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COMMITTEE D02 ON PETROLEUM PRODUCTS, LIQUID FUELS, AND LUBRICANTS

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Issued: 07.12.2017
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These are the unapproved minutes of the 07.11.2017 Sequence VI Conference Call.

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The meeting was called to order at 9:05 AM Central Time by Chair Greg Miranda.

Agenda

The Agenda is the included as **Attachment 1**.

1.0 Roll Call

The Attendance list is **Attachment 2**. There were no member changes.

2.0 Approval of Meeting minutes from 06.20.2017 Seq. VI SP meeting

2.1 Greg Miranda made the motion and Rich Grundza seconded.

NOTE: Amol noted that 4.1 had a typo where the oil should be 542-3. Rich will correct this.

2.2 The minutes were approved unanimous with this change.

3.0 Old Business

3.1 Seq. VIE/F Short Block Hardware Task Force Update Adrian Alfonso

3.1.1 Hardware availability update

The industry has concerns about the remaining life of the OHT-2 engines. There are 9 of those left. OHT has worked on re-distribution. Jason noted these would be depleted by the end of August. Dan noted the Kit order for SwRI will be delivered in July.

3.1.2 Status of Short block hardware introduction Matrix

All tests for 3 labs are reported. The 4th lab has reported one, completed the second, and started the third test in their series. They should complete in early August.

3.2 Seq. VIE/F Equivalency Update

Intertek discussed the VIF issue of Vi alarms on the second reference test on a stand. The second run tends to be milder. Rich noted this is a concern that was not seen with the first few VIF references. Adrian asked that the Vi alarm limits be reviewed. Dan agreed. Greg made a note to watch for this.

NOTE: Amol asked about the VIE procedure. It has been approved and assigned number D8114. Hap noted it was being processed and would release next week. He sent an email that it was released and available for download. There is an issue with equations, and this will need correction with an information letter.

4.0 New Business

4.1 Review of Seq. VIE/F Short Block Hardware Matrix Results

See **Attachment 3**. Todd presented the slides. The engine hour correction and slope for the equations may need to be modified. The slope will be about ½ the current value. Slide 8 shows the resultant equations for FEI 1. The Stat group does want the data from the 4th lab as there is a concern with loss of separation for FEI 2. This was indicated in earlier test data. Bill noted aging was increased to 125 hours total and this may be a factor. Todd suggested looking at oxidation on reference oils. There was discussion of two references per stand and then 3 candidates [5 runs per engine]. This will provide better severity adjustment values, but will not resolve the FEI 2 severity shift. A Task Force was created for VIE/VIF severity. Dan Worcester will chair. People can volunteer.

5.0 Next Meeting

5.1 The next SP meeting is planned the week of August 07, 2017 at 10:00 Eastern Time.

The meeting adjourned at 10:27 AM.

Sequence VI Surveillance Panel Conference Call Agenda July 11, 2017 @ 10:00-12:00 EST

Audio Connection

Call-in Number: +1-415-655-0001
Conference Code: 193 359 273

Webex Meeting URL:

<https://meetings.webex.com/collabs/#/meetings/detail?uuid=MAMHISN3ZSKY7D0A65UXIYAVFL-20XT&rnd=675234.87742>

1. Roll Call (start 10:05 EST)

1.1. *SP Membership changes and additions*

2. Approval of Meeting minutes from June 20, 2017 Seq. VI SP meeting

3. Old Business

3.1	Seq. VIE/F Short Block Hardware Task Force Update 3.1.1 Hardware availability update 3.1.2 Status of Short block hardware introduction Matrix	Adrian Alfonso
3.2	Seq. VID-VIF Equivalency Update	

4. New Business

4.1. Review of Seq. VIE/F Short Block Hardware Matrix Results

5. Next Meeting

5.1. *TBD*

6. Meeting Adjourned

ASTM SEQUENCE VI

Name	Email/Phone	Company	Attend
Adrian Alfonso Voting Member	Phone: (210) 838-0431 Adrian.Alfonso@intertek.com	Intertek	ATTEND
Jason Bowden Voting Member	Phone: (440) 354-7007 jhbowden@ohtech.com	OHT	ATTEND
Amol Savant Voting Member	acsavant@valvoline.com	Valvoline	ATTEND
Tim Cushing Voting Member	Phone: (248) 881-3518 Timothy.Cushing@gm.com	General Motors	ATTEND
Rich Grundza Voting Member	Phone: (412) 365-1034 reg@astmtmc.cmu.edu	TMC	ATTEND
Jeff Hsu Voting Member	Phone: (832) 419-3482 j.hsu@shell.com	Shell	
Teri Kowalski Voting Member	Phone: (734) 995-4032 Teri.Kowalski@tema.toyota.com	Toyota	ATTEND
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Katerina Pecinovsky Voting Member	Phone: Katerina.Pecinovsky@AftonChemical.com	Afton	ATTEND
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Clifford Salvesen Voting Member	Phone: (856) 224-2954 Clifford.r.Salvesen@exxonmobil.com	ExxonMobil	ATTEND
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Haiying Tang Voting Member	Phone: (248) 512-0593 HT146@Chrysler.com	Chrysler	
Dan Worcester Voting Member	Phone: (210) 522-2405 Dan.Worcester@swri.org	SwRI	ATTEND

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Hap Thompson	Hapjthom@aol.com	Vix Facilitator	ATTEND
Chris Taylor	Chris.Taylor@vpracingfuels.com	VP Racing Fuels	
Rasad Thompson			

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MOTION:			
Adrian Alfonso Voting Member			
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Ron Romano Voting Member			
Clifford Salvesen Voting Member			
Kaustav Sinha Voting Member			
Haiying Tang Voting Member			
Dan Worcester Voting Member			
VOTES			

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Haiying Tang Voting Member			
Dan Worcester Voting Member			
VOTES			

Preliminary VIE Engine Short Block Matrix Analysis

Statistics Group

July 11, 2017

Statistics Group

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

Executive Summary

Concerns/Complications:

- As presented in February, there is a severity shift Post PM and appears to be the same in SBM
- FEI2 Post PM and SBM oil discrimination is diminished
- Appears that engine hour adjustment between PM and SBM may be different

