

# Volatility Surveillance Panel Telecon: Discussion of New D5800 Reference Oils

September 17, 2013

# Agenda

- Discussion on RR results of potential D5800 reference oils
  - TMC analysis
  - Additional EM analysis
- Discussion and selection of new D5800 reference oils
  - Reminder of voting requirements
  - Additional EM and LZ analysis
- Additional topics
  - Replacement of D6417 reference oils with new D5800 reference oils?
  - Others

# D5800 VOL12 RR Final Summary

- Round Robin purpose is to select replacement reference oils for oils 52 and 55, which have significant long-term and ongoing severity trends in the test monitoring program.
- Meetings, teleconferences and a Procedure B workshop were held prior to running the RR
- Oils supplied are modern chemistries (presumably GF-5 technology)

# D5800 VOL12 RR Final Summary

- Eight Labs Participating (A, B, D, F, G, I, J, V)
- Fourteen Instruments
- Data Excluded From Statistical Estimates:
  - Twelve samples assigned but not run (lab A)
  - One test reported with no recent QC check run (Lab D, VOL12C)
  - One test with QC check severe of nominal acceptance range (Lab F, VOL12C)
  - One result tested as outlier (Lab A, VOL12C)

# D5800 RR Final Summary

Performance by Severity  
Operationally Valid Tests, One Outlier Excluded  
Mass % Volatiles Loss

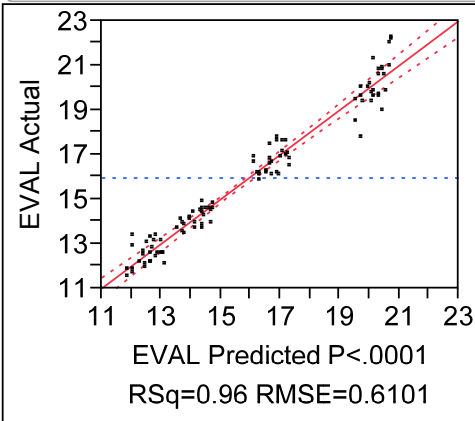
Oil	SAE Grade	n	Mean	Sr	95% Lower	95% Upper
VOL12D	0W-20	27	12.52	0.52	11.5	13.5
52	15W-40	33	13.75	0.61	12.6	14.9
VOL12C	5W-30	24	14.19	0.40	13.4	15.0
58	5W-30	37	15.20	0.72	13.8	16.6
VOL12E	5W-20	27	16.74	0.55	15.7	17.8
55	10W-30	32	17.09	0.76	15.6	18.6
VOL12B	5W-20	27	20.20	1.06	18.1	22.3

# Additional EMRE Analysis Overview

- Goal: Measure the effect of various variables (oil, room temperature, lab, etc.) on round robin volatility data
- Variables
  - Test Lab                      LTMSLAB
  - Method                        Method1
  - Voltage                        Voltage
  - Room Temperature        RoomTemp
  - Model                         Model
  - Atm. Pressure              AtmPres
- Could not measure effect of Pressure
  - Some Pressure data is missing
  - Singularity – confounding with other variables
- Could not measure effect of Model
  - Singularity – confounding with other variables

# Overall Model Fit

**Actual by Predicted Plot**



**Summary of Fit**

RSquare	0.964533
RSquare Adj	0.95941
Root Mean Square Error	0.610137
Mean of Response	15.95865
Observations (or Sum Wgts)	104

**Analysis of Variance**

		Sum of			
Source	DF	Squares	Mean Square	F Ratio	Prob > F
Model	13	911.14822	70.0883	188.2745	
Error	90	33.50400	0.3723		
C. Total	103	944.65221			<.0001*

