Proposed updated correction factors for ISB N/G/F hardware

Statistics Group

06/01/2023

Statistics Group

- Amanda Stone, NewMarket
- Elisa Santos, Infineum
- Jo Martinez, Chevron Oronite
- Martin Chadwick, IAR
- Phil Scinto, Lubrizol
- Sean Moyer, TMC
- Seth Demel, Shell
- Todd Dvorak, Infineum
- Travis Kostan, SwRI

Objective

- CAM/CRH/TAPP ID N/G/F hardware were introduced
- Should current correction factors be updated?

Summary

- The Statistics Group met on 06/01/2023 and would like to recommend either option below for each parameter

- ACSW: Average Cam Shaft Wear
  - Option 1: Apply CF = 0.88 to tests with N/G/F hardware and corresponding ltms field called ACSWorig
  - Option 2: Do nothing, keep current CF (0.77) as is, reevaluate when we have ten tests with N/G/F hardware

- ATWL: Average Tappet weight loss
  - Option 1: Apply CF = 0.92 to tests with N/G/F hardware and corresponding ltms field called ATWLorig
  - Option 2: Do nothing, keep current CF (0.785) as is, reevaluate when we have ten tests with N/G/F hardware

ACSW: Average Cam Shaft Wear

- Data set used: CAM/CRH/TAPP ID equal to J/D/C forward, corresponding to when target was last reset

- Excluded 150998 (ACSW=91) and 150999 (ACSW=90.2) from Lab D to be consistent with most recent past analysis

  - CAM/CRH/TAPP ID   # of tests
CAM/CRH/TAPP ID	# of tests
J/D/C	24
K/D/D	16
K/ E/D	13
L/ E/ E	9
M/ F/ F	11
N/ G/ F	5
Total	78

- Excluded only test on L/F/F hardware (165499). Including this test has no impact on CF
- Used model with Lab to do the analysis and calculate CF, similarly to previous analysis

