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Mack T-12 Industry Correction Factors

**Presented to Mack Surveillance Panel
May 31, 2012
jar**

Prolegomena

- Using all chartable PC10E, 821, 821-1, and 821-2 plus STVN references – 61 tests
- A lot of pictures of the data
- Many different approaches to analysis
- LTMS V2 type industry adjustments were calculated based on industry charts without ICF's or SA's.
- Full LTMS V2 charting for labs etc were not processed.
- LTMS V2 type adjustments are dependent on targets and standard deviations. The usual ICF's are dependent on targets.
- PC (Passenger Car, Politically Correct) type analyses were completed without ICF's applied.

From the latest (18.5 draft) for LTMS V2them

iii. Industry Charting and Actions

For the entire testing industry, let

- $X_i = i^{\text{th}}$ test result in original units in end of test order,
- $T_i = i^{\text{th}}$ test result in appropriate units in end of test order,
($T_i = X_i$ unless a transformation is used in which case $T_i = \text{transformed } (X_i)$)
- $Y_i = i^{\text{th}}$ standardized test result = $Y_i = (T_i - \text{target}) / (\text{standard deviation})$,
(Target and standard deviation are as currently defined for the reference oil used in the reference test)
- and,
- $Z_i = \text{EWMA} = \lambda Y_i + (1 - \lambda) Z_{i-1}$.
(By default, $\lambda = 0.2$. With sufficient data and appropriate analyses, λ could be optimized by Box procedure minimizing sum of squares for prediction, $\sum_i e_i^2$, see Reference 1, pages 87-88.)
(Fast start is used, i.e., $Z_0 = \text{average of } Y_1, Y_2, \text{ and } Y_3$.)

Industry Z_i charts without application of severity adjustment can indicate when a change in testing has caused the entire industry to drift. Such drift would be captured by severity adjustments. However, the industry chart might alert faster than individual testing entities. It might also indicate when the entire industry has shifted to the extent that the originally intended engine oil performance characteristics can no longer be reliably measured.

TMC will maintain industry Z_i charts and include them in semiannual reports. To enhance understanding of trends, individual reference entities will be indicated on the charts through color or symbols in coded form. Further, when the following limits are exceeded in absolute value, the TMC will take actions as indicated in Appendix B.

As described in Section G, the surveillance panel should determine level 2 limits based on mechanistic understanding of the test and discussed in engineering units. Suggested level 1 limits are shown in the following table.

Industry EWMA Limits for Severity Adjustment Parameters

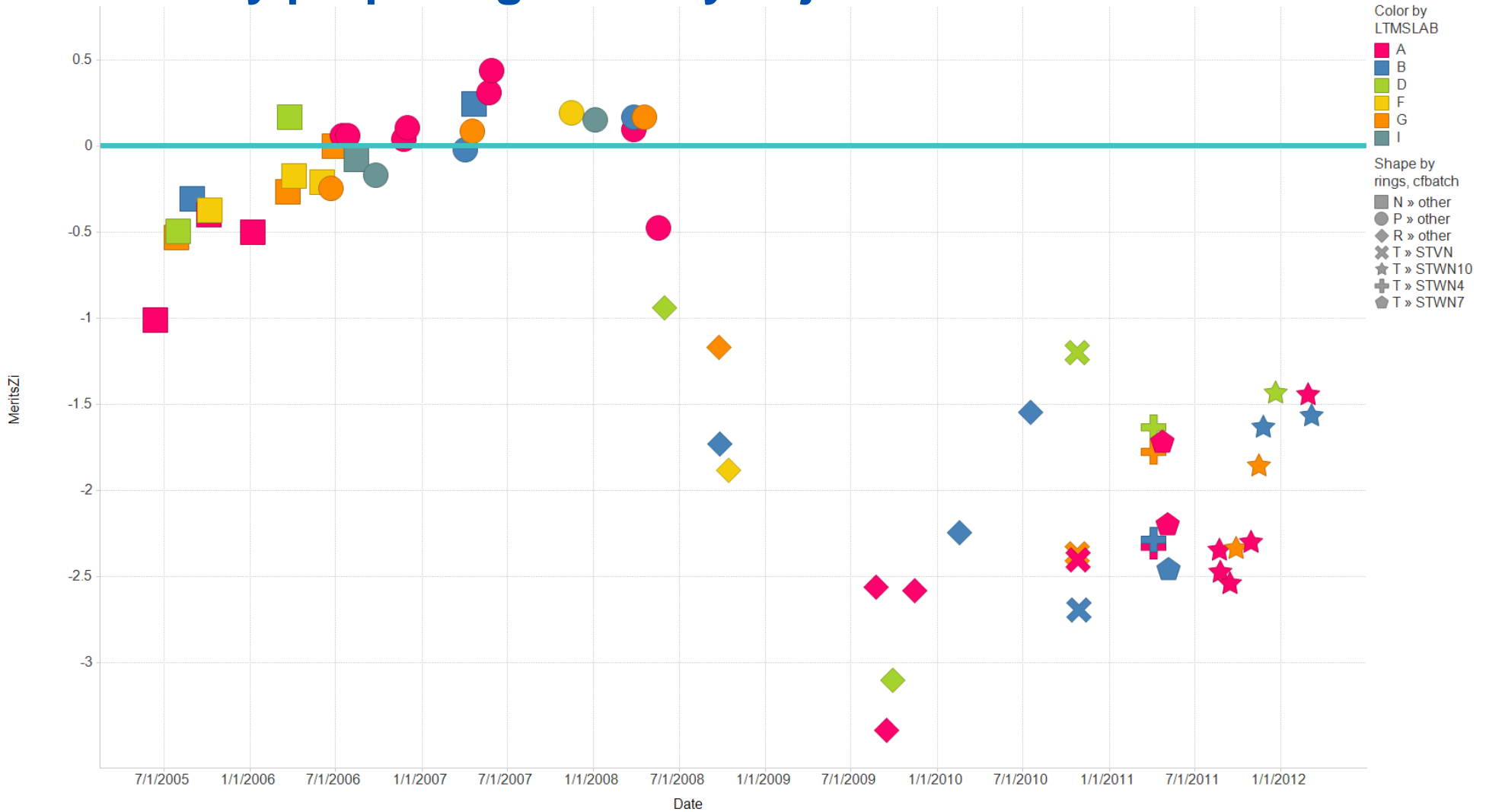
EWMA of Standardized Test Result $Z_i = \lambda(Y_i) + (1 - \lambda)Z_{i-1}$			
Limit Type	Tightened	Default	Loosened
Level 1	0.548	0.653	0.775
Level 2	0.653	0.747	0.859



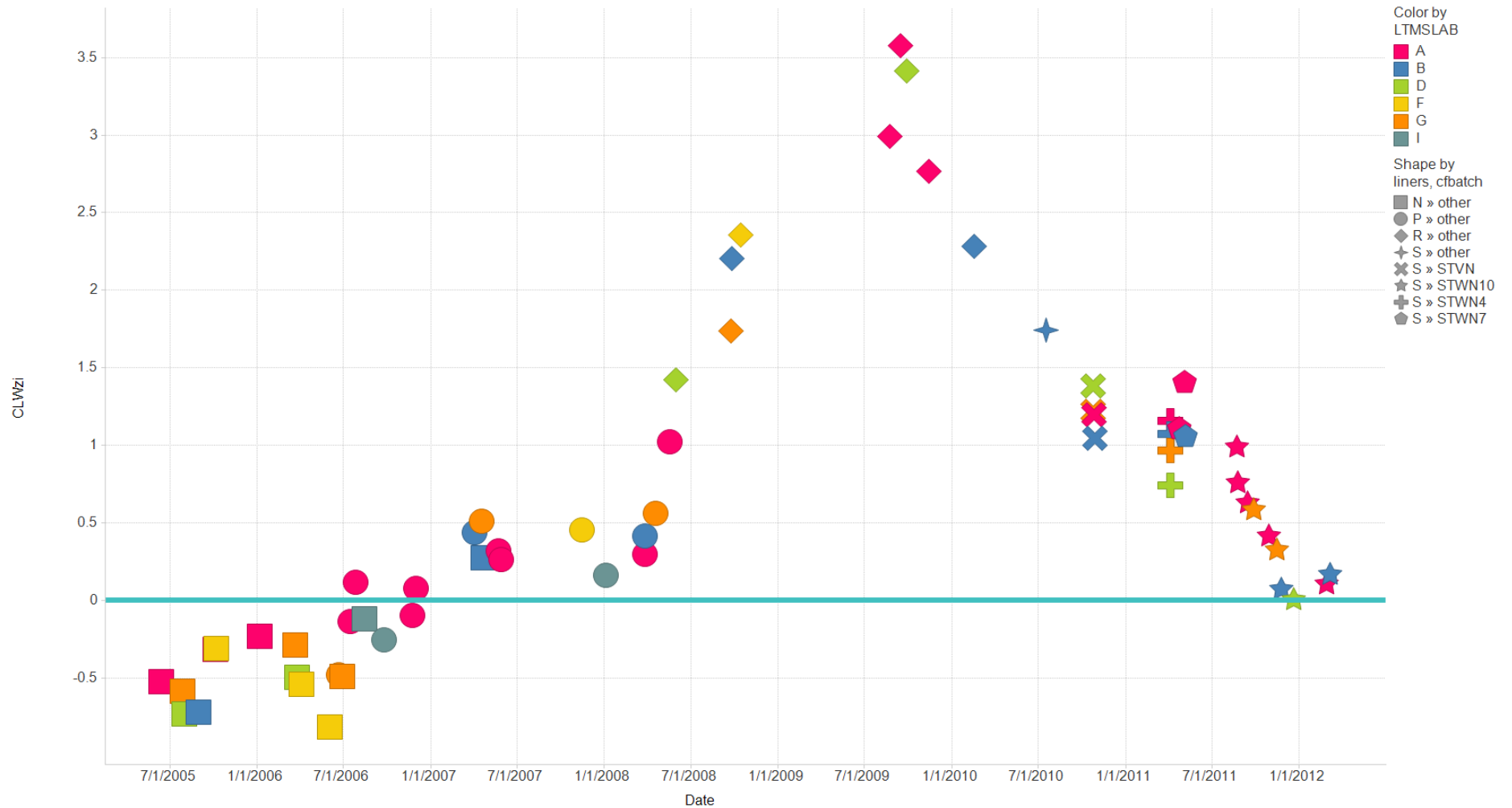
Targets, etc. – more about adjustments later

T-12 Reference Oil Targets															
Oil	Level	n	Effective Dates		Cylinder Liner Wear		Top Ring Weight Loss		Oil Consumption		ΔPB @ End of Test		ΔPB 250-300 Hours		
			From	To ₁	X	s	X	s	X	s	X	s	X	s	
821 (PC10E)	Stand	6	6-13-05	3-12-08	15.1	3.4	66.4	24.9	4.0830	0.0610	3.2590	0.2880	2.2510	0.3630	Original
821 (PC10E)	Stand	25	3-13-08	***	16.2	3.7	62.0	28.2	4.0930	0.0790	3.1060	0.2420	2.1250	0.3330	
821 (PC10E)	Lab	6	6-13-05	3-12-08	14.6	1.6	66.4	24.9	4.0830	0.0610	3.2590	0.2880	2.2510	0.3630	
821 (PC10E)	Lab	25	3-13-08	***	15.1	2.8	62.0	28.2	4.0930	0.0790	3.1060	0.2420	2.1250	0.3330	
821-1 ₂	Stand	--	3-13-08	***	16.2	3.7	62.0	28.2	4.0930	0.0790	3.1060	0.2420	2.1250	0.3330	
821-1 ₂	Lab	--	3-13-08	***	15.1	2.8	62.0	28.2	4.0930	0.0790	3.1060	0.2420	2.1250	0.3330	
821-2 ₃	Stand	--	9-27-11	***	16.2	3.7	62.0	28.2	4.0930	0.0790	3.1060	0.2420	2.1250	0.3330	Current
821-2 ₃	Lab	--	9-27-11	***	15.1	2.8	62.0	28.2	4.0930	0.0790	3.1060	0.2420	2.1250	0.3330	
1	*** = currently in effect														
2	Targets based on oil 821														
3	Targets based on 25 tests on 821														

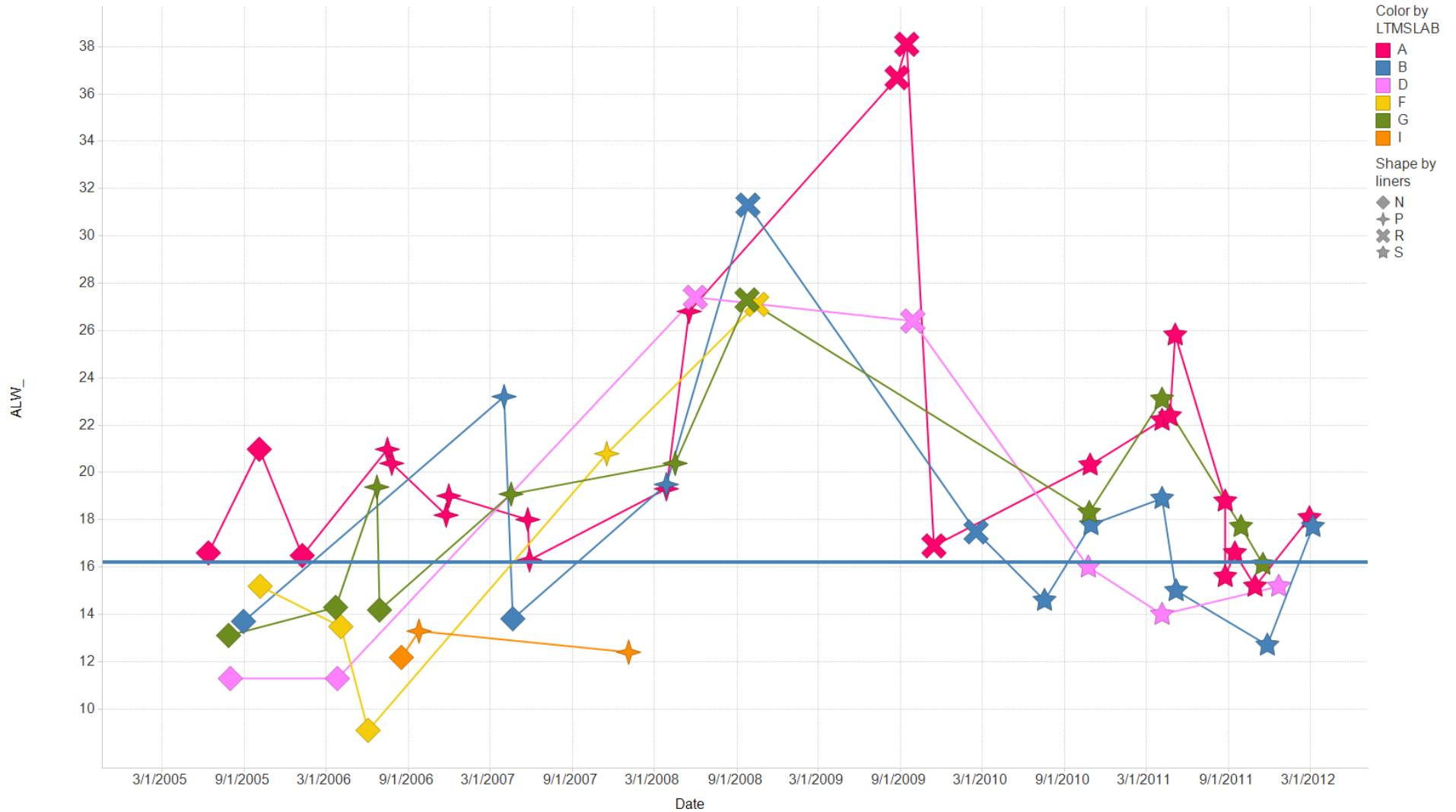
Mack Merits Z_i – not really proposing industry adjustment to Merits



