



A Program of ASTM International

Test Monitoring Center

<http://astmtmc.cmu.edu>

ASTM D02.B2 Semi-Annual Report Heavy Duty Reference Oil Testing

Spring 2021

Table of Contents

Section	Topic
Executive Summary	
	<u>Summary Items</u>
	<u>Calibrated Labs and Stands</u>
CAT Tests	
	<u>1K</u>
	<u>1N</u>
	<u>1M-PC</u>
	<u>1P</u>
	<u>1R</u>
	<u>C13</u>
	<u>COAT</u>
Daimler Tests	
	<u>DD13</u>

Table of Contents

Section	Topic
Cummins Tests	
	ISB
	ISM
Light Duty Diesel Tests	
	EOAT
	RFWT
Mack Tests	
	T-8/T-8E
	T-11
	T-12
	T-12A
	T-13

Table of Contents

Section	Topic
Additional Information	
	<u>Information Letters</u>
	<u>Memos</u>
	<u>Reference Oil Inventory</u>
	<u>LTMS Deviations</u>
	<u>Quality Index Deviations</u>
	<u>TMC Laboratory Visits</u>
	<u>Test Area Time Lines</u>
	<u>Rating Workshop Data</u>
	<u>Misc. Information</u>

Heavy Duty Testing

Executive Summary

▶ Test Issues

- Alternate fuel supplier criteria discussions across test areas.
- COAT to EOAT equivalency testing finished completed and an analysis of test data is ongoing.
- T12 new hardware caused excessive oil consumption. Panel working to find hardware combination that brings oil consumption to acceptable levels to continue testing.
- Re-blend of 823 in progress and re-blend of 1005-5 being pursued.

[Return to Table of Contents](#)

Test Monitoring Center

<http://astmtmc.cmu.edu>



A Program of ASTM International

Calibrated Labs and Stands*

Test	Labs	Stands
1K	0	0
1N	2	3
1M-PC	1	1
1P	1	1
1R	1	1
C13	3	3
ISB	3	3
ISM	3	3
EOAT	1	1
RFWT	2	2
T-8/E	1	1
T-11	2	3
T-12/T-12A	0/0	0/0
T-13	4	7
COAT	3	3
DD13	3	3

*As of 06/1/2021

[Return to Table of Contents](#)

Test Monitoring Center

<http://astmtmc.cmu.edu>



A Program of ASTM International

SCOTE 1K

»» June 2021

Test Monitoring Center

<http://astmtmc.cmu.edu>



A Program of ASTM International

1 K Test Activity

Test Status	Validity Code	#
Acceptable Calibration Test	AC	0
Failed Calibration Test	OC	0
Operationally Invalid	LC	0
Aborted	XC	0
Total		0

1 K Failed Tests

Failed Parameter	Number of Tests
No failed tests	0
Total	0

1 K Lost Tests*

Status	Cause	#
Invalid	No invalid tests	0
Aborted	No aborted tests	0
Total		0

*Invalid and aborted tests

1 K Test Severity

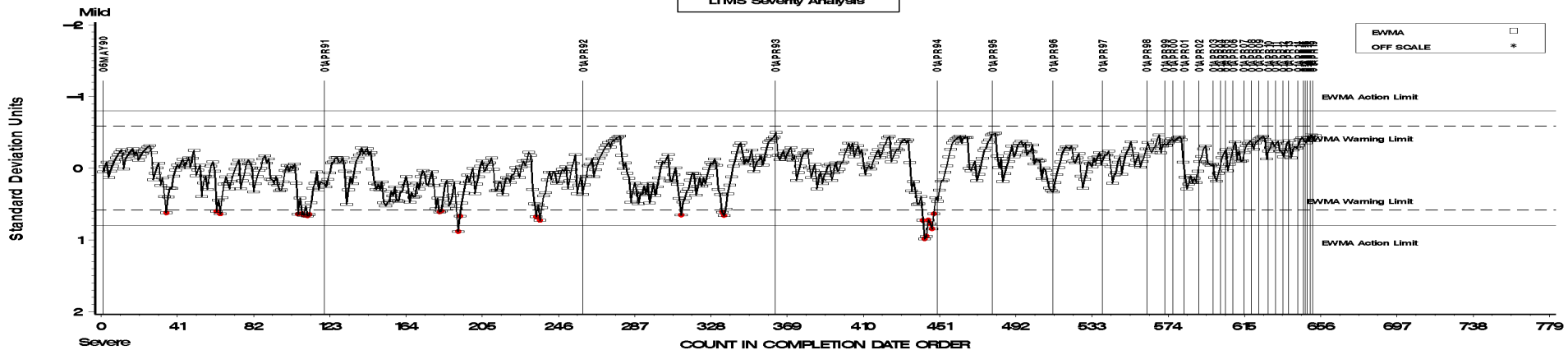
- ▶ As no 1K tests were run during this period no statement about test severity can be made.

CATERPILLAR 1K INDUSTRY OPERATIONALLY VALID DATA

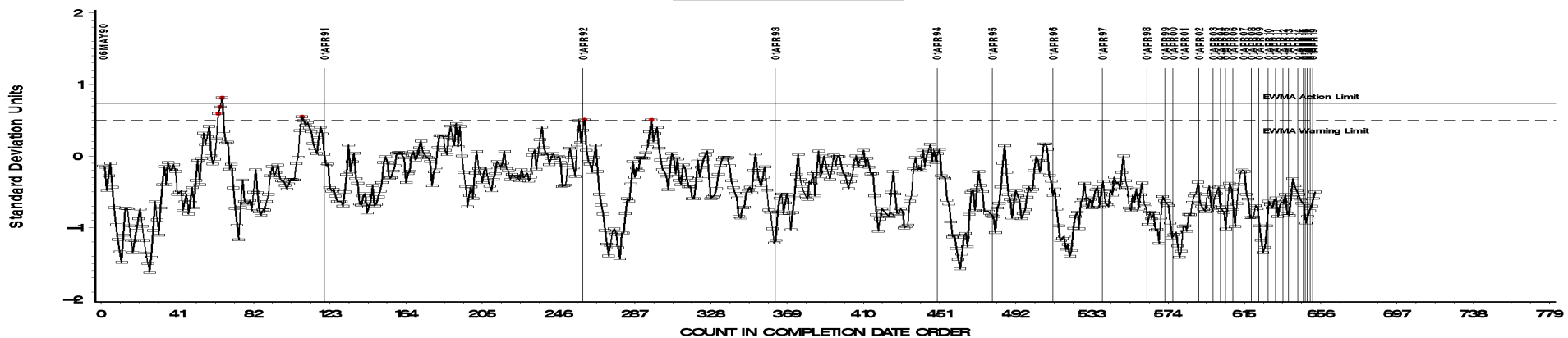


FINAL TLHC

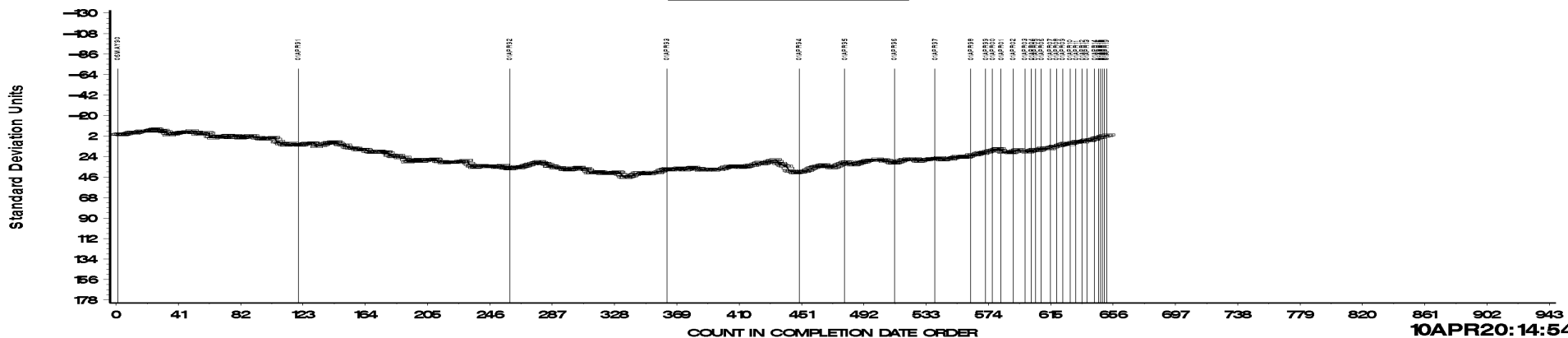
LTMS Severity Analysis



LTMS Precision Analysis



CUSUM Severity Analysis

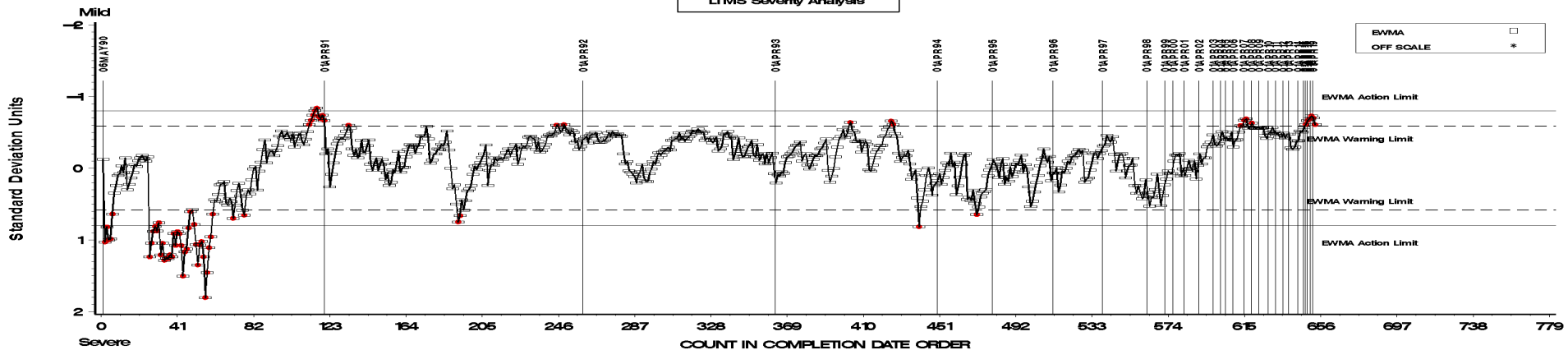


CATERPILLAR 1K INDUSTRY OPERATIONALLY VALID DATA

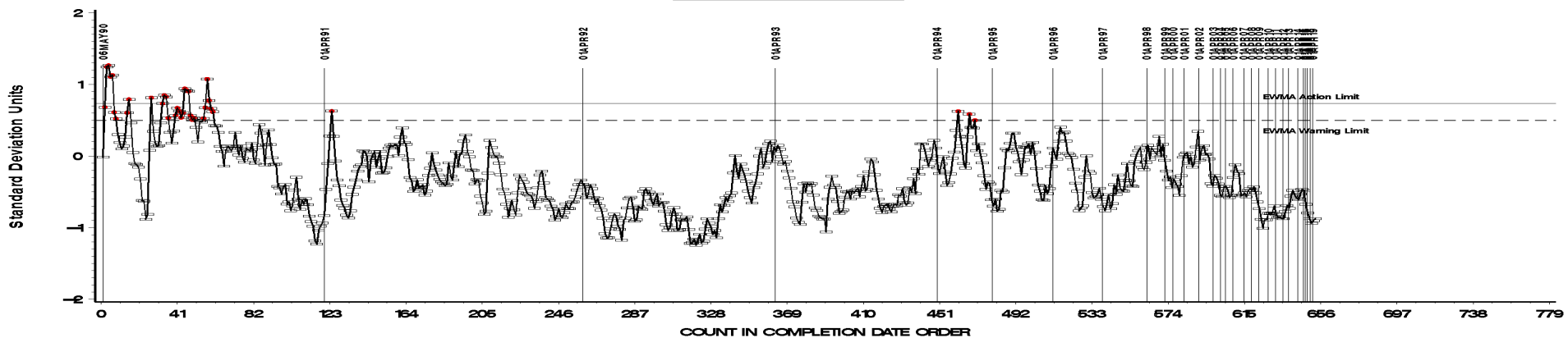


FINAL TGF

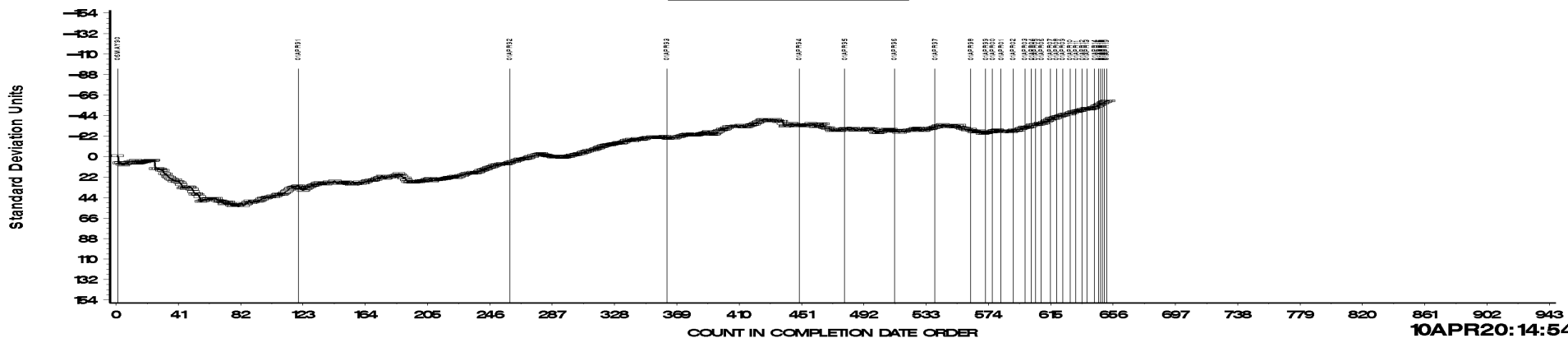
LTMS Severity Analysis



LTMS Precision Analysis

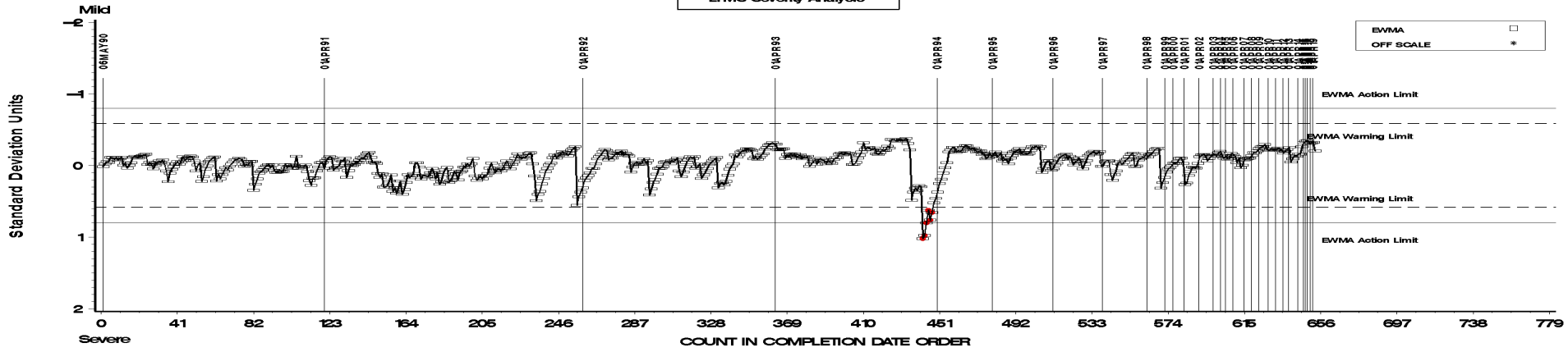


CUSUM Severity Analysis

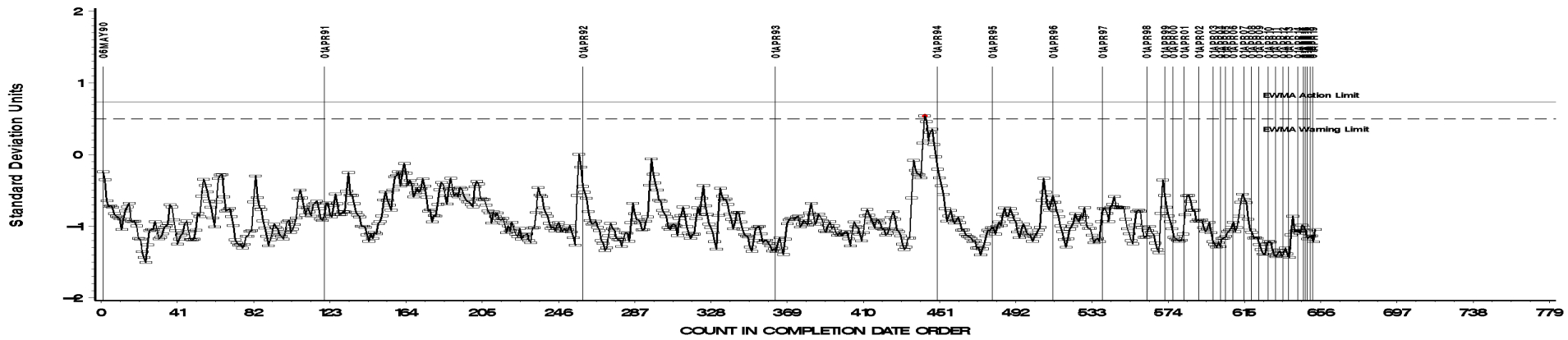


FINAL EOTOC

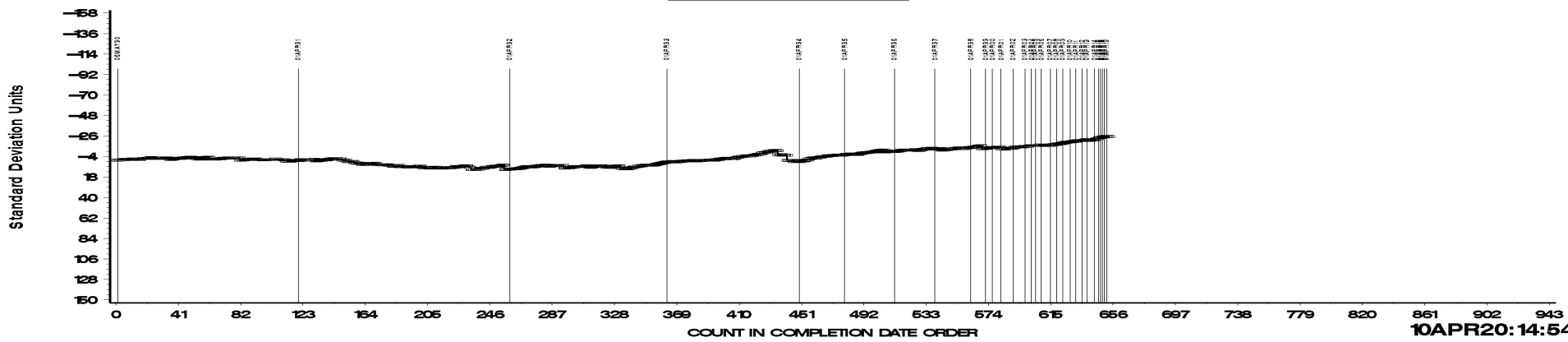
LTMS Severity Analysis



LTMS Precision Analysis



CUSUM Severity Analysis

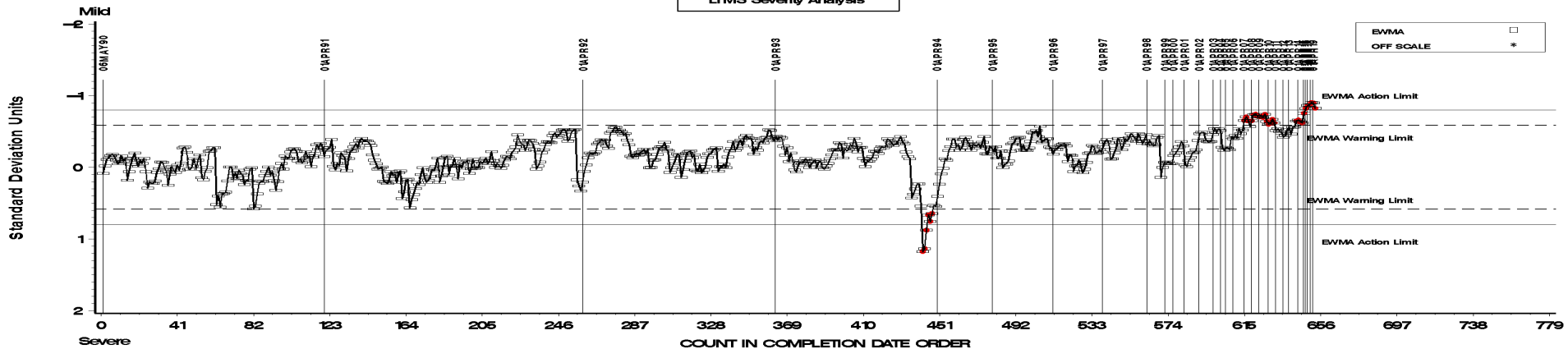


CATERPILLAR 1K INDUSTRY OPERATIONALLY VALID DATA

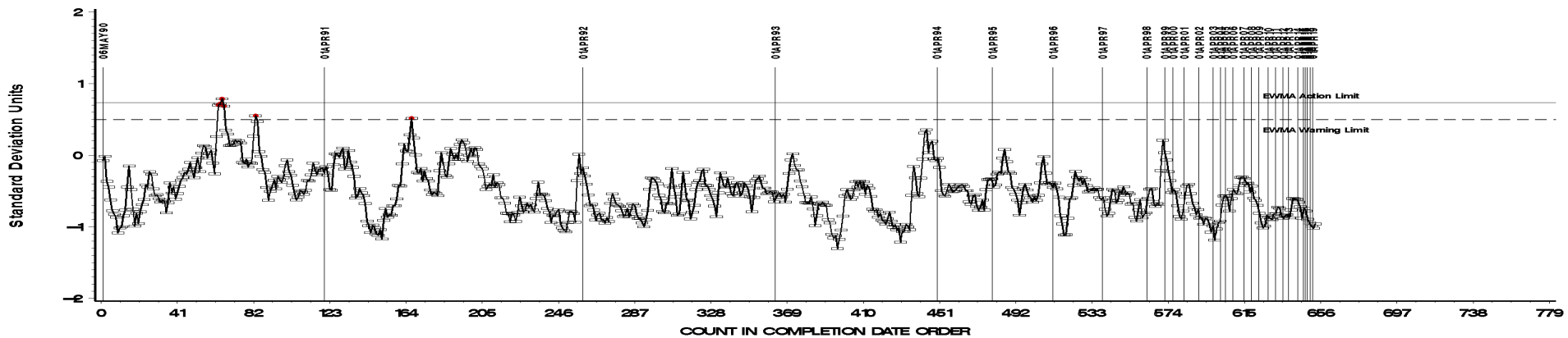


FINAL BSOC

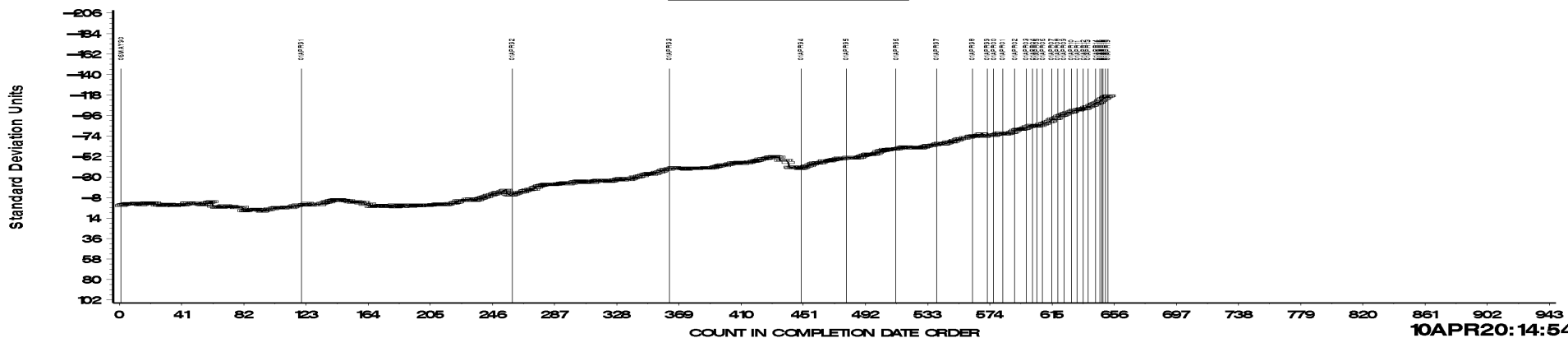
LTMS Severity Analysis



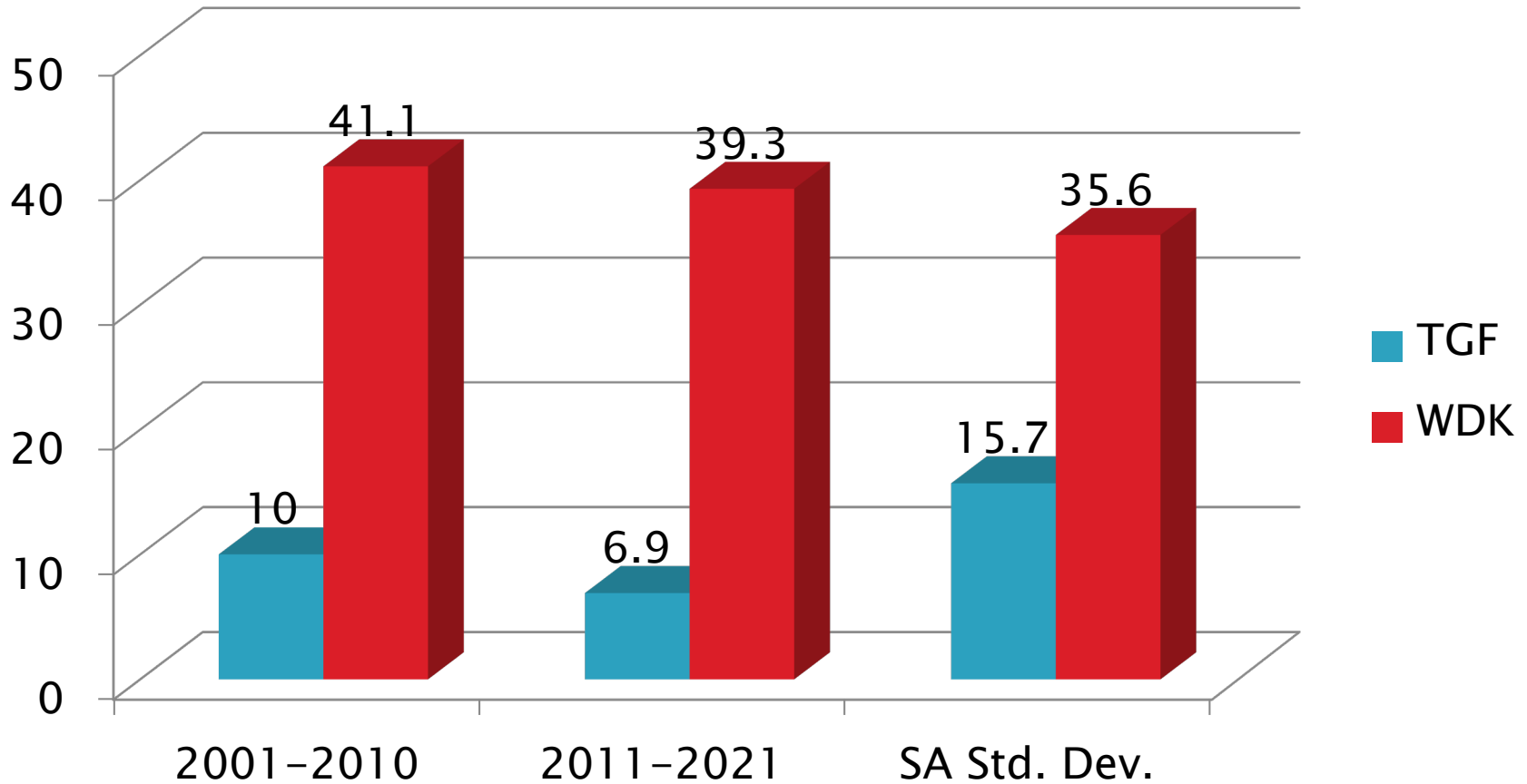
LTMS Precision Analysis



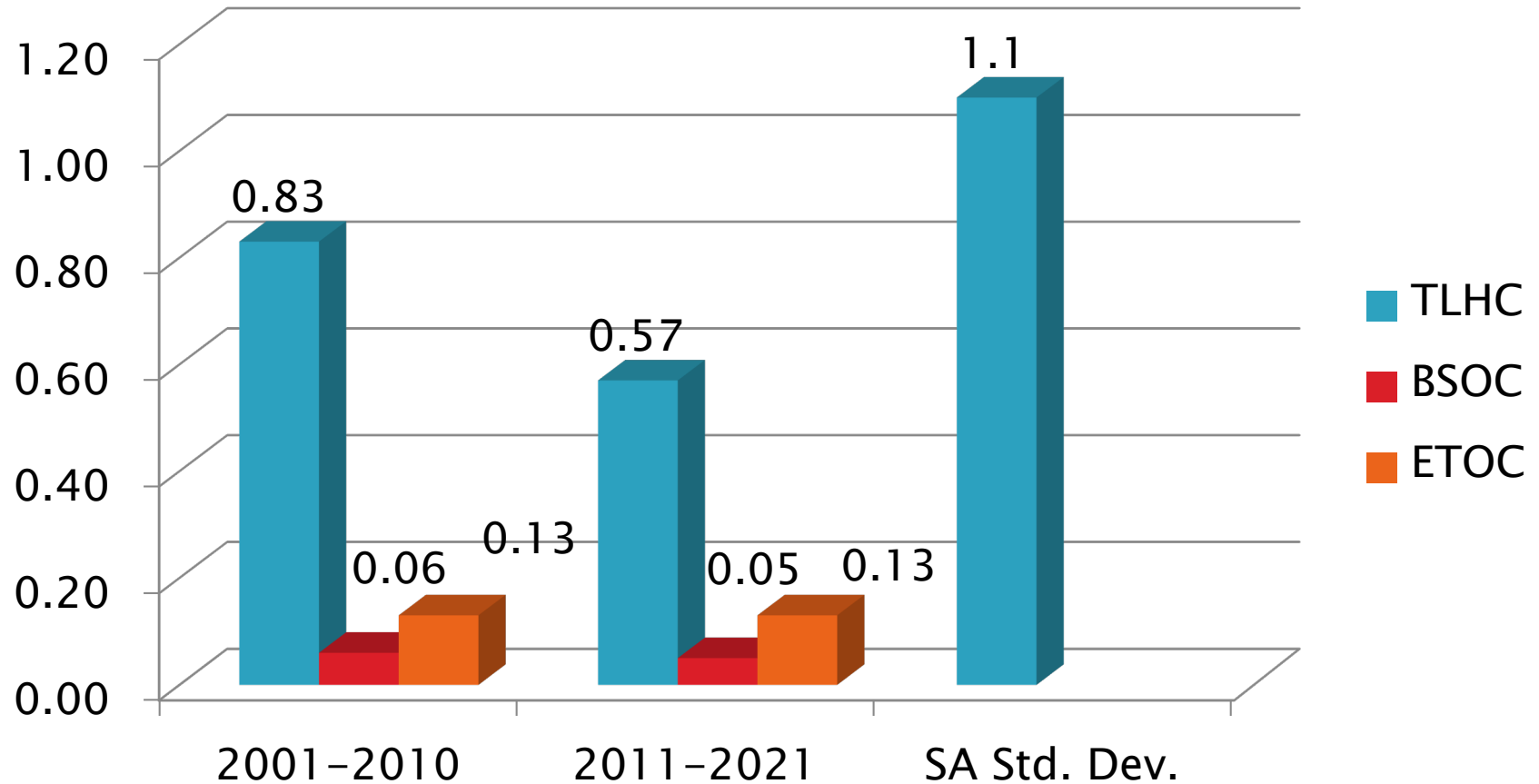
CUSUM Severity Analysis



1 K Precision Estimates



1 K Precision Estimates



[Return to Table of Contents](#)

SCOTE 1N

»» June 2021

Test Monitoring Center

<http://astmtmc.cmu.edu>



A Program of ASTM International

1 N Test Activity

Test Status	Validity Code	#
Acceptable Calibration Test	AC	3
Failed Calibration Test	OC	1
Operationally Invalid	LC	0
Aborted	XC	0
Informational	NN	0
Total		4

1 N Failed Tests

Failed Parameter	Number of Tests
TGF Severe	1
Total	1

1 N Lost Tests*

Status	Cause	#
Invalid	No invalid tests	0
Aborted	No aborted tests	0
Total		0

*Invalid and aborted tests

1 N Test Severity

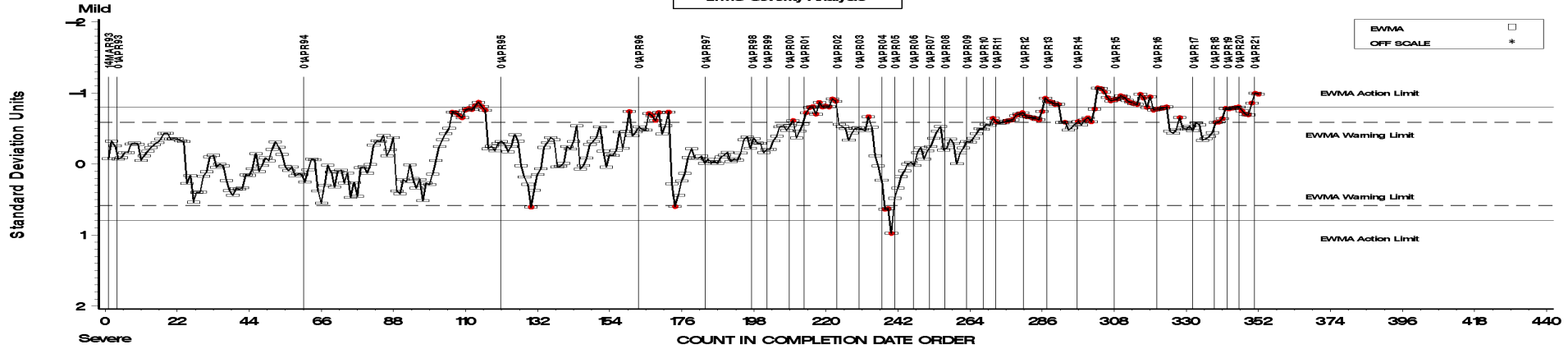
- ▶ TGF, WDN and TLHC are in control.
- ▶ BSOC in severity action alarm in mild direction
- ▶ Severity trends are being evaluated by surveillance panel

