



A Practical Guide to
Race Car Data Analysis

by Bob Knox



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- Author of 'A Practical Guide to Race Car Data
Analysis'
- Writes Software for his Role as a Data Engineer

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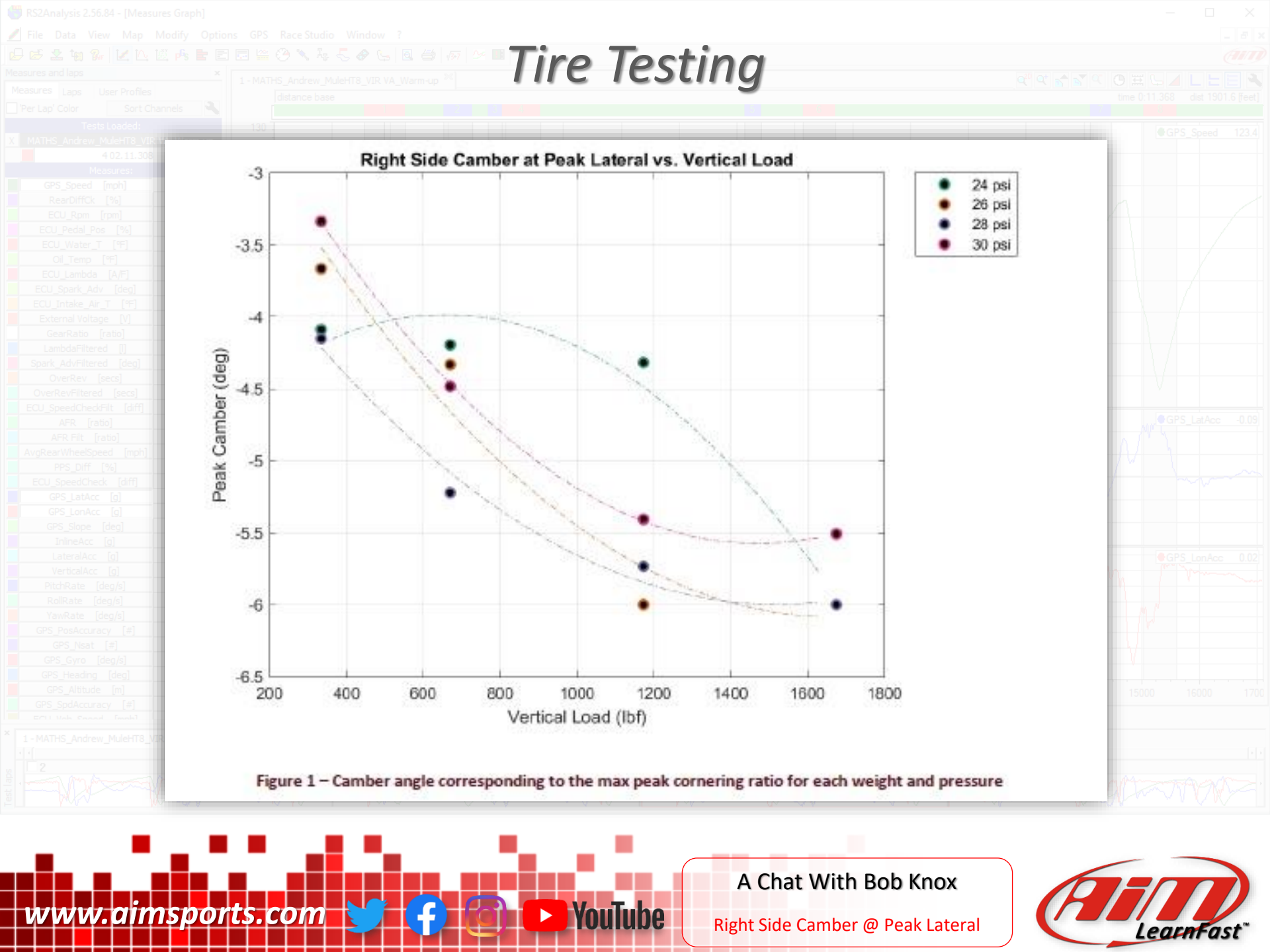