Cylinder Liner Wear Z_i –



Cylinder Liner Wear – without industry corrections

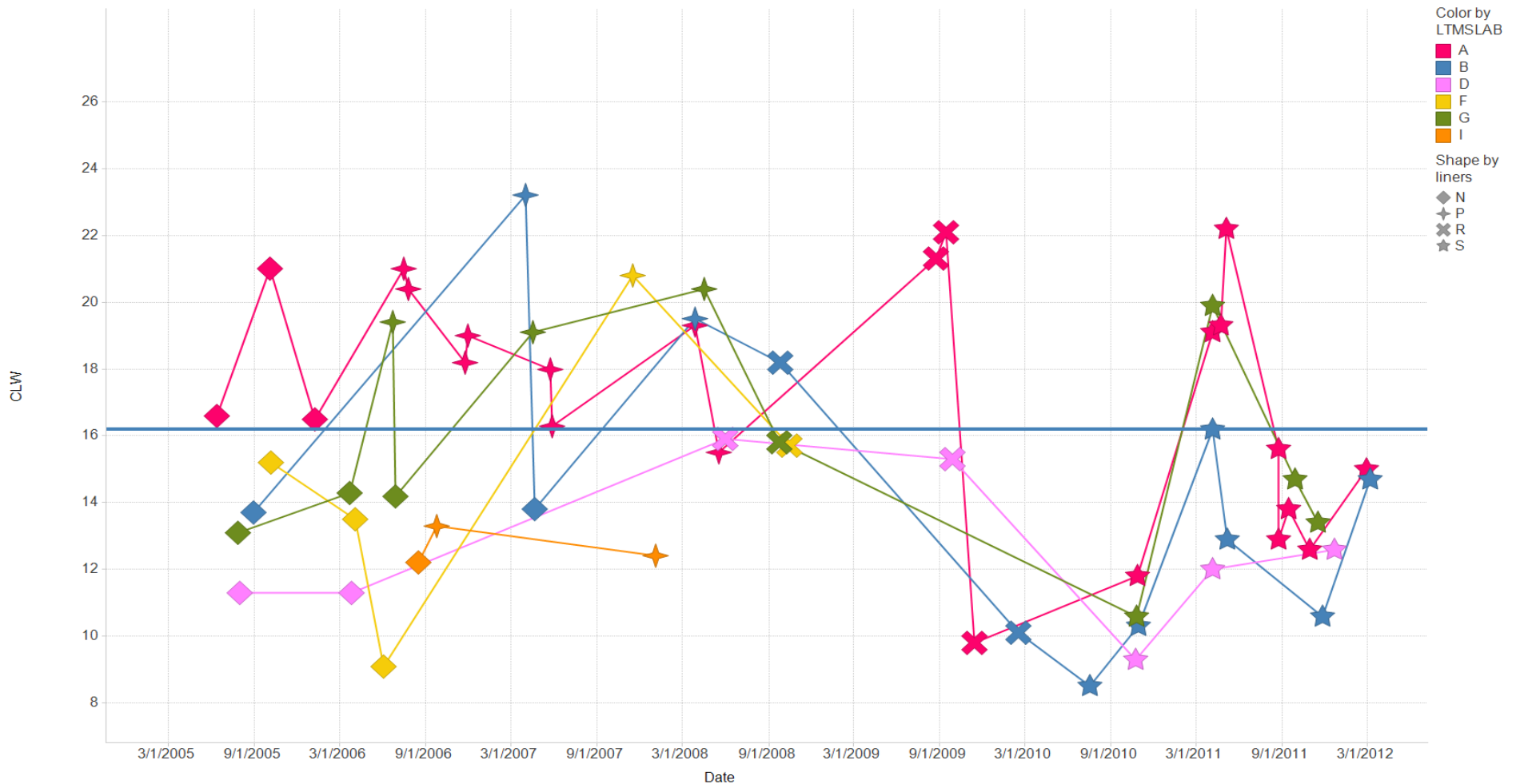


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Cylinder Liner Wear – with industry corrections

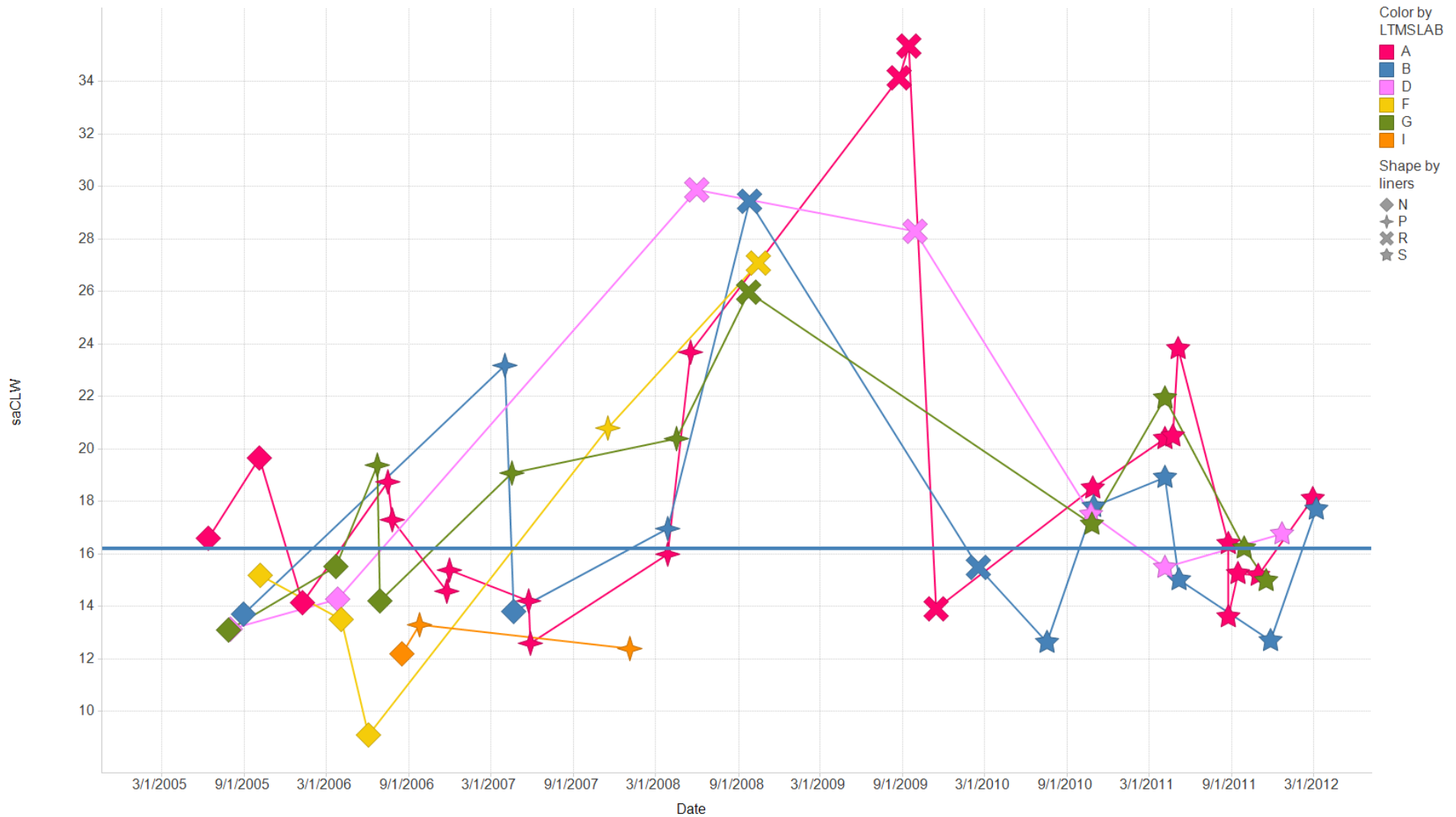


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Cylinder Liner Wear – with severity adjustments

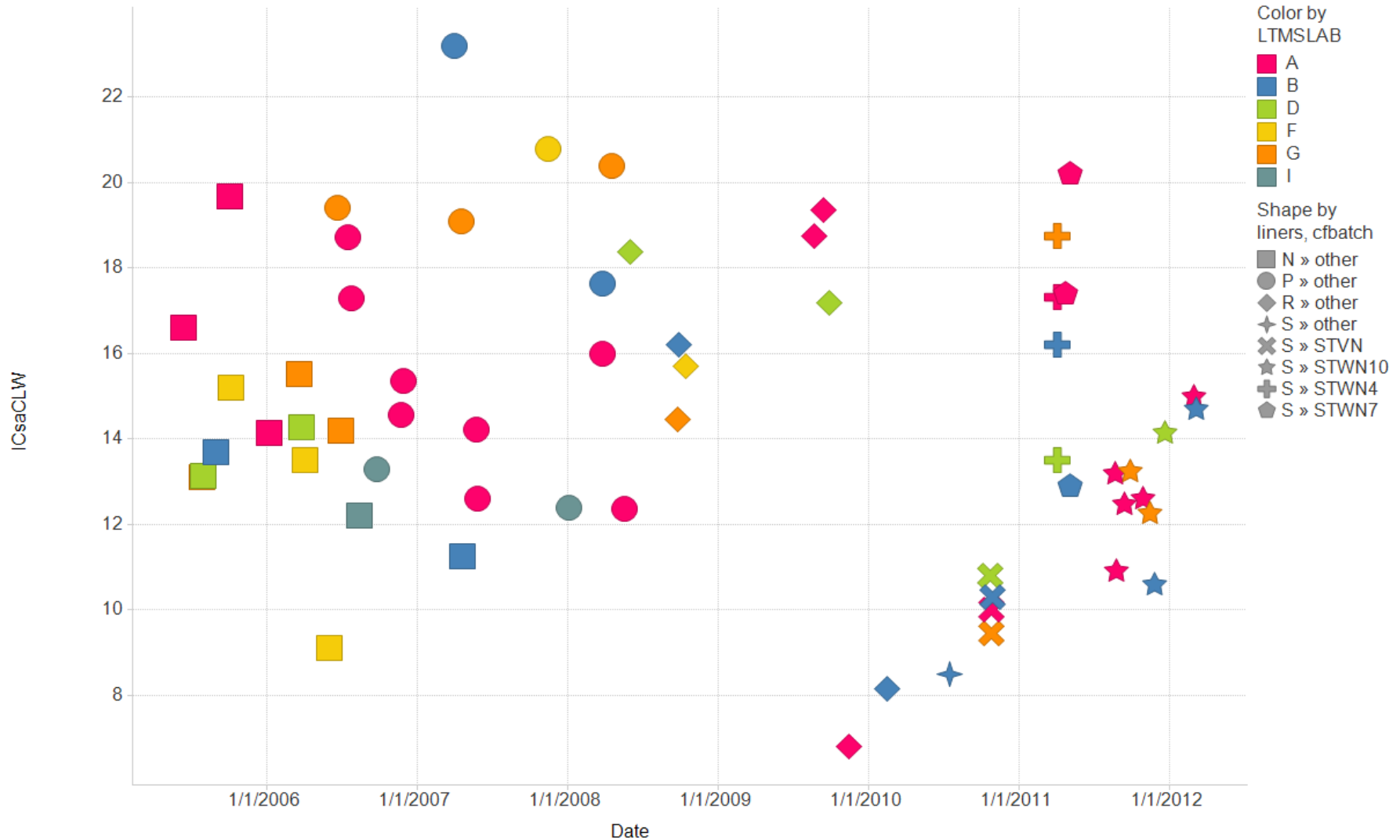


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Cylinder Liner Wear – with severity adjustments and industry corrections



Cylinder Liner Wear – PC type analyses part 1

ALW_						
Source	DF	Sum of Squares	Mean Square	F Value	Pr > F	
Model	10	1273	127	8.97	<.0001	
Error	50	710	14			
Corrected Total	60	1982				
R-Square	Coeff Var	Root MSE	ALW_ Mean			
0.64	20	3.77	18.7			
Source	DF	Type III SS	Mean Square	F Value	Pr > F	
liners	3	674	225	15.82	<.0001	
IND	2	24	12	0.84	0.436	
LTMSLAB	5	185	37	2.61	0.036	
liners	ALW_ LSMEAN	N	P	R	S	95% Confidence
N	14.3		0.05	0.00	0.97	10.1 18.5
P	18.4	0.05		0.04	0.66	14.8 21.9
R	25.4	0.00	0.04		<.0001	22.1 28.7
S	15.6	0.97	0.66	<.0001		13.1 18.1
saCLW						
Source	DF	Sum of Squares	Mean Square	F Value	Pr > F	
Model	10	984	98	6.24	<.0001	
Error	50	788	16			
Corrected Total	60	1772				
R-Square	Coeff Var	Root MSE	saCLW Mean			
0.56	22	3.97	17.9			
Source	DF	Type III SS	Mean Square	F Value	Pr > F	
liners	3	560	187	11.84	<.0001	
IND	2	18	9	0.56	0.576	
LTMSLAB	5	56	11	0.71	0.618	
liners	saCLW LSMEAN	N	P	R	S	95% Confidence
N	14.9		0.29	0.01	1.00	10.5 19.4
P	17.8	0.29		0.06	0.82	14.1 21.5
R	24.9	0.01	0.06		<.0001	21.4 28.4
S	15.6	1.00	0.82	<.0001		13.0 18.2

- With or without lab severity adjustments, there were significant differences among liner batches for liner wear.
- The current batch, S, were not significantly different from the target, 16.2. Only batch R were.
- Multiplicative adjustment for batch S rings like we have now: $16.2/15.6=1.04$
- Version 2 type additive adjustment: $-.165 * 3.7 = -0.6$

Cylinder Liner Wear – PC type analyses part 2

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	14	1341.702193	95.835871	6.88	<.0001
Error	46	640.430266	13.922397		
Corrected Total	60	1982.132459			

R-Square	Coeff Var	Root MSE	ALW_ Mean
0.676898	19.90099	3.731273	18.74918

Source	DF	Type III SS	Mean Square	F Value	Pr > F
IND	2	14.6492427	7.3246214	0.53	0.594
LTMSLAB	5	180.2194406	36.0438881	2.59	0.038
linerbatch	7	742.8478315	106.1211188	7.62	<.0001

