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Committee D02 on PETROLEUM PRODUCTS AND LUBRICANTS

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Issued: March 05, 2015

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

These are the unapproved minutes of the 03.02.2015 Sequence VI Surveillance Panel call.

The meeting was called to order at 1:00 PM Central Time by Chairman Nathan Moles.

Agenda

The Agenda is the included as Attachment 1.

1.0 Roll Call

The Attendance list Attachment 2.

2.0 Approval of minutes

2.1 Approval of the minutes of the 02.18.2015 conference call.

Motion – Accept the minutes of the 02.18.2015 VI SP Conference Call.
Dan Worcester, Rich Grundza, second.

2.2 This motion received unanimous approval.

3.0 Action Item Review

3.1 OHT to report VIE engine usage and depletion date of VID engines.
There are 0 VID and 80 VIE engines in inventory.

3.2 SP chair and test sponsor to investigate what is needed to establish VID equivalent limits for VIE. This will be an on-going effort.

3.3 Create a group to review friction modifier carry over into baseline oils effects or possible changes. This will be an on-going effort. Contact Nathan Moles for interest.

3.4 TMC to check with ASTM on the removal process for the Seq. VIB. This will be an on-going effort.

3.5 List of items to discuss regarding the Sequence VIE test ready for matrix to be submitted by Tuesday 2/24/2015 to be compiled and sent out to SP prior to next meeting. The list is included as Attachment 3. Dave Glaenzer requested the following wording be included in the minutes: While we are concerned with the precision of FEI 1 as evidenced in the Statistical Group report, we believe that once the analysis of the Precision Matrix data is undertaken and an engine hour correction factor is defined, there may be an opportunity to reevaluate the methodology of defining FEI 1, FEI 2 and FEI Sum. The weighting of the six individual stages as well as the appropriateness and weighting of BLB2 and BLA may be studied. Statistical work such as this may lead to better precision as well as enhanced discrimination between 0W-16 and 0W-20 oils. These items should be considered during the analysis of the Precision Matrix data. If there is opportunity to improve the test over its predecessor, it must be done during that data analysis or forever lost. The list points were reviewed and were answered by the Statistical Group presentation [see Attachment 4] or will be completed with the TMC lab visits prior to starting the Precision Matrix.

4.0 Old Business

4.1 Review targets for Sequence VID RO 542-2 and updated results from TMC. See Attachment 5 for the update. There will be another update when the 10th test completes, and the targets will be reviewed and updated again at 20 tests then locked at 30 tests if that many are run on the VID engines.

ACTION: The data review will move to the Statistical Group.

4.2 Discussion to consider allowing the oil be changed at 75 hours during the break-in for Seq. VIE
-Labs to sending oil samples to IAR for DIR analysis. Three labs have shipped 75 hour oil samples.

4.3 Do we really need to run three RO tests to establish the new engine for LTMS? – Dave Glaenzer
-Discussion of reducing the new reference requirement to two oils, then a third oil run after a defined number of candidates.
-Discussion of using FEI 2 and FEI Sum for references to match candidate pass/fail criteria.
-Discussion of evaluating 80/20 ratio of BL before to after for FEI 1 and 10/90 for FEI 2.
-Should the acceptance bands value of 1.96 be rounded up? Due to the rounding on FEI 1 and 2 the actual pass limit is 1.91 and 1.92.
-This will be reviewed after the Precision Matrix

4.4 Discussion regarding Sequence VIE test ready to proceed with precision matrix. Chair to report results of vote at joint AOAP and PCEOCP meeting March 19th in Detroit.
-The Memorandum of Agreement must be signed and the test receive AOAP approval before the Precision Matrix begins. Lab Visits will be required by TMC. Labs must have two valid tests run on their stands to participate. 4 of 6 interested labs have data on the current version of the test.
-Review list of items submitted by members (attached)
-Updated presentation from industry statisticians (attached) There is an engine hour effect that will need review. The matrix will look at lab and engine effects. Most data will be on new or low hour engines. One lab has agreed to run engines with higher hours. Existing VIE data does show reference oil discrimination, but there have been variations on when and how many references were run. Lab visits will be completed by 04.16.2015. The matrix will not be delayed for the fuel additive testing running now. There was no motion to begin the Precision Matrix. Nathan will report at the 03.19.2015 AOAP meeting.

4.5 Order of service engines on hold due to concerns that engine life could change as result of fuel treat rate.
-This continues on hold. There is no deadline with GM on when to order the engines. OHT is waiting on customer input.
-There are also concerns on what the new VIE engine hour correction will do for engine life.
-Lubrizol has been working with the same additive used for the VIE but at 3 times the treat rate and have not seen a reference shift to date.
-The engine order will remain open. The matrix will begin without the fuel additive data so the service engine order can be placed.

4 New Business

5.1 There are several of items in the most current draft version of the Seq. VIE test procedure posted on the TMC website that need to be updated. Dave Glaenzer has agreed to re-convene the Task Force to review the procedure.

6 **Next Conference Call will be at the Chair notification.**

The meeting adjourned at 2:30 PM.

Sequence VI Surveillance Panel Conference Call Agenda
March 2 @ 2:00PM EST

Call-in information is included below:

Call-in Number: 866-528-2256
Conference Code: 3744024

1.0) Roll Call

Do we have any membership changes or additions?

2.0) Approval of minutes

2.1) Approve the minutes from the February 18, 2015 Sequence VI Surveillance Panel.

3.0) Action Item Review

3.1 OHT to report VID & VIE engine usage and expected depletion date of VID engines. – OHT

-The remaining VID engines sales will be based on percentage of historical sales and will be discussed offline if necessary.

3.2 SP chair and test sponsor to investigate what is needed to establish VID equivalent limits for VIE

3.3 Create a group to review friction modifier carry over into baseline oils effects or possible changes

3.4 TMC to check with ASTM on the removal process for the Seq. VIB.

3.5 List of items to discuss regarding the Sequence VIE test ready for matrix to be submitted by Tuesday 2/24/2015 to be compiled and sent out to SP prior to next meeting

4.) Old Business

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-Discussion of using FEI 2 and FEI Sum for references to match candidate pass/fail criteria.
-Discussion of evaluating 80/20 ratio of BL before to after for FEI 1 and 10/90 for FEI 2.
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-Review list of items submitted by members (attached)
-Updated presentation from industry statisticians (attached)

4.5 Order of service engines on hold due to concerns that engine life could change as result of fuel treat rate.

-This continues on hold. There is no deadline with GM on when to order the engines. OHT is waiting on customer input.
-There are also concerns on what the new VIE engine hour correction will do for engine life.
-Lubrizol has been working with the same additive used for the VIE but at 3 times the treat rate and have not seen a reference shift to date.
-The engine order will remain open.

5.) New Business

5.1 There are several of items in the most current draft version of the Seq. VIE test procedure posted on the TMC website that need to be updated.

6.) Next Meeting

Call of the chairman

7.) Meeting Adjourned

ASTM SEQUENCE VI

Name	Address	Phone/Fax/Email	Attendance
Jason Bowden Voting Member	OH Technologies, Inc.	Phone: 440-354-7007 jhbowden@ohtech.com	Attend
Timothy Caudill Voting Member	Ashland, Inc.	Phone: 606-329-5708 Tlcaudill@ashland.com	
David Glaenzer Voting Member	Afton Research Center	Phone: 804-788-5214 Dave.Glaenzer@aftonchemical.com	Attend
Rich Grundza Voting Member	ASTM TMC	Phone: 412-365-1034 reg@astmtmc.cmu.edu	Attend
Tracey King Voting Member	Haltermann	Phone: tking@jhaltermann.com	Attend
Charlie Leverett Voting Member	Intertek Automotive Research	Phone: 210-647-9422 charlie.leverett@intertek.com	Attend
Terry Kowalski Voting Member	Toyota	teri.kowalski@tema.toyota.com	
Bruce Matthews Voting Member	GM Powertrain Engine Oil Group	Phone: 248-830-9197 bruce.matthews@gm.com	Attend
Timothy Miranda Voting Member	BP Castrol Lubricants USA	Phone: 973-305-3334 Timothy.Miranda@bp.com	
Nathaniel Moles Voting Member	Lubrizol	Phone: (440) 347-4472 Nathaniel.Moles@Lubrizol.com	Attend
Mark Mosher Voting Member	ExxonMobil	Phone: 856-224-2132 mark_r_mosher@exxonmobil.com	
Andy Ritchie Voting Member	Infineum	Phone: 908-474-2097 Andrew.Ritchie@infineum.com	
Ron Romano Voting Member	Ford Motor Company	Phone: 313-845-4068 rromano@ford.com	Attend
Kaustav Sinha Voting Member	Chevron Oronite Company LLC	Phone: 713.432.6642 LFNQ@chevron.com	Attend
Mark Sutherland Voting Member	TEI	Phone: 123.456.7890 msutherland@tei-net.com	
Haiying Tang Voting Member	Chrysler	Phone: 248-512-0593 HT146@Chrysler.com	
Dan Worcester Voting Member	Southwest Research Institute	Phone: 210.522.2405 dan.worcester@swri.org	Attend

