LEARN FAST™

SEMINAR SERIES

BRINGING DATA SUPPORT AND TRAINING TO YOU

PRACTICAL DATA ACQUISITION

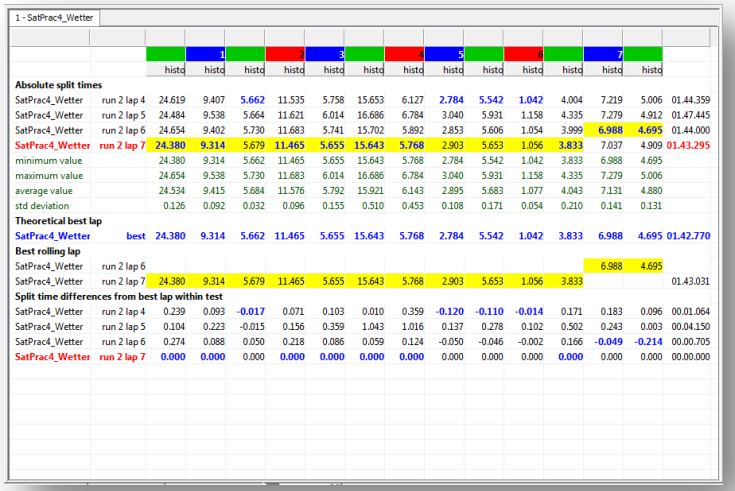
FOR AUTOMOTIVE RACERS & ENTHUSIASTS

PART 2 - DATA ANALYSIS

KRAUSE & ASSOCIATES

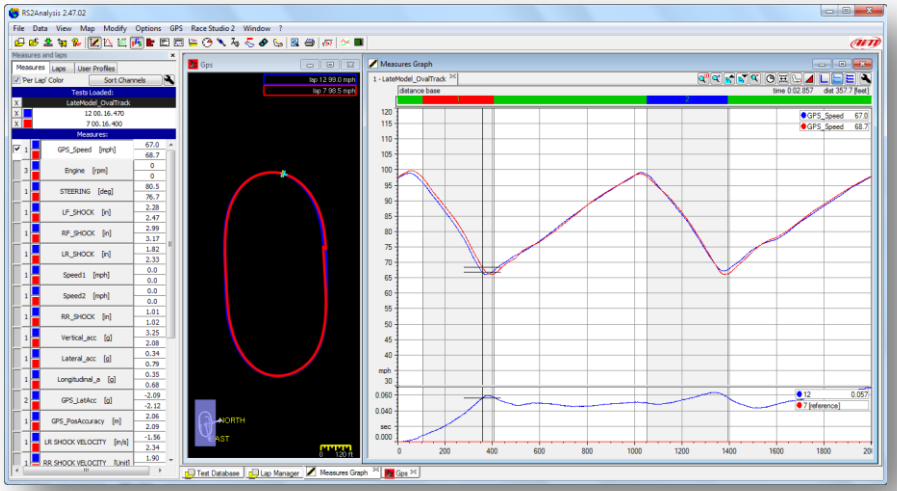
HOW TO USE DATA ACQUISITION

DATA ANALYSIS



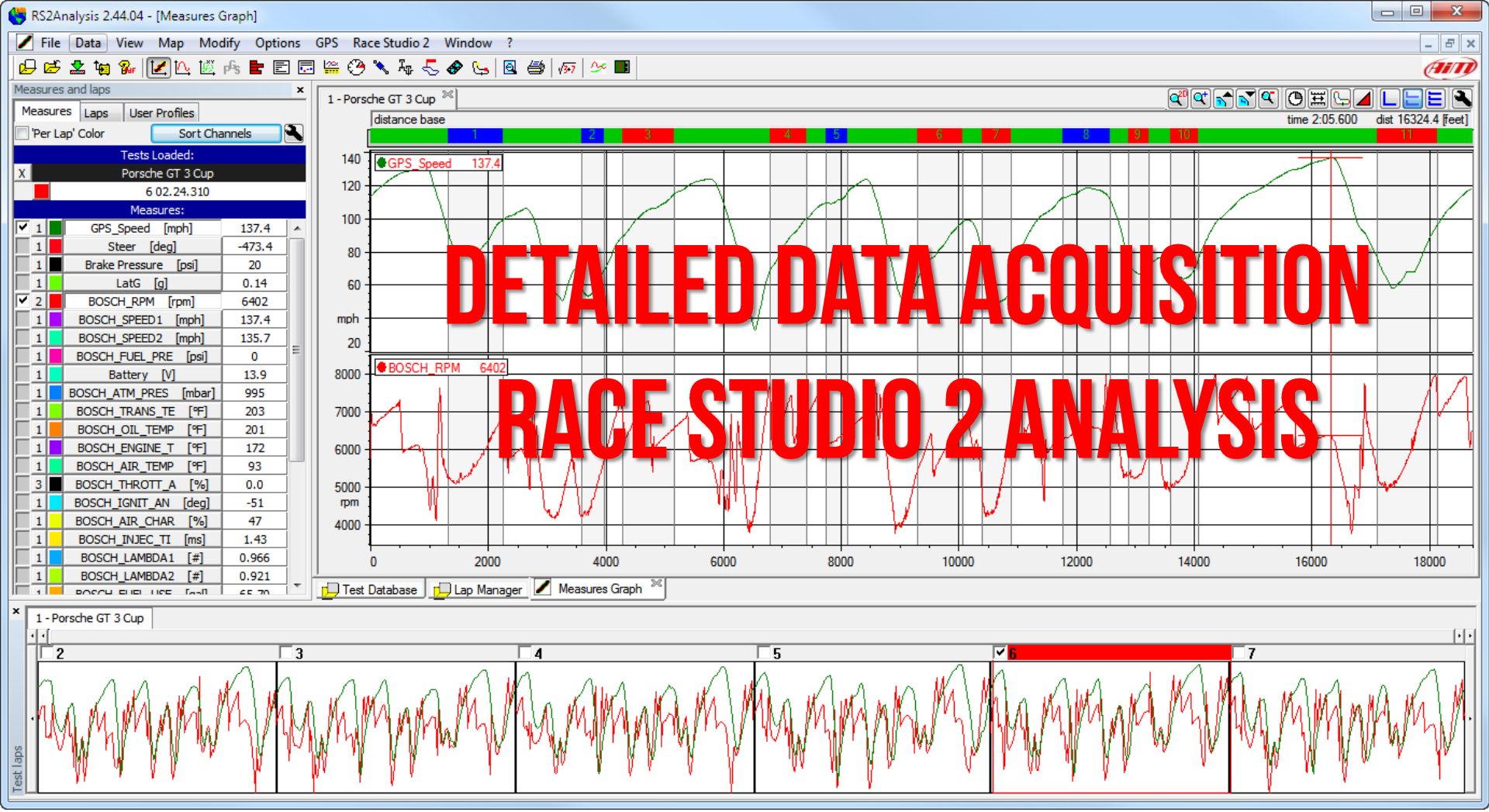
1 - SatPrac4_Wetter

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

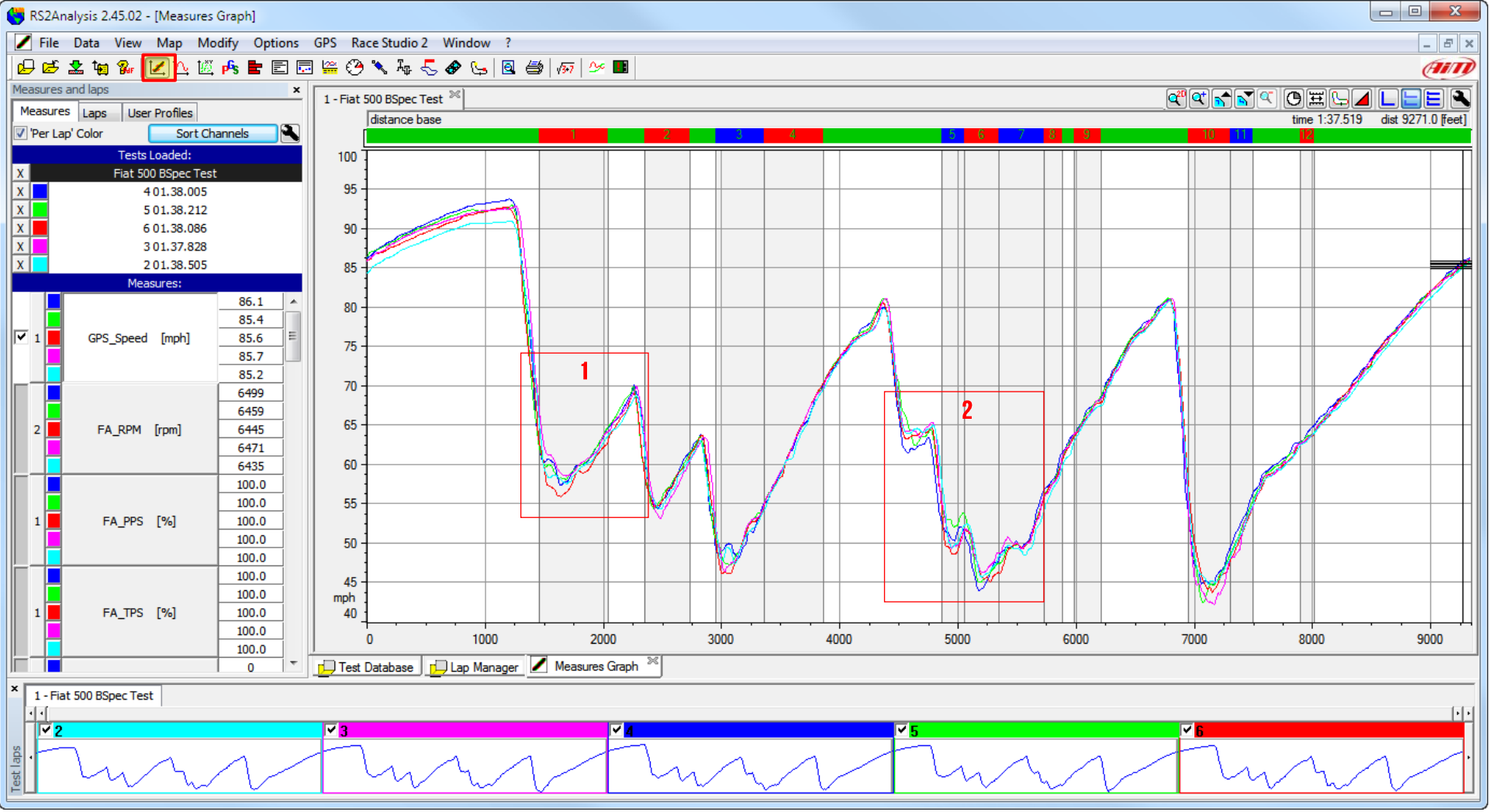


DATA ANALYSIS CONCEPTS

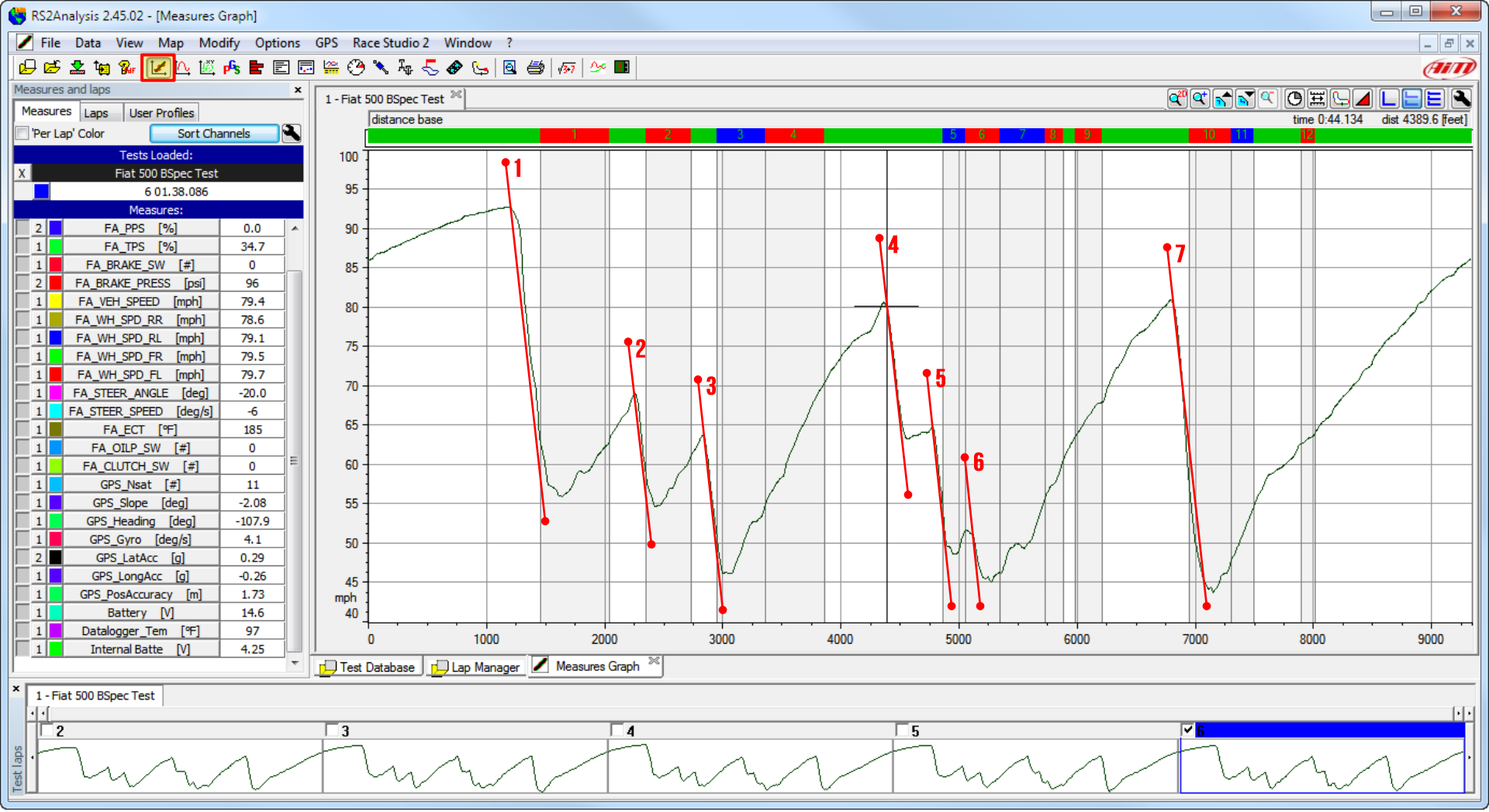
- MONEY CHANNELS
  - *LAP TIMES* AND *SPEED*
  - ALL OTHER CHANNELS SUPPORT THE MONEY CHANNELS
- ANALYZE
  - DETERMINE *WHAT* THE VEHICLE IS DOING *(MANY STOP HERE!)*
  - *WHEN* THE VEHICLE IS DOING IT
  - *WHY* THE VEHICLE IS DOING IT
- ANALYZE DEEPER
  - IS THE DRIVER *REACTING* TO WHAT THE VEHICLE IS DOING
  - OR *CREATING* THE VEHICLES REACTION
  - CRITICAL DIFFERENCE



LET'S LOOK AT SEVERAL DETAILED RACE STUDIO 2 ANALYSIS EXAMPLES.

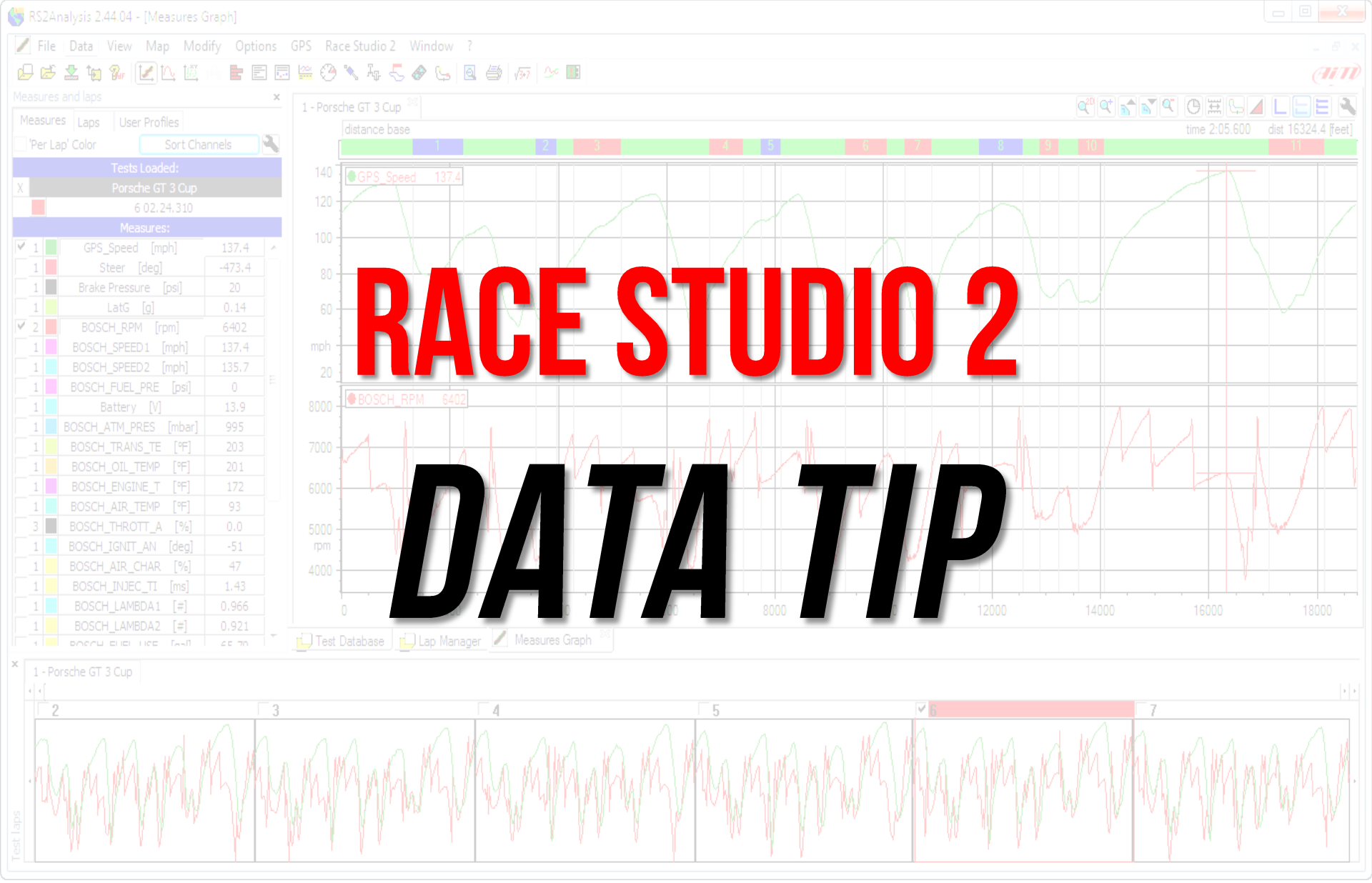


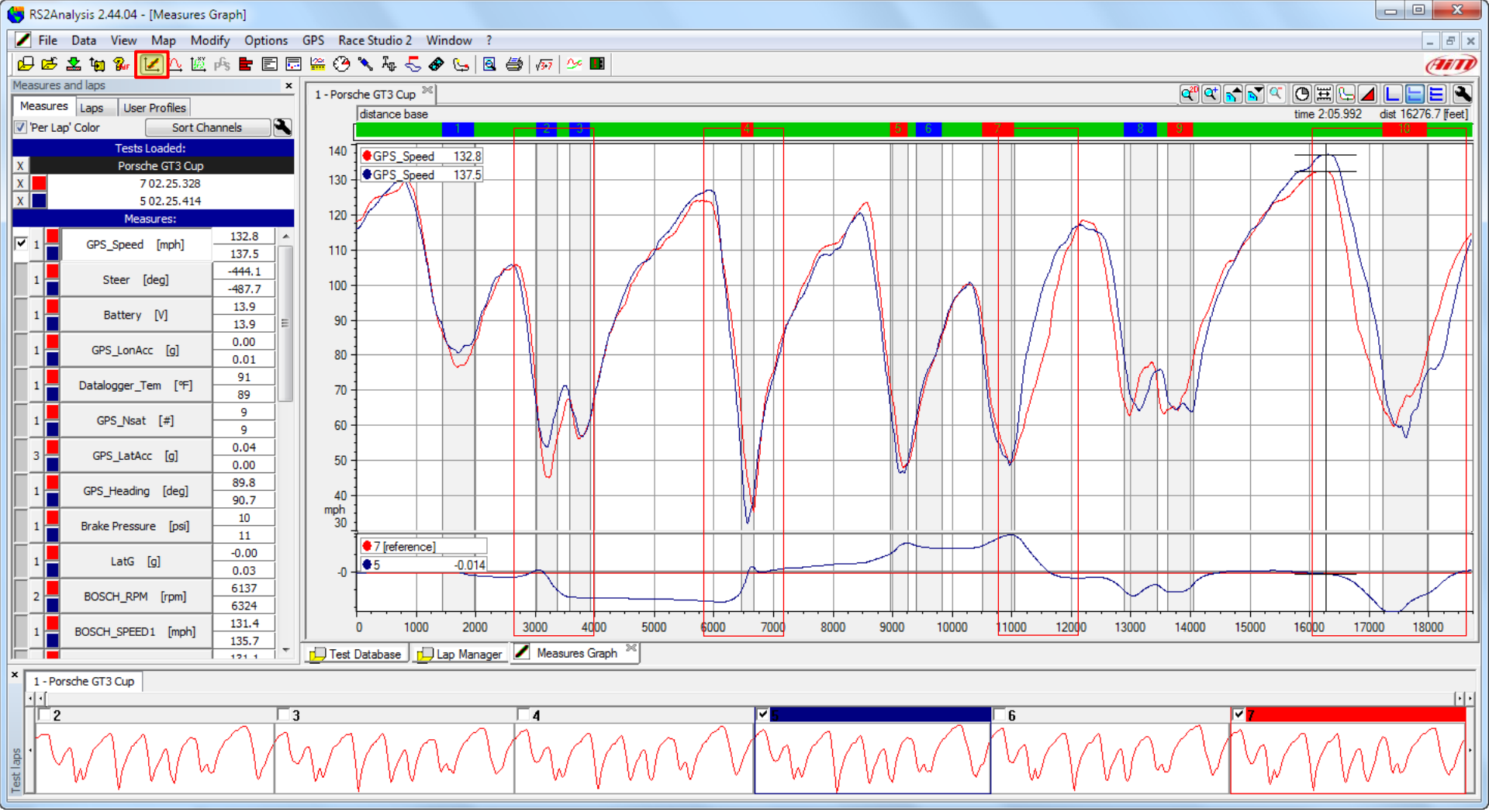
MULTIPLE SPEED TRACES (SOLO DATA) CAN BE USED TO POINT OUT INCONSISTENCY AND POINT TO AREAS FOR IMPROVEMENT. IN THIS SAMPLE, TWO AREAS STAND OUT.
IN AREA #1, THE INCONSISTENCY BEGINS ON CORNER ENTRY AND CLEARLY AFFECTS EXIT SPEED UNTIL THE NEXT BRAKING ZONE.
IN AREA #2, THE INCONSISTENCY IS UNDER THE 1ST BRAKING ZONE AND GETS WORSE AND CONTINUES TO THE LAST EXIT.



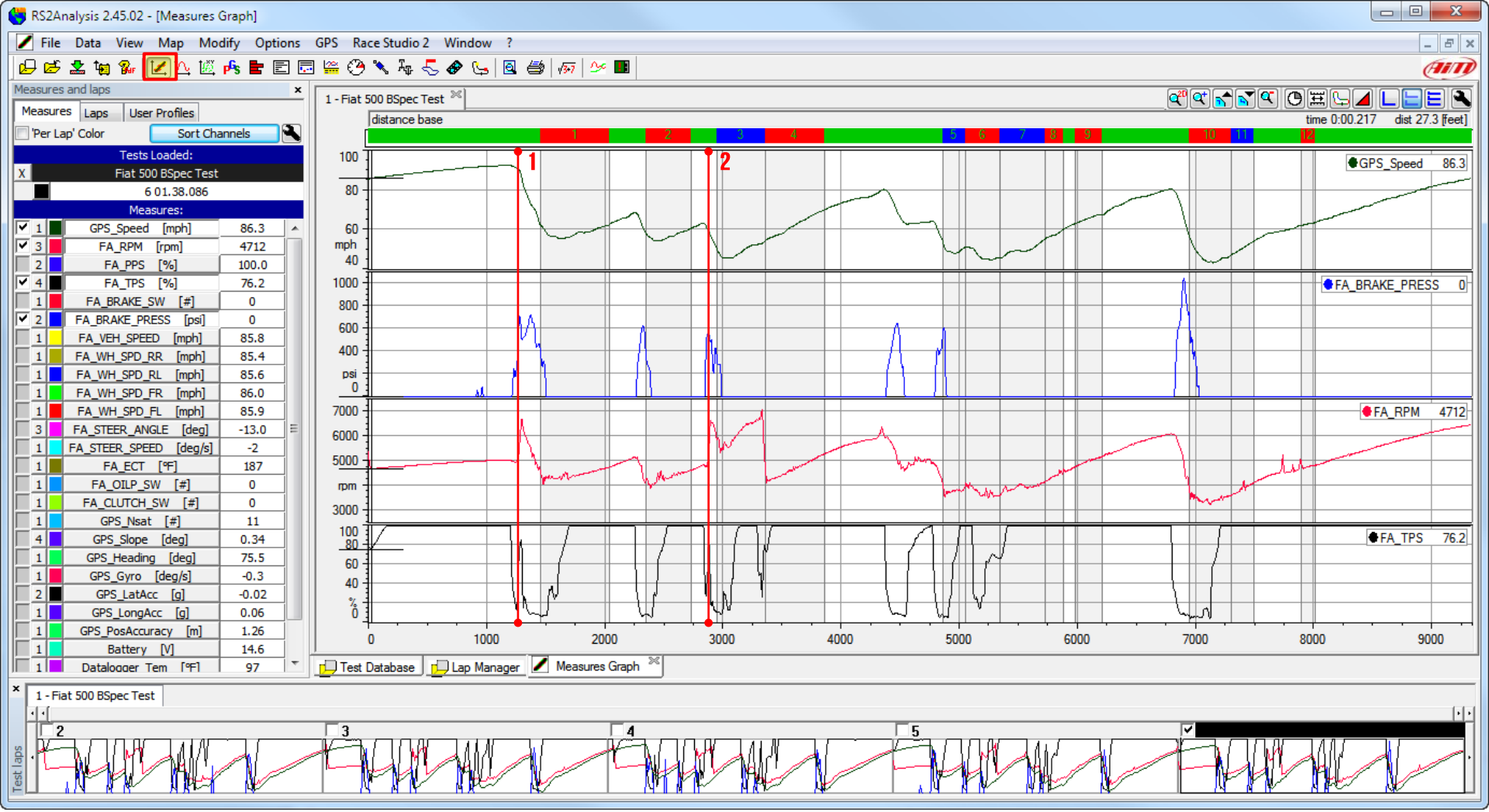
SPEED TRACES CAN BE USED TO POINT OUT AREAS FOR IMPROVEMENT IN BRAKING. IN THIS SAMPLE, LETS LOOK AT EVERY BRAKING ZONE.
IN ZONE #1, SOFT ON THE BRAKES EARLY, THEN SOFT AGAIN AT ABOUT 2/3RDS OF THE BRAKING ZONE. ZONE.
ALL LINES ARE AT THE SAME ANGLE, SOME BRAKING ZONES ARE CONSISTENT BUT THE 2 LONGEST ZONES ARE NOT. (1 AND 7)

IMPROVEMENT IN BRAKING. NOW LETS ADD SOME MORE CHANNELS TO THE "MONEY" CHANNEL OF SPEED. BY ADDING BRAKE PRESSURE, STEERING, AND GPS_SLOPE, WE HAVE MORE INFO. #1 THE ENTRY LOOKS FLAT AND THERE IS LOW TRAIL BRAKING. #2 THE TRACK IS FALLING OFF AND THERE IS TRAIL BRAKING, THE DECELERATION SLOPE IS WHAT WE SHOULD EXPECT. #3 MORE BRAKE PRESSURE WAS ADDED ABOUT HALFWAY INTO THE ZONE AND THE DECELERATION INCREASED AND TRAIL BRAKING AT THE END. #4 HEAVY TRAIL BRAKING


RACE STUDIO 2
DATA TIP



THE TIME COMPARE FUNCTION IS A TOOL THAT MAKES IT EASY TO COMPARE LAPS AND PINPOINT AREAS WHERE ONE LAP IS FASTER THAN ANOTHER. THE FASTEST LAP IS THE REFERENCE LINE AND THE SLOWER LAP IS COMPARED AGAINST IT. IN THIS CASE THE RED LAP WAS THE FASTEST OF THE 2 ACTIVE LAPS. WHERE THE BLUE LINE IS BELOW THE RED LINE, THE BLUE LAP WAS ACTUALLY FASTER THAN THE RED LAP. AREAS OF QUICK CHANGES ARE AREAS YOU SHOULD FOCUS ON.



HERE, YOU CAN EASILY SEE THE CONNECTION BETWEEN THE THROTTLE POSITION AND BRAKE PRESSURE. IN SAMPLE #1, THE DRIVER BLIPS THE THROTTLE AND HAS A RELEASE OF BRAKE PRESSURE. THIS RESULTS IN A REDUCTION OF DECELERATION. IN SAMPLE #2, THE DOES WELL ON THE BLIP OF THE THROTTLE. BUT THEN REDUCES THE BRAKE PRESSURE AND THE DECELERATION DOES NOT DECREASE. THE VEHICLE WAS SLOWING DOWN MORE ON BASED ON ENGINE BRAKING AND NOT NORMAL BRAKING. NOT GOOD FOR MAXIMUM GRIP AND ALSO HARD ON PARTS.

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DRIVER IMPROVEMENT

BRAKE PRESSURE

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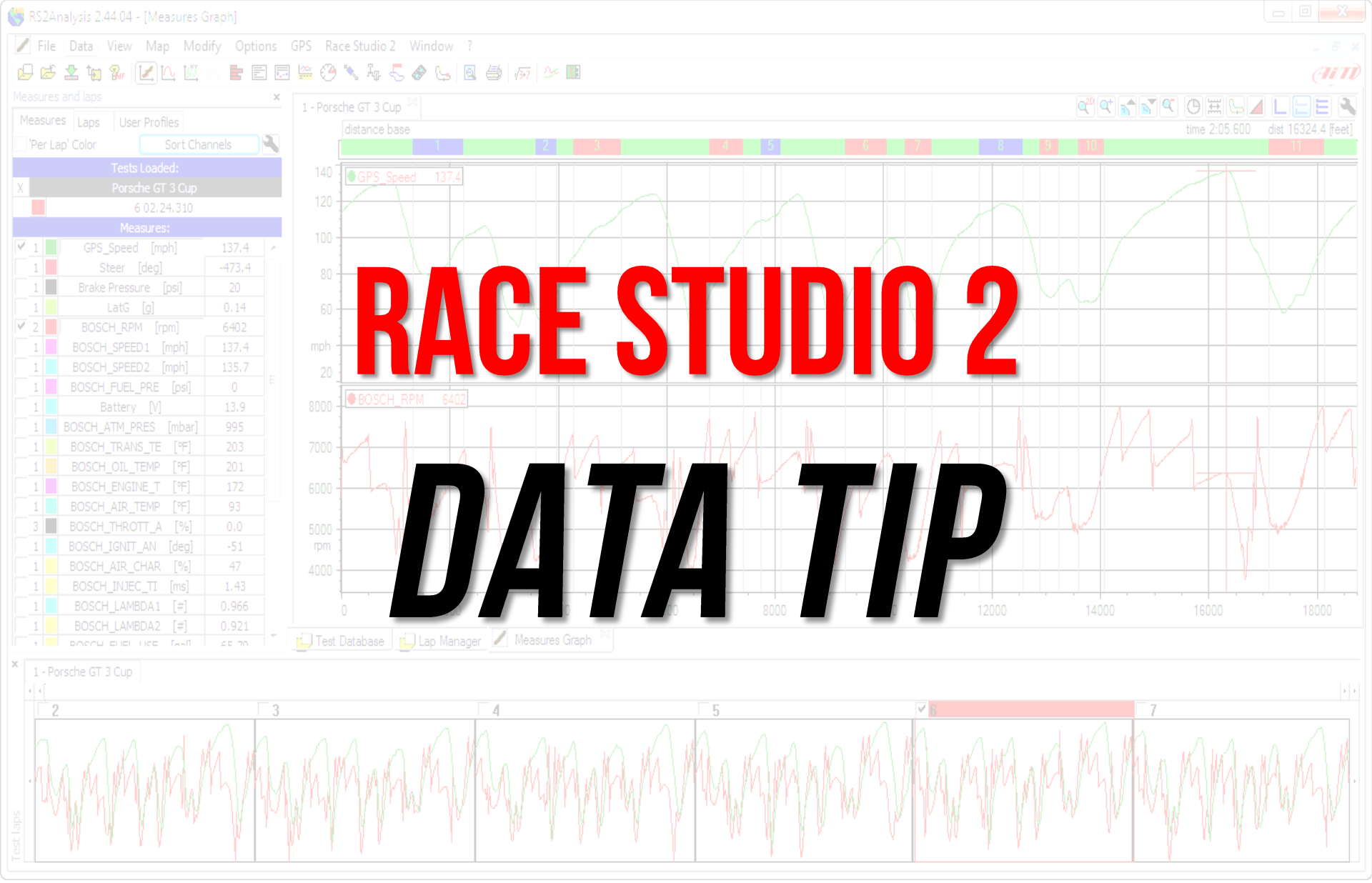

RACE STUDIO 2

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DATA TIP

DELTA FUNCTION

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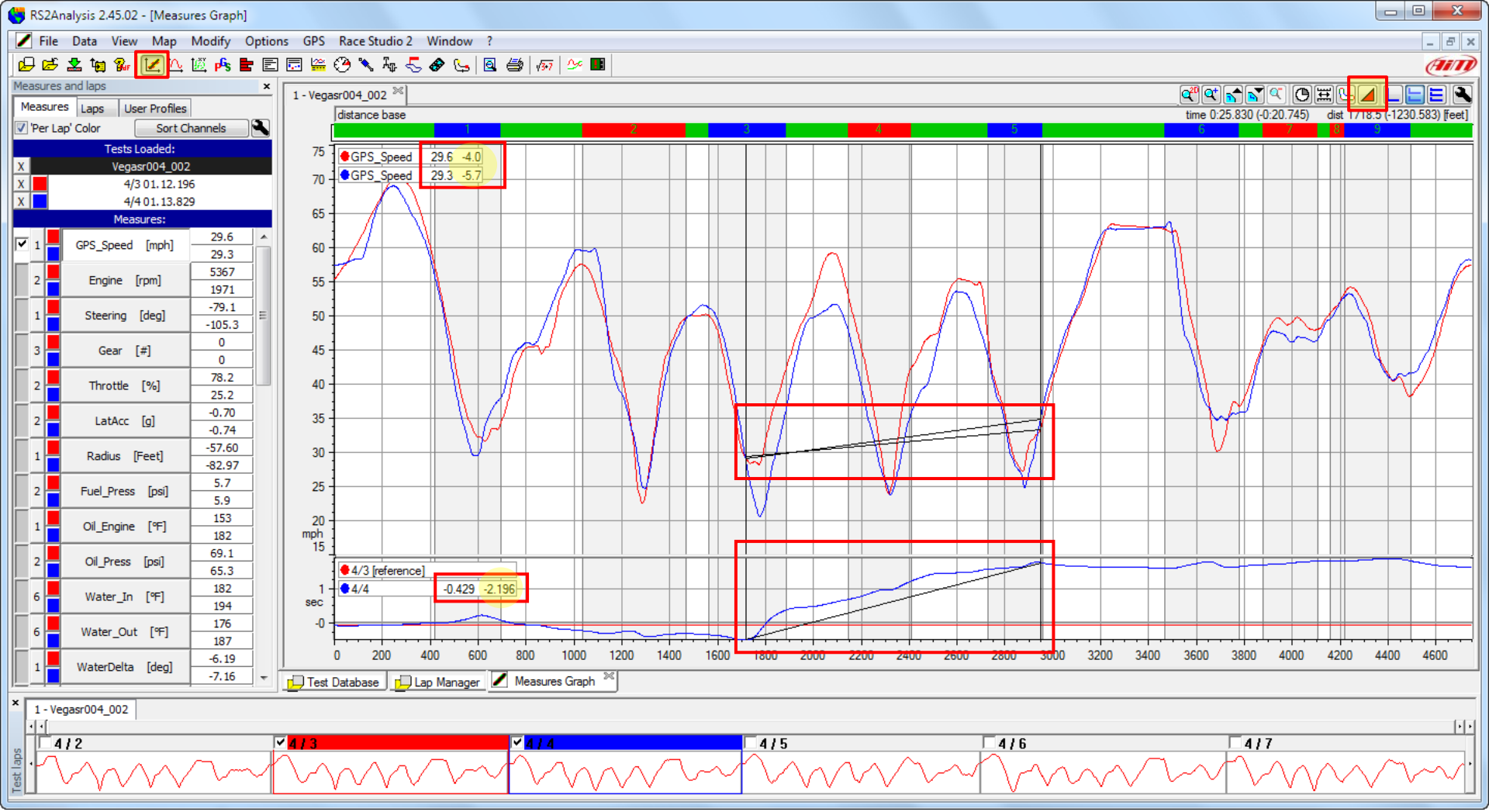
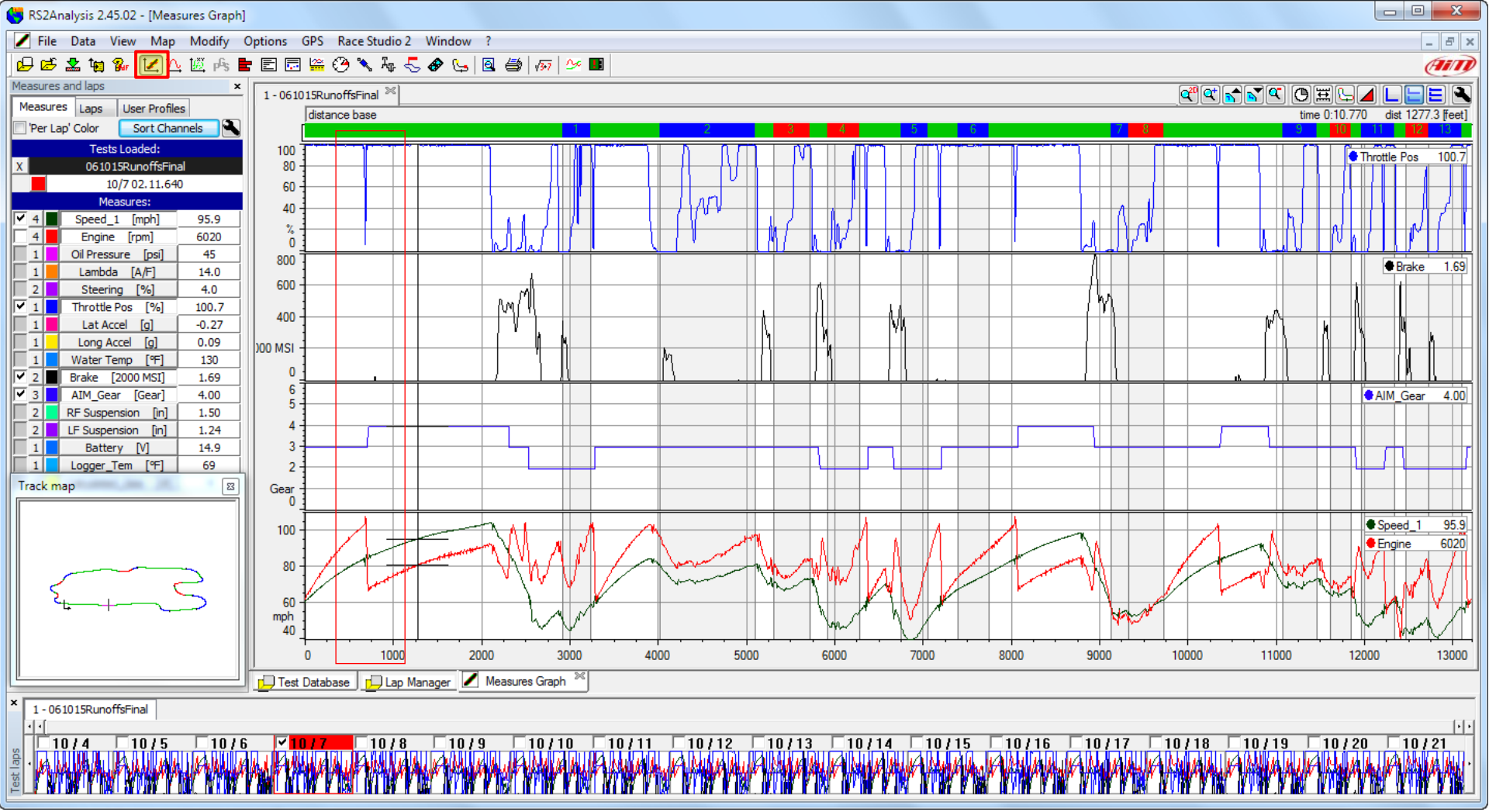


THE DELTA FUNCTION MAKE MEASURES DIFFERENCES VERY EASY. AFTER SELECTING A STARTING AND ENDING POINTS, EACH ENDING POINT VALUE IS REPORTED ALONG WITH THE DIFFERENCE BETWEEN THE 2 POINTS.



