

February 2017 Water Wash of INT Primary mirror - Reflectivity data from CT7 and SMS reflectometers
Washing carried out by Lucia Suarez, Taoran Li (INT student SAs) and Neil O'Mahony. Measurements by Emilie Lhome and Neil.

				Tempr. °C	wavelength of band (nm)							"Dust Indices"						
					365	404	464	522	624	760	970	365	404	464	522	624	760	970
Previous measurement July 2016				88.4	87.3	87.1	87.6	86.7	84.5	90.4	8.2	7.8	8.0	6.0	7.2	5.9	5.8	
Immediately before wash:																		
991	23/02/2017 10:37	4 INTM1 relfs	16.9	83.2	82.2	81.7	82.4	80.6	78.7	83.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
992	23/02/2017 10:38	4 INTM1 relfs	17	82.1	81.0	80.9	81.0	79.9	77.5	82.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
993	23/02/2017 10:38	4 INTM1 relfs	17.1	82.1	81.1	80.9	81.0	79.9	77.4	82.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
994	23/02/2017 10:39	4 INTM1 relfs	17.3	83.3	82.3	81.9	82.3	80.9	78.4	83.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
995	23/02/2017 10:39	4 INTM1 relfs	17.4	83.3	82.3	81.9	82.3	80.9	78.4	83.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
996	23/02/2017 10:41	4 INTM1 relfs	17.6	82.6	81.0	80.9	80.1	80.4	77.1	82.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
997	23/02/2017 10:42	4 INTM1 relfs	17.6	82.2	80.6	80.8	80.0	80.1	77.0	82.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Average before wash				82.7	81.5	81.3	81.3	80.4	77.8	83.0								
Loss in reflectivity since July 2016				5.7	5.8	5.8	6.3	6.3	6.7	7.4								
Loss in %R in WHT M1, same period				~2.5%														

998	23/02/2017 14:21	4 INTM1 relfs	10.8	88.7	87.9	88.8	89.2	88.9	86.2	92.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0
999	23/02/2017 14:27	3 INTM1 all	12.5	90.4	89.2	89.1	89.5	88.9	86.3	92.7	5.6	5.3	4.8	3.4	3.2	2.6	2.3
1000	23/02/2017 14:28	3 INTM1 all	13.4	89.7	88.8	88.9	89.3	88.7	86.3	92.6	5.8	4.8	4.5	2.7	2.9	1.9	1.9
1001	23/02/2017 14:29	3 INTM1 all	13.9	90.7	89.6	89.6	89.9	89.2	86.7	93.0	3.9	3.3	3.0	1.9	1.9	1.3	1.3
1002	23/02/2017 14:30	3 INTM1 all	14.6	89.9	88.8	88.9	89.4	88.7	86.2	92.7	5.2	4.9	4.4	2.9	2.9	2.2	1.8
1003	23/02/2017 14:31	3 INTM1 all	15.1	90.5	89.5	89.4	89.9	89.1	86.7	93.0	5.6	4.6	4.1	2.5	2.8	1.7	1.6
1004	23/02/2017 14:32	3 scratches	15.6	88.5	87.9	88.3	88.4	88.2	85.7	91.9	8.8	8.5	6.7	5.2	4.7	3.6	3.6
Average after wash				89.8	88.8	89.0	89.4	88.8	86.3	92.7	5.0	4.5	3.9	2.7	2.6	1.9	1.8
Change in Reflectivity				7.1	7.3	7.7	8.1	8.4	8.5	9.7							

Washing results from WHT M1 8/2015				90.3	89.0	89.0	89.4	88.7	86.2	92.2	6.6	6.0	5.6	3.9	3.8	2.7	2.3
INT M1 wash result relative to above				-0.6	-0.2	0.0	0.0	0.1	0.1	0.5	1.6	1.5	1.7	1.3	1.1	0.8	0.5

Averages following aluminisation (WHT, 2016)	93.1	91.3	90.9	90.9	90.0	87.2	93.3	2.3	2.1	2.0	1.4	1.4	1.1	1.0
INT M1 current difference from fresh Alum.	-3.3	-2.5	-1.9	-1.6	-1.2	-0.9	-0.6	2.7	2.4	1.9	1.2	1.2	0.8	0.8

Conclusions: Wash successfully restored reflectivity to within almost 2% of the levels of fresh aluminium.

Scaterring was slightly lower than on the WHT M1 after water wash. Reflectivity was less than 0.5% different.