ASTM SEQUENCE VI

Name	Address	Phone/Fax/Email	Attendance

Guests

Ed Altman	ed.altman@aftonchemical.com	Afton	
Bob Campbell	Bob.Campbell@aftonchemical.com	Afton	
Todd Dvorak	todd.dvorak@aftonchemical.com	Afton	
Christian Porter	Christian.porter@aftonchemical.com	Afton	Attend
Terry Hoffman	Terry.Hoffman@aftonchemical.com	Afton	
Jeremy Styer	Jeremy.styer@aftonchemical.com	Afton	
Greg Guinther	greg.guinther@aftonchemical.com	Afton	
Don Smolenski	donald.j.smolenski@gm.com	Evonik	
Doyle Boese	Doyle.boese@infineum.com	Infineum	Attend
Mike McMillan	mmcmillan123@comcast.net	Infineum	Attend
Bob Olree	olree@netzero.net	Intertek	
Addison Schweitzer	addison.schweitzer@intertek.com	Intertek	
Angela Willis	angela.p.willis@gm.com	GM	
Jeff Kettman	Jeff.kettman@gm.com	GM	
Jerry Brys	Jerome.brys@lubrizol.com	Lubrizol	Attend
Jessica Buchanan	Jessica.Buchanan@Lubrizol.com	Lubrizol	Attend
Michael Conrad	Michael.Conrad@Lubrizol.com	Lubrizol	
Dwight Bowden	dhbowden@ohtech.com	OHT	
Matt Bowden	mjbowden@ohtech.com	OHT	Attend
Guy Stubbs	Guy.Stubbs@swri.org	SwRI	
William Buscher	william.buscher@intertek.com	Intertek	
Scott Stap	Scott.stap@tgdirect.com	TG Direct	
Robert Stockwell		Oronite	Attend
Clayton Knight	cknight@tei-net.com	TEI	
Jeff Clark	jac@astmtmc.cmu.edu	TMC	
Hap Thompson	Hapjthom@aol.com	ASTM VIE Facilitator	Attend
Tom Smith		Valvoline	
Mark Adams	mark@tribologytesting.com		
Dan Lanctot	dlanctot@tei-net.com	TEI	
Adrian Alfonso	adrian.alfonso@intertek.com 210.838.0431	Intertek	Attend
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Zack Bishop	zbishop@tei-net.com 210.877.0223	TEI	
Patrick Lang	Patrick.lang@swir.org 210.522.2820	SwRI	
Mike Warholic	Michael.warholic@Infineum.com 908.474.2065	Infineum	

ASTM SEQUENCE VI

Name	Address	Phone/Fax/Email	Attendance
Jordan Pastor	Jordan.pastor@Infineum.com 313.348.3120	Infineum	
Jim Linden	lindenjim@jlindenconsulting.com 248.321.5343	J Linden Consulting	
Janet Buckingham		SwRI	Attend
Gordon Farnsworth		Infineum	Attend
Timothy Cushing		GM	Attend
Valeriu Lieu		Oronite	Attend
Jeff Hsu		Shell	Attend
Jo Martinez		Oronite	Attend
Amol Savant		Ashland	Attend

ASTM SEQUENCE VI

Name	Address	Phone/Fax/Email	Attendance

- Test Discrimination:
    - Is discrimination between the reference oils sufficient?
        - If so based on what?
    - Are we comfortable with consistency of results between the batches of 542?
        - Discrimination between batches is based on how many tests per batch?

- Sufficient Test Data
    - Are we comfortable with the limited results at higher engine hours determining the oil discriminate through the engine life?
    - Are we comfortable with the limited number of engines that ran more than one test on a reference oil to determine the engine correction that resulted in the oil discrimination?
    - Will there be enough data from the precision matrix generated at higher hours to generate a reliable engine hour correction factor beyond 1800 hours?
    - How many tests have been run on a VIE with each reference oil?

- Procedure/Operational Items
    - Are we comfortable with the increased number of BLA flushes as the current resolution to FM carryover?
    - Should we review the operational data for each lab and have TMC perform a lab inspection?
    - What assurance do we have that all test stand/engine combinations are performing equally understanding that there is an engine hour factor which has not yet been determined?
    - Is TMC going to inspect all test stands prior to precision matrix?
    - What are the criteria for labs participating in the precision matrix in regards to providing two successful runs on reference oils?
    - Should we wait for the completion of the high treat rate engine to extend the engine life and improve response at higher engine hours?
    - Has running the reference oils in the same order resulted a biased engine hour correction?

- VID vs VIE Comparison
    - Does the VIE rank the reverence oils in the same order as the VID?
    - Is the VIE variability as good as or better than the VID?
    - How does the precision of the VIE compare to the VID?

VIE Prove-Out Data Analysis

Statisticians Group

2/23/15

Statisticians Group

- Art Andrews, Exxon Mobil
- Doyle Boese, Infineum
- Janet Buckingham, SwRI
- Martin Chadwick, Intertek
- Todd Dvorak, Afton
- Rich Grundza, TMC
- Kevin O'Malley, Lubrizol
- Jo Martinez, Oronite

Conclusions

The current VIE data indicates statistical discrimination among the oils tested for FEI1 and FEI2.

Based on the analysis presented the estimated standard deviation for FEI1 and FEI2 is 0.21 and 0.16, respectively. VID standard deviation is 0.12 and 0.14 for FEI1 and FEI2, respectively.

The standard deviations above were based on inclusion of statistically significant engine hour effect.

Engine Hours should be included in the precision matrix design.

In some of the analyses, lab and engine within lab effects are statistically significant.

Data

Oil	Sample Size	Engine Hours
542	8	347-1606
542-1	27	347-2827
542-2	2	2011-3130
1010	17	346-2411
541-1	10	346-746
0W16T1	5	908-2751
Total	69	346-3130

Data Concerns

- Data used in the analysis is not designed but observational and therefore have a lot of correlation among the variables
  - Engines did not run the same mix of oils
  - Many engines have limited tests
- High percentage of the tests were run in early engine hours
  - In most cases there's a lack of randomization of oil order in new engines
- Most of the data in higher hours are with 542
- FM carry-over effects could not be accounted for in this data

VIE FEI1_OR

Combined Oils 542, 542-1, 542-2

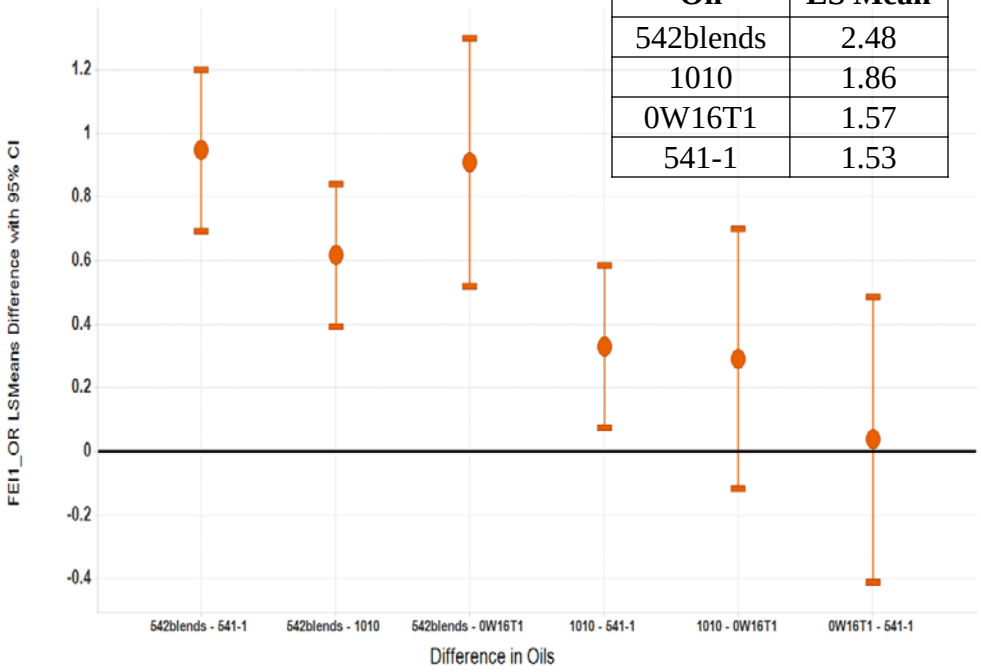
Model: s = 0.21

- Engine Hours [linear]
- Oils [542, 1010, 541-1, 0W16T1]
- Labs [A, B, D, G]
- Engine(Lab)

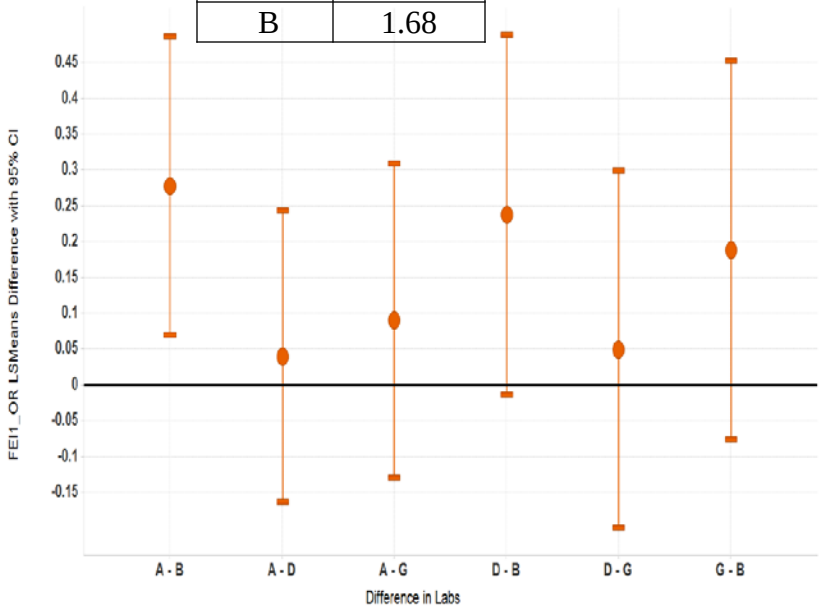
Conclusions (5% level of significance):

