T13 RO823 & RO823-1 Re-blend Data Analysis

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Executive Summary

- The LTMS data for both Sqrt(KV40) and IRPH parameters have been mild of target since the beginning of the test in 2015
- Analysis of data with new control strategy reveals that Lab, Stand[Lab], Reference Oil Re-blend (823 & 823-1), Liner/Rod Bearing hardware factors are not statistically significant (at $p \leq 0.05$ significance threshold)
- Recommend updating the Reference Oil Targets (823/823-1) to the values listed below:

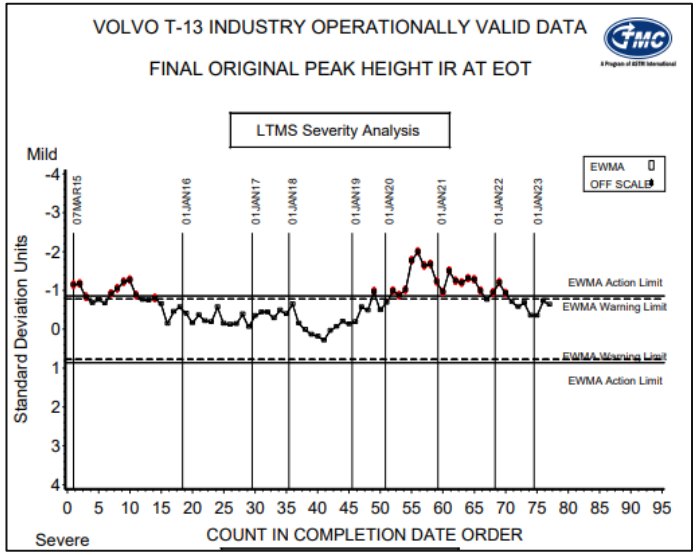
Test Parameter	LSMeans RO Target	RO StdDev	Sp
IRPH	118.8	14.6	14.6
Sqrt(KV40)	7.447	0.854	0.854

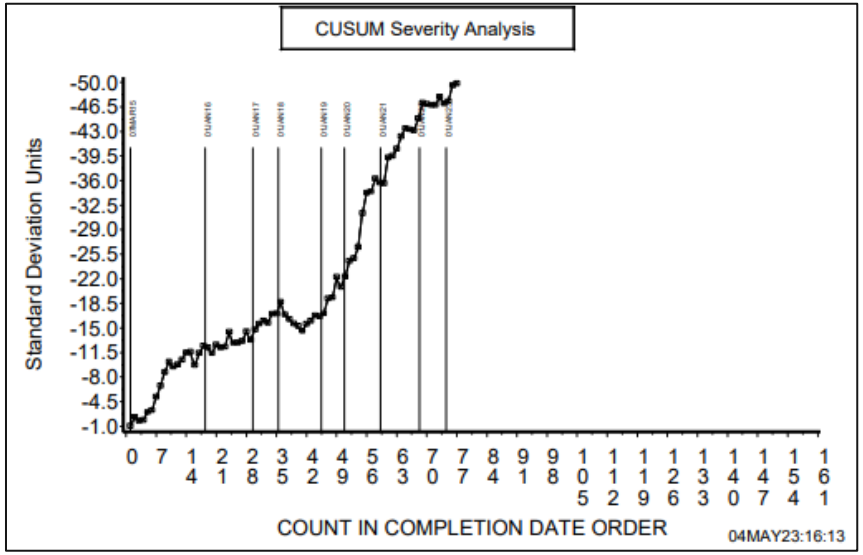
- The Surveillance Panel shall review and select the best option - for implementing the new targets and calculating the corresponding severity adjustments.
- A follow up data analysis should be performed after at least n = 10 test results have been completed to re-evaluate liner/bearing hardware effects & reference oil targets

T13 - IRPH & Sqrt(KV40) Trend History & Analysis Dataset Review

T13 Trend History & Analysis Dataset Review

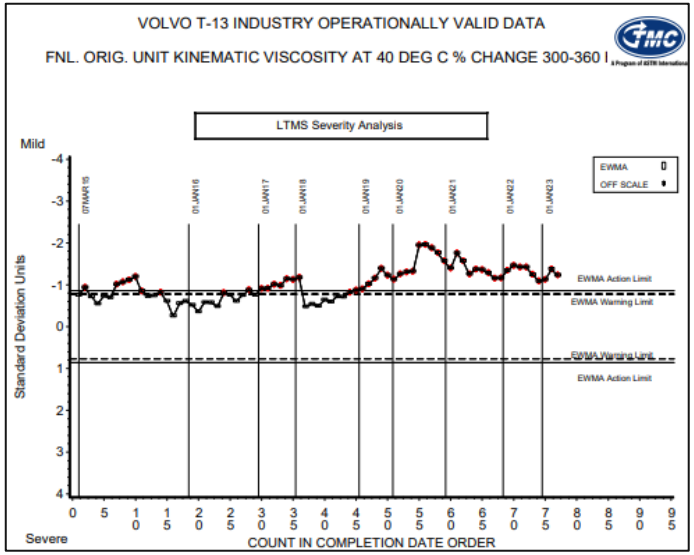
- LTMS Charts - Peak Height IR Trend:
  - Both EWMA and CUSUM plots show that the Peak Height IR parameter has been trending mild of target – since the beginning of the test in 2015

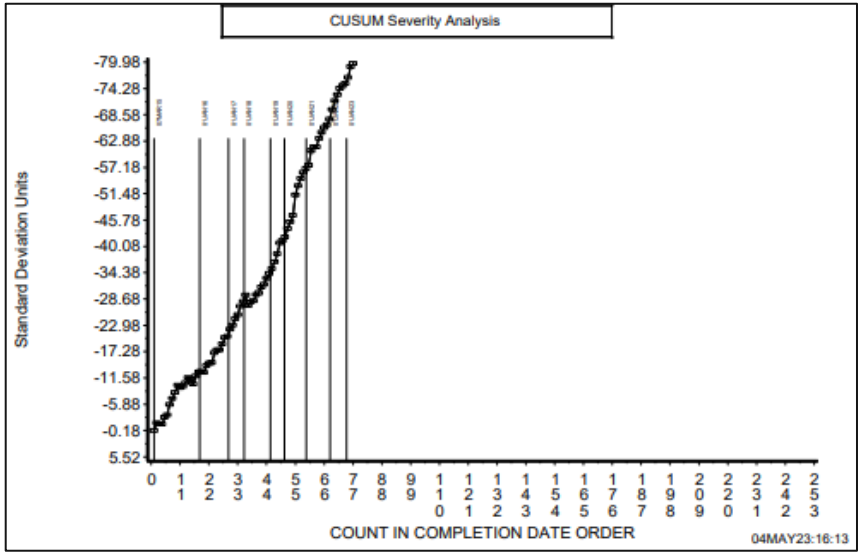




T13 Trend History & Analysis Dataset Review

- LTMS Charts - Sqrt(KV40 Increase) Trend:
  - Both EWMA and CUSUM plots show that the Sqrt(KV40 Increase) parameter has been trending mild of target - since the beginning of the test in 2015





