IIIH Task Force Conference Call
October 23, 2015 2:00PM Eastern
Call-in 713-222-0377
Pass Code 5214824464

Attendees:

Chrysler: Haiying Tang
Shell: Karin Haumann, Scott Lindholm
Oronite: Jo Martinez, Kaustav Sinha, Ricardo Affinito
Afton: Ed Altman, Bob Campbell, Dave Glaenzer, Todd Dvorak
Ashland: Amol Savant
Infineum: Andy Ritchie, Gordon Farnsworth, Doyle Boese
Lubrizol: George Szappanos, Kevin OMalley
Intertek: Adison Schweitzer, Bill Buscher
SwRI: Travis Kostan, Sid Clark
TMC: Rich Grundza
OHT: Jason Bowden, Matt Bowden
IMTS: Dave Passmore
Neste Oil: Chris Castanien
Halterman: Tracy King

Karin opened the meeting with a review of the objectives for Today's meeting;
1st, objective is to go over the Matrix Analysis.
2nd, is to confirm the validity of Ashland's 4th test.
Karin wanted to express a big thanks to Jo Martinez and the Statistical Group for their expedient work after receiving the data on Monday and having it ready for Today's review. Karin also reminded everyone our objective was to review this data and put together a recommendation to the Surveillance Panel on the 29th of October so they in turn could have a recommendation ready for the Passenger Car Classification Panel in November.

With that said, Karin turned the meeting over to Jo Martinez to review the Statistical Review of the available IIH Matrix Test Data. **(Attachment #1 Sequence IIIH Precision Matrix Statistical Analysis (Preliminary) October 22, 2015**)

Comments and questions for subsequent slides:

Slide #3: Karin informed everyone the reason the analysis was only on 26 tests was because the Matrix Test Review Group realized they may have made a mistake interpreting the MAP Values on test G-2 Test 1 during an earlier review and the group and lab agreed to re-run the test to make the data set cleaner. Slide #3 shows both tests in question as currently running. (E-1 Test 2 and G-2 Test 1)

Lab comments:
Lab G expected to have operational data with ratings to TMC Monday 10/26/2015

Lab E was currently running at 23 hours and should EOT Monday with data to TMC be Wednesday 10/27/2015

Slide #4: Jo Martinez informed the group the slide needed to be updated to reflect the stands being compared within the two labs with multiple stands.

In the interest of time Jo Martinez went through the remaining slides requesting members hold their questions until after her review.

Slide #10: Jo noted that the group should also be comparing Stands A1 & A2 and G1 & G2.

After review of the PVIS Data Summary, Jo Martinez asked for any questions;
Karin asked why the RMSE for the Phos. was so high. Rich indicated the value was in percent and looking at two transformations.

Slide #26: Jo reminded everyone we also need to compare Stands A1 vs A2 and G1 vs G2.

Slide #36: Jo indicated the group was going to study the data and see if they needed to make a better recommendation for LTMS Lab / Stand Recommendation.

Slide #43: Jo commented about Reference Oil 438 supposedly being only used for WPD. Haiying Tang also commented about her conversations with Jo Martinez about PVIS results using Reference Oil 438 where Reference Oils 434-2 and 436 are OK. Jo Martinez also commented there are two 436 runs still pending on the re-runs.

After completion of the presentation, the group discussed reasoning for calling outliers influential observations and Rich Grundza explained just because something trips as an outlier doesn't mean you exclude that data. The group has determined the tests were valid and the few that the group decided to be re-run were for specific reasons.

Rich informed the group he has received additional MRV data and will send that to the stats group after the call.

The group discussed the 434-2 PVIS data which seemed to break from 75 to 90 hours with Ed Altman commenting that if you look at the Oil Pressure Plot for the one influential data point from lab "D" you will see it dropped right at 90 hours which would be indicative of a false impression for the final PVIS. Kevin OMalley also expressed concern about how we view 434-2 in the test.

Travis Kostan went back to Slide #6 and explained the data points for Lab / Stand results for Stand A Matrix vs Prove-out testing and the effects of 438. Karin also commented the Prove-out data showed one high and one low result. Kevin reiterated the Matrix data had two high results on 438 on one stand and the statistical model interprets that as a stand difference.

The group continued to discuss the 438 results and re-confirmed that the focus on 438 was for WPD not PVIS. Comments related to oil additions and 438's performance in the IIIG and another test currently being developed. Bob Campbell expressed concern about how the results might affect the decision for replacing the current Sequence IIIG with the IIIH.

The group continued discussion understanding we have 26 of 28 results and unless we have another outlier on the re-run tests yet pending, the tests would not make a substantial difference in the data. Karin explained the data from the IIIG was taken from the IIIG Precision Matrix and more recent data shows the IIIG may be performing differently. Discussion continued on the concerns about the analysis showing the PVIS being no significant difference between 150% - 689% as shown on Slide #12. Bob Campbell and Chris Castanien expressed this concern and Karin mentioned the slope of the increase and the exponential increase and the shape of the curve.

Karin asked if we needed to go back and compare the slides presented during the Spring Meetings. Kaustav reminded everyone that all the requests made to review the data showed the IIIH better than the IIIG.

Haiying Tang reminded everyone we discussed the difference between the IIIH and the IIIG during the Prove-out testing and we don't need to go back.

The group continued discussion on this and other parameters and the secretary could not record everything said exactly as discussed. Highlights of additional discussions focused on the influential data points and oil pressure dips just prior to exponential oil viscosity increase, removal of influential data points with comments we better have sound statistical reasoning to remove said data to Karin reminding everyone we have a very small amount of data being analyzed.

Kaustav commented on all the data analysis processes from Prove-out to Precision Matrix commenting we can continue looking at this for another 6 months to a year and still be asking the same questions. Kaustav asked what else anyone wanted referencing the WPD and PVIS data right now. Bob Campbell suggested we replace the Prove-out data with the Matrix data and see what it shows in comparison to the IIIG. Karin indicated that has been done in the early analysis to compare how the Prove-out data vs the Matrix data compared to the IIIG data. Jo Martinez indicated she has used several models looking at the data and they are comparable.

After much more discussion about PVIS and Hours to % Increase and an exponential increase being part of the test comments still focused on how to interpret the data.

Haiying Tang expressed concern that she wanted to make a motion to recommend the test for GF-6. The group then discussed wording of a motion to the Sequence III Surveillance Panel. Resulting from these discussions, the decision was made that the Task Force could only recommend the Sequence III Surveillance Panel recommend the IIIH Test move forward as an ASTM Standardized Test. Subsequently, the following motion was made;

Motion: Haiying Tang, 2nd Kaustav Sinha

The task force as a technical group has vetted the precision matrix data reported to date, and determined the tests included are operationally valid. Based on the matrix data the test is capable of measuring PVis and WPD. We recommend to the Surveillance Panel that the matrix data be used to consider the test to be used as an ASTM Standardized Test.

Voting Results from Roll Call Vote; Approved 9, Abstains 3, Negatives 0.

Discussions continued with Addison Schweitzer explaining the data on the TMC Website for the 4th round Lab "E" Re-run. The Task Force reviewed the data analysis and Adison indicated the data were included in Today's Matrix Analysis. Adison indicated all QI's were positive and all Non-Controlled Parameters contained no outliers.

After this discussion Addison made the following motion:
Addison / Karin
Motion for the Task Force to approve Test CMIR 106785 as an operationally valid test after based on review of the data during this call and the previous call.

Motion carried with no Abstains or Negatives.

Bob Campbell asked if it was possible for some more recent IIIG data to be made available for the upcoming Sequence III Surveillance Panel Meeting.

Karin indicated she would try to gather more data.
Jo Martinez indicated she would update the MRV and Phos. Data

The meeting adjourned at 15:30

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

Attachment #1

Sequence IIIH Precision Matrix Statistical Analysis (Preliminary)

Statistics Group

October 23, 2015

Preliminary

Statistics Group

- Arthur Andrews, ExxonMobil
- Doyle Boese, Infineum
- Jo Martinez, Chevron Oronite
- Ricardo Affinito, Chevron Oronite
- Kevin O'Malley, Lubrizol
- Martin Chadwick, Intertek
- Richard Grundza, TMC
- Lisa Dingwell, Afton
- Todd Dvorak, Afton
- Travis Kostan, SwRI

Preliminary

IIIH Matrix Status:
26 out of 28 tests validated

	Lab-Stand	D-1	E-1	B-1	G-1	G-2	A-1	A-2
Run Order	1	434-2 106788-IIIH ✓	438-1 106784-IIIH Low MAP and Fuel Flow	438-1 106796-IIIH Oil Leak	436 106763-IIIH ✓	436 106764-IIIH Low MAP & Erratic Fuel Flow	438-1 106774-IIIH ✓	434-2 106778-IIIH ✓
			438-1 106785-IIIH ✓	438-1 106797-IIIH ✓		436 111422-IIIH		
	2	434-2 106789-IIIH Loss of Oil Pressure	436 106782-IIIH Low MAP & Fuel Flow	436 106792-IIIH ✓	438-1 106767-IIIH ✓	434-2 107873-IIIH ✓	438-1 107869-IIIH ✓	438-1 107870-IIIH ✓
		434-2 106789A-IIIH ✓	436					
	3	436 106786-IIIH ✓	434-2 106781-IIIH ✓	436 106793-IIIH ✓	438-1 106768-IIIH ✓	434-2 110227-IIIH ✓	434-2 106779-IIIH ✓	436 106775-IIIH ✓
	4	438-1 106791-IIIH ✓	434-2 106780-IIIH ✓	434-2 106795-IIIH ✓	434-2 110228-IIIH ✓	438-1 107872-IIIH ✓	436 106777-IIIH ✓	436 106776-IIIH ✓

✓ Indicates operation task force has reviewed operational data and found the test to be operationally valid.

* Indicates operations task force is still discussing operational validity of test.

