



A Program of ASTM International

Test Monitoring Center

<http://astmtmc.cmu.edu>

ASTM D02.B1 Semi-Annual Report Passenger Car Reference Oil Testing

October 2013

Passenger Car Engine Oil Testing Executive Summary

▶ IIIF

- ‘Hours to 275% Vis Increase’ replaced ‘% Vis Increase’ as monitored and severity adjusted parameter.

▶ IIIG

- Re-blend of oil 434 is currently in progress

▶ IVA

- TMC reference oil 300, an oil performing in the 50–60 μm range, has been obtained and the panel needs to address its introduction into LTMS.

Passenger Car Engine Oil Testing Executive Summary

▶ VG

- Batch AK2821NX10-1 approved with correction factors.

▶ VID

- 20 tests have been reported which were run using Proposed VIE conditions.
- 14 of these tests have been run on fuel with IVD additives
 - to address “burnt valves” encountered with the some of the 2012 engines.

Calibrated Labs and Stands*

Test	Labs	Stands
IIIF	4	5
IIIG/A/B	5	13
IVA	3	4
VG	3	6**
VID	4	8
VIII	3	4

** 2 Stands have had calibration periods extended for fuel batch transition

*As of 9/30/2013

Test Monitoring Center
<http://astmtmc.cmu.edu>



A Program of ASTM International

Test Activity Levels

»» April 1, 2013 –

September 30, 2013

Test Monitoring Center

<http://astmtmc.cmu.edu>



A Program of ASTM International

Sequence Tests

Test Status	Validity Code	IIIF	IIIG	IVA
Acceptable Calibration Test	AC	9	9	7
Failed Calibration Test	OC	0	1	1
Operationally Invalid by Lab	LC	0	0	1
Aborted	XC	2	2	1
Test Stand Removed from LTMS	MC	0	2	0
Decoded/Donated	NN/AG	2	0	1
Total		13	14	11

Sequence Tests

Test Status	Validity Code	VG	VID	VIII
Acceptable Calibration Test	AC	4	19	4
Failed Calibration Test	OC	0	6	0
Operationally Invalid	LC	0	3	1
Aborted	XC	1	1	0
Fuel Approval	AF	24	0	0
Operationally Invalid, Lab & TMC	RC	0	0	1
Decoded/Donated	NN/AG	0	23	0
Total		29	52	6

Failed Tests

Test Status	Test	Number of Tests
Severe ACLW	IIIG	1
Severe ACW	IVA	1
FEI1 Mild	VID	2
FEI2 Mild	VID	2
FEI1 and FEI2 Mild	VID	1
FEI2 Severe	VID	1
Total		8

Lost Tests*

Slide 1 of 2

Test Status	Cause	IIIF	IIIG	IVA	VG	VID	VIII
Aborted	High Oil Consumption	2	2	0	0	0	0
Invalid	Stand Removed From System	0	2	0	0	0	0
Invalid	Driveline and Engine Mounting Failure	0	0	1	0	0	0
Aborted	Break-in not Performed on New Cylinder Head	0	0	1	0	0	0
Aborted	Cam Sensor Wiring Failed	0	0	0	1	0	0
(continued on next slide)							

*Invalid and aborted tests

Lost Tests*

Slide 2 of 2

Test Status	Cause	IIIF	IIIG	IVA	VG	VID	VIII
Invalid	Downtime Exceeded Procedural Limit	0	0	0	0	3	0
Aborted	Engine Coolant Leak	0	0	0	0	1	0
Invalid	Excessive Camshaft Wear	0	0	0	0	0	1
Invalid	High Mechanical Wear	0	0	0	0	0	1
Totals		2	4	2	1	4	2

*Invalid and aborted tests

Test Monitoring Center

<http://astmtmc.cmu.edu>



A Program of ASTM International

Test Severity

»» April 1, 2013 –
September 30, 2013

Test Monitoring Center

<http://astmtmc.cmu.edu>



A Program of ASTM International

Test Severity

▶ IIIF

- WPD in control.
- Hours to 275% Vis Increase in Control
- APV
 - In severity action alarm, mild
 - Long-term mild trend continuing (Since October 2006)
- PV60
 - In precision warning alarm

- Charts shown in [Appendix 1.a.](#)

Test Severity

▶ IIIG

- MRV is in control.
 - PHOS in control.
 - WPD is in control.
 - Long-term severe trend continuing (Since late 2004)
 - PVIS is in control
 - ACLW in mild warning alarm .
 - Severity Action alarm (Mild direction)
 - Long-term mild trend
- Charts shown in [Appendix 1.b.](#)

Test Severity

▶ IVA

- ACW in control.

- Charts shown in [Appendix 1.c.](#)

▶ VG

- AEV and APV in severity EWMA Warning alarm (Mild)
- AES, RAC and OSCAR are in control for severity and precision.

- Charts shown in [Appendix 1.d.](#)

Test Severity

▶ VID

- FEI1 and FEI2 are in control.

- Charts shown in [Appendix 1.e.](#)

▶ VIII

- BWL is in control.
- Stripped Viscosity in EWMA Precision warning alarm.

- Charts shown in [Appendix 1.f.](#)

Test Precision

»» April 1, 2013 –
September 30, 2013

Test Monitoring Center

<http://astmtmc.cmu.edu>



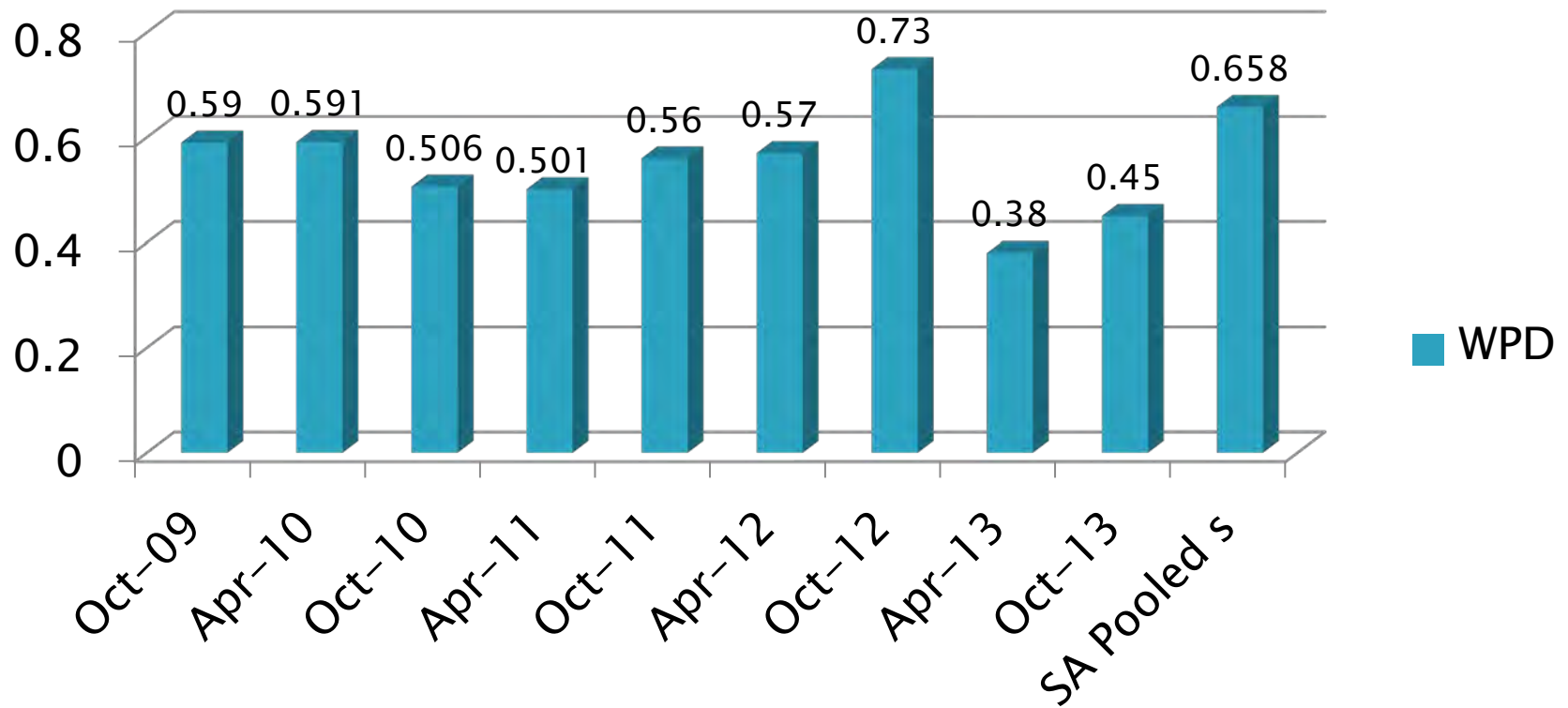
A Program of ASTM International

Test Precision Estimates

- ▶ Presented on a six month basis.
- ▶ Data presented for past four years.