T13 Trend History & Analysis Dataset Review

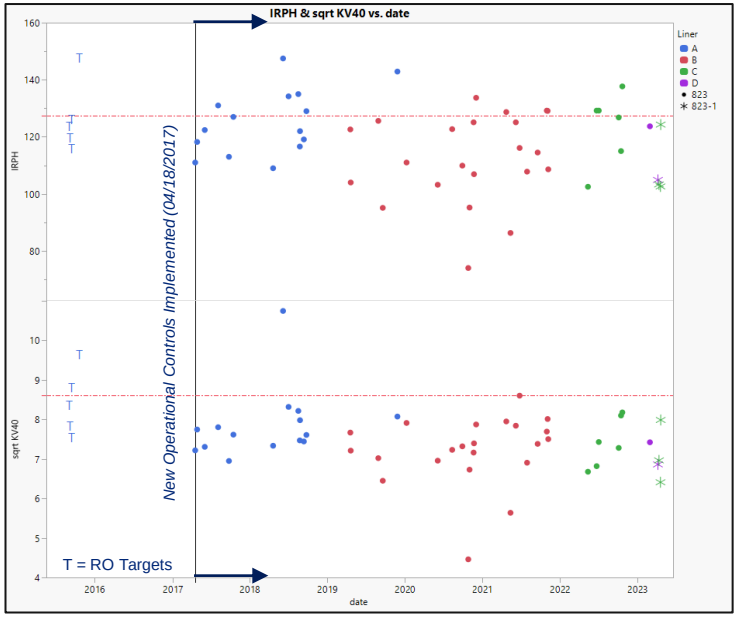
- In 2017, the Surveillance Panel added operational control limits/parameters to improve test precision / repeatability – *to ensure that all labs are running the same test*. These modifications included the following:
  - Dynamometer Load Control: "*Fuel Flow*"
  - Humidity Control: "Yes"
  - Coolant Filter Usage: *"Only Once"*

- Data reviewed/ analyzed from this point forward will only include this subset of the data *(starting on April 18, 2017)*

T13 Trend History & Analysis Dataset Review

- Below plot shows all Chart = “Y” for Reference Oils 823 and 823-1 data:
  - Vertical line indicates implementation of the new operational controls *(04/18/2017)*
    - *Shift in performance appears to have occurred when all labs adopted the same operational controls*
  - *Follow-on analysis dataset will include:*
    - *Chartable = “Y”*
    - *Test Completion Date ≥ 04/18/17*
    - *RO823 & RO823-1*
    - *n = 50*
    - *Total Liner/Rod Bearing Batch Count*
      - *(2) results are without Hardware IDs*
      - *Only (2) results on new liner batch “D”*
        - *(1) RO823 result & (1) RO823-1 result*

LINER	Liner/ROD BEARING	IND 2	N
A	A/B	823	14
	A/PNB3	823	1
B	B/PNB3	823	22
C	C/PNB3	823	6
		823-1	3
D	D/PNB3	823	1
		823-1	1

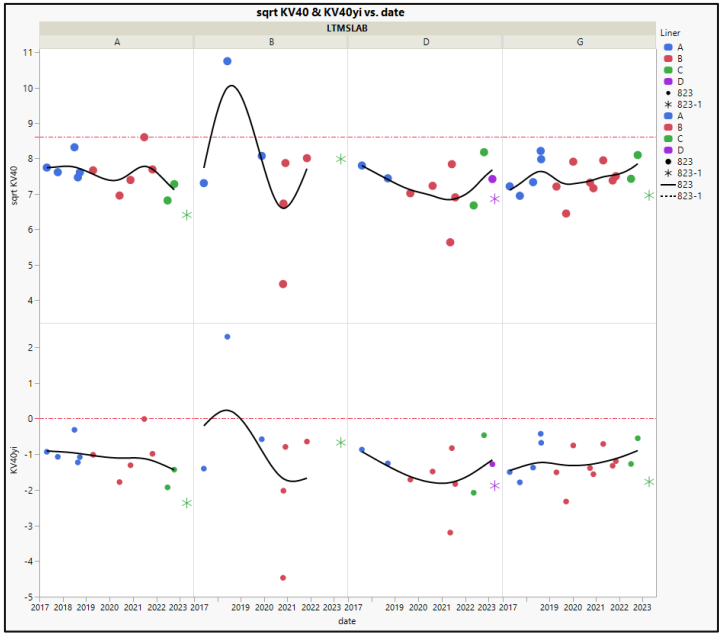


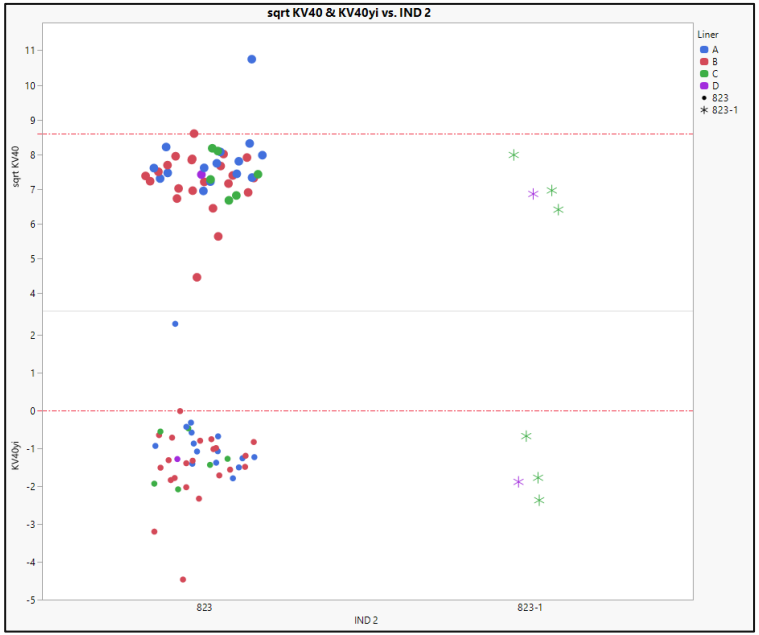
T13 Trend History & Analysis Dataset Review

- Sqrt(KV40 Increase) Parameter Analysis Dataset is shown below *(Date ≥ 04/18/17)*
  - Plot indicates that a high proportion of the data is mild/below the target value
  - RO823-1 appears within the same range of results as RO823

RO Target

RO Target



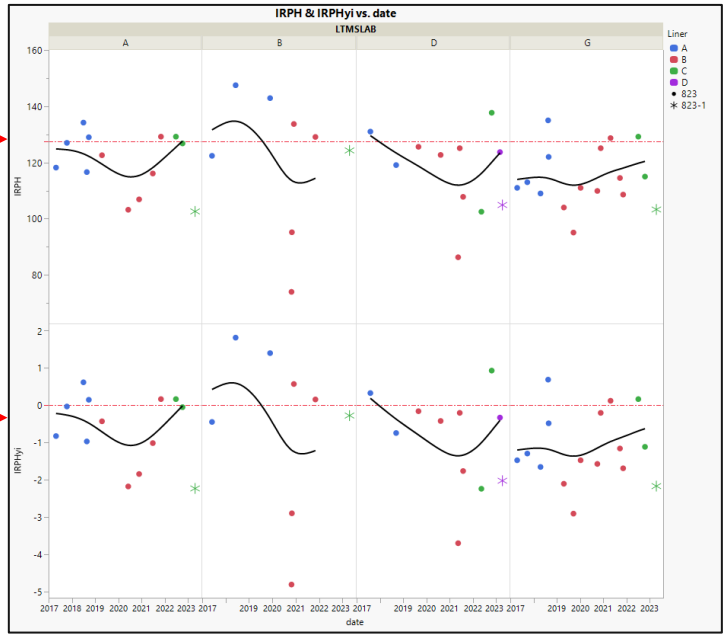


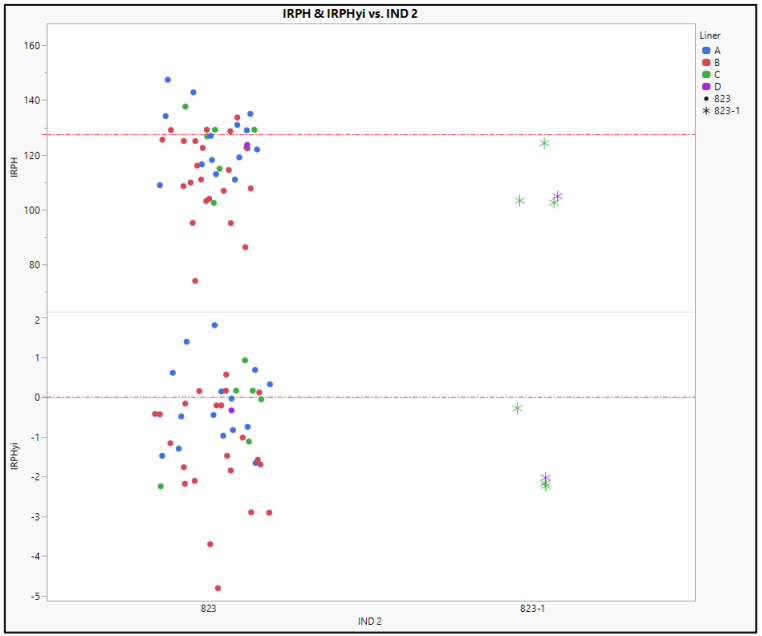
T13 Trend History & Analysis Dataset Review

