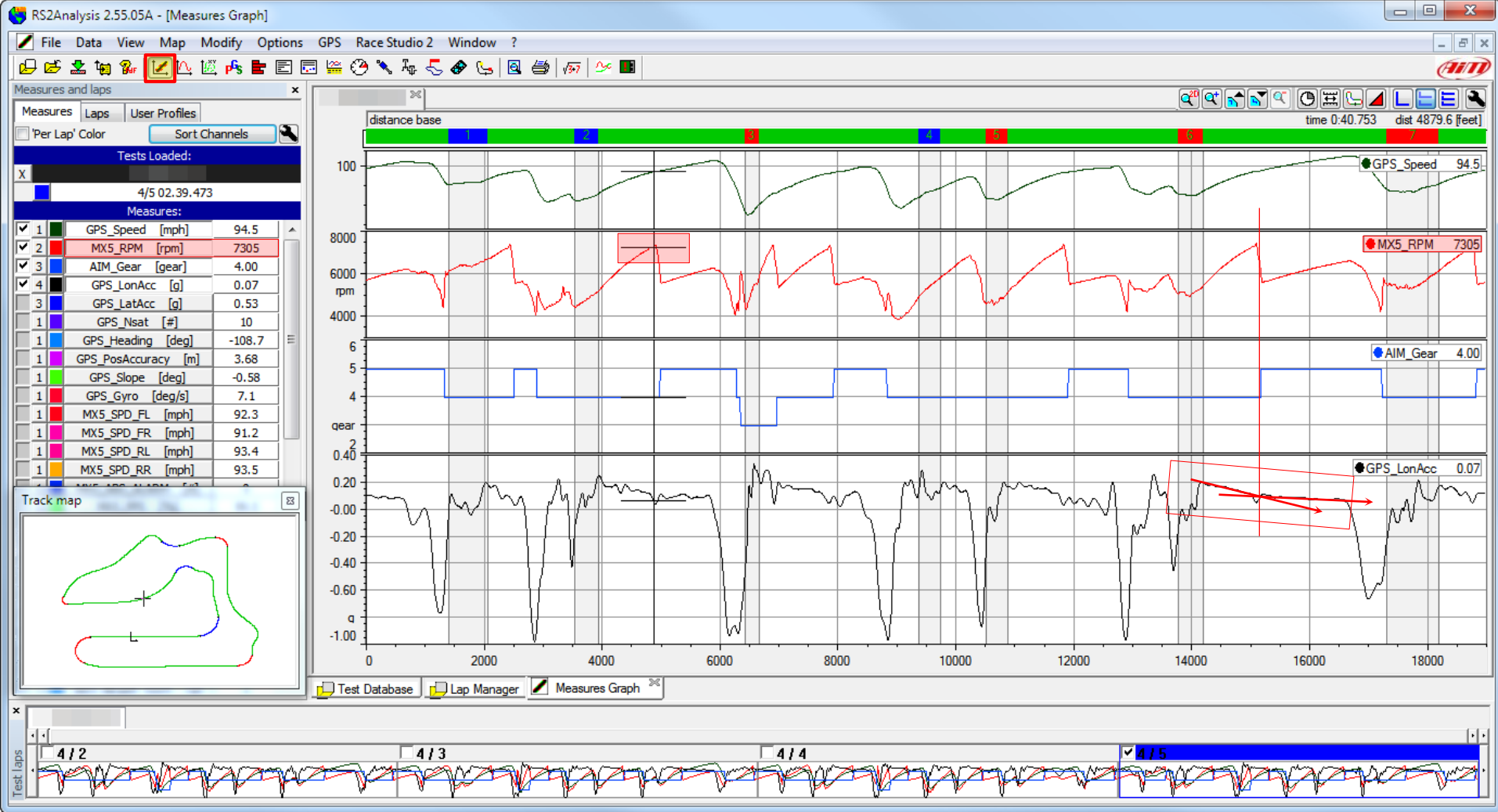
Entry has some **Understeer** but as soon as driver goes to full throttle, snap **Oversteer**.



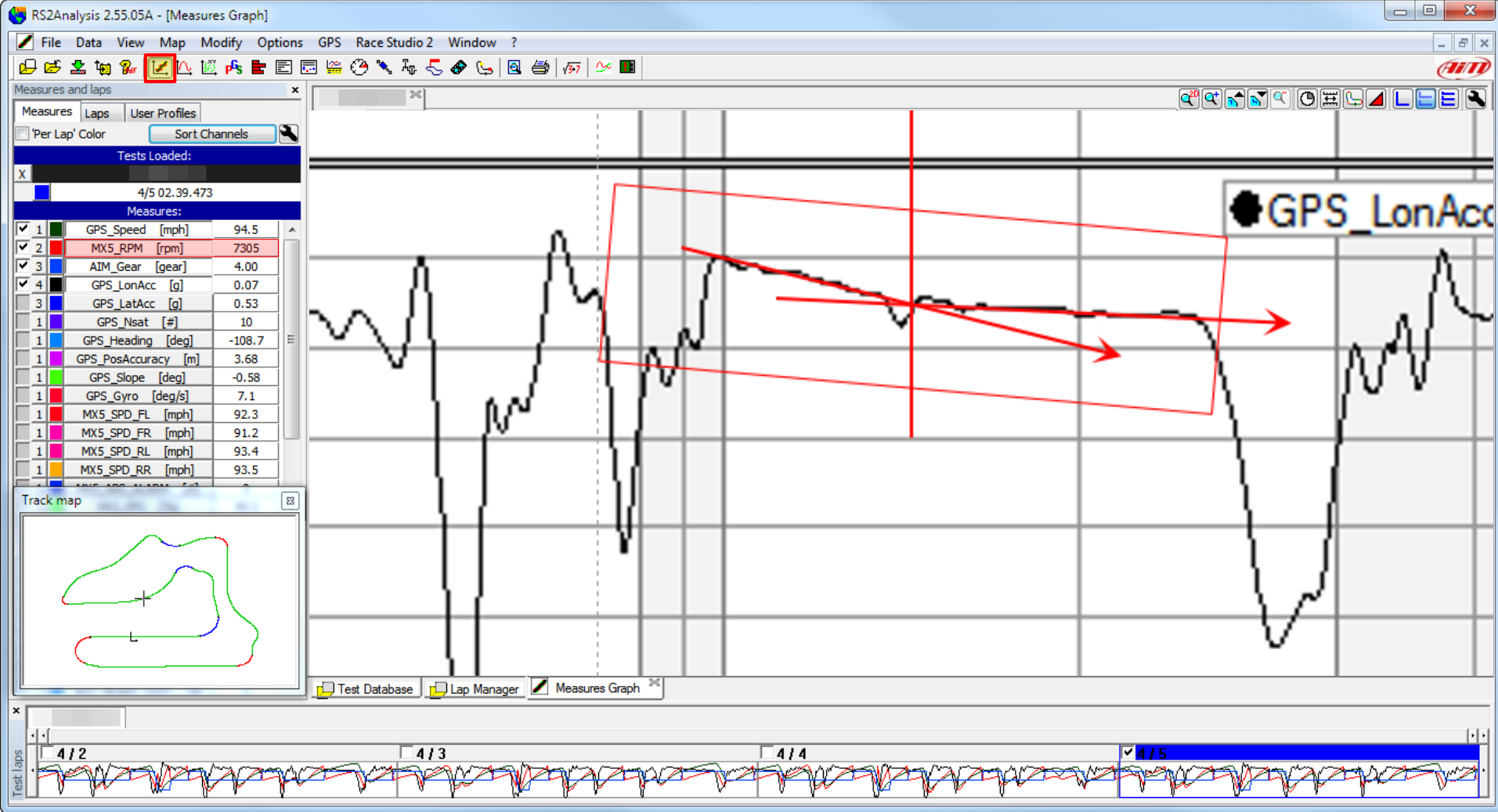
Here is yet another way to look at data and in this case, **Understeer**. In the **X/Y Plot** colored red we are looking at Steering plotted against Lateral Acc and where the ends of the bulk of the traces curve off of the straight trend, is showing a trend of understeer. The black X/Y plot is a **GG Diagram**. This is for a full lap. This is using **'Multiple Views'** and is something we discuss in the **Advanced Seminar**.



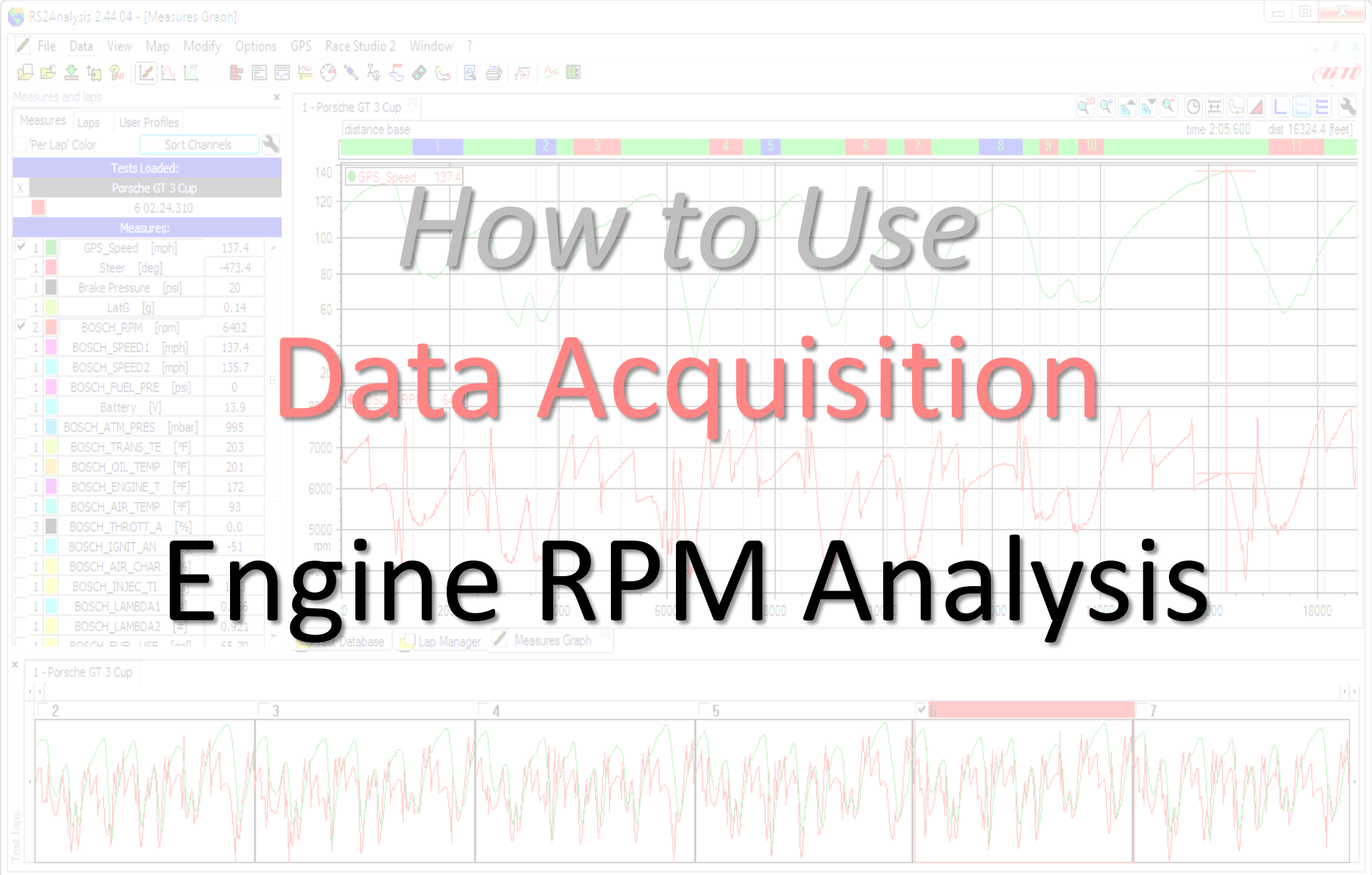
How to Use Data Acquisition Optimum Shift Point



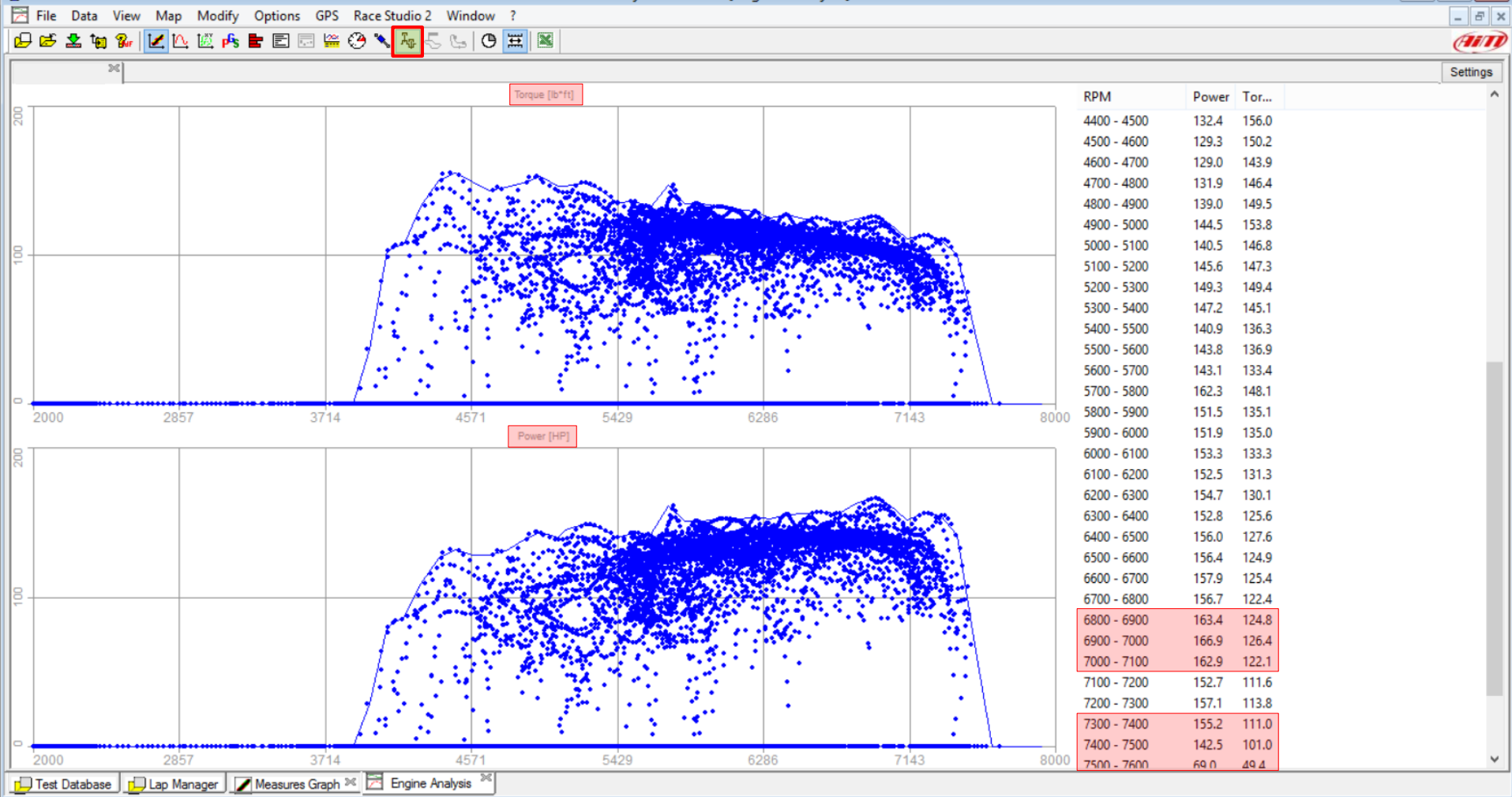
Gearing Here we have a lap showing Speed, RPM, Gear Position, and GPS_LonAcc. GPS_LonAcc, higher values is acceleration. Here we study the acceleration rate near shifts to help determine proper shift points. Notice that the driver is shifting at about 7,300rpm. This visual check gives a pretty good idea that the driver is close to being correct to not take the engine to the 7,500rpm rev limiter.



