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COMMITTEE D02 ON PETROLEUM PRODUCTS, LIQUID FUELS, AND LUBRICANTS

Issued: 12.14.2017

Reply to: Dan Worcester
Southwest Research Institute
6220 Culebra Rd.
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Phone: 210.522.2405
Email: dworcester@swri.org

These are the unapproved minutes of the 12.13.2017 Sequence VI Conference Call.

The meeting was called to order at 9:06 AM Central Time by Chair Andrew Stevens.

Agenda

The Agenda is the included as Attachment 1.

1.0 Roll Call

The Attendance list is Attachment 2.

2.0 Approval of Meeting minutes from 11.16.2017 Seq. VI SP meeting.

2.1 Bill Buscher made the motion and Robert Stockwell seconded.

2.2 The minutes were approved unanimously.

3.0 Old Business

3.1 Monitoring of the Sequence VIE Procedure Stat Group

3.1.1 5th Run Data

3.1.2 Test Severity & Engine Hour Adjustment

Slides were presented at the meeting 11.16.2017. These will be discussed at the VI SP next meeting. The Stat Group does not recommend going to a 5^{th} run on engines. The group is working on test severity.

3.2 Review of Action Items from 11.16.17 SP Meeting

Action Item #1 – Any laboratories interested in purchasing new exhaust fixed timing sprockets, are to contact Scott Stap at GM by 12/16/17.

Action Item #2 – Haltermann to report to the Sequence VI surveillance panel the process for building the Texas and Michigan Lube Cert EEE fuel batches and for additizing the SEQ VI-E + DCA fuel. Include details on component sourcing for the Texas and Michigan locations (i.e. are the components for both locations obtained from the same source and from the same component batches, etc.). Include details on the additizing process for the Texas and Michigan locations (i.e. are the additives for both locations obtained from the same source and from the same batches, when is the Lube Cert EEE additized, etc.). This will be covered in Section 3.3.

Action Item #3– Laboratories to inspect their stands and report to Rich Grundza on what valves they have installed on each stand for 150C in Section 6.5.3 of the Sequence VIE and Sequence VIF ASTM test procedures. Rich will review this item during lab visits.

Action Item #4 (as per Motion #4) – Add Section 11.6.5.1 from the Sequence VID (D7589) ASTM test procedure to the Sequence VIE (D8114) and Sequence VIF ASTM test procedures.

Action Item #5 – Rich Grundza to review the Sequence VIE and Sequence VIF ASTM test procedures for inclusion of the necessary sole source statements and to make recommendations, if needed, to the Sequence VI surveillance panel. Items 4 and 5 have a target completion date of 01.15.2018.

Action Item #6 - Laboratories to re-upload their Sequence VIE and VIF precision matrix tests (29 VIE and 18 VIF tests) with the engine hour adjustment applied. One lab has started sending files. This may have an effect on future severity adjustment calculations.

Action Item #7 – Greg Miranda/Andrew Stevens and Rich Grundza to provide all of the necessary information, to update the Sequence VIF test procedure draft, to Hap Thompson for the next and final procedure draft. This will be completed with an information letter. This also has a target completion date of 01.15.2018.

3.3 Seq. VIE Severity Task Force Update Dan Worcester

See Attachment 3. There was a lot of discussion on this presentation. There were slides on possible fuel factors. The two San Antonio labs use fuel from Nixon, Texas. All others are supplied by the Michigan facility. Mark gave an update on Sequence VIE fuel. The Nixon and Sterling facilities use the same sources for the additive, but different batches. There is discussion of producing a large batch [about 360,000 gallons] of VIE fuel. This would be dependent on the VH fuel moving to a one million gallon supply in a different tank and using the current VH tank for VIE fuel. All fuel for labs would then be supplied from the Nixon facility. Mark will confirm the supply of the current DCA additive.

Amol's presentation was discussed. There were unusual deposits on the ring packs, and high oil consumption. Scott has been asked to review these photos.

http://www.astmtmc.cmu.edu/ftp/docs/gas/sequencevi/minutes/VIE%20Engine%20Photos/

Action Item #1 – Ask Scott Stap to review the photos of ring deposits seen at Valvoline.

3.4 Seq. VIF Procedure Review: Prepare for balloting in new year All

- Build manual replaces Annex A17
- Fixed timing sprockets 9.4.20 revision
- Section 6.2 not allowing revision of short block

Rich will work on VIF procedure review with an estimated completion of 01.15.2018.

4.0 New Business

4.1 Seq. VIF Referencing Requirements – Katerina Pecinovsky

4.1.1 Background information with proposed Motion included in Appendix

The original goal was to get more data for the industry. Doyle stated that one more data set on one engine won't make a large difference. There was discussion on whether the wording needs to change in the procedure and/or LTMS document. Rich will check on this.

Motion #1 –No new lab requirements are needed for the Sequence VIF, thus nullifying Motion #4 from the 2/23/17 meeting.
Katerina Pecinovsky, Amol Savant second. Passed with one waive.

4.2 Seq. VIE BOI/VGRA Matrix Details Discussion

4.2.1 BOI/VGRA Group Expected Timeline

4.2.2 Engine Details

4.2.3 Labs' Expected Start Timelines

There was discussion on timing, engines to use and starting the matrix. The consensus was there should be more discussion and shared information as the start for this matrix was moved up quickly. There may be a lab meeting to determine when engines and starts will be available. Labs would need to run on the GM Kit engine so that will affect starts. Afton and Intertek plan to start early in 2018. SwRI will start at the end of December. Lubrizol will not run in this matrix.

5.0 Next Meeting

5.1 SP Meeting: TBD

5.2 Build Workshop: Jan 17, 2018 (8:00 – 12:00) at Intertek

6.0 Meeting Adjourned

The meeting adjourned at 10:30 AM.

Appendix

A motion was made and passed during the 2/23/17 meeting which outlined the steps a lab must take to gain approval for running a Seq. VIF test. The motion is as follows:

Motion 4: For a new lab (defined as a lab that did not participate in the precision matrix) to be calibrated, the lab must run four operationally valid tests on multiple reference oils, to be assigned by the TMC, in a single engine and stand combination, with at least one replicated reference oil, and with a minimum of two consecutive results that meet the acceptance criteria of the defined LTMS. This requirement also appears on page 14-2 of the LTMS document.

Typically, new lab requirements indicate a specific number of reference tests to start the LTMS system. The Seq. VIF is an engine/stand based system with Severity Adjustments calculated from the first two valid tests run on a given engine/stand combination. As the data pool is already diverse, there is no apparent reason to consume an engine and its tests in order for VIF approval. In addition, the VIF procedure only varies slightly in temperature set points from the VIE. A stand approved to run a VIE should easily and reliably have the ability to run a VIF. Quantities of these VIE/F engines are limited, therefore as the need for additional data has dissipated the requirement should be removed from the procedure and the LTMS document.

I would like to propose a motion that no new lab requirements are needed for the Sequence VIF if that lab is already running approved Sequence VIE tests, thus nullifying Motion #4 from the 2/23/17 meeting.