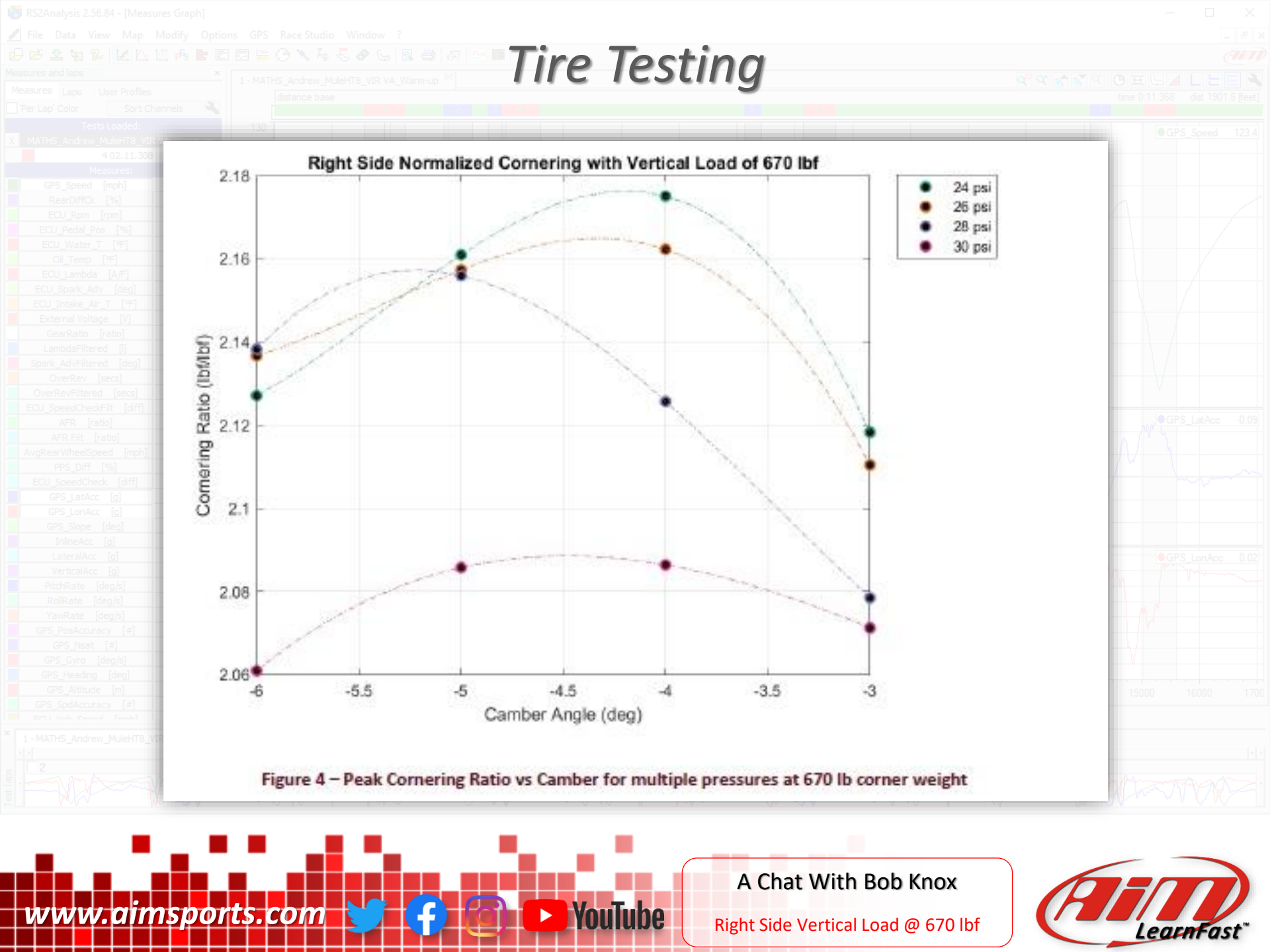
Bob Knox 2021 Racing Plans

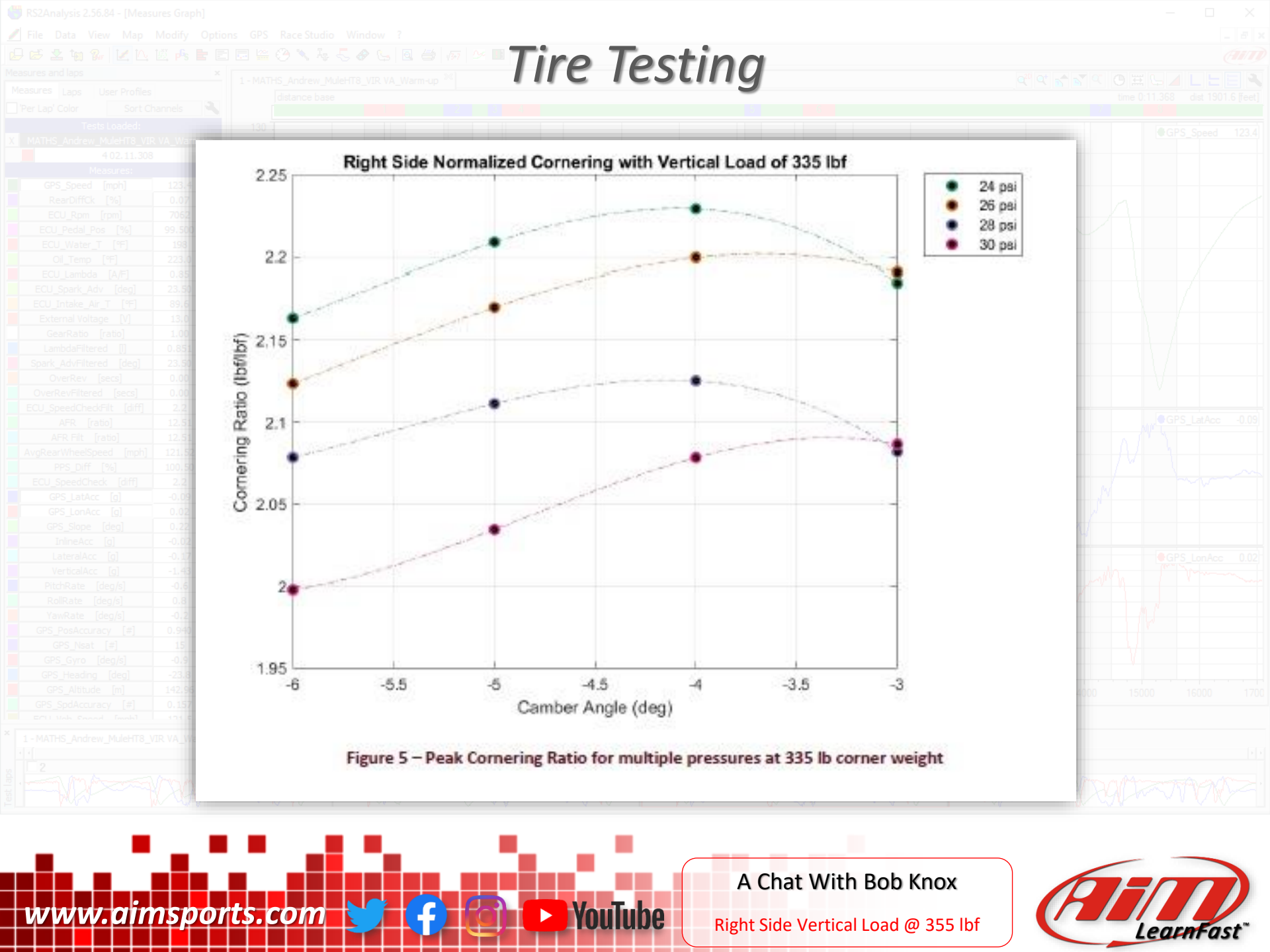


