CAT Aeration Test Task Force meeting
Sep 4, 2014

Proveout Matrix Plan

Attendees: Names Highlighted in Yellow attended the meeting

Participant	Name	Email	
1	Caroline Laufer Elisa Santos Pat Fetterman James Gutzwiller Bob Salgueiro	caroline.laufer@infineum.com elisa.santos@infineum.com pat.fetterman@infineum.com james.gutzwiller@infineum.com bob.salgueiro@infineum.com	Infineum
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7	Jason Bowden	jhbowden@ohtech.com	OHT
8	Mark Jarrett Hind Abi-Akar	jarrett_mark_w@cat.com abi-akar_hind@cat.com	Caterpillar
10	Greg Miranda, Kevin O'Mally Chris Mileti Michael Conrad	greg.miranda@lubrizol.com Kevin.OMalley@lubrizol.com Christopher.Mileti@Lubrizol.com	Lubrizol
	Bob Campbell Christian Porter	bob.campbell@aftonchemical.com	Afton
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18	Mike Alessi Ricardo Conti	ichael.l.alessi@exxonmobil.com	ExxonMobil
19	Barb Goodrich	GoodrichBarbaraE@JohnDeere.com	John Deere
20	Greg Shank	greg.shank@volvo.com	Volvo
21	Dan Arcy	Dan.arcy@shell.com	Shell

Test plan update, 4 Sep 2014

Lab	Test 0	Test 1	Test 2	Test 3	Test 4	Test 5	Test 6	Test 7
A	LZ oil (OS)	HA	1005	HA	1005	LZ oil start Thurs	LAD1	1005/1004?
B	LZ oil (OS)	HA	1005	HA – Start Friday	LZ oil	LAD1	Obtain info on insulation box - validate	
C	LZ oil (OS) Hi Si	1005	HA	1005- start Thurs	LZ oil	LZ oil*	LAD1	

Done by NCDT meeting

Done since NCDT meeting

*: different batch

Isolation box design:
Trial box built by Tim showed impact on the aeration: drop in aeration when the T increased. See attached file.
Martin showed potential design currently used to cover the controllers. This design used a heater element for temperature control.

- Controlling T inside the box: Need to be discussed further – up to 90 C has been proposed. Load cells and transducers may be burnt by certain heaters. Transducers have to be below 60 C.
- Actions: Determine all components that should be included in the enclosure. Identify the insulation inside the box. The dimensions of the box can be flexible as long as the components to be insulated are well defined.

Martin will write the description of this box and discuss with Tim and Greg.

Discussion: Specify the thermocouple placement and dimension for the MM.

Oil samples are pulled from the sump on the latest tests. Picture attached for the sampling device to reduce contamination and interruption of the test.

Si free gaskets: Cat is working on options/potential for alternative materials.

Updates:
Tim: Finished Test 5. All planned tests are done.
Greg: Si measurement for OS oil run 3 will be repeated due to high Si at the EOT sample. The retain oil will be tested to eliminate the potential of sample contamination.
Based on the Si data, the next test can be the planned LAD1 (if Si is stable per criteria described below) or OS oil test will be repeated.
Greg will communicate the results of the analysis.

