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# ***Test Monitoring Center***

<https://www.astmtmc.org>

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

Fall 2023

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# Heavy Duty Testing

## Executive Summary

### ▶ Test Issues

- COAT
  - COAT to EOAT equivalency process ongoing.
- T13
  - New reference oil blend (823-1) introduced with coordinated references. IRPH target mean updated. KV40PC target mean and standard deviation updated.
  - KV40PC Correction factor developed and applied to all tests on batch B liners.

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# Calibrated Labs and Stands\*

Test	Labs	Stands
1K	1	1
1N	3	5
1P	1	1
1R	0	0
C13	3	3
ISB	2	4
ISM	1	1
EOAT	1	1
RFWT	1	1
T-8/E	2	2
T-11	2	3
T-12/T-12A	3/3	3/3
T-13	3	5
COAT	2	2
DD13	2	2

\*As of 9/30/2023

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# SCOTE 1K

➤➤ October 2023

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# 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
<b>Total</b>		<b>0</b>

# 1 K Failed Tests

Failed Parameter	Number of Tests
No failed tests	0
<b>Total</b>	<b>0</b>

# 1 K Lost Tests\*

Status	Cause	#
Invalid	No invalid tests	0
Aborted	No aborted tests	0
<b>Total</b>		<b>0</b>

\*Invalid and aborted tests

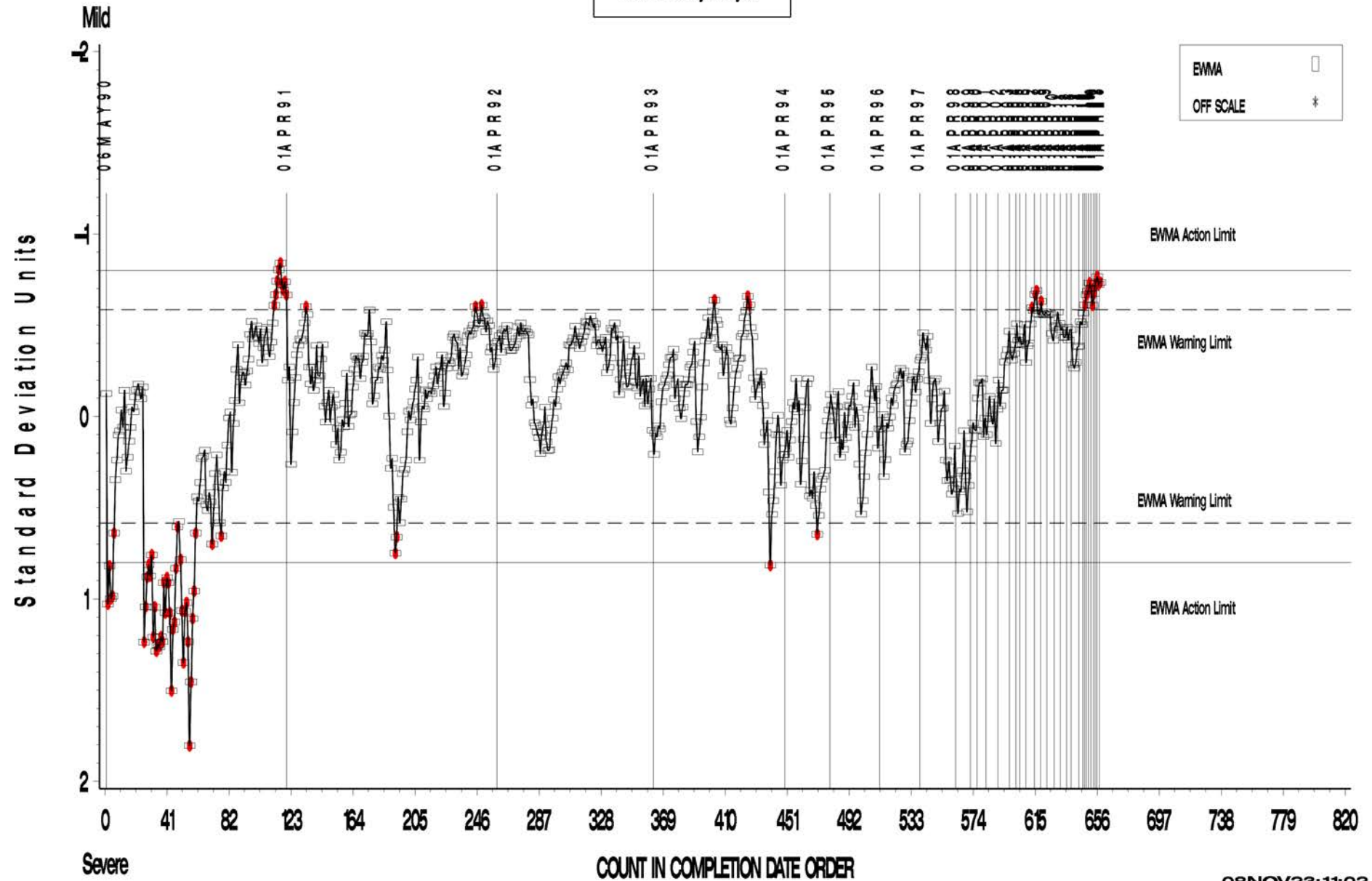
# 1 K Test Severity

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



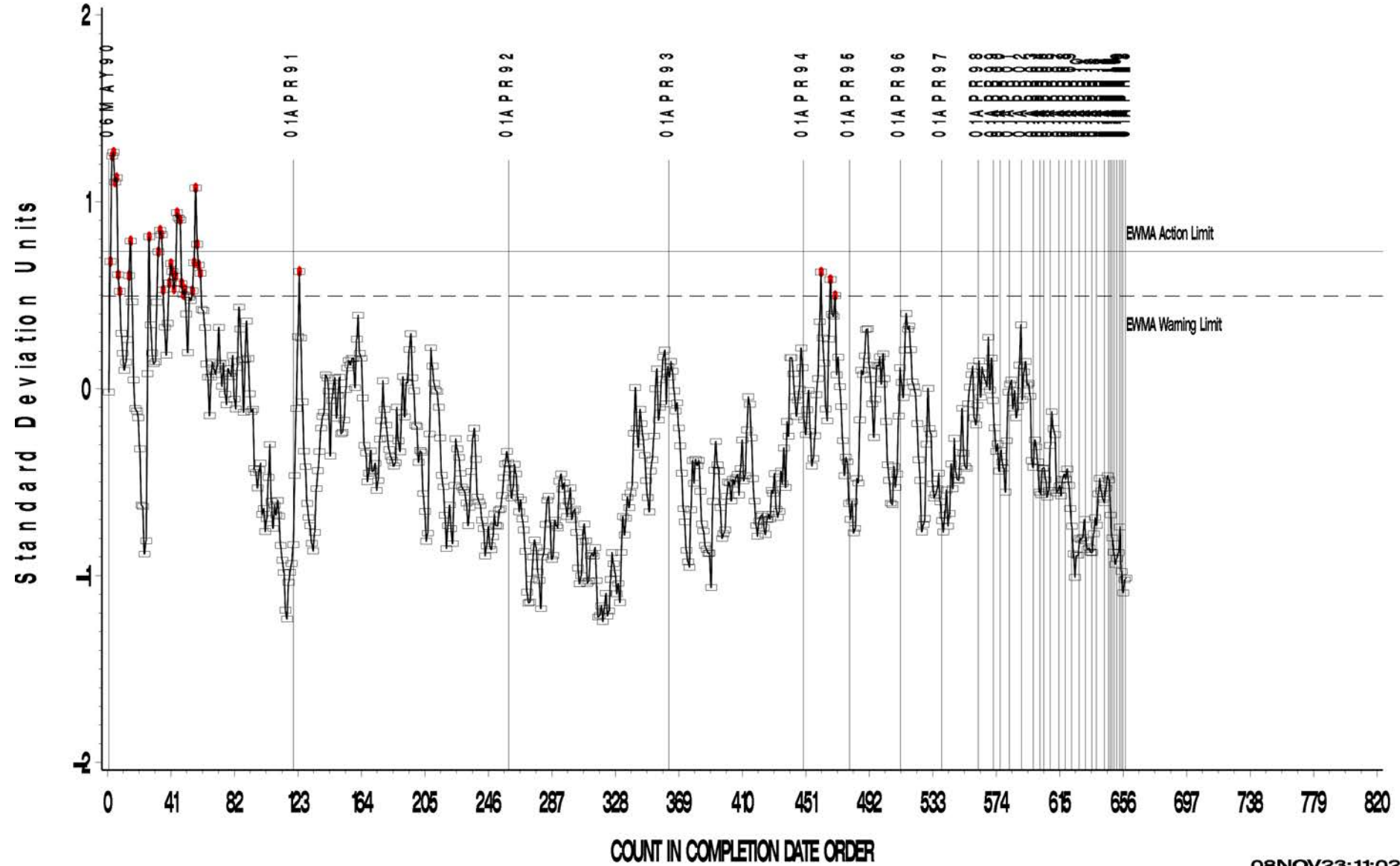
FINAL TGF

LTMS Severity Analysis



FINAL TGF

LTMS Precision Analysis



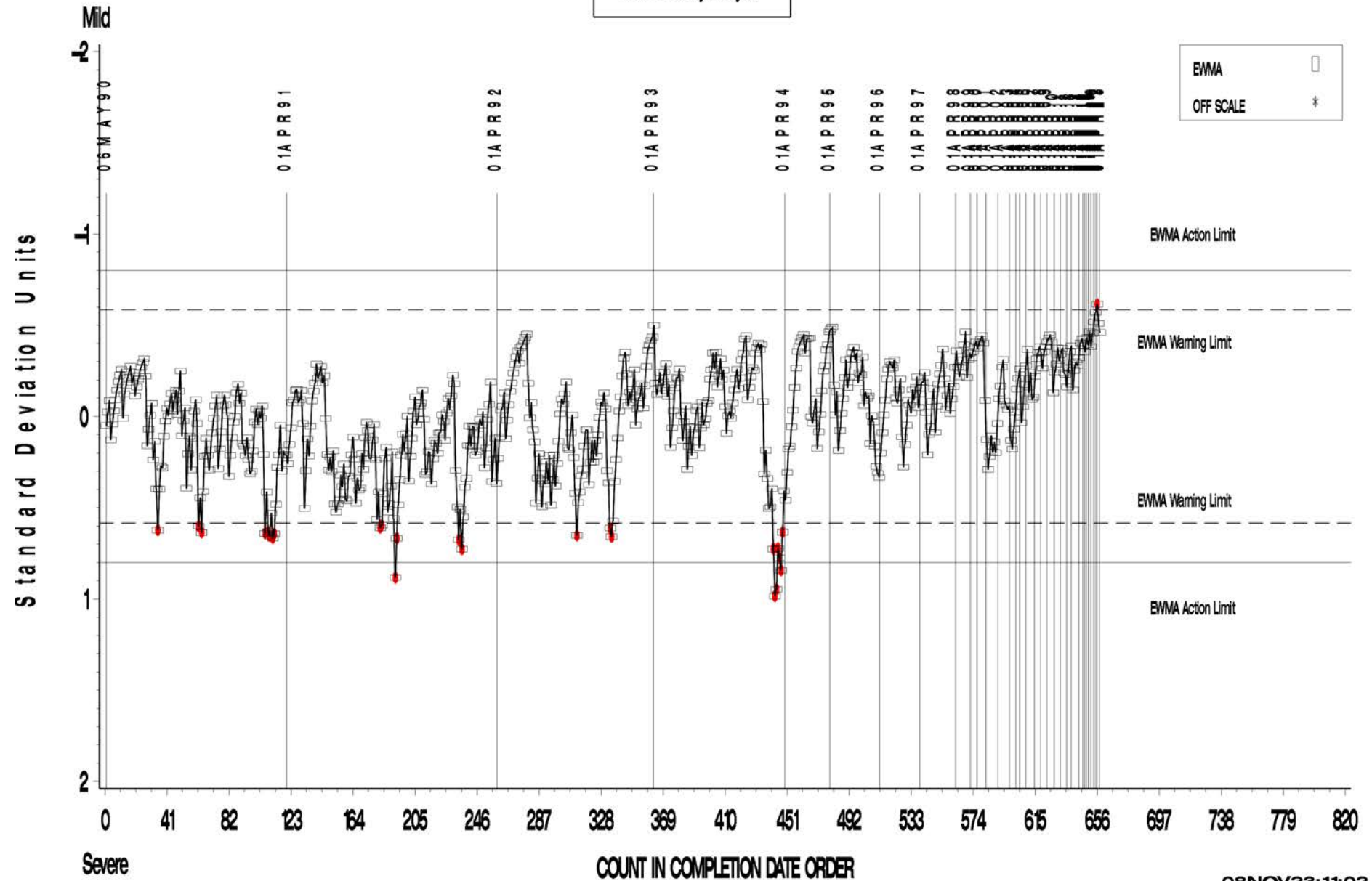
FINAL TGF

CUSUM Severity Analysis



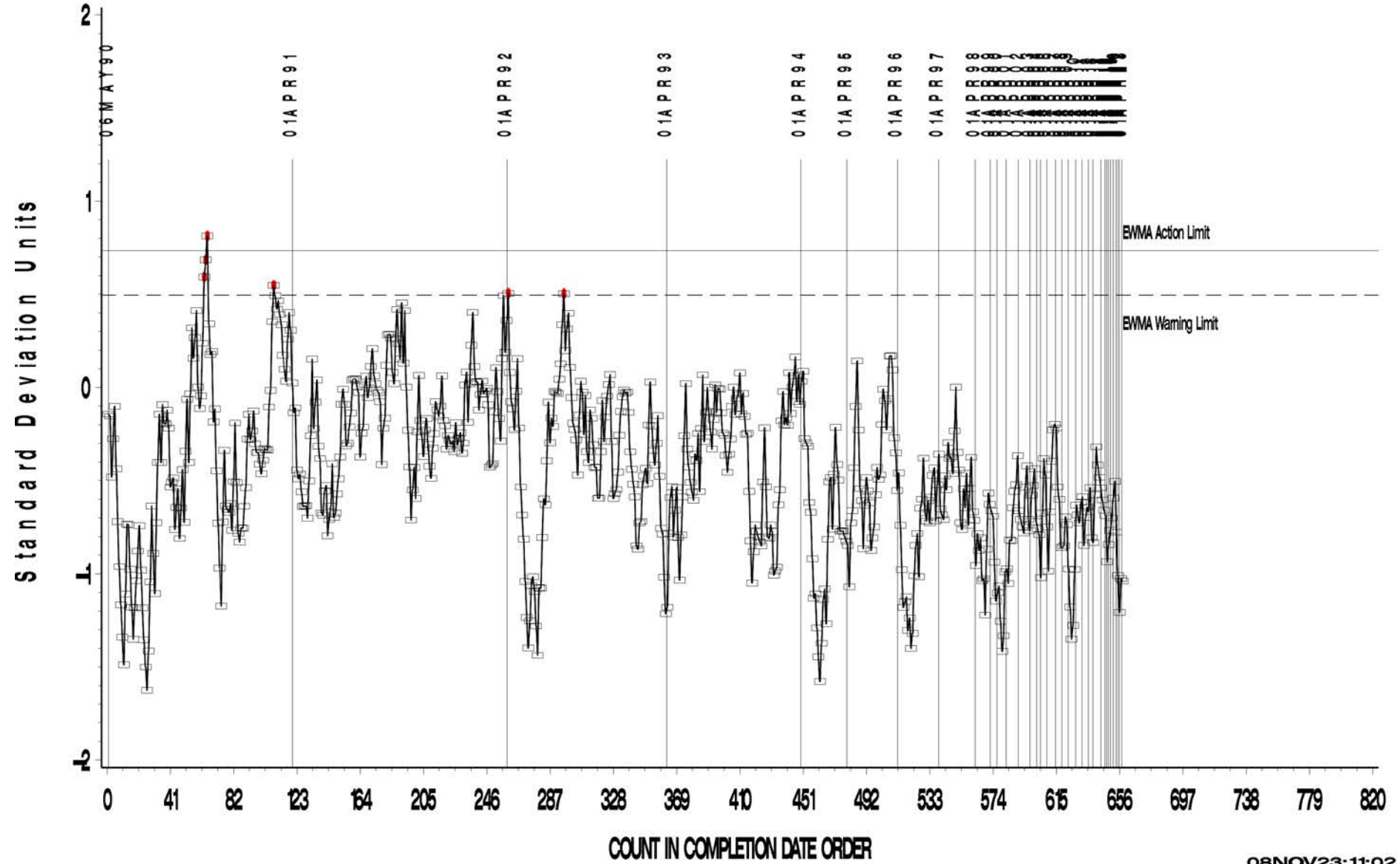
FINAL TLHC

LTMS Severity Analysis



FINAL TLHC

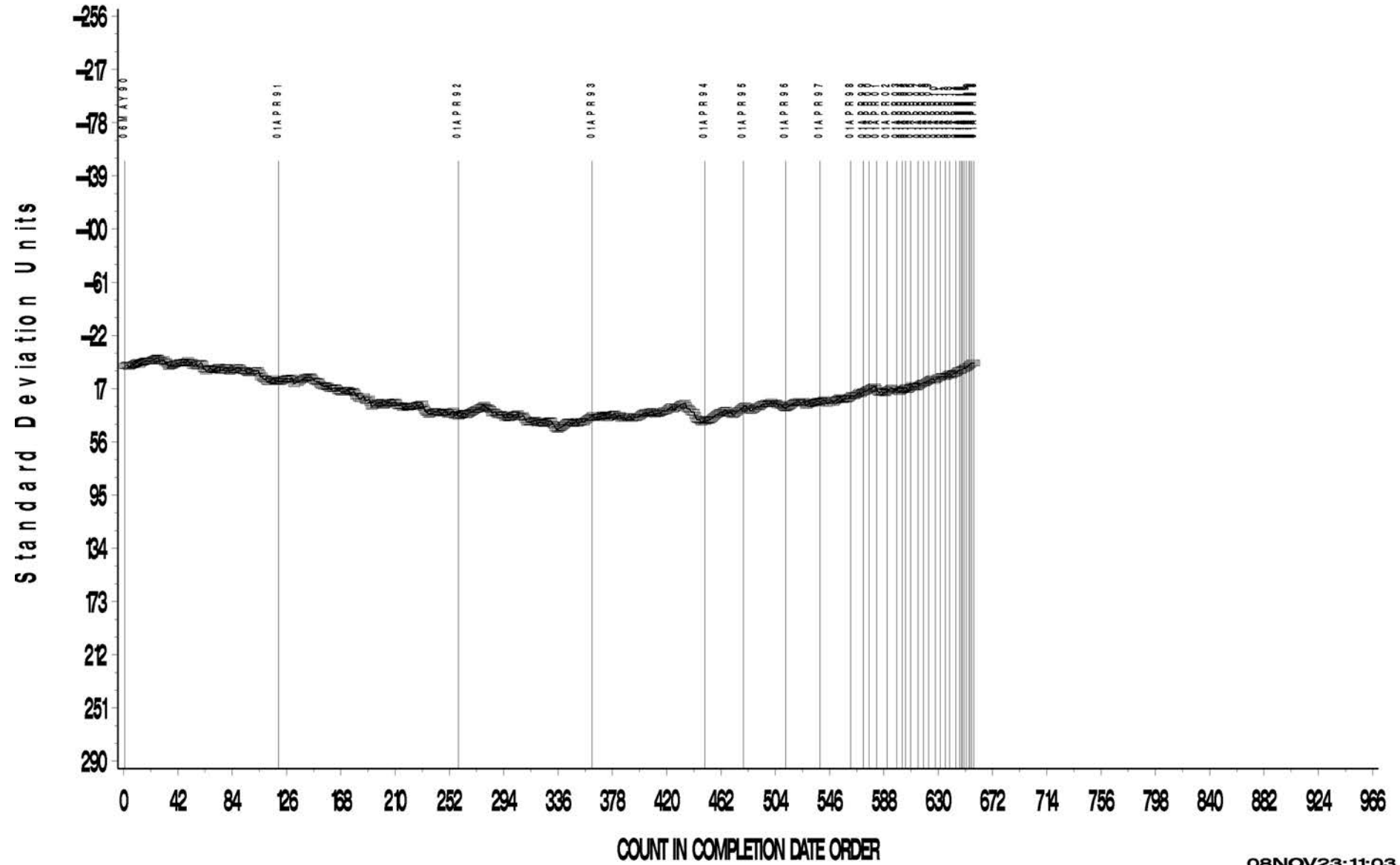
LTMS Precision Analysis





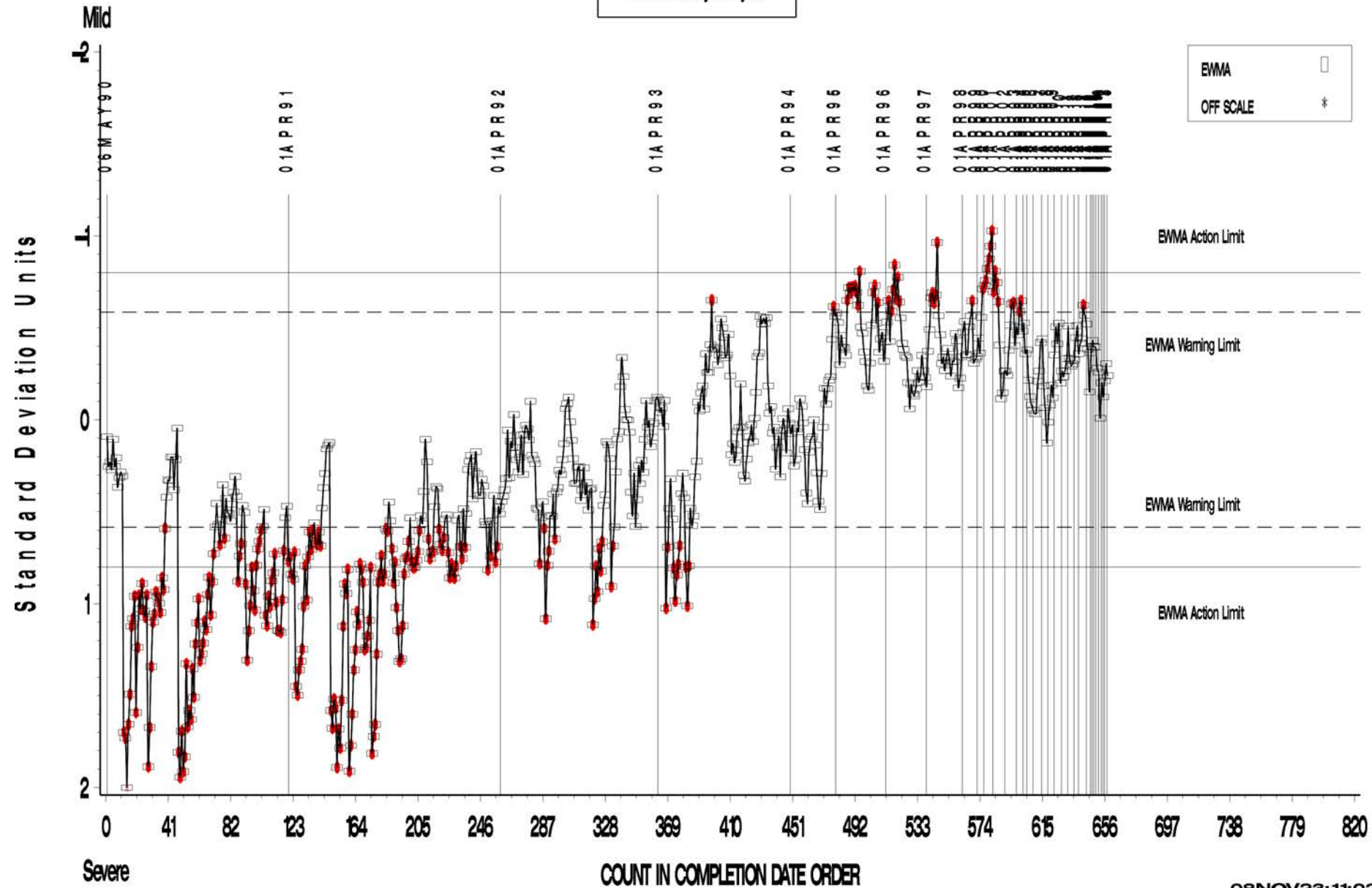
### FINAL TLHC

CUSUM Severity Analysis



FINAL Weighted Total Demerits

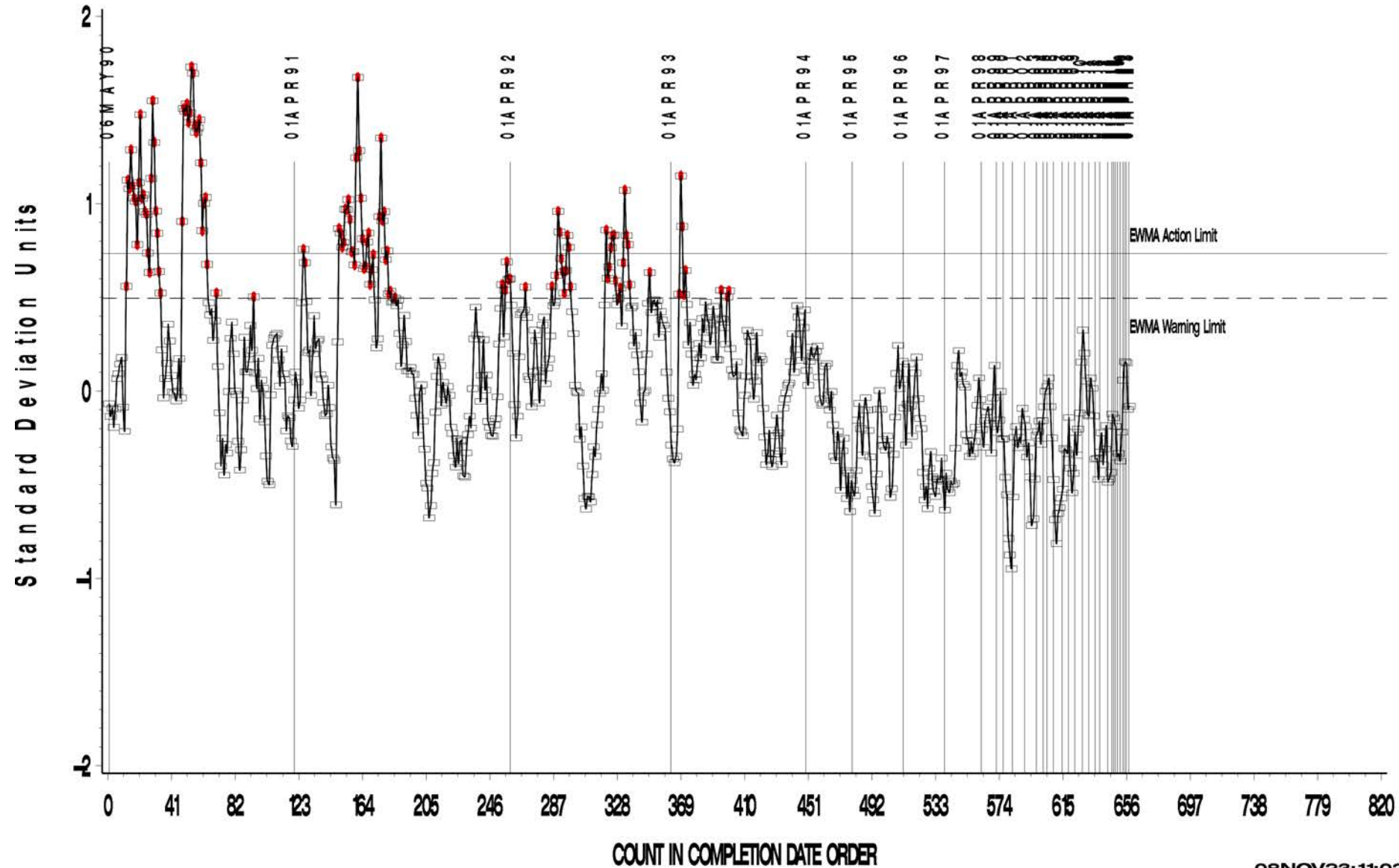
LTMS Severity Analysis





FINAL Weighted Total Demerits

LTMS Precision Analysis



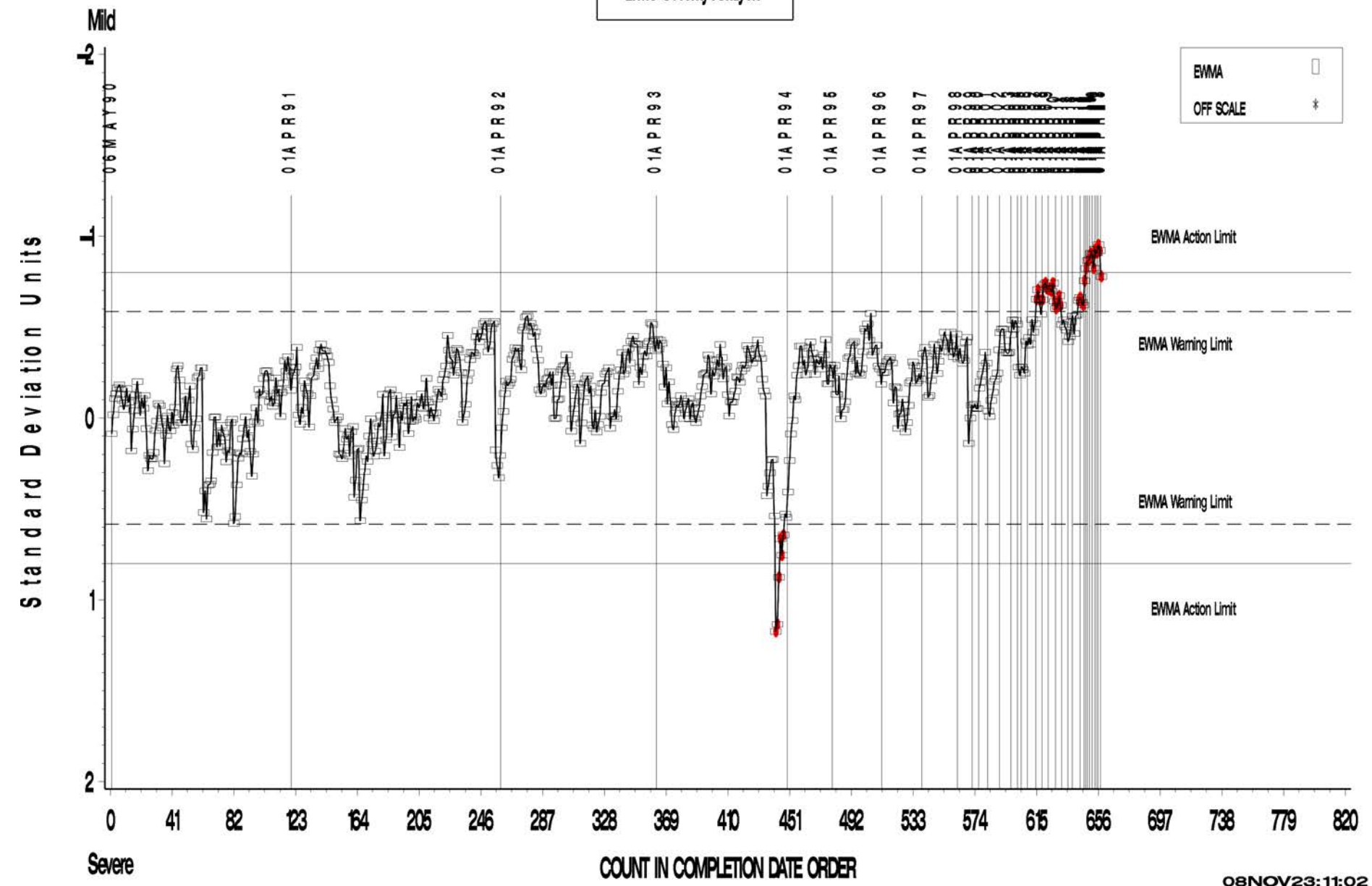
FINAL Weighted Total Demerits

CUSUM Severity Analysis



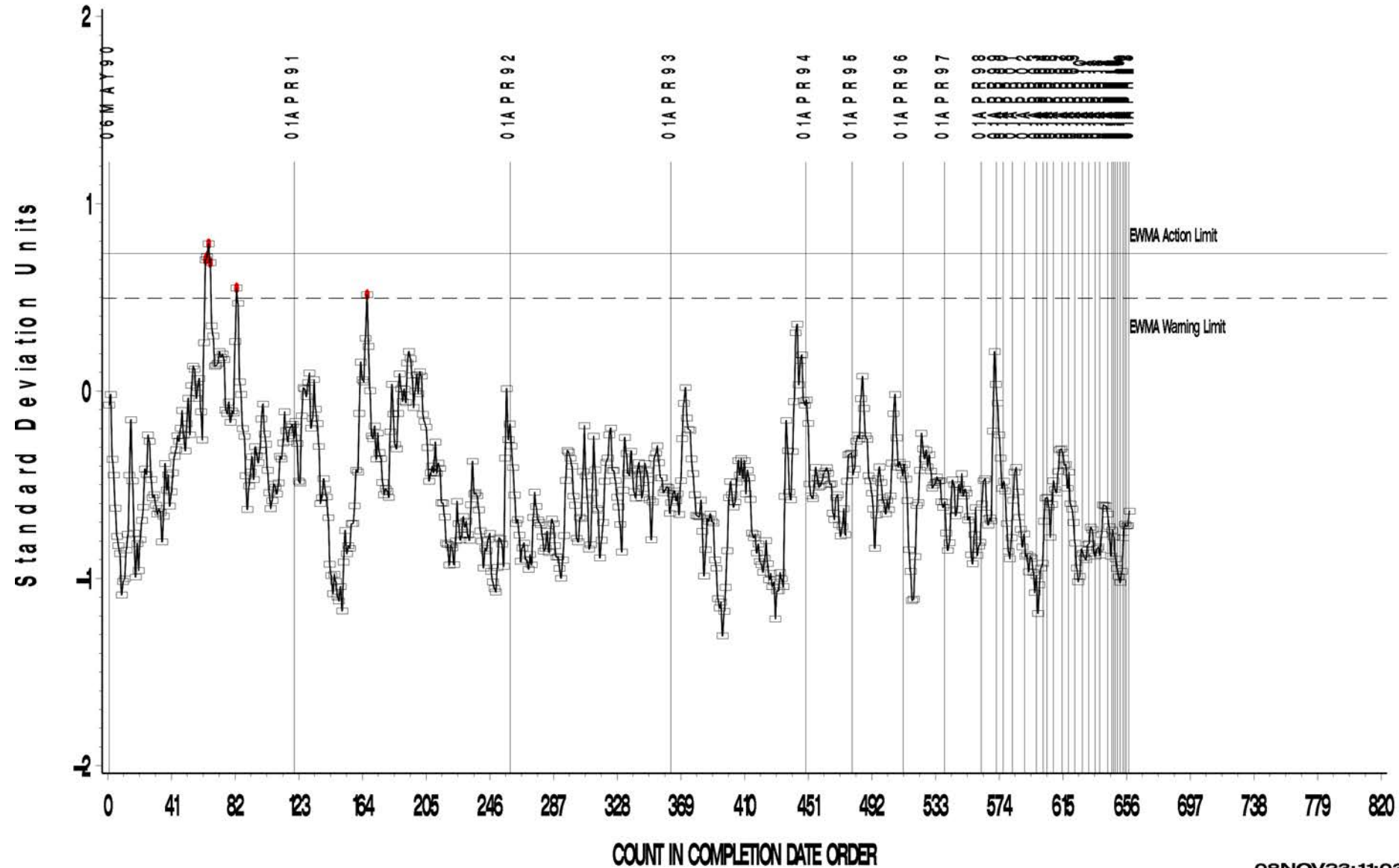
FINAL BSOC

LTMS Severity Analysis



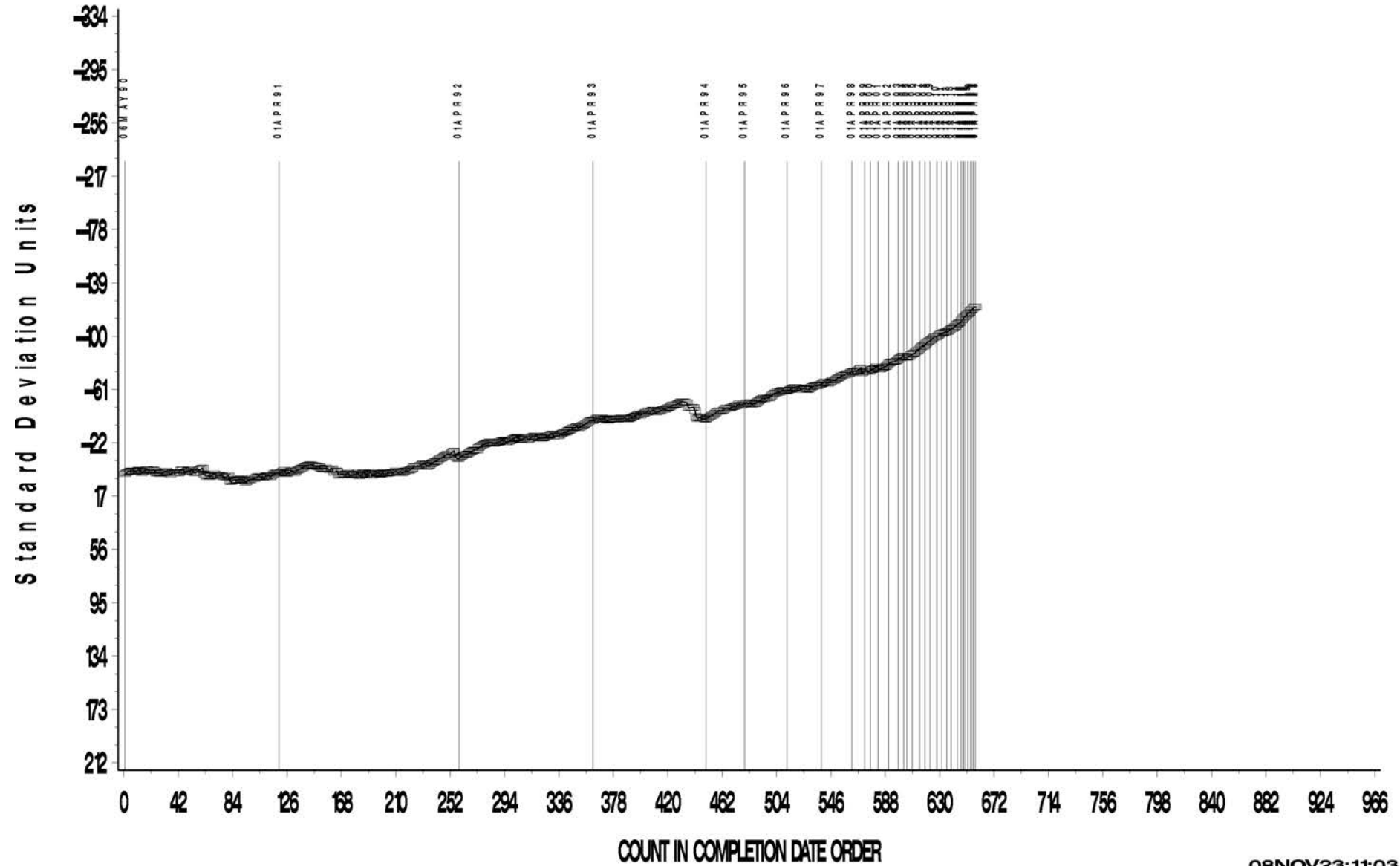
FINAL BSOC

LTMS Precision Analysis



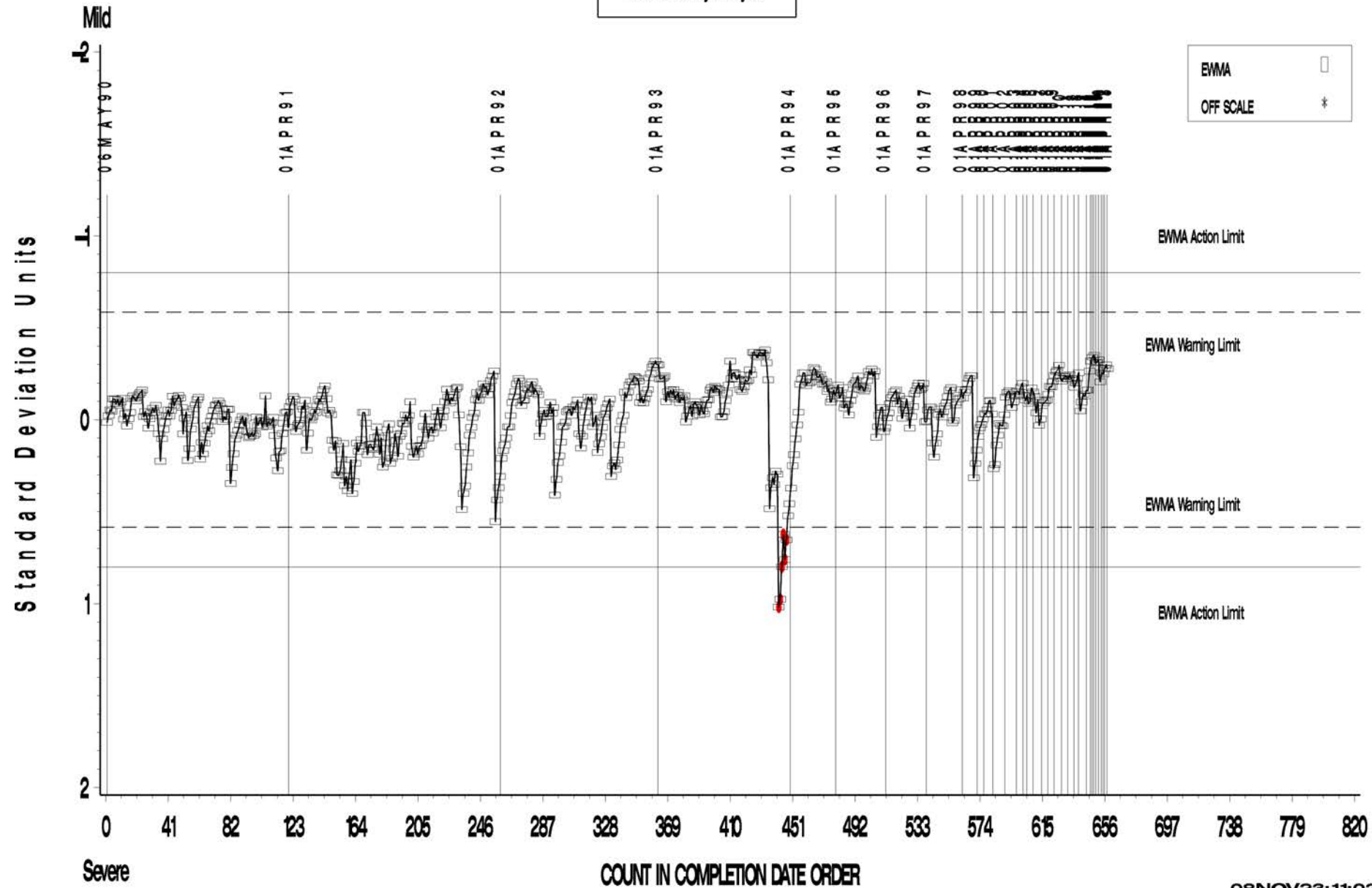
FINAL BSOC

CUSUM Severity Analysis



FINAL EOTOC

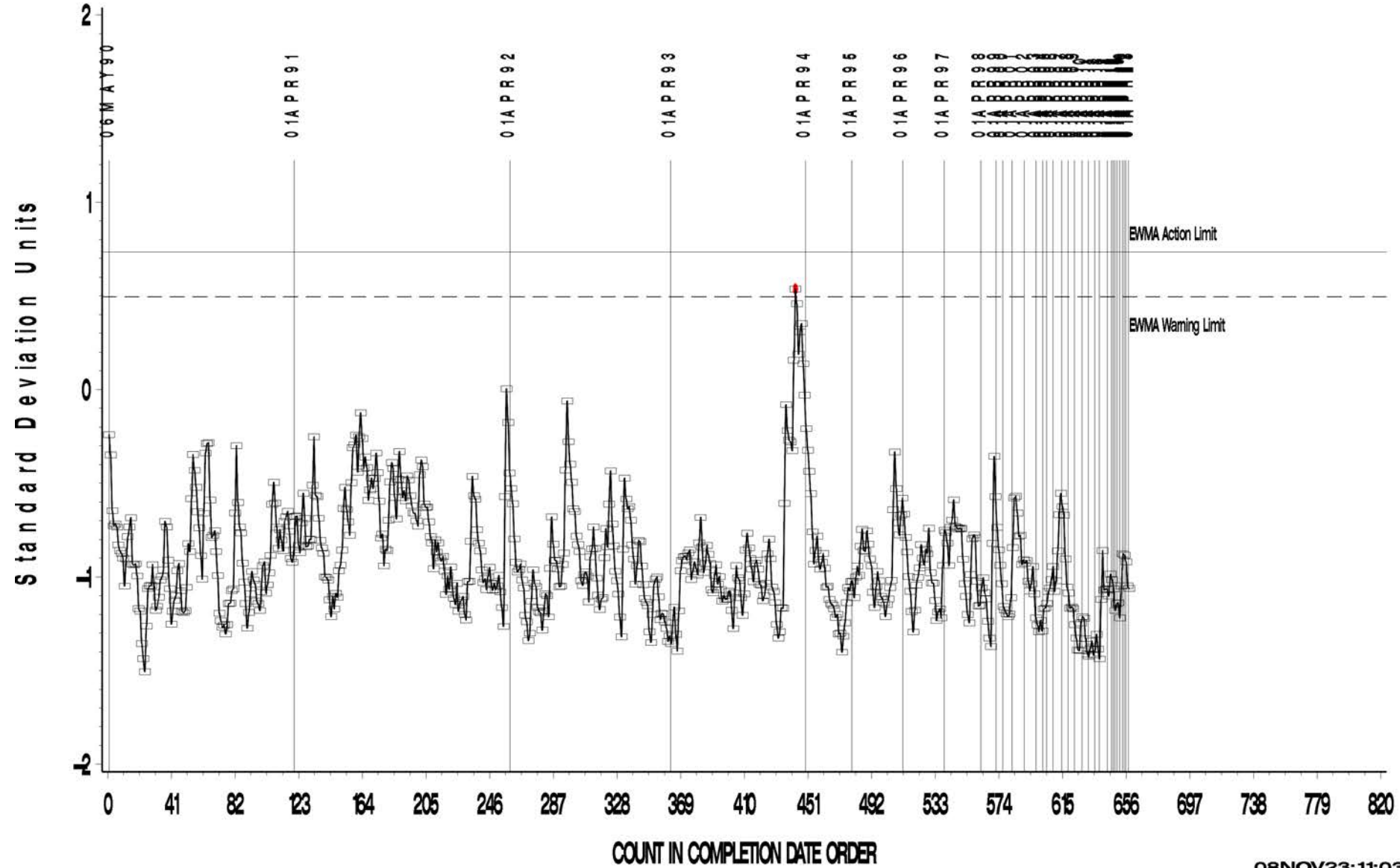
LTMS Severity Analysis





FINAL EOTOC

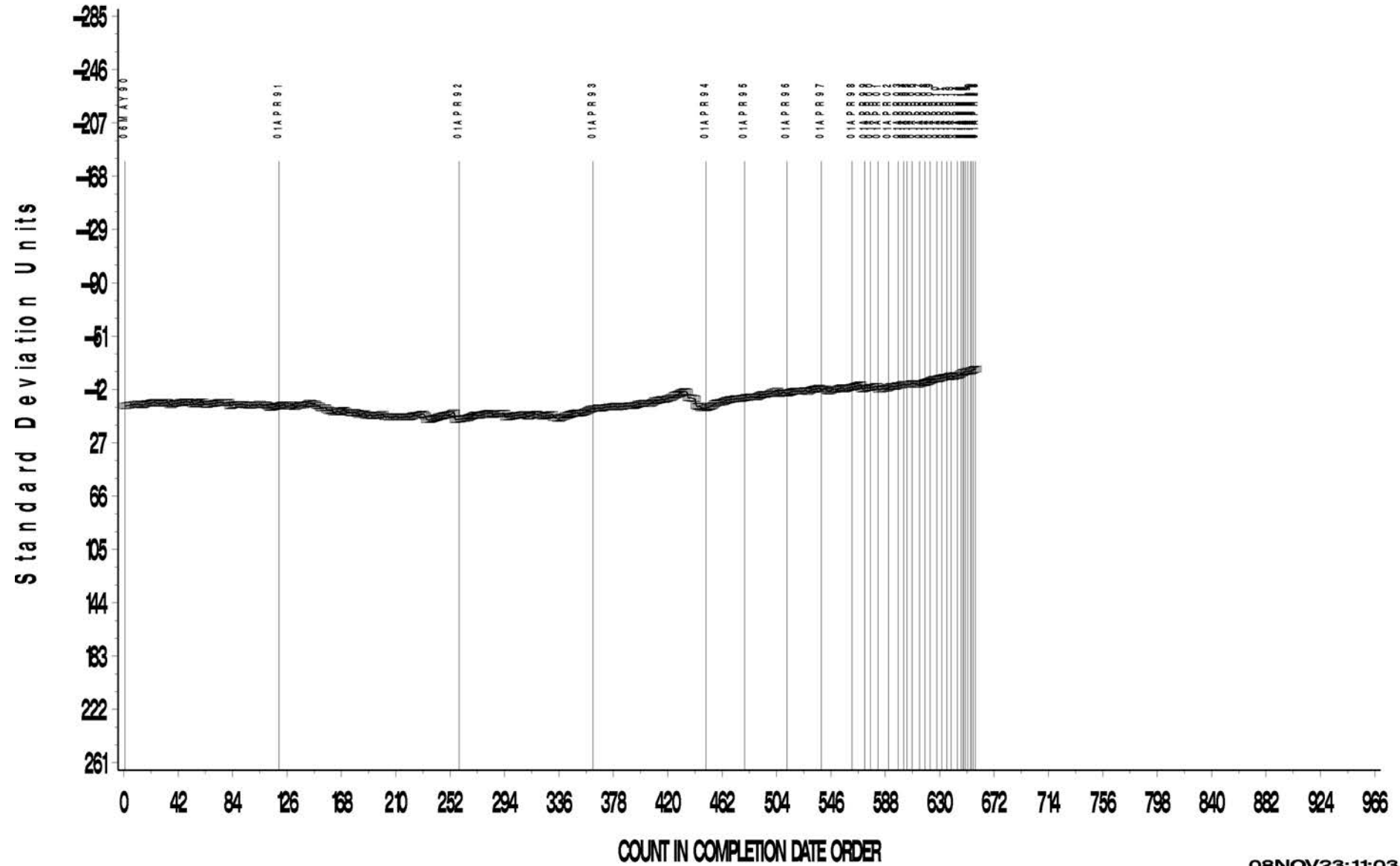
LTMS Precision Analysis



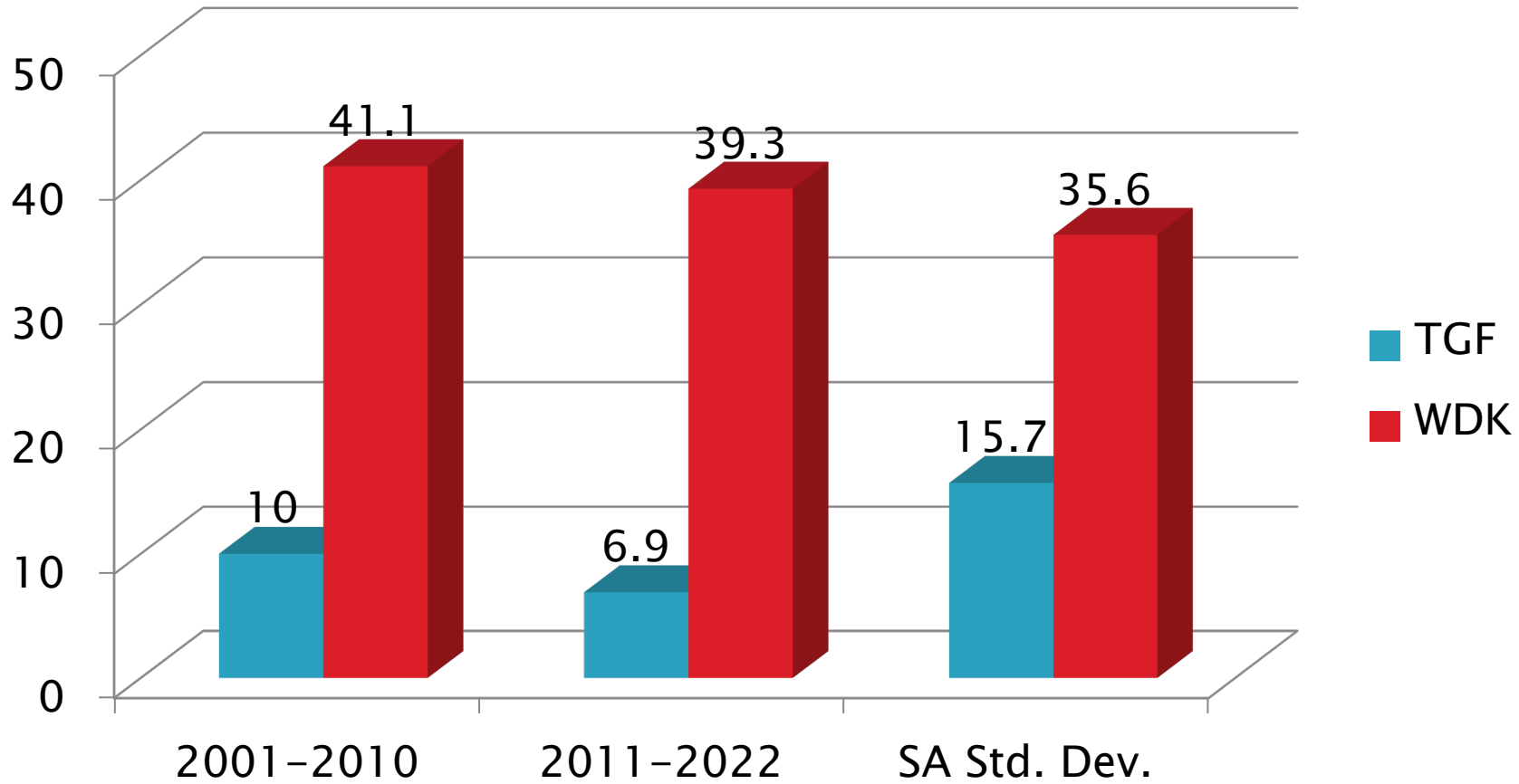


### FINAL EOTOC

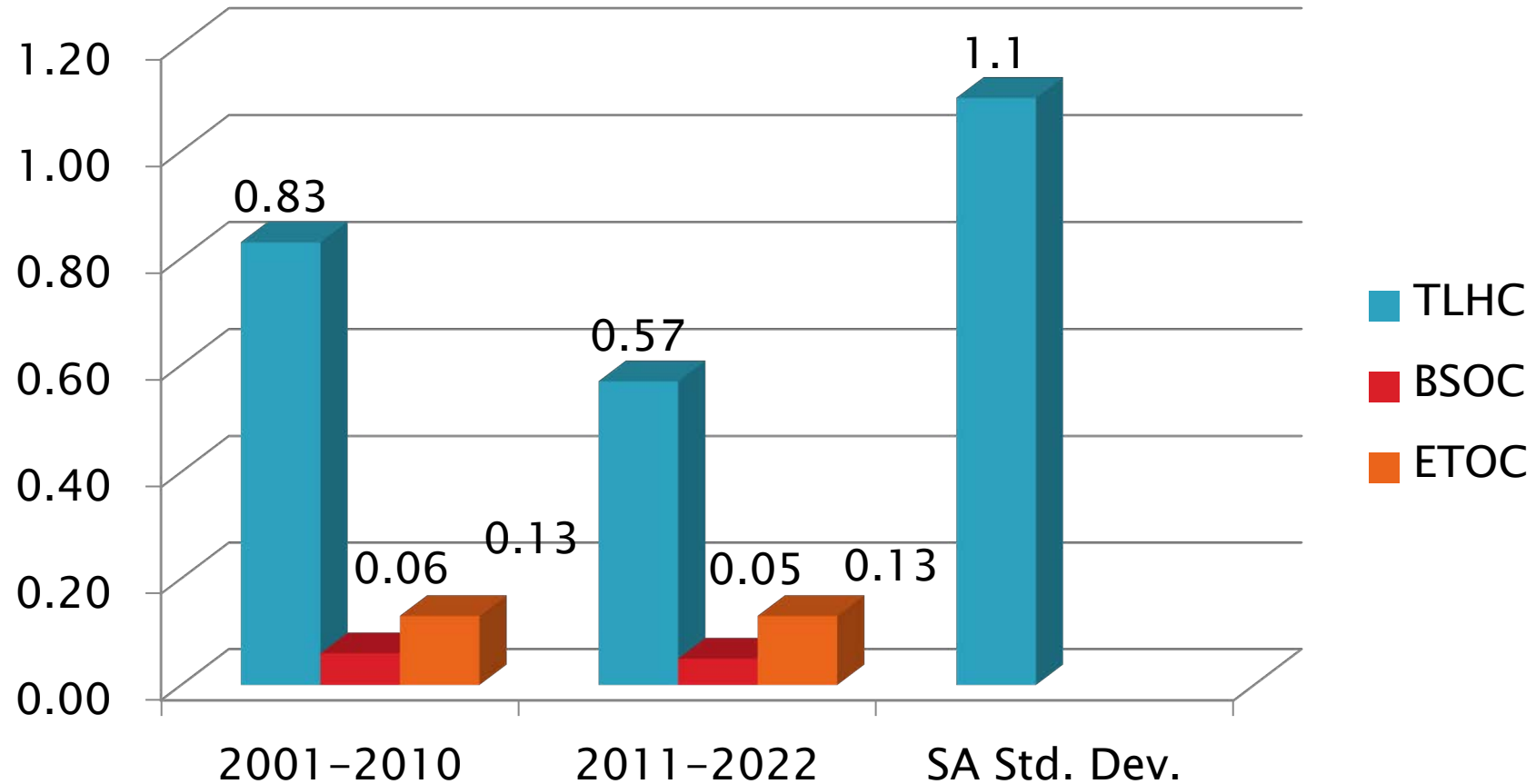
CUSUM Severity Analysis



# 1 K Precision Estimates



# 1 K Precision Estimates



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# SCOTE 1 N

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# 1 N Test Activity

Test Status	Validity Code	#
Acceptable Calibration Test	AC	2
Failed Calibration Test	OC	0
Operationally Invalid	LC	1
Aborted	XC	1
Informational	NN	0
<b>Total</b>		<b>4</b>

# 1 N Failed Tests

Failed Parameter	Number of Tests
TGF Severe	1
<b>Total</b>	<b>1</b>

# 1 N Lost Tests\*

Status	Cause	#
Invalid	No invalid tests	0
Aborted	Scuffed during break-in	1
<b>Total</b>		<b>1</b>

\*Invalid and aborted tests

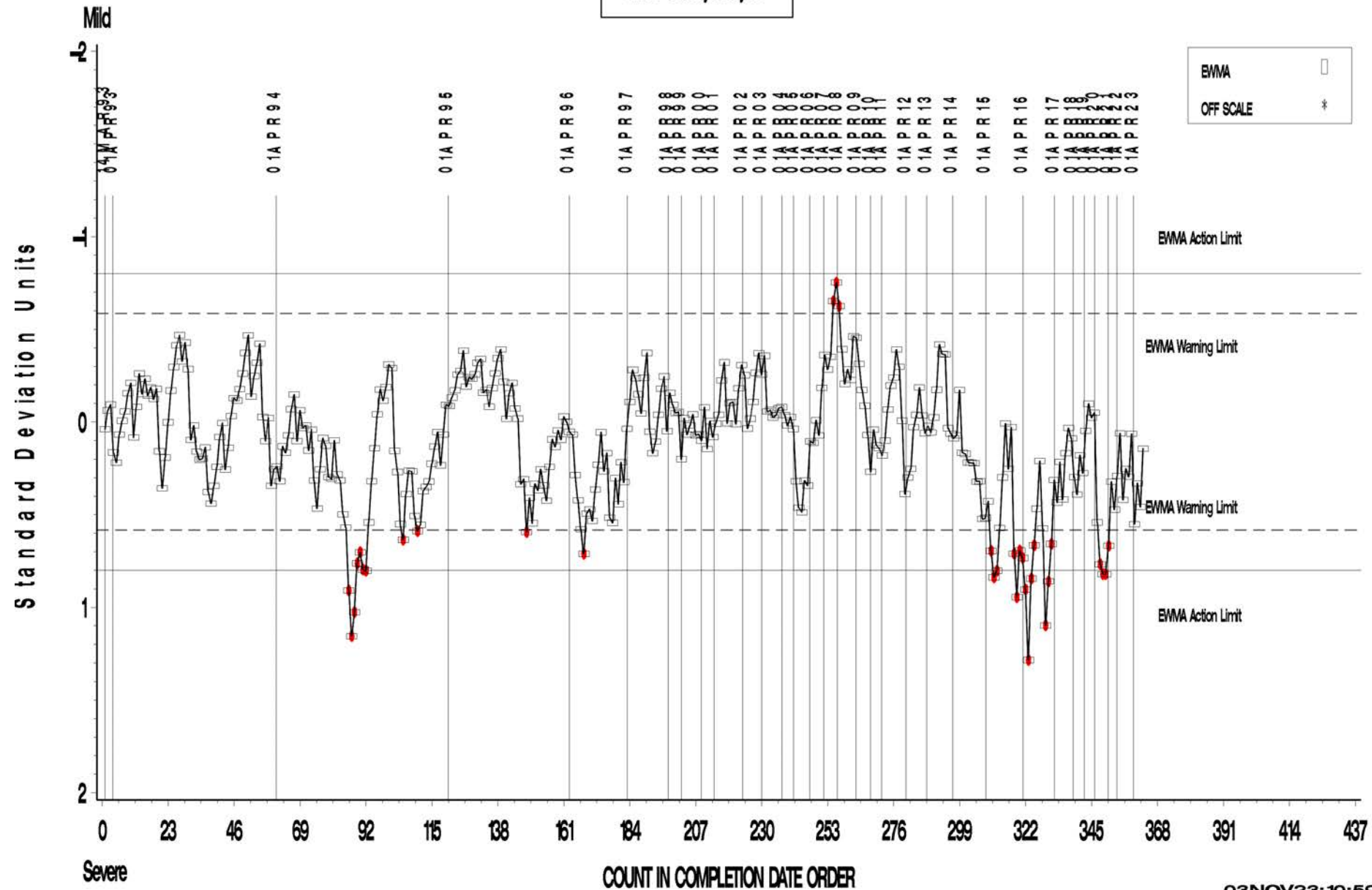


# 1 N Test Severity

- ▶ TLHC and BSOC are in control
- ▶ TGF is in precision action alarm
- ▶ WTD is in severity warning alarm in mild direction