Test Reported

Invalid

FMC
A Program of ASTM International

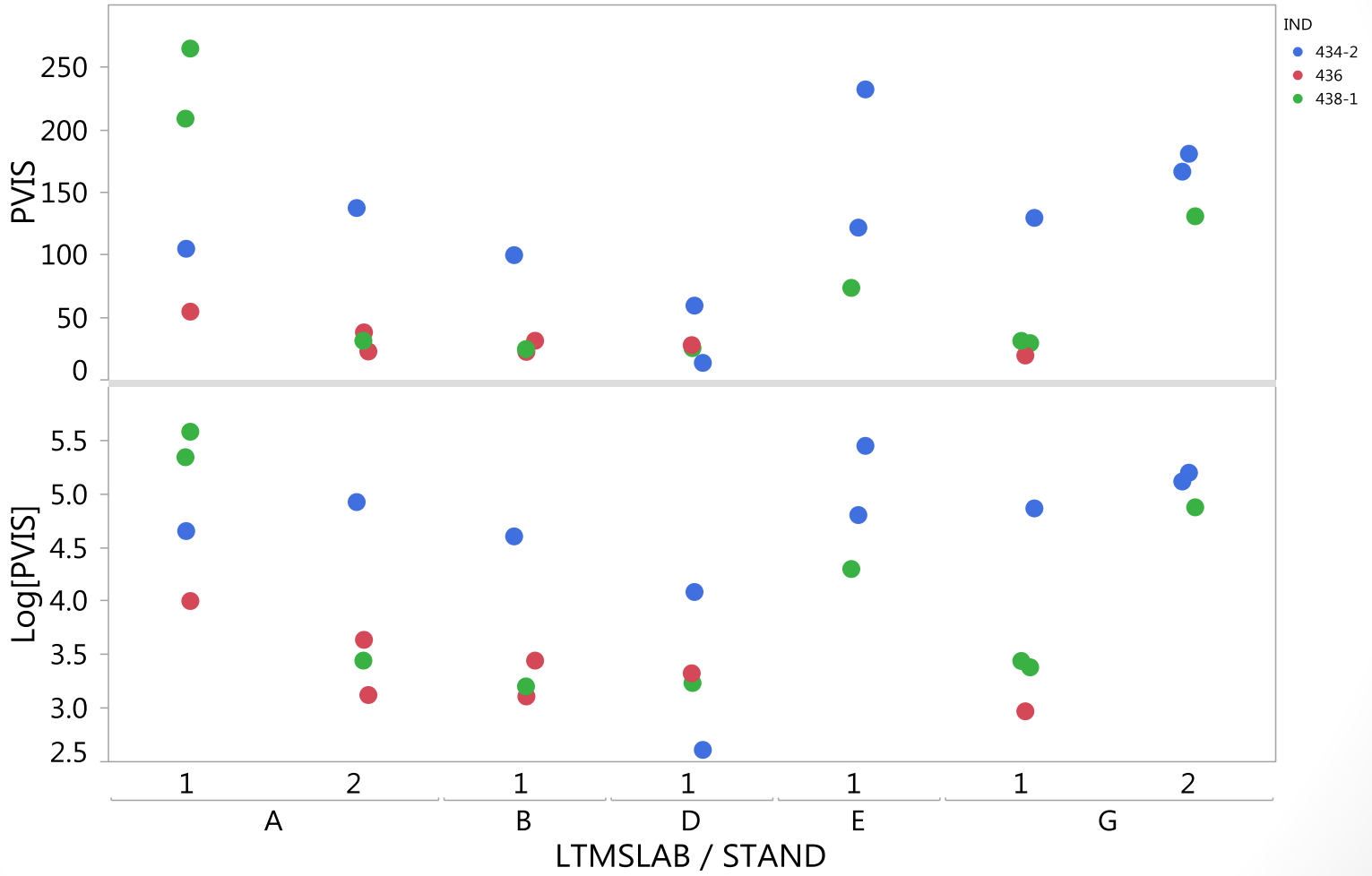
Preliminary

Summary

	LnPVIS	WPD	LnMRV	Phos
Lab Difference	D < A, E	No significant difference	D < E, A, G	No significant difference
Stand(Lab) Difference	D1 < A1, G2	No significant difference	D1 < E1, A1, G2	No significant difference
Oil Discrimination	436 < 434-2	436 > 438-1	436, 438-1 < 434-2	436 > 434-2, 438-1
Precision, s, RMSE	0.5500	0.48	0.4835	1.64

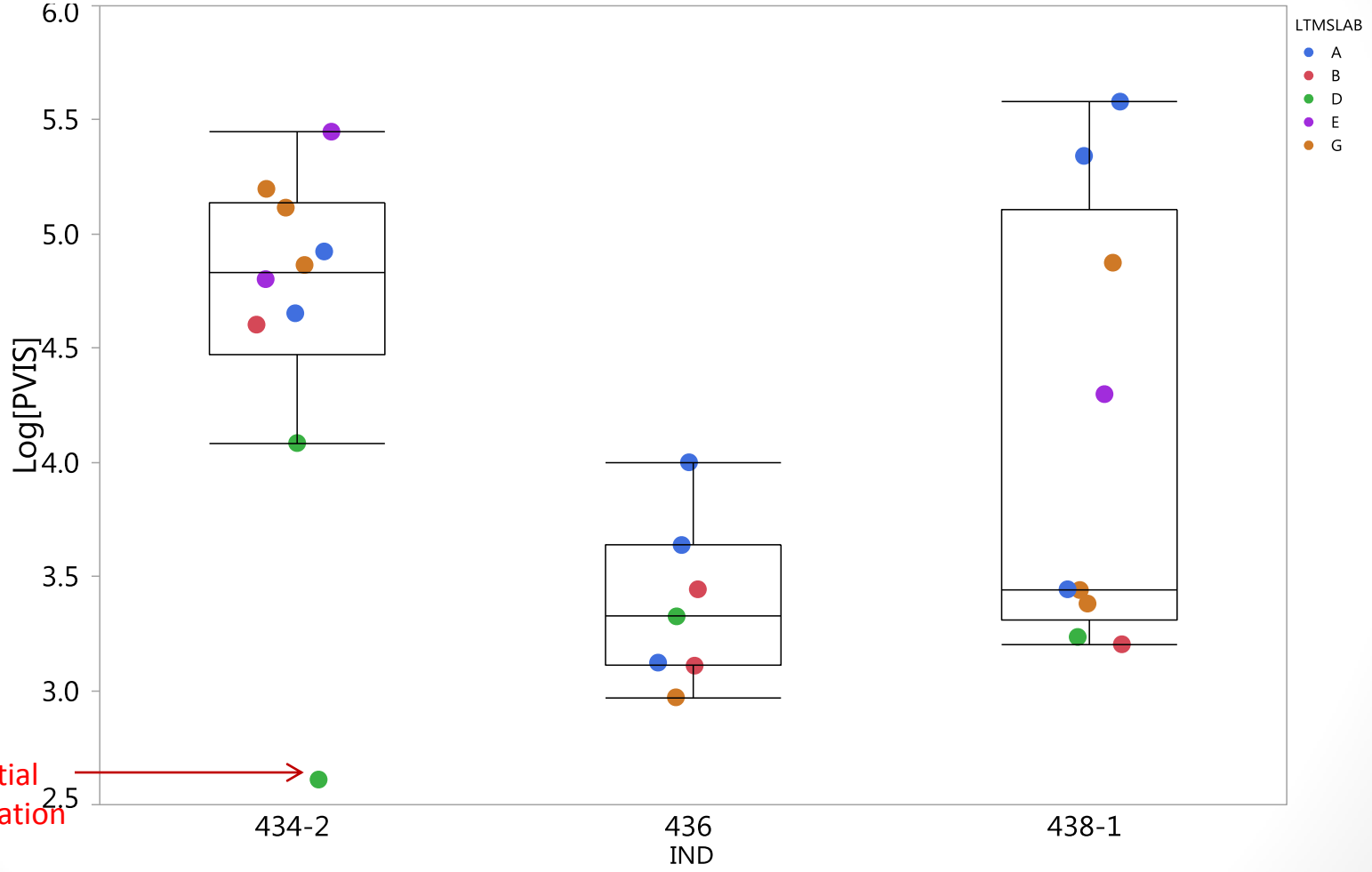
Preliminary

Percent Viscosity Increase n=26



Preliminary

LnPVIS



Influential Observation

Preliminary

LnPVIS ANOVA

Summary of Fit

RSquare	0.7475
RSquare Adj	0.628676
Root Mean Square Error	0.550034
Mean of Response	4.104198
Observations (or Sum Wgts)	26

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio
Model	8	15.225695	1.90321	6.2908
Error	17	5.143141	0.30254	Prob > F
C. Total	25	20.368836		0.0007*

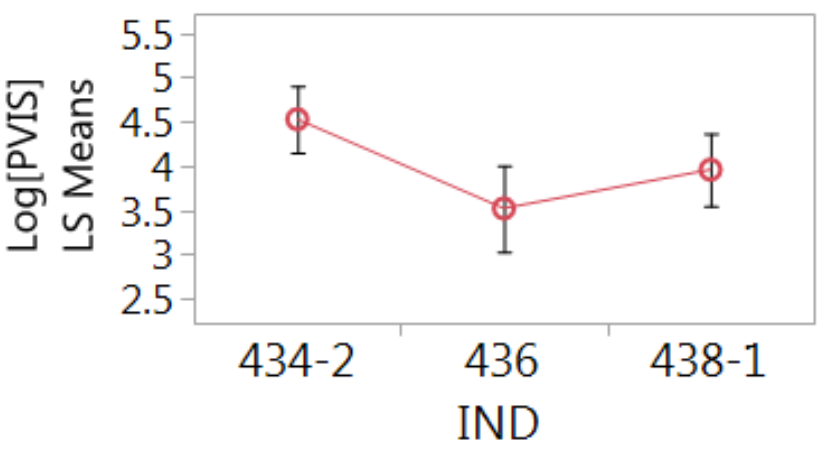
Effect Tests

Source	DF	Sum of Squares	F Ratio	Prob > F
IND	2	3.5572927	5.8791	0.0115*
LTMSLAB	4	5.1937339	4.2918	0.0140*
LTMSAPP[LTMSLAB]	2	3.6832092	6.0872	0.0101*

Preliminary

LnPVIS Oil Discrimination

436 is significantly lower than 434-2



Oil1	Oil2	Difference	p-Value
434-2	436	1.0095	0.01
434-2	438-1	0.5708	0.10
438-1	436	0.4388	0.32

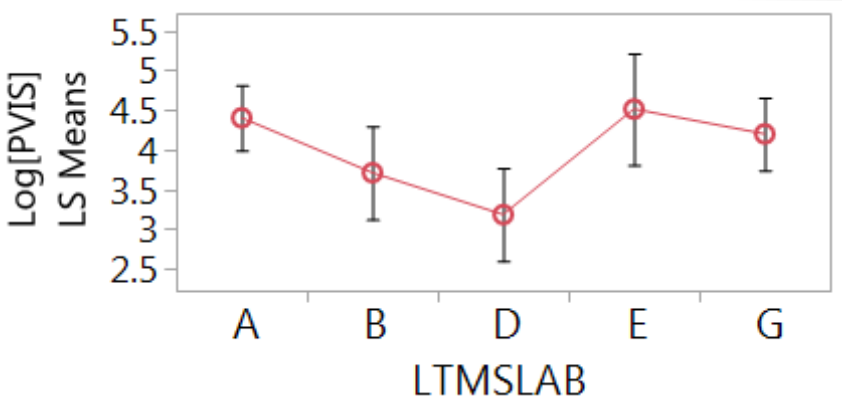
Oil	LnPVIS LS Mean	PVIS LS Mean
434-2	4.5287	93
436	3.5192	34
438-1	3.9580	52

Preliminary

LnPVIS Lab Difference

Lab D is significantly lower than Lab A

Lab D is significantly lower than Lab E



Lab1	Lab2	Difference	p-Value
E	D	1.3315	0.04
A	D	1.2218	0.02
G	D	1.0188	0.06
E	B	0.803	0.40
A	B	0.6933	0.29
B	D	0.5285	0.67
G	B	0.4903	0.66
E	G	0.3127	0.92
A	G	0.2031	0.96
E	A	0.1096	1.00

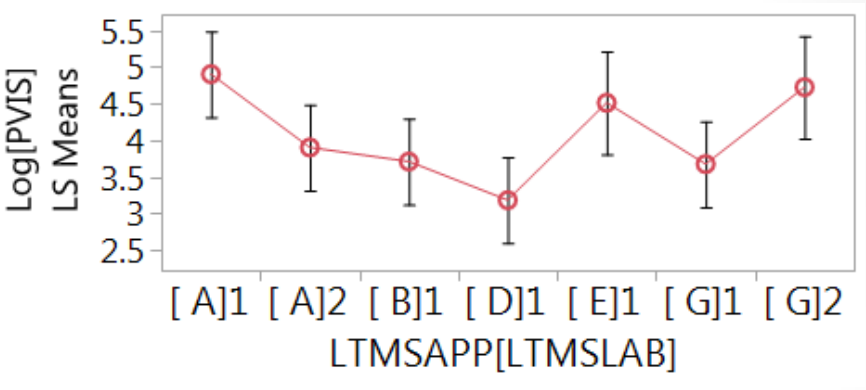
Lab	LnPVIS LS Mean	PVIS LS Mean
A	4.4037	82
B	3.7103	41
D	3.1818	24
E	4.5133	91
G	4.2006	67

Preliminary

LnPVIS Stand(Lab) Difference

Stand D1 is significantly lower than Stand A1

Stand D1 is significantly lower than Stand G2



Lab/Stand1	Lab/Stand2	Difference	p-Value
[A]1	[D]1	1.723	0.01
[G]2	[D]1	1.5443	0.03
[E]1	[D]1	1.3315	0.07
[A]1	[G]1	1.2298	0.07
[A]1	[B]1	1.1945	0.09
[G]2	[G]1	1.0511	0.25
[G]2	[B]1	1.0158	0.30
[A]1	[A]2	1.0024	0.21
[E]1	[G]1	0.8383	0.48
[G]2	[A]2	0.8237	0.53
[E]1	[B]1	0.803	0.56
[A]2	[D]1	0.7206	0.55
[E]1	[A]2	0.6108	0.81
[B]1	[D]1	0.5285	0.83
[G]1	[D]1	0.4932	0.86
[A]1	[E]1	0.3915	0.97
[A]2	[G]1	0.2274	1.00
[G]2	[E]1	0.2128	1.00
[A]2	[B]1	0.1921	1.00
[A]1	[G]2	0.1787	1.00
[B]1	[G]1	0.0353	1.00

