



Vehicle Tuning



Who's your presenter?

- Jim Kasprzak
 - 36 years racing experience
 - Developed 7-post testing for GM Racing
 - Currently Race Engineer for SRT Viper
 - Expertise includes:
 - Race Engineering
 - 7 post testing
 - Suspension Engineering
 - Shock design, development, & tuning
 - Vehicle Tuning
 - 31 years automotive experience
 - Arvin Ride Control
 - Director, Original Equipment Engineering
 - Director, New Product Development
 - Monroe Auto Equipment
 - Chief Engineer, Electronic Systems
 - Manager, Suspension System Programs



Outline

- **Preparation for Track Testing**
- **Data Acquisition**
- **Track Testing**



Preparation

for

Track Testing



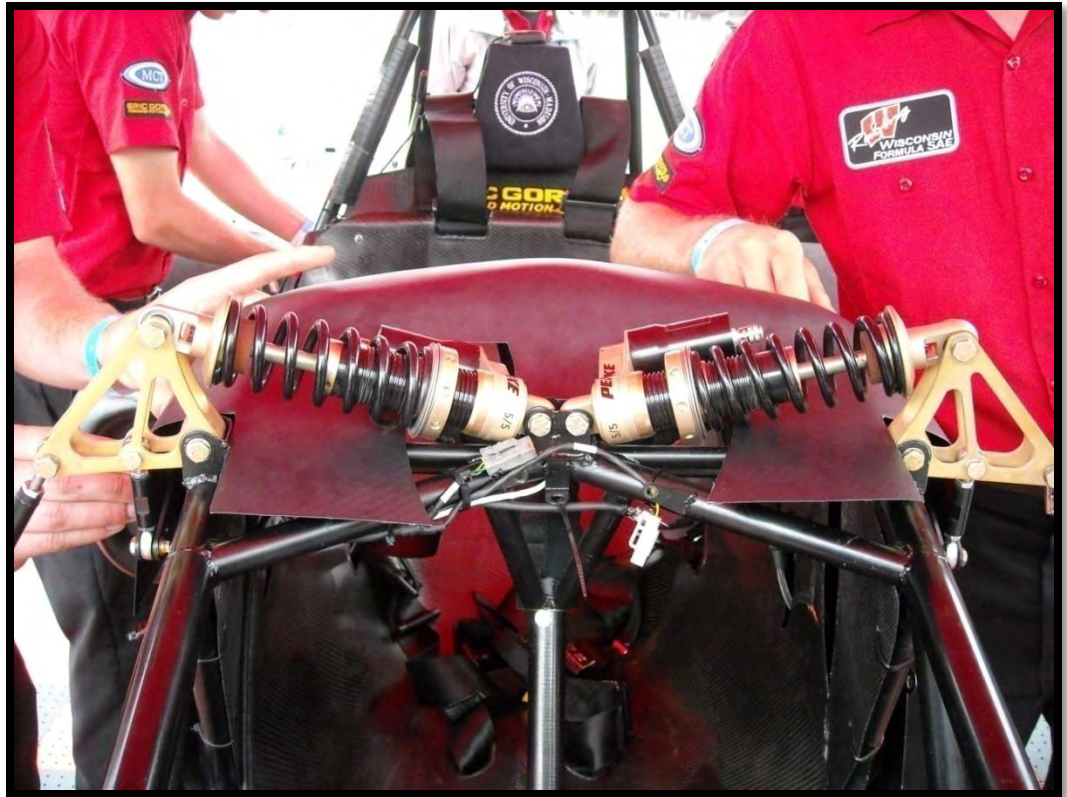
Preparation for Testing

- Vehicle Setup
- Damper fit check
- Suspension Setup
- Setup Sheet
- Checklists

Vehicle Setup

- Engine
- Gearbox & Drivetrain
- Electrical/Electronics System
- Data Acquisition System
- Suspension
- Brakes
- Aero

Damper Fit Check



Fit Check on Vehicle

Make sure shocks fit correctly!

- Correct travels
 - Shock and spring
- Check jounce bumper engagement
- No binding or interferences



Positioning Shock Travel

Must properly position shock at ride height

- Typically mid stroke at ride height
- Determine shock travel on track
 - Use data acquisition
 - Check for bottoming/topping
 - Use travel indicator on shock rod

Suspension Setup

- With driver and fuel weight
- Bumpsteer
- Ride heights & corner weights
- Camber, caster, toe settings
- Corner weights
- Damper adjustments

Vehicle Set-up Sheet

Chassis Information

Gearbox Information

Daytona Prototype Chassis Setup											
RILEY TECHNOLOGIES		Track	Laguna	Event	Race	Date	5/17/08	Session	Race		
		Driver	JM MG	Chassis	L-028	Engine		Miles	0		
Split Len	Full	Split Ang	0.0	Diveplane	BIG	S Flap	Big	Louver	12+kicker	S Boxes	Yes
Camber	-3.1	LF Sidepod	1.881	Ride Hgt	1.820	Ride Hgt	1.822	RF Sidepod	1.886	Camber	-3.4
Caster	9.50	Split Ht	1.575	FAR Bar	1.38	Split Min Ht	1.599	Split Ht	1.575	Caster	9.50
Toe	0.161o			L Blade	50	R Blade	50			Toe	0.162o
				Droop Lim	na	Droop Lim	na				
Code	Pirelli D2			LF Spring	800	RF Spring	800			Code	Pirelli D2
Dia	26.12			Wheel Rt	648	Wheel Rt	648			Dia	26.12
Setup PSI	30			Shocks	Pen	Shocks	Pen			Setup PSI	30
Cold PSI	18			Shock ID	Riley 5	Shock ID	Riley 6			Cold PSI	18
Hot PSI	28			File	Kaz 17	File	Kaz 17			Hot PSI	28
				Bump Rbr	Ohl 03	Bump Rbr	Ohl 03				
Rake In	0.689	Packer	0.188	Pack Gap	0.530	Pack Gap	0.498	Packer	0.188	Tilt Deg	0.00
Rake Deg				Gas Pres	150	Gas Pres	150				
				Set	-15+2-12	Set	-15+3-12				
				F Scoop	Open	F Press		F Mast	810	F Rot	250
				R Rest	1.25	R Press		R Mast	810	R Rot	252
				F Pad	rs5	R Pad	rs5				
Setup Fuel	15g	Driver	175	LF Wgt	597	RF Wgt	602	Setup Wgt	2596	Wedge %	49.88
Start Fuel	15g	Body On?	N	LR Wgt	693	RR Wgt	704	Tech Wgt	682	Front %	46.19
Fuel Wot	95.10									Right %	50.31
Sidepod	2.290	Spod Raise	0.015	Ride Hot	2.510	RAR Bar	0.500	Spod Raise	0.015	Sidepod	2.290
				Rock Link	no	Blade	Soft				
Camber	-1.6			LR Spring	1050	RR Spring	1050			Camber	-1.7
Toe	0.060i ?			Wheel Rt	723	Wheel Rt	723			Toe	0.060i ?
				Shocks	Pen	Shocks	Pen				
Code	Pirelli D2			Shock ID	Riley 7	Shock ID	Riley			Code	Pirelli D2
Dia	27.49			File	RT 1	File	RT 1			Dia	27.49
Setup PSI	30			Bump Rbr	Ohl 03	Bump Rbr	Ohl 03			Setup PSI	30
Cold PSI	18	Packer	0.000	Pack Gap	1.360	Pack Gap	1.410	Packer	0.000	Cold PSI	18
Hot PSI	28			Gas Pres	150	Gas Pres	150			Hot PSI	28
				Set	-10+6-11	Set	-10+6-9				
Main ang	18.50	Gurney	0.750	Spoiler ang	35.00	Sp Gurney	2.000	S Board	No	Sp hole	Center
				Uncut - No Taper		Sp Ext Ht	1.000				
R&P	12 : 36	Drop	1 : 1	Avg R Dia	27.49	RPM	7,100	Diff	50 pl+AA	6 plate	X-Trac
1st	14 : 35	2nd	16 : 31	3rd	20 : 33	4th	18 : 26	5th	22 : 28	6th	
MPH	77.4		99.9		117.3		134.0		152.1		
Drop	NA		1.598		1.054		885		844		
Other	V8 steering blocks (Low front roll center)(Low ackerman, Long tie rod)										
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Race Daytona Sess 1 End 5-17-08 Start 5-17-08 Sess 2 5-18-08 Sess 3 5-18-08 Sess 4 5-18-08 Sess 5 5-18-08 Sess 6 5-18-08 Sess 7 5-18-08 Sess 8 5-18-08 Sess 9 5-18-08 Sess 10 5-18-08 Sess 11 5-18-08 Sess 12 5-18-08 Sess 13 5-18-08 Sess 14 5-18-08 Sess 15 5-18-08 Sess 16 5-18-08 Sess 17 5-18-08 Sess 18 5-18-08 Sess 19 5-18-08 Sess 20 5-18-08 Sess 21 5-18-08 Sess 22 5-18-08 Sess 23 5-18-08 Sess 24 5-18-08 Sess 25 5-18-08 Sess 26 5-18-08 Sess 27 5-18-08 Sess 28 5-18-08 Sess 29 5-18-08 Sess 30 5-18-08 Sess 31 5-18-08 Sess 32 5-18-08 Sess 33 5-18-08 Sess 34 5-18-08 Sess 35 5-18-08 Sess 36 5-18-08 Sess 37 5-18-08 Sess 38 5-18-08 Sess 39 5-18-08 Sess 40 5-18-08 Sess 41 5-18-08 Sess 42 5-18-08 Sess 43 5-18-08 Sess 44 5-18-08 Sess 45 5-18-08 Sess 46 5-18-08 Sess 47 5-18-08 Sess 48 5-18-08 Sess 49 5-18-08 Sess 50 5-18-08 Sess 51 5-18-08 Sess 52 5-18-08 Sess 53 5-18-08 Sess 54 5-18-08 Sess 55 5-18-08 Sess 56 5-18-08 Sess 57 5-18-08 Sess 58 5-18-08 Sess 59 5-18-08 Sess 60 5-18-08 Sess 61 5-18-08 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Checklists

Before Each Dynamic Event

- Check fluid levels
- Check for full throttle
- Oil Chain
- Fill with fuel
- Ty-wrap spark plug boots to spark plugs
- Set tire pressures to proper pressures
- Start & warm up engine
- Check to make sure engine temp and oil pressure are normal during engine warm up



