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Committee D02 on PETROLEUM PRODUCTS AND LUBRICANTS

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Staff Manager: DAVID R. BRADLEY, (610) 832-9681, EMail: dbradley@astm.org

Originally Issued: August 27, 2015

Reply to: Richard Grundza
ASTM Test Monitoring Center
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Email: reg@astmtmc.cmu.edu

Unapproved Minutes of the August 24, 2015 Joint
Sequence III Surveillance Panel/Sequence IIIH Task Force Meeting.

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The meeting was called to order by Chairman Glaenzer at 2:00 PM Eastern Time.

A list of attendees is included as attachment 1.

No agenda was issued for this meeting, as the primary purpose of this meeting was to review the operations of the IIIH Matrix tests to establish validity of the matrix tests by the IIIH Task Force and to allow the Sequence III Surveillance Panel to review the test results. There had been concerns expressed by members of the surveillance panel about the test results reported to date.

Karin Haumann, Chair of the IIIH Task Force reviewed the status of the tests reported to date.

Attachment 2 contains the results of operational reviews from the first round of testing while attachment 3 summarizes the results of operational reviews conducted on the second round of matrix tests. After some discussion, Ed Altman moved to accept the Task Force's recommendation to declare all the tests completed during first and second rounds of the matrix operationally valid, with the exception of Testkey's 106782 and 106784, which are pending further investigation. The task Force vote was 11/0/3. A listing of the task force voting members is included as attachment 4.

Test results reported thus far were analyzed by Jo Martinez. A copy of her presentation is included as attachment 5. Bruce Matthews noted one conclusion was there was no oil difference for PVIS and questioned whether this was a positive or negative comment. Jo indicated that it was a negative. Because of the variability and the limited data, oil differences are not as pronounced as hoped for. Karin also noted that 438-1 was chosen primarily because it was more severe on WPD than either 436 or 434-2, and WPD severity appears to be appropriate between the oils. Karin also suggested that there may be some difference between oil blends. Rich Grundza mentioned that the reblend of 438 had been used in the VIB test with little cause for concern and 434-2 does have some limited data in the IIIG test.

The Surveillance Panel was asked if any members had any concerns or questions and several members asked what the path forward would be. Karin indicated the Task Force would continue to review the operations and tests results of future matrix test and continue to establish validity as per the MOA and advise the surveillance panel as testing continues. The membership was asked and agreed that matrix testing should continue through the next round. The status of the two tests which the Task Force had questions about was discussed and it was agreed that the laboratory in question would not start additional test until there was a satisfactory resolution to the Task Force's concern's about those tests operations.

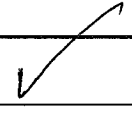

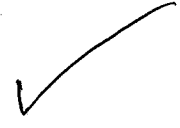
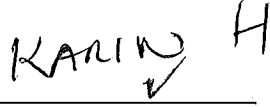
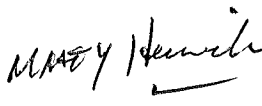
Sid Clark brought up some new business regarding the removal of an oil plug during IIIH engine assembly and it was decided to address that procedure change via eballot.





The next meeting(s) of the Task Force and Surveillance Panel will be at the call of the chair(s).



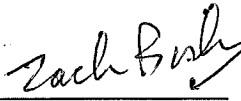


The meeting was adjourned at 3:05 PM.

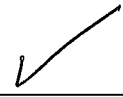


TELECONFERENCE
ASTM Sequence III Surveillance Panel (22 Voting members)



August 24, 2015 14:00 EDT
date:

Name/Address	Phone/Fax/Email		Signature
Ed Altman Afton Chemical Corporation 500 Spring Street Richmond, VA 23219 USA	804-788-5279 804-788-6358 ed.altman@aftonchemical.com	Voting Member	Present 
Jeff Betz Chrysler Mopar Parts USA	jeff.betz@fcagroup.com	Voting Member	Present _____
Jason Bowden OH Technologies, Inc. 9300 Progress Parkway P.O. Box 5039 Mentor, OH 44061-5039 USA	440-354-7007 440-354-7080 jhbowden@ohtech.com	Voting Member	Present 
Timothy L. Caudill Ashland Oil Inc. 22 nd & Front Streets Ashland, KY 41101 USA	606-329-1960 x5708 606-329-2044 tlcaudill@ashland.com	Voting Member	Present _____
Richard Grundza ASTM Test Monitoring Center 6555 Penn Avenue Pittsburgh, PA 15206 USA	412-365-1031 412-365-1047 reg@astmtmc.cmu.edu	Voting Member	Present 
Jeff Hsu, PE Shell Technology Center 3333 Hwy. 6 South, Mail Drop L107C Houston, TX 77082	j.hsu@shell.com	Voting Member	Present 
Tracey King Haltermann Solutions MI USA	947-517-4107 tking@Jhaltermann.com	Voting Member	Present _____
Teri Kowalski Toyota Motor North America, Inc. 1555 Woodridge Ann Arbor, MI 48105 USA	734-995-4032 734-995-9049 teri.kowalski@tema.toyota.com	Voting Member	Present _____
Patrick Lang	210-522-2820	Voting Member	Present 

Name/Address	Phone/Fax/Email		Signature
Southwest Research Institute 6220 Culebra Road P.O. Box 28510 San Antonio, TX 78228 USA	210-684-7523 plang@swri.edu		
Charlie Leverett Intertek Automotive Research 5404 Bandera Road San Antonio, TX 78238 USA	210-647-9422 210-523-4607 charlie.leverett@intertek.com	Voting Member Present	Represented by Addisen N Schweitzer
Bruce Matthews GM Powertrain Mail Code 483-730-472 823 Jocyn Avenue Pontiac, MI 48340 USA	248-830-9197 248-857-4441 bruce.matthews@gm.com Test Sponsor Representative	Voting Member Present	
David Tsui BP Castrol Lubricants USA 1500 Valley Road Wayne, NJ 07470 USA	973-305-2337 David.Tsui@bp.com	Voting Member Present	
Mark Mosher ExxonMobil Technology Co. Billingsport Road Paulsboro, NJ 08066 USA	856-224-2132 856-224-3628 mark.r.mosher@exxonmobil.com	Voting Member Present	
Andrew Ritchie Infineum 1900 East Linden Avenue P.O. Box 735 Linden, NJ 07036 USA	908-474-2097 908-474-3637 Andrew.Ritchie@Infineum.com	Voting Member Present	G Fawcett
Ron Romano Ford Motor Company Diagnostic Service Center II Room 410. 1800 Fairlane Drive	313-845-4068 313-32-38042 rromano@ford.com	Voting Member Present	


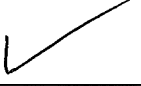
Name/Address	Phone/Fax/Email		Signature
Allen Park, MI 48101 USA	301-790-5817 greg.shank@volvo.com	Voting Member	Present _____
Kaustav Sinha, Ph.D. Chevron Oronite Co., LLC 4800 Fournace Place Bellaire, TX 77401 USA	713-432-6642 713-432-3330 LFNQ@chevron.com	Voting Member	Present  _____
Thomas Smith Valvoline P.O. Box 14000 Lexington, KY 40512-1400 USA	859-357-2766 859-357-7084 trsmith@ashland.com PCEOCP Chair	Voting Member	Present  _____
Scott Stap Chevrolet Performance	scott.stap@tgidirect.com	Voting Member	Present _____
Mark Sutherland Test Engineering, Inc. 12718 Cimarron Path San Antonio, TX 78249-3423 USA	210-867-8357 mrsutherland@tei-net.com	Voting Member	Present  _____
George Szappanos The Lubrizol Corporation 29400 Lakeland Boulevard Wickliffe, OH 44092 USA	440-347-2352 440-347-4096 greg.seman@lubrizol.com	Voting Member	Present  _____
Haiying Tang Chrysler LLC	248-512-0593 ht146@chrysler.com	Voting Member	Present  _____

Name/Address	Phone/Fax/Email		Signature
Ricardo Affinito Chevron Oronite Co. LLC	<u>affinito@chevron.com</u>	Non-Voting Member	Present _____
Art Andrews ExxonMobil Products Research 600 Billingsport Rd. Paulsboro, NJ 08066 USA	856-224-3013 <u>arthur.t.andrews@exxonmobil.com</u>	Non-Voting Member	Present _____
Zack Bishop Test Engineering, Inc. 12718 Cimarron Path San Antonio, TX 78249-3423 USA	210-877-0223 210-690-1959 <u>zbishop@tei-net.com</u>	Non-Voting Member	Present  _____
Doyle Boese Infineum 1900 E. Linden Avenue Linden, NJ 07036 USA	908-474-3176 908-474-3637 <u>doyle.boese@infineum.com</u>	Non-Voting Member	Present  _____
Adam Bowden OH Technologies, Inc. 9300 Progress Parkway P.O. Box 5039 Mentor, OH 44061-5039 USA	440-354-7007 440-354-7080 <u>adbowden@ohtech.com</u>	Non-Voting Member	Present _____
Dwight H. Bowden OH Technologies, Inc. 9300 Progress Parkway P.O. Box 5039 Mentor, OH 44061-5039 USA	440-354-7007 440-354-7080 <u>dhbowden@ohtech.com</u>	Non-Voting Member	Present _____
Matt Bowden OH Technologies, Inc. 9300 Progress Parkway	440-354-7007 440-354-7080 <u>mjbowden@ohtech.com</u>	Non-Voting Member	Present  _____

Name/Address	Phone/Fax/Email		Signature
P.O. Box 5039 Mentor, OH 44061-5039 USA		Non-Voting Member	Present _____
Jerome A. Brys Lubrizol Corp. 29400 Lakeland Blvd. Wickliffe, Ohio 44092 USA	440 347-2631 jerome.brys@lubrizol.com	Non-Voting Member	Present _____
Bill Buscher III Southwest Research Institute 6220 Culebra Road P.O. Box 28510 San Antonio, TX 78228 USA	210-522-6802 210-684-7523 william.buscher@swri.org	Non-Voting Member	Present _____
Bob Campbell Afton Chemical Corporation 500 Spring Street Richmond, VA 23219 USA	804-788-5340 804-788-6358 bob.campbell@aftonchemical.com	Non-Voting Member	Present _____
Chris Castanien	Chris.Castanien@gmail.com	Non-Voting Member	Present  _____
Martin Chadwick Intertek Automotive Research 5404 Bandera Road San Antonio, TX 78238 USA	210-706-1543 210-684-6074 martin.chadwick@intertek.com	Non-Voting Member	Present _____
Jeff Clark ASTM Test Monitoring Center 6555 Penn Avenue Pittsburgh, PA 15206 USA	412-365-1032 412-365-1047 jac@atc-erc.org Sequence III Secretary	Non-Voting Member	Present _____
Sid Clark Southwest Research 50481 Peggy Lane Chesterfield, MI 48047 USA	586-873-1255 sidney.l.clark@swri.org	Non-Voting Member	Present  _____
J. Michael Conrad, II The Lubrizol Corporation	440-347-4594 440-347-4096	Non-Voting Member	Present _____

ASTM Sequence III Surveillance Panel (22 Voting members)

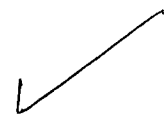


date:

Name/Address	Phone/Fax/Email	Non-Voting Member	Signature
29400 Lakeland Boulevard Wickliffe, OH 44902-2298 USA	Michael.conrad@lubrizol.com		
Todd Dvorak Afton Chemical Corporation P.O. Box 2158 Richmond, VA 23218-2158 USA	804-788- 6367 804-788- 6388 todd.dvorak@aftonchemical.com	Non-Voting Member	Present 
Frank Farber ASTM Test Monitoring Center 6555 Penn Avenue Pittsburgh, PA 15206 USA	412-365-1030 412-365-1047 fmf@astmtmc.cmu.edu	Non-Voting Member	Present 
Gordon R. Farnsworth Infineum RR # 5 Box 211 Montrose, PA 18801 USA	570-934-2776 570-934-0141 gordon.farnsworth@infineum.com	Non-Voting Member	Present 
Joe Franklin Intertek Automotive Research 5404 Bandera Road San Antonio, TX 78238 USA	210-523-4671 210-523-4607 joe.franklin@intertek.com	Non-Voting Member	Present _____
David L. Glaenzer Afton Chemical Corporation 500 Spring Street P.O. Box 2158 Richmond, VA 23218-2158 USA	804-788-5214 804-788-6358 dave.glaenzer@aftonchemical.com Surveillance Panel Chairman	Non-Voting Member	Present 
Karin E. Haumann Southwest Research Institute Fuels & Lubricants Res. Div.	210-522-6351 210-522-6858 karin.haumann@swri.org	Non-Voting Member	Present 
Walter Lerche GM M/C 482-A30-C71 100 Renaissance Center Detroit, MI 48265 USA	313-667-1918 313-667-4095 walt.lerche@gm.com	Non-Voting Member	Present _____

Name/Address	Phone/Fax/Email		Signature
Josephine G. Martinez Chevron Oronite Company LLC 100 Chevron Way Richmond, CA 94802 USA	510-242-5563 510-242-3173 jogm@chevrontexaco.com	Non-Voting Member	Present _____ ✓
Mike McMillan	mmcmillan123@comcast.net	Non-Voting Member	Present _____
Bob Olree 5388 Hill 23 Drive Flint, MI 48507 USA	248-689-3078 olree@netzero.net	Non-Voting Member	Present _____
Kevin O'Malley Lubrizol Corp.	kevin.omalley@lubrizol.com	Non-Voting Member	Present _____
Christian Porter Afton Chemical Corp. 500 Spring Street Richmond, VA 23219 USA	804-788-5837 804-788-6358 christian.porter@aftonchemical.com	Non-Voting Member	Present _____
Phil Rabbat BASF Corporation 500 White Plains Road Tarrytown, NY 10591-9005 USA	914-785-2217 914-785-3681 phil.rabbat@basf.com	Non-Voting Member	Present _____
Allison Rajakumar The Lubrizol Corporation Drop 152A 29400 Lakeland Blvd. Wickliffe, OH 44092 USA	440-347-4679 440-347-2014 Allison.Rajakumar@Lubrizol.com	Non-Voting Member	Present _____
Scott Rajala Idemitsu Lubricants America Corp.	srajala@ilacorp.com	Non-Voting Member	Present _____
Jim Rutherford Chevron Oronite Company LLC 100 Chevron Way	510-242-3410 510-242-3173 jaru@chevrontexaco.com	Non-Voting Member	Present _____

