

Cummins Surveillance Panel
Teleconference
Meeting Minutes
March 24, 2015

The teleconference convened at 10:30 a.m. EDT

Attendance:

Afton - Christian Porter

ChevronOronite - Jim Rutherford

Cummins - Dan Nyman

Infineum - Elisa Santos, Pat Fetterman, Jim Gutzwiller, Bob Salgueiro

Intertek - Jim Moritz, Mey Dewey

Lubrizol - Kevin O'Malley, Nick Secue

SwRI - Jim McCord, Perry Grosch, Jim Carroll

TEI - Zack Bishop, Dan Lanctot

TMC - Jeff Clark, Sean Moyer

New ISB Hardware:

The primary purpose of this call was to review the data from six tests run on new ISB hardware (batch K cams, batch D tappets). Kevin O'Malley provided an analysis of the results (attached). Kevin led the panel through a review of the analysis. After Kevin's review, general consensus was reached to use a modeling approach that would consider hardware batches (tappets and cams) and reference oil blends. Kevin will provide a further analysis based on this guidance. Based on some further discussion, Kevin will also try to look at the data relative to fuel batch. Jim Moritz will help decode some of the meaning from the fuel batch ids.

An additional discussion took place regarding the use of the new hardware for candidate tests on currently calibrated stands. *It was moved/seconded (McCord/Salgueiro) that currently calibrated stands that have not run a reference oil test on the new hardware (defined as batch K cams, batch D tappets) can run candidate tests on the new hardware, accepting the risk that the final results will not be known until the panel has resolved the full introduction of new hardware.* This motion passed without objection (TEI, TMC waive). Ideally, labs should not upload any candidate tests to the ACC-MA until the full hardware resolution is known. It was also noted that donated tests do not impact calibration periods.

Next Meeting:

The next meeting is tentatively scheduled for 4/2/15 at 10:30 Eastern, when the updated hardware analysis will be reviewed.

The teleconference concluded at 12:15 pm.



Cummins ISB Industry Severity

March 2014

Kevin O'Malley

Statistician

The Lubrizol Corporation

Current State of LTMS for ISB



LTMS file contains test results from 20041115 to 20150315

Severity adjustments are not currently applicable

1. These would affect candidate results only

Values used in ISB LTMS calculations

LUBRICANT TEST MONITORING SYSTEM CONSTANTS

		EWMA Chart				Shewhart Chart	
		LAMBDA		K		K	
Chart Level	Limit Type	Precision	Severity	Precision	Severity	Precision	Severity
Stand	Action	0.3	0.3	2.10	2.36	2.10	1.96
Industry	Warning	0.2	0.2	2.10	2.36	--	--
	Action	0.2	0.2	2.80	3.00	--	--

Current State of LTMS for ISB



Correction factors are currently in place for:
 Average Tappet Weight Loss (ATWL)
 Average Camshaft Wear (ACSW)

ISB	April 21, 2011	***	All tests using batch B tappets with batch E, F, and G cams	Multiply ATWL by 0.637; Add -9.5 to ACSW
ISB	December 11, 2011	November 12, 2012	All tests using batch C Tappets with batch H cams	Multiply ATWL by 0.637; Add -9.5 to ACSW
ISB	November 13, 2012	***	All tests using batch C tappets with batch H and J cams	Multiply ATWL by 0.711; Add -5.6 to ACSW

History of Reference Oil Targets (831-2 is new batch introduced Oct 2013)

ISB Reference Oil Targets							
Oil	n	Effective Dates		Average Camshaft Wear		Average Tappet Weight Loss	
		From	To ¹	\bar{X}	s	\bar{X}	s
821 (PC10E)	6	6-4-05	12-31-05	34.6	4.6	56.2	9.6
830-2	6	6-4-05	12-31-05	39.8	9.0	85.9	16.0
831 (PC10B)	6	6-4-05	1-24-07	41.9	5.6	88.7	15.9
	10	1-25-07	8-6-07	42.8	5.4	94.9	15.3
	14	8-7-07	***	42.5	5.0	97.2	14.8
831-1 ²	--	8-7-07	***	42.5	5.0	97.2	14.8
831-2 ²	--	8-6-13	***	42.5	5.0	97.2	14.8

1 *** = currently in effect

2 Targets based on oil 831

831-1 and 831-2 currently based on 831 targets



Current State of LTMS for ISB



Cummins ISB Critical Engine Parts Batch Changes		
ISB Camshaft Batch	Starting Kit #	Date
A	1	Jun-2004
B	135	Feb-2006
C	244	Aug-2007
D	290	Jul-2008
E	337	Apr-2009
F	389	Mar-2010
G	441	Mar-2011
H	486	Nov-2011
J	569	Aug-2012
K	821	Jan-2015
ISB Tappet Batch	Starting Kit #	Date
A	1	Jun-2004
B	279	Jan-2008
C	475	Aug-2011
D	821	Jan-2015
ISB Crosshead Batch	Starting Kit #	Date
A	1	Jun-2004
B	279	Jan-2008
C	475	Aug-2011
D	569	Aug-2012



Pushrod Batches

New pushrods estimated to start with Kit# 556

- 5000 were obtained on June 22, 2012
- We cannot guarantee these 5000 came from the same batch

Prior to new pushrod “batch”, pushrods came in small quantities from different batches