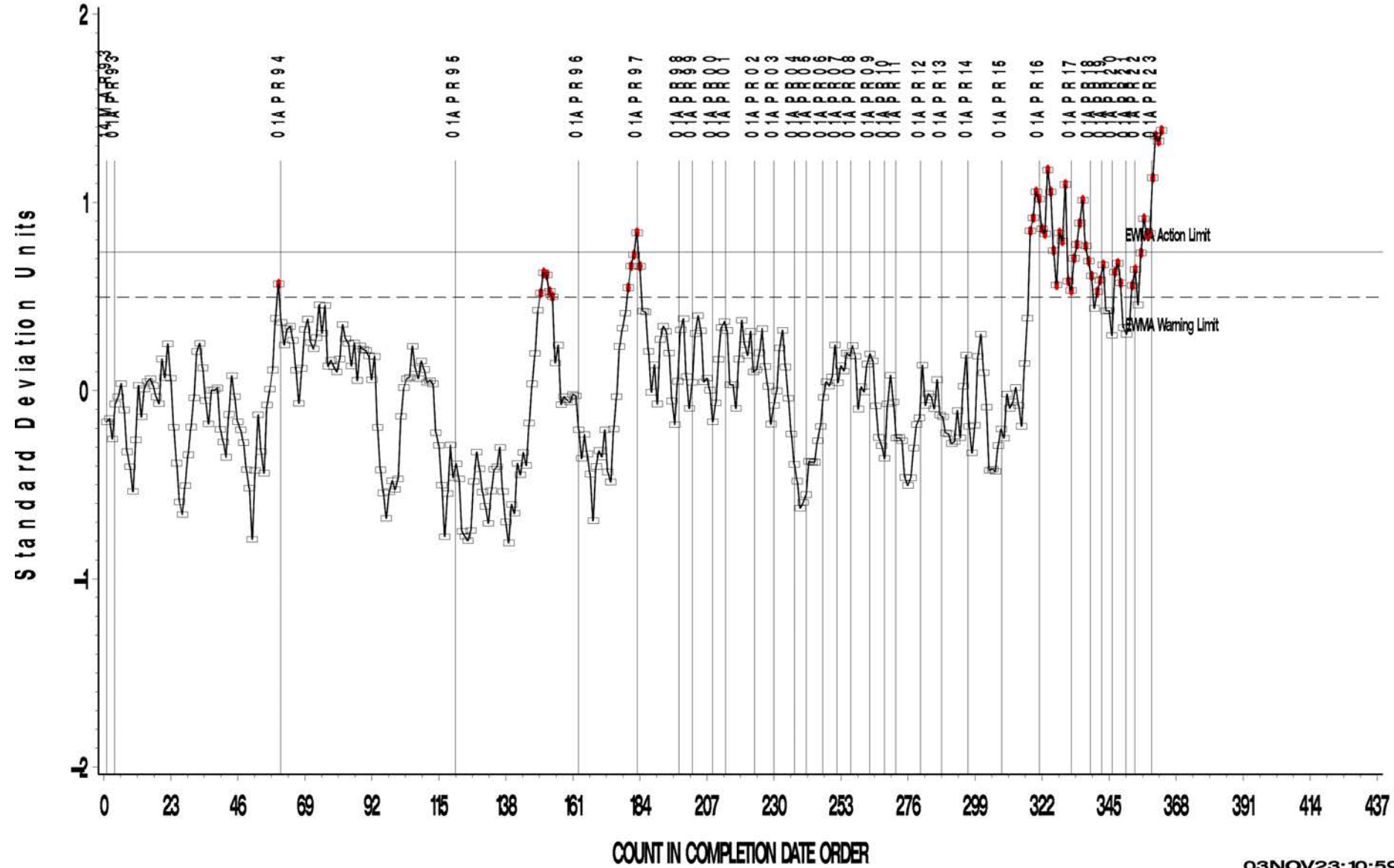
FINAL CORRECTED TGF

LTMS Severity Analysis



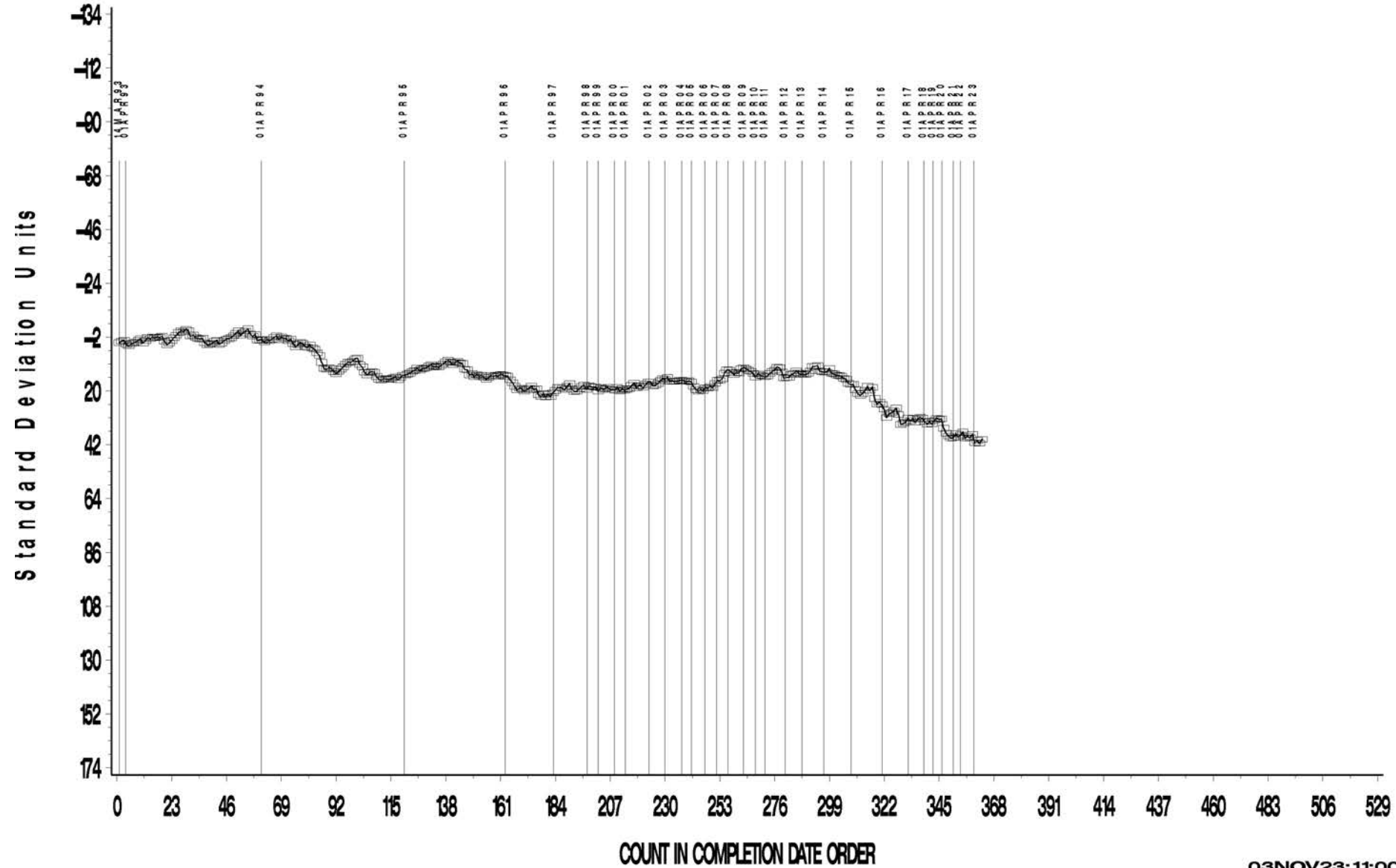
FINAL CORRECTED TGF

LTMS Precision Analysis



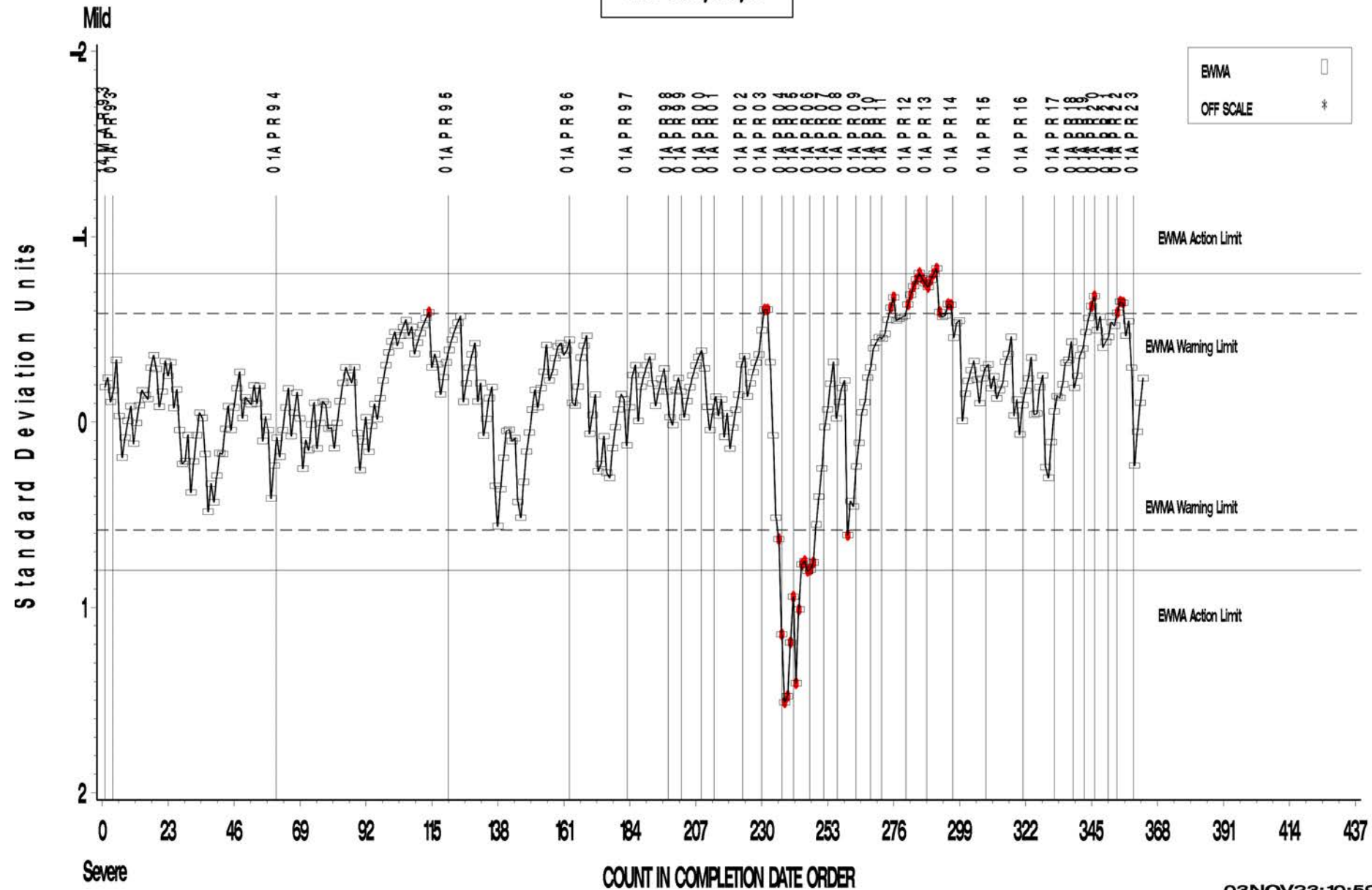
FINAL CORRECTED TGF

CUSUM Severity Analysis



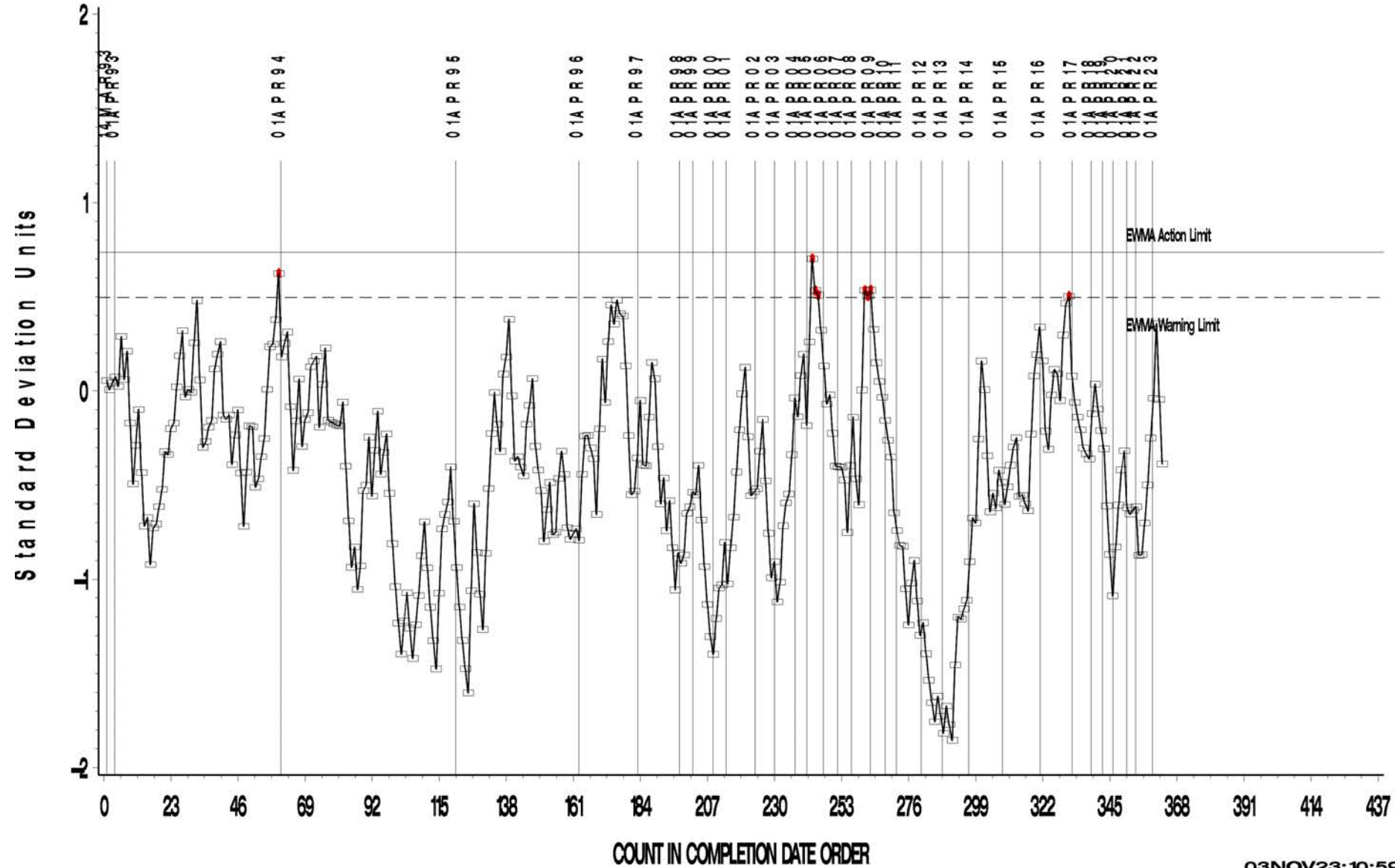
Top Land Heavy Carbon

LTMS Severity Analysis



Top Land Heavy Carbon

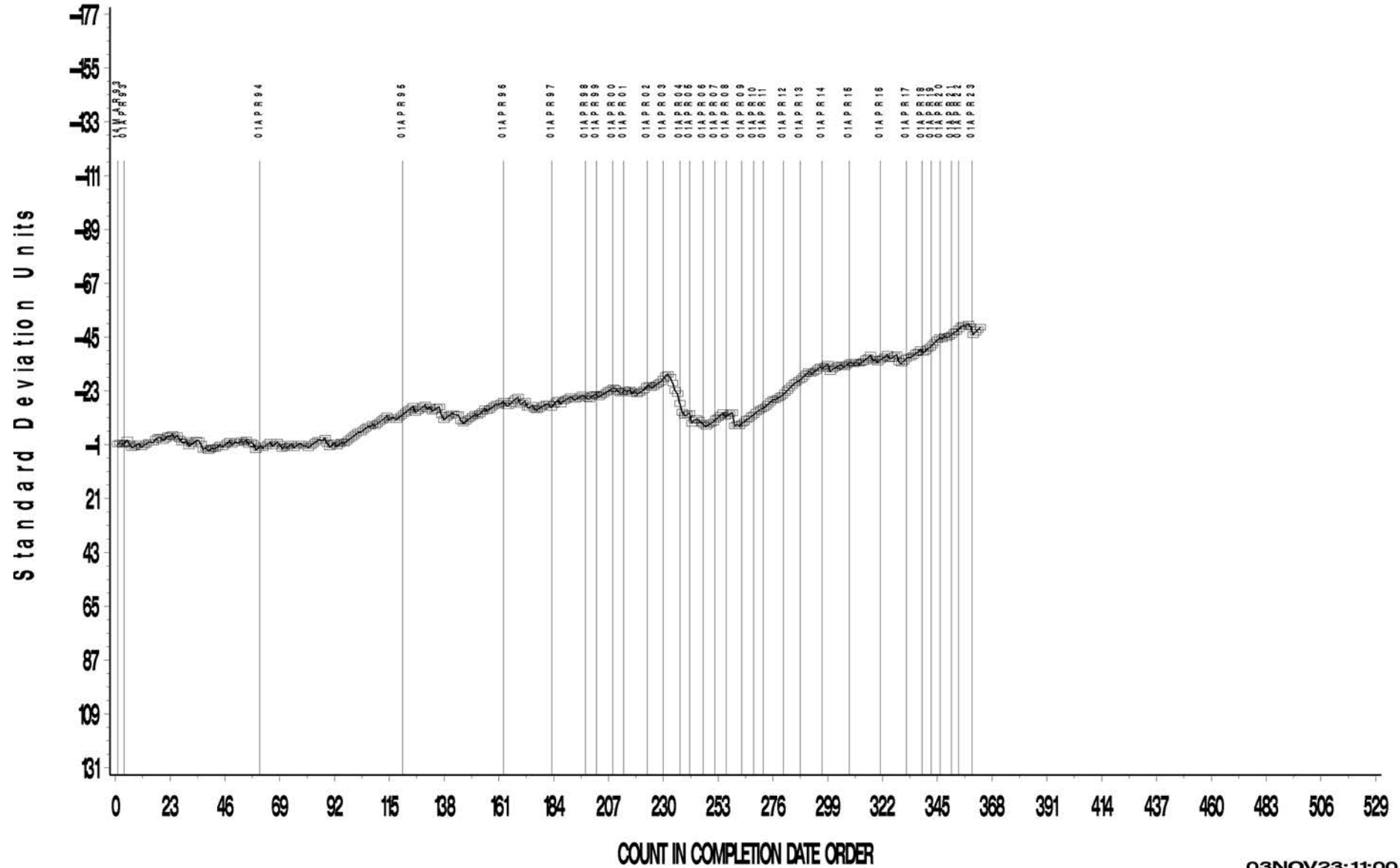
LTMS Precision Analysis





### Top Land Heavy Carbon

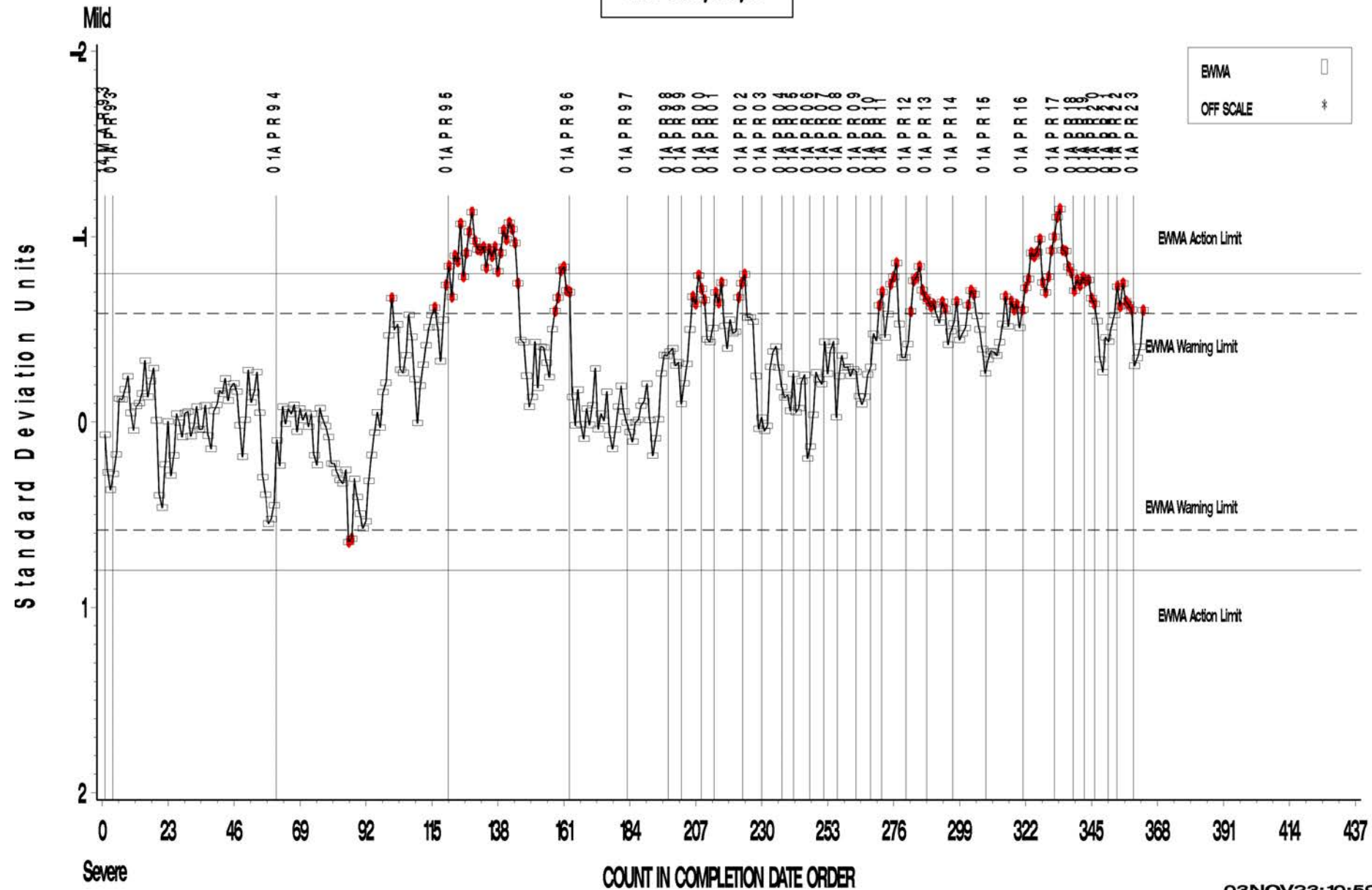
CUSUM Severity Analysis





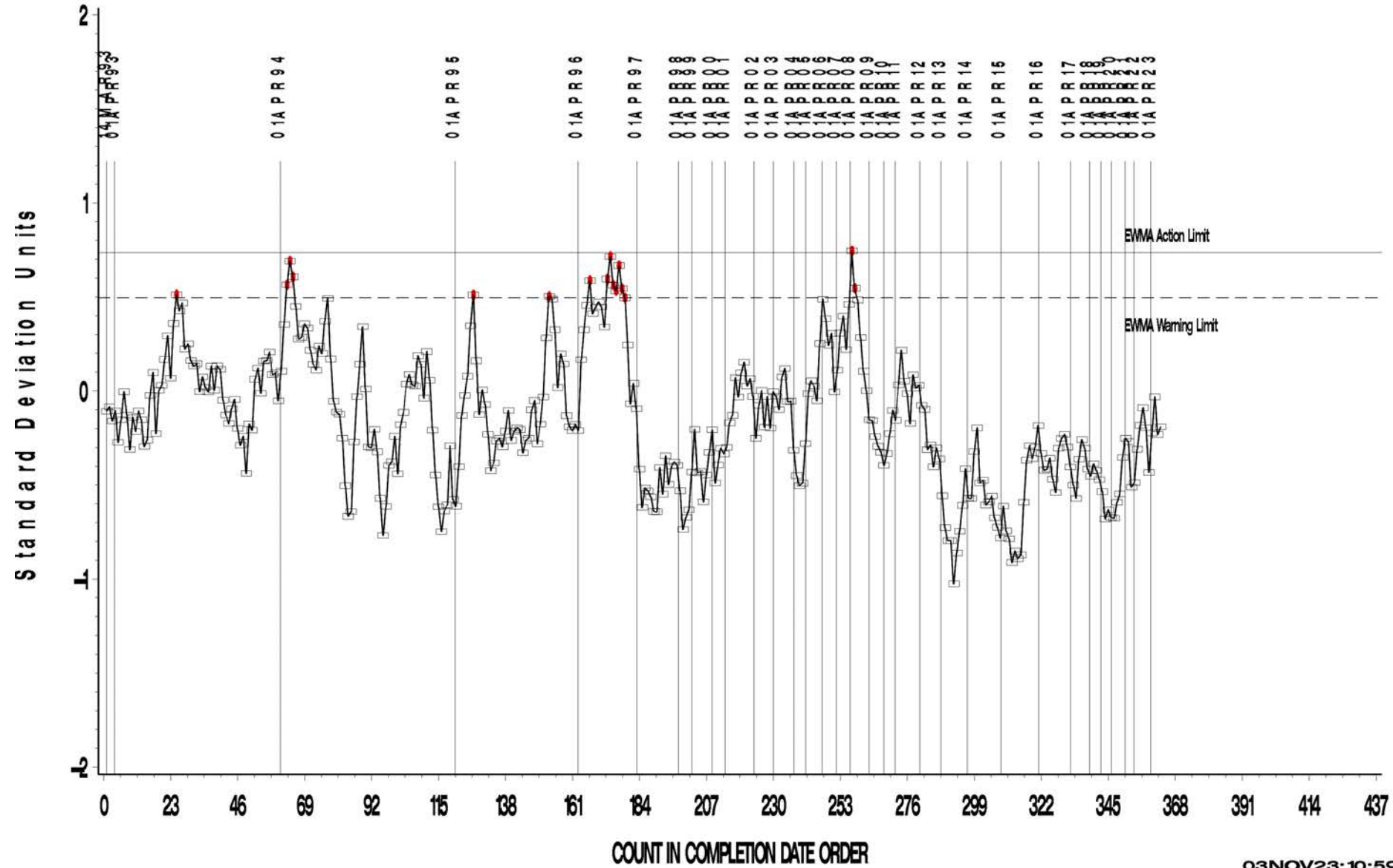
Weighted Total Demerits

LTMS Severity Analysis



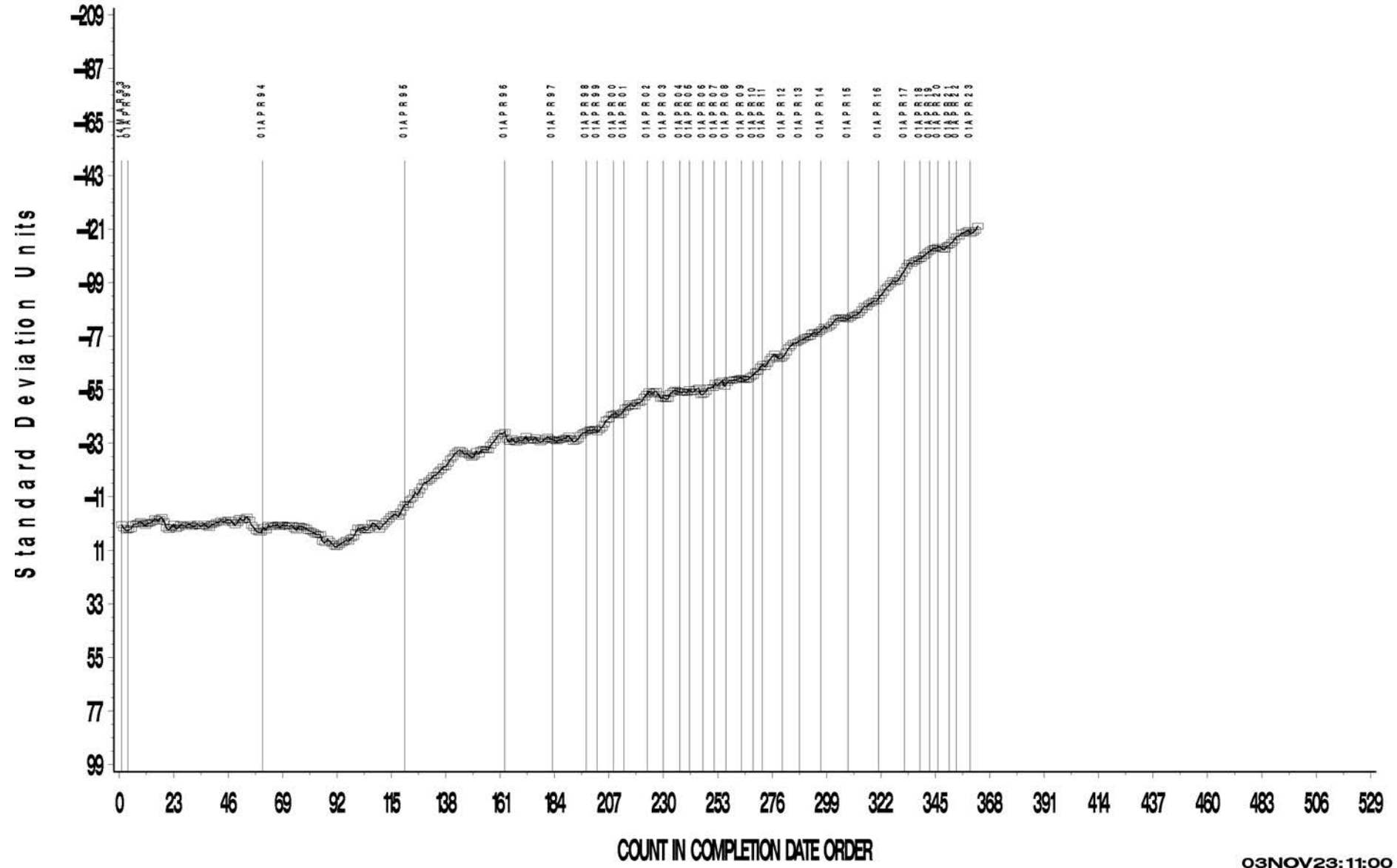
### Weighted Total Demerits

LTMS Precision Analysis



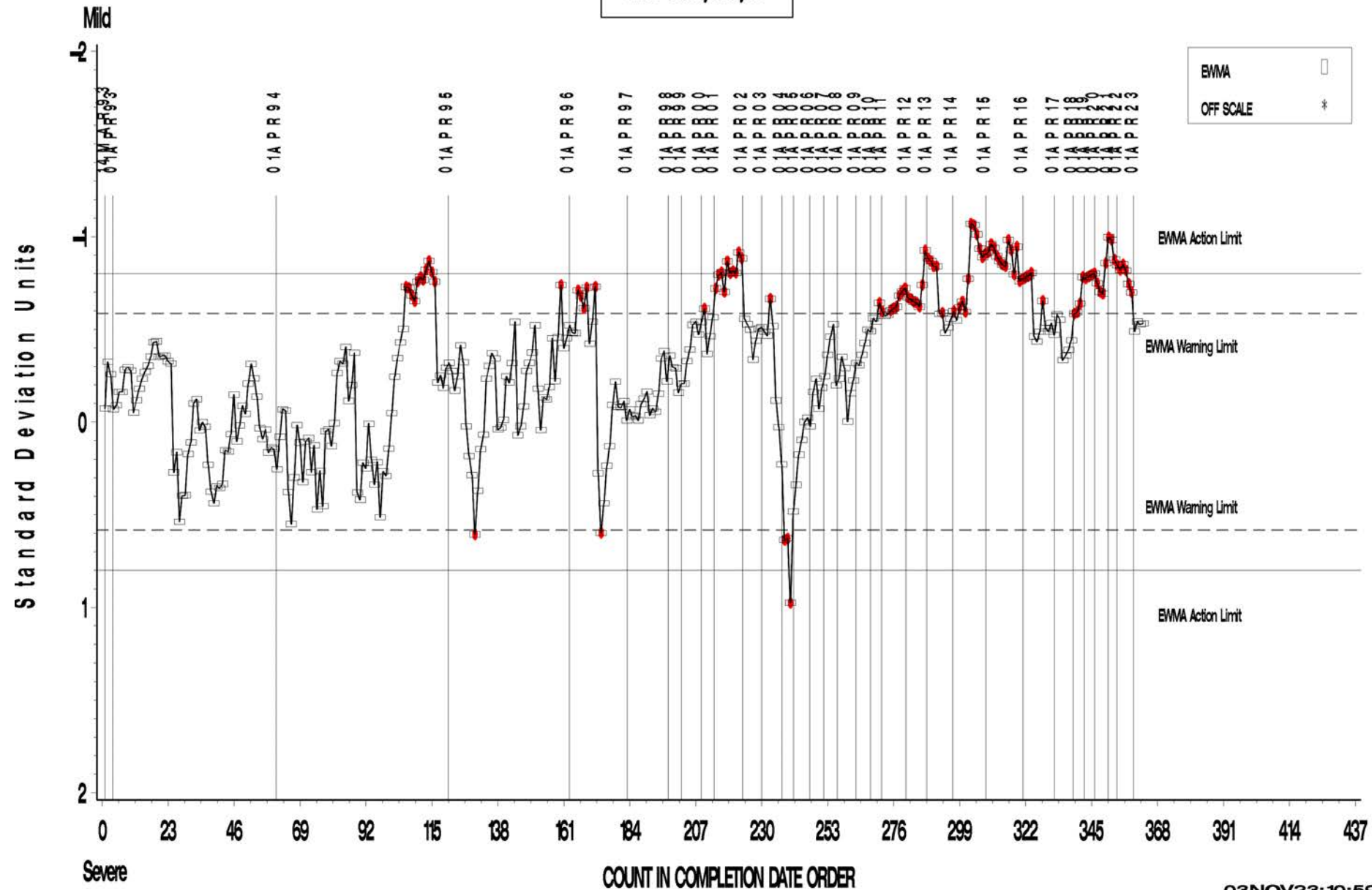
### Weighted Total Demerits

CUSUM Severity Analysis



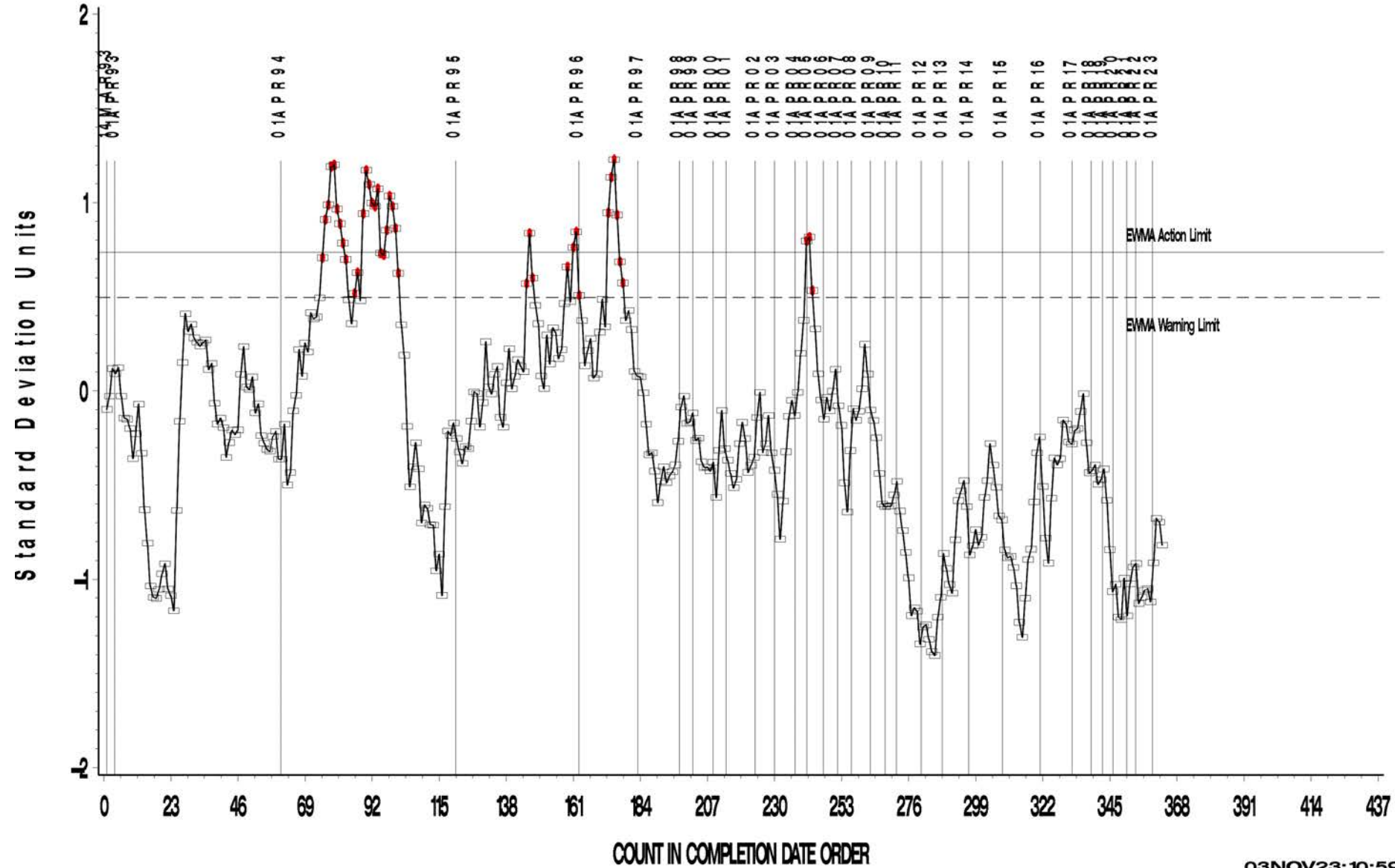
BSOC

LTMS Severity Analysis



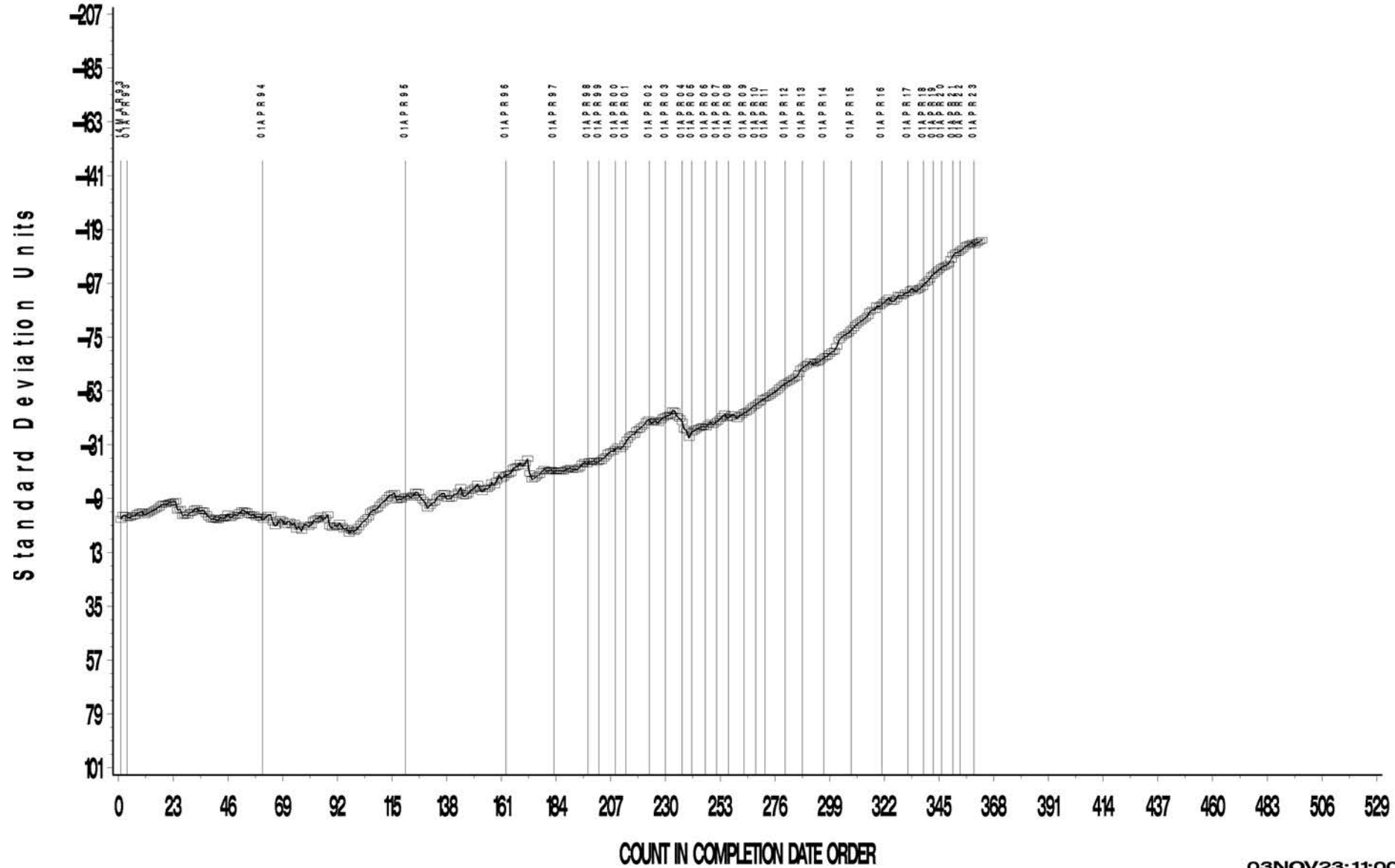
BSOC

LTMS Precision Analysis



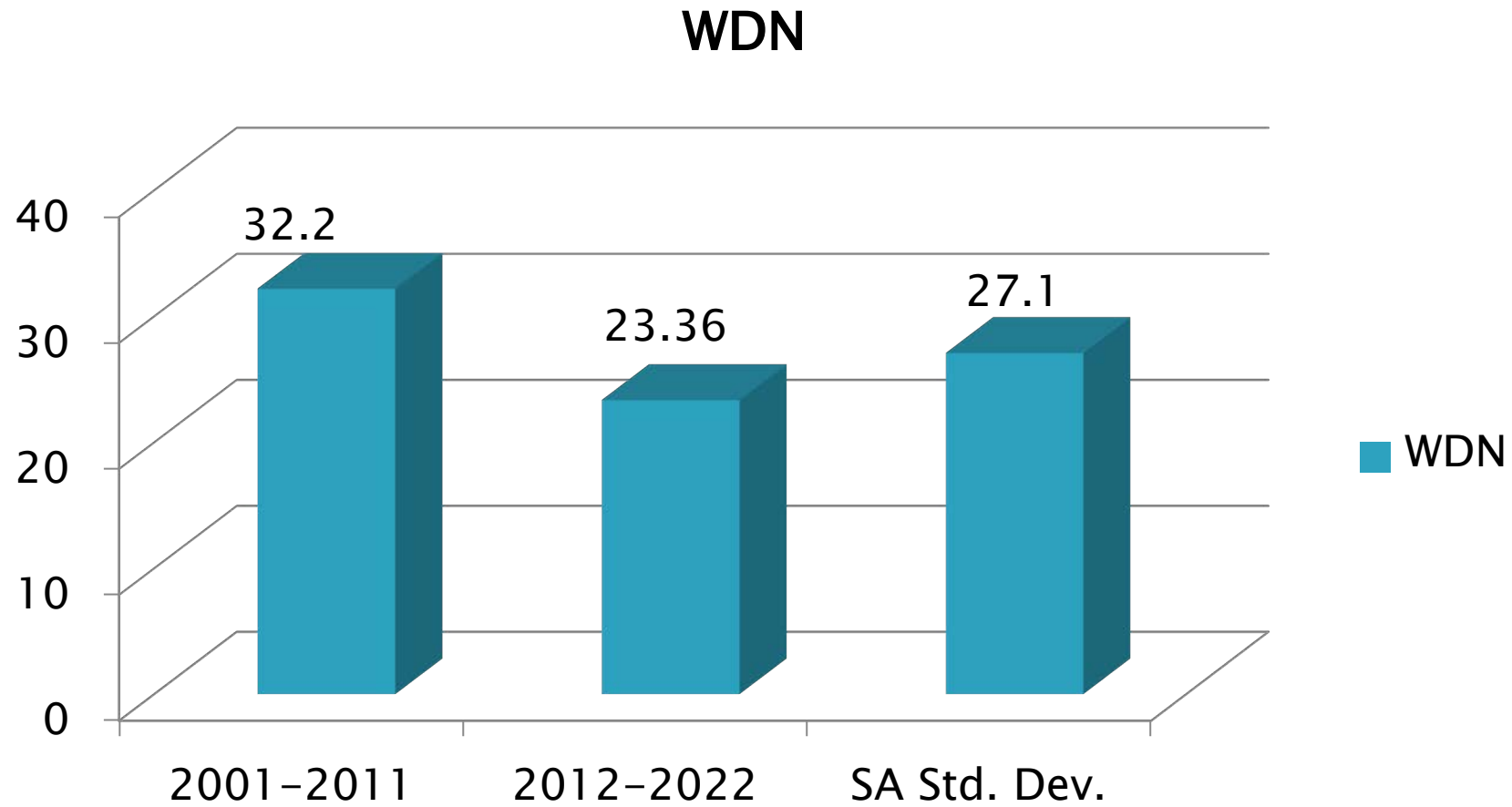
BSOC

CUSUM Severity Analysis



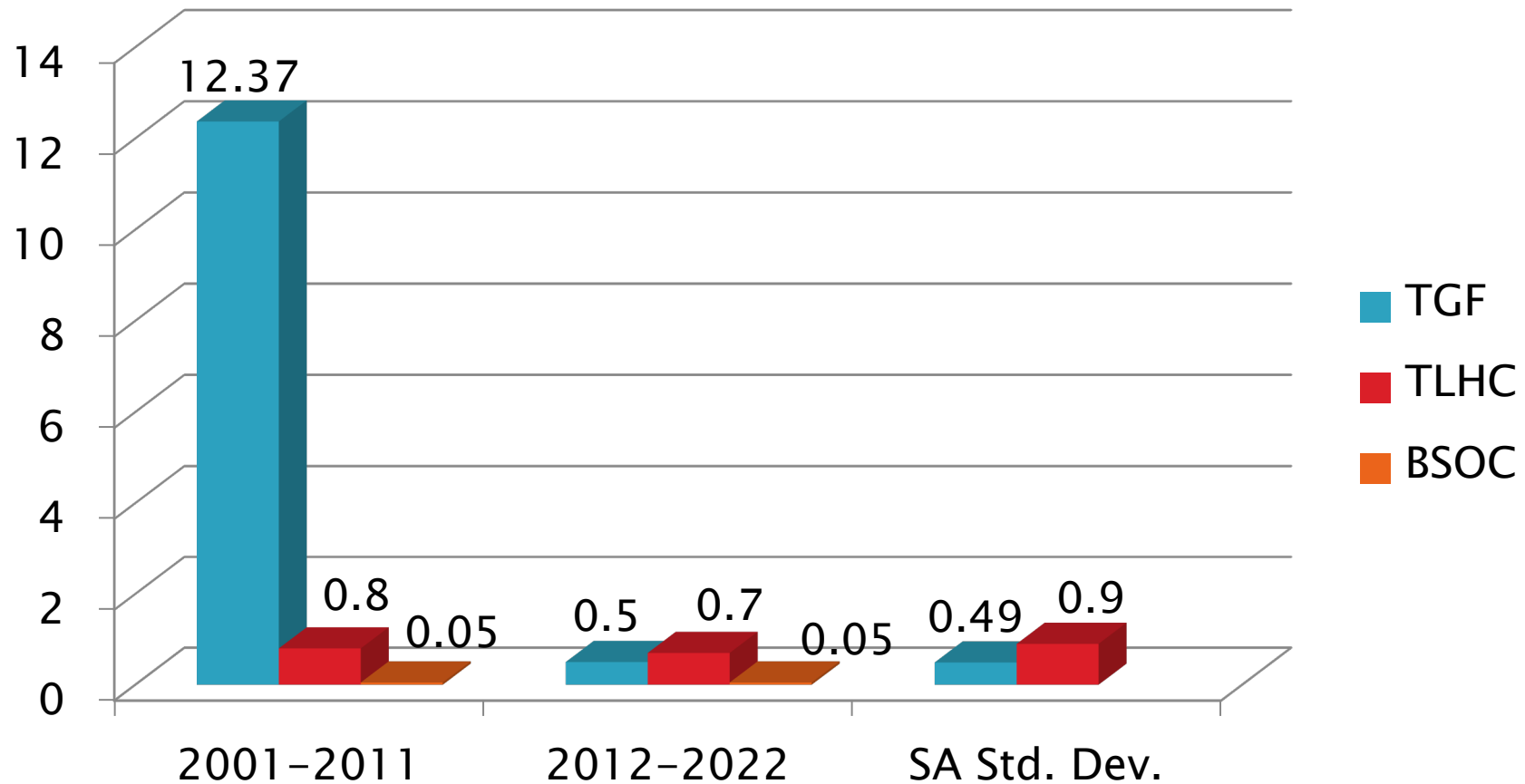


# 1 N Precision Estimates





# 1 N Precision Estimates



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# SCOTE 1 P

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# 1 P Test Activity

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

# 1 P Failed Tests

Failed Parameter	Number of Tests
No failed tests	0
<b>Total</b>	<b>0</b>

# 1P Lost Tests\*

Status	Cause	#
Invalid	No invalid tests	0
Aborted	No aborted tests	0
<b>Total</b>		<b>0</b>