CATERPILLAR 1N INDUSTRY OPERATIONALLY VALID DATA

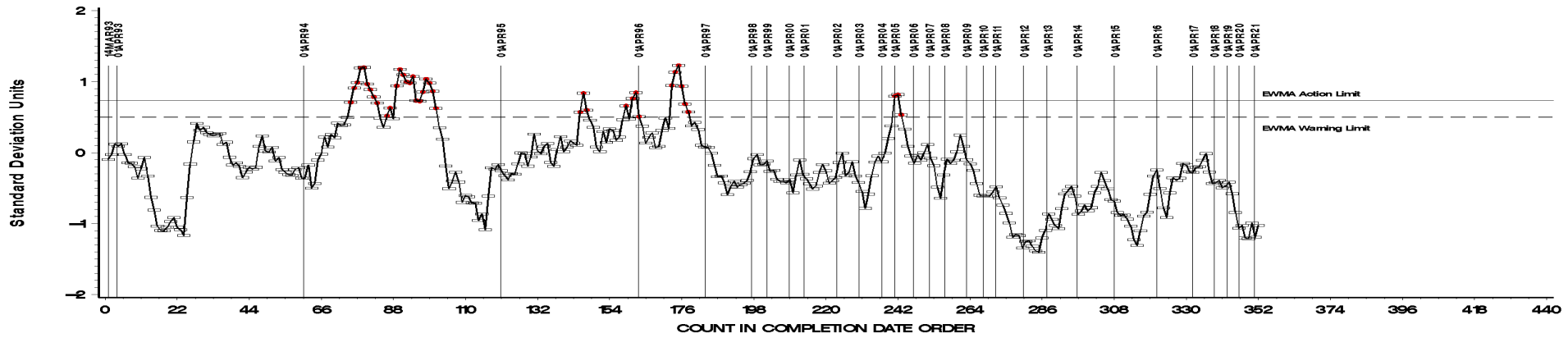


BSOC

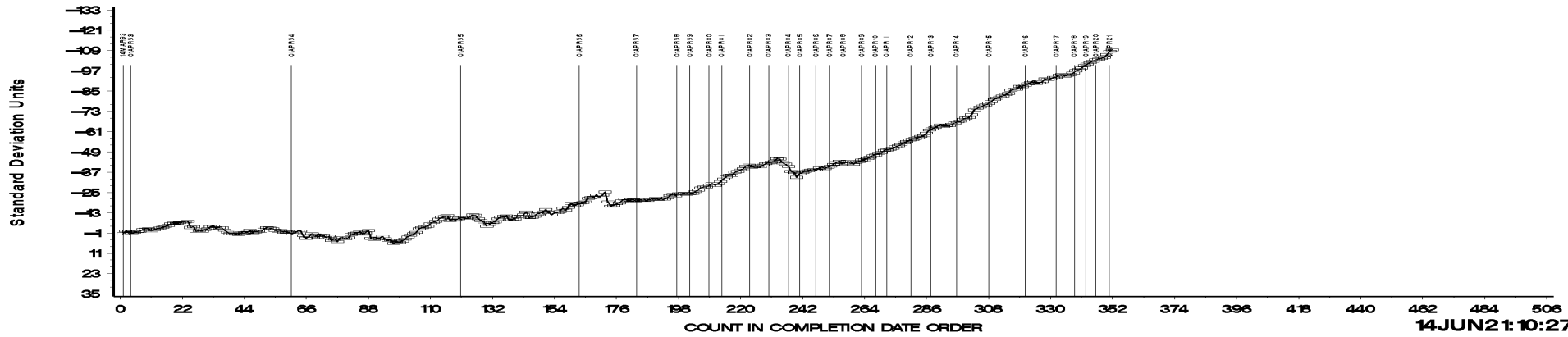
LTMS Severity Analysis



LTMS Precision Analysis

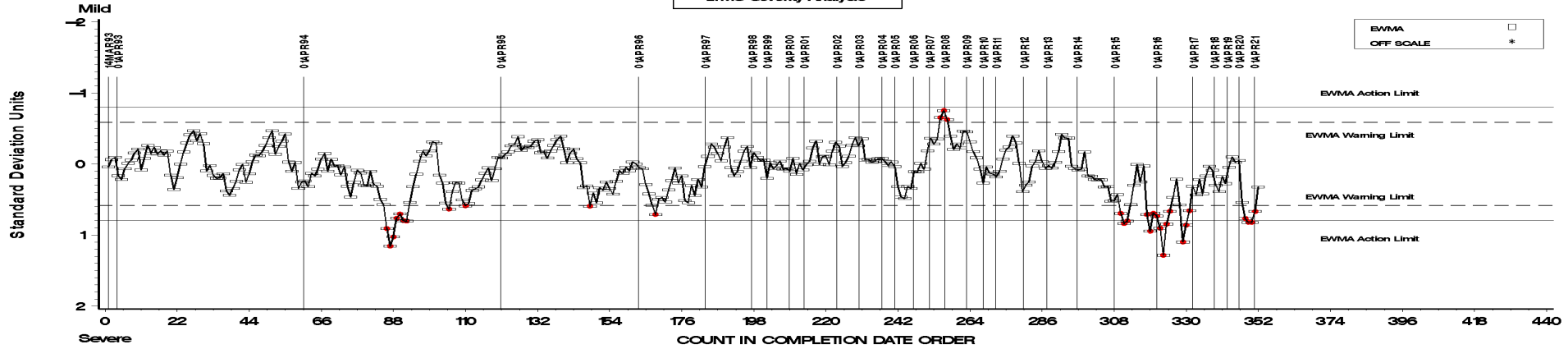


CUSUM Severity Analysis

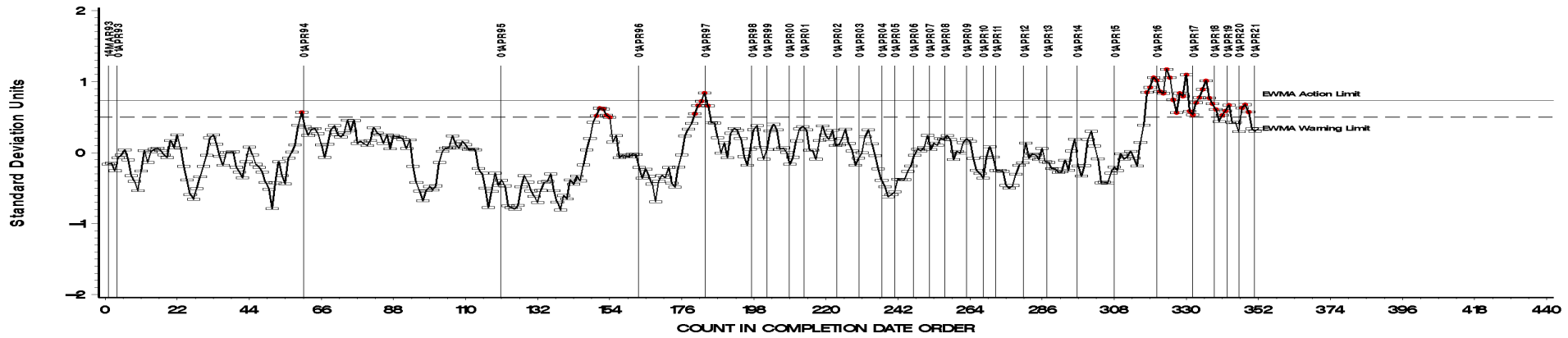


FINAL CORRECTED TGF

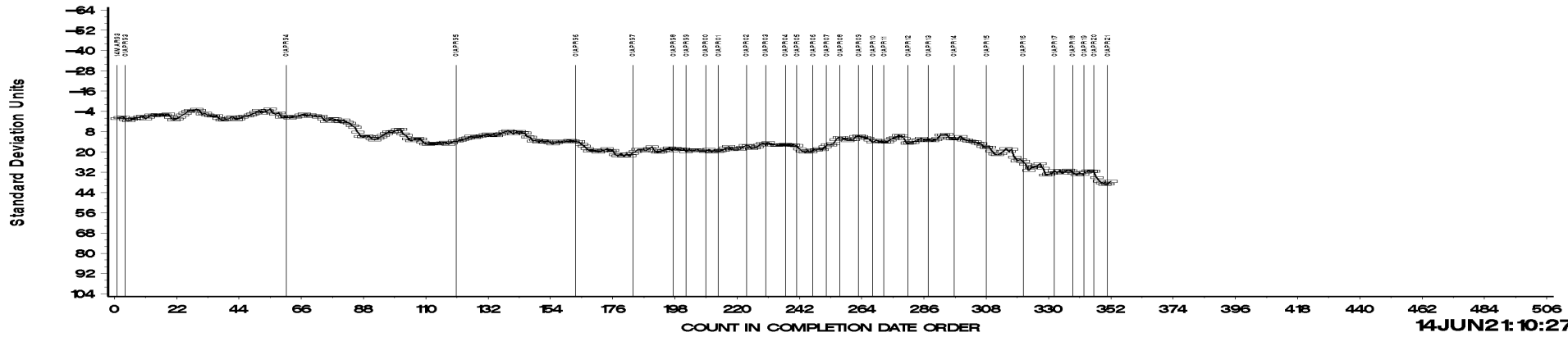
LTMS Severity Analysis



LTMS Precision Analysis

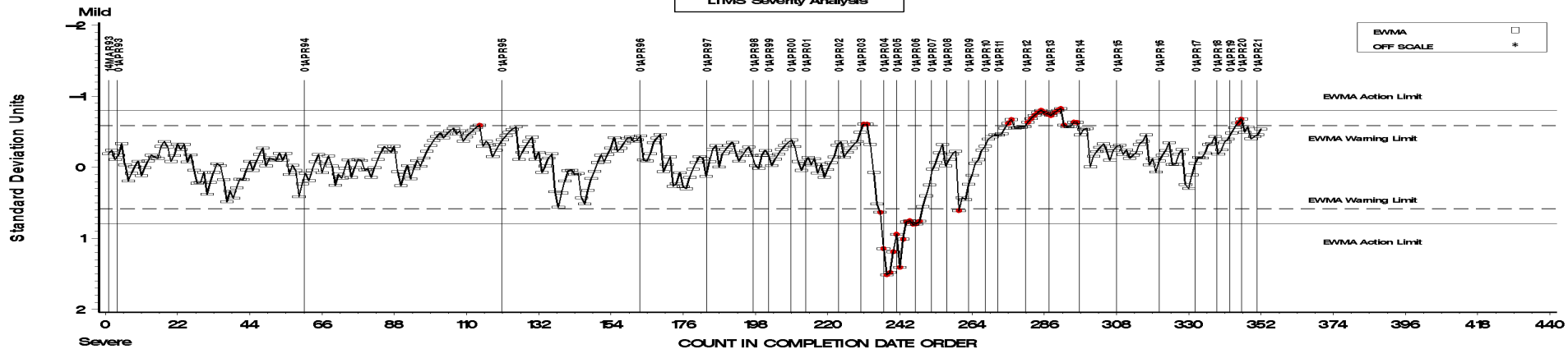


CUSUM Severity Analysis

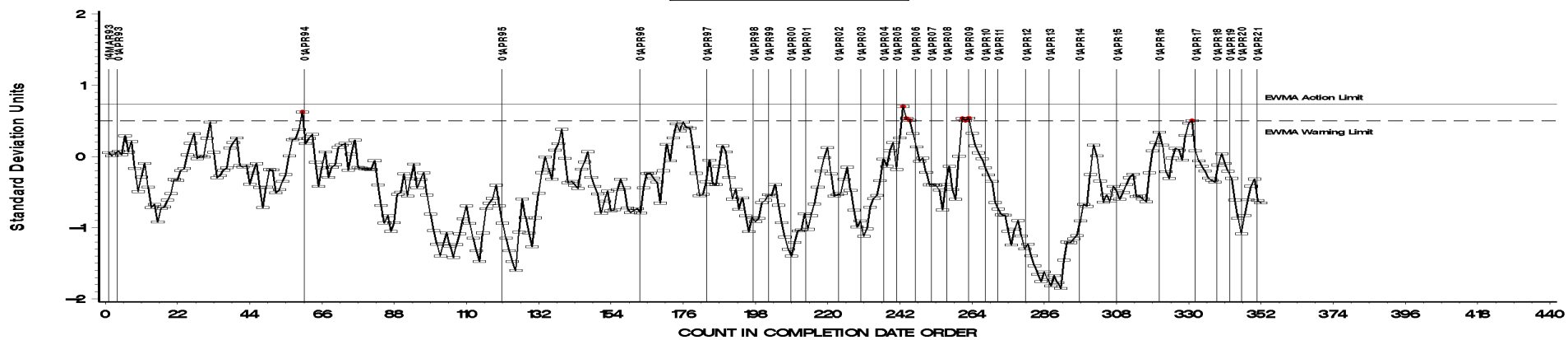


Top Land Heavy Carbon

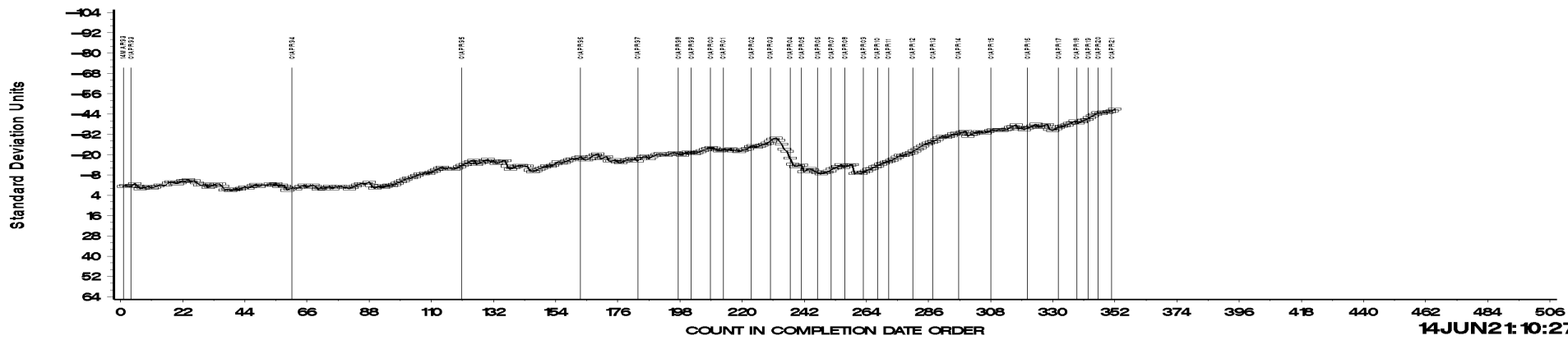
LTMS Severity Analysis



LTMS Precision Analysis

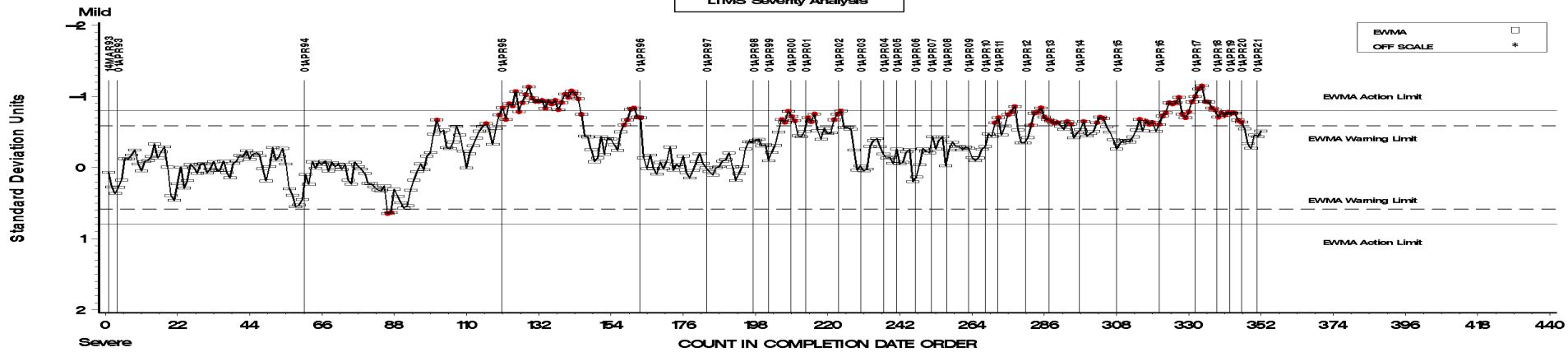


CUSUM Severity Analysis

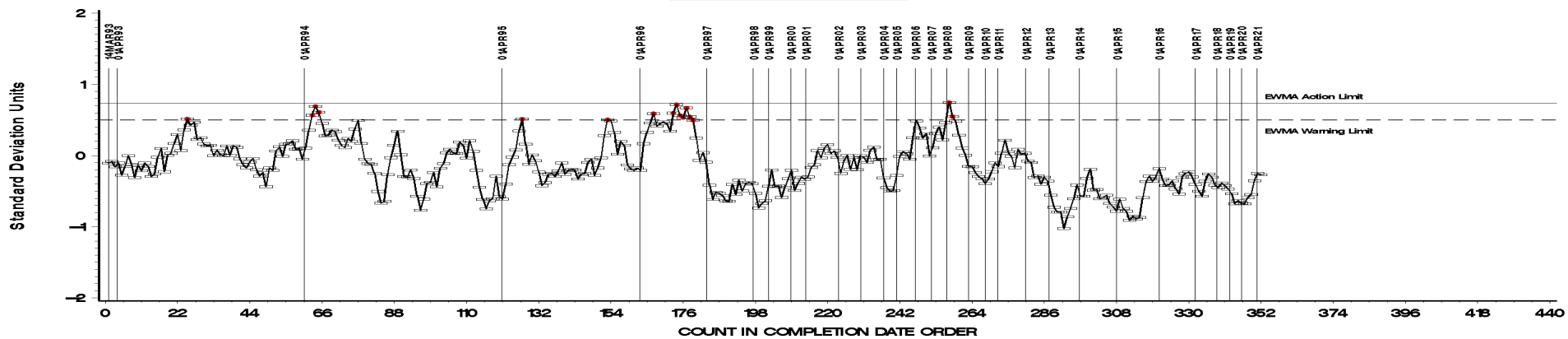


Weighted Total Demerits

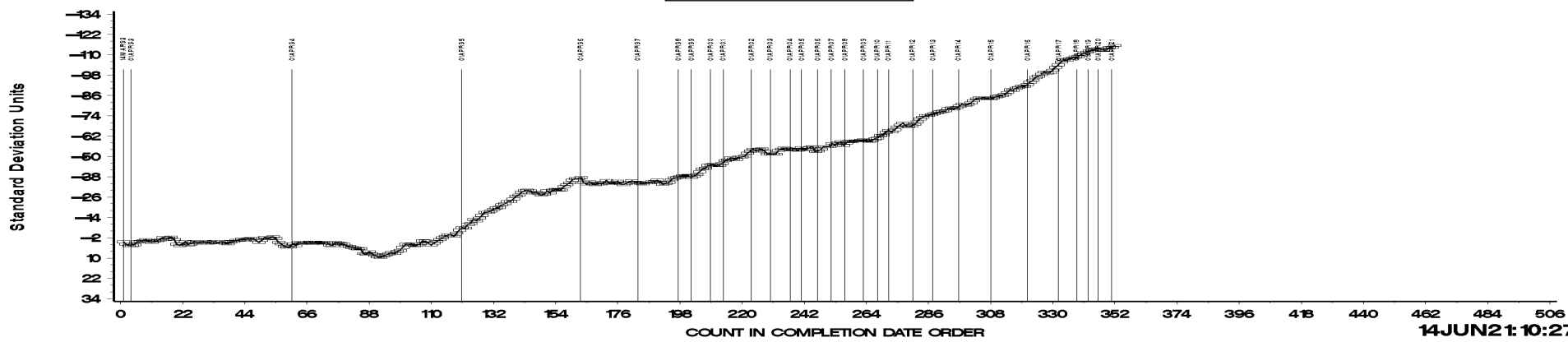
LTMS Severity Analysis



LTMS Precision Analysis

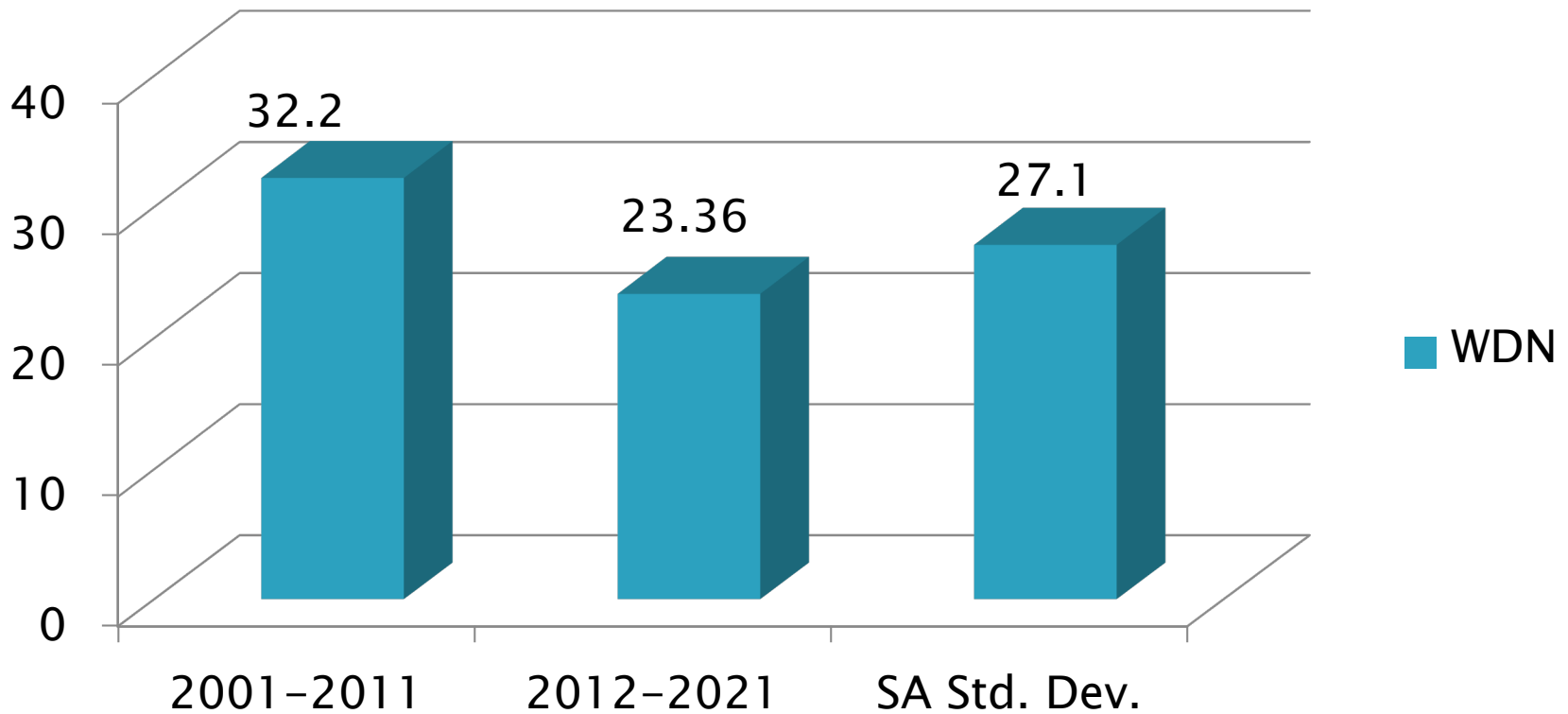


CUSUM Severity Analysis

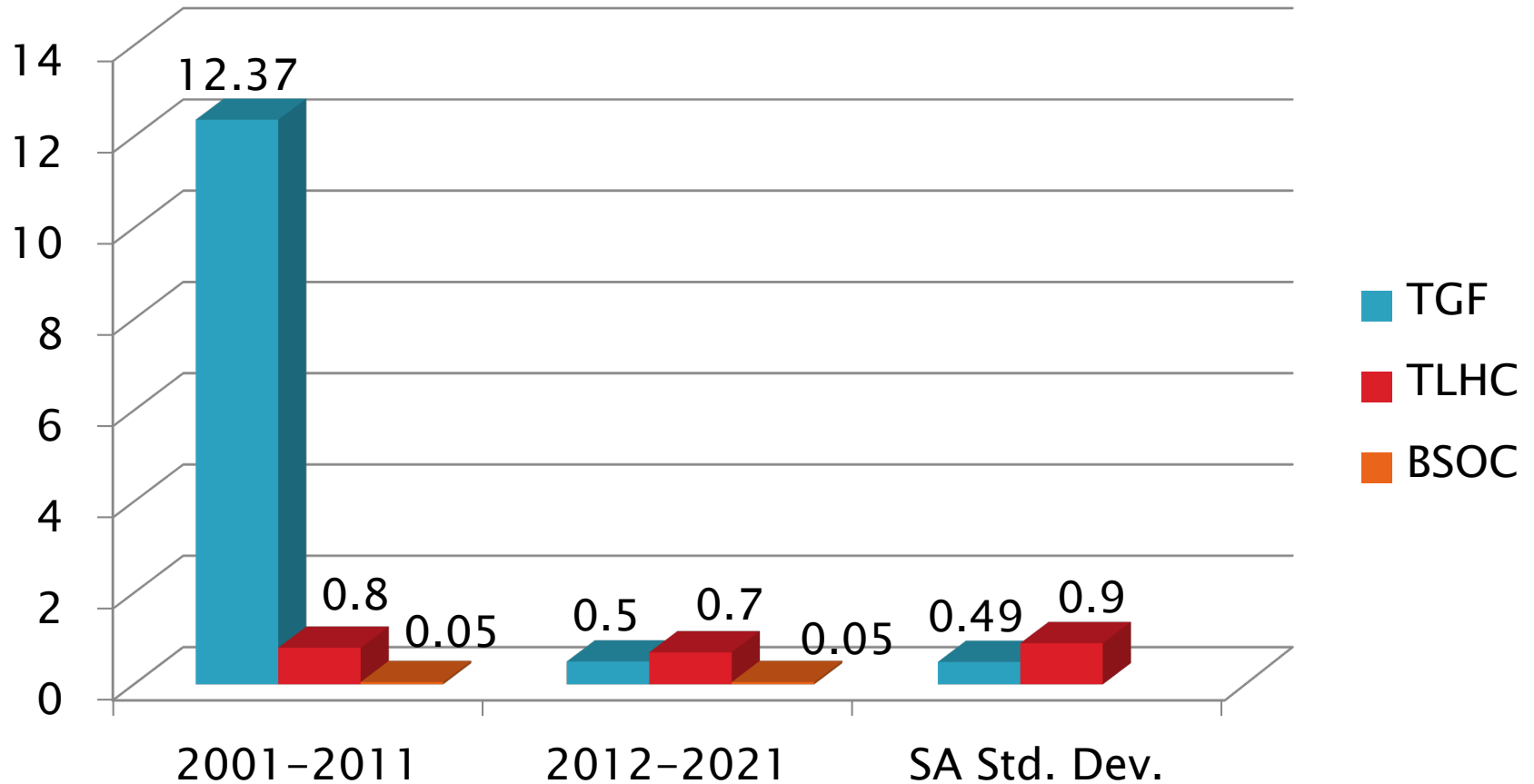


1 N Precision Estimates

WDN



1N Precision Estimates



[Return to Table of Contents](#)

SCOTE 1 M-PC

»» June 2021

Test Monitoring Center

<http://astmtmc.cmu.edu>



A Program of ASTM International

1 M-PC Test Activity

Test Status	Validity Code	#
Acceptable Calibration Test	AC	1
Failed Calibration Test	OC	0
Operationally Invalid	LC	0
Total		1

1 M-PC Failed Tests

Failed Parameter	Number of Tests
No Failed Test	0
Total	0

1 M-PC Lost Tests*

Status	Cause	#
Invalid	No invalid tests	0
Aborted	No aborted tests	0
Total		0

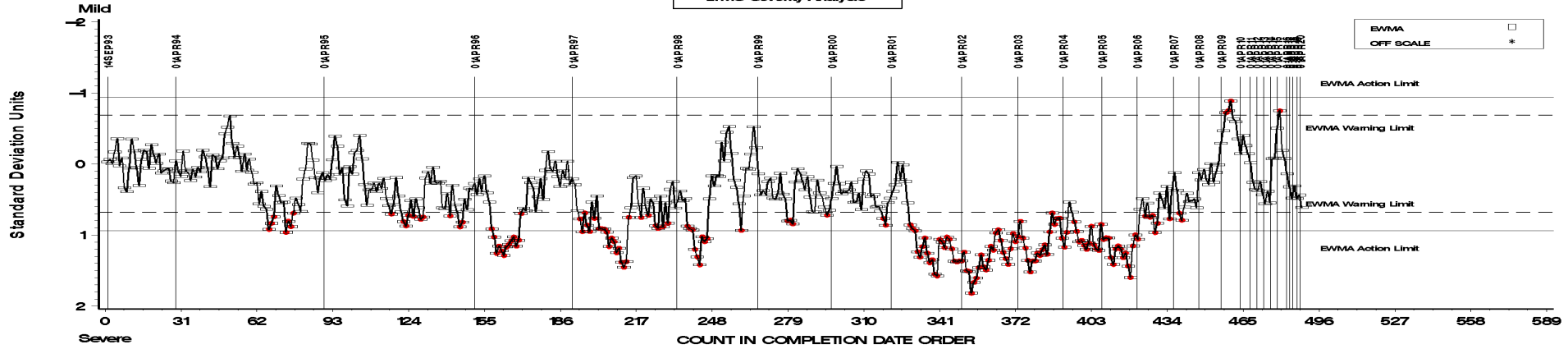
*Invalid and aborted tests

1 M-PC Test Severity

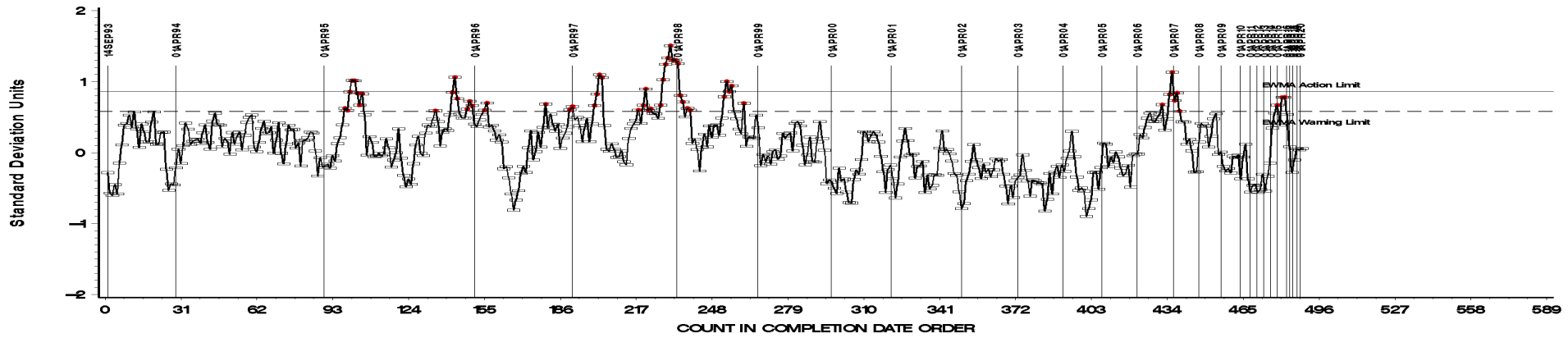
- ▶ TGF and WTD are in control.

FINAL TOP GROOVE FILLING

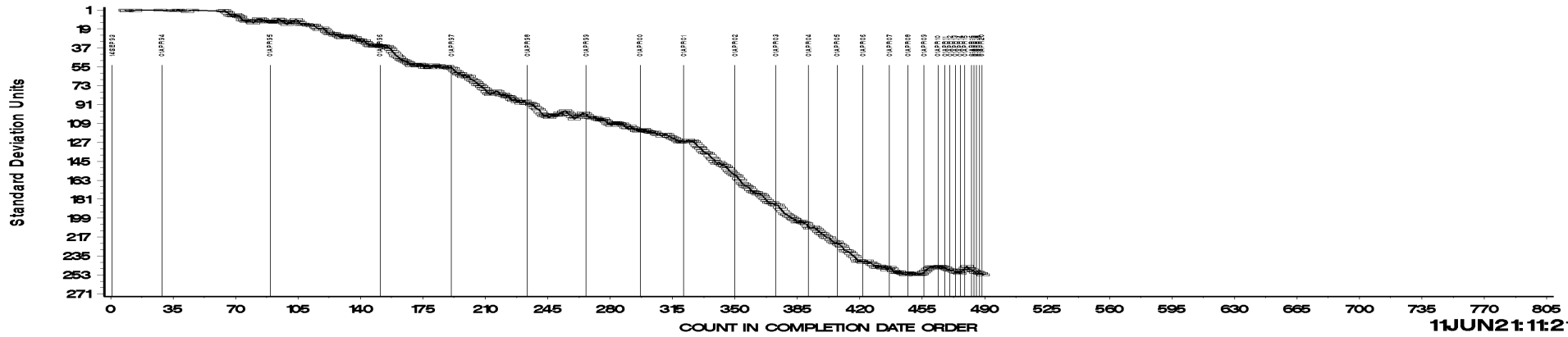
LTMS Severity Analysis



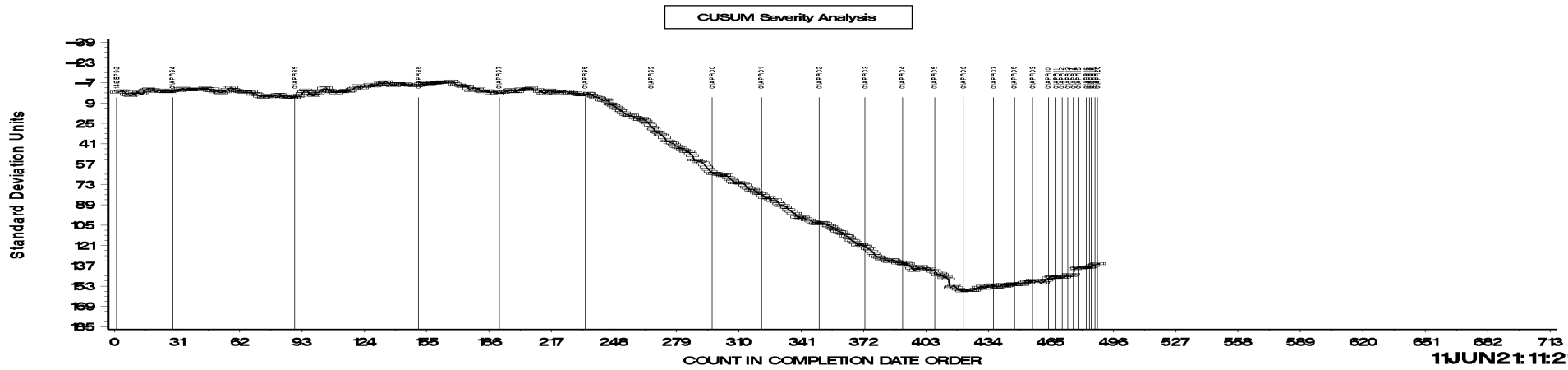
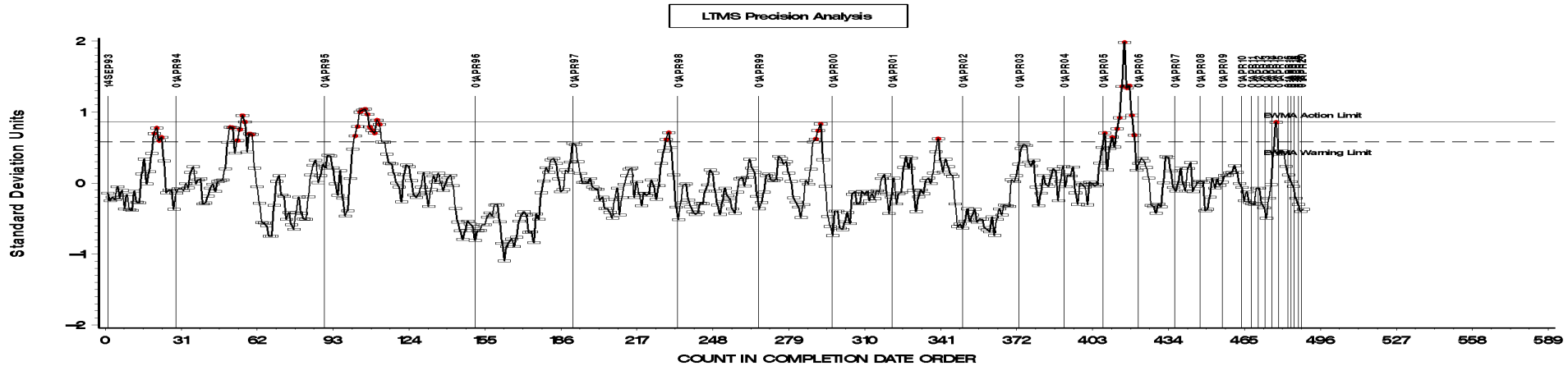
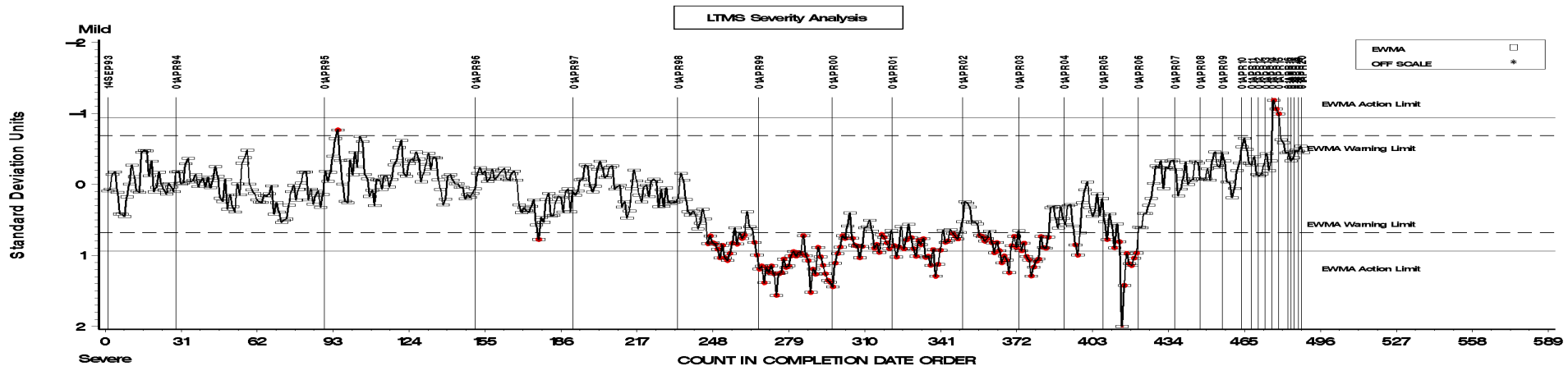
LTMS Precision Analysis



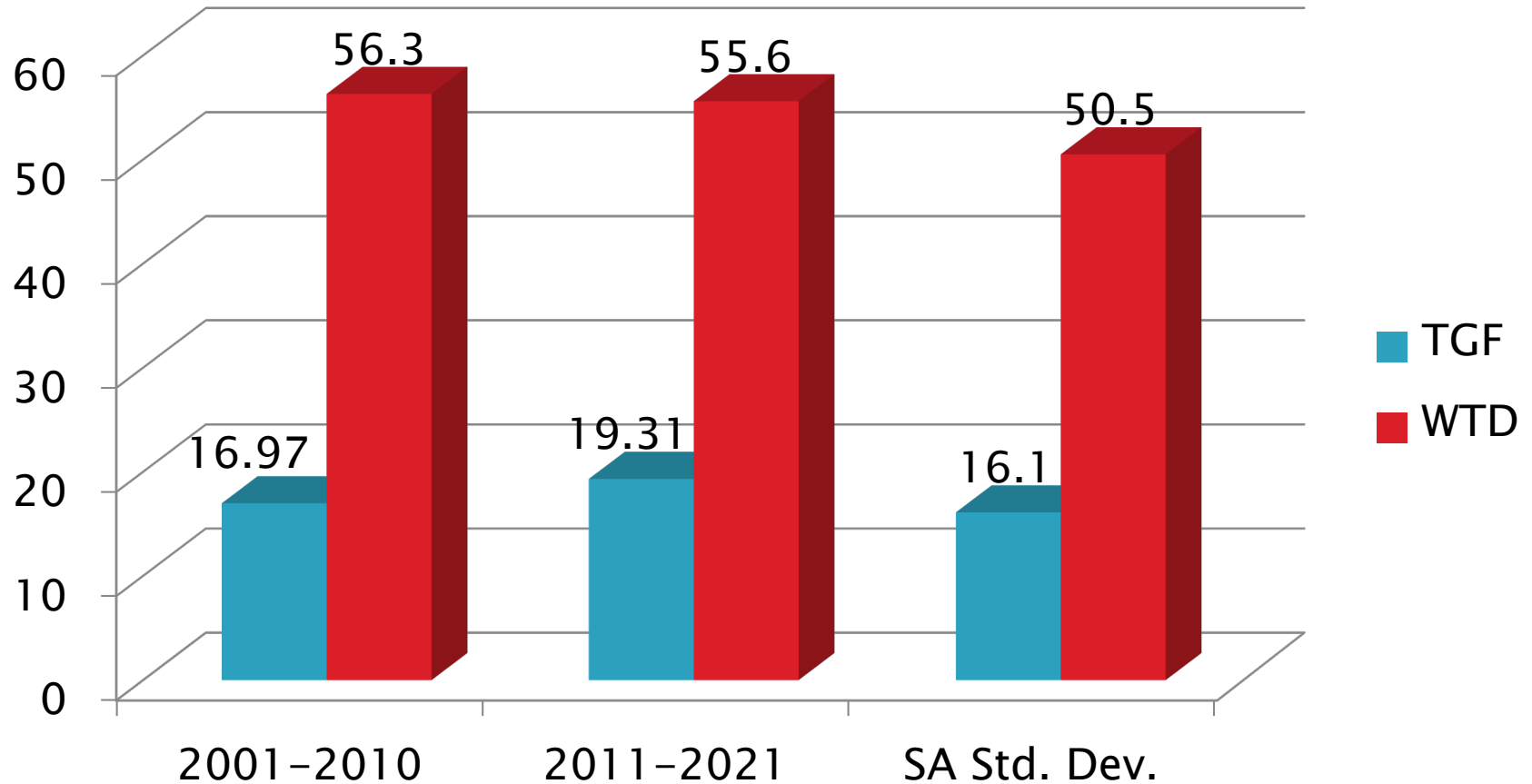
CUSUM Severity Analysis



Weighted Total Demerits



1 MPC Precision Estimates



[Return to Table of Contents](#)

SCOTE 1P

»» June 2021

Test Monitoring Center

<http://astmtmc.cmu.edu>



A Program of ASTM International

1P Test Activity

Test Status	Validity Code	#
Acceptable Calibration Test	AC	1
Failed Calibration Test	OC	0
Operationally Invalid	LC	0
Aborted	XC	3
Total		4

1 P Failed Tests

Failed Parameter	Number of Tests
No failed tests	0
Total	0

1P Lost Tests*

Status	Cause	#
Invalid	No invalid tests	0
Aborted	Piston Scuffing	1
Aborted	Facility power loss	1
Aborted	High oil consumption	1
Total		3

*Invalid and aborted tests

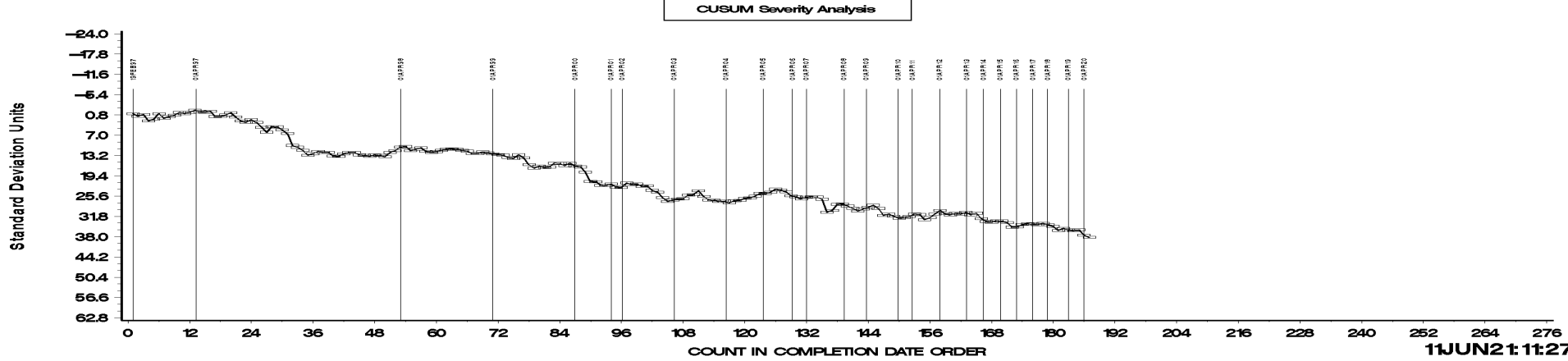
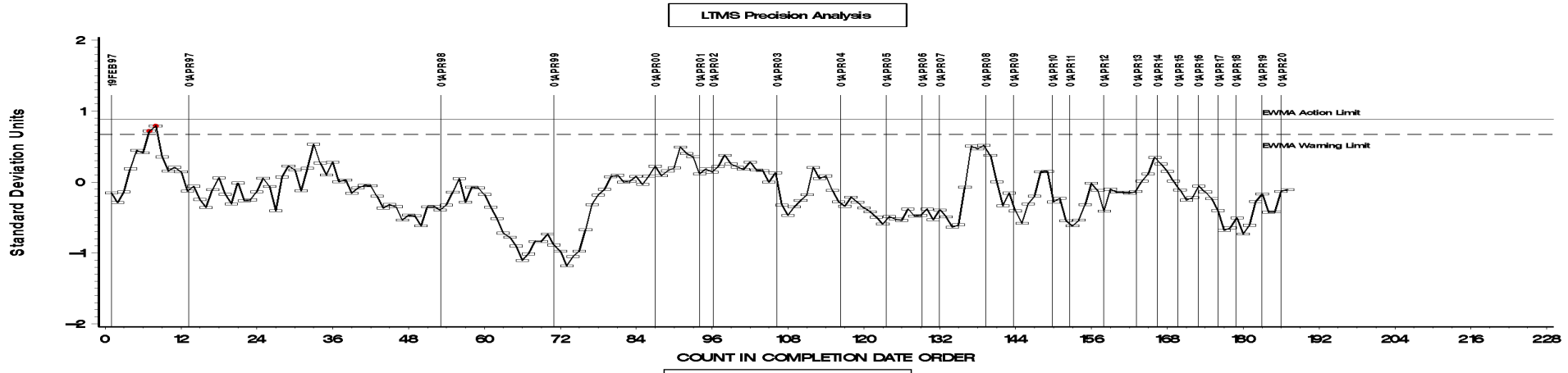
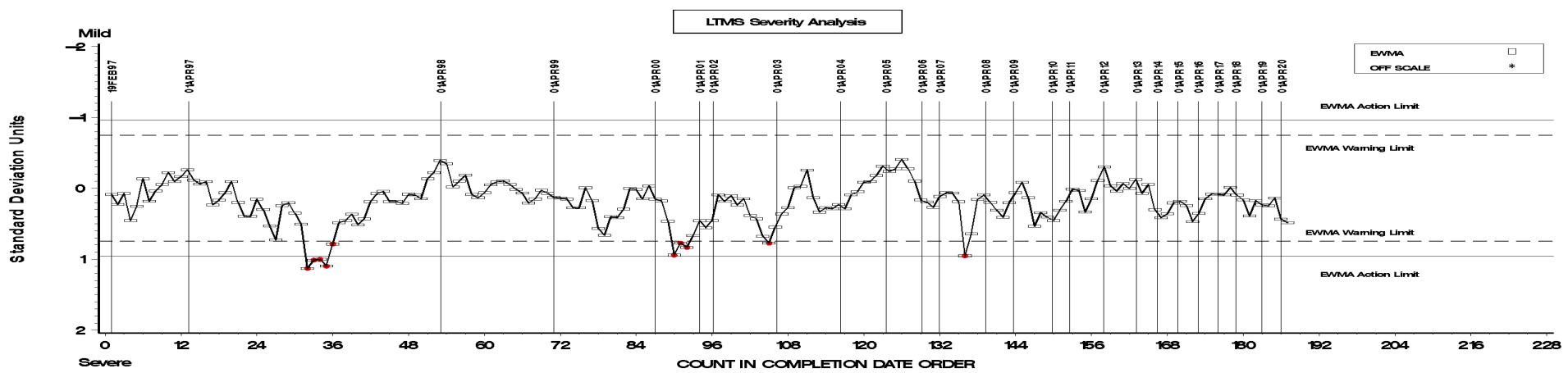
1 P Test Severity

- ▶ WD, TGC, TLC and OC are in control.
- ▶ ETOC is in severity action alarm in the severe direction.