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Sequence VI Surveillance Panel Call Meeting Agenda
December 13, 2017 @ 10:00-12:00 EST

Audio Connection

Call-in Number: +1-415-655-0001
Conference Code: 190 208 378

Webex Meeting URL:
https://meetings.webex.com/collabs/meetings/join?uuid=M4MIQ6VWMM5IA32EEX5VF974BA-20XT

1. **Roll Call (start 10:05 EST)**

   1.1. SP Membership changes and additions

2. **Approval of Meeting minutes from November 16, 2017 Seq. VI SP meeting**

3. **Old Business**

3.1	3.1. Monitoring of the Sequence VIE Procedure 3.1.1. 5th Run Data 3.1.2. Test Severity & Engine Hour Adjustment	Stats Group
3.2	Review of Action Items from 11/16/17 SP Meeting - **Action Item #1 –** Any laboratories interested in purchasing new exhaust fixed timing sprockets, are to contact Scott Stap at GM by 12/16/17 - **Action Item #2 –** Haltermann to report to the Sequence VI surveillance panel the process for building the Texas and Michigan Lube Cert EEE fuel batches and for additizing the SEQ VI-E + DCA fuel. Include details on component sourcing for the Texas and Michigan locations (i.e. are the components for both locations obtained from the same source and from the same component batches, etc.). Include details on the additizing process for the Texas and Michigan locations (i.e. are the additives for both locations obtained from the same source and from the same batches, when is the Lube Cert EEE additized, etc.)	Andrew Stevens

	- **Action Item #3**– Laboratories to inspect their stands and report to Rich Grundza on what valves they have installed on each stand for 150C in Section 6.5.3 of the Sequence VIE and Sequence VIF ASTM test procedures - **Action Item #4** (as per Motion #4) – Add Section 11.6.5.1 from the Sequence VID (D7589) ASTM test procedure to the Sequence VIE (D8114) and Sequence VIF ASTM test procedures. - **Action Item #5** – Rich Grundza to review the Sequence VIE and Sequence VIF ASTM test procedures for inclusion of the necessary sole source statements and to make recommendations, if needed, to the Sequence VI surveillance panel - **Action Item #6** - Laboratories to re-upload their Sequence VIE and VIF precision matrix tests (29 VIE and 18 VIF tests) with the engine hour adjustment applied. - **Action Item #7** – Greg Miranda/Andrew Stevens and Rich Grundza to provide all of the necessary information, to update the Sequence VIF test procedure draft, to Hap Thompson for the next and final procedure draft	
3.3	Seq. VIE Severity Task Force Update	Dan Worcester
3.4	Seq. VIF/VIE Procedure Review: Prepare for balloting in new year - Build manual replaces Annex A17 - Fixed timing sprockets 9.4.20 revision - Section 6.2 not allowing revision of short block	ALL

4. New Business

4.1. Seq. VIF Referencing Requirements – Katerina Pecinovsky

4.1.1. Background information with proposed Motion included in Appendix

4.2. Seq VIE BOI/VGRA Matrix Details Discussion
    4.2.1. BOI/VGRA Group Expected Timeline
    4.2.2. Engine Details
    4.2.3. Labs' Expected Start Timelines

5. Next Meeting

5.1. SP Meeting: TBD
5.2. Build Workshop: Jan 17, 2018 (8:00 – 12:00) at Intertek

6. Meeting Adjourned

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Dan Worcester **Voting Member**				
VOTES				

Sequence
VIE FEI 2 Response Shift Task Force

SOUTHWEST RESEARCH INSTITUTE®

WINTER 2017

Task Force Members

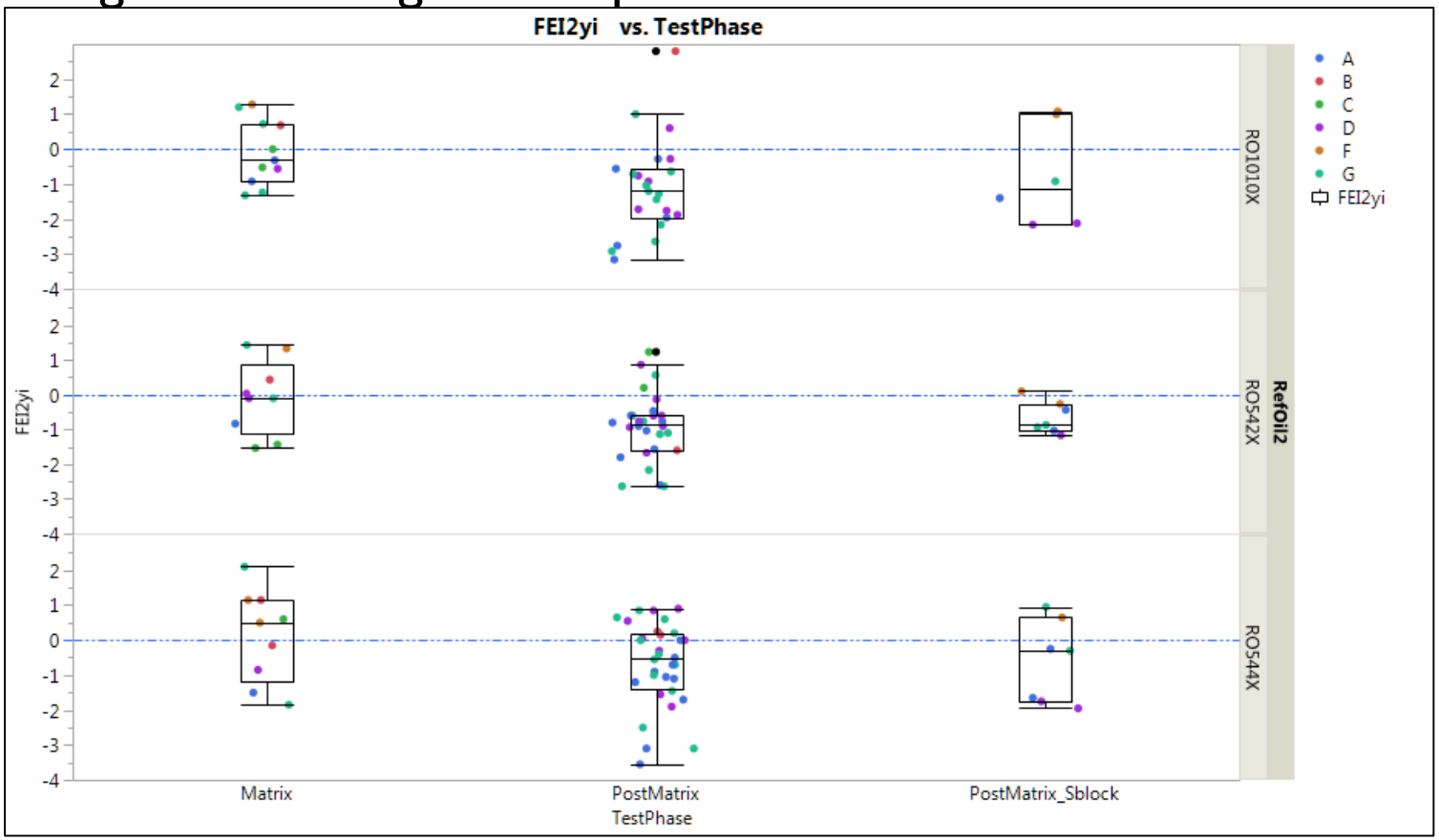
Adrian Alfonso	Intertek
Jerry Brys	Lubrizol
Bill Buscher	Intertek
Todd Dvorak	Afton
Rich Grundza	TMC
Charlie Leverett	Infineum
Katerina Pecinovsky	Afton
Cliff Salvesen	ExxonMobil
Andrew Stevens	Lubrizol
Amol Savant	Valvoline
Dan Worcester	SwRI

Task Force Scope

The Task Force will review data, chemical analysis for the 109 hour aging, and other factors for the VIE test looking for a root cause for a response shift affecting FEI 2.