1. Oil: 542 > 1010 > 541-1
   542 > 0W16T1
2. Lab: A > B

Oil	LS Mean
542blends	2.48
1010	1.86
0W16T1	1.57
541-1	1.53



Lab	LS Mean
A	1.96
D	1.92
G	1.87
B	1.68



Oil/Lab Comparisons with intervals that do not include 0 are significantly different

VIE FEI2_OR

Combined Oils 542, 542-1, 542-2

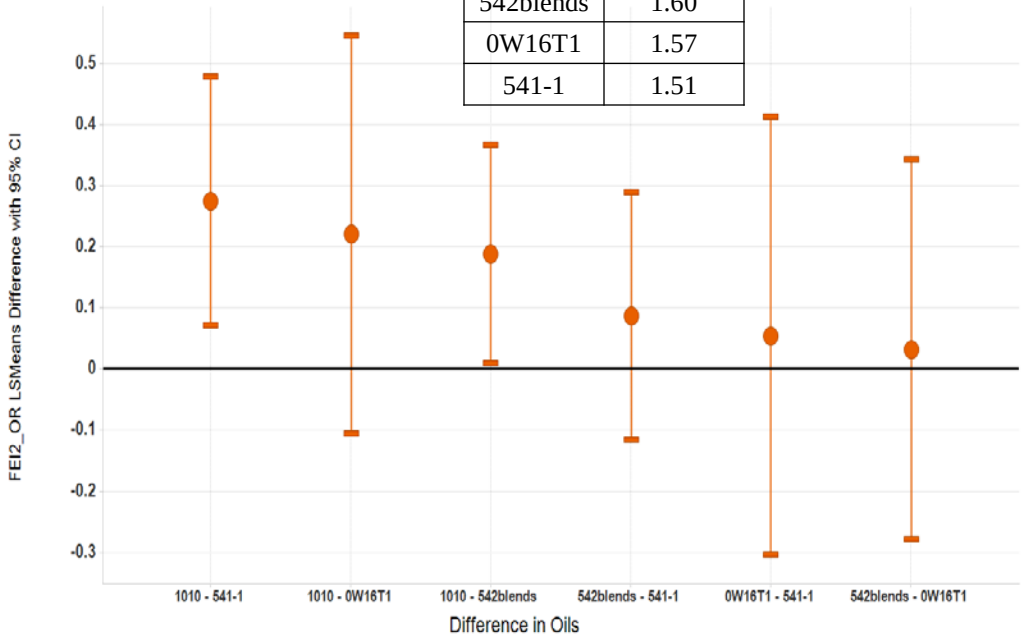
Model: s = 0.16

- Engine Hours [linear]
- Oils [542, 1010, 541-1]
- Labs [A, B, D, G]
- Engine(Lab)

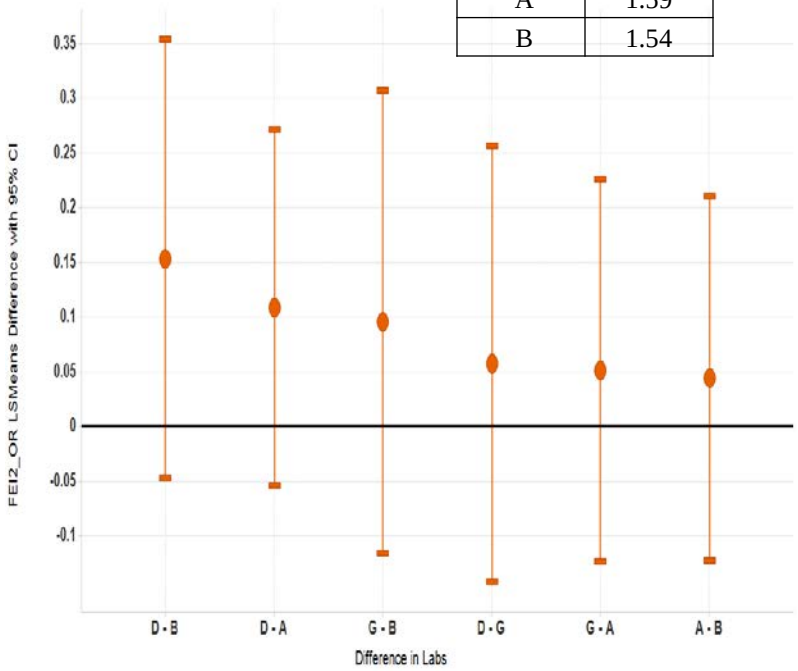
Conclusions (5% level of significance):

1. Oil: 1010 > 542 and 541-1
2. Lab: No significant differences

Oil	LS Mean
1010	1.79
542blends	1.60
0W16T1	1.57
541-1	1.51

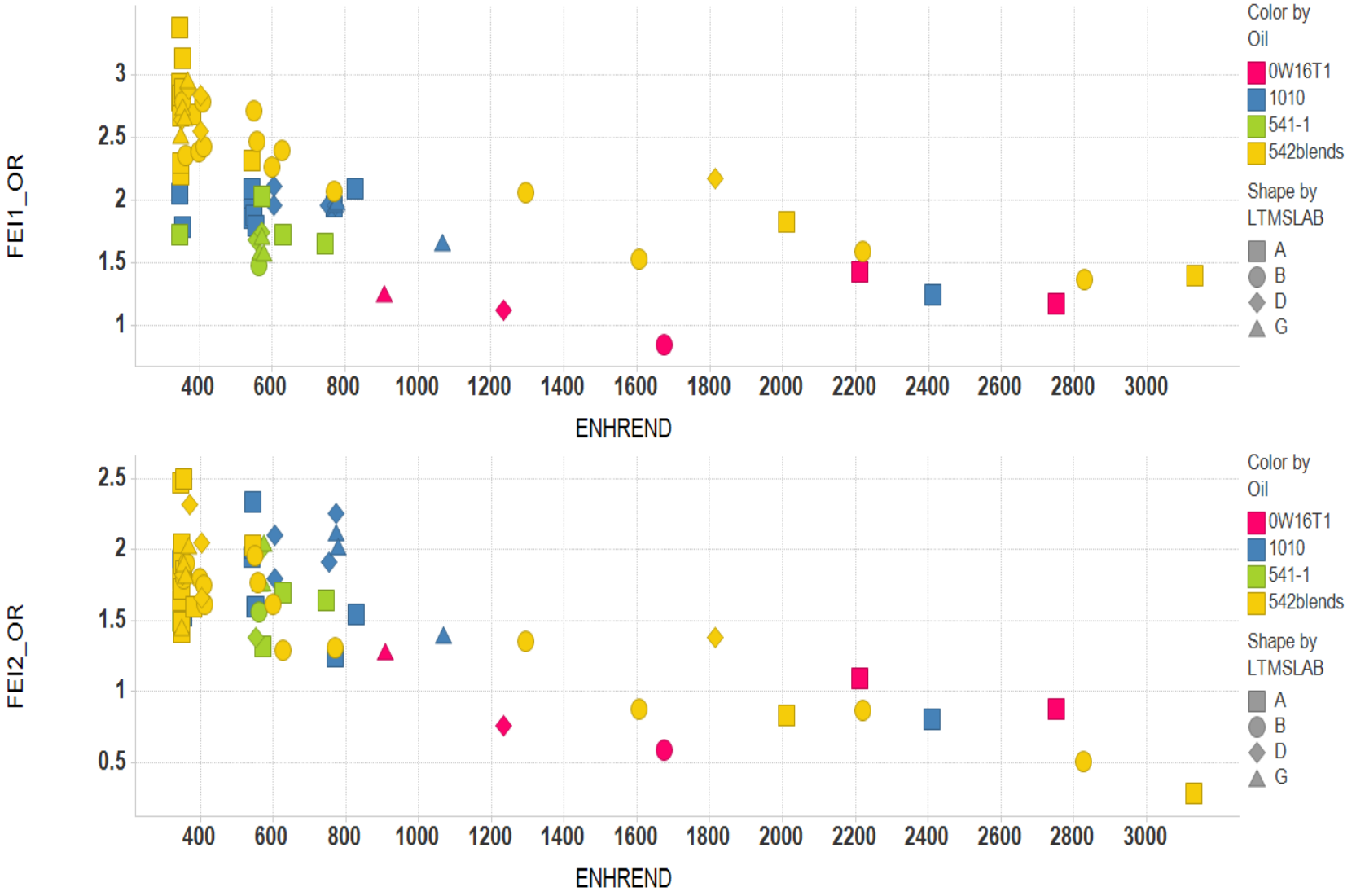


Lab	LS Mean
D	1.70
G	1.64
A	1.59
B	1.54



Oil/Lab Comparisons with intervals that do not include 0 are significantly different

