

Sequence III Surveillance Panel Meeting
SwRI In-person and Teams
Tuesday November 19, 2024, 8:00 am – 10:00 am CST

Agenda

1.0) Attendance

See attached

2.0) Chairman Comments

New vice-chair Joseph Anthony

3.0) Approval of minutes

3.1) Motion to approve minutes from 5/30/2024 Meeting

- Motion Approved

4.0) IIH Action Items

4.1) Fuel Update – Haltermann

- Current fuel batch is sufficient - A new batch of fuel will be blended when needed.
- There is about 27,000 gallons of fuel available, and it will take about 20-days to build a new batch.
 - Labs should contact Haltermann about fuel needs and the remaining fuel will be allocated.
- It is projected that test activity, and therefore fuel consumption rate, has plateaued and will remain at the current level through 2025Q1 before dropping to previous levels.

4.2) CPD Update

4.2.1) Batch 9 Pistons and Rings Update - OHT

- Enough engines are stored for the life of the category, AER Manufacturing is storing and distributing the engines and as of 20241114 AER had 1,105 engines in stock.
- Engine consumption has increased from ~45 per month in the first half of 2024 to over 70 per month for the last 6-months.
- At current consumption rates:
 - About a 3-month supply of Batch Code (BC) 8 pistons are in stock.
 - About a 5-month supply of BC 8 piston rings remain in stock at the CPD.

- The CPD expects to receive the BC 9 pistons prior to Thanksgiving. Upon receipt, the CPD will be shipping donated engine kits, including BC9 pistons and BC8 rings, to the labs for prove-out testing of BC9 pistons.
- The BC9 pistons are the BC6 pistons that have been re-machined. They have been processed on the same dedicated machining center as the Batch Code 8 pistons.
- The shipment of the Batch Code 9 rings has been delayed by the manufacturer and are now expected to be received by February 14th. The CPD is working with the manufacturer to expedite the delivery of this material.
- The original goal was to ship the BC9 pistons and BC9 rings together to simplify the introduction process, but we believe it is important to have the BC9 pistons received at the labs and tested ASAP.
- Stats Group confirmed that new piston batches have never been introduced without a new ring batch, but ring batches have been introduced independently.

4.2.2) Analysis of Batch Code 8 Piston Results – TMC & Stats Group

- Analysis based on 5 reported results on BC8 pistons.
- For all parameters: PVIs, WPD, PSV & phosphorus retention have both mild and severe results close to target.
- Once more data is received after the labs reference additional stands the stats group will be asked to evaluate the data to determine if there is a need for an ICF.
- TMC adjusted stand calibration intervals as needed to facilitate the consumption of BC5 pistons and the smooth transition to BC8 pistons.
- TMC will coordinate and recommend when there is a need for the next meeting.

4.3) Motion for procedure clarification, PVIS LN transform as follows,

12.4.4.1 Adjust the PVIS result for stand severity by taking the natural log (ln) of the end of test PVIS result and adding the stand severity adjustment in effect at the time of test completion to the transformed result. Report this value in the appropriate space on the test report. Convert to original units by taking the inverse transform (e^x). Report this value as the final PVIS result.

- Motion – J. Bowden (OHT)
- Seconded by A. Ritchie (Infineum)
- The motion passed with 16 approve, 1 waive and no opposed.

4.4) Engine Rebuild Update - IMTS

- IMTS IIIH Status

- Completed and delivered one of the engines to a lab for evaluation.
- ECMs have been programmed, tested, ready for shipment.
- Working on altering ECMs for other test types.

4.5) Chair Semi-Annual Report Review – Chair & TMC

4.5.1) Industry Capacity

- Sequence IIIH
 - 14 Stands
 - 5 Labs
- Sequence IIIH
 - RO 434-3 Active Reference Oil (Approximately 4 yr)
 - RO 436 Active Reference Oil (Approximately 6 yr)
 - RO 438-2 Active Reference Oil (Suspended while introducing BC 8 Pistons)
- No reference oil supply issues

4.5.2) LTMS Update

- LTMS Parameter for PVIS is in control.
- LTMS Parameter for WPD is in control.
- Average piston skirt varnish is in control.
- PSV has shifted closer to target with BC8 pistons.
- EOT MRV is in control.
- Phosphorus retention has been running mild for the past year.

4.5.2.1) LTMS data since 2024Q1 Batch 8 Introduction

- PVIS was severe but has since moved close to target and is stable.
- WPD started trending severe.
- APV was above 1 standard deviation high and is now mild between 1 standard deviation mild and the target.
 - The variability in APV may be due to the small rating area.
- Both reference oils are trending the same.
- No differences due to different fuel batches.
- LMTS is receiving more data due to more stands coming online.
 - It is difficult to de-couple new part batch with new stands introduced.
 - Have had a mild trend due to the Batch 3 pistons.
 - Batch 4 was very mild compared to Batch 5.

4.5.2.2) Shift in WPD severity explained

- Stats group proposed increasing the target for 438-2 because of mild results.

- Removing Reference Oil 438 from the referencing system resulted in an apparent overall severity shift in the reference data.

4.6) ECM Status

4.6.1) ECM Inventory Issues

- Afton brought up the concern about no spare IIIH ECMs.
-
- The original batch of spare ECMs were flashed with the wrong calibration file by Stellantis.
- IMTS is working through the challenges of trying to copy the current program onto new ECMs.
-
- Dealerships do not have the ability to download IIIH ECM calibrations to re-flash new ECMs.

4.6.2) ECM Software & Aftermarket ECM Discussion

- Afton recommended having all new ECM calibrations being saved on an ASTM server to guarantee access and traceability.
 - SwRI agreed that ASTM is a trusted entity to store the calibrations.
- TMC proposed using an aftermarket ECM and re-create the operation and make changes as necessary.
 - Pro: Better control and ease of use.
 - Con: Requires calibration verification.

4.7) Other Topics

4.7.1) Engine Part Number List Update:

- The O&H group, led by W. Murdock (SwRI), compiled a list of part numbers for the IIIH test.
 - The group will schedule a meeting to review the list and update it, if necessary.
 - OHT noted that some items that were going out of production and lifetime buys or builds were made.
 - TMC noted Chrysler verified the current O₂ sensors are the correct sensors,
 - OHT has said there is a parts shortage.
 - Second life engines (there are 1100 new engines left).
 - Valvoline buys soft parts on a quarterly basis. Buying parts from dealerships that are not specified in the procedure.

- TMC noted that very few PNs are in the procedure, which allows either PNs to be used or is an opportunity for the O&H group to standardize and track PNs.

4.7.2) Dropping 438 Discussion

- SP felt 438 was not representative of current category technologies because it clearly failed WPD for GF-6 and now is not very useful for GF-7.
- Proposed adding reference oils that can discriminate between GF-7 & GF-8.
- This was followed by a discussion of how meaningful reference oil 438 is with the higher GF-7 limits.
- Oil WPD Target PVIS Target
 - 434 4.2 -2 ~112%, -3 ~200%
 - 436 4.6 28%
 - 438 3.6 ~80%
- There is value in having 3 reference oils, but the group decided that for the implementation of BC8 pistons data on oils 434 & 436 was most meaningful.

(Previous meeting)

- Tim Cushing recommended that the surveillance panel investigate implementing a new LSPI capable reference oil.
 - This will be added to a future agenda.
- It was noted that if oils are not running on target it can affect SA results.

5.0) Old Business

None

6.0) New Business

None

7.0) Review / Update Scope and Objectives

8.0) Next Meeting

TBD ~Late December

9.0) Meeting Adjourned

Meeting adjourned at 9:55 CST

Sequence III Surveillance Panel Meeting

SwRI in person and Teams

Tuesday November 19, 2024 8:00 – 10:00 CST

Agenda

1.0) Attendance

2.0) Chairman Comments

3.0) Approval of minutes

3.1) Minutes from 5/30/2024 Meeting

4.0) IIH Action Items

4.1) Fuel Update – Haltermann

4.2) CPD Update - OHT

4.3) Procedure clarification, PVis LN transform

How about:

12.4.4.1 Adjust the PVIS result for stand severity by taking the natural log (\ln) of the end of test PVIS result and adding the stand severity adjustment in effect at the time of test completion to the transformed result. Report this value in the appropriate space on the test

report. Convert to original units by taking the inverse transform (e^x). Report this value as the final PVIS result.

Does this make sense.

4.4) Engine rebuild update

4.5) Semi-annual report

4.6) ECM status

4.7) Other Topics

5.0) Old Business

5.1) TBD

6.0) New Business

6.1) TBD

7.0) Review / Update Scope and Objectives

8.0) Next Meeting
TBD

9.0) Meeting Adjourned

20241119 III ATTENDANCE

ROBERT STACKWELL	GRANITE ROBERT STACKWELL
PAT LANG	Sun
Bill Buschen	INTERTEK
Tony Catanese	Lubrizol
George Szappanos	Lubrizol
Jason Bowden	OHT
Travis Kostan	SwRI
Will Murdock	SwRI
DAVE PASSMORE	IMTS
Sid Clark	IMTS
Alfonso Lopez	Intertek
William HAIRSTON	HALTERMANN
Ed Hennessey	Haltermann
Ben Maddock	Afton
Bob Cypell	Afton
ANDREW ROTHFING	Afton
Amanda Stone	Afton
Ricardo E. Appinto	Oronite
Jesus Flores	Infinium
← Todd Dvorak	Infinium
JOE ANTHONY	Infinium
Andy Ritchie	Infinium
Paul Mckarucha	Infinium
Dan Lanctot	TEI
Peruk Grosch	TEI
Rich Grundza	ASTM - TMC
JEFFREY ASU	STEEL
Adeian Alvarez	Intertek
Tim Cushing	GM
VENKAT DESHPANDE	TOYOTA
Ali Acosta	Infinium
PAUL RUBAS	EXXON MOBIL

Sequence IIIH
Summation Delta/s by Piston Batch
Oil 434 Blends

The GLM Procedure

Class Level Information		
Class	Levels	Values
PISTBAT	5	2 3 4 5 8

Number of Observations Read	377
Number of Observations Used	377

Sequence IIIH
Summation Delta/s by Piston Batch
Oil 434 Blends

The GLM Procedure

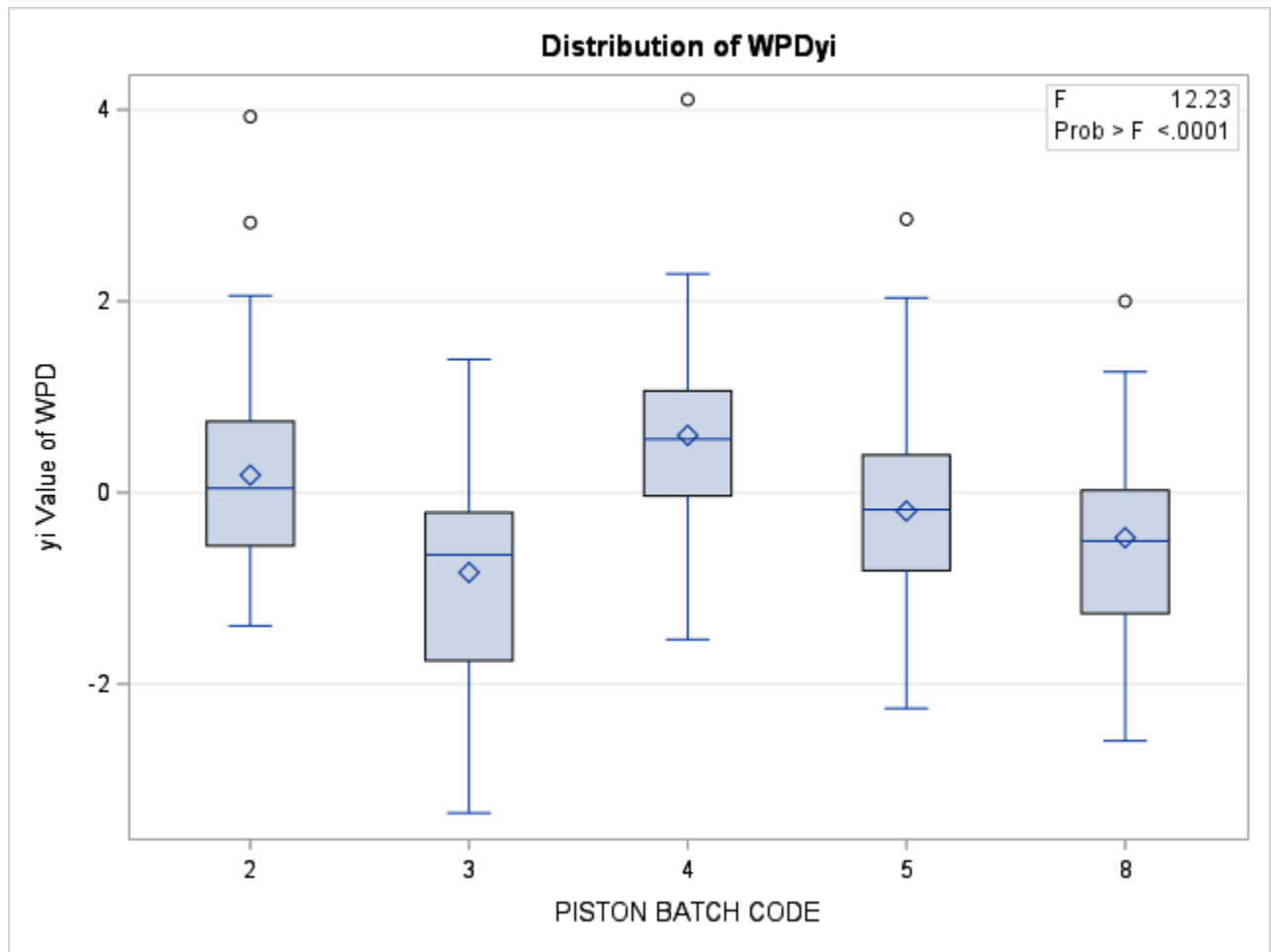
Dependent Variable: WPDyi yi Value of WPD

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	4	42.9222617	10.7305654	12.23	<.0001
Error	372	326.3785185	0.8773616		
Corrected Total	376	369.3007802			

R-Square	Coeff Var	Root MSE	WPDyi Mean
0.116226	-866.8941	0.936676	-0.108050

Source	DF	Type I SS	Mean Square	F Value	Pr > F
PISTBAT	4	42.92226174	10.73056544	12.23	<.0001

Source	DF	Type III SS	Mean Square	F Value	Pr > F
PISTBAT	4	42.92226174	10.73056544	12.23	<.0001



Sequence IIIH
Summation Delta/s by Piston Batch
Oil 434 Blends

The GLM Procedure

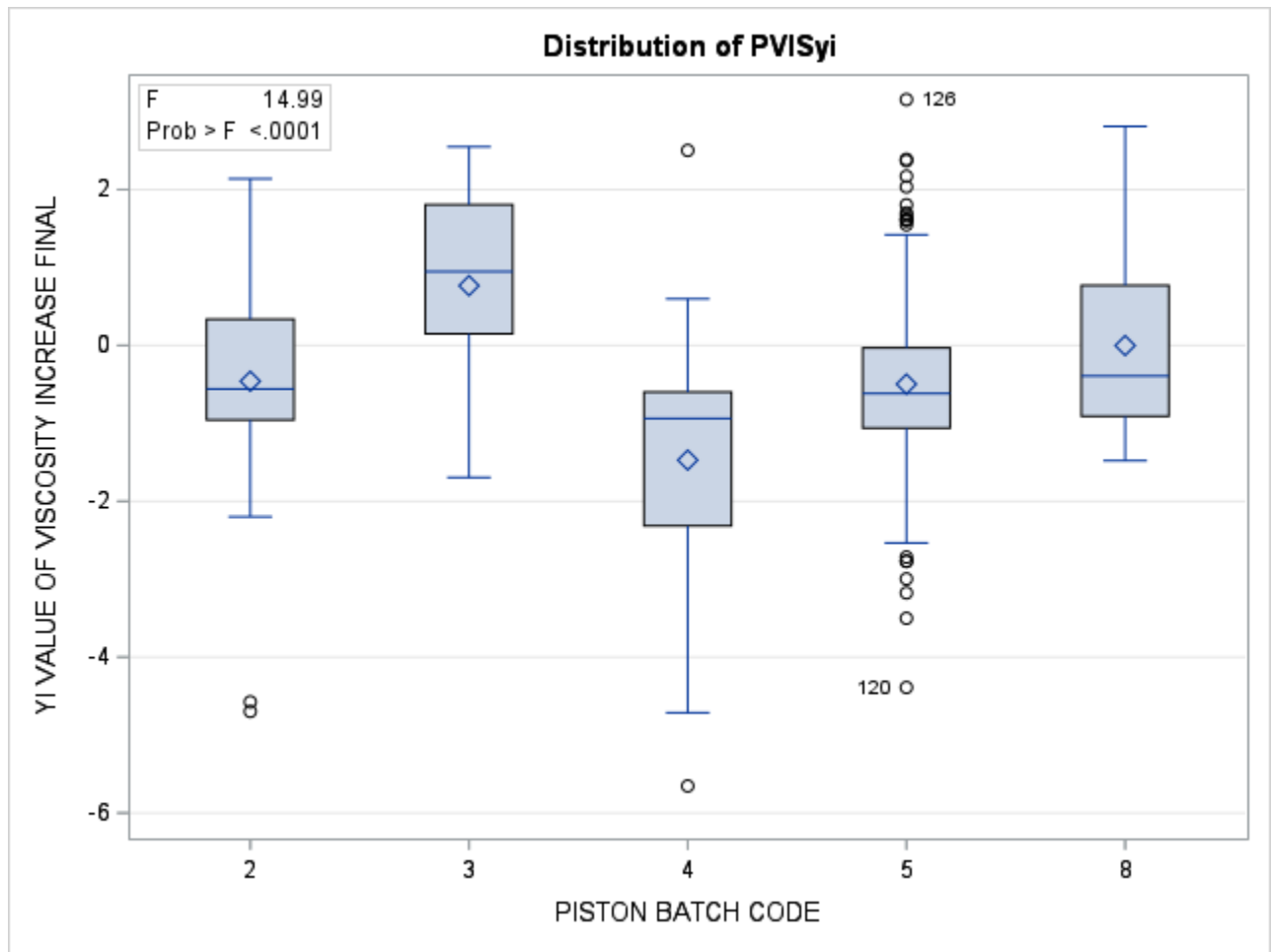
Dependent Variable: PVISyi YI VALUE OF VISCOSITY INCREASE FINAL

