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

April 2012

Passenger Car Engine Oil Testing Executive Summary

▶ IVA

- Reference oil 1006-2 reintroduced February 2, 2012. Calibration periods with 1006-2 reduced to generate additional data for targets. Removed 1009 for calibration.

▶ VG

- Replacement oil for 925-3 approved, oil being obtained by TMC.

▶ VID

- Targets Updated in December for reference oil 1010.
- Results reported on new blend of 541

Calibrated Labs and Stands*

Test	Labs	Stands
IIIF	3	3
IIIG/A/B	6	15
IVA	3	5
VG	4	8
VIB	0	0
VID	5	10
VIII	3	4

*As of 3/31/2012

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Test Activity Levels

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Sequence Tests

Test Status	Validity Code	IIIF	IIIG	IVA
Acceptable Calibration Test	AC	7	12	9
Failed Calibration Test	OC	1	3	2
Operationally Invalid	LC	0	0	1
Aborted	XC	1	1	0
Abandon Stand/Eng	MC	0	0	3
Decoded/Donated	NN/AG	0	0	7
Total		9	16	22

Sequence Tests

Test Status	Validity Code	VG	VID	VIII
Acceptable Calibration Test	AC	8	26	5
Failed Calibration Test	OC	0	1	4
Operationally Invalid	LC	0	1	0
Aborted	XC	0	0	0
Abandon Stand/Eng	MC	0	2	0
Decoded/Donated	NN/AG	1	10	0
Total		9	40	9

Failed Tests

Test Status	Test	Number of Tests
Screened ACLW >20µm	IIIF	1
Severe Viscosity Increase	IIIG	2
Severe Viscosity Increase and WPD	IIIG	1
Mild Average Cam Wear	IVA	2
Stand EWMA Precision Alarm, FEI2	VID	1
Severe Stripped Viscosity Result	VIII	2
Severe Stripped Viscosity, BWL Precision Alarm	VIII	2
Total		11

Lost Tests*

*Invalid and aborted tests

Test Status	Cause	IIIF	IIIG	IVA	VG	VID	VIII
Aborted	Oil Temperature Control	1	0	0	0	0	0
Aborted	Blown Head Gasket	0	1	0	0	0	0
Invalid	Engine Oil Thermocouple Failed	0	0	1	0	0	0
Invalid	Knock Sensor Wiring Issue	0	0	0	0	1	0
Total		1	1	1	0	1	0

Test Severity

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Test Severity

▶ IIIF

- PVIS and WPD are in control.
 - APV
 - In mild action alarm
 - Long-term mild trend continuing (Since April 2006)
 - PV60
 - In severe warning alarm
 - Long-term severe trend continuing (Since April 2007)
- Charts shown in [Appendix 1.a.](#)

Test Severity

▶ IIIG

- PHOS and MRV are in control.
 - WPD is in control
 - Long-term severe trend continuing (Since late 2004)
 - PVIS in severity action alarm
 - ACLW in severity action alarm and precision warning alarm
 - Long-term mild trend
- Charts shown in [Appendix 1.b.](#)

Test Severity

▶ IVA

- ACW in mild warning alarm
- Trending mild for most of the report period

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

▶ VG

- RAC, AEV, APV and OSCAR are in control.
- AES in warning alarm, mild direction.
 - Milder this period than previous periods.

- 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 severe action alarm

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

Test Precision

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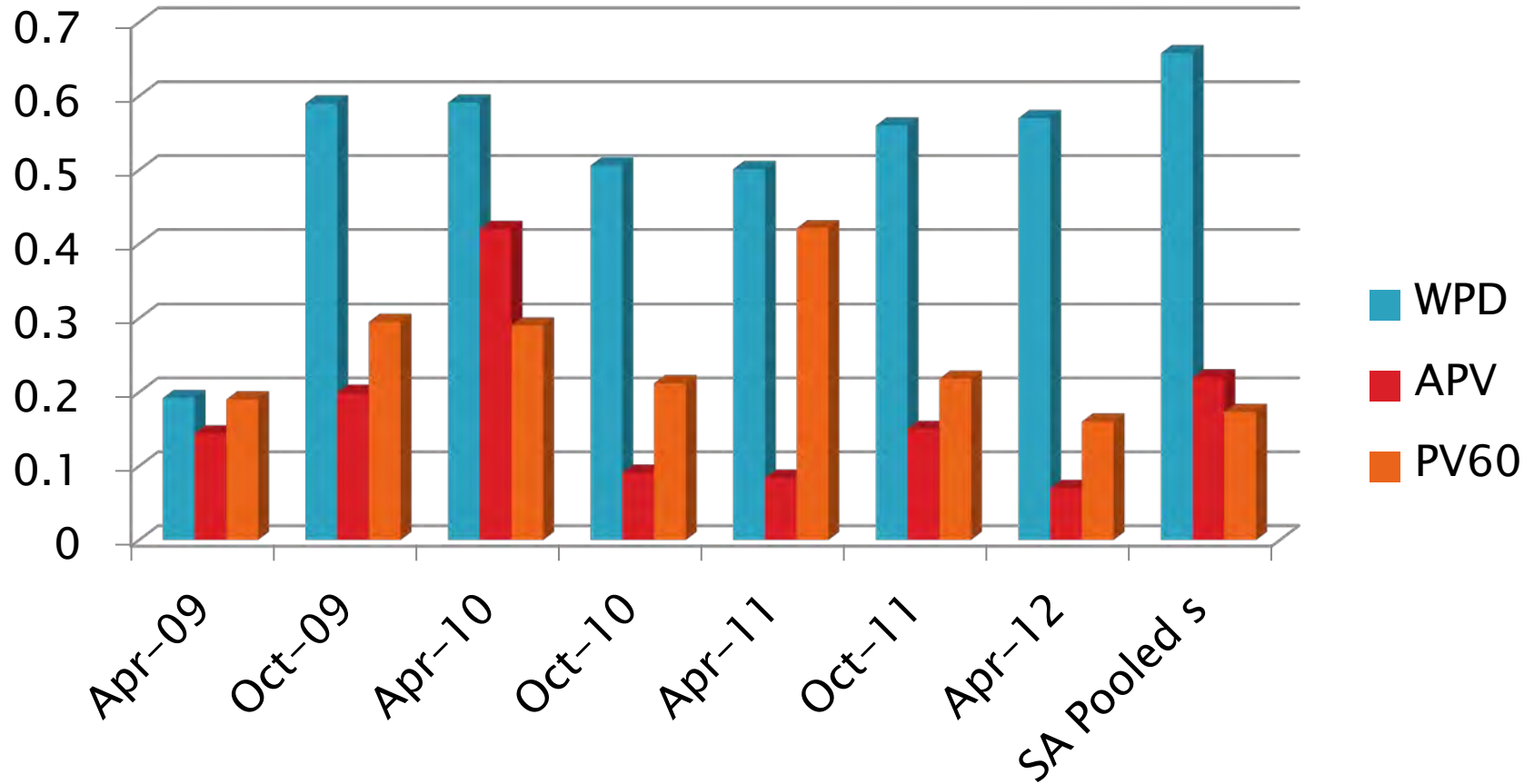


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Test Precision Estimates

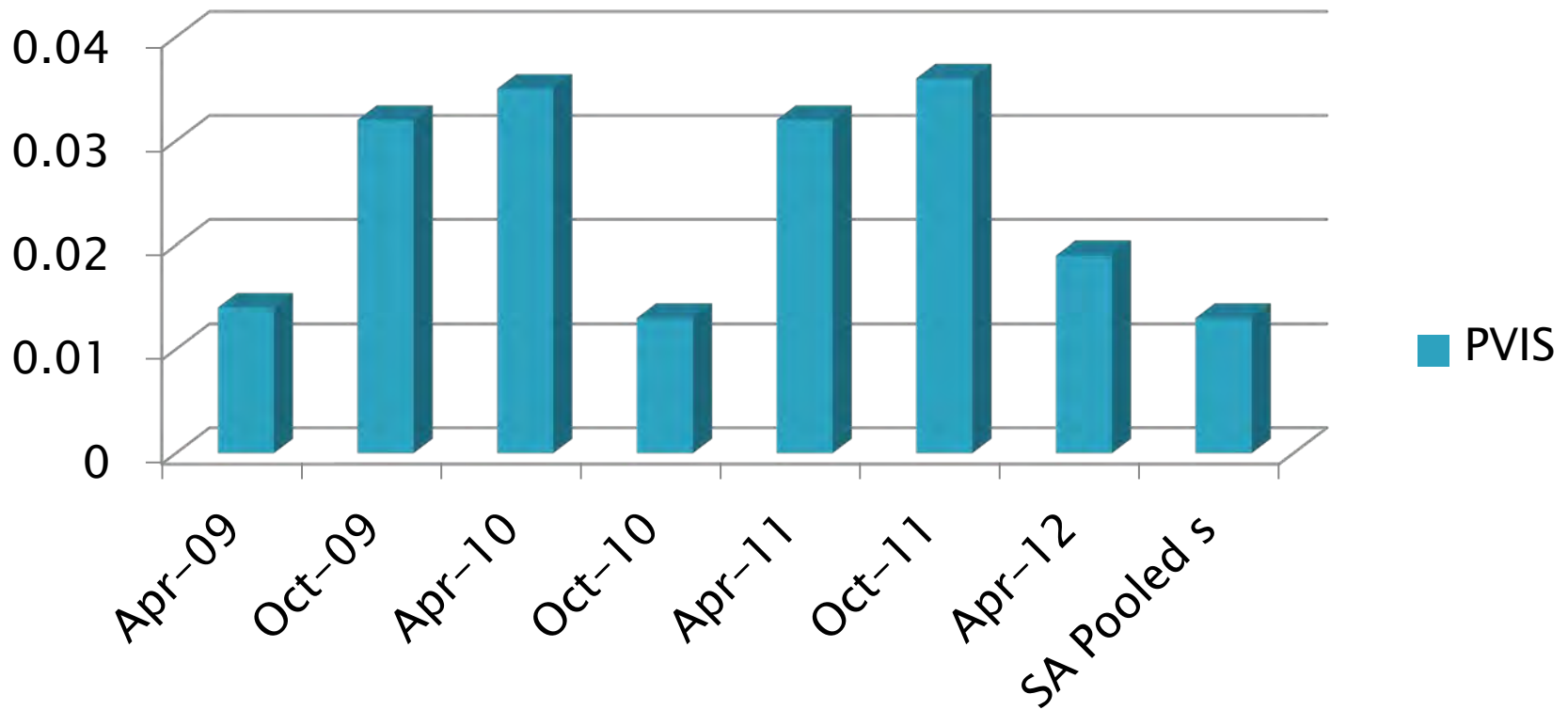
- ▶ Presented on an six month basis.
- ▶ Data presented for past four years.