VIE FEI by Engine Hour



VID Precision Matrix and VIE Comparison

FEI1				FEI2			
VID Precision Matrix		VIE Prove-Out		VID Precision Matrix		VIE Prove-Out	
Oil	LS Mean	Oil	LSMean	Oil	LS Mean	Oil	LSMean
X (542)	1.49	542blends	2.48	X (542)	0.8	542blends	1.6
		1010	1.86			1010	1.79
A (540)	1.32			A (540)	1.04		
		0W16T1	1.57			0W16T1	1.57
D (541)	0.87	541-1	1.53	D (541)	0.71	541-1	1.51
s	0.14	s	0.21	s	0.16	s	0.16

VID Precision Matrix Oil Discrimination

FEI1: X(542), A(540) > D(541)

FEI2: A(540) > D(541), X(542)

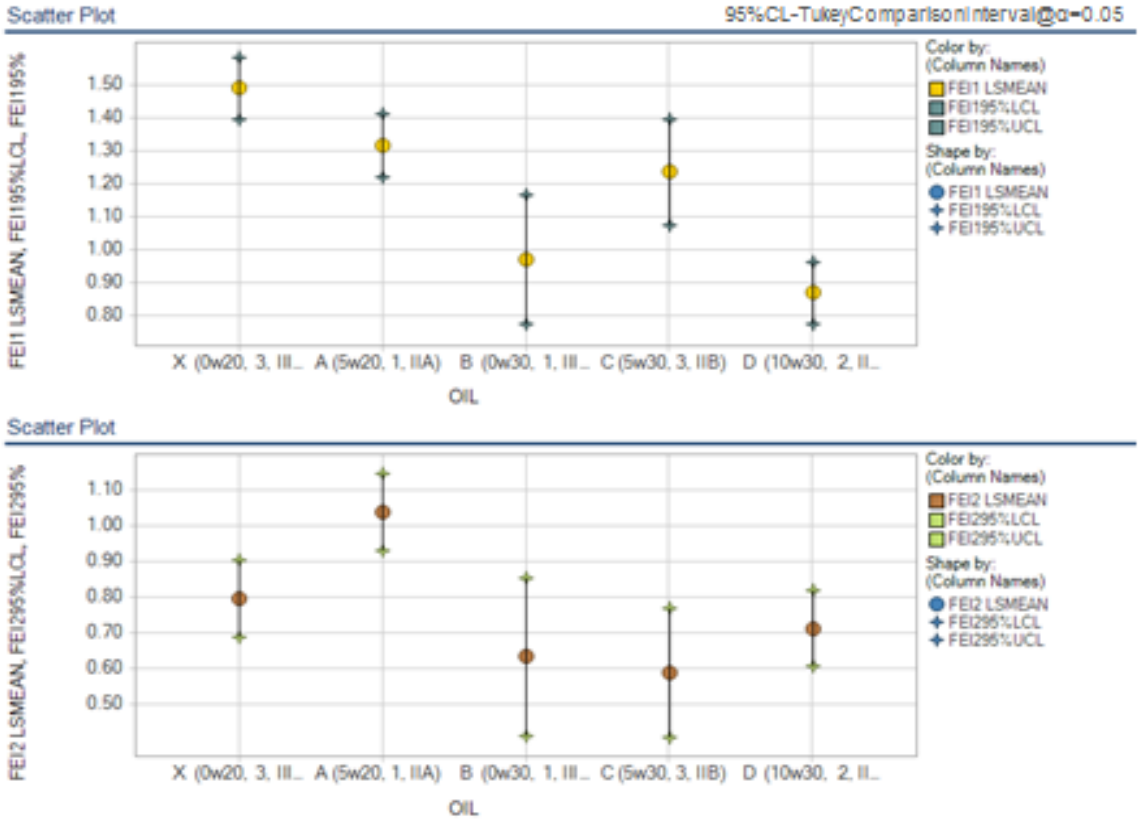
VIE Prove-Out Oil Discrimination

FEI1: 542blends > 1010 > 541-1
542blends > 0W16T1

FEI2: 1010 > 541-1, 542blends

VID Precision Matrix

FEI LSMean by Oil



OIL	FEI1 LSMEAN	FEI2 LSMEAN
A	1.32	1.04
B	0.97	0.63
C	1.24	0.59
D	0.87	0.71
X	1.49	0.80
OIL Difference	**P-value**	**P-value**
A-B	0.0172	0.0133
A-C	0.8792	0.0008
A-D	<.0001	0.0007
A-X	0.0706	0.0173
B-C	0.1651	0.9963
B-D	0.8579	0.9612
B-X	0.0002	0.6228
C-D	0.0018	0.7044
C-X	0.0468	0.2286
D-X	<.0001	0.7457

FEI1: A, X > B, D

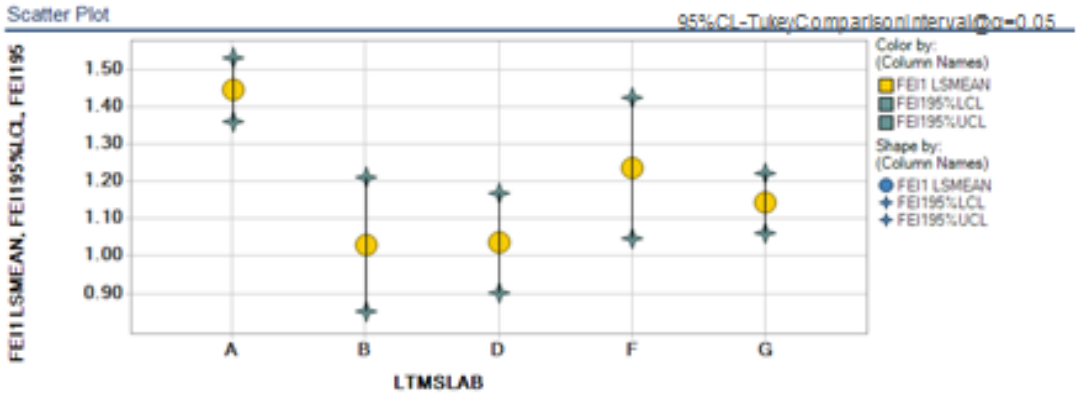
X > C > D

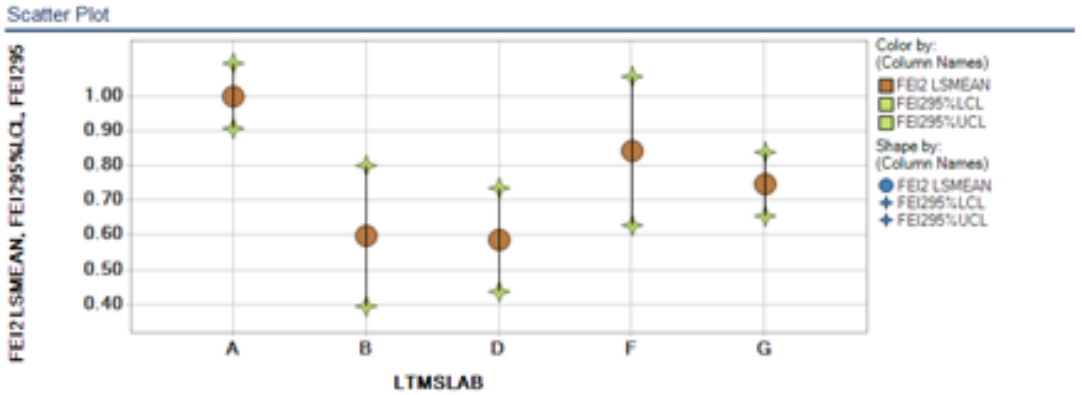
FEI2: A > B, C, D, X

Based on repeated oils data.

