



A Program of ASTM International

Test Monitoring Center

<https://www.astmtmc.org>

ASTM D02.B1 Semiannual Report Passenger Car Reference Oil Testing

October 2022

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Passenger Car Engine Oil Testing Executive Summary

- ▶ Reference oils 704-1 and 224
 - Both oils have been depleted at the TMC.
 - A reblend of 224 should be available shortly.
 - Reference oil 704-1 cannot be re-blended
- ▶ Reblends of oils 1010-1, 543, 542 and 940.
 - Inventories are low on the current blends of these oils and reblends are available for introduction.

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Passenger Car Engine Oil Testing

Executive Summary (cont.)

▶ IIIH PVIS/MRV/APV Trends

- Both PVIS and MRV have been trending mild, and have been encountering sporadic warning and action alarms. The panel may wish to further evaluate this situation. APV is also in mild alarm, but the panel has decided to take no action to correct at this time.

▶ Sequence VIE Severity

- Both FEI1 And FEI2 have exhibited long term severe trends as evidenced by Cusum and EWMA charts. The Sequence VI panel has formed a task force to try and understand the continuing severity trend and should hear a report from this task force during its next meeting.

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Passenger Car Engine Oil Testing Executive Summary (cont.)

- ▶ New blend of VIE Baseline and Flush Oil
 - A new blend of VIE Baseline and Flush oil, awaiting panel approval for use.
- ▶ Aged Oil LSPI
 - The Sequence X panel is conducting a matrix to age oils to determine their ability to limit preignition as they age. All tests have been completed and matrix data is to be analyzed.

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Passenger Car Engine Oil Testing Executive Summary (cont.)

- ▶ New blend of VH Fuel
 - A new blend of VGM2 fuel should be available for prove out testing Early November.
 - Some labs are out of fuel and others will be out shortly.

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Calibrated Labs and Stands*

Test	Labs	Stands
IIIH/A/B	6	12
IVA	2	2
IVB	3	5
VH	4	10
VIE	4	8
VIF	2	4
VIII	2	4
IX	3	6
X	4	6

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*As of 9/30/2022

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Sequence IIIH/A/B

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Sequence IIIH/A/B Activity

Test Status	Validity Code	#
Acceptable Calibration Test	AC	12
Operationally Invalid Calibration Attempt	LC	1
Total		13

Sequence IIIH – Lost Tests*

Test Status	Cause	#
Invalid	Power Failure	1
Totals		1

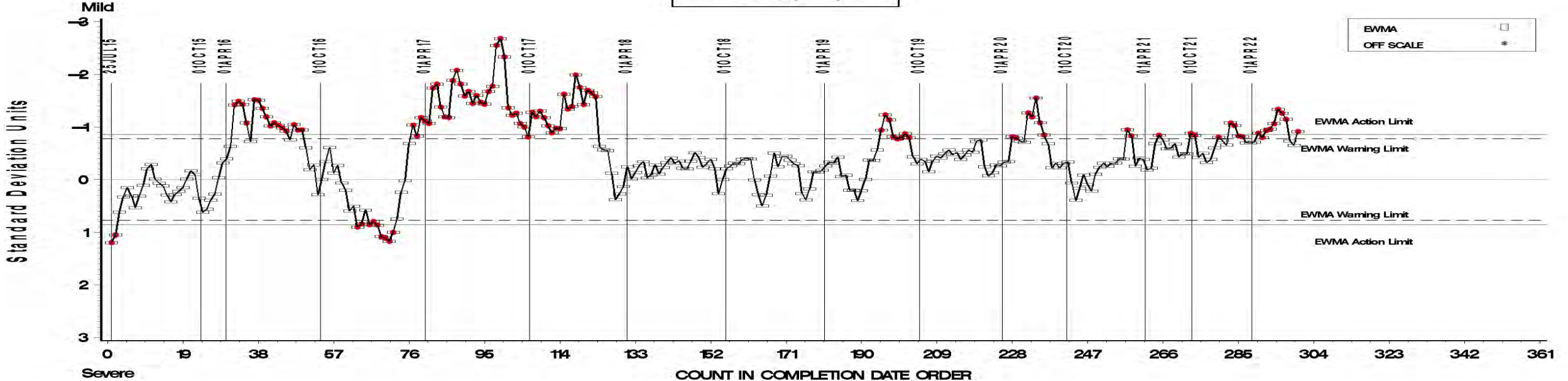
*Invalid and aborted tests

Sequence IIIH Test Severity

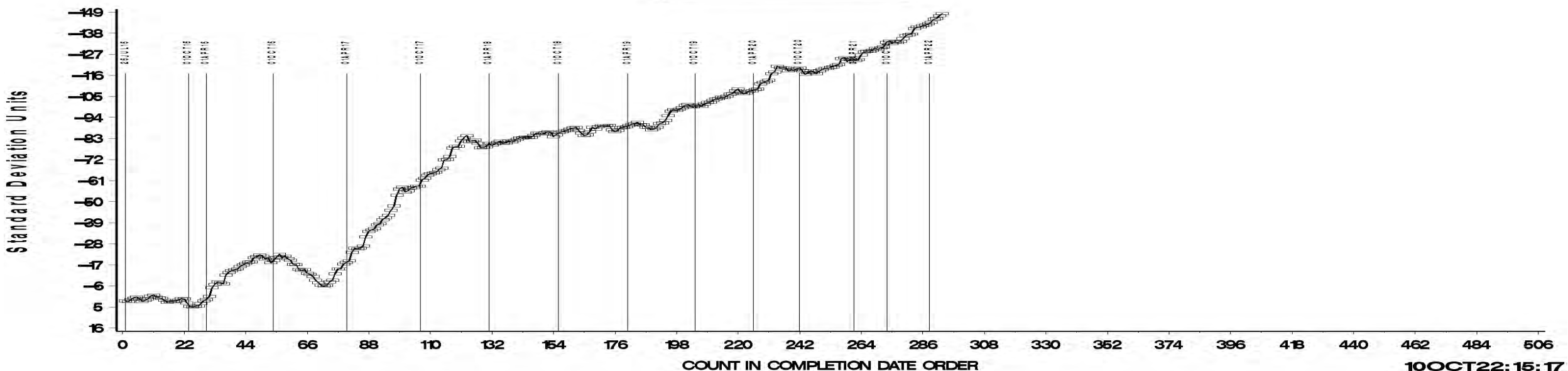
- APV and PVIS are in action alarm (mild direction)
- MRV is in warning alarm (mild direction)
- All other parameters are in control.

VISCOSITY INCREASE FINAL ORIG UNIT RES

LTMS Severity Analysis

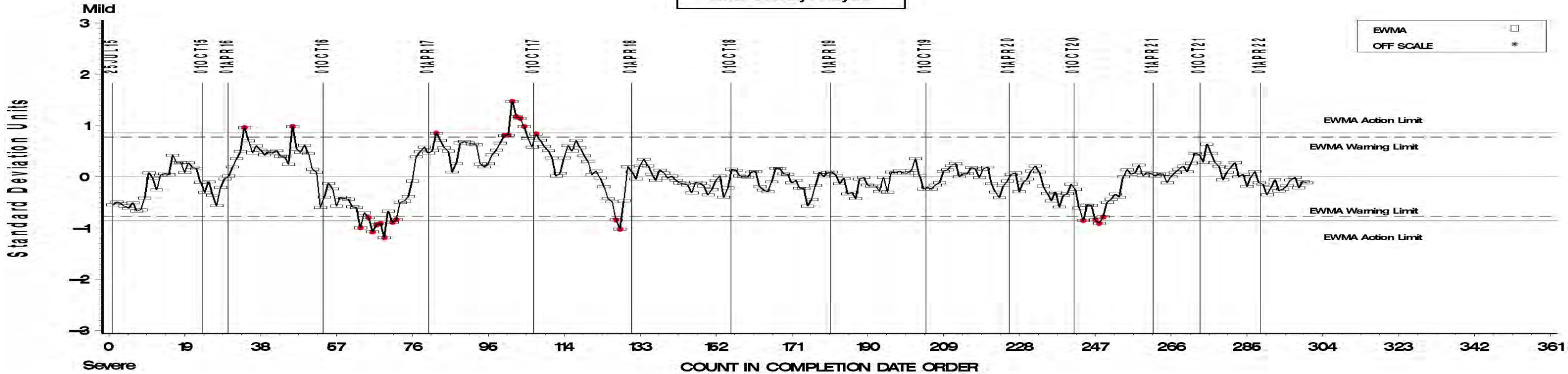


CUSUM Severity Analysis

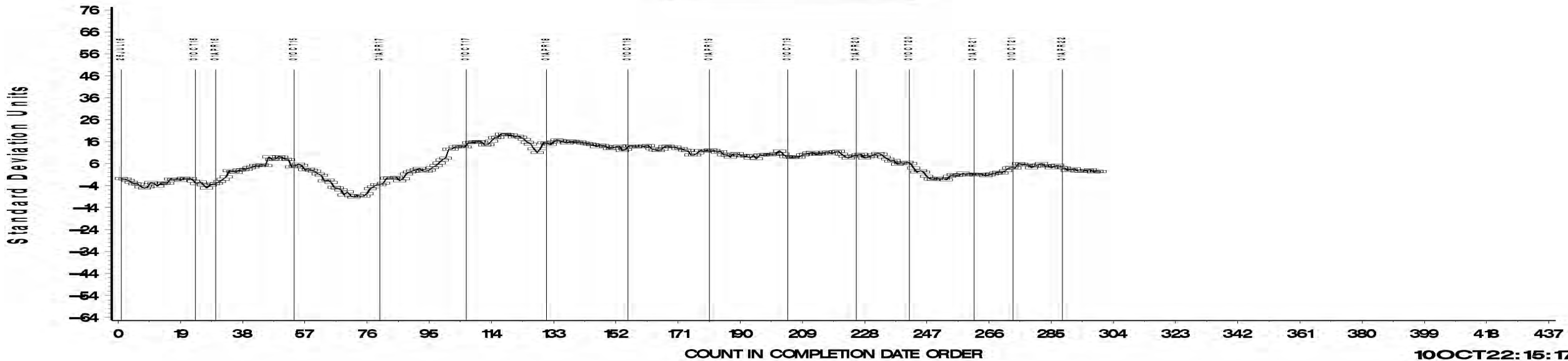


AVERAGE WEIGHTED PISTON DEPOSITS FNL ORIG U

LTMS Severity Analysis

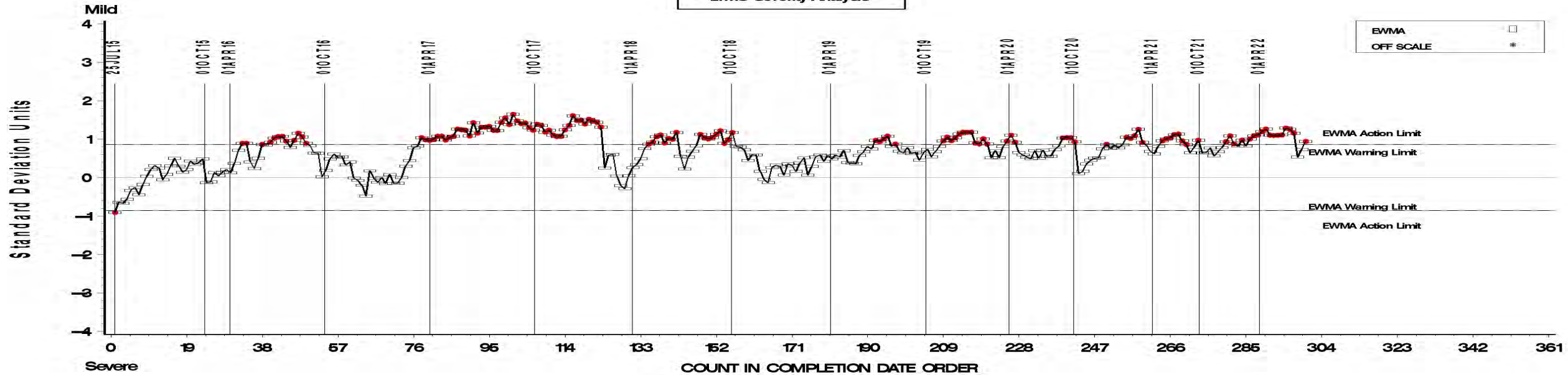


CUSUM Severity Analysis

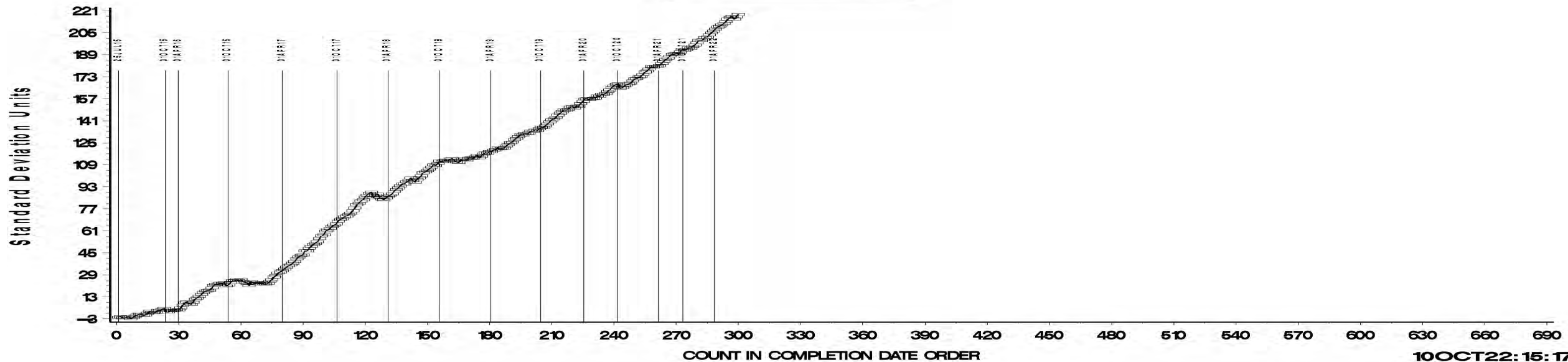


AVERAGE PISTON SKIRT VARNISH

LTMS Severity Analysis

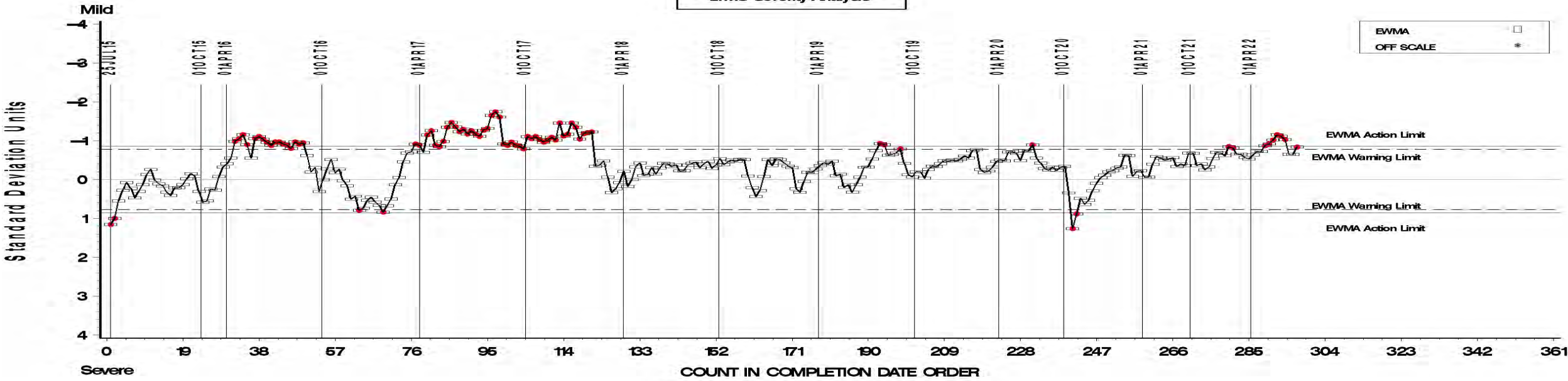


CUSUM Severity Analysis

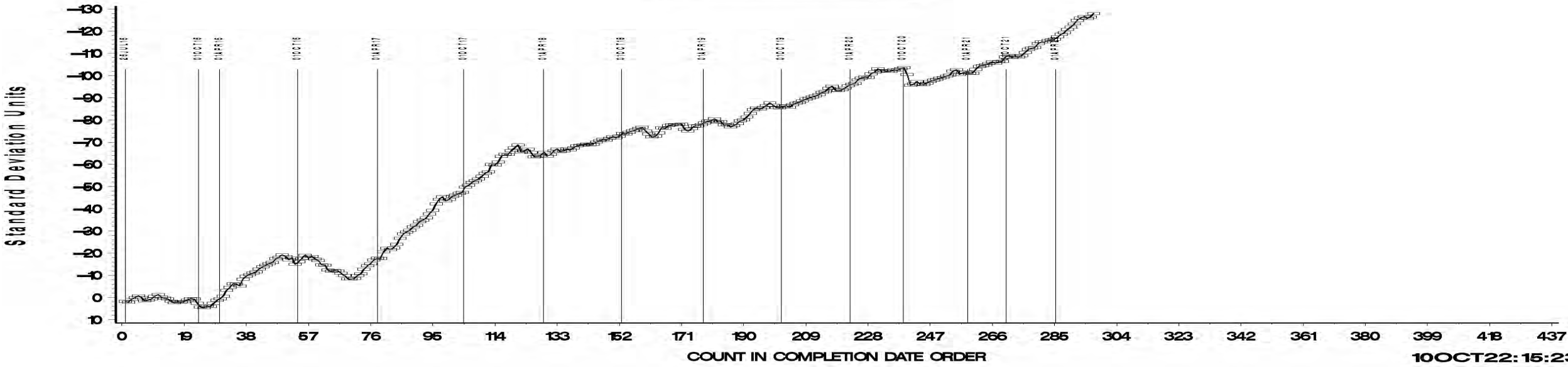


MRV FINAL ORIG UNIT RES [NM, FROZEN, SOLID]

