NOACK Update
for the Volatility Surveillance Panel

8/29/2019

Acknowledgements

- Amy Ross
- Elisa Santos
- Jo Martinez
- Martin Chadwick
- Todd Dvorak
- Tom Schofield
- Travis Kostan

Outline

- Evaluation of the appropriateness of the NOACK calibration interval
- Storing Daily QC oil data
- Evaluation if current standard deviation (0.73) is still appropriate

Evaluation of the appropriateness of the NOACK calibration interval

Evaluation of the appropriateness of current 30-day

- The current TMC calibration period for D5800 Rigs is 30 days.
- Severity adjustments (SAs) are calculated for rigs based on TMC calibration results. SAs are applied to candidate runs over that 30-day calibration period.
- Several analyses were done
  - Graphical evaluation by apparatus of the agreement between the standardized Evaporation loss (Yi) from 30-day Calibration runs and VOLD14 Daily checks: In general, the plots by apparatus showed varying levels of agreement between the two series over time. Some instruments had better agreement than others.
  - Graphical evaluation comparing SA's generated by 30-day Calibration runs and by VOLD14 Daily checks. We expect that the respective SAs be "close" to each other.
  - The observations made, as the work described above progressed, led us to focus on keeping or reducing the current calibration period. The next bullet point is a comparison within VOLD14.
- A particular apparatus was selected for comparing severity adjustments based only in VOLD14, varying the frequency of data collection
  - daily check
  - every two weeks
  - every month

  The comparisons made do not seem to support decreasing the 30-day period

- See Appendix 1 for more details

Recommendation

- The analyses did not support increasing or decreasing the 30-day calibration period

- After several meetings, the statisticians decided to recommend the SP to maintain the 30-day interval as is

Storing of All Daily QC data (VOLD14) versus storing the last two years of data

Storing of Daily QC data (VOLD14)

- Question: Should the SP continue requiring reporting of VOLD14 daily QC within a calibration period?
  - Daily QC oil data have been used to evaluate appropriateness of the calibration interval
  - The daily QC oil is a useful check for laboratories to monitor and predict performance issues which could in turn affect calibration
  - Currently all data are being stored
- Drawback: size of the database is growing to be quite large
- Potential solution: keep only the last two years of data
- Stats team recommendation: two years of data will be enough to do a future evaluation, if needed.

Evaluation of standard deviation: update it or not

Evaluation if current standard deviation (0.73) is still appropriate

- Revisions of the standard deviation for untransformed and LN transformed evaporation loss were discussed in detail by the statisticians
- Details of the calculations are presented in Appendix 2
- After applying the LN transformation, the new standard deviation should be equal to 0.0465
- After reviewing the most recent data, the statisticians would like to recommend that the LN transformation be applied to Evaporation Loss

NOACK target and standard deviation for LTMS

- Recommendation: adopt the following targets and standard deviation

Reference oil	Target Mean w/ LN Xform	Standard deviation w/ LN Xform
VOLC12	2.6523	0.0465
VOLD12	2.5264	0.0465
VOLE12	2.8175	0.0465

- Recommendation: adopt the same standard deviation (0.0465) for calculating instrument severity adjustment

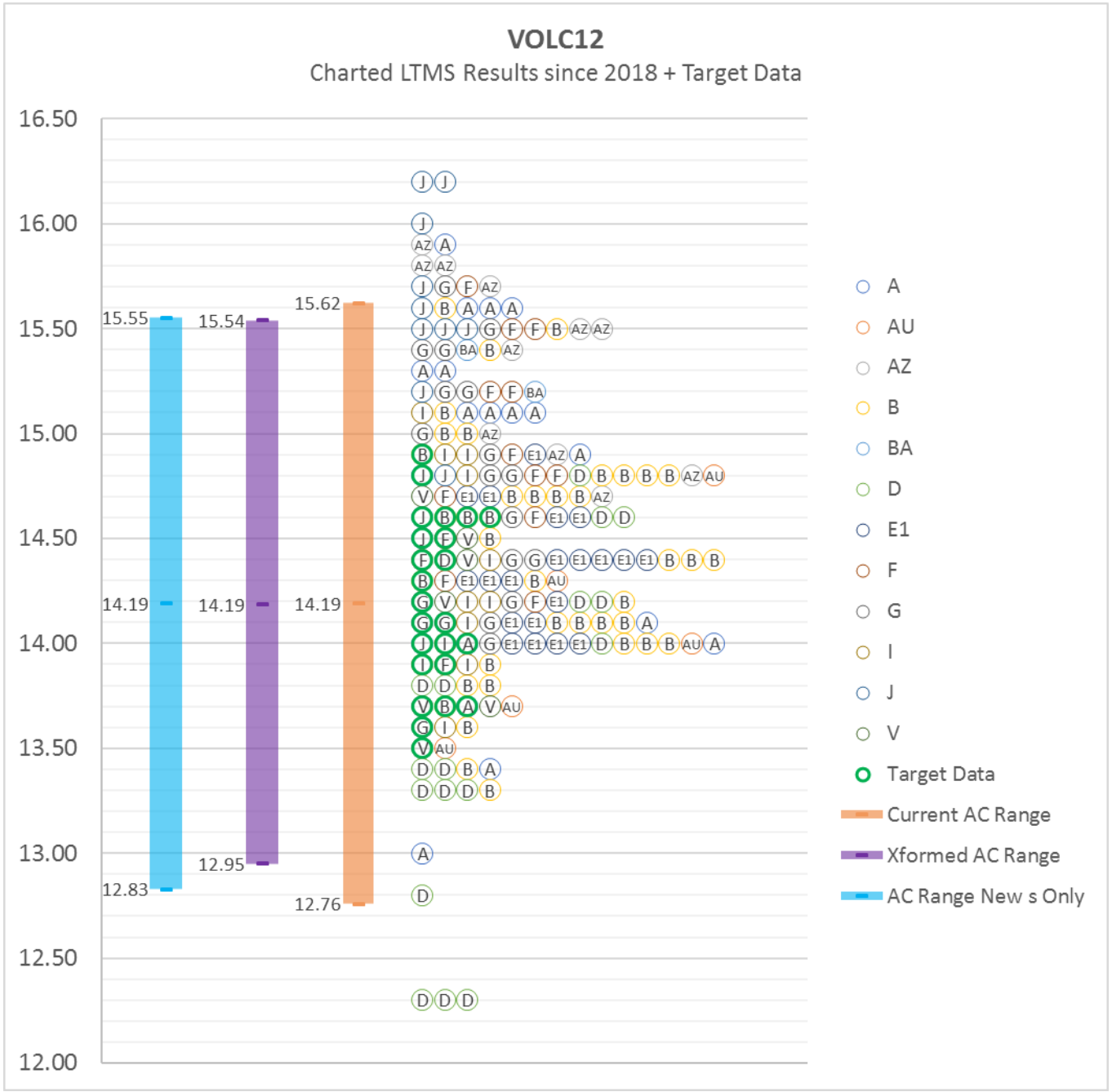
- Evaluation of LN transformation impact on the acceptance range for each reference oil is presented next