VID Precision Matrix

FEI LSMean by Lab



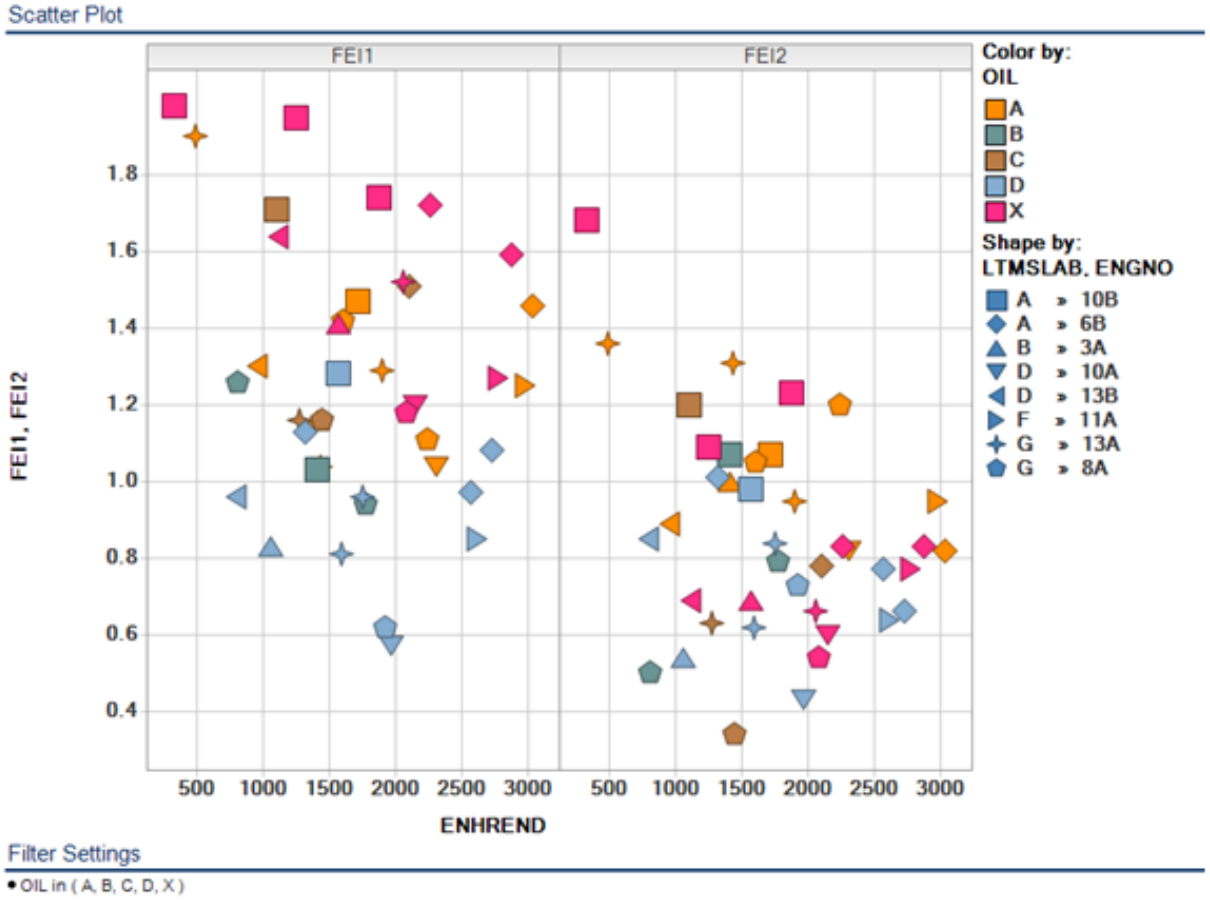


Lab A is significantly higher than labs B, D and G while lab F is not significantly different than the other labs.

Based on repeated oils data.

VID Precision Matrix

FEI by Engine Hours



VID Data and VIE Comparison

FEI1				FEI2			
VID Data		VIE Prove-Out		VID Data		VIE Prove-Out	
Oil	LS Mean	Oil	LSMean	Oil	LS Mean	Oil	LSMean
542blends	1.52	542blends	2.48	542blends	0.83	542blends	1.6
1010	1.34	1010	1.86	1010	1.07	1010	1.79
540	1.32			540	1.01		
		0W16T1	1.57			0W16T1	1.57
541blends	0.91	541-1	1.53	541blends	0.67	541-1	1.51
s	0.12	s	0.21	s	0.13	s	0.16

VID Data Oil Discrimination

FEI1: 542blends > 1010, 540 > 541blends

FEI2: 1010 > 540 > 542blends > 541blends

VIE Prove-Out Oil Discrimination

FEI1: 542blends > 1010 > 541-1
542blends > 0W16T1

FEI2: 1010 > 541-1, 542blends

VID FEI1

Combined Oils 542, 542-1, 542-2 and Oils 541, 541-1

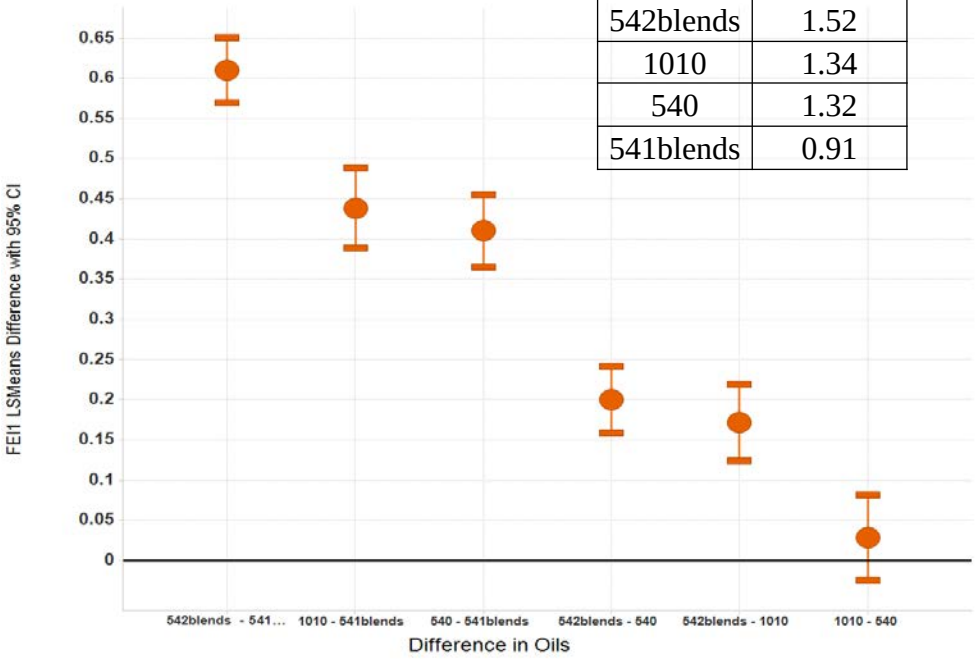
Model: s = 0.12

- Oils [542, 1010, 541, 540]
- Labs [A, B, C, D, F, G]
- Engine(Lab)

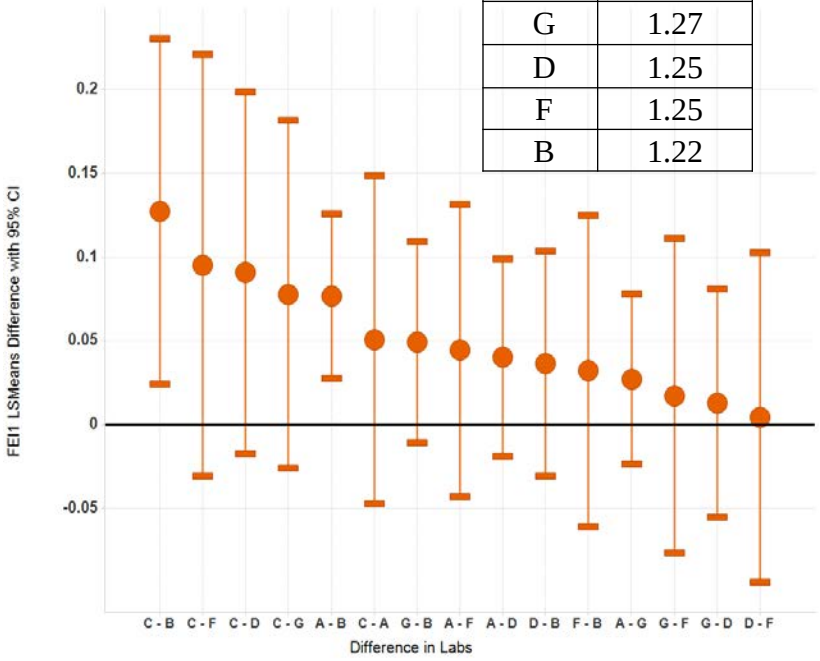
Conclusions (5% level of significance):

1. Oil: 542 > 1010, 540 > 541
2. Lab: C, A > B

Oil	LS Mean
542blends	1.52
1010	1.34
540	1.32
541blends	0.91



Lab	LS Mean
C	1.34
A	1.29
G	1.27
D	1.25
F	1.25
B	1.22



Oil/Lab Comparisons with intervals that do not include 0 are significantly different

VID FEI2

Combined Oils 542, 542-1, 542-2 and Oils 541, 541-1

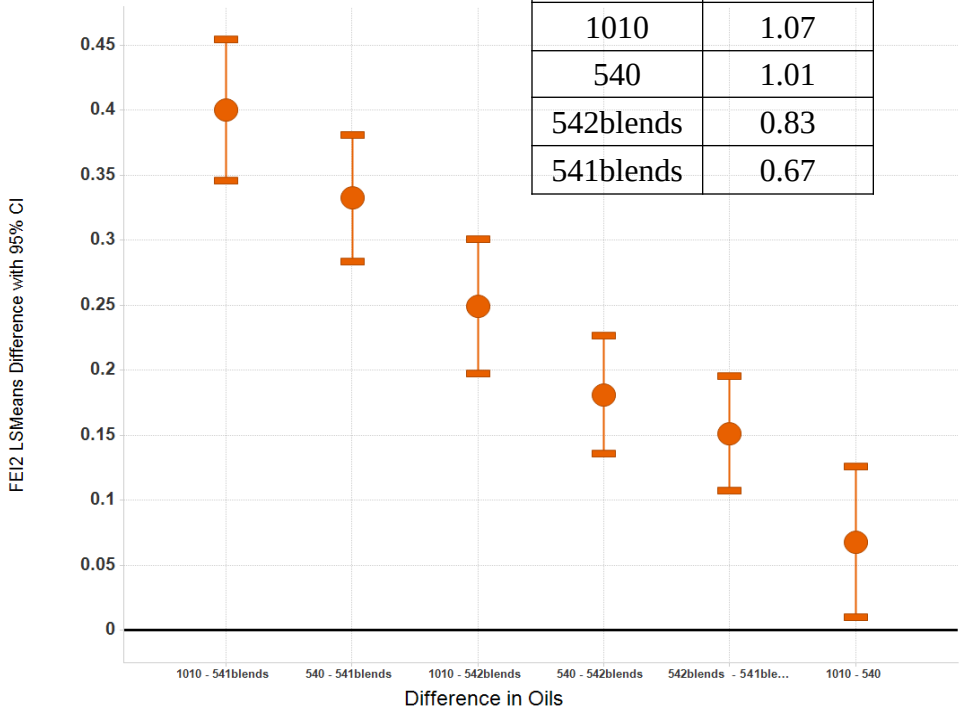
Model: s = 0.13

- Oils [542, 1010, 541, 540]
- Labs [A, B, C, D, F, G]
- Engine(Lab)