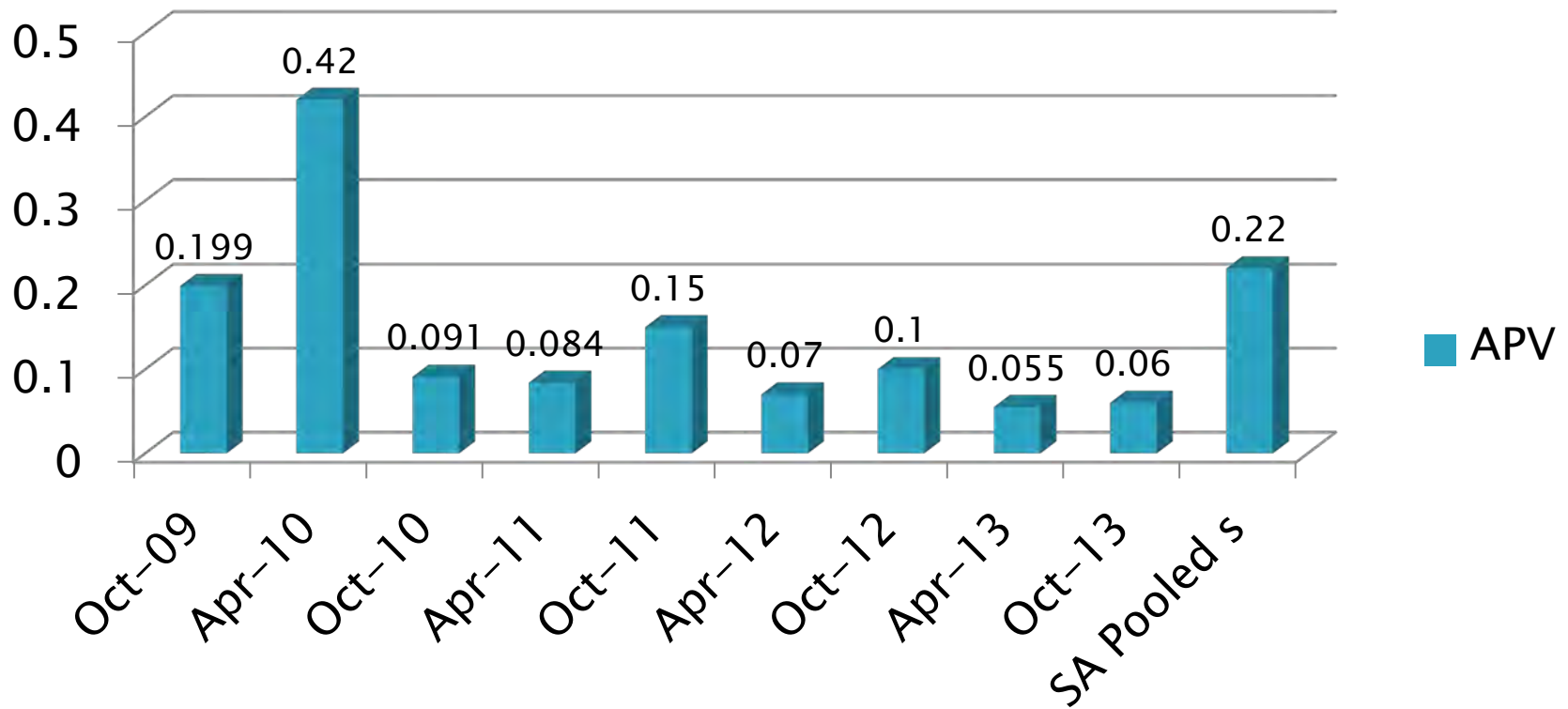
IIIF Precision Estimates

WPD



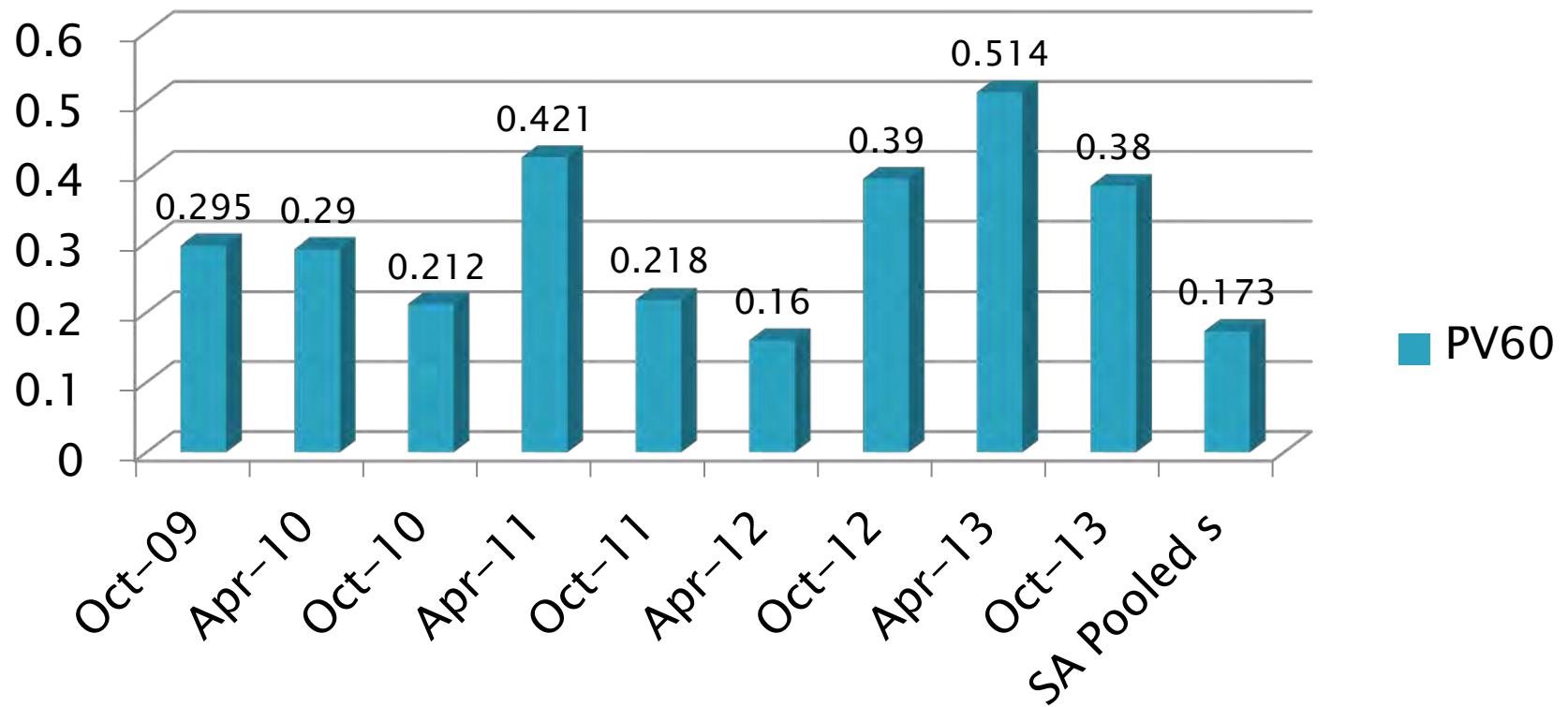
IIIF Precision Estimates

APV



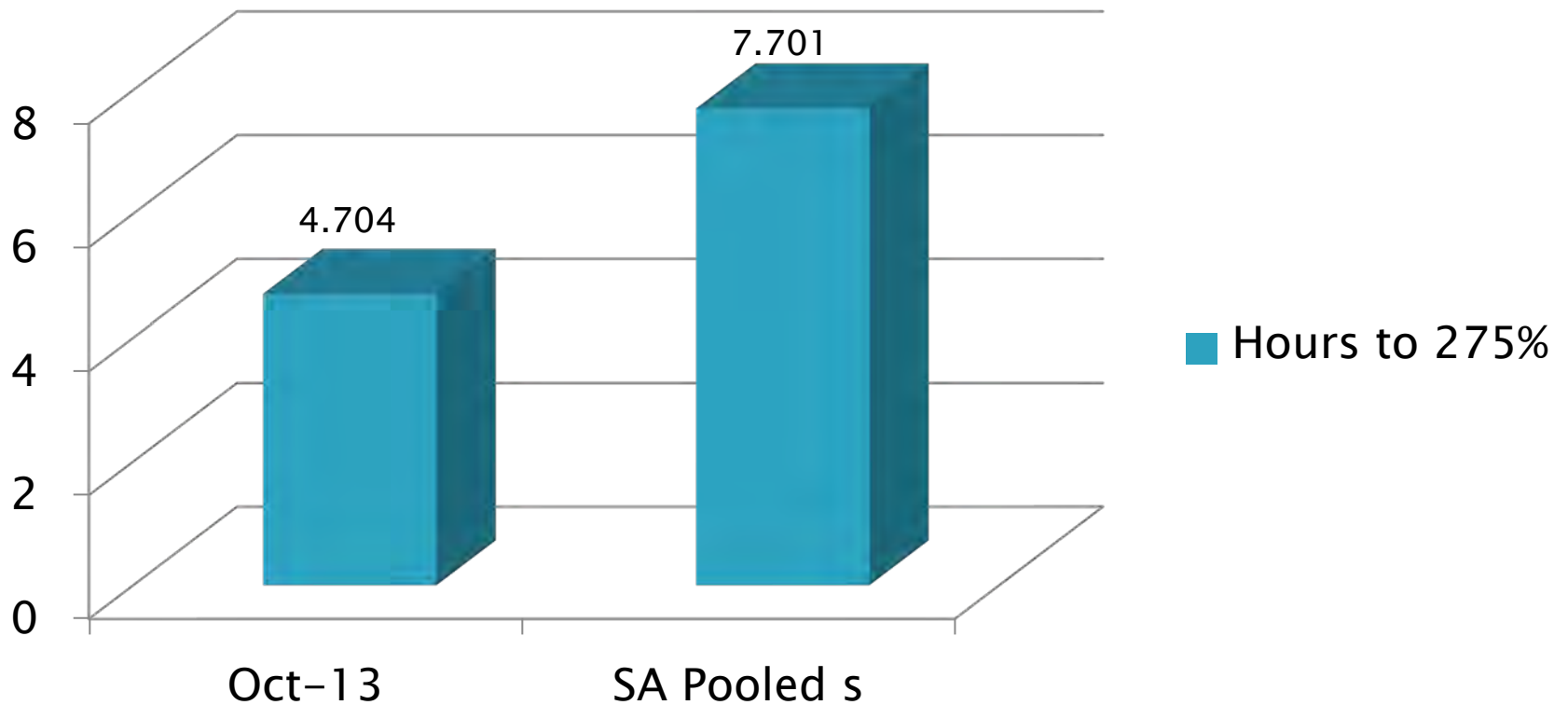
IIIF Precision Estimates

PV60

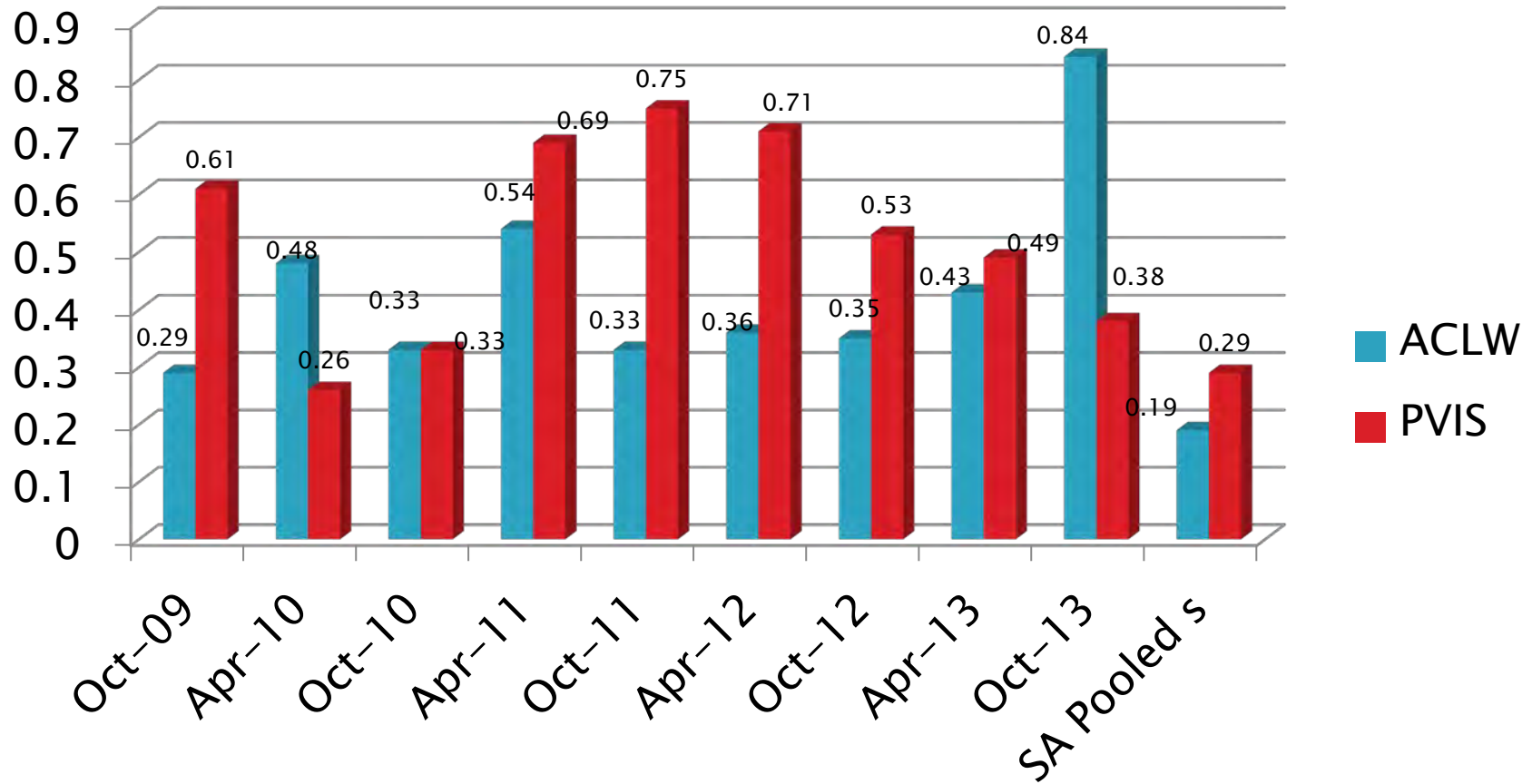


IIIF Precision Estimates

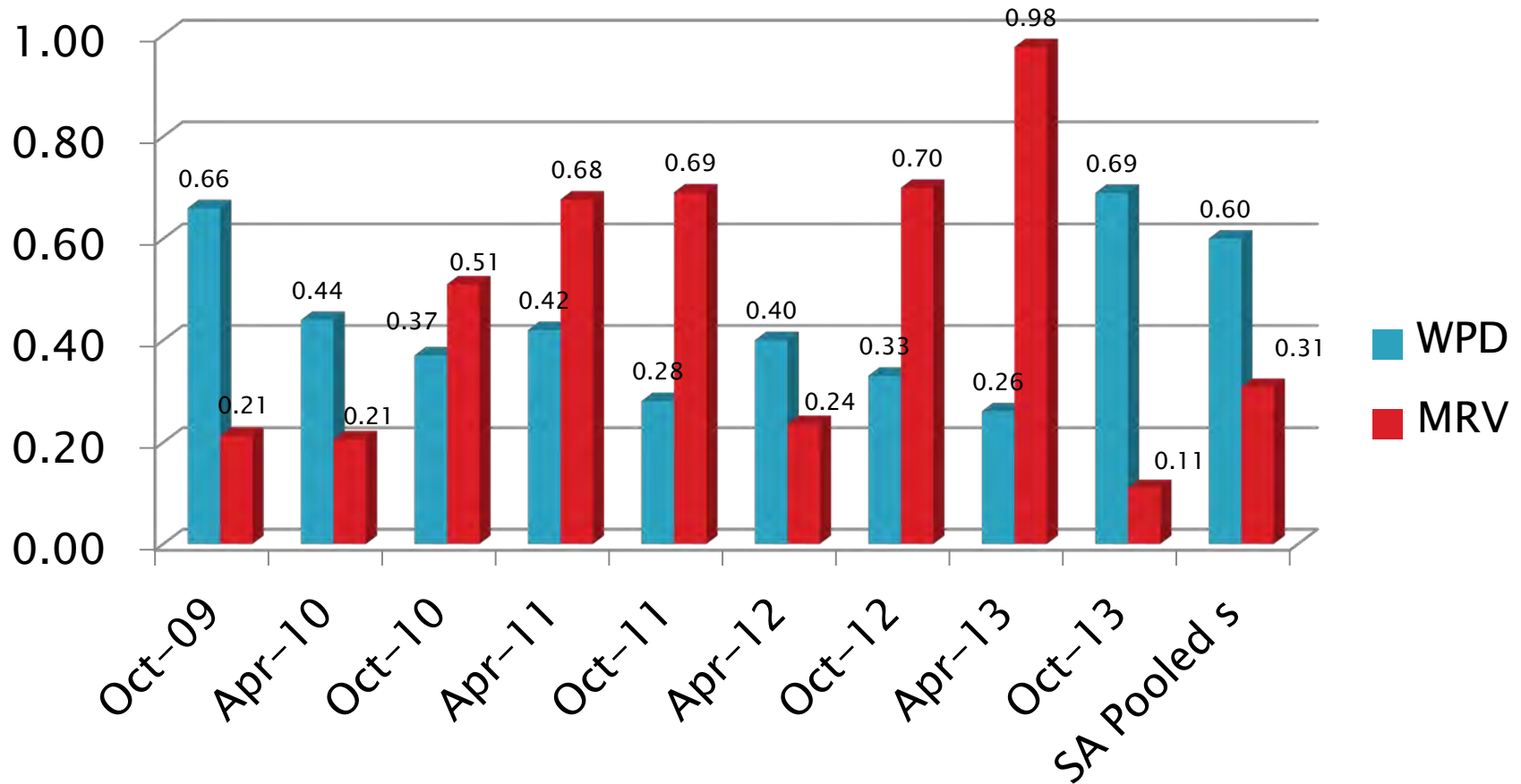
Hours to 275%



IIIG Precision Estimates

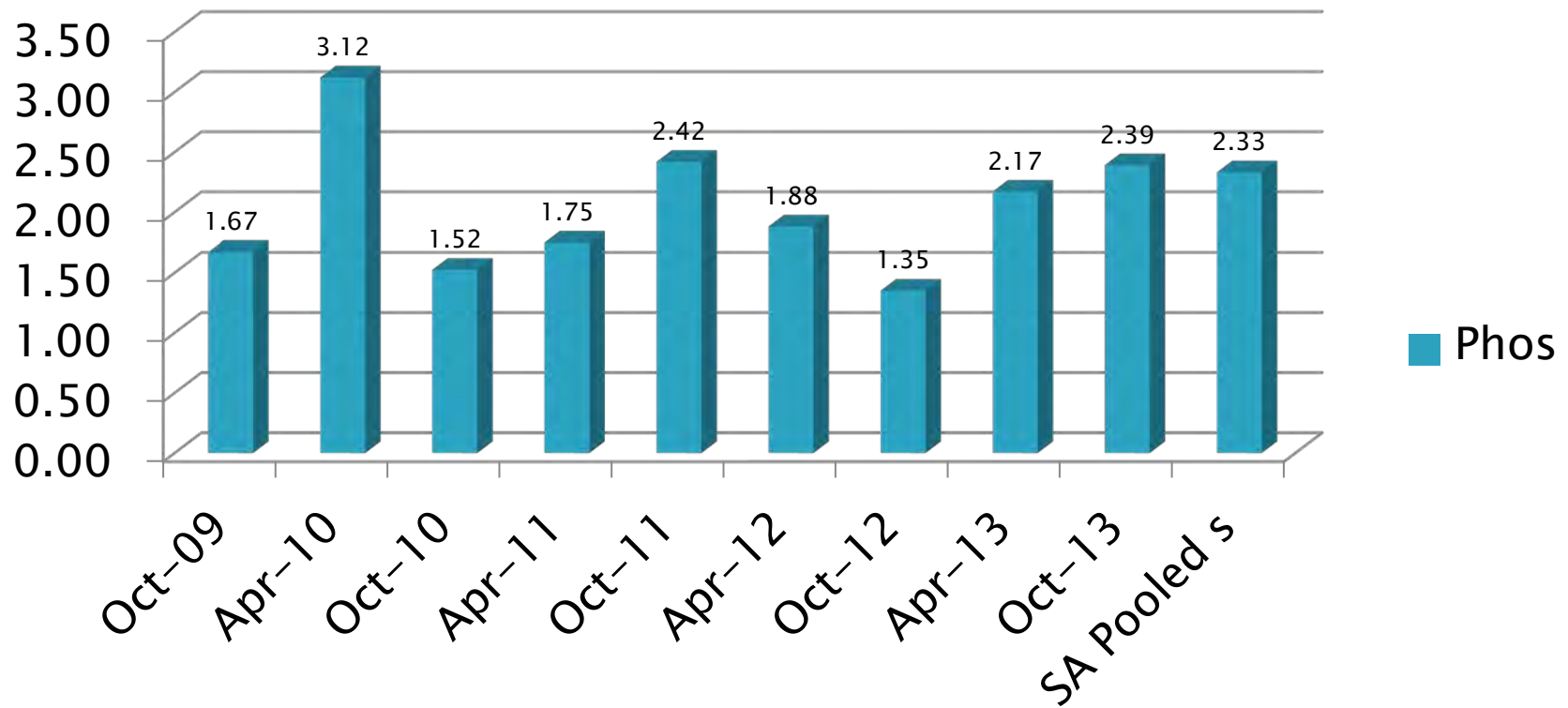


IIIG Precision Estimates



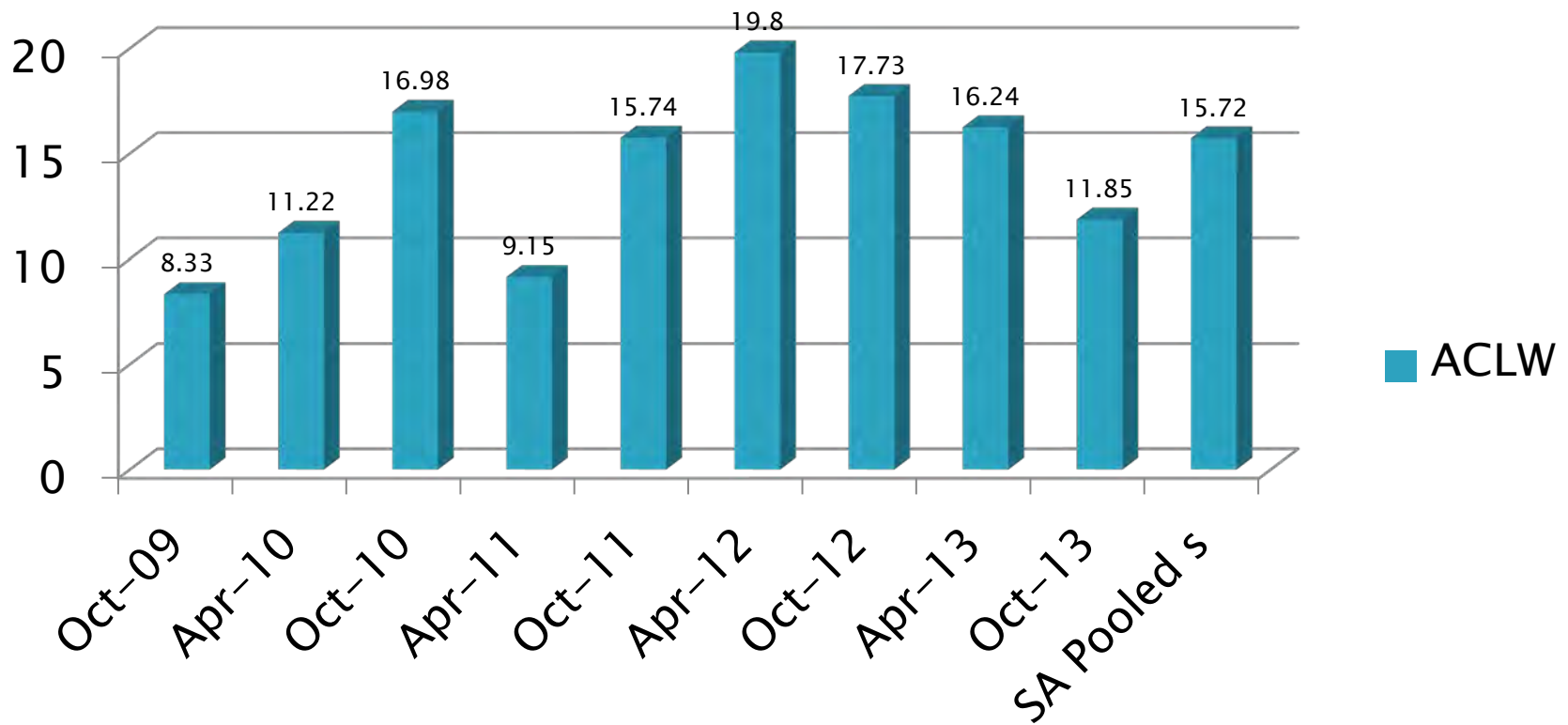
IIIG Precision Estimates

Phos

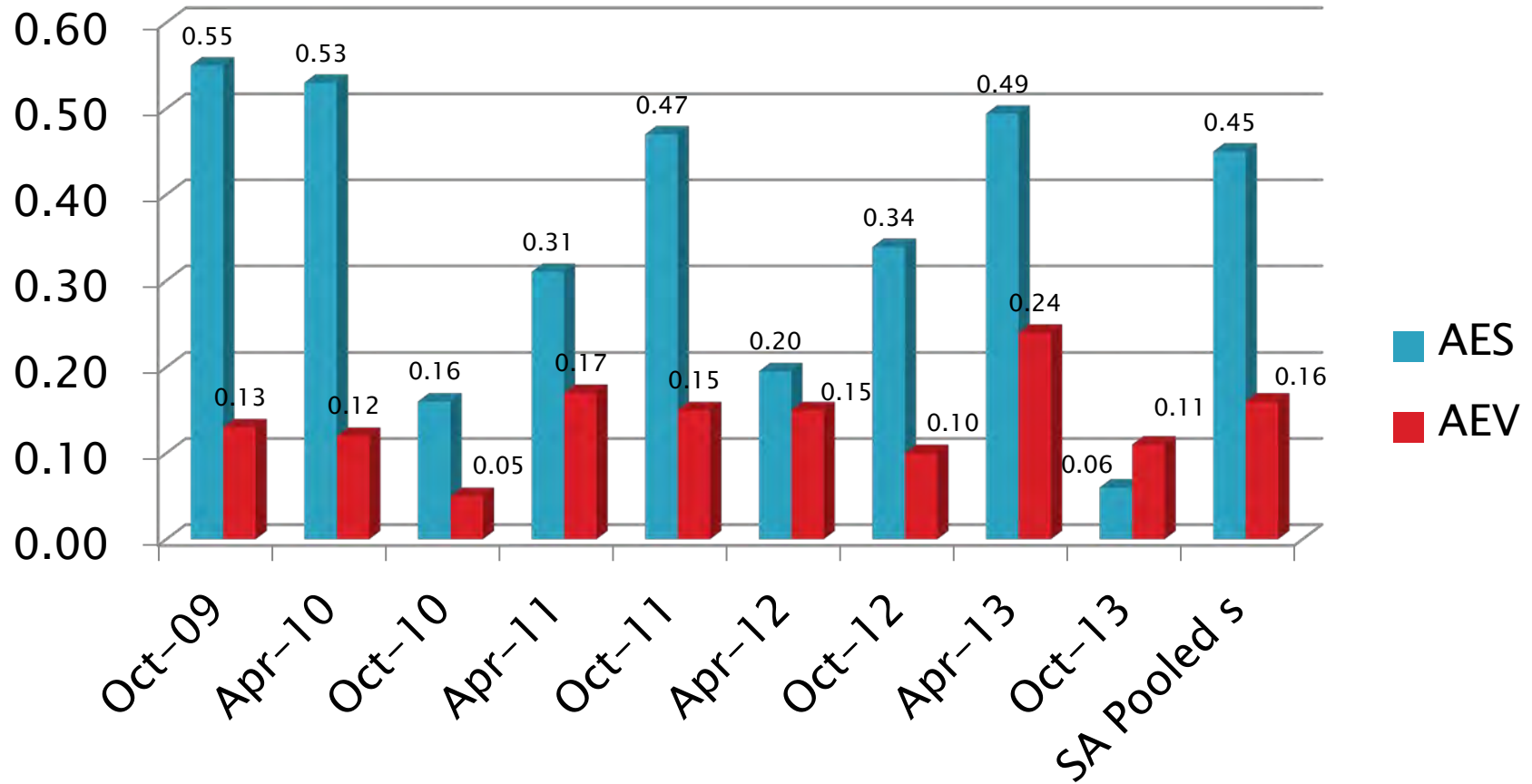


Sequence IVA Precision Estimates

ACW

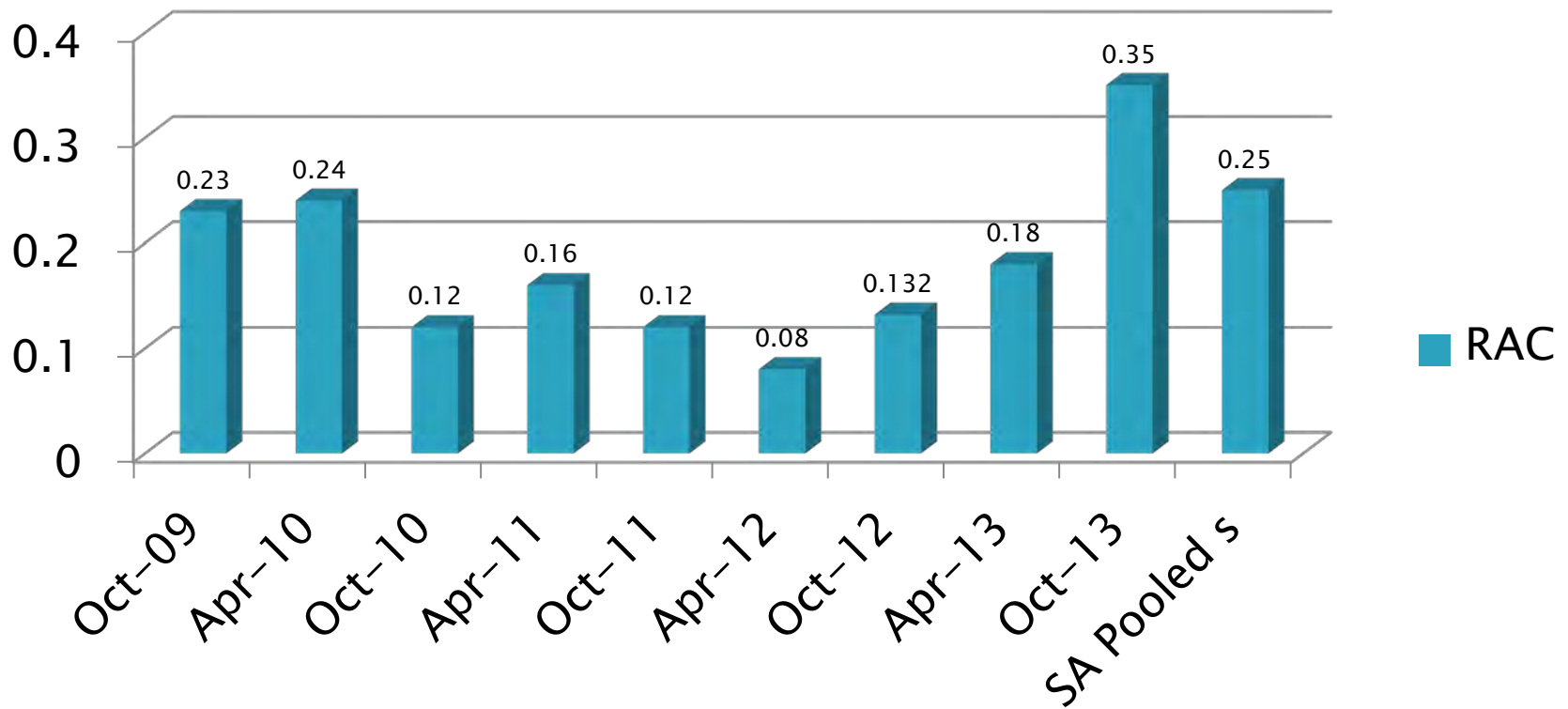


Sequence VG Precision Estimates

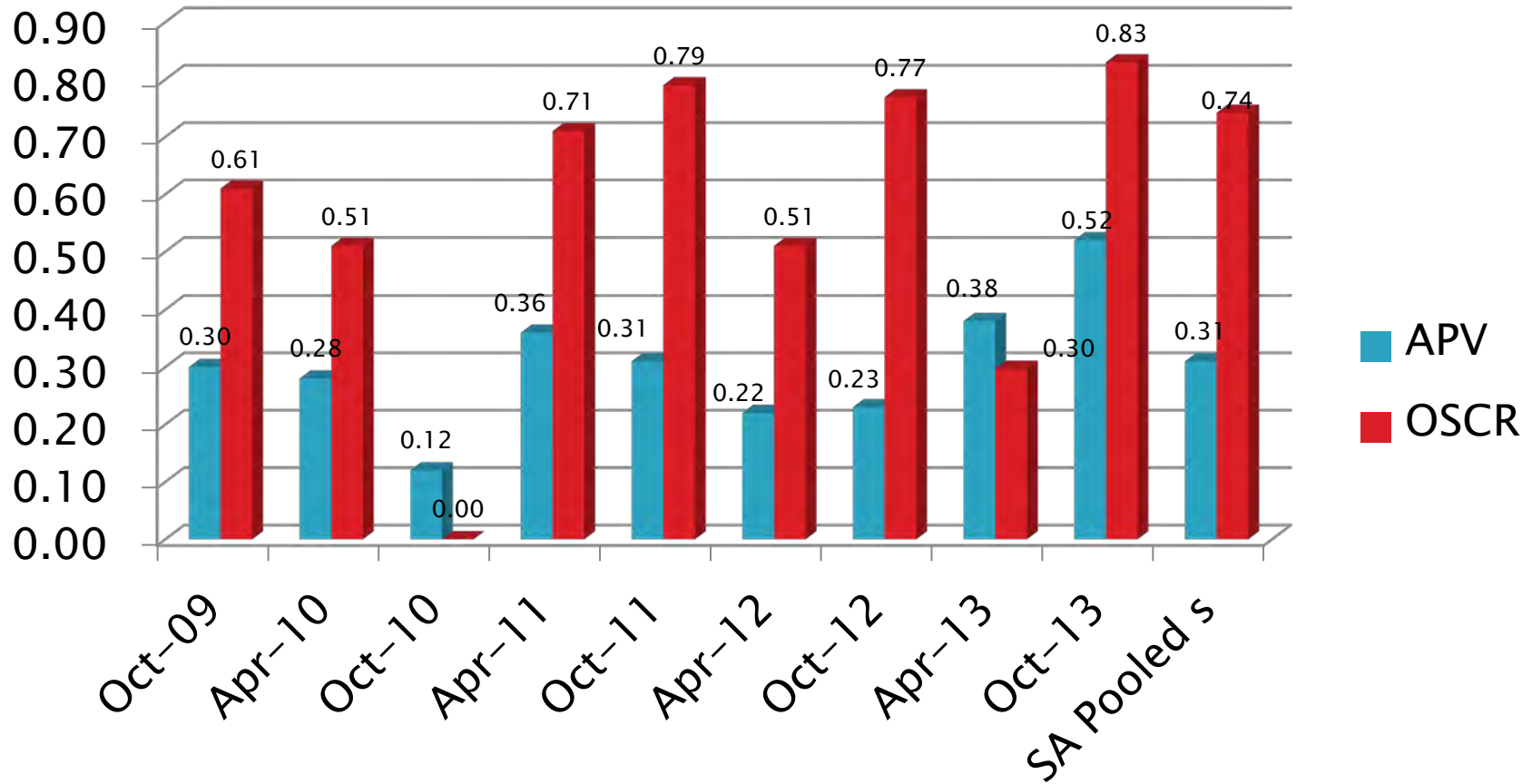


Sequence VG Precision Estimates

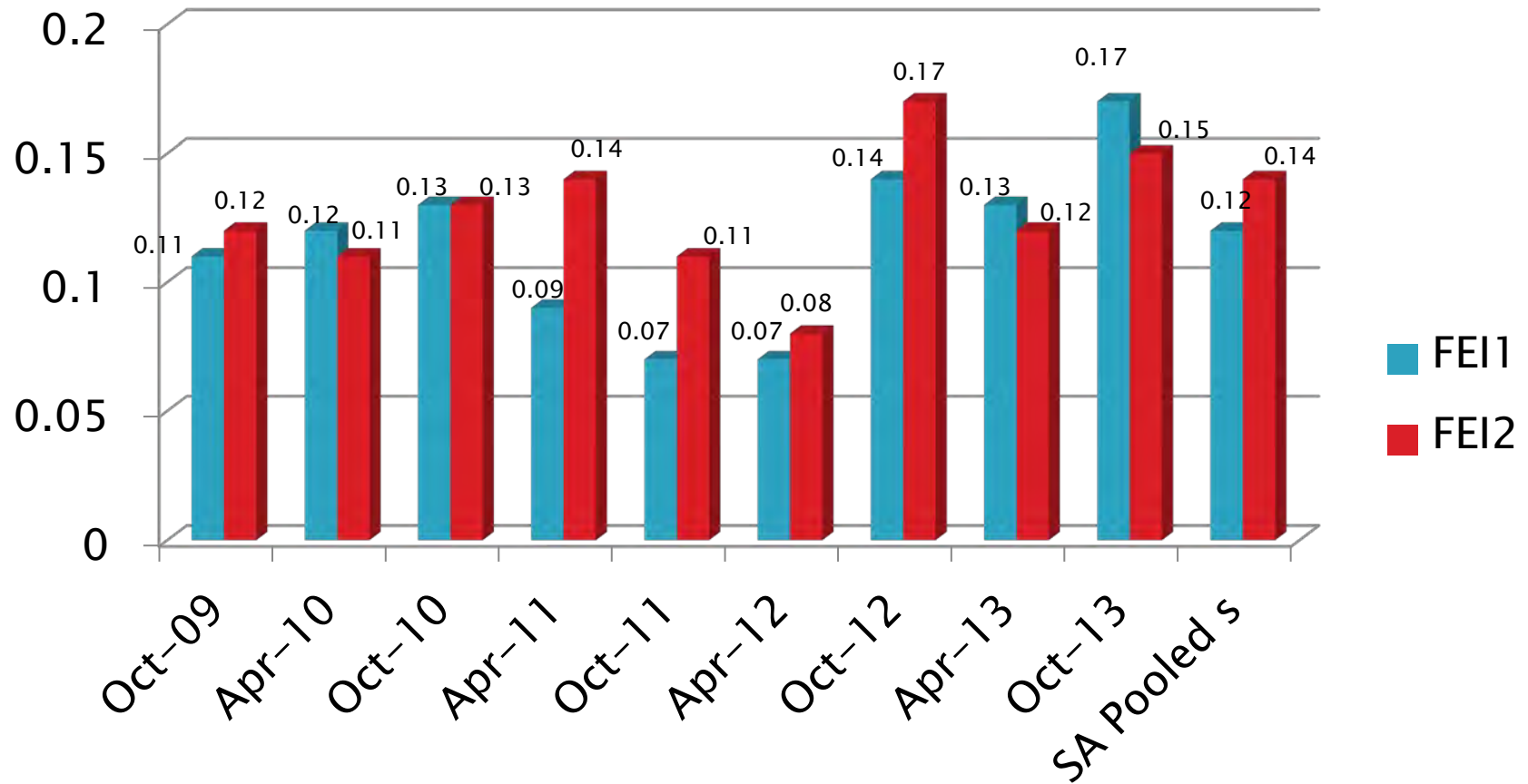
RAC



Sequence VG Precision Estimates

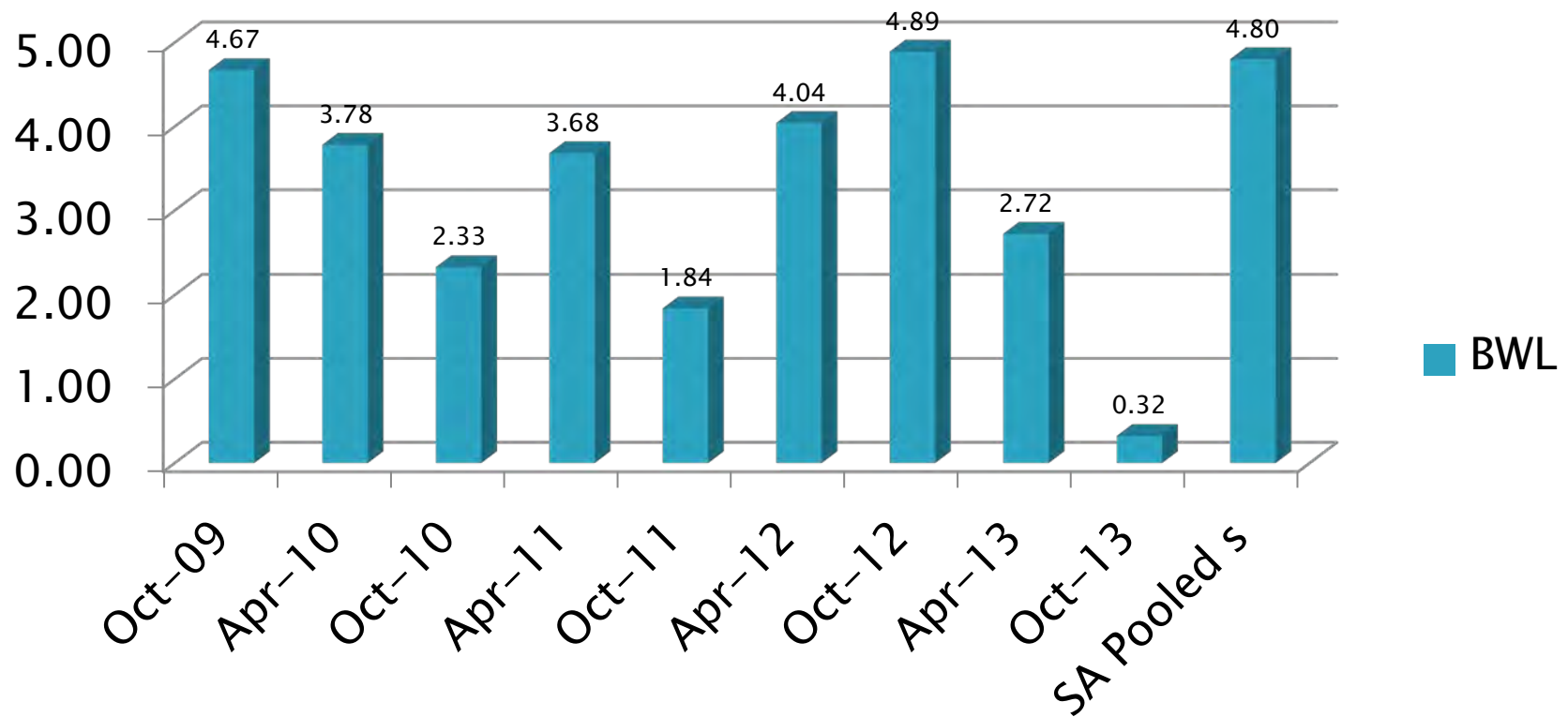


Sequence VID Precision Estimates



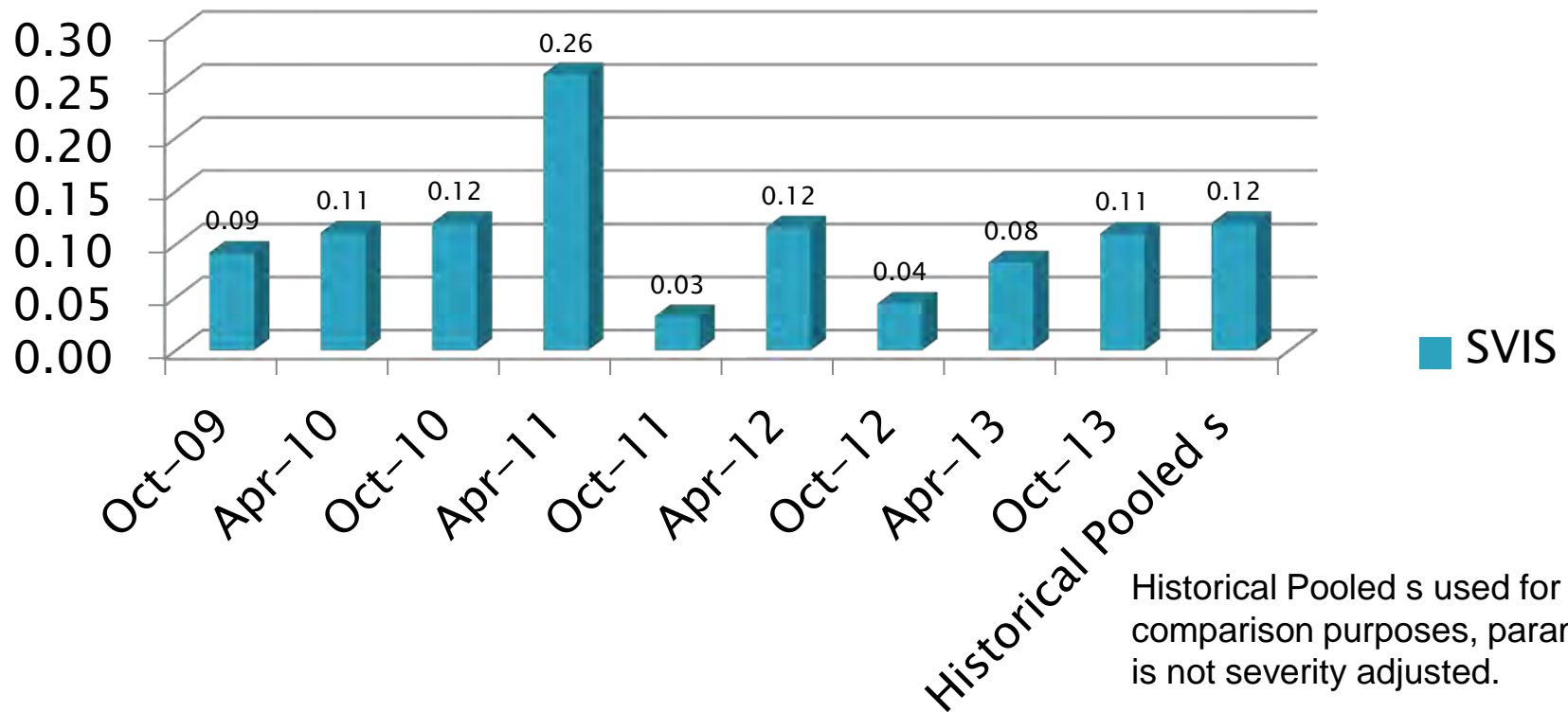
Sequence VIII Precision Estimates

BWL



Sequence VIII Precision Estimates

SVIS



Information Letters

»» April 1, 2013 –
September 30, 2013

Test Monitoring Center

<http://astmtmc.cmu.edu>



A Program of ASTM International

Information Letters*

Test	Date	IL	Topic
IIIF	20130509	13-2	Replaced PVIS with Hours to 275 % Viscosity Increase for reference test acceptance and correction of non-reference oil test results.
IIIF	20130918	13-3	Included provisions to address how to handle negative values when calculating Hours to 275% Viscosity Increase.
VG	20130925	13-2	Approved Fuel Batch AK2721NX10-1 and implemented correction factors for AES, RAC, AEV and OSCR and decreased the length of calibration periods.
VIII	20130524	13-1	Allow the use reworked camshafts and approved the use of piston rings from a different source