Lab/Stand	LnPVIS LS Mean	PVIS LS Mean
[A]1	4.9049	135
[A]2	3.9025	50
[B]1	3.7103	41
[D]1	3.1818	24
[E]1	4.5133	91
[G]1	3.6751	39
[G]2	4.7262	113

Preliminary

LnPVIS Precision

Model: Oil, Lab, Stand(Lab)

Model RMSE	Repeatability	Reproducibility
• s = 0.5500 • IIIG s=0.2919	• s = 0.5500 • r = 1.5245	• s = 0.7761 • R = 2.1512

Preliminary

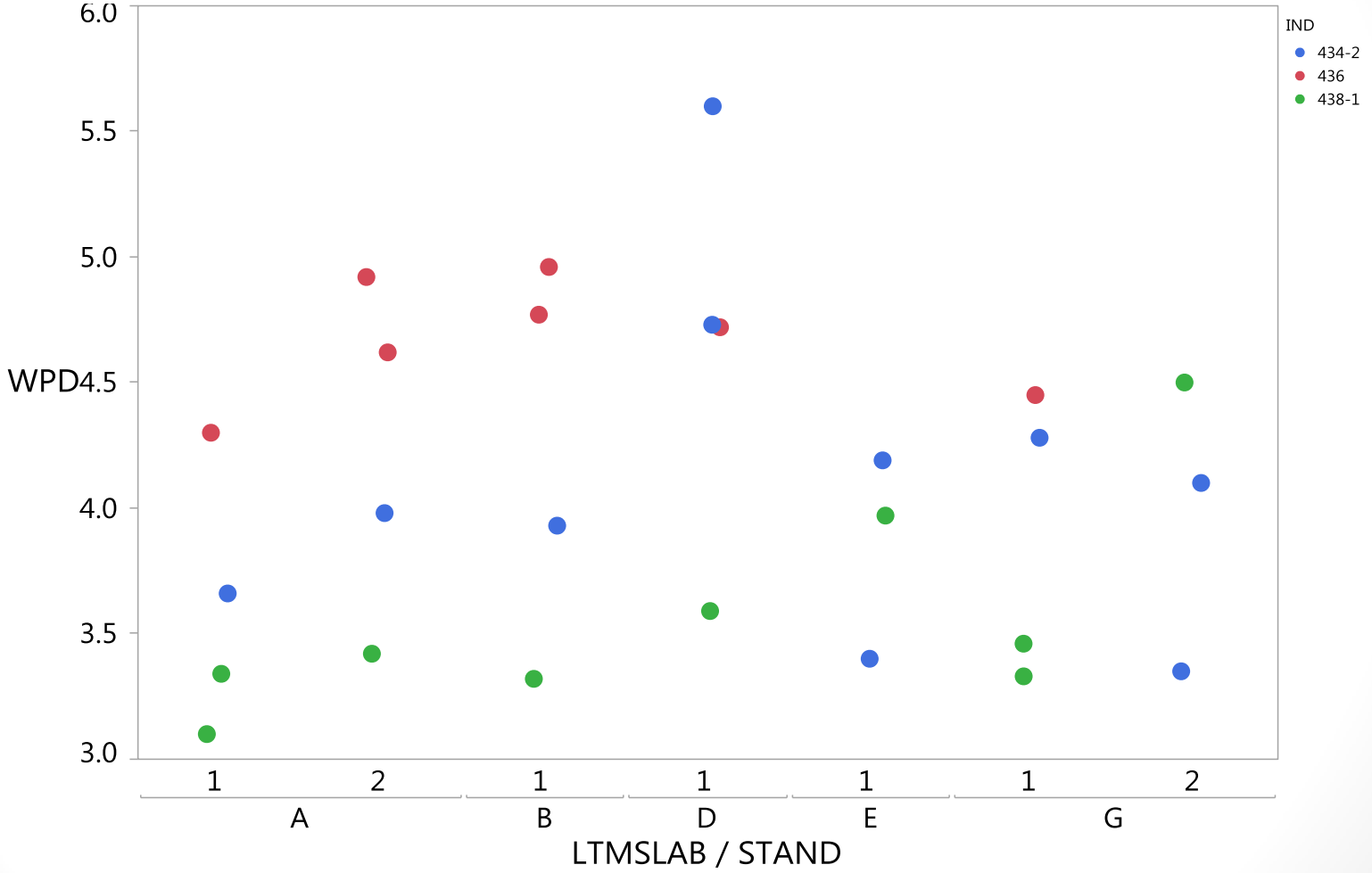
PVIS Precision

Based upon the Seq. III pooled standard deviations (s_r) and ASTM's repeatability (r) definition for the *maximum allowable difference between successive test results*, there is no significant difference between a PVIS result[1] of *150% - 689%* for the IIIH and *150% - 337%* for the IIIG.

Preliminary

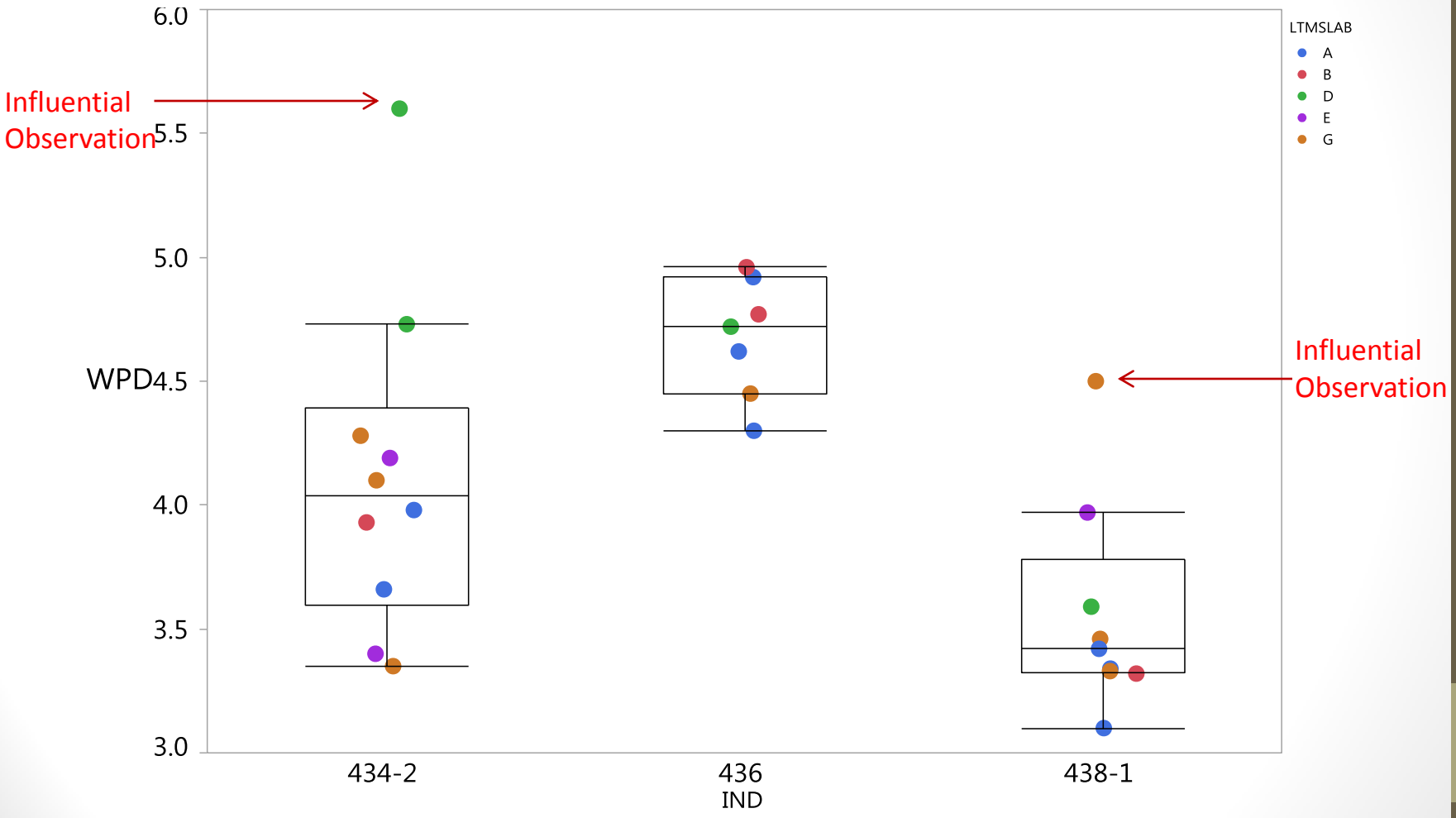
Note 1: A PVIS of 150% was arbitrarily selected in the calculations as the lower pass/fail limit.

Weighted Piston Deposit n=26



Preliminary

WPD



Preliminary

WPD ANOVA

Summary of Fit

RSquare	0.636043
RSquare Adj	0.464769
Root Mean Square Error	0.479261
Mean of Response	4.076538
Observations (or Sum Wgts)	26

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio
Model	8	6.823846	0.852981	3.7136
Error	17	3.904743	0.229691	Prob > F
C. Total	25	10.728588		0.0110*

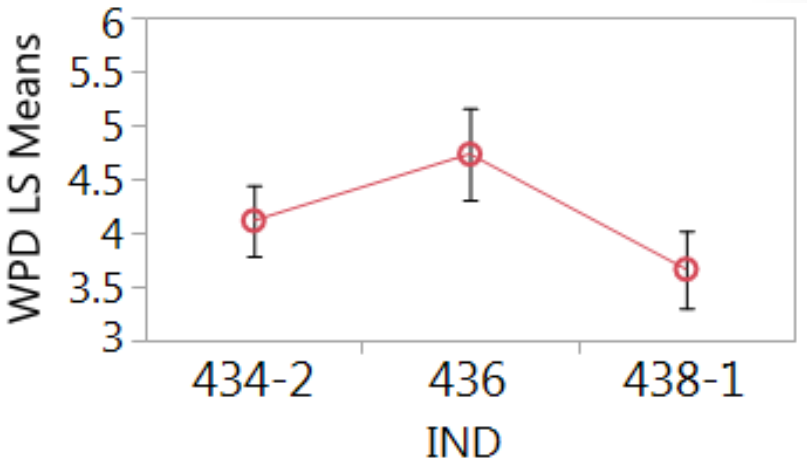
Effect Tests

Source	DF	Sum of Squares	F Ratio	Prob > F
IND	2	4.0097905	8.7287	0.0025*
LTMSLAB	4	1.5619090	1.7000	0.1963
LTMSAPP[LTMSLAB]	2	0.3181248	0.6925	0.5139

Preliminary

WPD Oil Discrimination

436 is significantly higher than 438-1



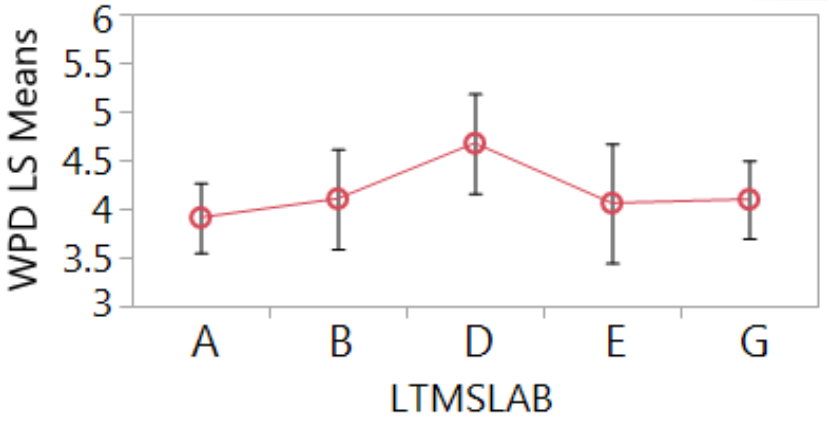
Oil1	Oil2	Difference	p-Value
436	438-1	1.07	0.00
436	434-2	0.62	0.07
434-2	438-1	0.45	0.15