CATERPILLAR 1P INDUSTRY OPERATIONALLY VALID DATA



WEIGHTED TOTAL DEMERITS

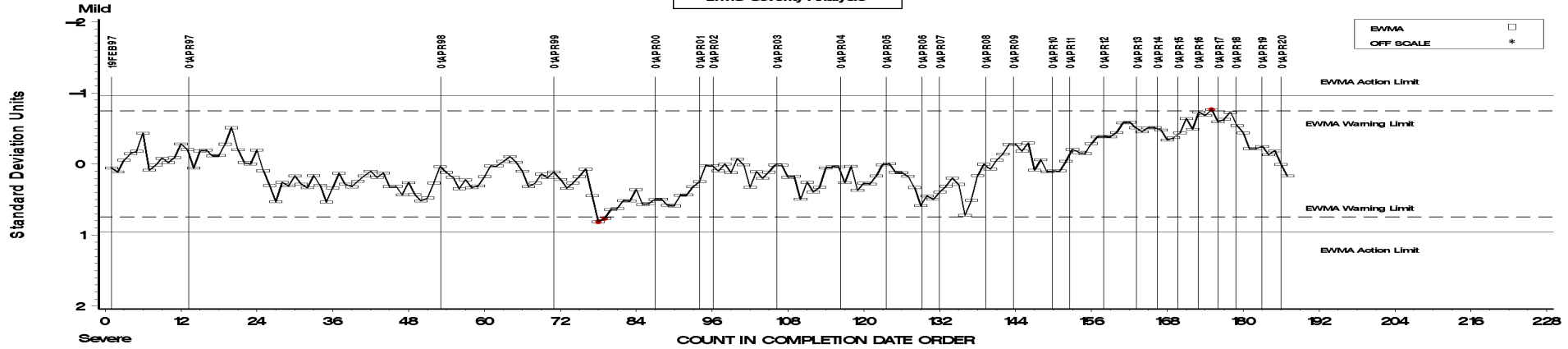


CATERPILLAR 1P INDUSTRY OPERATIONALLY VALID DATA

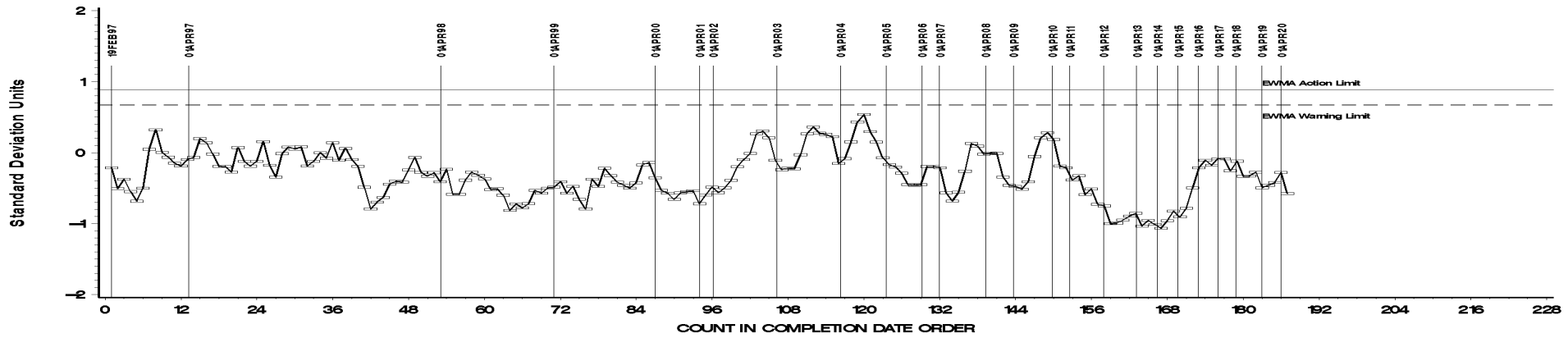


TOP LAND CARBON

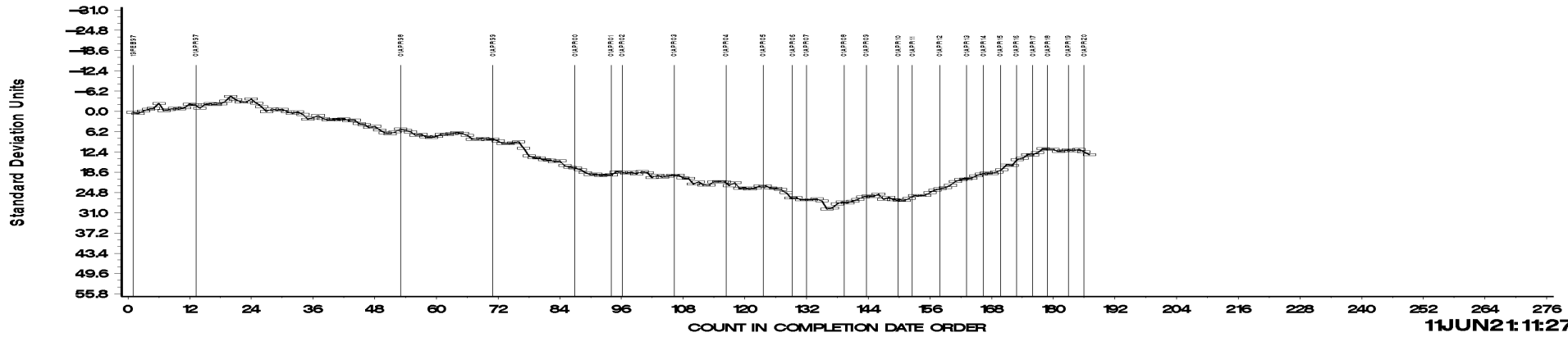
LTMS Severity Analysis



LTMS Precision Analysis



CUSUM Severity Analysis

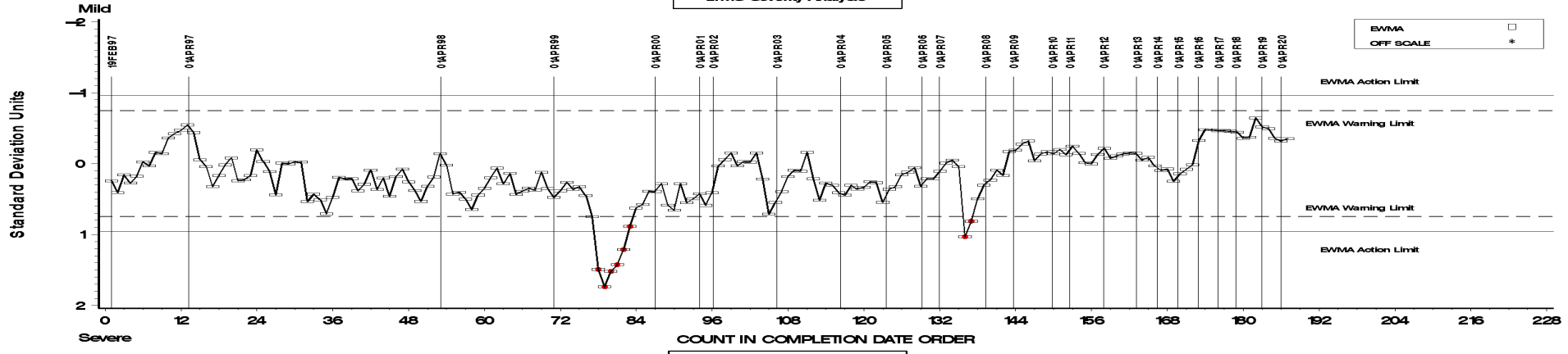


CATERPILLAR 1P INDUSTRY OPERATIONALLY VALID DATA

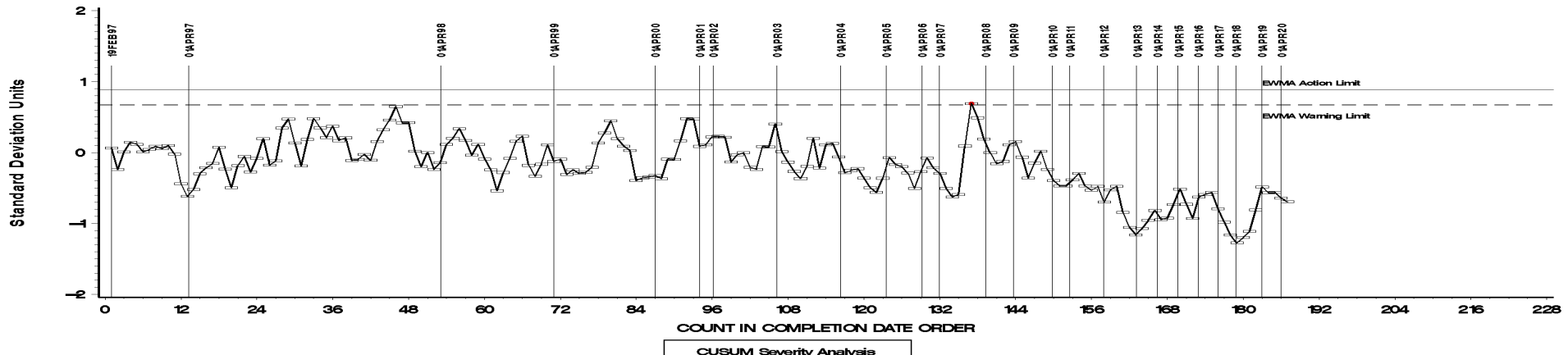


TOP GROOVE CARBON

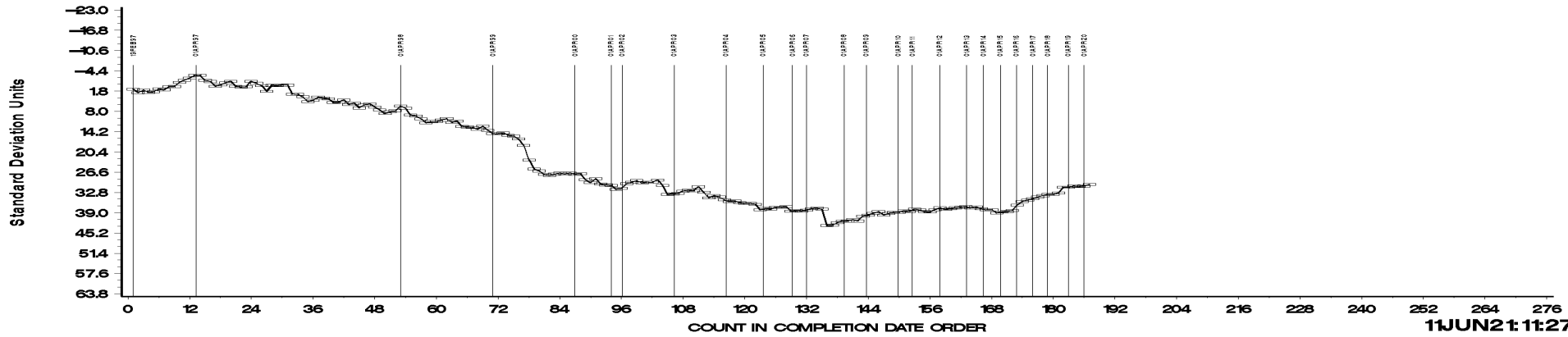
LTMS Severity Analysis



LTMS Precision Analysis



CUSUM Severity Analysis

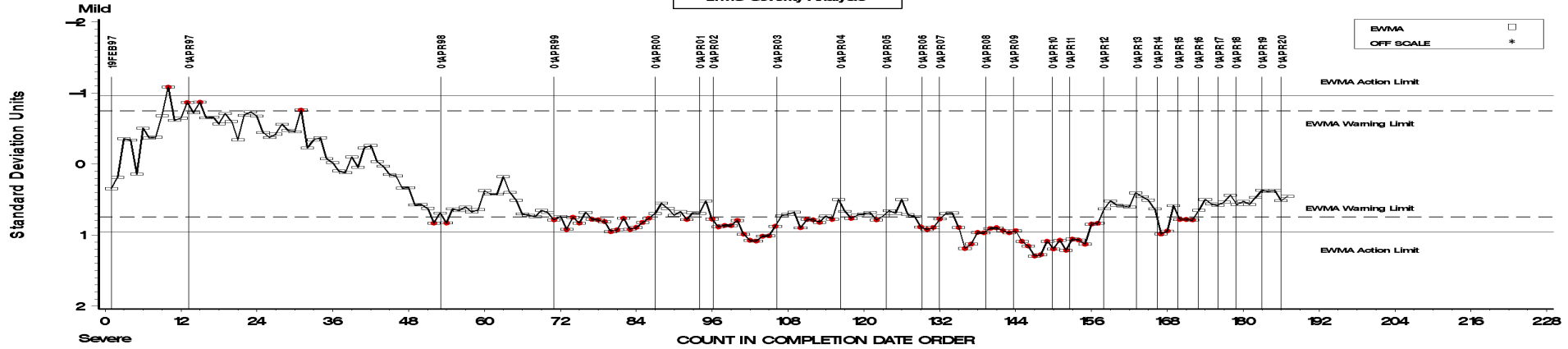


CATERPILLAR 1P INDUSTRY OPERATIONALLY VALID DATA

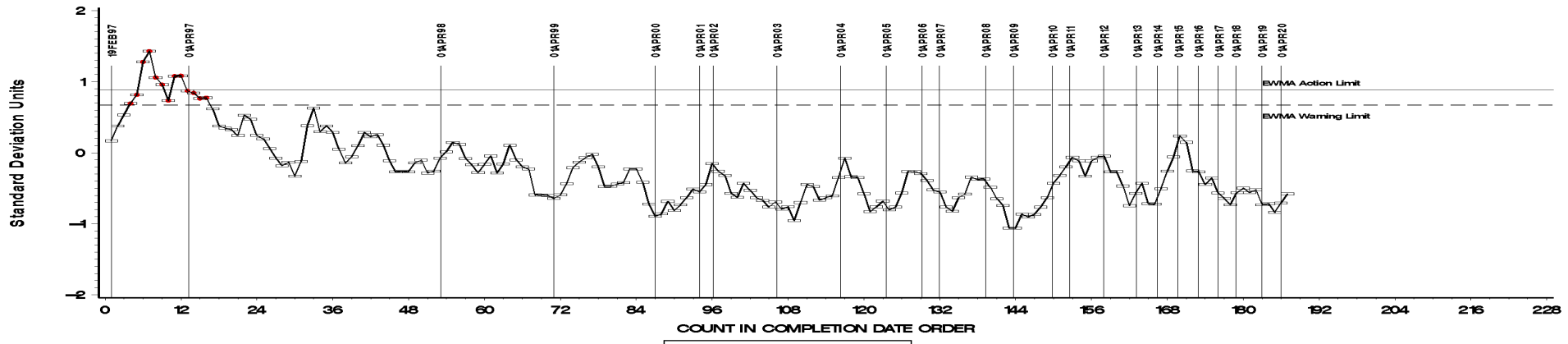


OIL CONSUMPTION

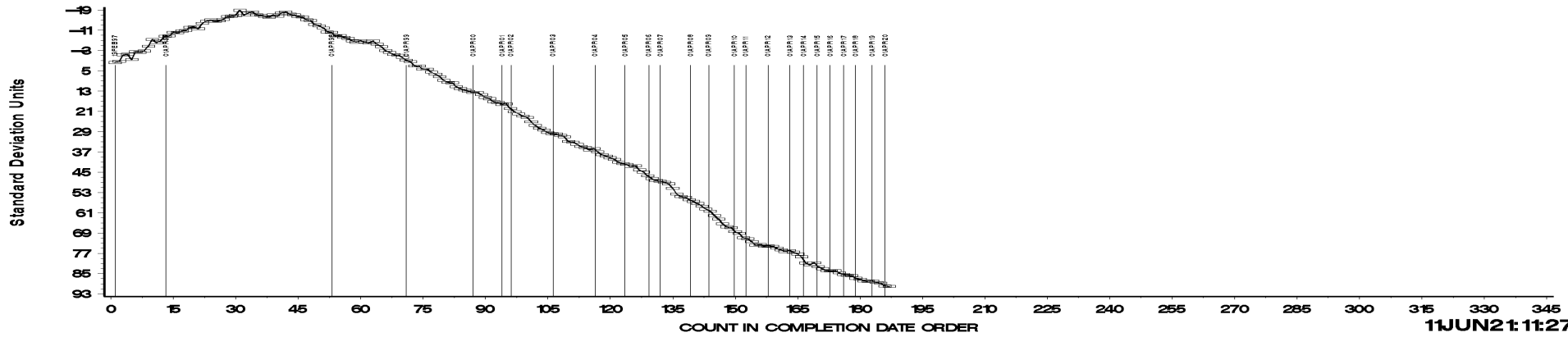
LTMS Severity Analysis



LTMS Precision Analysis



CUSUM Severity Analysis

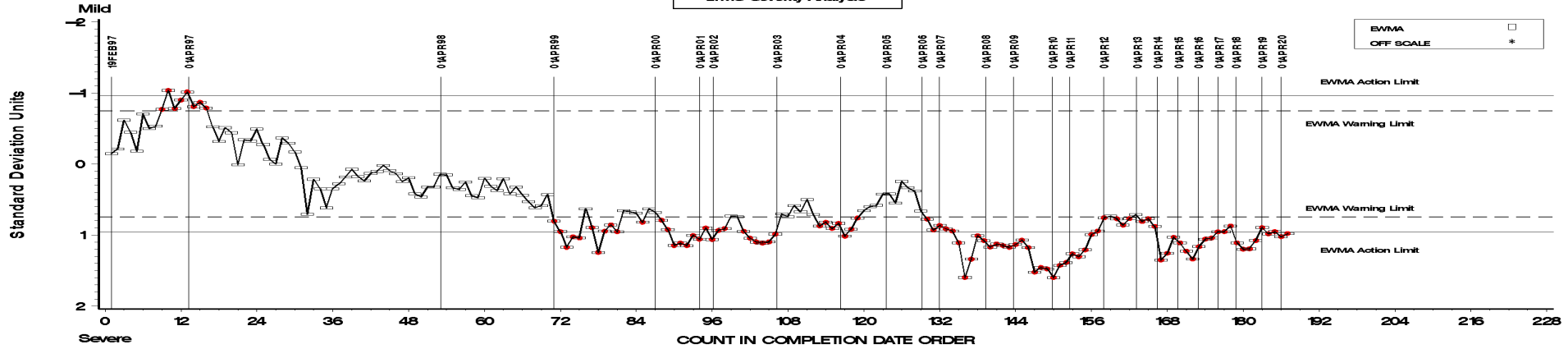


CATERPILLAR 1P INDUSTRY OPERATIONALLY VALID DATA

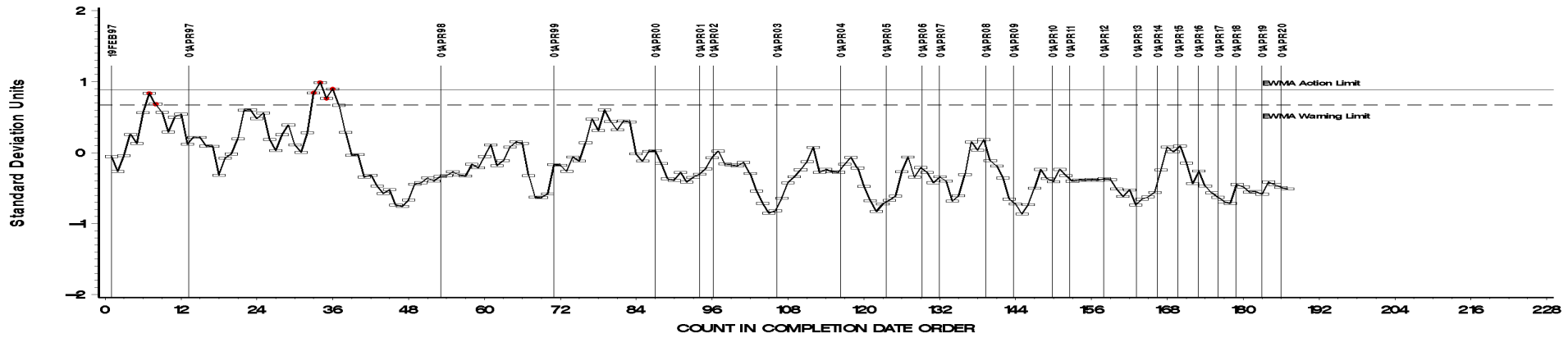


EOTOC

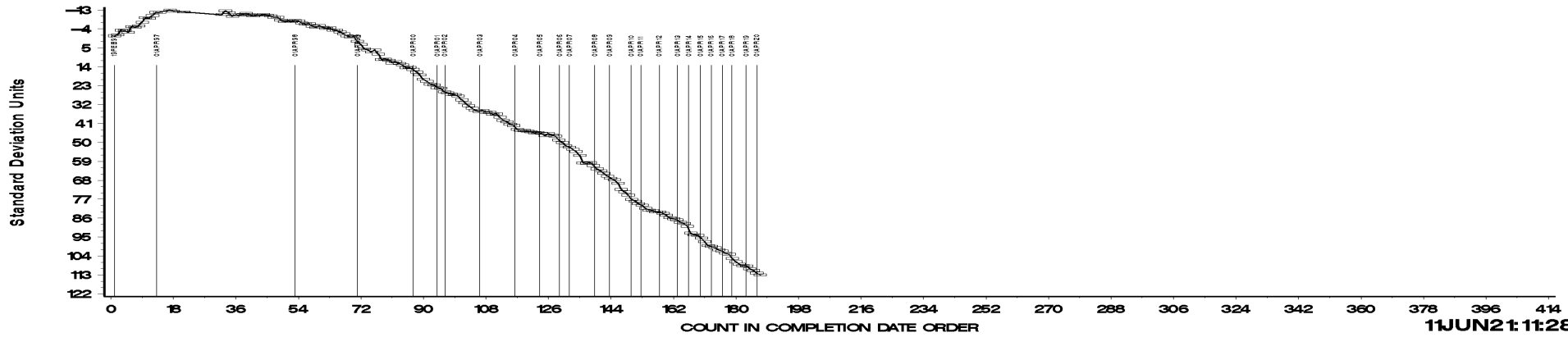
LTMS Severity Analysis



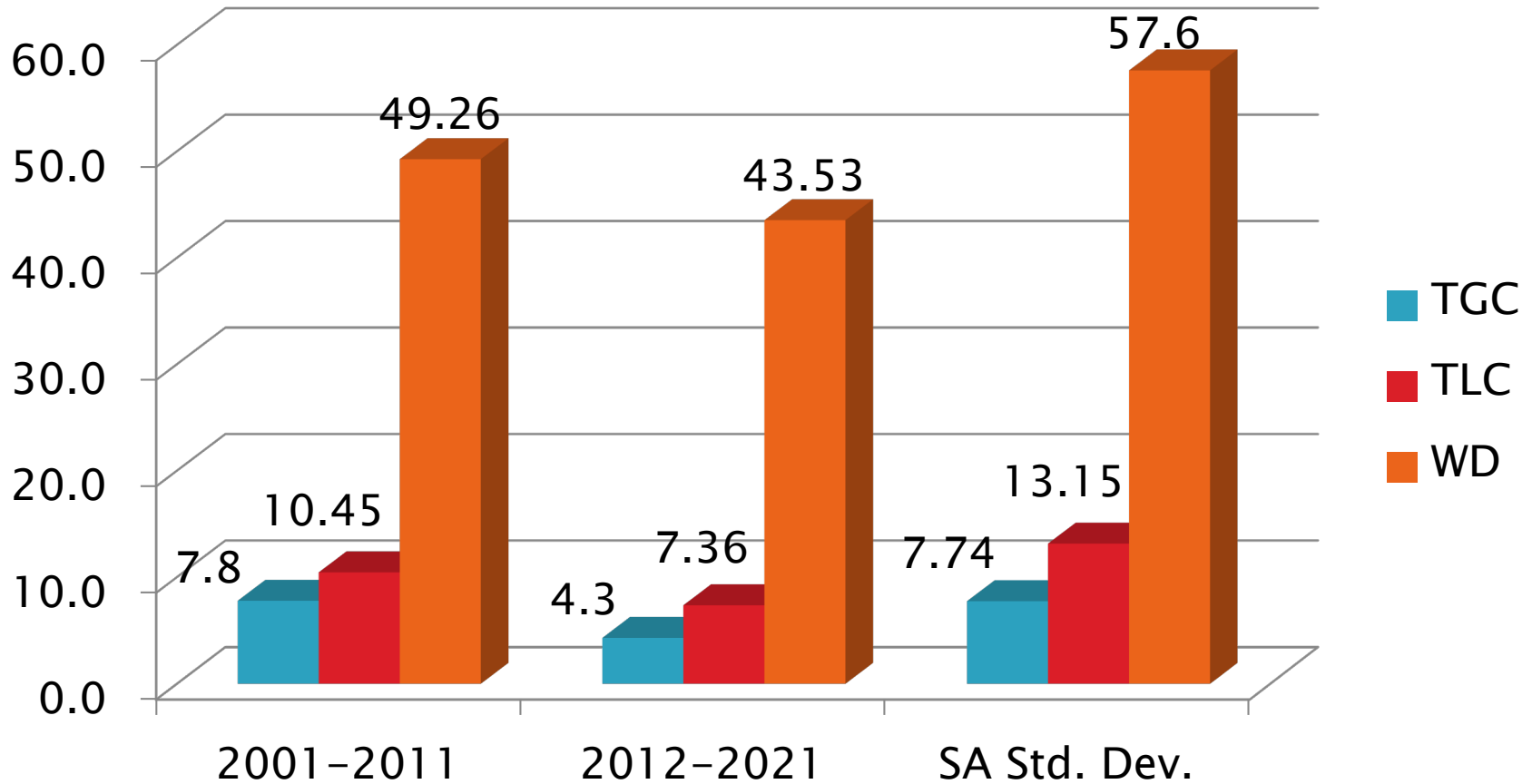
LTMS Precision Analysis



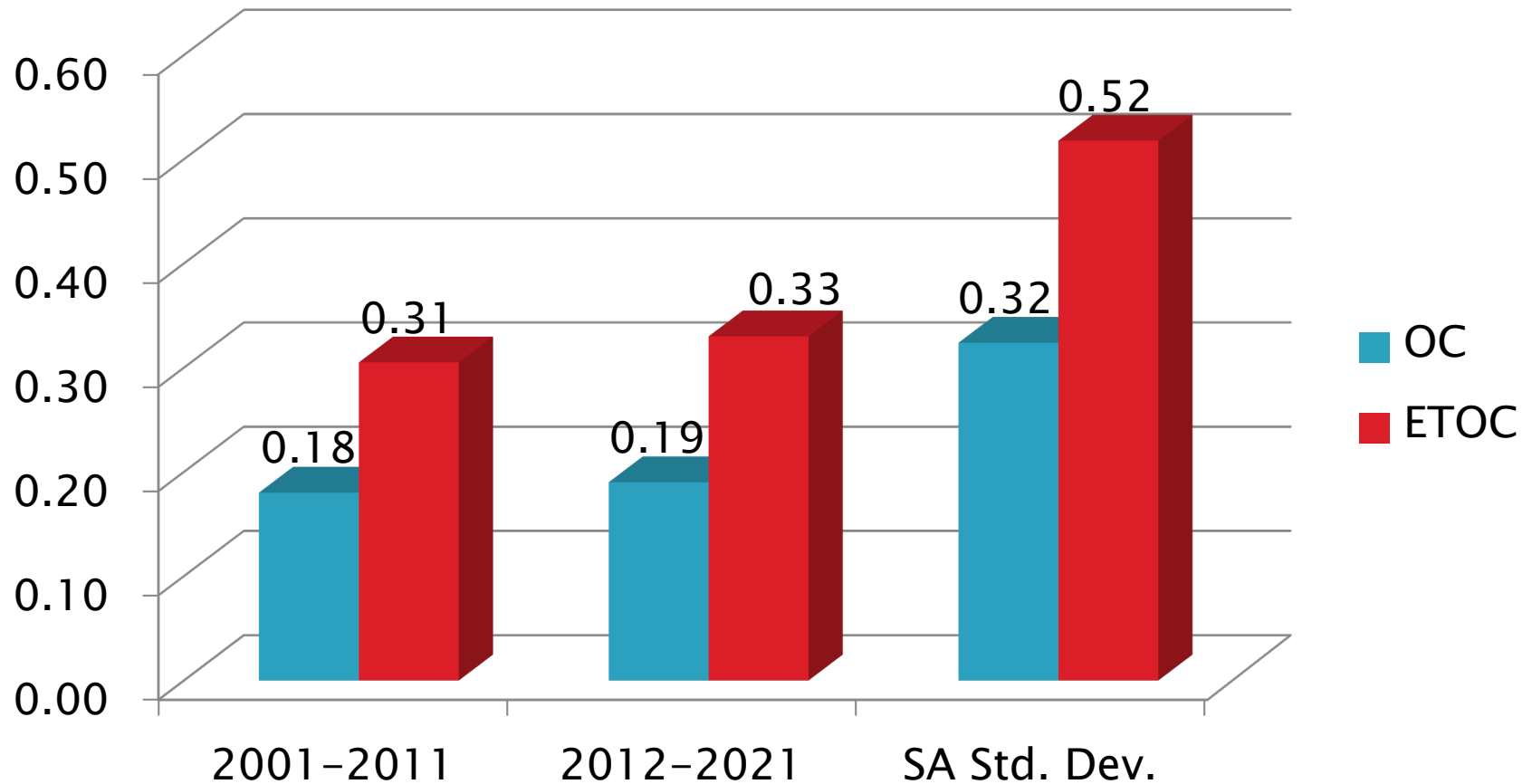
CUSUM Severity Analysis



1P Precision Estimates



1P Precision Estimates



[Return to Table of Contents](#)

SCOTE 1 R

»» June 2021

Test Monitoring Center

<http://astmtmc.cmu.edu>



A Program of ASTM International

1 R Test Activity

Test Status	Validity Code	#
Acceptable Calibration Test	AC	1
Failed Calibration Test	OC	0
Operationally Invalid	LC	0
Aborted	XC	1
Total		2

1 R Failed Tests

Failed Parameter	Number of Tests
No failed tests	0
Total	0

1 R Lost Tests*

Status	Cause	#
Invalid	No invalid tests	0
Aborted	Piston scuffing due to cracked cylinder head	1
Total		1

*Invalid and aborted tests

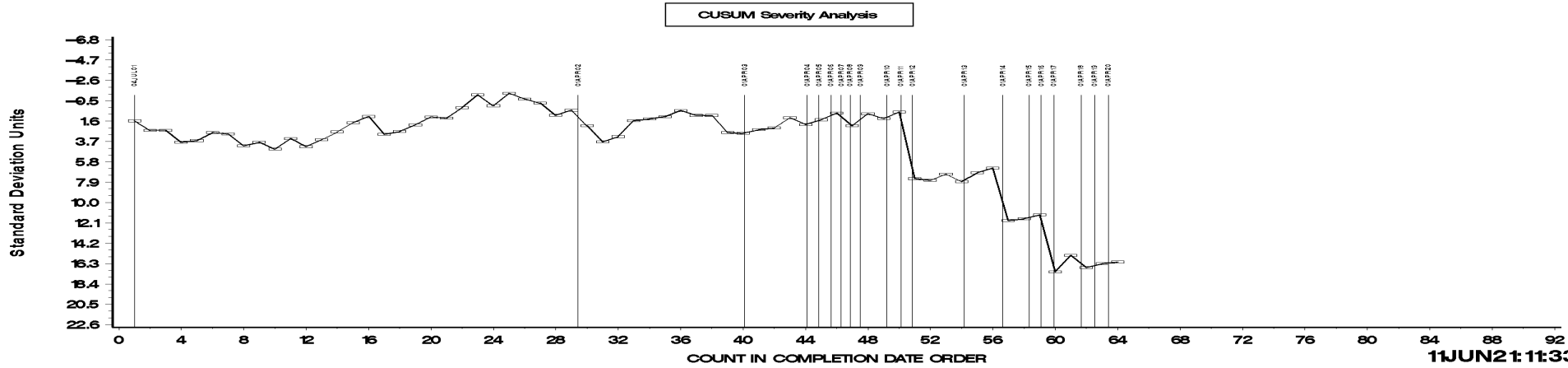
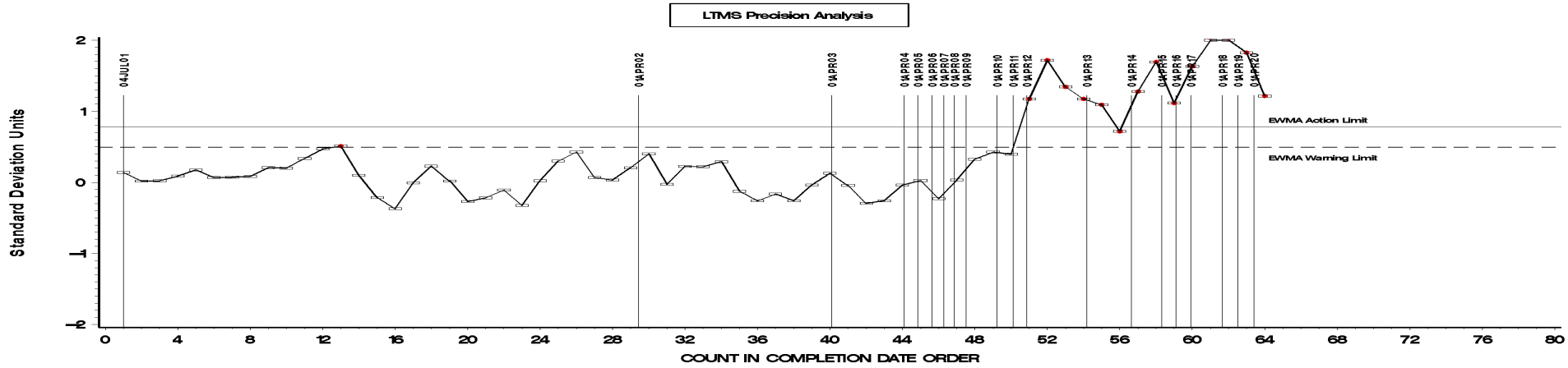
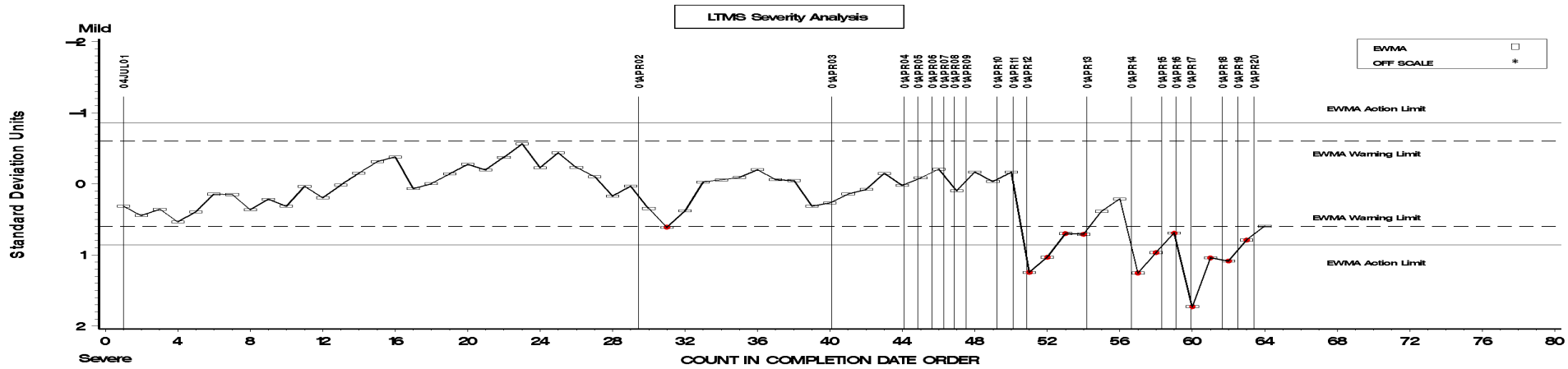
1 R Test Severity

- ▶ TLC in severity warning alarm in the mild direction.
- ▶ BTOC in severity action alarm in the mild direction.
- ▶ WD and ETOC in precision action alarm.
- ▶ TGC in precision warning alarm.

CATERPILLAR 1R INDUSTRY OPERATIONALLY VALID DATA



FINAL WEIGHTED TOTAL DEMERITS (DEMERITS)

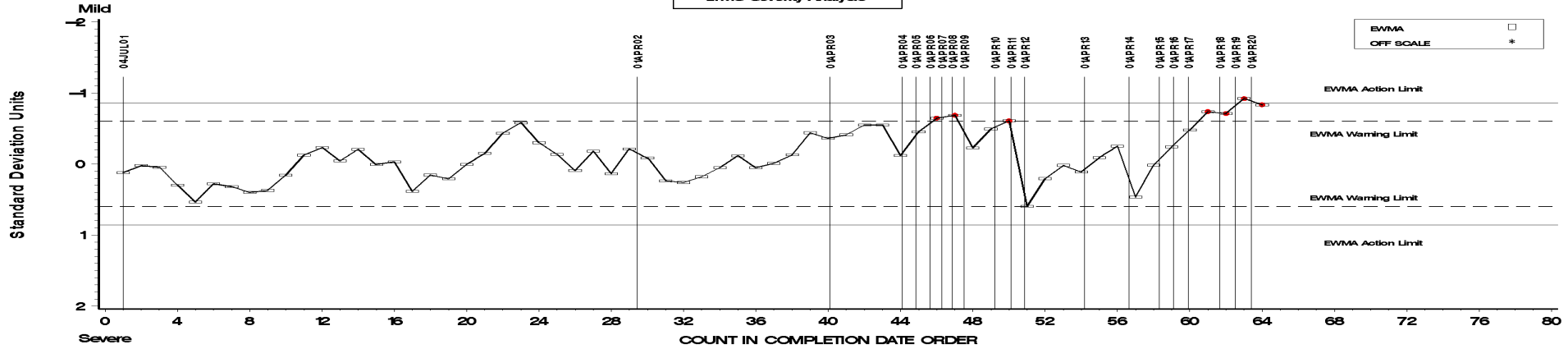


CATERPILLAR 1R INDUSTRY OPERATIONALLY VALID DATA

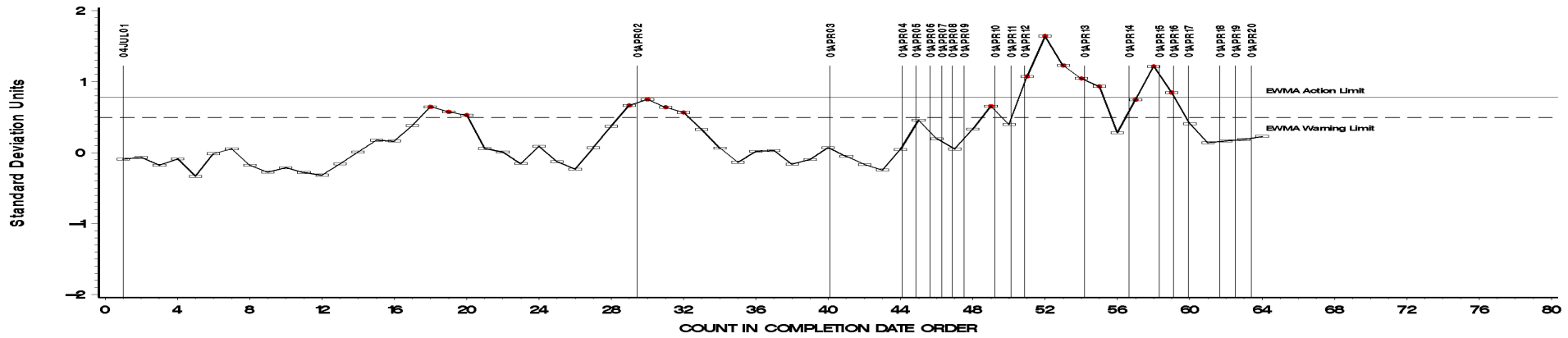


FINAL TOP LAND CARBON (DEMERITS)

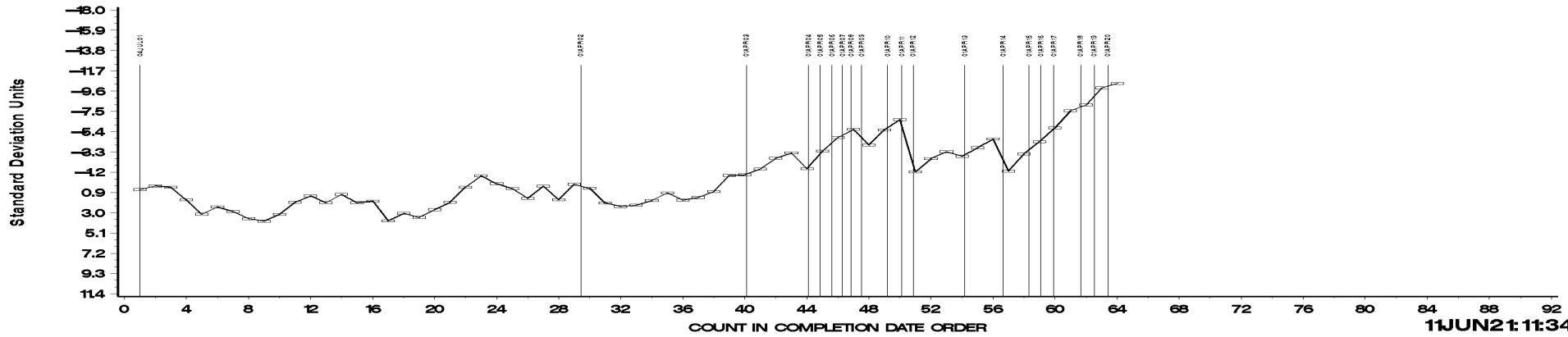
LTMS Severity Analysis



LTMS Precision Analysis



CUSUM Severity Analysis

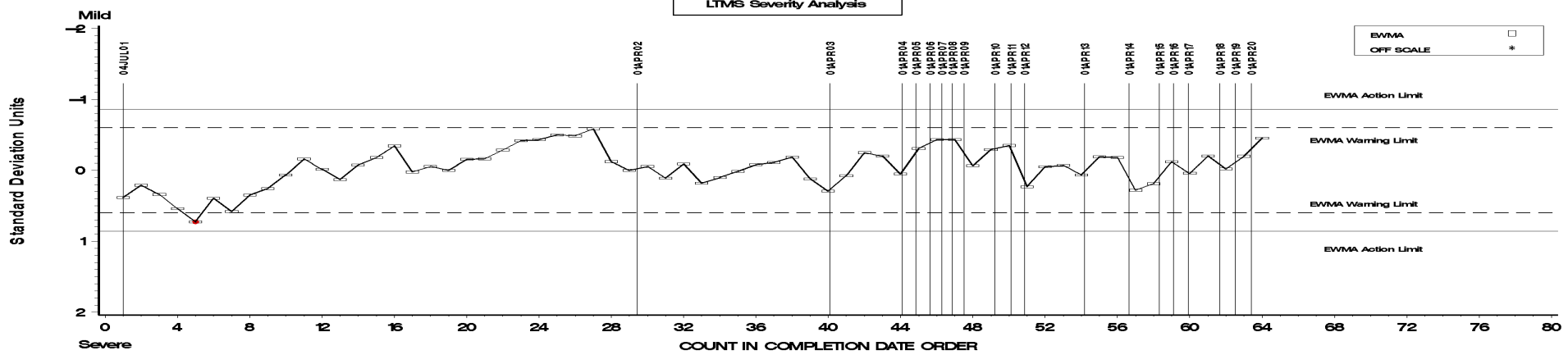


CATERPILLAR 1R INDUSTRY OPERATIONALLY VALID DATA

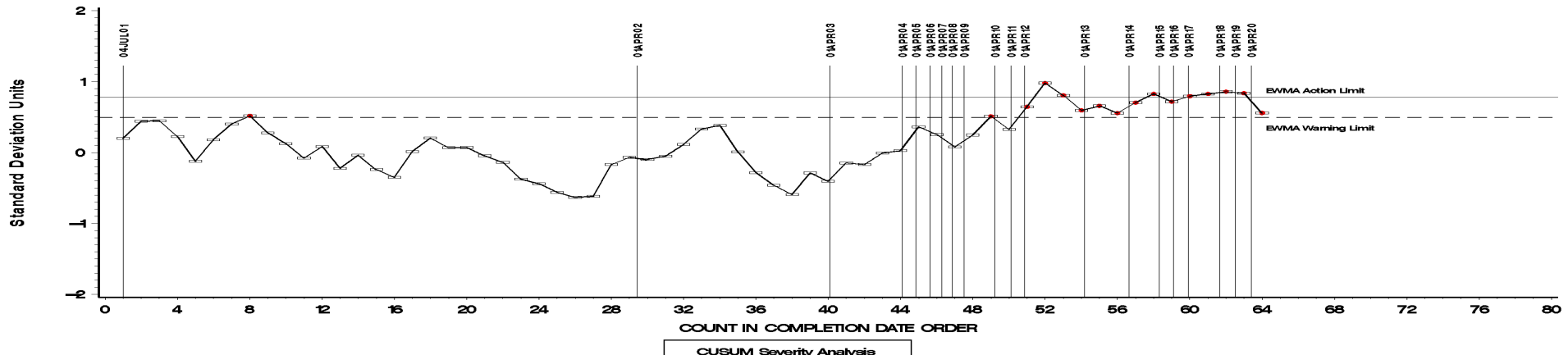


FINAL TOP GROOVE CARBON (DEMERITS)

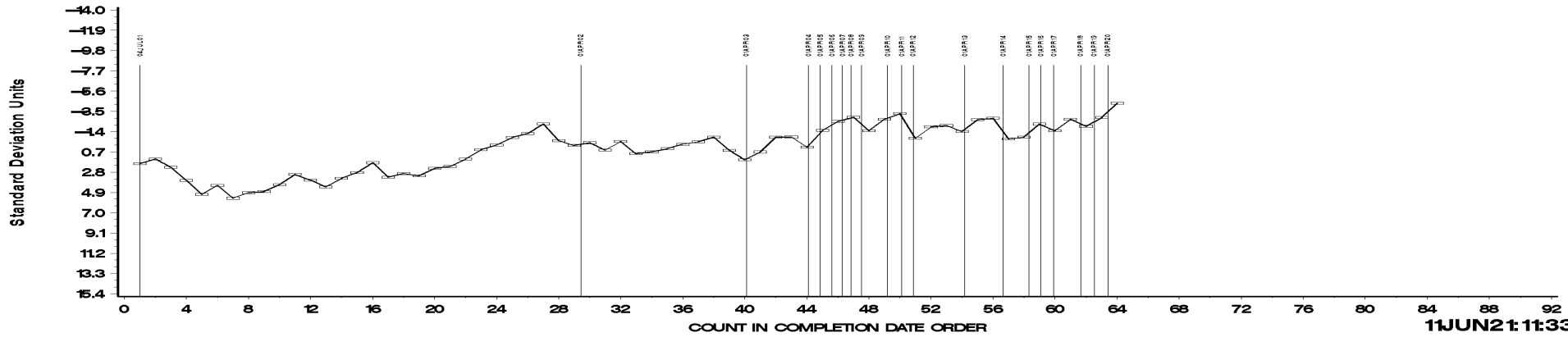
LTMS Severity Analysis



LTMS Precision Analysis



CUSUM Severity Analysis

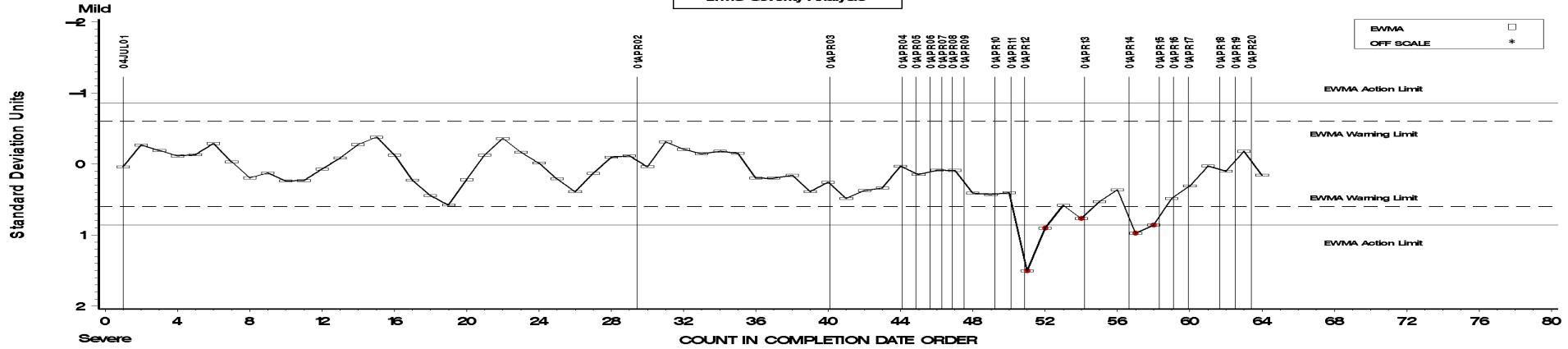


CATERPILLAR 1R INDUSTRY OPERATIONALLY VALID DATA

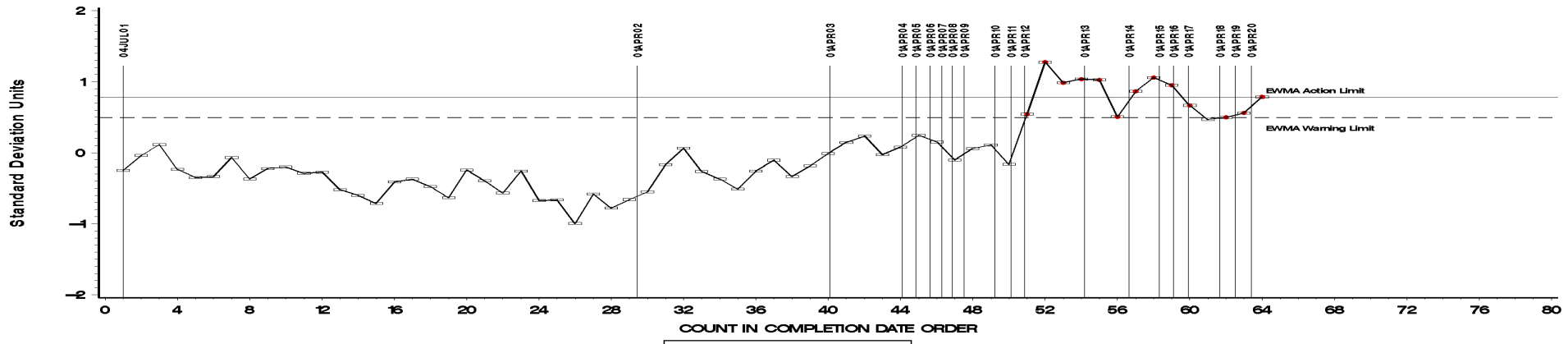


FINAL EOTOC (g/h)