*Available from TMC Website

[Return to Exec. Summary](#)

Test Monitoring Center

<http://astmtmc.cmu.edu>



A Program of ASTM International

Reference Oil Inventory

»» Actions, Re-blends, Inventories
and Estimated Life

Test Monitoring Center

<http://astmtmc.cmu.edu>



A Program of ASTM International

Reference Oil Re-blends

➤ Oils affected

- 434-1
- Re-blend is in process
- delivery expected in near future

[Return to Executive Summary](#)

Reference Oil Inventory Estimated Life

Oil	Tests	Original Blend Amount	Quantity Shipped in last 6 months	TMC Inventory	Lab Inventory	Estimated Life
300	IVA	330	0	330	0	5+ years
433-1	IIIF	1045	28	8	44	<1 year
433-2	IIIF	500	16	484	12	3+ years
434	IIIG	550	0	<1	12	<1 year
434-1	IIIG	660	32	135	36	3 years
435	IIIG	550	0	2	4	<1 year
435-2	IIIG	550	28	322	24	5+ years
438	IIIG	990	16	192	24	3+ years
540	VID	1100	20	365	50	4+ years
541	VID	550	35	5	10	<1 year

Reference Oil Inventory Estimated Life

Oil	Tests	Original Blend Amount	Quantity Shipped in last 6 months	TMC Inventory	Lab Inventory	Estimated Life
541-1	VID	550	66	224	60	5+ years
542	VID	1100	60	49	40	1 year
542-1	VID	275	35	240	35	2+ years
704-1	VIII	897	12	180	14	5+ years
925-3	VG	975	0	10	6	<1 year
940	VG	560	15	496	36	5+ years
1006-2	IVA, VG, VIII	5500	171	3312	127	5+ years
1007	IVA, VG	1968	2	19	35	<1 year
1009	VG	1100	53	294	51	5+ years
1010	IIIG, VID	1100	66	409	86	5+ years

LTMS Deviations

»» April 1, 2013 –
September 30, 2013

LTMS Deviations

- One LTMS Deviation in Current Period
 - IIF Stand removed from system, data returned to lab charts
 - change in parameter from PVIS to Hours negated the precision issues which caused a stand to be removed.
 - test data was returned to control charts
 - Itmsdate was changed to allow proper application of severity adjustments.