Next Steps:

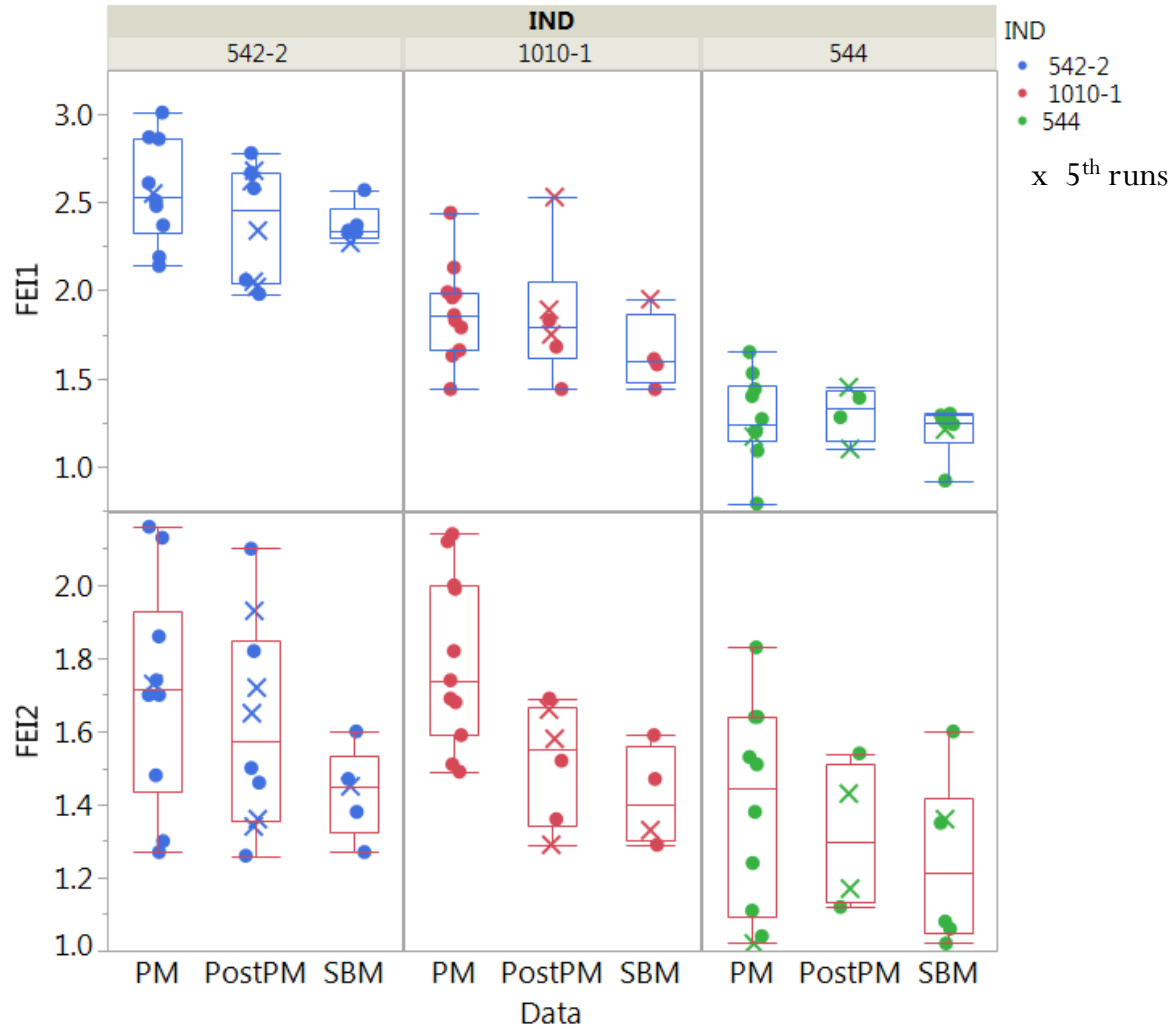
- Wait for 4th engine data
- Analyze data with and without Post PM and SBM 5th runs

Note: SG recommends that the Sequence VI Surveillance Panel investigate the potential root cause(s) of the severity shift and diminished discrimination for FEI2.