Current CF applied (0.77)
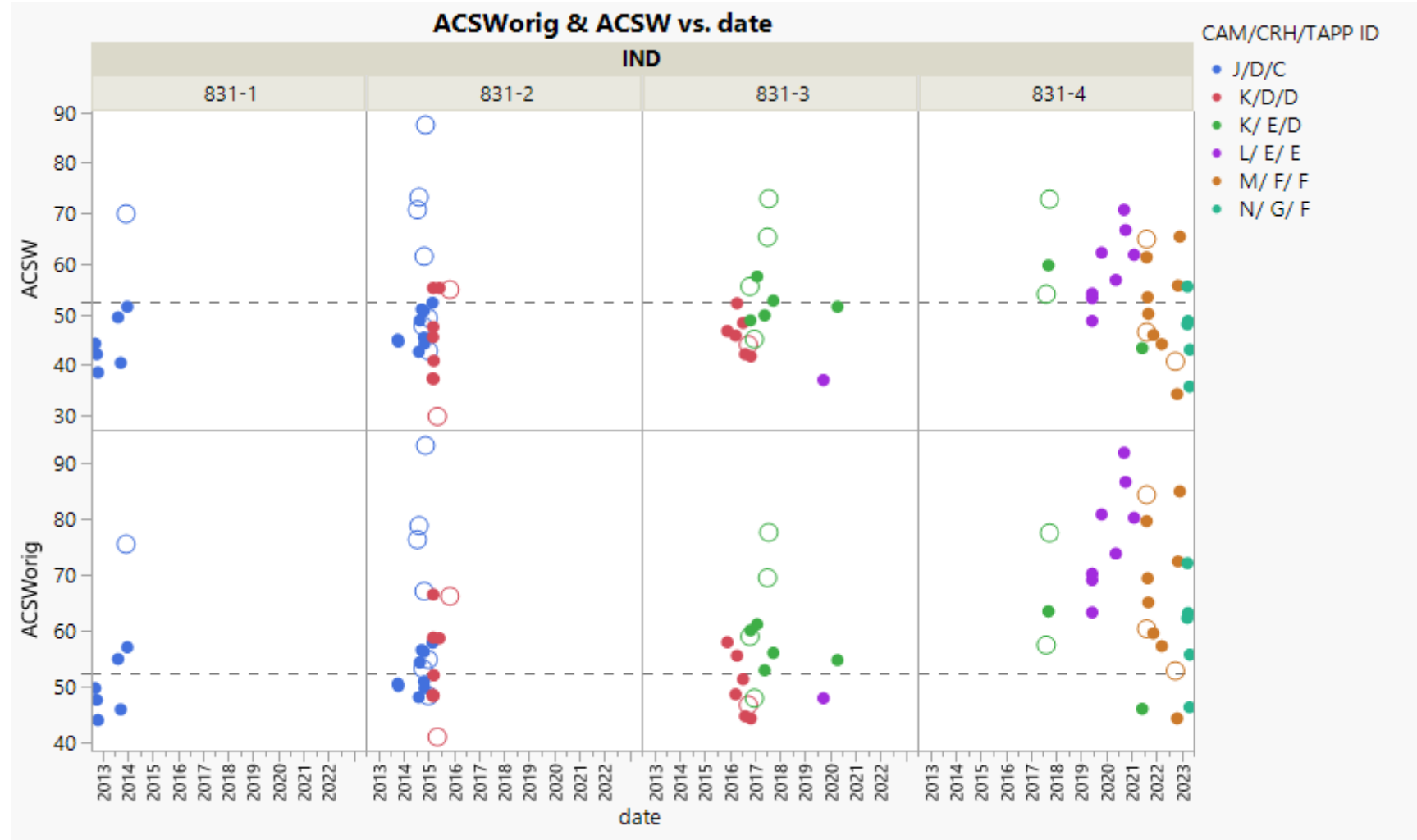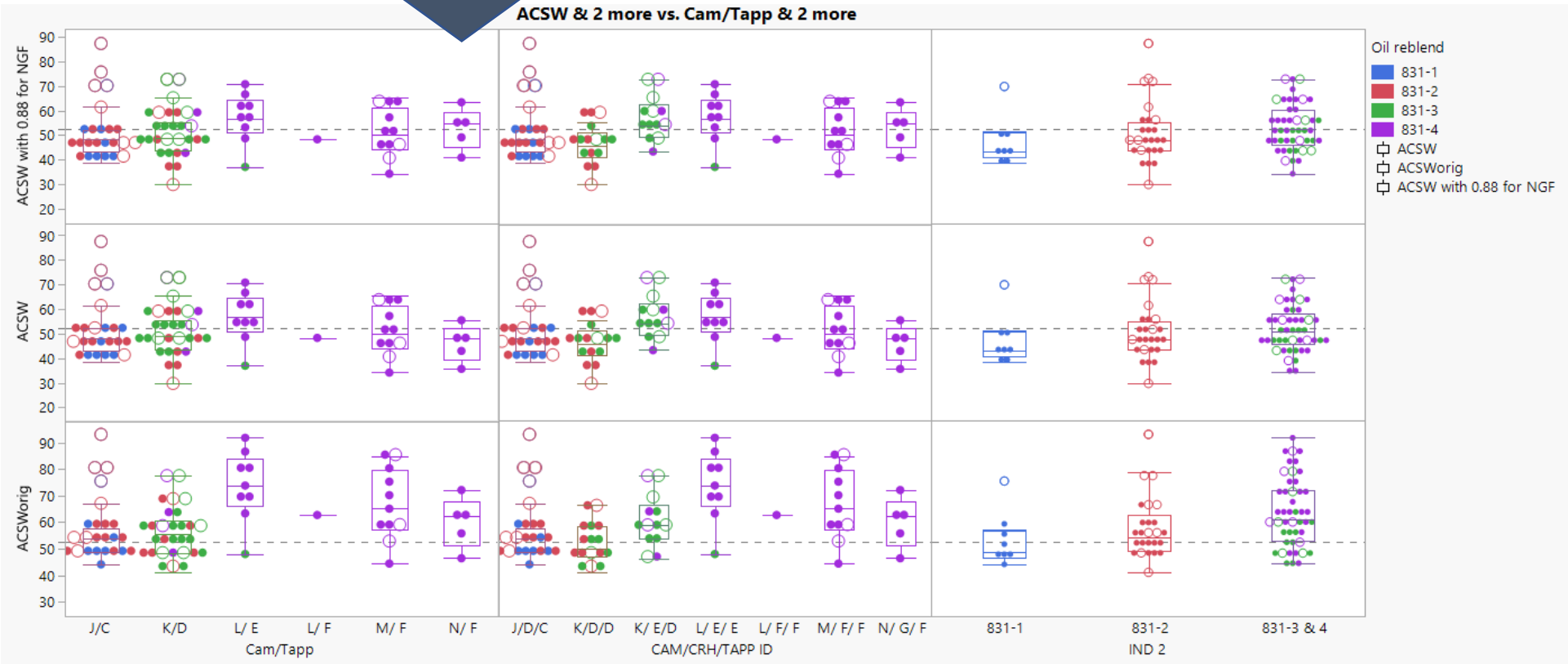
Original data without CF