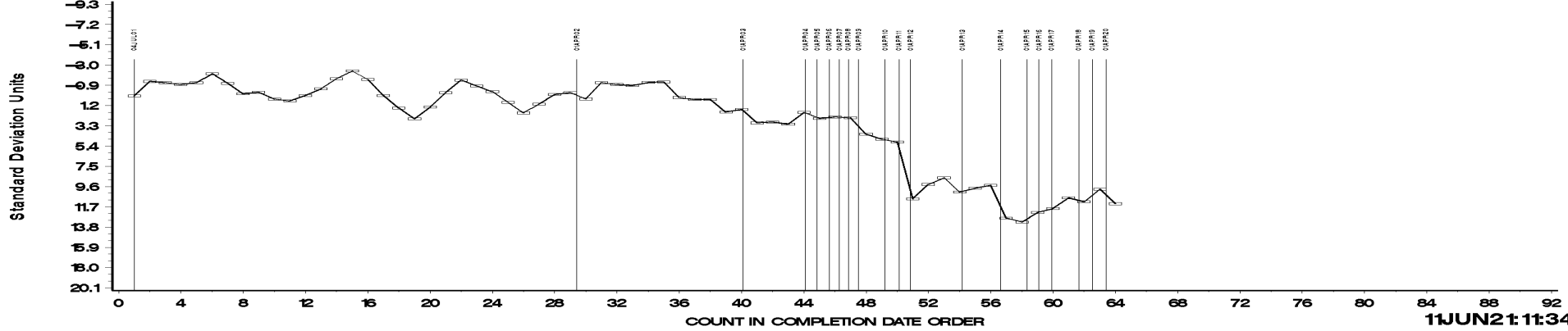
LTMS Severity Analysis



LTMS Precision Analysis



CUSUM Severity Analysis

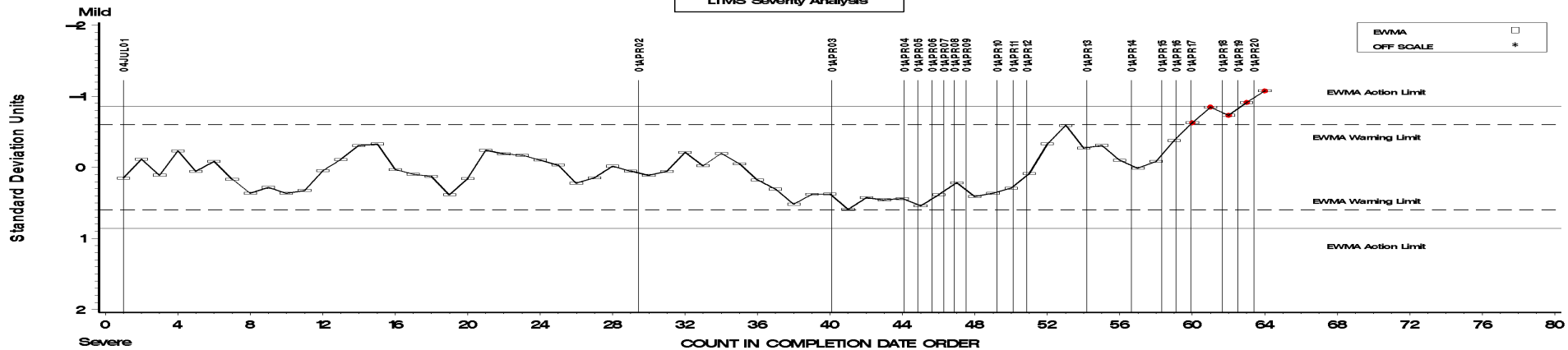


CATERPILLAR 1R INDUSTRY OPERATIONALLY VALID DATA

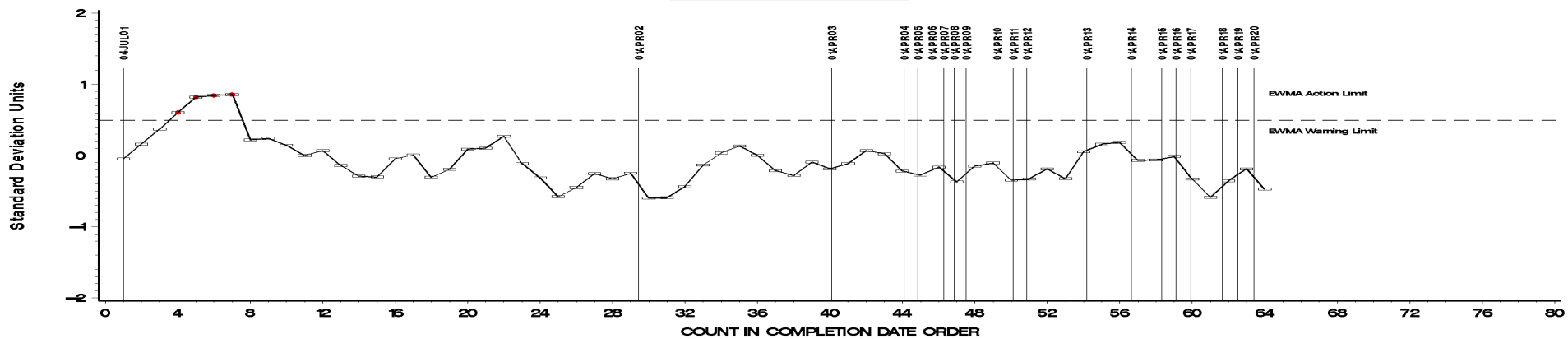


FINAL BOTOC

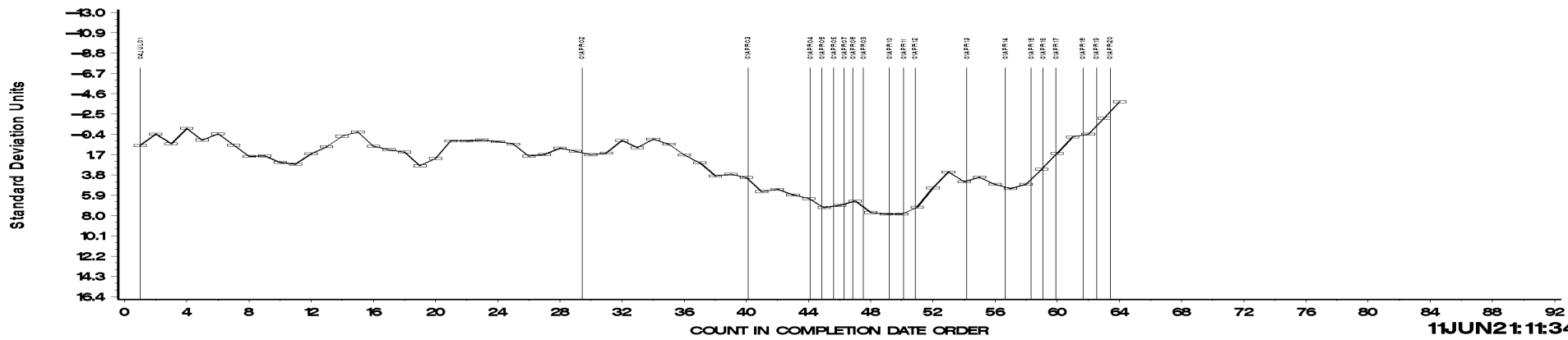
LTMS Severity Analysis



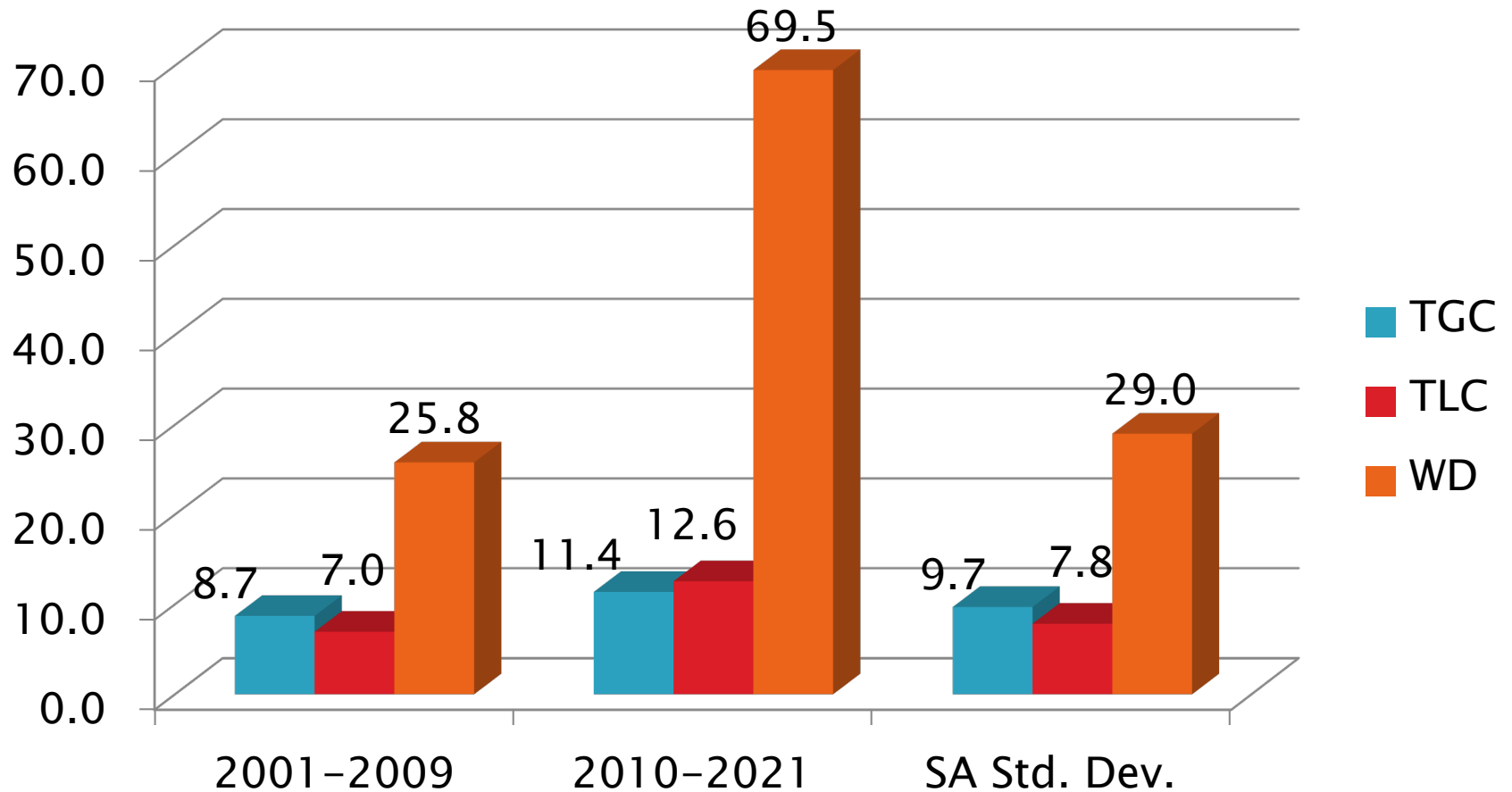
LTMS Precision Analysis



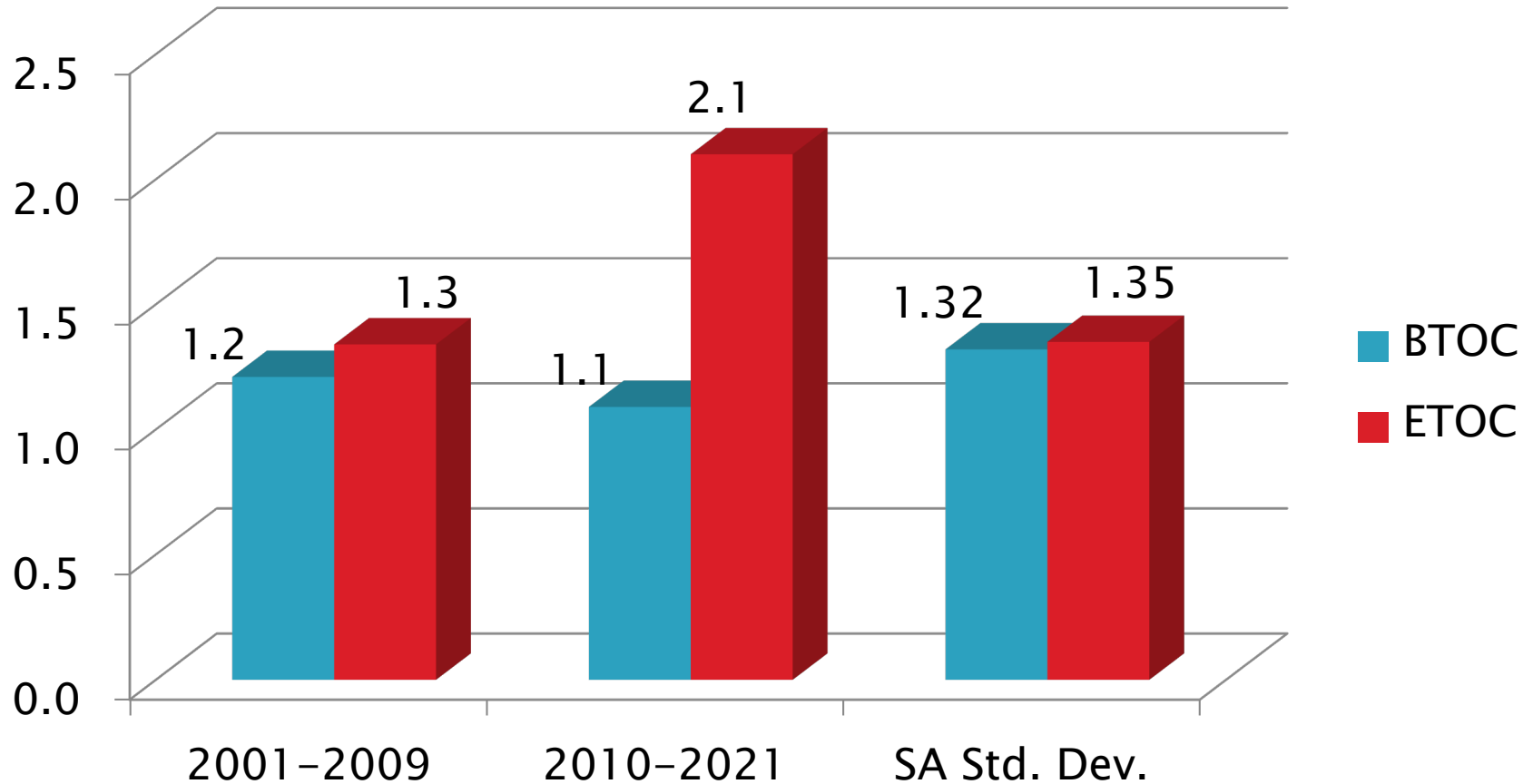
CUSUM Severity Analysis



1R Precision Estimates



1 R Precision Estimates



[Return to Table of Contents](#)

CAT C13

»» June 2021

Test Monitoring Center

<http://astmtmc.cmu.edu>



A Program of ASTM International

C13 Test Activity

Test Status	Validity Code	C13
Acceptable Calibration Test	AC	1
Failed Calibration Test	OC	0
Operationally Invalid	LC	0
Aborted	XC	0
Total		1

C13 Failed Tests

Failed Parameter	Number of Tests
No Failed Tests	0
Total	0

C13 Lost Tests*

Status	Cause	#
Invalid	No invalid tests	0
Aborted	No aborted tests	0
Total		0

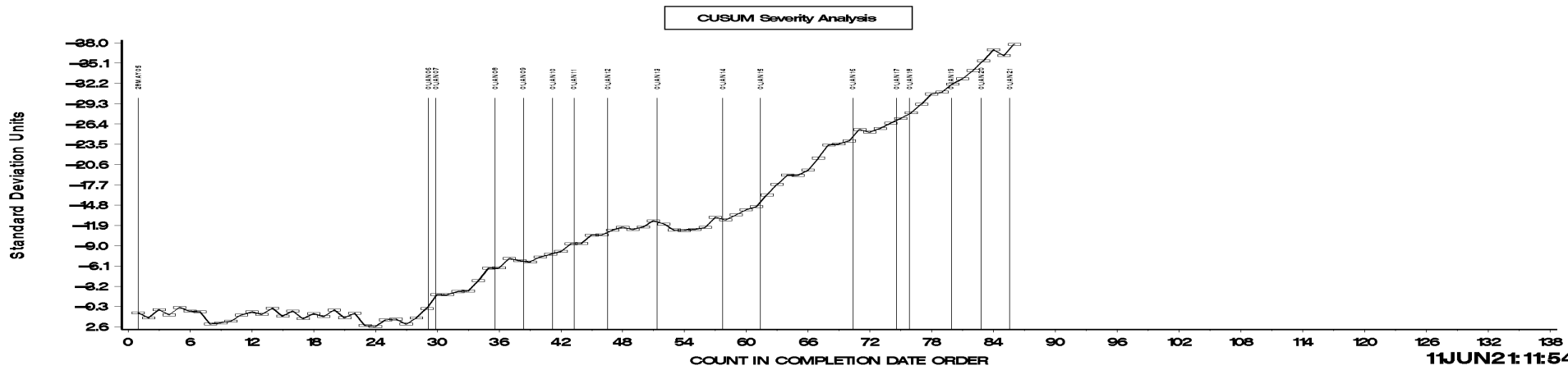
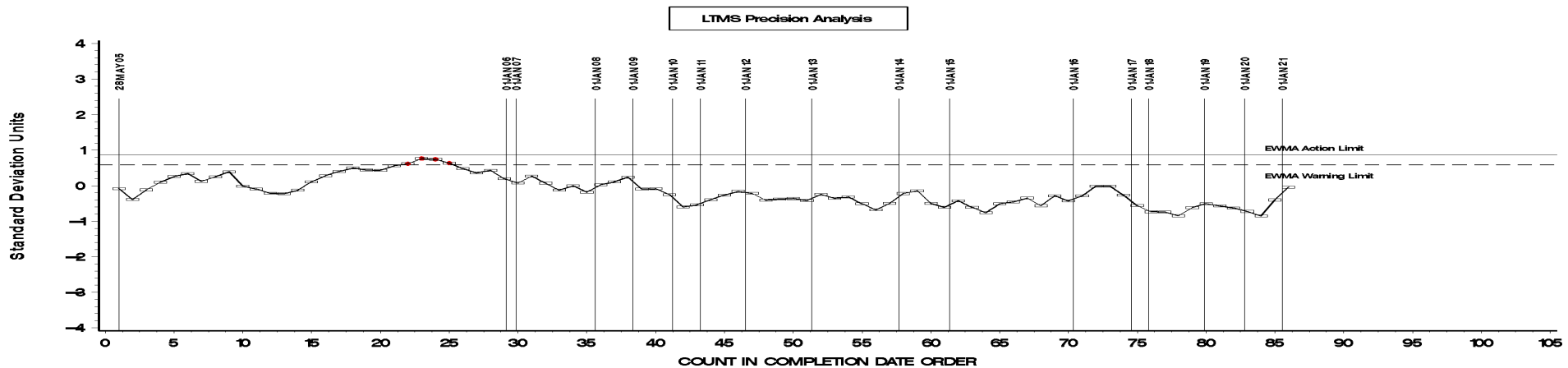
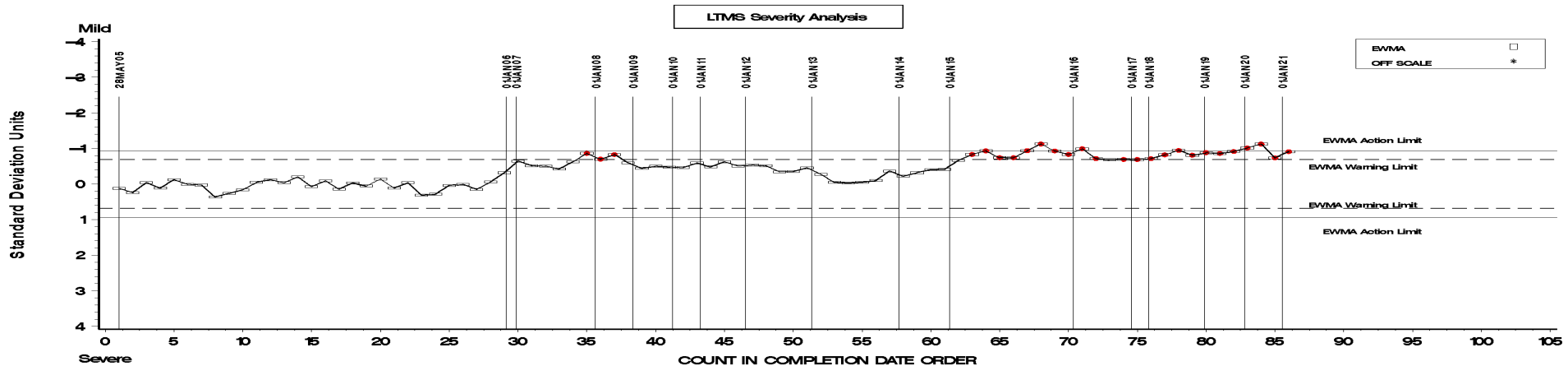
*Invalid and aborted tests

C13 Test Severity

- ▶ OC is in control
- ▶ TLC in severity warning alarm in the mild direction but very near action alarm
- ▶ R2TC is in precision warning alarm
- ▶ TGC is in control

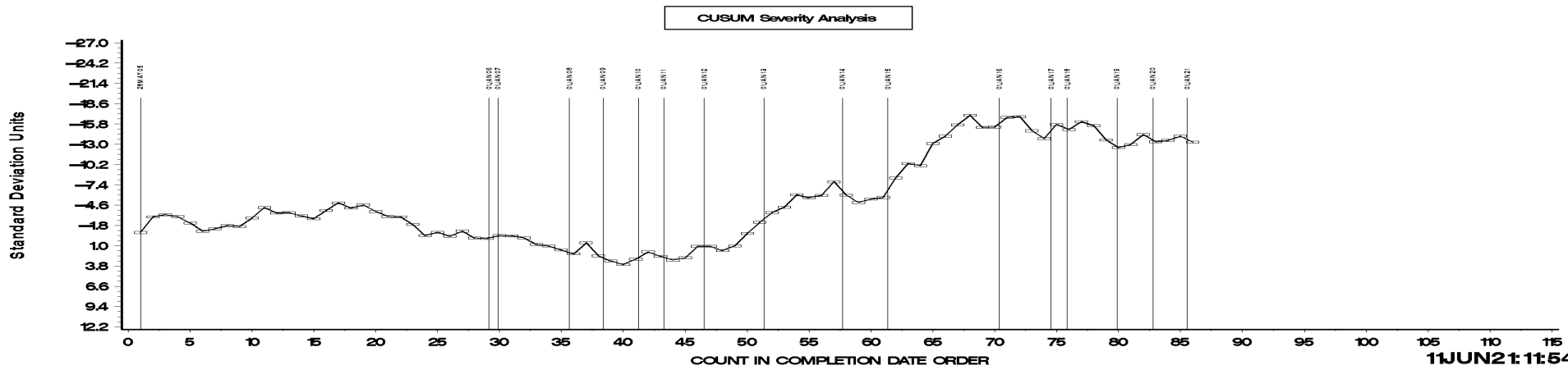
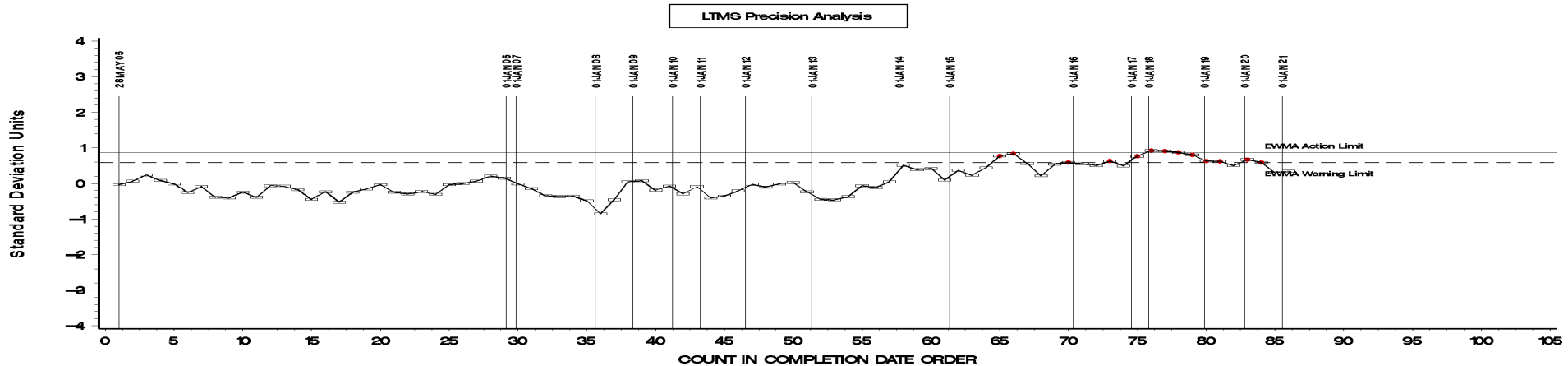
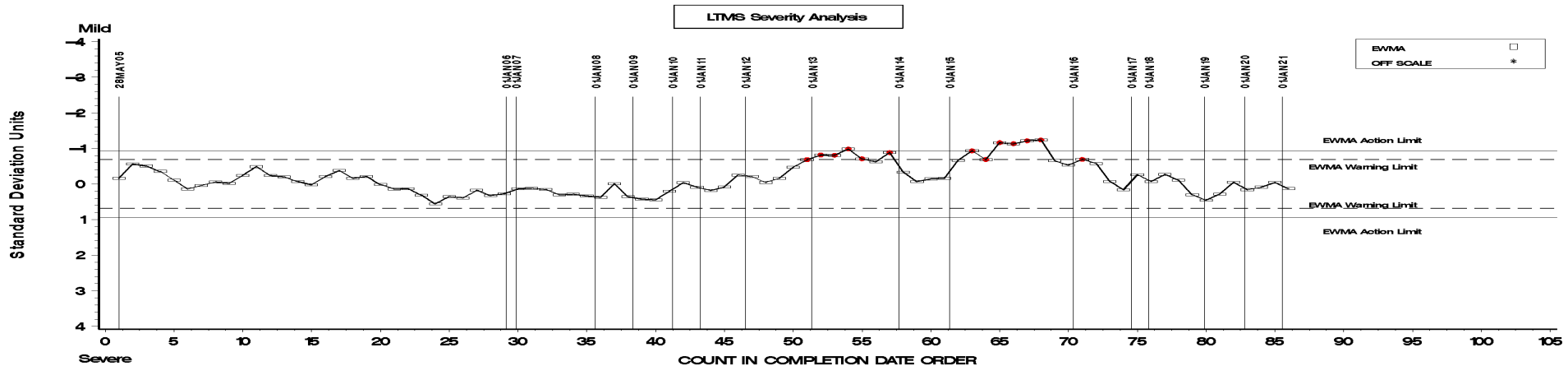
C13 INDUSTRY OPERATIONALLY VALID DATA

TOP LAND CARBON AVG. — FINAL RESULT



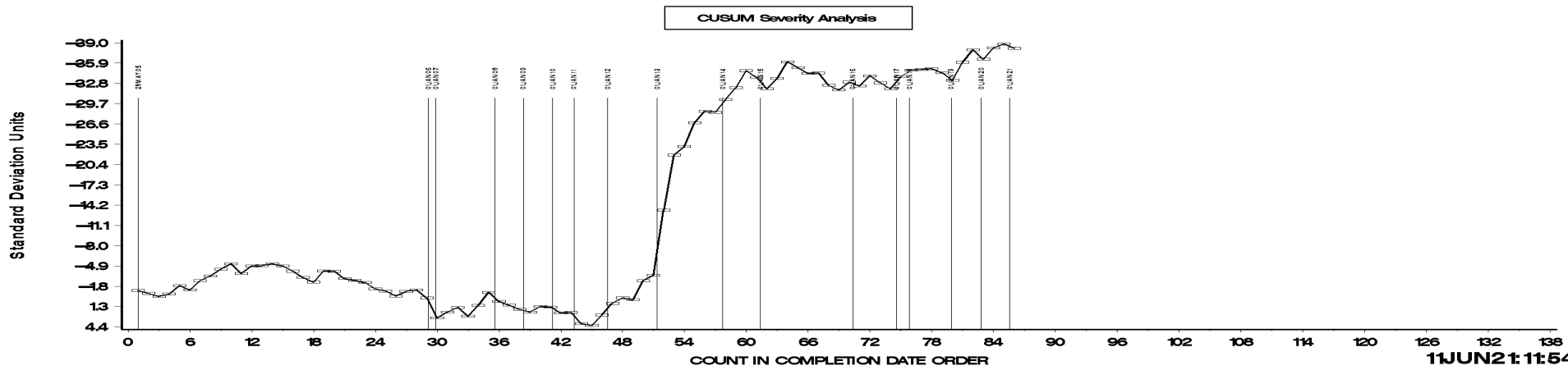
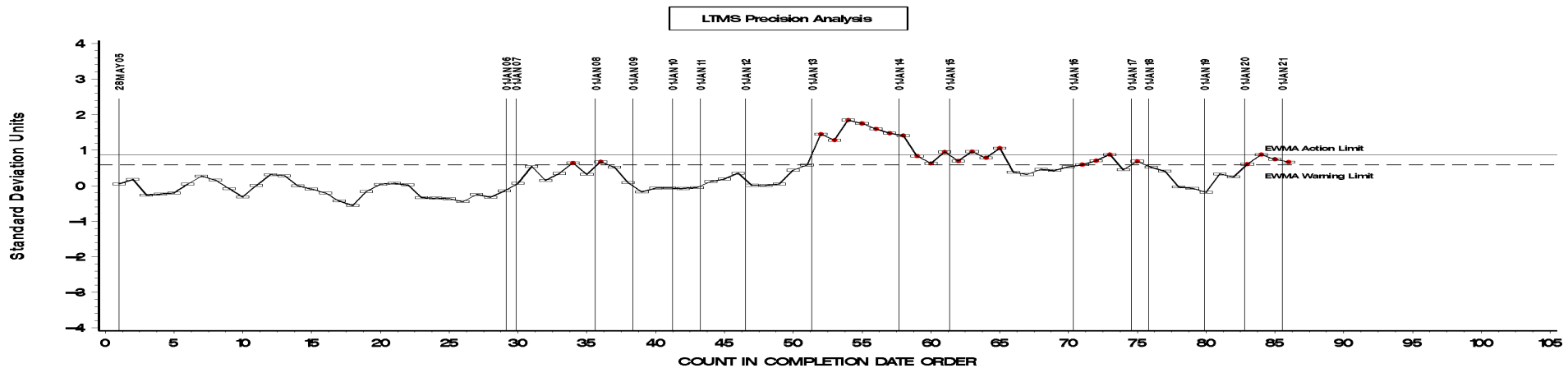
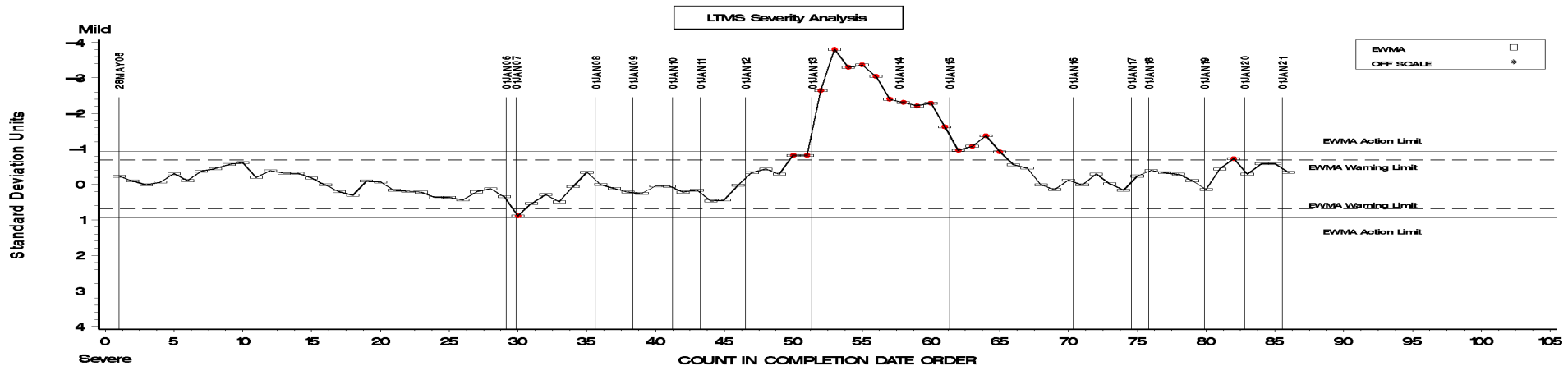
C13 INDUSTRY OPERATIONALLY VALID DATA

TOP GROOVE CARBON AVG —FINAL RESULT



C13 INDUSTRY OPERATIONALLY VALID DATA

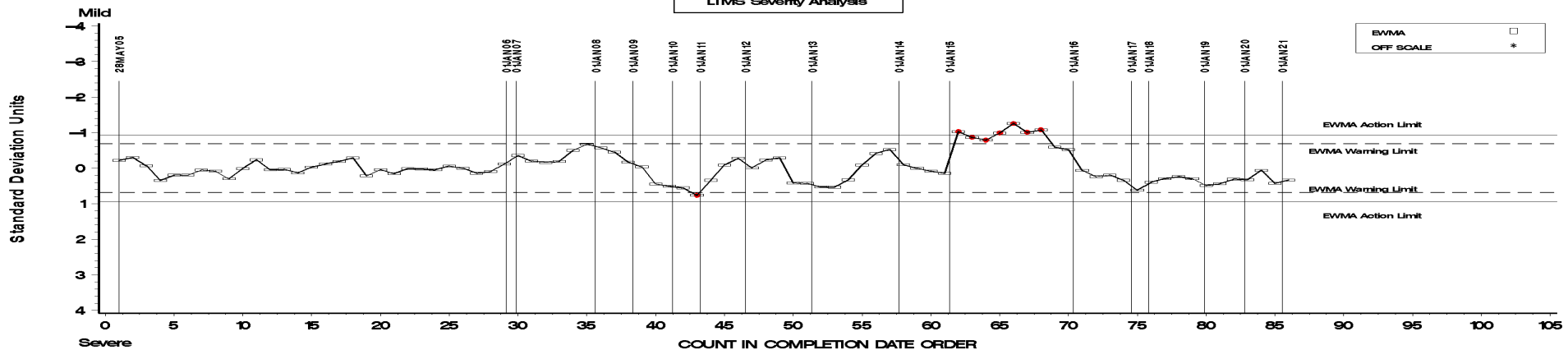
2ND RING TOP CARBON AVG. —FINAL RESULT



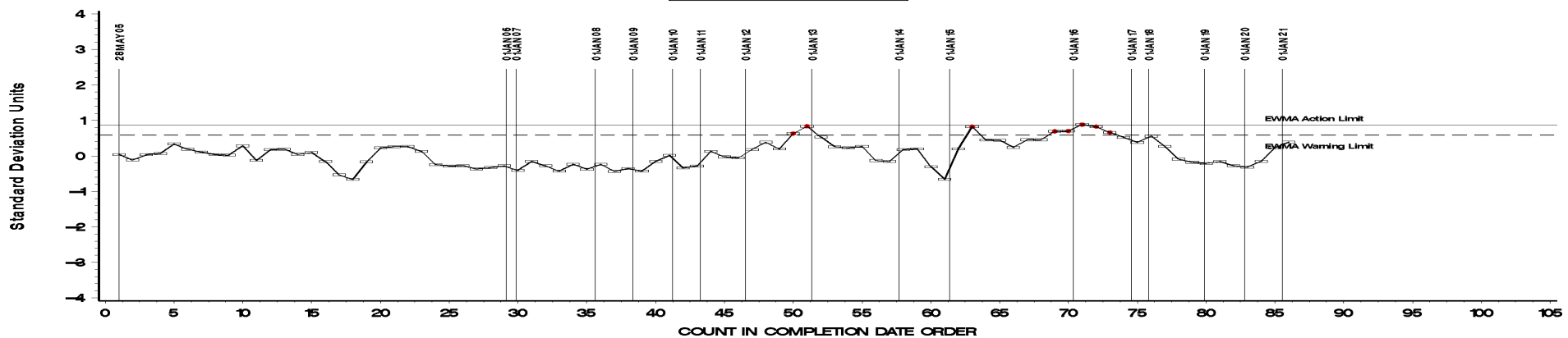
C13 INDUSTRY OPERATIONALLY VALID DATA

OIL CONS. DELTA — FINAL RESULT

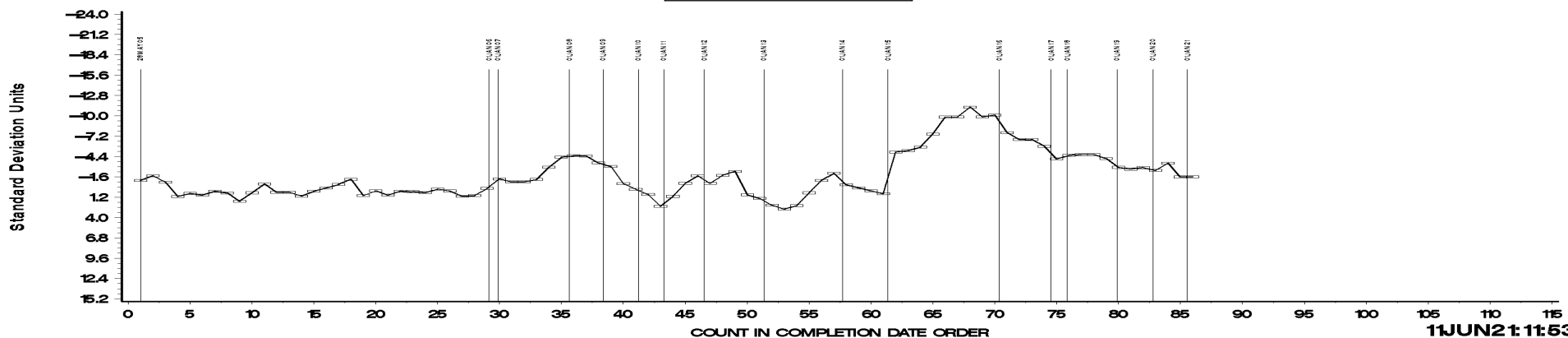
LTMS Severity Analysis



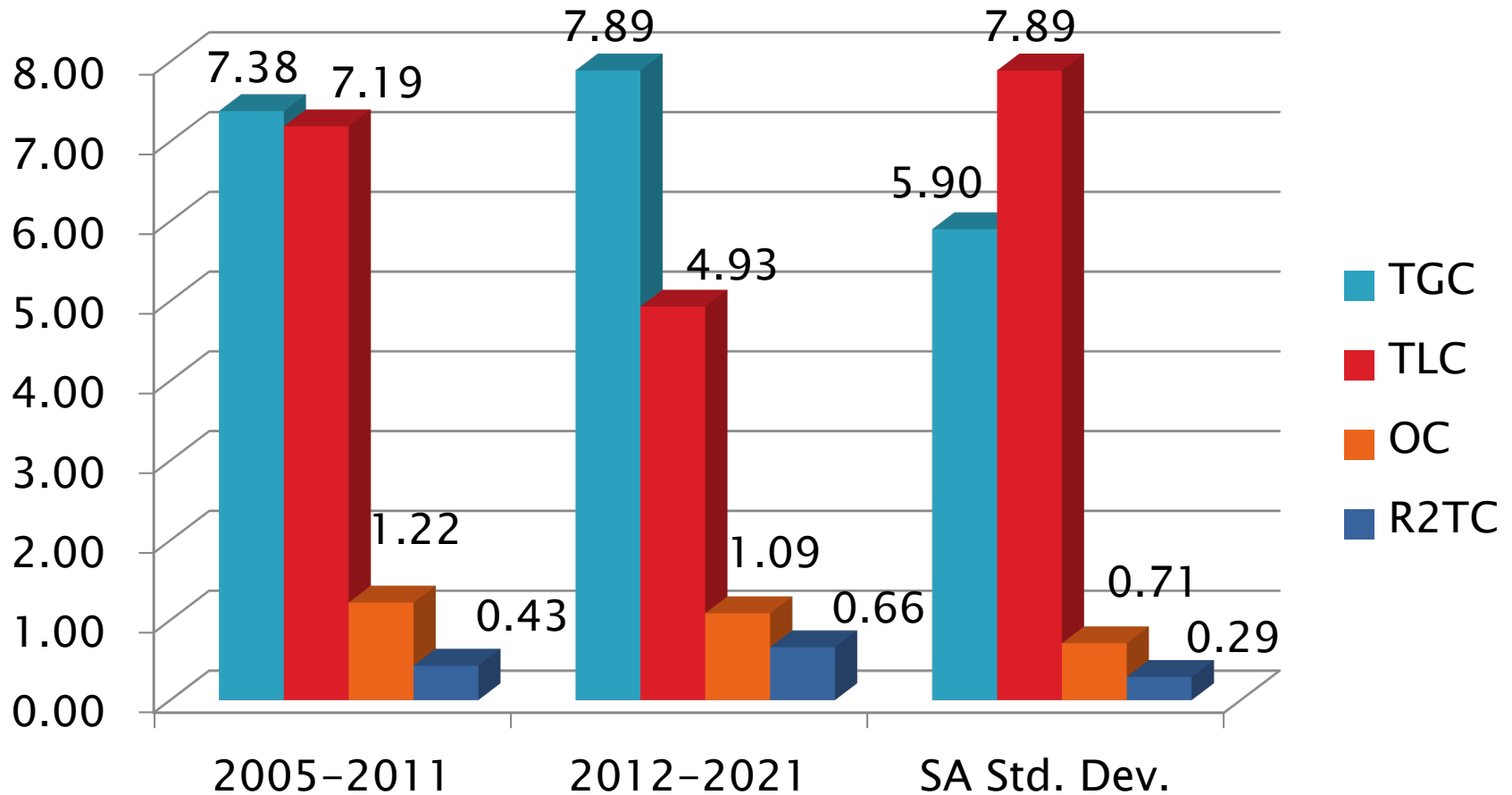
LTMS Precision Analysis



CUSUM Severity Analysis



C13 Precision Estimates



[Return to Table of Contents](#)

C13 Oil Aeration (COAT)

»» June 2021

Test Monitoring Center

<http://astmtmc.cmu.edu>



A Program of ASTM International

COAT Test Activity

Test Status	Validity Code	COAT
Acceptable Calibration Test	AC	3
Failed Calibration Test	OC	2
Operationally Invalid	LC	3
Aborted	XC	0
EOAT Equivalency Matrix	NN	6
Total		14

COAT Failed Tests

Failed Parameter	Number of Tests
Average oil aeration mild	2
Total	2

COAT Lost Tests*

Status	Cause	#
Invalid	Incorrect delta pressure transducer calibration	2
Invalid	Sample pressure valve malfunction	1
Aborted	No aborted tests	0
Total		0

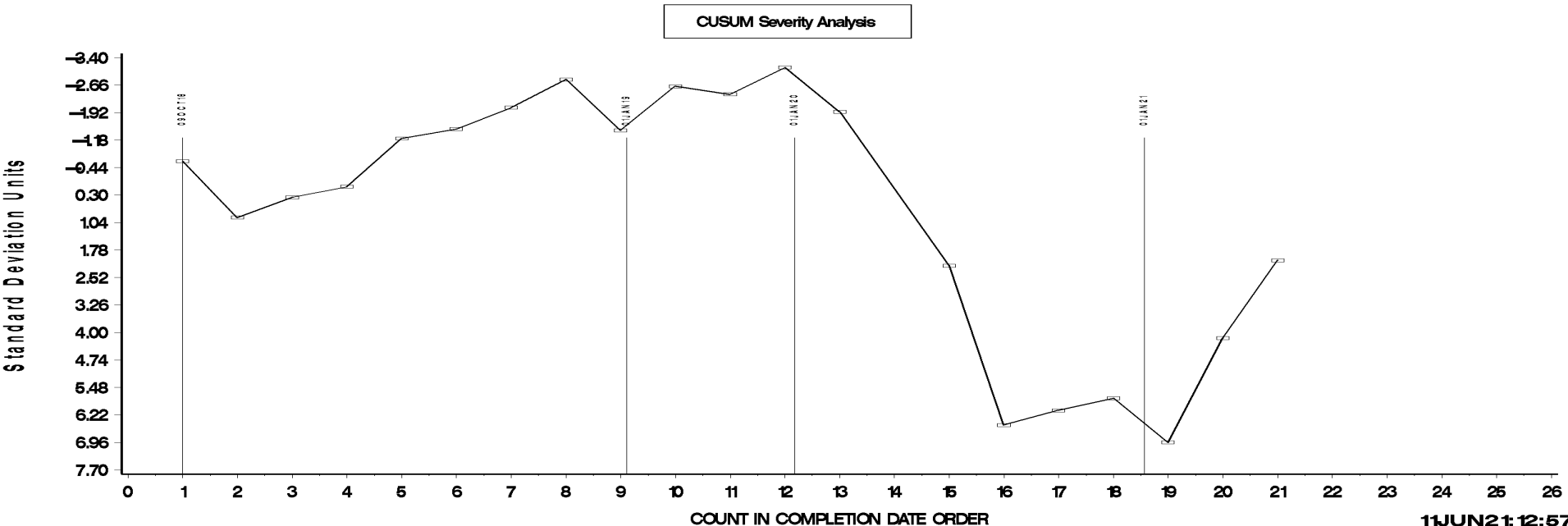
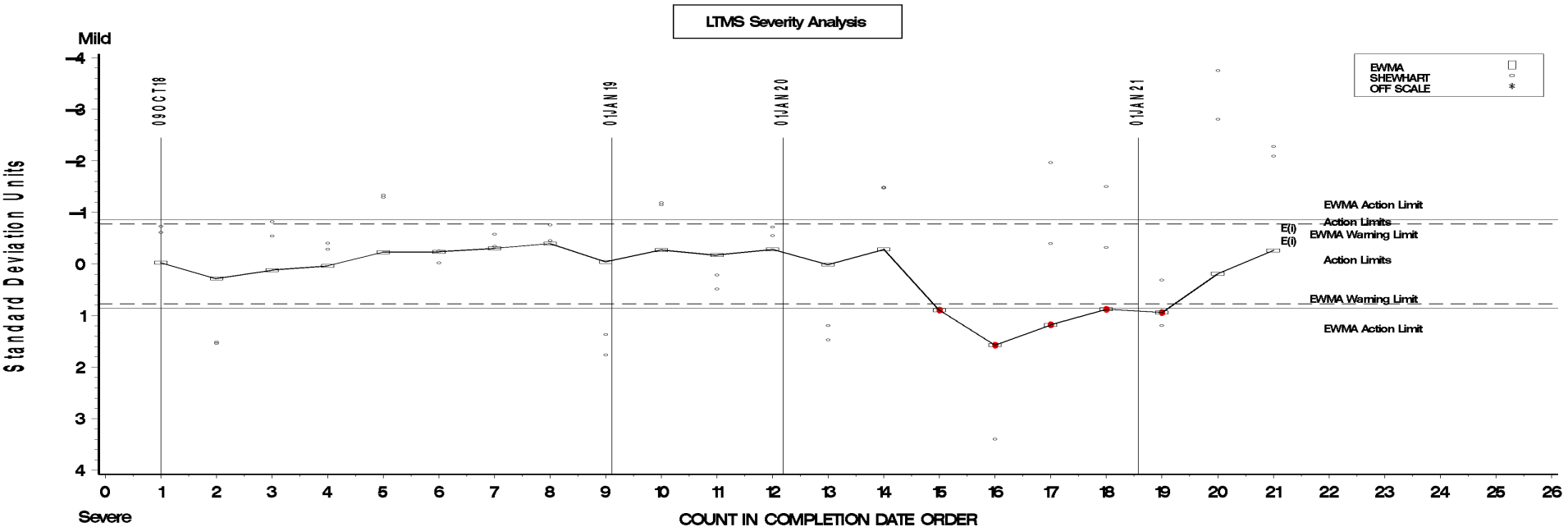
*Invalid and aborted tests

COAT Test Severity

- ▶ AAVE is in control

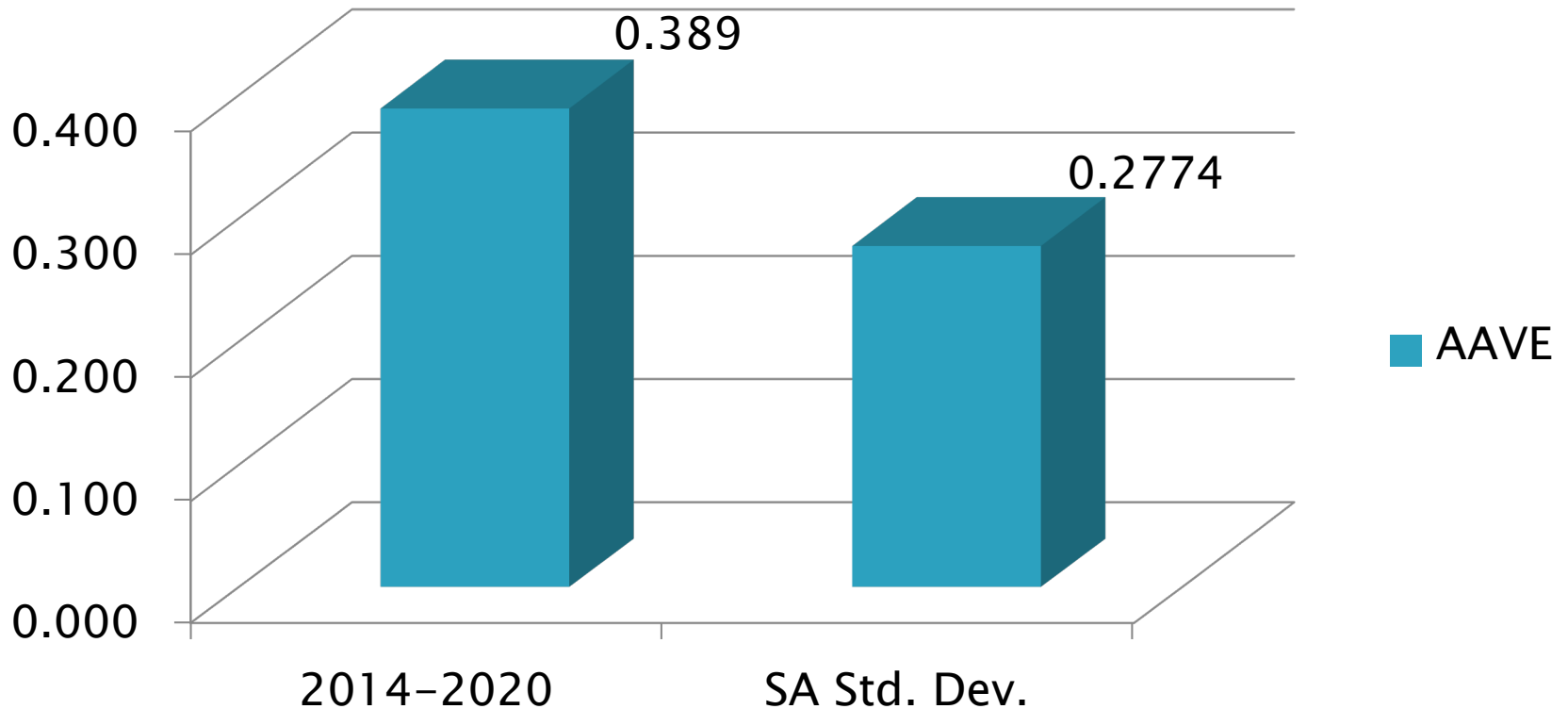
LTMSAPP= '1A'

CORRECTED AVERAGE OIL AERATION OVER TEST HOURS 40 —50



COAT Precision Estimates

AAVE



[Return to Table of Contents](#)

Test Monitoring Center

<http://astmtmc.cmu.edu>



A Program of ASTM International

Daimler DD13 Scuffing Test

»» June 2021

Test Monitoring Center

<http://astmtmc.cmu.edu>



A Program of ASTM International

DD13 Test Activity

Test Status	Validity Code	COAT
Acceptable Calibration Test	AC	3
Failed Calibration Test	OC	1
Operationally Invalid	LC	3
Aborted	XC	0
Total		7

DD13 Failed Tests

Failed Parameter	Number of Tests
Hours to scuff severe	1
Total	1

DD13 Lost Tests*

Status	Cause	#
Invalid	Scuffed before 30 hours	3
Aborted	No aborted tests	0
Total		3

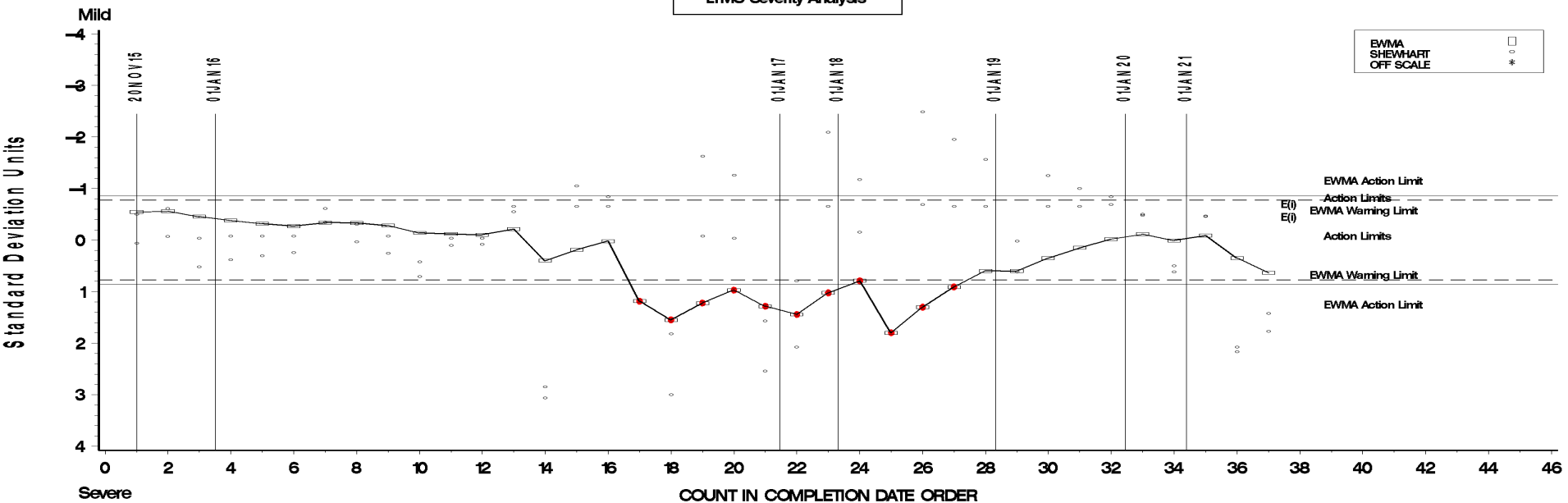
*Invalid and aborted tests

DD13 Test Severity

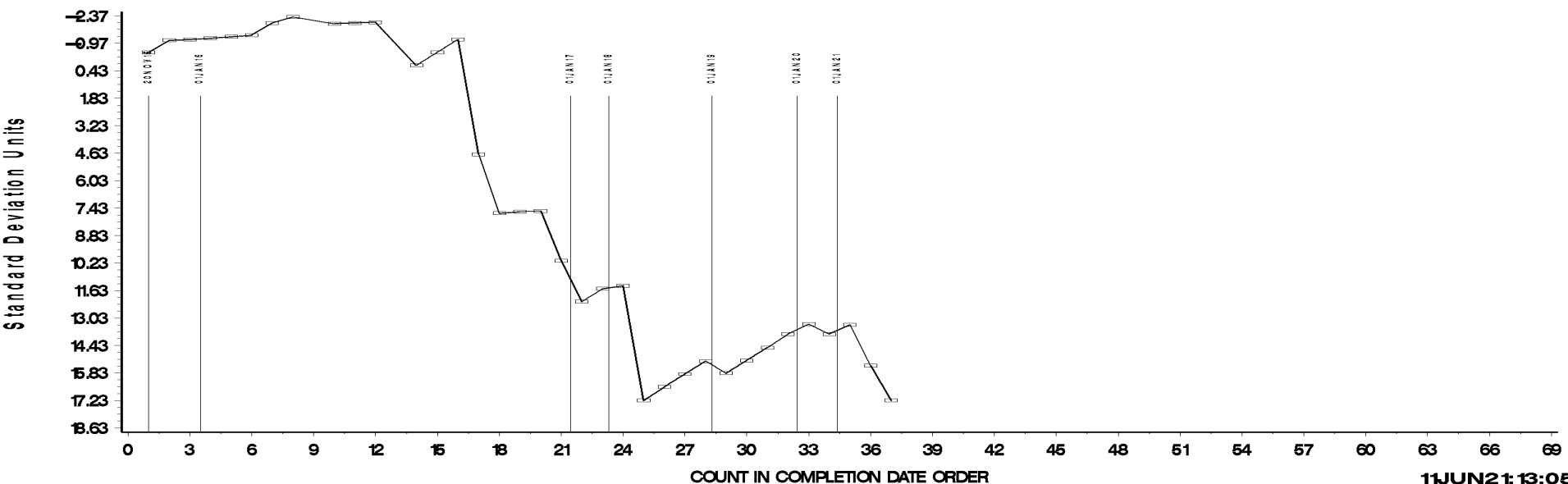
- ▶ HRS2 is in control.

