



**Oronite**

# **Mack T12 LTMS20160222 New Parts and ICF Review**

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02/25/2016



# Contents

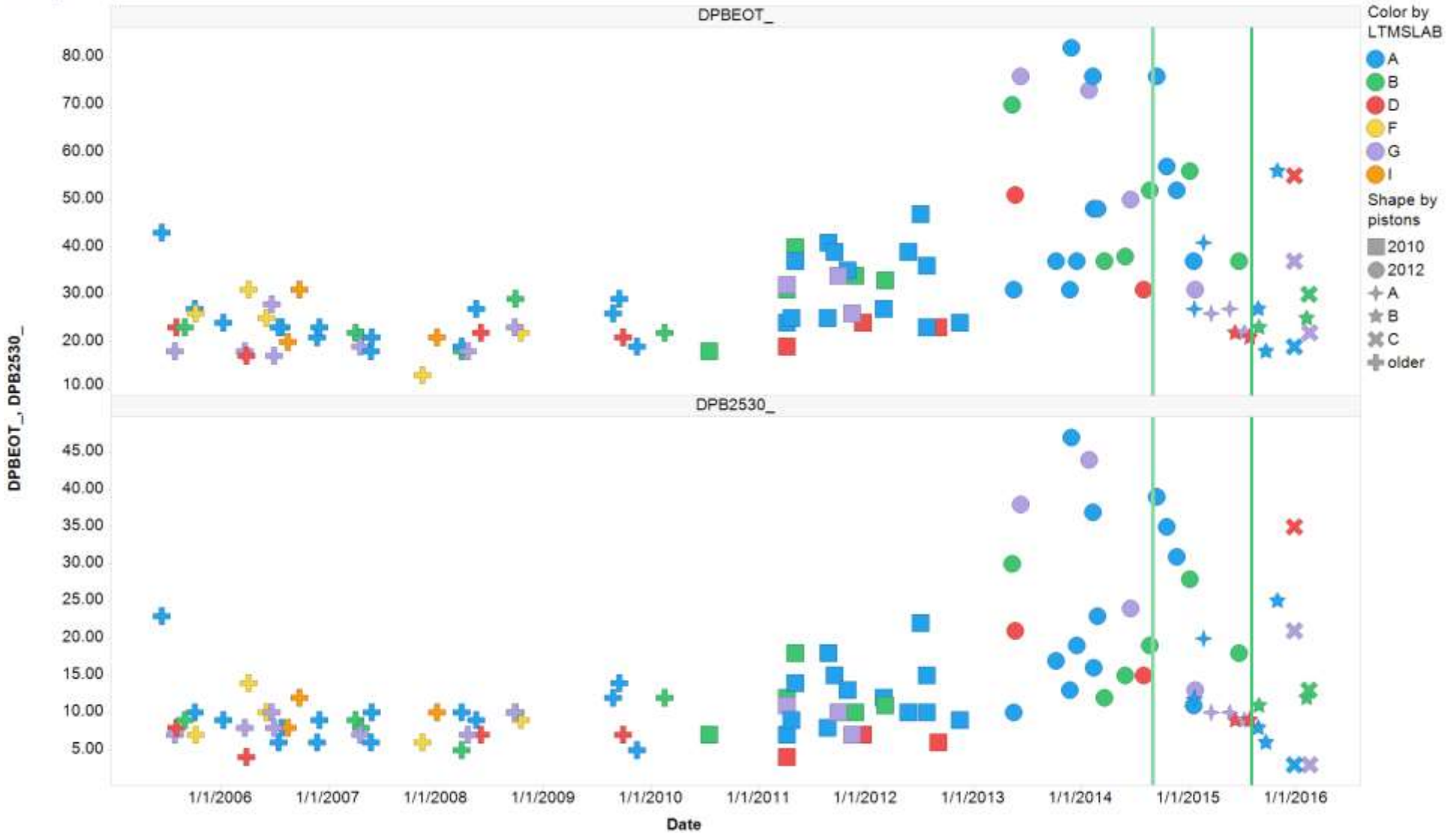
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- **Dataset**
  - **821 and variants**
  - **Chart  $\neq$  N (except VUYPC)**
  - **Testkey  $\neq$  98459, 98867 (goofy tests)**
  - **Testkey  $\neq$  109182 (thrown out last time)**
  - **Testkey  $\neq$  110864 (VUXPB)**
  - **$\Rightarrow$  104 tests**
- **Views of the data**
- **Proposed correction factors**