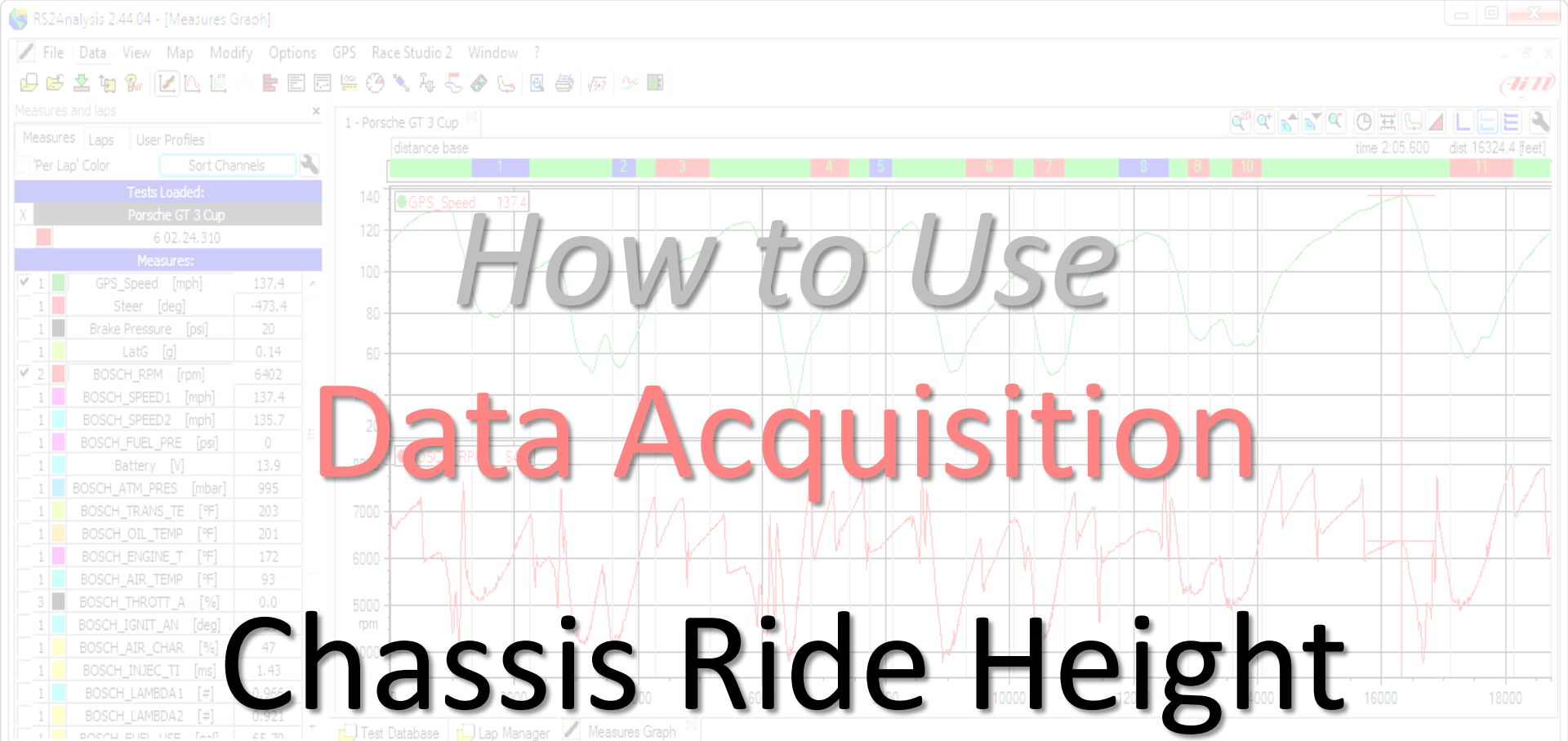
Gearing Here is a close up view of the previous slide.



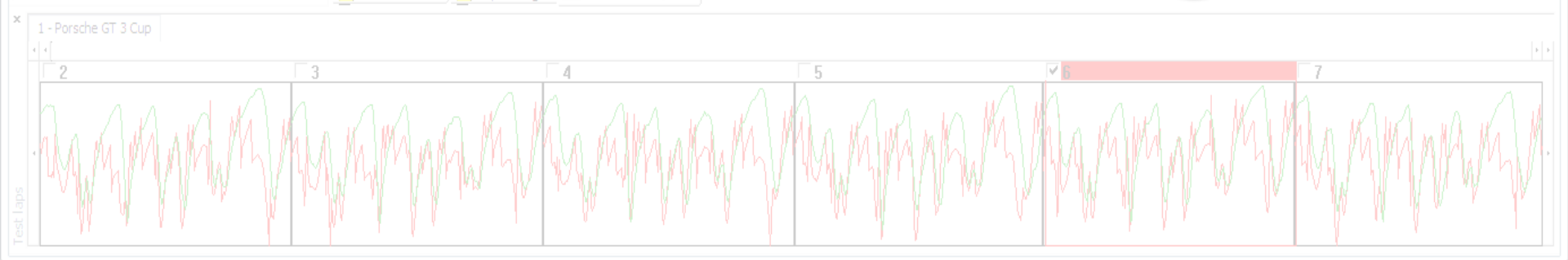
How to Use Data Acquisition Engine RPM Analysis

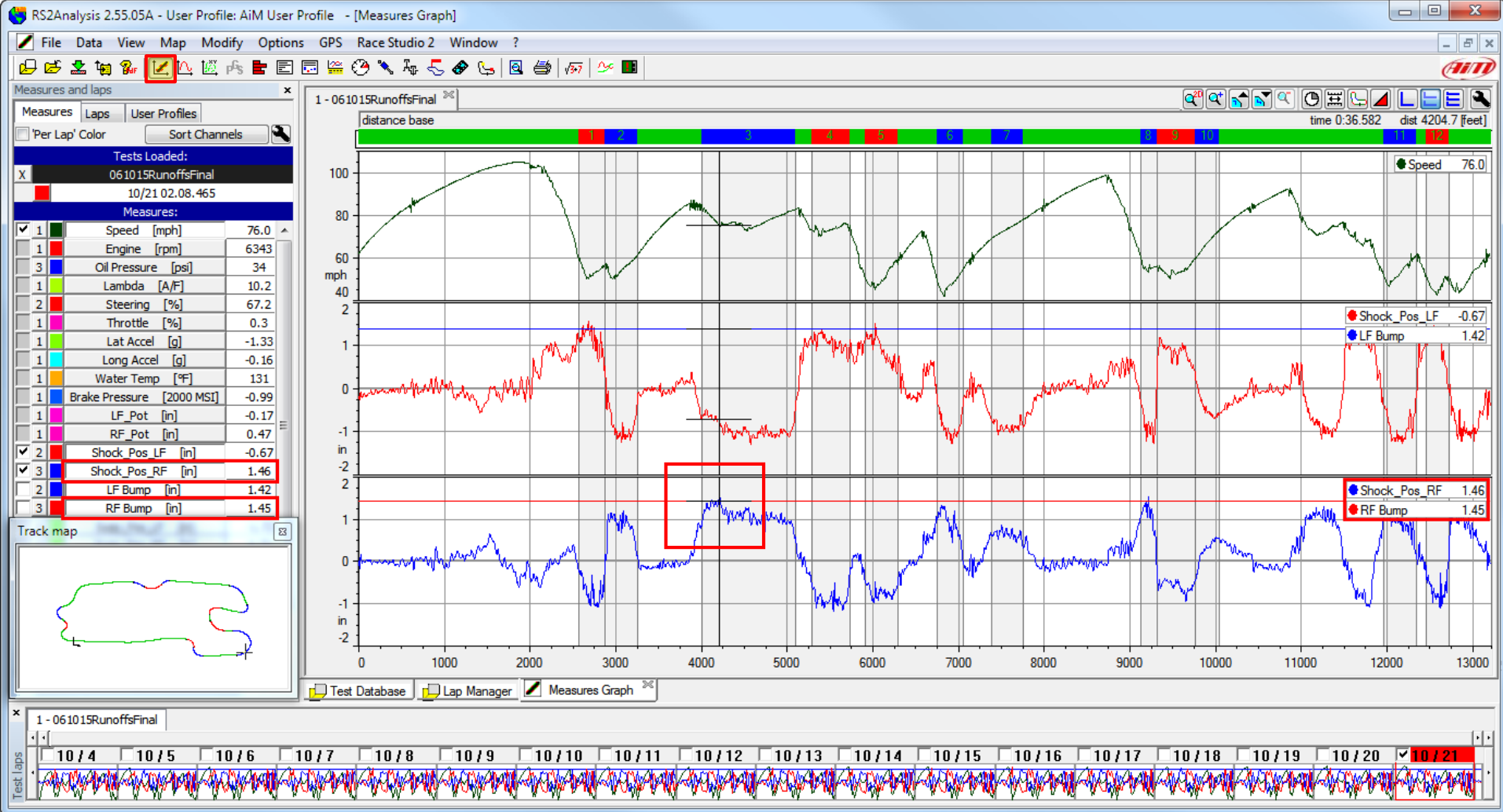


Horsepower Here we are showing the **RPM Engine Analysis Report**. This function uses the data collected to calculate horsepower and torque. This engine horsepower output is highest at 6,800 to 7,100 rpm and falls off quickly and is only 142.5hp at the 7,400rpm. The car has a **7500rpm** rev limiter and the driver is wisely shifting before the limiter.

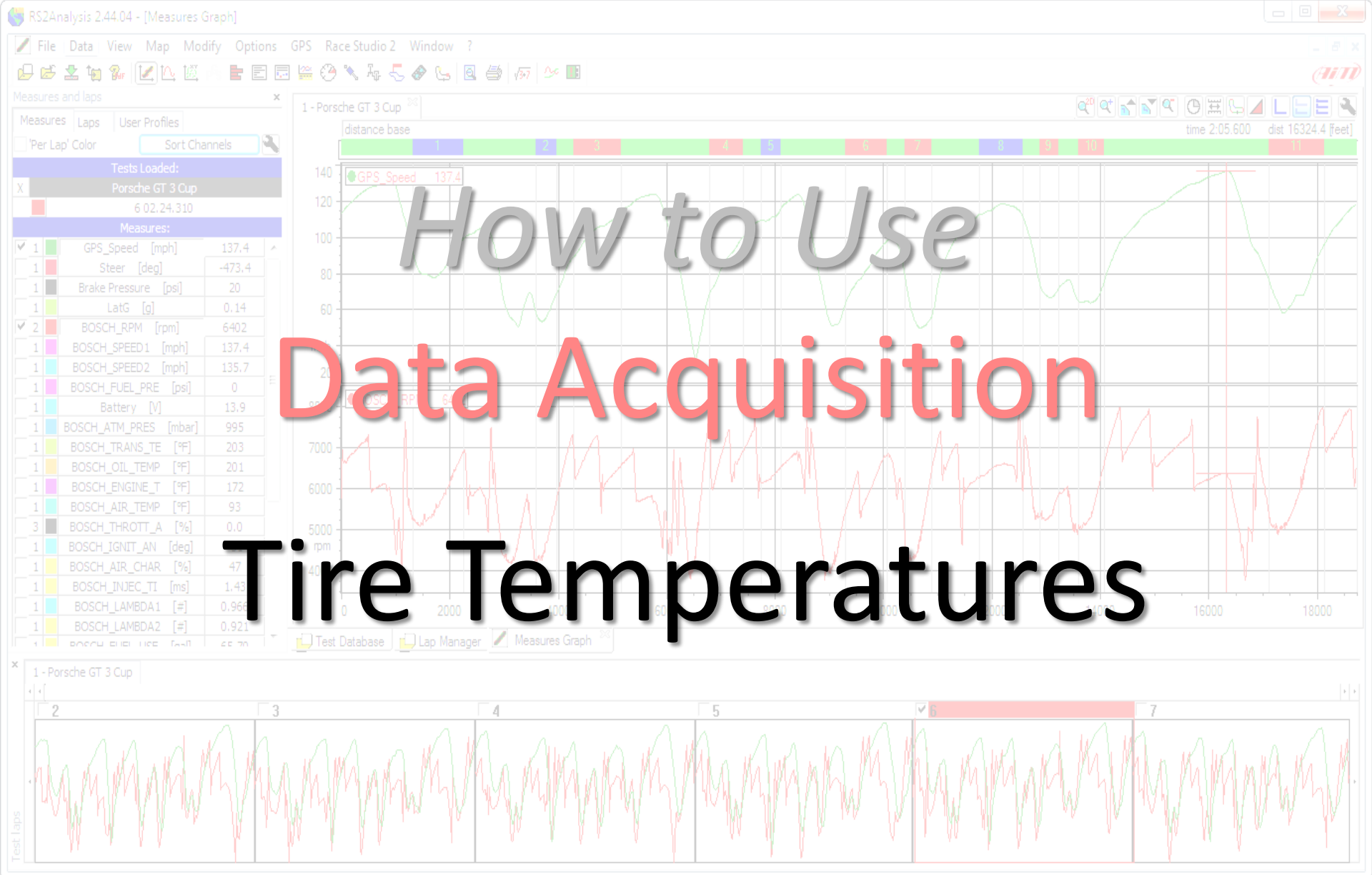


How to Use Data Acquisition Chassis Ride Height

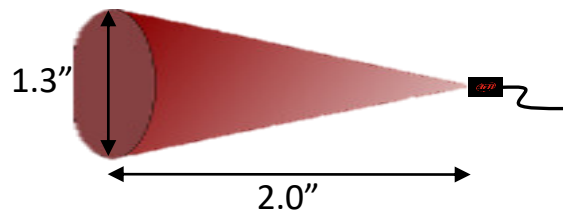




Suspension Sensors: Example of **Front Shock Sensors** used to set ride height. We knew that the front bump stops touched at 1.45in of travel due to cycling the suspension before the event. On this track the important corner to check was the RF corner. We used this information to get/keep the car as low as possible for maximum dynamic camber but off the bump stops as much as possible.



How to Use Data Acquisition Tire Temperatures



Sensor Distance From Tire (35° Cone)	Average Tire Surface Temp (Circle Dia.)
0.5"	0.3"
1.0"	0.6"
2.0"	1.3"
3.0"	1.9"
4.0"	2.6"
5.0"	3.2"
6.0"	2.9"



Infrared Tire Temps The AiM Sports Tire Temperature Sensor measures the surface temperature of the tire using infrared technology. The sensor should be mounted between 1 and 3 inches from the surface of the tire. The sensor samples the data with a 35 degree cone and then averages the tire temperature based on the area of the circle. Above is a chart of the sample size based on the distance the sensor is from the tire.