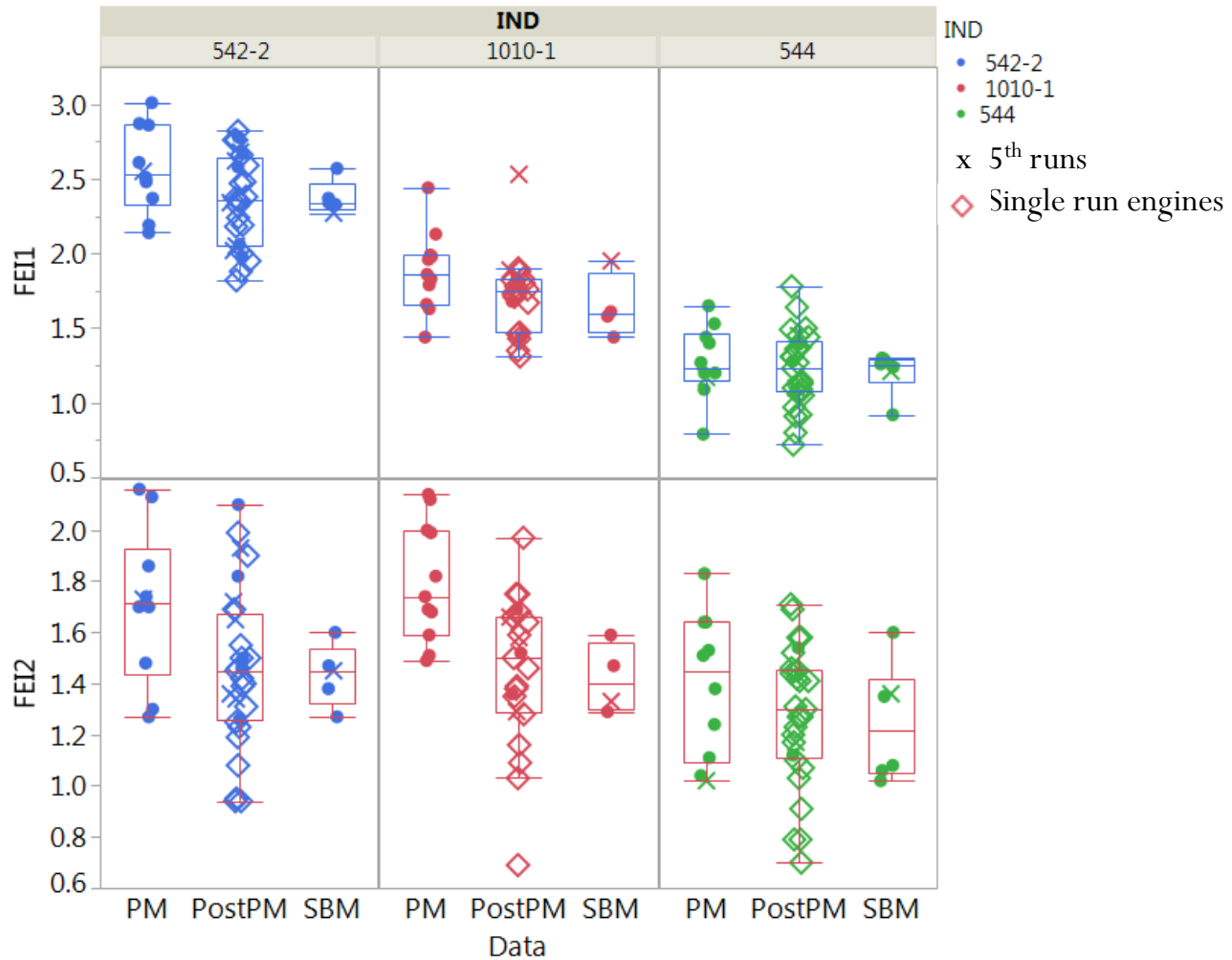
Data

- **Short block matrix (with 5th runs)**
 - 3 Reference Oils {1010-1, 542-2, 544}
 - 3 Labs {A, D, G}
 - 3 Engines {A2 101A, D3 001G, G2 200C}
 - Total number of tests = 15
- **Precision matrix**
 - 3 Reference Oils {1010-1, 542-2, 544}
 - 6 Labs {A, B, C, D, F, G}
 - 8 Engines {A2 103, B1 123, D2 11, F2 136, C2 29, C2 31, G2 55, G1 60}
 - Within lab statistical tests - 2 Labs each with 2 engines
 - Lab C: 29 vs. 31
 - Lab G: 55 vs. 60
 - Total number of tests = 29 (31 including 5th runs)
- **Post Precision matrix with 5th runs**
 - 3 Reference Oils {1010-1, 542-2, 544}
 - 4 Labs {A, C, D, G}
 - 10 Engines {A3 301, A8 262, A10 254, A11 99, D1 112, D2 14, C2 36, G2 222, G4 328, G6 253}
 - Total number of tests = 20
- **Post Precision matrix single run engines = 61**