# Raw Lead Results by Date (bearing outlier adjusted)

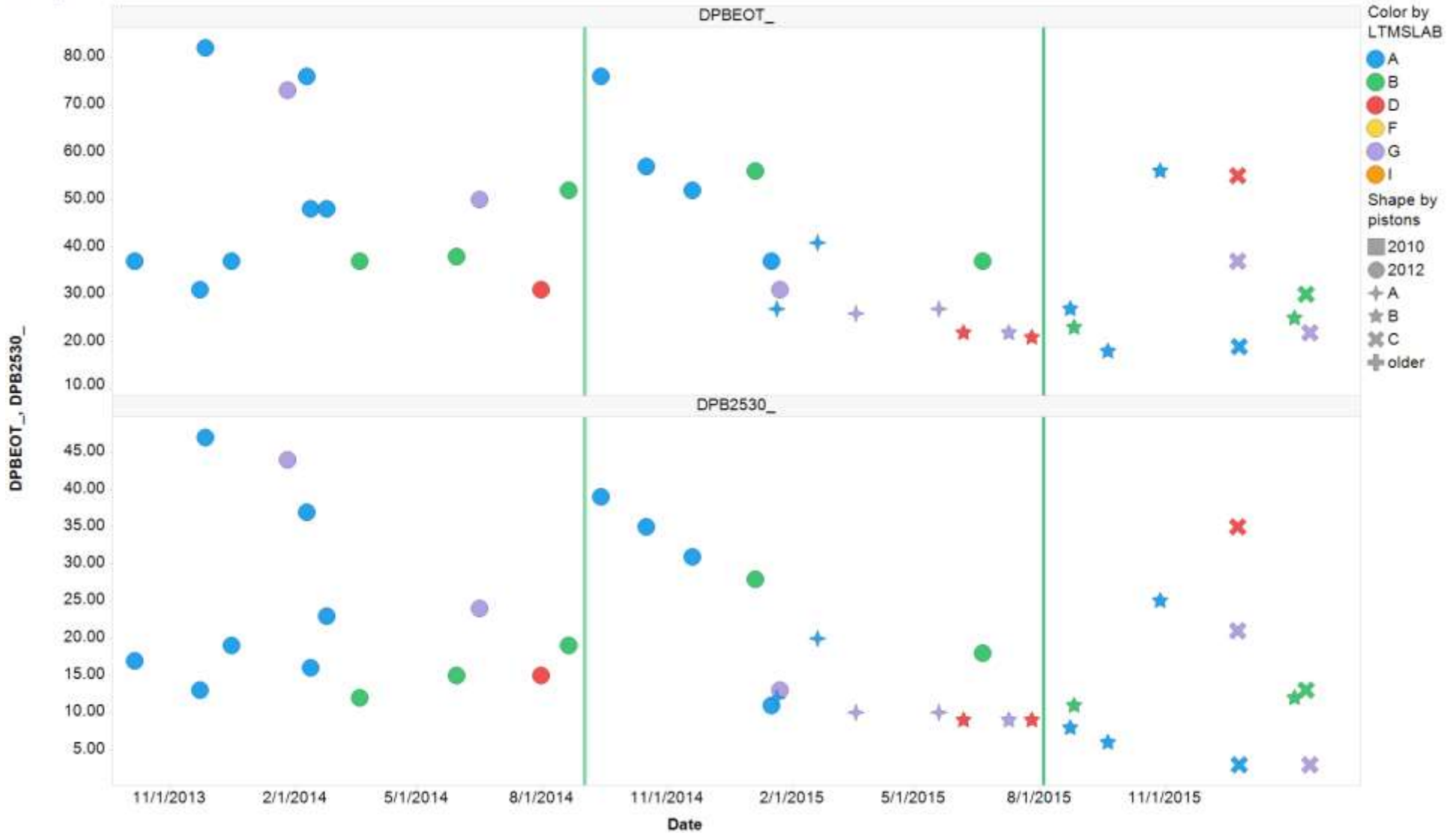
DPBEOT\_, DPB2530\_ vs. Date





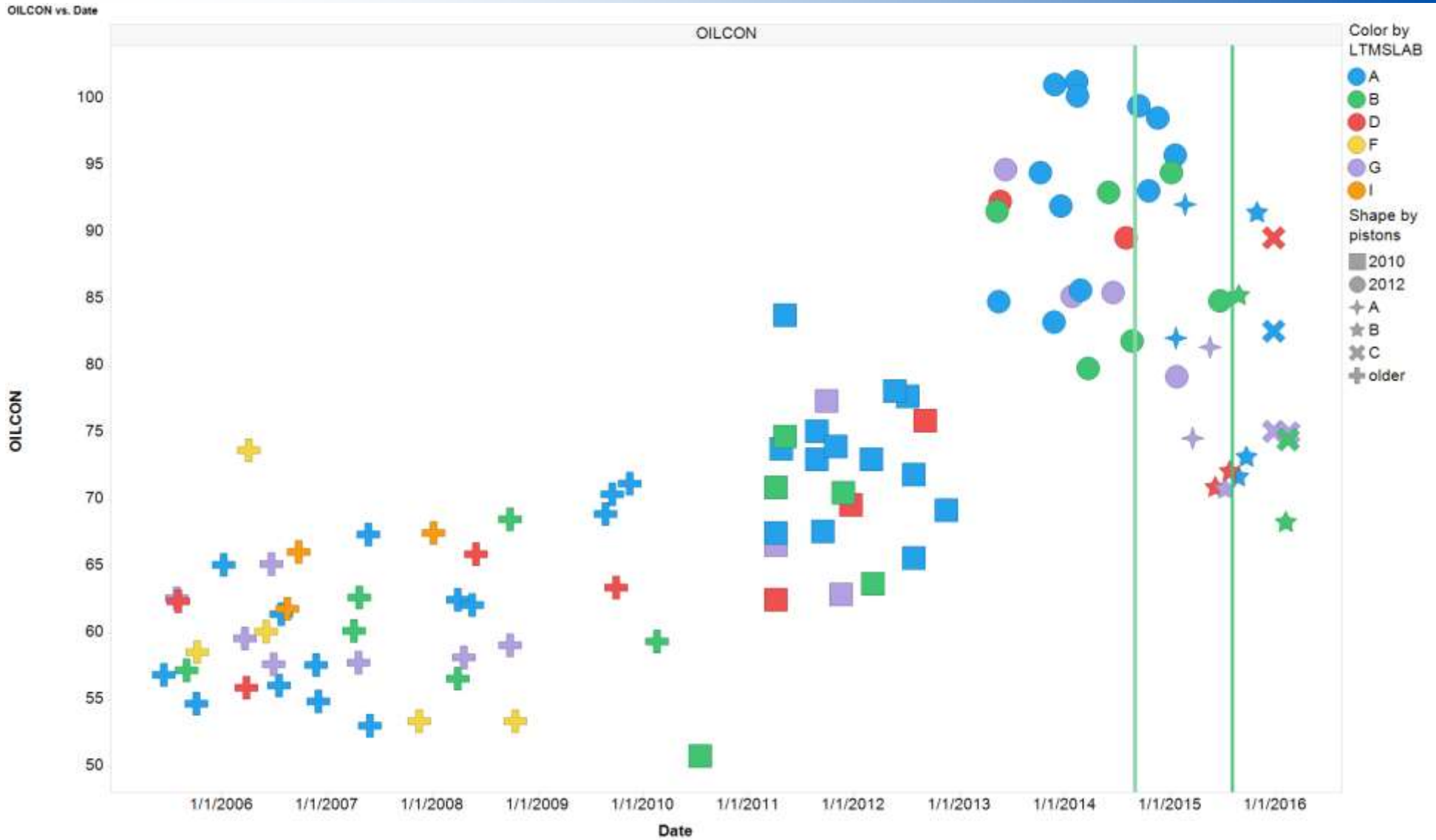
# Raw Lead Results by Date (bearing outlier adjusted)

