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Committee D02 on PETROLEUM PRODUCTS AND LUBRICANTS

Originally Issued: June 6, 2011

Reply to: Jeff Clark
Test Monitoring Center
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Sequence III Surveillance Panel
Unapproved Meeting Minutes

June 2, 2011
GM Technical Center
Warren, Michigan

1.0) Membership & Agenda

1.1) The meeting agenda is shown in **Attachment 1**.

1.2) The meeting attendance is shown in **Attachment 2**.

2.0) Approval of minutes

2.1) The minutes from 03/31/2011 teleconference were approved without objection.

3.0) Action Item Review

3.1) *09/11/2009 (Glaenzer/Grundza) - conduct a round robin to study Phosphorus measurement for IIIGB test*. Following a brief discussion, this action item was removed.

3.2) *03/17/2011 - Surveillance Panel to seek replacement oil for IIIF RO 1006-2, perhaps in the 275% PVIS range.* OPEN

3.3) *03/17/2011 (Glaenzer) - Form a Task Force to explore different methods for evaluating IIIF PVIS data*. COMPLETED

4.) Old Business

4.1) *Report from Stats Group review of RO 1006-2. (Jo Martinez & Todd Dvorak)*

Jo's presentation is shown in **Attachment 3**. Jo stated that there was no improvement in the data in using a new transformation. Todd's presentation is shown in **Attachment 4**. Todd noted that the severe trend is across both reference oils and all labs. The trend seems to coincide with a change in blowby. Todd's recommendation is to closely examine hardware to identify possible root causes. Ed Altman presented (**Attachment 5**) on a preliminary hardware check. Ed noted some differences in the oil return hole locations for different piston batches. Pat Lang stated that SwRI has noted differences in chamfers that also seem to coincide with the severity issue.

The panel discussed the issue at length. Dave Glaenzer encouraged members to look for a reference oil in the 275% PVIS range.

4.2) Procedural editorial items:

a) *Section 9.11.3.1 requires equipment accurate to 0.01mm whereas Sections 9.11.5 and 9.11.6 require measurement to 0.001mm*.

After discussion, it was decided that labs would investigate the accuracy of their camshaft wear measurement equipment, and report to the panel chairman.

4.2) Procedural editorial items (cont.):

b) *SP Chairman to form Task Force to upgrade wording of Section 6.10 to reflect current lab practices regarding oil temperature control.*

After discussion, Greg Seman agreed to lead a task force to address this issue.

4.3) *Sequence IIIF Camshafts. (OH Technologies)*

Adam Bowden brought to the attention of the panel that camshafts are being reground to meet surface finish spec. SwRI stated that they are having cam wear problems. Pat Lang noted that it is start up wear (evidenced by timing run iron levels). Other labs stated they have seen wear problems with J camshafts also. A lengthy, ranging discussion took place. No actions were assigned, but Dave Glaenzer encouraged labs to work together as the IIIF severity issues unfold.

4.4) *Test Activity and hardware:*

a) Chairman report of critical parts usage and test activity.

Dave Glaenzer's report is shown in **Attachment 6**. Key test component supply should be adequate through 2015.

b) CPD Report:

The CPD (OHT) report is shown in **Attachment 7**.

4.5) *TMC report on Sequence IIIG RO 435-2 status*.

Rich Grundza updated the panel on 435-2 results (**Attachment 8**).

4.6) *Status of negative votes on oil filter replacement issue.*

The ballot comment and negatives are shown in **Attachment 9**. The panel discussed the comment on the relevant information letter (IIIG 11-1). The panel chose not to accept the suggestion made in Ms. Hind Abi-Akar's comment.

The panel also discussed the negatives on the information letter. No resolution was reached and representatives of all three negatives indicated an unwillingness to withdraw their negatives at this time.

5.) New Business

5.1) *Unified Engine Build follow-up:*

a) *Results to date* (**Attachment 10**) – these results were reviewed for the group by Rich Grundza. The dual rating summary was presented by Pat Lang (**Attachment 11**).

b) Recommended changes to standards – this list (**Attachment 12**) was developed out of the UEB. The list was reviewed. Following the review, a motion was made and approved to accept all recommended changes with the exception of the changes to Sections 9.5.3.1, 9.5.3.3, and AM Section 1 Sheet 5A. Changes are effective 7/1/11. The motion passed without objection. Charlie Leverett will lead future discussions in an attempt to resolve the remaining items from the UEB.

5.2) *Cylinder Head Studies*

Pat Lang presented some work on cylinder heads that arose out of UEB discussions (**Attachment 13**). It was noted that valve recession has been observed. Where rotation has taken place, greater recession occurs. Compression loss and intake seat burnout have also been observed. SwRI run a IIIG test on modified heads with intake valve seat inserts. The test was aborted at 95 hours, and showed compression loss and intake seat burnout. Other labs commented that they have seen these phenomena as well. SwRI is going to continue their investigation.

5.3) *TGC Assignment # 1*

a) *Best Practices in Lubricant Test Development* – **Attachment 14**. Dave Glaenzer updated the panel on the status of this TGC task. Panel members were asked to consider items for the best practices list. TGC will be having a face to face meeting at some point; the hopes are to have something to forward to the TMB by December ASTM.

6.) Motions and Action Items – resulting from this meeting are shown in **Attachment 15**.

7.) Meeting Adjourned – the meeting adjourned at 3:15 pm.

Attachment 1

Sequence III Surveillance Panel
June 2, 2011
09:00 – 15:00 EDT
GM Technical Center
Warren, Michigan

Agenda

1.0) Membership

2.0) Approval of minutes

2.1) Approve the minutes from 03/31/2011 teleconference

3.0) Action Item Review

3.1) A.I. 09/11/2009 (Glaenzer/Grundza) conduct a round robin to study Phosphorus measurement for IIIGB test. OPEN

3.2) A.I. 03/17/2011 SP to seek replacement oil for IIIF RO 1006-2, perhaps in the 275% PVIS range. OPEN

3.3) A.I. 03/17/2011 (Glaenzer) Form TF to explore different methods for evaluating IIIF PVIS data. COMPLETE

4.) Old Business

4.1) Report from Stats Group review of RO 1006-2. (Todd Dvorak)

4.2) Procedural editorial items:

- a) Section 9.11.3.1 requires equipment accurate to 0.01mm whereas Sections 9.11.5 and 9.11.6 require measurement to 0.001mm.
- b) SP Chairman to form TF to upgrade wording of Section 6.10 to reflect current lab practices regarding oil temperature control.

4.3) Sequence IIIF Camshafts. (OH Technologies)

4.4) Test Activity and hardware:

- a) Chairman report of critical parts usage and test activity.
- b) CPD Reports:
  - OH Technologies
  - GM Racing

4.5) TMC report on Sequence IIIG RO 435-2 status.

4.6) Status of negative votes on oil filter replacement issue.

5.) New Business

5.1) Unified Engine Build follow-up:

- a) Results to date.
- b) Recommended changes to standards.

5.2) Cylinder Head Studies. (Lang)

5.3) TGC Assignment # 1

- a) Best Practices in Lubricant Test Development
- b) Brainstorm and discuss items for the guide

6.) Review Scope and Objectives

7.) Next Meeting

8.) Meeting Adjourned

Attachment 2

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
Art Andrews ExxonMobil Products Research 600 Billingsport Rd. Paulsboro, NJ 08066 USA	856-224-3013 arthur.t.andrews@exxonmobil.com	Non-Voting Member	Present
Zack Bishop Test Engineering, Inc. 12718 Cimarron Path San Antonio, TX 78249-3423 USA	210-877-0223 210-690-1959 zbishop@tei-net.com	Non-Voting Member	Present
Doyle Boese Infineum 1900 E. Linden Avenue Linden, NJ 07036 USA	908-474-3176 908-474-3637 doyle.boese@infineum.com	Non-Voting Member	Present
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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
Dwight H. Bowden OH Technologies, Inc. 9300 Progress Parkway P.O. Box 5039 Mentor, OH 44061-5039 USA	440-354-7007 440-354-7080 dhbowden@ohtech.com	Non-Voting Member	Present

Name/Address	Phone/Fax/Email		Signature
Matt Bowden OH Technologies, Inc. 9300 Progress Parkway P.O. Box 5039 Mentor, OH 44061-5039 USA	440-354-7007 440-354-7080 mjbowden@ohtech.com	Non-Voting Member	Present [signature]
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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 WAB
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_______________
James Carter Haltermann Solutions 2296 Hulett Rd. Okemos, MI 48864 USA	517-347-3021 517-347-1024 jecarter@jhaltermann.com Cell: 517-896-0897	Voting Member	Present [signature]
Chris Castanien The Lubrizol Corporation 29400 Lakeland Boulevard Wickliffe, OH 44092 USA	440-347-2973 440-944-8112 cca@lubrizol.com	Non-Voting Member	Present [signature]
Timothy L. Caudill Ashland Oil Inc. 22nd & Front Streets Ashland, KY 41101 USA	606-329-1960 x5708 606-329-2044 tlcaudill@ashland.com	Voting Member	Present PHONE
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_______________

Name/Address	Phone/Fax/Email		Signature
Jeff Clark Sequence III Secretary ASTM Test Monitoring Center 6555 Penn Avenue Pittsburgh, PA 15206 USA	412-365-1032 412-365-1047 jac@atc-erc.org	Non-Voting Member	Present
Sid Clark Southwest Research 50481 Peggy Lane Chesterfiled, MI 48047 USA	586-873-1255 Sidney.L.Clark@sbcglobal.net	Non-Voting Member	Present
Johnny M De La Zerda Intertek Automotive Research 5404 Bandera Road San Antonio, TX 78238 USA	210-523-4621 210-523-4607 johnny.delazerda@intertek.com	Non-Voting Member	Present
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

ASTM Sequence III Surveillance Panel (17 Voting members) date:

Name/Address	Phone/Fax/Email		Signature
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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 [signature]
Tracey King Chrysler LLC 800 Chrysler Drive CIMS 482-00-13 Auburn Hills, MI 48326-2757 USA	248-576-7500 248-576-7490 tek1@chrysler.com	Voting Member	Present
Clayton Knight Test Engineering, Inc. 12718 Cimarron Path San Antonio, TX 78249-3423 USA	210-690-1958 210-690-1959 cknight@tei-net.com	Voting Member	Present
Teri Kowalski Toyota Motor North America, Inc. 1555 Woodridge Ann Arbor, MI 48105	734-995-4032 734-995-9049 teri.kowalski@tema.toyota.com	Non-Voting Member	Present on phone
Patrick Lang Southwest Research Institute 6220 Culebra Road P.O. Box 28510 San Antonio, TX 78228 USA	210-522-2820 210-684-7523 plang@swri.edu	Voting Member	Present [signature]
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 [signature]

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_____
Bruce Matthews GM Powertrain Mail Code 483-730-472 823 Jocyln Avenue Pontiac, MI 48340 USA	248-830-9197 248-857-4441 bruce.matthews@gm.com **Test Sponsor Representative**	Voting Member	Present_____
Mike McMillan	mmcmillan123@comcast.net	Non-Voting Member	Present_____
Timothy Miranda BP Castrol Lubricants USA 1500 Valley Road Wayne, NJ 07470 USA	973-305-3334 973-686-4039 Timothy.Miranda@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_____
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_____

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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
Ron Romano Ford Motor Company Diagnostic Service Center II Room 410. 1800 Fairlane Drive Allen Park, MI 48101 USA	313-845-4068 313-32-38042 rromano@ford.com	Voting Member	Present
Jim Rutherford Chevron Oronite Company LLC 100 Chevron Way Richmond, CA 94802 USA	510-242-3410 510-242-3173 jaru@chevrontexaco.com	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
Greg Seman The Lubrizol Corporation 29400 Lakeland Boulevard Wickliffe, OH 44092 USA	440-347-2153 440-347-4096 greg.seman@lubrizol.com	Voting Member	Present
ANDREW BUCZYNSKY Matt J. Snider GM Powertrain General Motors Corporation MC - 483-730-322 823 Joclyn Rd. Pontiac, MI 48090-9055 USA	SUBSTITUTING FOR MATT SNIDER 248-672-3563 248 330-1733 248-857-4441 mathew.j.snider@gm.com ANDREW.BUCZYNSKY@GM.COM	Non-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

ASTM Sequence III Surveillance Panel (17 Voting members) date:

Name/Address	Phone/Fax/Email		Signature
Mark Sutherland Chevron Oronite Company LLC 4502 Centerview Drive Suite 210 San Antonio, TX 78228 USA	210-731-5621 210-731-5699 msut@chevrontexaco.com	Voting Member	Present
Joe Vujica The Lubrizol Corporation 29400 Lakeland Boulevard Wickliffe, OH 44092 USA	440-347-2057 440-347-4096 jsvu@lubrizol.com	Non-Voting Member	Present
Jerry Wang Chevron Oronite Company LLC 7080 Colchester Lane Ypsilanti, MI 48197	734-48- 3806 none jwdy@chevron.com	Non-Voting Member	Present
Ben O. Weber Southwest Research Institute 6220 Culebra Road P.O. Box 28510 San Antonio, TX 78228 USA	210-522-5911 210-684-7530 bweber@swri.edu **Sub-Committee D02.B01 Chair**	Non-Voting Member	Present
Tom Wingfield Chevron Phillips Chemical Co.	wingftm@cpchem.com	Non-Voting Member	Present
Jeff Kettman GM Racing 5388 Hill 23 Drive Flint, MI 48507	jeff.kettman@gm.com P: 313-667-0493 C: 313-319-0139	Non-voting	
Scott Stap GM Racing	810-691-0687	Non-Voting	
Bob Olree	248-689-3078	Non	
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Don Smolenski	GM Road D	donald.j.smolenski@gm.com 248-255-7892
CHRISTIAN PORTER	AFTON CHEMICAL	CHRISTIAN.PORTER@AFTONCHEMICAL.COM P: 804 788 5837
Jim Linden	via Phone	

Attachment 3

IIIF Percent Viscosity Increase New Transformation Analysis

Jo Martinez

May. 25, 2011

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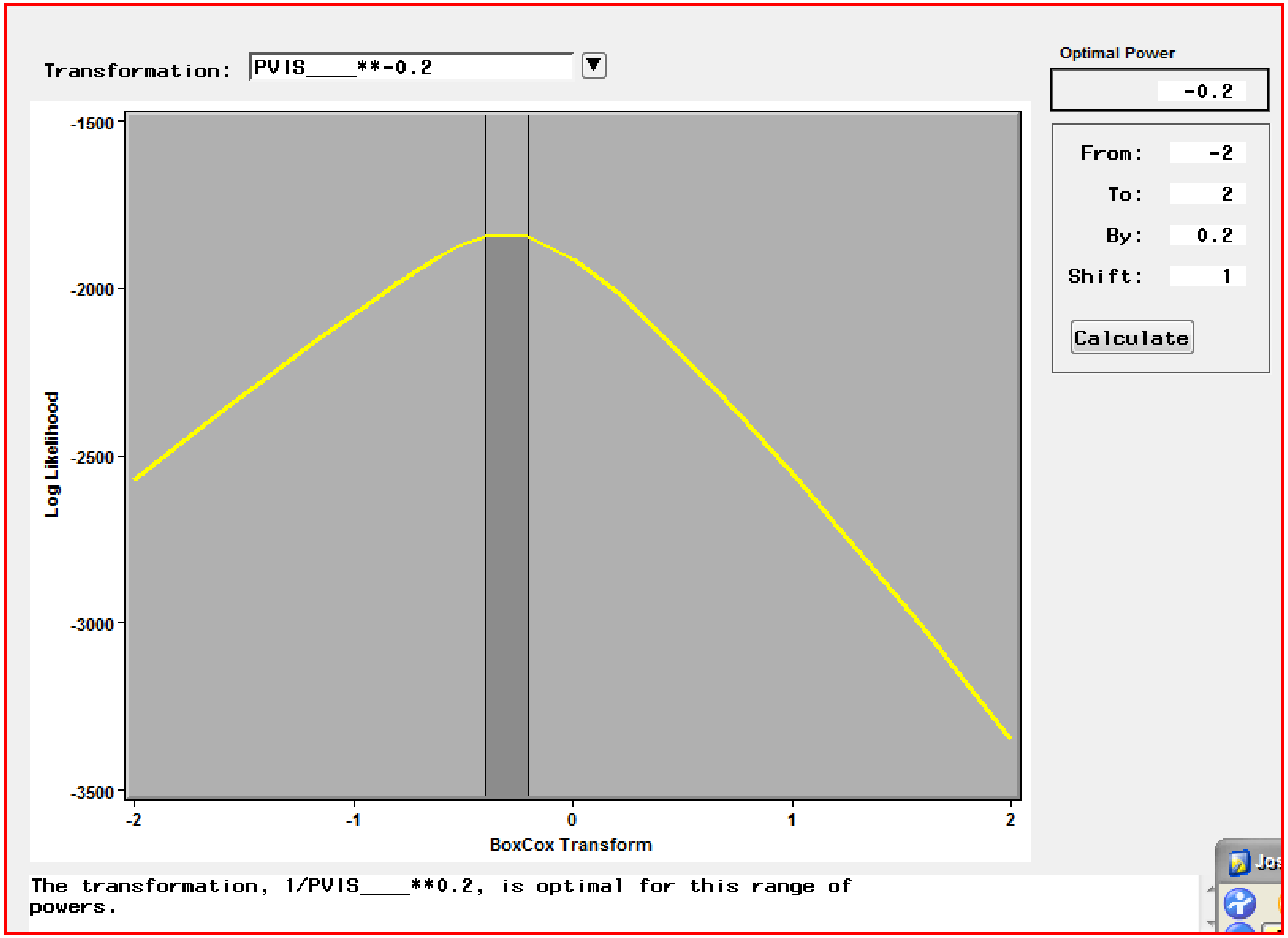
Summary

- **1/PVIS^0.2** is the optimal transformation based on Box-Cox Transformation
- Using the new transformation, none of statistically unacceptable runs become acceptable
- EWMA didn't change much from before
- No improvement in the use of new transformation

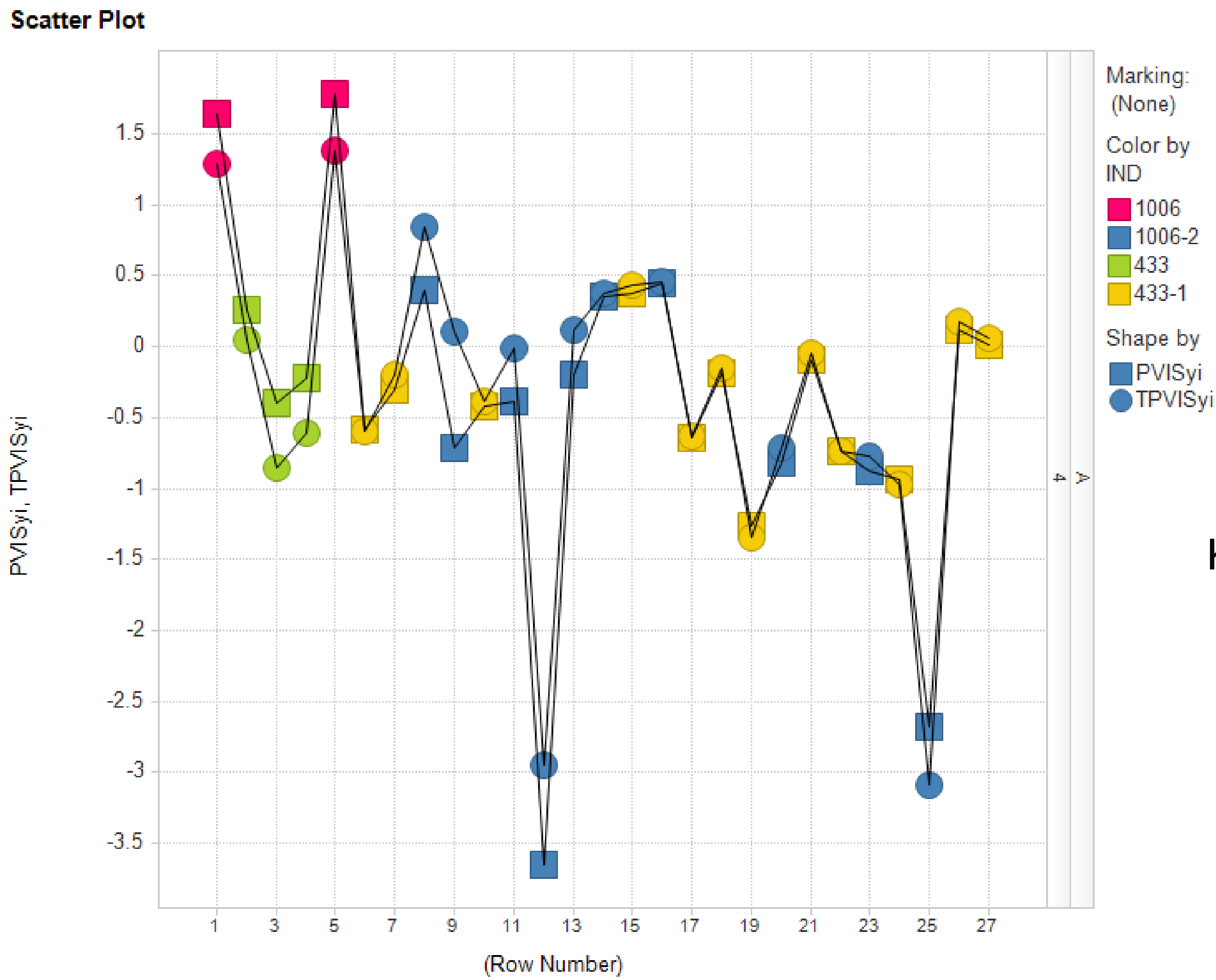
Box-Cox Transformation



New Targets Using 1/PVIS**0.2

IND	Std Dev	TPVIS MEAN	N Obs
1006	0.0399355	0.1886858	35
1006-2	0.0295455	0.2846992	30
433	0.0181051	0.4861452	19
433-1	0.0347360	0.4828178	31

Shewhart (Yi) – Lab A Stand 4



K=1.8

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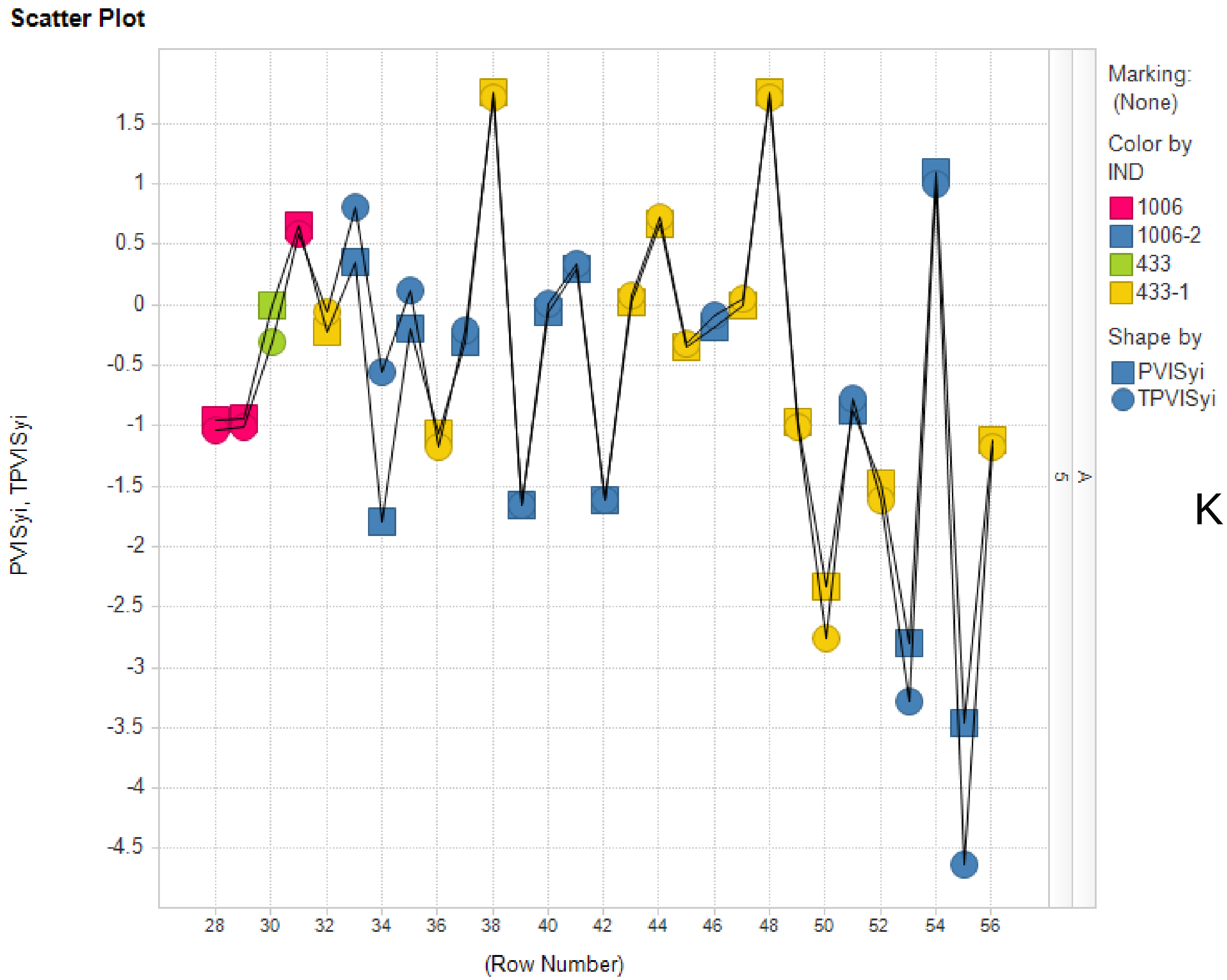
Shewhart (Yi) – Lab A Stand 5



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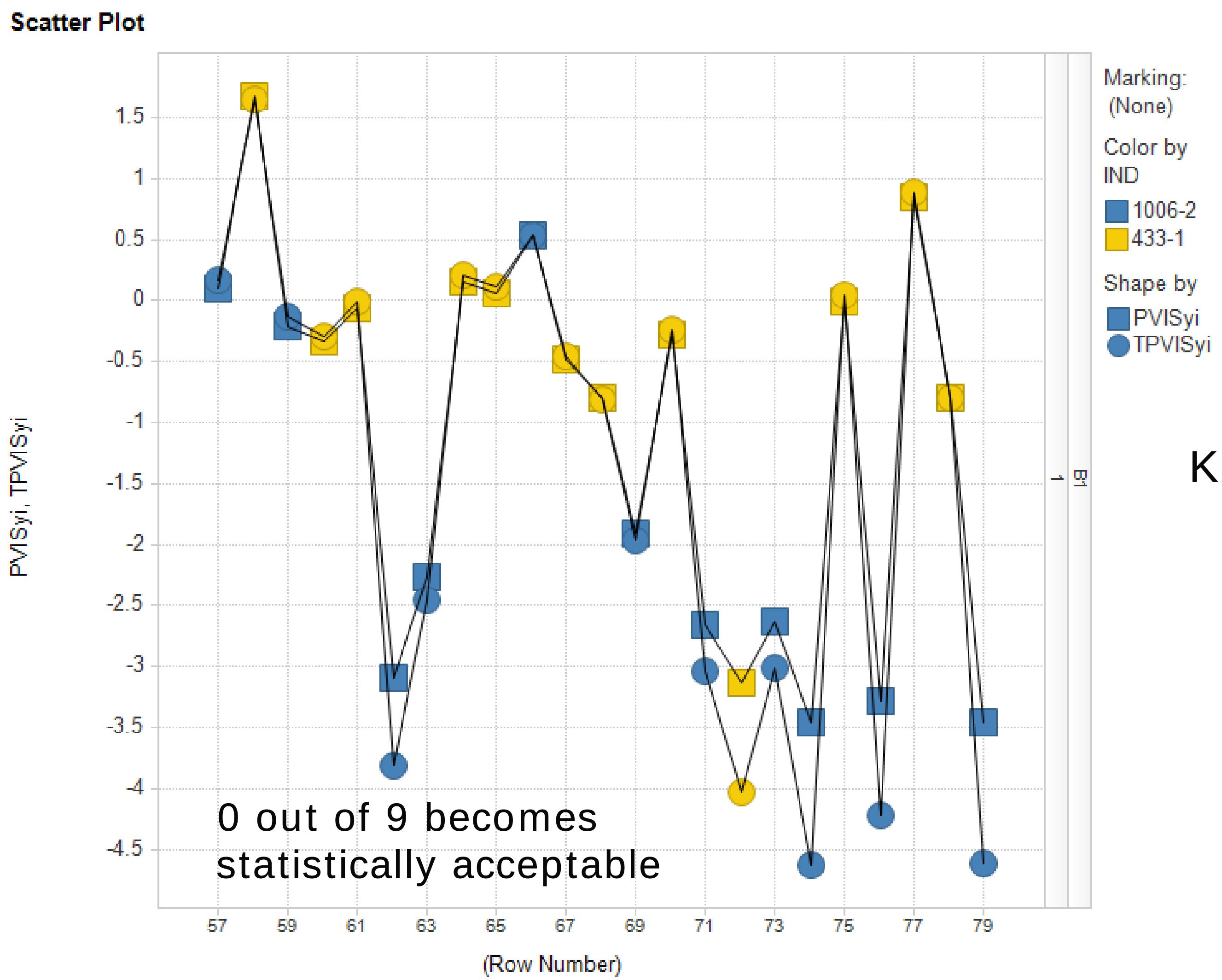
Shewhart (Yi) – Lab B1 Stand 1



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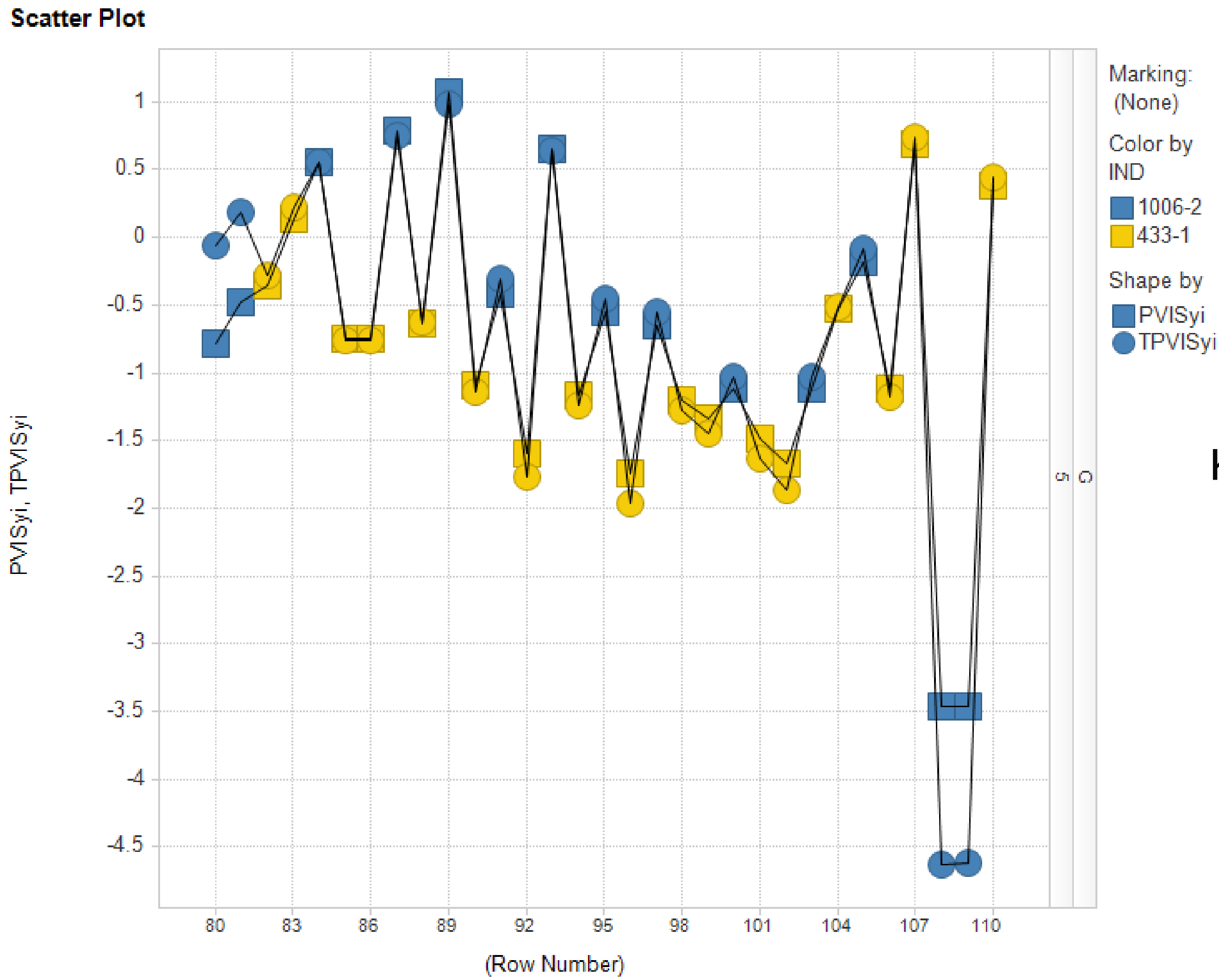
Shewhart (Yi) – Lab G Stand 5



