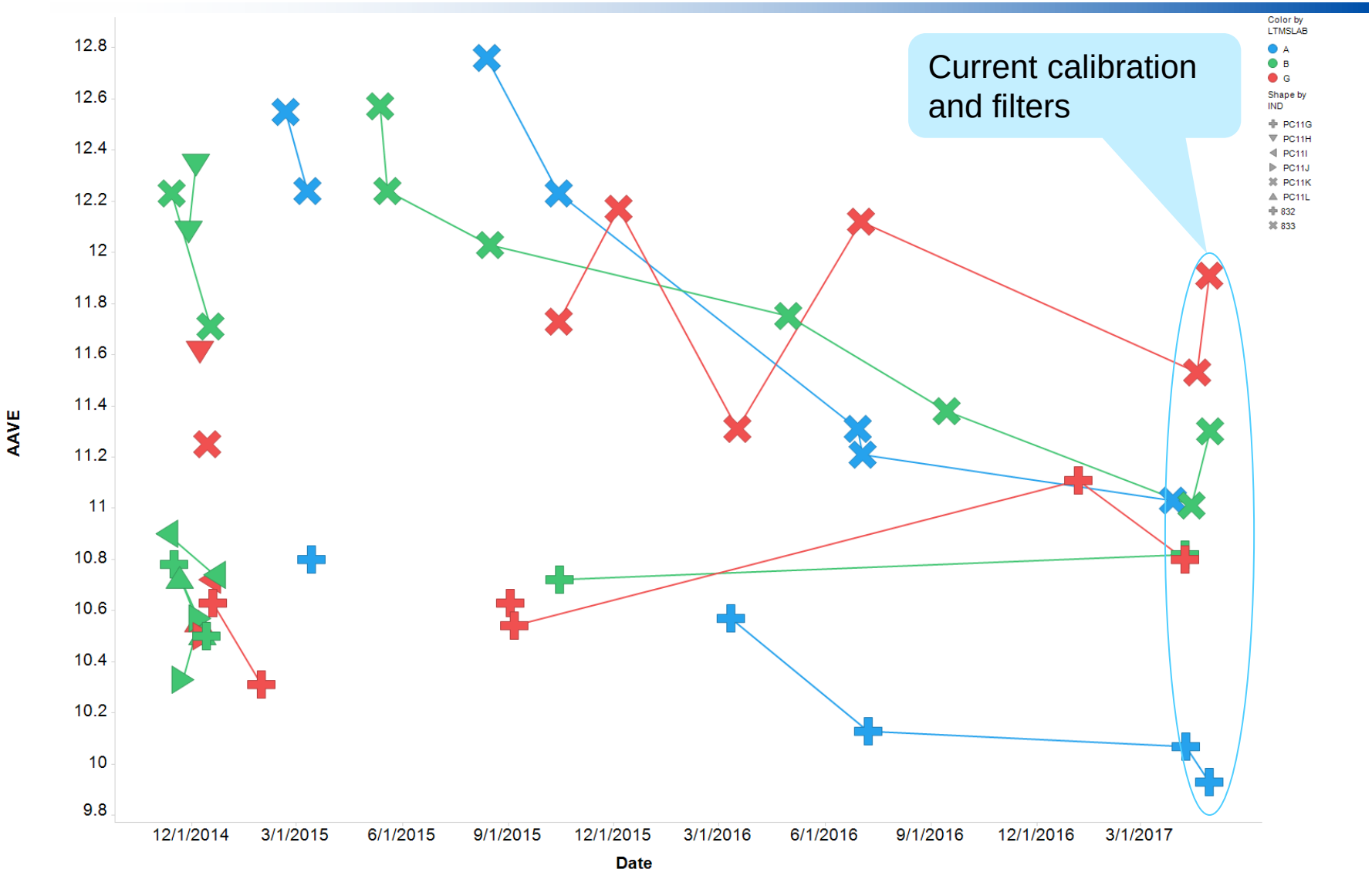
Chevron Oronite

Caterpillar Aeration Test Chartable Reference Tests LTMS 20170503

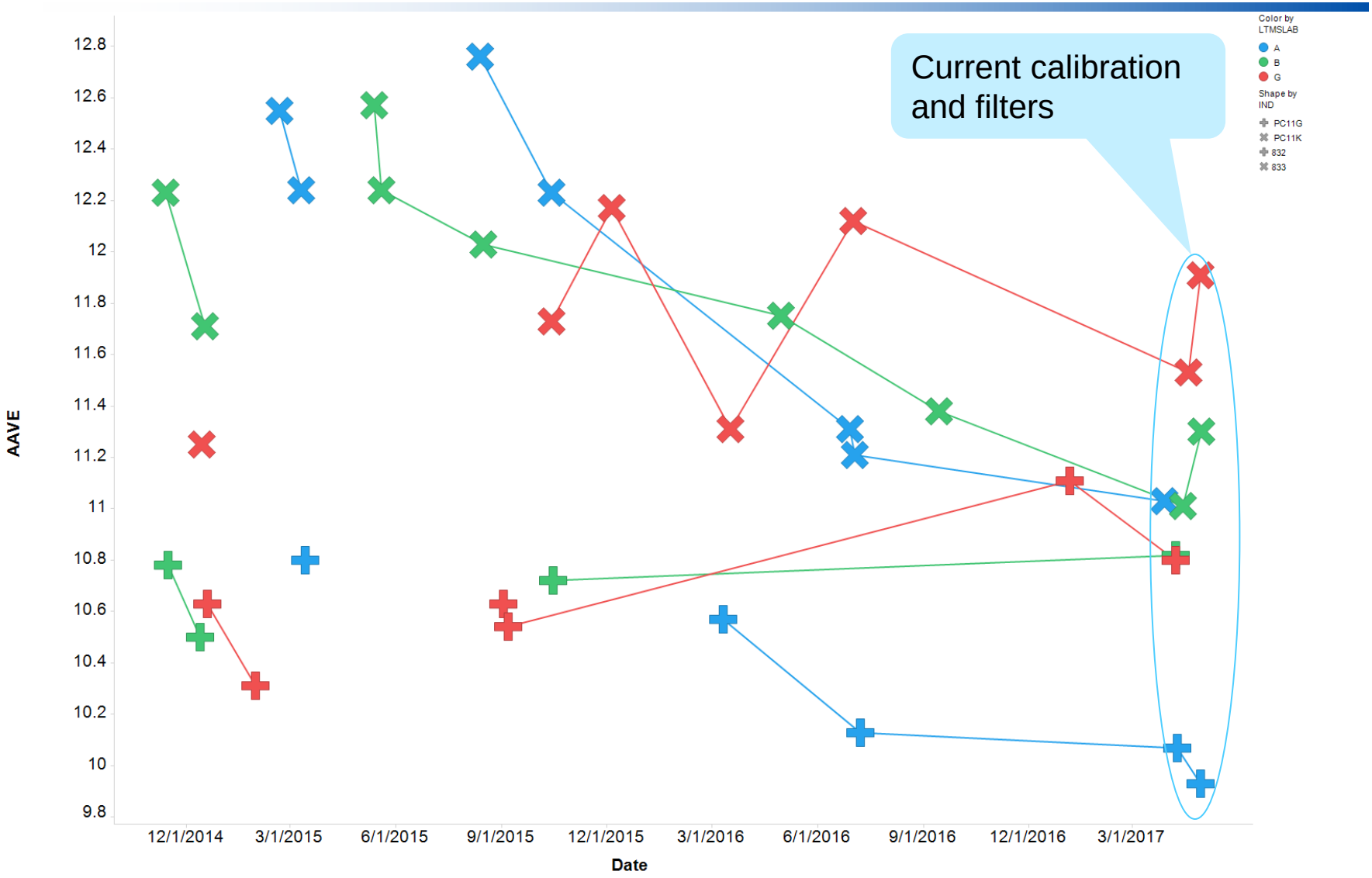
09 May 2017

ADDING UP For 100 Years

LTMS Chart Data



LTMS Chart Data



LTMS Chart Data

TESTKEY	LTMSLAB	IND	AAVEyi	AAVEti	Zi	COM1	COM2	COM3	COM4	OILFILDC
104081	B	PC11I	-0.1439	10.9	0.3487	MATRIX				N/A
103459	B	PC11K	1.0175	12.23	0.4824	MATRIX				N/A
103625	B	PC11G	0.5419	10.78	0.4943	MATRIX				N/A
103957	B	PC11L	0	10.73	0.3955	MATRIX				N/A
103465	B	PC11J	-1.33	10.33	0.0504	MATRIX				N/A
103452	B	PC11H	-0.2105	12.08	-0.0018	MATRIX				N/A
103453	B	PC11H	0.7018	12.34	0.1389	MATRIX				N/A
103954	G	PC11L	-1.223	10.56	-0.1335	MATRIX				UMNLUR
103455	G	PC11H	-1.8596	11.61	-0.4787	MATRIX				UMNLUR
103466	B	PC11J	-0.1478	10.57	-0.4125	MATRIX				N/A
103958	B	PC11L	-1.5827	10.51	-0.6465	MATRIX				N/A
103468	G	PC11J	-0.4926	10.5	-0.6158	MATRIX				UMNLUR
103626	B	PC11G	-0.8374	10.5	-0.6601	MATRIX				N/A