DPBEOT\_, DPB2530\_ vs. Date



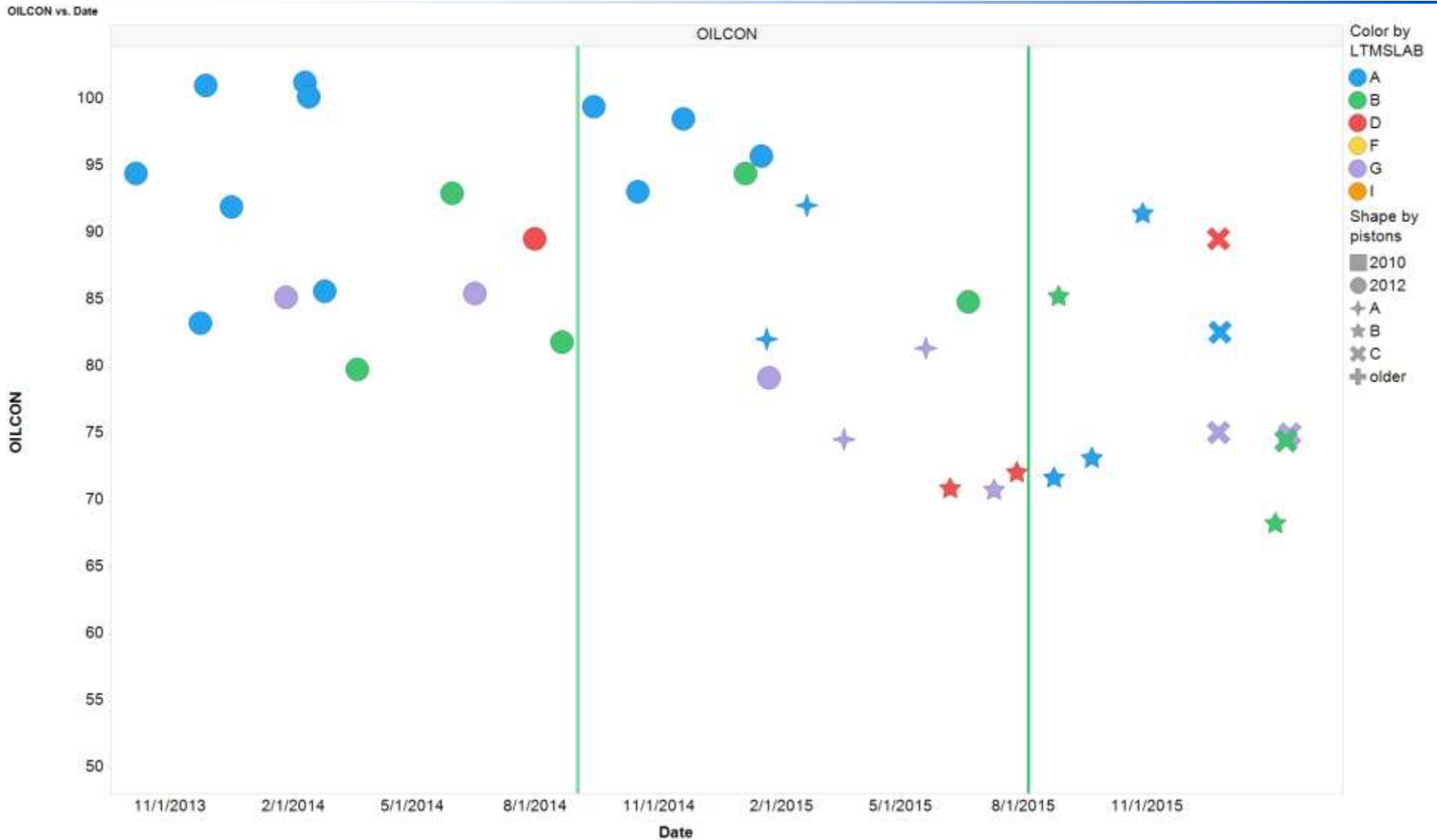


# Raw Oil Consumption Results by Date





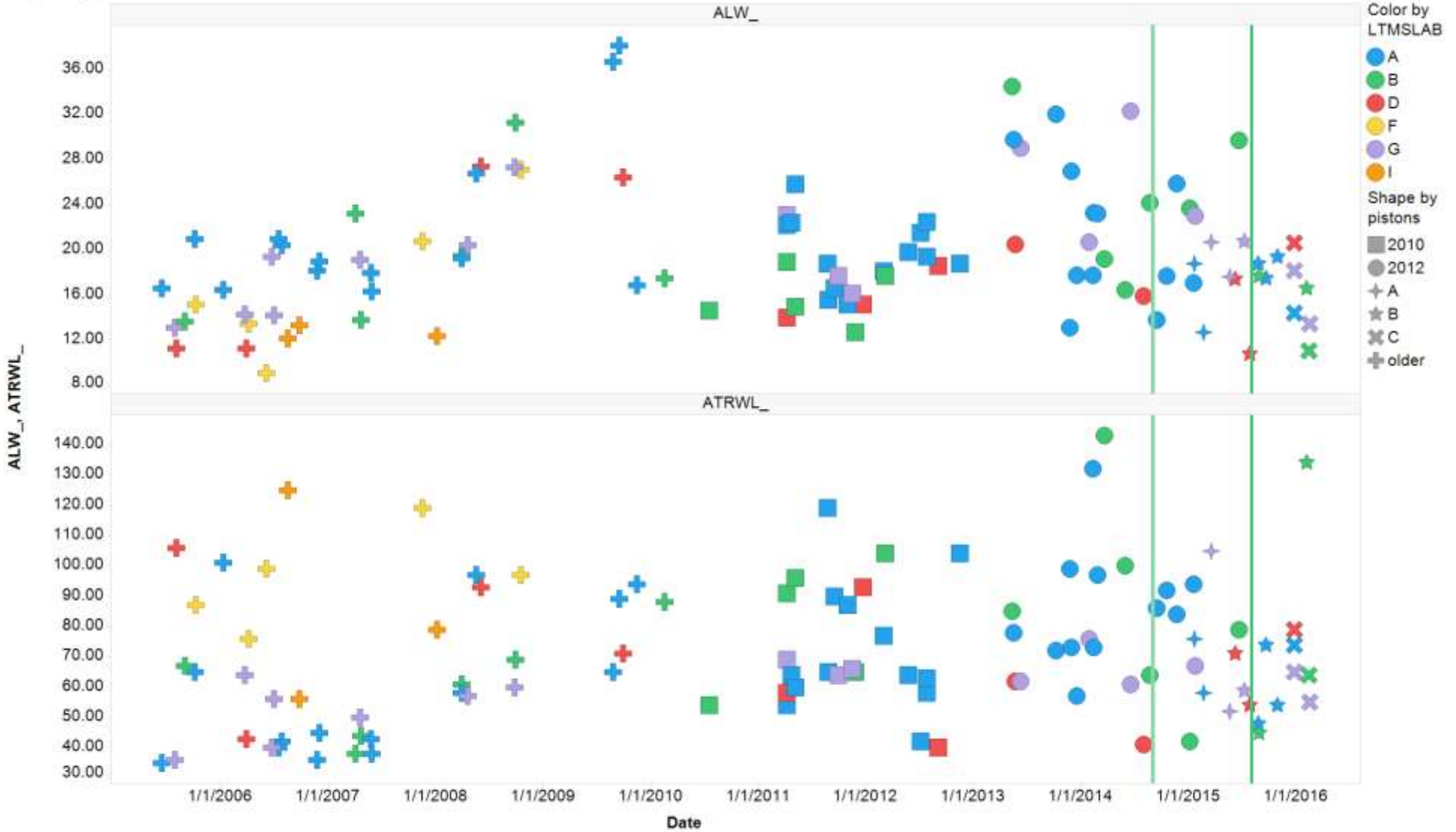
# Raw Oil Consumption Results by Date





# Raw Wear Results by Date

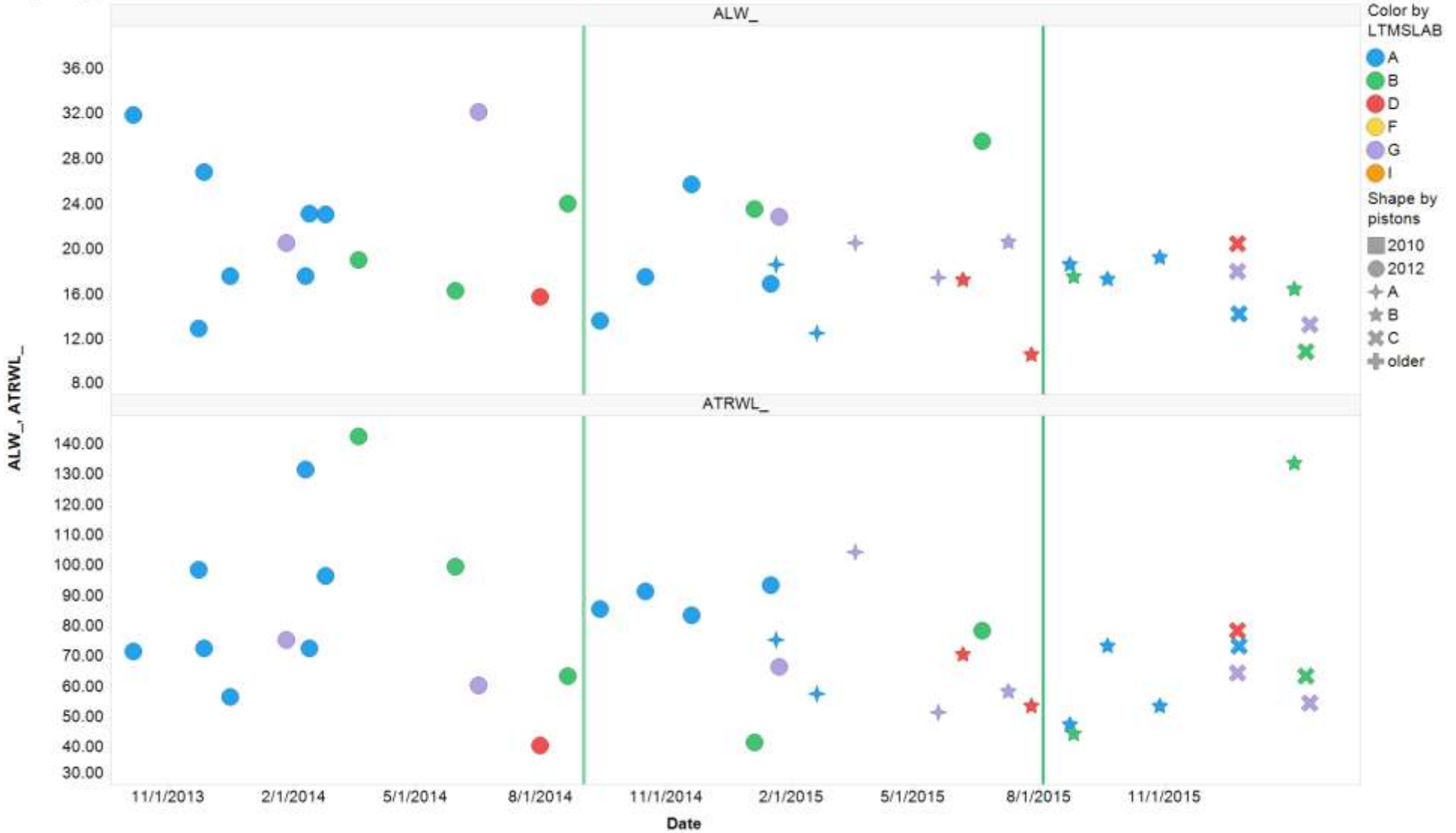
ALW\_ ATRWL\_ vs. Date





# Raw Wear Results by Date

ALW\_ ATRWL\_ vs. Date

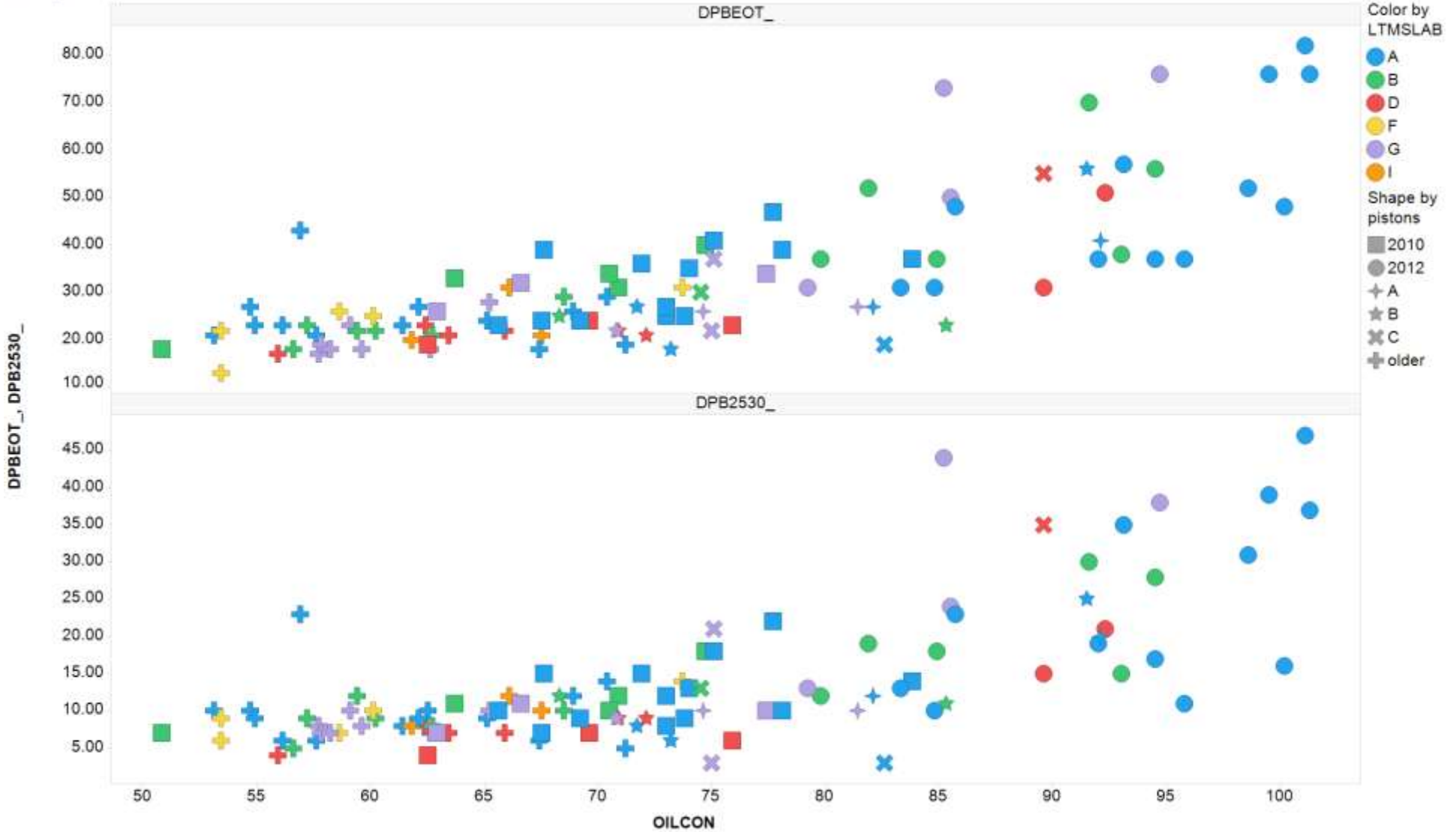






# Raw Lead Results vs. OC (bearing outlier adjusted)

DPBEOT\_, DPB2530\_ vs. OILCON