IIF Precision Estimates

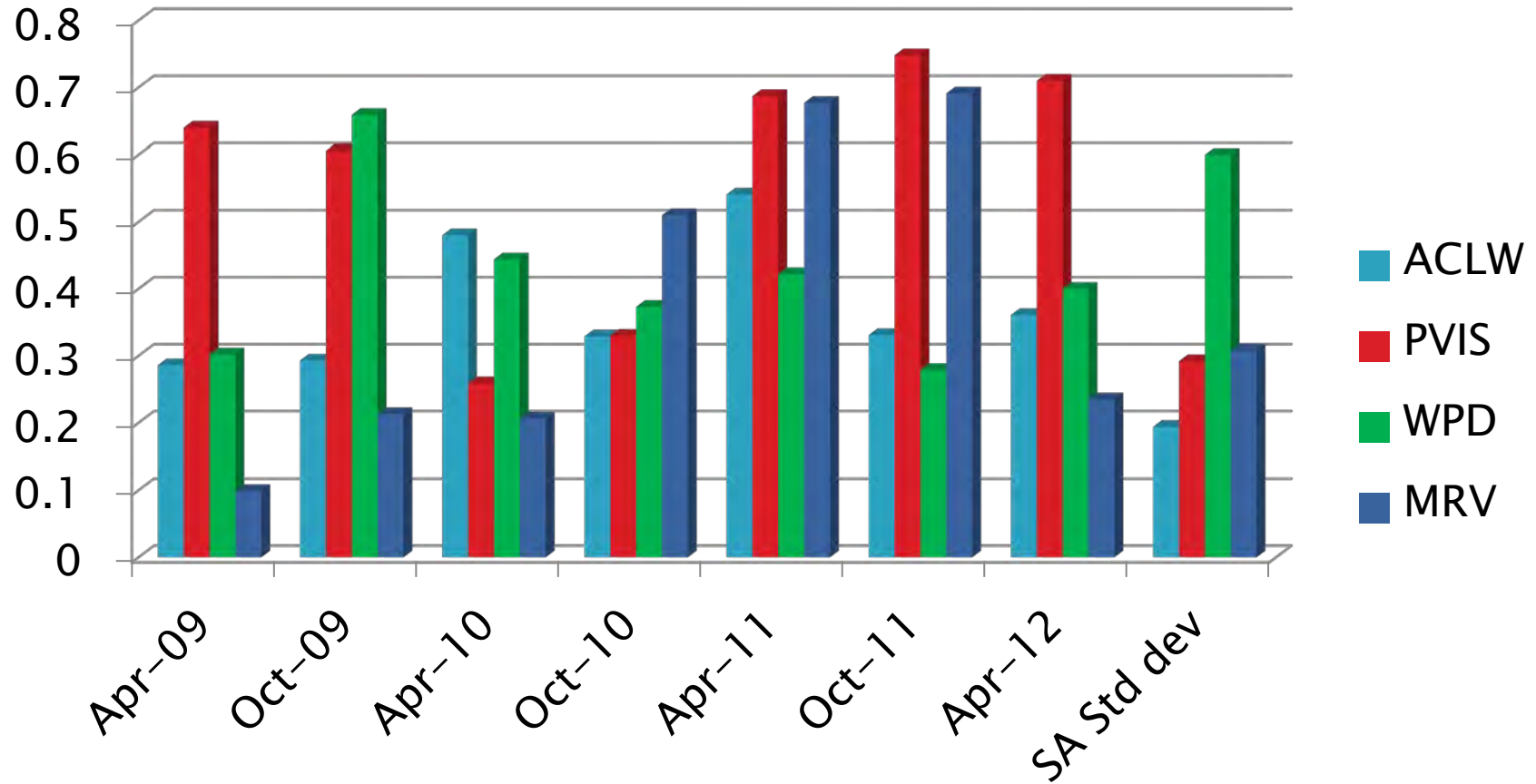


IIIF Precision Estimates

PVIS

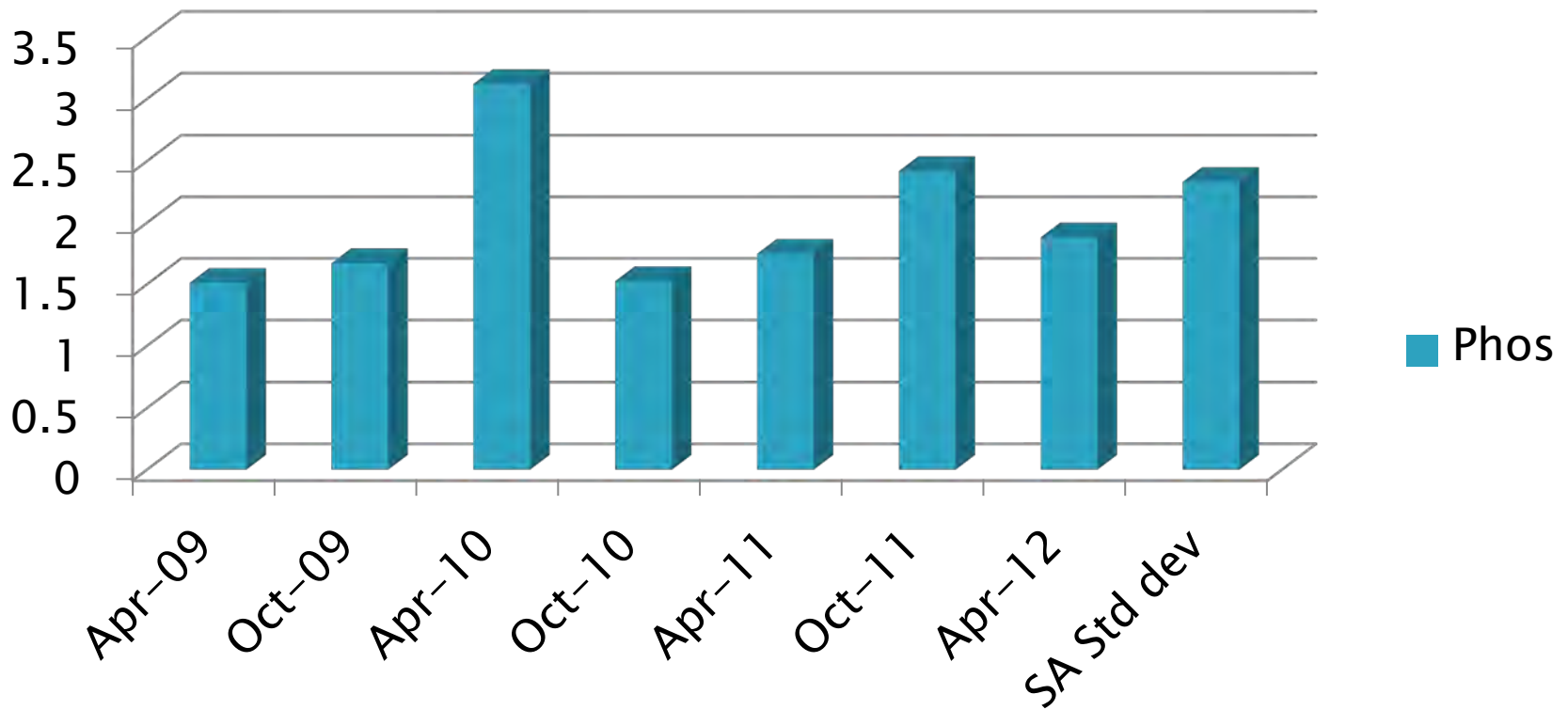


IIIG Precision Estimates



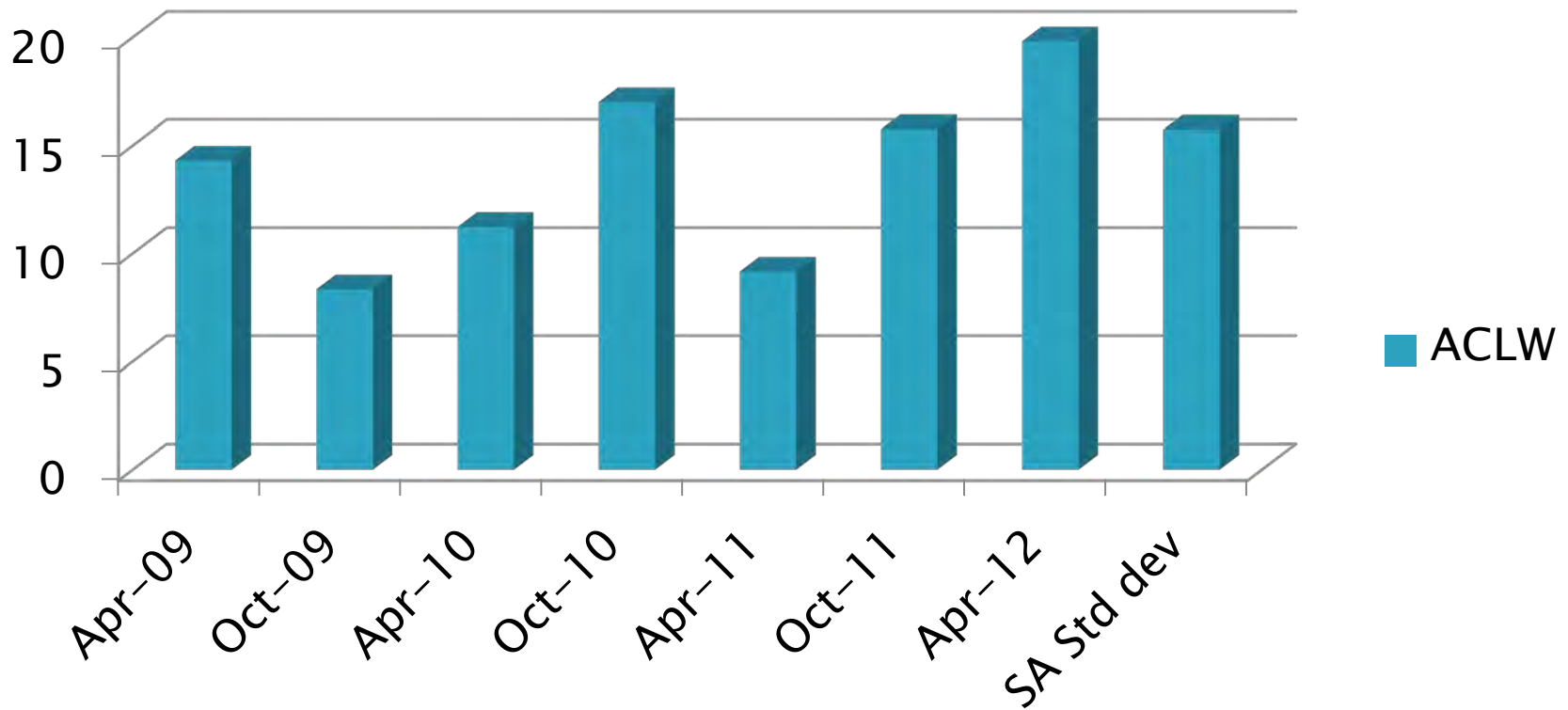
IIIG Precision Estimates

Phos

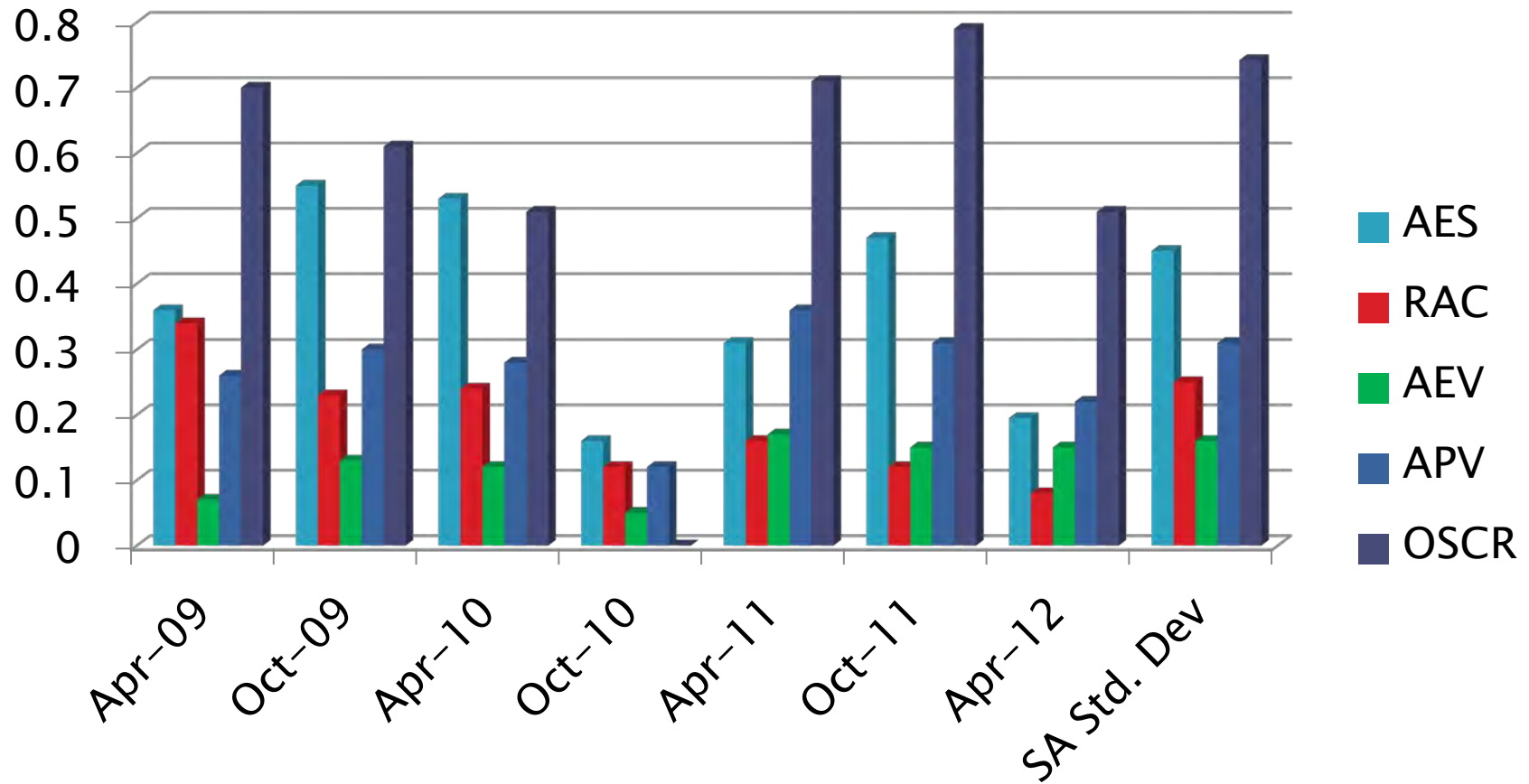


Sequence IVA Precision Estimates

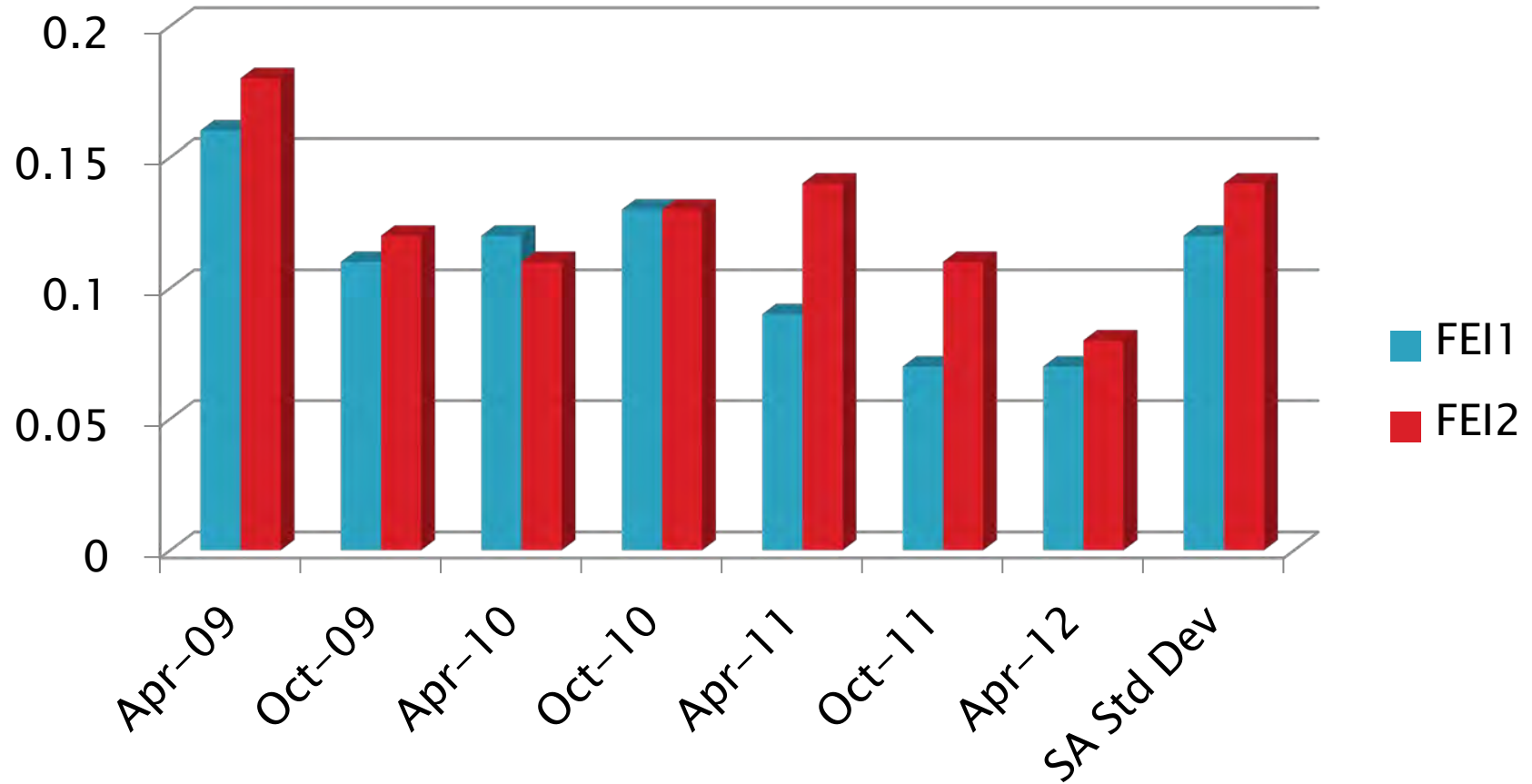
ACLW



Sequence VG Precision Estimates

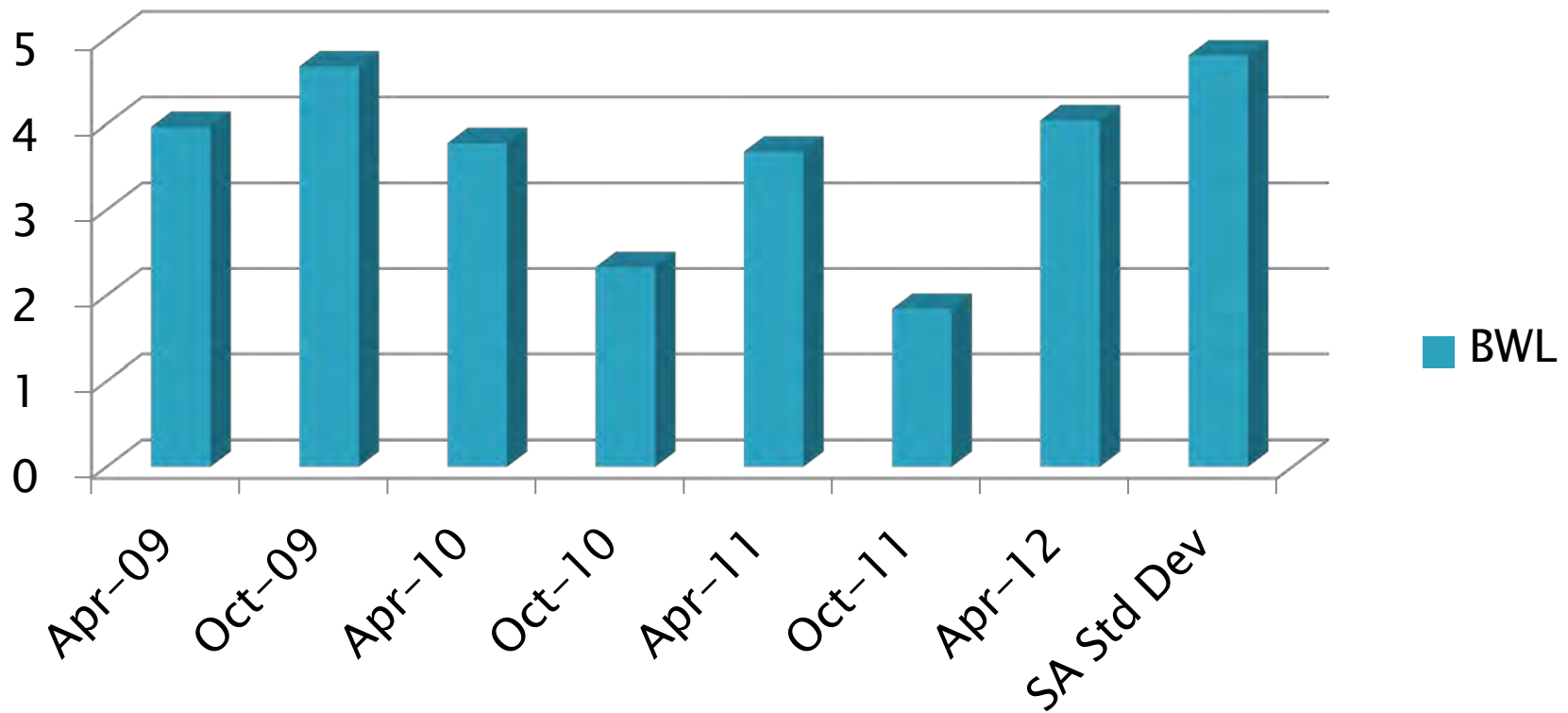


Sequence VID Precision Estimates



Sequence VIII Precision Estimates

BWL



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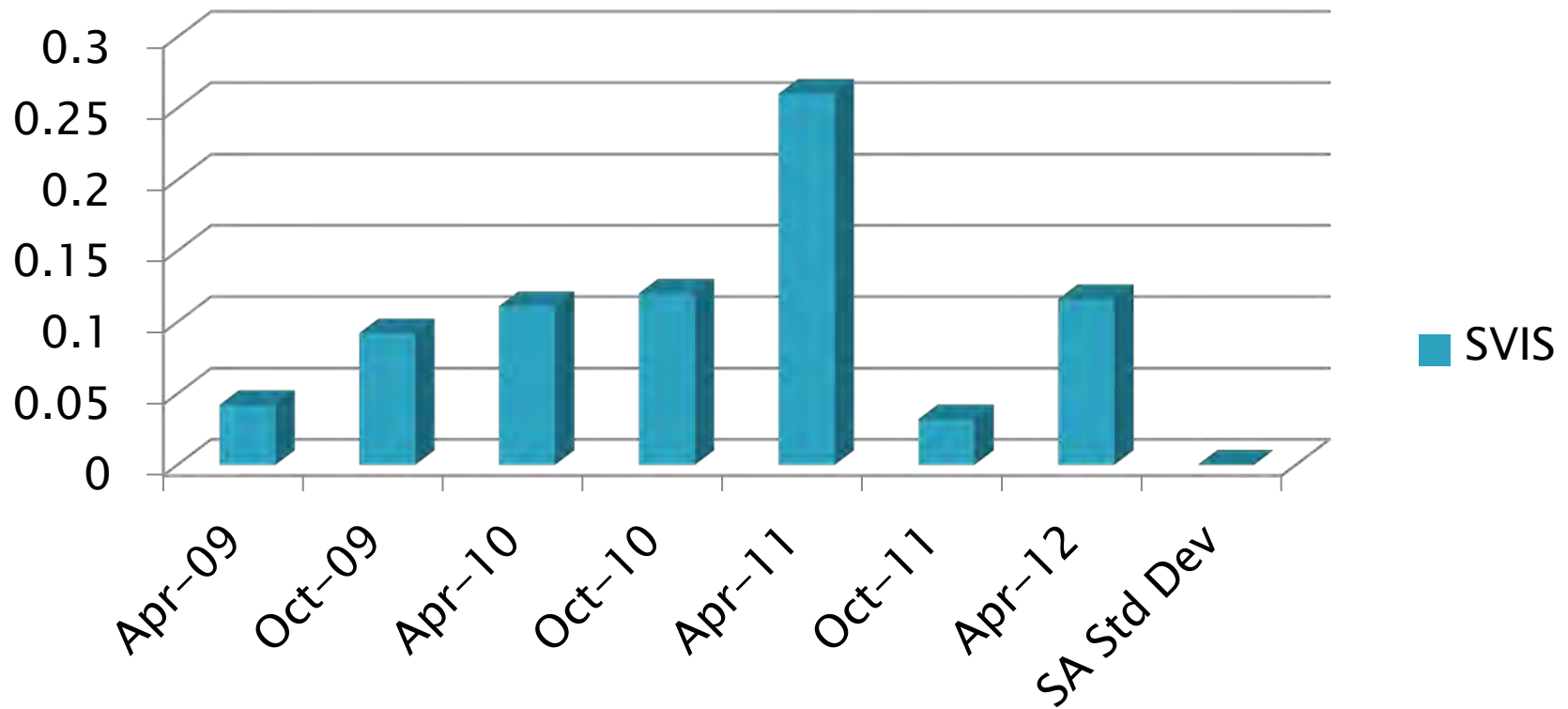
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Sequence VIII Precision Estimates

SVIS



Information Letters

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Information Letters*

Test	Date	IL	Topic
IIIG	November 29 , 2011	11-4, Seq. 34	Added provisions for strainers in coolant system Updated tolerances for cam and lifter measurement devices
IIIG	December 12, 2011	11-5, Seq. 35	Added First-in, First-out criteria for specific hardware and corrected harmonic balancer p/n
VID	January 11, 2012	12-1, Seq. 9	Clarified procedure for oil additions during new engine break-in

*Available from TMC Website

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Reference Oil Inventory

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

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Reference Oil Re-blends

- Oils with ~ 2 years or less supply
 - Re-blends no longer available
 - Oils Affected
 - 925-3 and 1007
 - A replacement oil for 925-3 has been approved, TMC contacting supplier to obtain
 - 1007 replaced with 1006-2 in IVA

Reference Oil Re-blends

- Oils with ~ 2 years or less supply
 - Re-blends available
 - Oils Affected: 541-1 and 435-2
 - 435-2 in use.
 - 3 test completed on 541-1

Reference Oil Inventory Estimated Life

Oil	Tests	Original Blend Amount	Quantity Shipped in last 6 months	TMC Inventory	Lab Inventory	Estimated Life
433-1	IIIF	1045	40	198	48	2.5 years
434	IIIG	550	0	5	12	<1 year
434-1	IIIG	660	0	254	24	5+ years
435	IIIG	550	0	2	4	<1 year
435-2	IIIG	550	37	437	28	5+ years
438	IIIG	990	24	712	32	5+ years
540	VID	1100	25	463	40	5+ years

Reference Oil Inventory Estimated Life

Oil	Tests	Original Blend Amount	Quantity Shipped in last 6 months	TMC Inventory	Lab Inventory	Estimated Life
541	VID	550	35	5	45	<1 year
541-1	VID	550	25	515	20	5+ years
542	VID	1100	85	358	65	5+ years
704-1	VIII	897	12	206	10	5+ years
925-3	VG	975	0	10	6	<1 year
1006-2	IVA, VG, VIII	5500	91	3772	63	5+ years