K=1.8

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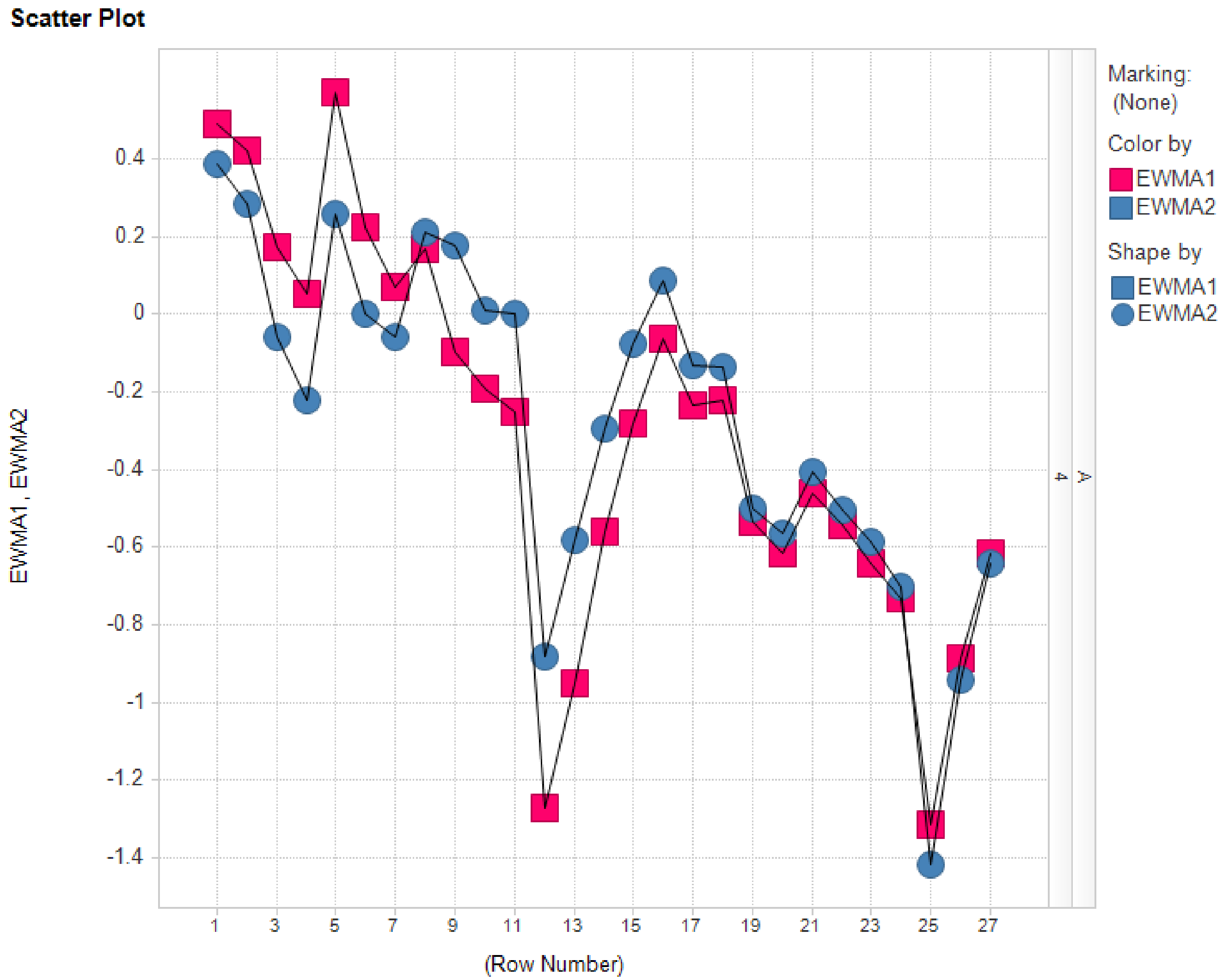
EWMA (Zi) – Lab A Stand 4



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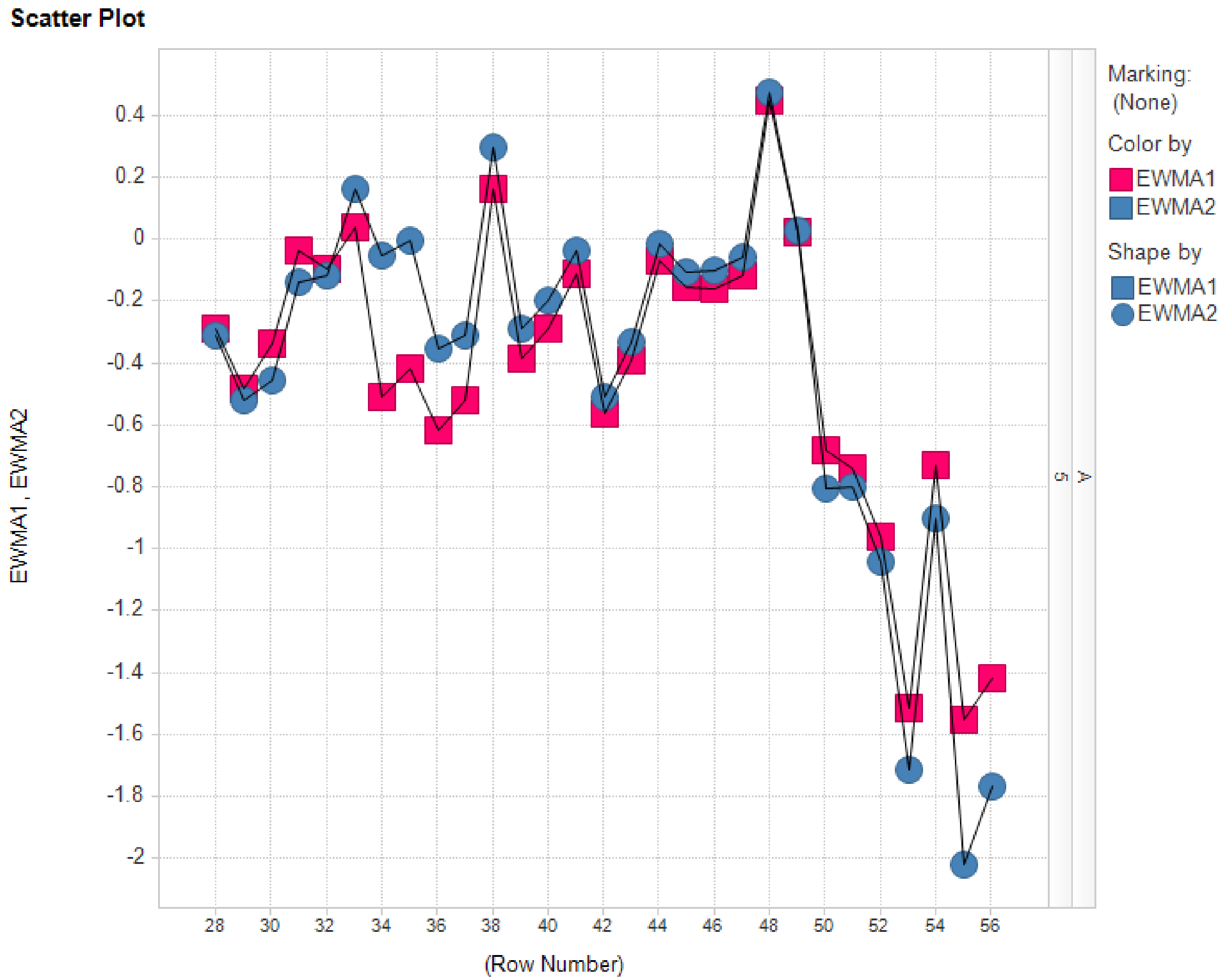
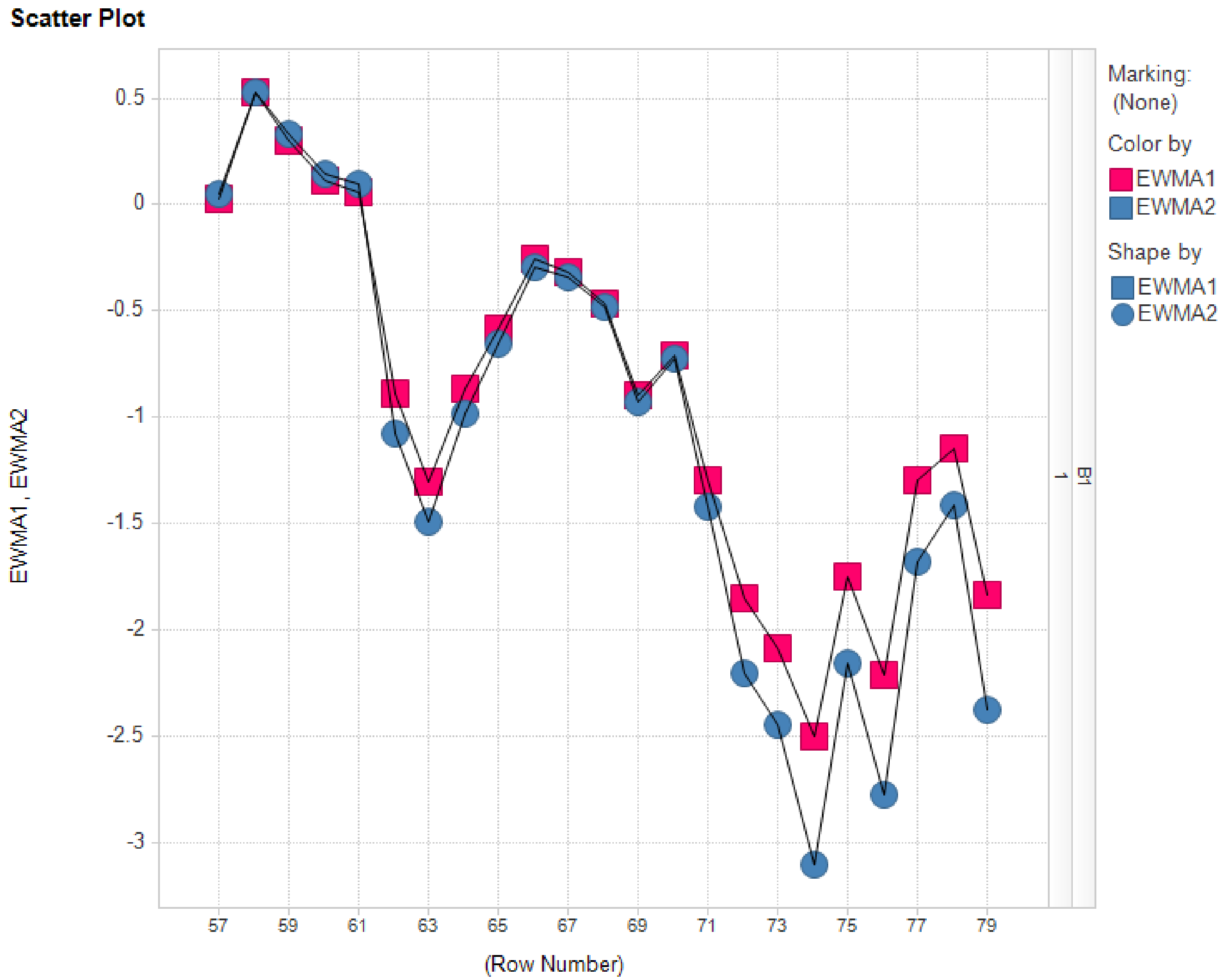
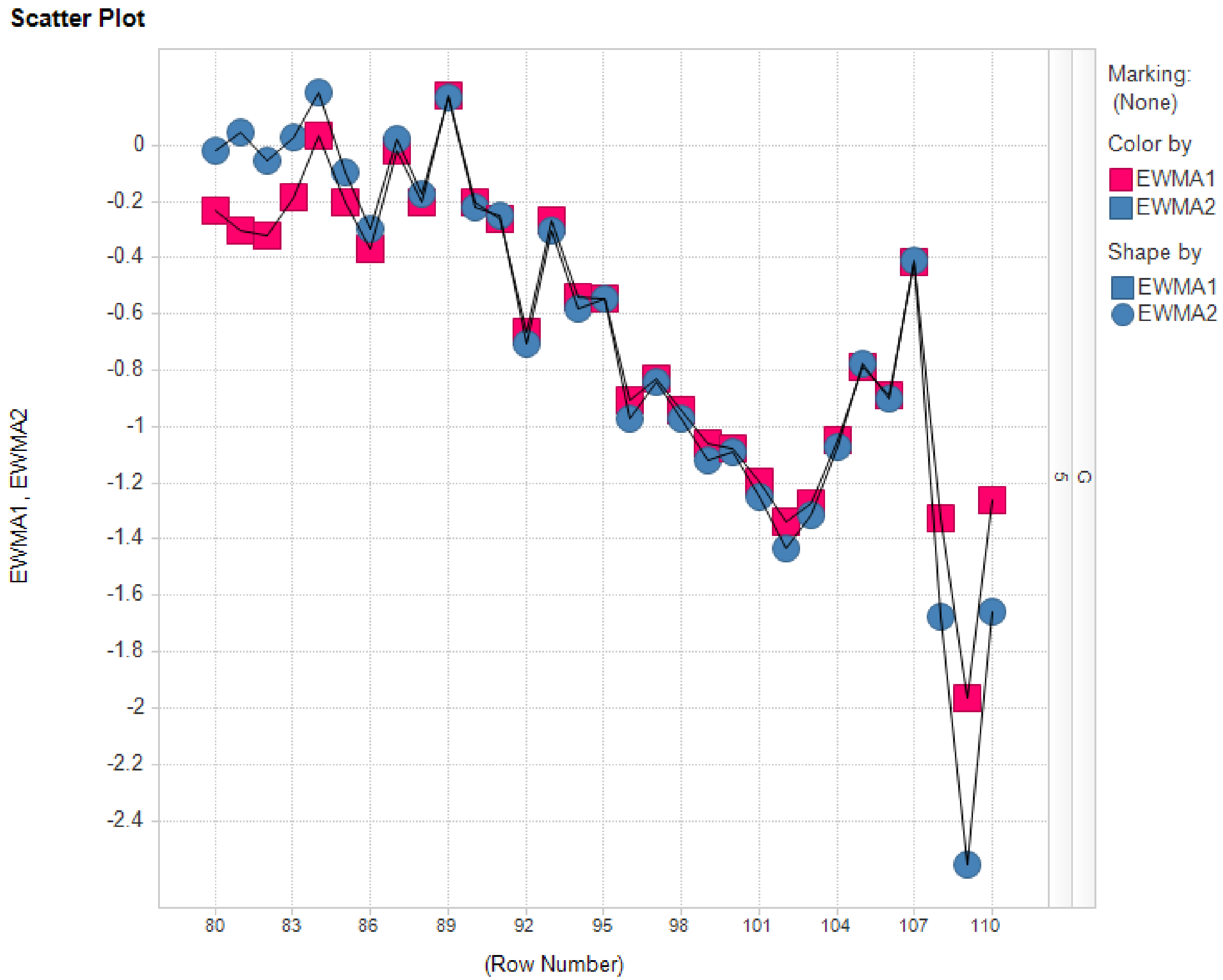
EWMA (Zi) – Lab A Stand 5



EWMA (Zi) – Lab B1 Stand 1



EWMA (Zi) – Lab G Stand 5



Attachment 4

IIIF 1006 Reference Oil Severity Trend

Presented by: Todd Dvorak

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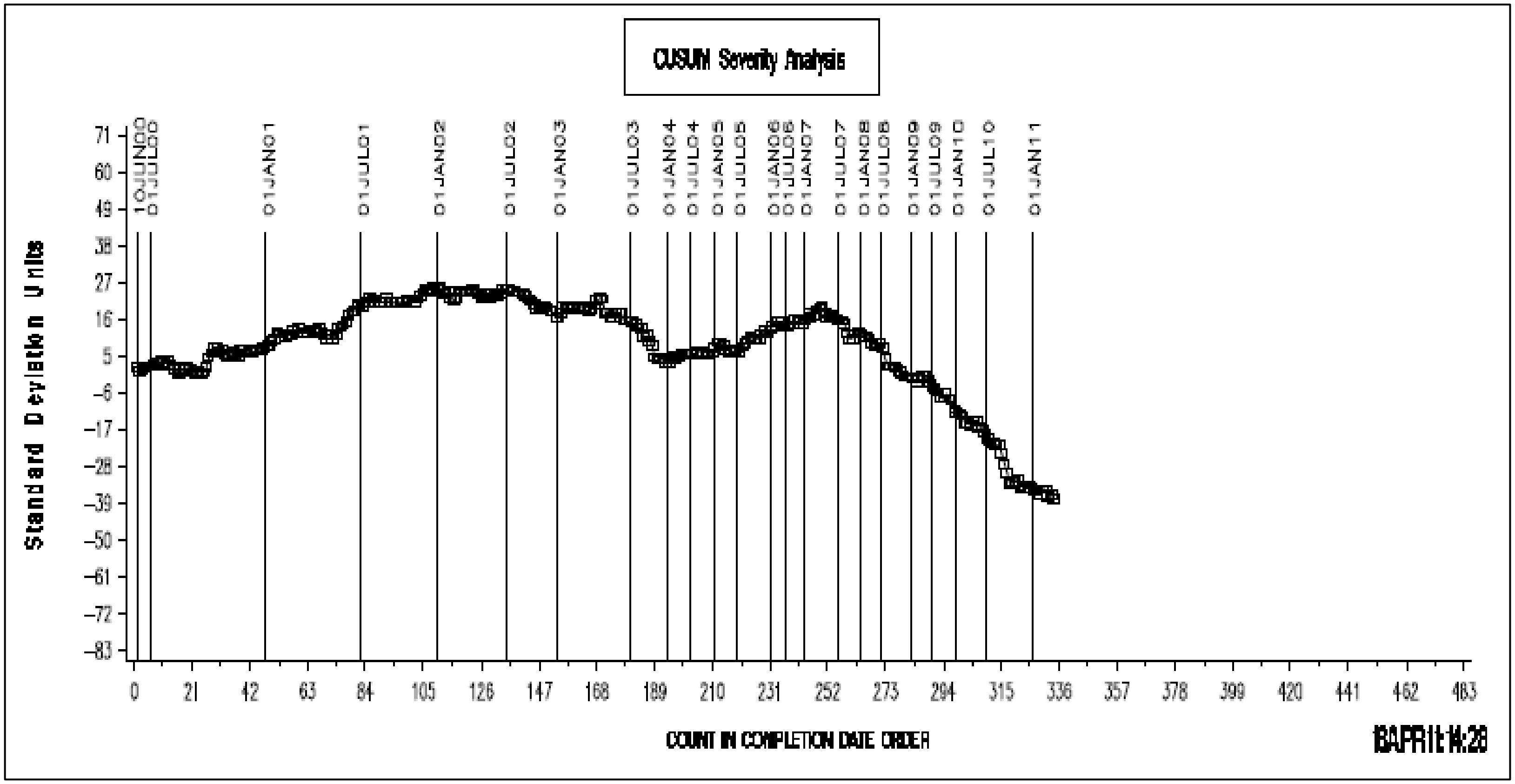
IIIF Severity Trend Summary

- **Test labs are having calibration problems with reference oil 1006**
- **A review of the (TMC) CUSUM chart indicates that the PVIS parameter has been trending severe of target since 2007**
- **Coincidental with PVIS severity trend, the initial and average test blow-by has been increasing**
- **Possible factors such as ring and piston batches appear to be coincidental with the increase in Blow-By and PVIS**
- **Would not recommend the development of a modified TPVIS calculation approach for reference oil 1006 without further investigation into possible root causes**
- **Following slides examine the reference oil test data trends and the corresponding factors that may be related to the PVIS severity**

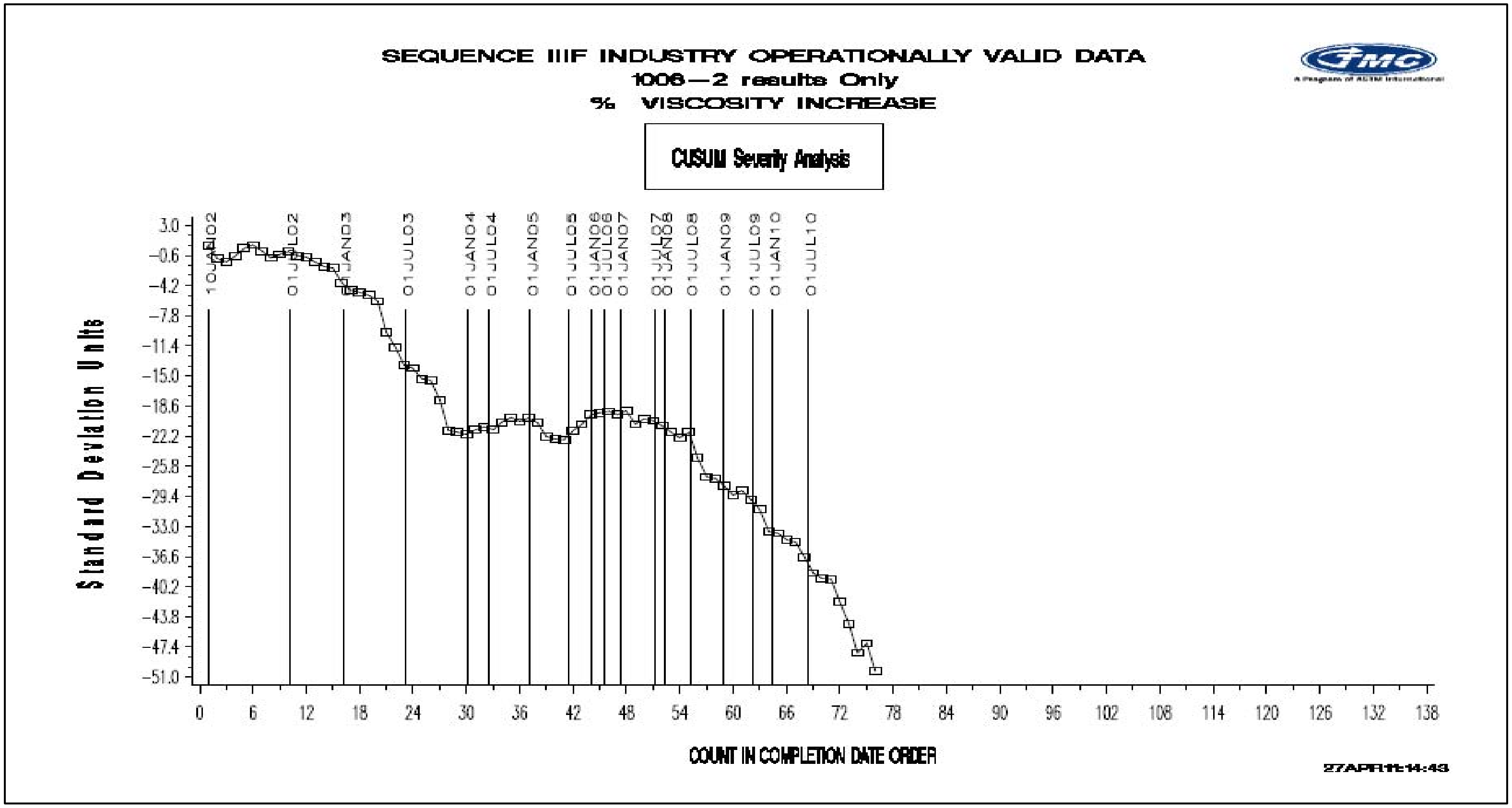
PVIS Severity Trend

- **Plot of IIIF PVIS Industry CUSUM Chart suggests that the PVIS parameter has been trending severe - since the first quarter of 2007.**



PVIS Severity Trend

- **Plot of reference oil 1006-2 exclusively suggests that the PVIS parameter has been trending severe - since the first quarter of 2007.**



Afton CHEMICAL

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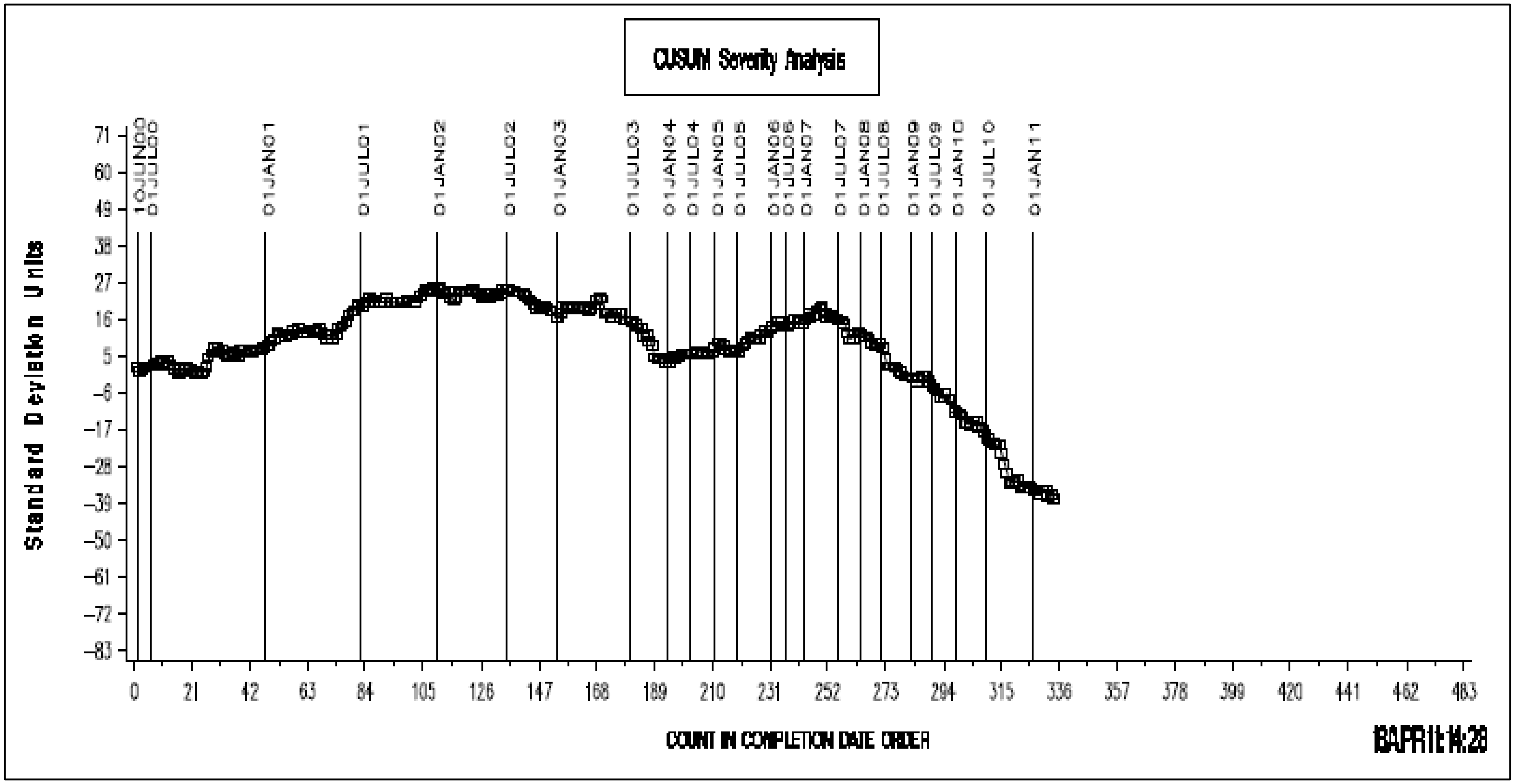
PVIS Severity Trend

- **Plot of reference oil 433-1 exclusively also suggests that the PVIS parameter has been trending severe - since the first quarter of 2007.**



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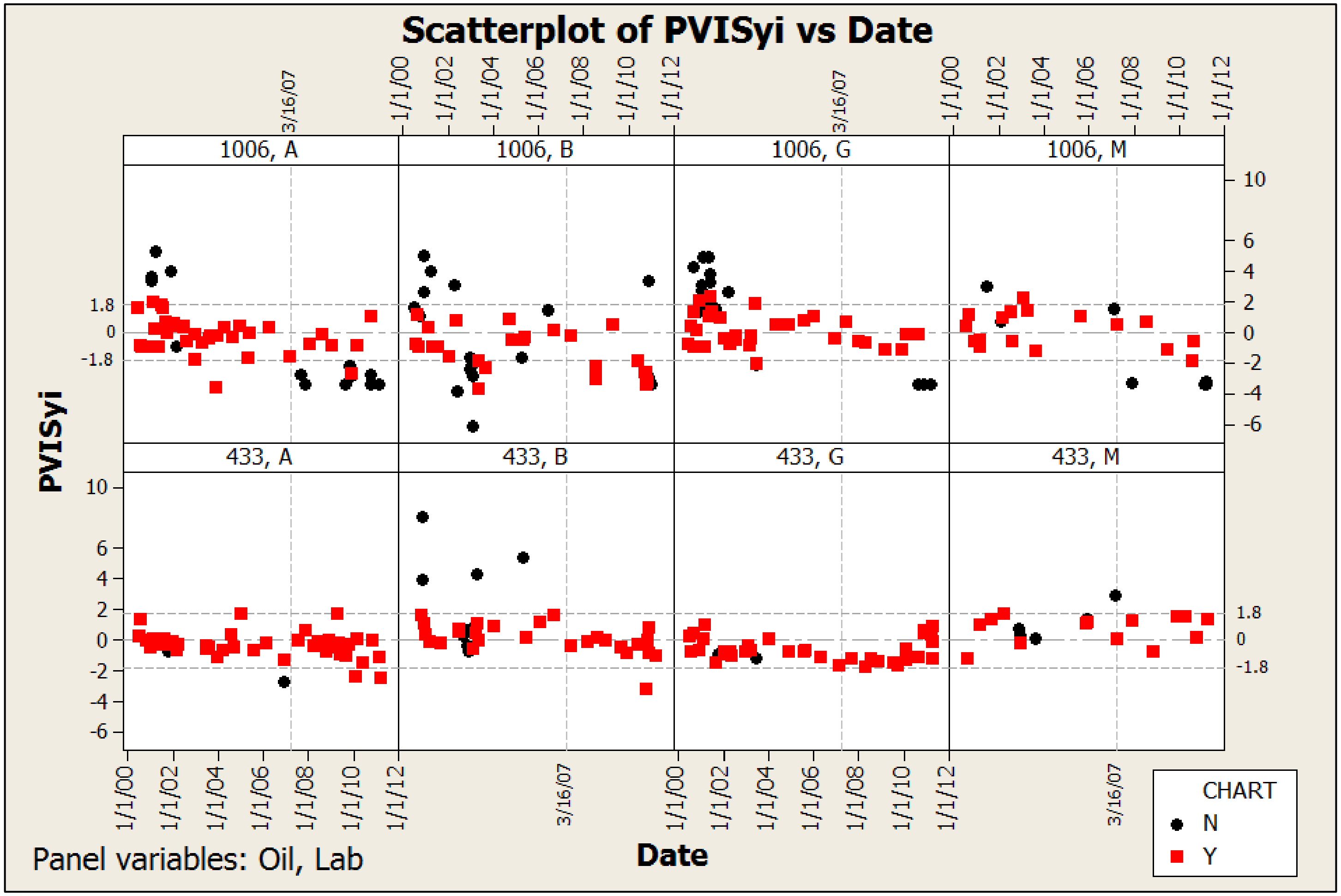
PVIS Severity Trend

- **Plot of Chartable & Non-Chartable IIIF PVIS Y_i data suggests a similar trend that occurred near the first quarter of 2007.**

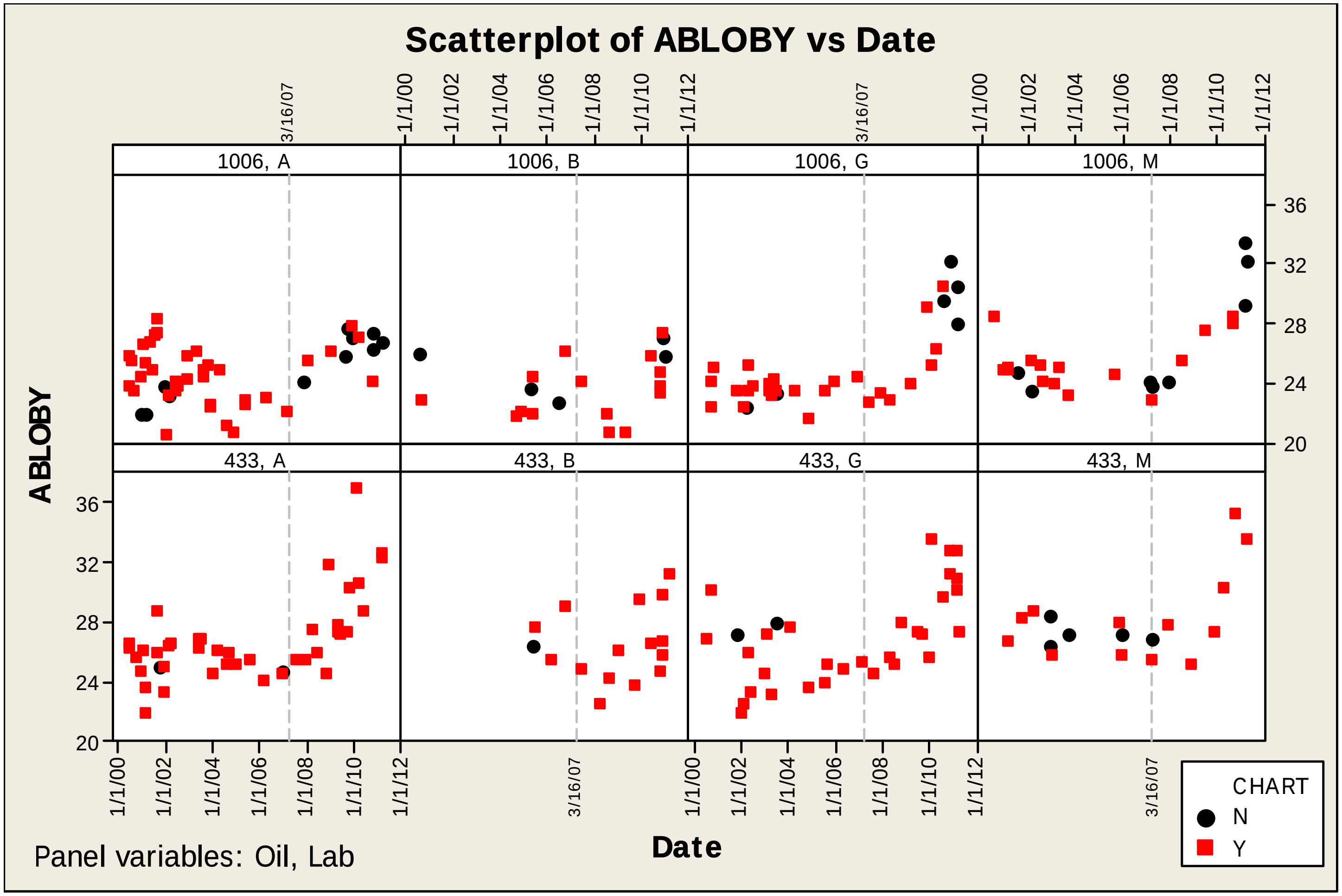


Afton Chemical

Passion for Solutions™

PVIS Severity Trend

- **Plot of Chartable & Non-Chartable (Oil 433 & 1006) Avg Blow-by data suggests a similar increasing trend - near the first quarter of 2007.**