ACSW

Proposed CF applied (0.88)

Current CF applied (0.77)

Original data without CF

Reminder:

Last time we worked on the ISB: Sean confirmed that 831-3 and 831-4 used the exact same base oil and components

Model details: this model is consistent with the most recent analysis

Summary of Fit

RSquare	0.294224
RSquare Adj	0.17835
Root Mean Square Error	9.548223
Mean of Response	51.15316
Observations (or Sum Wgts)	79

Effect Tests

Source	Nparm	DF	Sum of Squares	F Ratio	Prob > F
CAM/CRH/TAPP ID	6	6	1047.0313	1.9141	0.0912
IND 2	2	2	183.8502	1.0083	0.3703
LTMSLAB	3	3	1038.8247	3.7982	0.0141*

FINAL
CAM/ TAPP

Response ACSW — excluding OC tests from Lab D to to be consistent with most recent past analysis
JCD parts forward — excluding LFF hardware (one test)

Expanded Estimates					predicted	target	CF for current ACSW	CF for original ACSW
Nominal factors expanded to all levels					45.99315	52.4	1.1393	0.877261

Term	Estimate	Std Error	t Ratio	Prob>|t|				
Intercept	48.29378	2.667786	18.1	<.0001	1	48.29378		
CAM/CRH/TAPP ID[J/D/C]	4.382032	4.312961	1.02	0.3133	0	0		
CAM/CRH/TAPP ID[K/D/D]	-4.93867	2.807554	-1.76	0.0831	0	0		
CAM/CRH/TAPP ID[K/ E/D]	2.817972	2.956603	0.95	0.344	0	0		
CAM/CRH/TAPP ID[L/ E/ E]	4.03725	3.190641	1.27	0.2101	0	0		
CAM/CRH/TAPP ID[M/ F/ F]	-0.65399	2.96514	-0.22	0.8261	0	0		
CAM/CRH/TAPP ID[N/ G/ F]	-5.6446	4.155888	-1.36	0.179	1	-5.6446		
IND 2[831-1]	-4.51632	3.237925	-1.39	0.1677	0	0		
IND 2[831-2]	1.172352	2.14948	0.55	0.5873	0	0		
IND 2[831-3 & 4]	3.343971	3.502293	0.95	0.3431	1	3.343971		
LTMSLAB[A]	-4.22509	2.042668	-2.07	0.0425	0.25	-1.05627		
LTMSLAB[B]	-1.08235	2.437647	-0.44	0.6585	0.25	-0.27059		
LTMSLAB[D]	0.934232	3.730992	0.25	0.803	0.25	0.233558		
LTMSLAB[G]	4.373206	1.931128	2.26	0.0268	0.25	1.093302		