Measures and laps

Measures Laps User Profiles

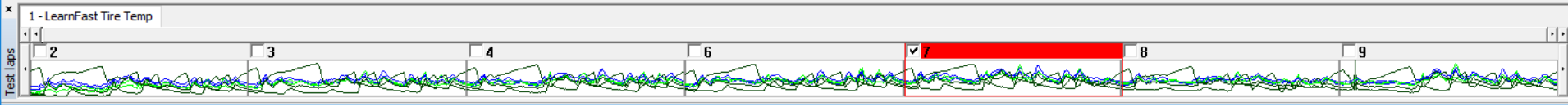
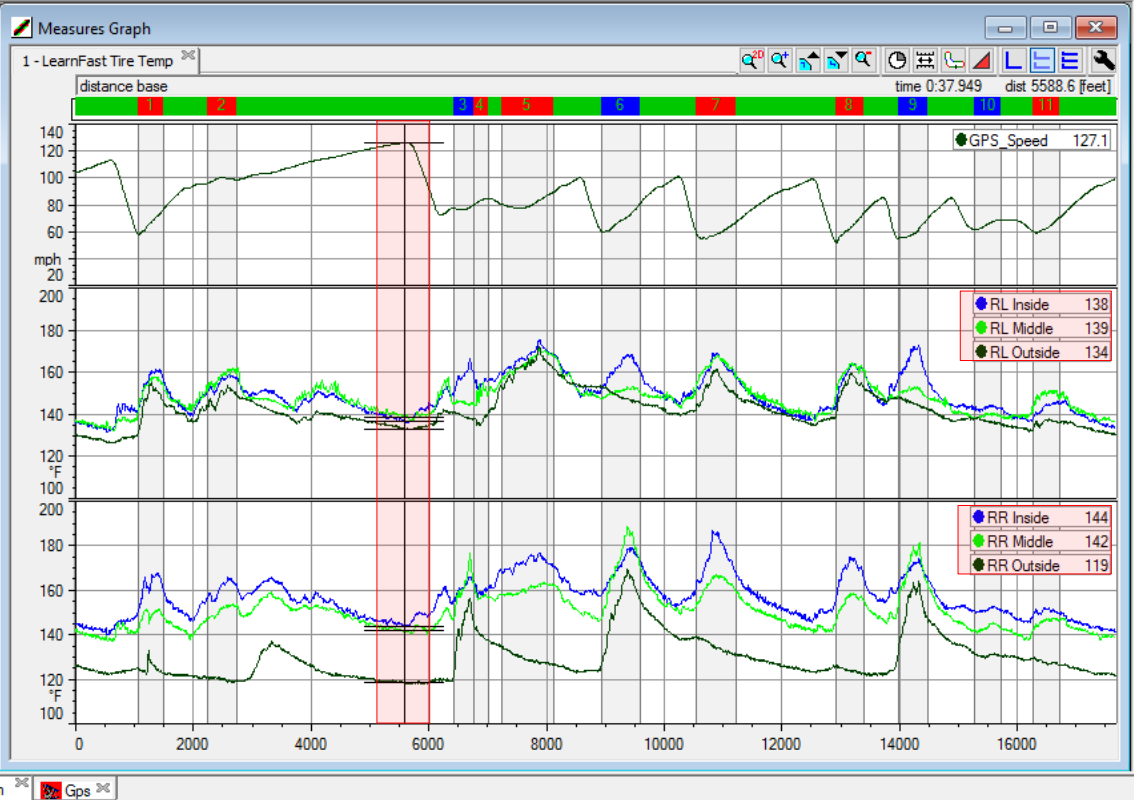
Per Lap Color Sort Channels

Tests Loaded:
LearnFast Tire Temp

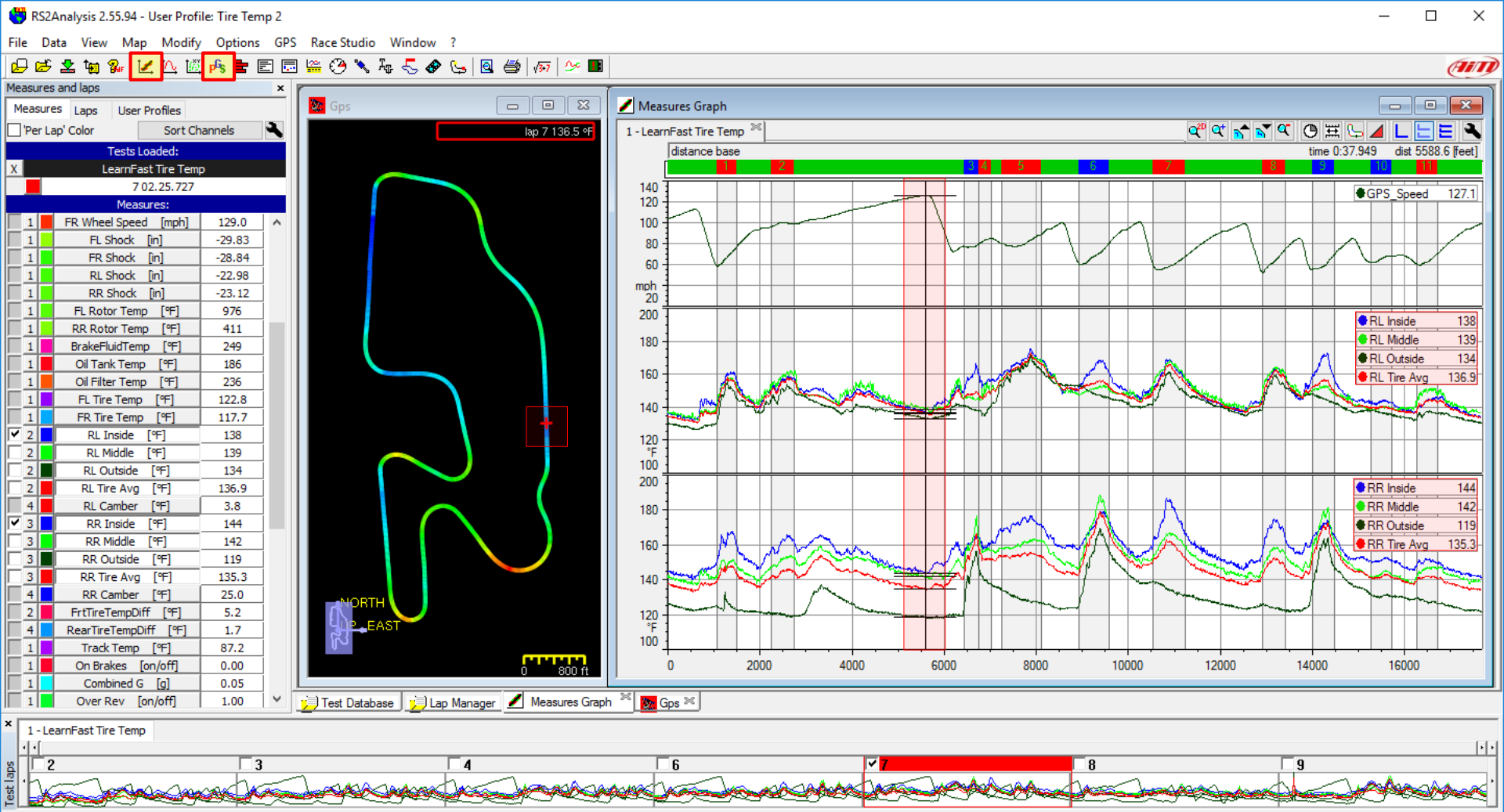
7 02.25.727

Measures:

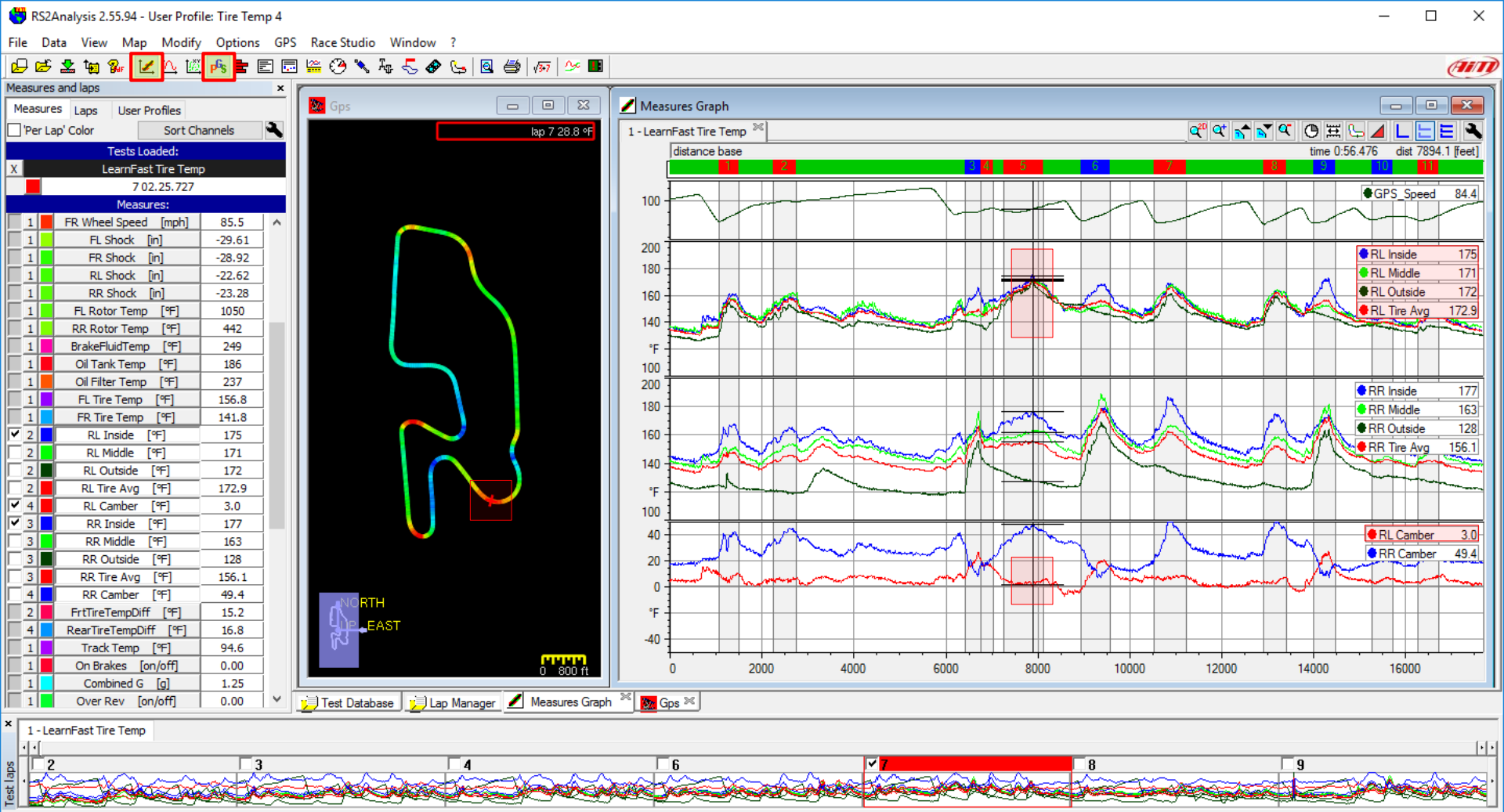
1	FR Wheel Speed [mph]	129.0
1	FL Shock [in]	-29.83
1	FR Shock [in]	-28.84
1	RL Shock [in]	-22.98
1	RR Shock [in]	-23.12
1	FL Rotor Temp [°F]	976
1	RR Rotor Temp [°F]	411
1	BrakeFluidTemp [°F]	249
1	Oil Tank Temp [°F]	186
1	Oil Filter Temp [°F]	236
1	FL Tire Temp [°F]	122.8
1	FR Tire Temp [°F]	117.7
2	RL Inside [°F]	138
2	RL Middle [°F]	139
2	RL Outside [°F]	134
2	RL Tire Avg [°F]	136.9
4	RL Camber [°F]	3.8
3	RR Inside [°F]	144
3	RR Middle [°F]	142
3	RR Outside [°F]	119
3	RR Tire Avg [°F]	135.3
4	RR Camber [°F]	25.0
2	FrtTireTempDiff [°F]	5.2
4	RearTireTempDiff [°F]	1.7
1	Track Temp [°F]	87.2
1	On Brakes [on/off]	0.00
1	Combined G [g]	0.05
1	Over Rev [on/off]	1.00



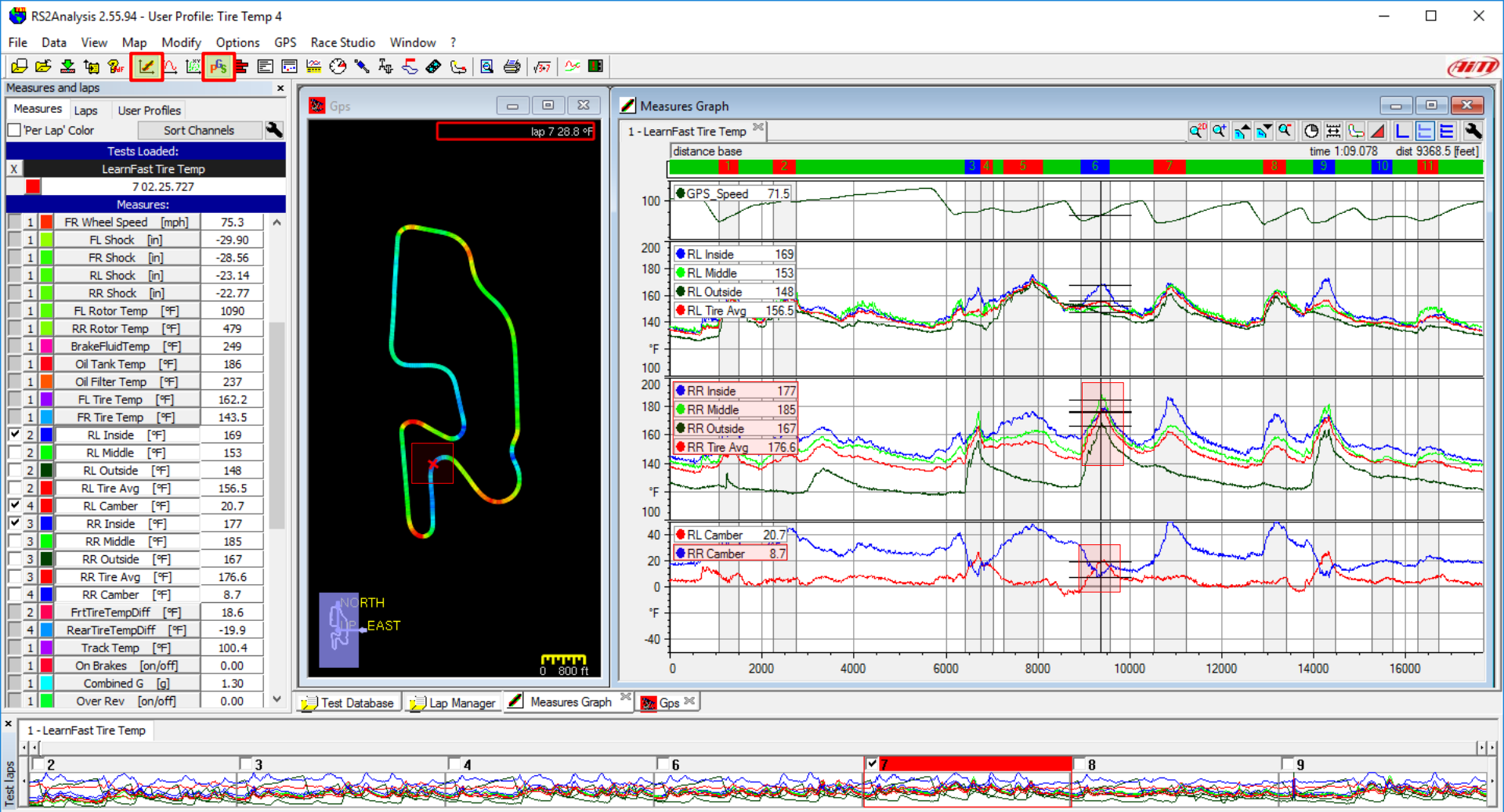
Infrared Tire Temps are a powerful tool. This data is from a Sports Car at Watkins Glen and we are looking at the rear tires with 3 infrared tire temps per tire; Inside, Middle, and Outside.