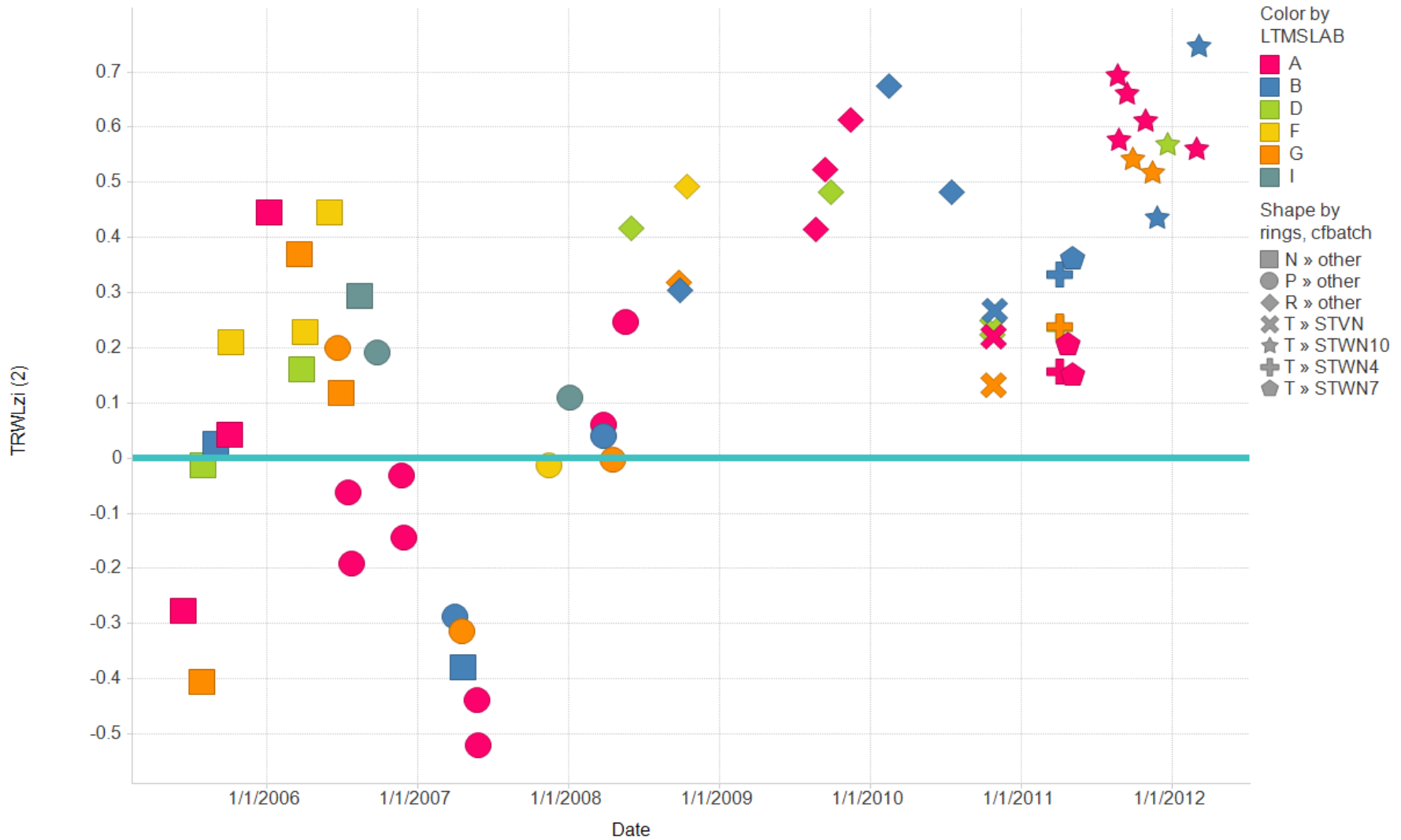
Parameter	Estimate	Standard Error	t Value	Pr > t
Intercept	16.5673808 B	3.97701406	4.17	1E-04
IND 821	-3.2874419 B	3.4633051	-0.95	0.348
IND 821-1	-0.97130861 B	2.42943409	-0.4	0.691
IND 821-2	0 B			1
LTMSLAB A	6.41427526 B	2.38627224	2.69	0.01
LTMSLAB B	3.583233 B	2.53801286	1.41	0.165
LTMSLAB D	2.17175058 B	2.74970291	0.79	0.434
LTMSLAB F	3.71573084 B	2.79890902	1.33	0.191
LTMSLAB G	4.8147414 B	2.533013	1.9	0.064
LTMSLAB I	0 B			0.1666667
linerbatch N	-3.31881098 B	3.44970961	-0.96	0.341
linerbatch P	0.6894972 B	3.09519262	0.22	0.825
linerbatch R	7.67245393 B	2.54006433	3.02	0.004
linerbatch S	-4.57930516 B	4.40776415	-1.04	0.304
linerbatch STVN	-1.74207222 B	2.91115164	-0.6	0.553
linerbatch STWN10	-4.81563403 B	2.74562354	-1.75	0.086
linerbatch STWN4	-0.29207222 B	2.91115164	-0.1	0.921
linerbatch STWN7	0 B			0.17647059

linerbatch	ALW_ LSMEAN	N	P	R	S	STVN	STWN10	STWN4	STWN7	95% Confidence Limits
N	15.2789415		0.1588	0.01	1	0.9997	0.9997	0.9806	0.9775	11.001656 19.556227
P	19.2872496	0.1588		0.1402	0.937	0.99	0.5056	1	1	15.662762 22.911737
R	26.2702064	0.01	0.1402		0.073	0.0031	<.0001	0.0199	0.0727	22.849249 29.691163
S	14.0184473	1	0.9366	0.073		0.9976	1	0.9721	0.9657	5.84205 22.194845
STVN	16.8556802	0.9997	0.99	0.0031	0.998		0.9245	0.9993	0.9987	12.38755 21.323811
STWN10	13.7821184	0.9997	0.5056	<.0001	1	0.9245		0.6347	0.653	10.66182 16.902417
STWN4	18.3056802	0.9806	1	0.0199	0.972	0.9993	0.6347		1	13.83755 22.773811
STWN7	18.5977524	0.9775	1	0.0727	0.966	0.9987	0.653	1		13.539101 23.656404

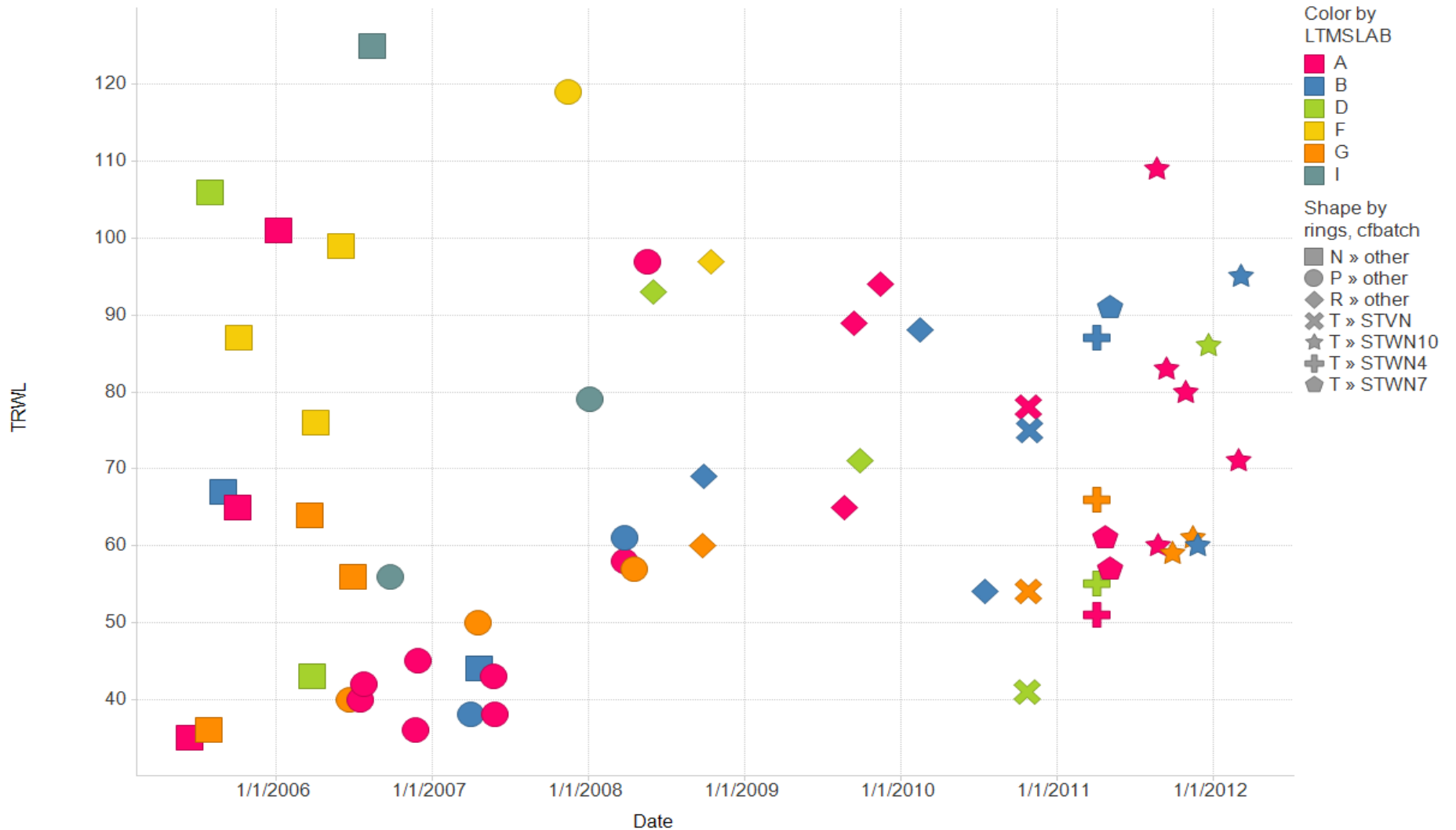
Contrast	DF	Contrast SS	Mean Square	F Value	Pr > F
last 10?	1	62.31803137	62.31803137	4.48	0.04

- There were significant differences among batches for liner wear.
- The last 10 STWN were significantly different from the first 7.
- Multiplicative adjustment for predicted STWN using all 17 tests: $16.2/17.1=0.95$

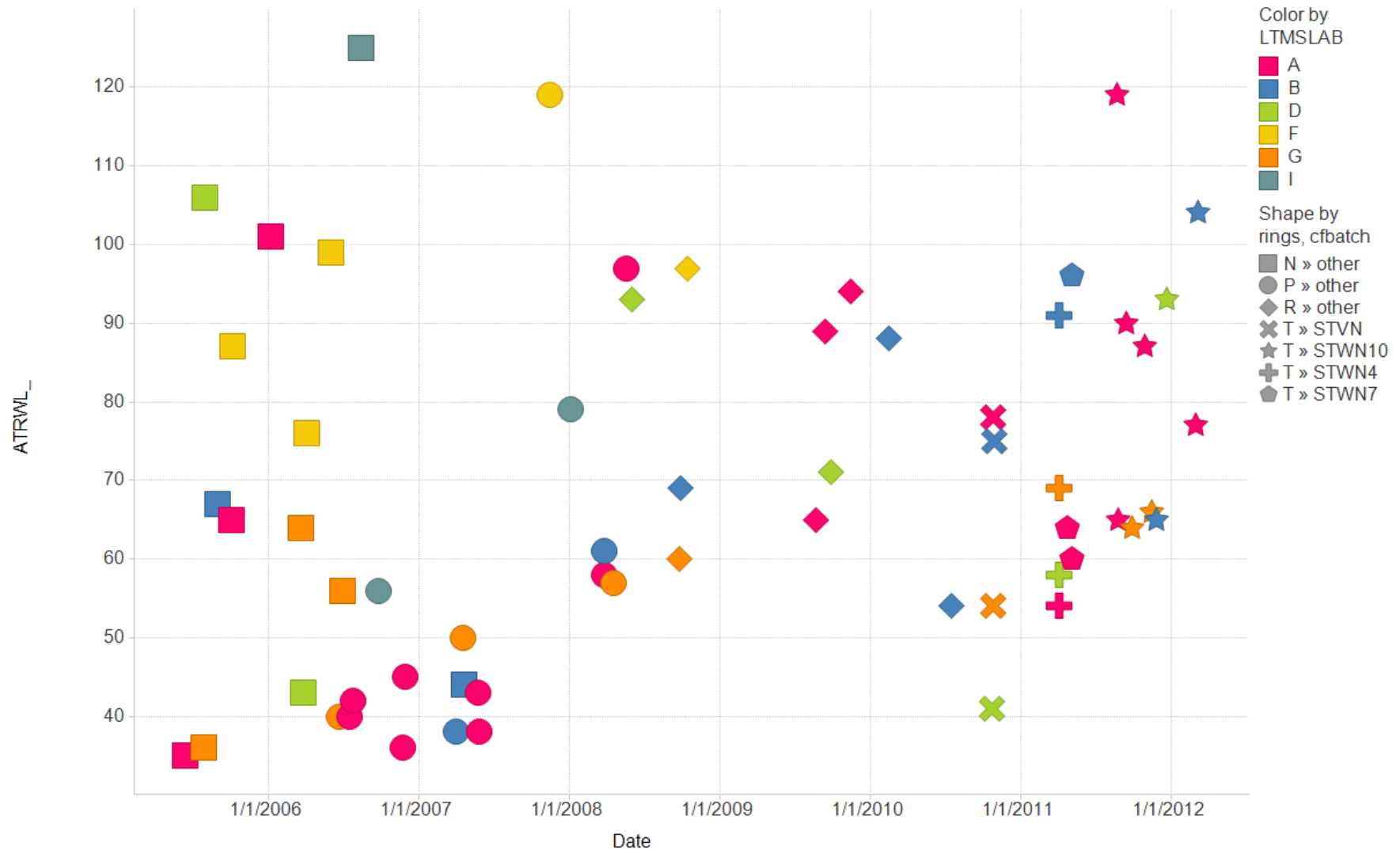
Top Ring Weight Loss Z_i –



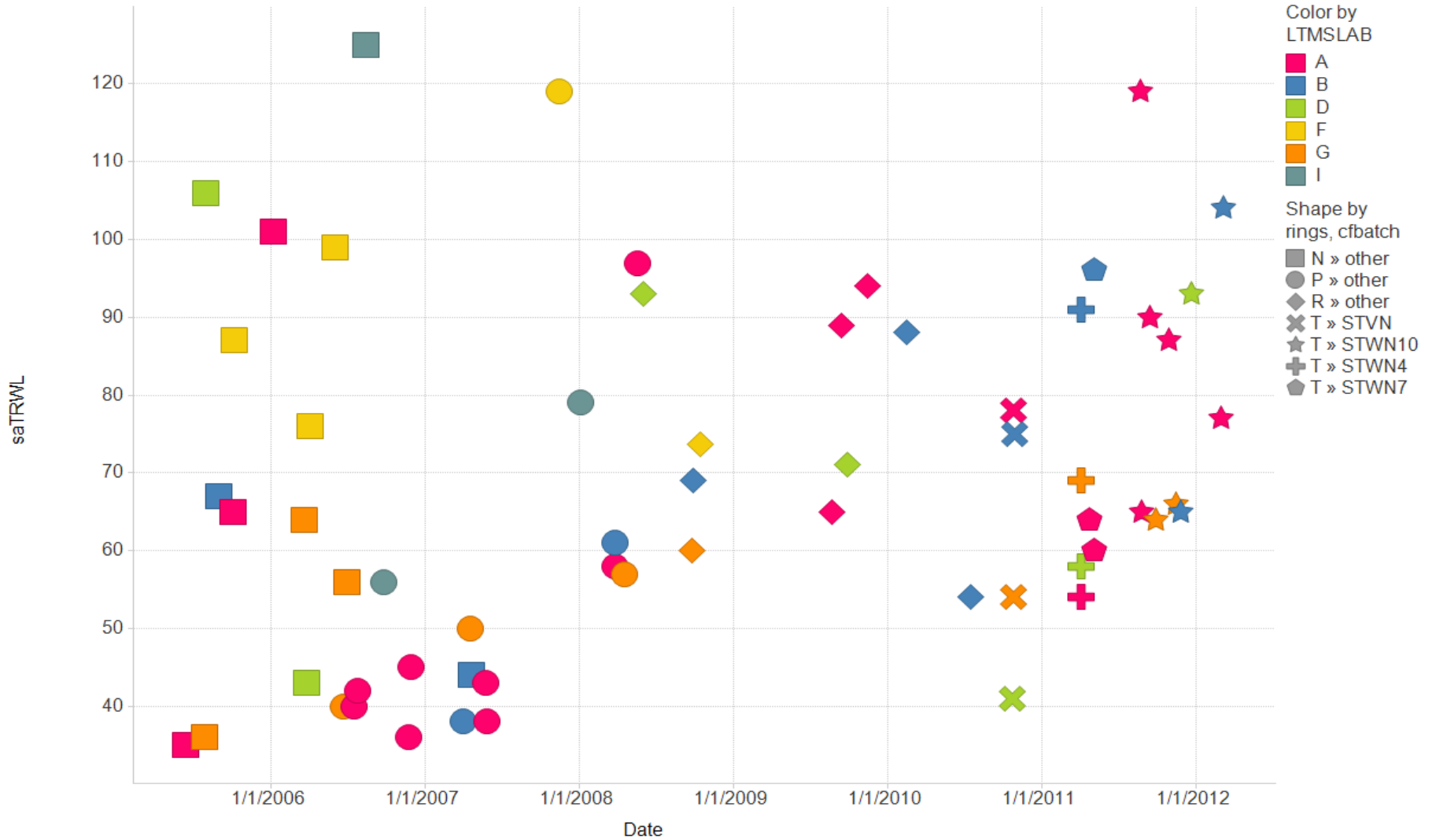
Top Ring Weight Loss – with industry corrections