LTMS Deviations

Historical Count of PCEO LTMS Deviations

Test	LTMS Deviations
IIIF	6
IIIG	6
IVA	7
VG	8
VID	2
VIII	3

Quality Index Deviations

»» April 1, 2013 –

September 30, 2013

Test Monitoring Center

<http://astmtmc.cmu.edu>



A Program of ASTM International

Quality Index Deviations

- One IIF Quality Index Deviation this period for right exhaust backpressure control

Historical Count of PCEO Quality Index Deviations

Test	Quality Index Deviations
IIF	25
IIIG	11
IVA	28
VG	38

TMC Laboratory Visits

»» April 1, 2013 –

September 30, 2013

Test Monitoring Center

<http://astmtmc.cmu.edu>



A Program of ASTM International

TMC Lab Visits

Test	Number of Labs Visited
III	4
IVA	1
VID	4
VIII	1

TMC Lab Visits

- VID visits identified two issues at different labs.
 - One lab had a pressure transducer in the engine coolant system not listed in the procedure
 - One lab had the fuel flowmeter thermocouple located outside the procedural requirements

Test Area Timelines

»» April 1, 2013 –
September 30, 2013

Test Monitoring Center

<http://astmtmc.cmu.edu>



A Program of ASTM International

Test Area Timeline Additions*

Test	Date	Topic	IL
IIIF	20130514	Dropped Percent Viscosity Increase a calibrated parameter and replaced it with Hours to 275% Viscosity increase. Defined procedure to interpolate Percent Viscosity Increase from Hours to 275% Viscosity Increase for non-reference oil results.	13-2
IIIF	20130918	Specified use of 0.1% for percent viscosity increase when negative values are encountered for viscosity increase	13-3
VG	20130925	Adopted use of oil 1009 standard deviations for AES, AEV, APV and OSCR with reference oil 1006-2 and adopted new standard deviations for RAC for all reference oils and dropped precision for OSCR and increased shewhart limit to 2.0	
VG	20130925	Approved Fuel Batch AK2821NX10-1 and implemented correction factors for AES, RAC, APV and OSCR when using this fuel batch	13-1
VIII	20130524	Allow use Reworked Camshaft and Approved use of Piston Rings from Different Source	13-1

*As of 09/30/2013

Additional Information

»» April 1, 2013 –
September 30, 2013

Test Monitoring Center

<http://astmtmc.cmu.edu>



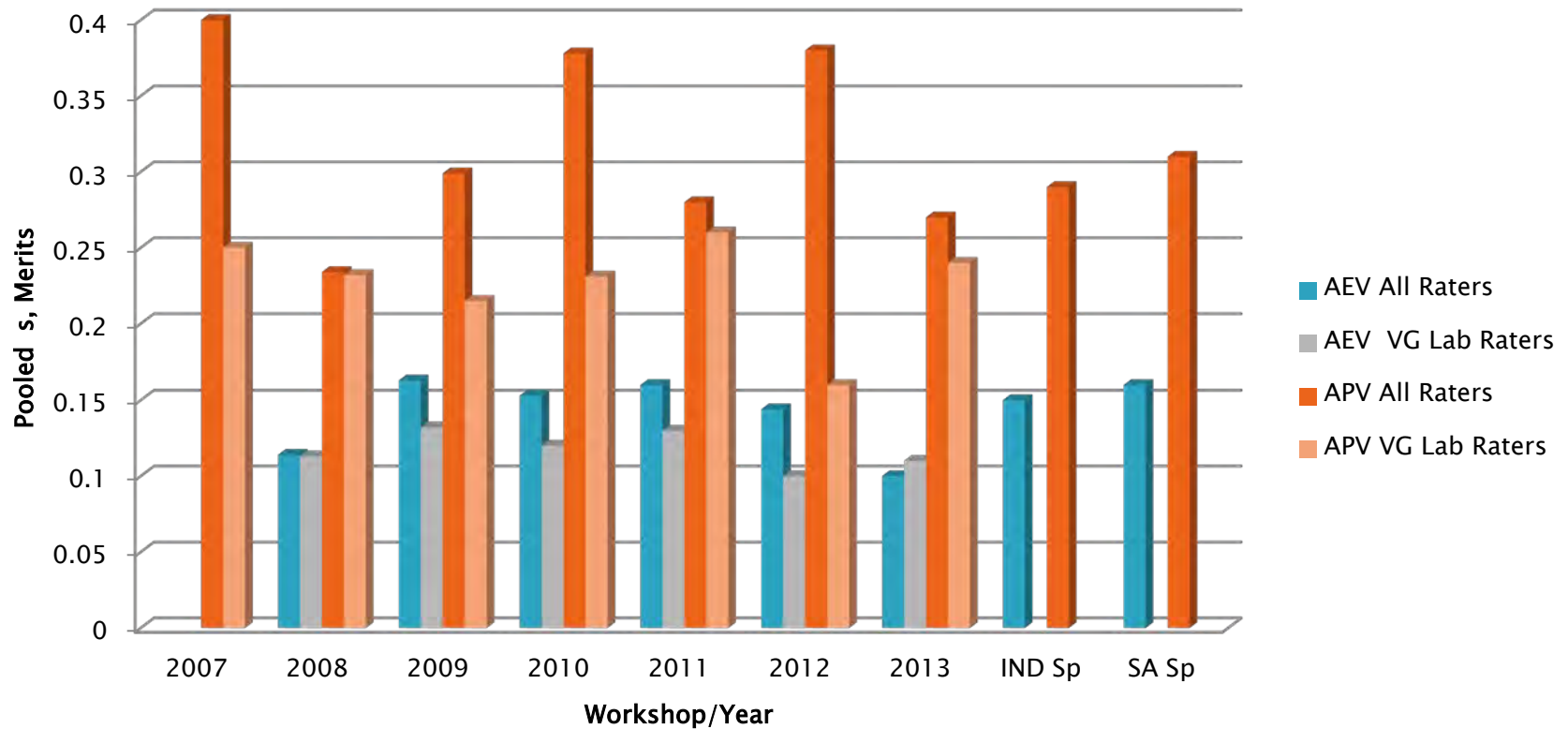
A Program of ASTM International

Additional Information

- ▶ Summary of Precision Data From Light Duty Rating workshops:
 - VG Average Piston and Average Engine Varnish.
 - IIIG WPD.

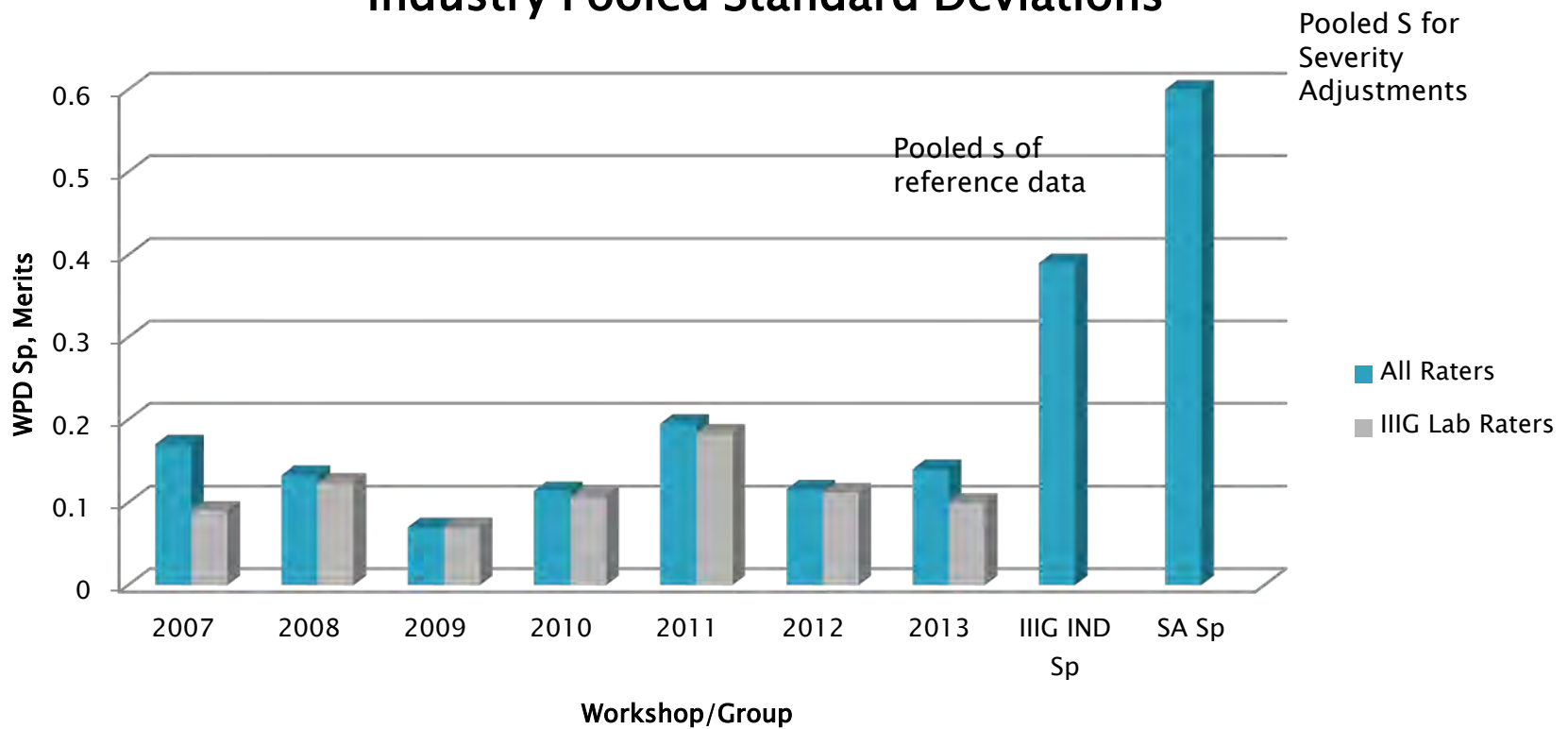
Sequence VG Precision Estimates

Workshop Data for VG Varnish



Sequence IIIG Precision Estimates

Comparison of Workshop Pooled Standard Deviations with Industry Pooled Standard Deviations



Additional Information

- ▶ Available on TMC Website:
 - Live Reference Test Data Bases
 - Surveillance Panel Meeting Minutes
 - Test Area Alarm Logs
 - Complete Test Area Timelines
 - LTMS Manual

- ▶ www.astmtmc.cmu.edu



A Program of ASTM International



A Program of ASTM International

Test Monitoring Center

<http://astmtmc.cmu.edu>

Appendix 1 PCMO Reference Oil Testing Control Charts October 2013

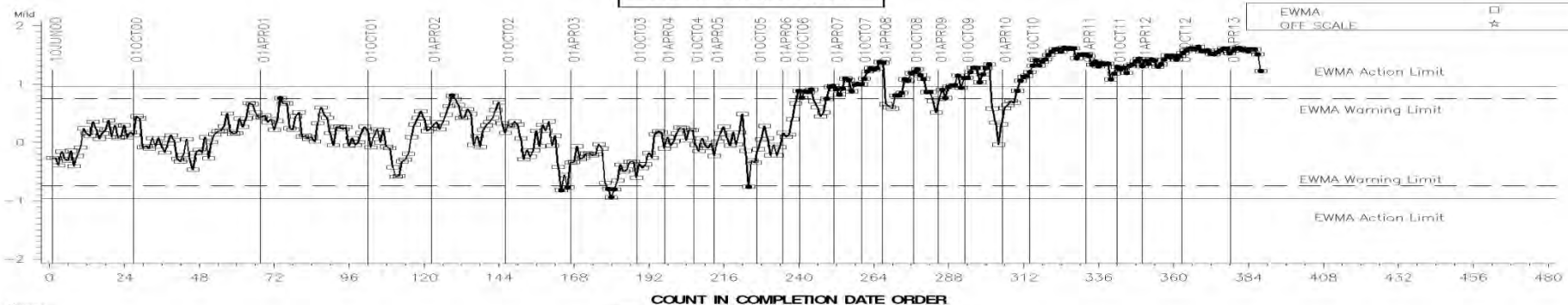
Appendix 1.a

IIIF Control Charts

» Severity, Precision, and CuSum

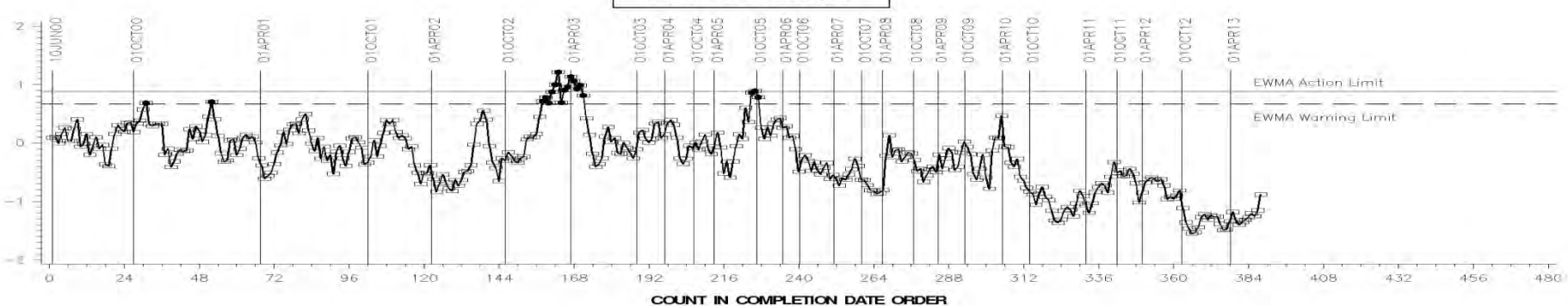
AVERAGE PISTON SKIRT VARNISH FINAL ORIG UNIT RES

LTMS Severity Analysis



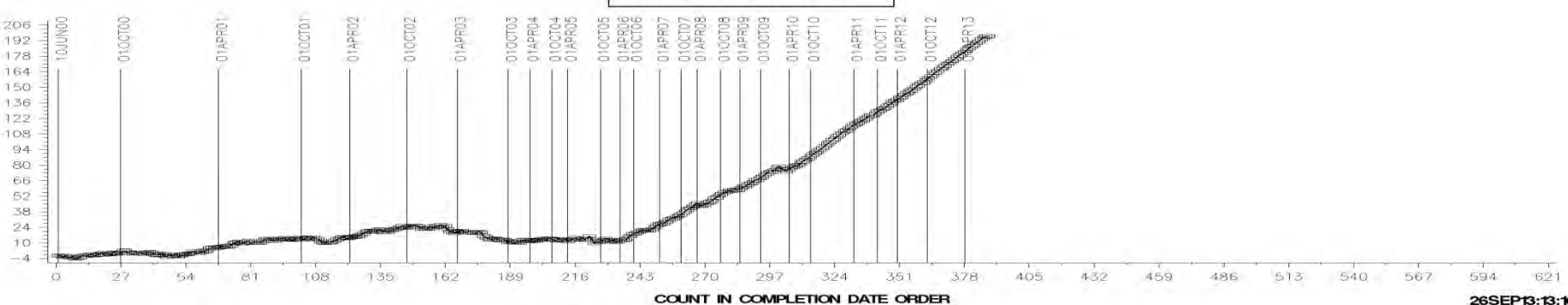
COUNT IN COMPLETION DATE ORDER

LTMS Precision Analysis



COUNT IN COMPLETION DATE ORDER

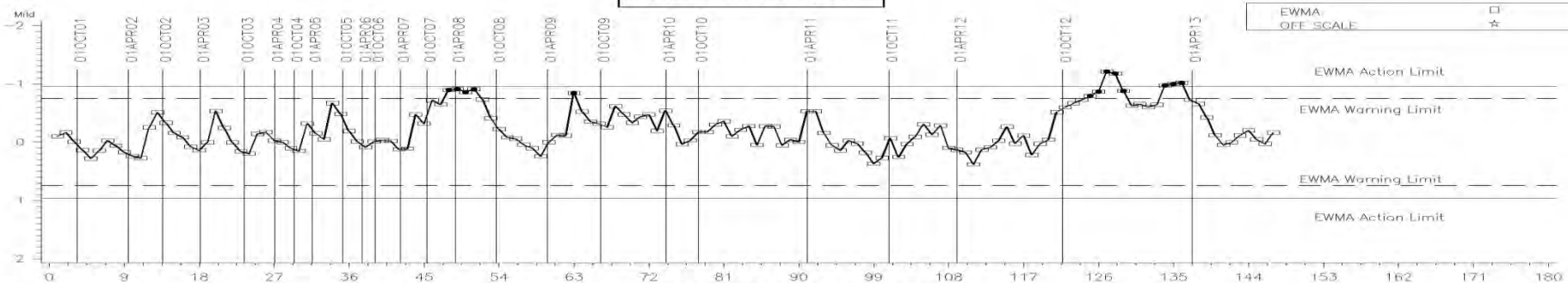
CUSUM Severity Analysis



COUNT IN COMPLETION DATE ORDER

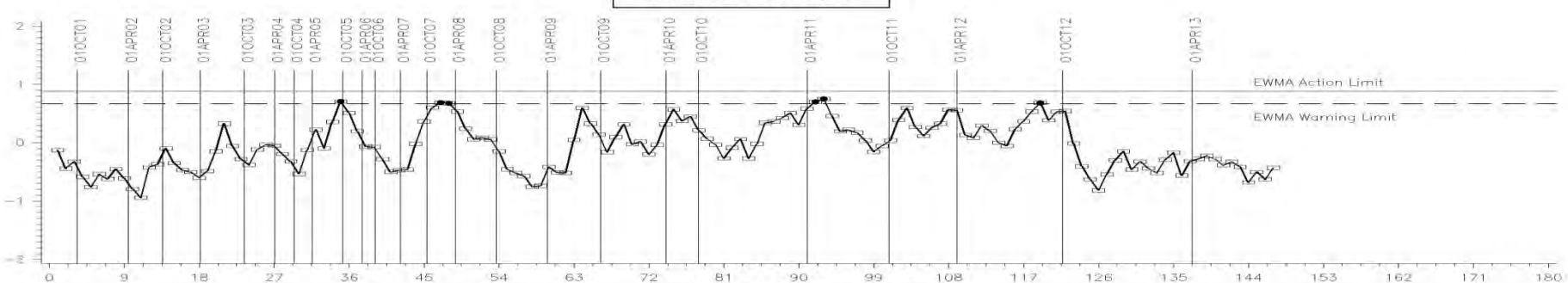
HOURS FINAL ORIG RES (REFERENCE TESTS ONLY)