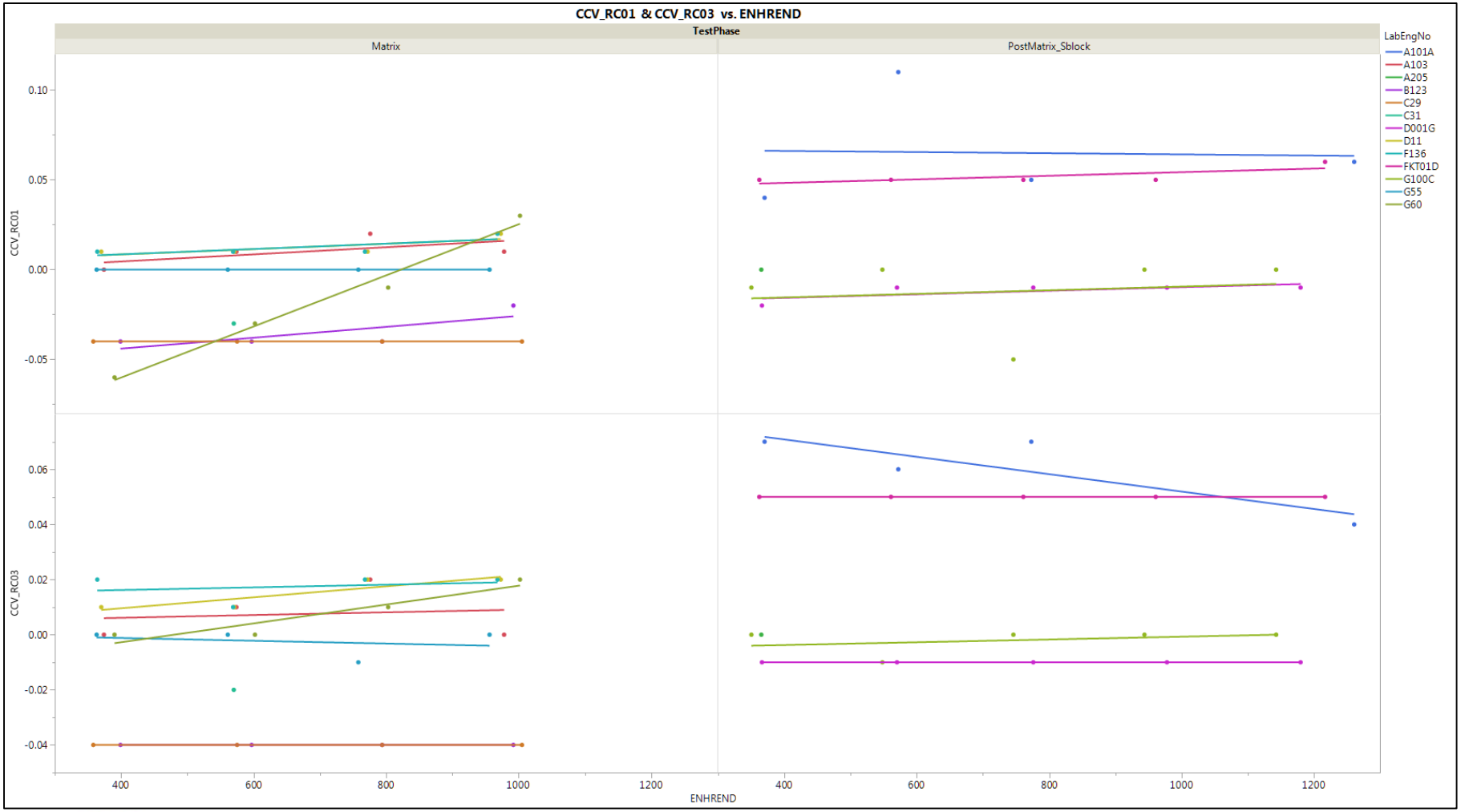
Review of VIE Data

- Plot of VIE $FEI2Y_i$ Chart provided by Todd Dvorak
  - Data suggests that the $FEI2Y_i$ performance has shifted severe of target - following the VIE precision matrix.



