

IIH Task Force Conference Call February 20, 2015
09:30 Eastern

Attendees:

Chrysler: Haiying Tang, Jeff Betz

Intertek: Adison Schweitzer, Charlie Leverett

Lubrizol: George Szappanos, Kevin OMalley

Afton: Ed Altman, Bob Campbell

SwRI: Karin Haumann, Sid Clark, Janet Buckingham, Pat Lang

Ashland: Amol Savant, Tim Caudill

Infineum: Mike McMillan, Andy Ritchie, Gordon Farnsworth, Doyle Boese

Shell: Scott Lindholm, Jeff Shu

Oronite: Robert Stockwell, Kaustav Sinha

IMTS: Dave Passmore

OHT: Matt Bowden, Jason Bowden

TMC: Rich Grundza

GM: Bruce Matthews

Ford: Ron Romano

Karin opened the meeting indicating the plans to review the PVIS Analysis for the comparison between the Sequence IIIG and the Chrysler IIH performed by Janet Buckingham, SwRI Statistician. Karin also informed the group that the planned review of the thermocouple issues was being tabled due to additional data and information still coming in to that database late last night.

Janet reviewed the database criterion used for the analysis outlining the parameters used for her presentation. See Attachment 1.

Questions:

- Andy Ritchie asked if this analysis could also be performed for WPD
- Bob Campbell asked if the IIH data set was the same as what was presented at the February AOAP meeting. Karin answered indicating the data set used contained one additional test reported from Afton.
- Rich Grundza asked the criterion for selection of the data set used for the analysis. Discussion concluded the data from 2009 was representative of GF-5 Testing. Karin commented the analysis did not include data on the Stellite Seat Tests. Pat Lang commented this is all chartable results.

Janet continued explaining she used 154 observations and LN(PVIS) for the analysis.

Janet reviewed the presentation slide by slide starting with the IIIG data set explaining the observations through slides 1 – 14. Janet summarized her reasoning for the IIIG data selection as wanting to compare the IIH data to something more current in the IIIG. Rich Grundza

agreed commenting the variability of the IIIG has increased over time and the IIIH test is extremely variable.

Janet continued her review explaining there is a typo error on the n size reported on slide #15.

Note: There are two corrections on slide #15, the n size data for Reference Oils REO2 and REO3 are reversed on the slide. The correct n size is; REO2 n=10 and REO3 n=2. These corrections have been indicated in Attachment 1 Slide #15 as indicated by the Secretary in Red Block Text.

Janet continued reviewing slides 15 – 20 explaining her analysis and observations for the IIIH data followed by her presentation summary.

The following are some of the questions and comments as noted by the secretary.

- Doyle Boese commented he felt it was a good analysis;
 - IIIG data included a wide time span
 - IIIH is over a shorter time period
 - This could inflate the variation for the IIIG
- Janet agreed, and Karin commented as they reduced from 154 data points to 75 data points, the variability increased. Janet agreed a shorter time period would decrease the degrees of freedom; however there is an oil that is reporting a large variability in PVIS that may have a surprising effect on the results.
- Rich Grundza commented this test has experienced a number of changes over time reviewing some such as, connecting rod designs, honing changes, etc. that might make finding a stable data set very difficult.
- Bob Campbell indicated he understood comparison to the IIIG was what was asked at the AOAP meeting; however he didn't feel the IIIG should be the poster child for precision for any new test.
- Haiying Tang commented the intent was to answer GM's comment that the IIIH precision was worse than the IIIG at the AOAP meeting.
- Pat Lang reminded everyone that a comment was made at the AOAP meeting that we needed to prove that the IIIH is at least equal to or better than the IIIG and that is what this presentation is addressing.
- Bob Campbell agreed indicating this presentation has done a good job helping understand that but again reminding everyone that he felt the IIIG should not be the poster child for comparison. Bob also asked if any work comparing hours to 100 or 150% increase.
- The group discussed variability in 434-1 testing and Rich Grundza commented indicating by Today's referencing standards, the high viscosity increase test on 434-1 that the lab engineer indicated should be considered an outlier, would be considered non-valid and should be considered an outlier and he had discussed this with Janet.
- Ron Romano asked;
 - This analysis is showing the IIIG and IIIH is fairly comparable
 - GM's analysis showed the variability was not comparable

- Ron asked which set of data is he supposed to believe

After much discussion, Doyle suggested asking if one is based on a different data set than the other, Scott asked Bruce to comment and he replied he did not know the data set used for the analysis but understood that based on the raw data, GM felt the IIIH could not evaluate the performance of 434-1 properly going into the precision matrix. Sid commented that during the AOAP meeting, Karin showed data indicating the outlier data on 434-1 should be considered non-valid and dropped that data point from the data. GM agreed they would also remove that from their data. Ron Romano commented that Angela commented to him that even with the outlier removed they still felt the test was more variable with the 400 plus % increase data point.

Scott Lindholm pulled up the comments and read the comment from GM. After review he commented it looked like the comparison was made against the acceptance bands for reference oil 434-1, rather than the actual data as used by Janet for her comparison. Robert Stockwell commented acceptance bands vs raw data are different, there are 434-1 test results in the IIIG above 244% and therefore it was not a fair comparison.

Karin commented, the overall variability in Janet's analysis is a comprehensive evaluation of all the oils where GM's analysis was just IIIH 434 raw data compared to the IIIG acceptance band for that oil. Karin explained she asked Janet to compare the variability of the IIIG to the IIIH and this analysis shows the IIIH is no more variable than the IIIG.

The group Thanked Janet for her work and Ron Romano agreed the discussion answered his questions.

Bob Campbell asked if there was going to be an effort to look at Hours to PVIS.

Janet explained she discussed this with Karin and cautioned the data set is so small that it would be hard to come up with an estimated slope would not be anything like the slope they would get with a large amount of data. Janet asked Doyle to comment and he indicated he had not thought the process through but agreed we did not have enough data. Rich commented the majority of the people that did the work for the IIIF Heavy Duty Test are not on the call, but indicated we would have to target the data centered around an oil that is going to start to break in the test.

Scott suggested that moving forward this should be a decision made by the AOAP and decided after the precision matrix. Scott suggested that data will be collective and the statisticians will make that decision.

There were a number of additional comments, one indicating the Heavy Duty Group is currently going through some of these questions about looking at hours to PVIS.