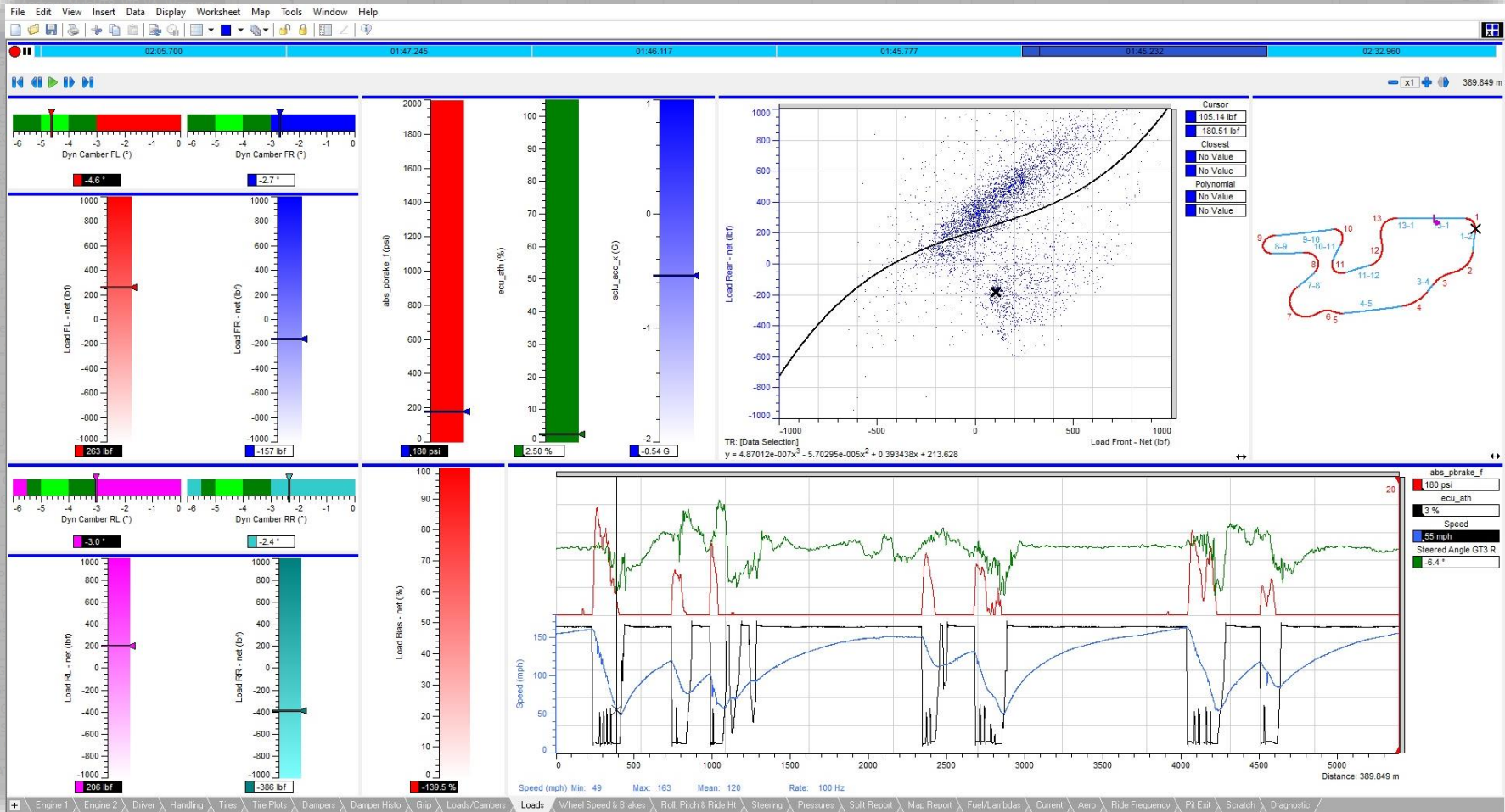
Two-time Rolex 24 At Daytona-winning team Alegra Motorsports has joined Mercedes-AMG Motorsport Customer Racing for a 2021 IMSA WeatherTech SportsCar Championship GT Daytona program with a Mercedes-AMG GT3.