Average Camshaft Wear ACSWzi EWMA Control Chart



CUMMINS ISB INDUSTRY OPERATIONALLY VALID DATA



AVERAGE CAMSHAFT WEAR

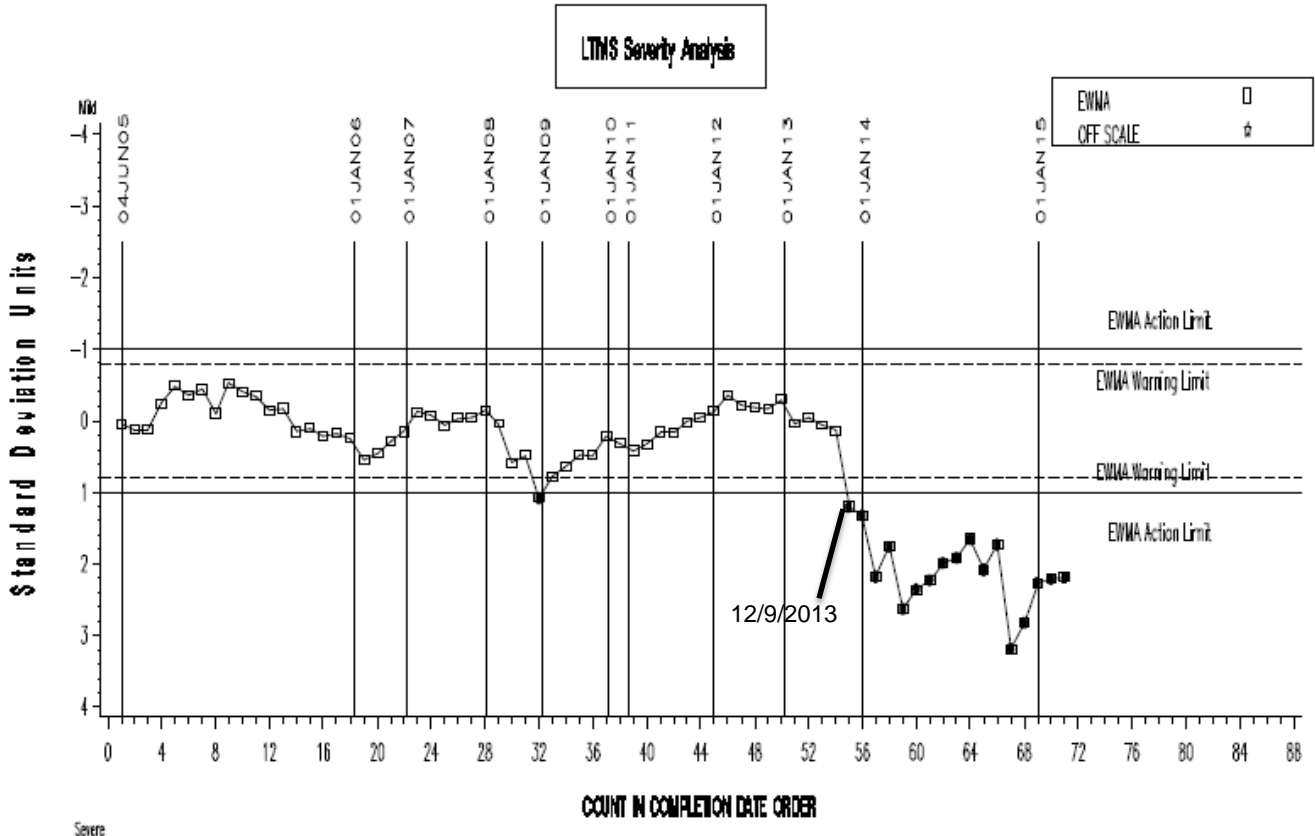


Chart indicates ACSW trending severe since around beginning of 2014



Average Tappet Weight Loss ATWLzi EWMA Control Chart



CUMMINS ISB INDUSTRY OPERATIONALLY VALID DATA



AVERAGE TAPPET WEIGHT LOSS

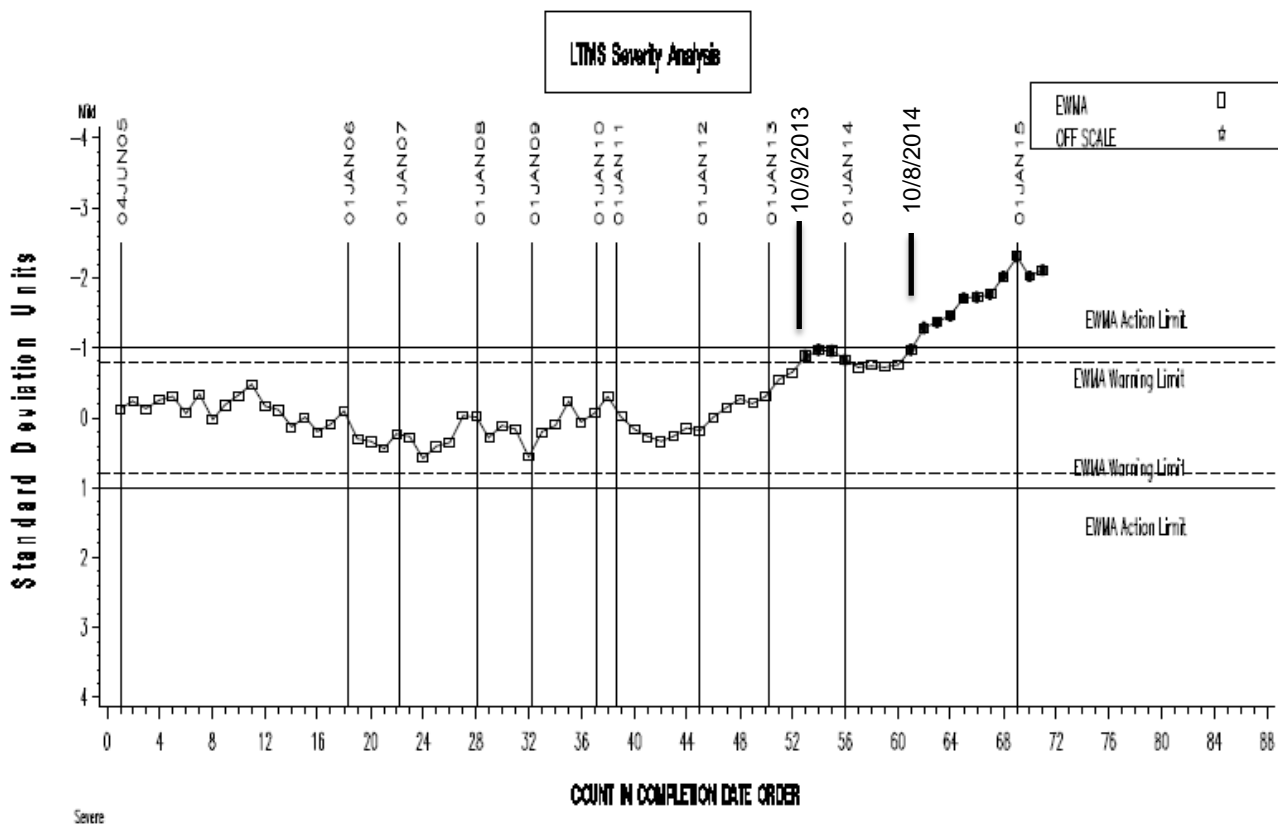


Chart indicates ATWL trending mild since about Oct 2014
(Possibly since Oct 2013)



Analysis Includes chart="Y" data prior to 1/29/2015

+

Additional Tests (since last analysis update):

TESTKEY	LTMSLAB	IND	LTMSAPP	ENGINE	ENHOURS	VAL	LTMSDATE	CHART	ENKIT	COM1	COM2	COM3	COM4	TAPBID	CRHBID	CAMBID
98396-ISB	B	831-2	3	46560892	4900	LC	20150129	N	ISB-749	SEVERE	ACSW	FAILED	INJ295HR	C	D	J
98397-ISB	B	831-2	3	46562869	5253	XC	20150206	N	ISB-765	ABORTED	EGR VLV	FAILURE	HIGH SOO	C	D	J
106237-ISB	B	831-2	3	46560892	5250	AC	20150226	Y	ISB-750					C	D	J
104605-ISB	A	831-2	3	46560643	7486	PC	20150227	N	ISB-824	NEW CAM	NEW TAP			D	D	K
105876-ISB	G	831-2	4	46561166	13355	XH	20150303	N	ISB-823	ENGINE	HW FAIL	OIL LOSS		D	K	J
105875-ISB	G	831-2	3	46560027	3457	PC	20150305	N	ISB-822	NEW CAM	NEW TAP			D	D	K
104606-ISB	A	831-2	4	49342610	3150	PC	20150307	Y	ISB-825	NEW CAM	NEW TAP			D	D	K
106978-ISB	G	831-2	1	46560896	7910	AG	20150308	N	ISB-826	NEW CAM	NEW TAP		HARDWARE	D	D	K
106854-ISB	B	831-2	3	46562869	5280	PC	20150313	N	ISB-821	NEW CAM	HARDWARE			D	D	K
106979-ISB	G	831-2	5	57339278	6950	PC	20150315	N	ISB-827	NEW CAM	NEW TAP			D	D	K

