T12 – Data Review & ICF Evaluation

Exploring the potential impact of Delo 50/50 Coolant & Current Hardware Batch

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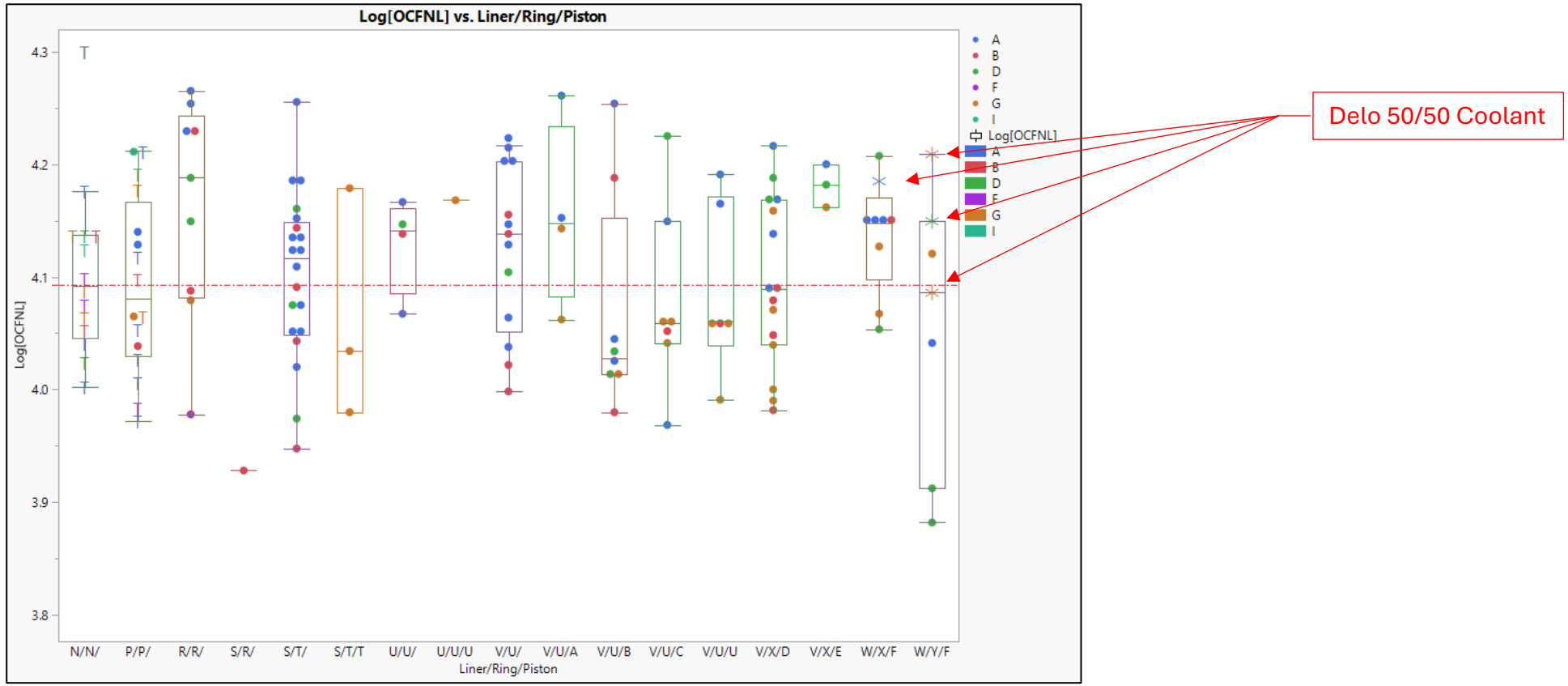
12/2/24

OilCon Data Review

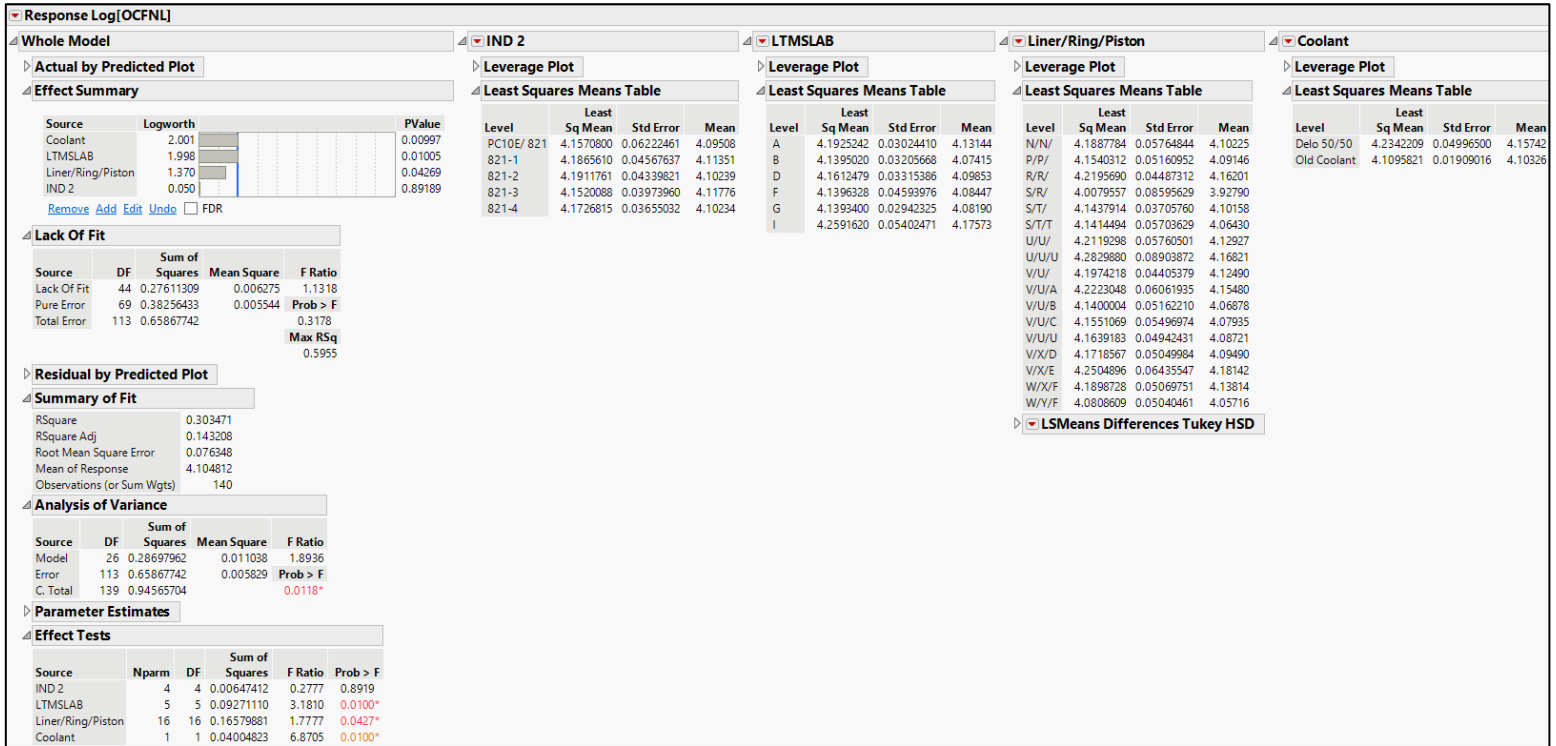
Oil Consumption - Data Review

- Ln[OCFNL] Plot shown below
  - Includes multiplicative ICF of 0.907 & with RO821-X re-blends, exclusively
  - Delo 50/50 results on current Liner/Ring/Piston batch appears higher



Ln(OCFNL) Data Review with Coolant Factor

- Analysis of Ln[OCFNL] with corrected data *[current ICF = 0.907]*
  - Includes RO821-X data, exclusively
  - Includes Liner/Ring/Piston Hardware and Delo 50/50 coolant in the model
  - Hardware and Coolant factor are significant
  - Evaluation of expanded estimates with current hardware and Delo 50/50 coolant indicates that the predicted Ln(OCFNL) differs by 0.022 as compared to target
    - Refer to Appendix E for details



Response Log[OCFNL]

Whole Model

Actual by Predicted Plot

Effect Summary

Source	Logworth	PValue
Coolant	2.001	0.00997
LTMSLAB	1.998	0.01005
Liner/Ring/Piston	1.370	0.04269
IND 2	0.050	0.89189

Remove Add Edit Undo FDR

Lack Of Fit

Source	DF	Sum of Squares	Mean Square	F Ratio
Lack Of Fit	44	0.27611309	0.006275	1.1318
Pure Error	69	0.38256433	0.005544	Prob > F
Total Error	113	0.65867742		0.3178
				Max RSq
				0.5955

Residual by Predicted Plot

Summary of Fit

RSquare	0.303471
RSquare Adj	0.143208
Root Mean Square Error	0.076348
Mean of Response	4.104812
Observations (or Sum Wgts)	140

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio
Model	26	0.28697962	0.011038	1.8936
Error	113	0.65867742	0.005829	Prob > F
C. Total	139	0.94565704		0.0118*

Parameter Estimates

Effect Tests

Source	Nparm	DF	Sum of Squares	F Ratio	Prob > F
IND 2	4	4	0.00647412	0.2777	0.8919
LTMSLAB	5	5	0.09271110	3.1810	0.0100*
Liner/Ring/Piston	16	16	0.16579881	1.7777	0.0427*
Coolant	1	1	0.04004823	6.8705	0.0100*

IND 2

Leverage Plot

Least Squares Means Table

Level	Least Sq Mean	Std Error	Mean
PC10E/ 821	4.1570800	0.06222461	4.09508
821-1	4.1865610	0.04567637	4.11351
821-2	4.1911761	0.04339821	4.10239
821-3	4.1520088	0.03973960	4.11776
821-4	4.1726815	0.03655032	4.10234