103462	G	PC11K	-2.4211	11.25	-1.0123	MATRIX				UMNLUR
104083	G	PC11I	-1.4388	10.72	-1.0976	MATRIX				UMNLUR
103460	B	PC11K	-0.807	11.71	-1.0395	MATRIX				N/A
103629	G	PC11G	-0.197	10.63	-0.8710	MATRIX				UMNLUR
105877	B	PC11I	-1.295	10.74	-0.9558	MATRIX				N/A
106458	G	PC11G	-1.7734	10.31	-1.1193	MATRIX	RERUN			NANUUA
106980	A	PC11K	2.1404	12.55	-0.4674					
107256	A	PC11K	1.0526	12.24	-0.1634	MATRIX	RERUN	OILK		
107255	A	PC11G	0.6404	10.8	-0.0026					
108857	B	833	2.2105	12.57	0.4400	SEVERE	AAVE			N/A
108858	B	833	1.0526	12.24	0.5625					MENUUA
108379	A	833	2.8772	12.76	1.0255					
110230	B	833	0.3158	12.03	0.8835					MENKUR
110235	G	832	-0.197	10.63	0.6674					NANUUA
110728	G	832	-0.6404	10.54	0.4059					UUUUUR
108380	A	833	1.0175	12.23	0.5282	QI DEV				MUNRUA
111346	G	833	-0.7368	11.73	0.2752					UENEUA
110736	B	832	0.2463	10.72	0.2694					UMNOUA
111347	G	833	0.807	12.17	0.3769	QI DEV	SAMP			NMUNUA
111341	A	832	-0.4926	10.57	0.2030	QI < 0	INT AIR	INT MAN	TEMP	MUNRUA
112704	G	833	-2.2105	11.31	-0.2797					UNNMUL