Ignoring cross head in the model results in the same CF

Top panel, under oil 831-4, *ACSW with proposed CF 0.88 applied* is highlighted

ATWL: Average Tappet weight loss

- Data set used: most data (116 tests)
  - Excluded 150998 (ACSW=91) and 150999 (ACSW=90.2) from Lab D to be consistent with most recent past analysis

- Used model with Lab to do the analysis and calculate CF, similarly to previous analysis

- Number of tests by batch of parts is shown on the table to the right

	CAM/CRH/TAPP ID	N Rows
1	A/A/A	7
2	B/A/A	12
3	C/A/A	2
4	C/B/B	3
5	D/B/B	1
6	E/B/B	4
7	F/B/B	3
8	G/B/B	1
9	H/C/C	4
10	J/D/C	24
11	K/D/D	16
12	K/ E/D	13
13	L/ E/ E	9
14	L/ F/ F	1
15	M/ F/ F	11
16	N/ G/ F	5
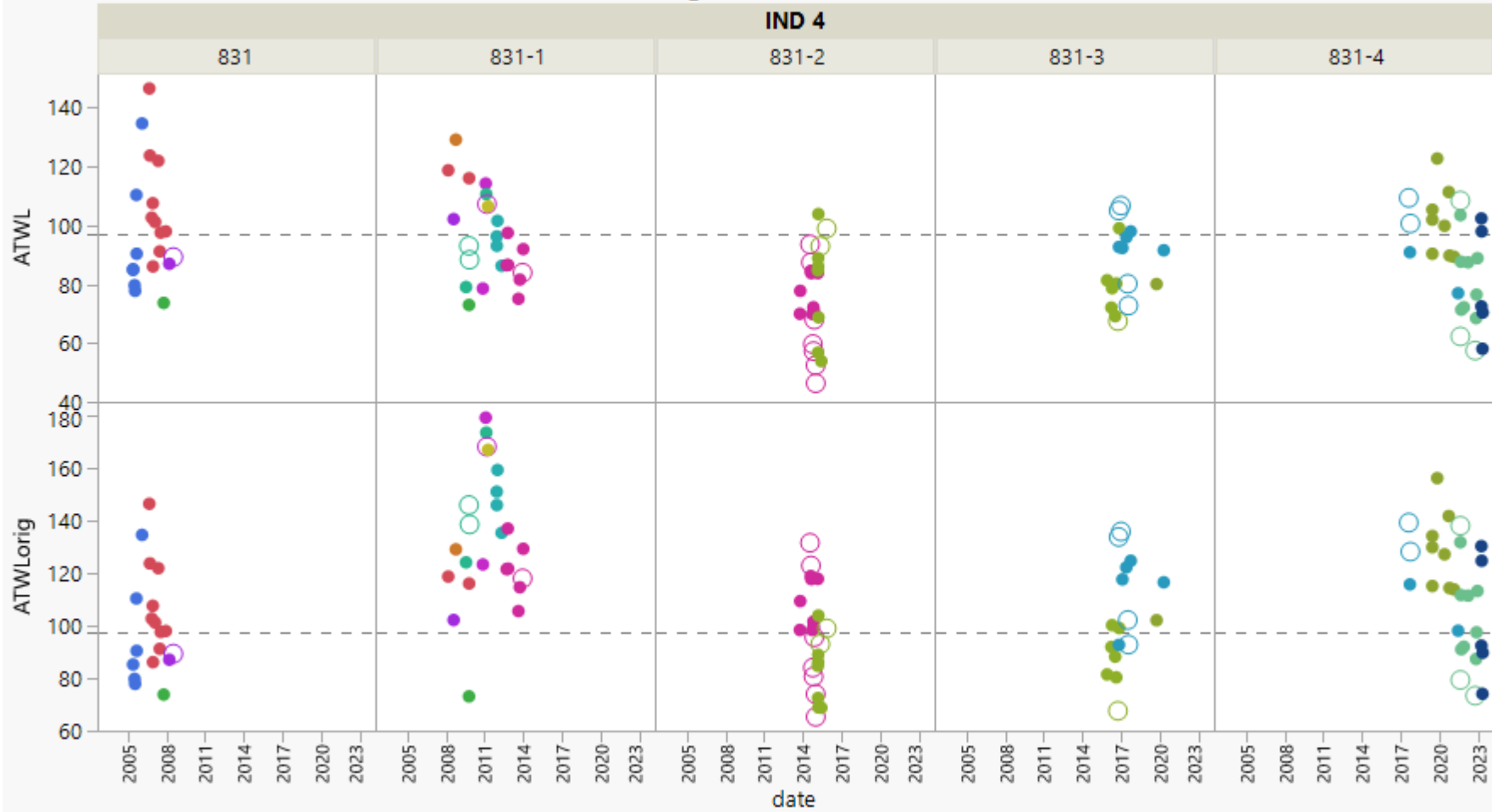
Current CF applied (0.785)