- IRPH Parameter Analysis Dataset is shown below *(Date ≥ 04/18/17)*
  - Similar plot indicating that a high proportion of the data is mild/below the target value
  - RO823-1 appears within the same range of results as RO823

RO Target

RO Target

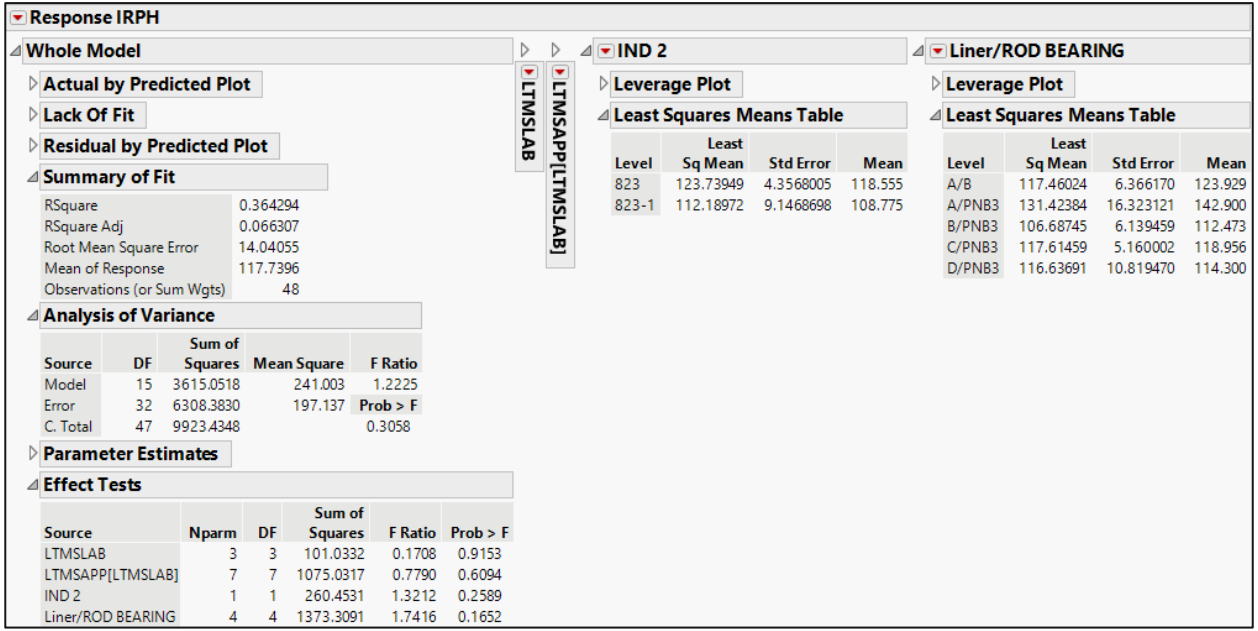




T13 Data Analysis – with emphasis on RO823/RO823-1 Targets

T13 Data Analysis (RO823/RO823-1 Targets)

- T13 – IRPH ANOVA for Model 1 Factors:
  - Factors include Lab, Stand[Lab], Oil, Liner/Rod (n = 48 *[50 w/2 results of unknown hardware]*)
  - Analysis results indicate no significant effects of factors in model *(at the 5% threshold)*



Response IRPH

Whole Model

Actual by Predicted Plot

Lack Of Fit

Residual by Predicted Plot

Summary of Fit

RSquare	0.364294
RSquare Adj	0.066307
Root Mean Square Error	14.04055
Mean of Response	117.7396
Observations (or Sum Wgts)	48

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio
Model	15	3615.0518	241.003	1.2225
Error	32	6308.3830	197.137	Prob > F
C. Total	47	9923.4348		0.3058

Parameter Estimates

Effect Tests

Source	Nparm	DF	Sum of Squares	F Ratio	Prob > F
LTMSLAB	3	3	101.0332	0.1708	0.9153
LTMSAPP[LTMSLAB]	7	7	1075.0317	0.7790	0.6094
IND 2	1	1	260.4531	1.3212	0.2589
Liner/ROD BEARING	4	4	1373.3091	1.7416	0.1652

LTMSLAB

LTMSAPP[LTMSLAB]

IND 2

Leverage Plot

Least Squares Means Table

Level	Least Sq Mean	Std Error	Mean
823	123.73949	4.3568005	118.555
823-1	112.18972	9.1468698	108.775

Liner/ROD BEARING

Leverage Plot

Least Squares Means Table

Level	Least Sq Mean	Std Error	Mean
A/B	117.46024	6.366170	123.929
A/PNB3	131.42384	16.323121	142.900
B/PNB3	106.68745	6.139459	112.473
C/PNB3	117.61459	5.160002	118.956
D/PNB3	116.63691	10.819470	114.300

T13 Data Analysis (RO823/RO823-1 Targets)

- T13 – IRPH ANOVA Model Summary:
  - LSMeans, *p* values, VIF max, & RMSE model based highlights are shown in below table
  - None of the Lab, Oil, hardware factors in any of the 6 models achieve a significance of 5%

IRPH Model Table											
ANOVA Summary	LAB Effect *p* value	Stand[Lab] Effect *p* value	Oil Effect *p* value	Liner/Rod Brg Effect *p* value	Hardware Model Term	RO823 LSMeans	RO823-1 LSMeans	RO823-X LSMeans	Overall RMSE	Max Coef VIF	n
Model 1	0.9153	0.6094	0.2589	0.1652	Rod Bearing & Liner	123.7	112.2		14.0	2.535	48*
Model 2	0.8540	0.5667	0.2534	0.1218	Liner	120.7	109.1		14.0	2.473	48*
Model 3	0.6450		0.0855	0.0516	Liner	121.7	106.0		13.8	2.186	48*
Model 4	0.7439			0.0875	Liner			118.1	14.1	2.120	48*
Model 5	0.4281		0.1538			119.7	108.8		14.4	1.788	50*
Model 6	**0.4698**							**118.8**	**14.6**	**1.790**	**50***

- Supplemental analysis related information:
  - Should we have a separate target for the RO823-1 re-blend?
    - As reported by the TMC, the Oil Supplier indicates that RO823-1 & RO823 formulations are identical
    - At the 5% significance, there's a lack of statistical evidence for a shift in IRPH test results with the re-blend in the above table
    - *Conclusion: Reference Oils 823 & 823-1 should have the same IRPH targets*

T13 Data Analysis (RO823/RO823-1 Targets)