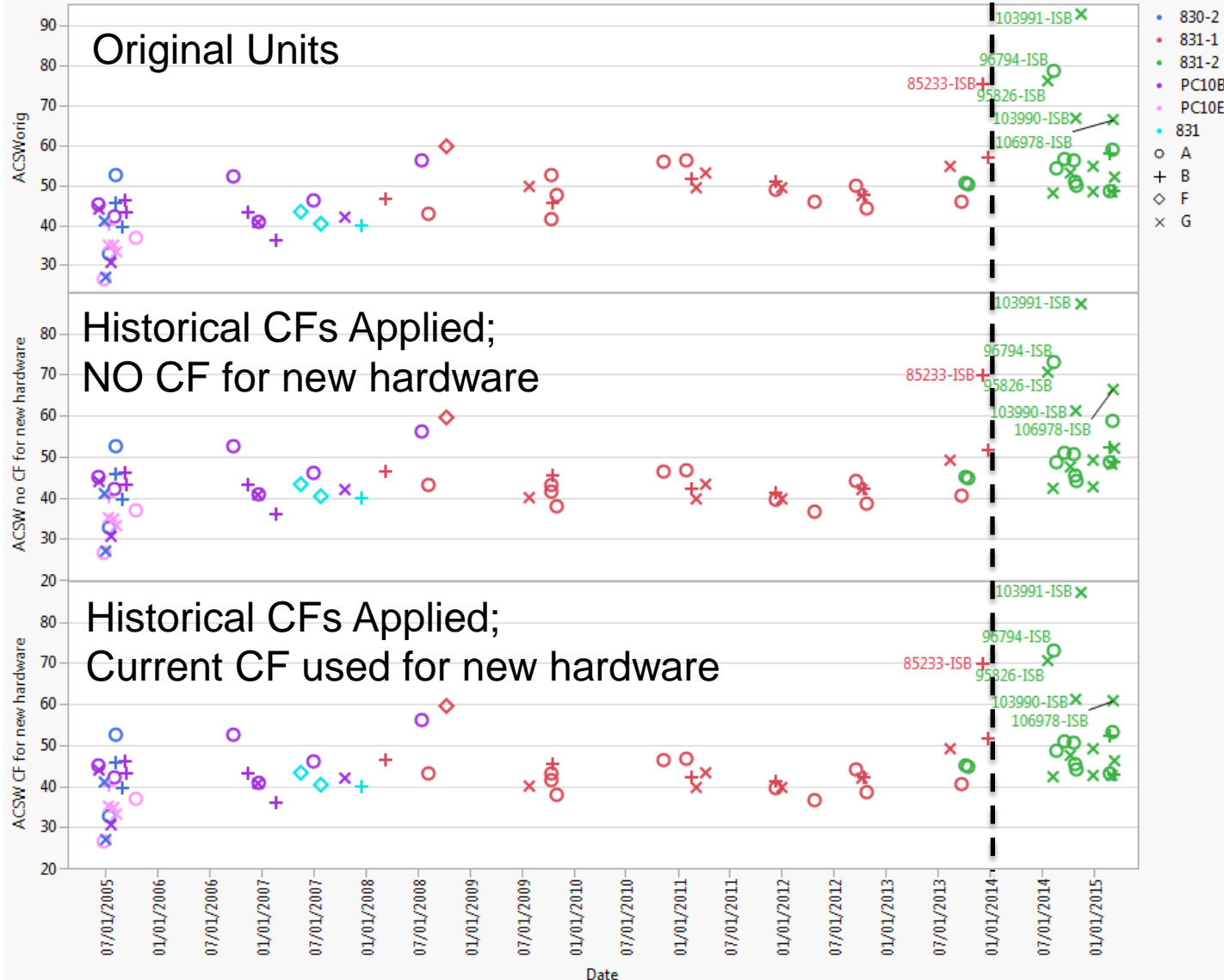
Included in graphs/analyses



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Average Camshaft Wear

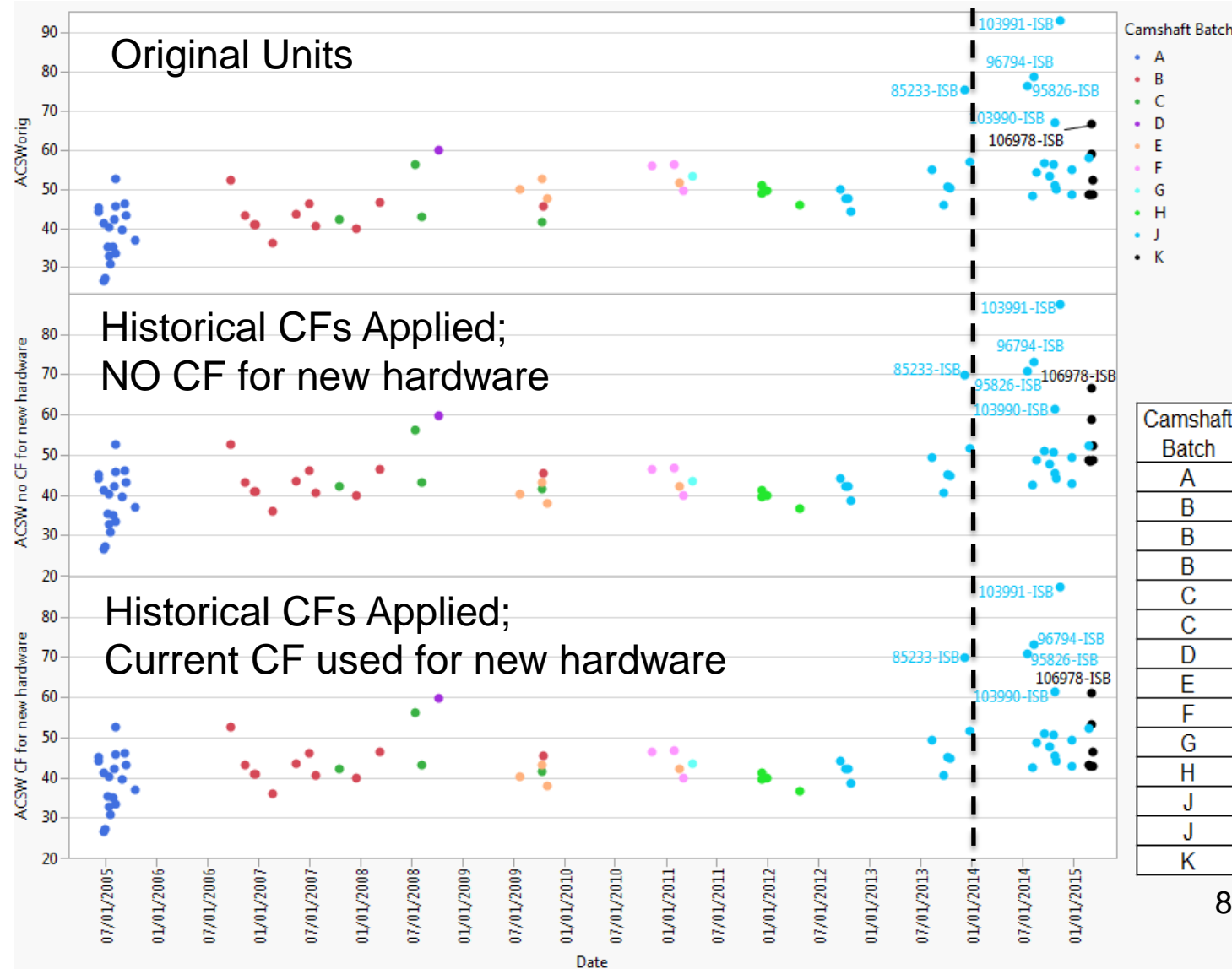
Average Camshaft Wear By OIL and LAB



OIL
LAB



Average Camshaft Wear By Camshaft Batch