**Effect Tests**

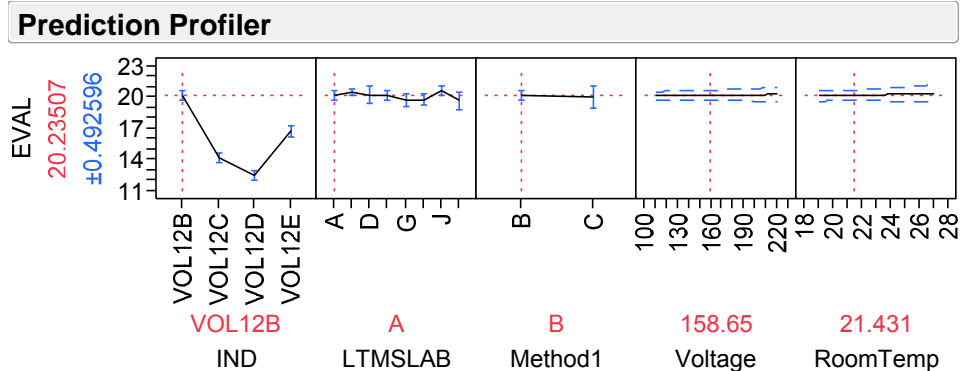
Source	Nparm	DF	Sum of Squares	F Ratio	Prob > F
IND	3	3	894.88449	801.2935	<.0001*
LTMSLAB	7	7	7.09272	2.7218	0.0131*
Method1	1	1	0.02688	0.0722	0.7888
Voltage	1	1	0.12331	0.3312	0.5664
RoomTemp	1	1	0.12895	0.3464	0.5576

# Significance of Variables

## Expanded Estimates

Nominal factors expanded to all levels

Term	Estimate	Std Error	t Ratio	Prob> t
Intercept	14.902152	1.194613	12.47	<.0001*
IND[VOL12B]	4.2814454	0.102471	41.78	<.0001*
IND[VOL12C]	-1.725725	0.106996	-16.13	<.0001*
IND[VOL12D]	-3.398476	0.102444	-33.17	<.0001*
IND[VOL12E]	0.8427562	0.103833	8.12	<.0001*
LTMSLAB[A]	0.0832123	0.269752	0.31	0.7584
LTMSLAB[B]	0.3589171	0.180814	1.99	0.0502
LTMSLAB[D]	0.1157379	0.312966	0.37	0.7124
LTMSLAB[F]	0.0906365	0.203036	0.45	0.6564
LTMSLAB[G]	-0.362808	0.229601	-1.58	0.1176
LTMSLAB[I]	-0.345837	0.283761	-1.22	0.2261
LTMSLAB[J]	0.477491	0.196595	2.43	0.0171*
LTMSLAB[V]	-0.41735	0.302213	-1.38	0.1707
Method1[B]	0.0542517	0.201913	0.27	0.7888
Method1[C]	-0.054252	0.201913	-0.27	0.7888
Voltage	0.0013852	0.002407	0.58	0.5664
RoomTemp	0.0323942	0.055041	0.59	0.5576



- Oil differences are the most important
- Oil differences are statistically significant.
- Lab J has statistically significant difference from some of the other labs
- No other variable is statistically significant



# Oil LS Means

- The LS Mean is the expected performance of the oils with effect of other variables removed
- Because measured effect of Temp, Pressure, Method, etc. were very small, Mean and LS Mean are nearly the same (there is no bias to correct for)

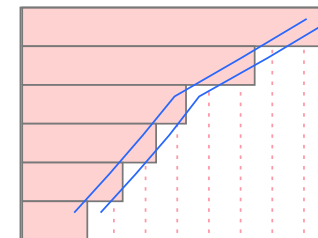
**Least Squares Means Table**

Level	Least Sq Mean	Std Error	Mean
VOL12B	20.097610	0.15145084	20.2000
VOL12C	14.090439	0.15842866	14.1917
VOL12D	12.417688	0.15150056	12.5185
VOL12E	16.658921	0.15313310	16.7577

**LSMeans Differences Student's t**

$\alpha = 0.050$   $t = 1.98667$

Level	- Level	Difference	Std Err Dif	Lower CL	Upper CL	p-Value
VOL12B	VOL12D	7.679922	0.1660793	7.349976	8.009867	<.0001*
VOL12B	VOL12C	6.007171	0.1717608	5.665938	6.348404	<.0001*
VOL12E	VOL12D	4.241233	0.1678015	3.907866	4.574599	<.0001*
VOL12B	VOL12E	3.438689	0.1677541	3.105416	3.771962	<.0001*
VOL12E	VOL12C	2.568482	0.1733526	2.224086	2.912877	<.0001*
VOL12C	VOL12D	1.672751	0.1716521	1.331734	2.013768	<.0001*



