101 Things You Can Learn from Claude Rouelle's Race Car Engineering and Data Acquisition Seminar:

1. The cost efficient reasons why the competitive, amateur and professional racing teams have decided to use data acquisition systems.

2. Why drivers skills, intuition and experience are indispensable but not sufficient to win races.

3. How much data acquisition costs, how much it can improve your cars performance, what is the minimum knowledge and experience you need to get the best of it and how hard (if not impossible…) it will be to be competitive and efficient without it.

4. Why a good engineer is not only the one who finds the best setup but also who understands WHY and HOW MUCH a setup change does affect its car performance.

5. In an extremely competitive racing world where dozens of drivers can be within a few 1/10 of a second a lap, where testing time is restricted, where circuit or special stages are less and less available and more and more expensive, where sponsors want immediate results.

6. What do you want to work on first when you have understeer or oversteer.: tire pressures, camber caster, toe, springs, antirollbars, shocks, front or rear wing front or rear gurney, anti dive or antisquat ? So many solutions. But only one will work better than any others. Only one will preserve your tires better than any others. The seminar will tell you how to find the order in which you want to work on the different setup parameters.

7. How to notice and quantify on the data acquisition the different kinds of understeer (oversteer): braking, turn in, coasting or power U/S (O/S)

8. How to analyze data to quantify how much the driver is under using or over using his front or rear or both end tires.

9. How to analyze the data to understand the driver style and adapt the car setup to it.

10. How to "read" the tires by visual, tire temperatures and data analysis.

11. Why it is important to hit the brakes pedal as hard as possible in the first few meters (feet) of the braking zone.

12. Why, for the same exact trajectory in a corner there could be several steering wheel inputs. One driving style will be more efficient and will save the tires better than any other.

13. How to quantify the U/S and the O/S just by looking at the steering trace and compare it to a very slow lap.

14. The speed that any data acquisition system measures is not the real speed. Why and what are the differences.

15. Why 80 % of your corner speed is determined in the first 10 % of the corner.

16. Why the roll center position and its vertical and lateral movements are so important at the corner entry.

17. Why modern racing cars demand less and less shock absorber low speed bump control.

18. Why modern racing tires and cars demand a less aggressive driving style in the slow corners and a more aggressive driving style in the fast corners.

19. How to organize driver briefing and debriefing sessions.

20. Why changing the car ballast position (or the driver seat) by only a few cm (inches) could change the handling of your car and the way your tires wear.

21. How to choose the spring stiffness and the shock setup of a car you have never worked with before.

22. How to make an aeromap.

23. How to find the best tire pressure for the race and for qualifying.

24. Why a shock absorber is like an antirollbar which works only at the entry and exit phases of the corner.

25. How to decide if you want to work on your shock high speed or low speed adjustments in order to improve your car performance.

26. Why you need to completely change your brake fluid after a race in the rain.

27. How to use RPM and speed data and a spreadsheet to calculate the best gear ratios in less than 5 minutes.

28. How to calibrate pushrods or spring perch strain gauges.

29. How to choose what you want to work on first: maximum total lateral grip or car balance.

30. All the information the data acquisition engineer and the race engineer will learn by comparing all the data on different circuits (rallies) at the end of the season and how it can lead them to better setup for the next season.

31. How to setup your brake balance by analyzing your data.

32. How much you need to change your front and rear ride heights when you change you front and/or rear springs.

33. Why gurney flaps work better in the slow corners.

34. How to adjust your tire cold pressure to weather change.

35. How to increase your tires temperature by changing your suspension pickup point.

36. Why it is important to know your tire vertical stiffness.

37. Why your tire vertical stiffness can change as the tires wear out, despite keeping the same running pressure.

38. How to use strain gauge, gyros, laser sensors, what you can learn about your car thanks to these sensors and how to cope without them.

39. How to establish a quick and efficient technical dialogue between the driver and the engineer.

40. Why we put negative camber on a road course car.

41. Why is some cases, a softer rear antiroll bar could give less turn in understeer.

42. Why on most stock car oval races you don't want to have a front roll center moving towards the inside corner.

43. How to calculate and measure lateral and longitudinal weight transfer.

44. How to measure the track slope and banking angle with the car at speed on the race track.

45. How to analyze the driver style just by looking at the throttle and the steering data.

46. What kind of technical data you should ask your race tire manufacturer (and what kind of technical information he should give you).