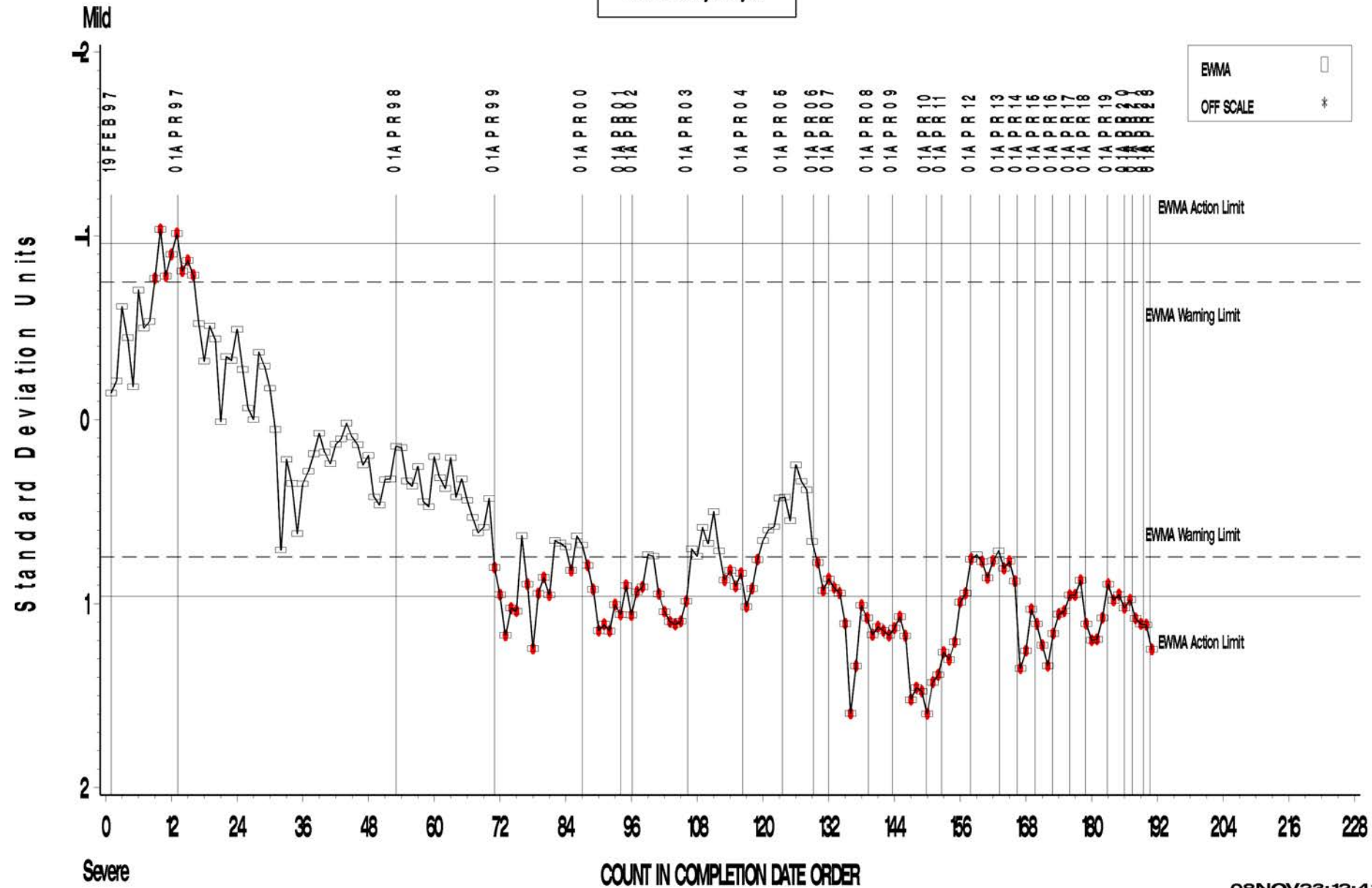
\*Invalid and aborted tests

# 1 P Test Severity

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

EOTOC

LTMS Severity Analysis

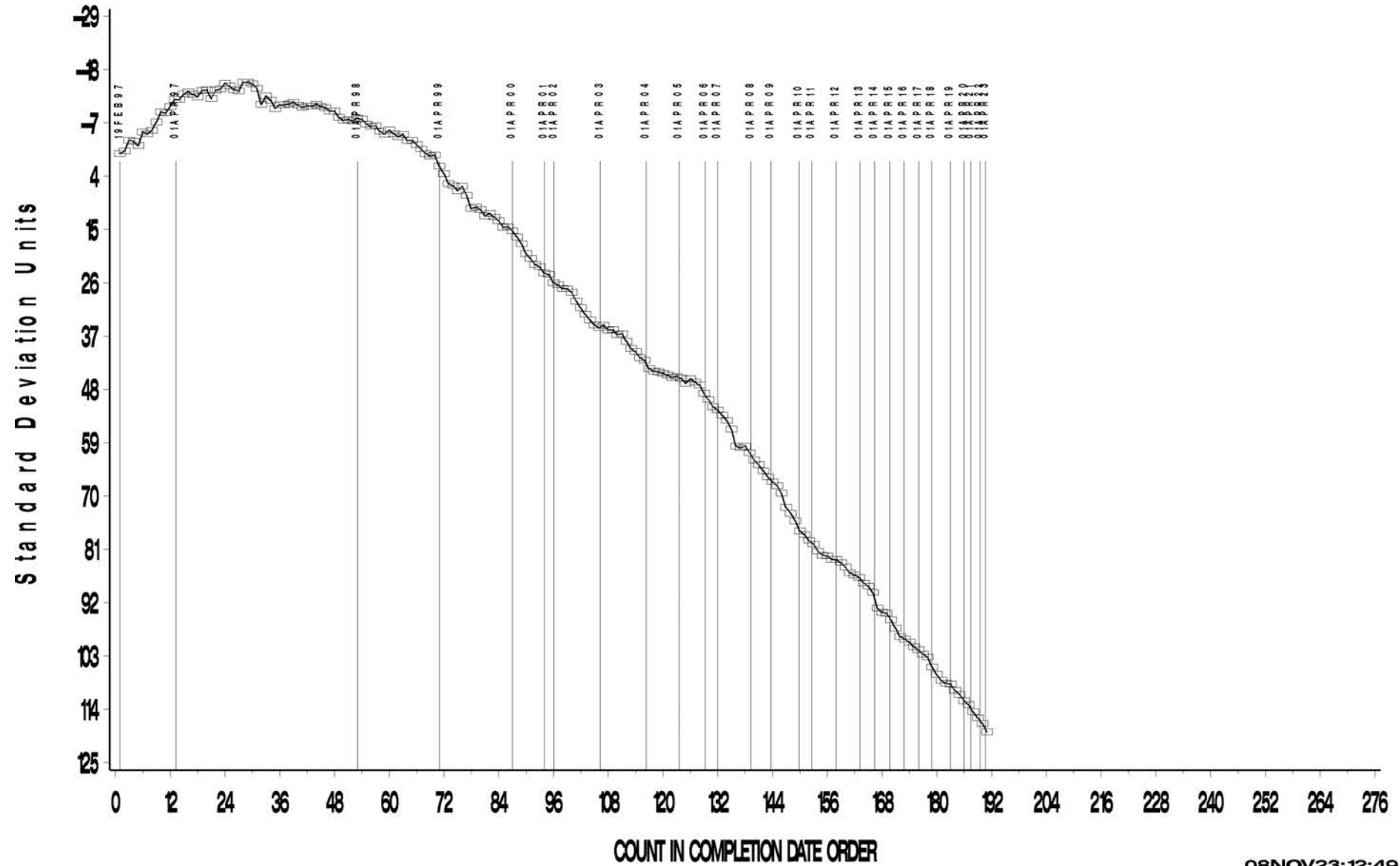






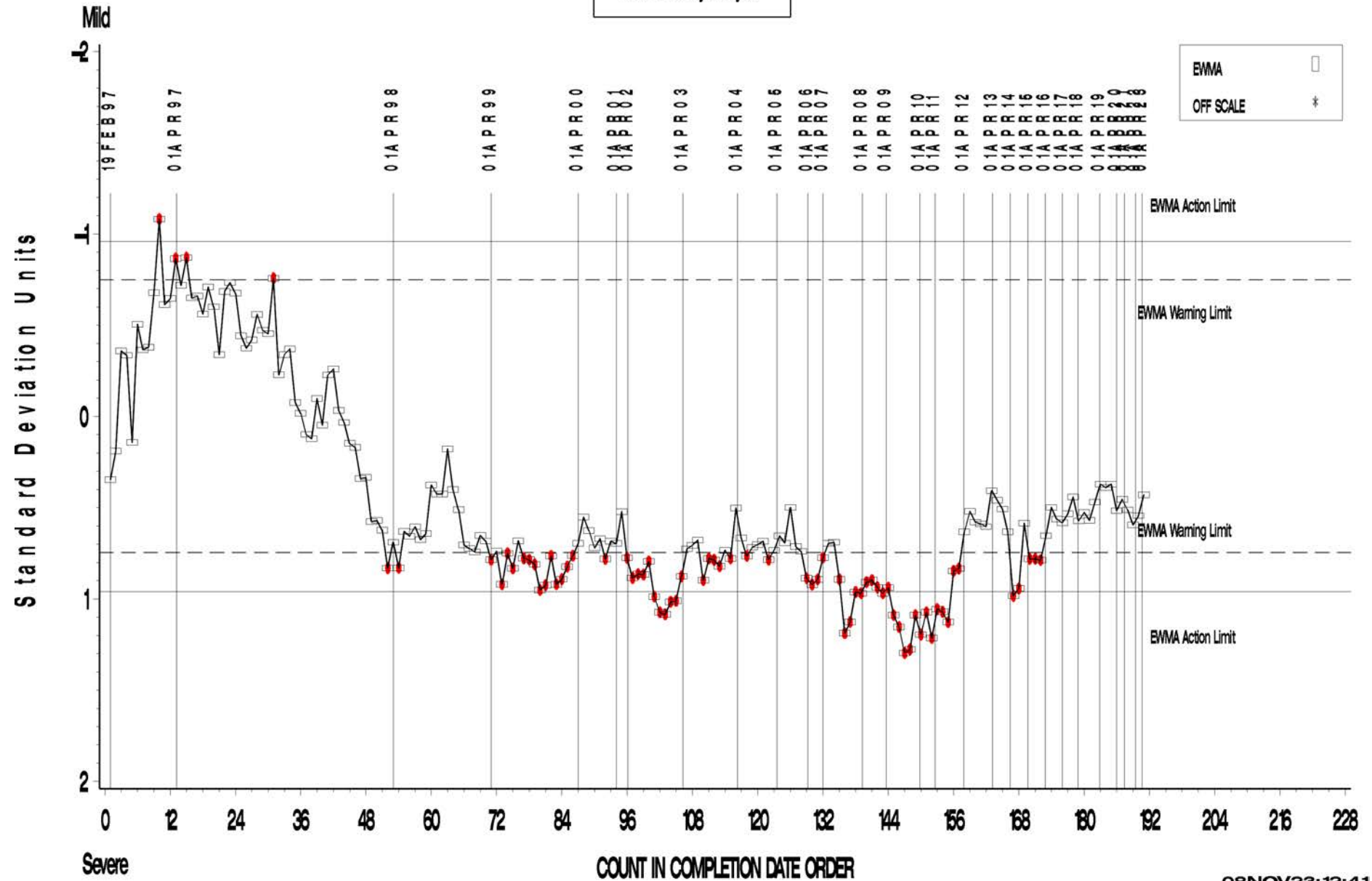
EOTOC

CUSUM Severity Analysis



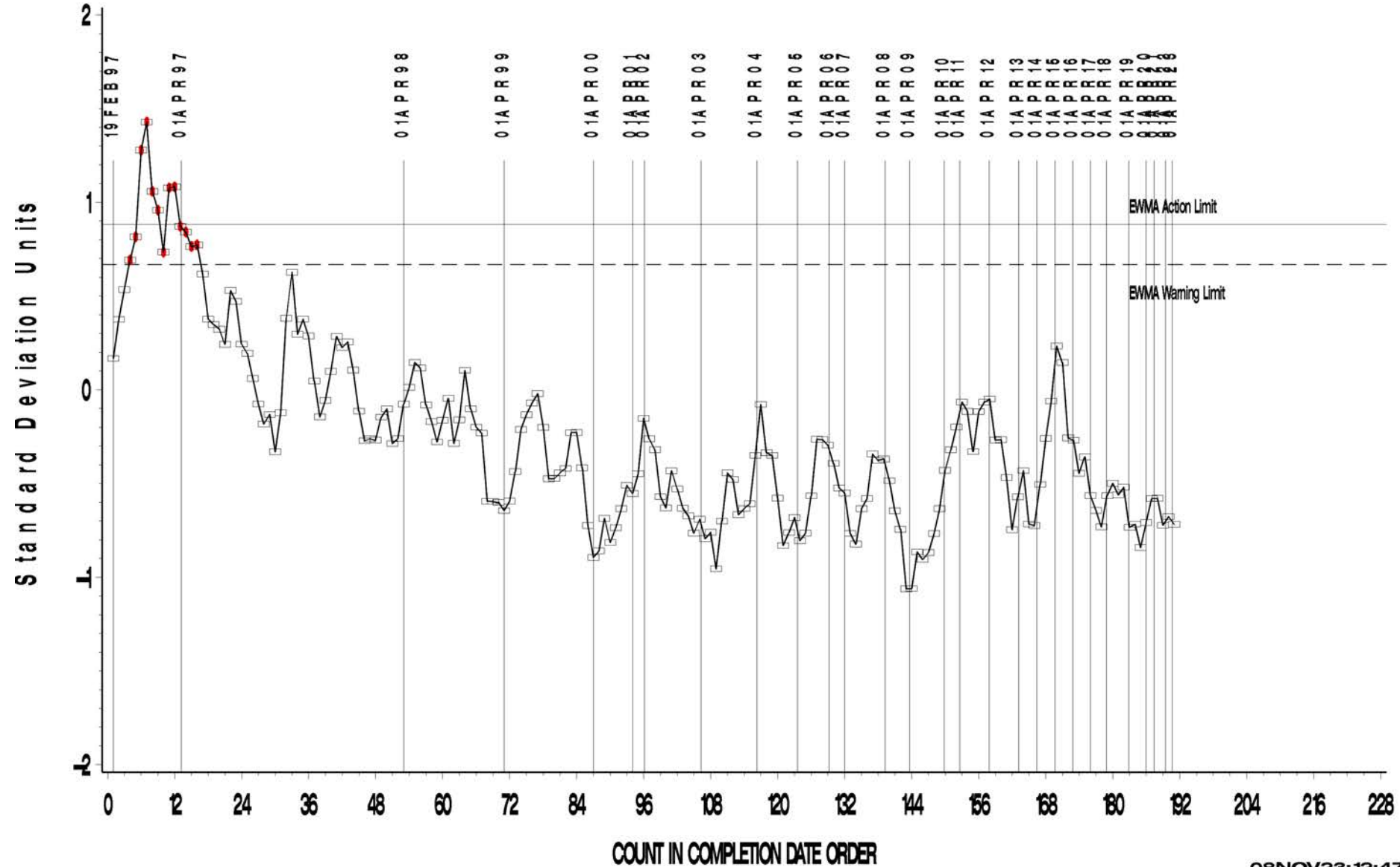
OIL CONSUMPTION

LTMS Severity Analysis



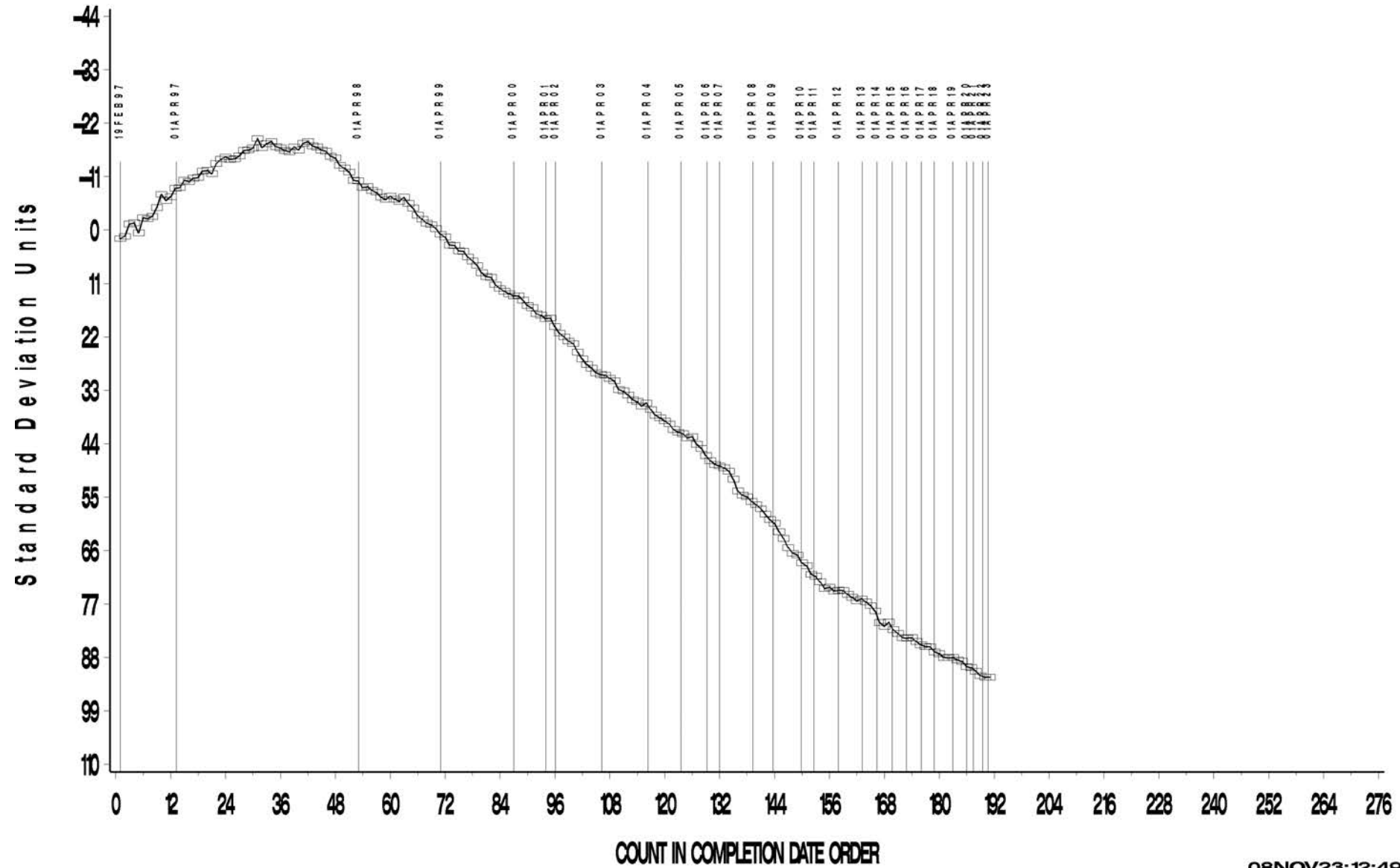
OIL CONSUMPTION

LTMS Precision Analysis



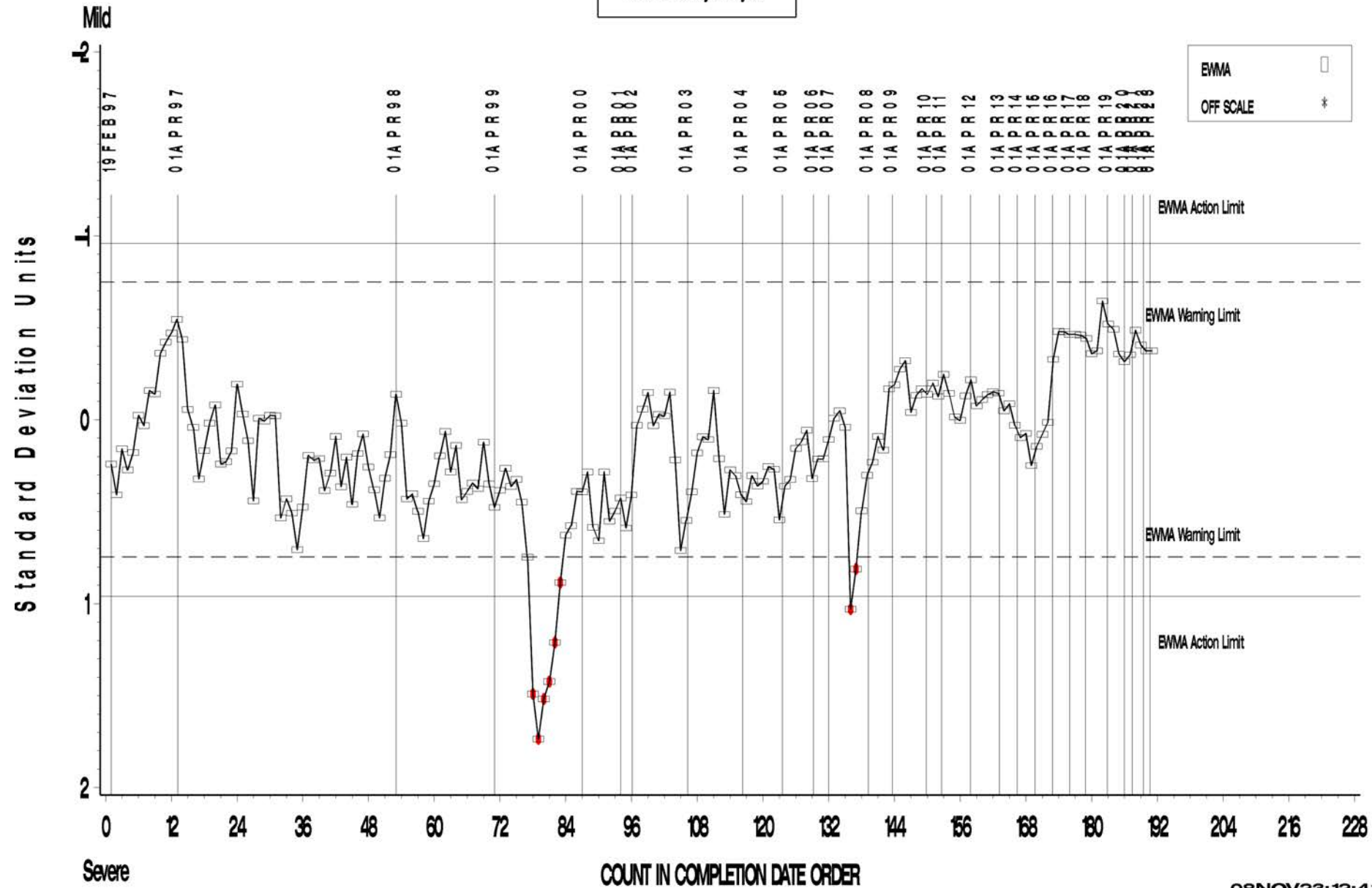
### OIL CONSUMPTION

CUSUM Severity Analysis



TOP GROOVE CARBON

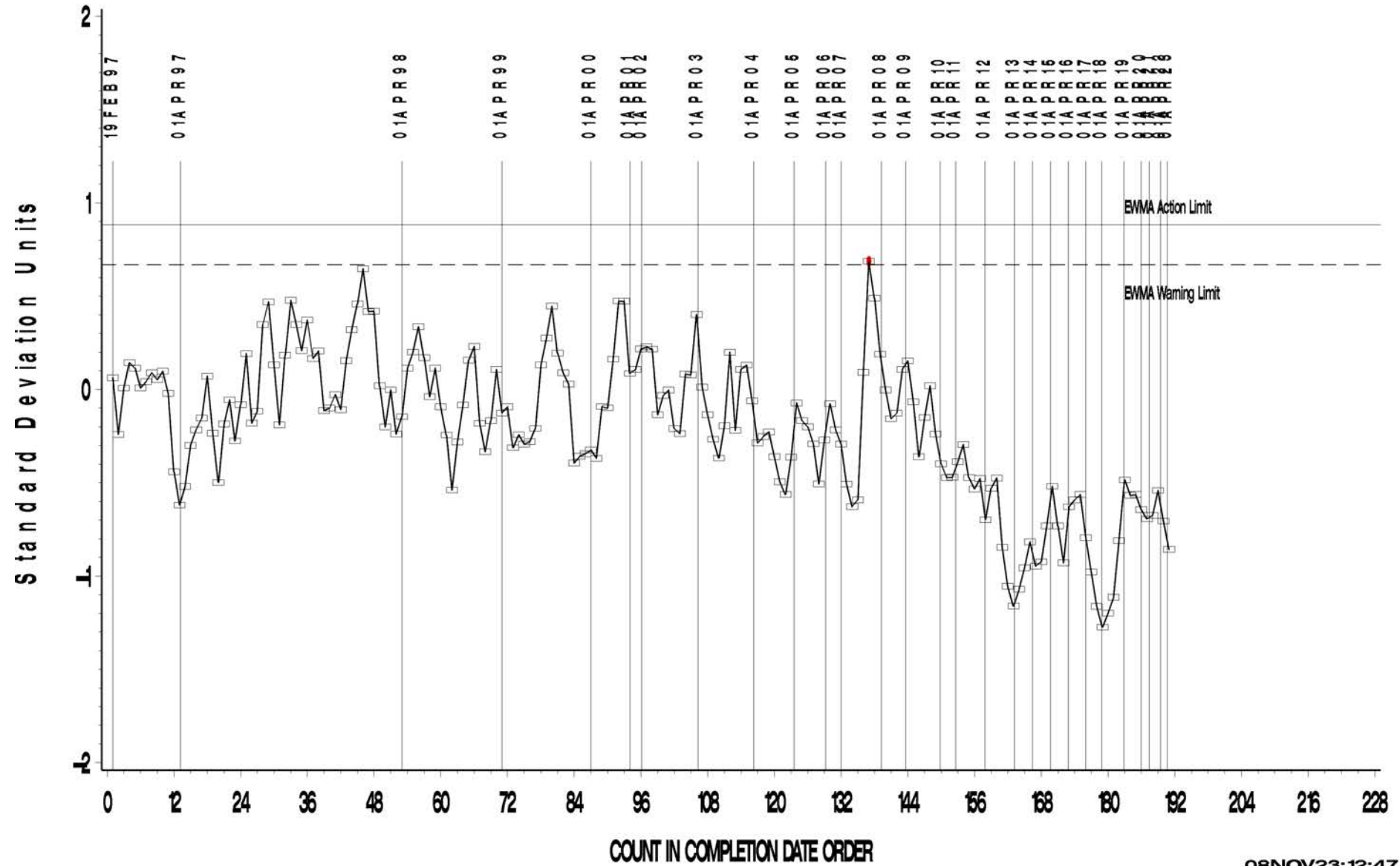
LTMS Severity Analysis





TOP GROOVE CARBON

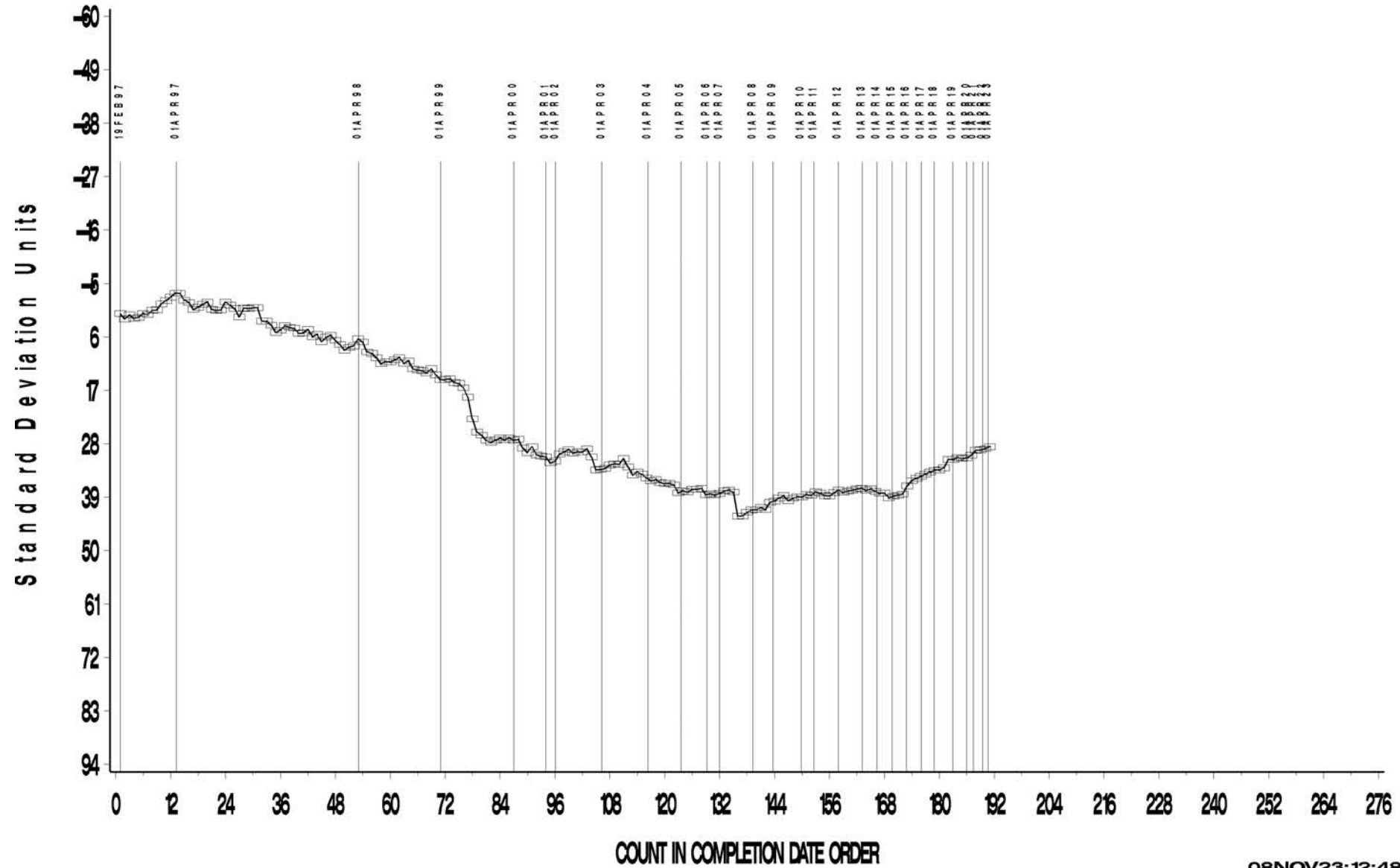
LTMS Precision Analysis





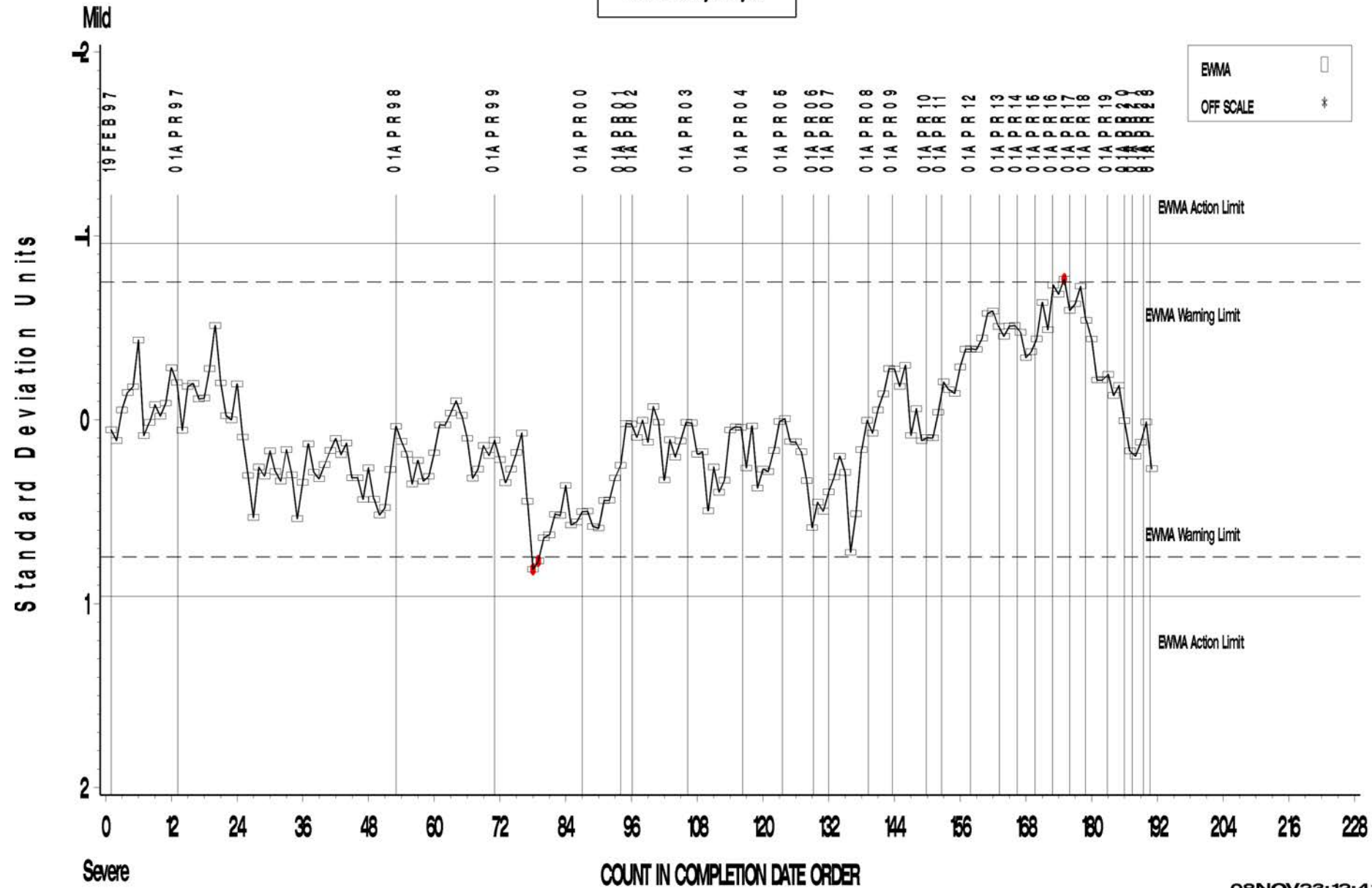
TOP GROOVE CARBON

CUSUM Severity Analysis



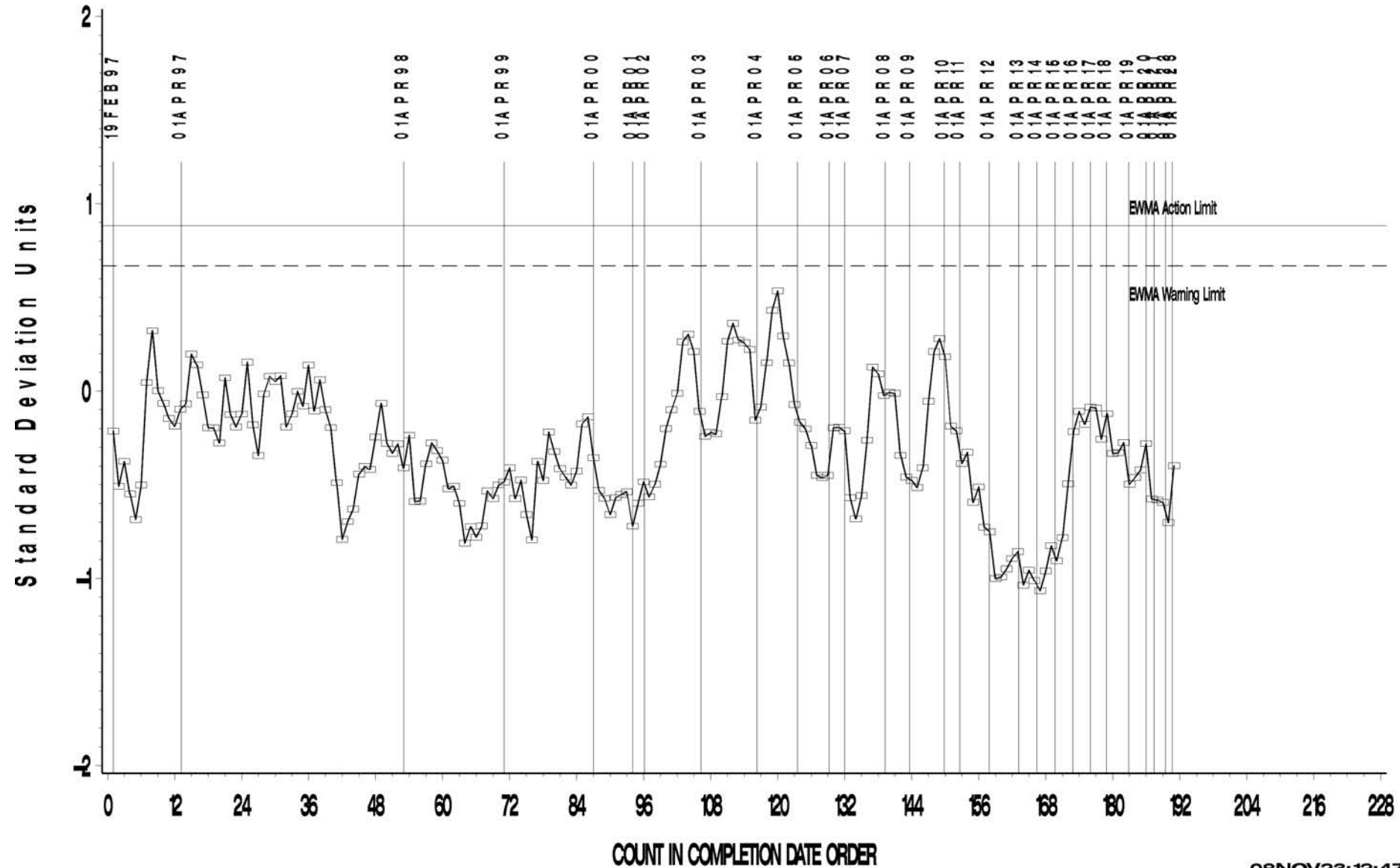
TOP LAND CARBON

LTMS Severity Analysis



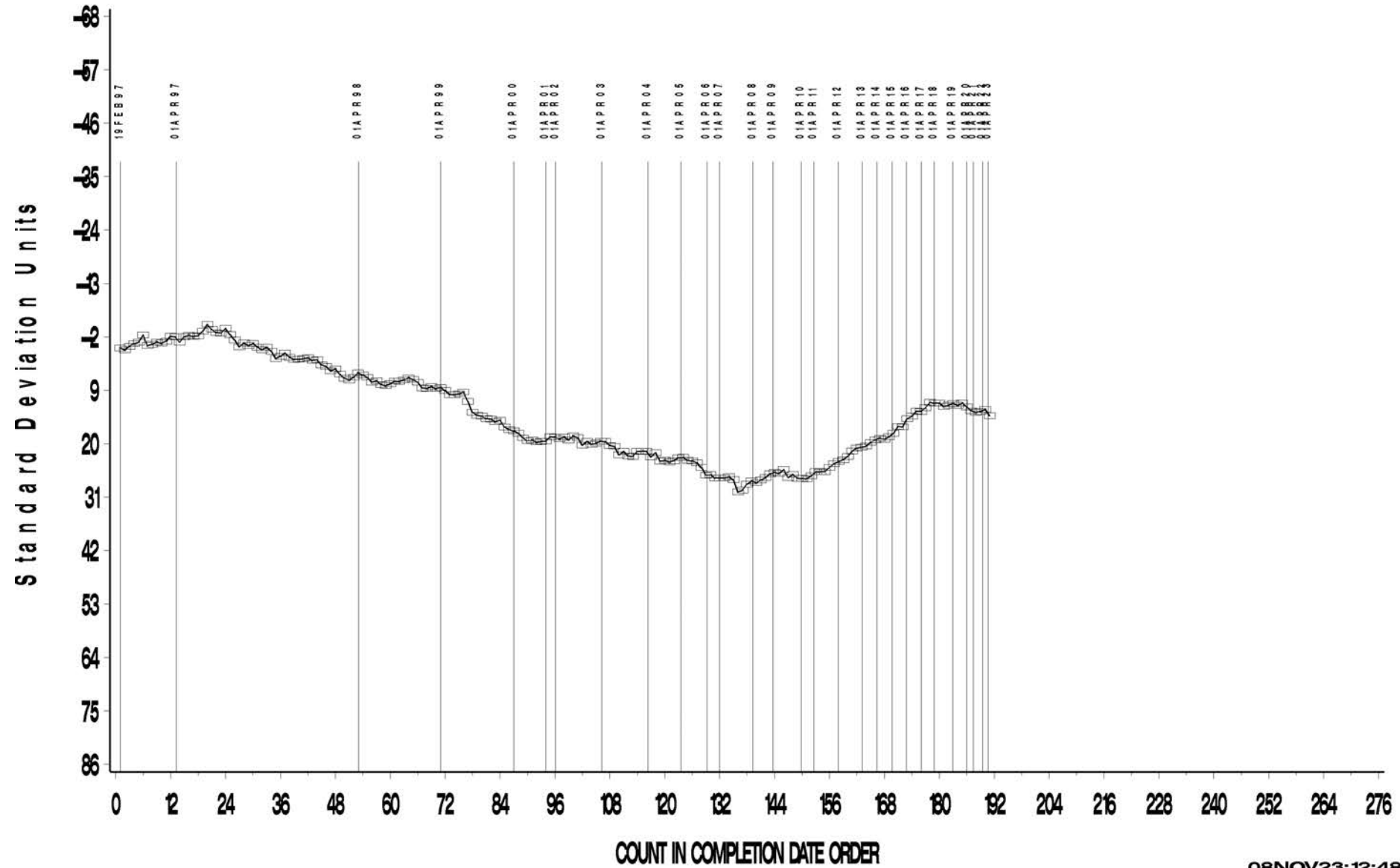
TOP LAND CARBON

LTMS Precision Analysis



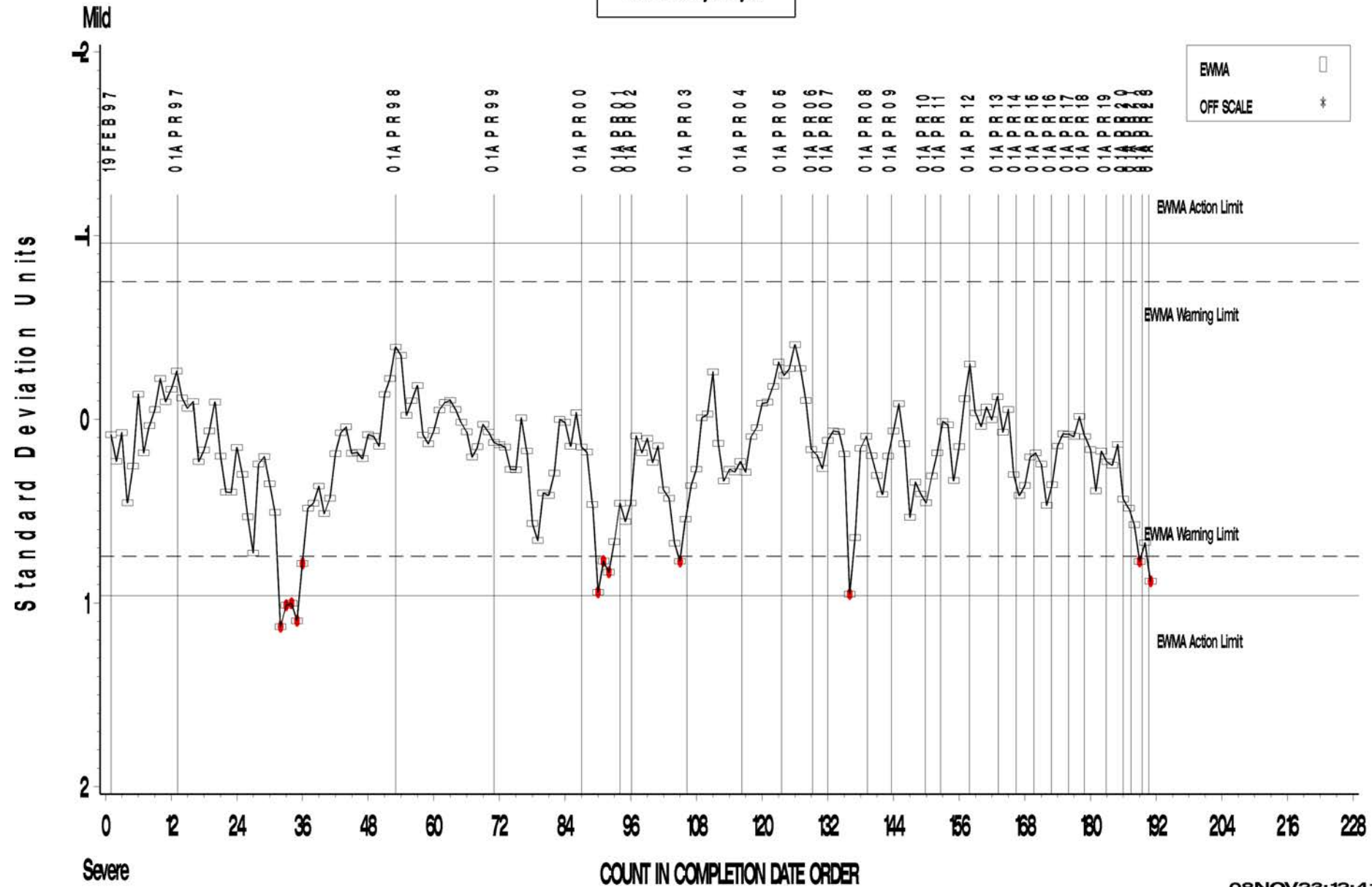
TOP LAND CARBON

CUSUM Severity Analysis



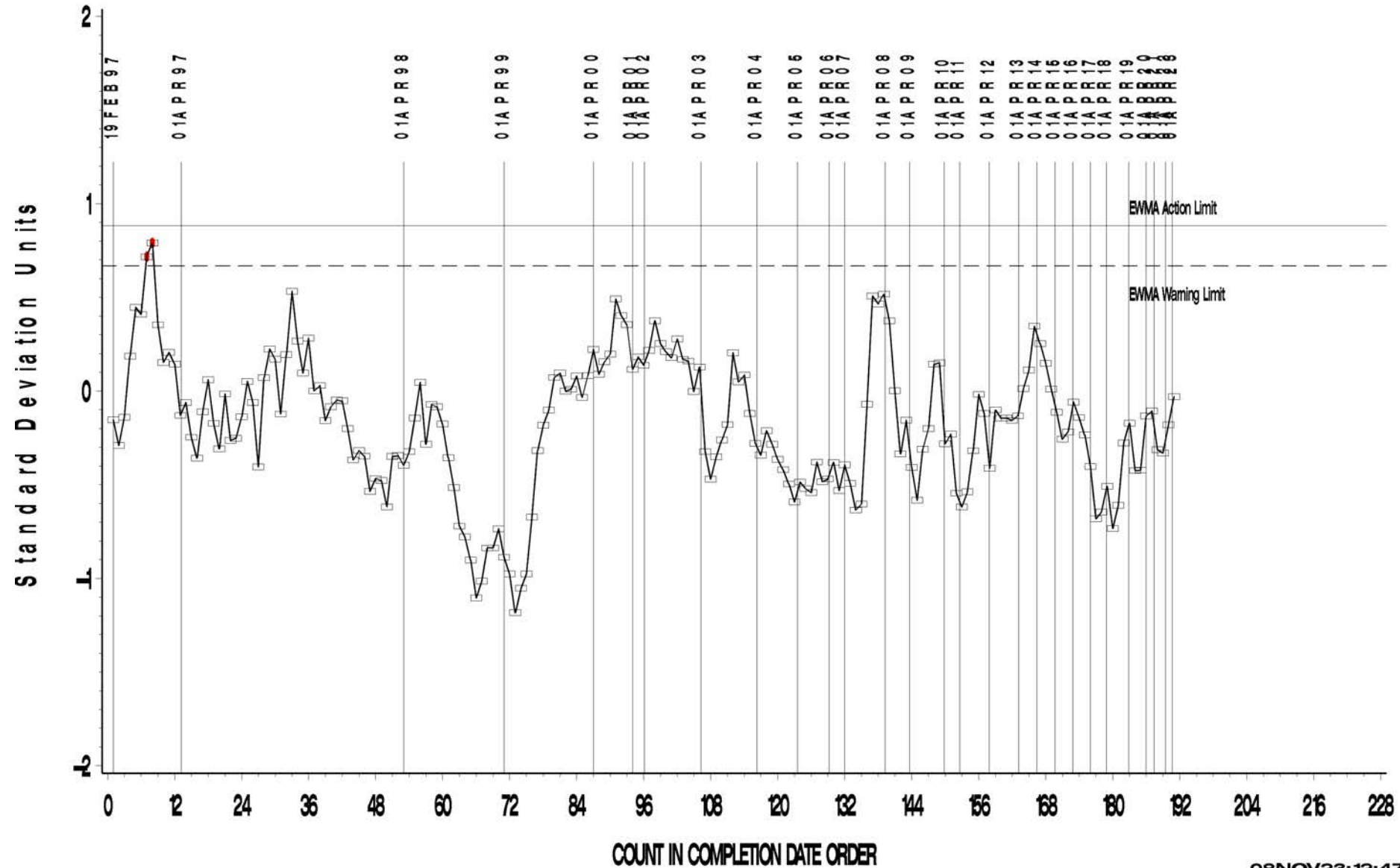
WEIGHTED TOTAL DEMERITS

LTMS Severity Analysis



WEIGHTED TOTAL DEMERITS

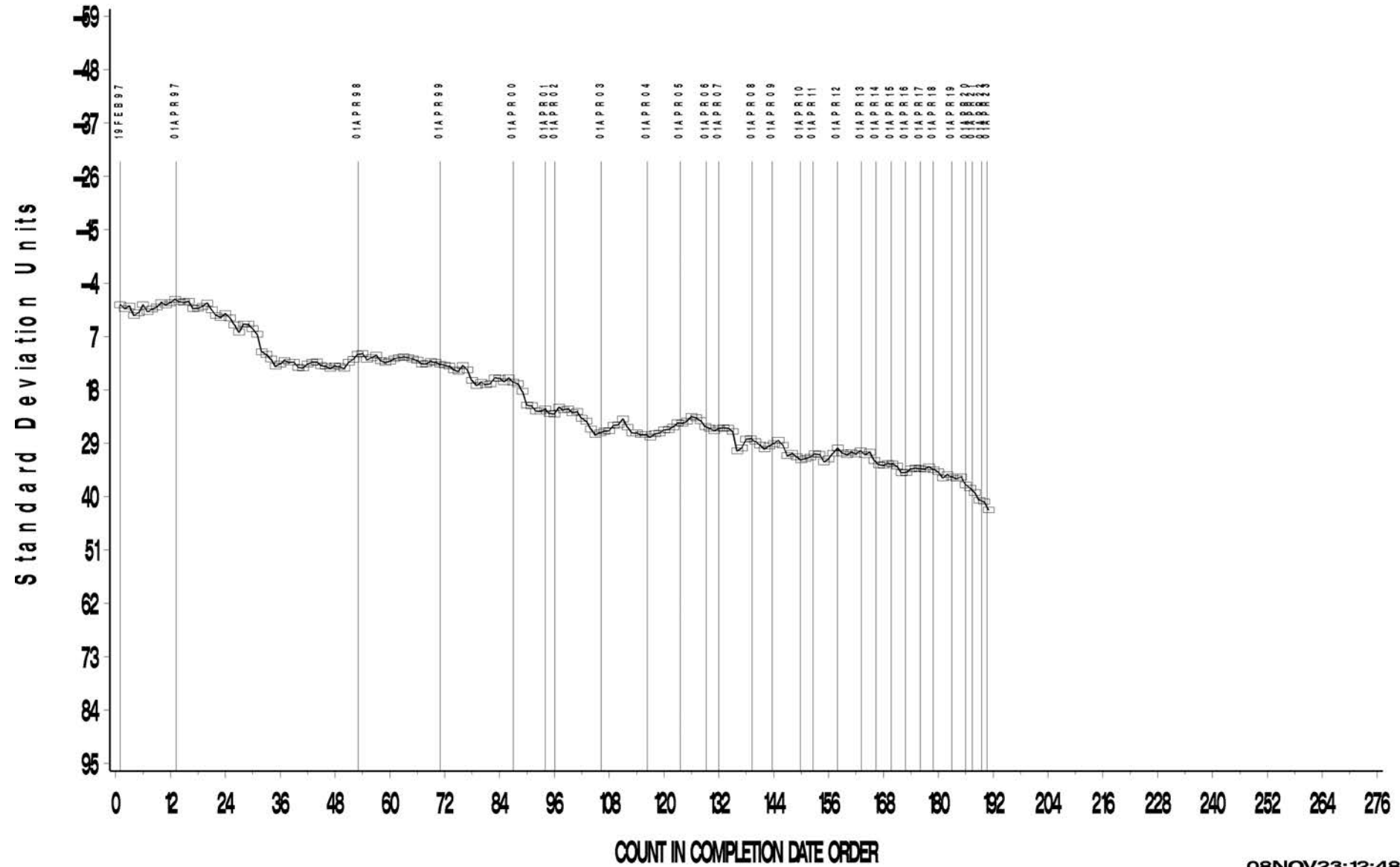
LTMS Precision Analysis





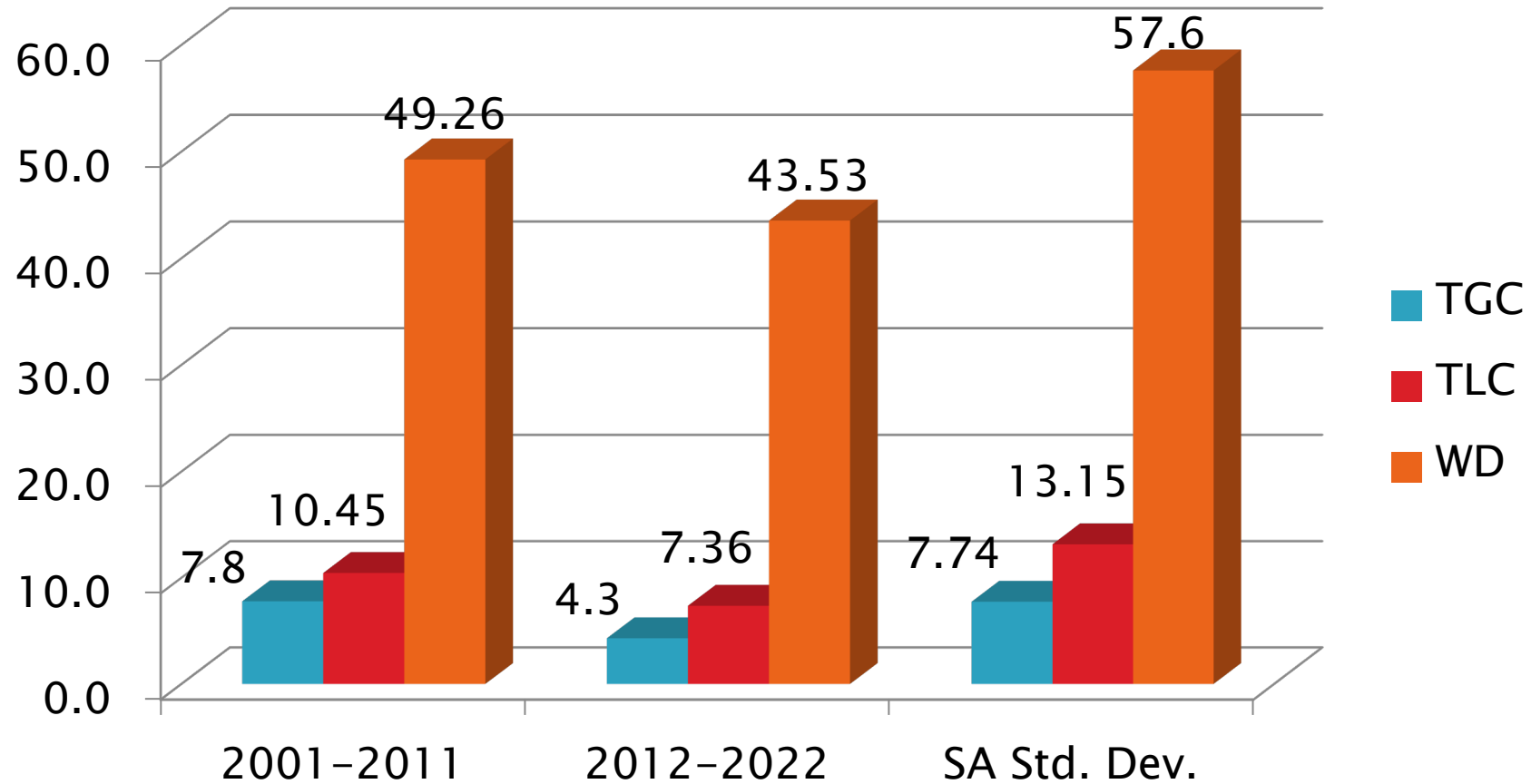
WEIGHTED TOTAL DEMERITS

CUSUM Severity Analysis

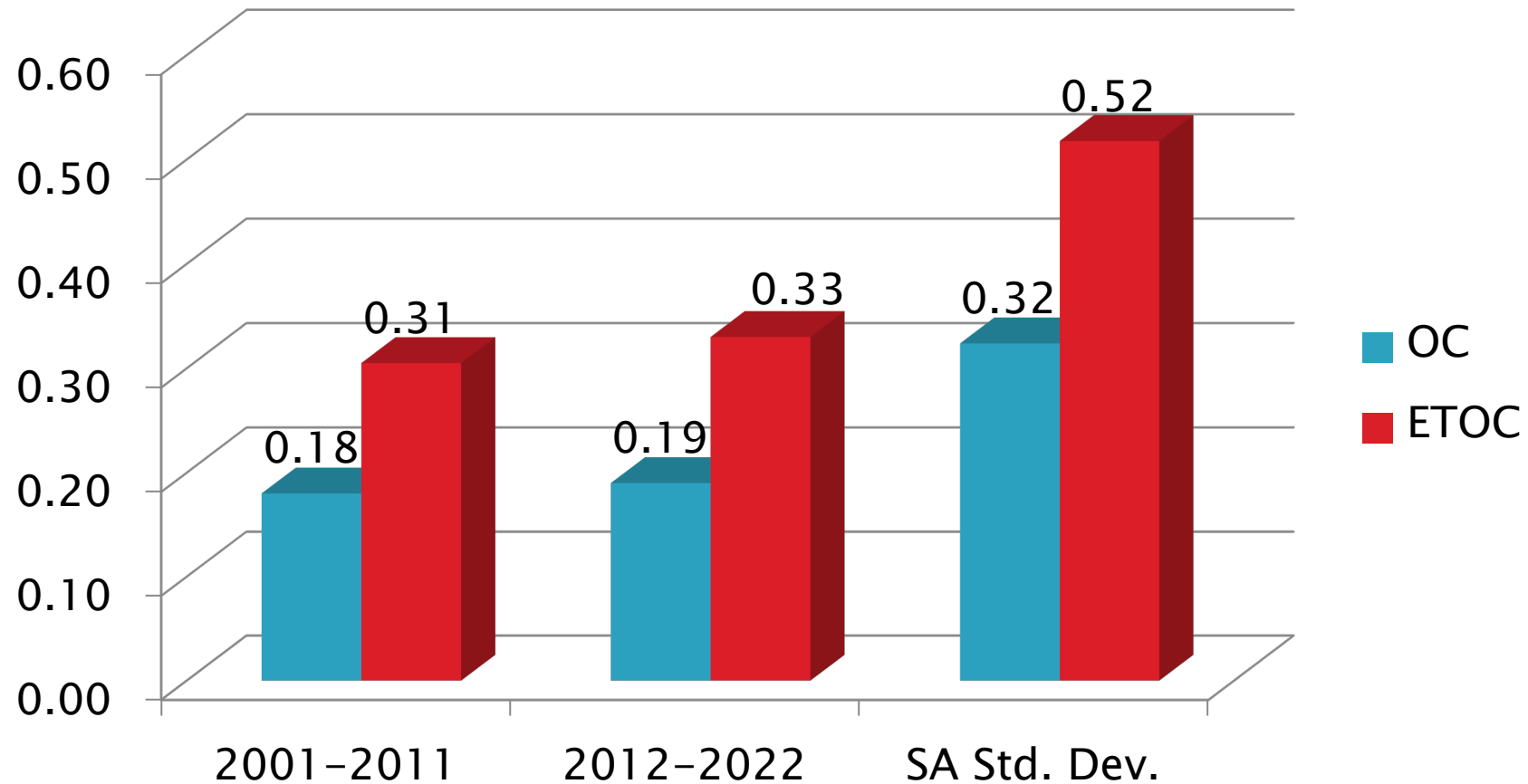




# 1 P Precision Estimates



# 1 P Precision Estimates



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# SCOTE 1 R

➤➤ October 2023

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# 1 R Test Activity

Test Status	Validity Code	#
Acceptable Calibration Test	AC	0
Failed Calibration Test	OC	0
Operationally Invalid	LC	0
Aborted	XC	4
<b>Total</b>		<b>4</b>

# 1 R Failed Tests

Failed Parameter	Number of Tests
No failed tests	0
<b>Total</b>	<b>0</b>

# 1 R Lost Tests\*

Status	Cause	#
Invalid	No invalid tests	0
Aborted	High oil consumption	3
Aborted	Piston scuffing	1
<b>Total</b>		<b>4</b>

\*Invalid and aborted tests

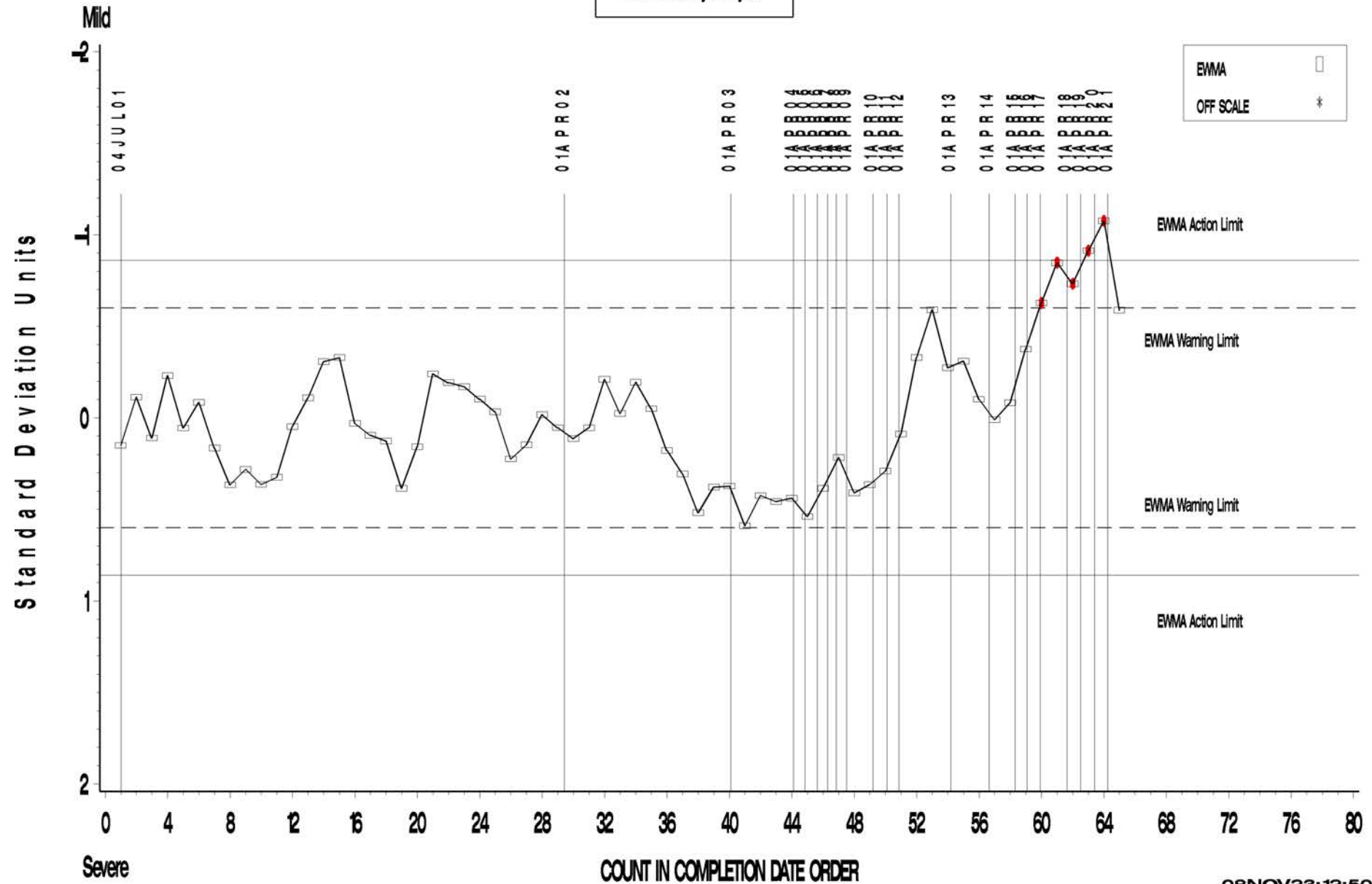
# 1 R Test Severity

- ▶ As no chartable 1R tests were run during this period no statement on test severity can be made.



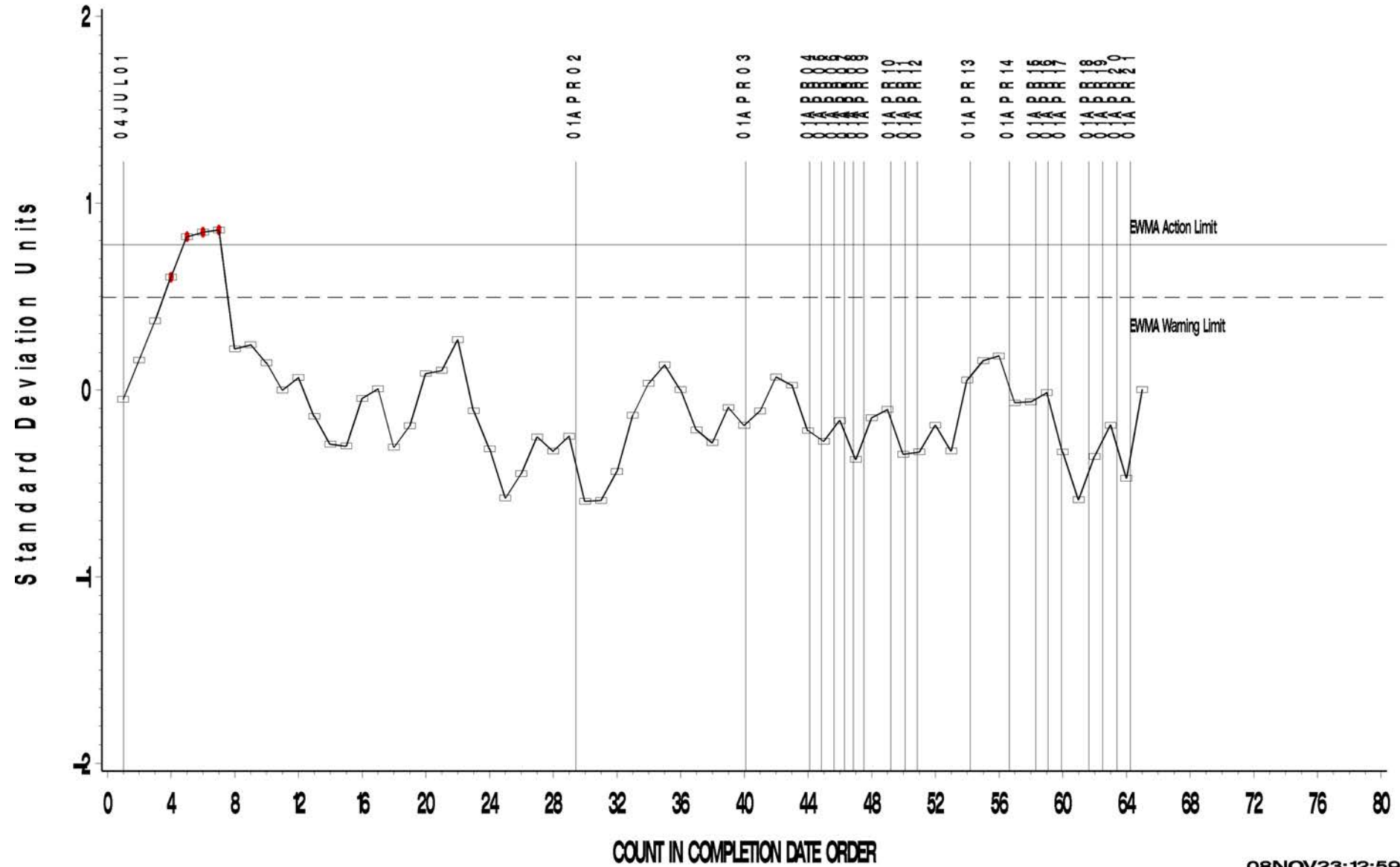
FINAL BOTOC

LTMS Severity Analysis



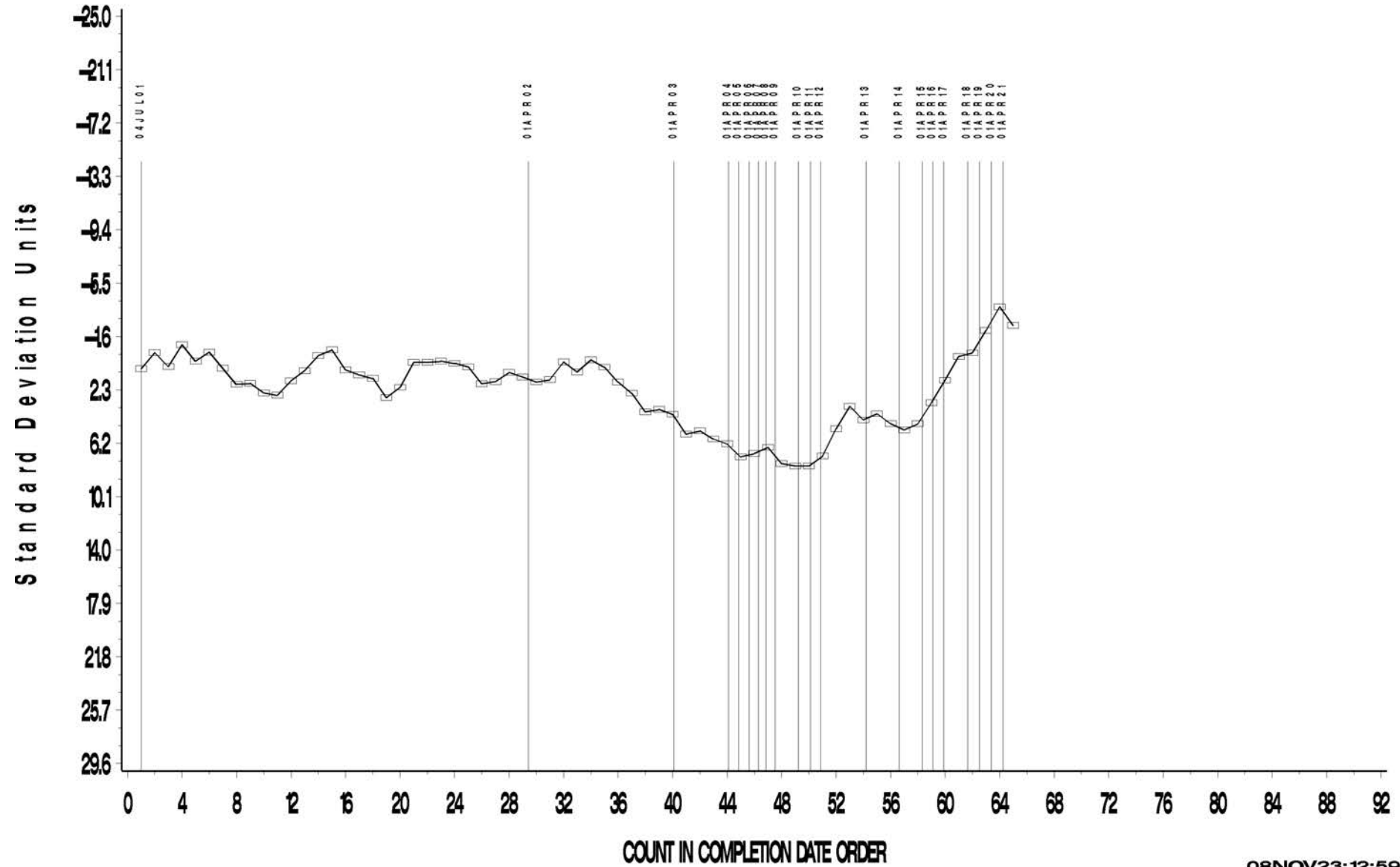
FINAL BOTOC

LTMS Precision Analysis



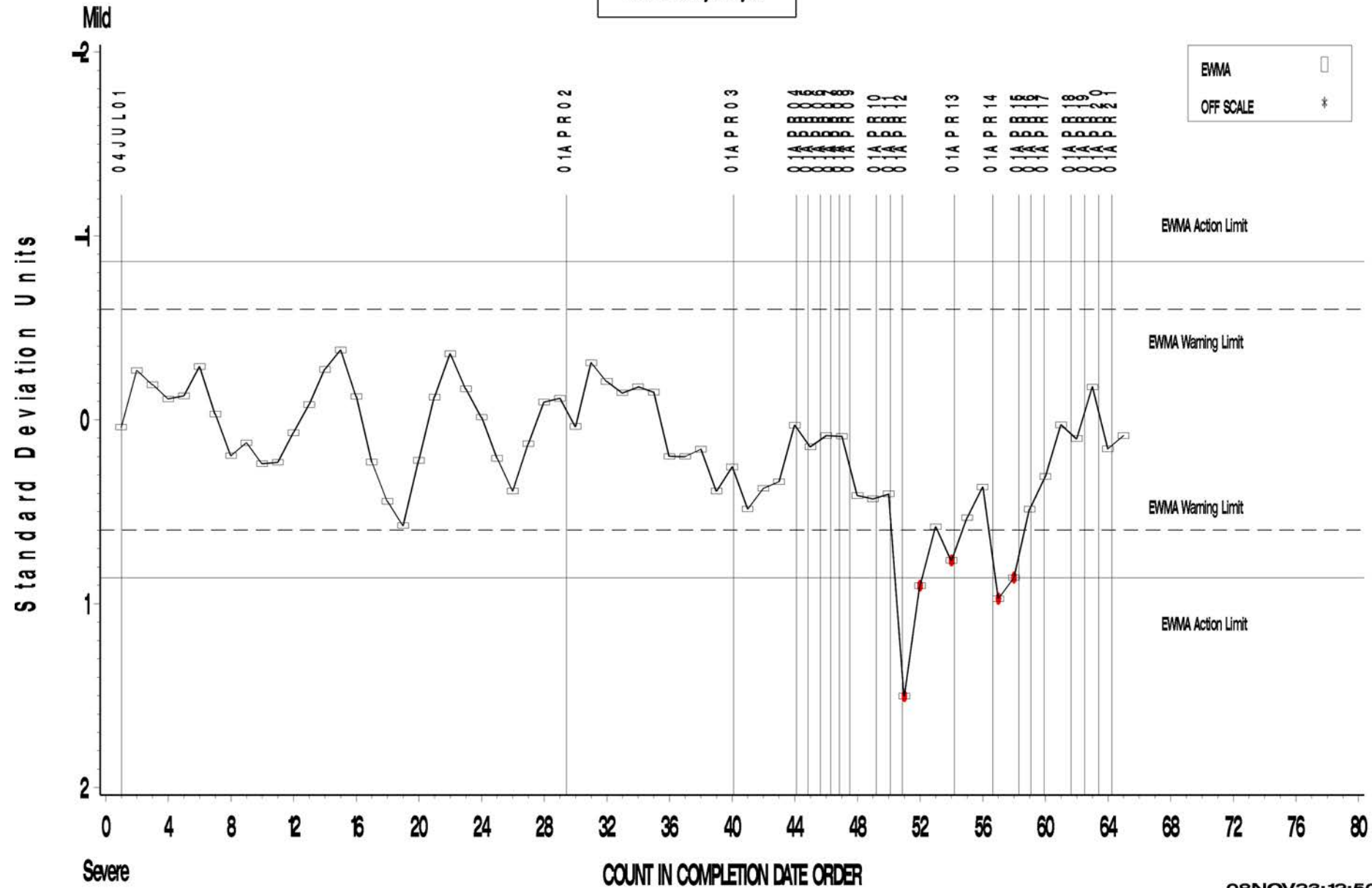
FINAL BOTOC

CUSUM Severity Analysis



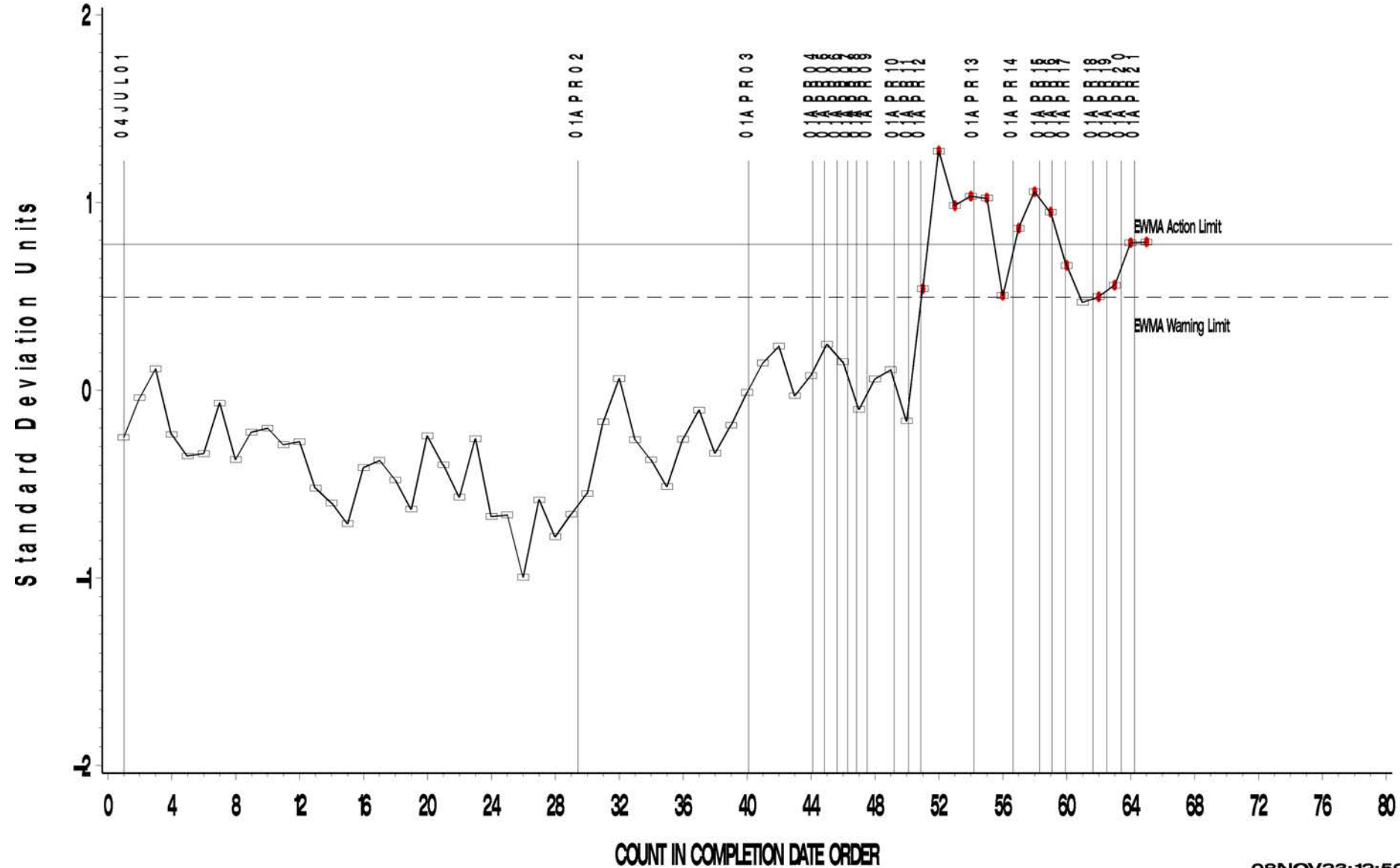
FINAL EOTOC (g/h)

LTMS Severity Analysis



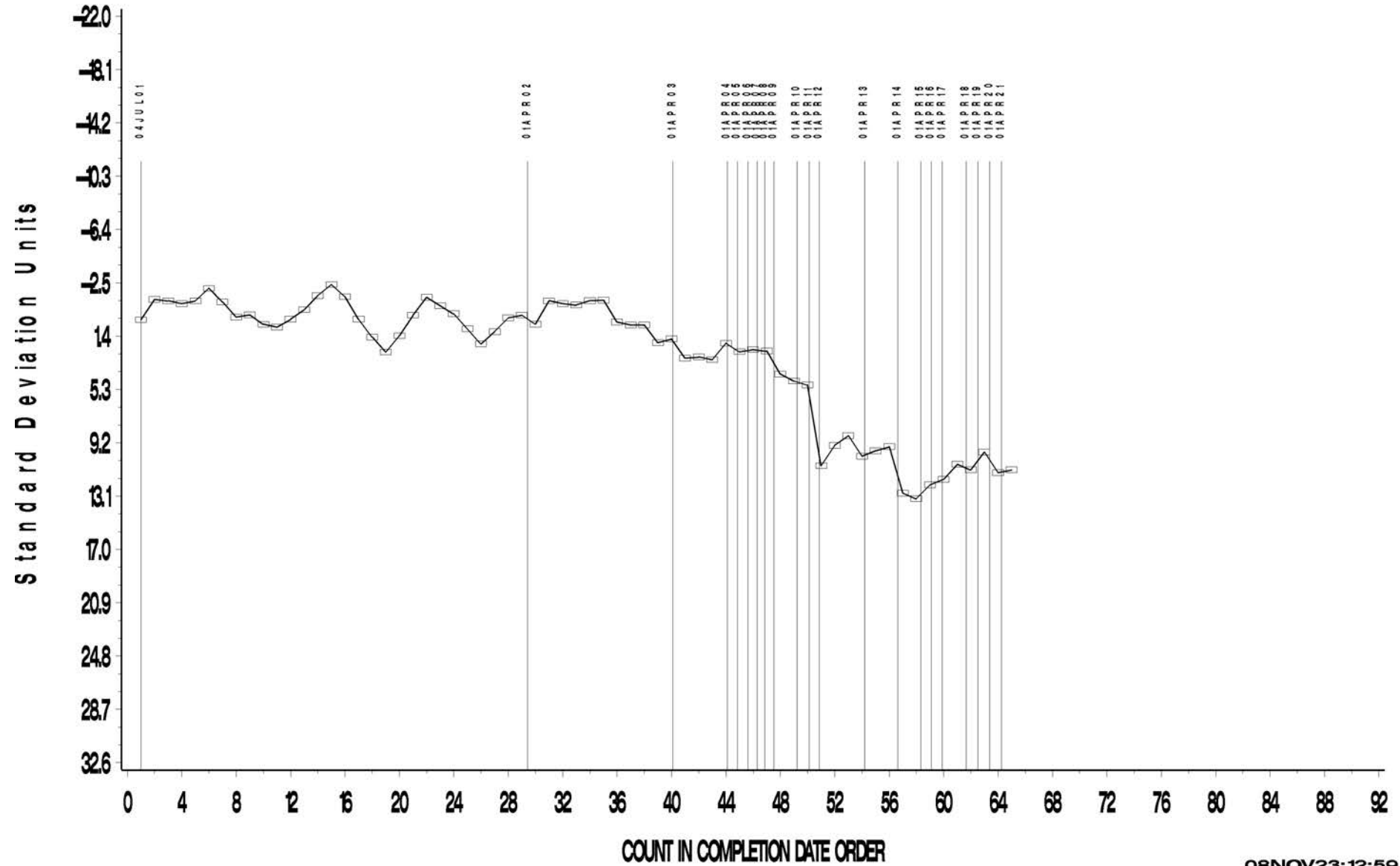
FINAL EOTOC (g/h)

LTMS Precision Analysis



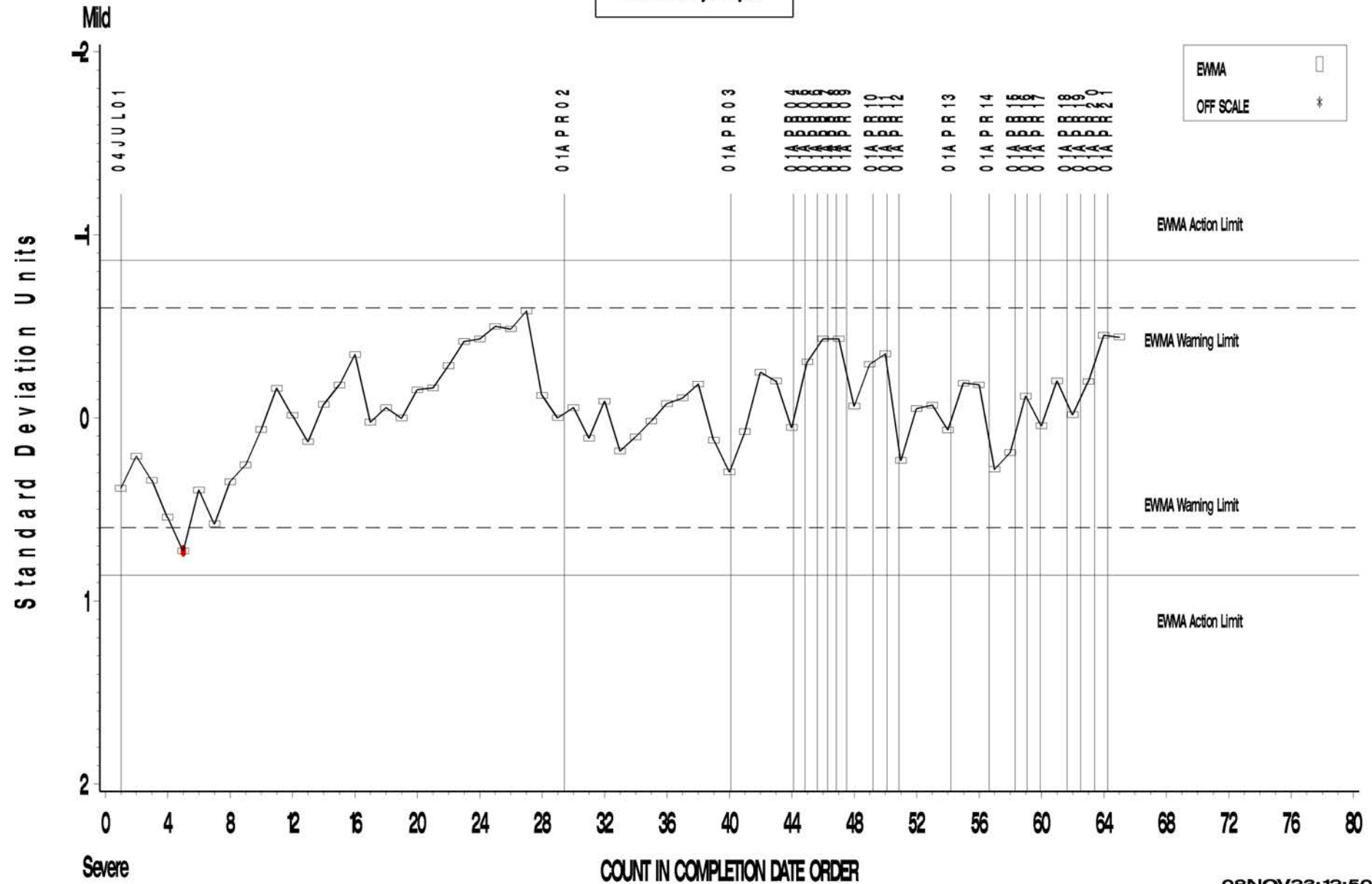
FINAL EOTOC (g/h)

CUSUM Severity Analysis



FINAL TOP GROOVE CARBON (DEMERITS)

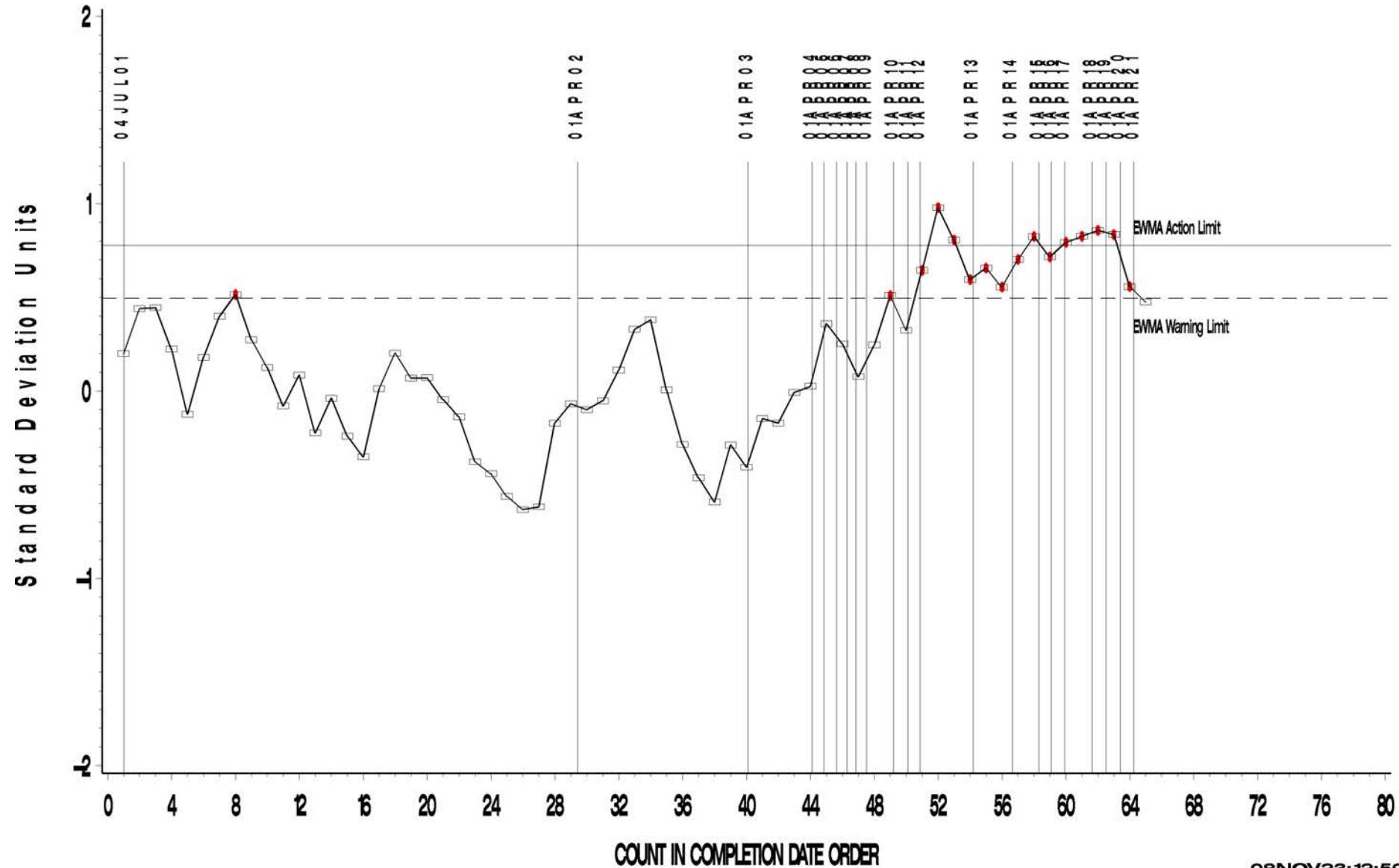
LTMS Severity Analysis





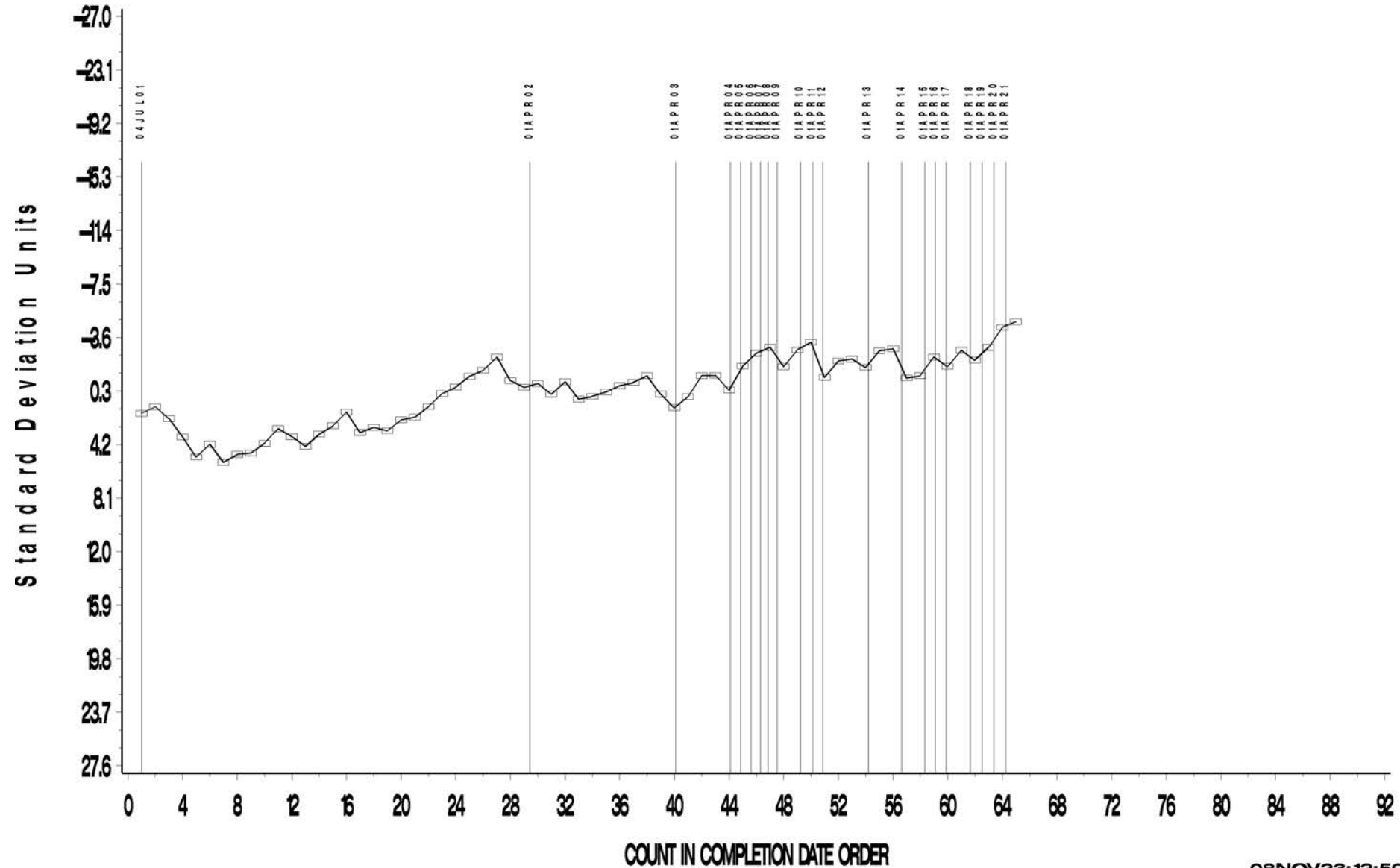
FINAL TOP GROOVE CARBON (DEMERITS)

LTMS Precision Analysis



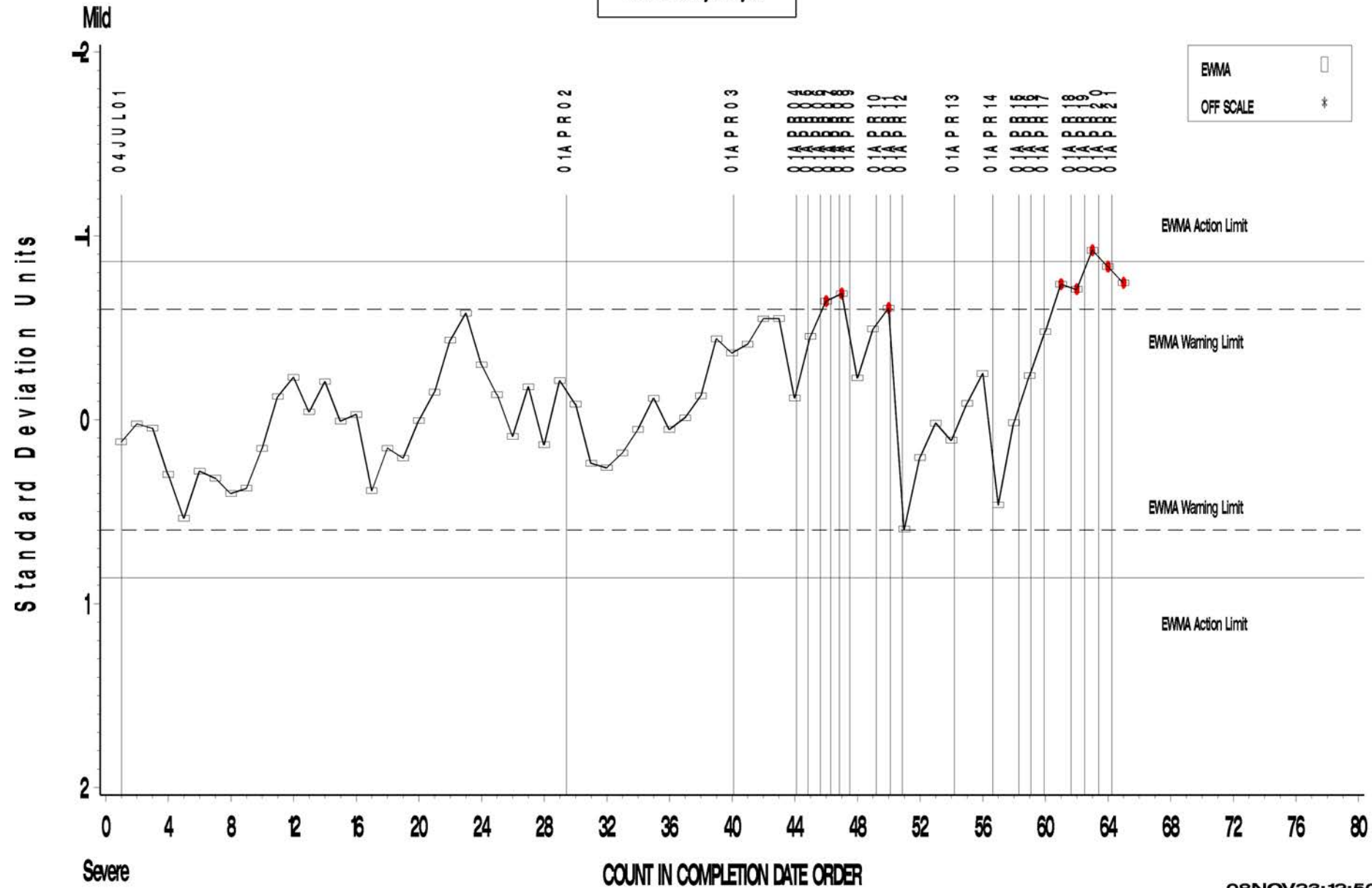
FINAL TOP GROOVE CARBON (DEMERITS)

CUSUM Severity Analysis



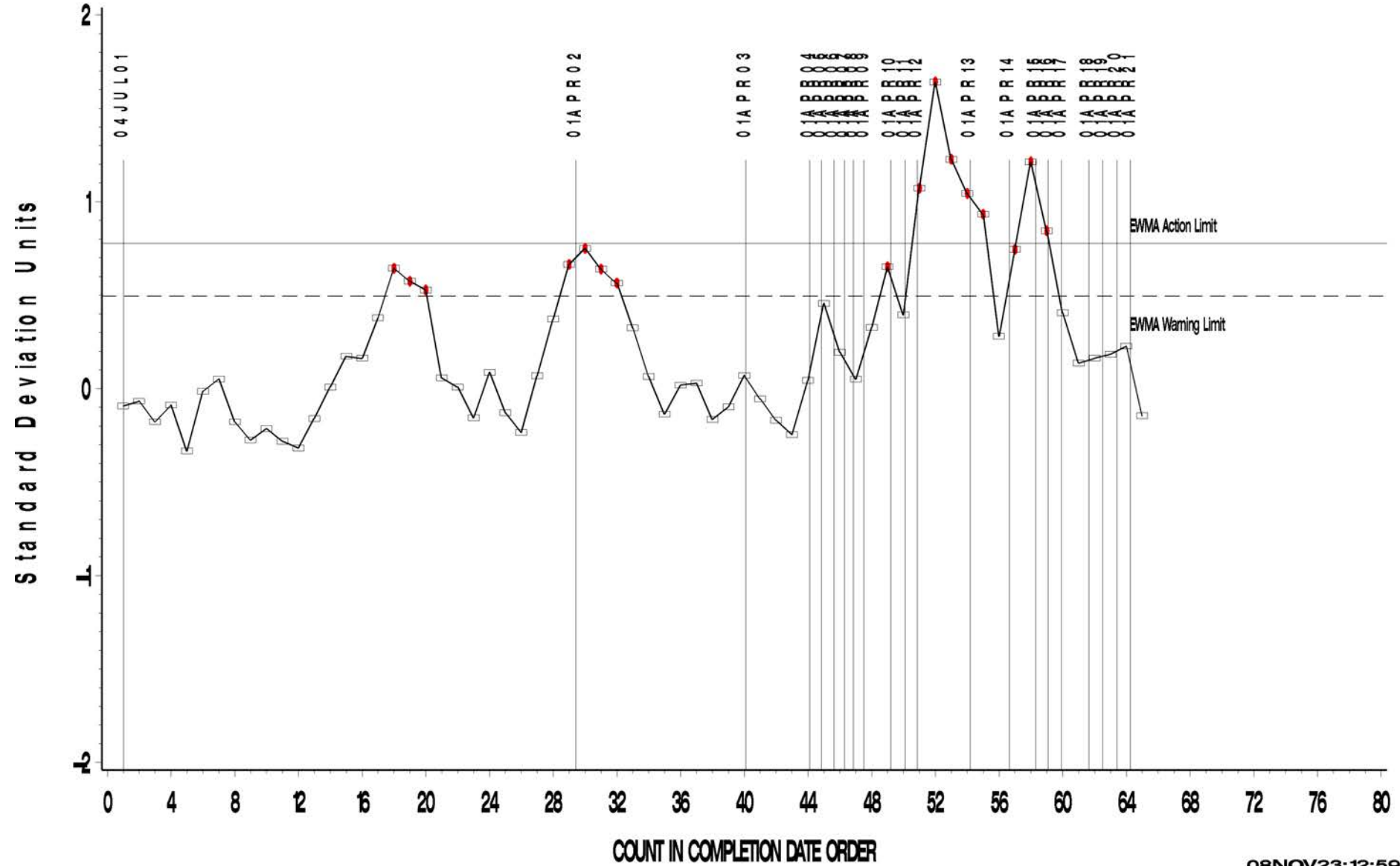
FINAL TOP LAND CARBON (DEMERITS)