The Tampa, Florida-based team will debut a single Mercedes-AMG GT3 at the season-opening Rolex 24 At Daytona in January, with plans for a possible second entry later in the 2021 season.

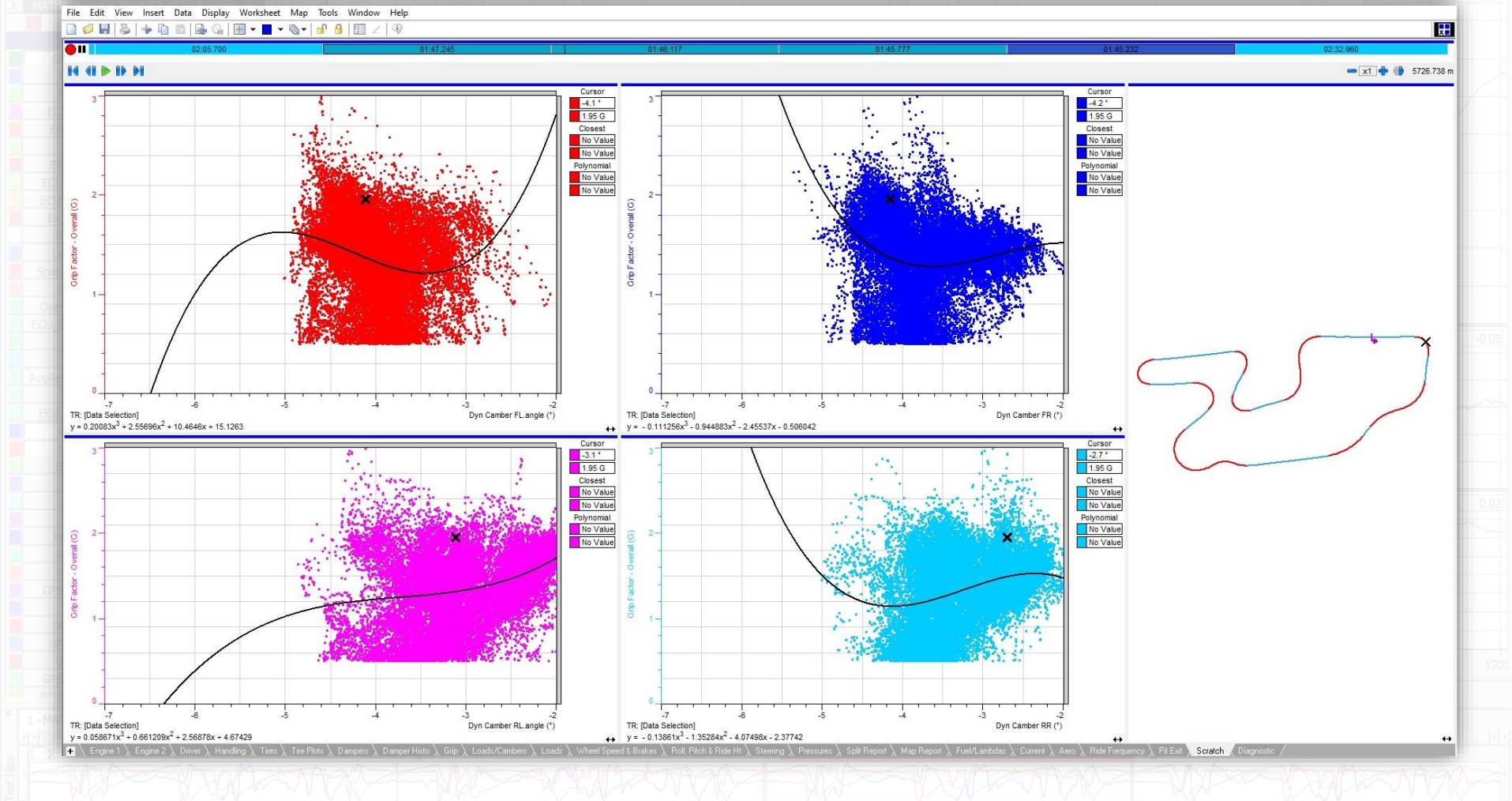








Calculating Dynamic Camber



A Practical Guide to Race Car Data Analysis

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A Practical Guide to Race Car Data Analysis was written for the amateur and lower-level professional racers who either have a data system in their cars or who may be thinking about installing one but who do not have access to an experienced data engineer. Many of the data systems available today at reasonable prices offer capabilities that only professional race teams could afford just a few years ago. Unfortunately, most of these racers do not know how to use more than a small part of those capabilities. Using real track data, numerous real-world examples, and more than 200 illustrations, the Guide gives them the knowledge and skills they need to select, configure and use their data systems efficiently and effectively.

Beginning with a detailed discussion of the things racers need to know about the hardware and software necessary for an effective data system, the Guide continues with chapters on basic data analysis tools, more sophisticated data analysis tools like x-y plots and math channels, damper potentiometers and the wealth of important data they produce, brake and clutch pressure sensors, and creative use of math channels. The Guide concludes with a comprehensive scheme for analyzing data, examples of the data views used with the scheme, and detailed information on how to create and configure the data views.



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- Damper Potentiometers
- Brake and Clutch Pressure Sensors
- More Math Channels
- Putting It All Together
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CHAPTER 1 Introduction

WHY DO YOU HAVE A DATA SYSTEM?

You just bought a new or used race car with a data system already installed or you just installed the new "world's best data system" from Trick Data Systems, Ltd. You've read the skimpy manual and looked at the analysis software using the sample data that came with it, but you're not really sure how to do much more than download the data and look at speed and rpm traces. The manual and help that came with the data analysis software offer few clues about what data to look at or what the data means when you do look at it. Left to your own devices you may, like many racers, lose interest in your new toy and ultimately conclude that, except for the dash display, it was a waste of time and money.