ASTM Sequence III Surveillance Panel (22 Voting members)

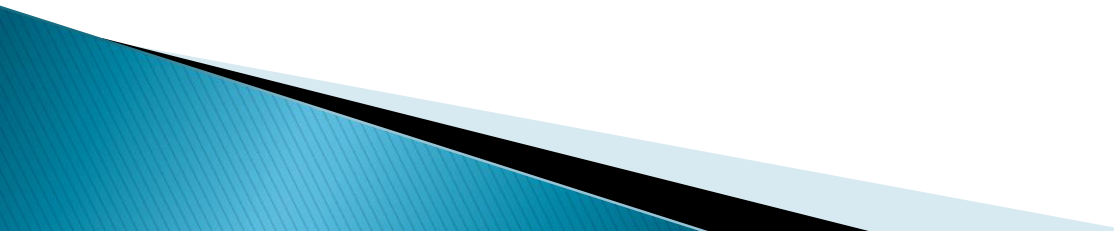
date:

Name/Address	Phone/Fax/Email		Signature
Richmond, CA 94802 USA			
Amol Savant Ashland Engine Lab 121 22 nd St. Ashland, KY 41101 USA	606-320-1960 x5604 acsavant@ashland.com	Non-Voting Member	Present 
Addison Schweitzer Intertek AR		Non-Voting Member	Present 
Philip R. Scinto The Lubrizol Corporation 29400 Lakeland Boulevard Wickliffe, OH 44092 USA	440-347-2161 440-347-9031 prs@lubrizol.com	Non-Voting Member	Present _____
Don Smolenski GM	248-255-7892 donald.j.smolenski@gm.com	Non-Voting Member	Present _____
Ben O. Weber Consultant 9902 Cominsky Park San Antonio, TX 78250 USA	210-241-5313 bweber1@satx.rr.com Sub-Committee D02.B01 Chair	Non-Voting Member	Present _____
Tom Wingfield Chevron Phillips Chemical Co. USA	wingftm@cpchem.com	Non-Voting Member	Present _____

IIH PM Op Data Review

First Round of IIH PM Tests

Overview

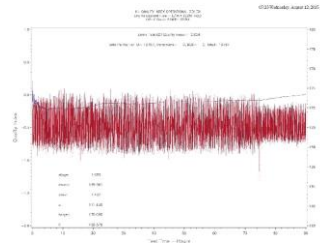
- ▶ The IIIH Task Force has Performed a Preliminary Review of the Following:
 - Controlled Parameters
 - QI's
 - Non-controlled Parameters
 - ▶ Anomalies were identified and investigated to determine potential effects on validity
- 

Controlled Parameters

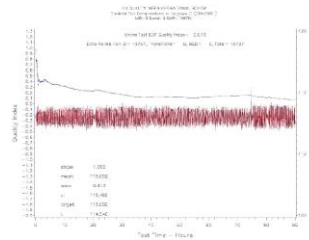
- ▶ **Controlled Parameters Identified:**
 - Coolant Flow – CMIR 106764
 - Coolant Out Temperature – CMIR 106764
 - Fuel Temperature – CMIR 106763
 - IAP – CMIR 106788
 - IAP – CMIR 106763
 - IAP – CMIR 106764
 - IAP – CMIR 106774

Coolant Flow and Coolant Out

- ▶ Coolant Flow – CMIR 106764



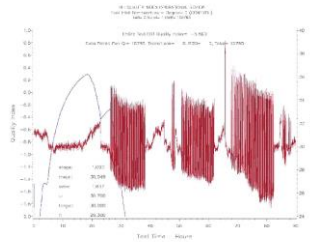
- ▶ Coolant Out – CMIR 106764



Both QIs were positive, but investigated due to relatively low values. Additional tuning has subsequently improved control.

Fuel Temperature

- ▶ Fuel Temp – CMIR 106763

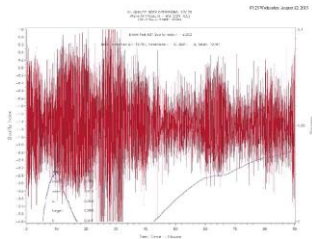


Increased ambient temperatures made fuel temp control more difficult. The fuel temperature control circuit was modified and this issue was resolved following this test.

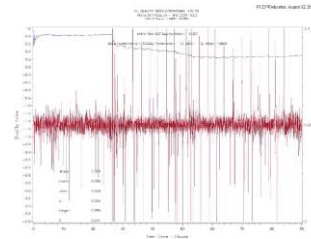
The fuel temperature fluctuations experienced during this test should not affect the test validity.

Inlet Air Pressure

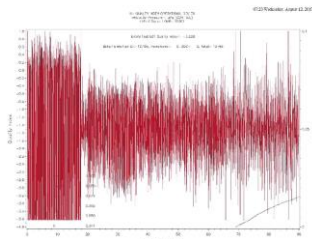
▶ IAP – CMIR 106764



▶ IAP – CMIR 106788



▶ IAP – CMIR 106763



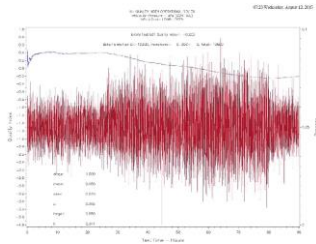
A combination of using the stock air filter and running the intake air on a mainline system that supplies other stands has led to difficulty in control.

Alternative air filtration is being installed.

Pressure is controlled to nearly zero (0.05 kPa), and while control band was wide, the pressure was always positive.

Inlet Air Pressure

- ▶ IAP – CMIR 106774

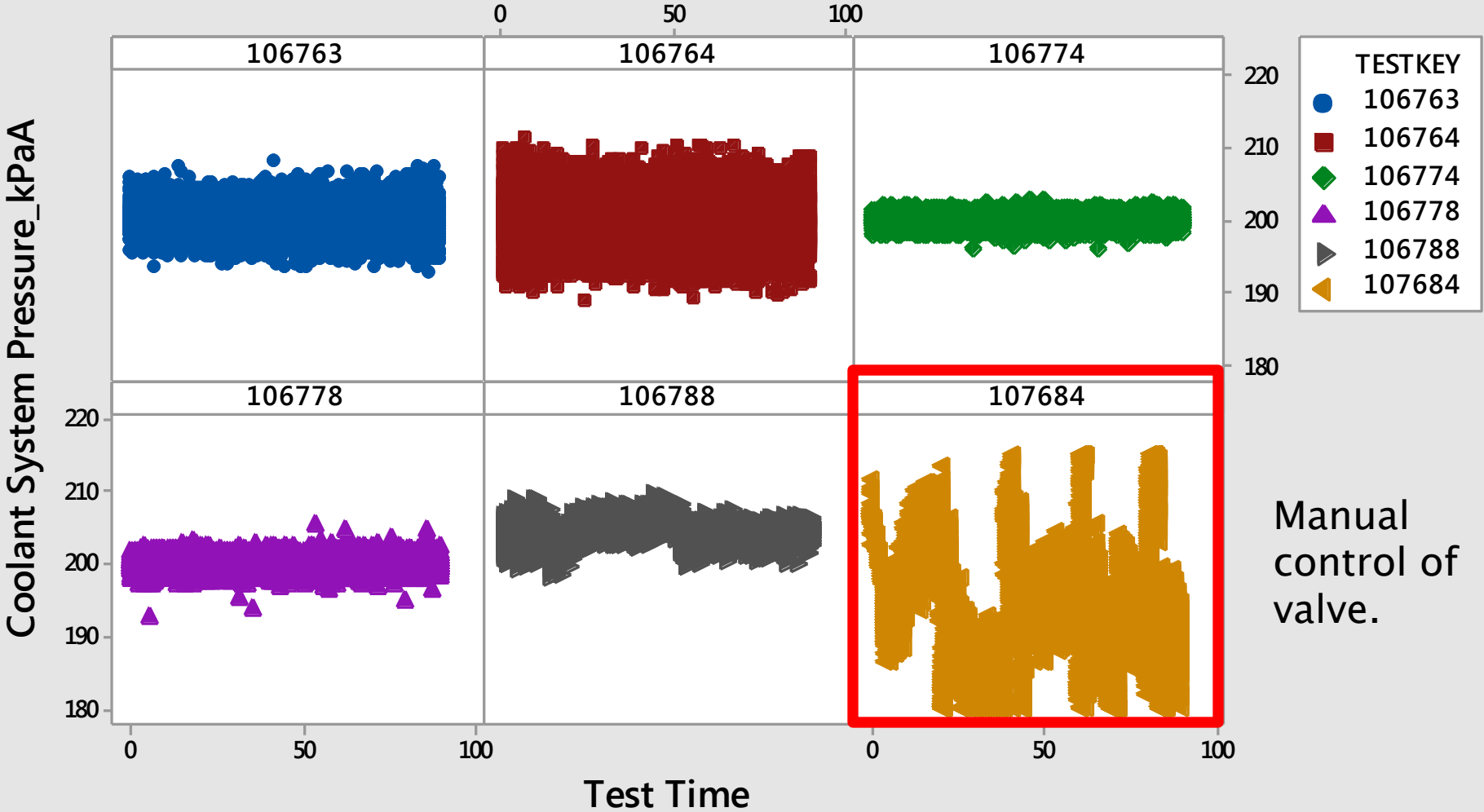


The actuator for the air control flapper needed adjustment. The actuator was replaced to correct the problem. The air pressure was continuously positive, and should not have effected the test negatively.

Non-controlled Parameters

- ▶ **Non-Controlled Parameters Identified:**
 - Coolant Tank Pressure – CMIR 107684
 - Right AFR – CMIR 107684
 - Oil Pump Temperature – CMIR 107684
 - MAP – CMIR 107684
 - Fuel Flow – CMIR 107684
 - Oil Sump Temperature – CMIR 106764
 - Left Exhaust Temperature – CMIR – 106764
 - MAP – CMIR 106764

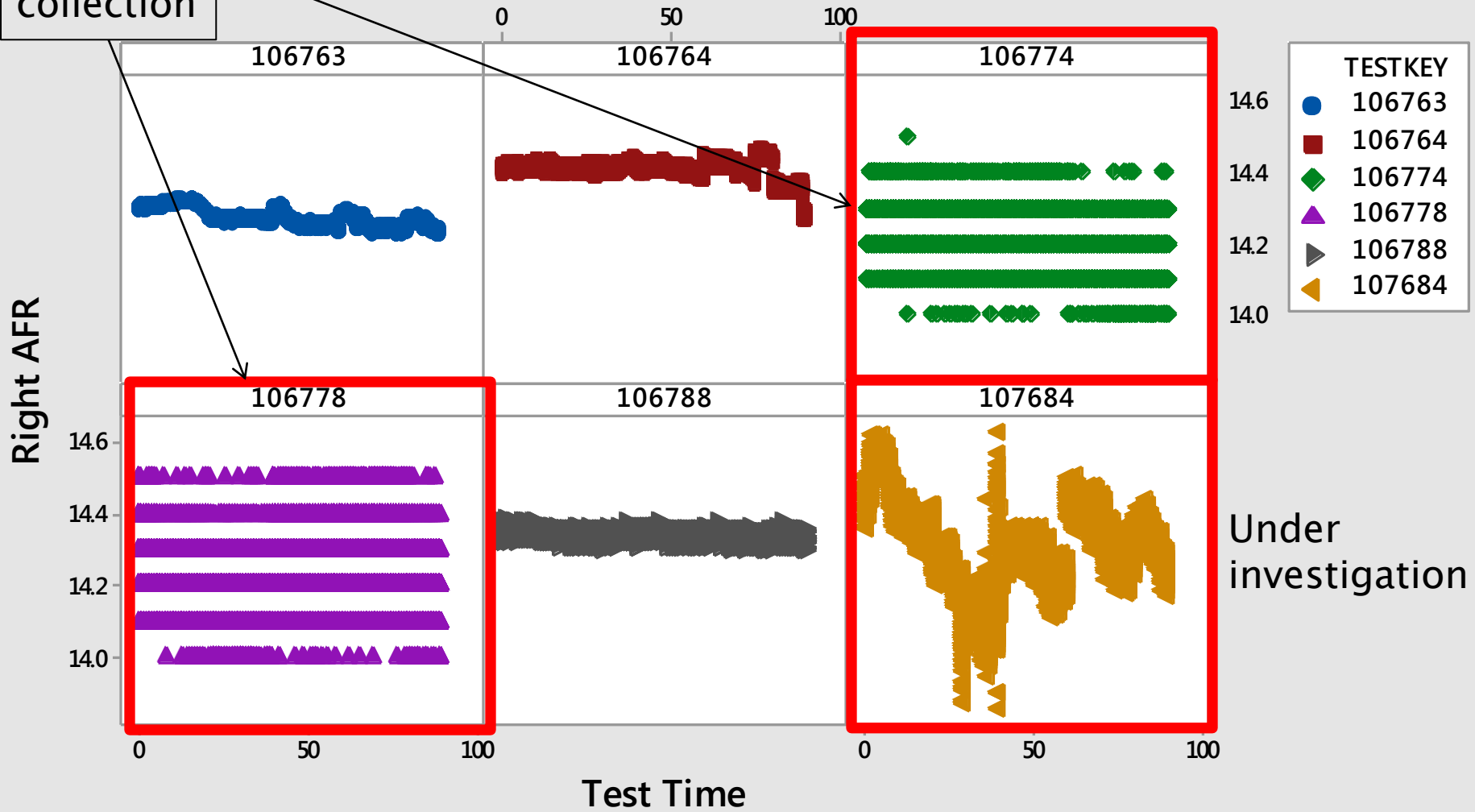
Scatterplot of Coolant System Pressure_kPaA vs Test Time