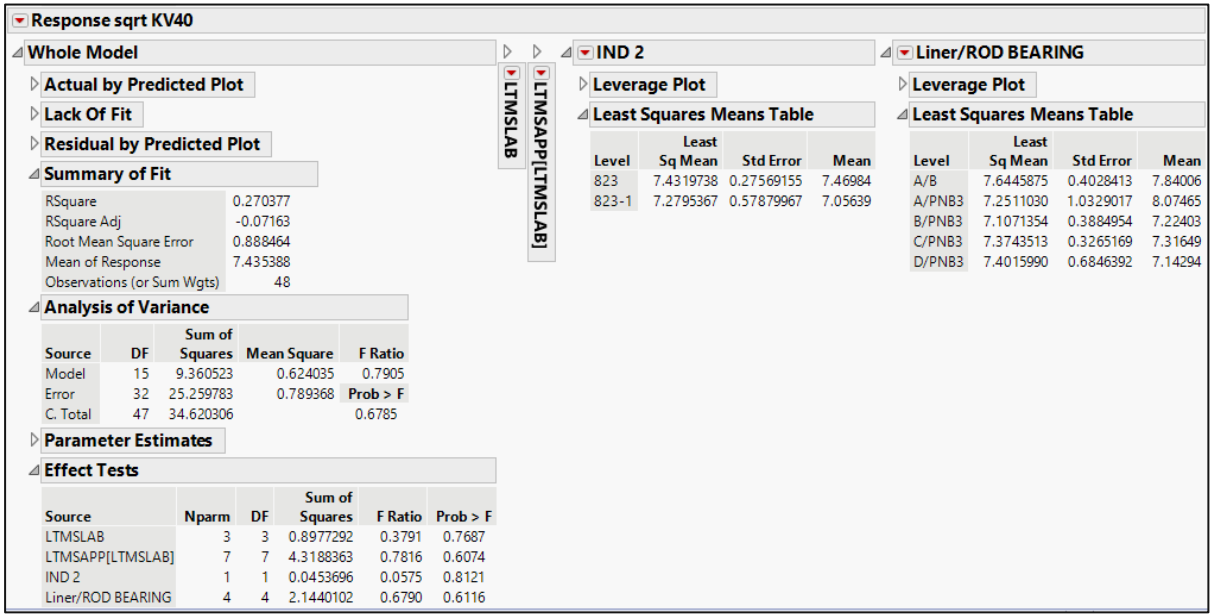
- Supplemental analysis related information (continued):
  - Should a correction factor be applied to the IRPH parameter?
    - *No* - for the following reasons:
      - The IRPH parameter test results have been mild since the beginning of the T13 test in 2015 – indicating that the targets were set incorrectly
      - We also have 50 test results – post PM with the improved T13 control strategy *(Dynamometer Load Control, Humidity Control, and Coolant Filter Usage). This data should be used to develop new targets.*

- Recommended RO823/RO823-1 targets for the T13's IRPH parameter:
  - *Use "Model 6" on previous slide – with Lab factor only model & n = 50 to establish reference oil targets:*
    - *LSMeans = 118.8* *(Originally = 127.4)*
    - *StDev & S_p = 14.6*[1] *(Originally = 11.1)*

Note 1: Based on the Lab factor model RMSE with (n = 50) test results with completion dates ≥ 04/18/2017

T13 Data Analysis (RO823/RO823-1 Targets)

- T13 – Sqrt(KV40) ANOVA for Model 1 Factors:
  - Factors include Lab, Stand[Lab], Oil, Liner/Rod (n = 48 *[50 w/2 results of unknown hardware]*)
  - Analysis results indicate no significant effects of factors in model



Response sqrt KV40

Whole Model

Actual by Predicted Plot

Lack Of Fit

Residual by Predicted Plot

Summary of Fit

RSquare	0.270377
RSquare Adj	-0.07163
Root Mean Square Error	0.888464
Mean of Response	7.435388
Observations (or Sum Wgts)	48

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio
Model	15	9.360523	0.624035	0.7905
Error	32	25.259783	0.789368	Prob > F
C. Total	47	34.620306		0.6785

Parameter Estimates

Effect Tests

Source	Nparm	DF	Sum of Squares	F Ratio	Prob > F
LTMSLAB	3	3	0.8977292	0.3791	0.7687
LTMSAPP[LTMSLAB]	7	7	4.3188363	0.7816	0.6074
IND 2	1	1	0.0453696	0.0575	0.8121
Liner/ROD BEARING	4	4	2.1440102	0.6790	0.6116

LTMSLAB

LTMSAPP[LTMSLAB]

IND 2

Leverage Plot

Least Squares Means Table

Level	Least Sq Mean	Std Error	Mean
823	7.4319738	0.27569155	7.46984
823-1	7.2795367	0.57879967	7.05639

Liner/ROD BEARING

Leverage Plot

Least Squares Means Table

Level	Least Sq Mean	Std Error	Mean
A/B	7.6445875	0.4028413	7.84006
A/PNB3	7.2511030	1.0329017	8.07465
B/PNB3	7.1071354	0.3884954	7.22403
C/PNB3	7.3743513	0.3265169	7.31649
D/PNB3	7.4015990	0.6846392	7.14294

T13 Data Analysis (RO823/RO823-1 Targets)

- T13 – Sqrt(KV40) Model Summary:
  - LSMeans, *p* values, VIF max, & RMSE model based highlights are shown in below table
  - None of the Lab, Oil, hardware factors in any of the 6 models achieve a significance of 5%

Sqrt(KV40) Model Table											
ANOVA Summary	LAB Effect *p* value	Stand[Lab] Effect *p* value	Oil Effect *p* value	Liner/Rod Brg Effect *p* value	Hardware Model Term	RO823 LSMeans	RO823-1 LSMeans	RO823-X LSMeans	Overall RMSE	Max Coef VIF	n
Model 1	0.7687	0.6074	0.8121	0.6116	Rod Bearing & Liner	7.432	7.280		0.888	2.535	48*
Model 2	0.7773	0.6086	0.8127	0.4630	Liner	7.448	7.300		0.877	2.473	48*
Model 3	0.7787		0.4069	0.2385	Liner	7.543	7.077		0.860	2.186	48*
Model 4	0.8479			0.2180	Liner			7.436	0.857	2.120	48*
Model 5	0.6415		0.3455			7.482	7.056		0.855	1.788	50*
Model 6	**0.6434**							**7.447**	**0.854**	**1.790**	**50***

- Supplemental analysis related information:
  - Should we have a separate target for the RO823-1 re-blend?
    - As reported by the TMC, the Oil Supplier indicates that RO823-1 & RO823 formulations are identical
    - At the 5% significance, there's a lack of statistical evidence for a shift in Sqrt(KV40) test results with the re-blend in the above table
    - *Conclusion: Reference Oils 823 & 823-1 should have the same Sqrt(KV40) targets*

T13 Data Analysis (RO823/RO823-1 Targets)

- Supplemental analysis related information (continued):
  - Should a correction factor be applied to the Sqrt(KV40) parameter?
    - *No* - for the following reasons:
      - The Sqrt(KV40) parameter test results have been mild since the beginning of the T13 test in 2015 – indicating that the targets were set incorrectly
      - We also have 50 test results – post PM with the improved T13 control strategy *(Dynamometer Load Control, Humidity Control, and Coolant Filter Usage). This data should be used to develop new targets.*

- Recommended RO823/RO823-1 targets for the T13's Sqrt(KV40) parameter:
  - *Use "Model 6" on previous slide – with Lab factor only model & n = 50 to establish reference oil targets:*
    - *LSMeans = 7.447* *(Originally = 8.610)*
    - *StDev & S_p = 0.854*[1] *(Originally = 0.929)*

Note 1: Based on the Lab factor model RMSE with (n = 50) test results with completion dates ≥ 04/18/2017

Summary

- T13 – Recommendations:
  - Update the RO823/RO823-1 Targets to the values listed in the below table:

Test Parameter	LSMeans RO Target	RO StdDev	Sp
IRPH	118.8	14.6	14.6
Sqrt(KV40)	7.447	0.854	0.854

  - A follow up data analysis should be performed after at least a total of n = 10 test results have been completed to re-evaluate liner/bearing hardware effects & reference oil targets