LTMS Severity Analysis



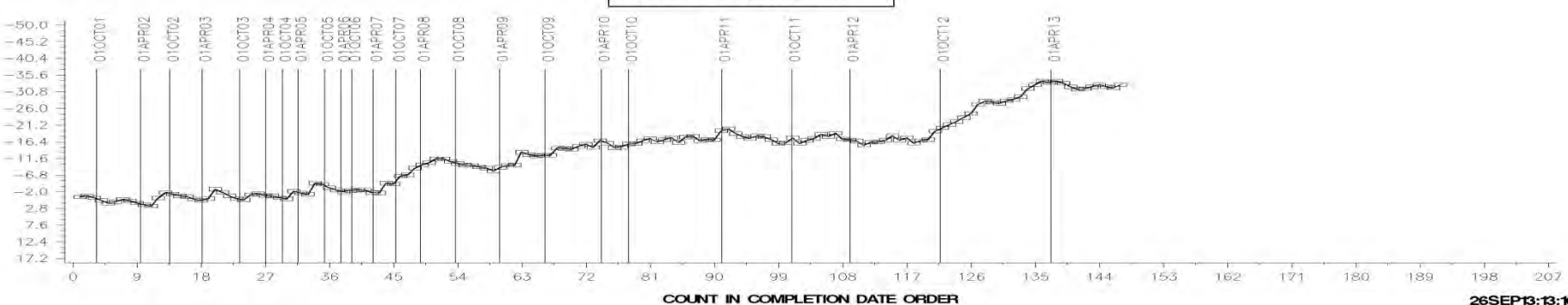
COUNT IN COMPLETION DATE ORDER

LTMS Precision Analysis



COUNT IN COMPLETION DATE ORDER

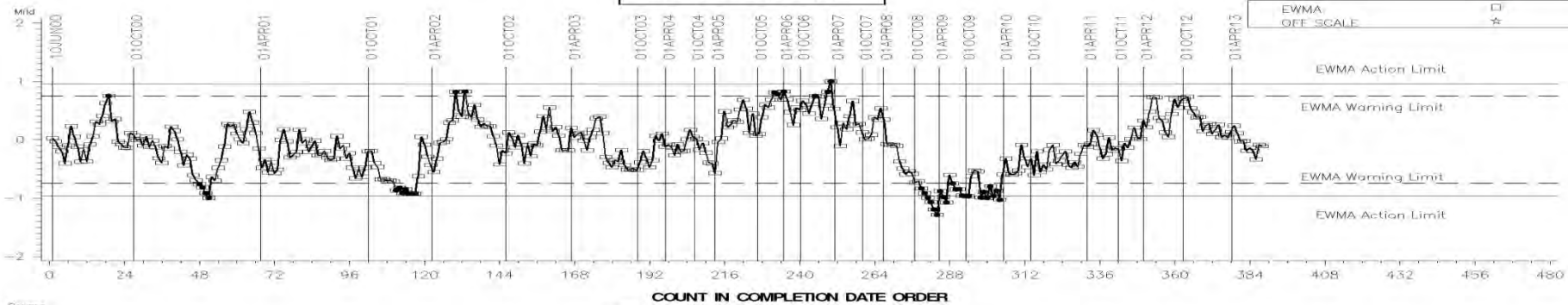
CUSUM Severity Analysis



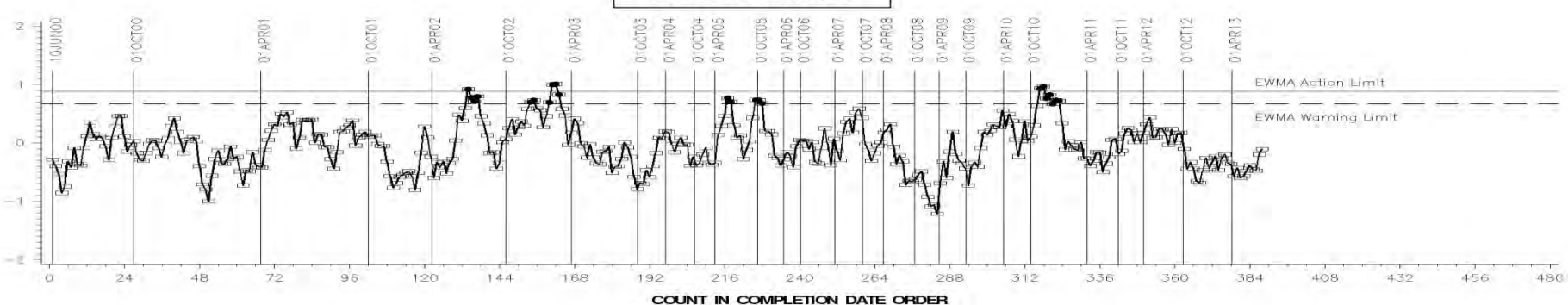
COUNT IN COMPLETION DATE ORDER

AVERAGE WEIGHTED PISTON DEPOSITS FNL ORIG UNIT RES

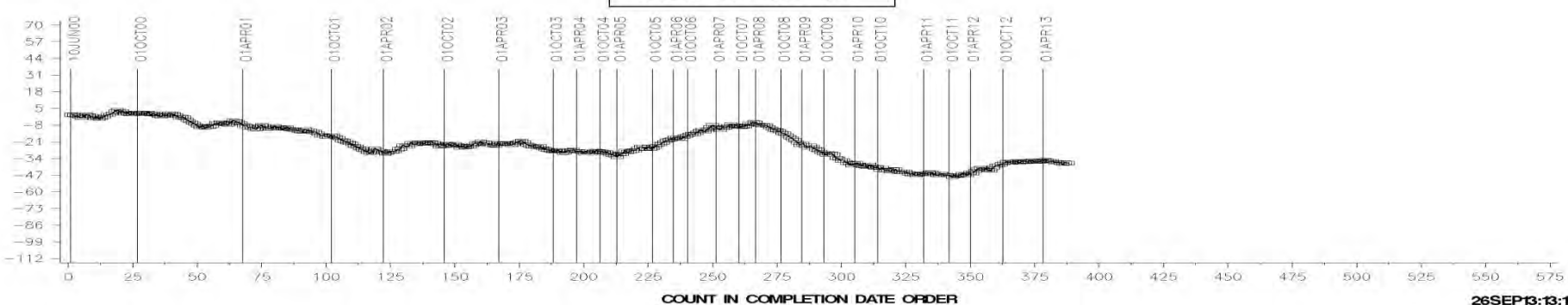
LTMS Severity Analysis



LTMS Precision Analysis



CUSUM Severity Analysis



% VISCOSITY INCREASE @ 060 HOURS

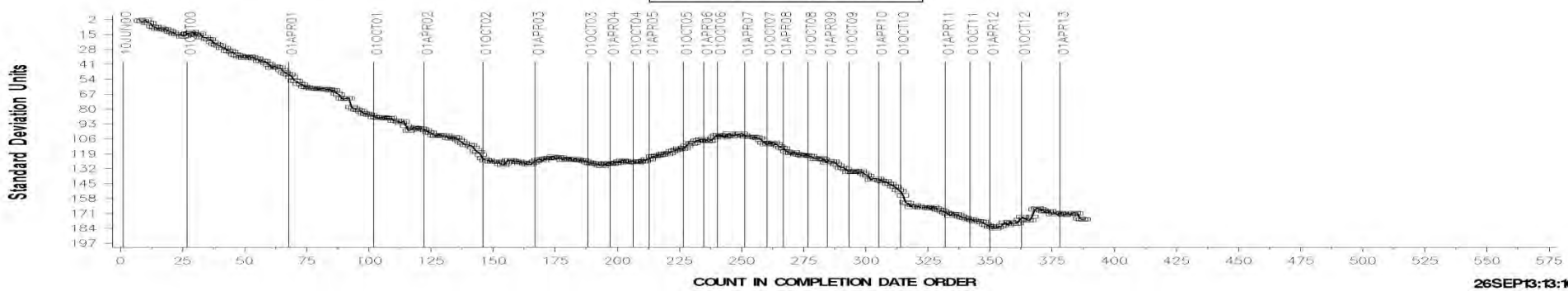
LTMS Severity Analysis



LTMS Precision Analysis



CUSUM Severity Analysis



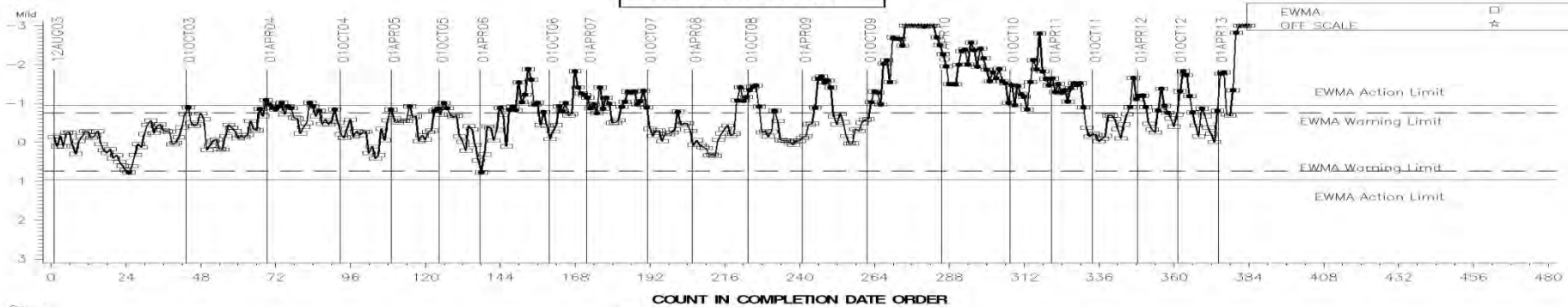
Appendix 1.b

IIIG/A/B Control Charts

» Severity, Precision, and CuSum

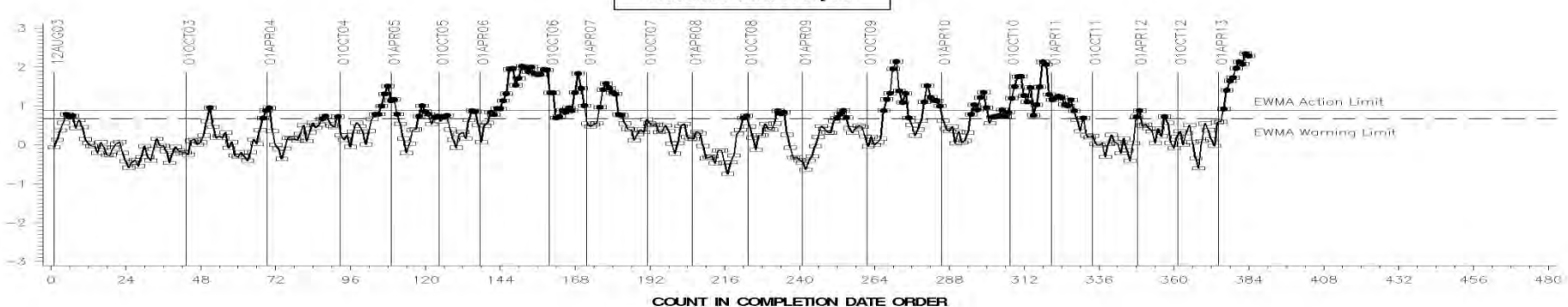
AVERAGE CAM + LIFTER WEAR

LTMS Severity Analysis



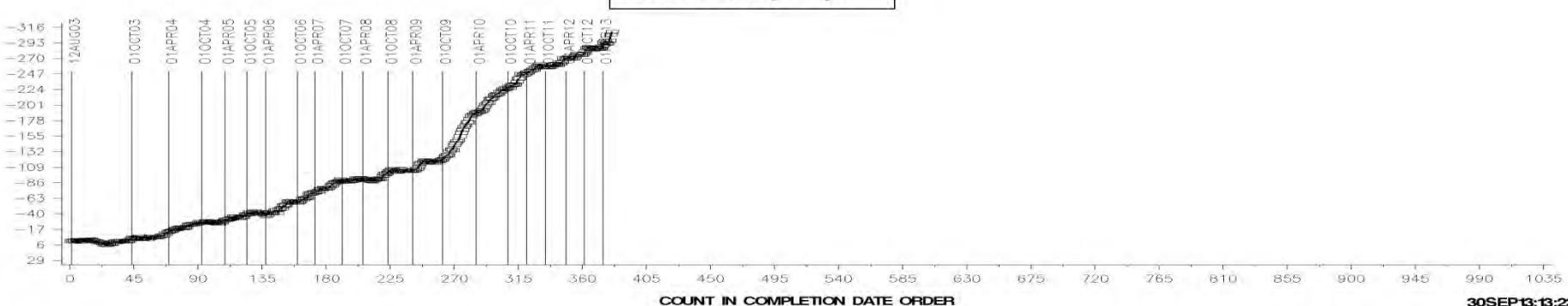
COUNT IN COMPLETION DATE ORDER

LTMS Precision Analysis



COUNT IN COMPLETION DATE ORDER

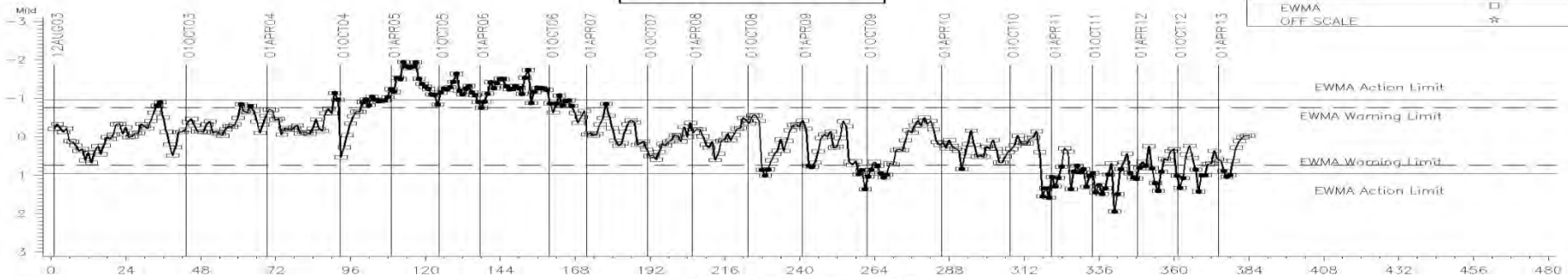
CUSUM Severity Analysis



COUNT IN COMPLETION DATE ORDER

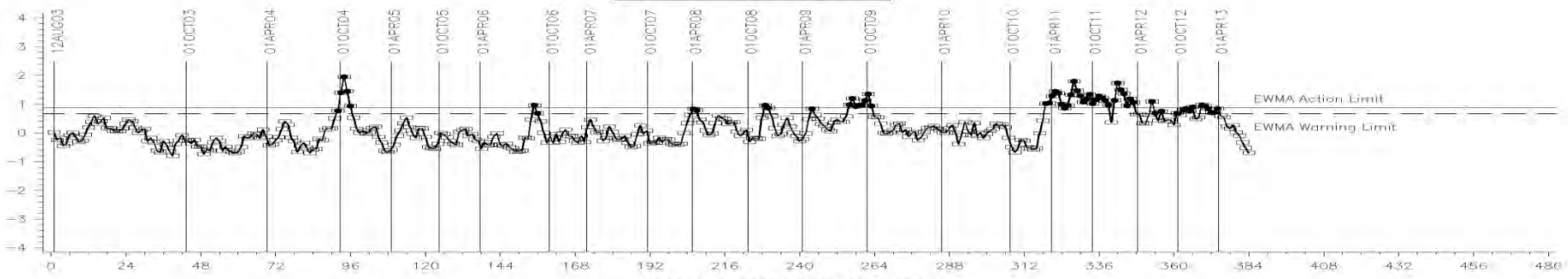
VISCOSITY INCREASE

LTMS Severity Analysis



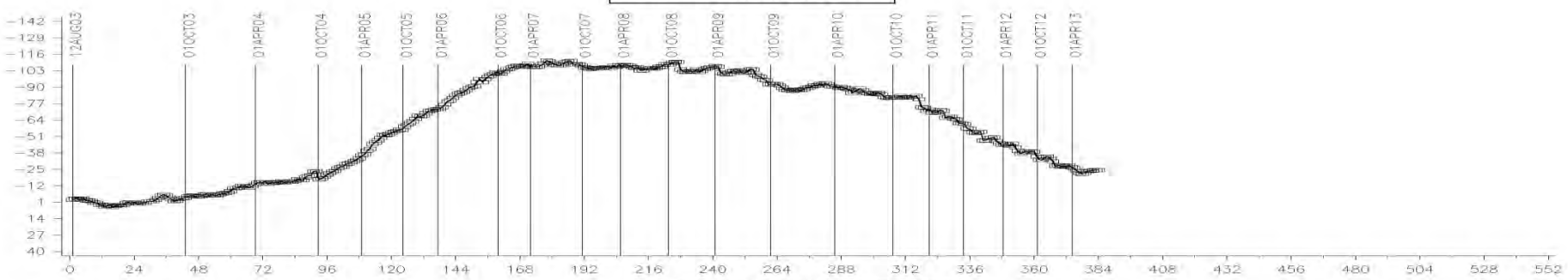
COUNT IN COMPLETION DATE ORDER