Panel variable: TESTKEY

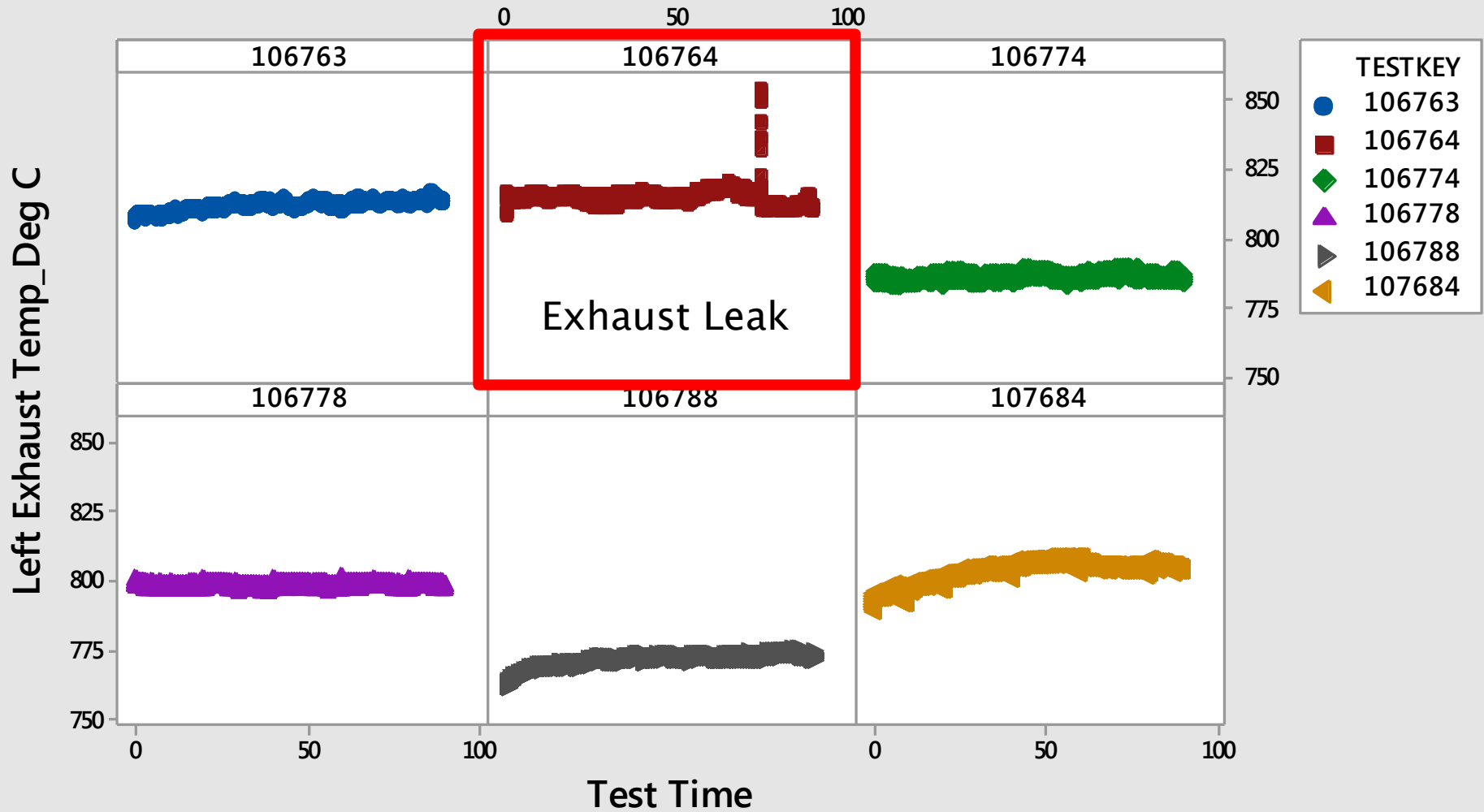
Scatterplot of Right AFR vs Test Time

Precision of data collection



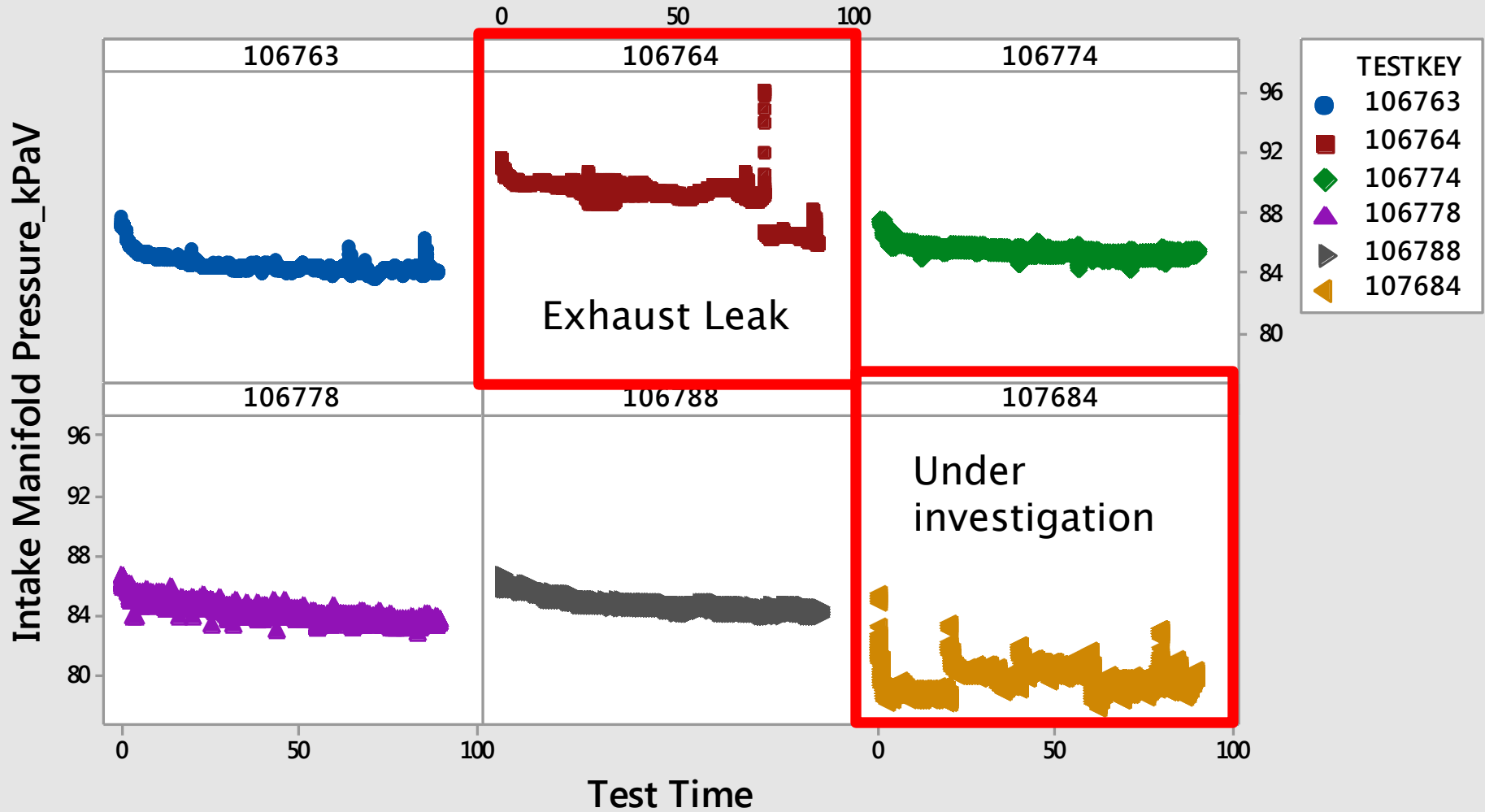
Panel variable: TESTKEY

Scatterplot of Left Exhaust Temp_Deg C vs Test Time



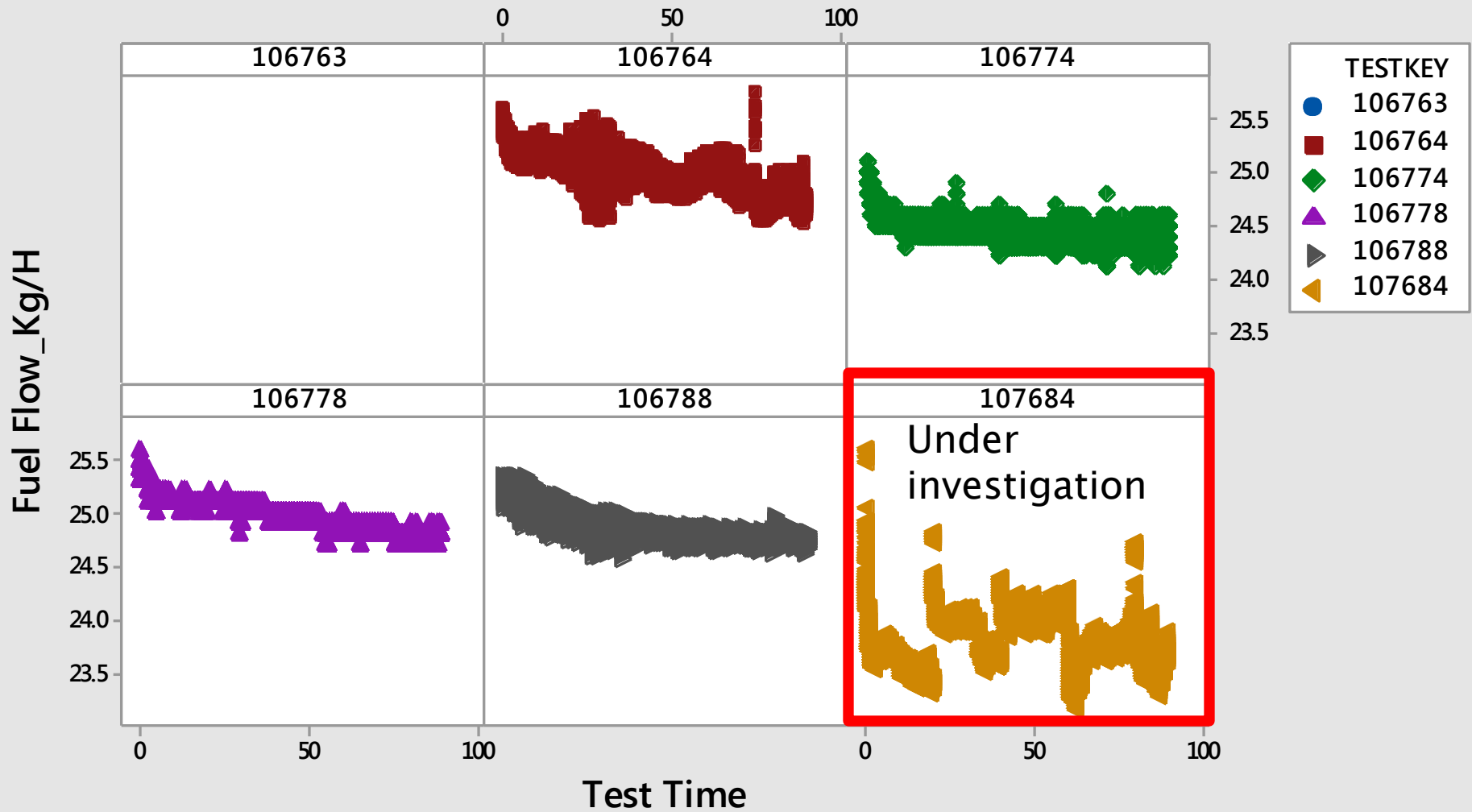
Panel variable: TESTKEY

Scatterplot of Intake Manifold Pressure_kPaV vs Test Time



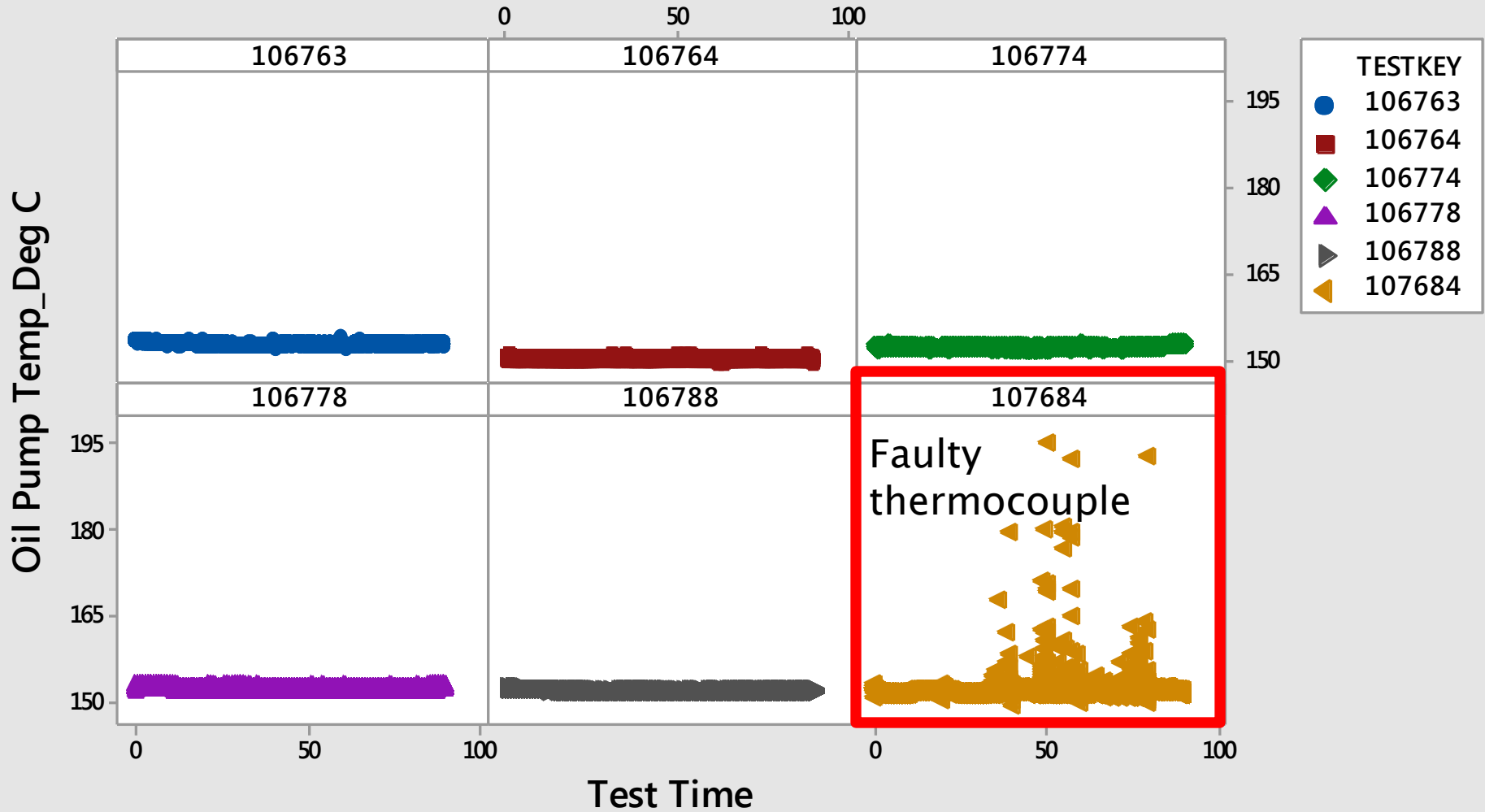
Panel variable: TESTKEY

Scatterplot of Fuel Flow_Kg/H vs Test Time



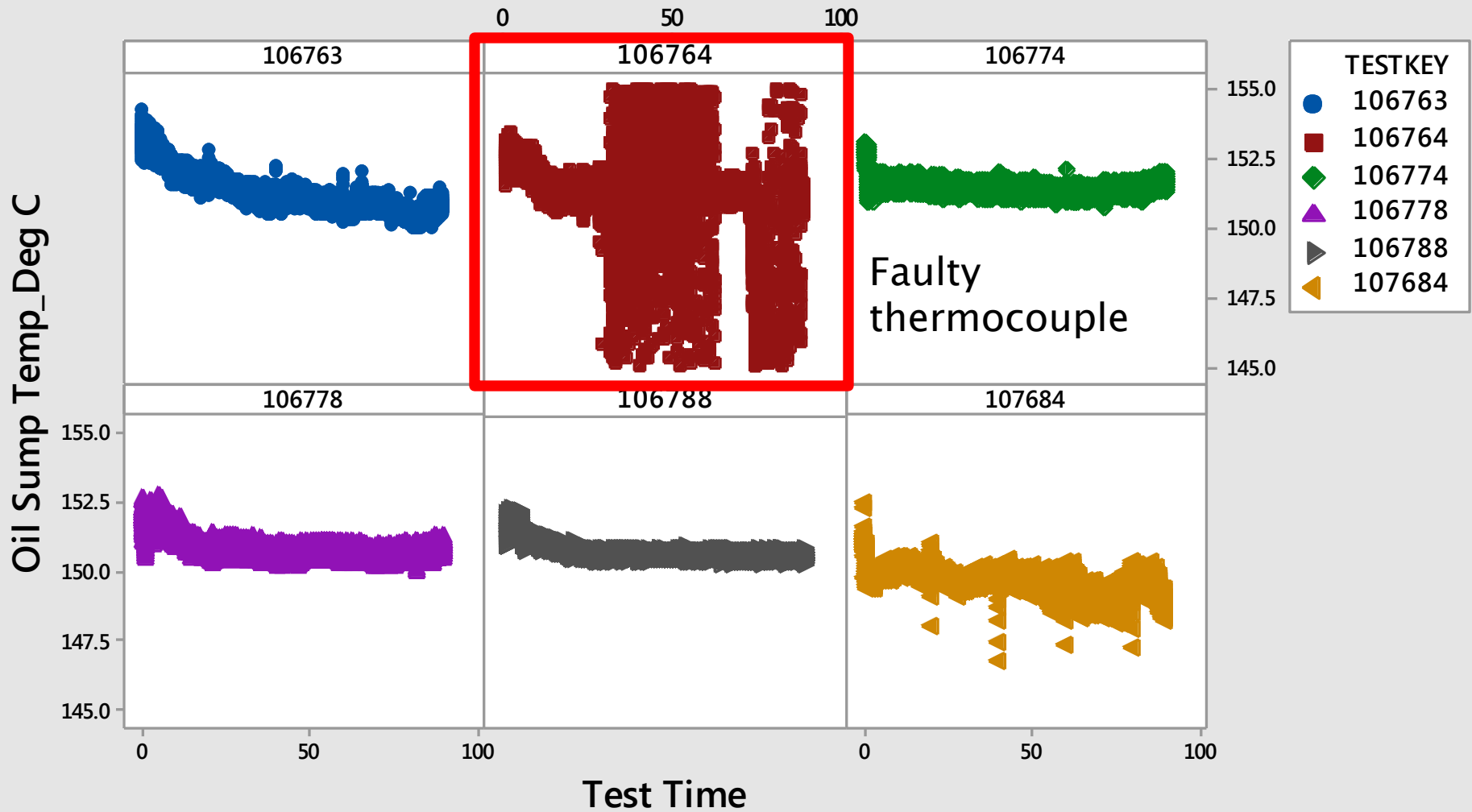
Panel variable: TESTKEY

Scatterplot of Oil Pump Temp_Deg C vs Test Time



Panel variable: TESTKEY

Scatterplot of Oil Sump Temp_Deg C vs Test Time



Panel variable: TESTKEY

Conclusion

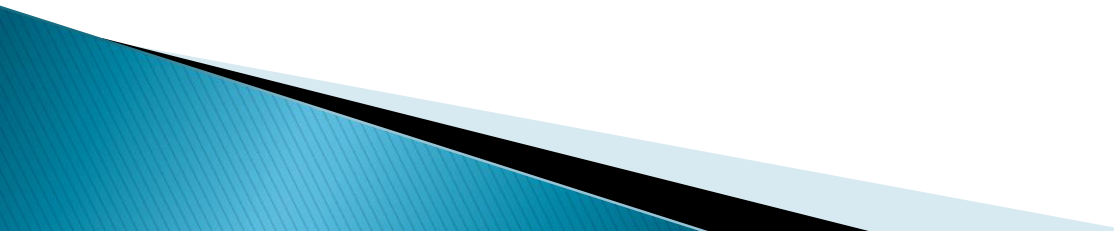
The labs recommend to the Task Force that all tests be considered valid with the exception of CMIR 107684 which is pending investigation of MAP and fuel flow differences.

Upon completion of investigating the validity of CMIR 107684 will be reconsidered.

IIIH PM Op Data Review

Second Round of IIH PM Tests

Overview