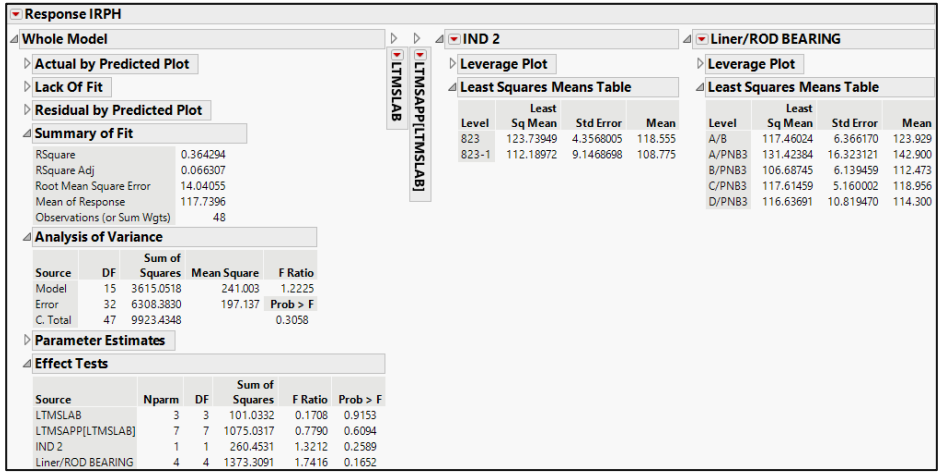
T13 Data Analysis (RO823/RO823-1 Targets)

- The Surveillance Panel can choose from the below list of options - for implementing the new targets and calculating the corresponding Lab based severity adjustments:
  - Option 1:
    - Calculate the Lab based SA's – with a (Z_0) start date of April 18, 2017
    - Using the historical data since April 2017 to update the severity adjustments is consistent with the target and standard deviation updates
  - Option 2:
    - Calculate the Lab based SA's with Z_0 = average of the (2) most recent test results
      - It will include (1) RO823 & (1) 823-1 test result
  - Option 3:
    - Calculate the Lab based SA's – with updated targets being applied to the new 823-1 test result data

Appendix – All Models & Raw Standard Deviation Summaries

T13 Data Analysis (823-X Targets)

- T13 ANOVA – Model 1:
  - Model factors include Lab, Stand[Lab], Oil, and Liner/Bearing Hardware (n = 48)



Response IRPH

Whole Model

Actual by Predicted Plot

Lack Of Fit

Residual by Predicted Plot

Summary of Fit

RSquare	0.364294
RSquare Adj	0.066307
Root Mean Square Error	14.04055
Mean of Response	117.7396
Observations (or Sum Wgts)	48

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio
Model	15	3615.0518	241.003	1.2225
Error	32	6308.3830	197.137	Prob > F
C. Total	47	9923.4348		0.3058

Parameter Estimates

Effect Tests

Source	Nparm	DF	Sum of Squares	F Ratio	Prob > F
LTMSLAB	3	3	101.0332	0.1708	0.9153
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LTMSLAB

LTMSAPP[LTMSLAB]

IND 2

Leverage Plot

Least Squares Means Table

Level	Least Sq Mean	Std Error	Mean
823	123.73949	4.3568005	118.555
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Liner/ROD BEARING

Leverage Plot

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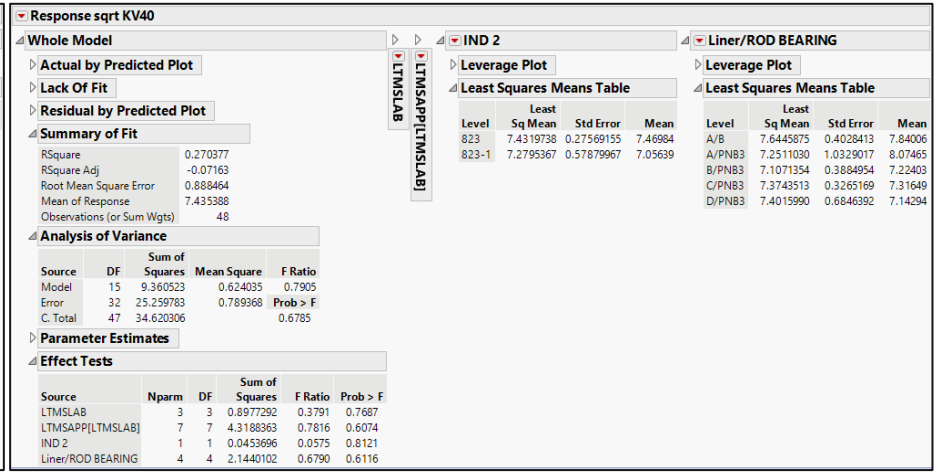

Response sqrt KV40

Whole Model

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Lack Of Fit

Residual by Predicted Plot

Summary of Fit

RSquare	0.270377
RSquare Adj	-0.07163
Root Mean Square Error	0.888464
Mean of Response	7.435388
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Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio
Model	15	9.360523	0.624035	0.7905
Error	32	25.259783	0.789368	Prob > F
C. Total	47	34.620306		0.6785

Parameter Estimates

Effect Tests

Source	Nparm	DF	Sum of Squares	F Ratio	Prob > F
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LTMSLAB

LTMSAPP[LTMSLAB]

IND 2

Leverage Plot

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Level	Least Sq Mean	Std Error	Mean
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823-1	7.2795367	0.57879967	7.05639

Liner/ROD BEARING

Leverage Plot

Least Squares Means Table

Level	Least Sq Mean	Std Error	Mean
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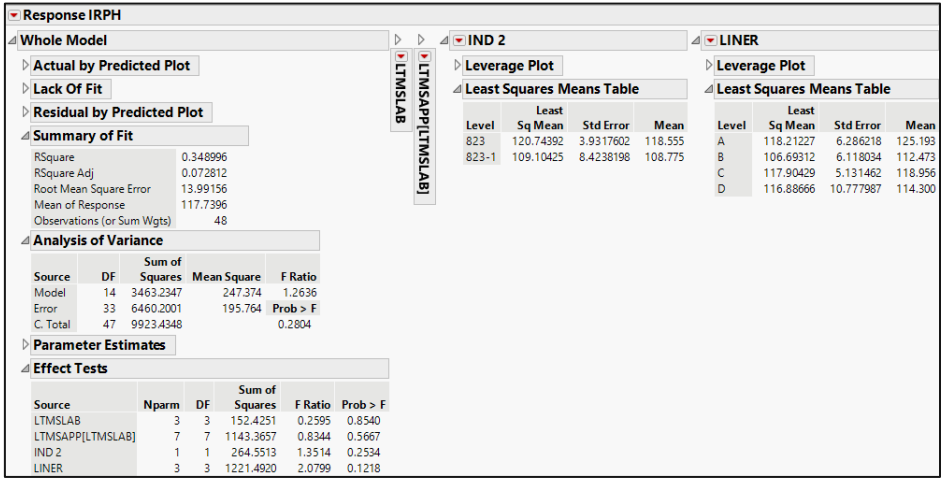
A/PNB3	7.2511030	1.0329017	8.07465
B/PNB3	7.1071354	0.3884954	7.22403
C/PNB3	7.3743513	0.3265169	7.31649
D/PNB3	7.4015990	0.6846392	7.14294

T13 Data Analysis (823-X Targets)

- T13 ANOVA – Model 2:
  - Model factors include Lab, Stand[Lab], Oil, and Liner Hardware (n = 48)



Response IRPH

Whole Model

Actual by Predicted Plot

Lack Of Fit

Residual by Predicted Plot

Summary of Fit

RSquare	0.348996
RSquare Adj	0.072812
Root Mean Square Error	13.99156
Mean of Response	117.7396
Observations (or Sum Wgts)	48

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio
Model	14	3463.2347	247.374	1.2636
Error	33	6460.2001	195.764	Prob > F
C. Total	47	9923.4348		0.2804

Parameter Estimates

Effect Tests

Source	Nparm	DF	Sum of Squares	F Ratio	Prob > F
LTMSLAB	3	3	152.4251	0.2595	0.8540
LTMSAPP[LTMSLAB]	7	7	1143.3657	0.8344	0.5667
IND 2	1	1	264.5513	1.3514	0.2534
LINER	3	3	1221.4920	2.0799	0.1218

LTMSLAB

LTMSAPP[LTMSLAB]