LTMSLAB

Leverage Plot

Least Squares Means Table

Level	Least Sq Mean	Std Error	Mean
A	4.1925242	0.03024410	4.13144
B	4.1395020	0.03205668	4.07415
D	4.1612479	0.03315386	4.09853
F	4.1396328	0.04593976	4.08447
G	4.1393400	0.02942325	4.08190
I	4.2591620	0.05402471	4.17573

Liner/Ring/Piston

Leverage Plot

Least Squares Means Table

Level	Least Sq Mean	Std Error	Mean
N/N/	4.1887784	0.05764844	4.10225
P/P/	4.1540312	0.05160952	4.09146
R/R/	4.2195690	0.04487312	4.16201
S/R/	4.0079557	0.08595629	3.92790
S/T/	4.1437914	0.03705760	4.10158
S/T/T	4.1414494	0.05703629	4.06430
U/U/	4.2119298	0.05760501	4.12927
U/U/U	4.2829880	0.08903872	4.16821
V/U/	4.1974218	0.04405379	4.12490
V/U/A	4.2223048	0.06061935	4.15480
V/U/B	4.1400004	0.05162210	4.06878
V/U/C	4.1551069	0.05496974	4.07935
V/U/U	4.1639183	0.04942431	4.08721
V/X/D	4.1718567	0.05049984	4.09490
V/X/E	4.2504896	0.06435547	4.18142
W/X/F	4.1898728	0.05069751	4.13814
W/Y/F	4.0808609	0.05040461	4.05716

LSMeans Differences Tukey HSD

Coolant

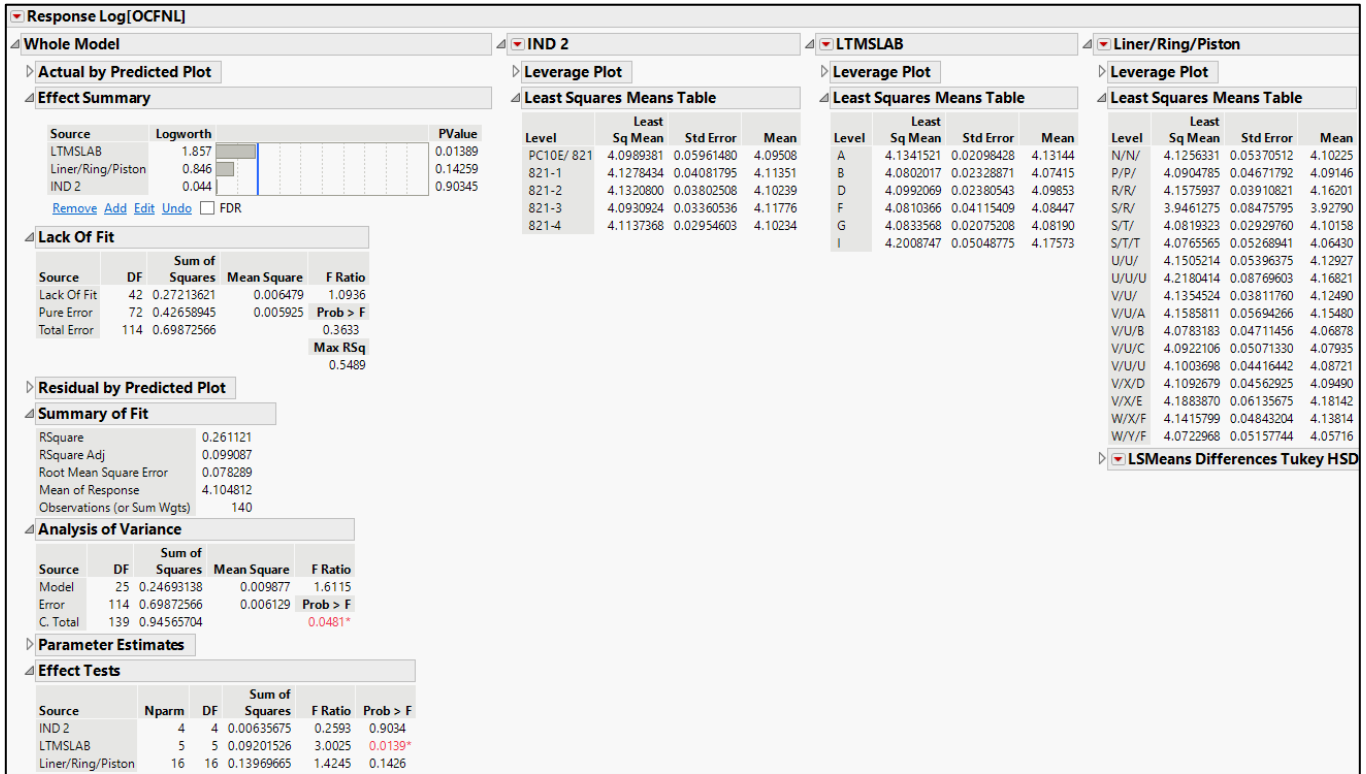
Leverage Plot

Least Squares Means Table

Level	Least Sq Mean	Std Error	Mean
Delo 50/50	4.2342209	0.04996500	4.15742
Old Coolant	4.1095821	0.01909016	4.10326

Ln(OCFNL) Data Review without Coolant Factor

- Analysis of Ln[OCFNL] with corrected data *[current ICF = 0.907]*
  - Includes RO821-X data, exclusively
  - Includes Liner/Ring/Piston Hardware in the model
  - Hardware is not significant
  - Evaluation of expanded estimates with current hardware indicates that the predicted Ln(OCFNL) differs by 0.049 as compared to target
    - Refer to Appendix F for details



Response Log[OCFNL]

Whole Model

Actual by Predicted Plot

Effect Summary

Source	Logworth	PValue
LTMSLAB	1.857	0.01389
Liner/Ring/Piston	0.846	0.14259
IND 2	0.044	0.90345

Remove Add Edit Undo FDR

Lack Of Fit

Source	DF	Sum of Squares	Mean Square	F Ratio
Lack Of Fit	42	0.27213621	0.006479	1.0936
Pure Error	72	0.42658945	0.005925	Prob > F
Total Error	114	0.69872566		0.3633
				Max RSq
				0.5489

Residual by Predicted Plot

Summary of Fit

RSquare	0.261121
RSquare Adj	0.099087
Root Mean Square Error	0.078289
Mean of Response	4.104812
Observations (or Sum Wgts)	140

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio
Model	25	0.24693138	0.009877	1.6115
Error	114	0.69872566	0.006129	Prob > F
C. Total	139	0.94565704		0.0481*

Parameter Estimates

Effect Tests

Source	Nparm	DF	Sum of Squares	F Ratio	Prob > F
IND 2	4	4	0.00635675	0.2593	0.9034
LTMSLAB	5	5	0.09201526	3.0025	0.0139*
Liner/Ring/Piston	16	16	0.13969665	1.4245	0.1426

IND 2

Leverage Plot

Least Squares Means Table

Level	Least Sq Mean	Std Error	Mean
PC10E/ 821	4.0989381	0.05961480	4.09508
821-1	4.1278434	0.04081795	4.11351
821-2	4.1320800	0.03802508	4.10239
821-3	4.0930924	0.03360536	4.11776
821-4	4.1137368	0.02954603	4.10234

LTMSLAB

Leverage Plot

Least Squares Means Table

Level	Least Sq Mean	Std Error	Mean
A	4.1341521	0.02098428	4.13144
B	4.0802017	0.02328871	4.07415
D	4.0992069	0.02380543	4.09853
F	4.0810366	0.04115409	4.08447
G	4.0833568	0.02075208	4.08190
I	4.2008747	0.05048775	4.17573

Liner/Ring/Piston

Leverage Plot

Least Squares Means Table

Level	Least Sq Mean	Std Error	Mean
N/N/	4.1256331	0.05370512	4.10225
P/P/	4.0904785	0.04671792	4.09146
R/R/	4.1575937	0.03910821	4.16201
S/R/	3.9461275	0.08475795	3.92790
S/T/	4.0819323	0.02929760	4.10158
S/T/T	4.0765565	0.05268941	4.06430
U/U/	4.1505214	0.05396375	4.12927
U/U/U	4.2180414	0.08769603	4.16821
V/U/	4.1354524	0.03811760	4.12490
V/U/A	4.1585811	0.05694266	4.15480
V/U/B	4.0783183	0.04711456	4.06878
V/U/C	4.0922106	0.05071330	4.07935
V/U/U	4.1003698	0.04416442	4.08721
V/X/D	4.1092679	0.04562925	4.09490
V/X/E	4.1883870	0.06135675	4.18142
W/X/F	4.1415799	0.04843204	4.13814
W/Y/F	4.0722968	0.05157744	4.05716