Data Acquisition

Data Acquisition Sensors

- **Steering - 25 Hz**
- **Throttle – 20 Hz**
- **Lateral Acceleration - 100 Hz**
- **4 Corner Damper Displacement – 250 Hz**
- **Brake Pressure - 25 Hz**
- **4 Corner Wheel Speed – 100 Hz**

Initial Analysis Page

Speed



Throttle & Brake



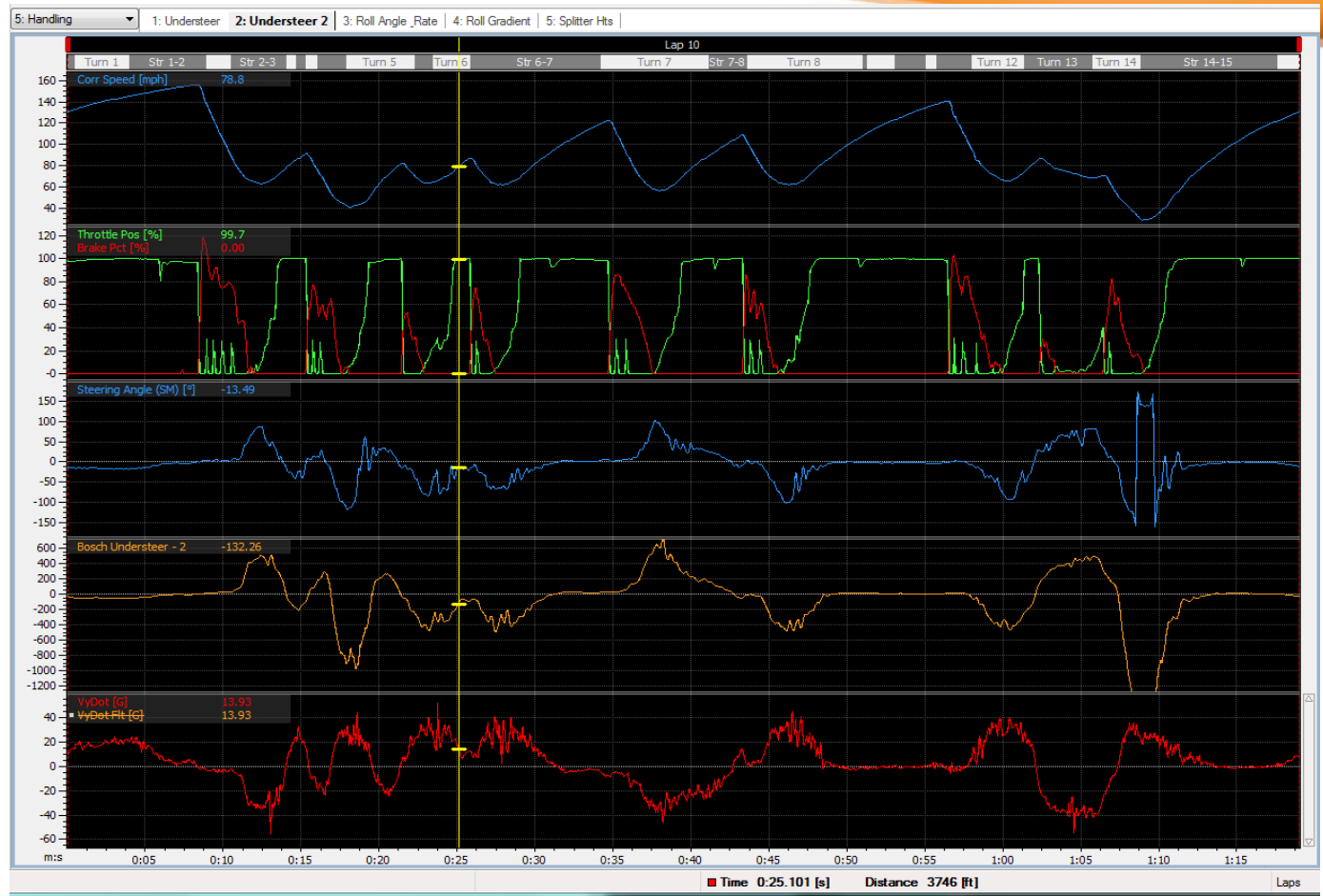
Steering



Understeer



VyDot



Unfiltered Dampers

Steering

Throttle

Damper
Displacement

Damper
Velocity



Travel to Jounce Bumper

Jounce Bumper Engagement

Rear Shocks



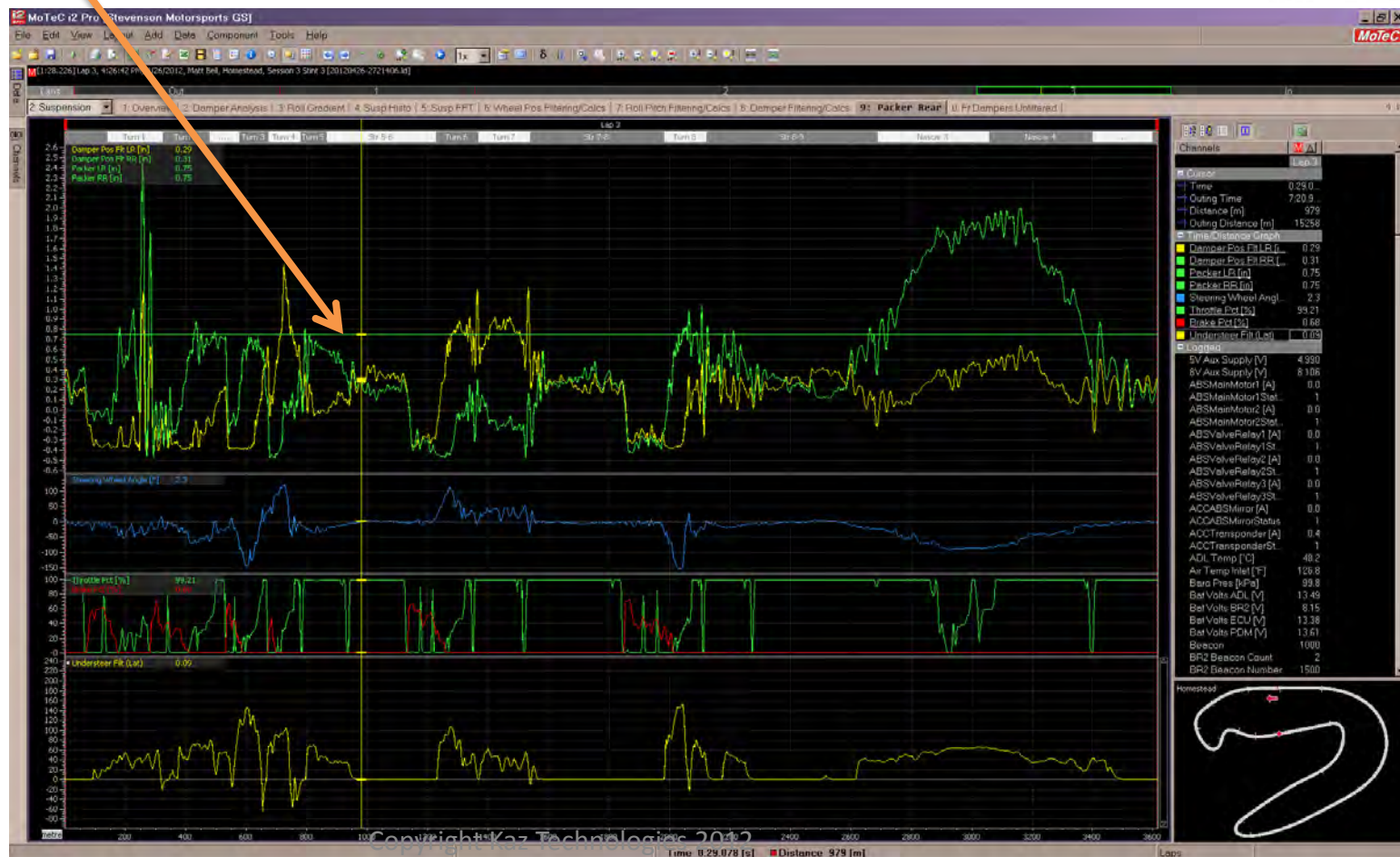
Steering



Throttle Brake



Understeer

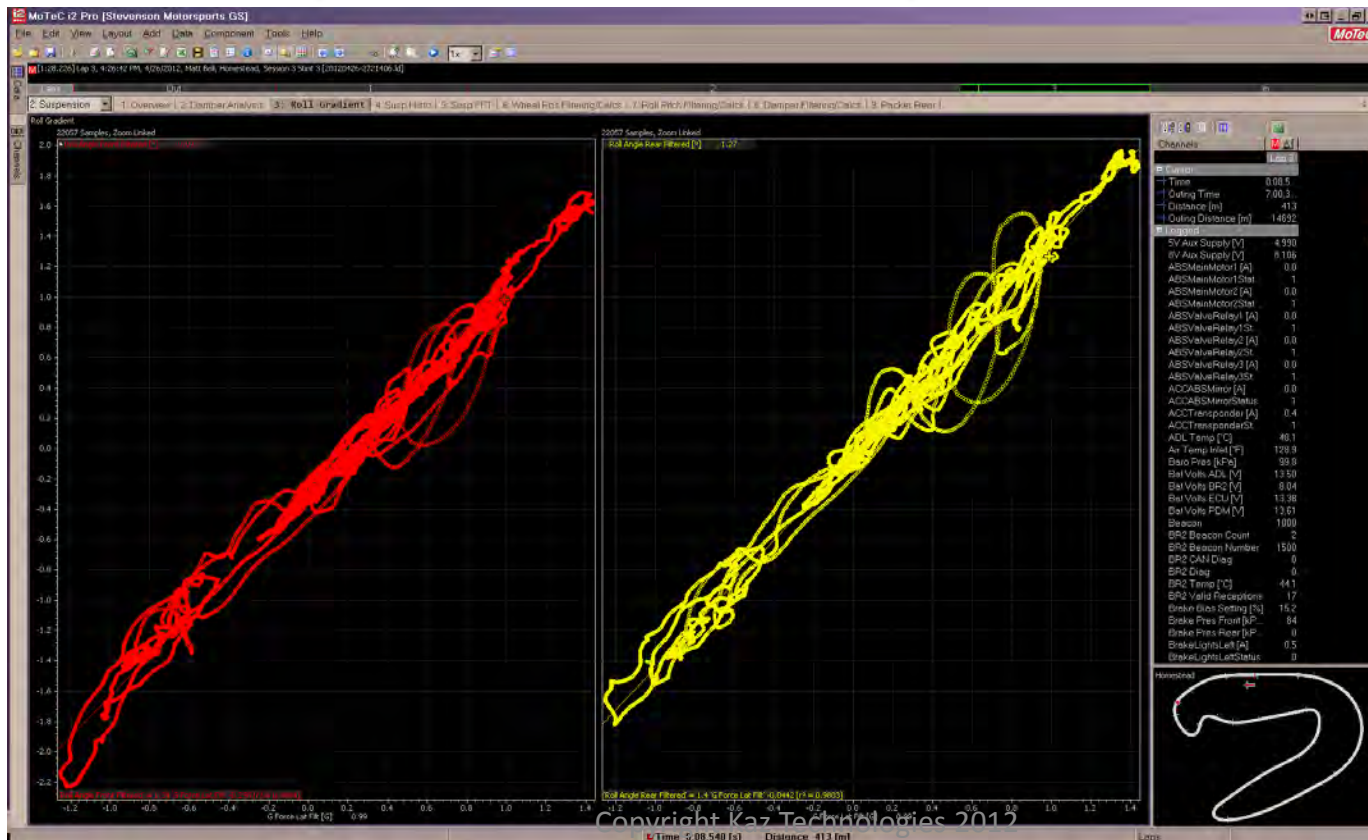


Roll Gradient

Front Roll Gradient (1.34)



Rear Roll Gradient (1.4)





Track Testing



Track Testing

- Vehicle Setup
- Run Log
- Basic handling
- Damper tuning
- More advanced tuning
- Test summary

Vehicle Set-up Sheet

Chassis Information

Gearbox Information

Daytona Prototype Chassis Setup											
RILEY TECHNOLOGIES		Track	Laguna	Event	Race	Date	5/17/08	Session	Race		
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Dia	26.12			Wheel Rt	648	Wheel Rt	648			Dia	26.12
Setup PSI	30			Shocks	Pen	Shocks	Pen			Setup PSI	30
Cold PSI	18			Shock ID	Riley 5	Shock ID	Riley 6			Cold PSI	18
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				Bump Rbr	Ohl 03	Bump Rbr	Ohl 03				
Rake In	0.689	Packer	0.188	Pack Gap	0.530	Pack Gap	0.498	Packer	0.188	Tilt Deg	0.00
Rake Deg				Gas Pres	150	Gas Pres	150				
				Set	-15+2-12	Set	-15+3-12				
				F Scoop	Open	F Press		F Mast	810	F Rot	250
				R Rest	1.25	R Press		R Mast	810	R Rot	252
				F Pad				Pagid	rs5		
				R Pad				Pagid	rs5		
Setup Fuel	15g	Driver	175	LF Wgt	597	RF Wgt	602	Setup Wgt	2596	Wedge %	49.88
Start Fuel	15g	Body On?	N	LR Wgt	693	RR Wgt	704	Tech Wgt	682	Front %	46.19
Fuel Wot	95.10									Right %	50.31
Sidepod	2.290	Spod Raise	0.015	Ride Hot	2.510	RAR Bar	0.500	Spod Raise	0.015	Sidepod	2.290
				Rock Link	no	Blade	Soft				
Camber	-1.6			LR Spring	1050	RR Spring	1050			Camber	-1.7
Toe	0.060i ?			Wheel Rt	723	Wheel Rt	723			Toe	0.060i ?
				Shocks	Pen	Shocks	Pen				
Code	Pirelli D2			Shock ID	Riley 7	Shock ID	Riley			Code	Pirelli D2
Dia	27.49			File	RT 1	File	RT 1			Dia	27.49
Setup PSI	30			Bump Rbr	Ohl 03	Bump Rbr	Ohl 03			Setup PSI	30
Cold PSI	18	Packer	0.000	Pack Gap	1.360	Pack Gap	1.410	Packer	0.000	Cold PSI	18
Hot PSI	28			Gas Pres	150	Gas Pres	150			Hot PSI	28
				Set	-10+6-11	Set	-10+6-9				
Main ang	18.50	Gurney	0.750	Spoiler ang	35.00	Sp Gurney	2.000	S Board	No	Sp hole	Center
				Uncut - No Taper		Sp Ext Ht	1.000				
R&P	12 : 36	Drop	1 : 1	Avg R Dia	27.49	RPM	7,100	Diff	50 pl+AA	6 plate	X-Trac
1st	14 : 35	2nd	16 : 31	3rd	20 : 33	4th	18 : 26	5th	22 : 28	6th	
MPH	77.4		99.9		117.3		134.0		152.1		
Drop	NA		1.598		1.054		885		844		
Other	V8 steering blocks (Low front roll center)(Low ackerman, Long tie rod)										
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Race Daytona Sess 1 End 5-17-08 Start 5-17-08 Sess 2 5-18-08 Sess 3 5-18-08 Sess 4 5-18-08 Sess 5 5-18-08 Sess 6 5-18-08 Sess 7 5-18-08 Sess 8 5-18-08 Sess 9 5-18-08 Sess 10 5-18-08 Sess 11 5-18-08 Sess 12 5-18-08 Sess 13 5-18-08 Sess 14 5-18-08 Sess 15 5-18-08 Sess 16 5-18-08 Sess 17 5-18-08 Sess 18 5-18-08 Sess 19 5-18-08 Sess 20 5-18-08 Sess 21 5-18-08 Sess 22 5-18-08 Sess 23 5-18-08 Sess 24 5-18-08 Sess 25 5-18-08 Sess 26 5-18-08 Sess 27 5-18-08 Sess 28 5-18-08 Sess 29 5-18-08 Sess 30 5-18-08 Sess 31 5-18-08 Sess 32 5-18-08 Sess 33 5-18-08 Sess 34 5-18-08 Sess 35 5-18-08 Sess 36 5-18-08 Sess 37 5-18-08 Sess 38 5-18-08 Sess 39 5-18-08 Sess 40 5-18-08 Sess 41 5-18-08 Sess 42 5-18-08 Sess 43 5-18-08 Sess 44 5-18-08 Sess 45 5-18-08 Sess 46 5-18-08 Sess 47 5-18-08 Sess 48 5-18-08 Sess 49 5-18-08 Sess 50 5-18-08 Sess 51 5-18-08 Sess 52 5-18-08 Sess 53 5-18-08 Sess 54 5-18-08 Sess 55 5-18-08 Sess 56 5-18-08 Sess 57 5-18-08 Sess 58 5-18-08 Sess 59 5-18-08 Sess 60 5-18-08 Sess 61 5-18-08 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Run Log

RILEY TECHNOLOGIES **KAZ TECHNOLOGIES IES** **Practice Session Sheet**

Date 9/18/08 Track Miller Event Miller Race

Session 2 Drivers Jim Matthews, Marc Goossens, Ryan Hunter-Reay 2:42.670

Laps Tot/Tires	Lap Times	Lap Time (Sec)	Changes/Comments
			Tire Set 2 20.5 19.5
			Stickers 22.0 22.0
			Changes
			Tire pressures up
90.5 F			Rear springs from 1100 to 1150
15%			Rear spoiler from 2" to 1"
25.93			Rear brake restrictor from 1.25 to 2.0
5:27			Outing 4 Jim In
15/1	Out		FARB 3 RARB 3 MAP 1
	2:44.430		
	2:44.040		
P10	2:42.590		P1 #10 2:38.048 Hot Press 28.2 27.5
	2:43.010		28.0 28.2
	2:43.170		FARB 2
	In		
			Outing 5 Ryan In
			RF to 28 psi Hot
22/8	Out		FARB 2 RARB 3 MAP 1
	2:44.560		Track 96
			Hot Press 29.0 29.0
P11	2:40.560		P1 #59 2:37.313 28.9 29.4
P6	2:38.800		P1 #59 2:37.313
	In		
			Car is a bit of push high and low speed corners center off, power down.
			flat corners especially
			Then the car goes loose. But I think that is because of the amount of wheel
			Platform feels real solid. Just needs a tweak
			Outing 6 No Bar Setup - No FARB or RARB
			Fr springs from 850 to 1100
			Rr springs from 1150 to 1250
			RR tire press to 29 psi HOT
27/13	Out		FARB -- RARB -- MAP 1
P4	2:38.040		P1 #59 2:37.313 Track 96