## Discussion on selection of new reference oils

- Additional analysis by EMRE indicates that the RR results for the four candidate oils are not impacted by another variable in the study and can be used for either Method B or C
- As a result, the data from the RR is acceptable for use and the discussion on which oils to select can be done

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## Discussion on selection of new reference oils

- Voting procedure – Each voting interest gets a vote, not each person
- Voting interest does not always mean corporation/company
  - For example, EM Research and Engineering, EM Refining and Supply, and EM Chemical Company each have a vote
- Review voting interests at this point

# Discussion on selection of new reference oils

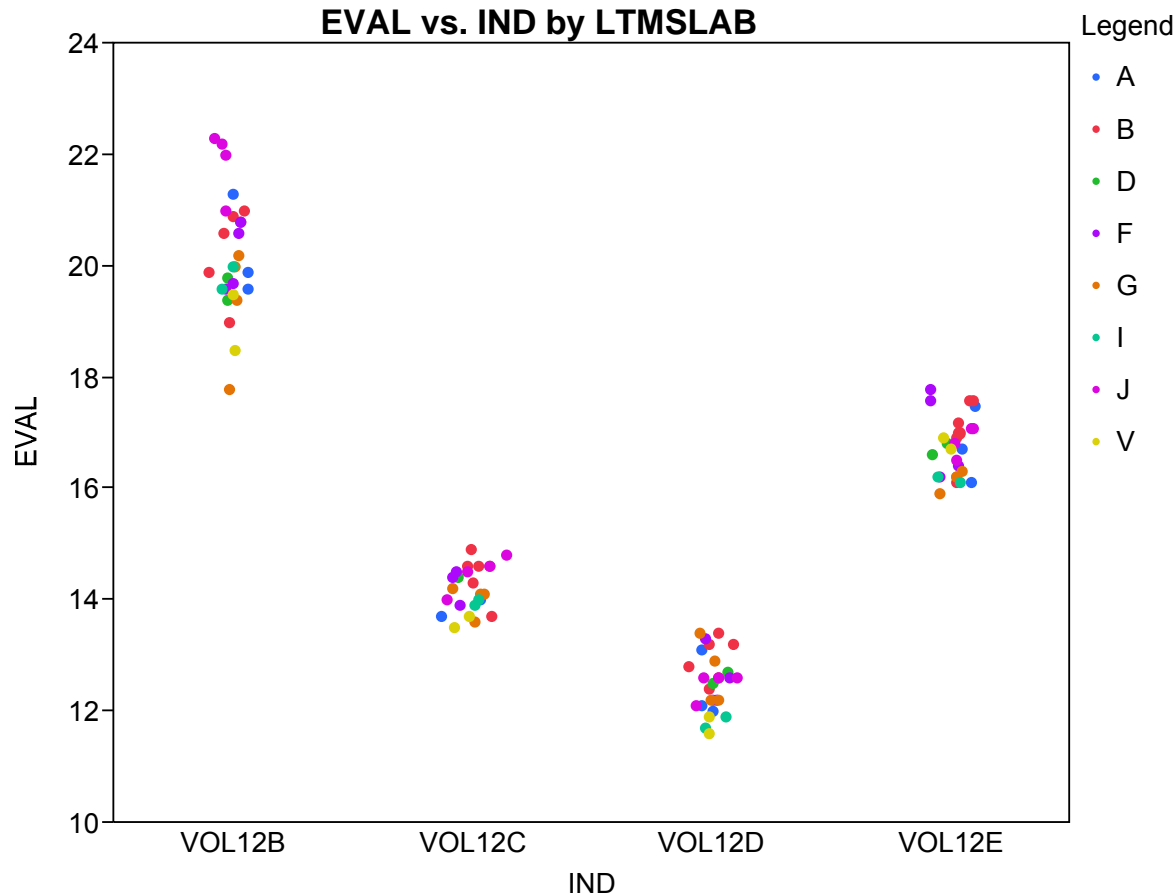
- First discussion point – Retain or discard oil 58 as a reference oil
- Two options for reference oil replacement
  - Option 1: Replace Oil 52 with either Oil D or C, replace Oil 55 with either Oil E or B, and retain Oil 58
    - For no overlap in confidence limits, Oils D and B would need to be selected with Oil 58
  - Option 2: Replace all three current reference oils with candidate oils
    - Oils D, C and either E/B would be the good/borderline/poor reference oils
- Rationale for replacing Oil 58 is due to its age, use of older technology, and the potential to reduce confidence limit overlap between reference oils
- Comments on whether to retain or discard Oil 58 as a reference oil