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	4	83.3657855	20.8414464	14.99	<.0001
Error	372	517.1160758	1.3900970		
Corrected Total	376	600.4818613			

R-Square	Coeff Var	Root MSE	PVISyi Mean
0.138831	-237.0888	1.179024	-0.497292

Source	DF	Type I SS	Mean Square	F Value	Pr > F
PISTBAT	4	83.36578551	20.84144638	14.99	<.0001

Source	DF	Type III SS	Mean Square	F Value	Pr > F
PISTBAT	4	83.36578551	20.84144638	14.99	<.0001

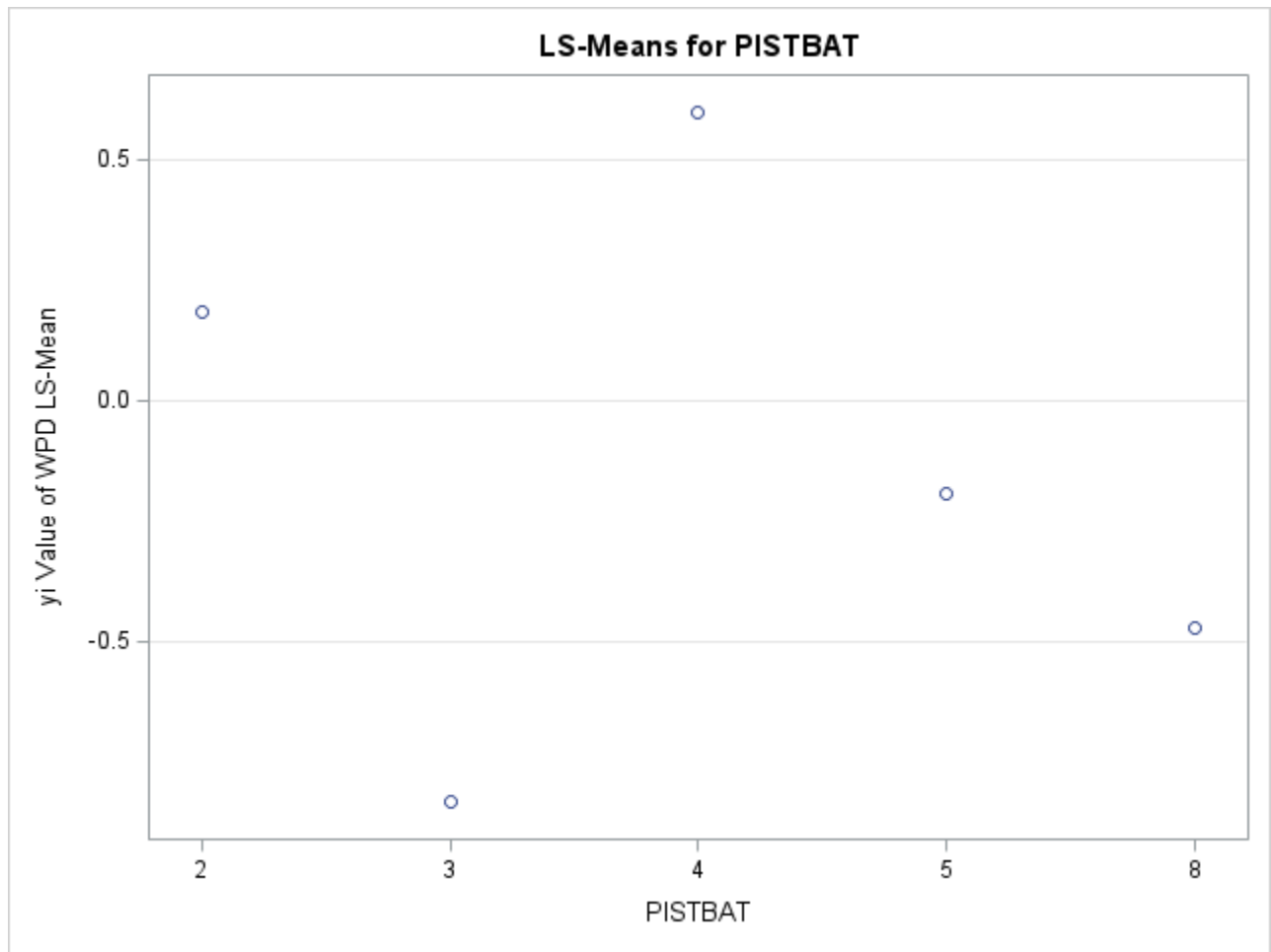


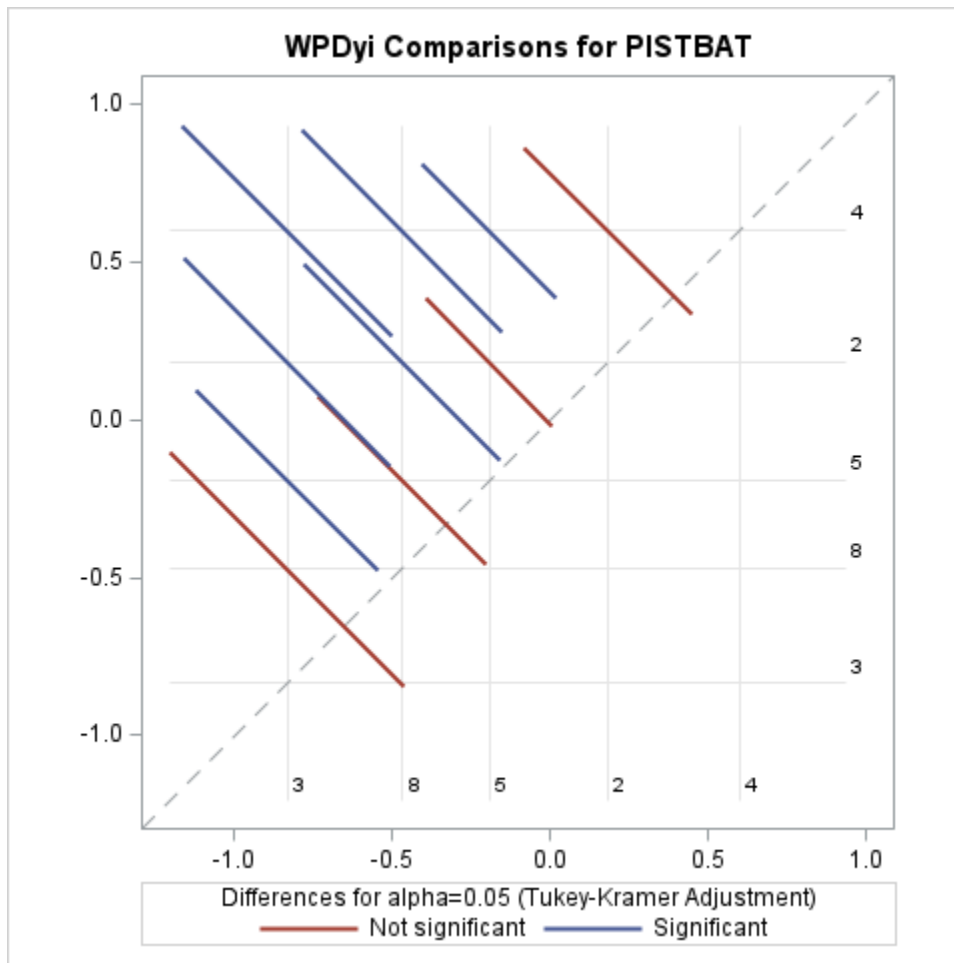
Sequence IIIH
Summation Delta/s by Piston Batch
Oil 434 Blends

The GLM Procedure
Least Squares Means
Adjustment for Multiple Comparisons: Tukey-Kramer

PISTBAT	WPDyi LSMEAN	LSMEAN Number
2	0.18214618	1
3	-0.83492902	2
4	0.59774237	3
5	-0.19359158	4
8	-0.47231615	5

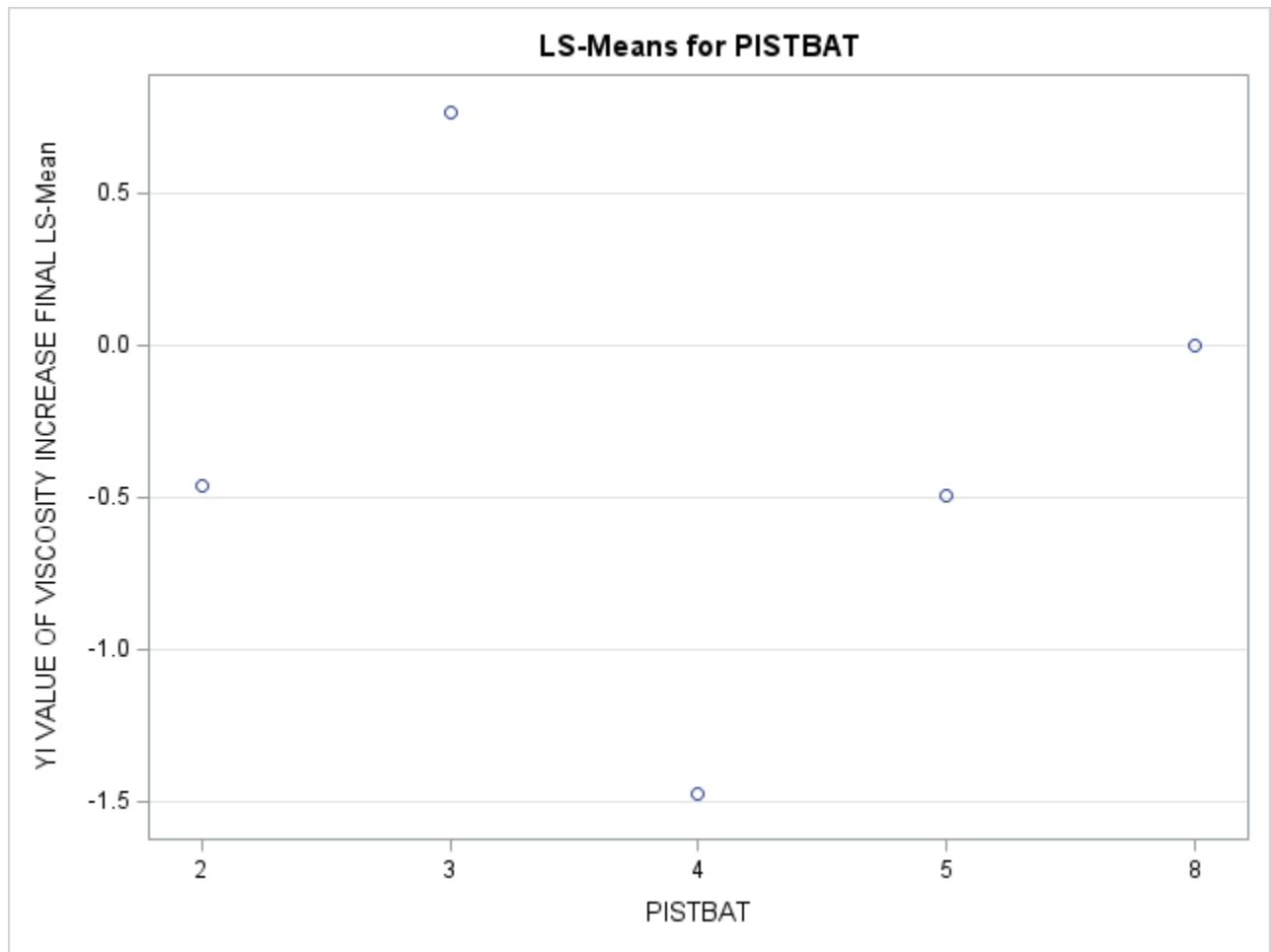
Least Squares Means for effect PISTBAT Pr > t for H0: LSMean(i)=LSMean(j) Dependent Variable: WPDyi					
i/j	1	2	3	4	5
1		0.0003	0.2028	0.0770	0.0331
2	0.0003		<.0001	0.0193	0.6686
3	0.2028	<.0001		<.0001	<.0001
4	0.0770	0.0193	<.0001		0.6023
5	0.0331	0.6686	<.0001	0.6023	

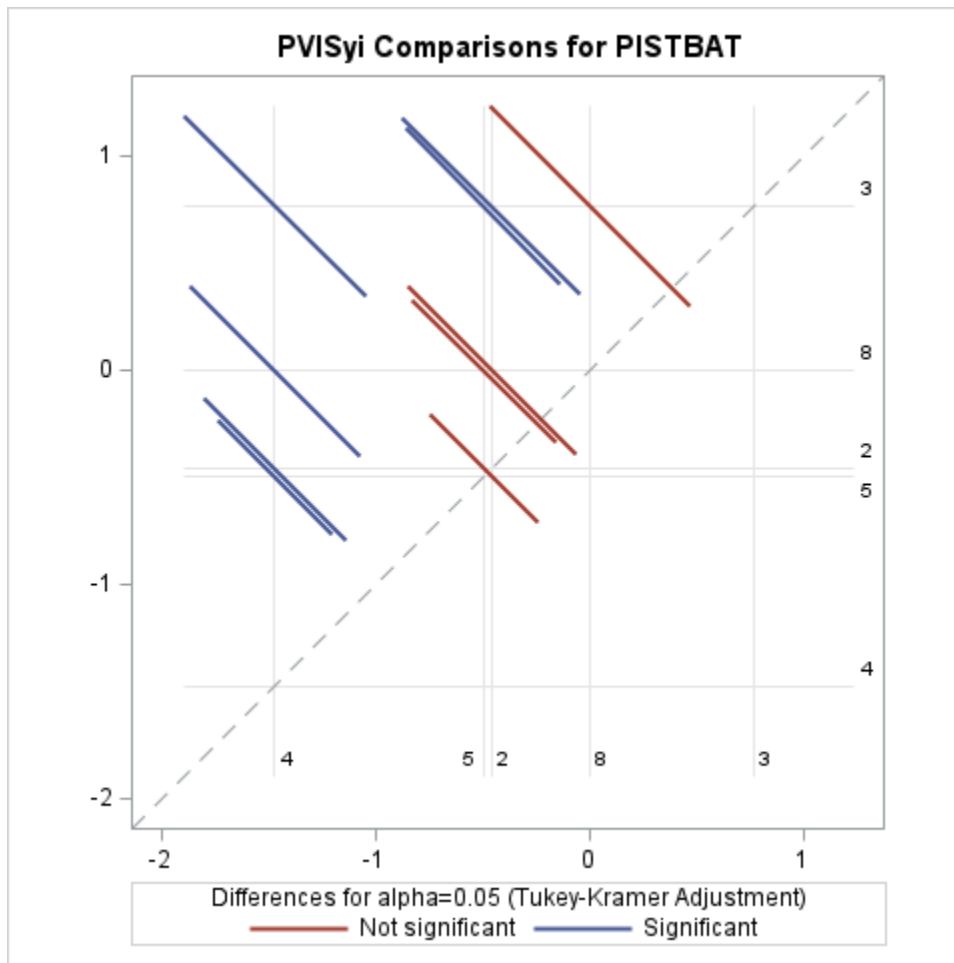




PISTBAT	PVISyi LSMEAN	LSMEAN Number
2	-0.45948531	1
3	0.76694959	2
4	-1.47136025	3
5	-0.49613365	4
8	-0.00178686	5

Least Squares Means for effect PISTBAT					
Pr > t for H0: LSMean(i)=LSMean(j)					
Dependent Variable: PVISyi					
i/j	1	2	3	4	5
1		0.0006	0.0004	0.9996	0.4947
2	0.0006		<.0001	<.0001	0.1636
3	0.0004	<.0001		<.0001	<.0001
4	0.9996	<.0001	<.0001		0.2543
5	0.4947	0.1636	<.0001	0.2543	

