Address *100 Barr Harbor Drive*
PO Box C700
W. Conshohocken, PA
19428-2959 | USA

Phone *610.832.9500*
Fax *610.832.9666*
Web *www.astm.org*

COMMITTEE D02 ON PETROLEUM PRODUCTS, LIQUID FUELS, AND LUBRICANTS

Issued: 03.20.2018

Reply to: Dan Worcester
Southwest Research Institute
6220 Culebra Rd.
San Antonio, TX 78238
Phone: 210.522.2405
Email: dworcester@swri.org

These are the unapproved minutes of the 03.19.2018 Sequence VI Conference Call.

The meeting was called to order at 1:03 PM Central Time by Chair Andrew Stevens.

Agenda

1.0 The Agenda is the included as Attachment 1.

2.0 Roll Call The Attendance list is Attachment 2. There were no membership changes.

2.0 Approval of Meeting minutes from 02.28.2018 Seq. VI SP call.

2.1 Andrew Stevens made the motion and Adrian Alfonso seconded.

2.2 The minutes were approved unanimously.

3.0 Old Business

3.1 Review of Action Items from 12/13/17 SP Meeting

3.1.1 **Action Item #1** – Haltermann to report to the Sequence VI surveillance panel on details of building large batch of Lube Cert EEE fuel + DCA

This decision is pending the Sequence VH test moving to a larger batch. Contract review is in process.

3.1.2 **Action Item #2**– Progress Report: 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

This information has been supplied and this item can be closed. The procedure calls for the Burkert 2000. This will be discussed further in A2.

3.1.3 **Action Item #3** – Progress Report: 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.

This was done with Information Letter 17-4.

3.1.4 **Action Item #4** – Progress Report: 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

Rich is working on this item. It will be completed before the VIF procedure is released for final edits and ASTM number assignment. An Information Letter will be generated.

3.1.5 **Action Item #5** – Progress Report: Laboratories to re-upload their Sequence VIE and VIF precision matrix tests (29 VIE and 18 VIF tests) with the engine hour adjustment applied.

Not all references for all labs have been updated. The action is to complete this for all labs by March 30, 2018.

3.1.6 **Action Item #6** – Progress Report: 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 has been completed, but Hap noted in an email after the meeting he will need Surveillance Panel approval to move the VIF procedure forward.

3.1.7 **Action Item #7** – Progress Report: 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

These items will be updated with an Information Letter.

3.2 Seq. VIE Severity Task Force Update Dan Worcester

3.2.1 Results of Scott Stap review of photos of ring deposits seen at Valvoline.

See Attachment 3 for the final meeting update from the Task Force. Special thanks were for Todd Dvorak for providing many of the slides and analysis. Scott was not on the call to review the photos. This will be an action for the next meeting. Crankcase pressure is higher on tests after the Precision Matrix. There are two fuel batches, one in Michigan and one in Texas. There is an effort to build one large batch at the Nixon facility. This did not show a response delta but would help minimize variation at labs. There was also small variations in chemical analysis, and oil pressure. OHT-1 engines were used for the Precision Matrix. All labs either have converted to GM Kit engines or will soon. BSFC [brake specific fuel consumption] was also reviewed. Only runs 1-4 were used for comparison.

4.0 New Business

4.1 Seq VIE BOI/VGRA Matrix Details Discussion

4.1.1 Progress Report

Intertek has completed the VIE portion and is working on stand calibration for the VIF tests. SwRI has completed the VIE and VIF. Afton has completed the VIE. Valvoline is running a new engine but failed the first reference. A new engine may be required to allow them to complete the matrix tests on one engine. ExxonMobil is working on the matrix.

4.2 Meeting Minutes Adjustments: Rich Grundza (see Appendix A1)

There were some changes needed in the minutes. Rich will make these changes on the posted minutes.

For the August 9, 2017 meeting minutes in New Business lists repeatability check limit as 2.6 but should be 2.8. For required equipment, sole source information is required, and TMC does not have the authority to approve equivalent replacement substitutions.

4.3 Solenoid valves, Section 6.6.5.3 (See Appendix A2)

4.3.1 Type 312 is no longer available, Type 331 is direct replacement but not listed in procedure

Motion #1 –Recommend to the Surveillance Panel: Add the 331 solenoid valve to Section 3.3.1.

Andrew Stevens, Adrian Alfonso, second.

This motion was retracted and Andrew will generate an E-ballot.

Documentation will be needed to show the replacement valve information. Cliff provided this in an email after the meeting.

There was discussion about the industry correction factors. Amol noted the Zi values for recent tests were within limits. Travis and Todd commented they had not seen this shift and Rich commented that not all oils show the same trend.

Amol also asked about when a lab could switch oils whether reference or candidate. The procedure may not be clear on running the two FO and 6 BL flushes.

Action #1 –Labs will go back and review their procedure for termination. This will be added to the procedure for clarification if not included now.

5.0 Meeting Adjourned

The meeting adjourned at 2:23 PM Central Time.

Sequence VI Surveillance Panel Call Meeting Agenda
March 12, 2018 @ 10:00-11:30 EST

Webex Meeting Details Below Agenda

1. **Roll Call (start 2:05 EST)**

   1.1. SP Membership changes and additions

2. **Approval of Meeting minutes from February 28, 2017 Seq. VI SP meeting**

3. **Old Business**

3.1	Review of Action Items from 12/13/17 SP Meeting - **Action Item #1** – Haltermann to report to the Sequence VI surveillance panel on details of building large batch of Lube Cert EEE fuel + DCA - **Action Item #2**– Progress Report: 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 #3** – Progress Report: 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 #4** – Progress Report: 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	Andrew Stevens

	- **Action Item #5** – Progress Report: 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 #6 –** Progress Report: 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 - **Action Item #7** – Progress Report: 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	
3.2	Seq. VIE Severity Task Force Update 3.3.1 Results of Scott Stap review of photos of ring deposits seen at Valvoline.	Dan Worcester

4. New Business

4.1. Seq VIE BOI/VGRA Matrix Details Discussion
  4.1.1. Progress Report
4.2. Meeting Minutes Adjustments: Rich Grundza (see Appendix A1)
4.3. Solenoid valves, Section 6.6.5.3 (See Appendix A2)
  4.3.1. Type 312 is no longer available, Type 331 is direct replacement but not listed in procedure

5. Next Meeting

5.1. SP Meeting: TBD

6. Meeting Adjourned

Appendix

A1

A couple of items we need to discuss during the call.

1) The minutes from the August 9, 2017 conference call incorrectly listed the repeatability check limit as 2.6 in 4.1 new business,

4.1 VIF Post PM Vi Limit Review | Calibration of VIF engines | VID-VIF Equivalency Greg Miranda/ Stats Group See Attachment 5. The recommendation on Slide 3 is to increase R for FEI 1 from 0.95 to 1.00 and for FEI 2 from 0.63 to 0.95. The upper Vi limit for FEI 1 would increase to 4.64 from 2.6. FEI 2 Vi would be unchanged. These changes would be temporary and need review later. There is a bias indicated, but that will remain unchanged for now. SwRI will run a 5th run on engine 206 after candidate tests complete. Data will be reviewed when this run is completed. Martin recommended reference oil 1011 not be used as the first oil on a new engine.

The limit was 2.8 as noted in the stats group presentation and the stats group presentation noted that this was 2.8 (excerpt below).

> Revise the Upper Vi Limit for FEI1 to account for the current average Yi difference in 1st and 2nd run reference oil pairs. FEI1 Upper Vi limit = 4.64 (was 2.8)

The lower limit was not revised and remains 2,8. The 8/9/17 minutes need to be corrected to show this.

2) For required equipment, sole source information needs to be footnoted in the current VIE test method. This was somehow missed. I have gone through the VIF draft and addressed thse items but would like to generate and information letter to address this situation in the Sequence Vie Method, D8114. Also A 18.1 states that If substitutions are deemed appropriate … permission in writing must be obtained from the TMC… Unfortunately this is incorrect as the TMC does not have the authority to deem equivalency so this needs corrected as well.

A2

6.6.5.3 Use solenoid valves (FCV-150A, FCV-150C, FCV-150D, and FCV-150E, in Fig. A5.6) (see X1.16).
(1) FCV-150F and its related lines/piping are optional.
(2) FCV-150A is a Burkert Type 251 piston-operated valve used with a Type 312 solenoid valve (or a Burkert Type 2000 piston-operated valve used with a Type 311, 312, or 330 solenoid valve) for actuation of air supply to the piston valve, solenoid valve direct-coupled to piston valve, normally closed, explosion proof (left to the discretion of the laboratory), and watertight, 3⁄4 in., 2-way, stainless steel NPT fitting.