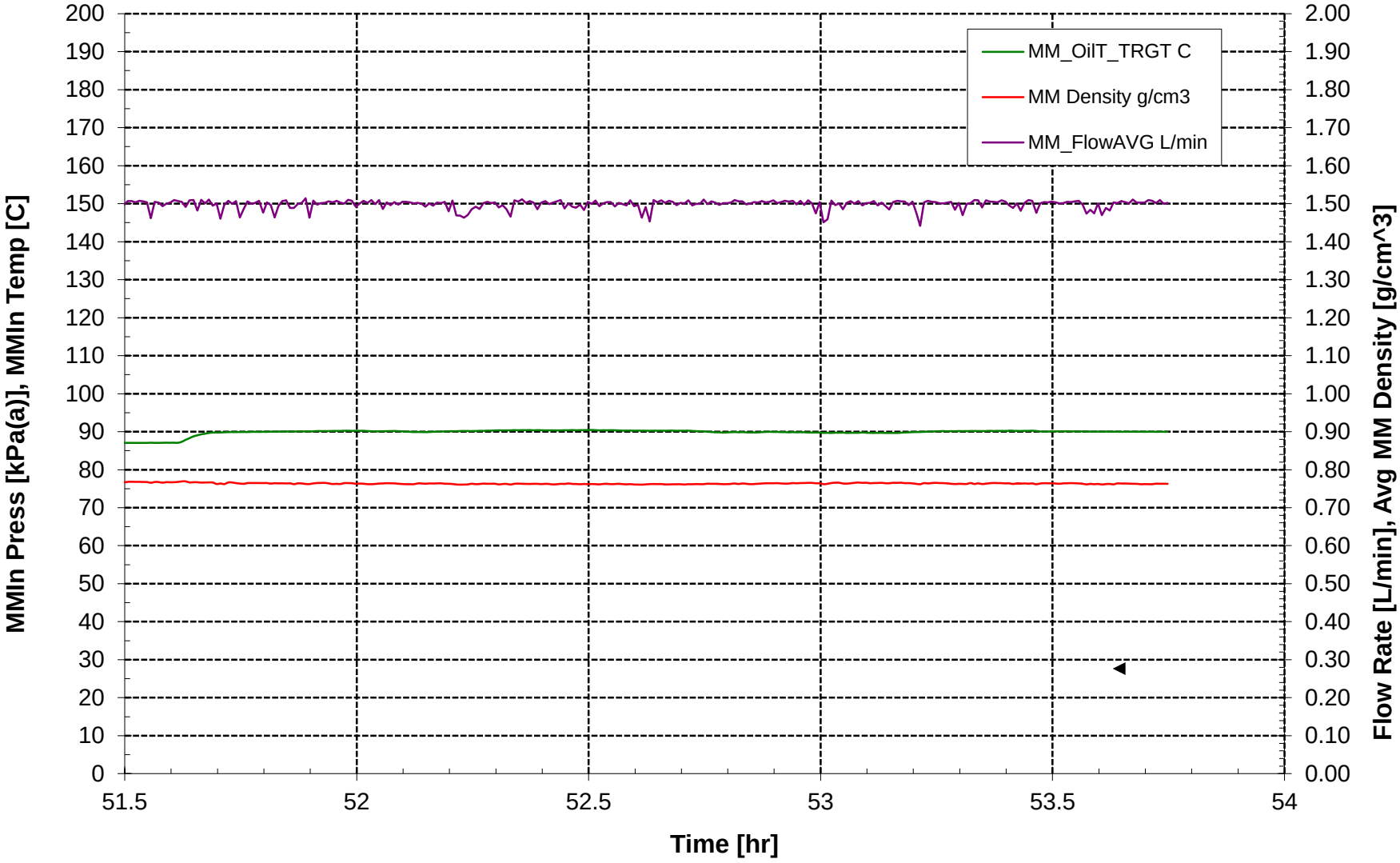
Discussion:
Si stabilization: engine will be considered stable if the lowest to highest delta: ~3 ppm and last data point is lower than or equal to the initial data point.

Si influences the measurements. The group discussed the impact of Si and the necessity of applying a correction factor.
Elisa will look into correcting the aeration data to compensate for Si variability among the tests. Data presented today is without correction. A comparison of with and without correction will be presented.

Next meeting: TF to vote on the readiness of the test.