FNL. ORIG. UNIT HOURS TO SCUFF

LTMS Severity Analysis

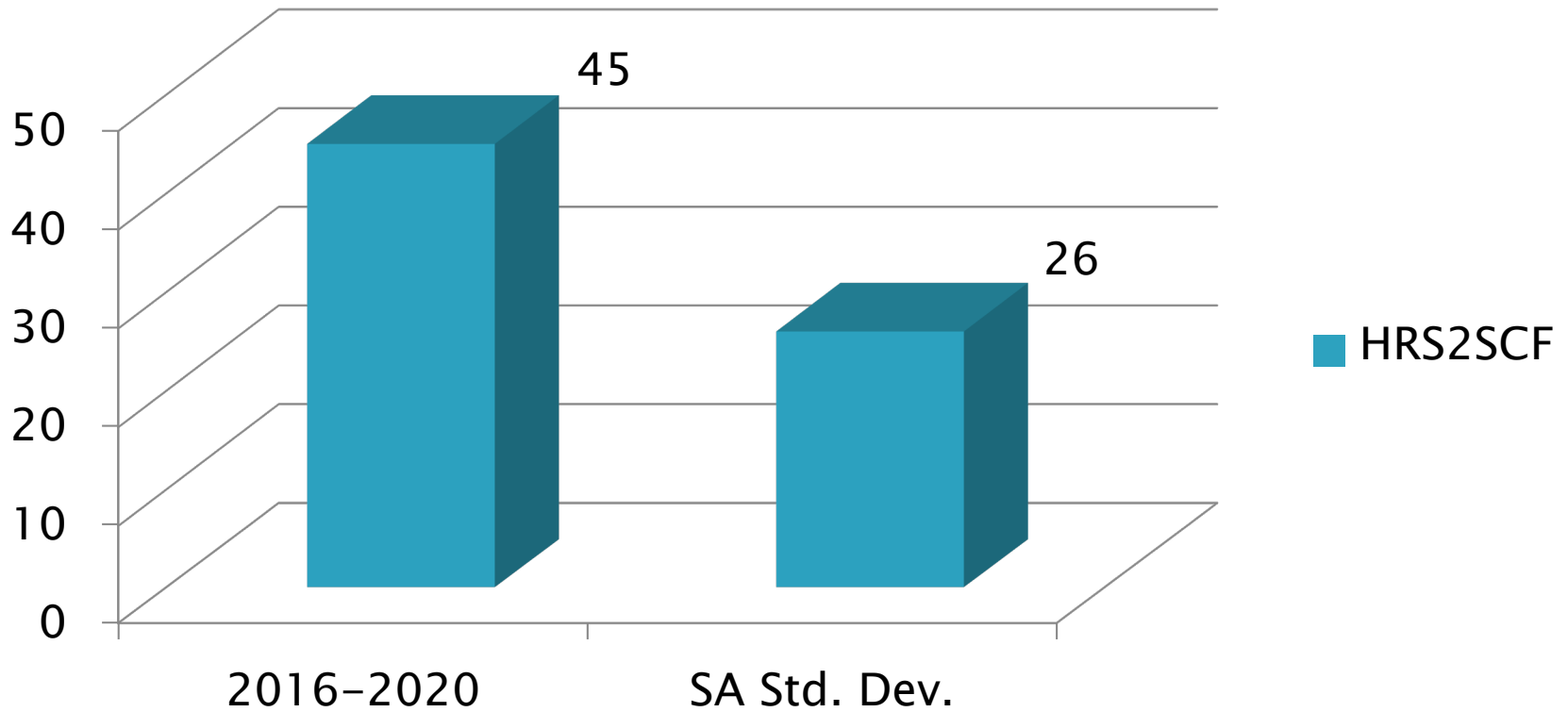


CUSUM Severity Analysis



DD13 Precision Estimates

HRS2SCF



[Return to Table of Contents](#)

Test Monitoring Center

<http://astmtmc.cmu.edu>



A Program of ASTM International

Cummins ISB

»» June 2021

Test Monitoring Center

<http://astmtmc.cmu.edu>



A Program of ASTM International

ISB Test Activity

Test Status	Validity Code	#
Acceptable Calibration Test	AC	2
Failed Calibration Test	OC	0
Operationally Invalid	LC	0
Aborted	XC	1
Total		3

ISB Failed Tests

Failed Parameter	Number of Tests
No failed tests	0
Total	0

ISB Lost Tests*

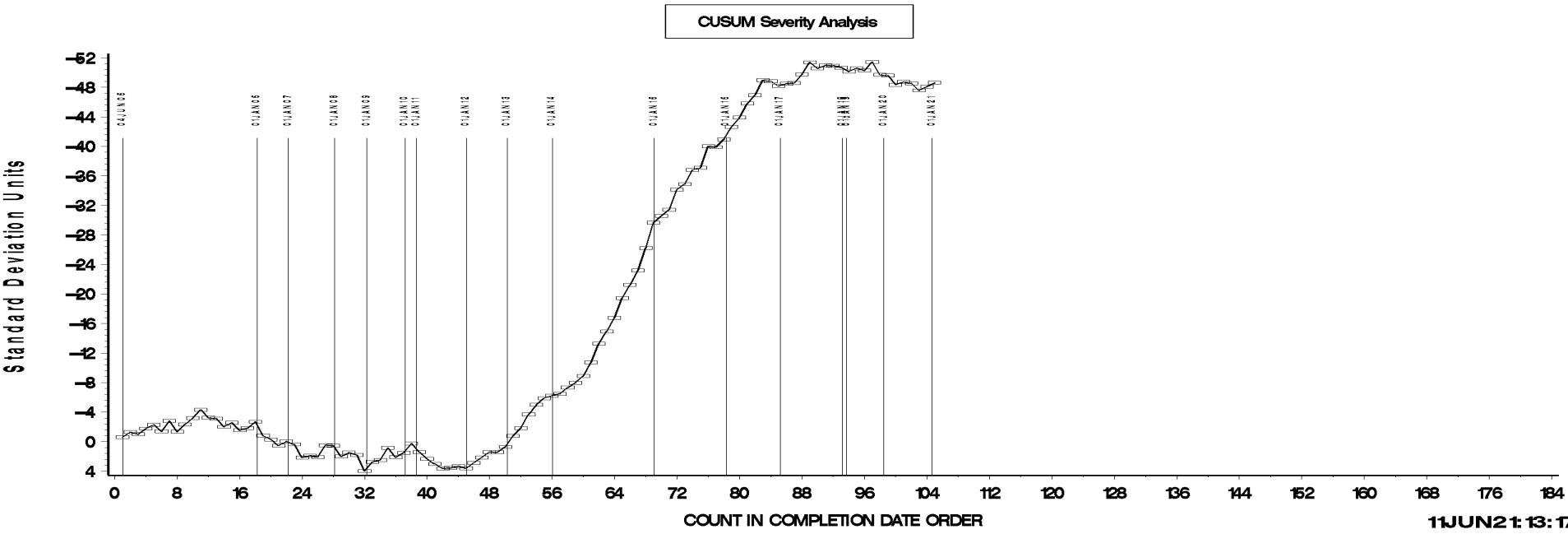
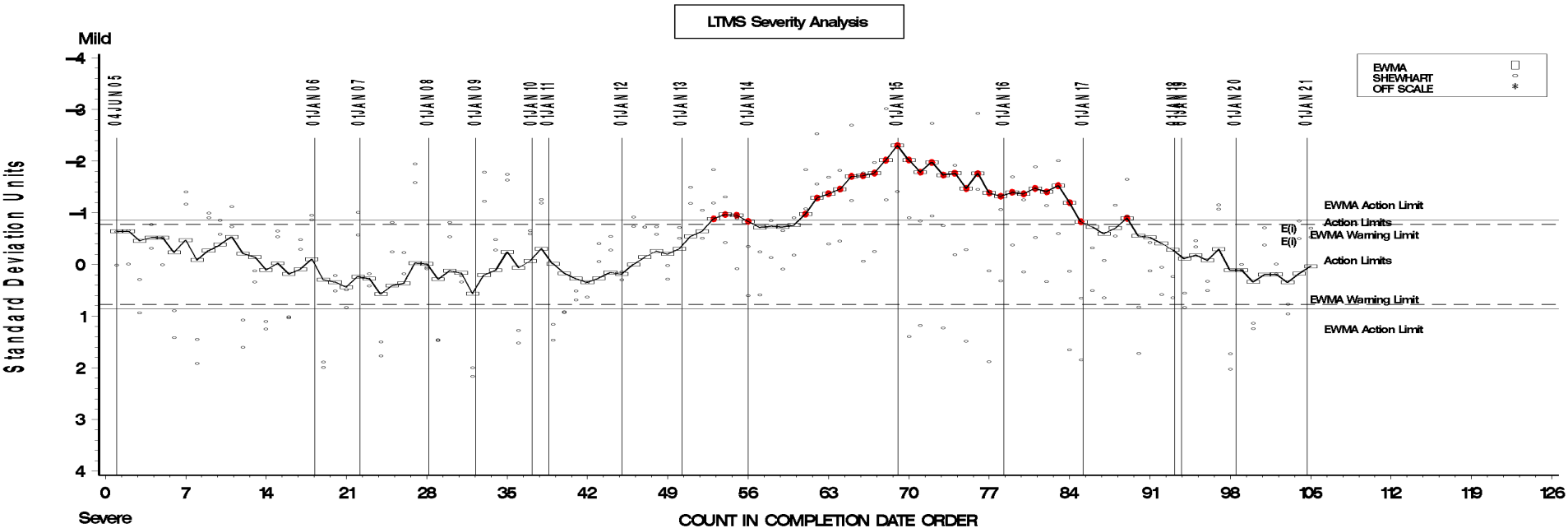
Status	Cause	#
Invalid	No invalid tests	0
Aborted	High oil consumption	1
Total		1

*Invalid and aborted tests

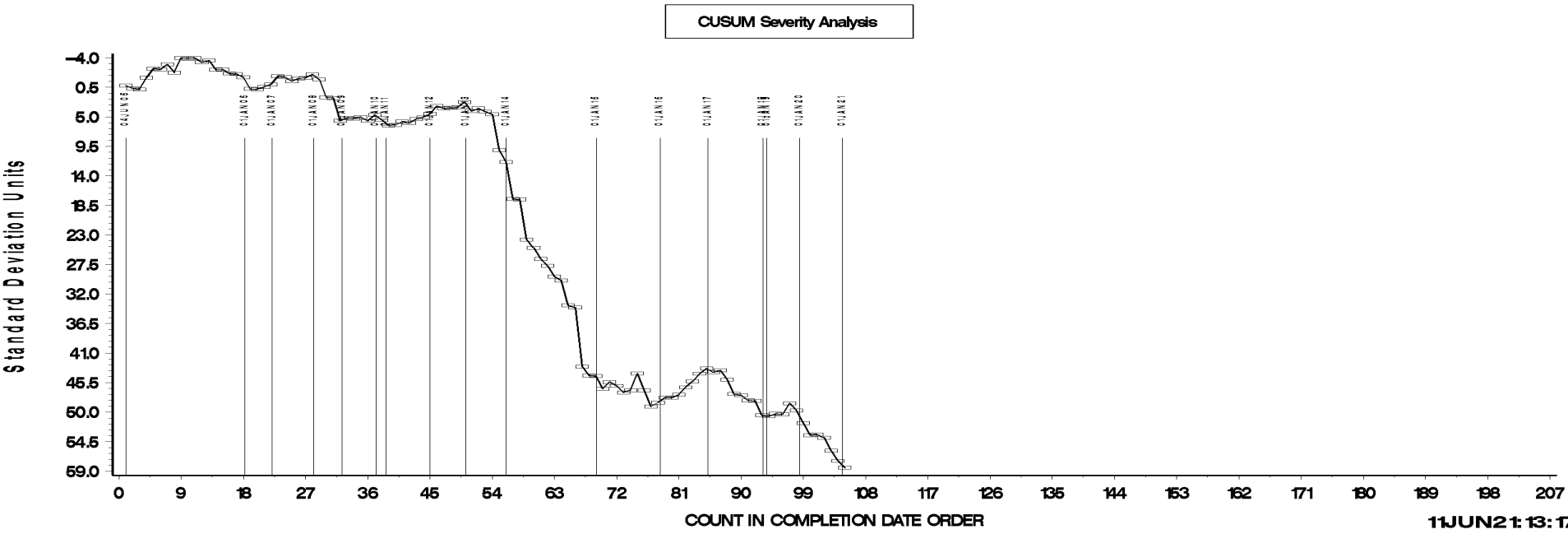
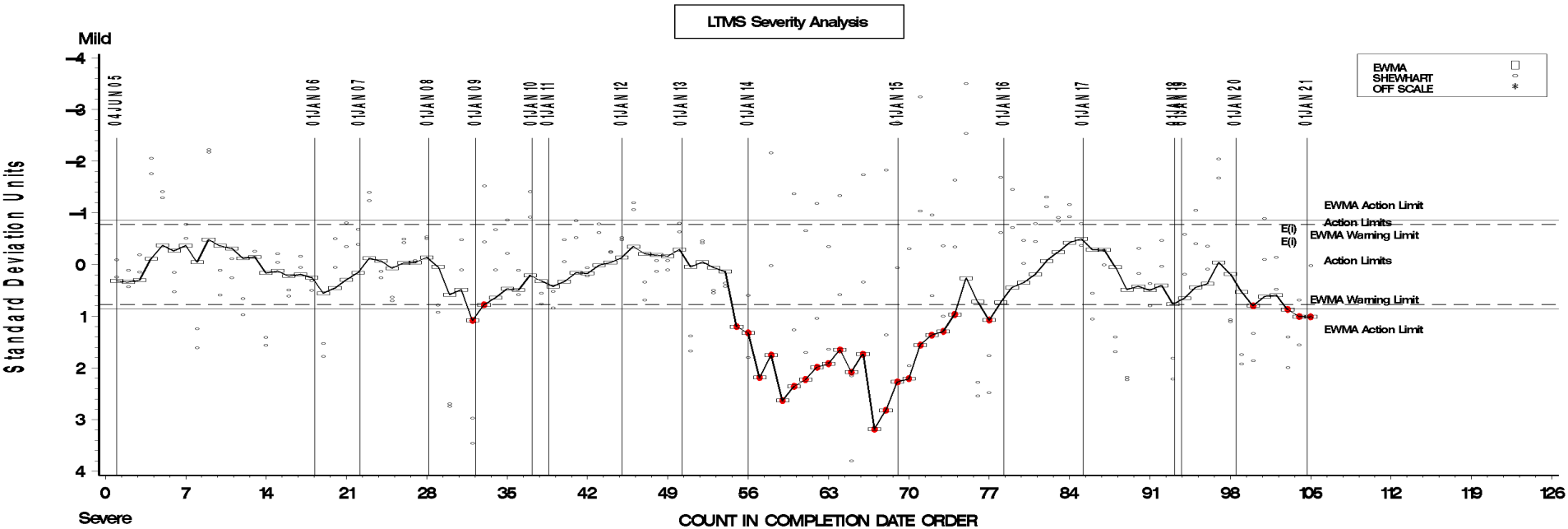
ISB Test Severity

- ▶ ATWL in control.
- ▶ ACSW in Zi level 2 alarm in severe direction.

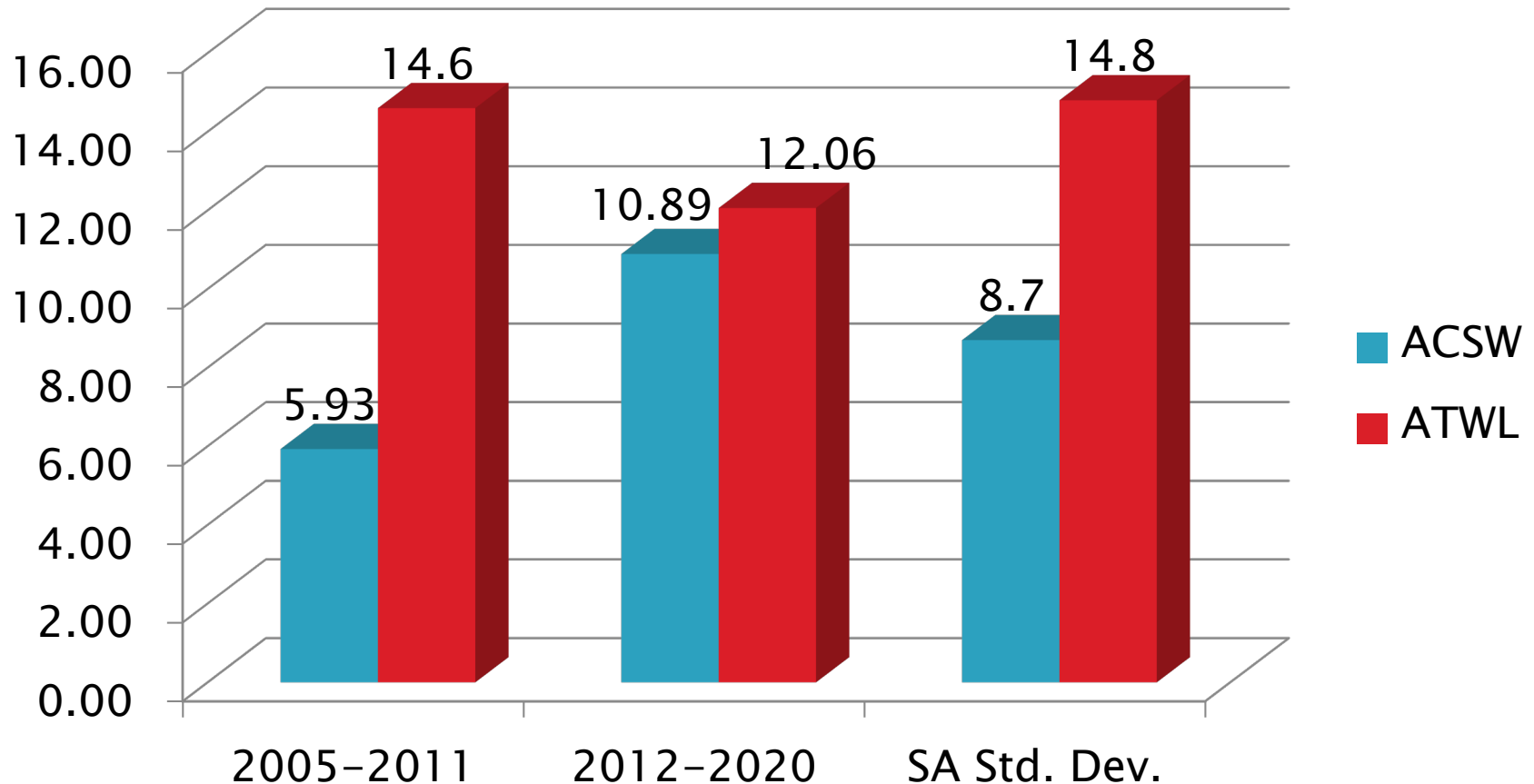
AVERAGE TAPPET WEIGHT LOSS



AVERAGE CAMSHAFT WEAR



ISB Precision Estimates



[Return to Table of Contents](#)

Cummins ISM

»» June 2021

Test Monitoring Center

<http://astmtmc.cmu.edu>



A Program of ASTM International

ISM Test Activity

Test Status	Validity Code	#
Acceptable Calibration	AC	2
Failed Calibration	OC	0
Operationally Invalid	LC	0
Aborted	XC	0
Total		2

ISM Failed Tests

Failed Parameter	Number of Tests
No failed tests	0
Total	0

ISM Lost Tests*

Status	Cause	#
Invalid	No invalid tests	0
Aborted	No aborted tests	0
Total		0

*Invalid and aborted tests

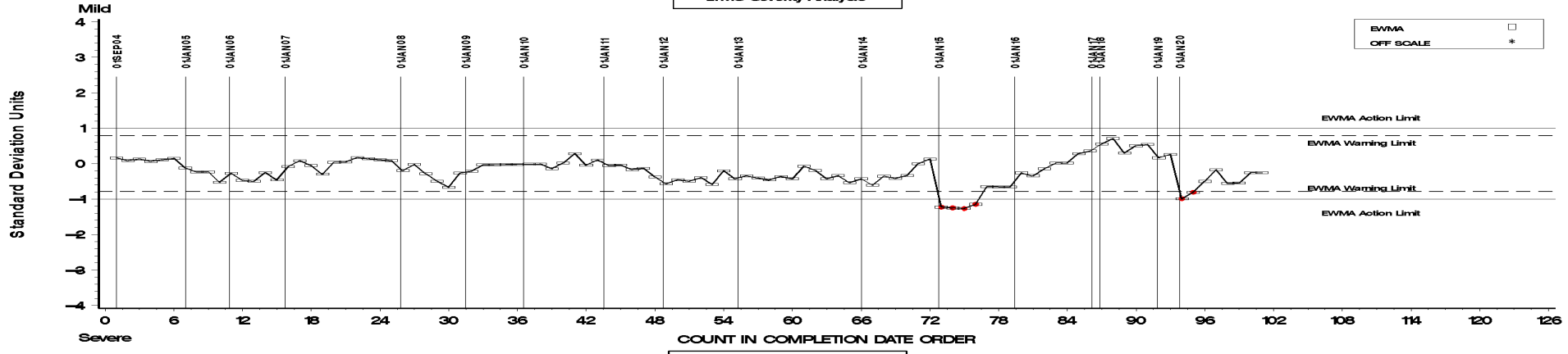
ISM Test Severity

- ▶ CWL and FPD are in control.
- ▶ ASR and IAS are in a precision warning alarm.
- ▶ IAS is in a severity action alarm in the severe direction.

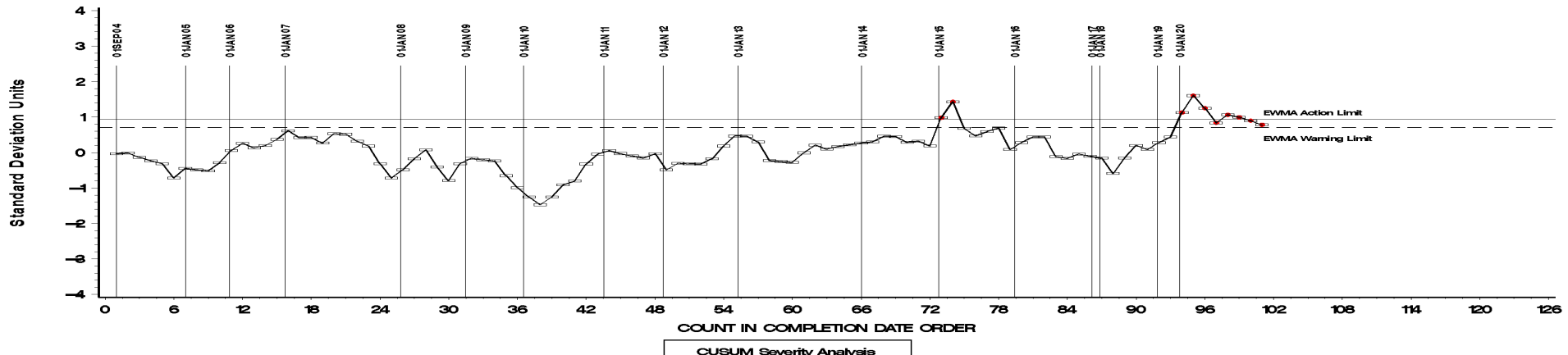
ISM INDUSTRY OPERATIONALLY VALID DATA

AVERAGE SLUDGE RATING

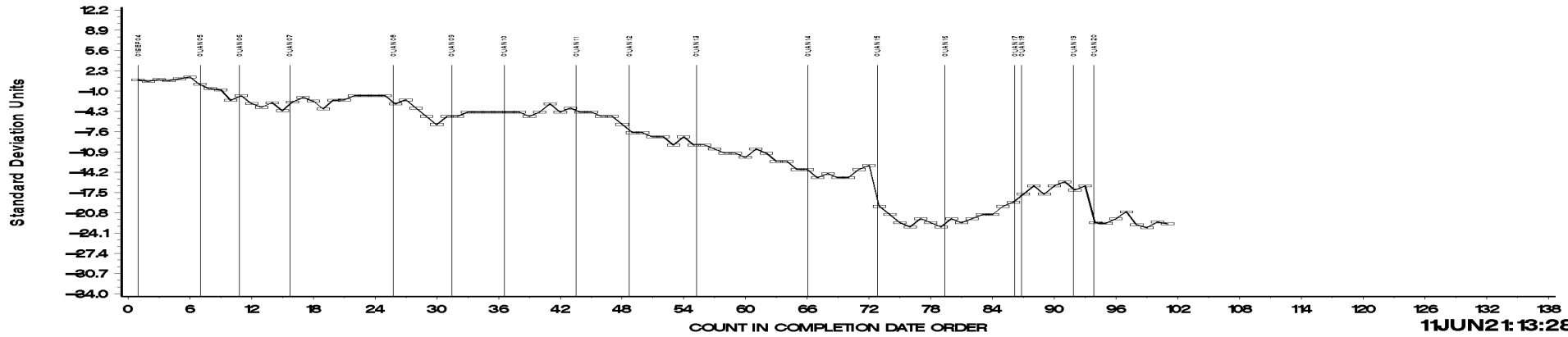
LTMS Severity Analysis



LTMS Precision Analysis



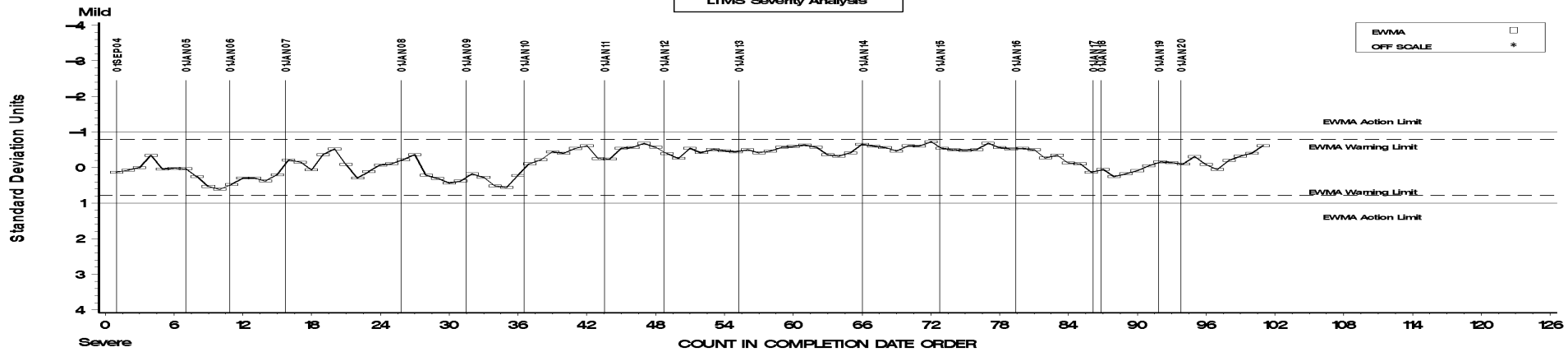
CUSUM Severity Analysis



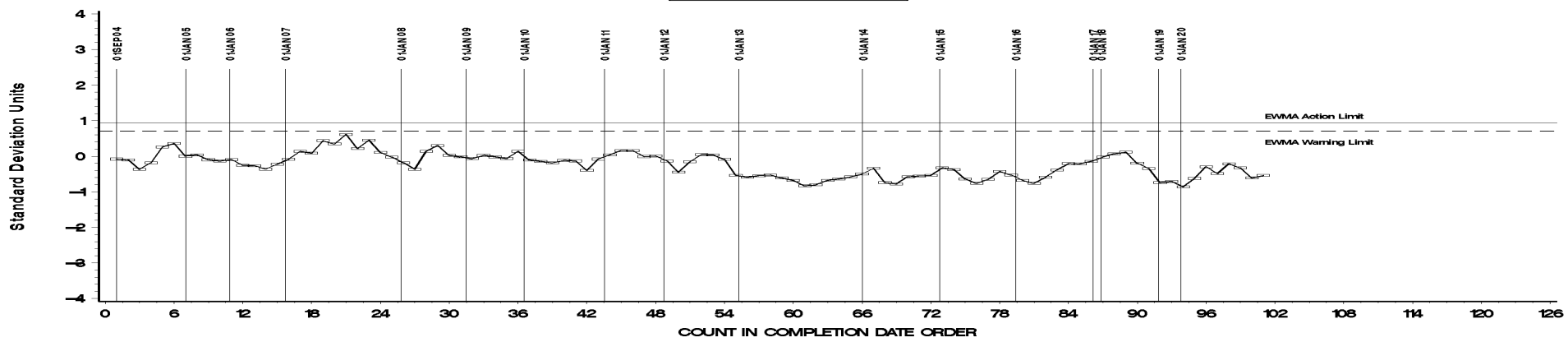
ISM INDUSTRY OPERATIONALLY VALID DATA

CROSSHEAD WEIGHT LOSS ADJUSTED TO 3.9 % SOOT

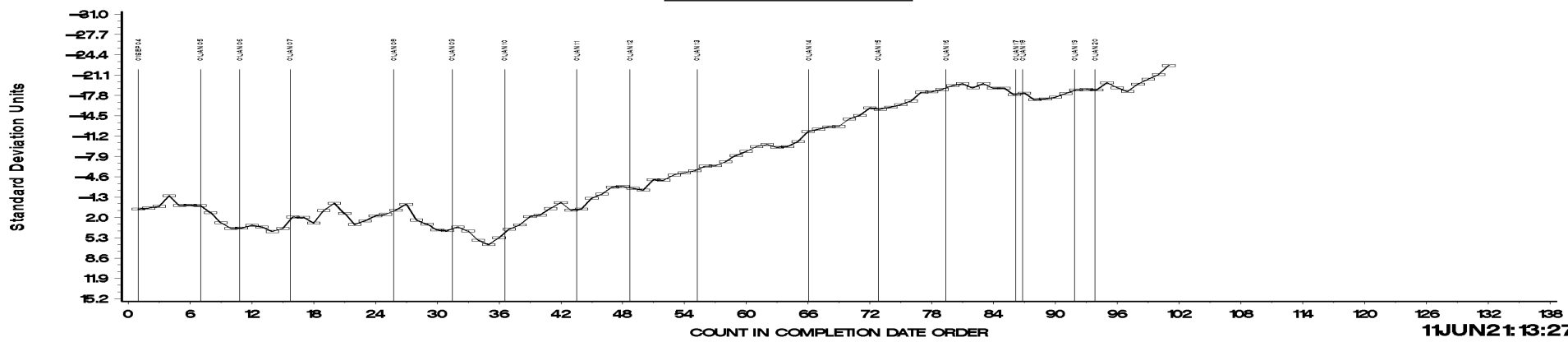
LTMS Severity Analysis



LTMS Precision Analysis



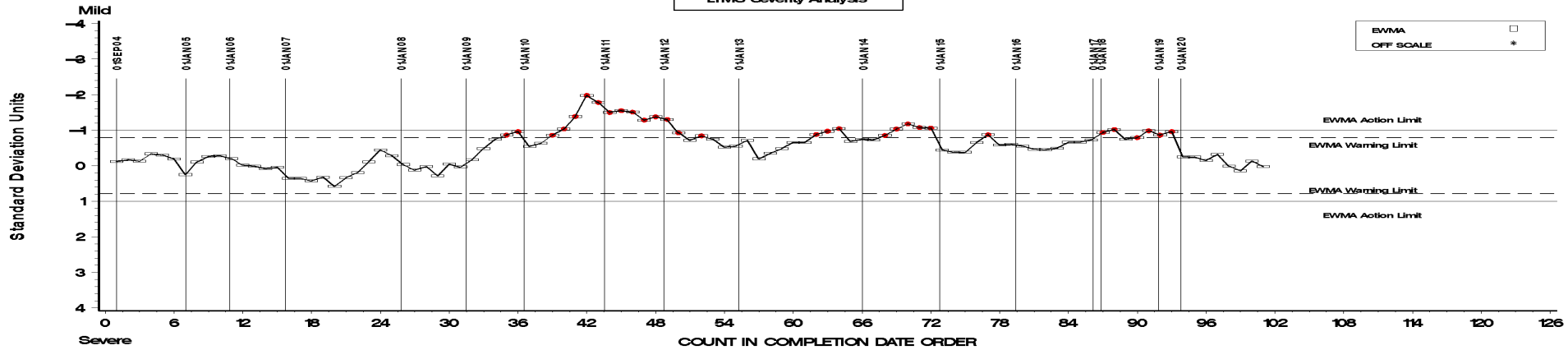
CUSUM Severity Analysis



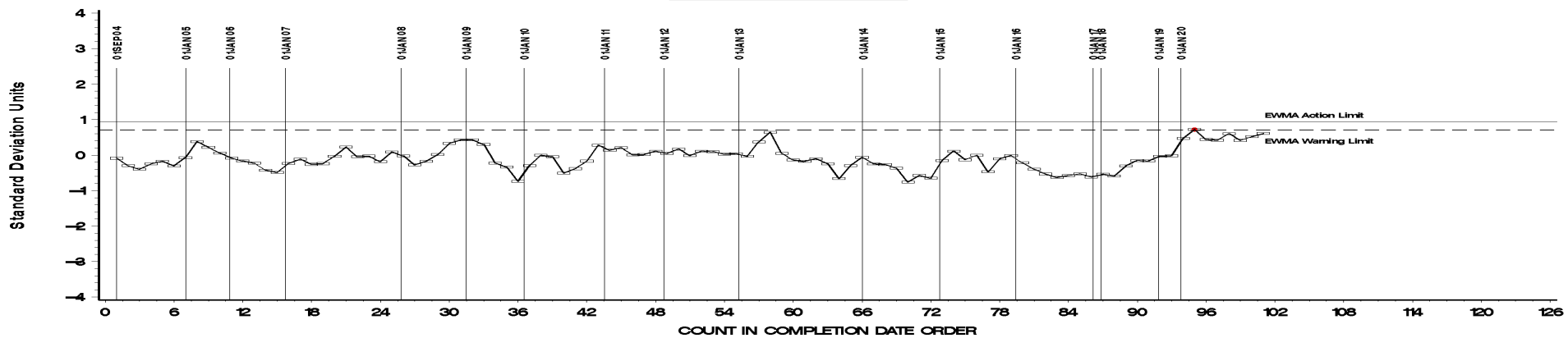
ISM INDUSTRY OPERATIONALLY VALID DATA

FILTER PLUGGING DELTA P

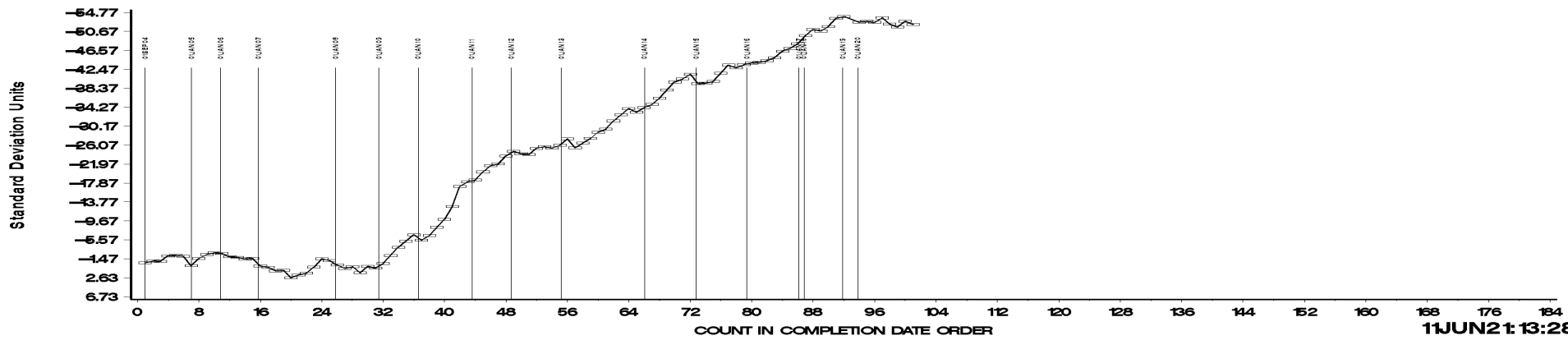
LTMS Severity Analysis



LTMS Precision Analysis



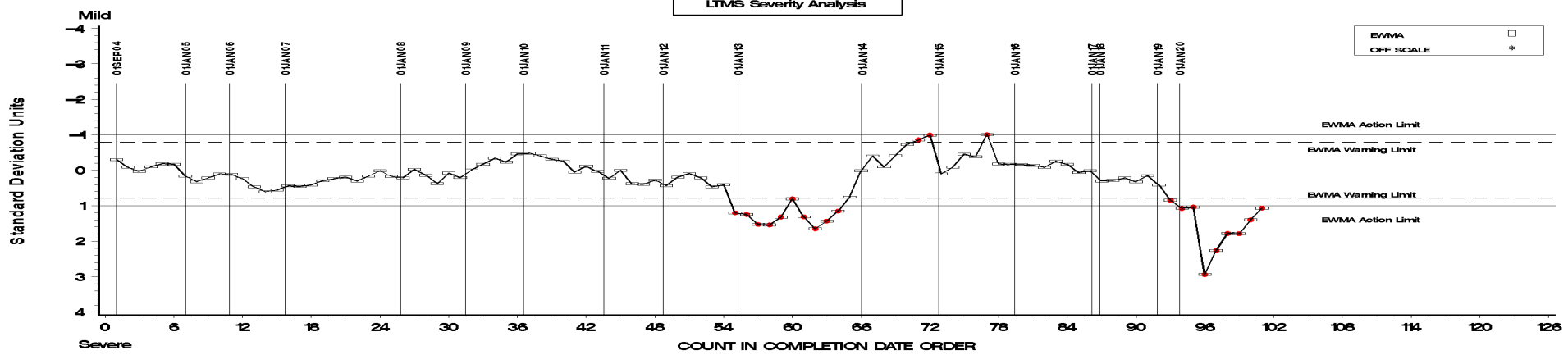
CUSUM Severity Analysis



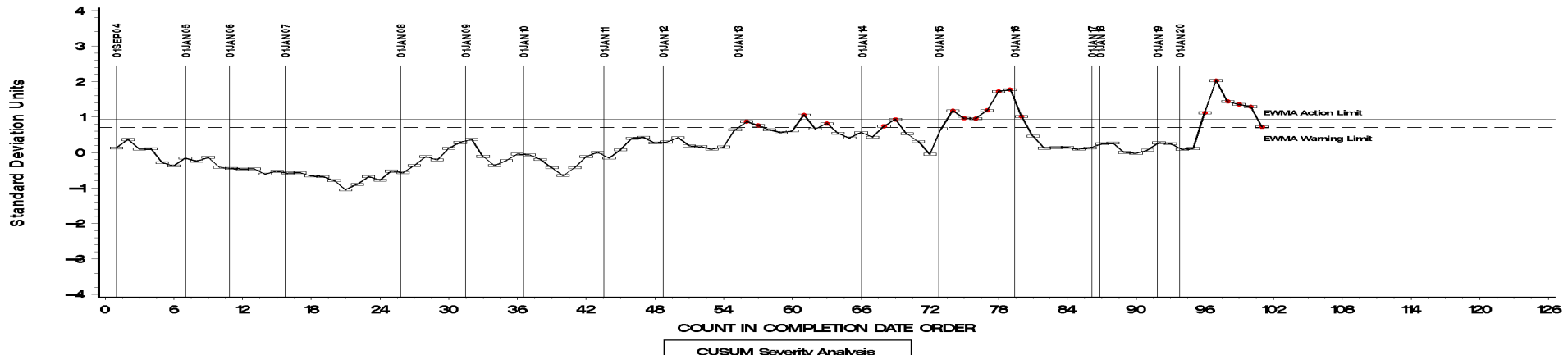
ISM INDUSTRY OPERATIONALLY VALID DATA

INJECTOR SCREW WEIGHT LOSS ADJUSTED TO 3.9% SOOT

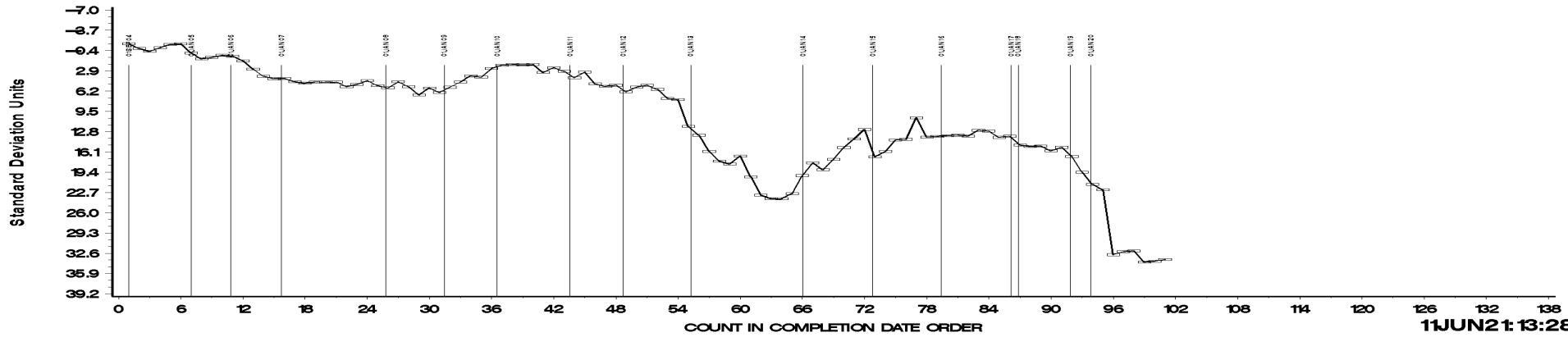
LTMS Severity Analysis



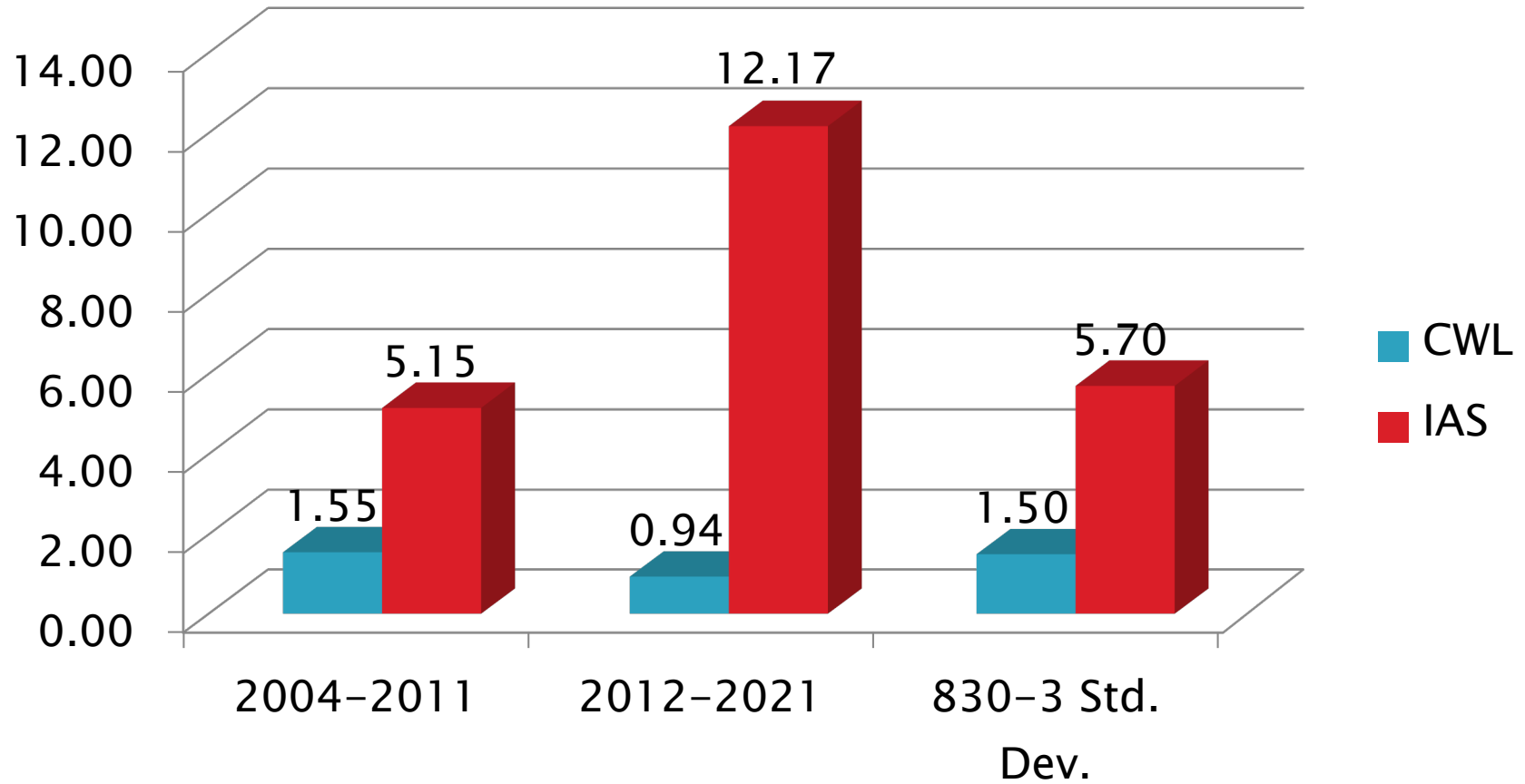
LTMS Precision Analysis



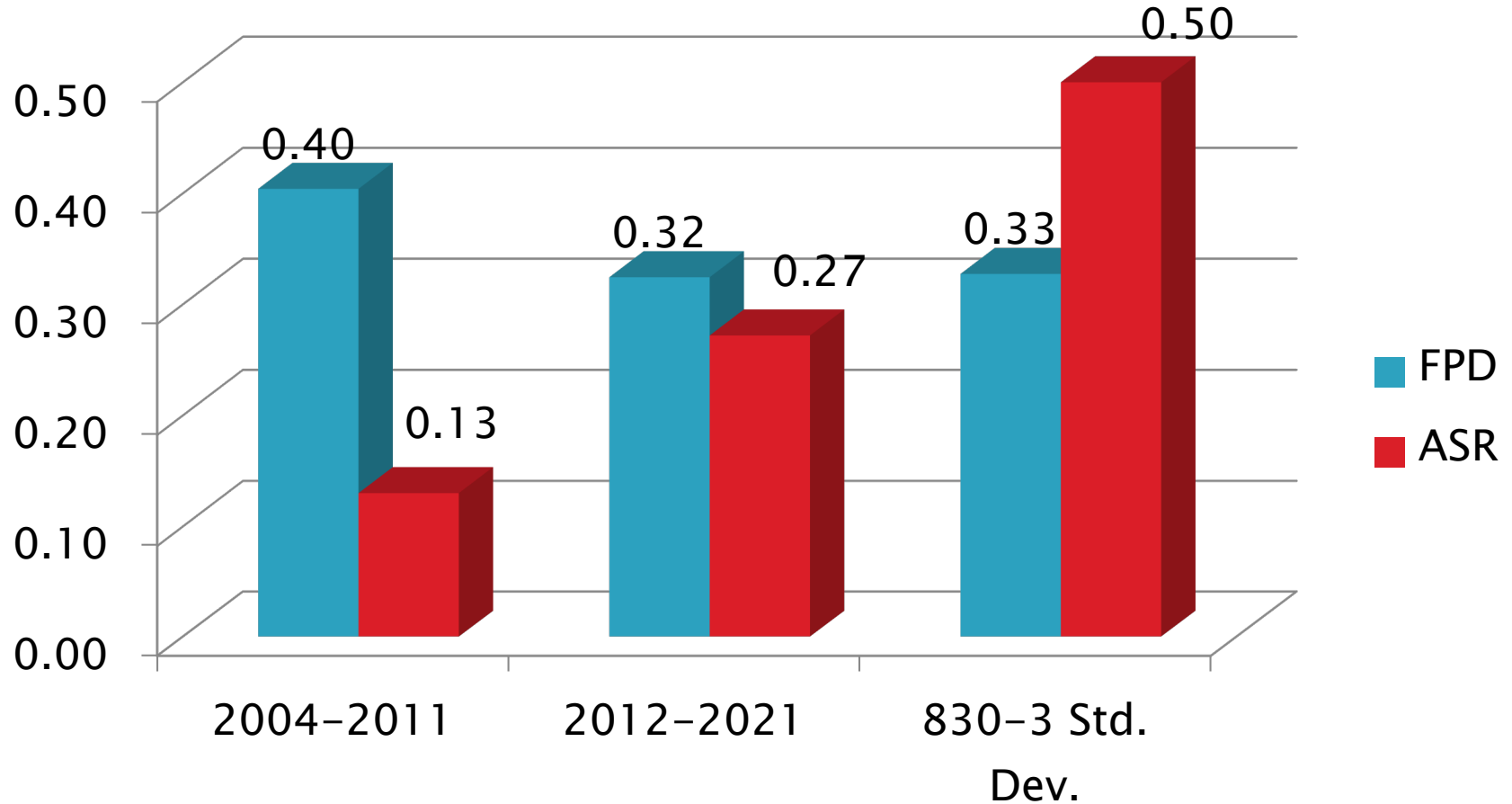
CUSUM Severity Analysis



ISM Precision Estimates



ISM Precision Estimates



[Return to Table of Contents](#)