Oil	WPD LS Mean
434-2	4.11
436	4.73
438-1	3.66

Preliminary

WPD Lab Difference

No significant lab difference



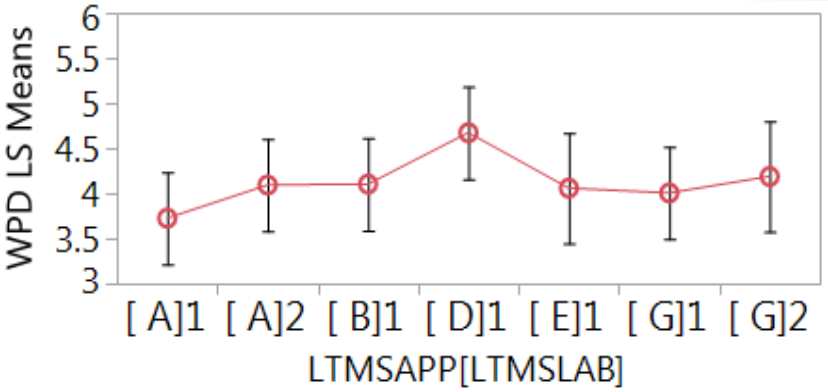
Lab1	Lab2	Difference	p-Value
D	A	0.76	0.12
D	E	0.61	0.48
D	G	0.58	0.36
D	B	0.57	0.49
B	A	0.19	0.96
G	A	0.19	0.95
E	A	0.15	0.99
B	E	0.05	1.00
G	E	0.04	1.00
B	G	0.01	1.00

Lab	WPD LS Mean
A	3.91
B	4.10
D	4.67
E	4.06
G	4.10

Preliminary

WPD Stand(lab) Difference

No significant stand(lab) difference



Lab/Stand1	Lab/Stand2	Difference	p-Value
[D]1	[A]1	0.9500	0.14
[D]1	[G]1	0.6700	0.48
[D]1	[E]1	0.6100	0.65
[D]1	[A]2	0.5800	0.64
[D]1	[B]1	0.5700	0.65
[D]1	[G]2	0.4800	0.84
[G]2	[A]1	0.4600	0.87
[B]1	[A]1	0.3800	0.92
[A]2	[A]1	0.3700	0.93
[E]1	[A]1	0.3300	0.97
[G]1	[A]1	0.2800	0.98
[G]2	[G]1	0.1800	1.00
[G]2	[E]1	0.1300	1.00
[B]1	[G]1	0.1000	1.00
[G]2	[A]2	0.0900	1.00
[A]2	[G]1	0.0900	1.00
[G]2	[B]1	0.0800	1.00
[E]1	[G]1	0.0500	1.00
[B]1	[E]1	0.0500	1.00
[A]2	[E]1	0.0400	1.00
[B]1	[A]2	0.0100	1.00

Lab/Stand	WPD LS Mean
[A]1	3.73
[A]2	4.09
[B]1	4.10
[D]1	4.67
[E]1	4.06
[G]1	4.01
[G]2	4.19

Preliminary

WPD Precision

Model: Oil, Lab, Stand(Lab)

Model RMSE	Repeatability	Reproducibility
• s = 0.48 • IIIG s = 0.60	• s = 0.48 • r = 1.33	• s = 0.50 • R = 1.39

Preliminary

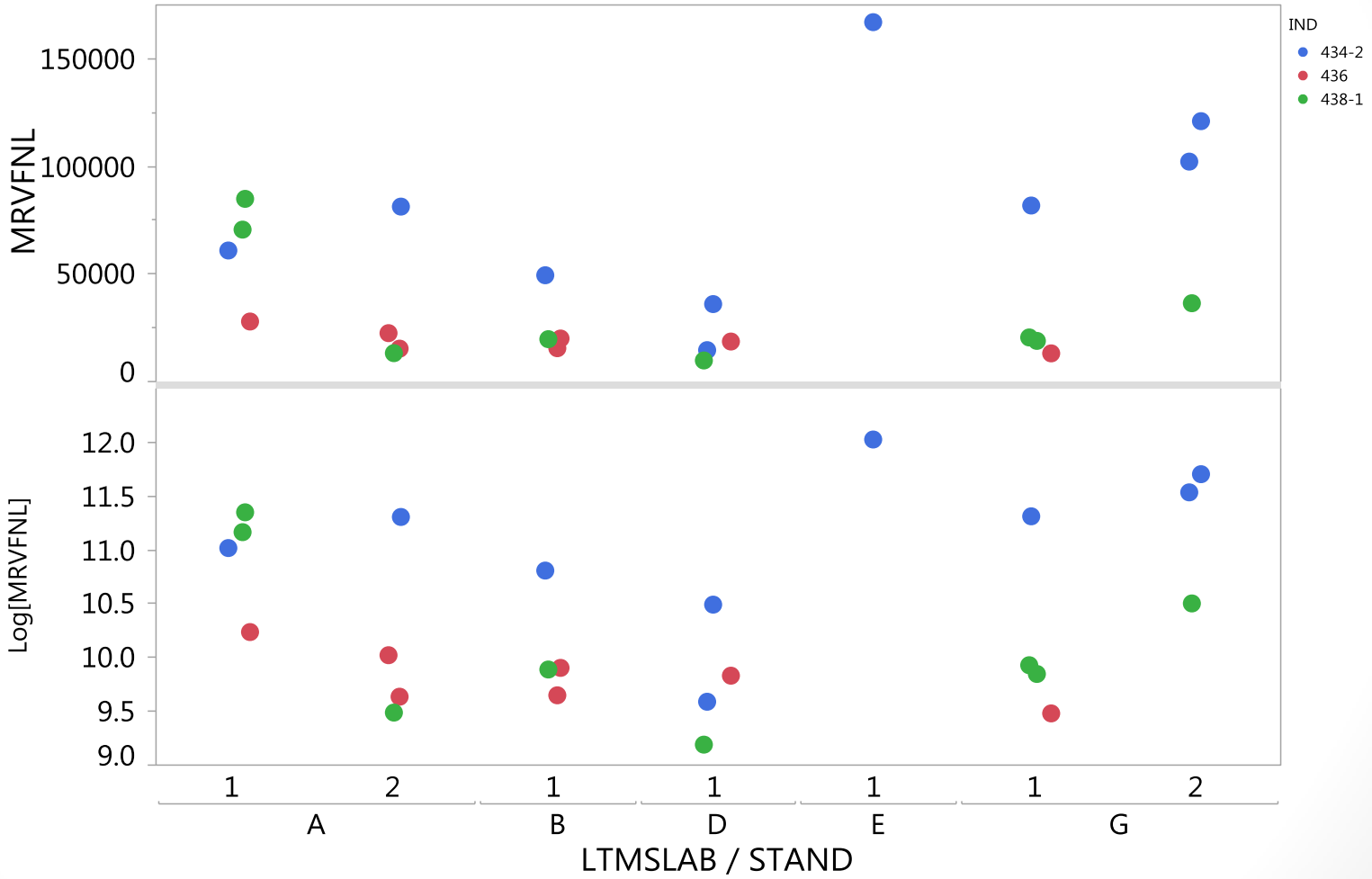
WPD Precision

Based upon the Seq. III pooled standard deviations (s_r) and ASTM's repeatability (r) definition for the *maximum allowable difference between successive test results*, there is no significant difference between a WPD result[1] of *2.7 – 4.0* for the IIIH and *2.3 – 4.0* for the IIIG.

Note 1: A WPD of 4.0 was arbitrarily selected in the calculations as the upper pass/fail limit.

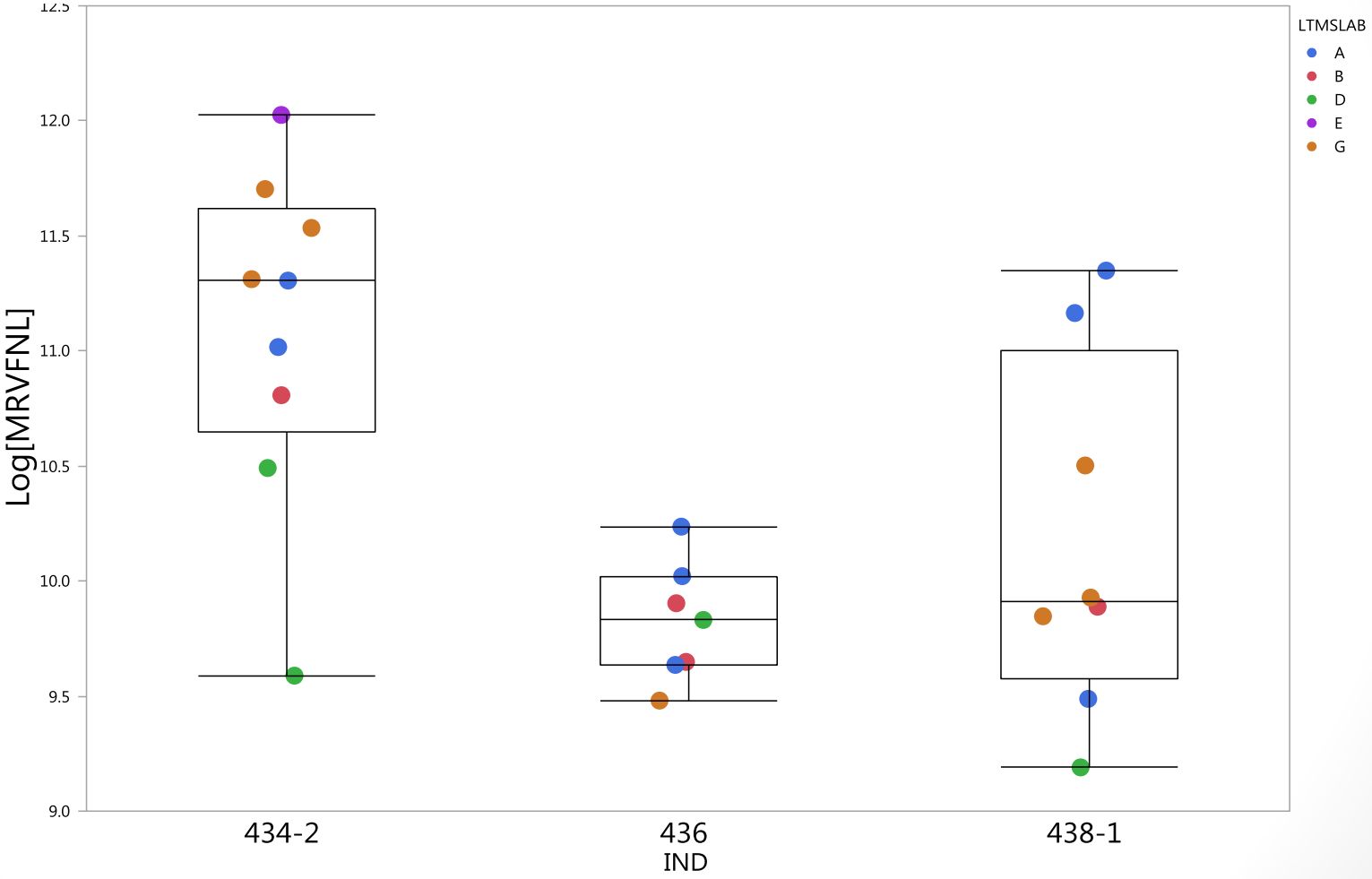
Preliminary

MRV Viscosity n=24



Preliminary

LnMRV



Preliminary

LnMRV ANOVA

Summary of Fit

RSquare	0.817572
RSquare Adj	0.720278
Root Mean Square Error	0.438486
Mean of Response	10.41255
Observations (or Sum Wgts)	24

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio
Model	8	12.925211	1.61565	8.4031
Error	15	2.884044	0.19227	**Prob > F**
C. Total	23	15.809255		0.0002*

Effect Tests

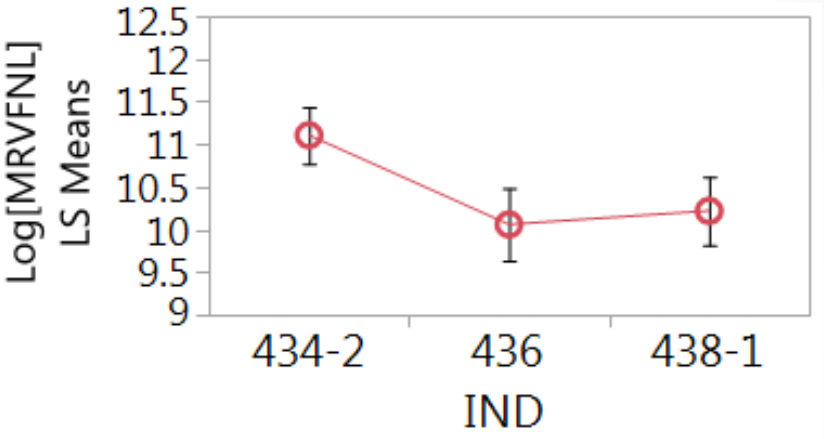
Source	DF	Sum of Squares	F Ratio	Prob > F
IND	2	4.3453729	11.3002	0.0010*
LTMSLAB	4	4.1199367	5.3570	0.0070*
LTMSAPP[LTMSLAB]	2	1.9616170	5.1012	0.0204*