Intertek Carnot Emission Services

CAT LAD1 Oil; Box Check; High Eff Oil Filter 1R-1808
Stand has MP, RCV, Return to Sump, CCPress @ 103 kPa(a)

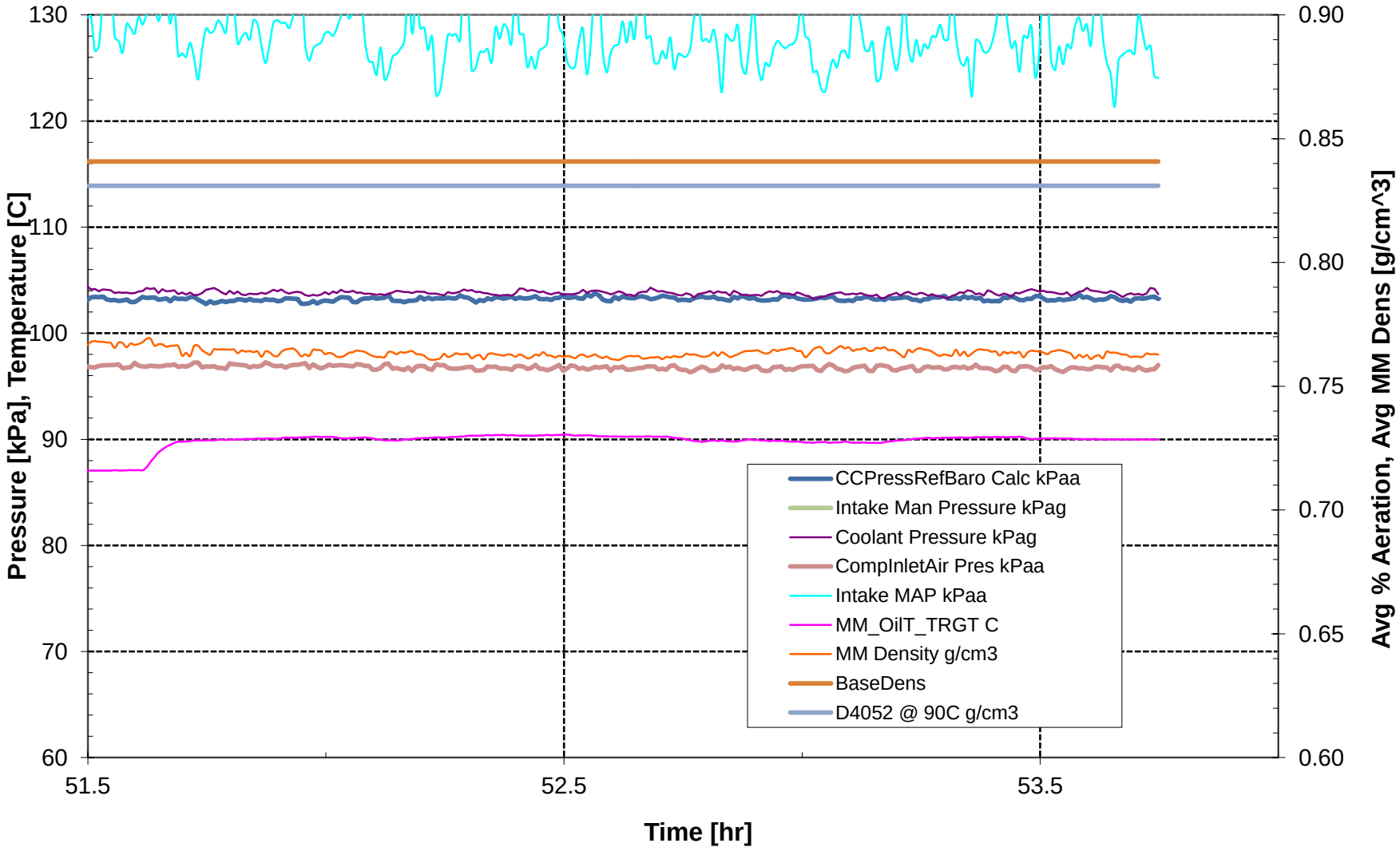


140829_CAT LAD1_Oil_Test5BB Box Check
Warm UP

9/4/2014
Printed
9/4/2014

Intertek Carnot Emission Services

CAT LAD1 Oil; Box Check; High Eff Oil Filter 1R-1808
Stand has MP, RCV, Return to Sump, CCPress @ 103 kPa(a)