# Discussion on selection of new reference oils

- Second discussion point – Selection of new reference oils  
See next two slides for additional information
- Comments on new reference oil selection.
- Next step: Selection of new reference oils

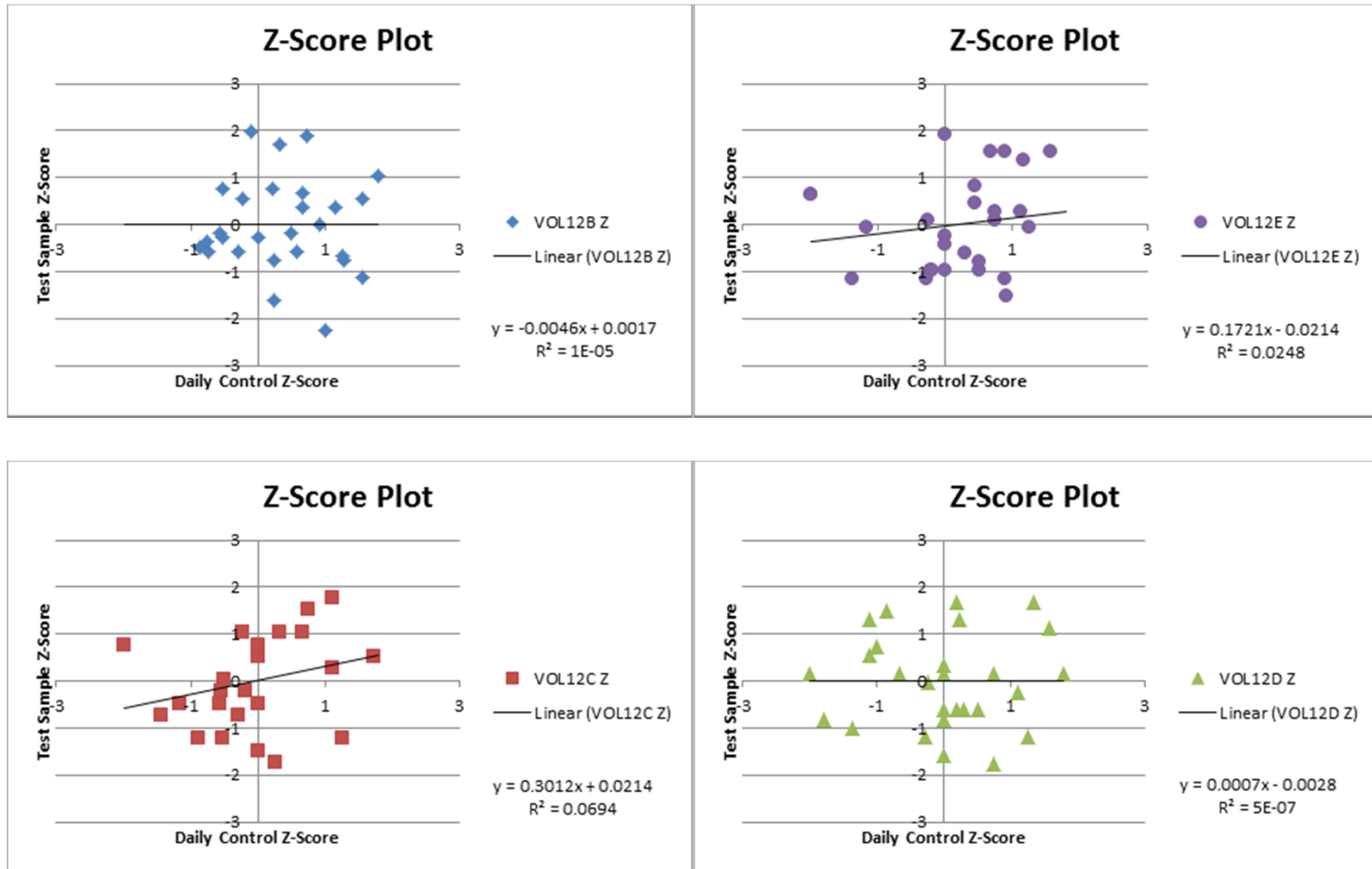
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# Additional information - EMRE Analysis Plot: Oil differences