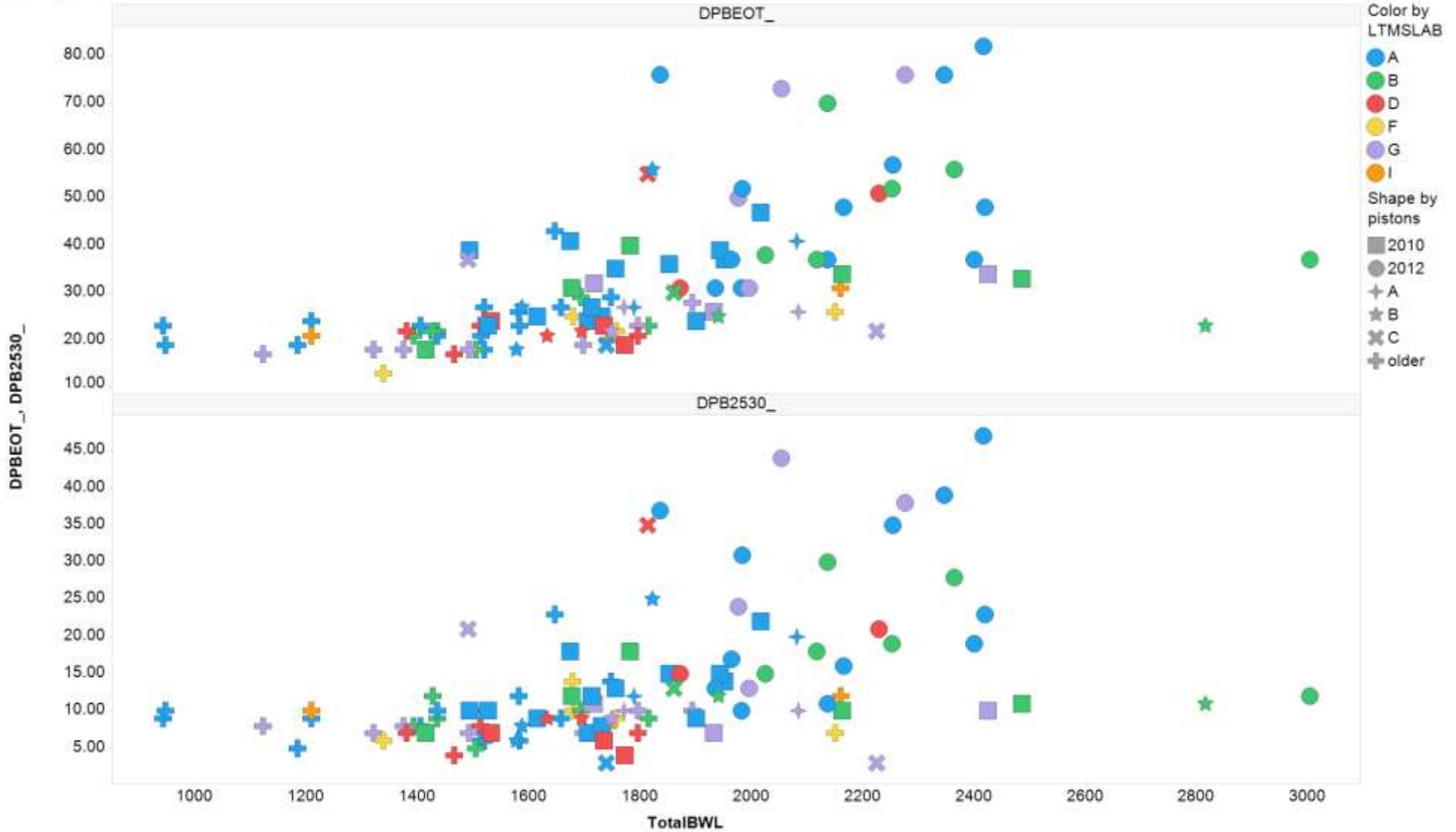


# Raw Lead Results vs. Total Bearing Weight Loss (bearing outlier adjusted)



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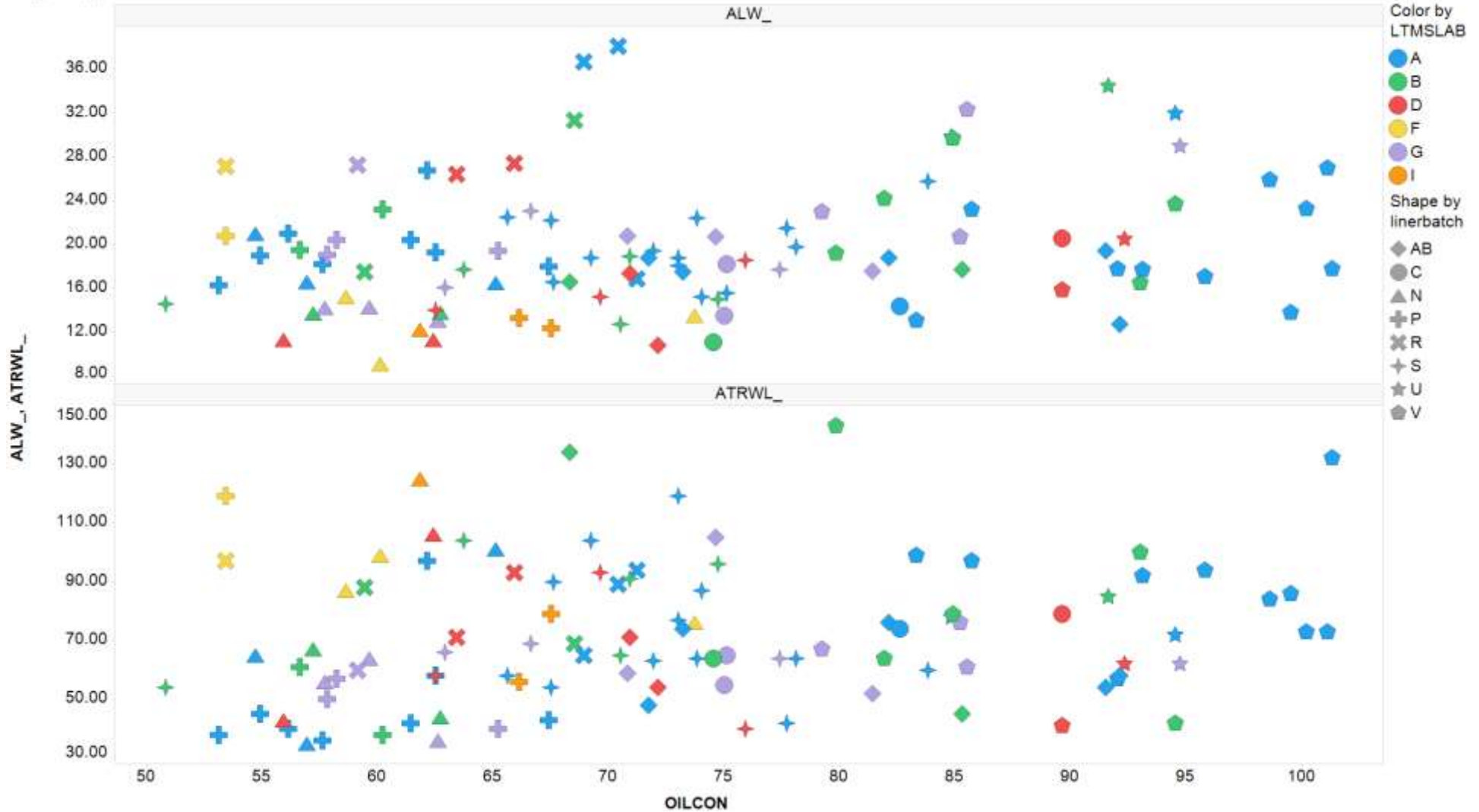
DPBEOT\_ DPB2530\_ vs. TotalBWL





# Raw Wear Results vs. OILCON

ALW\_ ATRWL\_ vs. OILCON



Correction Factor for  $\Delta\text{Lead}$  at EOT—For all tests after April 5, 2011, determine the final  $\Delta\text{Lead}$  at EOT result by applying the correction:

$$\text{if } OC_{100-300} > 65, \text{ then } \Delta\text{Lead}_{\text{Final}} = e^{\Delta\text{Lead} + (65 - OC_{100-300}) \times 0.03088},$$

$$\text{if } OC_{100-300} \leq 65, \text{ then } \Delta\text{Lead}_{\text{Final}} = \Delta\text{Lead},$$

where

$\Delta\text{Lead}_{\text{Final}}$  = final  $\Delta\text{Lead}$  at EOT,  
 $\Delta\text{Lead}$  = value calculated per Eq 2, and  
 $OC_{100-300}$  = average oil consumption from 11.6.6.