Preliminary

LnMRV Oil Discrimination

436 is significantly lower than 434-2

438-1 is significantly lower than 434-2



Oil1	Oil2	Difference	p-Value
434-2	436	1.0465	0.00
434-2	438-1	0.8870	0.00
438-1	436	0.1595	0.78

Oil	LnMRV LS Mean	MRV LS Mean
434-2	11.1077	66683
436	10.0612	23417
438-1	10.2207	27466

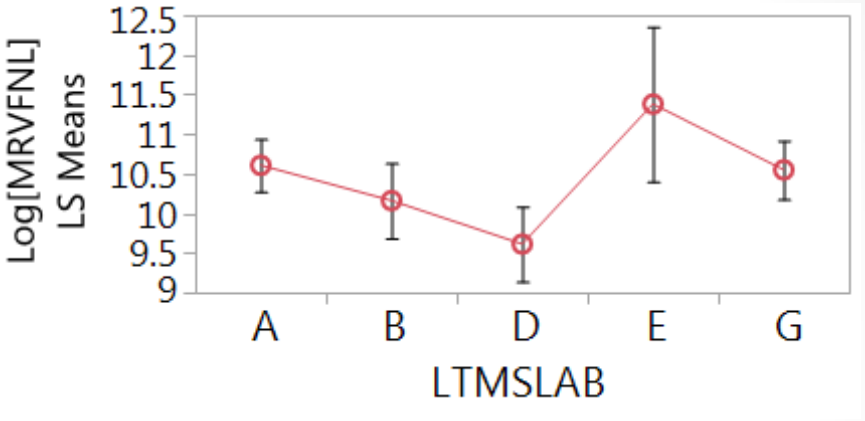
Preliminary

LnMRV Lab Difference

Lab D is significantly lower than Lab E

Lab D is significantly lower than Lab A

Lab D is significantly lower than Lab G



Lab1	Lab2	Difference	p-Value
E	D	1.7671	0.02
E	B	1.2187	0.18
A	D	0.9937	0.02
G	D	0.9361	0.03
E	G	0.831	0.45
E	A	0.7734	0.53
B	D	0.5484	0.44
A	B	0.4453	0.49
G	B	0.3877	0.67
A	G	0.0576	1.00

Lab	LnMRV LS Mean	MRV LS Mean
A	10.6078	40449
B	10.1625	25913
D	9.6142	14976
E	11.3813	87667
G	10.5503	38189

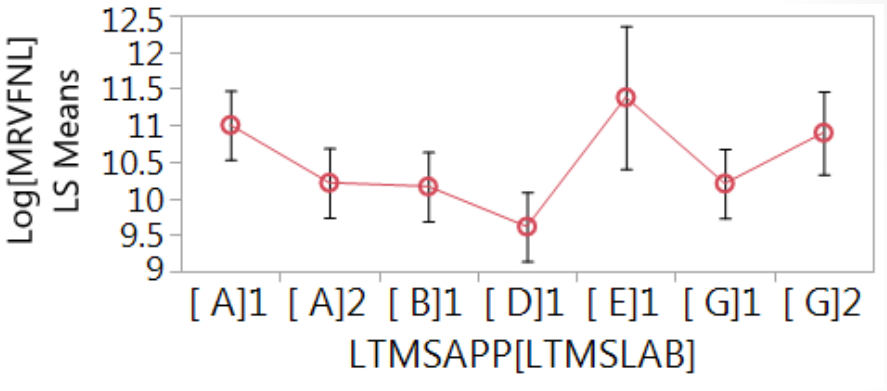
Preliminary

LnMRV Stand(Lab) Difference

Stand D1 is significantly lower than Stand E1

Stand D1 is significantly lower than Stand A1

Stand D1 is significantly lower than Stand G2



Lab/Stand1	Lab/Stand2	Difference	p-Value
[E]1	[D]1	1.7671	0.04
[A]1	[D]1	1.3883	0.01
[G]2	[D]1	1.2839	0.02
[E]1	[B]1	1.2187	0.28
[E]1	[G]1	1.1788	0.31
[E]1	[A]2	1.1681	0.32
[A]1	[B]1	0.8399	0.18
[A]1	[G]1	0.8000	0.20
[A]1	[A]2	0.7893	0.23
[G]2	[B]1	0.7355	0.41
[G]2	[G]1	0.6955	0.45
[G]2	[A]2	0.6848	0.49
[A]2	[D]1	0.5990	0.51
[G]1	[D]1	0.5883	0.53
[B]1	[D]1	0.5484	0.61
[E]1	[G]2	0.4832	0.96
[E]1	[A]1	0.3788	0.99
[A]1	[G]2	0.1044	1.00
[A]2	[B]1	0.0506	1.00
[G]1	[B]1	0.0400	1.00
[A]2	[G]1	0.0107	1.00

Lab/Stand	LnMRV LS Mean	MRV LS Mean
[A]1	11.0025	60024
[A]2	10.2132	27261
[B]1	10.1625	25913
[D]1	9.6142	14976
[E]1	11.3813	87667
[G]1	10.2025	26971
[G]2	10.8980	54068

Preliminary

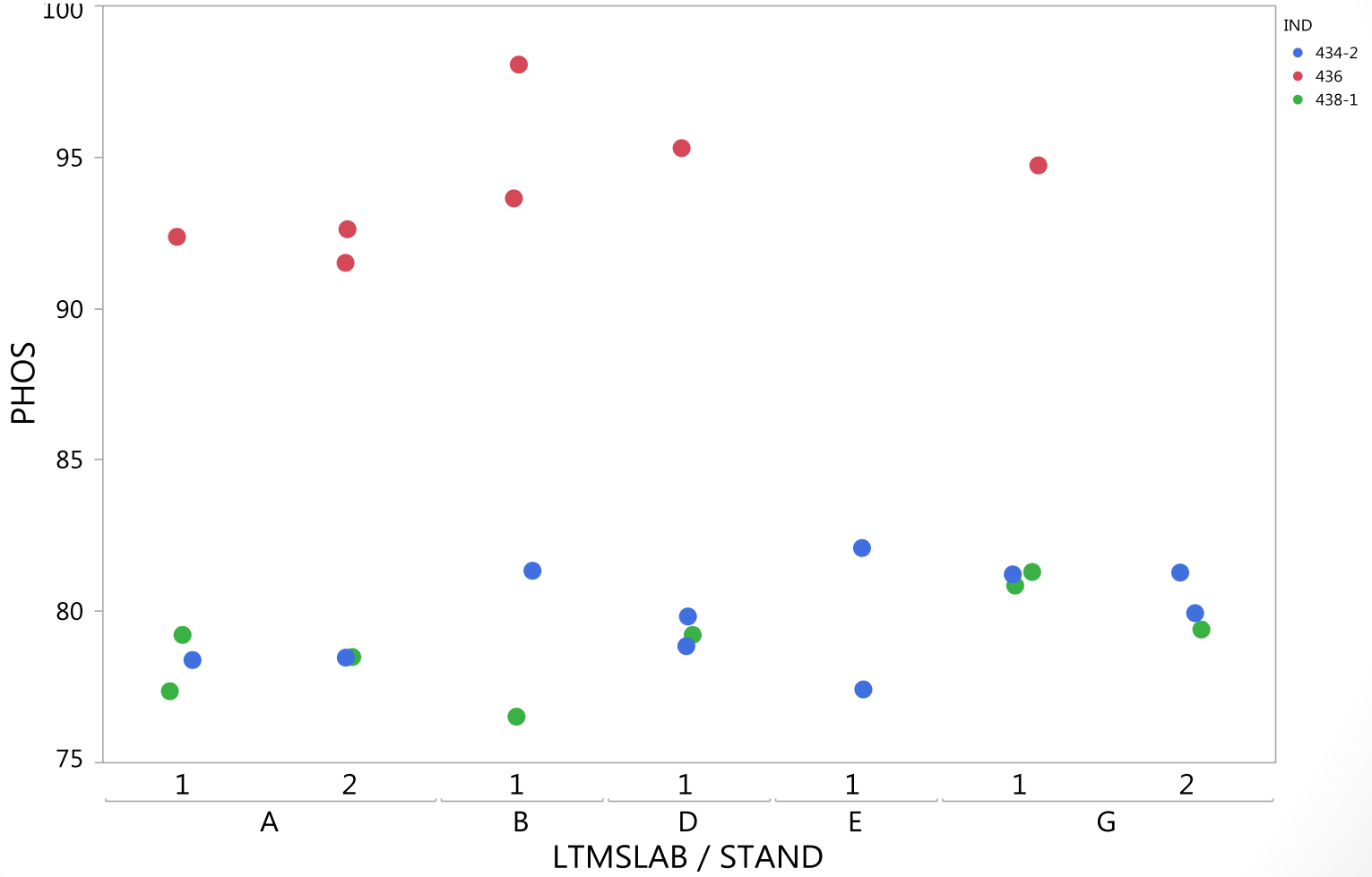
LnMRV Precision

Model: Oil, Lab, Stand(Lab)

Model RMSE	Repeatability	Reproducibility
• s = 0.4385 • No IIIGA s	• s = 0.4385 • r = 1.2155	• s = 0.6474 • R = 1.7945

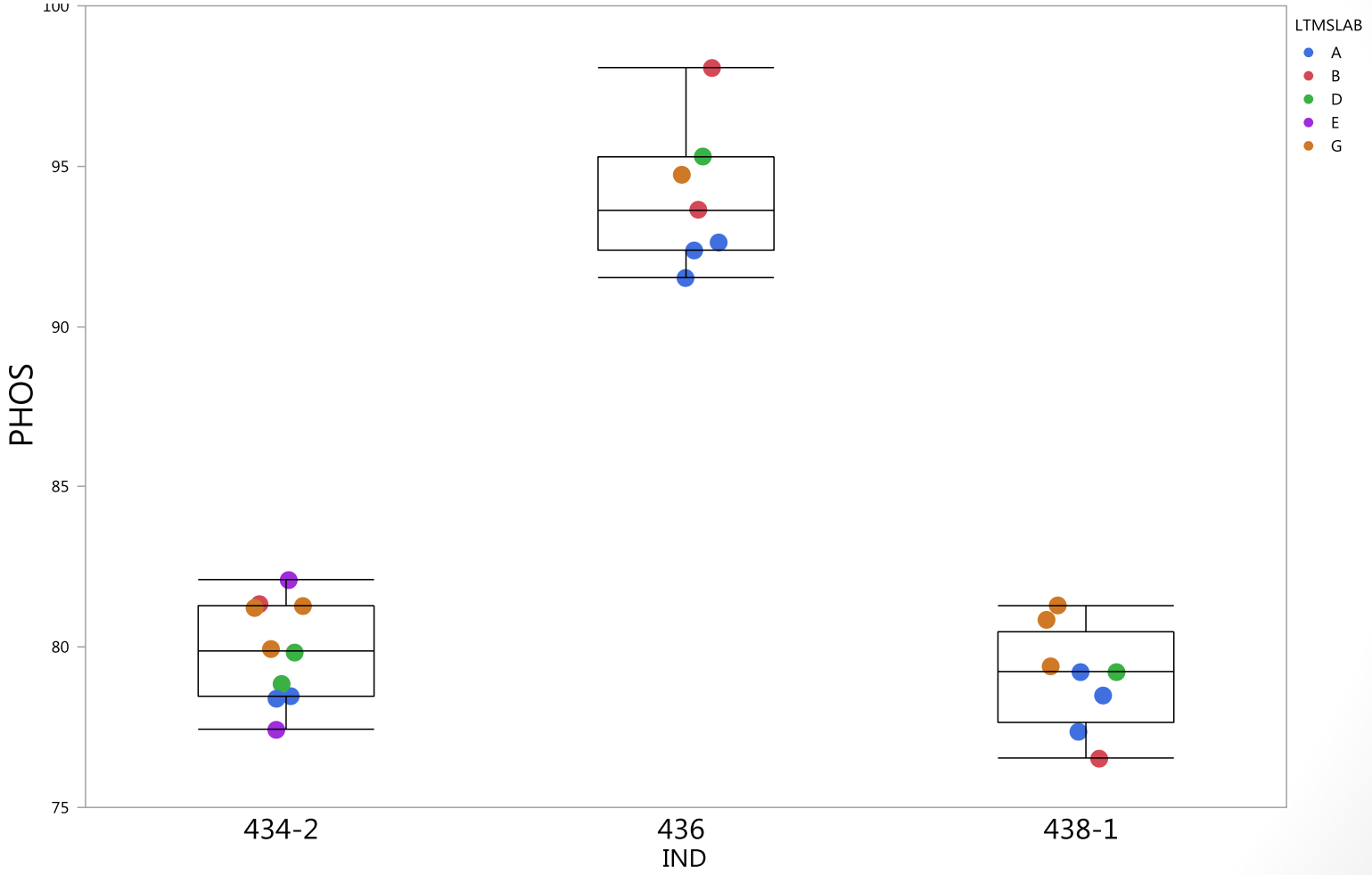
Preliminary

Phosphorus Retention n=25



Preliminary

PHOS



Preliminary

PHOS ANOVA

Summary of Fit

RSquare	0.962013
RSquare Adj	0.943019
Root Mean Square Error	1.642131
Mean of Response	83.5768
Observations (or Sum Wgts)	25