1007	IVA, VG	1968	40	21	41	<1 year
1009	VG	1100	34	379	33	5+ years
1010	IIIG, VID	1100	55	712	60	5+ years

LTMS Deviations

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LTMS Deviations

- Two IVA LTMS Deviations in Current Period
 - Stand precision EWMA Alarm
 - requires two tests
 - due to change in hardware and oil selection
 - cleared after one test; second test waived
 - Results removed from lab charts for abandoned cam batch

LTMS Deviations

Historical Count of PCEO LTMS Deviations

Test	LTMS Deviations
IIIF	5
IIIG	5
IVA	7
VG	8
VID	1
VIII	3

Quality Index Deviations

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Quality Index Deviations

- Two PCEO Quality Index Deviations this period
 - IIIG Deviation for EBP and Load Control
 - IVA Deviation for EBP

Historical Count of PCEO Quality Index Deviations

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

TMC Laboratory Visits

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TMC Lab Visits

- Two Sequence III lab visits this period
 - Issue with fuel injector flow measurements –
Incorrect voltage and time
- Two VID lab visits this period
 - No issues identified

Test Area Timelines

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Test Area Timeline Additions

Test	Date	Topic	IL
IIIG	20111129	Added provisions for strainers in coolant system Updated tolerances for cam and lifter measurement devices	11-3
IIIG	20111212	Added First-in, First-out criteria for specific hardware and corrected harmonic balancer p/n	11-4
VID	20120111	Clarified procedure for oil additions during new engine break-in	12-1
IVA	20120204	Reintroduced reference oil 1006-2, targets with N = 4	
IVA	20120209	Updated standard deviation for severity adjustments	

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Additional Information

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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



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Appendix 1 PCMO Reference Oil Testing Control Charts

April 2012

Appendix 1.a

IIIF Control Charts

» Severity, Precision, and CuSum

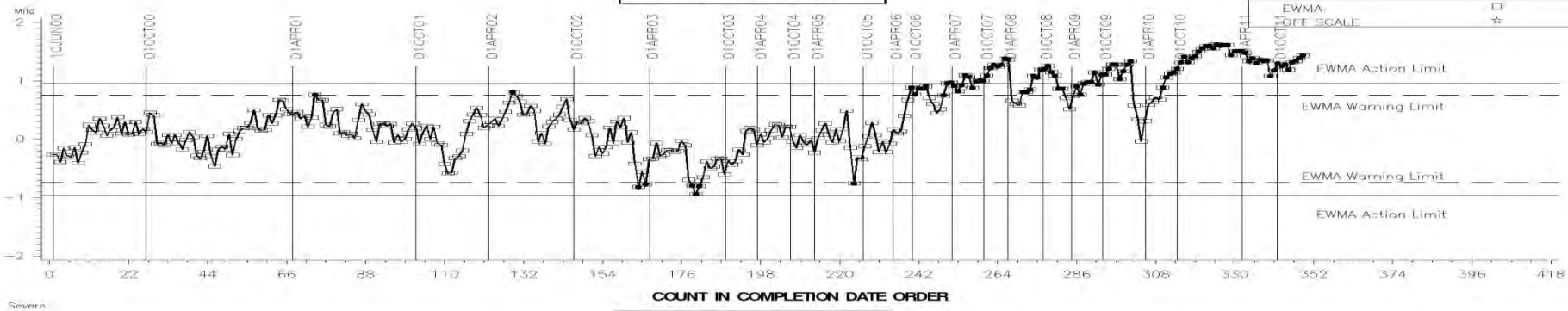
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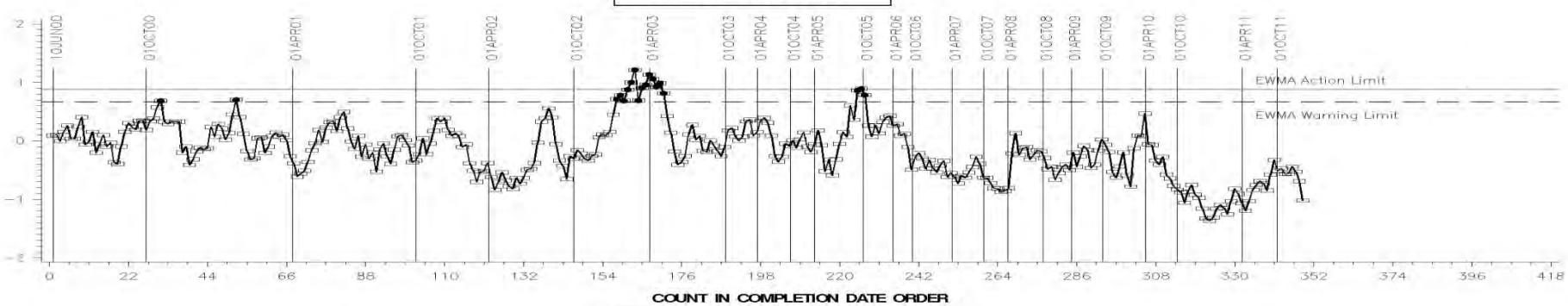


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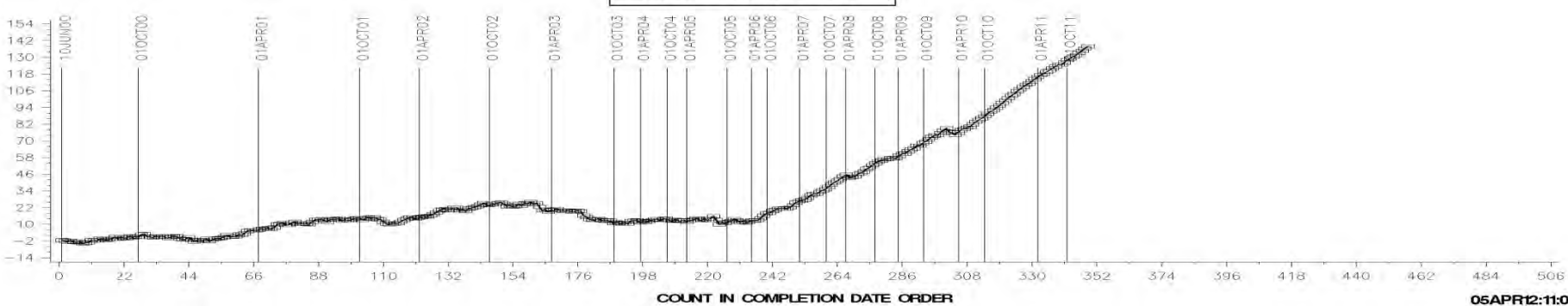
LTMS Severity Analysis



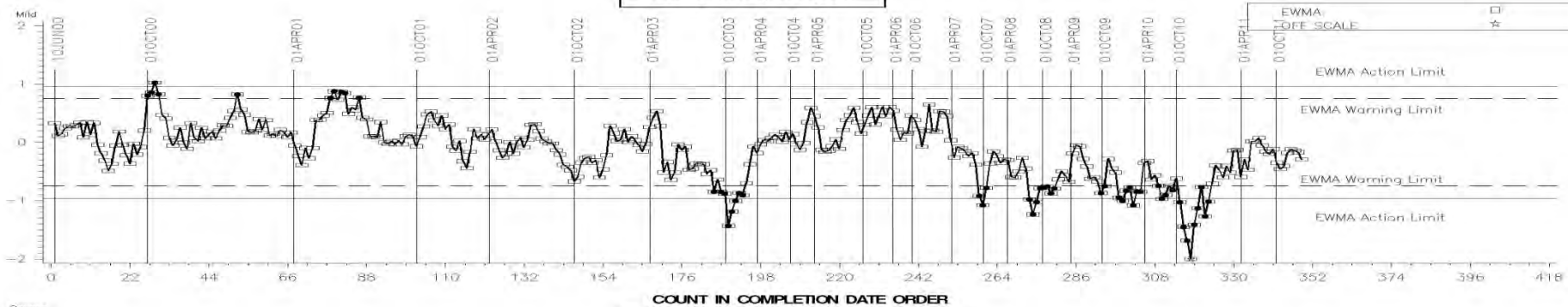
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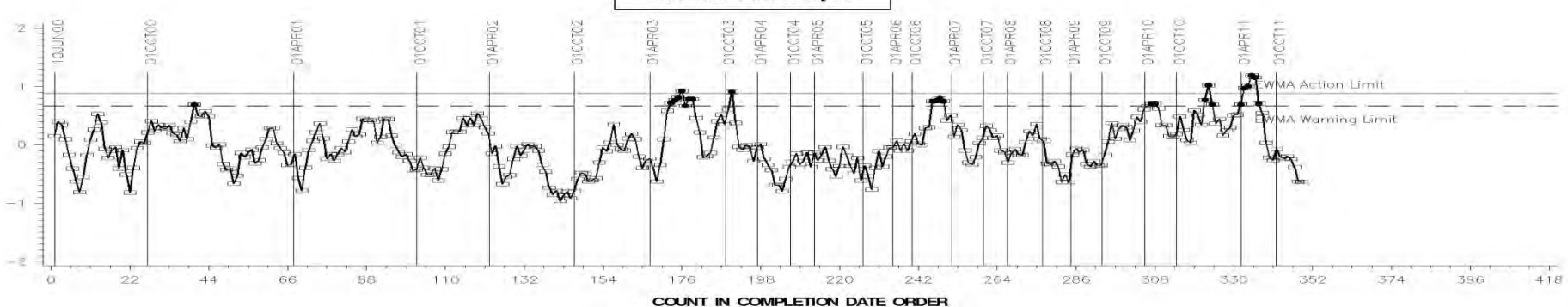
CUSUM Severity Analysis