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**
Kevin Brodwater **Voting Member**	Phone: (510) 242-2291 KBrodwater@chevron.com	Chevron	**ATTEND**
Tim Cushing **Voting Member**	Phone: (248) 881-3518 Timothy.Cushing@gm.com	GM	
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	**ATTEND**
Teri Kowalski **Voting Member**	Phone: (734) 995-4032 Teri.Kowalski@tema.toyota.com	Toyota	**ATTEND**
Dan Lanctot **Voting Member**	Phone: (210) 690-1958 dlanctot@tei-net.com	TEI	**ATTEND**
Katerina Pecinovsky **Voting Member**	Phone: (804) 788 – 5520 Katerina.Pecinovsky@AftonChemical.com	Afton	**ATTEND**
Brianne Pentz **Voting Member**	Phone: (973) 317-6364 Brianne.Pentz@bp.com	BP	
Andy Ritchie **Voting Member**	Phone: (908) 474-2097 Andrew.Ritchie@infineum.com	Infineum	
Ron Romano **Voting Member**	Phone: (313) 845-4068 rromano@ford.com	Ford	
Clifford Salvesen **Voting Member**	Phone: (856) 224-2954 Clifford.r.Salvesen@exxonmobil.com	ExxonMobil	**ATTEND**
Amol Savant **Voting Member**	Phone: (606) 585-8982 acsavant@valvoline.com	Valvoline	**ATTEND**
Andrew Stevens **Voting Member**	Phone: (440) 347-4020 andrew.stevens@Lubrizol.com	Lubrizol	**ATTEND**
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**

ASTM SEQUENCE VI

Name	Email/Phone	Company	Attend
Ed Altman	Ed.Altman@aftonchemical.com	Afton	
Bill Anderson	Bill.anderson@aftonchemical.com	Afton	
Bob Campbell	Bob.Campbell@aftonchemical.com	Afton	ATTEND
Lisa Dingwell	Lisa.Dingwell@AftonChemical.com	Afton	
Todd Dvorak	Todd.Dvorak@aftonchemical.com	Afton	ATTEND
Greg Guinther	Greg.Guinther@aftonchemical.com	Afton	
Terry Hoffman	Terry.Hoffman@aftonchemical.com	Afton	
Christian Porter	Christian.Porter@aftonchemical.com	Afton	
Jeremy Styer	Jeremy.Styer@aftonchemical.com	Afton	
Tisha Joy	Tisha.Joy@bp.com	BP	
Michael Blumenfeld	Michael.l.Blumenfeld@exxonmobil.com Phone: (856) 224.2865	EM	
Jim Carter	jcarter@gageproducts.com	Gage Products	
Andy Buczynsky	Andrew.Buczynsky@gm.com	GM	
Meryn Hopp	Meryn.Hopp@GM.com	GM	
Mike Raney	Michael.P.Raney@gm.com Phone: (248) 408-5384	GM	
Angela Willis	Angela.P.Willis@gm.com	GM	
Prasad Tumati	ptumati@jhaltermann.com	Haltermann	
Doyle Boese	Doyle.Boese@infineum.com Phone: (908) 474-3176	Infineum	
Gordon Farnsworth	Gordon.Farnsworth@infineum.com	Infineum	
Charlie Leverett	Charlie.Leverett@yahoo.com Phone: (210) 414-5448	Infineum	ATTEND
Mike McMillan	mmcmillan123@comcast.net	Infineum	
Jordan Pastor	Jordan.Pastor@Infineum.com Phone: (313) 348-3120	Infineum	
William Buscher	William.Buscher@intertek.com	Intertek	
Martin Chadwick	Martin.Chadwick@intertek.com	Intertek	
Al Lopez	Al.Lopez@intertek.com	Intertek	
Mike Noriega	Mike.Noriega@intertek.com	Intertek	
Addison Schweitzer	Addison.Schweitzer@intertek.com	Intertek	
Scott Rajala	srajala@ILAcorp.com	Idemitsu	
Dave Passmore	dpassmore@imtsind.com	IMTS	
Jerry Brys	Jerome.Brys@lubrizol.com Phone: (440) 347.2631	Lubrizol	ATTEND
Jessica Buchanan	Jessica.Buchanan@Lubrizol.com	Lubrizol	
Joe Gleason	Jog1@lubrizol.com	Lubrizol	
James Matasik	James.Matasic@lubrizol.com	Lubrizol	
Greg Miranda	Greg.Miranda@Lubrizol.com	Lubrizol	
Kevin O'Malley	Kevin.OMalley@lubrizol.com	Lubrizol	

ASTM SEQUENCE VI

Name	Email/Phone	Company	Attend
	Phone: (440) 347.4141		
Chris Castanien	Chris.Castanien@neste.com Phone: (440) 290-9766	Neste	
Dwight Bowden	dhbowden@ohtech.com	OHT	
Matt Bowden	mjbowden@ohtech.com	OHT	ATTEND
Ricardo Affinito	affinito@chevron.com Phone: (510) 242-4625	Oronite	
Ian Elliot	IanElliott@chevron.com	Oronite	
Jo Martinez	jogm@chevron.com	Oronite	ATTEND
Robert Stockwell	rsto@chevron.com	Oronite	ATTEND
Don Smolenski	Donald.Smolenski@gmail.com	Strategic	
Travis Kostan	Travis.Kostan@swRI.org Phone: (210) 522-2407	SwRI	ATTEND
Patrick Lang	Patrick.Lang@swRI.org Phone: (210) 522-2820	SwRI	ATTEND
Michael Lochte	mlochte@swri.org	SwRI	
Khalid Rais	Khalid.Rais @swri.org	SwRI	ATTEND
Karen Haumann	Karen.Haumann@shell.com	Shell	
Scott Stap	Scott.Stap@tgdirect.com	TG Direct	
Jeff Clark	jac@astmtmc.cmu.edu	TMC	
Hirano Satoshi	Satoshi_Hirano_aa@mail.toyota.co.jp	Toyota	
Jim Linden	lindenjim@jlindenconsulting.com Phone: (248) 321-5343	Toyota	
Mark Adams	mark@tribologytesting.com	Tribology Testing	
Timothy Caudill	Tlcaudill@valvoline.com	Valvoline	
Thom Smith	trsmith@valvoline.com	Valvoline	
Hap Thompson	Hapjthom@aol.com	VIx Facilitator	
Chris Taylor	Chris.Taylor@vpracingfuels.com	VP Racing Fuels	

ASTM SEQUENCE VI

Name	Email/Phone	Company	Attend

MOTION:				
Adrian Alfonso **Voting Member**				
Jason Bowden **Voting Member**				
Kevin Brodwater **Voting Member**				
Tim Cushing **Voting Member**				
Rich Grundza **Voting Member**				
Jeff Hsu **Voting Member**				
Teri Kowalski **Voting Member**				
Dan Lanctot **Voting Member**				
Katerina Pecinovsky **Voting Member**				
Brianne Pentz **Voting Member**				
Andy Ritchie **Voting Member**				
Ron Romano **Voting Member**				
Clifford Salvesen **Voting Member**				
Amol Savant **Voting Member**				
Andrew Stevens **Voting Member**				
Haiying Tang **Voting Member**				
Dan Worcester **Voting Member**				
VOTES				

ASTM SEQUENCE VI

Name	Email/Phone	Company	Attend

MOTION:				
Adrian Alfonso **Voting Member**				
Jason Bowden **Voting Member**				
Kevin Brodwater **Voting Member**				
Tim Cushing **Voting Member**				
Rich Grundza **Voting Member**				
Jeff Hsu **Voting Member**				
Teri Kowalski **Voting Member**				
Dan Lanctot **Voting Member**				
Katerina Pecinovsky **Voting Member**				
Brianne Pentz **Voting Member**				
Andy Ritchie **Voting Member**				
Ron Romano **Voting Member**				
Clifford Salvesen **Voting Member**				
Amol Savant **Voting Member**				
Andrew Stevens **Voting Member**				
Haiying Tang **Voting Member**				
Dan Worcester **Voting Member**				
VOTES				

ASTM SEQUENCE VI

Name	Email/Phone	Company	Attend

MOTION:				
Adrian Alfonso **Voting Member**				
Jason Bowden **Voting Member**				
Kevin Brodwater **Voting Member**				
Tim Cushing **Voting Member**				
Rich Grundza **Voting Member**				
Jeff Hsu **Voting Member**				
Teri Kowalski **Voting Member**				
Dan Lanctot **Voting Member**				
Katerina Pecinovsky **Voting Member**				
Brianne Pentz **Voting Member**				
Andy Ritchie **Voting Member**				
Ron Romano **Voting Member**				
Clifford Salvesen **Voting Member**				
Amol Savant **Voting Member**				
Andrew Stevens **Voting Member**				
Haiying Tang **Voting Member**				
Dan Worcester **Voting Member**				
VOTES				