Test Monitoring Center

<http://astmtmc.cmu.edu>



A Program of ASTM International

EOAT

»» June 2021

EOAT Test Activity

Test Status	Validity Code	#
Acceptable Calibration Test	AC	1
Failed Calibration Test	OC	0
Operationally Invalid	LC	0
Aborted	XC	0
Total		1

EOAT Failed Tests

Failed Parameter	Number of Tests
No failed tests	0
Total	0

EOAT Lost Tests*

Status	Cause	#
Invalid	No invalid tests	0
Aborted	No aborted tests	0
Total		0

*Invalid and aborted tests

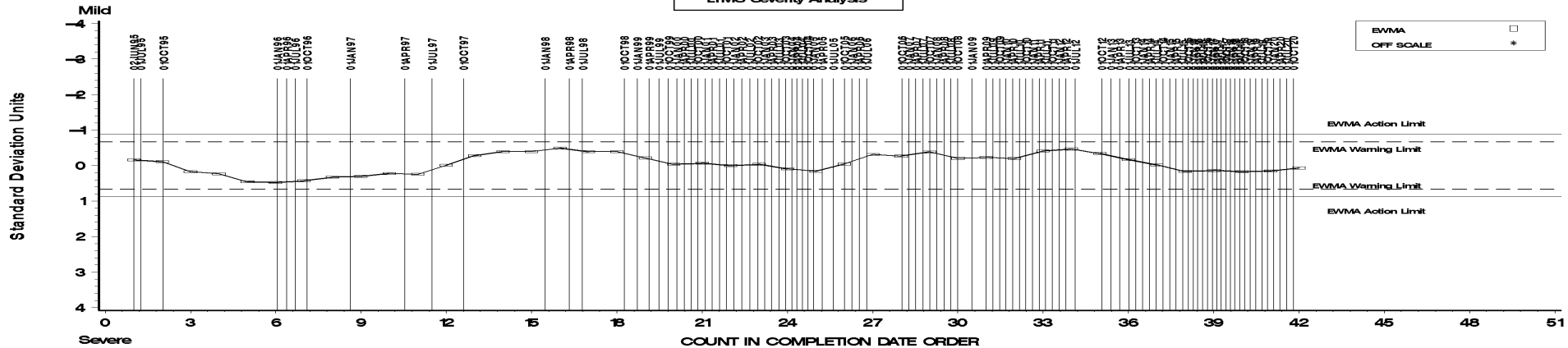
EOAT Test Severity

- ▶ AEOA is in control

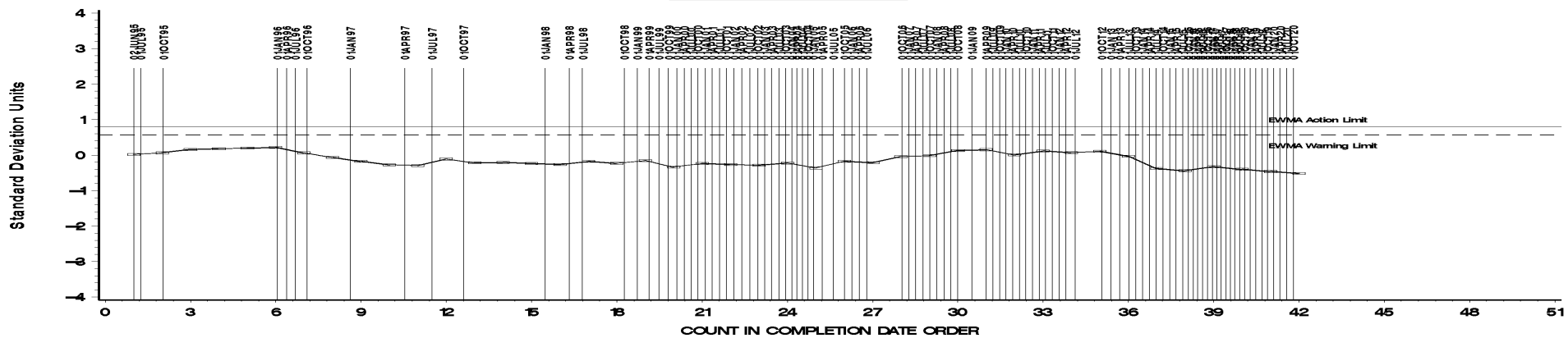
EOAT INDUSTRY OPERATIONALLY VALID DATA

ENGINE OIL AERATION

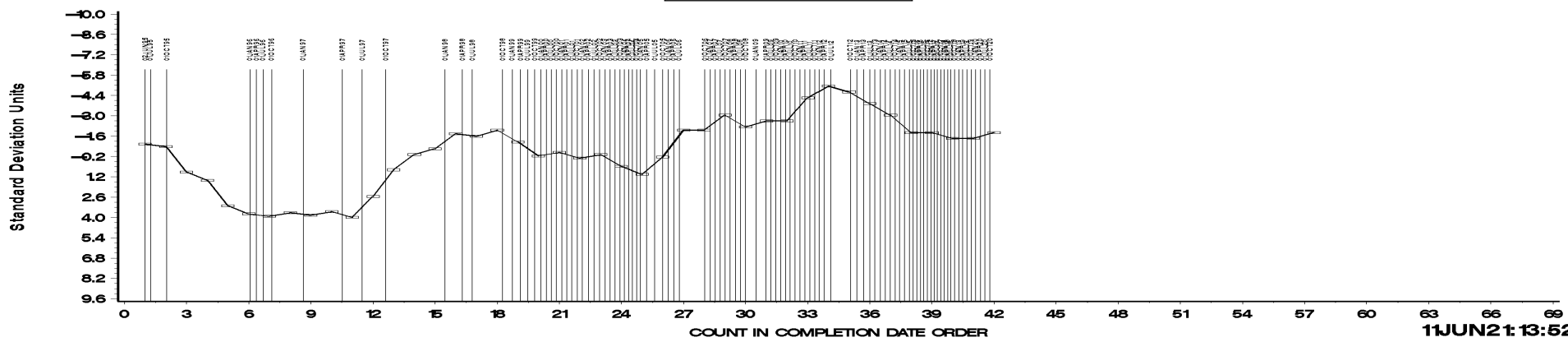
LTMS Severity Analysis



LTMS Precision Analysis

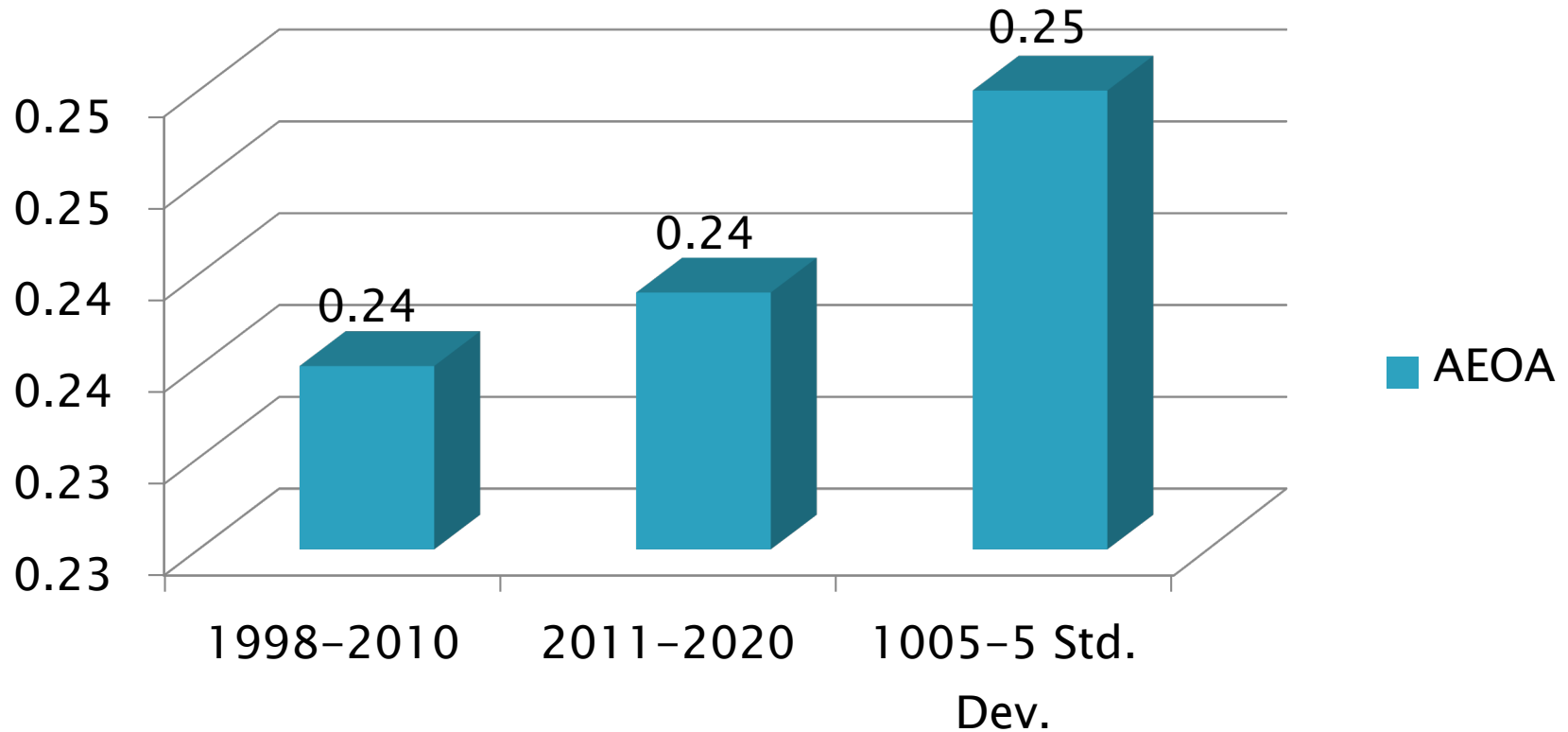


CUSUM Severity Analysis



EOAT Precision Estimates

AEOA



[Return to Table of Contents](#)

Test Monitoring Center

<http://astmtmc.cmu.edu>



A Program of ASTM International

RFWT

»» June 2021

Test Monitoring Center

<http://astmtmc.cmu.edu>



A Program of ASTM International

RFWT Test Activity

Test Status	Validity Code	#
Acceptable Calibration Test	AC	2
Failed Calibration Test	OC	0
Operationally Invalid	LC	0
Aborted	XC	0
Total		2

RFWT Failed Tests

Failed Parameter	Number of Tests
No failed tests	0
Total	0

RFWT Lost Tests*

Status	Cause	#
Invalid	No invalid tests	0
Aborted	No aborted tests	0
Total		0

*Invalid and aborted tests

RFWT Test Severity

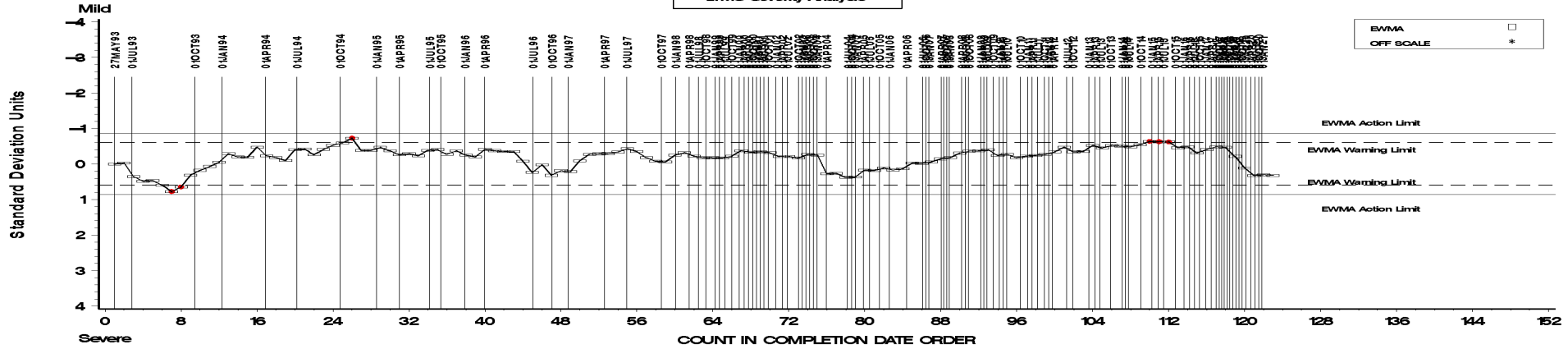
- ▶ AFW is in control

RFWT INDUSTRY OPERATIONALLY VALID DATA

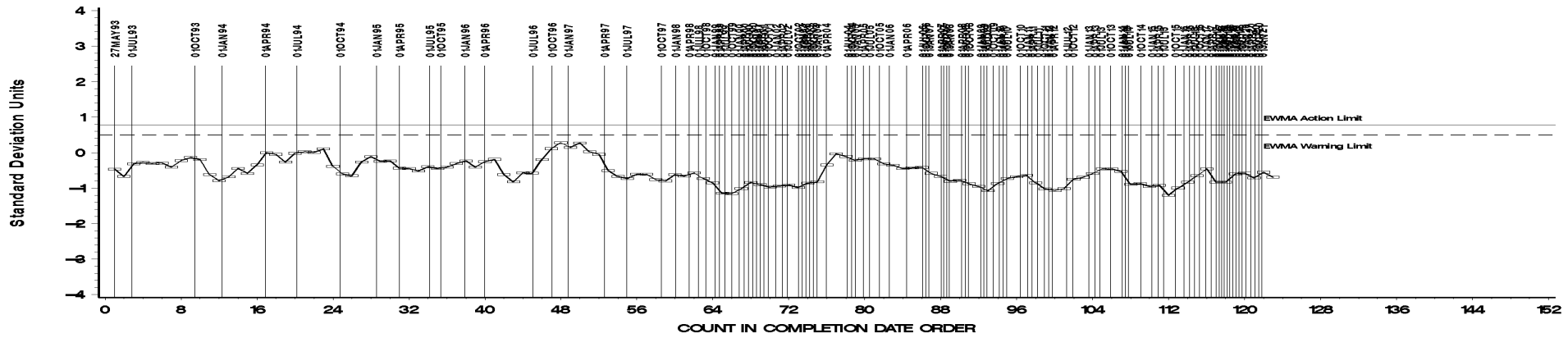


Average Follower Wear

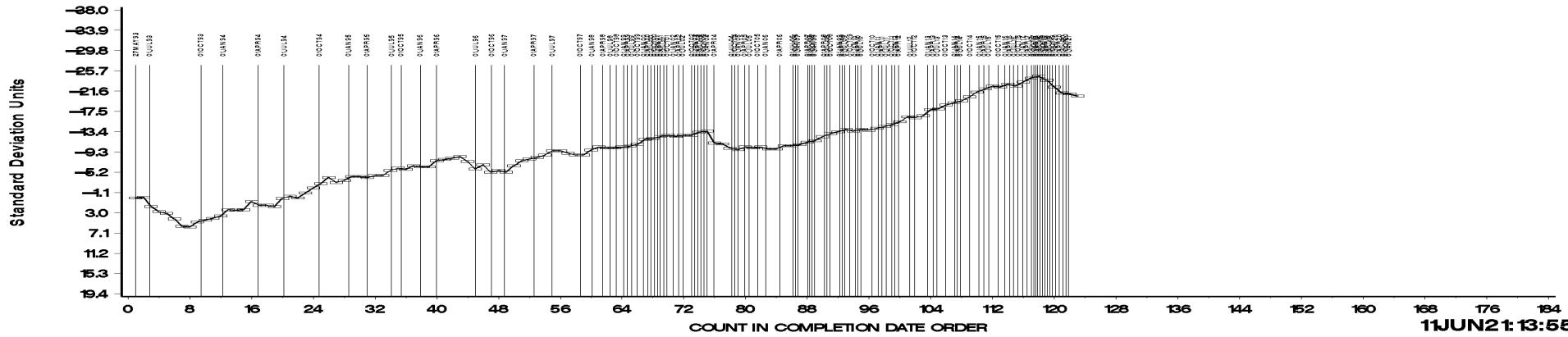
LTMS Severity Analysis



LTMS Precision Analysis

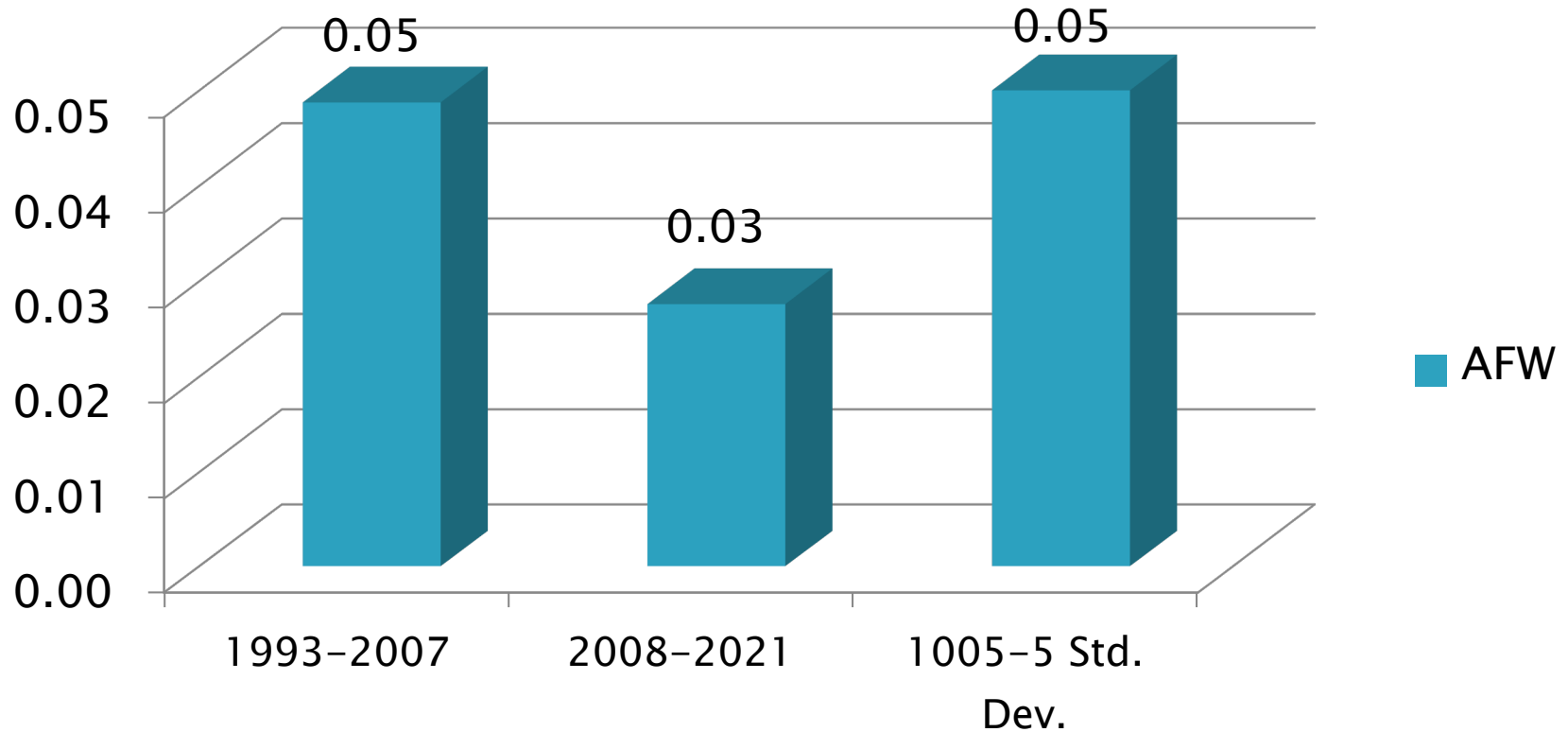


CUSUM Severity Analysis



RFWT Precision Estimates

AFW



[Return to Table of Contents](#)

Test Monitoring Center

<http://astmtmc.cmu.edu>



A Program of ASTM International

Mack T-8/T-8E

»» June 2021

Test Monitoring Center

<http://astmtmc.cmu.edu>



A Program of ASTM International

T-8/T-8E Test Activity

Test Status	Validity Code	#
Acceptable Calibration Test	AC	1
Failed Calibration Test	OC	0
Operationally Invalid	LC	0
Aborted	XC	1
Total		2

T-8/T8-E Failed Tests

Failed Parameter	Number of Tests
No failed tests	0
Total	0

T-8/T8-E Lost Tests*

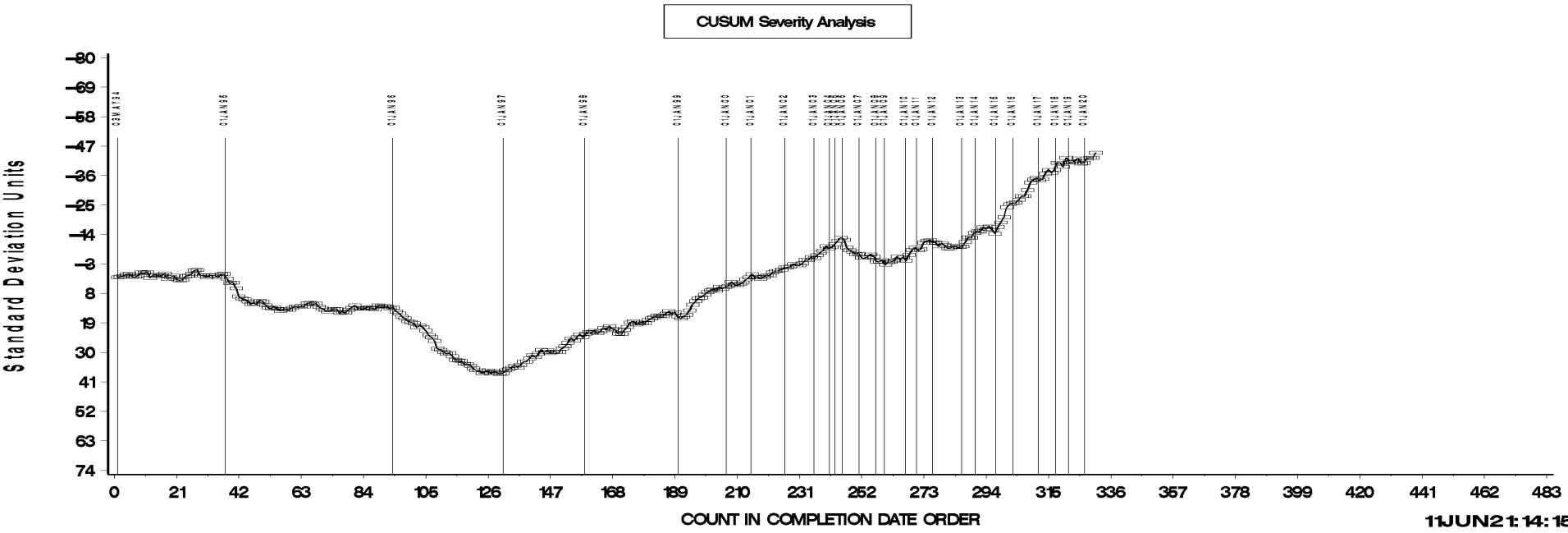
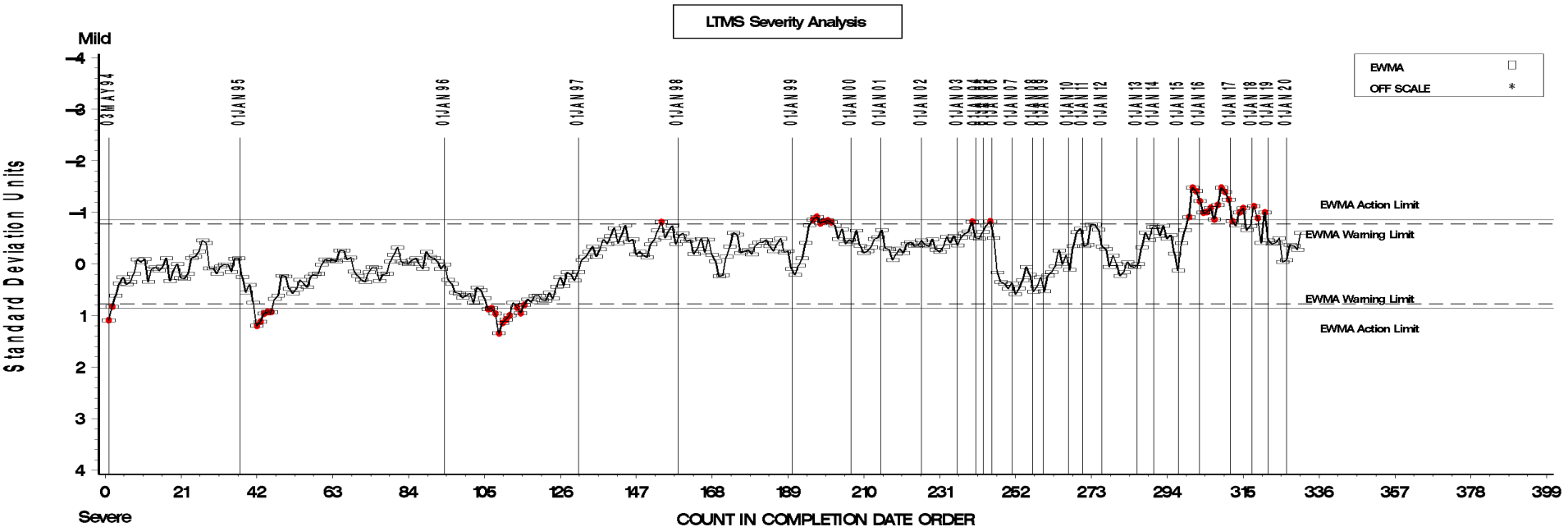
Status	Cause	#
Invalid	No invalid tests	0
Aborted	Missed oil addition	1
Total		1

*Invalid and aborted tests

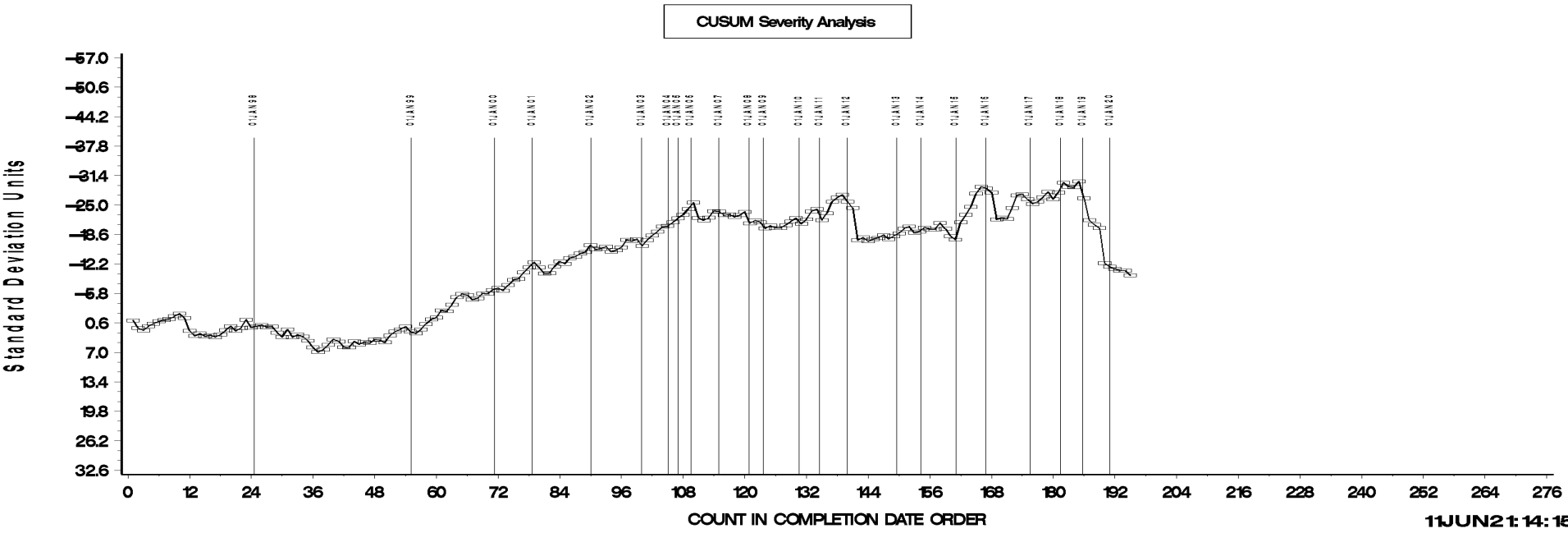
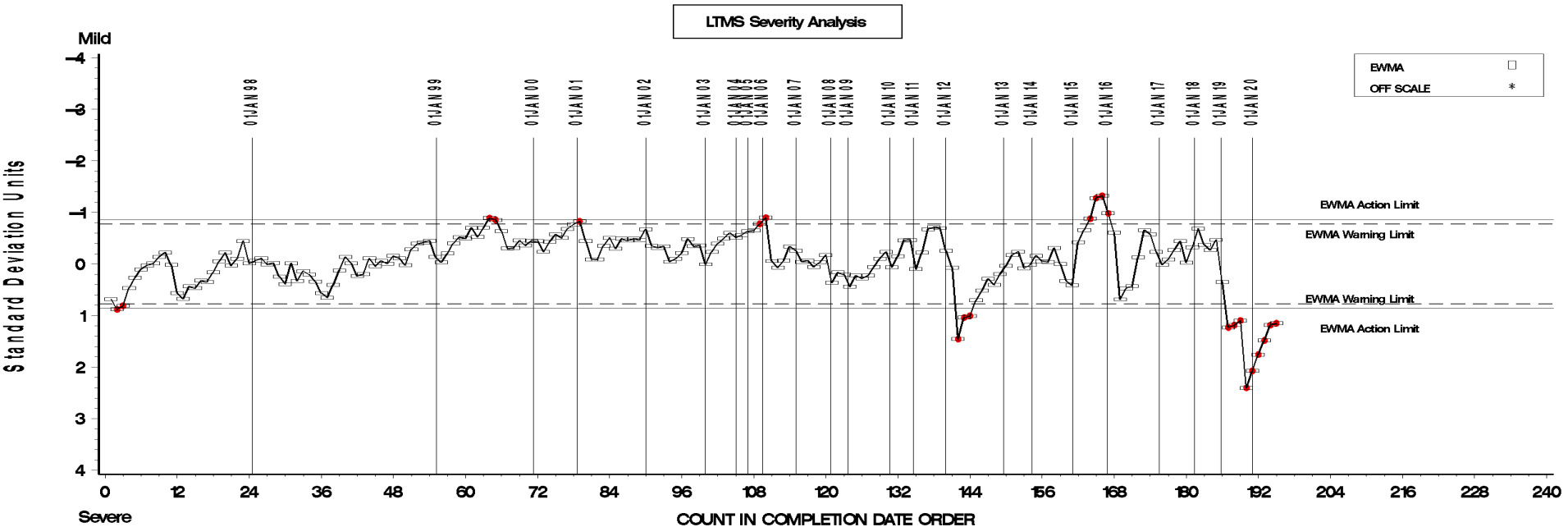
T-8/T-8E Test Severity

- ▶ VI38 is in control.
- ▶ RV48 is in Level 2 Zi alarm in severe direction.
- ▶ RV2 is in Level 2 Zi alarm in severe direction.

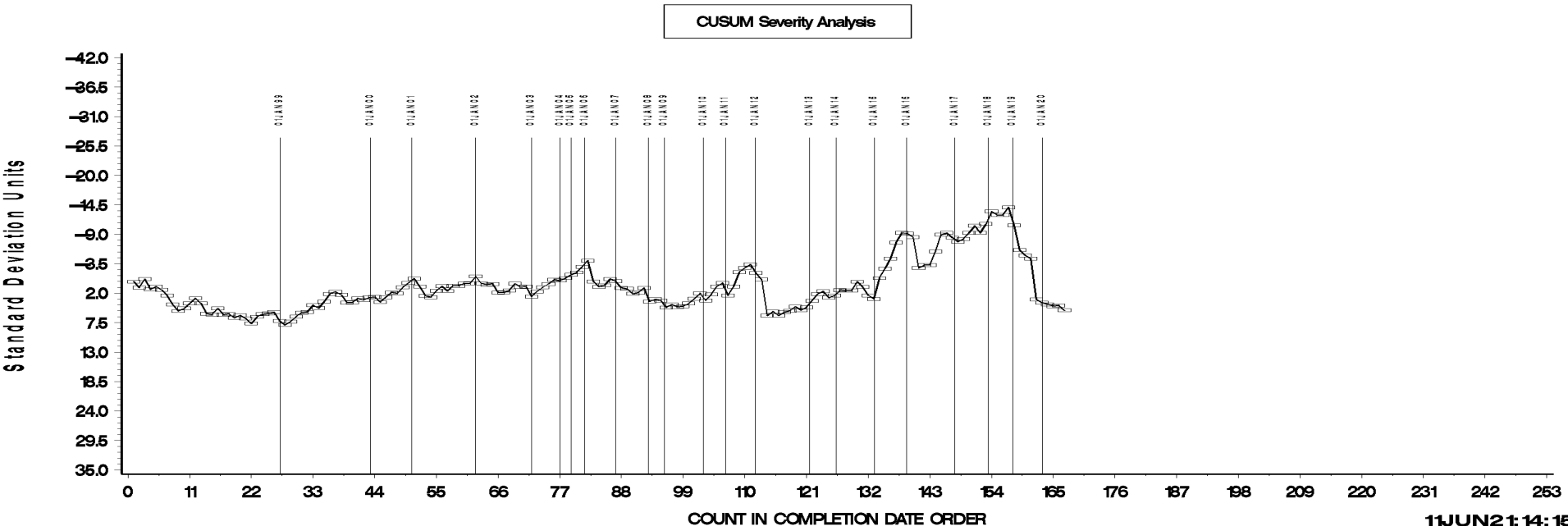
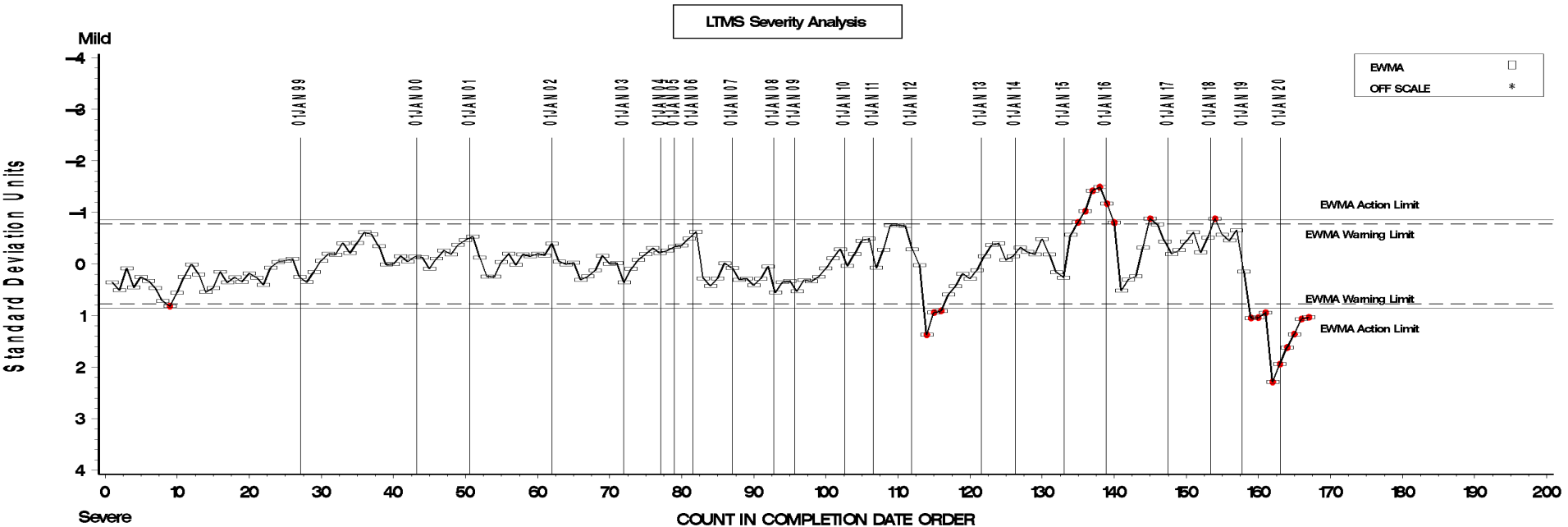
VISCOSITY INCR @ 3.8% SOOT



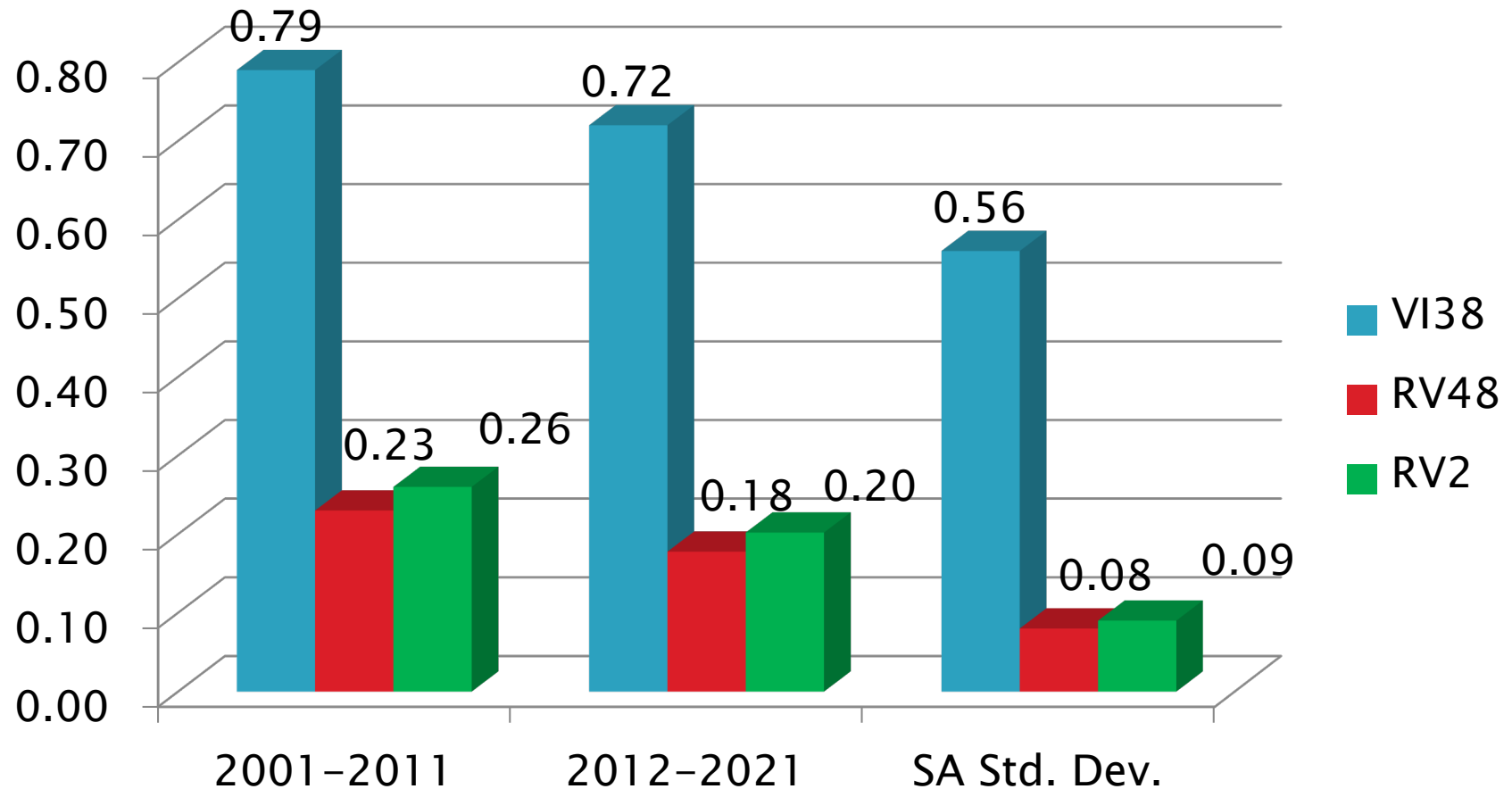
RELATIVE VISCOSITY @ 4.8% (50% LOSS)



RELATIVE VISCOSITY @ 4.8% (100% LOSS)



T-8/E Precision Estimates



[Return to Table of Contents](#)

Test Monitoring Center

<http://astmtmc.cmu.edu>



A Program of ASTM International

Mack T-11

»» June 2021

Test Monitoring Center

<http://astmtmc.cmu.edu>



A Program of ASTM International

T-11 Test Activity

Test Status	Validity Code	#
Acceptable Calibration Test	AC	4
Failed Calibration Test	OC	1
Operationally Invalid	LC	0
Aborted	XC	2
Total		6

T-11 Failed Tests

Failed Parameter	Number of Tests
SOOT, SOOT4 and SOOT5 Severe	1
Total	1

T-11 Lost Tests*

Status	Cause	#
Invalid	No invalid tests	0
Aborted	Facility power failure	1
Aborted	Missed soot window	1
Total		1

*Invalid and aborted tests

T-11 Test Severity

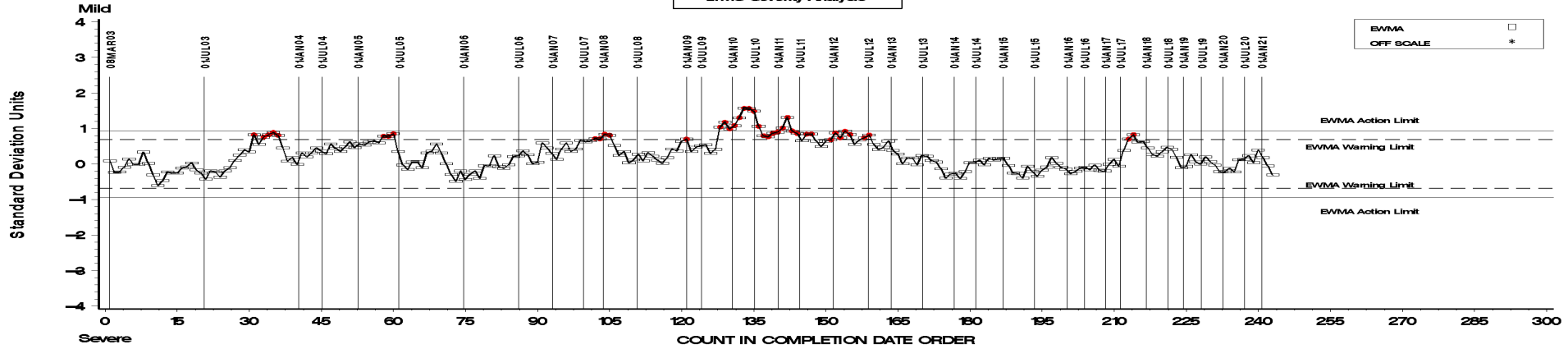
- ▶ SOOT and SOOT5 are in control.
- ▶ SOOT4 is in severity action alarm in the severe direction.
- ▶ MRV is in severity warning alarm in the severe direction.