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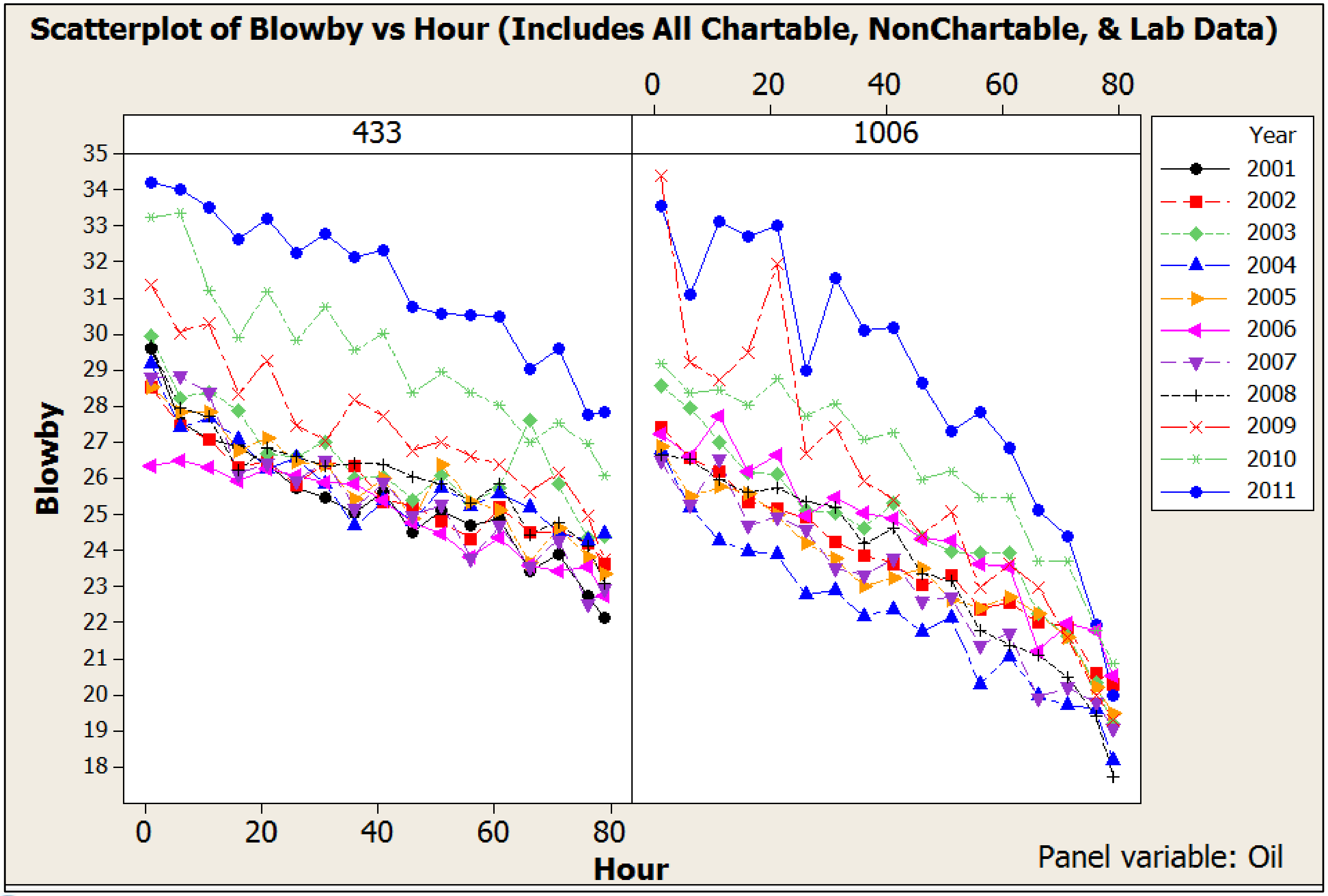
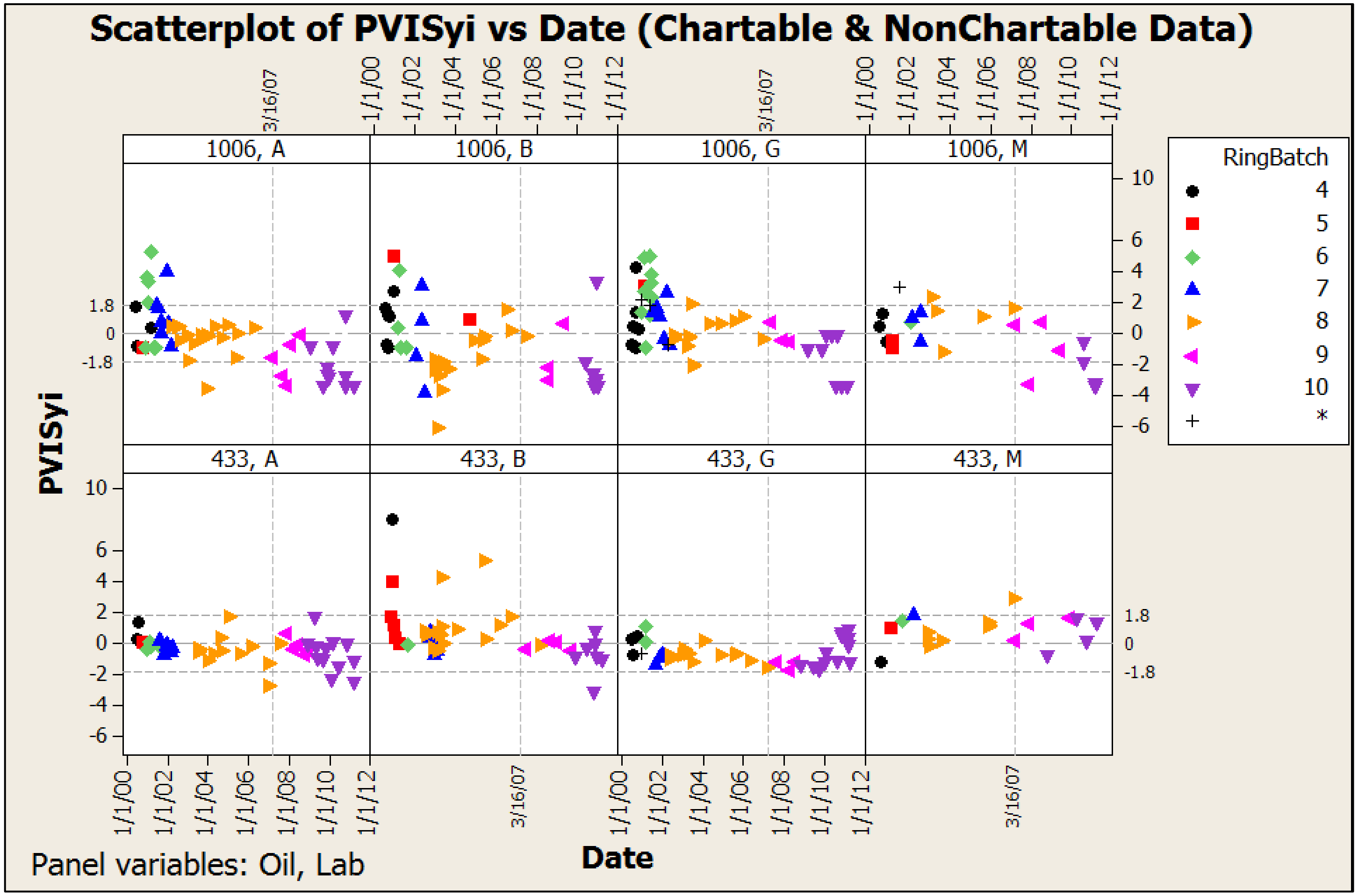
PVIS Severity Trend

- **Industry average hourly blow-by for both reference oils (Chart = Y & N and all lab data) suggests an increasing trend - in 2009, 2010, and 2011.**



PVIS Severity Trend

- **Plot of Chartable & Non-Chartable IIIF PVIS Y_i data suggests that Ring batches 9 & 10 may be coincidental with the apparent severity shift**



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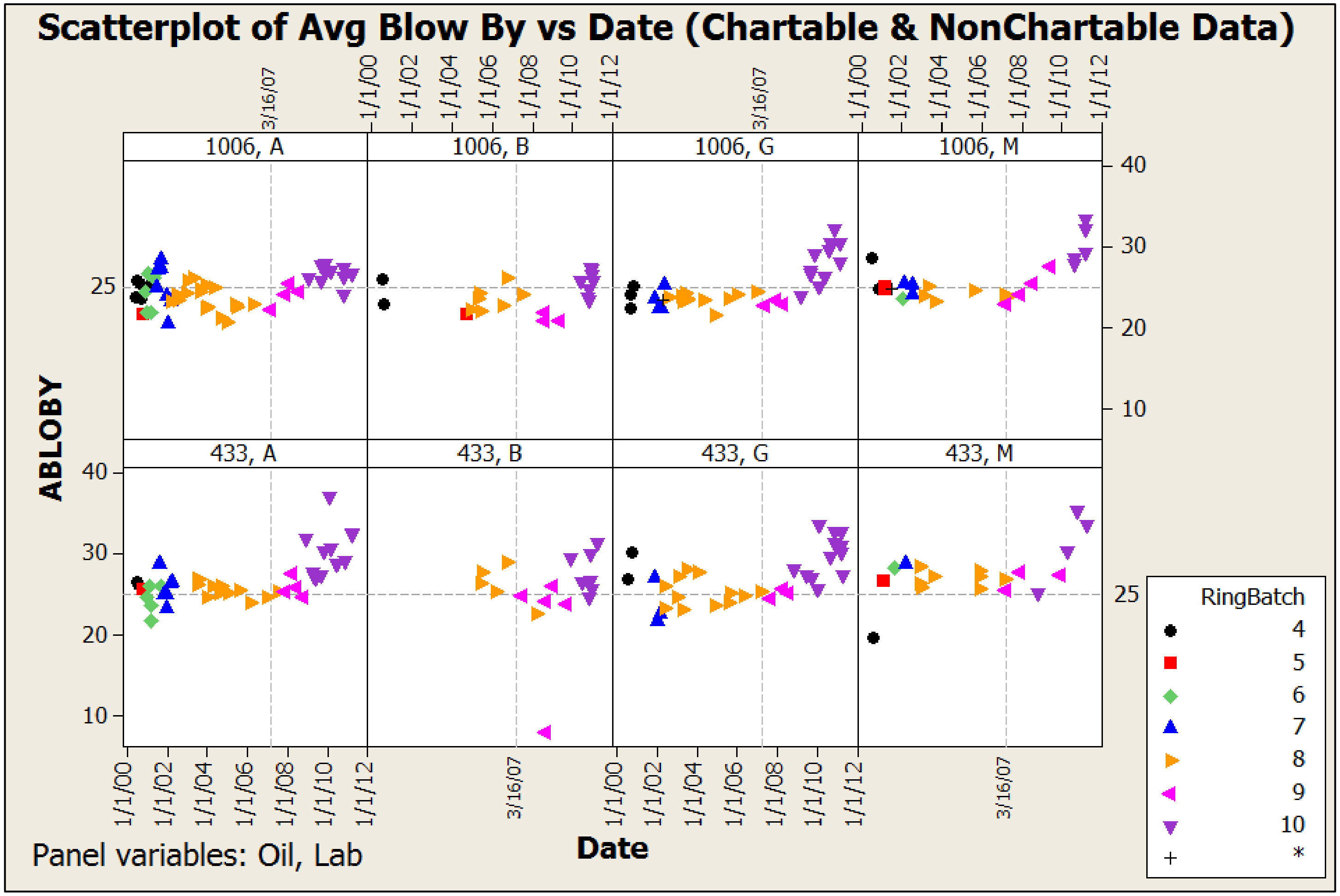
PVIS Severity Trend

- **Similar Blow-by trend plot with ring batch identification**



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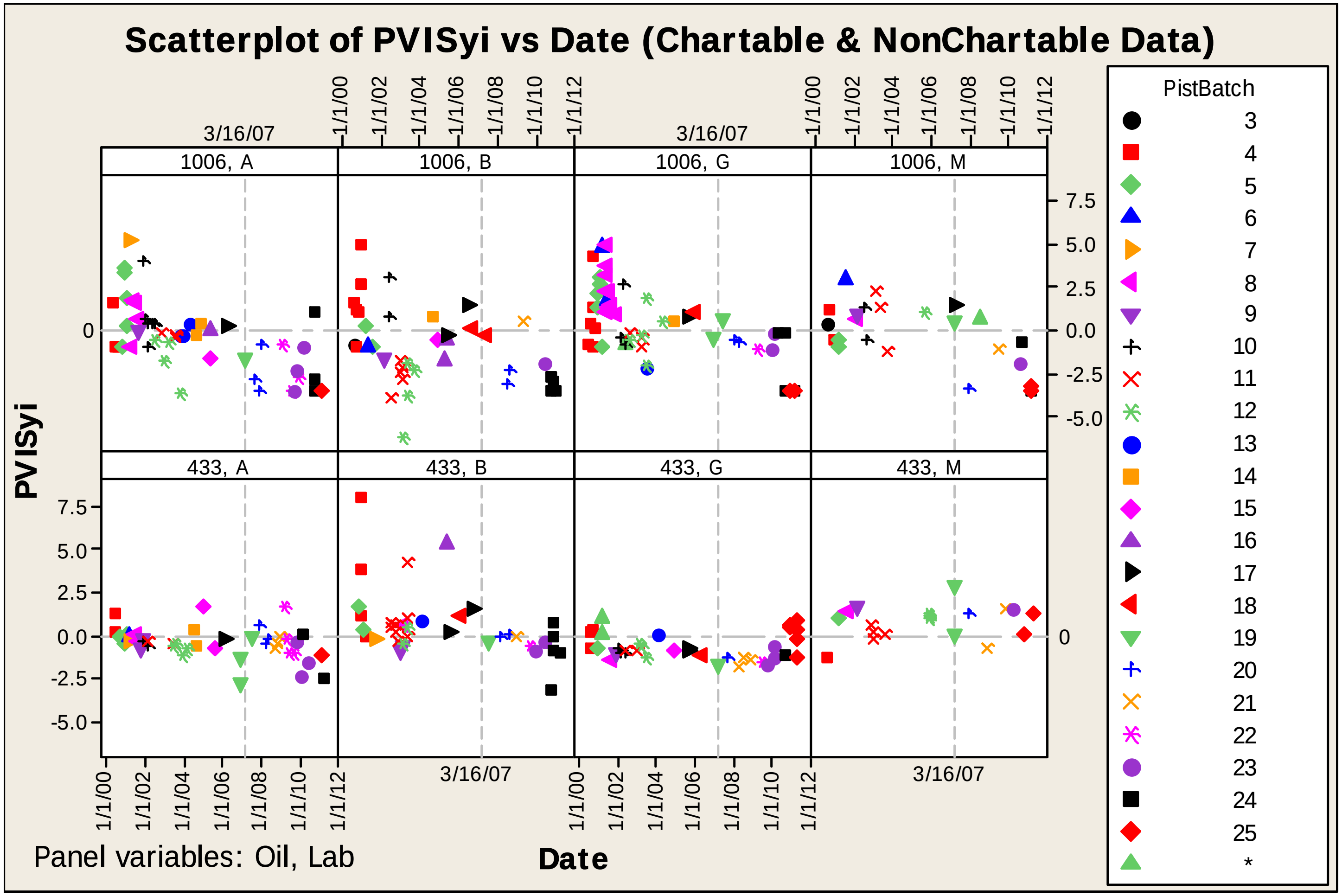
PVIS Severity Trend

- **Similar PVIS Y_i plot with piston batch identification**



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PVIS Severity Trend

Analysis of TPVIS & Ring Batch Data *(Chart = 'Y' data exclusively)*

- Analysis suggests ring batch is related to TPVIS
- *Caution: Ring batches are correlated with calendar date*

```
General Linear Model: TPVIS versus Lab, RingBatch, Oil

Factor     Type   Levels  Values
Lab        fixed       5  A, B, E, G, M
RingBatch  fixed       7  4, 5, 6, 7, 8, 9, 10
Oil        fixed       3  1006, 1008, 433


Analysis of Variance for TPVIS, using Adjusted SS for Tests

Source      DF    Seq SS    Adj SS    Adj MS        F      P
Lab          4  0.004051  0.008700  0.002175     5.98  0.000
RingBatch    6  0.049039  0.009353  0.001559     4.29  0.000
Oil          2  0.899912  0.899912  0.449956  1236.90  0.000
Error      317  0.115318  0.115318  0.000364
Total      329  1.068318


S = 0.0190730   R-Sq = 89.21%   R-Sq(adj) = 88.80%
```

```
Least Squares Means for TPVIS

Lab           Mean   SE Mean
A          0.09059  0.001914
B          0.09421  0.002307
E          0.10097  0.008749
G          0.08791  0.002139
M          0.10442  0.002984

RingBatch
 4         0.08741  0.003939
 5         0.09863  0.005002
 6         0.09647  0.003401
 7         0.09823  0.003158
 8         0.10273  0.002511
 9         0.09658  0.003952
10         0.08929  0.003360

Oil
1006       0.03386  0.002474
1008       0.09156  0.002700
433        0.16144  0.002539
```

PVIS Severity Trend

Analysis of TPVIS & Piston Batch Data *(Chart = 'Y' data exclusively)*

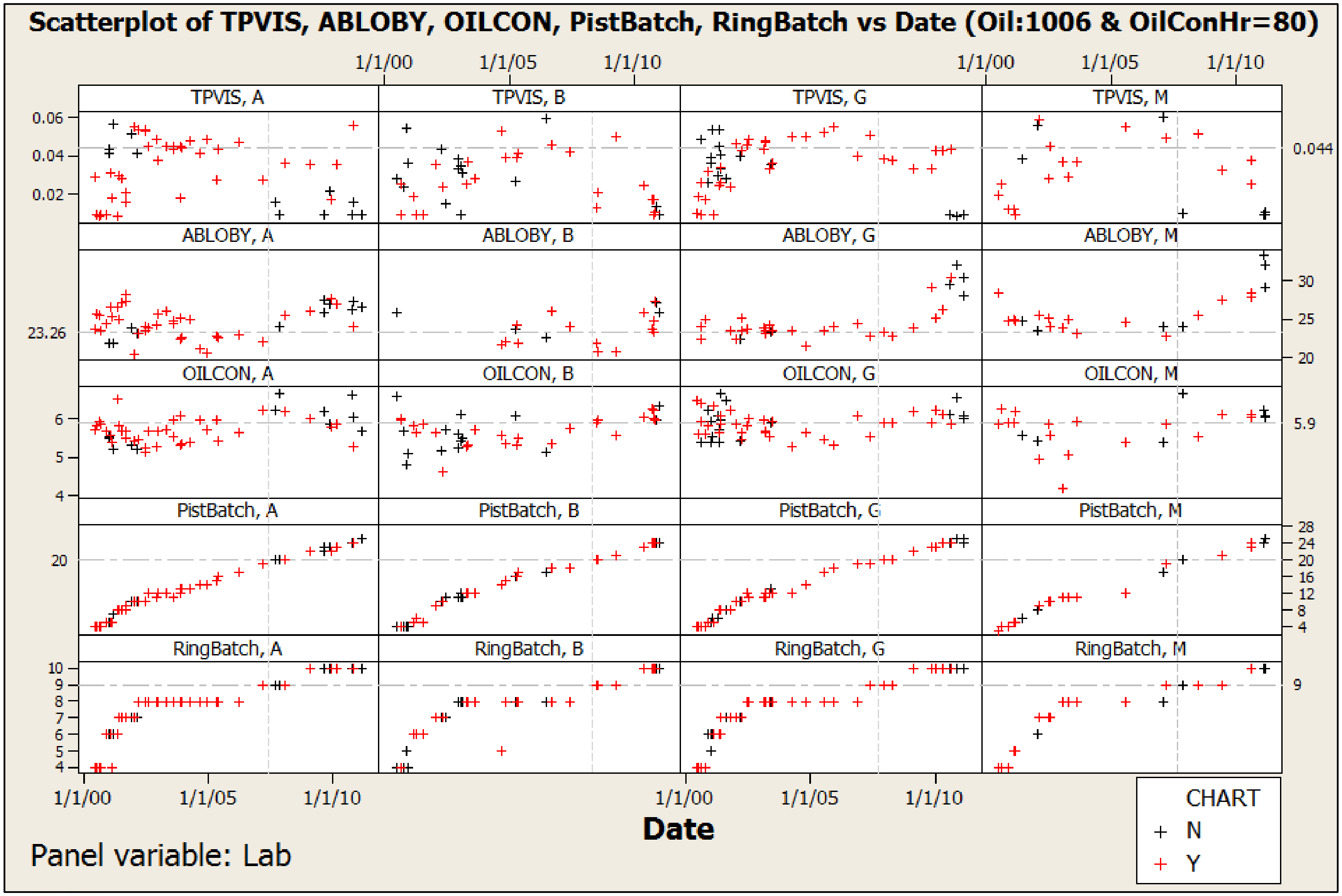
- Analysis also suggests Piston batch is related to TPVIS
- *Caution: Piston batches are also correlated with calendar date*

```
General Linear Model: TPVIS versus Lab, PistBatch, Oil

Factor     Type   Levels  Values
Lab        fixed       5  A, B, E, G, M
PistBatch  fixed      23  3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14,
                          15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25
Oil        fixed       3  1006, 1008, 433

Analysis of Variance for TPVIS, using Adjusted SS for Tests

Source      DF    Seq SS    Adj SS    Adj MS        F      P
Lab          4  0.006239  0.009504  0.002376     6.70  0.000
PistBatch   22  0.117358  0.017364  0.000789     2.22  0.002
Oil          2  0.830895  0.830895  0.415448  1170.72  0.000
Error      300  0.106460  0.106460  0.000355
Total      328  1.060953

S = 0.0188379   R-Sq = 89.97%   R-Sq(adj) = 89.03%

Least Squares Means for TPVIS

Lab           Mean   SE Mean
A          0.09292  0.001982
B          0.09752  0.002398
E          0.10189  0.009070
G          0.08919  0.002190
M          0.10703  0.003116
```

```
Least Squares Means for TPVIS
PistBatch     Mean   SE Mean
 3          0.07235  0.011168
 4          0.09129  0.003976
 5          0.09294  0.003982
 6          0.09483  0.007234
 7          0.09672  0.007994
 8          0.09666  0.003955
 9          0.10942  0.006347
10          0.09683  0.004489
11          0.10204  0.004194
12          0.09995  0.003643
13          0.11016  0.007417
14          0.10708  0.006634
15          0.10255  0.007988
16          0.10818  0.011096
17          0.10701  0.006046
18          0.10792  0.006969
19          0.09606  0.005221
20          0.09752  0.004954
21          0.08805  0.006095
22          0.09309  0.006695
23          0.08486  0.005455
24          0.08355  0.005082
25          0.10831  0.006821

Oil
1006        0.03611  0.002539
1008        0.09439  0.002795
433         0.16264  0.002604
```

PVIS Severity Trend

- **Relationship of TPVIS, OilCon, RingB, Blow-by, PistonB by date (Oil 1006)**

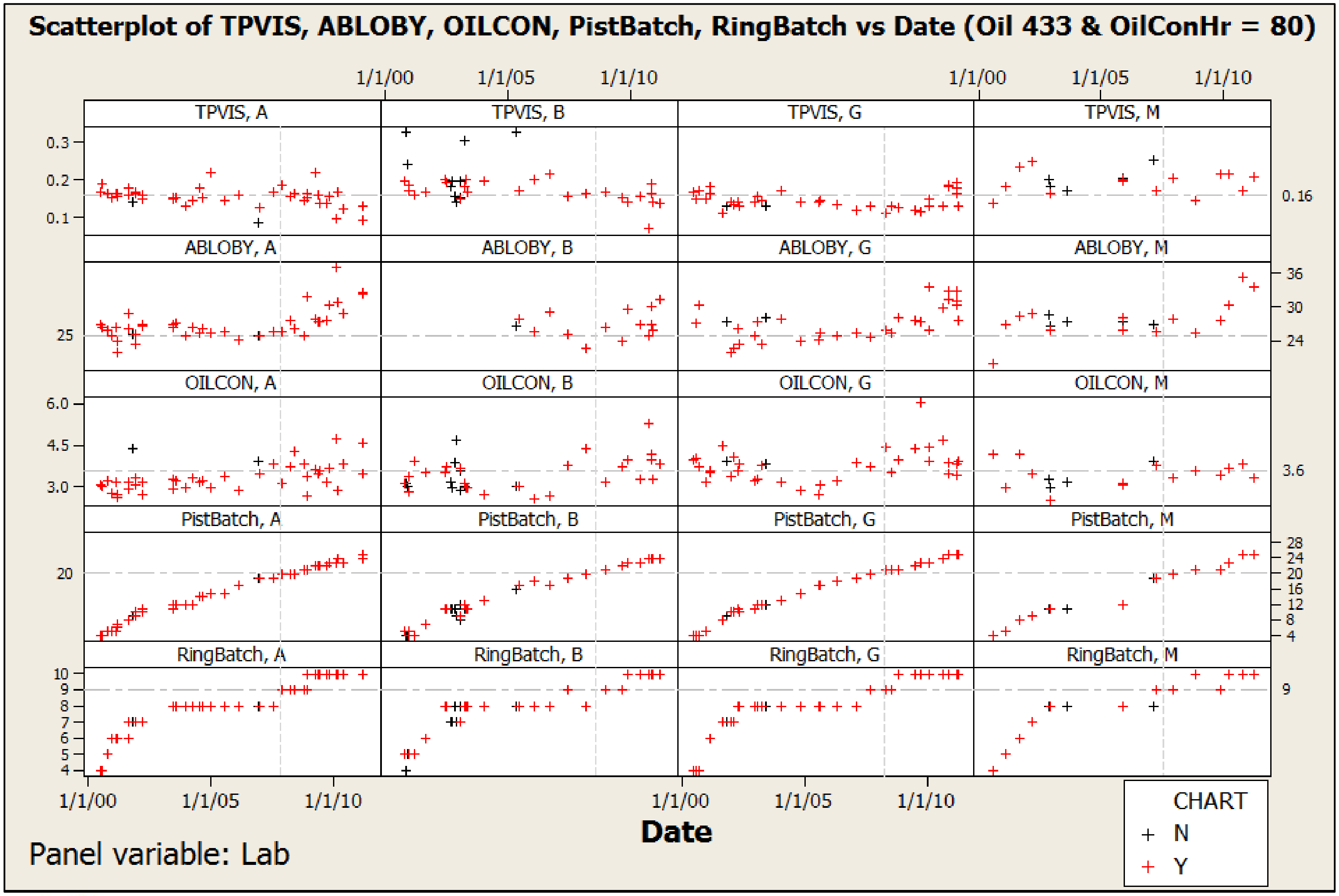


Afton CHEMICAL

Passion for Solutions™

PVIS Severity Trend

Relationship of TPVIS, OilCon, RingB, Blow-by, PistonB by date (Oil 433)



Afton CHEMICAL

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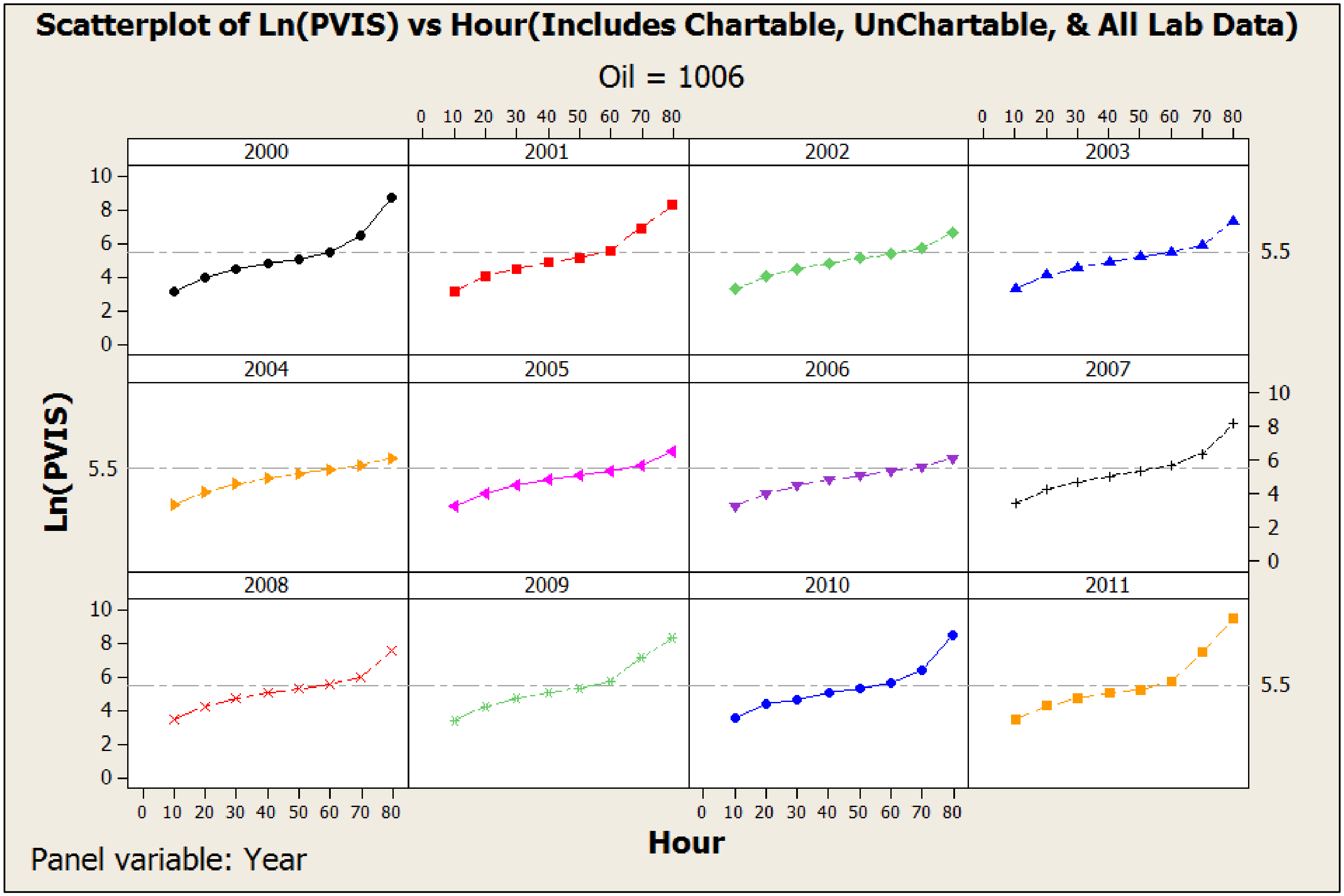
IIIF Severity Trend Summary

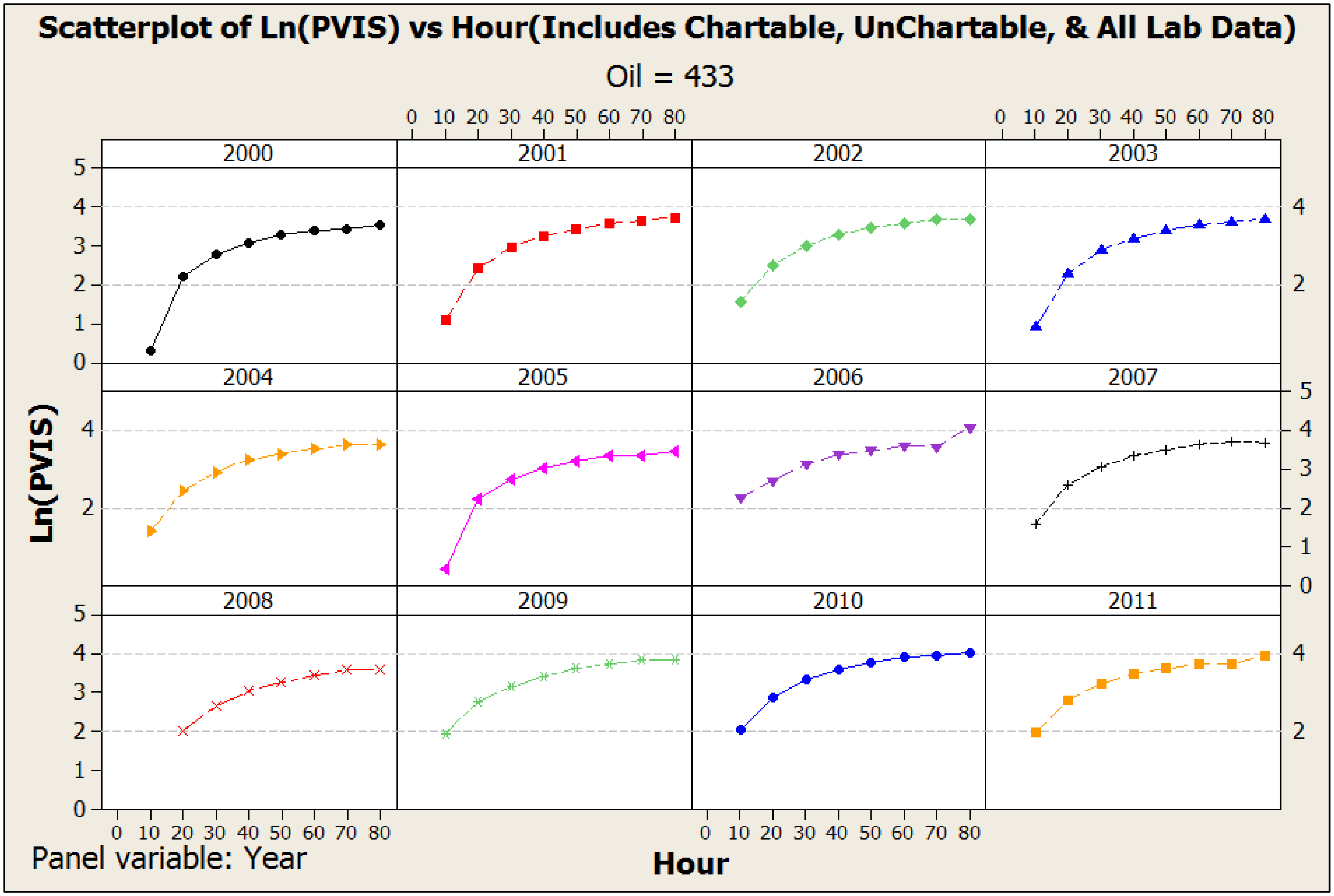
- **PVIS has been trending severe since 2007**
- **The measured blow-by has also been on a similar increasing trend since 2007**
- **Recent piston and ring batch codes seem to be coincidental with an increase in the PVIS and blow-by**
- **Parts batch changes are coincidental with calendar date and may have no relationship with the current (PVIS) test severity**
- **Recommend the Surveillance Panel investigate test hardware to identify possible root cause(s) for the increase in PVIS and blow-by**