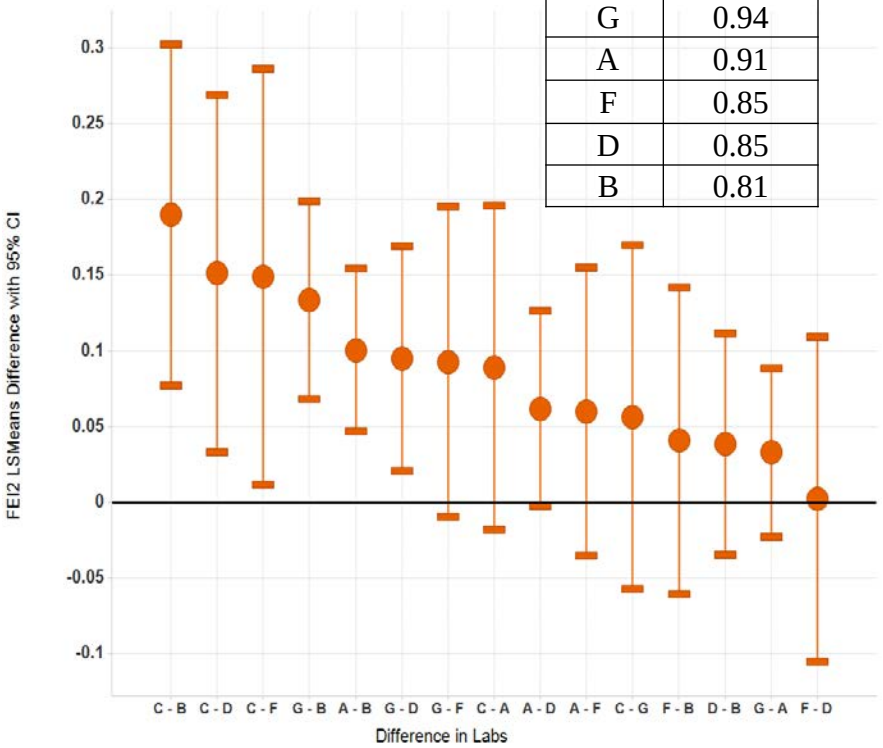
Conclusions (5% level of significance):

1. Oil: 1010 > 540 > 542 > 541
2. Lab: C > B, D, F; G, A > B; G > D

Oil	LS Mean
1010	1.07
540	1.01
542blends	0.83
541blends	0.67

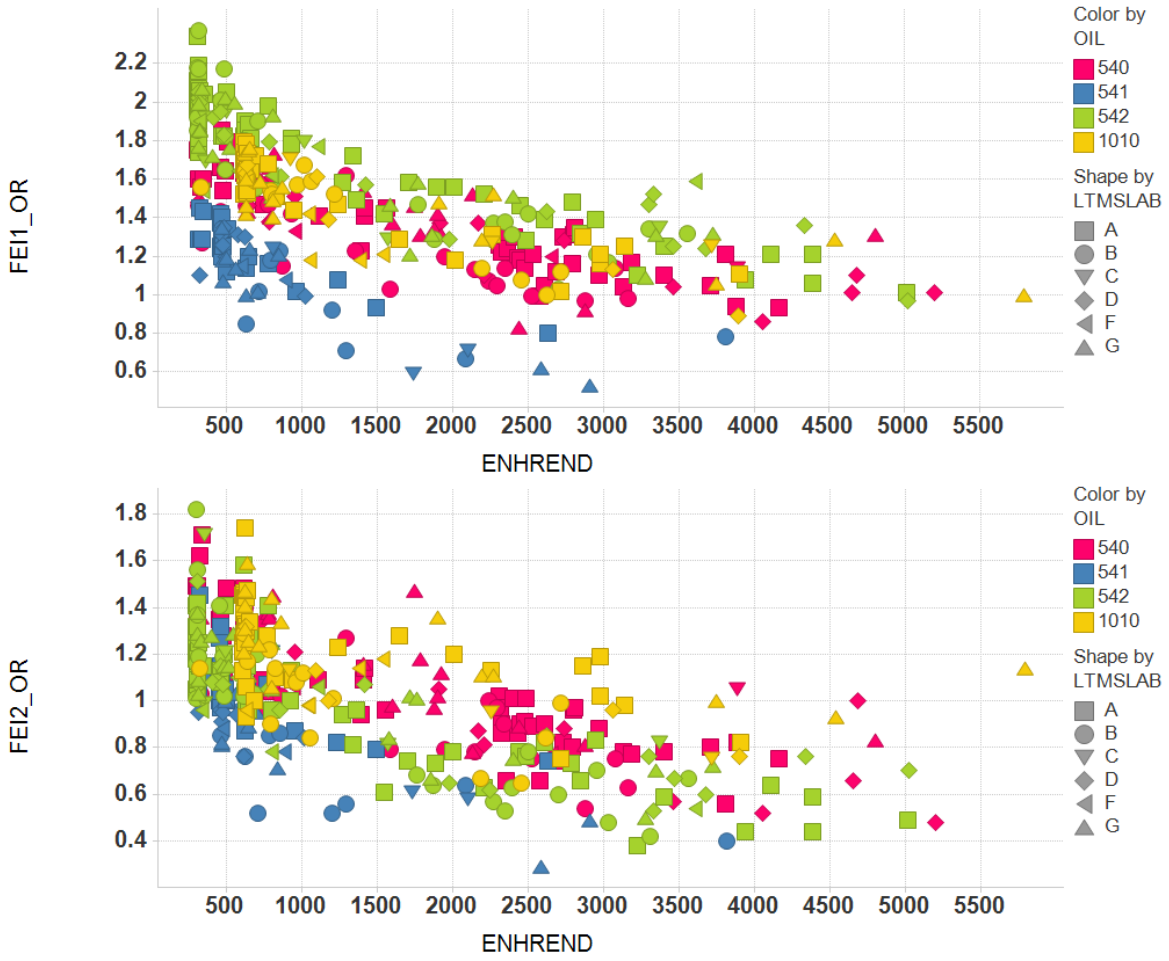


Lab	LS Mean
C	1.00
G	0.94
A	0.91
F	0.85
D	0.85
B	0.81

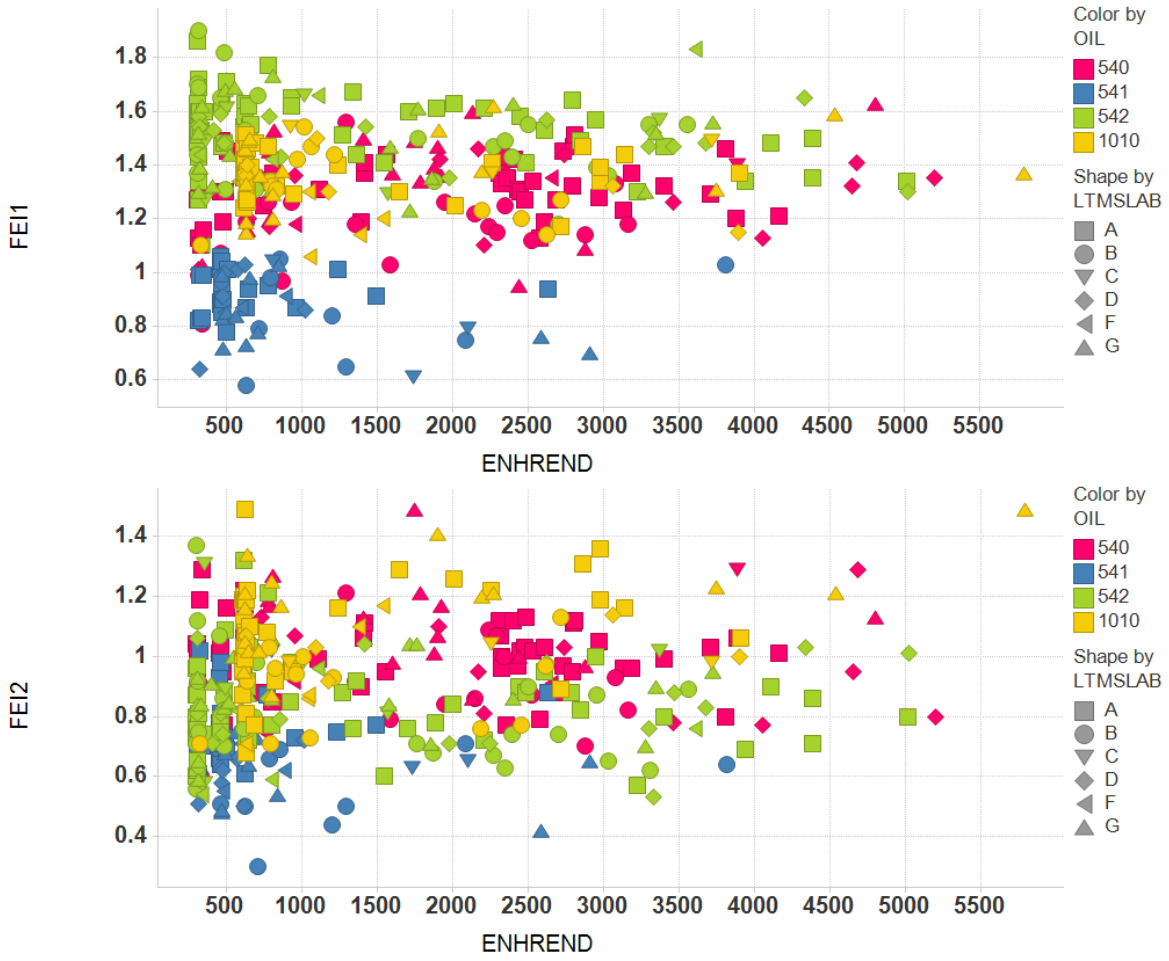


Oil/Lab Comparisons with intervals that do not include 0 are significantly different