Intertek Carnot Emission Services

CAT LAD1 Oil; Box Check; High Eff Oil Filter 1R-1808
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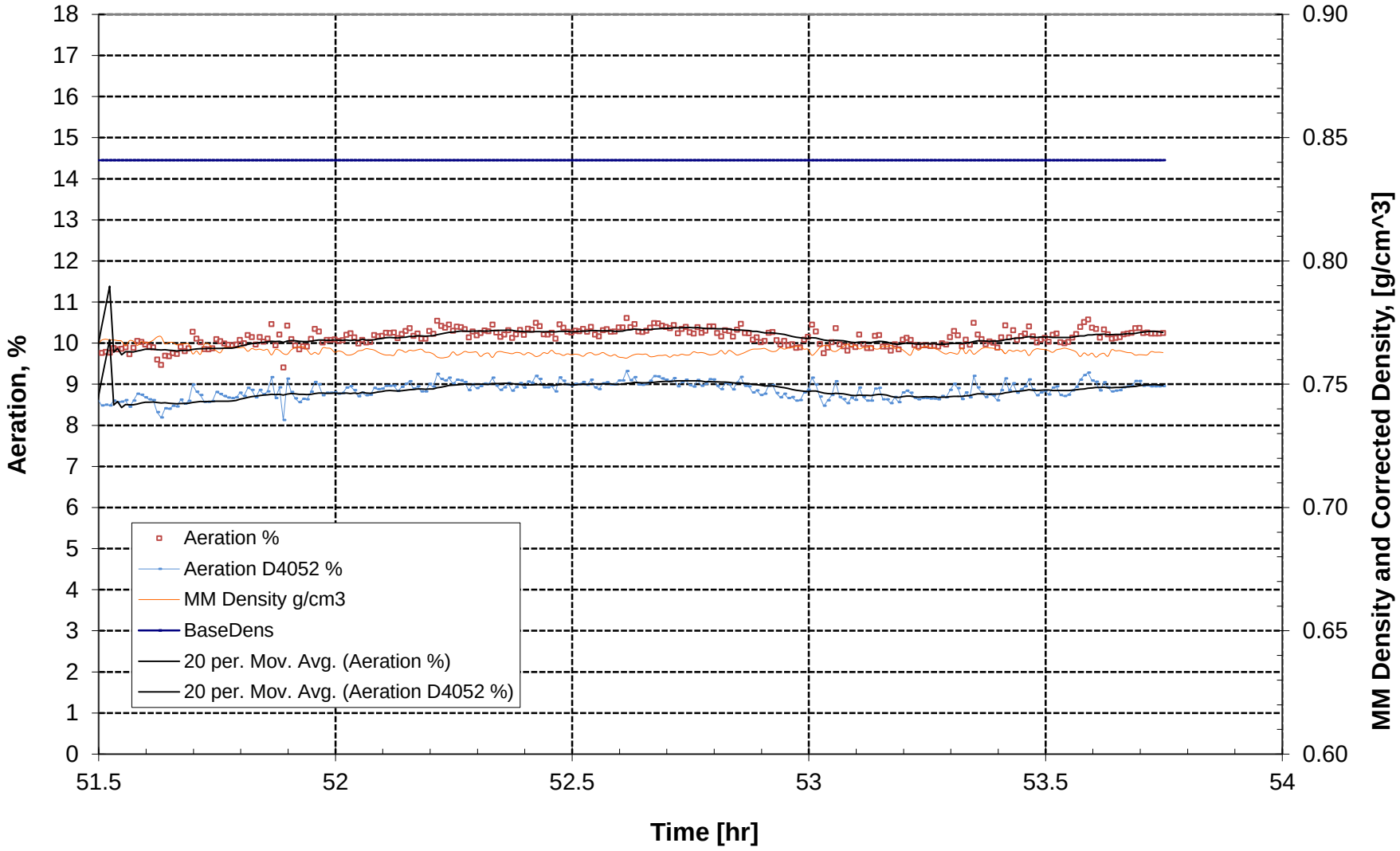