Scott and Ron suggested possibly looking at WPD. Karin indicated she had discussed this with Janet and the group suggested looking at WPD after additional data on 438 is available for the IIIH.

At this time people started dropping off the call and Karin agreed to adjourn the call.

This is a compilation from notes recorded during the call, with comments from member participants during the Draft Review. Certain subjects may not necessarily be in exact order; however, they are believed to represent an accurate account of the call. If anyone feels changes or additional content may be necessary, please contact Sid Clark @ 586-873-1255 or Sidney.Clark@swri.org

Thanks, Sid

PVIS Analysis for IIIG and IIIH

Janet Buckingham, SwRI

2/20/15

Summary

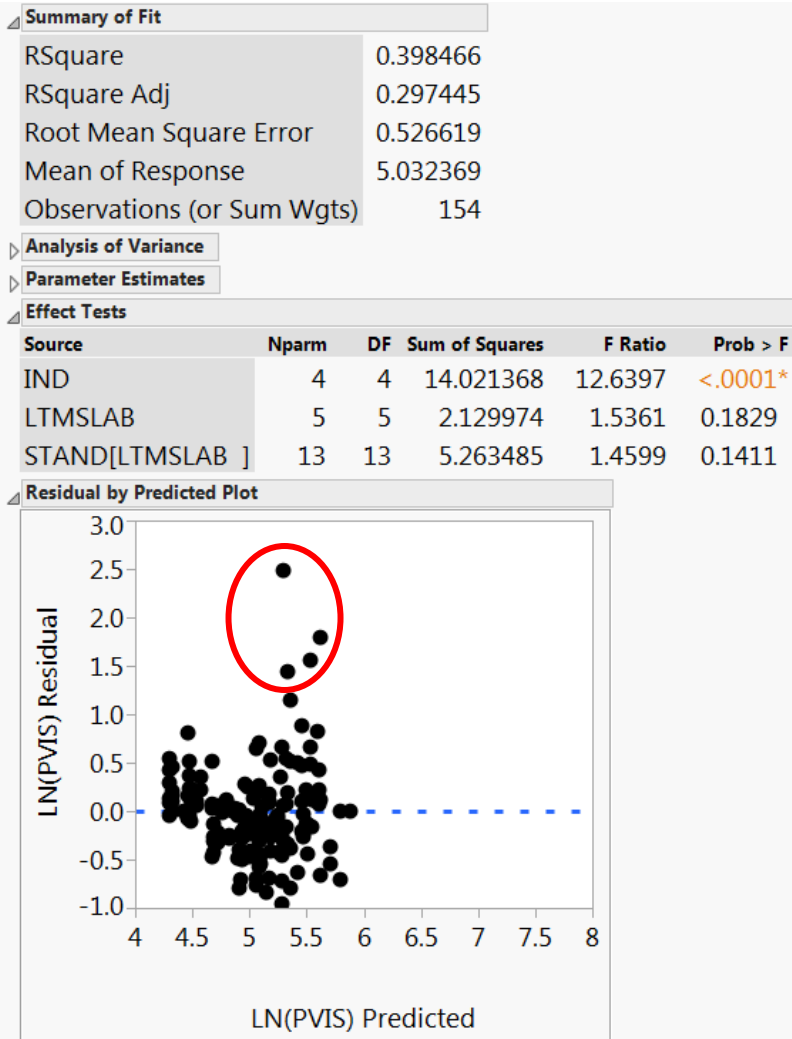
- All models included Oil, Lab and Stand(Lab)
- Used 5% level of significance

IIIG			IIIH		
Model	Oil Discrimination	RMSE	Model	Oil Discrimination	RMSE
#1 (n=154) All data	438 < (435,435-2,434-1)	0.53	#1 (n=18) All Data	REO3 < REO2 < 434-1	0.44
#2 (n=150) Removed 4 outliers	438 < (435,435-2,434-1) 434-1 < 435-2	0.40	#2 (n=17) Removed LZ Oil 434-1 with PVIS=754.7	REO3 < REO2 < 434-1	0.40
#3 (n=150) Removed 4 outliers Combined 435 oils	438 < 434-1 < 435	0.40			
#4 (n=75) Last 75 ref tests	438 < (435-2,434-1)	0.63			
#5 (n=74) Last 75 ref tests Removed 1 outlier Lab B with PVIS=2403	438 < (435-2, 434-1)	0.55			

Seq IIIG PVIS Analysis

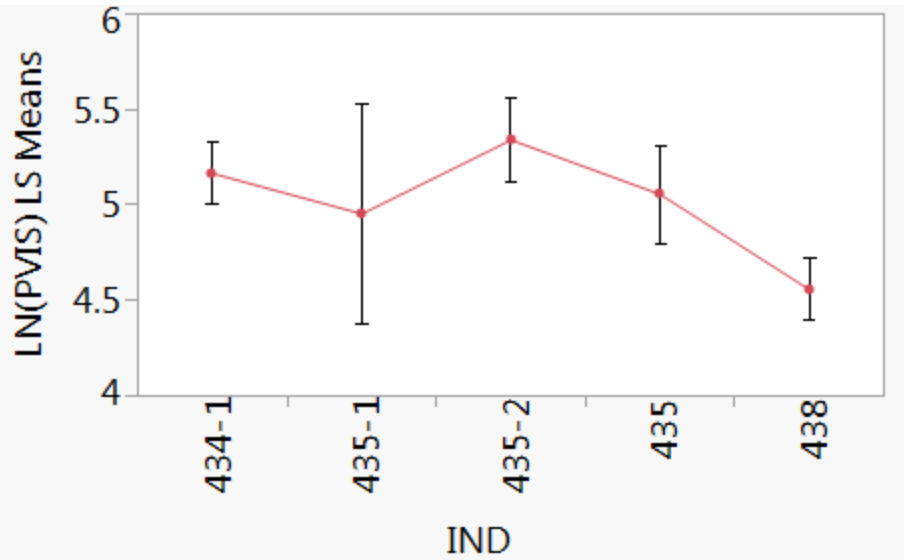
- LTMS Reference data
 - n=154 tests
 - Test dates: 1/6/2009 – 2/2/2014
 - All tests with original cylinder heads
- Used LN(PVIS) transformation in model

Model #1 (all data)



- Model includes:
 - Oil
 - Lab
 - Stand(Lab)
- Oil Discrimination
 - $438 < (435, 435-2, 434-1)$
- No significant lab differences
- No significant stand differences
- RMSE = 0.53
- IIIIG target $s = 0.2919$