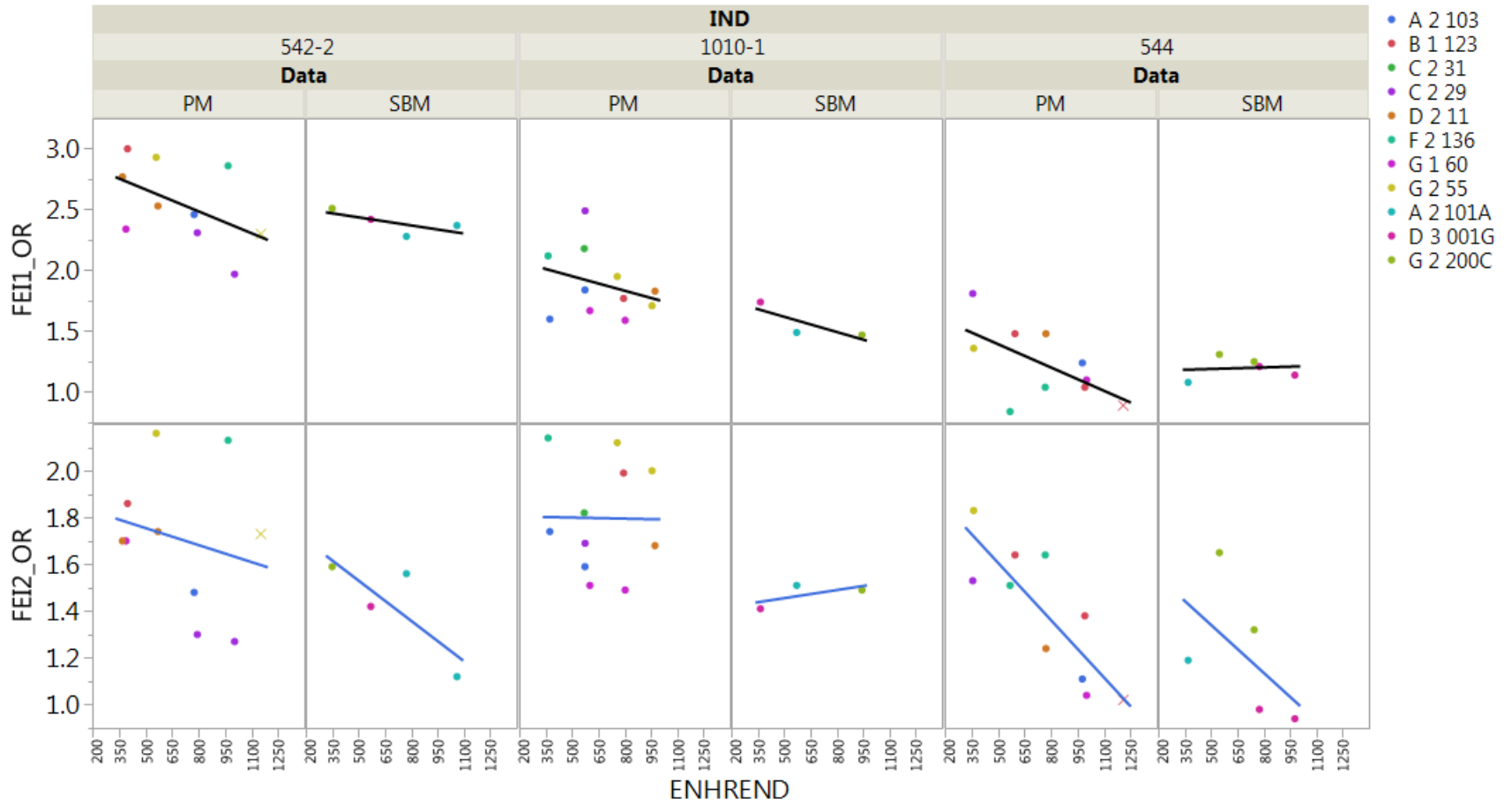
Severity Shift



Severity Shift with Single Run Engines



PM vs SBM



ANOVA - FEI1

PM

Summary of Fit					
RSquare Adj			0.756539		
Root Mean Square Error			0.29684		
Mean of Response			1.907241		
Observations (or Sum Wgts)			29		
Analysis of Variance					
Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Model	10	8.547732	0.854773	9.7008	
Error	18	1.586047	0.088114		Prob > F
C. Total	28	10.133779			<.0001*
Parameter Estimates					
Term	Estimate	Std Error	t Ratio	Prob> t	
Intercept	2.2802397	0.177255	12.86	<.0001*	
IND[542-2]	0.6405282	0.082937	7.72	<.0001*	
IND[1010-1]	-0.018512	0.08079	-0.23	0.8214	
LabStandEngine[A 2 103]	-0.140736	0.142729	-0.99	0.3372	
LabStandEngine[B 1 123]	0.0579996	0.145523	0.40	0.6949	
LabStandEngine[C 2 29]	0.058389	0.145562	0.40	0.6930	
LabStandEngine[C 2 31]	0.2135041	0.273982	0.78	0.4460	
LabStandEngine[D 2 11]	0.0599326	0.145465	0.41	0.6852	
LabStandEngine[F 2 136]	-0.064132	0.145432	-0.44	0.6645	
LabStandEngine[G 1 60]	-0.238434	0.142959	-1.67	0.1126	
ENHREND	-0.000518	0.000249	-2.08	0.0522	
Effect Tests					
Source	Nparm	DF	Sum of Squares	F Ratio	Prob > F
IND	2	2	6.6934985	37.9822	<.0001*
LabStandEngine	7	7	0.4045268	0.6559	0.7056
ENHREND	1	1	0.3809584	4.3235	0.0522

SBM

Summary of Fit					
RSquare			0.964464		
RSquare Adj			0.944721		
Root Mean Square Error			0.126616		
Mean of Response			1.66		
Observations (or Sum Wgts)			15		
Analysis of Variance					
Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Model	5	3.9159155	0.783183	48.8524	
Error	9	0.1442845	0.016032		Prob > F
C. Total	14	4.0602000			<.0001*
Parameter Estimates					
Term	Estimate	Std Error	t Ratio	Prob> t	
Intercept	1.8816119	0.091464	20.57	<.0001*	
IND[542-2]	0.6509407	0.047689	13.65	<.0001*	
IND[1010-1]	-0.113692	0.05059	-2.25	0.0512	
LabStandEngine[A 2 101A]	-0.077116	0.046723	-1.65	0.1332	
LabStandEngine[D 3 001G]	0.0814858	0.047686	1.71	0.1217	
ENHREND	-0.000249	0.00011	-2.27	0.0497*	
Effect Tests					
Source	Nparm	DF	Sum of Squares	F Ratio	Prob > F
IND	2	2	3.8122200	118.8970	<.0001*
LabStandEngine	2	2	0.0599488	1.8697	0.2094
ENHREND	1	1	0.0822949	5.1333	0.0497*

FEI1 Engine Hours Adjustment:

$$FEI1_{PM} = FEI1_OR + 0.000518*(ENHREND - 675)$$

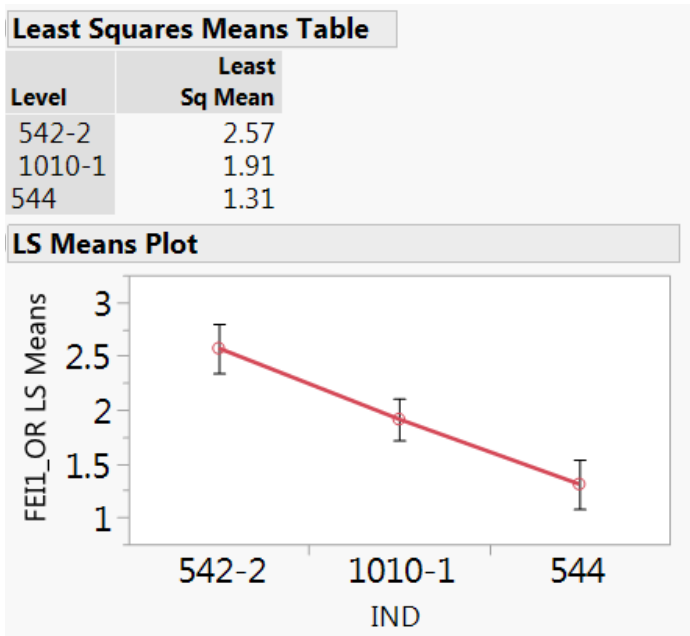
$$FEI1_{SBM} = FEI1_OR + 0.000249*(ENHREND - 776)$$