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio
Model	8	1092.6388	136.580	50.6490
Error	16	43.1455	2.697	Prob > F
C. Total	24	1135.7843		<.0001*

Effect Tests

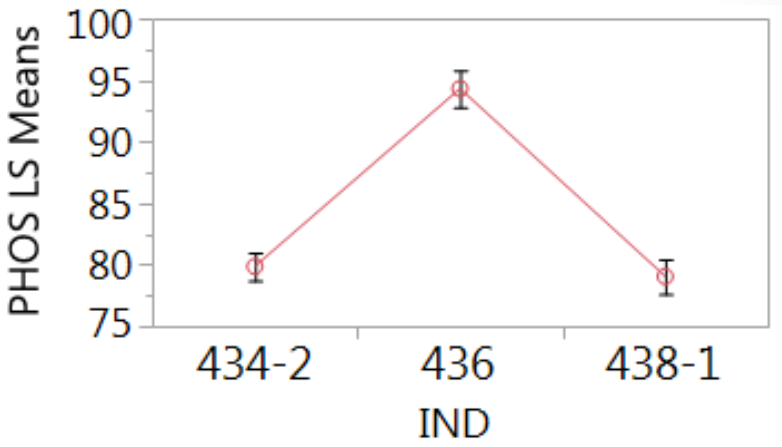
Source	DF	Sum of Squares	F Ratio	Prob > F
IND	2	943.65130	174.9710	<.0001*
LTMSLAB	4	23.63246	2.1910	0.1163
LTMSAPP[LTMSLAB]	2	1.42888	0.2649	0.7706

Preliminary

PHOS Oil Discrimination

436 is significantly higher than 438-1

436 is significantly higher than 434-2



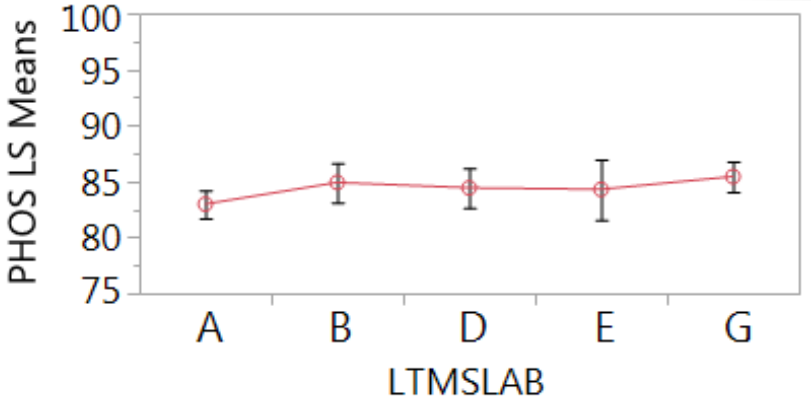
Oil1	Oil2	Difference	p-Value
436	438-1	15.27	0.00
436	434-2	14.45	0.00
434-2	438-1	0.82	0.61

Oil	PHOS LS Mean
434-2	79.87
436	94.32
438-1	79.05

Preliminary

PHOS Lab Difference

No significant lab difference



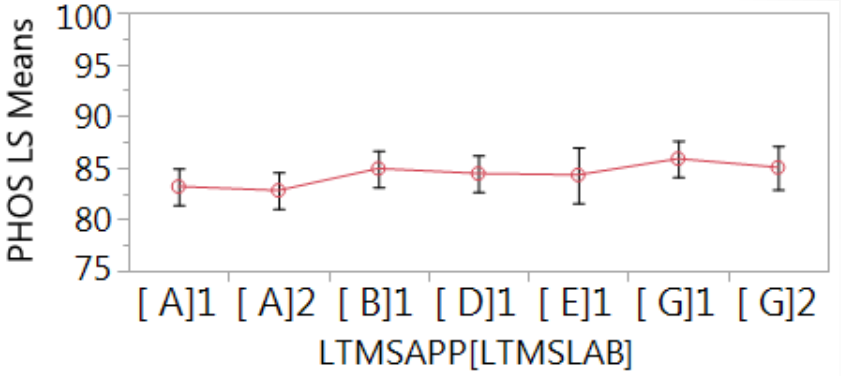
Lab1	Lab2	Difference	p-Value
G	A	2.46	0.08
B	A	1.93	0.35
D	A	1.45	0.63
E	A	1.31	0.88
G	E	1.15	0.92
G	D	1.01	0.87
B	E	0.62	0.99
G	B	0.53	0.99
B	D	0.48	0.99
D	E	0.14	1.00

Lab	PHOS LS Mean
A	82.99
B	84.91
D	84.44
E	84.30
G	85.44

Preliminary

PHOS Stand(Lab) Difference

No significant stand(lab) difference



Lab/Stand1	Lab/Stand2	Difference	p-Value
[G]1	[A]2	3.07	0.19
[G]1	[A]1	2.69	0.29
[G]2	[A]2	2.23	0.64
[B]1	[A]2	2.12	0.55
[G]2	[A]1	1.85	0.78
[B]1	[A]1	1.74	0.76
[D]1	[A]2	1.64	0.80
[G]1	[E]1	1.57	0.94
[E]1	[A]2	1.50	0.95
[G]1	[D]1	1.43	0.88
[D]1	[A]1	1.26	0.93
[E]1	[A]1	1.12	0.99
[G]1	[B]1	0.95	0.98
[G]1	[G]2	0.84	0.99
[G]2	[E]1	0.72	1.00
[B]1	[E]1	0.62	1.00
[G]2	[D]1	0.59	1.00
[B]1	[D]1	0.48	1.00
[A]1	[A]2	0.38	1.00
[D]1	[E]1	0.14	1.00
[G]2	[B]1	0.11	1.00

Lab/Stand	PHOS LS Mean
[A]1	83.18
[A]2	82.80
[B]1	84.91
[D]1	84.44
[E]1	84.30
[G]1	85.87
[G]2	85.02

Preliminary

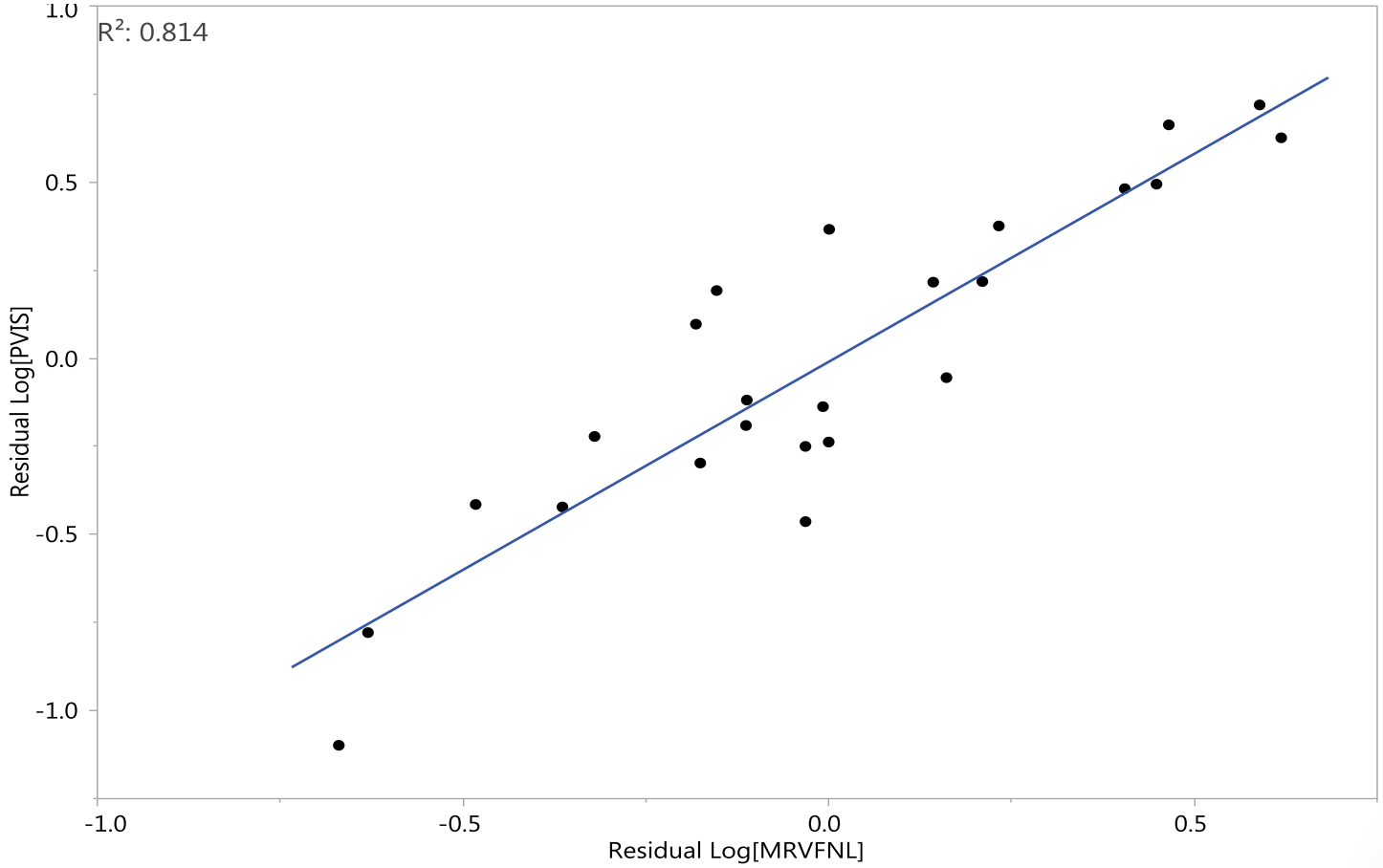
PHOS Precision

Model: Oil, Lab, Stand (Lab)

Model RMSE	Repeatability	Reproducibility
• s = 1.64 • IIIGB s=2.33	• s = 1.64 • r = 4.55	• s = 1.78 • R = 4.93

Preliminary

Correlation



PVIS and MRV are correlated

Preliminary

LTMS

ANOVA Factor	P-value			
	LnPVIS	WPD	LnMRV	PHOS
IND	0.01	0.00	0.00	0.00
LTMSLAB	0.01	0.20	0.00	0.12
LTMSAPP[LTMSLAB]	0.01	0.51	0.03	0.77

Stand(Lab) is significant for PVIS and MRV so a Stand-based LTMS is recommended for Sequence IIIH

Reference Oil Targets (Preliminary)

PERCENT VISCOSITY INCREASE

Unit of Measure: LN(PVIS)