Appendix 1 –Supplemental IIIF Plots

PVIS by Hour Plot – categorized by year (Oil 1006)



PVIS by Hour Plot – categorized by year (Oil 433)



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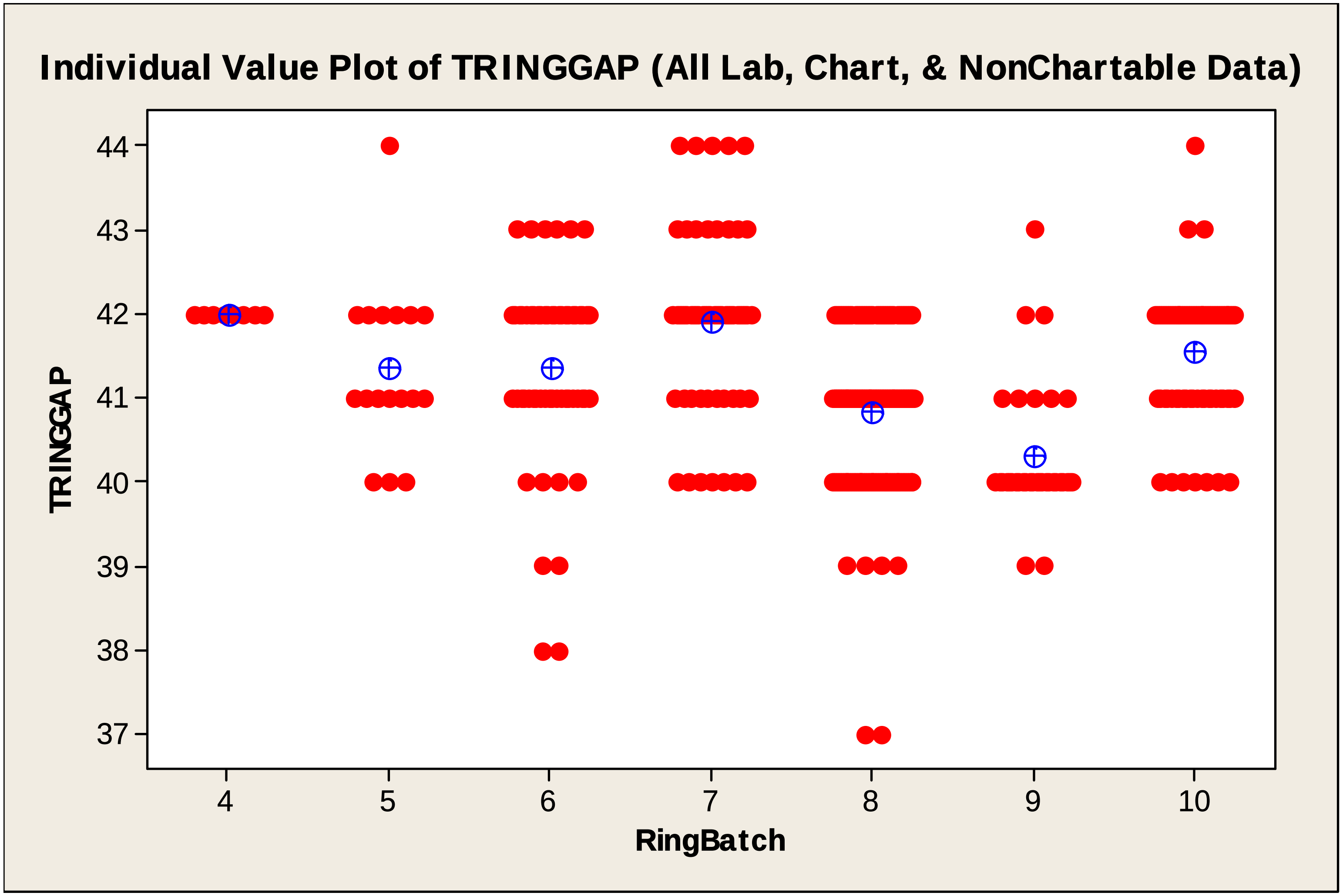
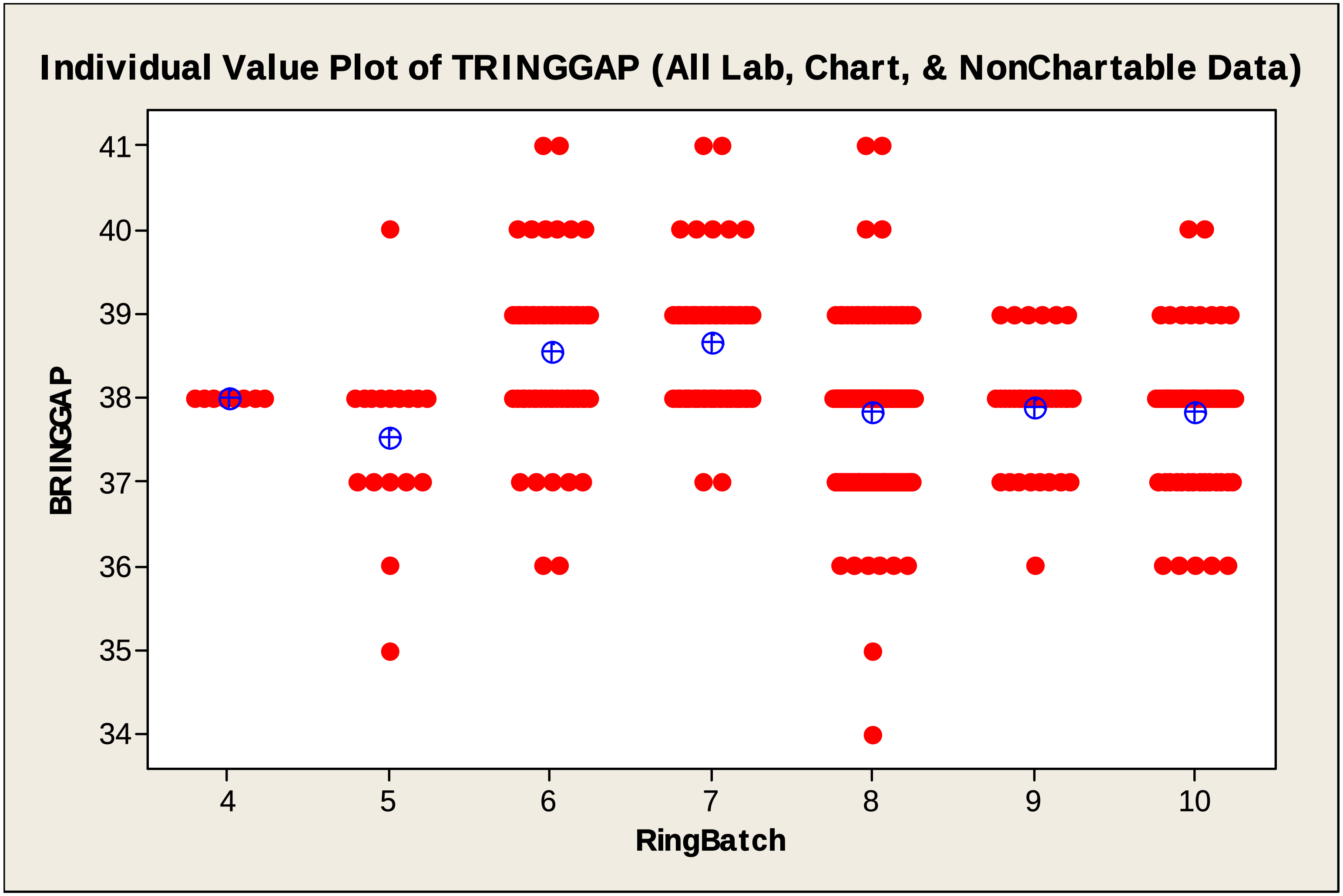
Top Ring Gap by Ring Batch Code (All Labs)



Bottom Ring Gap by Ring Batch Code (All Labs)



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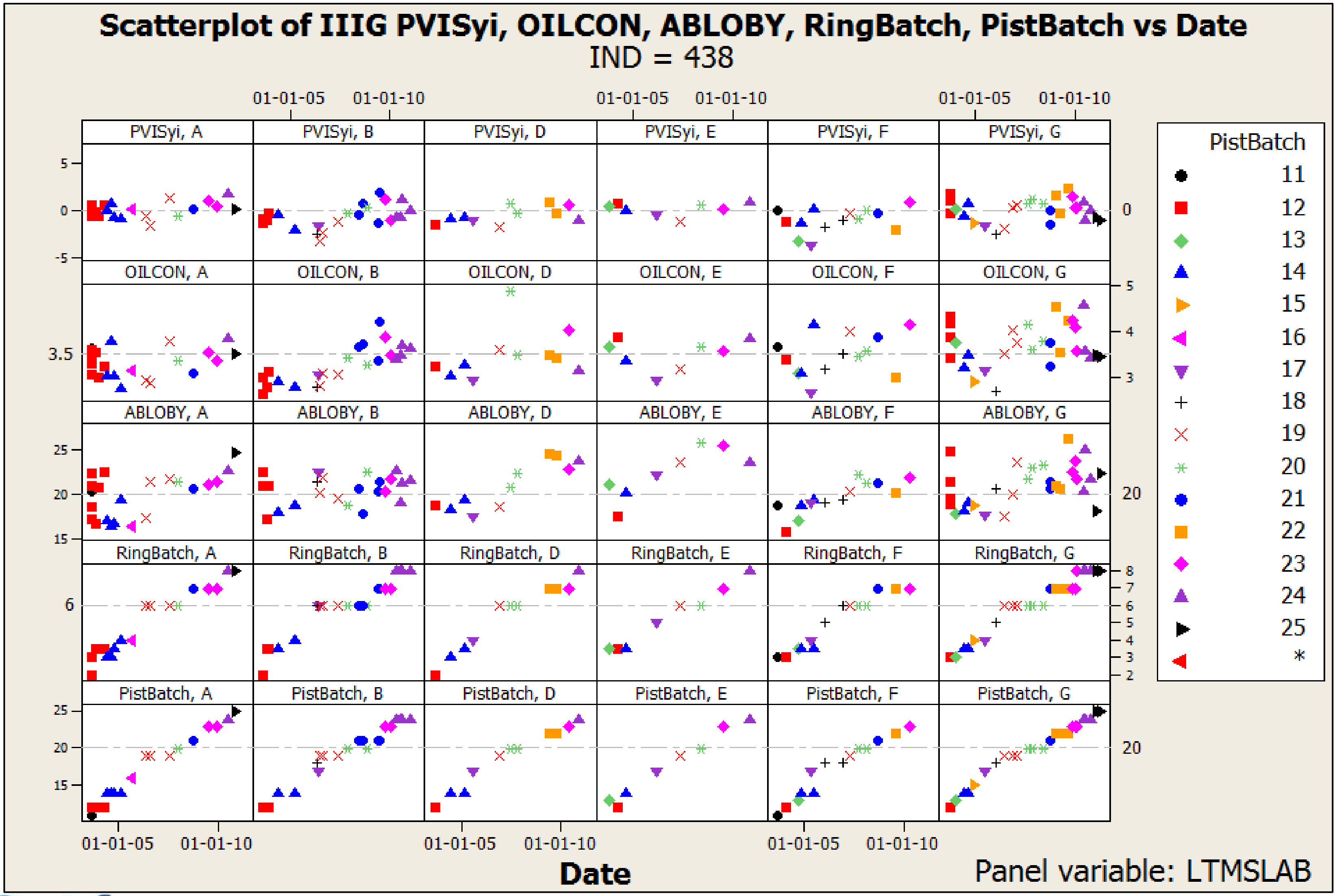
Appendix 2 –Supplemental IIIG Plots

IIIG PVIS Data Plot with Ring & Piston Hardware(Oil 438)



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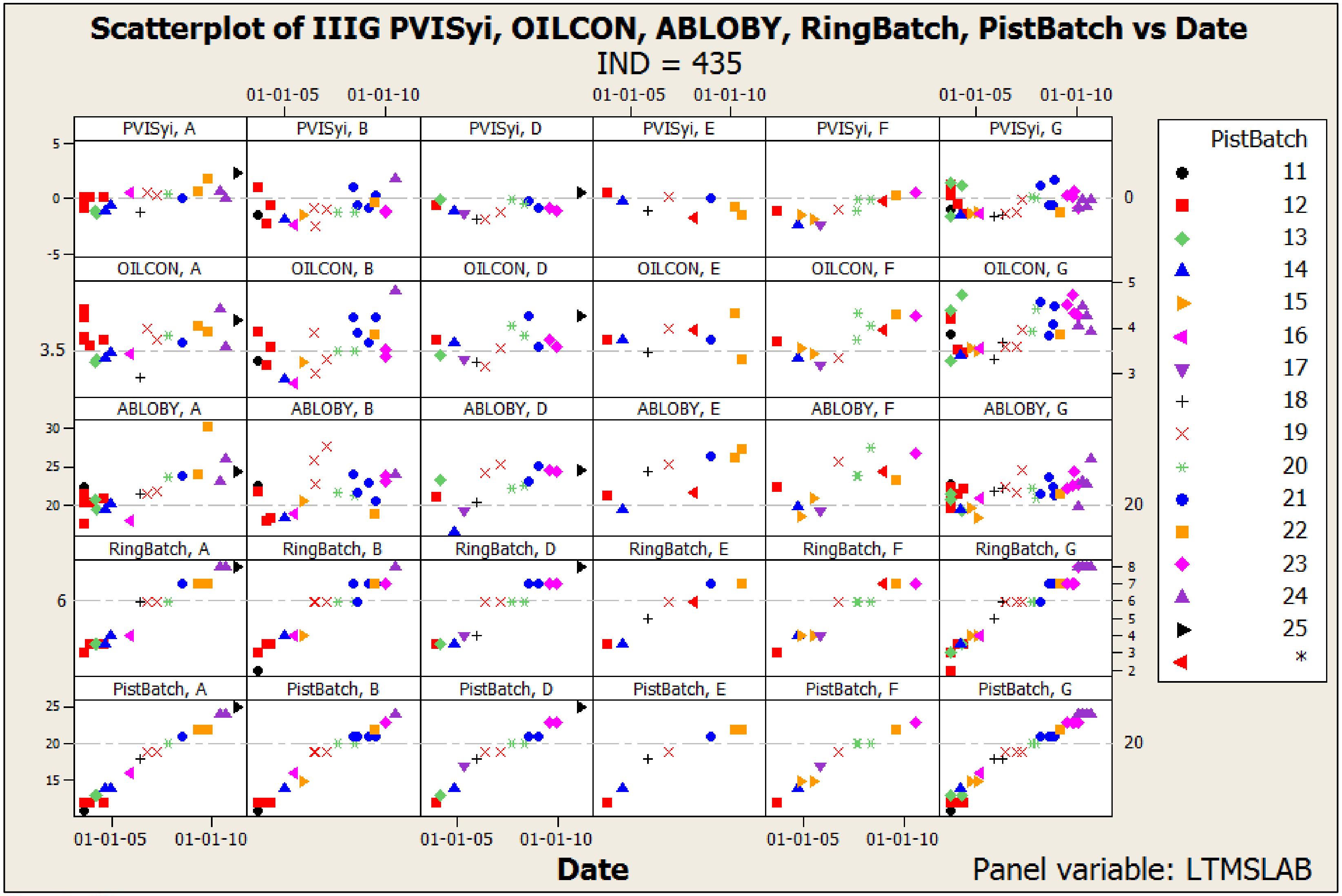
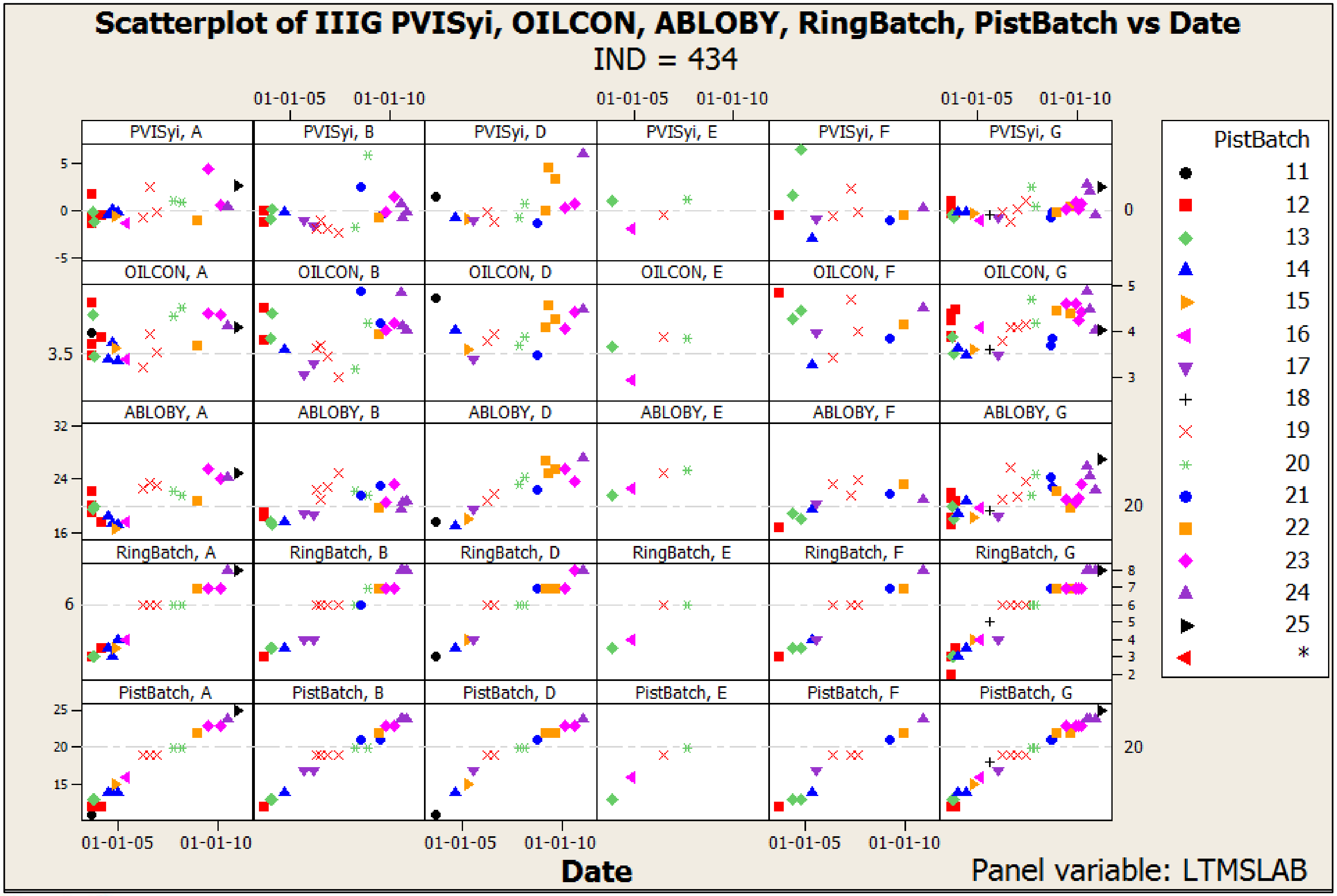
IIIG PVIS Data Plot with Ring & Piston Hardware(Oil 435)



IIIG PVIS Data Plot with Ring & Piston Hardware(Oil 435)



Afton CHEMICAL

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Attachment 5

Preliminary IIIF Hardware Check

Presented by: Ed Altman
6/2/11

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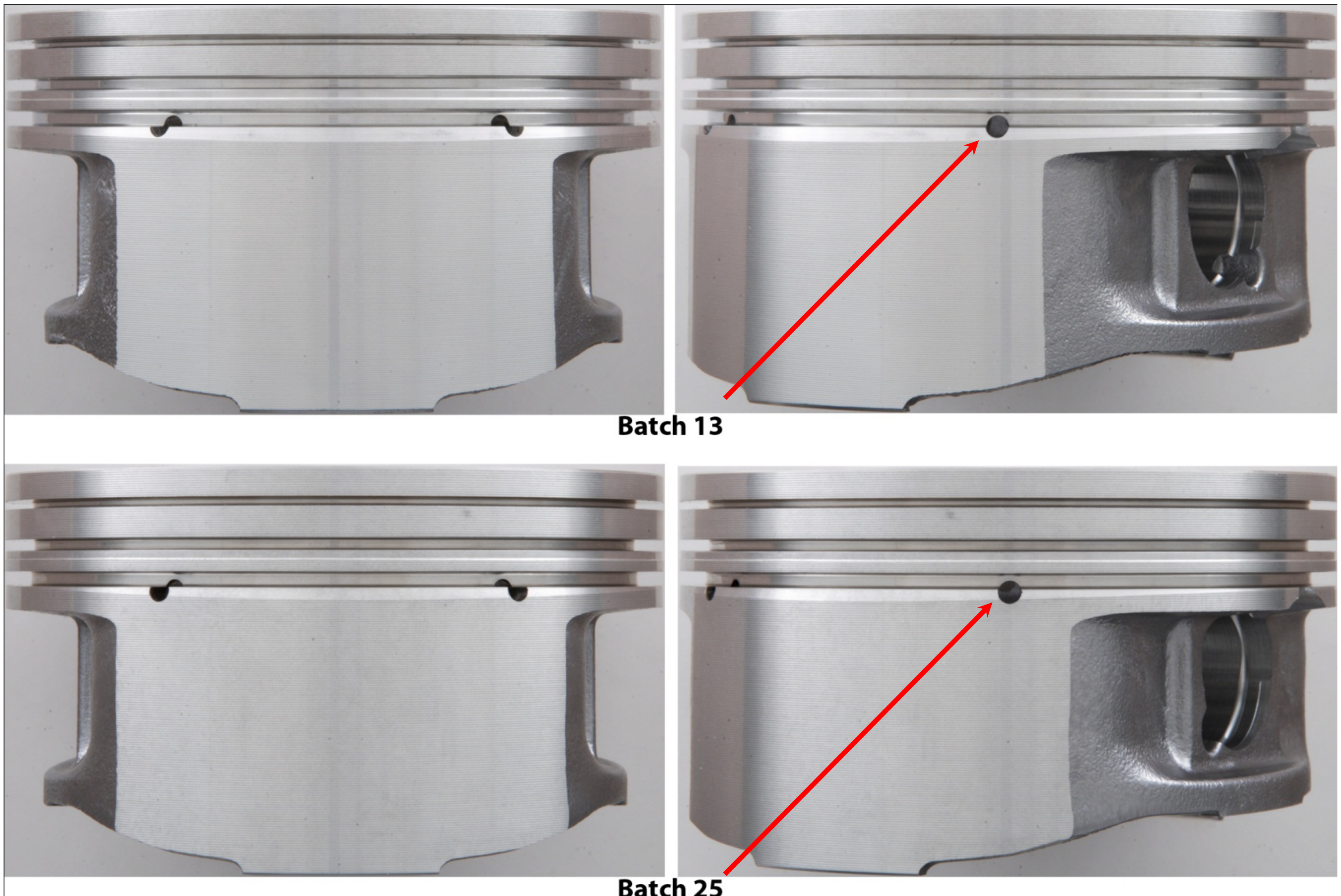
Preliminary IIIF Hardware Check

- **IIIF data suggests that a change in the amount of blow-by has occurred.**
- **Attributes of the piston batch may be related to the increase in blow-by and/or factors related to oil consumption**
- **Various piston batches have been examined to identify possible hardware related attributes that are related to the increased levels of blow-by.**
  - There does appear to be a difference in the location of the oil return hole location on the piston
  - Pin gauge checks of the piston may suggest that there could be differences in the height of the top ring groove height.
- **Is not known if either of the identified attributes are related to the increased severity of the IIIF PVIS parameter**
- **Hardware related pictures/graphs on following slides.**

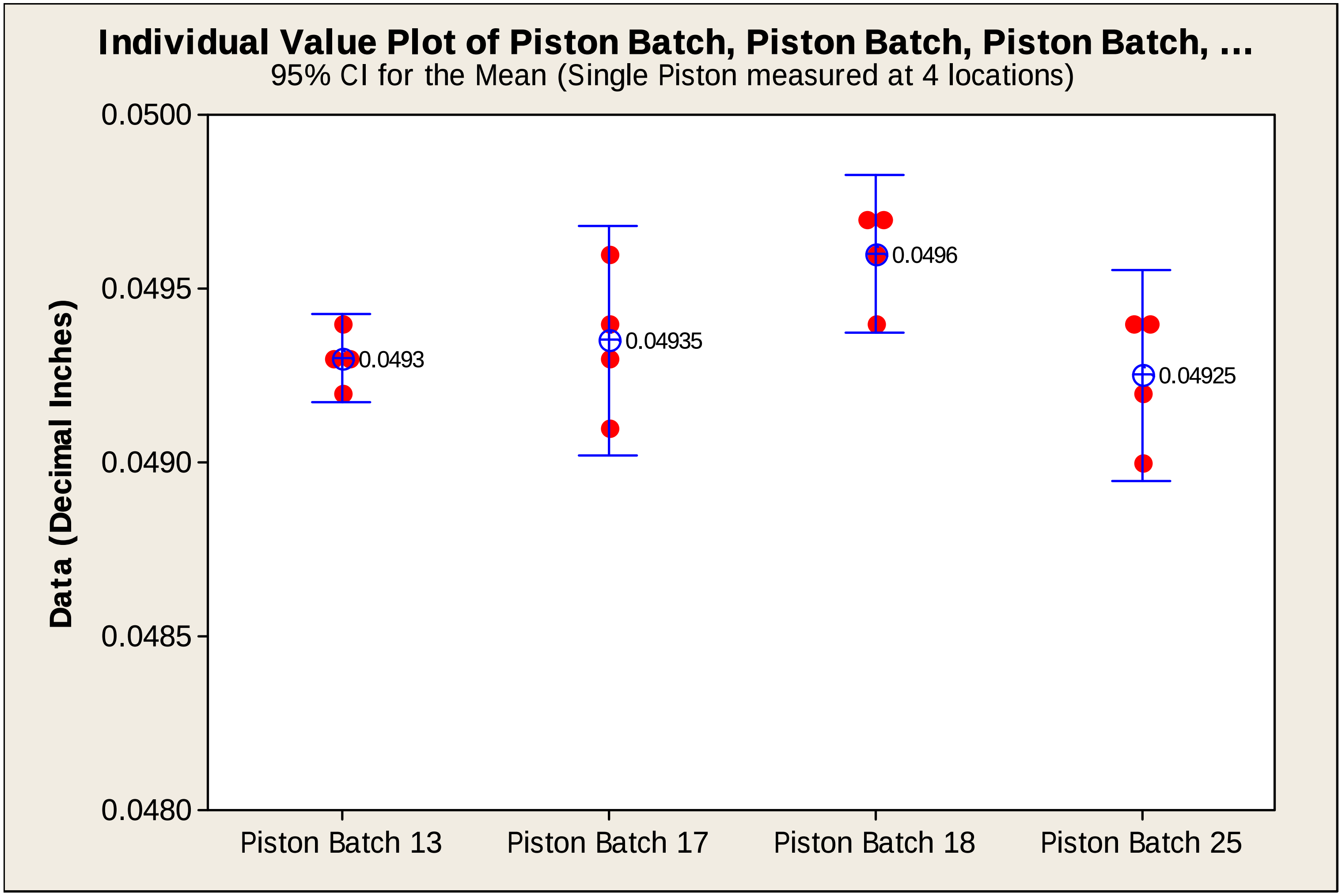
Preliminary IIIF Hardware Check

- **Oil return hole locations on piston (BC13 vs. BC25):**



Preliminary IIIF Hardware Check

Sample measurements of top ring groove height:



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Attachment 6

Sequence IIIF and IIIG Test Activity and Performance

Report of the Sequence III Surveillance Panel to ASTM D02.B

David L. Glaenzer

June, 2011

Sequence IIIF / IIIG Test Reference Oils

Number of IIIF Active Reference Oils: 2

RO 1006-2	**Use suspended by SP**
RO 433-1	**Active reference oil**

Number of IIIG Active Reference Oils: 4

RO 434-1	**Active reference oil**
RO 435-2	**Active reference oil**
RO 438	**Active reference oil**
RO 1010	**Use on hold, target generation**

Reference Fuel: Haltermann EEE

Supplier indicates no problem with supply through GF-5.

Sequence IIIF / IIIG Surveillance Panel Activity

- Face to Face Meetings
  - January 19, 2011 to review LTMSV2 proposal
  - June 2, 2011 to review UEB suggested changes and RO 1006-2
- Teleconferences
  - November 19 & December 16, 2010 to review RO 1010 data
  - February 10, 2011 to review negative votes on LTMSV2
  - March 3, 2011 held Ad Hoc meeting on Unified Engine Build (UEB)
  - March 17, 2011 to review UEB proposal & use of RO 1006-2 in IIIF
  - March 24, 2011 Statistician group discuss RO 1006-2 data
  - March 31, 2011 to finalize UEB plans. Proposal to modify oil filter replacement criteria
  - April 27, 2011 Statistician group recommendation for RO 1006-2

IIIF TEST PRECISION Pooled Standard Deviation

Parameter	Reference Oils		Candidate Oils	
	Current	Previous	Current	Previous
PVIS **(transformed)**	**0.032**	0.013	**N/A**	0.00331
APV	**0.084**	0.091	**N/A**	0.48083
WPD	**0.501**	0.506	**N/A**	0.65761
Degrees of Freedom	**17**	7		1

IIIG TEST PRECISION Pooled Standard Deviation

Parameter	Reference Oils		Candidate Oils	
	Current (Avg delta in units)	**Previous (Avg delta in units)**	**Current**	**Previous**
PVIS (transformed)	**0.687**	0.330	**0.17723**	0.50017
WPD	**0.422**	0.373	**0.36740**	0.58910
ACLW (transformed)	**0.541**	0.329	**0.57257**	0.46767
Degrees of Freedom	**12**	21	**3**	10

Sequence IIIF / IIIG

Summary of Key Test Components

- 12593374 Connecting Rods
  - GM Racing 17,014 pieces
  - Labs 787 pieces
  - Total 17,801 pieces (**<u>2966</u>** <u>runs</u>)

  Based on 6 pieces per run

- 24502168 Crankshaft
  - GM Racing 406 pieces
  - Labs 80 pieces
  - Total 486 pieces (**<u>2916</u>** <u>runs</u>)

  Based on 6 runs per crankshaft

Sequence IIIF / IIIG

Summary of Key Test Components (cont.)

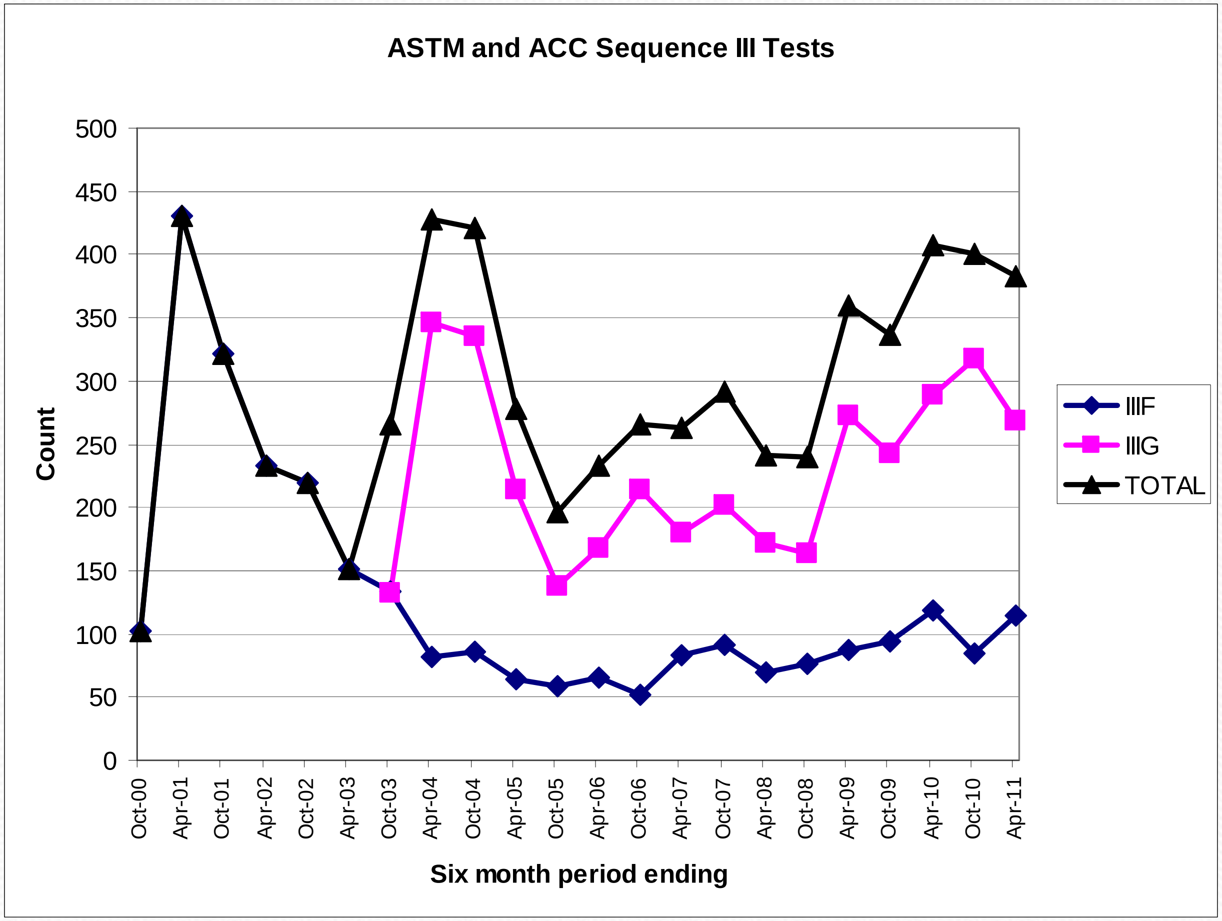
- 24502286 Cylinder Case (Block)
  - GM Racing 394 pieces
  - Labs 39 pieces
  - Total 433 pieces (**2598** runs)

    Based on 6 runs per block

- 24502260B Cylinder Head
  - GM Racing 4638 pieces
  - Labs 280 pieces
  - Total 4918 pieces (**2459** runs)

    Based on 2 heads per run

Sequence IIIF / IIIG Test Activity



June, 2011

Sequence IIIF / IIIG

Summary of Key Test Components (cont.)