Sequence
VIE FEI 2 Response Shift Task Force

SOUTHWEST RESEARCH INSTITUTE®

01.30.2018

Task Force Members

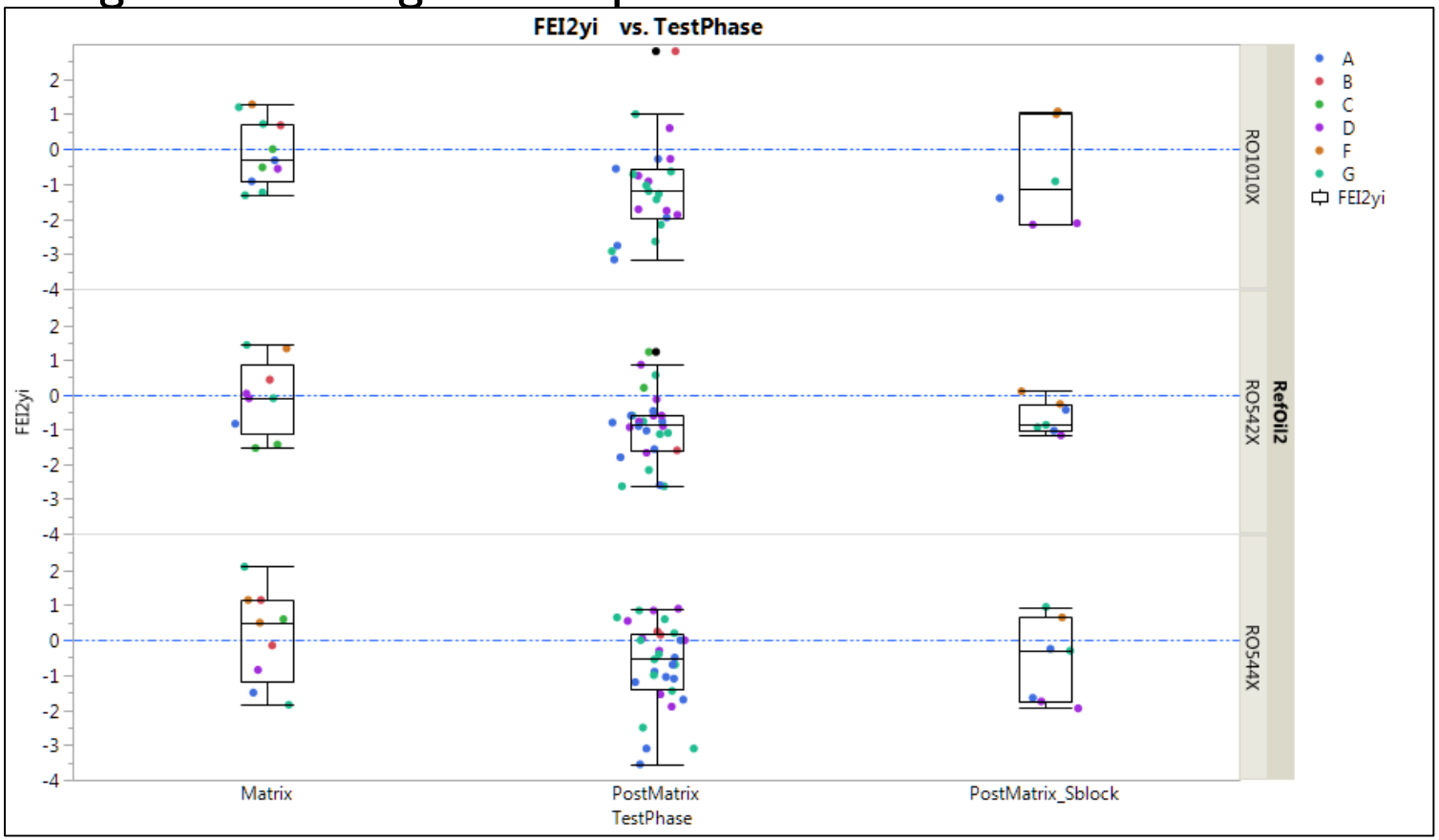
Adrian Alfonso	Intertek
Jerry Brys	Lubrizol
Bill Buscher	Intertek
Todd Dvorak	Afton
Rich Grundza	TMC
Charlie Leverett	Infineum
Katerina Pecinovsky	Afton
Cliff Salvesen	ExxonMobil
Andrew Stevens	Lubrizol
Amol Savant	Valvoline
Dan Worcester	SwRI

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.