Model #1: Oil Discrimination (all data)

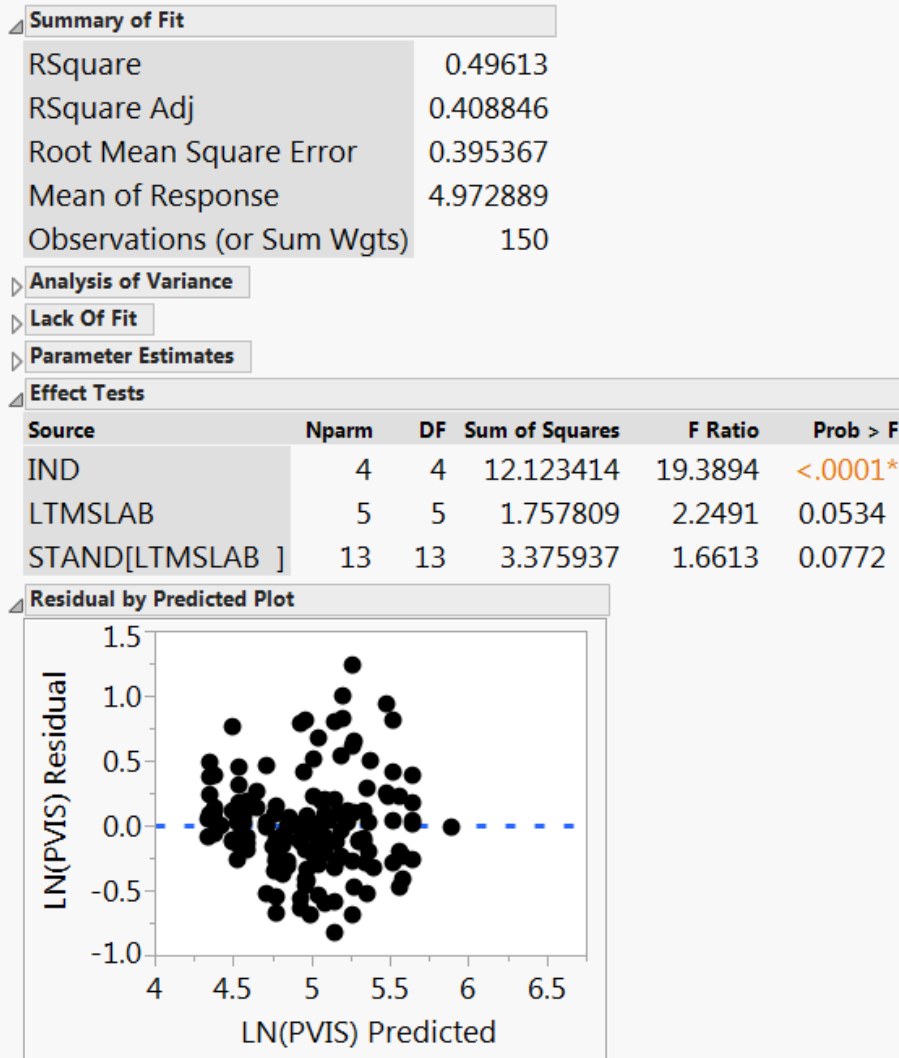


Oil	IIIG Target	IIIG #1 LS Means
438	4.57	4.56
434-1	4.73	5.17
435	5.18	5.06
435-1	5.18	4.95
435-2	5.18	5.34
s	0.2919	0.53

Level	- Level	Difference	Std Err Dif	Lower CL	Upper CL	p-Value
435-2	438	0.7843112	0.1280988	0.429972	1.138651	<.0001*
434-1	438	0.6087097	0.1068566	0.313129	0.904290	<.0001*
435	438	0.4992472	0.1432095	0.103109	0.895385	0.0059*
435-1	438	0.3970138	0.2960911	-0.422016	1.216044	0.6663
435-2	435-1	0.3872974	0.3041925	-0.454142	1.228737	0.7081
435-2	435	0.2850640	0.1592783	-0.155522	0.725650	0.3839
434-1	435-1	0.2116959	0.2977747	-0.611991	1.035383	0.9537
435-2	434-1	0.1756015	0.1299462	-0.183848	0.535051	0.6597
434-1	435	0.1094625	0.1444786	-0.290186	0.509111	0.9421
435	435-1	0.1022335	0.3118901	-0.760499	0.964966	0.9975

Note: 95% confidence intervals on LSMeans are not used for comparisons

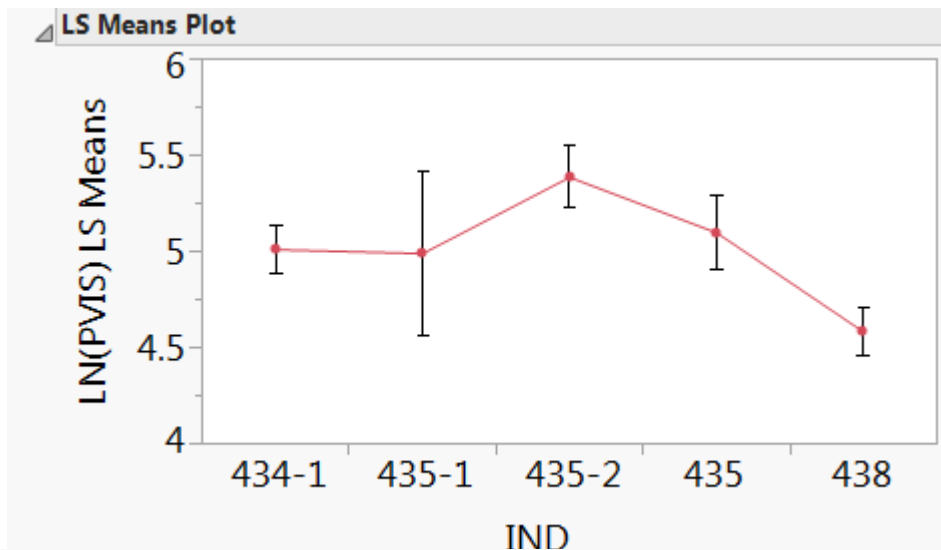
Model #2: (removed 4 434-1 outliers)