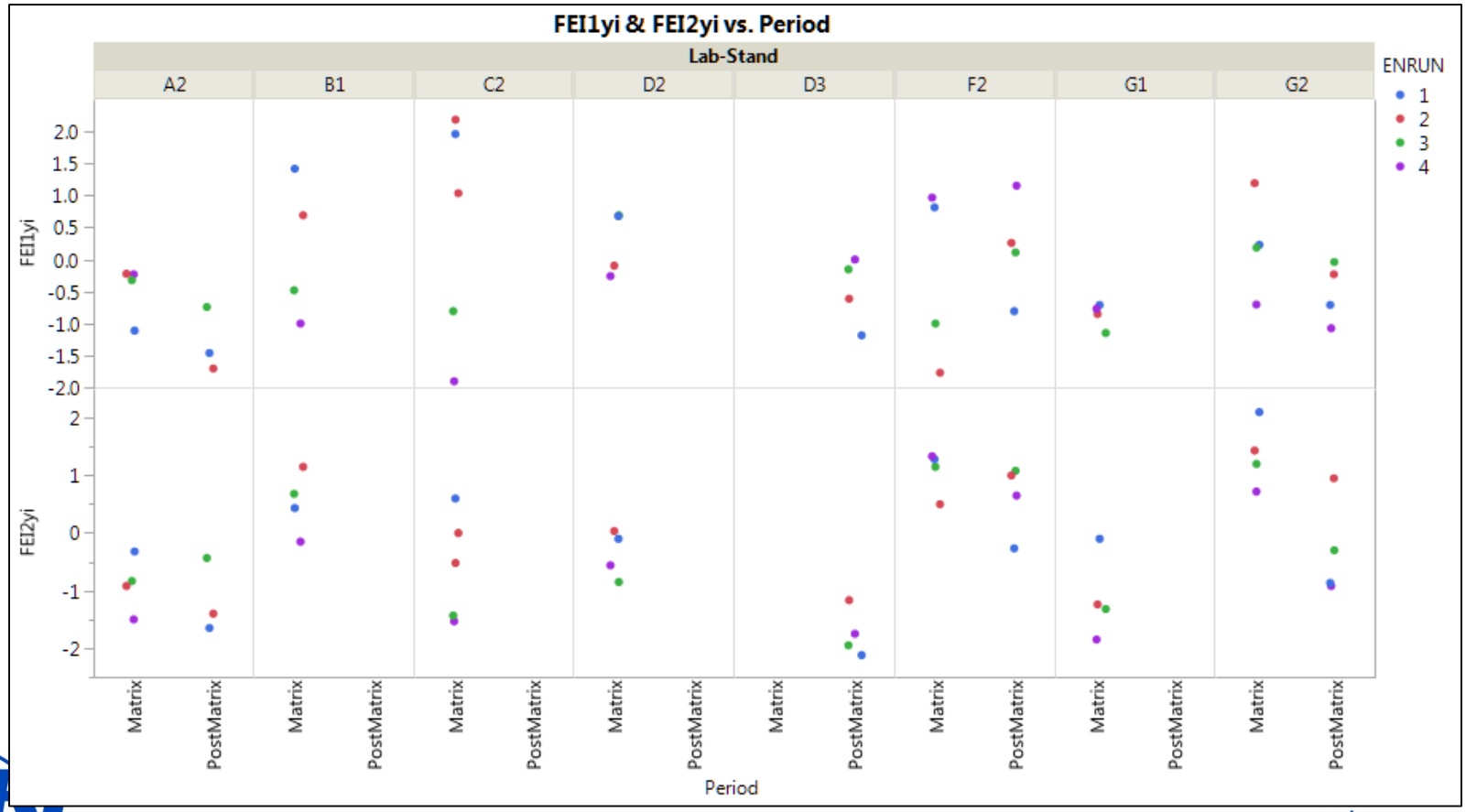
Review of VIE Data

Crankcase pressure is higher with PostMatrix SBEngines



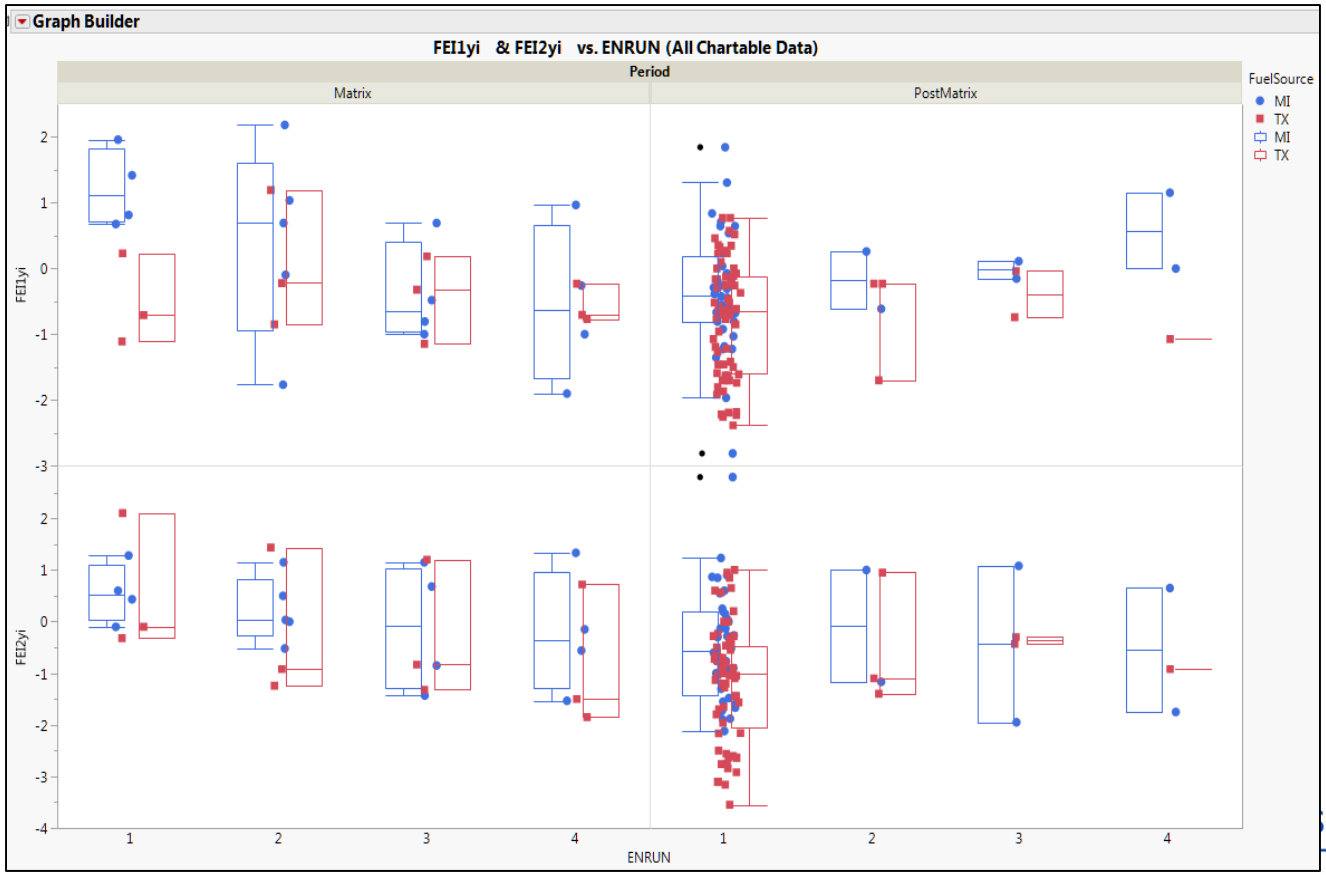
Lab-Stand Comparison of PM and PPM Test Severity

- Plot of Precision Matrix and Short Block Post Matrix data by Lab-Stand combination
  - General trend of test being more severe during PostMatrix



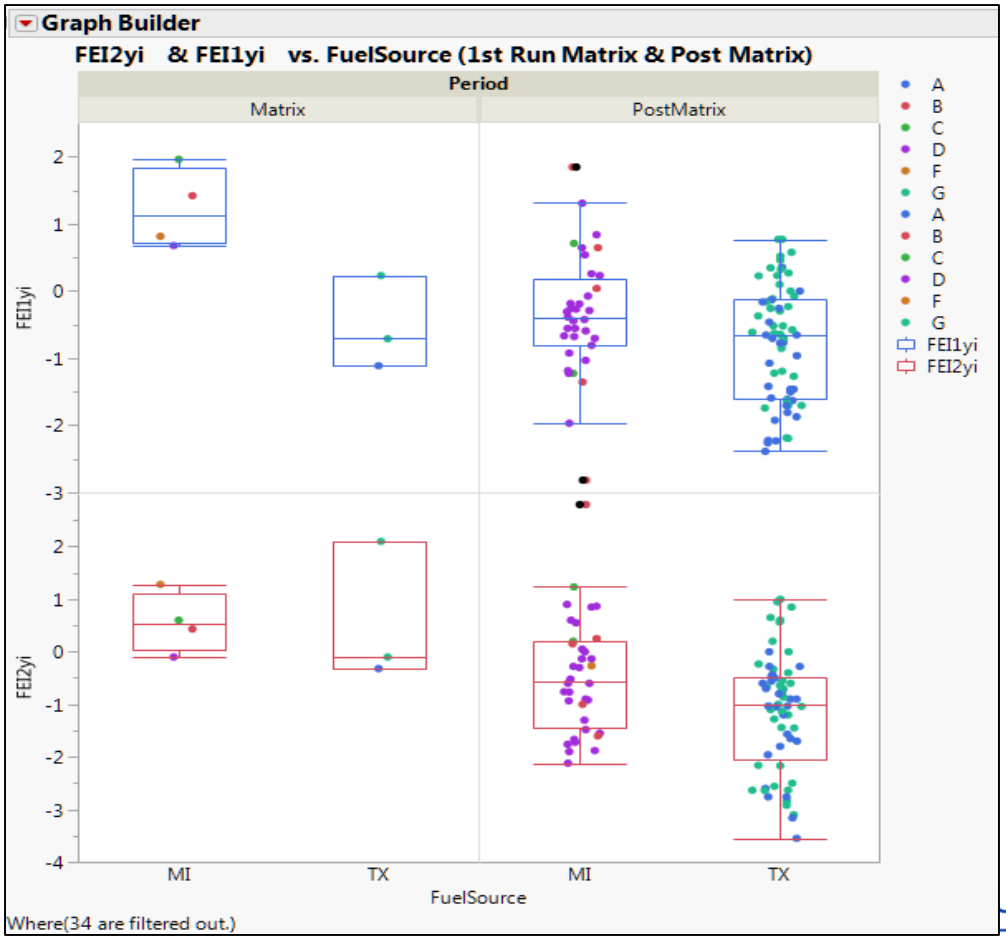
VIE Analysis of Fuel Source Analysis

- Plot of all chartable FEI_Yi data by test run, period (Matrix vs. PostMatrix) and fuel source (Texas vs. Michigan)
  - Plot may suggest difference in FEI2_Yi during PostMatrix)