Original data without CF

ATWL: Model details in the next slide

Proposed CF applied (0.92)

Current CF applied (0.785)

Original data without CF

0.92 CF brings N/G/F tests to target

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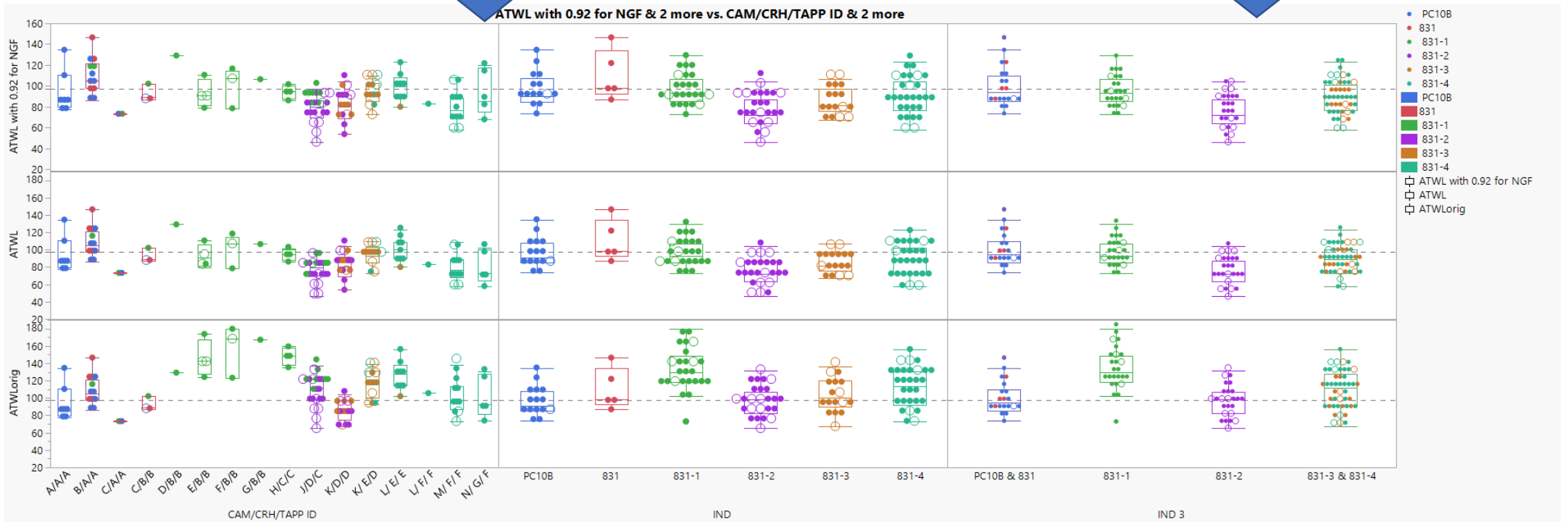
Last time we worked on the ISB: Sean has confirmed that 831-4 used the exact same base oil and components as 831-3

