ASTM D02.B1 Semiannual Report Passenger Car Reference Oil Testing

October 2015

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Passenger Car Engine Oil Testing Executive Summary

- Seq. IIIF
  - Two laboratories successfully calibrated with tests on size 7-8 pistons and rings.
- Seq. IIIG
  - New re-blend of oil 434 is now available, four successful calibration tests completed on oil 434-2. There was one failing result on this blend.
  - Size 9 pistons were introduced by one lab this period.

Passenger Car Engine Oil Testing Executive Summary

- Seq. VI
  - 1010 has been depleted at the TMC, 3 gallons remain. A re-blend has been procured and two successful calibration attempts were reported this period.
  - Industry estimates show a limited number of engines remain for Sequence VID Testing
  - A new blend of 542 has been blended and should be available in the next few weeks.

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Calibrated Labs and Stands*

Test	Labs	Stands
IIIF	4	4
IIIG/A/B	4	11
IVA	3	4
VG	3	5
VID	4	7
VIII	2	3

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*As of 9/30/2015

Sequence IIIF

- October 2015

Sequence IIIF Activity

Test Status	Validity Code	#
Acceptable Calibration Test	AC	5
Total		**5**

Sequence IIIF Test Severity

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

SEQUENCE IIIF INDUSTRY OPERATIONALLY VALID DATA

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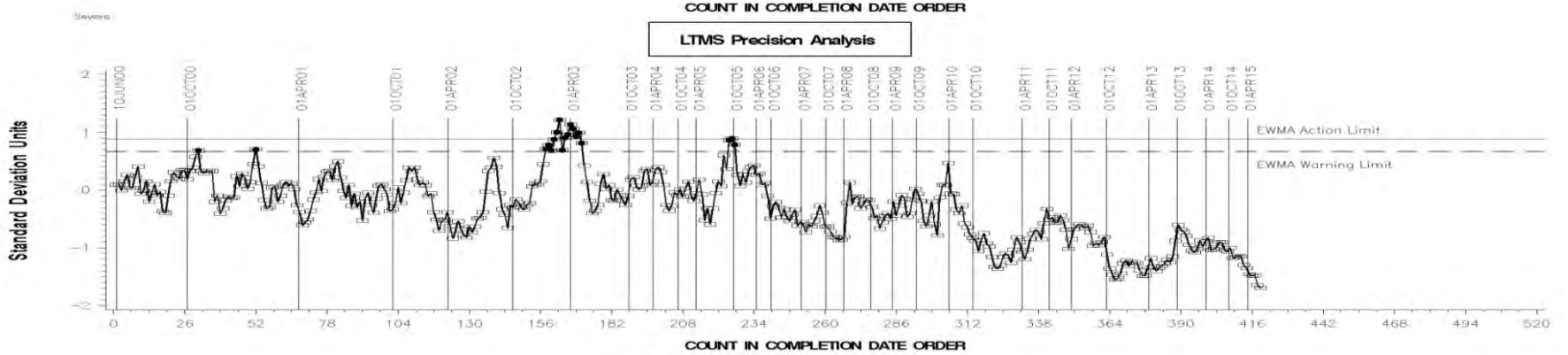
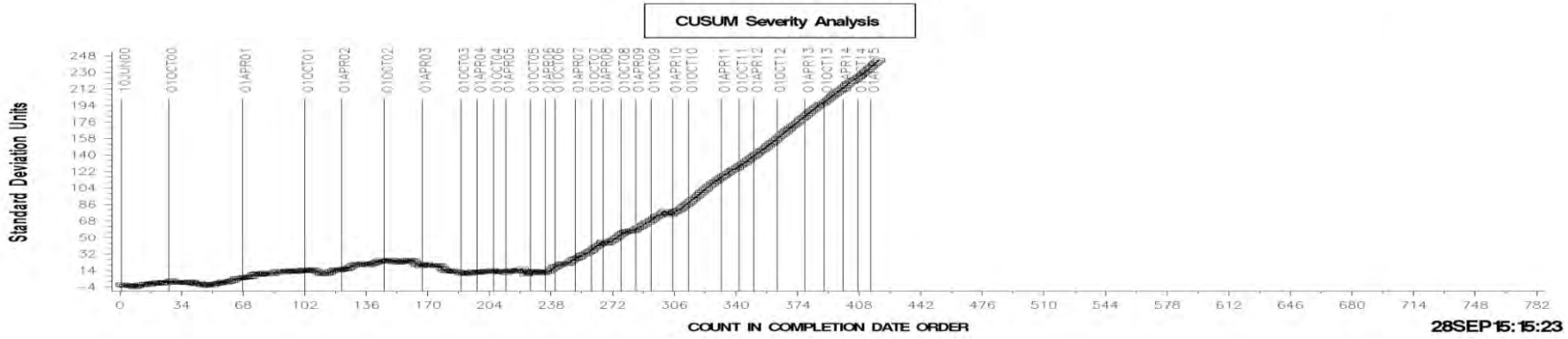
AVERAGE PISTON SKIRT VARNISH FINAL ORIG UNIT RES

LTMS Severity Analysis

LTMS Precision Analysis



CUSUM Severity Analysis



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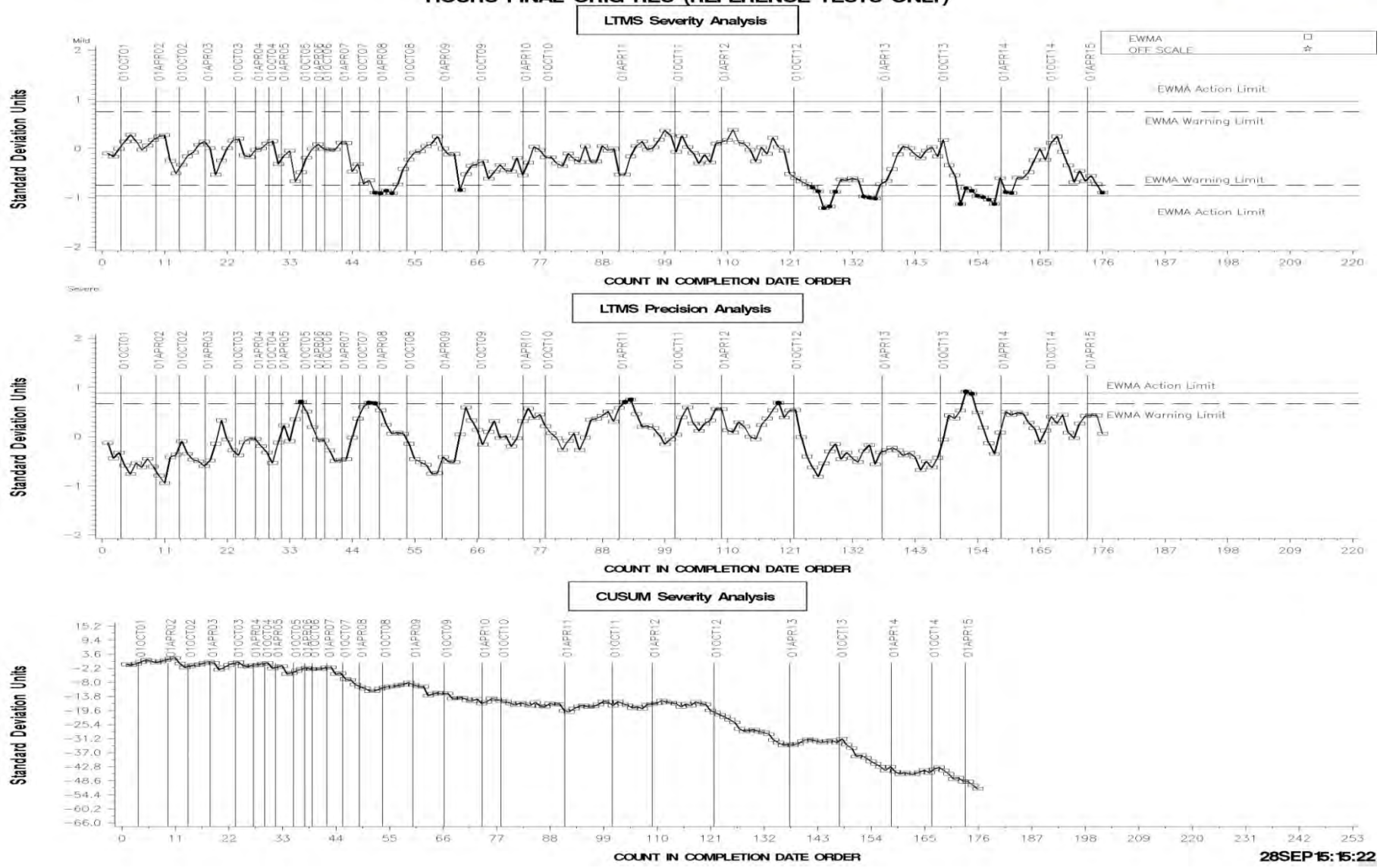
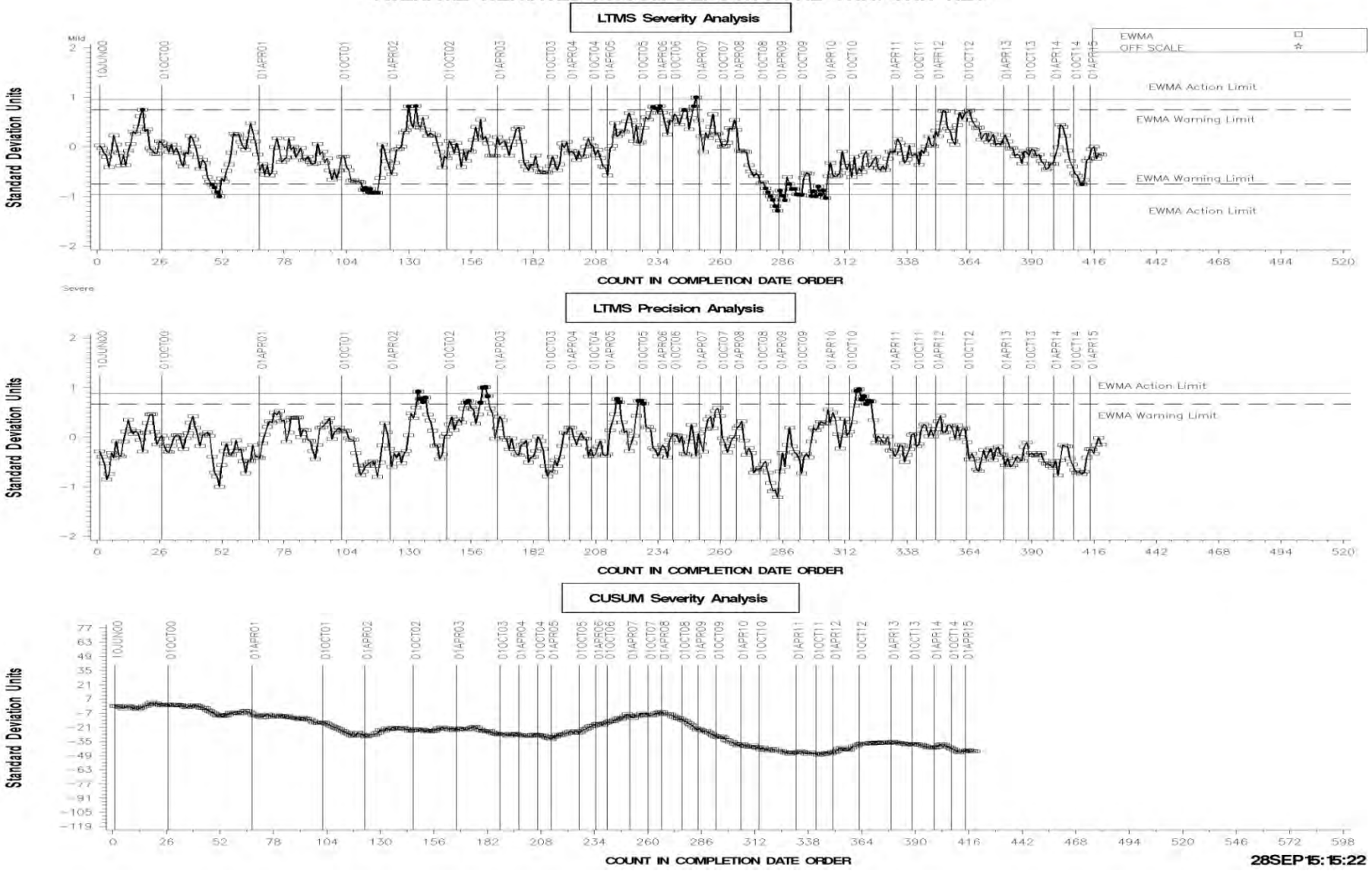
HOURS FINAL ORIG RES (REFERENCE TESTS ONLY)



SEQUENCE IIIF INDUSTRY OPERATIONALLY VALID DATA

AVERAGE WEIGHTED PISTON DEPOSITS FNL ORIG UNIT RES



SEQUENCE IIIF INDUSTRY OPERATIONALLY VALID DATA

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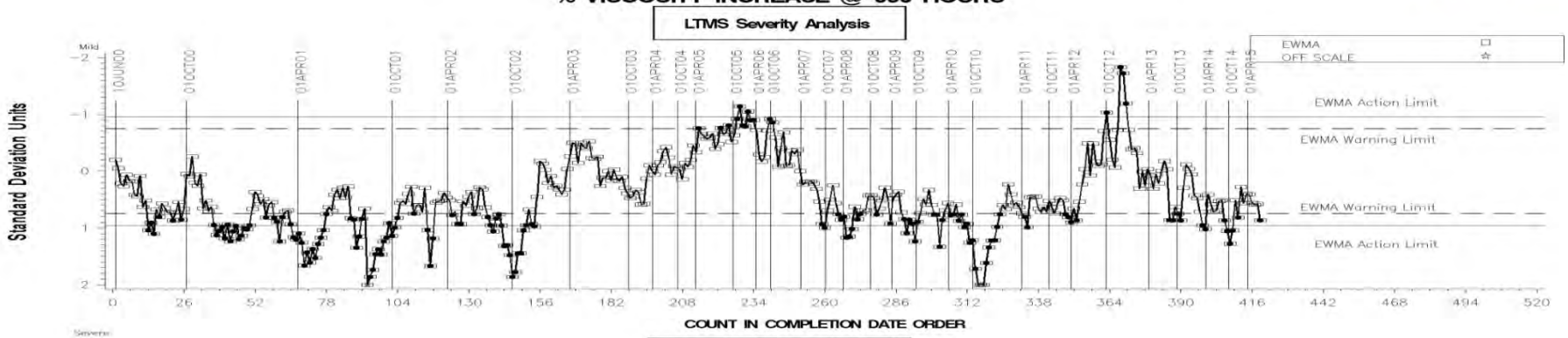
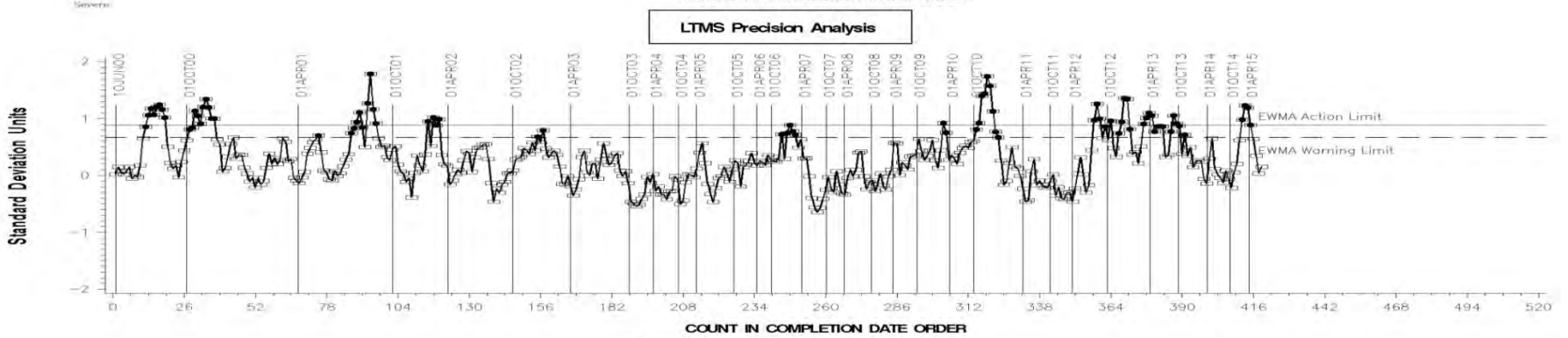
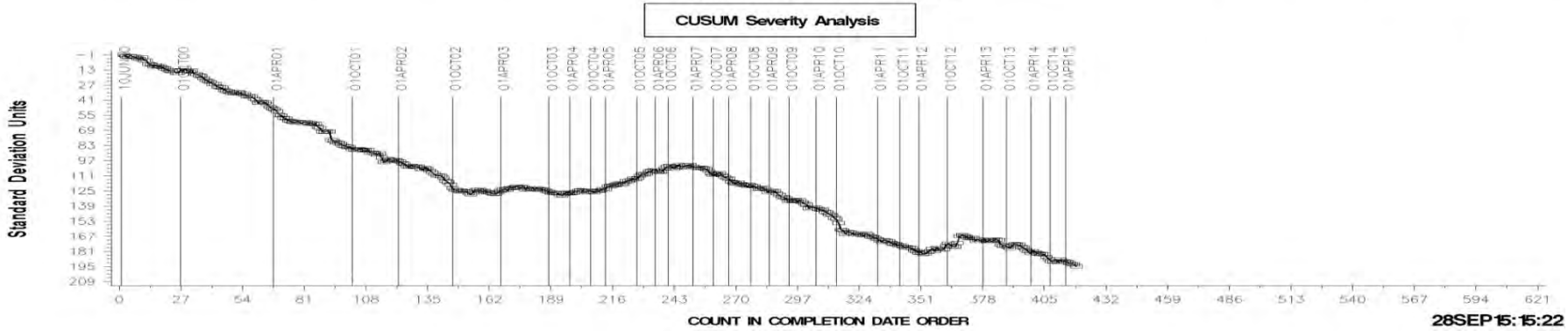
% VISCOSITY INCREASE @ 060 HOURS