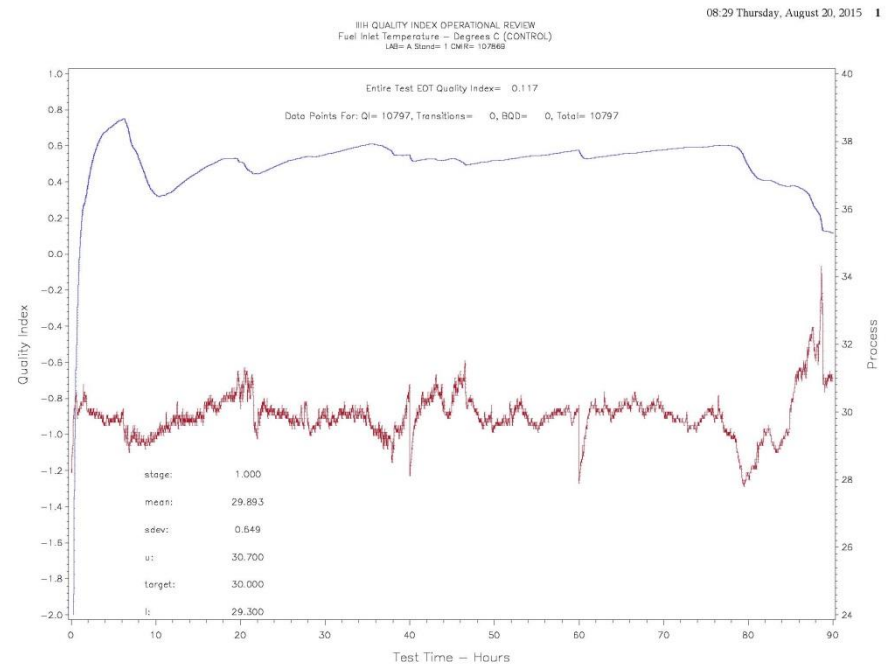
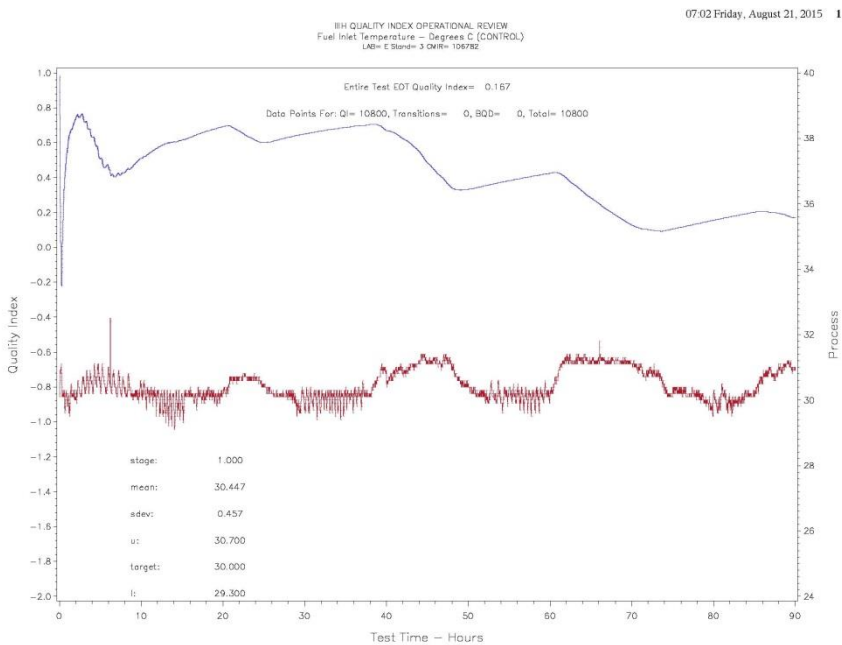
- ▶ The IIIH Task Force has Performed a Preliminary Review of the Following:
 - Controlled Parameters
 - QI's
 - Non-controlled Parameters
 - ▶ Anomalies were identified and investigated to determine potential effects on validity
- 

Controlled Parameters

- ▶ **Controlled Parameters Identified:**
 - Fuel Temperature – CMIR 106782 and 107869
 - Intake Air Pressure – CMIR 106767, 107869 and 107873

Fuel Temperature

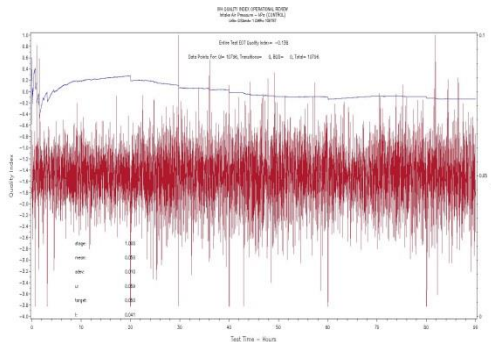
- ▶ CMIR 106782 and 107869



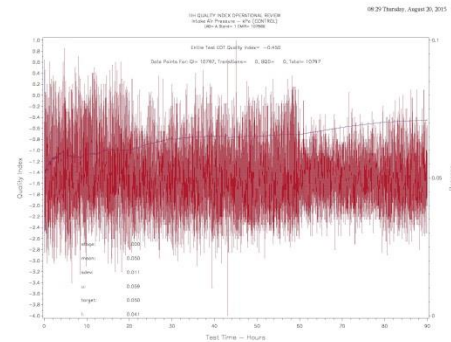
Both QIs were positive, but investigated due to relatively low values (0.117 and 0.167). Lab has redesigned fuel coolant circuit.

Inlet Air Pressure

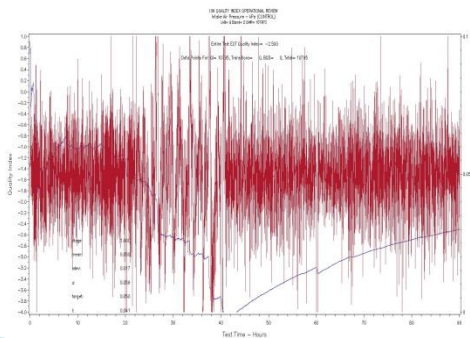
▶ IAP - CMIR 106767



▶ IAP - CMIR 107869



▶ IAP - CMIR 107873



A combination of using the stock air filter and running the intake air on a mainline system that supplies other stands has led to difficulty in control.

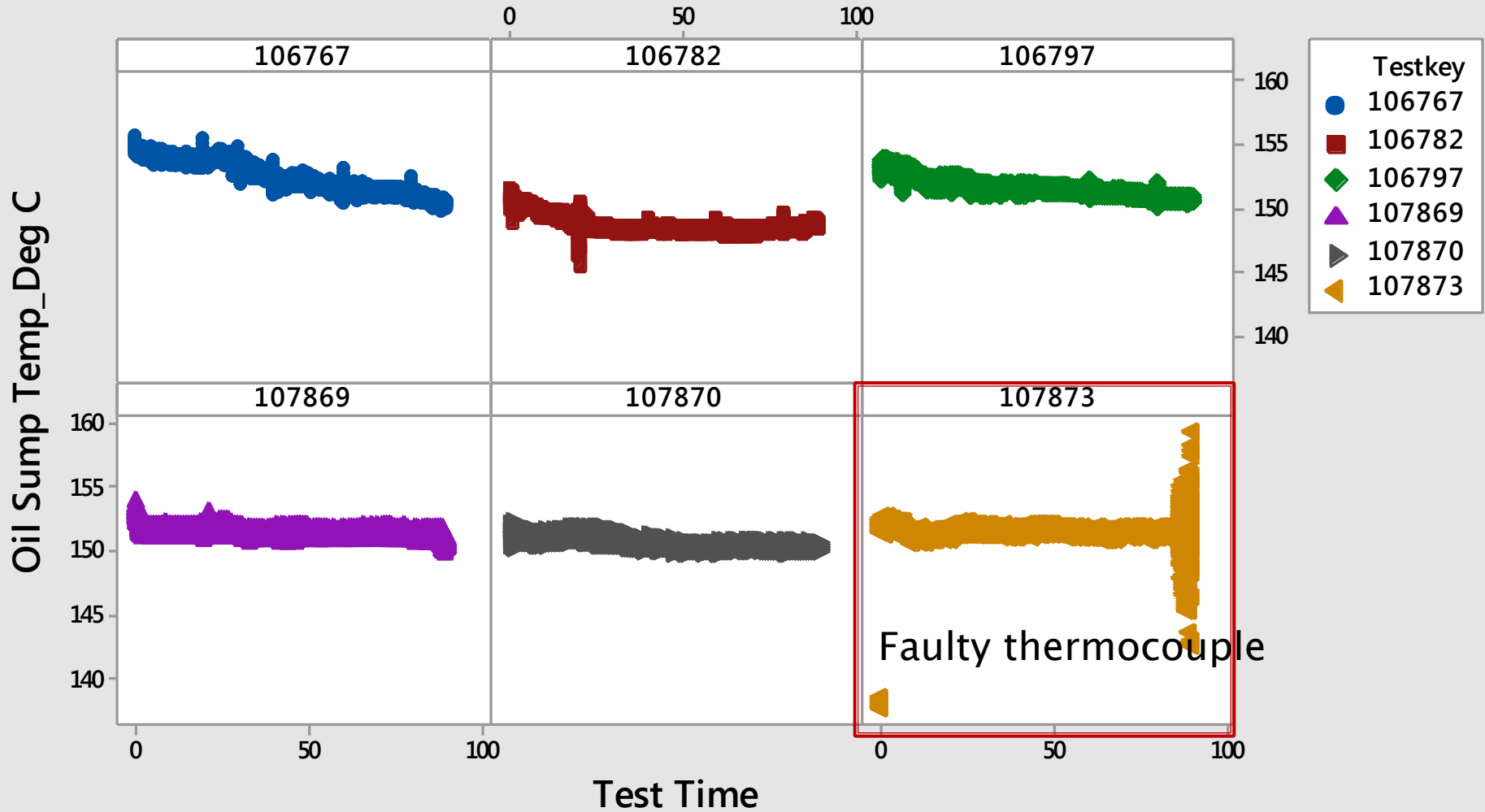
Alternative air filtration is being installed.