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Session Information

Tire Info

Tire Data

Driver Comments

Changes

Session Information

Setup Info

Changes


Driver Comments

Data Analysis

Run Log

Tire Data

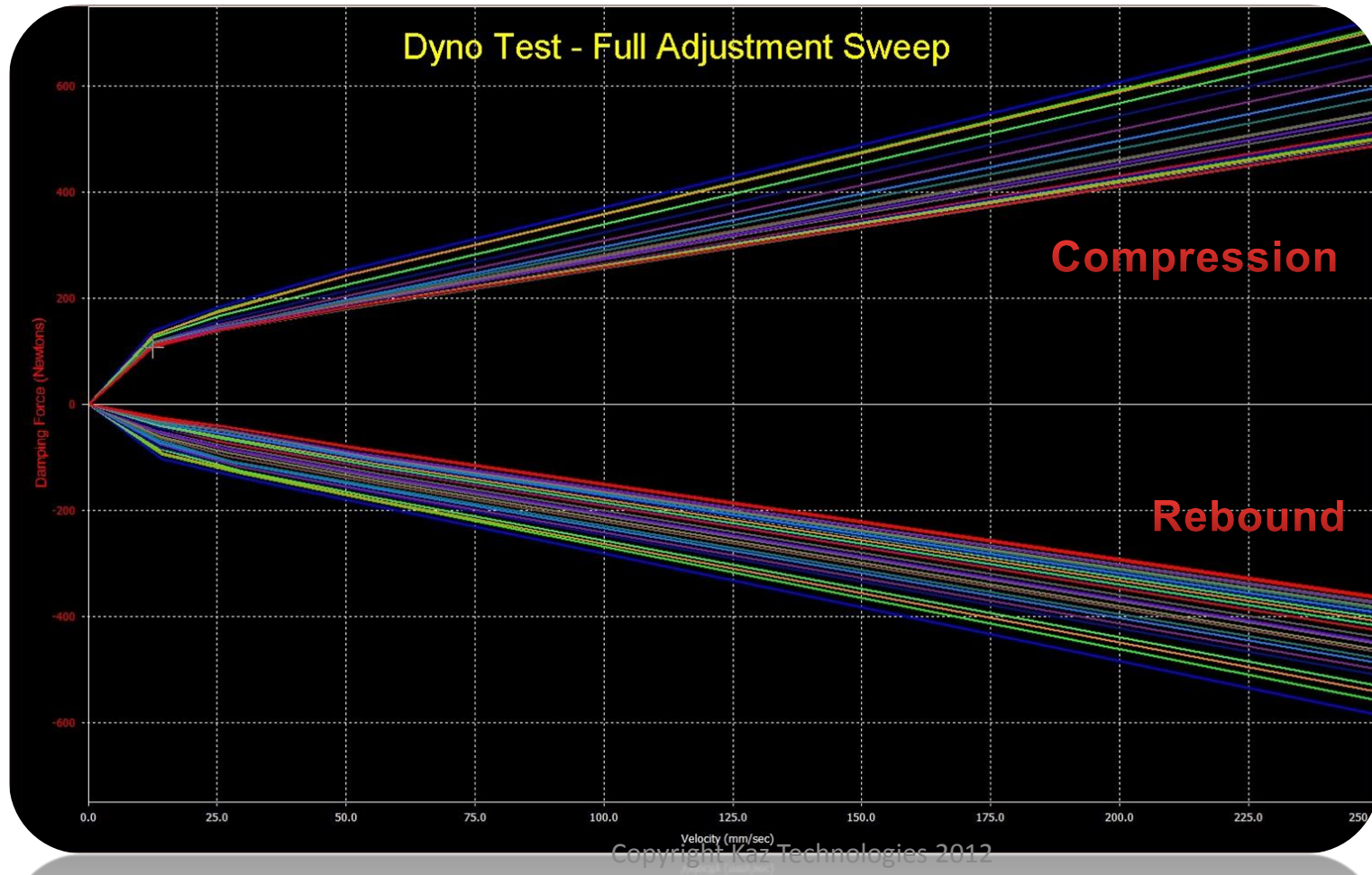
Lap Times

A B C D E F G H I J K L M V W X Y Z																													
										Lap Distance: 3.740																			
										Event: 12 Hours of Sebring										2011 GT Pole: 1:58.9 Corvette									
										<input type="checkbox"/> Telemetry ON/OFF										Laps and Mileage					On Track				
Run # Time of Day Weather		Setup				Changes				Driver Comments				Data / Post Processing Comments				Tires		Lap No	Tire Laps	Tire Mileage	Lap Time	IMSA Lap Times	On- Com				
S6 R1		3/14/13 Day 4 AM Session 6																											
Jonathan		Sprints Fr Dampers R ST08-01F				Tire Set 4 Med - Stickers				Still getting better								Tire Set 4 Med - Stickers		72	0	0	0						
10:15		Fr Rr -8+0-37+4 -8+0-37+4				Jonathan in				Best it has been								Start Press A 68 T 72		73	1	4	0		In Red Flag				
		600 700 Rr Dampers JR ST08-R				Front springs +150 from 450 to 600				Aero balance is excellent								+1.1 all around		74	2	7	124.46						
		FARB -9+2-20+6 -9+2-20+6				Rear springs +100 from 600 to 700				Rear need a bit of help								18.6 19.0		75	3	11	122.72						
		Dia 1.250 RARB MAP 2				FARB from 1.38 sft/stf to 1.25 stiff				Little too free								17.0 17.3		76	4	15	122.64						
		Set Stiff Dia 1.125 Lower A-arm				RARB from soft to med				Front holds over bumps wher rear can't hold on								In Press		77	5	19	122.64		A lot of Traffic				
		Wing 15 Set Mid Outer				Rake -0.250 from 0.850 to 0.600												25.4 24.4											
		DvPins 2 Splitter Offset -0.100				Reset toes to 0.050				No clear laps								25.6 25.5											
						New brakes (1st race set)												A 56 T 76											
						MAP 2																							
S6 R2																													
Kuno						Kuno in				Car is really really good								In Press		78	6	22	0						
10:49						+ 15 gal fuel				Balance is really good								+1.0 +1.1		79	7	26	123.84						
										Some push exit low speed corner								25.5 25.4		80	8	30	122.7						
										push when pick up throttle								26.6 26.1		81	9	34	122.7						
										Bottoming in T17 right under seat								+0.4		82	10	37	122.7						
										rear in compression																			
										Car not undersprung																			
S6 R3																													
		Sprints Fr Dampers R ST08-01F				Front LSR +3 from +37 to +34				That change was good				Negative rake out of corners.				In Press		83	11	41	131.82						
		Fr Rr -8+0-34+4 -8+0-34+4								Gave front a lot more bite				Flying nose on corner exits				26.7 26.2		84	12	45	123						
		600 700 Rr Dampers JR ST08-R								Front would dive and stay down								26.9 27.2		85	13	49	121.24		P1 #97 2:00.786				
		FARB -9+2-20+6 -9+2-20+6								Could use a bit more										86	14	52	121.42						
		Dia 1.250 RARB MAP 2								Same amount more in rear								Brake Temps		87	15	56	121.42						
		Set Stiff Dia 1.125 Lower A-arm								Took a little of rear stability on braking								250 730 710 260											
		Wing 15 Set Mid Outer								Car very consistent thru session								360 890 860 375											
		DvPins 2 Splitter Offset -0.100																											
										Kuno - Holding me back																			
										T5 rear a bit unstable on transition																			
										T13 a bit unstable under braking																			
										T3,7,10 3/4 throttle push. Changed helped, but not enough																			
										T10 over bumps on exit. Jumping around on TC.																			

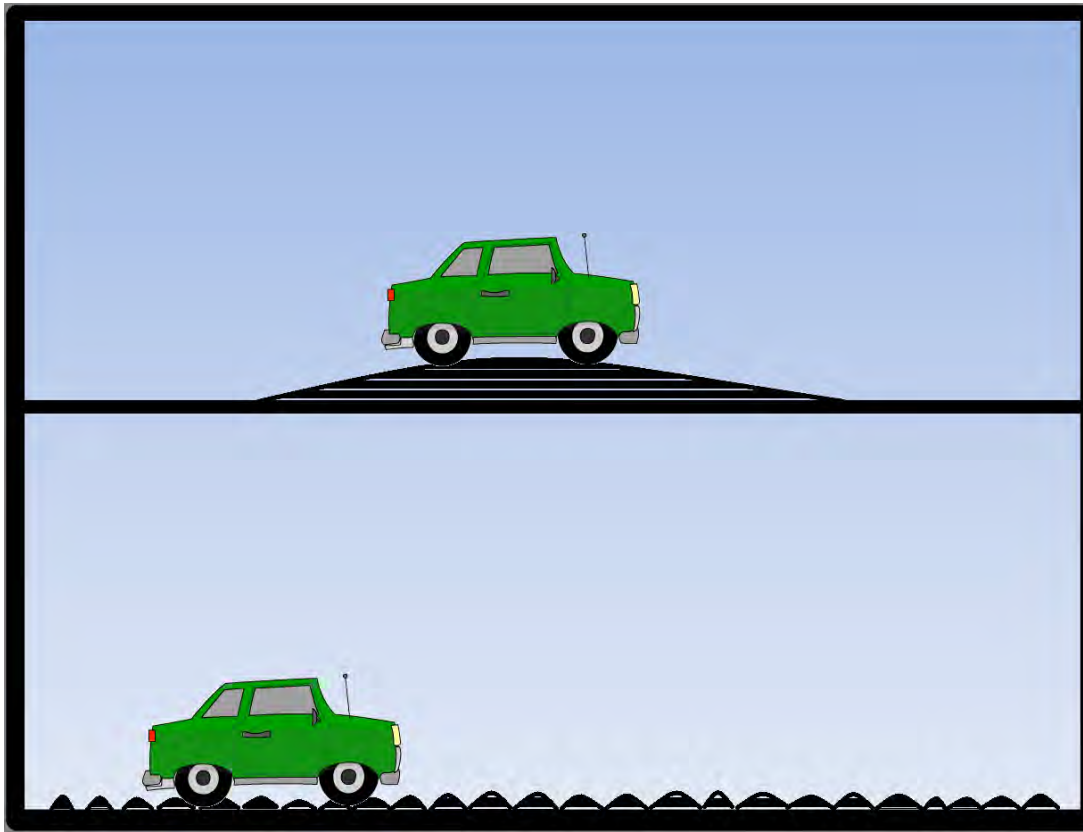
Basic Damper Tuning

- ➔ **Low frequency heave, pitch, balance**
- ➔ **High frequency (Bumps)**
- ➔ **Handling**
 - Steady state
 - Braking
 - Turn-in
 - Mid-Corner
 - Exit
- ➔ **Rebound and compression adjustments**

Damping Adjustment Data



Vehicle Input



**Low Frequency
Hump**



**High Frequency
Bumps**

Low frequency heave, pitch, balance

- **Find low frequency hump**
 - ✓ To make car move at Sprung Mass Resonance
- **Set dampers to full soft front and rear**
- **Drive over hump at increasing speed until car bounces**
 - ✓ Observe visually
 - ✓ Analyze data
- **Adjust damping to balance and damp**
 - ✓ Fix pitch, then heave
 - ✓ May have to adjust spring rates