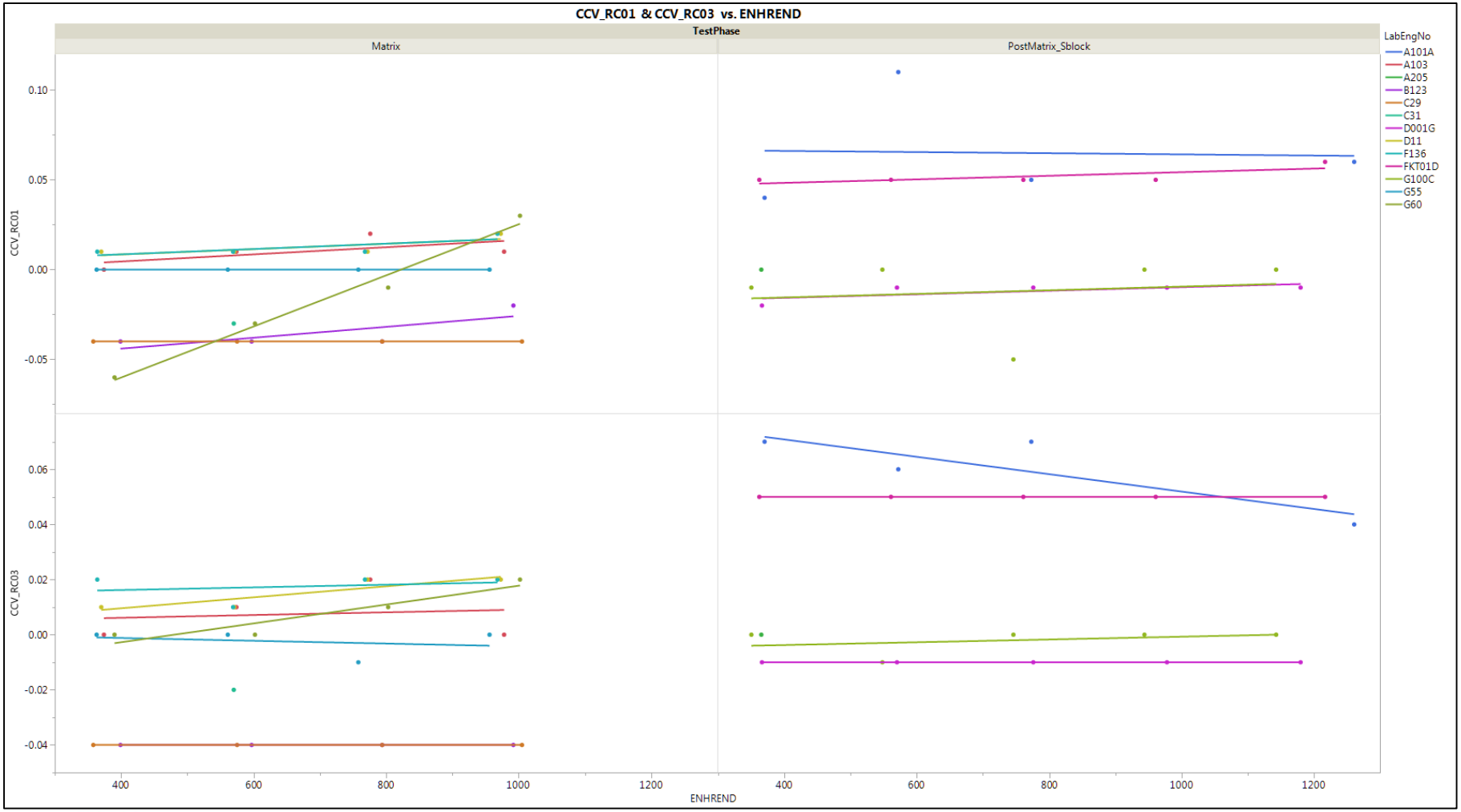
Review of VIE Data

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



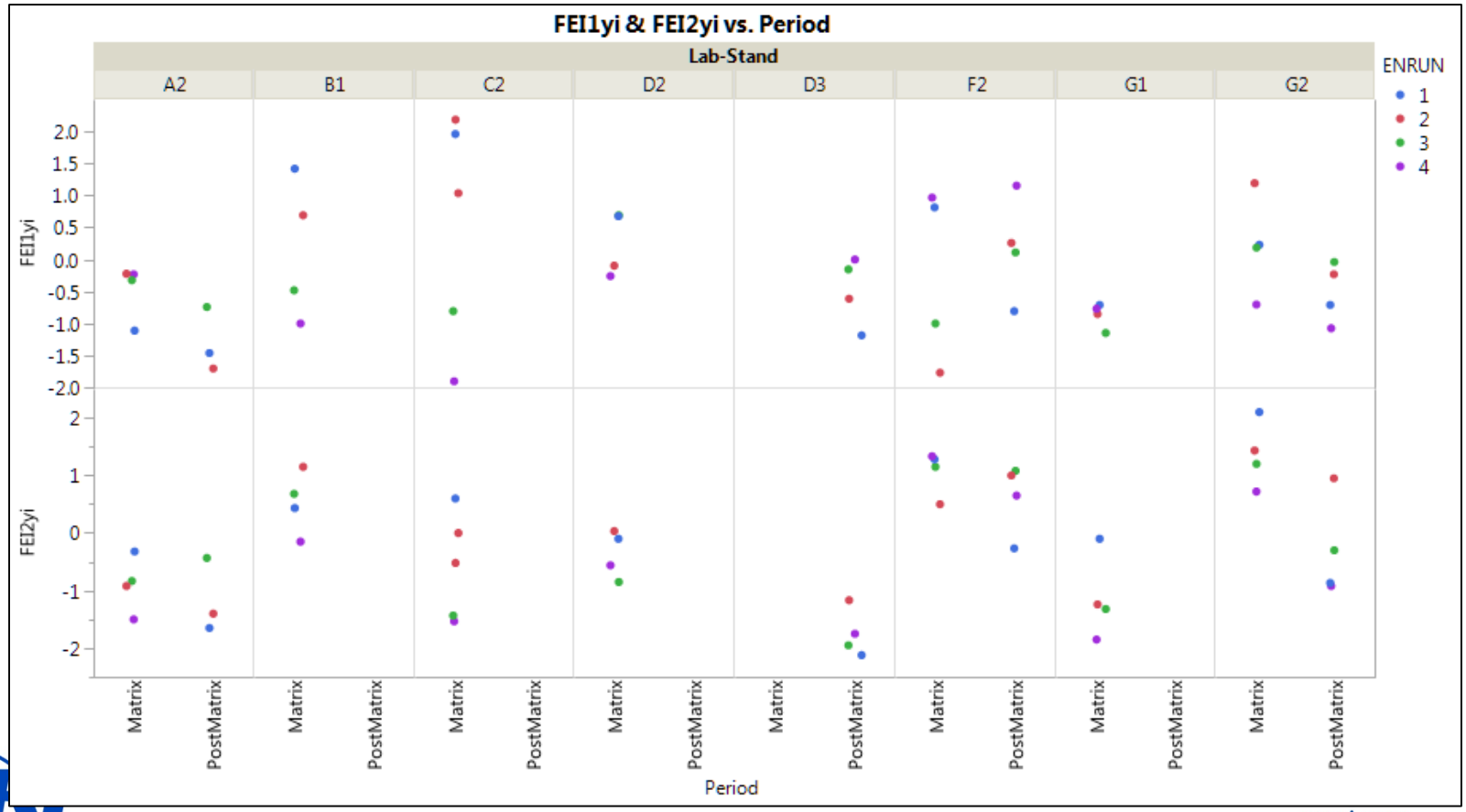
Review of VIE Data

Crankcase pressure is higher with PostMatrix SBEngines



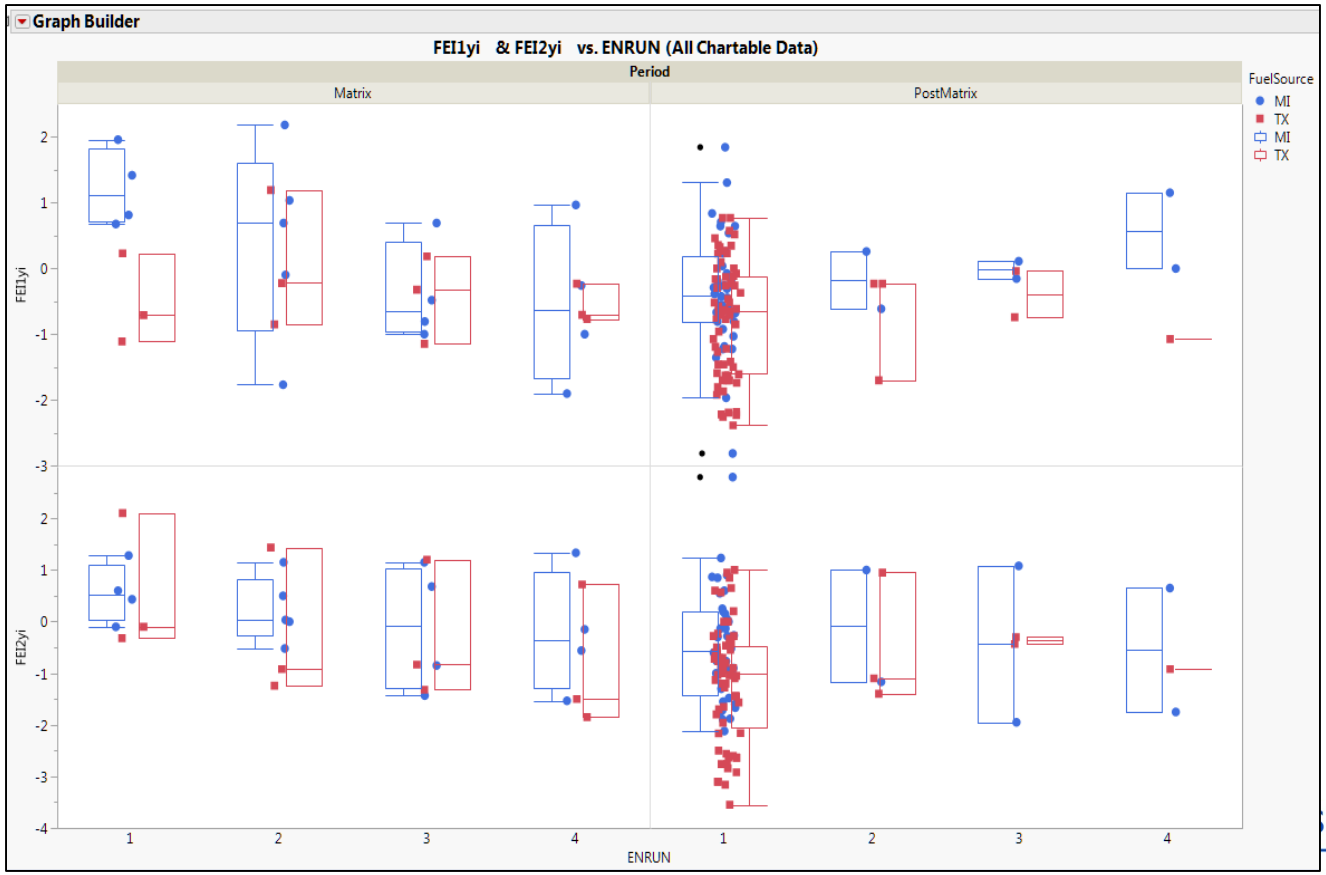
Lab-Stand Comparison of PM and PPM Test Severity