EXAMPLE OF THROTTLE POSITION RELEASE DURING A SHIFT. USE THIS TO DETERMINE THE SPEED OF THE SHIFT. LETS ZOOM IN TO MEASURE IT.

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DRIVER IMPROVEMENT

SHIFT SPEED

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EXAMPLE OF TPS RELEASE DURING A SHIFT. USE THIS TO DETERMINE THE SPEED OF THE SHIFT. USING THE DELTA FUNCTION, WE SEE THAT THE SHIFT WAS FULLY COMPLETED IN 0.216 SECS.

DRIVER IMPROVEMENT

SHIFT SPEED - ZOOMED IN

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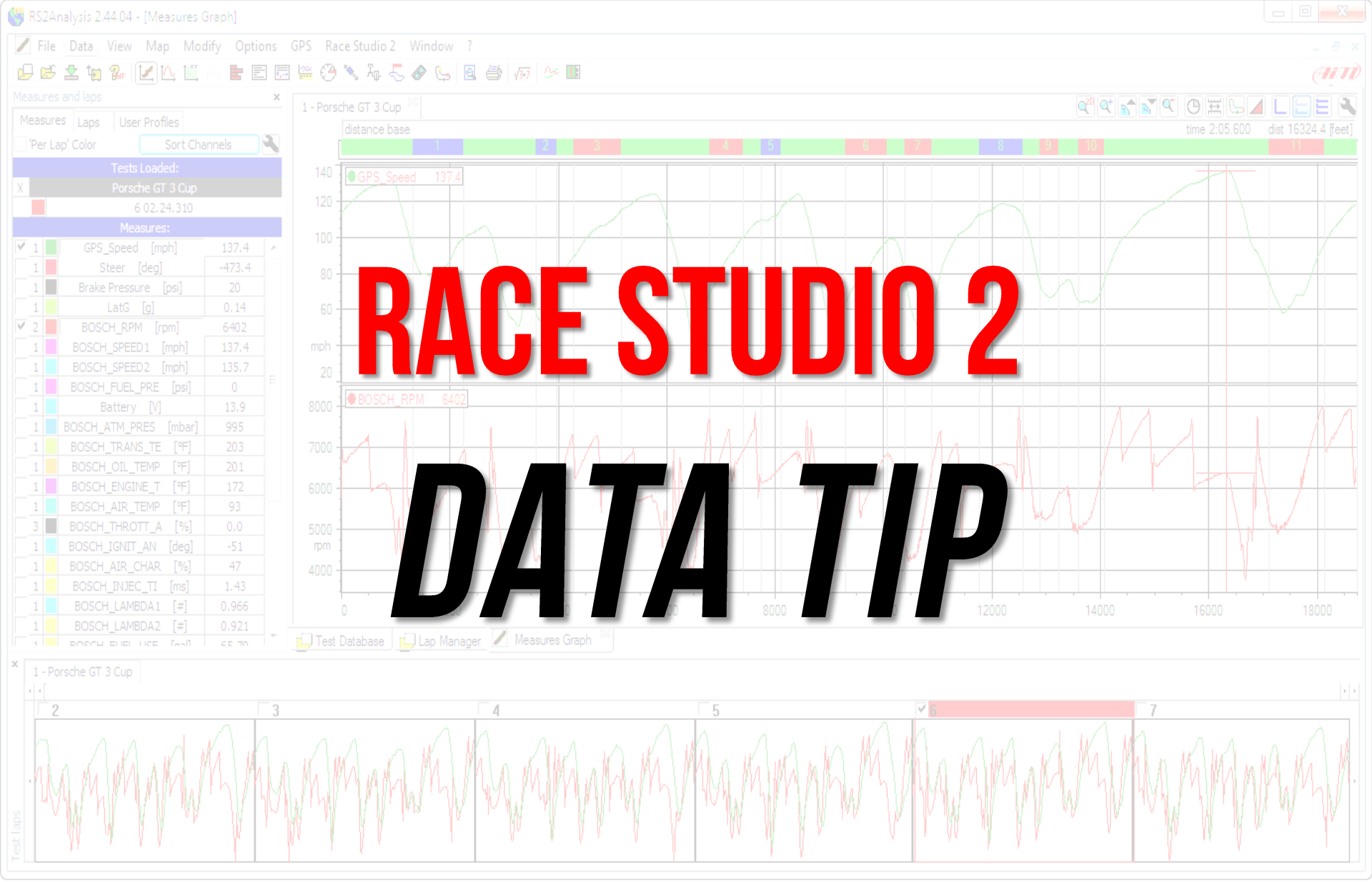

RACE STUDIO 2

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DATA TIP

PER LAP COLOR AND SORT CHANNELS

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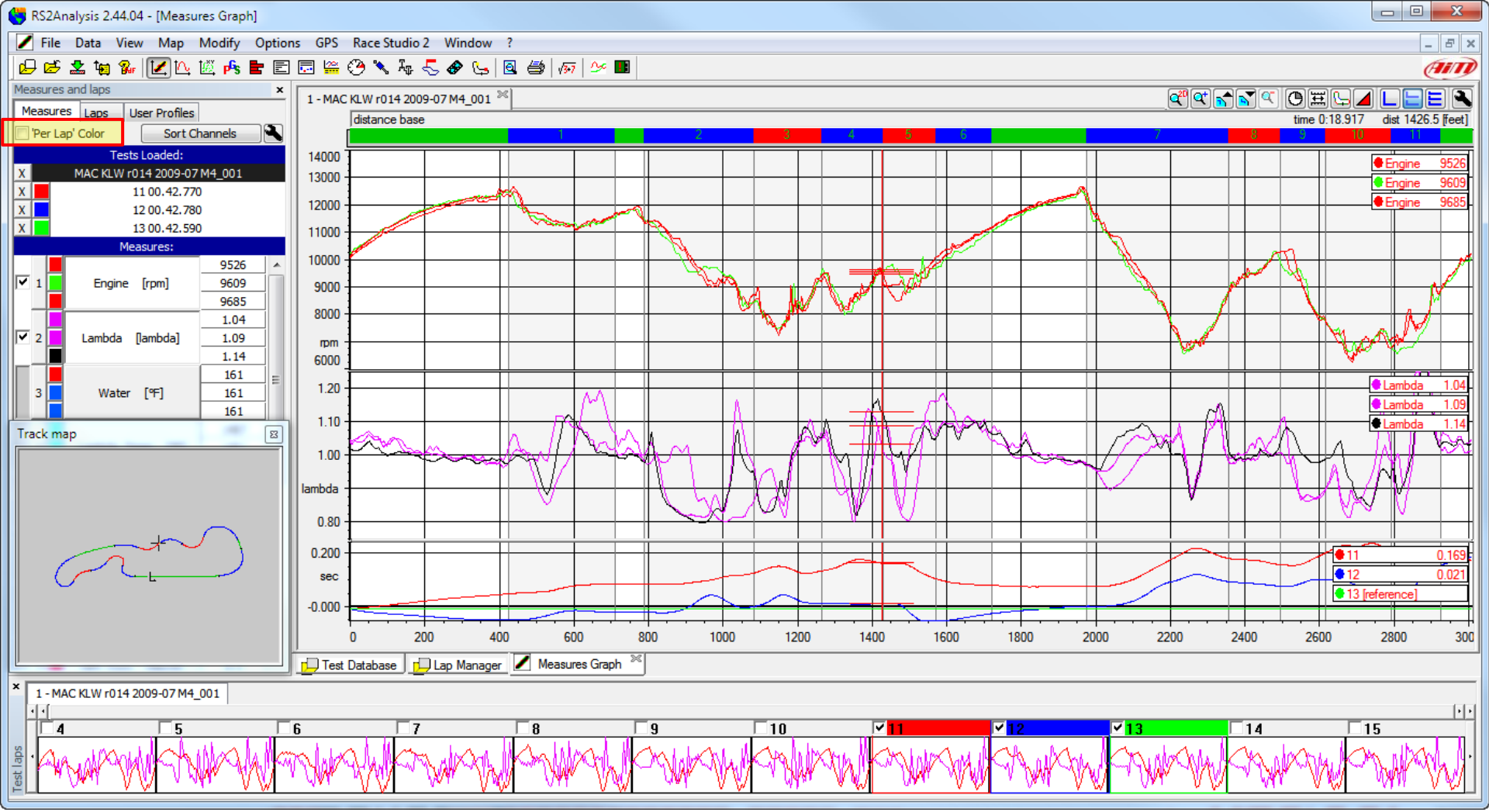
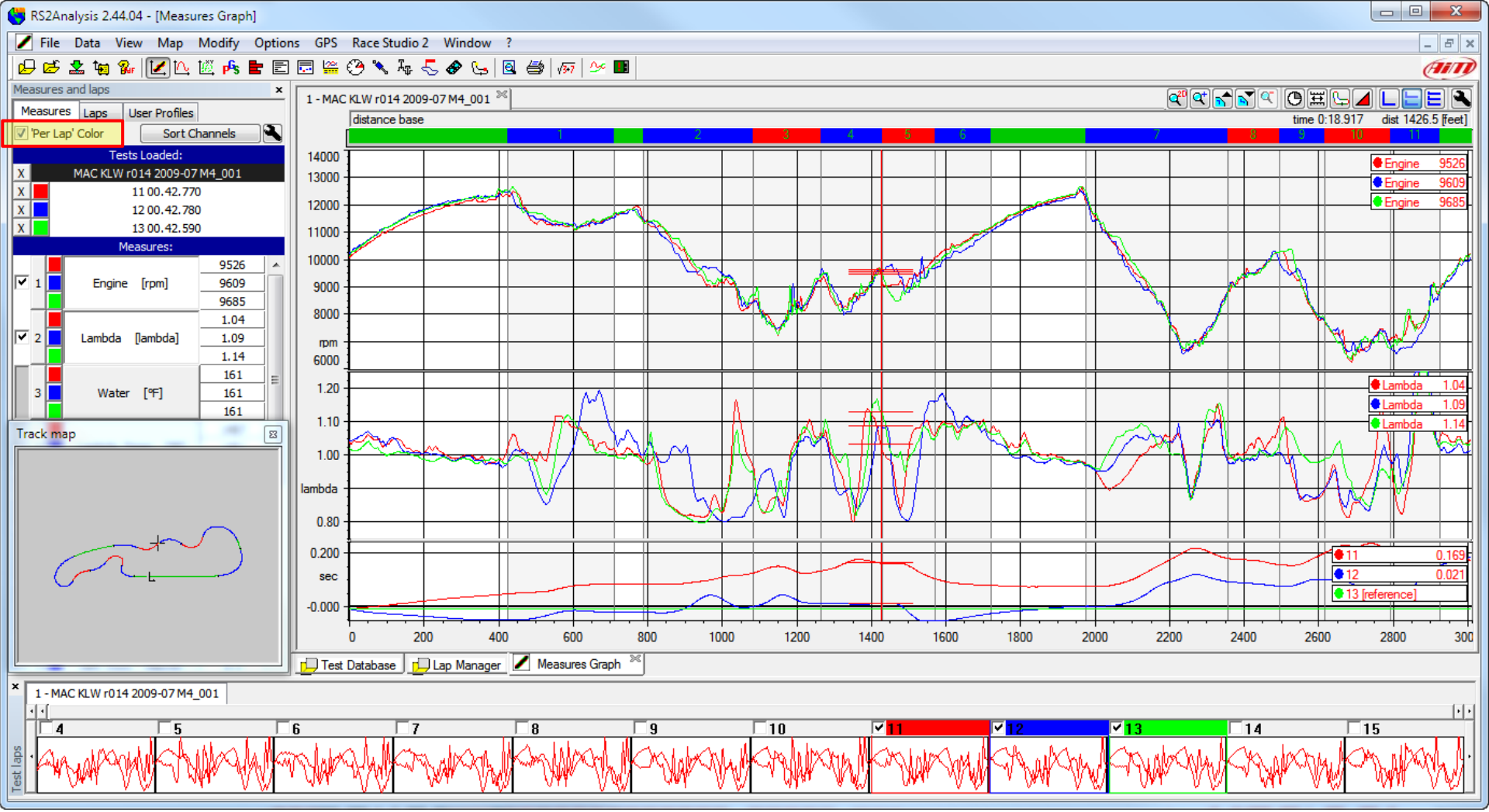
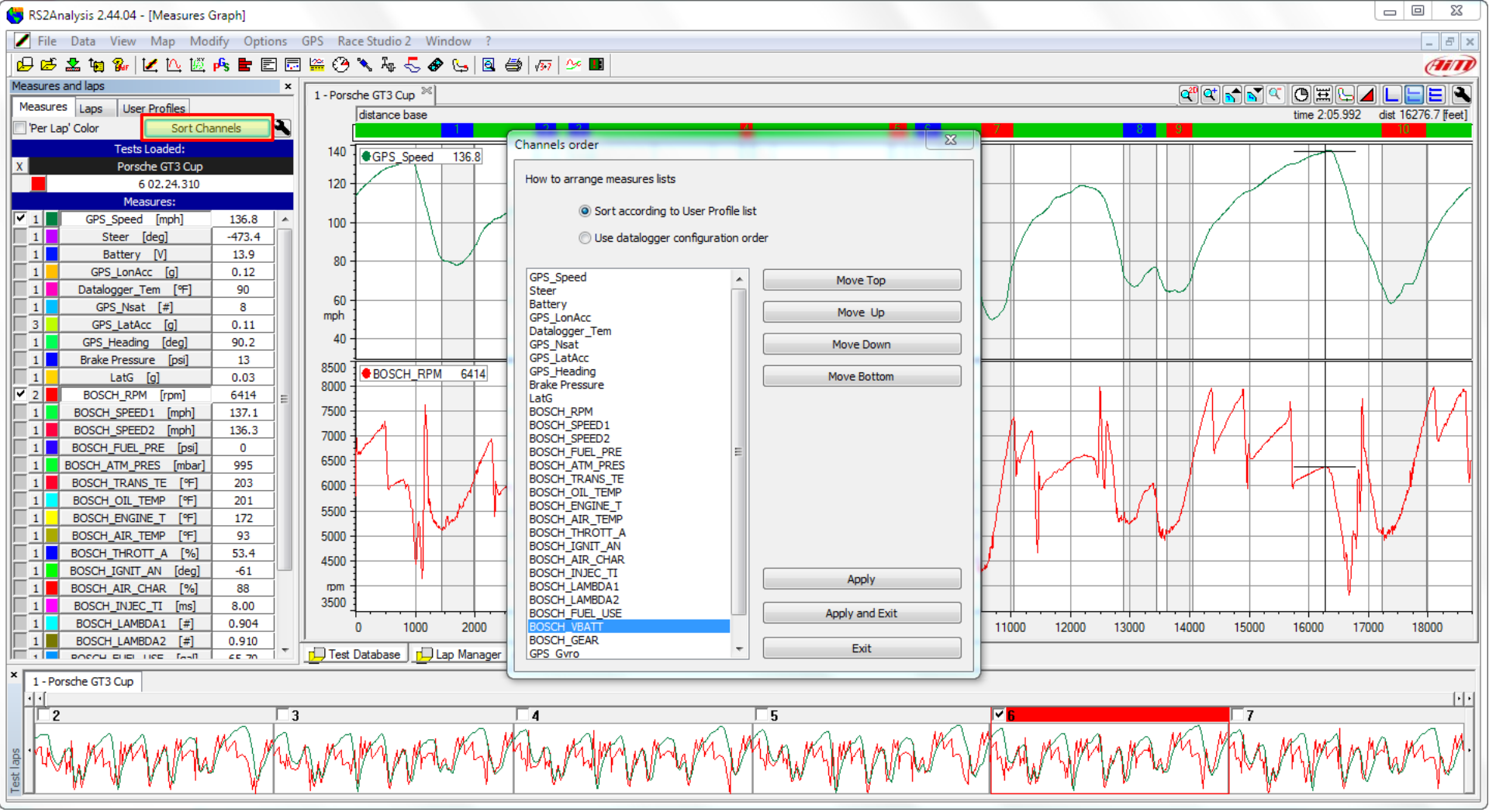


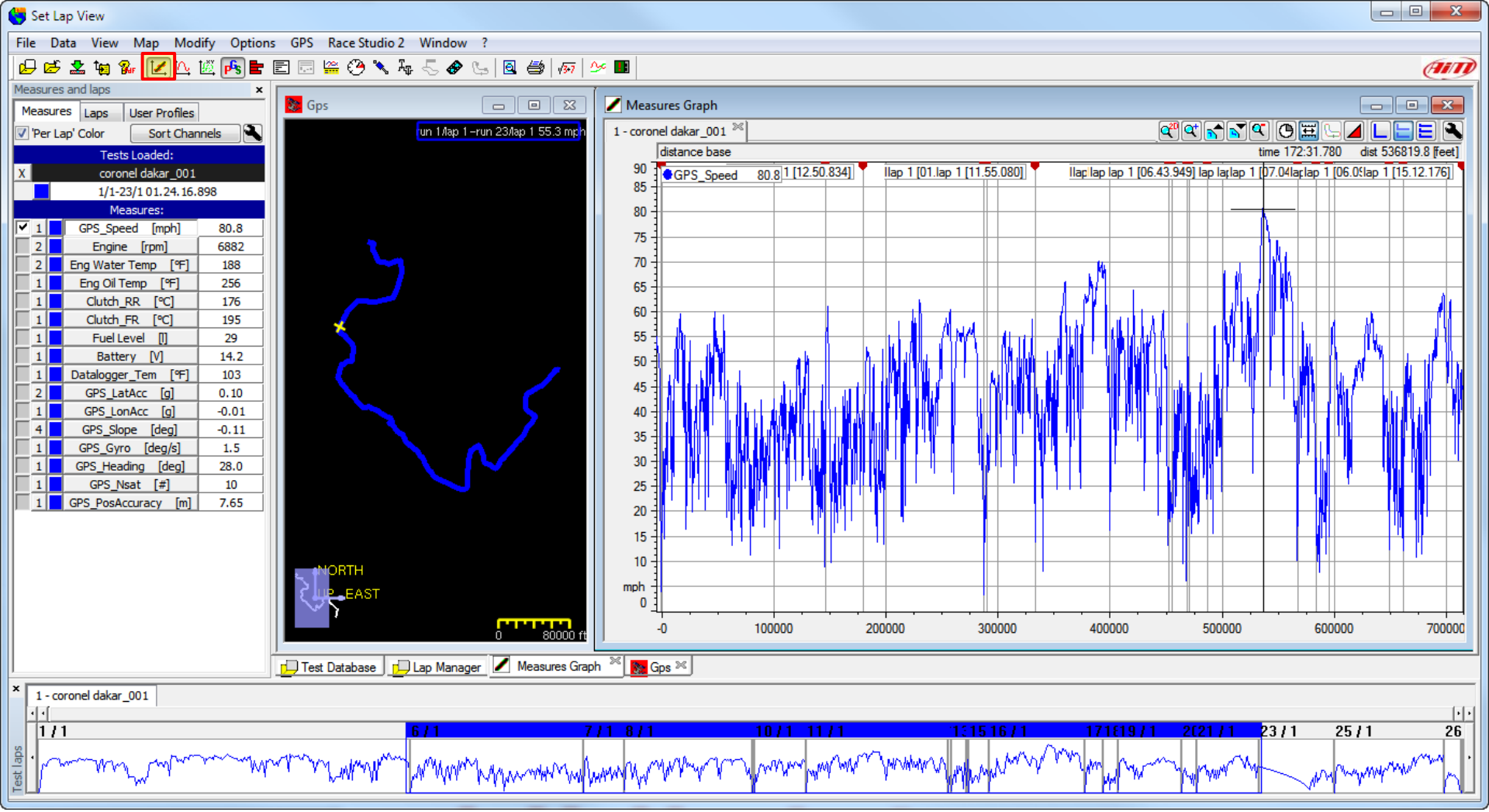
THE PER LAP COLOR OPTION QUICKLY CHANGES ALL OF THE COLORS AND TRACES FOR EACH LAP TO A SINGLE COLOR. THIS IS ESPECIALLY HELPFUL WHEN YOU HAVE MORE THAN ONE LAP ACTIVE WITH MORE THAN ONE CHANNEL SELECTED.



THE PER LAP COLOR OPTION QUICKLY CHANGES ALL OF THE COLORS AND TRACES FOR EACH LAP TO A SINGLE COLOR. THIS IS ESPECIALLY HELPFUL WHEN YOU HAVE MORE THAN ONE LAP ACTIVE WITH MORE THAN ONE CHANNEL SELECTED. NOW THE LAP COLOR = TIME COMPARE COLOR = LAMBDA COLOR = SPEED COLOR. MUCH EASIER TO UNDERSTAND WHAT YOU ARE LOOKING AT.



YOU CAN EASILY SORT CHANNELS IN THE MEASURE AND LAPS TOOLBAR BY CLICKING ON THE SORT CHANNELS BUTTON. THE RESULTING DIALOG BOX ALLOWS YOU TO HIGHLIGHT A CHANNEL AND THEN MOVE IT UP OR DOWN. WHEN YOU GET THE ORDER THE WAY YOU WANT IT (TYPICALLY THE MOST USED CHANNELS AT THE TOP) JUST PRESS THE APPLY AND EXIT BUTTON AND THE CHANNELS WILL BE SORTED..



AUTOCROSS AND RALLY DATA CAN START AND FINISH AT DIFFERENT LOCATIONS. THE SOLO IS BECOMING A POPULAR TOOL IN AUTOCROSS. HOWEVER THIS DATA IS FROM THE DAKAR RALLY. 192 MILES AND 5 1/2HRS ON THIS ONE STAGE ALONE!

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VEHICLE IMPROVEMENT

POINT TO POINT DATA

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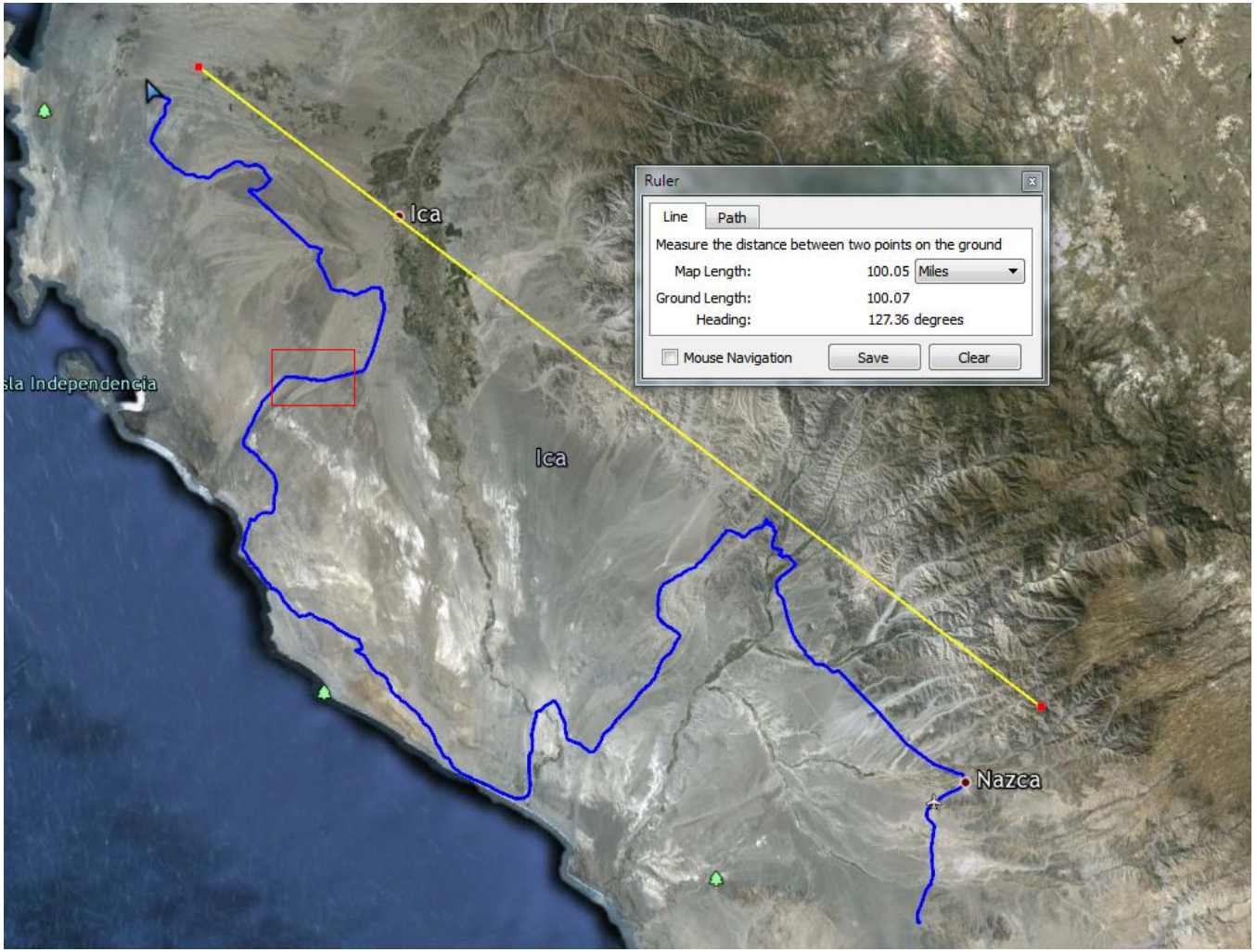
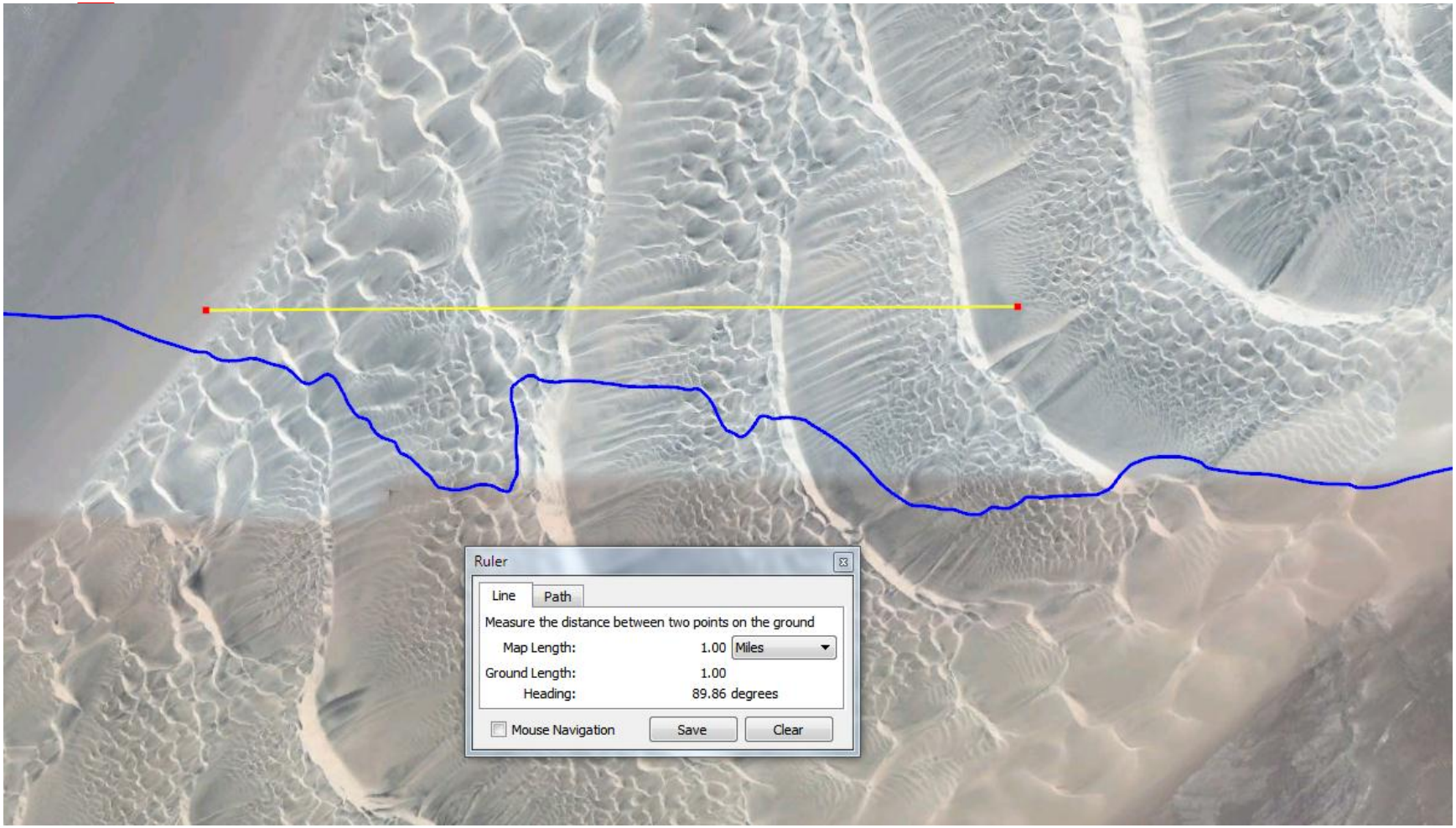
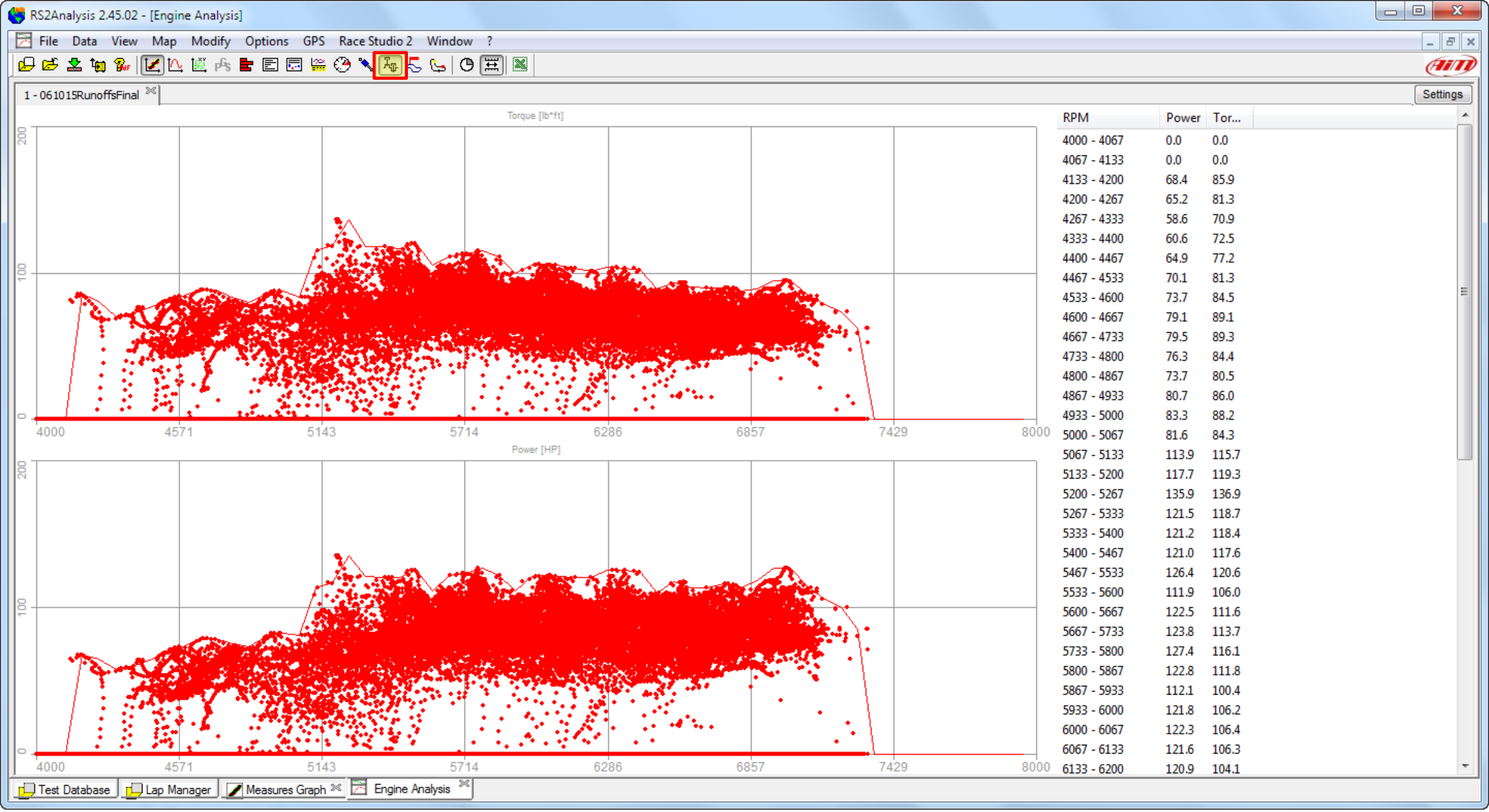
DAKAR RALLY .KML FILE 192 MILES AND 5 1/2HRS ON THIS ONE STAGE ALONE!