INT M1 measurements nearly 2 weeks after wash

1008	07/03/2017 12:14	3 INTM1 all	19.3	87.6	86.7	87.3	87.5	87.3	84.8	91.2	10.0	9.2	8.2	6.2	6.1	4.8	4.9
1009	07/03/2017 12:15	3 INTM1 all	19.4	90.1	88.8	88.7	89.0	88.3	85.6	92.0	3.9	3.8	3.6	2.7	2.9	2.6	2.6
1010	07/03/2017 12:16	3 INTM1 all	19.5	90.2	88.9	89.0	89.1	88.7	85.9	92.2	4.8	4.5	4.2	3.2	3.0	2.6	2.5
1011	07/03/2017 12:17	3 INTM1 all	19.6	90.2	89.1	89.2	89.4	88.7	86.1	92.5	4.1	3.4	3.1	2.3	2.5	2.0	2.2
1012	07/03/2017 12:18	3 INTM1 all	19.8	88.7	87.7	87.8	88.3	87.6	85.3	91.7	7.5	7.1	7.0	4.8	5.2	4.1	3.6
Change since 23/2				89.4	88.2	88.4	88.7	88.1	85.5	91.9	6.1	5.6	5.2	3.8	3.9	3.2	3.2
				-0.4	-0.6	-0.6	-0.7	-0.7	-0.8	-0.8	1.1	1.1	1.3	1.2	1.3	1.3	1.4

This is a typical loss after a week of calima

Measurements before and after INT M1 wash using the SMS micro-scan laser reflectometer/scatterometer.

Measurements before Wash:

datum #	Scattering at angles Θ, Φ			Reflectivity	user comment	Roughness RMS(\AA)	TIME	DATE
	Θ s->	0	50					
	Φ s->	0	180					
32	pos 1	2.39E-02	1.41E-02	0.764		118	10:43:55	02-23-2017
33		2.39E-02	1.40E-02	0.761		118.1	10:44:00	02-23-2017
34	pos 2	2.21E-02	1.29E-02	0.780		112.2	10:44:10	02-23-2017
35		2.21E-02	1.29E-02	0.770		113	10:44:16	02-23-2017
36	pos 3	2.29E-02	1.10E-02	0.765		116.3	10:44:36	02-23-2017
37		2.28E-02	1.10E-02	0.752		117.1	10:44:46	02-23-2017
38	pos 4	2.54E-02	1.33E-02	0.759		122.4	10:44:59	02-23-2017
39		2.54E-02	1.34E-02	0.747		123.3	10:45:04	02-23-2017
40		4.88E-03	2.47E-05	0.001	null	>1177	10:46:20	02-23-2017
average		2.36E-02	1.28E-02	0.762		117.6		

After Wash:

41	pos 1	2.29E-03	3.81E-04	0.830		43	14:23:51	02-23-2017
42		2.32E-03	3.89E-04	0.827		43.2	14:23:57	02-23-2017
43	pos 2	5.41E-03	1.00E-03	0.826		63.7	14:24:22	02-23-2017
44		5.42E-03	1.01E-03	0.834		63.3	14:24:27	02-23-2017
45		5.46E-03	9.97E-04	0.828		64.3	14:24:34	02-23-2017
46	pos 3	1.64E-03	2.37E-04	0.845		38.3	14:24:56	02-23-2017
47		1.64E-03	2.38E-04	0.842		38.3	14:25:01	02-23-2017
48	pos 4	1.99E-03	3.10E-04	0.840		40.9	14:25:28	02-23-2017
average		2.83E-03	4.83E-04	0.835		48.3		

Comparison with results from previous washes:

WHT M1 2015/08	3.85E-03	7.52E-04	0.848	58.0
WHT M1 2014/10	3.38E-03	5.32E-04	0.854	54.9
INT M1 2014/09	1.17E-03	2.44E-04	0.856	28.2
INT M1 2013/12	1.87E-03	3.15E-04	0.857	37.5

**Conclusion: Scattering and roughness is consistent with previous values, in between levels of INT and WHT.
Reflectivity is 2% lower, contadicting coclusion from CT7 (but using older results for comparison).**

Reference mirror check

49	ref	2.39E-03	8.79E-04	0.939	34.7	14:27:41	02-23-2017
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The reference mirror reflectivity is above 93% , which means there is no evidence of dirt contamination of the head
The reference scattering measurements are lower than usual, particularly at 50,180 deg.