Class Level Information						
Class	Levels	Values				
IND	6	821	821-1	821-2	821-3	821-4 PC10E
LTMSLAB	6	A	B	D	F	G I
cfbatch	9	AB	C	STWN10	STWN17	STWN4 STWN7 UUXO VUXO other

TRNDPB						TRNDPB					
Source	DF	Sum of Squares	Mean Square	F Value	Pr > F	Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	18	9.72400439	0.54022247	6.89	<.0001	Model	11	6.88606149	0.62600559	10.41	<.0001
Error	85	6.66044557	0.07835818			Error	60	3.60654858	0.06010914		
Corrected Total	103	16.38444996				Corrected Total	71	10.49261007			
R-Square	Coeff Var	Root MSE	TRNDPB Mean			R-Square	Coeff Var	Root MSE	TRNDPB Mean		
0.59349	8.273896	0.279925	3.383235			0.656277	6.963571	0.245172	3.520775		
Source	DF	Type III SS	Mean Square	F Value	Pr > F	Source	DF	Type III SS	Mean Square	F Value	Pr > F
IND	5	0.22178713	0.04435743	0.57	0.7257	IND	5	0.77043958	0.15408792	2.56	0.0362
LTMSLAB	5	0.37378455	0.07475691	0.95	0.4507	LTMSLAB	5	0.57080033	0.11416007	1.9	0.1078
cfbatch	8	2.58895914	0.32361989	4.13	0.0003	OILCON	1	3.70452232	3.70452232	61.63	<.0001
						Parameter	Estimate	Standard Error	t Value	Pr >  t	
						OILCON	0.030882994	0.0039339	7.85	<.0001	



# Pb2 ICF

Correction Factor for  $\Delta\text{Lead}(250-300) h$ —For all tests after April 5, 2011, determine the final  $\Delta\text{Lead}(250-300)h$  result by applying the correction:

$$\text{if } OC_{100-300} > 65, \text{ then } \Delta\text{Lead}(250-300)_{\text{Final}} = e^{\Delta\text{Lead}(250-300) + (65 - OC_{100-300}) \times 0.04021},$$

$$\text{if } OC_{100-300} \leq 65, \text{ then } \Delta\text{Lead}(250-300)_{\text{Final}} = \Delta\text{Lead}(250-300),$$

where

$\Delta\text{Lead}(250-300)_{\text{Final}}$  = final  $\Delta\text{Lead}(250-300) h$ ,  
 $\Delta\text{Lead}(250-300)$  = value calculated per 11.6.5, and  
 $OC_{100-300}$  = average oil consumption from 11.6.6.

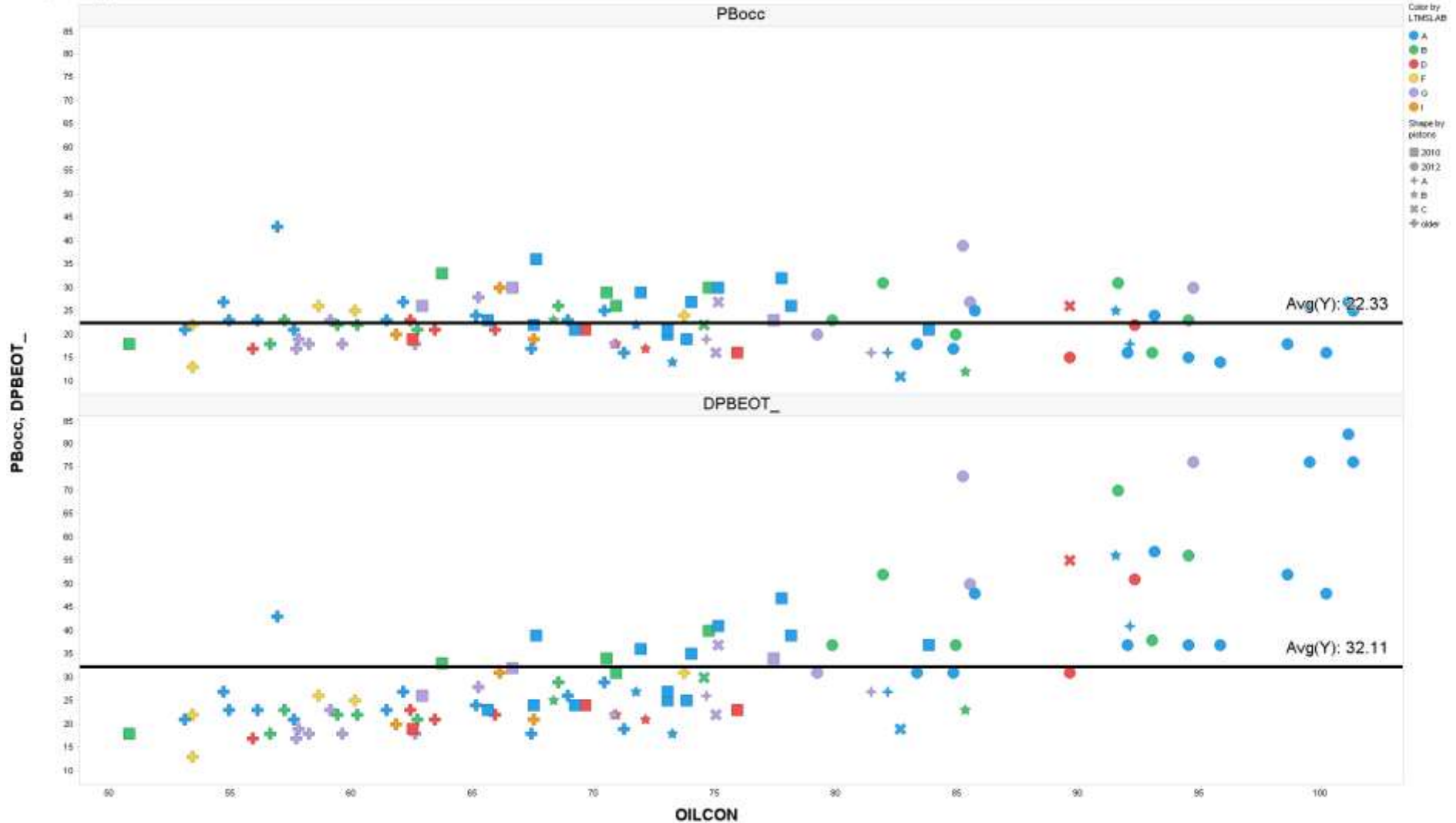
Class Level Information	
Class	Levels Values
IND	6 821 821-1 821-2 821-3 821-4 PC10E
LTMSLAB	6 A B D F G I
cfbatch	9 AB C STWN10 STWN17 STWN4 STWN7 UUXO VUXO other