IIIH			IIIG		
Reference Oil	LSMean	Standard Deviation	Reference Oil	Mean	Standard Deviation
434-2	4.5287	0.8013	434	4.7269	0.3859
436	3.5192	0.3571			
438-1	3.9580	0.9558	438	4.5706	0.1768

WEIGHTED PISTON DEPOSITS

Unit of Measure: Merits

IIIH			IIIG		
Reference Oil	LSMean	Standard Deviation	Reference Oil	Mean	Standard Deviation
434-2	4.11	0.66	434	4.80	0.96
436	4.73	0.24			
438-1	3.66	0.43	438	3.20	0.33

Preliminary

Reference Oil Targets (Preliminary)

MRV VISCOSITY

Unit of Measure: LN(MRV)

IIIH			IIIGA		
Reference Oil	LSMean	Standard Deviation	Reference Oil	Mean	Standard Deviation
434-2	11.1077	0.72825	434	10.7881	0.45550
436	10.0612	0.25809			
438-1	10.2207	0.77072	438	9.8277	0.16646

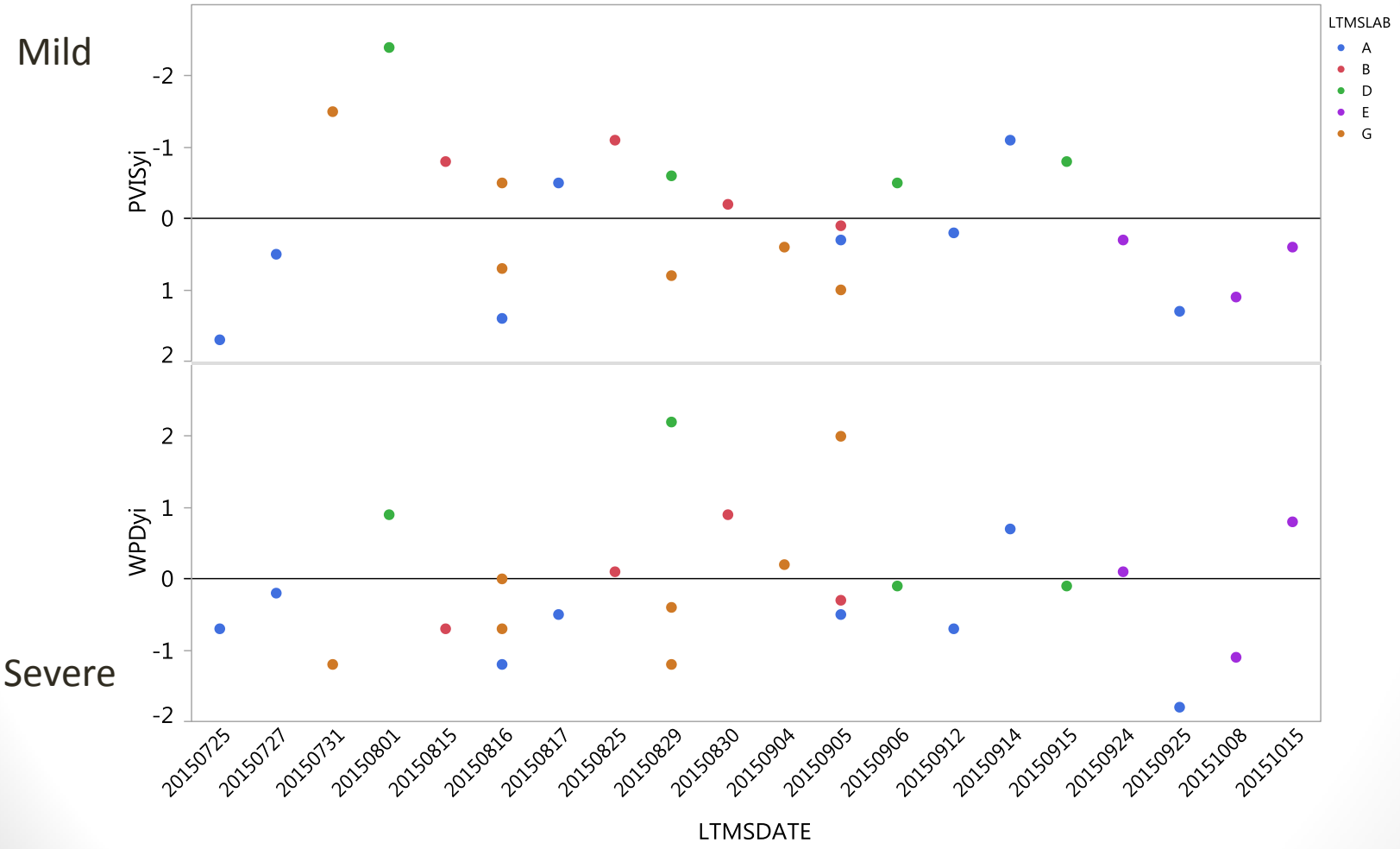
PHOSPHORUS RETENTION

Unit of Measure: Percent

IIIH			IIIGB		
Reference Oil	LSMean	Standard Deviation	Reference Oil	Mean	Standard Deviation
434-2	79.87	1.57	434	76.00	2.02
436	94.32	2.22			
438-1	79.05	1.61	438	78.20	2.56

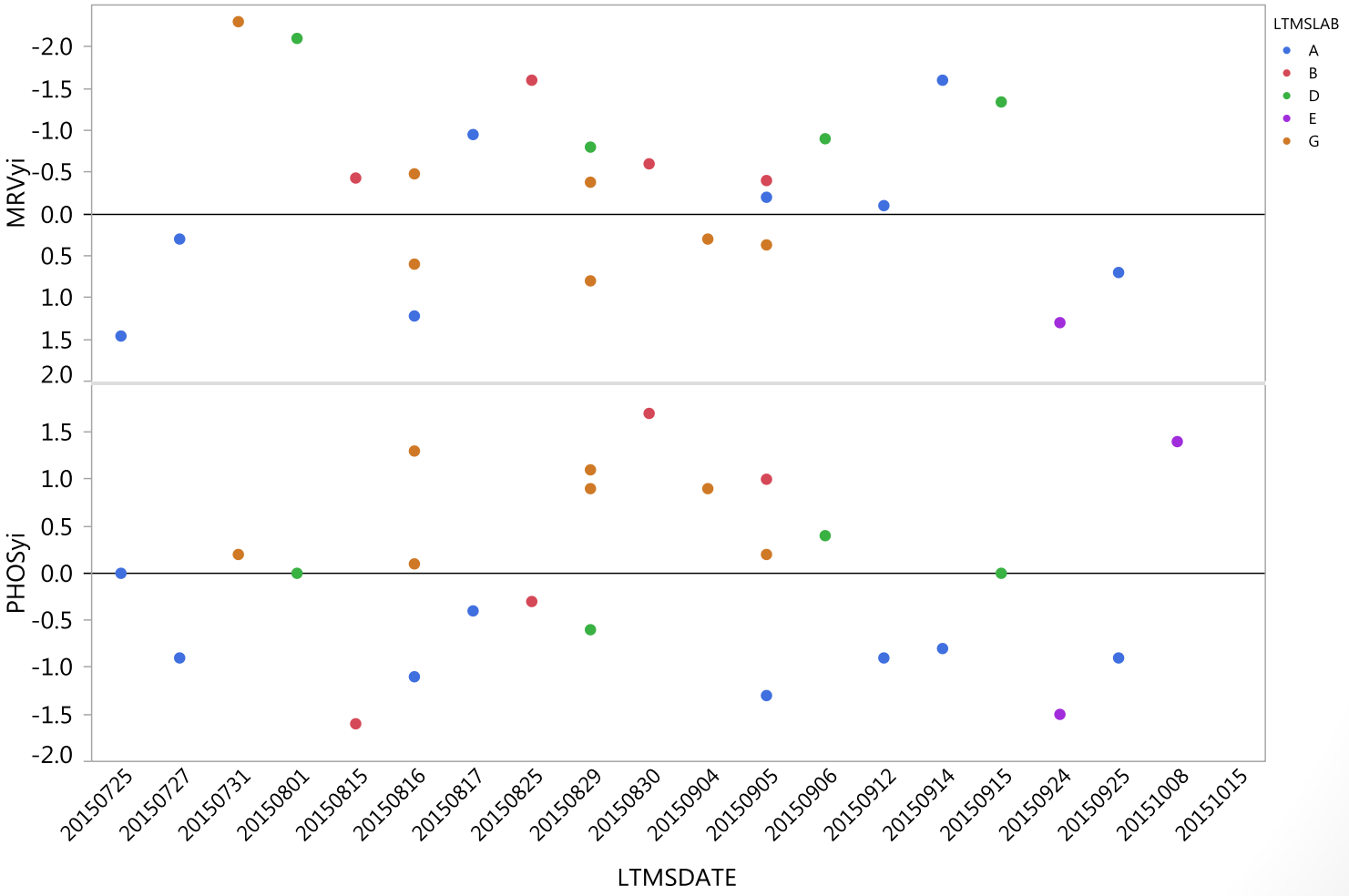
Preliminary

Industry Yi (Preliminary)



Industry Yi (Preliminary)

Mild



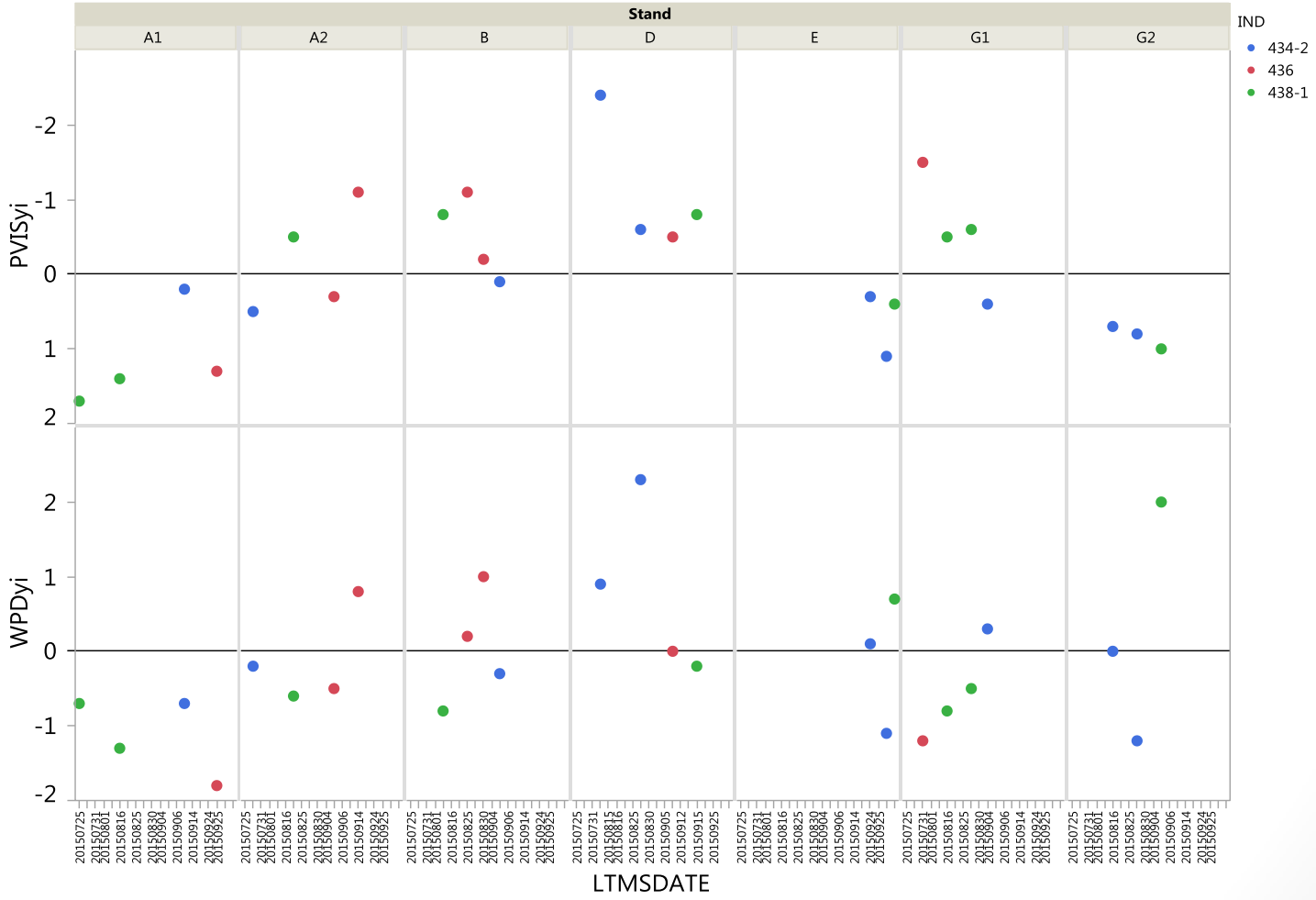
Severe

Preliminary

Stand Yi (Preliminary)