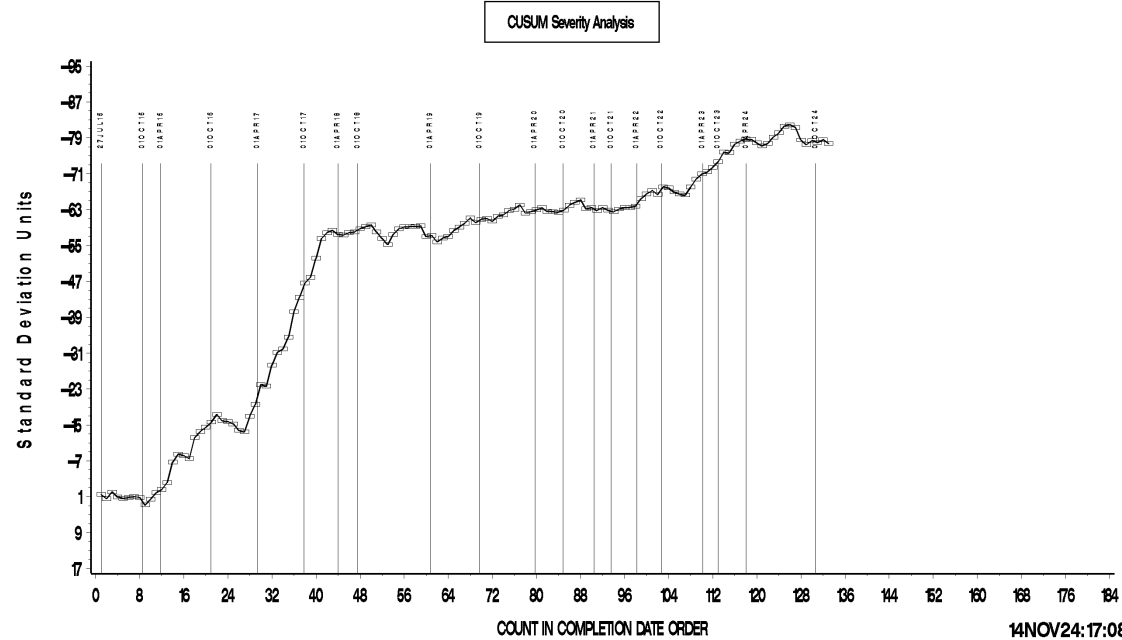
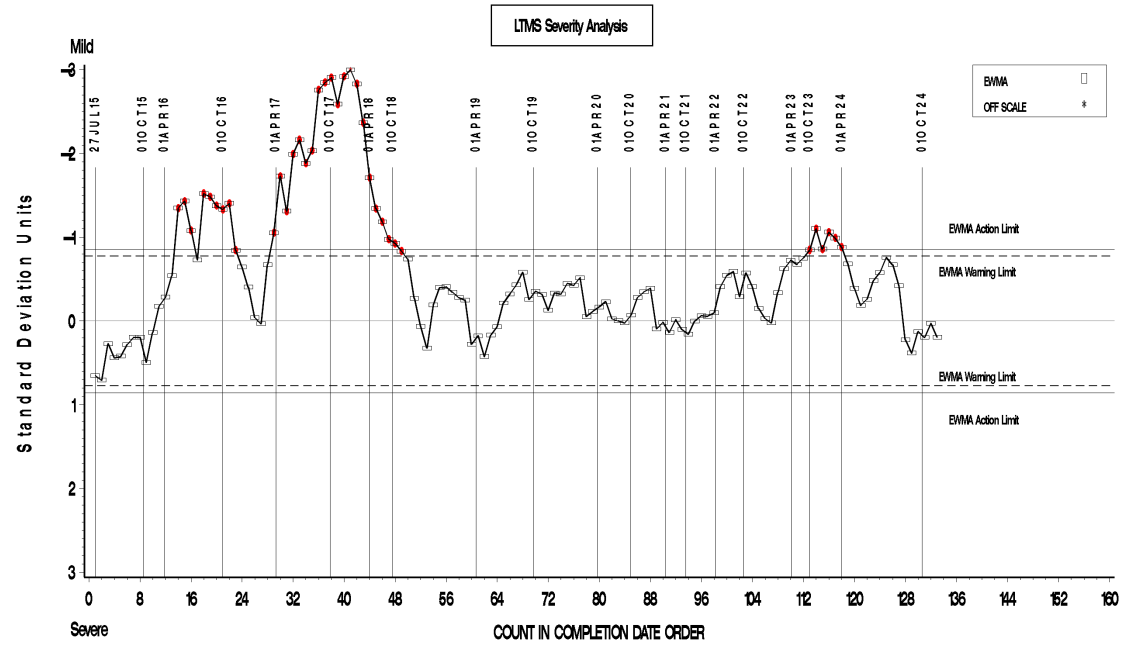




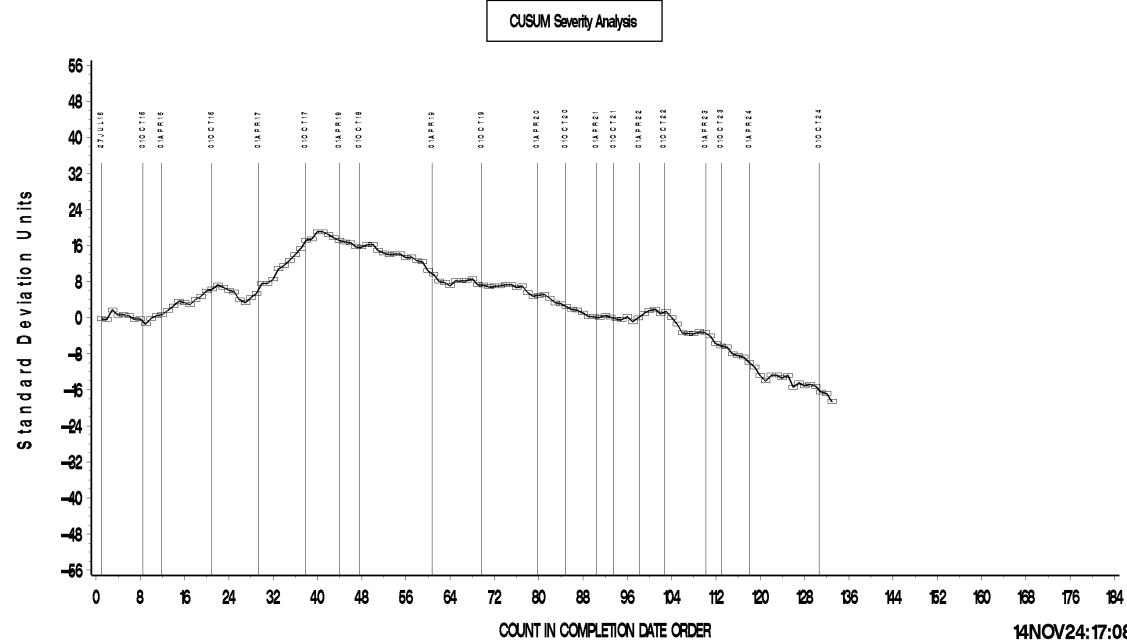
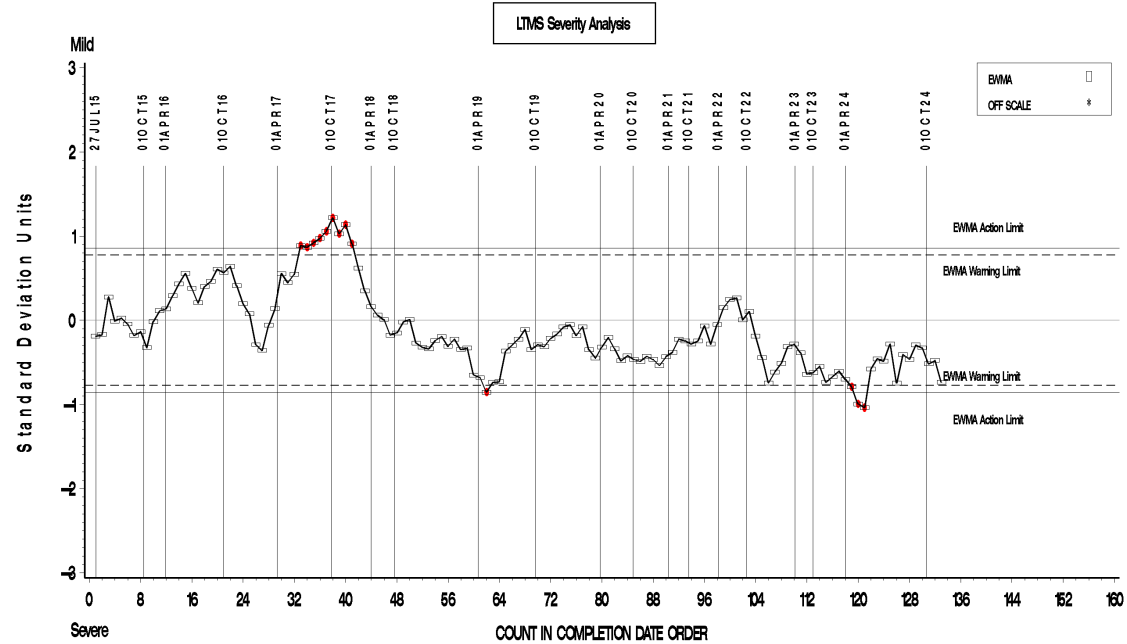
SEQUENCE IIIH INDUSTRY OPERATIONAL VALID DATA

Reference oil 434 Blends Only

VISCOSITY INCREASE FINAL ORIG UNIT RES



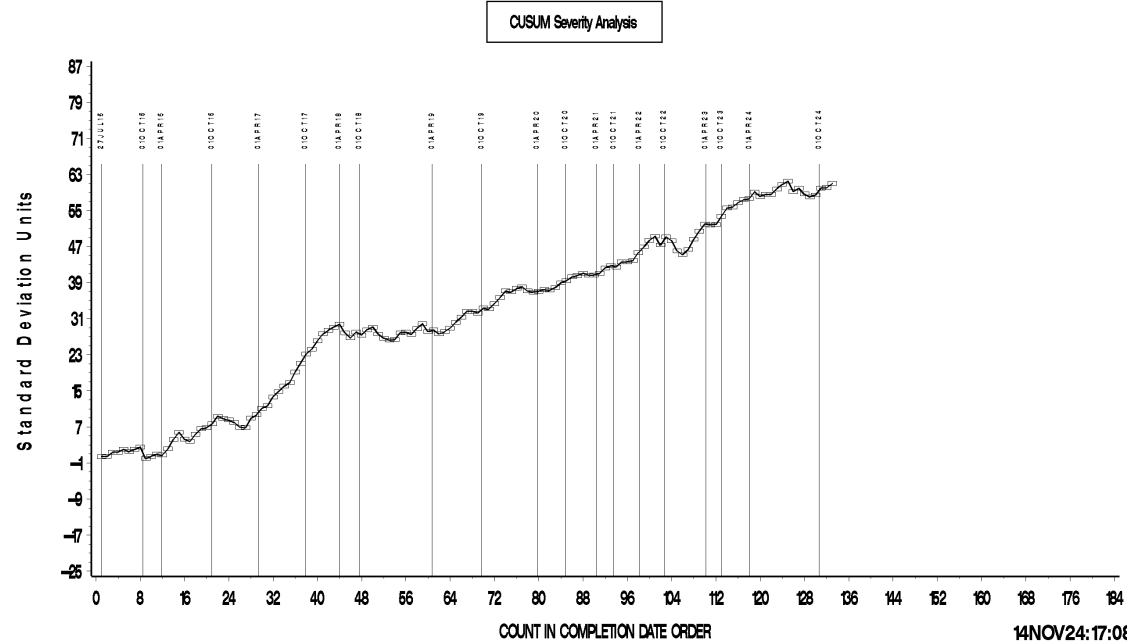
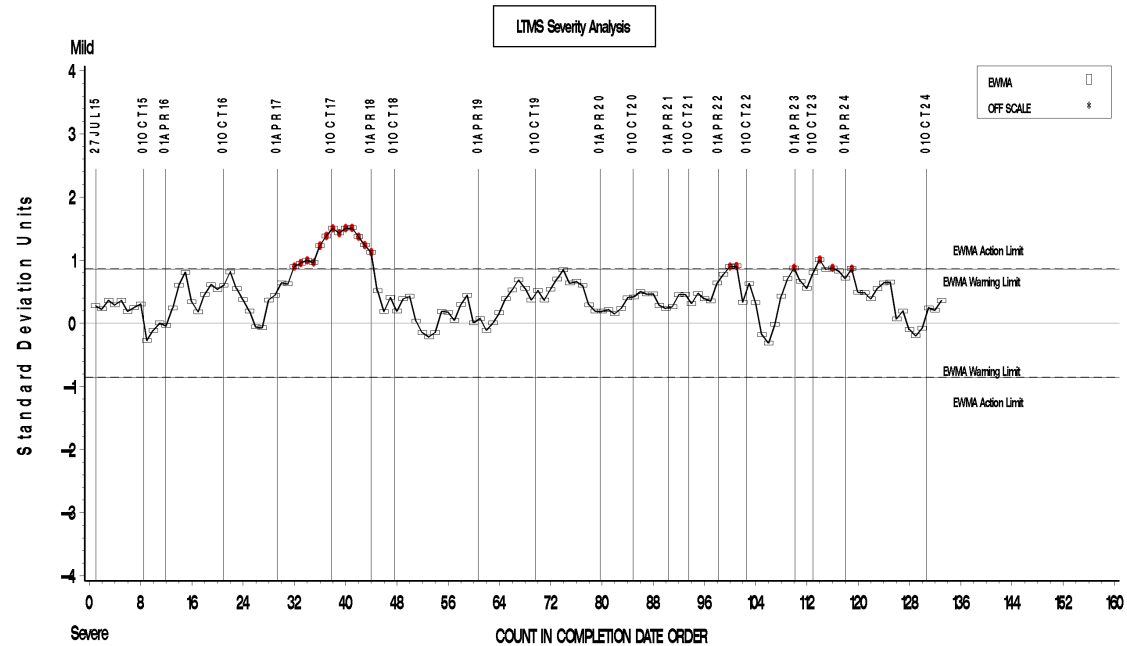
SEQUENCE IIIH INDUSTRY OPERATIONALLY VALID DATA
Reference oil 434 Blends Only
AVERAGE WEIGHTED PISTON DEPOSITS FNL ORIG U



SEQUENCE IIIH INDUSTRY OPERATIONALLY VALID DATA

Reference oil Blends Only

AVERAGE PISTON SKIRT VARNISH



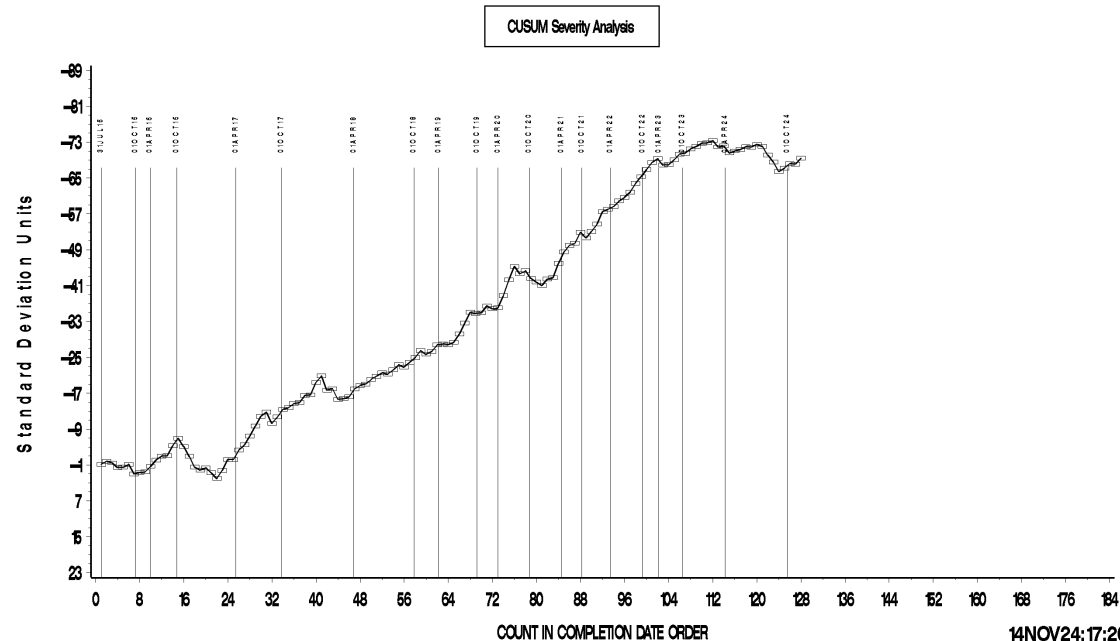
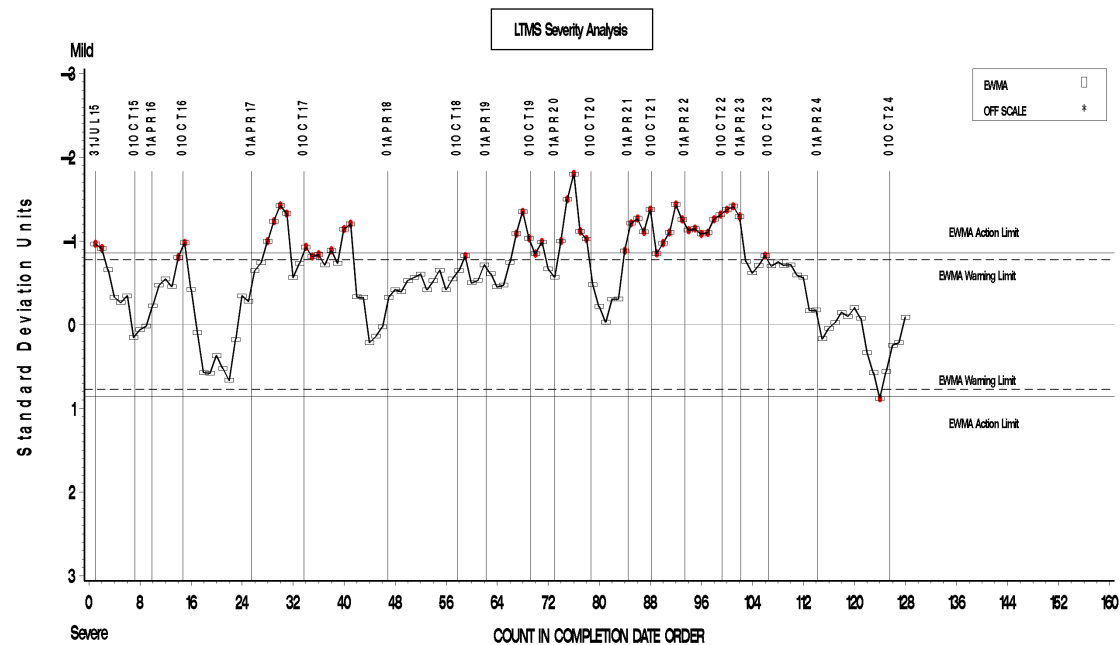
SEQUENCE IIIH INDUSTRY OPERATIONAL VALID DATA