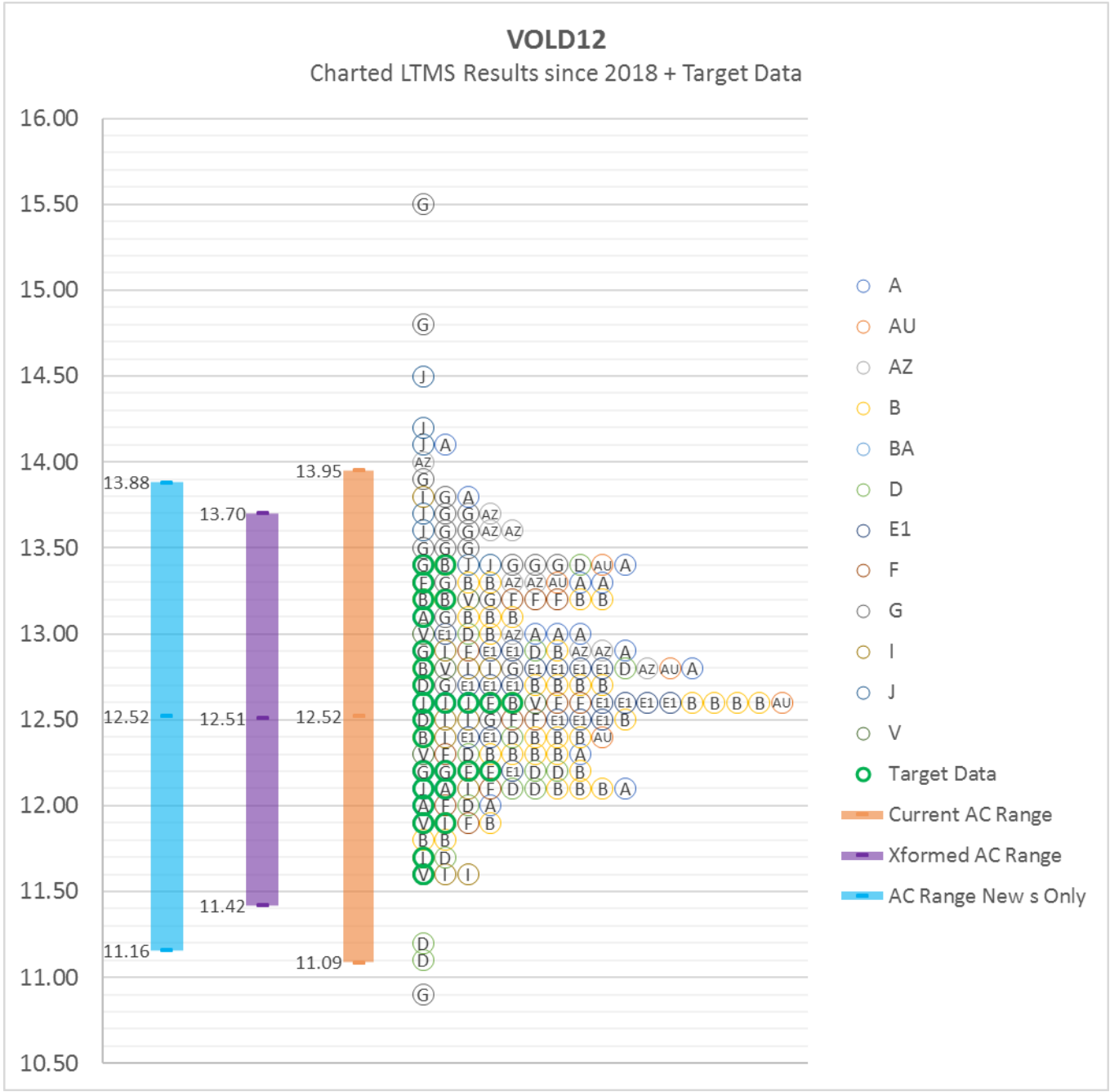
NOACK Target Comparisons

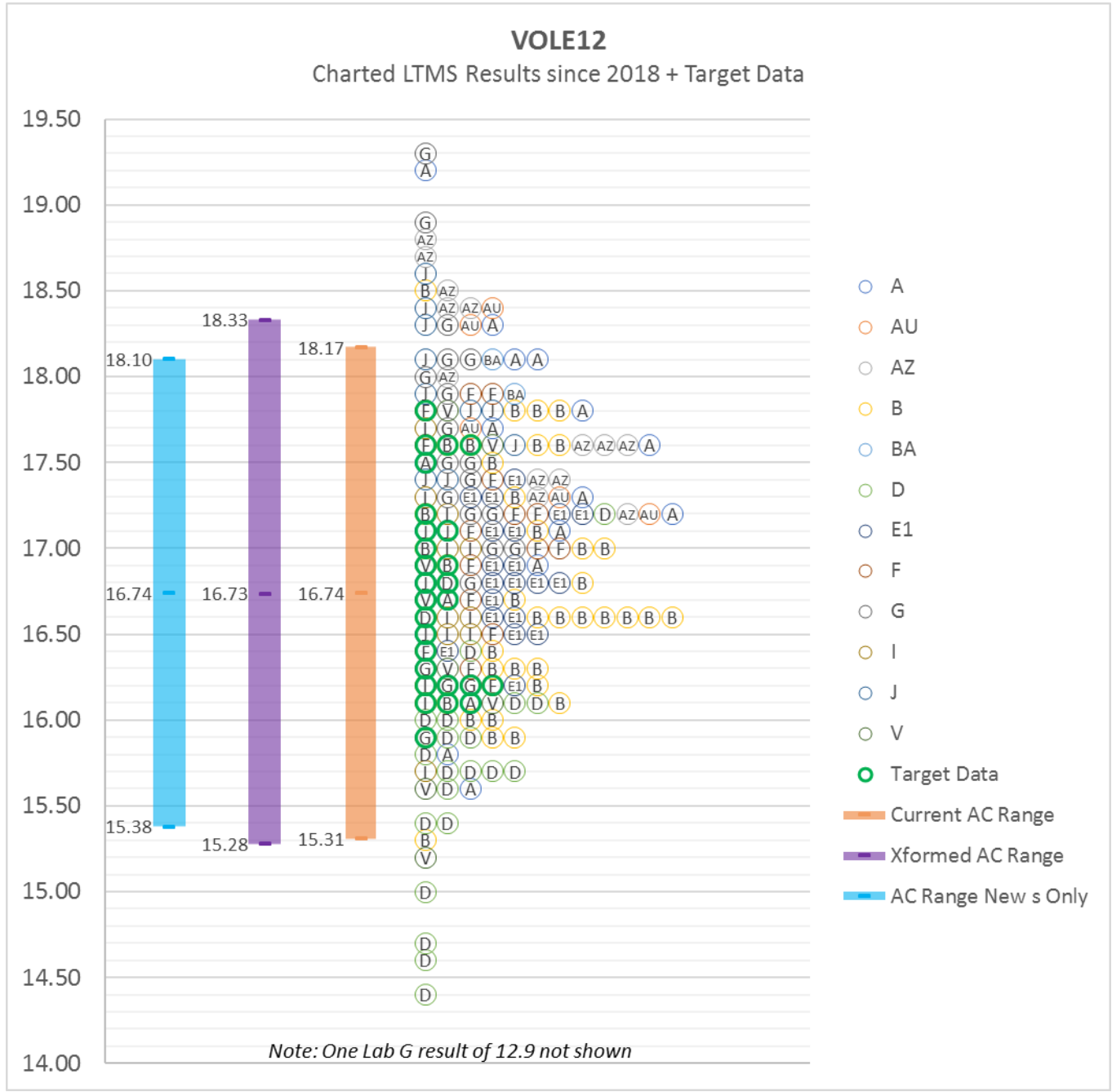
- Determine Target Mean if LN Transform is accepted.
  - Original Target Mean was the average with no weighting or model of the target data sets.
  - New target mean is the average of the transformed results. New target mean is very similar to original target mean (columns with blue arrow below)

	Original Target Mean	LN(Original Mean)	Target Mean w/ LN Xform	Xform Mean in Measured Units
VOLC12	14.19	2.6525	2.6523	14.19
VOLD12	12.52	2.5273	2.5264	12.51
VOLE12	16.74	2.8178	2.8175	16.73

- Comparison Charts that follow use the recalculated mean for the LN transform and the standard deviations of 0.0465 (LN) and 0.6945.
  - The charts show similar acceptance bands


VOLC12
Charted LTMS Results since 2018 + Target Data
16.50
16.00
15.50
15.00
14.50
14.00
13.50
13.00
12.50
12.00
15.55
15.54
15.62
14.19
14.19
14.19
12.95
12.83
12.76
A
AU
AZ
B
BA
D
E1
F
G
I
J
V
Target Data
Current AC Range
Xformed AC Range
AC Range New s Only


VOLD12
Charted LTMS Results since 2018 + Target Data
16.00
15.50
15.00
14.50
14.00
13.50
13.00
12.50
12.00
11.50
11.00
10.50
13.88
12.52
11.16
13.70
12.51
11.42
13.95
12.52
11.09
A
AU
AZ
B
BA
D
E1
F
G
I
J
V
Target Data
Current AC Range
Xformed AC Range
AC Range New s Only


VOLE12
Charted LTMS Results since 2018 + Target Data
19.50
19.00
18.50
18.00
17.50
17.00
16.50
16.00
15.50
15.00
14.50
14.00
18.10
18.33
18.17
16.74
16.73
16.74
15.38
15.28
15.31
Note: One Lab G result of 12.9 not shown
A
AU
AZ
B
BA
D
E1
F
G
I
J
V
Target Data
Current AC Range
Xformed AC Range
AC Range New s Only