LTMS Severity Analysis



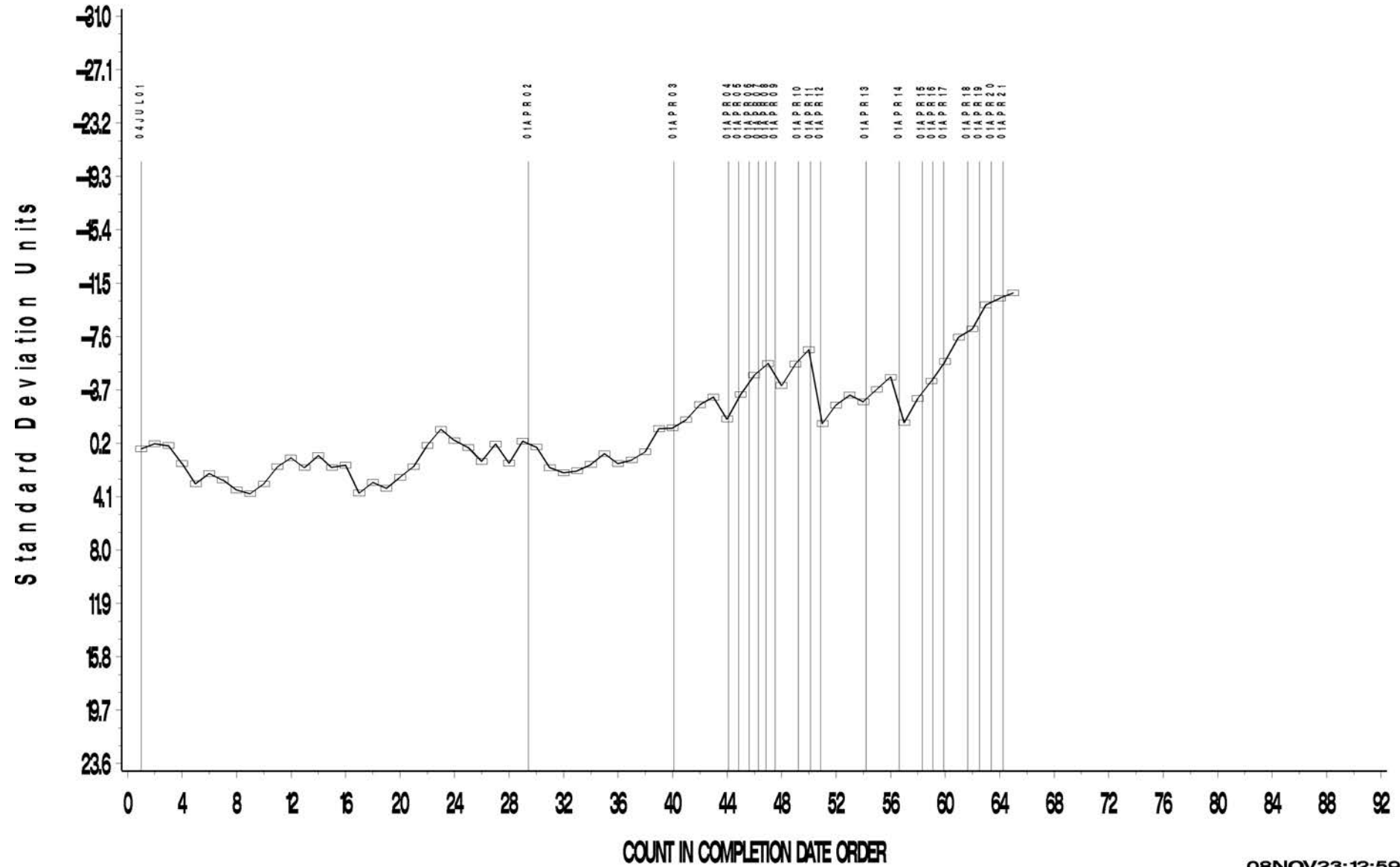
FINAL TOP LAND CARBON (DEMERITS)

LTMS Precision Analysis



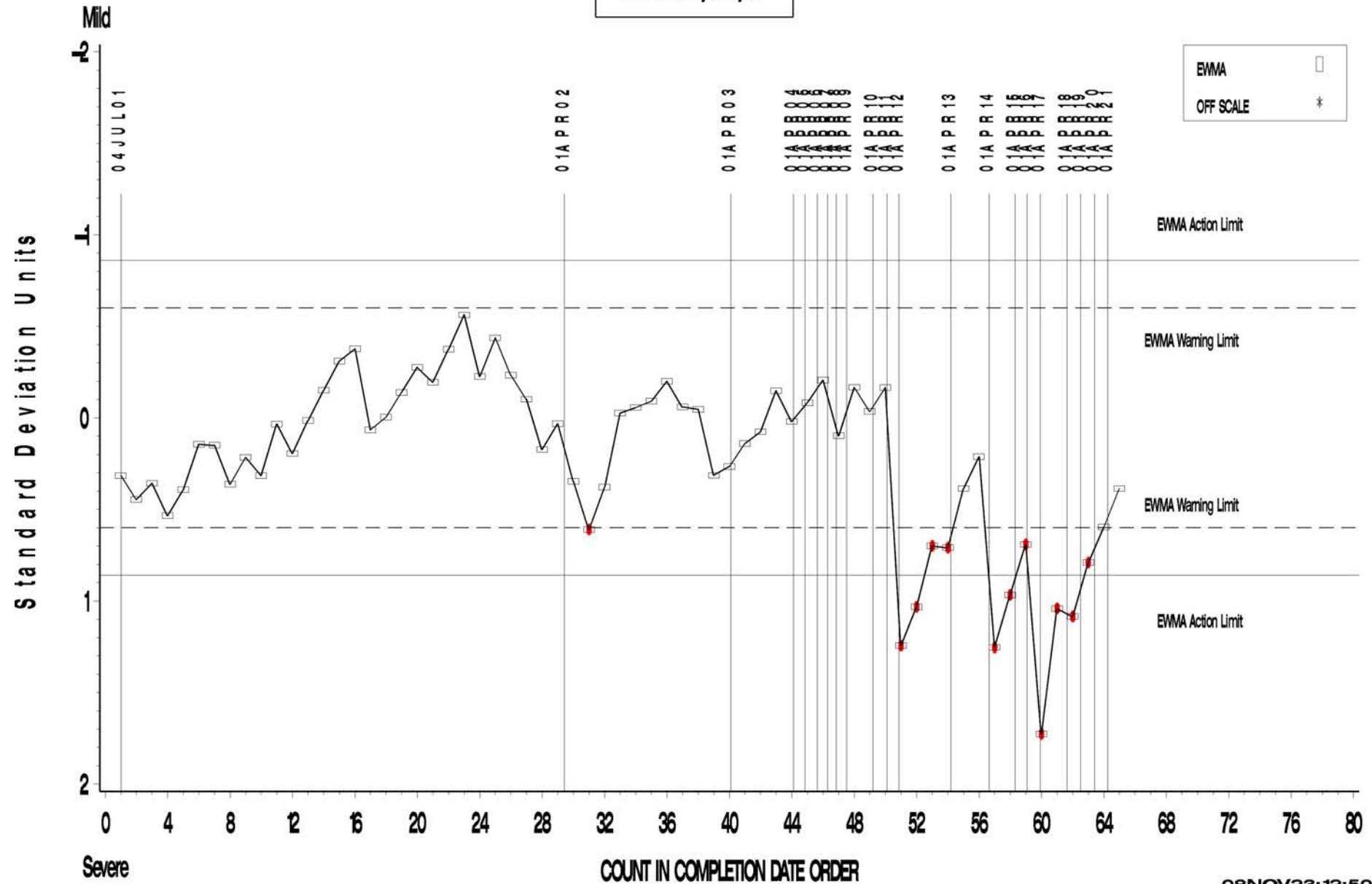
FINAL TOP LAND CARBON (DEMERITS)

CUSUM Severity Analysis



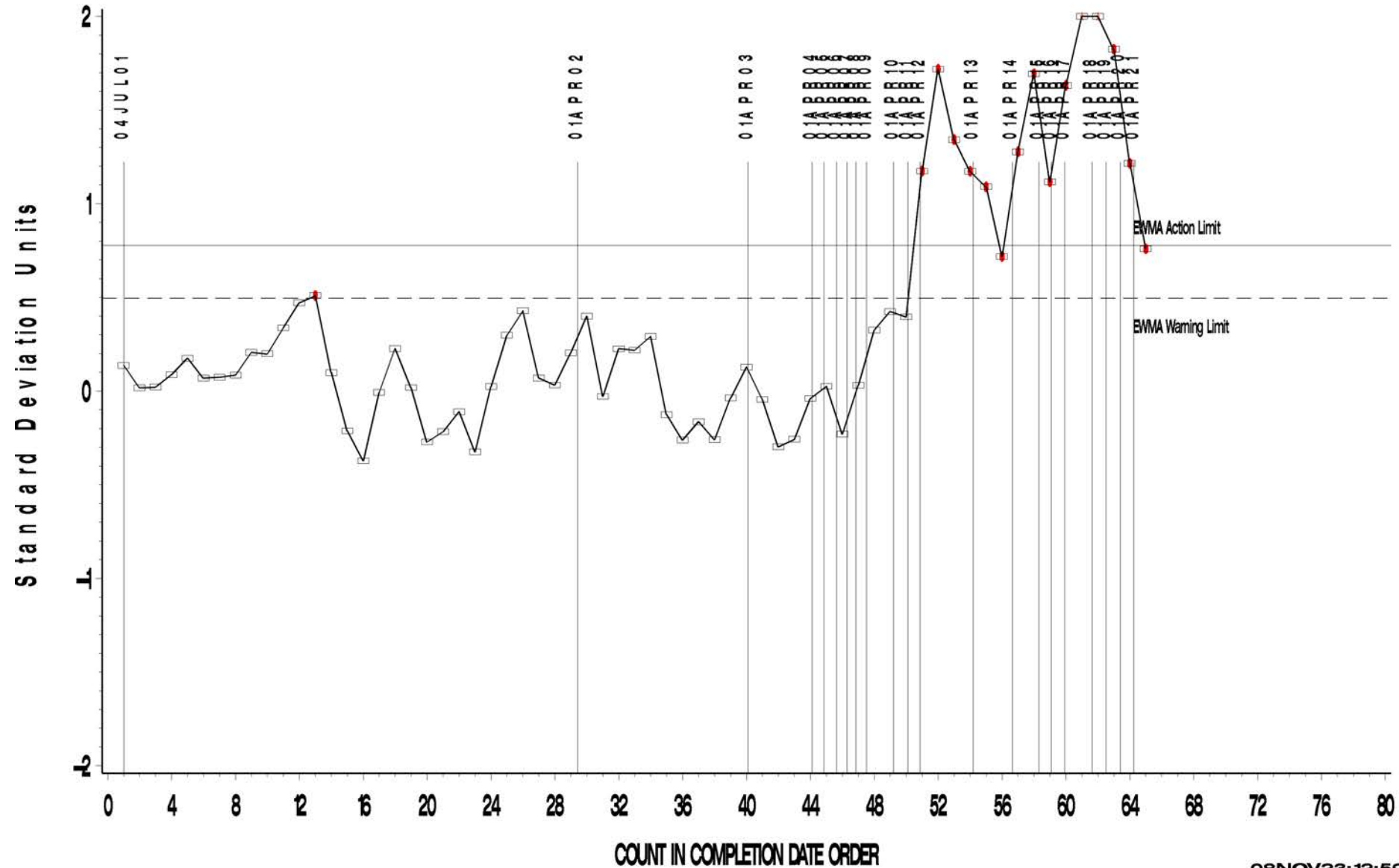
FINAL WEIGHTED TOTAL DEMERITS (DEMERITS)

LTMS Severity Analysis



FINAL WEIGHTED TOTAL DEMERITS (DEMERITS)

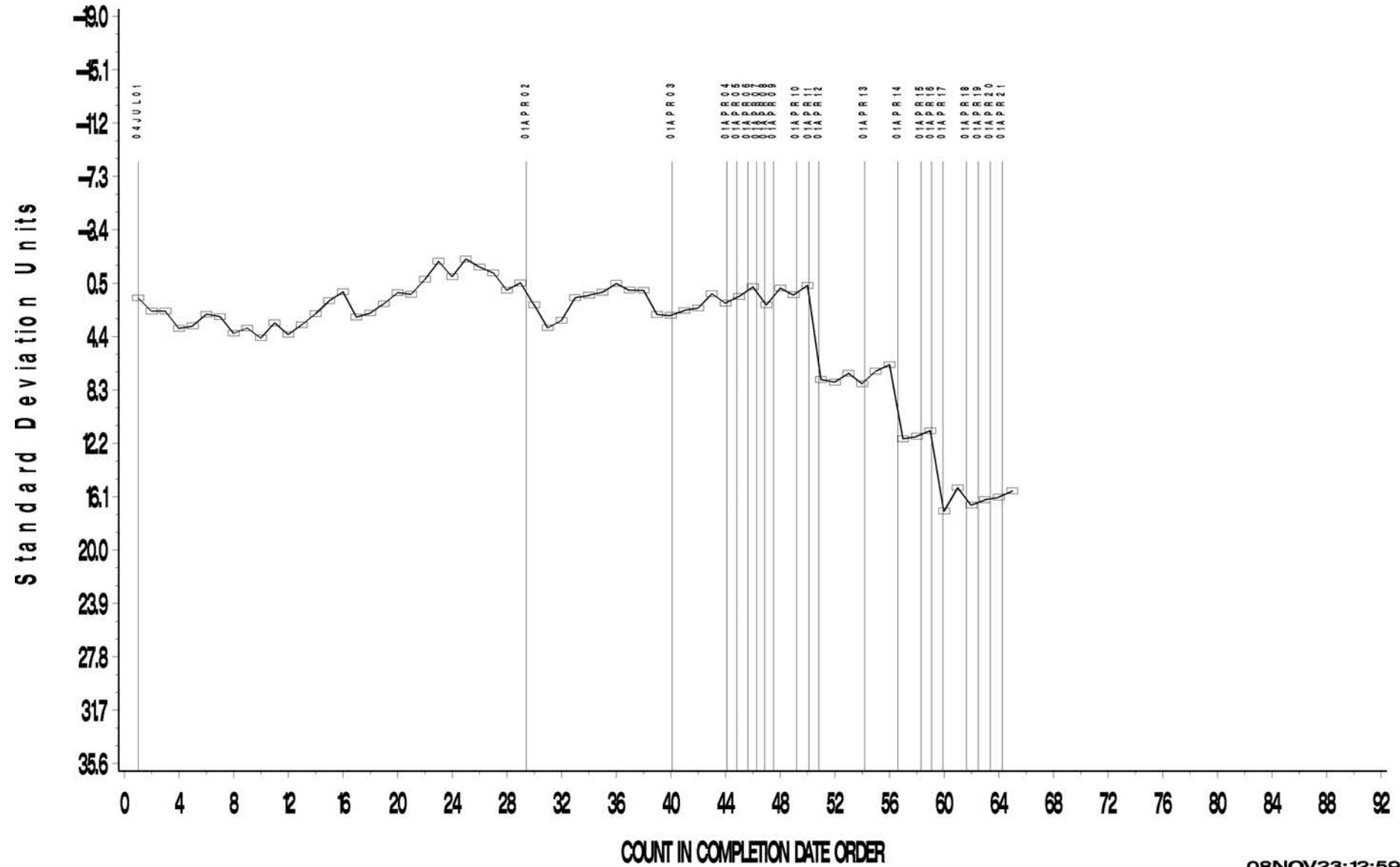
LTMS Precision Analysis



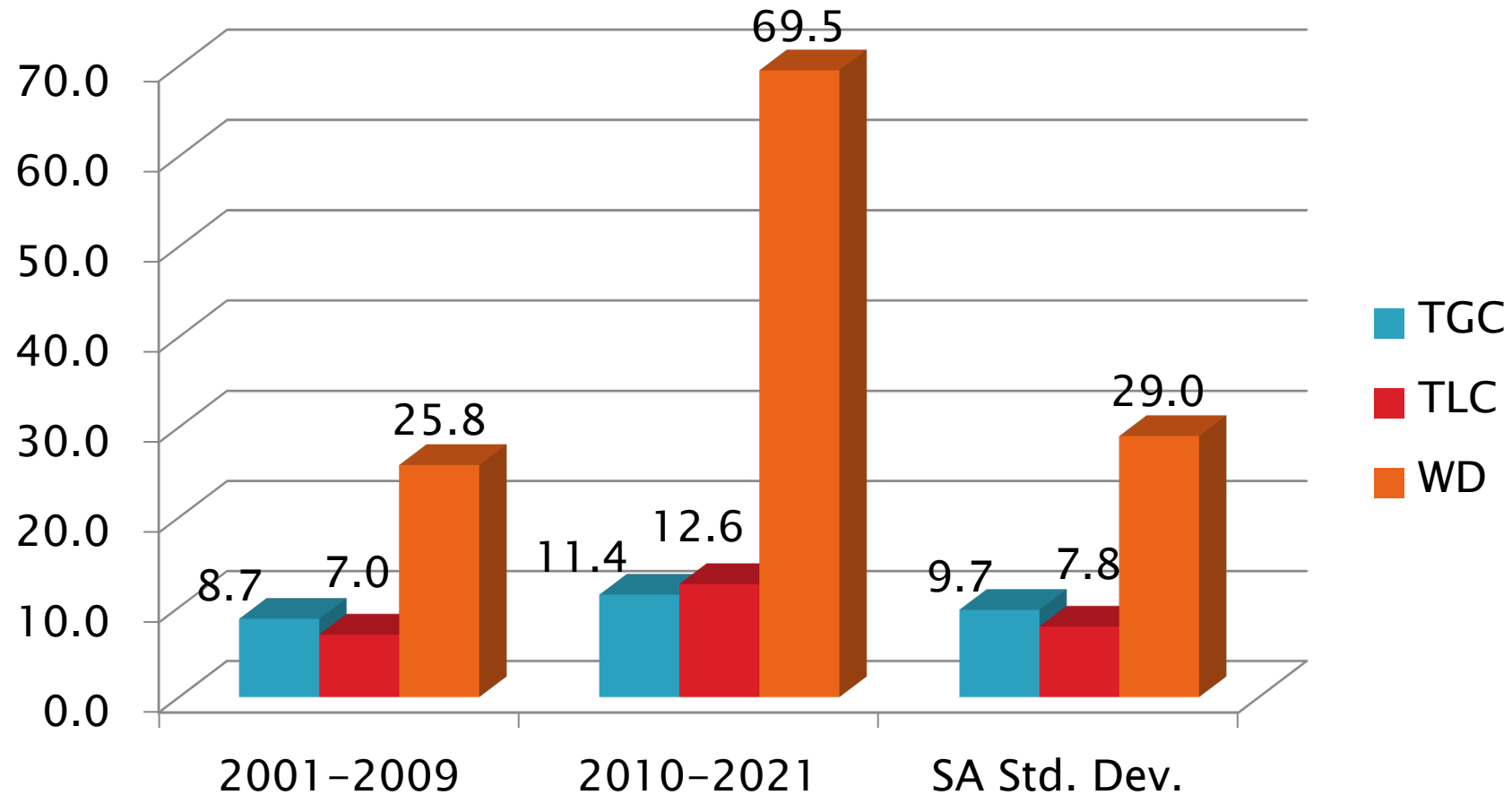


FINAL WEIGHTED TOTAL DEMERITS (DEMERITS)

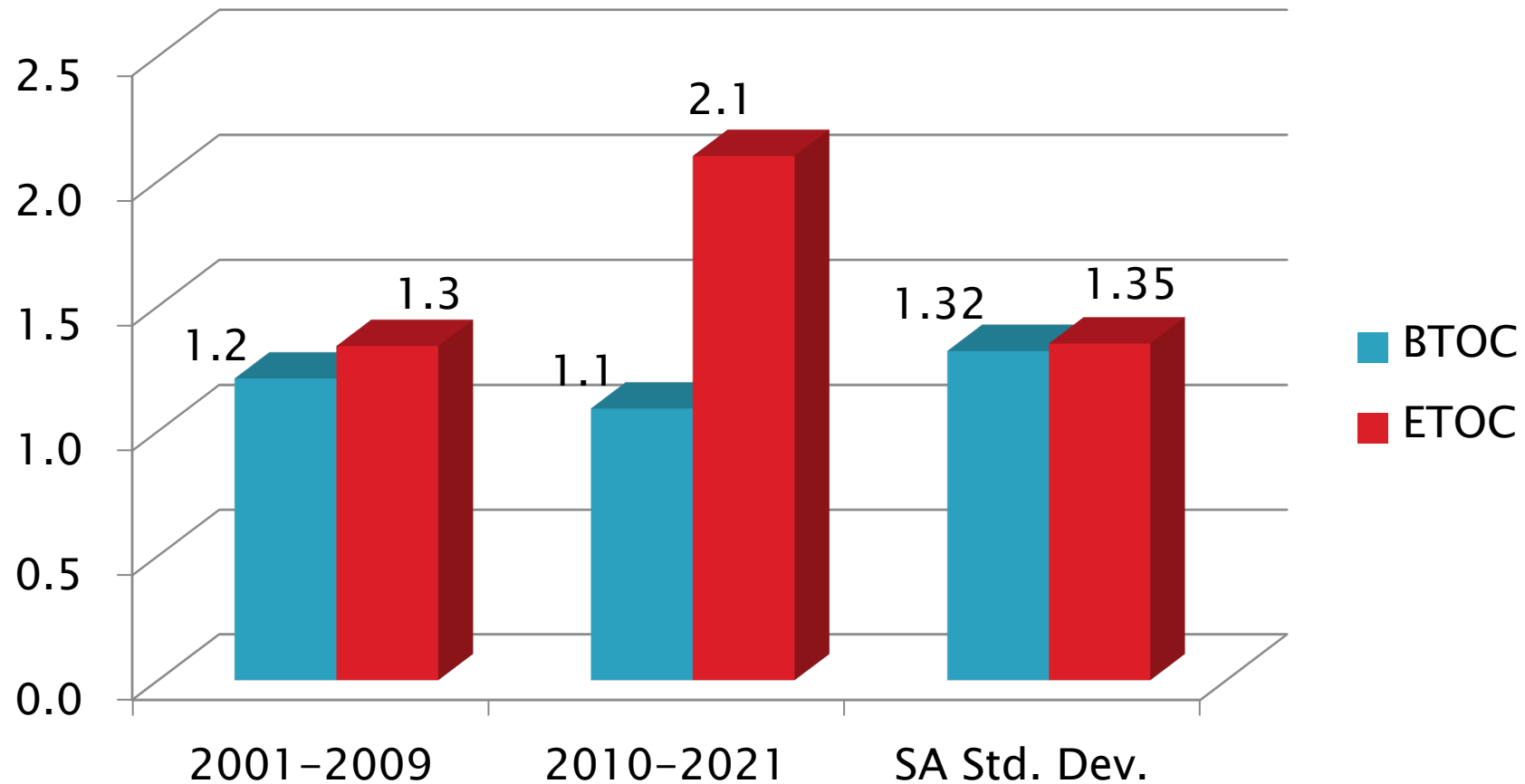
CUSUM Severity Analysis



# 1 R Precision Estimates



# 1 R Precision Estimates



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**Test Monitoring Center**  
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# CAT C13

➤➤ October 2023

**Test Monitoring Center**  
<https://www.astmtmc.org>



A Program of ASTM International

# C13 Test Activity

Test Status	Validity Code	C13
Acceptable Calibration Test	AC	2
Failed Calibration Test	OC	0
Operationally Invalid	LC	0
Aborted	XC	0
<b>Total</b>		<b>2</b>

# C13 Failed Tests

Failed Parameter	Number of Tests
No failed tests	0
<b>Total</b>	<b>0</b>

# C13 Lost Tests\*

Status	Cause	#
Invalid	No invalid tests	0
Aborted	No aborted tests	0
<b>Total</b>		<b>0</b>

\*Invalid and aborted tests

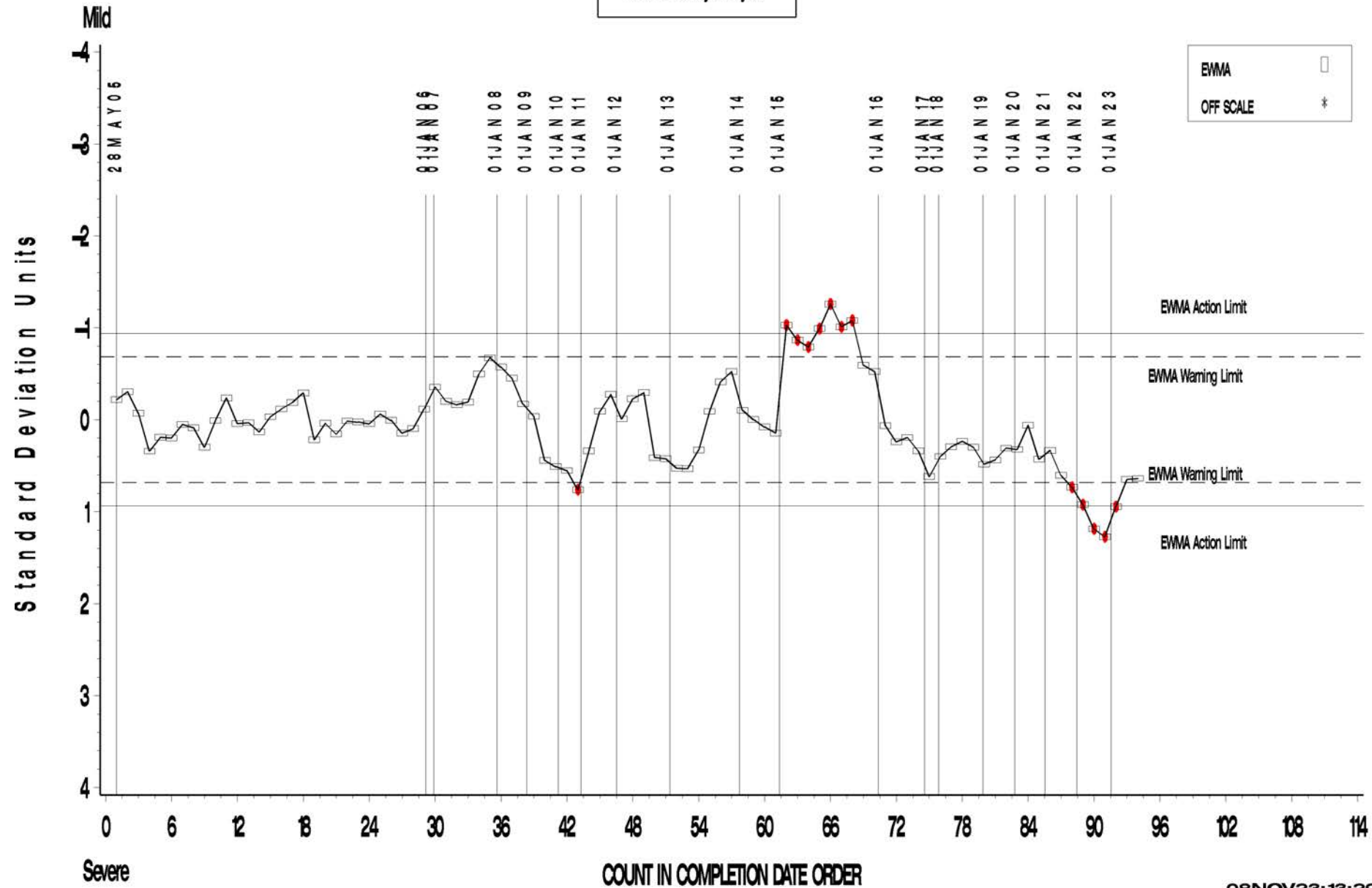


# C13 Test Severity

- ▶ TGC, OC are in control
- ▶ TLC is in severity warning alarm in the mild direction
- ▶ R2TC in severity warning alarm in the severe direction
- ▶ R2TC in precision warning alarm

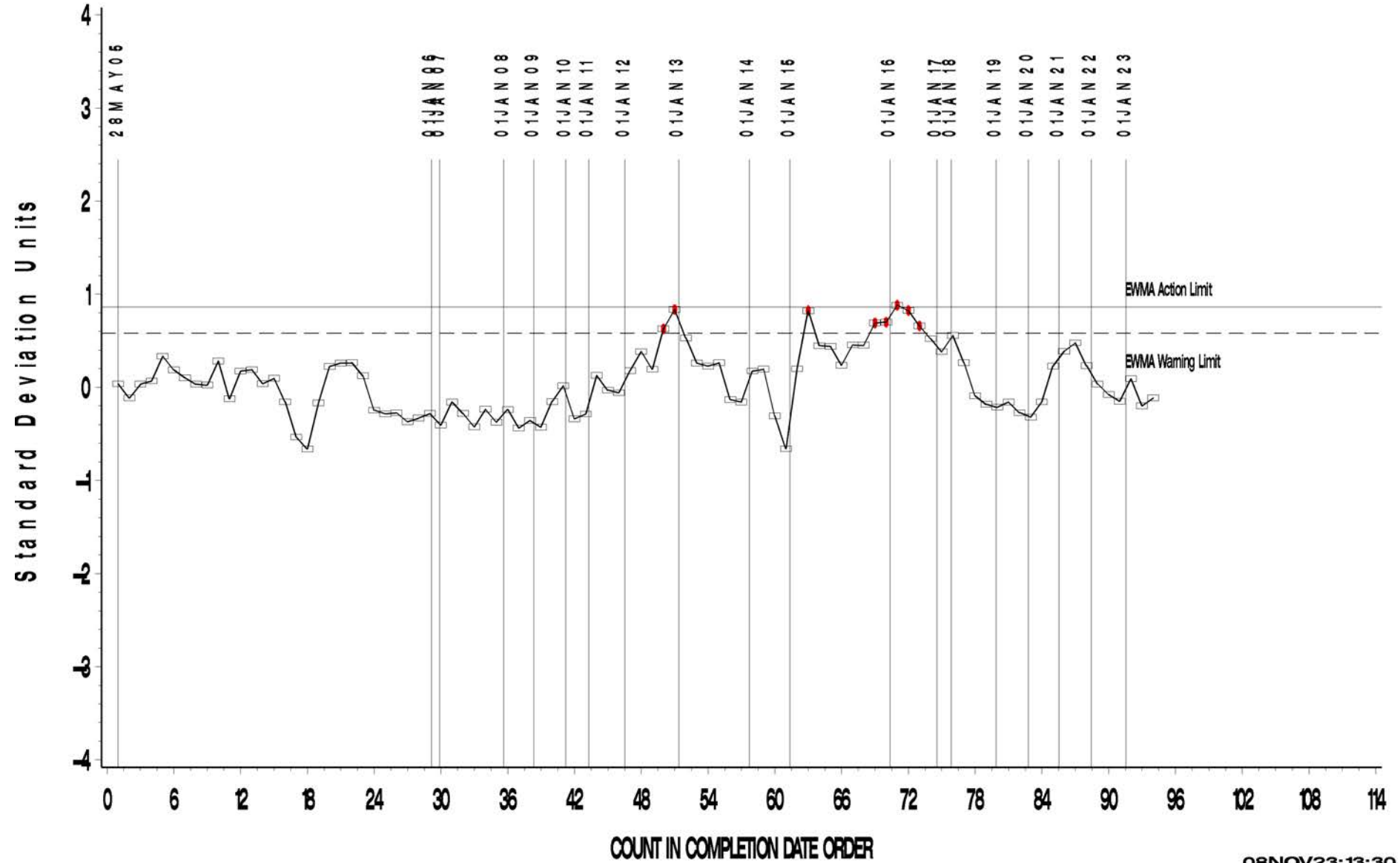
OIL CONS. DELTA — FINAL RESULT

LTMS Severity Analysis



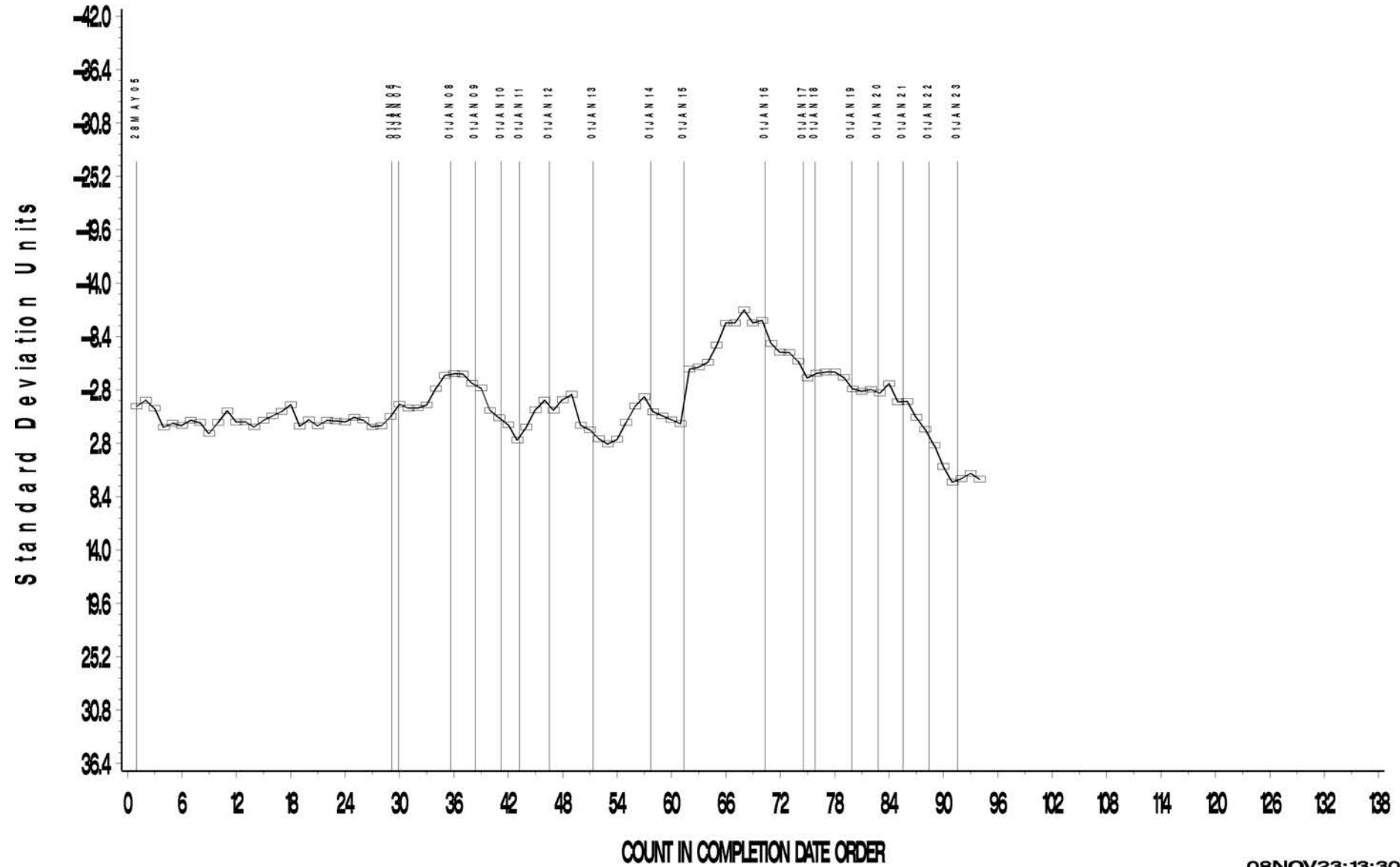
OIL CONS. DELTA — FINAL RESULT

LTMS Precision Analysis

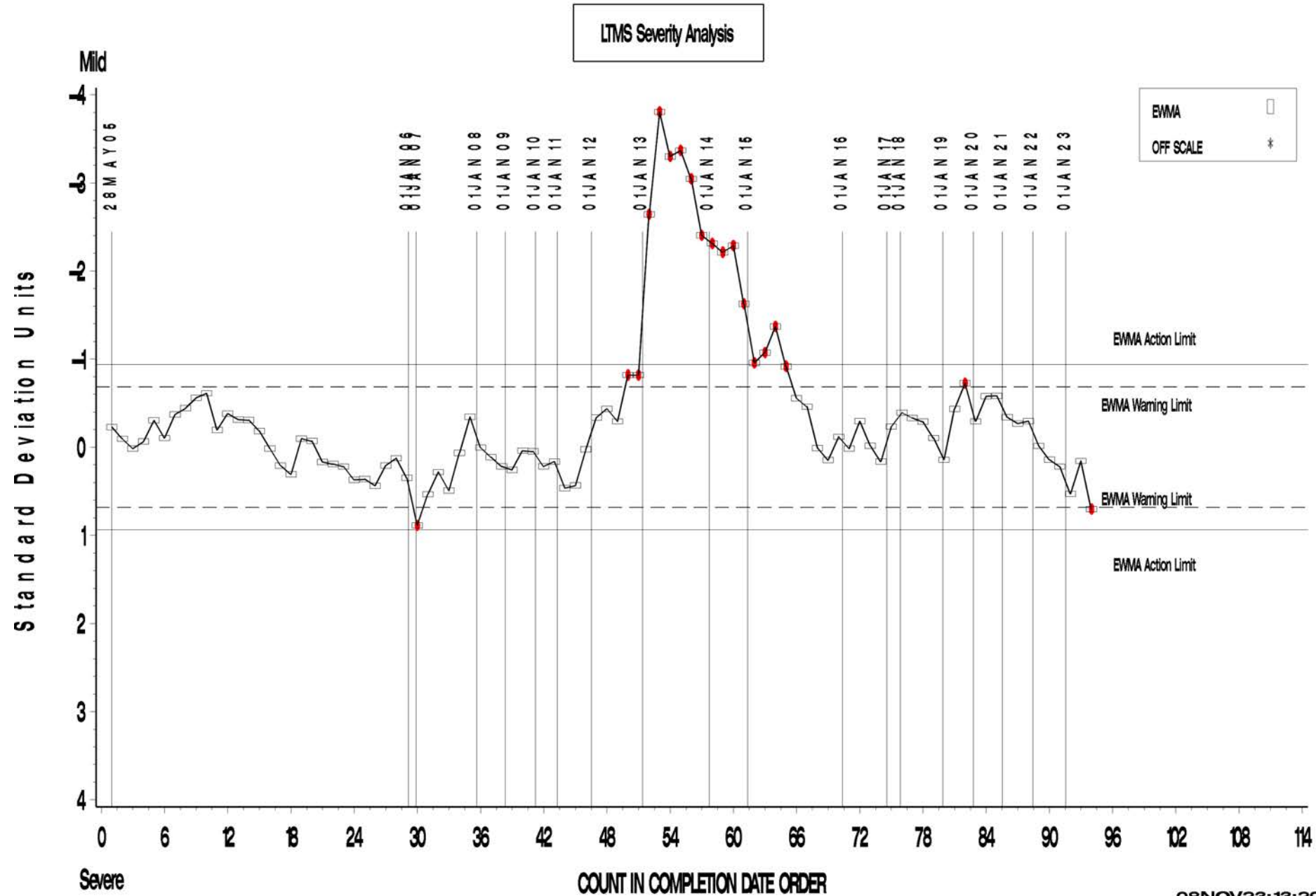


OIL CONS. DELTA — FINAL RESULT

CUSUM Severity Analysis

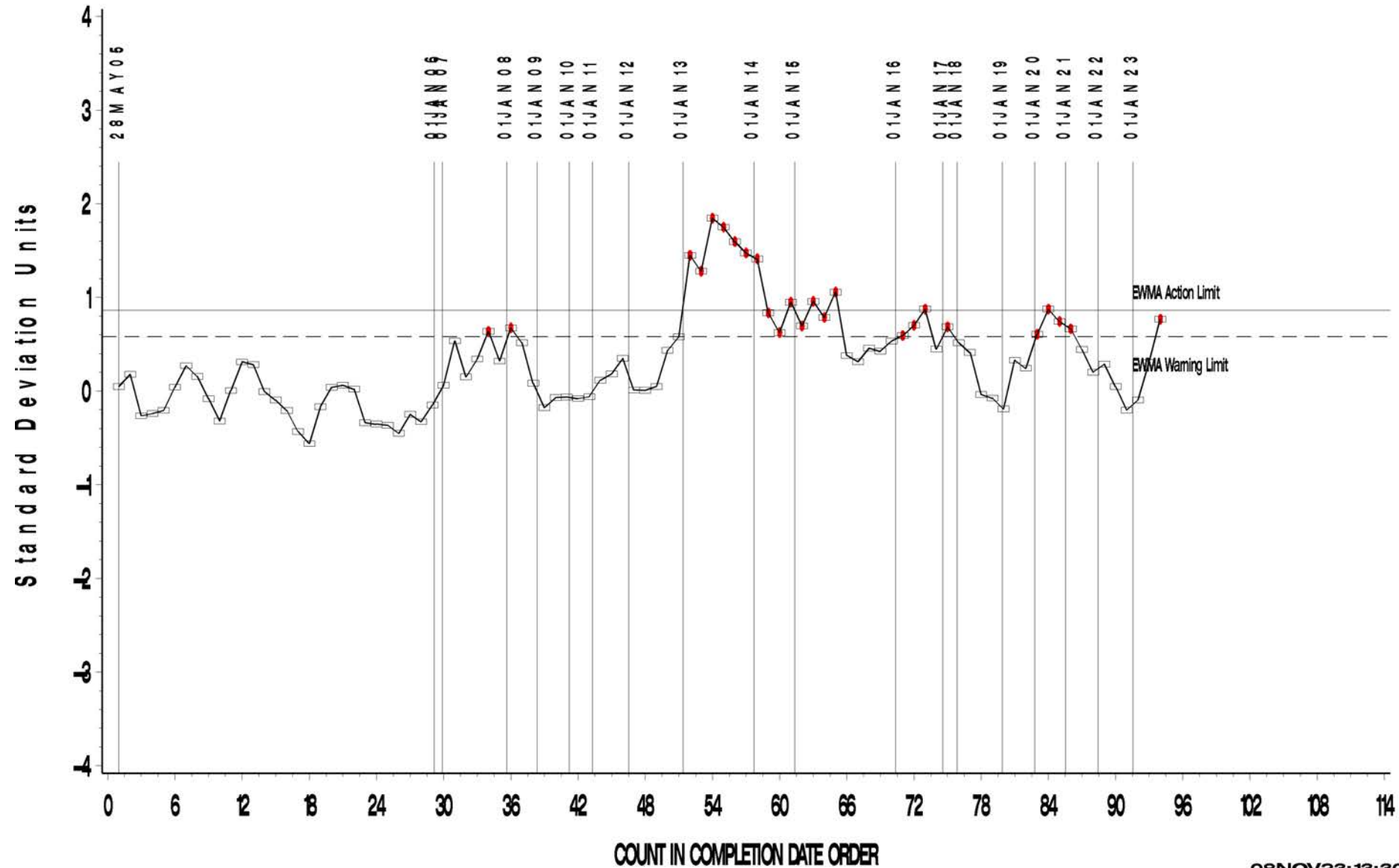


2ND RING TOP CARBON AVG. — FINAL RESULT



2ND RING TOP CARBON AVG. — FINAL RESULT

LTMS Precision Analysis



2ND RING TOP CARBON AVG. — FINAL RESULT

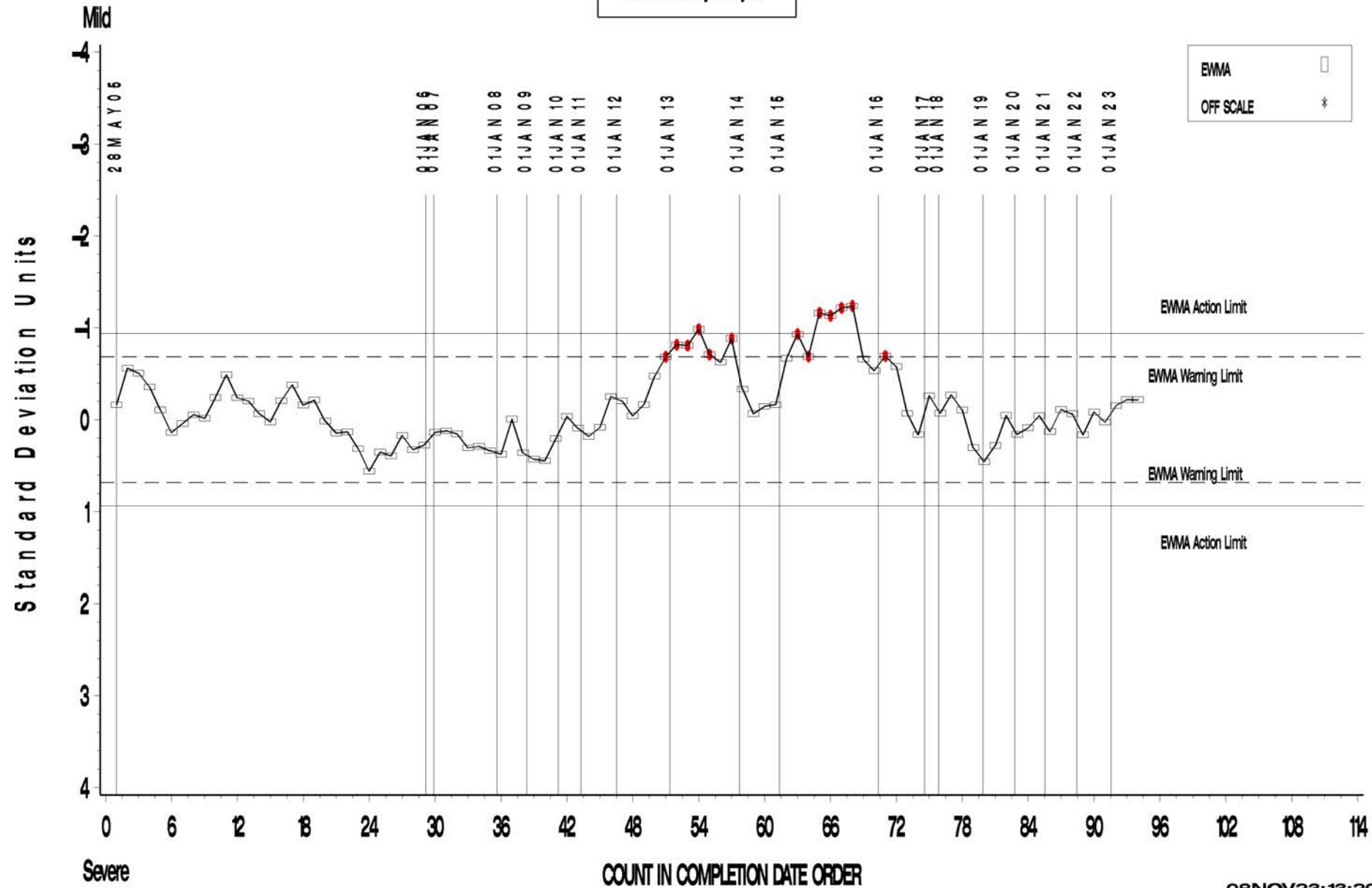
CUSUM Severity Analysis





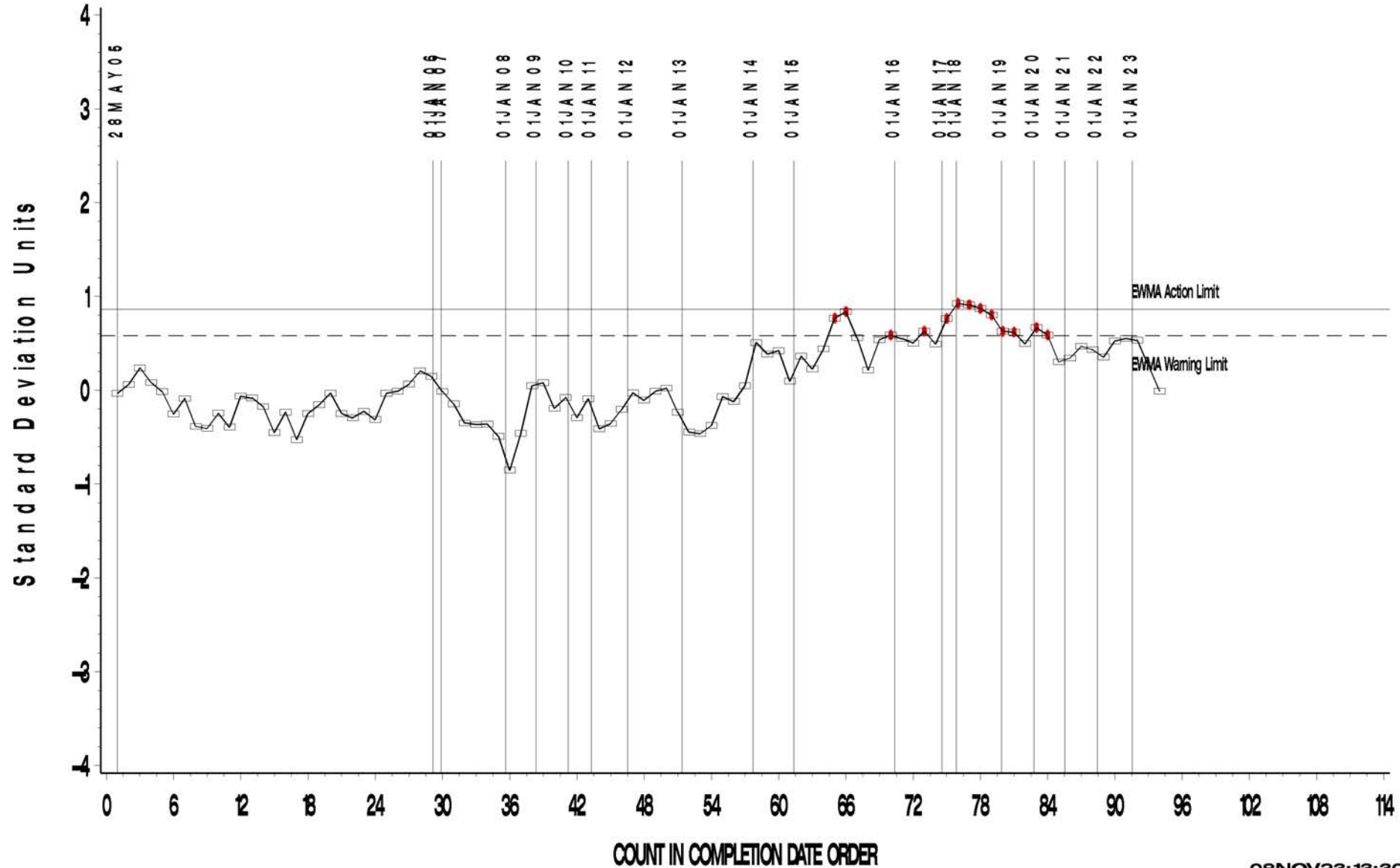
TOP GROOVE CARBON AVG —FINAL RESULT

LTMS Severity Analysis



TOP GROOVE CARBON AVG —FINAL RESULT

LTMS Precision Analysis



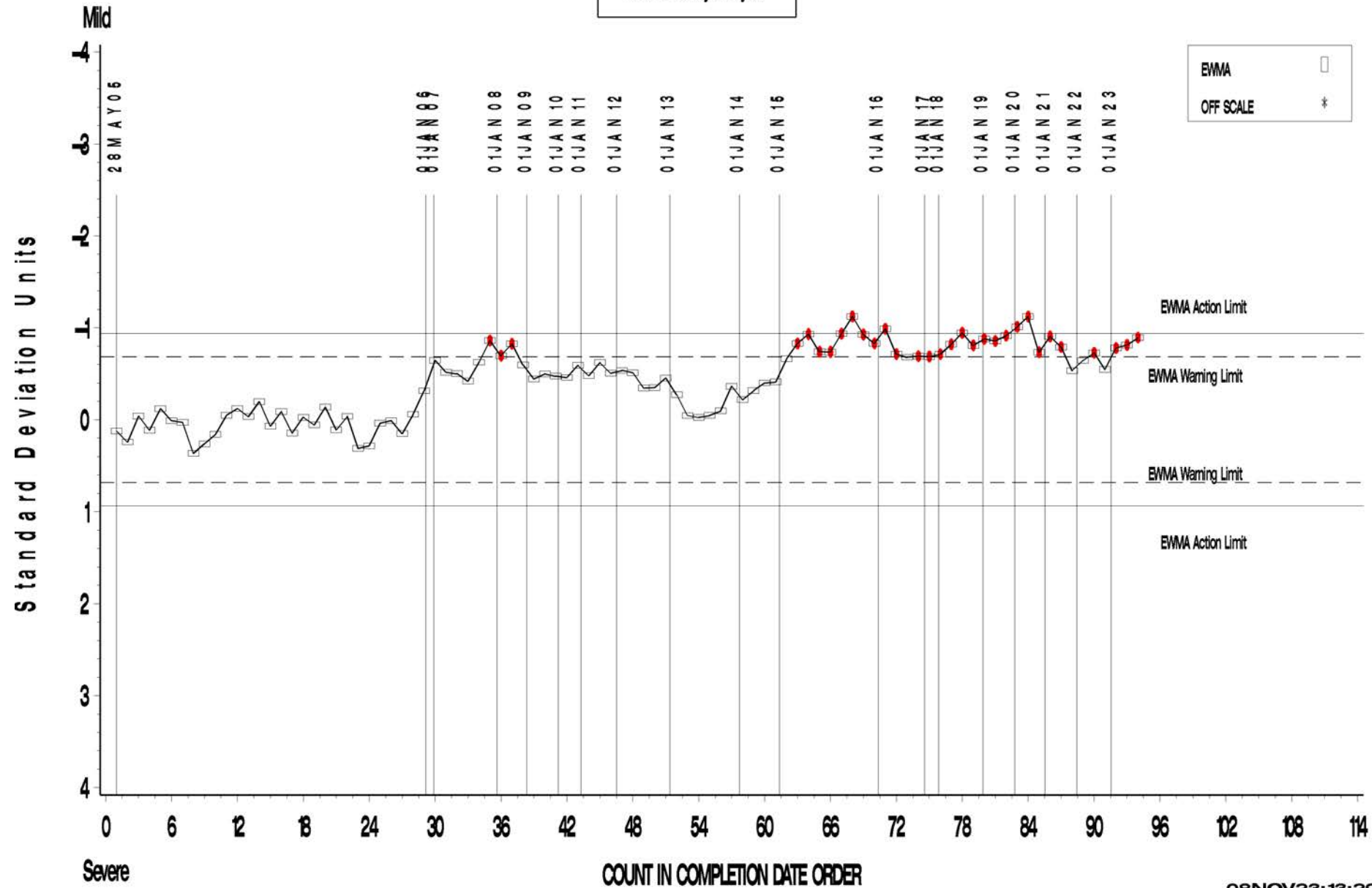
TOP GROOVE CARBON AVG — FINAL RESULT

CUSUM Severity Analysis



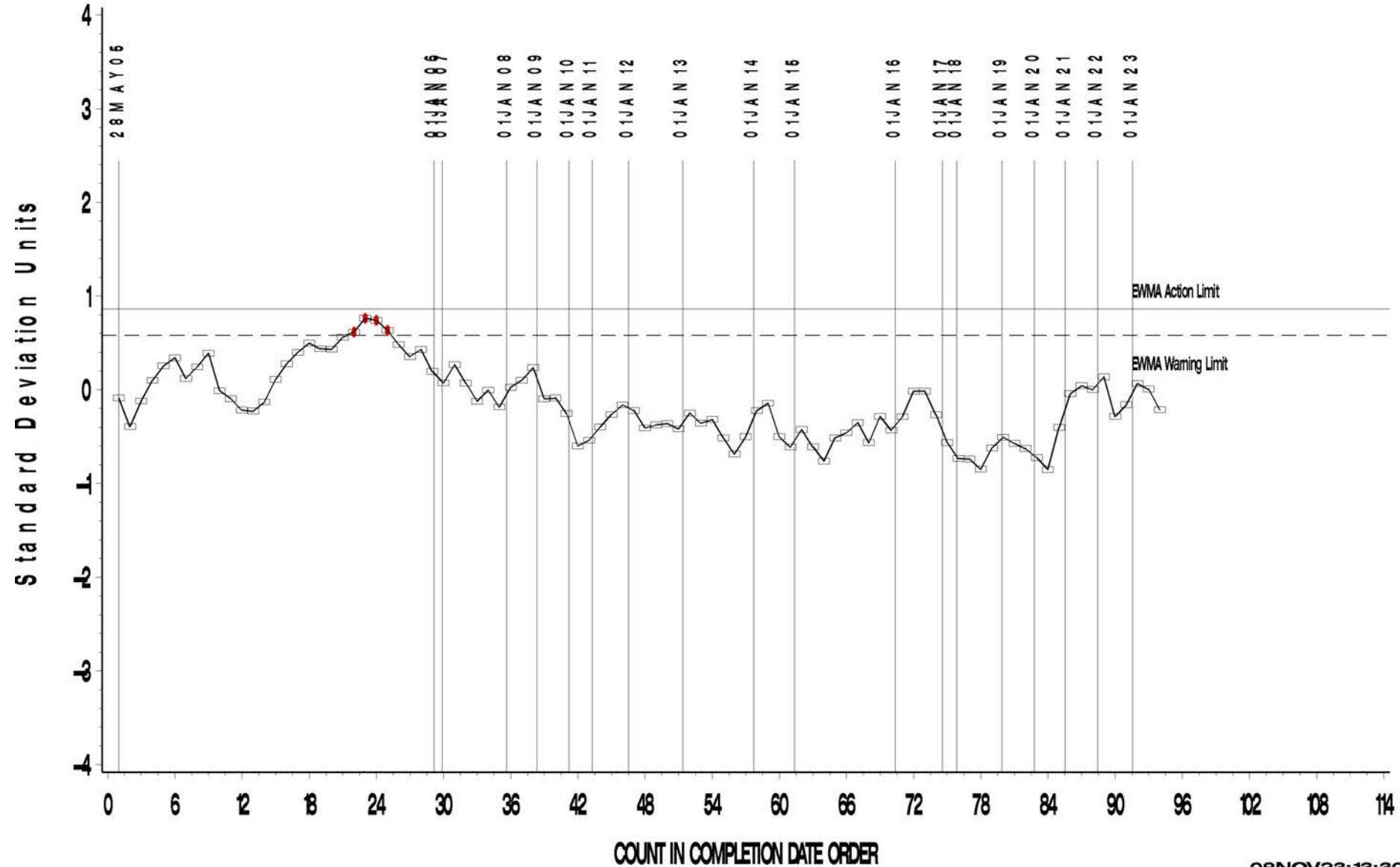
TOP LAND CARBON AVG. — FINAL RESULT

LTMS Severity Analysis



TOP LAND CARBON AVG. — FINAL RESULT

LTMS Precision Analysis

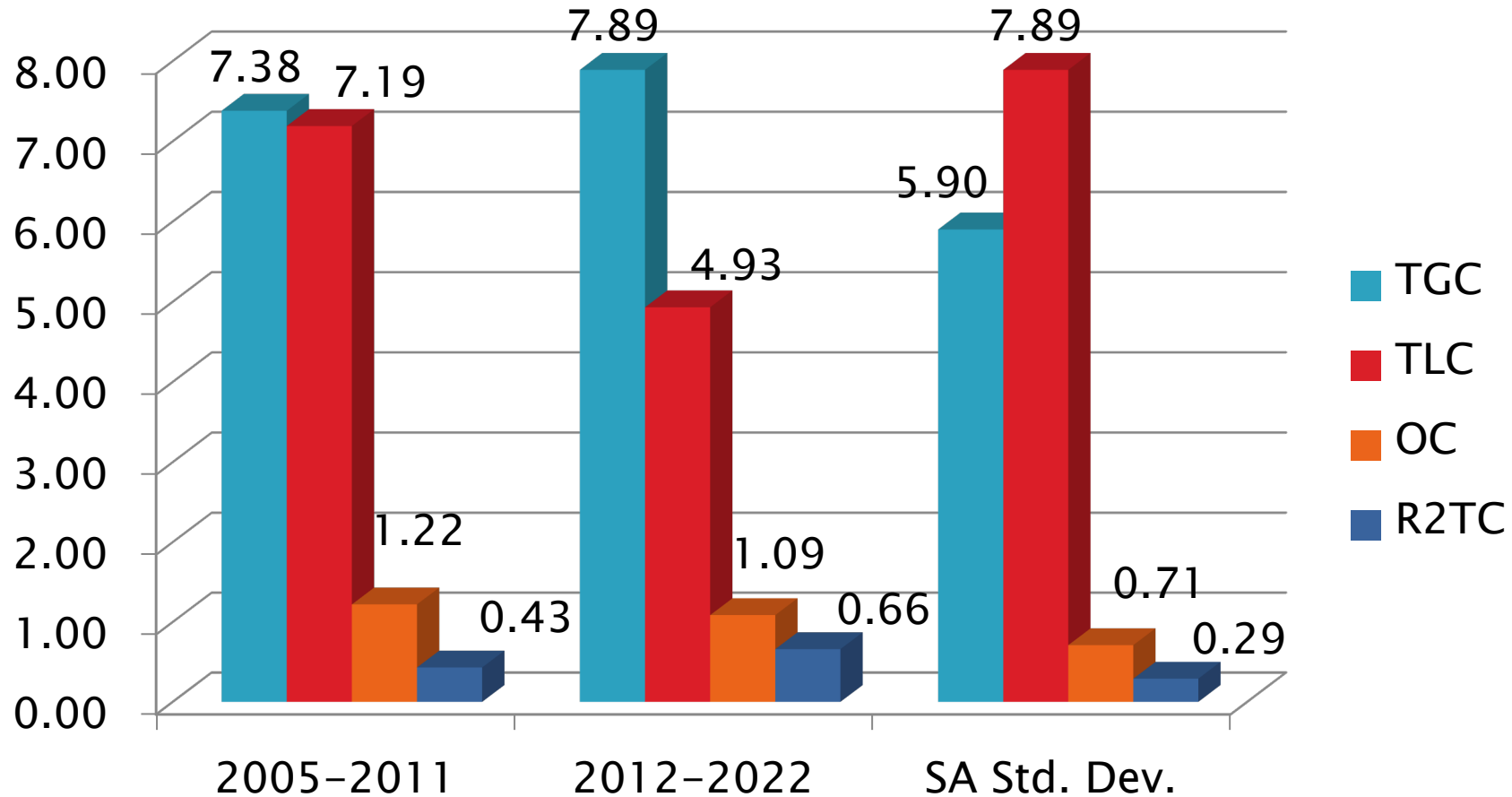


TOP LAND CARBON AVG. — FINAL RESULT

CUSUM Severity Analysis



# C13 Precision Estimates



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# C13 Oil Aeration (COAT)

»» October 2023

**Test Monitoring Center**  
<https://www.astmtmc.org>



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# COAT Test Activity

Test Status	Validity Code	COAT
Acceptable Calibration Test	AC	2
Failed Calibration Test	OC	0
Operationally Invalid	LC	0
Aborted	XC	0
<b>Total</b>		<b>2</b>

# COAT Failed Tests

Failed Parameter	Number of Tests
No failed tests	0
<b>Total</b>	<b>0</b>

# COAT Lost Tests\*

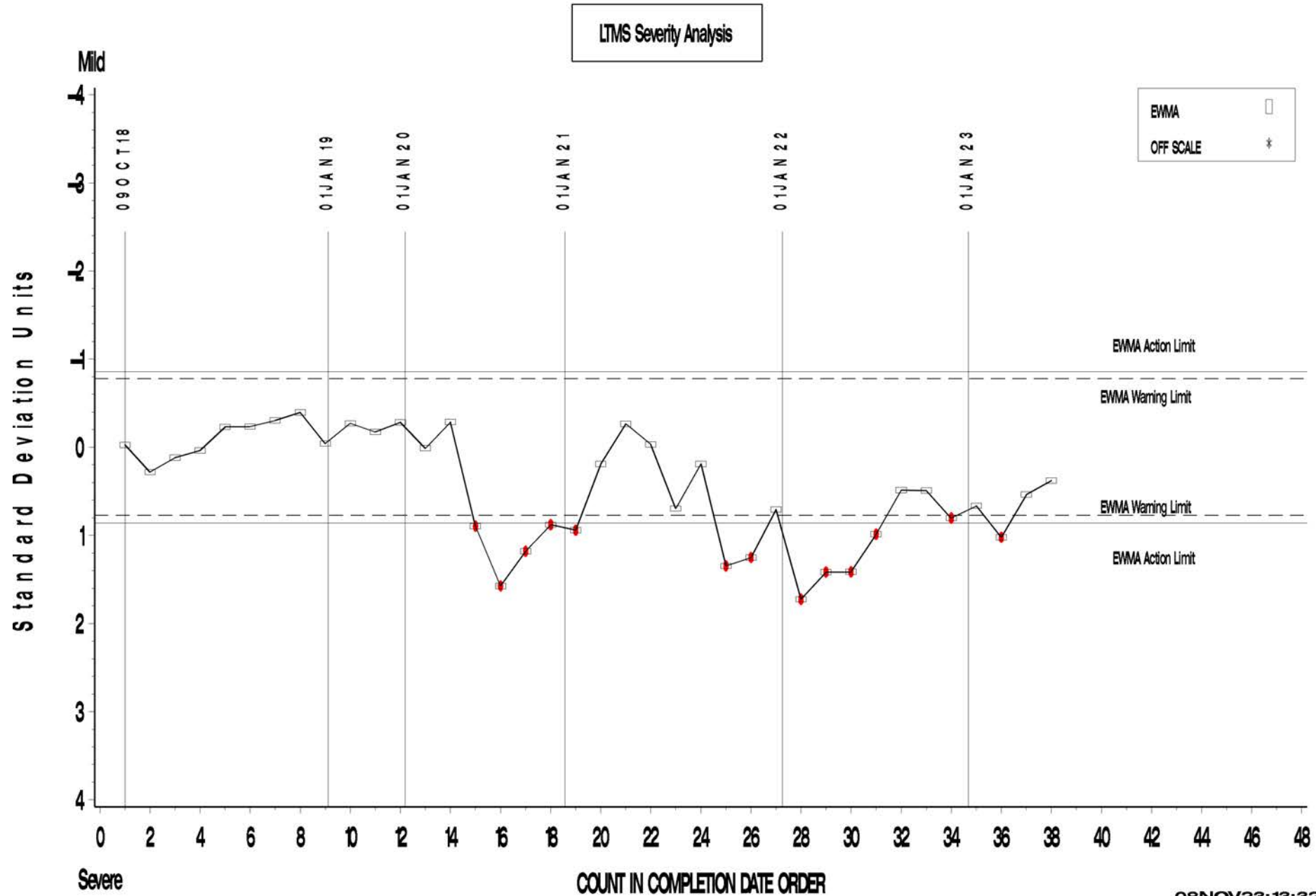
Status	Cause	#
Invalid	No invalid tests	0
Aborted	No aborted tests	0
<b>Total</b>		<b>0</b>

\*Invalid and aborted tests

# COAT Test Severity

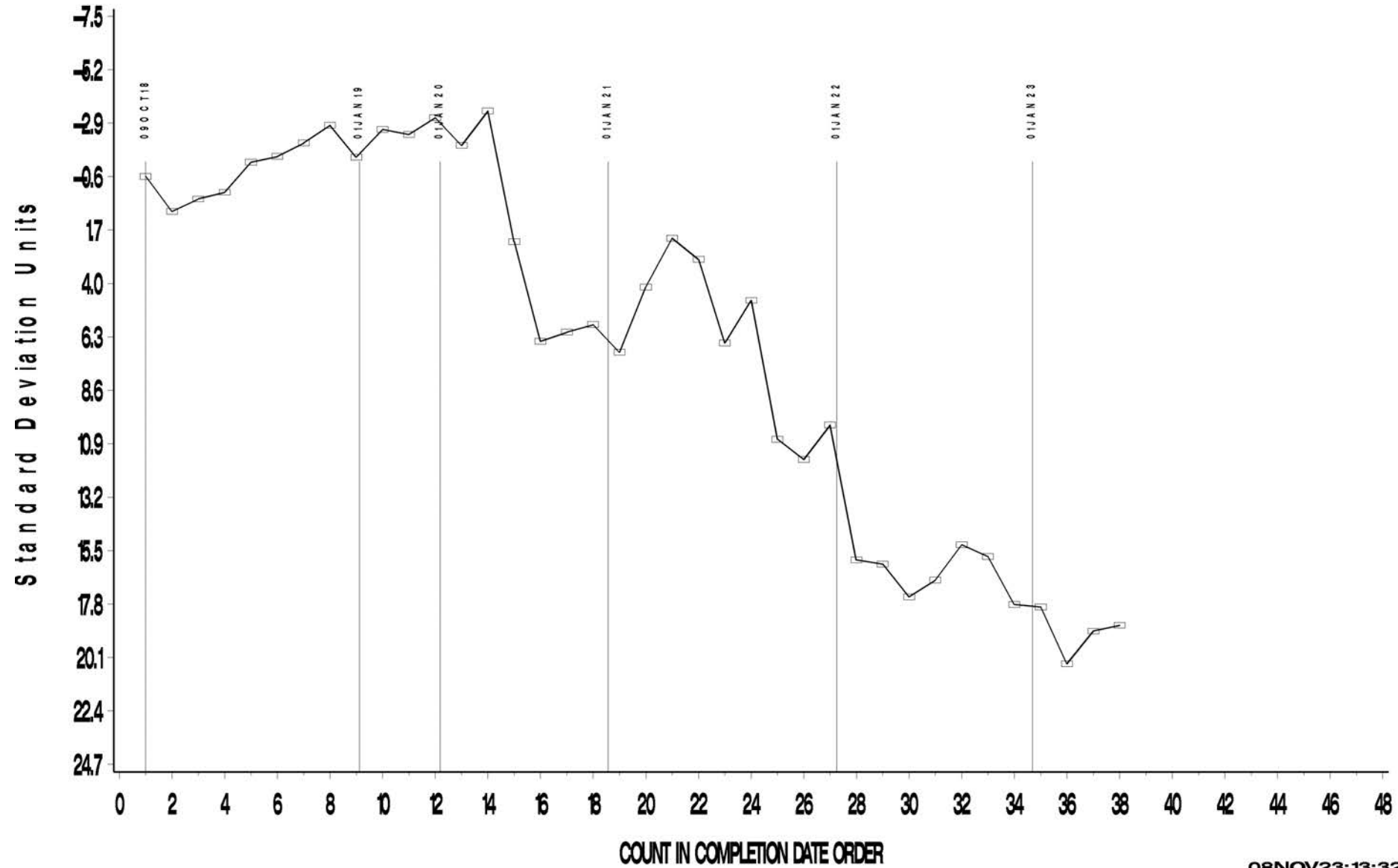
- ▶ AAVE is in control

CORRECTED AVERAGE OIL AERATION OVER TEST HOURS 40 —50



CORRECTED AVERAGE OIL AERATION OVER TEST HOURS 40 —50

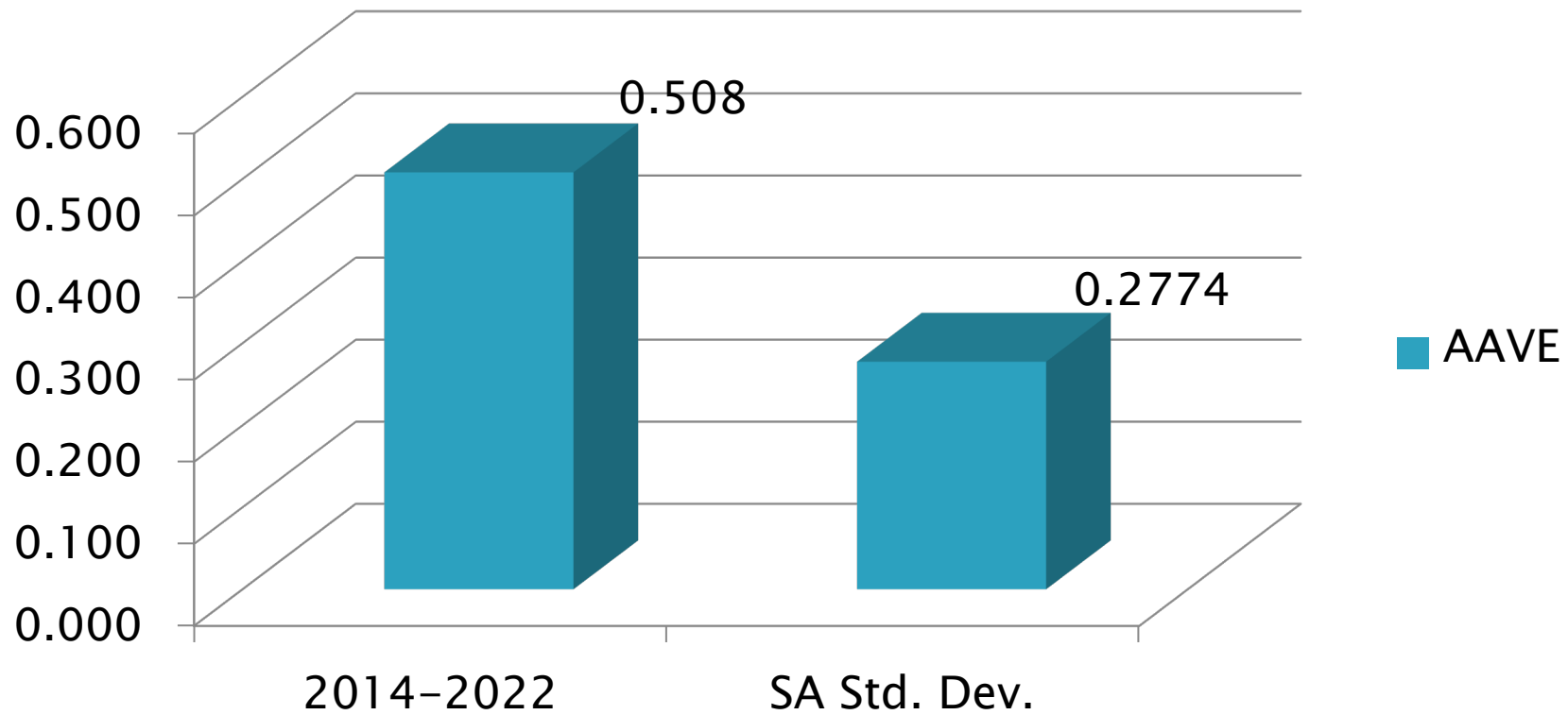
CUSUM Severity Analysis





# COAT Precision Estimates

AAVE



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**Test Monitoring Center**  
<https://www.astmtmc.org>



# Daimler DD13 Scuffing Test

➤➤ October 2023

**Test Monitoring Center**  
<https://www.astmtmc.org>



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# DD13 Test Activity

Test Status	Validity Code	COAT
Acceptable Calibration Test	AC	2
Failed Calibration Test	OC	0
Operationally Invalid	LC	0
Aborted	XC	0
<b>Total</b>		<b>2</b>

# DD13 Failed Tests

Failed Parameter	Number of Tests
No failed tests	0
<b>Total</b>	<b>0</b>

# DD13 Lost Tests\*

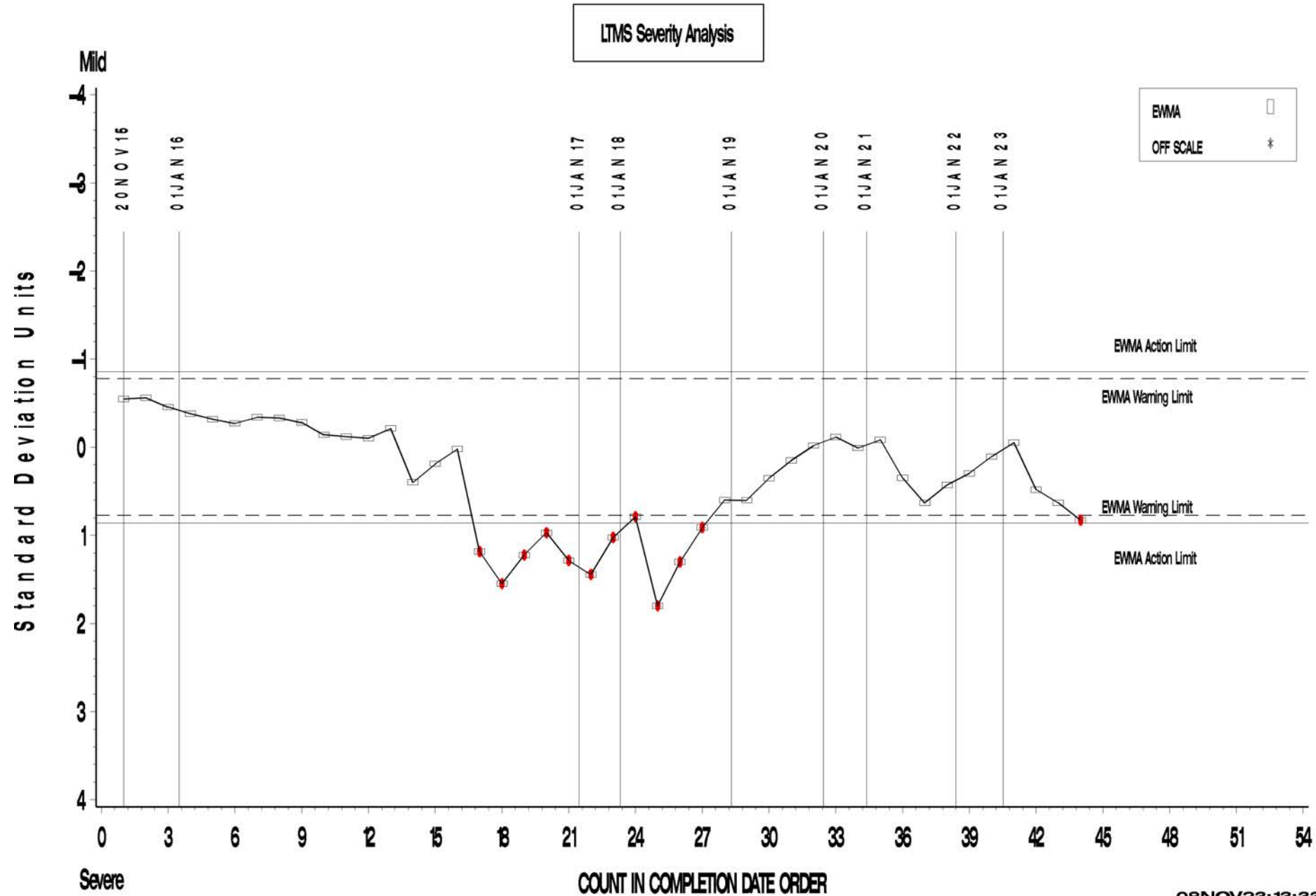
Status	Cause	#
Invalid	No invalid tests	0
Aborted	No aborted tests	0
<b>Total</b>		<b>0</b>

\*Invalid and aborted tests

# DD13 Test Severity

- ▶ HRS2 is in Zi Level 1 alarm in the severe direction.