In phase, underdamped



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Overdamped

Steering



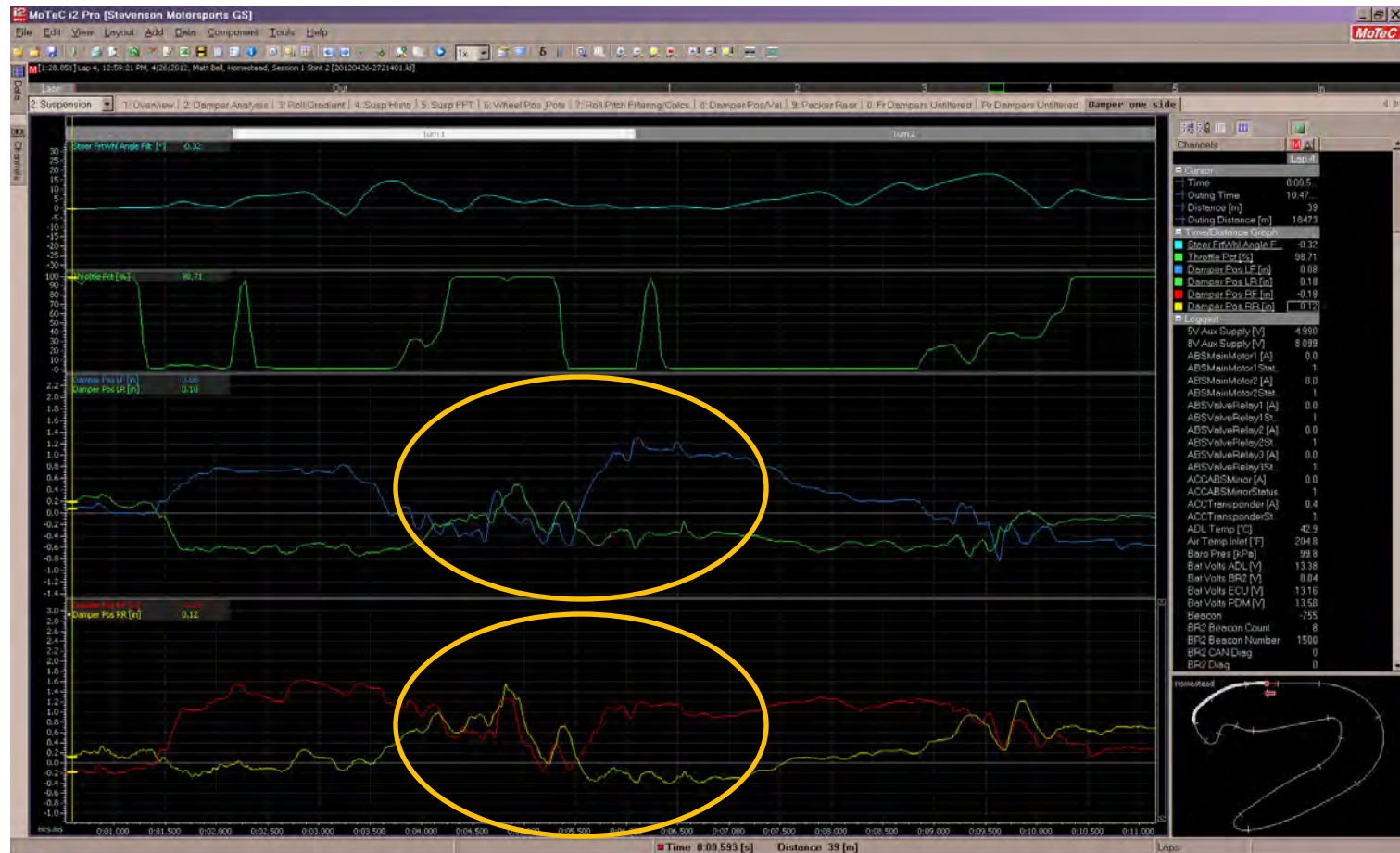
Throttle



Left Damper



Right Damper



Shock Travel

Shock is topping out!