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



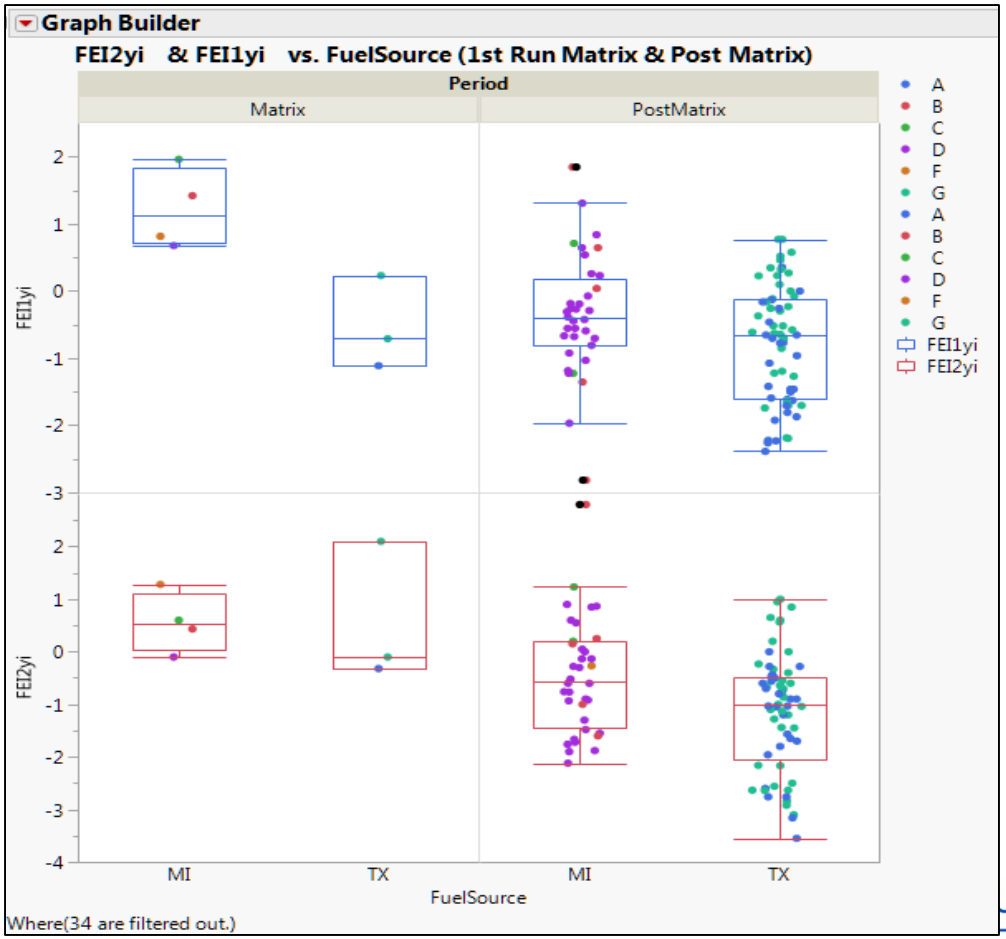
VIE Analysis of Fuel Source Analysis

- 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

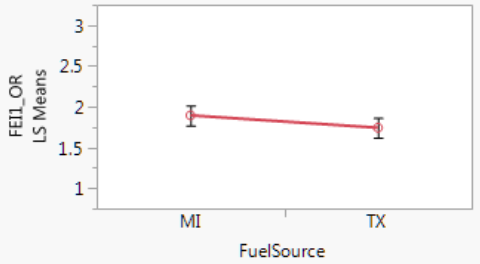
FuelSource

Leverage Plot

Least Squares Means Table

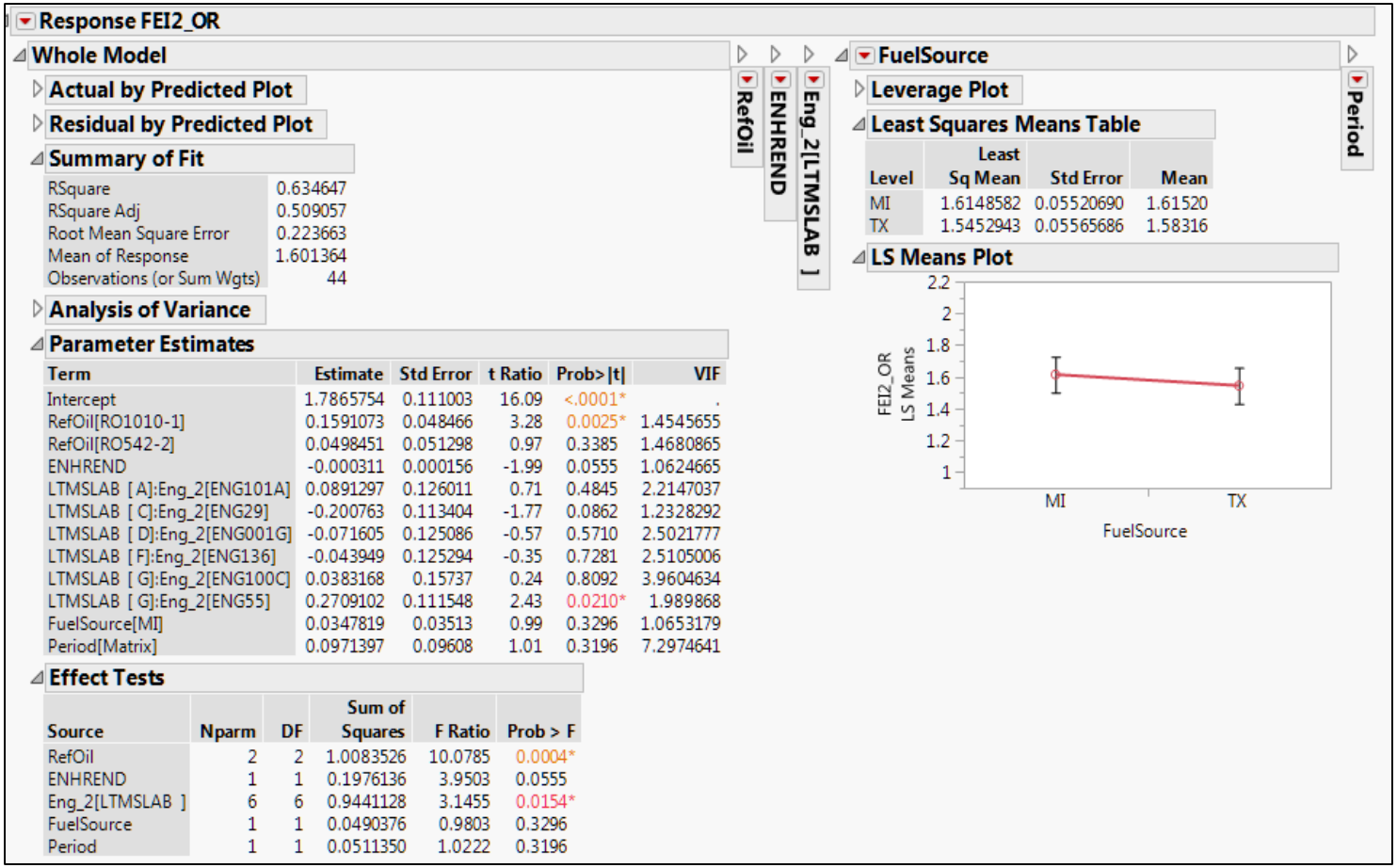
Level	Least Sq Mean	Std Error	Mean
MI	1.8936224	0.05958571	1.91440
TX	1.7423295	0.06007136	1.74632

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	45.2286
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	[illegible]	0.481718	95.10	<.0001*
LTMSLAB[A]	2.0196639	0.340681	5.93	<.0001*
LTMSLAB[B]	-0.206296	0.461472	-0.45	0.6577
LTMSLAB[C]	-0.057277	0.418085	-0.14	0.8919
LTMSLAB[D]	-0.857541	0.340012	-2.52	0.0165*
LTMSLAB[F]	-0.49093	0.363751	-1.35	0.1878
TestPhase2[Matrix]	[illegible]	[illegible]	[illegible]	[illegible]
RefOil[REO1010-1]	-3.12665	0.214111	-14.60	<.0001*
RefOil[REO542-2]	[illegible]	[illegible]	-1.90	0.0657
ENLIBEND	0.002506	[illegible]	3.29	[illegible]

Effect Tests

Source	Nparm	DF	Sum of Squares	F Ratio	Prob > F
LTMSLAB	5	5	41.88179	8.2465	<.0001*
TestPhase2	1	1	9.89202	9.7394	0.0037*
RefOil	2	2	316.08649	155.5309	<.0001*
ENLIBEND	1	1	11.02711	10.8476	0.0023*