- Model includes:
 - Oil
 - Lab
 - Stand(Lab)
- Oil Discrimination
 - 438 < (435, 435-2, 434-1)
 - 434-1 < 435-2
- No significant lab differences
- No significant stand differences
- RMSE = 0.40
- IIIG target s = 0.2919

Model #2: Oil Discrimination

(removed 4 434-1 outliers)

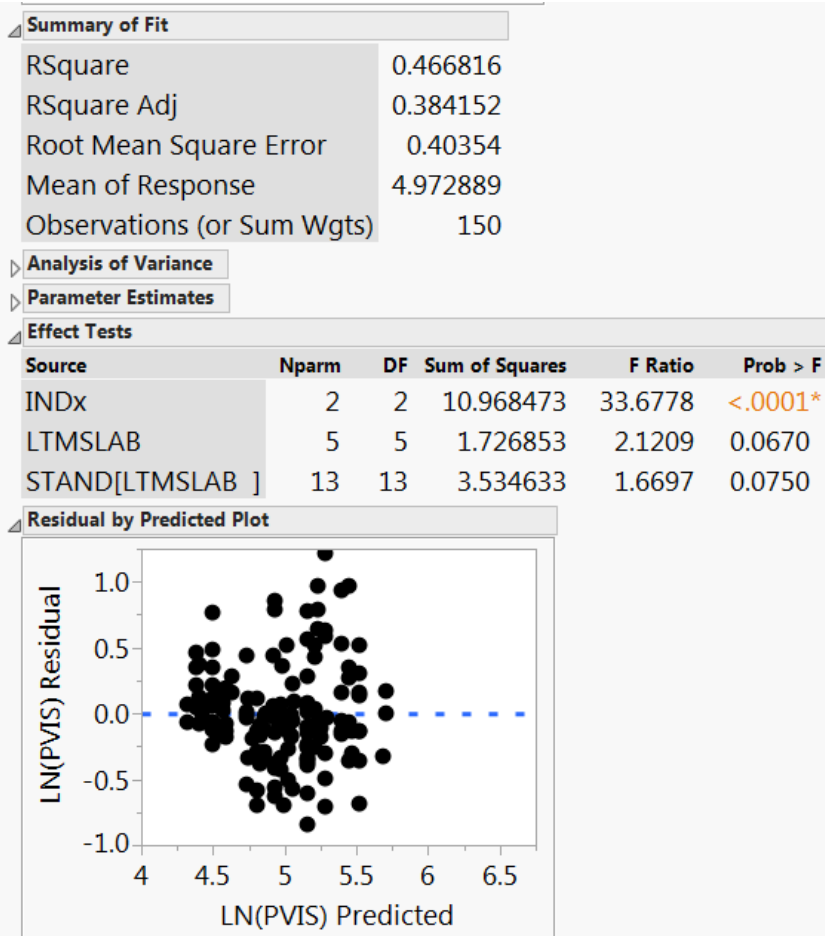


Level	- Level	Difference	Std Err Dif	Lower CL	Upper CL	p-Value
435-2	438	0.8044034	0.0962675	0.537996	1.070810	<.0001*
435	438	0.5155944	0.1076736	0.217623	0.813566	<.0001*
434-1	438	0.4277852	0.0822802	0.200086	0.655484	<.0001*
435-1	438	0.4073312	0.2224366	-0.208231	1.022894	0.3603
435-2	435-1	0.3970722	0.2285084	-0.235293	1.029437	0.4148
435-2	434-1	0.3766183	0.0995436	0.101145	0.652091	0.0022*
435-2	435	0.2888090	0.1196741	-0.042373	0.619991	0.1184
435	435-1	0.1082632	0.2341999	-0.539853	0.756379	0.9905
435	434-1	0.0878093	0.1101840	-0.217110	0.392728	0.9311
434-1	435-1	0.0204540	0.2243921	-0.600520	0.641428	1.0000

Oil	IIIG Target	IIIG #2 LS Means
438	4.57	4.58
434-1	4.73	5.01
435	5.18	5.10
435-1	5.18	4.99
435-2	5.18	5.37
s	0.2919	0.40

Note: 95% confidence intervals on LSMeans are not used for comparisons

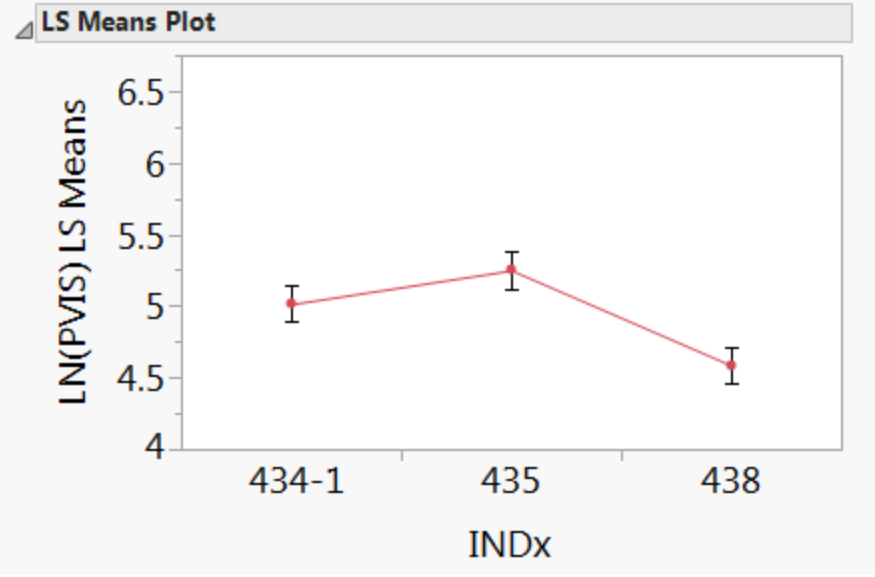
Model#3: (removed 4 434-1 outliers, combined 435 oils)



- Model includes:
 - Oil
 - Lab
 - Stand(Lab)
- Oil Discrimination
 - $438 < 434-1 < 435$
- No significant lab differences
- No significant stand differences
- RMSE = 0.40
- IIIG target $s = 0.2919$

Model #3: Oil Discrimination

(removed 4 434-1 outliers, combined 435 oils)



Oil	IIIG Target	IIIG #3 LS Means
438	4.57	4.59
434-1	4.73	5.02
435	5.18	5.25
s	0.2919	0.40