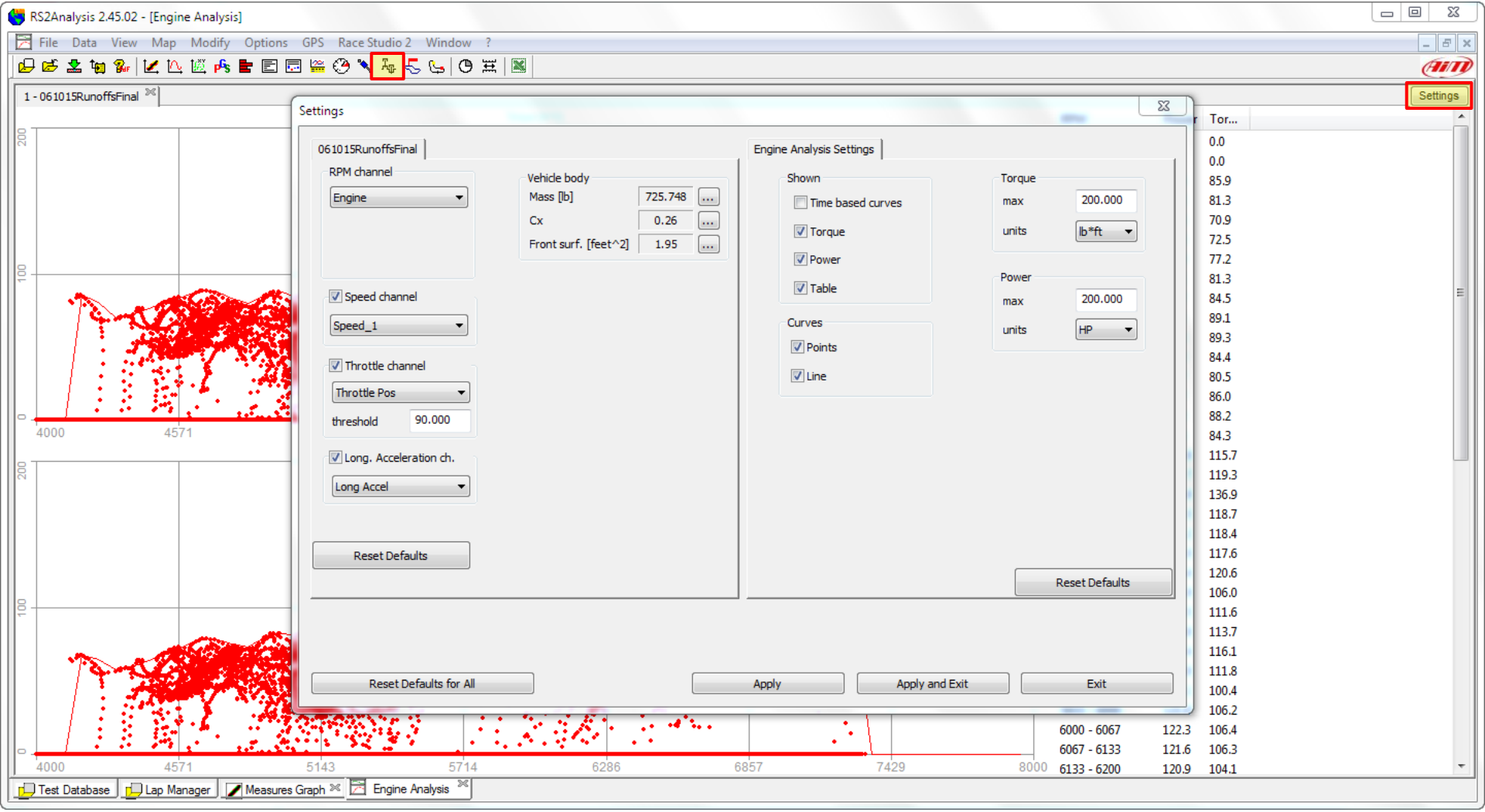
DAKAR RALLY .KML FILE 192 MILES AND 5 1/2HRS ON THIS ONE STAGE ALONE!



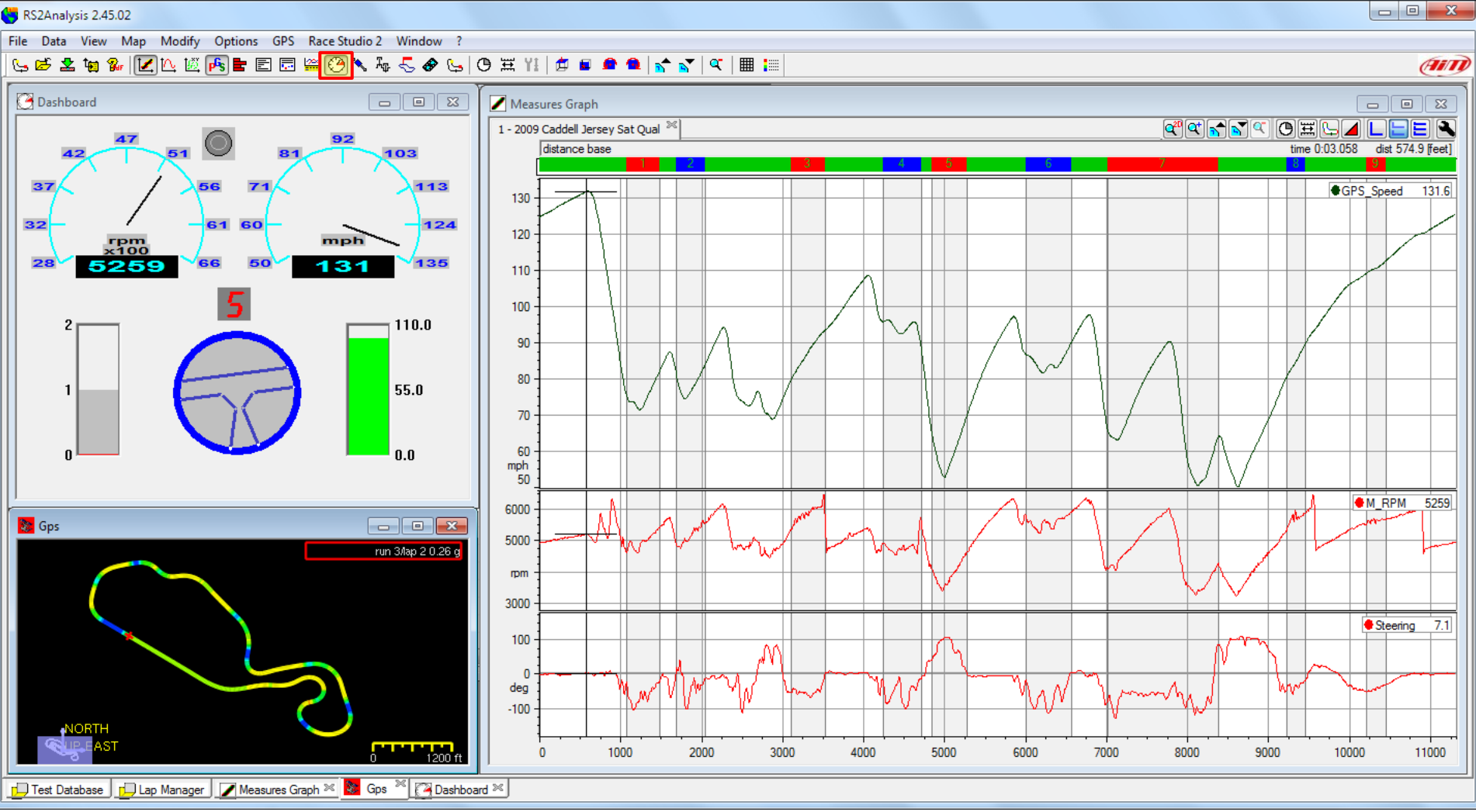
DAKAR RALLY .KML FILE 192 MILES AND 5 1/2HRS ON THIS ONE STAGE ALONE!



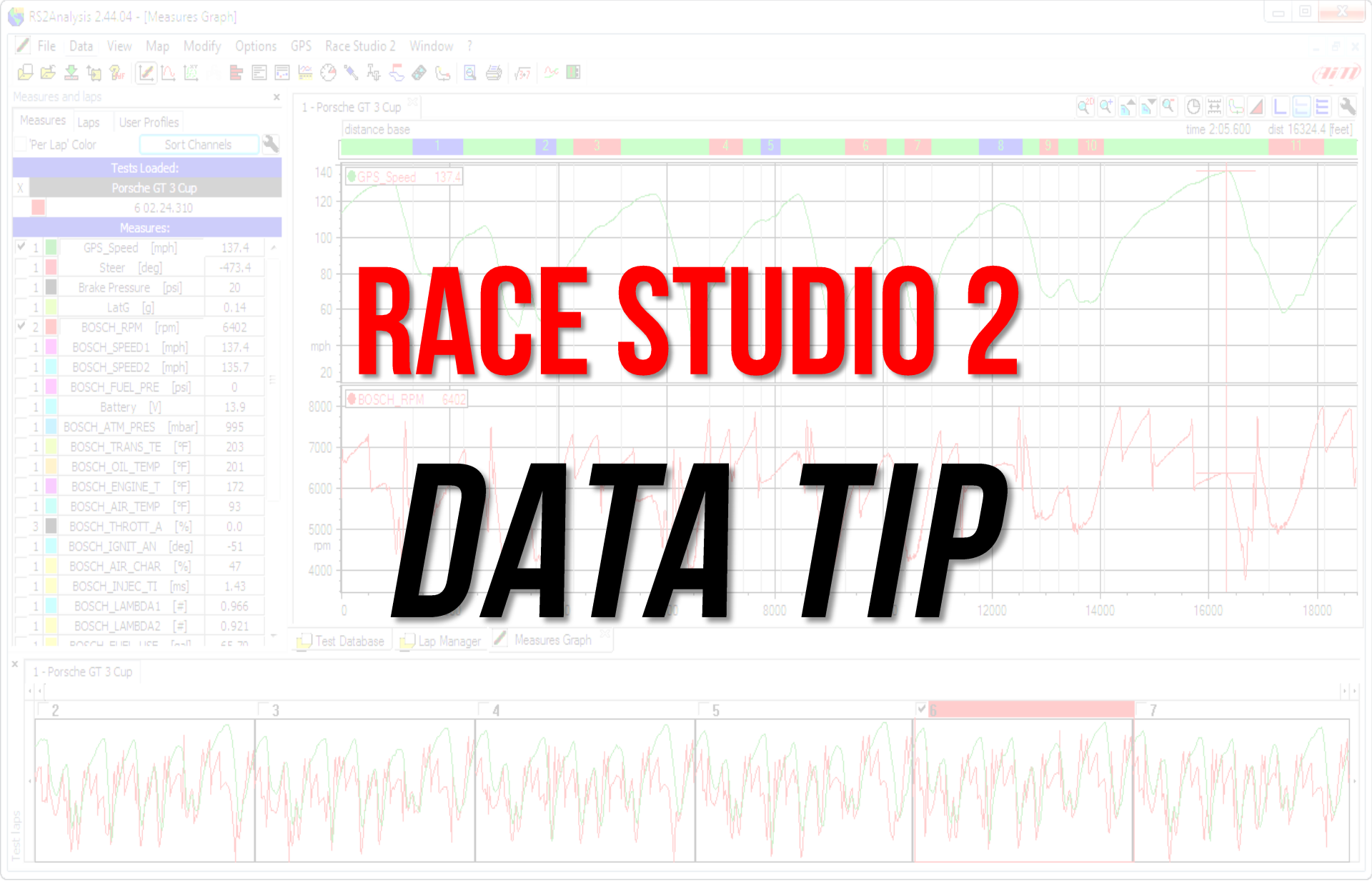
ENGINE ANALYSIS THE ENGINE ANALYSIS FUNCTION CALCULATES HORSEPOWER AND TORQUE FROM DATA GATHERED ON THE TRACK. THE DATA USED FOR CALCULATIONS IS THE DATA VIEWED IN THE MEASURES GRAPH.



ENGINE ANALYSIS THE ENGINE ANALYSIS FUNCTION CALCULATES HORSEPOWER AND TORQUE FROM DATA GATHERED ON THE TRACK. HERE IS THE "SETTINGS" DIALOG BOX.



DASHBOARD SIMULATION. HERE WE CAN VIEW THE NORMAL TRACES OF DATA BUT ALSO A GRAPHICAL REPRESENTATION OF THE DASHBOARD. AS IN EVERY OTHER FUNCTION IN RACE STUDIO2, THE DATA IS DYNAMICALLY LINKED. WHERE YOU PLACE THE CURSER IN THE MEASURES GRAPH, THE GPS MAP AND THE DASHBOARD REFLECT THE INFORMATION AT EXACTLY THE SAME POSITION.



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DATA TIP

TRACK MAP GENERATION

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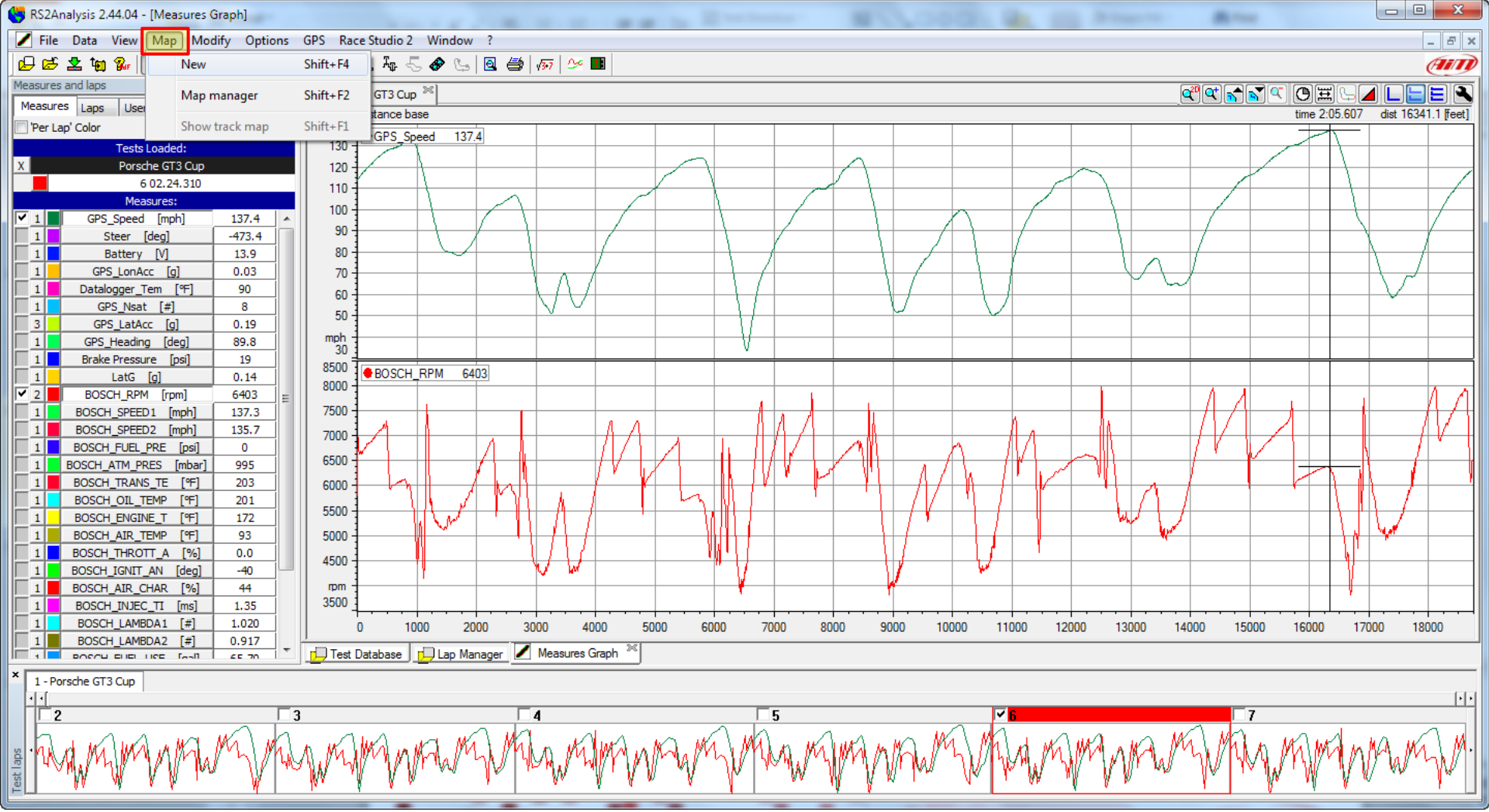
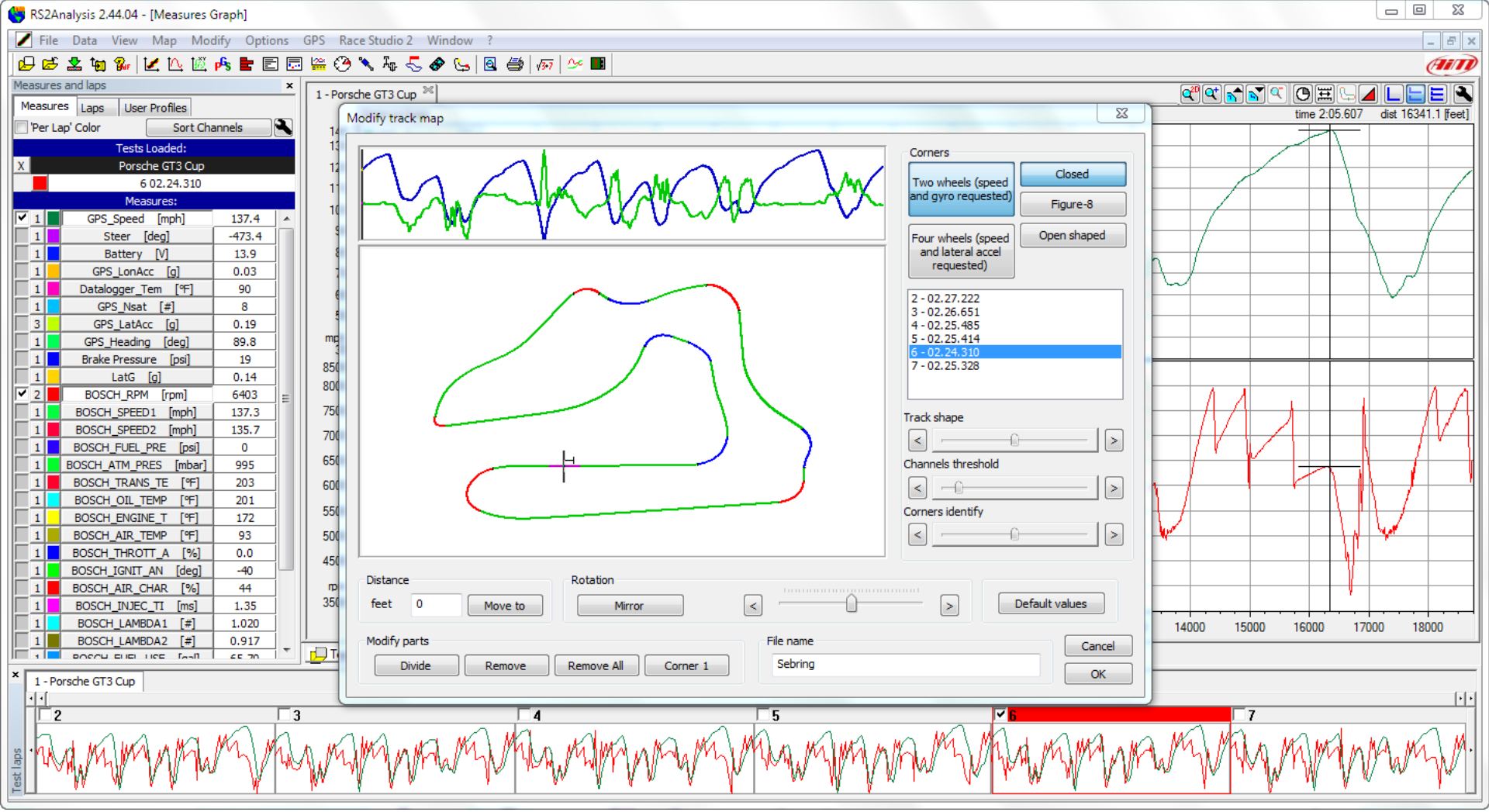
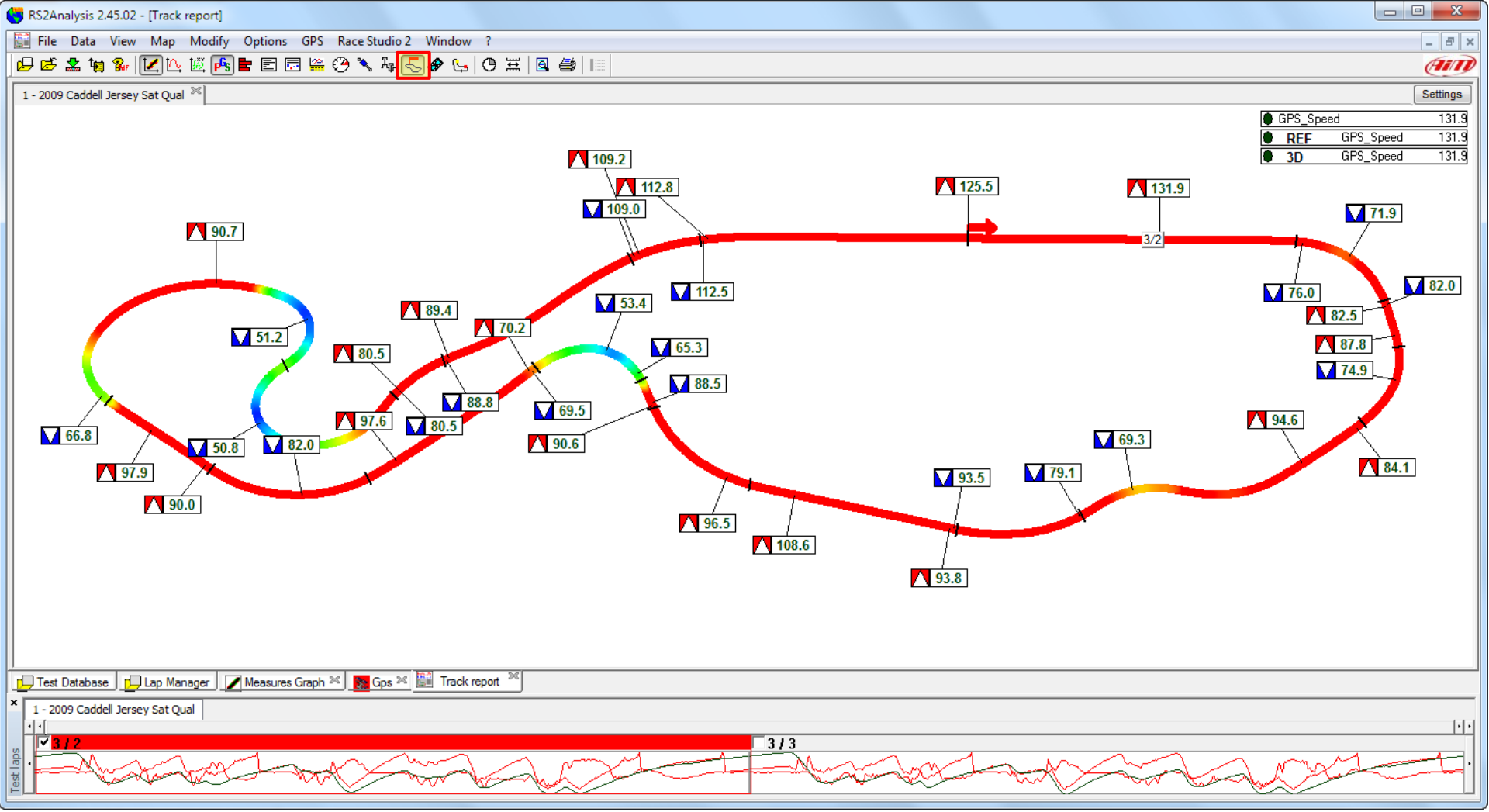


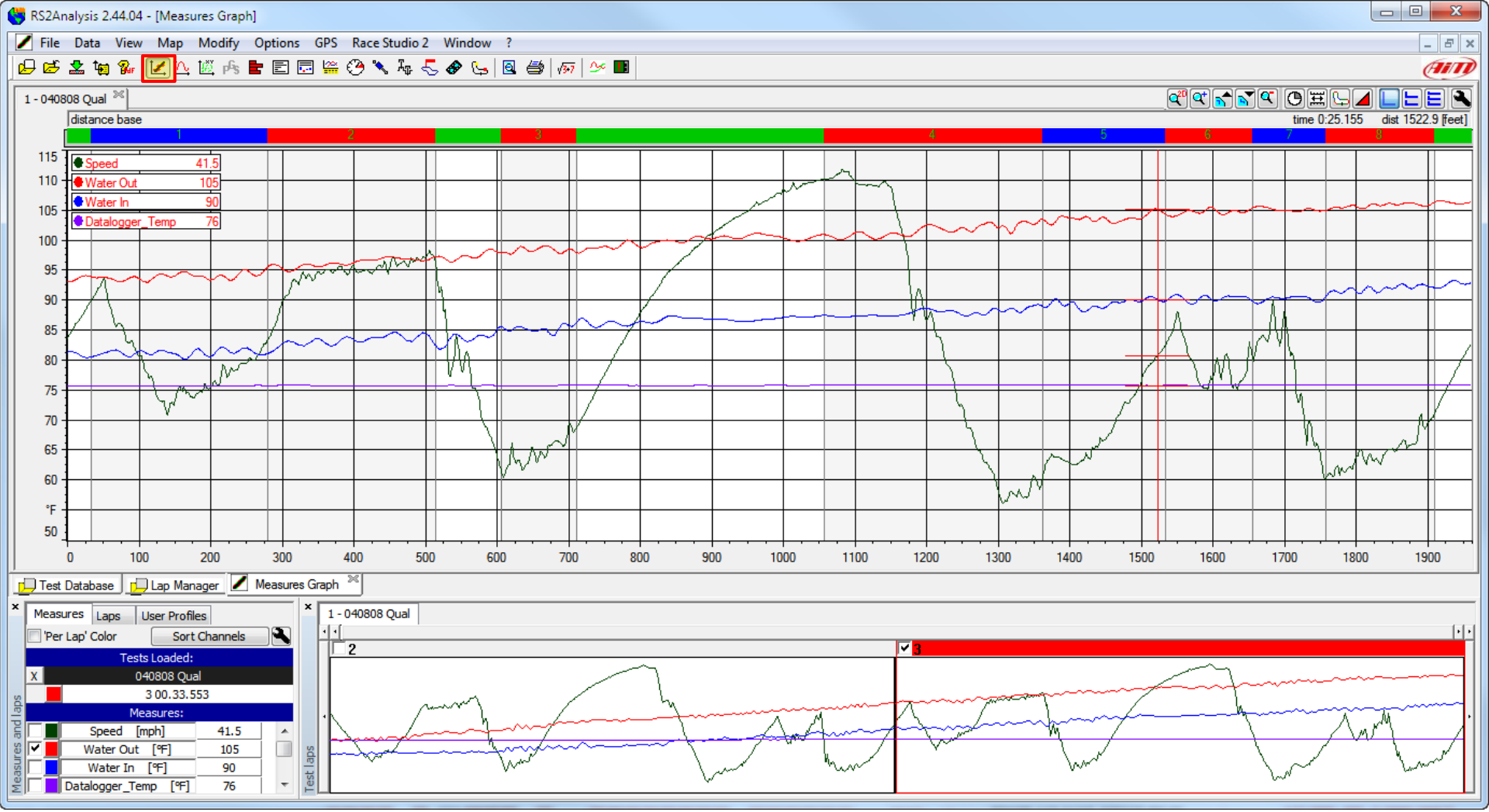
TO GENERATE A **TRACK MAP**, SELECT THE MAP PULLDOWN MENU AND THE NEW COMMAND.



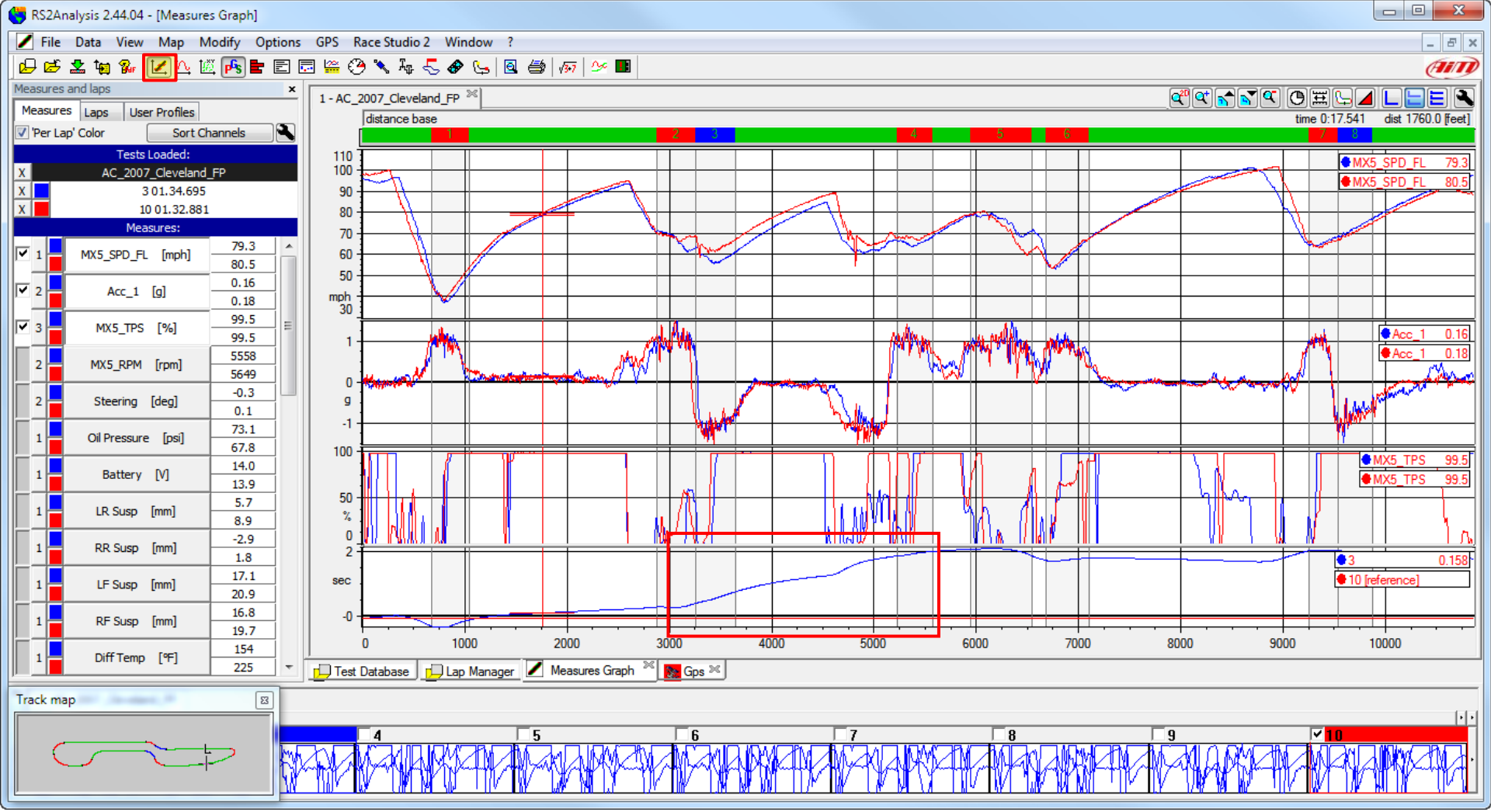
THE **MODIFY TRACK MAP** DIALOG BOX WILL APPEAR. TYPICALLY IT WILL DISPLAY YOUR BEST LAPTIME. HOWEVER YOU CAN SELECT ANY OF YOUR LAPS. YOU HAVE OPTIONS TO MODIFY THE DEFAULT SETTINGS; TRACK SHAPE, CHANNELS THRESHOLD, CORNERS IDENTIFY, AND ROTATION. WHEN YOU HAVE THE MAP THE WAY YOU WANT IT, INPUT A FILE NAME AND CLICK ON THE OK BUTTON.



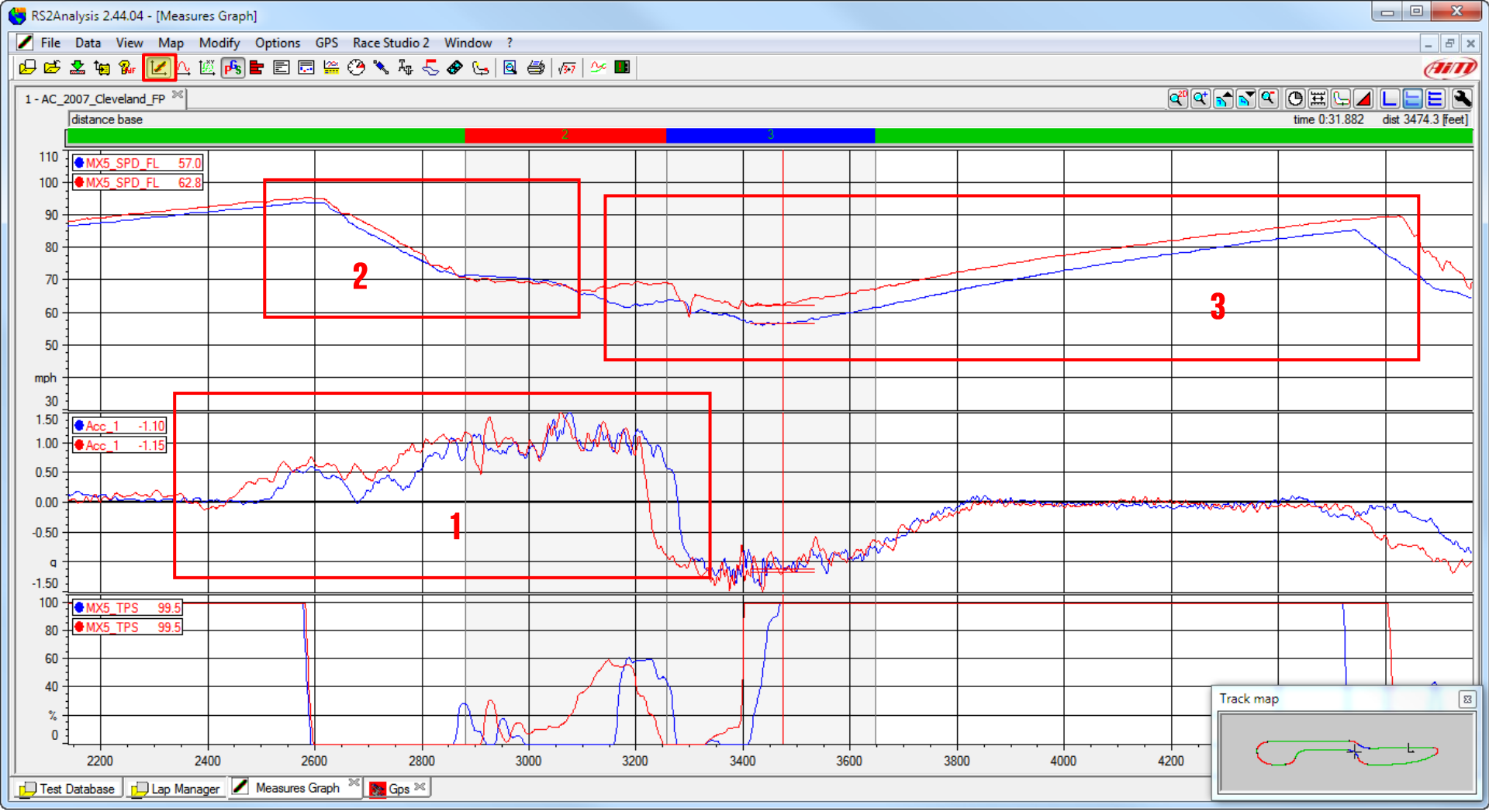
TRACK REPORT. THIS FUNCTION PROVIDES A QUICK VIEW OF THE LOW AND HIGH VALUES OF ANY CHANNEL (IN THIS CASE SPEED) BROKEN DOWN BY SEGMENTS.