Pressure is controlled to nearly zero (0.05 kPa), and while control band was wide, the pressure was always positive.

Non-controlled Parameters

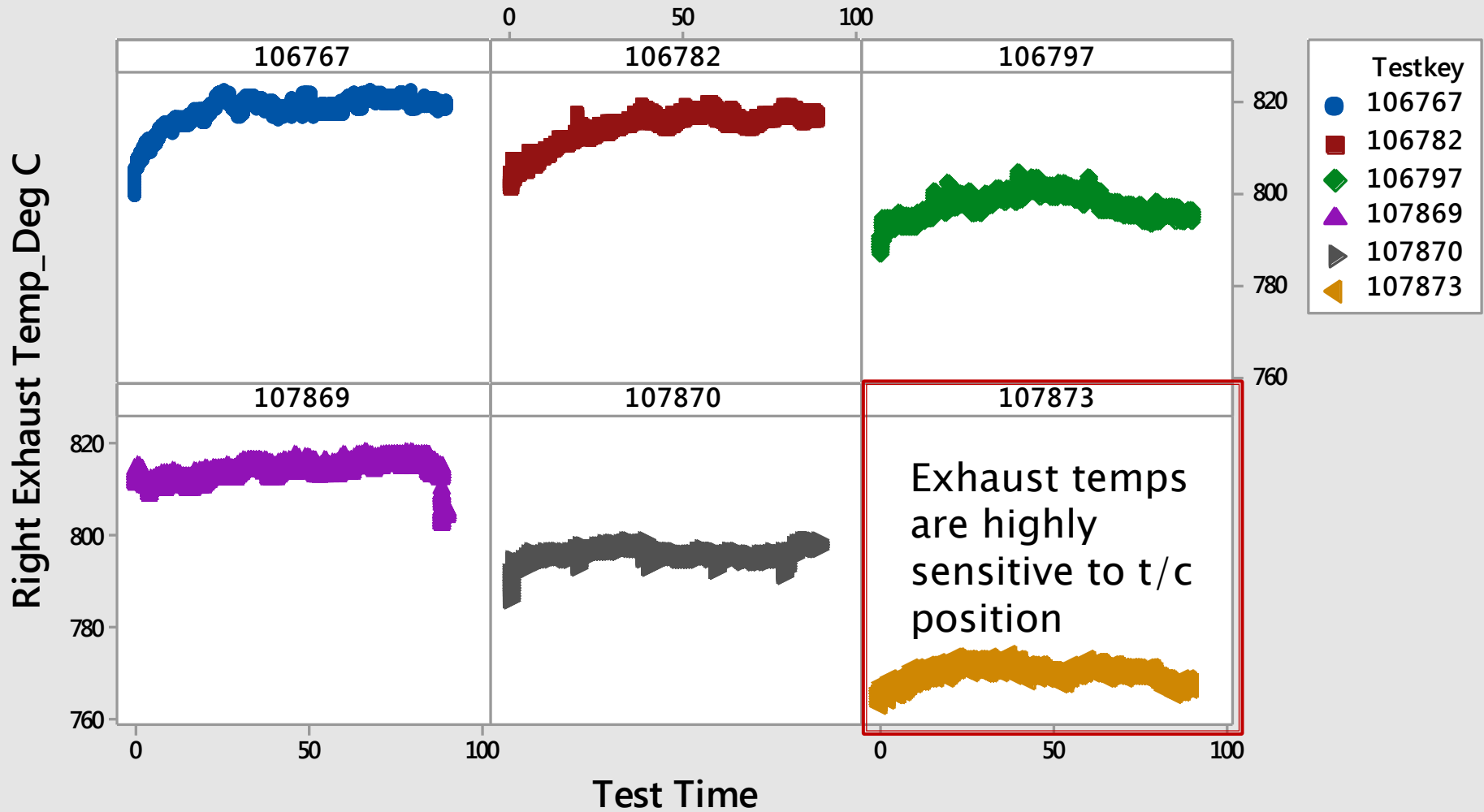
- ▶ **Non-Controlled Parameters Identified:**
 - Oil Sump Temperature – CMIR 107873
 - Right Exhaust Temperature – CMIR 107873
 - Coolant In Temperature – CMIR 106782
 - Manifold Absolute Pressure – CMIR 106782
 - Fuel Flow – CMIR 106782
 - Right AFR – CMIR 107869 and 107870
 - Left AFR – CMIR 107869 and 107870