111033	B	833	-0.6667	11.75	-0.3571					MRNKUAA
108860	A	833	-2.2105	11.31	-0.7278	AAVE	MILD			MNNMUL
112705	G	833	0.6316	12.12	-0.4559					NEUNUA
116584	A	833	-2.5614	11.21	-0.8770	AAVE	MILD			MONEUL
111342	A	832	-2.6601	10.13	-1.2336					MONEUL
115075	B	833	-1.9649	11.38	-1.3799	CALIBRTN	TERM	MM CAL	ISSUE	MMNUUA
111343	G	832	2.1675	11.11	-0.6704	AAVE	SEVERE			NONOUL
118883	A	833	-3.193	11.03	-1.1749	NEW FLTR	NEW MM	CALIBRAT		NONOUL
119478	B	832	0.7389	10.82	-0.7922	NEW FLTR	NEW MM	CALIBRAT		NONOUL
111344	G	832	0.6404	10.8	-0.5056	NEW FLTR	NEW MM	CALIBRAT		NONOUL
111348	A	832	-2.9557	10.07	-0.9957	NEW FLTR	NEW MM	CALIBRAT		NONOUL
120248	B	833	-3.2632	11.01	-1.4492	NEW FLTR	NEW MM	CALIBRAT		NONOUL
116607	G	833	-1.4386	11.53	-1.4471	NEW FLTR	NEW MM	CALIBRAT		NONOUL
116608	G	833	-0.1053	11.91	-1.1787	NEW FLTR	NEW MM	CALIBRAT		NONOUL
126228	A	832	-3.6453	9.93	-1.6720	NEW FLTR	NEW MM	CALIBRAT	AAVE	NONOUL
120249	B	833	-2.2456	11.3	-1.7867	NEW FLTR	NEW MM	CALIBRAT		NONOUL