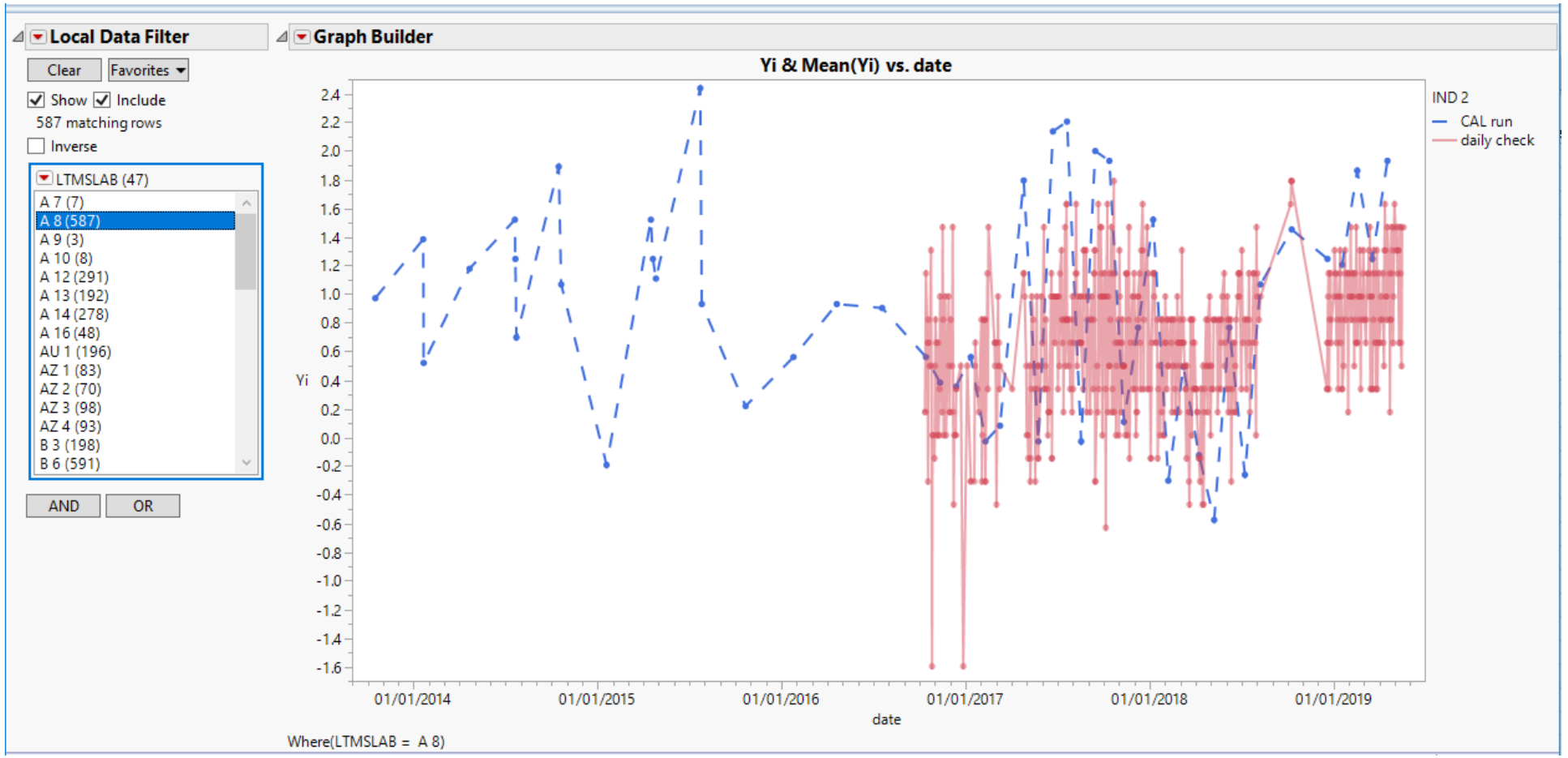
Appendix 1

Evaluation of the appropriateness of the calibration interval

Apparatus A8

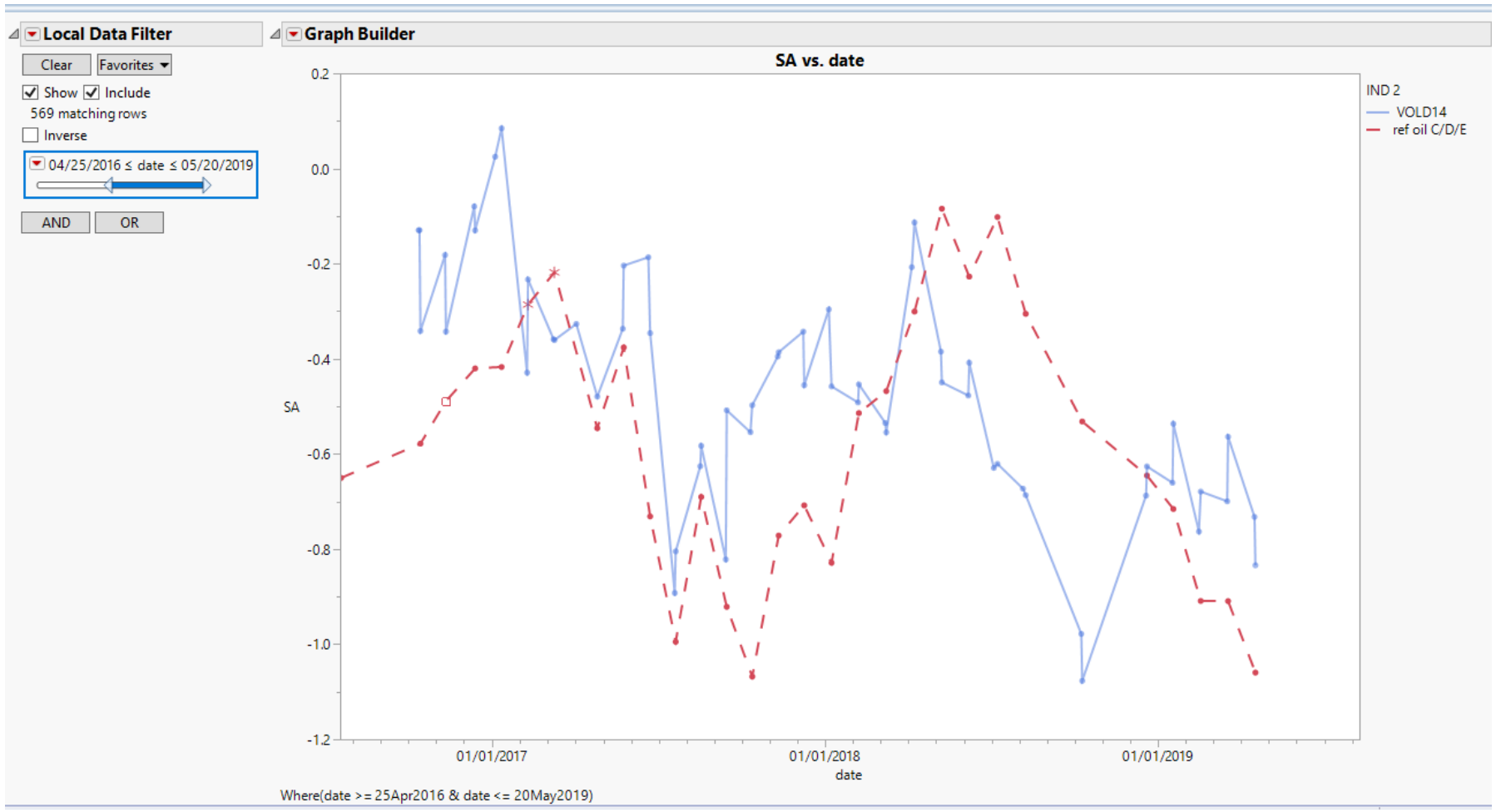
Standardized Evaporation loss (Yi) versus date by Calibration Run and Daily Check testing

- The plot below shows a certain degree of agreement between the Calibration Run and Daily Check testing. The more recent data seem to show an upward trend.