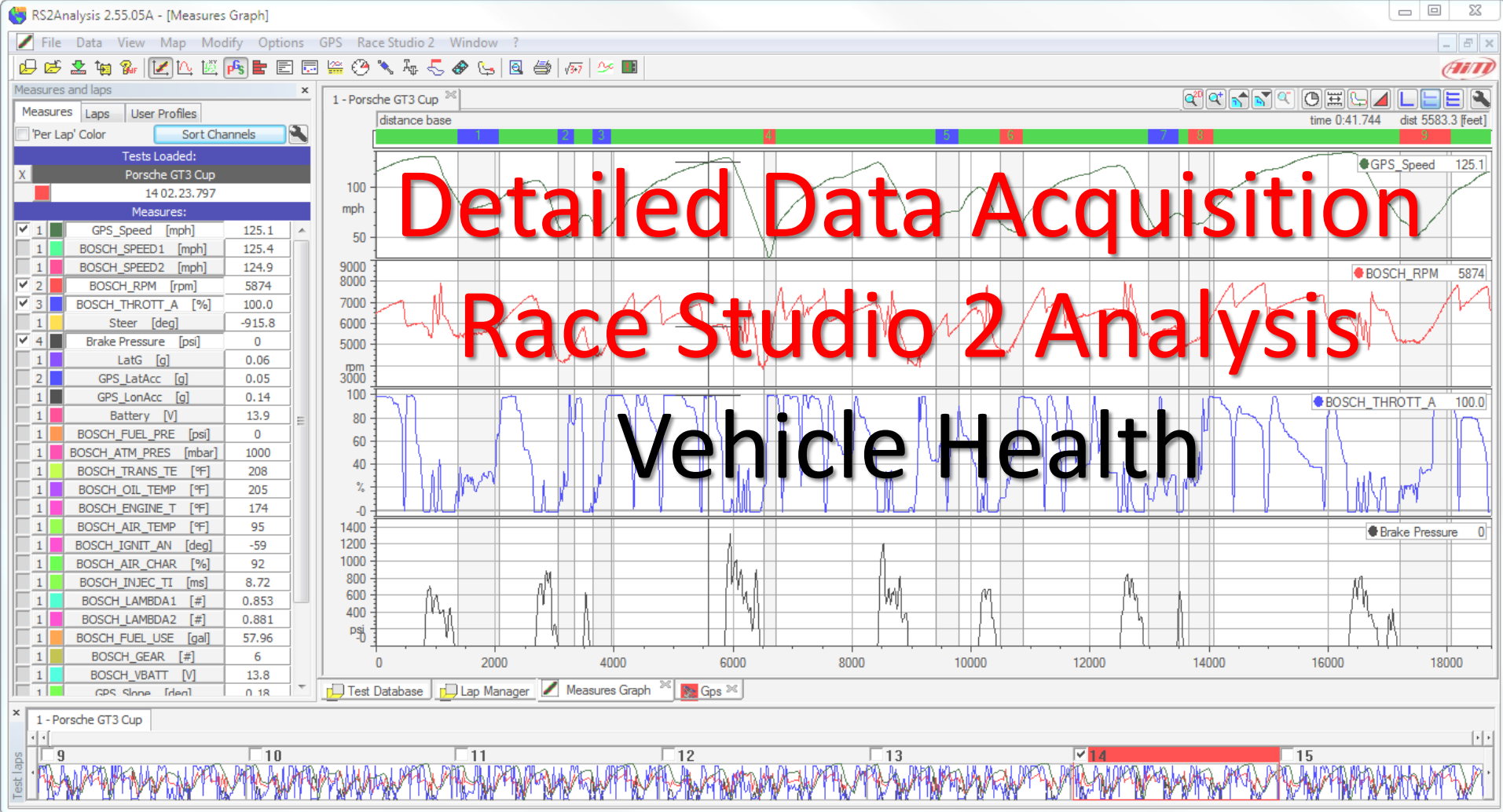
Infrared Tire temps are a powerful tool. This data is from a Sports Car at Watkins Glen and we are looking at the rear tires with 3 infrared tire temps per tire; Inside, Middle, and Outside. Here we have created and displayed in red a simple 'Average' tire temp value for each rear tire.



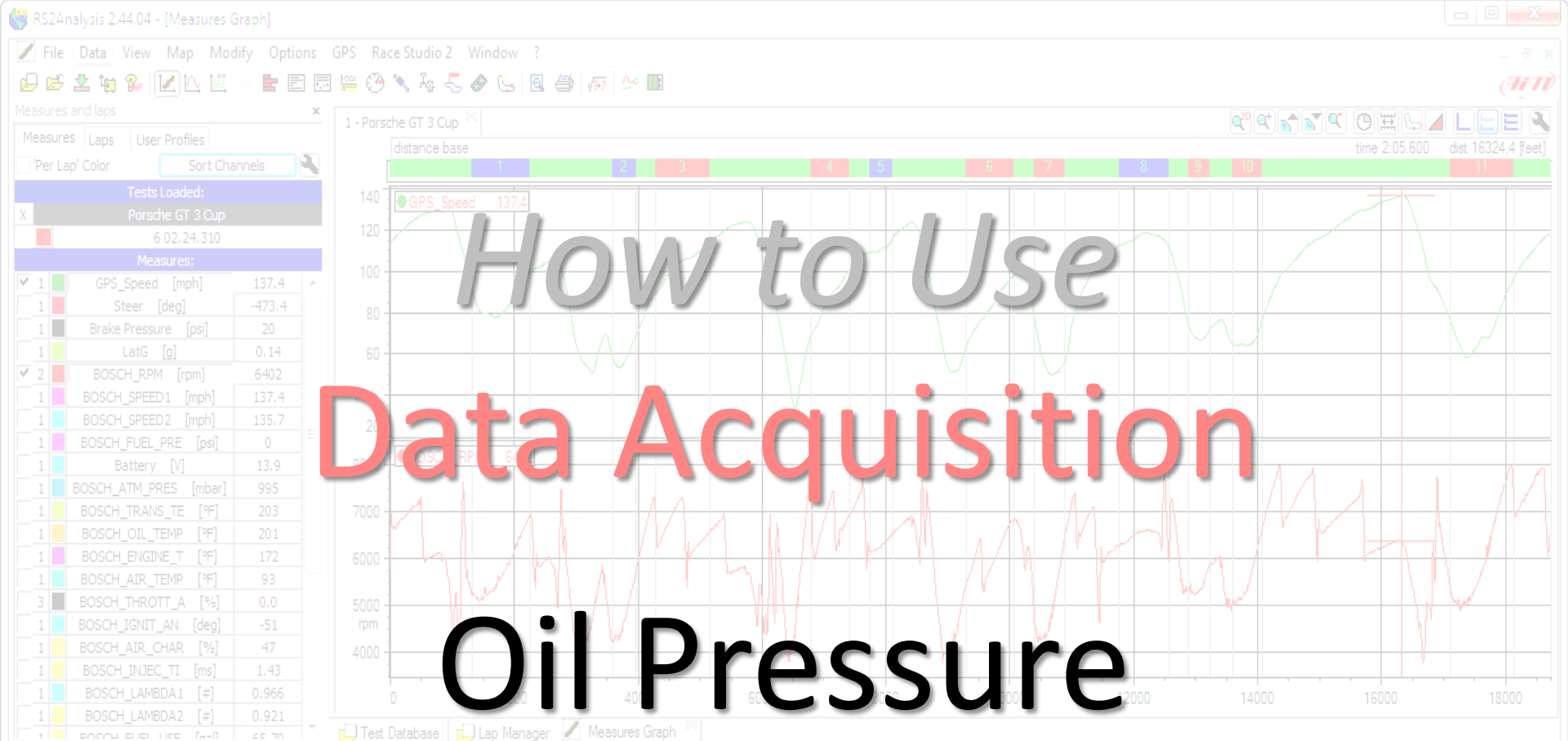
Infrared Tire temps are a powerful tool. This data is from a Sports Car at Watkins Glen and we are looking at the rear tires with 3 infrared tire temps per tire; Inside, Middle, and Outside. Here we have also created and displayed 'RL Camber' and 'RR Camber' math channels. These are the Inside-Outside tire temperatures. So if the number is 'positive', the inner edge of the tire is hotter and may be suggesting less camber at that point.



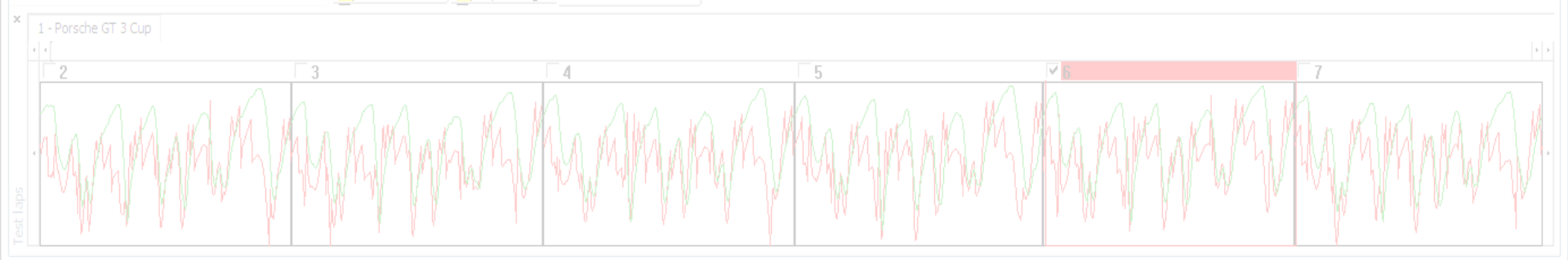
Infrared Tire temps are a powerful tool. This data is from a Sports Car at Watkins Glen and we are looking at the rear tires with 3 infrared tire temps per tire; Inside, Middle, and Outside. Here we have also created and displayed 'RL Camber' and 'RR Camber' math channels. These are the Inside-Outside tire temperatures. So if the number is 'positive', the inner edge of the tire is hotter and may be suggesting less camber at that point.

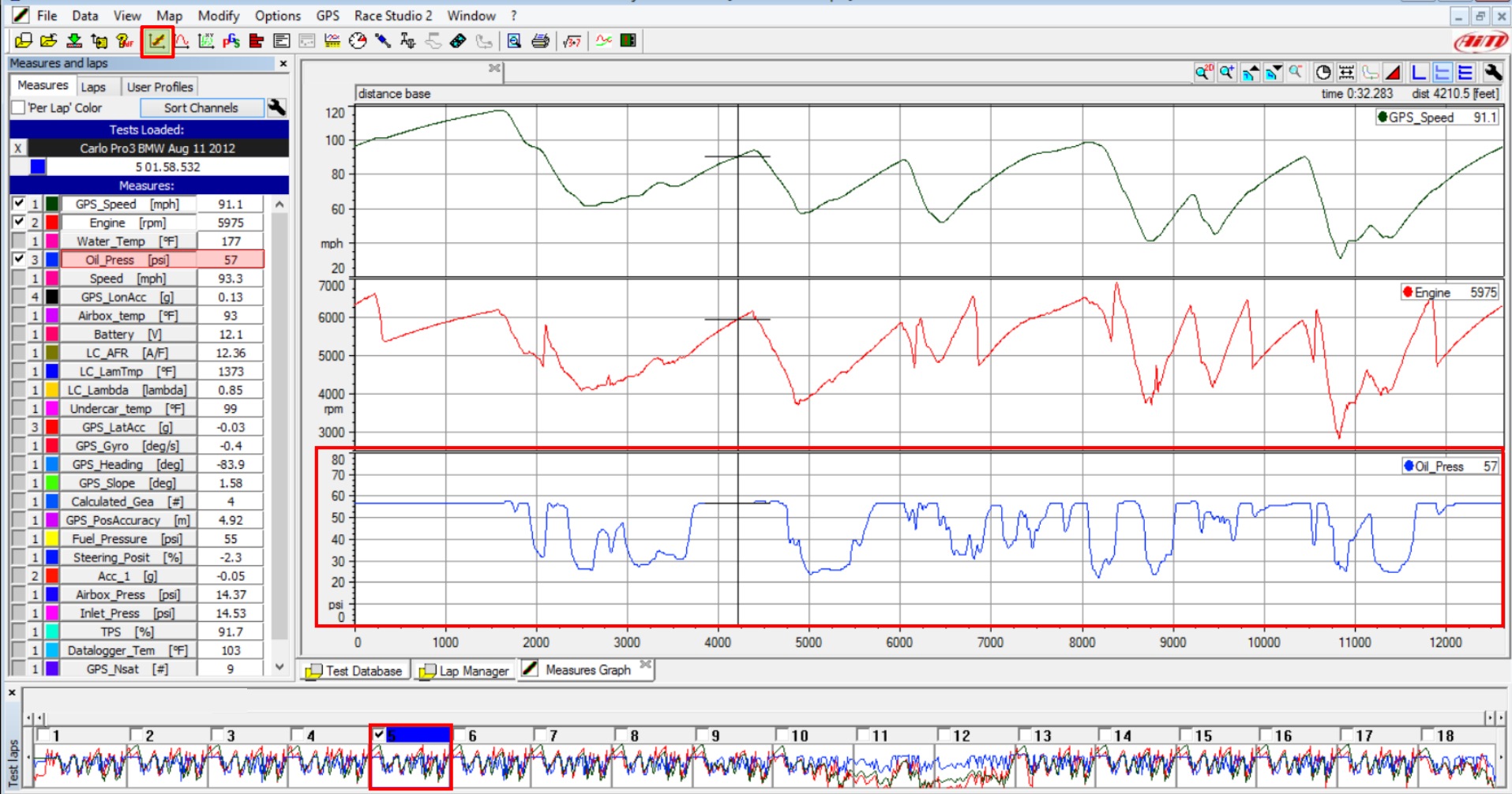


Let's look at several detailed Race Studio 2 Analysis examples to help you with Vehicle health.