Summary of Fit

|	
RSquare	0.55196
RSquare Adj	0.445972
Root Mean Square Error	13.35338
Mean of Response	88.6181
Observations (or Sum Wgts)	116

Effect Tests

Source	Nparm	DF	Sum of Squares	F Ratio	Prob > F
CAM/CRH/TAPP ID	15	15	6038.2938	2.2576	0.0093*
LTMSLAB	4	4	3578.4602	5.0171	0.0010*
IND 3	3	3	1213.8384	2.2691	0.0856

FINAL
ATWL
For consistency, excludes 150998 & 150999 as it was done before

Expanded Estimates						predicted	target	CF for current ATWL	CF for original ATWL
Nominal factors expanded to all levels						105.2387	82.6124	97.2	1.176579	0.923614

Term	Estimate	Std Error	t Ratio	Prob>|t|			
Intercept	92.99646	2.615306	35.56	<.0001	1	92.99646	
CAM/CRH/TAPP ID[A/A/A]	1.637027	8.989971	0.18	0.8559	0	0	
CAM/CRH/TAPP ID[B/A/A]	10.22364	7.565766	1.35	0.1799	0	0	
CAM/CRH/TAPP ID[C/A/A]	-19.6033	10.03885	-1.95	0.0539	0	0	
CAM/CRH/TAPP ID[C/B/B]	1.609613	9.171013	0.18	0.8611	0	0	
CAM/CRH/TAPP ID[D/B/B]	0.478989	15.03708	0.03	0.9747	0	0	
CAM/CRH/TAPP ID[E/B/B]	-7.50072	7.519426	-1	0.3211	0	0	
CAM/CRH/TAPP ID[F/B/B]	1.127616	8.42599	0.13	0.8938	0	0	
CAM/CRH/TAPP ID[G/B/B]	8.35784	13.32893	0.63	0.5322	0	0	
CAM/CRH/TAPP ID[H/C/C]	-6.00072	7.519426	-0.8	0.4269	0	0	
CAM/CRH/TAPP ID[J/D/C]	-14.7568	4.485294	-3.29	0.0014	0	0	
CAM/CRH/TAPP ID[K/D/D]	-5.66796	5.314336	-1.07	0.2889	0	0	
CAM/CRH/TAPP ID[K/ E/D]	9.15027	7.179546	1.27	0.2057	0	0	
CAM/CRH/TAPP ID[L/ E/ E]	18.40047	7.454092	2.47	0.0154	0	0	
CAM/CRH/TAPP ID[L/ F/ F]	0.13287	13.95902	0.01	0.9924	0	0	
CAM/CRH/TAPP ID[M/ F/ F]	0.096187	7.252615	0.01	0.9894	0	0	
CAM/CRH/TAPP ID[N/ G/ F]	2.314964	8.664666	0.27	0.7899	1	2.314964	
LTMSLAB[A]	-3.82095	2.798072	-1.37	0.1754	0.25	-0.95524	
LTMSLAB[B]	1.327286	3.112411	0.43	0.6708	0.25	0.331821	
LTMSLAB[D]	-18.0526	5.772213	-3.13	0.0024	0.25	-4.51316	
LTMSLAB[F]	25.56257	6.317007	4.05	0.0001	0	0	
LTMSLAB[G]	-5.01628	2.813323	-1.78	0.0778	0.25	-1.25407	
IND 3[PC10B & 831]	-1.41102	6.935631	-0.2	0.8392	0	0	
IND 3[831-1]	10.16198	3.979861	2.55	0.0123	0	0	
IND 3[831-2]	-2.44257	3.915303	-0.62	0.5343	0	0	
IND 3[831-3 & 831-4]	-6.30839	6.169782	-1.02	0.3092	1	-6.30839	