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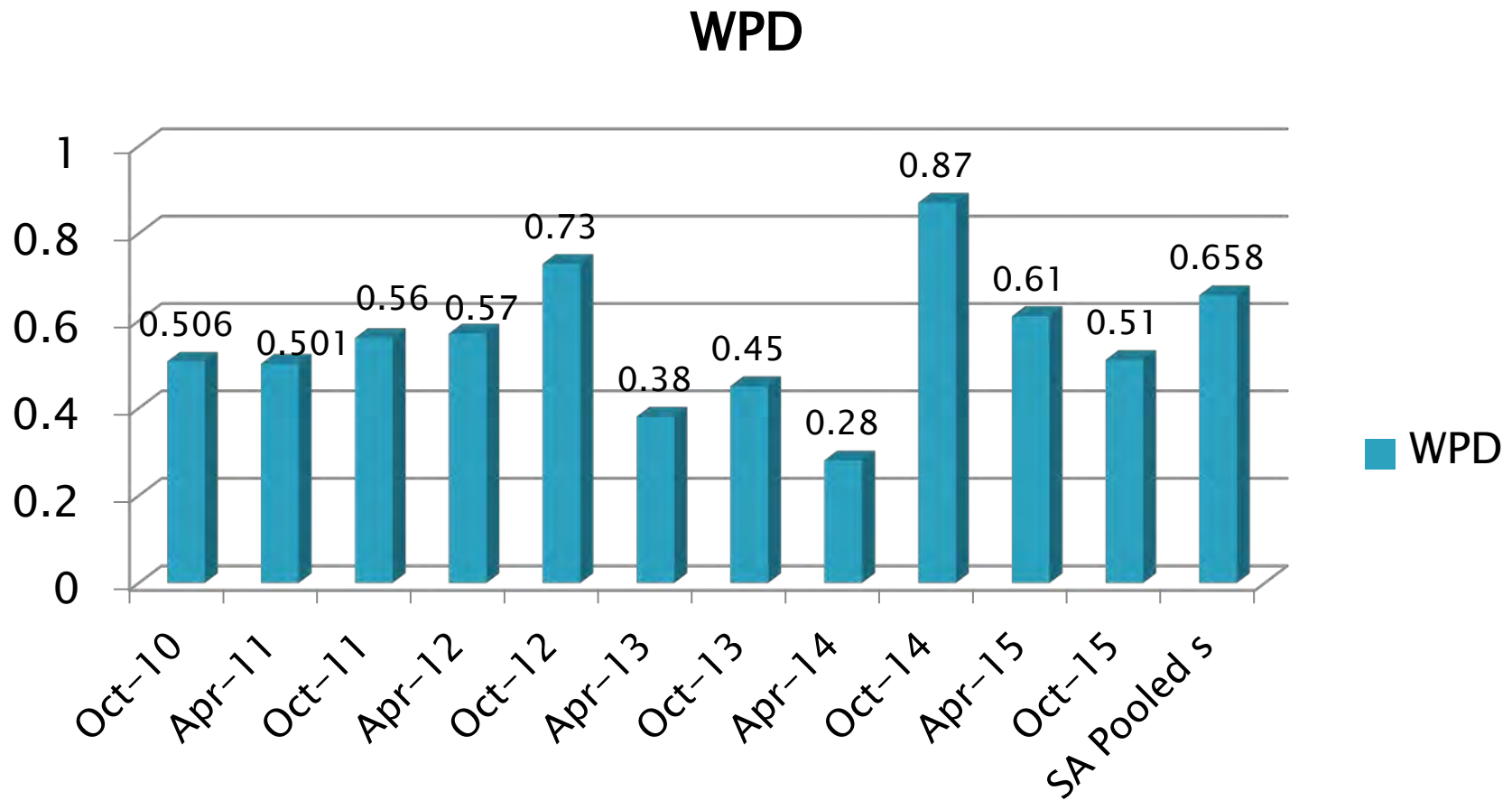
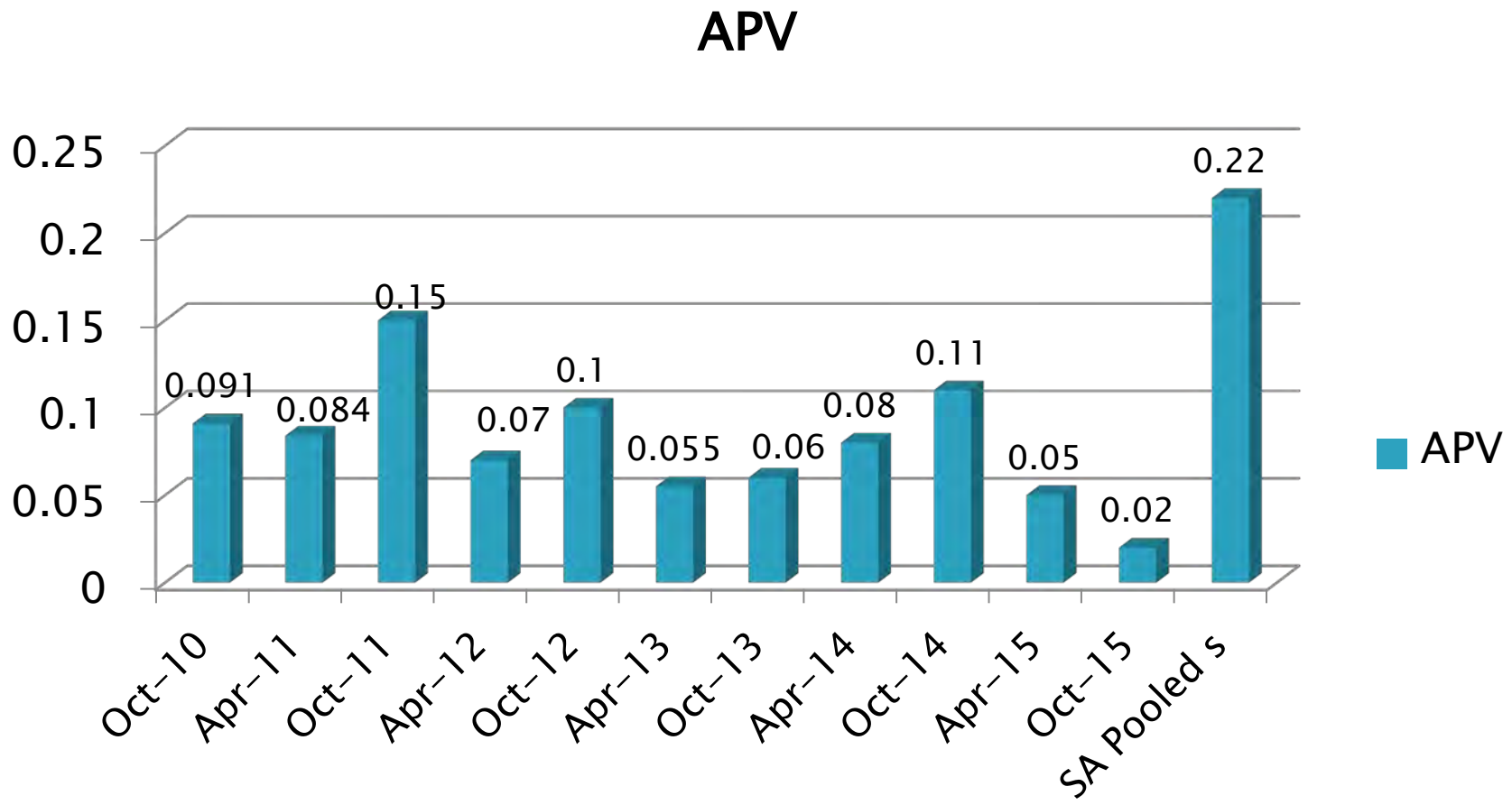


IIIF Precision Estimates



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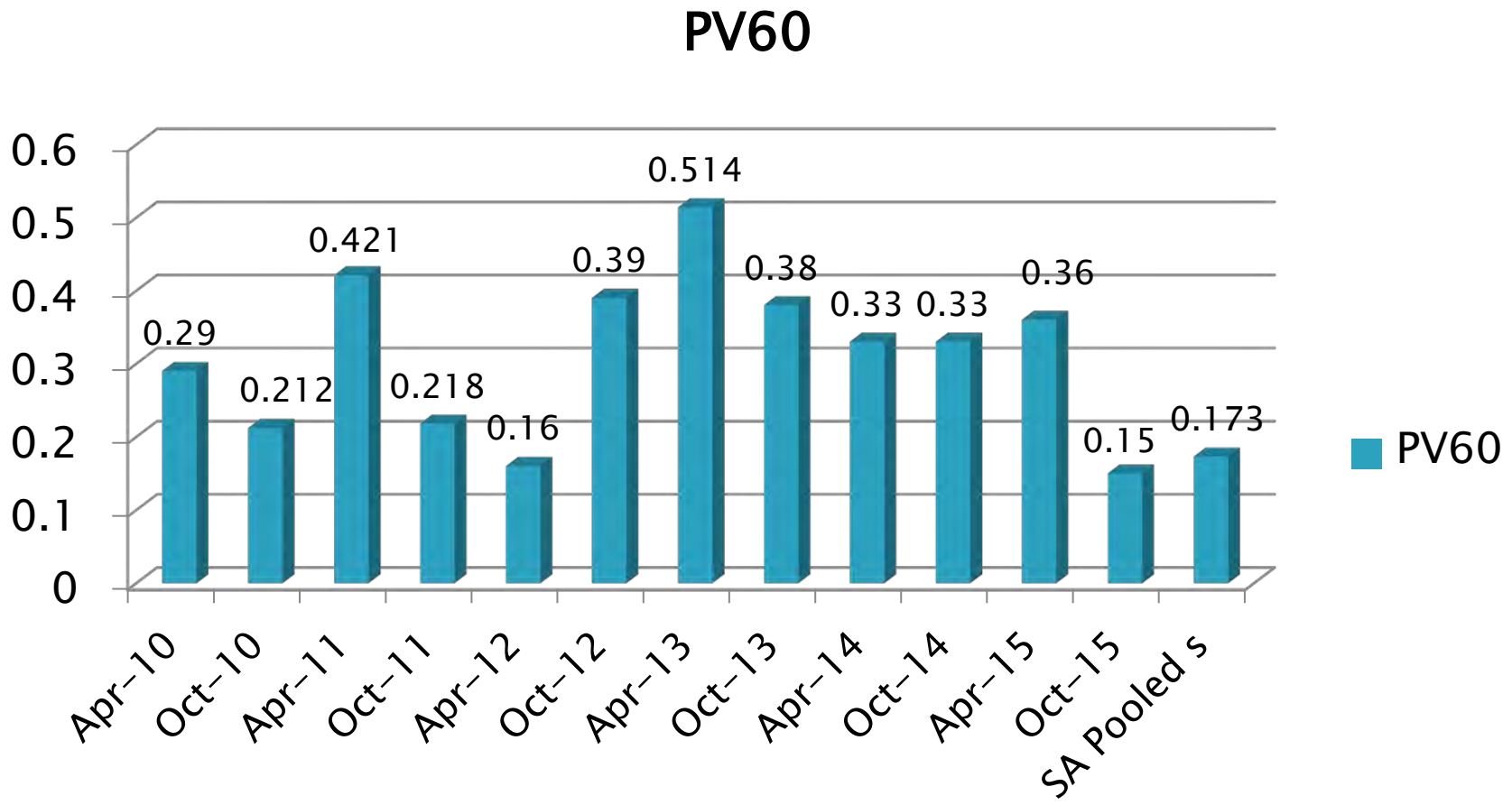

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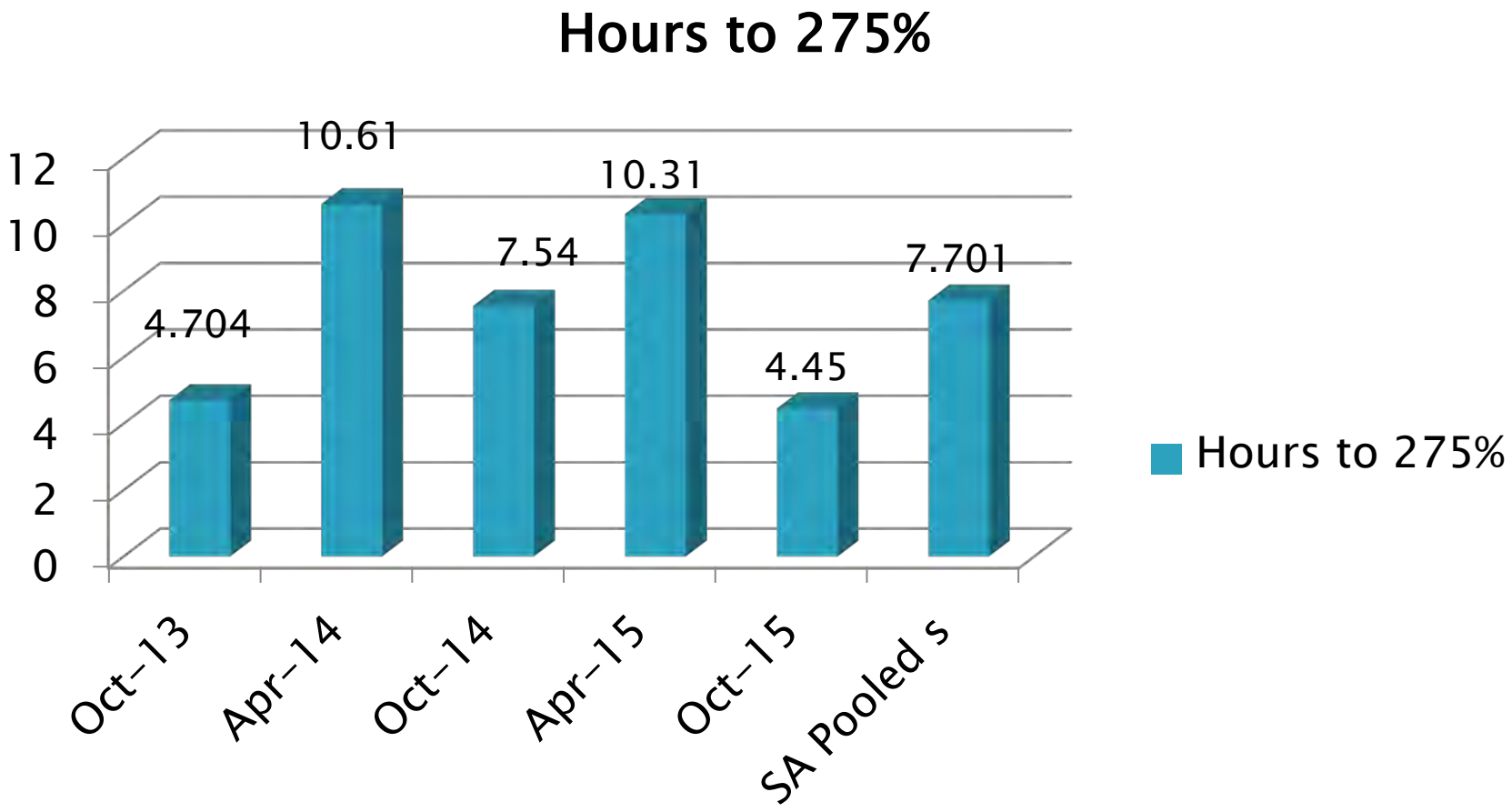

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Sequence IIIG/A/B

- October 2015

Sequence IIIG Activity

Test Status	Validity Code	#
Acceptable Calibration Test	AC	8
Failed Calibration Test	OC	1
Operationally Invalid	LC	1
Hardware Test	NH	1
Total		11

Sequence IIIG – Failed Tests

Test Status	Number of Tests
Severe PVIS	1
Total	1

Sequence IIIG – Lost Tests*

Test Status	Cause	#
Invalid	Load Control Issues	1
Totals		1

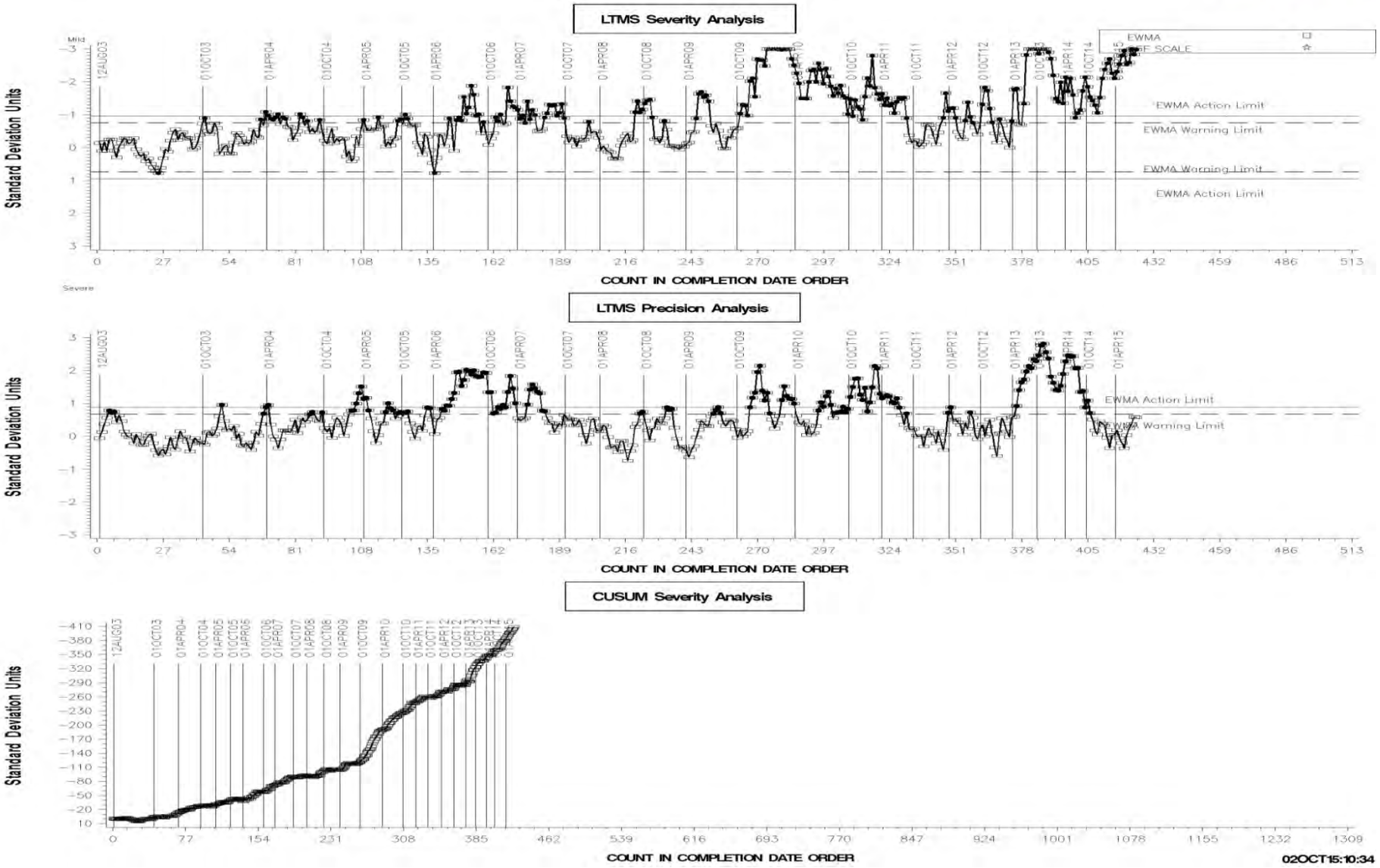
*Invalid and aborted tests

Sequence IIIG Test Severity

- ACLW in severity action alarm
  - Long-term mild trend
- PVIS in severity and precision action alarm (severe)
- WPD is in control
  - Long-term severe trend continuing
- MRV is in severity action alarm (severe)
- PHOS in precision warning alarm