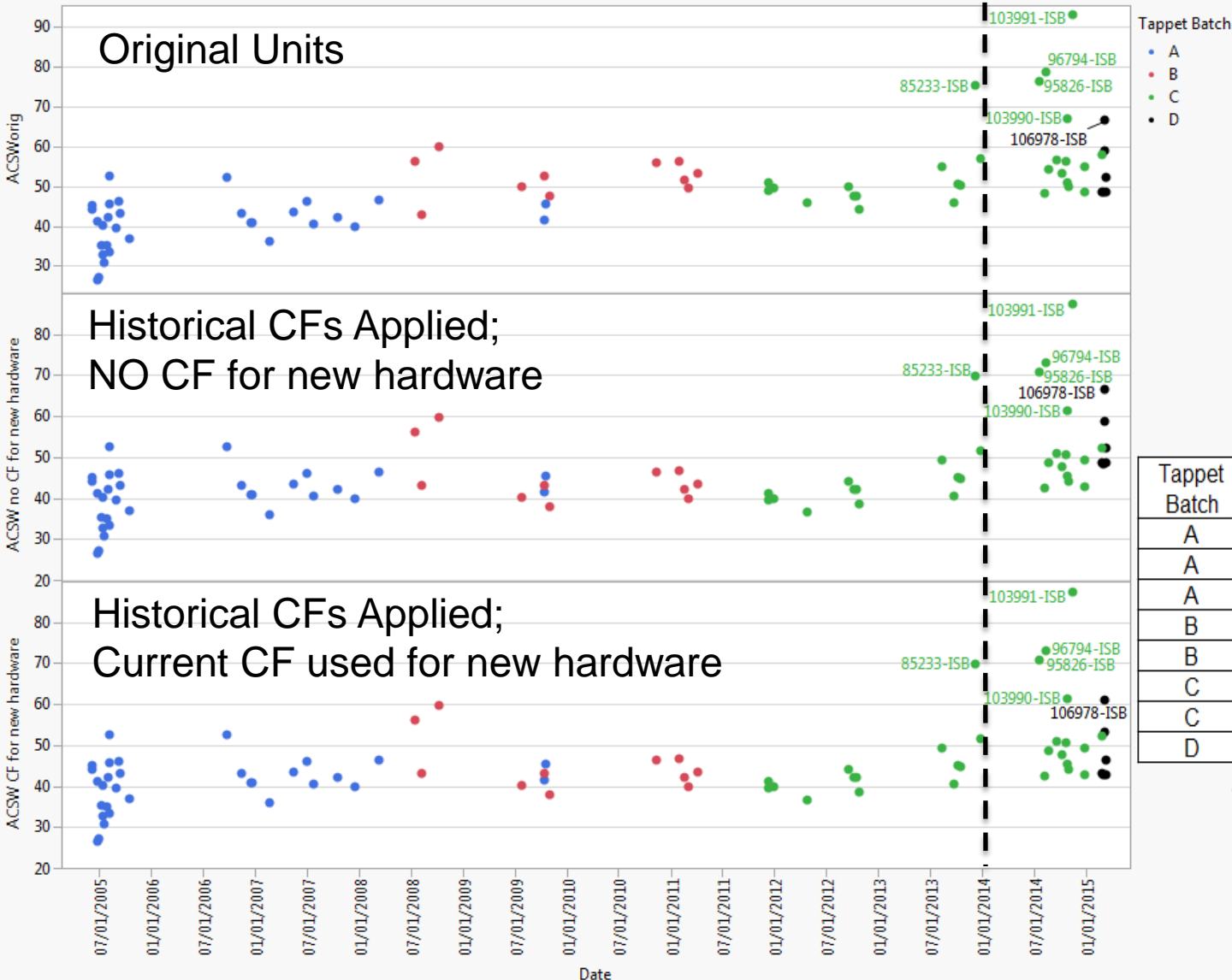


Camshaft Batch	IND	Number of tests	Mean(ACSWorig)
A	PC10B	6	41.9
B	831-1	2	45.9
B	PC10B	6	43.2
B	831	3	41.3
C	831-1	2	42.2
C	PC10B	2	49.2
D	831-1	1	59.8
E	831-1	4	50.4
F	831-1	3	53.8
G	831-1	1	53.1
H	831-1	4	48.8
J	831-1	8	52.9
J	831-2	16	59.2
K	831-2	6	53.8