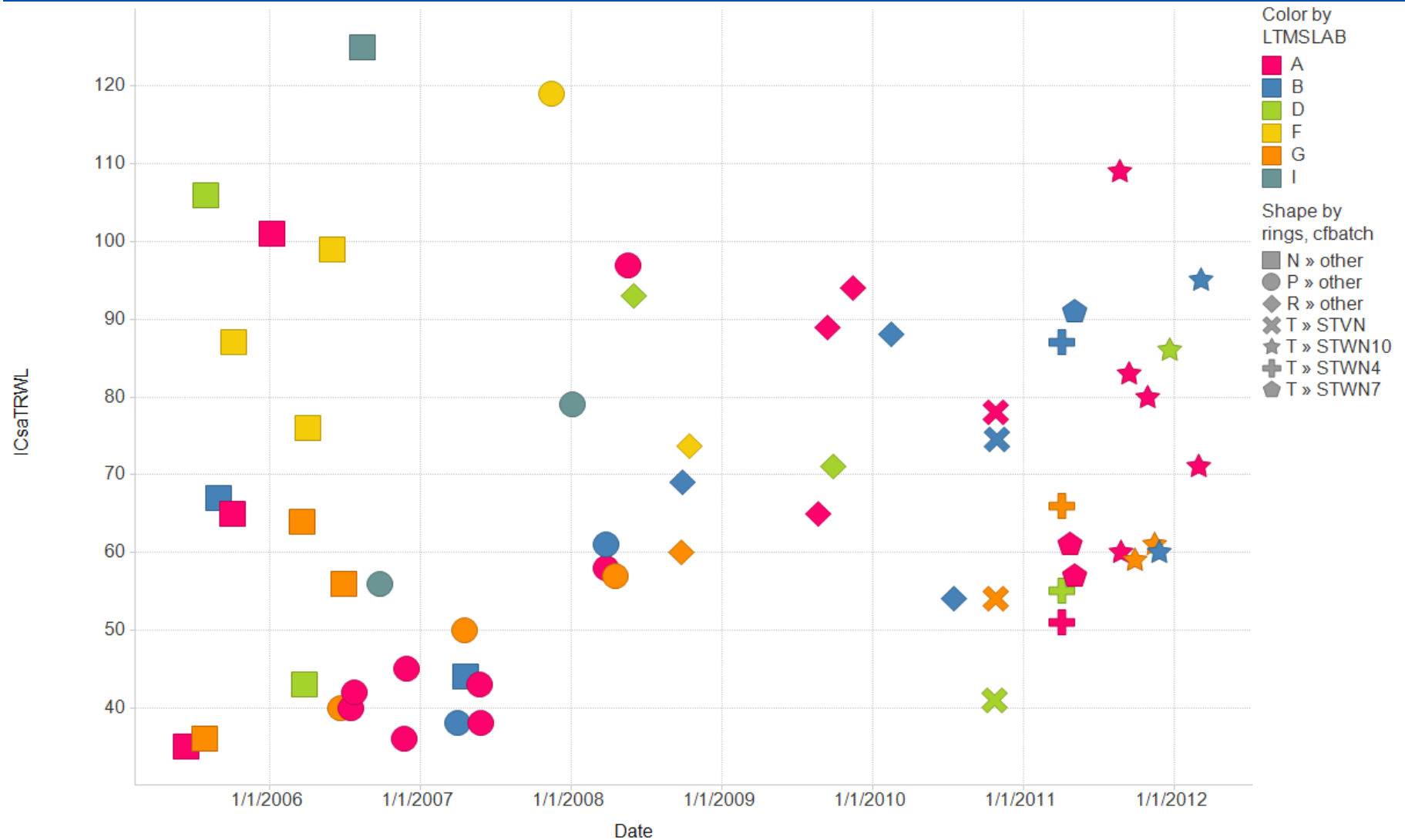
Top Ring Weight Loss – without industry corrections



Top Ring Weight Loss – with severity adjustments



Top Ring Weight Loss – with severity adjustments and industry corrections



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Top Ring Weight Loss – PC type analyses part 1

ATRWL_						
Source	DF	Sum of Squares	Mean Square	F Value	Pr > F	
Model	10	14197	1420	3.88	0.001	
Error	50	18310	366			
Corrected Total	60	32506				
R-Square	Coeff Var	Root MSE	ATRWL_ Mean			
0.44	27	19.14	69.7			
Source	DF	Type III SS	Mean Square	F Value	Pr > F	
IND	2	2176	1088	2.97	0.06	
LTMSLAB	5	9064	1813	4.95	0.001	
rings	3	2009	670	1.83	0.154	
rings	ATRWL_ LSMEAN	N	P	R	T	95% Confidence Limits
N	96.1		0.103	0.648	0.574	74.7 117.4
P	78.1	0.103		1.000	1.000	60.1 96.0
R	78.7	0.648	1.000		0.999	62.2 95.1
T	77.5	0.574	1.000	0.999		64.9 90.2
saTRWL						
Source	DF	Sum of Squares	Mean Square	F Value	Pr > F	
Model	10	12580	1258	3.28	0.003	
Error	50	19189	384			
Corrected Total	60	31769				
R-Square	Coeff Var	Root MSE	saTRWL Mean			
0.40	28	19.59	69.3			
Source	DF	Type III SS	Mean Square	F Value	Pr > F	
IND	2	2131	1065	2.78	0.072	
LTMSLAB	5	7787	1557	4.06	0.004	
rings	3	2161	720	1.88	0.146	
rings	saTRWL LSMEAN	N	P	R	T	95% Confidence Limits
N	96.0		0.10	0.56	0.56	74.2 117.8
P	77.4	0.10		1.00	1.00	59.1 95.8
R	76.0	0.56	1.00		1.00	59.2 92.9
T	76.7	0.56	1.00	1.00		63.8 89.7

➤ With or without lab severity adjustments, rings and other batches showed no significant differences.

➤ The current batch, T, were significantly different from the target, 62.

➤ Multiplicative adjustment like we have now:

$$62.0/77.5=0.80$$

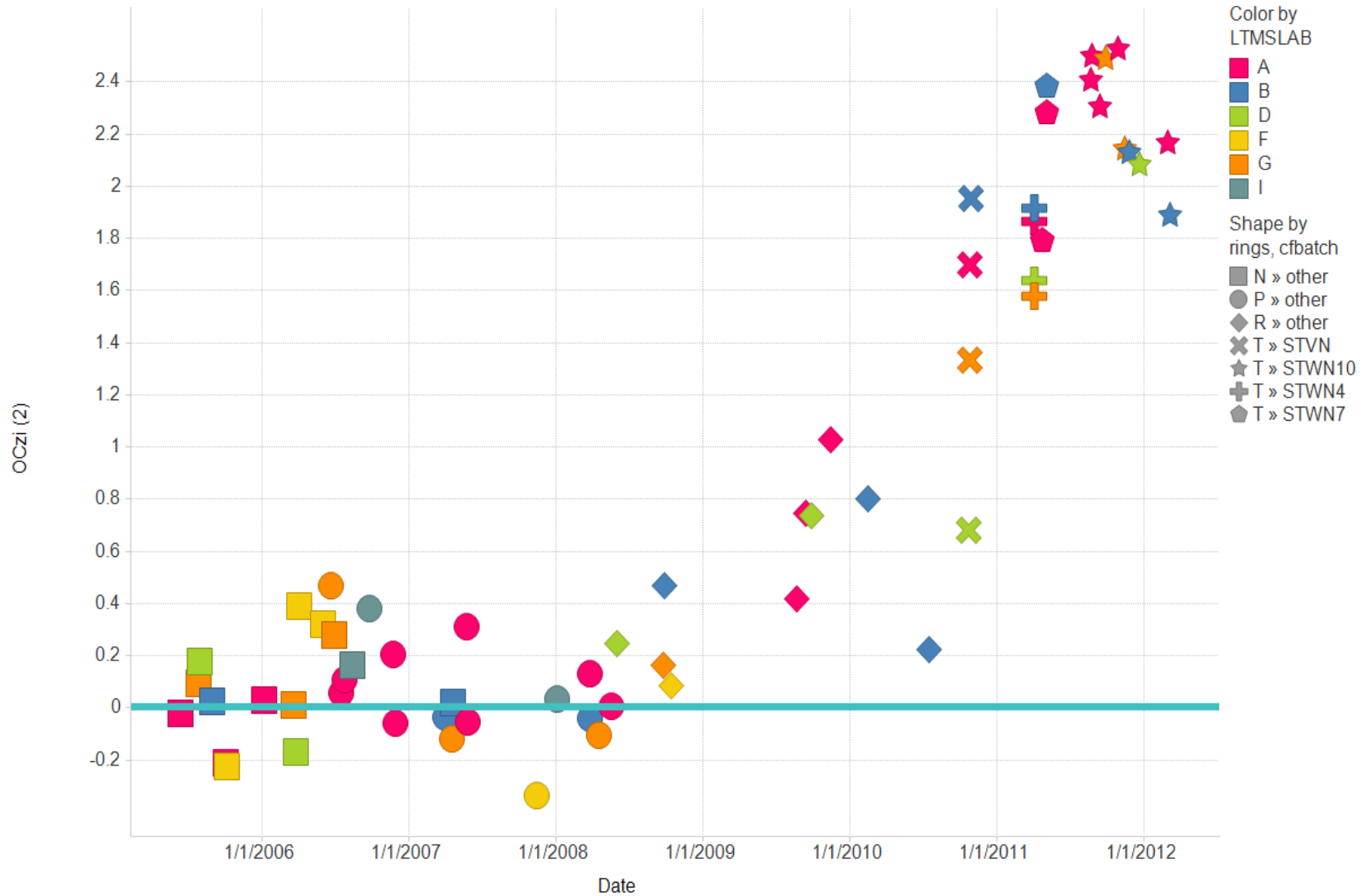
➤ Version 2 type additive adjustment: $-.746 * 28.2 = -21$

Top Ring Weight Loss – PC type analyses part 2

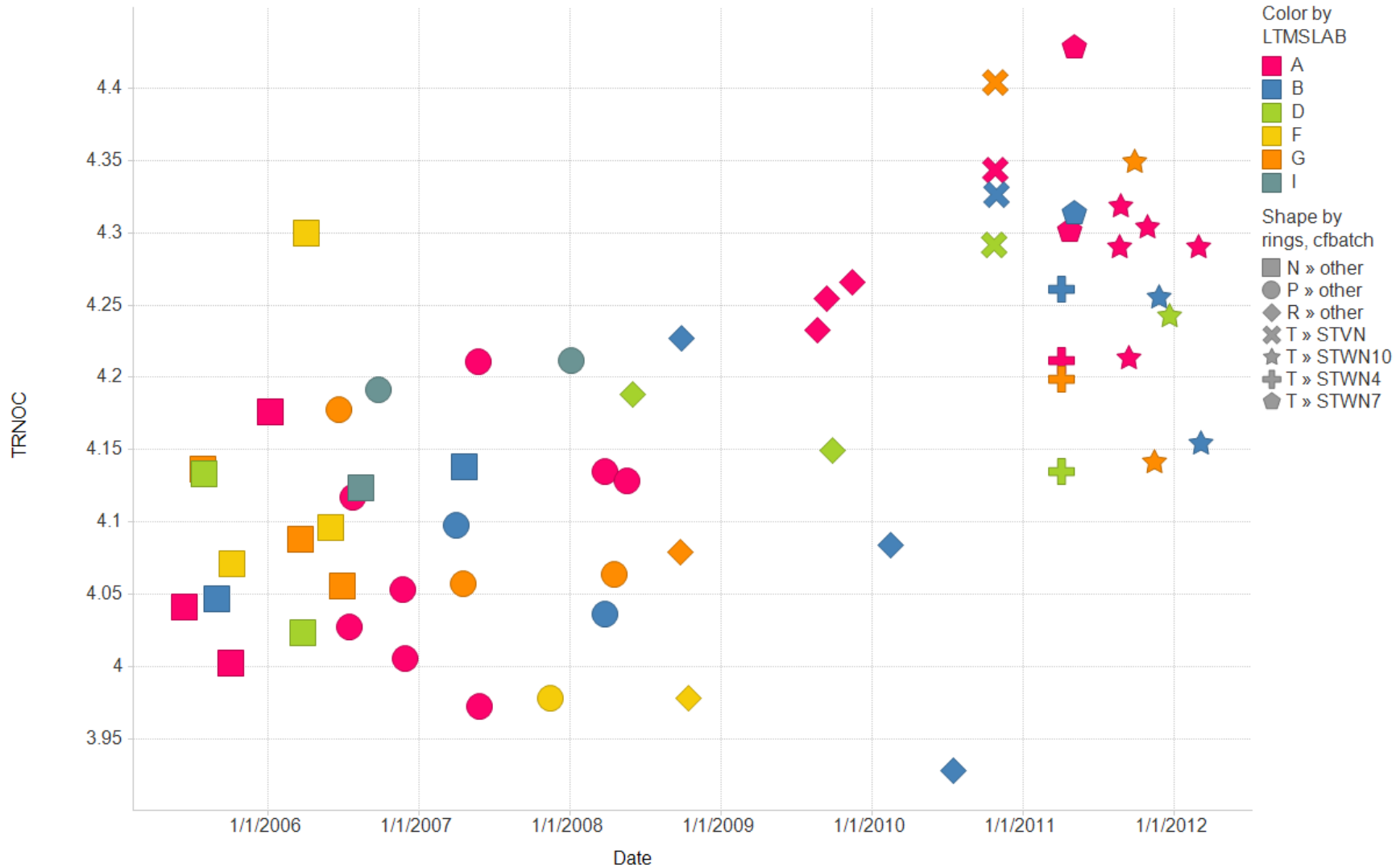
Source	DF	Sum of Squares	Mean Square	F Value	Pr > F		
Model	11	13420.68705	1220.06246	3.13	0.003		
Error	49	19085.57525	389.50154				
Corrected Total	60	32506.2623					
R-Square	0.412865	Coeff Var	28.30669	Root MSE	19.73579	ATRWL_ Mean	69.72131
Source	DF	Type III SS	Mean Square	F Value	Pr > F		
IND	2	2963.510579	1481.755289	3.8	0.029		
LTMSLAB	5	9330.556946	1866.111389	4.79	0.001		
cfbatch	4	1232.849336	308.212334	0.79	0.537		
Parameter	Estimate	Standard Error	t Value	Pr > t			
Intercept	103.312158 B	18.40513241	5.61	<.0001	1		
IND 821	-16.6454917 B	14.45389407	-1.15	0.255	0		
IND 821-1	2.3330841 B	12.84456533	0.18	0.857	0		
IND 821-2	0 B	.	.	.	1		
LTMSLAB A	-32.6930613 B	12.5813012	-2.6	0.012	0.166667		
LTMSLAB B	-28.6108291 B	13.25361222	-2.16	0.036	0.166667		
LTMSLAB D	-27.4001118 B	14.25209392	-1.92	0.06	0.166667		
LTMSLAB F	5.1376182 B	14.47866652	0.35	0.724	0.166667		
LTMSLAB G	-41.2138763 B	13.26169702	-3.11	0.003	0.166667		
LTMSLAB I	0 B	.	.	.	0.166667		
cfbatch STVN	-11.1657728 B	11.36095327	-0.98	0.331	0		
cfbatch STWN10	11.5727825 B	10.50092945	1.1	0.276	0.588235		
cfbatch STWN4	-5.1657728 B	11.36095327	-0.45	0.651	0.235294		
cfbatch STWN7	-0.9795919 B	12.82043021	-0.08	0.939	0.176471		
cfbatch other	0 B	.	.	.	0		
Contrast	DF	Contrast SS	Mean Square	F Value	Pr > F		
last 10?	1	613.1453187	613.1453187	1.57	0.216		