Oil Discrimination – FEI1

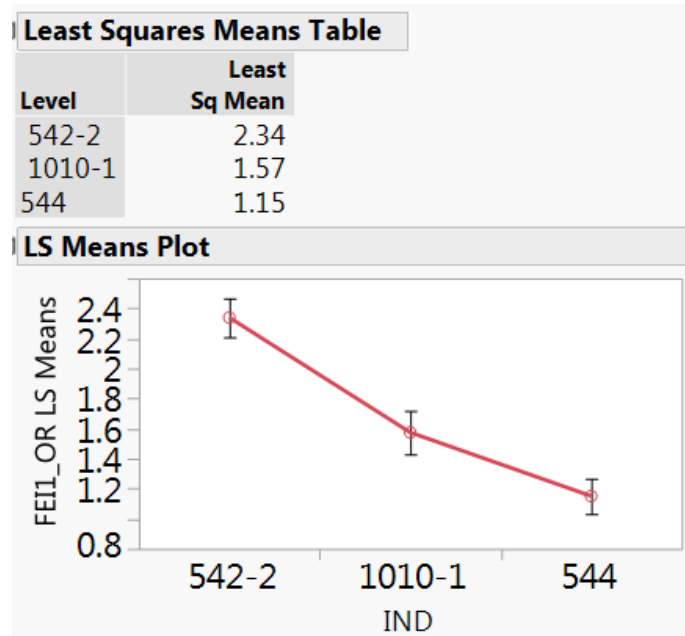
PM and SBM discriminate oils similarly:

- All oil contrasts are significantly different
- $544 < 1010-1 < 542-2$

PM

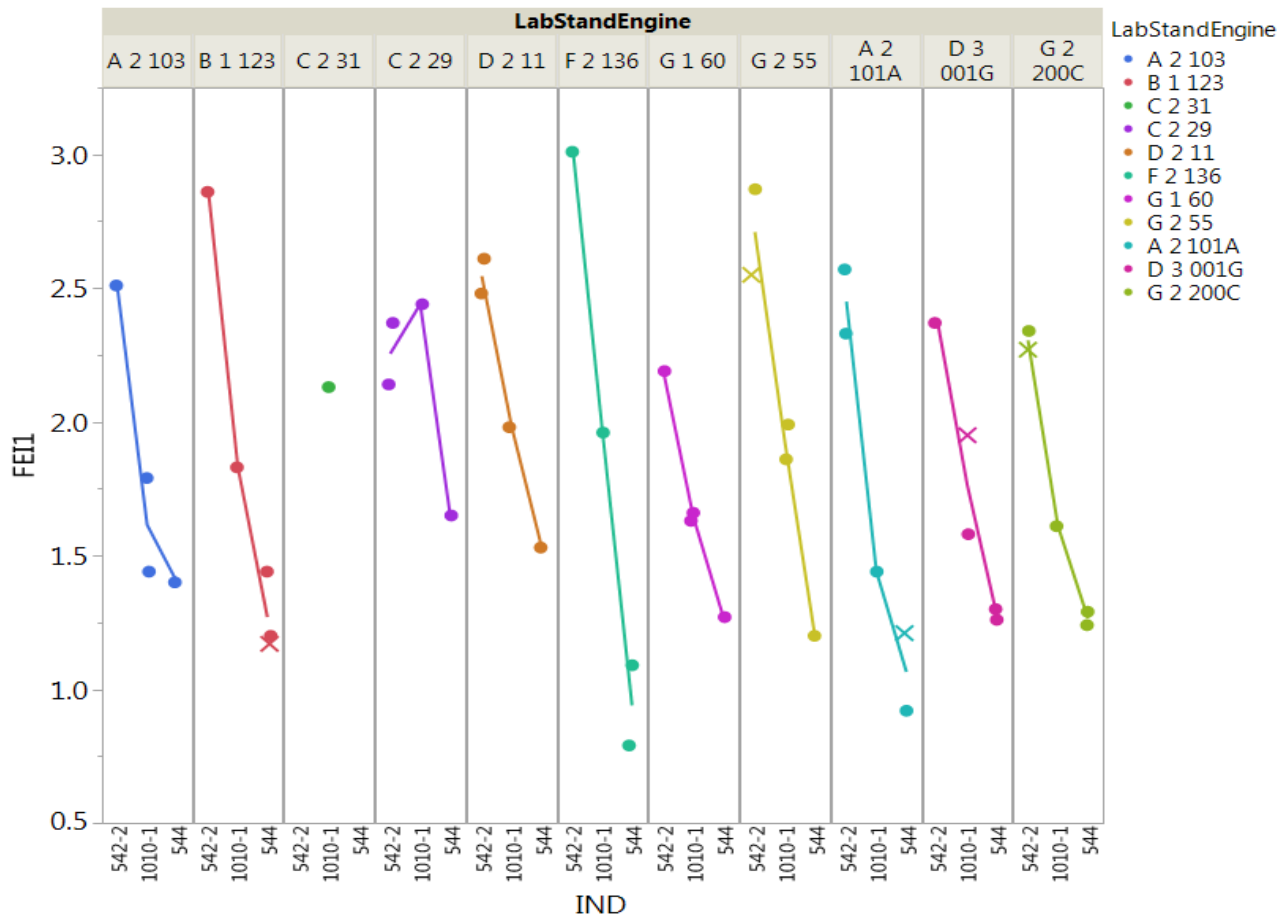


SBM



FEI1 Adjusted Oil Discrimination

- Oil discrimination consistent among Short Block engines (last three engines)



ANOVA – FEI2

PM

Summary of Fit					
RSquare		0.897781			
RSquare Adj		0.840993			
Root Mean Square Error		0.121536			
Mean of Response		1.656207			
Observations (or Sum Wgts)		29			

Analysis of Variance					
Source	DF	Sum of Squares	Mean Square	F Ratio	
Model	10	2.3352039	0.233520	15.8093	
Error	18	0.2658788	0.014771		Prob > F
C. Total	28	2.6010828			<.0001*

Parameter Estimates					
Term	Estimate	Std Error	t Ratio	Prob> t	
Intercept	1.8995313	0.072574	26.17	<.0001*	
IND[542-2]	0.0807964	0.033957	2.38	0.0286*	
IND[1010-1]	0.1611275	0.033078	4.87	0.0001*	
LabStandEngine[A 2 103]	-0.202744	0.058438	-3.47	0.0027*	
LabStandEngine[B 1 123]	0.1431304	0.059582	2.40	0.0273*	
LabStandEngine[C 2 31]	-0.023739	0.112178	-0.21	0.8348	
LabStandEngine[C 2 29]	-0.212307	0.059598	-3.56	0.0022*	
LabStandEngine[D 2 11]	-0.074183	0.059558	-1.25	0.2289	
LabStandEngine[F 2 136]	0.2698796	0.059545	4.53	0.0003*	
LabStandEngine[G 1 60]	-0.238705	0.058532	-4.08	0.0007*	
ENHREND	-0.000381	0.000102	-3.73	0.0015*	