831 Target mean = 42.5



Average Camshaft Wear By Tappet Batch

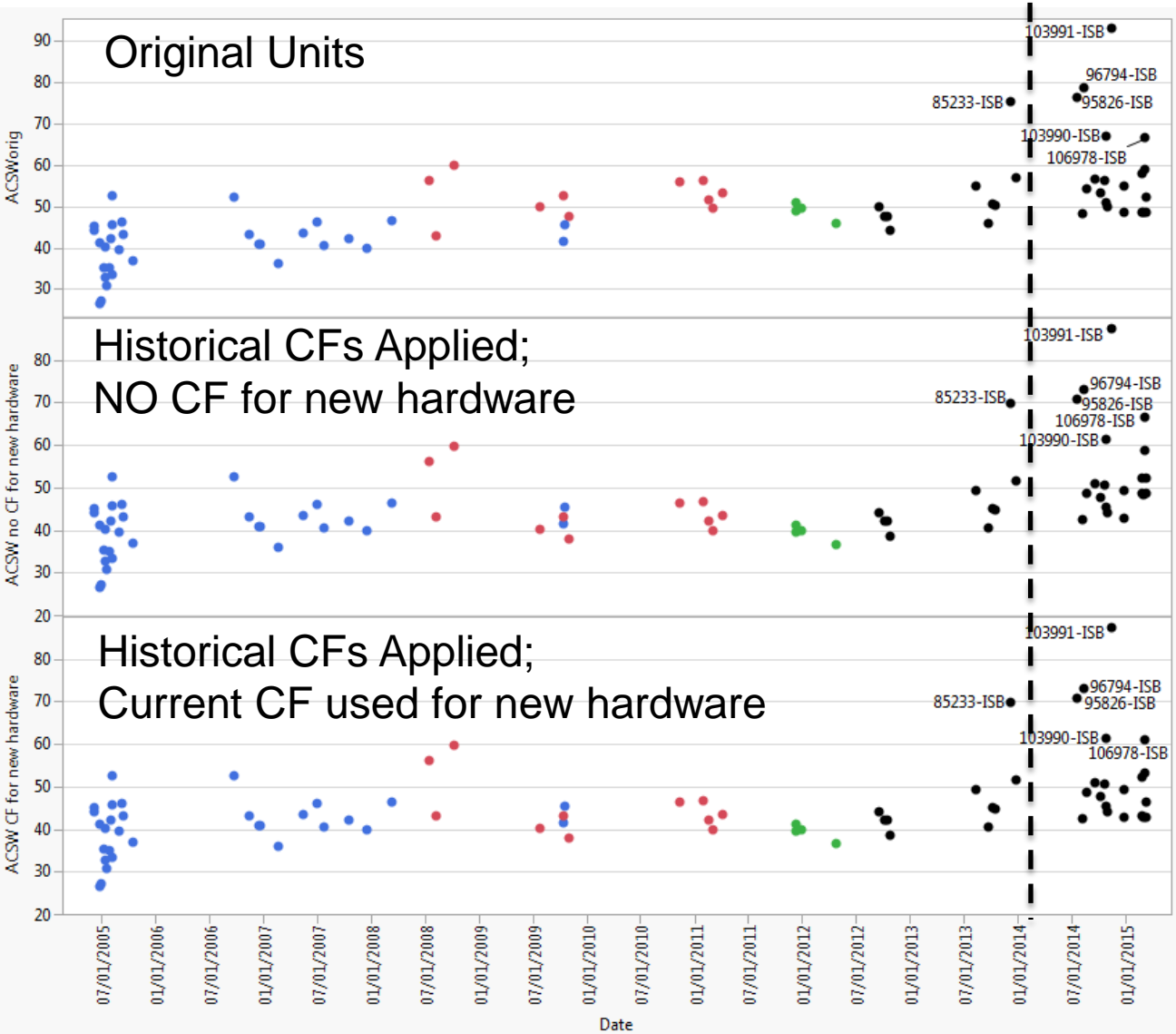


Tappet Batch	IND	Number of tests	Mean(ACSWorig)
A	831-1	3	44.4
A	PC10B	13	42.5
A	831	3	41.3
B	831-1	10	51.9
B	PC10B	1	56.2
C	831-1	12	51.5
C	831-2	16	59.2
D	831-2	6	53.8

831 Target mean = 42.5



Average Camshaft Wear By Crosshead Batch



Crosshead Batch

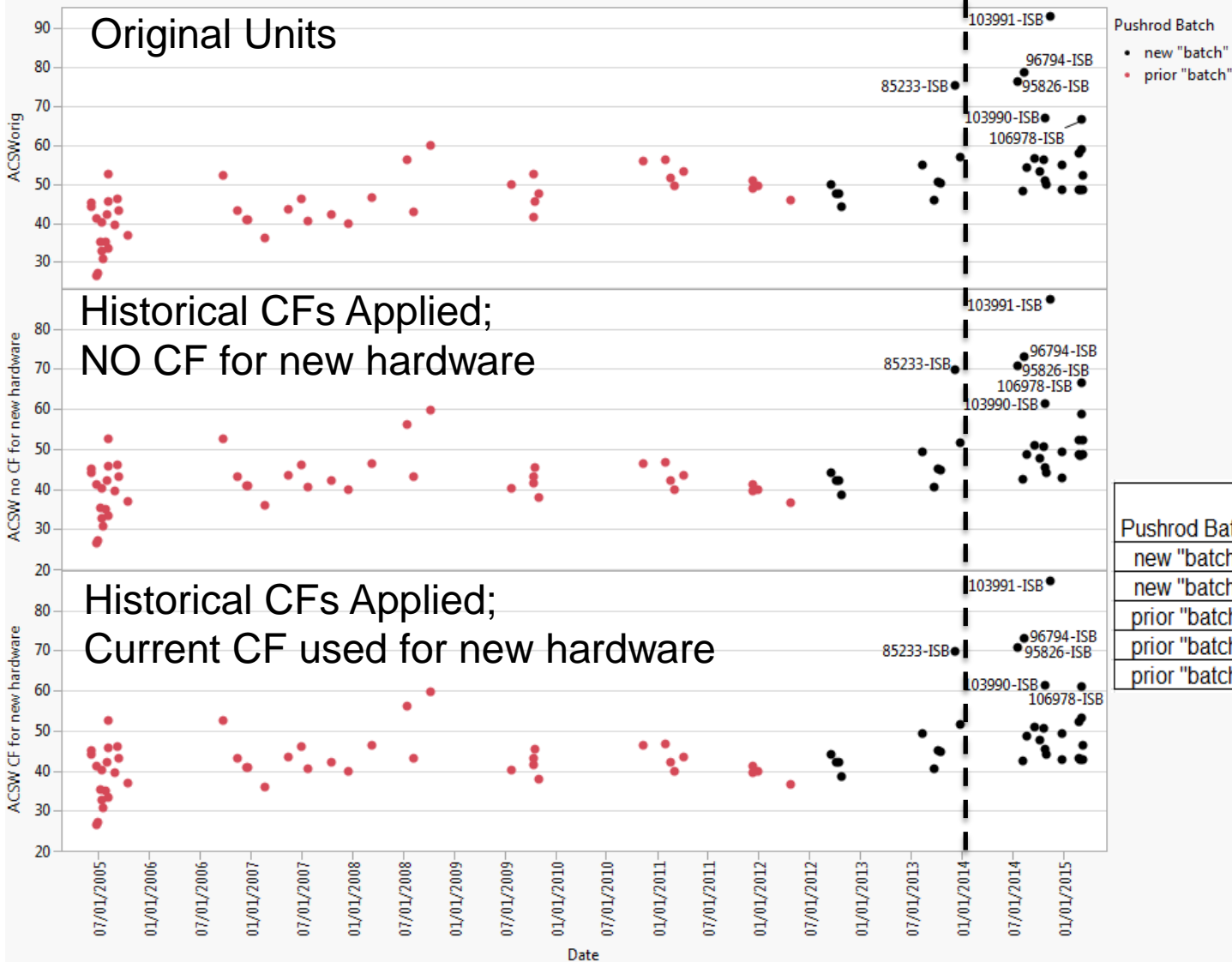
- A
- B
- C
- D

Crosshead Batch	IND	Number of tests	Mean(ACSWorig)
A	831-1	3	44.4
A	PC10B	13	42.5
A	831	3	41.3
B	831-1	10	51.9
B	PC10B	1	56.2
C	831-1	4	48.8
D	831-1	8	52.9
D	831-2	22	57.7

831 Target mean = 42.5



Average Camshaft Wear By Pushrod "Batch"



Pushrod Batch	IND	Number of tests	Mean(ACS _W orig)
new "batch"	831-1	8	52.9
new "batch"	831-2	22	57.7
prior "batch"	831-1	17	49.8
prior "batch"	PC10B	14	43.5
prior "batch"	831	3	41.3