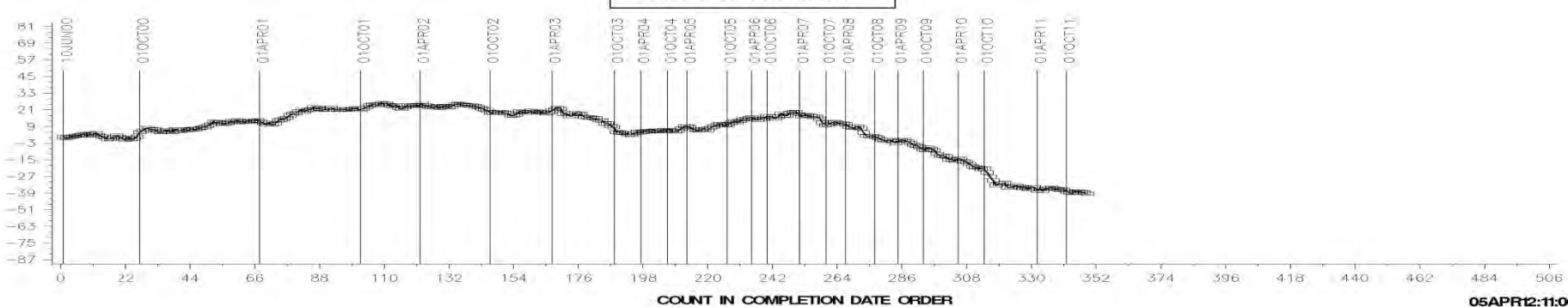
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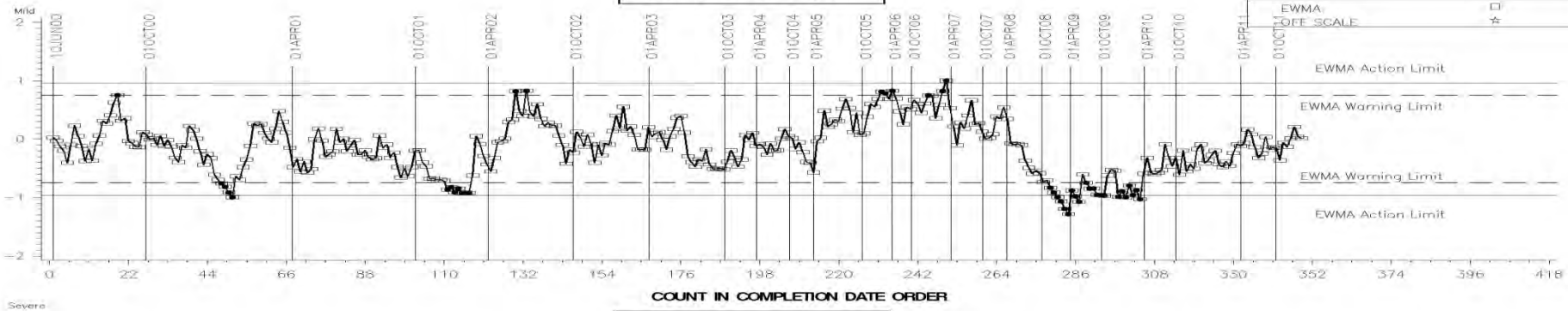
LTMS Precision Analysis



CUSUM Severity Analysis

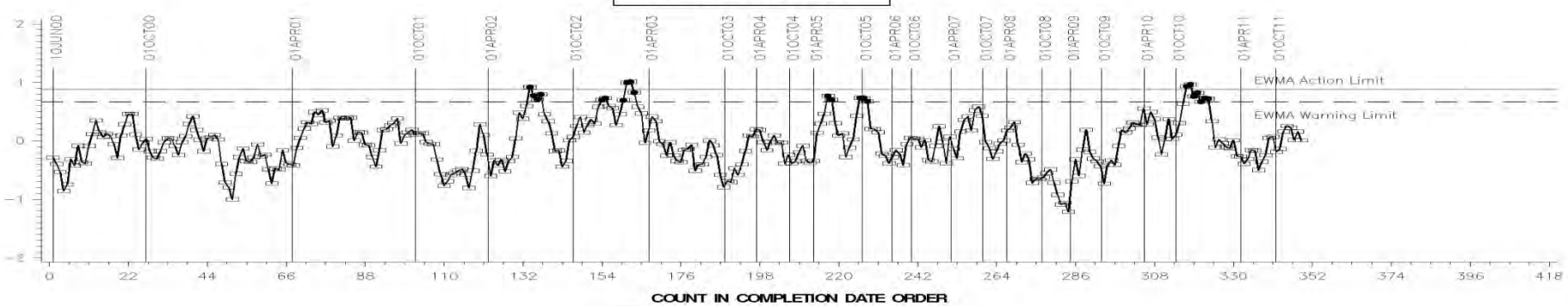


LTMS Severity Analysis



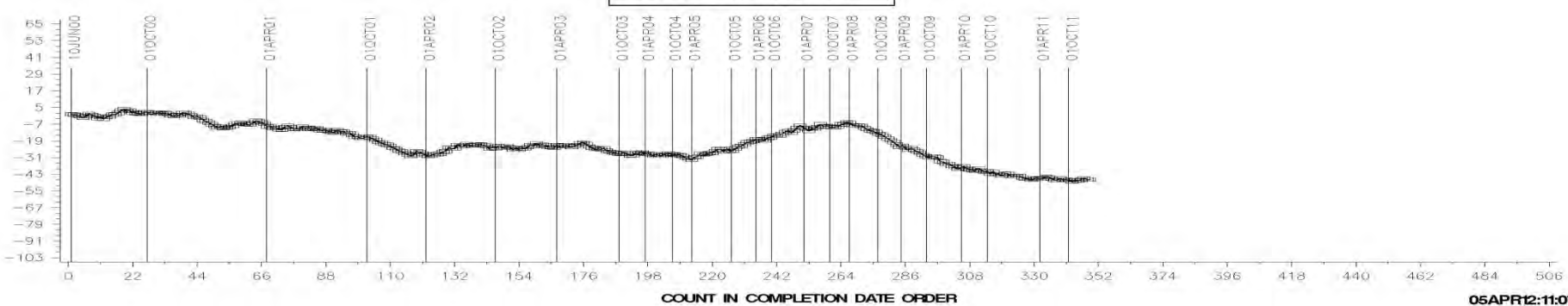
COUNT IN COMPLETION DATE ORDER

LTMS Precision Analysis



COUNT IN COMPLETION DATE ORDER

CUSUM Severity Analysis

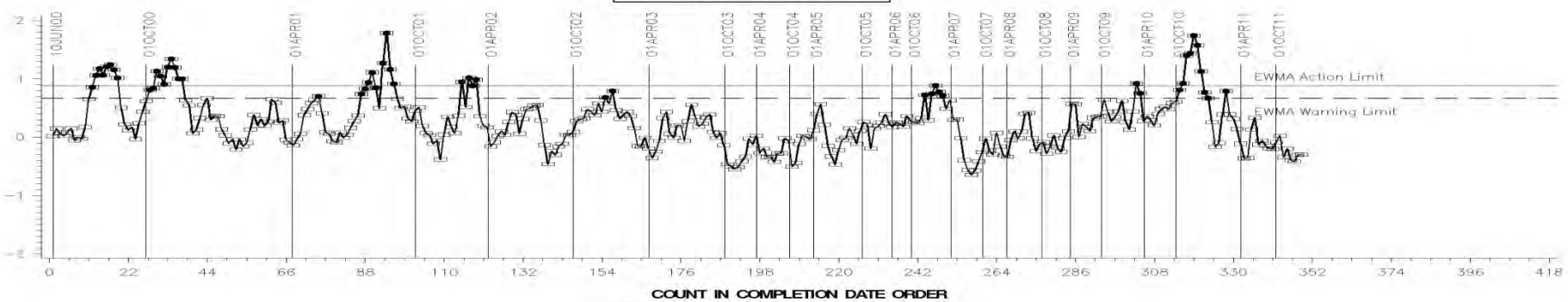


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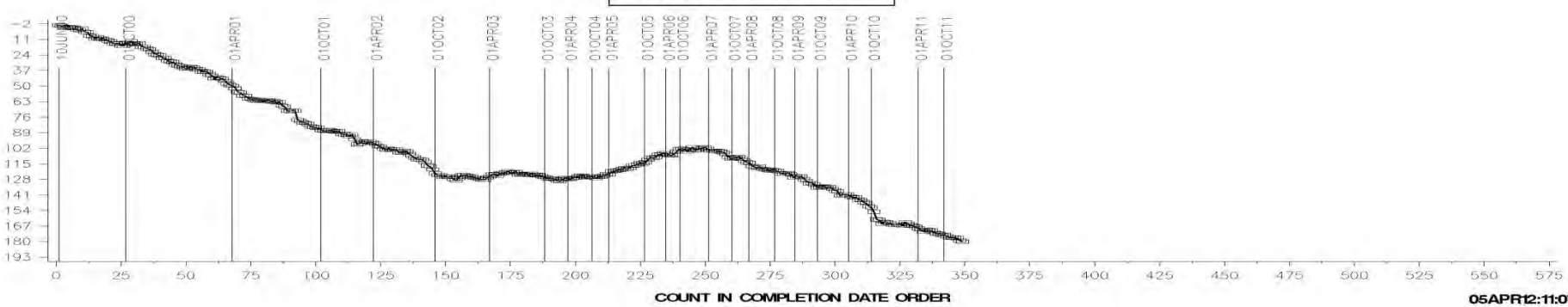
LTMS Severity Analysis



LTMS Precision Analysis



CUSUM Severity Analysis



Appendix 1.b

IIIG/A/B Control Charts

» Severity, Precision, and CuSum

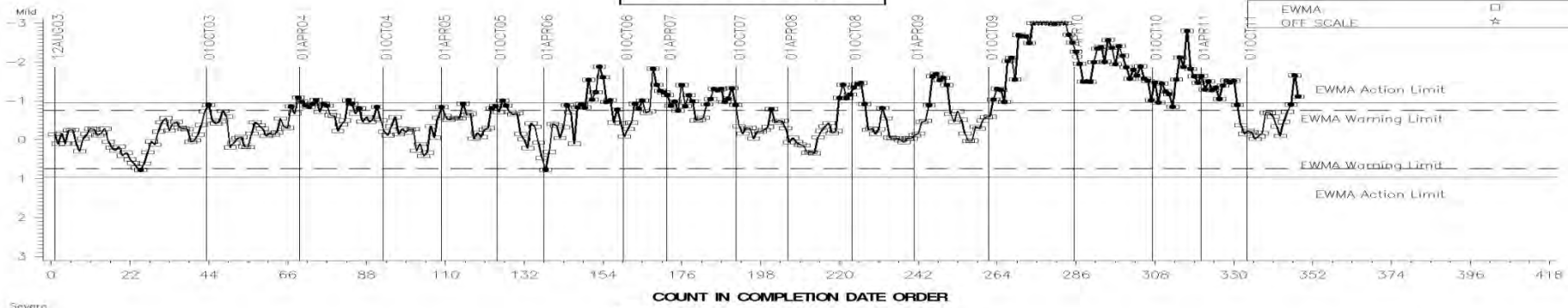
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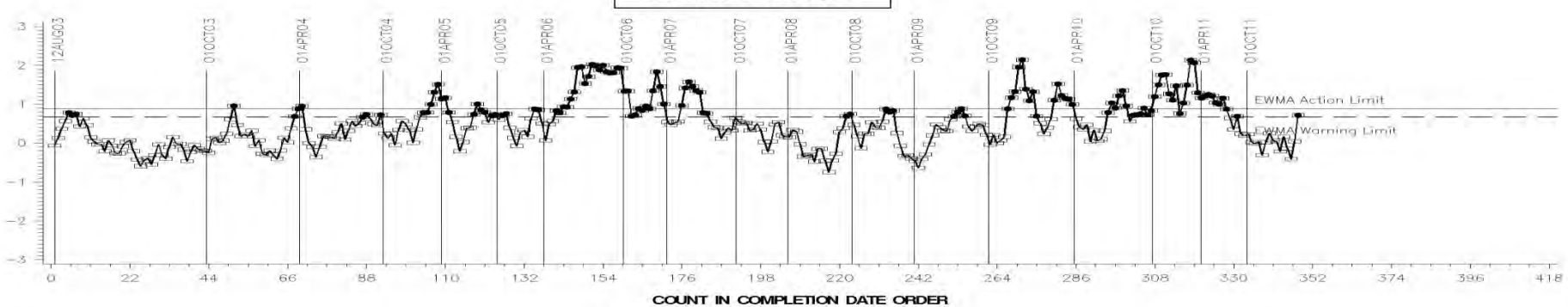


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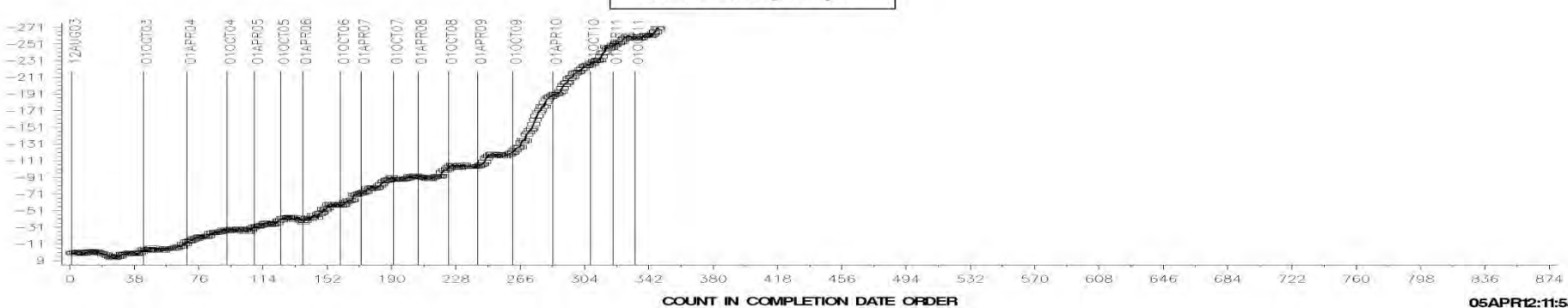
LTMS Severity Analysis



LTMS Precision Analysis

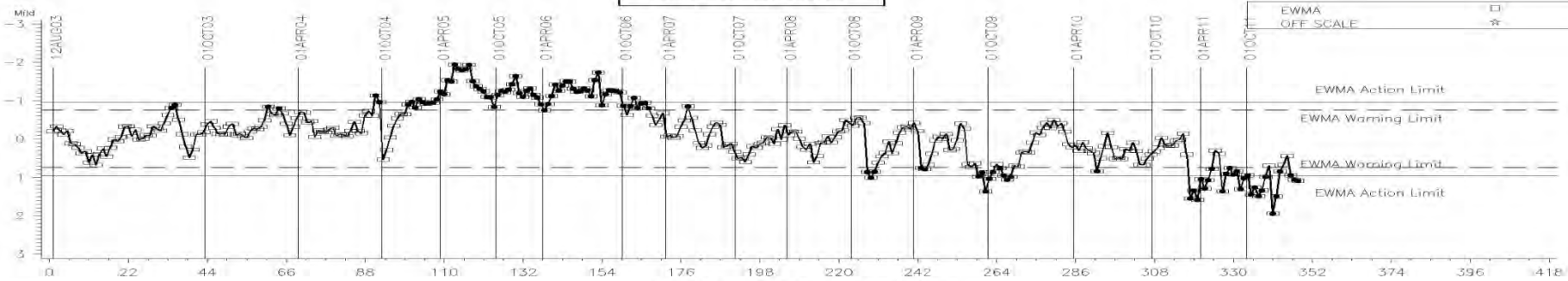


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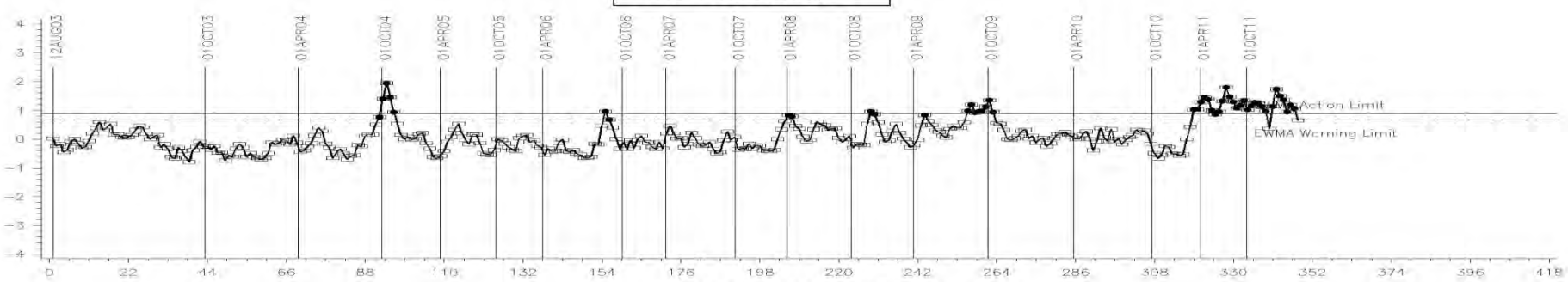
VISCOSITY INCREASE