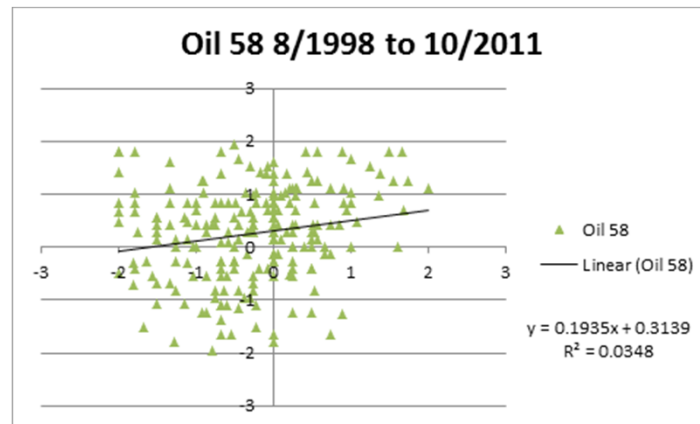
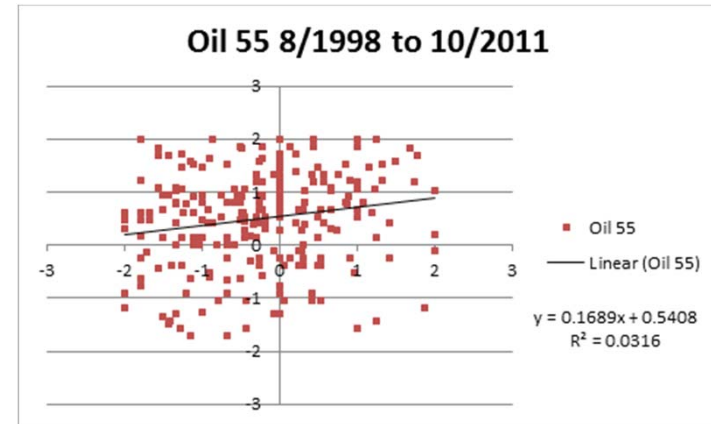
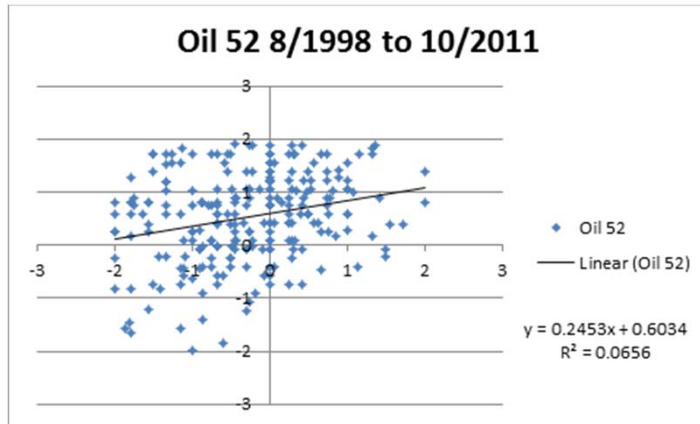
- No visible lab bias for oil C, D, E, but what about B? (Lab J results are “high”)
- Removal of high points from Oil B reduces sR to ~ 0.8 while removal of low and high points (6 points) reduces sR to ~0.6 with no change in mean

# Additional information - LZ Analysis



- Plots of severity of the round robin samples as a function of the daily control
- Suggest that selected reference oils should have random correlation with daily control severity