Rear Shocks

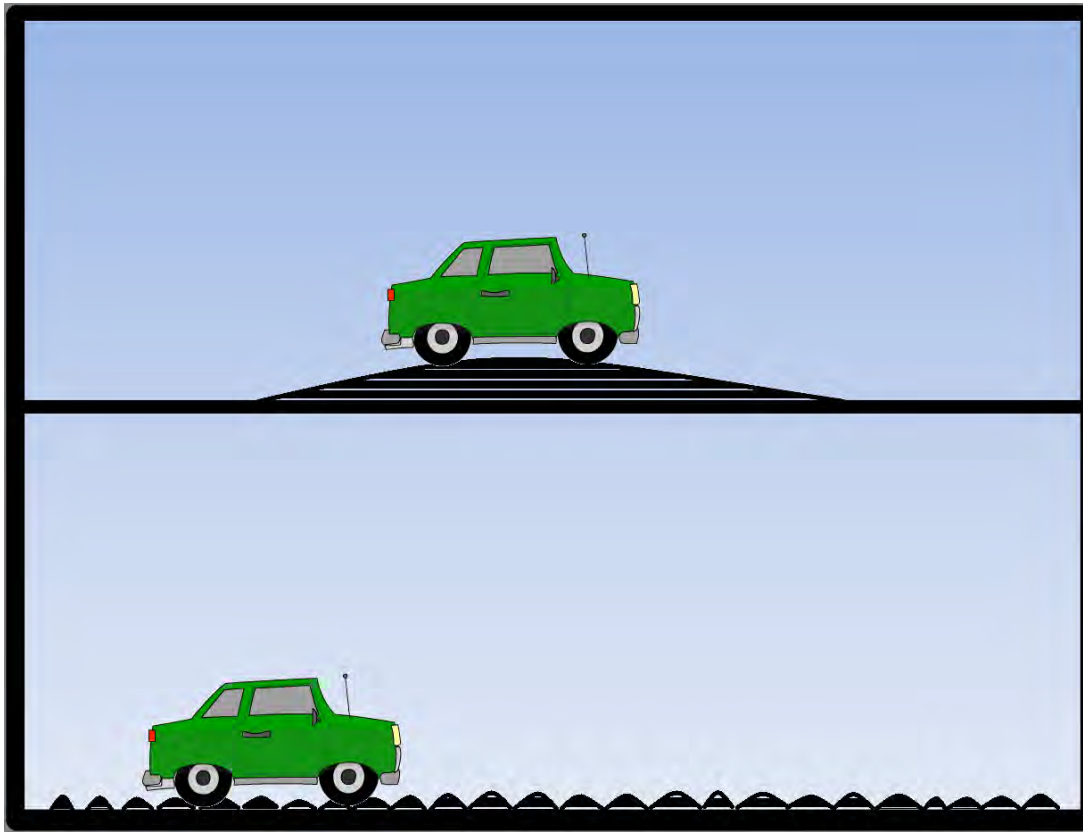
Steering

Throttle Brake

Understeer



Vehicle Input



**Low Frequency
Hump**

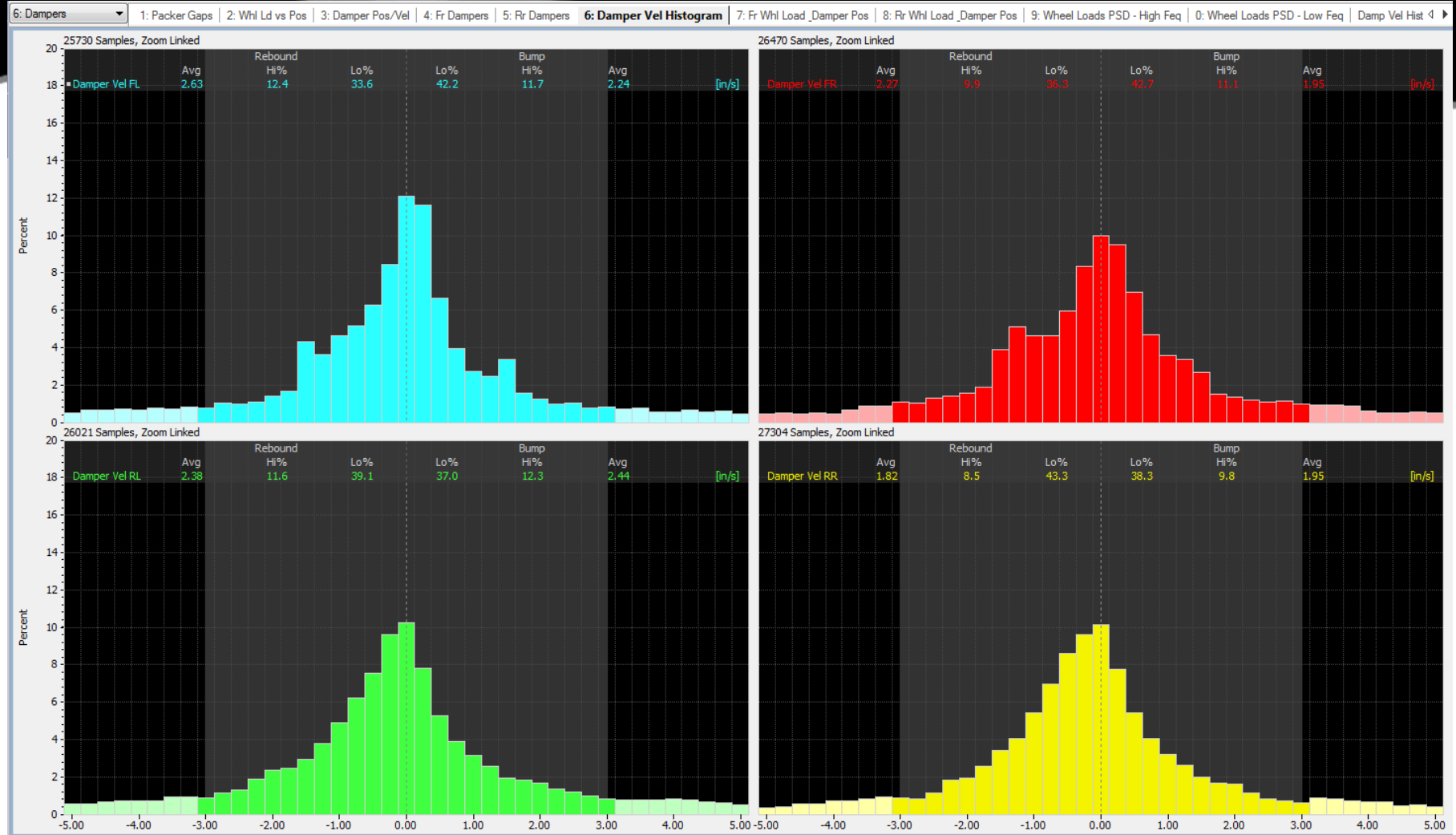


**High Frequency
Bumps**

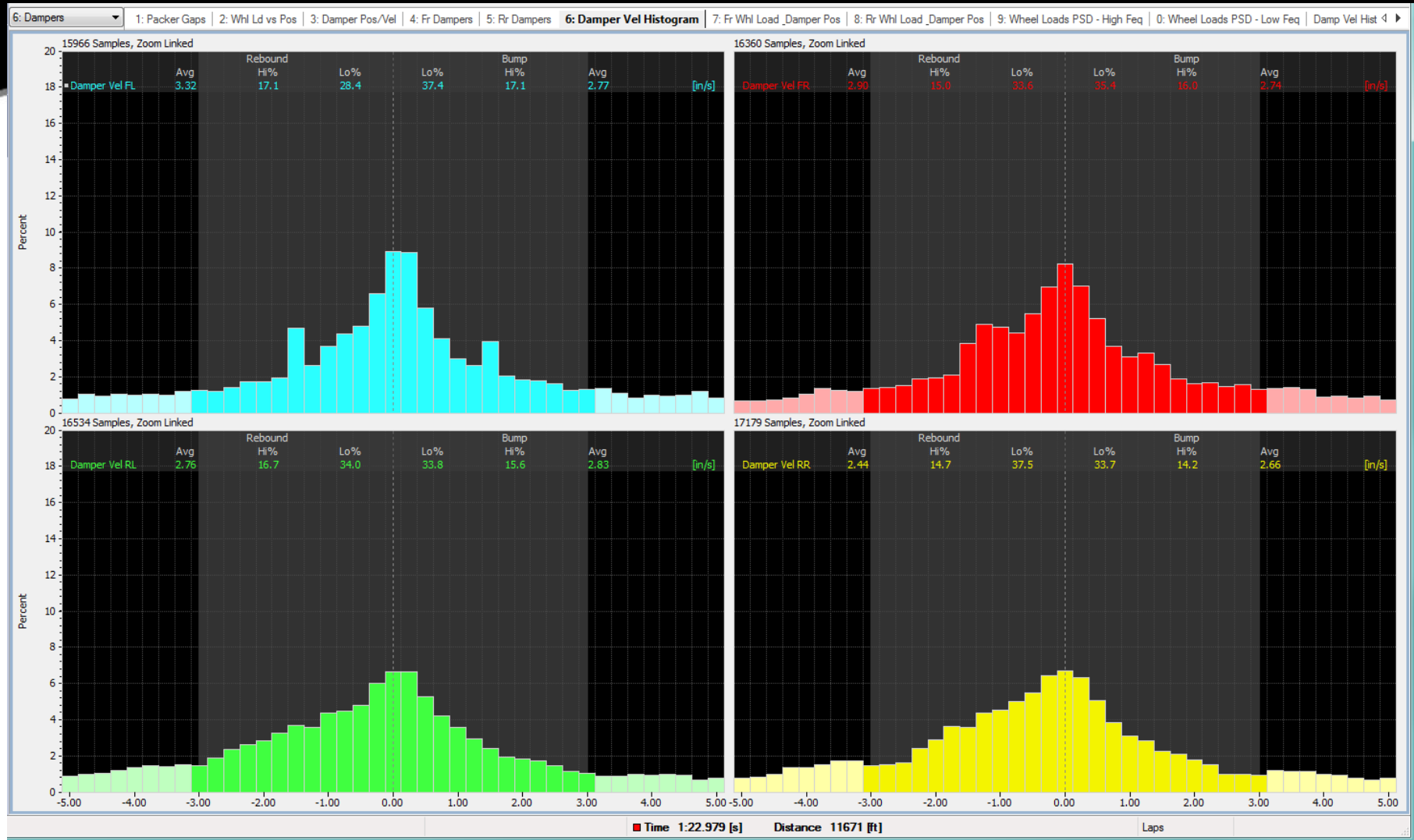
High frequency control

- **Find high frequency bumps**
 - ✓ To make wheels resonate or bounce
- **Set dampers to low frequency settings**
- **Drive over bumps at increasing speed**
- **Do the tires bounce or go into resonance? Lose traction?**
 - ✓ Observe visually
 - ✓ Analyze data
- **Adjust damping**
 - ✓ More AND less compression