LSMeans Differences Tukey HSD

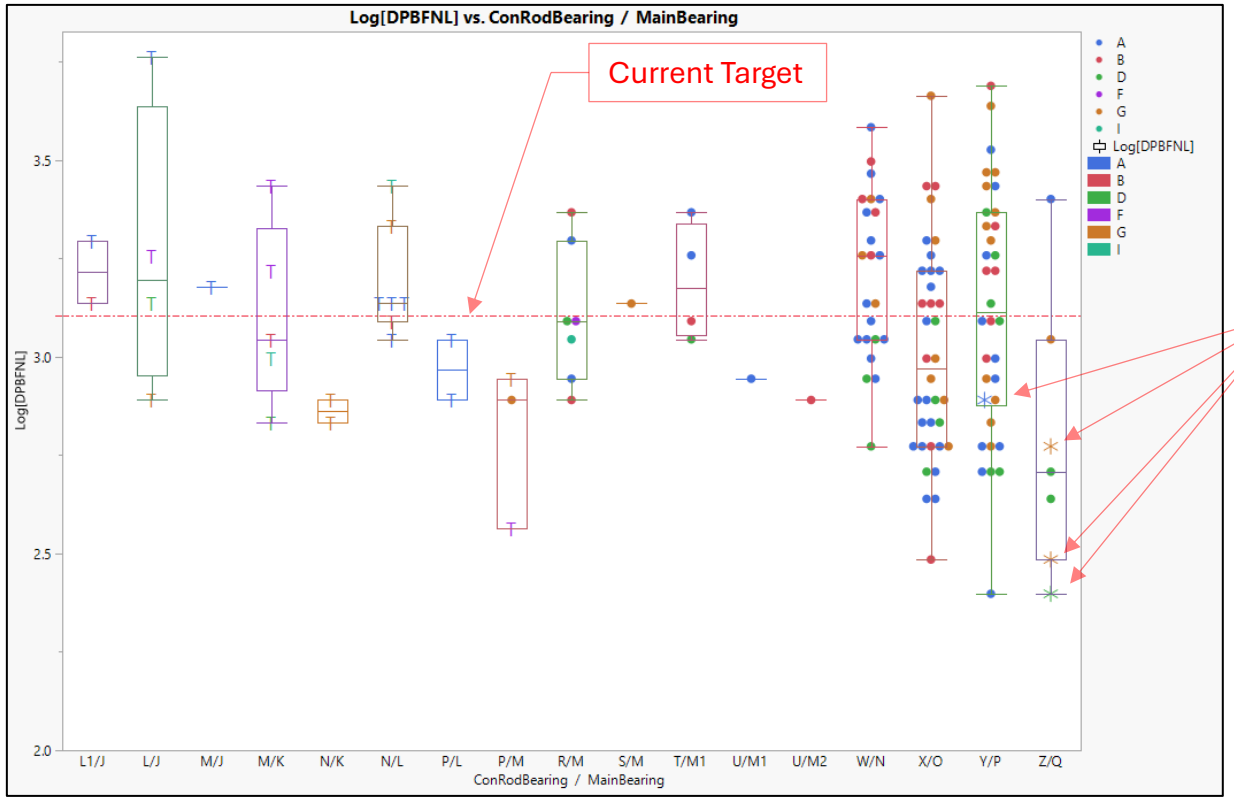
Oil Consumption - Data Review

- Update Oil Consumption ICF?
  - Evaluation of expanded estimates on current hardware indicates that the current ICF is correcting the OC to near target value
  - Recommend no change to OC ICF at this time

PB Data Review - with Coolant Factor

PBFNL- Data Review

- Ln[PBFNL] (with current ICF) data plot shown below
  - Includes RO821-X data, exclusively
  - Pb ICF function based on †Oil Consumption
  - Delo 50/50 results on the current Con-Rod-Bearing (Z/Q) batch appear lower



Delo 50/50 Coolant

† *Current Pb ICF Equation:*

If $OC_{100\text{-}300} > 65.0$:

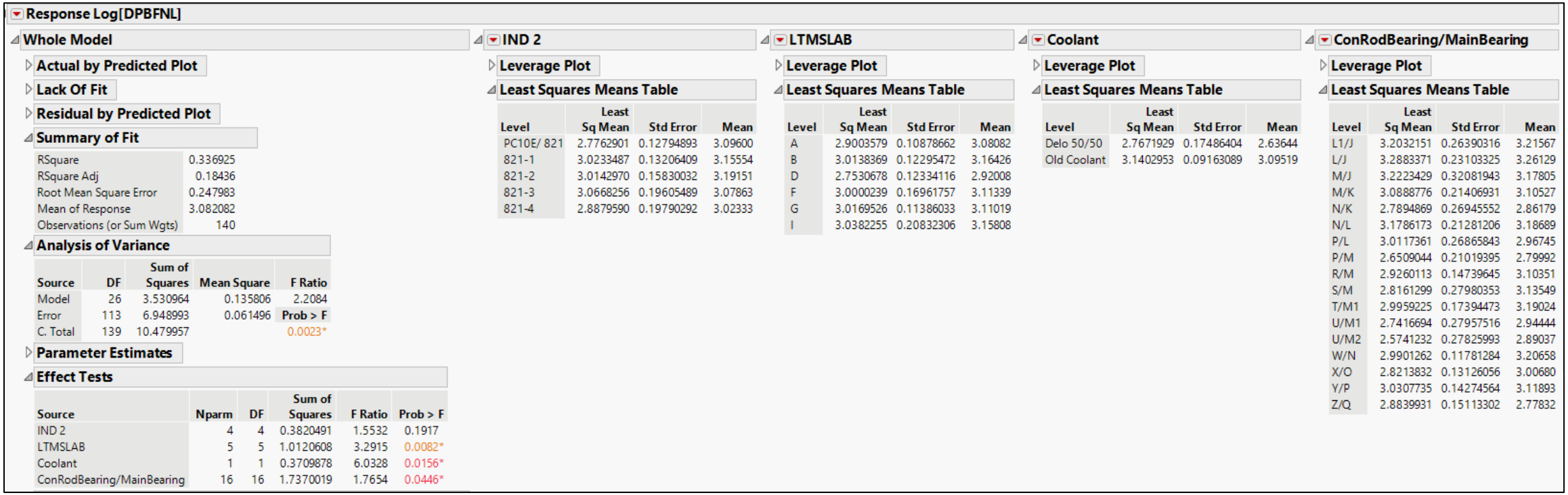
$$PbFNL_{cor} = exp(Ln(Pb) + (65 - OC_{100\text{-}300}) \times 0.03234)$$

else:

$$PbFNL_{cor} = Pb$$

PBFNL- Data Review with Coolant Factor

- Ln[PBFNL] ICF corrected data analysis:
  - Includes RO821-X data, exclusively
  - Effect related to Delo 50/50 coolant is significant
  - LSMeans for current hardware [Z/Q] & Delo 50/50 coolant is 0.619 lower than target
  - Option: Consider additional ICF of $^{+}0.619$ to Ln[PBFNL][1]



Response Log[DPBFNL]

Whole Model

Actual by Predicted Plot

Lack Of Fit

Residual by Predicted Plot

Summary of Fit

RSquare	0.336925
RSquare Adj	0.18436
Root Mean Square Error	0.247983
Mean of Response	3.082082
Observations (or Sum Wgts)	140

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio
Model	26	3.530964	0.135806	2.2084
Error	113	6.948993	0.061496	Prob > F
C. Total	139	10.479957		0.0023*

Parameter Estimates

Effect Tests

Source	Nparm	DF	Sum of Squares	F Ratio	Prob > F
IND 2	4	4	0.3820491	1.5532	0.1917
LTMSLAB	5	5	1.0120608	3.2915	0.0082*
Coolant	1	1	0.3709878	6.0328	0.0156*
ConRodBearing/MainBearing	16	16	1.7370019	1.7654	0.0446*

IND 2

Leverage Plot

Least Squares Means Table

Level	Least Sq Mean	Std Error	Mean
PC10E/ 821	2.7762901	0.12794893	3.09600
821-1	3.0233487	0.13206409	3.15554
821-2	3.0142970	0.15830032	3.19151
821-3	3.0668256	0.19605489	3.07863
821-4	2.8879590	0.19790292	3.02333

LTMSLAB

Leverage Plot

Least Squares Means Table

Level	Least Sq Mean	Std Error	Mean
A	2.9003579	0.10878662	3.08082
B	3.0138369	0.12295472	3.16426
D	2.7530678	0.12334116	2.92008
F	3.0000239	0.16961757	3.11339
G	3.0169526	0.11386033	3.11019
I	3.0382255	0.20832306	3.15808

Coolant

Leverage Plot

Least Squares Means Table

Level	Least Sq Mean	Std Error	Mean
Delo 50/50	2.7671929	0.17486404	2.63644
Old Coolant	3.1402953	0.09163089	3.09519

ConRodBearing/MainBearing

Leverage Plot

Least Squares Means Table

Level	Least Sq Mean	Std Error	Mean
L1/J	3.2032151	0.26390316	3.21567
L/J	3.2883371	0.23103325	3.26129
M/J	3.2223429	0.32081943	3.17805
M/K	3.0888776	0.21406931	3.10527
N/K	2.7894869	0.26945552	2.86179
N/L	3.1786173	0.21281206	3.18689
P/L	3.0117361	0.26865843	2.96745
P/M	2.6509044	0.21019395	2.79992
R/M	2.9260113	0.14739645	3.10351
S/M	2.8161299	0.27980353	3.13549
T/M1	2.9959225	0.17394473	3.19024
U/M1	2.7416694	0.27957516	2.94444
U/M2	2.5741232	0.27825993	2.89037
W/N	2.9901262	0.11781284	3.20658
X/O	2.8213832	0.13126056	3.00680
Y/P	3.0307735	0.14274564	3.11893
Z/Q	2.8839931	0.15113302	2.77832

Note 1: Please refer to Appendix A for more details

PBFNL- Data Review with Coolant Factor

- Ln[PBFNL] ICF correction equation *(Delo 50/50 Coolant & Z/Q Hardware)*:

If $OC_{100\text{-}300} > 65.0$*:*

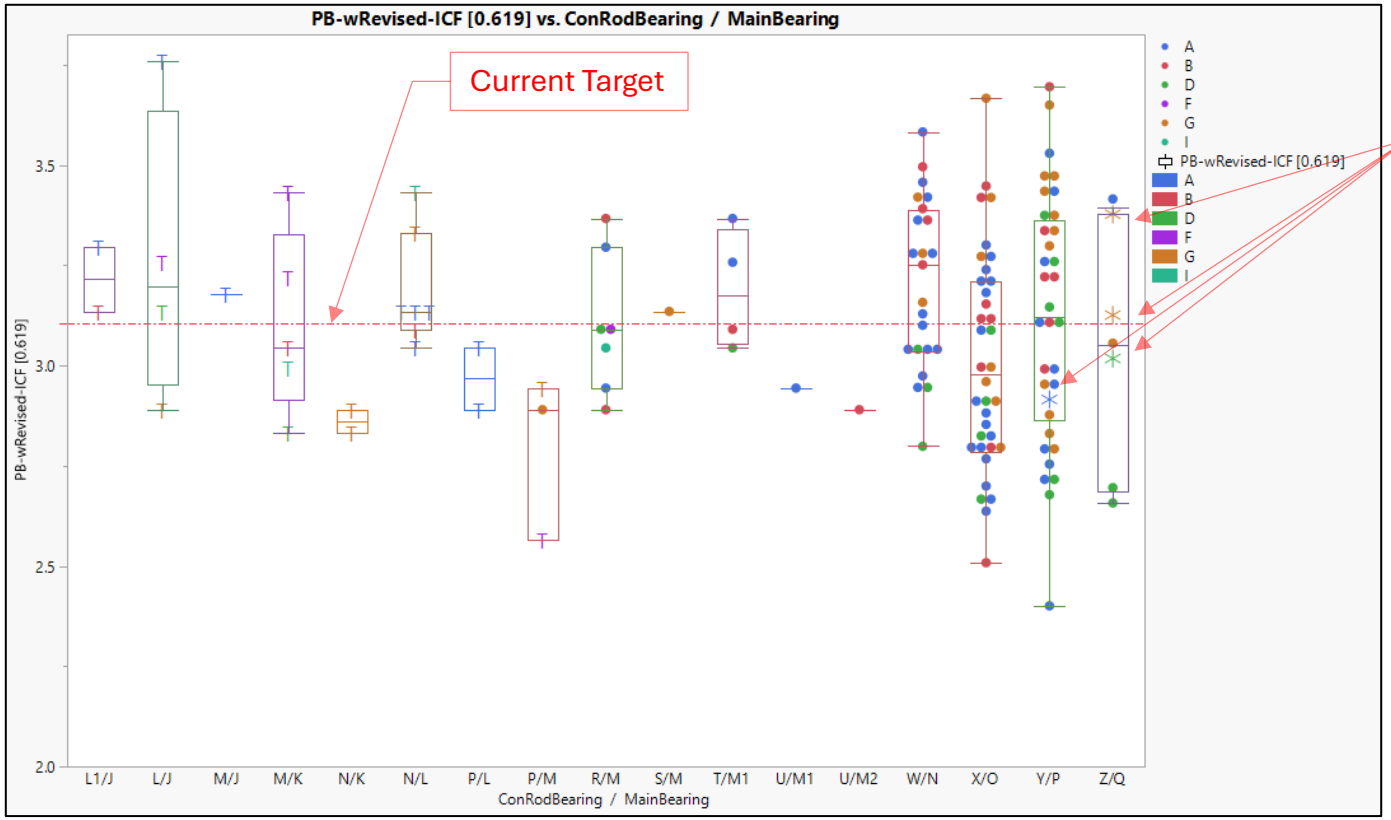
$$PbFNL_{cor} = exp(Ln(Pb) + (65 - OC_{100\text{-}300}) \times 0.03234 + 0.619)$$

else:

$$PbFNL_{cor} = exp(Ln(Pb) + 0.619)$$

PBFNL – Data Review with Coolant Factor

- Ln[PBFNL] with revised ICF shown below



Revised Pb ICF Equation (Delo 50/50 Coolant & Z/Q Hardware):

If $OC_{100\text{-}300} > 65.0$:

$$PbFNL_{cor} = \exp(Ln(Pb) + (65 - OC_{100\text{-}300}) \times 0.03234 + 0.619)$$

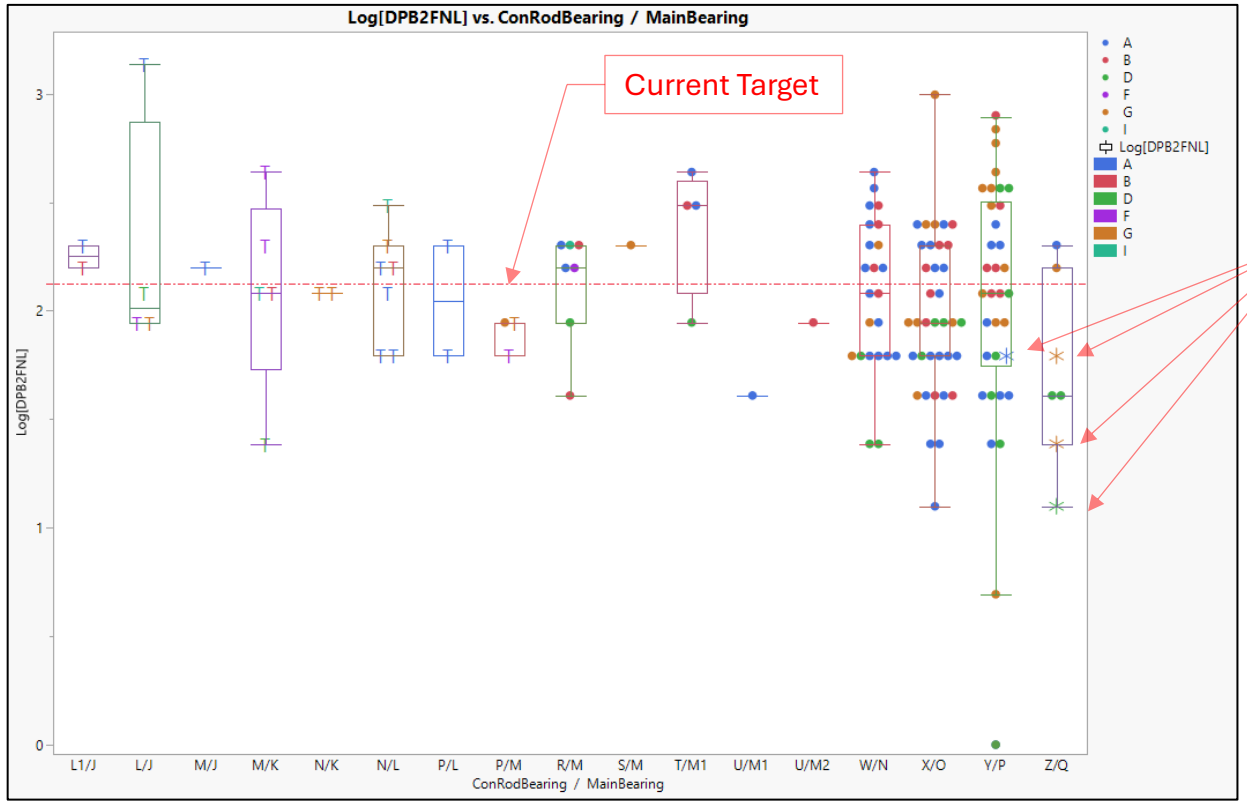
else:

$$PbFNL_{cor} = \exp(Ln(Pb) + 0.619)$$

PB2FNL Data Review with Coolant Factor

PB2FNL Data Review with Coolant Factor

- Ln[PB2FNL] data plot shown below
  - Includes ICF function based on Oil Consumption
  - Delo 50/50 results on the current Con-Rod-Bearing [Z/Q] batch appear lower



Current Pb2 ICF Equation:

If $OC_{100\text{-}300} > 65.0$*:*

$$Pb2FNL_{cor} = exp(Ln(Pb2) + (65 - OC_{100\text{-}300}) \times 0.04089)$$

else:

$$Pb2FNL_{cor} = Pb2$$

PB2FNL Data Review with Coolant Factor

- Ln[PB2FNL] ICF corrected data analysis
  - Significance of Coolant factor is marginal *(p = 0.075)*
  - LSMeans for current hardware [Z/Q] & Delo 50/50 coolant is 0.979 lower than target
  - Option: Consider additional ICF of $^{+}0.979^{3}$ to Ln[PB2FNL]

Response Log[DPB2FNL]

Whole Model

Actual by Predicted Plot

Lack Of Fit

Residual by Predicted Plot

Summary of Fit

RSquare	0.218174
RSquare Adj	0.038285
Root Mean Square Error	0.422441
Mean of Response	2.040775
Observations (or Sum Wgts)	140

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio
Model	26	5.627347	0.216436	1.2128
Error	113	20.165551	0.178456	Prob > F
C. Total	139	25.792898		0.2416

Parameter Estimates

Effect Tests

Source	Nparm	DF	Sum of Squares	F Ratio	Prob > F
IND 2	4	4	0.5963257	0.8354	0.5054
LTMSLAB	5	5	2.7774244	3.1127	0.0114*
Coolant	1	1	0.5757344	3.2262	0.0751
ConRodBearing/MainBearing	16	16	1.9266521	0.6748	0.8134

IND 2

Leverage Plot

Least Squares Means Table

Level	Least Sq Mean	Std Error	Mean
PC10E/ 821	1.6984315	0.21796201	2.11253
821-1	2.0602643	0.22497221	2.11966
821-2	2.0820473	0.26966583	2.08174
821-3	2.2481264	0.33398103	2.04671
821-4	2.0500643	0.33712916	1.96447

LTMSLAB

Leverage Plot

Least Squares Means Table

Level	Least Sq Mean	Std Error	Mean
A	1.8825778	0.18531886	1.99594
B	2.0963830	0.20945433	2.17397
D	1.6904022	0.21011263	1.79329
F	2.1167396	0.28894485	2.17531
G	2.0959706	0.19396196	2.12830
I	2.2846474	0.35487996	2.28898

Coolant

Leverage Plot

Least Squares Means Table

Level	Least Sq Mean	Std Error	Mean
Delo 50/50	1.7953904	0.29788226	1.51711
Old Coolant	2.2601831	0.15609394	2.05618

ConRodBearing/MainBearing

Leverage Plot

Least Squares Means Table

Level	Least Sq Mean	Std Error	Mean
L1/J	2.3851701	0.44956109	2.24990
L/J	2.4550121	0.39356694	2.27669
M/J	2.4393925	0.54651840	2.19722
M/K	2.1611273	0.36466874	2.09736
N/K	2.1082166	0.45901957	2.07944
N/L	2.2444013	0.36252700	2.12070
P/L	2.2893402	0.45766173	2.04717
P/M	1.7957677	0.35806703	1.89453
R/M	1.9816997	0.25109100	2.12251
S/M	1.9695274	0.47664749	2.30259
T/M1	2.2636229	0.29631620	2.38870
U/M1	1.4897730	0.47625847	1.60944
U/M2	1.6124401	0.47401795	1.94591
W/N	1.8984107	0.20069508	2.07567
X/O	1.7118678	0.22360338	1.97879
Y/P	1.8723450	0.24316830	2.04100
Z/Q	1.7942605	0.25745627	1.71362