LTMS Severity Analysis



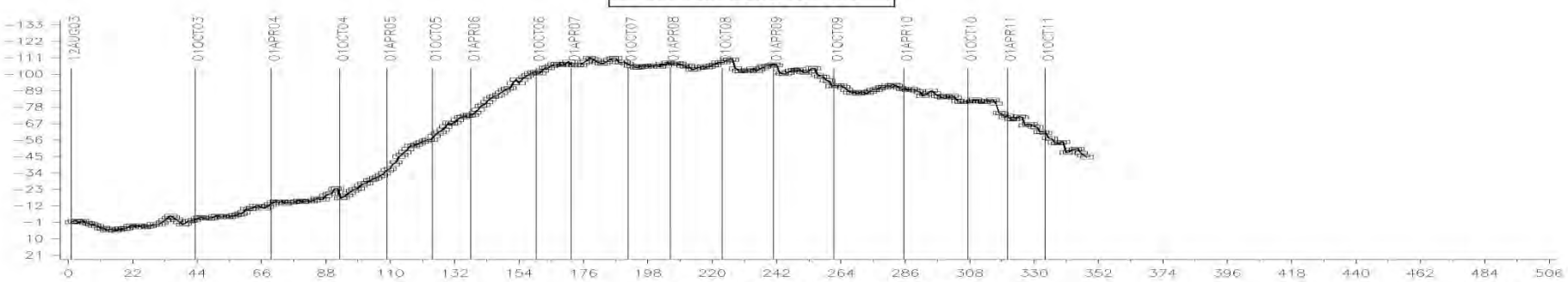
COUNT IN COMPLETION DATE ORDER

LTMS Precision Analysis



COUNT IN COMPLETION DATE ORDER

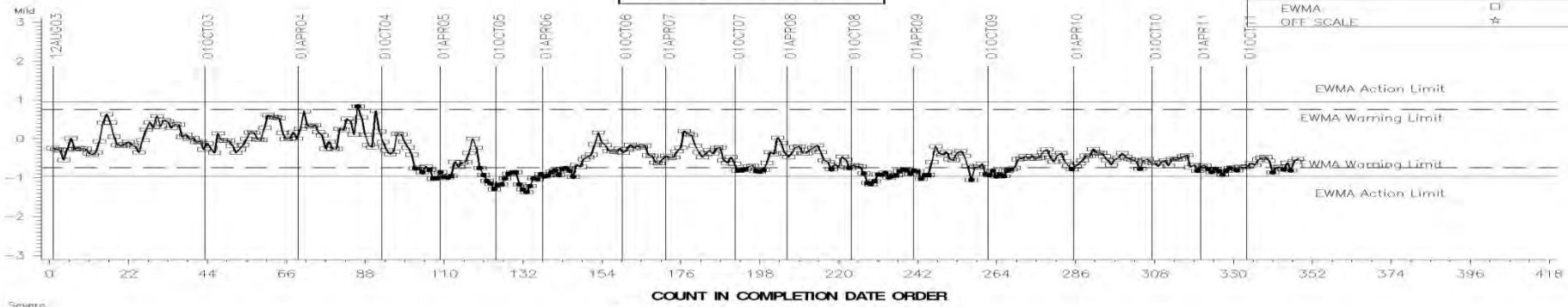
CUSUM Severity Analysis



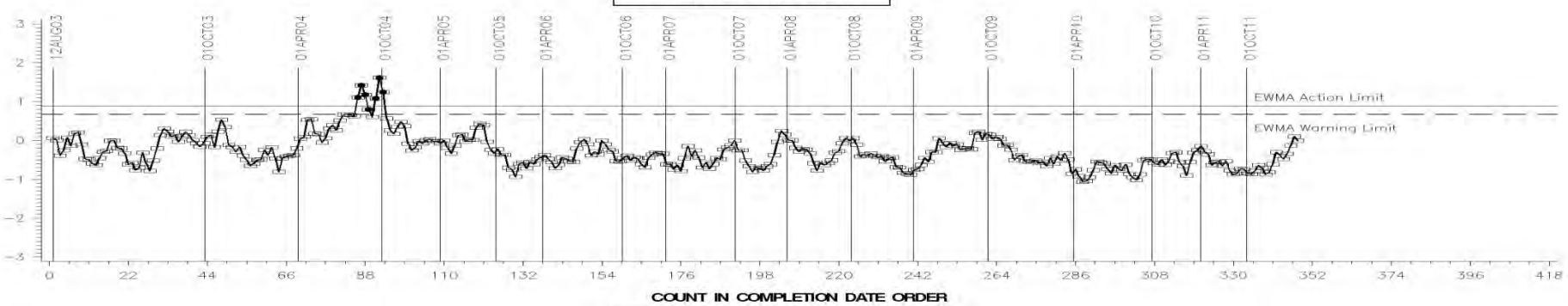
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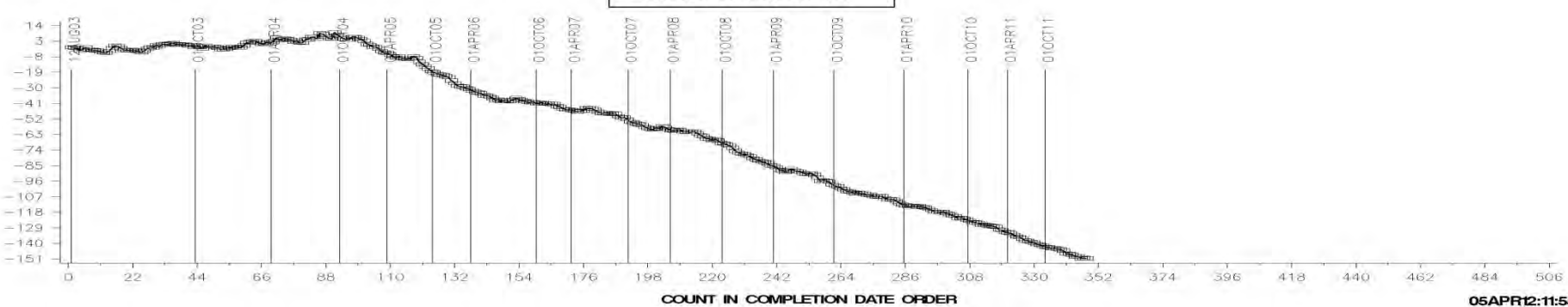
LTMS Severity Analysis



LTMS Precision Analysis

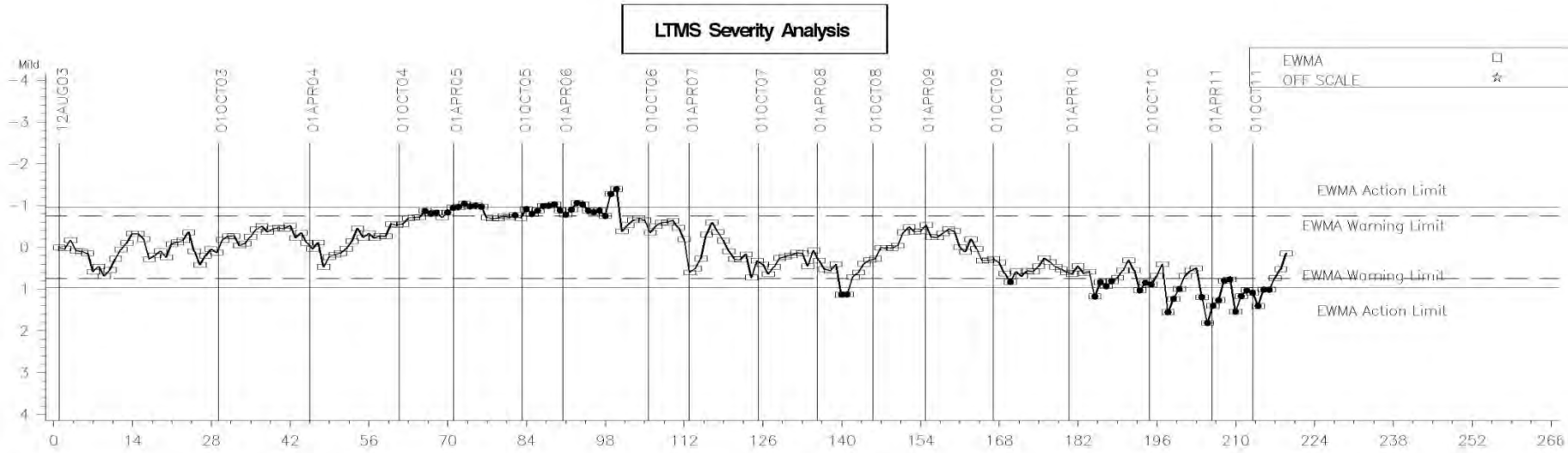


CUSUM Severity Analysis

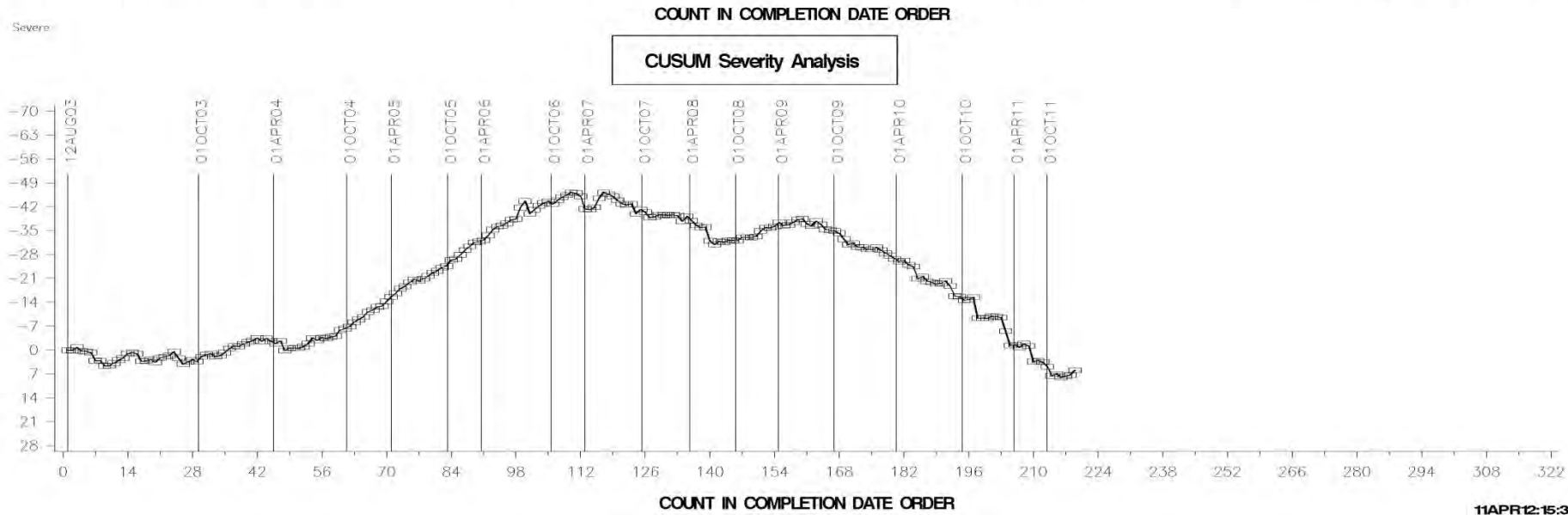


MRV VISCOSITY RESULT

Standard Deviation Units



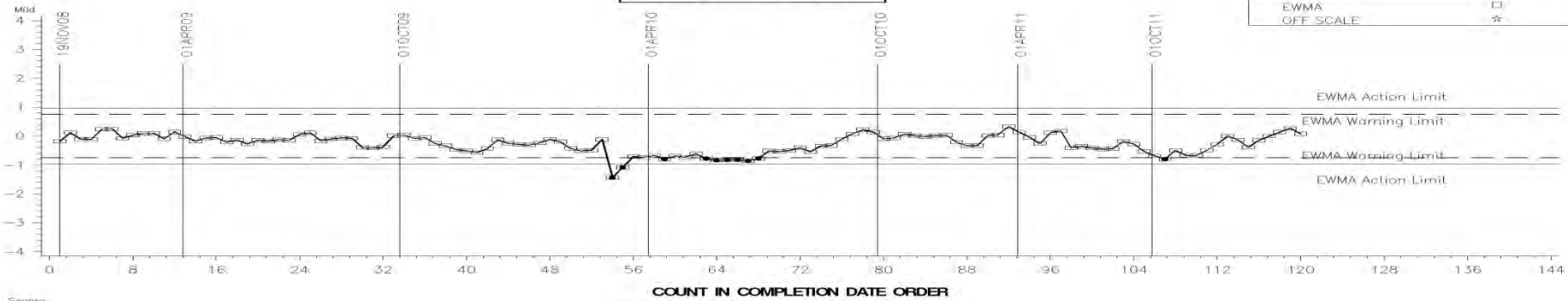
Standard Deviation Units



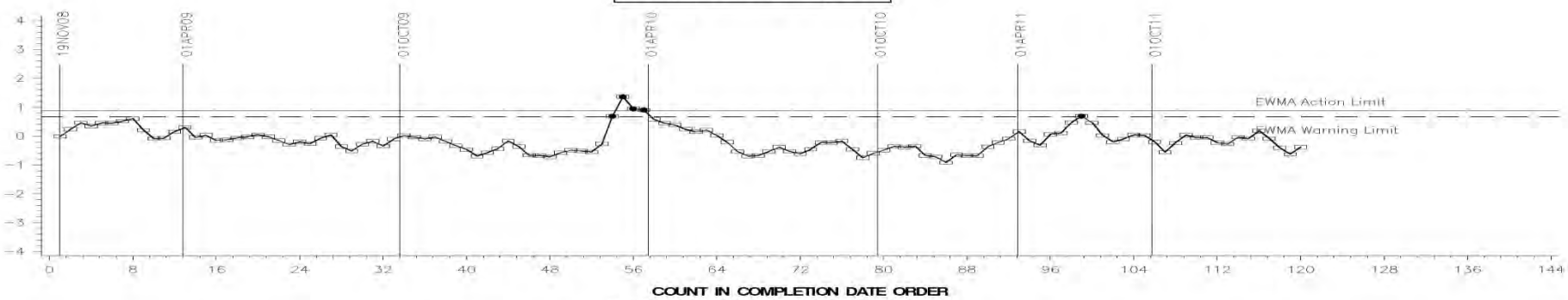
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PHOS RETENTION