IND 2

Leverage Plot

Least Squares Means Table

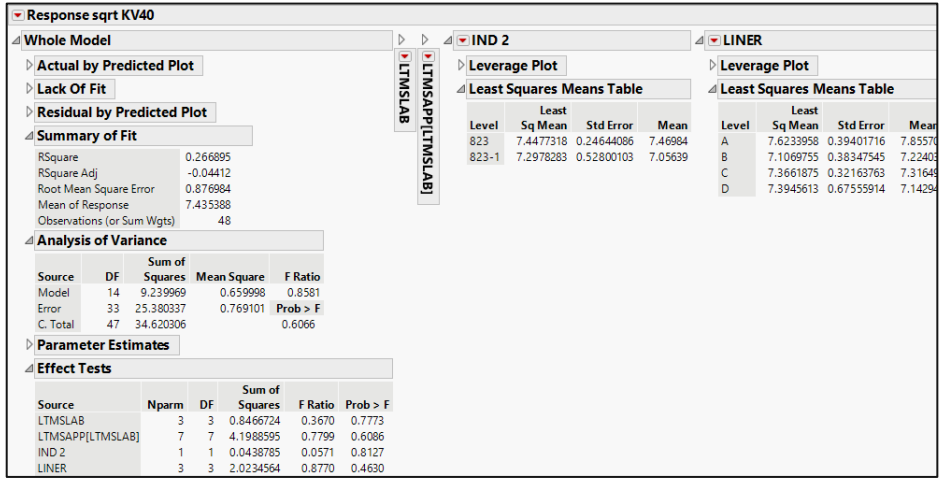
Level	Least Sq Mean	Std Error	Mean
823	120.74392	3.9317602	118.555
823-1	109.10425	8.4238198	108.775

LINER

Leverage Plot

Least Squares Means Table

Level	Least Sq Mean	Std Error	Mean
A	118.21227	6.286218	125.193
B	106.69312	6.118034	112.473
C	117.90429	5.131462	118.956
D	116.88666	10.777987	114.300



Response sqrt KV40

Whole Model

Actual by Predicted Plot

Lack Of Fit

Residual by Predicted Plot

Summary of Fit

RSquare	0.266895
RSquare Adj	-0.04412
Root Mean Square Error	0.876984
Mean of Response	7.435388
Observations (or Sum Wgts)	48

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio
Model	14	9.239969	0.659998	0.8581
Error	33	25.380337	0.769101	Prob > F
C. Total	47	34.620306		0.6066

Parameter Estimates

Effect Tests

Source	Nparm	DF	Sum of Squares	F Ratio	Prob > F
LTMSLAB	3	3	0.8466724	0.3670	0.7773
LTMSAPP[LTMSLAB]	7	7	4.1988595	0.7799	0.6086
IND 2	1	1	0.0438785	0.0571	0.8127
LINER	3	3	2.0234564	0.8770	0.4630

LTMSLAB

LTMSAPP[LTMSLAB]

IND 2

Leverage Plot

Least Squares Means Table

Level	Least Sq Mean	Std Error	Mean
823	7.4477318	0.24644086	7.46984
823-1	7.2978283	0.52800103	7.05639

LINER

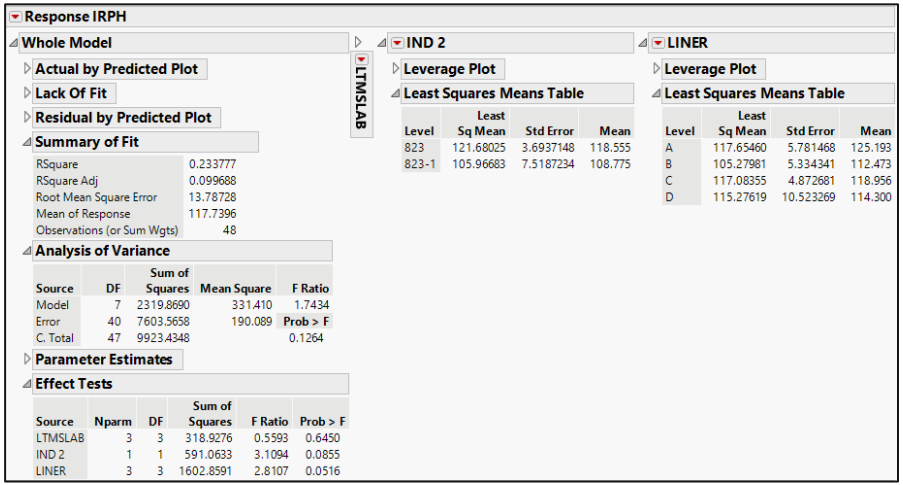
Leverage Plot

Least Squares Means Table

Level	Least Sq Mean	Std Error	Mean
A	7.6233958	0.39401716	7.8557
B	7.1069755	0.38347545	7.2240
C	7.3661875	0.32163763	7.3164
D	7.3945613	0.67555914	7.1429

T13 Data Analysis (823-X Targets)

- T13 ANOVA – Model 3:
  - Model factors include Lab, Oil Re-blend, & Liner Hardware (n = 48)



Response IRPH

Whole Model

Actual by Predicted Plot

Lack Of Fit

Residual by Predicted Plot

Summary of Fit

RSquare	0.233777
RSquare Adj	0.099688
Root Mean Square Error	13.78728
Mean of Response	117.7396
Observations (or Sum Wgts)	48

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio
Model	7	2319.8690	331.410	1.7434
Error	40	7603.5658	190.089	Prob > F
C. Total	47	9923.4348		0.1264

Parameter Estimates

Effect Tests

Source	Nparm	DF	Sum of Squares	F Ratio	Prob > F
LTMSLAB	3	3	318.9276	0.5593	0.6450
IND 2	1	1	591.0633	3.1094	0.0855
LINER	3	3	1602.8591	2.8107	0.0516

LTMSLAB

IND 2

Leverage Plot

Least Squares Means Table

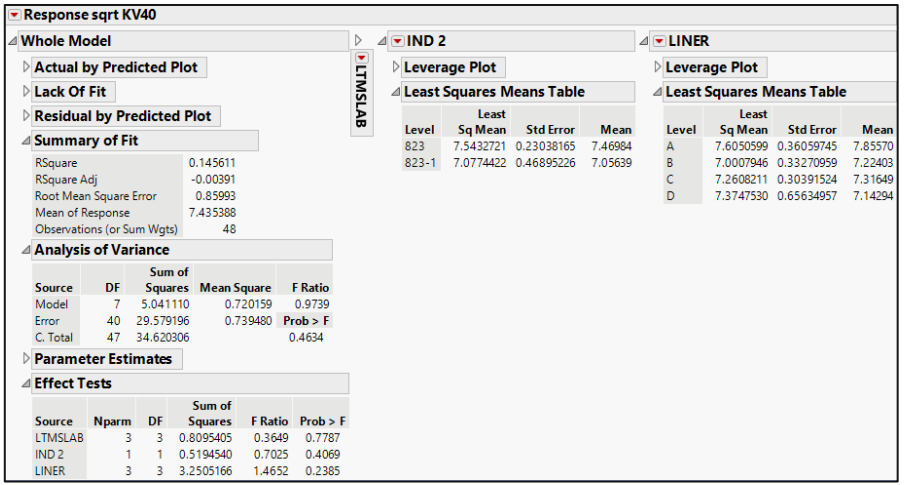
Level	Least Sq Mean	Std Error	Mean
823	121.68025	3.6937148	118.555
823-1	105.96683	7.5187234	108.775

LINER

Leverage Plot

Least Squares Means Table

Level	Least Sq Mean	Std Error	Mean
A	117.65460	5.781468	125.193
B	105.27981	5.334341	112.473
C	117.08355	4.872681	118.956
D	115.27619	10.523269	114.300



Response sqrt KV40

Whole Model

Actual by Predicted Plot

Lack Of Fit

Residual by Predicted Plot

Summary of Fit

RSquare	0.145611
RSquare Adj	-0.00391
Root Mean Square Error	0.85993
Mean of Response	7.435388
Observations (or Sum Wgts)	48

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio
Model	7	5.041110	0.720159	0.9739
Error	40	29.579196	0.739480	Prob > F
C. Total	47	34.620306		0.4634