 - ✓ More AND less rebound

Damper Velocity Histogram



Damper Velocity Histogram

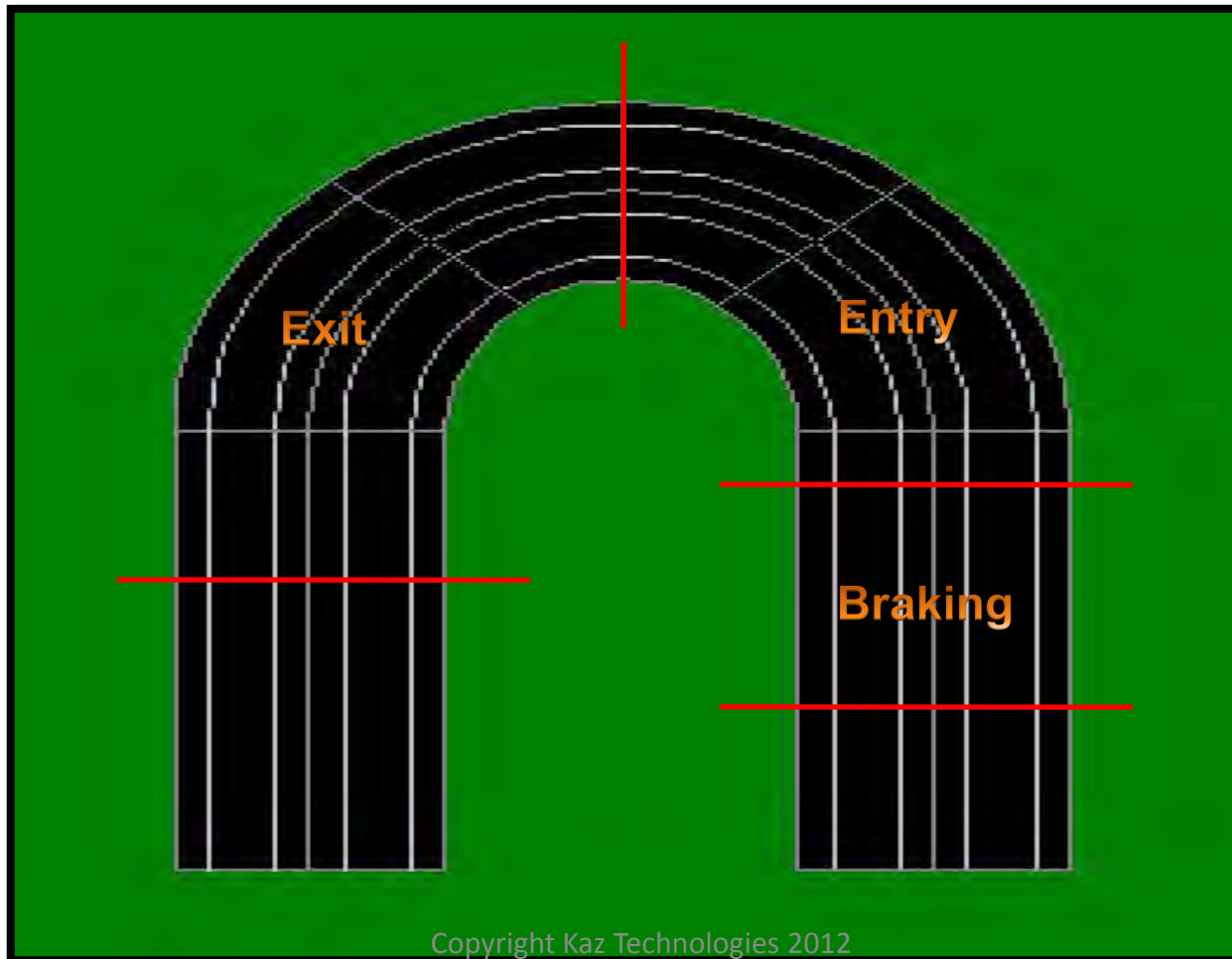


Basic Handling

Start Simple!!!

- Simple course
 - Oval
- Does it brake in a straight line?
- Does it drive in a straight line?
- Does it shift properly?
- Any bottoming?
- Basic handling
 - Braking, Entry, Exit

Basic Handling



Basic Handling

- **Driver Questions**

- **Braking**

- ✓ Stable? Yes, No

- **Entry**

- ✓ Neutral, Understeer or Oversteer?

- **Exit**

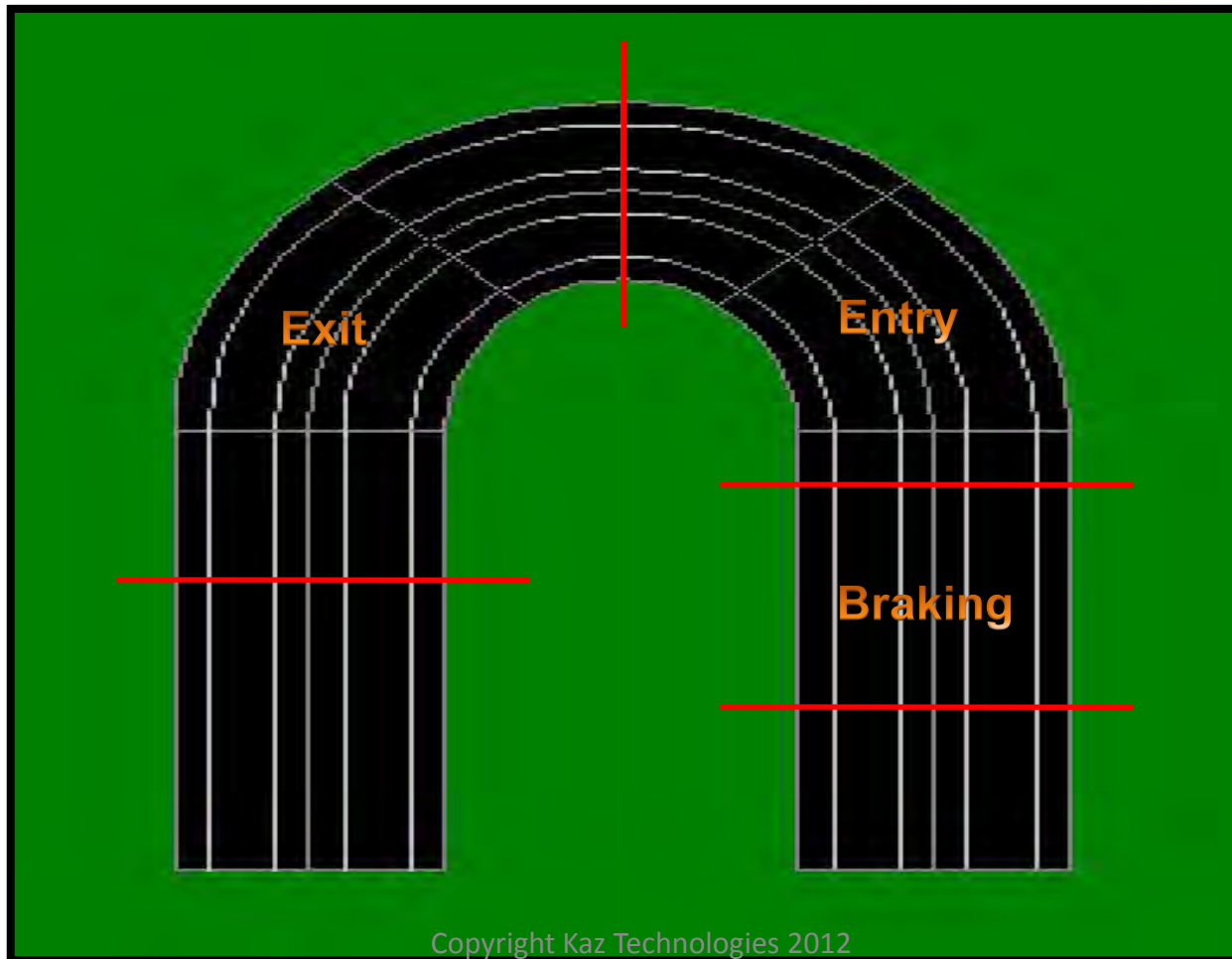
- ✓ Neutral, Understeer or Oversteer?