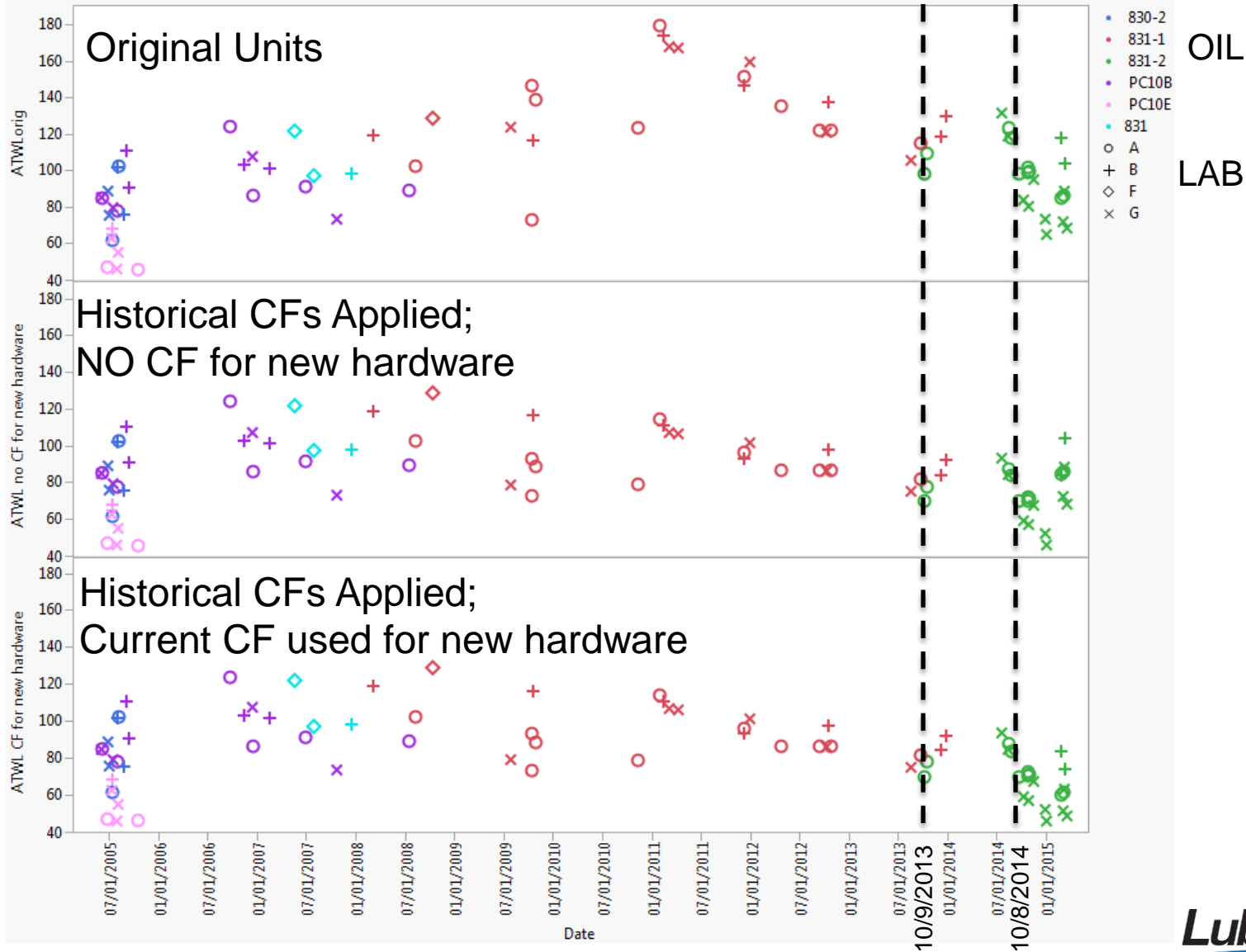
831 Target mean = 42.5



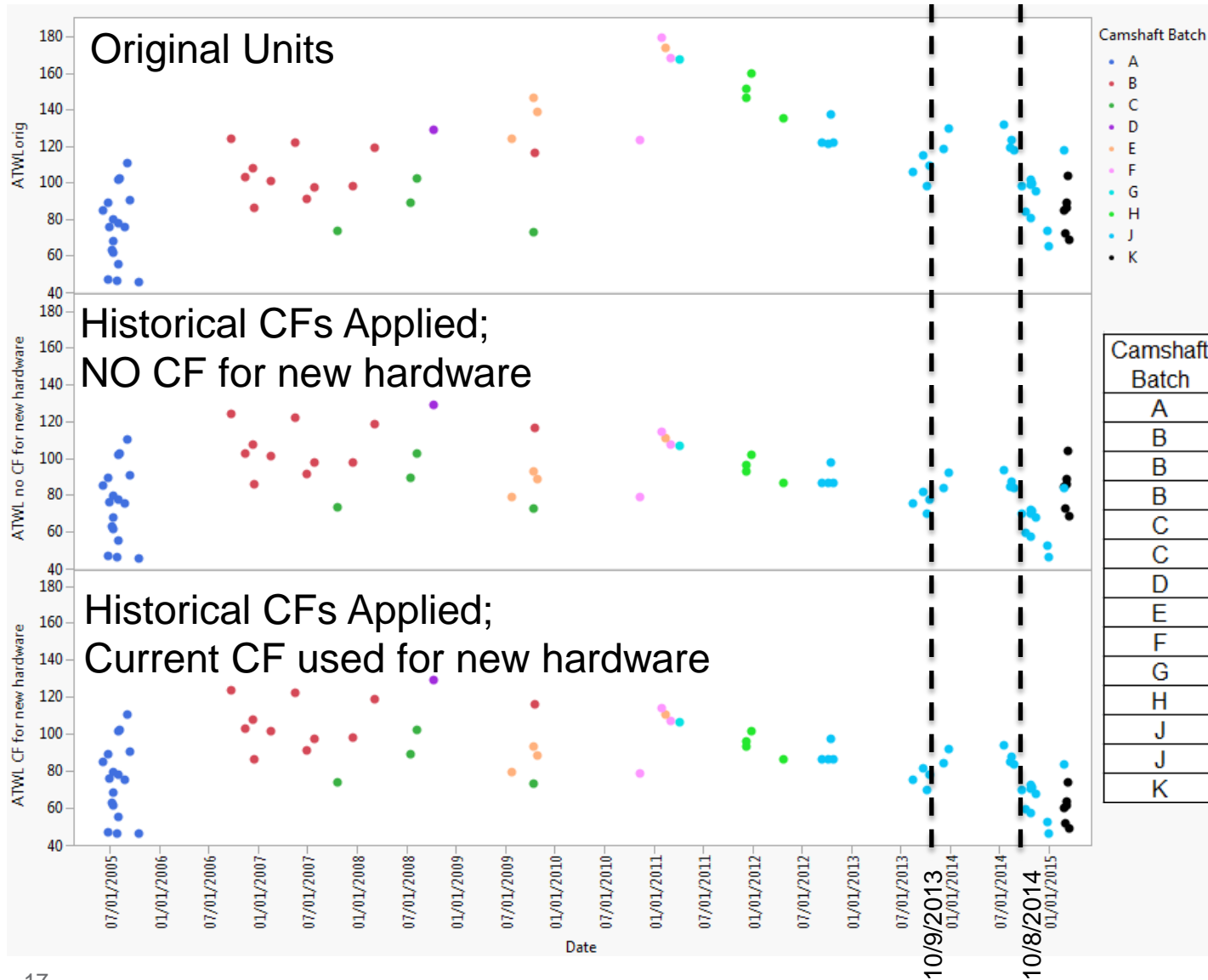
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Average Tappet Weight Loss