Ignoring cross head in the model results in the same CF
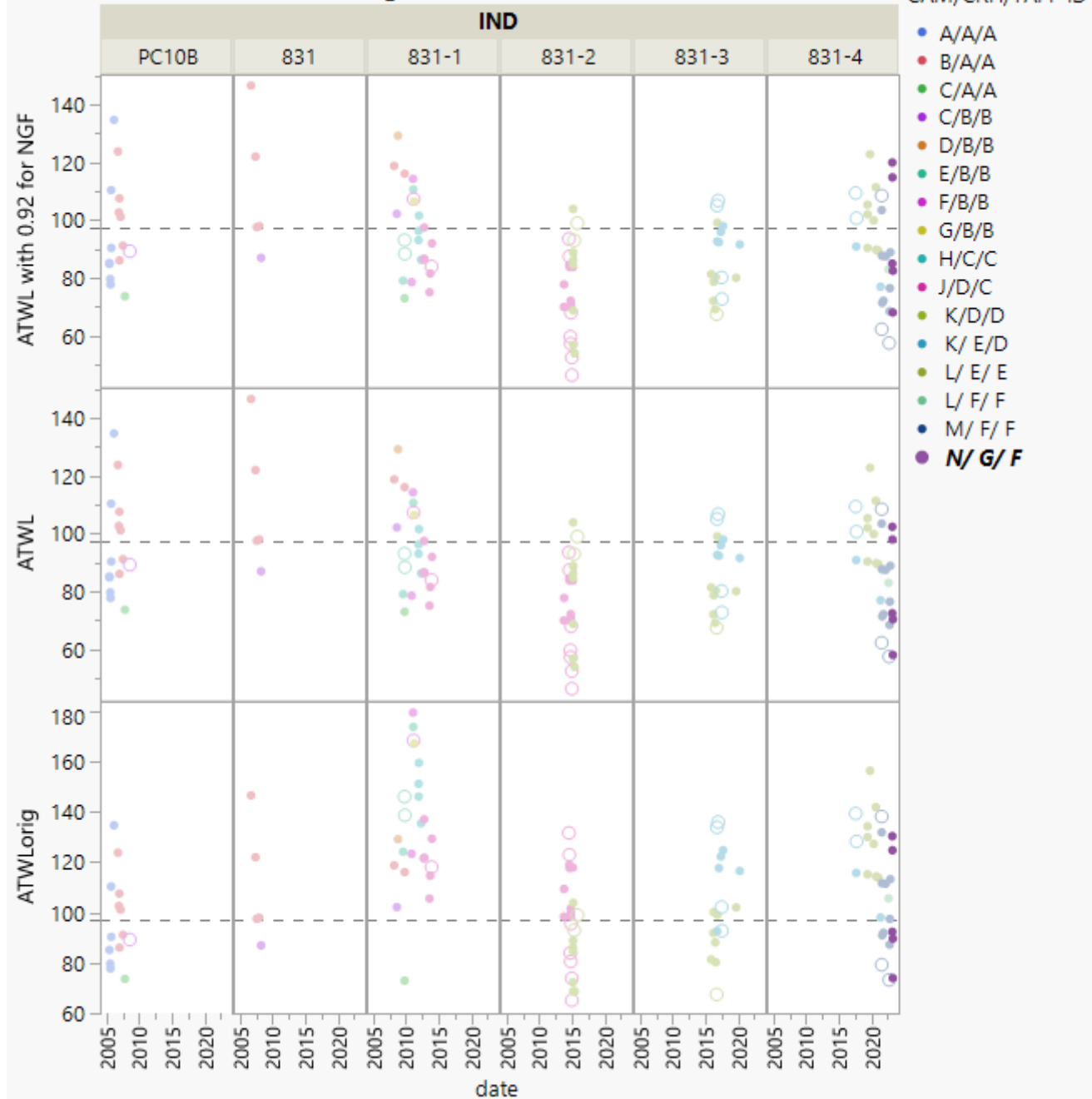
Proposed CF applied (0.92)

Current CF applied (0.785)

Original data without CF

Recommendation

- ACSW: Average Cam Shaft Wear
  - Option 1: Apply CF = 0.88 to tests with N/G/F hardware and corresponding ltms field called ACSWorig
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Thank you!