Note 3: Please refer to Appendix C for more details

PB2FNL Data Review with Coolant Factor

- Ln[PB2FNL] ICF correction equation *(Delo 50/50 Coolant & Z/Q Hardware)*:

  If $OC_{100\text{-}300} > 65.0$*:*

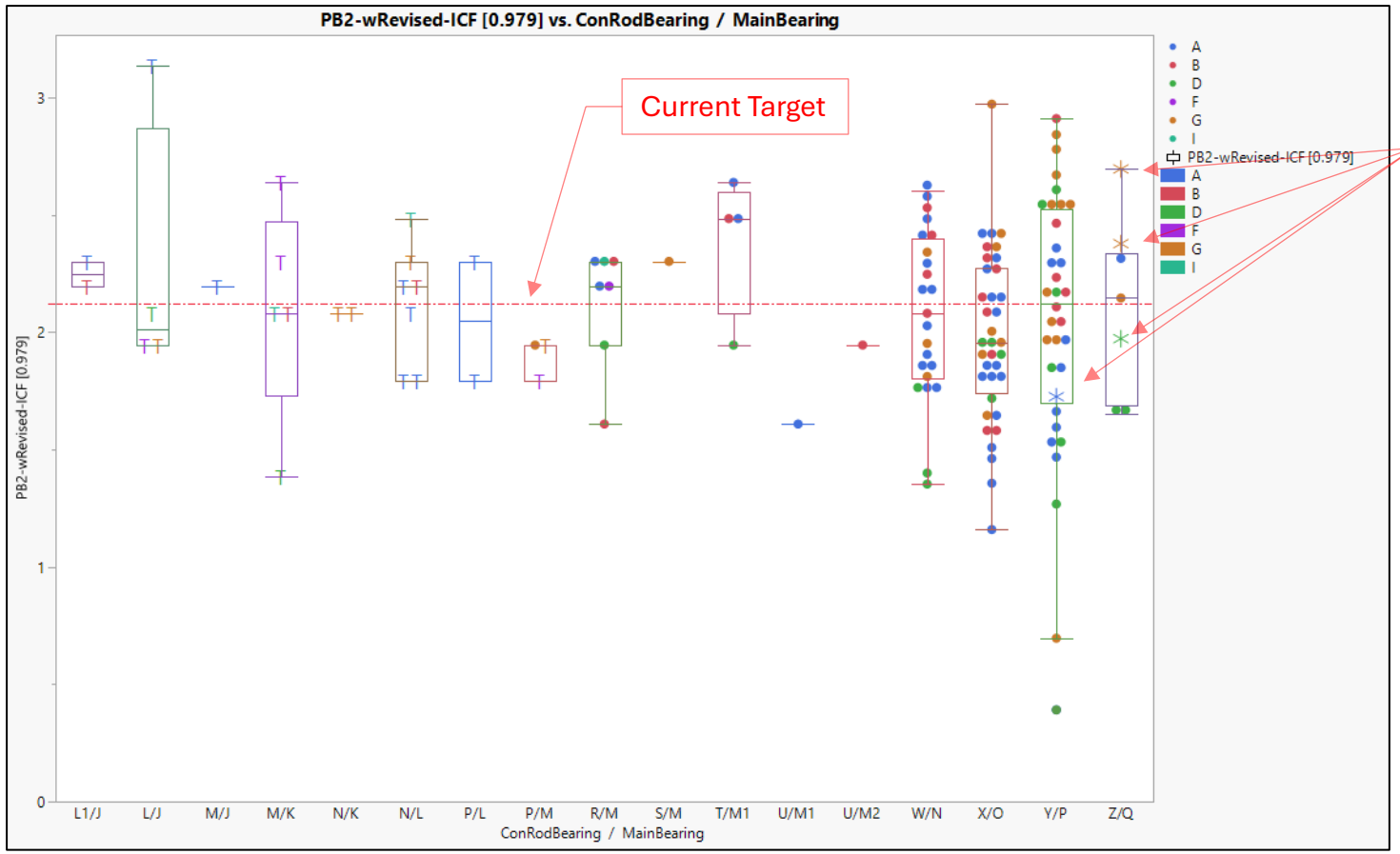
  $$Pb2FNL_{cor} = exp(Ln(Pb2) + (65 - OC_{100\text{-}300}) \times 0.04089 + 0.979)$$

  else:

  $$Pb2FNL_{cor} = exp(Ln(Pb2) + 0.979)$$

PB2FNL Data Review with Coolant Factor

- Ln[PB2FNL] with revised ICF shown below



Revised Pb2 ICF Equation (Delo 50/50 Coolant & Z/Q Hardware):

If $OC_{100\text{-}300} > 65.0$:

$$Pb2FNL_{cor} = exp(Ln(Pb) + (65 - OC_{100\text{-}300}) \times 0.04089 + 0.979)$$

else:

$$Pb2FNL_{cor} = exp(Ln(Pb) + 0.979)$$

Analysis Summary Highlights – with Coolant Factor

- PBFNL ICF Options:
  - Do nothing – let current SA's adjust for the mild shift in performance
  - Add *0.619* to current ICF – if SP selects Delo 50/50 & hardware [Z/Q] based model

- PB2FNL ICF Options:
  - Do nothing – let current SA's adjust for the mild shift in performance
  - Add *0.979* to current ICF – if SP selects Delo 50/50 & hardware [Z/Q] based model

PB Data Review - without Coolant Factor

PBFNL- Data Review without Coolant Factor

- Ln[PBFNL] ICF corrected data analysis
  - Hardware factor is significant
  - LSMeans for current hardware [Z/Q] is 0.409 lower than target
  - Option: Consider additional ICF of $^{+}0.409$ to Ln[PBFNL]^{2}

Response Log[DPBFNL]

Whole Model

Actual by Predicted Plot

Lack Of Fit

Residual by Predicted Plot

Summary of Fit

RSquare	0.301526
RSquare Adj	0.148352
Root Mean Square Error	0.253398
Mean of Response	3.082082
Observations (or Sum Wgts)	140

Analysis of Variance

Parameter Estimates

Effect Tests

Source	Nparm	DF	Sum of Squares	F Ratio	Prob > F
IND 2	4	4	0.3802432	1.4805	0.2127
LTMSLAB	5	5	0.9482337	2.9535	0.0152*
ConRodBearing / MainBearing	16	16	1.9574009	1.9053	0.0266*

Expanded Estimates

IND 2

Leverage Plot

Least Squares Means Table

Level	Least Sq Mean	Std Error	Mean
PC10E/ 821	2.9534352	0.10799238	3.09600
821-1	3.2018519	0.11267651	3.15554
821-2	3.1948445	0.14325967	3.19151
821-3	3.2465496	0.18585971	3.07863
821-4	3.0686697	0.18772977	3.02333

LTMSLAB

Leverage Plot

Least Squares Means Table

Level	Least Sq Mean	Std Error	Mean
A	3.0765842	0.08355767	3.08082
B	3.1948783	0.10056053	3.16426
D	2.9402819	0.09908769	2.92008
F	3.1792845	0.15645587	3.11339
G	3.1894114	0.09159021	3.11019
I	3.2179808	0.19930348	3.15808

ConRodBearing / MainBearing

Leverage Plot

Least Squares Means Table

Level	Least Sq Mean	Std Error	Mean
L1/J	3.3926394	0.25789364	3.21567
L/J	3.4776053	0.22255929	3.26129
M/J	3.4141748	0.31796181	3.17805
M/K	3.2756294	0.20448076	3.10527
N/K	2.9850863	0.26303947	2.86179
N/L	3.3697954	0.20239183	3.18689
P/L	3.2035681	0.26266811	2.96745
P/M	2.8437839	0.19923100	2.79992
R/M	3.1129902	0.12897206	3.10351
S/M	3.0103713	0.27425544	3.13549
T/M1	3.1824457	0.15990912	3.19024
U/M1	2.9321433	0.27446954	2.94444
U/M2	2.7597819	0.27364379	2.89037
W/N	3.1778790	0.09160446	3.20658
X/O	3.0085388	0.10921294	3.00680
Y/P	3.2064964	0.12621977	3.11893
Z/Q	2.9092640	0.15407475	2.77832

Note 2: Please refer to Appendix B for more details

PBFNL- Data Review Without Coolant Factor

- Ln[PBFNL] ICF correction equation *(Z/Q Hardware)*:

  If $OC_{100\text{-}300} > 65.0$*:*

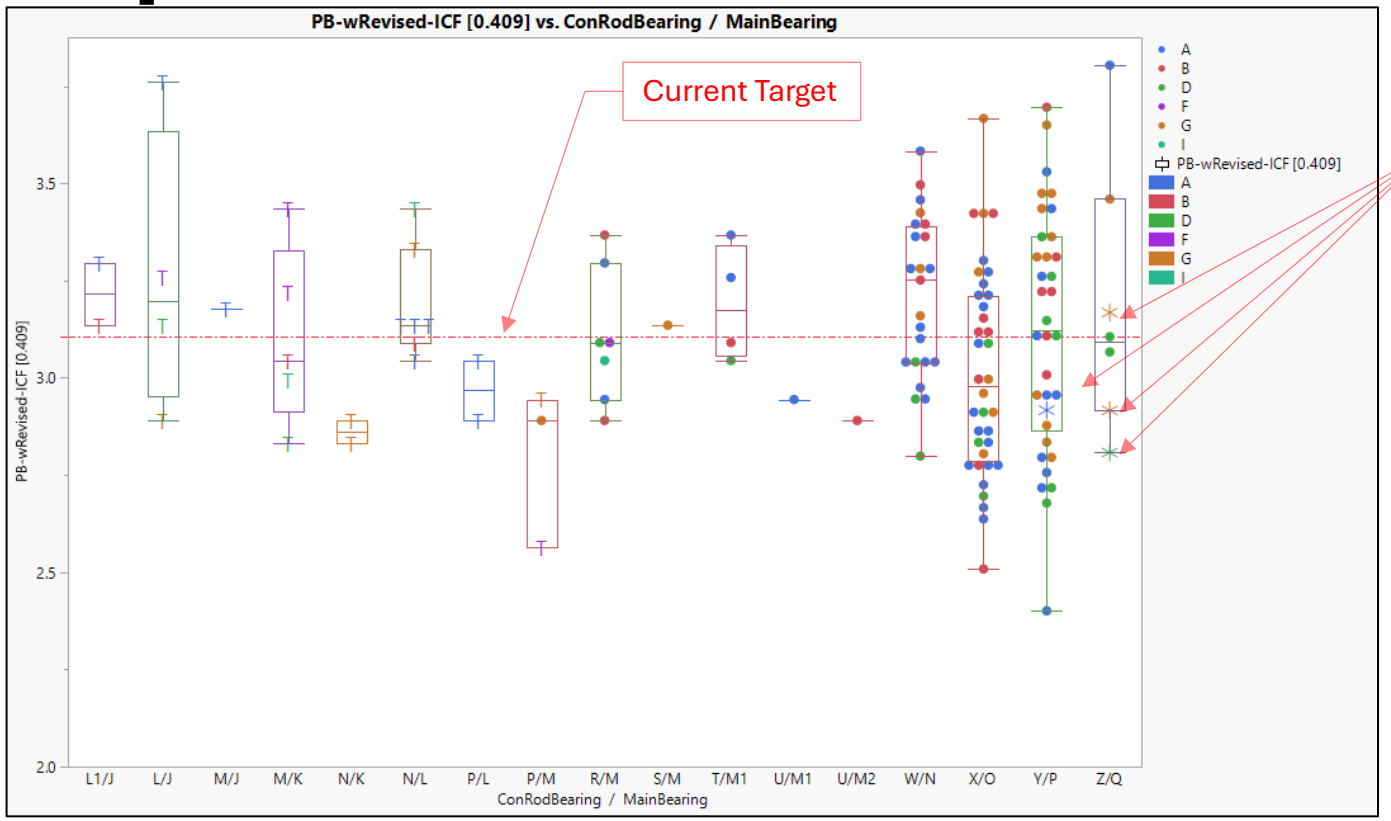
  $$PbFNL_{cor} = exp(Ln(Pb) + (65 - OC_{100\text{-}300}) \times 0.03234 + 0.409)$$

  else:

  $$PbFNL_{cor} = exp(Ln(Pb) + 0.409)$$

PBFNL – Data Review without Coolant Factor

- Ln[PBFNL] with revised ICF shown below



Revised Pb ICF Equation (Z/Q Hardware):

If $OC_{100\text{-}300} > 65.0$:

$$PbFNL_{cor} = \exp(Ln(Pb) + (65 - OC_{100\text{-}300}) \times 0.\ 0.03234 + 0.409)$$

else:

$$PbFNL_{cor} = \exp(Ln(Pb) + 0.409)$$

PB2FNL Data Review without Coolant Factor

PB2FNL Data Review without Coolant Factor

- Ln[PB2FNL] ICF corrected data analysis
  - Lack of significance of contrasts of [Z/Q] batch vs. target hardware batches *($p \geq 0.05$)*
  - LSMeans for current hardware [Z/Q] is 0.718 lower than target
  - Option: Consider additional ICF of $^{+}0.718^{4}$ to Ln[PB2FNL]

Response Log[DPB2FNL]

Whole Model

Actual by Predicted Plot

Lack Of Fit

Residual by Predicted Plot

Summary of Fit

RSquare	0.195853
RSquare Adj	0.019505
Root Mean Square Error	0.426546
Mean of Response	2.040775
Observations (or Sum Wgts)	140

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio
Model	25	5.051612	0.202064	1.1106
Error	114	20.741286	0.181941	Prob > F
C. Total	139	25.792898		0.3428

Parameter Estimates

Effect Tests

Source	Nparm	DF	Sum of Squares	F Ratio	Prob > F
IND 2	4	4	0.5952047	0.8179	0.5163
LTMSLAB	5	5	2.6634387	2.9278	0.0159*
ConRodBearing / MainBearing	16	16	2.1539707	0.7399	0.7480

IND 2

Leverage Plot

Least Squares Means Table

Level	Least Sq Mean	Std Error	Mean
PC10E/ 821	1.9191103	0.18178415	2.11253
821-1	2.2826348	0.18966896	2.11966
821-2	2.3069645	0.24114975	2.08174
821-3	2.4720178	0.31285862	2.04671
821-4	2.2751848	0.31600650	1.96447

LTMSLAB

Leverage Plot

Least Squares Means Table

Level	Least Sq Mean	Std Error	Mean
A	2.1021119	0.14065306	1.99594
B	2.3219156	0.16927406	2.17397
D	1.9236244	0.16679482	1.79329
F	2.3400537	0.26336299	2.17531
G	2.3108114	0.15417429	2.12830
I	2.5085777	0.33548859	2.28898

ConRodBearing / MainBearing

Leverage Plot

Least Squares Means Table

Level	Least Sq Mean	Std Error	Mean
L1/J	2.6211457	0.43411372	2.24990
L/J	2.6907933	0.37463522	2.27669
M/J	2.6783673	0.53522678	2.19722
M/K	2.3937736	0.34420353	2.09736
N/K	2.3518848	0.44277571	2.07944
N/L	2.4825616	0.34068723	2.12070
P/L	2.5283150	0.44215060	2.04717
P/M	2.0360475	0.33536658	1.89453
R/M	2.2146288	0.21709935	2.12251
S/M	2.2115038	0.46165562	2.30259
T/M1	2.4959844	0.26917586	2.38870
U/M1	1.7270562	0.46201601	1.60944
U/M2	1.8437247	0.46062602	1.94591
W/N	2.1323040	0.15419826	2.07567
X/O	1.9450171	0.18383871	1.97879
Y/P	2.0912520	0.21246640	2.04100
Z/Q	1.8257418	0.25935483	1.71362

Note 4: Please refer to Appendix D for more details

PB2FNL Data Review without Coolant Factor

- Ln[PB2FNL] ICF correction equation *(Z/Q Hardware)*:

  If $OC_{100\text{-}300} > 65.0$*:*

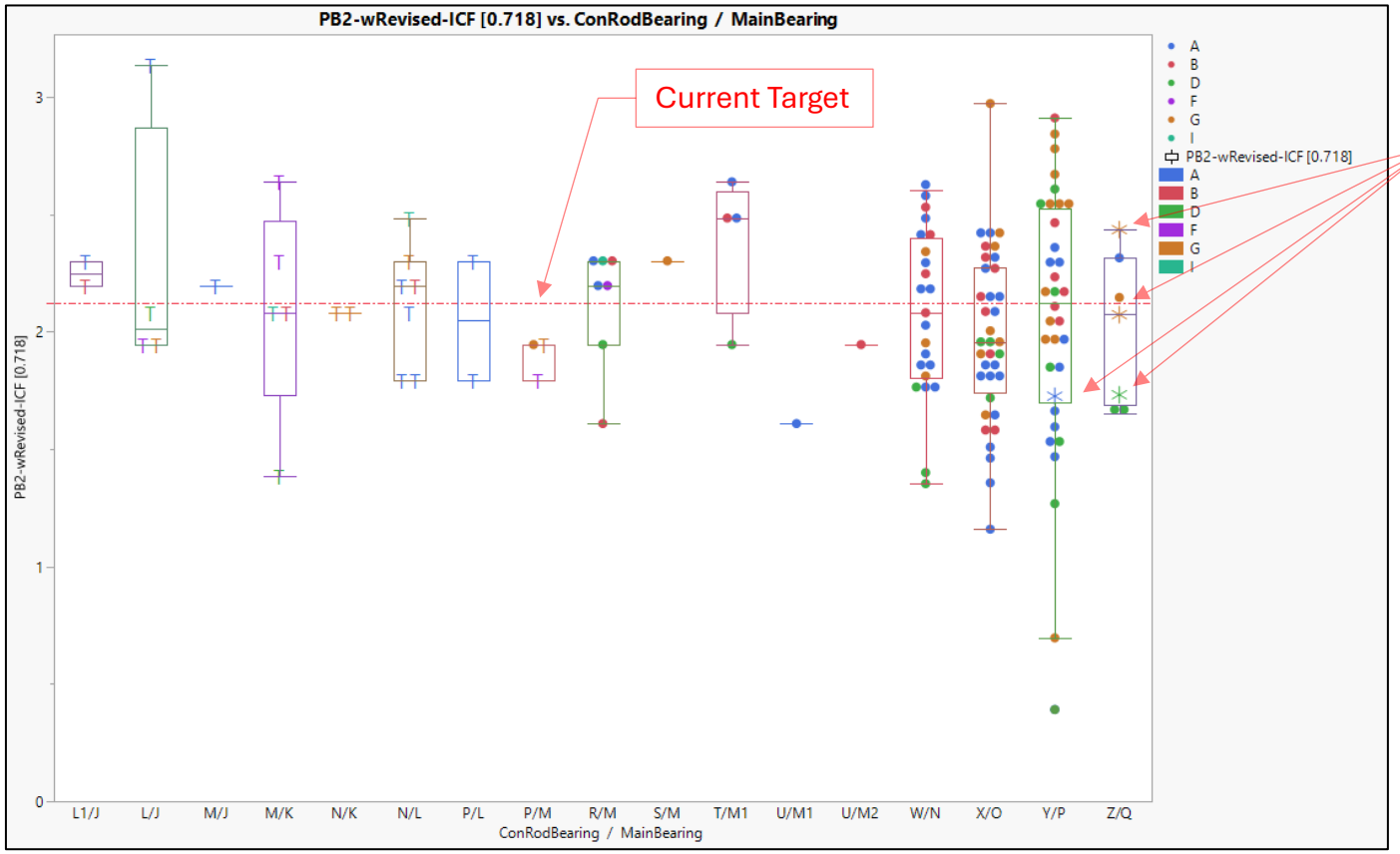
  $$Pb2FNL_{cor} = exp(Ln(Pb2) + (65 - OC_{100\text{-}300}) \times 0.04089 + 0.718)$$

  else:

  $$Pb2FNL_{cor} = exp(Ln(Pb2) + 0.718)$$

PB2FNL Data Review without Coolant Factor

- Ln[PB2FNL] with revised ICF shown below



Revised Pb ICF Equation (Z/Q Hardware):