LTMS Severity Analysis

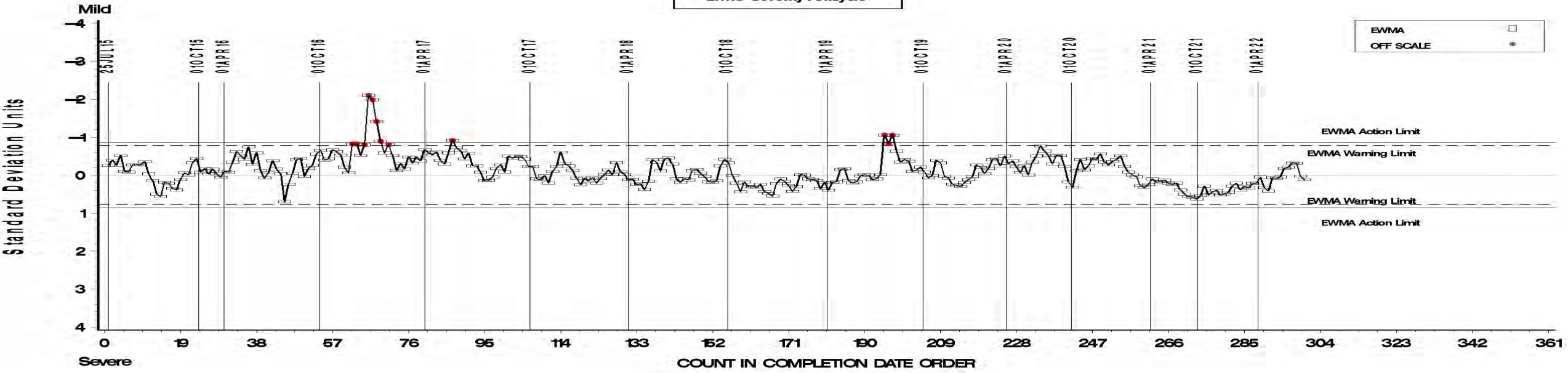


CUSUM Severity Analysis

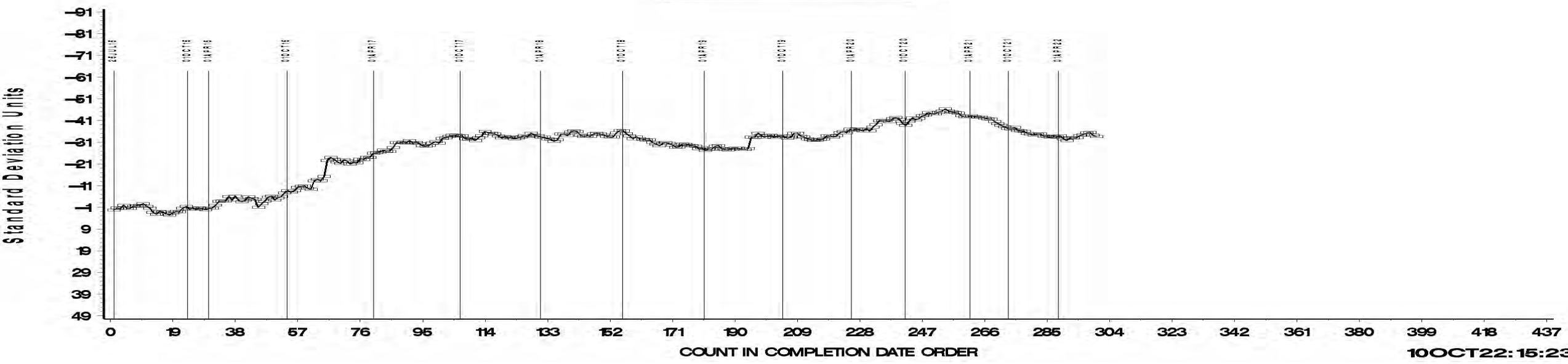


PHOSPHORUS RETENTION, FINAL RESULT

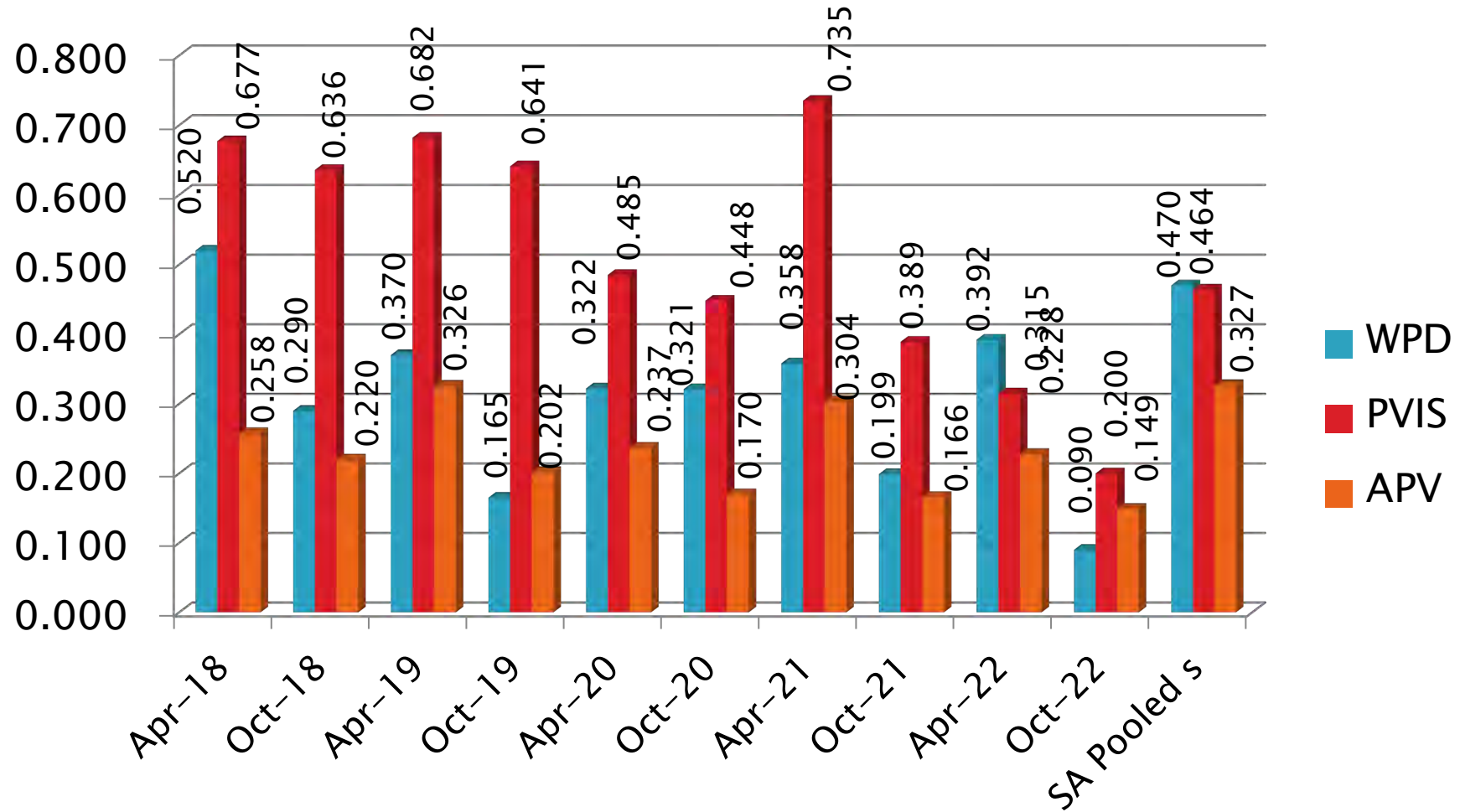
LTMS Severity Analysis



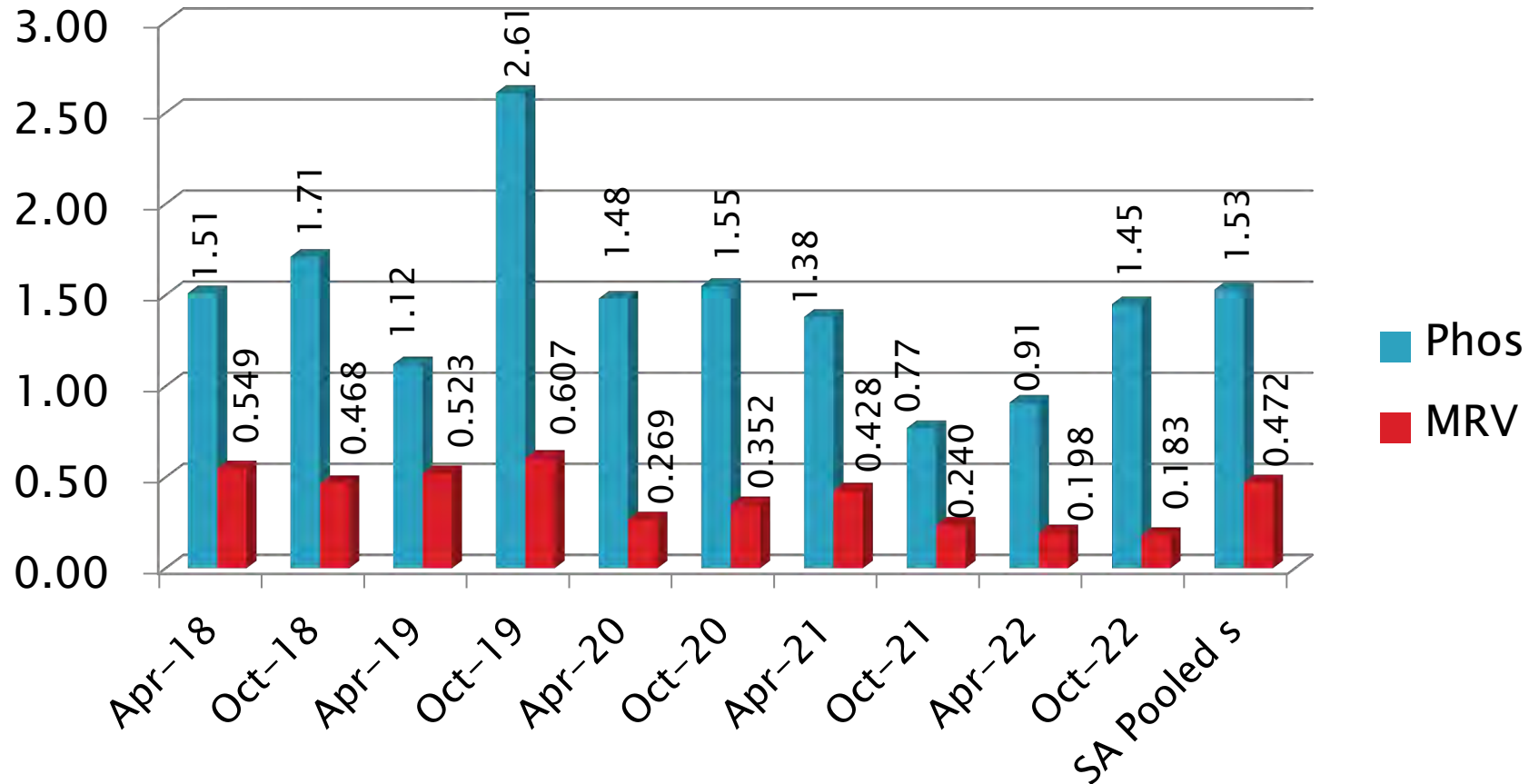
CUSUM Severity Analysis



IIH Precision Estimates



IIIHA/B Precision Estimates



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Sequence IVA

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Sequence IVA Activity

Test Status	Validity Code	#
Acceptable Calibration Test	AC	2
Total		2

Sequence IVA Test Severity

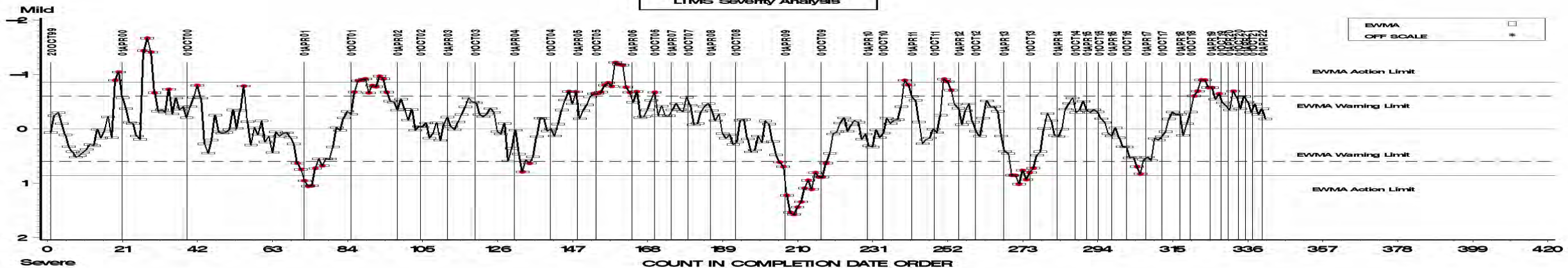
- ACW is within control limits.

SEQUENCE IVA INDUSTRY OPERATIONAL VALID DATA

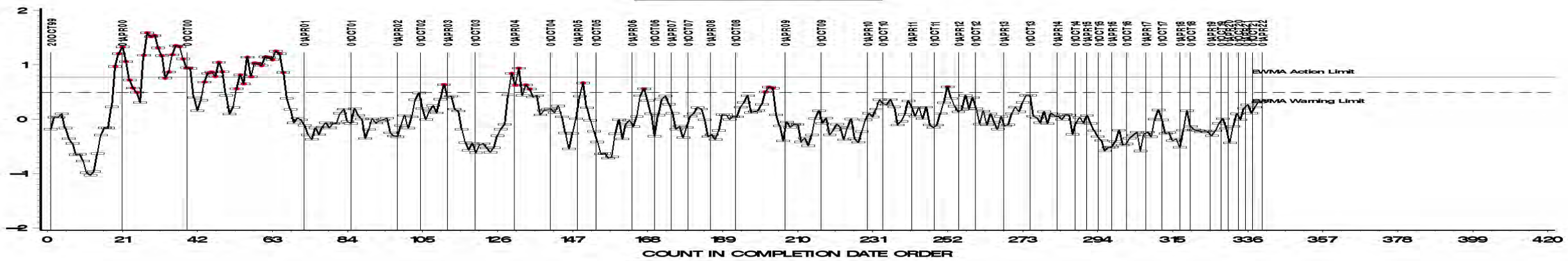


AVERAGE CAM WEAR

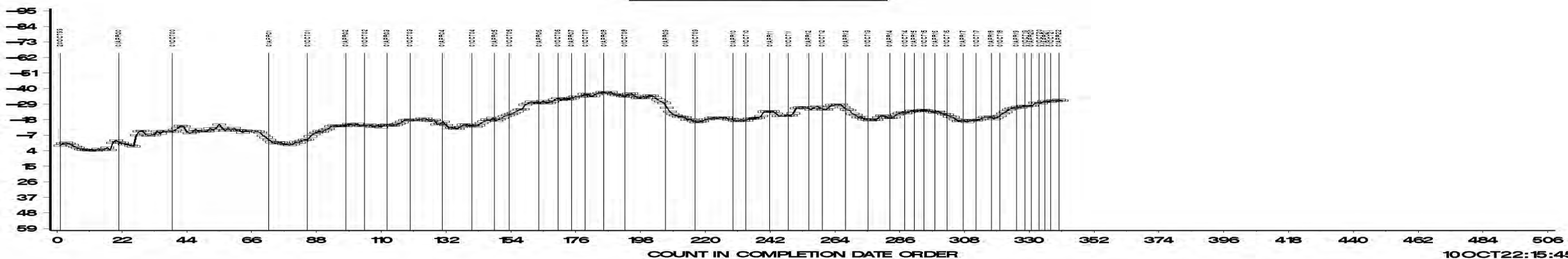
LTMS Severity Analysis



LTMS Precision Analysis



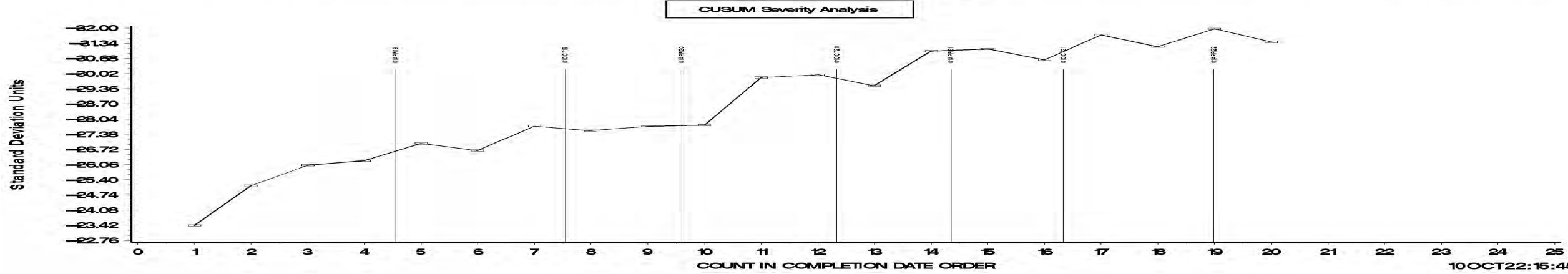
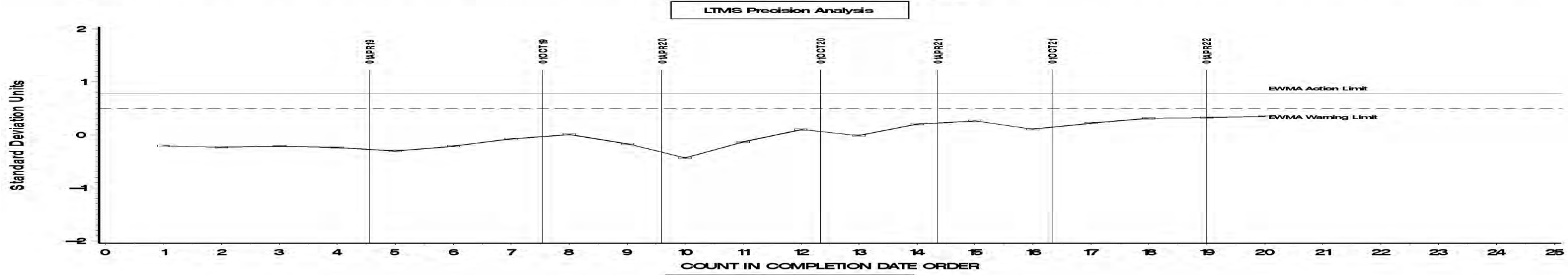
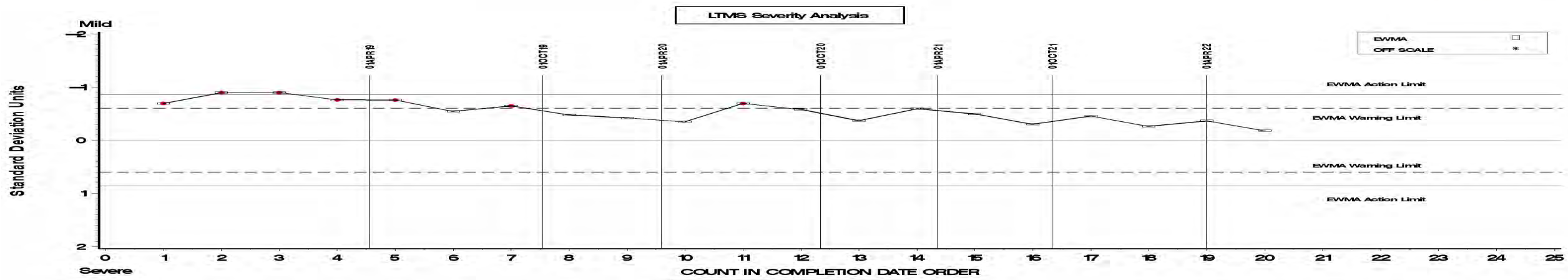
CUSUM Severity Analysis