SEQUENCE IIIG INDUSTRY OPERATIONALLY VALID DATA

AVERAGE CAM + LIFTER WEAR



SEQUENCE IIIG INDUSTRY OPERATIONALLY VALID DATA

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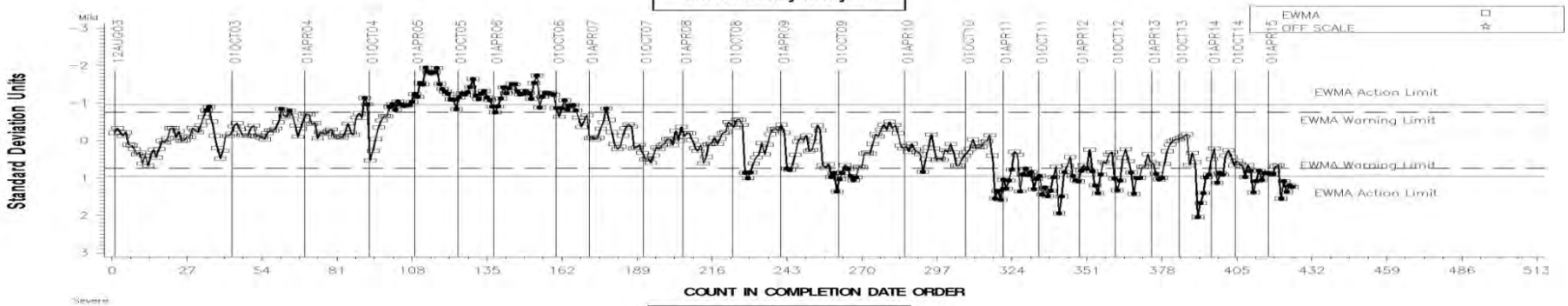
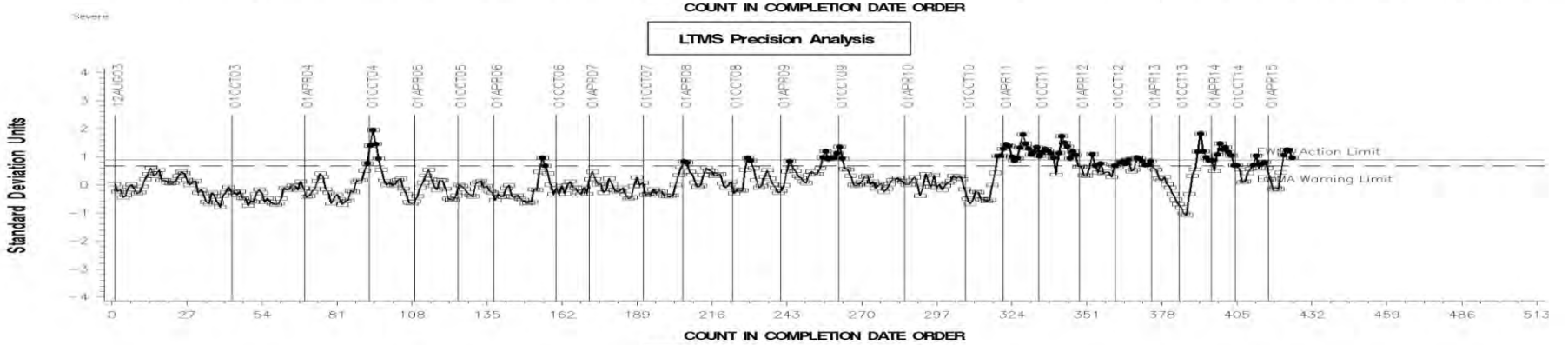
VISCOSITY INCREASE

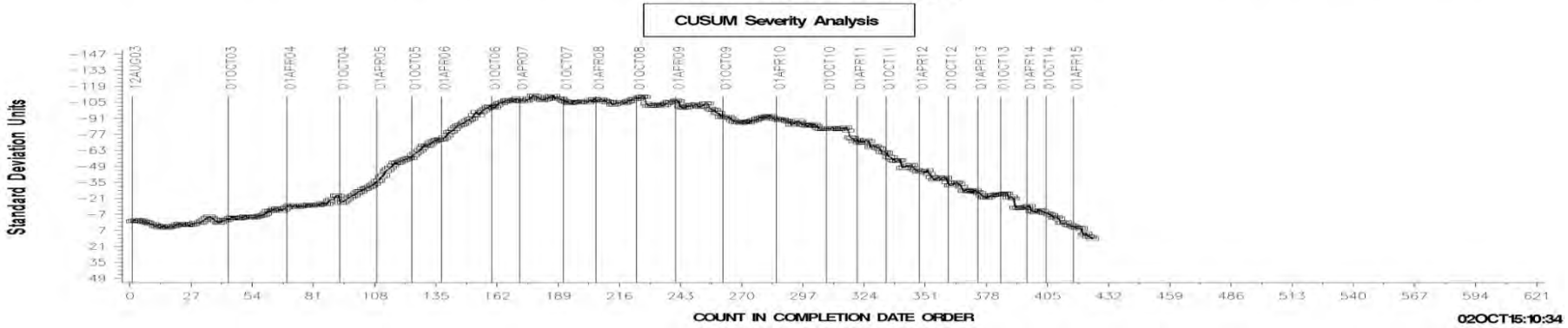
LTMS Severity Analysis



LTMS Precision Analysis



CUSUM Severity Analysis



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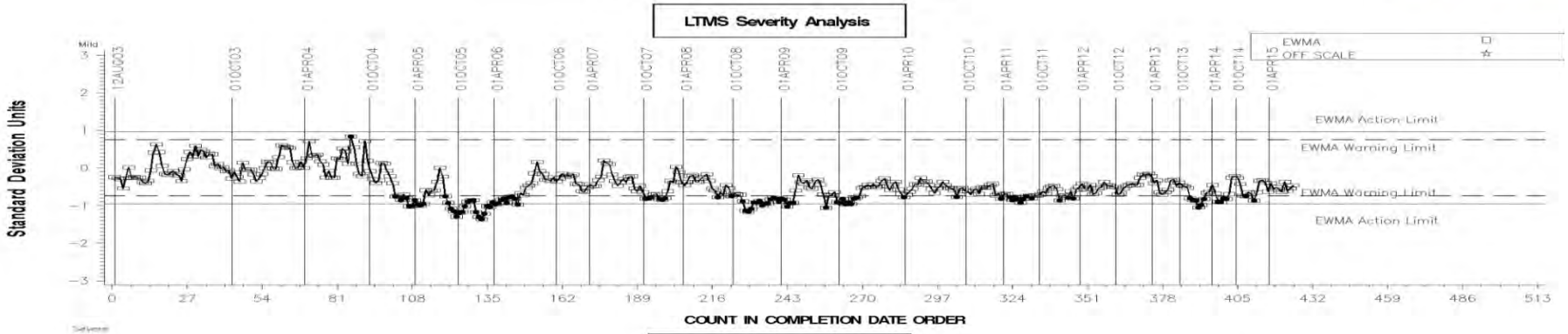
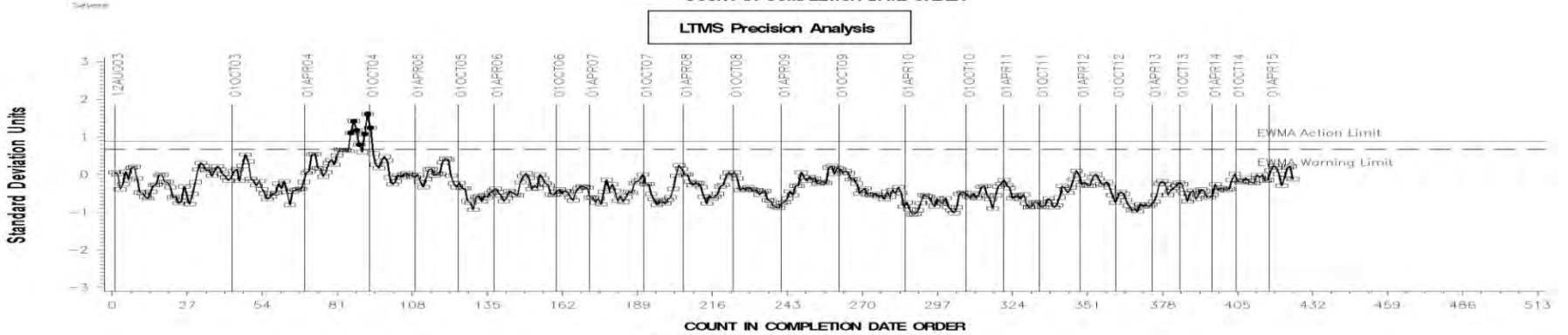
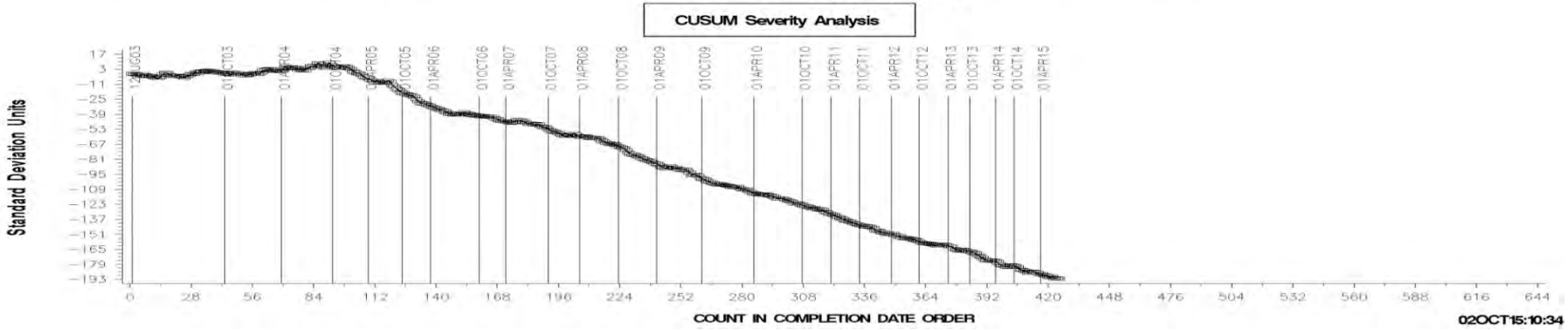
SEQUENCE IIIG INDUSTRY OPERATIONALLY VALID DATA

AVERAGE WEIGHTED PISTON DEPOSITS







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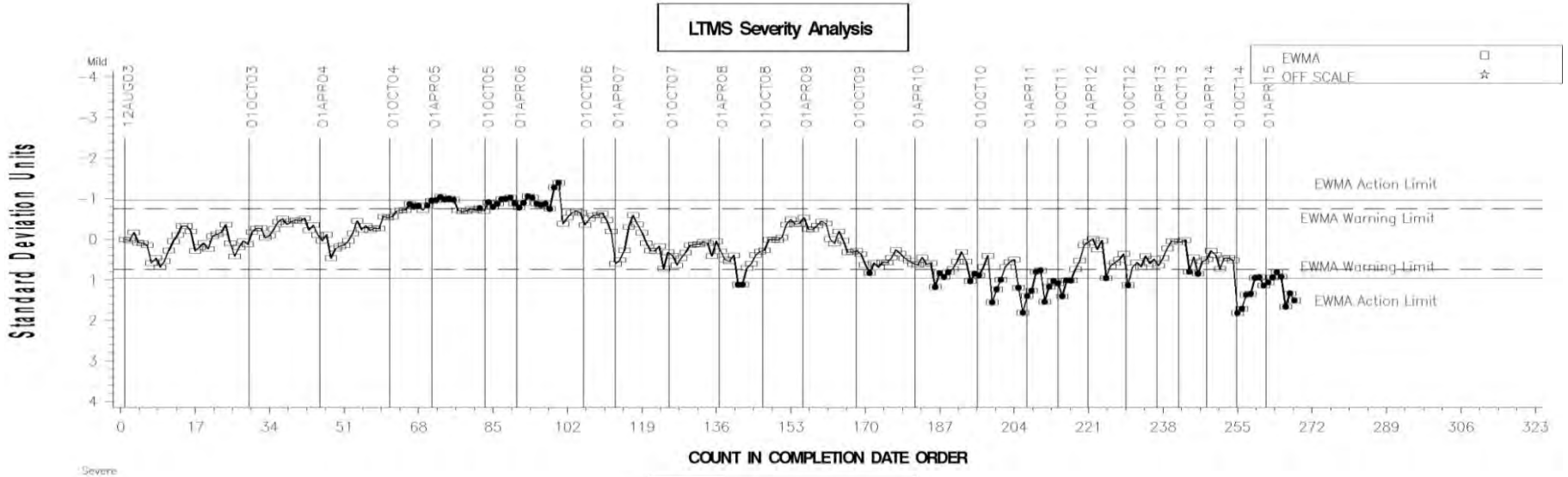
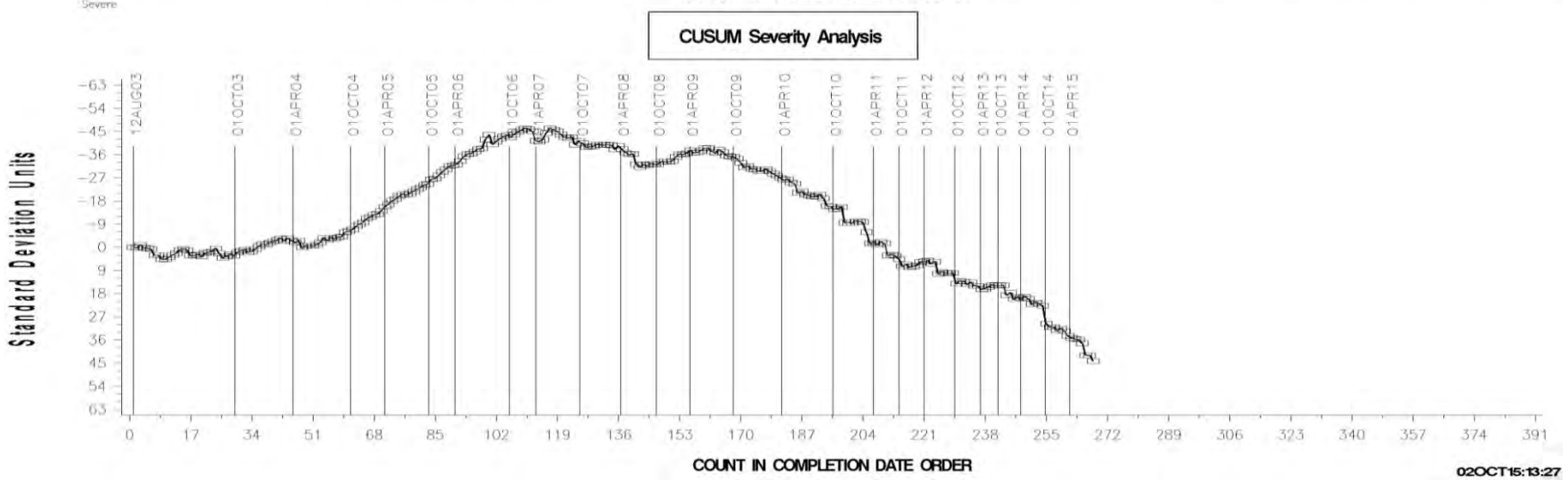
SEQUENCE IIIGA INDUSTRY OPERATIONALLY VALID DATA