- The last 10 STWN were not significantly different from the first 7.
- Multiplicative adjustment for predicted STWN using all 17 tests: $62.0/87.9=0.71$

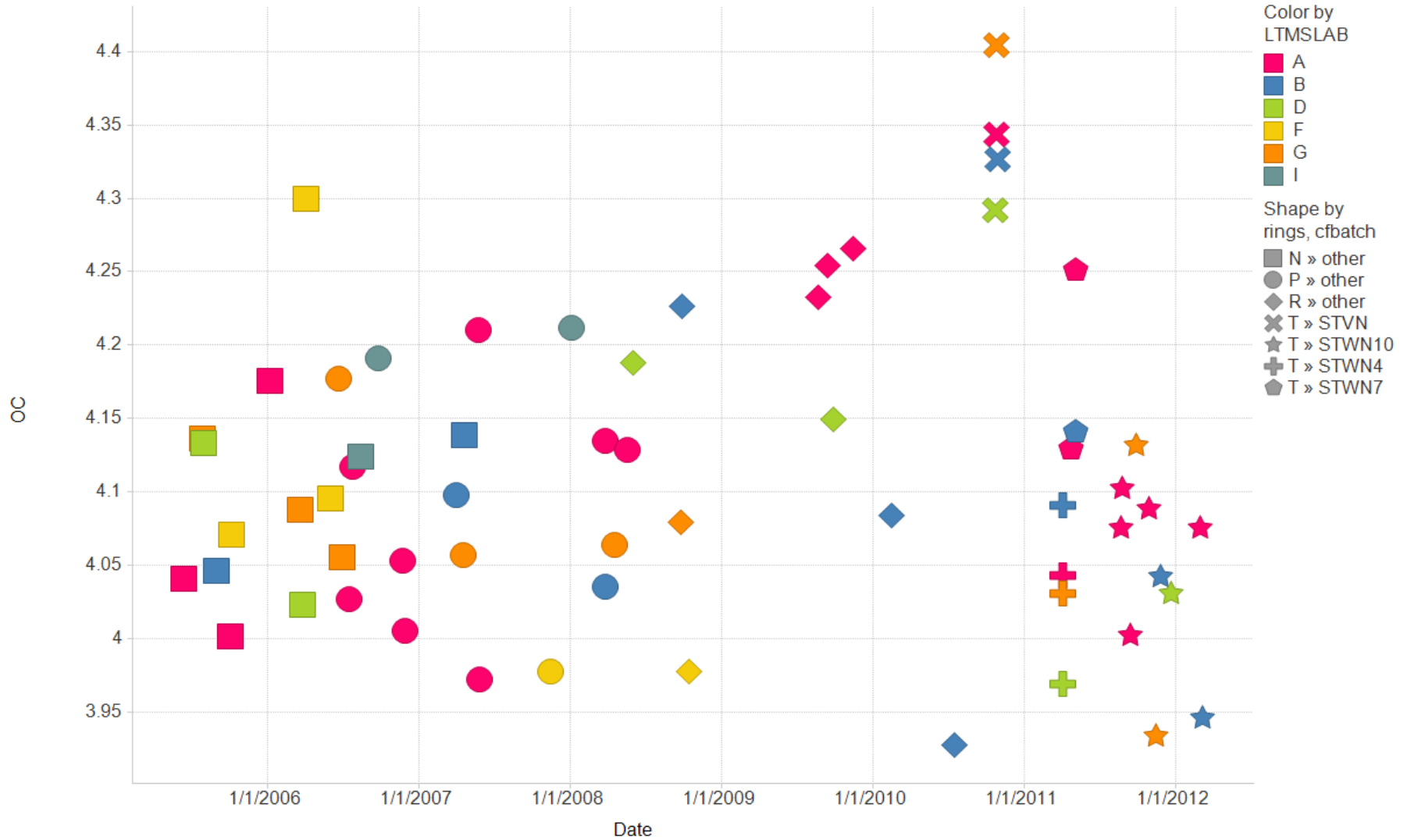
Transformed Oil Consumption Z_i –



Transformed Oil Consumption – without industry corrections



Transformed Oil Consumption – with industry corrections

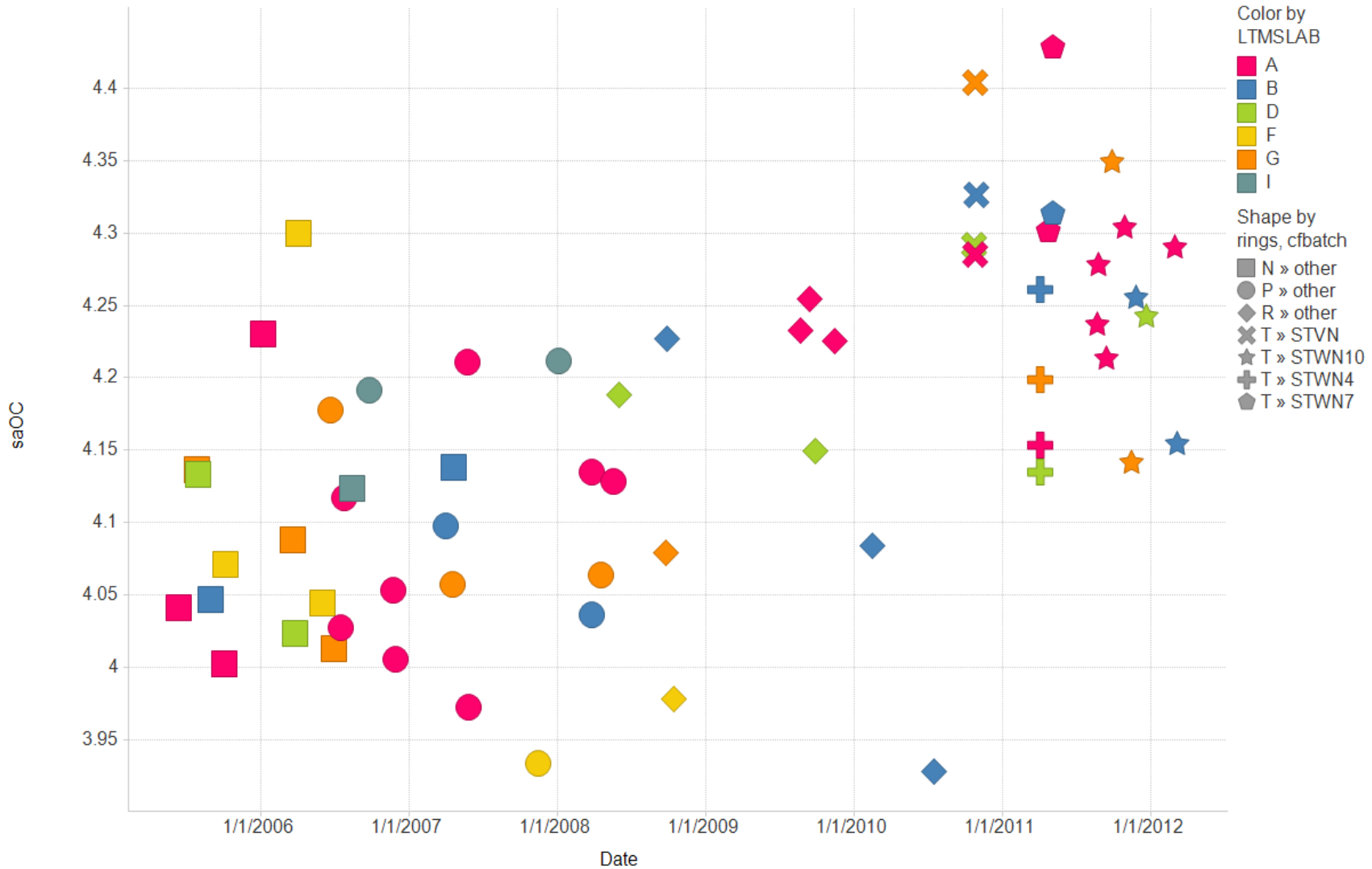


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Transformed Oil Consumption – with severity adjustments

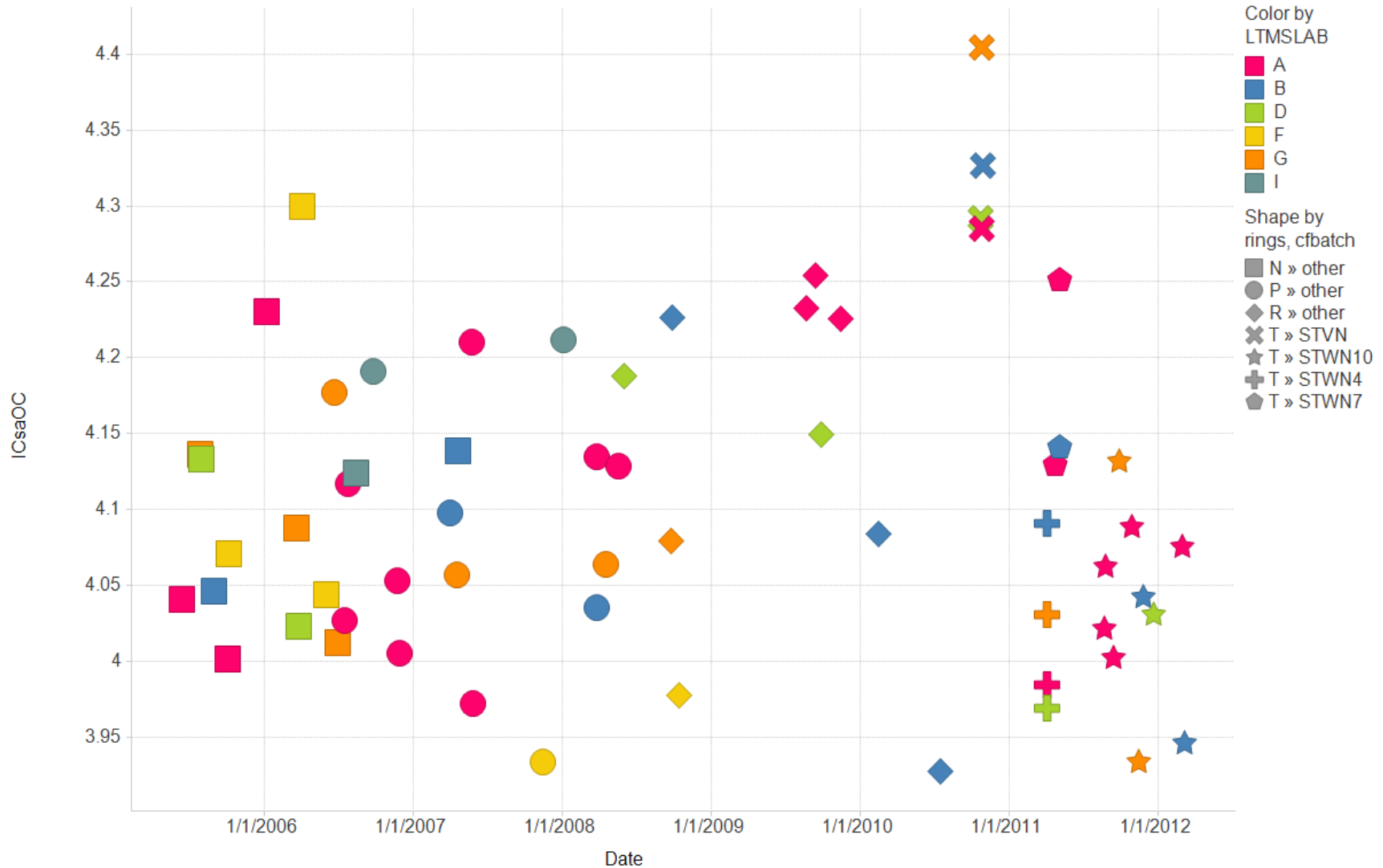


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Transformed Oil Consumption – with severity adjustments and industry corrections



Oil Consumption – PC type analyses part 1

TRNOC							
Source	DF	Sum of Squares	Mean Square	F Value	Pr > F		
Model	11	0.496	0.045	6.72	<.0001		
Error	49	0.329	0.007				
Corrected Total	60	0.825					
R-Square	Coeff Var	Root MSE	TRNOC Mean				
0.60	1.967	0.082	4.165				
Source	DF	Type III SS	Mean Square	F Value	Pr > F		
IND	2	0.020	0.010	1.46	0.24		
LTMSLAB	5	0.036	0.007	1.06	0.39		
cfbatch	4	0.215	0.054	7.99	<.0001		
cfbatch	TRNOC LSMEAN	STVN	STWN10	STWN4	STWN7	other	95% Confidence Limits
STVN	4.335		0.56	0.13	1.00	0.00	4.241 4.429
STWN10	4.251	0.56		0.86	0.64	0.04	4.189 4.312
STWN4	4.195	0.13	0.86		0.21	0.54	4.102 4.289
STWN7	4.334	1.00	0.64	0.21		0.00	4.227 4.440
other	4.122	0.00	0.04	0.54	0.00		4.072 4.173
saOC							
Source	DF	Sum of Squares	Mean Square	F Value	Pr > F		
Model	11	0.468	0.043	5.93	<.0001		
Error	49	0.351	0.007				
Corrected Total	60	0.819					
R-Square	Coeff Var	Root MSE	saOC Mean				
0.57	2.036	0.085	4.159				
Source	DF	Type III SS	Mean Square	F Value	Pr > F		
IND	2	0.017	0.009	1.22	0.30		
LTMSLAB	5	0.035	0.007	0.97	0.45		
cfbatch	4	0.198	0.050	6.91	0.00		
cfbatch	saOC LSMEAN	STVN	STWN10	STWN4	STWN7	other	95% Confidence Limits
STVN	4.324		0.56	0.15	1.00	0.00	4.227 4.421
STWN10	4.237	0.56		0.89	0.47	0.11	4.173 4.301
STWN4	4.184	0.15	0.89		0.14	0.75	4.087 4.281
STWN7	4.340	1.00	0.47	0.14		0.00	4.230 4.451
other	4.126	0.00	0.11	0.75	0.00		4.074 4.178

➤ With or without lab severity adjustments, there were significant differences among correction factor batches.

➤ The current batch, STWN10, were significantly different from the target, 4.093.

➤ Multiplicative adjustment like we have now:
 $4.093 / 4.291 = 0.96$

➤ Version 2 type additive adjustment:
 $-1.887 * 0.079 = -0.149$

Oil Consumption – PC type analyses part 2

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	11	0.49608914	0.04509901	6.72	<.0001
Error	49	0.32885716	0.00671137		
Corrected Total	60	0.8249463			

R-Square	Coeff Var	Root MSE	TRNOC Mean
0.601359	1.966985	0.081923	4.164901

Source	DF	Type III SS	Mean Square	F Value	Pr > F
IND	2	0.01953032	0.00976516	1.46	0.243
LTMSLAB	5	0.03571938	0.00714388	1.06	0.392
cfbatch	4	0.21458535	0.05364634	7.99	<.0001

Parameter	Estimate	Standard Error	t Value	Pr > t
Intercept	4.207731252 B	0.0763994	55.08	<.0001
IND 821	-0.031997918 B	0.05999788	-0.53	0.596
IND 821-1	0.016161015 B	0.05331758	0.3	0.763
IND 821-2	0 B	.	.	.
LTMSLAB A	-0.074257157 B	0.05222478	-1.42	0.161
LTMSLAB B	-0.113507426 B	0.05501553	-2.06	0.044
LTMSLAB D	-0.102878065 B	0.05916021	-1.74	0.088
LTMSLAB F	-0.10090512 B	0.06010071	-1.68	0.1
LTMSLAB G	-0.089165074 B	0.05504909	-1.62	0.112
LTMSLAB I	0 B	.	.	.
cfbatch STVN	0.212734664 B	0.04715913	4.51	<.0001
cfbatch STWN10	0.128199126 B	0.04358919	2.94	0.005
cfbatch STWN4	0.072884664 B	0.04715913	1.55	0.129
cfbatch STWN7	0.211214981 B	0.0532174	3.97	2E-04
cfbatch other	0 B	.	.	.