IN THIS EXAMPLE, WE ARE LOOKING AT WATER TEMPERATURES OUT OF THE ENGINE AND THEN GOING BACK INTO THE ENGINE. THIS IS TO CHECK RADIATOR COOLING EFFICIENCY. IN THIS CASE THERE IS 15 DEGREES OF COOLING BY THIS KART RADIATOR ON THE 2ND LAP OF THIS QUALIFYING SESSION.

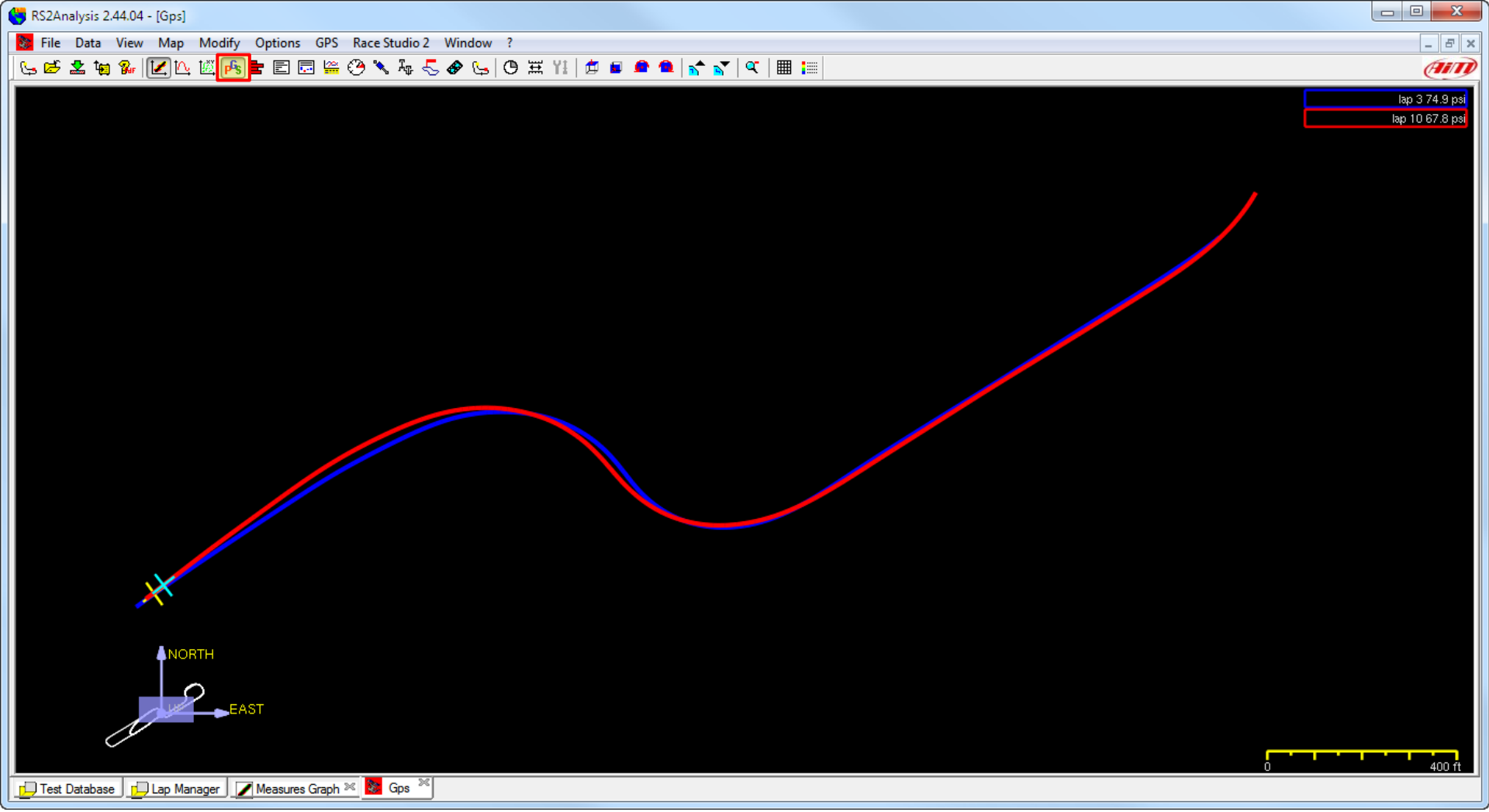


HERE IS A TEST WITH SPEED, LATERAL G'S, AND THROTTLE POSITION OPEN. THIS WAS THE FIRST PRACTICE SESSION ON A NEW TRACK AND WE ARE COMPARING AN EARLY LAP AGAINST A LATER LAP, WHAT HAS THE DRIVER LEARNED IN THE SESSION?
THE TIME COMPARE BAR POINTS OUT AN AREA WHERE THE BLUE LAP LOST A LOT OF TIME. LETS CLOSE THE TEST LAPS AND MEASURES TOOLBARS AND ZOOM IN STUDY THIS AREA.



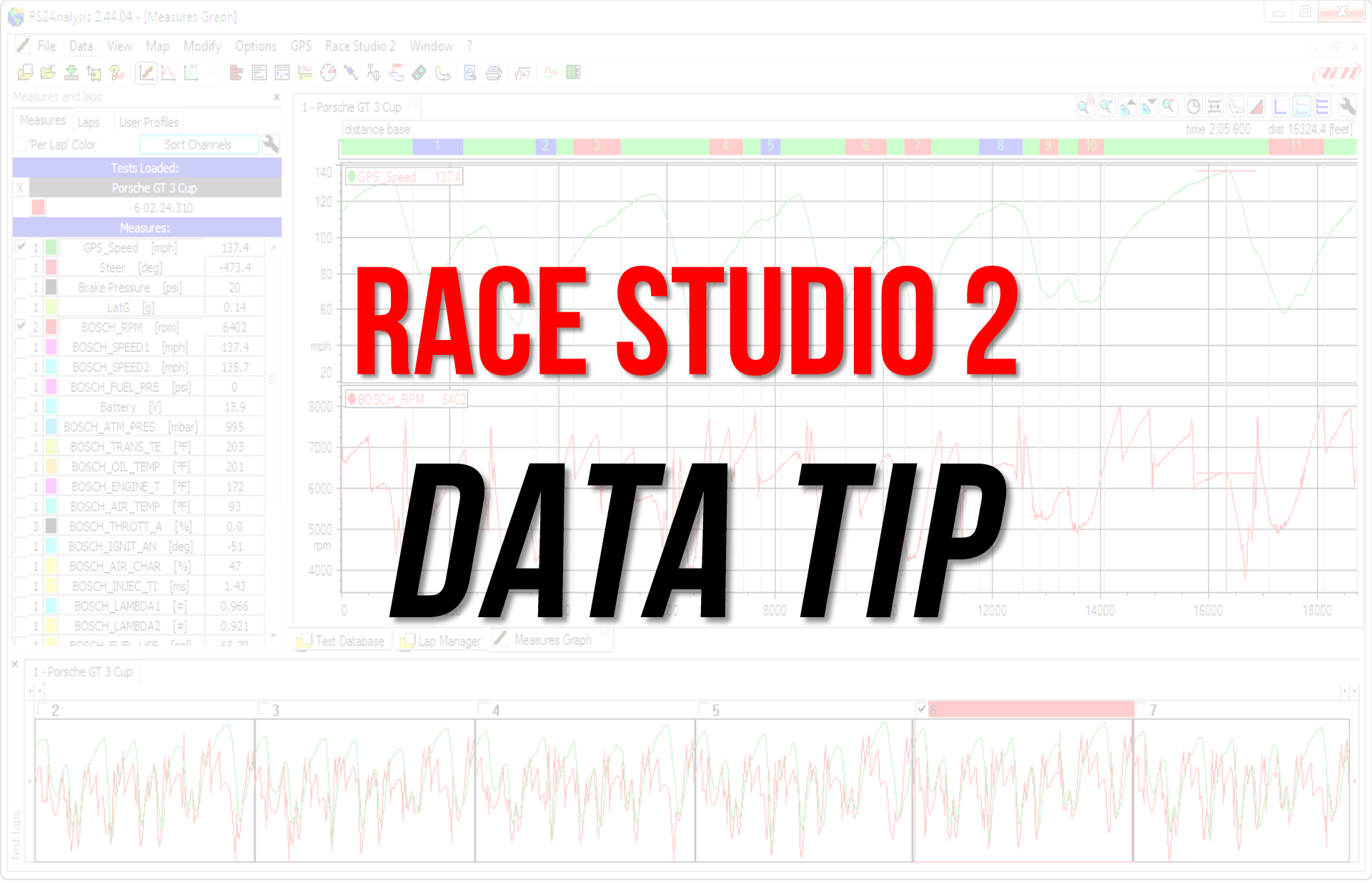
WHAT DO YOU SEE?

#1 – RED LAP SETUP EARLIER AND THEN TRANSITIONED FROM RIGHT TO LEFT EARLIER AND HARDER. #2 – BRAKING AND CORNER ENTRY SPEED WAS NOT MUCH HIGHER AS A RESULT BUT… #3 – …MID CORNER AND EXIT SPEED WAS A LOT HIGHER



THIS IS THE SAME SECTION OF TRACK WITH THE 2 LAPS AS SHOWN IN THE RACE STUDIO 2 GPS FUNCTION. THE DRIVER WAS LEARNING DIFFERENT LINES LOOKING FOR THE BEST WAY TO DRIVE THIS SERIES OF CORNERS AND THE PLACEMENT OF THE CONFIRMS WHAT WE READ FROM THE DATA TRACES.

THIS IS THE SAME AREA OF THE TRACK WITH ALL OF THE LAPS FROM THIS SESSION PROJECTED ONTO A GOOGLE EARTH MAP WITH THE RACE STUDIO 2 .KML EXPORT FUNCTION.



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DATA TIP

VIEWS FUNCTION

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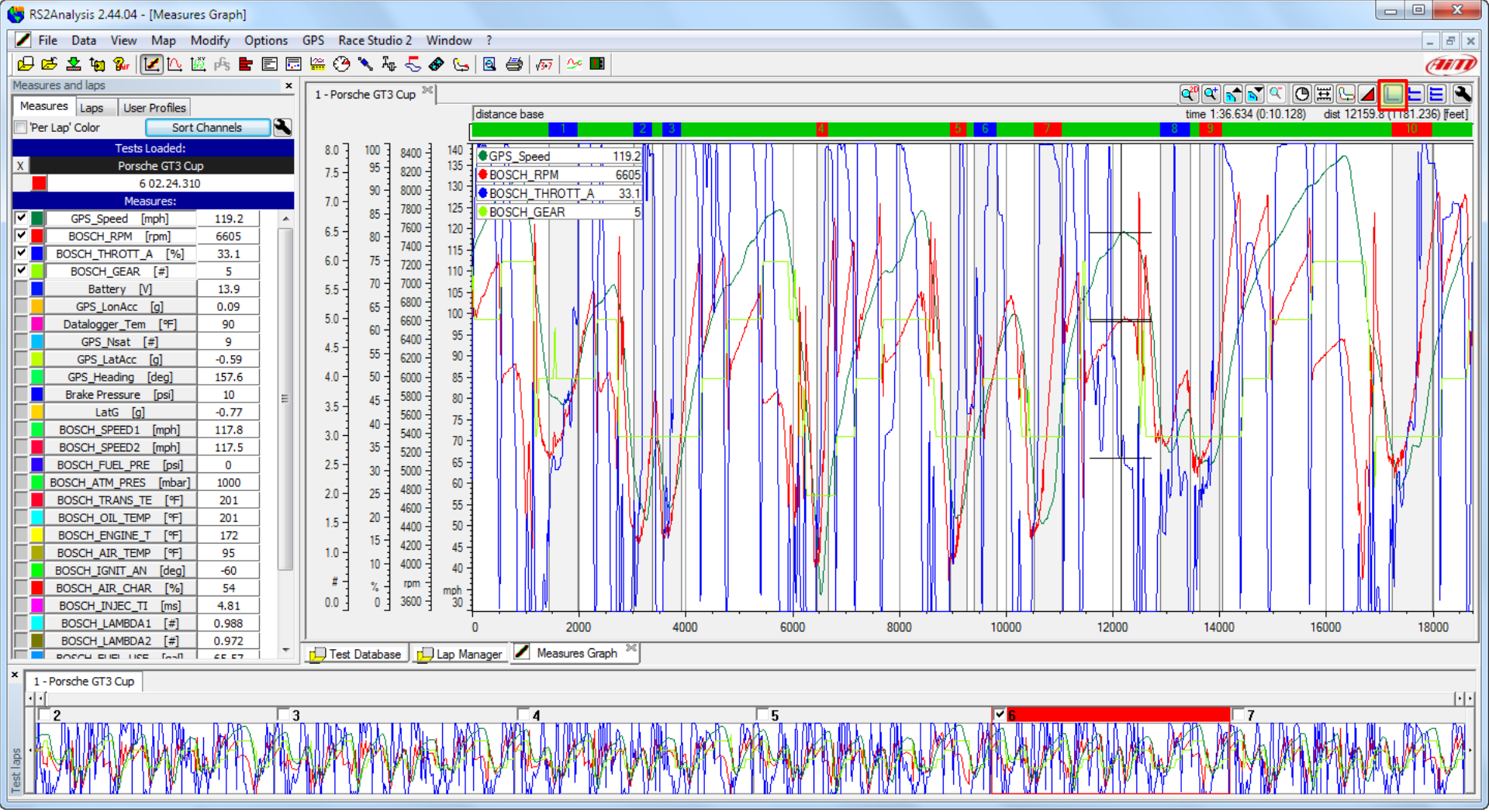

WHEN LOOKING AT MULTIPLE GRAPHS THE SCREEN CAN GET VERY BUSY AND HARD TO READ. IN THIS EXAMPLE WE HAVE 4 CHANNELS ACTIVE (SPEED, RPM, THROTTLE POSITION, AND GEAR) TO MAKE THIS MUCH EASIER TO READ, USE THE VIEWS FUNCTION. YOU HAVE 3 CHOICES; OVERLAPPED, MIXED, AND TILED. THIS IS THE OVERLAPPED VIEW. ALL OF THE CHANNEL TRACES FIT INTO THE MAIN VIEWING AREA BASED FULLY ON THE GRAPHING SCALING VALUES AS SEEN ON THE LEFT EDGE OF THE GRAPHS. VERY BUSY!

ADVANCED ANALYSIS TOOLS

OVERLAPPED, MIXED AND TILED VIEWS

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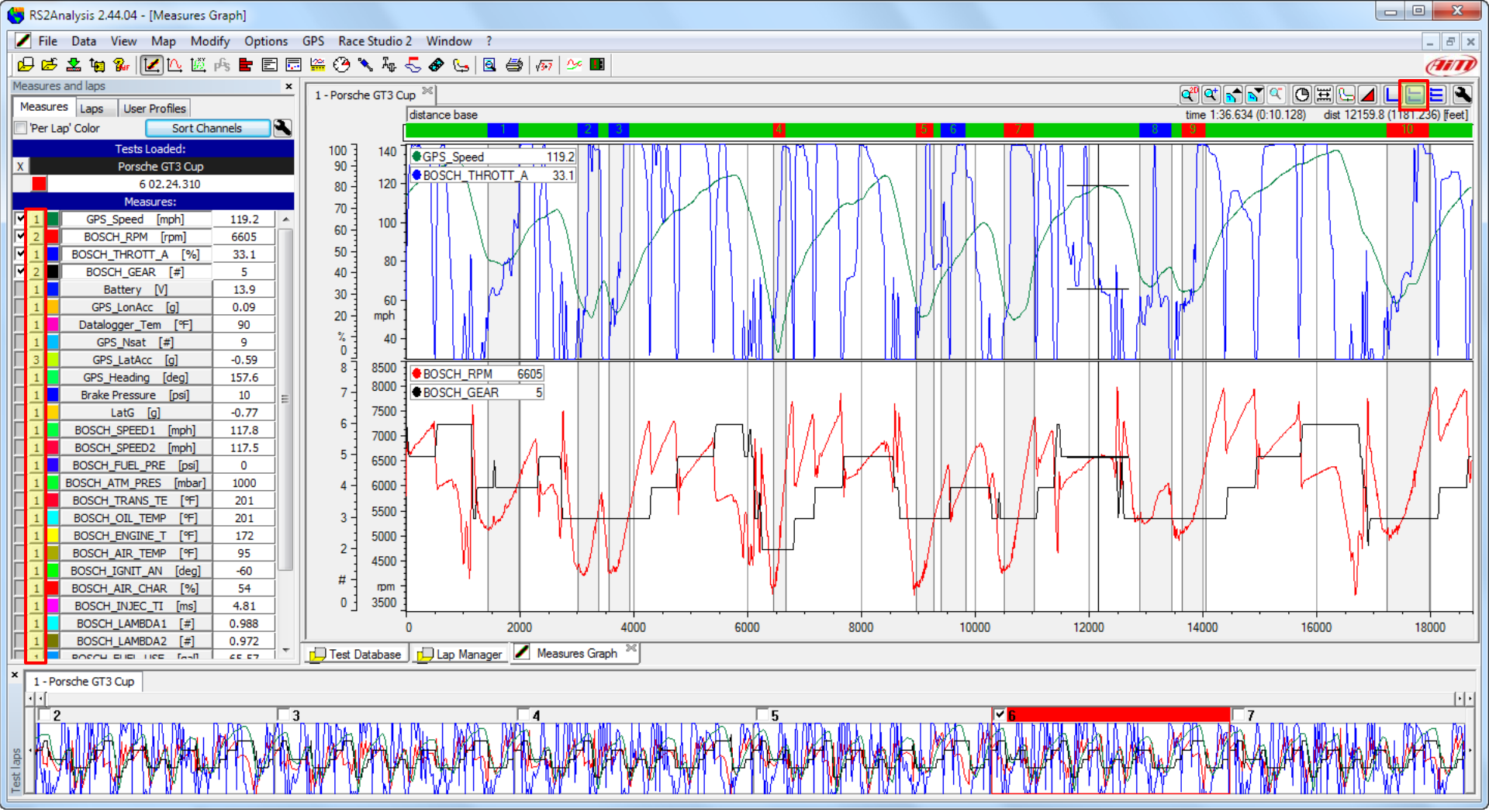
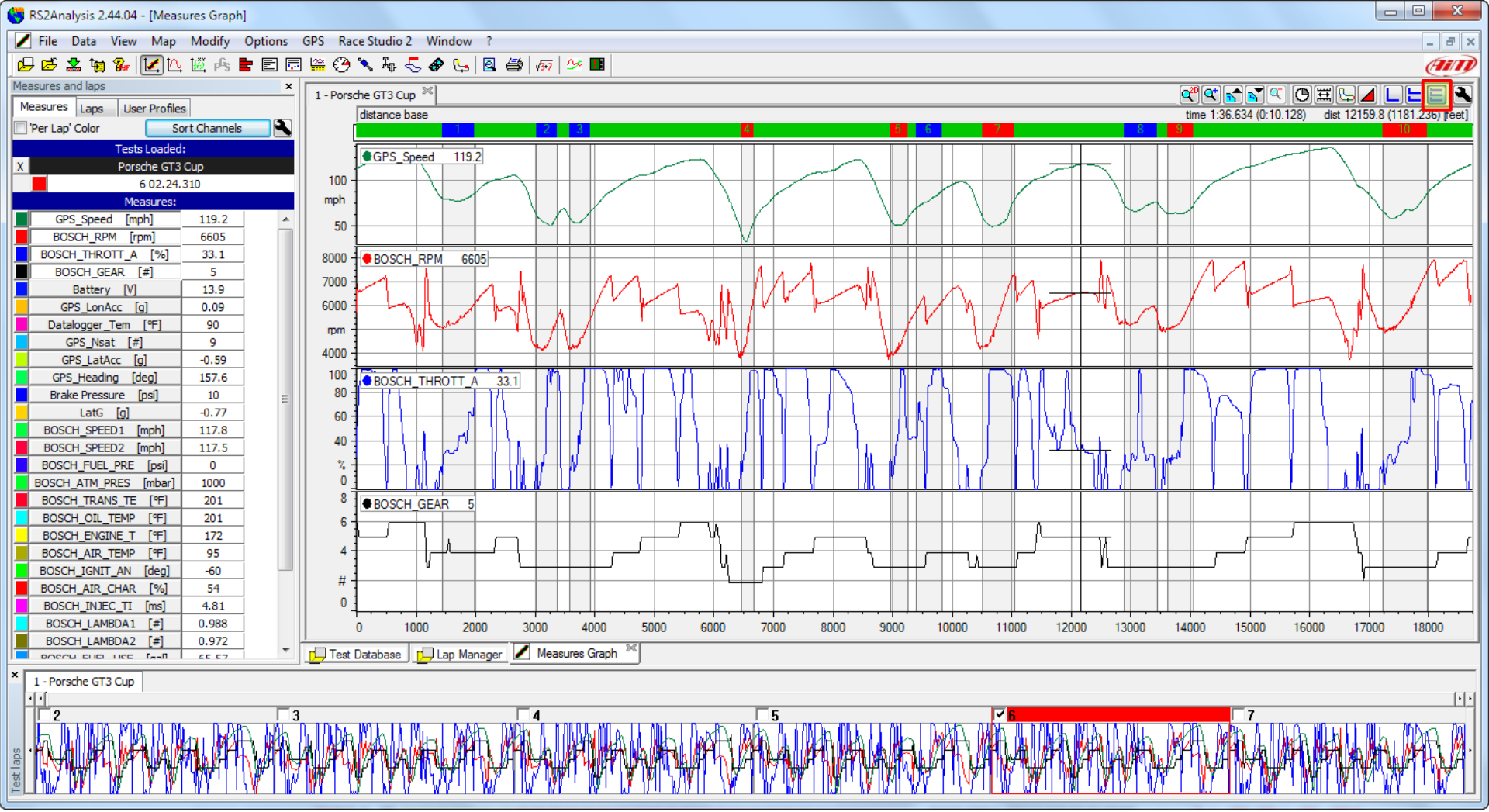
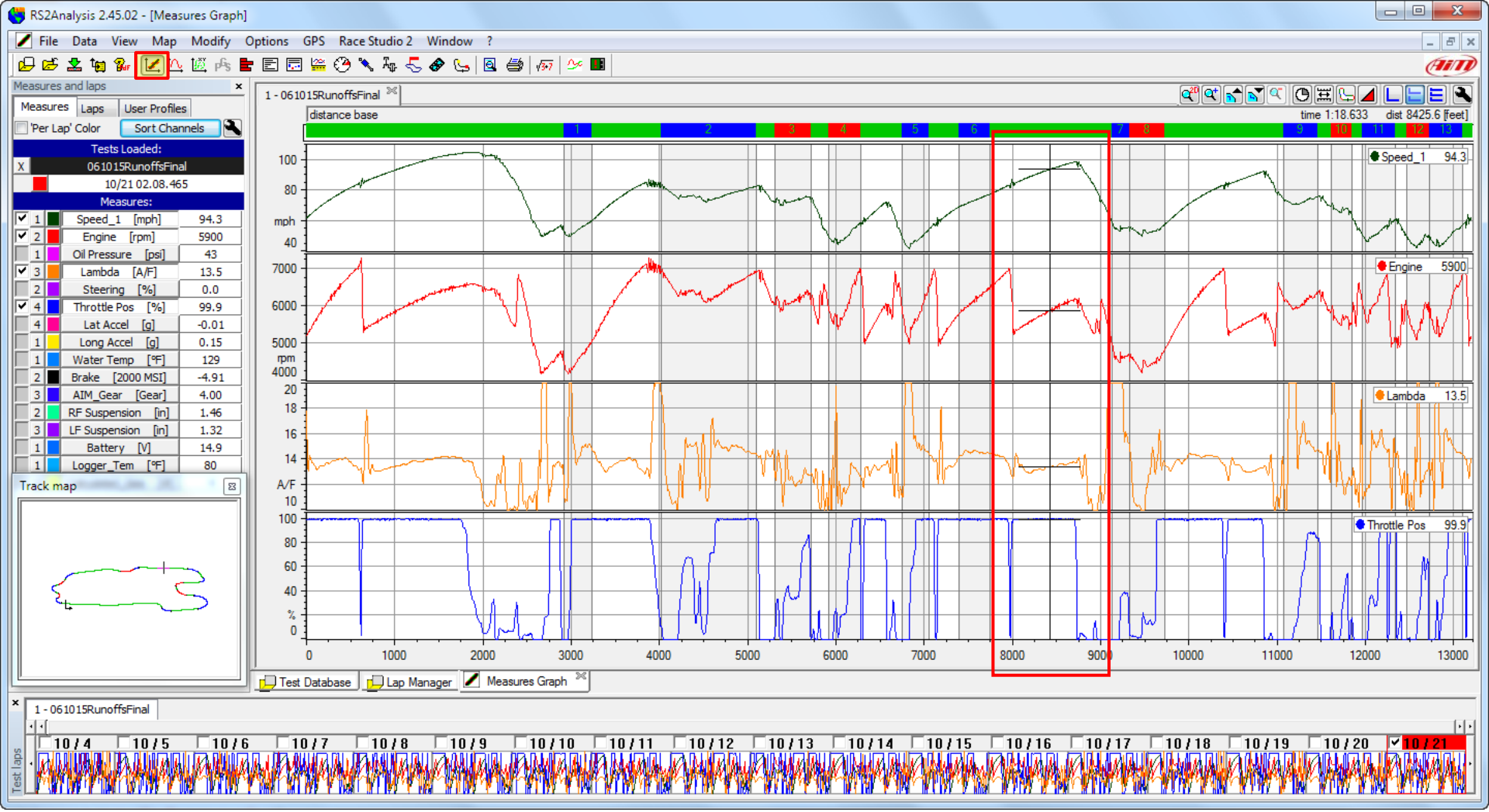


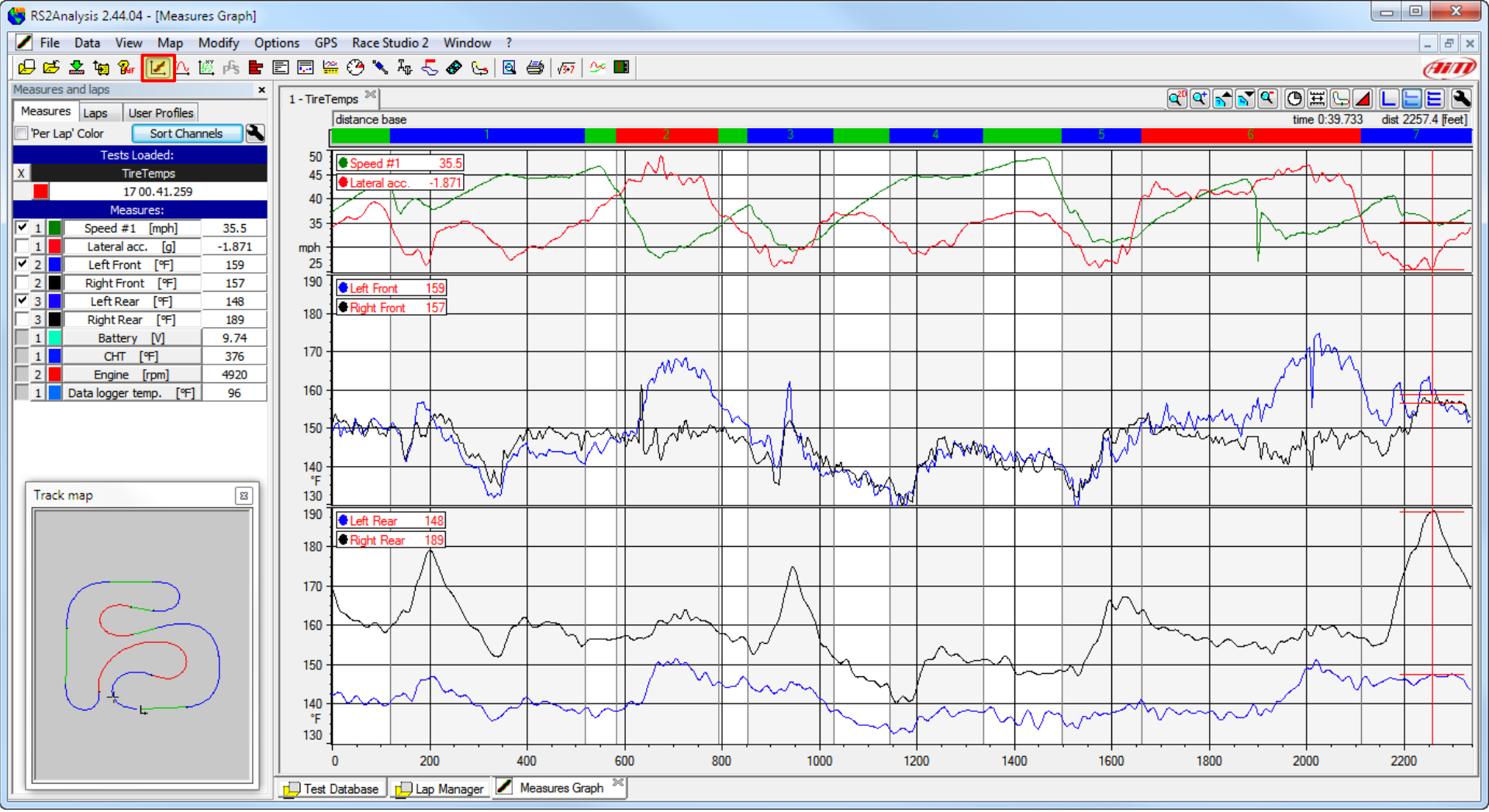
THIS IS THE **MIXED VIEW**. YOU CONTROL THE PLACEMENT OF THE DATA TRACES IN UP TO 6 WINDOWS BY THE WINDOW VALUES TO THE LEFT OF THE CHANNEL NAMES AND COLORS. HERE I HAVE SPLIT THE 4 CHANNELS INTO 2 GROUPS, SPEED AND THROTTLE POSITION IN WINDOW #1 AND RPM AND GEAR POSITION IN WINDOW #2. THE MIXED VIEW IS TYPICALLY THE MOST POPULAR WAY TO VIEW DATA.



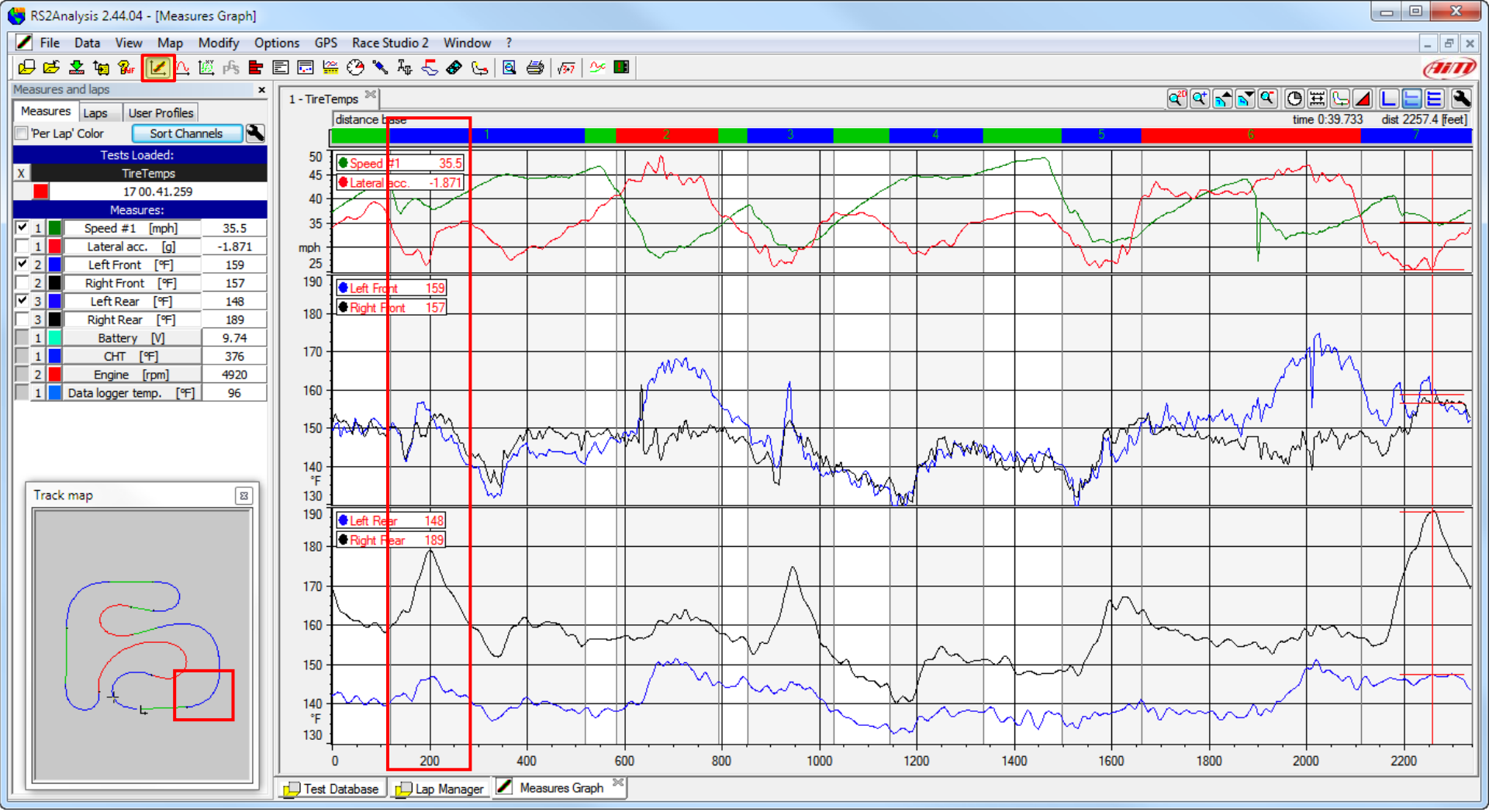
THIS IS THE TILED VIEW. THIS VIEW PLACES ALL OF THE ACTIVE CHANNELS INTO THEIR OWN WINDOW IN THE MAIN WINDOW.