## Additional information - LZ Analysis



- Current reference oils show similar trends based on a much larger data set



## Final topic (time permitting)

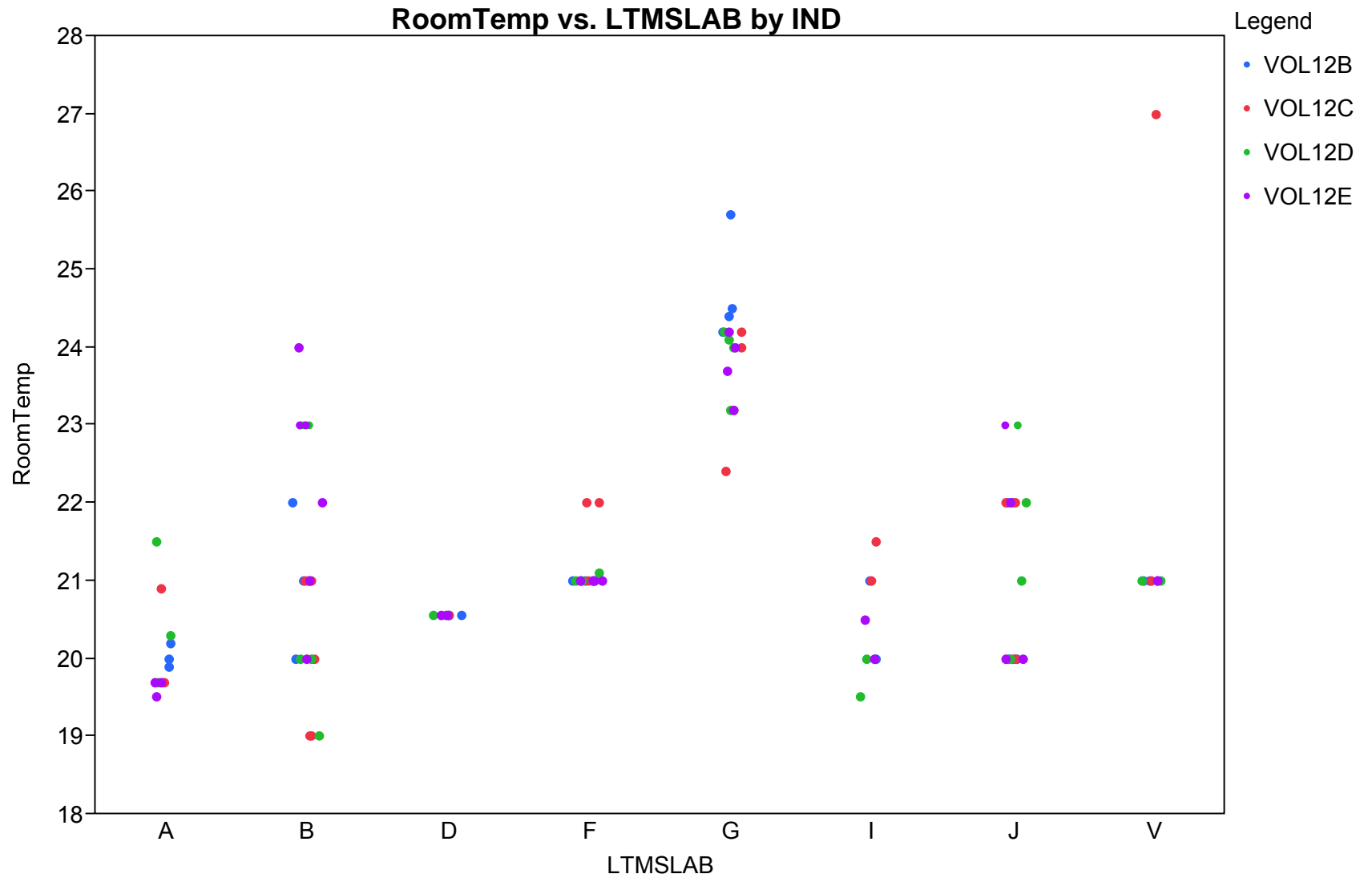
- Use of new D5800 reference oils as new reference oils for D6417
- Suggestion to test new reference oils in D6417 to understand their performance in test as potential future reference oils
- Comments?
- Next steps?