Reference Oil 436 Only

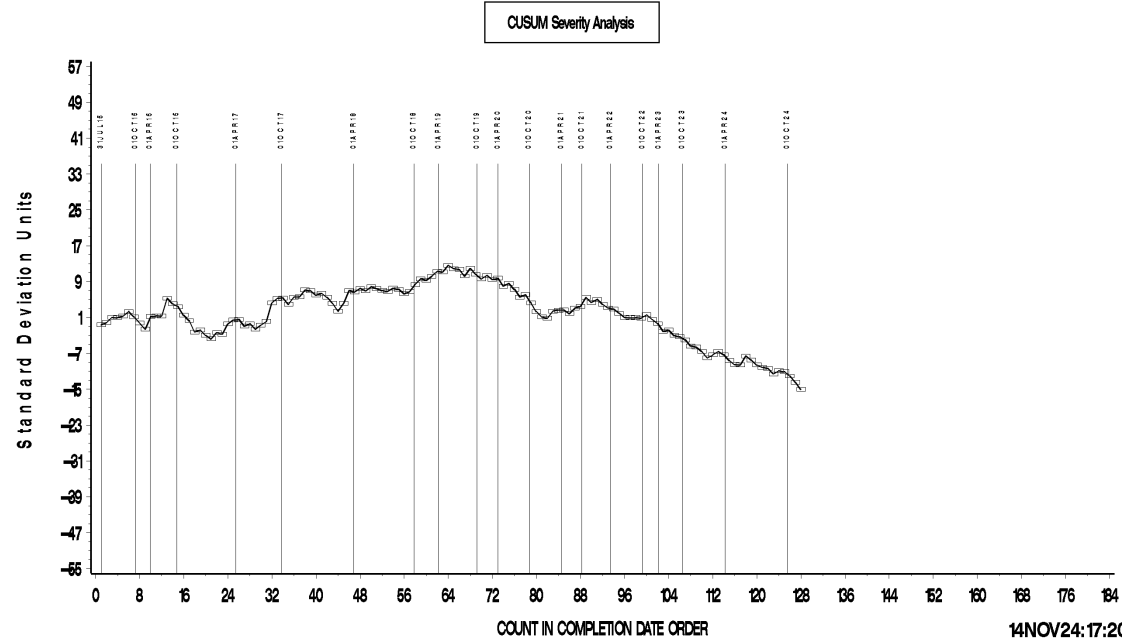
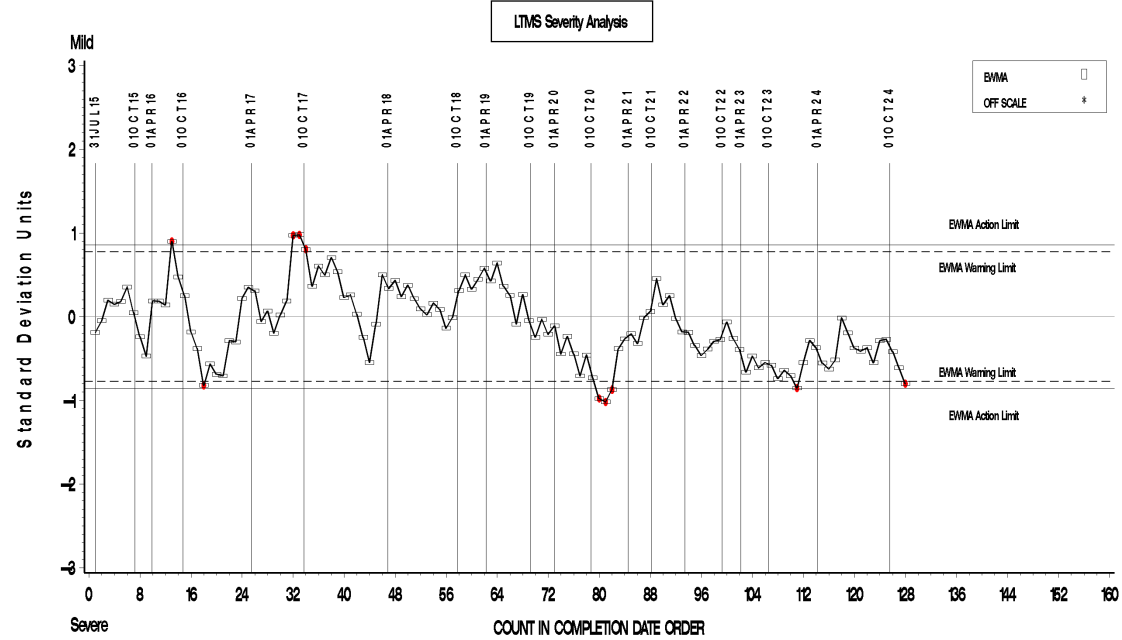
VISCOSITY INCREASE FINAL ORIG UNIT RES



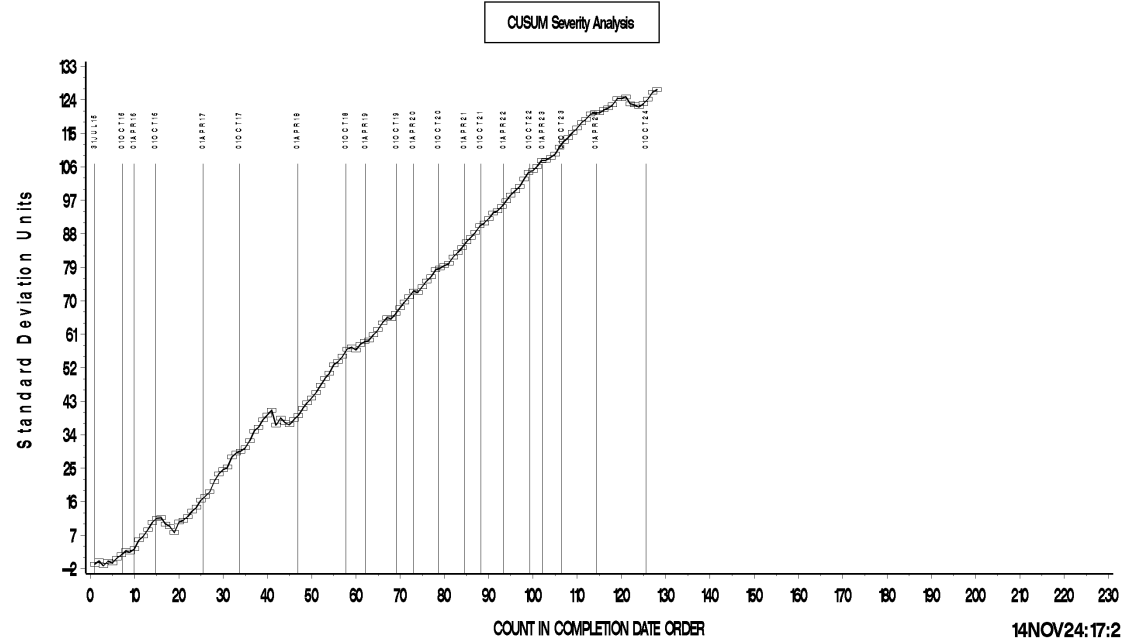
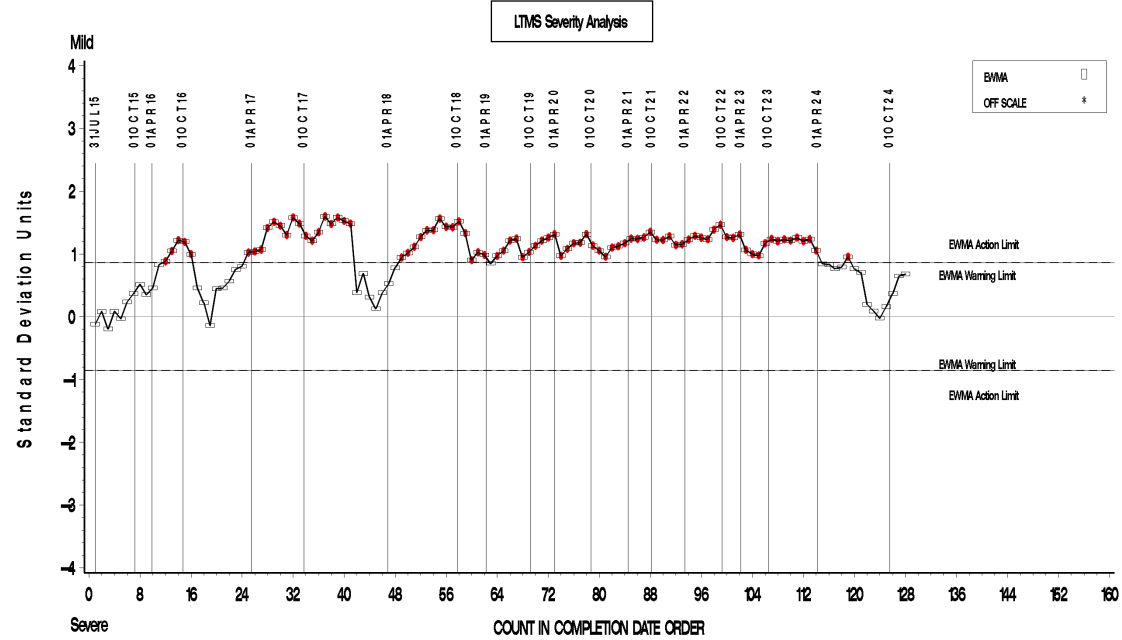
A Program of ASTM International



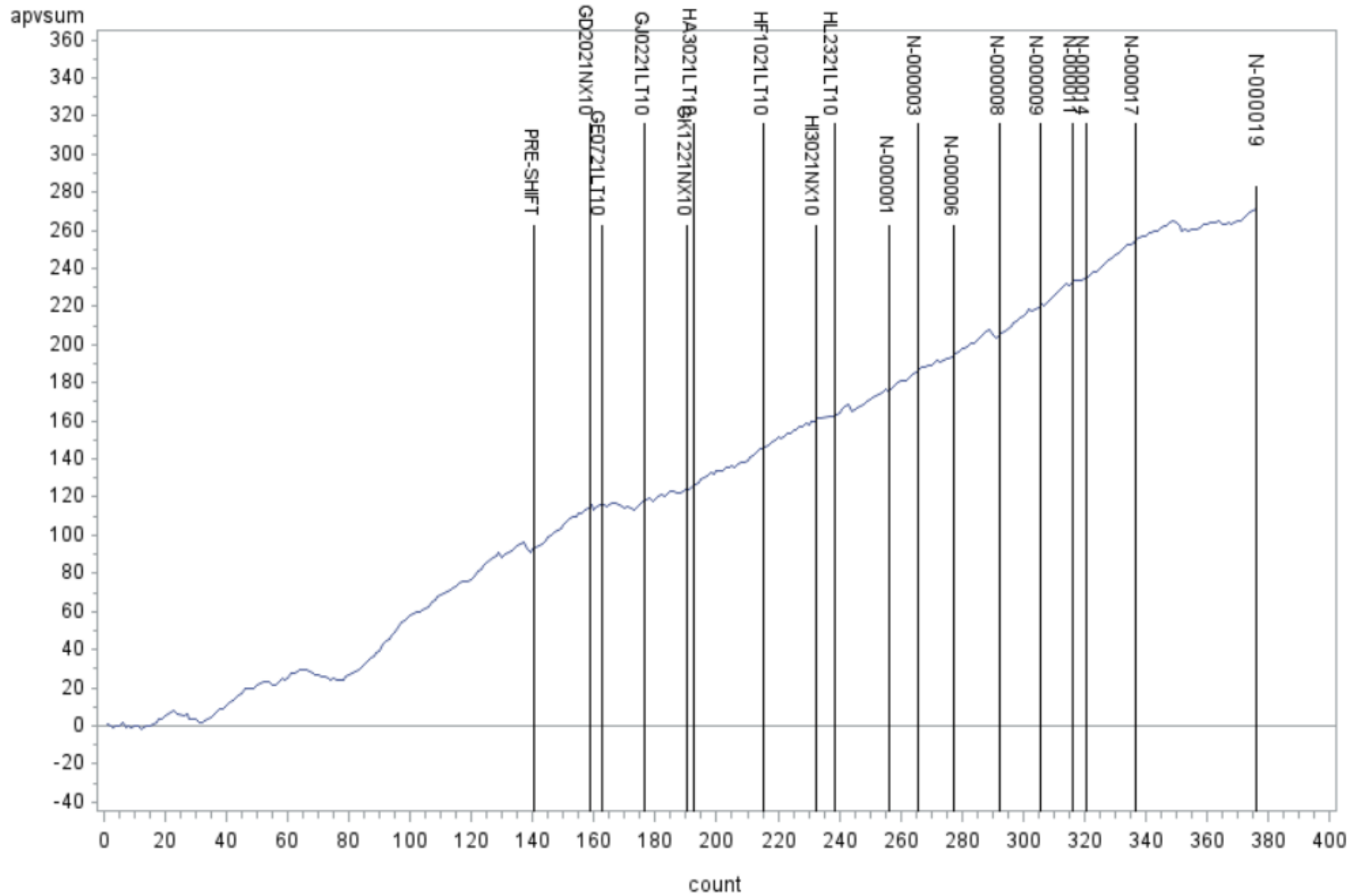
SEQUENCE IIIH INDUSTRY OPERATIONAL VALID DATA
 Reference Oil 436 Only
 AVERAGE WEIGHTED PISTON DEPOSITS FNL ORIG U