VIE Analysis of Fuel Source Analysis

- Plot of all chartable FEI_Yi 1st run data by Fuel Source and Period



VIE Analysis of Fuel Source Analysis

- Analysis of FEI1 chartable PM and SBM data
  - Analysis suggests fuel source is significant.
    - Fuel source confounded with test laboratory

Response FEI1_OR

Whole Model

Actual by Predicted Plot

Residual by Predicted Plot

Summary of Fit

RSquare	0.868613
RSquare Adj	0.823449
Root Mean Square Error	0.241403
Mean of Response	1.841818
Observations (or Sum Wgts)	44

Analysis of Variance

Parameter Estimates

Term	Estimate	Std Error	t Ratio	Prob>|t|	VIF
Intercept	2.0857973	0.119807	17.41	<.0001*	.
RefOil[RO1010-1]	-0.042199	0.05231	-0.81	0.4258	1.4545655
RefOil[RO542-2]	0.6232552	0.055366	11.26	<.0001*	1.4680865
ENHREND	-0.000403	0.000169	-2.39	0.0230*	1.0624665
LTMSLAB [A]:Eng_2[ENG101A]	0.0495838	0.136006	0.36	0.7178	2.2147037
LTMSLAB [C]:Eng_2[ENG29]	-0.067018	0.122399	-0.55	0.5878	1.2328292
LTMSLAB [D]:Eng_2[ENG001G]	0.0407069	0.135007	0.30	0.7650	2.5021777
LTMSLAB [F]:Eng_2[ENG136]	-0.205149	0.135231	-1.52	0.1391	2.5105006
LTMSLAB [G]:Eng_2[ENG100C]	0.1535584	0.169852	0.90	0.3727	3.9604634
LTMSLAB [G]:Eng_2[ENG55]	0.0714538	0.120395	0.59	0.5570	1.989868
FuelSource[MI]	0.0756464	0.037917	2.00	0.0546	1.0653179
Period[Matrix]	0.1524663	0.1037	1.47	0.1513	7.2974641

Effect Tests

Source	Nparm	DF	Sum of Squares	F Ratio	Prob > F
RefOil	2	2	9.2765911	79.5928	<.0001*
ENHREND	1	1	0.3324074	5.7041	0.0230*
Eng_2[LTMSLAB]	6	6	0.3620312	1.0354	0.4209
FuelSource	1	1	0.2319524	3.9803	0.0546
Period	1	1	0.1259715	2.1617	0.1513

RefOil | ENHREND | Eng_2[LTMSLAB] | Period

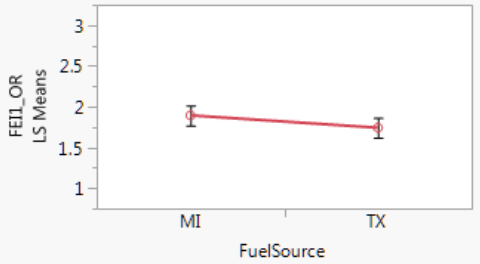
FuelSource

Leverage Plot

Least Squares Means Table

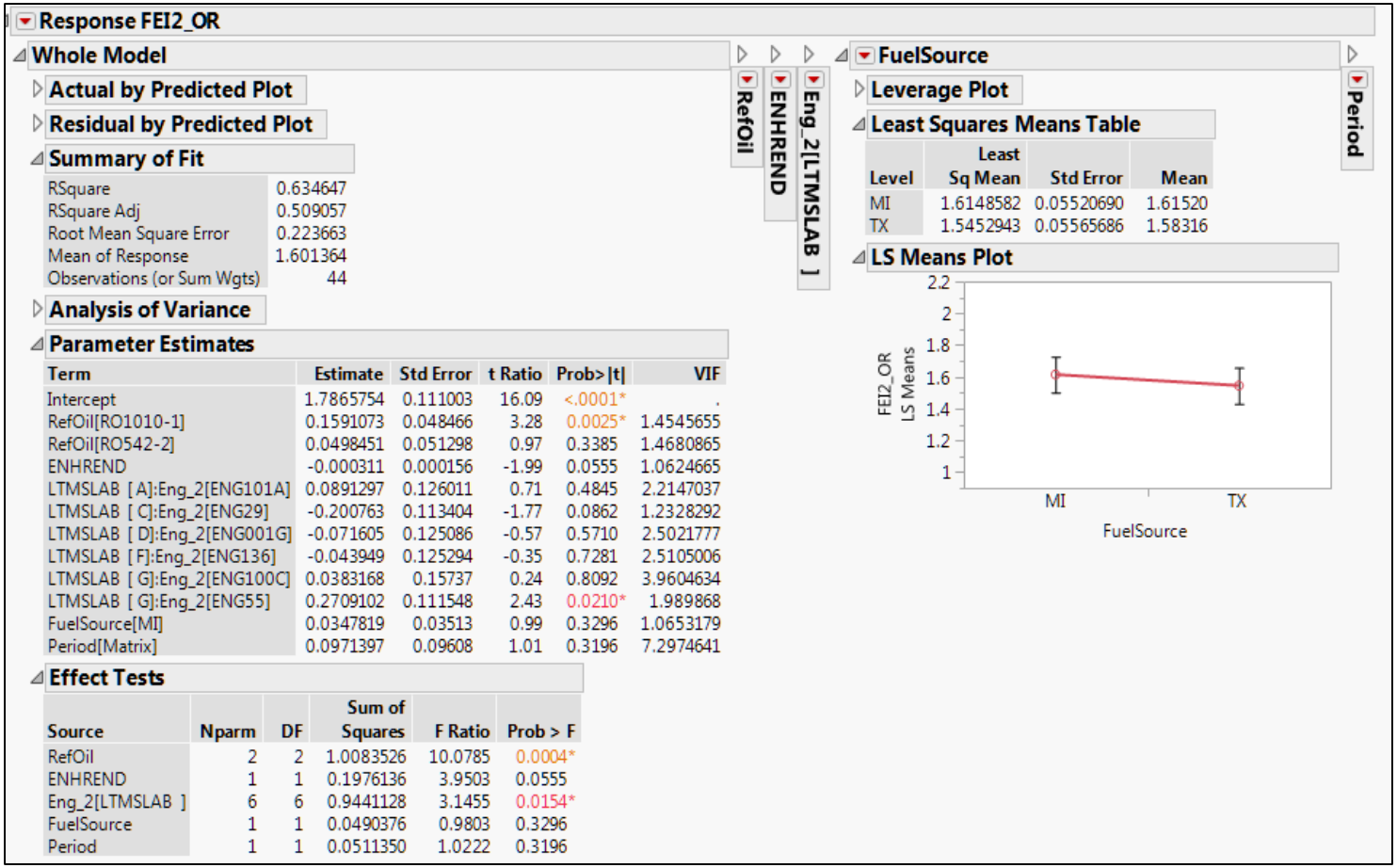
Level	Least Sq Mean	Std Error	Mean
MI	1.8936224	0.05958571	1.91440
TX	1.7423295	0.06007136	1.74632

LS Means Plot



VIE Analysis of Fuel Source Analysis

- Analysis of FEI2 chartable PM and SBM data
  - Analysis suggests fuel source is not significant.