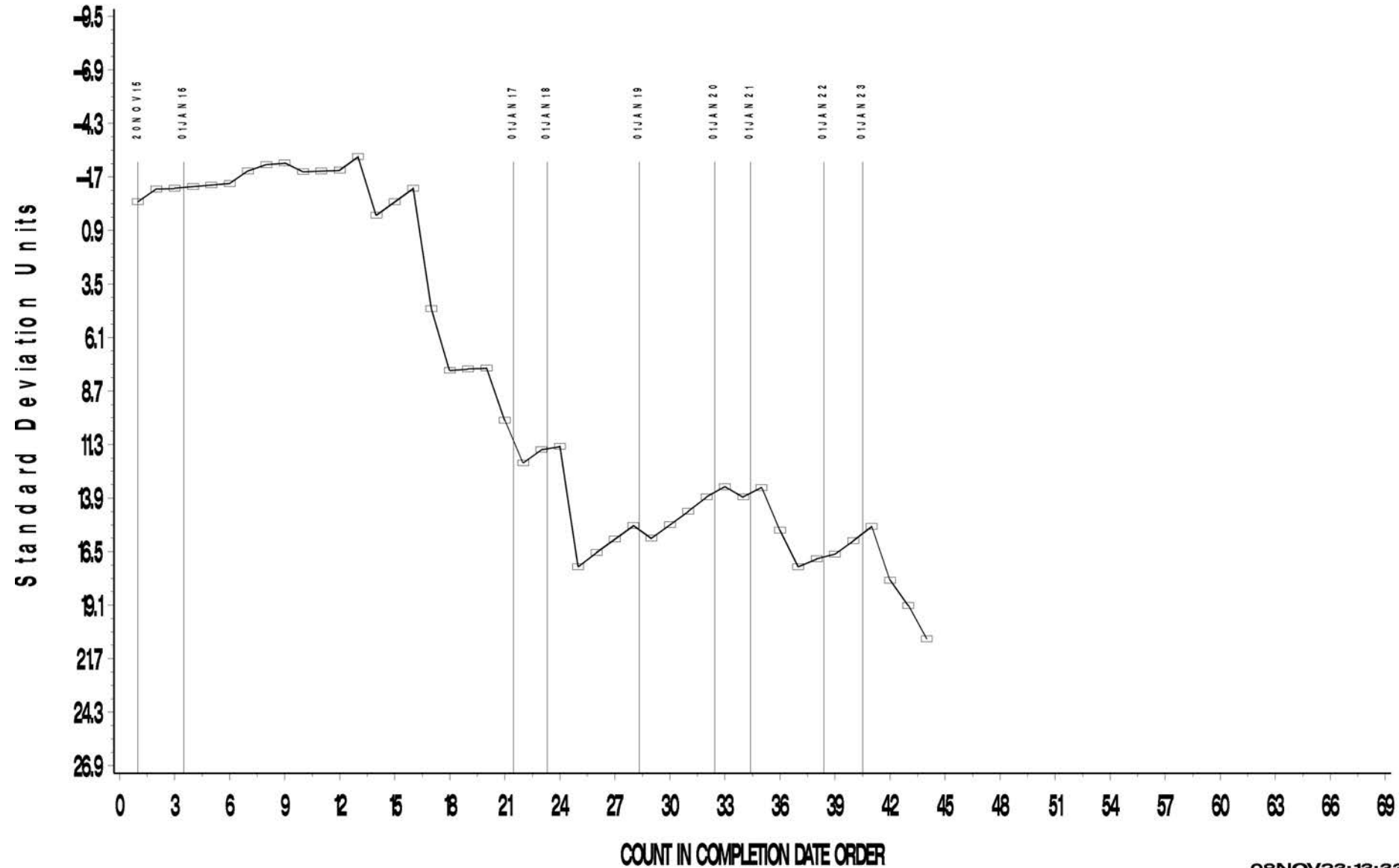
FNL. ORIG. UNIT HOURS TO SCUFF





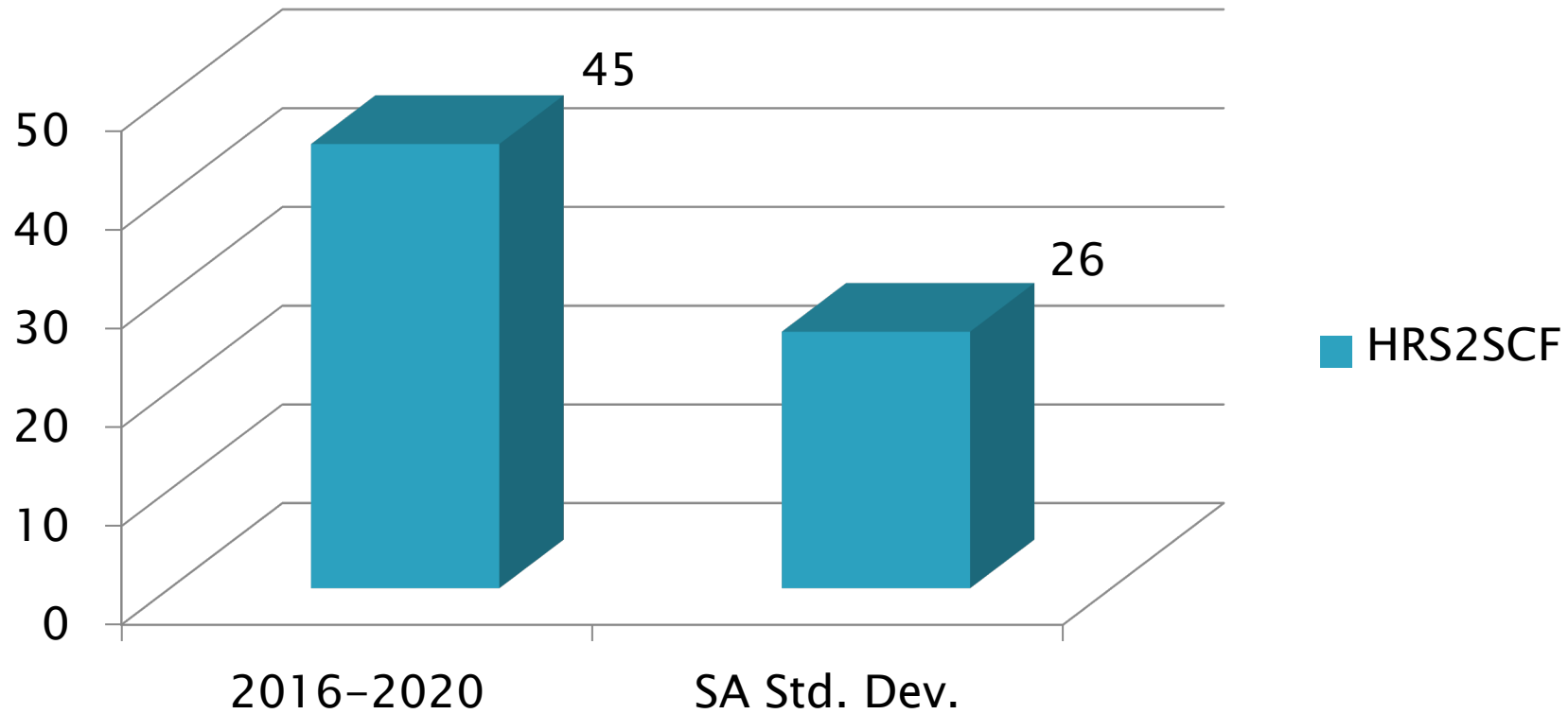
FNL. ORIG. UNIT HOURS TO SCUFF

CUSUM Severity Analysis



# DD13 Precision Estimates

## HRS2SCF



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**Test Monitoring Center**  
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# Cummins ISB

➤➤ October 2023

**Test Monitoring Center**  
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# ISB Test Activity

Test Status	Validity Code	#
Acceptable Calibration Test	AC	6
Failed Calibration Test	OC	1
Operationally Invalid	LC	0
Aborted	XC	1
<b>Total</b>		<b>8</b>

# ISB Failed Tests

Failed Parameter	Number of Tests
ATWL Level 3 Ei	1
<b>Total</b>	<b>1</b>

# ISB Lost Tests\*

Status	Cause	#
Invalid	No invalid tests	0
Aborted	Coolant dilution in oil	1
<b>Total</b>		<b>1</b>

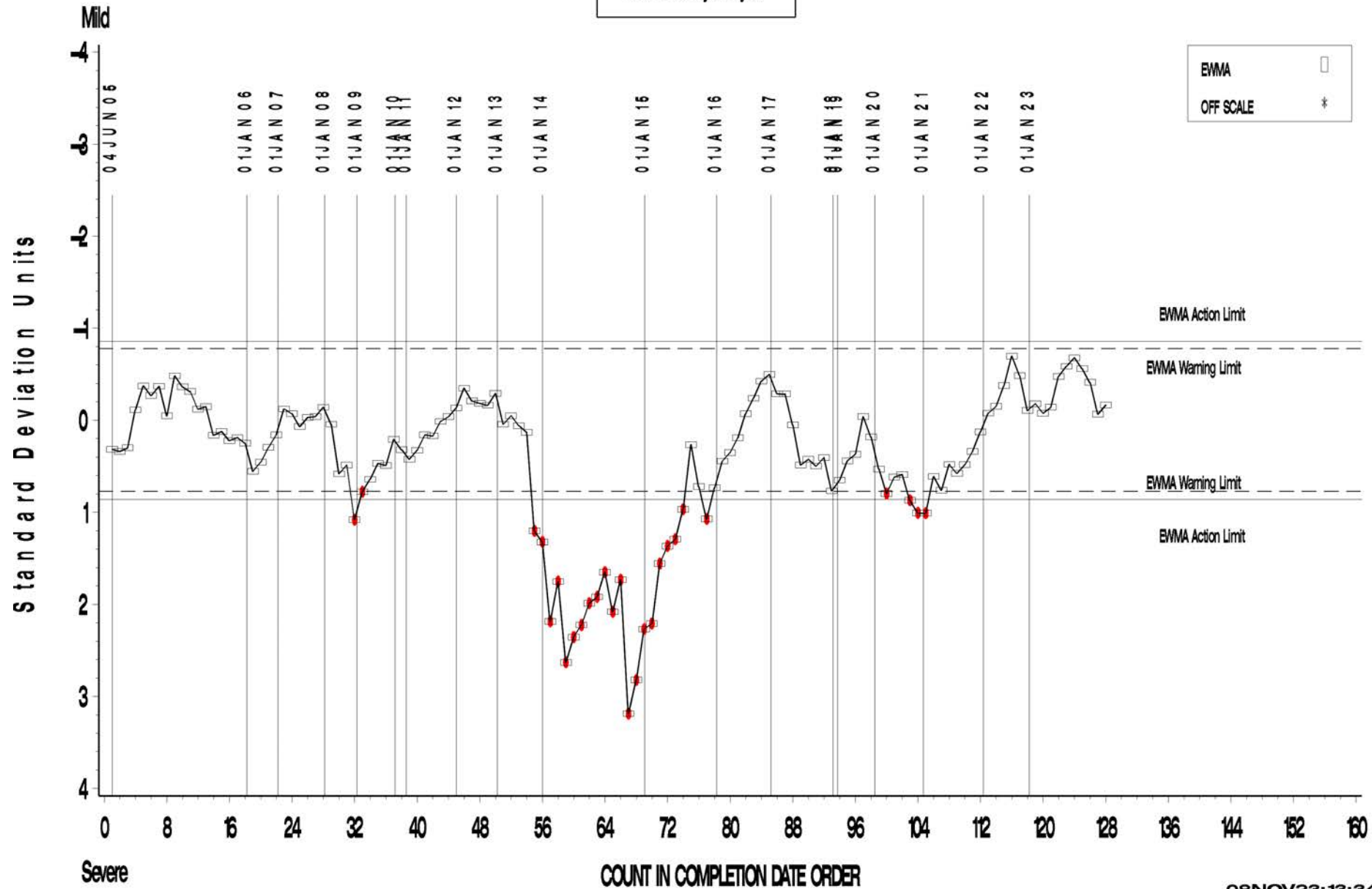
\*Invalid and aborted tests

# ISB Test Severity

- ▶ ACSW and ATWL are in control.

AVERAGE CAMSHAFT WEAR

LTMS Severity Analysis



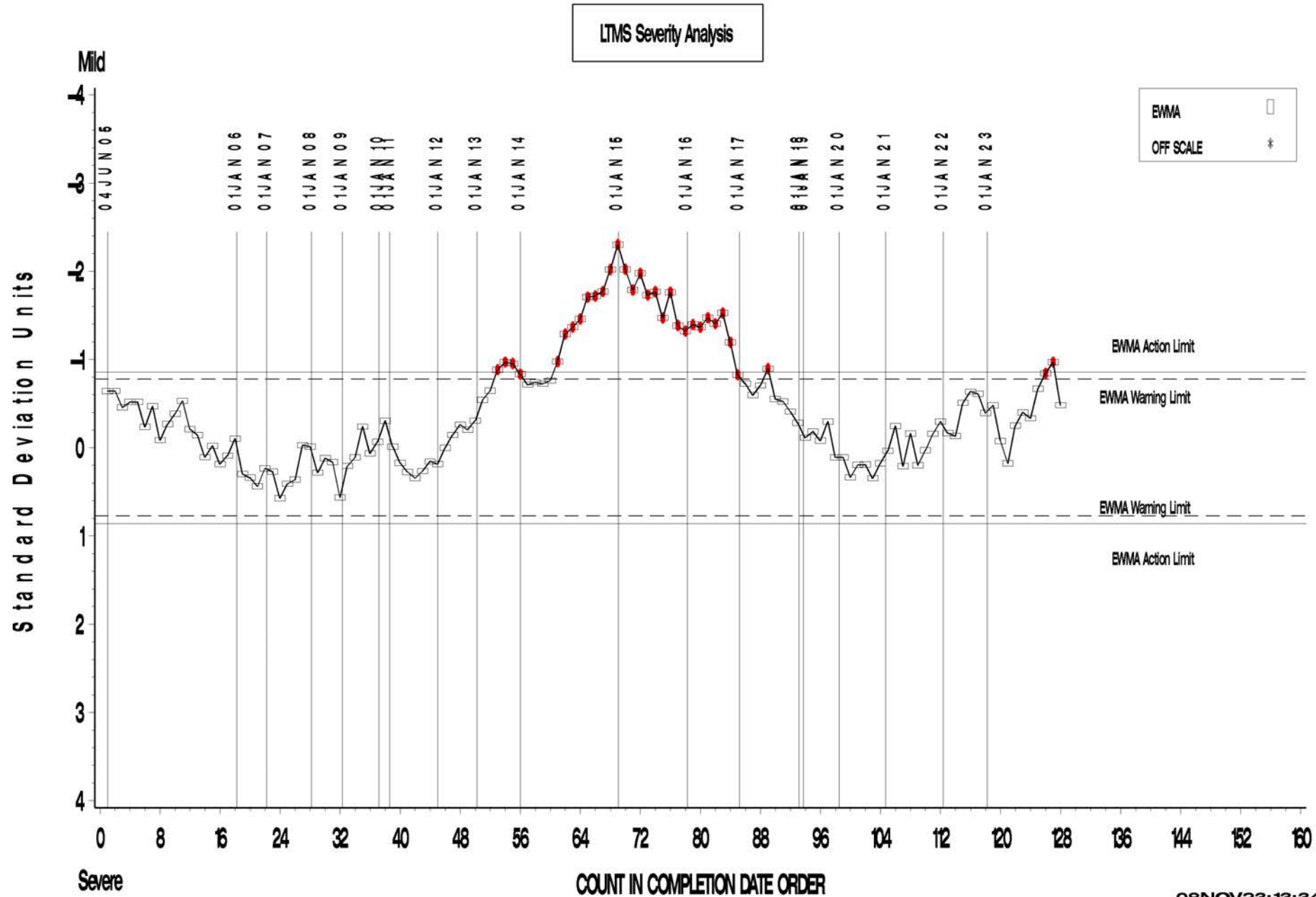


### AVERAGE CAMSHAFT WEAR

CUSUM Severity Analysis



AVERAGE TAPPET WEIGHT LOSS

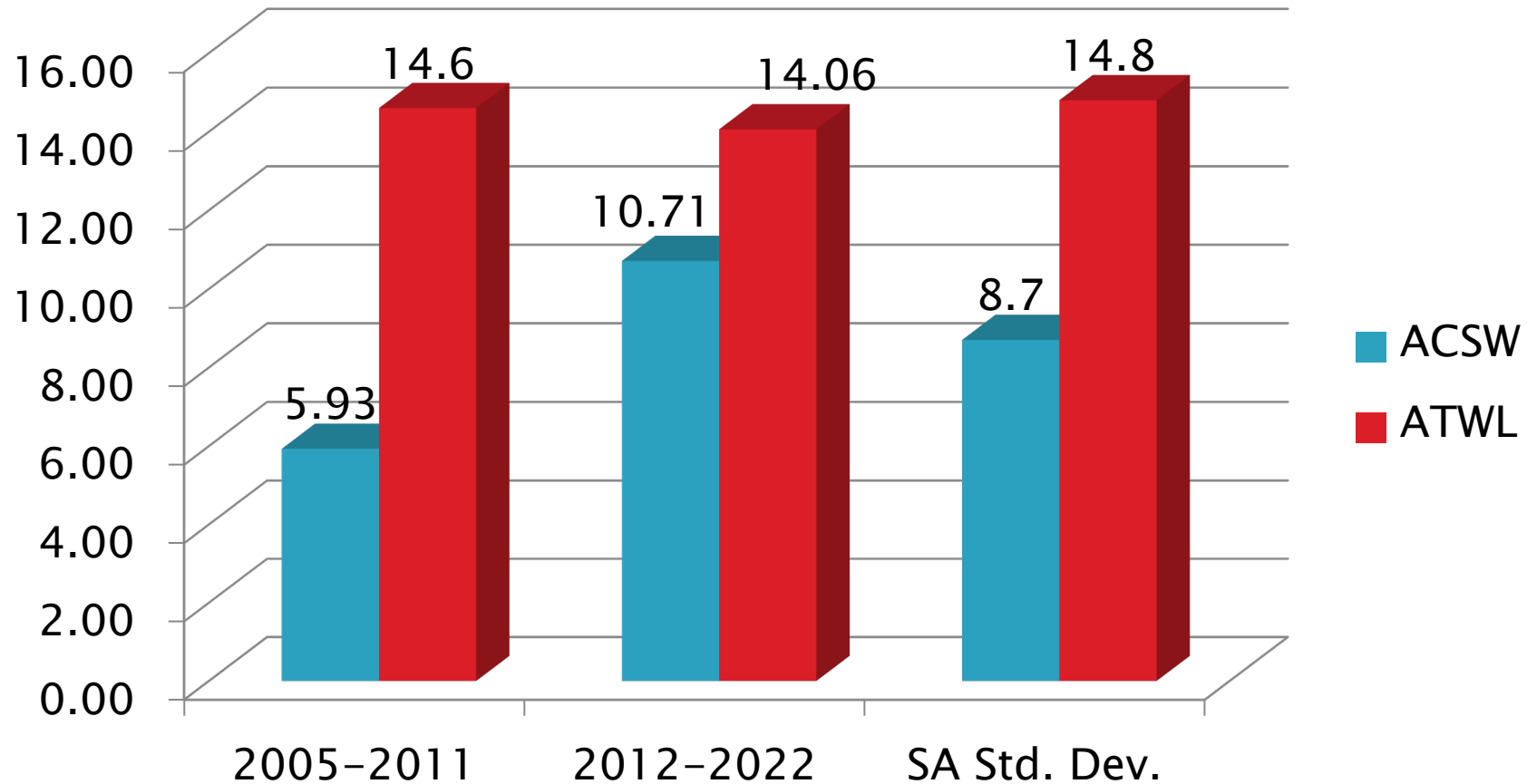


AVERAGE TAPPET WEIGHT LOSS

CUSUM Severity Analysis



# ISB Precision Estimates



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# Cummins ISM

➤➤ October 2023

**Test Monitoring Center**  
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# ISM Test Activity

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

# ISM Failed Tests

Failed Parameter	Number of Tests
No failed tests	0
<b>Total</b>	<b>0</b>

# ISM Lost Tests\*

Status	Cause	#
Invalid	No invalid tests	0
Aborted	Cam bearing failure	1
<b>Total</b>		<b>1</b>

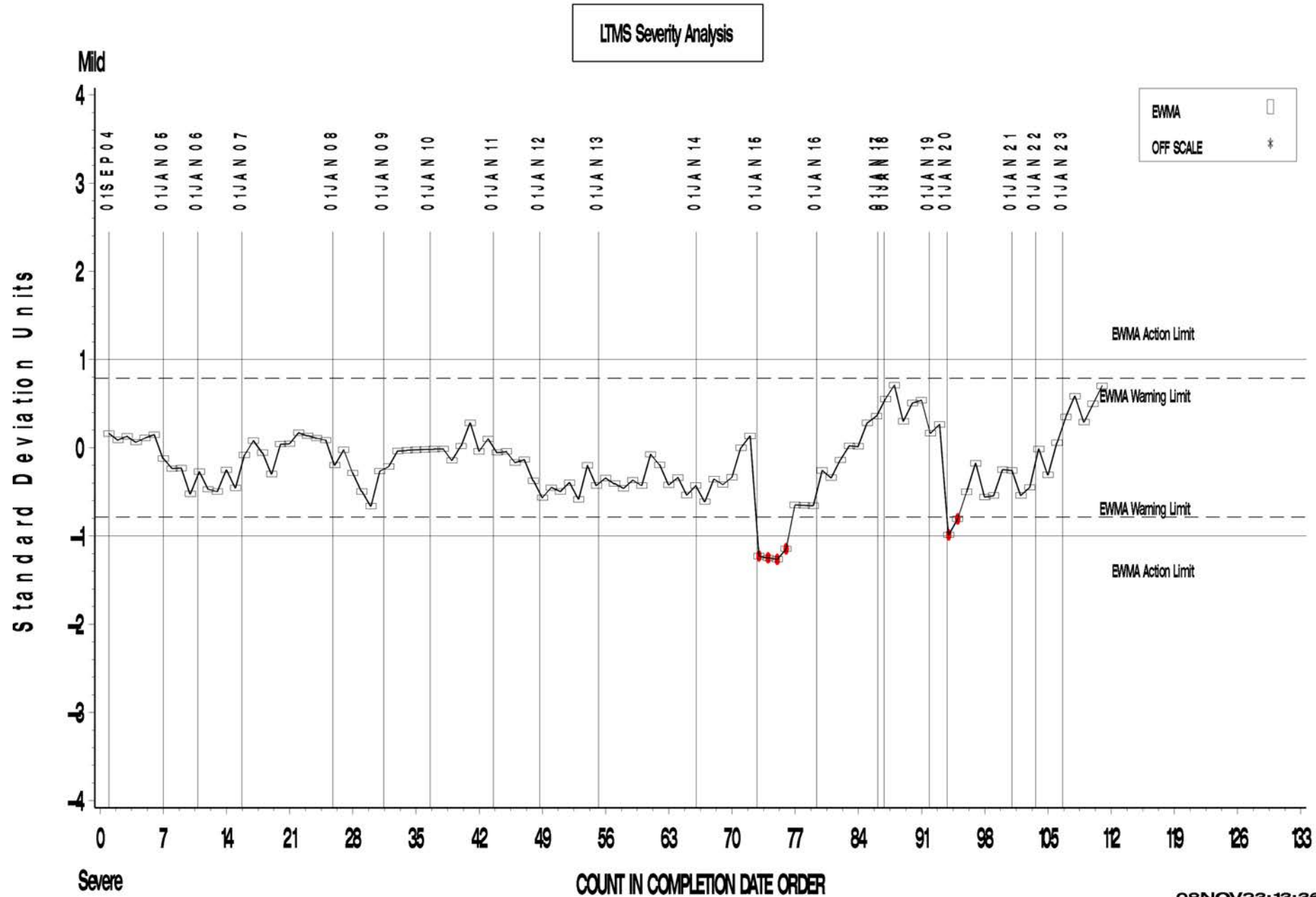
\*Invalid and aborted tests



# ISM Test Severity

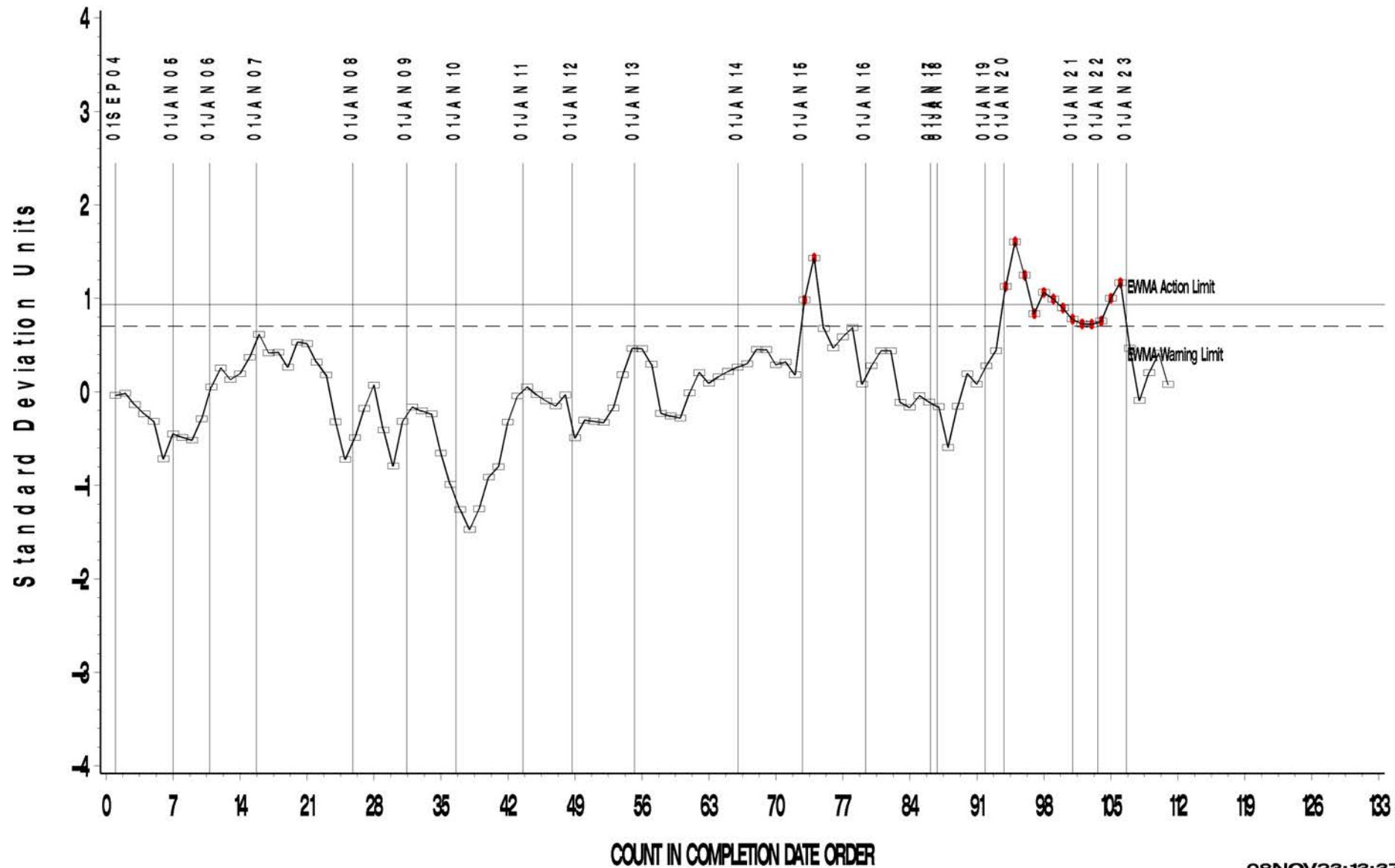
- ▶ ASR and FPD are in control
- ▶ CWL is in severity warning alarm in the mild direction
- ▶ IAS is in severity action alarm in the severe direction

AVERAGE SLUDGE RATING



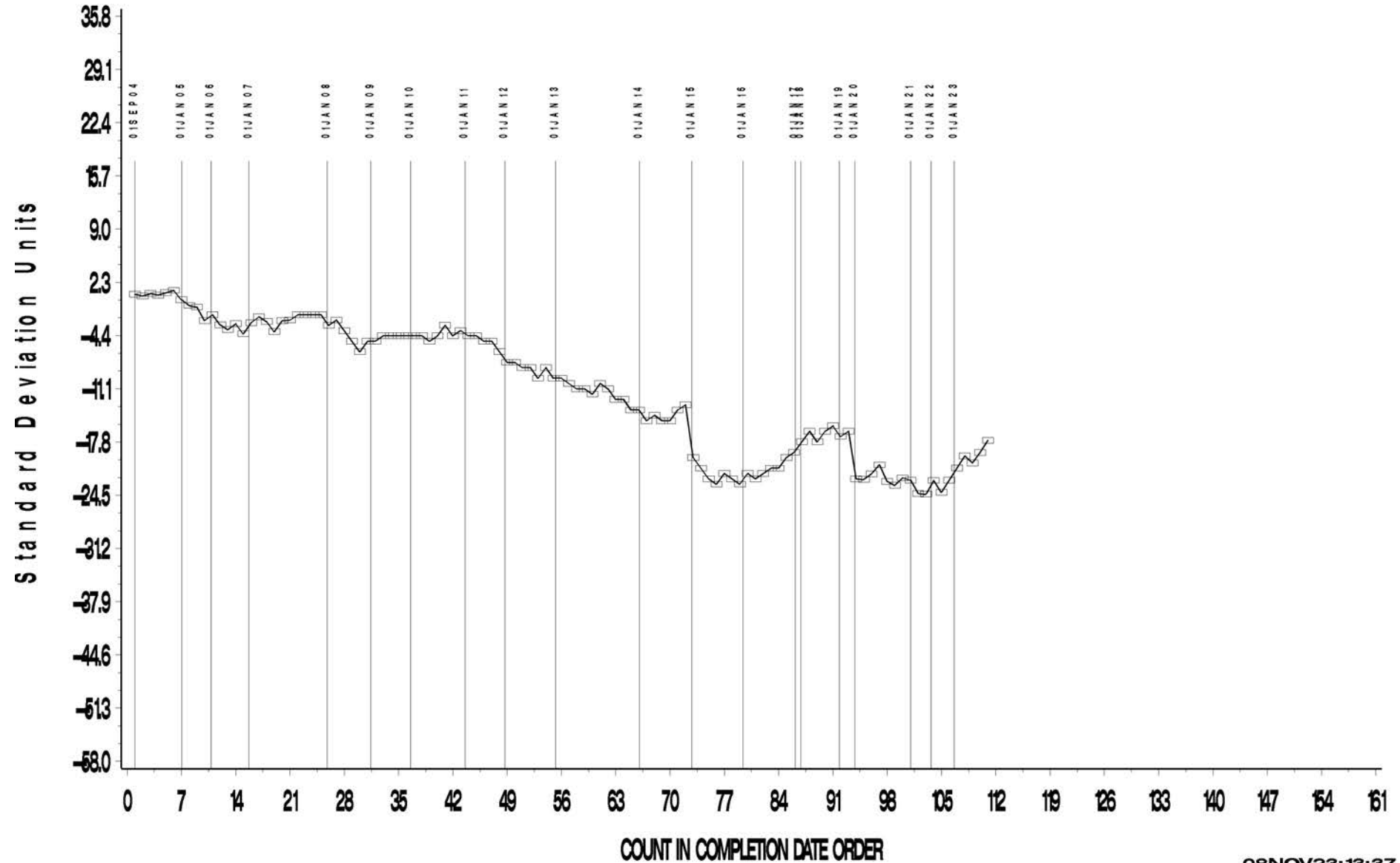
AVERAGE SLUDGE RATING

LTMS Precision Analysis



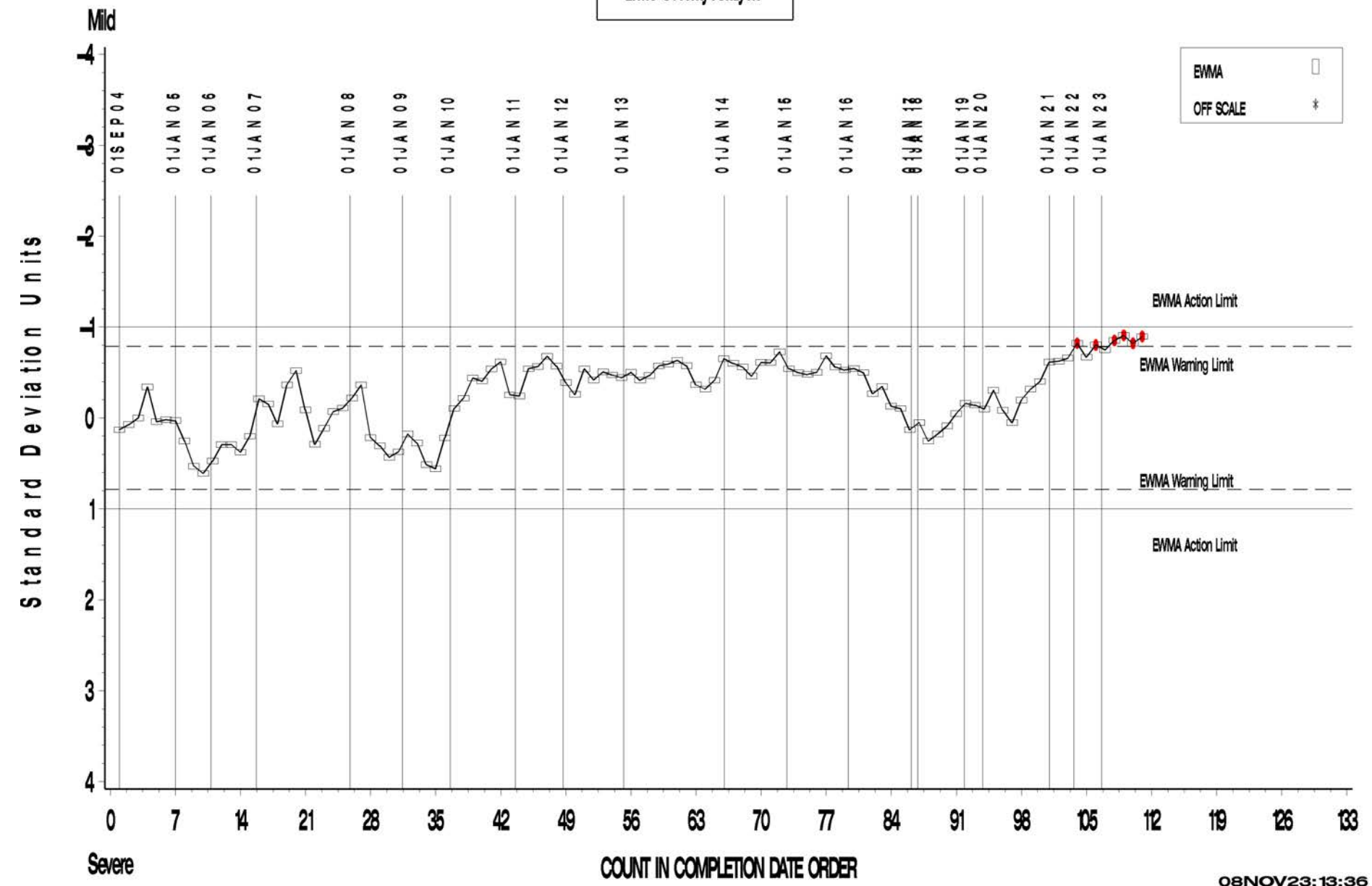
### AVERAGE SLUDGE RATING

CUSUM Severity Analysis



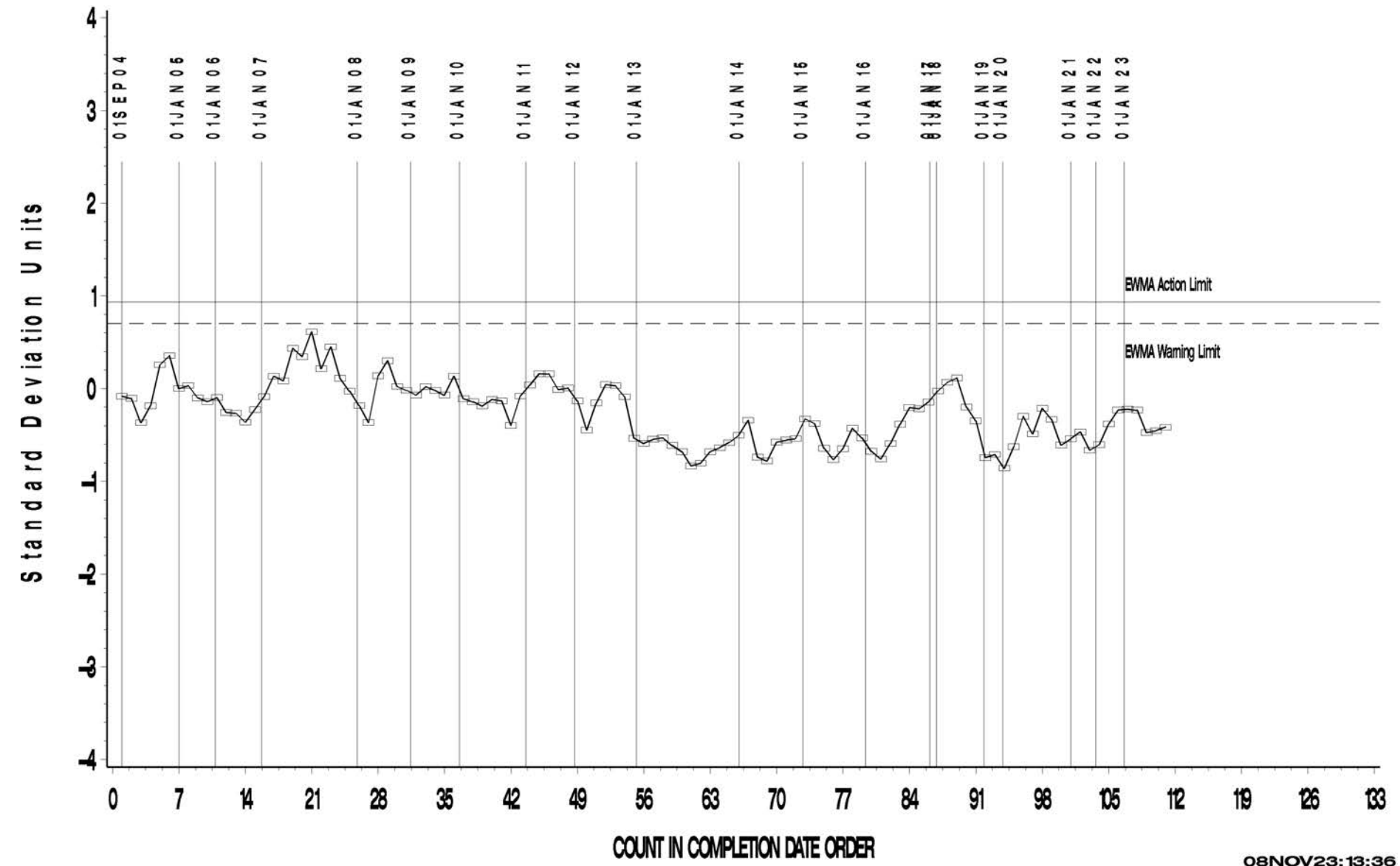
CROSSHEAD WEIGHT LOSS ADJUSTED TO 3.9 % SOOT

LTMS Severity Analysis



CROSSHEAD WEIGHT LOSS ADJUSTED TO 3.9 % SOOT

LTMS Precision Analysis



CROSSHEAD WEIGHT LOSS ADJUSTED TO 3.9 % SOOT

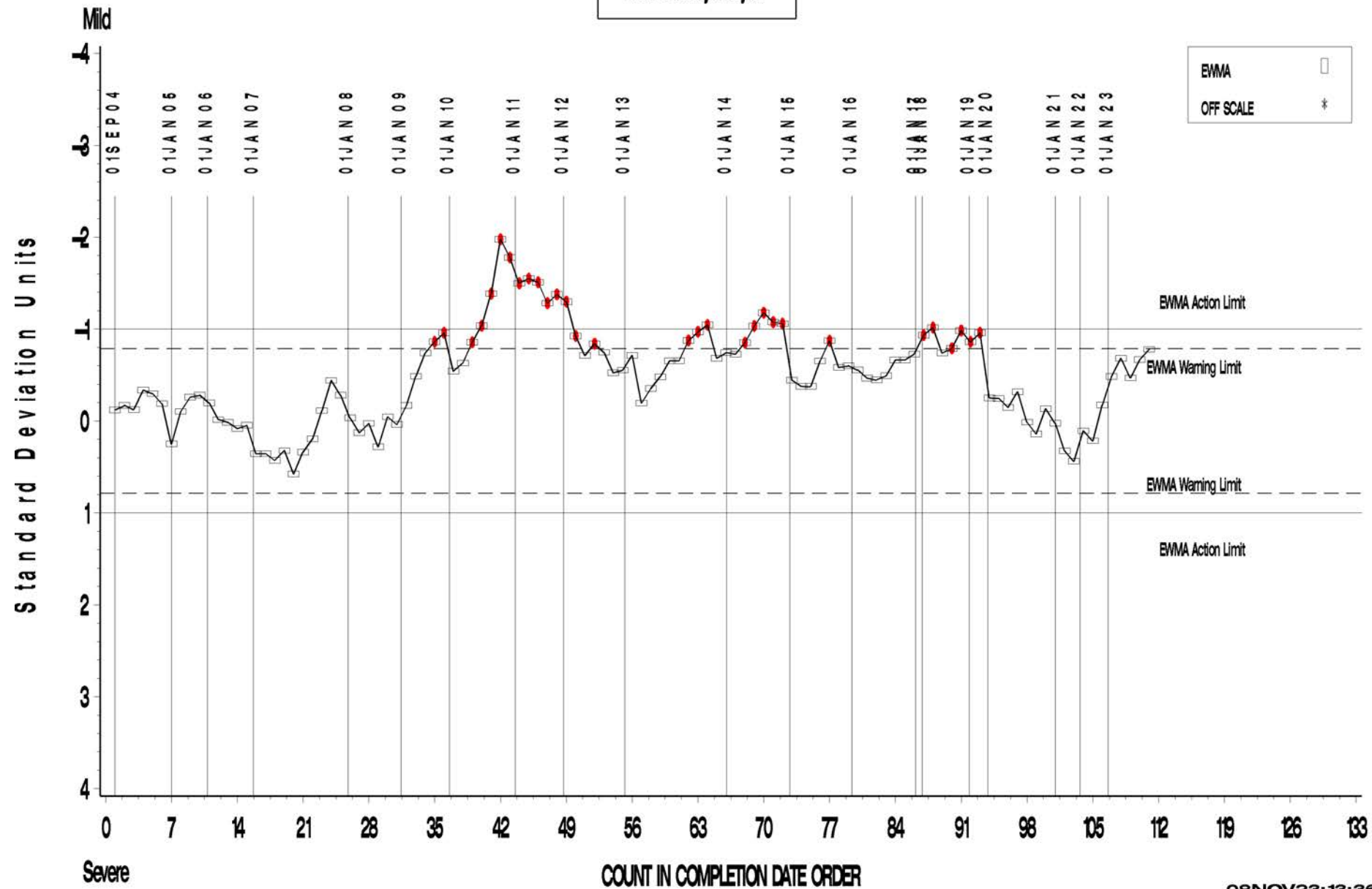
CUSUM Severity Analysis





OIL FILTER DELTA PRESSURE

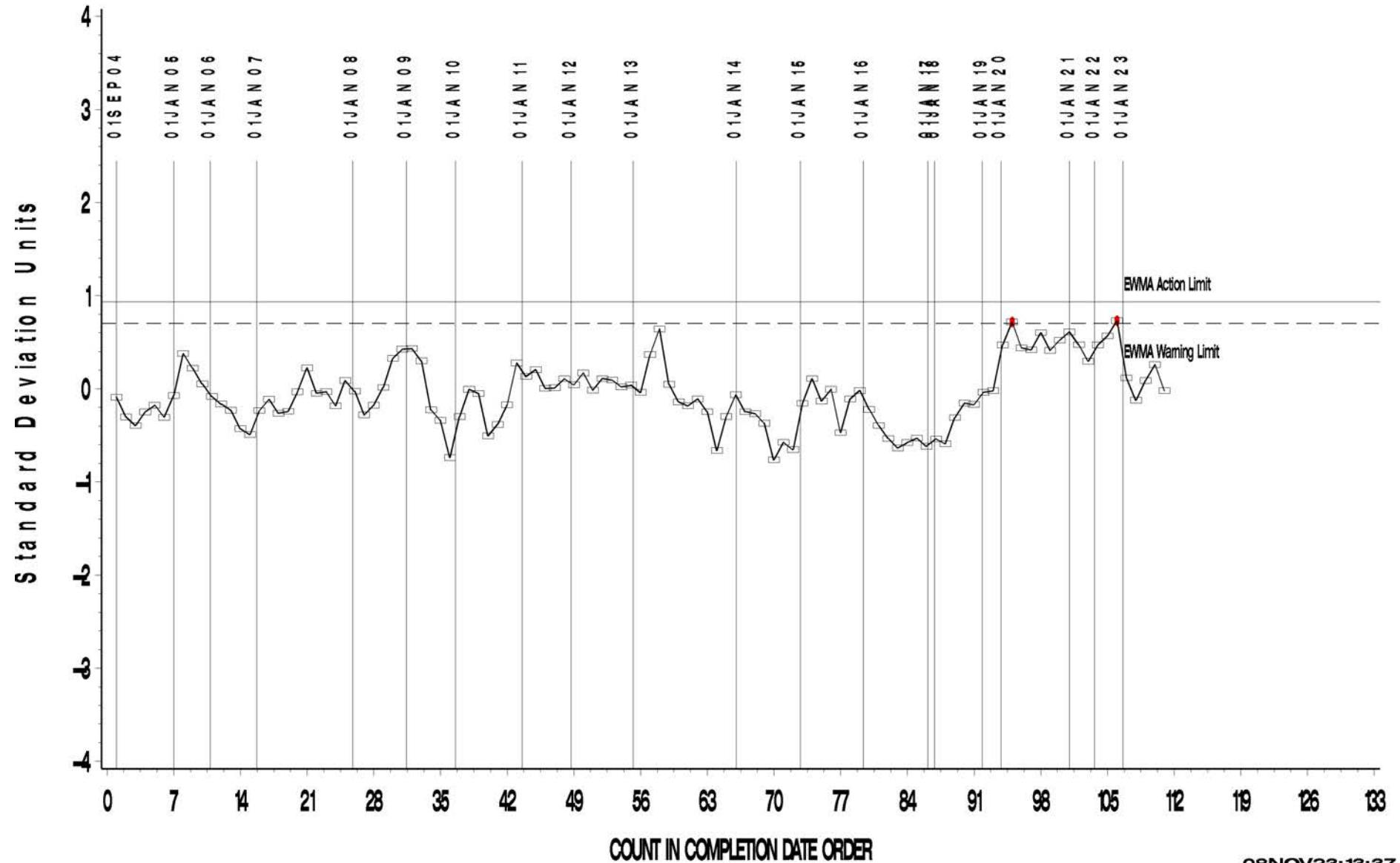
LTMS Severity Analysis





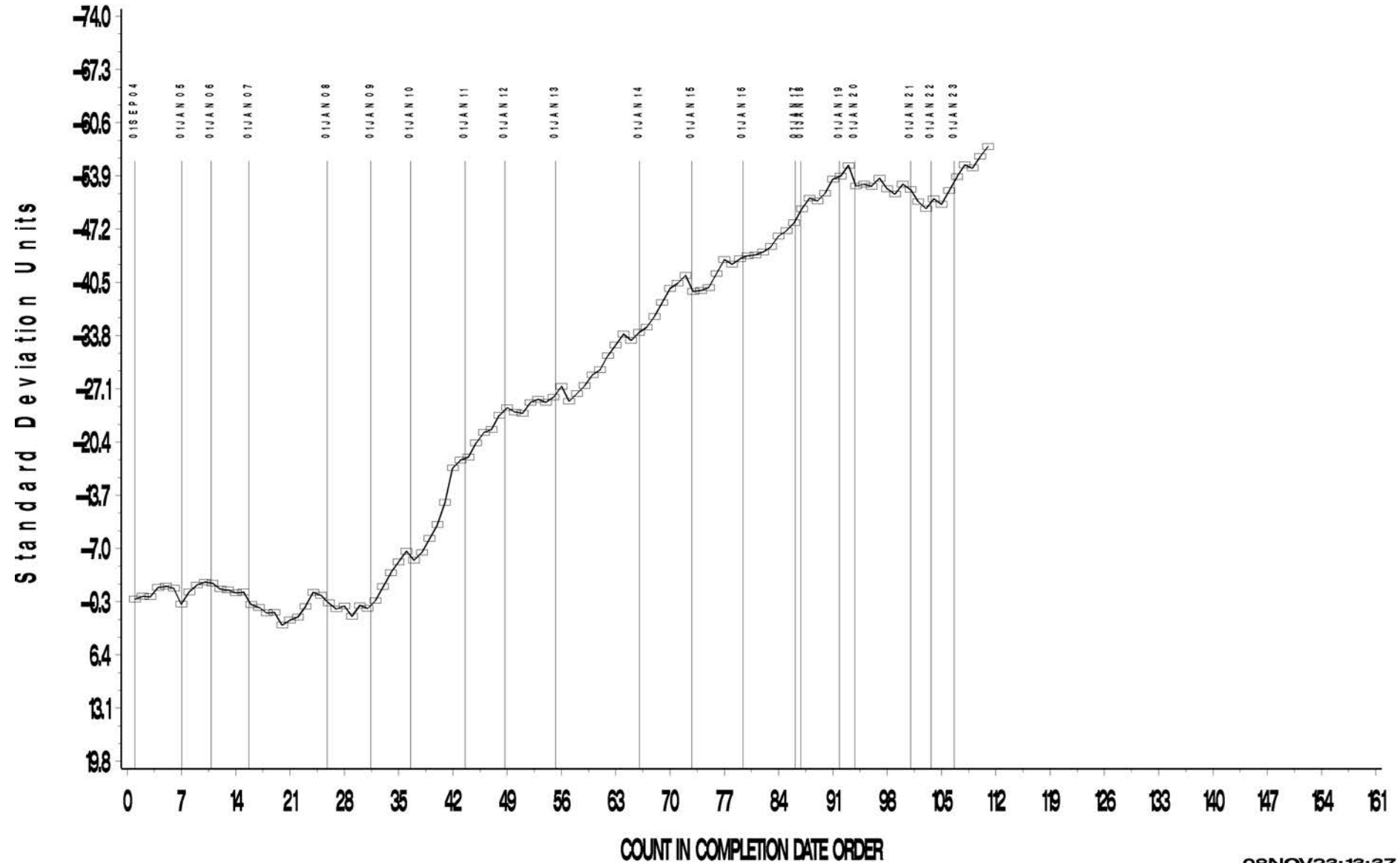
OIL FILTER DELTA PRESSURE

LTMS Precision Analysis



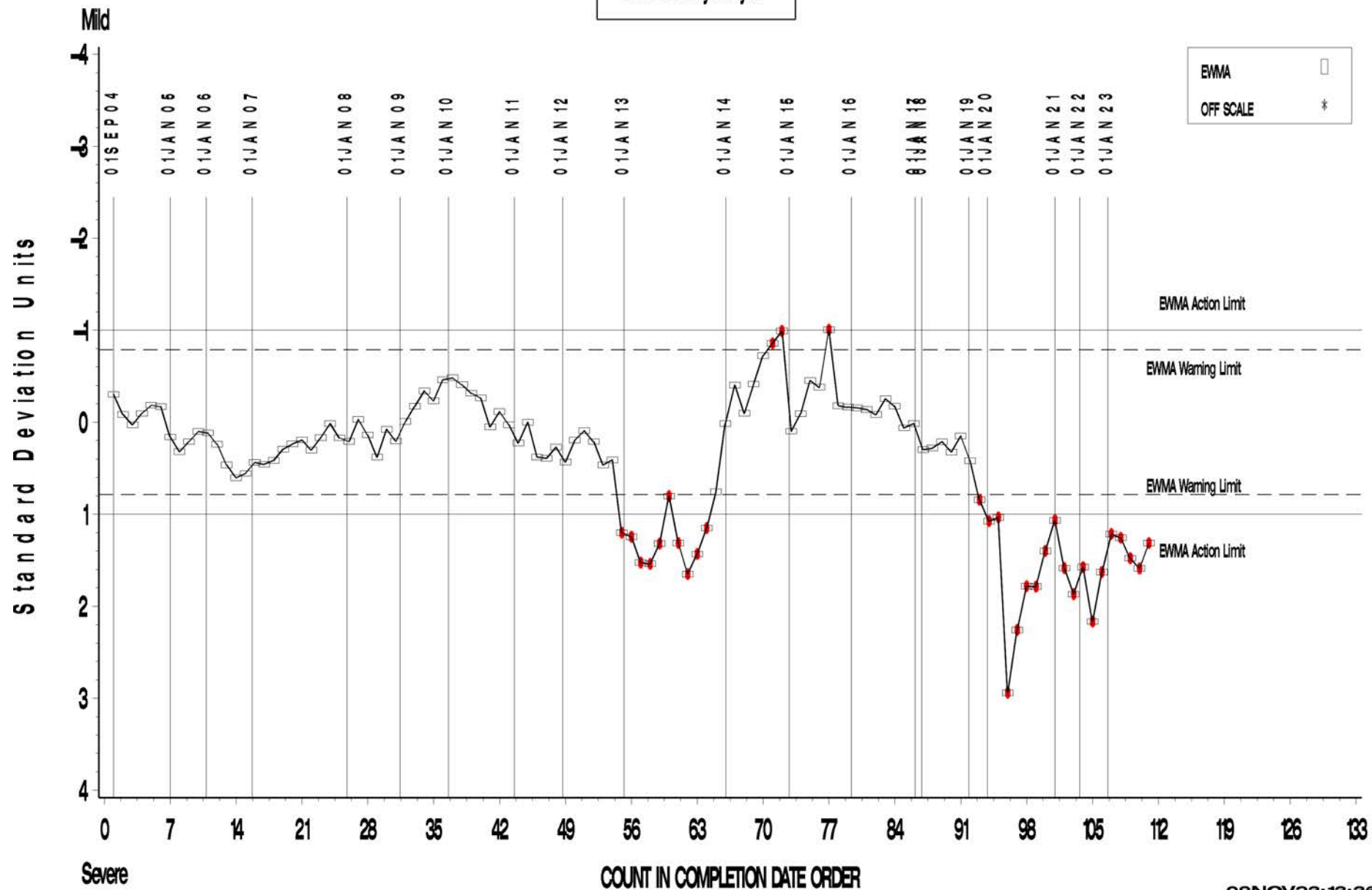
OIL FILTER DELTA PRESSURE

CUSUM Severity Analysis



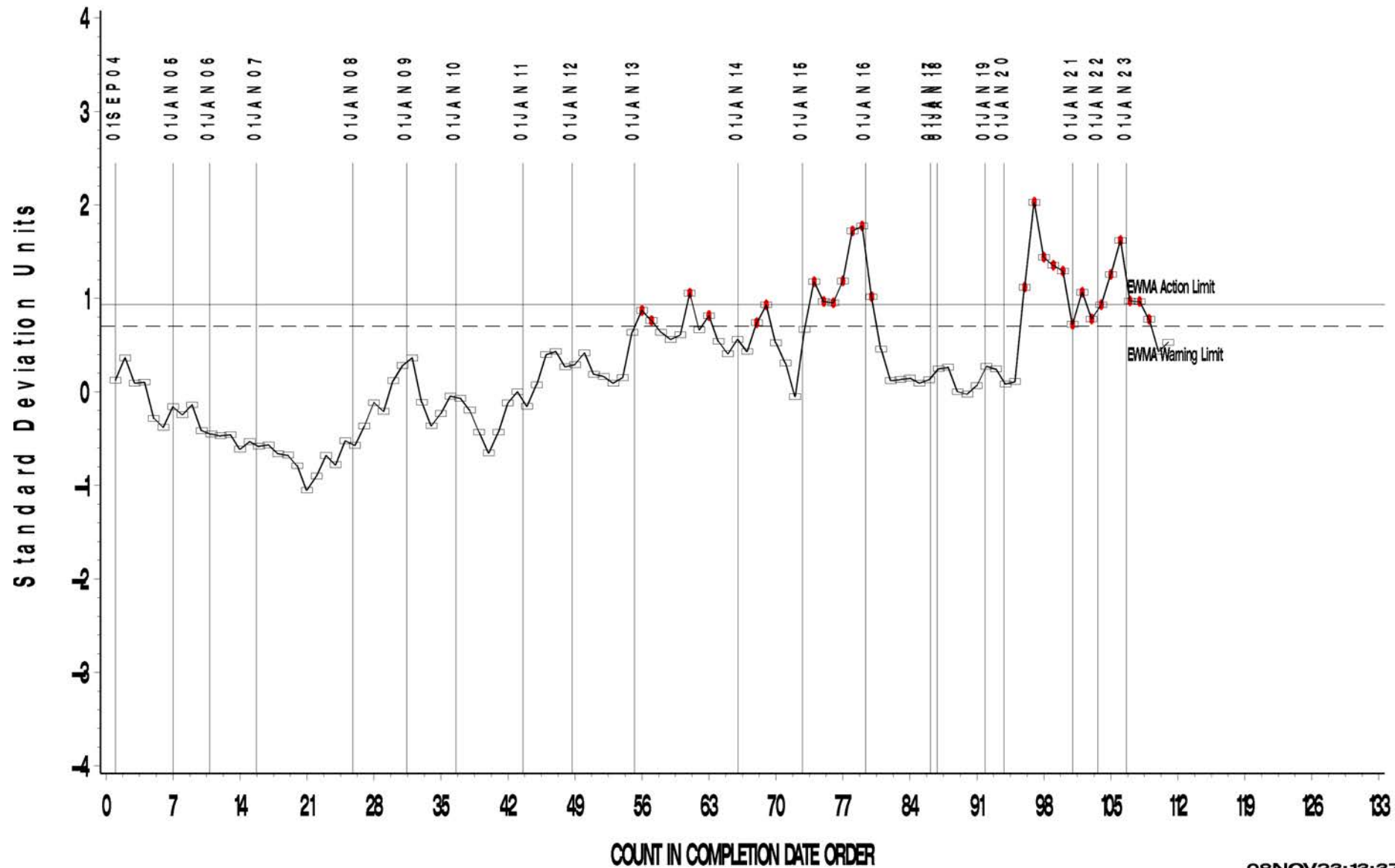
INJECTOR SCREW WEIGHT LOSS ADJUSTED TO 3.9% SOOT

LTMS Severity Analysis



INJECTOR SCREW WEIGHT LOSS ADJUSTED TO 3.9% SOOT

LTMS Precision Analysis

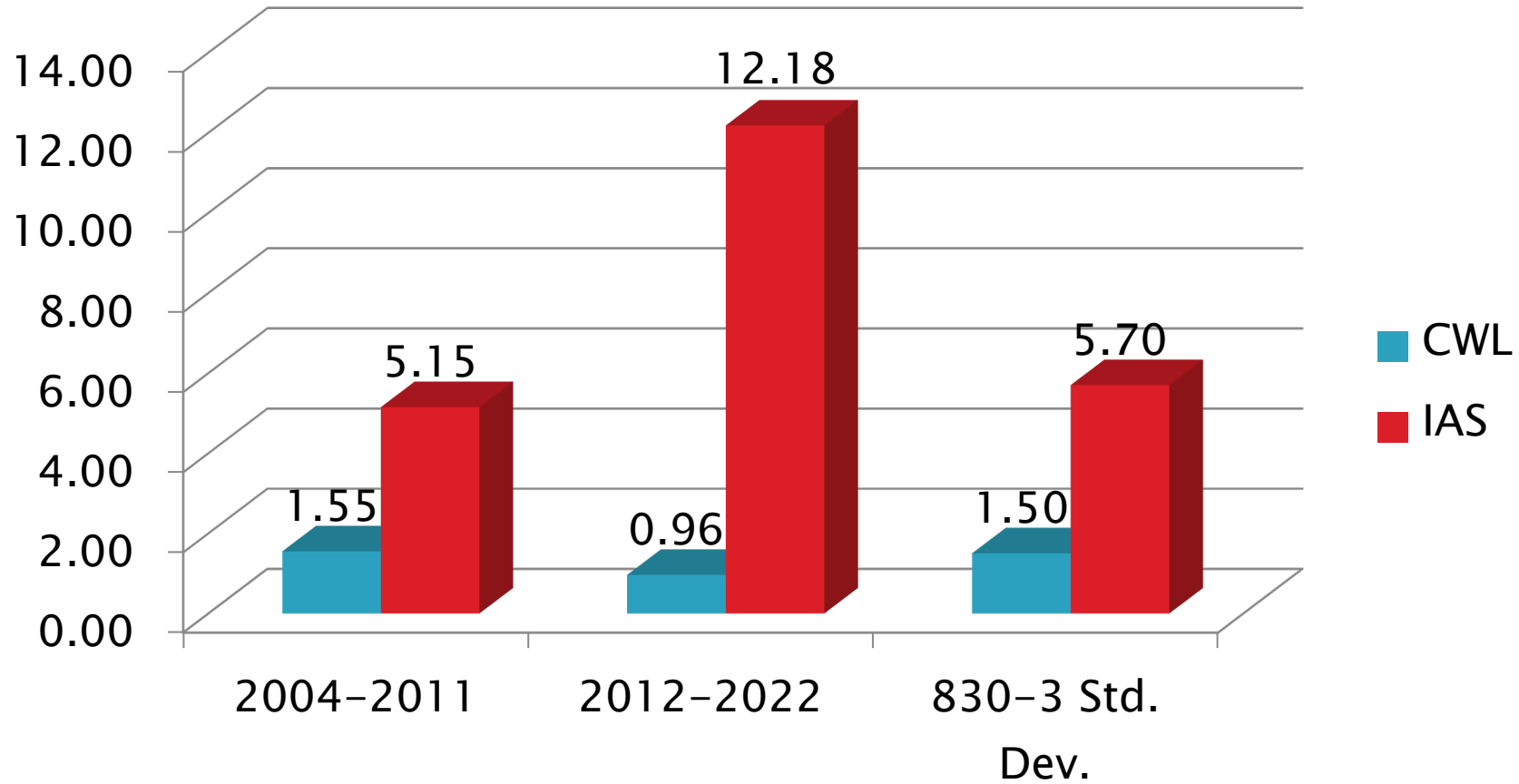


INJECTOR SCREW WEIGHT LOSS ADJUSTED TO 3.9% SOOT

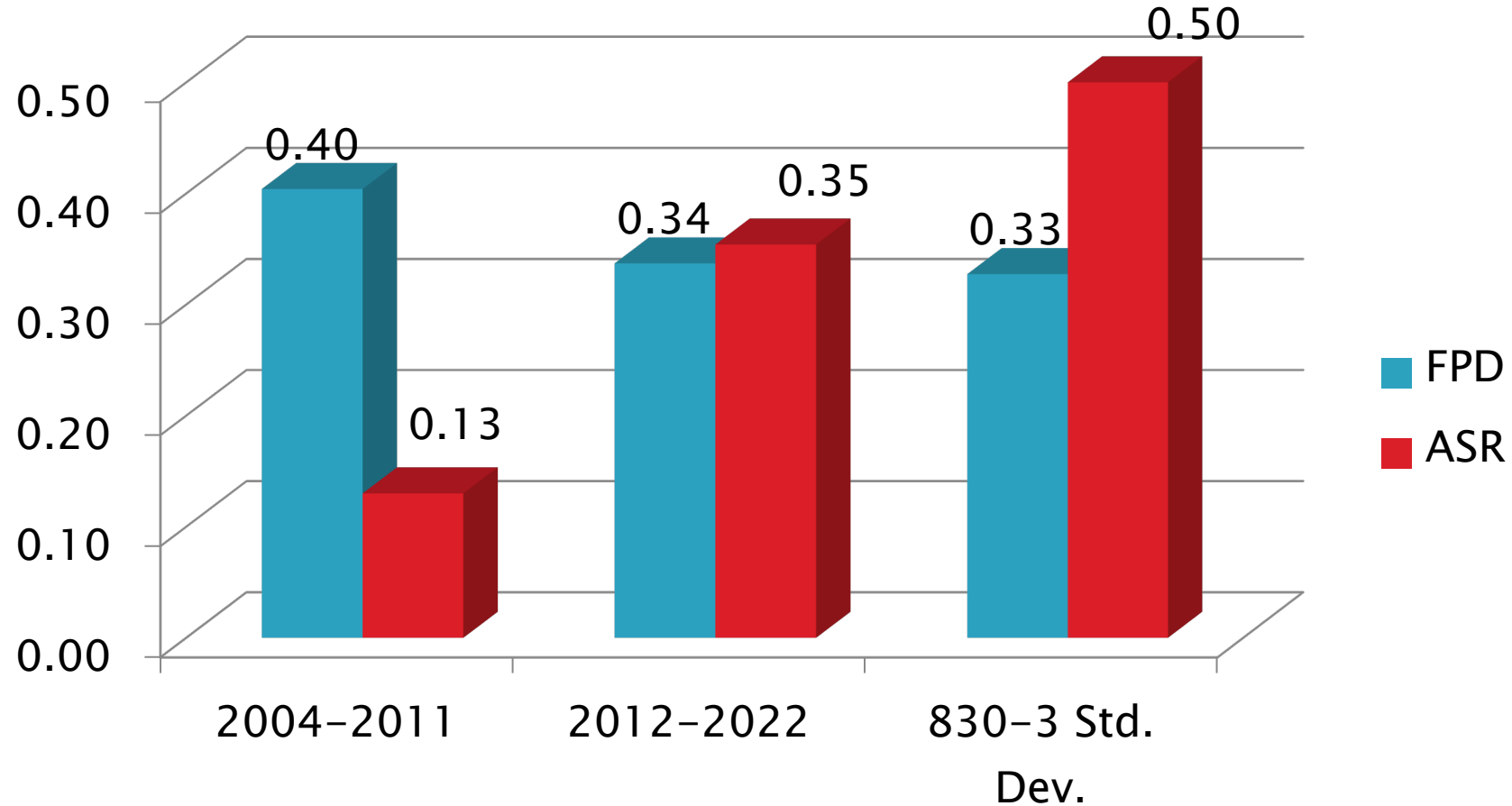
CUSUM Severity Analysis



# ISM Precision Estimates



# ISM Precision Estimates



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**Test Monitoring Center**  
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# EOAT

➤➤ October 2023

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# EOAT Test Activity

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

# EOAT Failed Tests

Failed Parameter	Number of Tests
No failed tests	0
<b>Total</b>	<b>0</b>

# EOAT Lost Tests\*

Status	Cause	#
Invalid	No invalid tests	0
Aborted	No aborted tests	0
<b>Total</b>		<b>0</b>

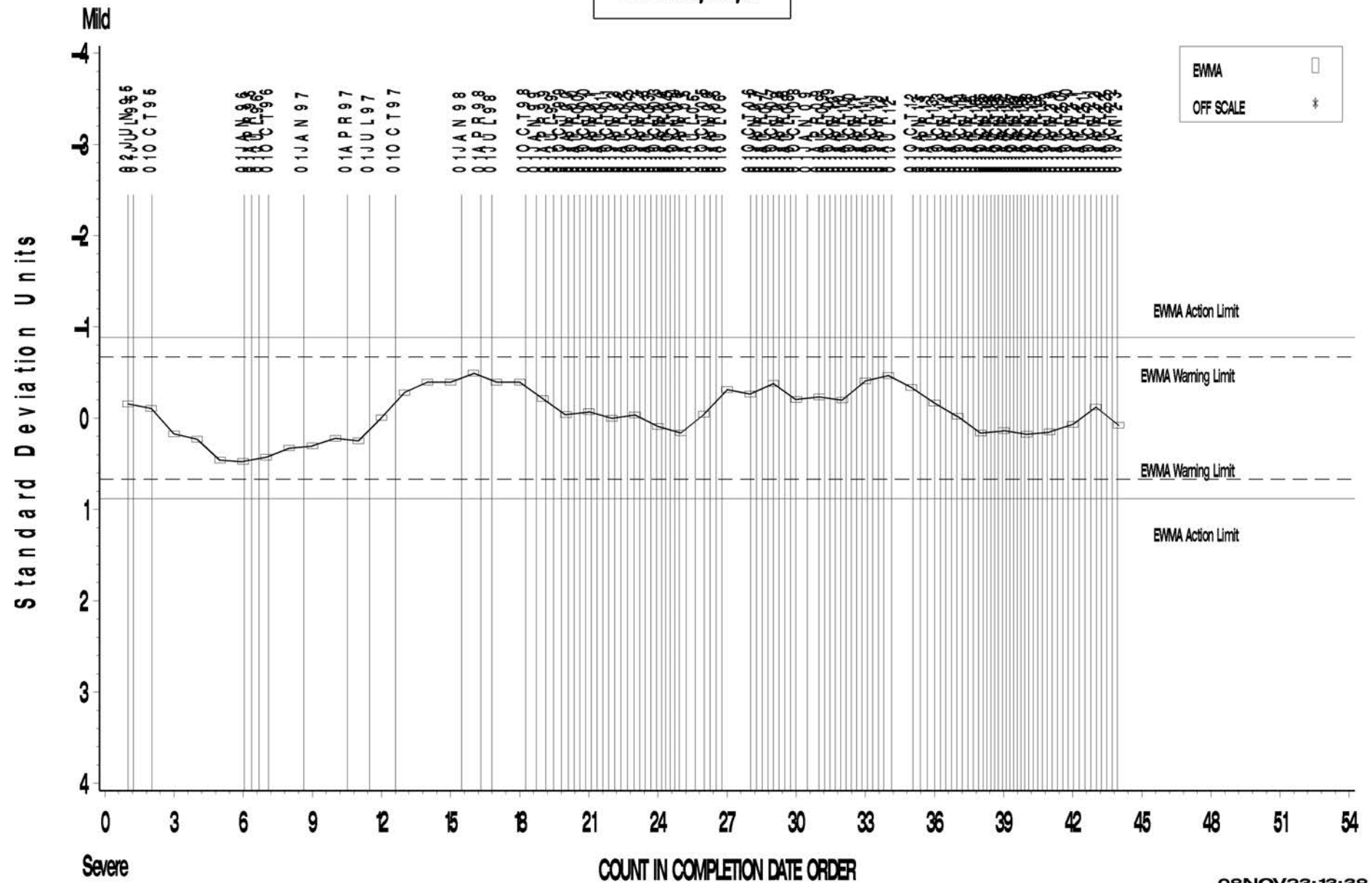
\*Invalid and aborted tests

# EOAT Test Severity

- ▶ As no EOAT tests were run during the reporting period no statement about test severity can be made.