- **Look at vehicle response in data analysis**

Basic Handling

- **Start with the basics**
 - **Springs and swaybars**
 - **Aero**
- **Move to suspension adjustments**
 - **Camber, caster, toe**
- **Fine tune transitions with dampers**

Basic Handling



Handling

•Braking

▪Car pulls to one side

- ✓Bleed brakes
- ✓Toes even side to side?

▪Rear instability

- ✓Rear bumpsteer
- ✓Rear toe
 - More rear toe for increased stability

▪Front instability

- ✓Front bumpsteer
- ✓Front toe
 - Front toe-in for stability

Handling

- **Entry**

- **Won't initiate turn**

- ✓ Too much front spring?
 - ✓ Too much front compression?
 - ✓ Front toe out

- **Understeer**

- ✓ Less front spring
 - ✓ Softer front anti-roll bar

- **Oversteer**

- ✓ More rear toe
 - ✓ Softer rear anti-roll bar
 - ✓ Less rear spring

Handling

- Exit

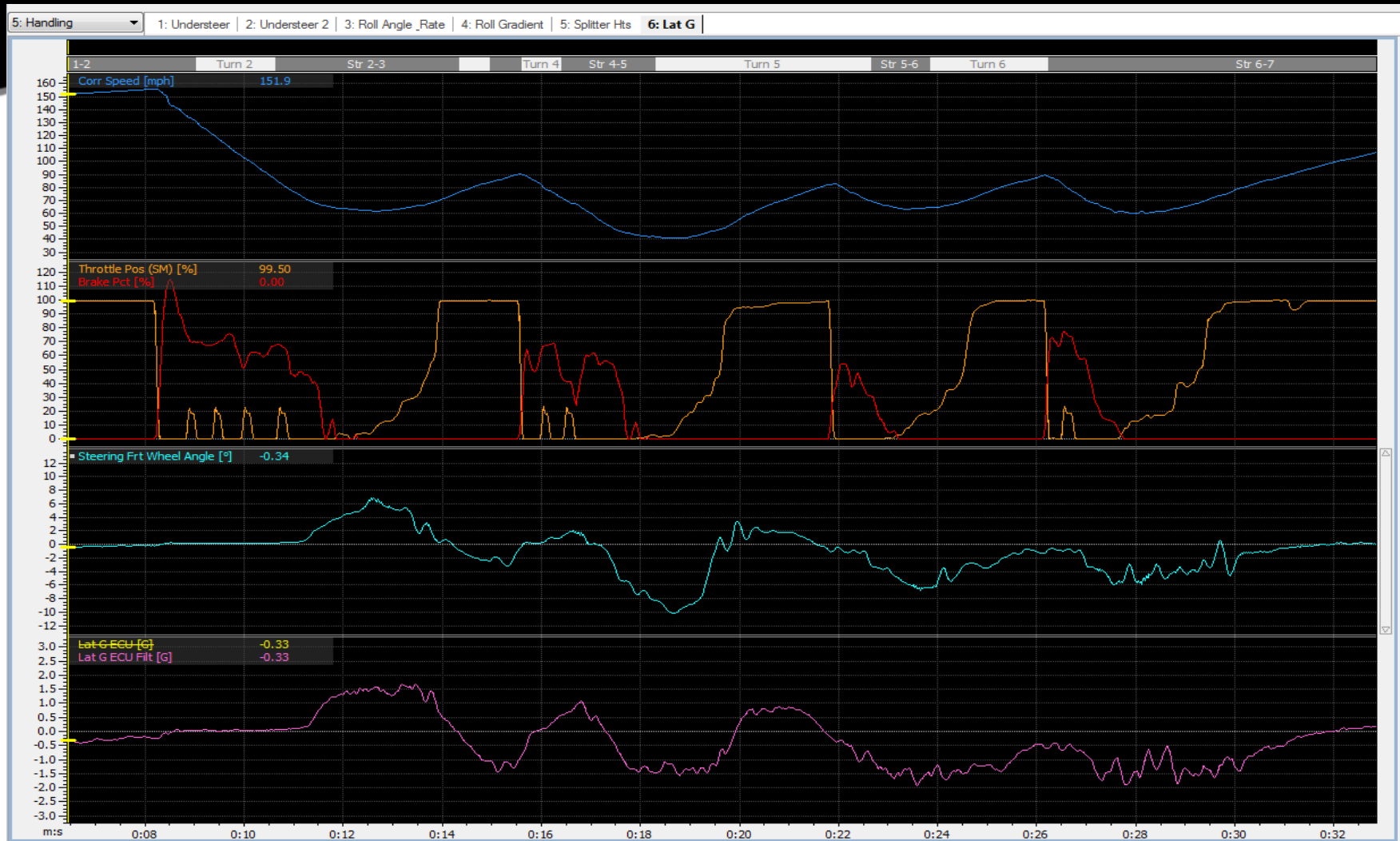
- Oversteer

- ✓Softer rear anti-roll bar
 - ✓Less rear spring
 - ✓Less rear damping
 - ✓Rear camber

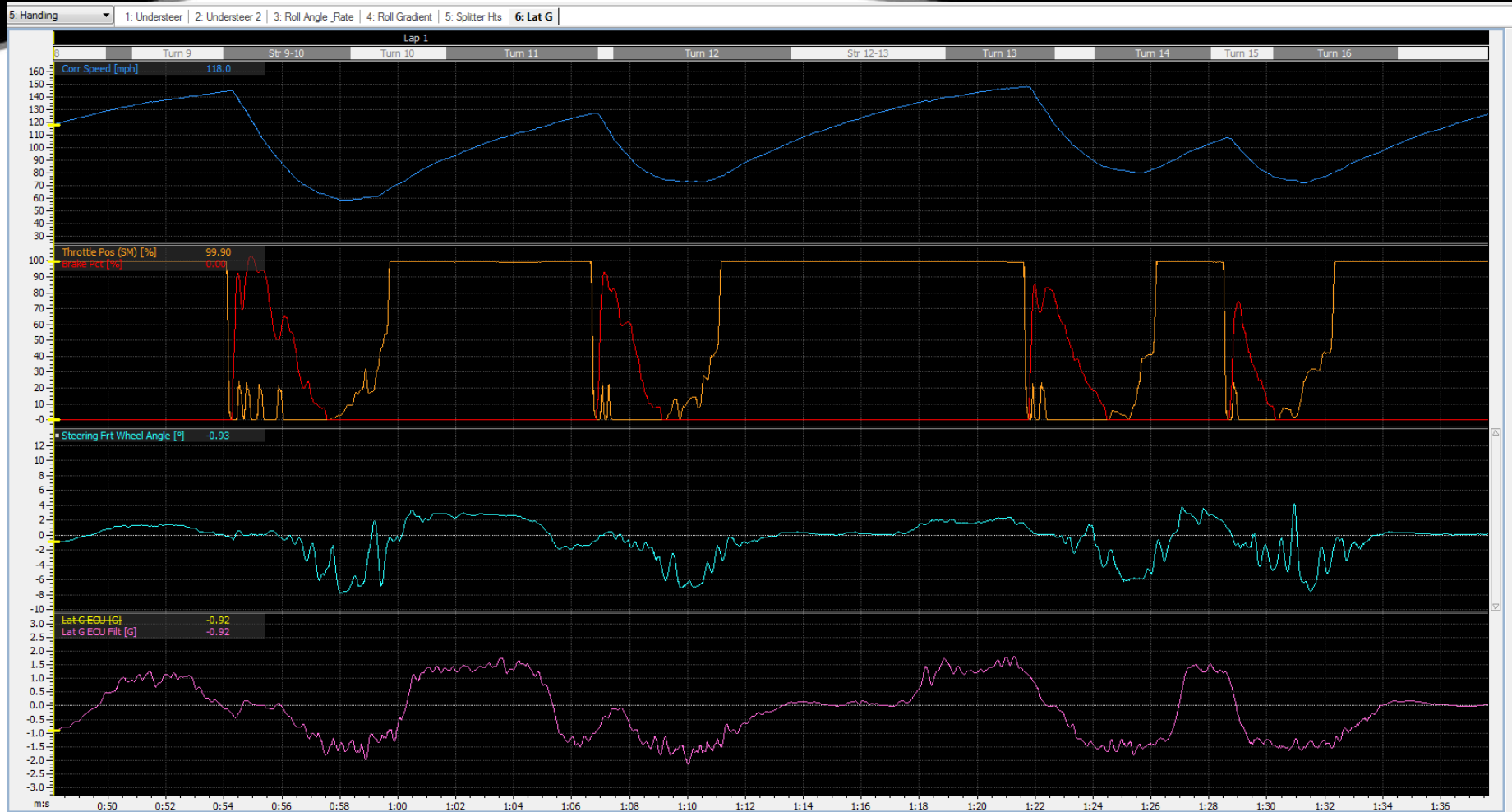
- Understeer

- ✓Less front spring
 - ✓Softer front anti-roll bar
 - ✓More caster
 - ✓More front camber