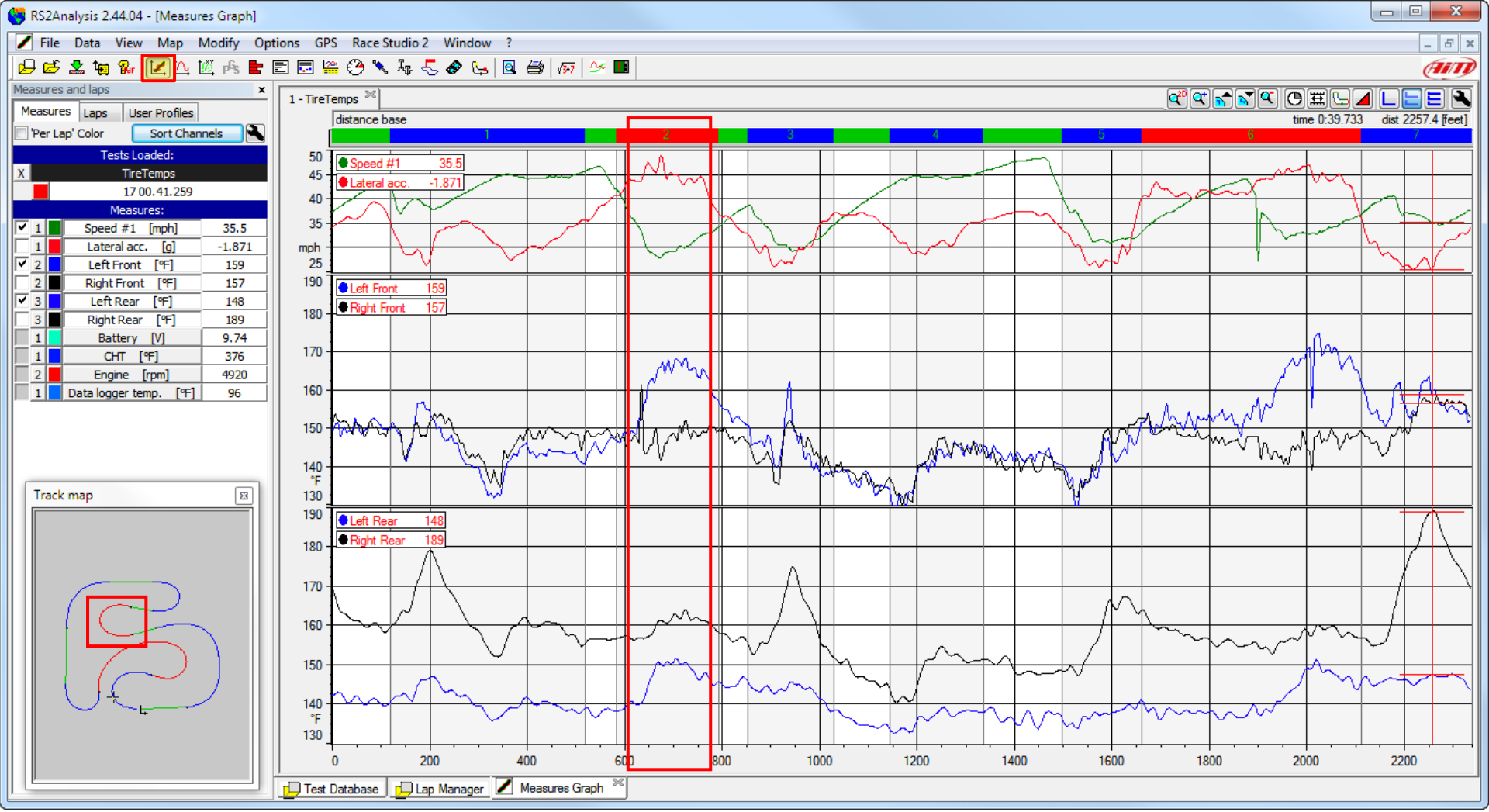
EXAMPLE OF LAMDBA – AIR/FUEL RATIO SENSOR. WE KNEW FROM CHASSIS DYNO WORK THAT WE WANTED 13.5:1 FOR MAXIMUM POWER. WE TRIED TO TUNE TO THAT VALUE.



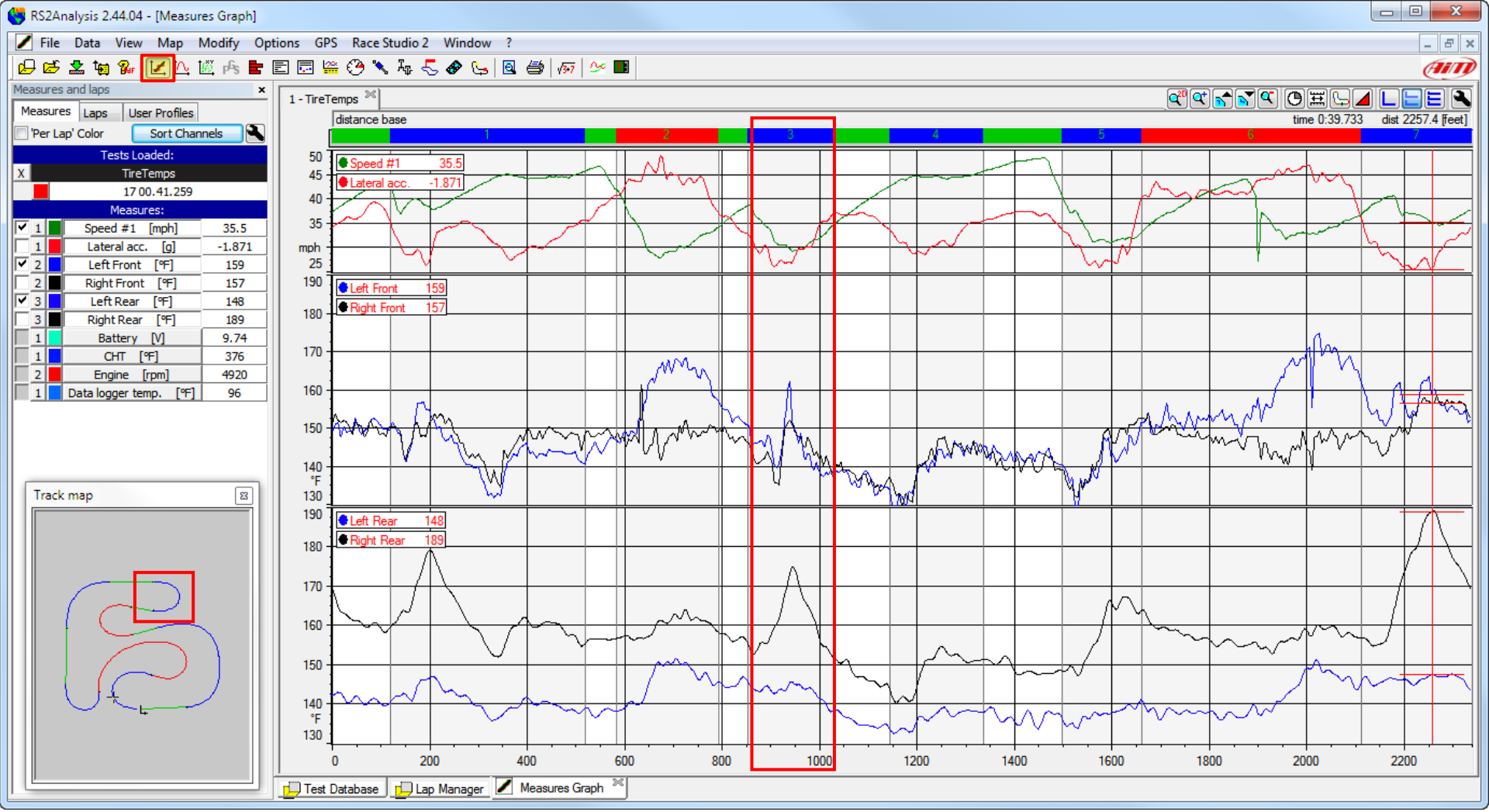
INFRARED TIRE TEMPS ARE A POWERFUL TOOL. LETS LOOK OVER A LAP OF TIRE TEMP DATA ON THIS KART WITH 4 INFRARED TEMP SENSORS POINTED AT THE CENTER OF EACH TIRE.



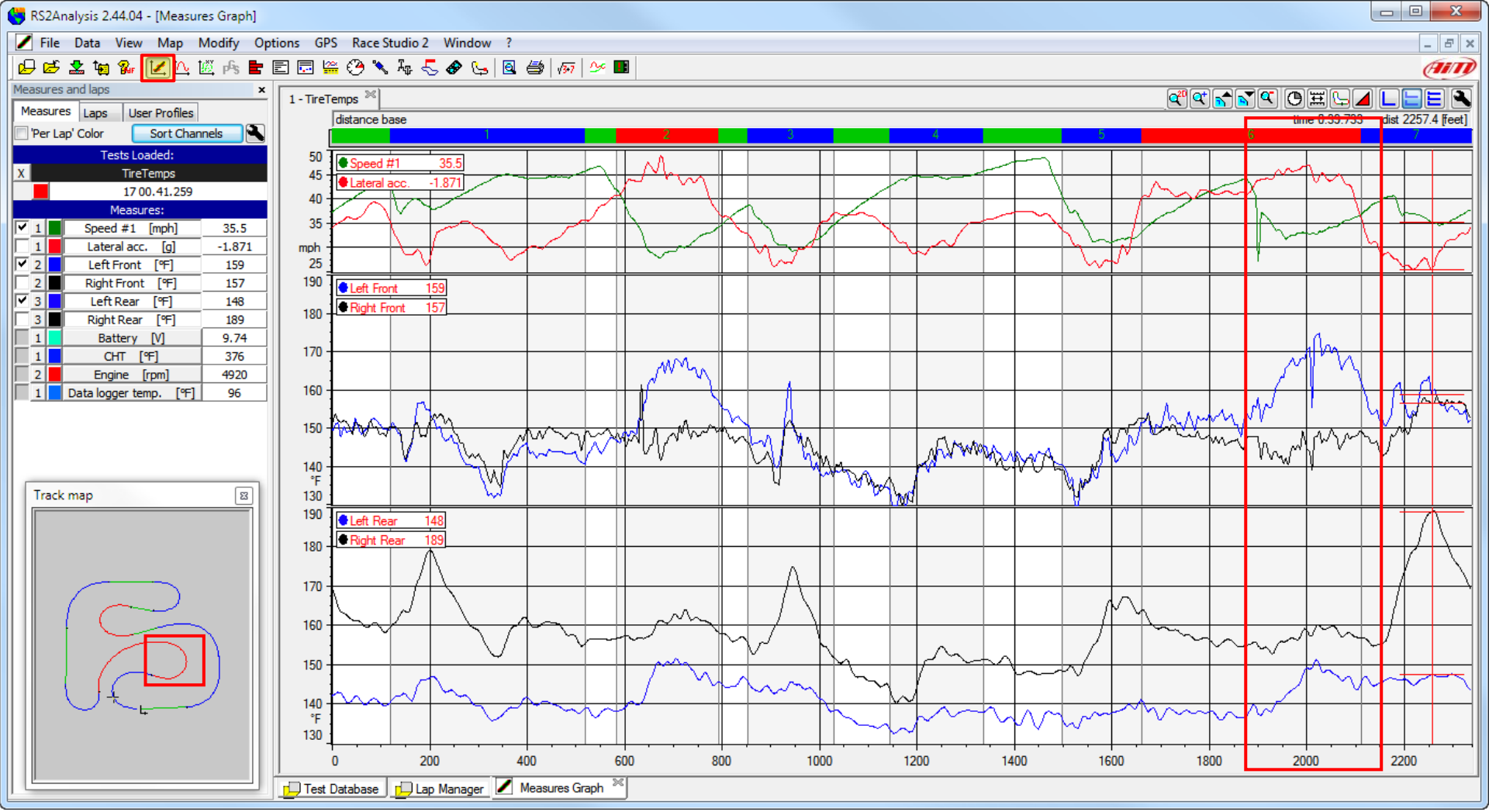
TURN 1 IS A LEFT TURN. THE LATERAL G'S SHOW A PEAK RIGHT WHERE THE RR TIRE IS LOADED AND PEAKS IN TEMP GROWTH. THE LR TIRE SHOWS ONLY A LITTLE TEMP GROWTH. BOTH FRONT TIRES GROW IN TEMP BUT ABOUT THE SAME AMOUNT.



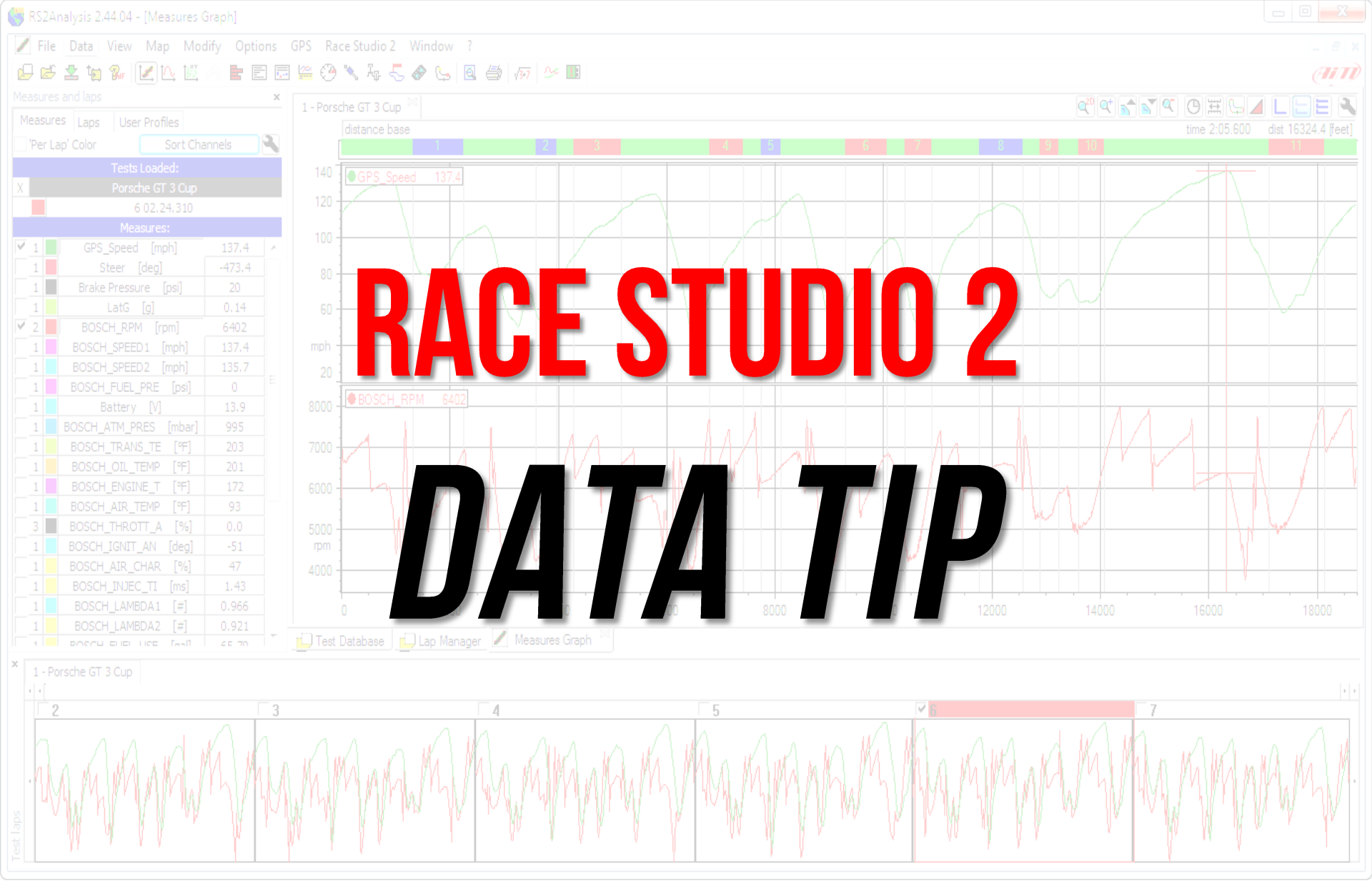
TURN 3 IS A RIGHT TURN. THE LATERAL G'S SHOW A PEAK RIGHT WHERE THE LR TIRE IS LOADED AND PEAKS IN TEMP GROWTH BUT THE RR TIRE SHOWS SOME TEMP GROWTH AS WELL. THE LF TIRE SHOWS A LOT OF TEMP GROWTH AS WELL.



TURN 4 IS A LEFT TURN. THE LATERAL G'S SHOW A PEAK RIGHT WHERE THE RR TIRE IS LOADED AND PEAKS IN TEMP GROWTH. THE LR TIRE SHOW ONLY A LITTLE TEMP GROWTH. BOTH FRONT TIRES SHOW A SUDDEN GROWTH IN TEMP BUT ABOUT THE SAME AMOUNT.



TURN 7 IS A RIGHT TURN. THE LATERAL G'S SHOW A PEAK RIGHT WHERE THE LR TIRE IS LOADED AND PEAKS IN TEMP GROWTH. THE RR TIRE ALSO SHOWS SOME TEMP GROWTH. THE LF TIRE SHOWS A STRONG GROWTH IN TEMP INDICATING A HEAVY UNDERSTEER. BOTH FRONT TIRES SHOW A SUDDEN DROP IN TEMP AT THE APEX.



DECEMBER 2012

DATA TIP

SPLIT AND CHANNEL REPORT S

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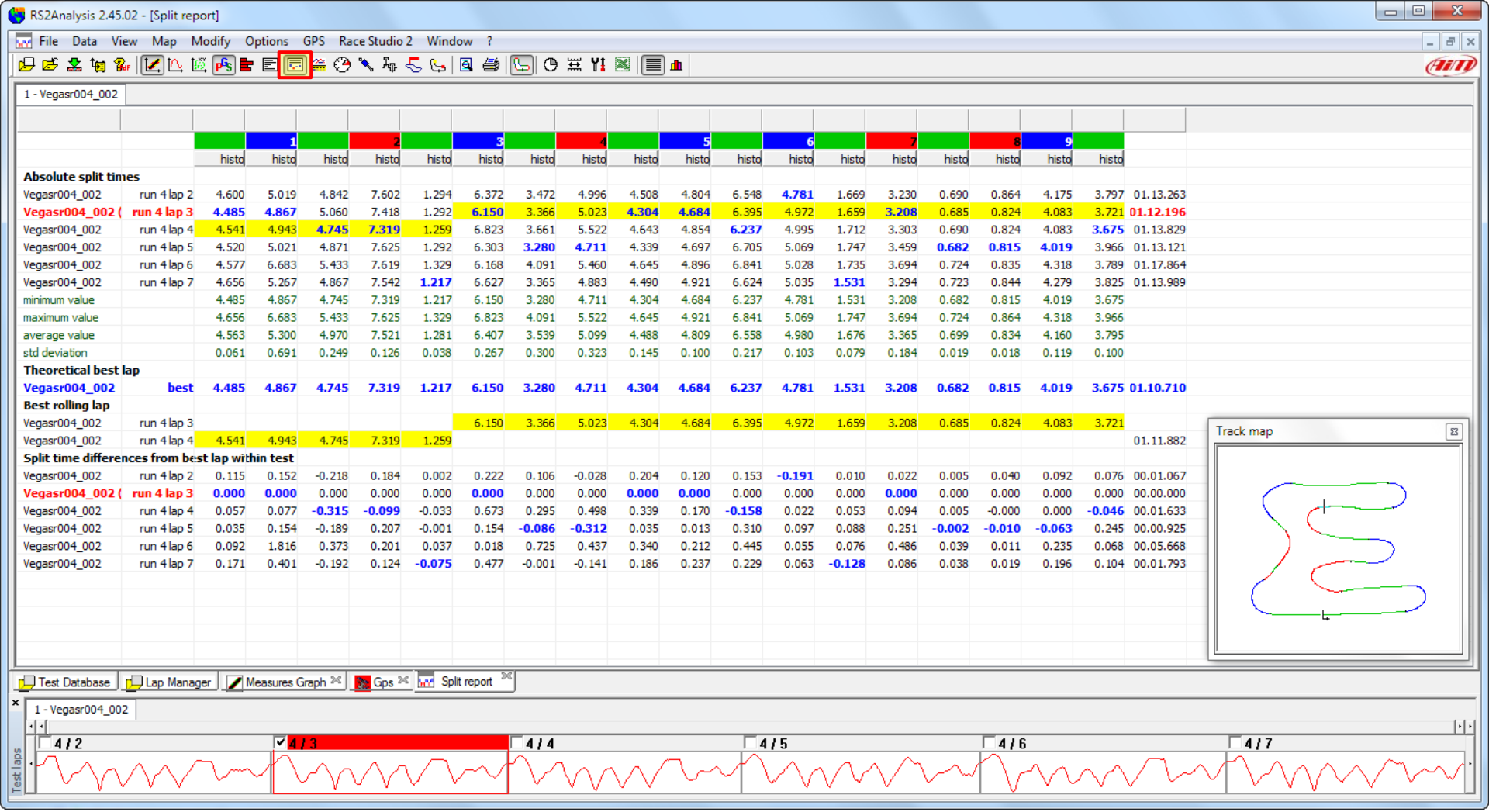
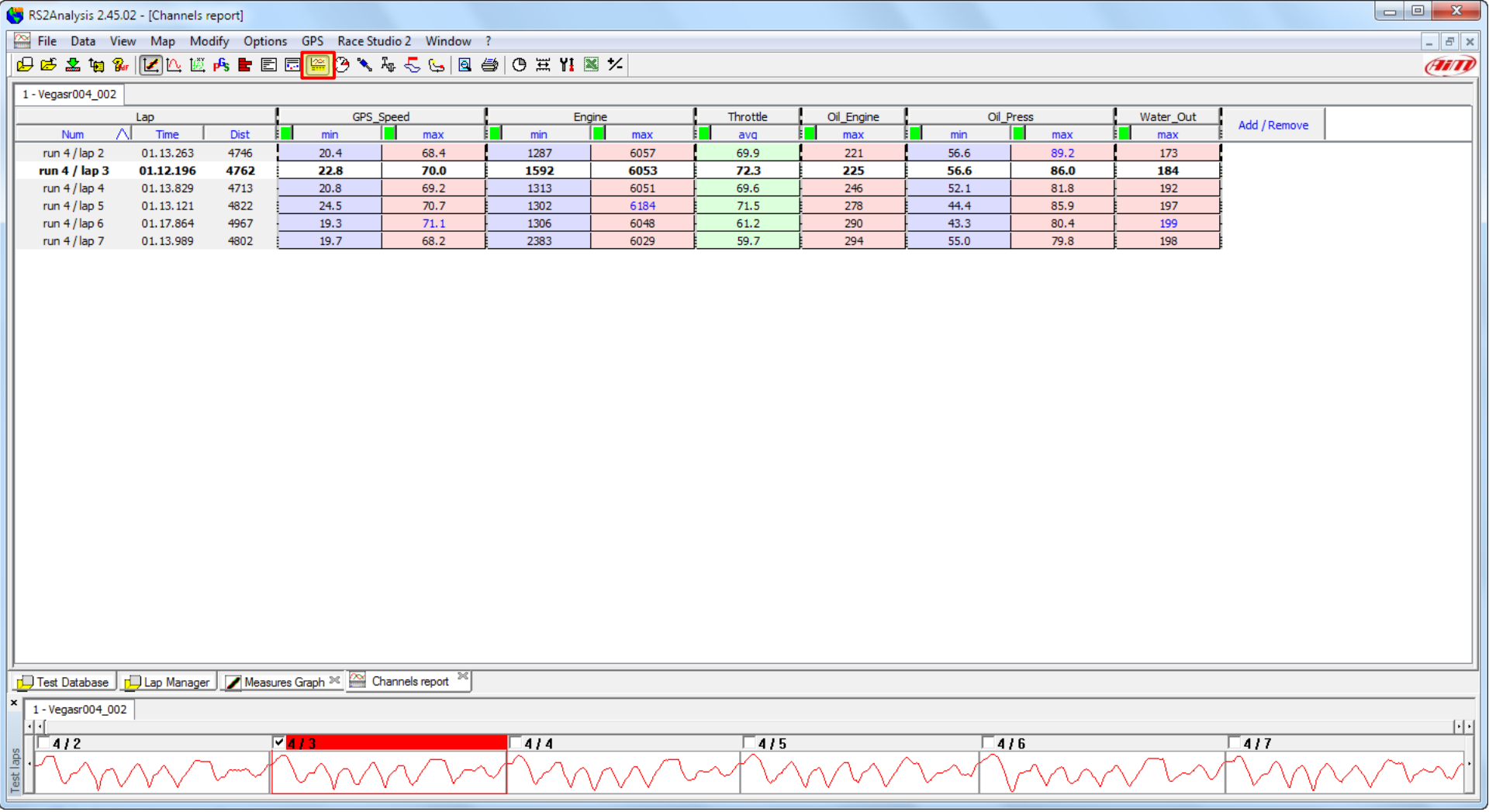


SPLIT REPORTS ARE A VALUABLE TOOL. THEY CALCULATE SEGMENT TIMES FOR EACH LAP BASED ON THE SEGMENTS OF THE ACTIVE TRACK MAP. ALSO PROVIDED ARE THE "BEST ROLLING LAP" AND THE "THEORETICAL BEST LAP". THE BLUE SEGMENT TIMES ARE THE BEST TIMES IN THAT SEGMENT FOR THE ENTIRE TEST.



CHANNEL REPORTS ARE A VALUABLE TOOL. THEY ARE USER DEFINABLE AND PROVIDE MIN, MAX, AVG, ETC. VALUES FOR EACH CHANNEL FOR EACH LAP. ALL MIN OR MAX VALUES ARE HYPERLINKED AND IF CLICKED ON TAKE YOU BACK TO THE MEASURES GRAPH AND PLACE THE CURSER RIGHT WERE THE MIN OR MAX VALUE OCCURRED.

BY USING THE FRONT RIGHT AND LEFT WHEELS SPEEDS OF THIS FRONT WHEEL DRIVE CAR, WE CAN SEE THE ABS CONTROLLED LOCKUP UNDER BRAKING AND THE INSIDE TIRE SPIN UNDER ACCELERATION. ALSO SHOWN IS THE BRAKING PRESSURE AND THE THROTTLE POSITION SO WE CAN HELP DETERMINE WHY THIS HAPPENED. SOLO DL WITH THE FIAT ECU CONNECTION.

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WHY USE DATA ACQUISITION?

DRIVEN WHEEL SPEED DIFFERENCES

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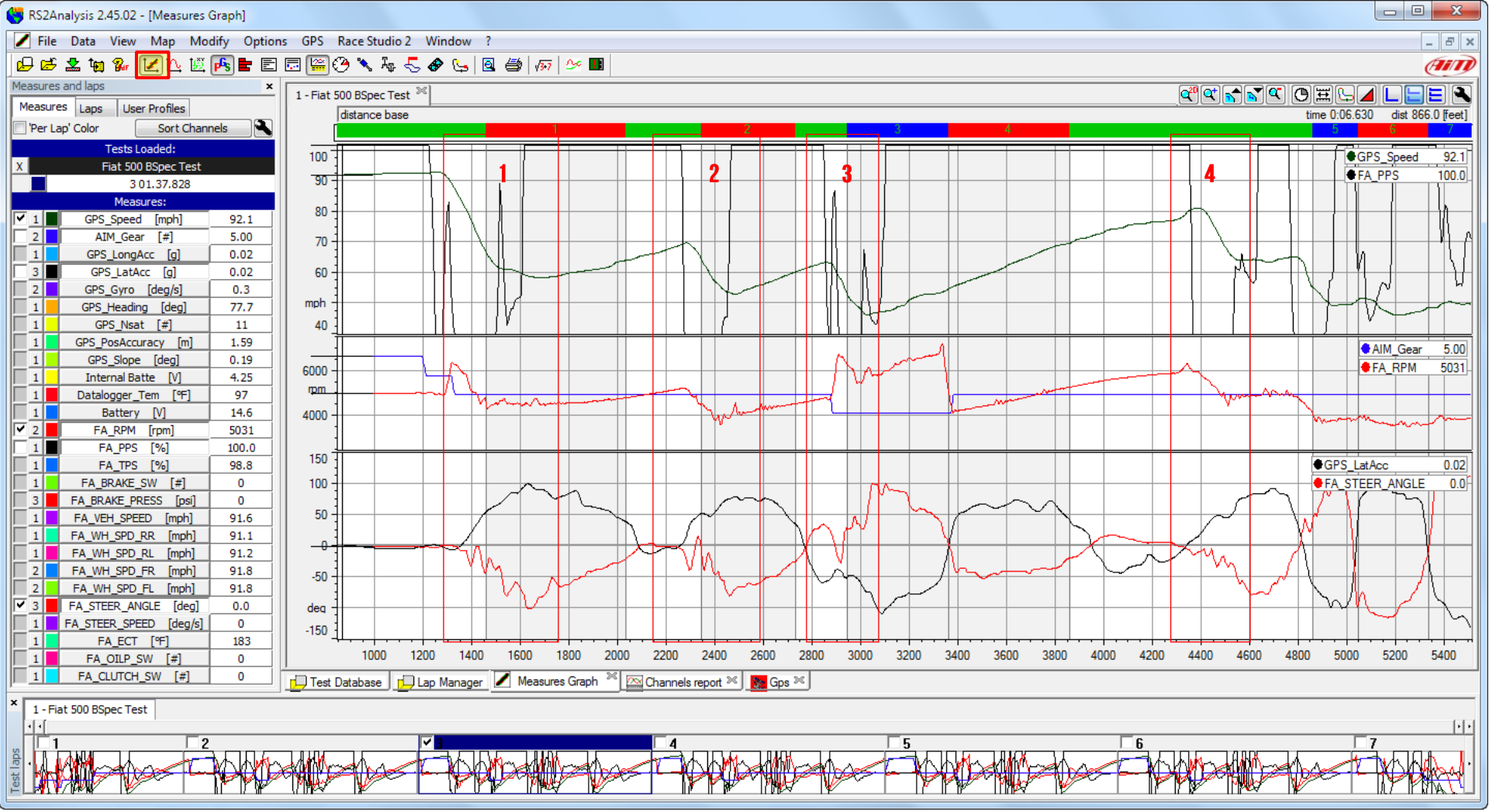

IN THESE 4 HIGHLIGHTED AREAS, THIS FRONT WHEEL DRIVE CAR IS UNSTABLE/LOOSE UNDER BRAKING. BUT VERY NEUTRAL FROM THE MIDDLE OUT UNDER HARD ACCELERATION.
SOLO DL WITH THE FIAT ECU CONNECTION.

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WHY USE DATA ACQUISITION?

BALANCE UNDER BRAKING

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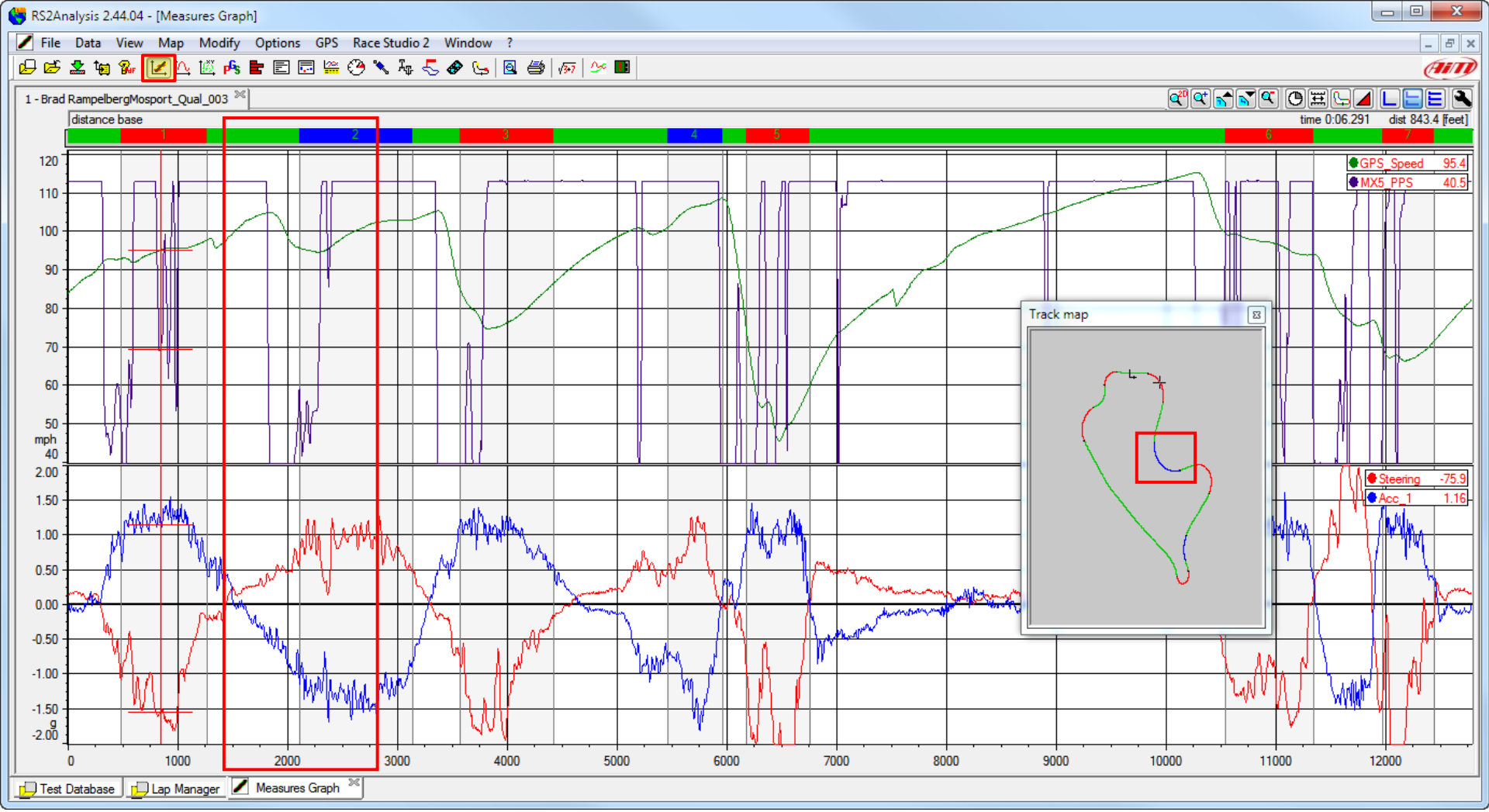
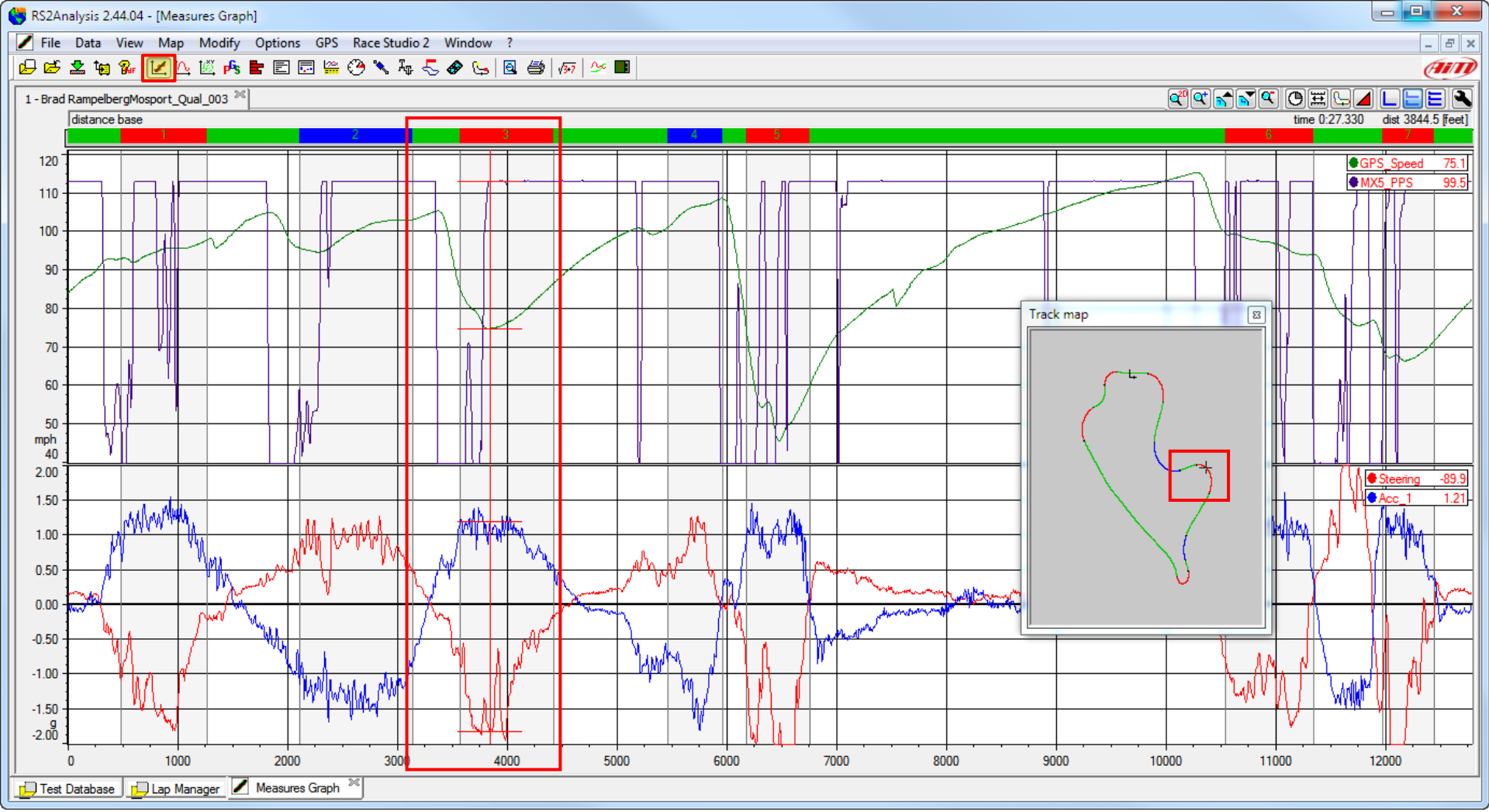


WITH A STEERING AND LATERAL ACCELERATION SENSORS, IDENTIFYING UNDER/OVERSTEER AREAS CAN BE SEEN. HERE WE ALSO HAVE A THROTTLE POSITION TO HELP UNDERSTAND WHY THE UNDER/OVERSTEER HAPPENED. INSIDE THE RED HIGHLIGHTED AREA; THE ENTRY IS OK BUT AS SOON AS HE WENT TO FULL THROTTLE, SNAP OVERSTEER.