Response FEI2_OR

Whole Model

Actual by Predicted Plot

Residual by Predicted Plot

Summary of Fit

RSquare	0.634647
RSquare Adj	0.509057
Root Mean Square Error	0.223663
Mean of Response	1.601364
Observations (or Sum Wgts)	44

Analysis of Variance

Parameter Estimates

Term	Estimate	Std Error	t Ratio	Prob>|t|	VIF
Intercept	1.7865754	0.111003	16.09	<.0001*	.
RefOil[RO1010-1]	0.1591073	0.048466	3.28	0.0025*	1.4545655
RefOil[RO542-2]	0.0498451	0.051298	0.97	0.3385	1.4680865
ENHREND	-0.000311	0.000156	-1.99	0.0555	1.0624665
LTMSLAB [A]:Eng_2[ENG101A]	0.0891297	0.126011	0.71	0.4845	2.2147037
LTMSLAB [C]:Eng_2[ENG29]	-0.200763	0.113404	-1.77	0.0862	1.2328292
LTMSLAB [D]:Eng_2[ENG001G]	-0.071605	0.125086	-0.57	0.5710	2.5021777
LTMSLAB [F]:Eng_2[ENG136]	-0.043949	0.125294	-0.35	0.7281	2.5105006
LTMSLAB [G]:Eng_2[ENG100C]	0.0383168	0.15737	0.24	0.8092	3.9604634
LTMSLAB [G]:Eng_2[ENG55]	0.2709102	0.111548	2.43	0.0210*	1.989868
FuelSource[MI]	0.0347819	0.03513	0.99	0.3296	1.0653179
Period[Matrix]	0.0971397	0.09608	1.01	0.3196	7.2974641

Effect Tests

Source	Nparm	DF	Sum of Squares	F Ratio	Prob > F
RefOil	2	2	1.0083526	10.0785	0.0004*
ENHREND	1	1	0.1976136	3.9503	0.0555
Eng_2[LTMSLAB]	6	6	0.9441128	3.1455	0.0154*
FuelSource	1	1	0.0490376	0.9803	0.3296
Period	1	1	0.0511350	1.0222	0.3196

RefOil

ENHREND

Eng_2[LTMSLAB]

FuelSource

Leverage Plot

Least Squares Means Table

Level	Least Sq Mean	Std Error	Mean
MI	1.6148582	0.05520690	1.61520
TX	1.5452943	0.05565686	1.58316

LS Means Plot

Period

Review of VIE Data

Analysis of VIE Reference Oil Viscosity Data

- KV40 EOT Oil Analysis (PM n = 28[1] & n = 16 SBM)
  - Analysis suggests significant increase in KV40 EOT viscosity between the 2 test phases (PM-EOT-KV40 < SBM-EOT-KV40)

Response V40EOT

Whole Model

- Actual by Predicted Plot
- Effect Summary
- Residual by Predicted Plot

Summary of Fit

RSquare	0.922923
RSquare Adj	0.902523
Root Mean Square Error	1.008013
Mean of Response	46.99795
Observations (or Sum Wgts)	44

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio
Model	9	413.67368	45.9644	45.2356
Error	34	34.54704	1.0161	Prob > F
C. Total	43	448.22072		<.0001*

Parameter Estimates

Term	Estimate	Std Error	t Ratio	Prob>|t|
Intercept	47.815023	0.481718	95.10	<.0001*
LTMSLAB[A]	2.0196839	0.340891	5.95	<.0001*
LTMSLAB[B]	-0.206296	0.461472	-0.45	0.6577
LTMSLAB[C]	-0.057277	0.418095	-0.14	0.8919
LTMSLAB[D]	-0.857541	0.340012	-2.52	0.0165*
LTMSLAB[E]	-0.44093	0.163751	-1.35	0.1878
TestPhase2[Matrix]	[illegible]	[illegible]	[illegible]	[illegible]
Batch[[illegible]]	[illegible]	[illegible]	-14.80	<.0001*
Batch[[illegible]]	[illegible]	[illegible]	-1.90	0.0657
ENDTREND	[illegible]	[illegible]	[illegible]	[illegible]

Effect Tests

Source	Nparm	DF	Sum of Squares	F Ratio	Prob > F
LTMSLAB	5	5	41.88179	8.2485	<.0001*
TestPhase2	1	1	9.89017	9.7350	0.0037*
BatchRO	2	2	316.06649	155.5309	<.0001*
ENDTREND	1	1	11.02711	10.8476	0.0023*