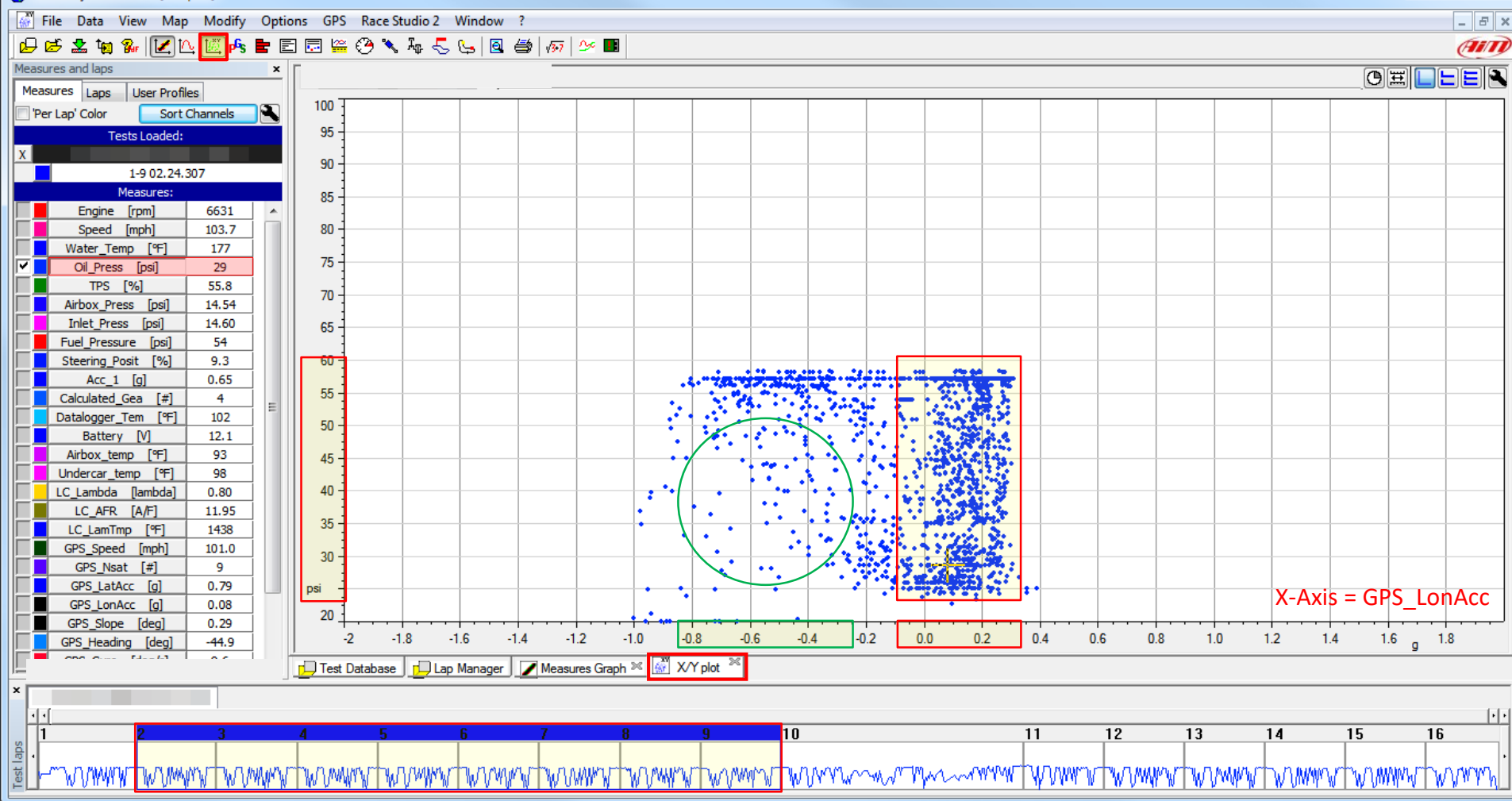


How to Use Data Acquisition Oil Pressure

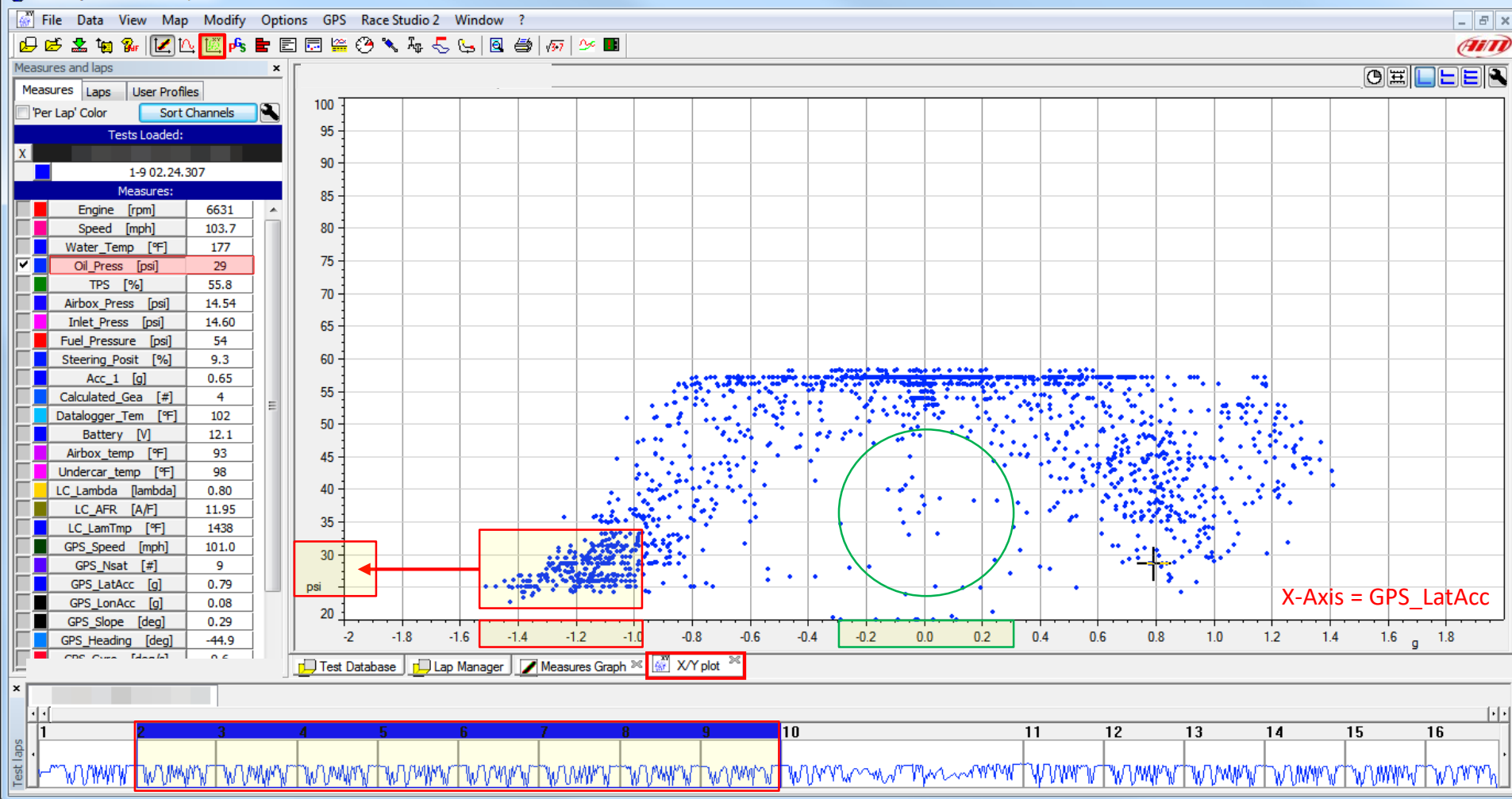




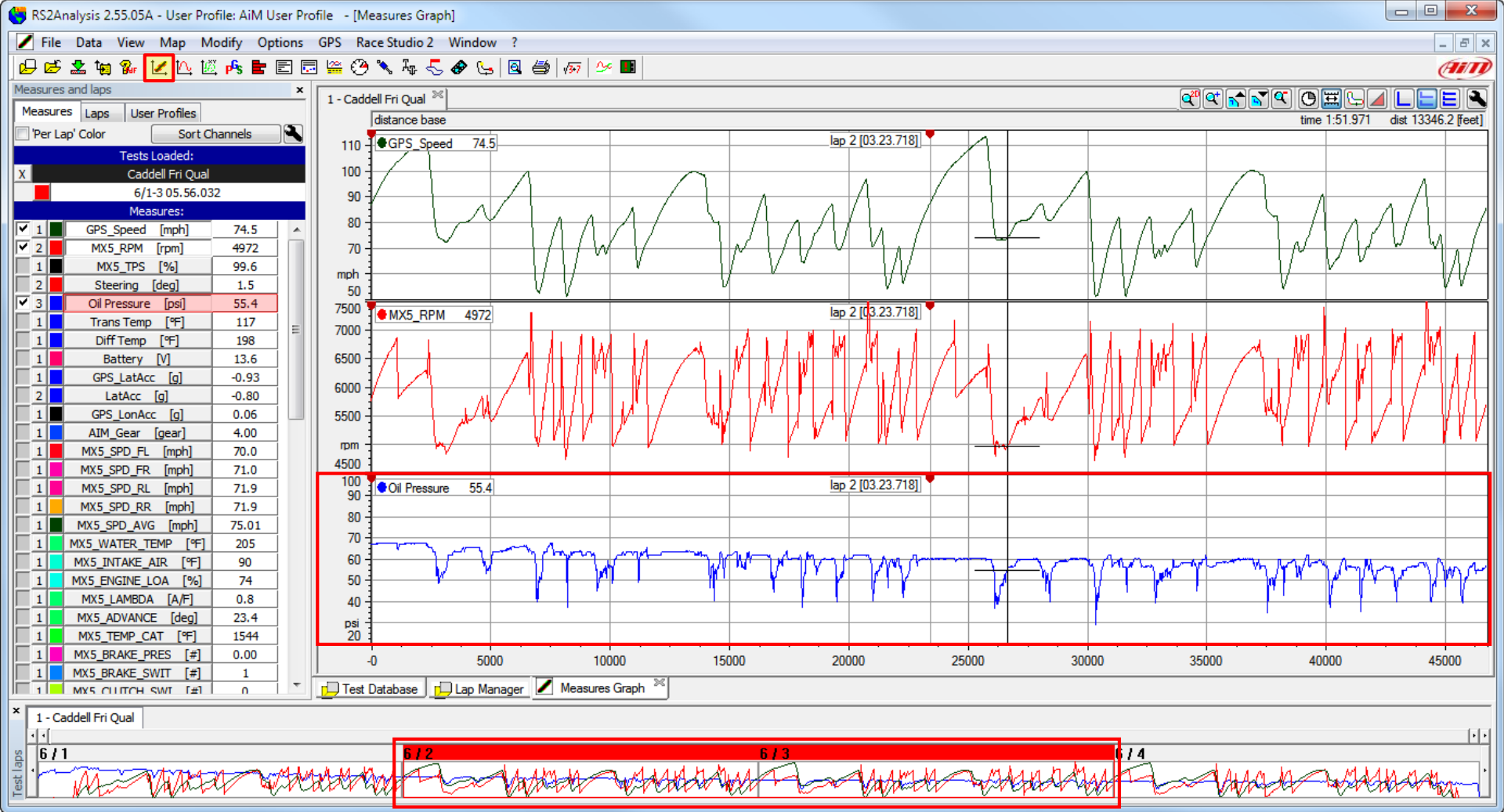
Oil Pressure Issues: This data is showing very erratic Oil Pressure issues. Why is this happening? To know for sure we need to look at the data in a different way.



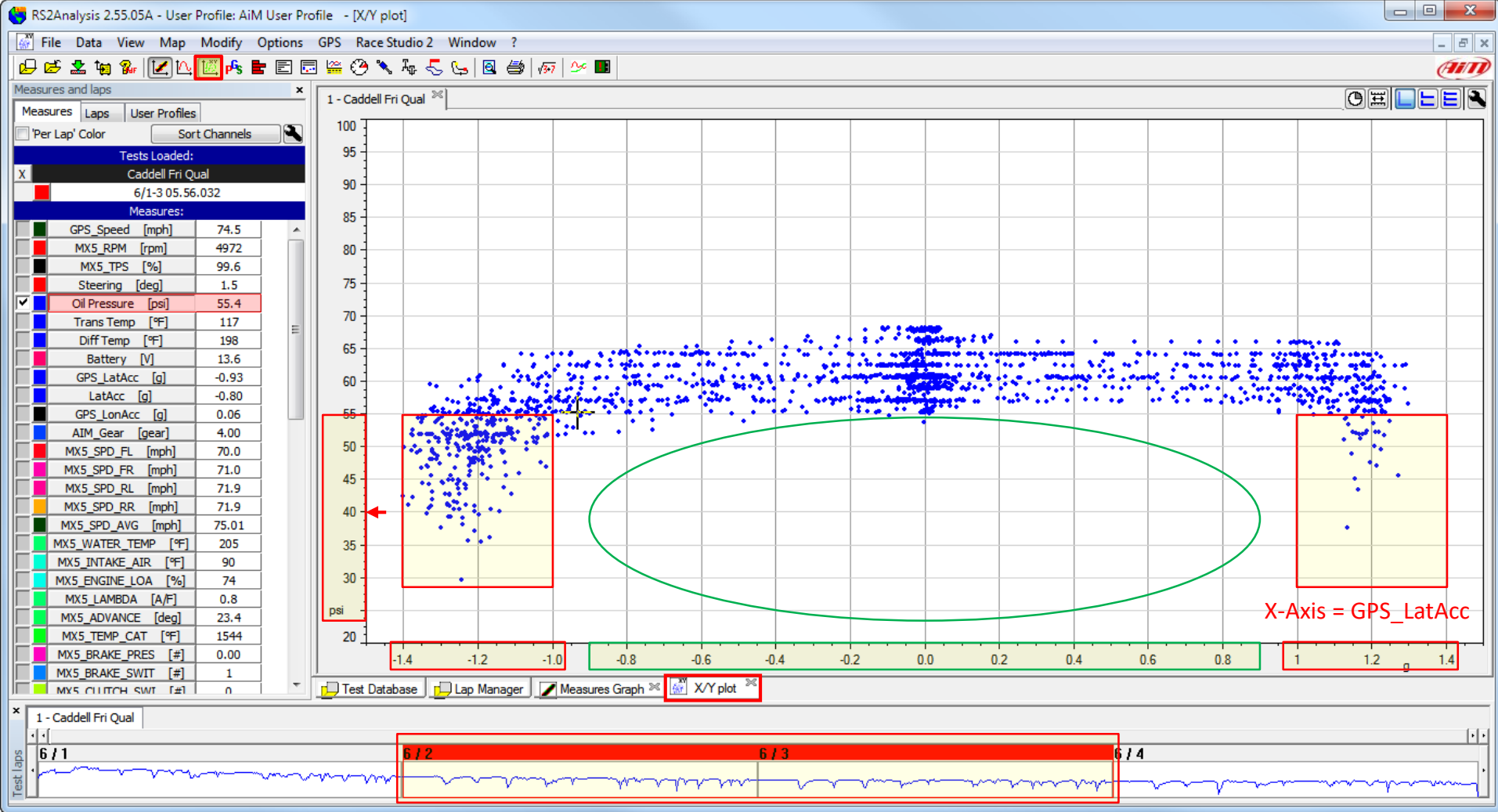
X/Y Graphs Oil Pressure vs. Longitudinal G's. Concerned with anything in the lower left as that shows high negative Long G forces (Braking) and low oil pressures. Wet sump motors will always have some of this effect but this shows no pattern of low oil pressure tendencies in high negative Long G forces.



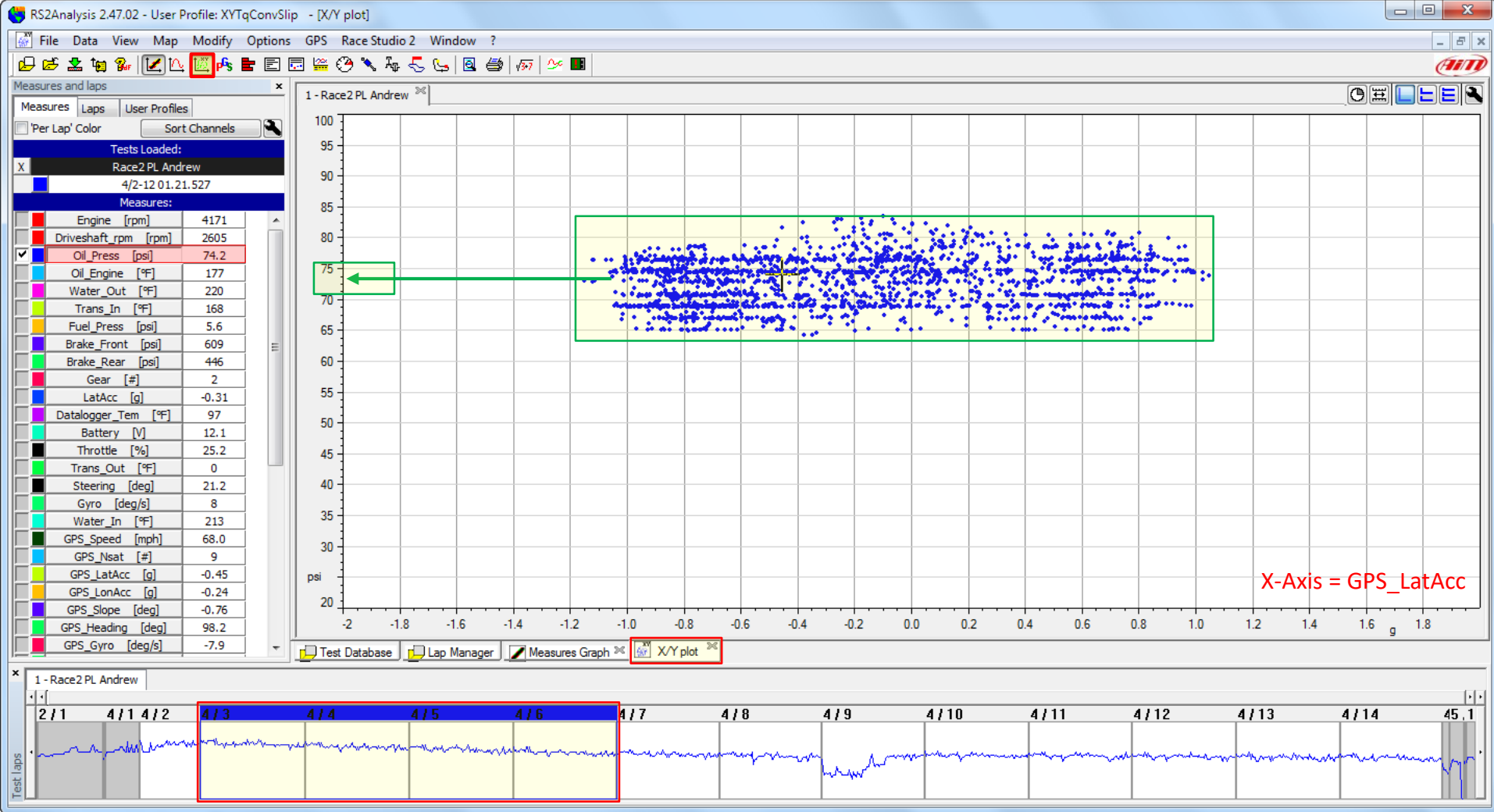
X/Y Graphs Oil Pressure vs. Lateral G's. Concerned with anything in the lower left and right corners as that shows high G forces and low oil pressures. Wet sump motors will always have some of this effect but this shows low oil pressure tendencies in high G left hand corners.