Contrast	DF	Contrast SS	Mean Square	F Value	Pr > F
last 10?	1	0.0005484	0.0005484	0.08	0.776

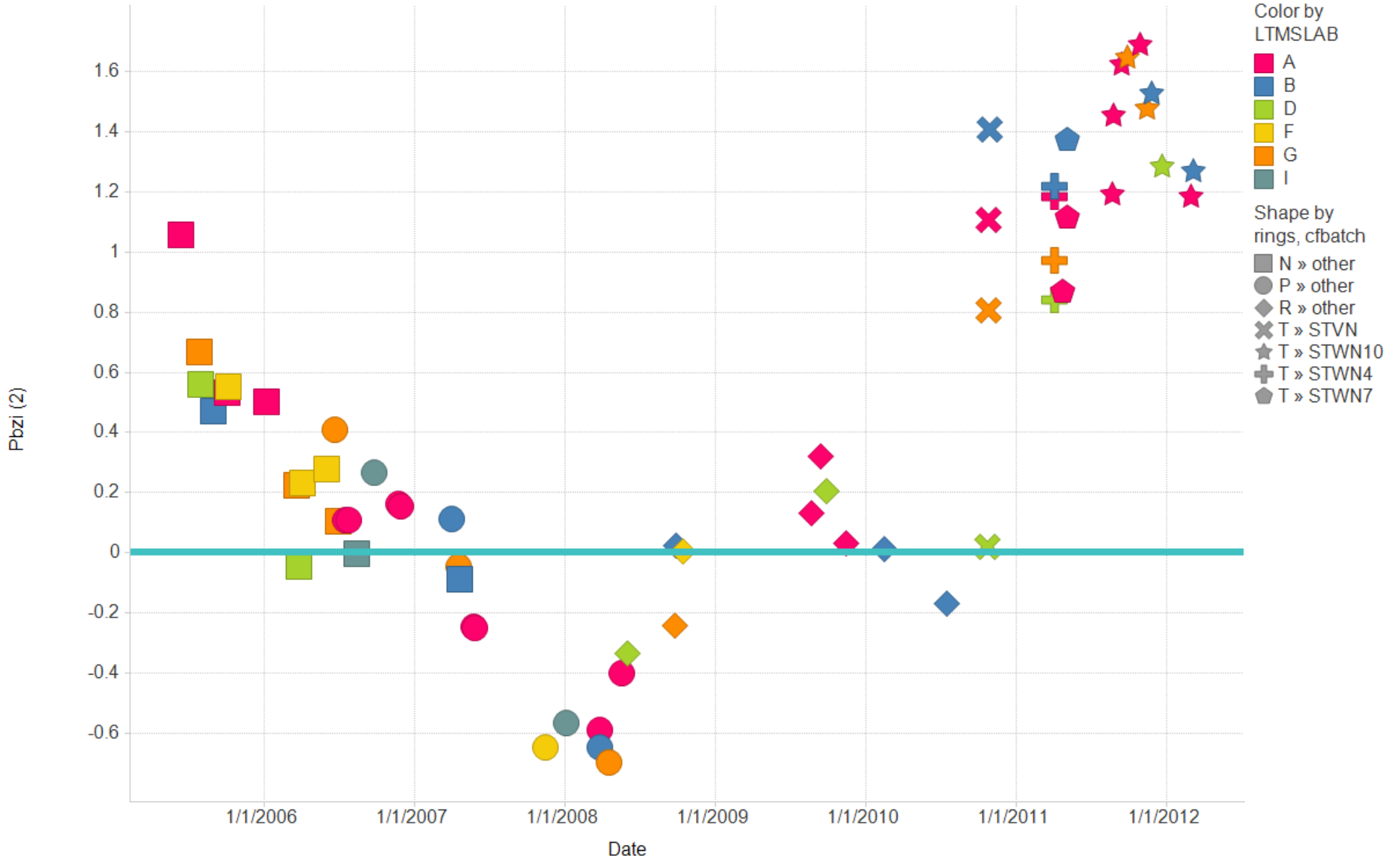
➤ The last 10 STWN were not significantly different from the first 7.

➤ Multiplicative adjustment for predicted STWN using all 17 tests:

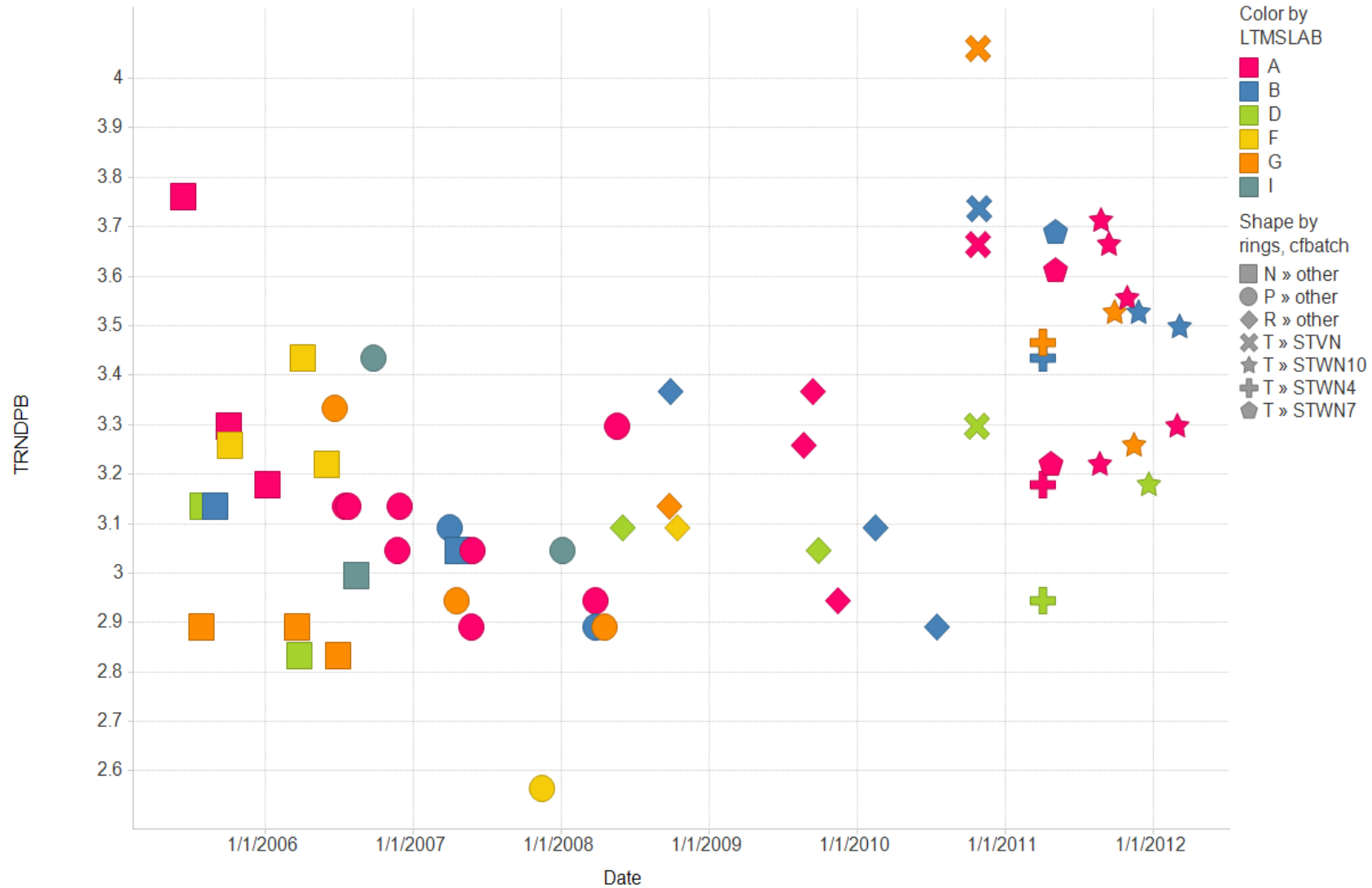
$$4.0930/4.2574=0.96$$



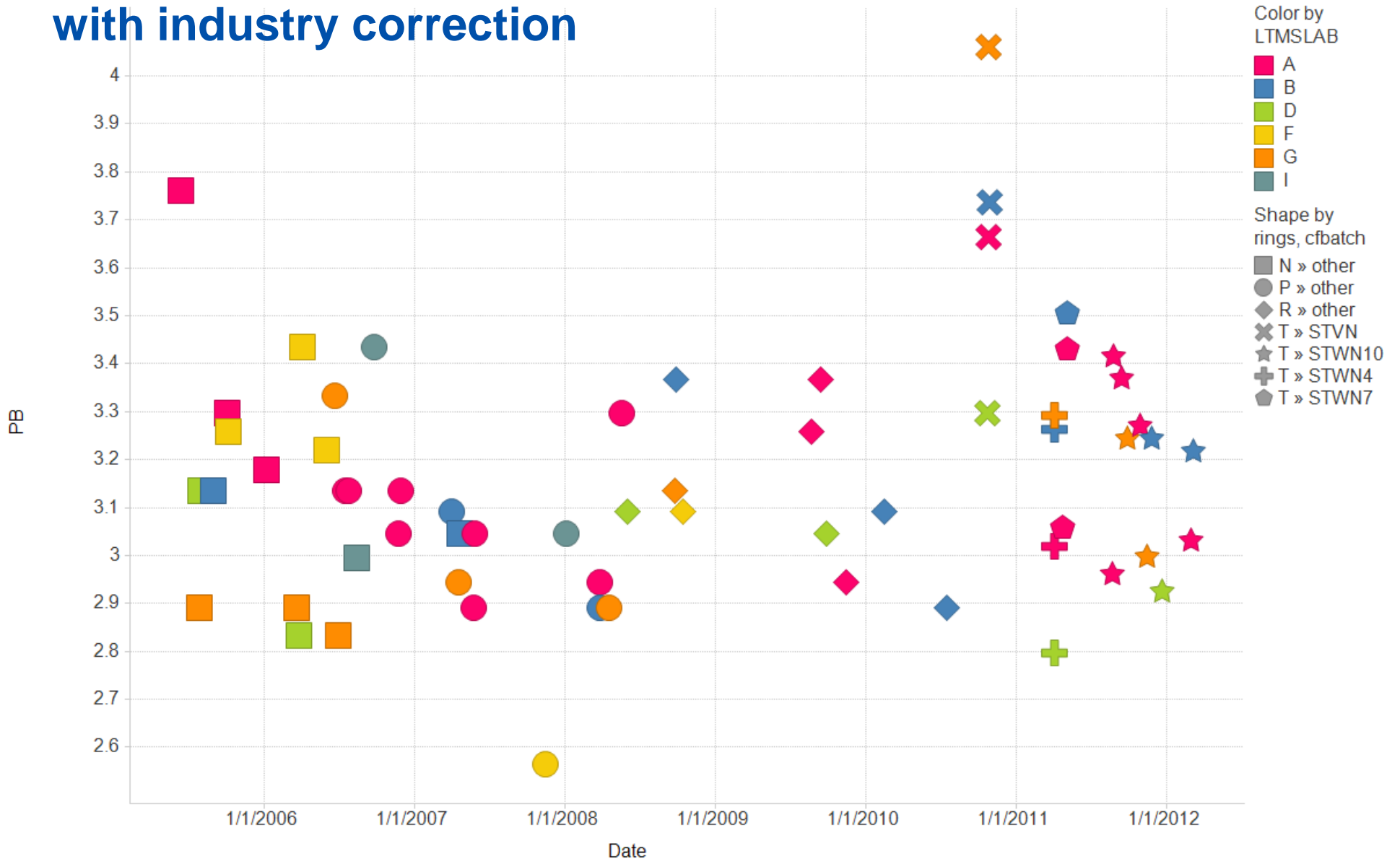
Transformed ΔPb @ EOT $Z_i -$



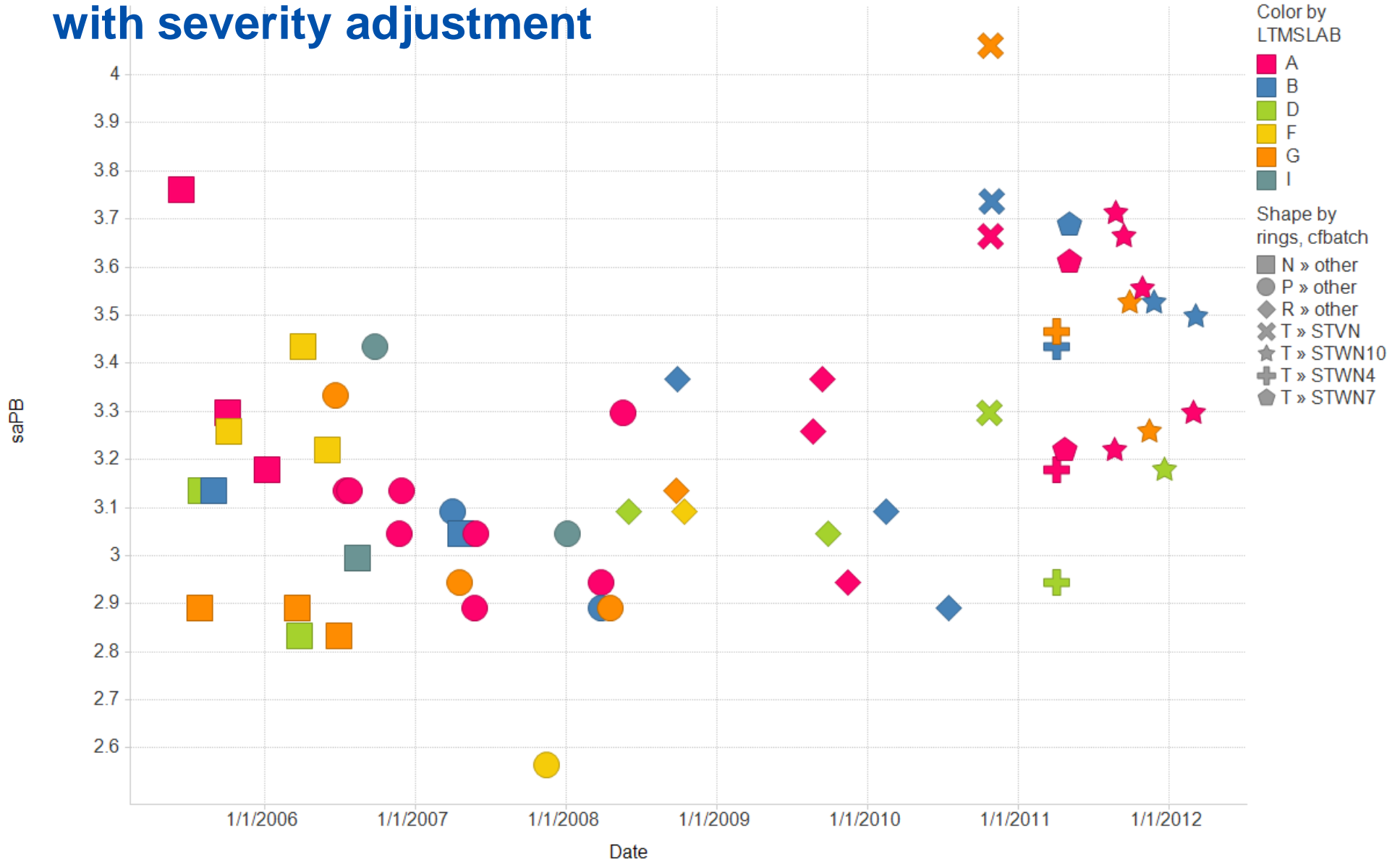
Transformed ΔPb @ EOT – without industry correction