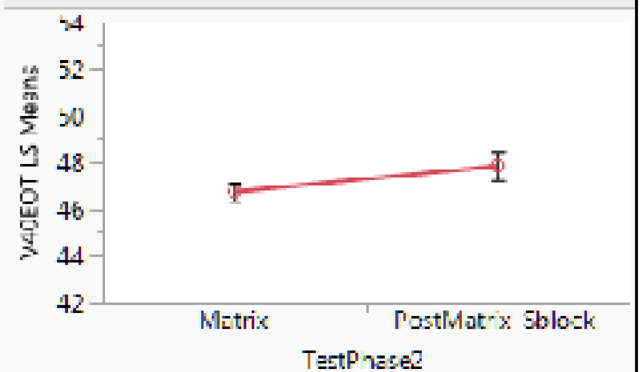
TestPhase2

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

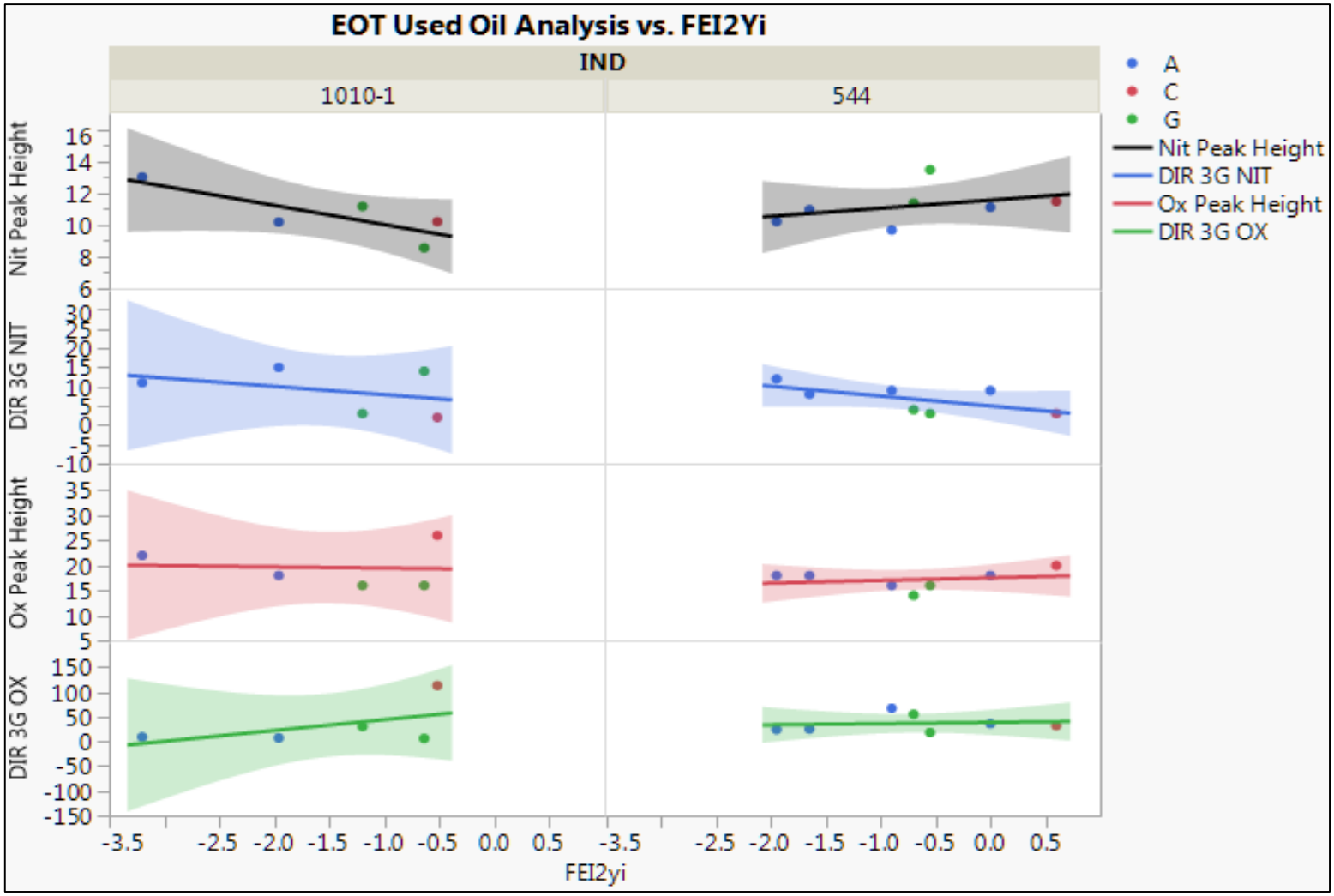


Note 1: One observation missing PM EOT viscosity data

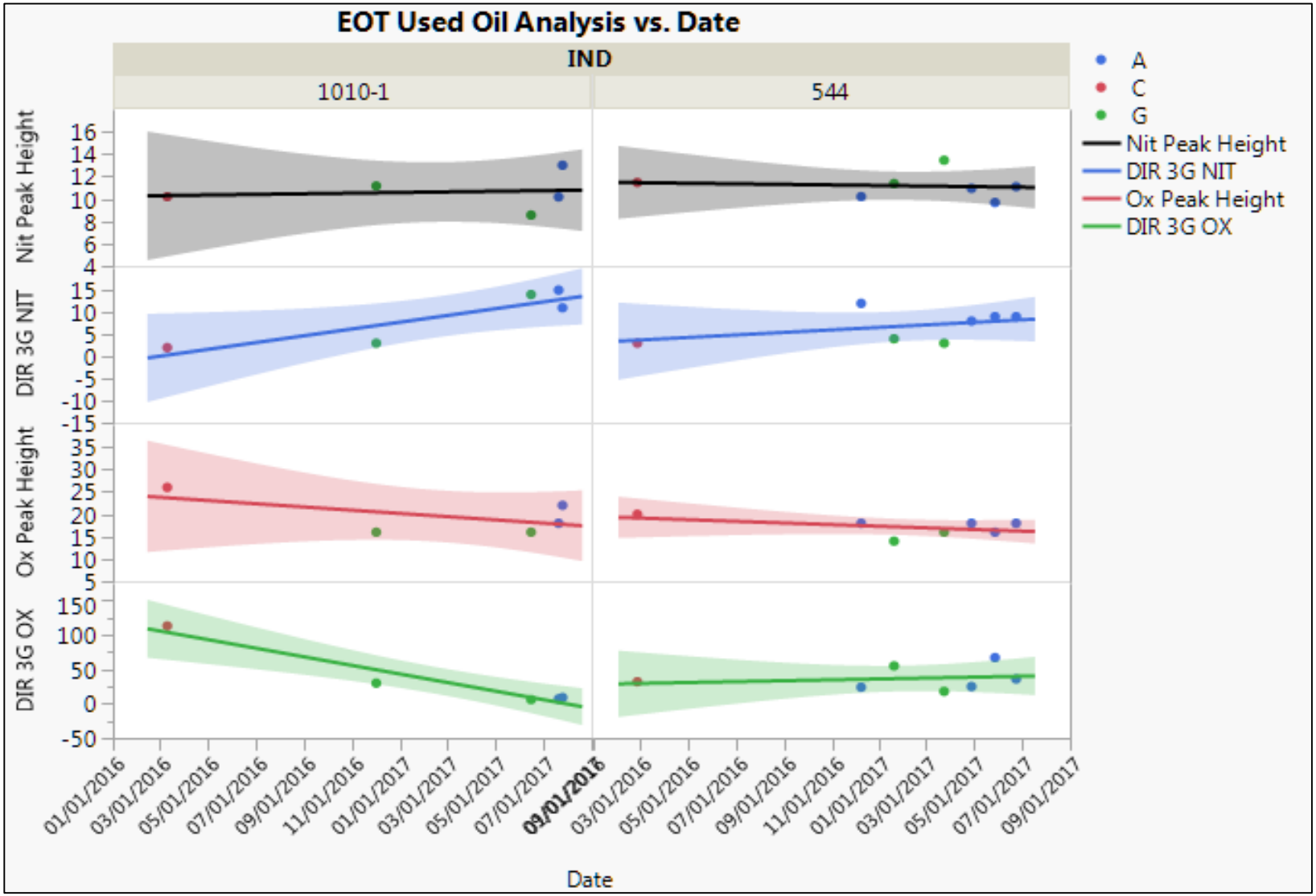
Afton Chemical

Passion for Solutions™

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 with those engines in 2018.

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.

Comparison of PM and PPM Test Severity for BSFCs

- Plot of Baseline BLB2 – Stage 1 BSFC
  - No significant difference between BSFCs - Stage 1 for matrix and post matrix test periods (runs 1 – 4).

Response BFCARA1A

Whole Model

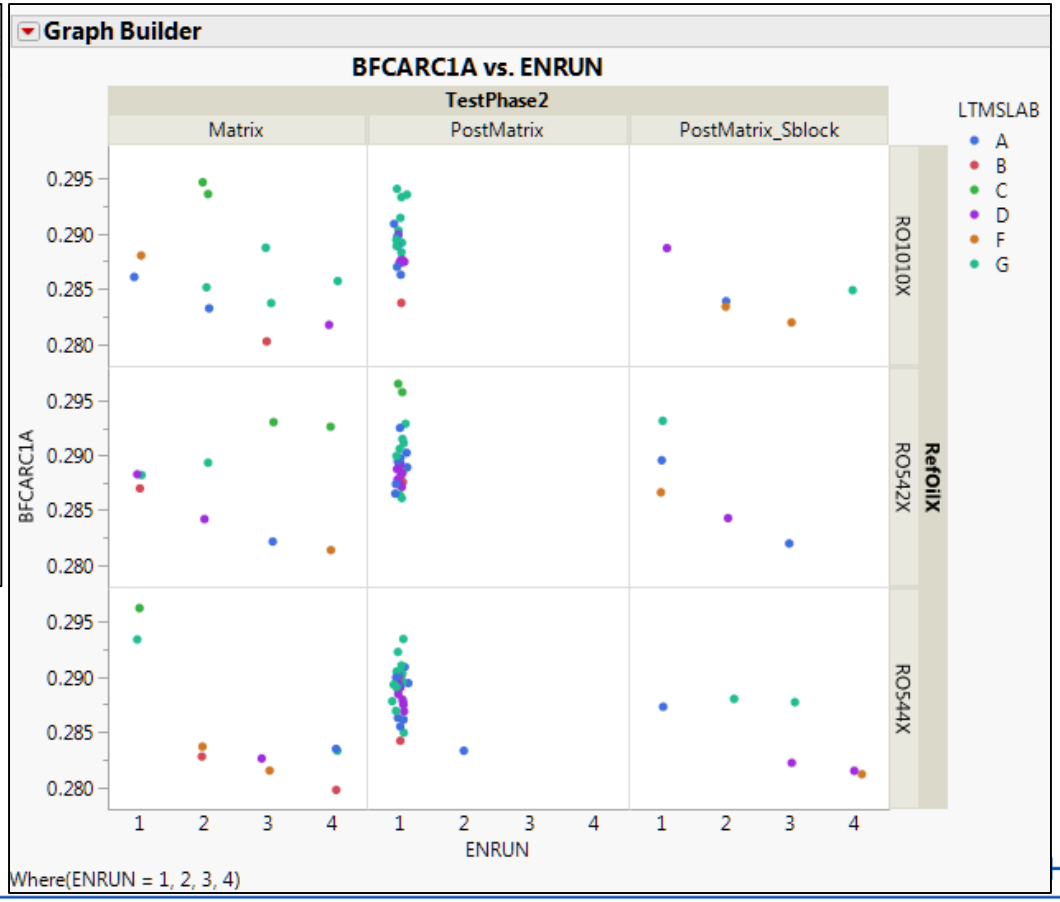
- Actual by Predicted Plot
- Effect Summary
- Lack Of Fit
- Residual by Predicted Plot

Summary of Fit

RSquare	0.124301
RSquare Adj	0.064594
Root Mean Square Error	0.002938
Mean of Response	0.285966
Observations (or Sum Wgts)	142

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio
Model	9	0.00016170	0.000018	2.0819
Error	132	0.00113914	8.63e-6	Prob > F
C. Total	141	0.00130084		0.0354*



Comparison of PM and PPM Test Severity for BSFCs

- Plot of Baseline BLA – Stage 1 BSFC
  - No significant difference between BSFCs (BLA Stage1) for matrix and post matrix test periods (runs 1 – 4).