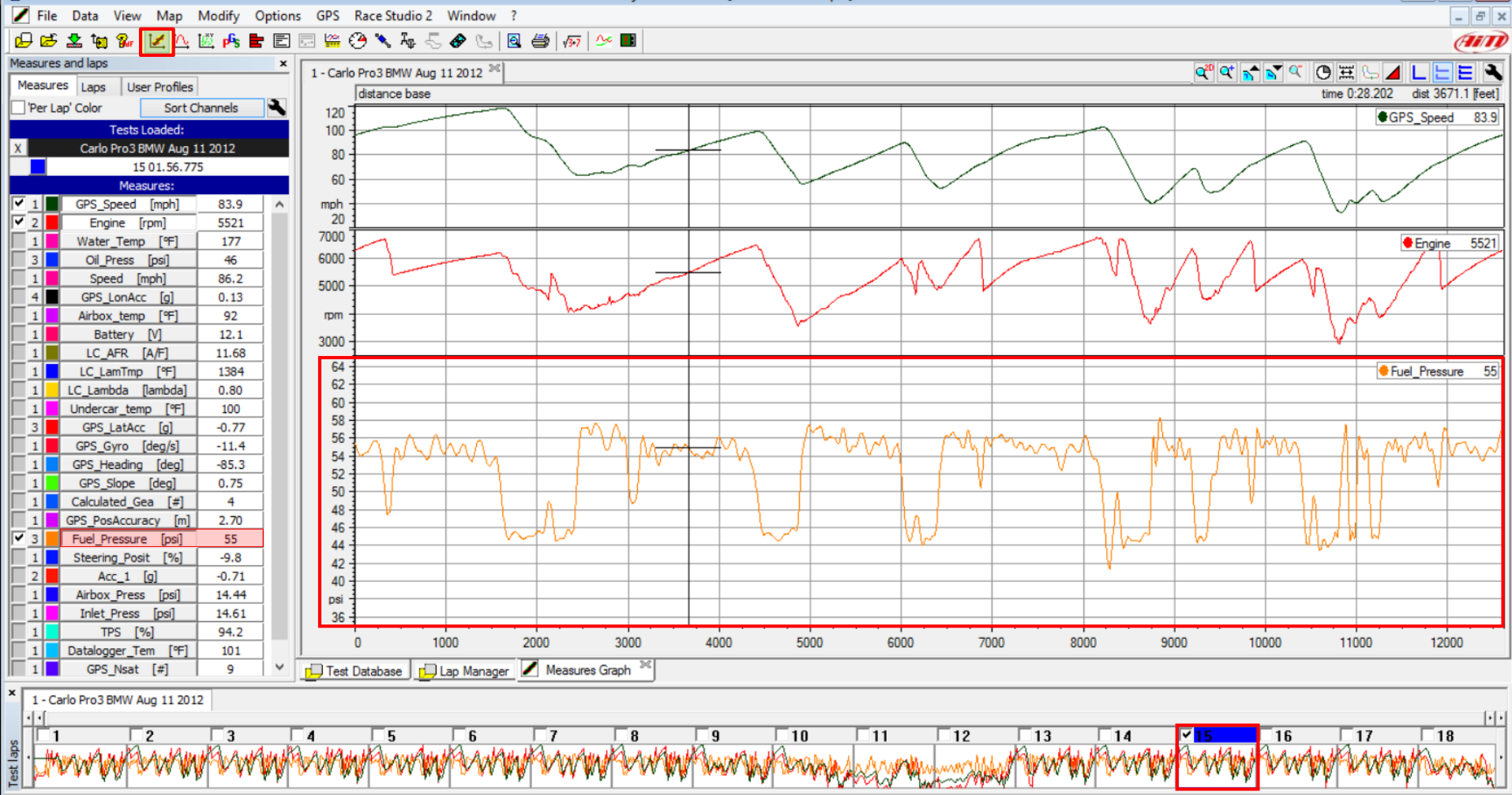
Oil Pressure Issues: This data is also showing Oil Pressure drops. Why is this happening? Let's again look at the data in an X/Y Plot to see the trends.



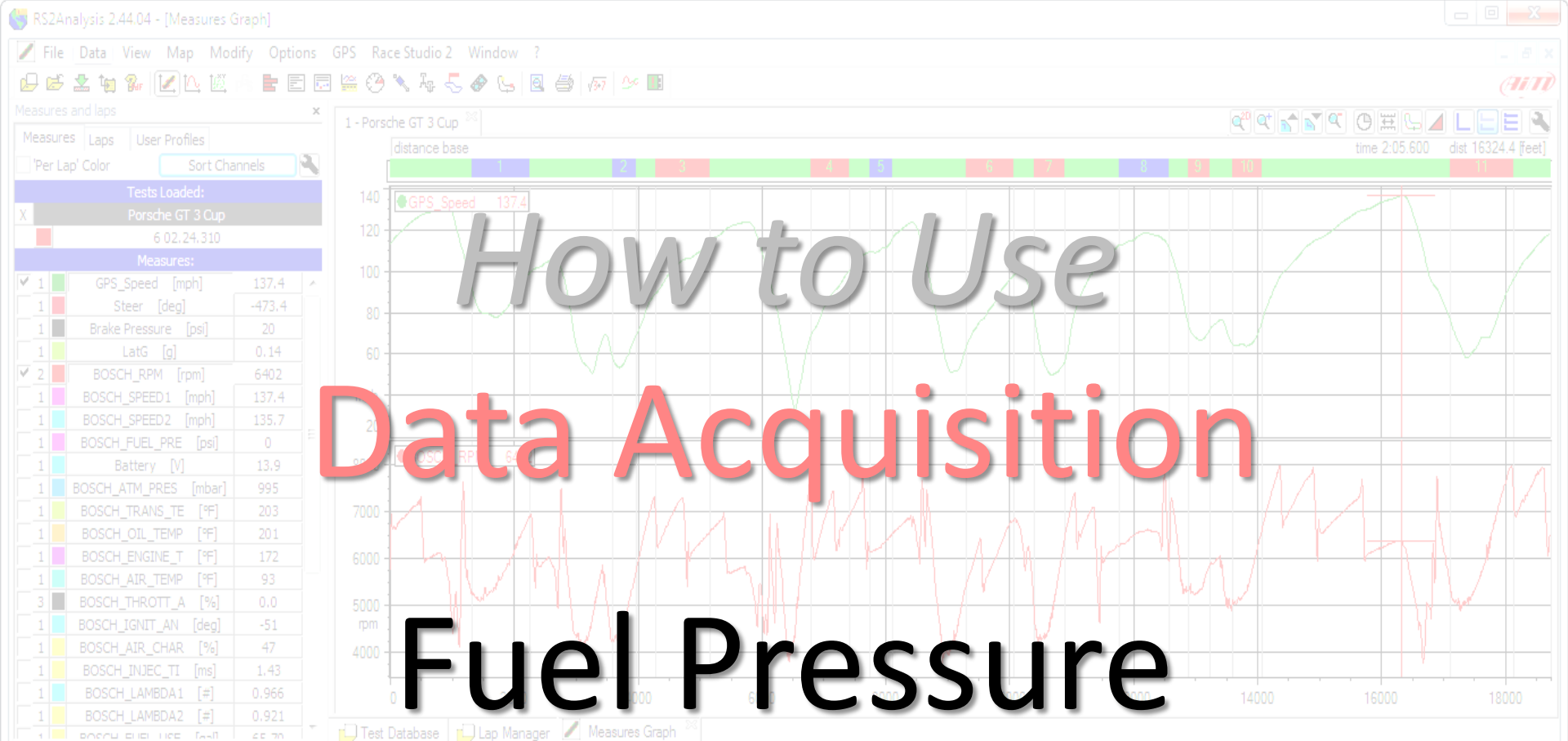
X/Y Graphs Oil Pressure vs. Lateral g's. Concerned with anything in the lower left and right corners as that shows high g forces and low oil pressures. Wet sump motors will always have some of this effect and this shows lower oil pressure tendencies in high g left hand corners.



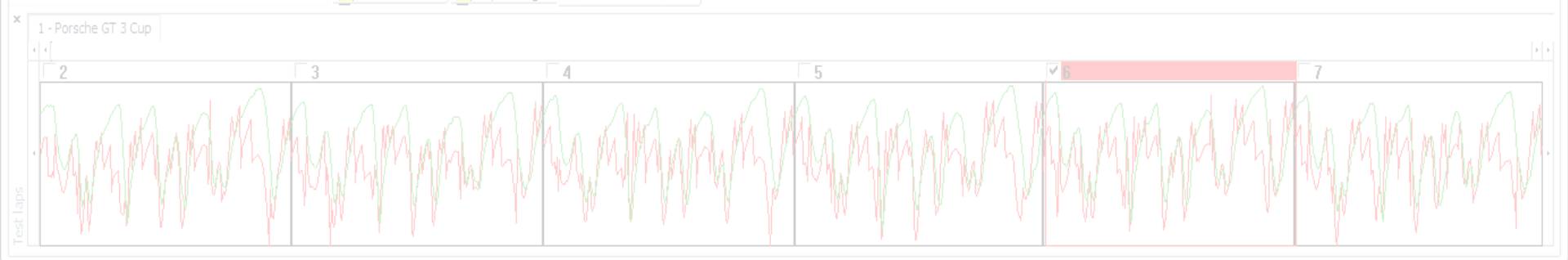
X/Y Graphs Oil Pressure vs. Lateral g's. This is data from a Dry Sump Motor and as you can see there is a big difference.

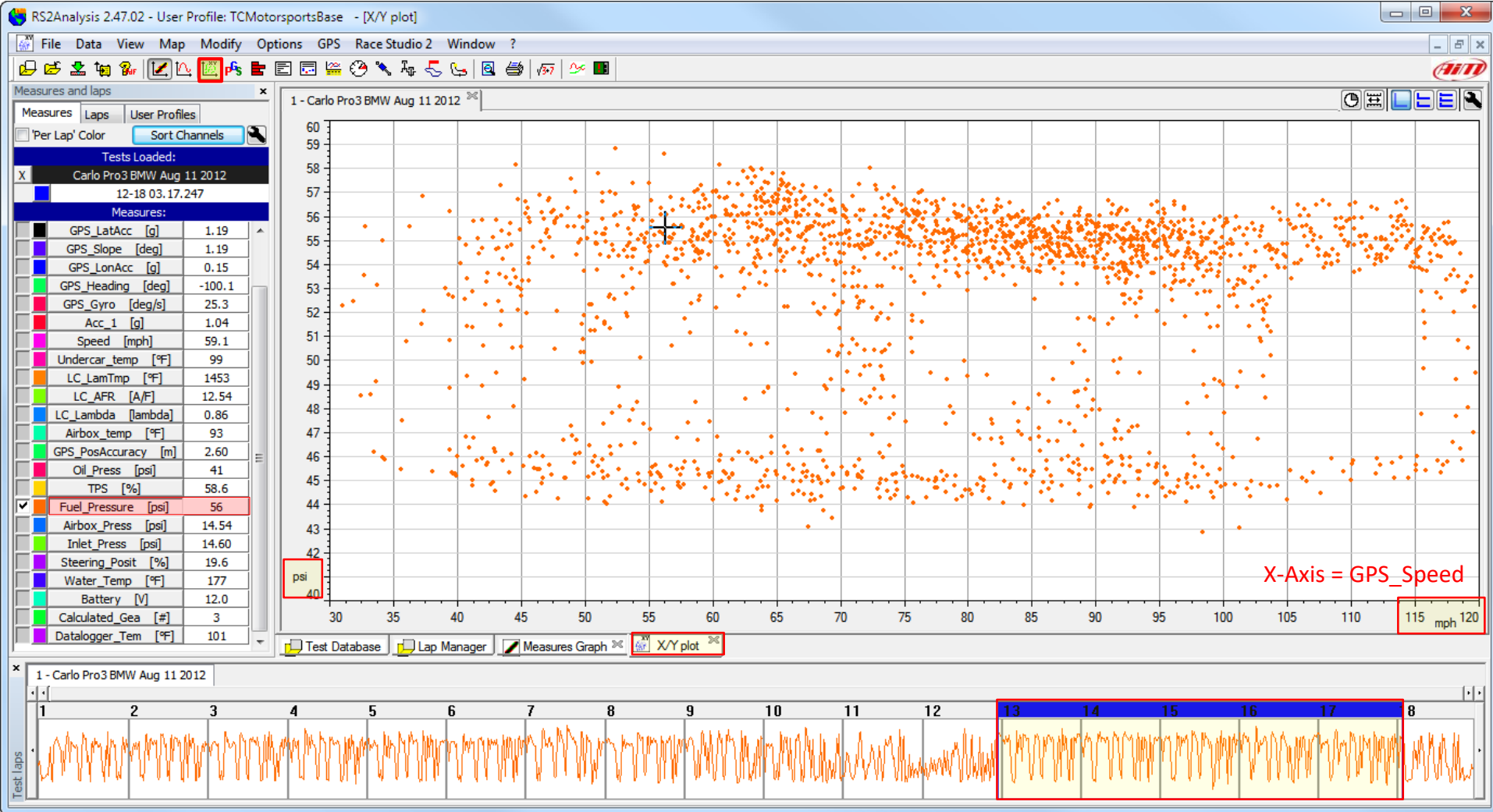


Fuel Pressure Issues This data is showing Fuel pressure with pressure drops. This is a concern but even more important to know is if this is happening during full throttle/high rpm runs. When are these fuel pressure drops happening? We need to look at the data in a different way.