MRV VISCOSITY RESULT





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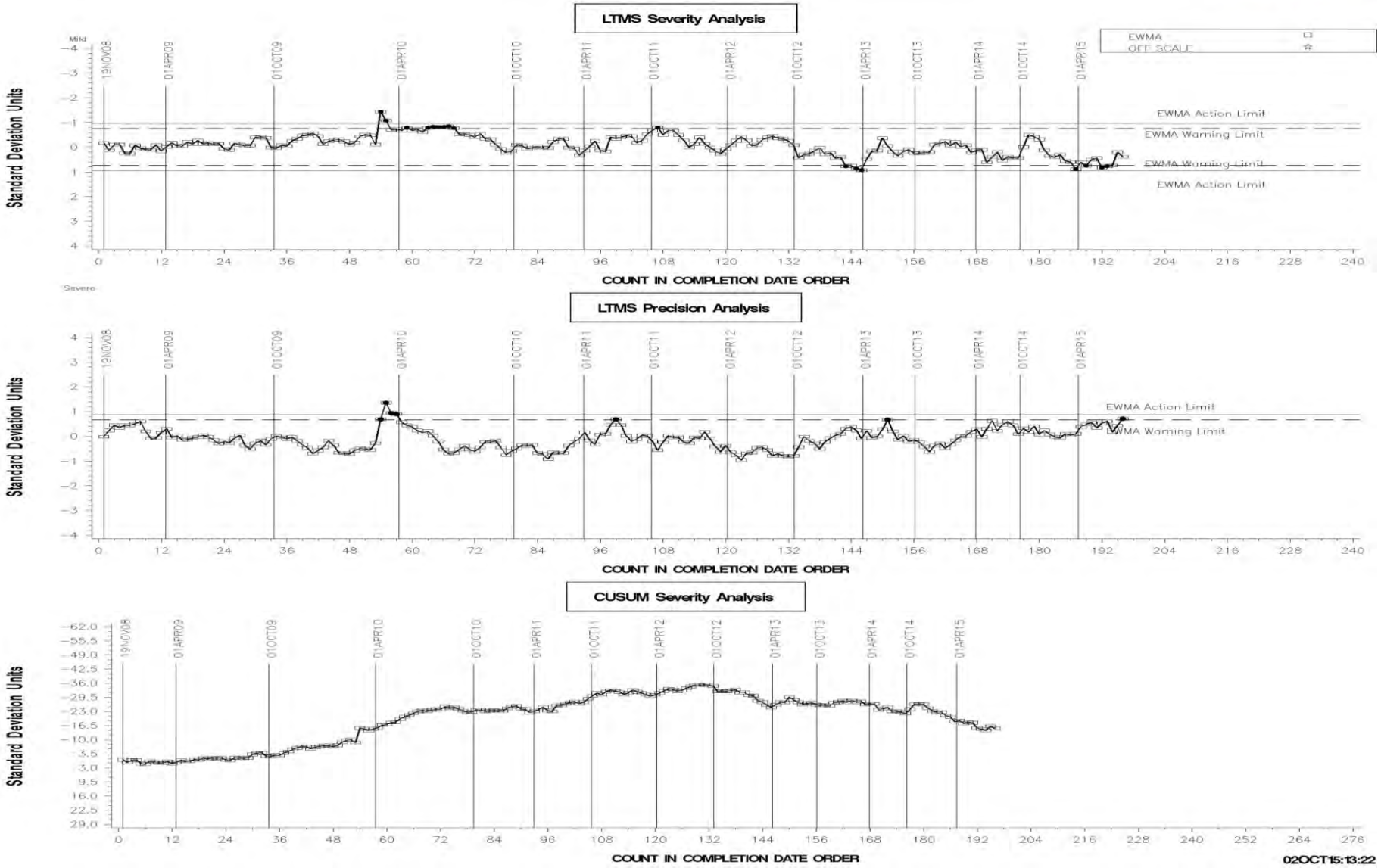
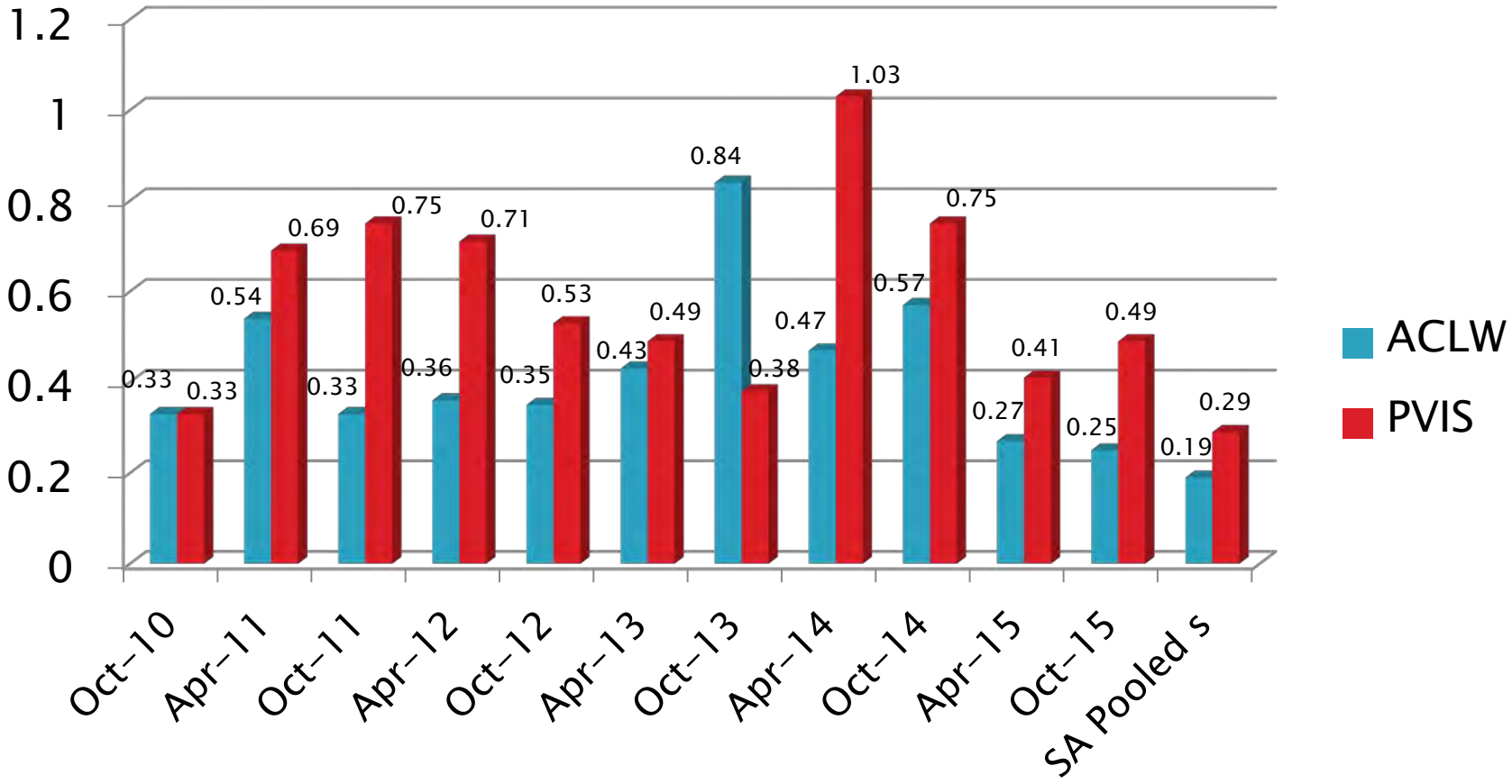
SEQUENCE IIIGB INDUSTRY OPERATIONALLY VALID DATA

PHOS RETENTION



IIIG Precision Estimates



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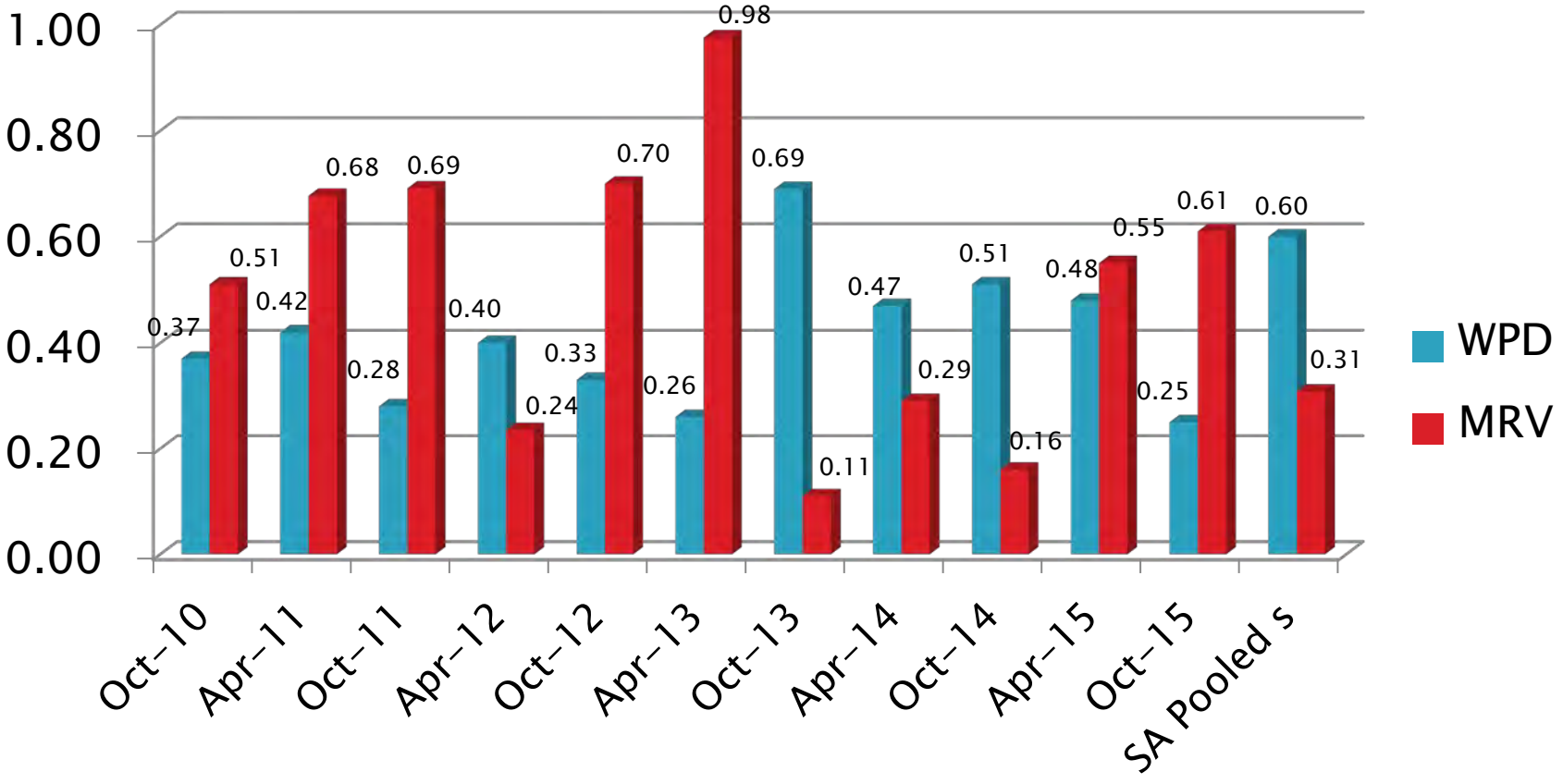

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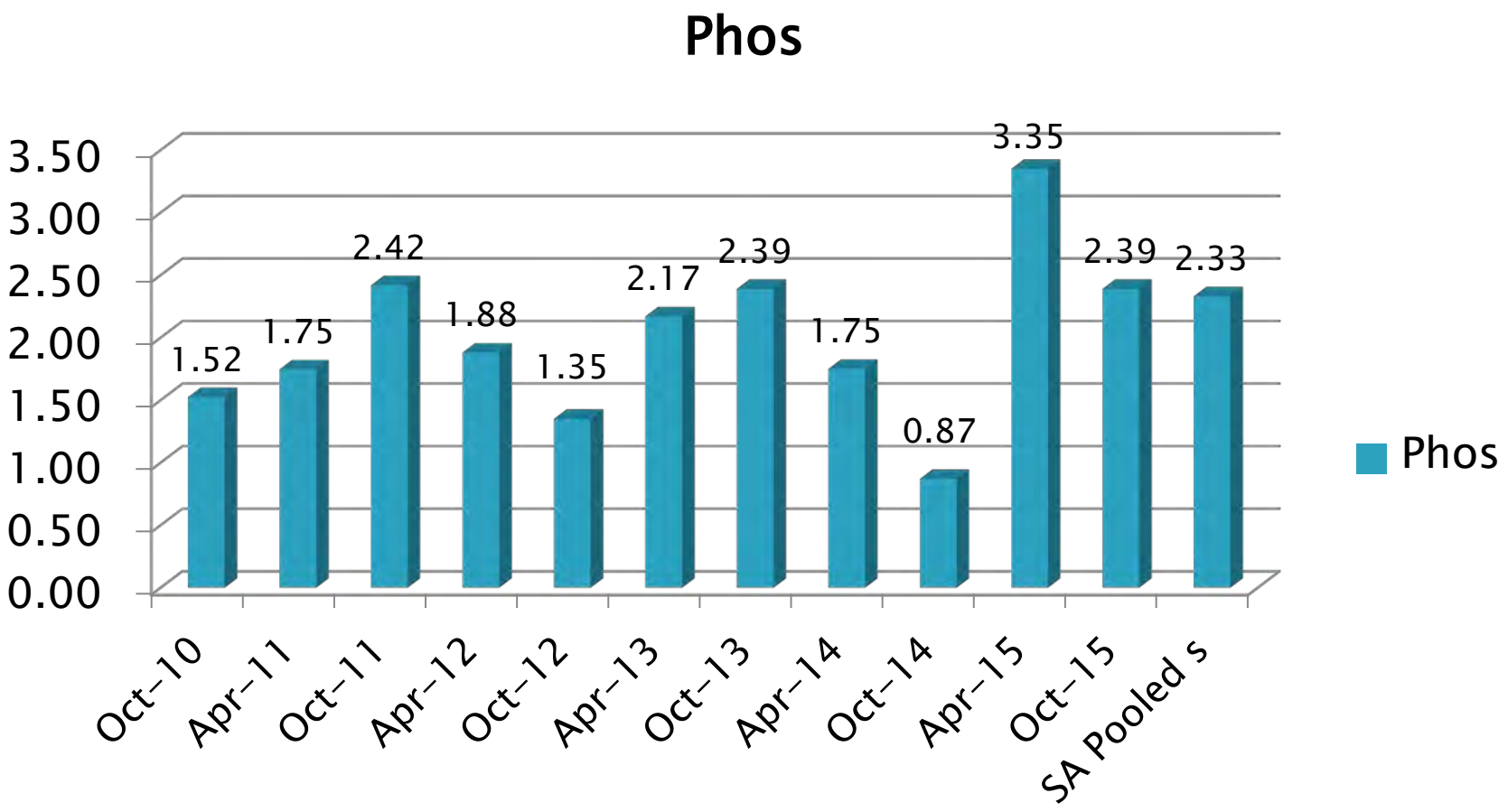

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Sequence IVA

- October 2015

Sequence IVA Activity

Test Status	Validity Code	#
Acceptable Calibration Test	AC	5
Operationally Invalid	LC	1
Total		6

Sequence IVA Test Severity

- ACW in control.

SEQUENCE IVA INDUSTRY OPERATIONALLY VALID DATA

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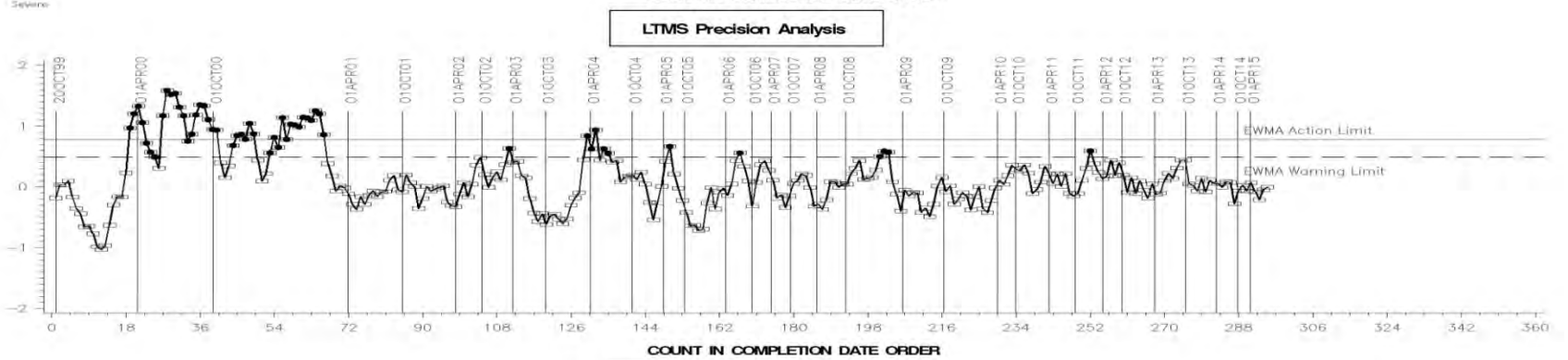
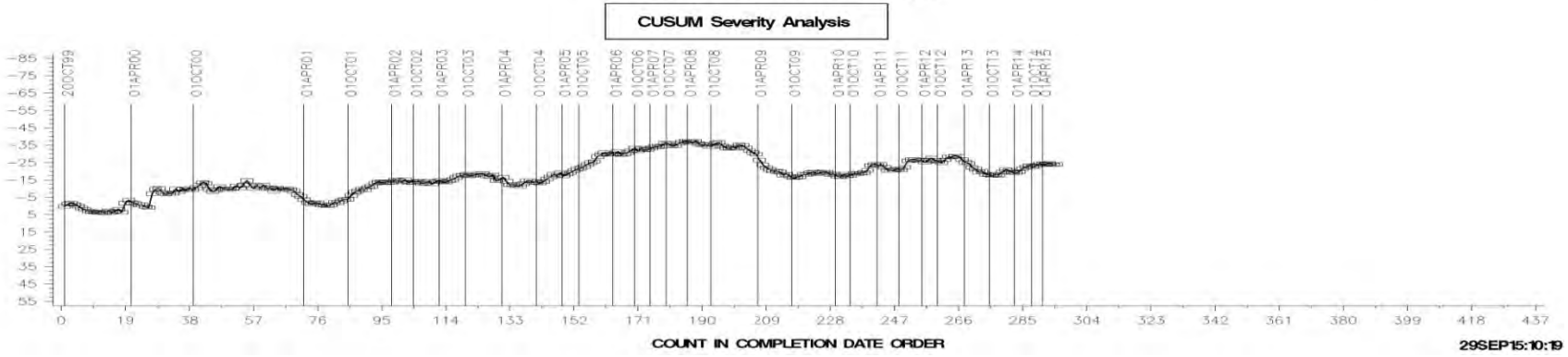
AVERAGE CAM WEAR

LTMS Severity Analysis

LTMS Precision Analysis



CUSUM Severity Analysis



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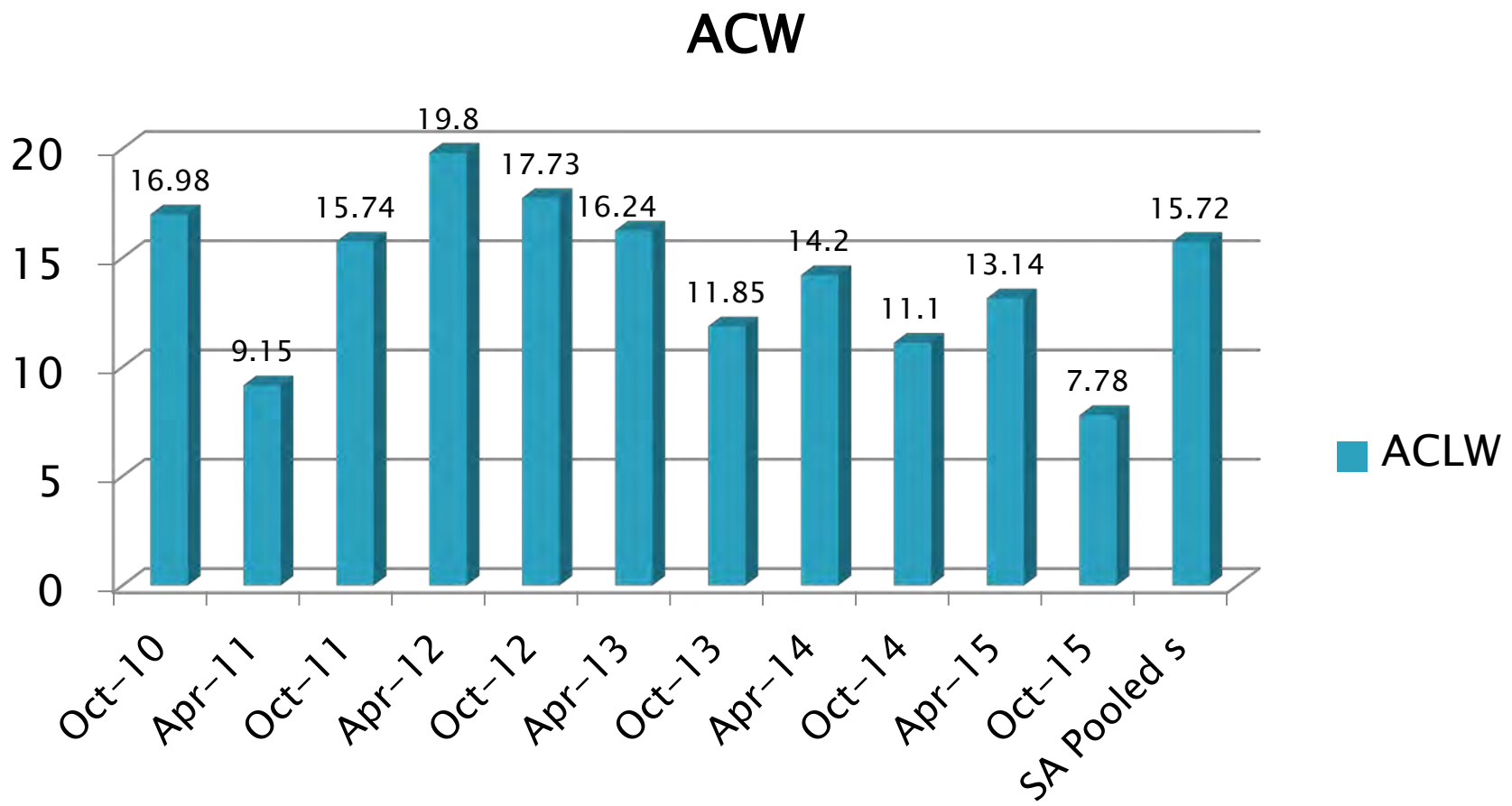
Sequence IVA Precision Estimates



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Sequence VG

- October 2015

Sequence VG Activity

Test Status	Validity Code	#
Acceptable Calibration Test	AC	7
Aborted	XC	1
Operationally Invalid	LC	1
Total		**9**

Sequence VG – Lost Tests*

Test Status	Cause	#
Aborted	Rocker Cover Coolant Leak	1
Invalid	Faulty O_2 Sensor, High Fuel Flow	1
Totals		**2**

*Invalid and aborted tests

Sequence VG Test Severity

- All parameters in control.