The new data put industry EWMA in consistent level 2 alarm

LTMS Chart Data

TESTKEY	LTMSLAB	IND	AAVEyi	AAVEti	Zi	ei	excess	COM1	COM2	COM3	COM4	OILFILDC
106980	A	PC11K	2.1404	12.55	1.53658	0.8626						
107256	A	PC11K	1.0526	12.24	1.39139	-0.484		MATRIX	RERUN	OILK		
107255	A	PC11G	0.6404	10.8	1.16609	-0.751						
108379	A	833	2.8772	12.76	1.67942	1.7111						
108380	A	833	1.0175	12.23	1.48085	-0.662		QI DEV				MUNRUA
111341	A	832	-0.4926	10.57	0.88881	-1.973		QI < 0	INT AIR	INT MAN	TEMP	MUNRUA
108860	A	833	-2.2105	11.31	-0.04098	-3.099	0.3509	AAVE	MILD			MNNMUL
116584	A	833	-2.5614	11.21	-0.79711	-2.52	0.0987	AAVE	MILD			MONEUL
111342	A	832	-2.6601	10.13	-1.356	-1.863						MONEUL
118883	A	833	-3.193	11.03	-1.9071	-1.837		NEW FLTR	NEW MM	CALIBRAT		NONOUL
111348	A	832	-2.9557	10.07	-2.22168	-1.049		NEW FLTR	NEW MM	CALIBRAT		NONOUL
126228	A	832	-3.6453	9.93	-2.64877	-1.424		NEW FLTR	NEW MM	CALIBRAT	AAVE	NONOUL
104081	B	PC11I	-0.1439	10.9	0.28711	-0.616		MATRIX				N/A
103459	B	PC11K	1.0175	12.23	0.50623	0.7304		MATRIX				N/A
103625	B	PC11G	0.5419	10.78	0.51693	0.0357		MATRIX				N/A
103957	B	PC11L	0	10.73	0.36185	-0.517		MATRIX				N/A
103465	B	PC11J	-1.33	10.33	-0.1457	-1.692		MATRIX				N/A
103452	B	PC11H	-0.2105	12.08	-0.16514	-0.065		MATRIX				N/A
103453	B	PC11H	0.7018	12.34	0.09494	0.8669		MATRIX				N/A
103466	B	PC11J	-0.1478	10.57	0.02212	-0.243		MATRIX				N/A
103958	B	PC11L	-1.5827	10.51	-0.45933	-1.605		MATRIX				N/A
103626	B	PC11G	-0.8374	10.5	-0.57275	-0.378		MATRIX				N/A
103460	B	PC11K	-0.807	11.71	-0.64302	-0.234		MATRIX				N/A
105877	B	PC11I	-1.295	10.74	-0.83862	-0.652		MATRIX				N/A
108857	B	833	2.2105	12.57	0.07612	3.0491	1.1579	SEVERE	AAVE			N/A
108858	B	833	1.0526	12.24	0.36906	0.9765						MENUUA
110230	B	833	0.3158	12.03	0.35308	-0.053						MENKUR