If $OC_{100\text{-}300} > 65.0$:

$$Pb2FNL_{cor} = \exp(Ln(Pb) + (65 - OC_{100\text{-}300}) \times 0.04089 + 0.718)$$

else:

$$Pb2FNL_{cor} = \exp(Ln(Pb) + 0.718)$$

Analysis Summary Highlights

- PBFNL ICF Options:
  - Do nothing – let current SA's adjust for the mild shift in performance
  - Add *0.409* to current ICF – if SP selects hardware [Z/Q] based model

- PB2FNL ICF Options:
  - Do nothing – let current SA's adjust for the mild shift in performance
  - Add *0.718* to current ICF – if SP selects hardware [Z/Q] based model

Appendix A

PBFNL ICF (with coolant factor):

Options:
Y/P & Delo
Z/Q & Pen Cool
Y/P & Pen Cool
Option 1: Z/Q & Delo
Option 2: Z/Q

Expanded Estimates

Term	Estimate	Std Error	t Ratio	Prob>|t|		Total
Intercept	2.953744	0.117124	25.22	<.0001	1	2.953744
IND 2[PC10E/ 821]	-0.17745	0.16785	-1.06	0.2927	1	-0.17745
IND 2[821-1]	0.069605	0.089037	0.78	0.436		
IND 2[821-2]	0.060553	0.085632	0.71	0.4809		
IND 2[821-3]	0.113082	0.108112	1.05	0.2978		
IND 2[821-4]	-0.06579	0.112966	-0.58	0.5615		
LTMSLAB[A]	-0.05339	0.053021	-1.01	0.3161	0.25	-0.01335
LTMSLAB[B]	0.060093	0.058463	1.03	0.3062	0.25	0.015023
LTMSLAB[D]	-0.20068	0.062542	-3.21	0.0017	0.25	-0.05017
LTMSLAB[F]	0.04628	0.111079	0.42	0.6777		
LTMSLAB[G]	0.063208	0.059563	1.06	0.2909	0.25	0.015802
LTMSLAB[I]	0.084481	0.137705	0.61	0.5408		
Coolant[Delo 50/50]	-0.18655	0.075952	-2.46	0.0156	1	-0.18655
Coolant[Old Coolant]	0.186551	0.075952	2.46	0.0156		
ConRodBearing/MainBearing[L1/J]	0.249471	0.199443	1.25	0.2136		
ConRodBearing/MainBearing[L/J]	0.334593	0.162787	2.06	0.0421		
ConRodBearing/MainBearing[M/J]	0.268599	0.260964	1.03	0.3056		
ConRodBearing/MainBearing[M/K]	0.135133	0.154361	0.88	0.3832		
ConRodBearing/MainBearing[N/K]	-0.16426	0.204436	-0.8	0.4234		
ConRodBearing/MainBearing[N/L]	0.224873	0.138952	1.62	0.1084		
ConRodBearing/MainBearing[P/L]	0.057992	0.202415	0.29	0.775		
ConRodBearing/MainBearing[P/M]	-0.30284	0.15498	-1.95	0.0532		
ConRodBearing/MainBearing[R/M]	-0.02773	0.112606	-0.25	0.8059		
ConRodBearing/MainBearing[S/M]	-0.13761	0.255297	-0.54	0.5909		
ConRodBearing/MainBearing[T/M1]	0.042178	0.153019	0.28	0.7833		
ConRodBearing/MainBearing[U/M1]	-0.21207	0.254274	-0.83	0.406		
ConRodBearing/MainBearing[U/M2]	-0.37962	0.258067	-1.47	0.1441		
ConRodBearing/MainBearing[W/N]	0.036382	0.111478	0.33	0.7448		
ConRodBearing/MainBearing[X/O]	-0.13236	0.168056	-0.79	0.4326		
ConRodBearing/MainBearing[Y/P]	0.077029	0.180101	0.43	0.6697		
ConRodBearing/MainBearing[Z/Q]	-0.06975	0.207551	-0.34	0.7374	1	-0.06975

		Target Pb
Estimated PbFNL with Delo & Z/Q Hardare =	2.487	3.106

Multiplicative ICF = 1.249
Additive ICF = 0.619

Appendix B

PBFNL ICF without coolant factor:

With Additional Data on New Hardware and no Coolant Factor

Expanded Estimates

Term	Estimate	Std Error	t Ratio	Prob>|t|		Total
Intercept	3.13307	0.093583	33.48	<.0001	1	3.13307
IND 2[PC10E/ 821]	-0.17963	0.171513	-1.05	0.2972	1	-0.17963
IND 2[821-1]	0.068782	0.09098	0.76	0.4512		
IND 2[821-2]	0.061774	0.0875	0.71	0.4816		
IND 2[821-3]	0.113479	0.110472	1.03	0.3065		
IND 2[821-4]	-0.0644	0.115431	-0.56	0.578		
LTMSLAB[A]	-0.05649	0.054163	-1.04	0.2992	0.25	-0.01412
LTMSLAB[B]	0.061808	0.059736	1.03	0.303	0.25	0.015452
LTMSLAB[D]	-0.19279	0.063824	-3.02	0.0031	0.25	-0.0482
LTMSLAB[F]	0.046214	0.113505	0.41	0.6847		
LTMSLAB[G]	0.056341	0.060796	0.93	0.356	0.25	0.014085
LTMSLAB[I]	0.084911	0.140712	0.6	0.5474		
ConRodBearing / MainBearing[L1/J]	0.259569	0.203755	1.27	0.2053		
ConRodBearing / MainBearing[L/J]	0.344535	0.16629	2.07	0.0405		
ConRodBearing / MainBearing[M/J]	0.281105	0.266612	1.05	0.2939		
ConRodBearing / MainBearing[M/K]	0.142559	0.157701	0.9	0.3679		
ConRodBearing / MainBearing[N/K]	-0.14798	0.20879	-0.71	0.4799		
ConRodBearing / MainBearing[N/L]	0.236725	0.1419	1.67	0.098		
ConRodBearing / MainBearing[P/L]	0.070498	0.206769	0.34	0.7338		
ConRodBearing / MainBearing[P/M]	-0.28929	0.158263	-1.83	0.0702		
ConRodBearing / MainBearing[R/M]	-0.02008	0.115021	-0.17	0.8617		
ConRodBearing / MainBearing[S/M]	-0.1227	0.260797	-0.47	0.6389		
ConRodBearing / MainBearing[T/M1]	0.049375	0.156331	0.32	0.7527		
ConRodBearing / MainBearing[U/M1]	-0.20093	0.259785	-0.77	0.4409		
ConRodBearing / MainBearing[U/M2]	-0.37329	0.263688	-1.42	0.1596		
ConRodBearing / MainBearing[W/N]	0.044809	0.113859	0.39	0.6947		
ConRodBearing / MainBearing[X/O]	-0.12453	0.171695	-0.73	0.4698		
ConRodBearing / MainBearing[Y/P]	0.073426	0.184027	0.4	0.6906		
ConRodBearing / MainBearing[Z/Q]	-0.22381	0.202167	-1.11	0.2706	1	-0.22381

Estimated PbFNL with Delo & Z/Q Hardare = 2.697

Target Pb
3.106

Multiplicative ICF = 1.152
Additive ICF = 0.409

Appendix C

PB2FNL ICF with coolant factor:

With Additional Data on New Hardware

Expanded Estimates

Term	Estimate	Std Error	t Ratio	Prob>|t|		Total
Intercept	2.027787	0.199522	10.16	<.0001	1	2.027787
IND 2[PC10E/ 821]	-0.32936	0.285934	-1.15	0.2518	1	-0.32936
IND 2[821-1]	0.032478	0.151675	0.21	0.8308		
IND 2[821-2]	0.054261	0.145874	0.37	0.7106		
IND 2[821-3]	0.22034	0.184169	1.2	0.234		
IND 2[821-4]	0.022278	0.192439	0.12	0.908		
LTMSLAB[A]	-0.14521	0.090321	-1.61	0.1107	0.25	-0.0363
LTMSLAB[B]	0.068596	0.099593	0.69	0.4924	0.25	0.017149
LTMSLAB[D]	-0.33738	0.106541	-3.17	0.002	0.25	-0.08435
LTMSLAB[F]	0.088953	0.189224	0.47	0.6392		
LTMSLAB[G]	0.068184	0.101465	0.67	0.503	0.25	0.017046
LTMSLAB[I]	0.256861	0.234581	1.09	0.2759		
Coolant[Delo 50/50]	-0.2324	0.129385	-1.8	0.0751	1	-0.2324
Coolant[Old Coolant]	0.232396	0.129385	1.8	0.0751		
ConRodBearing/MainBearing[L1/J]	0.357383	0.339754	1.05	0.2951		
ConRodBearing/MainBearing[L/J]	0.427225	0.277308	1.54	0.1262		
ConRodBearing/MainBearing[M/J]	0.411606	0.444554	0.93	0.3565		
ConRodBearing/MainBearing[M/K]	0.133341	0.262955	0.51	0.6131		
ConRodBearing/MainBearing[N/K]	0.08043	0.348258	0.23	0.8178		
ConRodBearing/MainBearing[N/L]	0.216615	0.236706	0.92	0.3621		
ConRodBearing/MainBearing[P/L]	0.261553	0.344816	0.76	0.4497		
ConRodBearing/MainBearing[P/M]	-0.23202	0.264009	-0.88	0.3814		
ConRodBearing/MainBearing[R/M]	-0.04609	0.191826	-0.24	0.8106		
ConRodBearing/MainBearing[S/M]	-0.05826	0.4349	-0.13	0.8937		
ConRodBearing/MainBearing[T/M1]	0.235836	0.260669	0.9	0.3675		
ConRodBearing/MainBearing[U/M1]	-0.53801	0.433159	-1.24	0.2168		
ConRodBearing/MainBearing[U/M2]	-0.41535	0.439619	-0.94	0.3468		
ConRodBearing/MainBearing[W/N]	-0.12938	0.189904	-0.68	0.4971		
ConRodBearing/MainBearing[X/O]	-0.31592	0.286285	-1.1	0.2721		
ConRodBearing/MainBearing[Y/P]	-0.15544	0.306803	-0.51	0.6134		
ConRodBearing/MainBearing[Z/Q]	-0.23353	0.353565	-0.66	0.5103	1	-0.23353