With ~2500 runs available, we should be OK through 2015.

Estimates

2010	1000	consumed ~850 in 12 months
2011	800	consumed <400 in last 6 months
2012	600	
2013	500	
2014	500	
2015	400	
TOTAL	3800	

Attachment 7

CENTRAL PARTS DISTRIBUTOR REPORT
OH Technologies, Inc.

Sequence III Surveillance Panel Meeting
GM Tech Center, Warren, MI
June 2, 2011

1) Technical Memos Issued (1/17/11 – 5/31/11)

NONE

2) Rejection Report

REPORTING PERIOD: 01/17/2011-05/31/2011					
ITEM	**DESCRIPTION**	**REASON REJECTED**	**QTY**	**REPLACED**	**DATE REPLACED**
OHT3F-008-6	CAMSHAFT, SPECIAL TEST, IIIF	SCRATCH/DAMAGE TO LOBE	2	YES	3/3/2011
OHT3F-008-8	CAMSHAFT, SPECIAL TEST, IIIG	SCRATCH/DAMAGE TO LOBE	1	YES	3/3/2011
OHT3F-029-3	LIFTER, TEST, ACI W/ FLAT	SCRATCH/DAMAGE TO FOOT	7	YES	3/3/2011
OHT3F-030-2	OIL COOLER	INADEQUATE PLATING	10	YES	4/20/2011

3) Batch Code Changes

IIIF	Batch Code	Date Introduced	IIIG	Batch Code	Date Introduced
IIIF Camshaft	PC 16	12/20/10	IIIG Camshaft	PC 16	1/11/11
Pushrods	BC 9	5/23/11	IIIG Springs	BC 11	4/14/11
Piston Grade 12	BC 25	1/7/11	Piston Grade 12	BC 25	12/21/10
Piston Grade 34	BC 25	12/28/10	Piston Grade 34	BC 25	12/21/10
Piston Grade 56	BC 26	4/04/11	Piston Grade 56	BC 26	4/29/11
Rocker Arms	BC 16	1/07/11	Rocker Arms	BC 16	1/11/11

Attachment 8

Sequence IIIG 435-2 Results

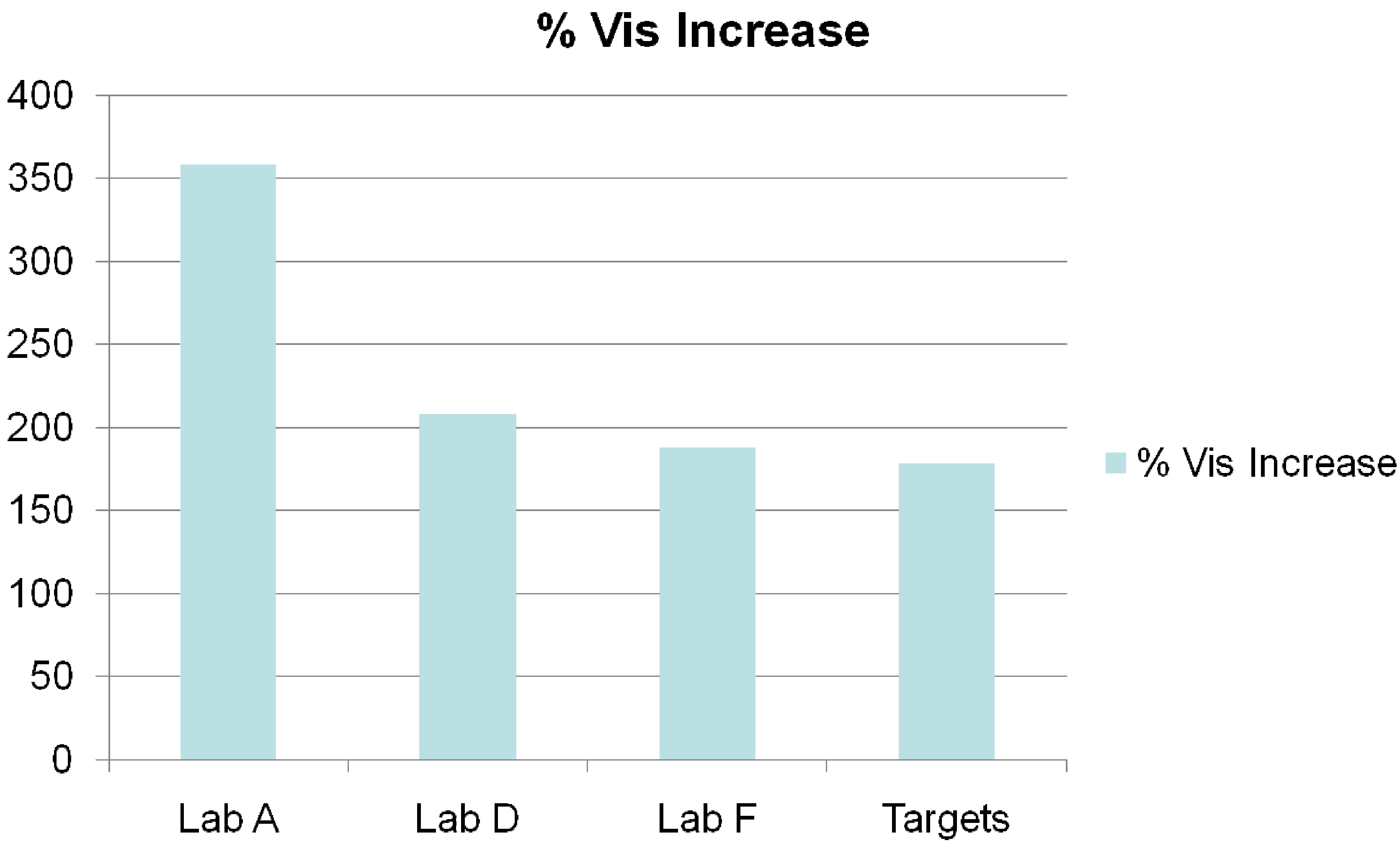
Sequence III Surveillance Panel

June 2, 2011

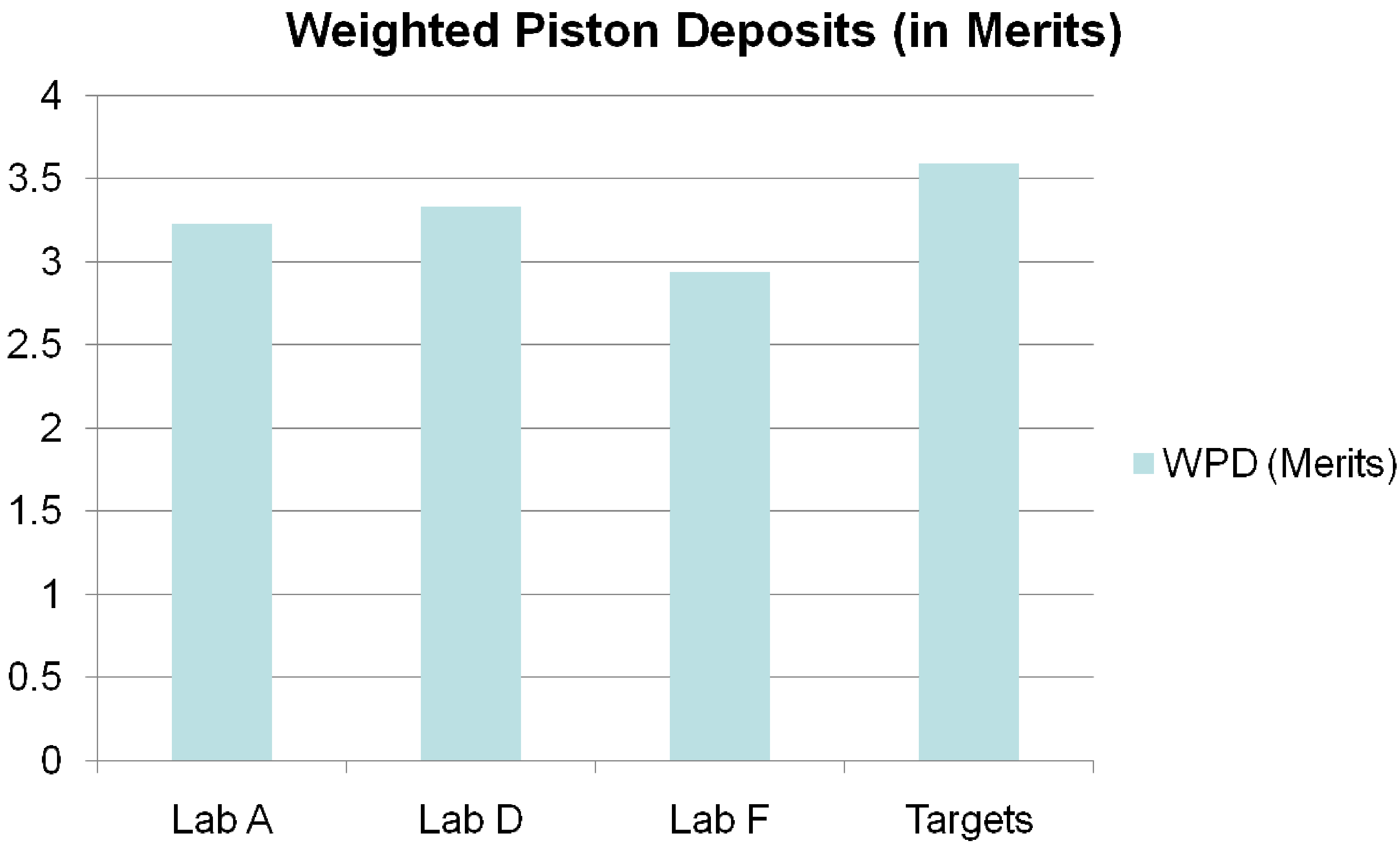
Summary of Results

- 3 tests reported from three labs
- Don’t anticipate any additional in the next 2 – 3 months due to UEB results
- Summary in next few slides

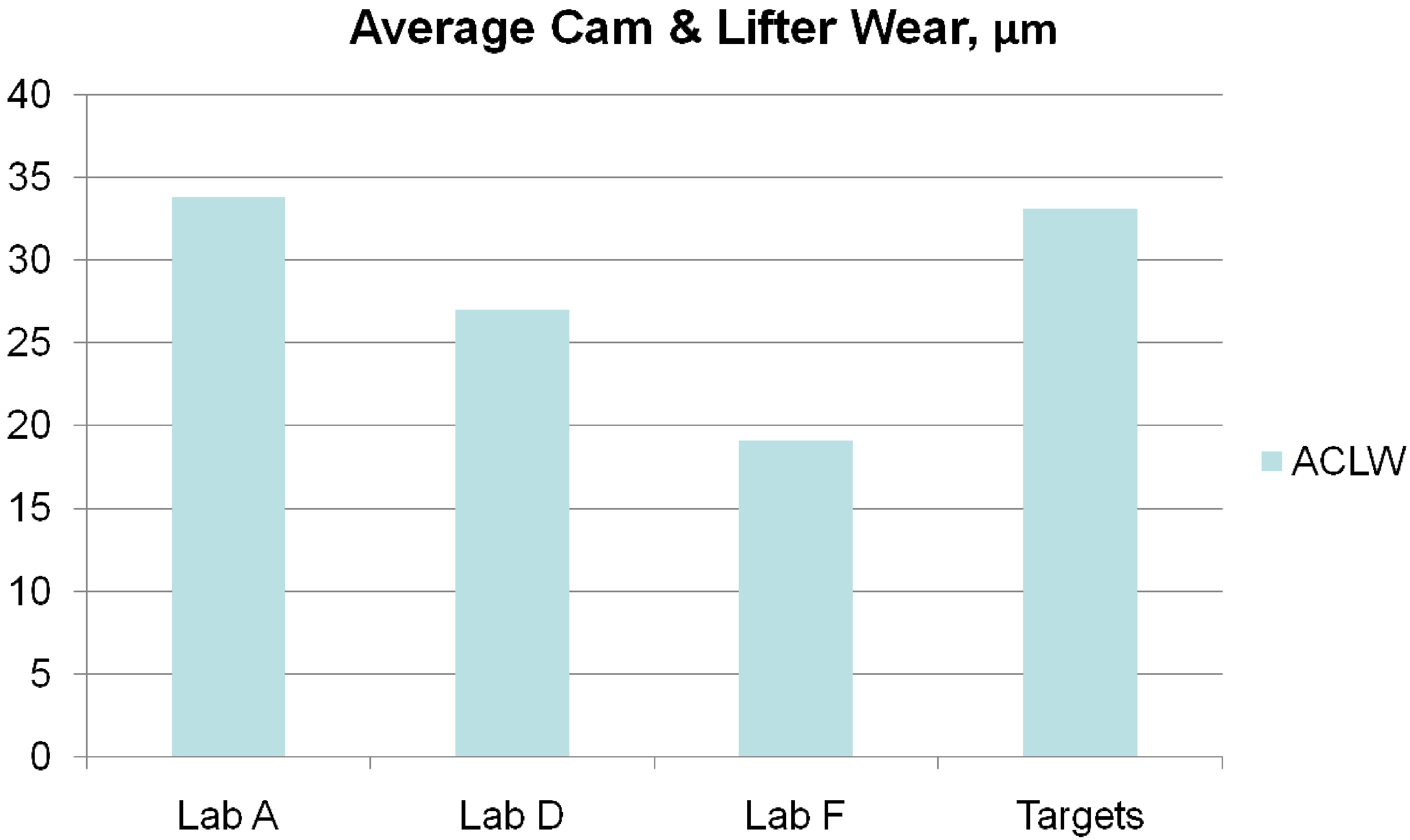
RO 435-2 Results for PVIS



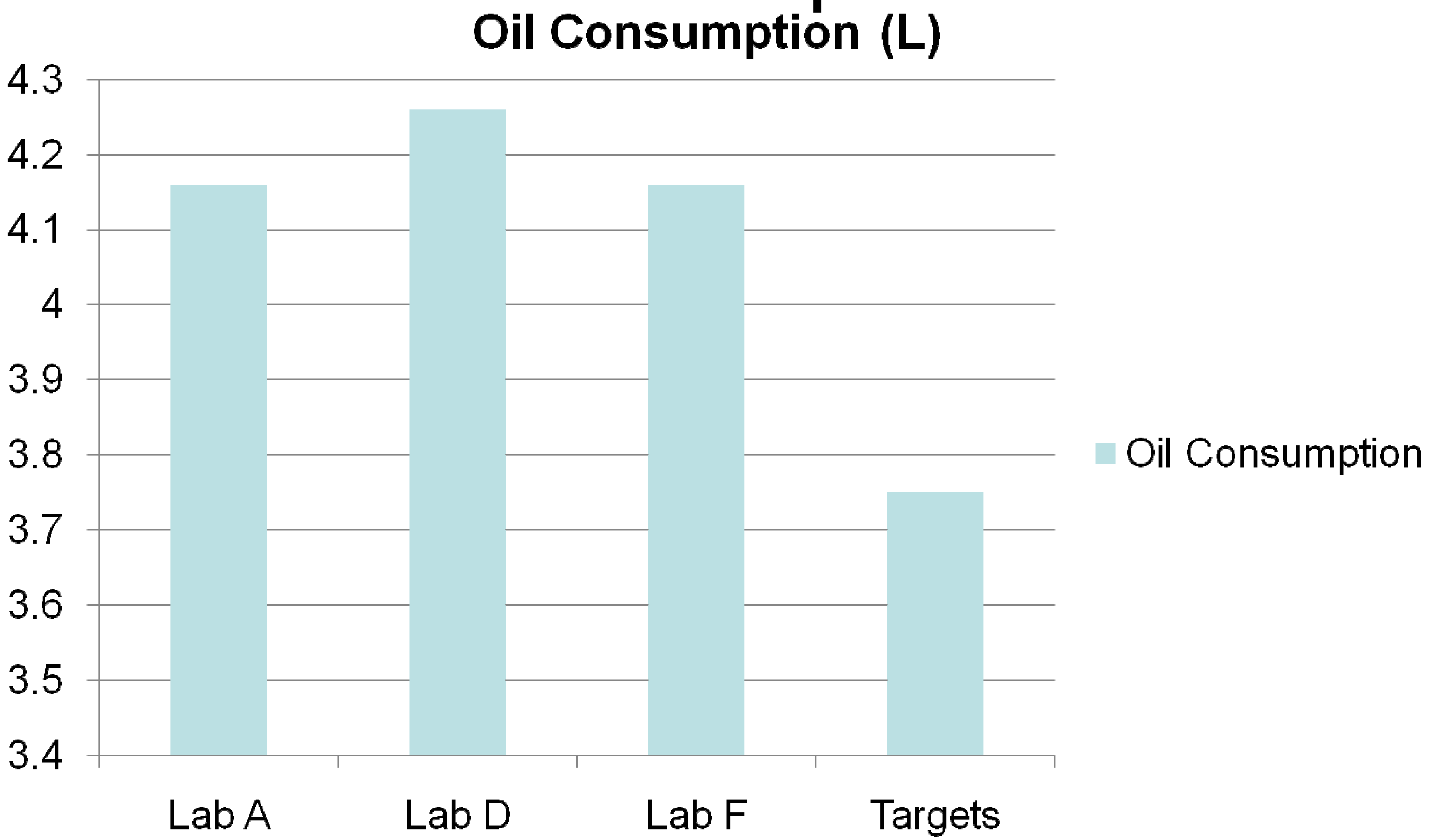
RO 435-2 Results for WPD



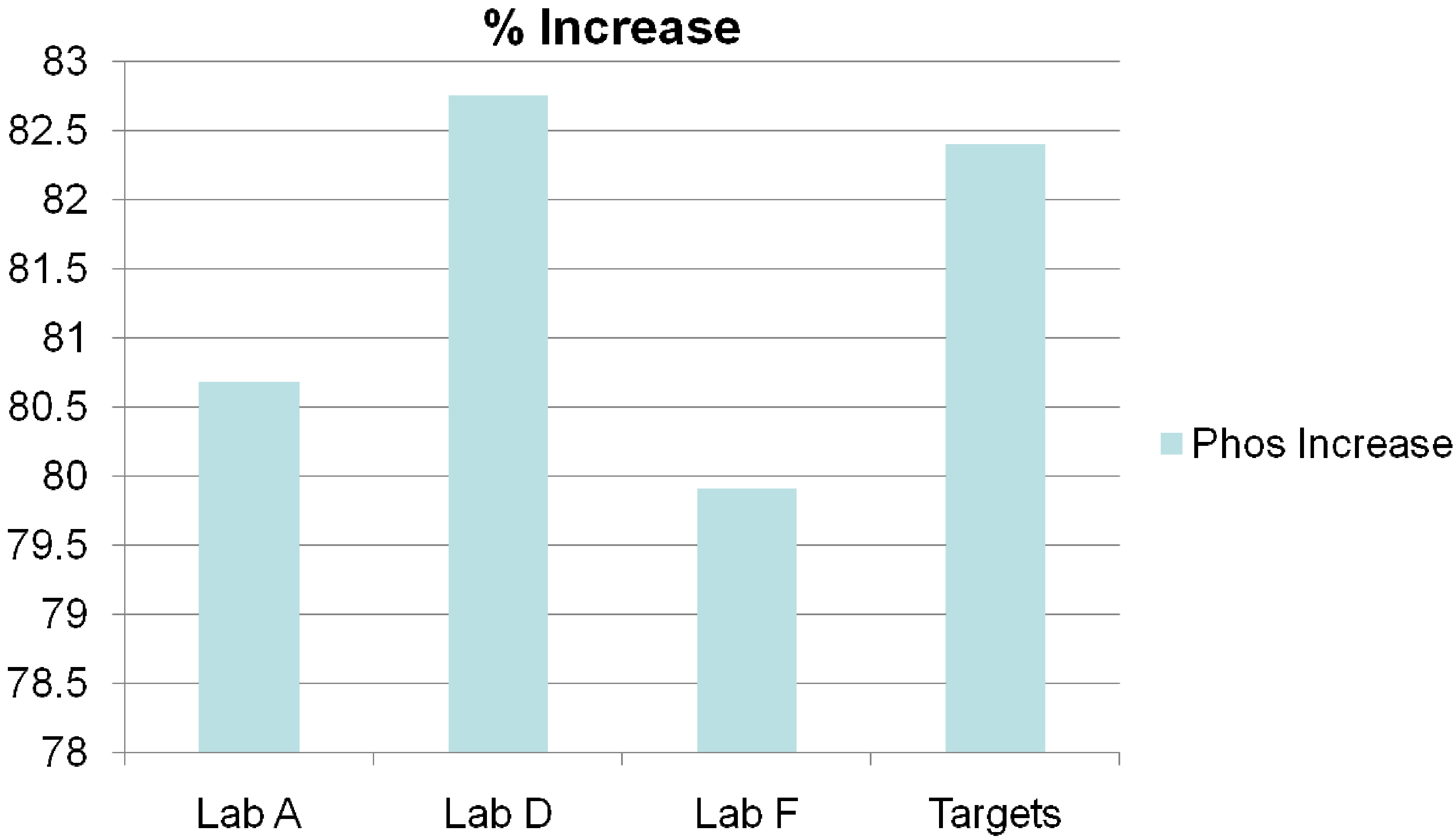
RO 435-2 Results for ACLW



RO 435-2 Results for Oil Consumption



RO 435-2 Results for Phos Increase



Attachment 9

SUBCOMMITTEE BALLOT REPORT D02.B0 (11-03)

BALLOT ISSUE DATE: 04/20/11   CLOSING DATE: 05/20/11   NEXT SUB COMMITTEE MEETING IS 06/19/11 IN Baltimore, MD
REVISIONS, NEW STANDARDS AND WITHDRAWALS WITHOUT NEGATIVES WILL BE ON NEXT MAIN COMMITTEE BALLOT

STAFF MANAGER: David Bradley

SUBCOMMITTEE OFFICERS: SUB CHRMN Joseph M Franklin
SUB V-C Tracey King
SUB SEC Glen Fetterman

****

	NO OF ITEMS	BALLOTS SENT	BALLOTS RETURNED	PERCENT RETURN
D02.B000	1	49	42	85.71

****

Please note that only voting members are counted in the tally of ballots. Also note that negative votes and comments from voting and non-official voting members shall be considered in accordance with the ″Regulations Governing ASTM Technical Committees″. Ballot report information and statements accompanying negative votes and comments shall not be reproduced or circulated in whole or part, outside if ASTM Committee activities, except with the approval of the Chairman of the committee having jurisdiction and President of the Society.

ITEM	SUB	ACTION		AFF	NEG	ABST	PCNT
001	B0	ADMINISTRATIVE OF 02D00181000	D02.B000	48.00	3.00	64.00	94.11

NEGATIVE VOTERS:
Douglas E Deckman
Glen Fetterman
Cathy Devlin

COMMENTS:
Hind M Abi-Akar

Negative

Date: 5/19/2011

Ballot Number: D02.B0 (03-11) Close Date: MAY 20, 2011

Item Number: 001 Sequence IIIG Information Letter 11-1, Sequence No. 31 (REFERENCE 01113A)

Member's Name: Douglas E Deckman

Address: Exxon Mobil
600 Billingsport Rd Rm 48231
Paulsboro Research Lab
PAULSBORO NJ 08066

Phone Nr: 8562242658 Fax Nr: 8562243613

Email Address: DOUG.DECKMAN@EXXONMOBIL.COM

File Attachment:

Statement:

Wording already exists to allow replacement of the filter if a filter tear is detected. The frequency of filter problems still seems to be very low throughout the industry. In addition,there have not been any data shown to justify the pre-emptive change of the filter.

Negative

Date:	5/20/2011	
Ballot Number:	D02.B0 (03-11)	Close Date: MAY 20, 2011
Item Number:	001 Sequence IIIG Information Letter 11-1, Sequence No. 31 (REFERENCE 01113A)	
Member's Name:	Glen Fetterman	
Address:	INFINEUM 15 Kenmore Lane Media PA 19063	
Phone Nr:	9083132705	Fax Nr: 9084743363
Email Address:	pat.fetterman@infineum.com	
File Attachment:		

Statement:

Infineum believes that there has been insufficient data presented to be able to discount the possibility that the predominant cause of "worm-holing" could be due to the composition of the lubricant.

Negative

Date: 5/20/2011

Ballot Number: D02.B0 (03-11) Close Date: MAY 20, 2011

Item Number: 001 Sequence IIIG Information Letter 11-1, Sequence No. 31 (REFERENCE 01113A)

Member's Name: Cathy Devlin

Address: Afton Chemical Corp.

500 Spring St

RICHMOND VA 23219

Phone Nr: 8047886316 Fax Nr:

Email Address: cathy.devlin@aftonchemical.com

File Attachment:

Statement:

Afton voted negative on the Sequence IIIG Information Letter 11-1 at the surveillance panel level and will maintain our negative on this ballot. While we agree that the oil filters are perhaps marginal when subjected to the IIIG operating conditions, our opinion is there was insufficient evidence provided to support the additional oil filter change criterion. We would like to see additional data provided to ensure that changing the oil filter based on a 10 kPa oil delta pressure rise as compared to the average of the first test hour is solely a precursor to oil filter failure, and could not be caused by viscosity increase or some other formulation-dependent phenomena. A portion of the newly added text as this could happen independent of viscosity increase.., suggests that this phenomena may also happen as a result of viscosity increase, which of course is very formulation dependent.

Further, we feel that changing the oil filter during a test will negatively impact viscosity increase on test oils since it is impossible to recover all oil from the filter prior to replacement, hence reducing the oil charge by some amount. We recommend this entire oil filter change section be reviewed and perhaps modified by the surveillance panel to ensure all oils are treated consistently and fairly.

Abstention with Comment

Date: 5/9/2011

Ballot Number: D02.B0 (03-11) Close Date: MAY 20, 2011

Item Number: 001 Sequence IIIG Information Letter 11-1, Sequence No. 31 (REFERENCE 01113A)

Member's Name: Hind M Abi-Akar

Address: Caterpillar Inc

Old Galena Road

Bldg H3000

MOSSVILLE IL 61552

Phone Nr: 3095789553 Fax Nr:

Email Address: abi-akar_hind@cat.com

File Attachment:

Statement:

I recommend a change to wording of the last sentence of 6.10.5.2. in order to avoid contaminating the clean side of the new filter

Current last sentence in 6.10.5.2: Add the captured oil to the new oil filter before installing it on the test engine.

Proposed: Add the captured oil to the oil sump through the fill cap.
Alternatively the following can be stated: Add the captured oil to the oil sump through the fill cap to avoid contaminating the clean side of the filter.

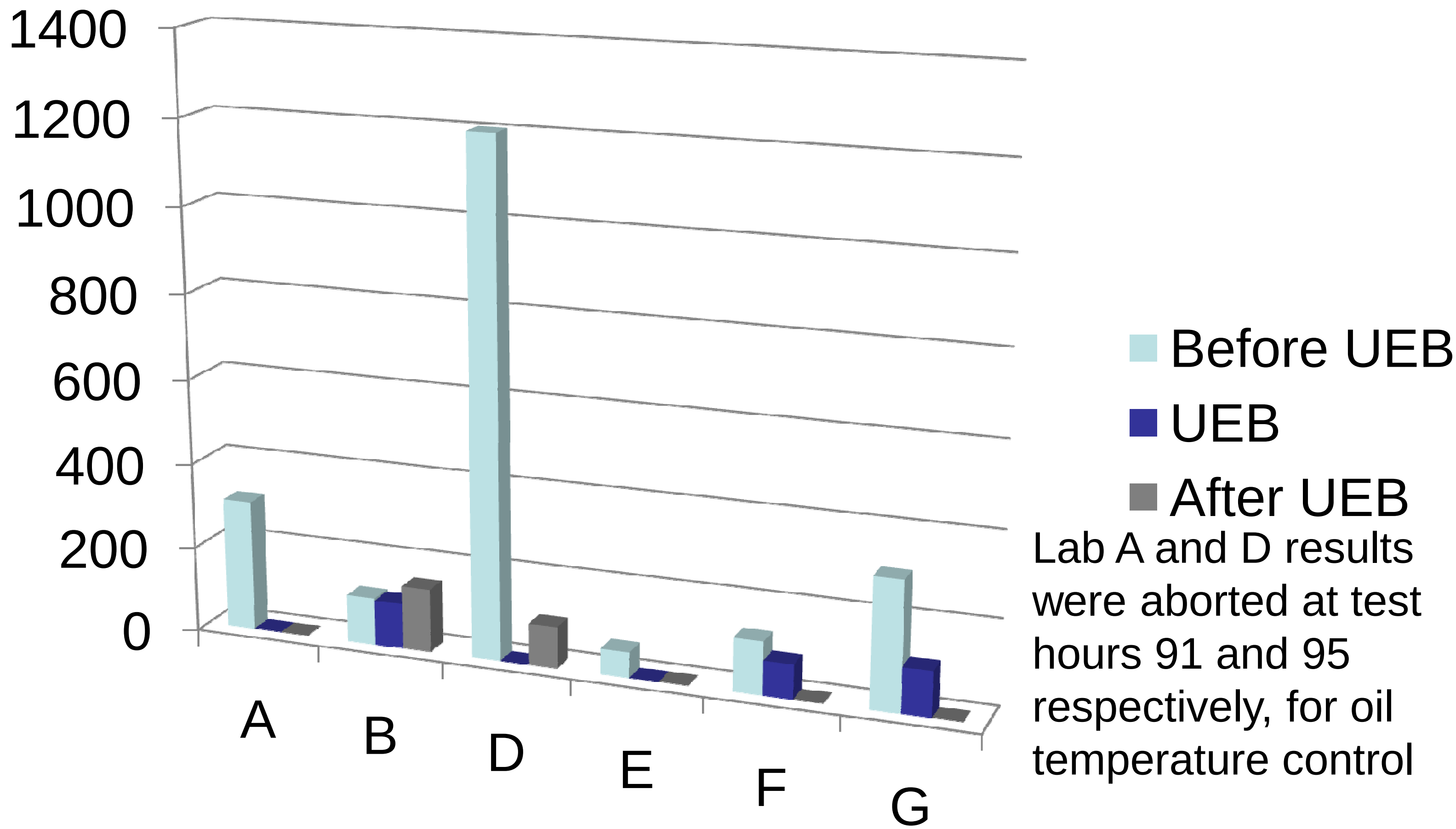
Attachment 10

Sequence IIIG UEB Results

Sequence III Surveillance Panel

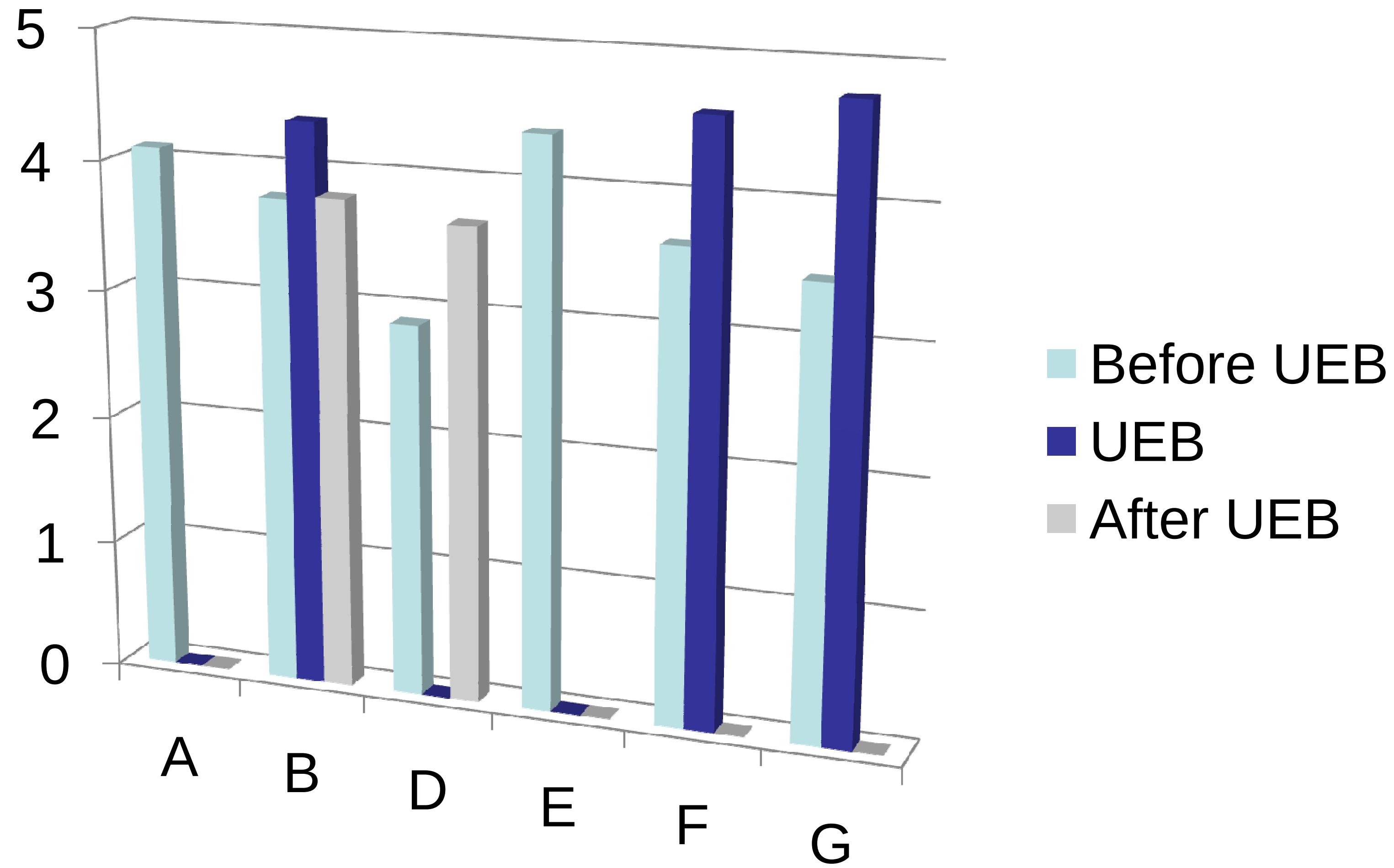
June 2, 2011

RO 434-1 Results for PVIS

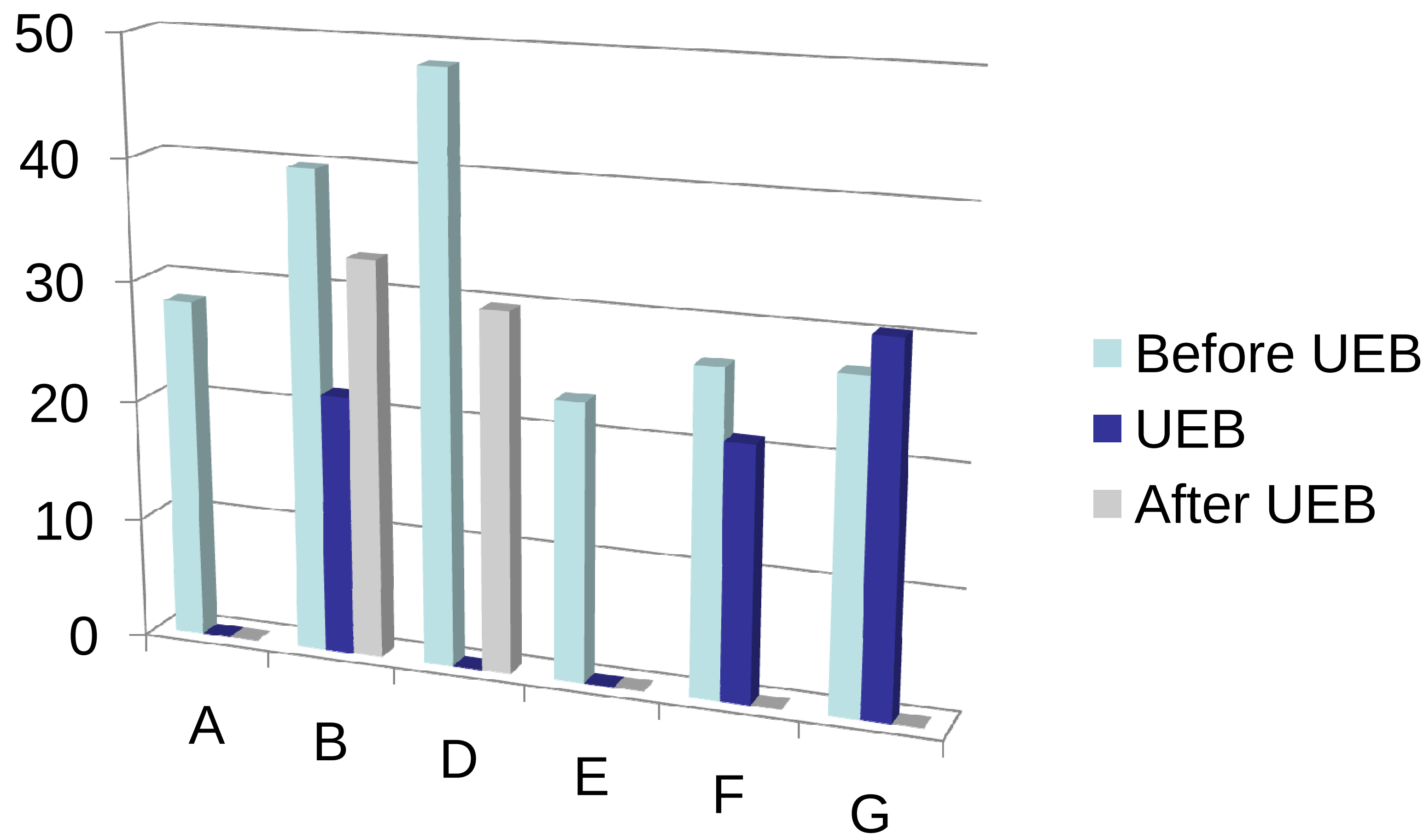


Lab A and D results were aborted at test hours 91 and 95 respectively, for oil temperature control