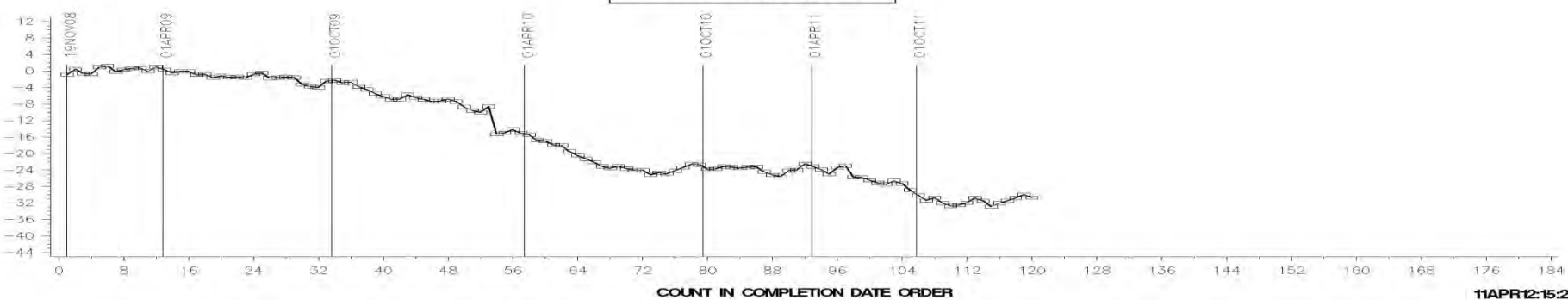
LTMS Severity Analysis



LTMS Precision Analysis



CUSUM Severity Analysis



11APR12:15:25

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Appendix 1.c

Sequence IVA Control Charts

» Severity, Precision, and CuSum

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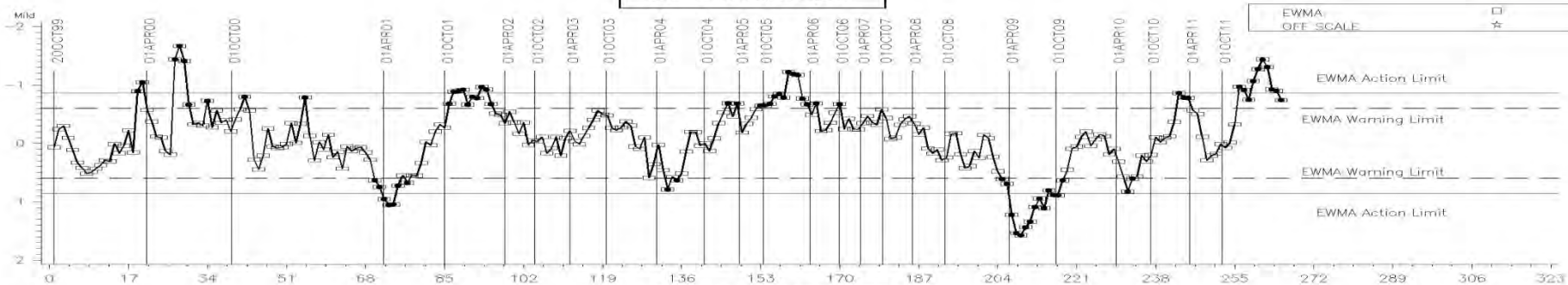
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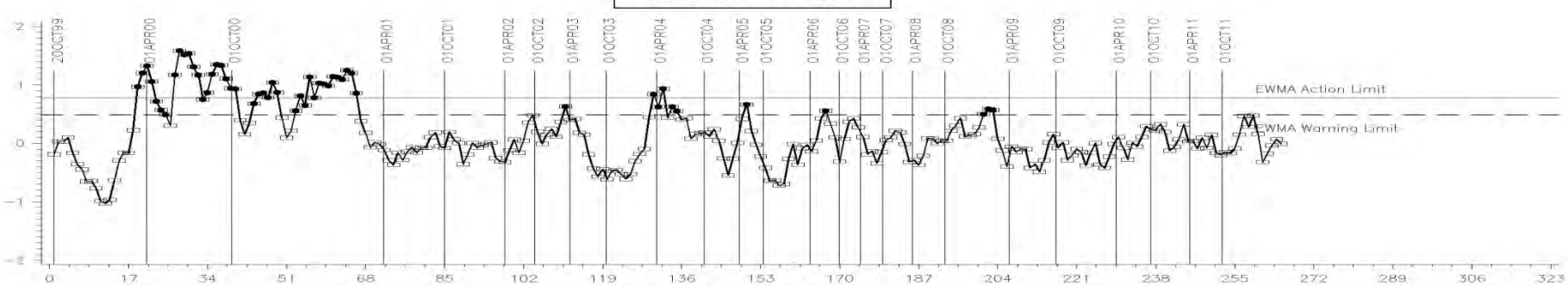
AVERAGE CAM WEAR

LTMS Severity Analysis



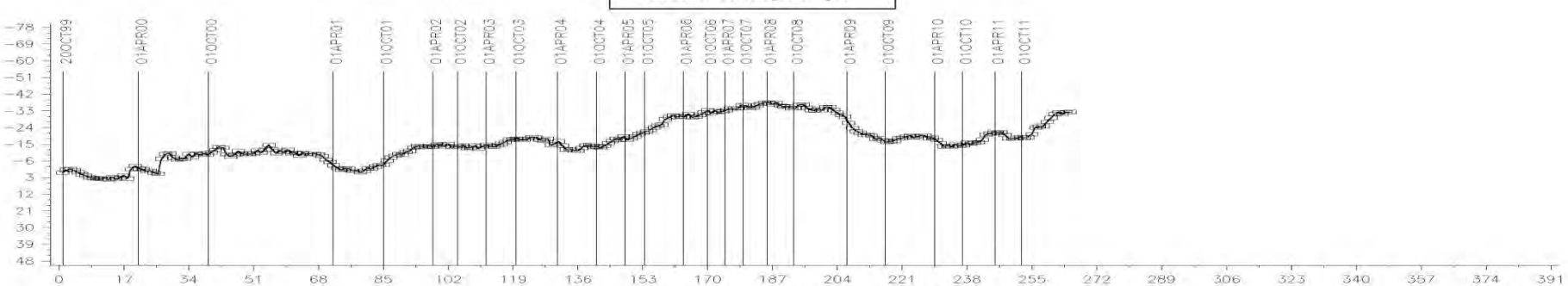
COUNT IN COMPLETION DATE ORDER

LTMS Precision Analysis



COUNT IN COMPLETION DATE ORDER

CUSUM Severity Analysis



COUNT IN COMPLETION DATE ORDER

05APR12:13:05

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Appendix 1.d

Sequence VG Control Charts

» Severity, Precision, and CuSum

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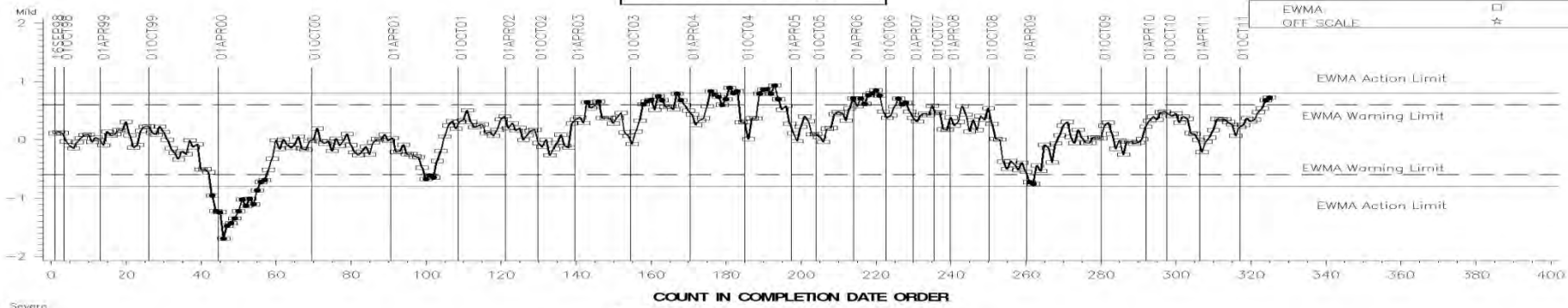
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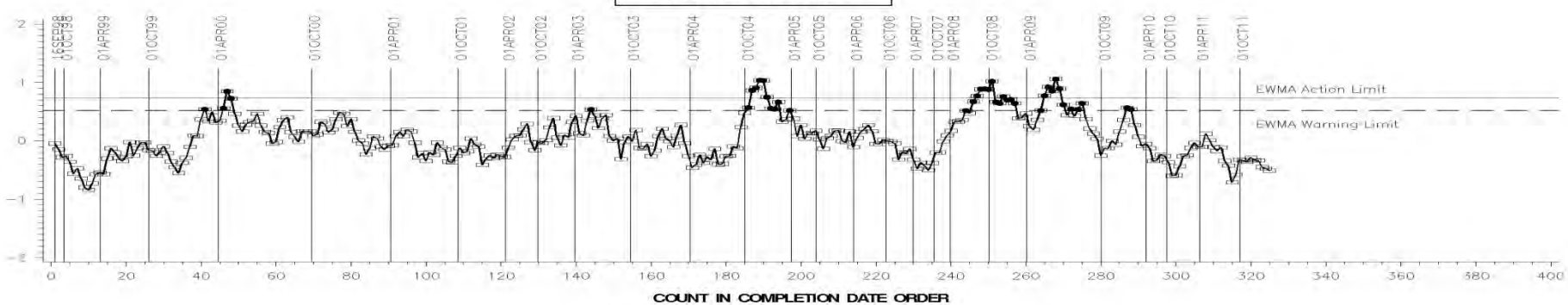
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AVERAGE ENGINE SLUDGE