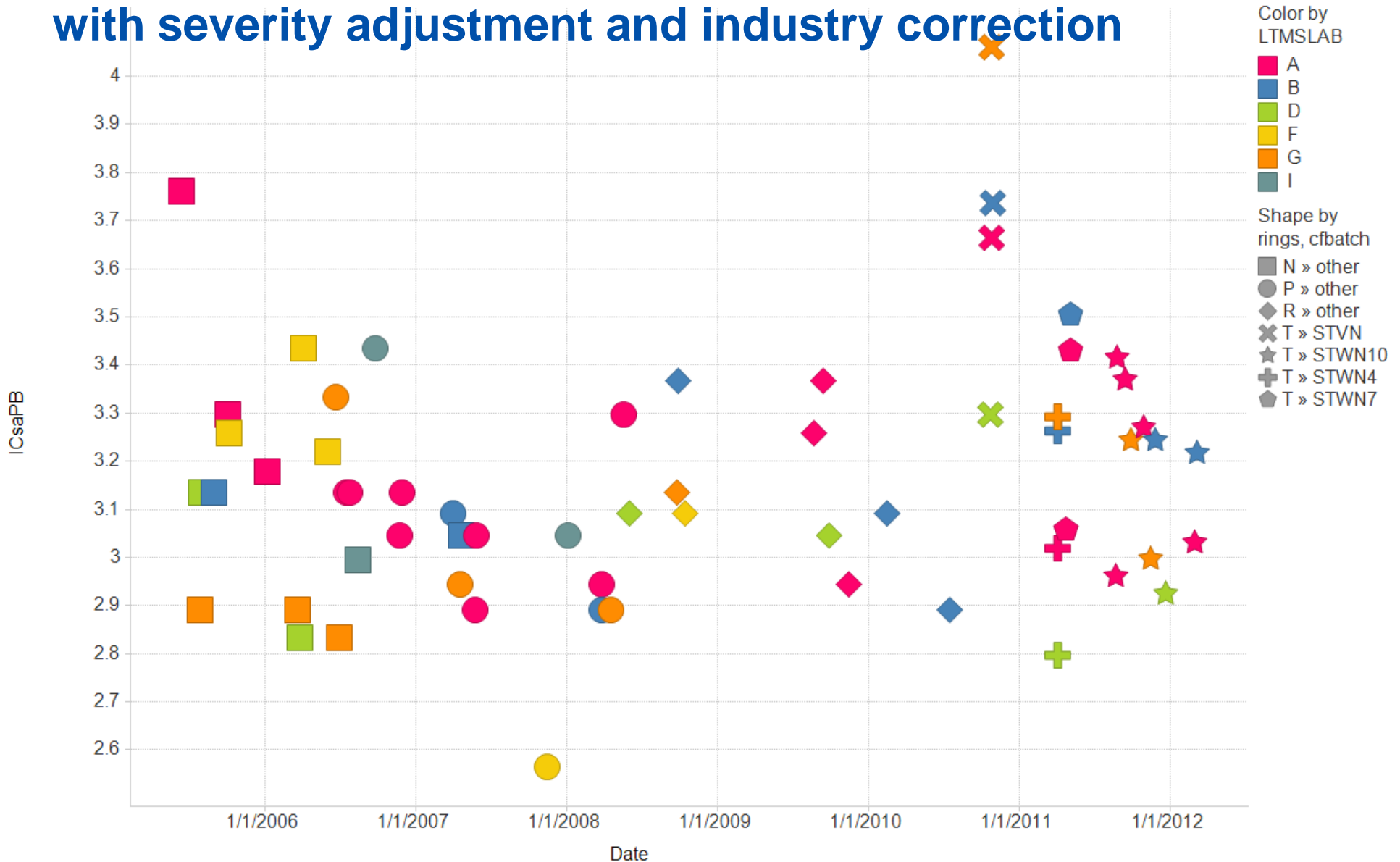
Transformed ΔPb @ EOT – with industry correction



Transformed ΔPb @ EOT – with severity adjustment



Transformed ΔPb @ EOT – with severity adjustment and industry correction



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Transformed ΔPb @ EOT – PC type analyses part 1

TRNDPB							
Source	DF	Sum of Squares	Mean Square	F Value	Pr > F		
Model	11	2.53	0.23	4.70	<.0001		
Error	49	2.40	0.05				
Corrected Total	60	4.94					
R-Square	Coeff Var	Root MSE	TRNDPB Mean				
0.51	6.86	0.221377	3.225148				
Source	DF	Type III SS	Mean Square	F Value	Pr > F		
IND	2	0.015	0.008	0.16	0.86		
LTMSLAB	5	0.326	0.065	1.33	0.27		
cfbatch	4	1.360	0.340	6.94	0.00		
cfbatch	TRNDPB LSMEAN	STVN	STWN10	STWN4	STWN7	other	95% Confidence Limits
STVN	3.6888		0.43	0.06	0.57	0.00	3.4359 3.9418
STWN10	3.4294	0.43		0.77	1.00	0.04	3.2624 3.5965
STWN4	3.2550	0.06	0.77		0.85	0.65	3.0021 3.5080
STWN7	3.4298	0.57	1.00	0.85		0.12	3.1411 3.7184
other	3.0797	0.00	0.04	0.65	0.12		2.9432 3.2161

There weren't any severity adjustments.

➤ There were significant differences among correction factor batches.

➤ The current batch, STWN10, were significantly different from the target, 3.1060.

➤ Multiplicative adjustment like we have now:

$$3.1060 / 3.4294 = 0.91$$

➤ Version 2 type additive adjustment:

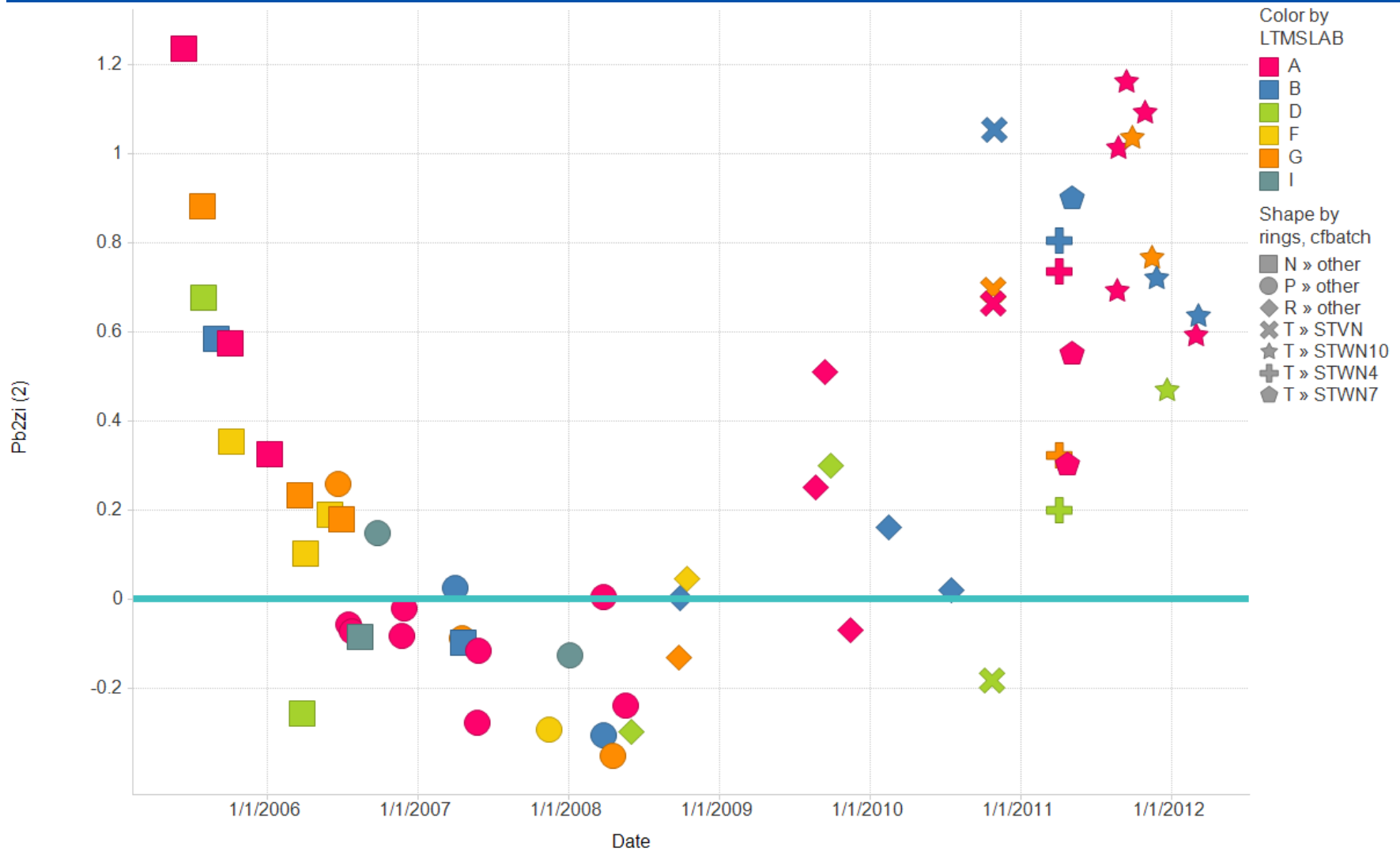
$$-1.269 * 0.2420 = -0.3070$$

Transformed ΔP_b @ EOT – PC type analyses part 2

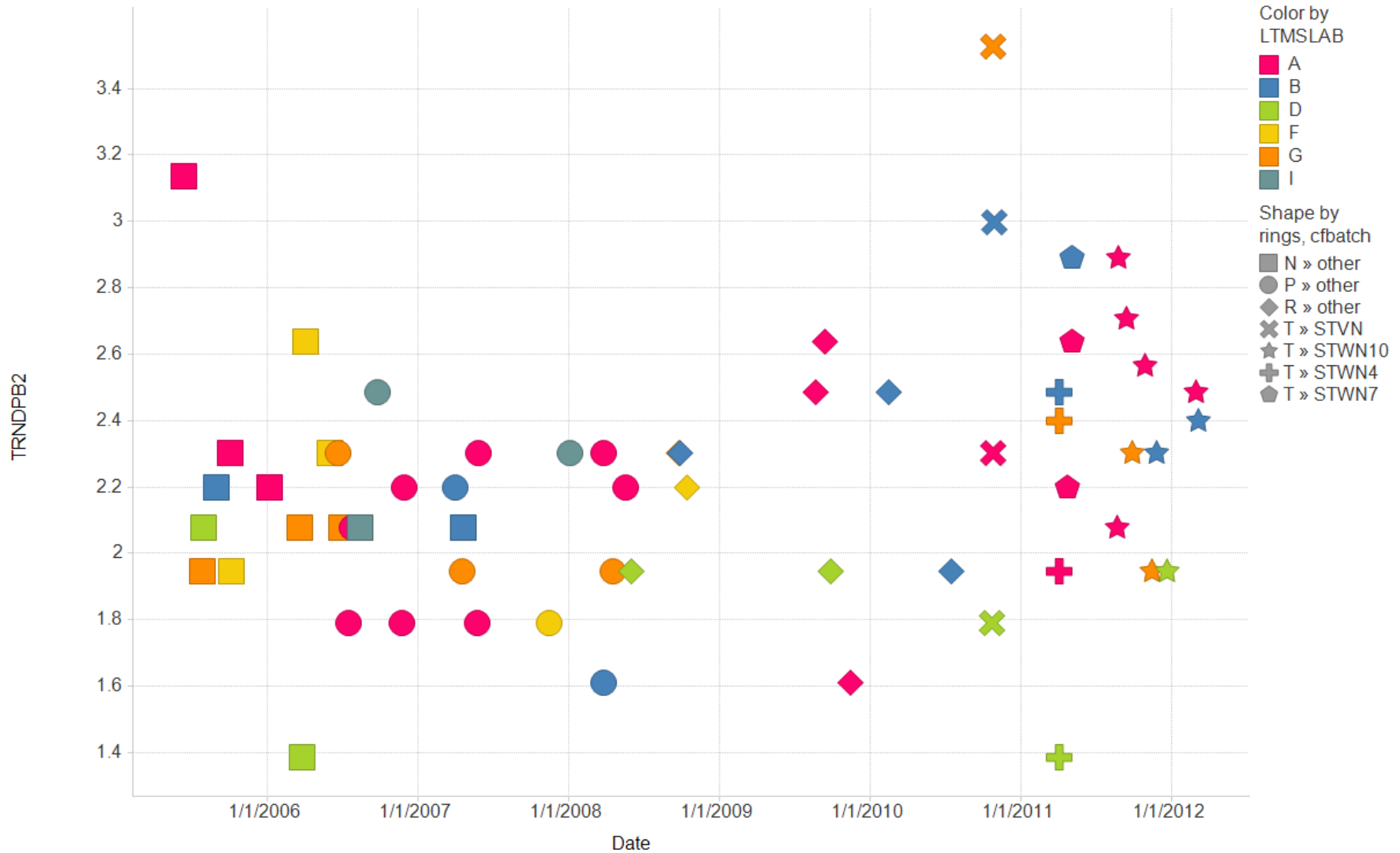
TRNDPB						
Source	DF	Sum of Squares	Mean Square	F Value	Pr > F	
Model	11	2.53478469	0.23043497	4.7	<.0001	
Error	49	2.40138292	0.04900781			
Corrected Total	60	4.93616761				
R-Square	Coeff Var	Root MSE	TRNDPB Mean			
0.513513	6.864092	0.221377	3.225148			
Source	DF	Type III SS	Mean Square	F Value	Pr > F	
IND	2	0.01520844	0.00760422	0.16	0.857	
LTMSLAB	5	0.32628445	0.06525689	1.33	0.267	Predicted
cfbatch	4	1.35960624	0.33990156	6.94	2E-04	17 STWN
						3.3634
Parameter	Estimate	Standard Error	t Value	Pr > t		
Intercept	3.136696363	0.20645102	15.19	<.0001	1	
IND 821	0.021370303	0.16212984	0.13	0.896	0	
IND 821-1	0.053850653	0.14407794	0.37	0.71	0	
IND 821-2	0				1	
LTMSLAB A	-0.028966041	0.1411249	-0.21	0.838	0.166667	
LTMSLAB B	-0.045270992	0.14866623	-0.3	0.762	0.166667	
LTMSLAB D	-0.268657504	0.15986624	-1.68	0.099	0.166667	
LTMSLAB F	-0.051182737	0.16240771	-0.32	0.754	0.166667	
LTMSLAB G	-0.098435141	0.14875692	-0.66	0.511	0.166667	
LTMSLAB I	0				0.166667	
cfbatch STVN	0.609160403	0.12743621	4.78	<.0001	0	
cfbatch STWN10	0.349738308	0.11778929	2.97	0.005	0.588235	
cfbatch STWN4	0.175335403	0.12743621	1.38	0.175	0.235294	
cfbatch STWN7	0.350087342	0.14380722	2.43	0.019	0.176471	
cfbatch other	0				0	
Contrast	DF	Contrast SS	Mean Square	F Value	Pr > F	
last 10?	1	0.02165033	0.02165033	0.44	0.509	

- The last 10 STWN were not significantly different from the first 7.
- Multiplicative adjustment for predicted STWN using all 17 tests:
 $3.1060/3.3634=0.92$