TRNDPB2						TRNDPB2					
Source	DF	Sum of Squares	Mean Square	F Value	Pr > F	Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	18	15.13821957	0.8410122	4.03	<.0001	Model	11	11.89578681	1.08143516	5.51	<.0001
Error	85	17.74083404	0.20871569			Error	60	11.76968748	0.19616146		
Corrected Total	103	32.87905361				Corrected Total	71	23.6654743			
R-Square	Coeff Var	Root MSE	TRNDPB2 Mean			R-Square	Coeff Var	Root MSE	TRNDPB2 Mean		
0.460421	18.77563	0.456854	2.433229			0.502664	17.0818	0.442901	2.592825		
Source	DF	Type III SS	Mean Square	F Value	Pr > F	Source	DF	Type III SS	Mean Square	F Value	Pr > F
IND	5	0.23736156	0.04747231	0.23	0.95	IND	5	0.83709825	0.16741965	0.85	0.5176
LTMSLAB	5	0.81723425	0.16344685	0.78	0.565	LTMSLAB	5	0.81831231	0.16366246	0.83	0.5305
cfbatch	8	3.86806571	0.48350821	2.32	0.027	OILCON	1	6.27948429	6.27948429	32.01	<.0001
						Parameter	Estimate	Standard Error	t Value	Pr >  t	
						OILCON	0.04020826	0.00710657	5.66	<.0001	



# Corrected and uncorrected PB

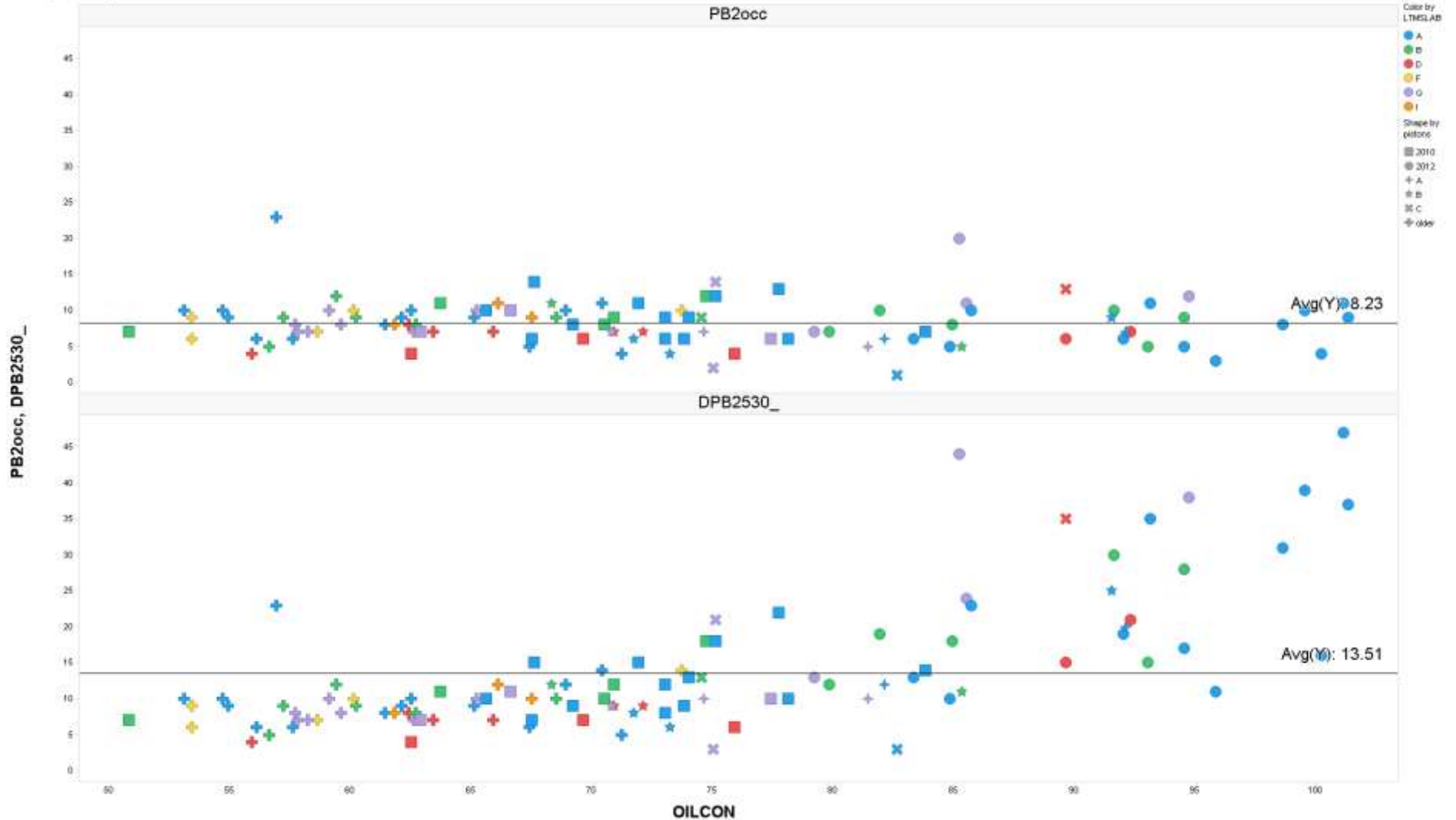
PBocc, DPBEOT\_ vs. OILCON





# Corrected and uncorrected PB2

PB2occ, DPB2530\_ vs. OILCON





# OC, Liner Wear, and TRWL ICFs

<b>IL 15-2 August 3, 2015</b>					
including only A and B pistons					
	TRNDPB	TRNDPB2	TRNOC	ALW_	ATRWL_
Predicted	3.255	2.375	4.347	17.0	68
Target	3.106	2.125	4.093	16.2	62
ICF	0.954	0.895	0.942	0.953	0.912
<b>VUYPC</b>					
	TRNDPB	TRNDPB2	TRNOC	ALW_	ATRWL_
Predicted			4.400	15.3	69
Target			4.093	16.2	62
ICF			0.930	1.059	0.899



# OC ICFs



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Source	DF	Sum of Squares	Mean Square	F Value	Pr > F	C Pistons / V Liners		
Model	18	2.67763116	0.14875729	22.02	<.0001	Predicted	Target	ICF
Error	85	0.57424322	0.0067558			4.400	4.093	0.930
Corrected Total	103	3.25187438						

R-Square	Coeff Var	Root MSE	TRNOC Mean	AB Pistons		
0.823412	1.92243	0.082194	4.275511	Predicted	Target	ICF
				4.344	4.093	0.942

Source	DF	Type III SS	Mean Square	F Value	Pr > F	VUXO		
IND	5	0.02569869	0.00513974	0.76	0.5806	Predicted	Target	ICF
LTMSLAB	5	0.08585474	0.01717095	2.54	0.0341	4.501	4.093	0.909
cfbatch	8	0.43517009	0.05439626	8.05	<.0001			