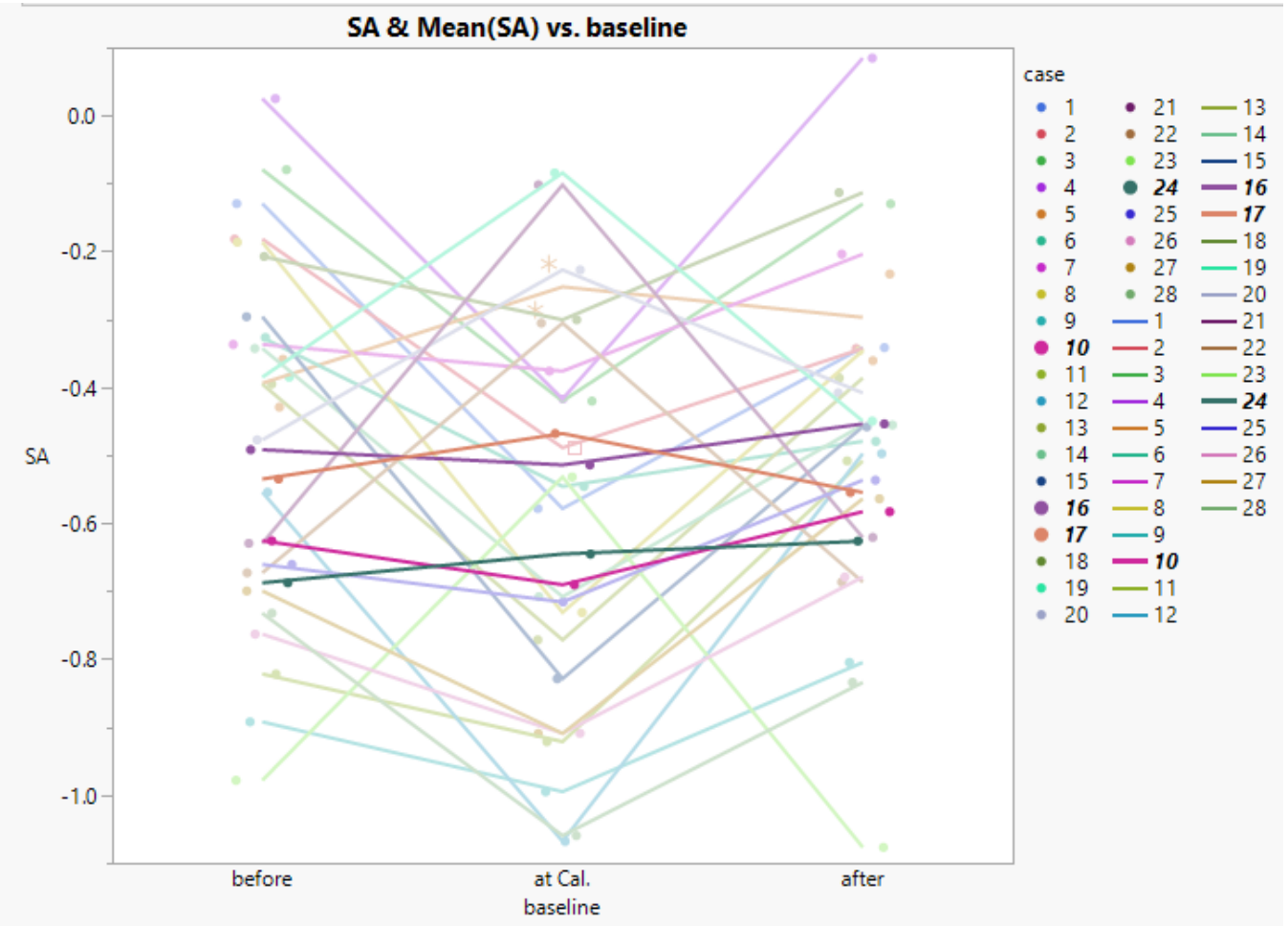
Severity adjustments based on daily VOLD14 versus Severity adjustments based on monthly Cal. run

Apparatus A8: the trend is similar, but there are differences between the two curves
The differences seem to be smaller than one standard deviation



Apparatus A8

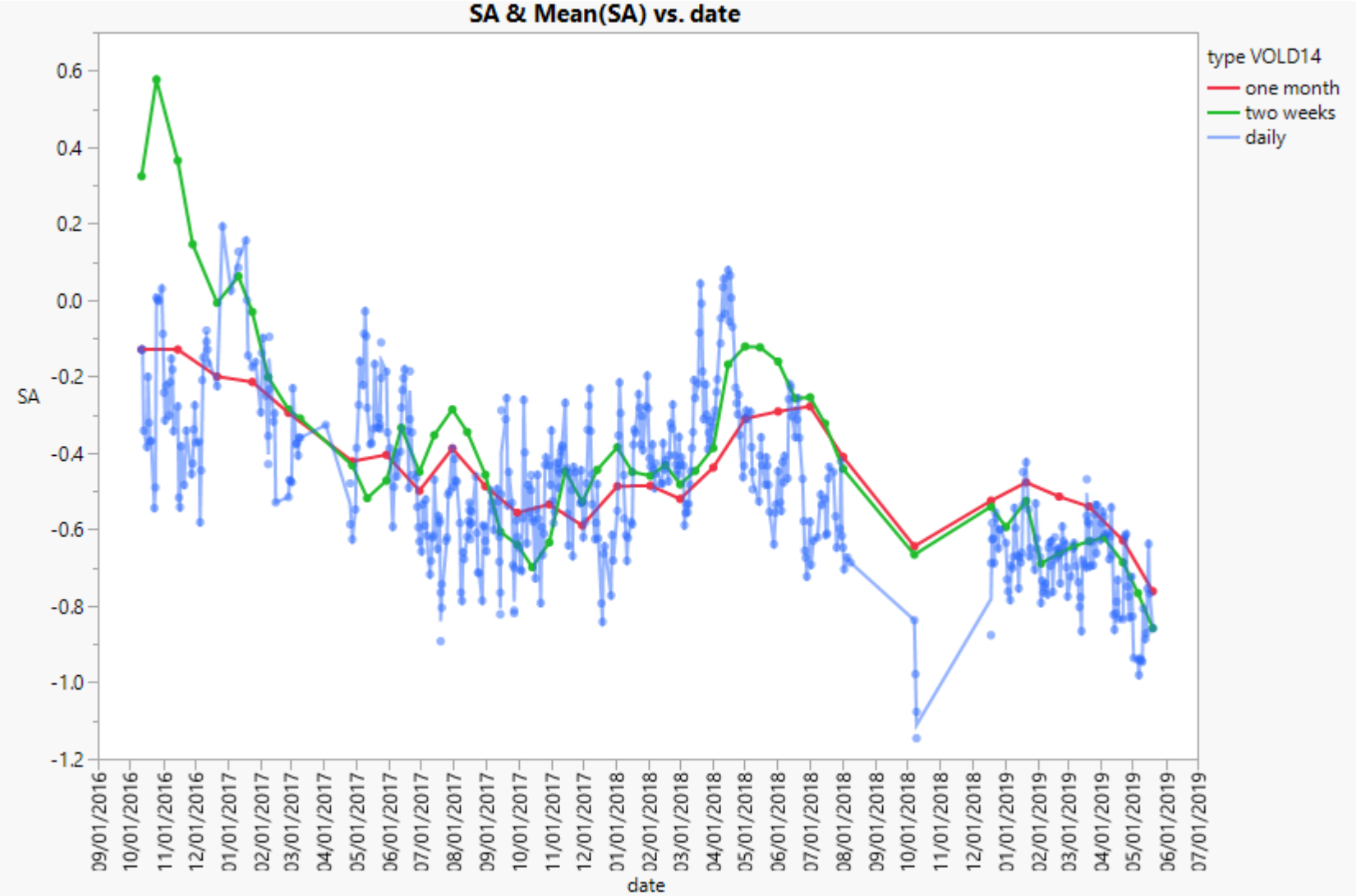
The plot below shows how close the VOLD14 SA is of the Cal run SA (at the Cal run time)



Note that one standard deviation is equal to ~ 0.73

The plot shows the two VOLD 14 runs around the CAL run. Ideally, each case would be a flat line. I highlighted the cases that correspond to “flat” lines. The other cases are either “V” or “A” shaped. Showing how different the SAs are at the CAL run time.