Level	- Level	Difference	Std Err Dif	Lower CL	Upper CL	p-Value
435	438	0.6635319	0.0823015	0.4683864	0.8586775	<.0001*
434-1	438	0.4279799	0.0839779	0.2288595	0.6271003	<.0001*
435	434-1	0.2355520	0.0861403	0.0313042	0.4397998	0.0194*

Model #4: (last 75 reference tests: 1/24/11 - 2/2/14)

Summary of Fit

RSquare	0.473839
RSquare Adj	0.304716
Root Mean Square Error	0.627319
Mean of Response	5.174737
Observations (or Sum Wgts)	75

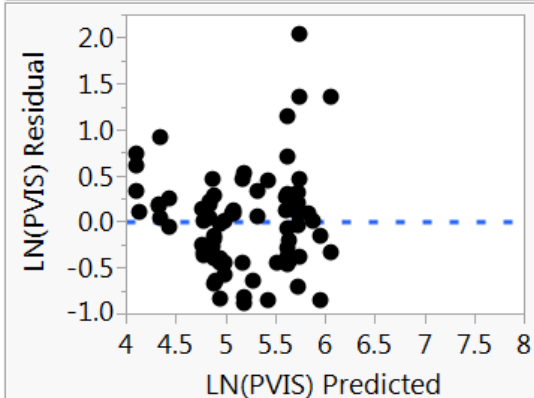
Analysis of Variance

Parameter Estimates

Effect Tests

Source	Nparm	DF	Sum of Squares	F Ratio	Prob > F
IND	2	2	8.6240571	10.9573	<.0001*
LTMSLAB	5	5	3.8533779	1.9584	0.0991
STAND[LTMSLAB]	11	11	4.7799723	1.1042	0.3753

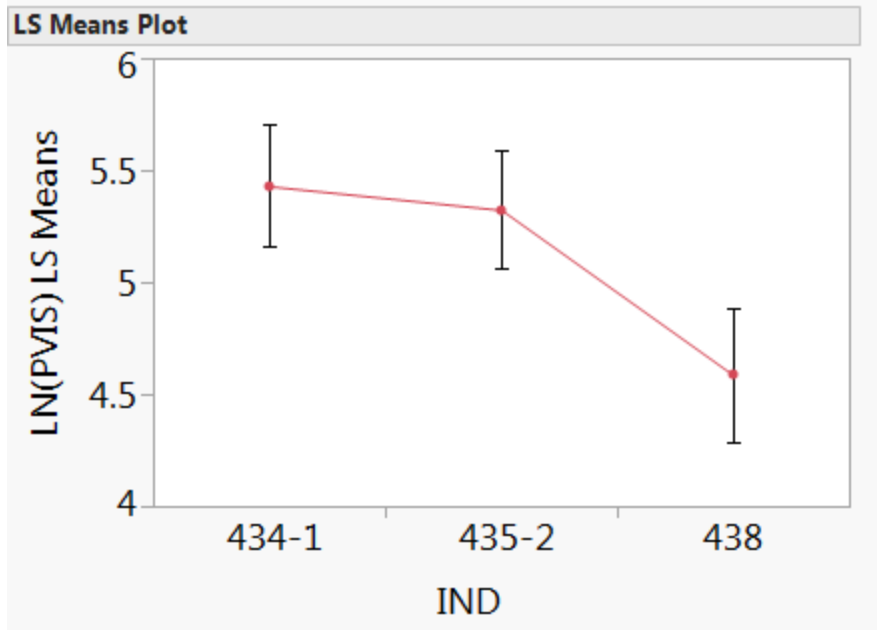
Residual by Predicted Plot



- Model includes:
 - Oil
 - Lab
 - Stand(Lab)
- Oil Discrimination
 - $438 < (435-2, 434-1)$
- No significant lab differences
- No significant stand differences
- RMSE = 0.63
- IIIG target $s = 0.2919$

Model #4: Oil Discrimination

(last 75 reference tests: 1/24/11 - 2/2/14)



Oil	IIIG Target	IIIG #4 LS Means
438	4.57	4.59
434-1	4.73	5.43
435-2	5.18	5.32
s	0.2919	0.63

Level	- Level	Difference	Std Err Dif	Lower CL	Upper CL	p-Value
434-1	438	0.8440431	0.1938007	0.377455	1.310632	0.0002*
435-2	438	0.7377256	0.1922442	0.274884	1.200567	0.0009*
434-1	435-2	0.1063176	0.1825899	-0.333280	0.545915	0.8301