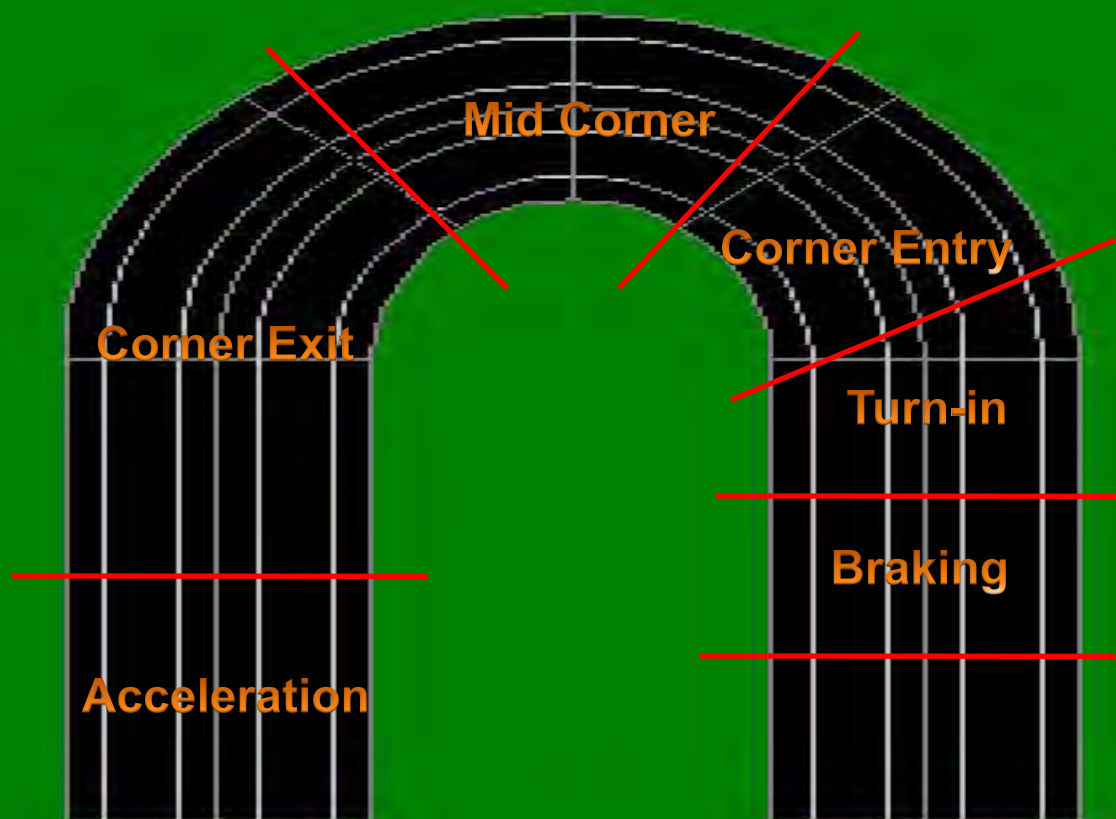
Vehicle Response Data



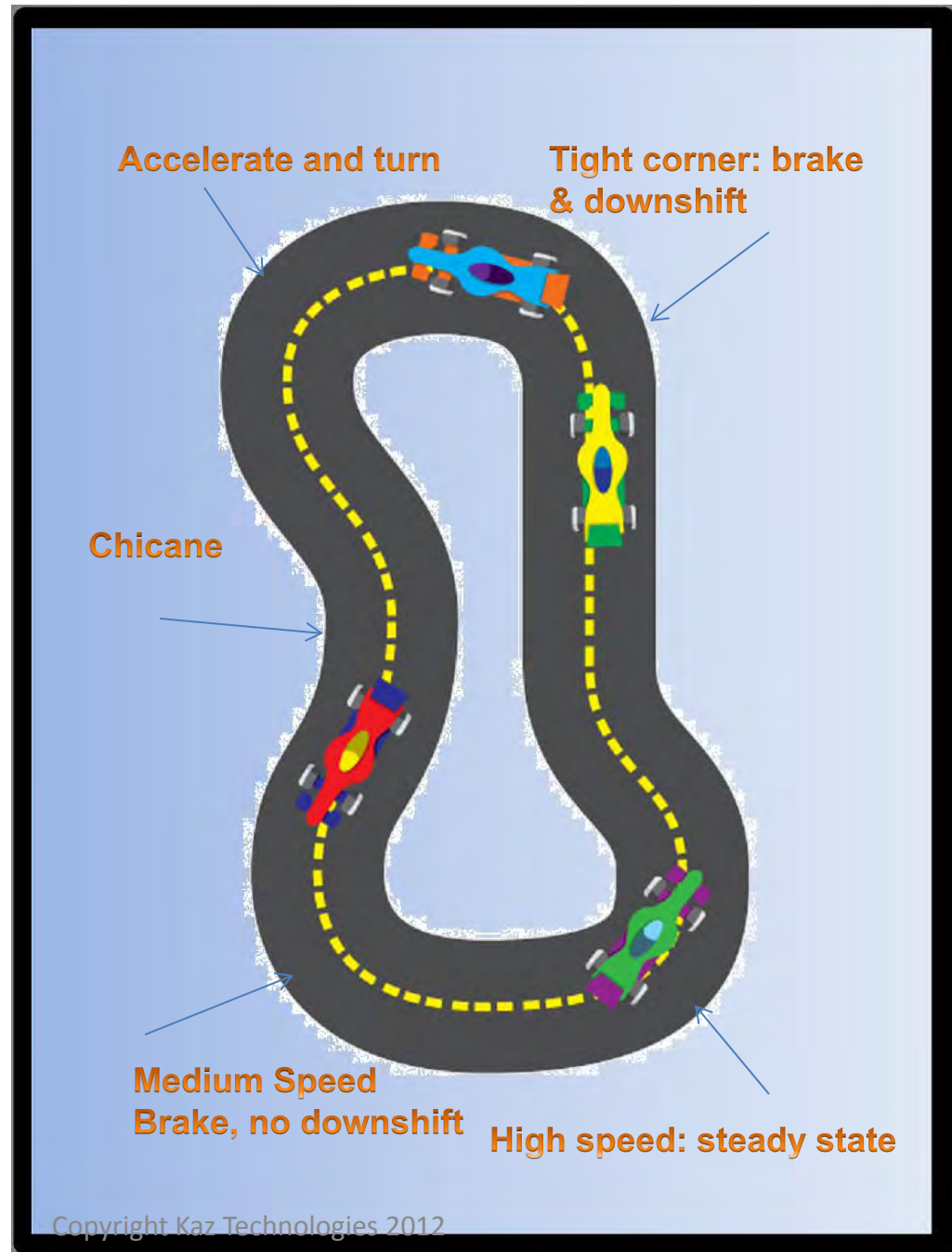
Vehicle Response Data



Advanced Handling



Advanced Handling



Damper Adjustments



Turn the knobs one at a time



Turn them enough to make a difference



Determine what each knob does

Heave/pitch balance

Braking

Turn-in

Mid-Corner

Exit



Turn the knobs again at the end of suspension tuning

Test Summary

- What went right?
- What went wrong?
- What worked?
- What didn't work?
- Issues
- Items for next test or event
- Final setup sheet



Event Summary

Dates 1/6-8/13

Track Sebring Jan Test

Event Sebring Jan Test

Drivers Dominik Farnbacher, Jonathan Bomorito, Ben Keating

Test Summary

To Be Done

Summary of Items tested

- Lower spring rates - Started 700/800, ended 600/600
- Softer FARB - Started 1.500, ended 1.38
- Penske adjustments
 - Rear HSC, Front LSR & LSC
- Lower rear ride h/less rake
- Dynamic shocks
 - As Received adjustments
 - Front rebound P_IDJ
- Michelin soft compound
- JRI shocks
- Rear brake Frisbees

What Worked

- Lower spring rates
 - More grip, better on bumps
- Softer FARB
 - More front grip, better on bumps
- Penske shocks
 - Rear HSC, Front LSR & LSC
 - Less oscillation, positive driver comments
- Lower rear ride h/less rake
 - Rear more stable, but more U/S
- Dynamic shocks (as received)
 - Instant lap time improvement (1.2 sec)
 - Better motion balance, less pitch
 - Softer Compression blow off - Better for impacts & Grip
 - Softer Front HSC - Better for impacts
- Dynamic shocks - Front Rebound P_IDJ
 - Less motion in front over bumps
- Michelin soft compound
 - Fastest times of test
 - Good lap times through 13 laps
- JRI shocks (Fr RadLin, Rr Inc Flow)
 - Times equal to Dynamics
 - Drivers like them better
 - Car motions as good as Dynamics

#93 Car Issues

Location of rake Bias adjustment knob for Jonathan (he can't reach it!)

Steering column tilt helms have play in them

Other Issues

Need the ability for Chris to push data to Matt and I on timing stand

#93 Car - Things to consider for next time at Sebring

More front weight percentage

Less front anti-dive (Help lock-up sensitivity??)

Wing from 11 to 10 degrees

Gears: 4th shorter, maybe 3rd shorter

What did not work

- More rake
- Dynamic shocks
 - More LSR
- Penske shocks
 - Less rear HSC - pitch was worse
 - Rear rebound - More helped pitch, but less stable
 - Rear rebound - less made pitch worse
- Dynamic shocks
 - Stiffer Front LSR - more understeer
- Michelin soft compound
 - Fronts started to give up after 6 laps
 - Rears started to give up after 9 laps
 - At 13 laps rears were really bad
- JRI shocks (Fr RadLin, Rr Inc Flow)
 - Can't run zero spring preload



Questions!!



Kaz is here for you!

Questions?

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Topics to Discuss?

<http://www.facebook.com/Kaz.Technologies>

Start a discussion!

Thanks!



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References

Books by Carroll Smith

- ✓ Engineer In Your Pocket
- ✓ Tune to Win
- ✓ Drive to Win
- ✓ Prepare to Win
- ✓ Engineer to Win
- ✓ Nuts, Bolts, Fasteners & Plumbing Handbook

Other Books

- ✓ Race Car Vehicle Dynamics
William F. Milliken and
Douglas L. Milliken
- ✓ Fundamentals of Vehicle Dynamics
Thomas D. Gillespie
- ✓ Shock Absorber Handbook
John C. Dixon