Mild

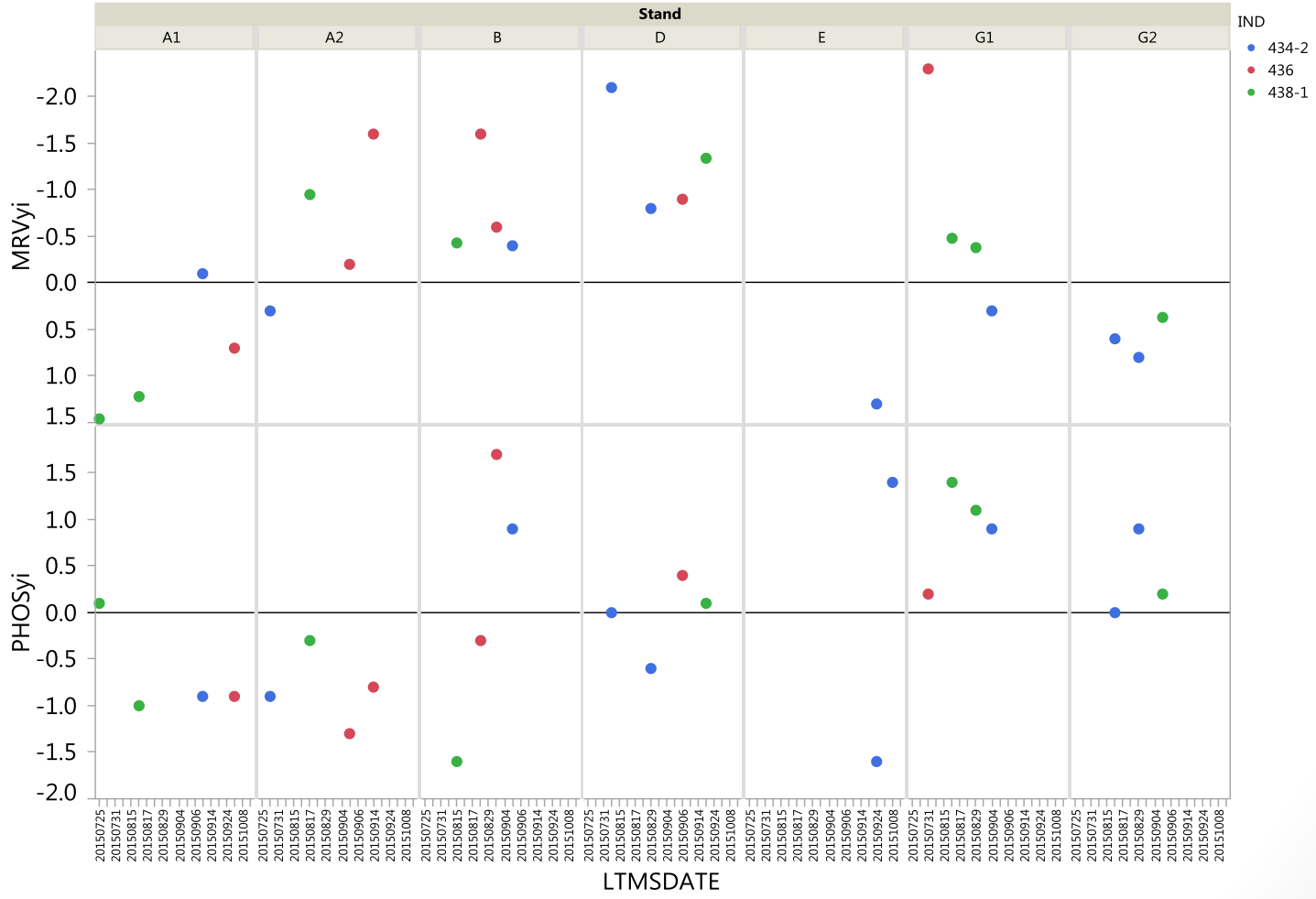
Severe



Preliminary

Stand Yi (Preliminary)

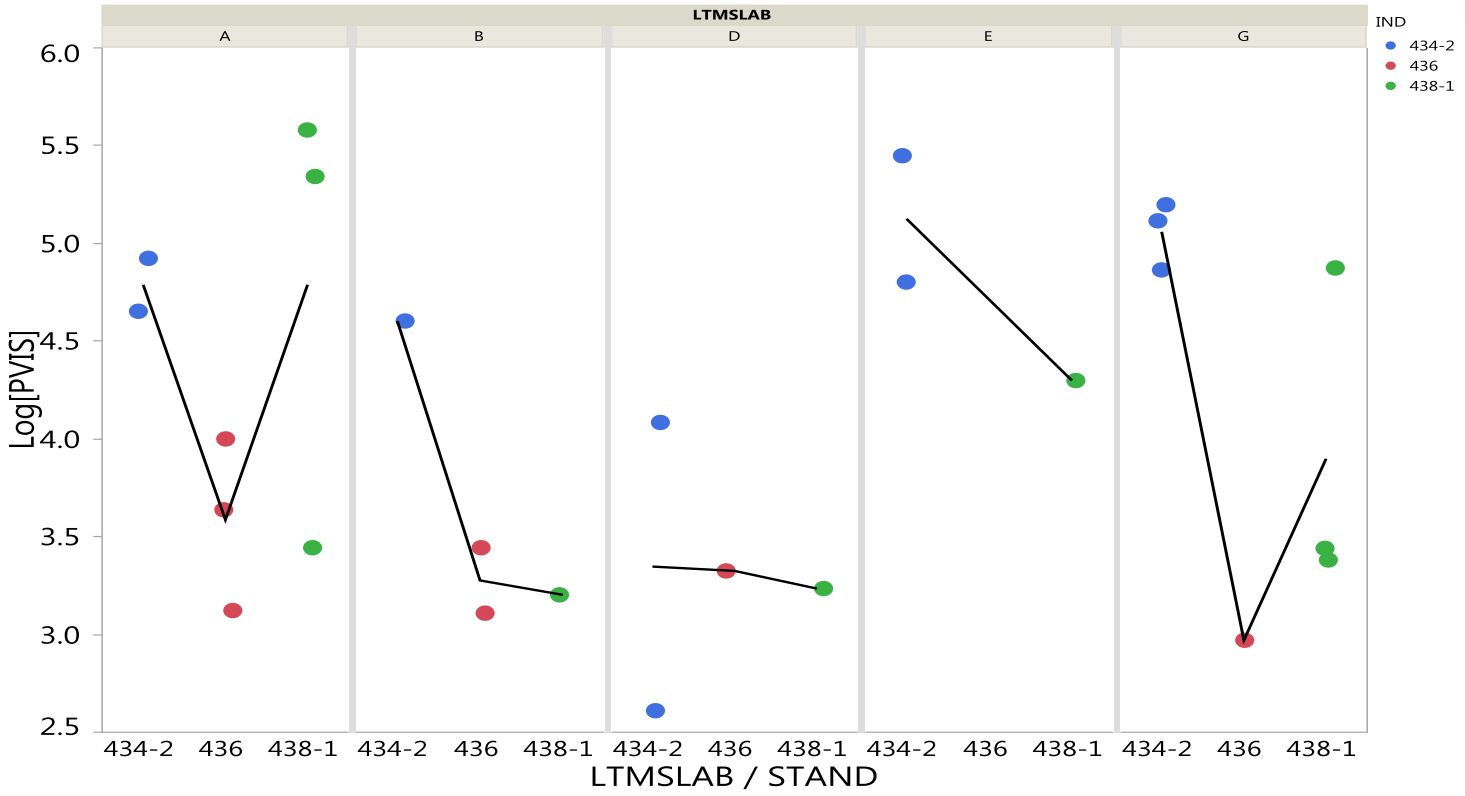
Mild



Severe

Preliminary

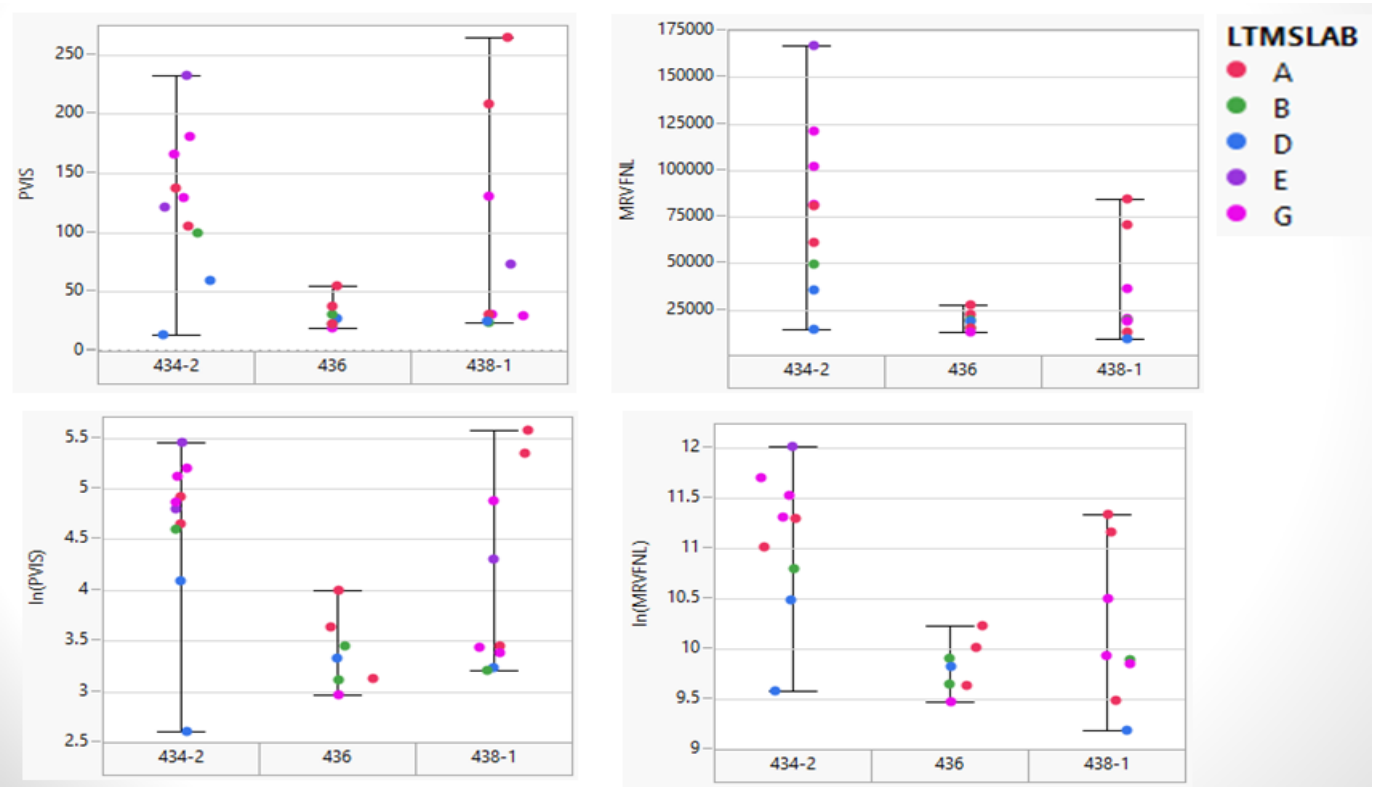
PVIS Concern 1



Labs do not discriminate the same way for PVIS

Preliminary

PVIS Concern 2



If 434-2 is meant to be a failing oil, then will PVIS and/or MRV be adequate parameters to ensure failing oils won't pass and passing oils won't fail?
Is the test severe enough for PVIS to consistently reflect that 434-2 "breaks"?

Preliminary