VID FEI (Unadjusted) by Engine Hour



VID FEI (Adjusted) by Engine Hour



542-2 Targets

February 19, 2015

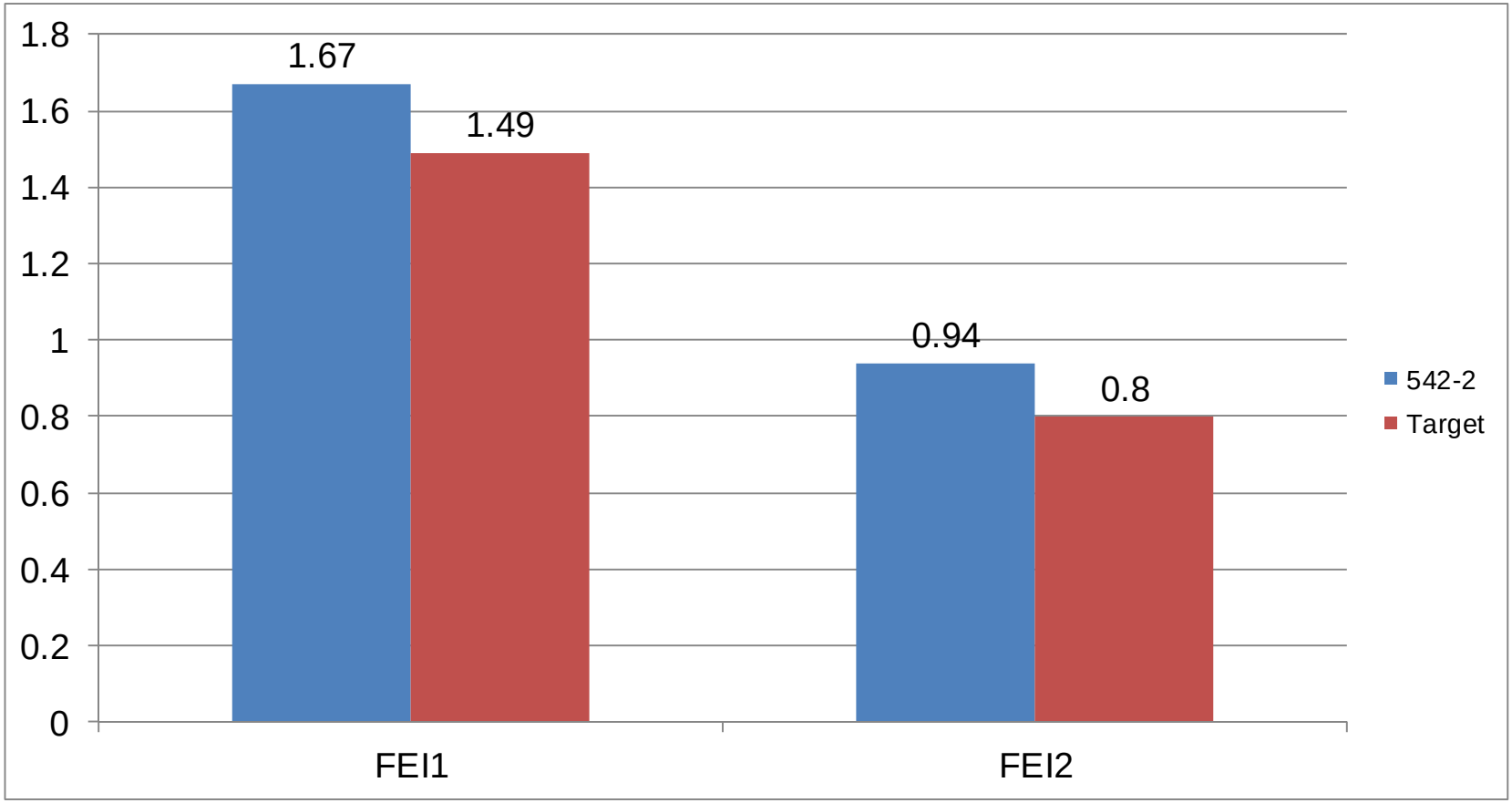
Results to Date

- 9 operationally valid results as of today
- 4 acceptable statistically
- 5 rejected statistically, Mild on FEI1 or FEI2 or Both
- 4 of Failing Results were on Engines that were abandoned
- Results to date summarized in the following slides

Results to Date

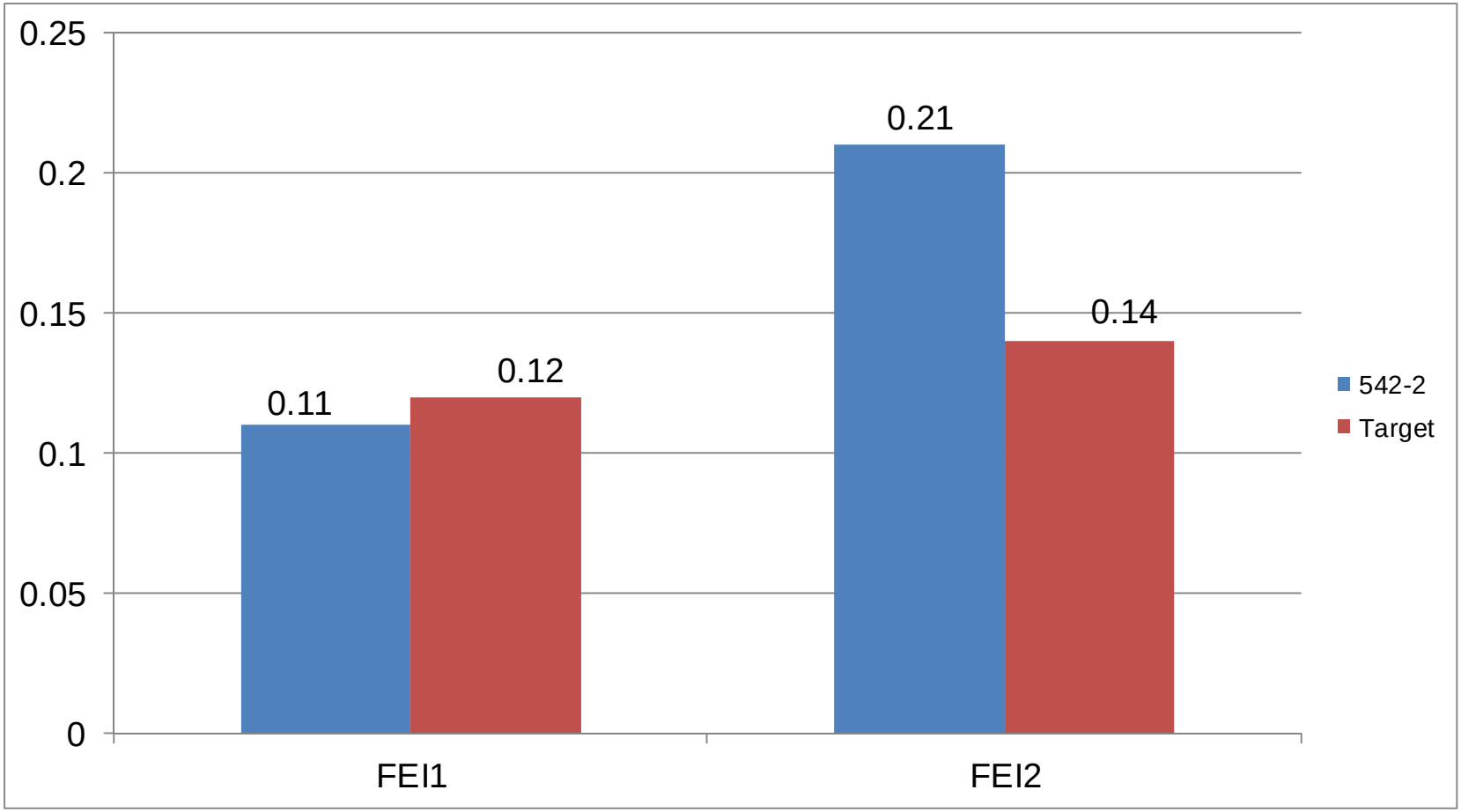
TESTKEY	LTMSAPP	LTMSLAB	IND	ENGNO	VAL	FEI1	FEI1yi	FEI2	FEI2yi	BLSFDT12	BLSFDT2A	ENHREND
105703-VID	2	G	542-2	84D	MC	1.74	2.0833	1.04	1.7143	0.05	0.31	363
105712-VID	2	B	542-2	84D	AC	1.63	1.1667	0.7	-0.7143	0.35	0.8	361
105715-VID	4	A	542-2	58D	AC	1.58	0.75	0.57	-1.6429	0.35	0.64	309
106082-VID	2	G	542-2	84D	MC	1.7	1.75	1.11	2.2143	-0.22	-0.58	847
106141-VID	1	D	542-2	88D	MC	1.84	2.9167	1.13	2.3571	0.22	0.13	630
106083-VID	2	G	542-2	84D	MC	1.78	2.4167	1.08	2	0.13	-0.47	1004
106452-VID	2	G	542-2	89D	OC	1.73	2	1.13	2.3571	0.28	0.41	314
106142-VID	1	D	542-2	92D	AC	1.58	0.75	0.77	-0.2143	0.3	0.77	311
105716-VID	1	A	542-2	85D	AC	1.49	0	0.9	0.7143	-0.17	0.24	339