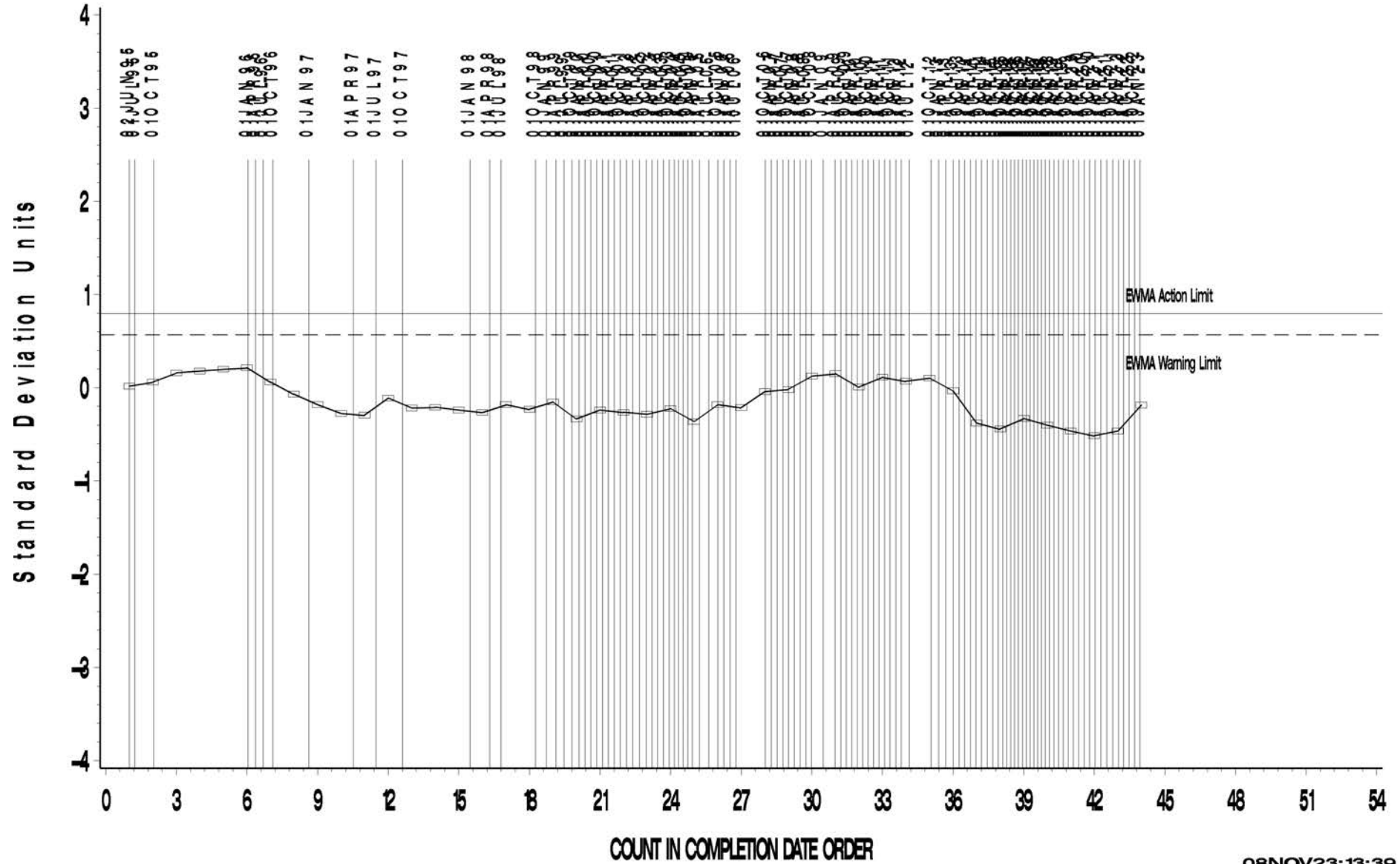
ENGINE OIL AERATION

LTMS Severity Analysis



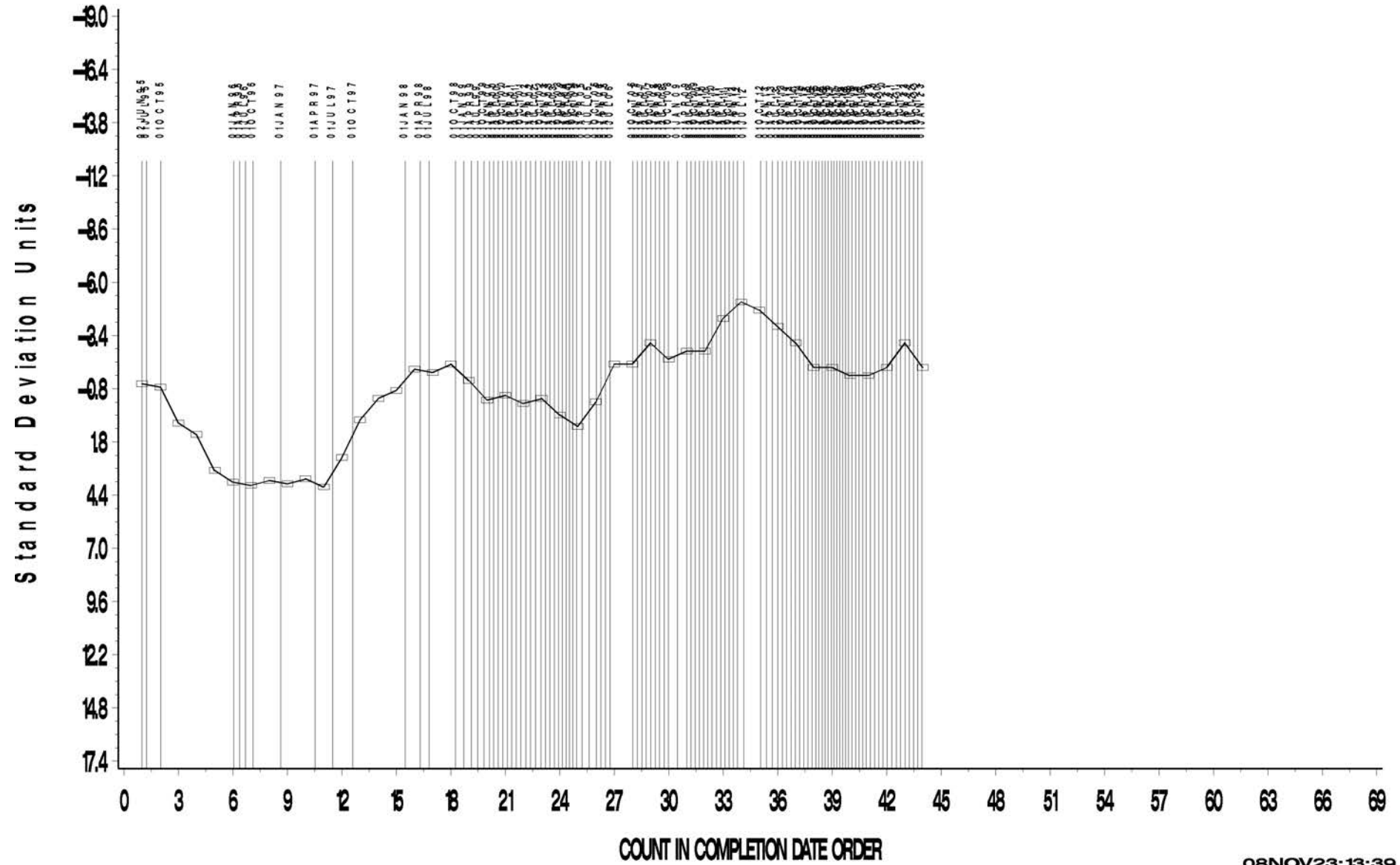
ENGINE OIL AERATION

LTMS Precision Analysis



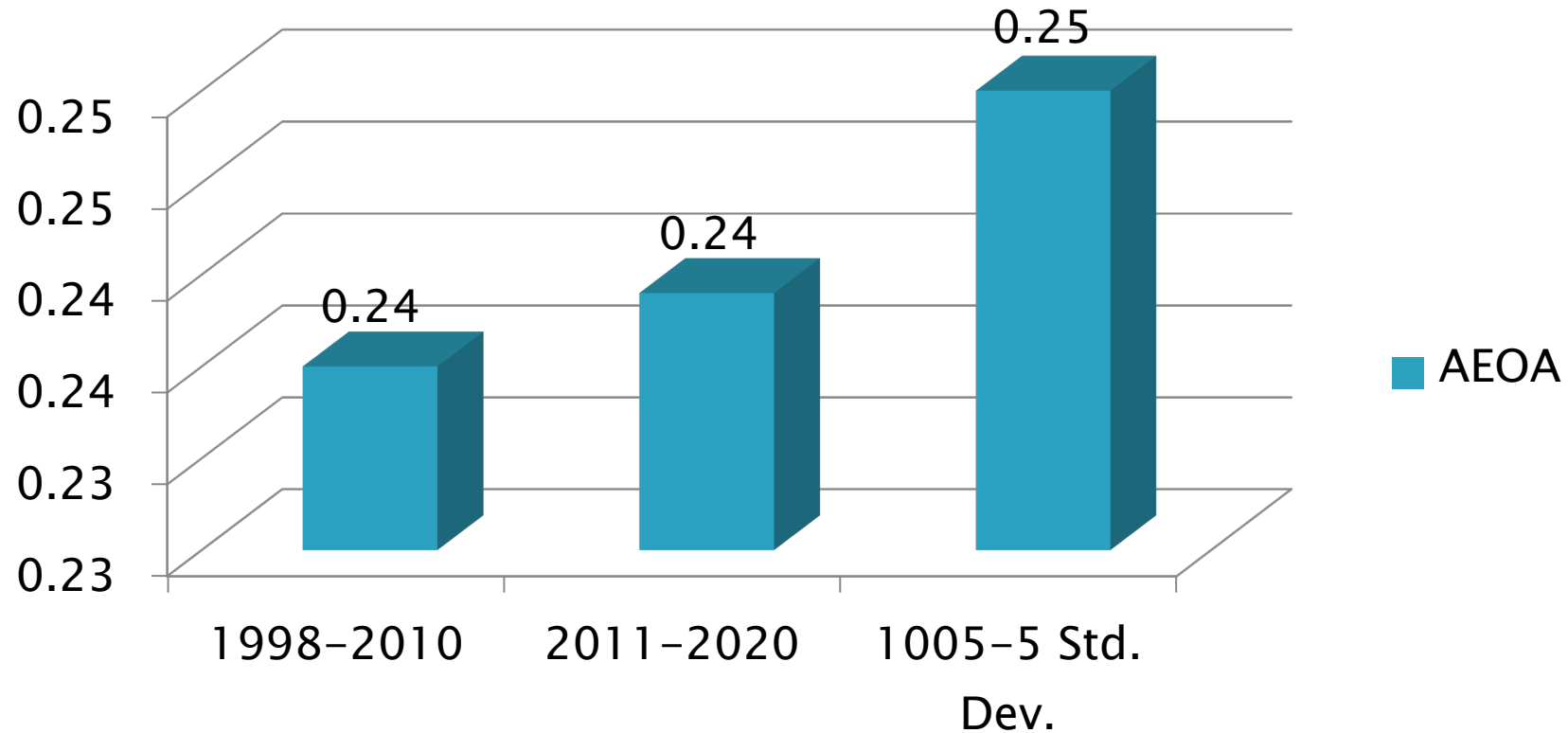
### ENGINE OIL AERATION

CUSUM Severity Analysis



# EOAT Precision Estimates

## AEOA



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**Test Monitoring Center**  
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# RFWT

➤➤ October 2023

**Test Monitoring Center**  
<https://www.astmtmc.org>



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# RFWT Test Activity

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

# RFWT Failed Tests

Failed Parameter	Number of Tests
No failed tests	0
<b>Total</b>	<b>0</b>

# RFWT Lost Tests\*

Status	Cause	#
Invalid	No invalid tests	0
Aborted	No aborted tests	0
<b>Total</b>		<b>0</b>

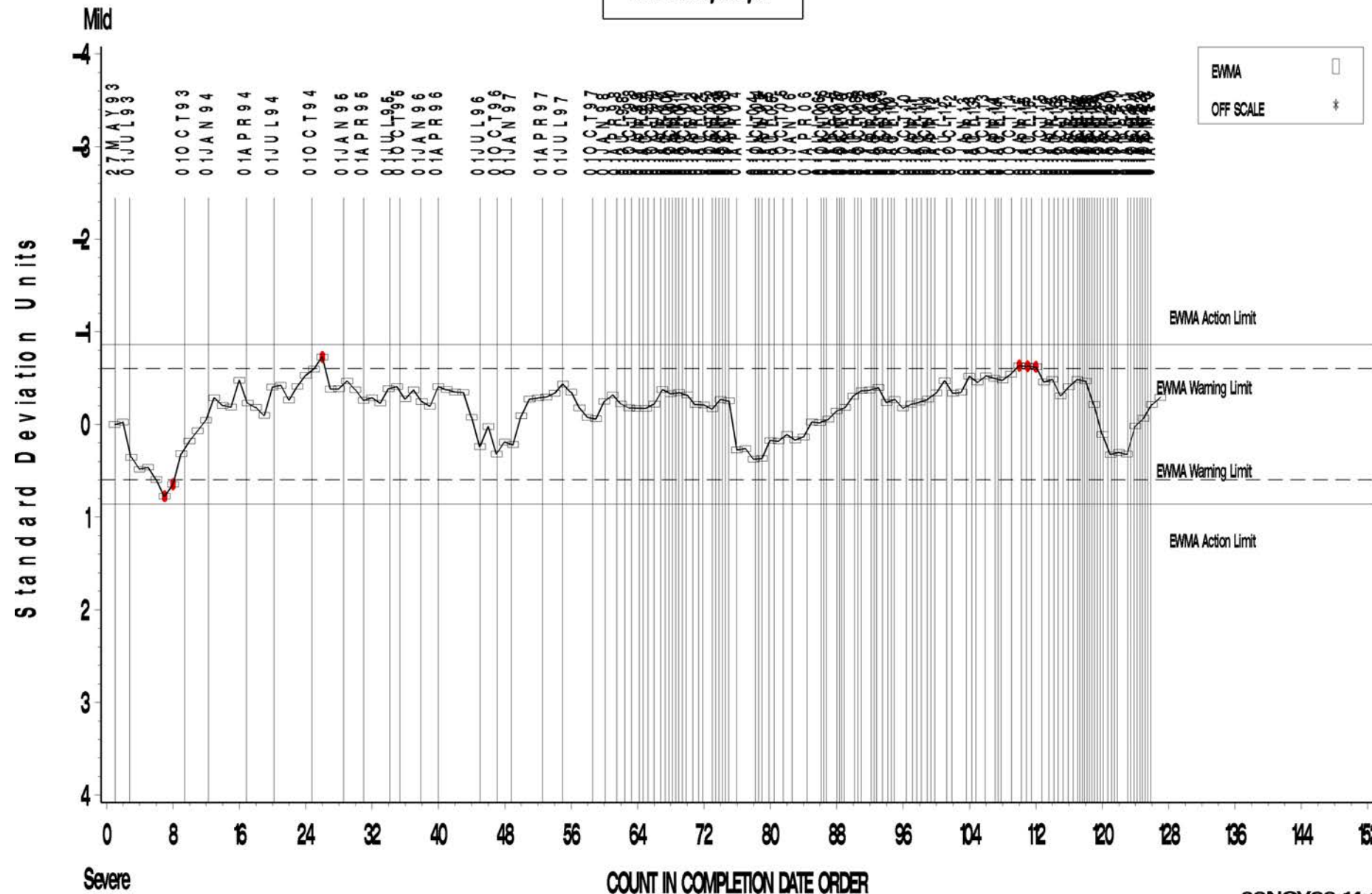
\*Invalid and aborted tests

# RFWT Test Severity

- ▶ AFW is in control

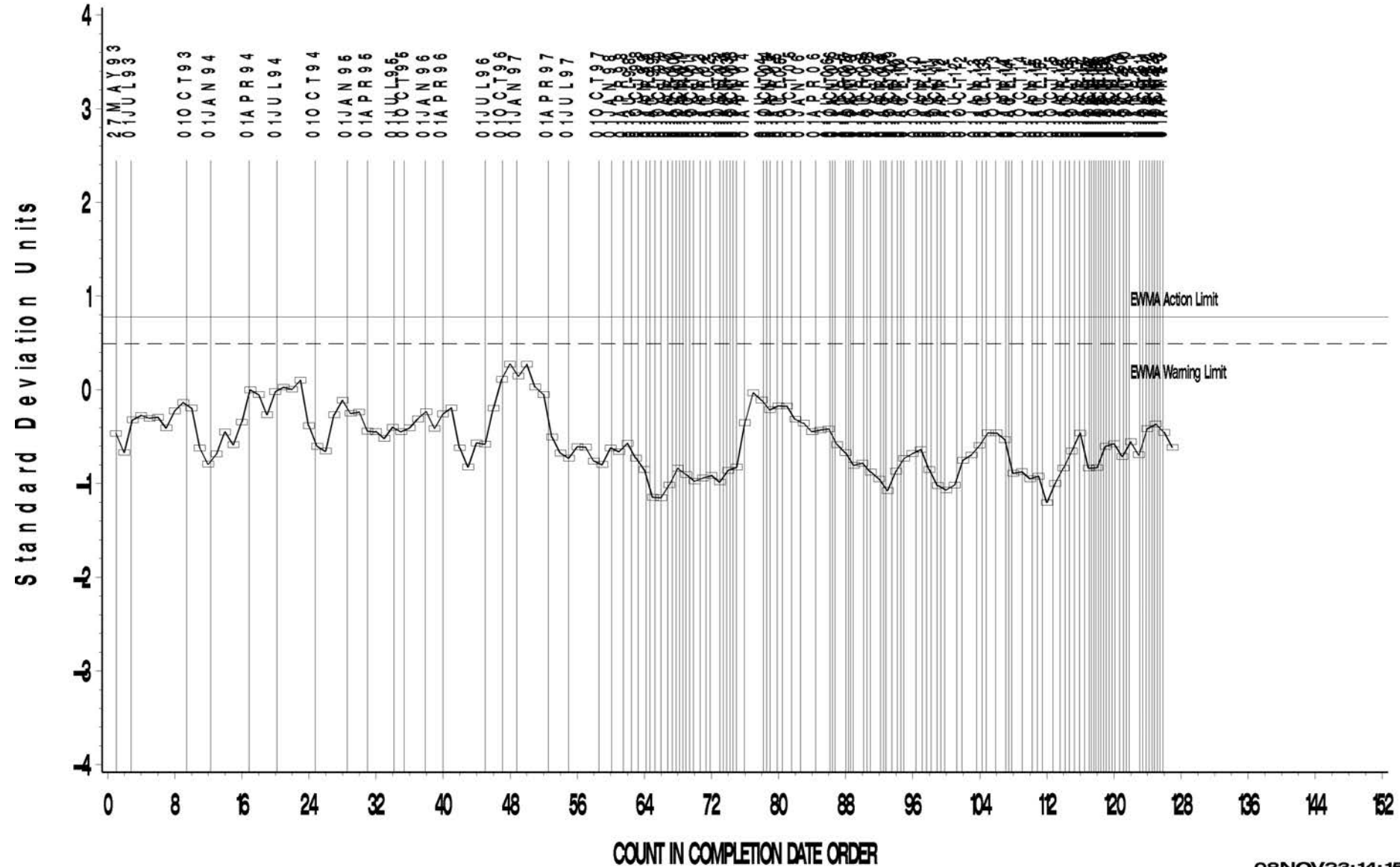
Average Follower Wear

LTMS Severity Analysis



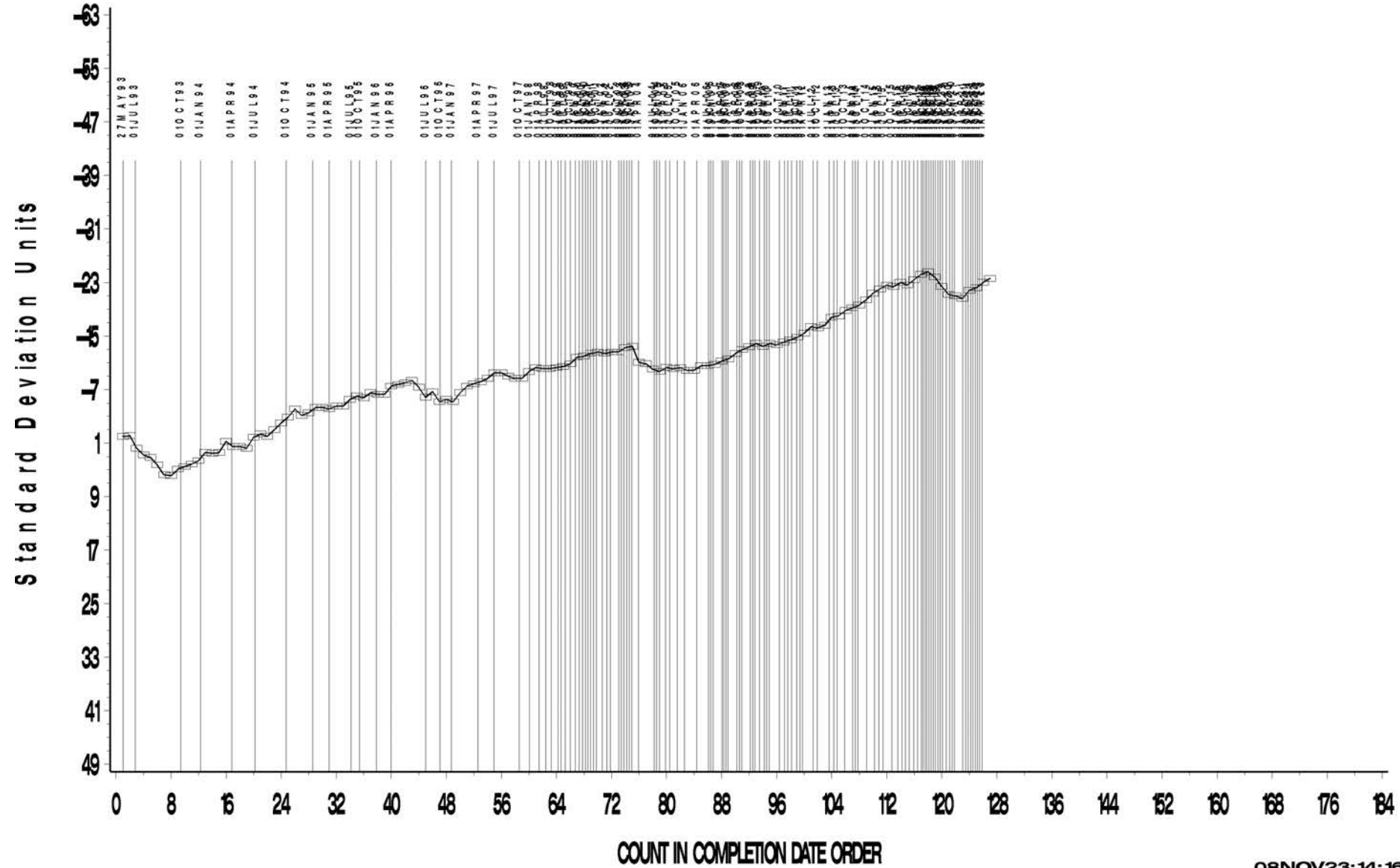
Average Follower Wear

LTMS Precision Analysis



Average Follower Wear

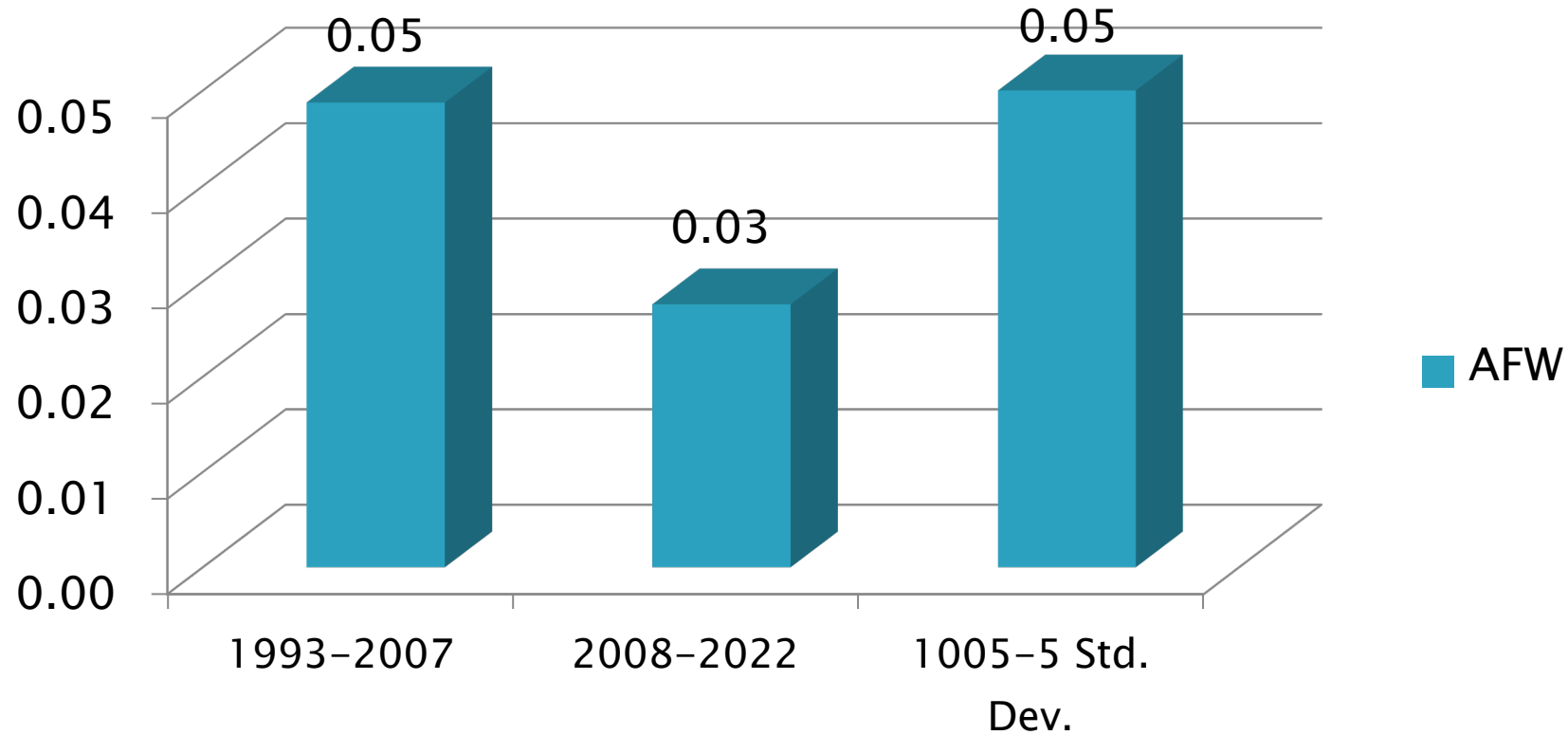
CUSUM Severity Analysis





# RFWT Precision Estimates

AFW



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**Test Monitoring Center**  
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# Mack T-8/T-8E

➤➤ October 2023

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# T-8/T-8E Test Activity

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

# T-8/T8-E Failed Tests

Failed Parameter	Number of Tests
No failed tests	0
<b>Total</b>	<b>0</b>

# T-8/T8-E Lost Tests\*

Status	Cause	#
Invalid	No invalid tests	0
Aborted	Hardware failure	1
Aborted	High oil consumption/projected to miss soot window	1
<b>Total</b>		<b>2</b>

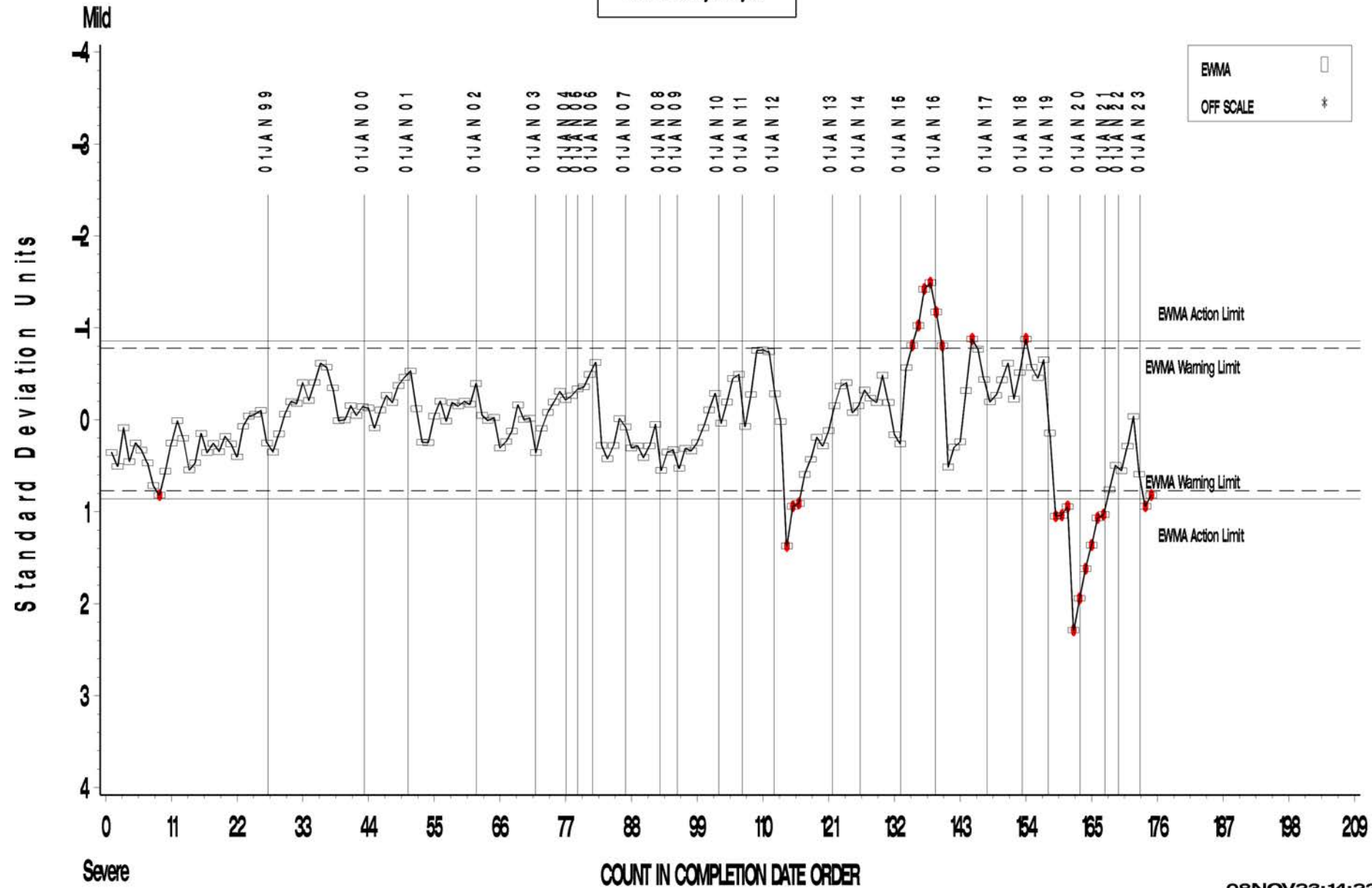
\*Invalid and aborted tests

# T-8/T-8E Test Severity

- ▶ VI38 is in level 2 Zi alarm in mild direction
- ▶ RV48 is in level 2 Zi alarm in severe direction
- ▶ RV2 is in control but very near level 2 Zi alarm in the severe direction

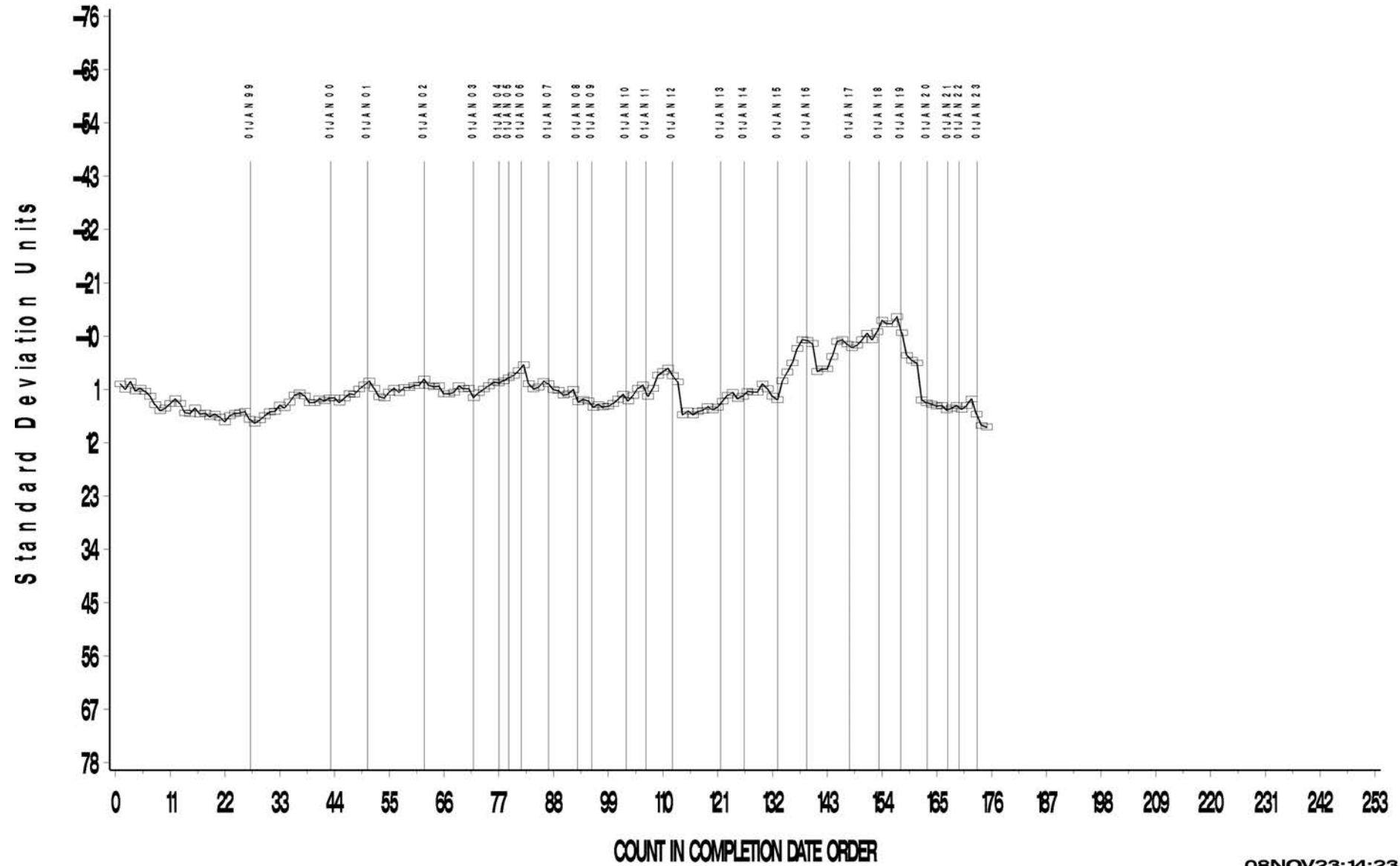
RELATIVE VISCOSITY @ 4.8% (100% LOSS)

LTMS Severity Analysis



RELATIVE VISCOSITY @ 4.8% (100% LOSS)

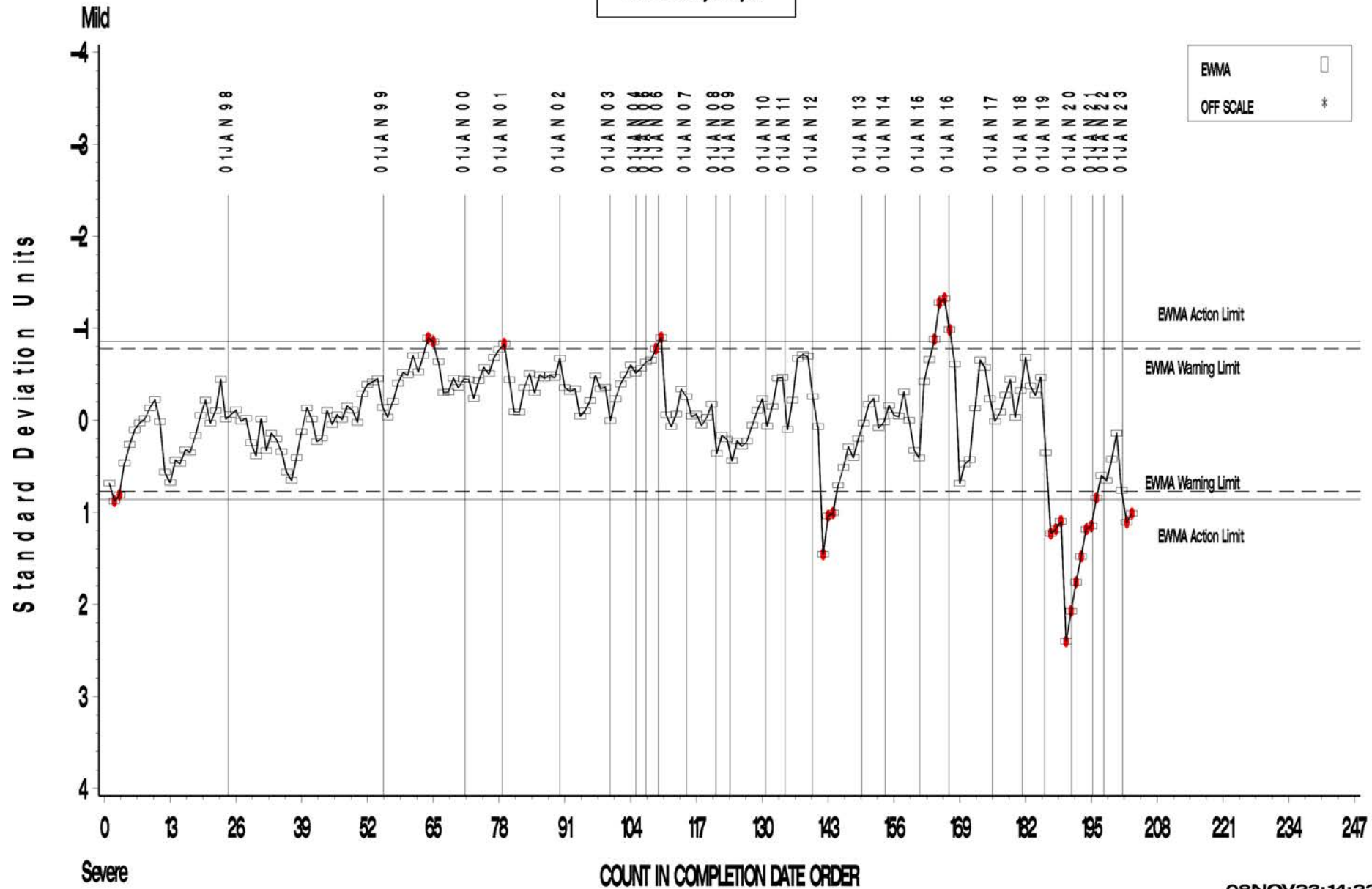
CUSUM Severity Analysis





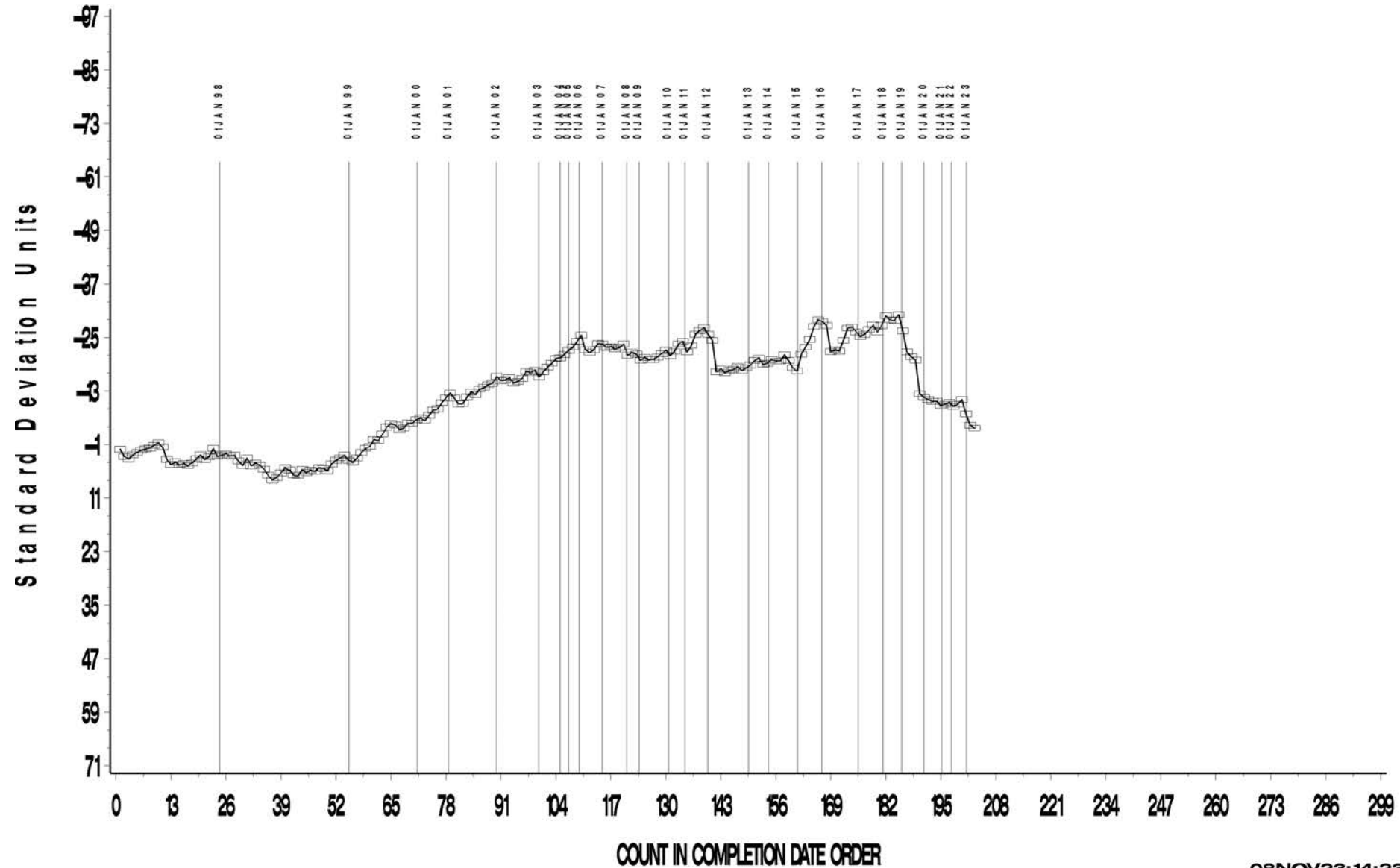
RELATIVE VISCOSITY @ 4.8% (50% LOSS)

LTMS Severity Analysis



RELATIVE VISCOSITY @ 4.8% (50% LOSS)

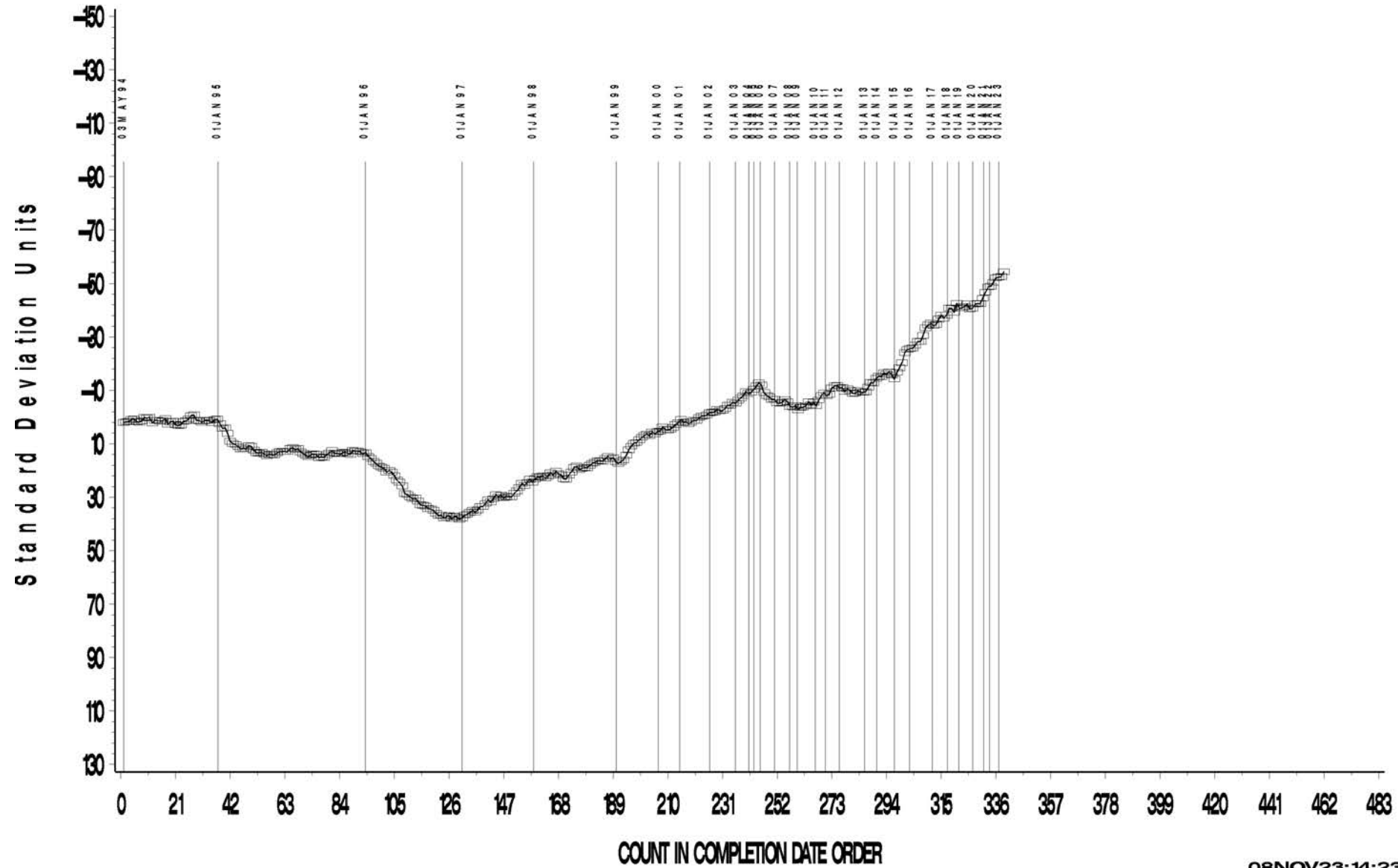
CUSUM Severity Analysis



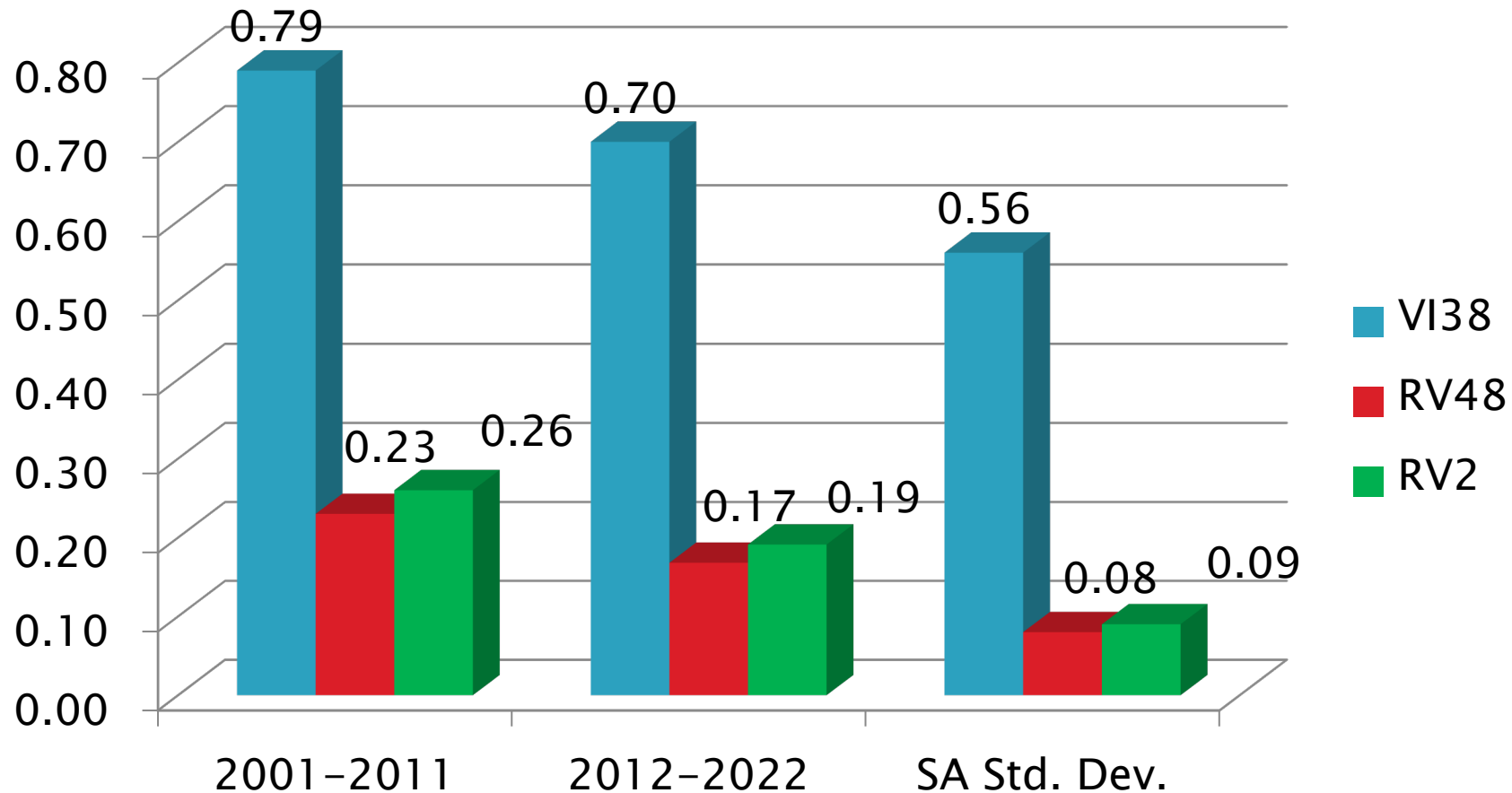


VISCOSITY INCR @ 3.8% SOOT

CUSUM Severity Analysis



# T-8/E Precision Estimates



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# Mack T-11

»» October 2023

**Test Monitoring Center**  
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# T-11 Test Activity

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

# T-11 Failed Tests

Failed Parameter	Number of Tests
No failed tests	0
<b>Total</b>	<b>0</b>



# T-11 Lost Tests\*

Status	Cause	#
Invalid	No invalid tests	0
Aborted	No aborted tests	0
<b>Total</b>		<b>0</b>