Average Tappet Weight Loss (ATW_{Lorig}): By Oil and Lab



Average Tappet Weight Loss (ATWLOrig): By Camshaft Batch

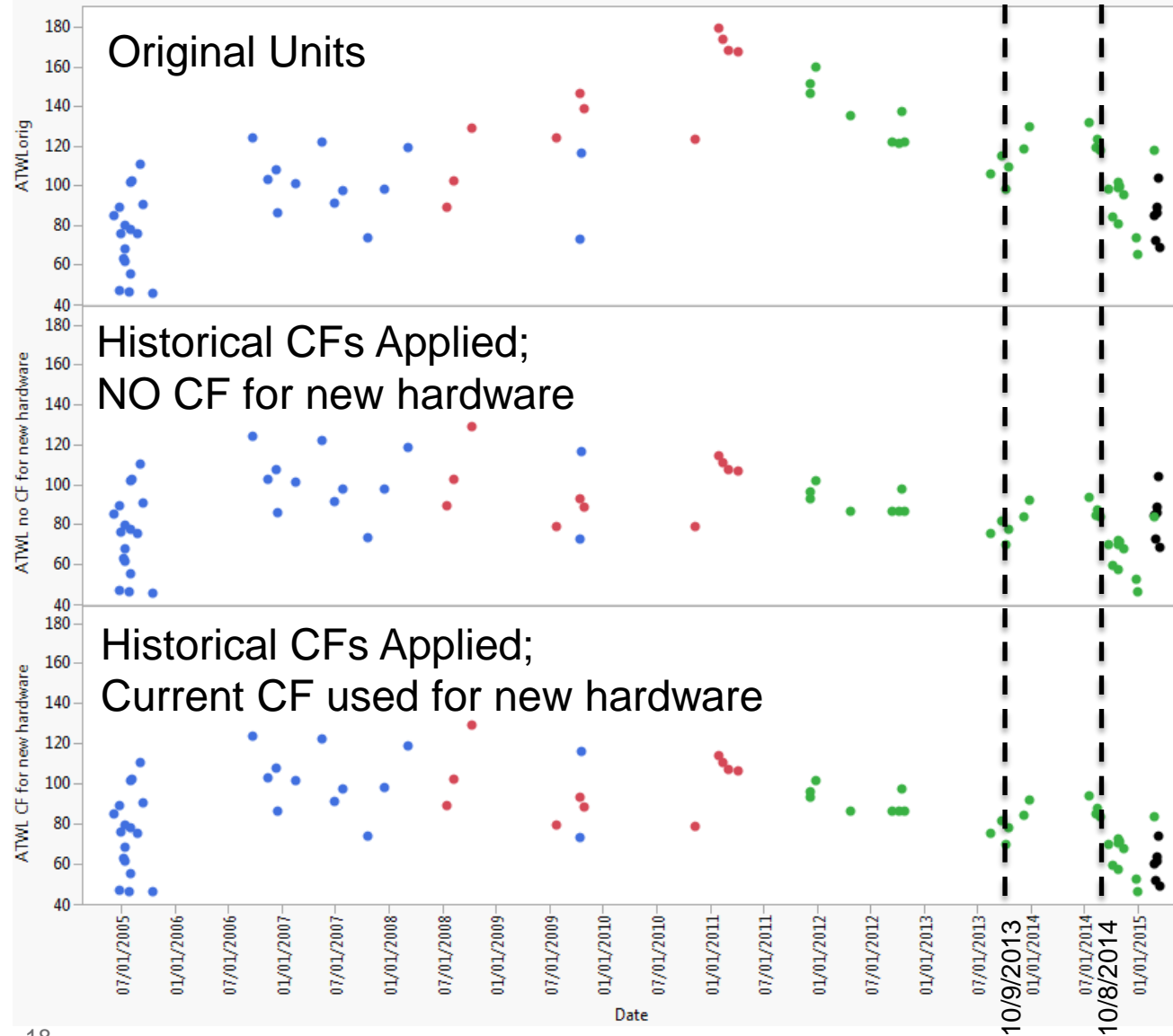


Camshaft Batch	IND	Number of tests	Mean(ATWLOrig)
A	PC10B	6	88.1
B	831-1	2	117.5
B	PC10B	6	102.1
B	831	3	105.9
C	831-1	2	87.6
C	PC10B	2	81.5
D	831-1	1	129.2
E	831-1	4	145.7
F	831-1	3	157.1
G	831-1	1	167.2
H	831-1	4	148.1
J	831-1	8	121.2
J	831-2	16	100.9
K	831-2	6	84.1

831 Target mean = 97.2



Average Tappet Weight Loss (ATWLOrig): By Tappet Batch



Tappet Batch

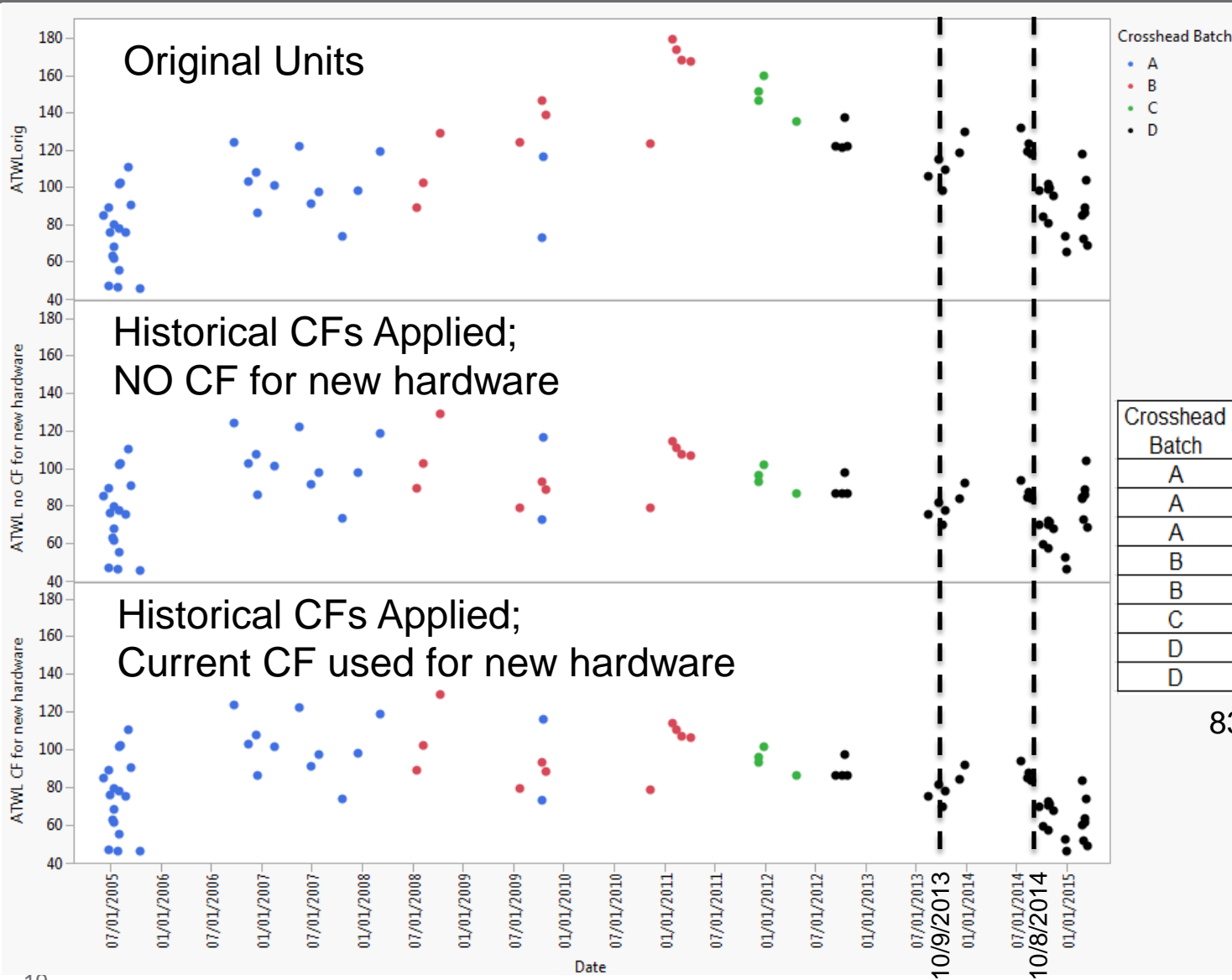
- A
- B
- C
- D

Tappet Batch	IND	Number of tests	Mean(ATWLOrig)
A	831-1	3	102.6
A	PC10B	13	93.4
A	831	3	105.9
B	831-1	10	145.3
B	PC10B	1	89.3
C	831-1	12	130.2
C	831-2	16	100.9
D	831-2	6	84.1