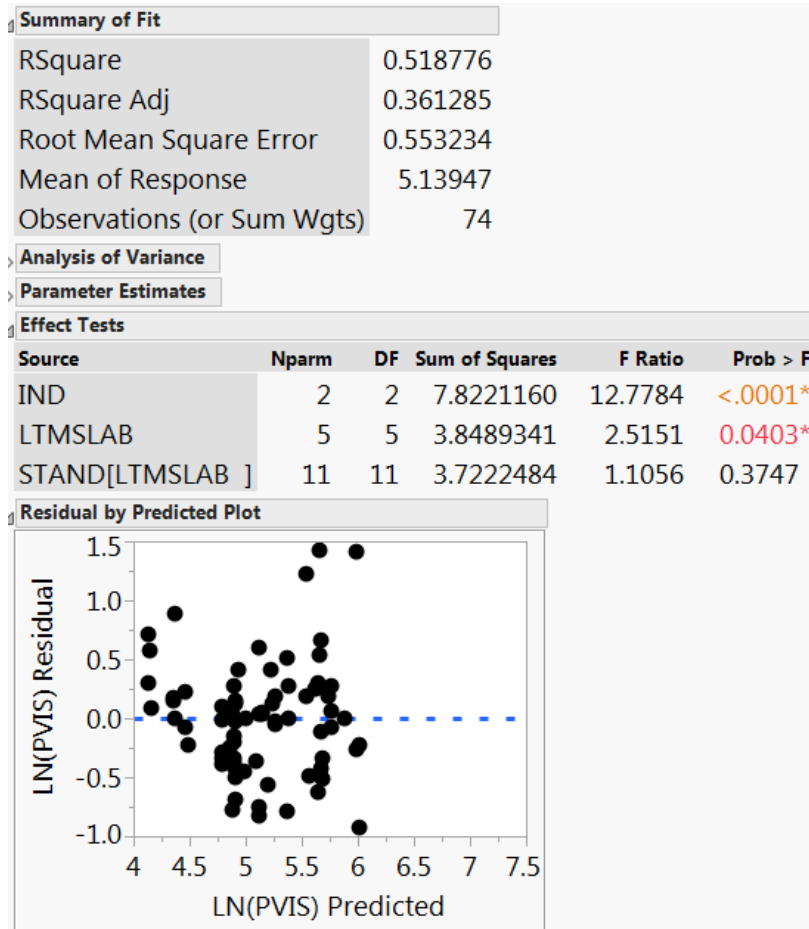
Model #5

Attachment 1

Chrysler IIIH Task Force Conference Call

2/20/2015

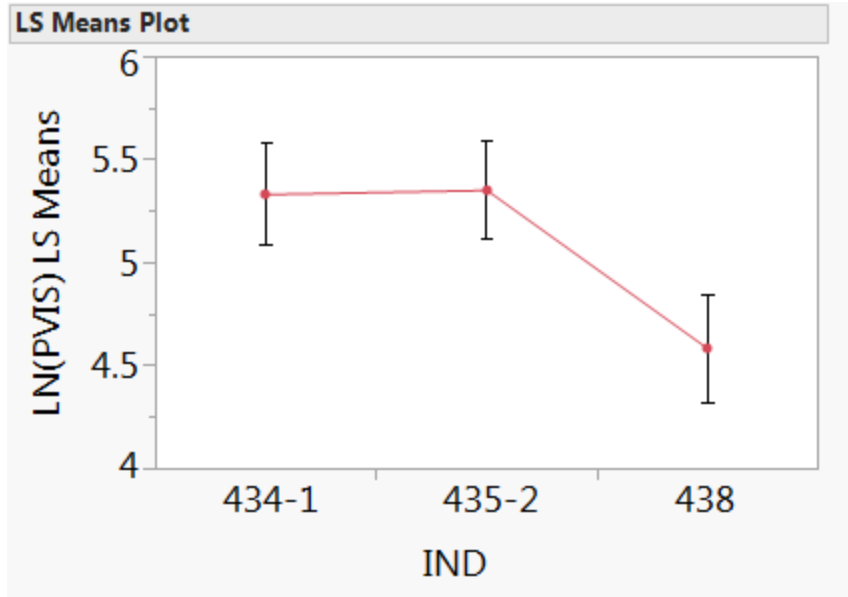
(last 75 ref tests; deleted 1 434-1 outlier with PVIS=2403)



- Model includes:
 - Oil
 - Lab
 - Stand(Lab)
- Oil Discrimination
 - 438 < (435-2, 434-1)
- Significant lab differences
- No significant stand differences
- RMSE = 0.55
- IIIG target $s = 0.2919$

Model #5: Oil Discrimination

(last 75 ref tests; deleted 1 434-1 outlier with PVIS=2403)

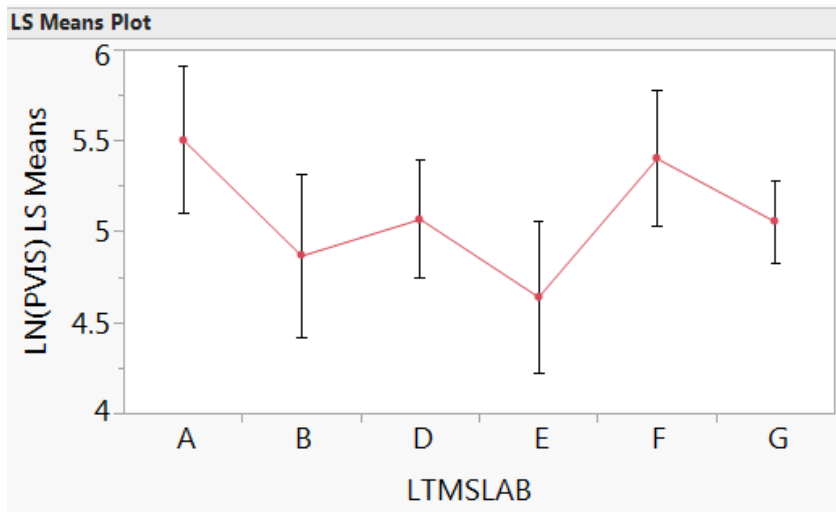


Oil	IIIG Target	IIIG #5 LS Means
438	4.57	4.58
434-1	4.73	5.33
435-2	5.18	5.35
s	0.2919	0.55

Level	- Level	Difference	Std Err Dif	Lower CL	Upper CL	p-Value
435-2	438	0.7684859	0.1697046	0.359709	1.177263	<.0001*
434-1	438	0.7486201	0.1724728	0.333175	1.164065	0.0002*
435-2	434-1	0.0198658	0.1639084	-0.374949	0.414681	0.9919

Model #5: Lab Differences

(last 75 ref tests; deleted 1 434-1 outlier with PVIS=2403)