Effect Tests					
Source	Nparm	DF	Sum of Squares	F Ratio	Prob > F
IND	2	2	0.7871158	26.6439	<.0001*
LabStandEngine	7	7	1.3942379	13.4843	<.0001*
ENHREND	1	1	0.2056602	13.9232	0.0015*

SBM

Summary of Fit					
RSquare		0.735237			
RSquare Adj		0.588147			
Root Mean Square Error		0.144153			
Mean of Response		1.315333			
Observations (or Sum Wgts)		15			

Analysis of Variance					
Source	DF	Sum of Squares	Mean Square	F Ratio	
Model	5	0.51935215	0.103870	4.9985	
Error	9	0.18702119	0.020780		Prob > F
C. Total	14	0.70637333			0.0182*

Parameter Estimates					
Term	Estimate	Std Error	t Ratio	Prob> t	
Intercept	1.6162251	0.104133	15.52	<.0001*	
IND[542-2]	0.034529	0.054294	0.64	0.5406	
IND[1010-1]	0.0903553	0.057597	1.57	0.1511	
LabStandEngine[A 2 101A]	0.0040343	0.053194	0.08	0.9412	
LabStandEngine[D 3 001G]	-0.145466	0.054291	-2.68	0.0252*	
ENHREND	-0.000369	0.000125	-2.95	0.0163*	

Effect Tests					
Source	Nparm	DF	Sum of Squares	F Ratio	Prob > F
IND	2	2	0.12866290	3.0958	0.0948
LabStandEngine	2	2	0.19604551	4.7171	0.0397*
ENHREND	1	1	0.18069690	8.6957	0.0163*

FEI2 Engine Hours Adjustment:

$$FEI2_{PM} = FEI1_OR + 0.000381*(ENHREND - 675)$$

$$FEI2_{SBM} = FEI1_OR + 0.000369*(ENHREND - 776)$$

Oil Discrimination – FEI2

Oils significantly differ for PM but *not* for SBM:

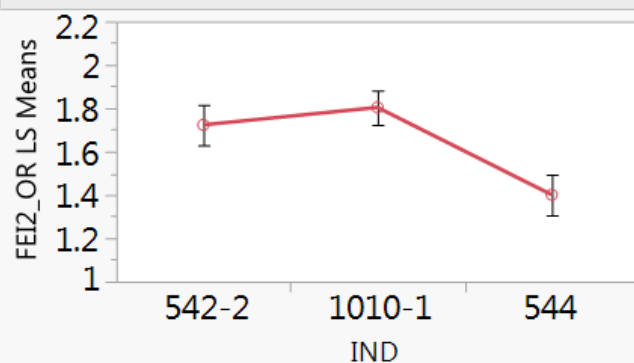
- PM: $544 < \{1010-1 \text{ \& } 542-2\}$
- SBM: $544 < 1010-1$ (p-value=0.11)

PM

Least Squares Means Table

Level	Least Sq Mean
542-2	1.72
1010-1	1.80
544	1.40

LS Means Plot

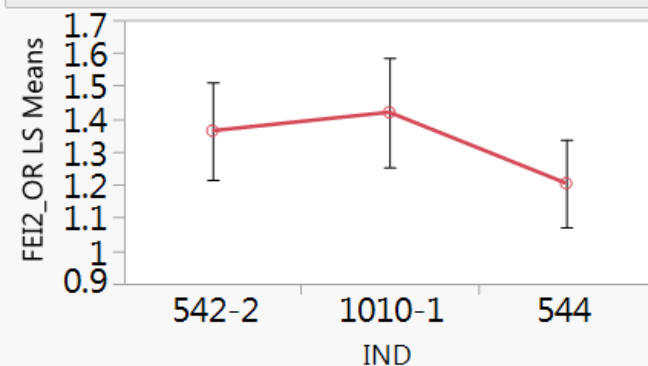


SBM

Least Squares Means Table

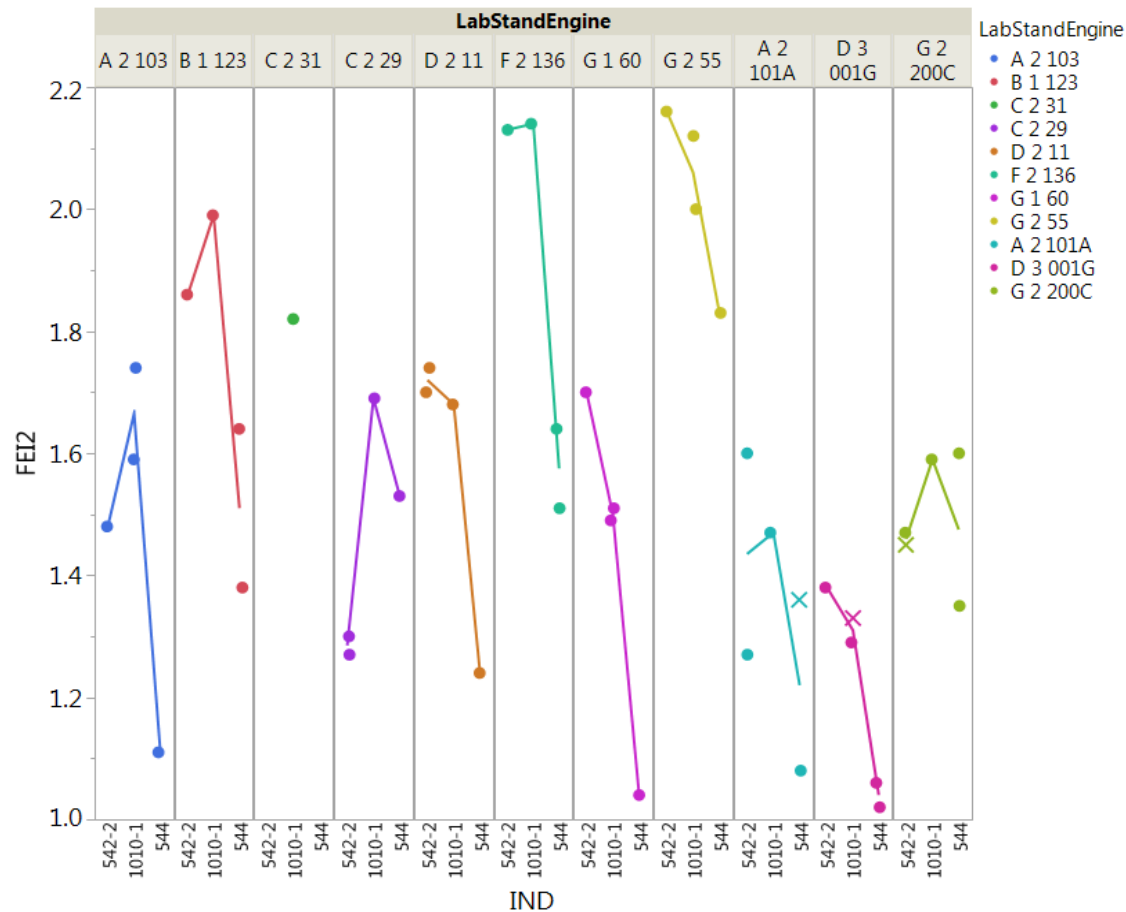
Level	Least Sq Mean
542-2	1.36
1010-1	1.42
544	1.20