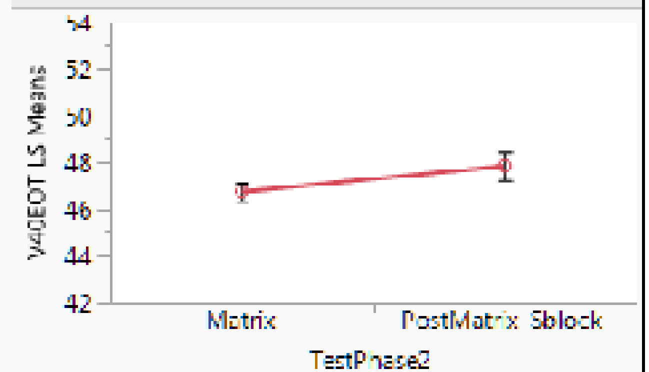
TestPhase2

- Leverage Plot

Least Squares Means Table

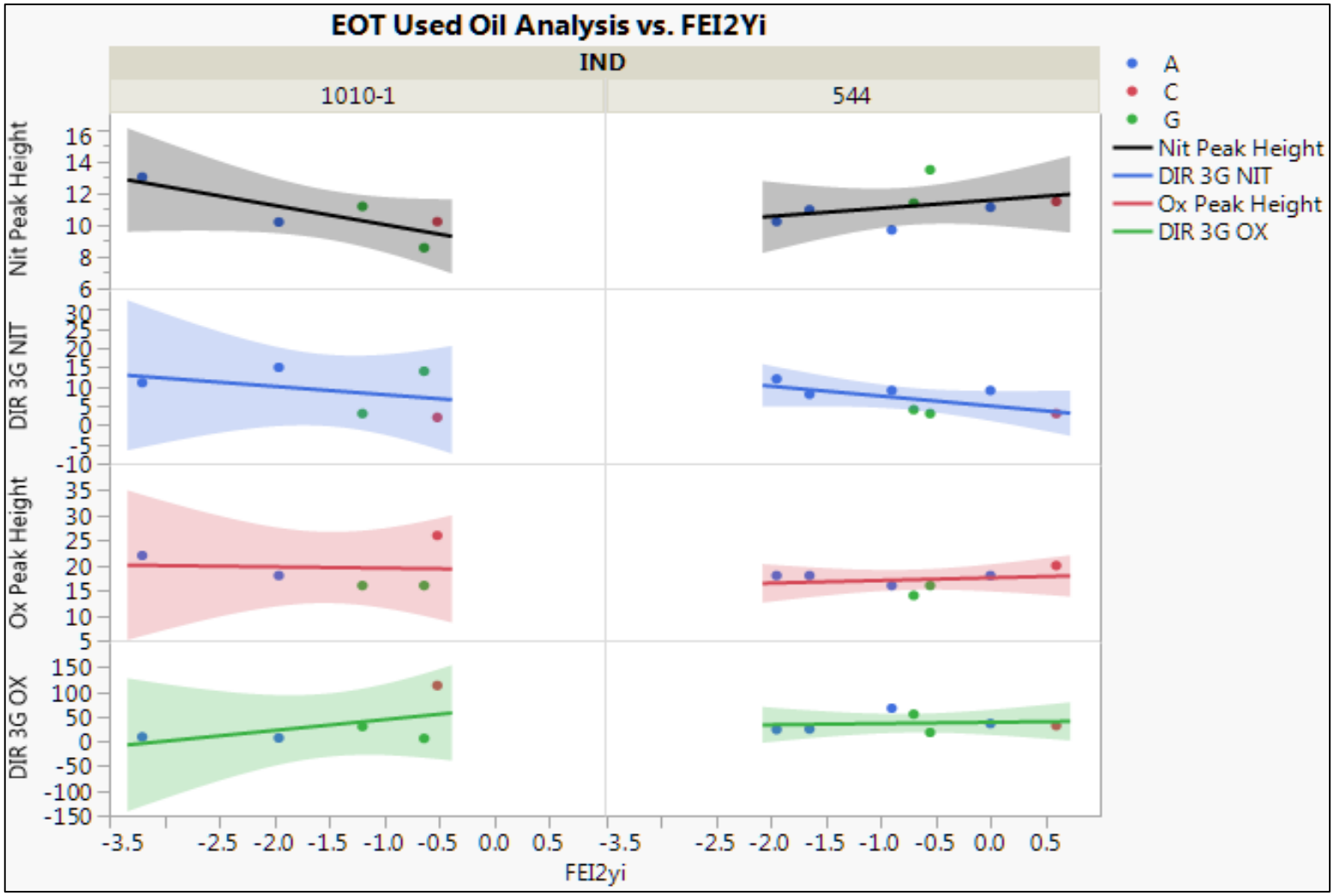
Level	Least Sq Mean	Std Error	Mean
Matrix	46.744931	0.19680592	46.3550
PostMatrix_Sblock	47.839677	0.28854523	48.1231

LS Means Plot

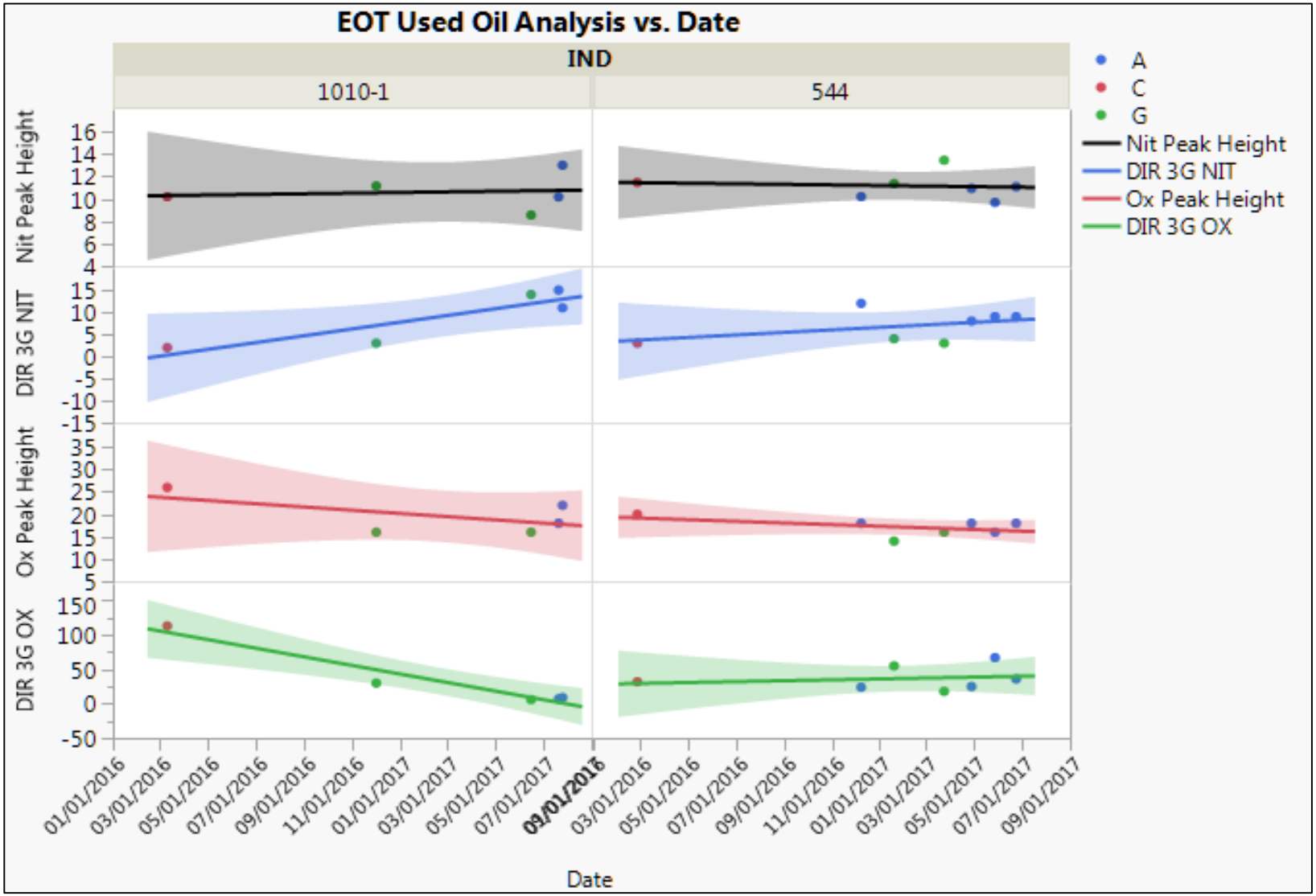


Note 1: One observation missing PM EOT viscosity data

FEI 2Yi CHEM DATA



EOT CHEM DATA by OIL



Engines

- OHT-1 engines were used for the Precision Matrix.
- Labs moved to OHT-2 engines in 2016.
- GM Short Block Kit engines are approved, and labs are running.
- All Labs will switch over this Fall.

Fuel Batches

- Haltermann to report to the Sequence VI surveillance panel the process for building the Texas and Michigan Lube Cert EEE fuel batches and for additizing the SEQ VI-E + DCA fuel. Include details on component sourcing for the Texas and Michigan locations (i.e. are the components for both locations obtained from the same source and from the same component batches, etc.). Include details on the additizing process for the Texas and Michigan locations (i.e. are the additives for both locations obtained from the same source and from the same batches, when is the Lube Cert EEE additized, etc.).

Fuel Batches

EEE Lube Cert blending

The components used in the EEE Lube Cert blending process (at both the Nixon and Sterling locations) are sourced from the same suppliers. This has been our standard practice since we place the Nixon tanks into service.

Seq.VI DCA additive

Original MOC for this additive was created on 09/03/2013. HS purchased 2 drums of this material in 2013 to start the project.

HS purchased an additional 7 drums in 2014 and four more drums in 2016.

The additive used when producing the Seq.VI fuel, HF-2003, has been and continues to be sourced from the same supplier.