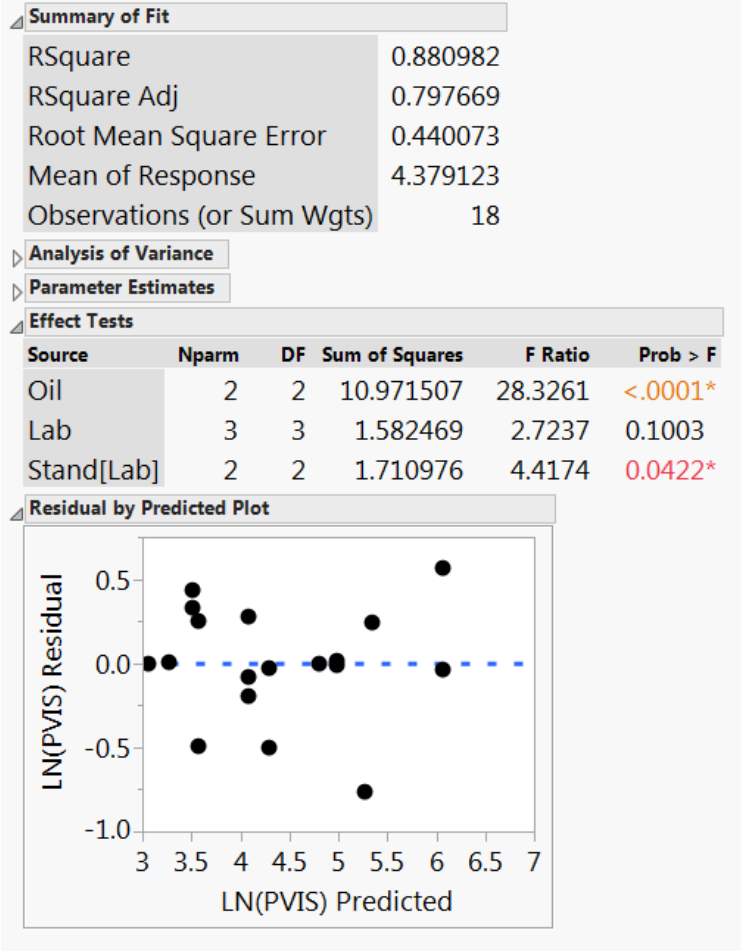
Level	- Level	Difference	Std Err Dif	Lower CL	Upper CL	p-Value
A	E	0.8646079	0.2912847	0.004579	1.724637	0.0481*
F	E	0.7621181	0.2805104	-0.066100	1.590336	0.0881
A	B	0.6379539	0.3014589	-0.252115	1.528023	0.2944
F	B	0.5354640	0.2911381	-0.324132	1.395060	0.4499
A	G	0.4513354	0.2308764	-0.230336	1.133007	0.3810
A	D	0.4367934	0.2569980	-0.322003	1.195590	0.5379
D	E	0.4278145	0.2635400	-0.350298	1.205926	0.5870
G	E	0.4132725	0.2382989	-0.290314	1.116859	0.5158
F	G	0.3488456	0.2170821	-0.292098	0.989789	0.5976
F	D	0.3343036	0.2452245	-0.389731	1.058338	0.7483
B	E	0.2266540	0.3051560	-0.674331	1.127639	0.9756
D	B	0.2011605	0.2740201	-0.607894	1.010215	0.9768
G	B	0.1866185	0.2505344	-0.553094	0.926331	0.9753
A	F	0.1024898	0.2719013	-0.700309	0.905289	0.9990
D	G	0.0145420	0.1968424	-0.566643	0.595727	1.0000

Seq IIIH Review

- Prove-Out Matrix data
 - n=18 tests
 - Test oils:
 - 434-1 (n=6)
 - REO2 (n=2) ← REO2 (n=10)
 - REO3 (n=10) ← REO3 (n=2)
 - All tests on final hardware
- Used LN(PVIS) transformation in model

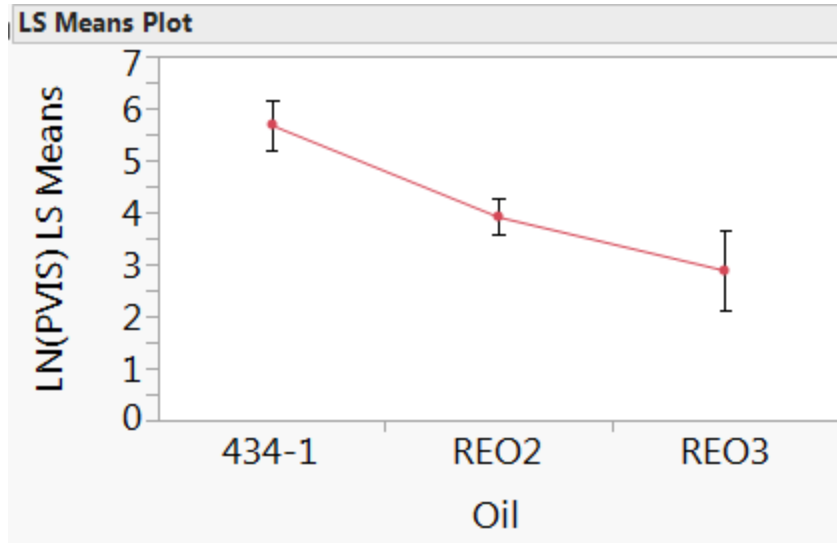
Note: n size corrections
Sid Clark, 2/20/2015

Model #1 (all data)



- Model includes:
 - Oil
 - Lab
 - Stand(Lab)
- Oil Discrimination
 - REO3 < REO2 < 434-1
- No significant lab differences
- No significant stand differences
- RMSE = 0.44
- IIIG target s = 0.2919

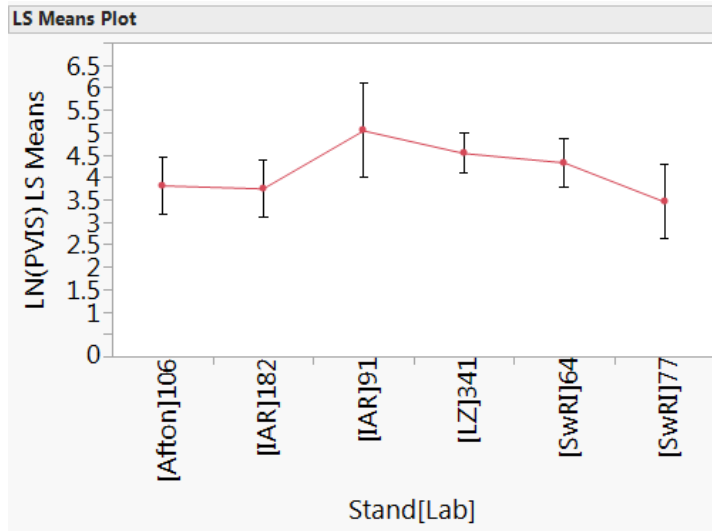
Model #1: Oil Discrimination (all data)



Oil	IIIG LS Means	IIIH #1 LS Means
434-1	5.01	5.68
REO2		3.92
REO3		2.89
s	0.40	0.44

Level	- Level	Difference	Std Err Dif	Lower CL	Upper CL	p-Value
434-1	REO3	2.791519	0.4108695	1.665208	3.917829	0.0001*
434-1	REO2	1.764392	0.2823009	0.990525	2.538260	0.0003*
REO2	REO3	1.027126	0.3609047	0.037783	2.016469	0.0421*