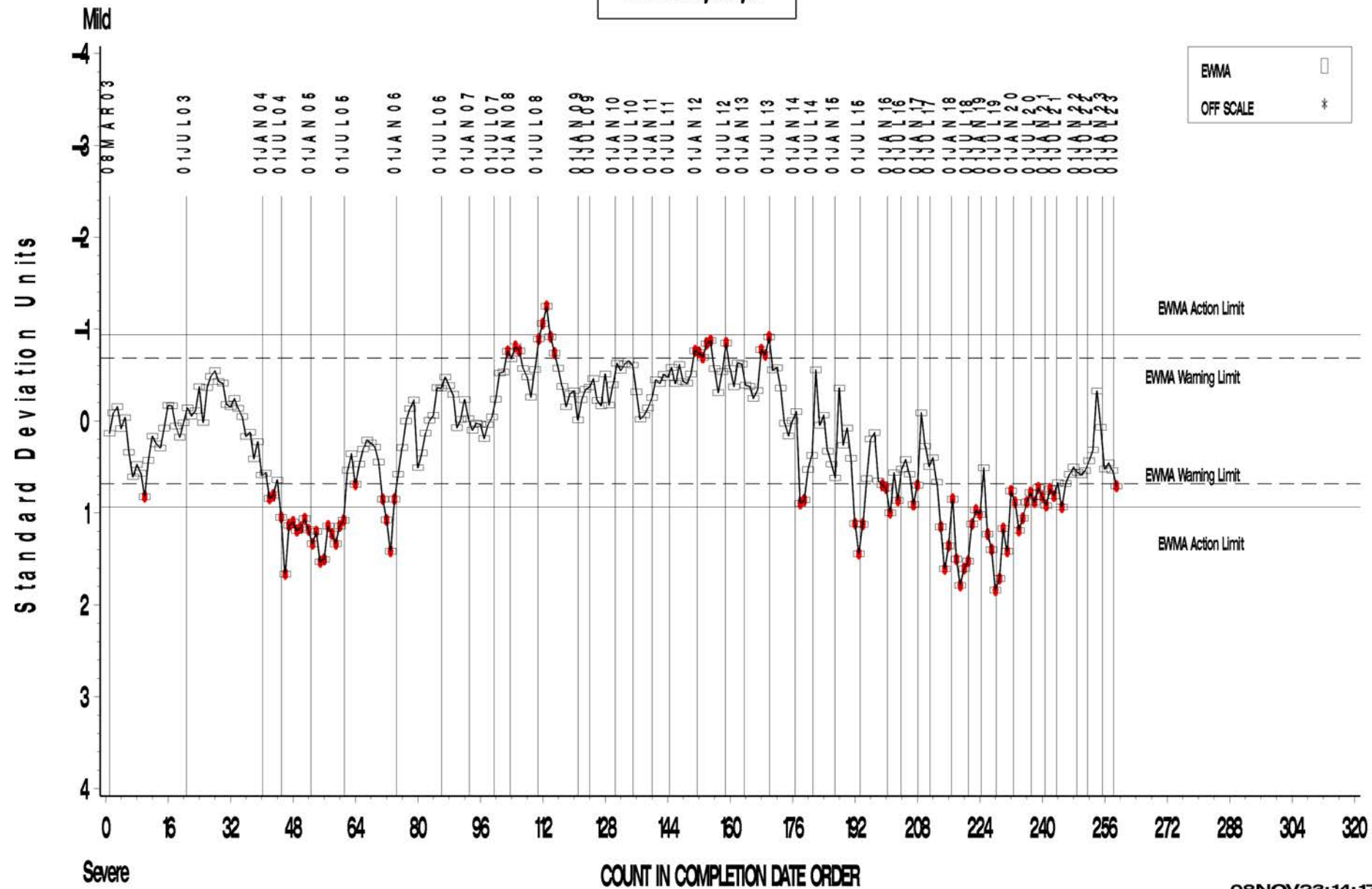
\*Invalid and aborted tests

# 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.

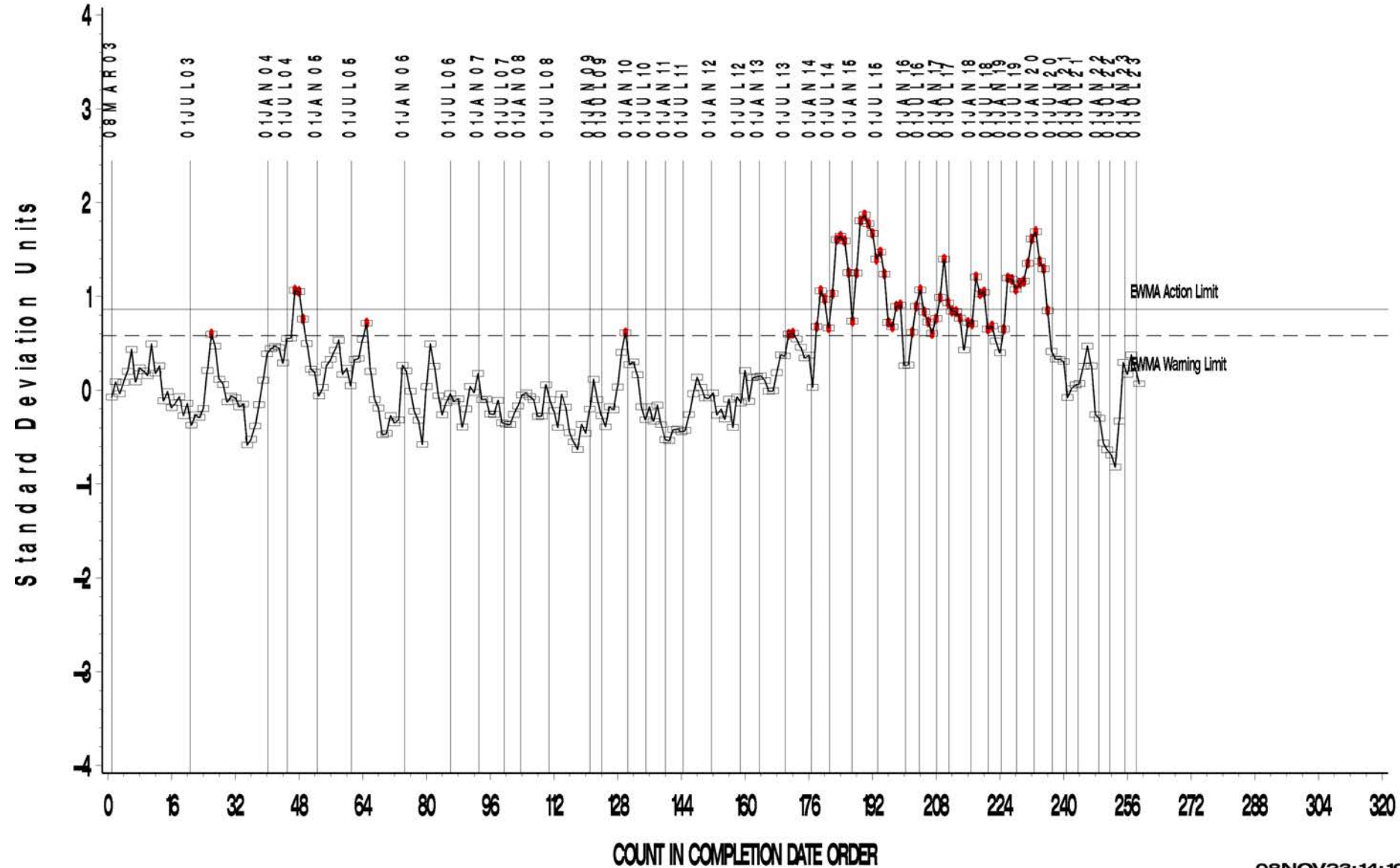
MRV VISCOSITY

LTMS Severity Analysis



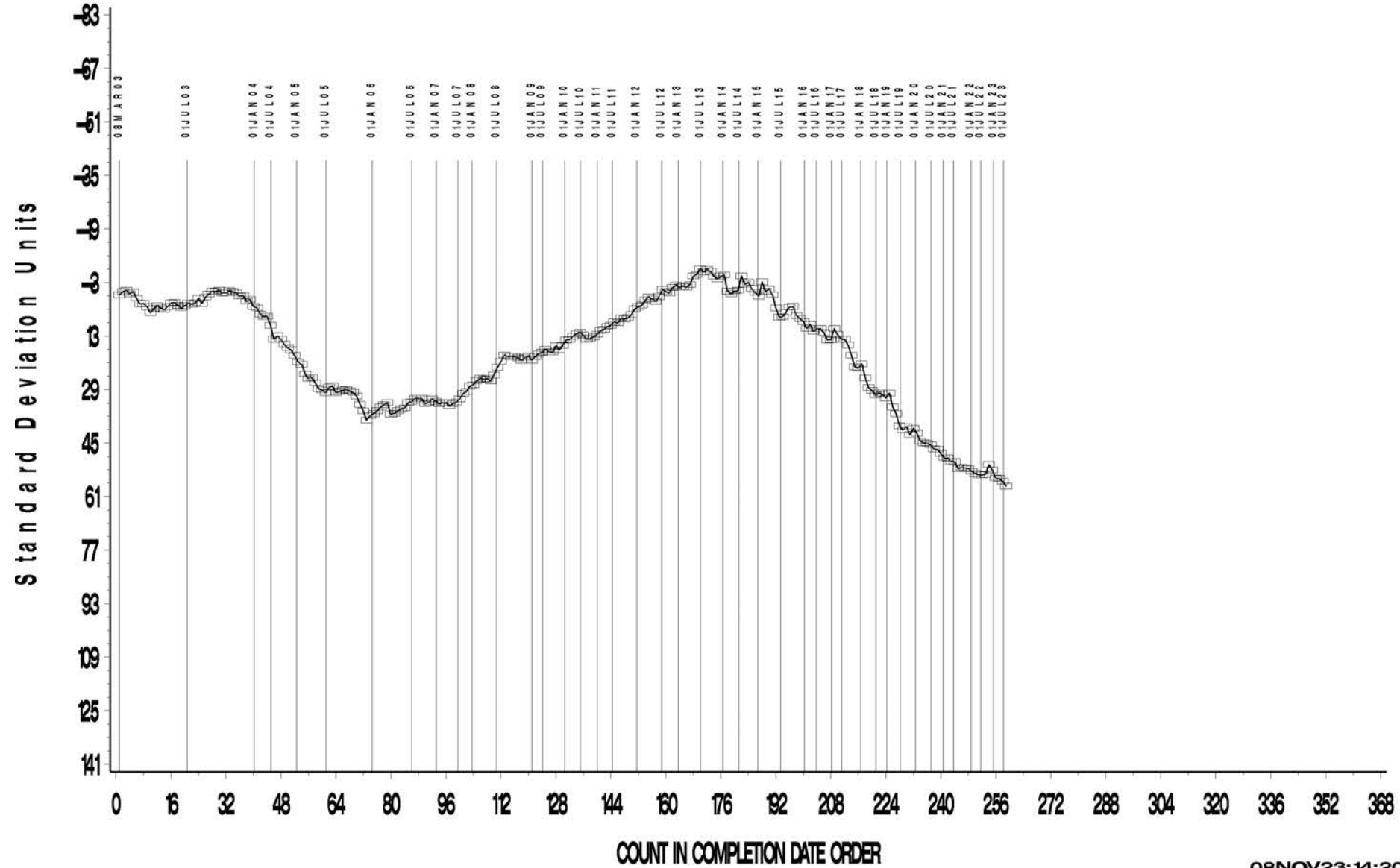
MRV VISCOSITY

LTMS Precision Analysis



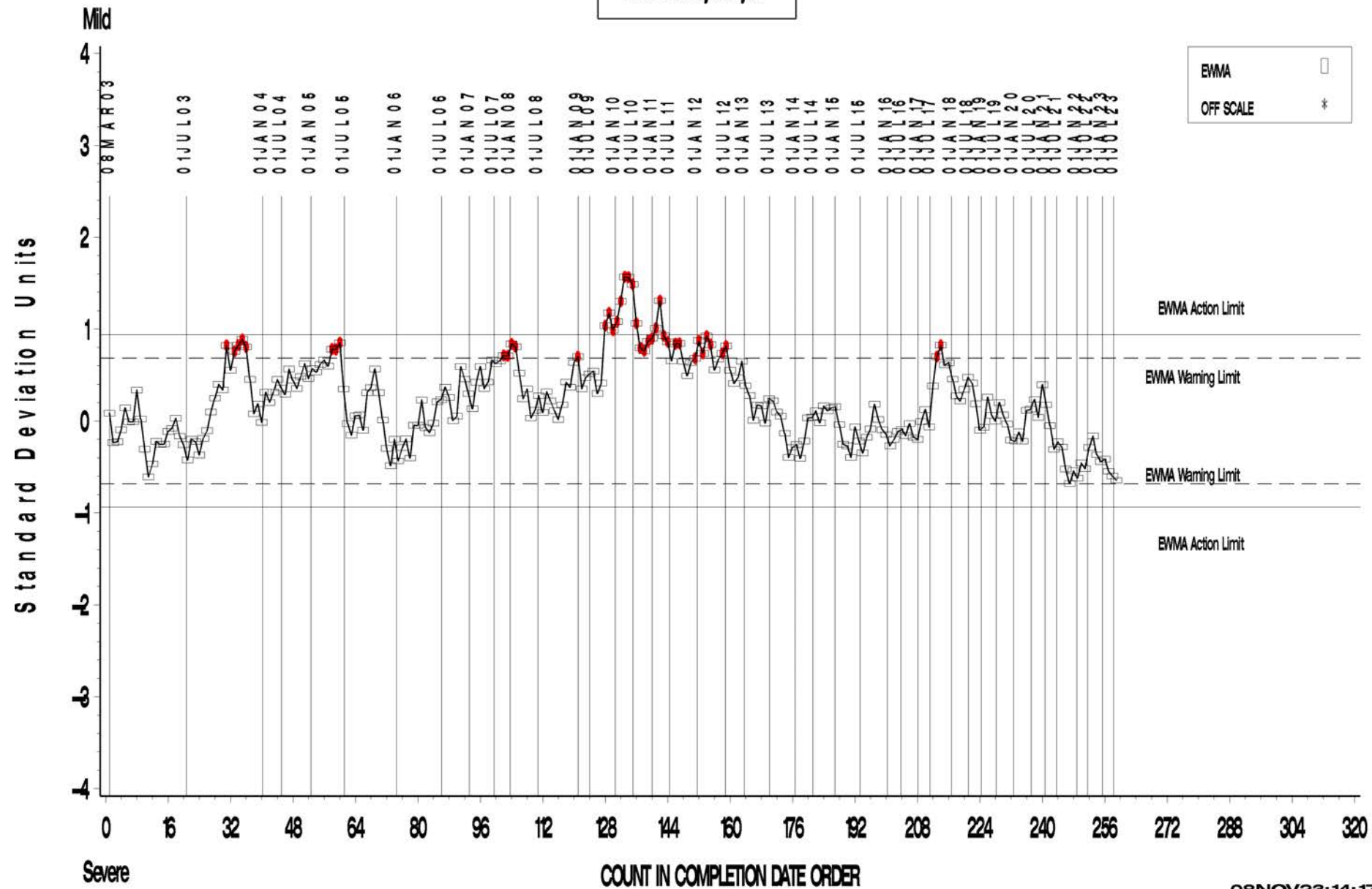
MRV VISCOSITY

CUSUM Severity Analysis



SOOT AT 12 cSt

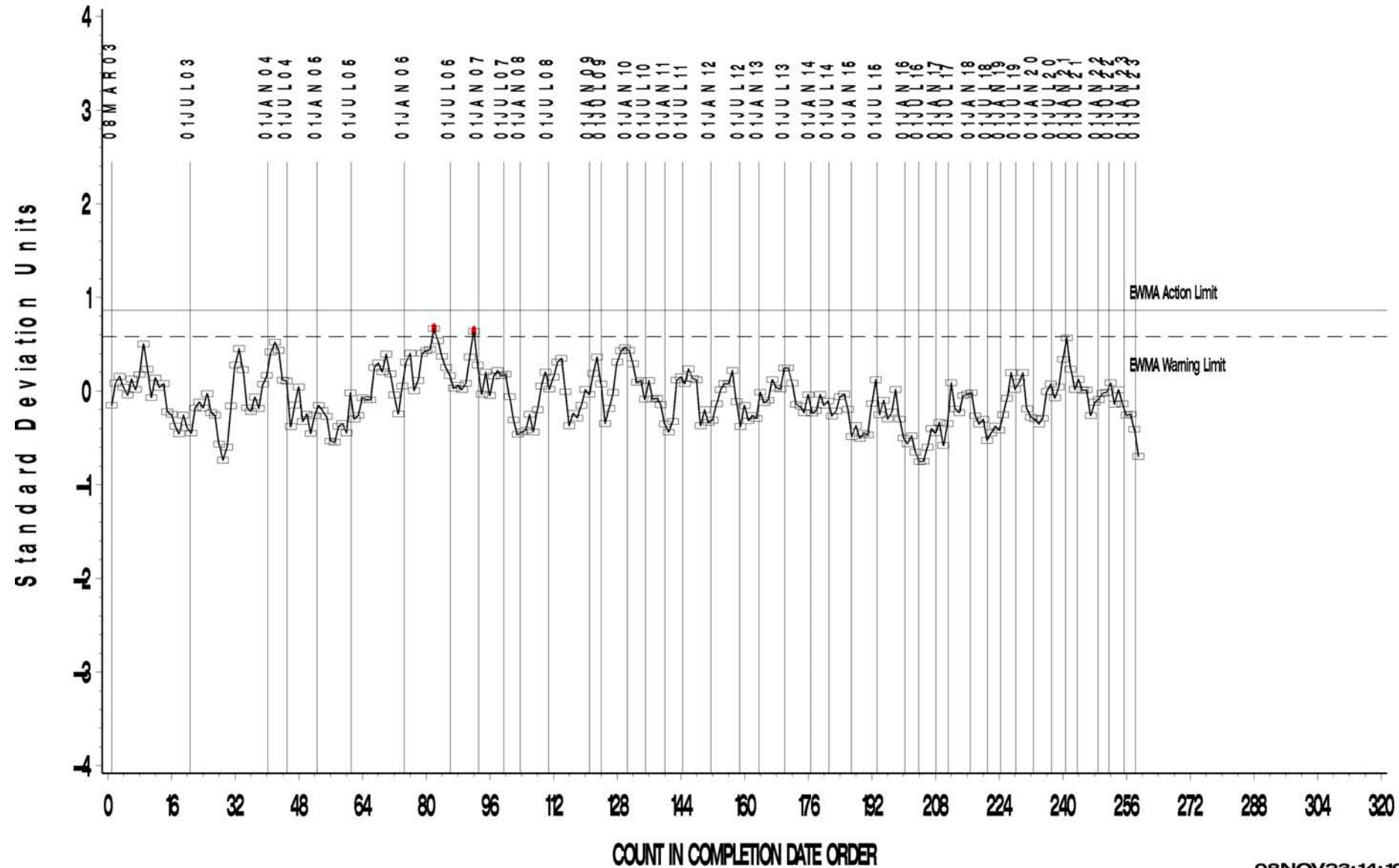
LTMS Severity Analysis





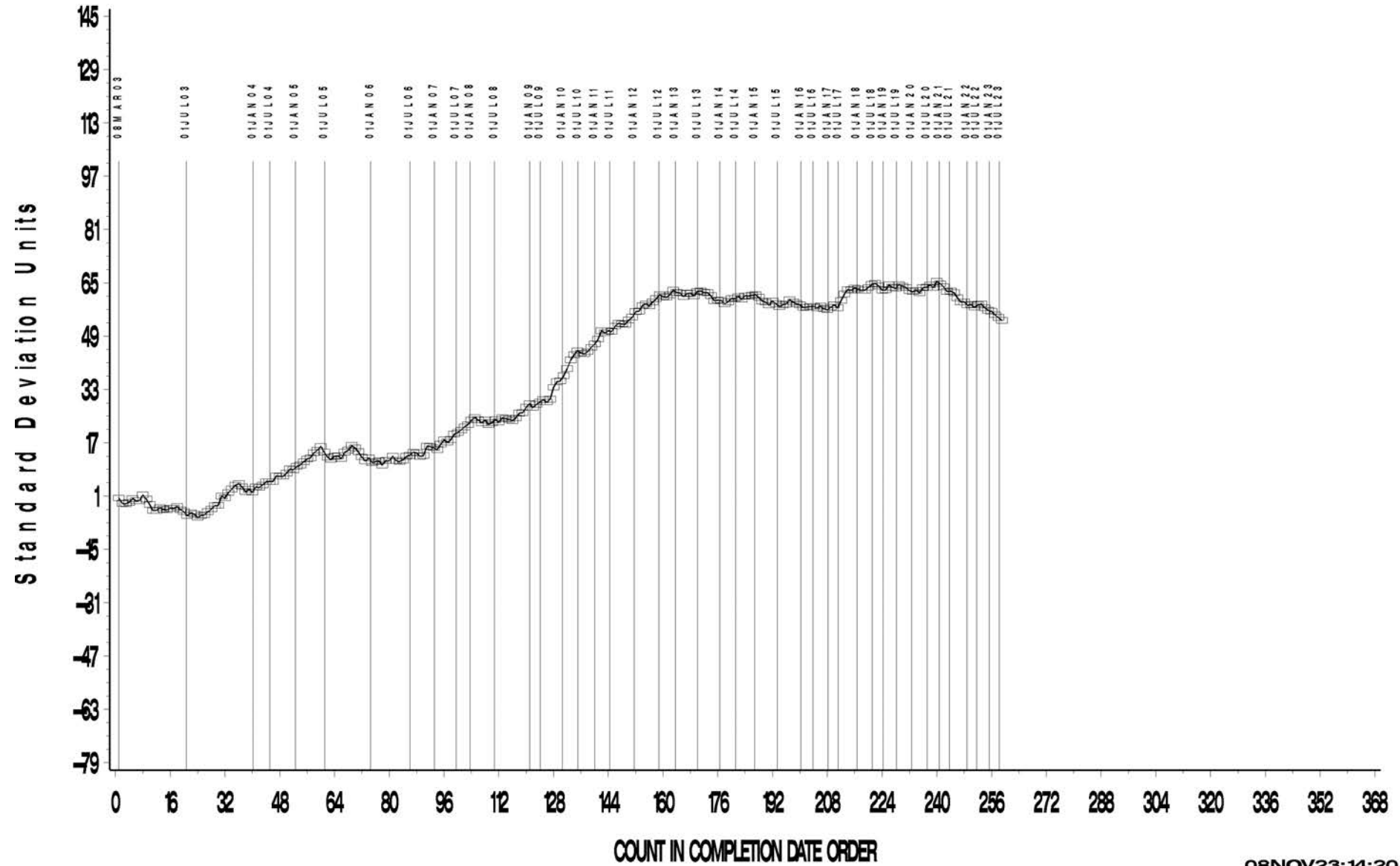
SOOT AT 12 cSt

LTMS Precision Analysis



SOOT AT 12 cSt

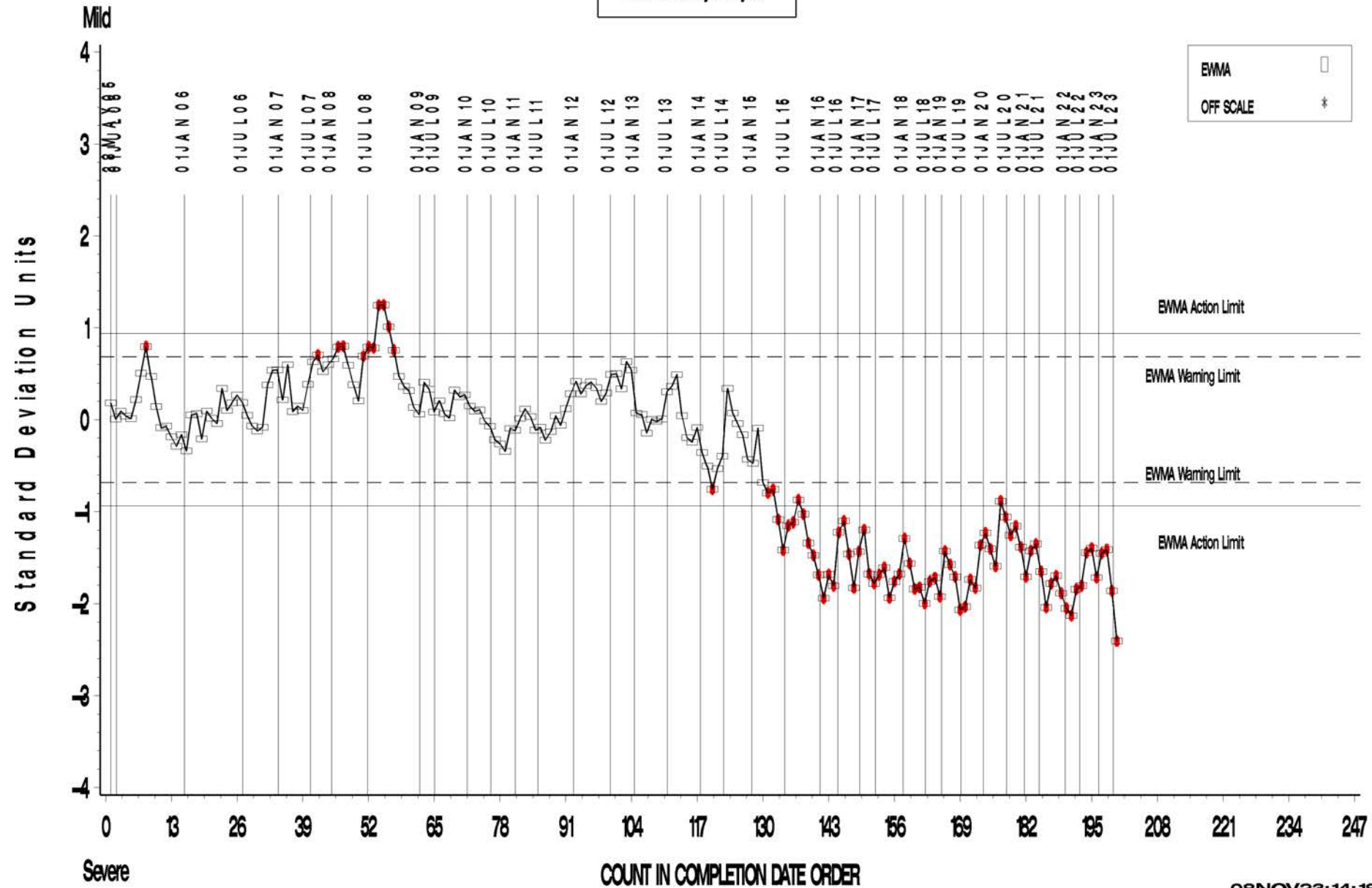
CUSUM Severity Analysis





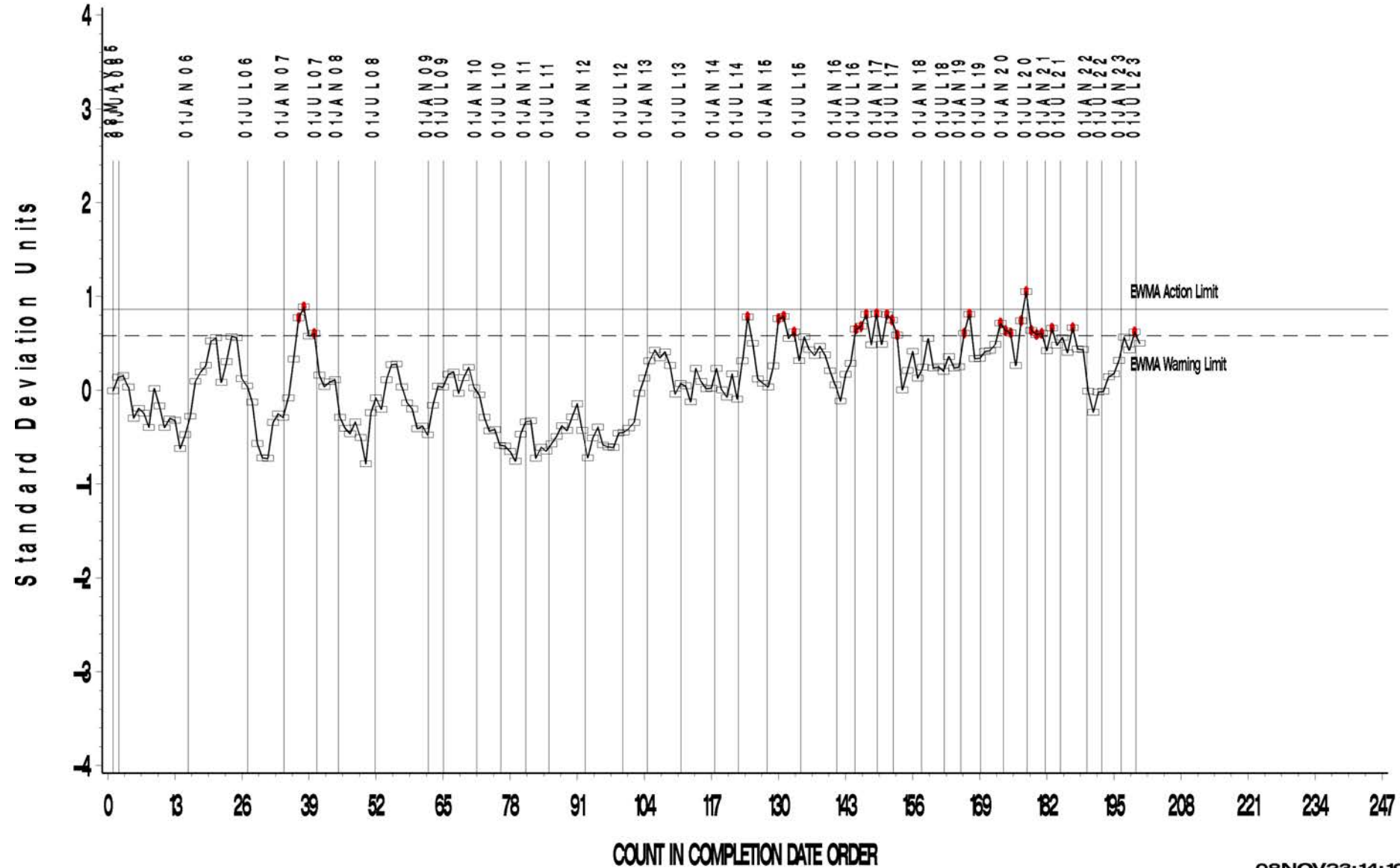
SOOT @ 4 cSt — FINAL RESULT

LTMS Severity Analysis



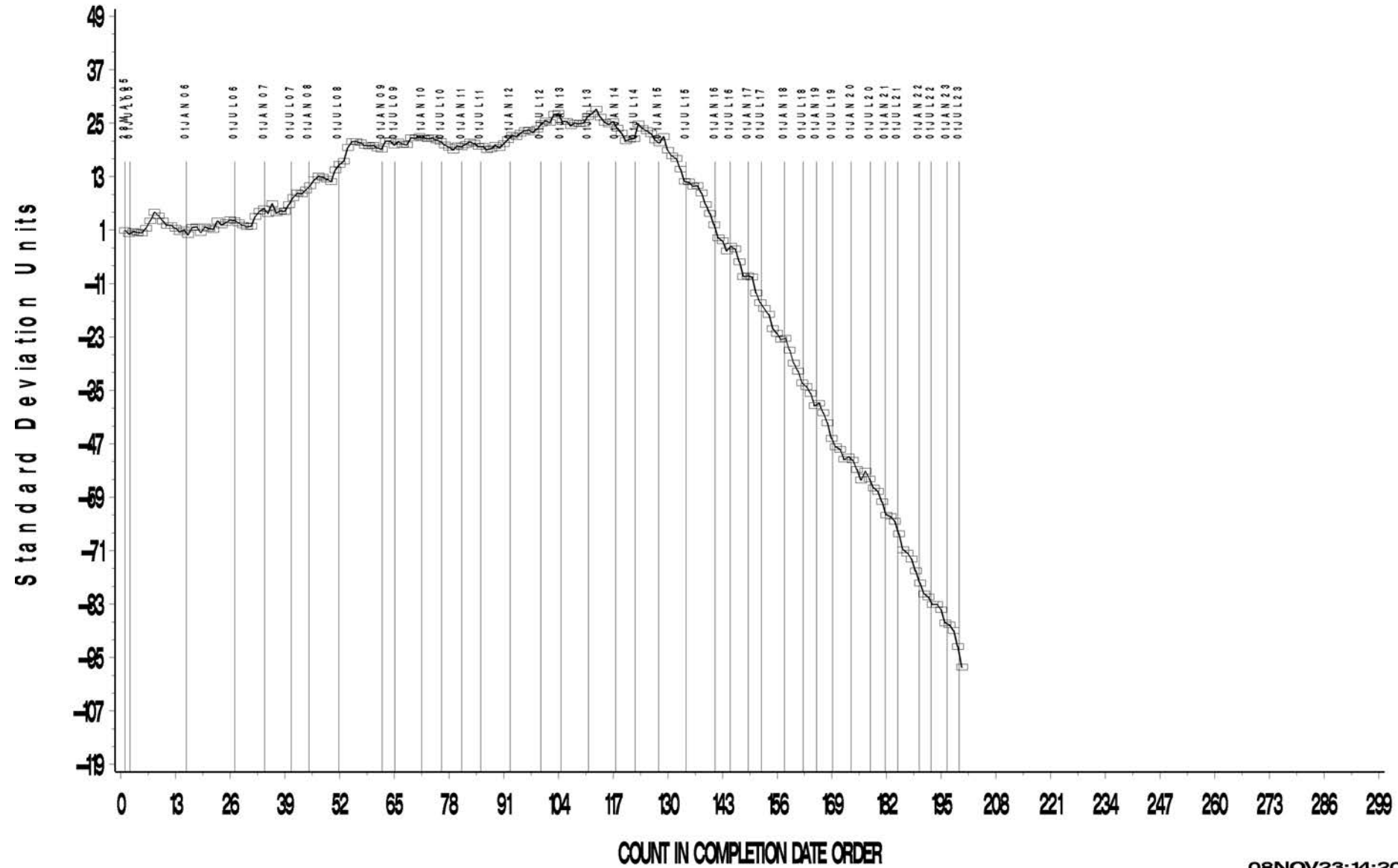
SOOT @ 4 cSt — FINAL RESULT

LTMS Precision Analysis



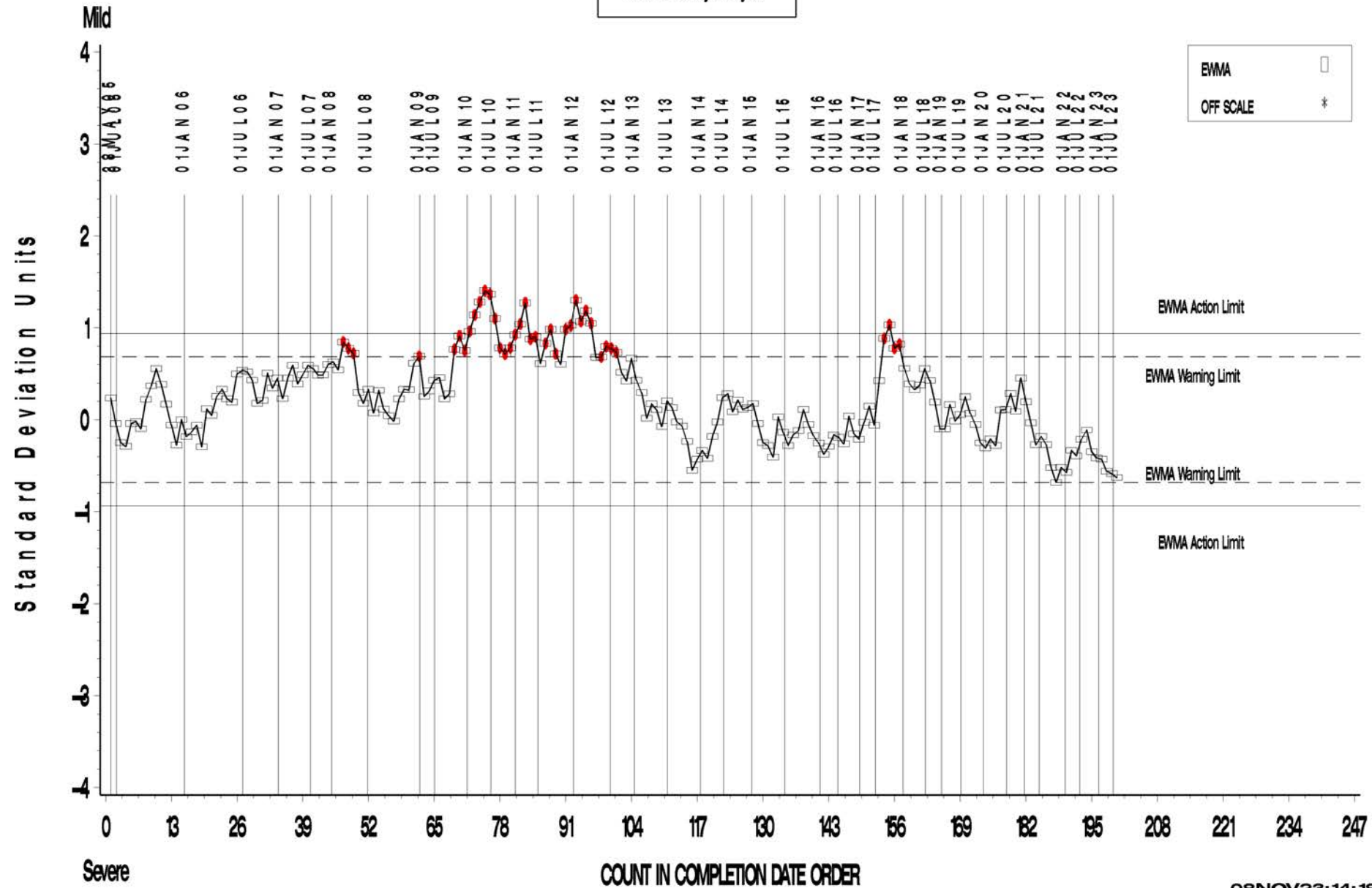
SOOT @ 4 cSt — FINAL RESULT

CUSUM Severity Analysis



SOOT @ 15 cSt — FINAL RESULT

LTMS Severity Analysis

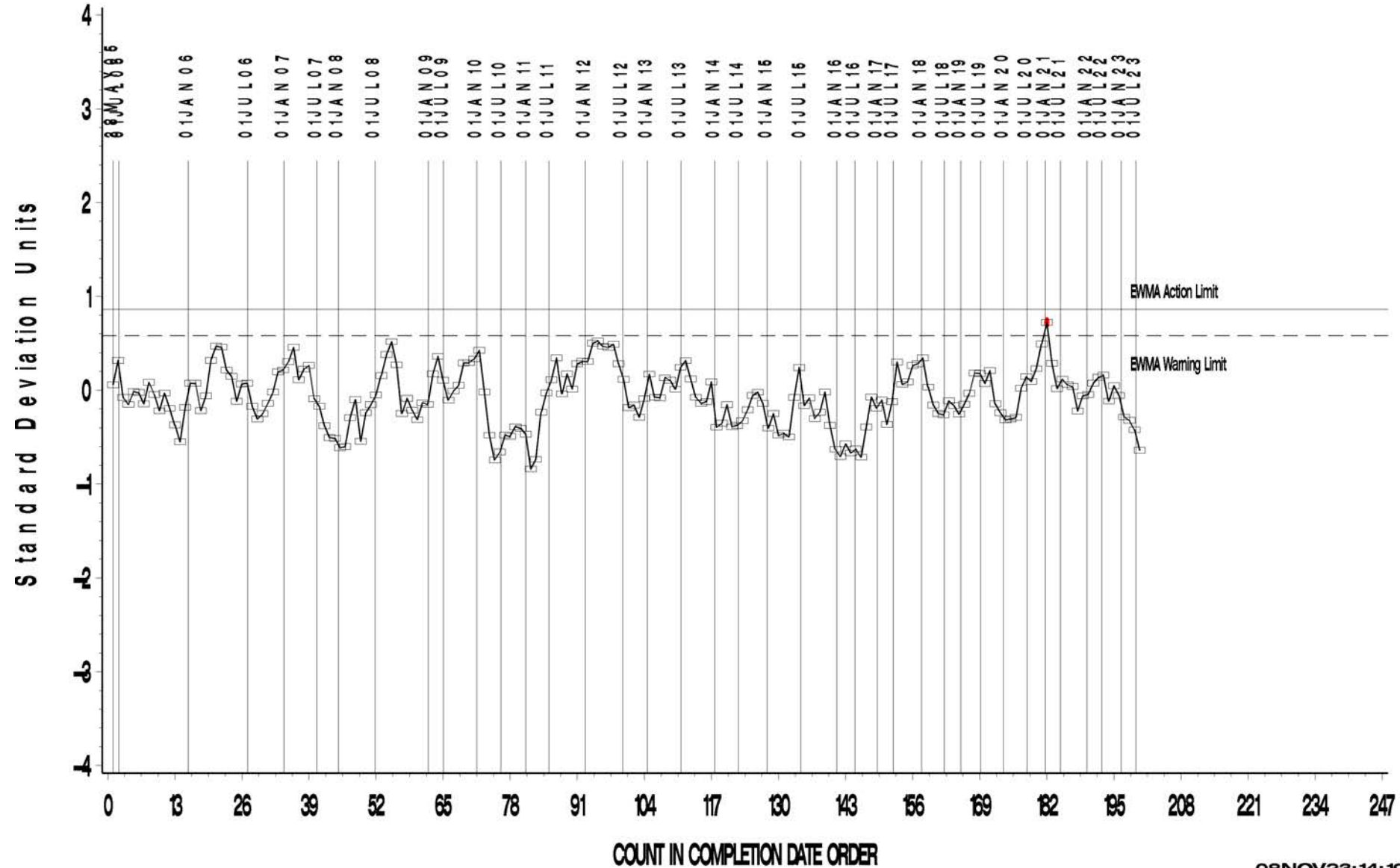


EWMA □  
OFF SCALE \*

EWMA Action Limit  
EWMA Warning Limit  
EWMA Warning Limit  
EWMA Action Limit

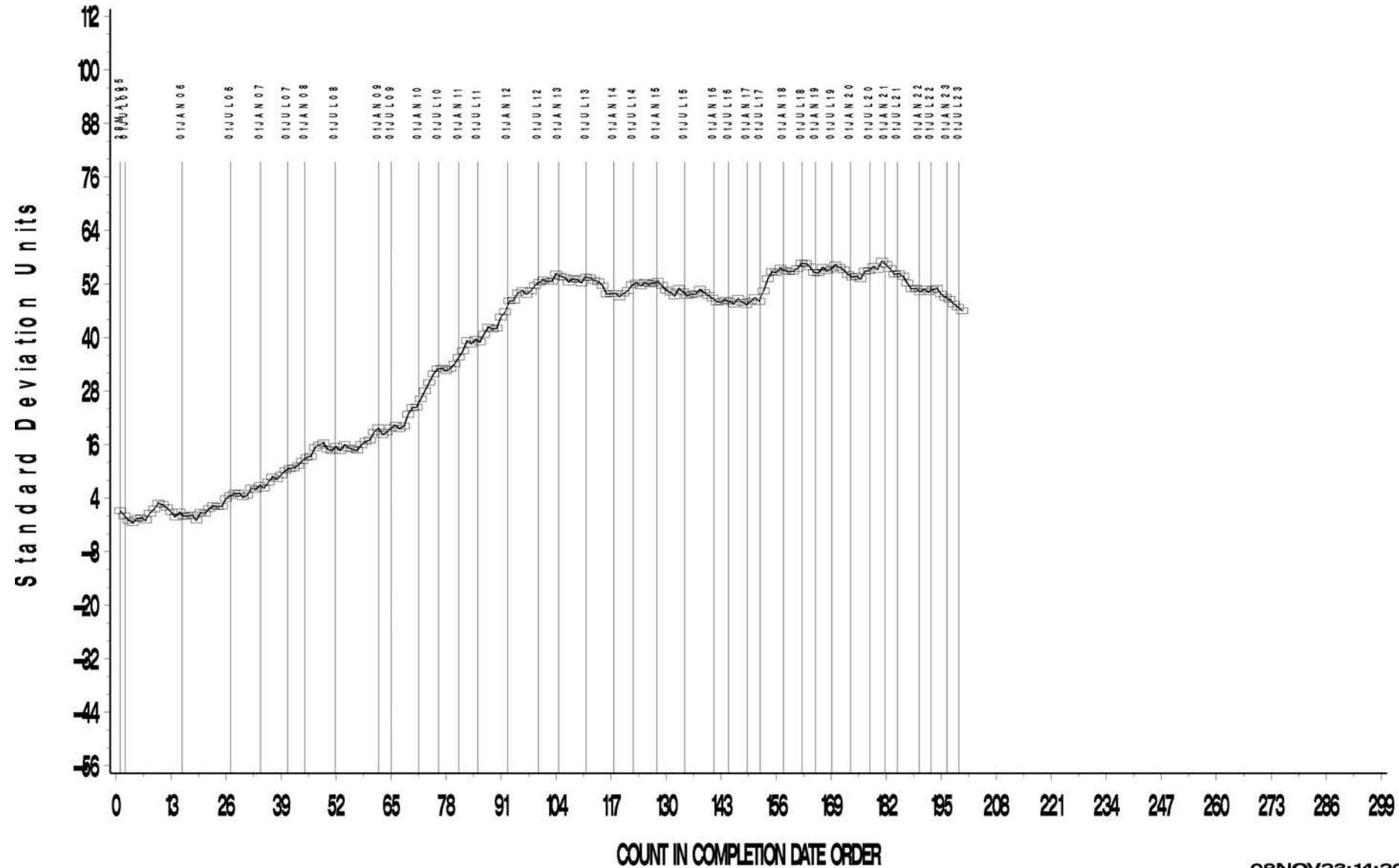
SOOT @ 15 cSt — FINAL RESULT

LTMS Precision Analysis



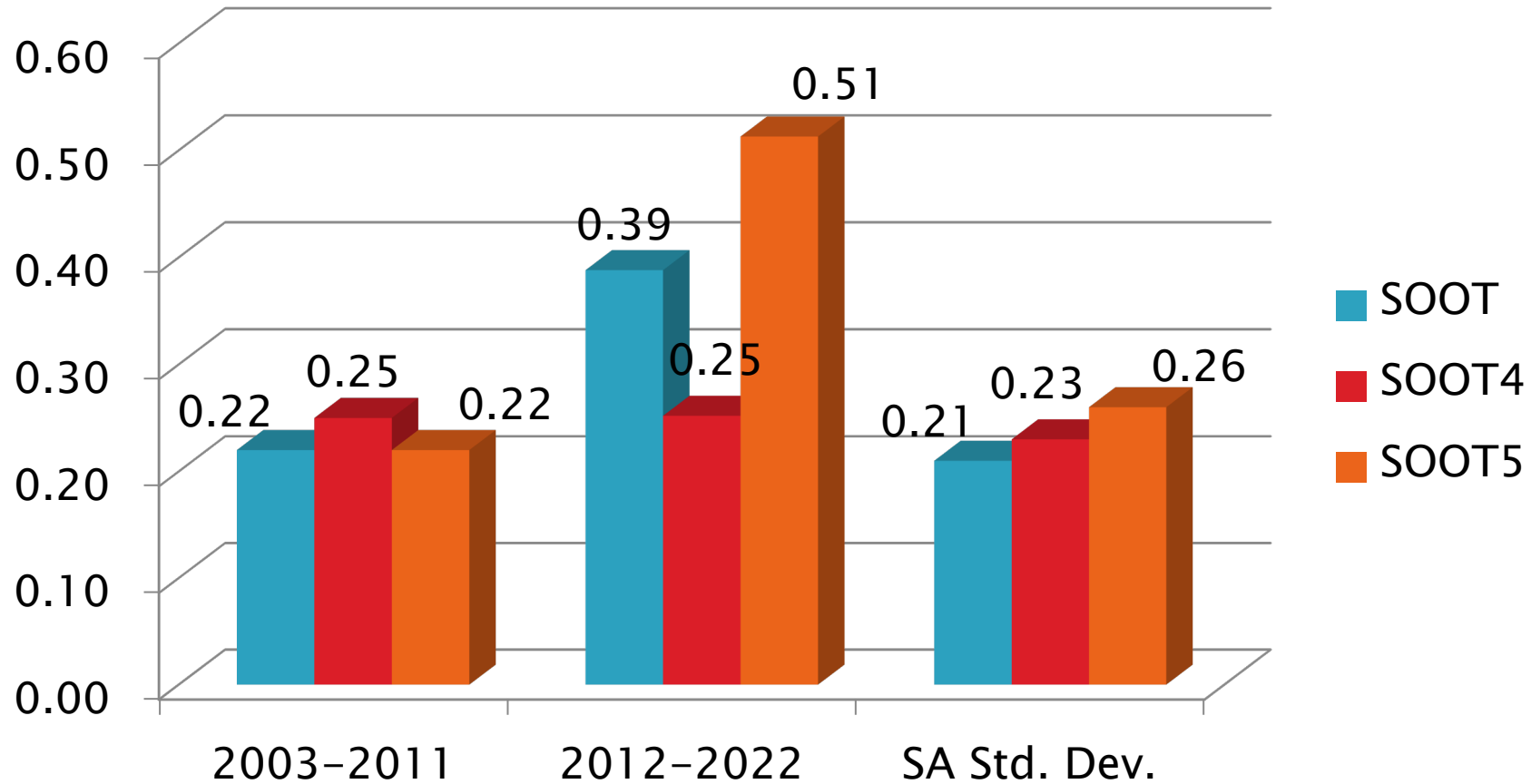
SOOT @ 15 cSt — FINAL RESULT

CUSUM Severity Analysis



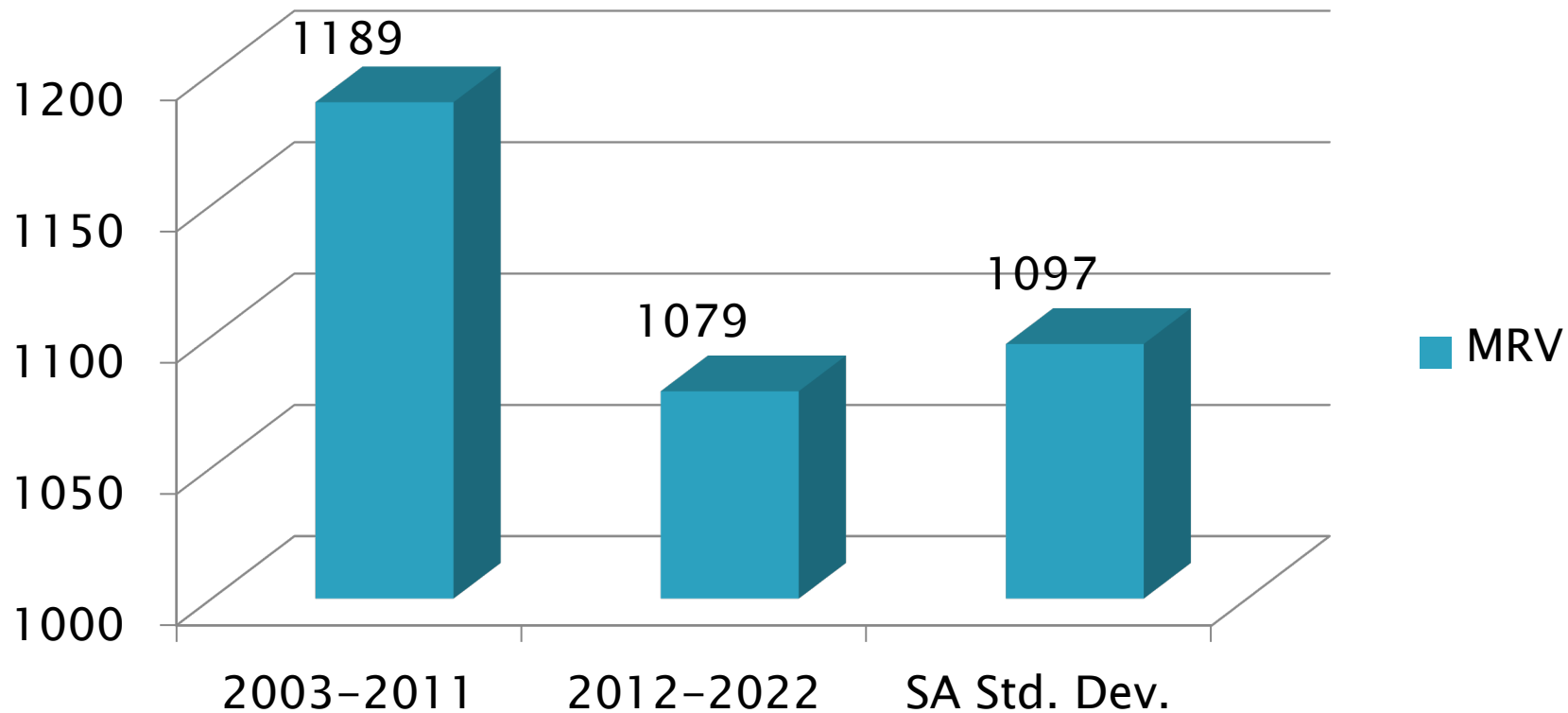


# T-11 Precision Estimates



# T-11 Precision Estimates

MRV



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# Mack T-12

➤➤ October 2023

# T-12 Test Activity

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

# T-12 Failed Tests

Failed Parameter	Number of Tests
Pb and OC Mild	1
<b>Total</b>	<b>1</b>

# T-12 Lost Tests\*

Status	Cause	#
Invalid	No invalid tests	0
Aborted	No aborted tests	0
<b>Total</b>		<b>0</b>

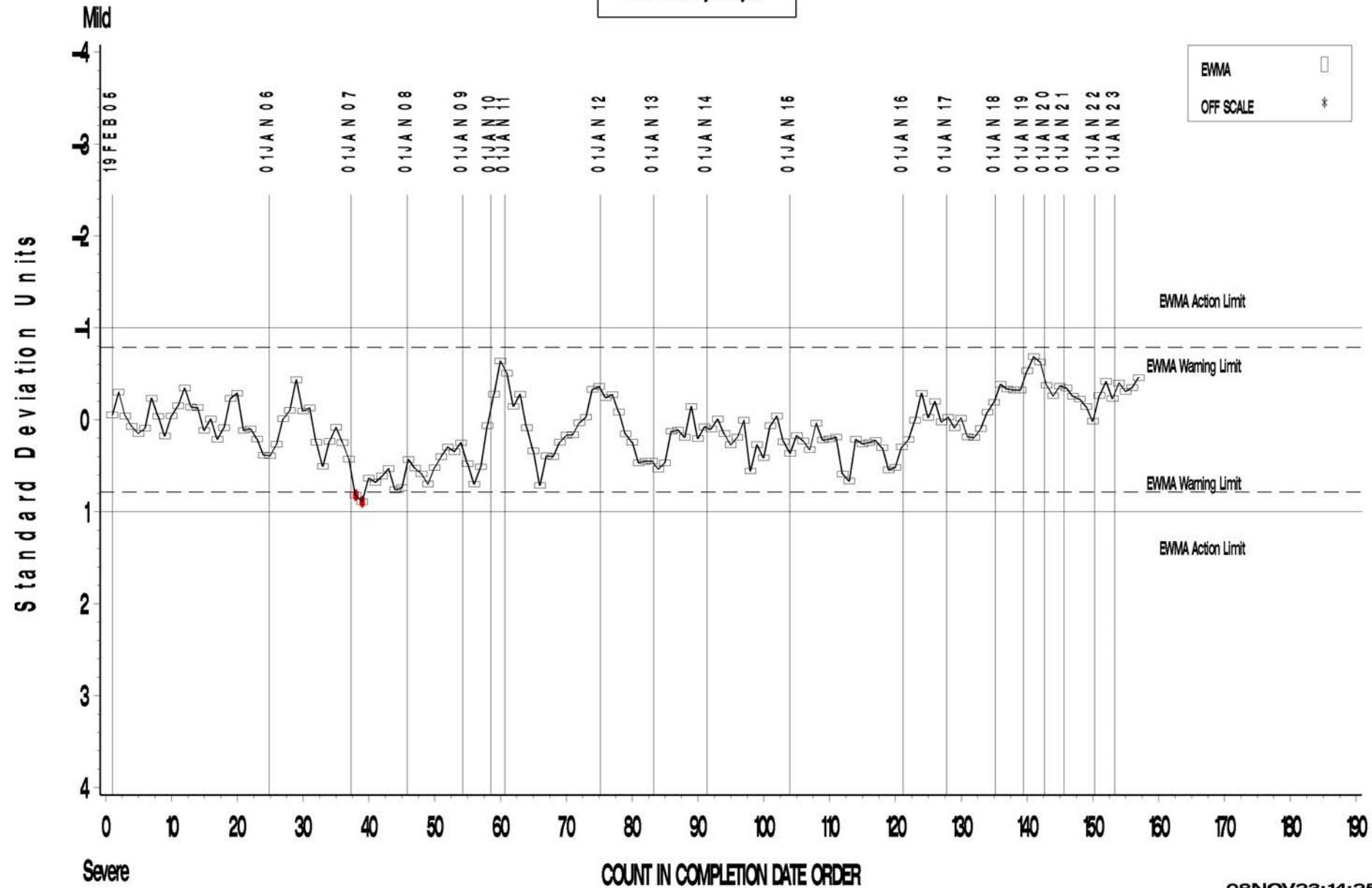
\*Invalid and aborted tests

# T-12 Test Severity

- ▶ All parameters are in control

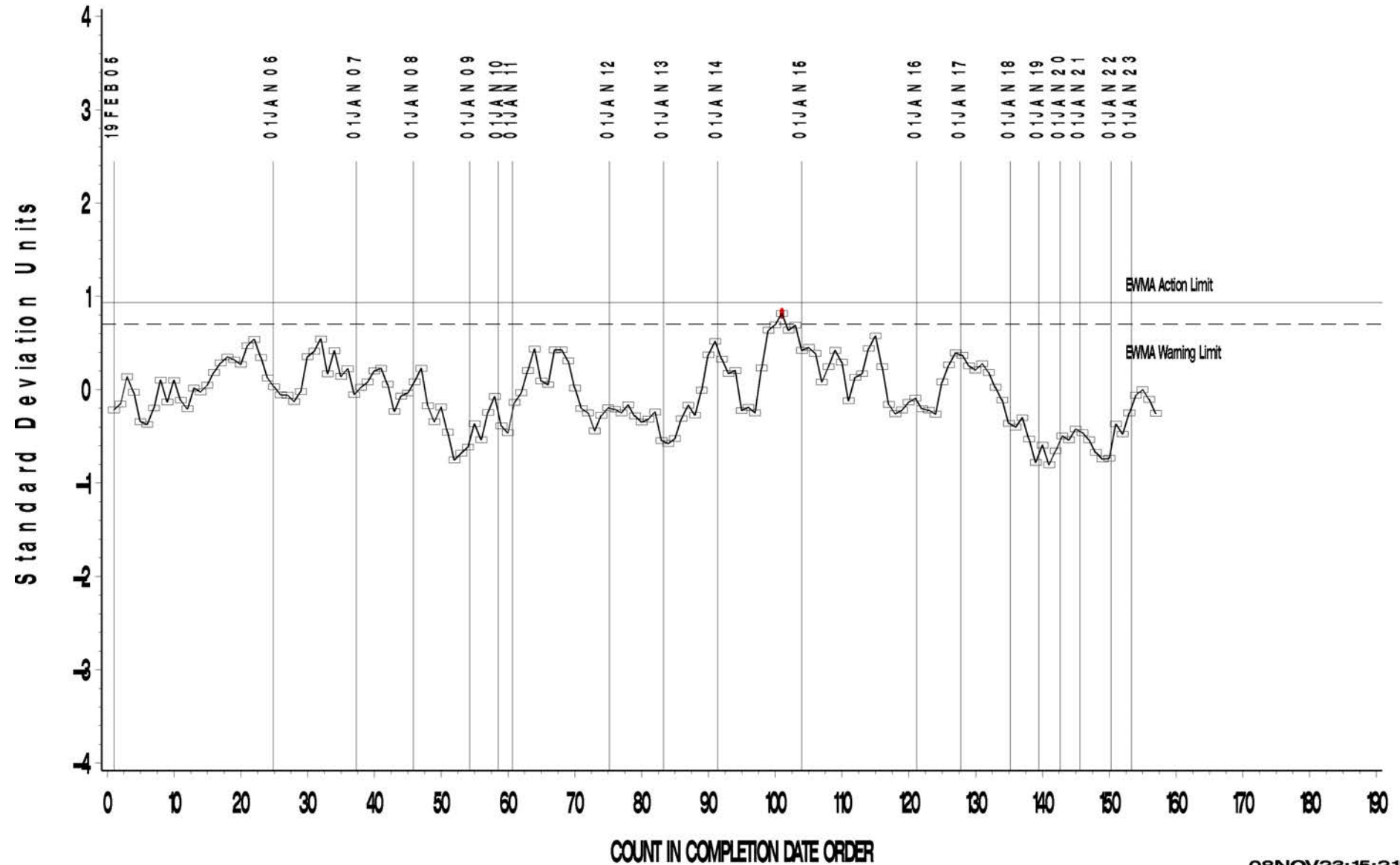
AVG. CYLINDER LINER WEAR (CLW)

LTMS Severity Analysis



AVG. CYLINDER LINER WEAR (CLW)

LTMS Precision Analysis



AVG. CYLINDER LINER WEAR (CLW)