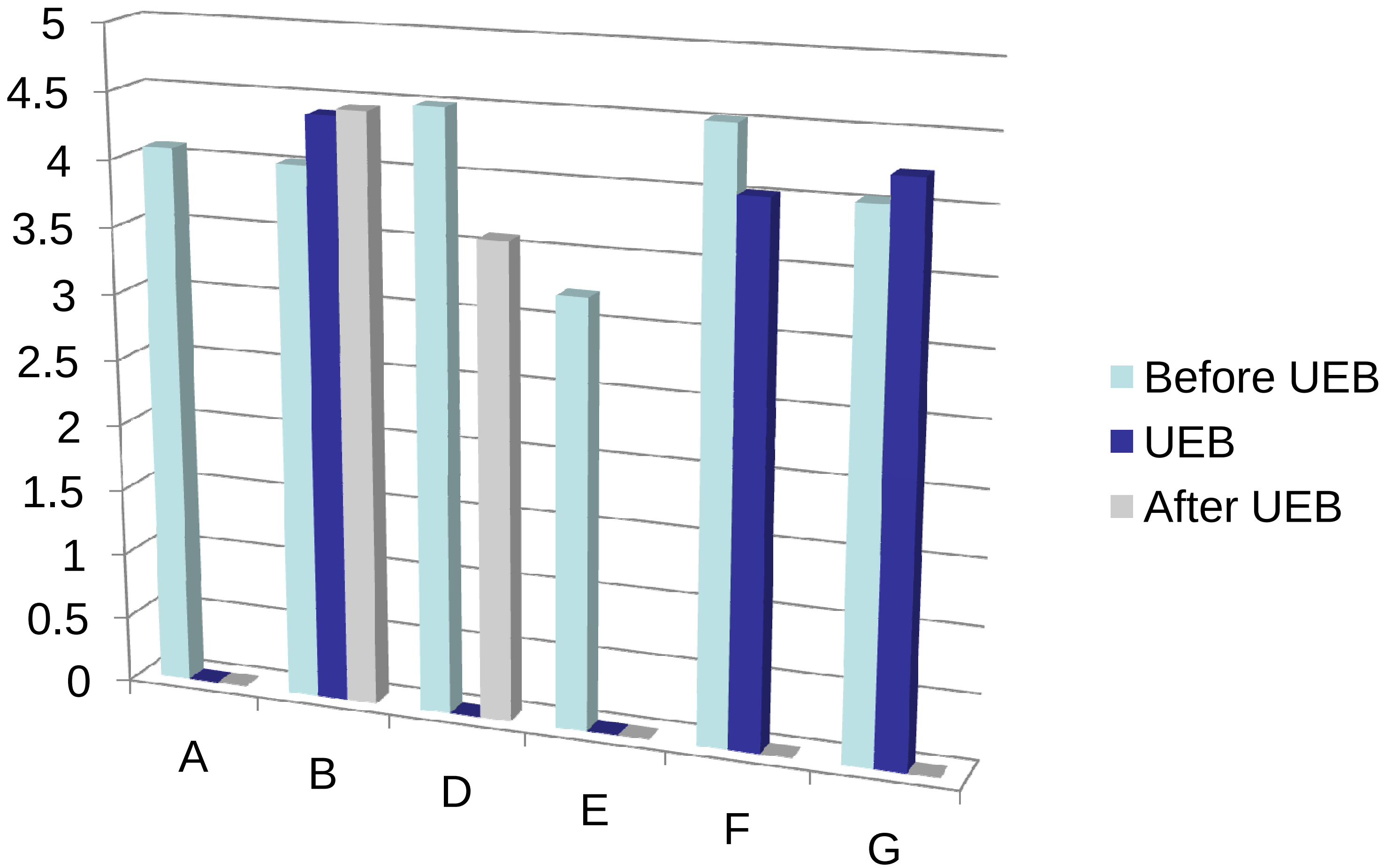
RO 434-1 Results for WPD



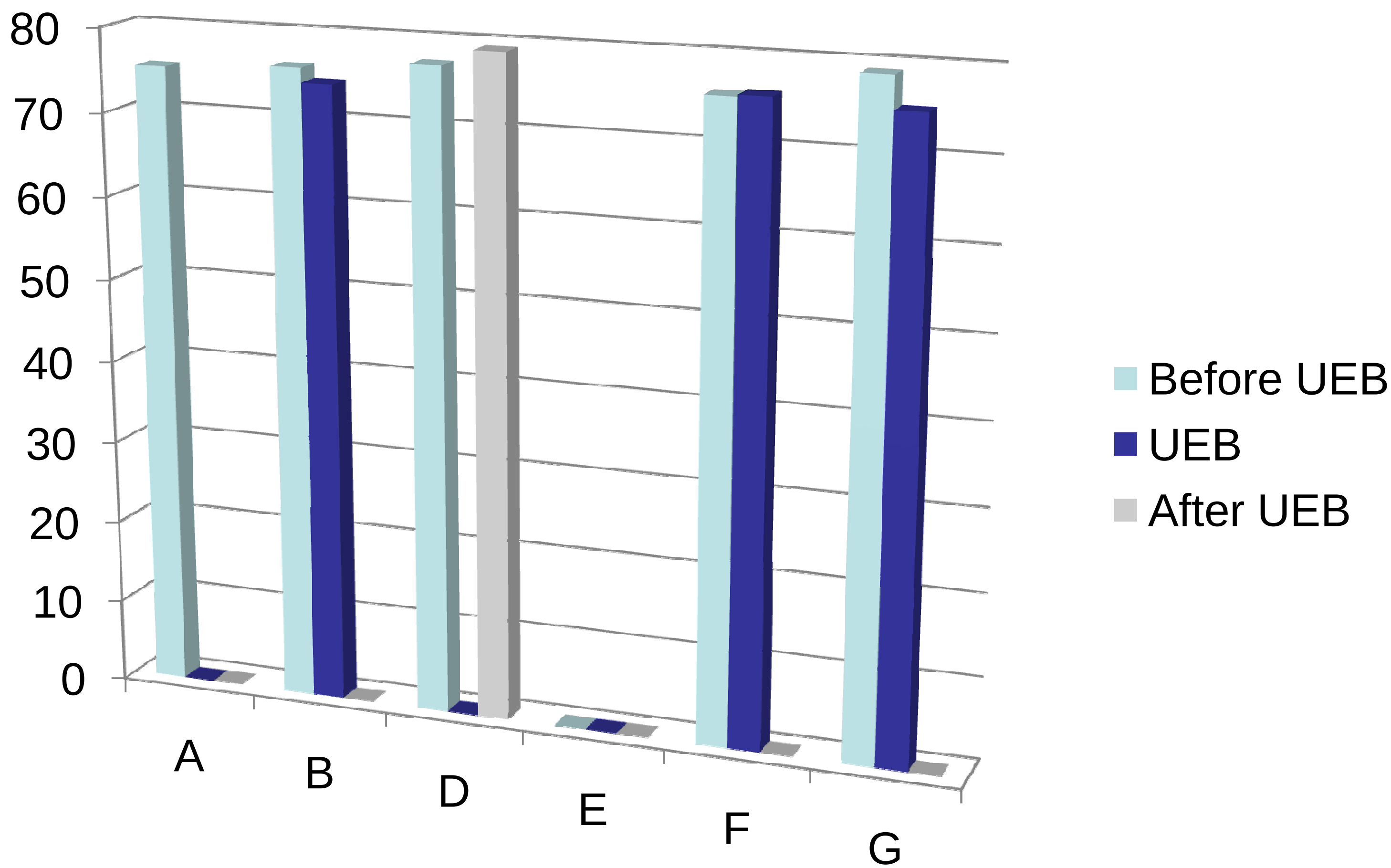
RO 434-1 Results for ACLW



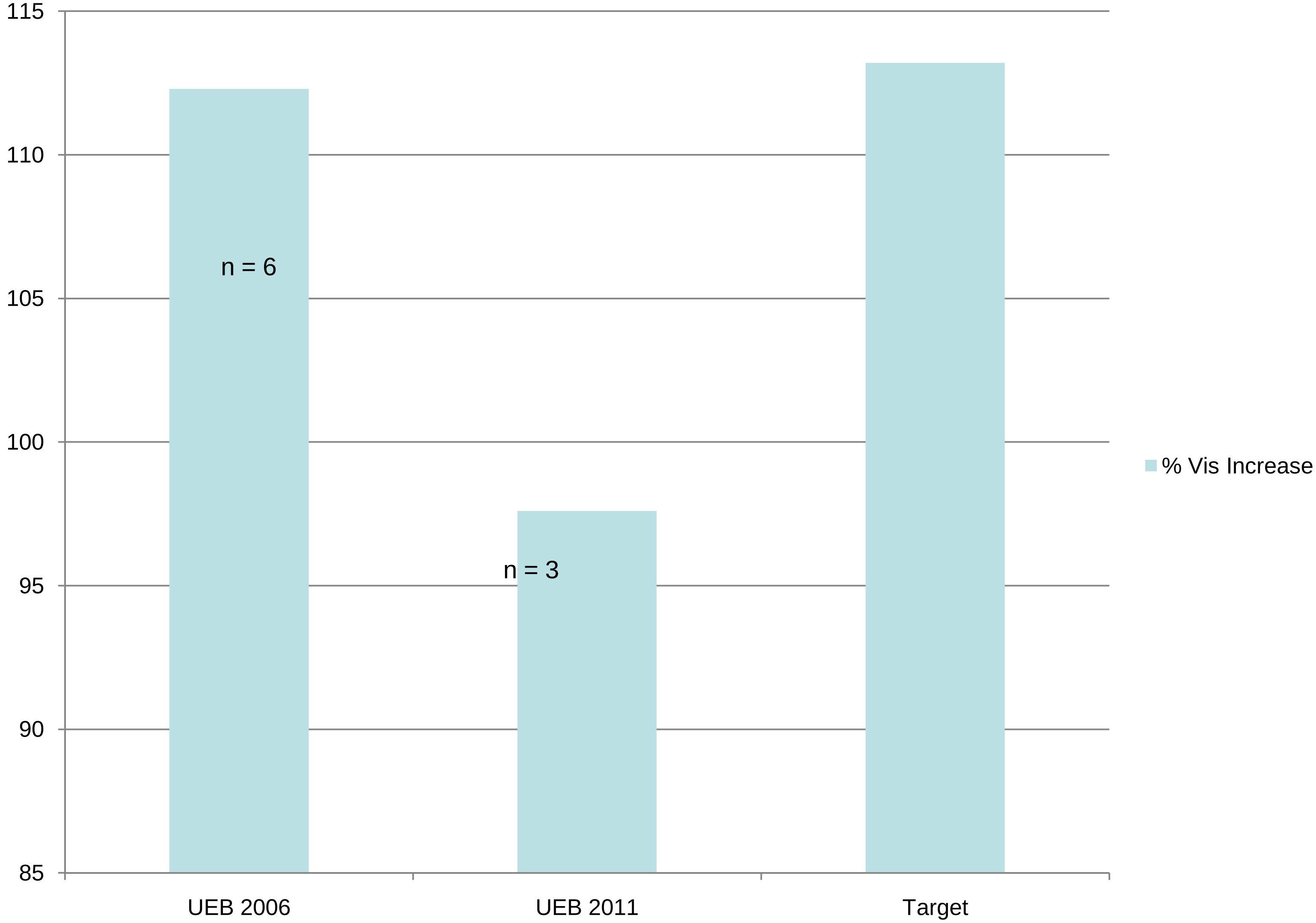
RO 434-1 Results for Oil Consumption

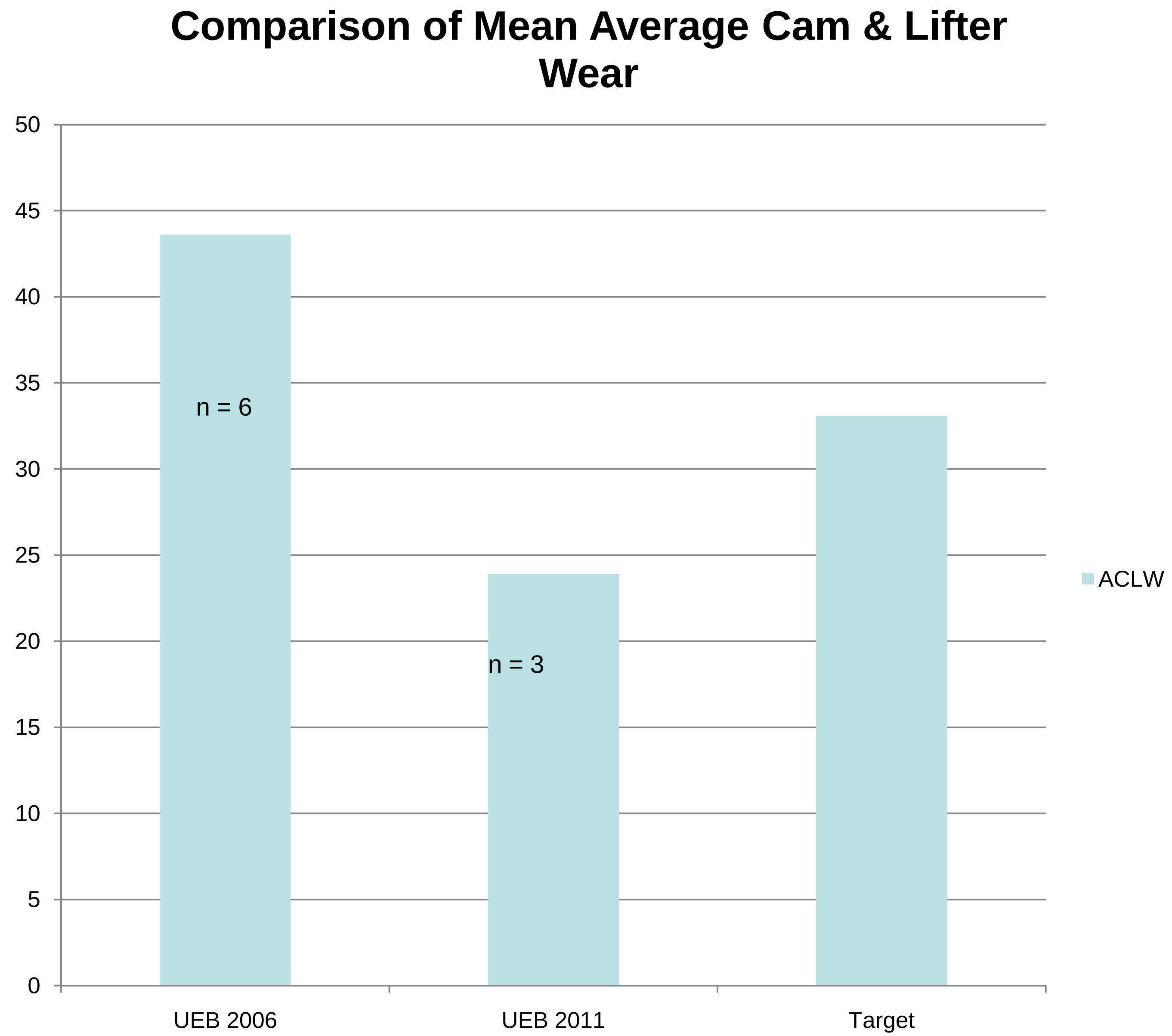


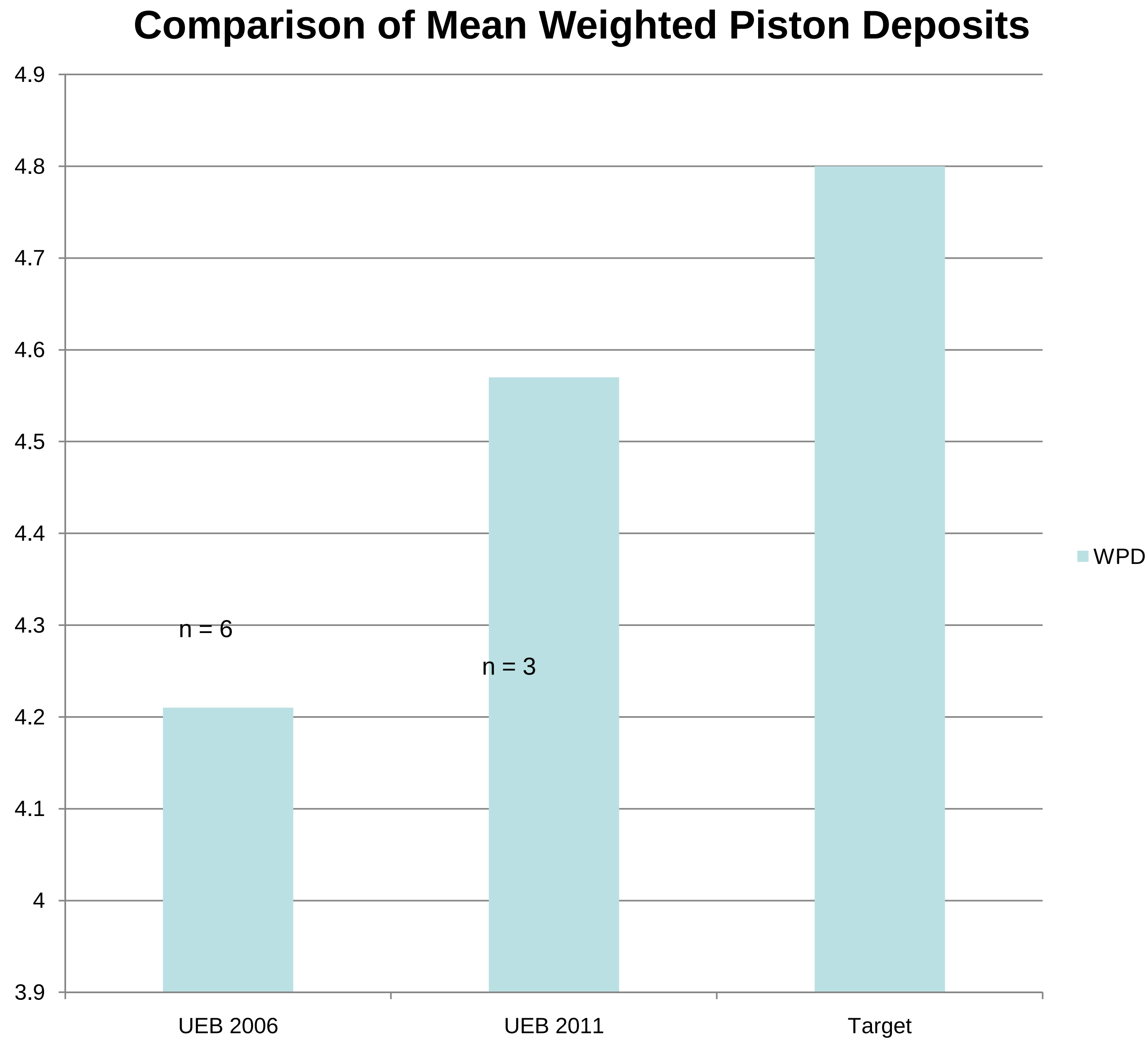
RO 434-1 Results for Phos Retention



Comparison of Mean % Vis Increase

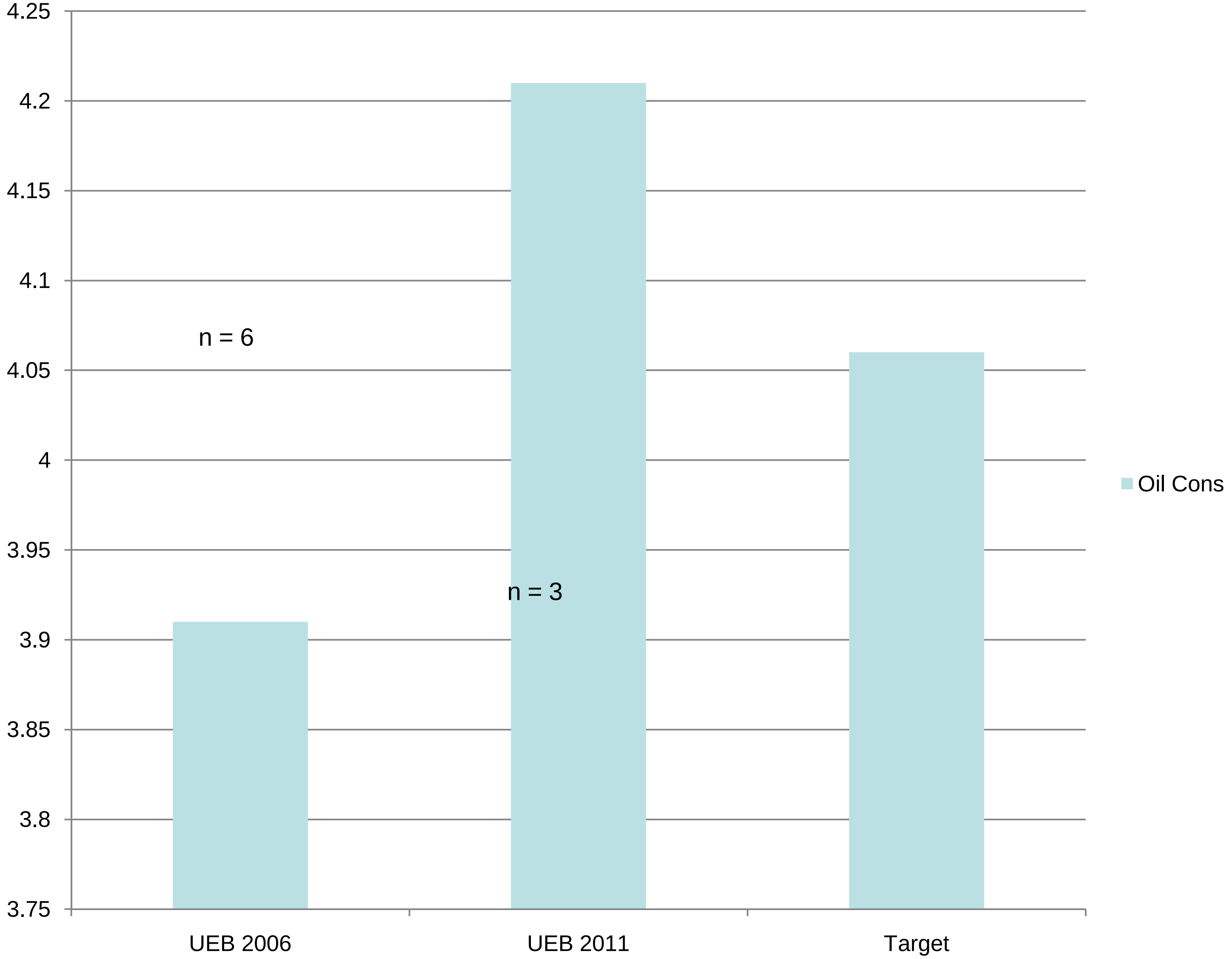



Comparison of Mean Average Cam & Lifter Wear
50
45
40
35
30
25
20
15
10
5
0
n = 6
n = 3
UEB 2006
UEB 2011
Target
ACLW

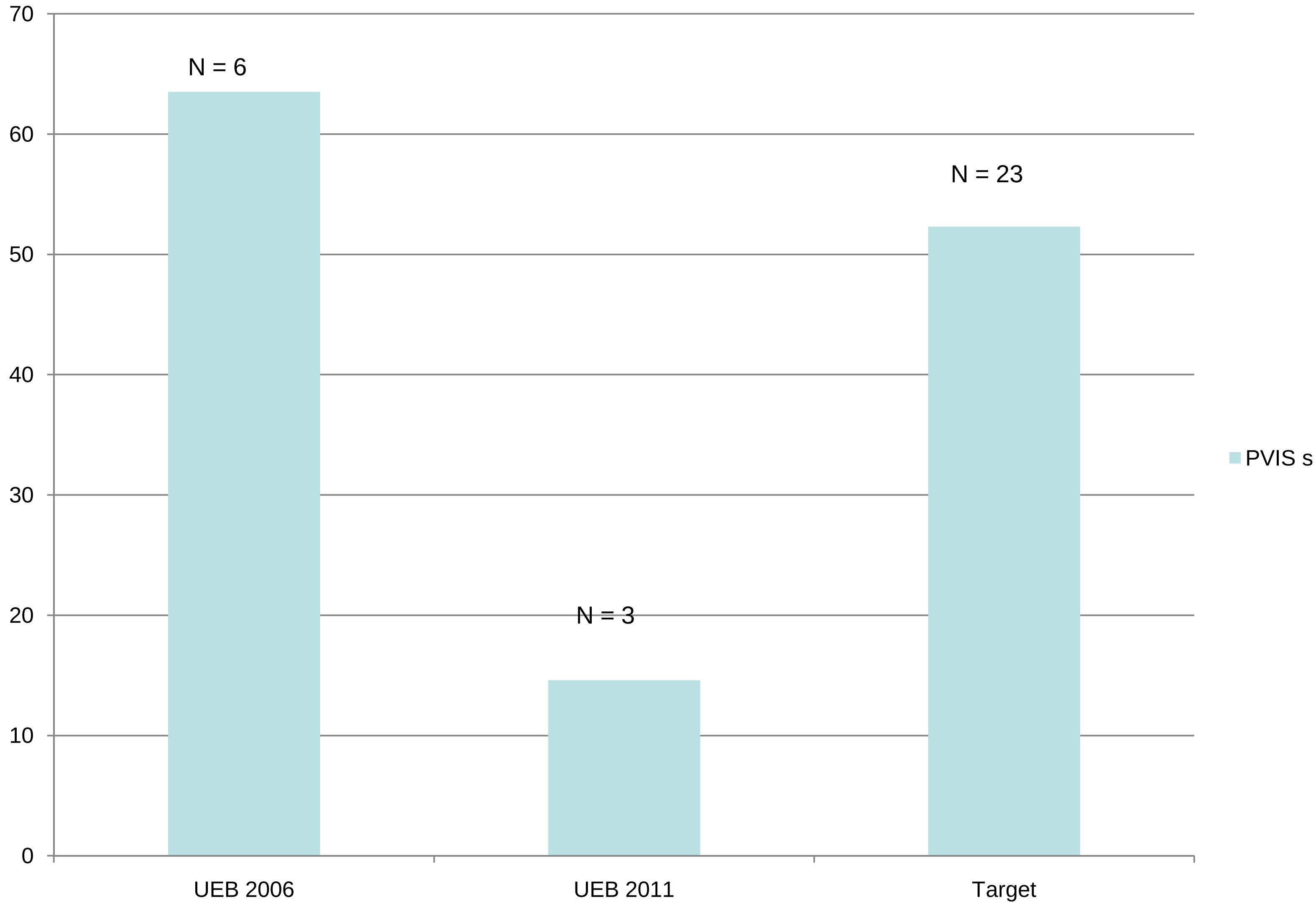


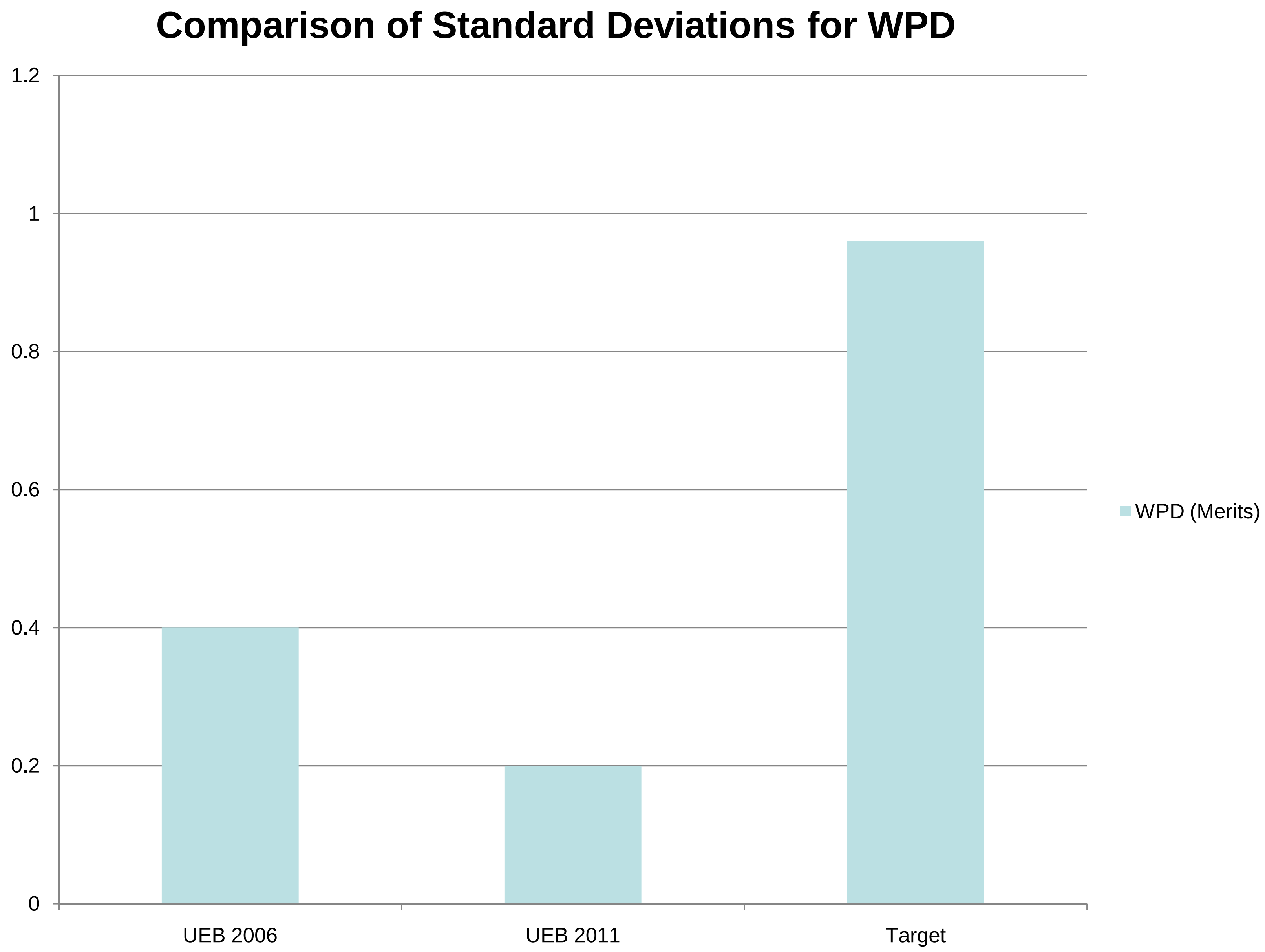
Test Monitoring Center
http://astmtmc.cmu.edu
A Program of ASTM International