Response BFCARC1A

Whole Model

Summary of Fit

RSquare	0.483409
RSquare Adj	0.444273
Root Mean Square Error	0.00287
Mean of Response	0.287375
Observations (or Sum Wgts)	143

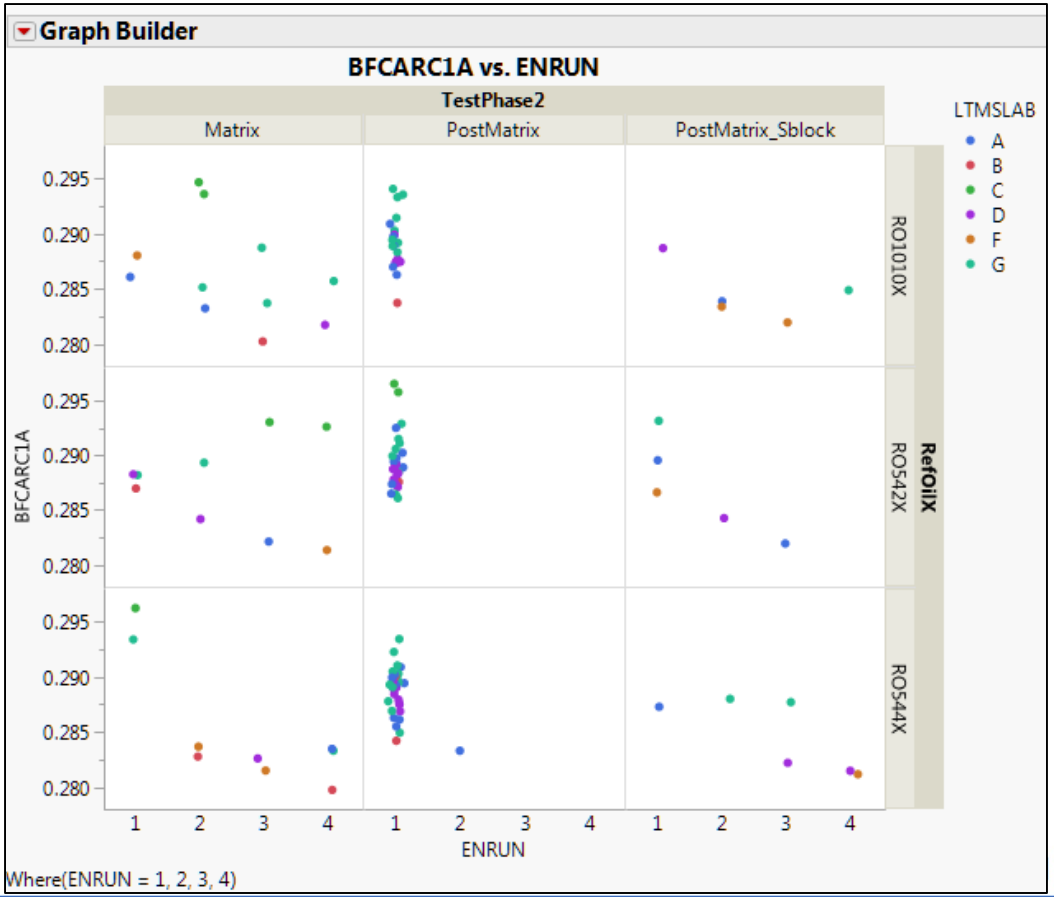
Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio
Model	10	0.00101752	0.000102	12.3521
Error	132	0.00108736	8.238e-6	Prob > F
C. Total	142	0.00210488		<.0001*

Parameter Estimates

Effect Tests

Source	Nparm	DF	Sum of Squares	F Ratio	Prob > F
TestPhase2	3	3	0.00002105	0.8519	0.4680
RefOilX	2	2	0.00002804	1.7018	0.1863
ENRUN	5	5	0.00031271	7.5923	<.0001*



Comparison of PM and PPM Test Severity for BSFCs

- Plot of Baseline BLB2 – Stage 1 Oil Pressure
  - No significant difference between BSFCs (BLA Stage1) for matrix and post matrix test periods (runs 1 – 4).

Effect Summary

Response EOP_RC01

Whole Model

Actual by Predicted Plot

Lack Of Fit

Residual by Predicted Plot

Summary of Fit

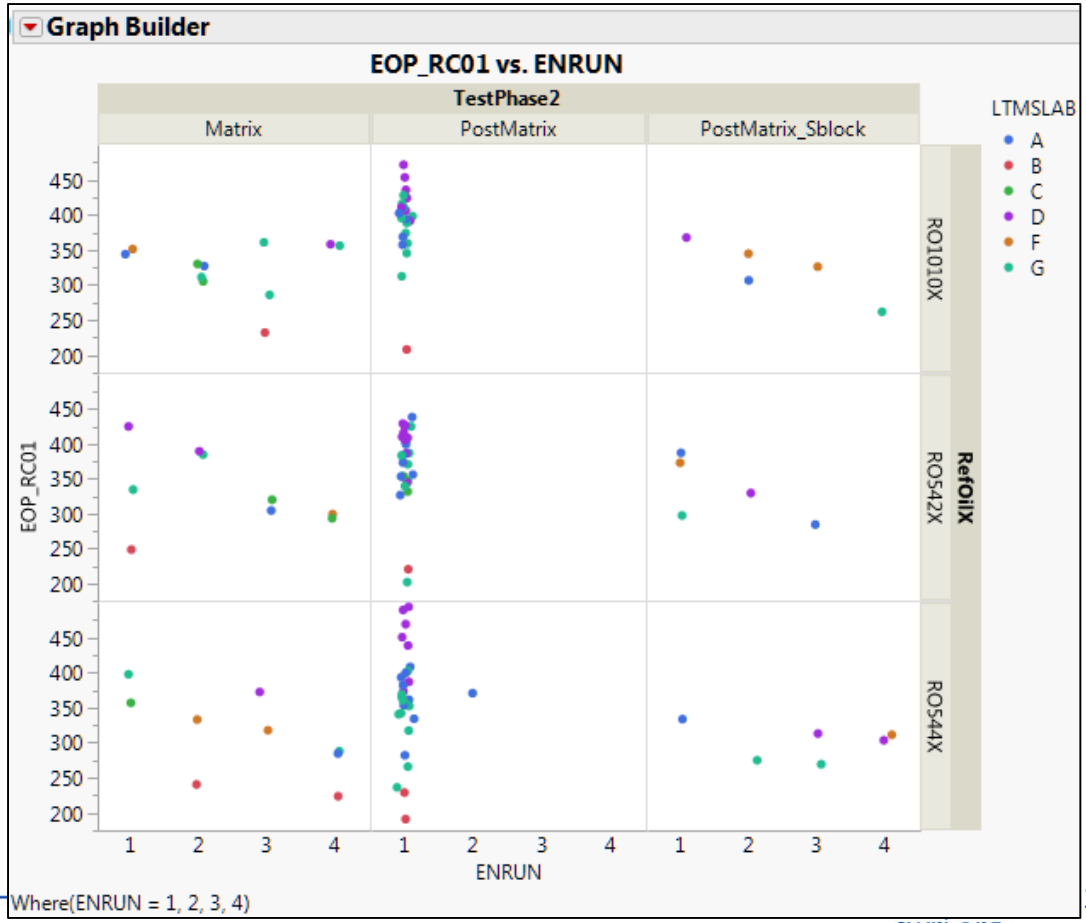
RSquare	0.281592
RSquare Adj	0.23261
Root Mean Square Error	54.48051
Mean of Response	349.4092
Observations (or Sum Wgts)	142

Analysis of Variance

Parameter Estimates

Effect Tests

Source	Nparm	DF	Sum of Squares	F Ratio	Prob > F
TestPhase2	3	3	9774.652	1.0977	0.3525
RefOilX	2	2	9935.367	1.6737	0.1915
ENRUN	4	4	20821.604	1.7538	0.1420



Comparison of PM and PPM Test Severity for BSFCs

- Plot of Baseline BLA – Stage 1 Oil Pressure
  - No significant difference between BSFCs (BLA Stage1) for matrix and post matrix test periods (runs 1 – 4).