Scatterplot of Oil Sump Temp_Deg C vs Test Time



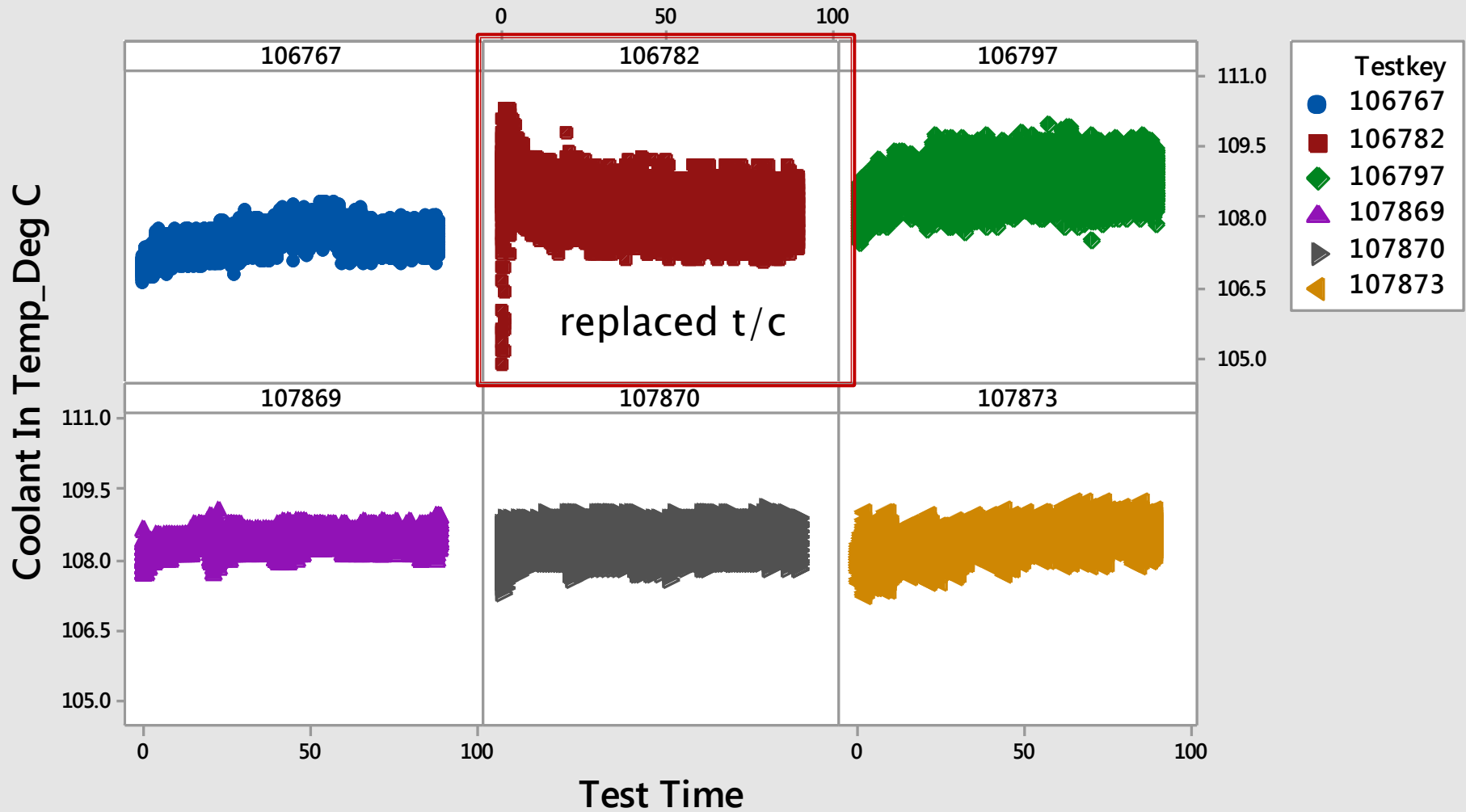
Panel variable: Testkey

Scatterplot of Right Exhaust Temp_Deg C vs Test Time



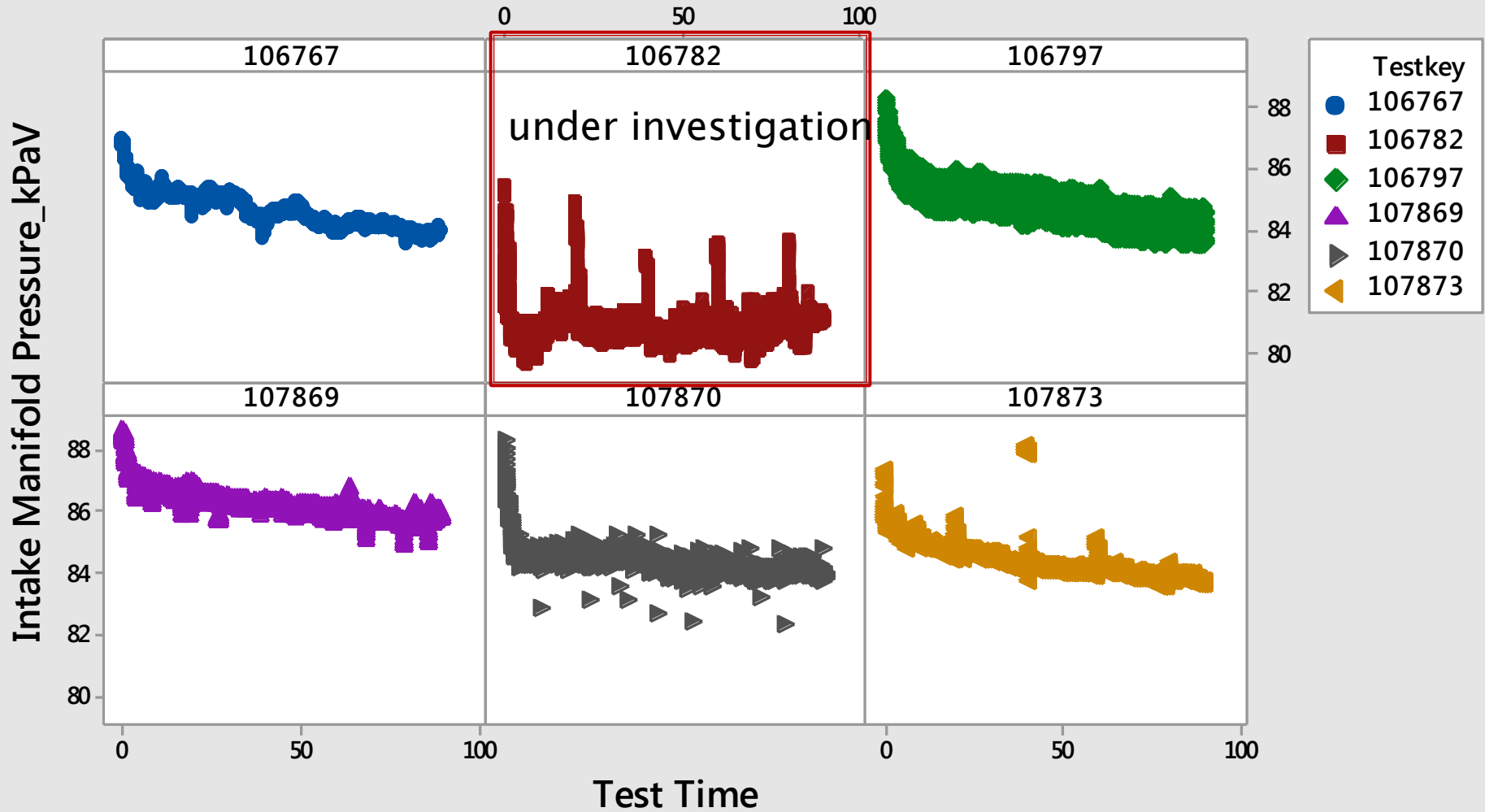
Panel variable: Testkey

Scatterplot of Coolant In Temp_Deg C vs Test Time



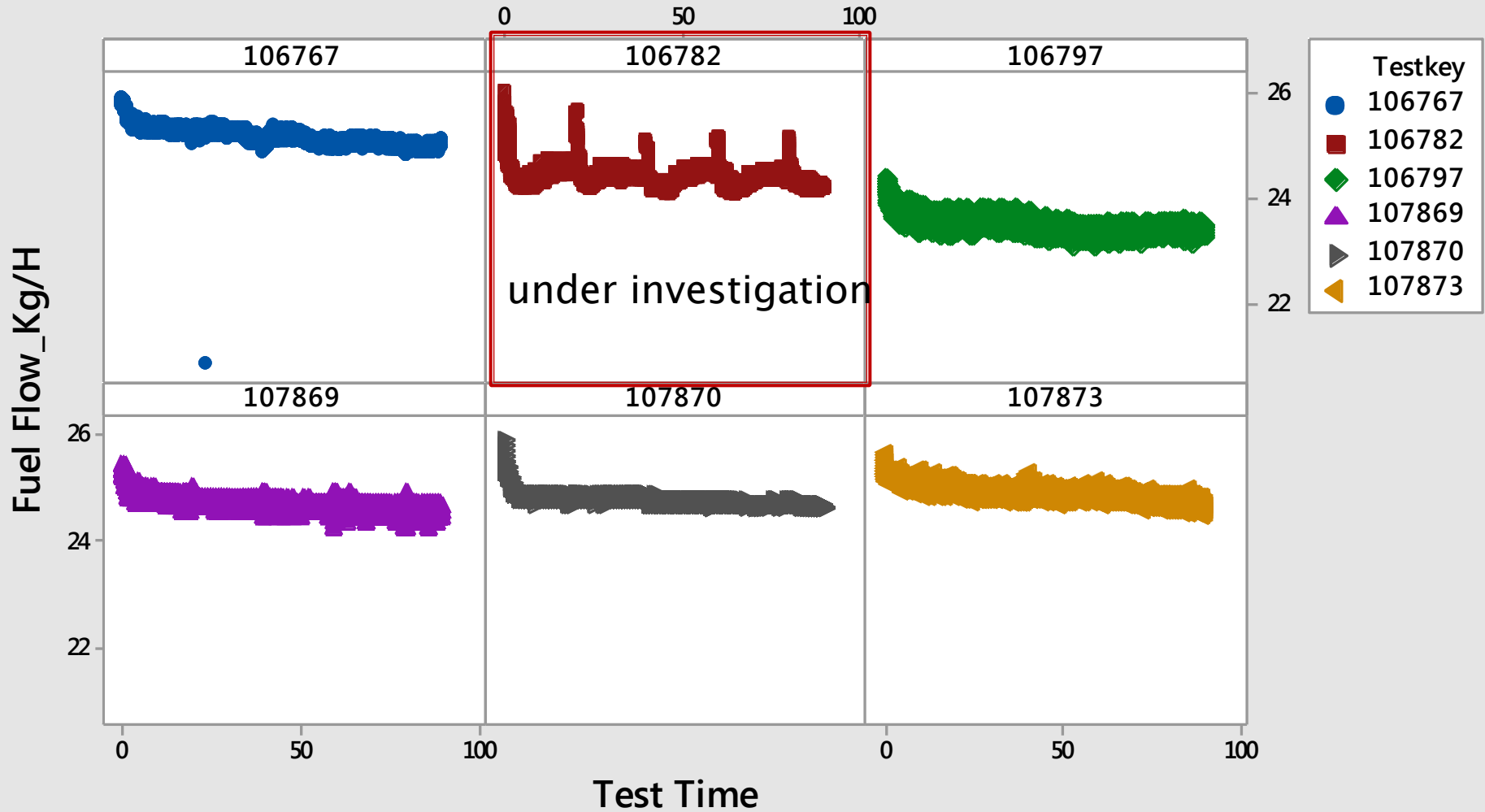
Panel variable: Testkey

Scatterplot of Intake Manifold Pressure_kPaV vs Test Time



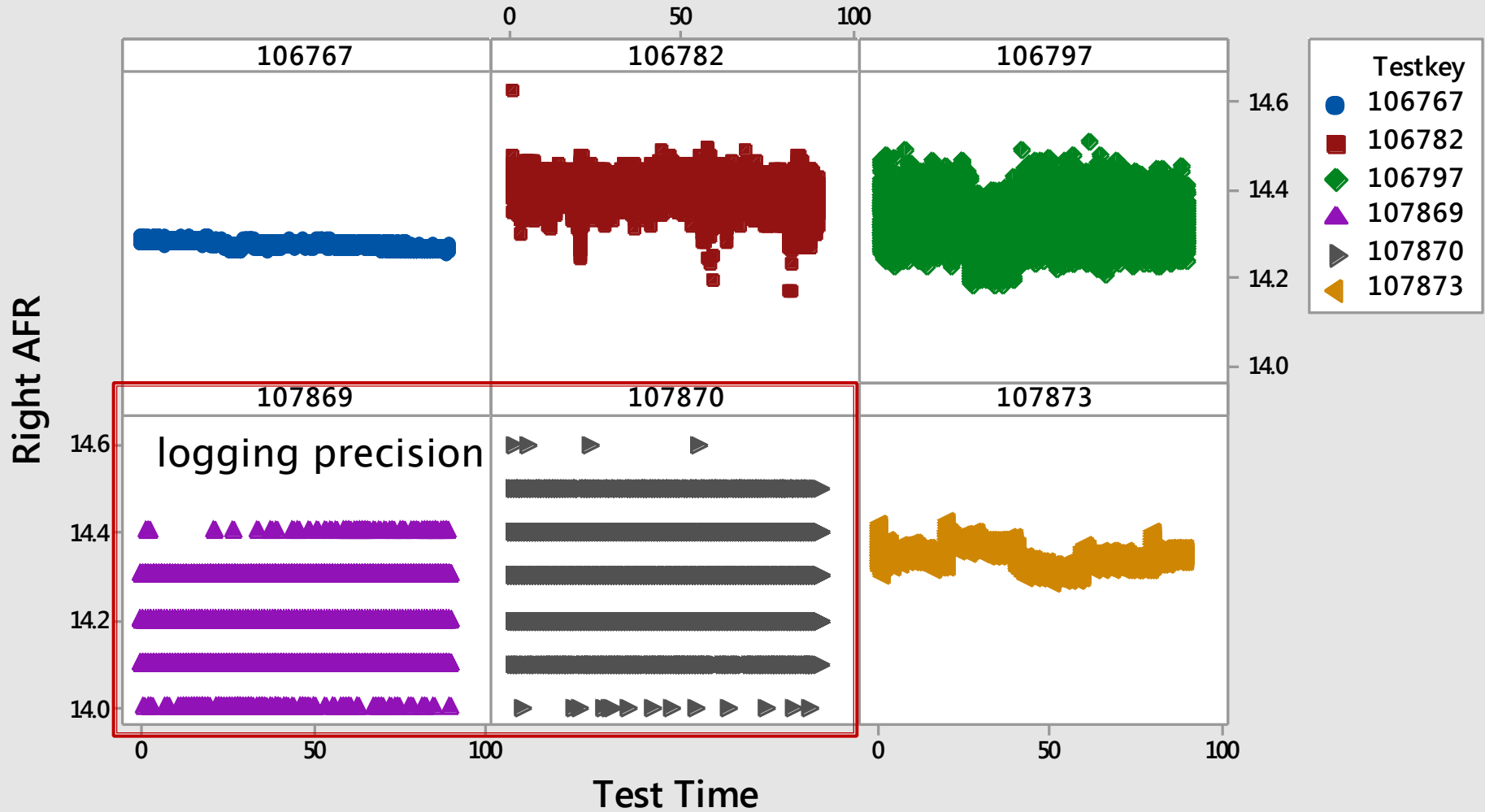
Panel variable: Testkey

Scatterplot of Fuel Flow_Kg/H vs Test Time



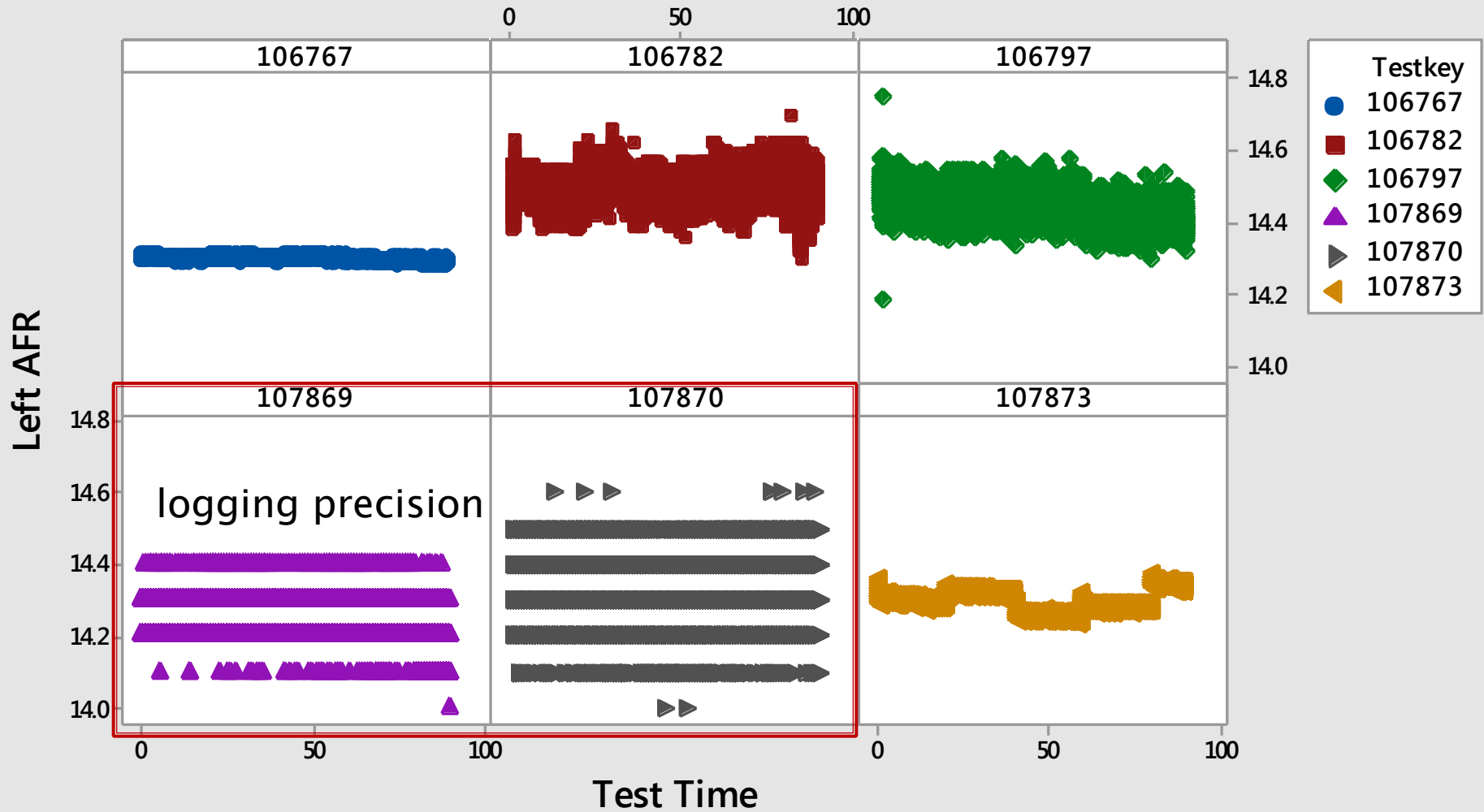
Panel variable: Testkey

Scatterplot of Right AFR vs Test Time



Panel variable: Testkey

Scatterplot of Left AFR vs Test Time



Panel variable: Testkey

Conclusion

The labs recommend to the Task Force that all tests be considered valid with the exception of CMIR 106782 which is pending investigation of MAP and fuel flow differences.

Upon completion of investigating the validity of CMIR 106782 will be reconsidered.



FIAT CHRYSLER AUTOMOBILES

Attachment 3

Chrysler Oxidation and Deposit Engine Test Development for GF-6

Precision Matrix

August 2015

NAFTA
REGION



Jeep



- Precision Matrix Testing started on July 21st.
- The date of estimated matrix completion is the week of Sep.14th.

Chrysler Oxidation and Deposit Matrix Test								
	Lab-Stand	D-1 (Afton)	E-1 (Ashland)	B-1 (Lubrizol)	G-1 (IAR)	G-2 (IAR)	A-1 (SWRI)	A-2 (SWRI)
Run Order	1	434-2 106788-IIIH	438-1 106784-IIIH	438-1 106769-IIIH	436 106763-IIIH	436 106764-IIIH	438-1 106774-IIIH	434-2 106778-IIIH
				438-1 106797-IIIH				
	2	434-2 106789	436 106782-IIIH	436	438-1 106767-IIIH	434-2 107873-IIIH	438-1 107869-IIIH	438-1 107870-IIIH
		434-2						
	3	436	434-2	436	438-1	434-2	434-2	436
	4	438-1	434-2	434-2	434-2	438-1	436	436

Test complete

Investigating validity

Aborted

Precision Matrix

Oil	Lab	Stand	TESTKEY	PVIS (%)	WPD (merits)	PHOS	MRV
436	G (IAR)	2	106764-IIIH	26.9	3.99	95.62	14800
	G (IAR)	1	106763-IIIH	19.5	4.45	94.73	13100
	E (Ashland)	1	106782-IIIH	19.5	4.25		
434-2	A (SR)	2	106778-IIIH	137.5	3.98	78.47	81300
	D (Afton)	1	106788-IIIH	13.6	4.73	79.83	
	G (IAR)	2	107873-IIIH	166.6	4.1	79.94	102200
438-1	A (SR)	1	106774-IIIH	265.1	3.34	79.22	84900
	E (Ashland)	1	106784-IIIH	34.5	3.72	78.54	22600
	B (LZ)	1	106797-IIIH	24.6	3.32	73.6	
	G (IAR)	1	106767-IIIH	31.2	3.33	81.3	18900
	A (SR)	1	107869-IIIH	209	3.1		
	A (SR)	2	107870-IIIH	31.3	3.42		