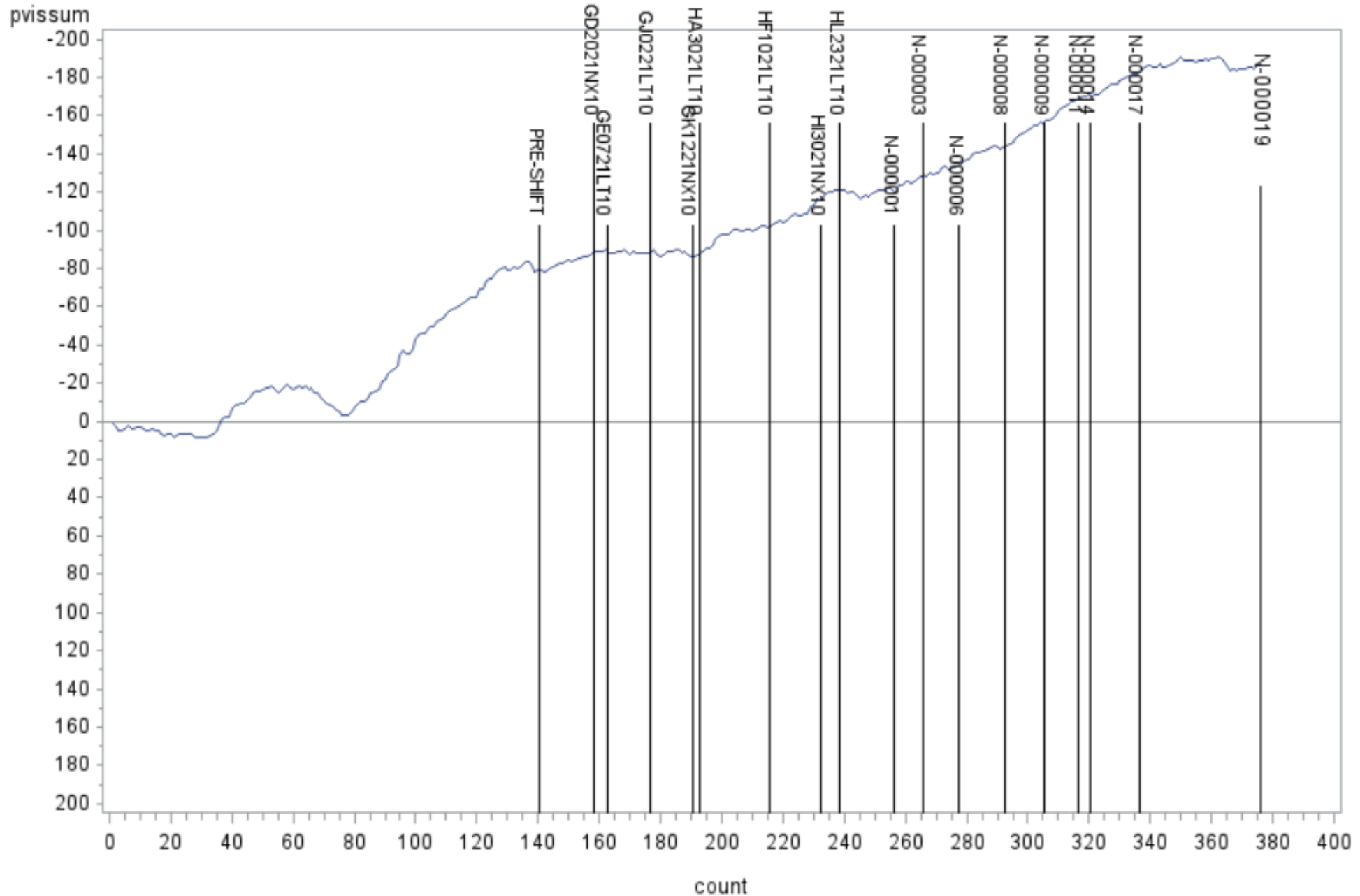
SEQUENCE IIH Industry Operationally Valid Data
Reference Oil 436 Only
AVERAGE PISTON SKIRT VARNISH



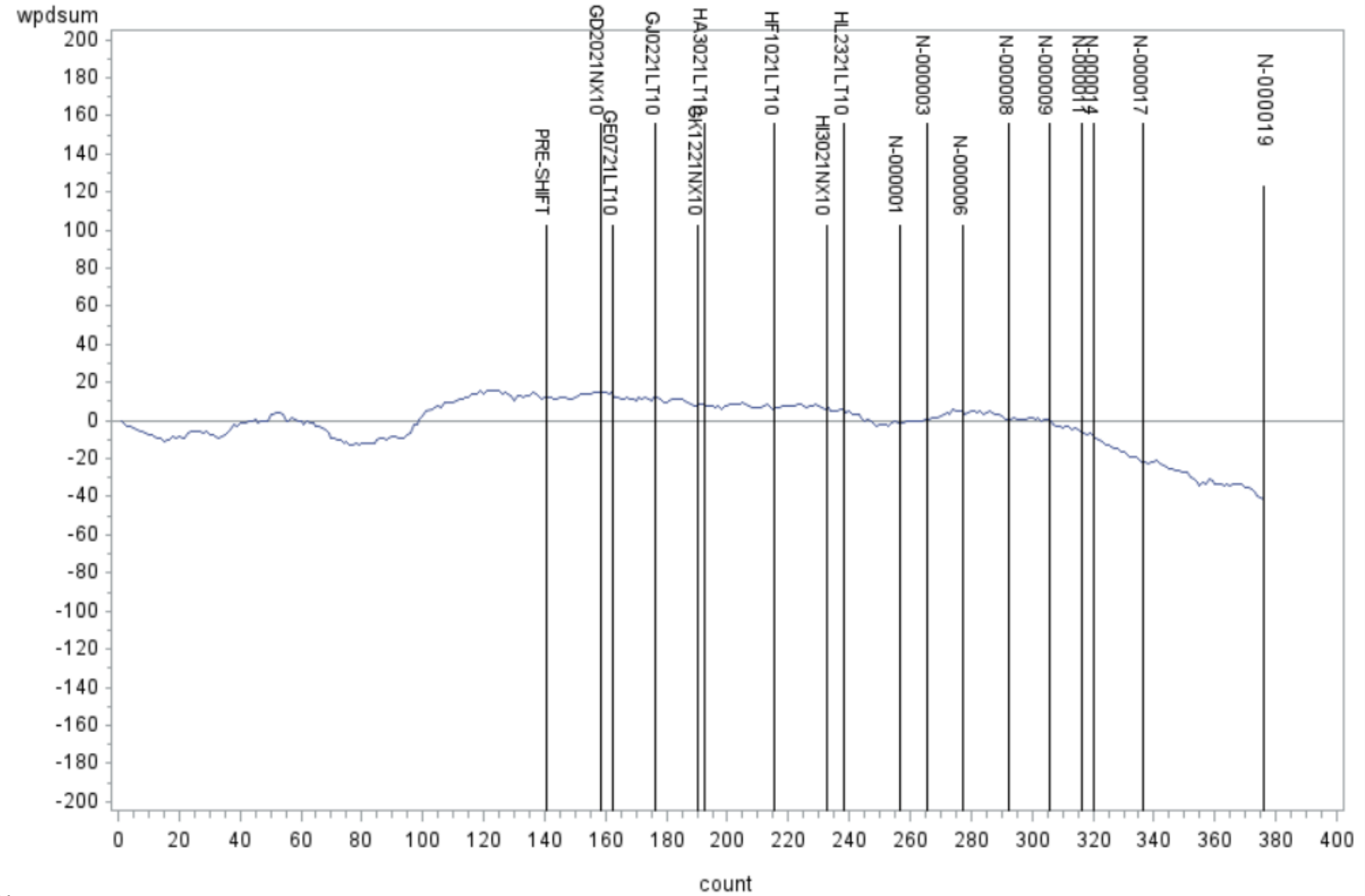
Sequence IIIH
Plot Of Average Piston Varnish Cusum by Fuel Batch



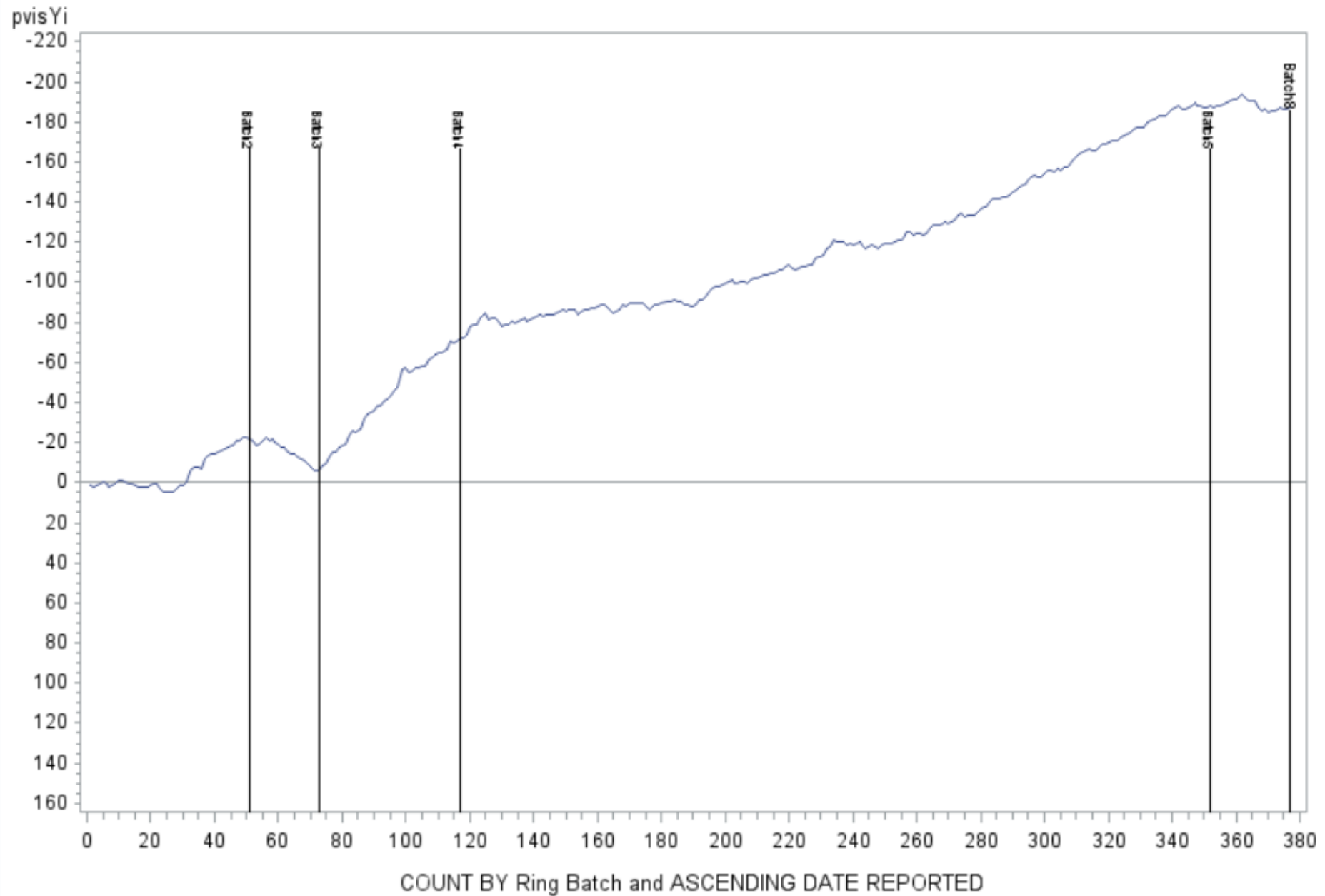
Sequence IIIH
Plot Of Average % Vis Increases Cusum by Fuel Batch