110736	B	832	0.2463	10.72	0.32105	-0.107						UMNOUA
111033	B	833	-0.6667	11.75	0.02472	-0.988						MRNKUAA
115075	B	833	-1.9649	11.38	-0.57216	-1.99		CALIBRTN	TERM	MM CAL	ISSUE	MMNUUA
119478	B	832	0.7389	10.82	-0.17884	1.3111		NEW FLTR	NEW MM	CALIBRAT		NONOUL
120248	B	833	-3.2632	11.01	-1.10415	-3.084		NEW FLTR	NEW MM	CALIBRAT		NONOUL
120249	B	833	-2.2456	11.3	-1.44659	-1.141		NEW FLTR	NEW MM	CALIBRAT		NONOUL
103954	G	PC11L	-1.223	10.56	-1.20111	-0.031		MATRIX				UMNLUR
103455	G	PC11H	-1.8596	11.61	-1.39866	-0.658		MATRIX				UMNLUR
103468	G	PC11J	-0.4926	10.5	-1.12684	0.9061		MATRIX				UMNLUR
103462	G	PC11K	-2.4211	11.25	-1.51512	-1.294		MATRIX				UMNLUR
104083	G	PC11I	-1.4388	10.72	-1.49222	0.0763		MATRIX				UMNLUR
103629	G	PC11G	-0.197	10.63	-1.10366	1.2952		MATRIX				UMNLUR
106458	G	PC11G	-1.7734	10.31	-1.30458	-0.67		MATRIX	RERUN			NANUUA
110235	G	832	-0.197	10.63	-0.97231	1.1076						NANUUA
110728	G	832	-0.6404	10.54	-0.87273	0.3319						UUUUUR
111346	G	833	-0.7368	11.73	-0.83195	0.1359						UENEUA
111347	G	833	0.807	12.17	-0.34027	1.639		QI DEV	SAMP			NMUNUA
112704	G	833	-2.2105	11.31	-0.90134	-1.87						UNNMUL
112705	G	833	0.6316	12.12	-0.44146	1.5329						NEUNUA
111343	G	832	2.1675	11.11	0.34123	2.609	1.5271	AAVE	SEVERE			NONOUL
111344	G	832	0.6404	10.8	0.43098	0.2992		NEW FLTR	NEW MM	CALIBRAT		NONOUL
116607	G	833	-1.4386	11.53	-0.12989	-1.87		NEW FLTR	NEW MM	CALIBRAT		NONOUL
116608	G	833	-0.1053	11.91	-0.12252	0.0246		NEW FLTR	NEW MM	CALIBRAT		NONOUL

One lab is in level 3 Z_i alarm and had a level 2 e_i alarm.
Other labs not currently in alarm but had level 2 or 3 e_i alarms.

LTMS Current Calibration and Filters

The good news is that the oils are still discriminated.
The bad news is that the labs are still significantly different, severity has shifted, and precision seems to have gotten worse.