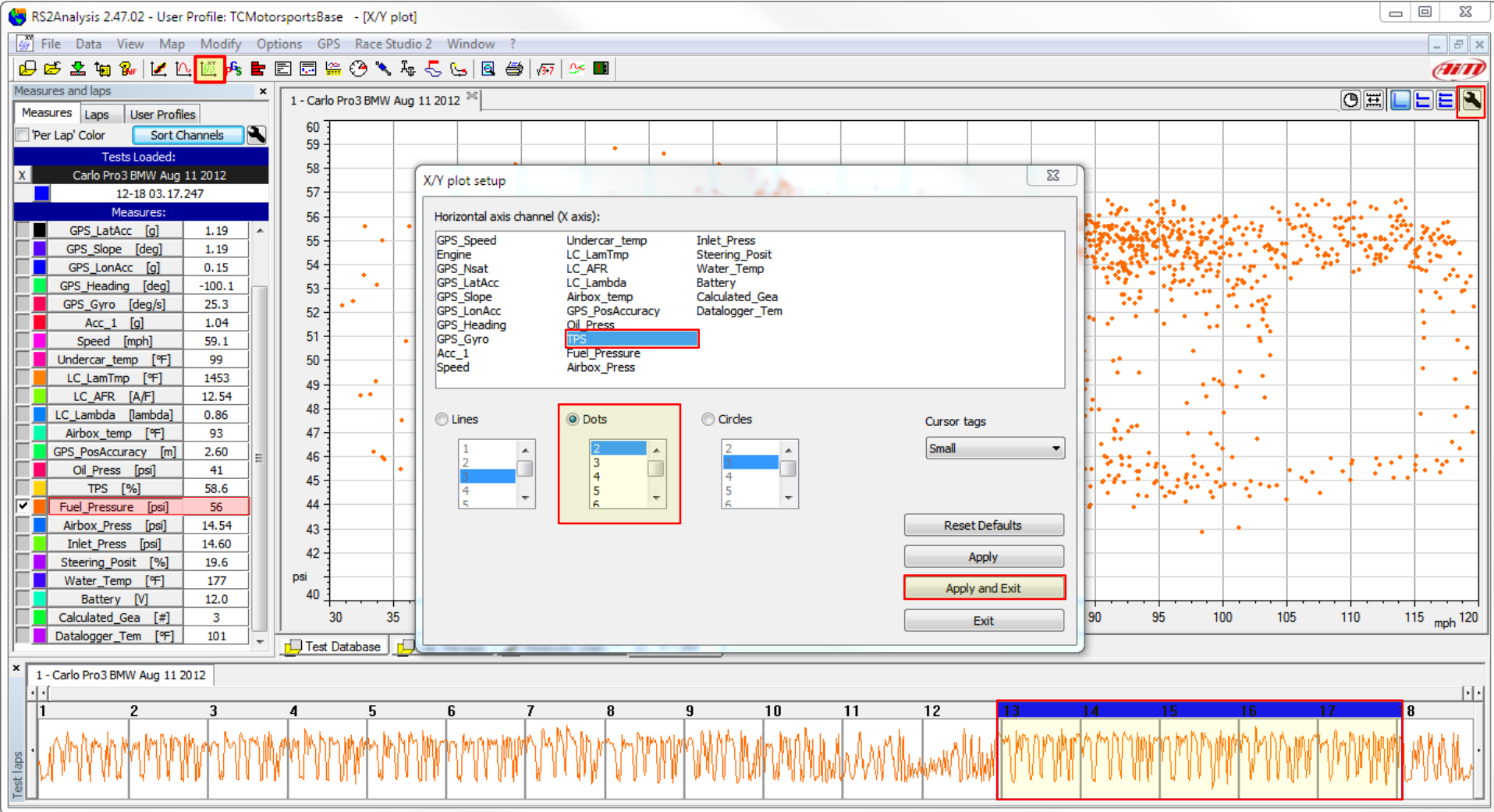


How to Use Data Acquisition Fuel Pressure

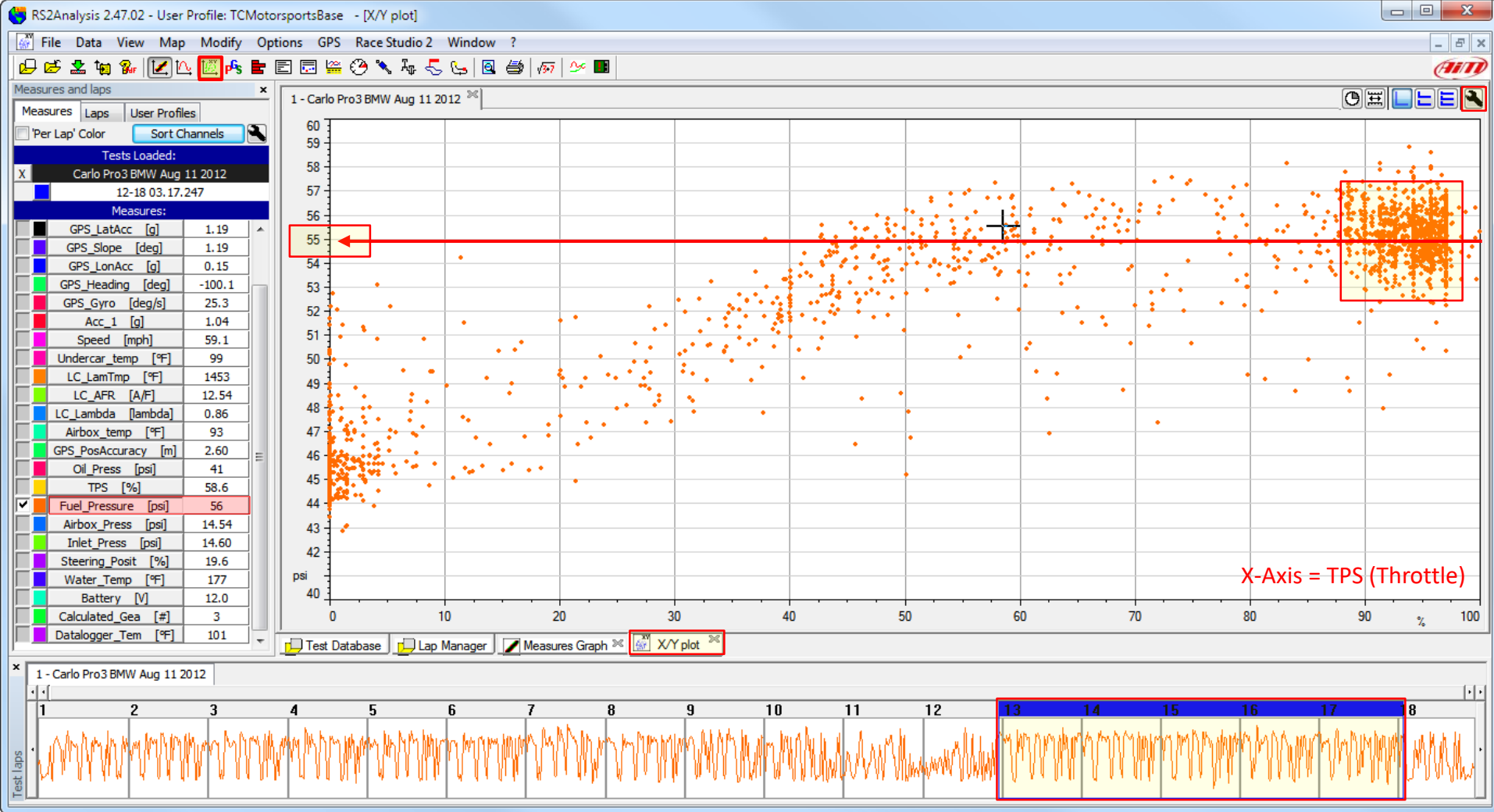




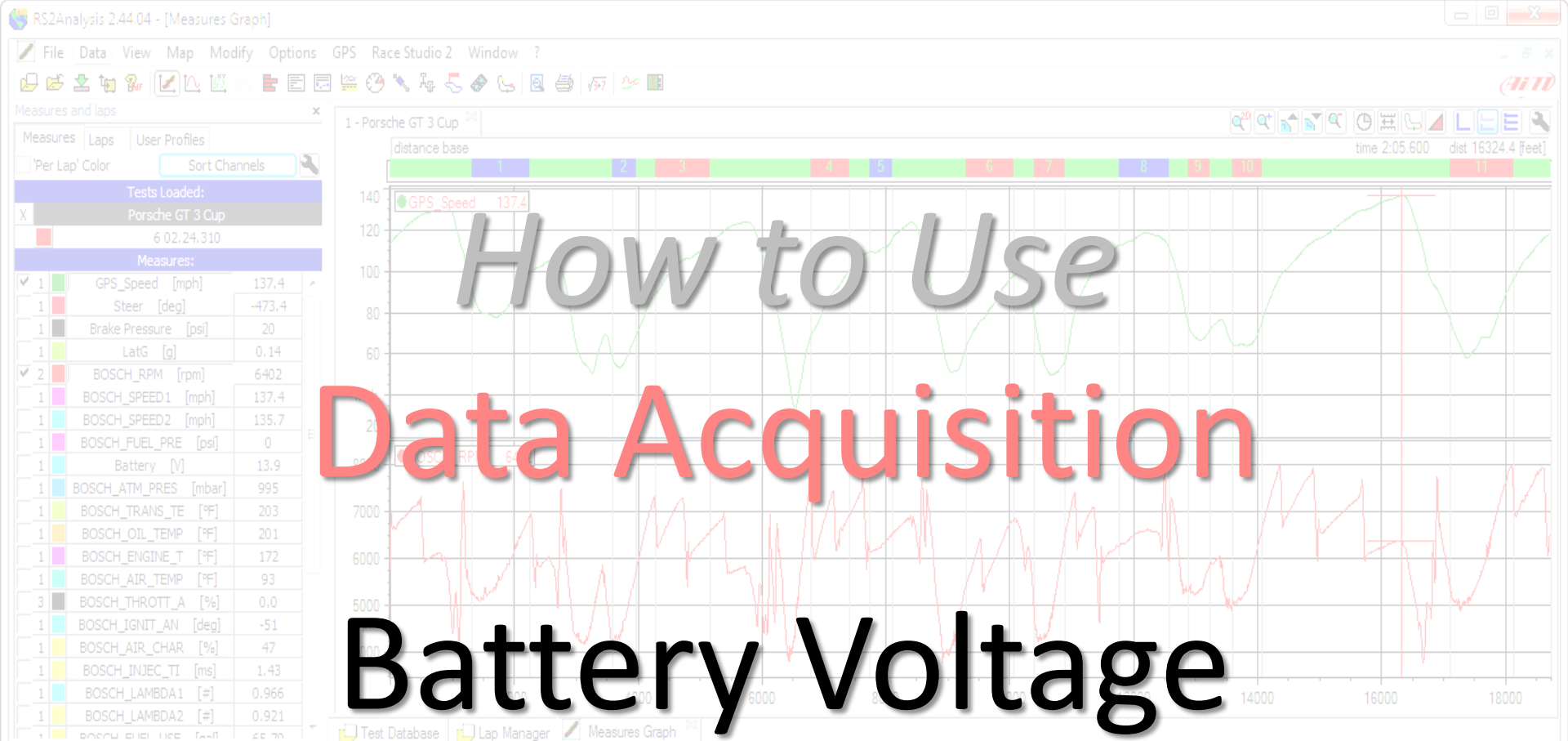
X/Y Graphs In the previous fuel pressure Histogram slide, the shown data did not tell us what we needed to know. Here we start to show fuel pressure vs. throttle position. I started the **X/Y Function** with the Fuel Pressure channel selected and it shows the **PSI** values in the **Y axis**. But we are showing it against **MPH** and we need to change the **X axis** channel.



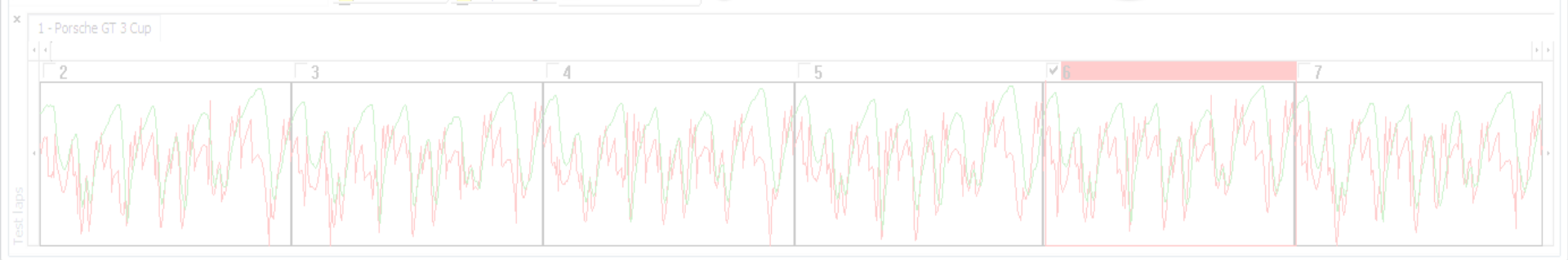
X/Y Graphs First click on the settings icon in the upper right corner to open the **X/Y Plot setup** box. Then select the **X axis channel**, in this case **TPS** or **throttle position**. Here you can also select if you want the output in lines, dots, or circles and the size. Here we have selected dots at a size of 2. Then click on the 'Apply and Exit' button.

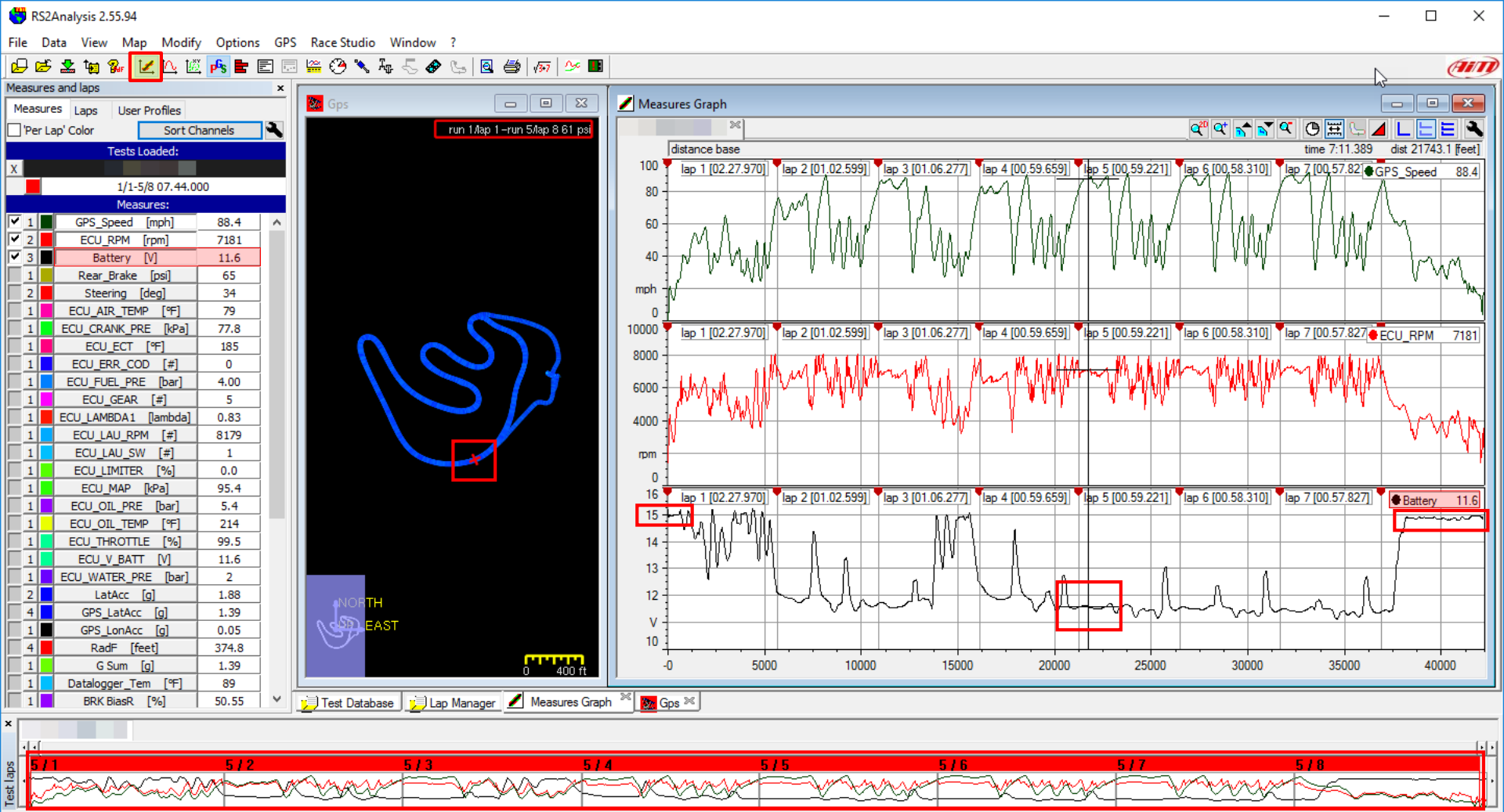


X/Y Graphs Here we now see the data viewed as dots showing what fuel pressures were and what the throttle positions were. I suppose that the most important time of the fuel pressures are when the driver is at full throttle and I have drawn a box around the mass of points at near or full throttle and then drew a line over to the pressure values. Again this is a nice large data sample of 5 laps.