Comparison of 542-2 Results with 542 Targets



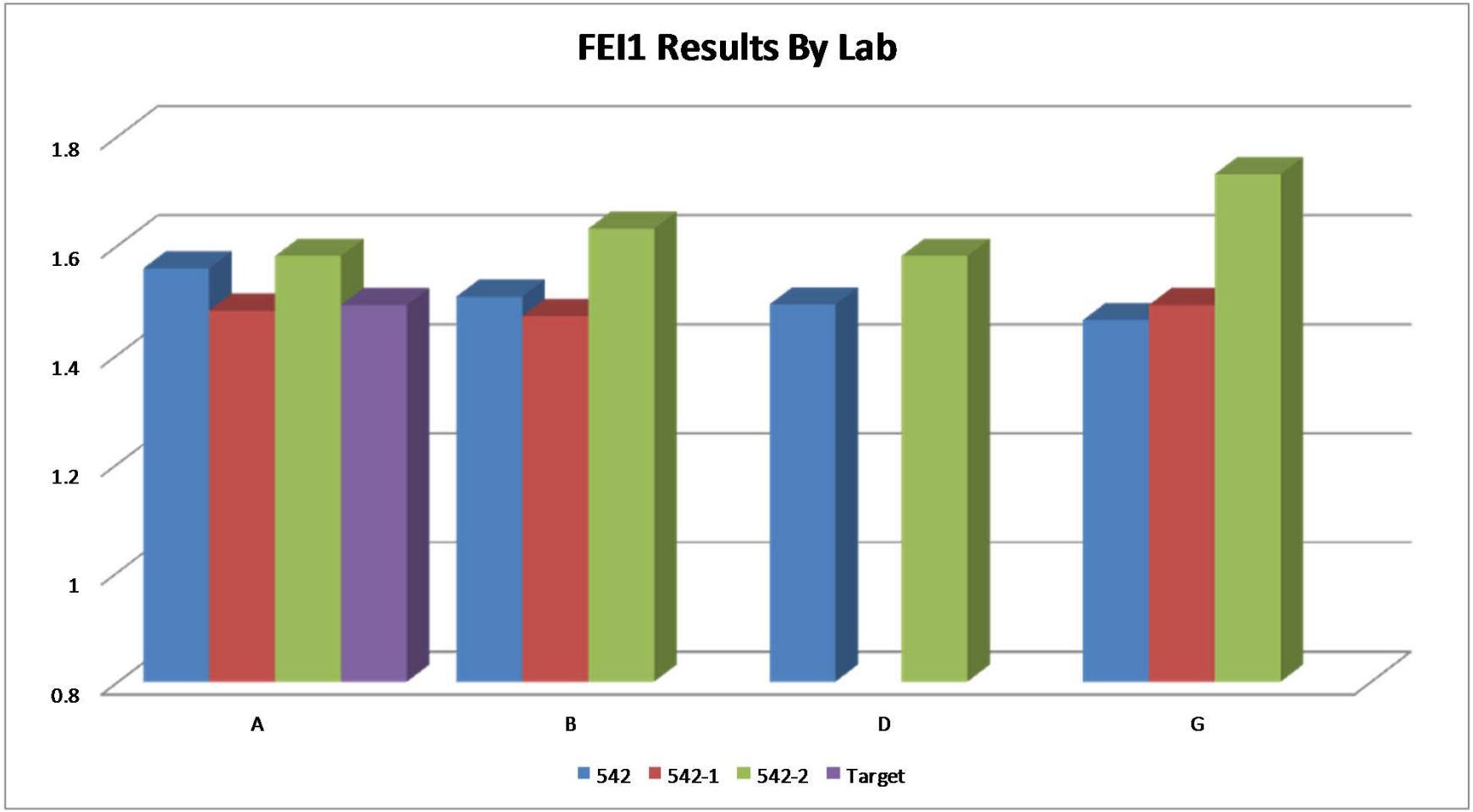
542-2 targets based on three tests

Comparison of 542-2 Results Standard Deviations with 542 Targets



542-2 targets based on three tests

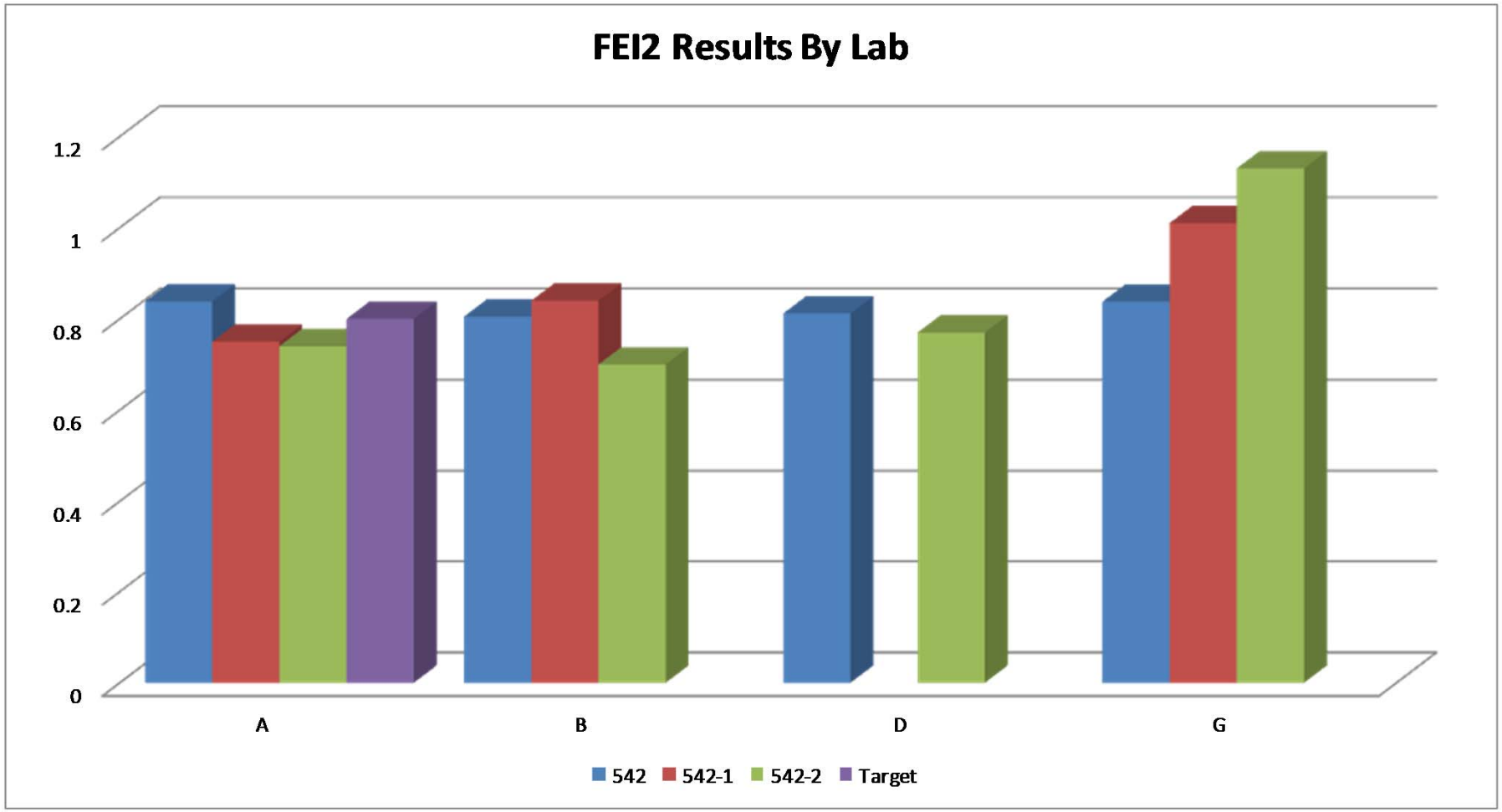
Comparison of 542-2 Results with Previous Blends



542-2 targets based on three tests

Test Monitoring Center
http://astmtmc.cmu.edu
A Program of ASTM International

Comparison of 542-2 Results with Previous Blends



542-2 targets based on four tests

Test Monitoring Center
http://astmtmc.cmu.edu
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Summary

- FEI1 is mild relative to the target, approximately 1 standard deviation milder, and has about the same level of variability as target, based on limited data.
- FEI2 is mild of target, with more variability, again based on limited data.
- 542 and 542-1 inventory depleted at TMC.
- Results to date have been on new engines.
- Two of those engines have been abandoned.

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