SEQUENCE VG INDUSTRY OPERATIONALLY VALID DATA

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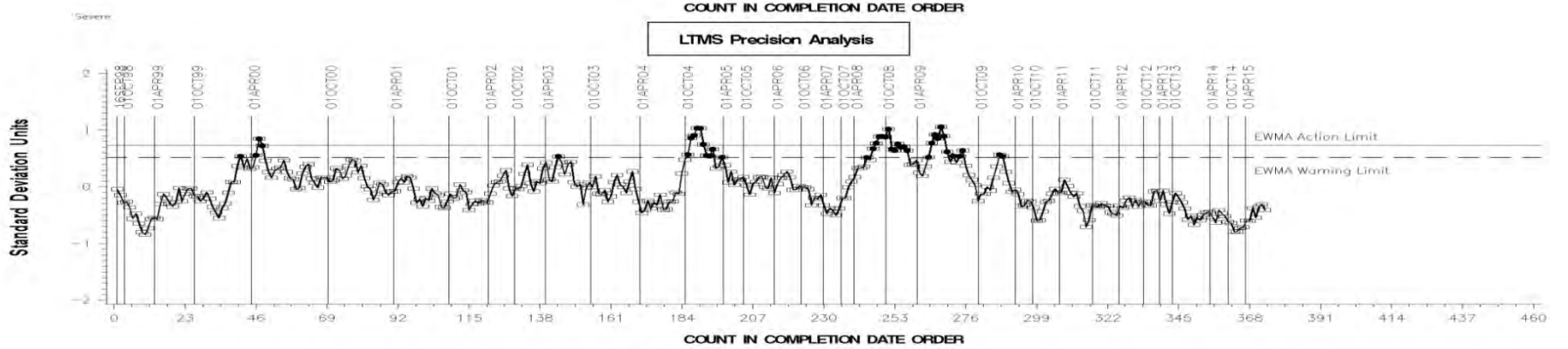
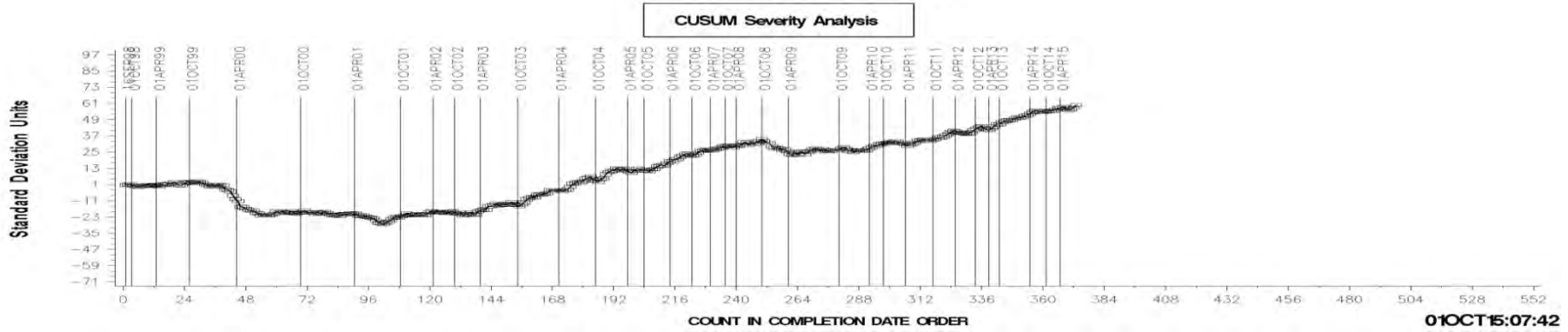
AVERAGE ENGINE SLUDGE

LTMS Severity Analysis

LTMS Precision Analysis



CUSUM Severity Analysis



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SEQUENCE VG INDUSTRY OPERATIONALLY VALID DATA

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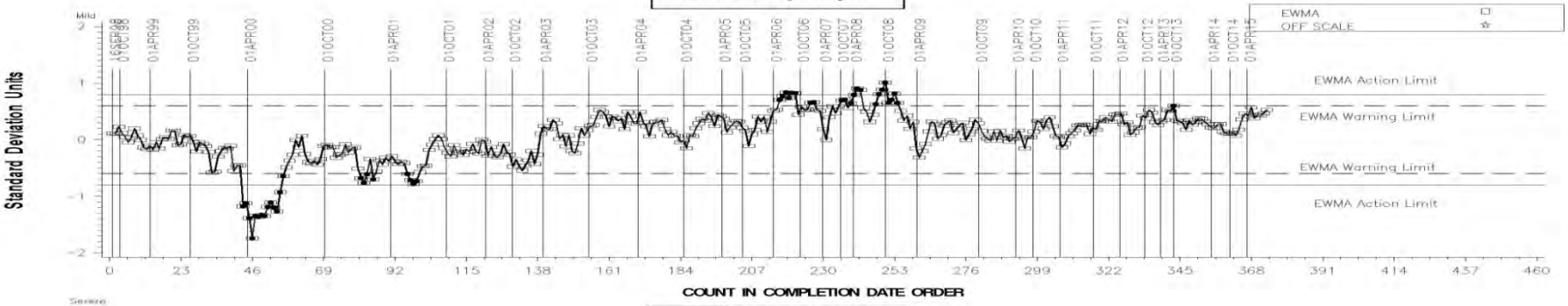
AVERAGE ROCKER COVER SLUDGE

LTMS Severity Analysis



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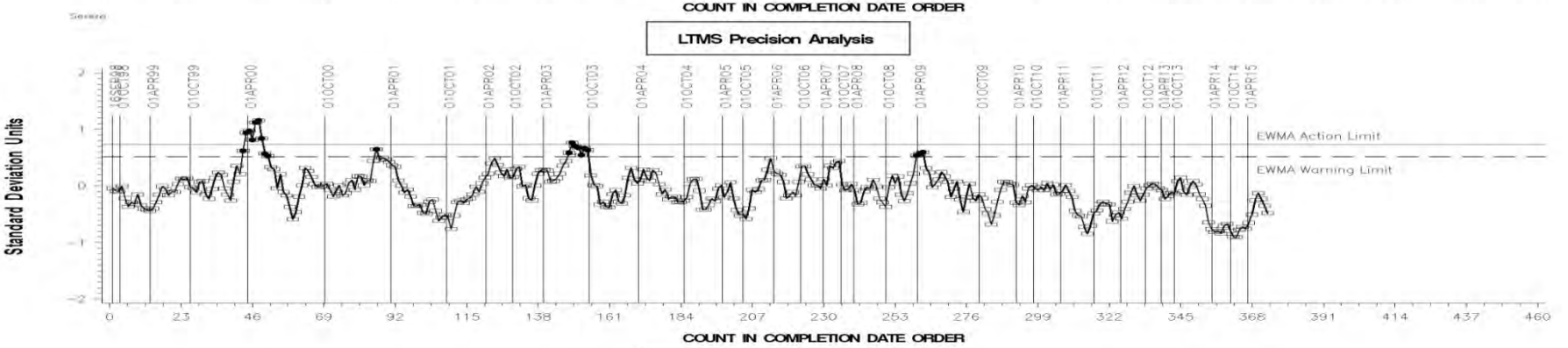

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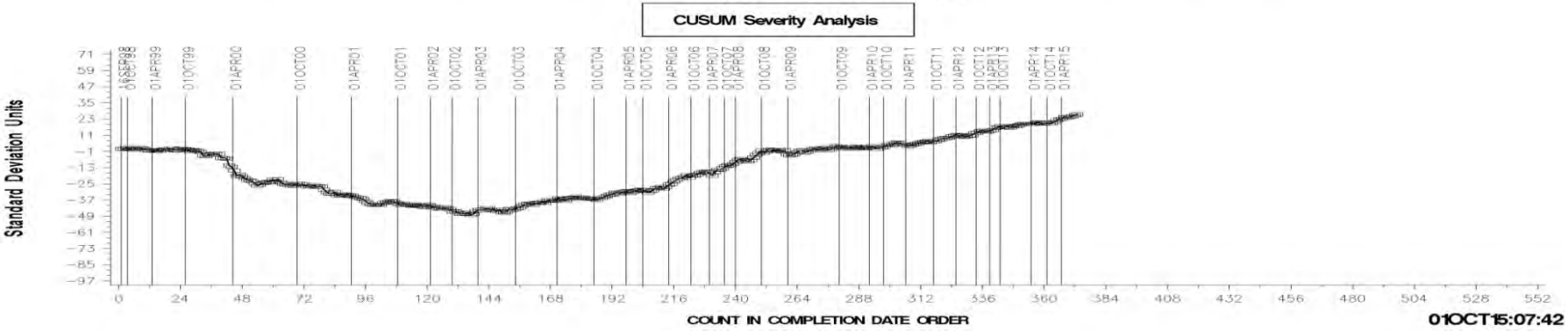

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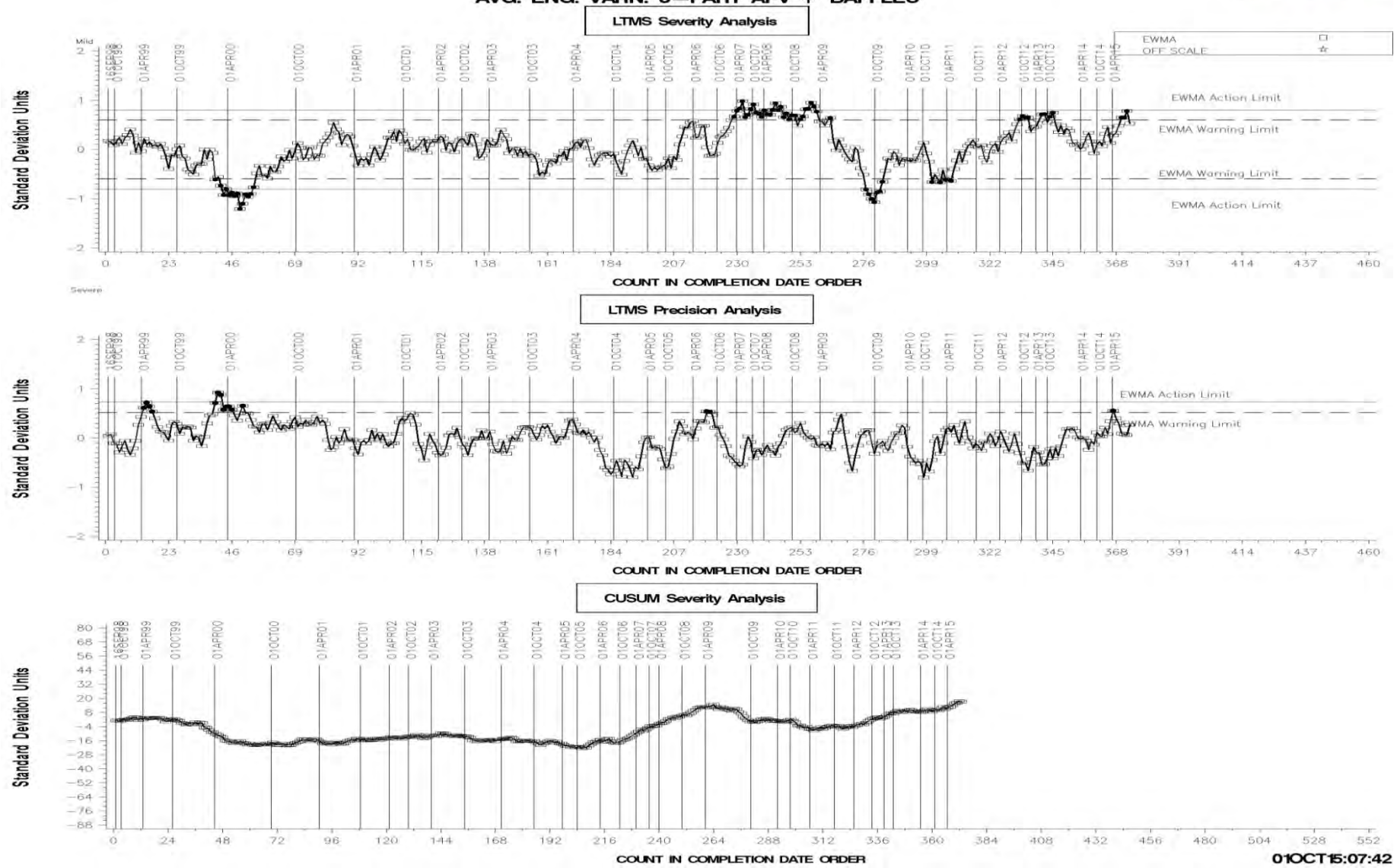
SEQUENCE VG INDUSTRY OPERATIONALLY VALID DATA

AVG. ENG. VARN. 3—PART APV + BAFFLES



SEQUENCE VG INDUSTRY OPERATIONALLY VALID DATA

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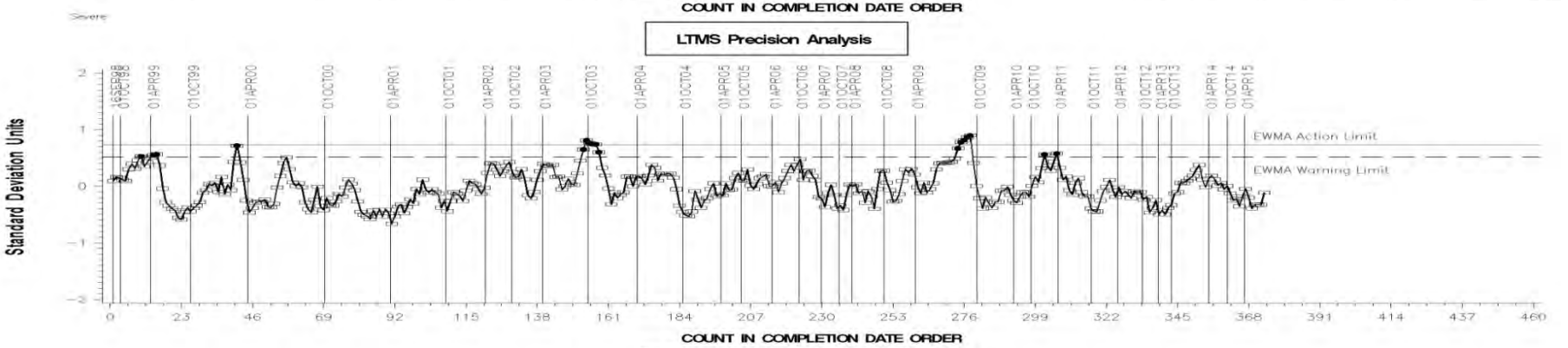
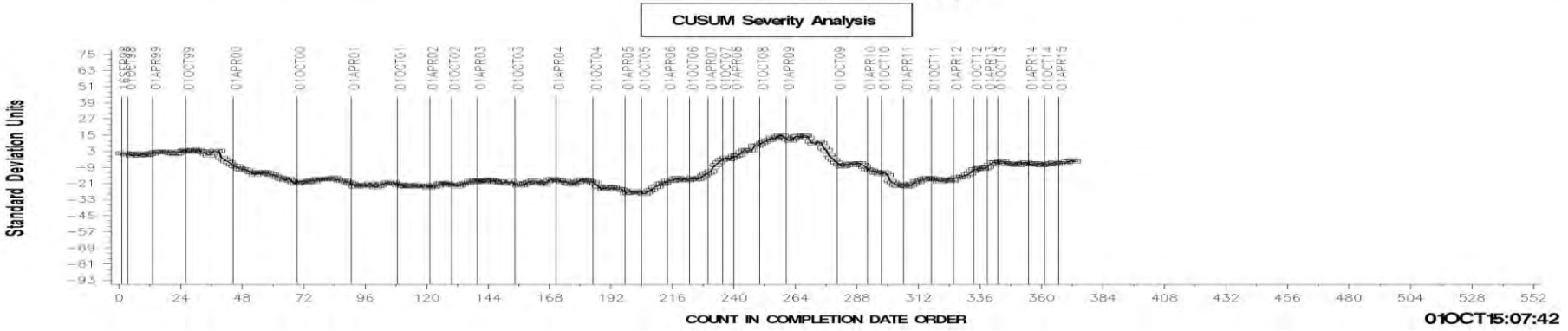
AVG PISTON SKIRT RATING