SEQUENCE IVA INDUSTRY OPERATIONALLY VALID DATA

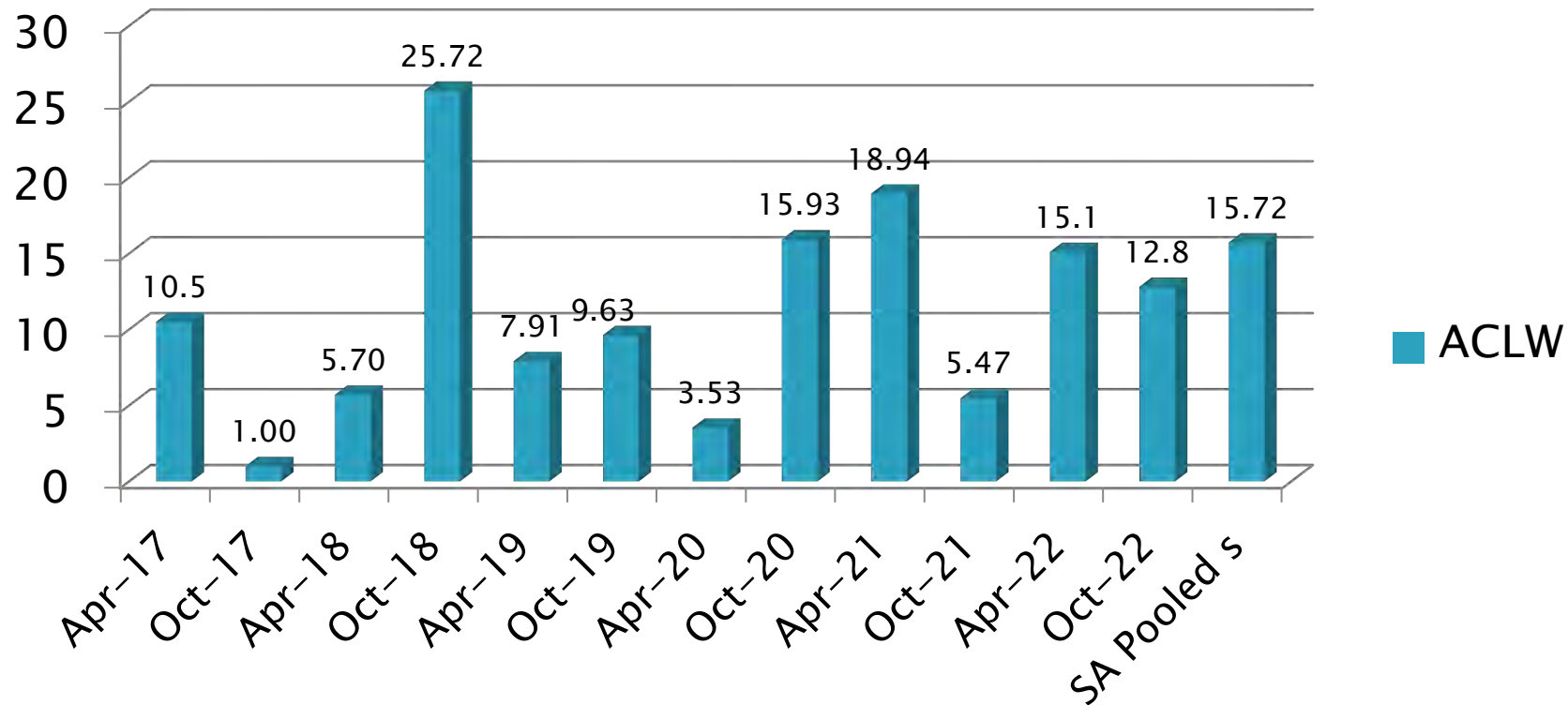


AVERAGE CAM WEAR



Sequence IVA Precision Estimates

ACW



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Sequence IVB

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Sequence IVB Activity

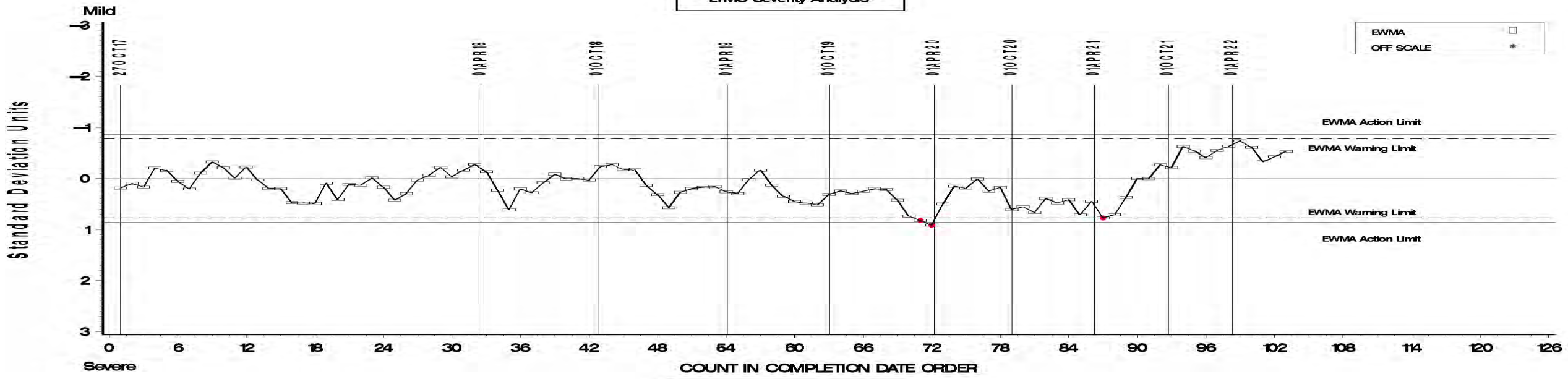
Test Status	Validity Code	#
Acceptable Calibration Test	AC	5
Total		5

Sequence IVB Test Severity

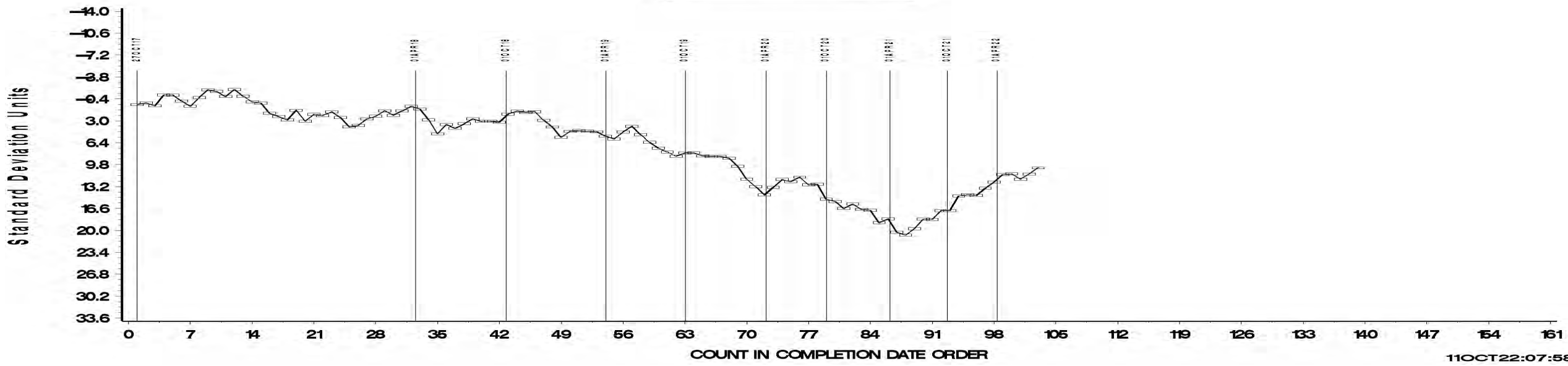
- AVLI and Fe are in control. Both parameters are showing a long-term mild trend.

AVERAGE VOLUME LOSS BY KEYENCE INTAKE Final

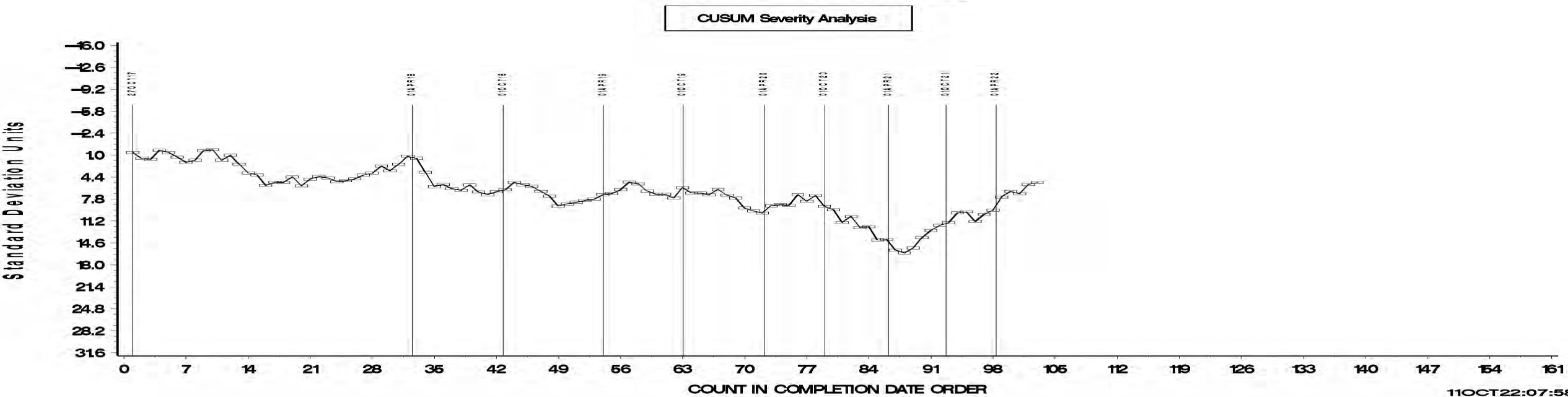
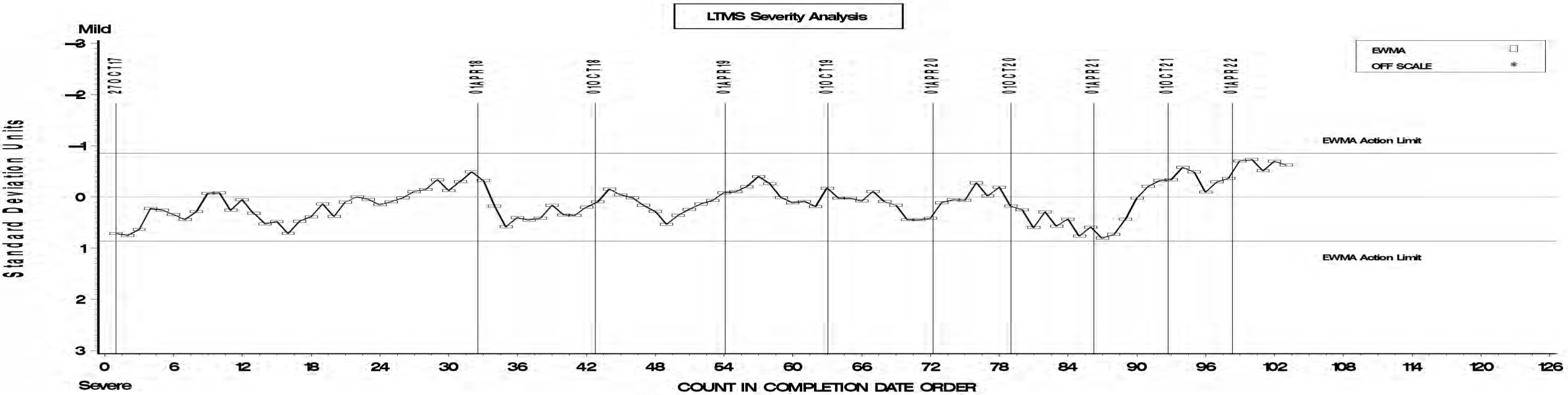
LTMS Severity Analysis



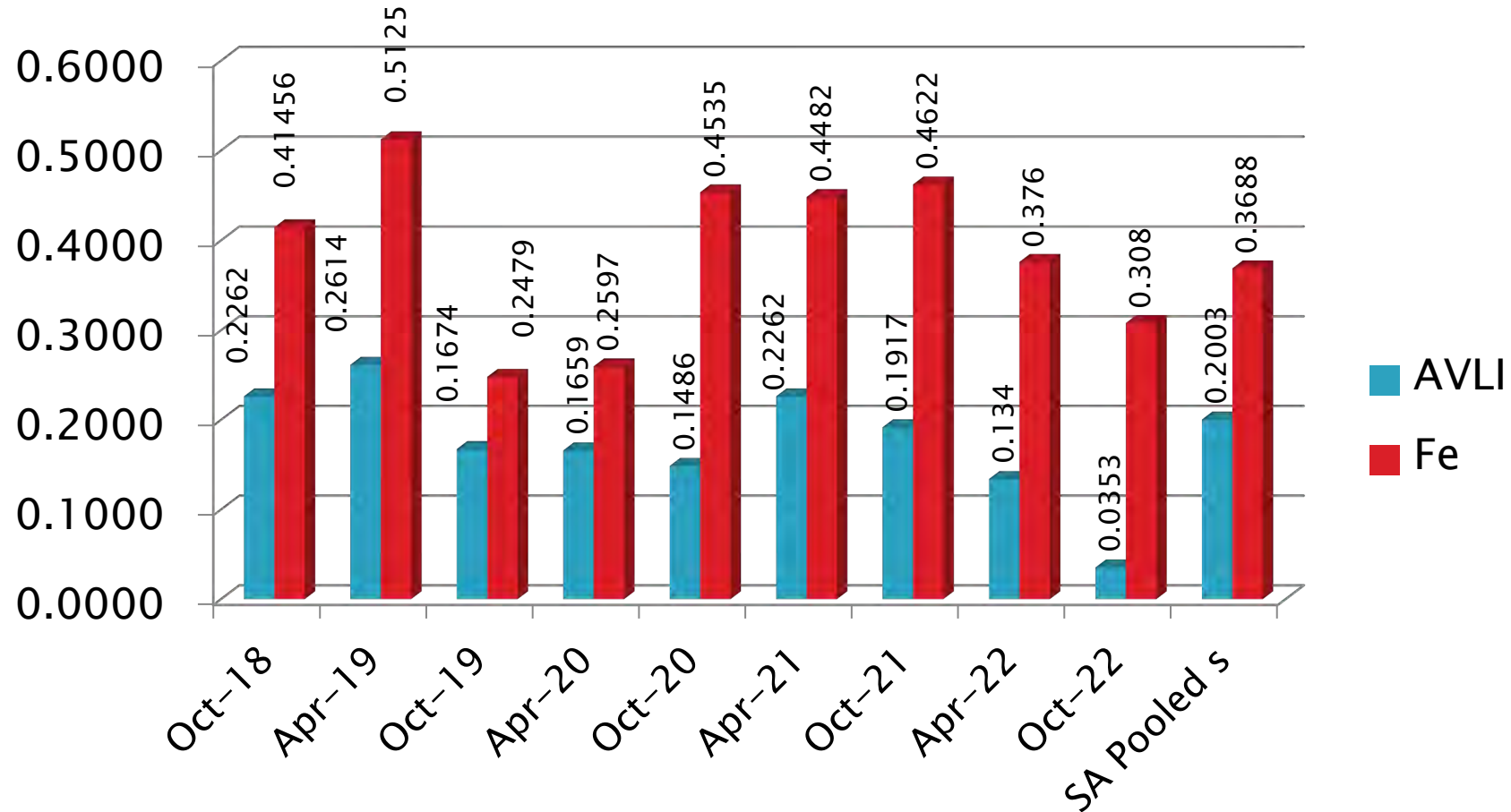
CUSUM Severity Analysis



END OF TEST FE FINAL Severity Adjusted RESULT



Sequence IVB Precision Estimates



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Sequence VH

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Sequence VH Activity

Test Status	Validity Code	#
Acceptable Calibration Test	AC	10
Statistically Unacceptable Calibration Test	OC	1
Calibration Attempt Terminated Early	XC	1
Fuel Approval Tests	PF	6
Total		18

Sequence VH – Lost Tests*

Test Status	Cause	#
Aborted	Intake Air Temperature Ran out of Spec for 7 hours	1
Totals		1

*Invalid and aborted tests

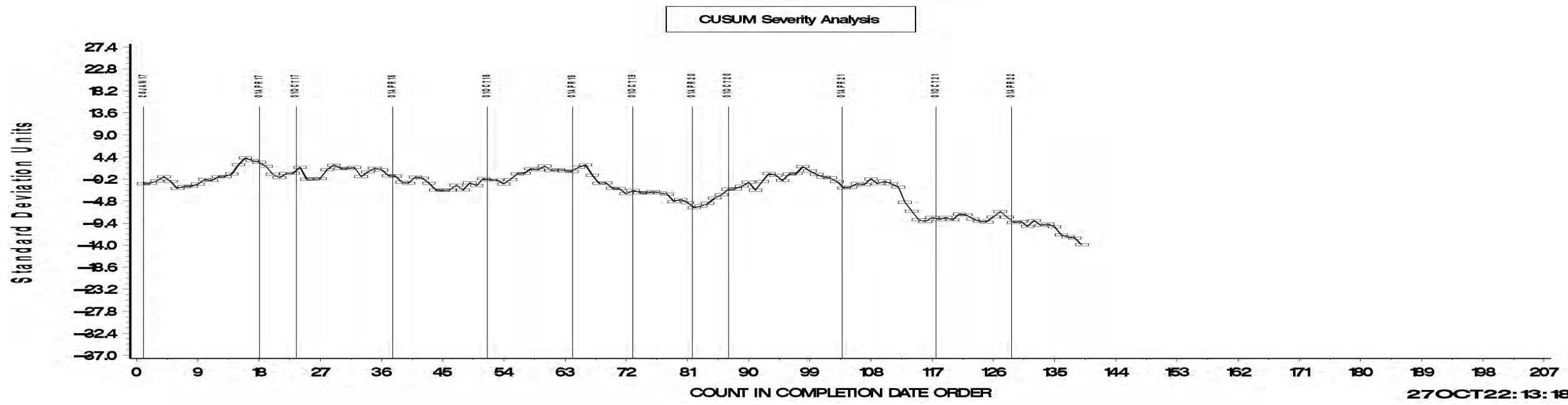
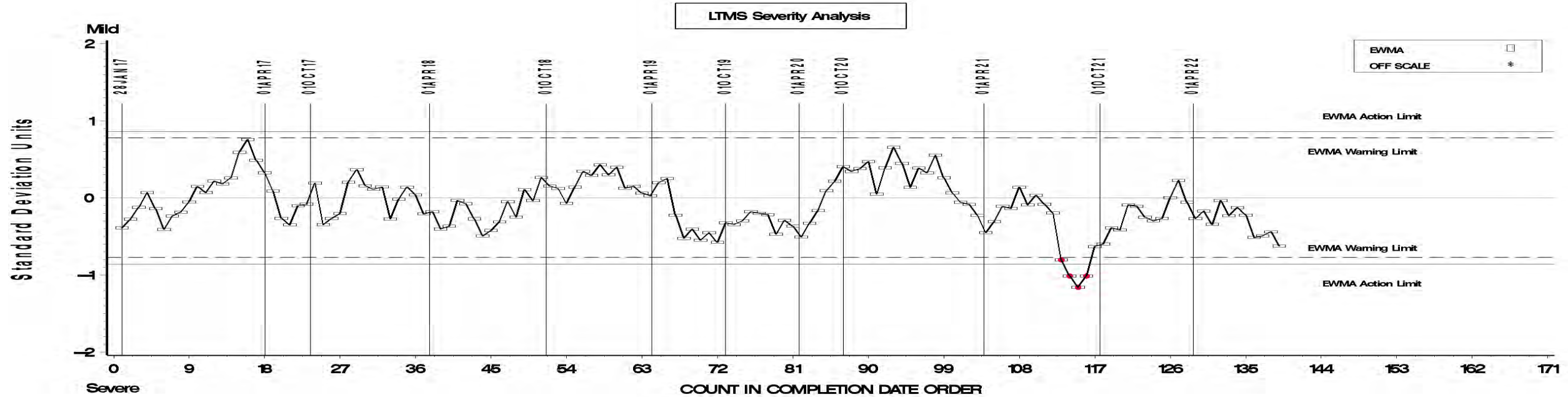
Sequence VH – Failing Tests

Test Status	#
AEV Ei Level 3 alarm (Severe Direction)	1
Total	1

Sequence VH Test Severity

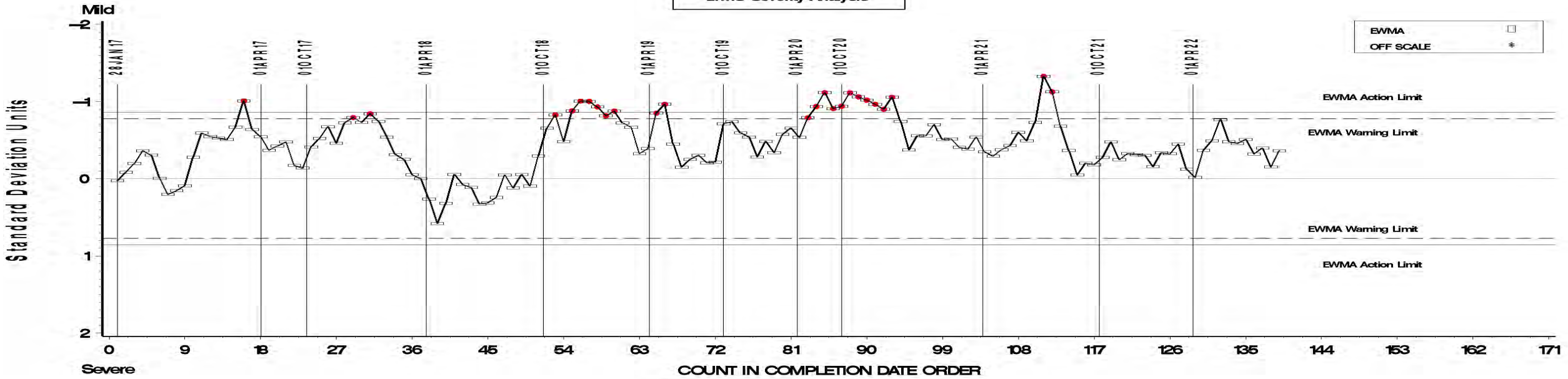
- Both APV and AEV ended the period in severity warning alarm.
- All other parameters within control limits