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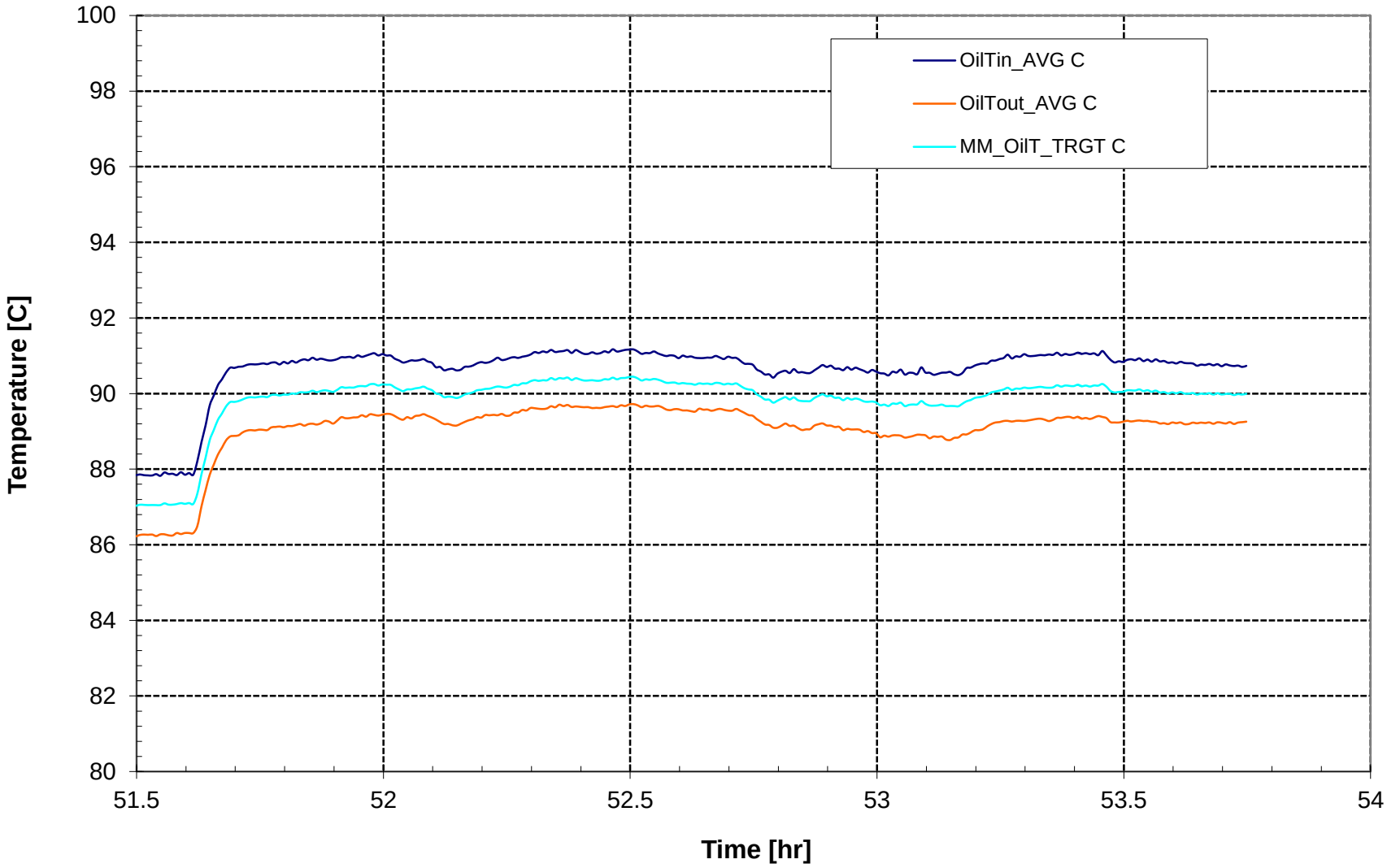


CAT AERATION ANALYSIS

September 4th, 2014

Performance you can rely on.