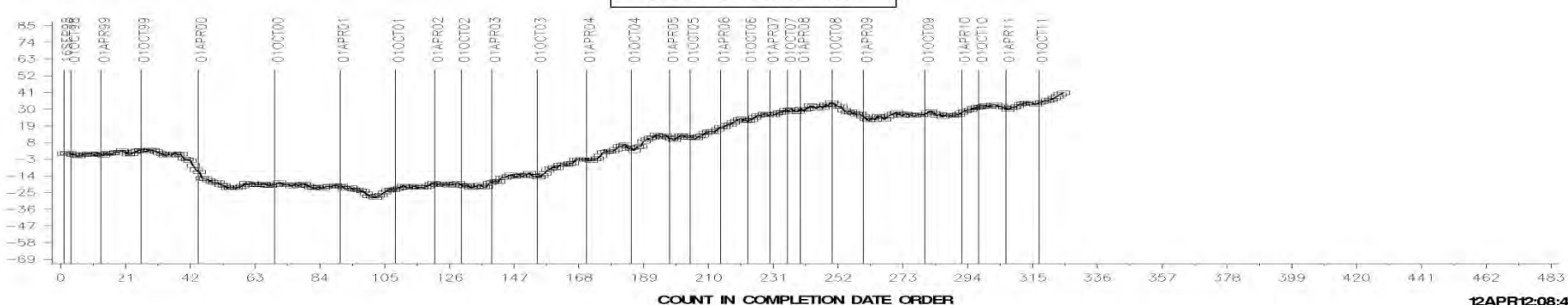
LTMS Severity Analysis



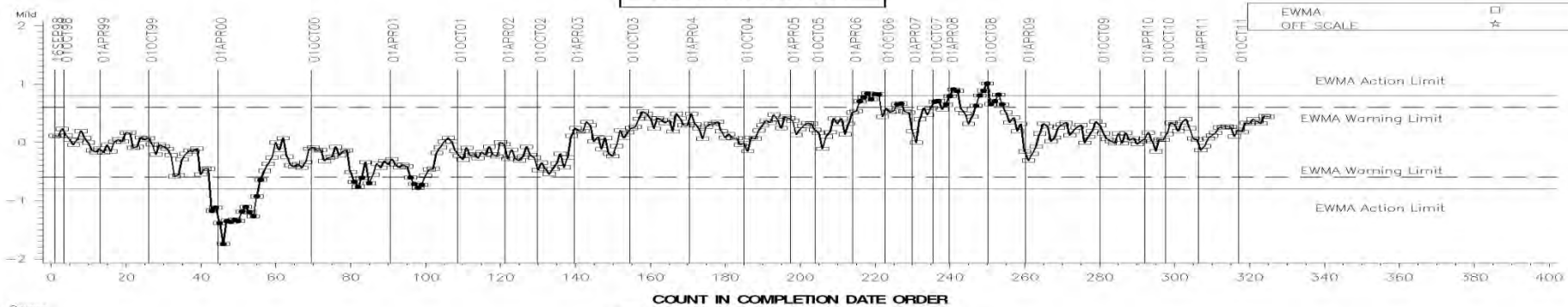
LTMS Precision Analysis



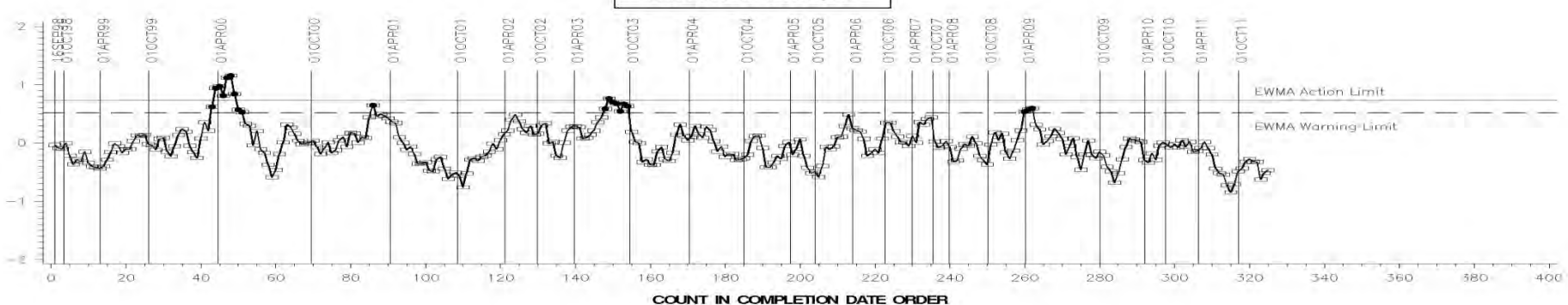
CUSUM Severity Analysis



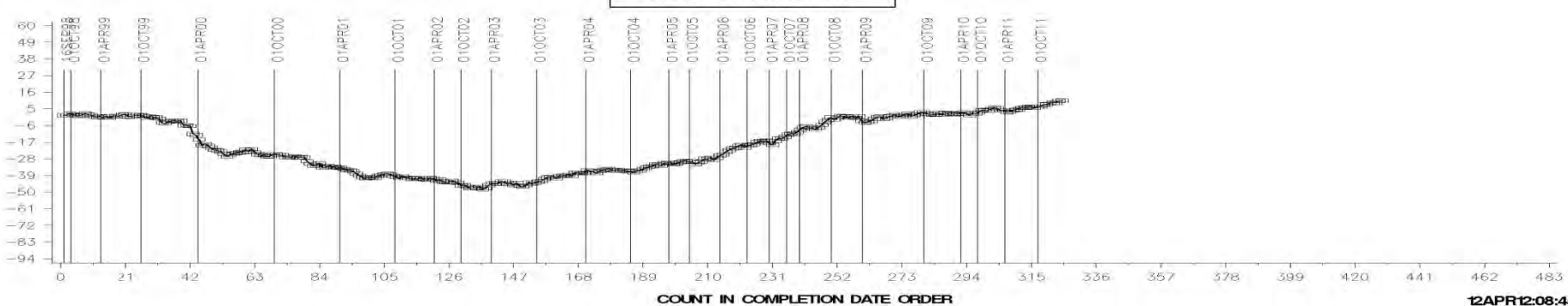
LTMS Severity Analysis



LTMS Precision Analysis



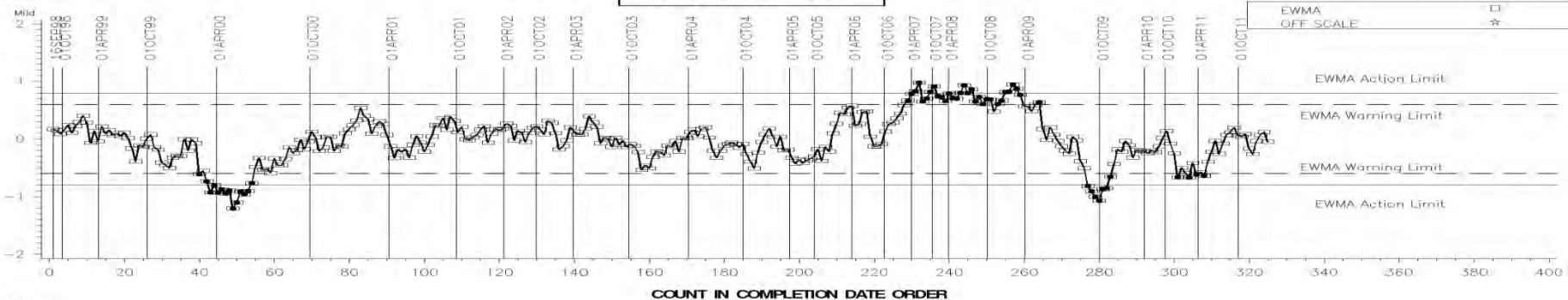
CUSUM Severity Analysis



SEQUENCE VG INDUSTRY OPERATIONALLY VALID DATA

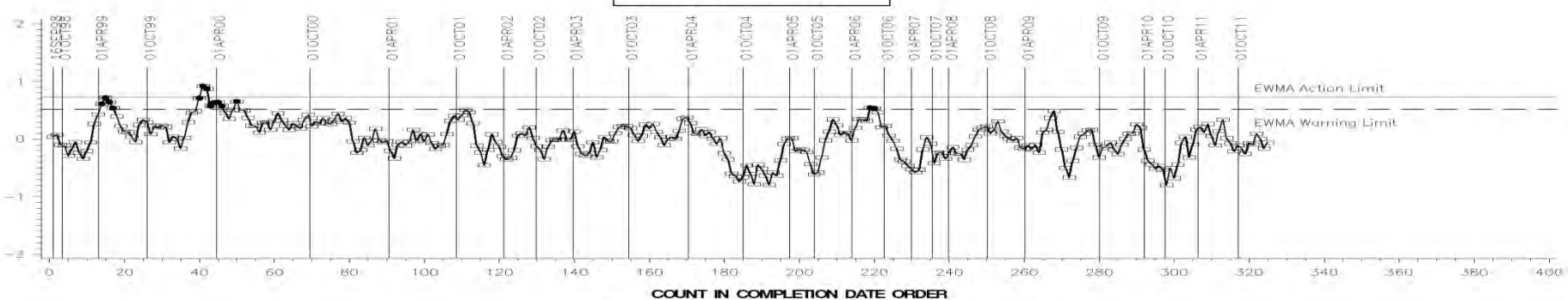
AVG. ENG. VARN. 3-PART APV + BAFFLES

LTMS Severity Analysis



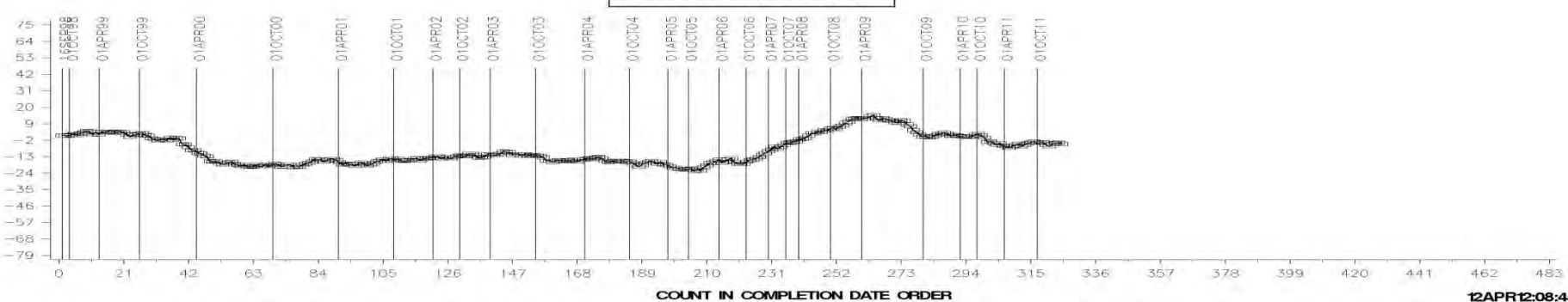
COUNT IN COMPLETION DATE ORDER

LTMS Precision Analysis



COUNT IN COMPLETION DATE ORDER

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COUNT IN COMPLETION DATE ORDER

12APR12:08:45

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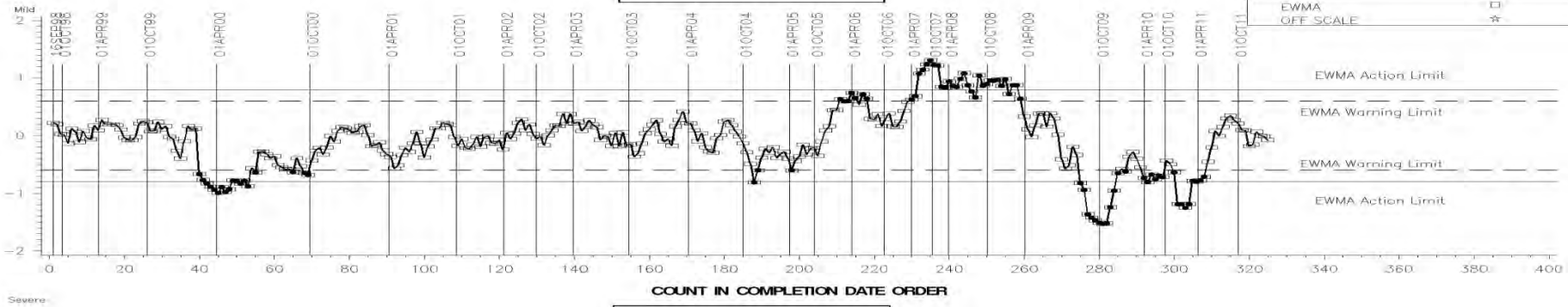
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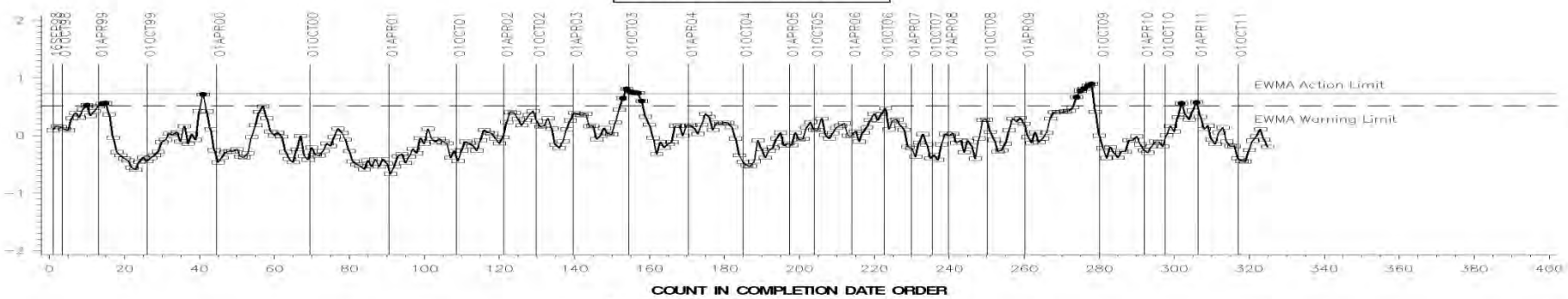
AVG PISTON SKIRT RATING

LTMS Severity Analysis



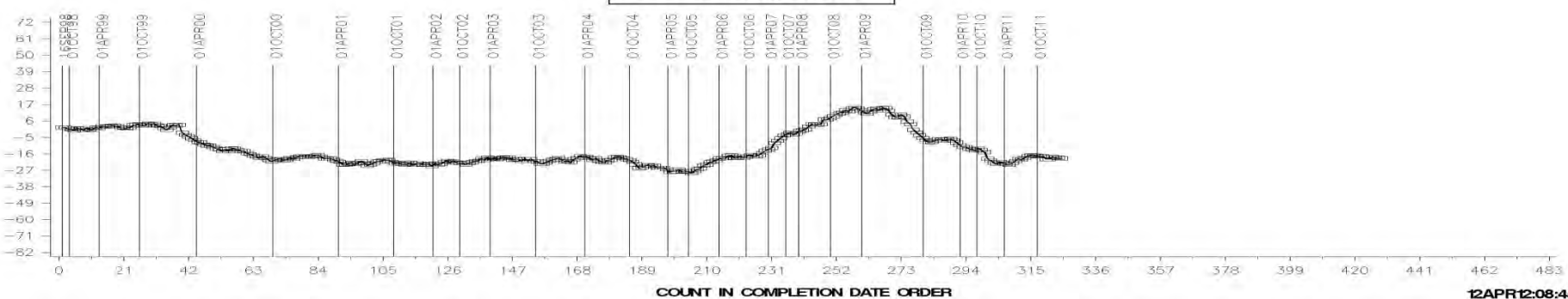
COUNT IN COMPLETION DATE ORDER

LTMS Precision Analysis



COUNT IN COMPLETION DATE ORDER

CUSUM Severity Analysis

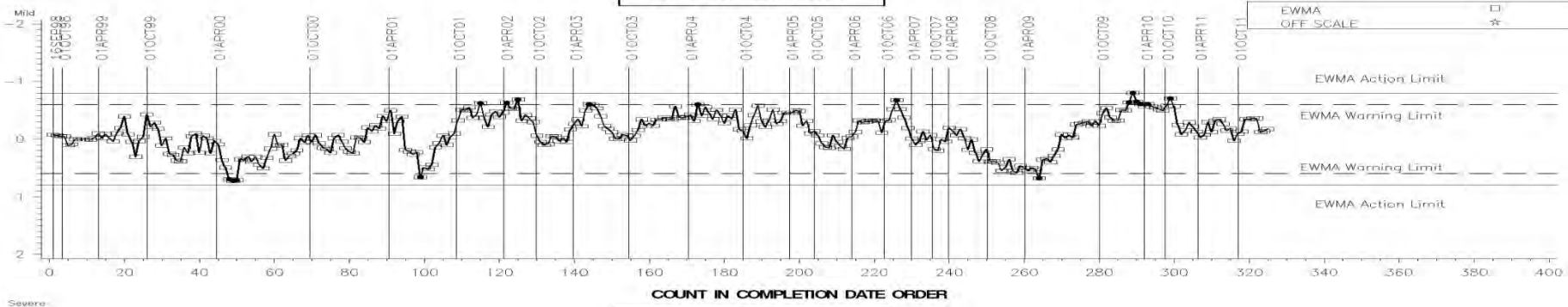


COUNT IN COMPLETION DATE ORDER

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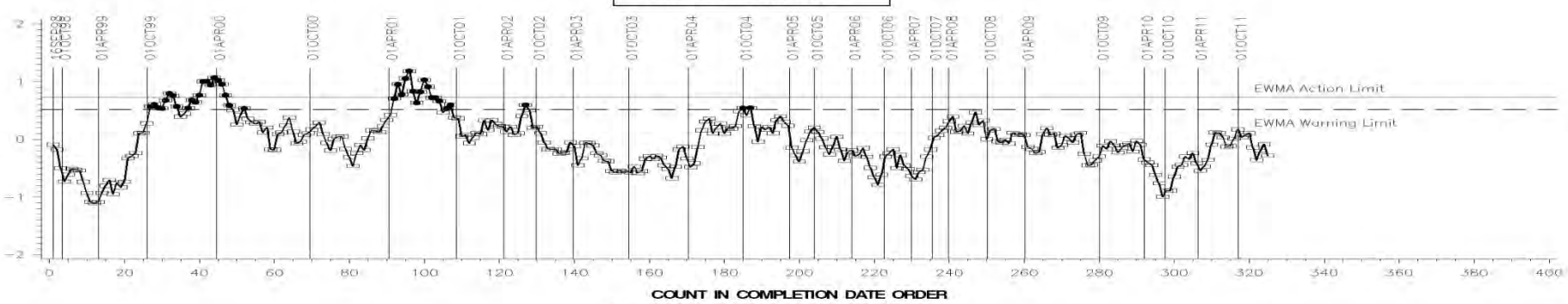
OIL SCREEN SLUDGE

LTMS Severity Analysis



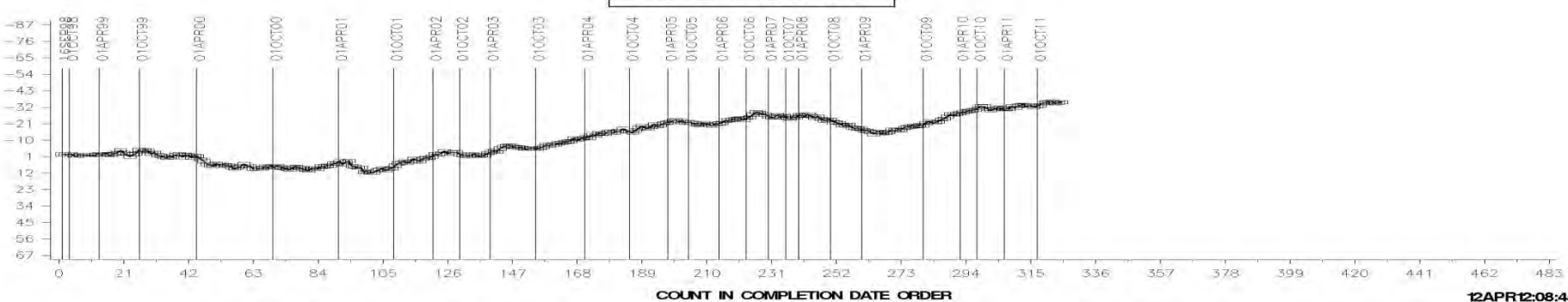
COUNT IN COMPLETION DATE ORDER

LTMS Precision Analysis



COUNT IN COMPLETION DATE ORDER

CUSUM Severity Analysis



COUNT IN COMPLETION DATE ORDER

12APR12:08:45

[Return](#)