Sequence IIIH
Plot Of Weighted Piston Deposits Cusum by Fuel Batch

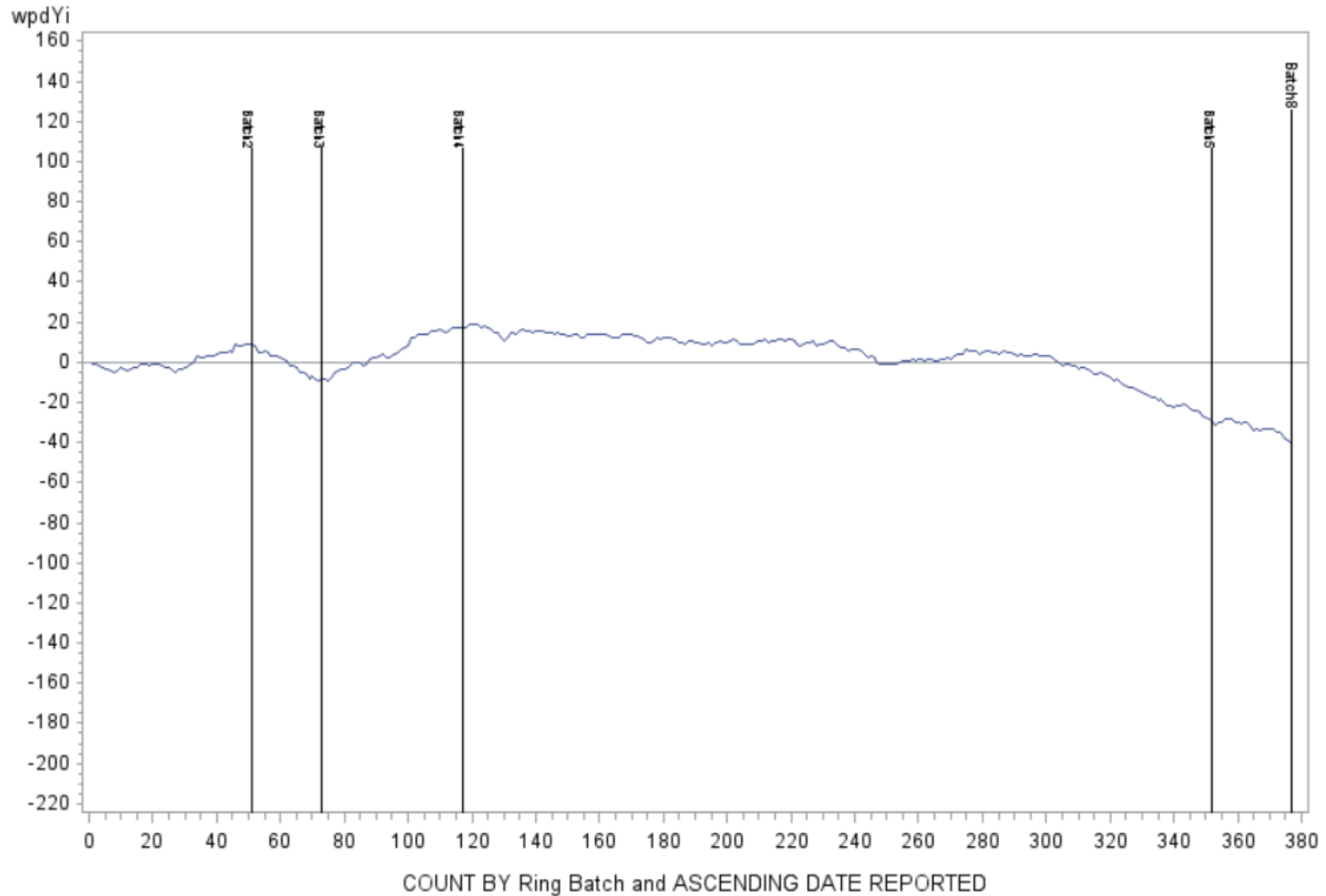


Sequence IIIH Summation Delta/s by Piston Batch



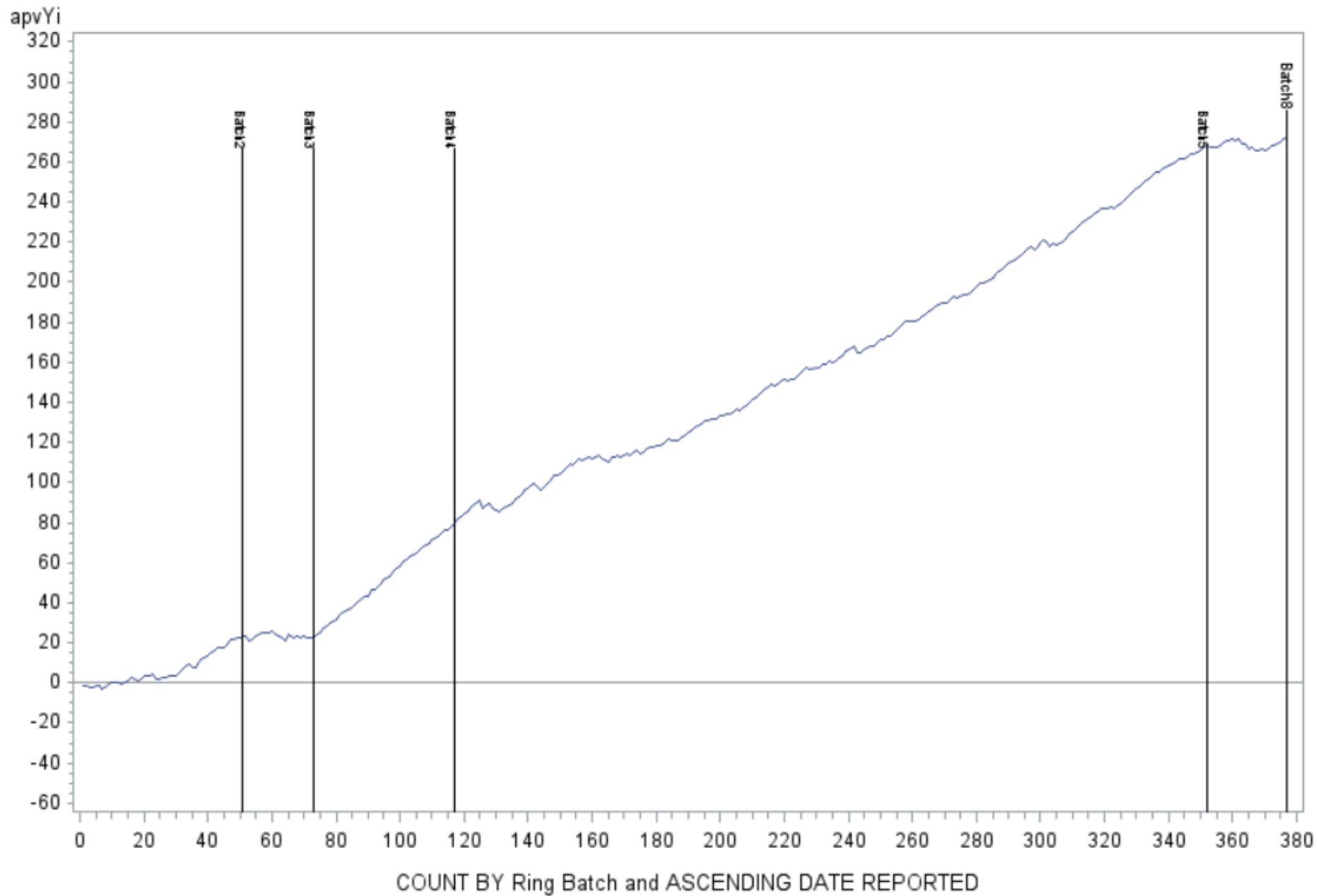
Sequence IIIH

Summation Delta/s by Piston Batch



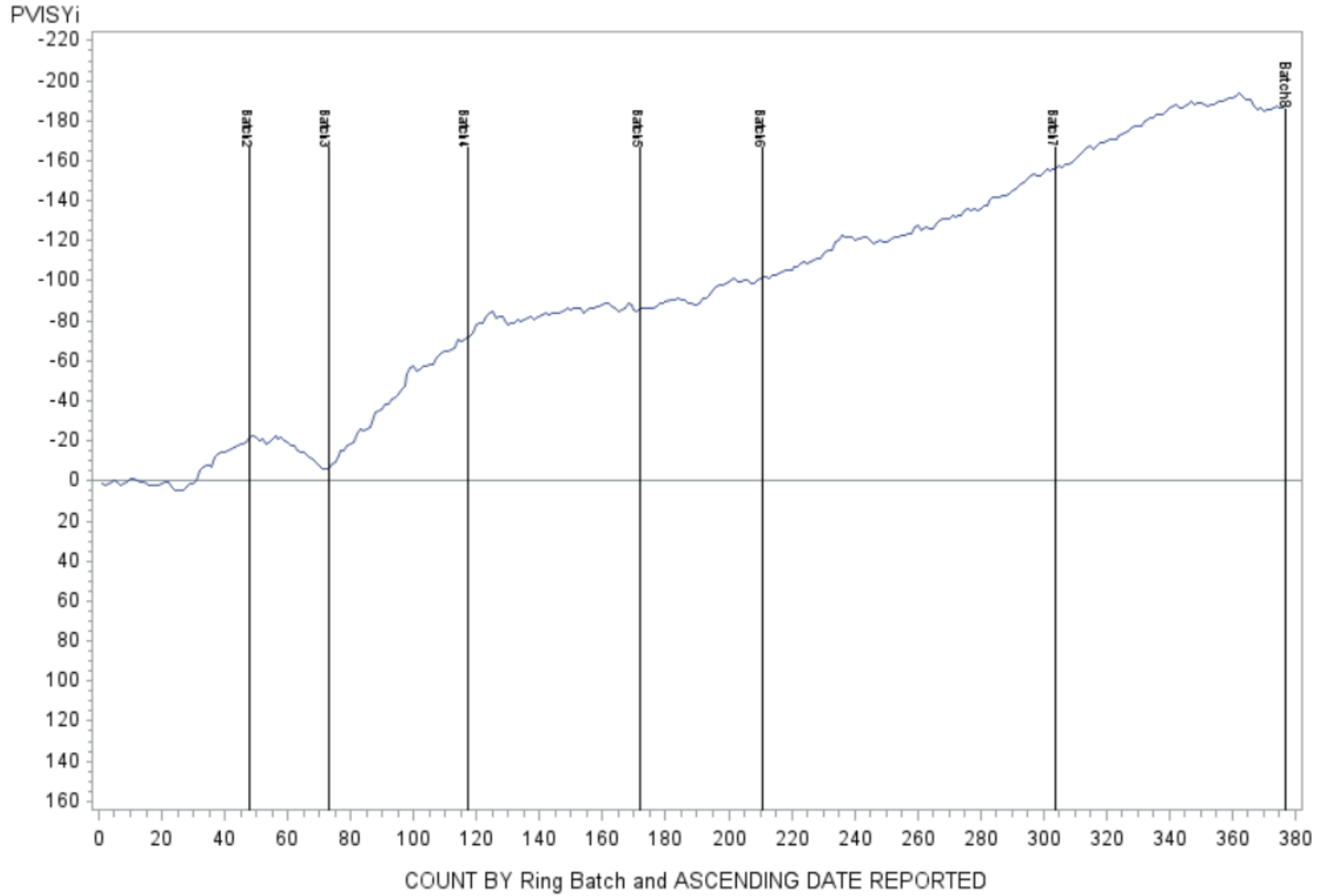
Sequence IIIH

Summation Delta/s by Piston Batch



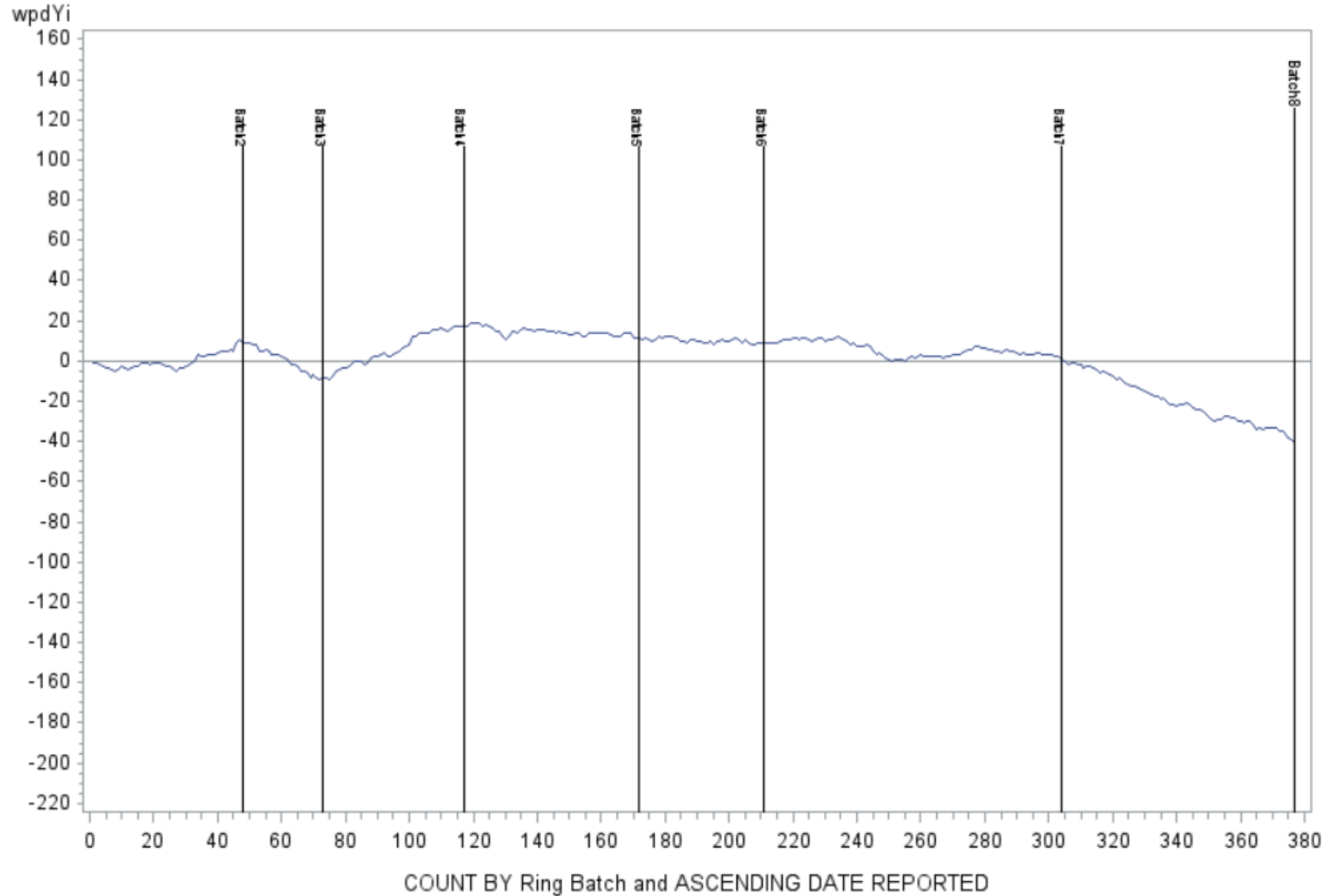
Sequence IIIH

Summation Delta/s by Ring Batch



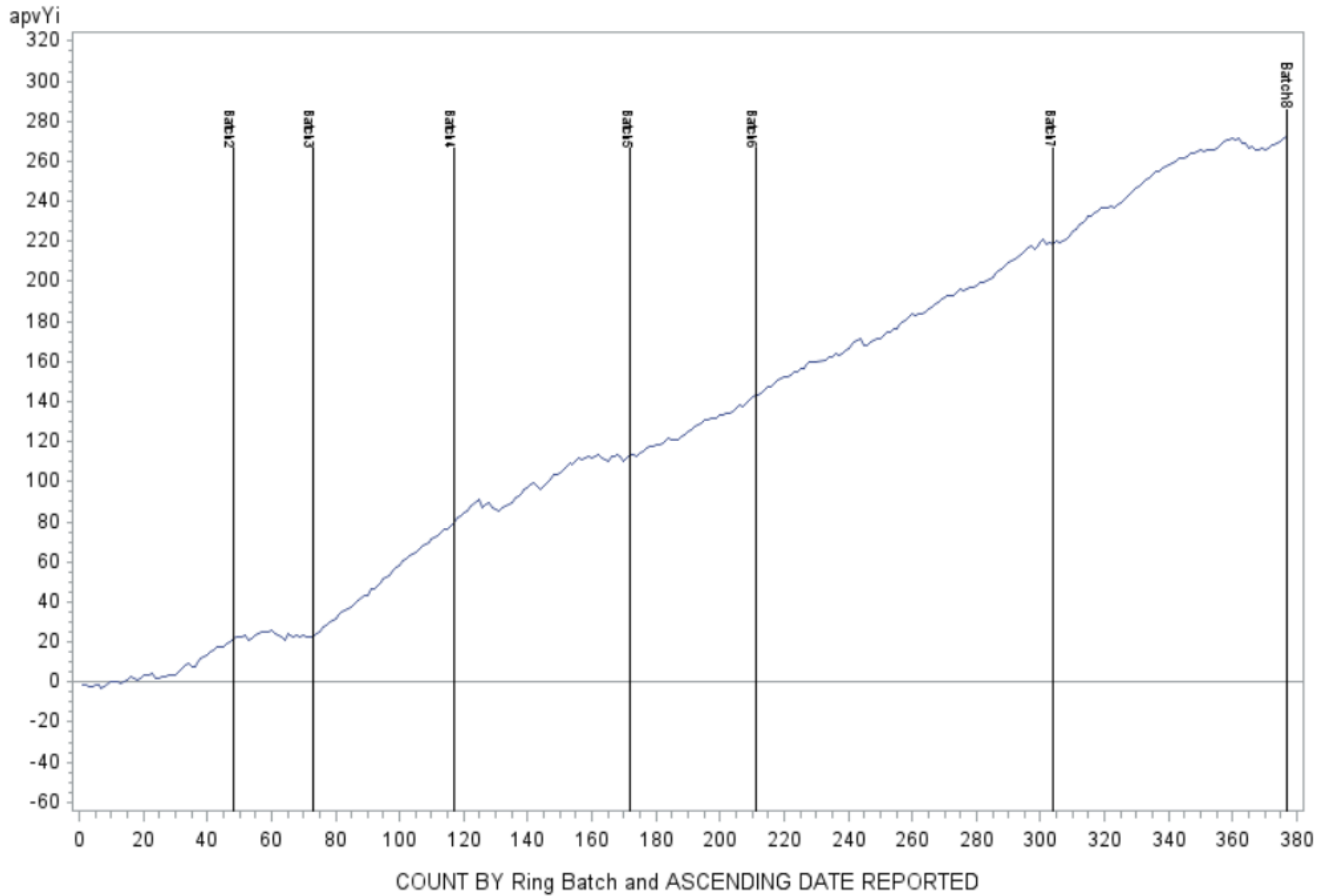