Comparison of Mean Oil Consumption

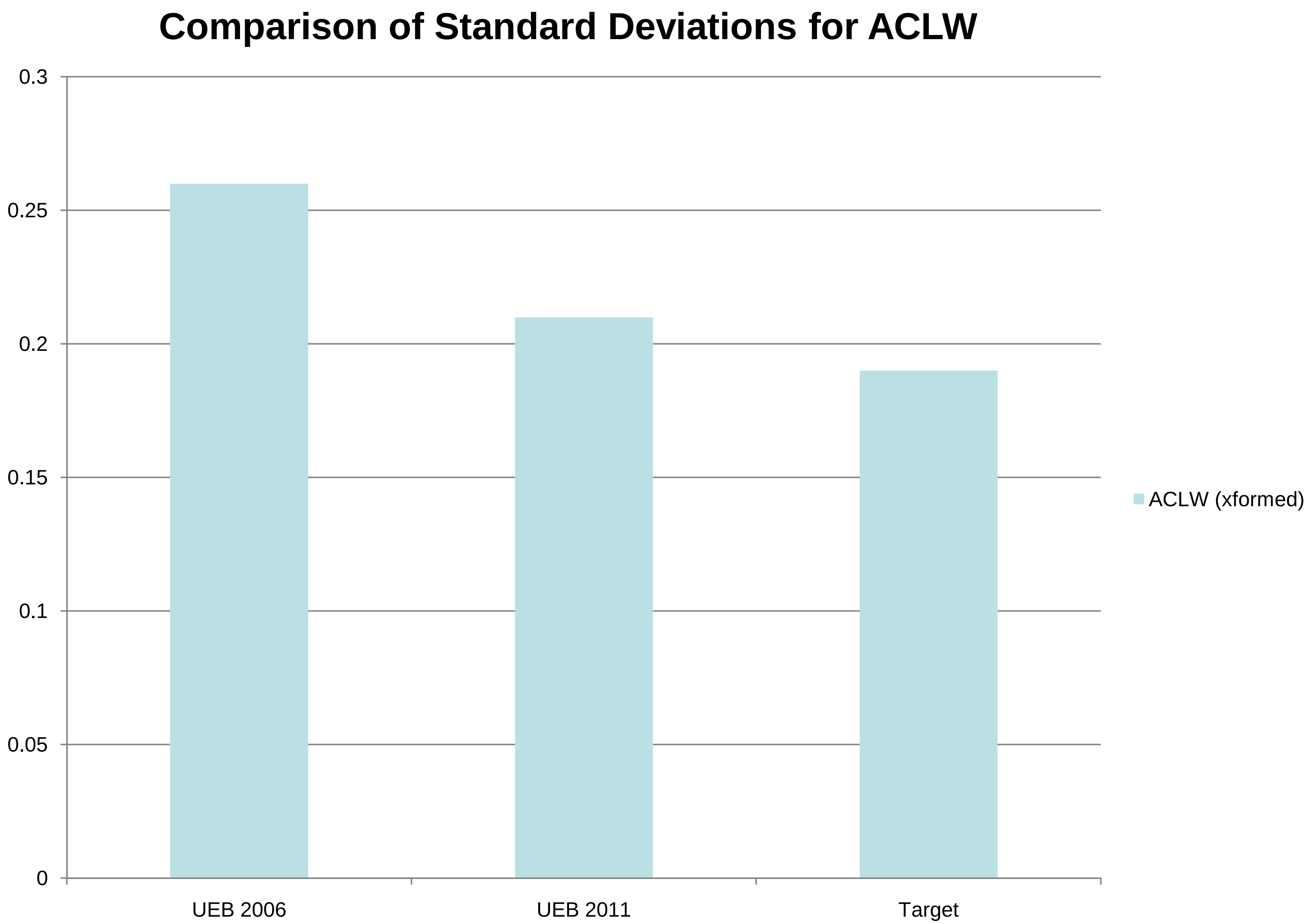


Comparison of Standard Deviations for PVIS



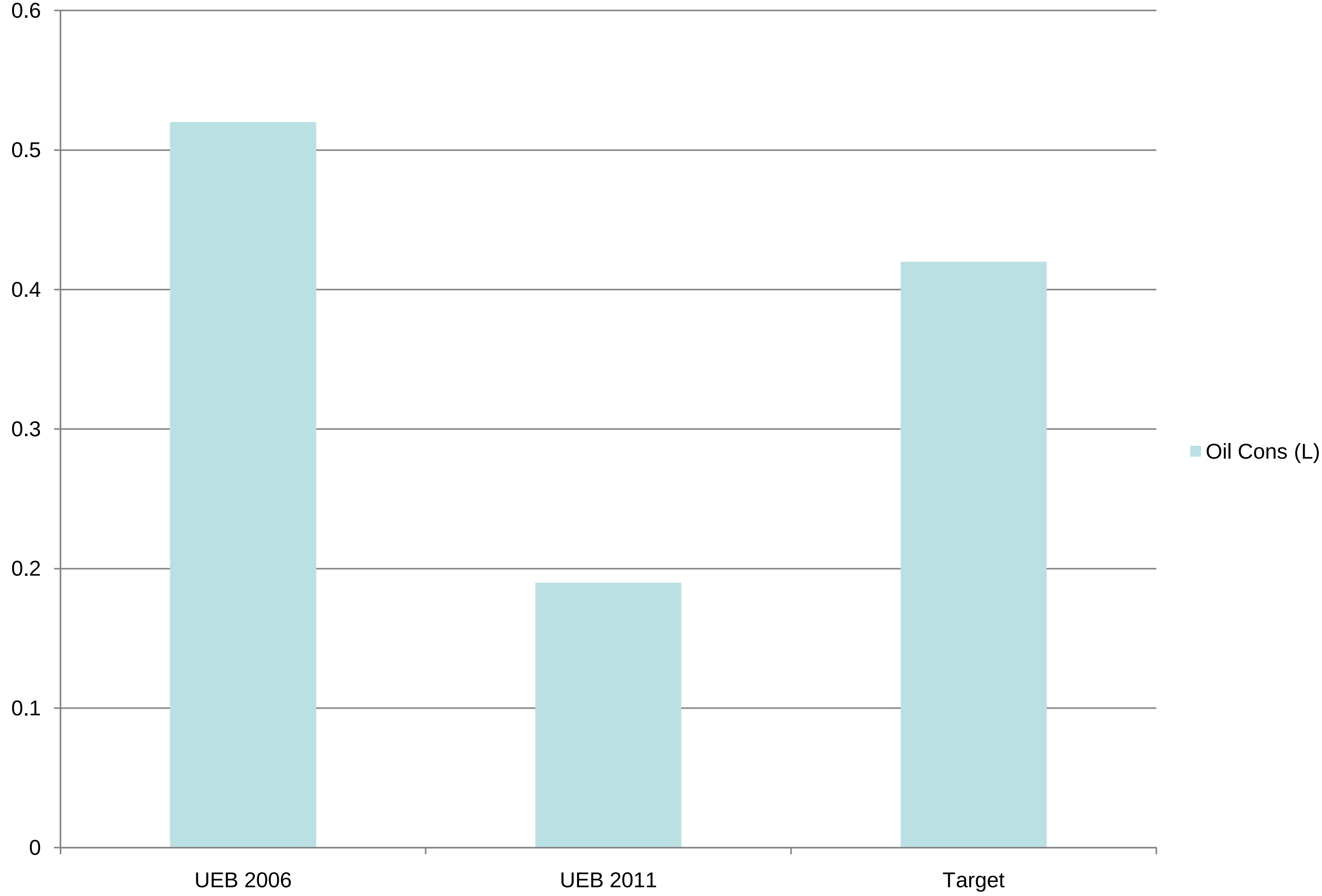


Test Monitoring Center
http://astmtmc.cmu.edu
A Program of ASTM International



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

Comparison of Standard Deviations for Oil Consumption



Attachment 11

2011 IIIG UEB Dual Rating Resuts

Lab ID	Lab Rating	SwRI Rerate	Test Length
A	4.09	n/a	91 hrs
B	4.36	4.34	100 hrs
D	3.00	2.94	95 hrs
F	4.59	4.72	100 hrs
G	4.76	4.61	100 hrs

Note: raw rating values are in the "Data" tab of this workbook

Attachment 12

Suggested Revisions to the ASTM Standard:

*Please note everything in **Bold Red** or **Crossed Out** are suggested changes to the current D7320 & Assembly Manual*

Agreed to by Panel

9.3 Cleaning of Engine Parts ~~(other than the block and heads)—~~Clean all engine parts (other than the connecting rods, block and heads; see 9.4, 9.5 and 9.6) thoroughly prior to engine assembly. **Degrease the parts (any reusable parts that come into contact with the test oil as shown in Table A2.2 of the ASTM D7320) then soak them with parts cleaning agent (7.5.1) for a period of at least 30 minutes but shall not to exceed 24 hrs.** Immediately remove the cleaner by spraying with hot tap water. Blow-dry the parts with clean, dry shop air (Warning—For technical use only) and immediately coat them with a 50/50 mixture of build-up oil and degreasing solvent.

Discussion: it was noted some Labs do not use the 50/50 mixture due to the engine will not be stored it will be assembled and installed on the test stand.

Agreed to by Panel

9.5.3 Thoroughly clean the block prior to honing as follows:

For new and used blocks ~~In the case of a block used in a previous test~~, remove the crankshaft, main bearings, and bearing caps. In addition, remove all bushings, bearings, and oil gallery plugs prior to cleaning. With either a new or a used block, prevent cleaner or oil from entering the engine coolant passages. (See Sequence IIIG Engine Assembly Manual, Section 1 Sheet 4.)

Discussion: Recommend during UEB Conference call to include new blocks into this section.

Tabled & To be addressed later (through item (10))

9.5.3.1 Clean the block in a ~~heated bath or~~ temperature controlled automated parts washer before and after honing **as stated in Section 1 Sheet 5 of the AM.** Follow these ~~suggested~~ guidelines to ensure there is no rusting of the engine block after this process:

Discussion: Recommend during UEB Conference call, all Labs use the temp controlled automatic parts washer so delete heated bath, also delete in Section 1 Sheet 5 of the AM.

(1) Use only NAT-50 or PDN-50 soap at a concentration of 7.3 kg of soap per 380 L of water. Change the soap and water solution ~~least every six months~~ each 3 months.

Discussion: Recommend during UEB Conference call Labs will install hour meters to determine a recommendation for hours in place of months.

(2) Set the water temperature to (60 ± 10) °C.
(3) Do not ~~in any manner~~ pre-condition the water that is being used **in any way**.

(4) ~~Prior to installing the engine in the parts washer, ensure that all coolant passages are blocked off to prevent cleaning solutions from entering the passages~~. **Prior to placing the block into the parts washer remove the torque and block-off plates.**

(5) Allow the block to run through the cleaning cycle for a period of (30 to 40) min. **plus XX-XX min. in the rinse cycle.**

Discussion: it was noted some Labs that use the automatic parts washer do not use the rinse cycle to standardize the SP may want to either specify or make the rinse optional?

(6) After the cycle**(s) are** ~~is~~ complete, immediately remove the block from the washer and spray it down with degreasing solvent **(7.5.2).**

(7) Wipe cylinder bores out with a lint free towel.
(8) Spray engine block with a 50:50 mixture of build-up oil and degreasing solvent.
(9) Do not remove the paint dot from the crankcase area of the block.
(10) Allow the block to cool to room temperature before honing the block.

Agreed to by Panel
9.5.3.2 See the Sequence IIIG Engine Assembly Manual, Section 2 for the honing procedure.

Tabled & To be addressed later
9.5.3.3 After honing the cylinder walls, then clean the engine block again according to **9.5.3** and **9.5.3.1** spray the engine block (including all oil galleries) first with degreasing solvent followed by a 50:50 mixture of degreasing solvent and build-up oil. Using this 50:50 mixture, wipe out the cylinder bores with clean cloth towels until all honing residue has been removed. 9.5.3.4 Air dry the engine block, using clean dry shop air, and coat the cylinder walls with build-up oil using soft, lint-free, clean cloths.

Agreed to by Panel
9.9.5 Use the honing torque plates B-H-J GM 3.8L/3E-Rs_ t-HT [11,23] to pre-stress the engine block for honing. Install the torque plates with the proper hardened washers (supplied with the honing torque plates), single washers on top row and double washers on bottom row, to establish proper ~~bolt~~ **fastener** depth. Clean the threaded bores for the cylinder head attachment ~~bolts~~ **fastener** using a bottoming tap before each installation of the torque plates. The torque plates require the use of new head gaskets, SPO Part No. 24503802 left head and 24503801 right head, along with cylinder head, torque-to-yield fasteners, SPO Part No. 25527831 (long). Clean all sealing and thread locking compounds from the fasteners for the torque plate installation. ~~Coat each fastener with build-up oil, and see Section 1 Sheet 7 of the Sequence IIIG Engine Assembly Manual for installation instructions~~**. Lightly lubricate the fasteners (head bolts) with EF-411 during his operation**.

Agreed to by Panel
9.10.1 *Piston Rings*—The rings are pre-sized for each run; check the gap in the cylinder bore for each test. The top ring gap shall be (0.635 ± 0.051) mm. The bottom ring gap shall be (1.067 ±.051) mm. The top ring gap shall be smaller than the bottom ring gap and the difference between the two ring gaps shall be between 0.330 mm and 0.533 mm. If the ring gap difference is below 0.330 mm, contact the Test Procedure Developer. Check the ring gap with a Starrett Ring Taper Gage No. 270 with the ring positioned in the cylinder bore using a piston ring depth gage (drawing RX-118602-B). **Remove the torque plates and position** ~~Position~~ the rings 23.67 mm below the cylinder-block deck surface during gap measurement. Record the top and bottom ring gaps on Form 12, Hardware Information, in standardized report form set (see Annex A5). Record and report ring gaps in mm.

Agreed to by Panel
9.12 *Camshaft Bearing Installation*—**Install the main bearing caps (see 9.14.2) before installing the camshaft bearings.** The camshaft tunnel is specially processed and uses oversize bearings provided through the CPD. Install the camshaft bearings according to the Sequence IIIG Engine Assembly Manual Section, 3 Sheet 3. Always inspect the lifter and main bearing oil galleries for splintered babbitt materials that might have been shaved from the outside diameter of the bearings during installation. Remove any materials from the oil galleries with clean dry shop air.

Discussion: If approved add note to Section 3, Sheet 1 of AM to state “Install the main bearing caps before installing the camshaft bearings”.

Suggested revisions to the Assembly Manual (AM)

Agreed to by Panel unless other wise noted

Section 1 Sheet 4

Note E

~~Install block-off plates over the coolant passages on the front face, rear face, and cylinder deck. (Fabricate in-house)~~ **Remove bearings, and oil gallery plugs and main caps prior to cleaning.**

Section 1 Sheet 5

Note A

The engine ~~may~~ shall be cleaned using an automated washing device however, caution should be used to prevent oxidation flash over of the ferrous surfaces. Note: **Only use specified cleaning materials, refer to section 7.5 of ASTM D7320 for approved cleaning materials.**

Editorial changes agreed to by Panel
Content changes Tabled & To be addressed later
Section 1 Sheet 5A

Automatic Parts Washer Procedure for ~~IIIF~~ **IIIG** Engine Blocks

1) Use only NAT-50-S or PDN-50 soap at a concentration of 16 pounds of soap per ~~100 gallons~~ **380 L** of water. Change the soap and water solution ~~least every six months~~ each **three** months.
2) Set the temperature of the water to 60±10 degrees C.
3) Do not pre-condition the water that is being used in any way.
4) Prior to installing the ~~engine~~ **block** in the parts washer, ~~ensure that all coolant passages are blocked off to prevent cleaning solutions from entering the passages~~. **remove the torque and/or block-off plates.**
5) Allow the block to run through the cleaning cycle for a period of 30 to 40 minutes, **plus XX – XX minutes of the rinse cycle.**
6) After the cycle**(s) are** complete, immediately remove the block from the washer and spray it down with degreasing solvent.
7) Wipe cylinder bores out with a lint free towel.
8) Spray engine block with a mixture of 50/50 **of** EF-411 and degreasing solvent.
9) Do not remove the paint dot from the crankcase area of the block.
10) Allow the block to cool to room temperature before honing block.

Section 1 Sheet 6

New Block and Pre-Hone Prep Sequence IIIG

Note A Clean and oil all main cap ~~bolts~~ **fasteners** (EF-411) and install main caps **(use used fasteners for honing).** Note: Do not use air tools to run main caps down.

Note B Install main cap with fasteners as guides and draw into position with speed handle and socket in crisscross pattern.

Y1 Torque and Angle

1.) Tighten all main ~~bolts~~ **fasteners** to 70 Nm to fully seat main caps.
2.) ~~and then~~ **L**oosen the ~~bolts~~ **fasteners** 360° counterclockwise.
3.) **Starting from the center of the block and moving out, torque the fasteners 20 Nm, then 40 Nm.**
4.) **Starting from the center of the block and moving out for each of the steps shown below, tighten the fasteners in the following steps:**
   First 35°, then another 35°, and finally to another 35°.

~~**Y2**Torque & Angle 20Nm then 40Nm + 35°+35°+35° (repeat~~
~~40Nm + 35° 3 times from center out)(use used fasteners for honing)~~
~~Torque & Angle 15Nm + 45°~~

Note C Install main cap side ~~bolts~~ **fasteners, torque to 15 Nm, and then + 45°**

~~**Z** Torque & Angle 15Nm + 45°~~

Discussion: *it was noted during the workshop that one or more Labs would skip step "Y1" and go directly to "Y2". As I remember this was done to properly seat/ align the main caps.* **The above revisions were made to reiterate the importance of Note Y1 and better define the process.**

Section 1 Sheet 7

Note A:
Remove cylinder deck block off plates, **coolant passage plates shall stay on during this process.**

Note B:
Install B-H-J Torque Plates (GM-3.8/3E-R-S-T-HT) w/gaskets.

Note C:

Note: When installing torque plates:

1) move the bottom row of fasteners **(long head bolts)** to the top
2) discard the top row of fasteners
3) use the post test fasteners **(long head bolts)** from the last teardown in the bottom row on the torque plates

Note: Fasteners (long head bolts) shall be lightly lubricated with EF-411 for this operation.

Note B

Install B-H-J Torque Plates **(GM-3.8/3E-R-S-T-HT)** **with the proper hardened washers (supplied with the honing torque plates), single washers on top row and double washers on bottom row, to establish proper fasteners depth ~~w/~~ with new gaskets refer to D7320 Table A2.1 of gasket part numbers.**

Note C

Torque fasteners in steps ~~from the center out using a crisscross pattern~~ **as shown in Section 5 Sheet 3:**

First - 30Nm
Second - 50Nm
Third - 80Nm
Fourth - 123±9Nm

~~**Note Z**~~

~~(Step Sec.2 sheet 1)~~

<u>Section 2 Sheet 8</u>

EHU-512 Stones, **Ratchet Feed Set to 1. Note: Block must be at room temperature before honing**

1 Insert hone head into cylinder and rotate feed handle to the left while shaking the hone head until a slight resistance is felt.

2 Adjust the feed dial to a point where it will not shut off the honer over fifteen strokes

3 Set mode switch to timed mode and set controller to 15 seconds (15 seconds = 15 strokes)

4 Start the **honer**~~-~~and adjust the load to ~~15 units, maintaining~~ **a minimum of** 15 units, **but not to exceed 20 units** load by hand during honing.

Apply no more than 15 strokes per cylinder at a time. (4 strokes minimum during final sizing)

Switch stone positions in the hone head between each cylinder.

Do not dwell machine when cylinder is within 0.01mm of target size.

~~Note:1 Unit load will oscillate during normal operation. The intent is to hold 15 units as a minimum load during the honing process~~.

Note: ~~2~~ **1** During final sizing, if less than 15 strokes are desired, set timer to desired seconds or operate in zero shut-off mode and never dwell machine or run less than 4 strokes / cylinder.
5 Follow recommended honing sequence (1,5,4,-3,2,6) do not hone adjacent cylinders
6 Size cylinders, 15 strokes / cylinder maximum, switching stone positions in hone head between each cylinder. Do not chase taper (dwell machine) when cylinder size is within 0.01mm of target. Stop honing with the EHU-512 stones when cylinder size is within 0.005mm of target size. Allow block to cool for fifteen minutes to confirm final size before brush honing.

Reminder: Renumber Note 3 to Note 2

Section 3 Sheet 2

Note B
Check and record cylinder bore surface finish Ra and confirm bore diameters / run number. **The optional method is, wipe the cylinders with a lint free towel and record cylinder bore surface finish Ra and confirm bore diameters at the completion of honing, allow the block to cool for a minimum of 10 min before taking final bore measurements.**

Section 3 Sheet 3

Discussion: *Some Labs install cam bushings prior to the main cap installation and others after the caps are installed and properly torque to procedure. The group held a discussion and agreed that the best lab practice was to install these once the main cap installation was competed.*

Recommendation: *Revise the AM to show cam bushing installation following the main cap installation currently shown in Section 3 Sheet 6. Renumber sheets accordingly.*

Section 3 Sheet 6

Note B Install main cap with new fasteners, **oil all main cap fasteners (EF-411)** and as guides and draw into position ~~using~~ **using** very light pressure by hand with speed handle and socket in crisscross pattern.

Section 3 Sheet 5

Clean the crankshaft using an approved commercial cleaning agent followed by degreasing solvent and Mylar strip polishing cloth (use Mylar polishing cloth only if journals are nicked or oxidized, Do Not use to remove varnish). The final step should be degreasing solvent and nylon bristle brushing of the oil galleries. Spray crankshaft with 50/50 solution and blow excess with compressed air.

Discussion: Some Lab(s) are using a tool to knock-off the sharp edges of the oil feed holes, the Assembly Manual does not provide nor prohibit this method, we should standardize, either allow or state in the AM it is not permitted? **During the UEB conference call it was decided to ask the vendor if they could include this process in their final machining of the crankshafts so everyone is consistent, GM agreed to contact the vendor. The vendor has responded that it can be done.**

Section 3 Sheet 8A

Position rings on piston according to ring gap stagger chart. Orientation of ~~BC-6~~ second ring must be taper down as shown in view. Orientation of oil control ring rails and expander are unidirectional, **although the orientation of oil control ring rails and expander are unidirectional, install the oil ring expanders with the gaps facing up".** Lubricate assembly with EF-411

Section 3 Sheet 11

Note D Lubricate the camshaft journals only (not lobes) with ~~EF-411~~ **test oil** and install. Note: If test oil is known, lubricate journals and lobes with test oil and install

Note E Lubricate thrust plate **with test oil** and install

Discussion: The AM and D7320 **are inconsistent** concerning Note D, the D7320 Section 9.13.1 Coat the camshaft lobes and journals with a light film of test oil.

Section 4 Sheet 9

Install rear main lip seal using GM R&D supplied installation tool or Kentmore J38196 and a light duty bench press until seal bottoms in housing. **Some Labs are not checking the depth, should this step be optional?**

Discussion: In the UEB Conference Call it was determined depth is not necessary, actually in this section it does not require a depth measurement but does include the spec in the drawing.

<u>Section 4 Sheet 12</u>

Insure that calibrated oil level dipstick clears windage tray before final assembly

Note: **DOW CORNING® 3145 RTV MIL-A-46146 ADHESIVE/SEALANT** or GM (see part number info) ~~or "Dow Corning 3154~~ may be used at corners of front and rear covers to aid in sealing.

GM Silicone Sealer
~~New numbers:~~
~~12346141 Tube~~
~~12551715 Cartridge~~

Change to:
12378577 Tube
12551715 Cartridges

<u>Section 5 Sheet 3</u>

Change note D to read:
- **First - 30Nm**
- **Second - 50Nm**
- **Third - 80Nm**
- **Fourth - 145±7Nm**

<u>Section 6 Sheet 6</u>

Apply RTV, GM (see part number info) or ~~Dow Corning 3154 sealer~~ **DOW CORNING® 3145 RTV MIL-A-46146 ADHESIVE/SEALANT** to both ends.

GM Silicone Sealer

New numbers:

~~12346141 Tube~~
~~12551715 Cartridge~~

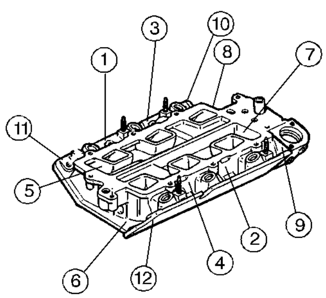
~~Old numbers: (Still acceptable for test)~~
~~12346192 Tube~~
~~12346193 Cartridge~~

Change to:
12378577 Tube
12551715 Cartridges

Section 6 Sheet 7

Install modified intake manifold

Recommendation: Include the GM specified fastener pattern shown below into the AM.



Other Items

Cylinder Heads

- Some labs try to minimize the amount of EF-411 used on valve stems when building the heads, while other labs attempt to maximize the amount of EF-411 used on valve stems when building the heads.
- Some labs soak and/or pre-lube valve stem seals prior to installation.

Valve Recession

All Labs noted they occasionally see excessive valve recession but no one could pin point the cause. The question was asked if harder Intake seats could be installed into the heads as done a few years back on the exhaust seats.

Discussion: GM and SwRI are working on this and will have a response at the June SP meeting.

General Concern

There are several inconsistencies between the ASTM IIIG Procedure (ASTM D7320-10b) and the IIIG Assembly Manual with respect to build-up of Sequence IIIG engines. In general, maintaining build procedures in both the Procedure and the Assembly Manual invites inconsistencies, errors, and confusion.

Recommendation: Including all IIIG build instructions up to the point of installation of the engine on the test stand in the Assembly Manual and eliminating all build instructions from the Procedure. In this manner, only one set of build instructions would need to be maintained and the opportunity for error and/or inconsistency would be greatly reduced.

Discussion: GM has talked to TMC about this and we should have a response at the June SP meeting.

Attachment 13

Sequence III Intake Valve Seat Studies

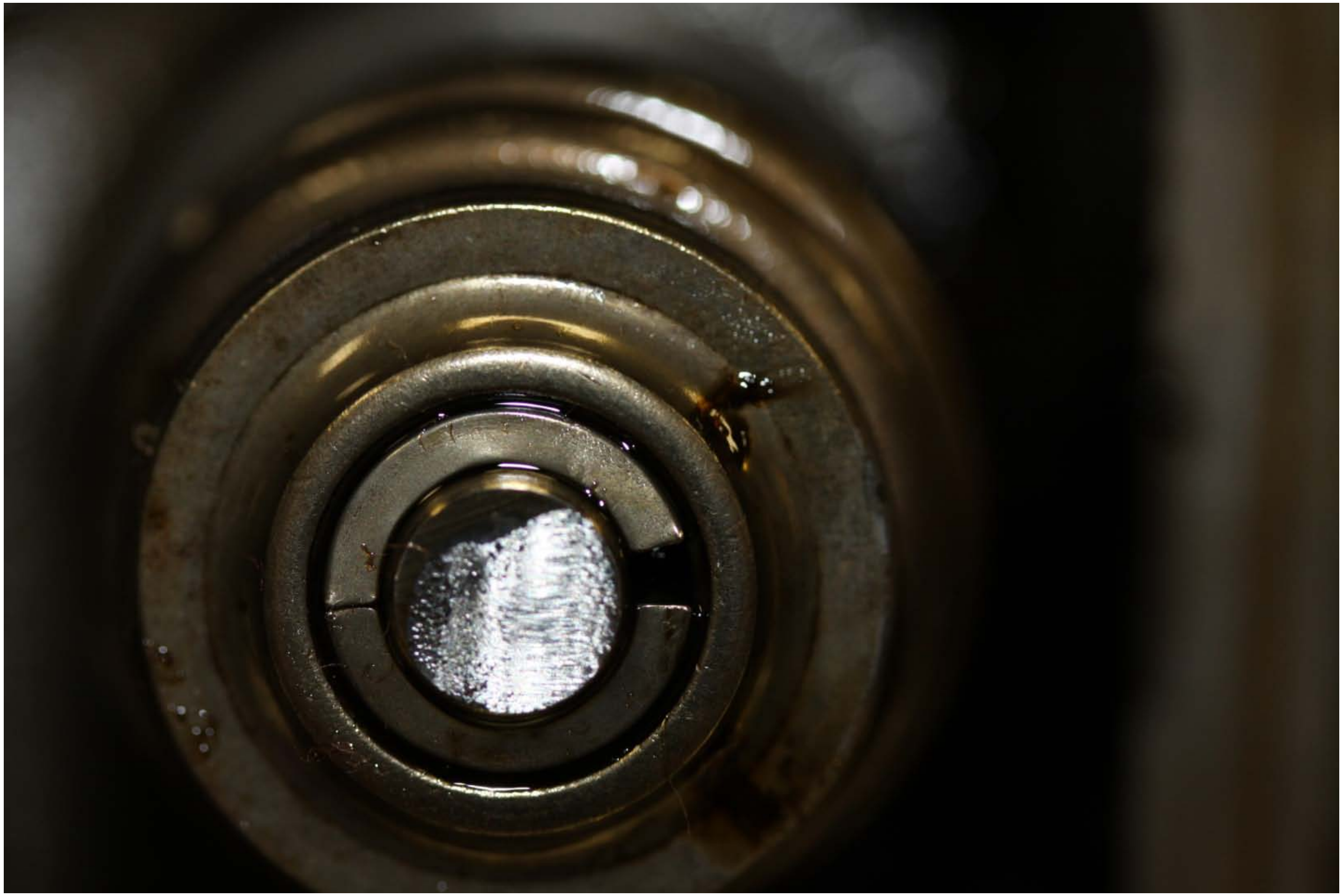
By Patrick Lang and Sid Clark, SwRI

Presented June 2, 2011

Sequence III Valve Recession

- Surveillance Panel has been aware of the Sequence III valve recession for years.
- End of test inspections of cylinder heads at SwRI suggests that valve recession is related to whether or not the intake valve rotates during engine operation.
- Based on a visual inspection of the valve tip, the valves that recede always exhibit a wear pattern that suggests rotation.

Intake Valve Tip w/out Rotation

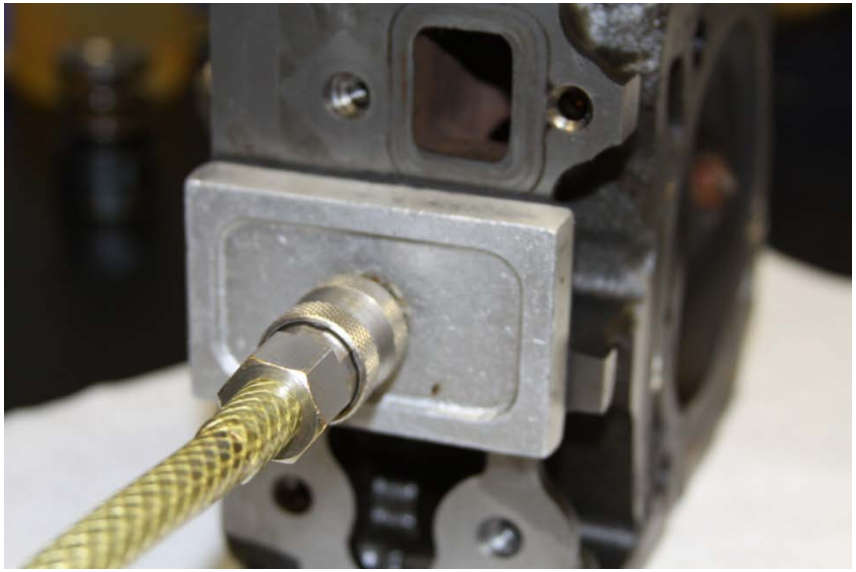


Intake Valve Tip with Rotation

Additional EOT Valve Seat Observations

- Although valve recession is very undesirable and needs to be corrected it may not be the worst of the problems that we have with Sequence III cylinder heads.
- Studies at SwRI have identified that the intake valve seats are losing their sealing ability as the test is running.