		Target
1.146056	2.125	2.125

Multiplicative 1.854186

Additive 0.978944

Appendix D

PB2FNL ICF without coolant factor:

With Additional Data on New Hardware (no Coolant Factor)

Expanded Estimates

Term	Estimate	Std Error	t Ratio	Prob>|t|		Total
Intercept	2.251182	0.157529	14.29	<.0001	1	2.251182
IND 2[PC10E/821]	-0.33207	0.288708	-1.15	0.2525	1	-0.33207
IND 2[821-1]	0.031452	0.153147	0.21	0.8376		
IND 2[821-2]	0.055782	0.147289	0.38	0.7056		
IND 2[821-3]	0.220835	0.185958	1.19	0.2375		
IND 2[821-4]	0.024002	0.194306	0.12	0.9019		
LTMSLAB[A]	-0.14907	0.091173	-1.64	0.1048	0.25	-0.03727
LTMSLAB[B]	0.070733	0.100553	0.7	0.4832	0.25	0.017683
LTMSLAB[D]	-0.32756	0.107435	-3.05	0.0029	0.25	-0.08189
LTMSLAB[F]	0.088871	0.191063	0.47	0.6427		
LTMSLAB[G]	0.059629	0.102338	0.58	0.5613	0.25	0.014907
LTMSLAB[I]	0.257395	0.236861	1.09	0.2795		
ConRodBearing / MainBearing[L1/J]	0.369963	0.342982	1.08	0.283		
ConRodBearing / MainBearing[L/J]	0.439611	0.279916	1.57	0.1191		
ConRodBearing / MainBearing[M/J]	0.427185	0.448789	0.95	0.3432		
ConRodBearing / MainBearing[M/K]	0.142591	0.26546	0.54	0.5922		
ConRodBearing / MainBearing[N/K]	0.100702	0.351457	0.29	0.775		
ConRodBearing / MainBearing[N/L]	0.231379	0.238862	0.97	0.3348		
ConRodBearing / MainBearing[P/L]	0.277133	0.348056	0.8	0.4276		
ConRodBearing / MainBearing[P/M]	-0.21513	0.266405	-0.81	0.421		
ConRodBearing / MainBearing[R/M]	-0.03655	0.193615	-0.19	0.8506		
ConRodBearing / MainBearing[S/M]	-0.03968	0.439001	-0.09	0.9281		
ConRodBearing / MainBearing[T/M1]	0.244802	0.263153	0.93	0.3542		
ConRodBearing / MainBearing[U/M1]	-0.52413	0.437298	-1.2	0.2332		
ConRodBearing / MainBearing[U/M2]	-0.40746	0.443868	-0.92	0.3606		
ConRodBearing / MainBearing[W/N]	-0.11888	0.191659	-0.62	0.5363		
ConRodBearing / MainBearing[X/O]	-0.30617	0.289015	-1.06	0.2917		
ConRodBearing / MainBearing[Y/P]	-0.15993	0.309774	-0.52	0.6067		
ConRodBearing / MainBearing[Z/Q]	-0.42544	0.340309	-1.25	0.2138	1	-0.42544

		Target
	1.407103	2.125	2.125
Multiplicative	1.510195		
Additive	0.717897		

Appendix E

Evaluation of OCFNL with current ICF, Delo 50/50 coolant factor, & current hardware = 4.11 vs. Target of 4.093

With Additional Data on New Hardware ******Delo Coolant Confounded with Hardware******

Expanded Estimates

Term	Estimate	Std Error	t Ratio	Prob>|t|		Total
Intercept	4.171901	0.029414	141.83	<.0001	1	4.171901
IND 2[PC10E/821]	-0.01482	0.047447	-0.31	0.7553	1	-0.01482
IND 2[821-1]	0.01466	0.027411	0.53	0.5938		
IND 2[821-2]	0.019275	0.026394	0.73	0.4667		
IND 2[821-3]	-0.01989	0.035026	-0.57	0.5712		
IND 2[821-4]	7.80E-04	0.03879	0.02	0.984		
LTMSLAB[A]	0.020623	0.014632	1.41	0.1615	0.25	0.005156
LTMSLAB[B]	-0.0324	0.017771	-1.82	0.0709	0.25	-0.0081
LTMSLAB[D]	-0.01065	0.018944	-0.56	0.575	0.25	-0.00266
LTMSLAB[F]	-0.03227	0.031495	-1.02	0.3078		
LTMSLAB[G]	-0.03256	0.017522	-1.86	0.0657	0.25	-0.00814
LTMSLAB[I]	0.087261	0.039465	2.21	0.029		
Liner/Ring/Piston[N/N/]	0.016877	0.061465	0.27	0.7841		
Liner/Ring/Piston[P/P/]	-0.01787	0.055142	-0.32	0.7465		
Liner/Ring/Piston[R/R/]	0.047668	0.045648	1.04	0.2986		
Liner/Ring/Piston[S/R/]	-0.16395	0.082573	-1.99	0.0495		
Liner/Ring/Piston[S/T/]	-0.02811	0.036648	-0.77	0.4447		
Liner/Ring/Piston[S/T/T]	-0.03045	0.053742	-0.57	0.5721		
Liner/Ring/Piston[U/U/]	0.040028	0.047764	0.84	0.4038		
Liner/Ring/Piston[U/U/U]	0.111086	0.07888	1.41	0.1618		
Liner/Ring/Piston[V/U/]	0.02552	0.030987	0.82	0.4119		
Liner/Ring/Piston[V/U/A]	0.050403	0.045088	1.12	0.266		
Liner/Ring/Piston[V/U/B]	-0.0319	0.035212	-0.91	0.3669		
Liner/Ring/Piston[V/U/C]	-0.01679	0.038351	-0.44	0.6623		
Liner/Ring/Piston[V/U/U]	-0.00798	0.034246	-0.23	0.8161		
Liner/Ring/Piston[V/X/D]	-4.5E-05	0.032651	0	0.9989		
Liner/Ring/Piston[V/X/E]	0.078588	0.049795	1.58	0.1173		
Liner/Ring/Piston[W/X/F]	0.017971	0.036195	0.5	0.6205		
Liner/Ring/Piston[W/Y/F]	-0.09104	0.04374	-2.08	0.0397	1	-0.09104
Coolant[Delo 50/50]	0.062319	0.023775	2.62	0.01	1	0.062319
Coolant[Old Coolant]	-0.06232	0.023775	-2.62	0.01		

		Target
4.114611	4.093	4.093
Multiplicative	0.994748	
Additive	0.021611	

Appendix F

Evaluation of OCFNL with current ICF & current hardware = 4.044 vs. Target of 4.093

Evaluation of Expanded Estimates

Term	Estimate	Std Error	t Ratio	Prob>|t|		Total
Intercept	4.113138128	0.019526021	210.7	<.0001	1	4.1131381
IND 2[PC10E/ 821]	-0.014200018	0.048653228	-0.29	0.7709	1	-0.0142
IND 2[821-1]	0.014705251	0.028107567	0.52	0.6019		
IND 2[821-2]	0.018941829	0.02706505	0.7	0.4854		
IND 2[821-3]	-0.020045685	0.035916965	-0.56	0.5779		
IND 2[821-4]	0.000598623	0.039776612	0.02	0.988		
LTMSLAB[A]	0.021014011	0.015003422	1.4	0.164	0.25	0.0052535
LTMSLAB[B]	-0.032936441	0.018221506	-1.81	0.0733	0.25	-0.0082341
LTMSLAB[D]	-0.013931274	0.019383488	-0.72	0.4738	0.25	-0.0034828
LTMSLAB[F]	-0.032101548	0.032295257	-0.99	0.3223		
LTMSLAB[G]	-0.029781322	0.017934792	-1.66	0.0996	0.25	-0.0074453
LTMSLAB[I]	0.087736575	0.040467811	2.17	0.0322		
Liner/Ring/Piston[N/N/]	0.012494945	0.063004707	0.2	0.8431		
Liner/Ring/Piston[P/P/]	-0.022659645	0.056512784	-0.4	0.6892		
Liner/Ring/Piston[R/R/]	0.044455563	0.046791798	0.95	0.3441		
Liner/Ring/Piston[S/R/]	-0.167010583	0.084663905	-1.97	0.051		
Liner/Ring/Piston[S/T/]	-0.031205818	0.037560728	-0.83	0.4078		
Liner/Ring/Piston[S/T/T]	-0.036581666	0.055055946	-0.66	0.5077		
Liner/Ring/Piston[U/U/]	0.037383313	0.048967251	0.76	0.4468		
Liner/Ring/Piston[U/U/U]	0.10490329	0.080848831	1.3	0.1971		
Liner/Ring/Piston[V/U/]	0.022314242	0.031749569	0.7	0.4836		
Liner/Ring/Piston[V/U/A]	0.045442979	0.046193448	0.98	0.3273		
Liner/Ring/Piston[V/U/B]	-0.034819847	0.036088796	-0.96	0.3367		
Liner/Ring/Piston[V/U/C]	-0.020927555	0.039292355	-0.53	0.5953		
Liner/Ring/Piston[V/U/U]	-0.012768371	0.035066444	-0.36	0.7164		
Liner/Ring/Piston[V/X/D]	-0.003870228	0.0334479	-0.12	0.9081		
Liner/Ring/Piston[V/X/E]	0.07524888	0.051044594	1.47	0.1432		
Liner/Ring/Piston[W/X/F]	0.028441794	0.036888456	0.77	0.4423		
Liner/Ring/Piston[W/Y/F]	-0.040841293	0.040324325	-1.01	0.3133	1	-0.0408413

		Target
4.0441881	4.093	4.093
	Multiplicative	1.01207
	Additive	-0.04881