So, why bother with a data system? I believe that by the time you finish reading A Practical Guide to Race Car Data Analysis, you will see that a good data system can be the most cost effective expenditure you can make for your car. When set up and used correctly, your data system will help you more quickly sort your car, make you a better driver, and improve your lap times.

There is one thing that you can count on at the race track: there is seldom enough time to do everything that should be done and never enough time to do all the things you want to do. You always have to prioritize. As I worked with various data systems over the years and became familiar with their strengths and weaknesses, I came to the conclusion that a truly productive data system is one where I spend no more than 5% of my time configuring the system and downloading data and 95% of my time analyzing the data and discussing what it tells me with the engineer(s) and driver(s). That's not always doable—some days s*** just happens—but that ratio is always my goal in selecting or recommending a data system and in configuring the systems I work with.

Over the years I found myself asking, or being asked, the same questions at the end of every track session:

- Is there anything I need to know about the engine and related systems?
- What is the mechanical and aero balance of the car?
- Does the car have corner entry, mid-corner, or corner exit handling problems?
- Is the driver inducing any of the handling problems?
- Is the driver getting the most out of the car?
- Is the gearing optimum?

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Obviously, each session will produce other questions, but these seem to be at the top of the list every time. As a result, I tried many different views of the data and, over time, came up with a basic set of data views that help me get the answers to these and more complex questions quickly and easily. My purpose in writing A Practical Guide to Race Car Data Analysis is to share what I have learned so that, with modest effort, you can select, configure and use your data system to get the most from it. I've worked with most of the major data systems on the market: AIM®, CDS®, EFI®, MoTeC®, Pi® and Stack®. Each has its strengths and weaknesses and costs run from moderate to expensive. I don't make direct comparisons or specific recommendations in the Guide. I do, however, tell you what I think you need in terms of hardware and software to get the job done. It is up to you to determine what you need, want and can afford.