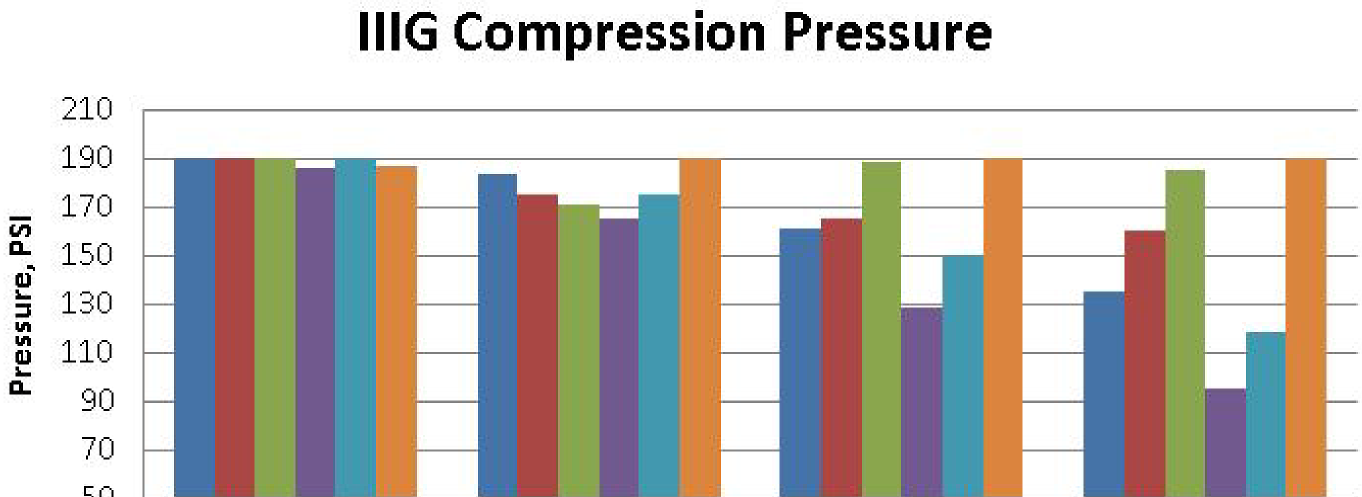
Cylinder Head Valve Seat Seal Checking Apparatus



IIIG Typical Cyl Head Sealing Check

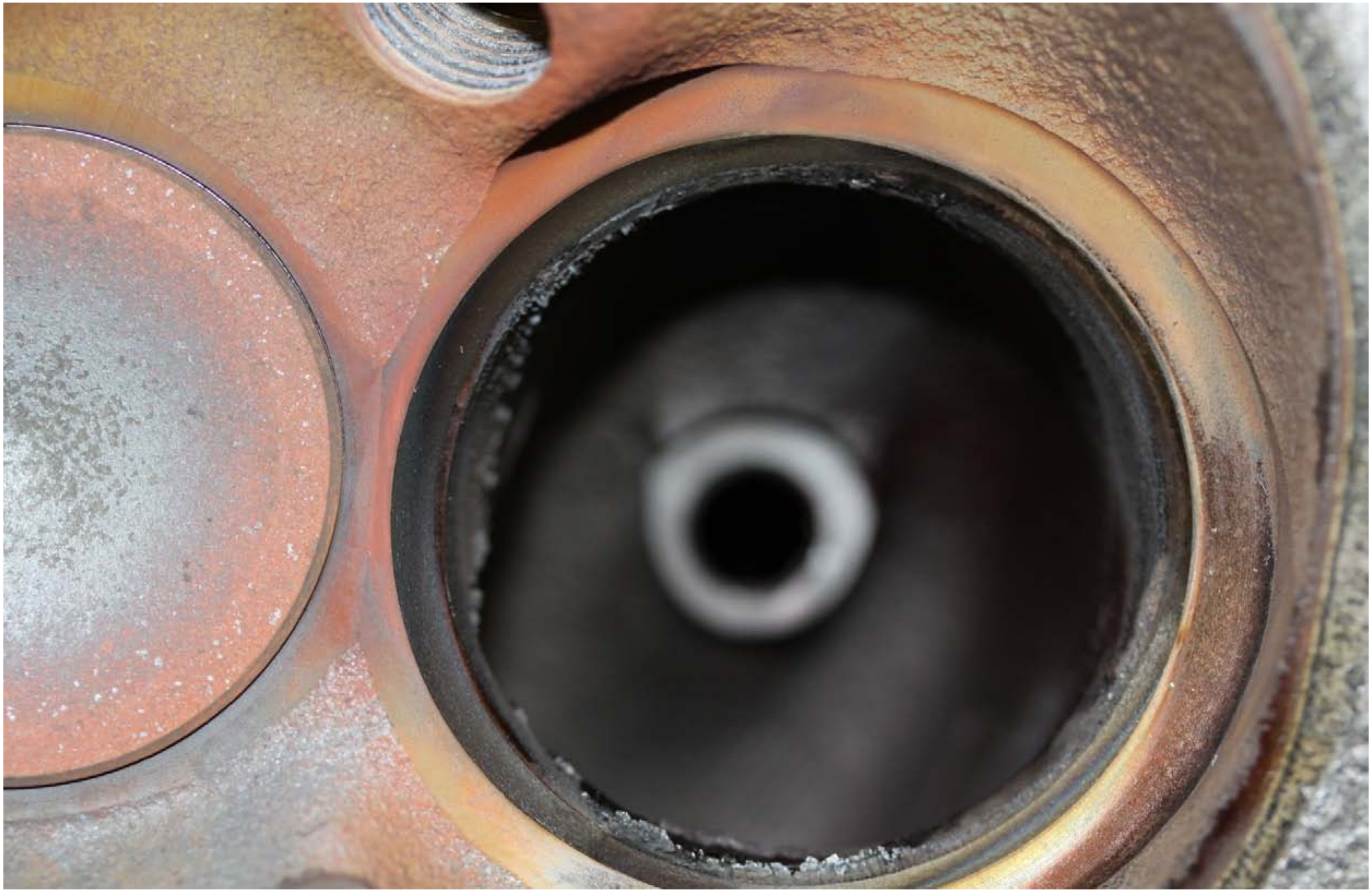
Cylinder	SOT Intake Valve Vacuum Check	SOT Exhaust Valve Vacuum Check	EOT Intake Valve Vacuum Check	EOT Exhaust Valve Vacuum Check
1	0.9	0.9	0.25	0.70
3	0.9	0.9	0.05	0.80
5	0.9	0.9	0.60	0.80
2	0.9	0.9	0.70	0.85
4	0.9	0.9	0.30	0.85
6	0.9	0.9	0.05	0.80

IIIG Compression Pressure Loss

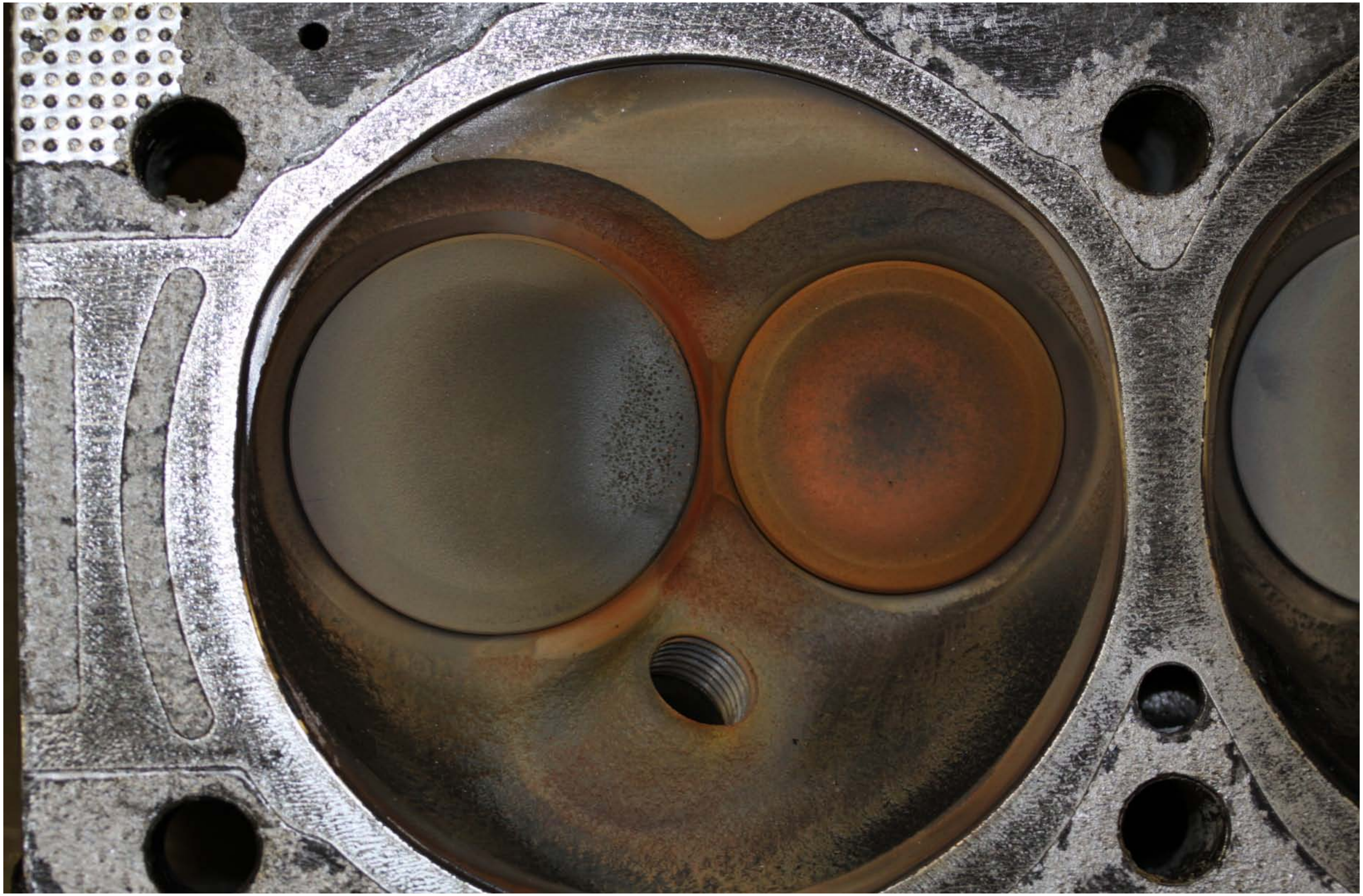


	new	20 hrs	40 hrs	60 hrs
Cyl 1	190	183	161	135
Cyl 3	190	175	165	160
Cyl 5	190	171	188	185
Cyl 2	186	165	128	95
Cyl 4	190	175	150	118
Cyl 6	187	190	190	190

Culprit for Compression Loss - Intake Seat Widening



Intake Valve Hot Spot

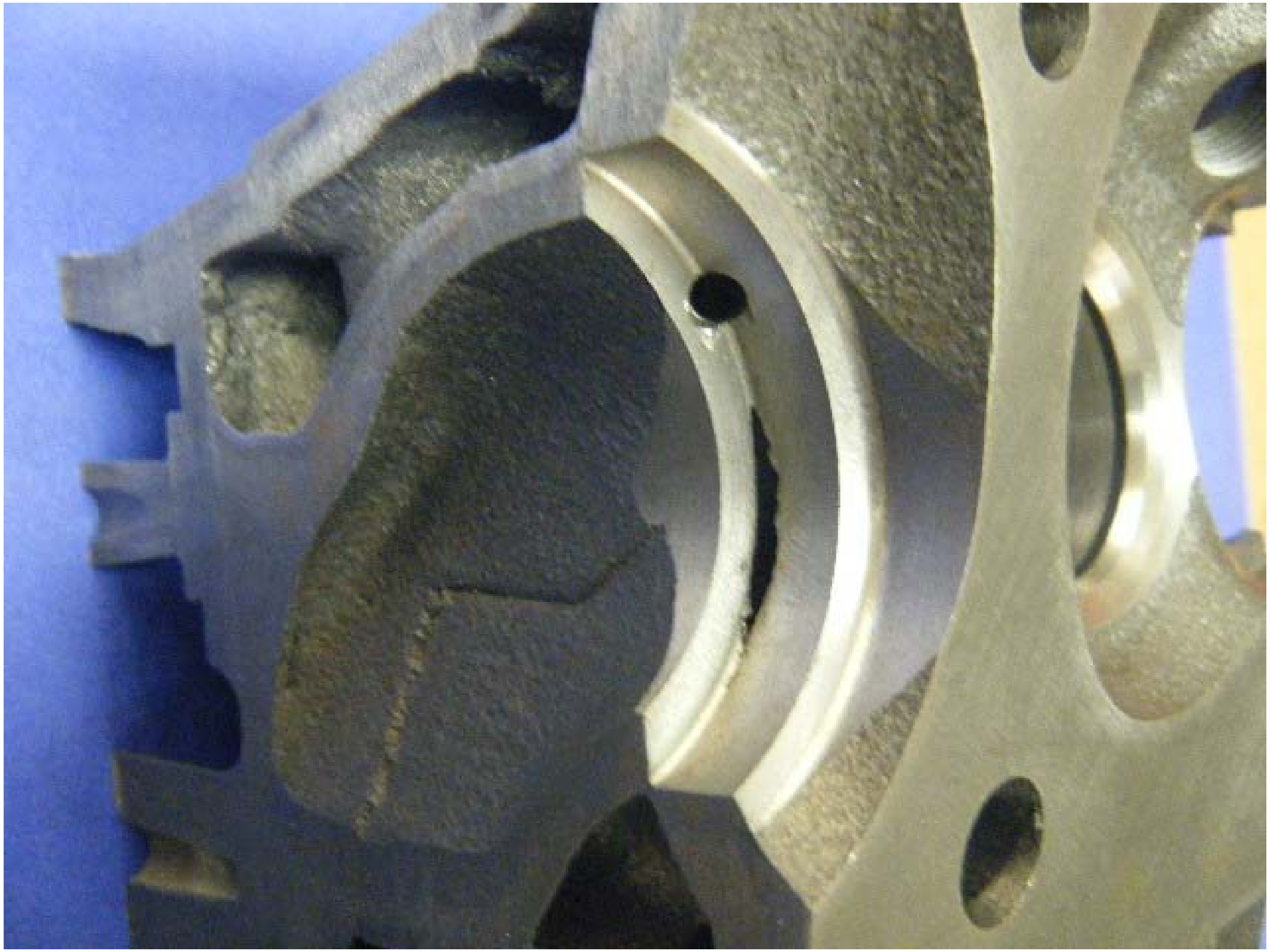


How Do We Fix the Problem?

- SwRI investigated having seat inserts installed in the intake valve position.
- A seat material of heat treated, hardened nodular iron used for exhaust seats in top fuel drag racing applications was chosen based on input from an experienced cylinder head machinist.
- Intake valve seat inserts were installed in a set of new cylinder heads.

Scoping Work Done to Determine max Seat Insert Depth

Break Through into Water Jacket

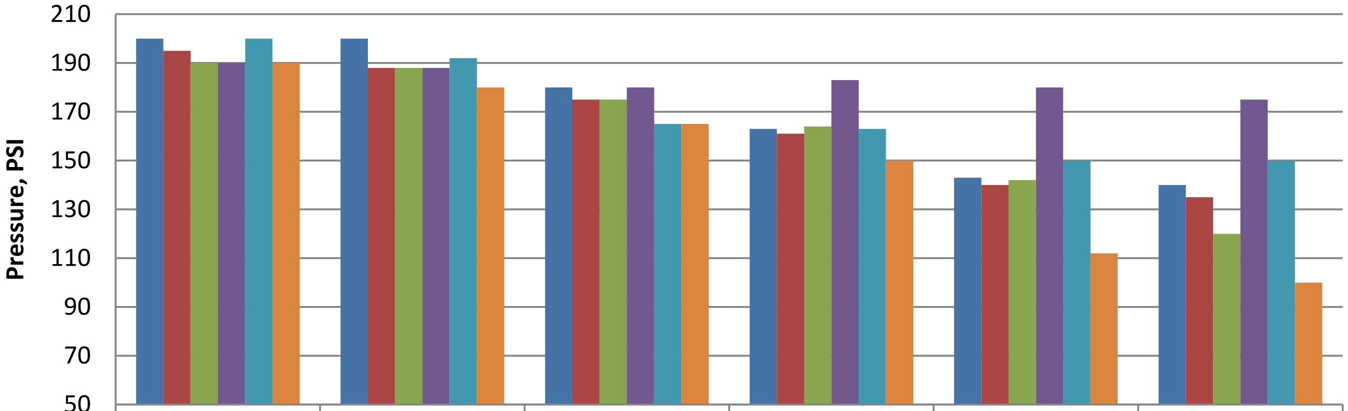


IIIG Test Conducted on Modified Heads

- A IIIG Test was conducted at SwRI using a standard IIIG Engine build and the heads with the intake valve seat inserts.
- The test was run on oil 434-1
- Due to a drop in intake manifold vacuum and detonation, the test was stopped at 95 hours (did not want to bring the engine to point of failure).

Compression Pressure

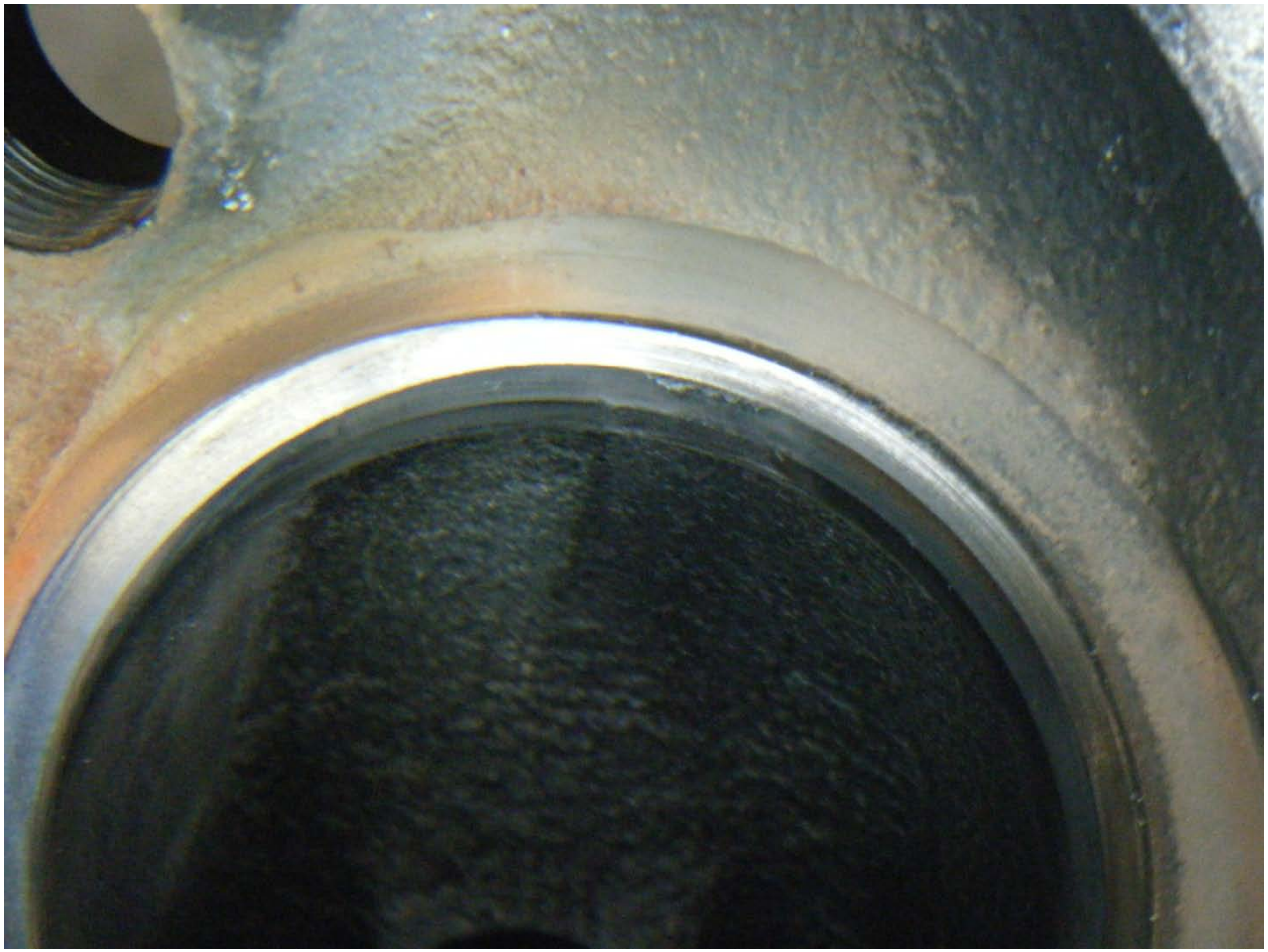
IIIG Compression Pressure w/Intake Valve Seat Inserts



	Timing	20 hrs	40 hrs	60 hrs	80 hrs	95 hrs
Cyl 1	200	200	180	163	143	140
Cyl 3	195	188	175	161	140	135
Cyl 5	190	188	175	164	142	120
Cyl 2	190	188	180	183	180	175
Cyl 4	200	192	165	163	150	150
Cyl 6	190	180	165	150	112	100

Post Test Pictures (intake seat insert)

Intake seat burnout (widening) between exhaust & intake



Post Test Pictures

Heat affect from exhaust showing in intake seat

Post Test Pictures

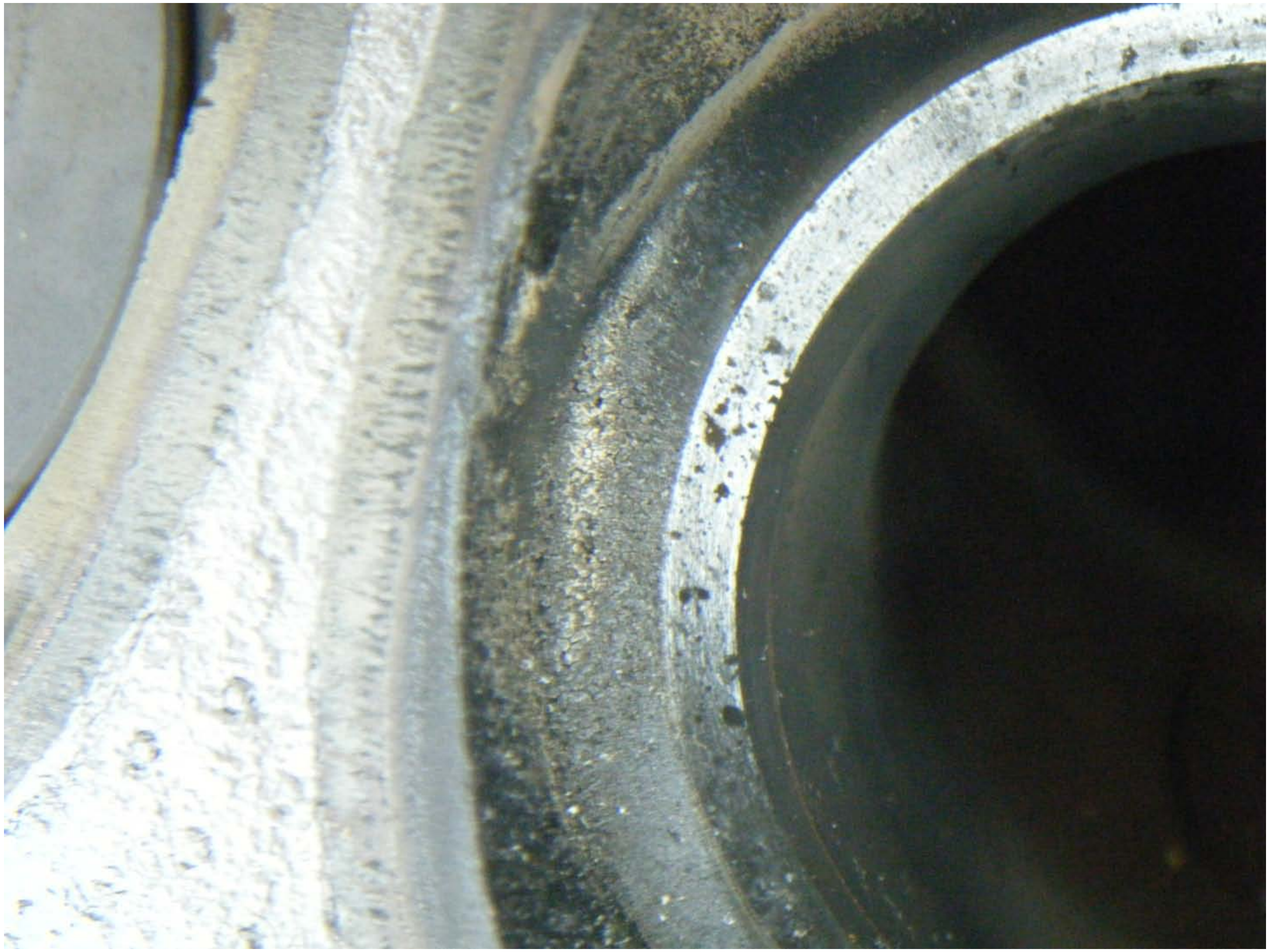
Burnt up pitted seat at heat affect zone between valves

Post Test Pictures

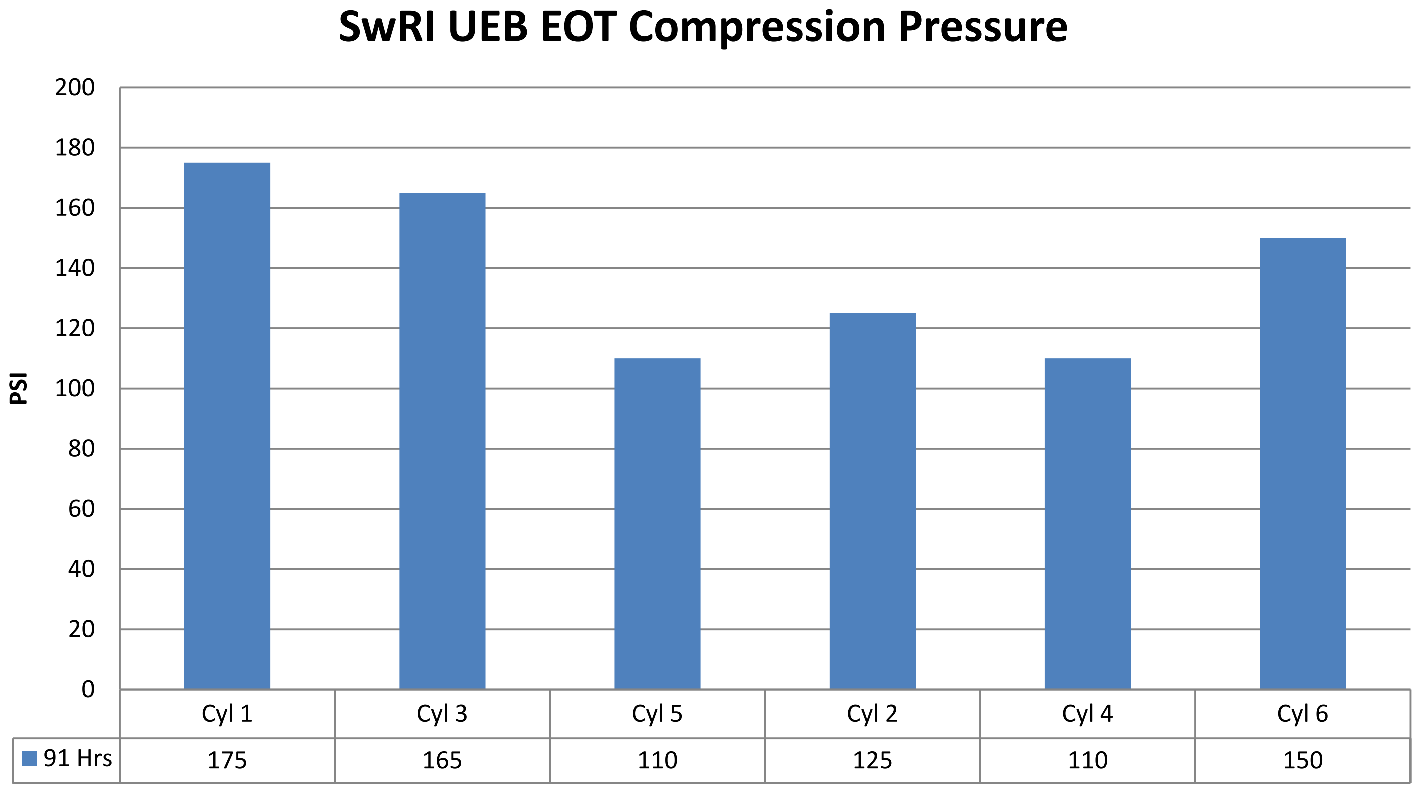
Note both valves run very hot as evidenced by no intake valve-back deposits and micro welding on exhaust

Post Test Pictures

Corresponding shot of material loss in exhaust seat due to micro welding



SwRI UEB Engine at 91 Hours



Conclusions

- Intake valve recession is not the only problem that we have with Sequence III cylinder heads.
- Sequence III intake valve seat sealing is degrading over the course of a standard test.
- The widening of the valve seats truly identifies the heat stresses the Sequence III is running under.
- Loss of compression pressure is causing the engine to work harder; this may help explain the random blown head gaskets experienced at multiple labs.
- Correcting this problem has potential to reduce variation in test results.

What's Next

- Identify an alternate seat material; something more closely representative of current Powertrain hardened chrome – nickel alloy.
- Modify another set of cylinder heads with alternate seat material.
- SwRI will run another donated test in support of this effort.
- Upon completion of determining the proper seat material, continue to work with GM Racing on implementing this change to all Sequence III cylinder heads.

Attachment 14

Best Practices in Lubricant Test Development
Task Force

Scope and Objectives

Scope

The scope of this task force is to create a template/checklist for best practices in lubricant test development, to be utilized for effective future test development. The goal is to build this template/checklist from a compilation of existing documents available within the industry and knowledge and data from previous test development.

Objectives

This document will assist future test development groups answer the following questions: What are we trying to measure (what are our objectives), how can the measured parameters be correlated to field service and/or back to previous test(s) being replaced, what impacts the parameters being measured.

Updated: January 27, 2009

Items to consider:

1. Define Need
    a. Define parameters to measure (must have sufficient range)
    b. Define platform
    c. Define funding
    d. Define participants (minimum of 2 independent labs)
2. Demonstrate test's ability to discriminate
3. Reference oil selection
    a. Target calculation
4. Calibration period
5. LTMS version
   ftp://ftp.astmtmc.cmu.edu/docs/LTMS%20v2%20Task%20Force%20Documents/
    a. Decide whether to chart final original units or final transformed units
6. Hardware control – ensure consistency (2 references below)
    a. Define critical parts and handling (CPD)
    b. Sufficient supply of quality parts in beginning and through out
    c. Supplier system to prevent running hardware and sub-suppliers changes
7. Fuel supply – notes from fuel task force:
    a. Incorporate fuel as a parameter and fuel suppliers as a partner in early test development.
    b. Include in the development discussions the use of modern, relevant fuel.
    c. Define recipe for fuel rather than finished specs.
    d. Develop a test that is insensitive to fuel if possible.
    e. Define ways to report identifying factors, such as fuel batch id parts batches, etc…
    f. Define standard batch id reporting
8. Instrumentation (DACA II below)
9. Rating and measurement methods
    a. Range of measurement large enough to correct for shifts
    b. If merit systems used, factor in range for corrections and shifts
    c. Determine appropriate significant digits for results
    d. Clearly state calculation methods for calculated results
10. Research Report ftp://ftp.astmtmc.cmu.edu/docs/Research_Report_Template.pdf

ACC Code of Practice Appendix K is a good place to start.
ftp://ftp.astmtmc.cmu.edu/docs/Technical_Guidance_Committee/Meeting_Minutes/BestPractices/ACCAppendixK.pdf

Other documents and guidelines that have already been developed:
TMB Rules and Regulations
ftp://ftp.astmtmc.cmu.edu/docs/test_monitoring_board/TMB%20Rules%20and%20Regulations.pdf

Information Letter Task Force Report
ftp://ftp.astmtmc.cmu.edu/docs/test_monitoring_board/minutes/information_letter_task_force_report.pdf

DACA II
ftp://ftp.astmtmc.cmu.edu/docs/quality_index_and_data_acquisition/daca_II_report_and_system_time_response.pdf

Test Hardware Control
ftp://ftp.astmtmc.cmu.edu/docs/Technical_Guidance_Committee/Meeting_Minutes/TestHardwareControl/Test%20Hardware%20Control.pdf

Sequence IID and IIIE Information Letter 60
ftp://ftp.astmtmc.cmu.edu/docs/Technical_Guidance_Committee/Meeting_Minutes/TestHardwareControl/IL60.pdf

PC-10 Lessons Learned
ftp://ftp.astmtmc.cmu.edu/docs/Technical_Guidance_Committee/Meeting_Minutes/BestPractices/HDECP20071204att3.pdf

Form and Style for ASTM Standards http://www.astm.org/COMMIT/Blue_Book.pdf

Other ASTM Committee work (relevance varies)
http://www.astm.org/COMMIT/SUBCOMMIT/D0294.htm
http://www.astm.org/COMMIT/SUBCOMMIT/E1120.htm

Best Practices in Lubricant Test Development: May 19, 2011

Jim Moritz
Bill Buscher
Frank Farber
Charlie Leverett
Chris Castanien
David Glaenzer
Jeff Clark
Jim Rutherford
Greg Shank

Chairman's comments: compilation of old documents. A test developer asked how this will be used. This checklist is meant for the earliest stages of test development. It should include technical recommendations in development like using forced oil adds instead of fill to full. If this group has recommendations for changes to Appendix K of the ACC Code of Practice, then they should be forwarded. A suggestion was made to update the draft template to remove references to engine oil testing to include bench and gears.

This guide should be a tool for the Surveillance Panels, engineers and test developers to use in the early phases of test development to archive details like controlling load cell temperatures and forced oil adds. RTV is a source of foaming. Also, the size of parts batches and how to introduce new fuel must be included. The guide will make clear that the TMC is able to hold Intellectual Property for items like fuel recipes. The suggestion was made that to be a fuel supplier, the recipe will have to be sent to the TMC. TMC will sign non-disclosure agreements and meet any fuel supplier's requirements. The feeling is that for new categories, the requirement be made that the fuel recipe will go to the TMC.

PC Surveillance Panel meetings (III, IV, V) in early June will include as an agenda item to brainstorm and discuss items for the guide.

Best Practices (draft list of recommendations):

- Forced oil consumption with fresh oil make up rather than fill to full.
- Control load cell temperatures (where relevant)
- Control inlet air restriction and exhaust back pressure and other pressures in absolute units if practical. If not, don't mix absolute and gage across the engine.
- RTV is a source of foaming
- Parts and fuel batches have been a major source of variability and severity shifts.
- Test developer/parts suppliers develop methods to prevent running parts changes or supplier sourcing changes. At a minimum, notification is necessary.
- Test platform/apparatus part numbers be clearly listed somewhere to refer back in time.

Attachment 15

Sequence IIIF/G Surveillance Panel
June 2, 2011
9:00AM – 3:00PM
GM Technical Center
Warren, MI

Motions and Action Items
As Recorded at the Meeting by Bill Buscher

1. Action Item – Sequence IIIF needs a replacement for RO 1006-2. Panel members to continue to solicit oil suppliers for a potential replacement reference oil with PVIS in the 275% range.

2. Action Item – Labs to investigate and report the accuracy of their camshaft wear measurement equipment, and report to the panel chairman for potential editorial changes of Sections 9.11.3.1, 9.11.5 and 9.11.6 of the test procedure.

3. Action Item – Greg Seman to a chair a task force to address issues with oil temperature control and current lab practices.

4. Action Item – Labs to install hour meters on their automated parts washer to determine a recommendation for hours in place of months for the soap and water change interval.

5. Action Item – Labs to review data on the two soaps used in the automated parts washer to standardize on one soap.

6. Action Item – Table the UEB group's recommended revisions to Sections 9.5.3.1 and 9.5.3.3 of the Sequence IIIG test procedure and Section 1 Sheet 5A of the Sequence IIIG assembly manual for further discussion prior to a surveillance panel motion. Charlie Leverett will readdress with UEB group.

7. Motion – Revise Sections 9.3, 9.5.3, 9.9.5, 9.10.1 and 9.12, of the Sequence IIIG test procedure, revise Section 1 Sheets 4, 5, 6 and 7, Section 2 Sheet 8, Section 3 Sheets 2, 3, 5, 6, 8A and 11, Section 4 Sheets 9 and 12, Section 5 Sheet 3 and Section 6 Sheets 6 and 7 of the Sequence IIIG assembly manual and include all Sequence IIIG build

instructions up to the point of installation of the engine on the test stand in the assembly manual and eliminating all build instructions from the test procedure as per the recommendations of the UEB group. Effective 7/1/11.

Charlie Leverett / Adam Bowden / Passed 12-0-0

8. Action Item – Labs to provide photos of combustion chambers and compression data from UEB test engines to Pat Lang.

9. Action Item – Surveillance panel members to provide input for the TGC Best Practices in Lubricant Test Development document by 8/1/11 to the panel chairman and the TMC. The chairman will distribute material as it comes in to the panel members for review. A face-to-face meeting for all interested will be scheduled prior to the next panel meeting and input for the document will be compiled for review at the next panel meeting.