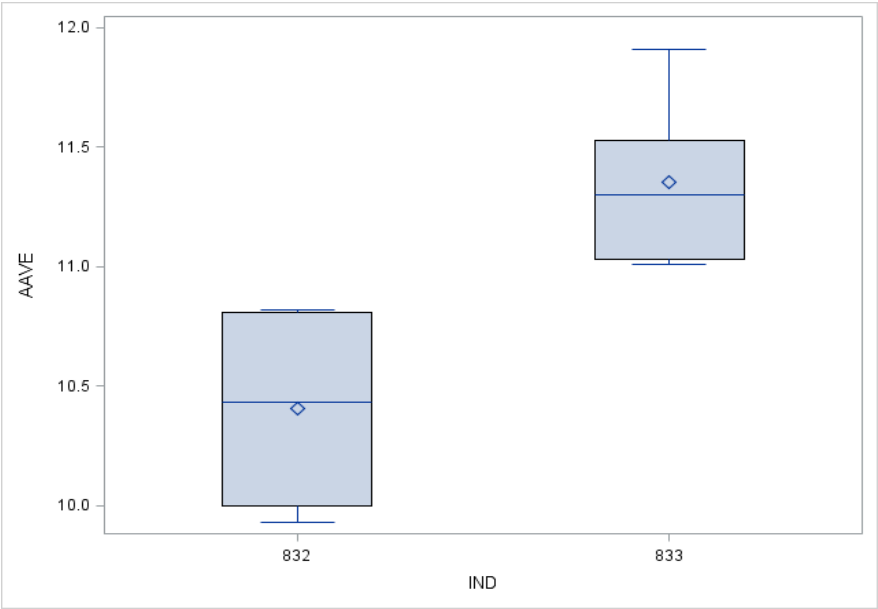
Dependent Variable: AAVE					
Source	**DF**	**Sum of Squares**	**Mean Square**	**F Value**	**Pr > F**
Model	3	2.9321	0.9774	15.76	0.006
Error	5	0.3101	0.0620		
Corrected Total	8	3.2422			
R-Square	**Coeff Var**	**Root MSE**	**AAVE Mean**		
0.90	2.3	0.249	10.93		
Source	**DF**	**Type III SS**	**Mean Square**	**F Value**	**Pr > F**
LTMSLAB	2	0.9223	0.4611	7.43	0.032
IND	1	1.1603	1.1603	18.71	0.008

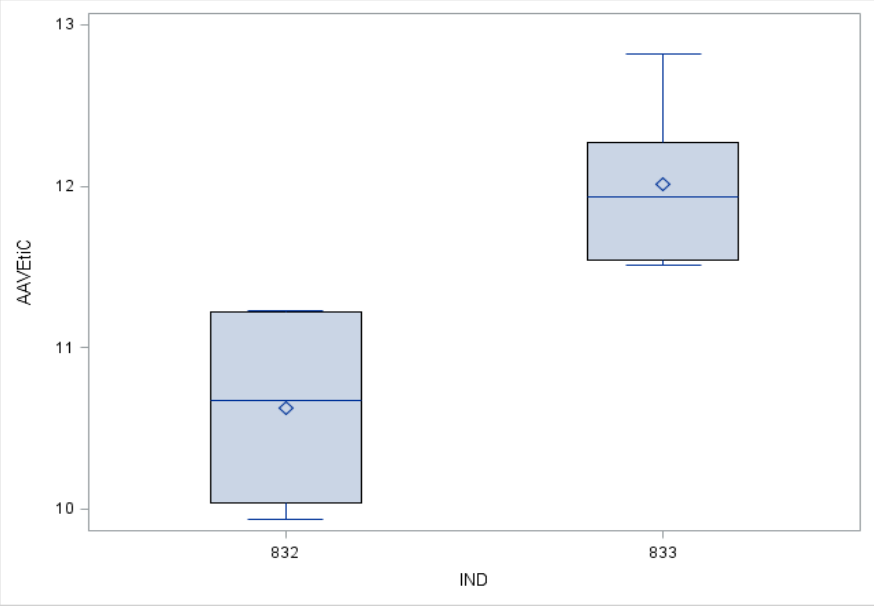
LTMS Current Calibration and Filters

AAVEtiC = 9.92+1.458x(AAVE-9.92)

IND	N Obs	Variable	Mean	Std Dev
832	4	AAVE	10.41	0.471
		AAVEtiC	10.63	0.687
833	5	AAVE	11.36	0.376
		AAVEtiC	12.01	0.549

Although not a recommendation, we can calculate a best ICF.