T-11 INDUSTRY OPERATIONALLY VALID DATA

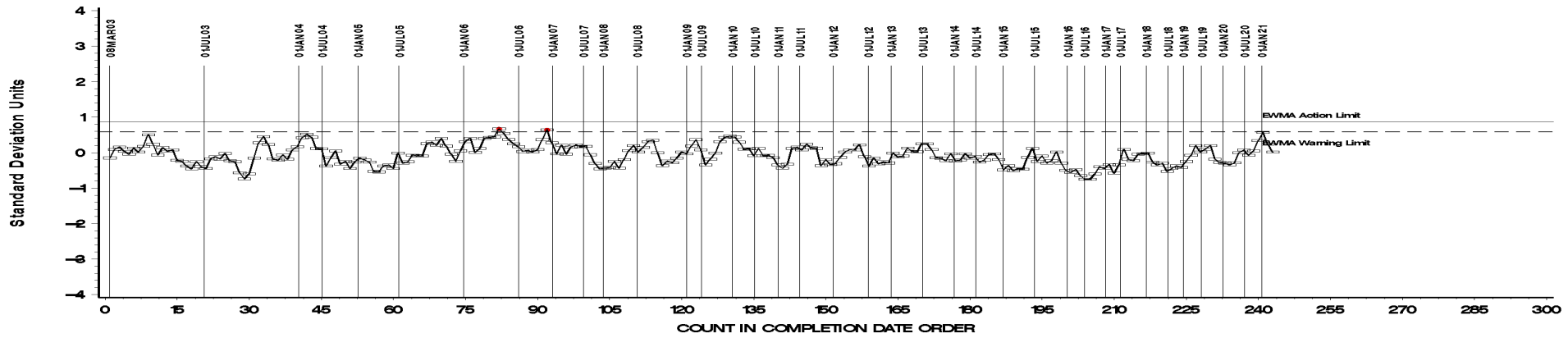


SOOT AT 12 cSt

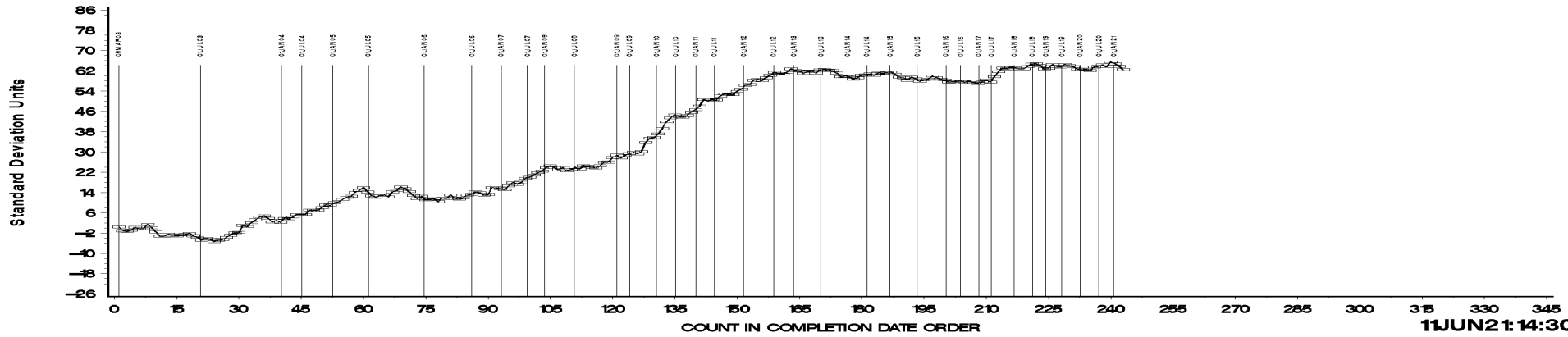
LTMS Severity Analysis



LTMS Precision Analysis



CUSUM Severity Analysis

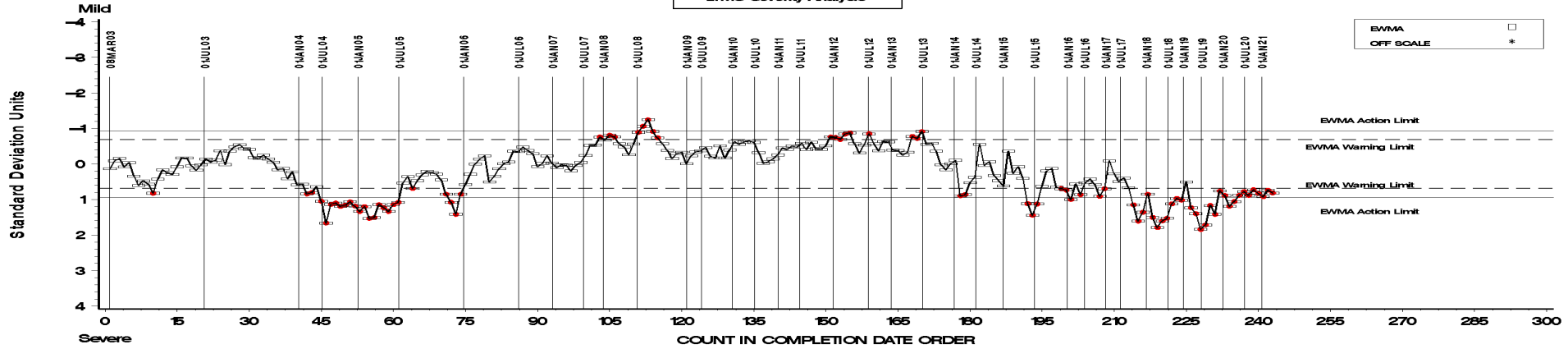


T-11 INDUSTRY OPERATIONAL DAILY VALID DATA

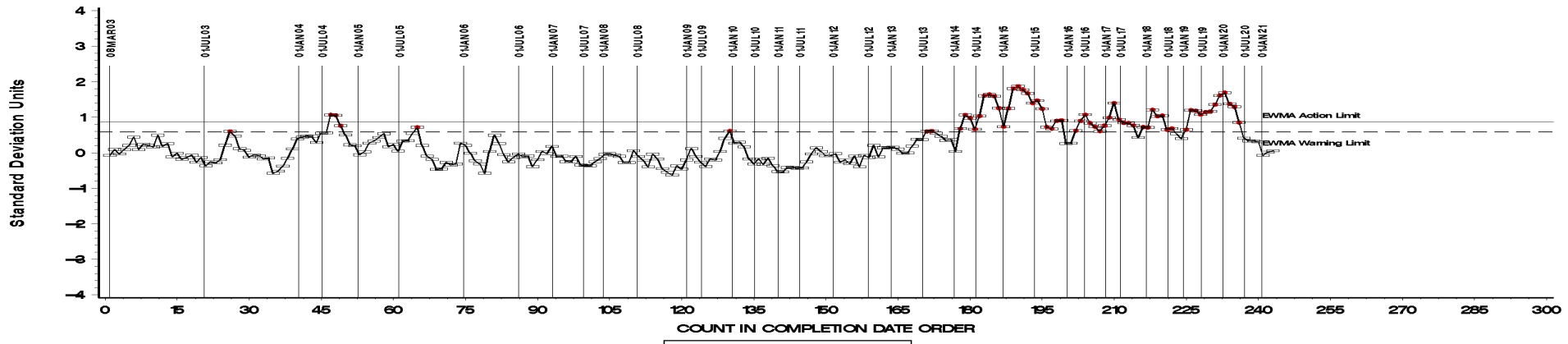


MRV VISCOSITY

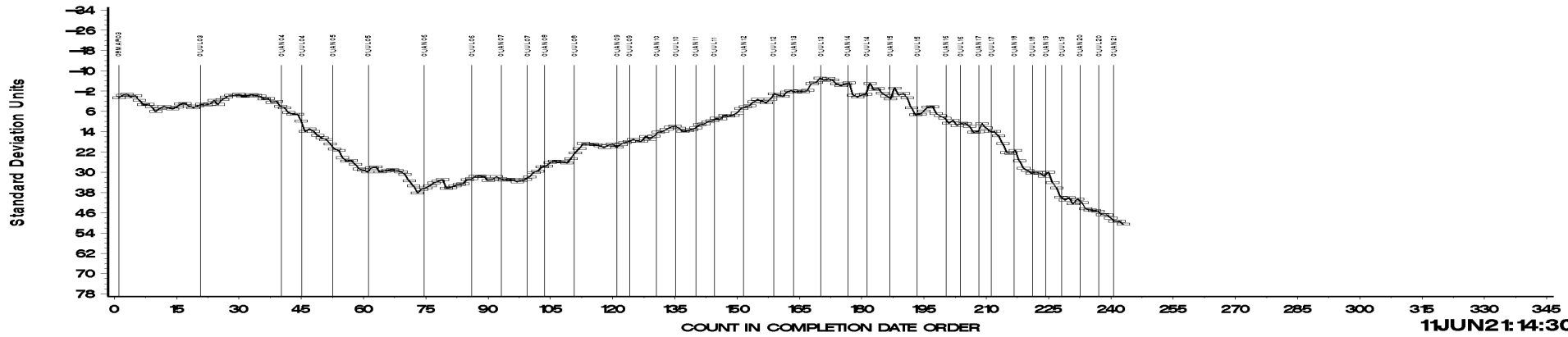
LTMS Severity Analysis



LTMS Precision Analysis

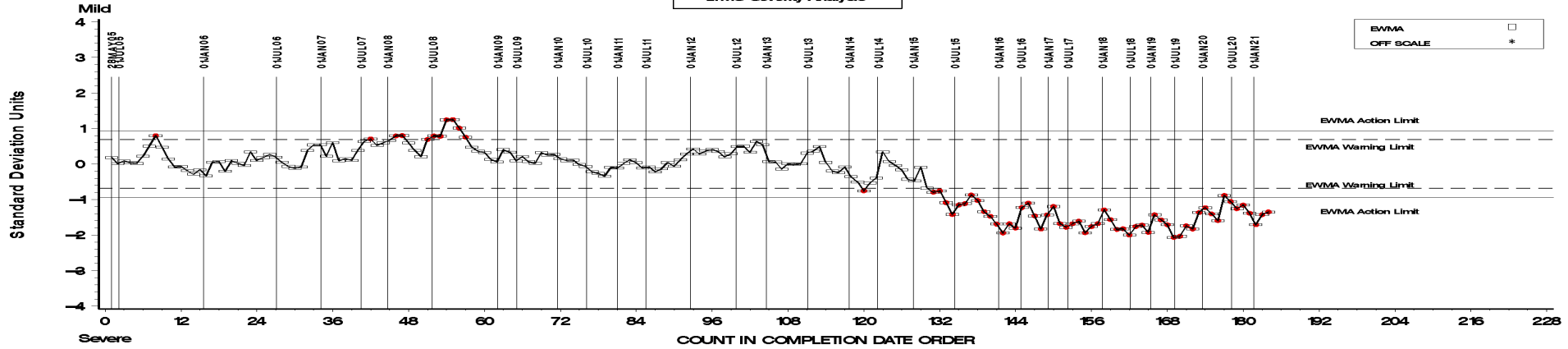


CUSUM Severity Analysis

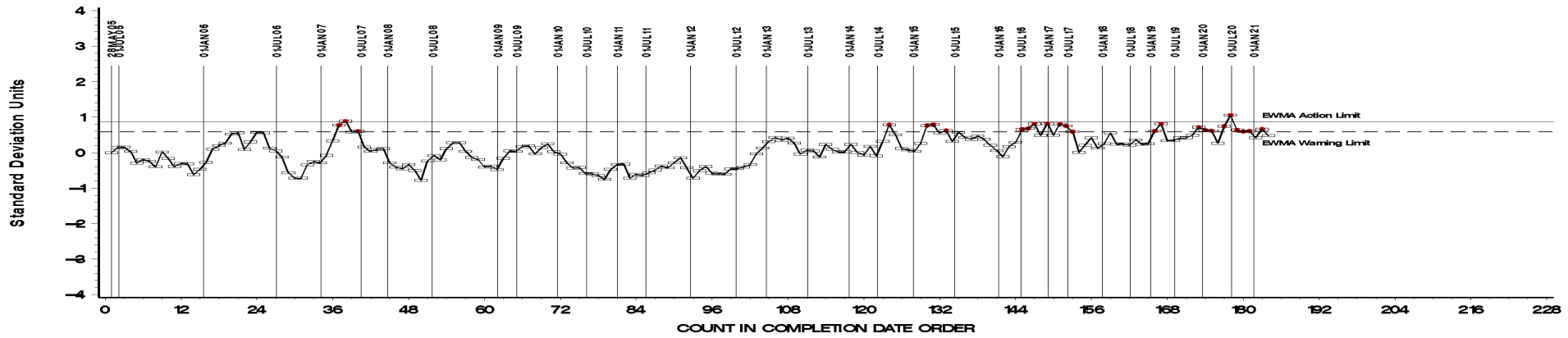


SOOT @ 4 cSt — FINAL RESULT

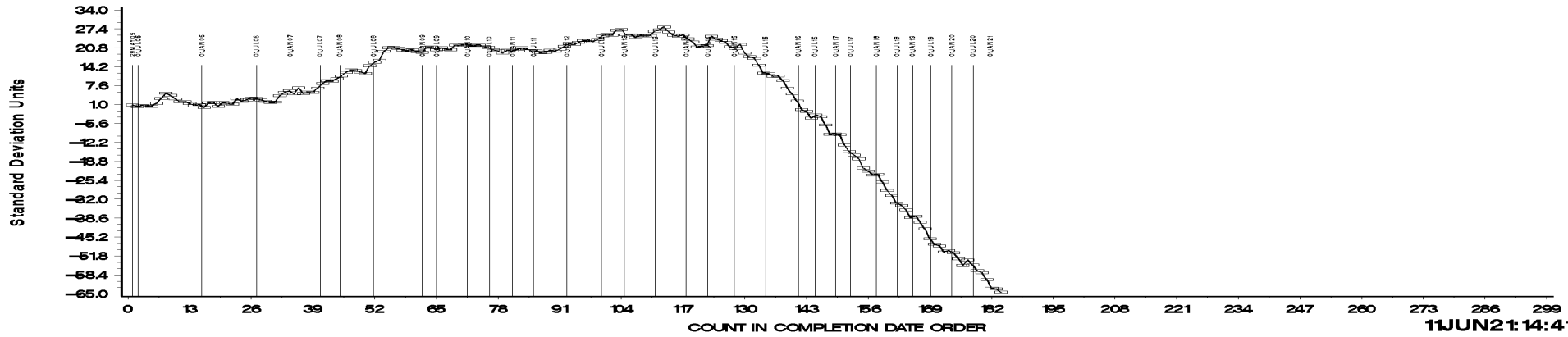
LTMS Severity Analysis



LTMS Precision Analysis



CUSUM Severity Analysis

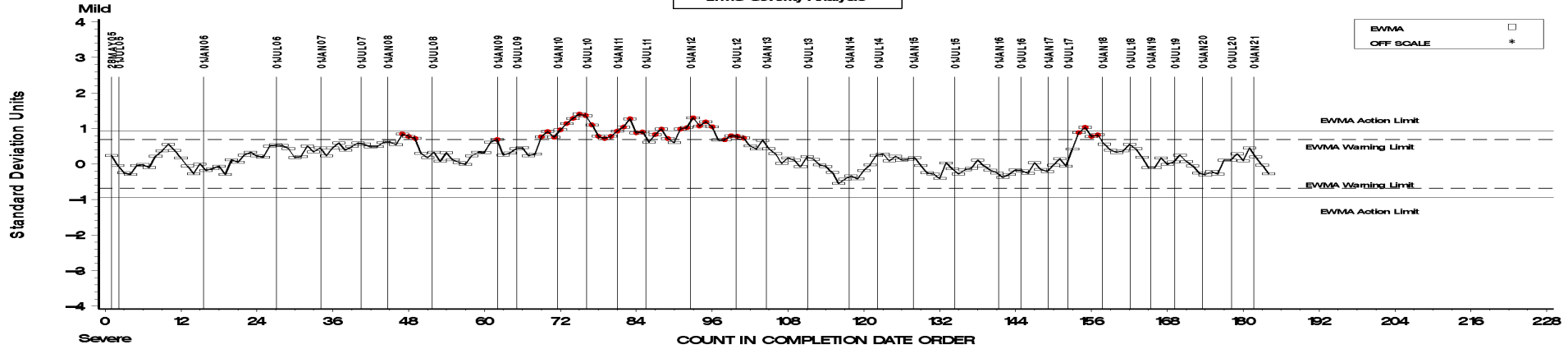


T-11 INDUSTRY OPERATIONALLY VALID DATA

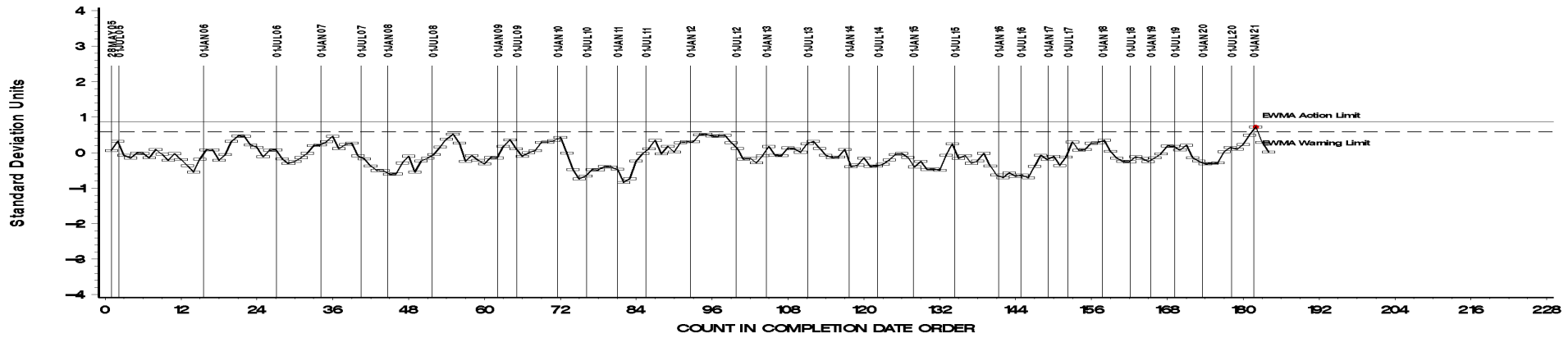


SOOT @ 15 cSt — FINAL RESULT

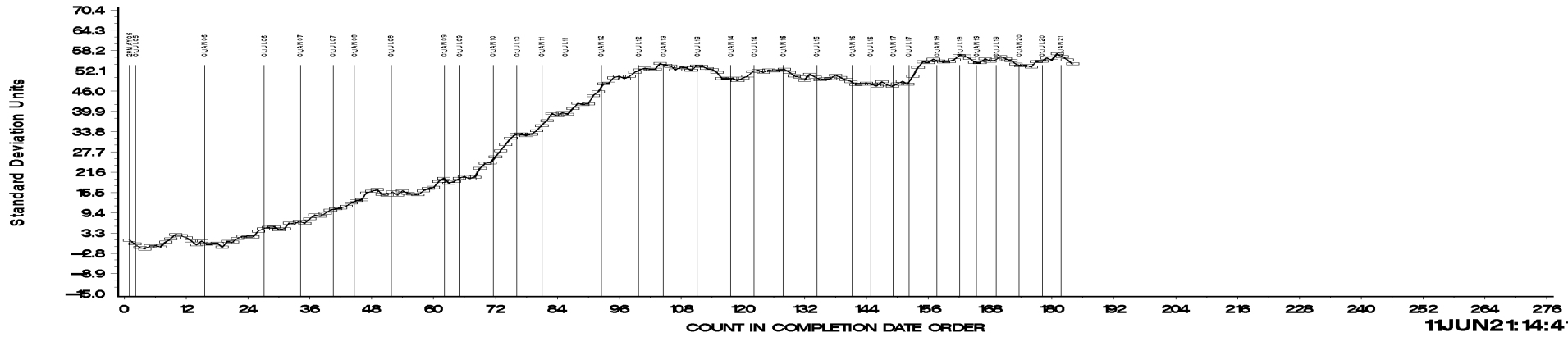
LTMS Severity Analysis



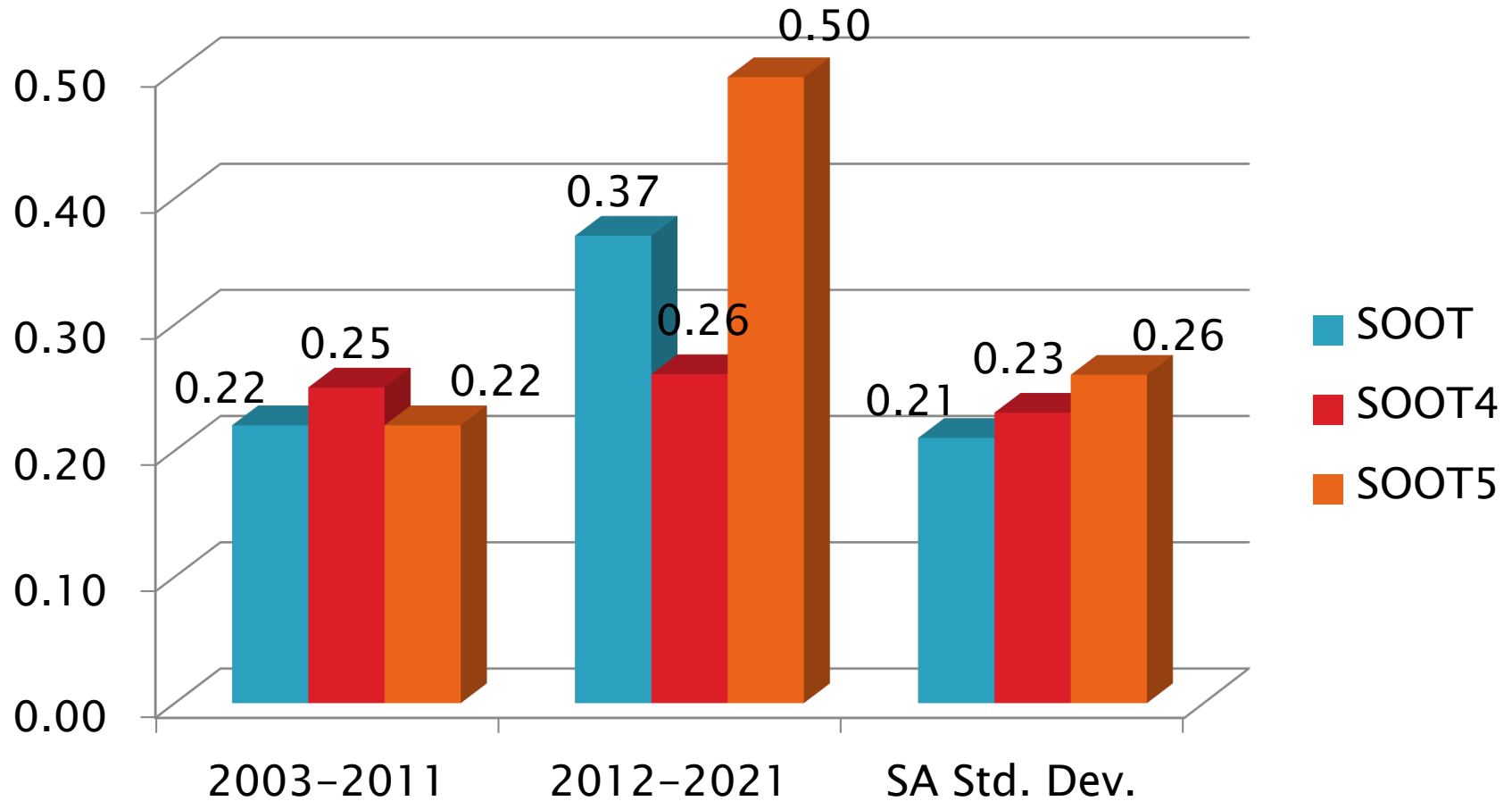
LTMS Precision Analysis



CUSUM Severity Analysis

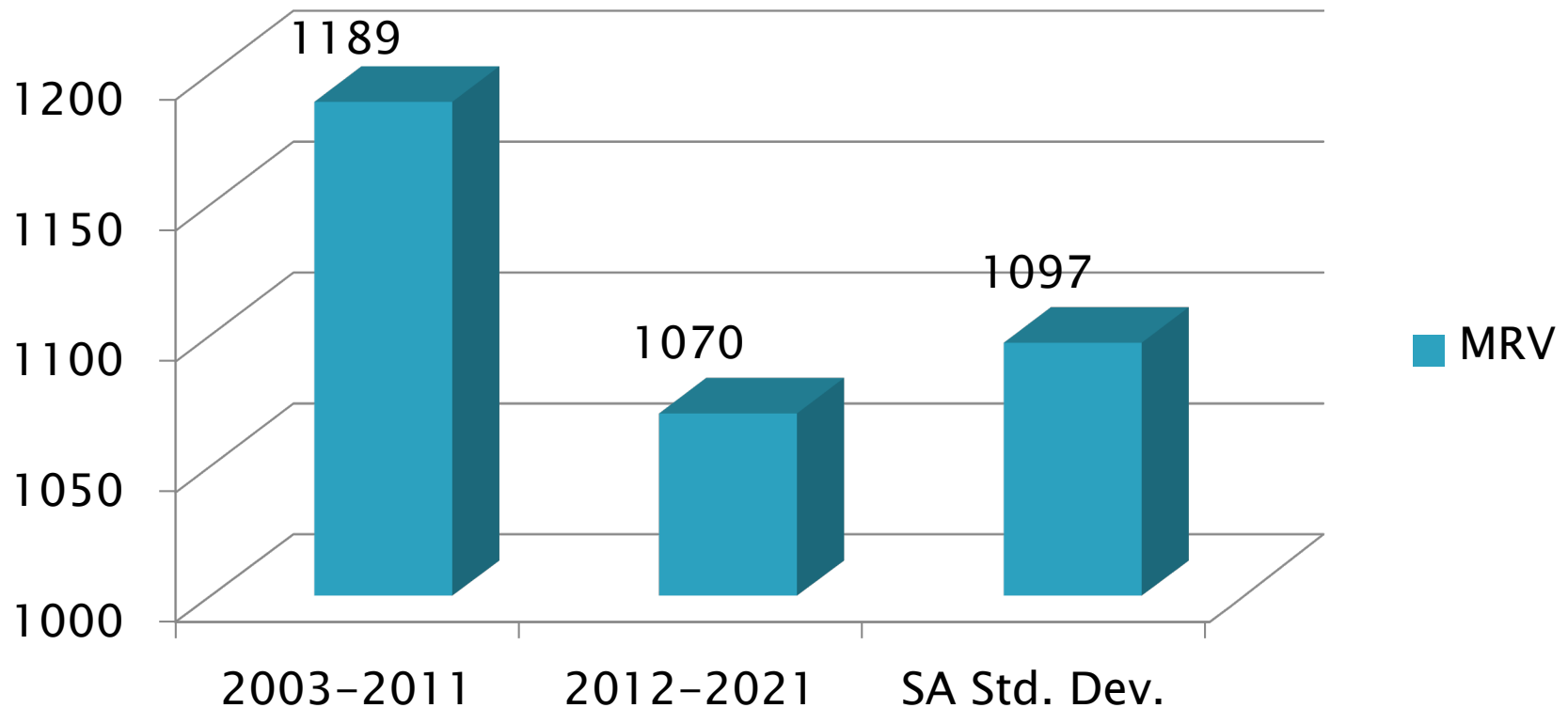


T-11 Precision Estimates



T-11 Precision Estimates

MRV



[Return to Table of Contents](#)

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



A Program of ASTM International

Mack T-12

»» June 2021

Test Monitoring Center

<http://astmtmc.cmu.edu>



A Program of ASTM International

T-12 Test Activity

Test Status	Validity Code	#
Acceptable Calibration Test	AC	0
Failed Calibration Test	OC	0
Operationally Invalid	LC	0
Aborted	XC	1
Pending	PC	1
Unacceptable HW Calibration run	MI	1
Invalid hardware approval run	LI	1
Valid hardware approval run	NI	1
Total		5

T-12 Failed Tests

Failed Parameter	Number of Tests
No failed tests	0
Total	0

T-12 Lost Tests*

Status	Cause	#
Invalid	Bad cylinder head caused high OC	1
Aborted	Lost oil charge due to hardware failure	1
Total		2

*Invalid and aborted tests

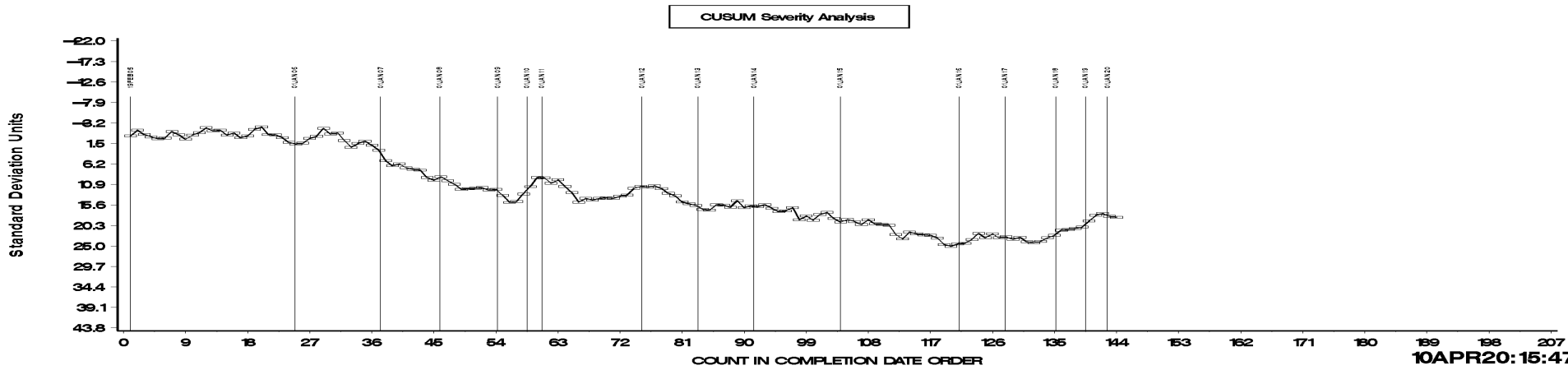
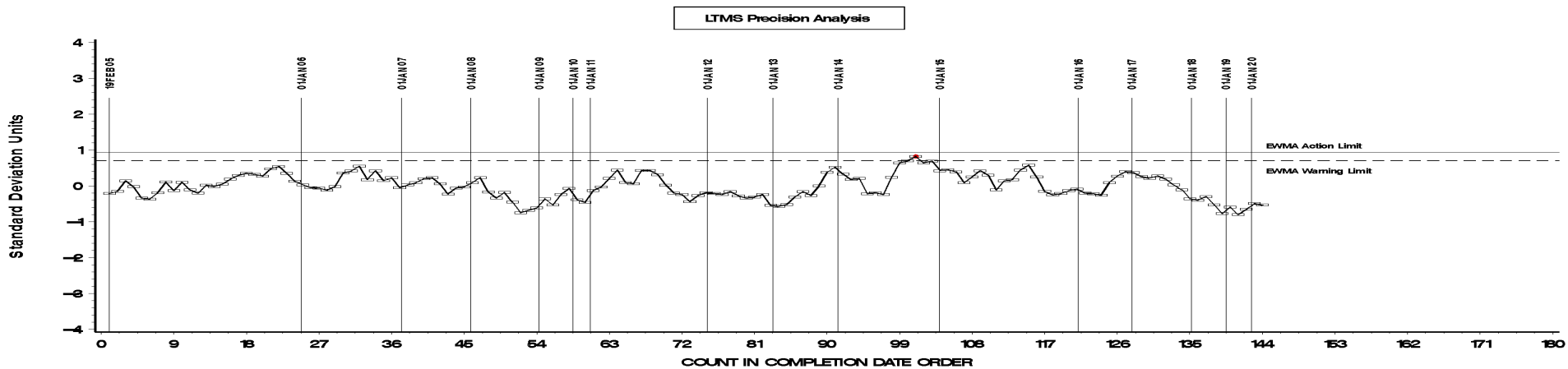
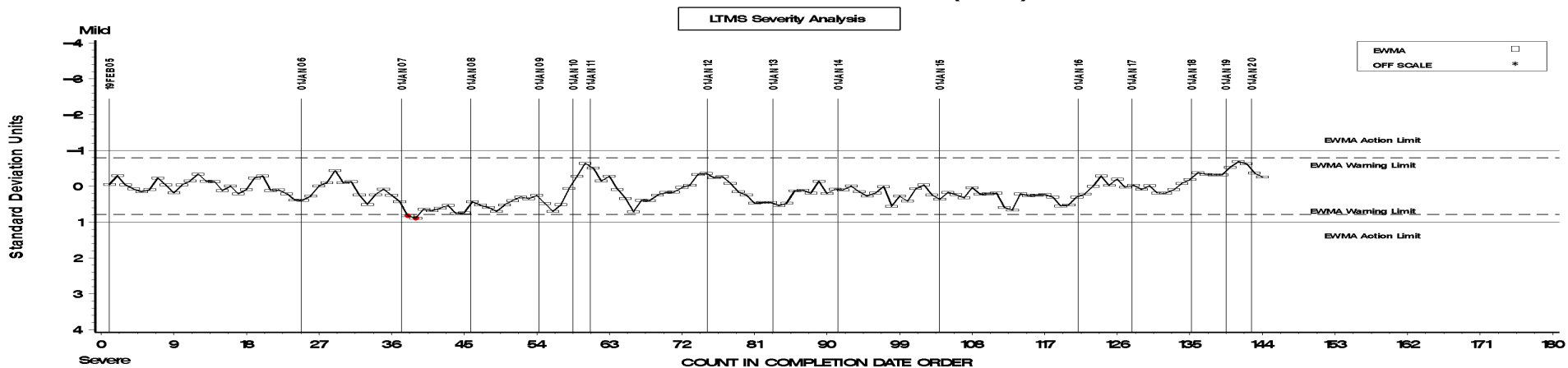
T-12 Test Severity

- ▶ As no chartable T12 tests were run during the period a statement about test severity can not be made.

MACK T-12 INDUSTRY OPERATIONALLY VALID DATA



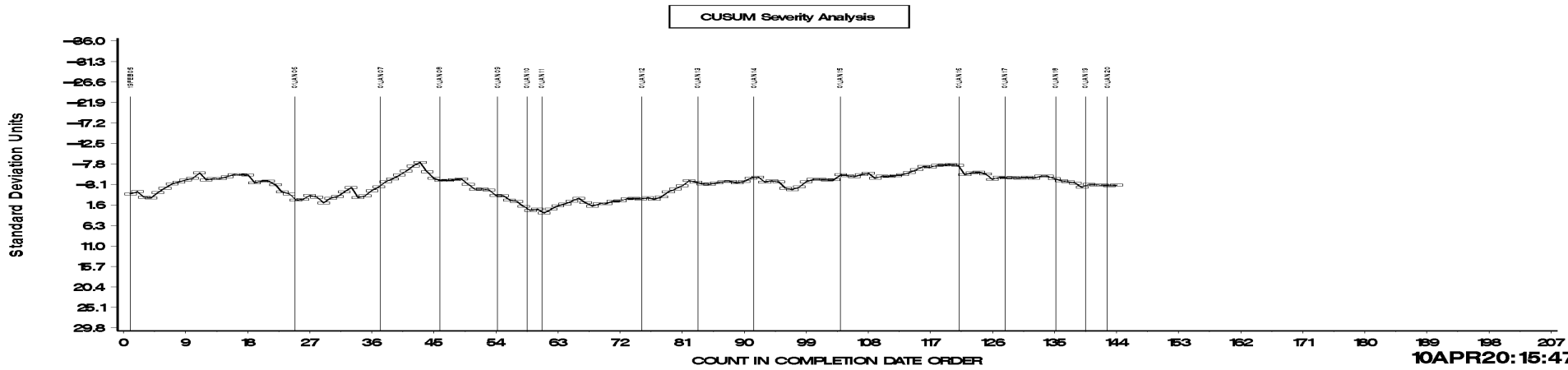
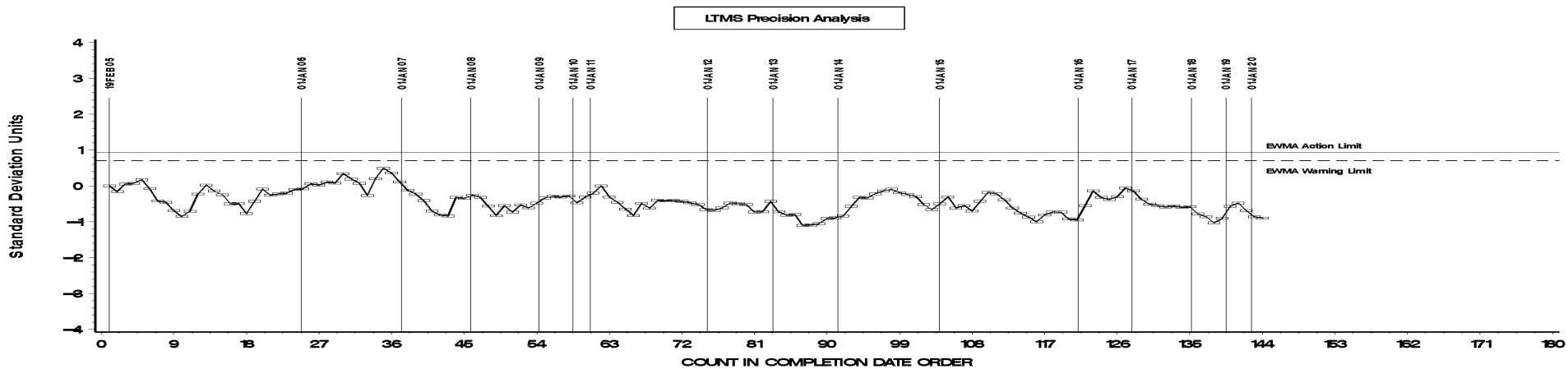
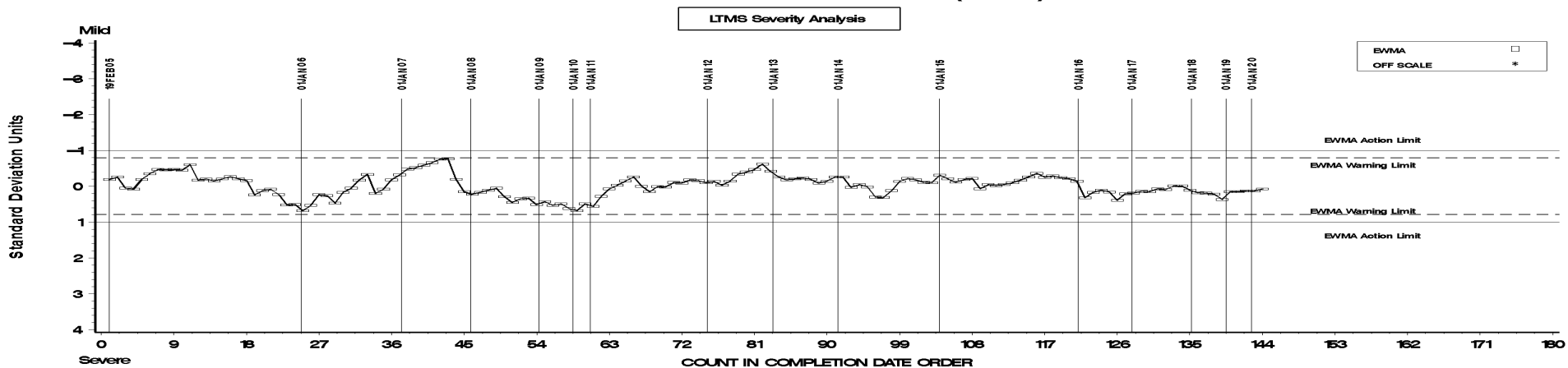
AVG. CYLINDER LINER WEAR (CLW)



MACK T-12 INDUSTRY OPERATIONALLY VALID DATA



AVG. TOP RING WEIGHT LOSS (TRWL)