ENTRY HAS SOME UNDERSTEER BUT AS SOON AS DRIVER GOES TO FULL THROTTLE, SNAP OVERSTEER.

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WHY USE DATA ACQUISITION?

OVER/UNDERSTEER

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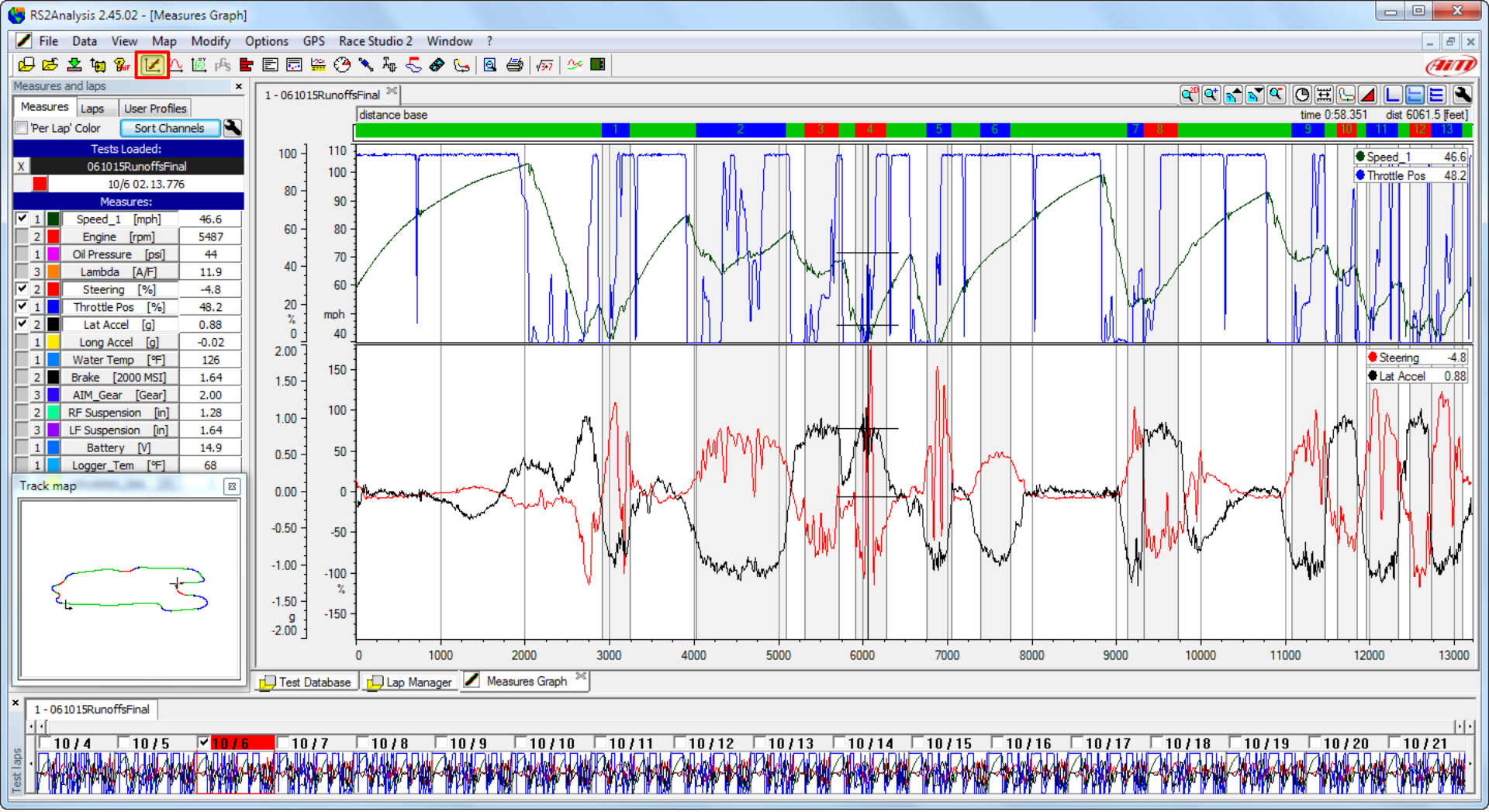
ENTRY IS OK BUT AS SOON AS HE WENT TO THROTTLE, SNAP OVERSTEER. DRIVER WAS COMPLAINING ABOUT AN UNDERSTEER IN THE 2ND PART OF THIS CORNER. WHEN WE FIXED THE ENTRY OVERSTEER HIS MIDDLE TO EXIT UNDERSTEER GOT BETTER.

NOTICE THE GENERAL OVERSTEER AND THE RESULTING DECREASE OF OVERALL GRIP. NOTICE THE TRAIL BRAKING OVERSTEER THAT QUICKLY TURNS INTO UNDERSTEER.



OVERSTEER IN WET CONDITIONS. I COUNTED 22 COUNTERSTEER EFFORTS DURING THIS SINGLE LAP.

OVERSTEER IN WET CONDITIONS. HERE IN TURN 5 IT LOOKS LIKE HE NEARLY LOST THE CAR WITH OVER 190 DEGREES OF COUNTER STEER OVER 1.6 SECONDS AND 106FT.

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VEHICLE IMPROVEMENT

WET WEATHER HANDLING

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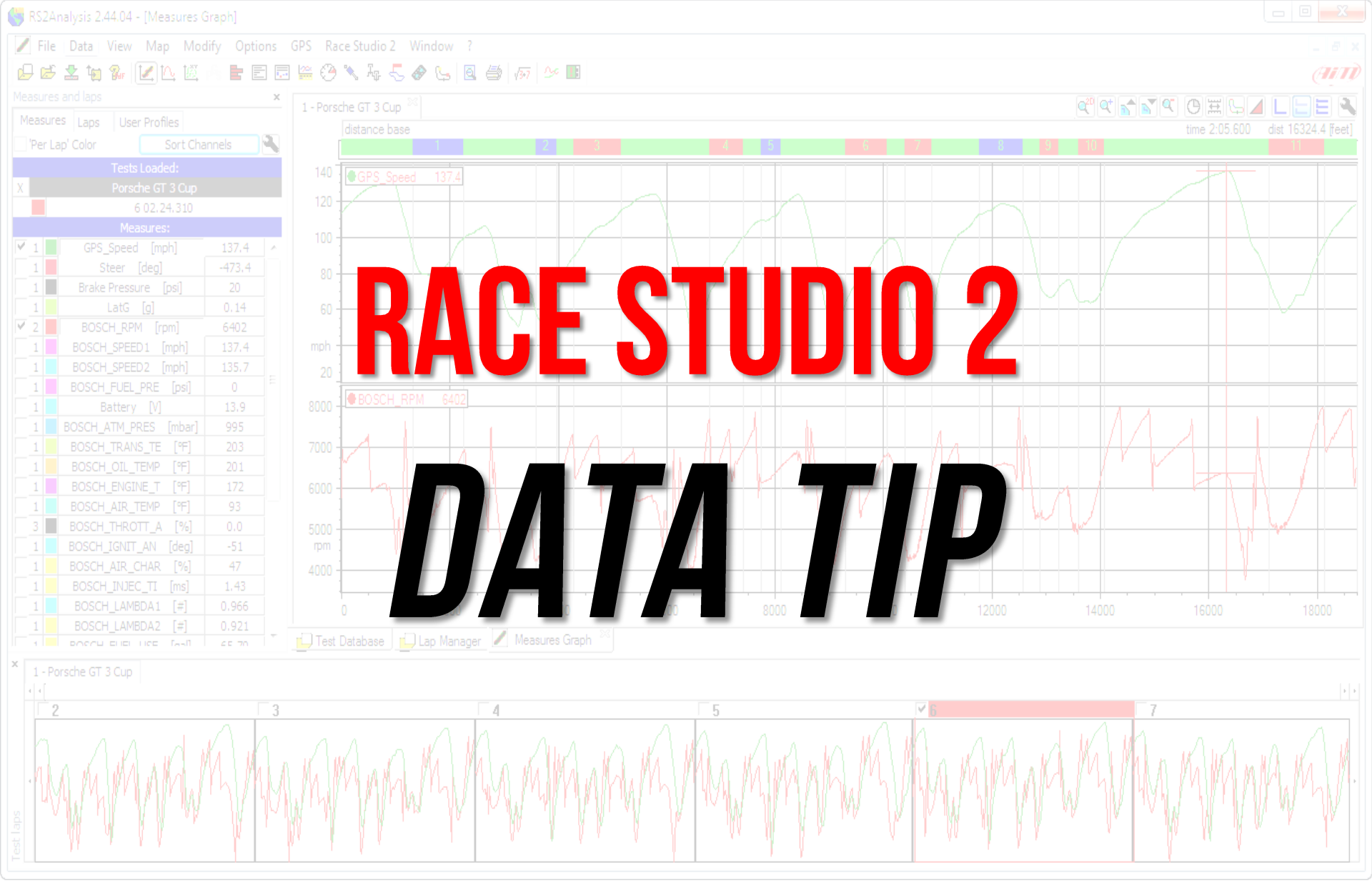
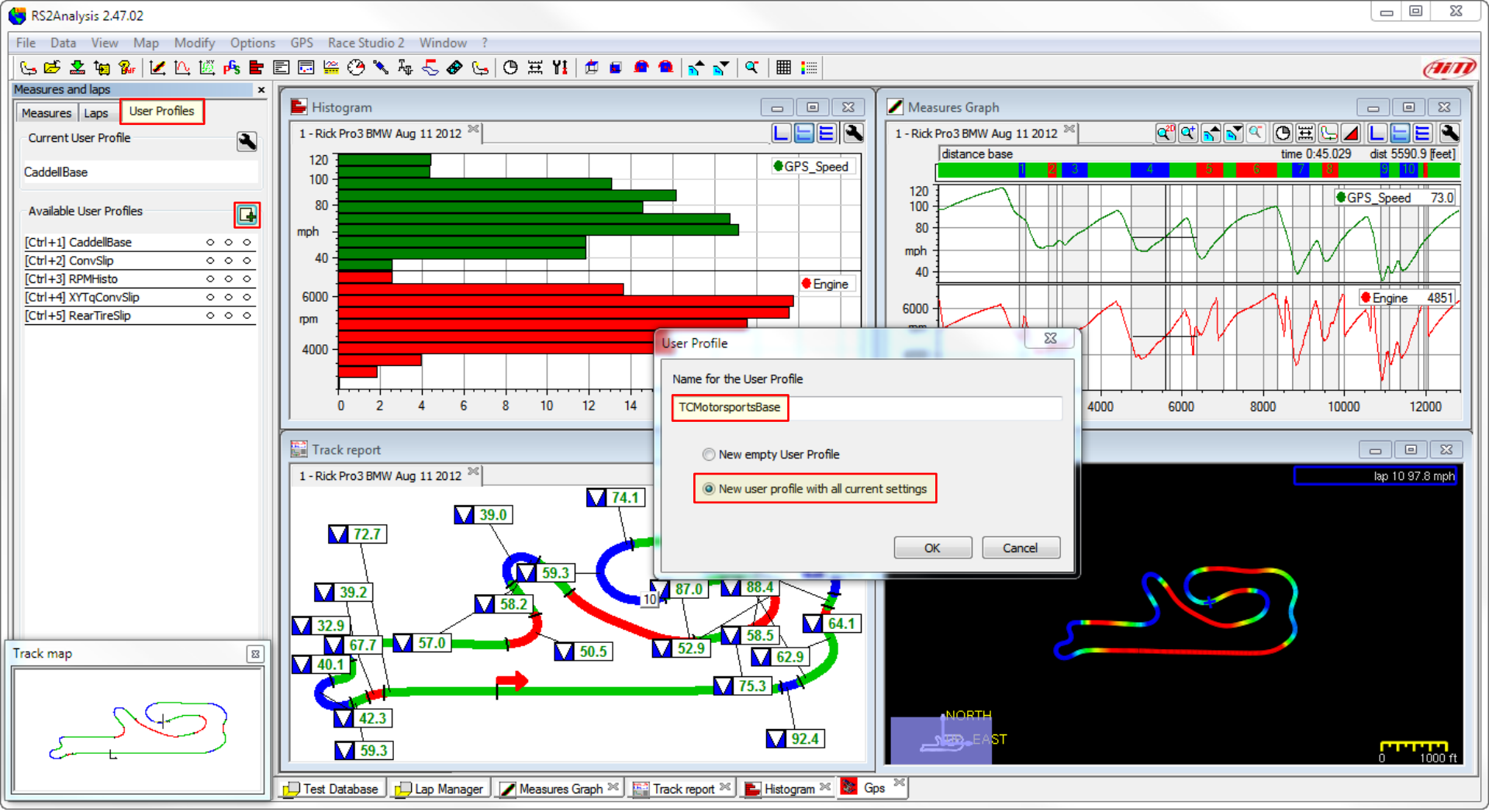
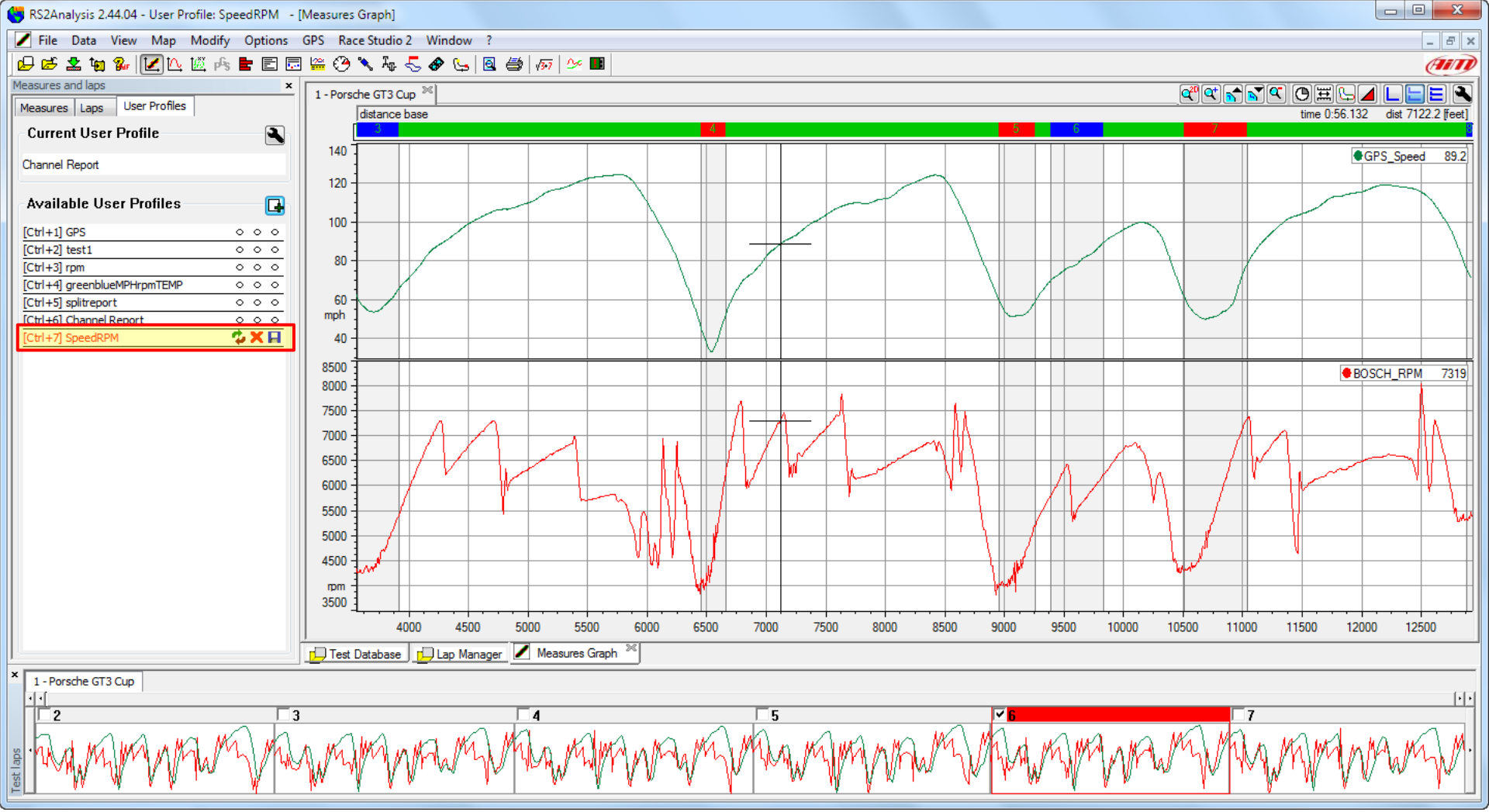


RACE STUDIO 2

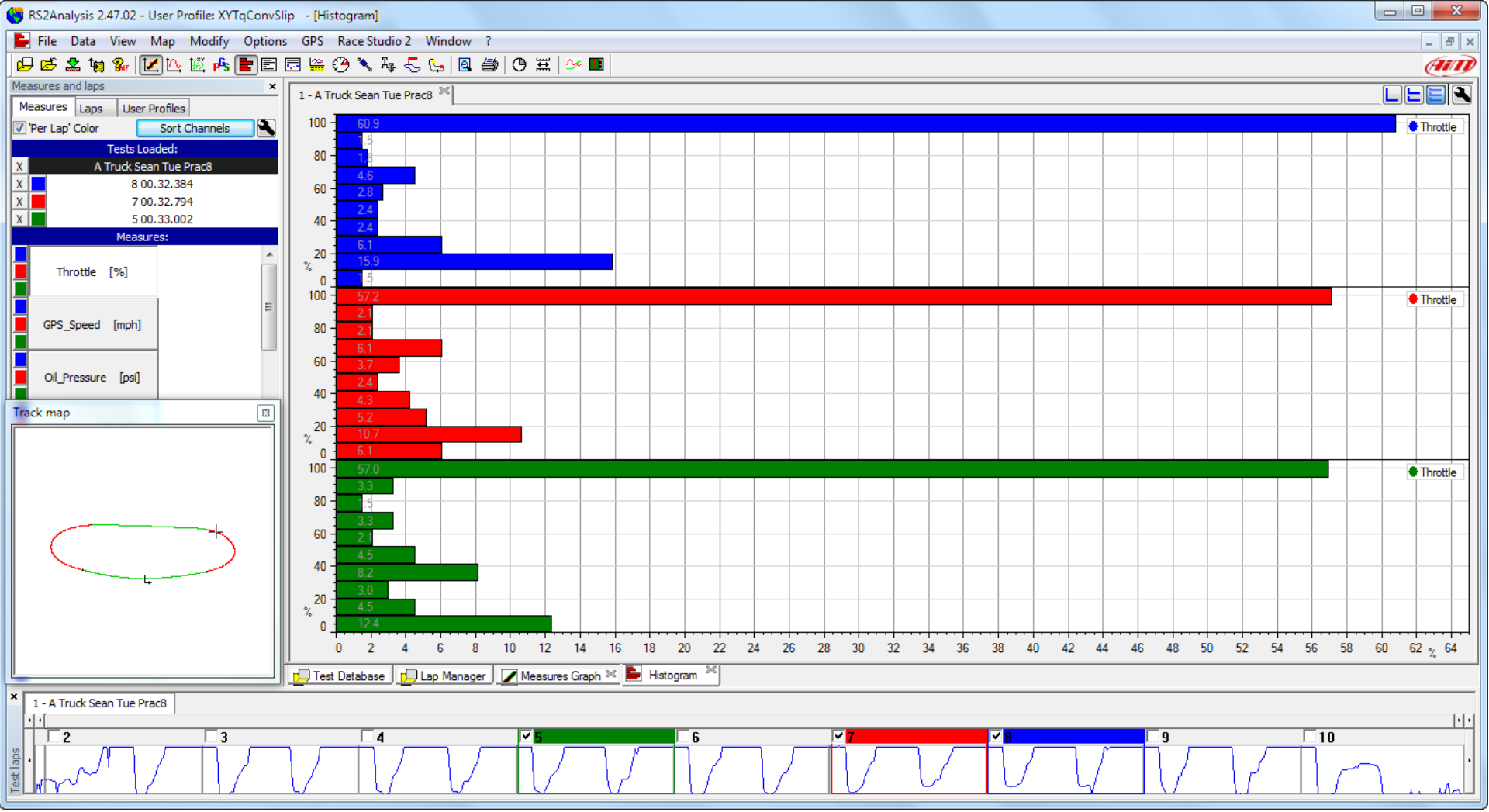
DATA TIP



USER PROFILES ARE USER DEFINED SHORTCUTS, QUICK PRE-DEFINED WAYS TO LOOK AT DATA WITH KEYBOARD SHORTCUTS, EXPORTABLE, EASY TO UPDATE
MAKE SURE YOU USE THE DEFAULT "NEW USER PROFILE WITH ALL CURRENT SETTINGS".



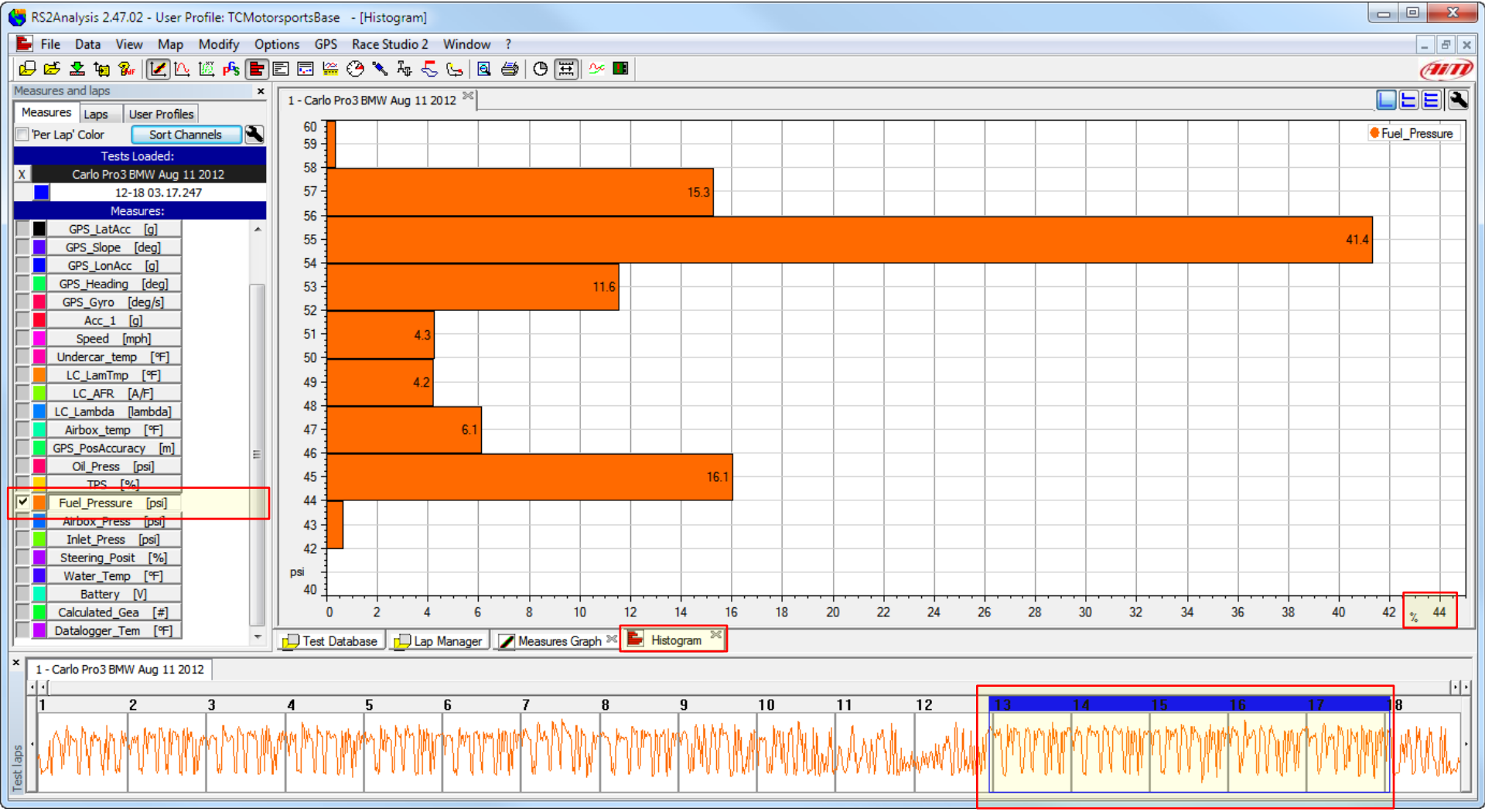
NOW YOUR NEW USER PROFILE IS STORED IN THE LIST AND CAN BE ACTIVATED IN SEVERAL WAYS; BY THE LISTED SHORTCUT OF "CTRL±7", BY CLICKING ON THE USER PROFILE NAME AND THEN CLICKING ON THE RED AND GREEN ARROWS, OR BY JUST DOUBLE CLICKING ON THE USER PROFILE NAME. HERE YOU CAN ALSO DELETE OR SAVE ANY CHANGES TO YOUR USER PROFILE.



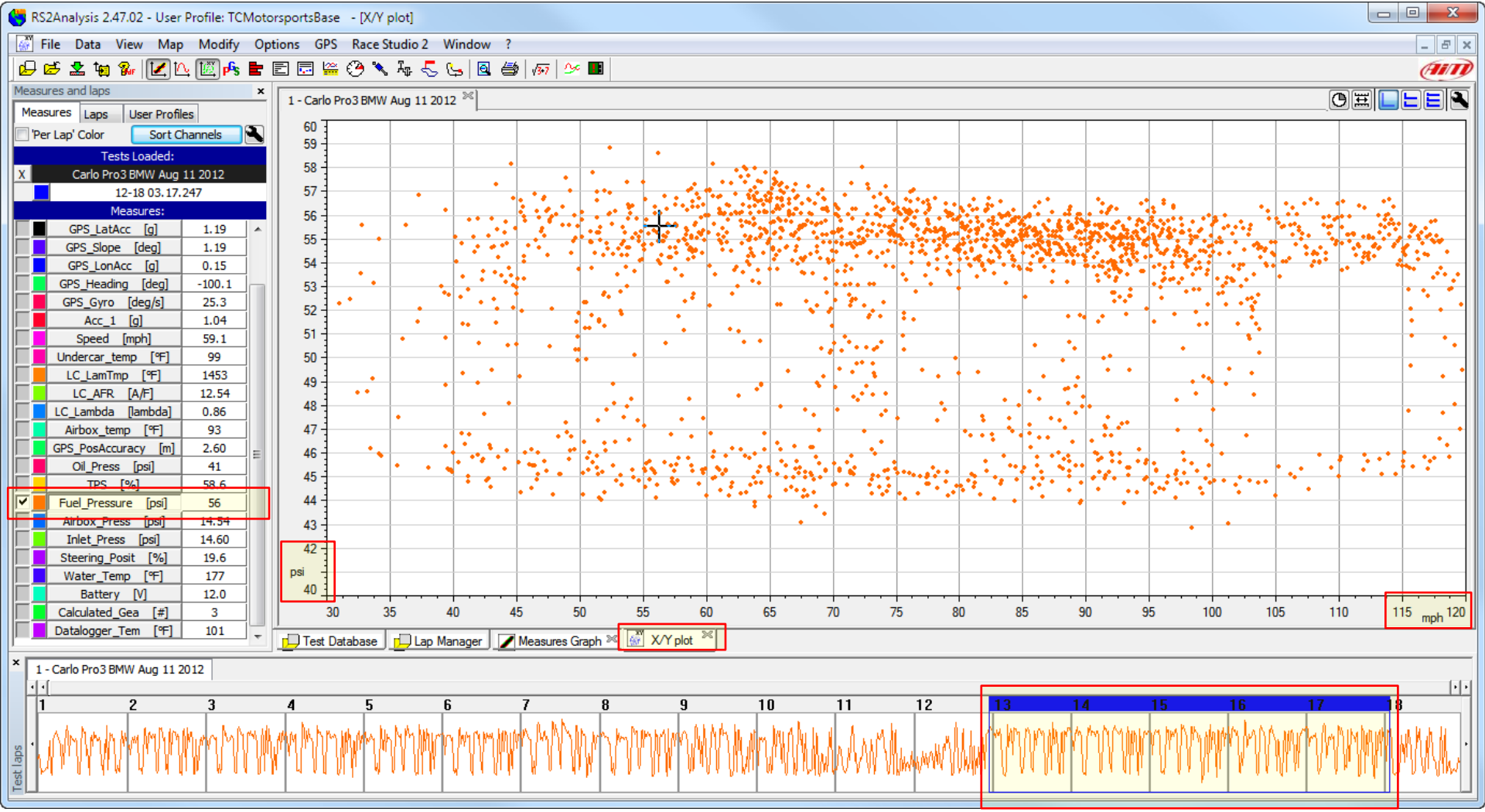
DATA ANALYSIS: HISTOGRAM VIEW OF THROTTLE POSITION

THE DATA IS VIEWED COMPARING 3 LAPS OF DATA AND THE % OF THE LAP THE DRIVER WAS AT FULL THROTTLE

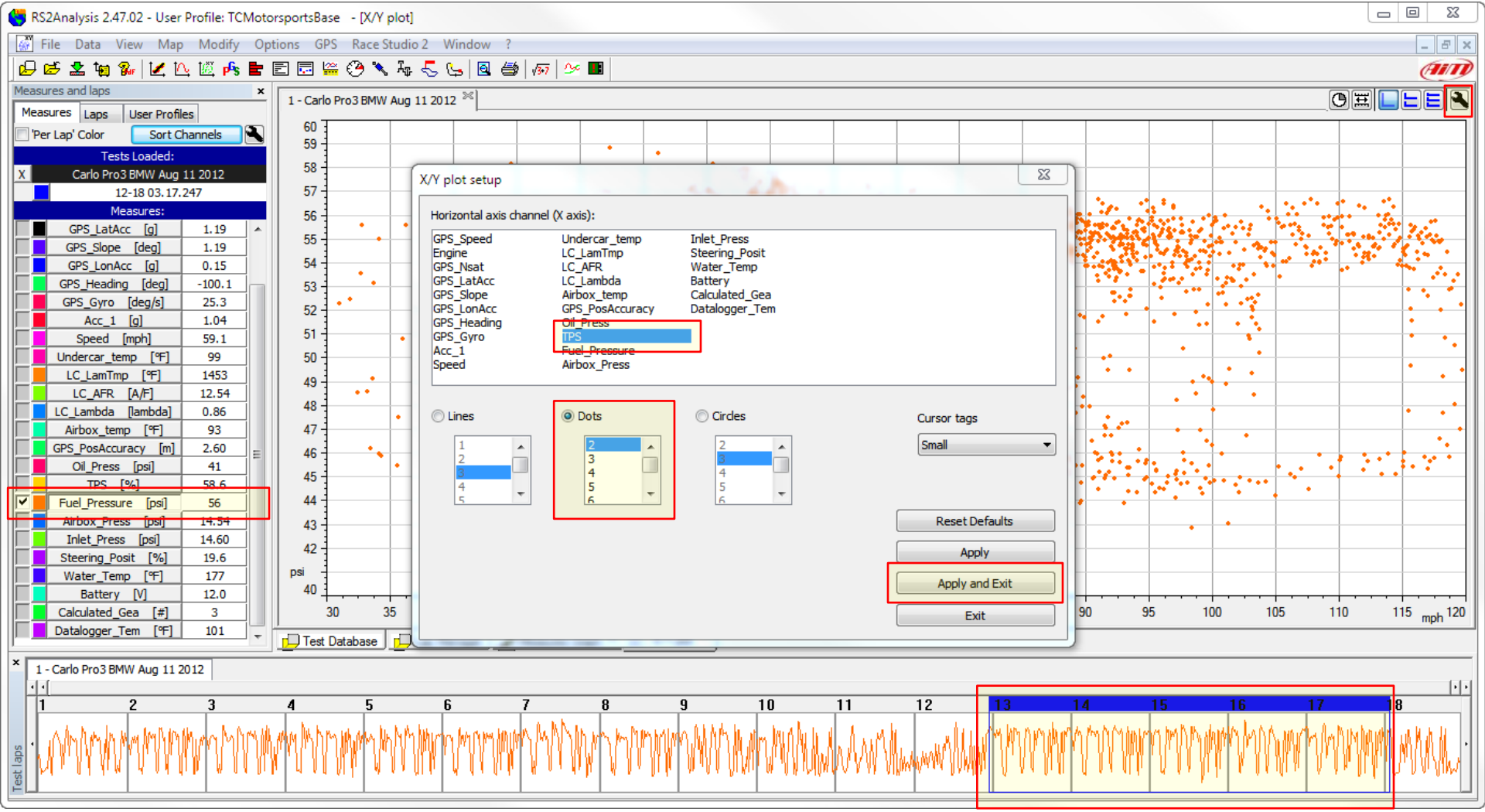
THE FASTEST LAP EQUALS THE HIGHEST % OF TIME AT FULL THROTTLE



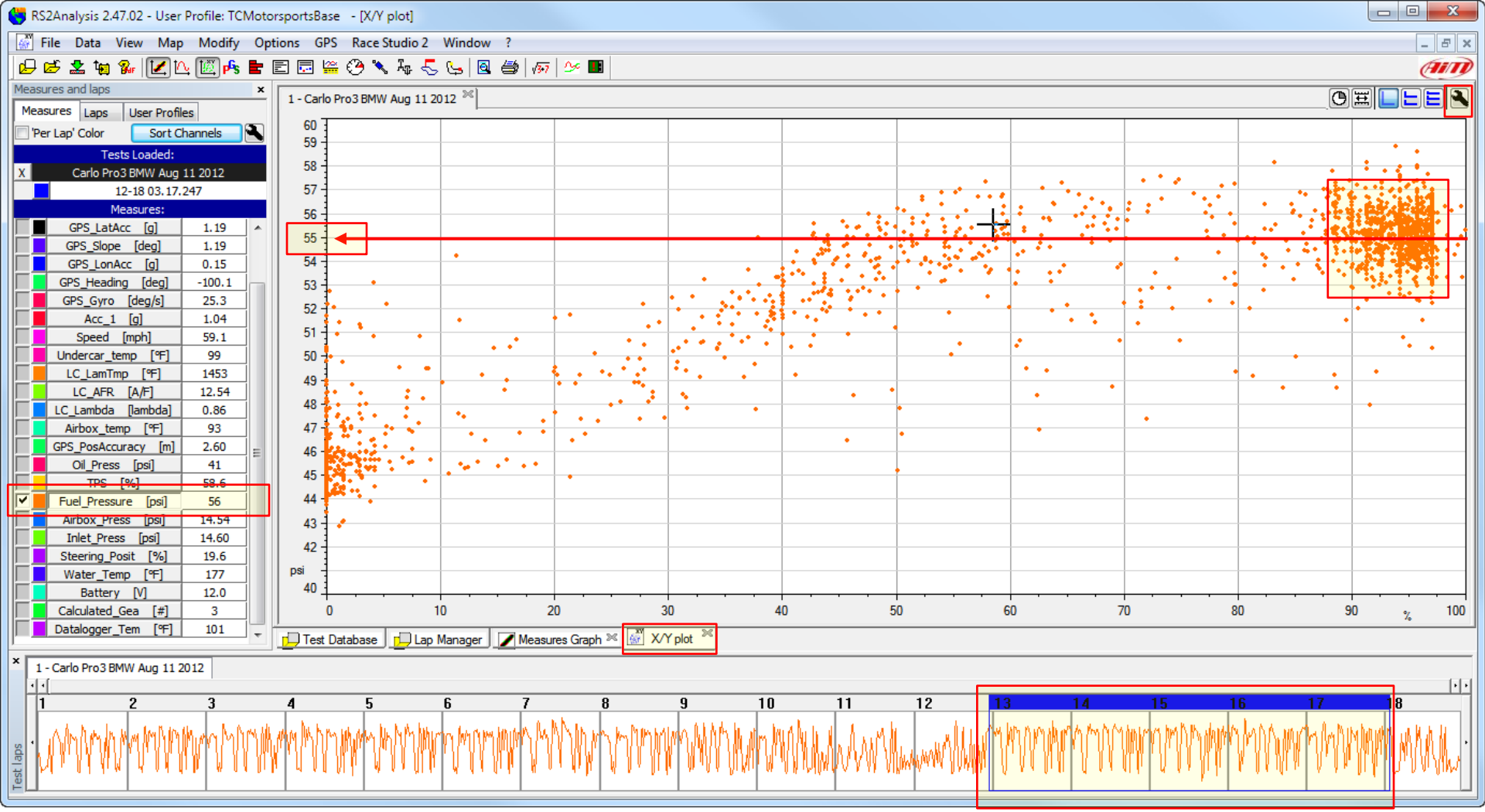
HISTOGRAMS: HERE WE ARE LOOKING AT FUEL PRESSURE AND SEE THAT THE ENGINE HAS 54-56PSI FOR THE LARGEST % OF TIME. BUT AS ALWAYS THERE IS MORE INFORMATION WE WOULD WANT ABOUT WHEN AND WHY. LETS LOOK AT THE DATA IN ANOTHER WAY FOR MORE INFORMATION.