LTMS Severity Analysis

LTMS Precision Analysis



CUSUM Severity Analysis



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SEQUENCE VG INDUSTRY OPERATIONALLY VALID DATA

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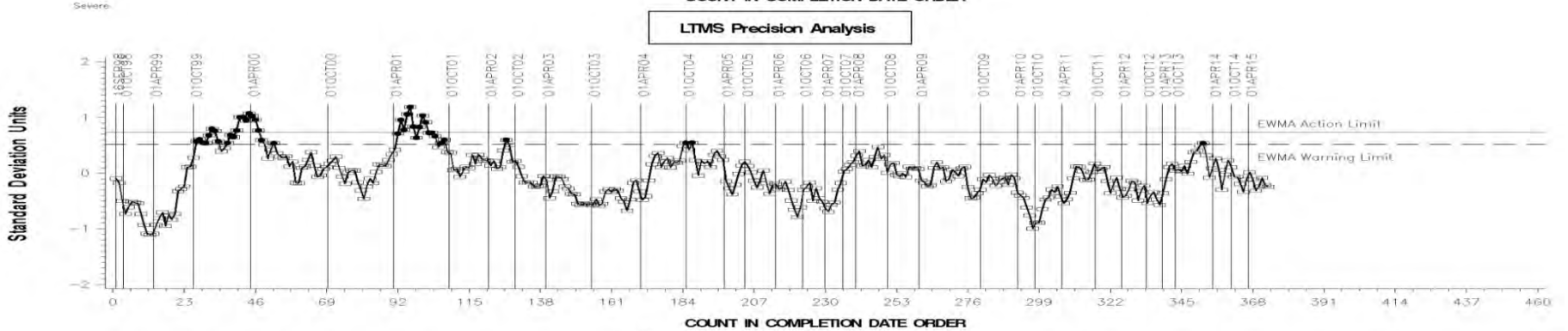
OIL SCREEN SLUDGE

LTMS Severity Analysis

LTMS Precision Analysis



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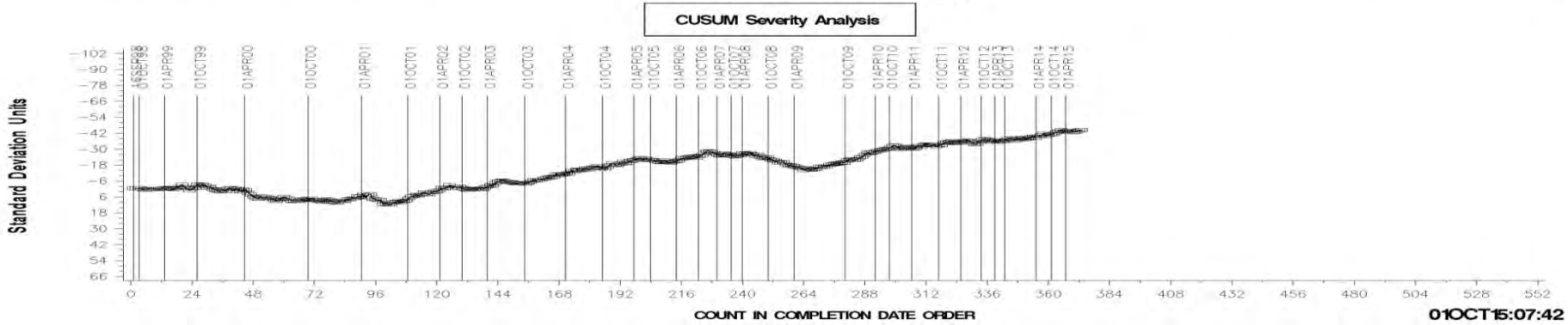

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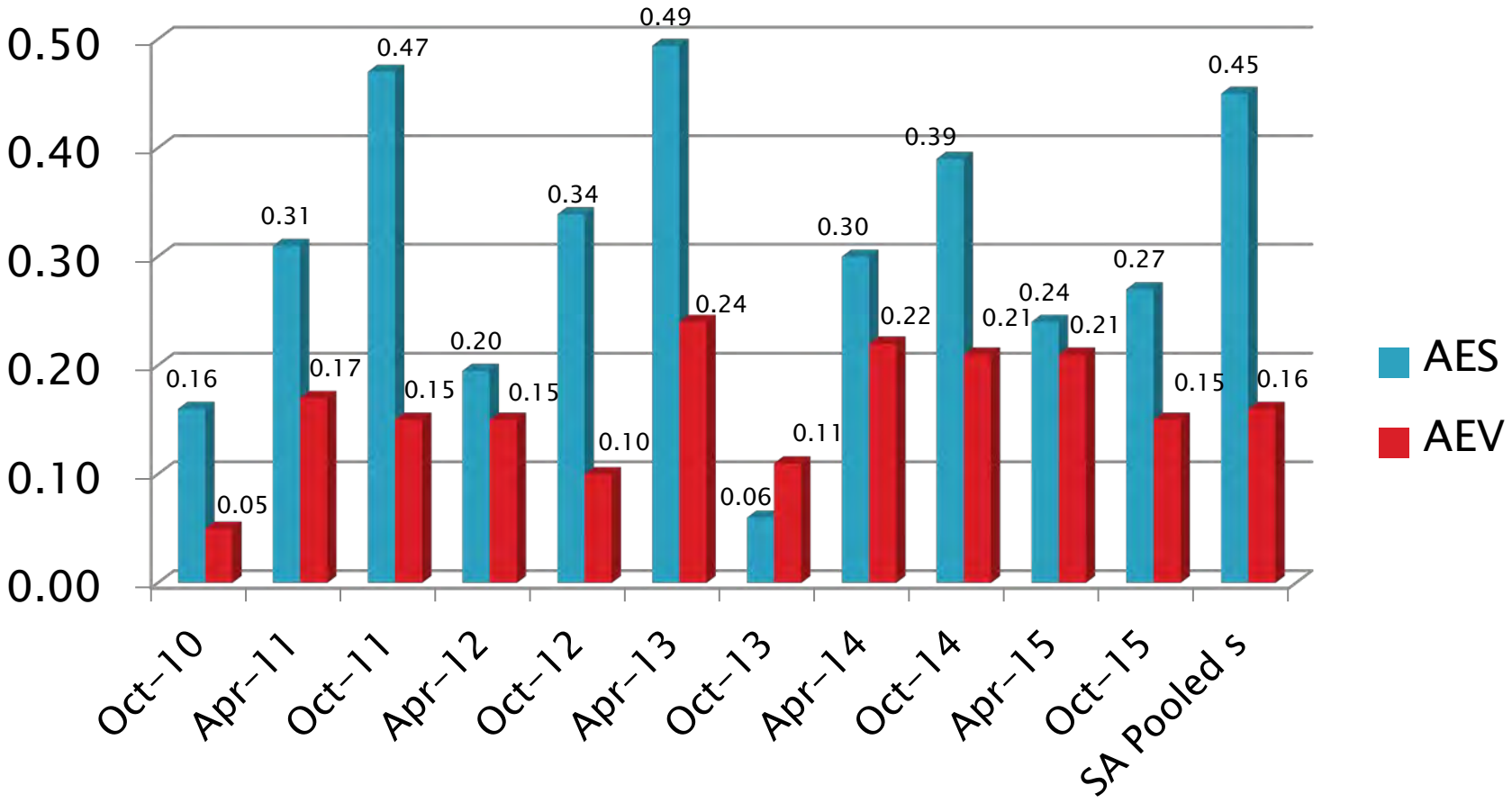
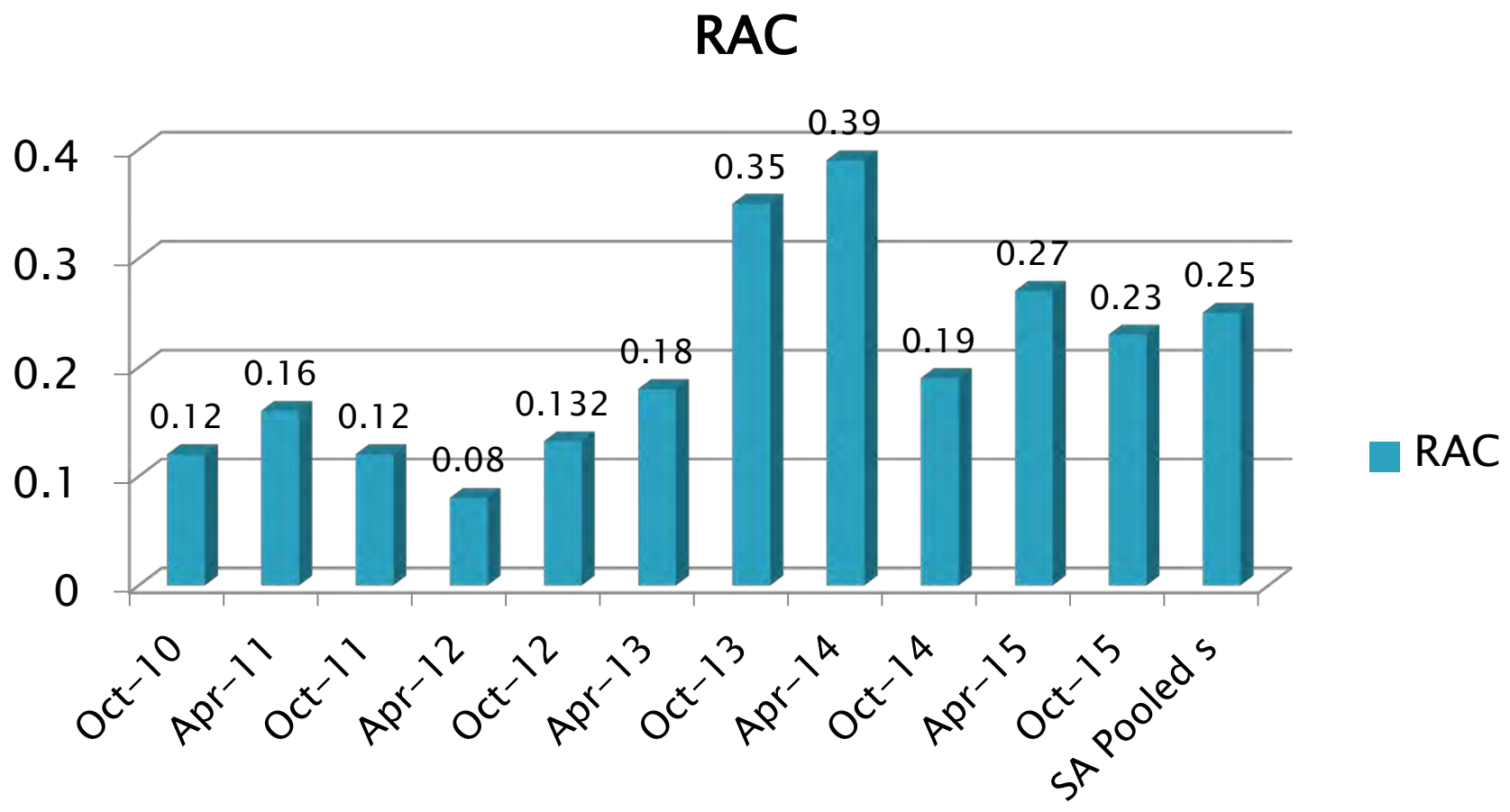
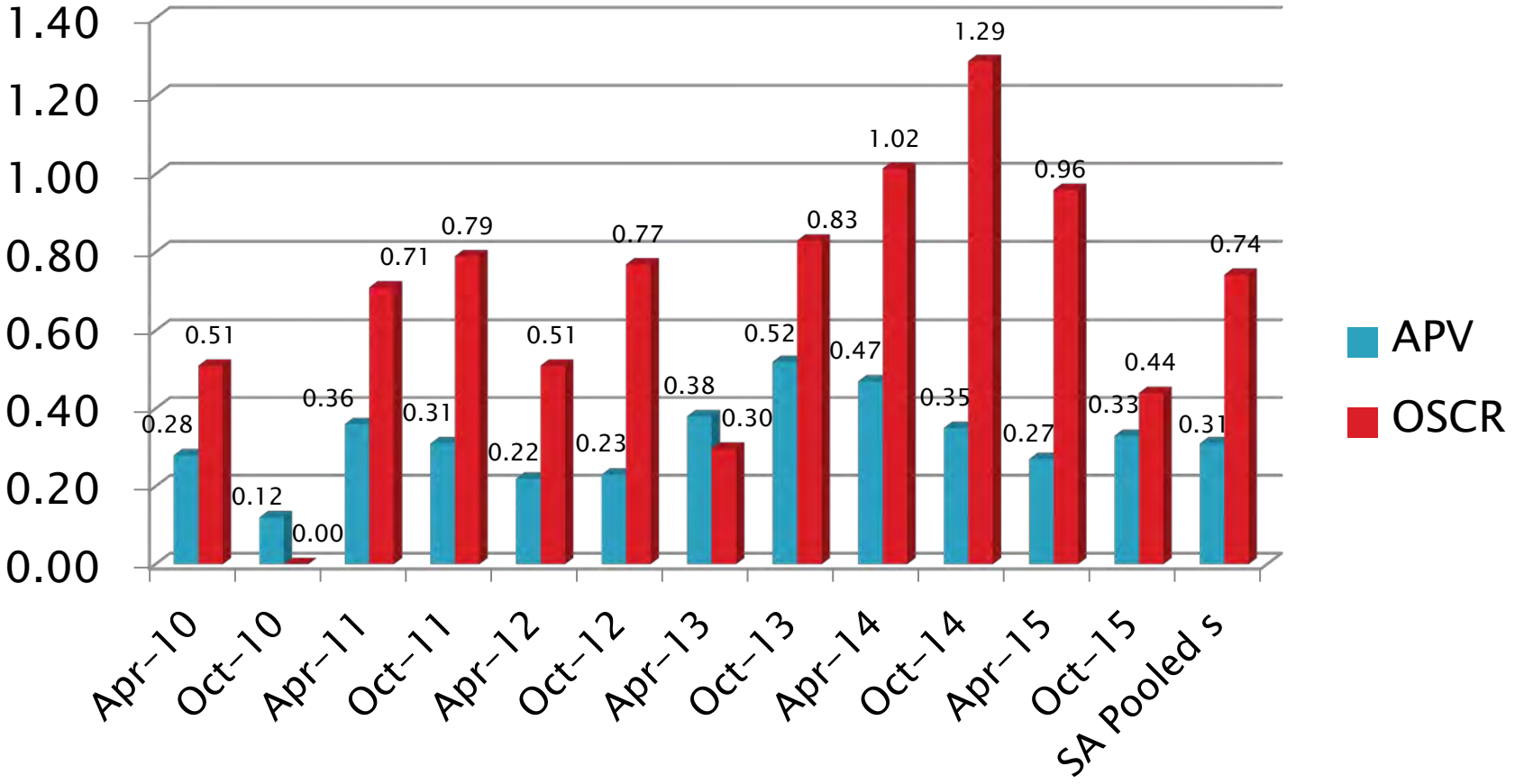
Sequence VG Precision Estimates



Sequence VG Precision Estimates



Sequence VG Precision Estimates



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Sequence VID

- October 2015

Sequence VID Activity

Test Status	Validity Code	#
Acceptable Calibration Test	AC	32
Failed Statistically	OC	7
Operationally Invalid	LC	3
Aborted	XC	4
Engine Abandoned, would not Calibrated	MC	5
Total		**51**

Sequence VID – Failed Tests

Test Status	Number of Tests
Severe FEI2	3
Mild FEI2	2
Severe FEI1 and FEI2	1
Mild FEI1 and FEI2	1
Total	**7**

Sequence VID – Lost Tests*

Test Status	Cause	#
Invalid	Ran VIE Fuel	1
Invalid	Load Cell Controller Calibration Error	1
Invalid	Load Cell Linkage Binding	1
Aborted	Exceeded Downtime Limit	2
Aborted	Driveline Failure	1
Aborted	Loss of Oil Pressure	1
Totals		**7**

*Invalid and aborted tests

Sequence VID Test Severity

- FEI1 in Control for Severity and Precision
- FEI2 in Severity Warning Alarm (Severe)

SEQUENCE VID INDUSTRY OPERATIONALLY VALID DATA

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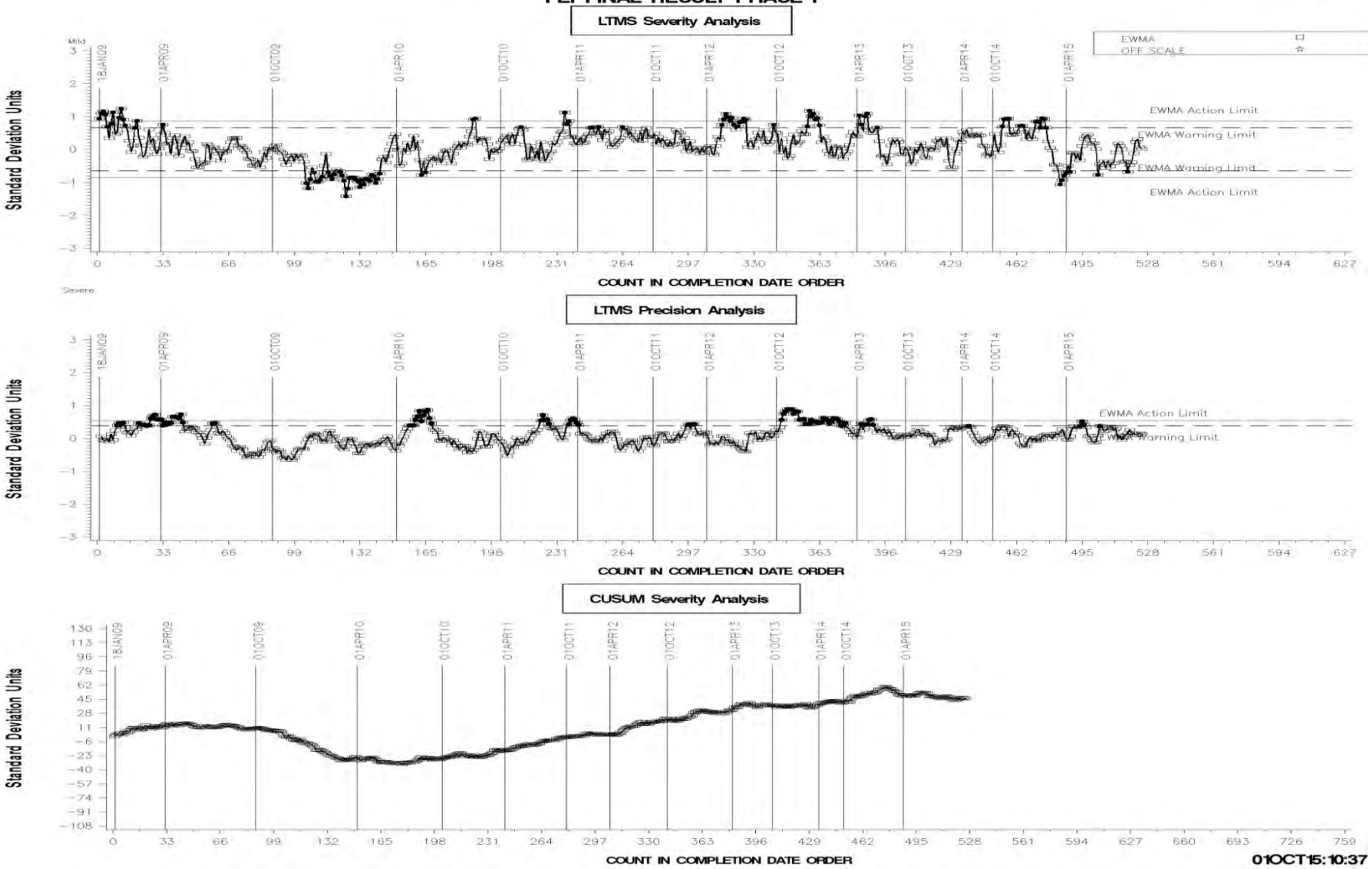
FEI FINAL RESULT PHASE I