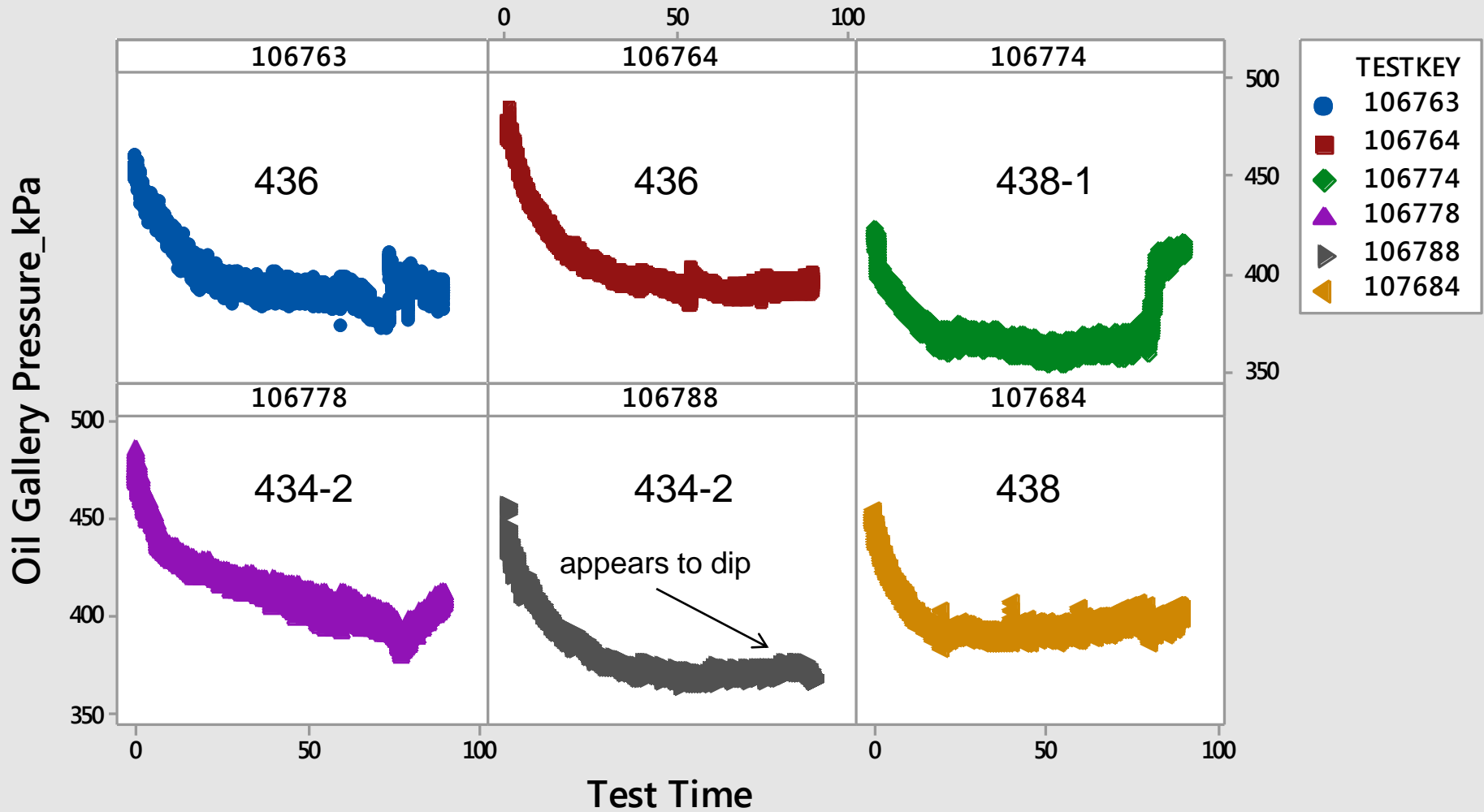
- Target: failing WPD in 438-1 and failing PVIS in 434-2

- Unexpected mild result on 434-2
 - Oil pressure indicates to exhibit a potential dip as seen in IIIIF

- PVIS variability on oil 438-1
 - Seen in prove-out matrix
 - Goal of 438-1 is failing WPD (PM range 3.10 to 3.72 merits)

- All oils are new blends

Scatterplot of Oil Gallery Pressure_kPa vs Test Time



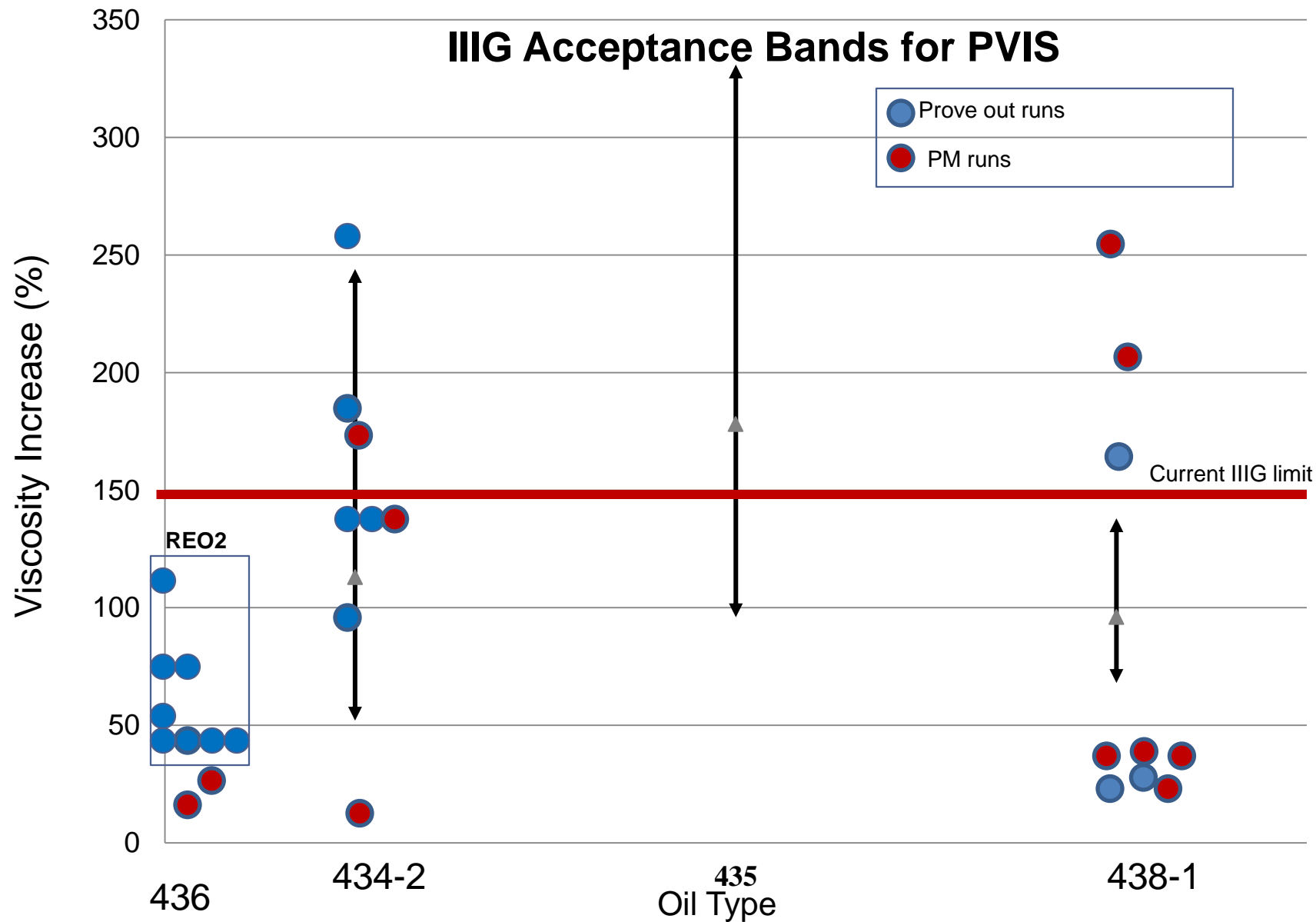
Panel variable: TESTKEY

Prove out Matrix

	SwRI		IAR		Lubrizol		Afton		Ashland	
	pVis, %	WPD	pVis, %	WPD	pVis, %	WPD	pVis, %	WPD	pVis, %	WPD
REO2	78.5	4.76	121.6	3.63	71.1	4.52	45.9	4.38	79.4	4.42
REO2	54.8	4.72	46.4	5.15	44.6	4.82	21.83	4.66	65.8	4.24
REO2	49.1	4.98	51.4	5.07						
434-1	143.7	4.27	90.5	4.76	754.7	3.8	264.3	4.46	956	4.14
434-1	146.8	4.61			412	3.84				
REO3	21.2	6.8			26.4	7.4				
438-1	155.1	3.43	34.0	3.56						
438-1	32.4	3.91								

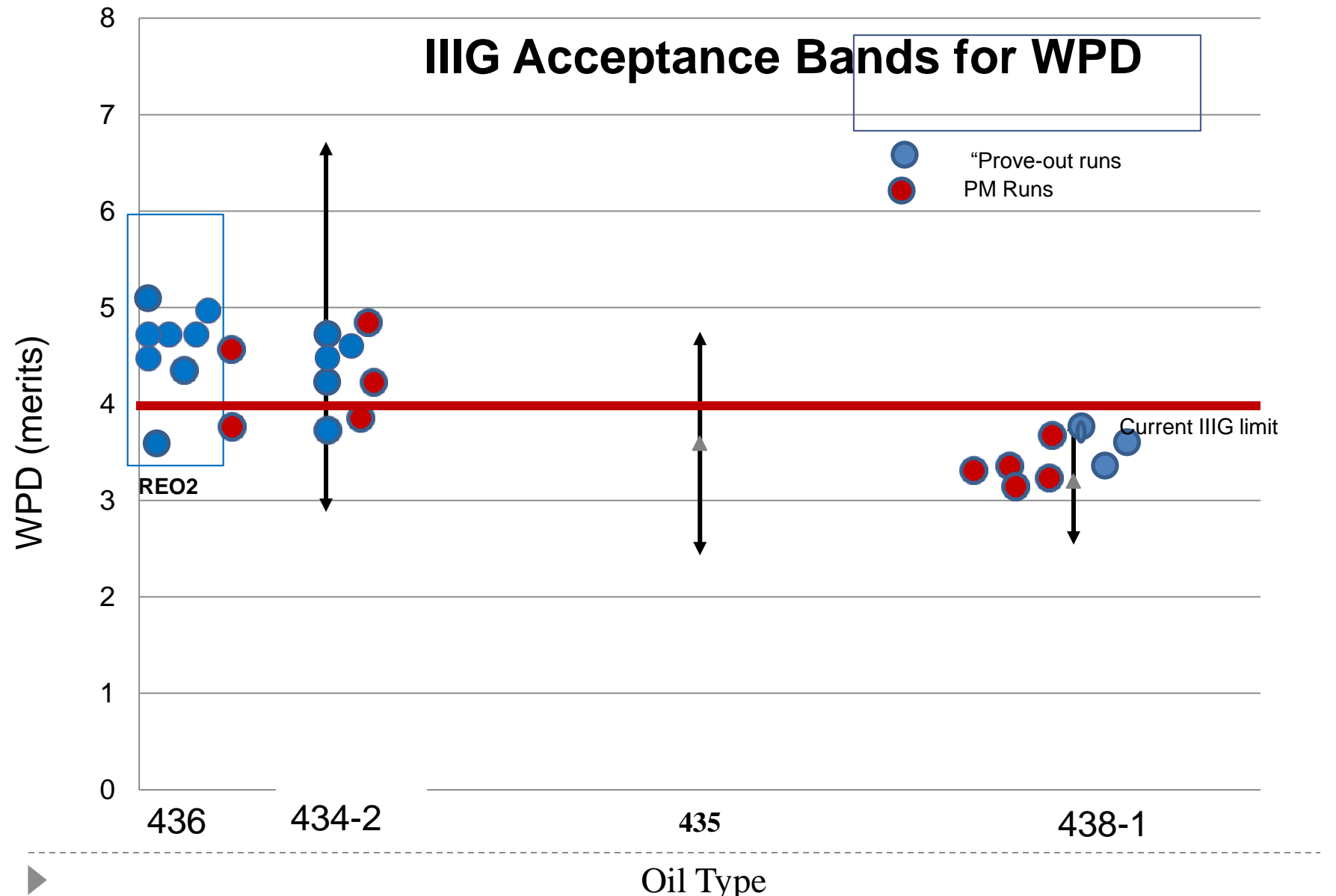
variability; same stand

Compared with IIIG PVIS



Vertical lines represent current IIIG acceptance bands based on original precision matrix data.

Compared with IIIG WPD



Vertical lines represent current IIIG acceptance bands based on original precision matrix data.

Attachment 4

Addison Schweitzer - affirm
Amol Savant - waive
Andy Ritchie - affirm
Bruce Matthews - waive
Ed Altman - affirm
Chris Castanien
Ankit Chaudhry - affirm
George Szappanos - affirm
Dave Passmore - affirm
Haiying Tang
Jason Bowden - waive
Jeff Betz - affirm
Karin Haumann - affirm
Terri Kowalski - affirm
Kaustav Sinha - affirm
Tracey King - affirm
Rich Grundza – affirm

Chris Castanien was not on the call.