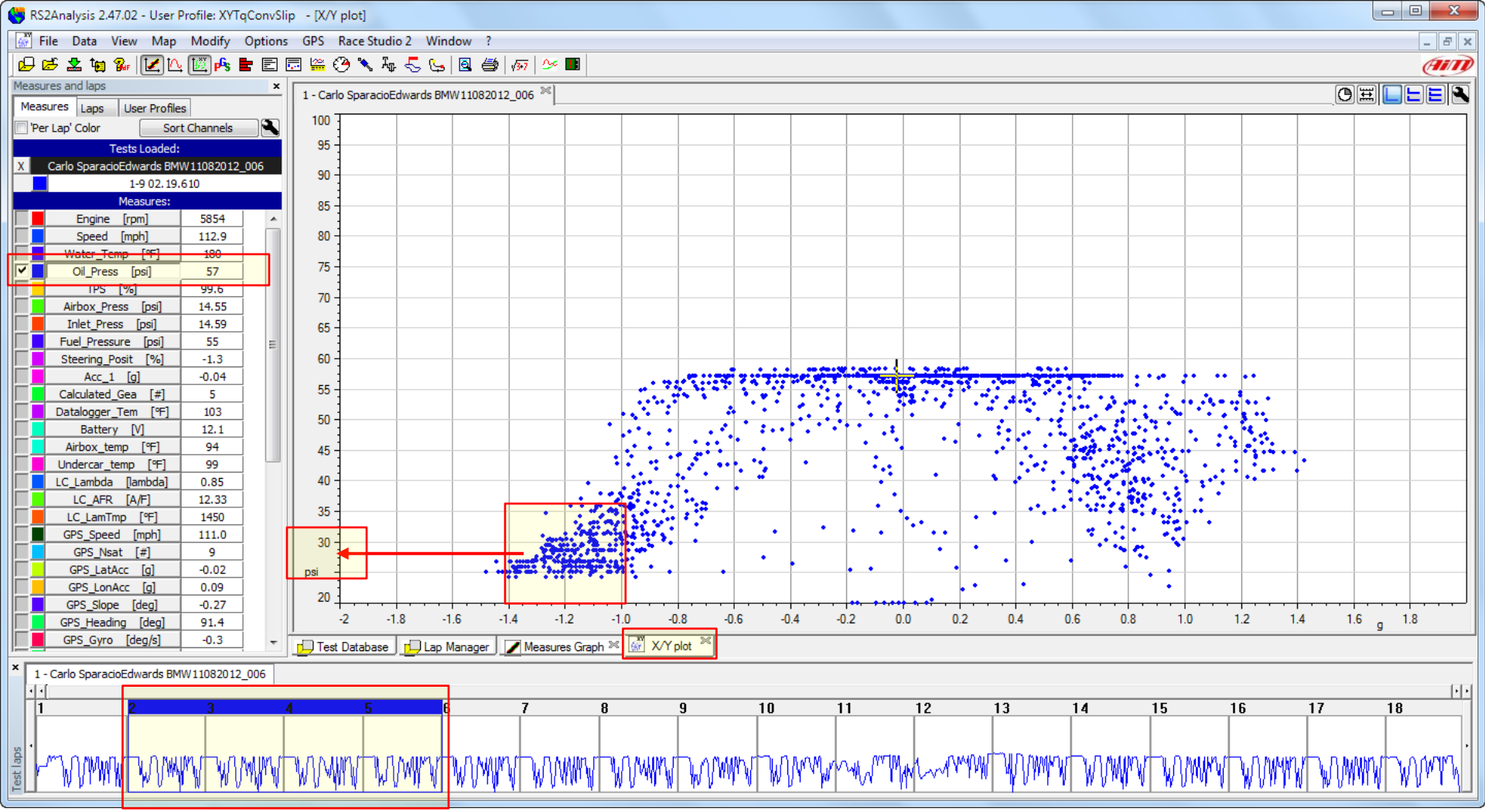
X/Y GRAPHS: THESE CAN BE POWERFUL TOOLS FOR LOOKING AT HOW ONE CHANNEL REACTS/AFFECTS WITH ANOTHER CHANNEL. IN THE PREVIOUS FUEL PRESSURE HISTOGRAM SLIDE, THE SHOWN DATA DID NOT TELL US WHAT WE NEEDED TO KNOW. HERE WE START TO SHOW FUEL PRESSURE VS. THROTTLE POSITION. I STARTED THE X/Y FUNCTION WITH 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.



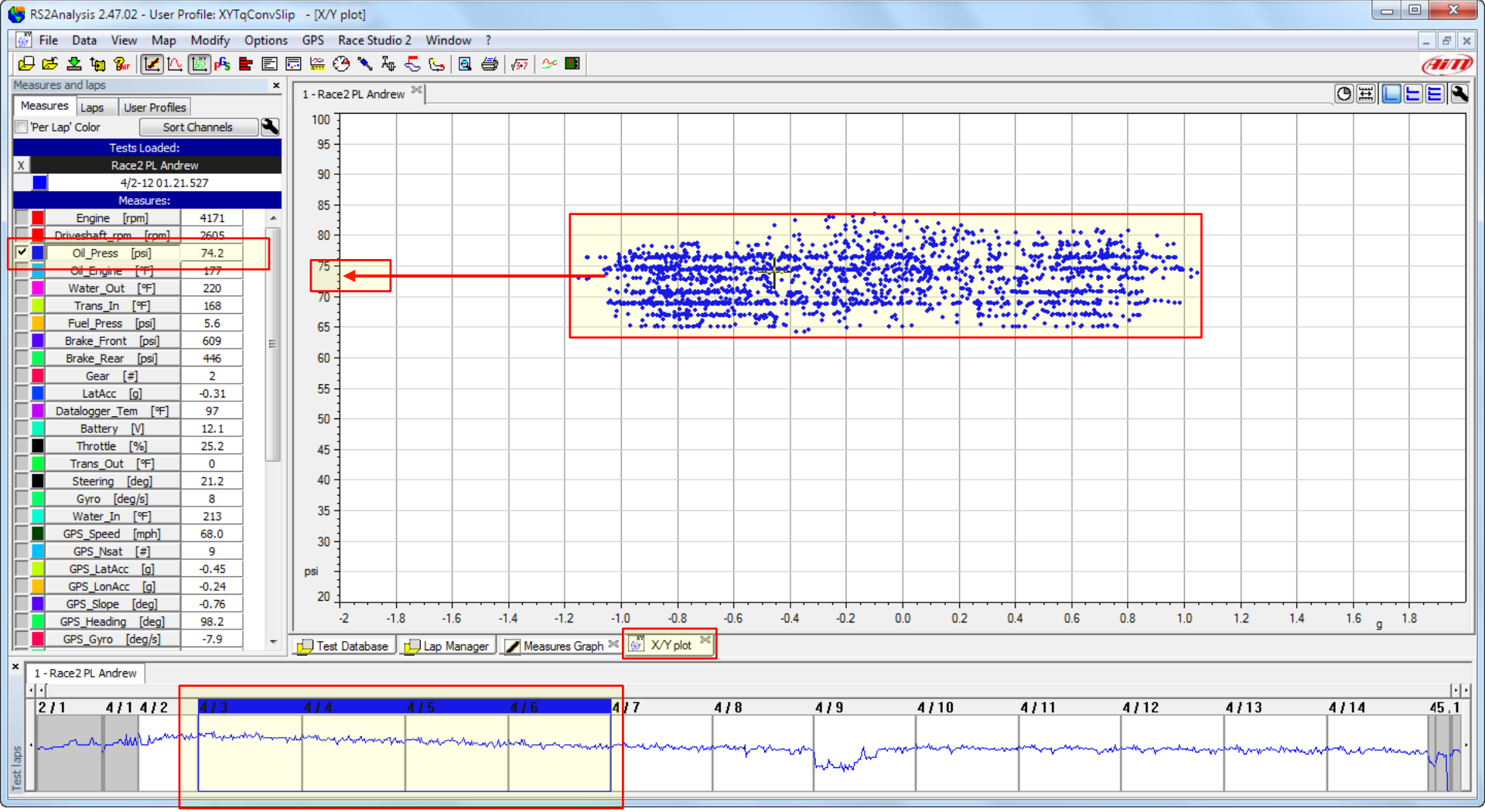
X/Y GRAPHS: FIRST CLICK ON THE SETTINGS ICON IN THE UPPER RIGHT CORNER TO OPEN THE X/Y PLOT SETUP BOX. THEN SELECT THE X AXIS CHANNEL, IN THIS CASE TPS OR THROTTLE POSITION. HERE YOU CAN ALSO SELECT IF YOU WANT THE OUTPUT IN LINES, DOTS, OR CIRCLES AND THE SIZE. HERE WE HAVE SELECTED DOTS AT A SIZE OF 2. THEN CLICK ON THE "APPLY AND EXIT BUTTON.



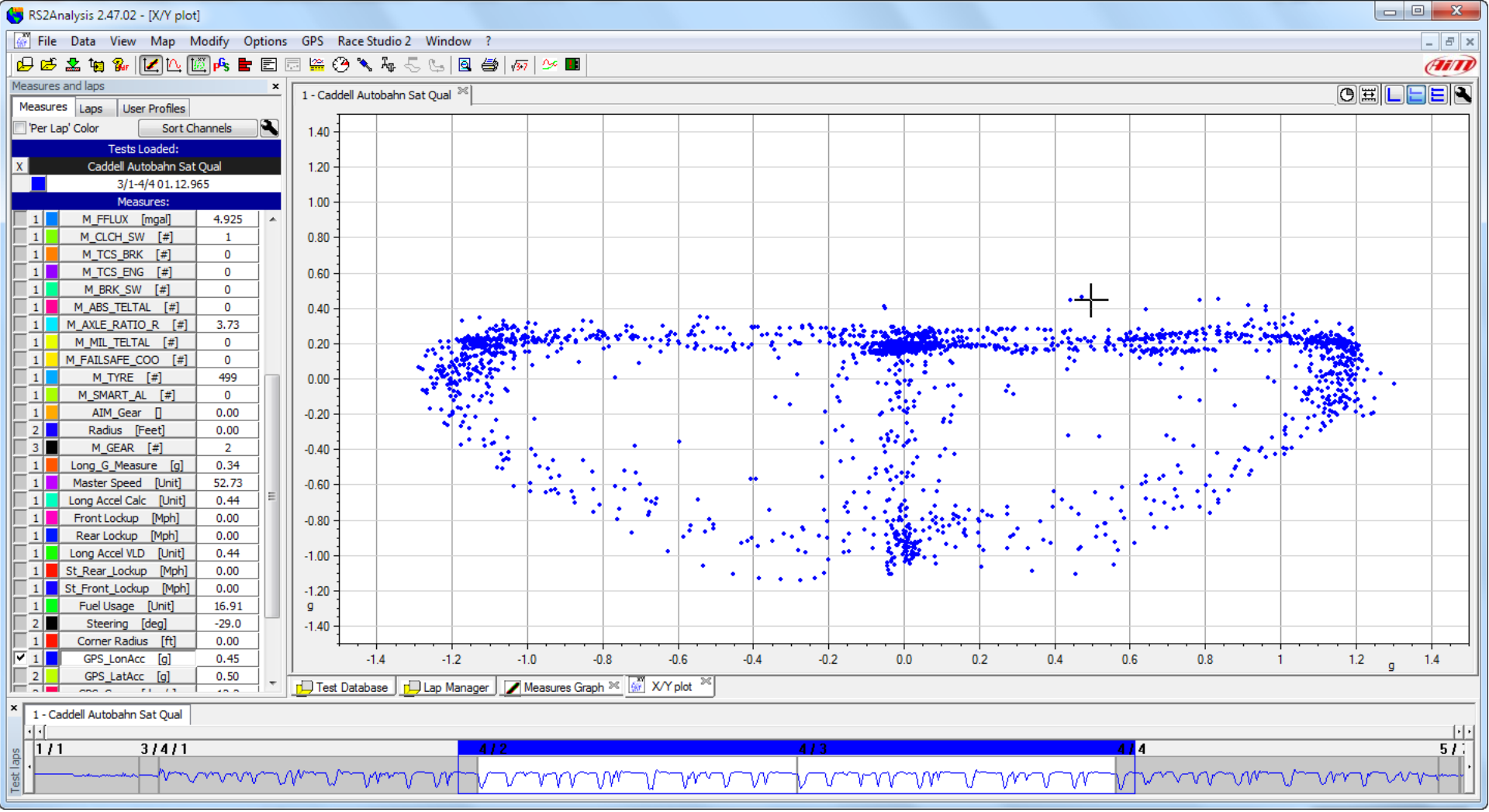
X/Y GRAPHS: HERE WE NOW SEE THE DATA VIEWED AS DOTS SHOWING WHAT FUEL PRESSURES WERE AND WHAT THE THROTTLE POSITIONS WERE. I SUPPOSE THAT THE MOST IMPORTANT TIME OF THE FUEL PRESSURES ARE WHEN THE DRIVER IS AT FULL THROTTLE AND I HAVE DRAWN A BOX AROUND THE MASS OF POINTS AT NEAR OR FULL THROTTLE AND THEN DREW A LINE OVER TO THE PRESSURE VALUES. AGAIN THIS IS A NICE LARGE DATA SAMPLE OF 5 LAPS.



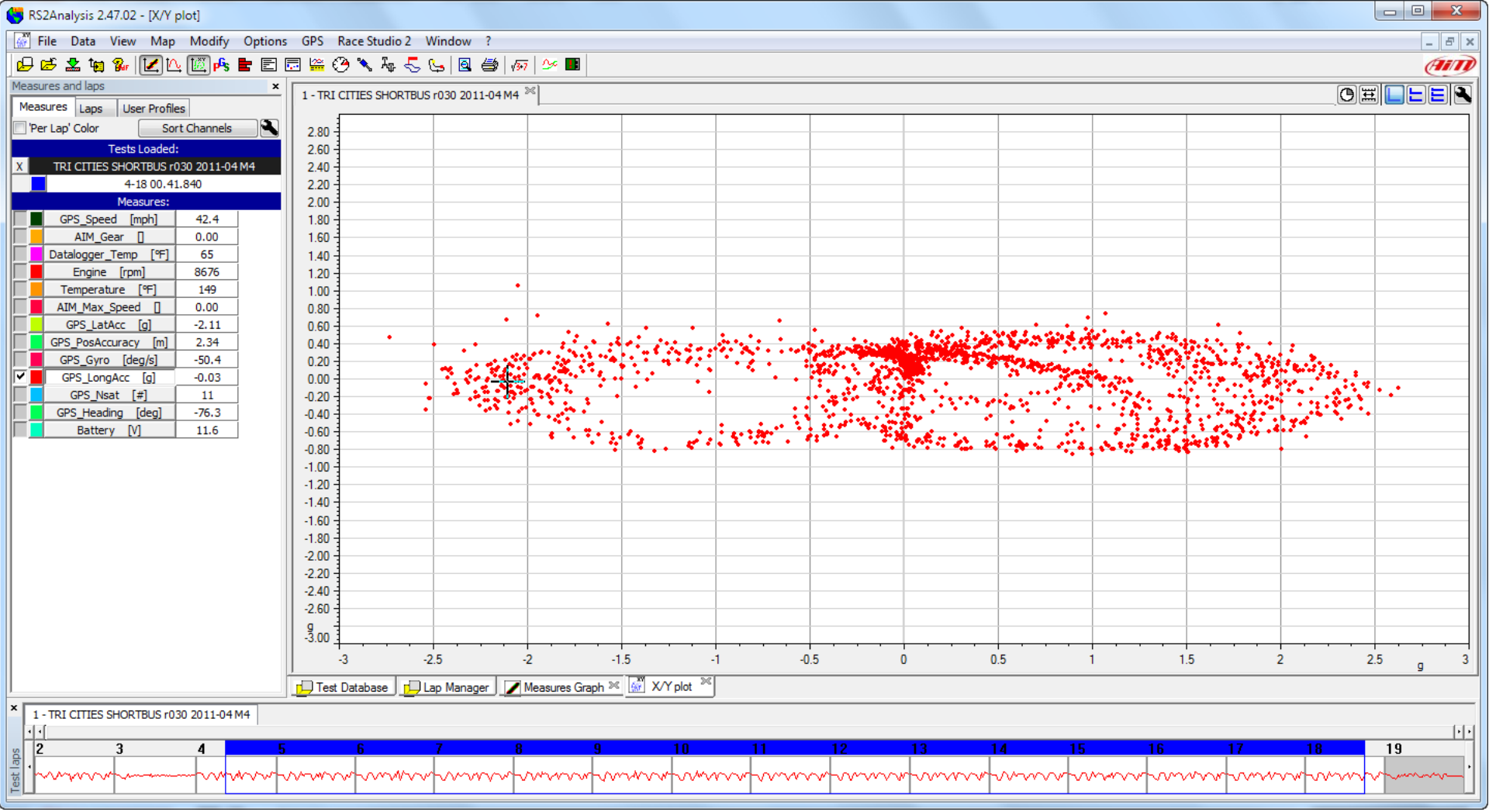
X/Y GRAPHS: LETS LOOK AT SOME OTHER EXAMPLES... OIL PRESSURE VS. LATERAL G'S. CONCERNED WITH ANYTHING IN THE LOWER LEFT AND RIGHT CORNERS AS THAT SHOWS HIGH G FORCES AND LOW OIL PRESSURES. WET SUMP MOTORS WILL ALWAYS HAVE SOME OF THIS EFFECT.



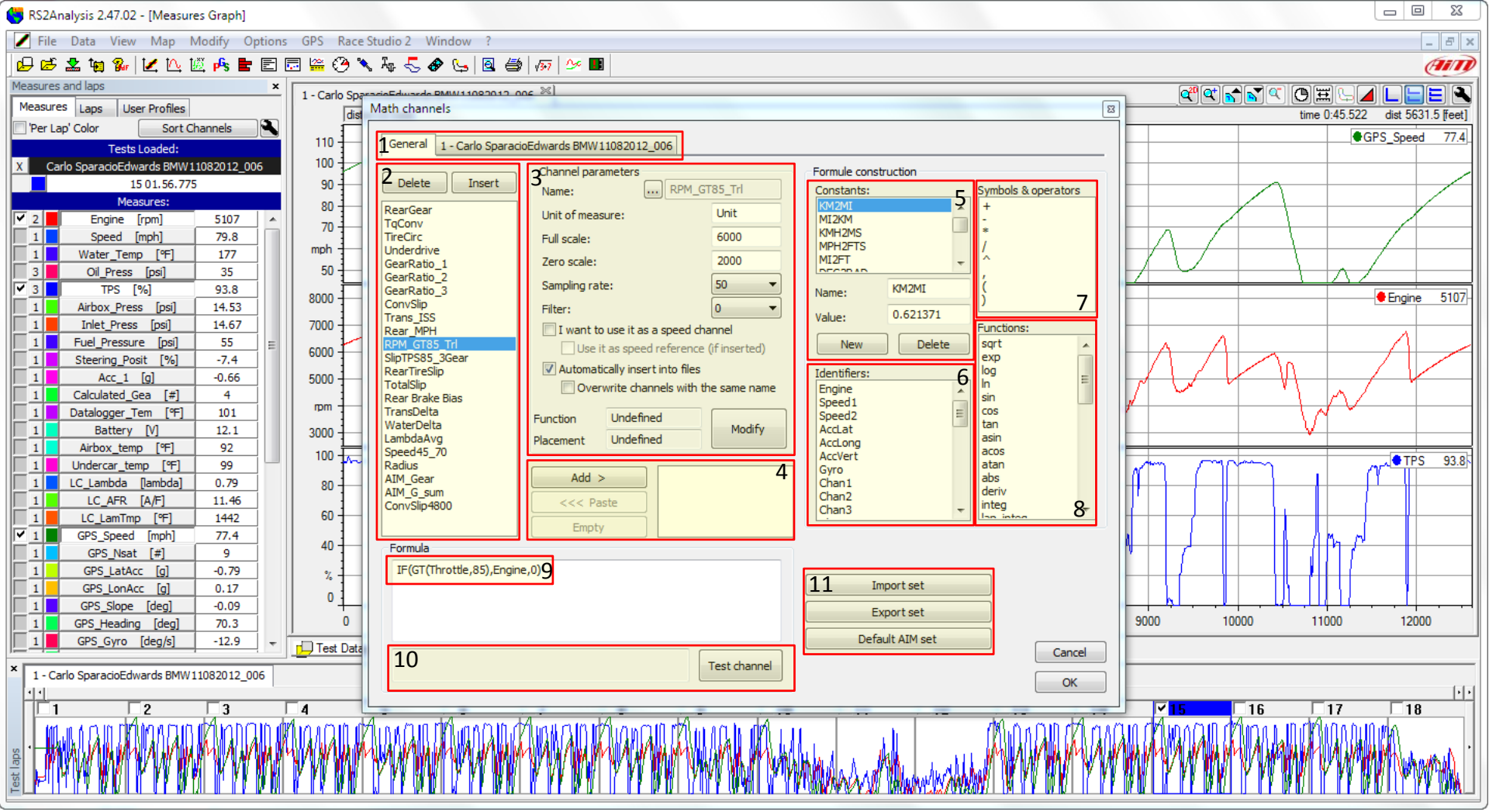
X/Y GRAPHS : OIL PRESSURE VS. LATERAL G'S. DRY SUMP MOTOR. BIG DIFFERENCE.



X/Y GRAPH YOU CAN PLOT 2 CHANNELS AGAINST ANOTHER. HERE WE HAVE PLOTTED GPS_LATERAL ACC VS. GPS LONGITUDINAL ACC AND FIND IF THE DRIVER IS USING MAXIMUM GRIP WHILE TRANSITIONING FROM LONG G'S TO LAT G'S.



X/Y GRAPH HERE IS AN EXAMPLE WHERE THE DRIVER WAS NOT USING MAX NEGATIVE G'S (BRAKING) AND WAS NOT DRIVING THE KART ON THE LIMIT ALL OF THE TIME.

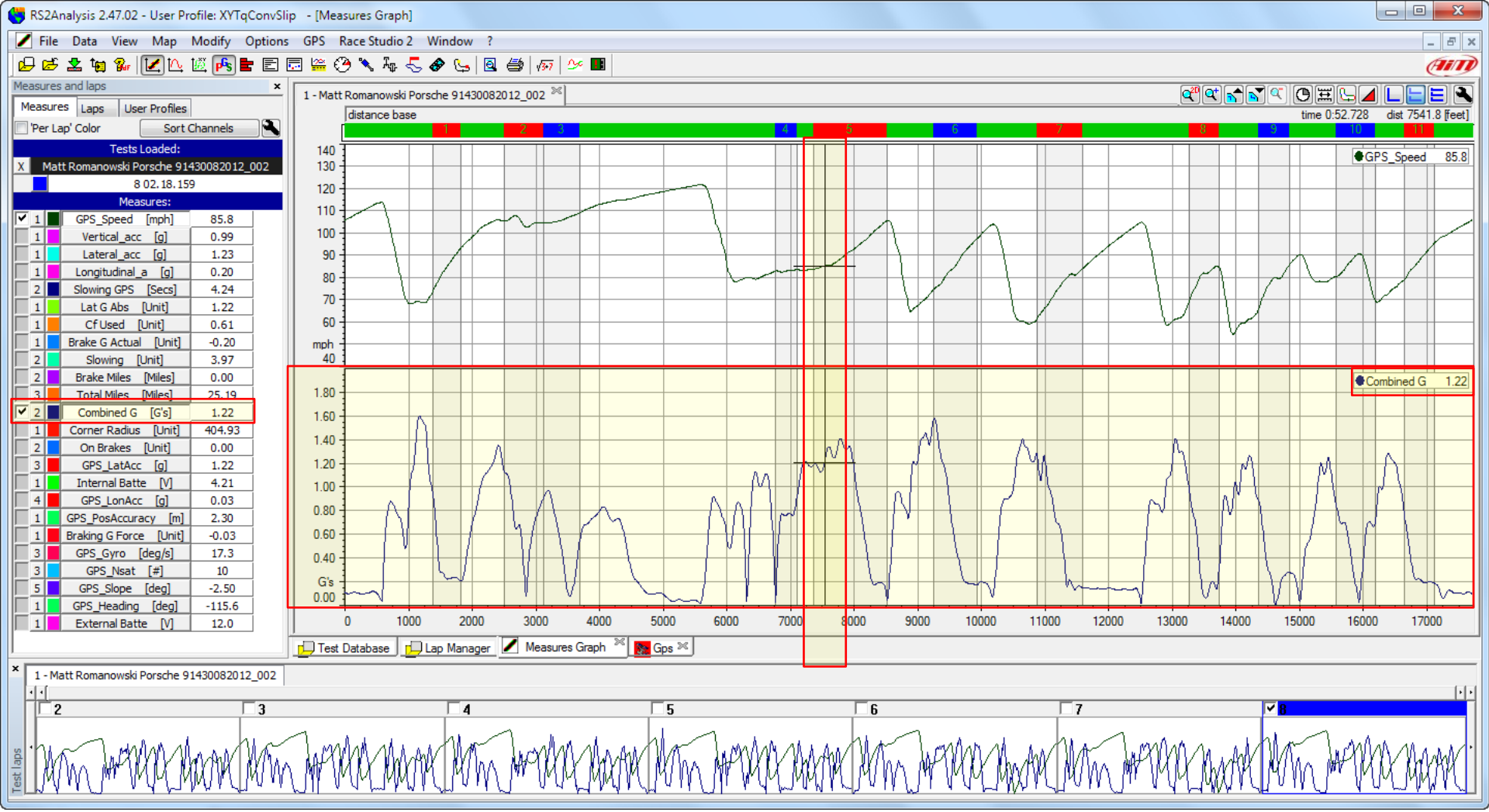


MATH CHANNELS: MATH CHANNELS ARE POWERFUL TOOLS LIMITED ONLY BY YOUR IMAGINATION.

MATH CHANNELS

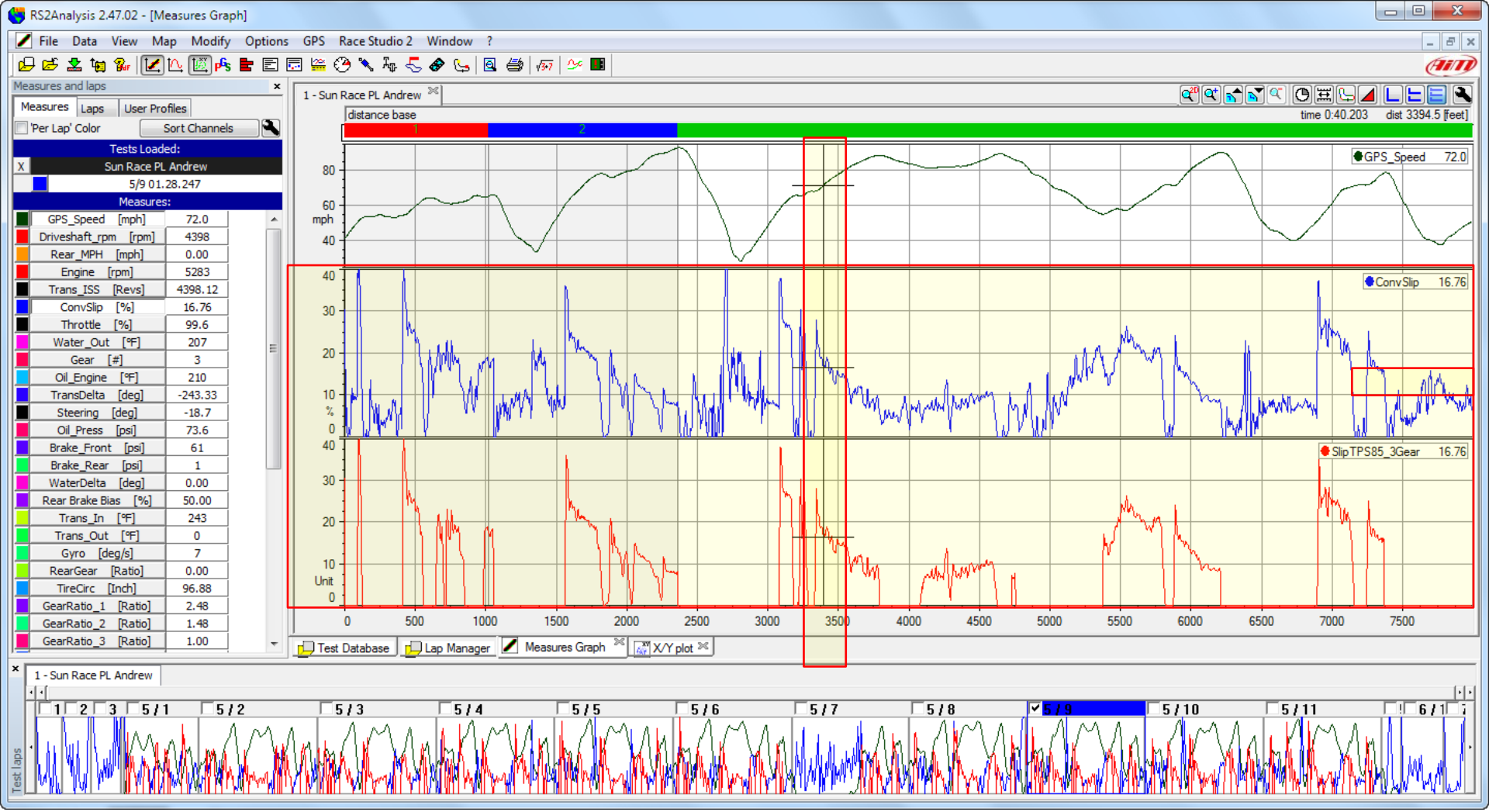
- MASTER SPEED (FR500S)
  IF(EQ(M_BRK_SW,1),MAX(MAX(M_WH_SPD_FL,M_WH_SPD_FR),MAX(M_WH_SPD_RL,M_WH_SPD_RR)),(M_WH_SPD_FL+M_WH_SPD_FR)/2)
- STRAIGHT REAR LOCKUP (FR500S)
  IF(LE(ABS(LATERAL_ACC),0.2),IF(EQ(M_BRK_SW,1),MASTER SPEED-MIN(M_WH_SPD_RL,M_WH_SPD_RR),0),0)
- STRAIGHT FRONT LOCKUP (FR500S)
  IF(LE(ABS(LATERAL_ACC),0.2),IF(EQ(M_BRK_SW,1),MASTER SPEED-MIN(M_WH_SPD_FL,M_WH_SPD_FR),0),0)
- COMBINED G'S (ABSOLUTE VALUE OF COMBINED G'S)
  SQRT(GPS_LATACC^2+GPS_LONACC^2)
- CORNER RADIUS
  ((GPS_SPEED*MPH2FTS)^2)/(GPS_LATACC*32.174)
- ON BRAKES RETURNS A "1" VALUE IF GPS_LONACC IS GREATER THAN .3
  IF(LT(-.3,GPS_LONACC),0,1)
- TOTAL MILES
  INTEG(GPS_SPEED/3600)
- BRAKE MILES
  IF(GT(ON BRAKES,0),INTEG(ON BRAKES*GPS_SPEED/3600),0)

MATH CHANNELS JUST A FEW EXAMPLES.



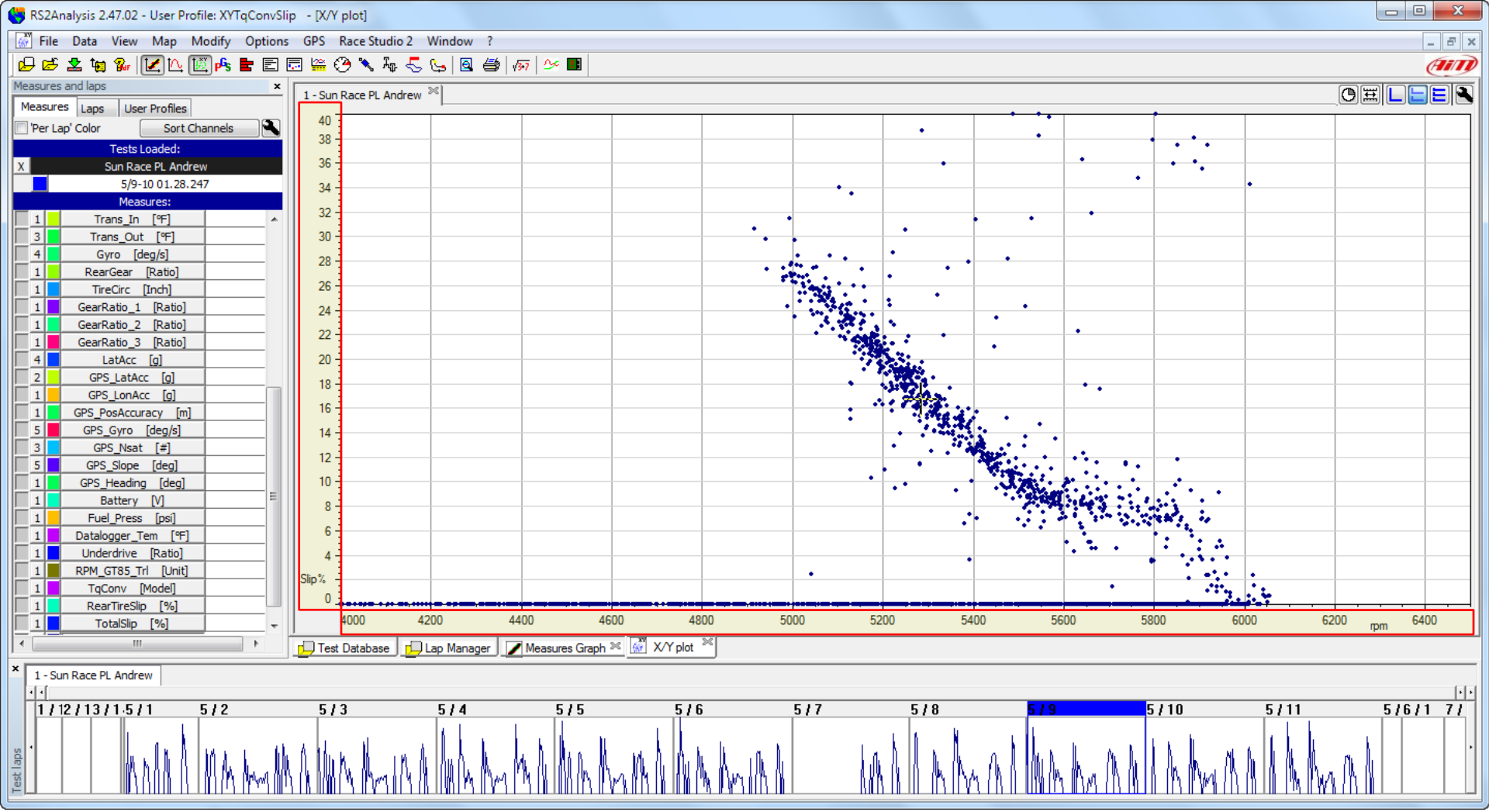
MATH CHANNELS: COMBINED G IS A CHANNEL THAT PRESENTS THE TOTAL G FORCES COMBINED AND CAN BE VIEWED IN A SIMILAR WAY AS A G/G FRICTION CIRCLE TO DISPLAY THE DRIVERS ABILITY TO KEEP THE VEHICLE AT THE LIMITS.