SEQUENCE VID INDUSTRY OPERATIONALLY VALID DATA

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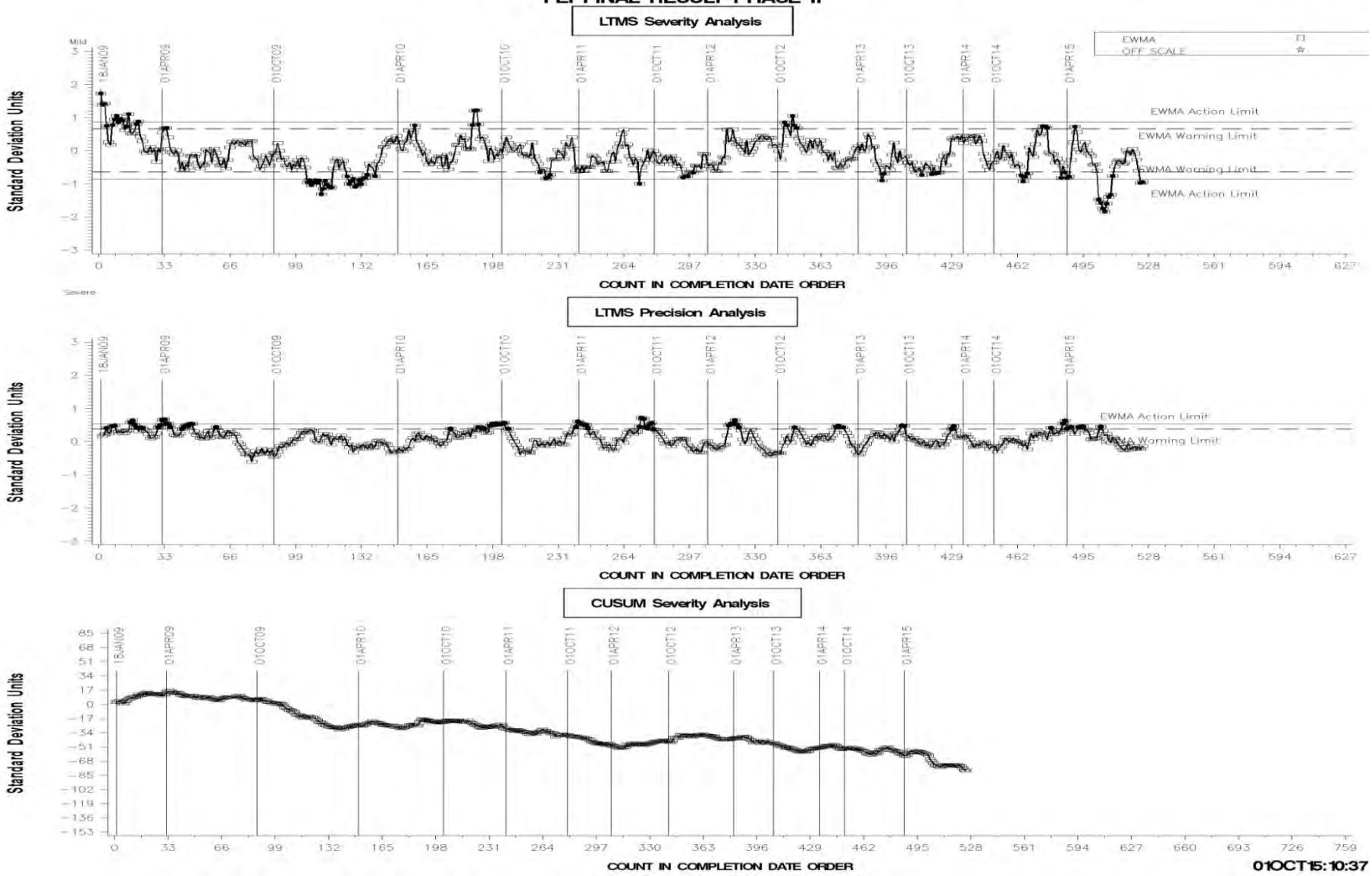
FEI FINAL RESULT PHASE II



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Test Monitoring Center

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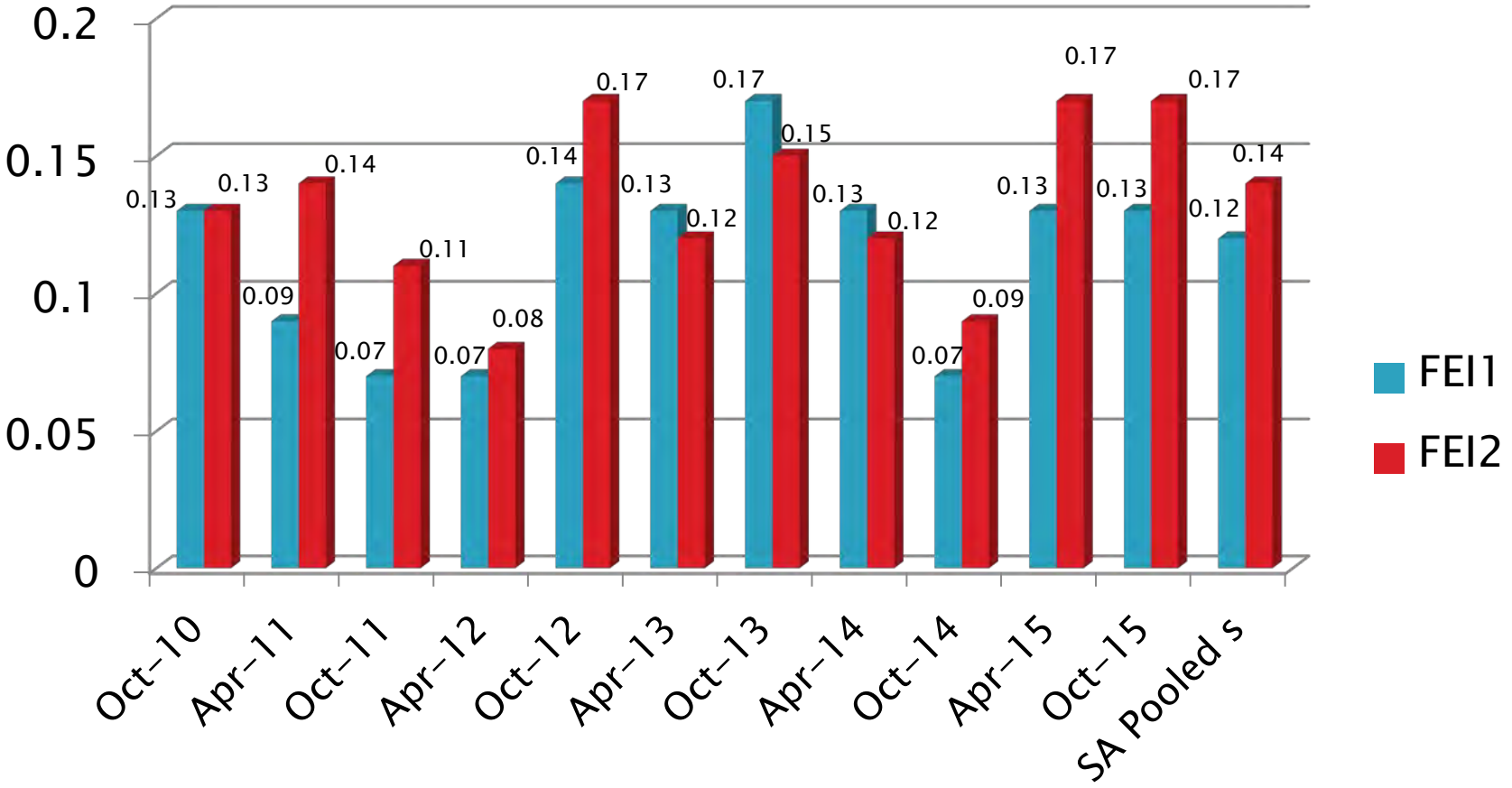
Sequence VID Precision Estimates



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Sequence VIII

- October 2015

Test Monitoring Center
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Sequence VIII Activity

Test Status	Validity Code	#
Acceptable Calibration Test	AC	5
Failed Statistically	OC	3
Aborted	XC	1
Total		9

Sequence VIII – Failed Tests

Test Status	Number of Tests
Severe SVIS	2
SVIS Precision Shewhart Alarm	1
Total	**3**

Sequence VIII – Lost Tests*

Test Status	Cause	#
Aborted	Attempted to start engine with external pump off	1
Totals		**1**

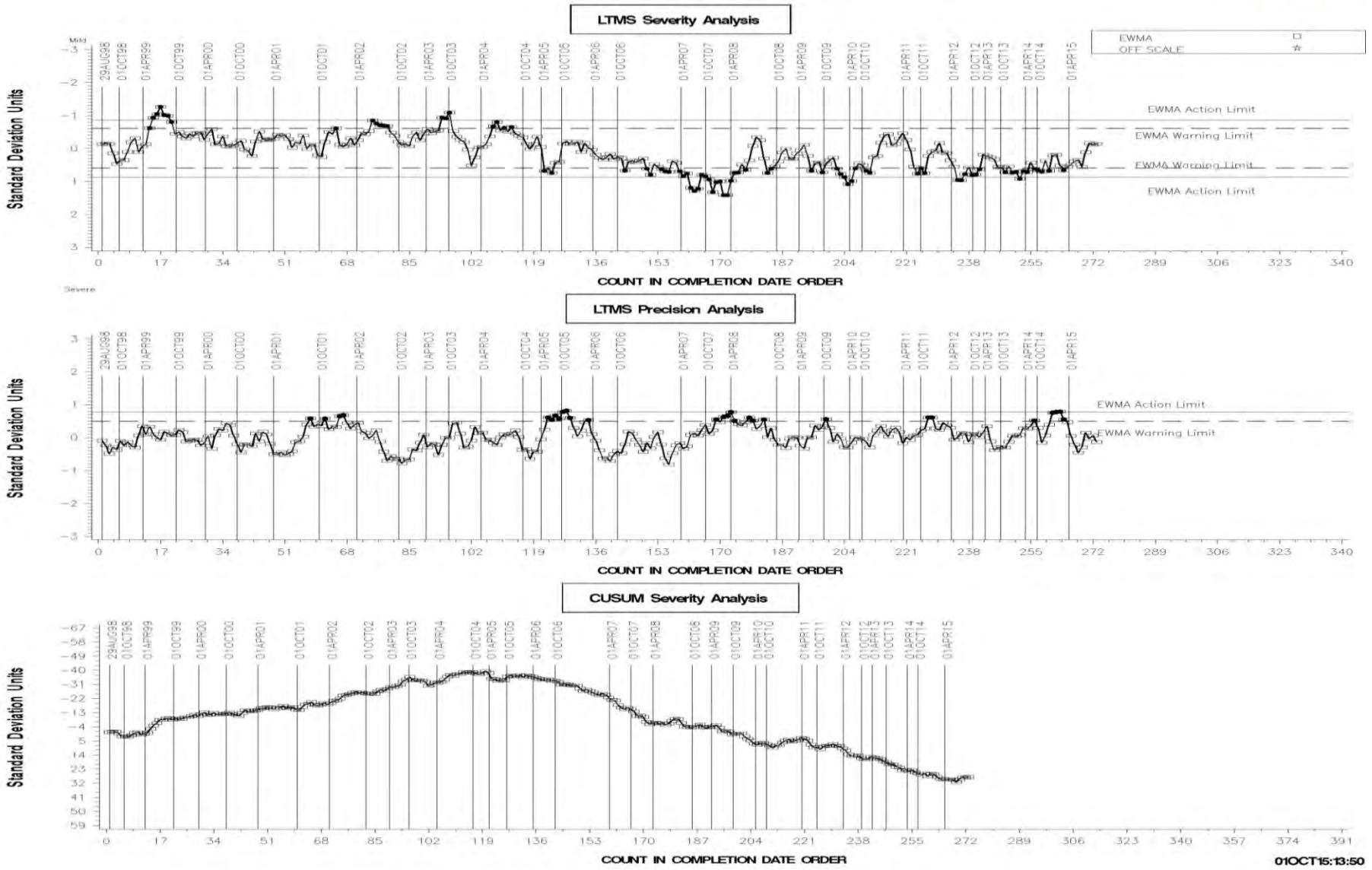
*Invalid and aborted tests

Sequence VIII Test Severity

- Bearing Weight Loss is in control.
- Stripped Viscosity is in severity action alarm and precision warning alarm.

SEQUENCE VIII INDUSTRY OPERATIONALLY VALID DATA

FINAL BEARING WEIGHT LOSS



SEQUENCE VIII INDUSTRY OPERATIONALLY VALID DATA

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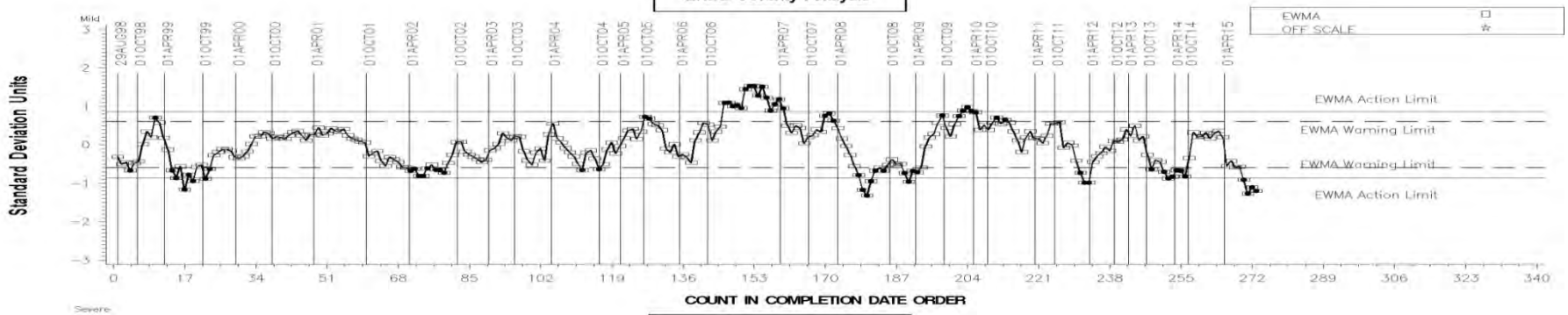
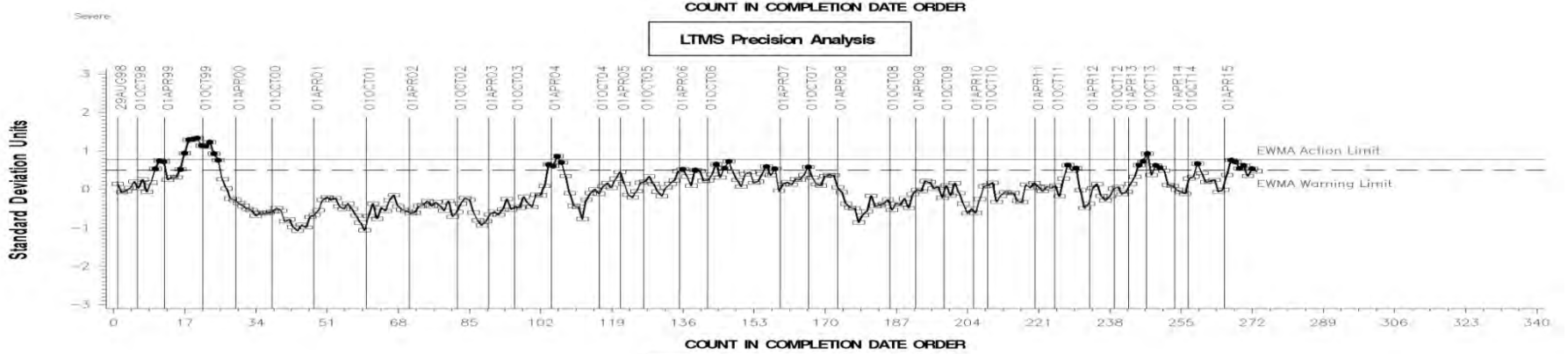
STRIPPED VIS. @ 100 DEG C