AVERAGE ENGINE SLUDGE FINAL RESULT

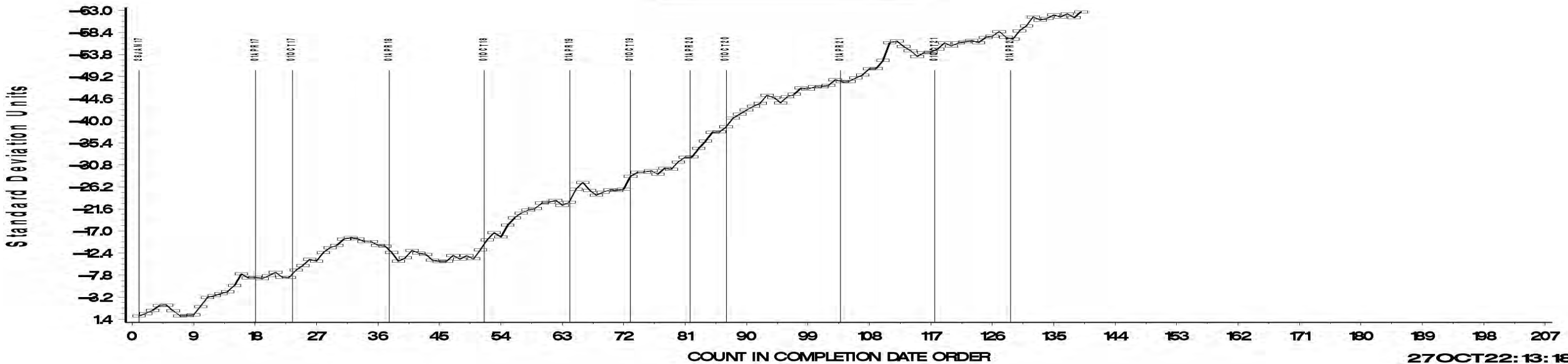


AVERAGE ROCKER COVER SLUDGE

LTMS Severity Analysis

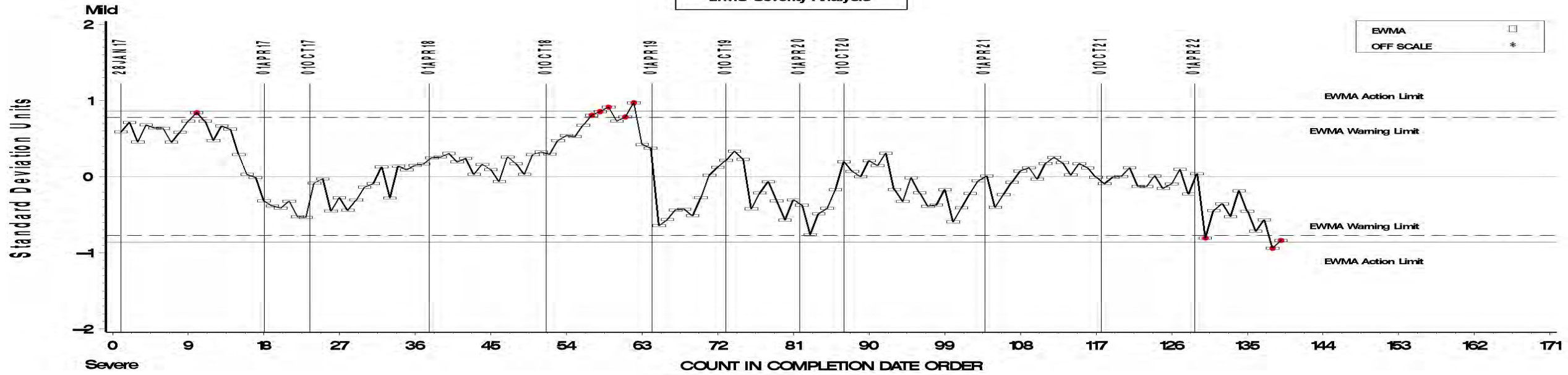


CUSUM Severity Analysis

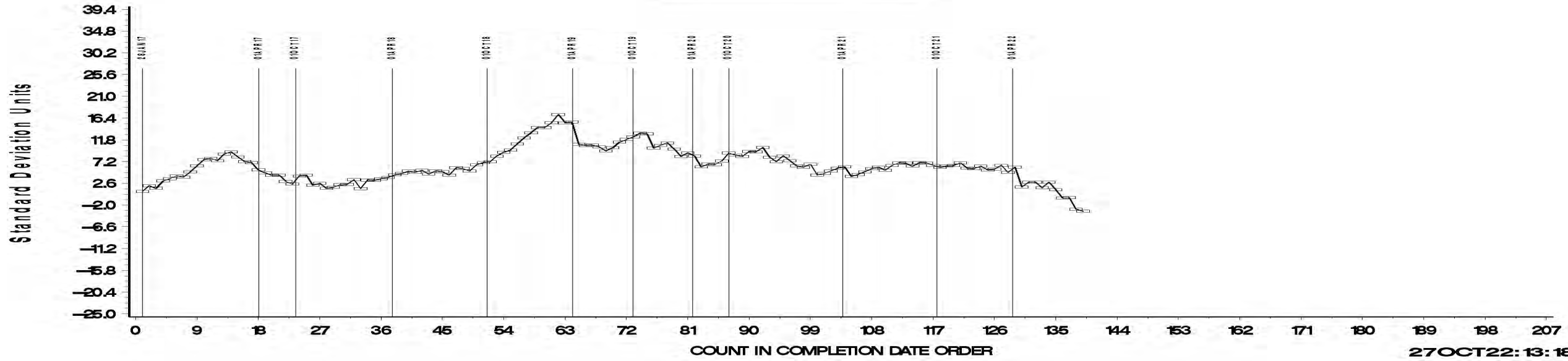


AVG. ENG. VARN. 50% RATING

LTMS Severity Analysis

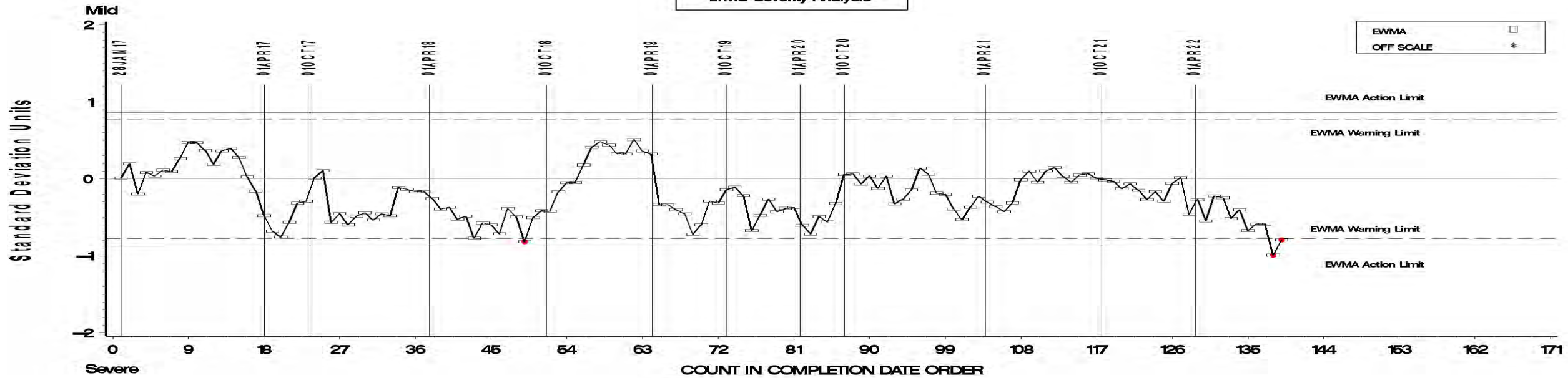


CUSUM Severity Analysis

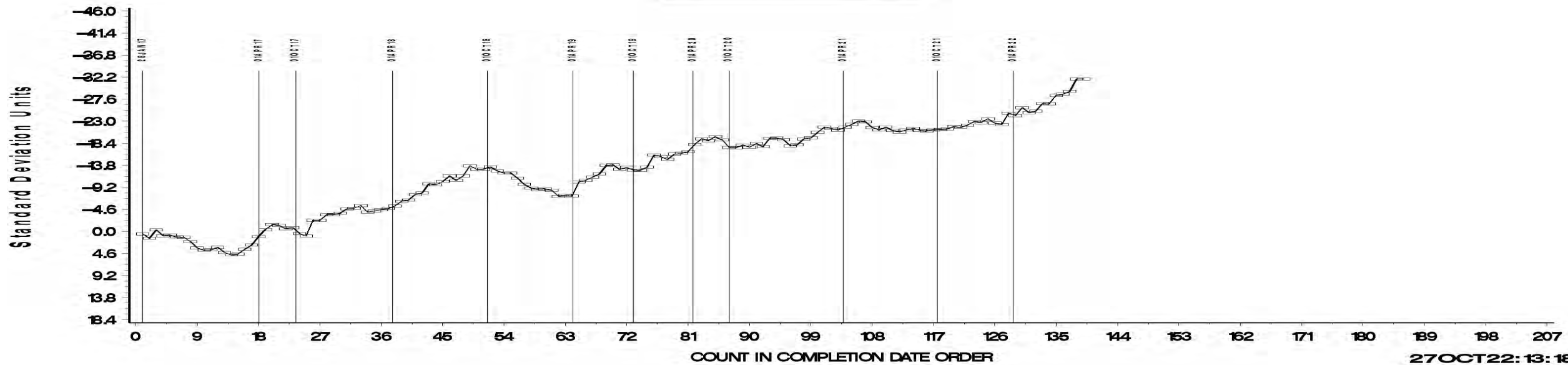


AVG PISTON SKIRT 50% RATING

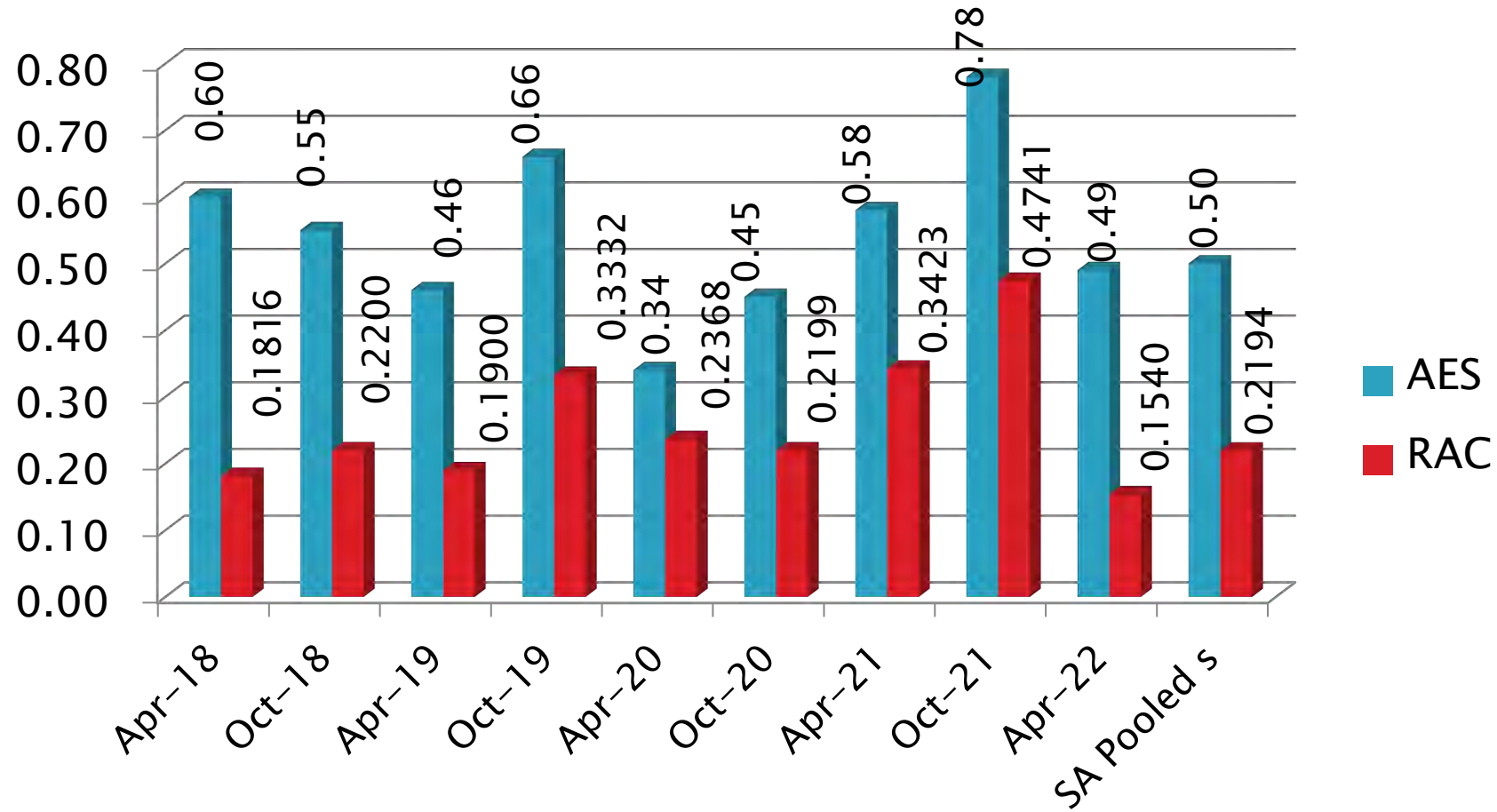
LTMS Severity Analysis



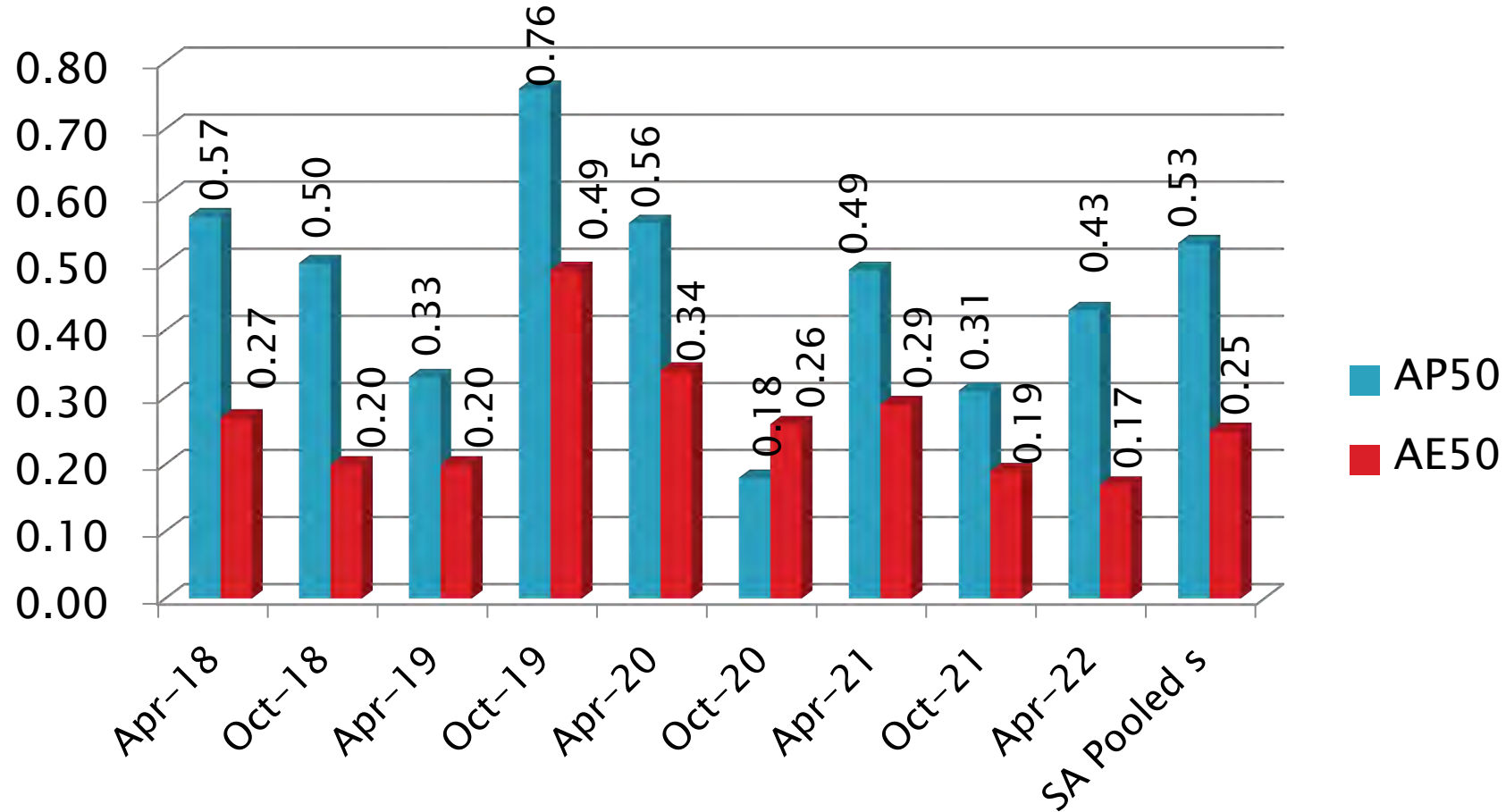
CUSUM Severity Analysis



Sequence VH Precision Estimates



Sequence VH Precision Estimates



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Sequence VIE

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Sequence VIE Activity

Test Status	Validity Code	#
Acceptable Calibration Test	AC	19
Statistically Unacceptable Calibration Test	OC	2
Operationally Invalid Calibration Test	LC	1
Total		22

Sequence VIE- Failed Tests

Test Status	#
FEI1 Severe	1
FEI1 Mild	1
Total	2

Sequence VIE – Lost Tests*

Test Status	Cause	#
Invalid	Dyno Failure	1
Totals		1

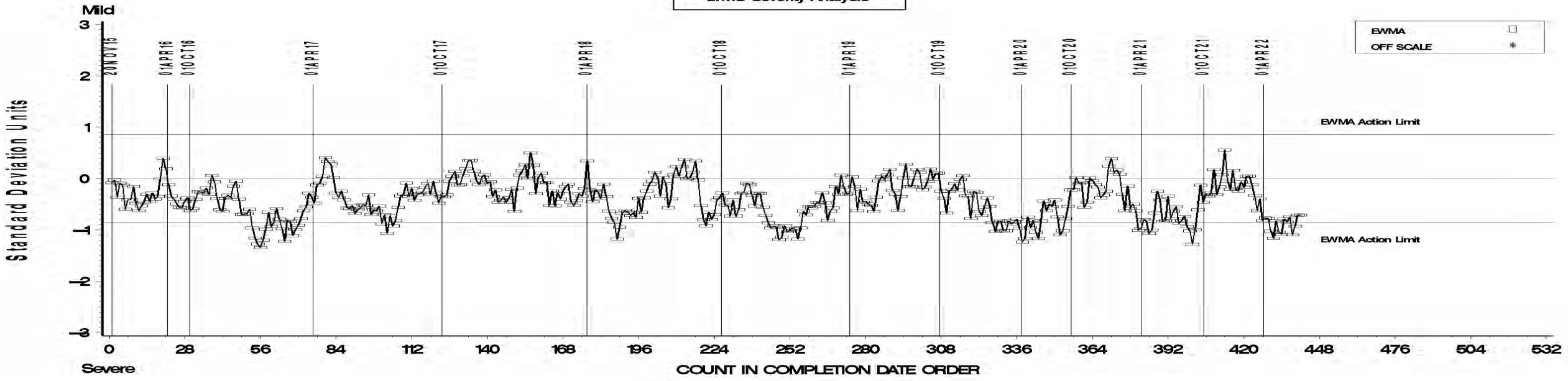
*Invalid and aborted tests

Sequence VIE Test Severity

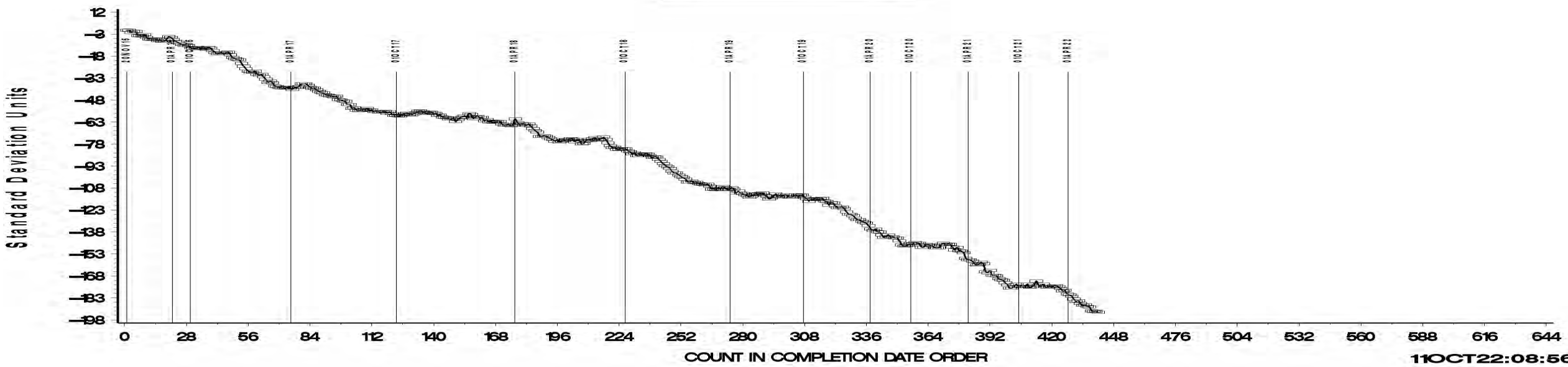
- FEI1 and FEI2 are in control, but showing long term severe trends in the Cusum and EWMA charts