Infineum

Data available from 2nd prove out runs

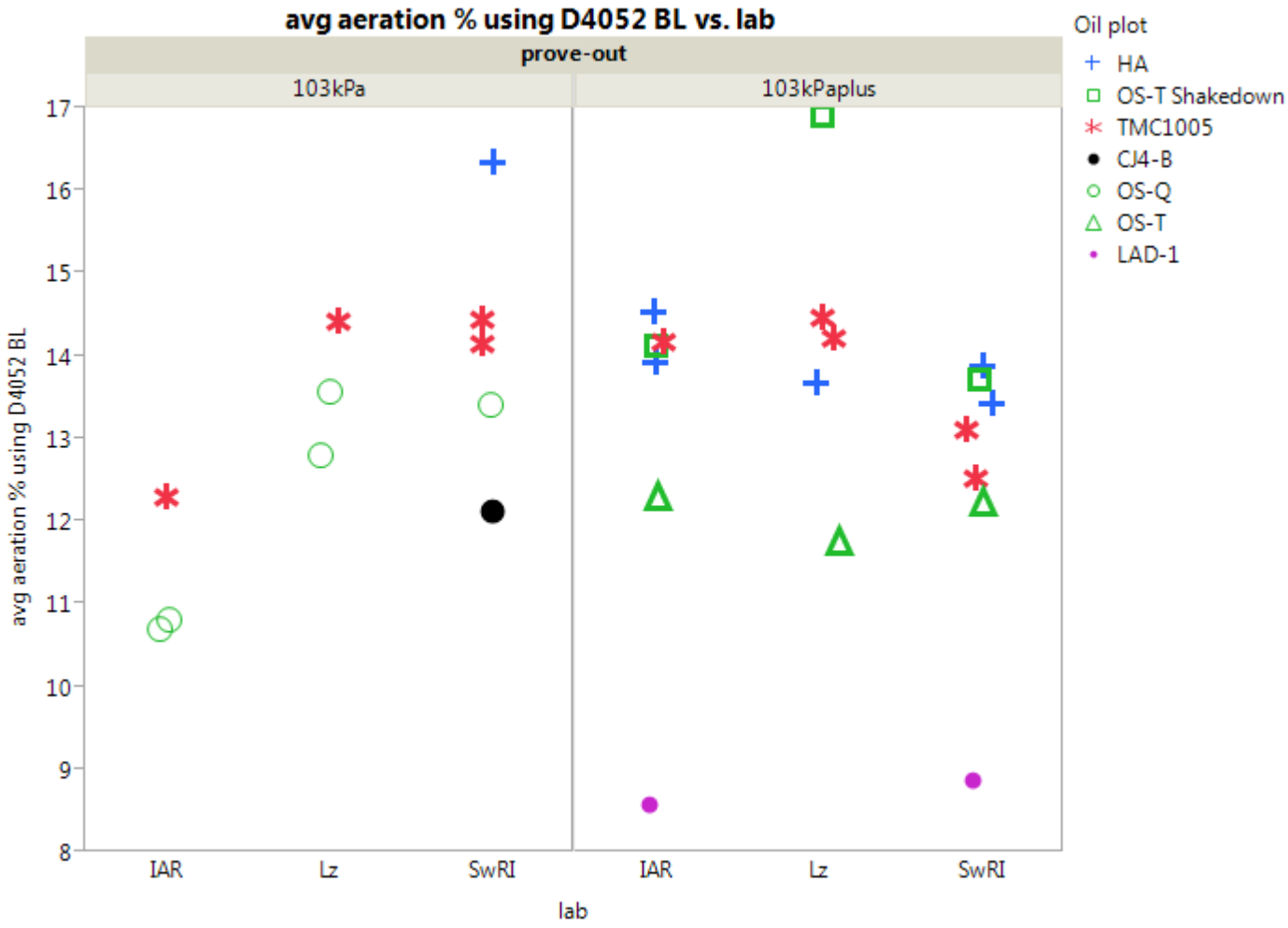
Test plan update, 27 Aug 2014

Lab	Test 0	Test 1	Test 2	Test 3	Test 4	Test 5	Test 6	Test 7
A	LZ oil (OS)	HA	1005	HA	1005	LZ oil start Thurs	LAD1	1005/1004?
B	LZ oil (OS)	HA	1005	HA – Start Friday	LZ oil	LAD1	Obtain info on insulation box - validate	
C	LZ oil (OS) Hi Si	1005	HA	1005- start Thurs	LZ oil	LZ oil*	LAD1	