LTMS Current Calibration and Filters

If we were to apply ICF and calculate new standard deviations in a manner similar to the way original standard deviations were calculated, we could restart LTMS with these nine tests.

Reference Oil	Mean	Standard Deviation
832	10.67	0.354
833	11.94	0.369

LTMS Current Calibration and Filters

Chevron Oronite

This potential ICF makes the industry chart look good but brings out the lab differences.

TESTKEY	LTMSLAB	Date	IND	AAVEyi	AAVEti	AAVExbar	AAVEsdev	Zi	AAVEsdevC	AAVEtiC	AAVEyiC	ZiC
118883-COAT	A	3/29/2017	833	-3.1930	11.03	11.94	0.285	-1.1223	0.369	11.5384	-1.0884	0.3171
119478-COAT	B	4/8/2017	832	0.7389	10.82	10.67	0.203	-0.7500	0.354	11.2322	1.5881	0.5713
111344-COAT	G	4/8/2017	832	0.6404	10.8	10.67	0.203	-0.4719	0.354	11.2030	1.5058	0.7582
111348-COAT	A	4/9/2017	832	-2.9557	10.07	10.67	0.203	-0.9687	0.354	10.1387	-1.5008	0.3064
120248-COAT	B	4/14/2017	833	-3.2632	11.01	11.94	0.285	-1.4276	0.369	11.5092	-1.1674	0.0116
116607-COAT	G	4/19/2017	833	-1.4386	11.53	11.94	0.285	-1.4298	0.369	12.2674	0.8872	0.1867
116608-COAT	G	4/29/2017	833	-0.1053	11.91	11.94	0.285	-1.1649	0.369	12.8214	2.3887	0.6271
126228-COAT	A	4/29/2017	832	-3.6453	9.93	10.67	0.203	-1.6610	0.354	9.9346	-2.0775	0.0862
120249-COAT	B	4/30/2017	833	-2.2456	11.3	11.94	0.285	-1.7779	0.369	11.9320	-0.0216	0.0647

TESTKEY	LTMSLAB	LTMSDATE	Date	IND	AAVE	AAVEyi	AAVEti	AAVExbar	AAVEsdev	Zi	ei	AAVEsdevC	AAVEtiC	AAVEyiC	ZiC	eiC
118883-COAT	A	20170329	3/29/2017	833	11.03	-3.193	11.03	11.94	0.283	-3.2432		0.369	11.5384	-1.0884	-1.415	
111348-COAT	A	20170409	4/9/2017	832	10.07	-2.9557	10.07	10.67	0.242	-3.1569	0.2875	0.354	10.1387	-1.5008	-1.441	-0.0854
126228-COAT	A	20170429	4/29/2017	832	9.93	-3.6453	9.93	10.67	0.242	-3.3034	-0.4884	0.354	9.9346	-2.0775	-1.632	-0.6364
119478-COAT	B	20170408	4/8/2017	832	10.82	0.7389	10.82	10.67	0.242	-0.8913		0.354	11.2322	1.5881	0.5696	
120248-COAT	B	20170414	4/14/2017	833	11.01	-3.2632	11.01	11.94	0.283	-1.6029	-2.3719	0.369	11.5092	-1.1674	0.0485	-1.7370
120249-COAT	B	20170430	4/30/2017	833	11.3	-2.2456	11.3	11.94	0.283	-1.7957	-0.6427	0.369	11.9320	-0.0216	0.0275	-0.0700
111344-COAT	G	20170408	4/8/2017	832	10.8	0.6404	10.8	10.67	0.242	-0.018696667		0.354	11.2030	1.5058	1.5674	
116607-COAT	G	20170419	4/19/2017	833	11.53	-1.4386	11.53	11.94	0.283	-0.444667667	-1.4199	0.369	12.2674	0.8872	1.3634	-0.6802
116608-COAT	G	20170429	4/29/2017	833	11.91	-0.1053	11.91	11.94	0.283	-0.342857367	0.3394	0.369	12.8214	2.3887	1.671	1.0253