FEI FINAL RESULT PHASE I

LTMS Severity Analysis

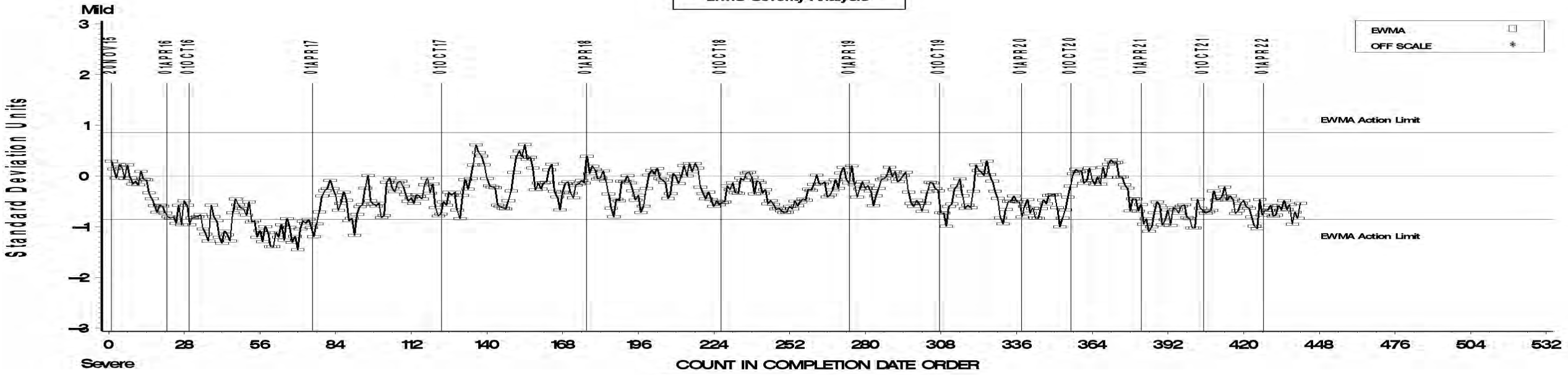


CUSUM Severity Analysis

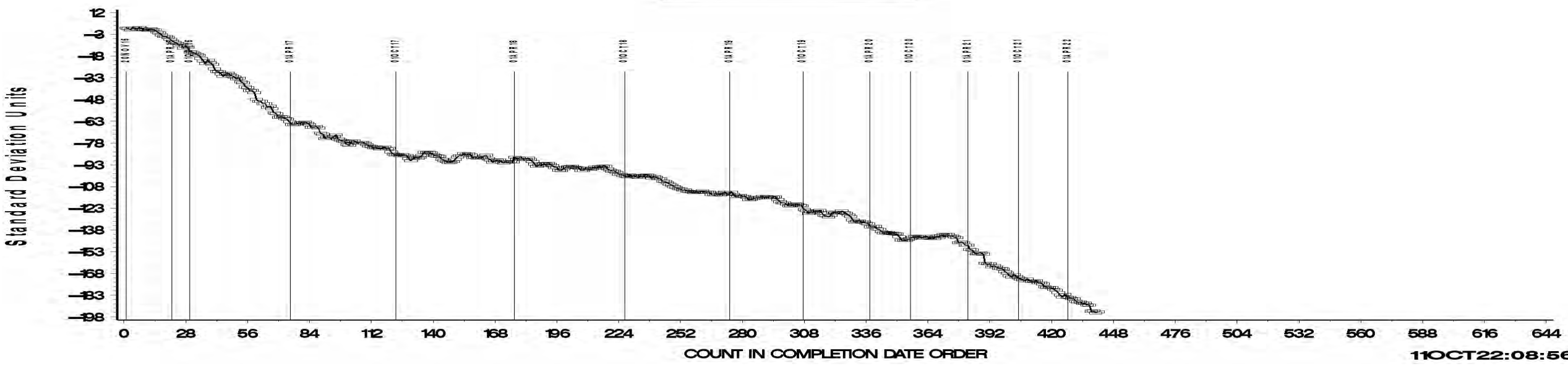


FEI FINAL RESULT PHASE II

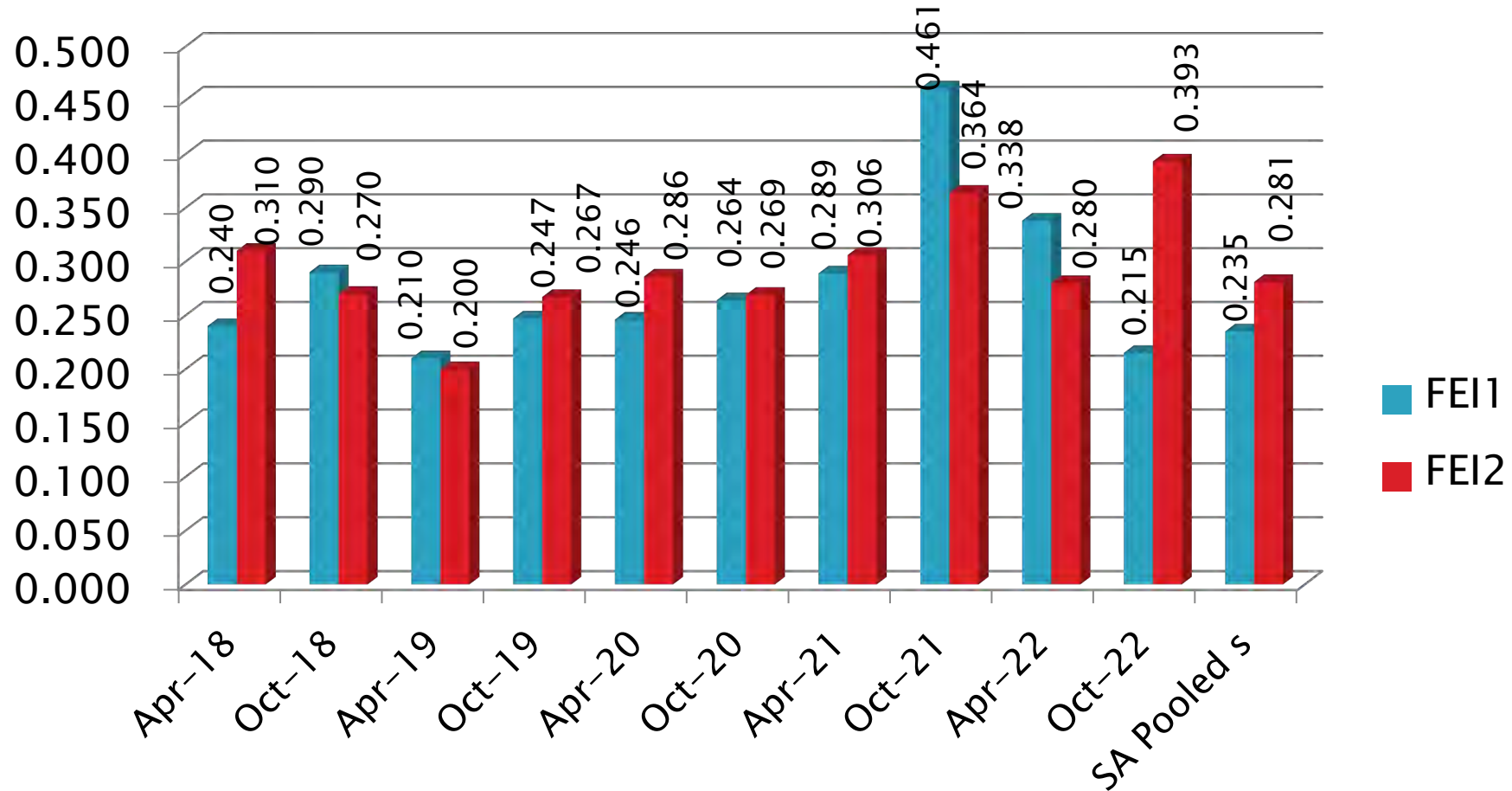
LTMS Severity Analysis



CUSUM Severity Analysis



Sequence VIE Precision Estimates



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Sequence VIF

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Sequence VIF Activity

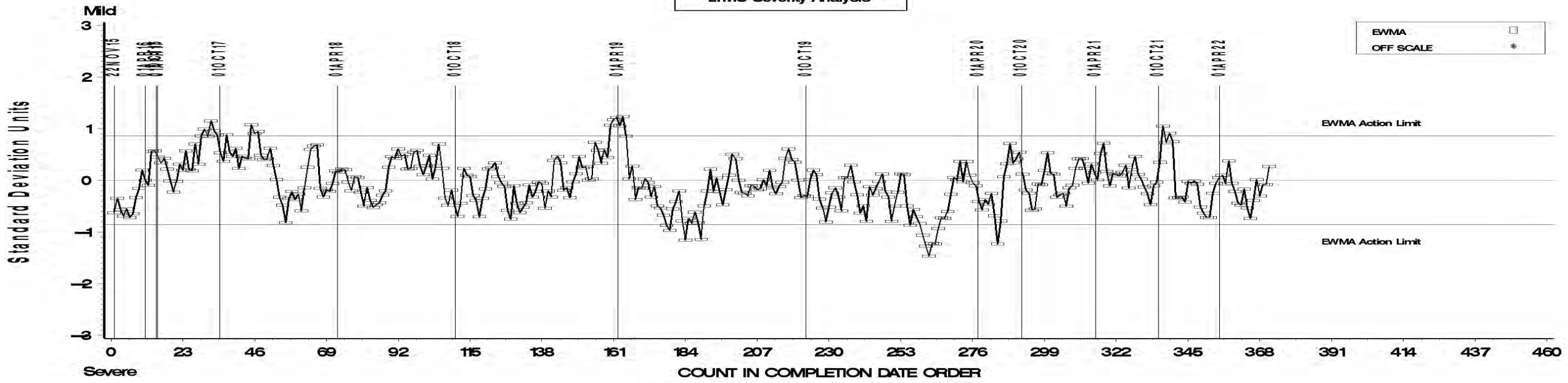
Test Status	Validity Code	#
Acceptable Calibration Test	AC	16
Stage 4 BL After Exhaust Backpressure Out of Spec	LC	1
Abandon Engine	MC	1
Total		18

Sequence VIF Test Severity

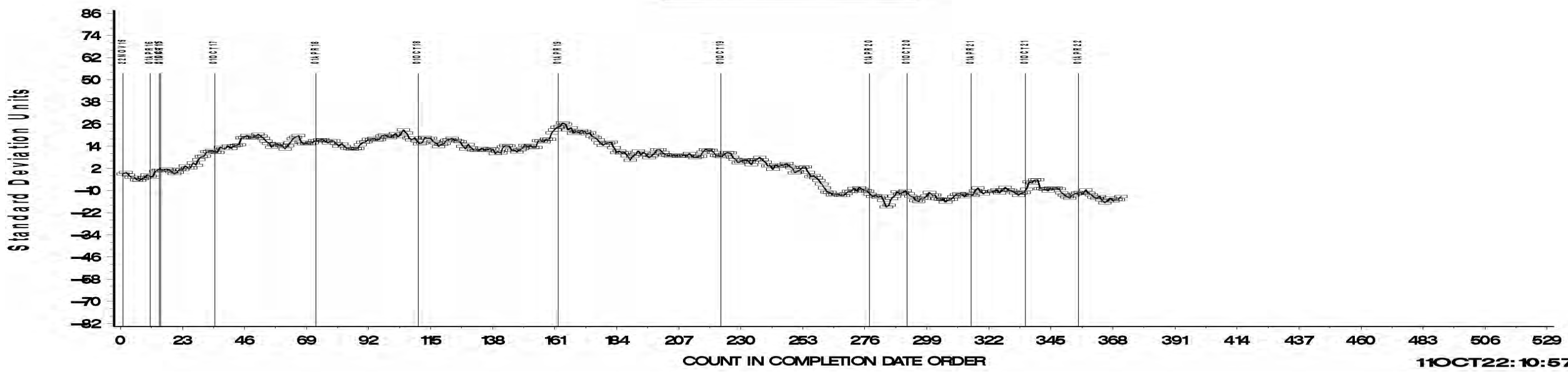
- FEI1 is in control
- FEI2 is in control

FEI FINAL RESULT PHASE I

LTMS Severity Analysis

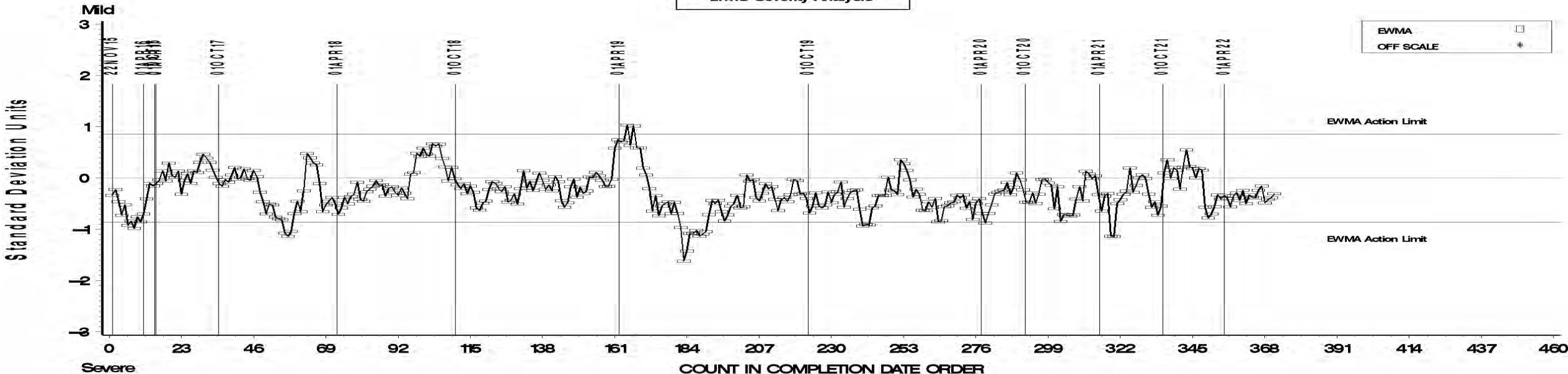


CUSUM Severity Analysis

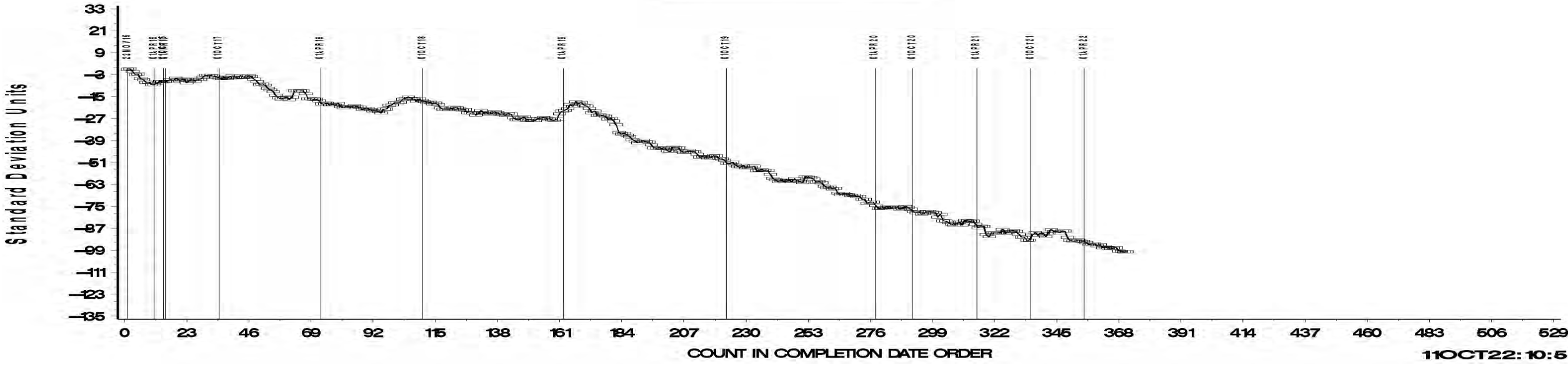


FEI FINAL RESULT PHASE II

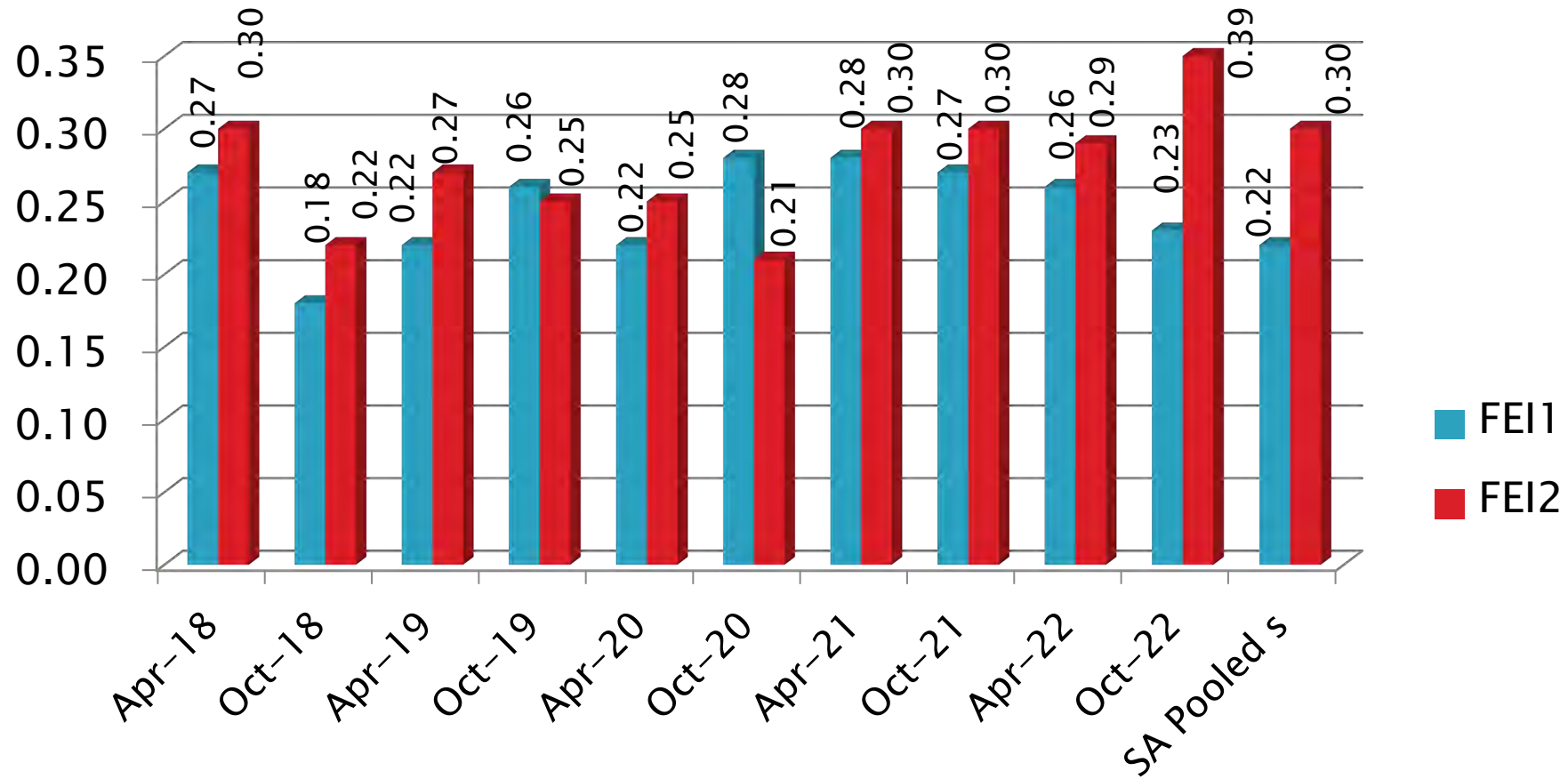
LTMS Severity Analysis



CUSUM Severity Analysis



Sequence VIF Precision Estimates



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Sequence VIII

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Sequence VIII Activity

Test Status	Validity Code	#
Acceptable Calibration Test	AC	4
Failed Calibration Test	OC	2
Total		6