LTMS Precision Analysis



COUNT IN COMPLETION DATE ORDER

CUSUM Severity Analysis

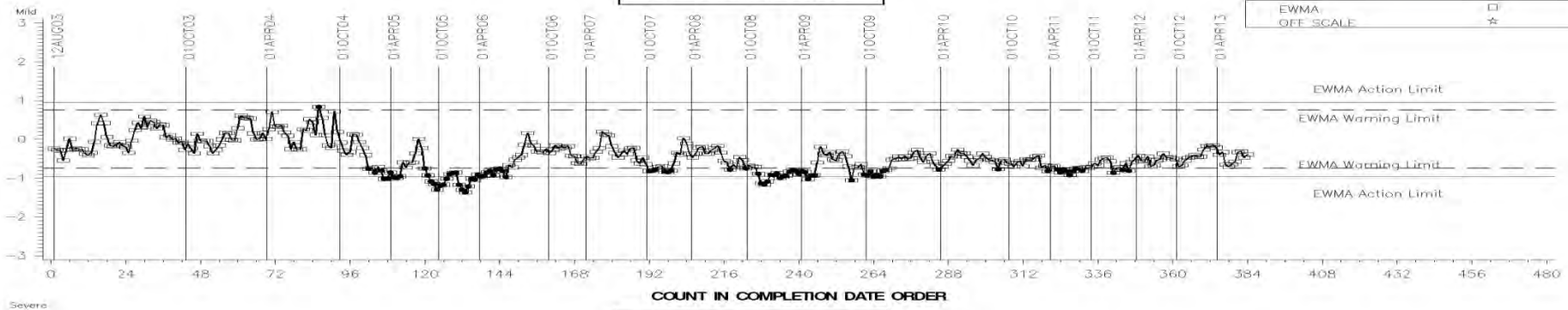


COUNT IN COMPLETION DATE ORDER

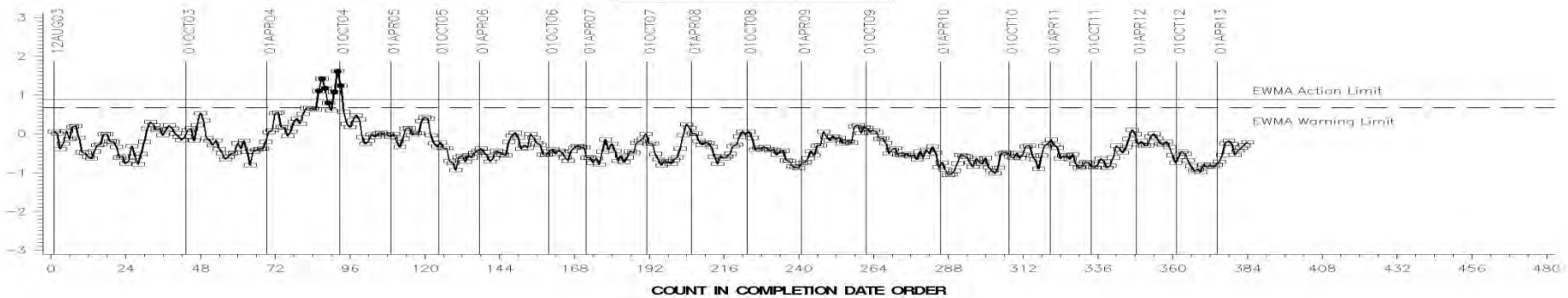
30SEP13:13:23

AVERAGE WEIGHTED PISTON DEPOSITS

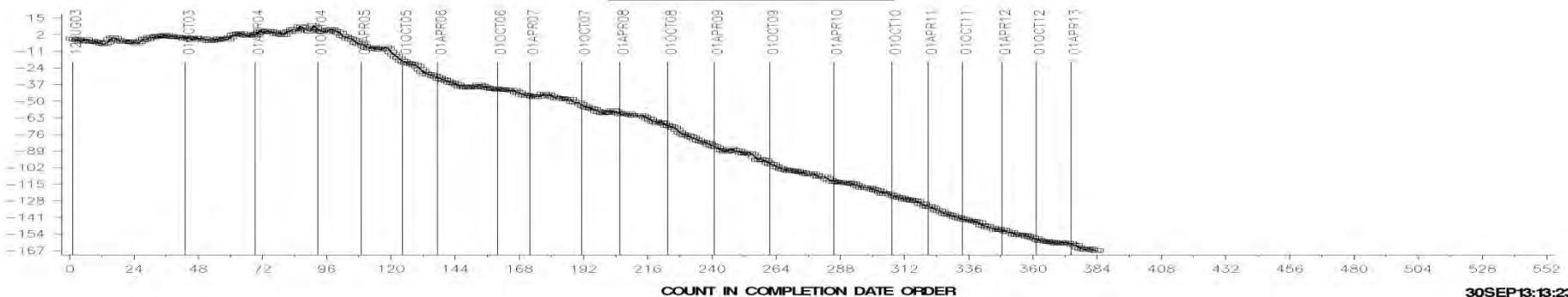
LTMS Severity Analysis



LTMS Precision Analysis



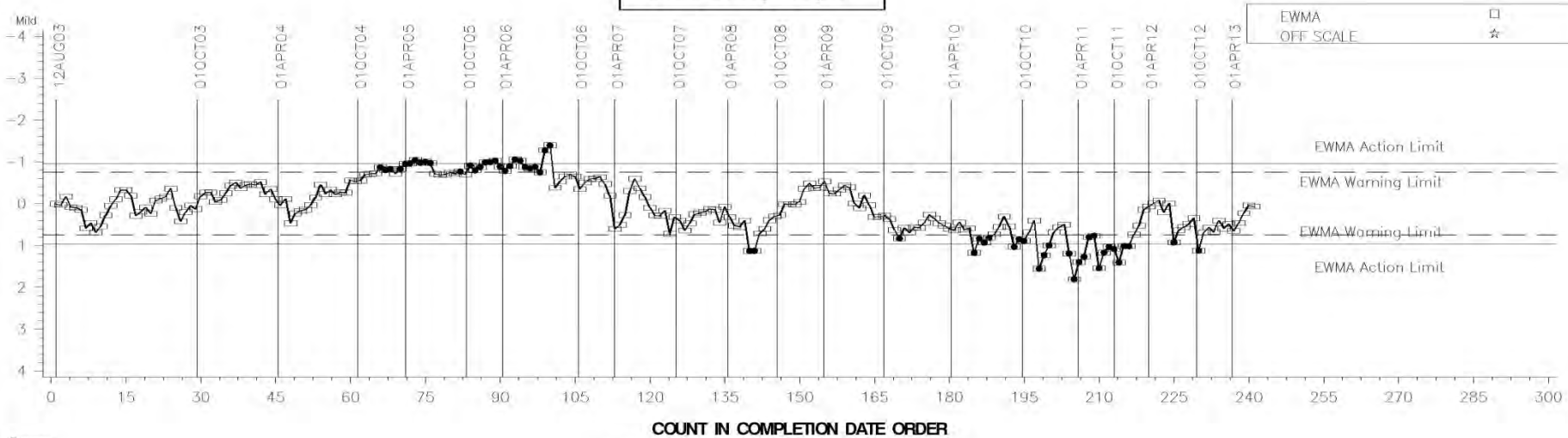
CUSUM Severity Analysis



MRV VISCOSITY RESULT

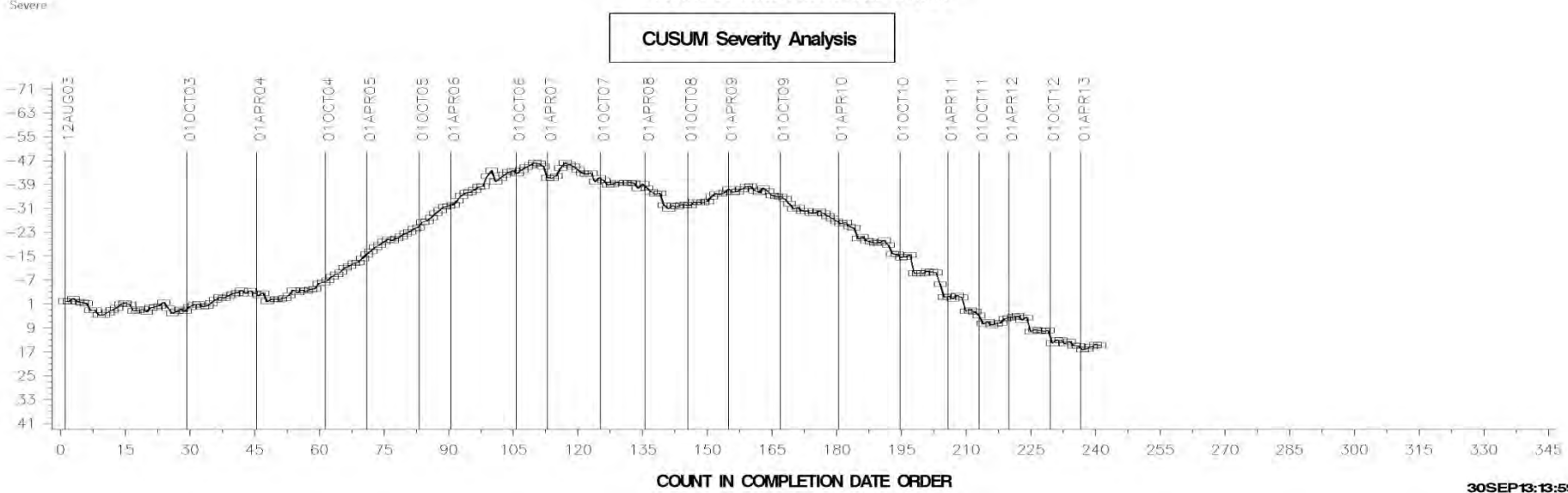
LTMS Severity Analysis

Standard Deviation Units



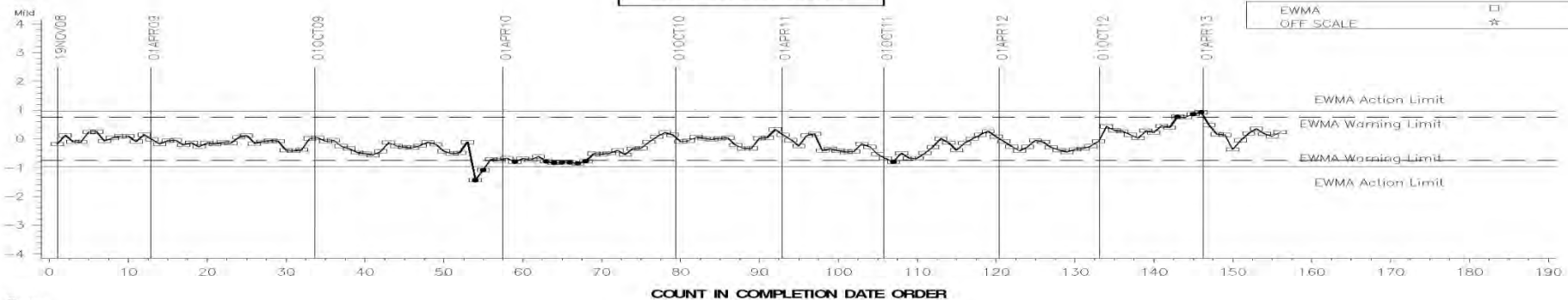
CUSUM Severity Analysis

Standard Deviation Units

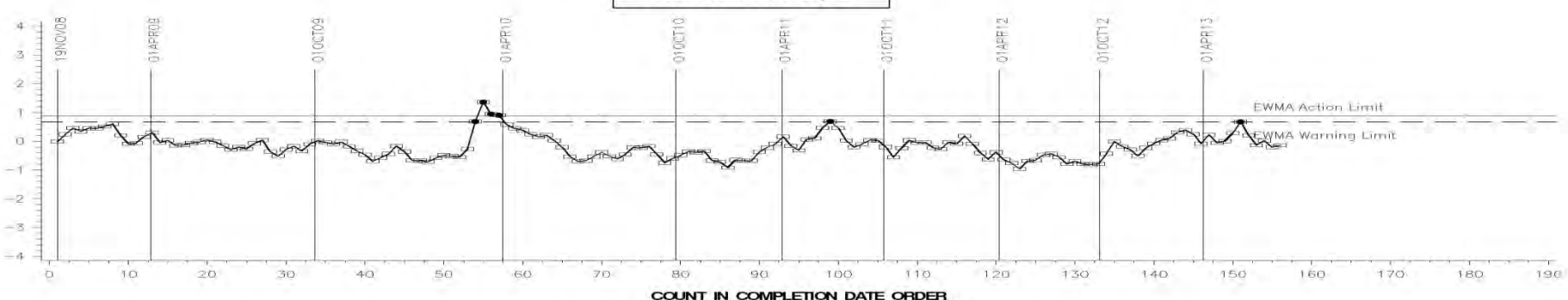


PHOS RETENTION

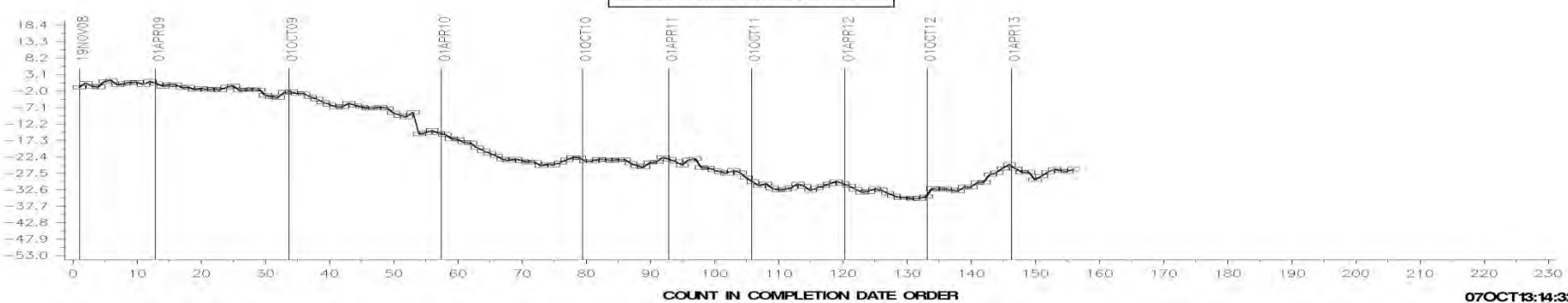
LTMS Severity Analysis



LTMS Precision Analysis



CUSUM Severity Analysis



07OCT13:14:32

[Return](#)

Test Monitoring Center

<http://astmtmc.cmu.edu>



A Program of ASTM International

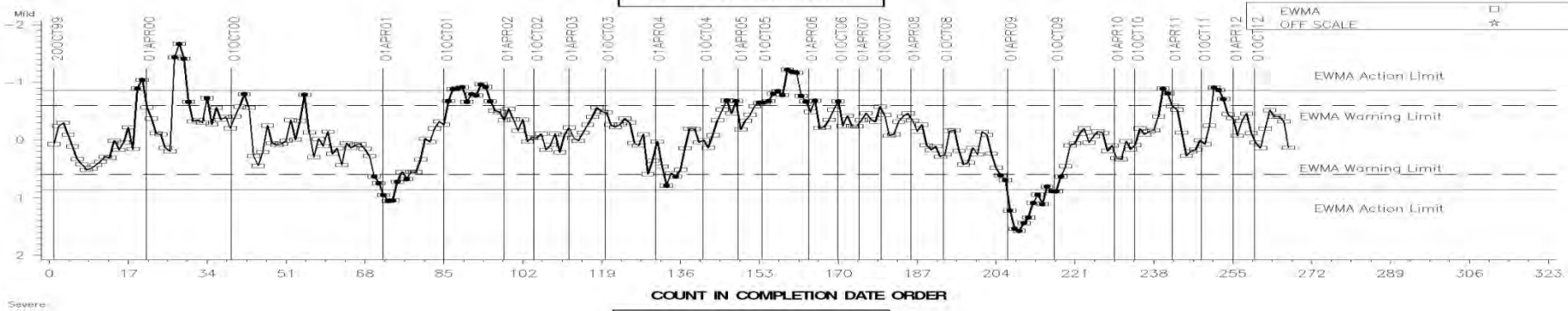
Appendix 1.c

Sequence IVA Control Charts

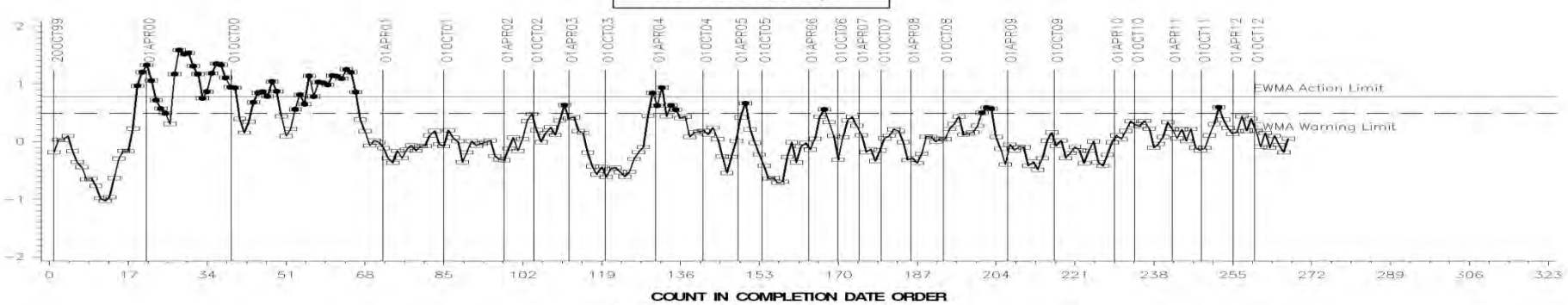
» Severity, Precision, and CuSum

AVERAGE CAM WEAR

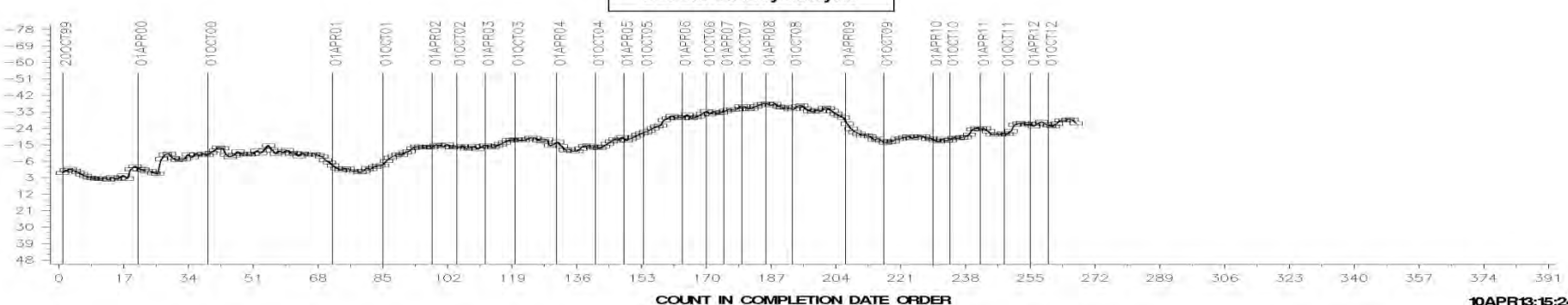
LTMS Severity Analysis



LTMS Precision Analysis



CUSUM Severity Analysis



10APR13:15:24

[Return](#)