ONLY VOLD14 comparisons: from daily checks, two weeks and monthly checks. This comparison eliminates the differences between VOLD14 and the reference oils, focusing the discussion on the frequency that the data are collected



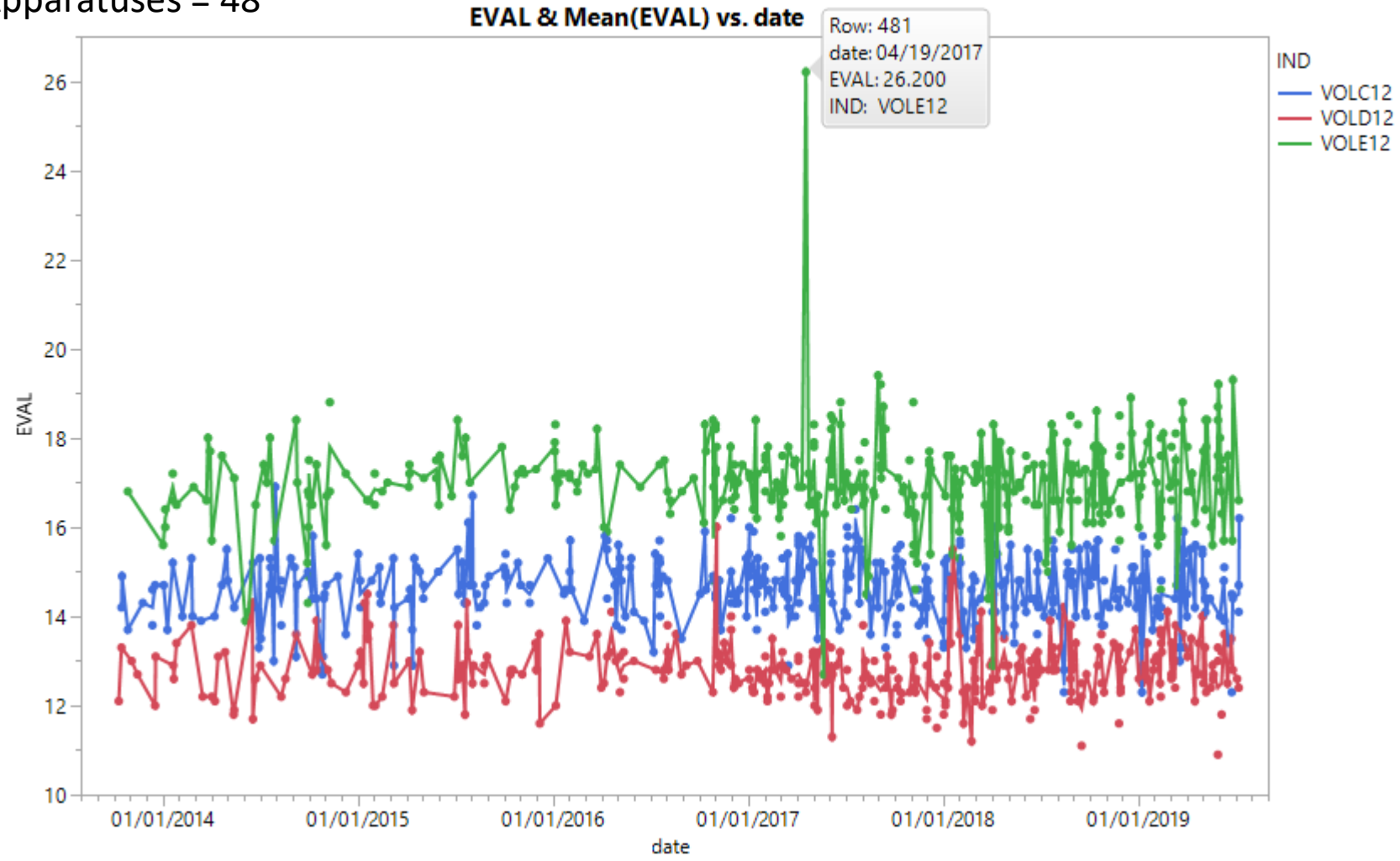
Appendix 2: Updated standard deviation

Summary

- After reviewing the most recent data, the statisticians would like to recommend that the LN transformation be applied to Evaporation Loss.
- After applying the LN transformation, the new standard deviation should be equal to 0.0465

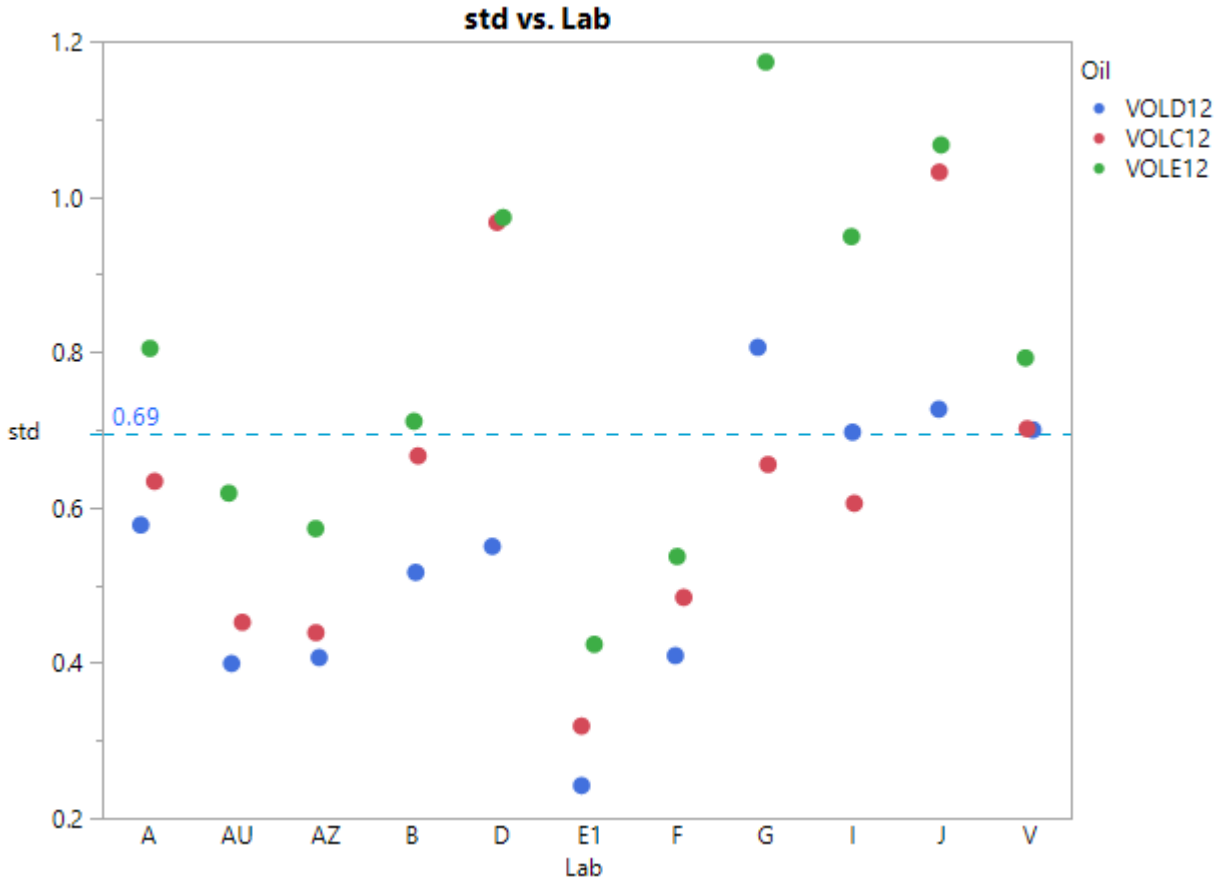
Updated Standard deviation

Data: 1,124 tests (file 07/09/2019); 10 2013 forward; chart =Yes
Apparatuses = 48