Sequence VIII– Failed Tests

Test Status	#
BWLS Stand Precision Shewhart Alarm	1
SVIS Shewhart alarm	1
Total	2

Sequence VIII Test Severity

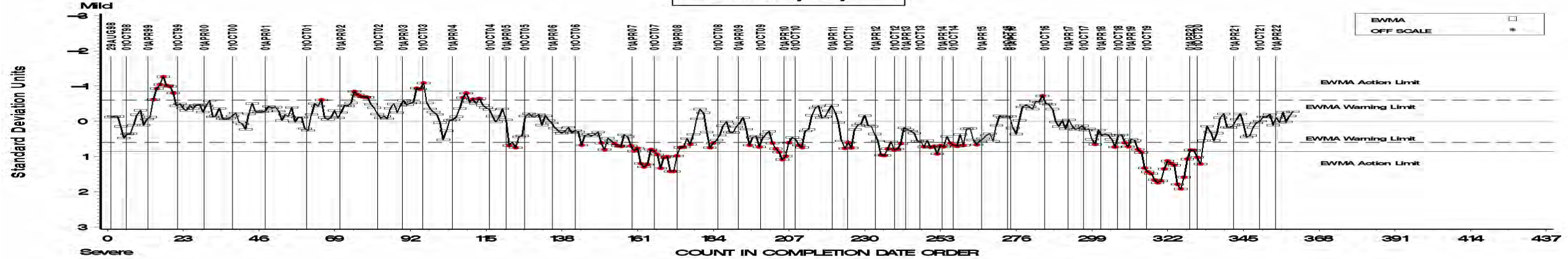
- BWLS is in control
- SVIS is in severity warning alarm