Sequence IIIH

Summation Delta/s by Ring Batch

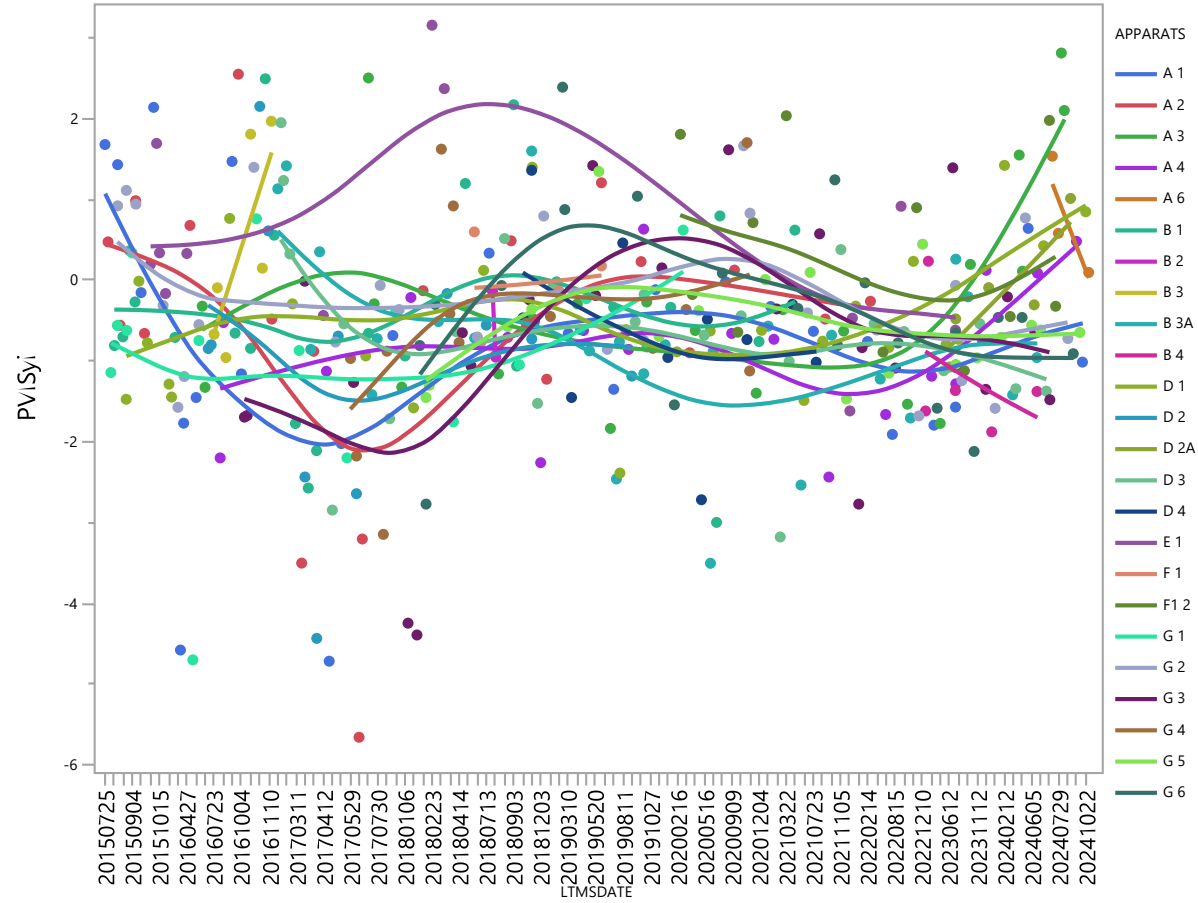


Sequence IIIH

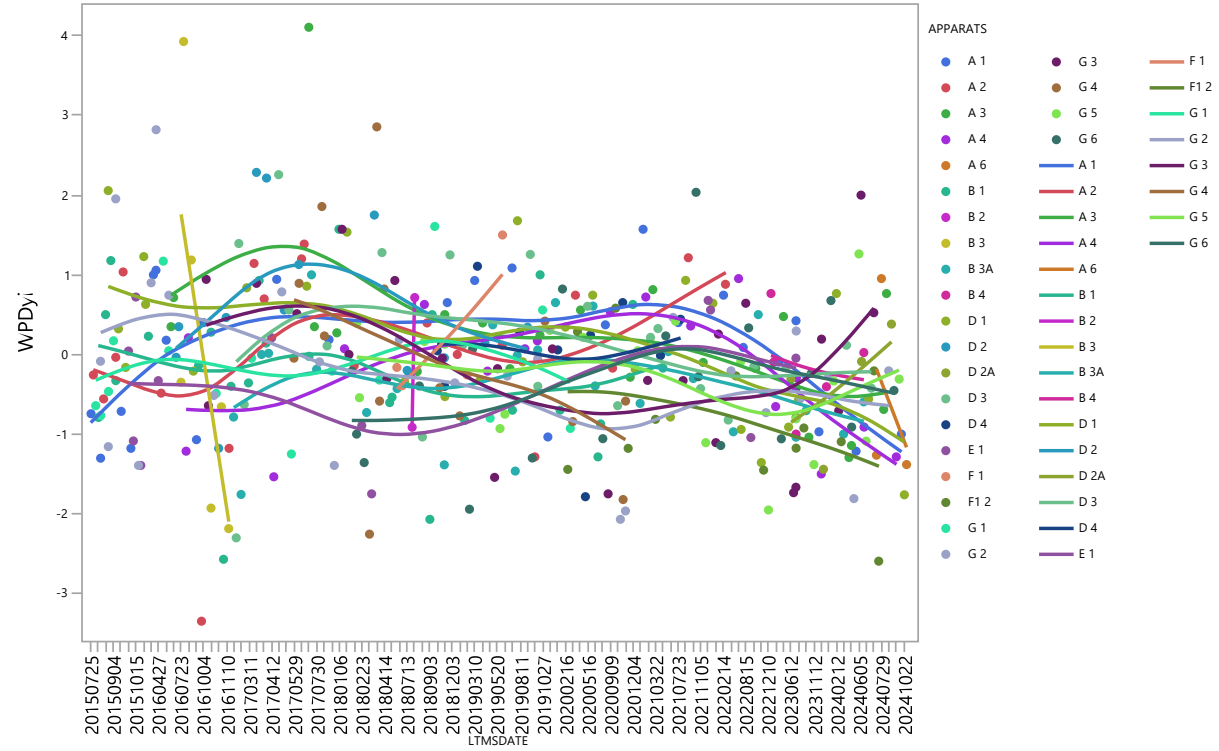
Summation Delta/s by Ring Batch



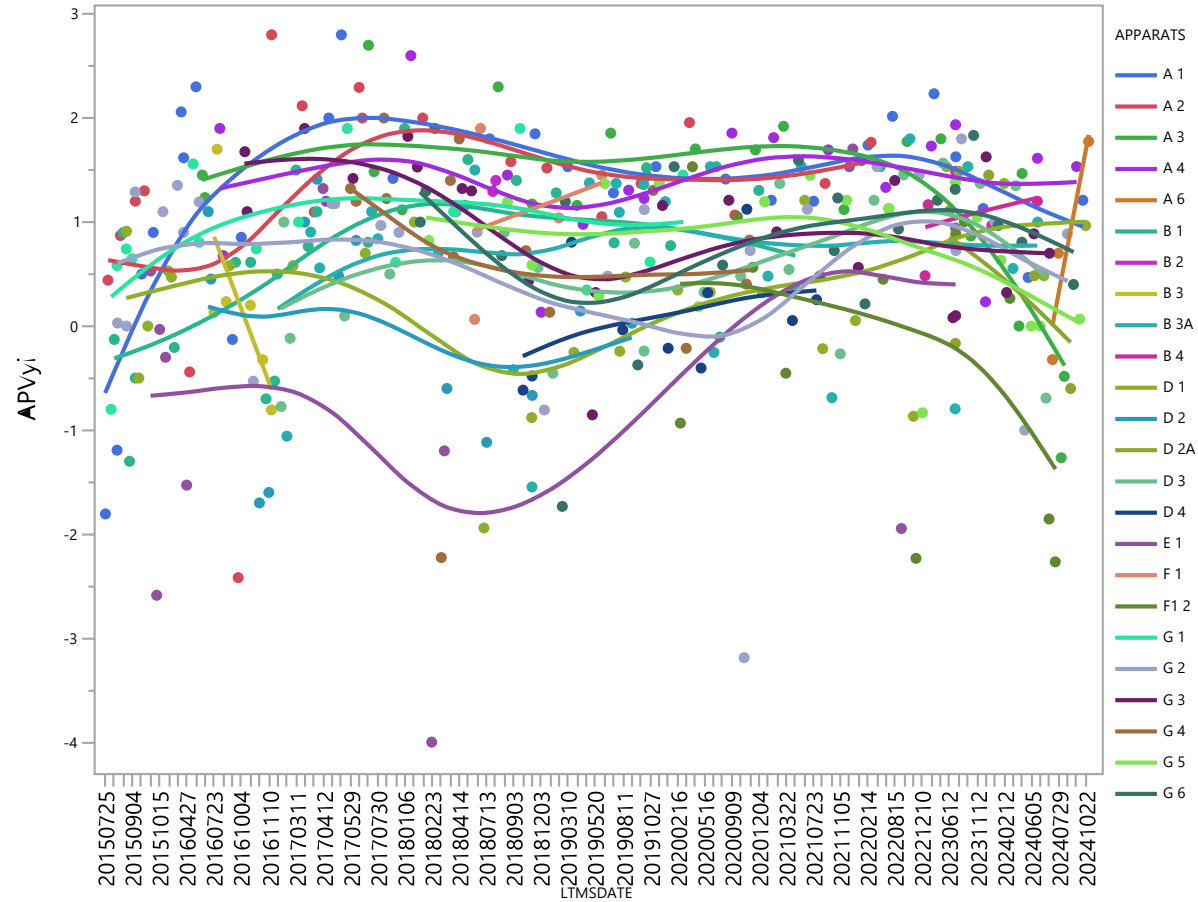
PVISyi vs. LTMSDATE



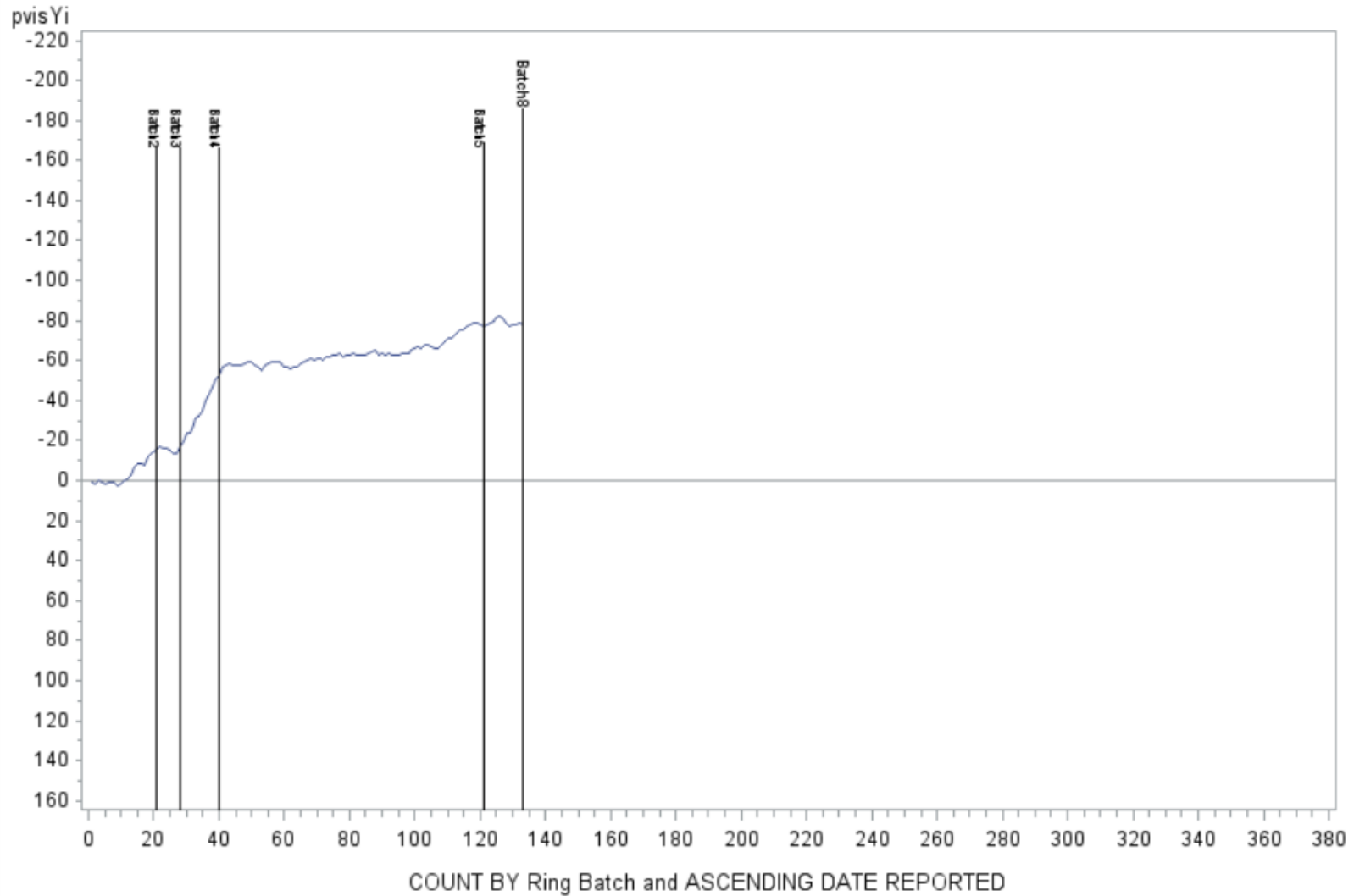
WPDyi vs. LTMSDATE



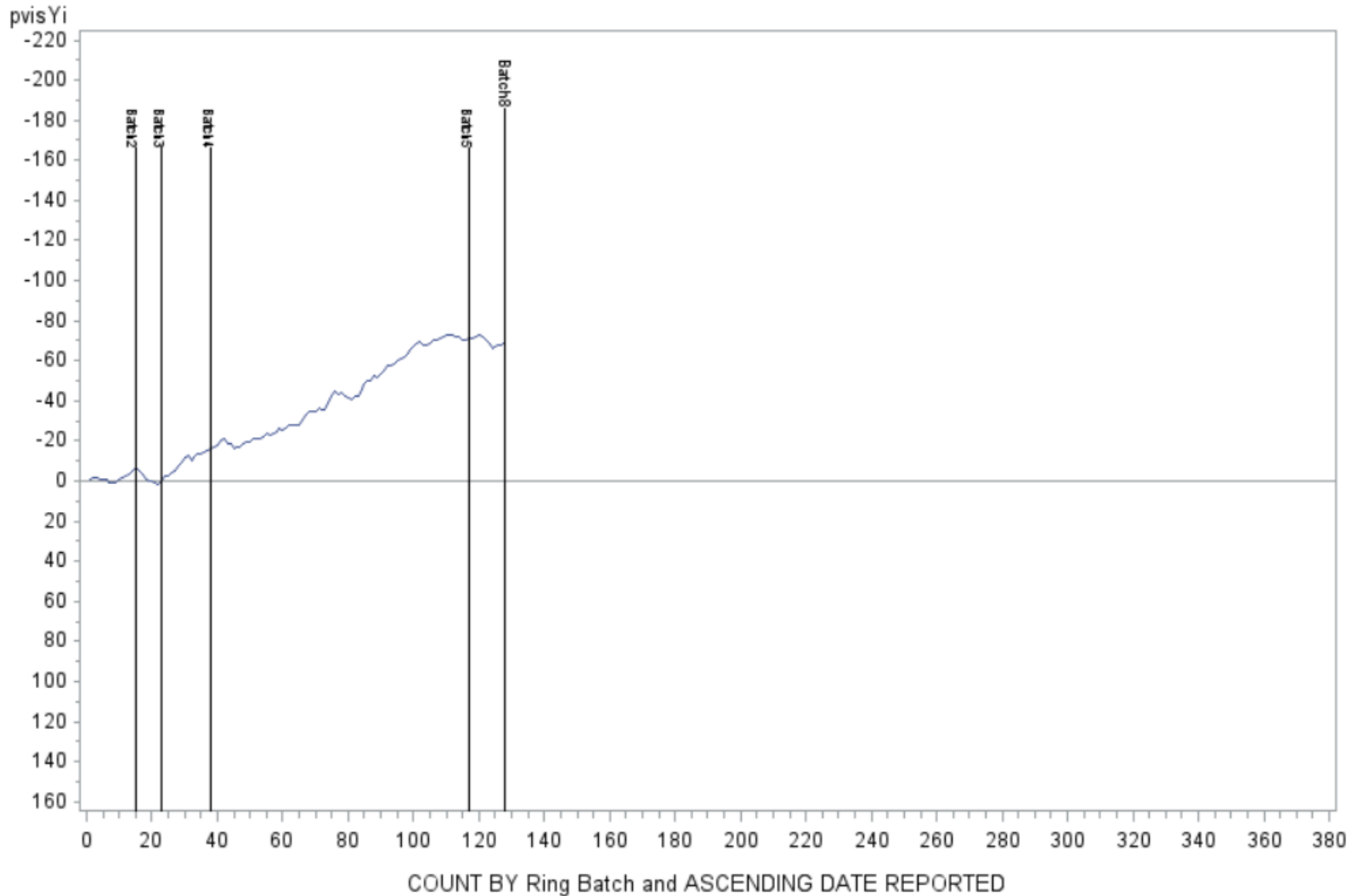
APVy_i vs. LTMSDATE



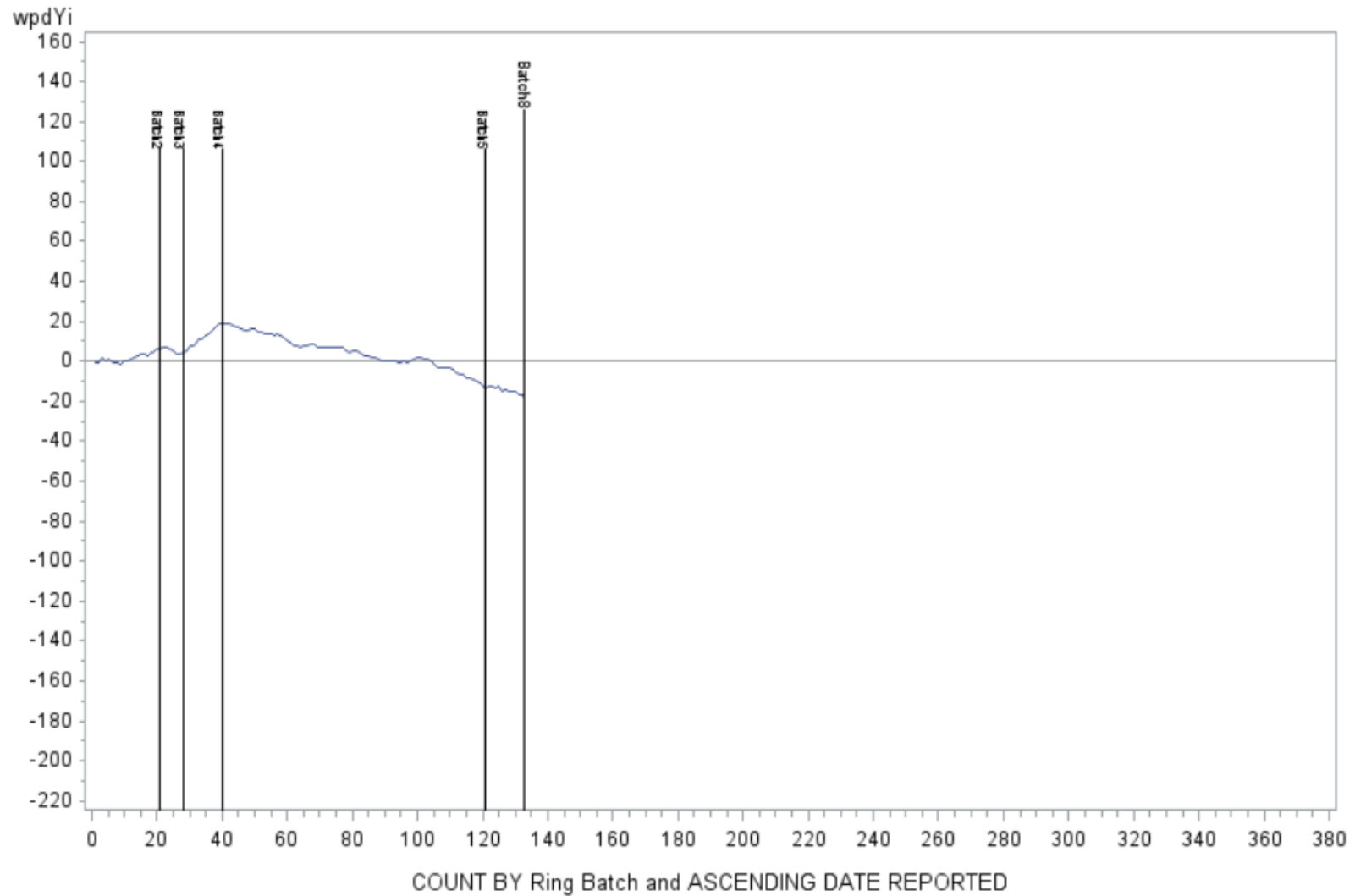
Sequence IIIH
Summation Delta/s by Piston Batch
Oil 434 Blends