831 Target mean = 97.2



Average Tappet Weight Loss (ATWLOrig): By Crosshead Batch

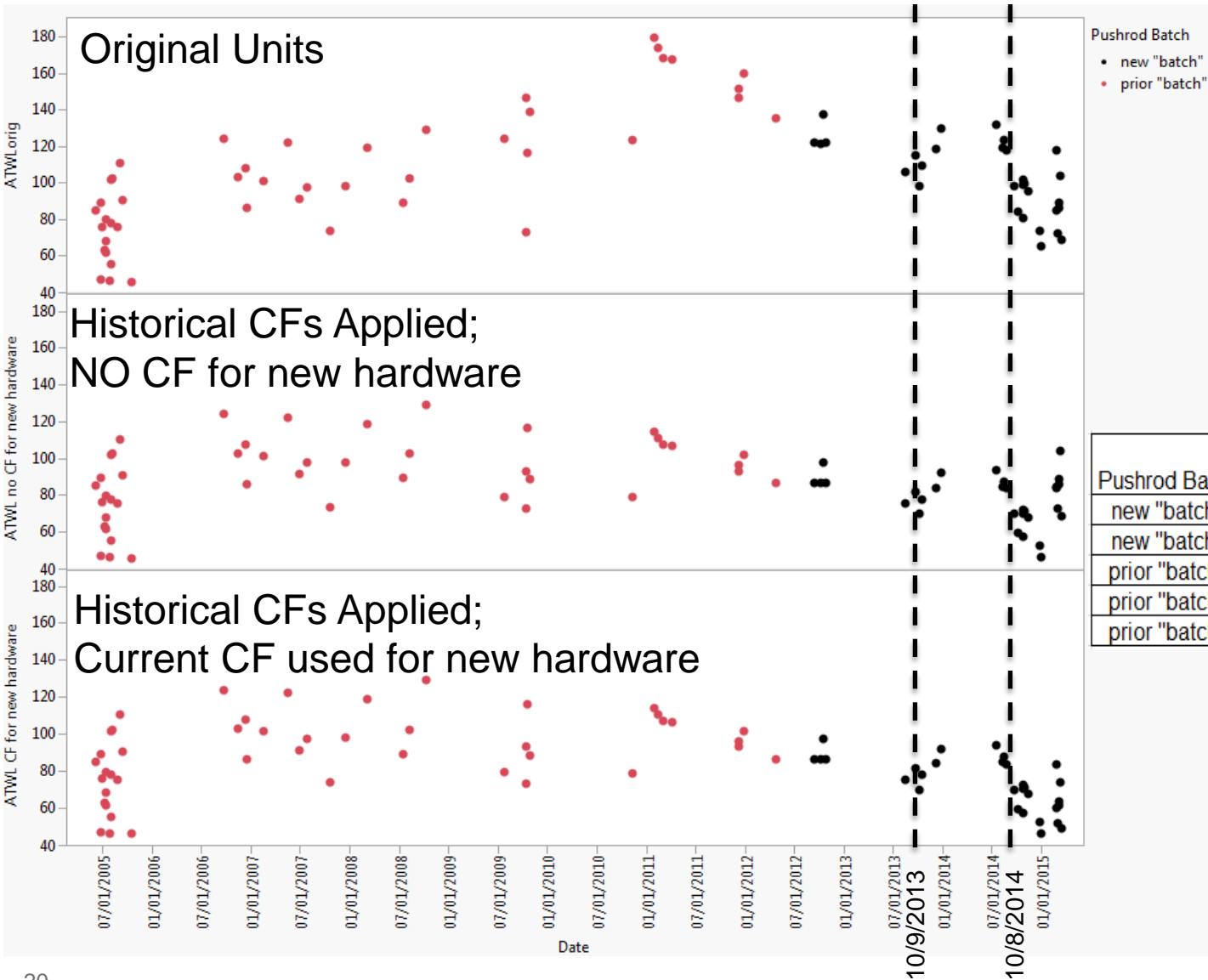


Crosshead Batch	IND	Number of tests	Mean(ATWLOrig)
A	831-1	3	102.6
A	PC10B	13	93.4
A	831	3	105.9
B	831-1	10	145.3
B	PC10B	1	89.3
C	831-1	4	148.1
D	831-1	8	121.2
D	831-2	22	96.4

831 Target mean = 97.2



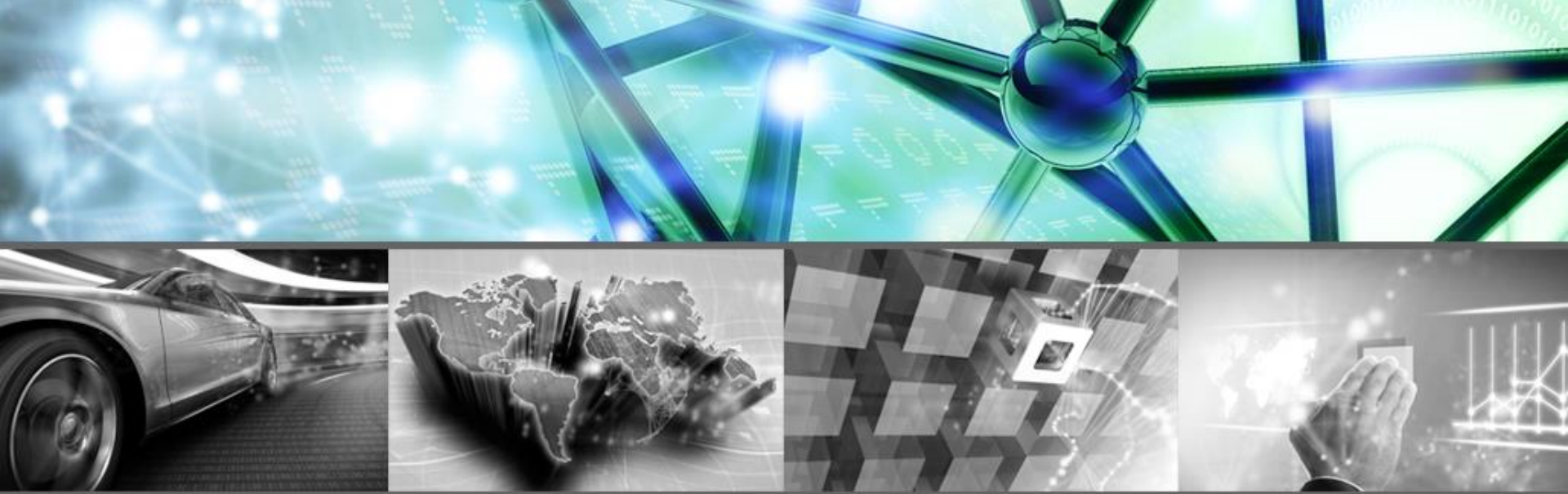
Average Tappet Weight Loss (ATWLOrig): By Pushrod Batch



Pushrod Batch	IND	Number of tests	Mean(ATWLOrig)
new "batch"	831-1	8	121.2
new "batch"	831-2	22	96.4
prior "batch"	831-1	17	138.4
prior "batch"	PC10B	14	93.1
prior "batch"	831	3	105.9

831 Target mean = 97.2





Working together, achieving great things

When your company and ours combine energies, great things can happen. You bring ideas, challenges and opportunities. We'll bring powerful additive and market expertise, unmatched testing capabilities, integrated global supply and an independent approach to help you differentiate and succeed.