SEQUENCE VIII INDUSTRY OPERATIONAL VALID DATA

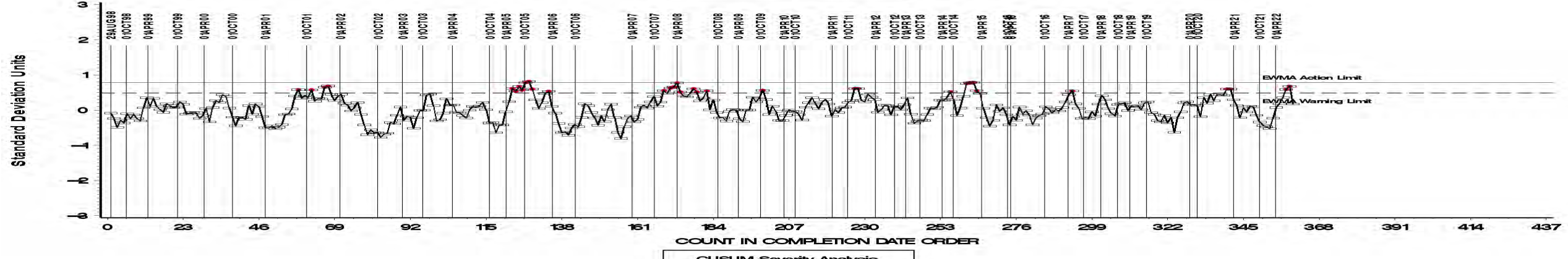


FINAL BEARING WEIGHT LOSS

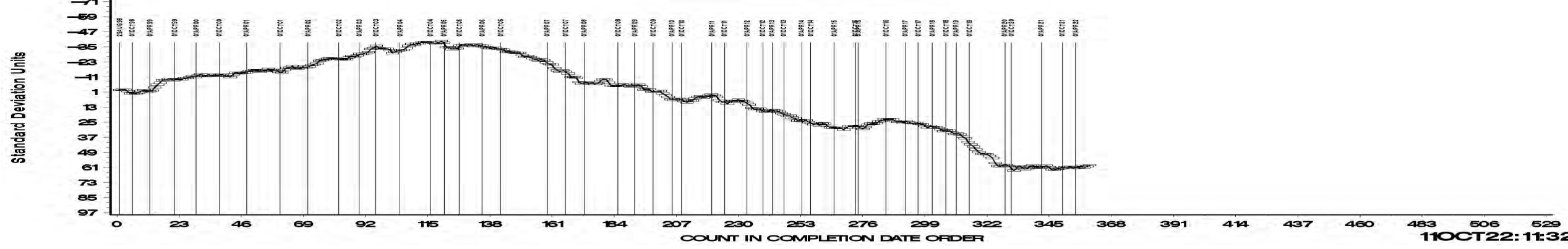
LTMS Severity Analysis



LTMS Precision Analysis



CUSUM Severity Analysis

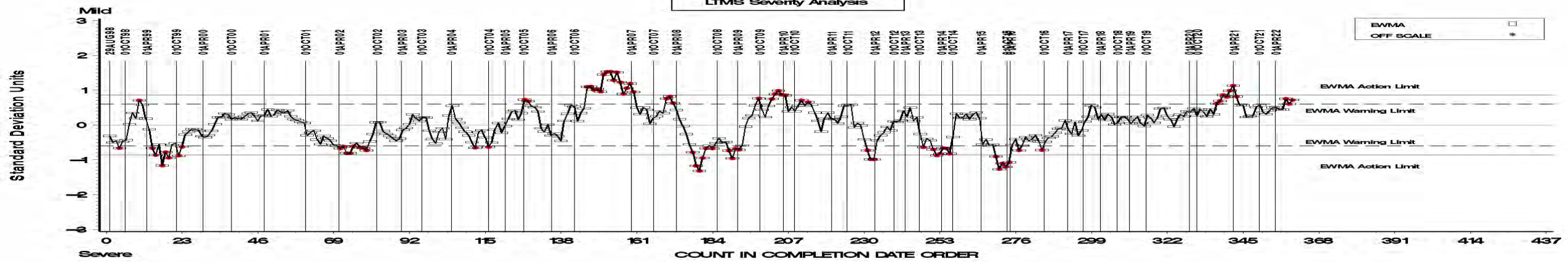


SEQUENCE VIII INDUSTRY OPERATIONALLY VALID DATA

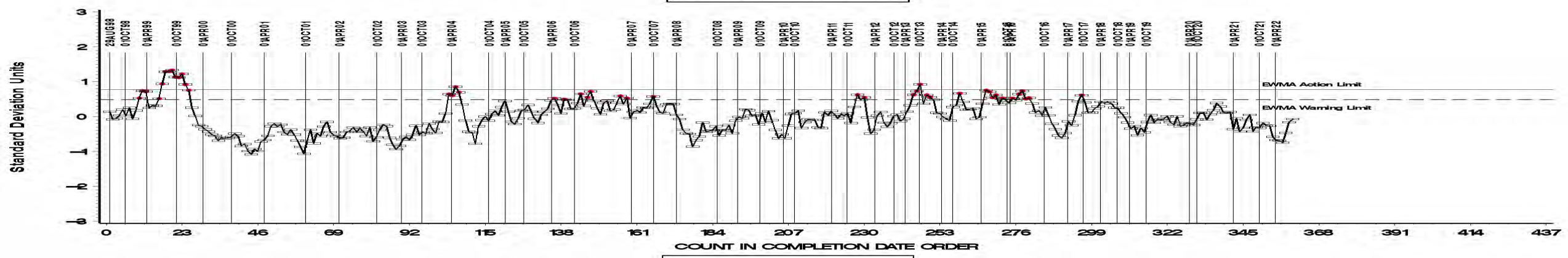


STRIPPED VIS. @ 100 DEG C

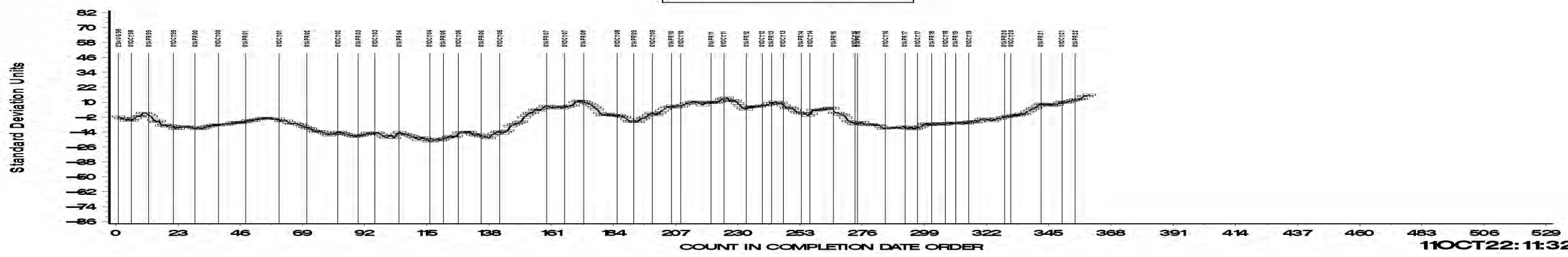
LTMS Severity Analysis



LTMS Precision Analysis

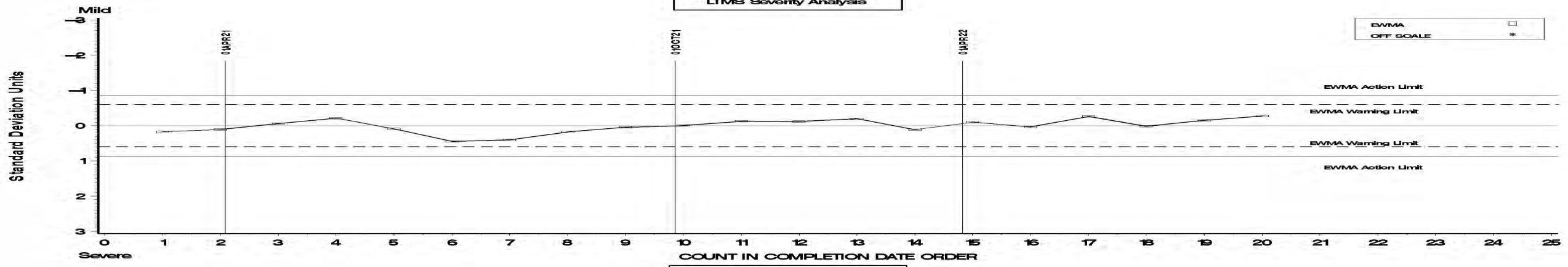


CUSUM Severity Analysis

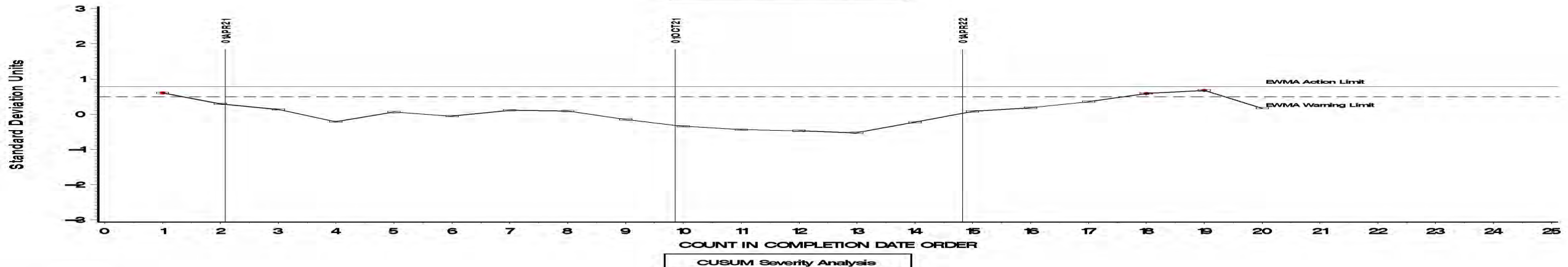


FINAL BEARING WEIGHT LOSS

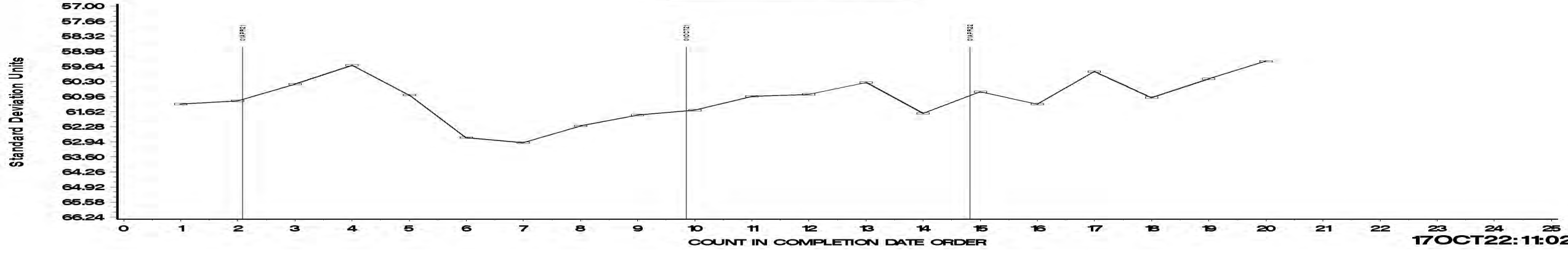
LTMS Severity Analysis



LTMS Precision Analysis



CUSUM Severity Analysis

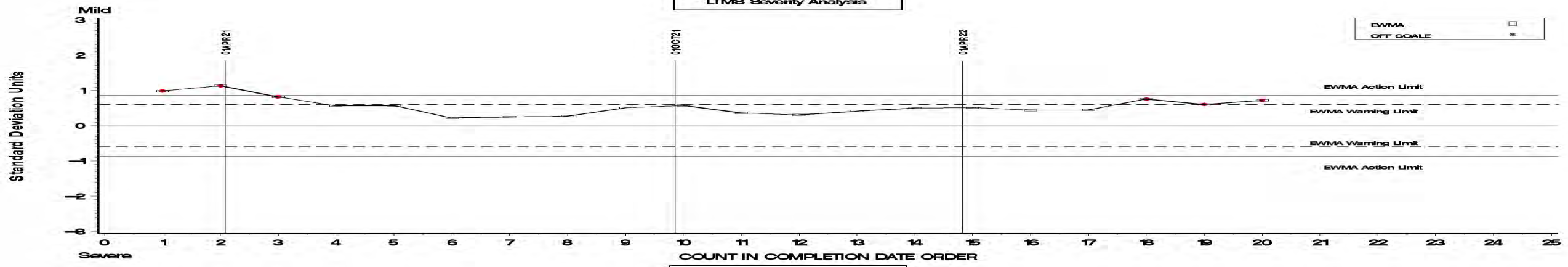


SEQUENCE VIII INDUSTRY OPERATIONALLY VALID DATA

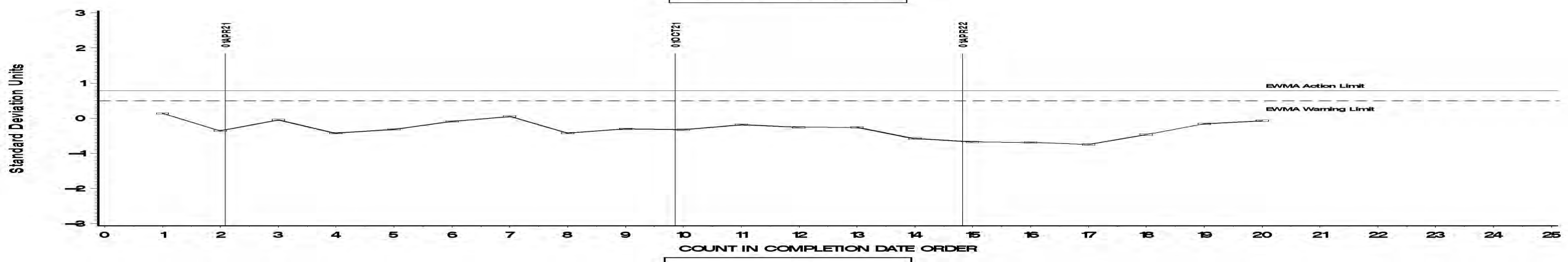


STRIPPED VIS. @ 100 DEG C

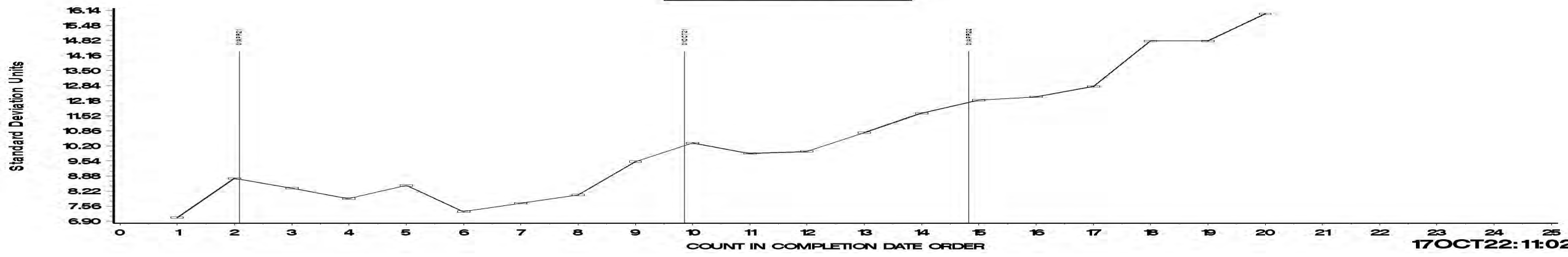
LTMS Severity Analysis



LTMS Precision Analysis

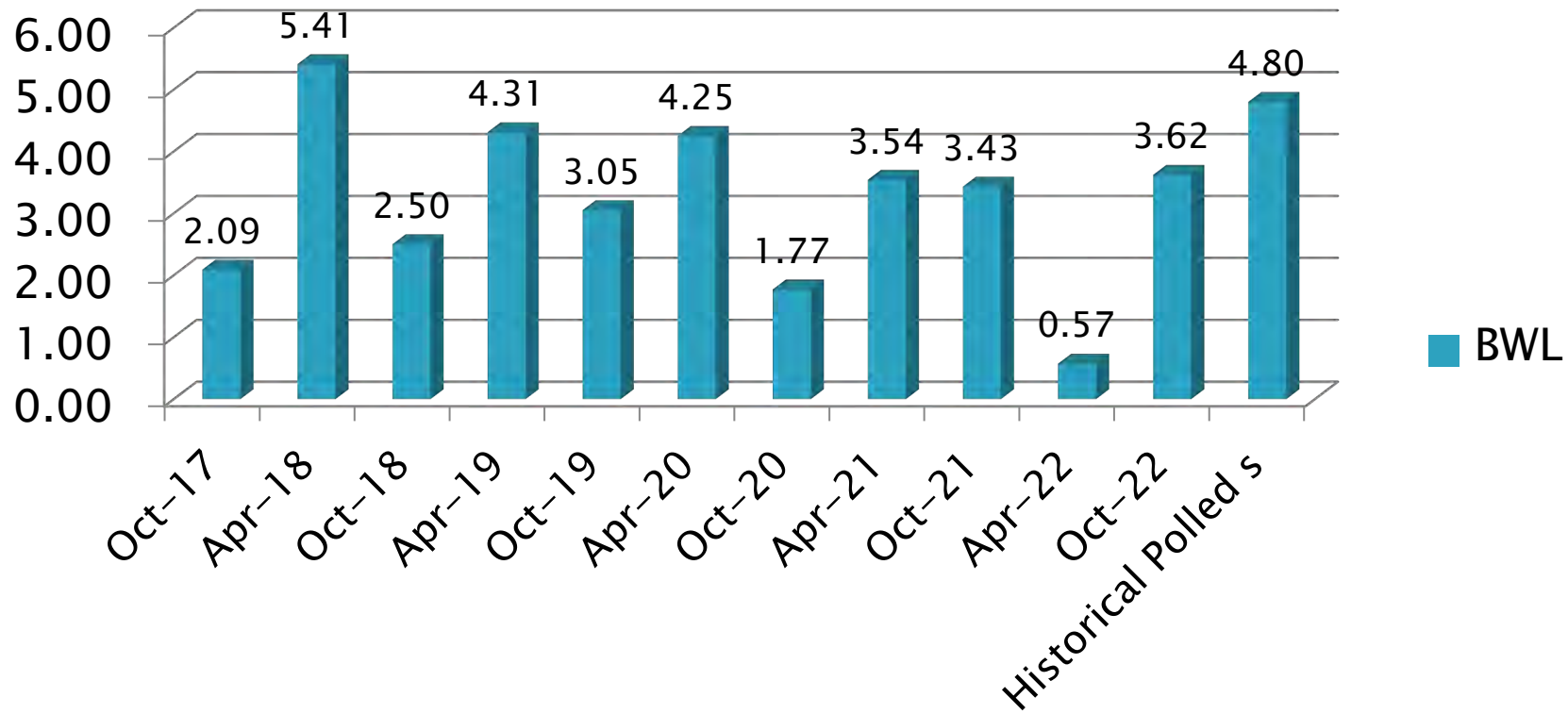


CUSUM Severity Analysis



Sequence VIII Precision Estimates

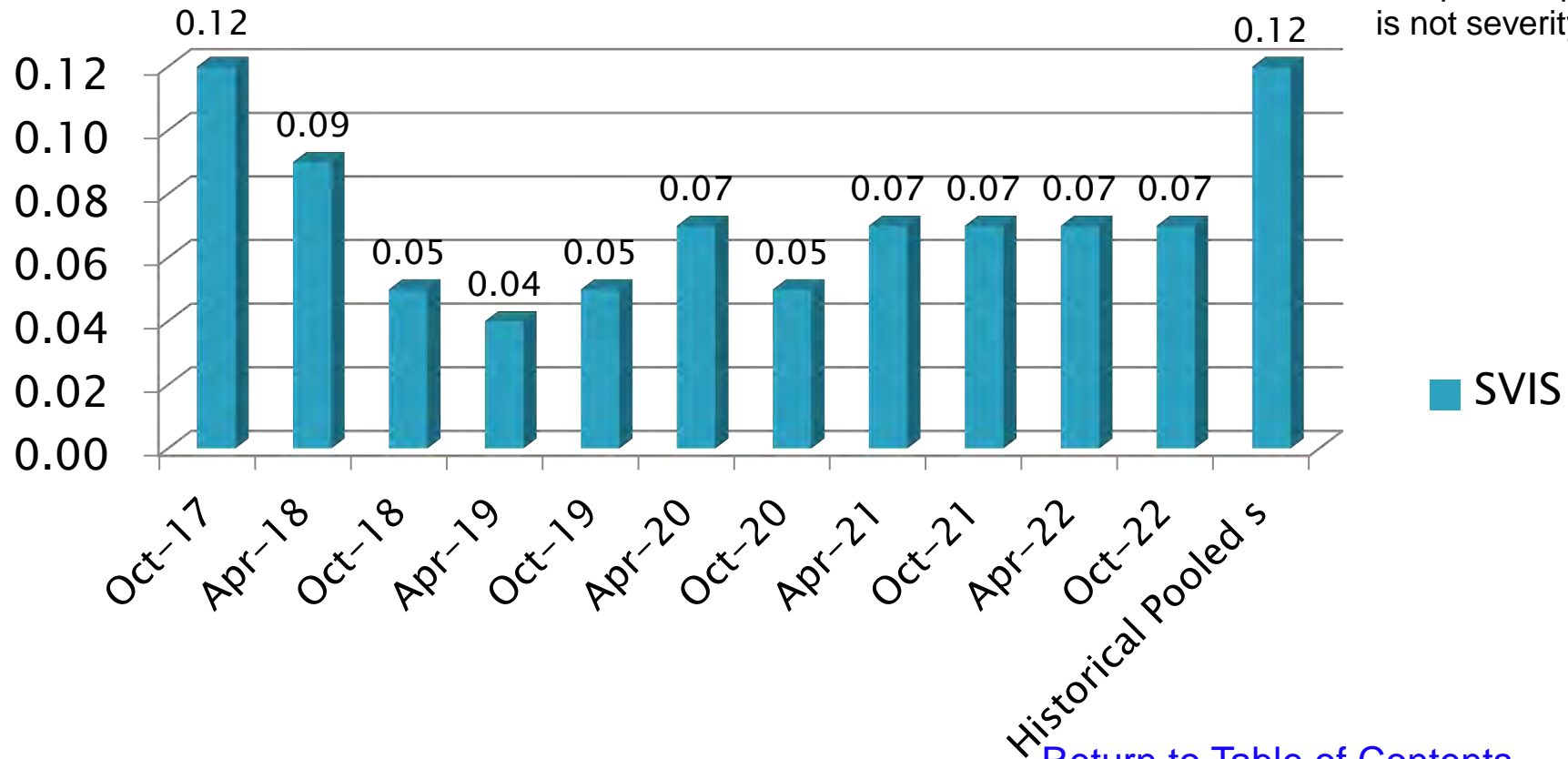
BWL



Sequence VIII Precision Estimates

SVIS

Historical Pooled s used for comparison purposes, parameter is not severity adjusted.



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Sequence IX

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Sequence IX Activity

Test Status	Validity Code	#
Acceptable Calibration Test	AC	26
Statistically Unacceptable Calibration Test	OC	6
Aborted Calibration Test	XC	1
Not for Industry Statistics Test, Alternate Fuel	NN	2
Not for Industry Statistics Test, Fresh oil Test on API02 (UOLSPI oil)	NI	2
Engine removed from stand, did not calibrate	MC	1
Total		38

Sequence IX – Failed Tests

Test Status	Number of Tests
Ei Level 3 alarm (mild direction)	5
Exceeded Maximum Number of Pre-ignition Limit	1
Total	6

Sequence IX – Lost Tests*

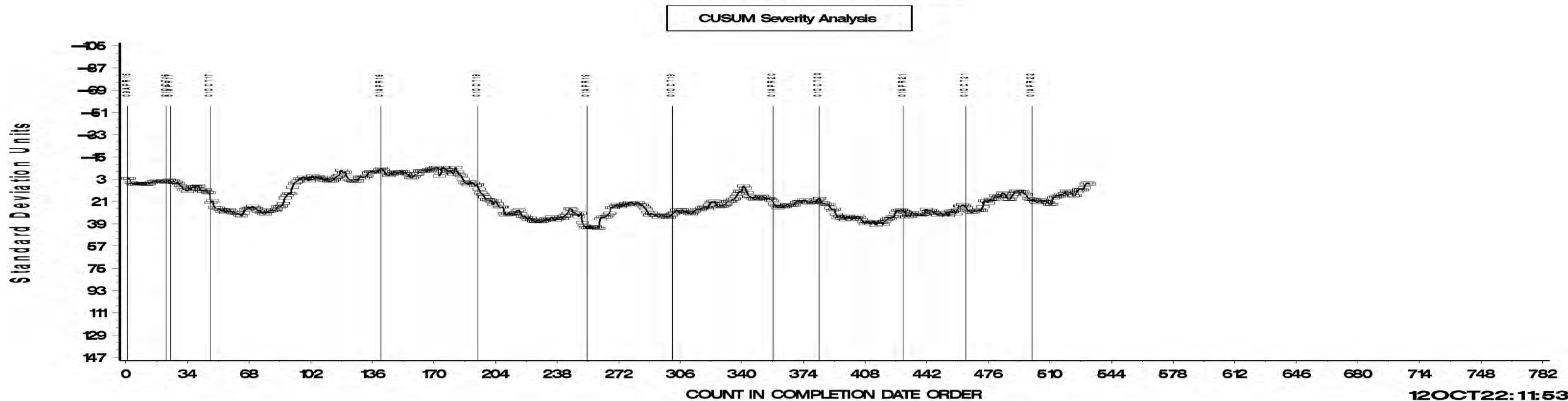
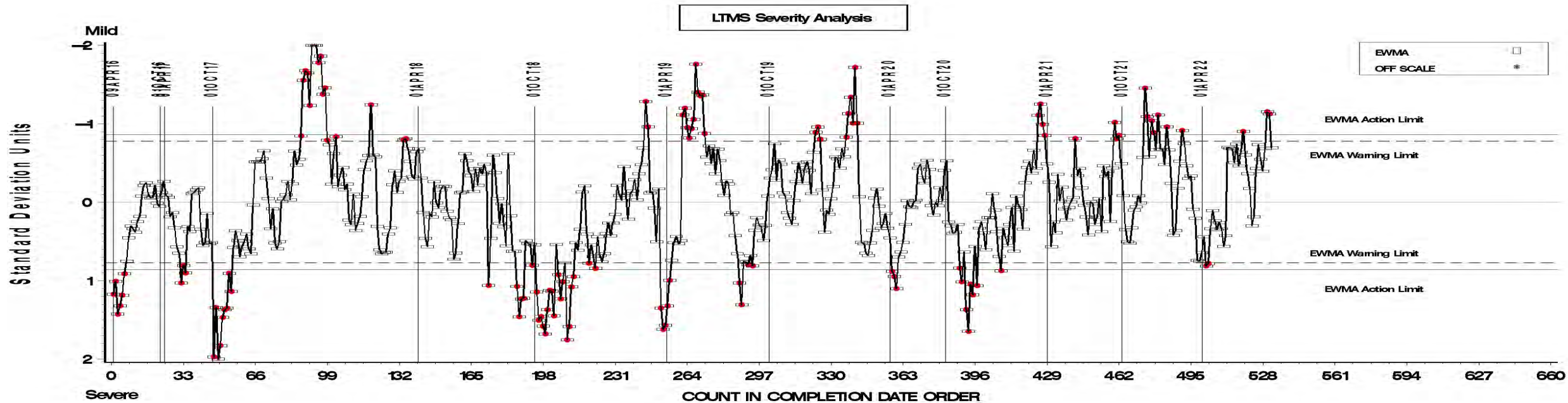
Test Status	Cause	#
Terminated	Engine damage	1
Totals		1

*Invalid and aborted tests

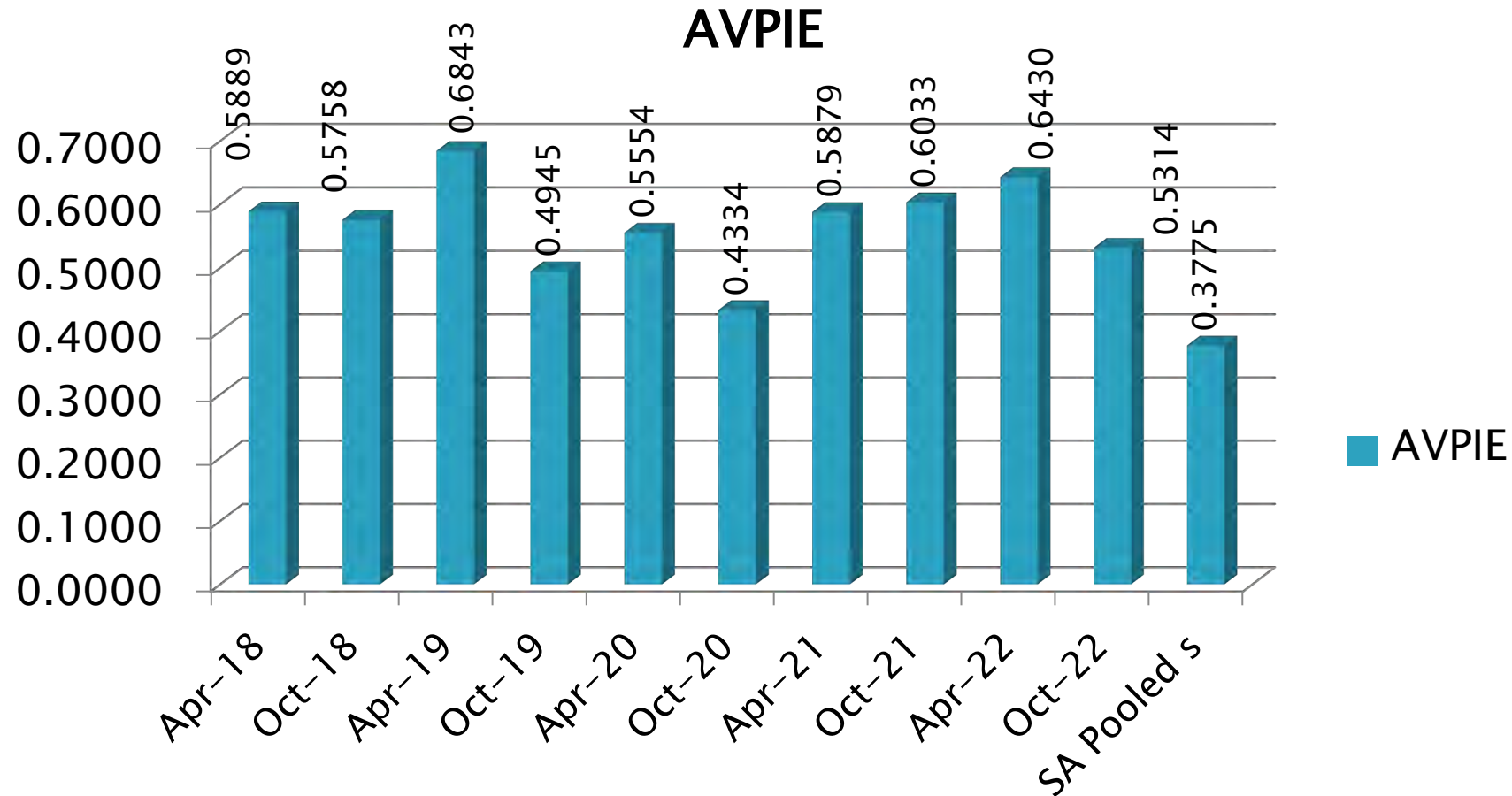
Sequence IX Test Severity

- Average number of Pre-ignitions in control.
(currently near severity warning alarm)

AVERAGE NUMBER OF PREIGNITIONS FROM VALID ITERATIONS



Sequence IX Precision Estimates



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Sequence X



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Sequence X Activity

Test Status	Validity Code	#
Acceptable Calibration Test	AC	6
Unacceptable Calibration Test	OC	1
Total Number of Tests		7

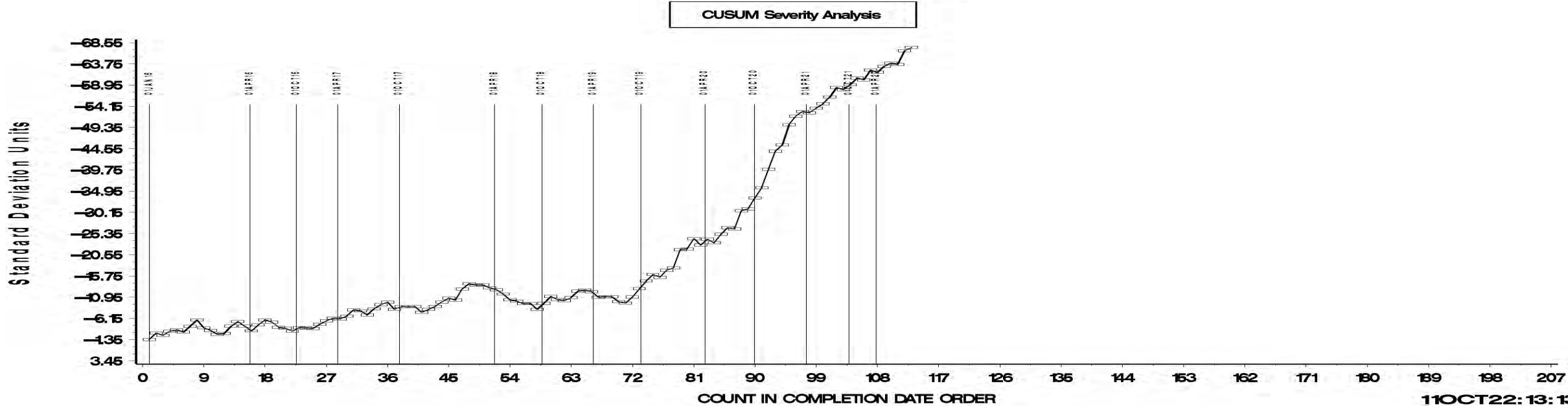
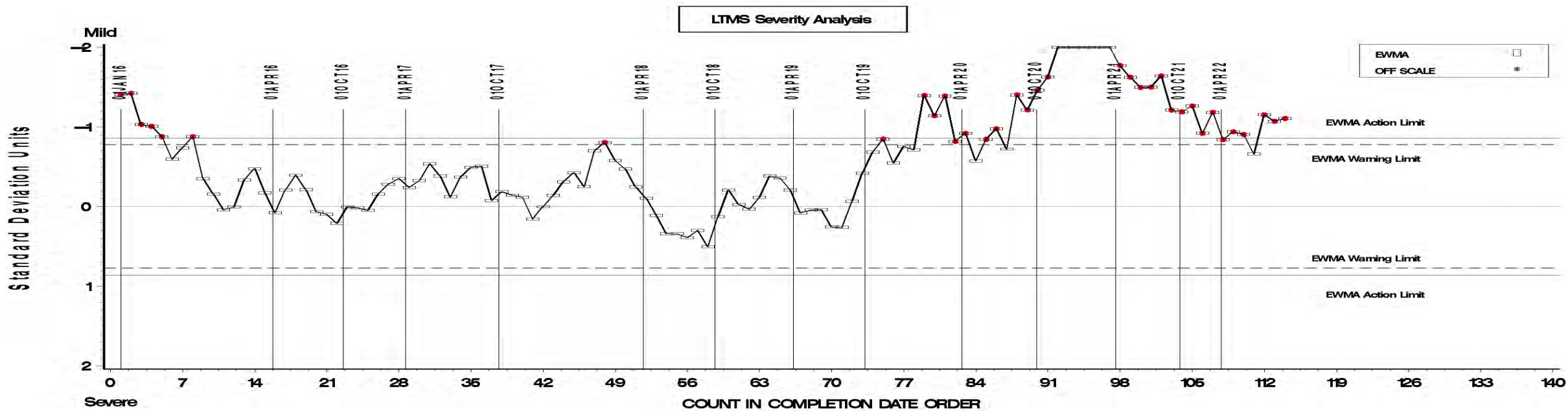
Sequence X – Failed Tests

Test Status	Number of Tests
Ei Level 1 alarm (mild direction)	1
Total	

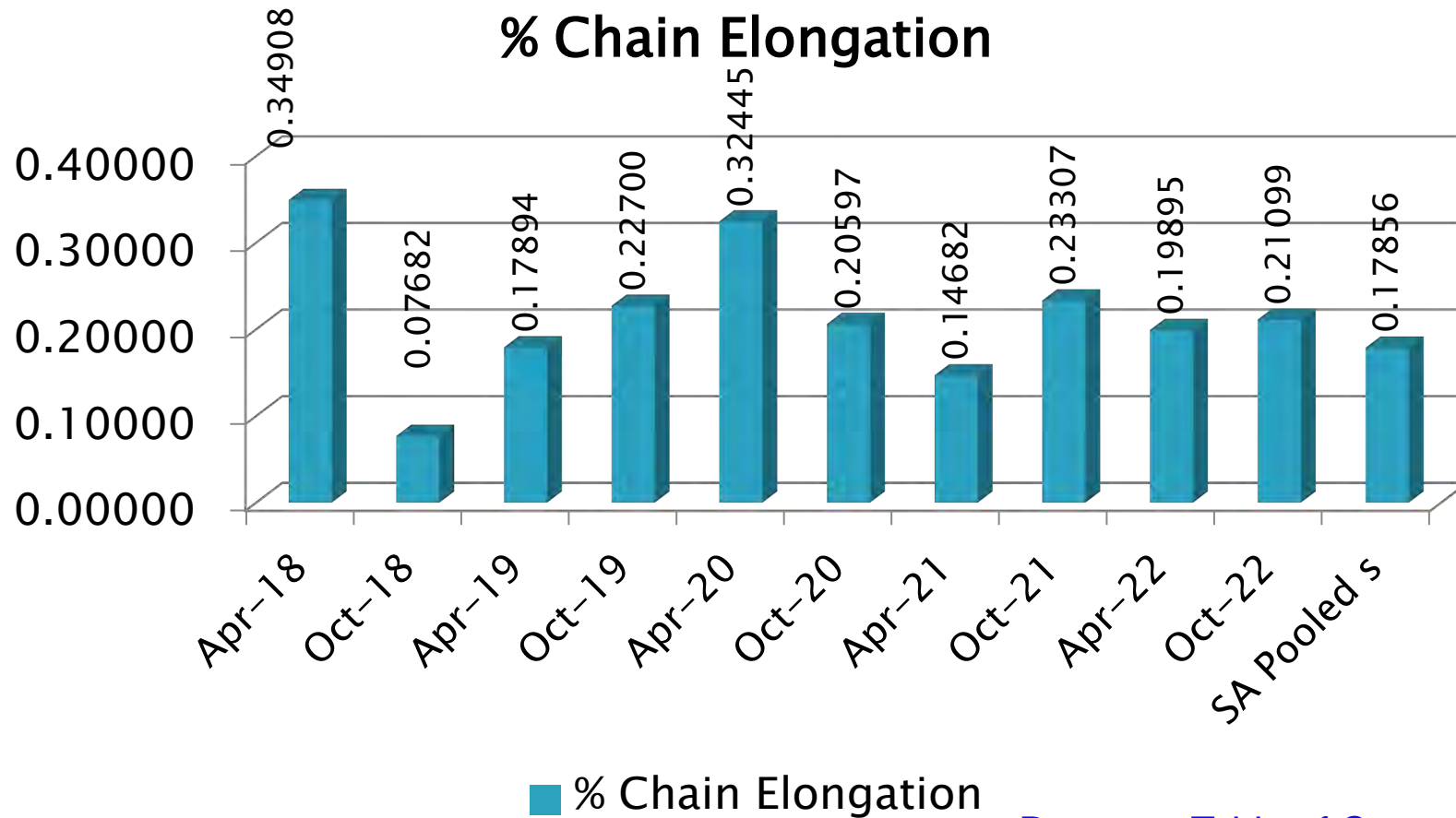
Sequence X Test Severity

- Average Chain Stretch % in Severity Action Alarm (mild).