Parameter Estimates

Effect Tests

Source	Nparm	DF	Sum of Squares	F Ratio	Prob > F
LTMSLAB	3	3	0.8095405	0.3649	0.7787
IND 2	1	1	0.5194540	0.7025	0.4069
LINER	3	3	3.2505166	1.4652	0.2385

LTMSLAB

IND 2

Leverage Plot

Least Squares Means Table

Level	Least Sq Mean	Std Error	Mean
823	7.5432721	0.23038165	7.46984
823-1	7.0774422	0.46895226	7.05639

LINER

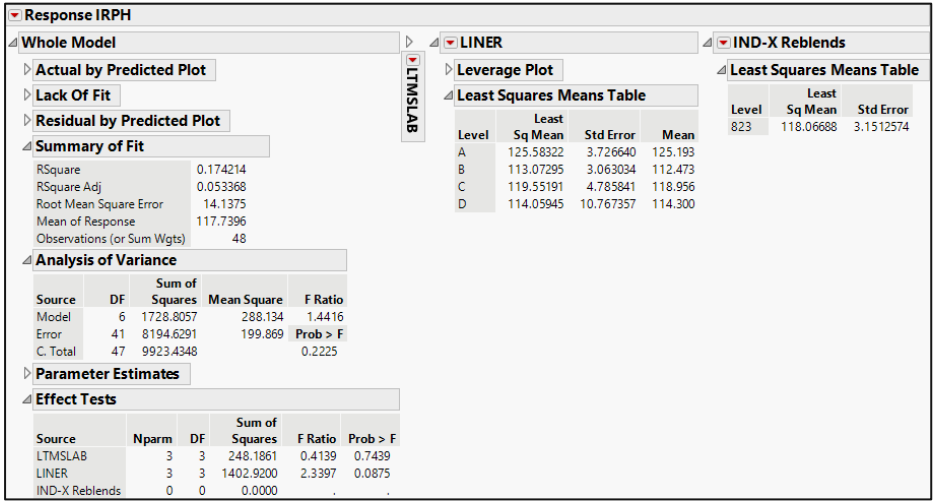
Leverage Plot

Least Squares Means Table

Level	Least Sq Mean	Std Error	Mean
A	7.6050599	0.36059745	7.85570
B	7.0007946	0.33270959	7.22403
C	7.2608211	0.30391524	7.31649
D	7.3747530	0.65634957	7.14294

T13 Data Analysis (823-X Targets)

- T13 ANOVA – Model 4:
  - Model factors include Lab & Liner Hardware (n = 48)



Response IRPH

Whole Model

Actual by Predicted Plot

Lack Of Fit

Residual by Predicted Plot

Summary of Fit

RSquare	0.174214
RSquare Adj	0.053368
Root Mean Square Error	14.1375
Mean of Response	117.7396
Observations (or Sum Wgts)	48

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio
Model	6	1728.8057	288.134	1.4416
Error	41	8194.6291	199.869	Prob > F
C. Total	47	9923.4348		0.2225

Parameter Estimates

Effect Tests

Source	Nparm	DF	Sum of Squares	F Ratio	Prob > F
LTMSLAB	3	3	248.1861	0.4139	0.7439
LINER	3	3	1402.9200	2.3397	0.0875
IND-X Reblends	0	0	0.0000	.	.

LTMSLAB

LINER

Leverage Plot

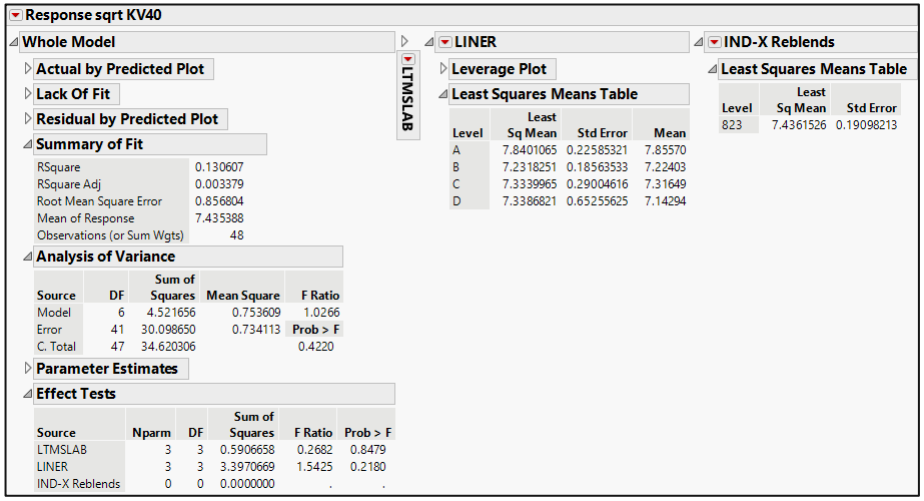
Least Squares Means Table

Level	Least Sq Mean	Std Error	Mean
A	125.58322	3.726640	125.193
B	113.07295	3.063034	112.473
C	119.55191	4.785841	118.956
D	114.05945	10.767357	114.300

IND-X Reblends

Least Squares Means Table

Level	Least Sq Mean	Std Error
823	118.06688	3.1512574



Response sqrt KV40

Whole Model

Actual by Predicted Plot

Lack Of Fit

Residual by Predicted Plot

Summary of Fit

RSquare	0.130607
RSquare Adj	0.003379
Root Mean Square Error	0.856804
Mean of Response	7.435388
Observations (or Sum Wgts)	48

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio
Model	6	4.521656	0.753609	1.0266
Error	41	30.098650	0.734113	Prob > F
C. Total	47	34.620306		0.4220

Parameter Estimates

Effect Tests

Source	Nparm	DF	Sum of Squares	F Ratio	Prob > F
LTMSLAB	3	3	0.5906658	0.2682	0.8479
LINER	3	3	3.3970669	1.5425	0.2180
IND-X Reblends	0	0	0.0000000	.	.

LTMSLAB

LINER

Leverage Plot

Least Squares Means Table

Level	Least Sq Mean	Std Error	Mean
A	7.8401065	0.22585321	7.85570
B	7.2318251	0.18563533	7.22403
C	7.3339965	0.29004616	7.31649
D	7.3386821	0.65255625	7.14294

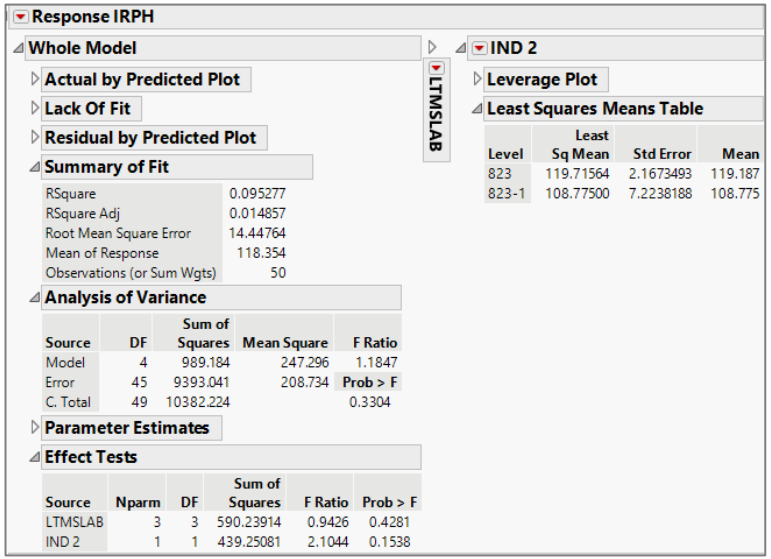
IND-X Reblends

Least Squares Means Table

Level	Least Sq Mean	Std Error
823	7.4361526	0.19098213

T13 Data Analysis (823-X Targets) -V

- T13 ANOVA – Model 5:
  - Model factors include Lab & Oil (n = 50)



Response IRPH

Whole Model

Actual by Predicted Plot

Lack Of Fit

Residual by Predicted Plot

Summary of Fit

RSquare	0.095277
RSquare Adj	0.014857
Root Mean Square Error	14.44764
Mean of Response	118.354
Observations (or Sum Wgts)	50