LS Means Plot

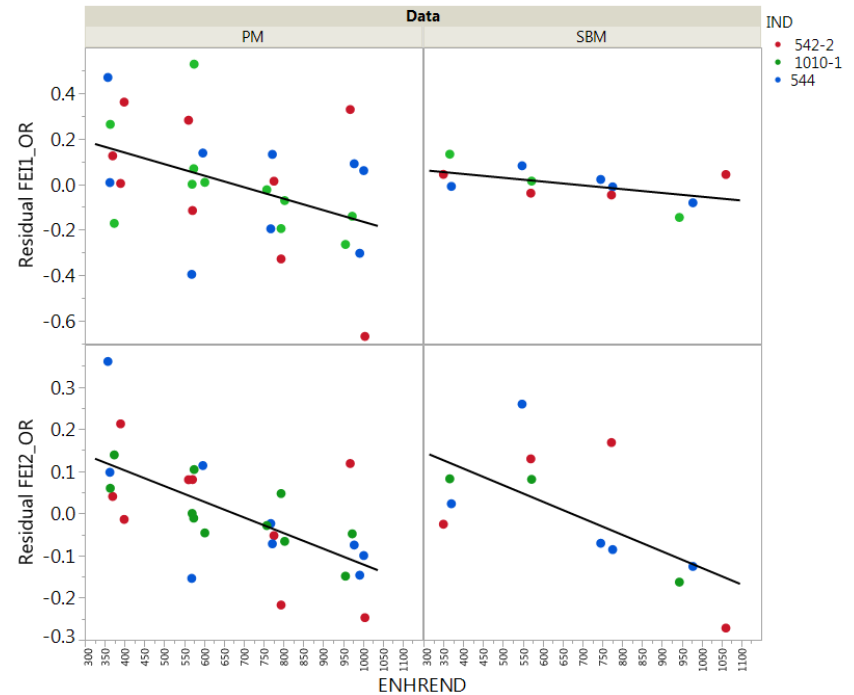
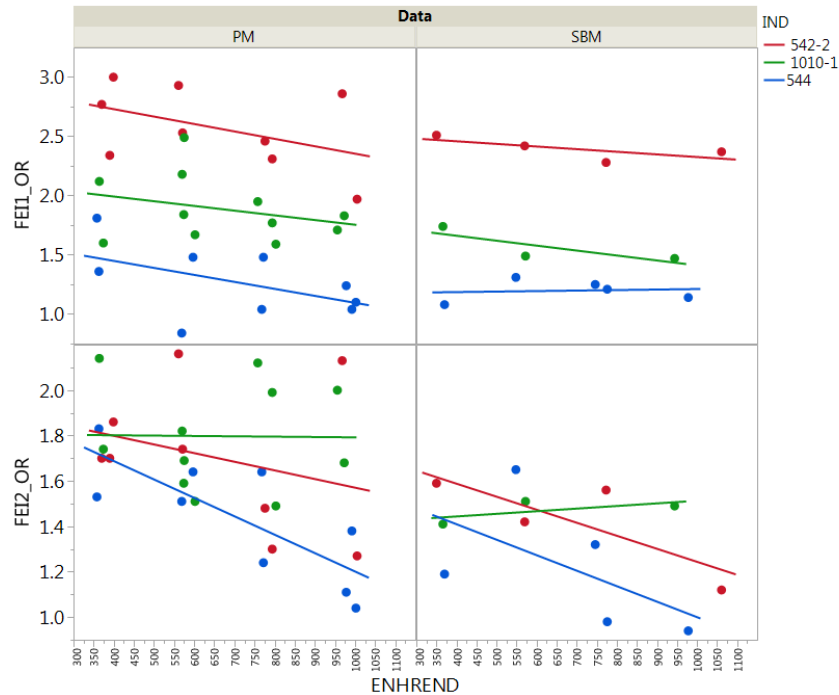


FEI2 Adjusted Oil Discrimination

- Oil discrimination *not* consistent among Short Block engines (last three engines)
- Engine D3 001G is significantly milder than engine G 2 200C