Test Monitoring Center

<http://astmtmc.cmu.edu>



A Program of ASTM International

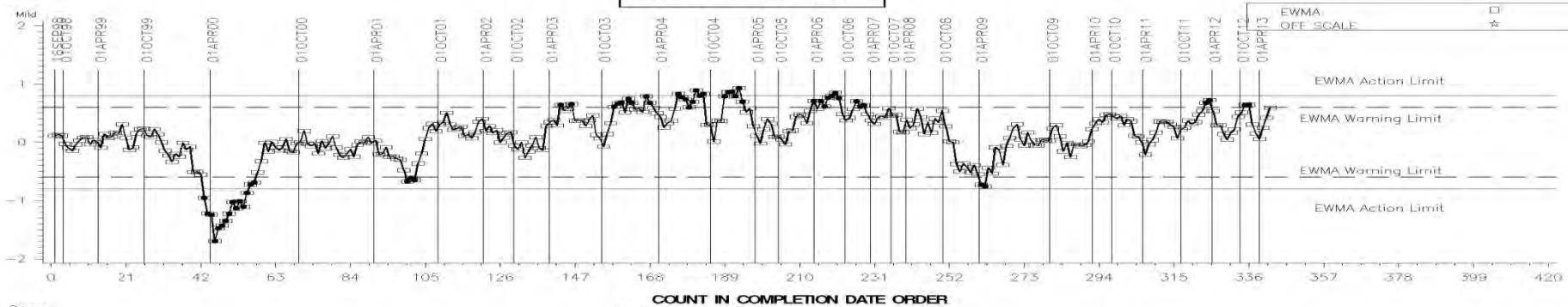
Appendix 1.d

Sequence VG Control Charts

» Severity, Precision, and CuSum

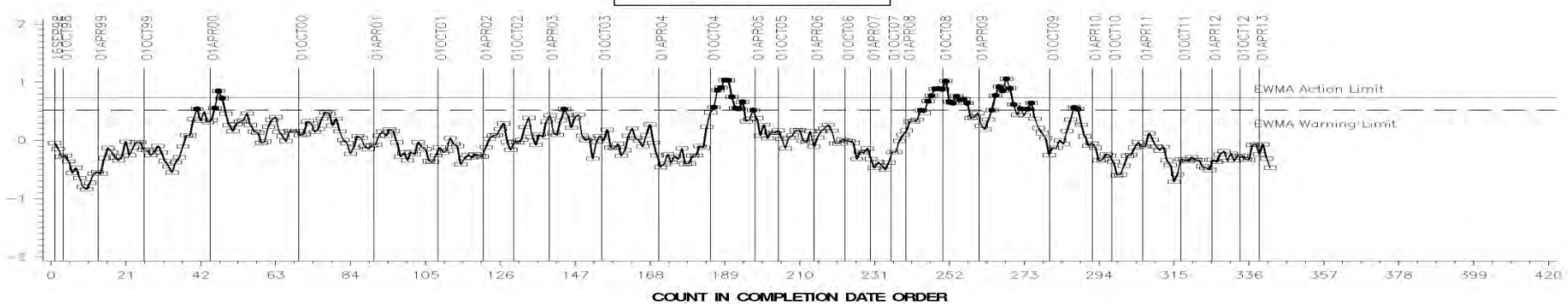
AVERAGE ENGINE SLUDGE

LTMS Severity Analysis



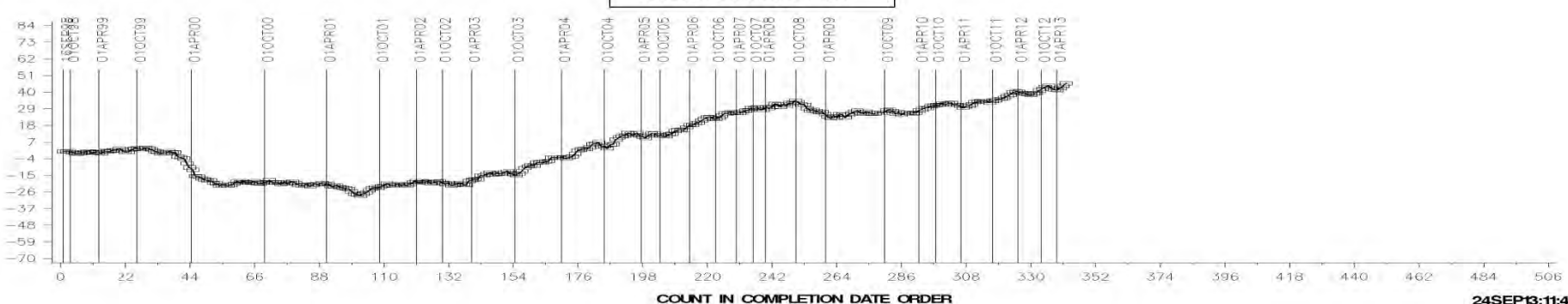
COUNT IN COMPLETION DATE ORDER

LTMS Precision Analysis



COUNT IN COMPLETION DATE ORDER

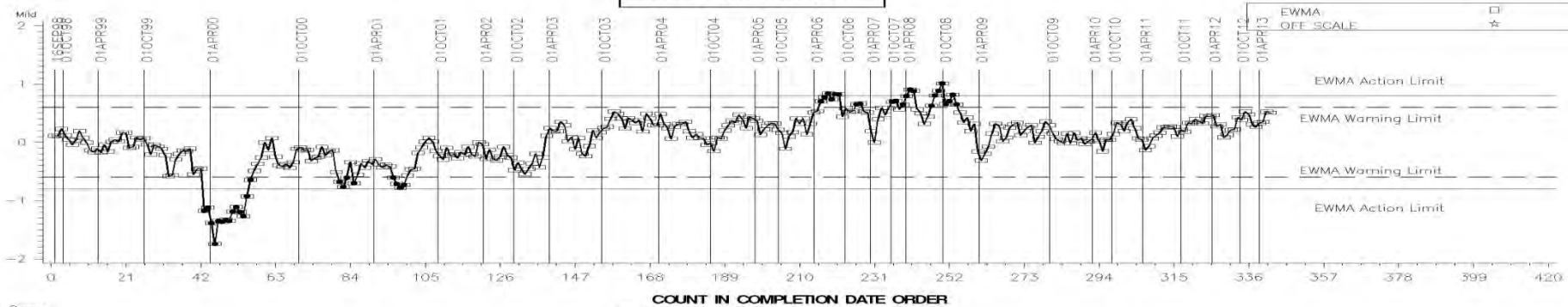
CUSUM Severity Analysis



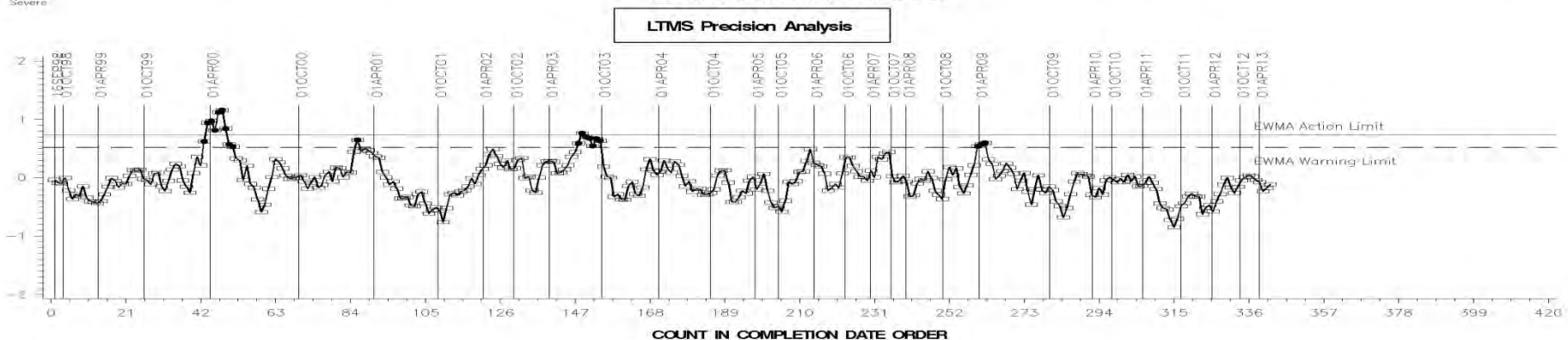
COUNT IN COMPLETION DATE ORDER

AVERAGE ROCKER COVER SLUDGE

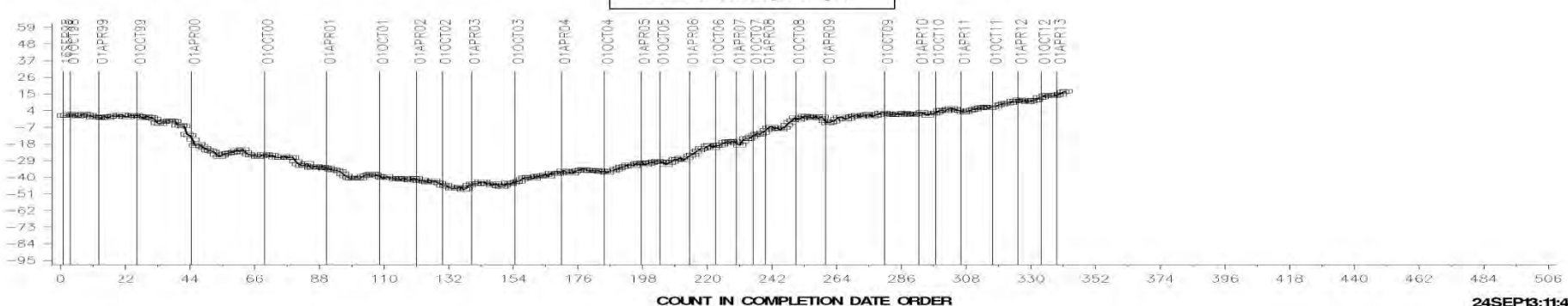
LTMS Severity Analysis



LTMS Precision Analysis

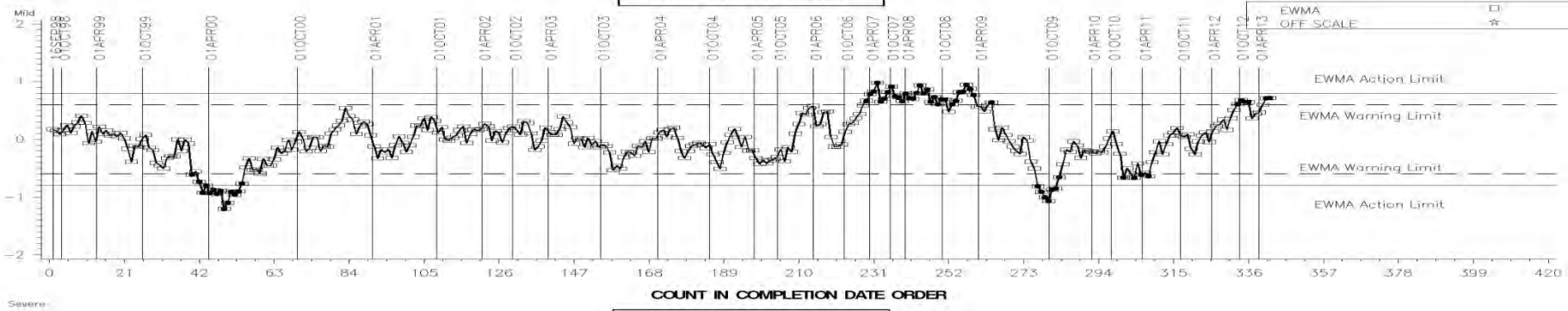


CUSUM Severity Analysis



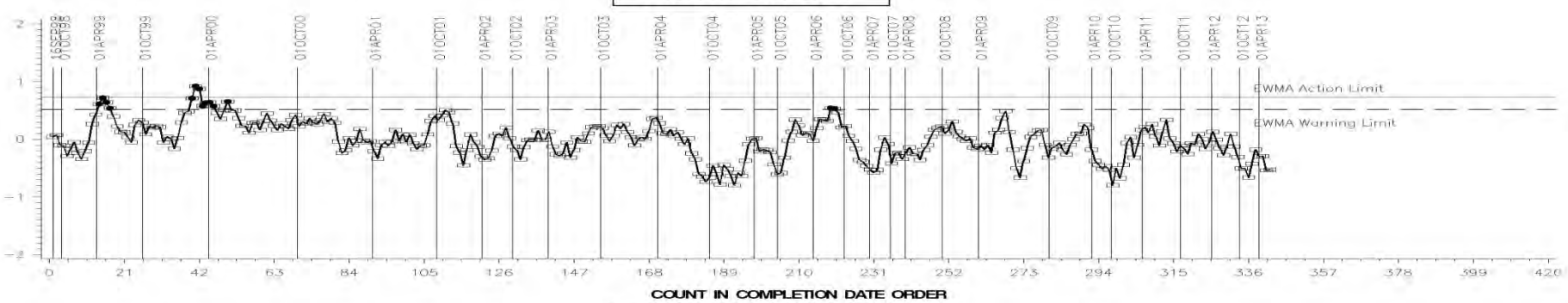
AVG. ENG. VARN. 3-PART APV + BAFFLES

LTMS Severity Analysis



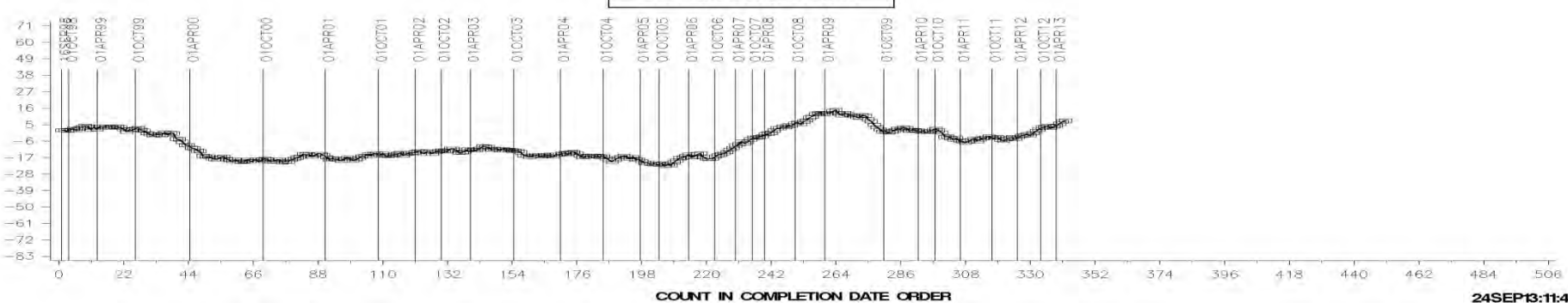
COUNT IN COMPLETION DATE ORDER

LTMS Precision Analysis



COUNT IN COMPLETION DATE ORDER

CUSUM Severity Analysis

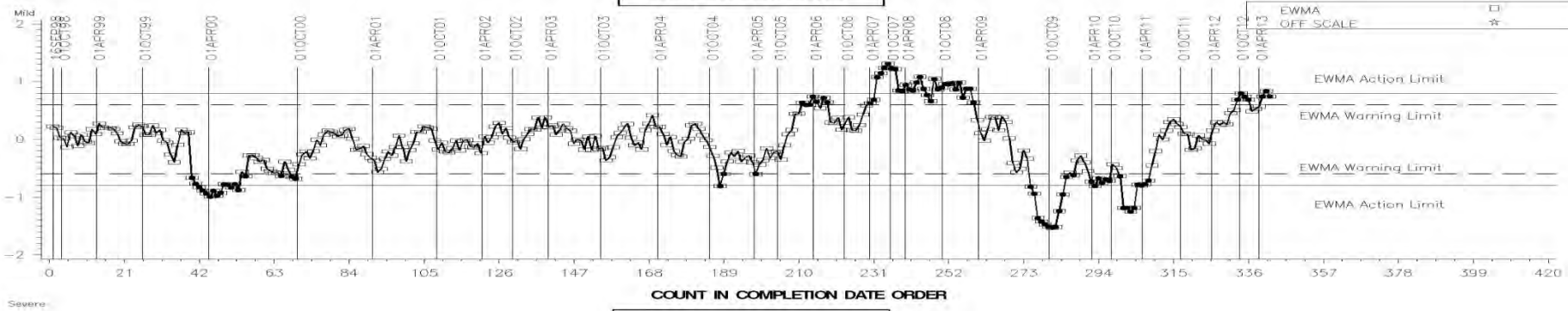


COUNT IN COMPLETION DATE ORDER

24SEP13:11:41

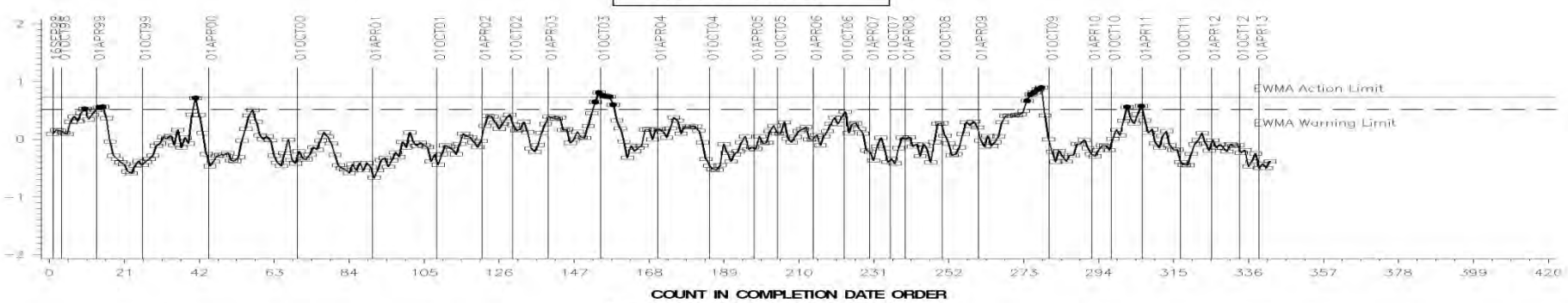
AVG PISTON SKIRT RATING

LTMS Severity Analysis



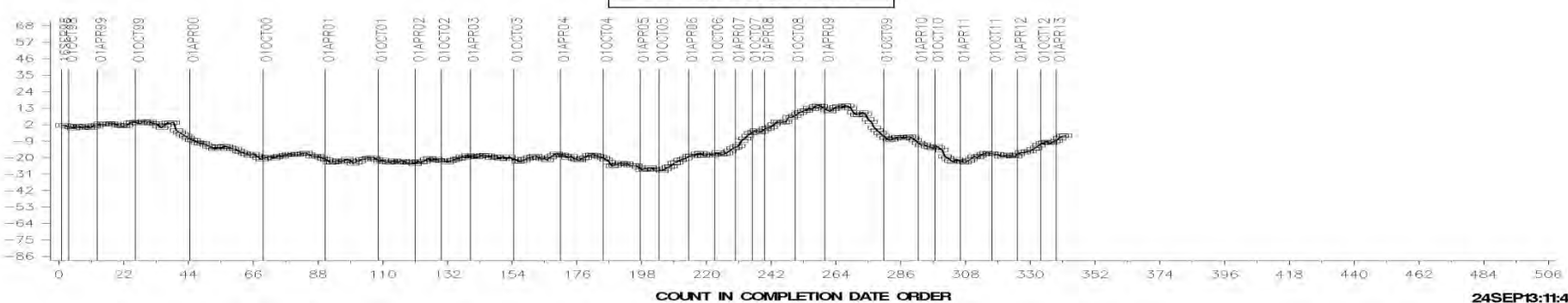
COUNT IN COMPLETION DATE ORDER

LTMS Precision Analysis



COUNT IN COMPLETION DATE ORDER

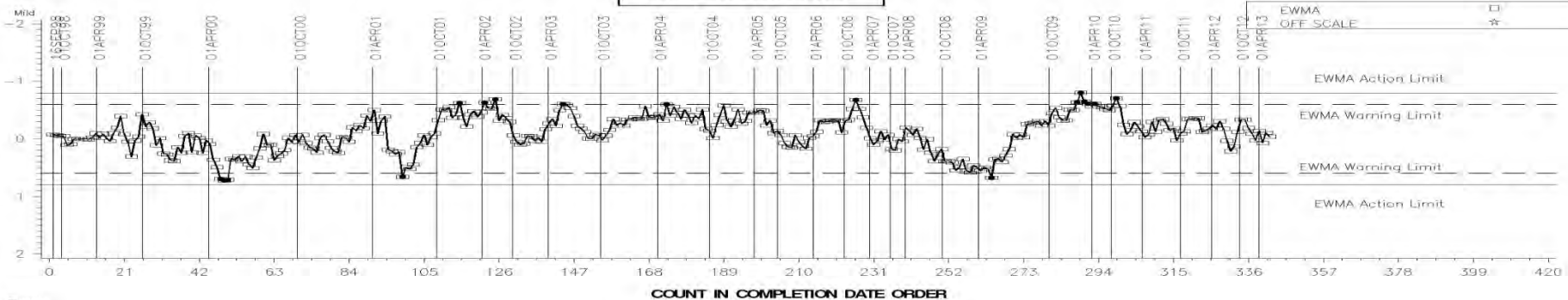
CUSUM Severity Analysis



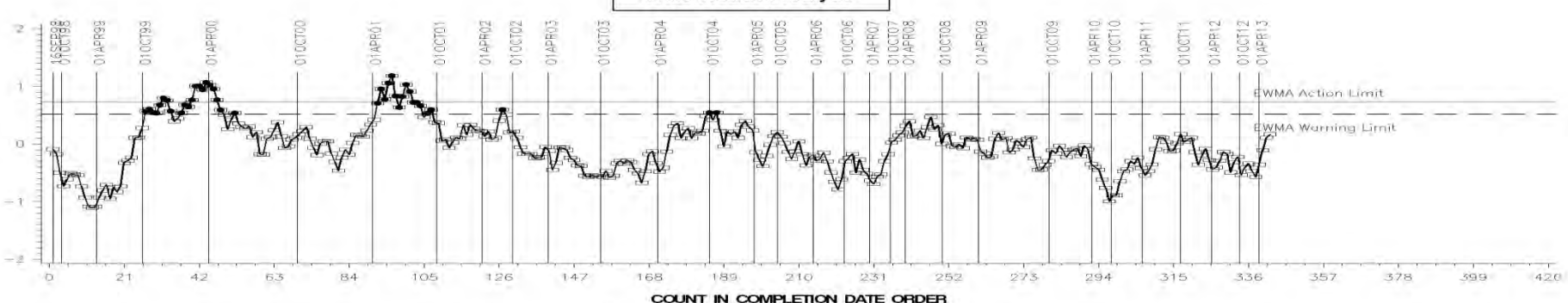
COUNT IN COMPLETION DATE ORDER

OIL SCREEN SLUDGE

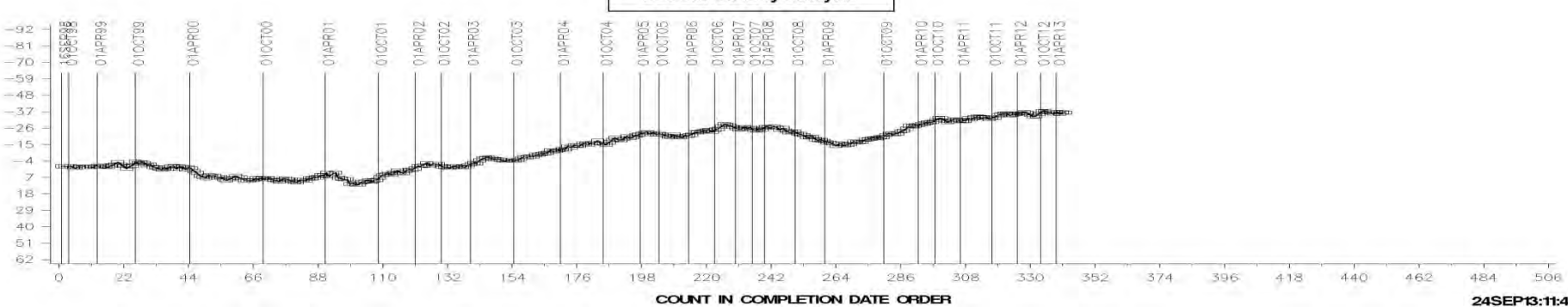
LTMS Severity Analysis



LTMS Precision Analysis



CUSUM Severity Analysis



24SEP13:11:41

[Return](#)