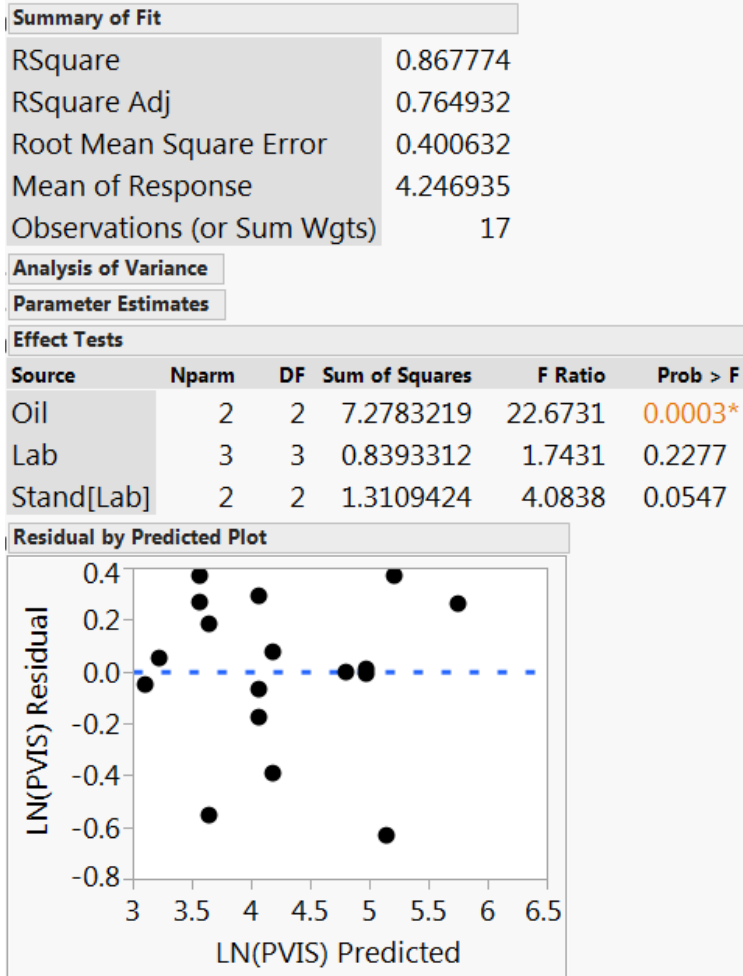
Model #1: Stand Effect (all data)



Level	- Level	Difference	Std Err Dif	Lower CL	Upper CL	p-Value
[IAR]91	[SwRI]77	1.586730	0.6084328	-0.52655	3.700012	0.1814
[IAR]91	[IAR]182	1.294772	0.5167922	-0.50021	3.089757	0.2096
[IAR]91	[Afton]106	1.226463	0.5167922	-0.56852	3.021448	0.2513
[LZ]341	[SwRI]77	1.082167	0.4056219	-0.32669	2.491022	0.1665
[SwRI]64	[SwRI]77	0.871437	0.4720168	-0.76803	2.510902	0.4813
[LZ]341	[IAR]182	0.790209	0.3307574	-0.35862	1.939035	0.2460
[LZ]341	[Afton]106	0.721900	0.3307574	-0.42693	1.870727	0.3229
[IAR]91	[SwRI]64	0.715293	0.5002213	-1.02214	2.452722	0.7107
[SwRI]64	[IAR]182	0.579479	0.3557230	-0.65606	1.815019	0.5998
[SwRI]64	[Afton]106	0.511170	0.3557230	-0.72437	1.746710	0.7068
[IAR]91	[LZ]341	0.504563	0.5036358	-1.24473	2.253851	0.9071
[Afton]106	[SwRI]77	0.360267	0.4436288	-1.18060	1.901132	0.9587
[IAR]182	[SwRI]77	0.291958	0.4436288	-1.24891	1.832823	0.9829
[LZ]341	[SwRI]64	0.210730	0.3152824	-0.88435	1.305807	0.9817
[Afton]106	[IAR]182	0.068309	0.3593183	-1.17972	1.316336	1.0000

Model #2

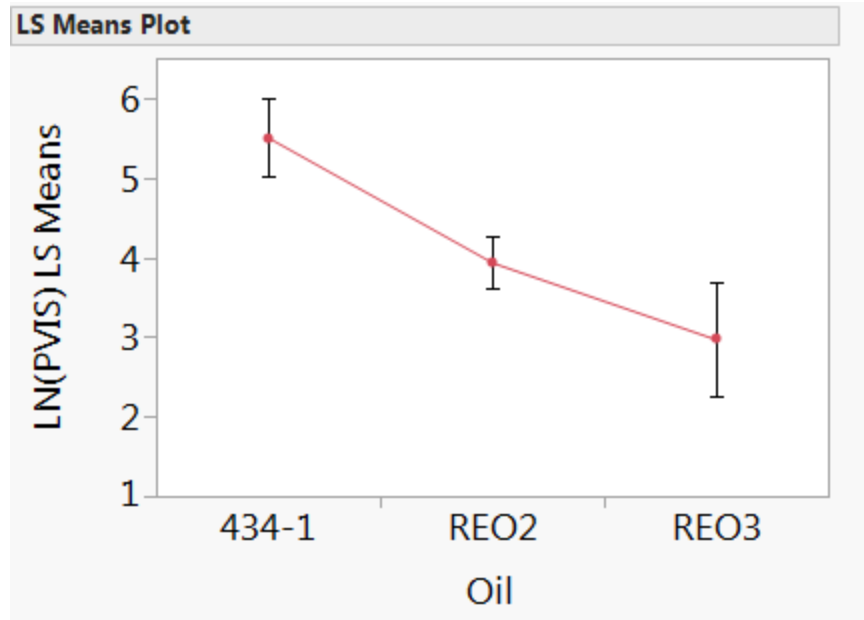
(removed LZ Oil 434-1 with PVIS=754.7)



- Model includes:
 - Oil
 - Lab
 - Stand(Lab)
- Oil Discrimination
 - REO3 < REO2 < 434-1
- No significant lab differences
- No significant stand differences
- RMSE = 0.40
- IIIG target s = 0.2919

Model #2: Oil Discrimination

(removed LZ Oil 434-1 with PVIS=754.7)



Oil	IIIG LS Means	IIH #2 LS Means
434-1	5.01	5.51
REO2		3.94
REO3		2.97
s	0.40	0.40

Level	- Level	Difference	Std Err Dif	Lower CL	Upper CL	p-Value
434-1	REO3	2.533658	0.4019922	1.411292	3.656024	0.0004*
434-1	REO2	1.568111	0.2803839	0.785276	2.350945	0.0009*
REO2	REO3	0.965548	0.3304356	0.042968	1.888127	0.0408*