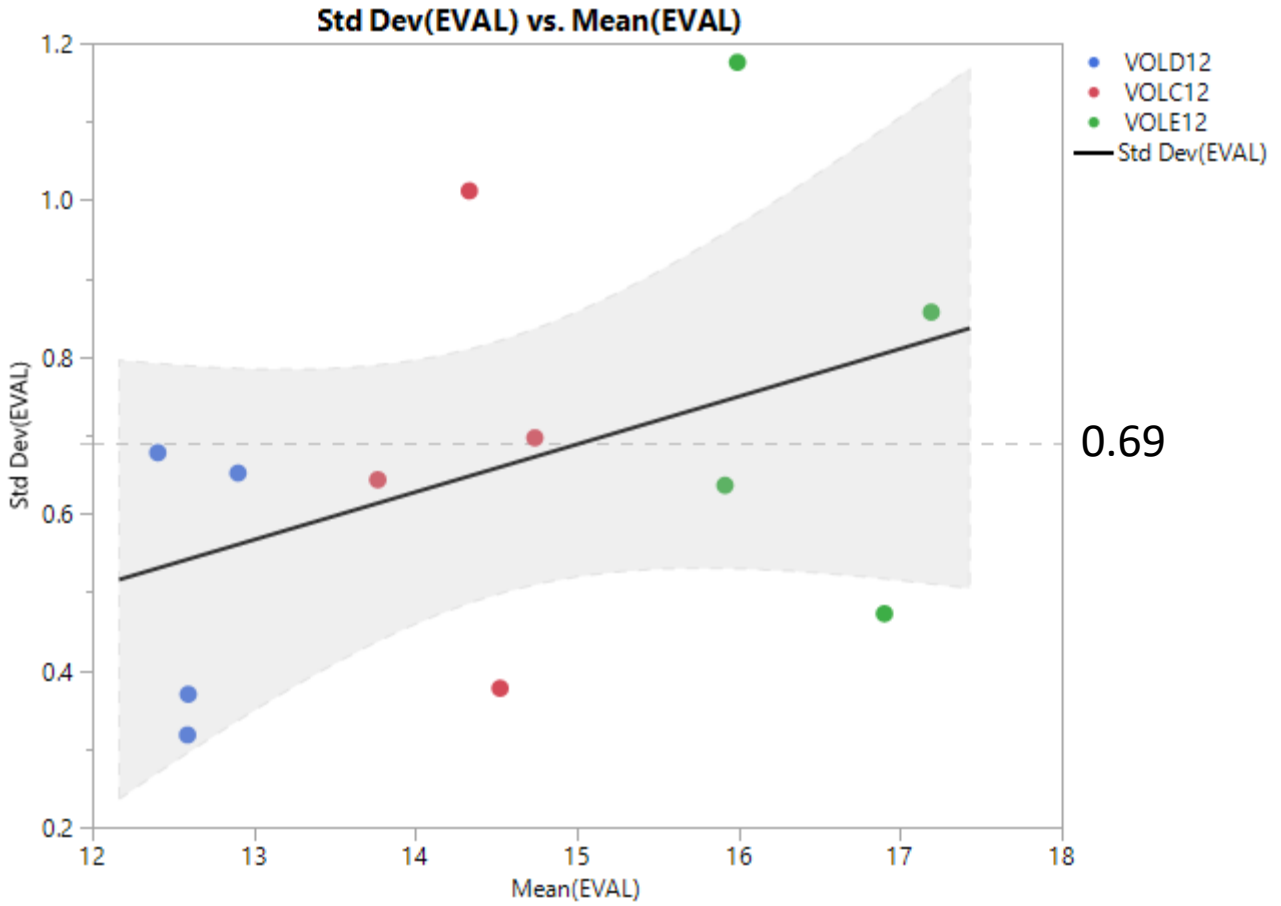
Standard deviation by Lab and Reference Oil Type

The line at 0.69 illustrates the calculated standard deviation without using a transformation



VOLC12 seems the closest to the pass/fail limit

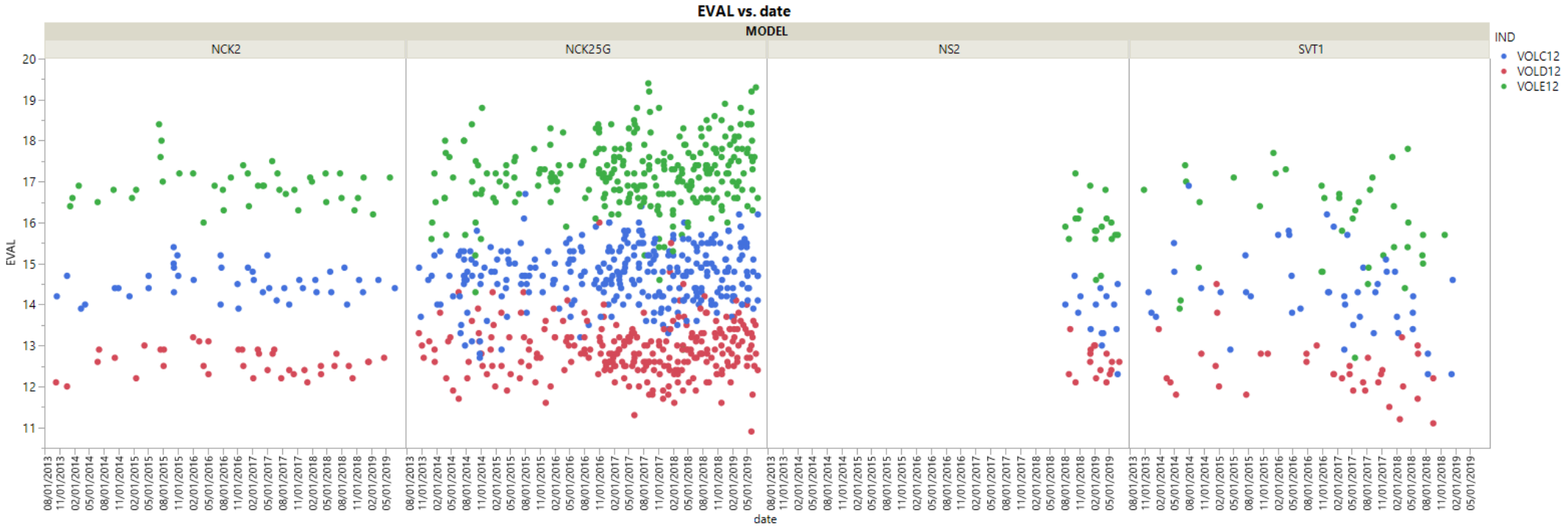
Variability increasing with Evaporation loss



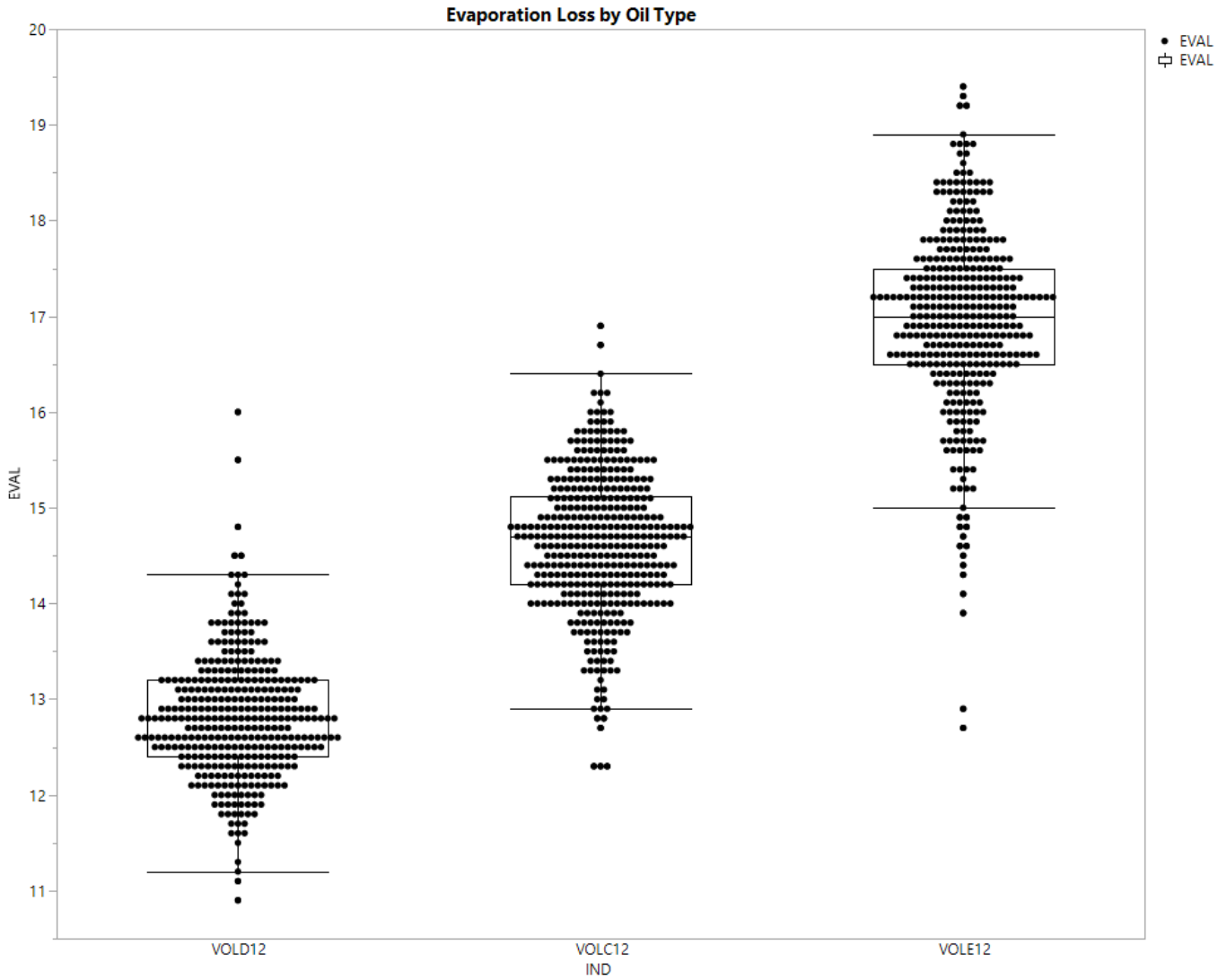
VOLC12 seems the closest to the pass/fail limit