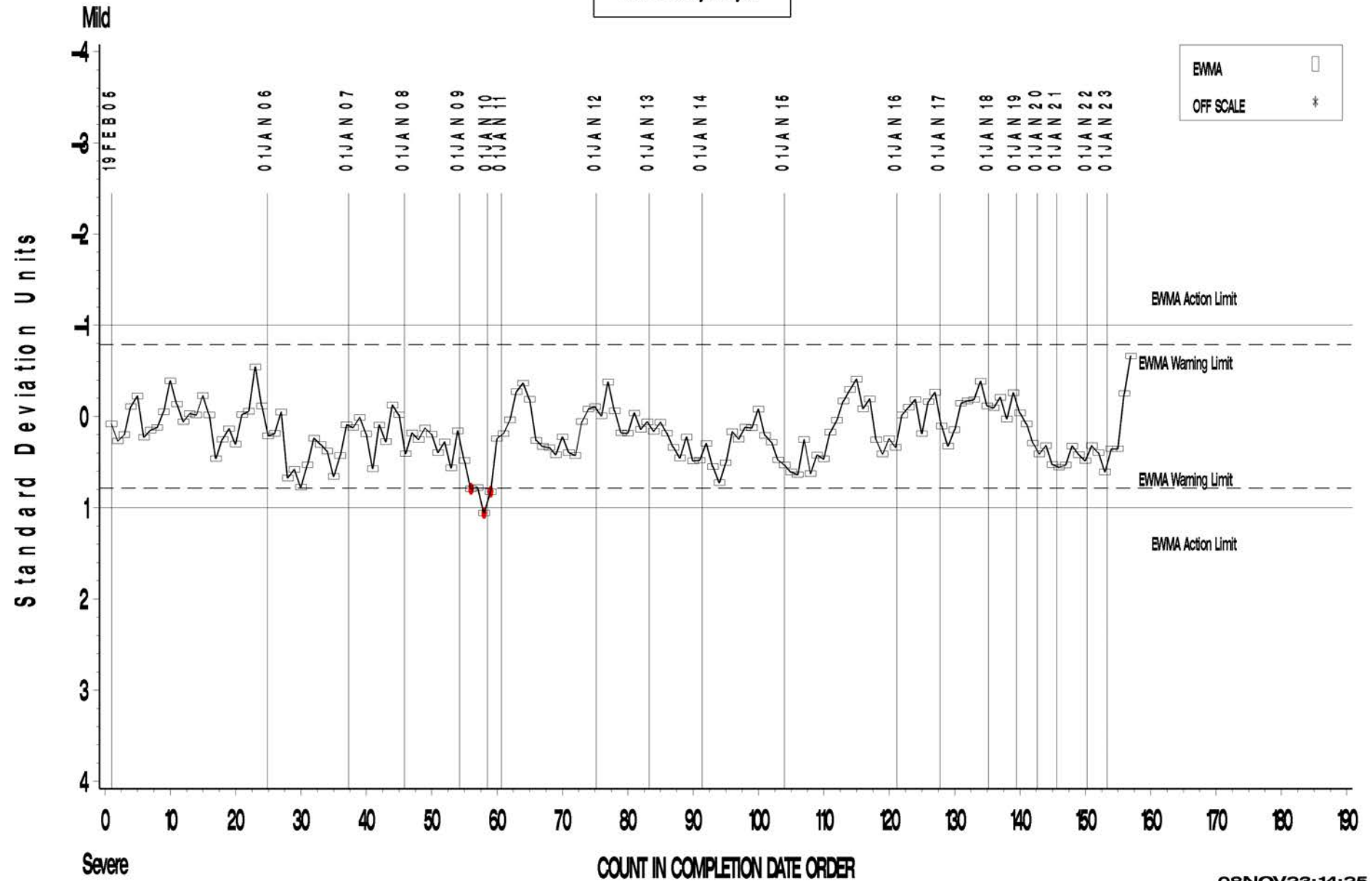
CUSUM Severity Analysis





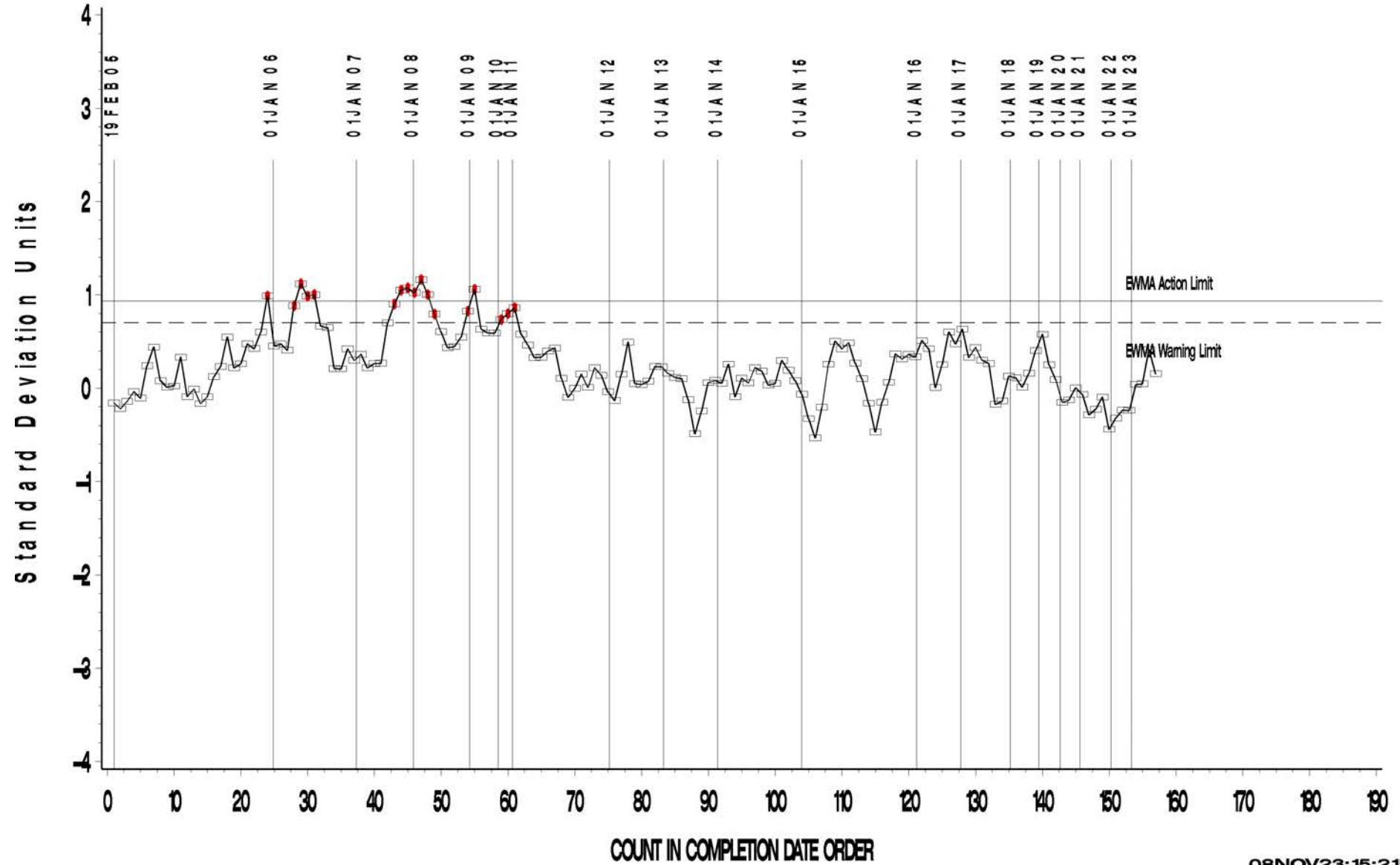
FINAL TRANS. RES. OIL CONSUMPTION

LTMS Severity Analysis



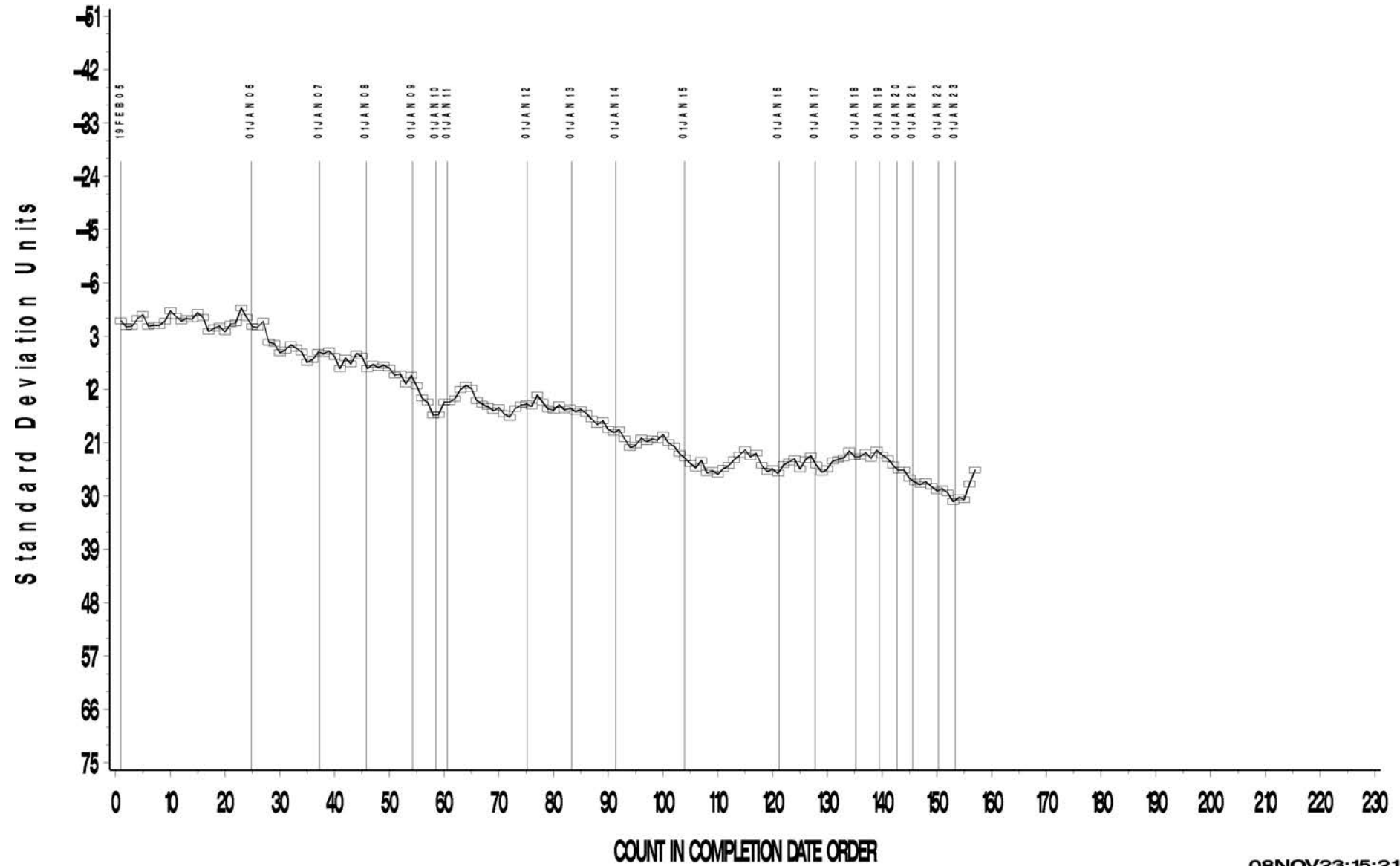
FINAL TRANS. RES. OIL CONSUMPTION

LTMS Precision Analysis



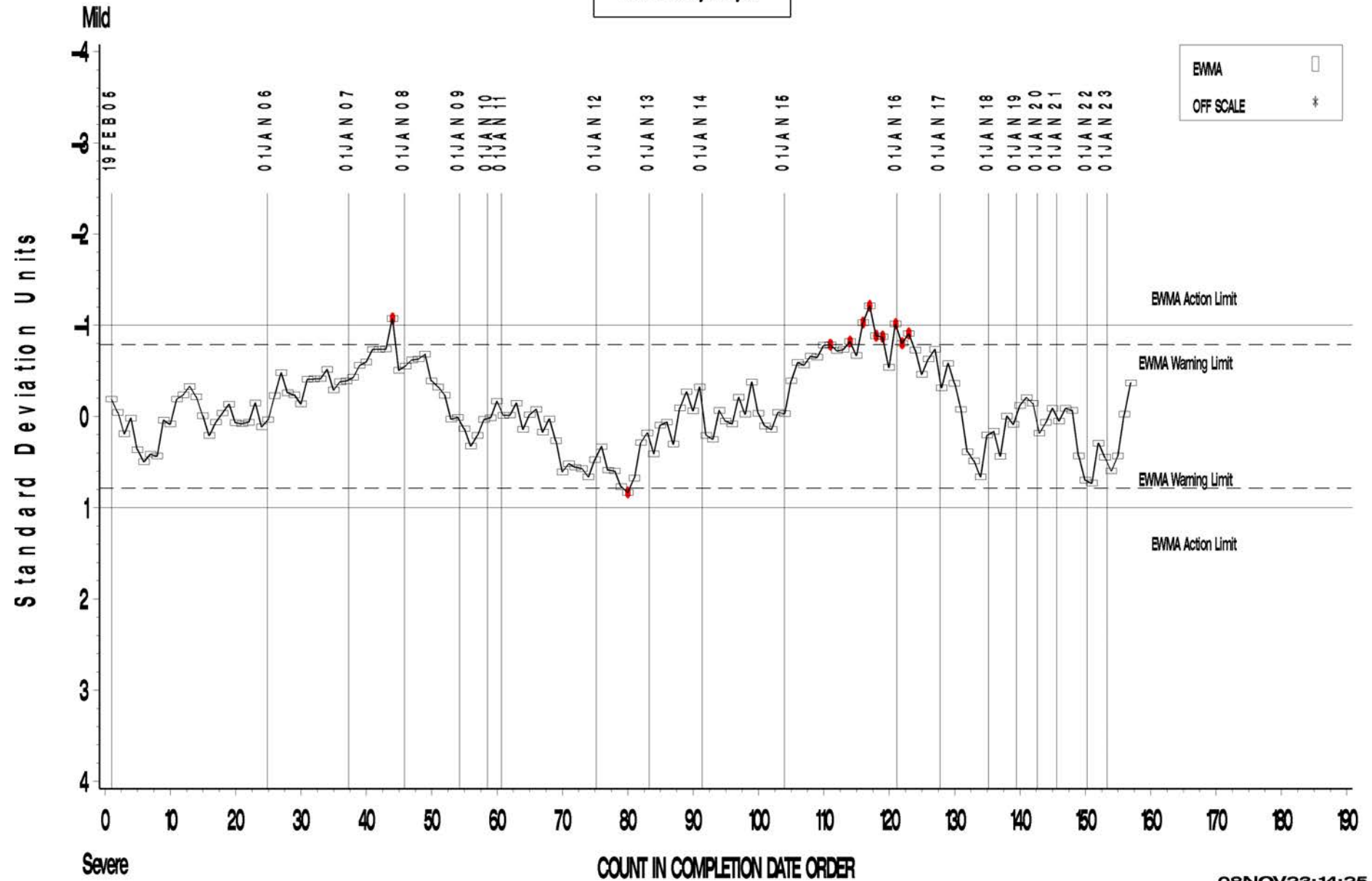
FINAL TRANS. RES. OIL CONSUMPTION

CUSUM Severity Analysis



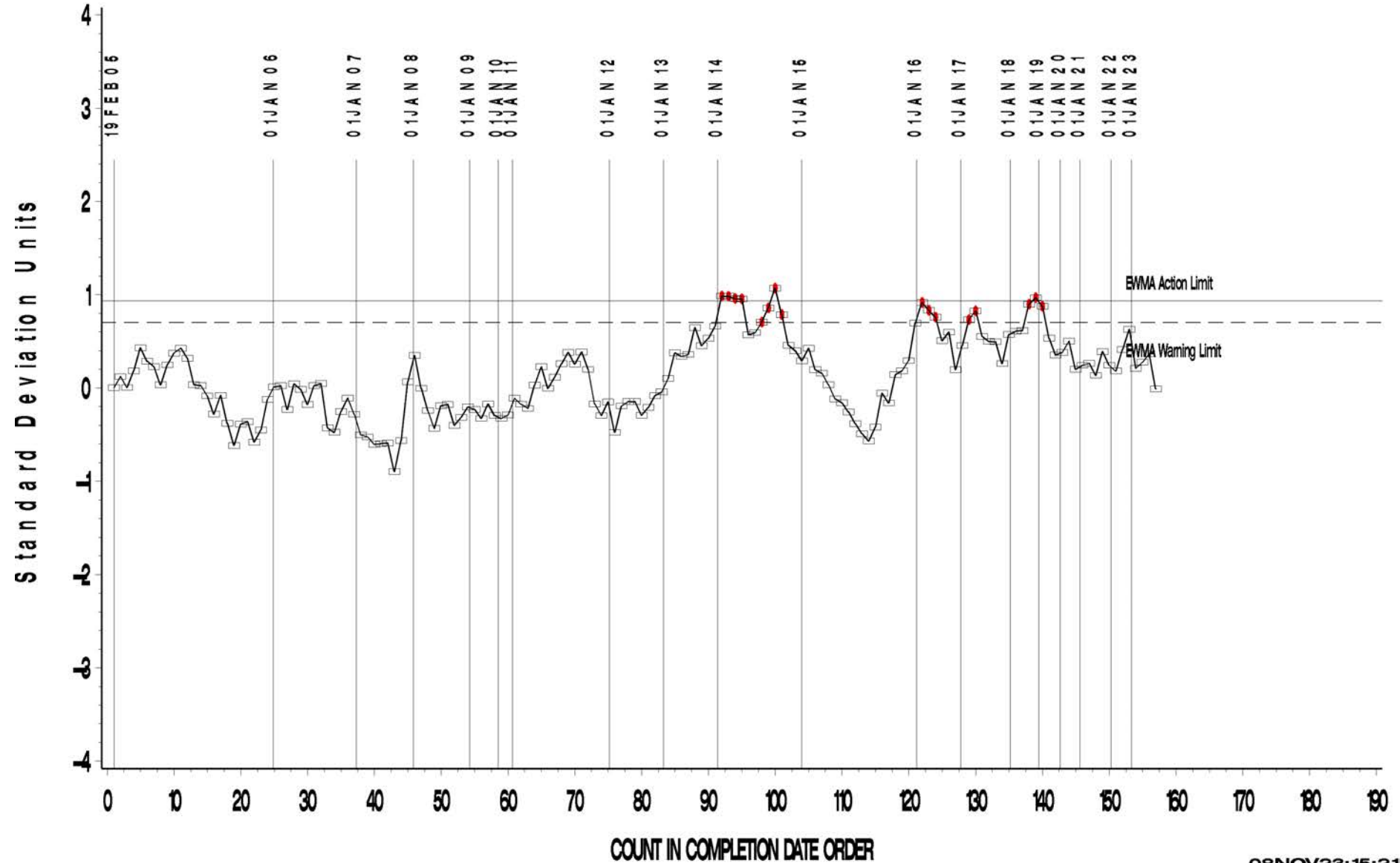
FINAL TRANS. RES. DELTA PB @ EOT

LTMS Severity Analysis



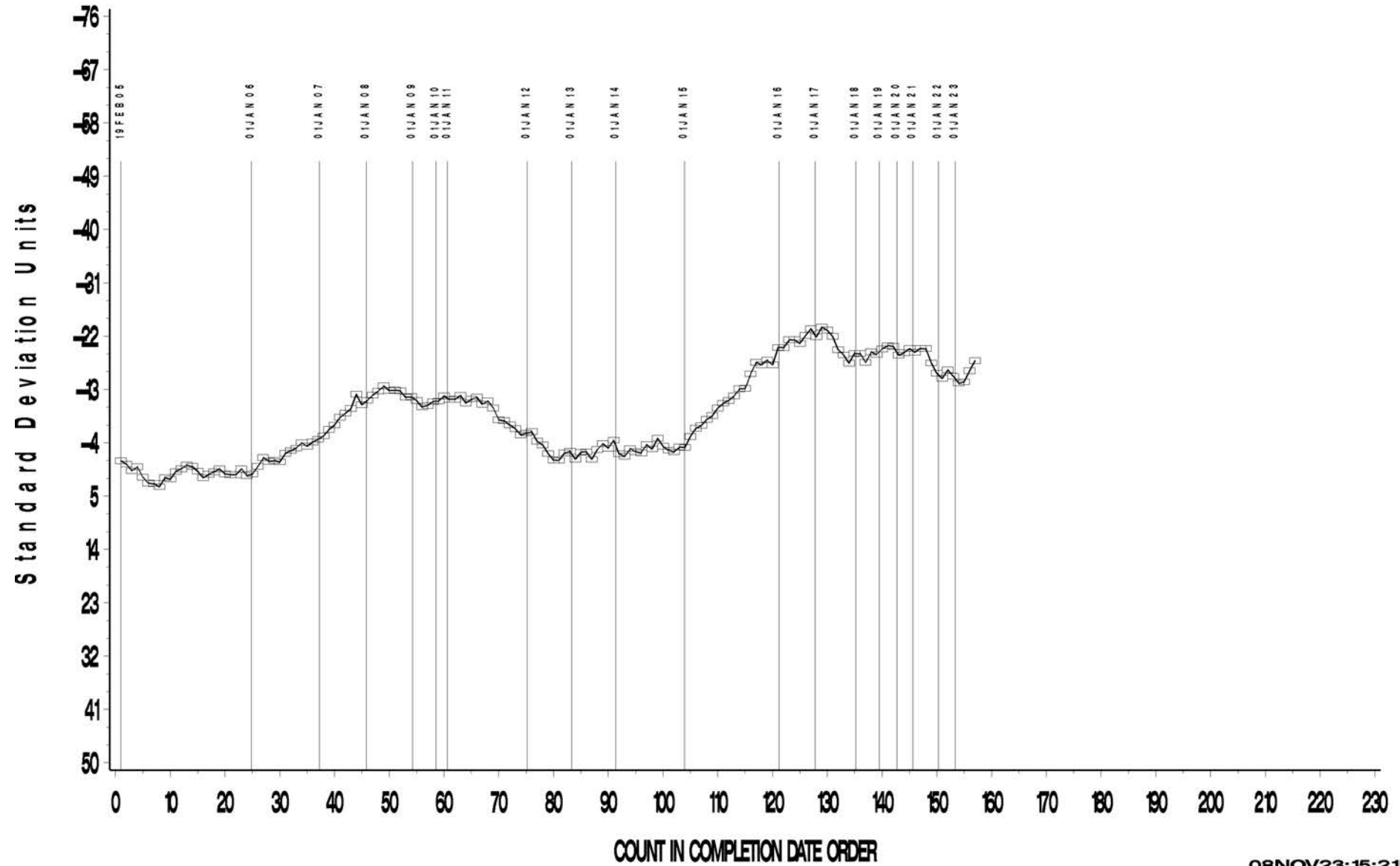
FINAL TRANS. RES. DELTA PB @ EOT

LTMS Precision Analysis



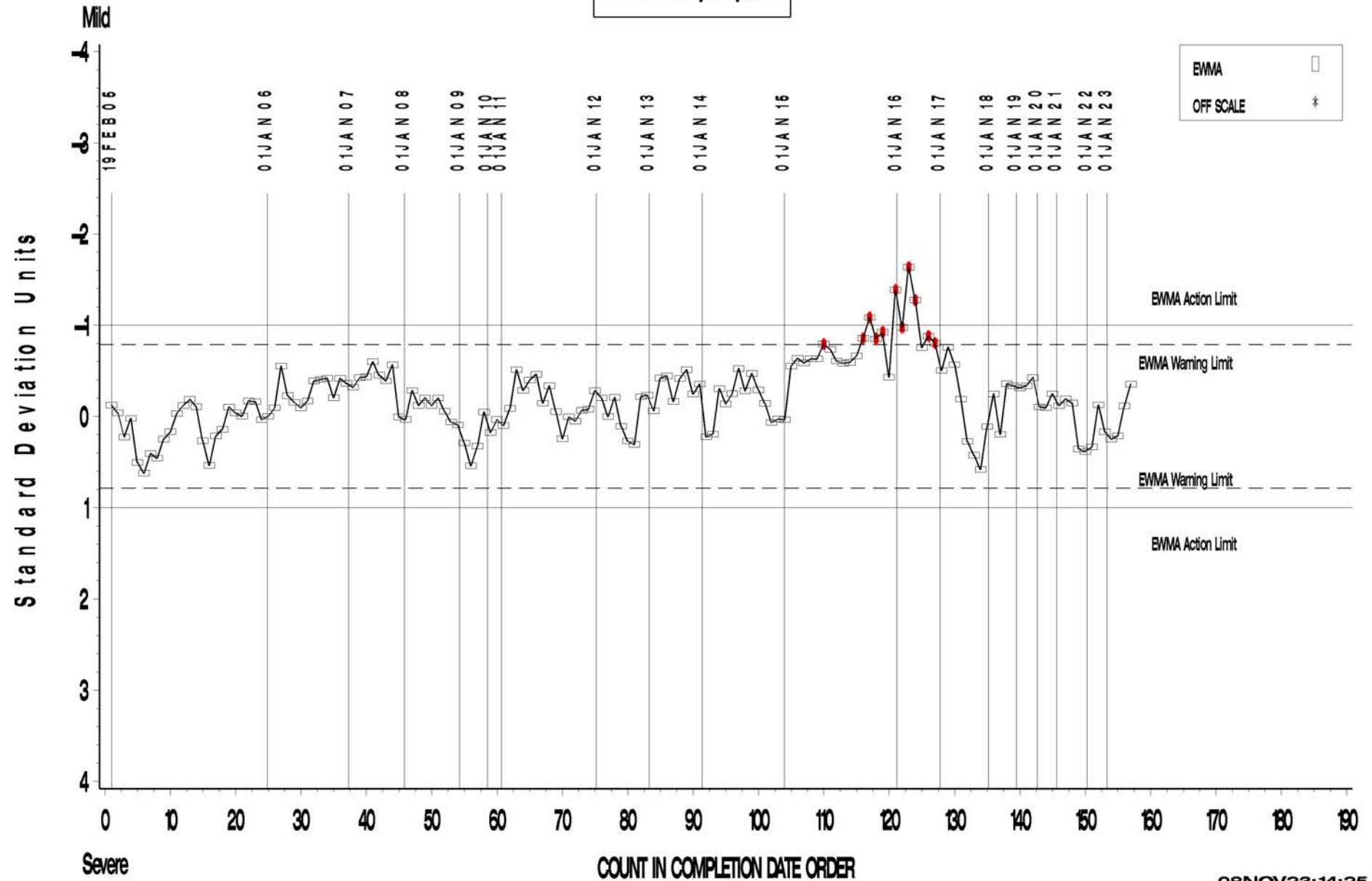
FINAL TRANS. RES. DELTA PB @ EOT

CUSUM Severity Analysis



FINAL TRANS. RES. DELTA PB 250-300H

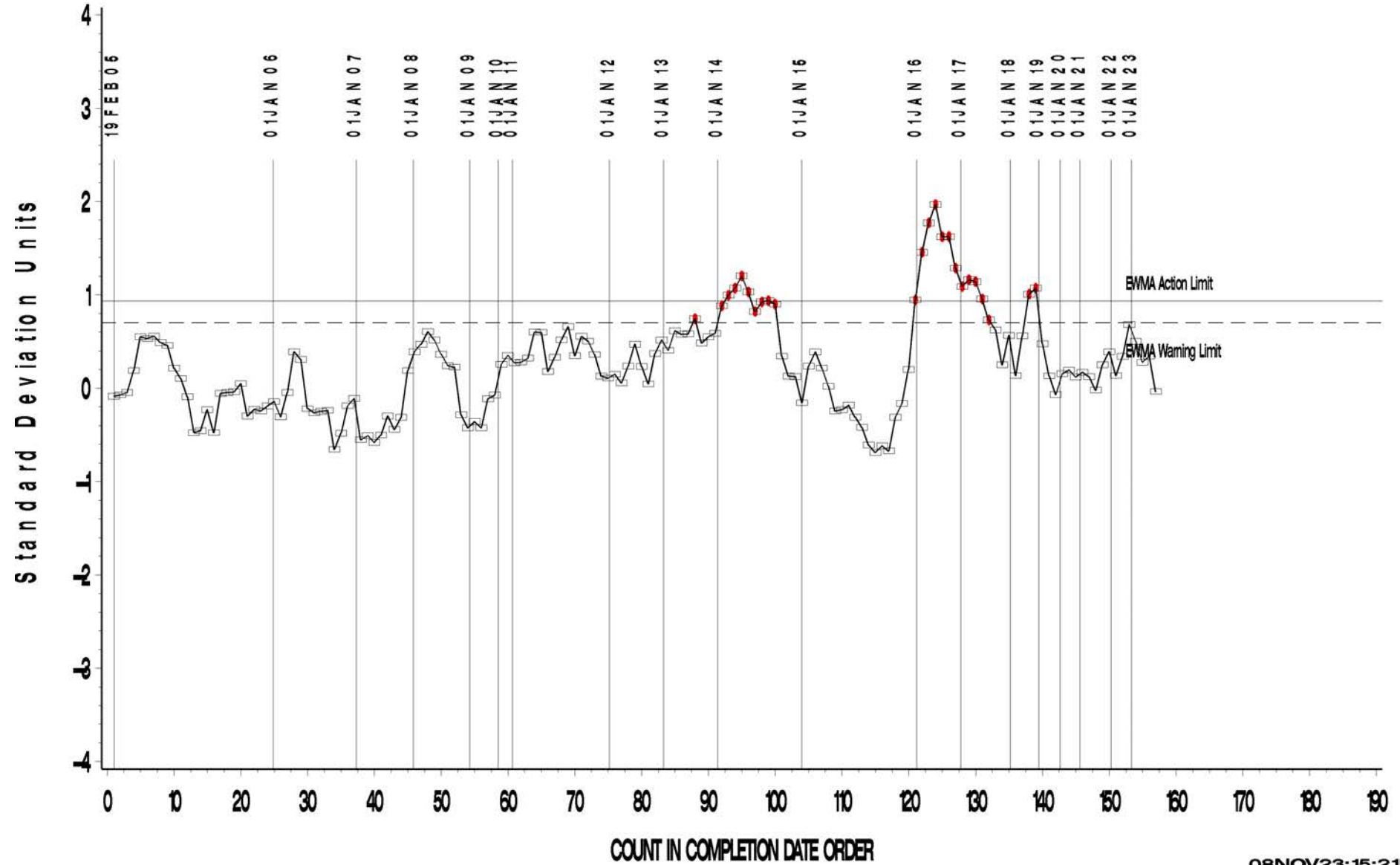
LTMS Severity Analysis





FINAL TRANS. RES. DELTA PB 250-300H

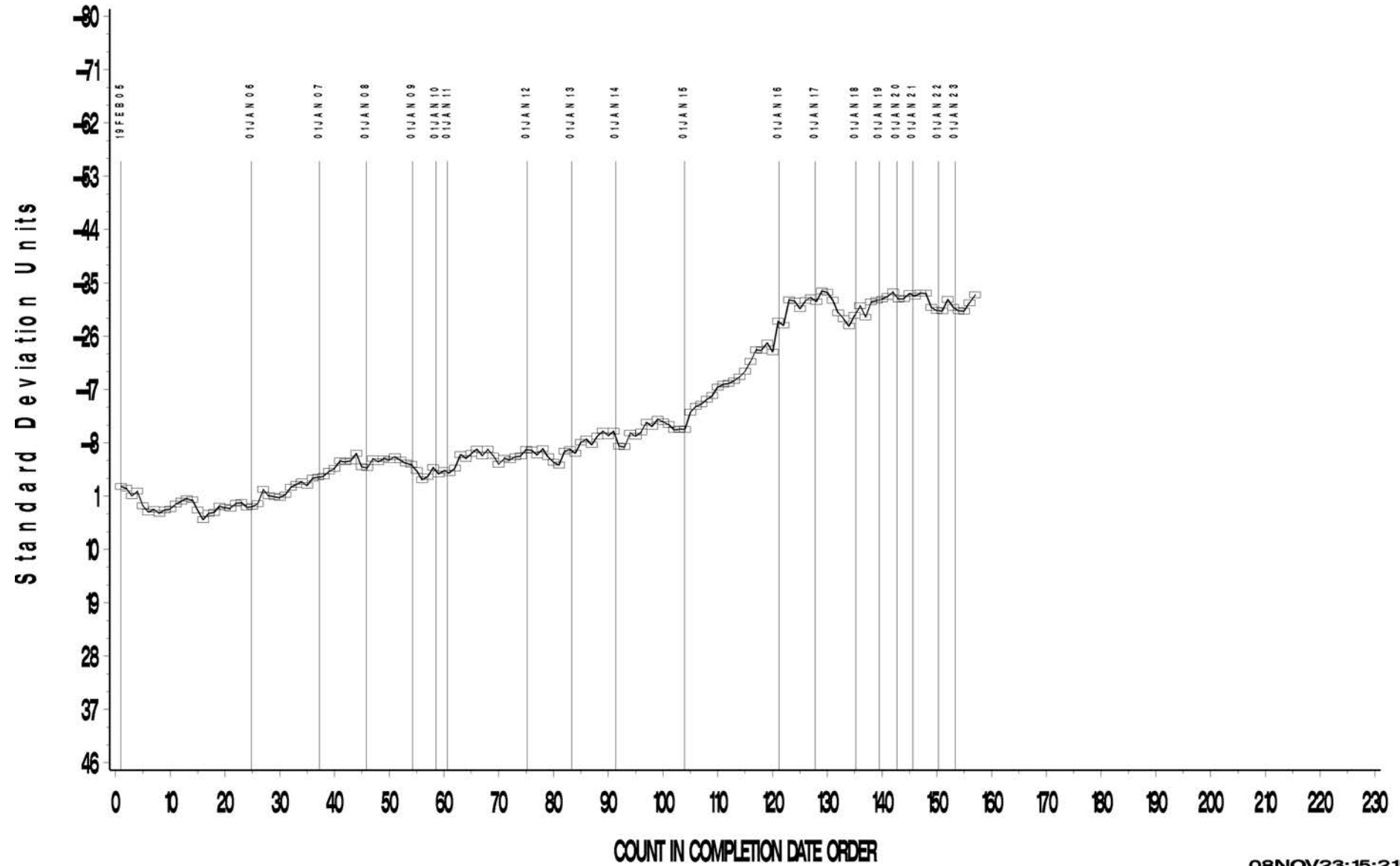
LTMS Precision Analysis



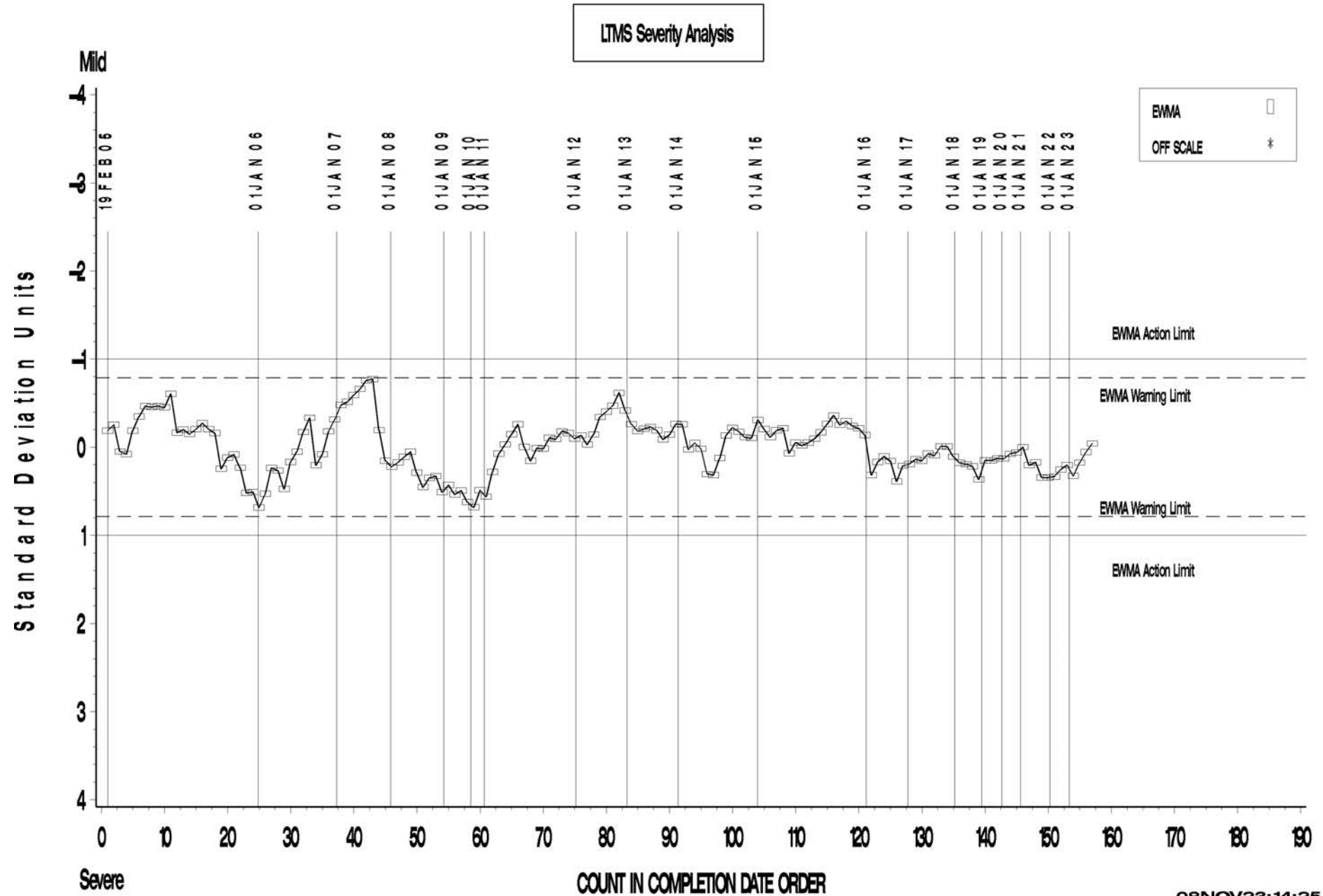


FINAL TRANS. RES. DELTA PB 250-300H

CUSUM Severity Analysis

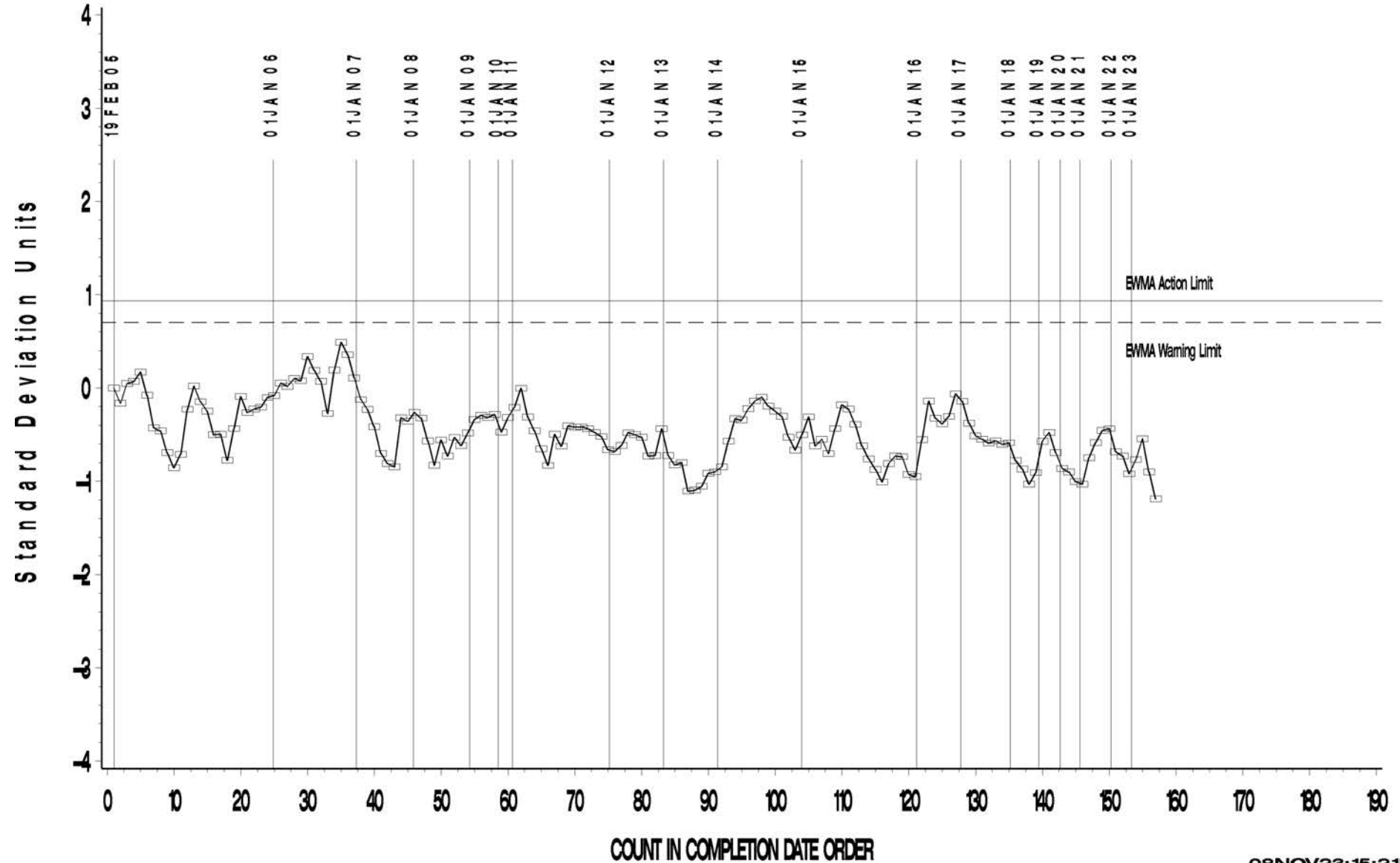


AVG. TOP RING WEIGHT LOSS (TRWL)



AVG. TOP RING WEIGHT LOSS (TRWL)

LTMS Precision Analysis

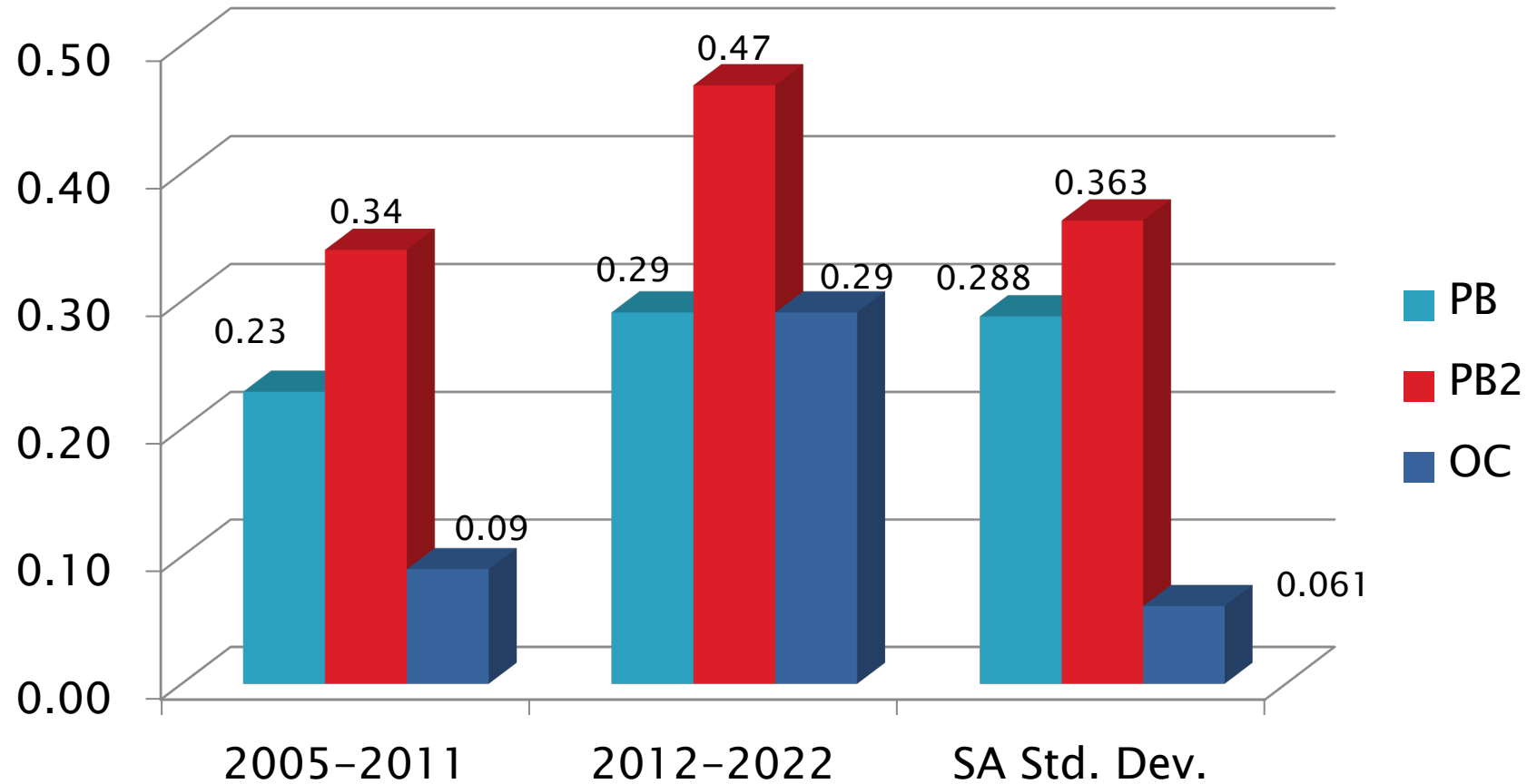


AVG. TOP RING WEIGHT LOSS (TRWL)

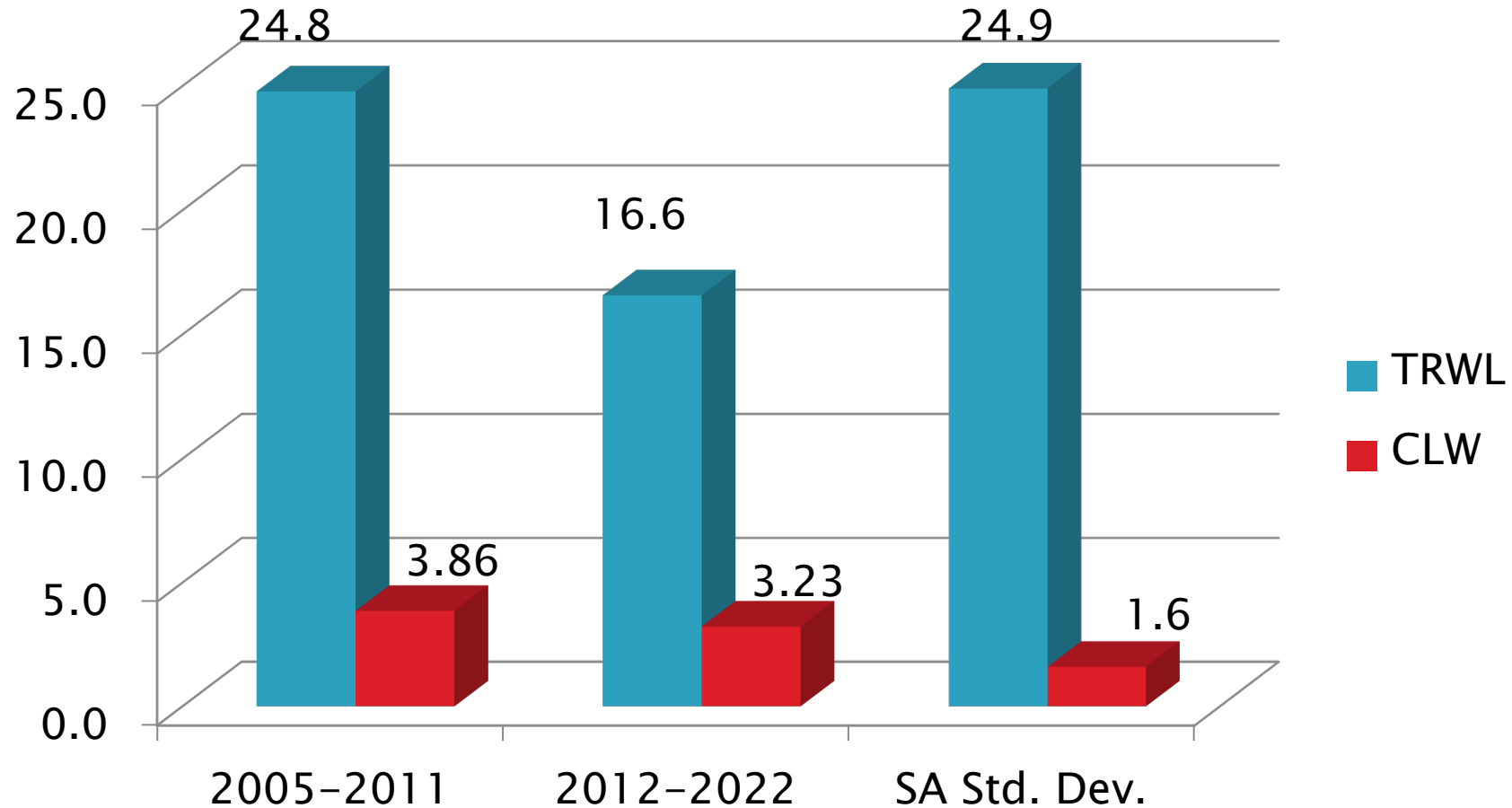
CUSUM Severity Analysis



# T-12 Precision Estimates



# T-12 Precision Estimates



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# Mack T-12A

➤➤ October 2023

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# T-12A Test Activity

Test Status	Validity Code	#
Acceptable Calibration Test	AC	4
Failed Calibration Test	OC	0
Operationally Invalid	LC	0
<b>Total</b>		<b>4</b>



# T-12A Failed Tests

Failed Parameter	Number of Tests
No failed tests	0
<b>Total</b>	<b>0</b>

# T-12A Lost Tests\*

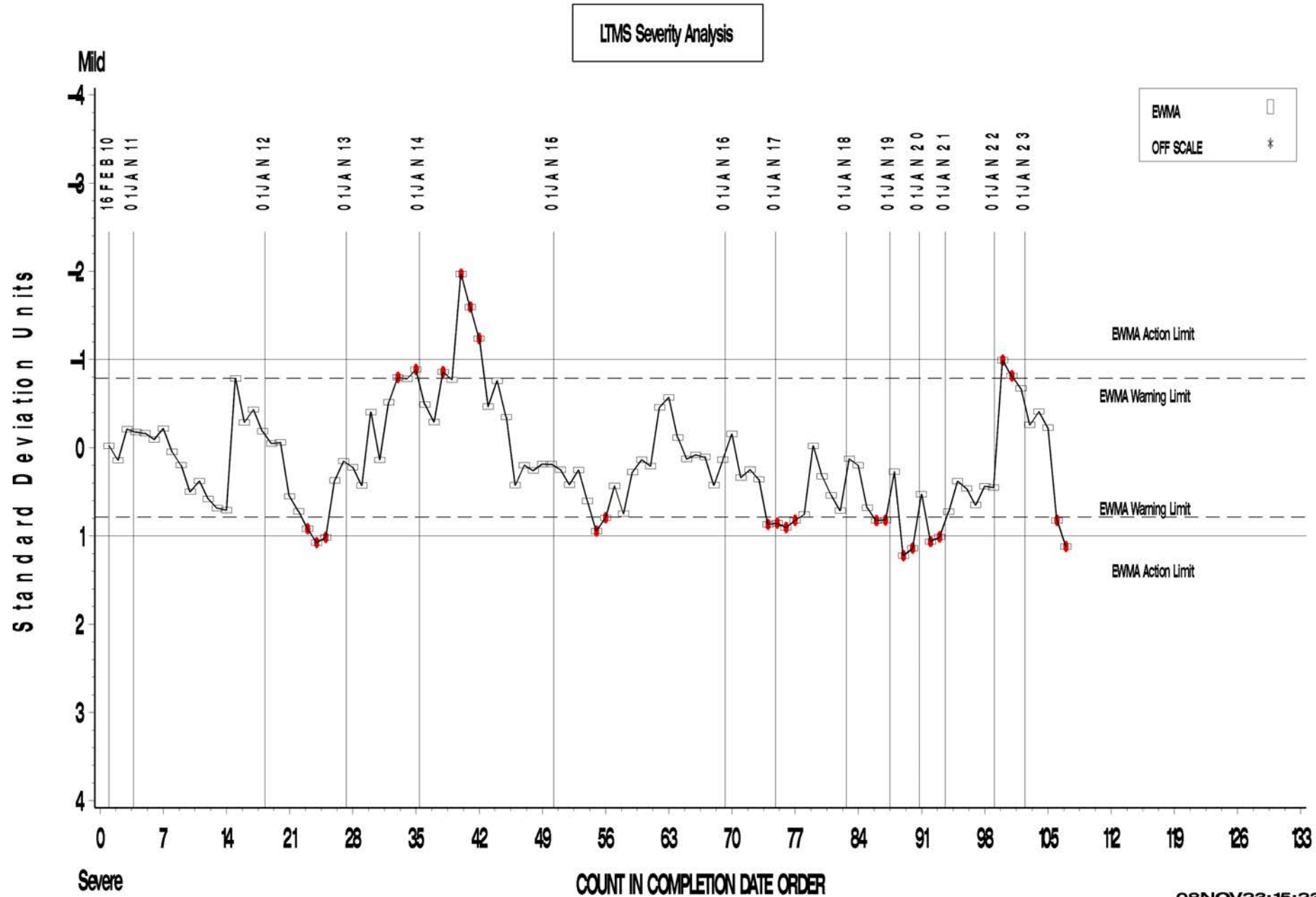
Status	Cause	#
Invalid	Missed soot window	0
Aborted	No aborted tests	0
<b>Total</b>		<b>0</b>

\*Invalid and aborted tests

# T-12A Test Severity

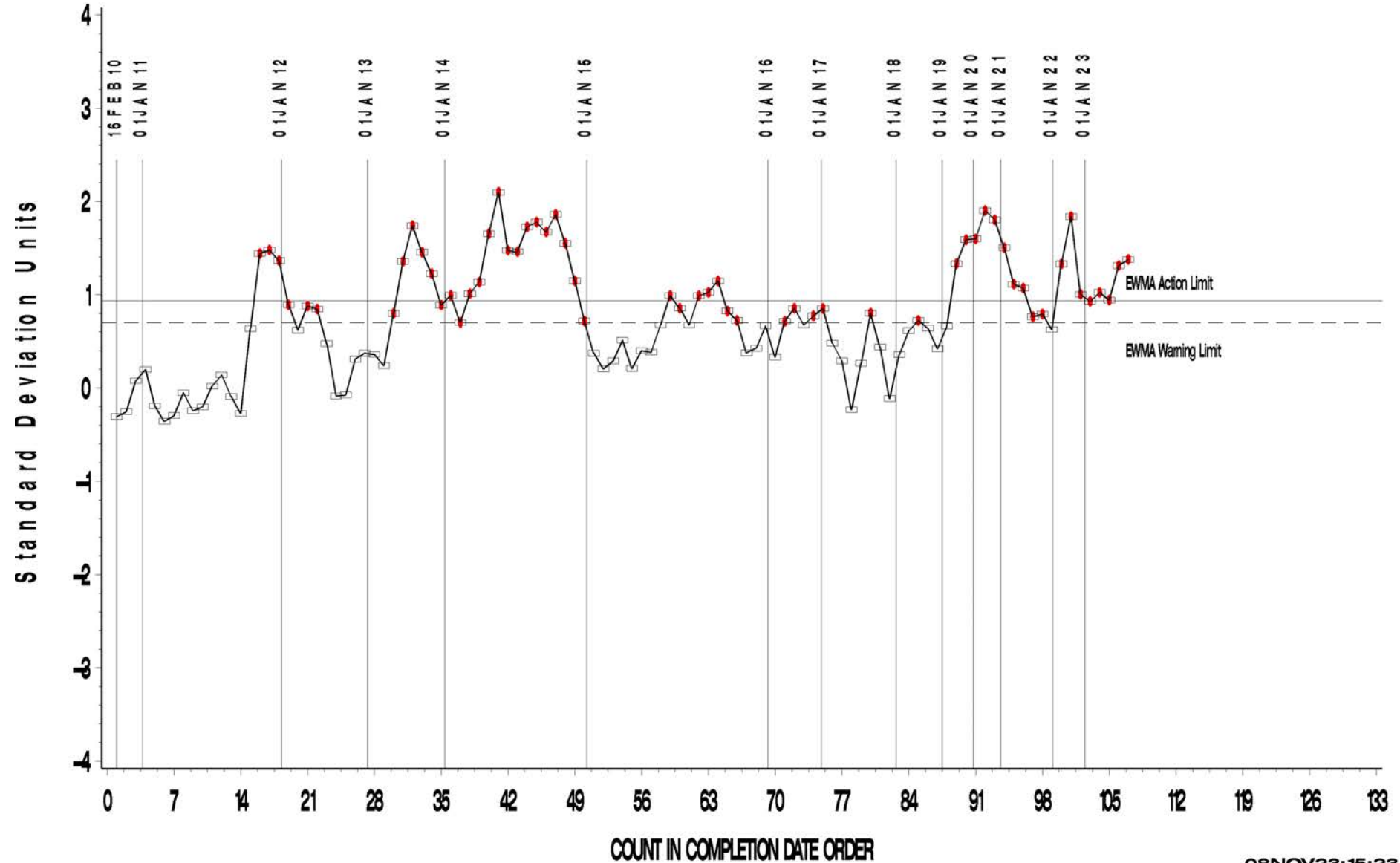
- ▶ MRV is in severity action alarm in the severe direction
- ▶ MRV is in precision action alarm

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



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

LTMS Precision Analysis



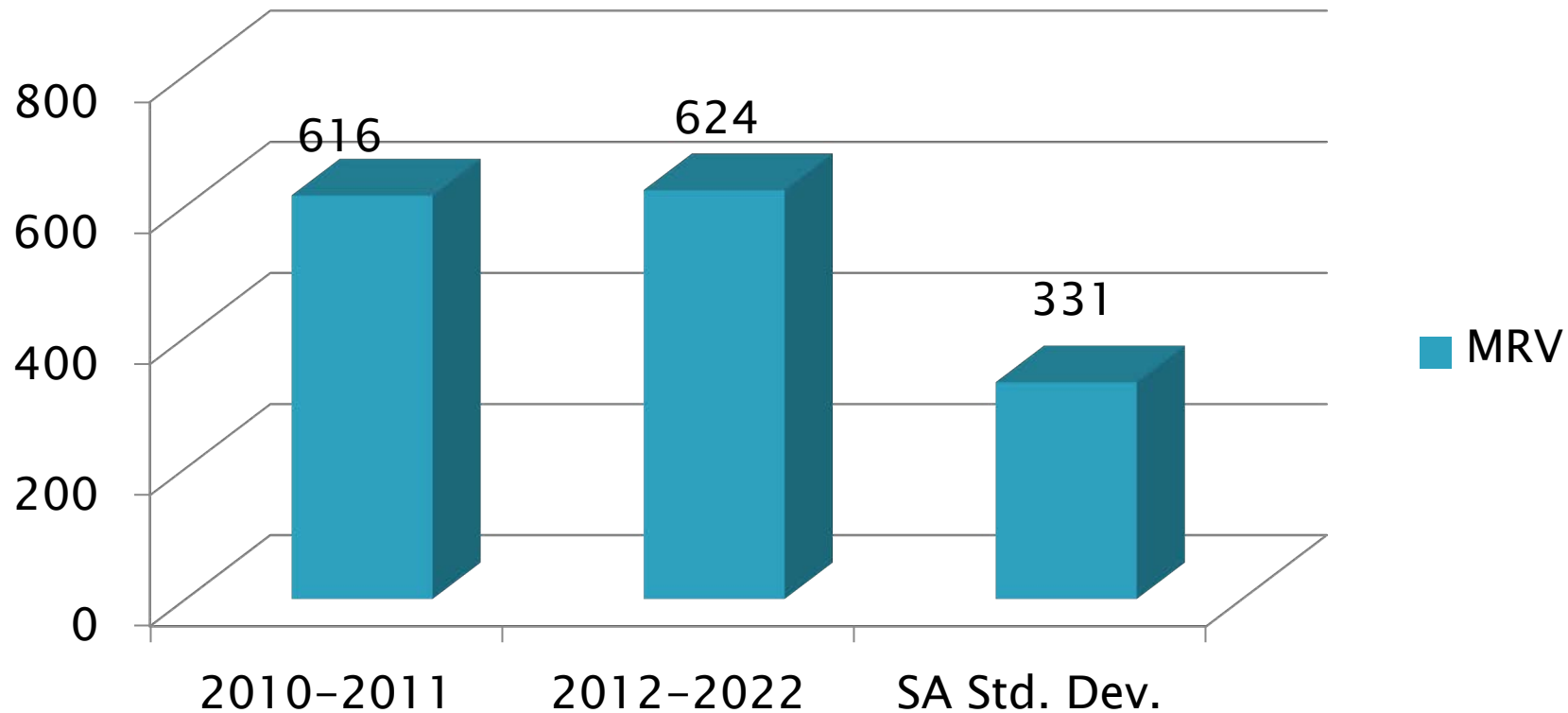
FINAL ORIGINAL UNIT MRV VISCOSITY [NM, SOLID, FROZEN, <, >]

CUSUM Severity Analysis



# T-12A Precision Estimates

MRV



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# Mack T-13

➤➤ October 2023



# T-13 Test Activity

Test Status	Validity Code	#
Acceptable Calibration Test	AC	7
Failed Calibration Test	OC	0
Operationally Invalid	LC	0
Aborted	XC	0
<b>Total</b>		<b>7</b>

# T-13 Failed Tests

Failed Parameter	Number of Tests
No failed tests	0
<b>Total</b>	<b>0</b>

# T-13 Lost Tests\*

Status	Cause	#
Invalid	No invalid tests	0
Aborted	No aborted tests	0
<b>Total</b>		<b>0</b>

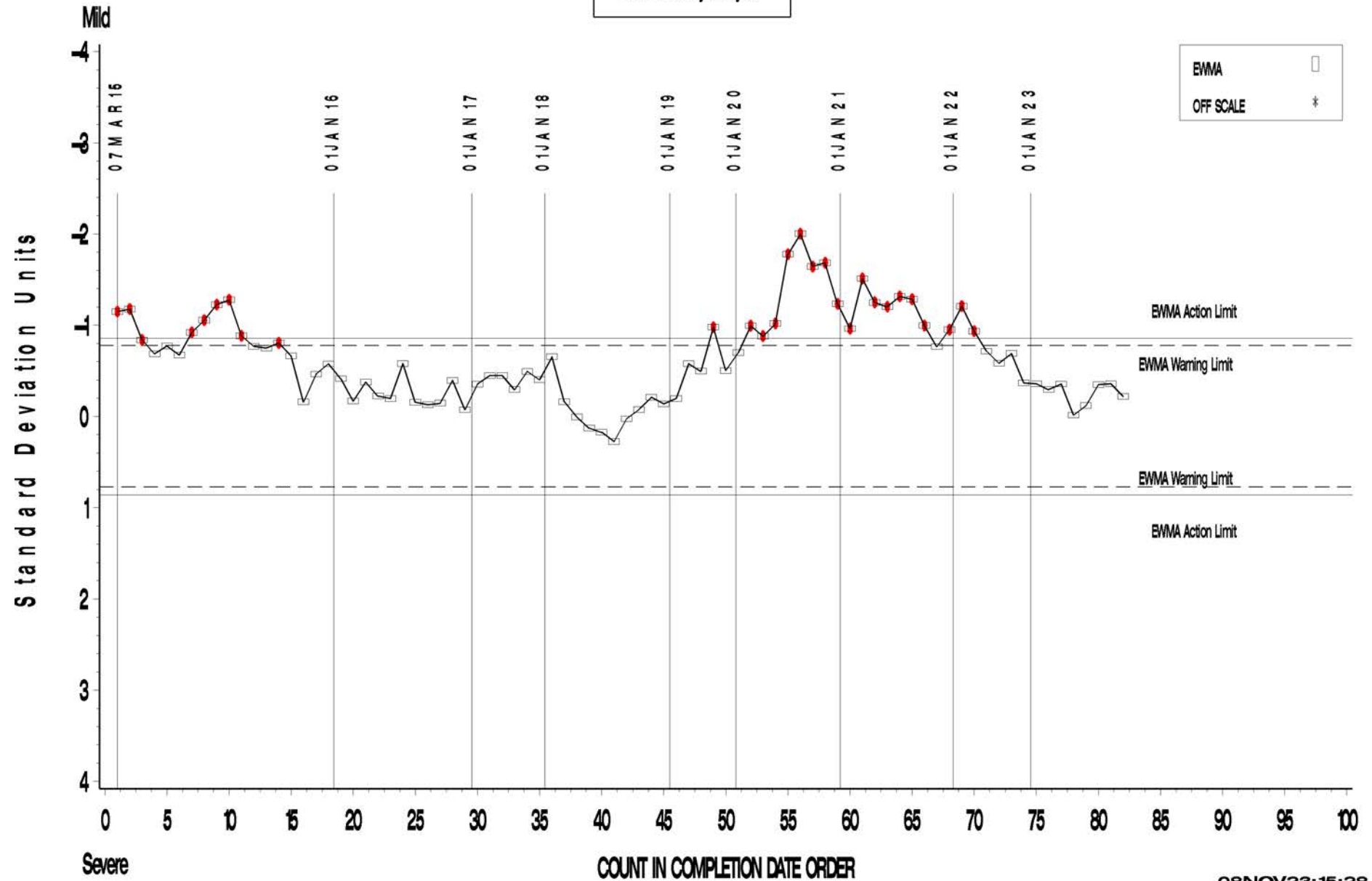
\*Invalid and aborted tests

# T-13 Test Severity

- ▶ IRPH and KV40 are in control

FINAL ORIGINAL PEAK HEIGHT IR AT EOT

LTMS Severity Analysis



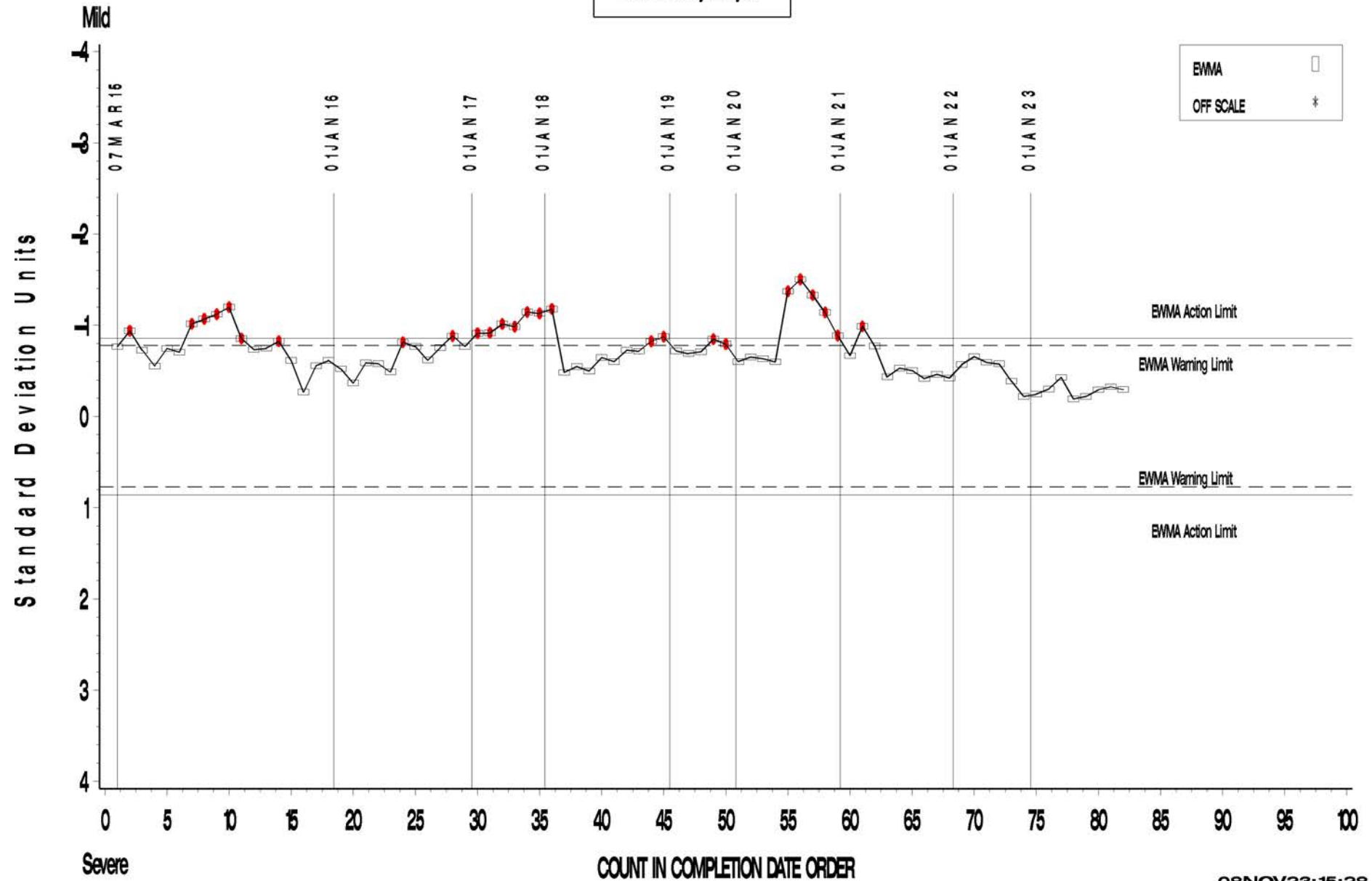
FINAL ORIGINAL PEAK HEIGHT IR AT EOT

CUSUM Severity Analysis



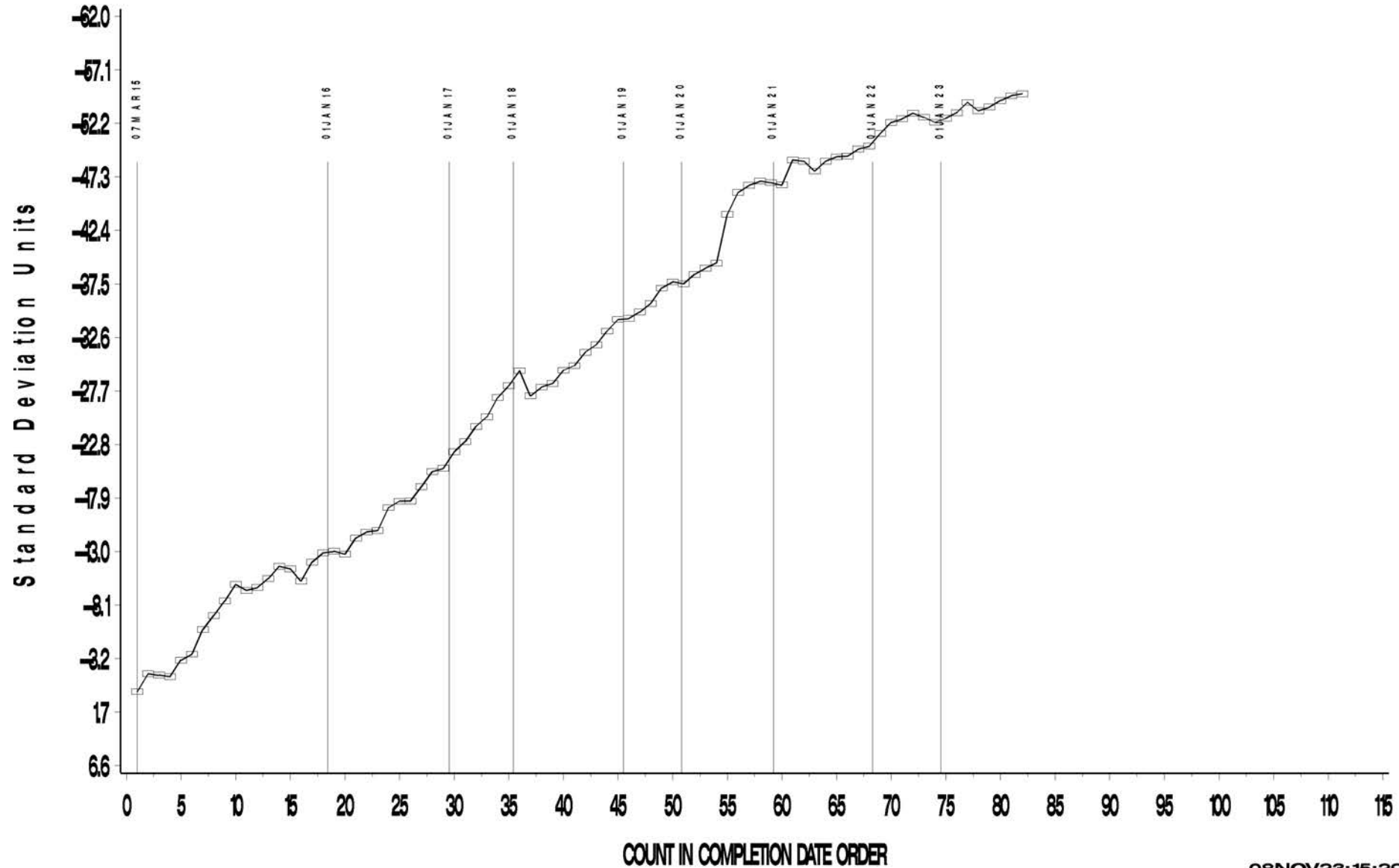
FNL. ORIG. UNIT KINEMATIC VISCOSITY AT 40 DEG C % CHANGE 300-360 HRS

LTMS Severity Analysis



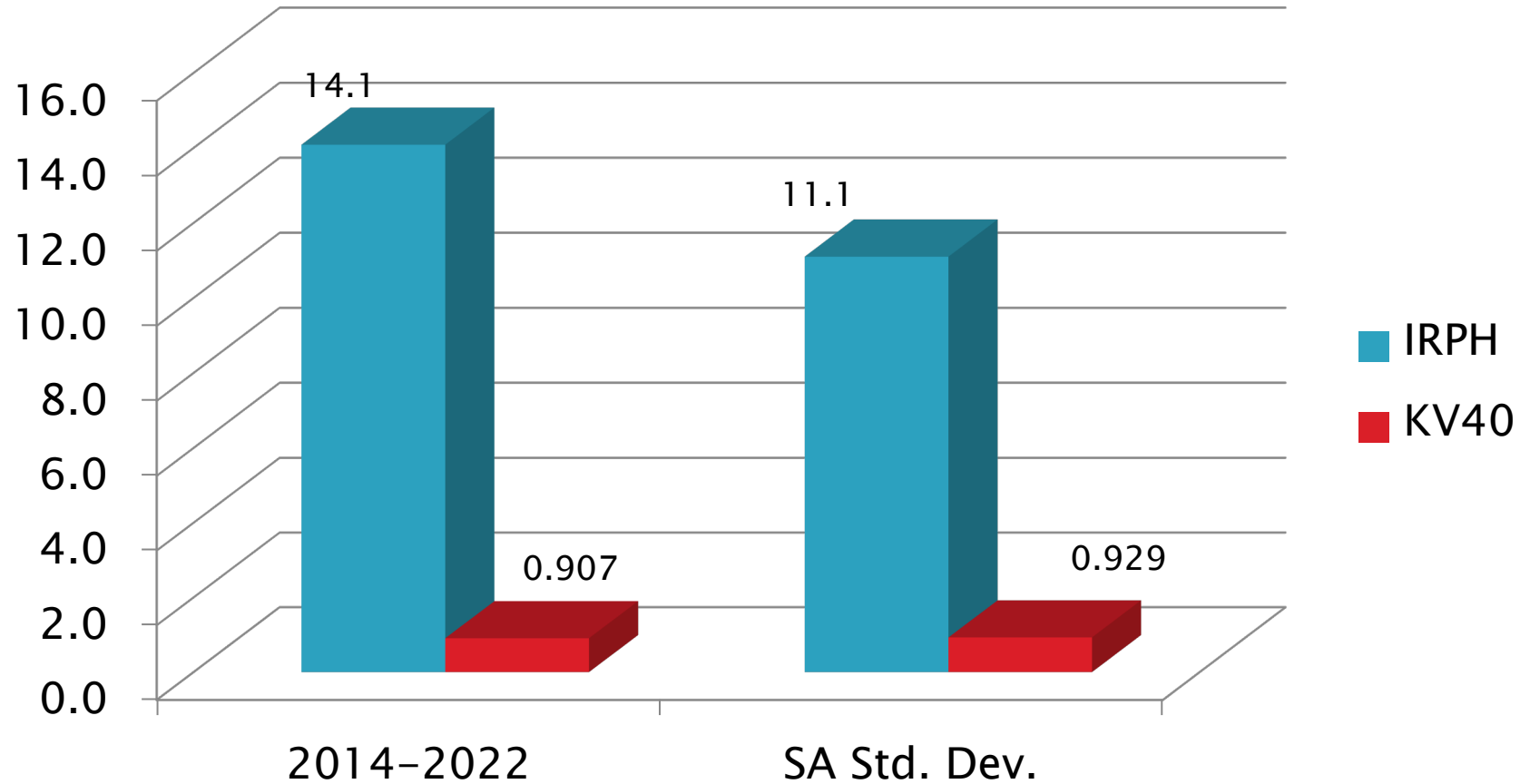
FNL. ORIG. UNIT KINEMATIC VISCOSITY AT 40 DEG C % CHANGE 300-360 HRS

CUSUM Severity Analysis





# T-13 Precision Estimates



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# Information Letters

➤➤ April 1, 2023–September 30, 2023

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# Information Letters\*

Test	Date	IL	Topic
DD13	7/6/23	23-1	DD13 Break-in Time Correction
ISB	8/8/23	23-1	Average Tappet Mass Loss Correction Factor Change

\*Available from TMC Website

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# Memos

➤➤ April 1, 2023–September 30, 2023

# Memos\*

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

\*Available from TMC Website

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# Reference Oil Inventory



Actions, Re-blends, Inventories  
and Estimated Life

# Reference Oil Reblends

- ▶ A re-blend of 864 (864-2) was received and is being readied for release to industry.
- ▶ Re-blend of 831 in progress.

# 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	10	1866	96	5+ years
811-2	1K, 1N	1732	40	720	40	5+ years
821-4	T-12	4495	200	1998	150	5+ years
822-2	1R, T-11	4386	196	1360	84	5+ years
823	T-13	1796	0	62	40	<1 year
823-1	T-13	1421	100	1224	80	5+ years
830-3	ISM	2891	100	2260	100	5+ years
831-4	C13, ISB	1699	210	330	180	2.5 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	0	1214	0	5+ years
832-2	COAT	733	168	513	140	5+ years
833-1	COAT	1248	56	221	84	1.5 years
833-2	COAT	1078	84	995	28	5+ years
864-1	DD13	1576	200	440	125	3 years
1005-5	1P, 1R, EOAT, RFWT, T-8/E	3826	207	487	137	1.75 years

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# LTMS Deviations

»» April 1, 2023–September 30, 2023

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# 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

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# Quality Index Deviations

»» April 1, 2023–September 30, 2023

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# Quality Index Deviations

- ▶ One Qi deviation was issued this period
  - A COAT deviation was issued for oil sample temperature due to a bad thermocouple connection after the pre-test temperature sweep and 3 – way valve calibration.

# 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	8
T-13	3
COAT	5

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# TMC Laboratory Visits

➤➤ April 1, 2023–September 30, 2023

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# TMC Lab Visits

- ▶ No HD lab visits were conducted during this reporting period.

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# Test Area Timelines

➤➤ April 1, 2023–September 30, 2023

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# Test Area Timeline Additions\*

Test	Date	IL/Memo	Topic
DD13	7/6/23	23-1	DD13 Break-in Time Correction
ISB	8/8/2023	23-1	ACSW CORRECTION FACTOR UPDATED
T13	8/28/23		Reference oil 823-1 added to LTMS

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\*As of 9/30/23

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# Rating Workshop Data



2023 Standardized Testing Deposit  
Rating Workshop

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# Rating Workshop Data

- ▶ The 2023 Standardized Testing Deposit Rating Workshop was held in March 2023 in San Antonio as the first combined light and heavy duty rating workshops. The heavy duty rating data is presented here.

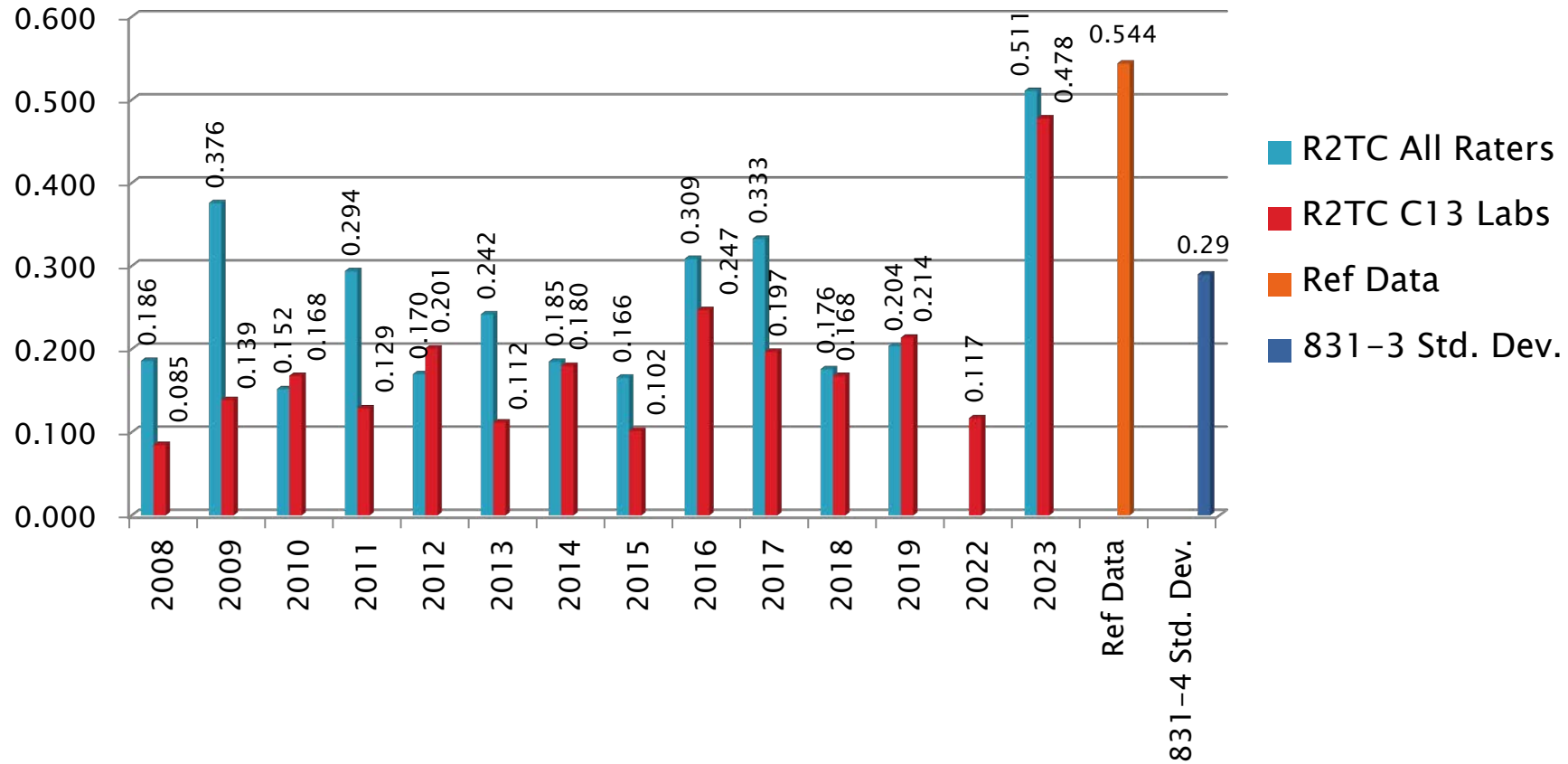
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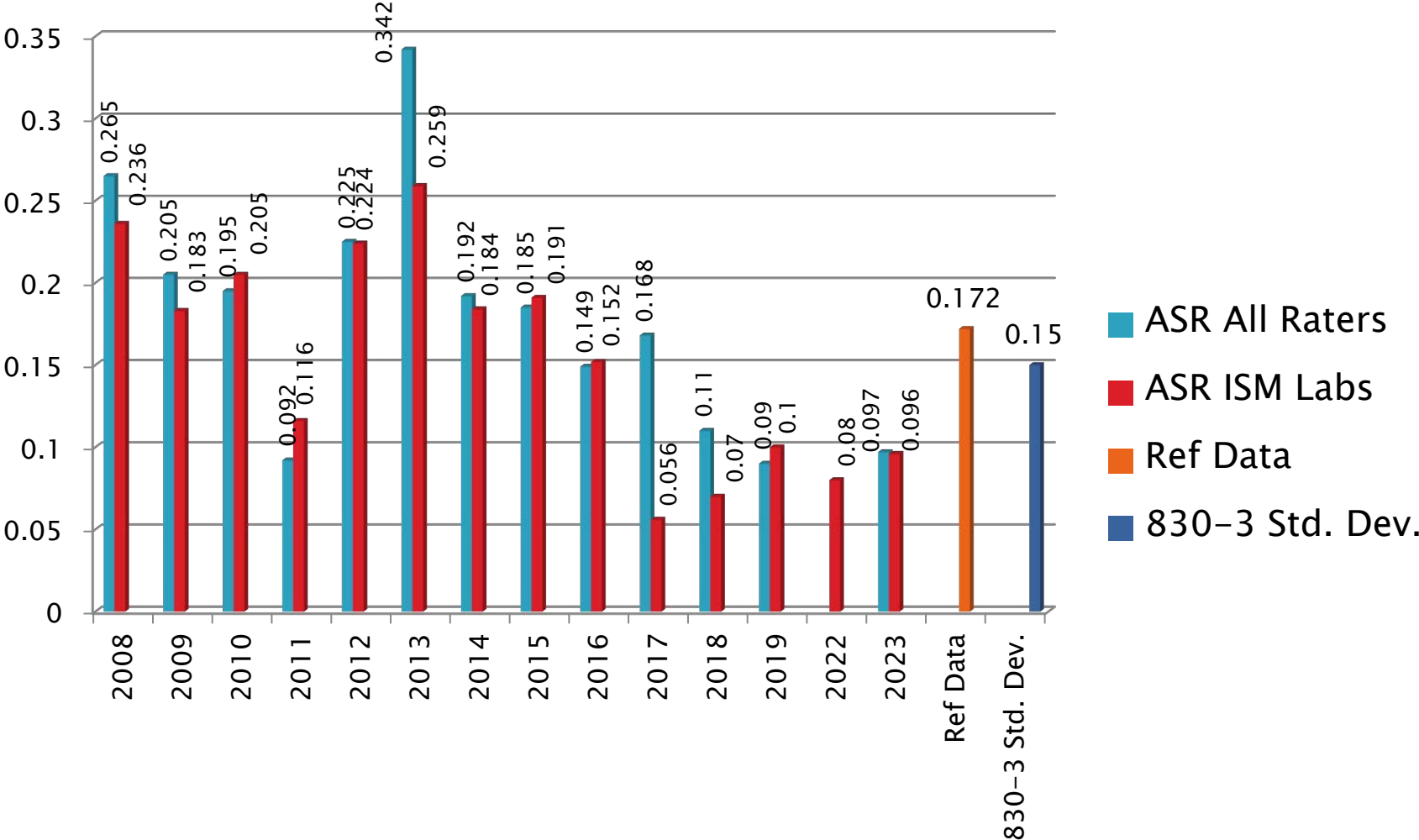


# C13 2<sup>nd</sup> Ring Carbon Precision – Rating Workshop Data

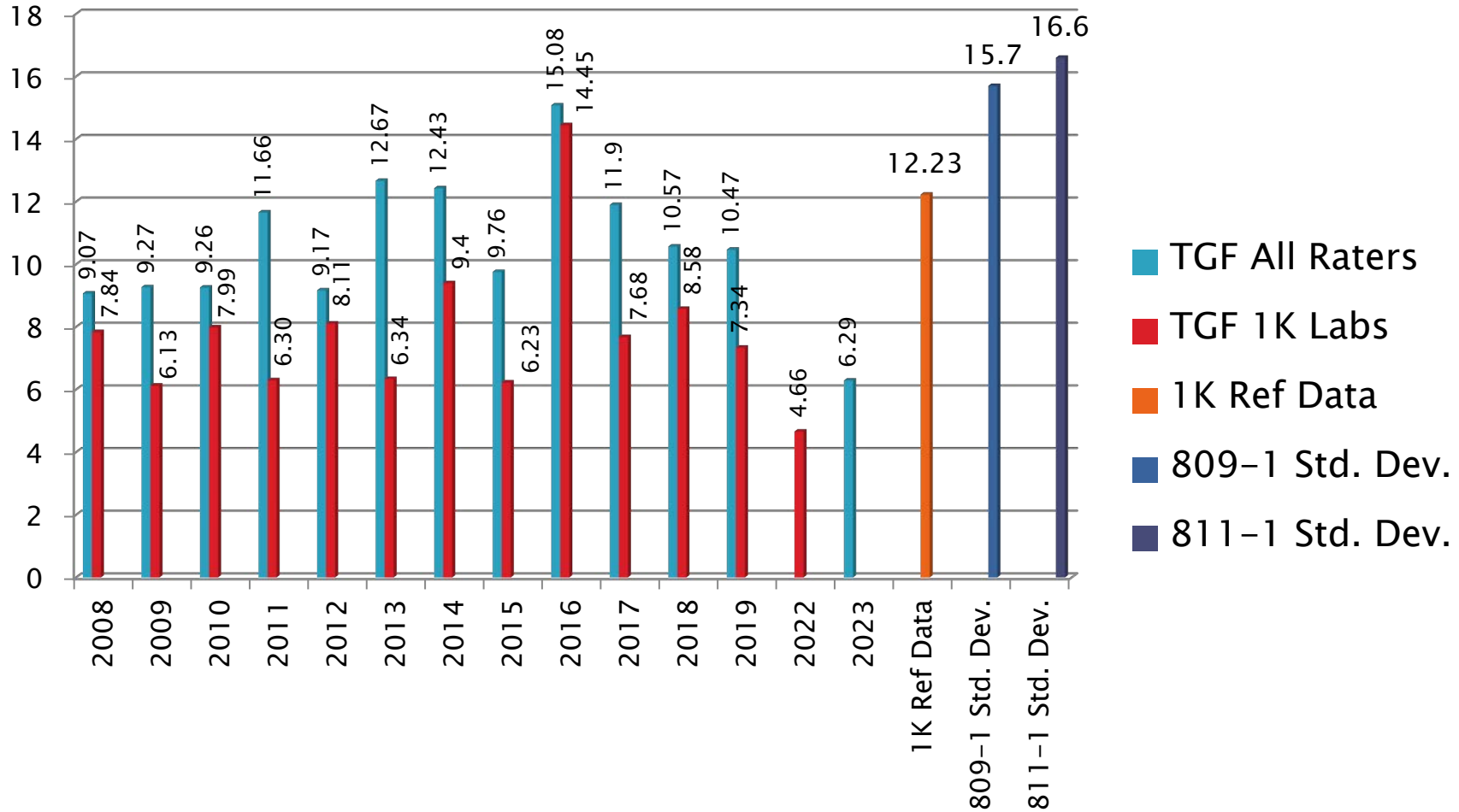
## R2TC



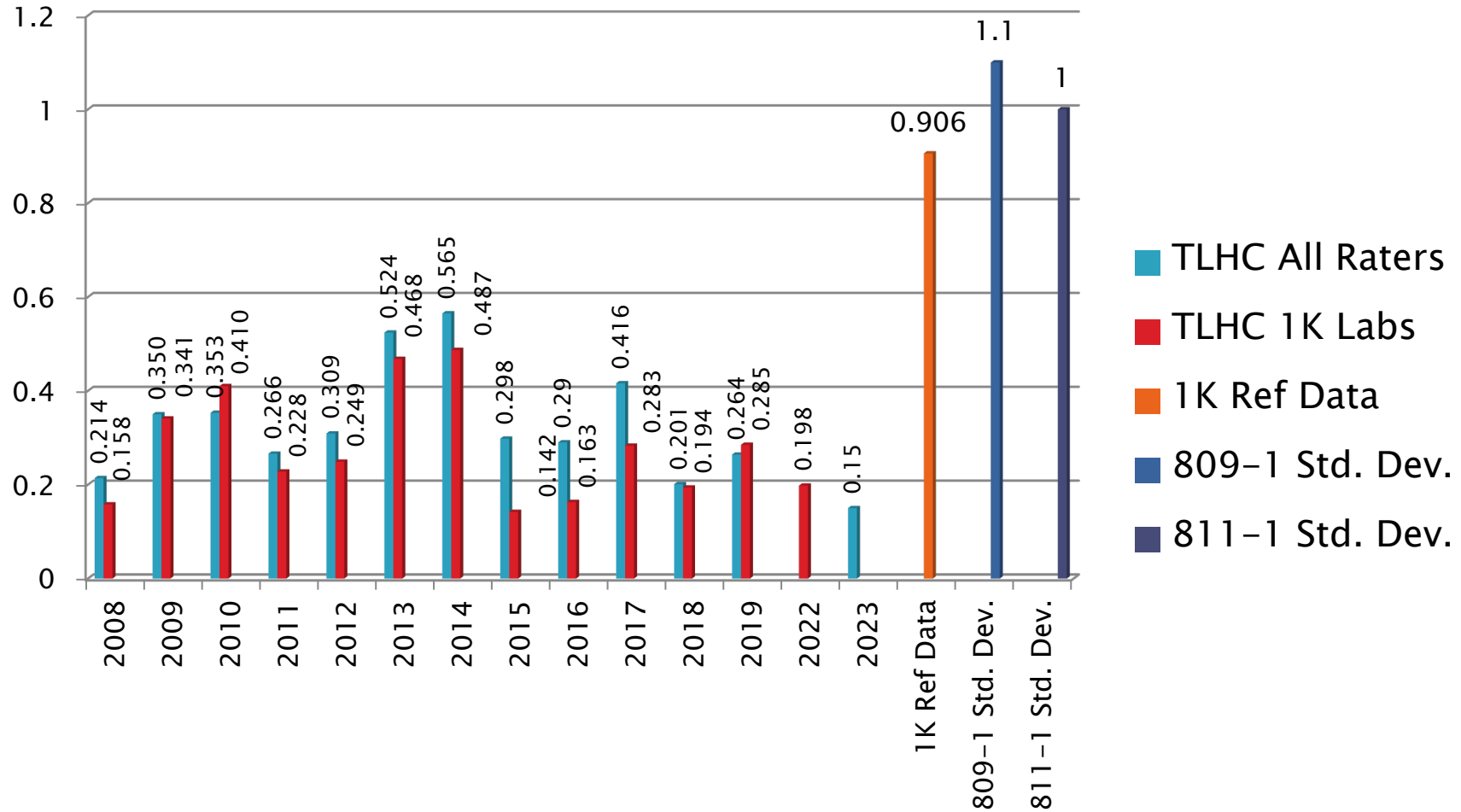
# ISM Sludge Rating Precision - Rating Workshop Data



# Deposit Rating Precision - Rating Workshop Data



## Deposit Rating Precision - Rating Workshop Data



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# 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
  
- ▶ <https://www.astmtmc.org>

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