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio
Model	4	989.184	247.296	1.1847
Error	45	9393.041	208.734	Prob > F
C. Total	49	10382.224		0.3304

Parameter Estimates

Effect Tests

Source	Nparm	DF	Sum of Squares	F Ratio	Prob > F
LTMSLAB	3	3	590.23914	0.9426	0.4281
IND 2	1	1	439.25081	2.1044	0.1538

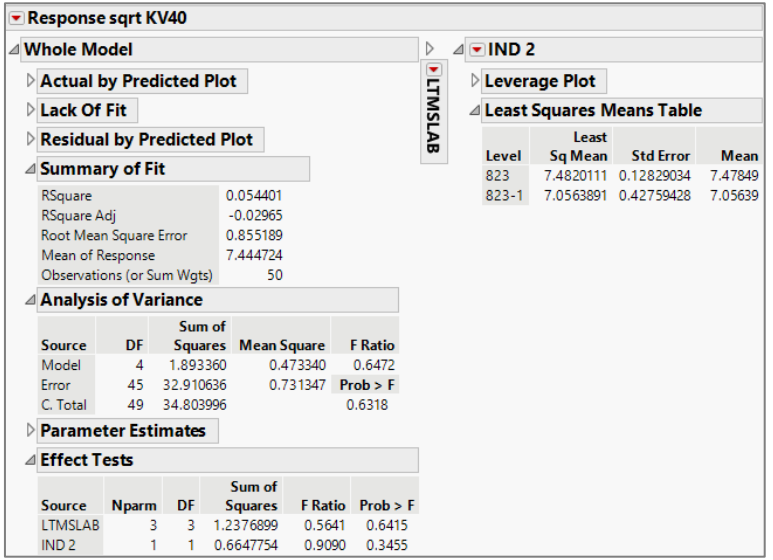
LTMSLAB

IND 2

Leverage Plot

Least Squares Means Table

Level	Least Sq Mean	Std Error	Mean
823	119.71564	2.1673493	119.187
823-1	108.77500	7.2238188	108.775



Response sqrt KV40

Whole Model

Actual by Predicted Plot

Lack Of Fit

Residual by Predicted Plot

Summary of Fit

RSquare	0.054401
RSquare Adj	-0.02965
Root Mean Square Error	0.855189
Mean of Response	7.444724
Observations (or Sum Wgts)	50

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio
Model	4	1.893360	0.473340	0.6472
Error	45	32.910636	0.731347	Prob > F
C. Total	49	34.803996		0.6318

Parameter Estimates

Effect Tests

Source	Nparm	DF	Sum of Squares	F Ratio	Prob > F
LTMSLAB	3	3	1.2376899	0.5641	0.6415
IND 2	1	1	0.6647754	0.9090	0.3455

LTMSLAB

IND 2

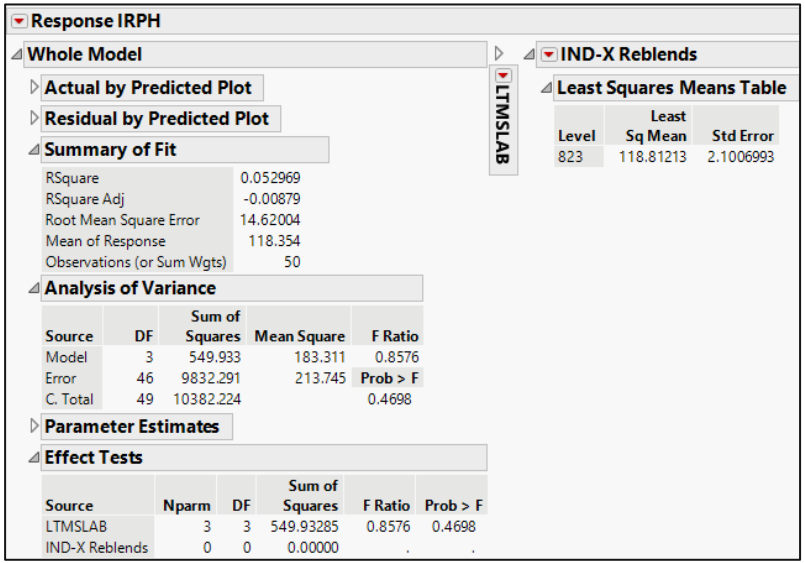
Leverage Plot

Least Squares Means Table

Level	Least Sq Mean	Std Error	Mean
823	7.4820111	0.12829034	7.47849
823-1	7.0563891	0.42759428	7.05639

T13 Data Analysis (823-X Targets) v

- T13 ANOVA – Model 6:
  - Model factors include Lab (n = 50)



Response IRPH

Whole Model

Actual by Predicted Plot

Residual by Predicted Plot

Summary of Fit

RSquare	0.052969
RSquare Adj	-0.00879
Root Mean Square Error	14.62004
Mean of Response	118.354
Observations (or Sum Wgts)	50

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio
Model	3	549.933	183.311	0.8576
Error	46	9832.291	213.745	Prob > F
C. Total	49	10382.224		0.4698

Parameter Estimates

Effect Tests

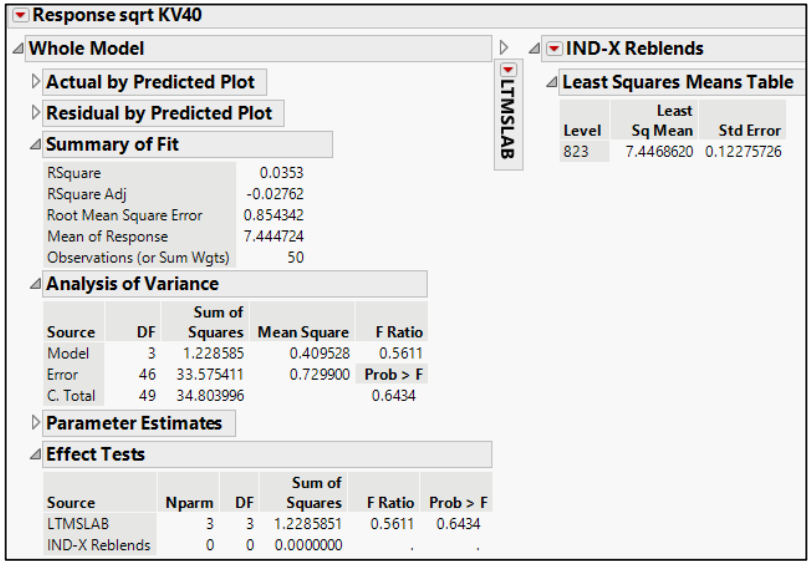
Source	Nparm	DF	Sum of Squares	F Ratio	Prob > F
LTMSLAB	3	3	549.93285	0.8576	0.4698
IND-X Reblends	0	0	0.00000	.	.

LTMSLAB

IND-X Reblends

Least Squares Means Table

Level	Least Sq Mean	Std Error
823	118.81213	2.1006993



Response sqrt KV40

Whole Model

Actual by Predicted Plot

Residual by Predicted Plot

Summary of Fit

RSquare	0.0353
RSquare Adj	-0.02762
Root Mean Square Error	0.854342
Mean of Response	7.444724
Observations (or Sum Wgts)	50

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio
Model	3	1.228585	0.409528	0.5611
Error	46	33.575411	0.729900	Prob > F
C. Total	49	34.803996		0.6434

Parameter Estimates

Effect Tests

Source	Nparm	DF	Sum of Squares	F Ratio	Prob > F
LTMSLAB	3	3	1.2285851	0.5611	0.6434
IND-X Reblends	0	0	0.0000000	.	.

LTMSLAB

IND-X Reblends

Least Squares Means Table

Level	Least Sq Mean	Std Error
823	7.4468620	0.12275726

T13 Data Analysis (823-X Targets)

- T13 Raw Standard Deviations (n=50) for RO823/RO823-1:

Std Dev(IRPH)	Std Dev(sqrt KV40)
14.556	0.843