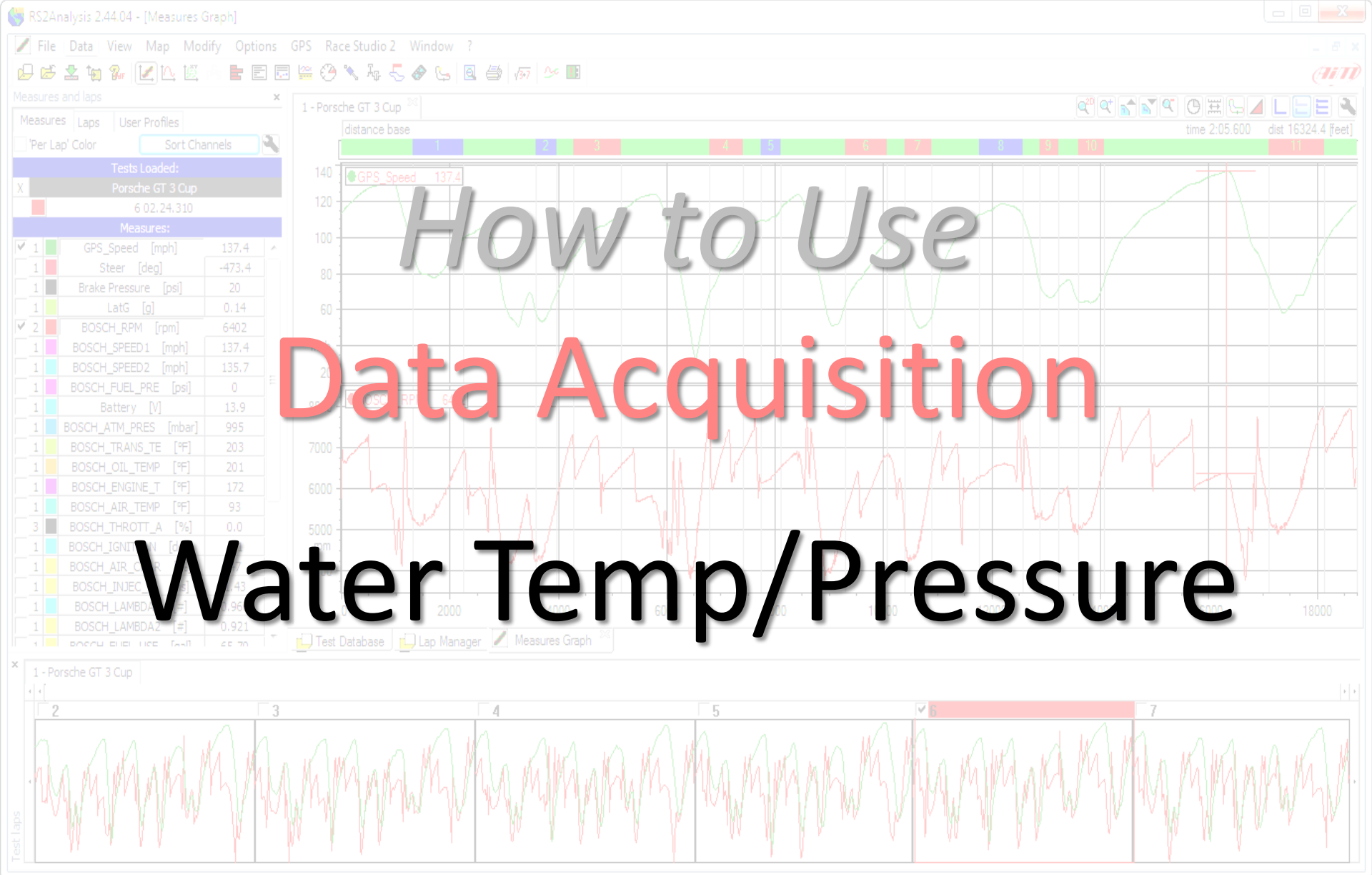


How to Use Data Acquisition Battery Voltage

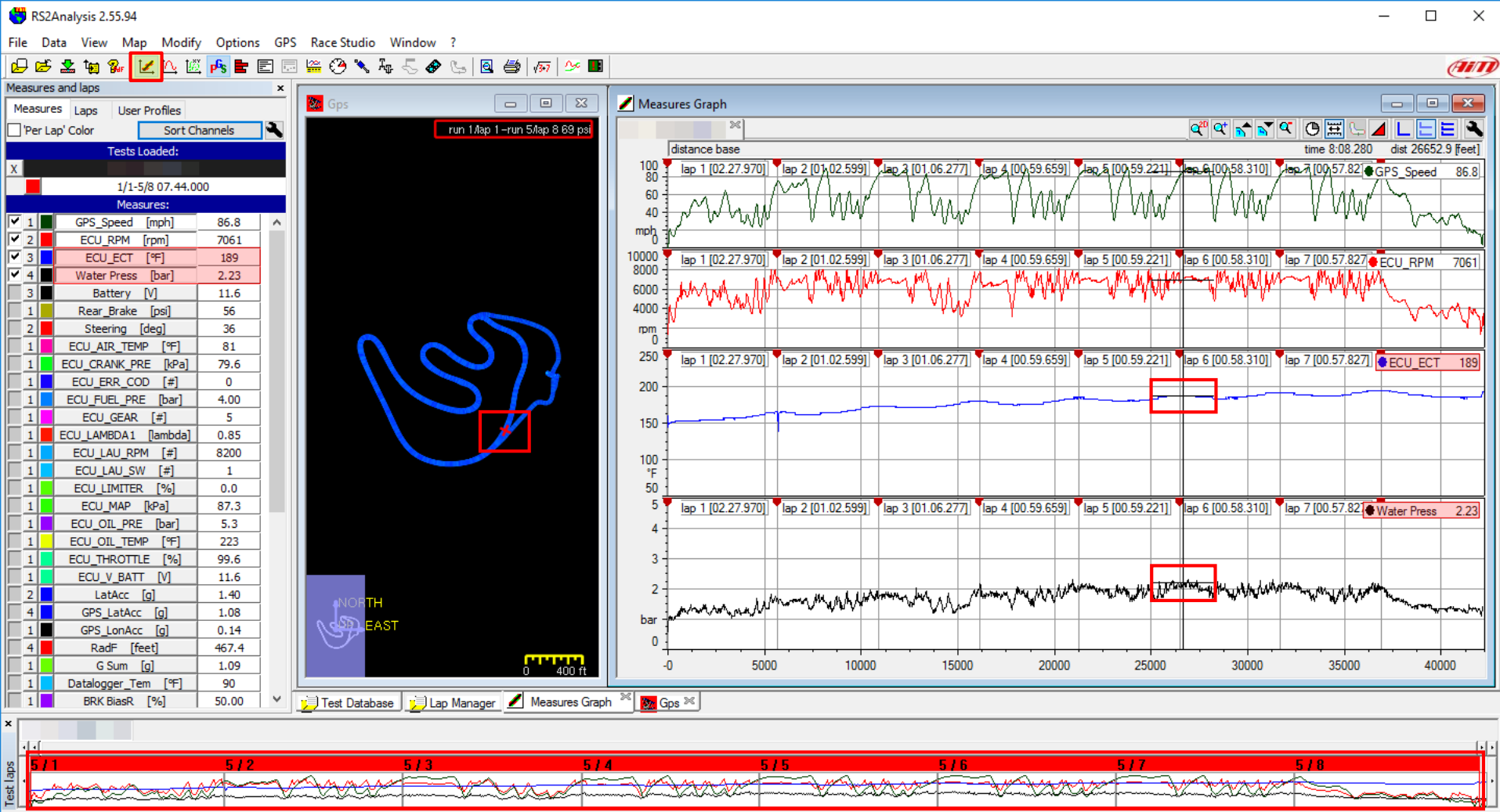




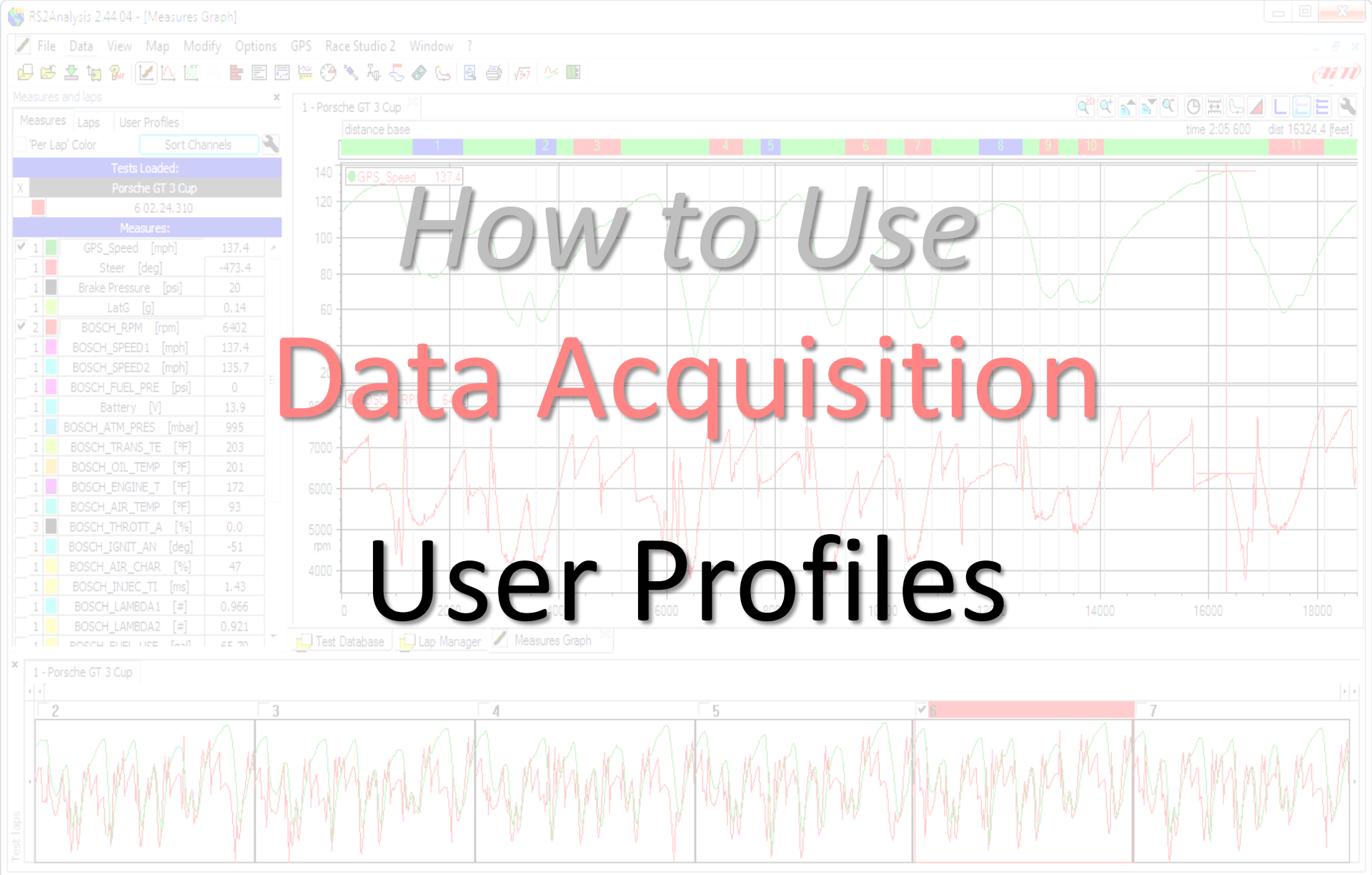
Battery Voltage Here we are looking at a full session of data. Showing the **GPS Speed**, **Engine RPM**, and **Battery Voltage**. Where the cursor is the voltage is 11.6v so it is clear that the alternator is not outputting enough power. However if you look at the early and late part of the session you can see that the battery voltage is approximately 15.0 volts. The alternator was defective but not at all times.



How to Use Data Acquisition Water Temp/Pressure



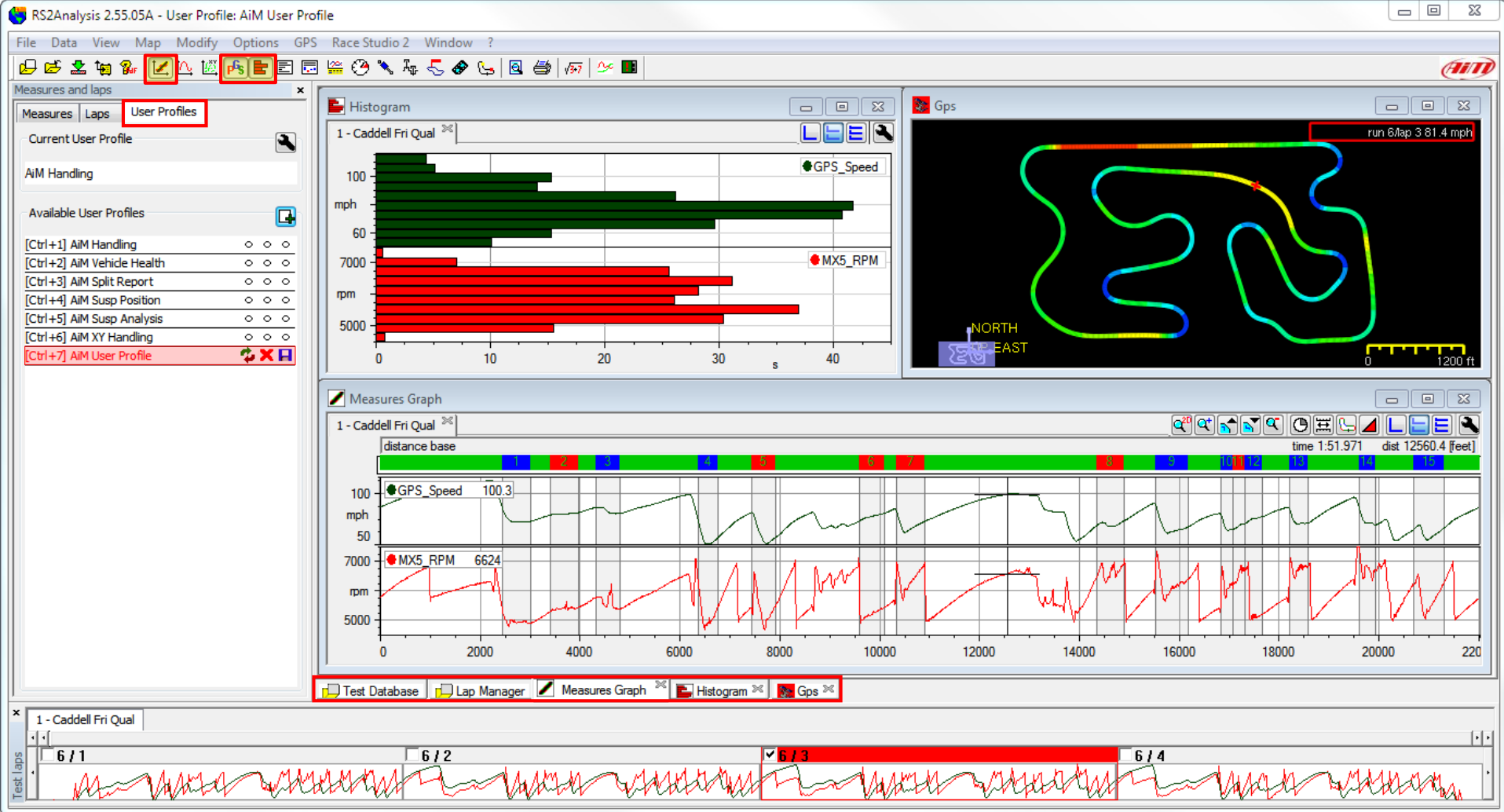
Temperatures Here we are looking at a full session of data. Showing the **GPS Speed**, **Engine RPM**, and **Water Temperature** and **Water Pressure**. Interesting that the **Water Temp** basically does not stabilize during the entire session. Also shown is the **Engine Water Pressure**, this is a very valuable channel to make sure head gaskets and the rest of the cooling system is OK.



How to Use Data Acquisition User Profiles

The screenshot displays the Race Studio 2 interface with several windows open. The 'Measures and laps' window on the left shows 'User Profiles' as the active tab, listing various user profiles with keyboard shortcuts. The 'Histogram' window shows a bar chart for '1 - Caddell Fri Qual' with 'GPS_Speed' (green) and 'MX5_RPM' (red) data series. The 'Gps' window shows a track map with a run time of 6/lap 3 81.4 mph. The 'Measures Graph' window shows a line graph for '1 - Caddell Fri Qual' with 'distance base' (green) and 'MX5_RPM' (red) data series. The 'User Profile' dialog box is centered, with the name 'AiM User Profile' and the 'New user profile with all current settings' option selected. The bottom status bar shows 'Test Database', 'Lap Manager', 'Measures Graph', 'Histogram', and 'Gps' windows.

User Profiles are user defined shortcuts, quick pre-defined ways to look at data with keyboard shortcuts, exportable, and easy to update. Make sure you use the default **"New user profile with all current settings"** choice as you save your **User Profiles**.



Now your new **User Profile** is stored in the list and can be activated in several ways; by the listed shortcut of "Ctrl+7", by clicking on the **User Profile** name and then clicking on the red and green arrows, or by just double clicking on the **User Profile** name. Here you can also delete or save any changes to your **User Profile**.

- 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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