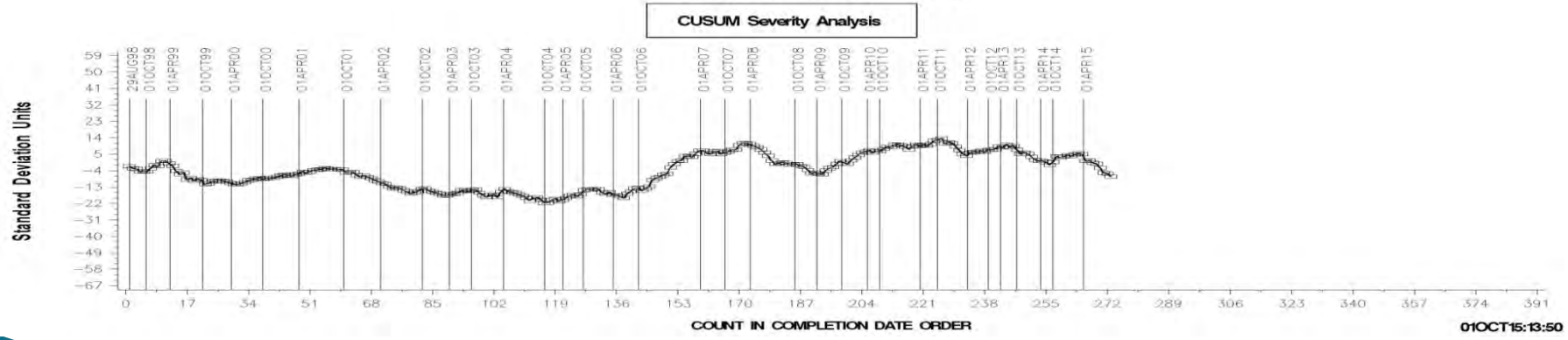
LTMS Severity Analysis



LTMS Precision Analysis

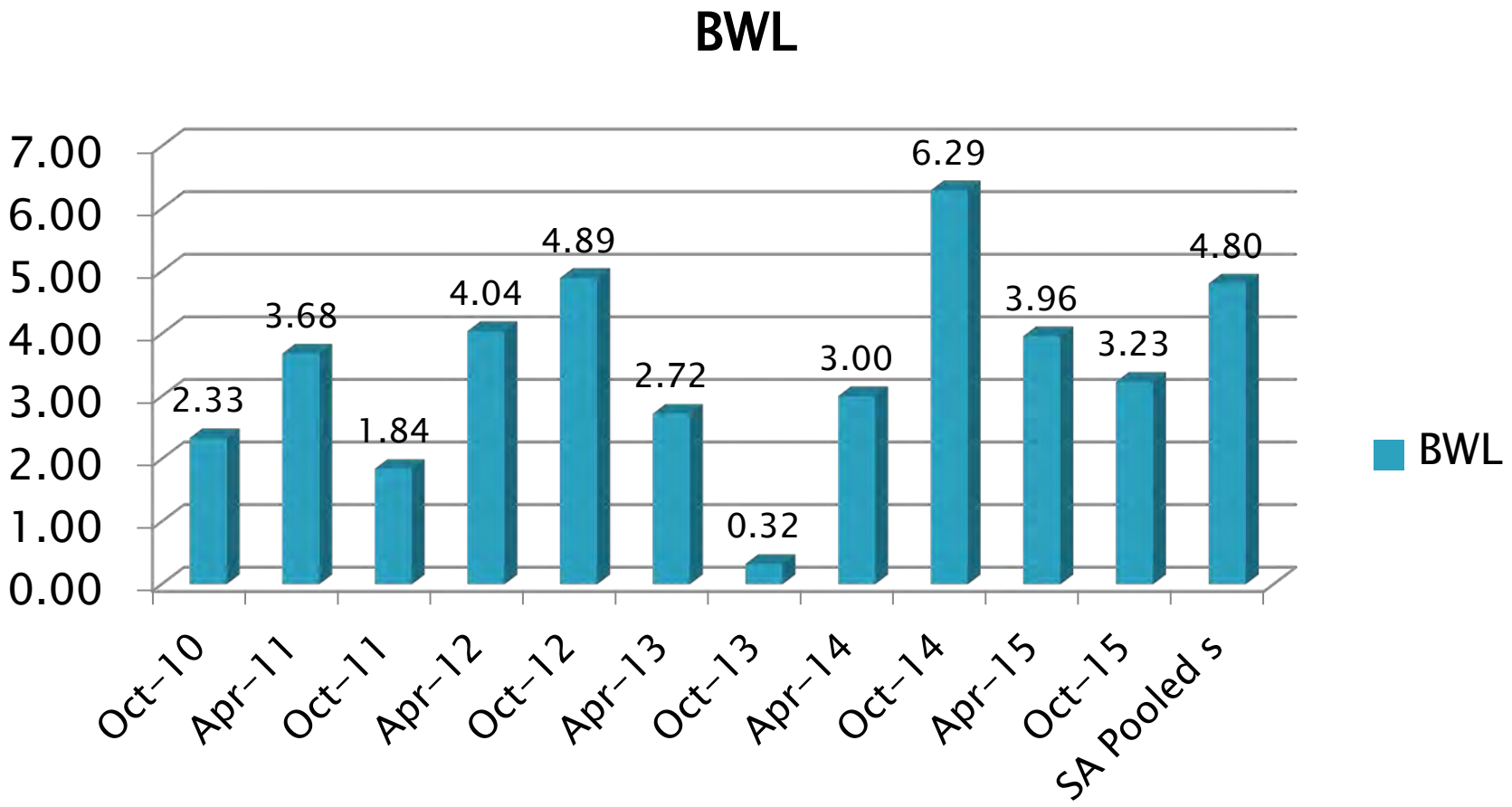


CUSUM Severity Analysis

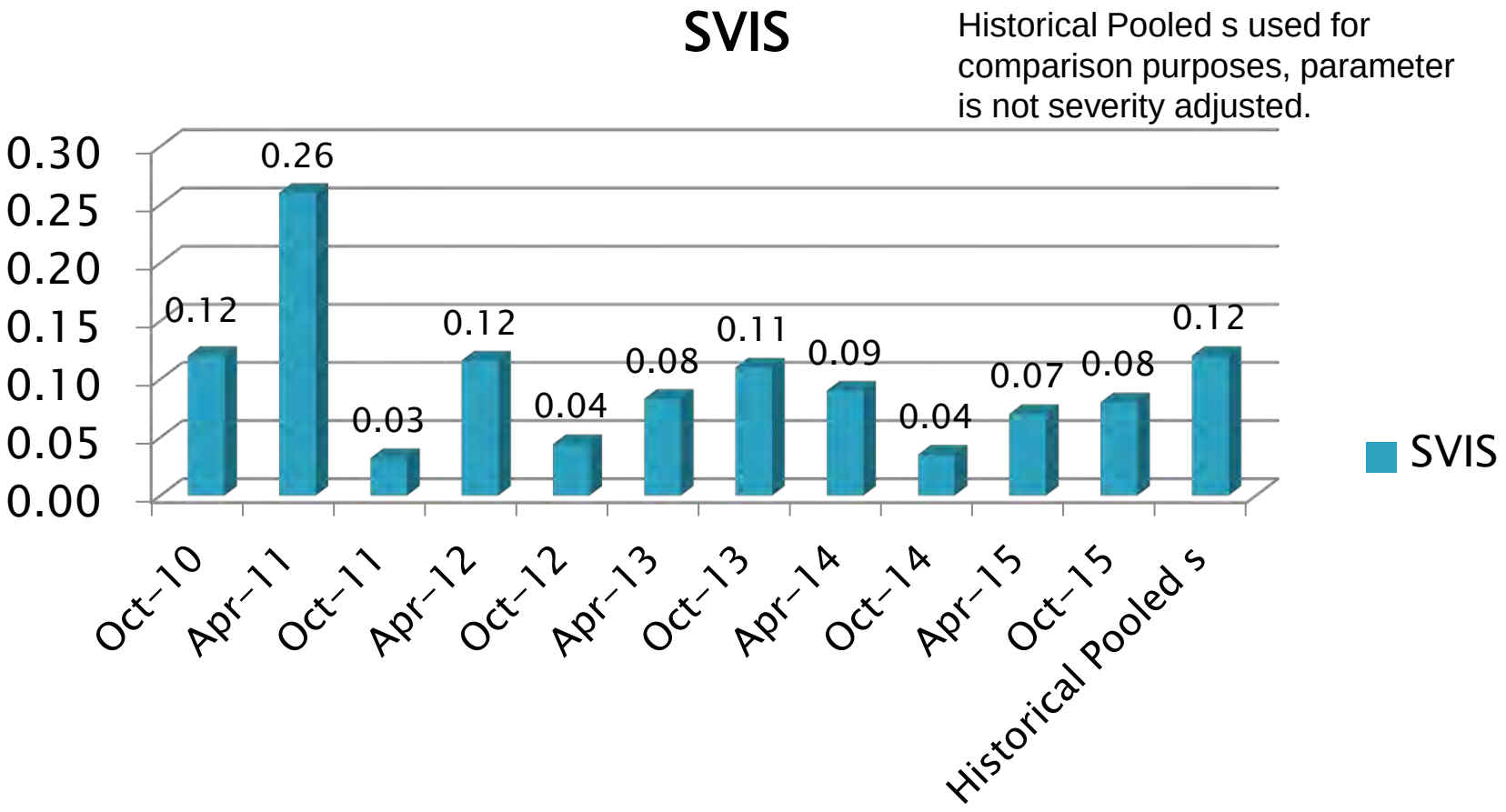


01OCT15:13:50

Sequence VIII Precision Estimates



Sequence VIII Precision Estimates



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Information Letters

- April 1, 2015 – September 30, 2015

Information Letters*

Test	Date	IL	Topic
VG	20150701	15-1	Allow use of alternate valves, water pump and added new source for wiring harness.
VID	20150916	15-1	Added additional part number for oil coolant heat exchanger.
VIII	20150617	15-1	Added additional part numbers for Permatex Ultra Blue 77B sealant.

*Available from TMC Website

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Reference Oil Inventory

- Actions, Re-blends, Inventories and Estimated Life

Reference Oil Re-blends

- TMC 434
  - Re-blend 434-2 distributed, four successful calibration attempts completed, one failing result.
- TMC438-1
  - Re-blend available; will be used for IIIH.
- TMC 542-3 and 1010-1
  - Re-blend of 542 has been obtained
  - Two results were reported this period on 1010-1. Most labs have enough 1010 to calibrate remaining engines

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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	68	231	60	5+ years
433-1	IIIF	1045	0	0	4	<1 year
433-2	IIIF	500	16	364	28	3+ years
434	IIIG	550	0	<1	12	<1 year
434-1	IIIG	660	52	4	28	1.5 years
434-2	IIIG	495	56	311	20	3+ years
435	IIIG	550	0	2	4	<1 year
435-2	IIIG	550	0	210	28	3+ years
438	IIIG	990	8	68	28	2 years
540	VID	1100	20	273	45	4+ years
541-1	VID	550	0	4	25	<1 year

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Reference Oil Inventory Estimated Life

Oil	Tests	Original Blend Amount	Quantity Shipped in last 6 months	TMC Inventory	Lab Inventory	Estimated Life
542	VID	1100	0	0	5	<1 year
542-1	VID	275	0	3	5	0 years
542-2	VID	1000	175	590	25	1.5 years
704-1	VIII	897	8	142	14	5+ years
925-3	VG	975	0	10	6	<1 year
940	VG, VH	560	45	339	15	5+ years
1006-2	IVA, VG, VIII	5500	94	2852	68	5+ years
1007	IVA, VG	1968	0	0	30	<1 year
1009	VG, VIII	1100	20	120	18	5+ years
1010	IIIG, VID	1100	50	3	30	<1 year
1010-1	IIIG, VID	1760	147	1567	54	5 years

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LTMS Deviations

- April 1, 2015 – September 30, 2015

LTMS Deviations

- No LTMS Deviations in Current Period

LTMS Deviations

Historical Count of PCEO LTMS Deviations

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

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Quality Index Deviations

- April 1, 2015 –
  September 30, 2015

Quality Index Deviations

- One Quality Index Deviation this Report Period.
  - VG – RAC coolant flow control.

Historical Count of PCEO Quality Index Deviations

Test	Quality Index Deviations
IIIF	26
IIIG	14
IVA	28
VG	42

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TMC Laboratory Visits

- April 1, 2015 –
  September 30, 2015

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

TMC Lab Visits

Test	Number of Labs Visited
III	2
VG	1
VID	2

TMC Lab Visits

- Three discrepancies noted during visits
  - VID – Heat exchanger model number did not match test method.
  - VID – Coolant in T/C had more than 2” of sheathing exposed.
  - VID – Fuel rail temperature thermocouple not properly located.

The laboratories have responded with corrective action.

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Test Area Timelines

- April 1, 2015 – September 30, 2015

Test Area Timeline Additions*

Test	Date	Topic	IL
IIIF	20150727	First occurrence of run 78 Pistons.	
IIIG	20150728	First occurrence of run 910 Pistons.	
VG	20150701	Allowed use of aftermarket intake and exhaust valves, alternate water pump and new source for engine wiring harness.	15-1
VID	20141104	Added oil heat exchanger part number 5-694-010-020-002 to test method.	15-1
VIII	20141110	Included additional part numbers for Permatex 77B sealant.	15-1

*As of 09/30/2015

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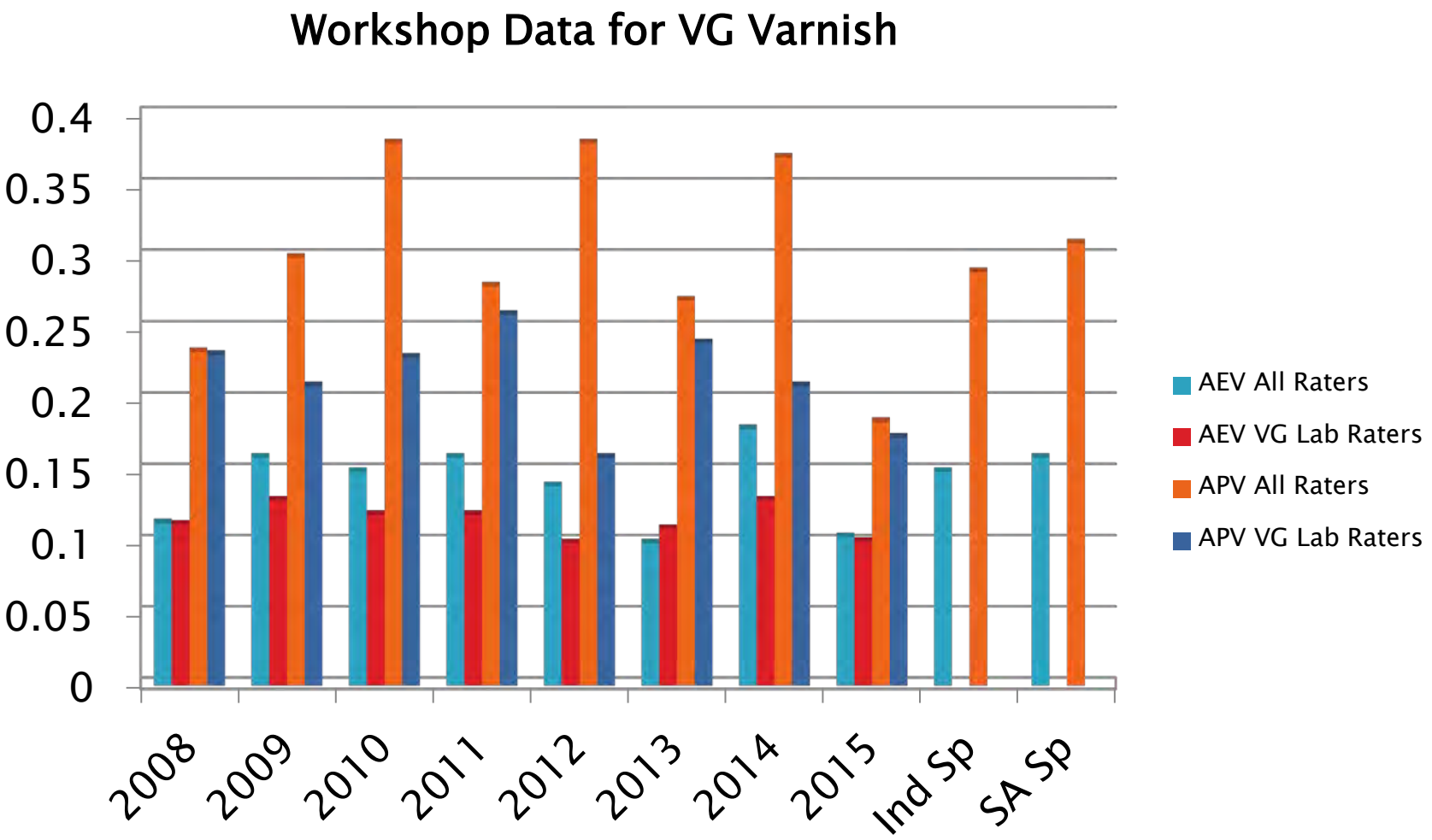
Rating Workshop Data

- 2015 Light Duty Workshop

Rating Workshop Data

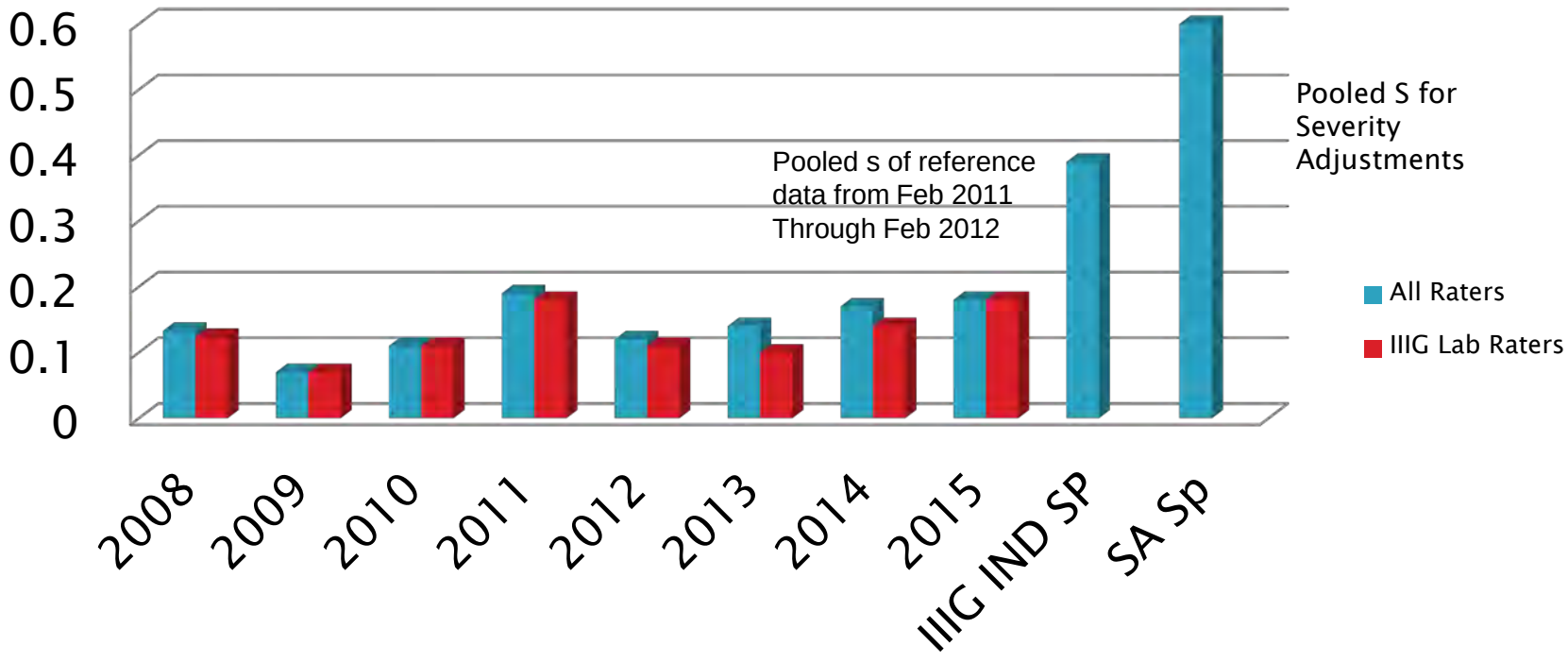
- Summary of Precision Data From Light Duty Rating workshops:
  - VG Average Piston and Average Engine Varnish.
  - IIIG WPD

Sequence VG Precision-Rating Workshop Data



Sequence IIIG Precision – Rating Workshop Data

Comparison of Workshop Pooled Standard Deviations with Industry Pooled Standard Deviations



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Miscellaneous 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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