Exploring the variability of the test by oil and model

Evaporation Loss by date, model and oil



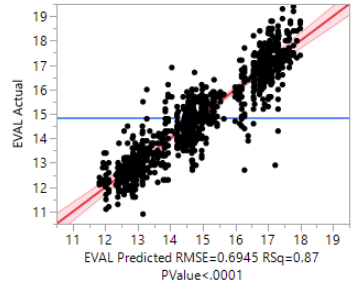
Evaporation Loss by Oil



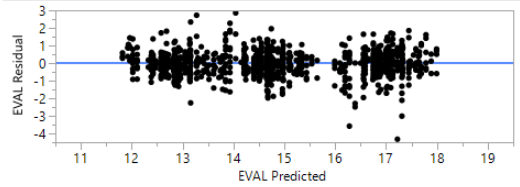
Model 1: Apparatus and Oil without transformation, excluded testkey 123872 (EVAL=26.2)

Response EVAL

Actual by Predicted Plot



Residual by Predicted Plot



Summary of Fit

RSquare	0.866031
RSquare Adj	0.859913
Root Mean Square Error	0.694468
Mean of Response	14.82342
Observations (or Sum Wgts)	1123

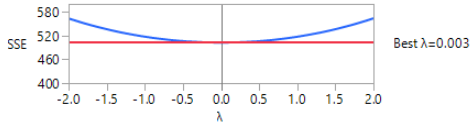
Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio
Model	49	3345.2814	68.2710	141.5573
Error	1073	517.4926	0.4823	Prob > F
C. Total	1122	3862.7741		<.0001*

Effect Tests

Source	Nparm	DF	Sum of Squares	F Ratio	Prob > F
APPARATS	47	47	186.8231	8.2419	<.0001*
IND	2	2	3142.1169	3257.526	<.0001*

Box-Cox Transformations

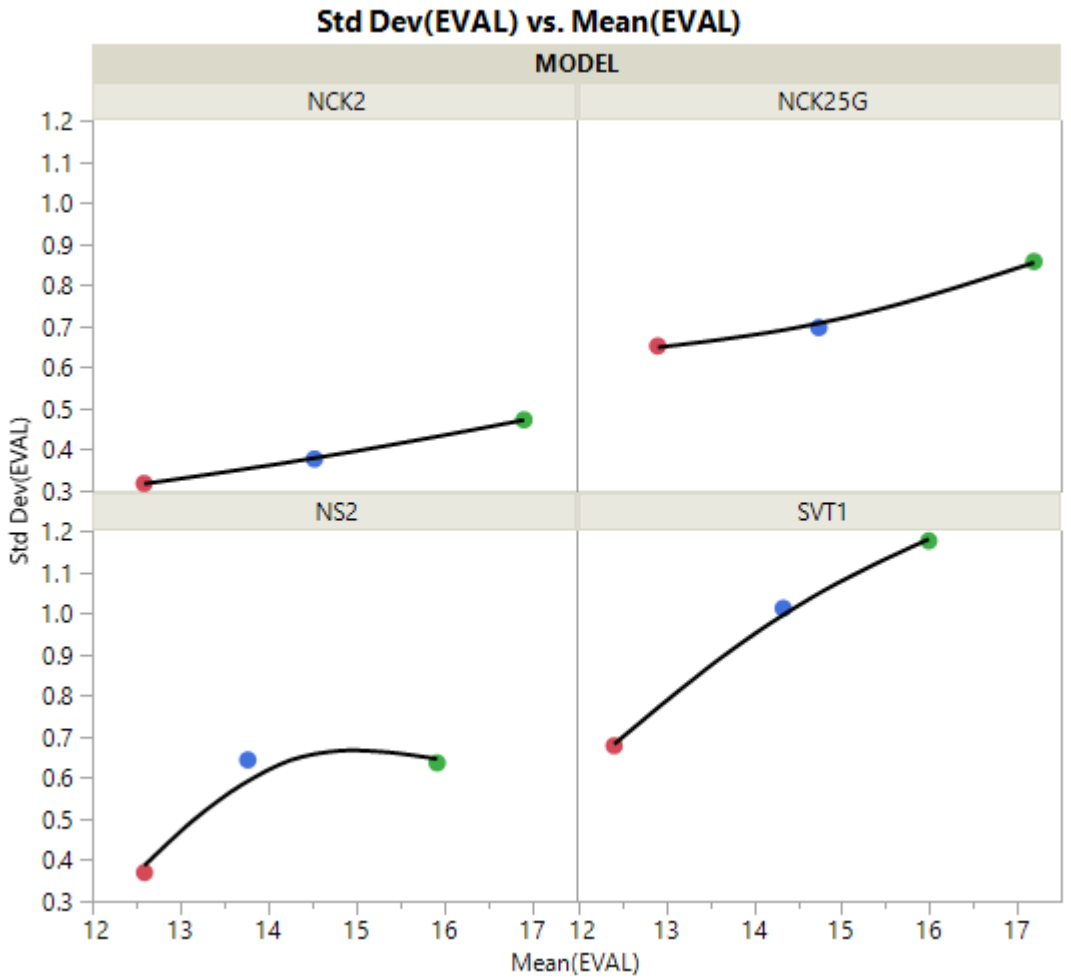


RMSE = 0.6945 compared to 0.73 (the current standard deviation)

LN transformation seems proper according to the Box-Cox method

	MODEL	N Rows
1	NCK2	121
2	NCK25G	831
3	NS2	50
4	SVT1	121

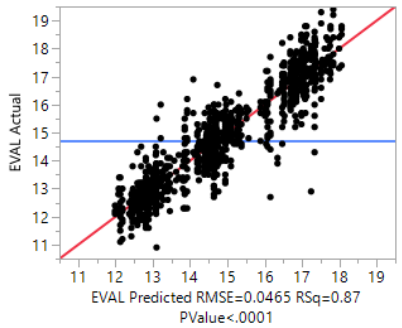
Variability seems to increase with the mean of Evaporation loss, indicating the need of a transformation for Evaporation loss.