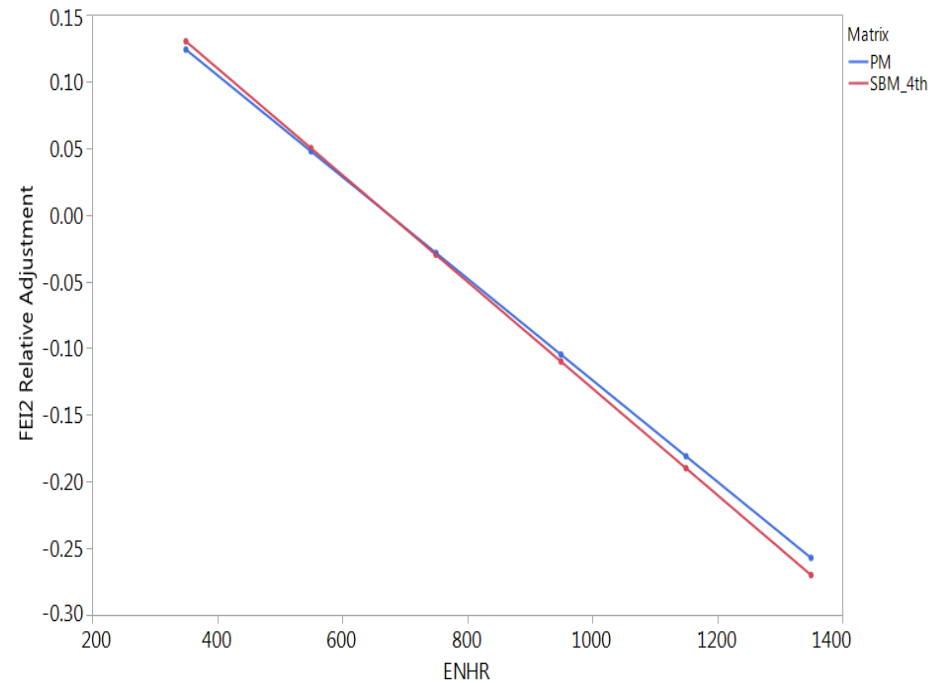
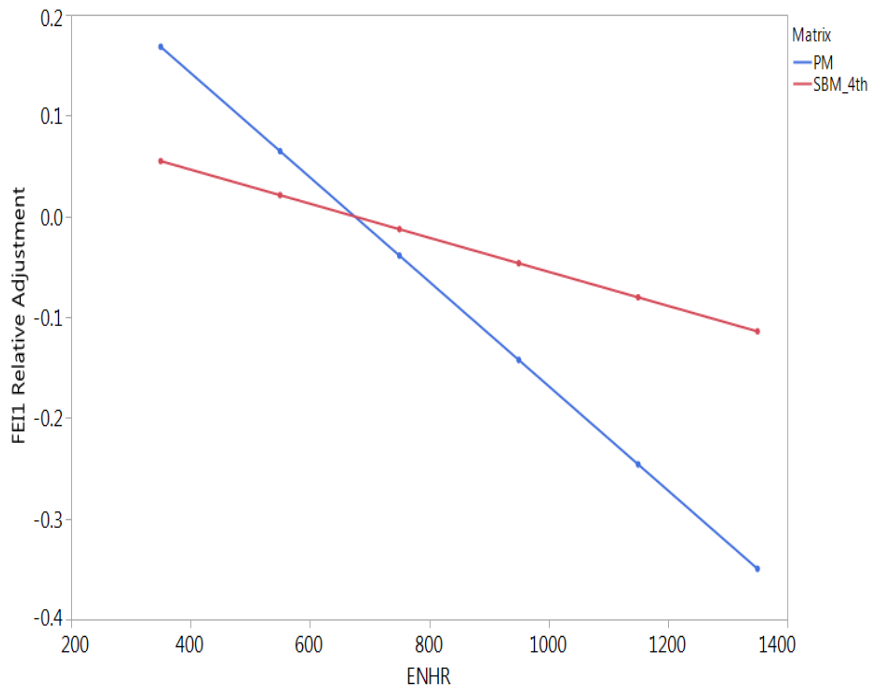


Evaluating Engine Hour Adjustment



- Appears that engine hour adjustment between PM and SBM may be different
- FEI2 appears to show higher 2nd runs than 1st runs, a phenomenon seen in VIF FEI1

FEI Relative Adjustment



Engine Hours Adjustment:

$$FEI1_{PM} = FEI1_{OR} + 0.000518 * (ENHREND - 675)$$

$$FEI1_{SBM} = FEI1_{OR} + 0.000249 * (ENHREND - 675)$$

$$FEI2_{PM} = FEI1_{OR} + 0.000381 * (ENHREND - 675)$$

$$FEI2_{SBM} = FEI1_{OR} + 0.000369 * (ENHREND - 675)$$

Appendix

Short Block Matrix Design

Task Force Request

The availability of current OEM built VIE/F engines is expected to be depleted by 3Q2017. The Task Force for introducing the new lab built engines is requesting the stats group to provide input on the best manner to introduce the new lab built engines to the system by May 31st, 2017. Please consider the questions below when providing your recommendations.

- Can the lab built engines be introduced through the normal referencing system?
If lab built engines are introduced through the normal referencing system there will be no data to determine if the engine hour adjustment has changed for the new engines as references are conducted on the first run only in most cases. If the SP believes the new engines may exhibit a different engine hour adjustment a matrix of tests across the life of the engines is required.
- How should the VIE and VIF be incorporated into the introduction?
A decision about the VIF should be made after VIE data is available.
- Do we need to reevaluate the engine hour adjustment?
This cannot be answered without producing the data to determine if a significant difference is present. If there is a belief in the SP that it could change based on the technical understanding of the process then data should be produced to evaluate the difference.

If a matrix or donated tests are determined to be necessary we expect four labs with one stand in each to be available.

VIE Matrix Design

Objectives:

1. Address the introduction of new engines
2. Confirm oil discrimination and appropriateness of engine hour adjustment
3. Address uniform reference oil selection for each row

Run Order	Engine/Lab 1	Engine/Lab 2	Engine/Lab 3	Engine/Lab 4
1	542-2	544	1010-1	542-2
2	544	1010-1	542-2	1010-1
3	544	542-2	544	1010-1
4	1010-1	542-2	544	544
5	542-2	544	1010-1	542-2

Notes:

- 1: Consider using only stands from the VIE precision matrix.
- 2: Determine VIF design depending on VIE matrix results.
- 3: If this matrix proves the test is different additional data may be required.