The HF-2003 is additized at the rack at both locations.

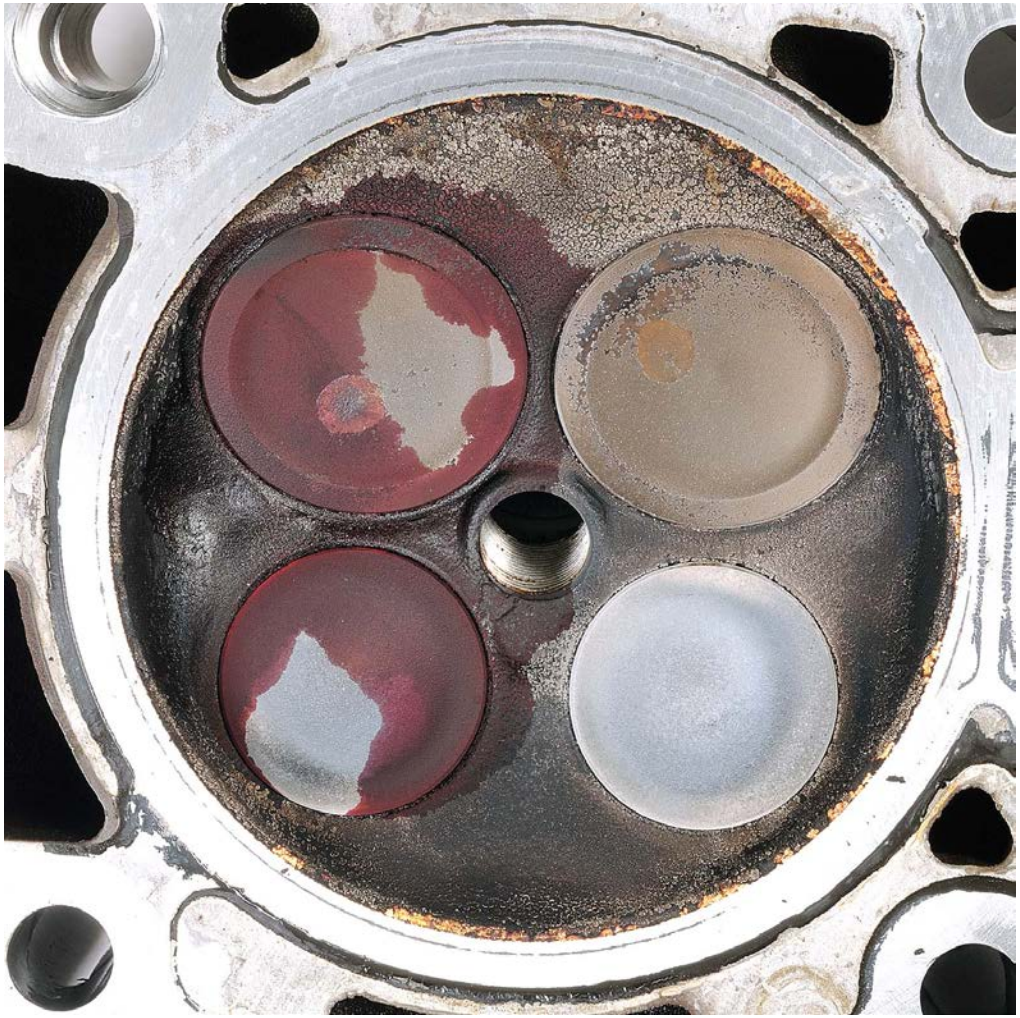
Action

- Amol has created Power Points comparing a pass and a fail engine.
- Those are posted at:
  - http://www.astmtmc.cmu.edu/ftp/refdata/gas/VIE/plots/

APPENDIX

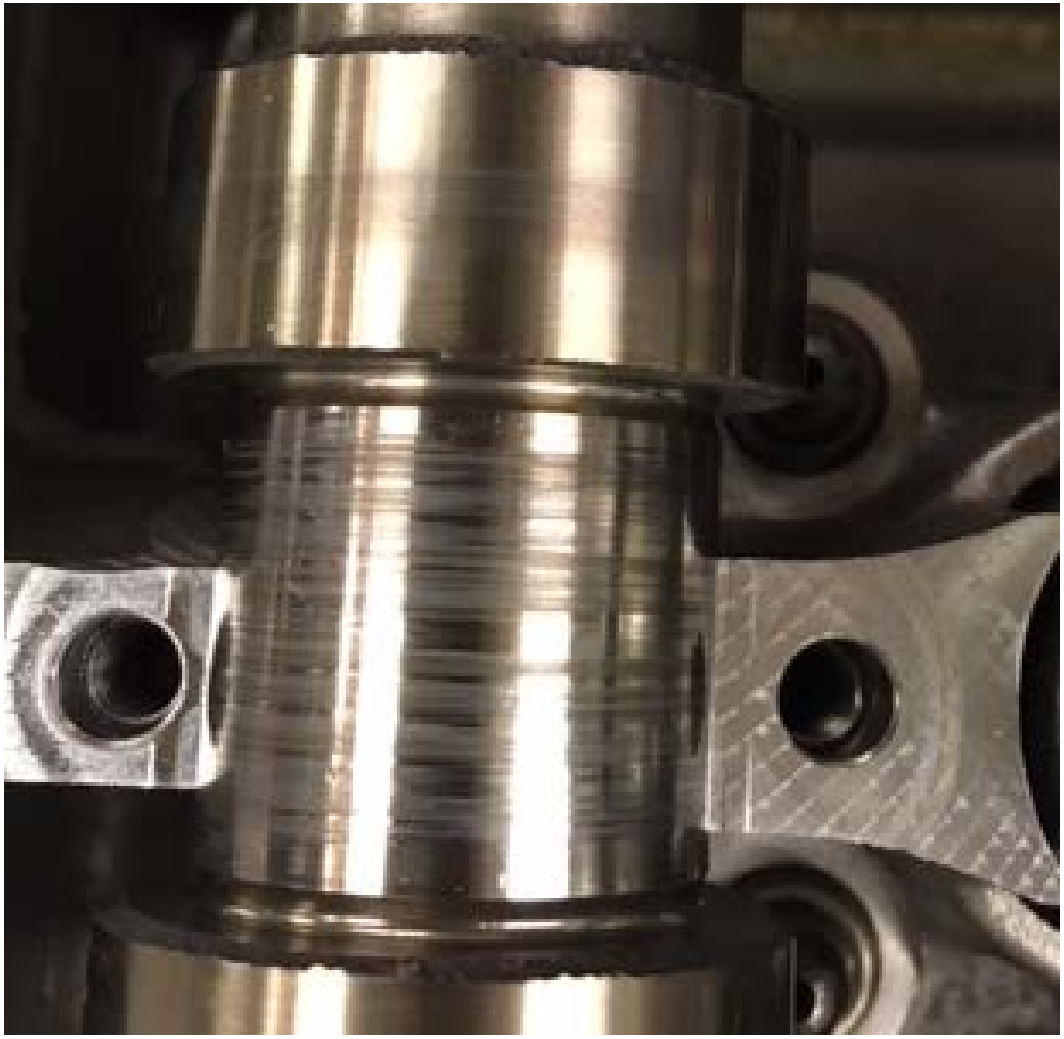
PHOTOS

VIE SwRI Valves



VIE IAR Piston Deposits

VIE Afton Journal Wear



VIE Valvoline Bore Polish