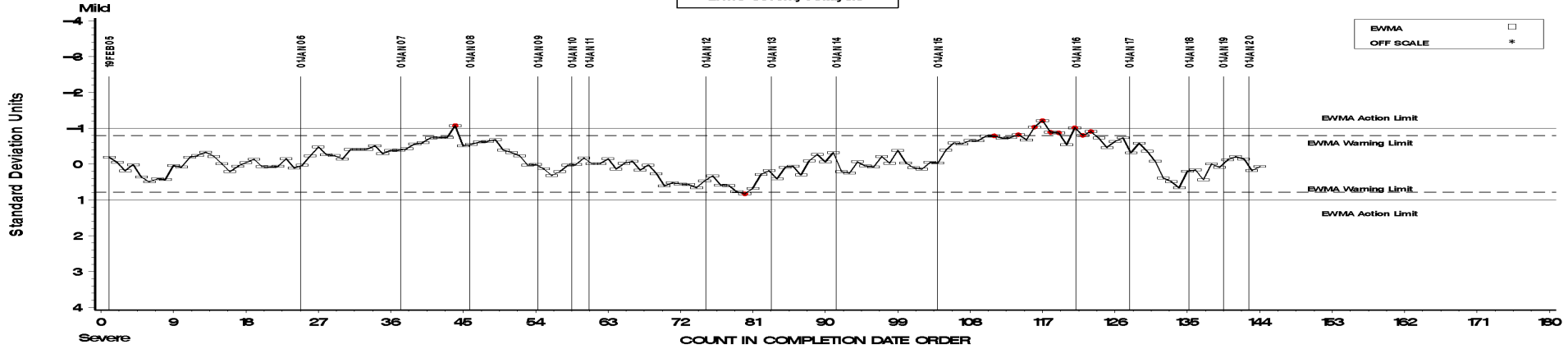


MACK T-12 INDUSTRY OPERATIONAL VALID DATA

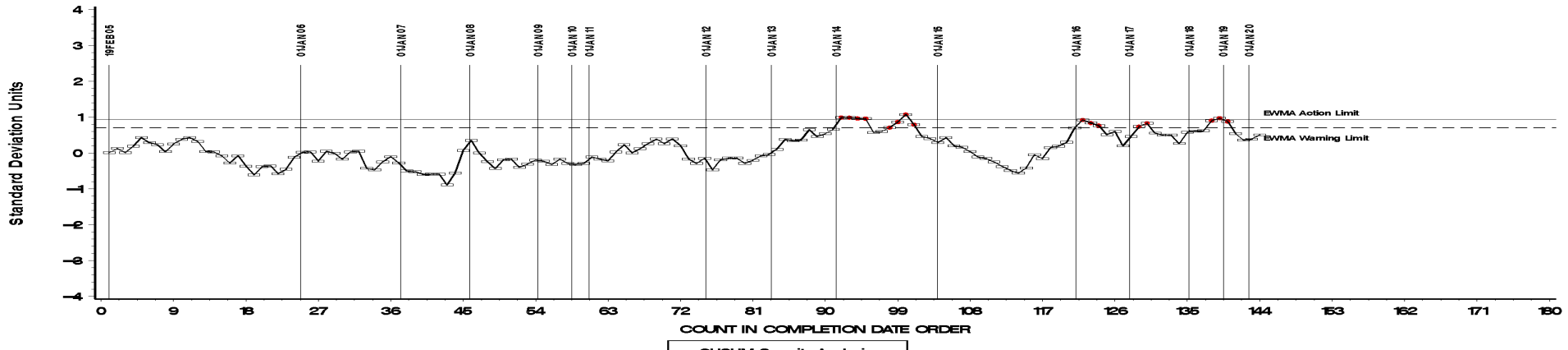


FINAL TRANS. RES. DELTA PB @ EOT

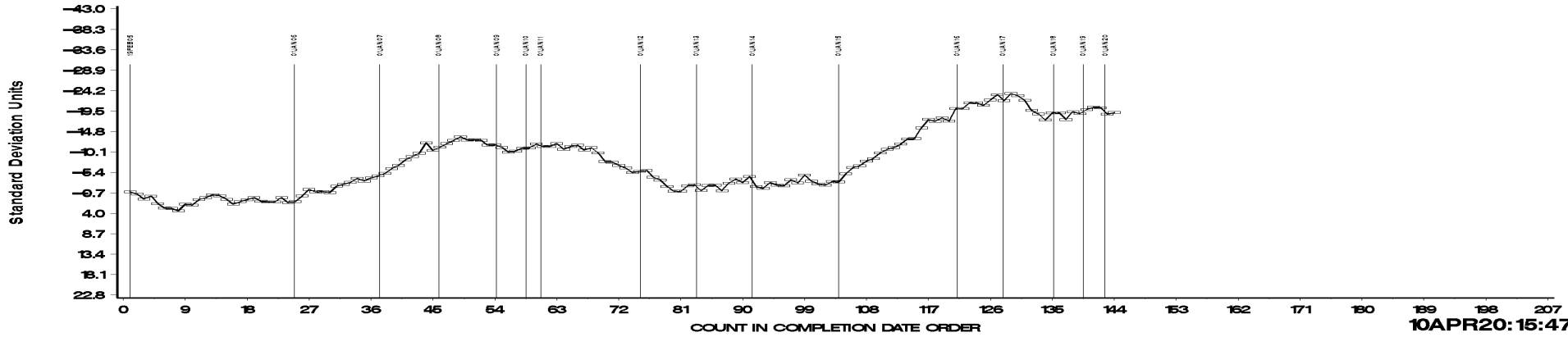
LTMS Severity Analysis



LTMS Precision Analysis



CUSUM Severity Analysis

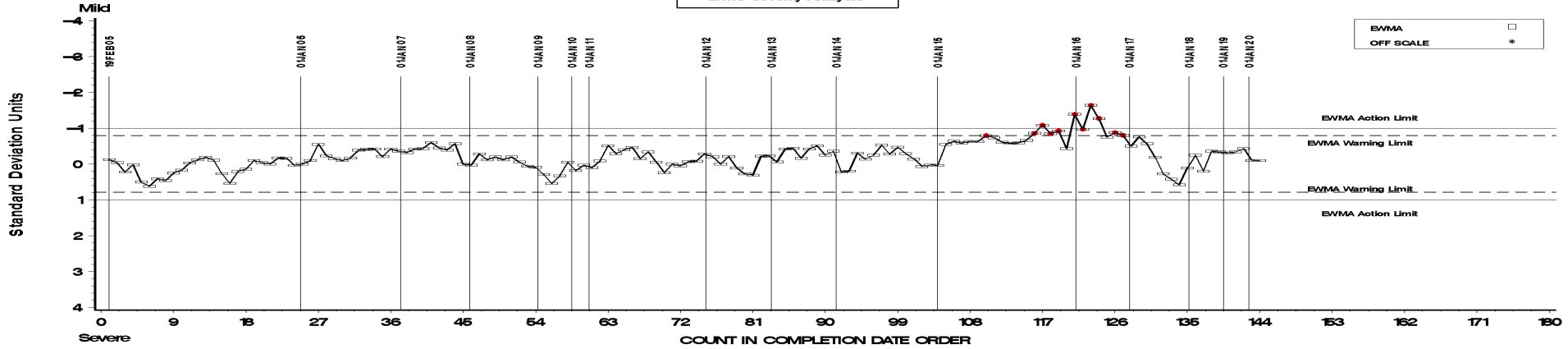


MACK T-12 INDUSTRY OPERATIONALLY VALID DATA

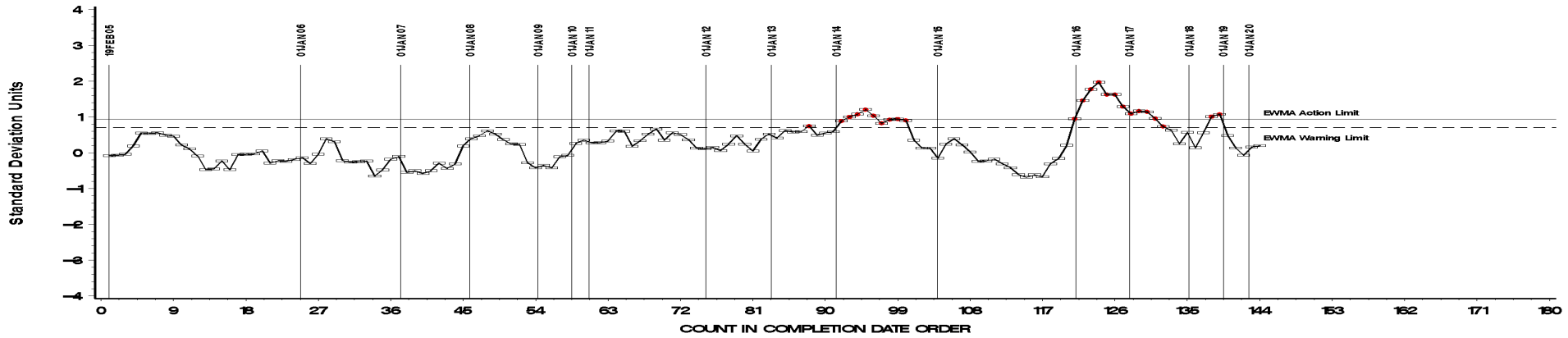


FINAL TRANS. RES. DELTA PB 250-300H

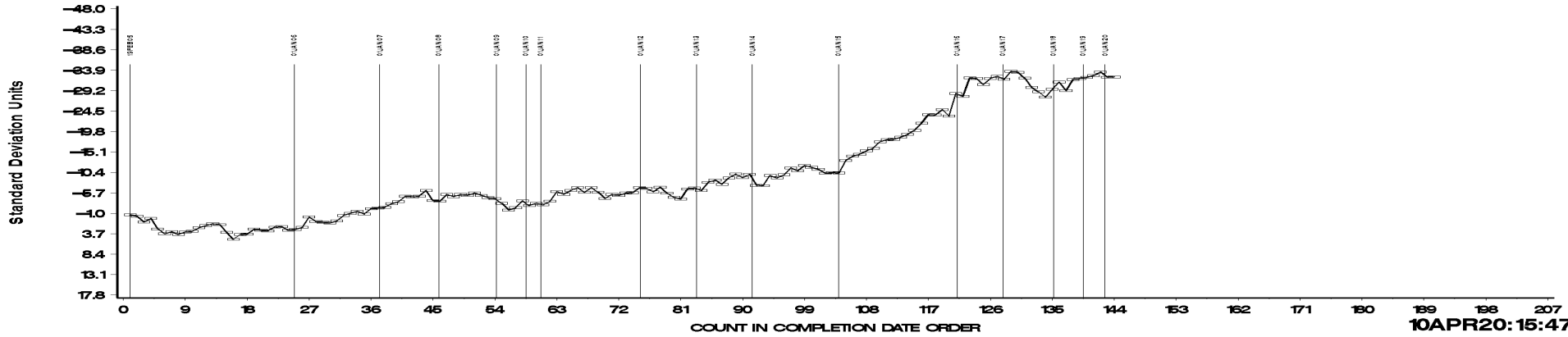
LTMS Severity Analysis



LTMS Precision Analysis



CUSUM Severity Analysis

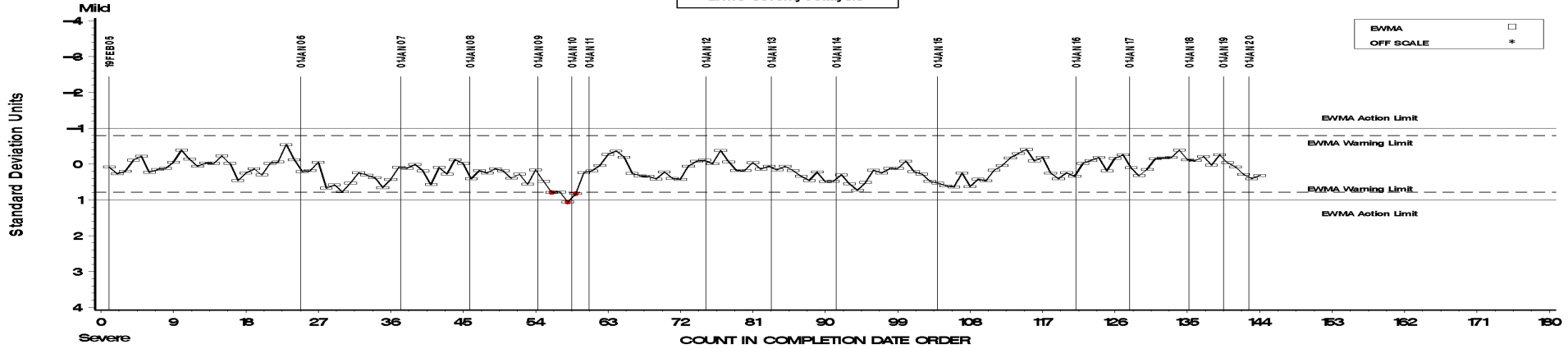


MACK T-12 INDUSTRY OPERATIONALLY VALID DATA

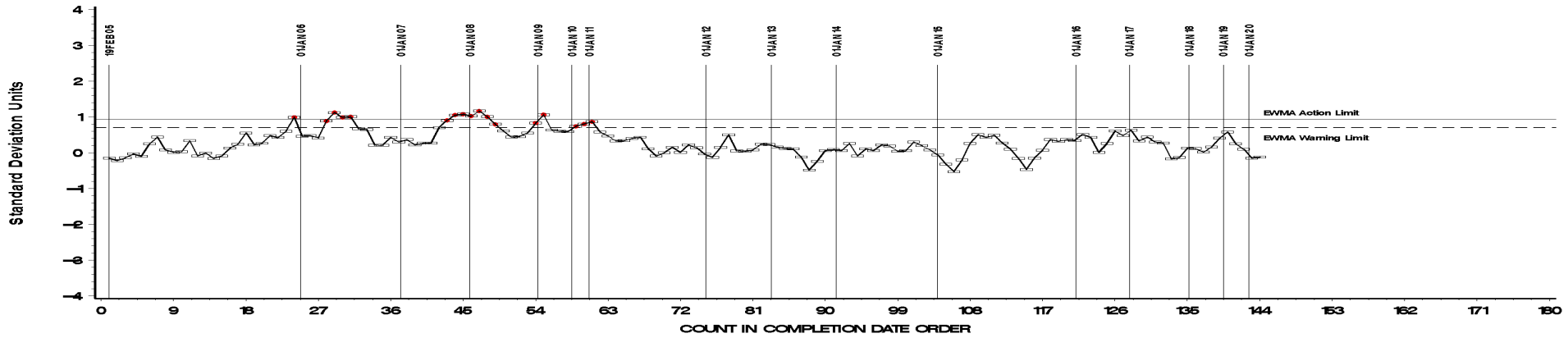


FINAL TRANS. RES. OIL CONSUMPTION

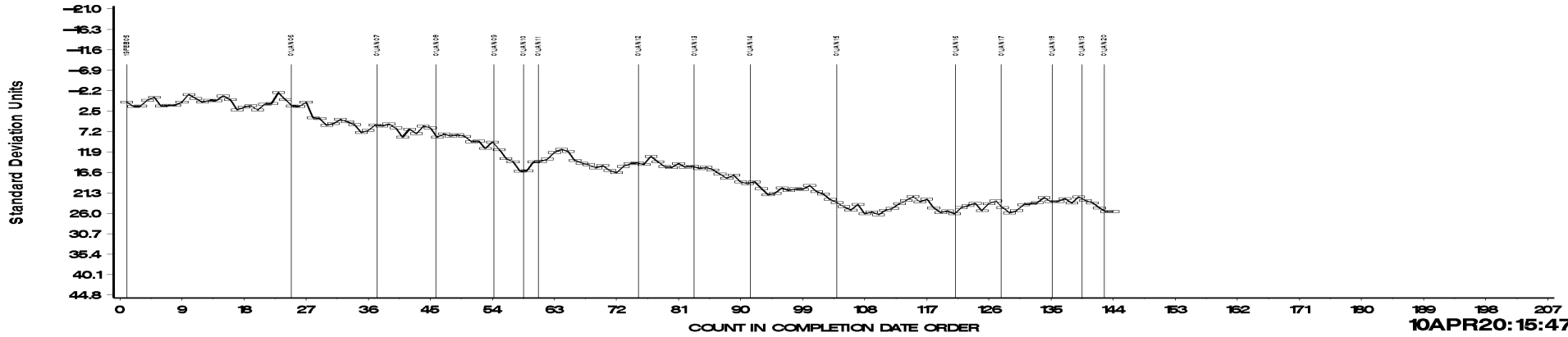
LTMS Severity Analysis



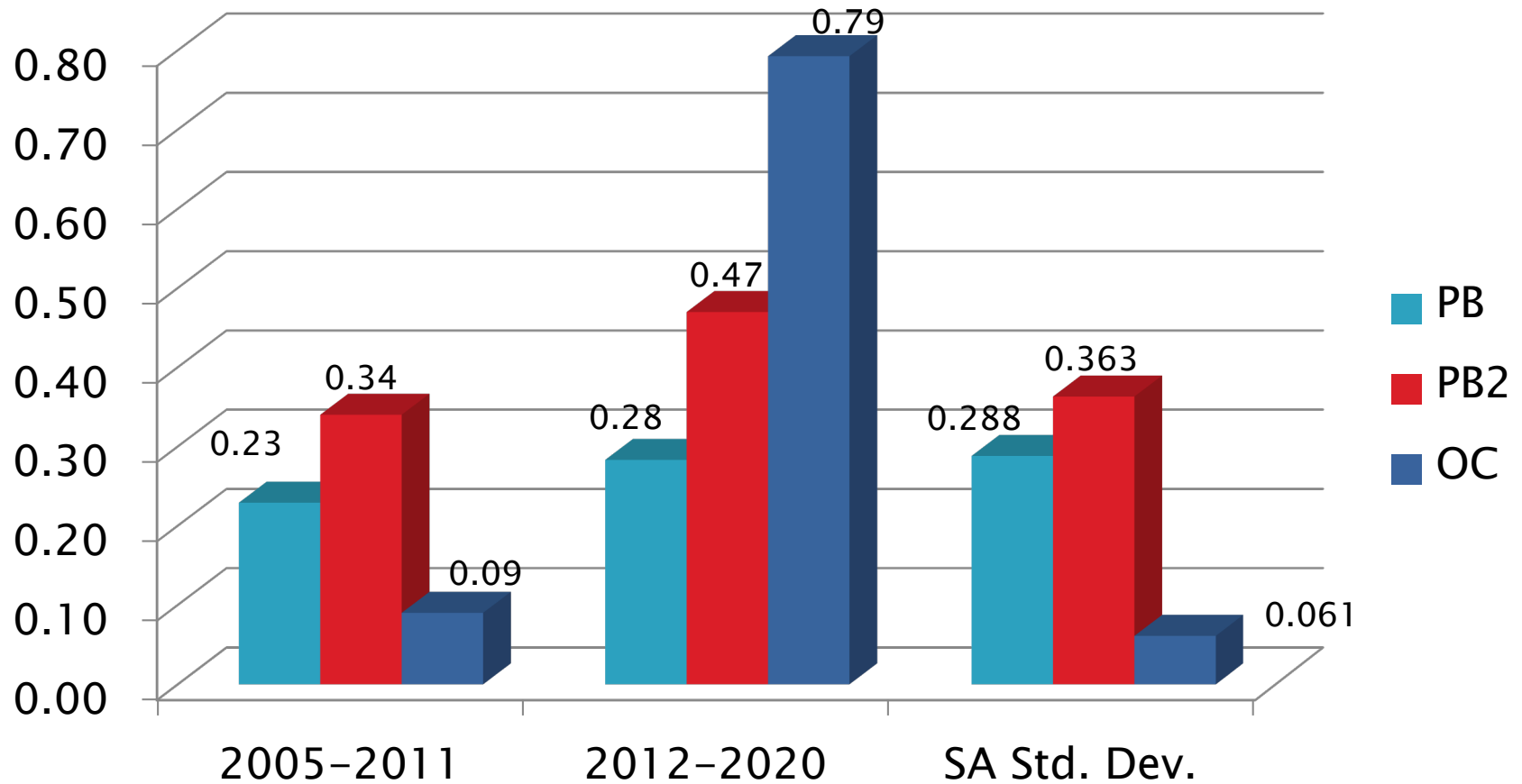
LTMS Precision Analysis



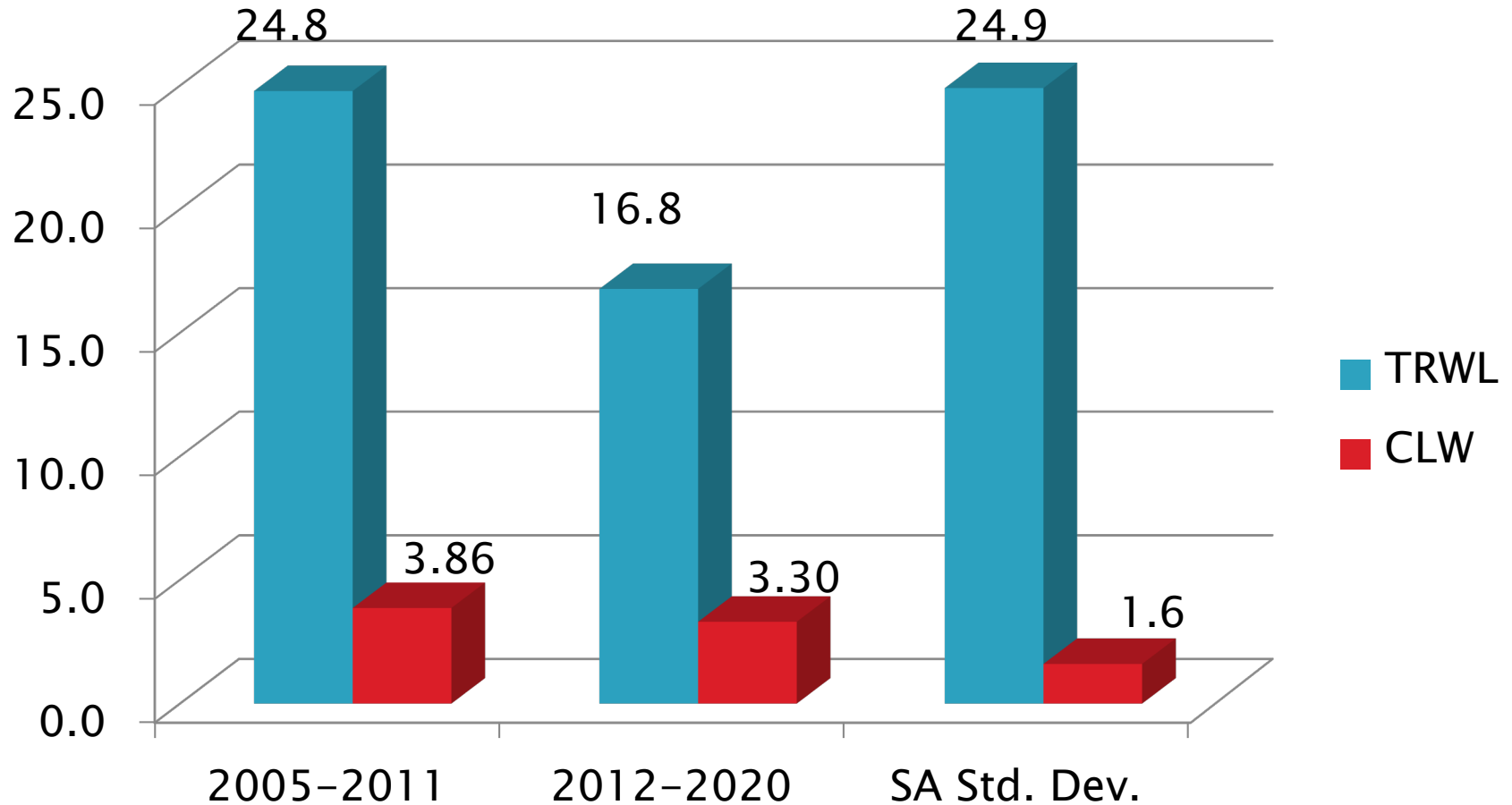
CUSUM Severity Analysis



T-12 Precision Estimates



T-12 Precision Estimates



[Return to Table of Contents](#)

Test Monitoring Center

<http://astmtmc.cmu.edu>



A Program of ASTM International

Mack T-12A

»» June 2021

Test Monitoring Center

<http://astmtmc.cmu.edu>



A Program of ASTM International

T-12A Test Activity

Test Status	Validity Code	#
Acceptable Calibration Test	AC	0
Failed Calibration Test	OC	0
Operationally Invalid	LC	0
Aborted	XC	1
Pending	PC	1
Unacceptable HW Calibration run	MI	1
Invalid hardware approval run	LI	1
Valid hardware approval run	NI	1
Total		5

T-12A Failed Tests

Failed Parameter	Number of Tests
No failed tests	0
Total	0

T-12A Lost Tests*

Status	Cause	#
Invalid	Bad cylinder head caused high OC	1
Aborted	Lost oil charge due to hardware failure	1
Total		2

*Invalid and aborted tests

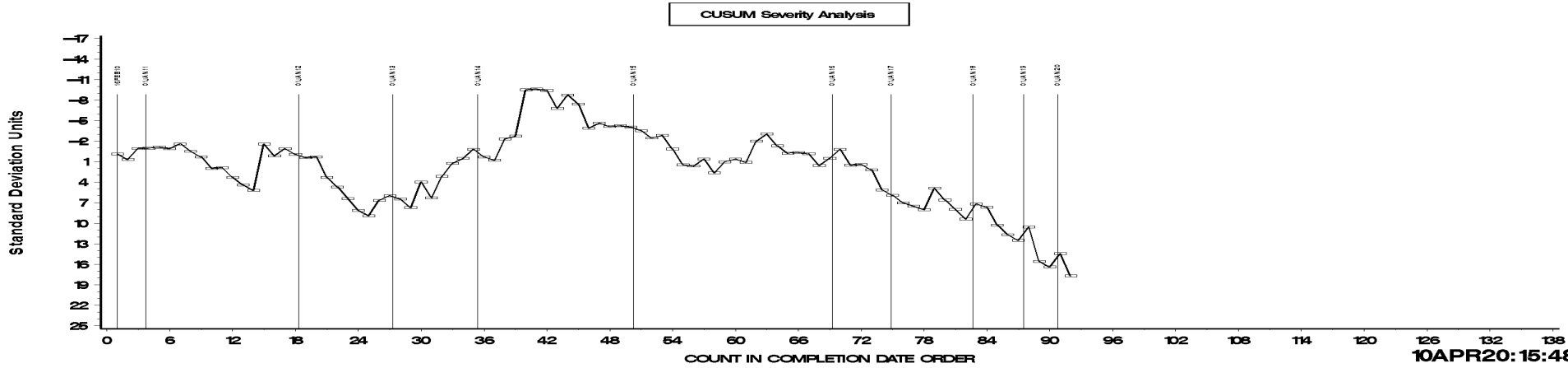
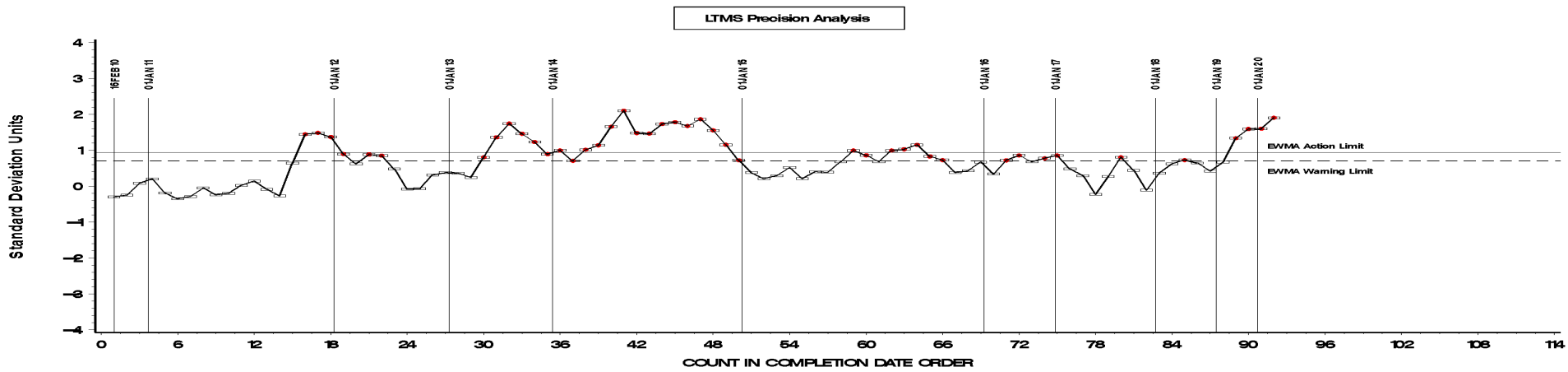
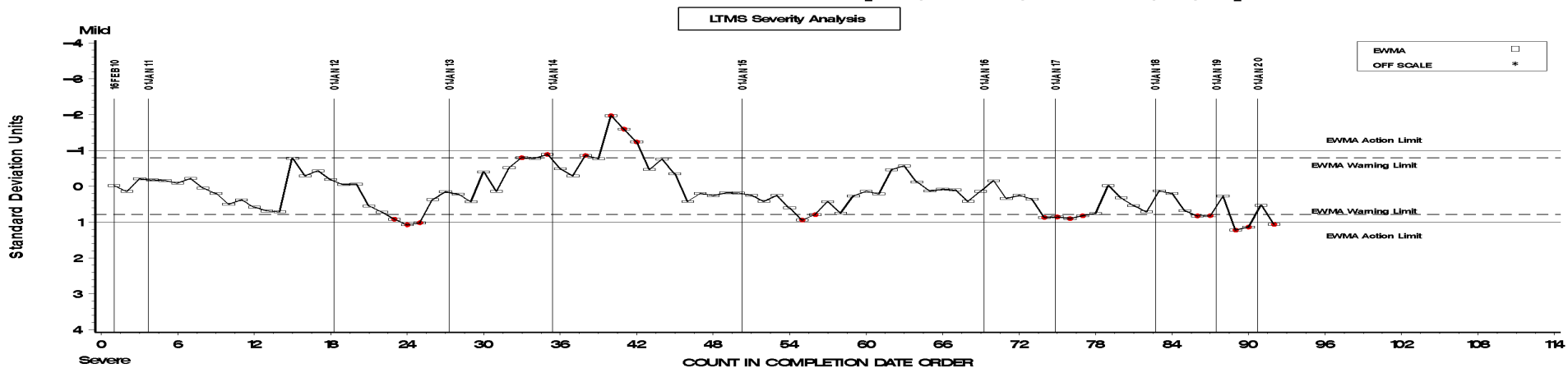
T-12A Test Severity

- ▶ As no chartable T12A tests were run during the period a statement about test severity can not be made.

MACK T-12A INDUSTRY OPERATIONALLY VALID DATA

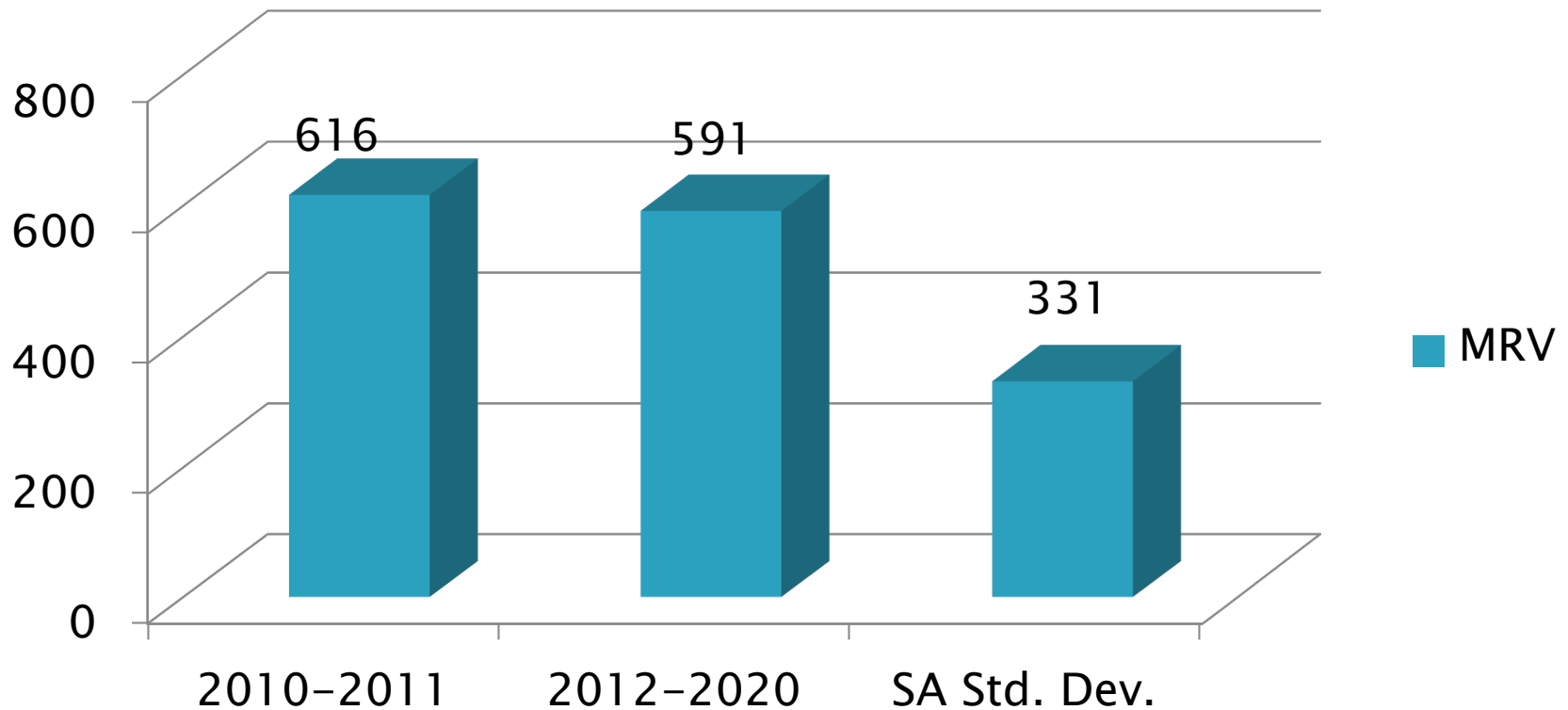


FINAL ORIGINAL UNIT MRV VISCOSITY [NM, SOLID, FROZEN, <, >]



T-12A Precision Estimates

MRV



[Return to Table of Contents](#)

Test Monitoring Center

<http://astmtmc.cmu.edu>



A Program of ASTM International

Mack T-13

»» June 2021

Test Monitoring Center

<http://astmtmc.cmu.edu>



A Program of ASTM International

T-13 Test Activity

Test Status	Validity Code	#
Acceptable Calibration Test	AC	5
Failed Calibration Test	OC	1
Operationally Invalid	LC	0
Aborted	XC	0
Total		6

T-13 Failed Tests

Failed Parameter	Number of Tests
KV40, IRPH Mild	1
Total	1

T-13 Lost Tests*

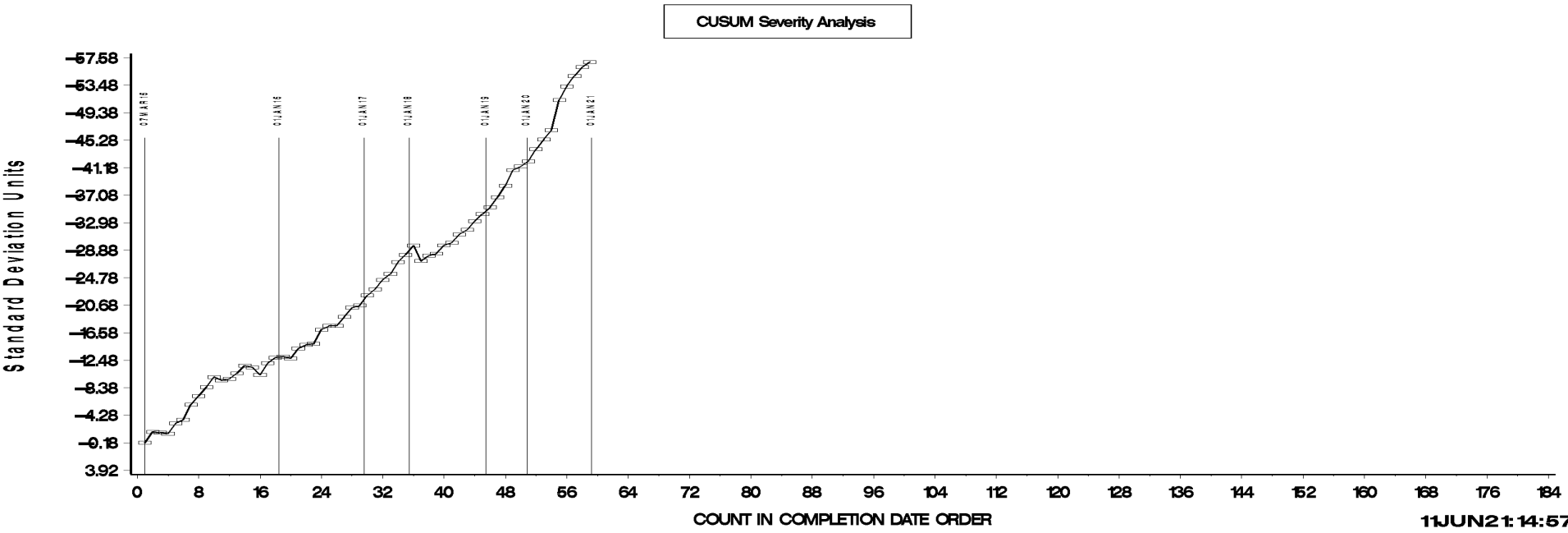
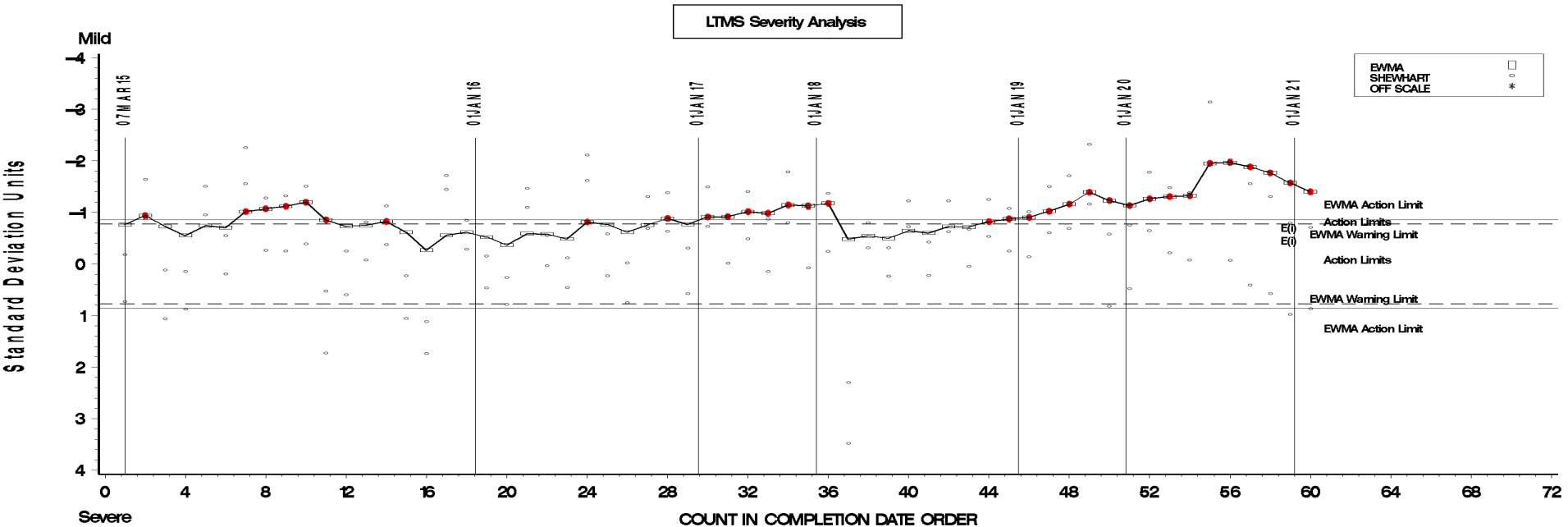
Status	Cause	#
Invalid	No invalid tests	0
Aborted	No aborted tests	0
Total		5

*Invalid and aborted tests

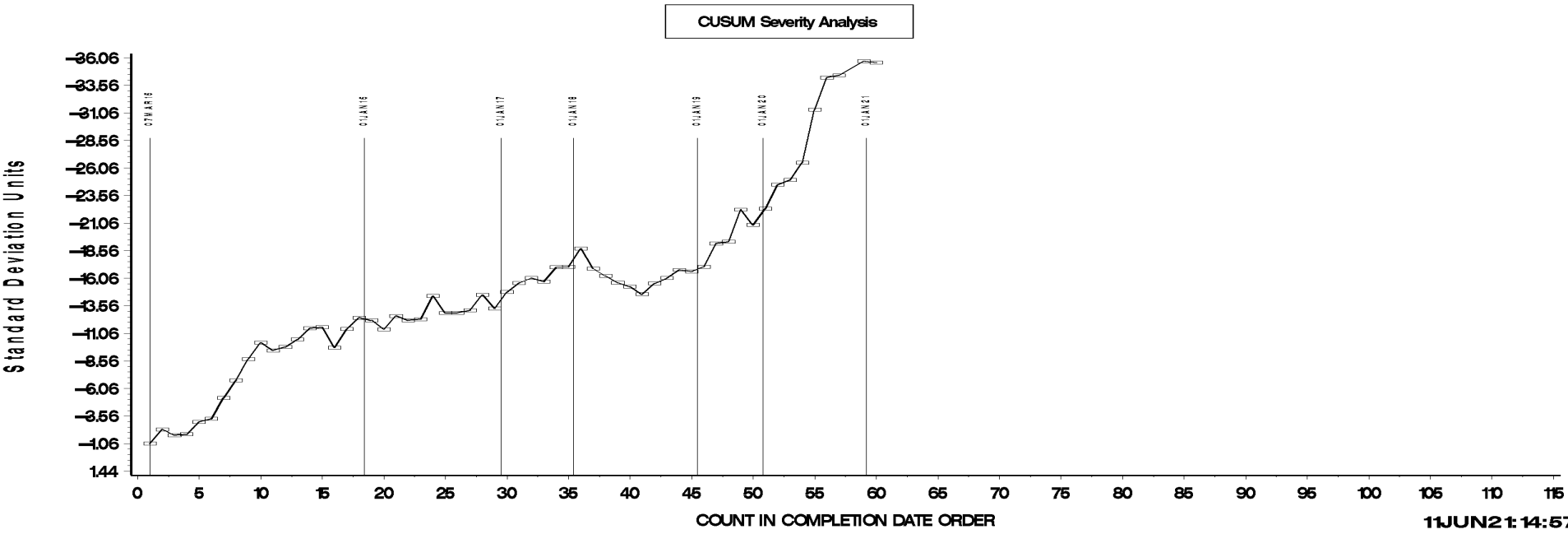
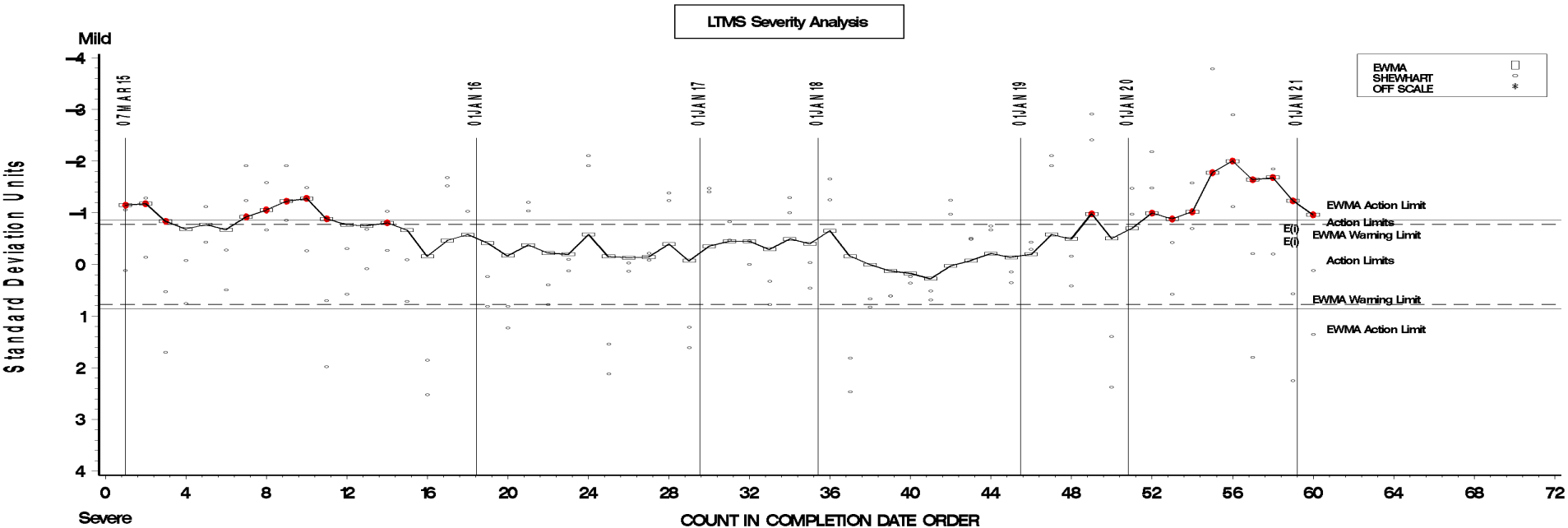
T-13 Test Severity

- ▶ IRPH and KV40 is in level 2 Zi alarm in the mild direction

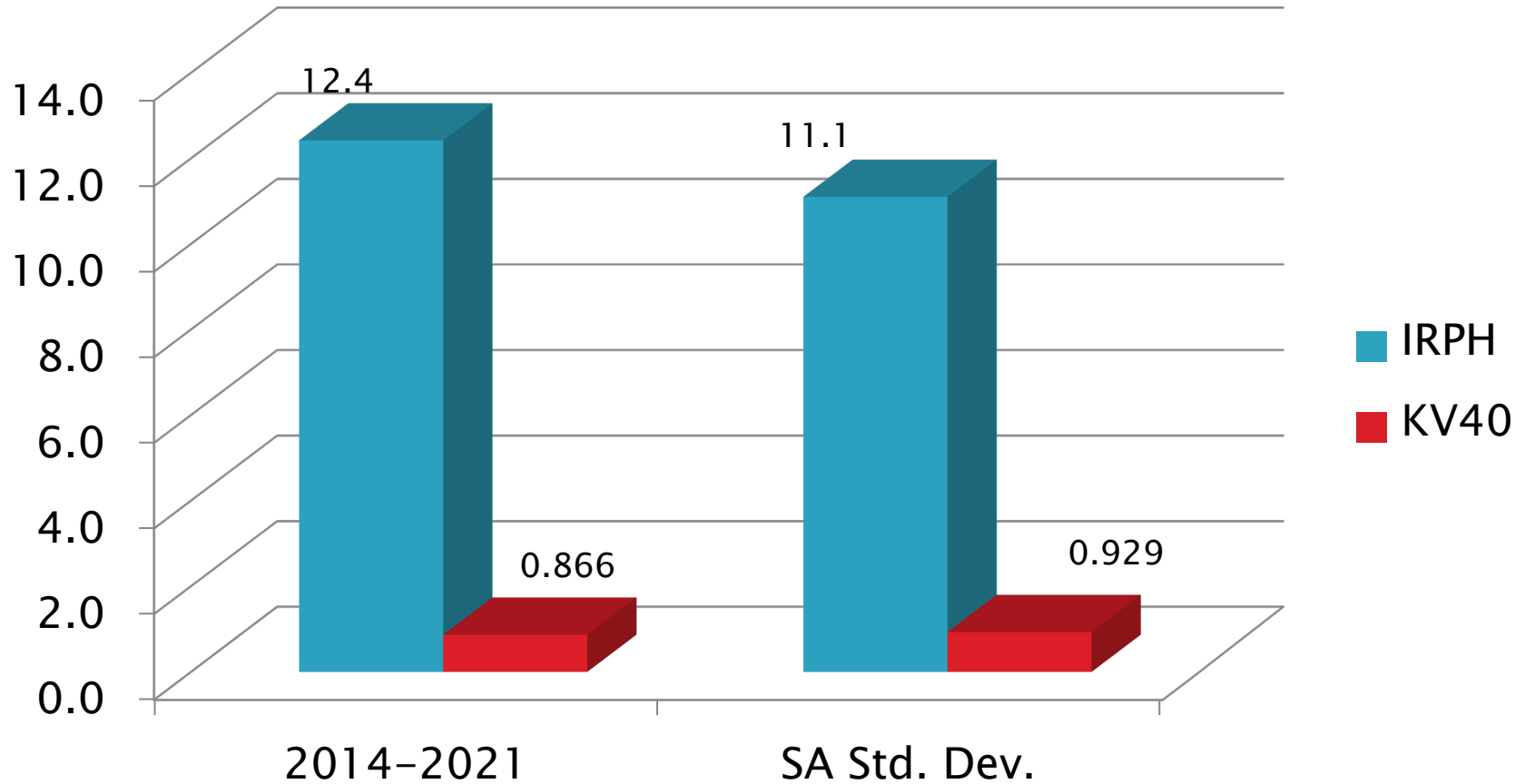
FNL. ORIG. UNIT KINEMATIC VISCOSITY AT 40 DEG C % CHANGE 300-360 HRS



FINAL ORIGINAL PEAK HEIGHT IR AT EOT



T-13 Precision Estimates



[Return to Table of Contents](#)

Information Letters

»» October 1, 2020–

March 31, 2021

Test Monitoring Center

<http://astmtmc.cmu.edu>



A Program of ASTM International

Information Letters*

Test	Date	IL	Topic
C13	11/16/2020	20-1	Updated Intake and Exhaust Valve Part Numbers in Critical Parts List

*Available from TMC Website

[Return to Table of Contents](#)

Test Monitoring Center

<http://astmtmc.cmu.edu>



A Program of ASTM International

Memos

»» October 1, 2020–
March 31, 2021

Test Monitoring Center

<http://astmtmc.cmu.edu>



A Program of ASTM International

Memos*

Date	Number	Topic
N/A	N/A	No memos were issued during the period

*Available from TMC Website

[Return to Table of Contents](#)

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 Reblends

- ▶ Re-blend of T13 reference oil 823 requested and in progress.
- ▶ Re-blend of 1005-5 being pursued as well

Reference Oil Inventory Estimated Life

Oil	Tests	Original Blend Amount	Quantity Shipped in last 6 months	TMC Inventory	Lab Inventory	Estimated Life
809-1	1K, 1N	9134	40	1948	116	5+ years
811-2	1K, 1N	1732	50	802	40	5+ years
821-4	T-12	4495	275	2347	125	4.5+ years
822-2	1R, T-11	4386	224	2169	140	2.5+ years
823	T-13	1796	200	350	120	<1 year
830-3	ISM	2891	50	2560	75	5+ years
831-4	C13, ISB	1699	85	1075	155	3+ years

Reference Oil Inventory Estimated Life

Oil	Tests	Original Blend Amount	Quantity Shipped in last 6 months	TMC Inventory	Lab Inventory	Estimated Life
832-1	COAT	1951	84	1439	56	3+ years
833-1	COAT	1248	84	772	56	2 years
864-1	DD13	1576	225	666	125	1 year
873-2	1M-PC	1650	0	6	10	1 year
1005-5	1P, 1R, EOAT, RFWT, T-8/E	3826	239	1239	144	1 year

[Return to Table of Contents](#)

Test Monitoring Center

<http://astmtmc.cmu.edu>



A Program of ASTM International

LTMS Deviations

»» October 1, 2020–

March 31, 2021

Test Monitoring Center

<http://astmtmc.cmu.edu>



A Program of ASTM International

LTMS Deviations

- No LTMS Deviations in Current Period

Historical Count of HD LTMS Deviations

Test	LTMS Deviations
1M-PC	2
1N	2
T-8/E	2
T-10A	1
T-12	1

[Return to Table of Contents](#)

Test Monitoring Center

<http://astmtmc.cmu.edu>



A Program of ASTM International

Quality Index Deviations

»» October 1, 2020–

March 31, 2021

Test Monitoring Center

<http://astmtmc.cmu.edu>



A Program of ASTM International

Quality Index Deviations

- ▶ T13 EGR Gas Out Temperature
 - Control issue caused by failing control valve and heat exchanger.

Quality Index Deviations

Historical Count of HD Quality Index Deviations

Test	Qi Deviations
1P	15
1R	1
ISM	3
C13	2
T-10A	1
T-11	3
T-12	7
T-13	3
COAT	4

[Return to Table of Contents](#)

Test Monitoring Center

<http://astmtmc.cmu.edu>



A Program of ASTM International

TMC Laboratory Visits

»» October 1, 2020–

March 31, 2021

Test Monitoring Center

<http://astmtmc.cmu.edu>



A Program of ASTM International

TMC Lab Visits

- ▶ No lab visits this period due to pandemic.

[Return to Table of Contents](#)

Test Monitoring Center

<http://astmtmc.cmu.edu>



A Program of ASTM International

Test Area Timelines

»» October 1, 2020–

March 31, 2021

Test Monitoring Center

<http://astmtmc.cmu.edu>



A Program of ASTM International

Test Area Timeline Additions*

Test	Date	IL/Memo	Topic
C13	11/16/2020	20-1	Updated Intake and Exhaust Valve Part Numbers in Critical Parts List

*As of 3/31/2021

[Return to Table of Contents](#)

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



A Program of ASTM International

Rating Workshop Data



2020 Heavy Duty Workshop

Test Monitoring Center

<http://astmtmc.cmu.edu>



A Program of ASTM International

Rating Workshop Data

- ▶ The 2020 HD Rating Workshop was cancelled due to the COVID-19 pandemic.

[Return to Table of Contents](#)

Test Monitoring Center

<http://astmtmc.cmu.edu>



A Program of ASTM International

Miscellaneous Information

- ▶ Available on TMC Website:
 - Oil Assignment Request and Test File Upload
 - Live Reference Test Data Bases
 - Surveillance Panel Meeting Minutes
 - Test Area Alarm Logs
 - Complete Test Area Timelines
 - LTMS Manual

- ▶ www.astmtmc.cmu.edu

[Return to Table of Contents](#)

Test Monitoring Center

<http://astmtmc.cmu.edu>



A Program of ASTM International



A Program of ASTM International