SQRT(GPS_LATACC^2±GPS_LONACC^2)

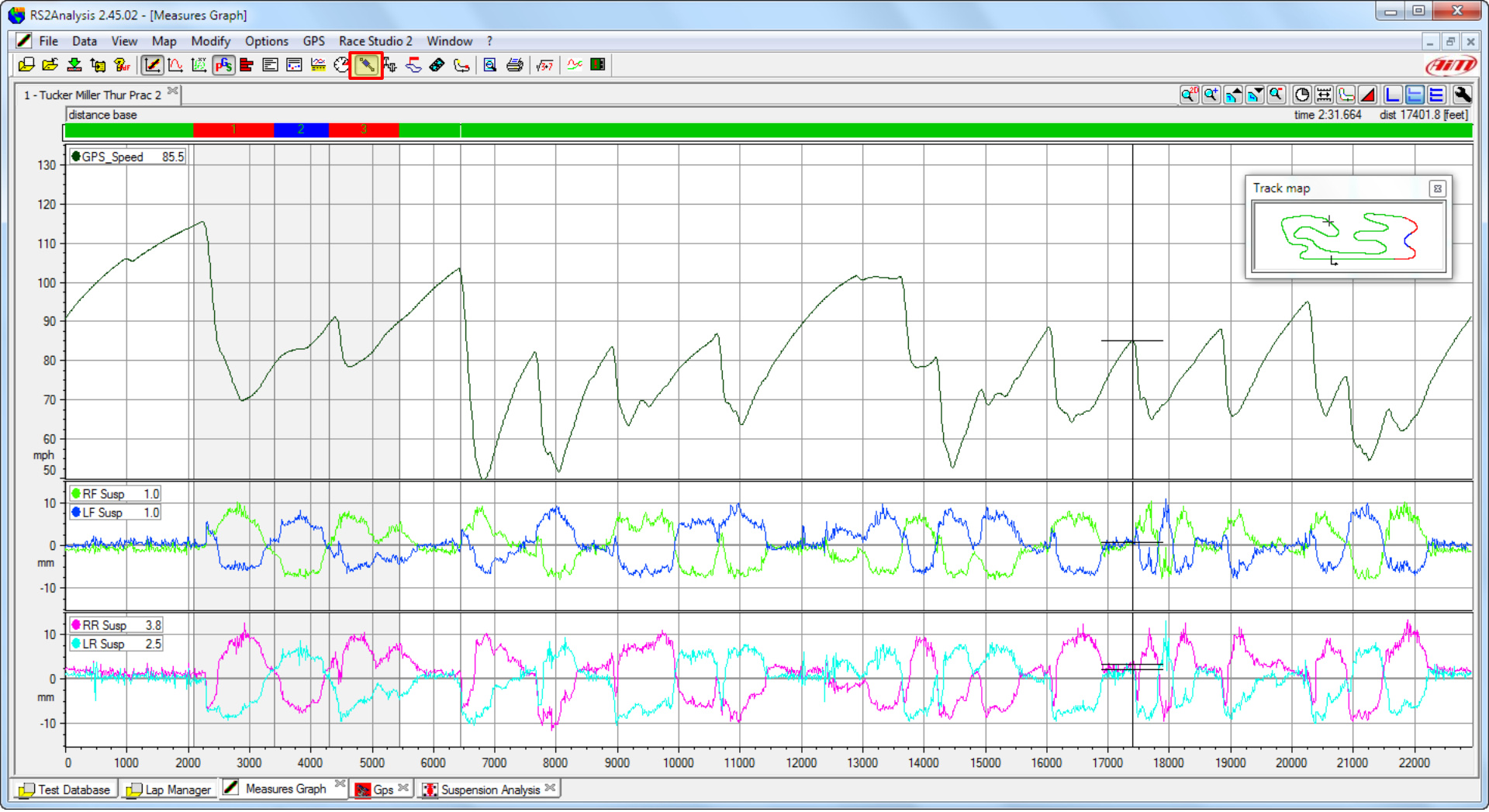


MATH CHANNELS: CONVSLIP IS A CHANNEL THAT PRESENTS THE SLIP CALCULATED FROM ENGINE RPM AND TRANS INPUT SHAFT REVS. THE "SLIPTPS85_3GEAR" CHANNEL TAKES THE CONVSLIP CHANNELS AND REMOVES ANY DATA THAT IS NOT IN 3RD GEAR AND IS NOT ABOVE 85% THROTTLE. THIS HELPS REMOVE THE DATA WE DO NOT WANT TO SEE.

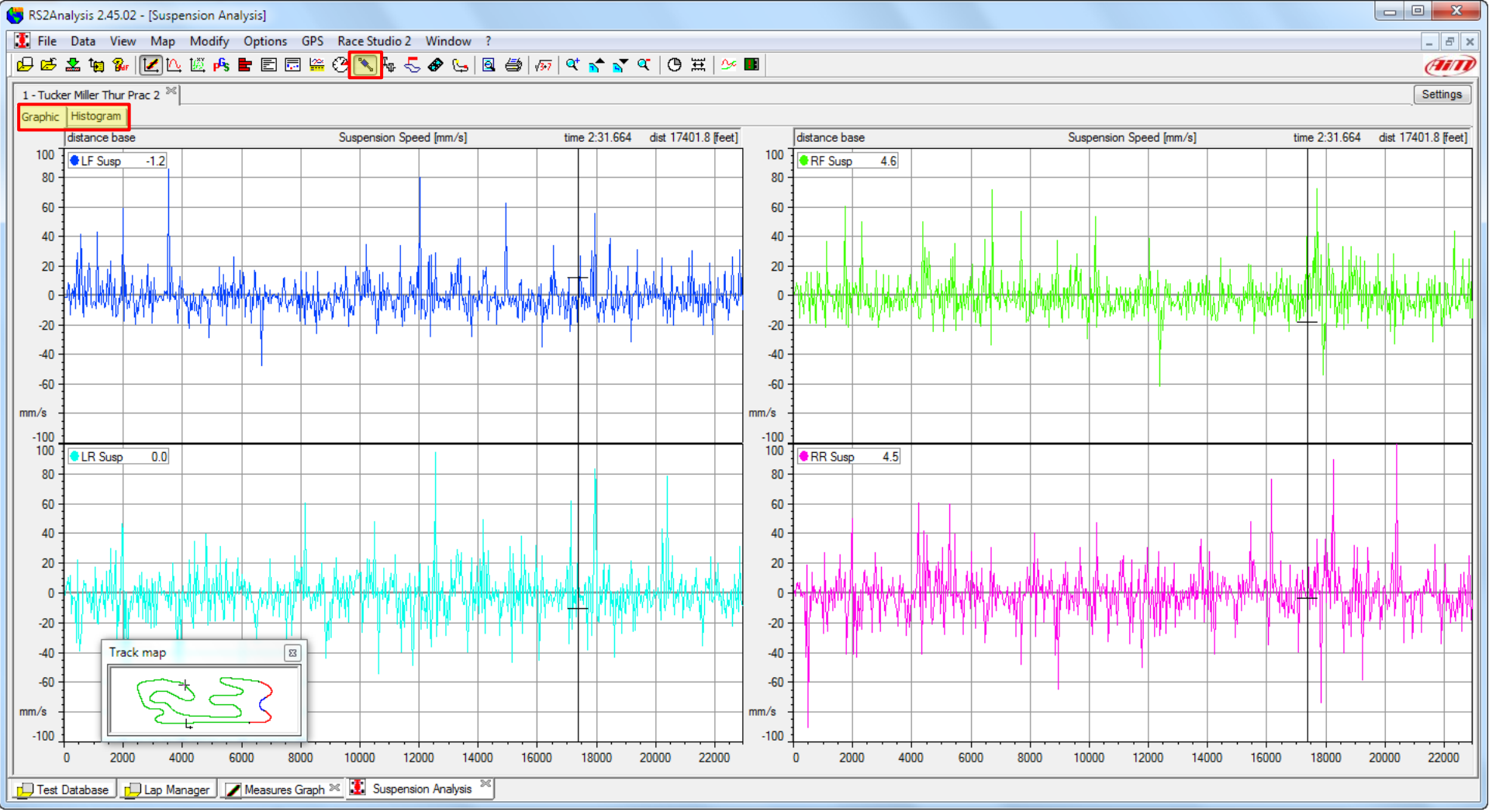
(ENGINE-TRANS_ISS)/ENGINE*100 IF(GT(THROTTLE,85),EQ(GEAR,3),0)*CONVSLIP



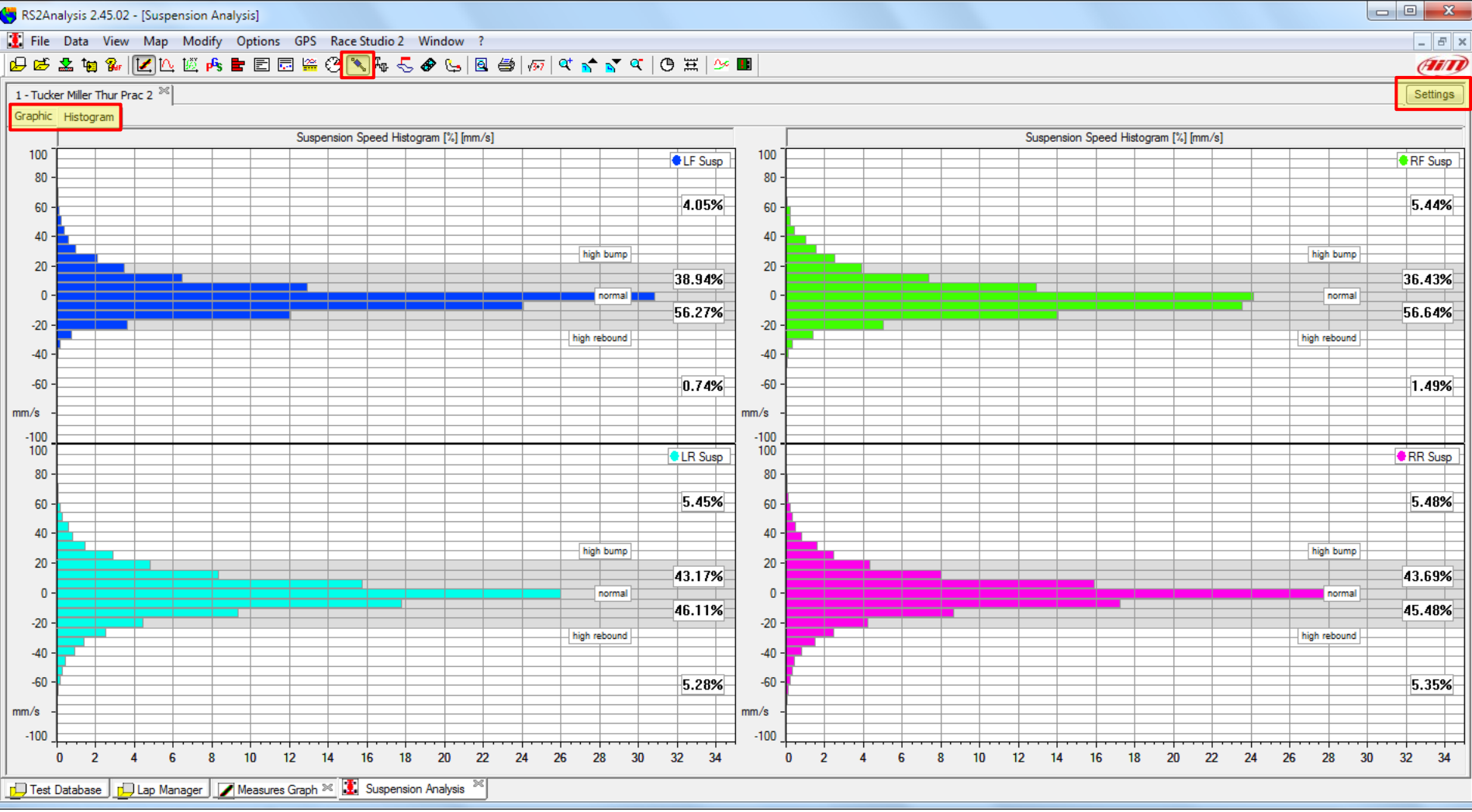
MATH CHANNELS: THE "SLIPTPS85_3GEAR" MATH CHANNEL IS THEN USED IN THE X/Y FUNCTION AND DISPLAYS ONLY THE TORQUE CONVERTOR SLIP DATA THAT IS IN 3RD GEAR AND ABOVE 85% THROTTLE.



SUSPENSION. WE CAN VIEW SHOCK POSITIONS IN THE MEASURES GRAPH.

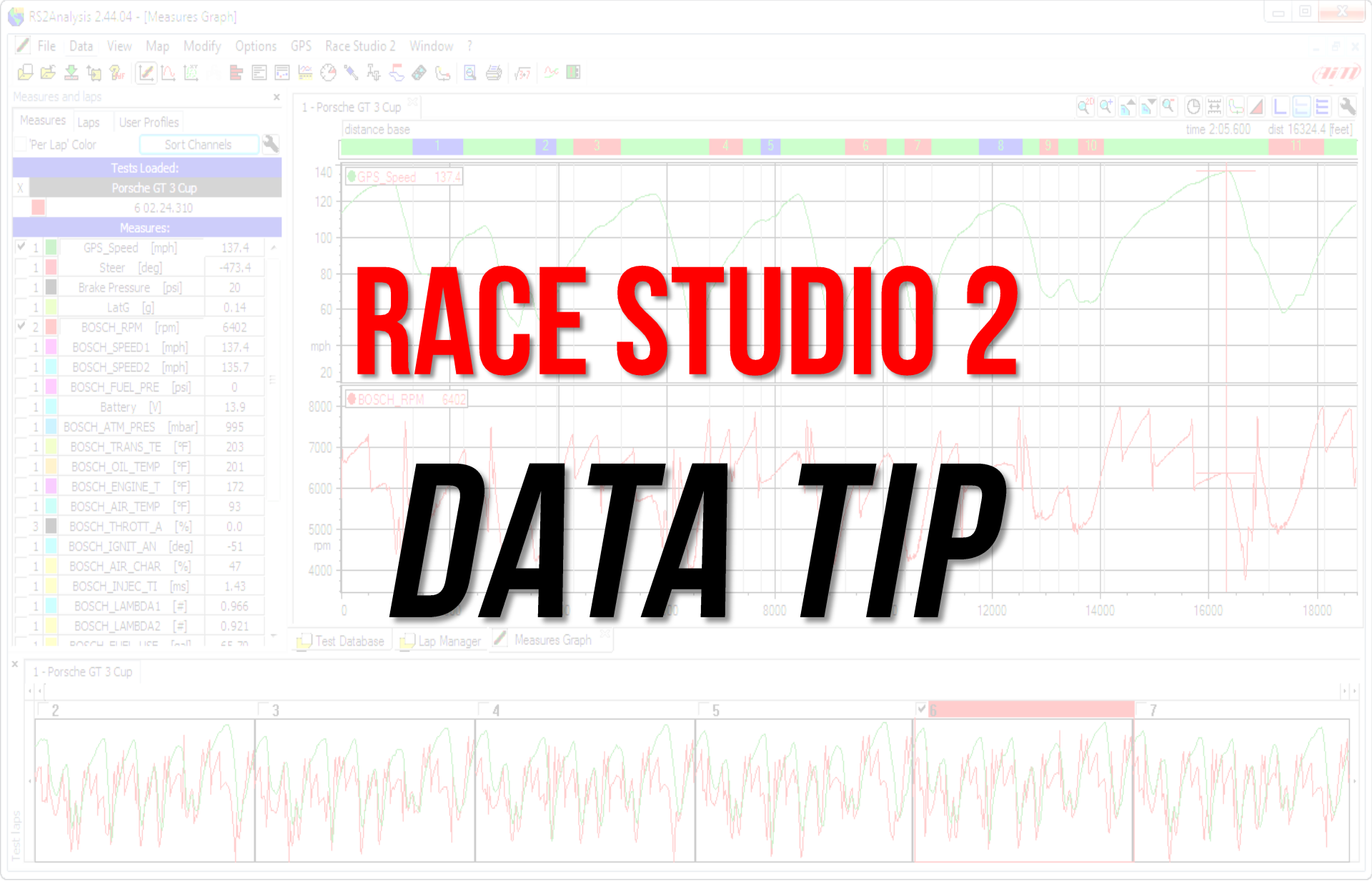


SUSPENSION ANALYSIS. WE CAN ALSO VIEW SHOCK VELOCITIES.



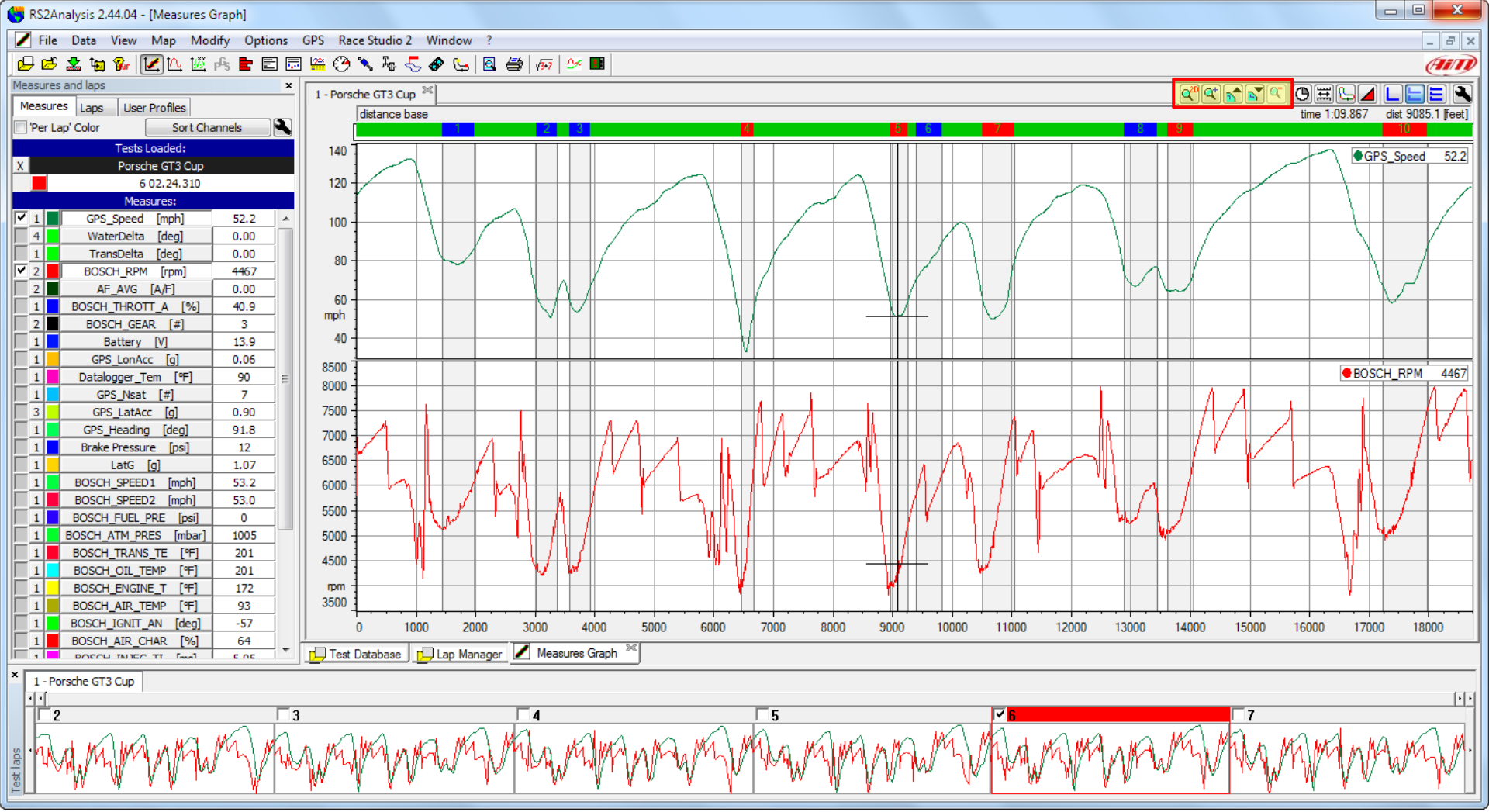
SUSPENSION ANALYSIS. VELOCITY HISTOGRAMS.

EXAMPLE OF FRONT SHOCK SENSORS HELPING SET RIDE HEIGHT. WE KNEW THAT THE FRONT BUMP STOPS TOUCHED AT 1.90IN OF TRAVEL ON THE IMPORTANT RF CORNER. WE USED THIS INFORMATION TO GET/KEEP THE CAR AS LOW AS POSSIBLE BUT NOT ON THE STOPS.



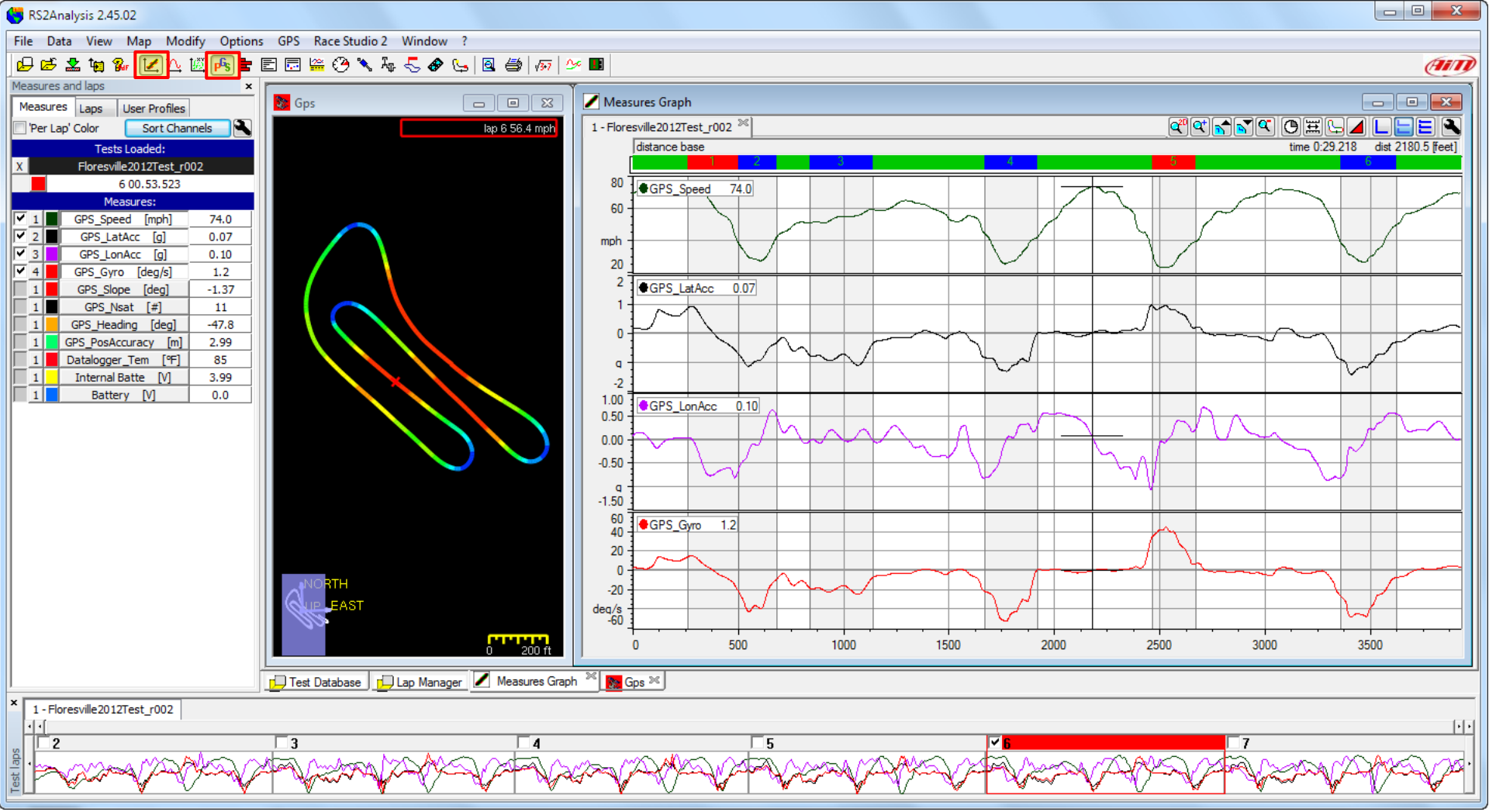
RACE STUDIO 2

DATA TIP



ZOOMING IN THE MAIN WINDOW CAN BE DONE BE DONE IN SEVERAL WAYS. IN THE BAR HIGHLIGHTED ABOVE IS THE ZOOM AREA OF THE TOOLBAR.

AIM SPORTS SOLO AND SOLO DL DATA LOGGER



AIM SPORTS SOLO DATA LOGGER SOLO DATA LOGGER
STANDALONE GPS BASED LAP TIMER / DATA LOGGER

DECEMBER 2012

DATA ACQUISITION TOOLS
HIGH VALUE DATA LOGGER
SOLO AND SOLO DL

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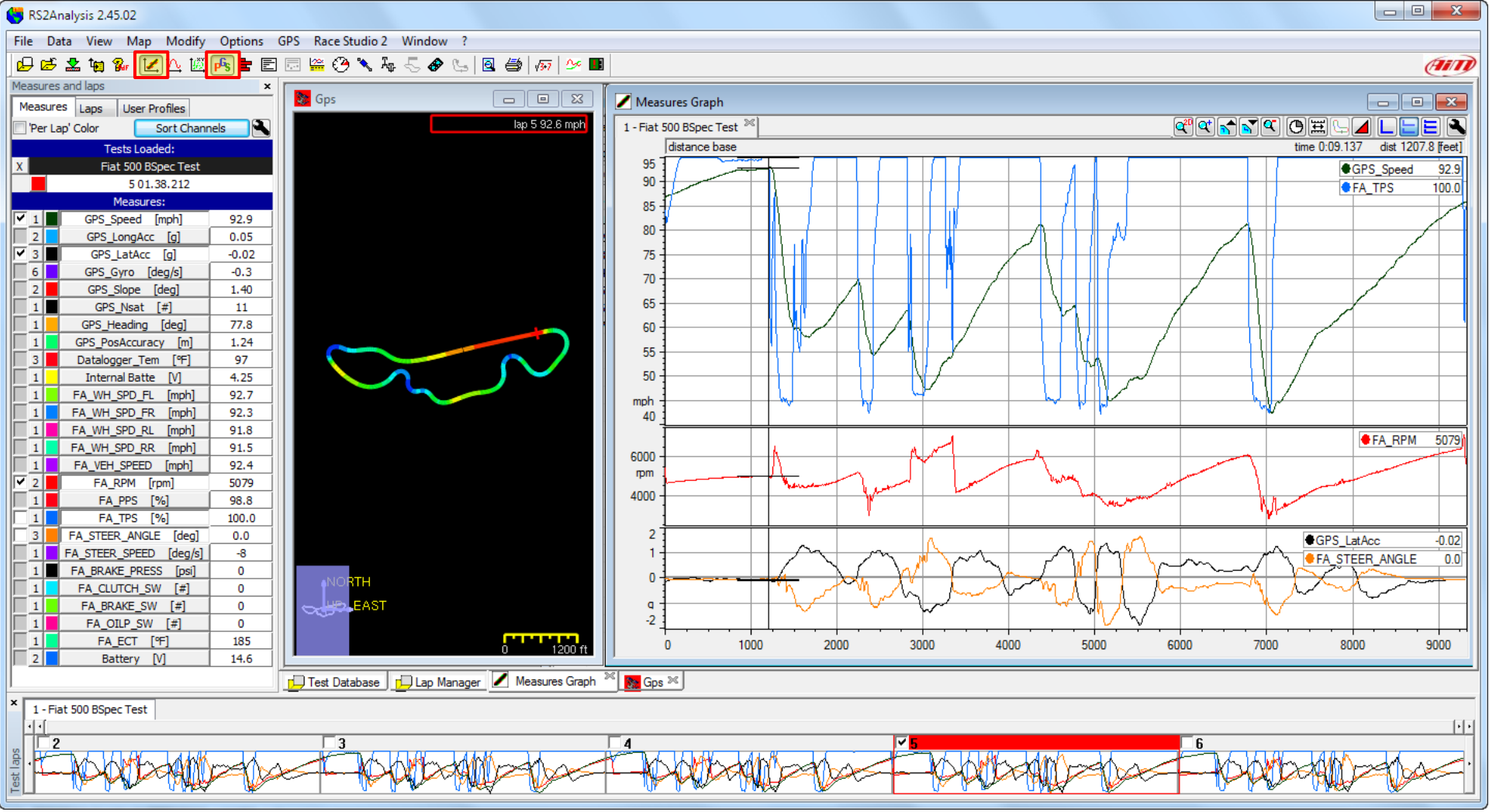
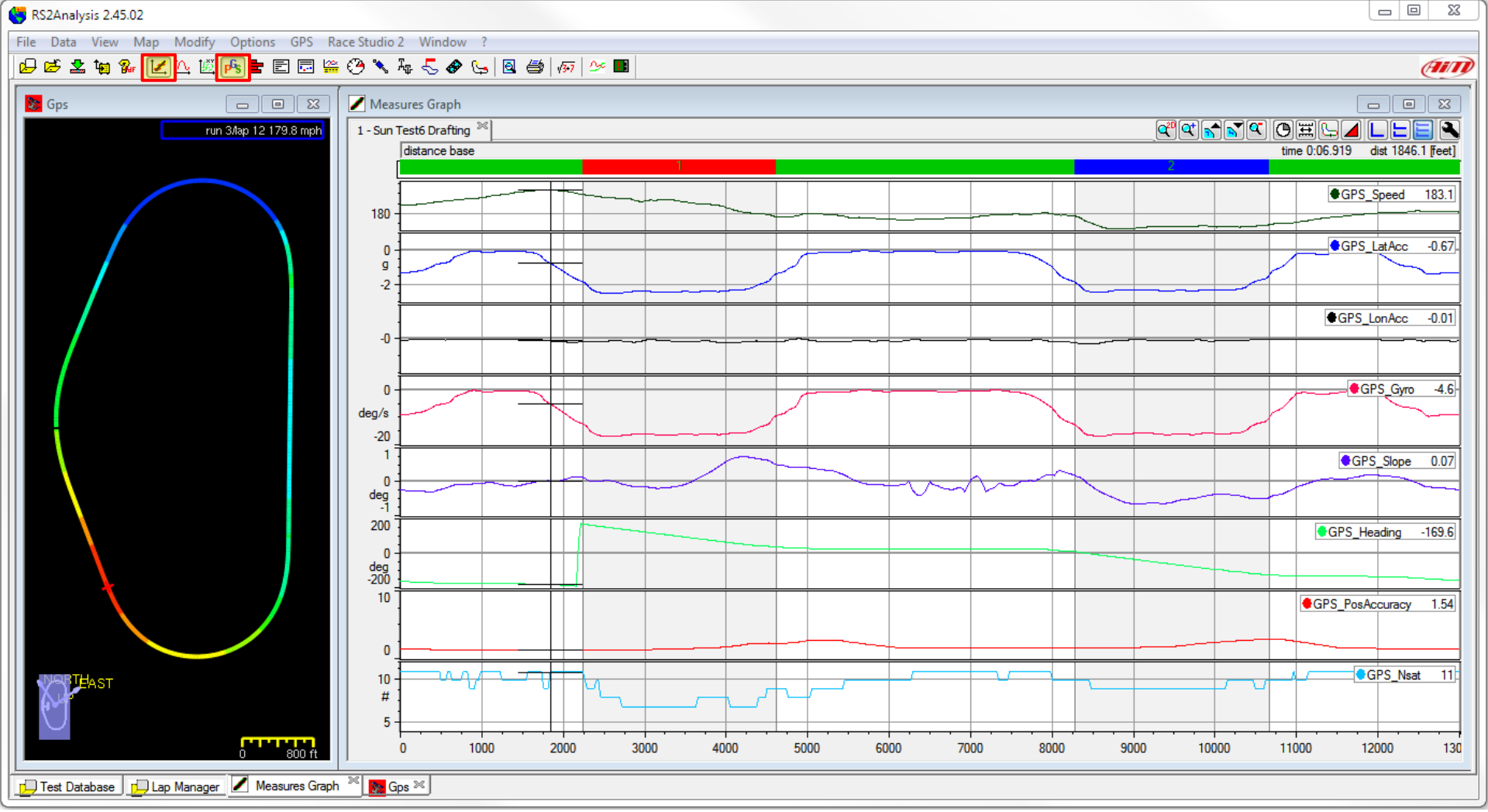


AIM SPORTS SOLO DATA LOGGER SOLO DL DATA LOGGER

STANDALONE GPS BASED LAP TIMER / DATA LOGGER WITH THE ABILITY TO CONNECT WITH MANY ECU'S FOR ADDITIONAL CHANNELS OF DATA

THIS EXAMPLE HAS THE SOLO DL CONNECTED TO A FIAT 500 B SPEC RACE CAR'S STOCK ECU.



AIM SPORTS GPS CHANNELS AVAILABLE FROM A SOLO: SPEED, LATERAL ACCELERATION, LONGITUDINAL ACCELERATION, GYRO, SLOPE, HEADING, POSITION ACCURACY, NUMBER SATELLITES

SMARTYCAM VIDEO


SMARTYCAM
MORE THAN JUST A VIDEO SYSTEM...

SMARTYCAM VIDEO

KART RACING

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UK racing
UK garage
0.6
0.5
LAP 3
00:16.35
THROTTLE
mph
78
RPM
x1000
8319

DECEMBER 2012

SMARTYCAM VIDEO

MAZDA MX5 CUP

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SMARTYCAM VIDEO

MAZDA MX5 CUP

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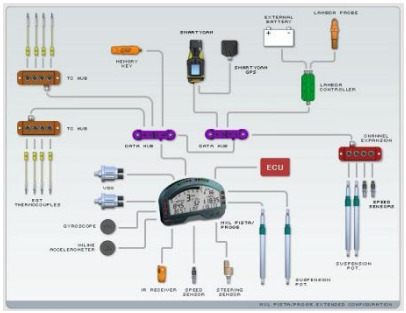
SMARTYCAM VIDEO

OFF ROAD RACING

- DATA IS GREAT BUT YOU STILL NEED TO UNDERSTAND THE DATA AND INTERPRET THE DATA CORRECTLY
- ALWAYS LOOK FOR TRENDS
- THERE IS NOT A BUTTON THAT TELLS YOU WHAT 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



DATA DISCLAIMER

YOU STILL MAKE ALL THE DECISIONS

ANY FURTHER QUESTIONS?

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