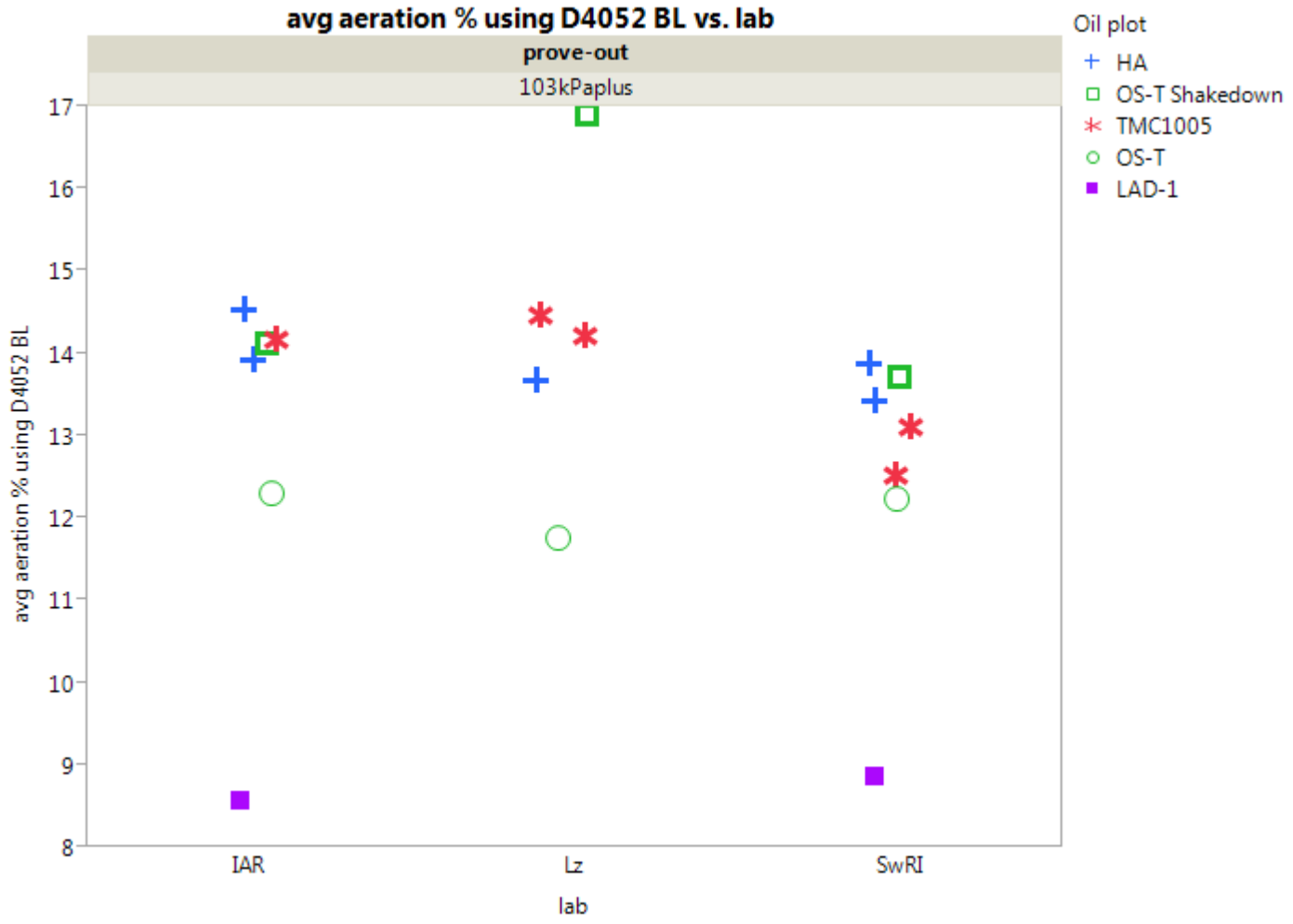
Done

* = LZ oil Test 5 Lab C, different batch , test completed but data not on TMC yet

Aeration % by Prove out phase and Lab



Aeration % by Lab: 2nd prove out tests

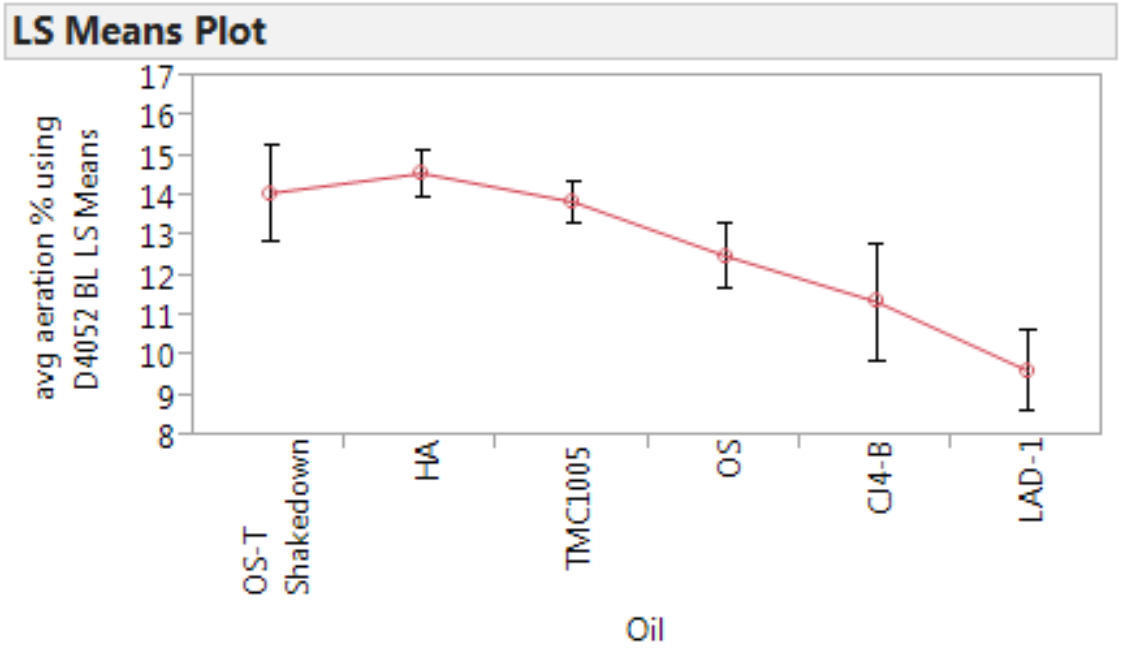


Statistically significant differences between oils

- HA from OS, CJ4-B, LAD-1
- TMC1005 from CJ4-B, LAD-1

Level					Least Sq Mean
HA	A				14.587962
OS-T Shakedown	A	B	C		14.094563
TMC1005	A	B			13.870171
OS		B	C		12.522340
CJ4-B			C	D	11.377177
LAD-1				D	9.645924

Levels not connected by same letter are significantly different.



For statisticians: the details

Now that we have more Si data, I included Si in the original model (Lab/ Prove out phase & Oil)

I just got the latest test results, so this model may change as I explore the data a bit more.

2014/09/04


2014/09/04


2014/09/04