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Appendix 1.e

Sequence VID Control Charts

» Severity, Precision, and CuSum

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LTMS Severity Analysis

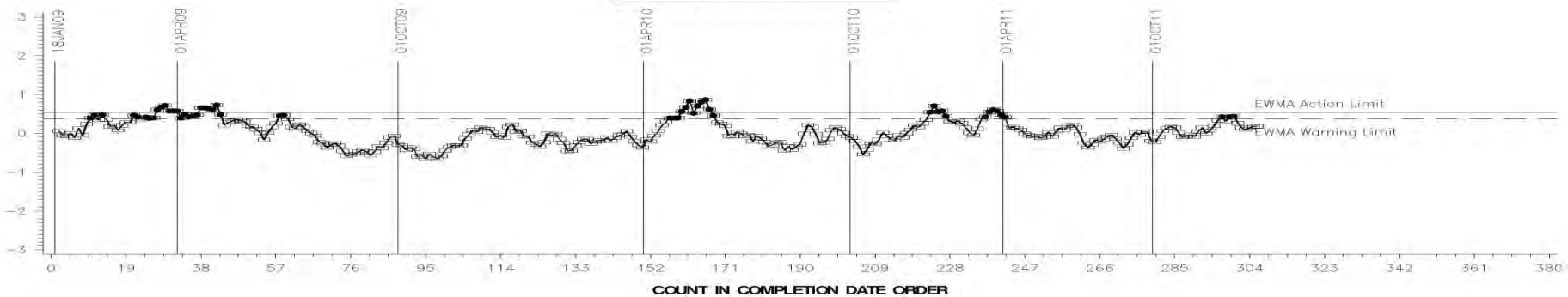
Standard Deviation Units



COUNT IN COMPLETION DATE ORDER

LTMS Precision Analysis

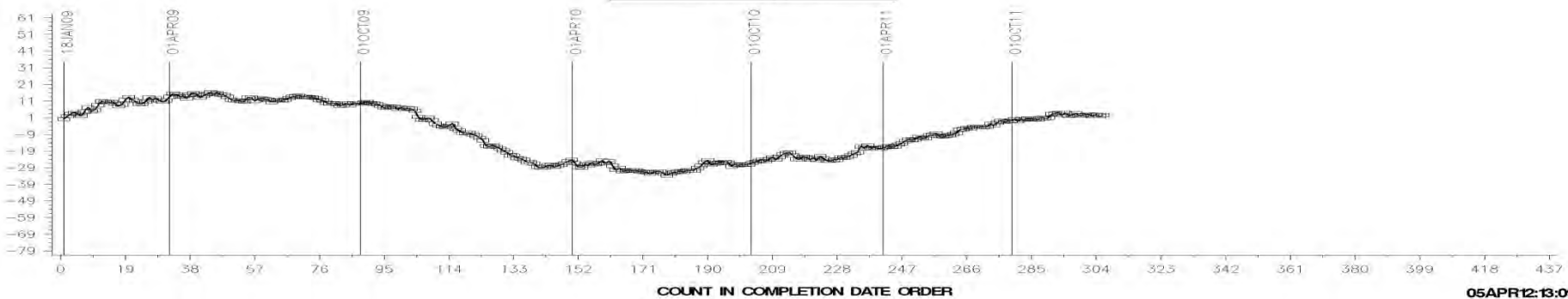
Standard Deviation Units



COUNT IN COMPLETION DATE ORDER

CUSUM Severity Analysis

Standard Deviation Units

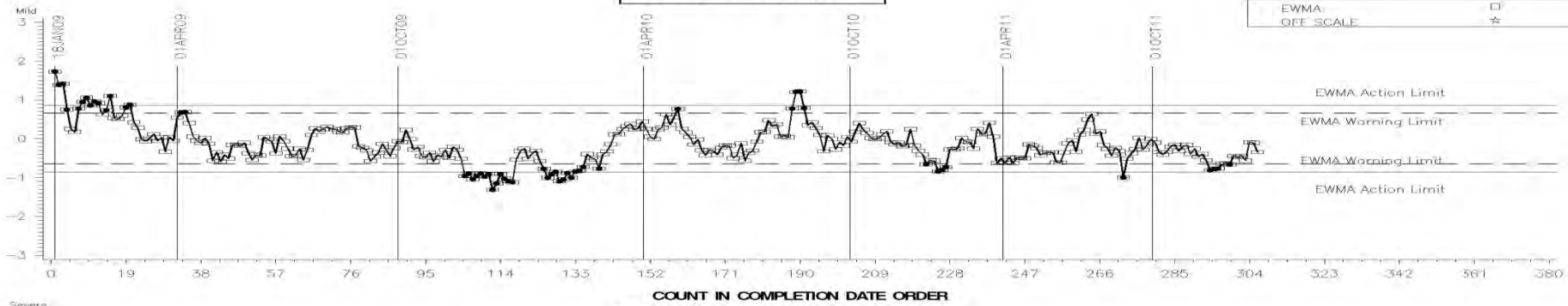


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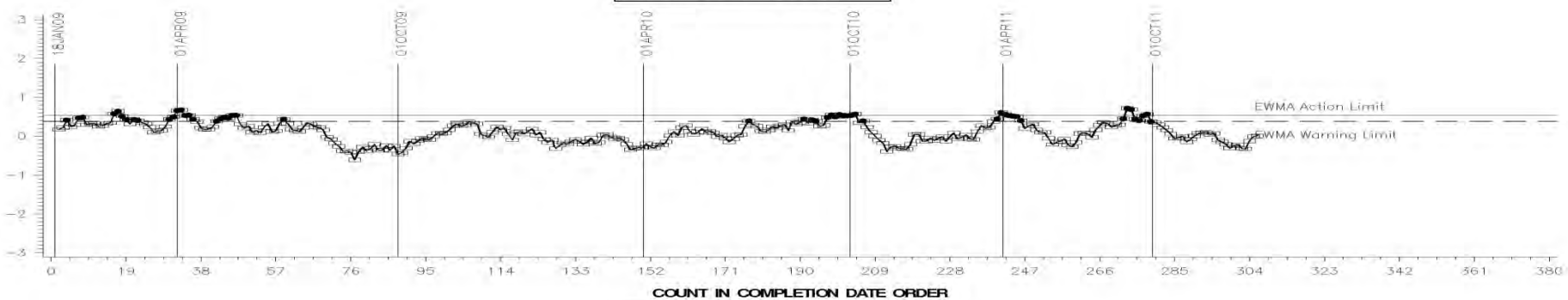
FEI FINAL RESULT PHASE II

LTMS Severity Analysis



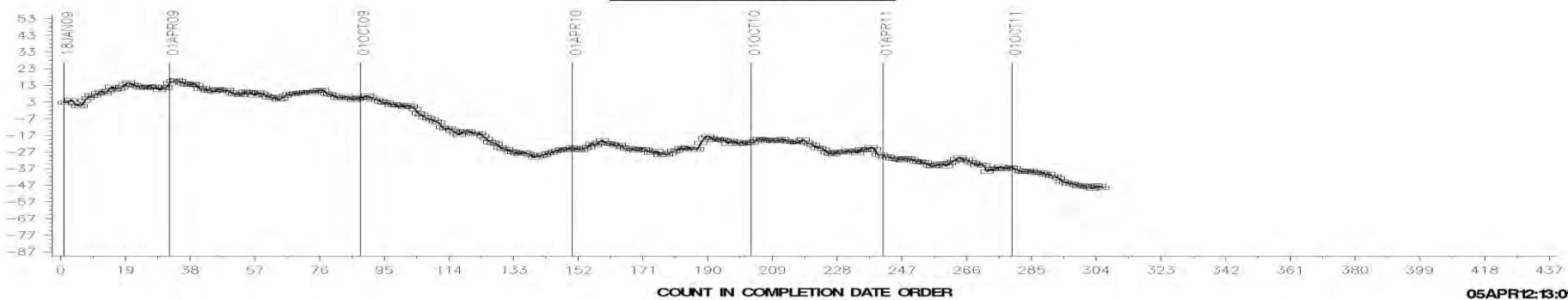
COUNT IN COMPLETION DATE ORDER

LTMS Precision Analysis



COUNT IN COMPLETION DATE ORDER

CUSUM Severity Analysis



COUNT IN COMPLETION DATE ORDER

05 APR 12:13:09

[Return](#)

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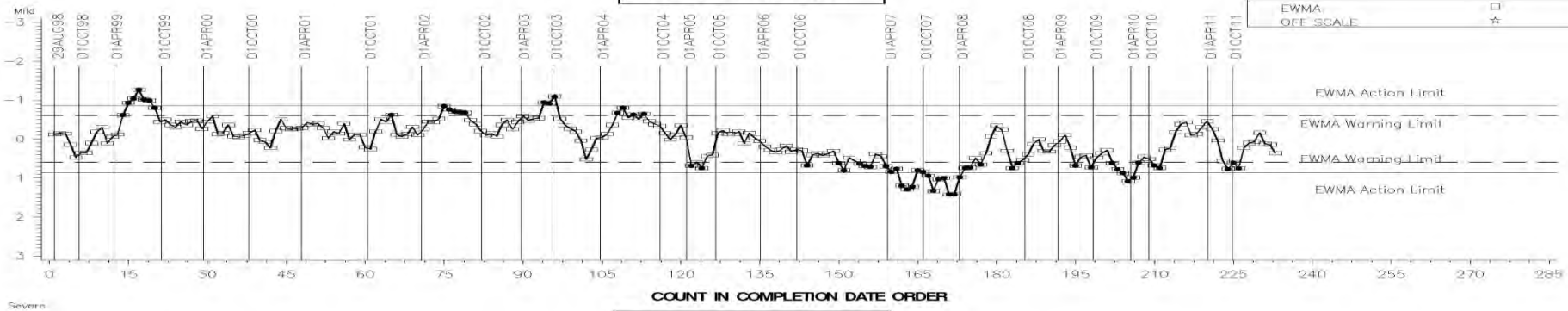
Appendix 1.f

Sequence VIII Control Charts

» Severity, Precision, and CuSum

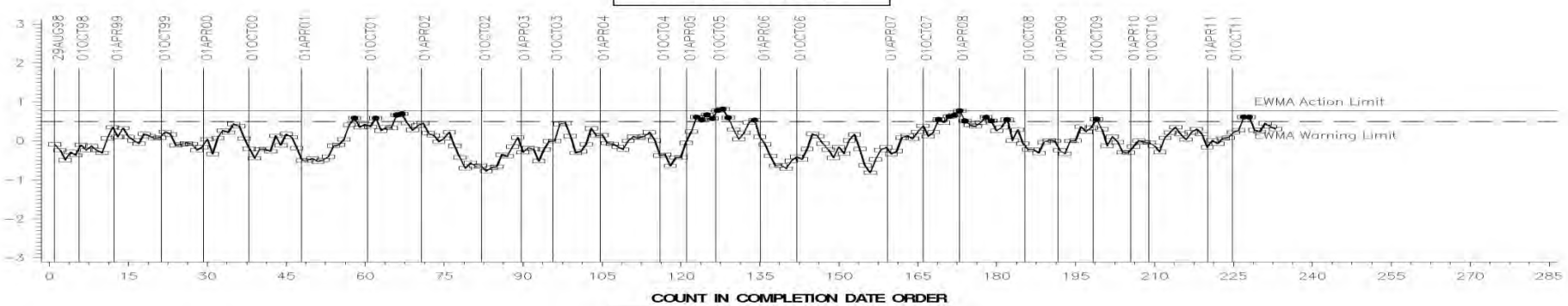
FINAL BEARING WEIGHT LOSS

LTMS Severity Analysis



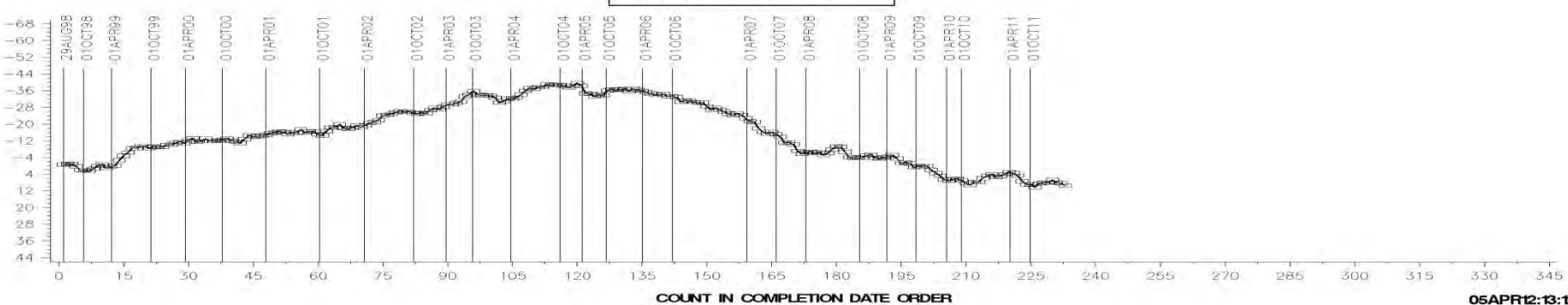
COUNT IN COMPLETION DATE ORDER

LTMS Precision Analysis



COUNT IN COMPLETION DATE ORDER

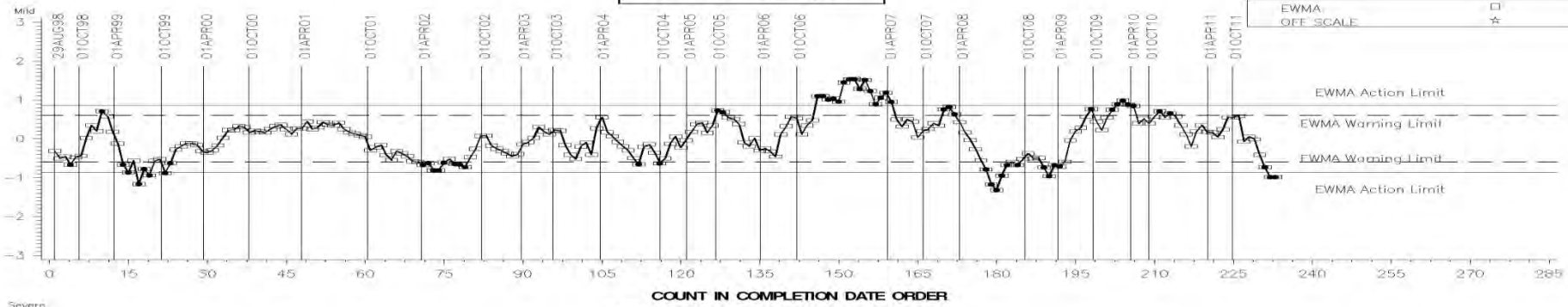
CUSUM Severity Analysis



COUNT IN COMPLETION DATE ORDER

LTMS Severity Analysis

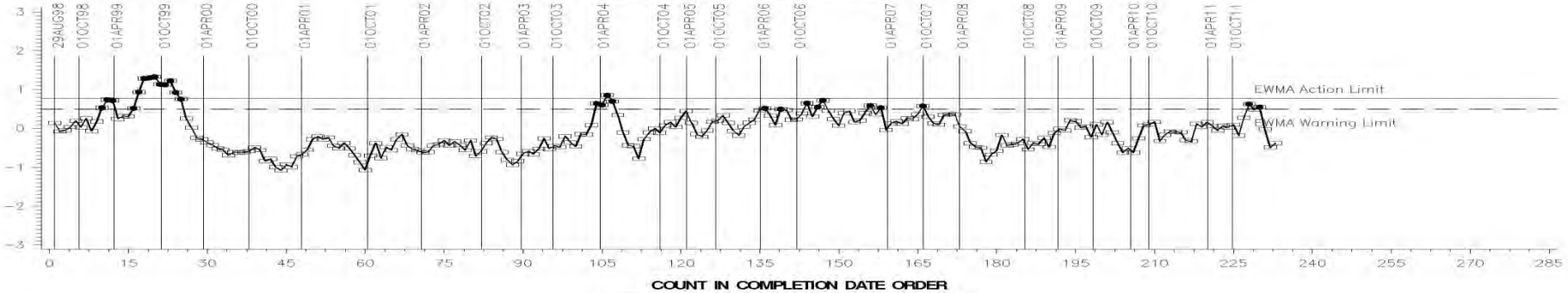
Standard Deviation Units



COUNT IN COMPLETION DATE ORDER

LTMS Precision Analysis

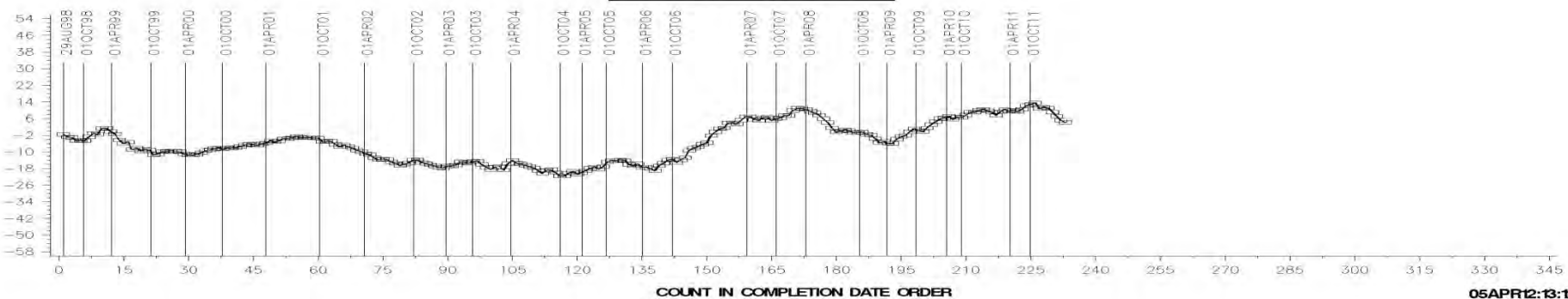
Standard Deviation Units



COUNT IN COMPLETION DATE ORDER

CUSUM Severity Analysis

Standard Deviation Units



COUNT IN COMPLETION DATE ORDER