END OF TEST CHAIN WEAR FINAL RESULT



Sequence X Precision Estimates



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Information Letters



October 2022

Information Letters*

Test	Date	IL	Topic
IIIH	20220705	22-2	Revised footnote 11 to reflect AER as the purchase point for the Sequence IIH engine
IIIH	20220310	22-3	Corrected reference in 10.4.6.1 to table 5.
VIE	20220421	22-2	Removed references to outdated hardware from various sections and captured the dated hardware in a new annex. Addressed instrumentation calibration discrepancies and allowed valve FCV-103 to be removed from cooling systems which utilize a variable frequency drive.

*Available from TMC Website

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<https://www.astmtmc.org>



Reference Oil Inventory



Actions, Re-blends, Inventories
and Estimated Life

Reference Oil Re-blends

➤ TMC 220

- A reblend for reference oils 220 has been received and is available to be introduced. This oil is used for Sequence IX engine break in only.

➤ TMC 224

- A reblend of this oil has been requested and is expected to be received shortly. This oil has been depleted at the TMC and limited quantities are currently available at the labs.

Reference Oil Re-blends (cont.)

➤ TMC 704-1

- The supplier has been contacted and this oil can not be reblended. The panel will need to search for a replacement. This oil is no longer available from the TMC. Seven tests of this oil remain in active labs..

➤ VIEBL and FO6

- A new batch of VIEBL and FO6 has been blended and shipped to the labs. Verification testing is completed and approval of VIEBL6 for use will be addressed at the next meeting.

Reference Oil Re-blends

➤ TMC 542-4 and 1010-1

- Both reference oils 542-4 and 1010-1 have been depleted at the TMC. Reblends for reference oils are available and introduction of these reblended oils will need to be addressed by the surveillance panel.

➤ TMC 543

- A limited quantity remains of reference oil 543. A reblend of this oil, 543-1 has been obtained by the TMC.

➤ TMC 940

A limited quantity remains of reference oil 940. A reblend of this oil, 940-1 has been obtained by the TMC.

Reference Oil Inventory Estimated Life

Oil	Tests	Original Blend Amount (gallons)	Quantity Shipped in last 6 months	TMC Inventory (gallons)	Lab Inventory (gallons)	Estimated Life
220	IX	1100	35	40.7	60	~1 year
221	IX	2120	125	313	55	2.5 years
222*	IX	1040	60	0	35	<1 year
224	IX	1026	65	0	60	<1 year
270	X	1100	55	574	25	5 years
271	X	980	0	677	30	5 years
300-1	IVB	378	15	221	30	3 years

* Reference oil 222 can not be re-blended

Reference Oil Inventory Estimated Life

Oil	Tests	Original Blend Amount (gallons)	Quantity Shipped in last 6 months	TMC Inventory (gallons)	Lab Inventory (gallons)	Estimated Life
434-3	IIIH	980	49	624	20	5+ years
436	IIIH	1100	12.5	590	17.5	5+ years
438-1	IIIH	605	0	0	2.5	<1 year
438-2	IIIH	540	7.5	366	27.5	5 years
542-3	VIE/VIF	997	0	0	18	<1 Year
542-4	VIE/VIF	1100	45	0	108	<1 Year
543	VIF	1100	36	44	54	<1 Year
544	VIE	897	6	180	36	3+ years

Reference Oil Inventory Estimated Life

Oil	Tests	Original Blend Amount (gallons)	Quantity Shipped in last 6 months	TMC Inventory (gallons)	Lab Inventory (gallons)	Estimated Life
704-1*	VIII	897	12	0	14	1.5 years
931	VH	908	6	819	27	5+ years
940	VH	560	24	25	24	1.5 years
1006-2	IVA, VIII	5500	24	182	32	4 years
1010-1	VIE	1760	30	36	54	~1 year
1011	IVB/VH/VIF/X	1100	0	0	34	Depleted
1011-1	IVB/VH/VIF/X	1395	56	1055	140	5+ years
1012	IVB	2200	72	1268	85	5+ years

*Reference oil 704-1 can not be reblended

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LTMS Deviations



April 1, 2022 – September 30, 2022

LTMS Deviations

- No LTMS Deviations this period

LTMS Deviations

Historical Count of PCEO LTMS Deviations

Test	LTMS Deviations
IIIH	0
IVA	7
IVB	0
VH	0
VIE	0
VIF	0
VIII	3
IX	0
X	0

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Quality Index Deviations



April 1, 2022 – September 30, 2022

Quality Index Deviations

- One deviation this period, a Seq. X Deviation for Intake Air temperature due to changes being made to the lab air handling system while the test was running.

Quality Index Deviations

Historical Count of PCEO Quality Index Deviations

Test	Quality Index Deviations
IIIH	8
IVA	32
IVB	2
VH	9
IX	1
X	3

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TMC Laboratory Visits

➤➤ April 1, 2022 – September 30, 2022

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TMC Lab Visits

Test	Number of Labs Visited
IIIH	2
IVB	0
IX	3
VH	0
VIE/VIF	2
VIII	0
X	3

Lab Visit Issues

Sequence IIIH–Fuel in thermocouple not at proper location.

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Test Area Timelines

➤➤ April 1, 2022 – September 30, 2022

Test Area Timeline Additions*

Test	Date	Topic	IL
IIIH	20220705	Revised footnote 11 to reflect AER as the purchase point for the Sequence IIH engine	22-2
IIIH	20220919	Corrected reference in 10.4.6.1 to table 5.	22-3
VIE	20220421	Removed references to outdated hardware from various sections and captured the dated hardware in a new annex. Addressed instrumentation calibration discrepancies and allowed valve FCV-103 to be removed from cooling systems which utilize a variable frequency drive.	22-2

*As of 09/30/2022

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Rating Workshop Data

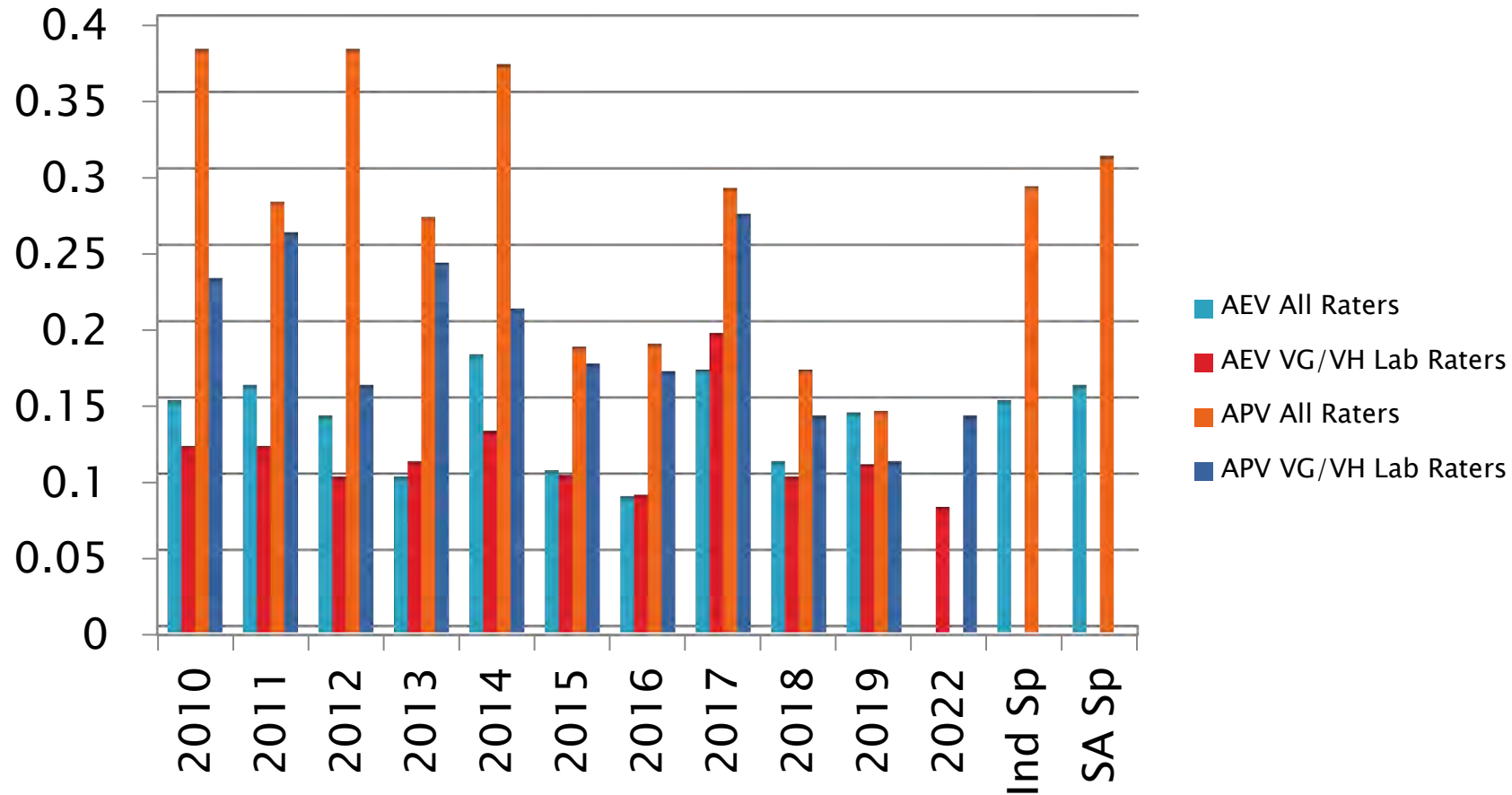
- ▶ Summary of Precision Data From Light Duty Rating workshops:
 - VH Average Piston, Average Engine Varnish.
 - VH Sludge added for this workshop as calibration requirement
 - IIIH WPD
 - Data is from 2022 workshop; 2020 and 2021 workshops were cancelled due to pandemic. The 2022 workshop only includes raters from calibrated labs.

Rating Workshop Data

➤➤ 2022 Light Duty Workshop

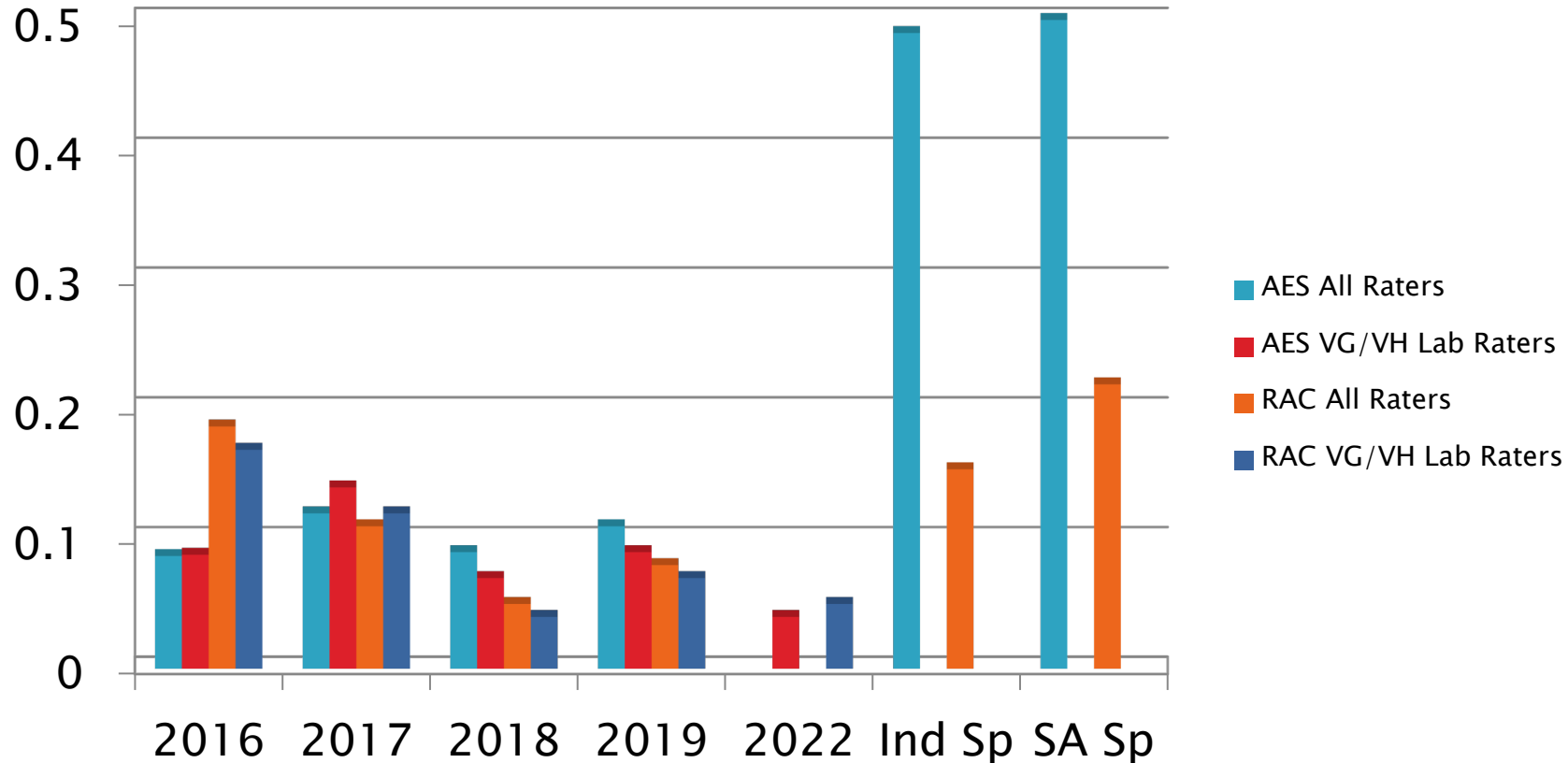
Sequence VG/VH Precision-Rating Workshop Data

Workshop Data for VG/VH Varnish



Sequence VH Precision–Rating Workshop Data

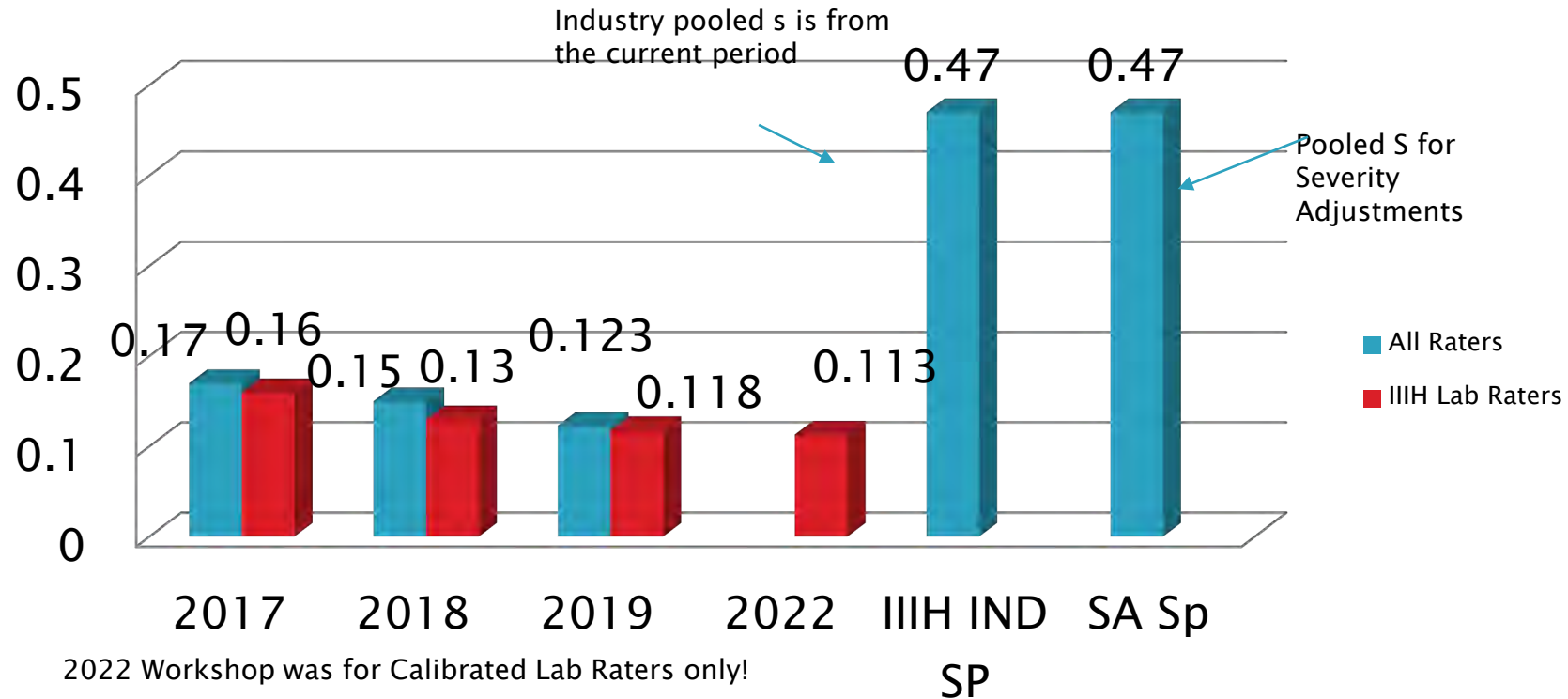
Workshop Data for VH Sludge



Sludge parameters were added for rater calibration in 2019
2022 Workshop was for Calibrated Lab Raters only!

Sequence IIH 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

- ▶ <https://www.astmtmc.org>

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