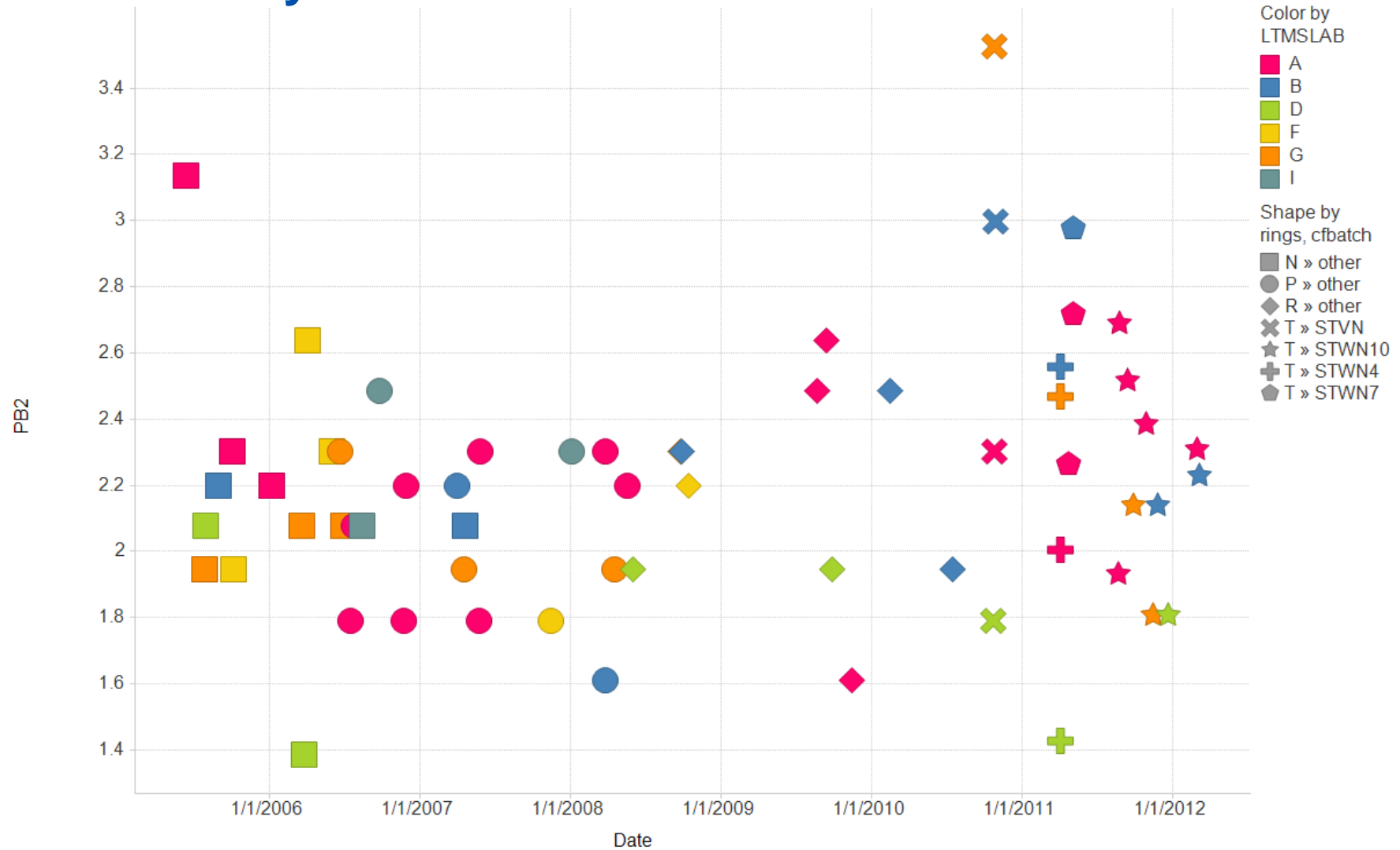
Transformed ΔPb 250-300 hours Z_i –



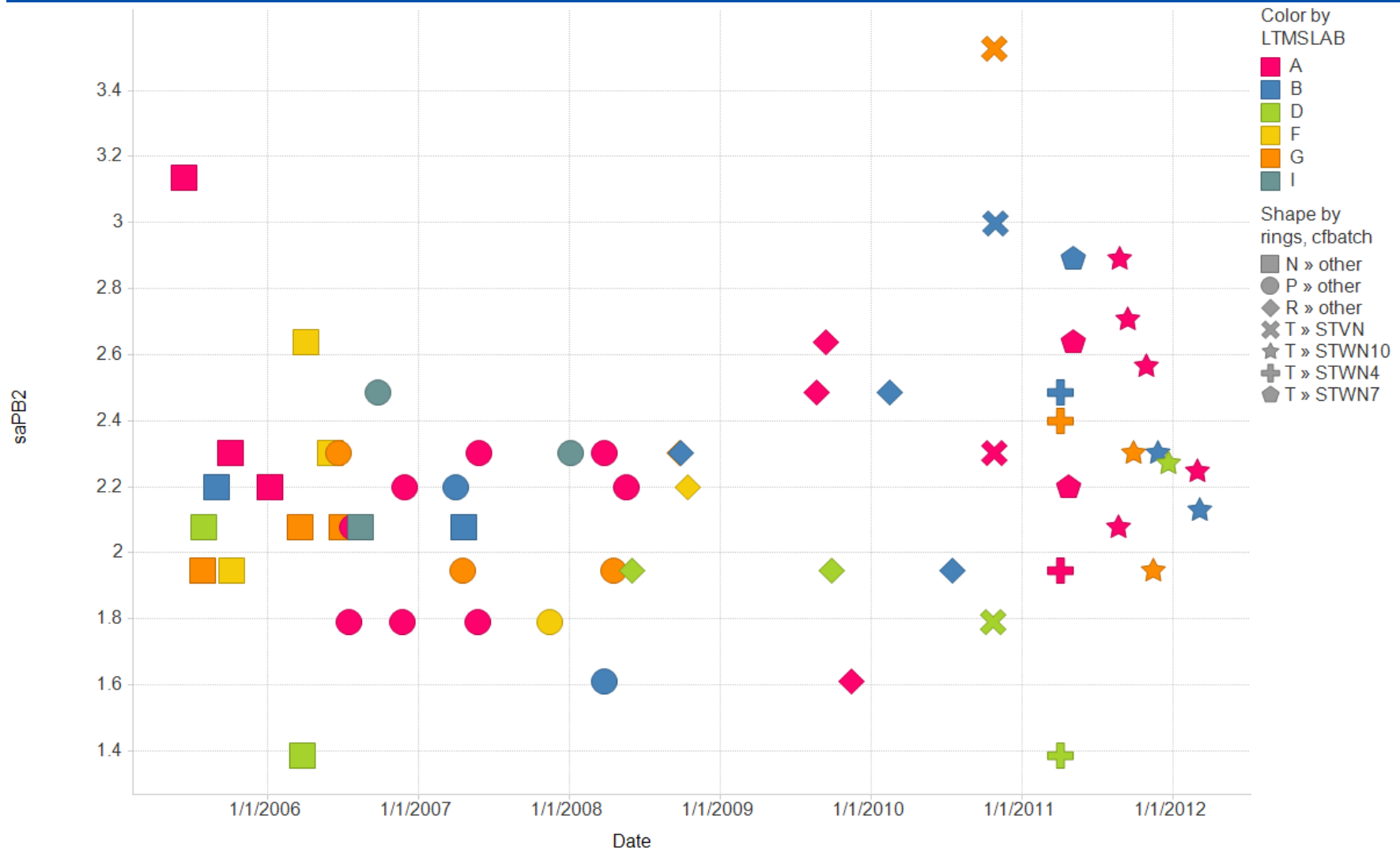
Transformed ΔPb 250-300 hours – without industry corrections



Transformed ΔPb 250-300 hours – with industry corrections



Transformed ΔPb 250-300 hours – with severity adjustments

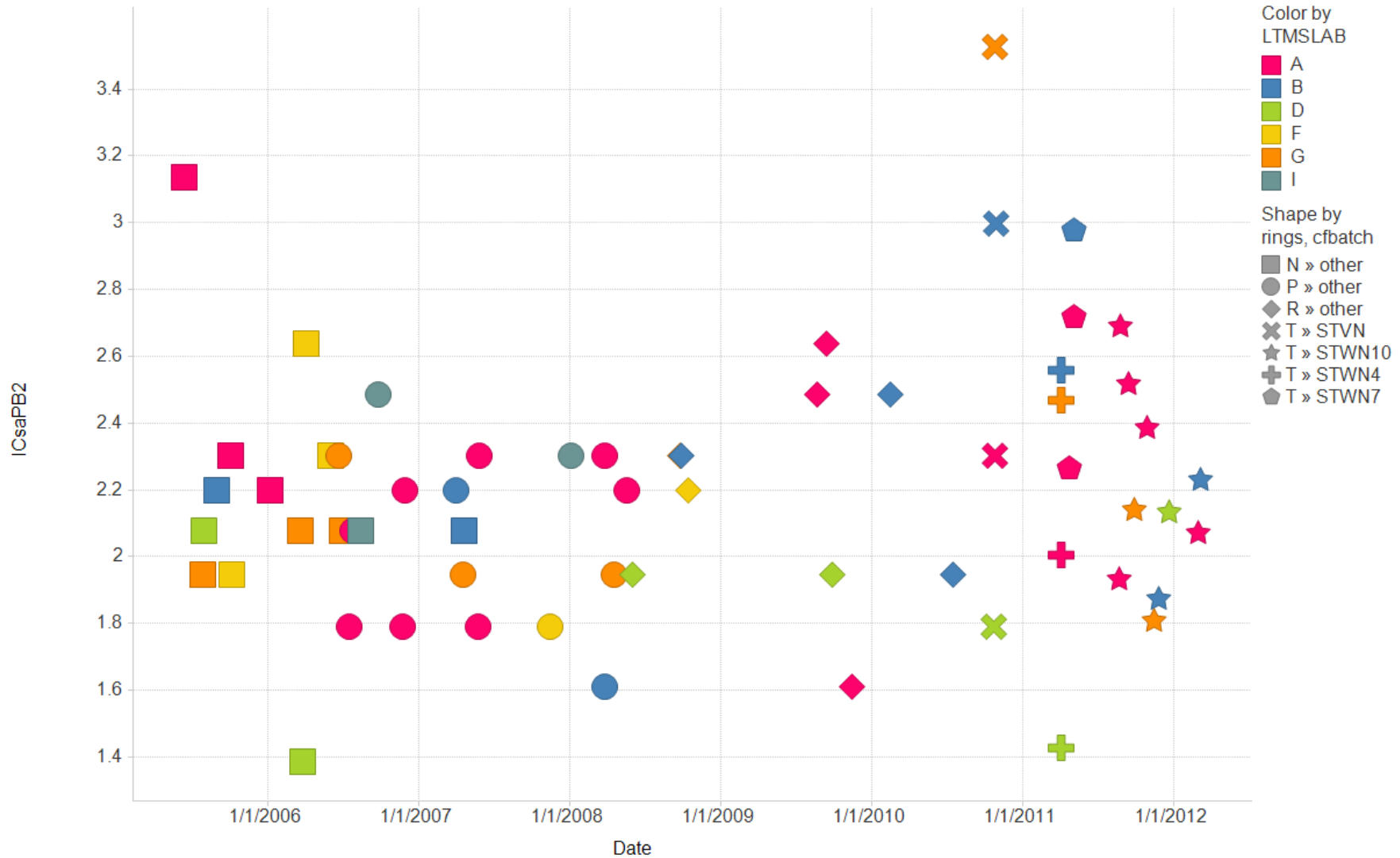


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Transformed ΔPb 250-300 hours – with severity adjustments and industry corrections



Transformed ΔPb 250-300 hours – PC type analyses part 1

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	11	3.598	0.327	2.78	0.01
Error	49	5.767	0.1177		
Corrected Total	60	9.364			

R-Square	Coeff Var	Root MSE	TRNDPB2 Mean
0.38	15.44	0.3431	2.2217

Source	DF	Type III SS	Mean Square	F Value	Pr > F
IND	2	0.180	0.090	0.76	0.47
LTMSLAB	5	1.811	0.362	3.08	0.02
cfbatch	4	1.171	0.293	2.49	0.06

cfbatch	TRNDPB2 LSMEAN	STVN	STWN10	STWN4	STWN7	other	95% Confidence Limits	
STVN	2.6349		0.72	0.11	0.93	0.07	2.2429	3.0269
STWN10	2.3406	0.72		0.69	1.00	0.70	2.0817	2.5995
STWN4	2.0345	0.11	0.69		0.60	1.00	1.6426	2.4265
STWN7	2.4214	0.93	1.00	0.60		0.62	1.9740	2.8687
other	2.1055	0.07	0.70	1.00	0.62		1.8940	2.3169

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	11	3.391	0.308	2.60	0.01
Error	49	5.808	0.119		
Corrected Total	60	9.199			

R-Square	Coeff Var	Root MSE	saPB2 Mean
0.37	15.52	0.3443	2.2187

Source	DF	Type III SS	Mean Square	F Value	Pr > F
IND	2	0.364	0.182	1.54	0.23
LTMSLAB	5	1.545	0.309	2.61	0.04
cfbatch	4	1.260	0.315	2.66	0.04

cfbatch	saPB2 LSMEAN	STVN	STWN10	STWN4	STWN7	other	95% Confidence Limits	
STVN	2.5765		0.88	0.12	0.95	0.08	2.1831	2.9699
STWN10	2.3568	0.88		0.49	1.00	0.47	2.0970	2.6166
STWN4	1.9761	0.12	0.49		0.56	0.99	1.5827	2.3695
STWN7	2.3838	0.95	1.00	0.56		0.58	1.9348	2.8327
other	2.0538	0.08	0.47	0.99	0.58		1.8416	2.2660

➤ There were marginally significant differences among correction factor batches before lab severity adjustment and significant differences after.

➤ Lab differences were still significant after severity adjustments.

➤ The current batch, STWN10, were not significantly different from the target, 2.1250.

➤ Multiplicative adjustment like we have now:

$$2.1250 / 2.3406 = 0.91$$

➤ Version 2 type additive adjustment:

$$-0.637 * 0.3330 = -0.2120$$

Transformed ΔPb 250-300 hours – PC type analyses part 2

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	11	3.59770181	0.3270638	2.78	0.007
Error	49	5.76674349	0.11768864		
Corrected Total	60	9.3644453			

R-Square	Coeff Var	Root MSE	TRNDPB2 Mean
0.384187	15.44128	0.343058	2.221692

Source	DF	Type III SS	Mean Square	F Value	Pr > F
IND	2	0.17990943	0.08995472	0.76	0.471
LTMSLAB	5	1.8108883	0.36217766	3.08	0.017
cfbatch	4	1.17098182	0.29274546	2.49	0.055

Parameter	Estimate	Standard Error	t Value	Pr > t
Intercept	2.261308632 B	0.31992755	7.07	<.0001
IND 821	0.027658035 B	0.25124508	0.11	0.913
IND 821-1	0.152609029 B	0.22327089	0.68	0.498
IND 821-2	0 B			1
LTMSLAB A	-0.161764795 B	0.2186947	-0.74	0.463
LTMSLAB B	-0.139255926 B	0.23038115	-0.6	0.548
LTMSLAB D	-0.694227106 B	0.24773728	-2.8	0.007
LTMSLAB F	-0.138636865 B	0.25167568	-0.55	0.584
LTMSLAB G	-0.161573379 B	0.23052169	-0.7	0.487
LTMSLAB I	0 B			0.166667
cfbatch STVN	0.529412641 B	0.19748198	2.68	0.01
cfbatch STWN10	0.235117823 B	0.1825326	1.29	0.204
cfbatch STWN4	-0.070962359 B	0.19748198	-0.36	0.721
cfbatch STWN7	0.315910845 B	0.22285136	1.42	0.163
cfbatch other	0 B			0

Contrast	DF	Contrast SS	Mean Square	F Value	Pr > F
last 10?	1	0.03627187	0.03627187	0.31	0.581

➤ The last 10 STWN were not significantly different from the first 7.

➤ Multiplicative adjustment for predicted STWN using all 17 tests:
 $2.1250 / 2.2228 = 0.96$

Conclusions

	batch differences significant?	current batch significantly different from target?	last 10 STWN significantly different from first 7?	target	sd	current zi	adjustment	current batch multiplicative factor	17 test multiplicative factor
CLW	no	no	yes	16.2	3.7	0.165	-0.6	1.04	0.95
InPb	yes	yes	no	3.106	0.242	1.269	-0.3070	0.91	0.92
TRWL	no	yes	no	62	28.2	0.746	-21	0.80	0.71
InOC	yes	yes	no	4.093	0.079	1.887	-0.1491	0.96	0.96
InPb2	yes	no	no	2.125	0.333	0.637	-0.2120	0.91	0.96
Merits				1226	260	-1.568	408		