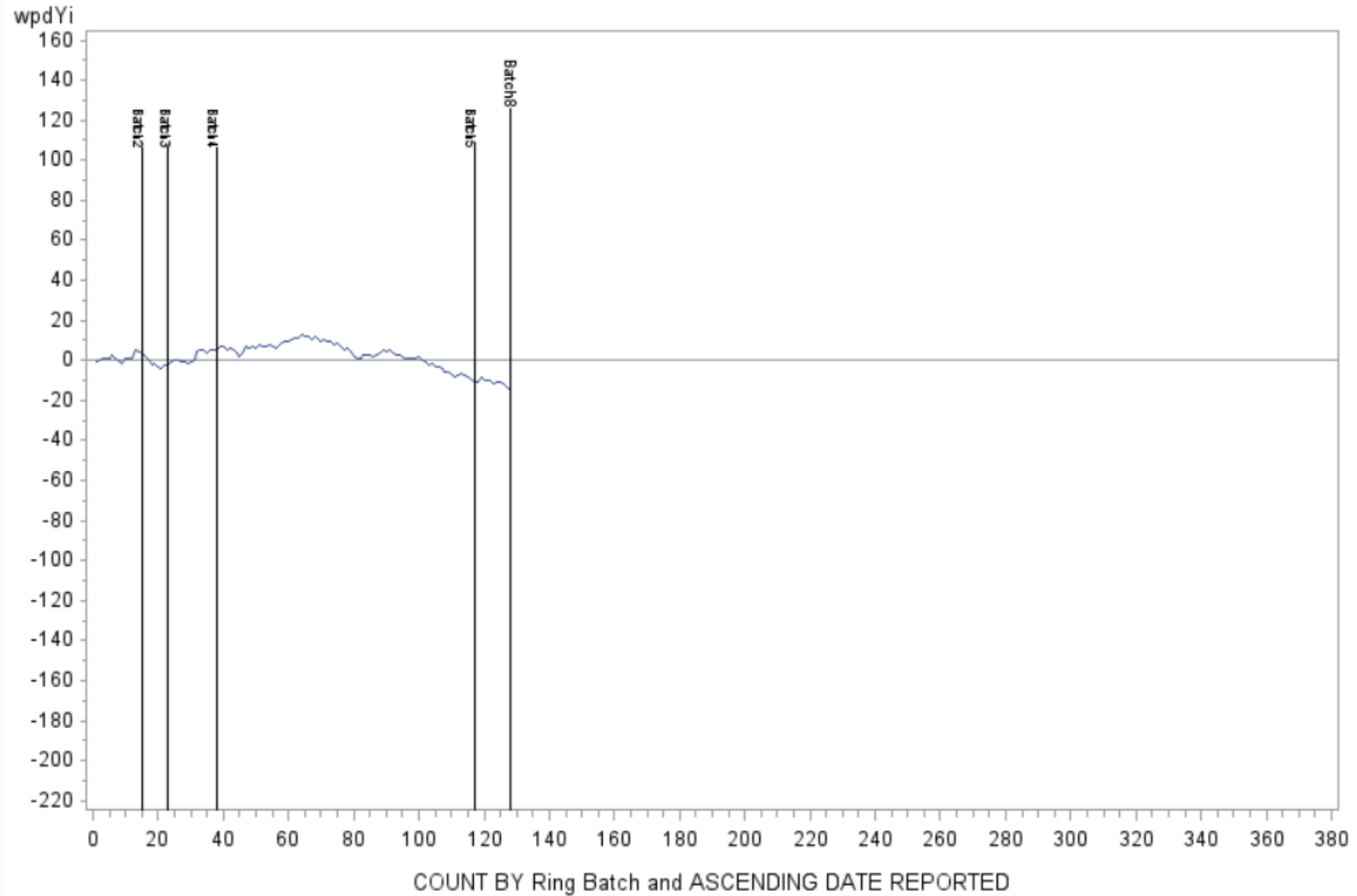
Sequence IIIH
Summation Delta/s by Piston Batch
Oil 436



Sequence IIIH
Summation Delta/s by Piston Batch
Oil 434 Blends



Sequence IIIH
Summation Delta/s by Piston Batch
Oil 436



PCM Availability

- ▶ Stellantis no longer supporting IIIH with PCMs
- ▶ IMTS working to remedy gap in PCM availability
 - ▶ Some success with new flash; currently running one stand with new IMTS PCM, however other PCMs sent would not ramp past 3500rpm

ASTM Sequence III Test Activity and Performance

Robert Stockwell
Sequence III Surveillance Panel Chairman
December 10, 2024

Sequence IIIH Capacity

Sequence IIIH

14 Stands

5 Labs

Sequence IIIH

RO 434-3 Active Reference Oil (Approximately 4 yr)

RO 436 Active Reference Oil (Approximately 6 yr)

RO 438-2 Active Reference Oil (Suspended while
introducing Batch 8 Pistons)

No reference oil supply issues

Sequence IIIH - hardware

- Enough engines are stored for the life of the category, AER Manufacturing is storing and distributing the engines and as of 20241114 AER had 1105 engines in stock.
 - Engine consumption has increased from ~45 per month in 1H to over 70 per month for the last 6-months.
- At current consumption rates:
 - About a 3-month supply of Batch 8 pistons are in stock
 - About a 5-month supply of Batch 8 piston rings remain in stock at the CPD
- Current fuel batch is sufficient - A new batch of fuel will be blended when needed

Sequence IIIH - hardware

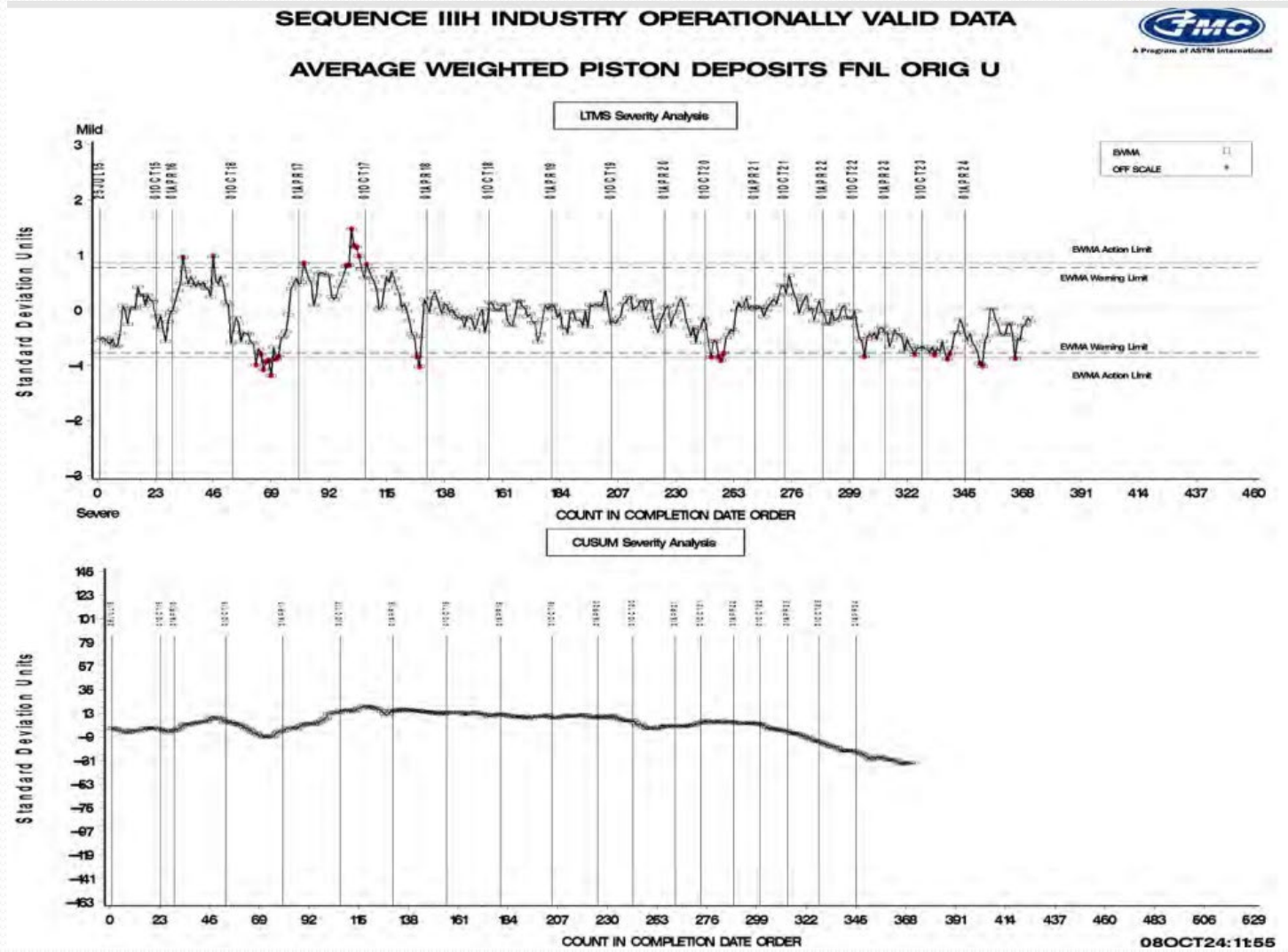
- The CPD expects to receive the Batch Code 9 pistons prior to Thanksgiving. Upon receipt, the CPD will be shipping donated engine kits, including BC9 pistons and BC8 rings, to the labs for prove-out testing of BC9 pistons.
- The BC9 pistons are the BC6 pistons that have been re-machined. They have been processed on the same dedicated machining center as the Batch Code 8 pistons.
- The shipment of the Batch Code 9 rings have been delayed by the manufacturer and are now expected to be received by February 14th. The CPD is working with the manufacturer to expedite the delivery of this material.
- The original goal was to ship the BC9 pistons and BC9 rings together to simplify the introduction process, but we believe it is important to have the BC9 pistons received at the labs and tested ASAP.

Sequence IIIH - operations

- LTMS Parameter for PVis is in control.
- LTMS Parameter for WPD is in Control.
- Average piston skirt varnish is in control. PSV has shifted closer to target with BC8 pistons.
- EOT MRV is in control
- Phosphorus retention has been running mild for the past year.

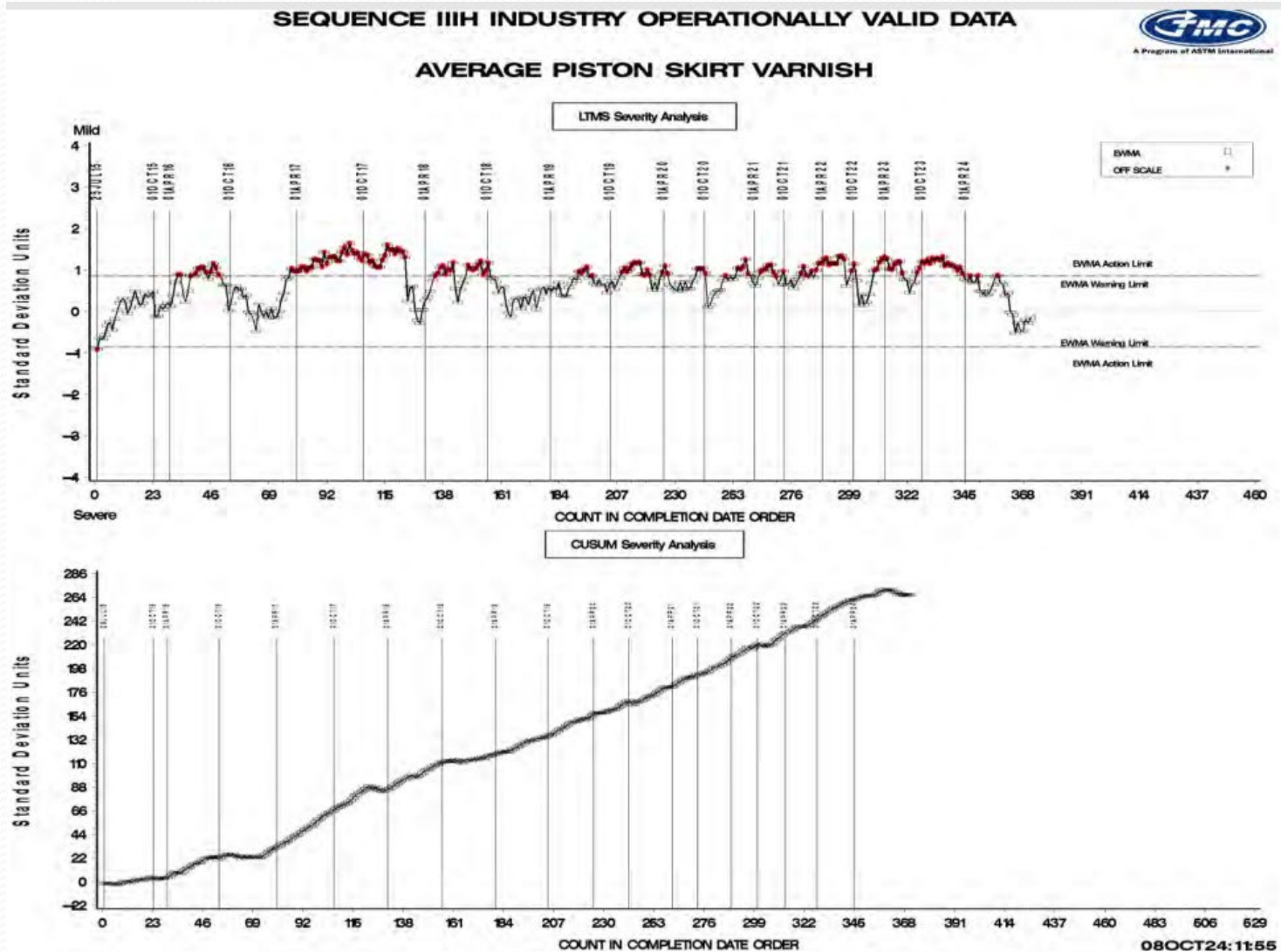
Sequence IIIH

- WPD in control



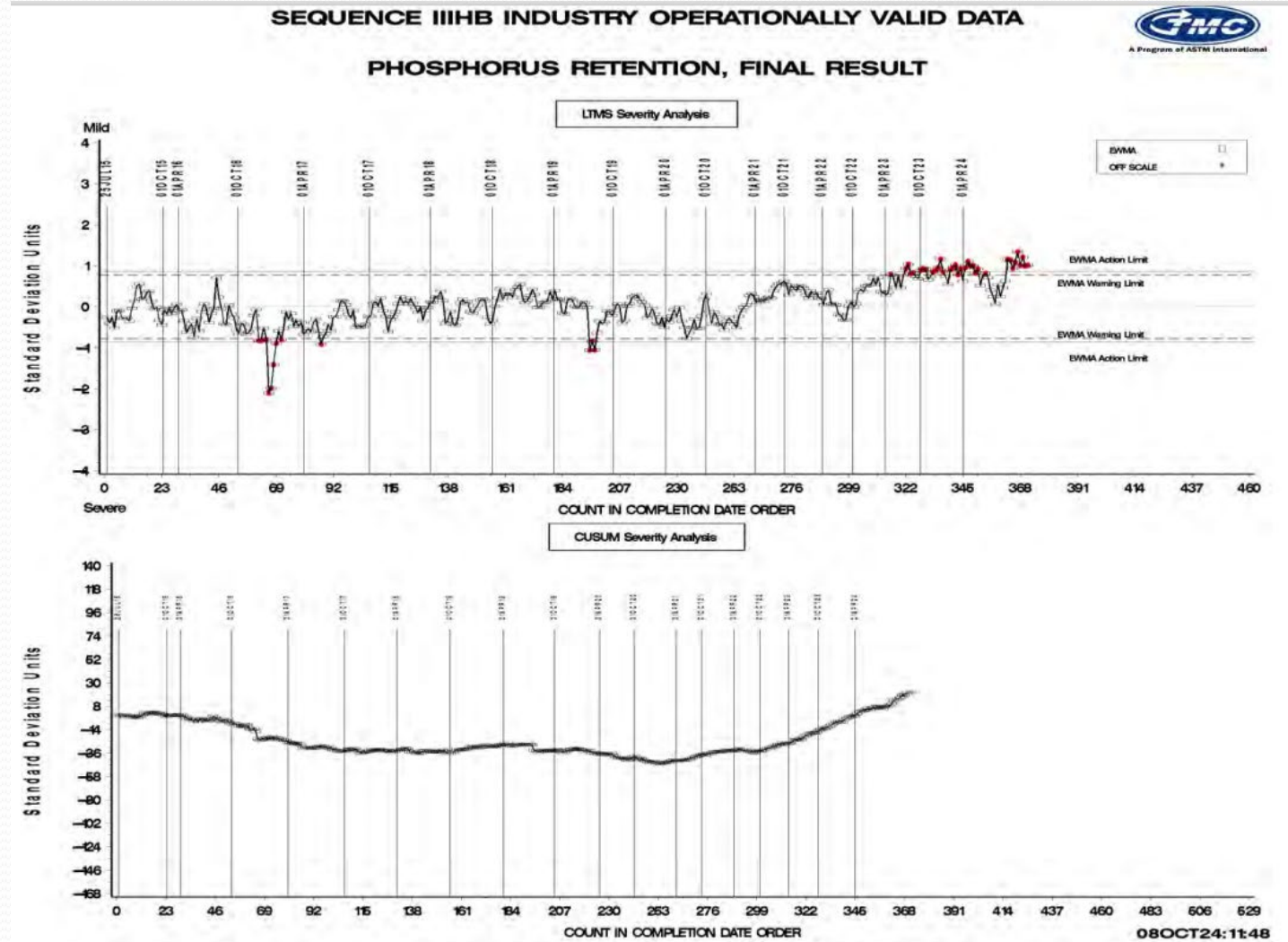
Sequence IIIH

- Average Skirt Varnish is in control



Sequence IIIH

- Phosphorus Retention is in alarm mild.



Sequence III Meetings

The November surveillance panel meeting focused on the supply of test pistons and rings, long term engine rebuilding challenges, a test procedure clarification and sourcing additional ECMs.