Parameter	Estimate	Standard Error	t Value	Pr >  t			
Intercept	4.202454579 B	0.05913073	71.07	<.0001	1	1	1
IND 821	-0.026721246 B	0.0352776	-0.76	0.4509	0	0	0
IND 821-1	0.036444211 B	0.03123643	1.17	0.2466	0	0	0
IND 821-2	0.035446492 B	0.06144732	0.58	0.5656	0	0	0
IND 821-3	-0.003306679 B	0.0800382	-0.04	0.9671	0	0	0
IND 821-4	0.013147978 B	0.08389249	0.16	0.8758	1	1	1
IND PC10E	0 B	.	.	.			
LTMSLAB A	-0.07813949 B	0.05665167	-1.38	0.1714	0.25	0.25	0.25
LTMSLAB B	-0.136710318 B	0.05848593	-2.34	0.0218	0.25	0.25	0.25
LTMSLAB D	-0.107103349 B	0.06134504	-1.75	0.0844	0.25	0.25	0.25
LTMSLAB F	-0.114594923 B	0.06312025	-1.82	0.073	0	0	0
LTMSLAB G	-0.131127122 B	0.05718769	-2.29	0.0243	0.25	0.25	0.25
LTMSLAB I	0 B	.	.	.	0	0	0
cfbatch AB	0.241219178 B	0.08367053	2.88	0.005	0	1	0
cfbatch C	0.272538924 B	0.08932131	3.05	0.003	0	0	1
cfbatch STWN10	0.121007637 B	0.0435912	2.78	0.0068	0	0	0
cfbatch STWN17	0.140891257 B	0.06809082	2.07	0.0416	0	0	0
cfbatch STWN4	0.07619628 B	0.04722189	1.61	0.1103	0	0	0
cfbatch STWN7	0.206530976 B	0.05312124	3.89	0.0002	0	0	0
cfbatch UUXO	0.423496054 B	0.08556038	4.95	<.0001	0	0	0
cfbatch VUXO	0.399017483 B	0.07550556	5.28	<.0001	1	0	0
cfbatch other	0 B	.	.	.			0



# Liner Wear ICFs

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F	C Pistons / V Liners		
Model	17	1990.917565	117.112798	6.98	<.0001	Predicted	Target	ICF
Error	86	1443.451281	16.784317			15.3	16.2	1.059
Corrected Total	103	3434.368846						
R-Square	Coeff Var	Root MSE	ALW_ Mean	AB Pistons				
0.579704	21.02824	4.096867	19.48269	Predicted	Target	ICF		
				17.2	16.2	0.942		
Source	DF	Type III SS	Mean Square	F Value	Pr > F	VUXO		
IND	5	82.12325	16.42465	0.98	0.4356	Predicted	Target	ICF
LTMSLAB	5	148.722568	29.744514	1.77	0.1271	21.9	16.2	0.740
linerbatch	7	1238.025244	176.860749	10.54	<.0001			
Parameter	Estimate	Standard Error	t Value	Pr >  t				
Intercept	17.70104335 B	5.03426066	3.52	0.0007	1	1	1	
IND 821	-2.13061745 B	2.03613021	-1.05	0.2983	0	0	0	
IND 821-1	1.13770094 B	2.93849961	0.39	0.6996	0	0	0	
IND 821-2	1.5054245 B	3.42788015	0.44	0.6616	0	0	0	
IND 821-3	-1.74956751 B	4.16021971	-0.42	0.6751	0	0	0	
IND 821-4	0.82130069 B	4.32759469	0.19	0.8499	1	1	1	
IND PC10E	0 B	.	.	.	0	0	0	
LTMSLAB A	4.40581722 B	2.85069895	1.55	0.1259	0.25	0.25	0.25	
LTMSLAB B	2.98853648 B	2.93948698	1.02	0.3122	0.25	0.25	0.25	
LTMSLAB D	1.28897048 B	3.06258956	0.42	0.6749	0.25	0.25	0.25	
LTMSLAB F	3.07994322 B	3.15440124	0.98	0.3316	0	0	0	
LTMSLAB G	4.67535753 B	2.85629873	1.64	0.1053	0.25	0.25	0.25	
LTMSLAB I	0 B	.	.	.	0	0	0	
linerbatch AB	-4.62561941 B	1.83693881	-2.52	0.0137	0	1	0	
linerbatch C	-6.56915189 B	2.39937757	-2.74	0.0075	0	0	1	
linerbatch N	-6.47579445 B	4.16362228	-1.56	0.1235	0	0	0	
linerbatch P	-1.16774162 B	3.73628203	-0.31	0.7554	0	0	0	
linerbatch R	5.51372611 B	3.1525481	1.75	0.0839	0	0	0	
linerbatch S	-4.28046335 B	2.5961175	-1.65	0.1028	0	0	0	
linerbatch U	9.65562438 B	2.20621381	4.38	<.0001	0	0	0	
linerbatch V	0 B	.	.	.	1	0	0	

# TRWL ICFs



Source	DF	Sum of Squares	Mean Square	F Value	Pr > F	C Pistons		
Model	17	19497.32878	1146.90169	2.58	0.0022	Predicted	Target	ICF
Error	86	38176.17122	443.90897			69	62	0.899
Corrected Total	103	57673.5						
R-Square	Coeff Var	Root MSE	ATRWL_ Mean	AB Pistons				
0.338064	29.36467	21.06915	71.75	Predicted	Target	ICF		
				68	62	0.912		
Source	DF	Type III SS	Mean Square	F Value	Pr > F	VUXO		
IND	5	4307.599341	861.519868	1.94	0.0958	Predicted	Target	ICF
LTMSLAB	5	7573.418913	1514.683783	3.41	0.0073	72	62	0.861
linerbatch	7	4121.996021	588.856574	1.33	0.2477			
Parameter	Estimate	Standard Error	t Value	Pr >  t				
Intercept	68.26781912 B	25.88992654	2.64	0.0099	1	1	1	
IND 821	14.48011957 B	10.47130157	1.38	0.1703	0	0	0	
IND 821-1	36.75529718 B	15.11195867	2.43	0.0171	0	0	0	
IND 821-2	31.76843141 B	17.62871876	1.8	0.075	0	0	0	
IND 821-3	48.11569458 B	21.39495549	2.25	0.0271	0	0	0	
IND 821-4	32.8529925 B	22.25572258	1.48	0.1436	1	1	1	
IND PC10E	0 B	.	.	.	0	0	0	
LTMSLAB A	-26.70408806 B	14.66042212	-1.82	0.072	0.25	0.25	0.25	
LTMSLAB B	-20.72717981 B	15.11703647	-1.37	0.1739	0.25	0.25	0.25	
LTMSLAB D	-33.57497926 B	15.75012183	-2.13	0.0359	0.25	0.25	0.25	
LTMSLAB F	2.46225383 B	16.22228602	0.15	0.8797	0	0	0	
LTMSLAB G	-35.83385348 B	14.68922041	-2.44	0.0168	0.25	0.25	0.25	
LTMSLAB I	0 B	.	.	.	0	0	0	
linerbatch AB	-4.09051022 B	9.44691067	-0.43	0.6661	0	1	0	
linerbatch C	-3.1860208 B	12.33939068	-0.26	0.7969	0	0	1	
linerbatch N	20.97439678 B	21.41245406	0.98	0.3301	0	0	0	
linerbatch P	-4.60910643 B	19.21475144	-0.24	0.811	0	0	0	
linerbatch R	0.32001503 B	16.21275581	0.02	0.9843	0	0	0	
linerbatch S	-3.16795787 B	13.35117428	-0.24	0.813	0	0	0	
linerbatch U	-15.87467596 B	11.34599843	-1.4	0.1654	0	0	0	
linerbatch V	0 B	.	.	.	0	0	0	