Response EOP_RA01

Whole Model

Actual by Predicted Plot

Lack Of Fit

Residual by Predicted Plot

Summary of Fit

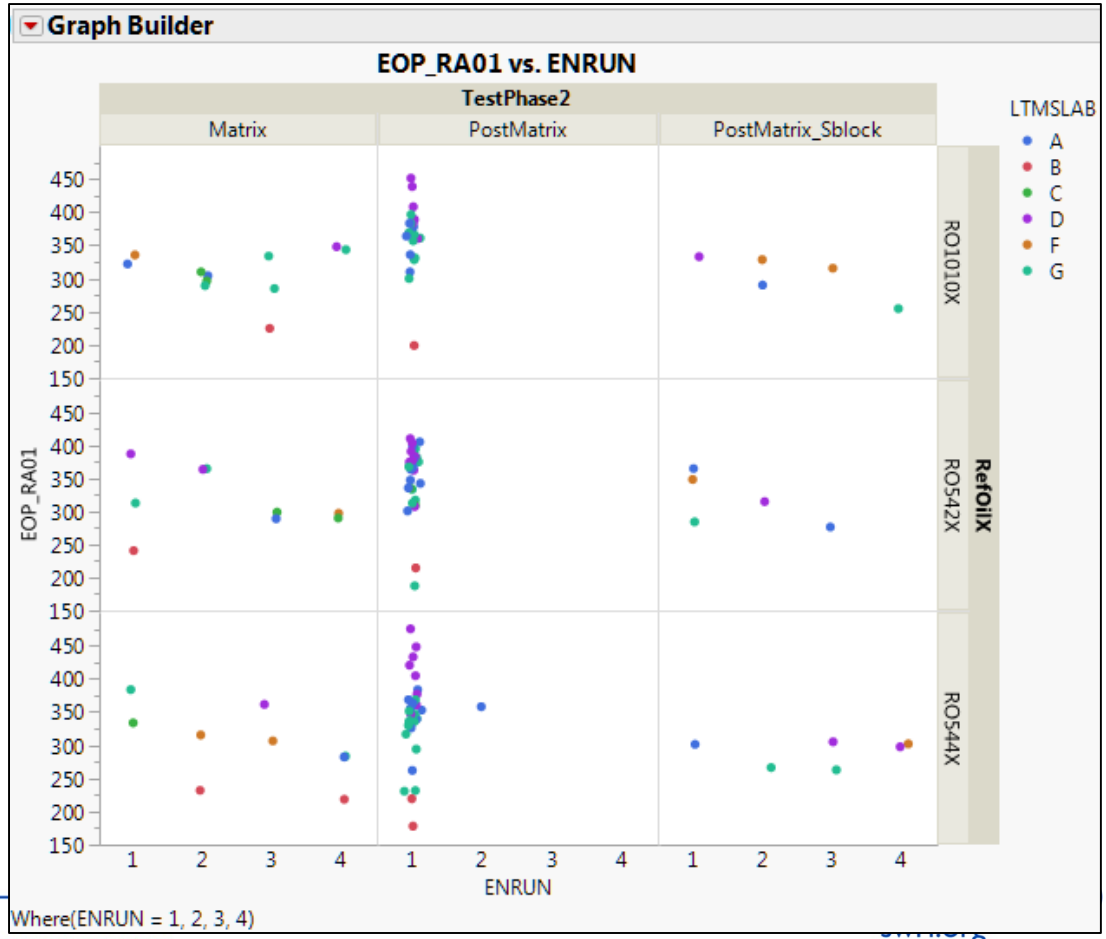
Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio
Model	9	97892.63	10877.0	4.1814
Error	132	343370.70	2601.3	Prob > F
C. Total	141	441263.33		<.0001*

Parameter Estimates

Effect Tests

Source	Nparm	DF	Sum of Squares	F Ratio	Prob > F
TestPhase2	3	3	8996.7900	1.1529	0.3304
RefOilX	2	2	7478.1319	1.4374	0.2412
ENRUN	4	4	9844.9054	0.9462	0.4395



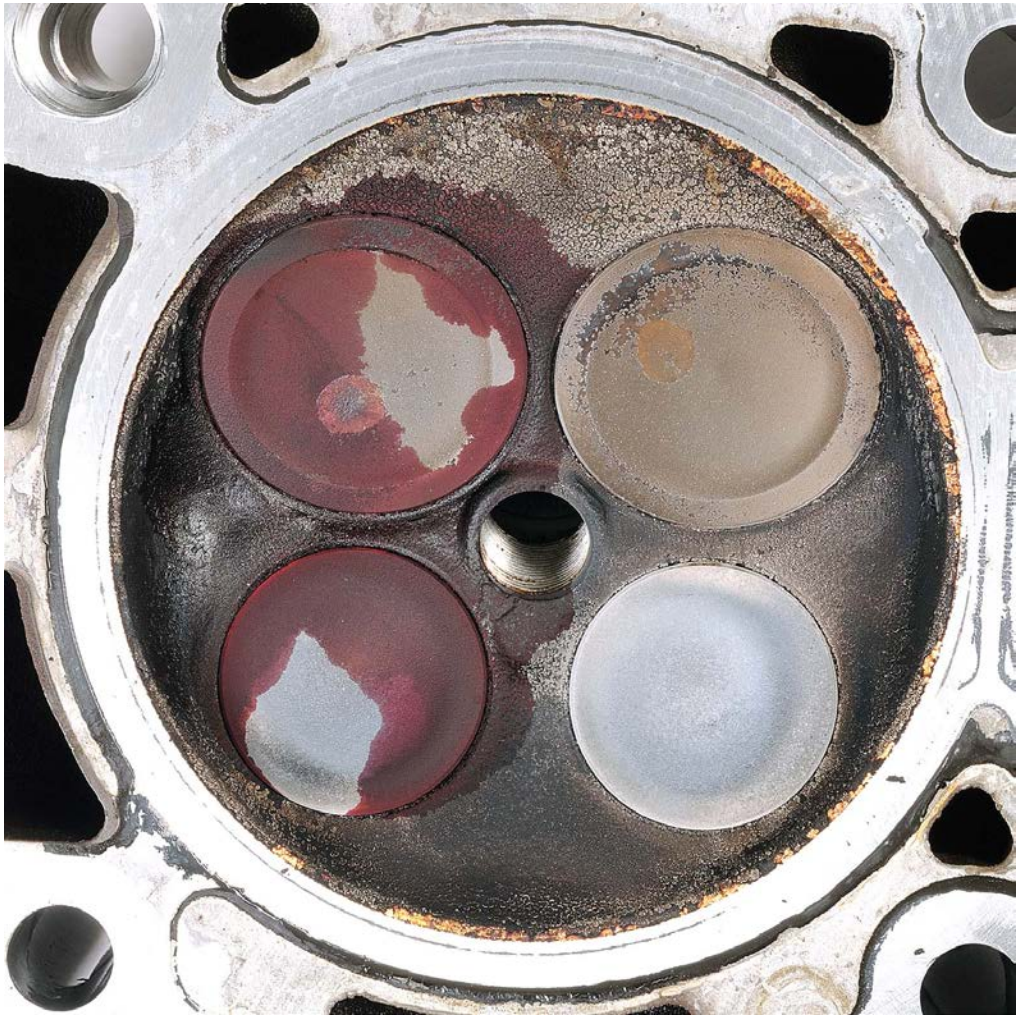
Action

- 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

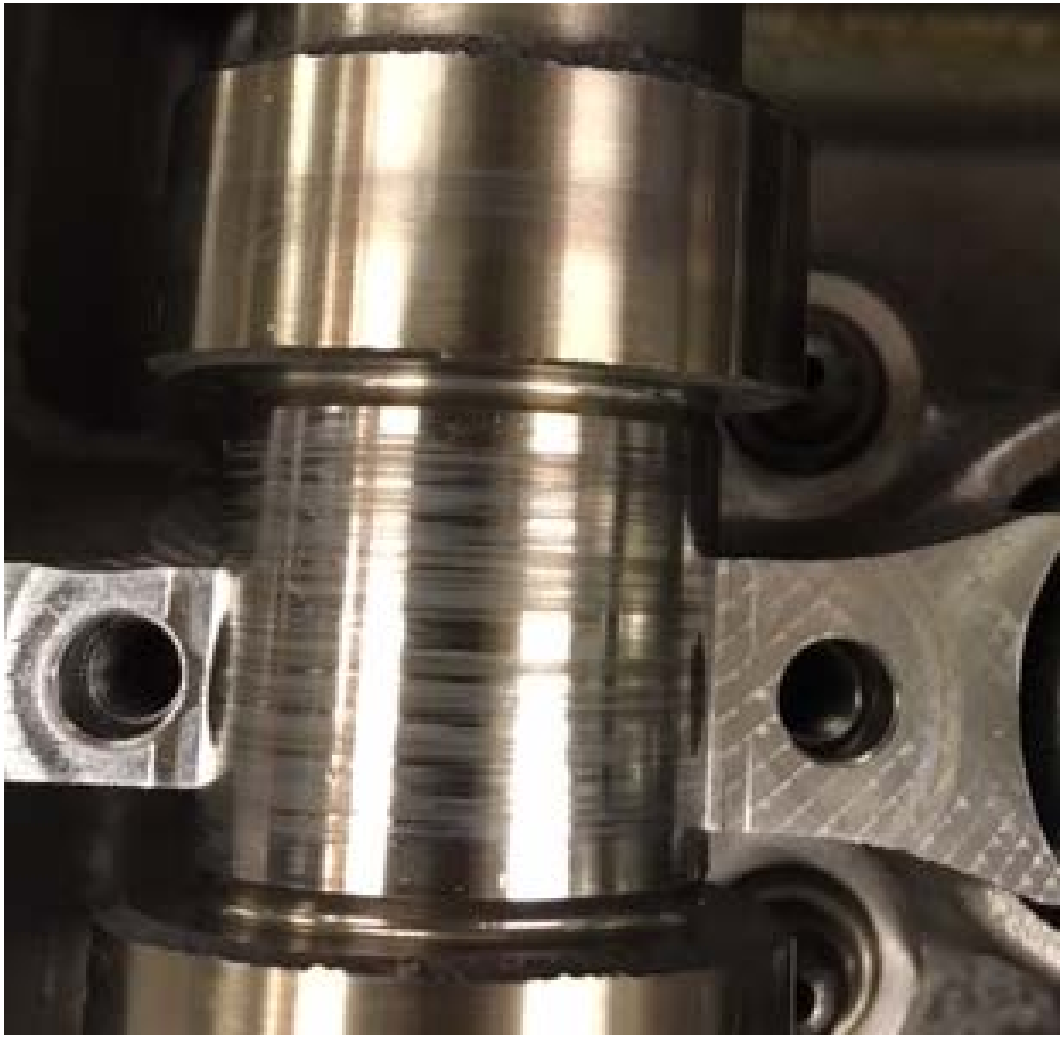
PHOTOS

VIE SwRI Valves



VIE IAR Piston Deposits

VIE Afton Journal Wear



VIE Valvoline Bore Polish