HARDWARE vs. SOFTWARE

There are two equally important parts to every data system:

1. Hardware: display, data logger, cables, connectors, sensors, and computer used to display the data
2. Software: display/logger configuration software, download software and data analysis software

In a perfect world you could select exactly the right hardware and separately select the most user friendly, flexible and powerful software. Unfortunately, each system comes with proprietary software and it is, for all practical purposes, impossible to use data created by vendor A's system with vendor B's data analysis software. As a result, you may find that the system that has the display you like cannot log all the channels you want or the software isn't powerful or flexible enough to view the data in the way that is most useful to you. Consequently, except for seriously expensive systems, you are likely to end up compromising somewhere. Like most things, you tend to get what you pay for in a data system, although some of the more moderately priced systems currently on the market can give you more of what you need than some of their more expensive competitors. If you already have a data system, you are stuck with its limitations unless it can be upgraded and, if so, at a reasonable cost. If you are buying a data system, make sure you know exactly what compromises you have to accept with each system.

HARDWARE

Data system hardware comes in a variety of shapes and sizes and you need to carefully consider what is the best compromise for you and your car.

Display size and complexity tend to be a matter of driver preference. Some drivers prefer a minimal display limited to shift lights, engine temp and oil pressure, lap time, and alarms.

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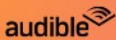


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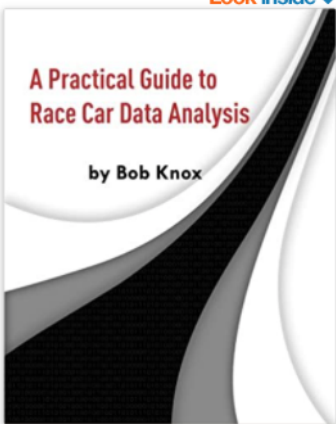
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by Bob Knox

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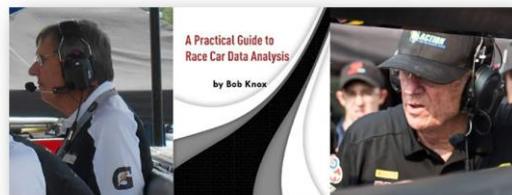
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Measures and laps

MeasuresLapsUser Profiles

Per Lap Color

Sort Channels

Tests Loaded:

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4 02:11.3

Measures:

GPS_Speed [km/h]

RearDiffCk [rpm]

ECU_Rpm [rpm]

ECU_Pedal_Pos [%]

ECU_Water_T [°F]

Oil_Temp [°F]

ECU_Lambda [A/F]

ECU_Spark_Adv [deg]

ECU_Intake_Air_T [°F]

External Voltage [V]

GearRatio [ratio]

LambdaFiltered []

Spark_AdvFiltered [deg]

1 - MATHS_Andrew_MuleHT8_VIR_VA_Warm-up

[distance base]

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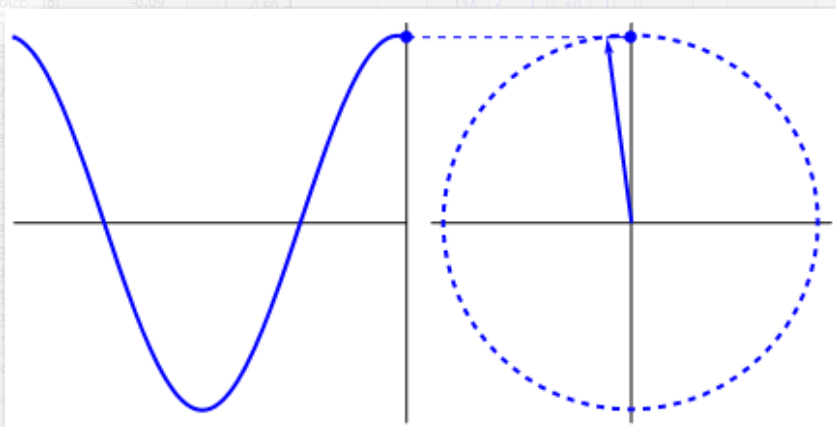
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Removing the Mystery





A Practical Guide to
Race Car Data Analysis

by Bob Knox



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