MODEL	IND	N Rows	Mean(EVAL)	Std Dev(EVAL)
NCK2	VOLC12	42	14.5238	0.37729
NCK2	VOLD12	38	12.5895	0.31775
NCK2	VOLE12	41	16.9024	0.47249
NCK25G	VOLC12	296	14.7389	0.69673
NCK25G	VOLD12	265	12.9019	0.65183
NCK25G	VOLE12	270	17.1922	0.8571
NS2	VOLC12	15	13.7667	0.64328
NS2	VOLD12	16	12.5938	0.36963
NS2	VOLE12	19	15.9158	0.63619
SVT1	VOLC12	45	14.3333	1.01175
SVT1	VOLD12	36	12.4056	0.67779
SVT1	VOLE12	40	15.9925	1.17569

Response Log(EVAL)

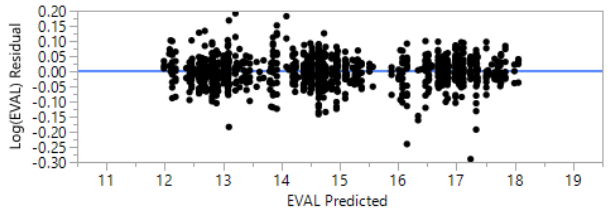
Actual by Predicted Plot



Lack Of Fit

Source	DF	Sum of Squares	Mean Square	F Ratio
Lack Of Fit	91	0.2699745	0.002967	1.4187
Pure Error	982	2.0535860	0.002091	Prob > F
Total Error	1073	2.3235605		0.0080*
				Max RSq
				0.8825

Residual by Predicted Plot



Summary of Fit

RSquare	0.867059
RSquare Adj	0.860988
Root Mean Square Error	0.046535
Mean of Response	2.688417
Observations (or Sum Wgts)	1123

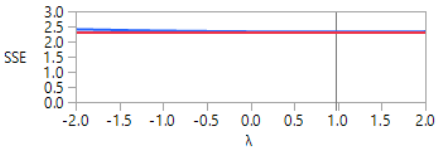
Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio
Model	49	15.154542	0.309276	142.8211
Error	1073	2.323560	0.002165	Prob > F
C. Total	1122	17.478102		<.0001*

Effect Tests

Source	Nparm	DF	Sum of Squares	F Ratio	Prob > F
APPARATS	47	47	0.830275	8.1577	<.0001*
IND	2	2	14.246743	3289.511	<.0001*

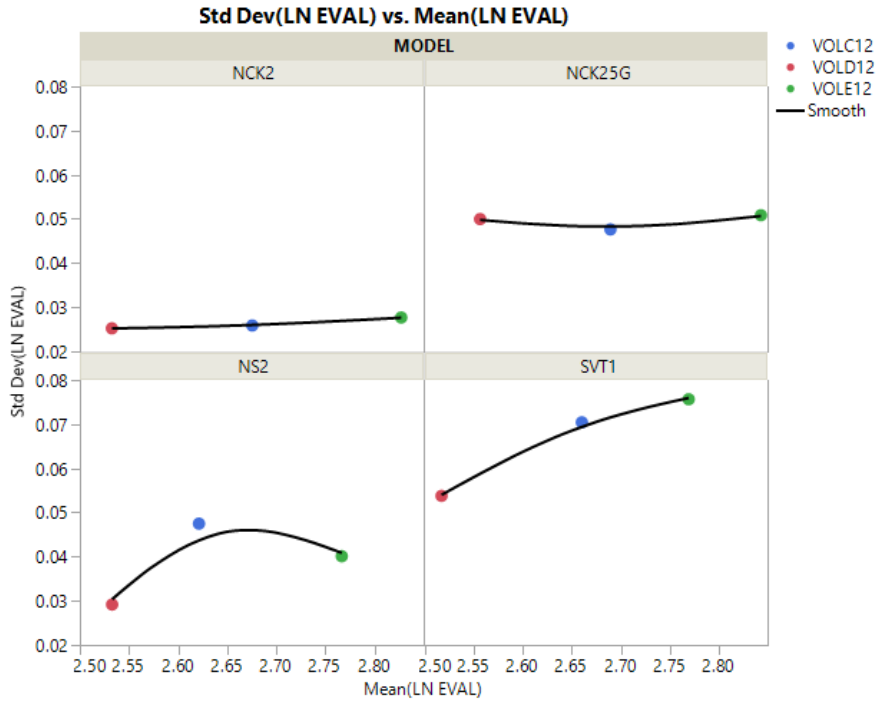
Box-Cox Transformations



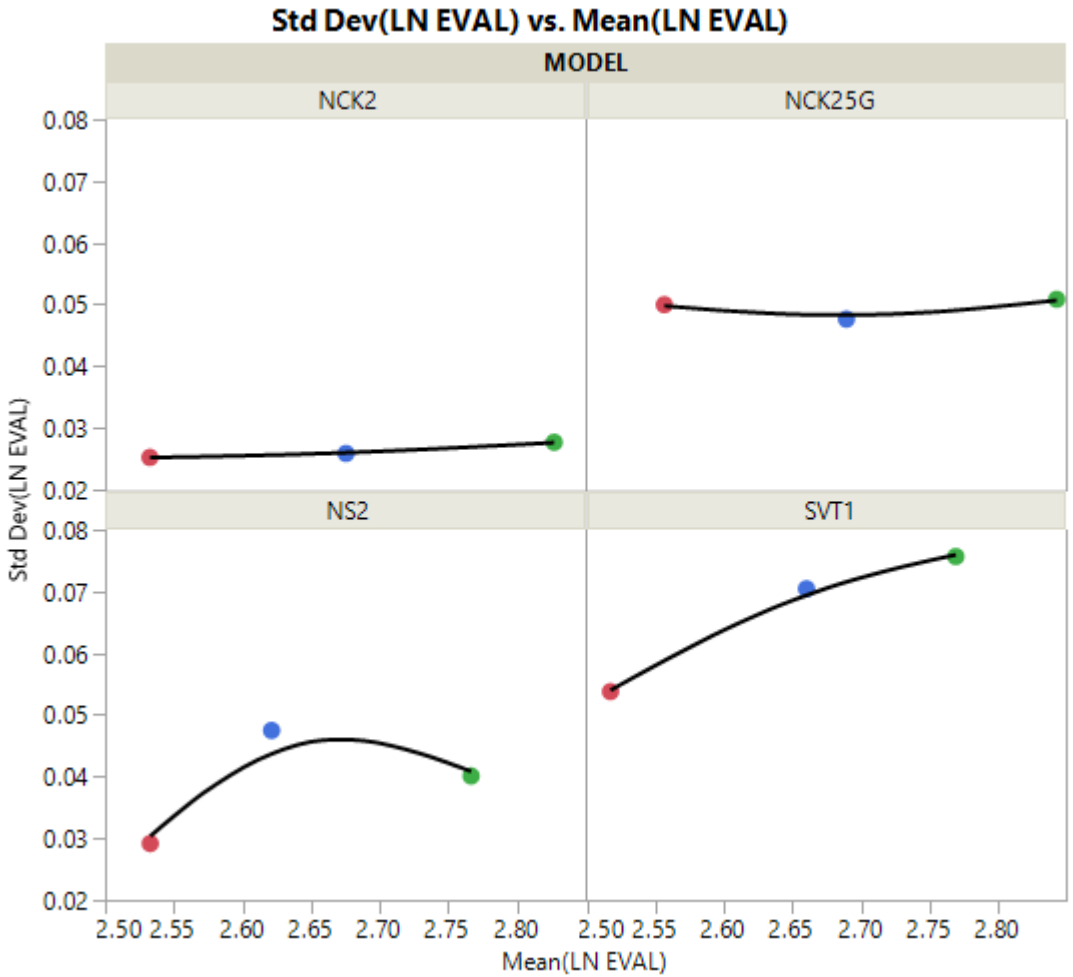
Model 2: Apparatus and Oil with LN transformation excluded testkey 123872 (EVAL=26.2)

RMSE = 0.0465 is the recommended standard deviation

LN transformation seems proper according to the Box-Cox method (more details in the next slide)



After the transformation, as desired, the variability is constant for NCK2 and NCK25G models – most of the test data. NS2 does not change. The variability for SVT1 does not increase as fast.



MODEL	IND	N Rows	Mean(LN EVAL)	Std Dev(LN EVAL)
NCK2	VOLC12	42	2.6755	0.0259
NCK2	VOLD12	38	2.5326	0.0252
NCK2	VOLE12	41	2.8271	0.0277
NCK25G	VOLC12	296	2.6894	0.0476
NCK25G	VOLD12	265	2.5561	0.05
NCK25G	VOLE12	270	2.8432	0.0509
NS2	VOLC12	15	2.6212	0.0475
NS2	VOLD12	16	2.5328	0.0292
NS2	VOLE12	19	2.7666	0.0401
SVT1	VOLC12	45	2.6602	0.0704
SVT1	VOLD12	36	2.5167	0.0538
SVT1	VOLE12	40	2.7694	0.0757