47. Where on the car to install a pitot tube.

48. What is the best choice of sensors for a given budget.

49. How the front and rear roll centers vertical and lateral movement in heave and in roll influence your cars handling.

50. Why on some road tracks it is worth it having asymmetrical cambers and corners weights.

51. How to efficiently use your brake pad manufacturer information.

52. The best ways for a young engineer to find a job in racing.

53. How to organize your data and the way you want to look at it on telemetry or as soon as you have downloaded it from the car.

54. The best way to integrate the data acquisition engineer duties with the driver and the race engineer job.

55. Why front toe out improves braking and rear toe in increase traction.

56. Why in some case reverse Ackerman steering geometry is better than standard Ackerman and the best way to modify it.

57. How to calculate and measure antidive and antisquat.

58. How to draw a line over which data are really useful and under which they could be real 'black holes'.

59. How to setup the dashboard in order to help the driver to help himself.

60. The concept of magic numbers that you can find on your setup sheet and on your data in order to quickly improve your car setup.

61. The 52 useful types of information you can learn about your car handling with just 4 linear potentiometers.

62. The kind of information your race tire manufacturer is expecting from you in order to help him to better help you.

63. Why and how much we want to limit the amount of camber changes.

64. How 5 minutes from the end of a qualifying session, just by looking at some magic numbers on your data acquisition you can decide what exactly to do to your tire pressures to improve significantly your position on the grid.

65. Why and in which conditions you want to have a roll center over or under the ground and by how much.

66. Why a kinematics software should be 3D, take the front and the rear of the car as a whole and should take into account the vertical, lateral and longitudinal tire deformations, the suspension and chassis compliance.

67. Why is some case more rear brake bias could give less turn in oversteer.

68. How to setup a car with your shock speed histogram.

69. How to analyze data in order to compare 2 drivers style and have each of them getting the best of the other.

70. How to measure your cars aerodynamic drag.

71. How to quantify understeer and oversteer in steady state and transient conditions.

72. How to find the correct tire rolling radius to input in the data acquisition software to measure the cars speed.

73. How to measure a differential efficiency.

74. How to measure the tire vertical stiffness when the car is on the race track (special stage)

75. How to write math functions for your data analysis.

76. If, when and how much you want to filter data.

77. What 3D kinematics, vehicle dynamics and lap time simulation software is available on the market and at which price.

78. How to measure real shock force (not shock dyno forces) when the car is on the racetrack.

79. Why increasing the rear shock low speed rebound forces decreases the turn in oversteer on some circuits and increases it on others.

80. Why front and rear negative camber on the inside wheel is not a good thing for your turn in performance.

81. That you can not decide the amount of camber variation you want to get from the design of your car suspension geometry until you know your tire lateral stiffness.

82. Why the less loaded tire is most of the time the one that has the best coefficient of friction.

83. What you could do with slip angle sensors.

84. How race tire manufacturers are measuring lateral and longitudinal tire grip, and how you could measure these yourself on your racecar while on the race track (special stage).

85. How to measure the tire rolling resistance.

86. Why you need to know as much about your pitch centers as you need to know about your roll centers.

87. What kind of test you can do on your race track to know the level of Ackerman (or reverse Ackerman) geometry which will get the most of your front tires.

88. Why it could useful to have front and rear bump and roll steer, how much and how to create it.

89. Why you will loose 3 % of downforce and get more understeer if the ambient temperature raises by only 5 degrees.

90. Why, if your car is perfectly balanced but is bottoming in the straight away, you need to raise the rear right height 3 to 5 times more than you raise the front ride height.

91. Why and how it is possible to have the car a few feet ahead of yours to get a sudden aerodynamic oversteer with having any understeer in your car.

92. How much to change the front and rear ride height to decrease the amount of power understeer (oversteer).

93. Why an independent suspension has 5 links.

94. How, during the suspension geometry design, to find the best compromise between camber variation in bump and in roll.

95. Why and how much the left and right antisquat and antidive characteristics change with the static and dynamic camber and with the steering.

96. Why it is important to know your KPI and caster trails and how much these change with the lateral and longitudinal tire deflection.

97. The specifics of different suspension types (double wishbones, Mac Pherson, stock car, rear GT#, V8 Australian suspension).

98. How to measure centers of gravity and the roll, pitch and yaw moments of inertia.

99. Four different methods to get a non linear wheel rate.

100. The advantages and the dangers of using bump rubbers.

101. Why and how much increasing the antisquat and antidive will increase the car's vibration in braking and acceleration.