# Back-Up – Additional statistical analysis details

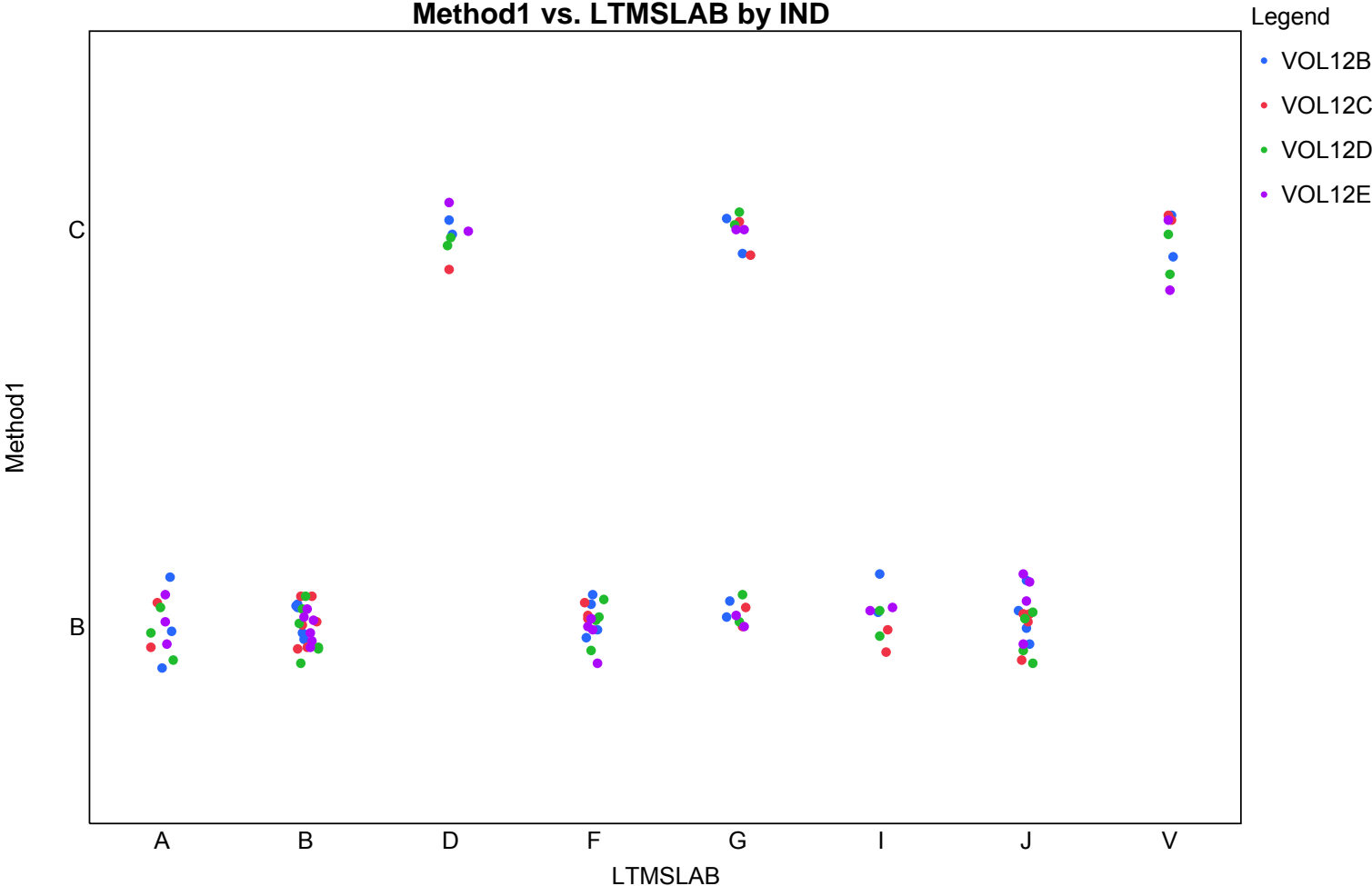
## D5800 RR Overall Severity by Lab and by Instrument Model

Lab or Model	n	Mean Yi (Delta/s)	Instrument Models Used at Lab
A	11	-0.19	NCK2, NCK25G
B	24	0.55	NCK2, NCK25G (2)
D	7	-0.06	SVT1
F	15	0.19	NCK2 (2)
G	16	-0.51	PS4000, SVT1
I	8	-0.86	NCK25G
J	16	0.61	NCK25G (2)
V	8	-0.99	SVT1
PS4000	8	-0.43	1 Lab, 1 Inst.
NCK2	31	0.10	3 Labs, 4 Inst.
NCK25G	43	0.32	4 Labs, 6 Inst.
SVT1	23	-0.57	3 Labs, 3 Inst.