IIH Precision Matrix Data Analysis

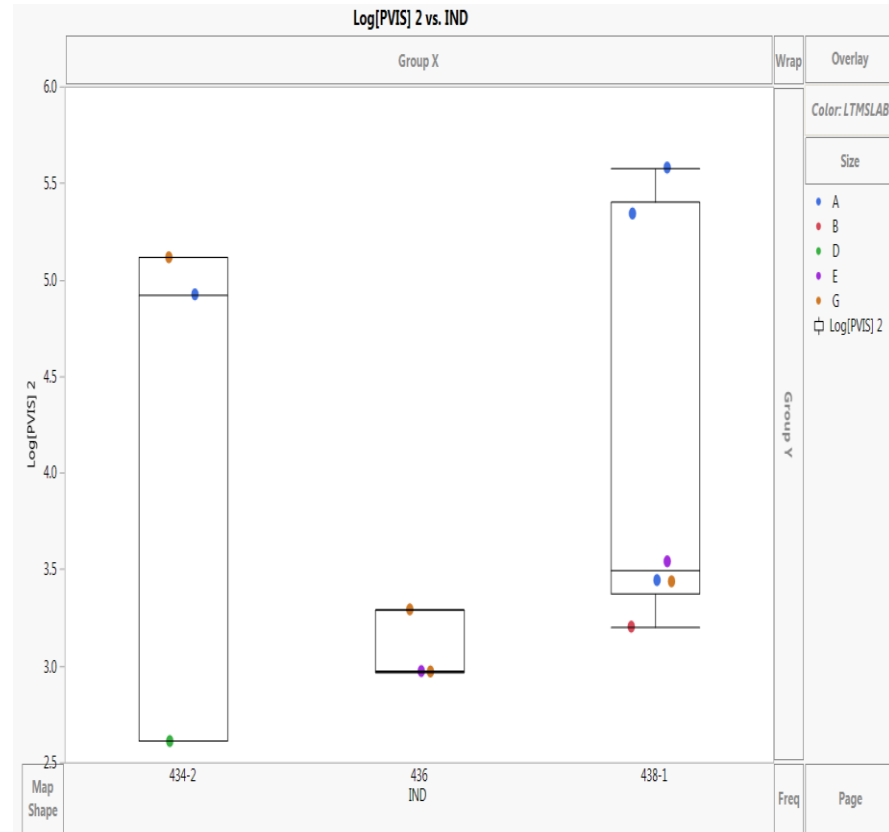
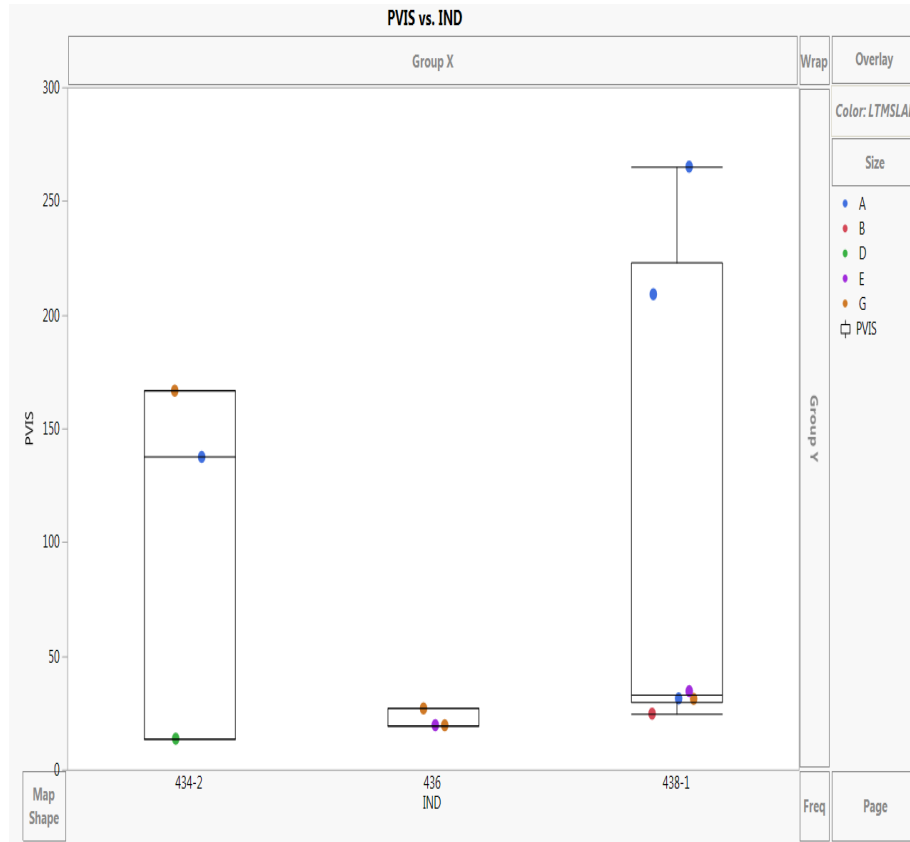
Jo Martinez

Aug. 20, 2015

PM Data

IND	PVIS	TESTKEY	WPD	PHOS	LTMSDATE	LTMSTIME	LTMSLAB	LTMSAPP
438-1	265.1	106774-IIIH	3.34	79.22	20150725	08:34	A	1
434-2	137.5	106778-IIIH	3.98	78.47	20150727	07:45	A	2
438-1	34.5	106784-IIIH	3.72	78.54	20150728	22:08	E	1
436	26.9	106764-IIIH	3.99	95.62	20150731	14:43	G	2
436	19.5	106763-IIIH	4.45	94.73	20150731	16:10	G	1
434-2	13.6	106788-IIIH	4.73	79.83	20150801	03:27	D	1
438-1	24.6	106797-IIIH	3.32	73.6	20150815	14:45	B	1
438-1	209	107869-IIIH	3.1	.	20150816	13:50	A	1
438-1	31.3	107870-IIIH	3.42	.	20150817	12:30	A	2
438-1	31.1	106767-IIIH	3.33	81.3	20150818	05:23	G	1
434-2	166.6	107873-IIIH	4.1	79.94	20150816	08:58	G	2
436	19.54	106763-IIIH	4.25	.	20150816	11:29	E	1

PVIS Data



Ln PVIS

Summary of Fit

RSquare	0.771235
RSquare Adj	0.161194
Root Mean Square Error	0.965027
Mean of Response	3.869272
Observations (or Sum Wgts)	12

Analysis of Variance

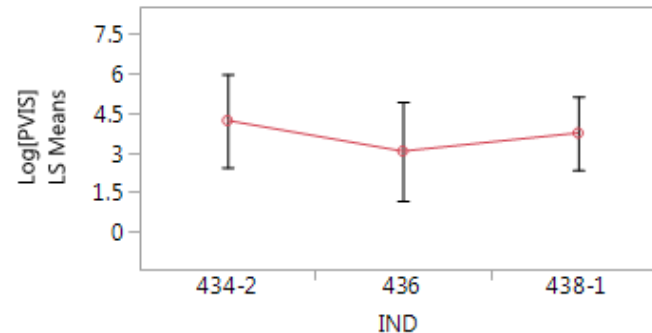
Parameter Estimates

Effect Tests

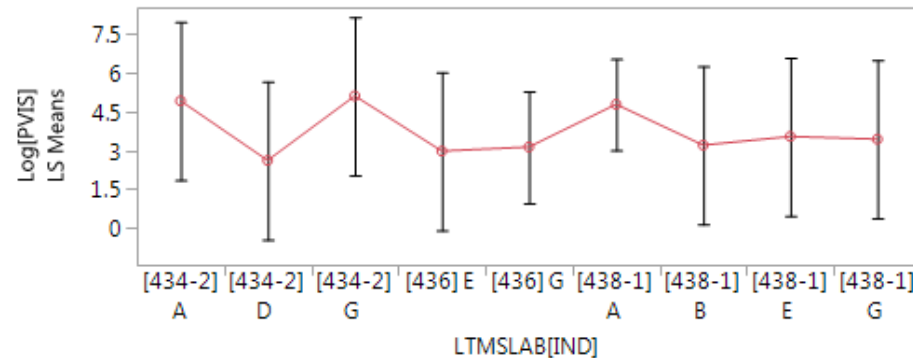
Source	Nparm	DF	Sum of Squares	F Ratio	Prob > F
IND	2	2	1.9288750	1.0356	0.4550
LTMSLAB[IND]	6	6	6.8851109	1.2322	0.4677

Conclusions:

- No significant oil differences
- No significant lab differences
- RMSE, $s = 0.97$ (Prove-out $s=0.56$)

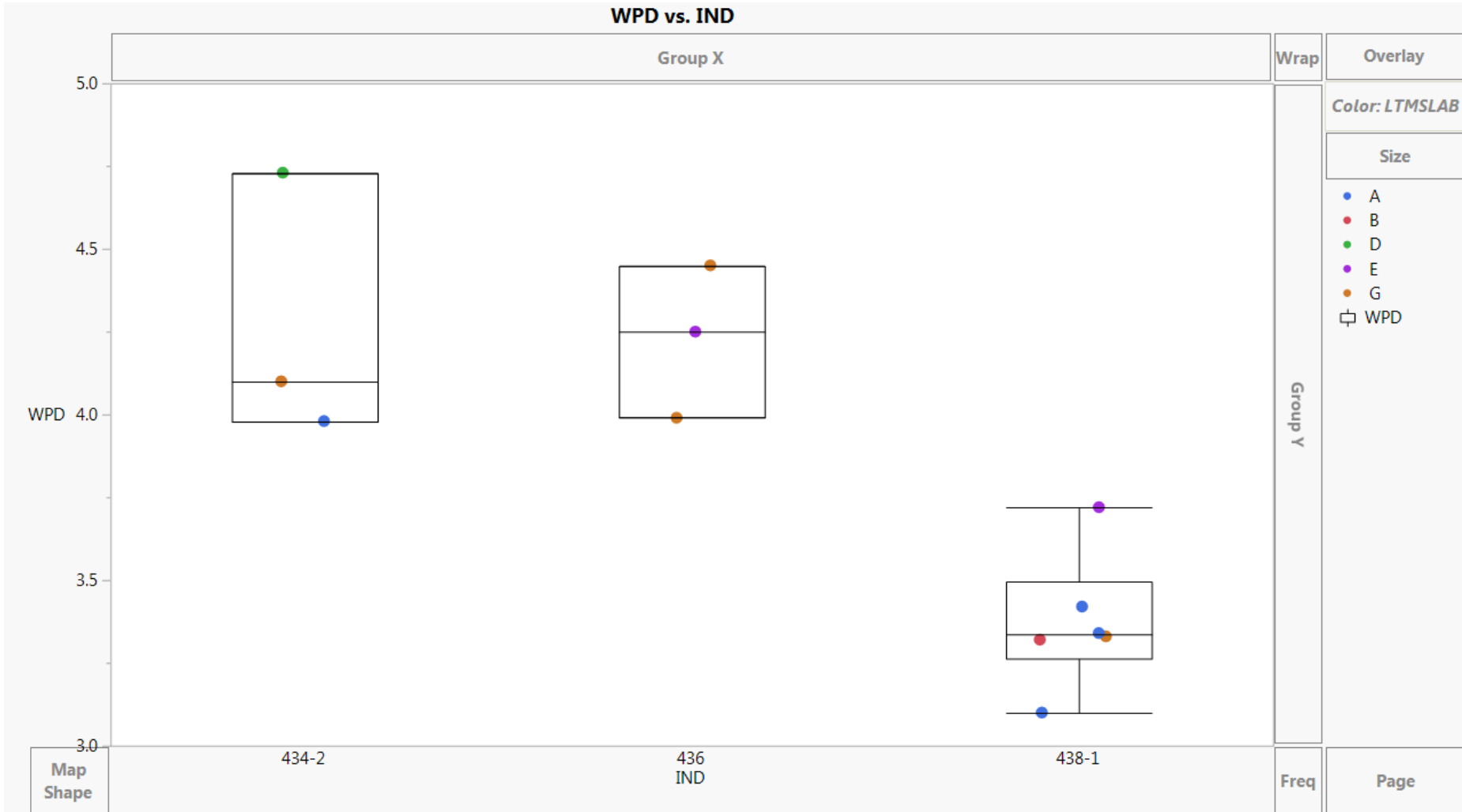


Level	Least Sq Mean
434-2	4.2164298
436	3.0518670
438-1	3.7424000



Level	Least Sq Mean
[434-2] A	4.9236239
[434-2] D	2.6100698
[434-2] G	5.1155957
[436] E	2.9724636
[436] G	3.1312704
[438-1] A	4.7886865
[438-1] B	3.2027464
[438-1] E	3.5409593
[438-1] G	3.4372078

WPD Data



WPD

Summary of Fit

RSquare	0.945346
RSquare Adj	0.799603
Root Mean Square Error	0.231852
Mean of Response	3.810833
Observations (or Sum Wgts)	12

Analysis of Variance

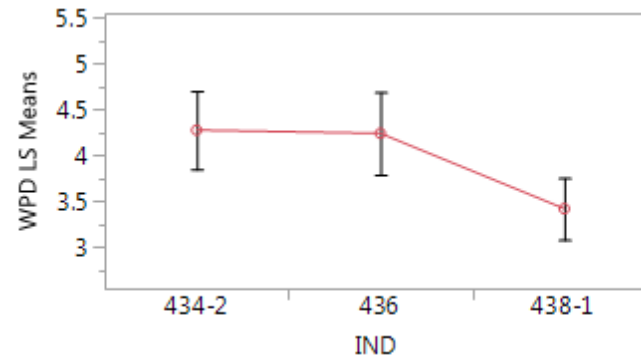
Parameter Estimates

Effect Tests

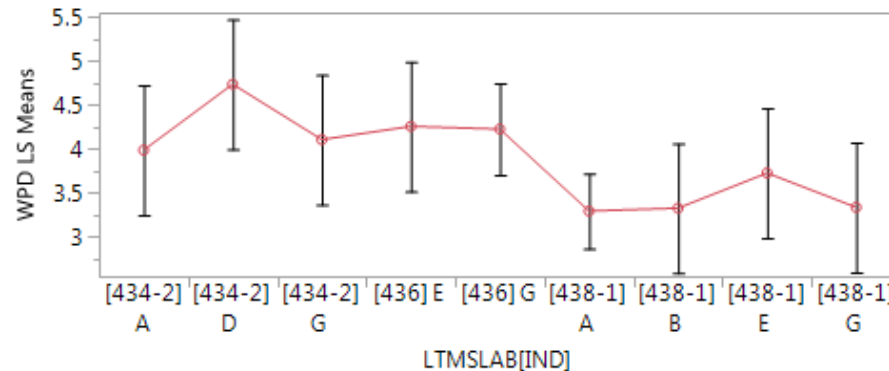
Source	Nparm	DF	Sum of Squares	F Ratio	Prob > F
IND	2	2	1.8326094	17.0458	0.0230*
LTMSLAB[IND]	6	6	0.4726167	1.4653	0.4056

Conclusions:

- 434-2, 436 > 438-1
- No significant lab differences
- RMSE, s=0.23 (Prove-out, s = 0.43)



Level	Least Sq Mean
434-2	4.2700000
436	4.2350000
438-1	3.4141667



Level	Least Sq Mean
[434-2] A	3.9800000
[434-2] D	4.7300000
[434-2] G	4.1000000
[436] E	4.2500000
[436] G	4.2200000
[438-1] A	3.2866667
[438-1] B	3.3200000
[438-1] E	3.7200000
[438-1] G	3.3300000