Test Monitoring Center

<http://astmtmc.cmu.edu>



A Program of ASTM International

Appendix 1.e

Sequence VID Control Charts

» Severity, Precision, and CuSum

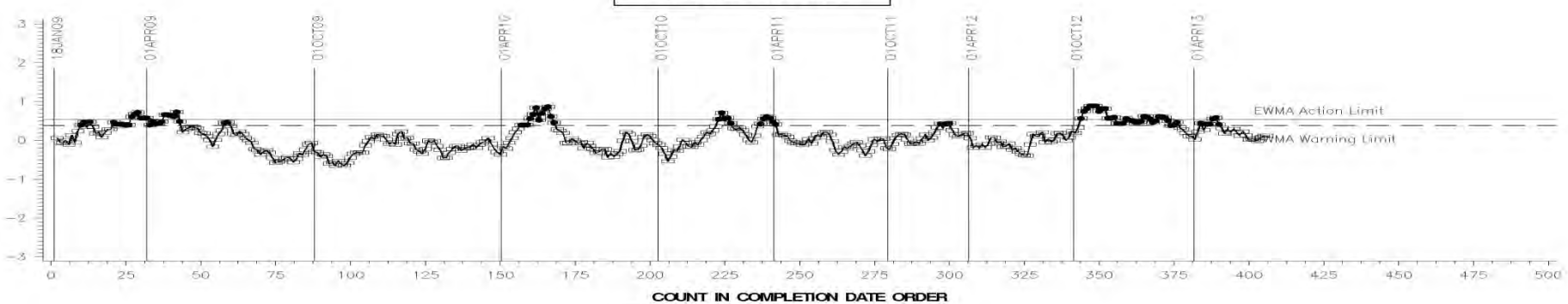
FEI FINAL RESULT PHASE I

LTMS Severity Analysis



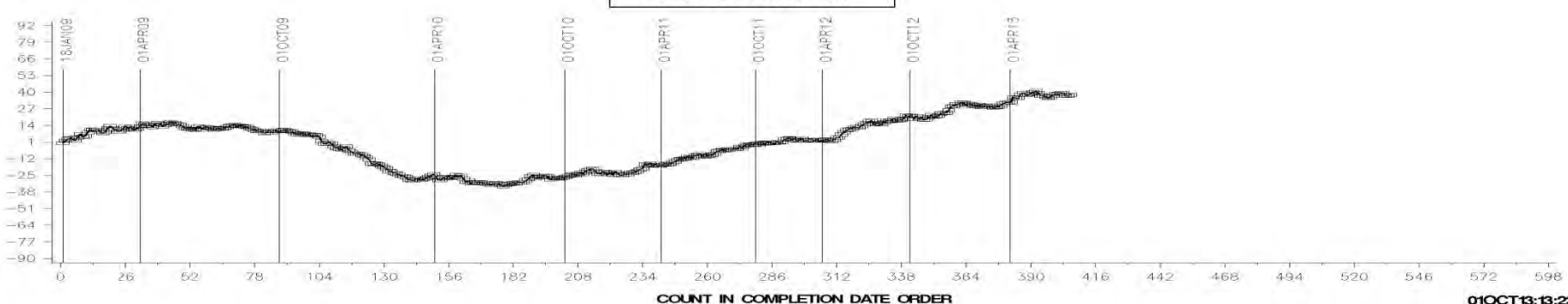
COUNT IN COMPLETION DATE ORDER

LTMS Precision Analysis



COUNT IN COMPLETION DATE ORDER

CUSUM Severity Analysis



COUNT IN COMPLETION DATE ORDER

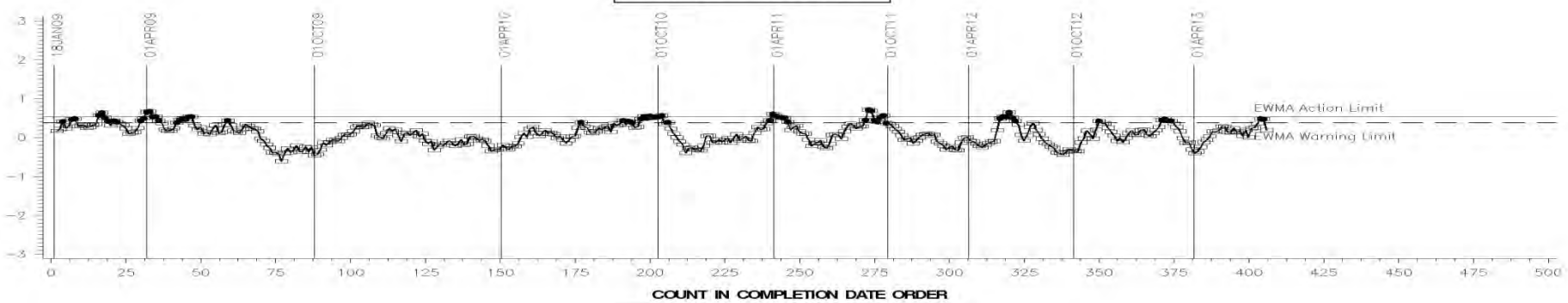
01OCT13:13:23

FEI FINAL RESULT PHASE II

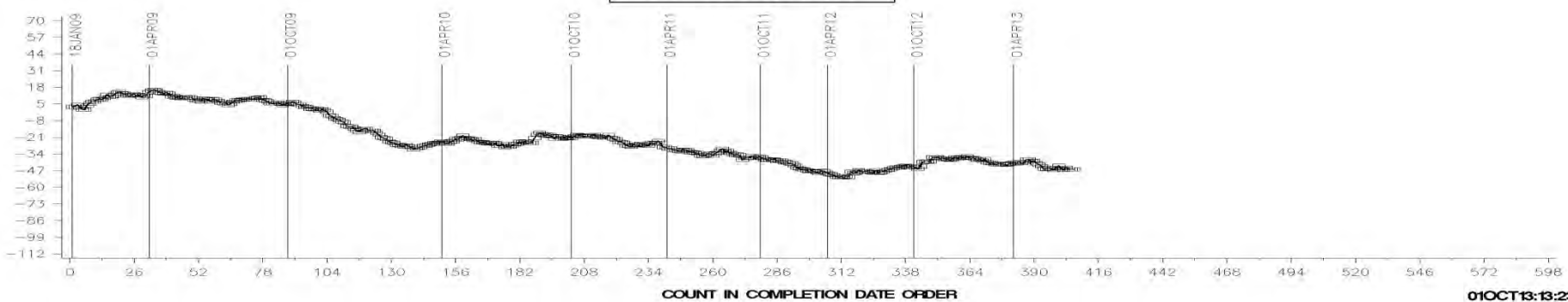
LTMS Severity Analysis



LTMS Precision Analysis



CUSUM Severity Analysis



01OCT13:13:23

[Return](#)

Test Monitoring Center

<http://astmtmc.cmu.edu>

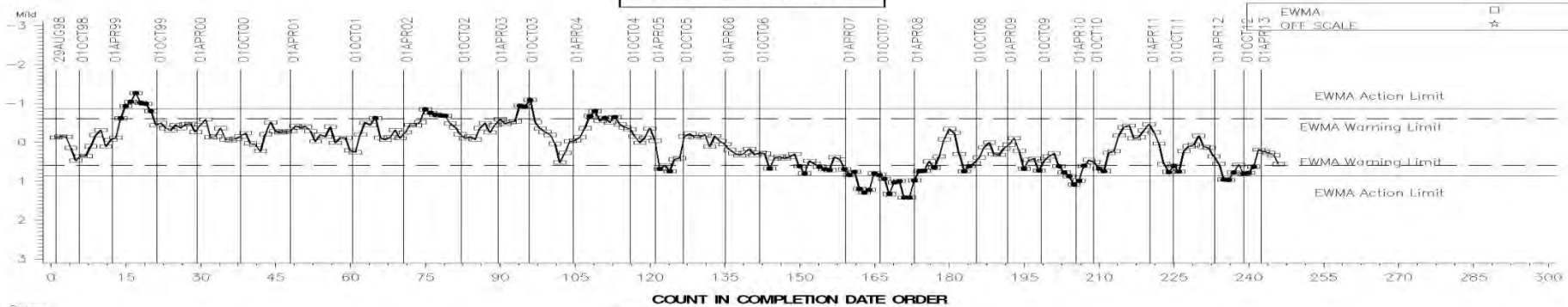
Appendix 1.f

Sequence VIII Control Charts

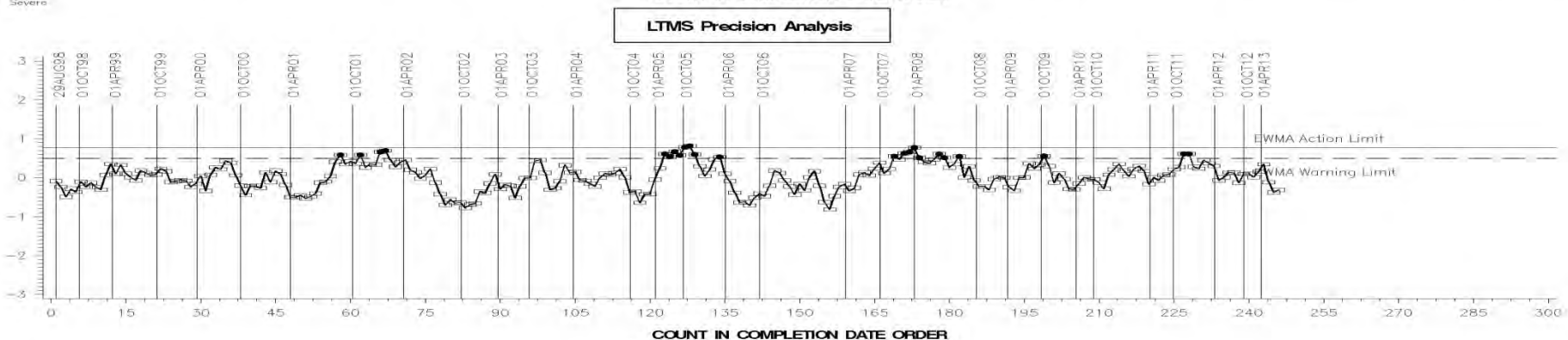
» Severity, Precision, and CuSum

FINAL BEARING WEIGHT LOSS

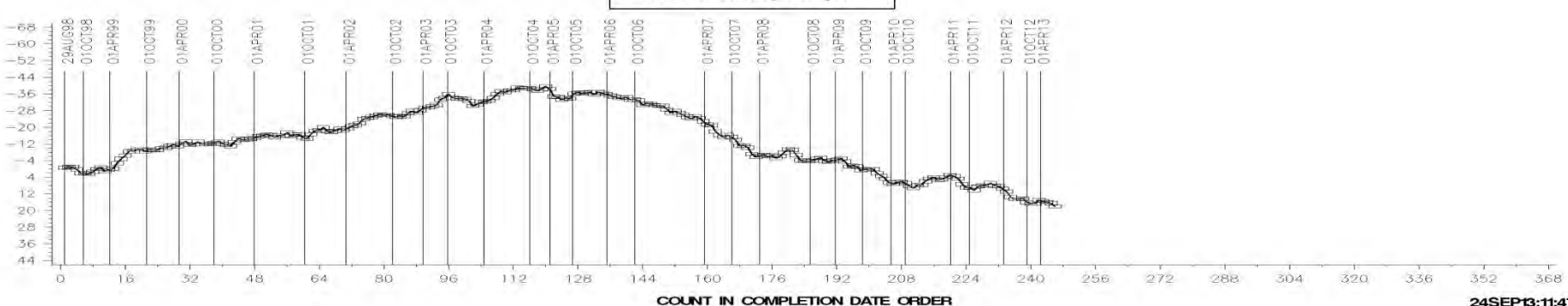
LTMS Severity Analysis



LTMS Precision Analysis

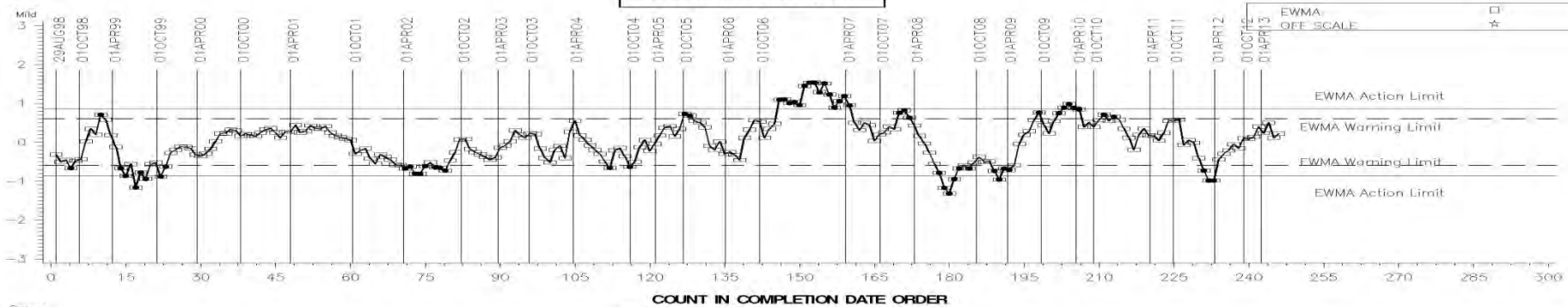


CUSUM Severity Analysis



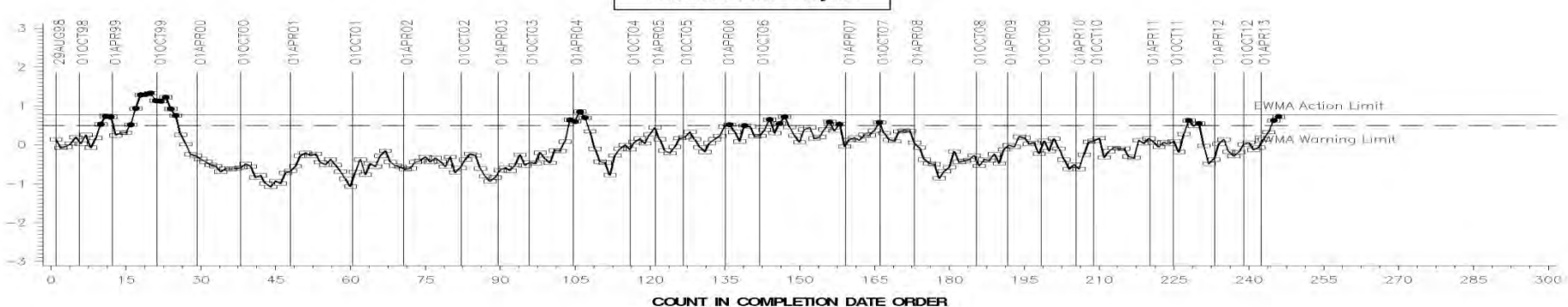
STRIPPED VIS. @ 100 DEG C

LTMS Severity Analysis



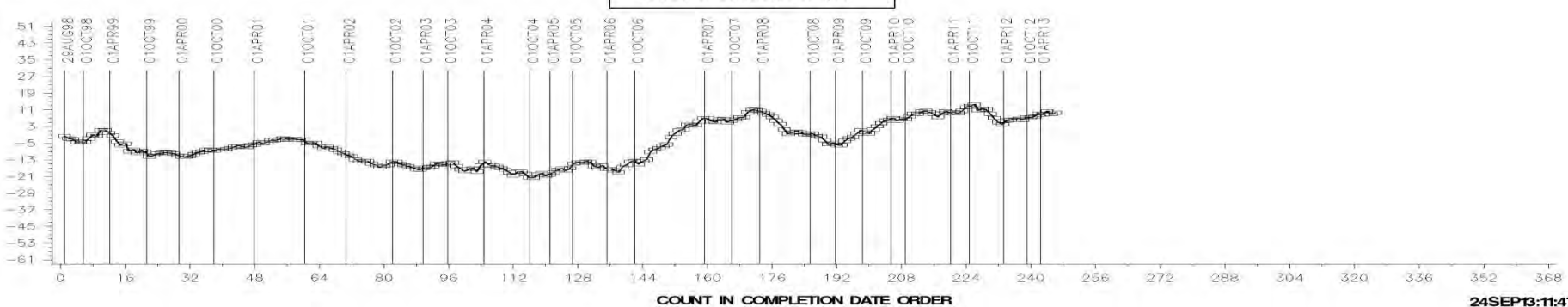
COUNT IN COMPLETION DATE ORDER

LTMS Precision Analysis



COUNT IN COMPLETION DATE ORDER

CUSUM Severity Analysis



COUNT IN COMPLETION DATE ORDER

24SEP13:11:47

[Return](#)

Test Monitoring Center

<http://astmtmc.cmu.edu>



A Program of ASTM International