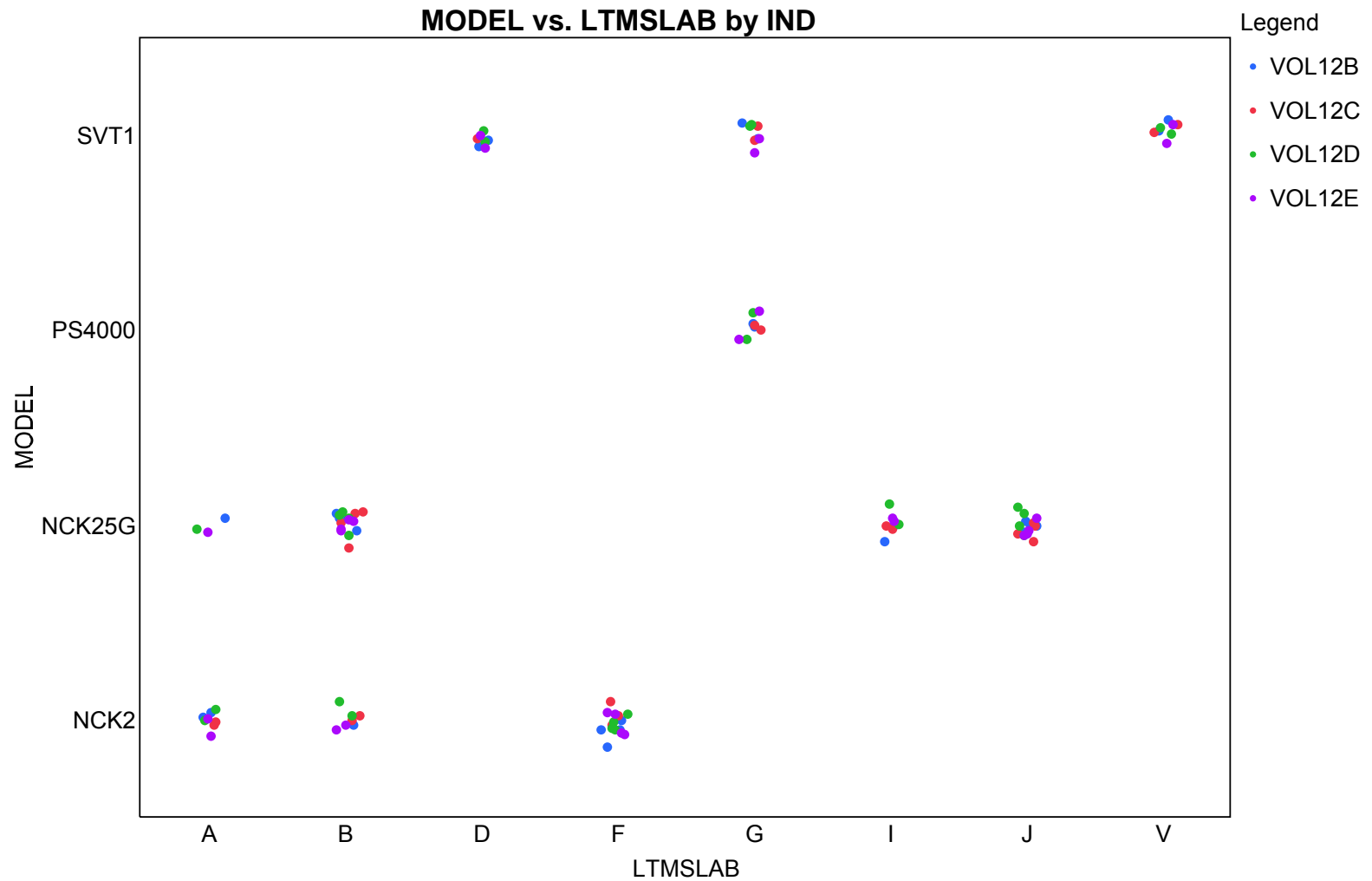
# EMRE Analysis Plot: Labs and Room Temp



# EMRE Analysis Plot: Labs and Methods



# EMRE Analysis Plot: Labs and Models



# EMRE Analysis Plot: Labs and Atmospheric Pressure

