

SMS Reflectometer measurements before and after CO2 cleaning of WHT Primary mirror
 2 September 2014. Cleaning and report by Neil.
 Measurements usually performed in pairs to check 0.05% repeatability.

Lambda	0.67 micron	
Incident Angle	25 deg	<--SMS Summary characteristics
BW Limits	1 0.01	

Measurements before cleaning

datum #	Scattering at angles Θ, Φ			Reflectivity	user comment	Roughness RMS(Å)	TIME	DATE
	$\Theta_s \rightarrow$	$\Phi_s \rightarrow$						
1	location 1	0	50	0.815	skip	82.4	11:17:33	09/02/1914
2		0	180	0.821	skip	82.1	11:17:38	09/02/1914
3	location 2			0.83		73.3	11:17:46	09/02/1914
4				0.831		73.2	11:17:52	09/02/1914
5	3			0.832		71.4	11:18:32	09/02/1914
6				0.832		71.2	11:18:37	09/02/1914
7	4			0.837		64.1	11:18:46	09/02/1914
8				0.834		64.2	11:18:50	09/02/1914
9	5			0.833		73.6	11:19:35	09/02/1914
10				0.828		73.7	11:19:41	09/02/1914
11	6			0.835		63.1	11:19:50	09/02/1914
12				0.835		63.1	11:19:55	09/02/1914
13	7			0.836		59.5	11:20:30	09/02/1914
14				0.836		59.5	11:20:36	09/02/1914
15				0.821	solo	74.7	11:20:44	09/02/1914

Averages	8.39E-03	3.62E-03	0.832	68.0
std deviations	1.25E-03	5.33E-04	0.004	5.8
std error			0.003	

M1 Measurements after cleaning

16	location 1			0.854		49.2	14:35:25	09/02/1914
17				0.856		49.1	14:35:30	09/02/1914
18				0.857		49.1	14:35:36	09/02/1914
19	2			0.845		55.6	14:35:49	09/02/1914
20				0.847		55.7	14:35:54	09/02/1914
21	3			0.848		55.2	14:36:02	09/02/1914
22				0.847		55.2	14:36:07	09/02/1914
23	4			0.848		62.3	14:36:16	09/02/1914
24				0.85		62.4	14:36:21	09/02/1914
25	6			0.854		46.5	14:36:29	09/02/1914
26				0.854		46.5	14:36:34	09/02/1914
27	7			0.846		51.5	14:36:41	09/02/1914
28				0.849		51.3	14:36:47	09/02/1914
29	8			0.847		67.2	14:36:57	09/02/1914
30				0.847		67.2	14:37:02	09/02/1914
31	9			0.85		54.7	14:38:05	09/02/1914

32		3.82E-03	6.41E-04	0.852		54.6	14:38:10	09/02/1914
33	10	7.43E-03	3.54E-03	0.832		63.6	14:38:19	09/02/1914
34		7.44E-03	3.54E-03	0.83		63.7	14:38:23	09/02/1914
35	11	3.82E-03	7.06E-04	0.849		52.9	14:38:31	09/02/1914
36		3.81E-03	7.05E-04	0.852		52.8	14:38:36	09/02/1914
37	12	7.23E-03	2.07E-03	0.833		66.2	14:38:43	09/02/1914
38		7.25E-03	2.07E-03	0.832		66.4	14:38:48	09/02/1914
39	13	6.51E-03	1.37E-03	0.822		67.5	14:38:56	09/02/1914
40		6.52E-03	1.38E-03	0.824		67.3	14:39:00	09/02/1914
41	14	3.55E-03	6.50E-04	0.841		51.4	14:39:07	09/02/1914
42		3.54E-03	6.57E-04	0.843		51.1	14:39:12	09/02/1914
43	15	5.03E-03	1.56E-03	0.826	skip	54.8	14:39:20	09/02/1914
44		5.01E-03	1.56E-03	0.82	skip	54.9	14:39:29	09/02/1914
45		4.80E-03	1.77E-03	0.832	solo	52.2	14:39:36	09/02/1914
46	16	6.21E-03	2.05E-03	0.842		59.8	14:39:48	09/02/1914
47		6.18E-03	2.04E-03	0.846		59.5	14:39:53	09/02/1914
48	17	6.81E-03	2.79E-03	0.831		61.6	14:40:59	09/02/1914
49		6.81E-03	2.81E-03	0.832		61.5	14:41:04	09/02/1914
50	18	6.64E-03	1.66E-03	0.83	skip	65.1	14:41:12	09/02/1914
51		6.61E-03	1.67E-03	0.811	skip	65.6	14:41:16	09/02/1914
52	19	5.61E-03	2.39E-03	0.827		55.8	14:41:25	09/02/1914
53		5.61E-03	2.42E-03	0.83		55.7	14:41:31	09/02/1914
Averages		5.33E-03	1.59E-03	0.843		57.6		
std deviations		1.43E-03	8.23E-04	0.010		4.9		
std error				0.003				

Reference mirror measurements

54		2.35E-03	2.07E-03	0.935		33.3	14:45:59	09/02/1914
55		2.34E-03	2.08E-03	0.934		33.3	14:46:08	09/02/1914
56		2.93E-03	1.51E-03	0.933		37.5	14:46:16	09/02/1914
57		2.42E-03	1.16E-03	0.941		34.1	14:46:25	09/02/1914

Measurements all > 93% and repeatable

Improvement in M1 due to cleaning:

Forward scattering reduced by factor	1.57		
Back scattering reduced by factor	2.27		
Reflectivity increased by	1.063 %	with std error	0.30%
Roughness reduced by	18 %		

CT7 measurements before and after CO2 cleaning, 2 September 2014
 Sample before cleaning is 1-2 measurements in each of 4 mirror cover portholes

			Tempr. °C	wavelength of band (nm)							
				365	404	464	522	624	760	970	
239	02/09/2014 10:53:15	0 Normal	26.1	92.1	86.9	89.7	88.4	86.7	86	89.9	
240	02/09/2014 10:53:51	0 Normal	26.1	91	85.9	88.8	87.8	86.3	85.5	89.5	
241	02/09/2014 10:54:54	0 Normal	25.9	90.6	85.6	88.3	87.2	85.6	84.8	88.6	
242	02/09/2014 10:55:40	0 Normal	25.8	89.3	84.6	87.5	86.4	85.1	84.4	88.4	
243	02/09/2014 10:56:07	0 Normal	25.8	90.6	85.8	88.7	87.5	86	85.2	89.1	
average before cleaning				90.75	85.75	88.58	87.45	85.93	85.18	89.1	
244	02/09/2014 14:04:45	0 Normal	13.8	91	86.3	88.9	87.5	86.2	85.5	88.9	
245	02/09/2014 14:05:08	0 Normal	13.9	91.3	86.8	89.5	88.1	86.8	86.1	89.5	
246	02/09/2014 14:05:31	0 Normal	14	92.4	87.8	90.5	89.1	87.8	87.1	90.6	
247	02/09/2014 14:05:51	0 Normal	14.2	91.2	86.9	89.6	88.5	87.3	86.7	90.1	
248	02/09/2014 14:06:13	0 Normal	14.3	88.3	84.3	87	86.3	85.3	84.8	88.3	
average porthole 1				90.84	86.42	89.1	87.9	86.68	86.04	89.48	
249	02/09/2014 14:07:18	0 Normal	14.7	90.3	85.9	88.6	87.1	85.8	85.1	88.4	
250	02/09/2014 14:07:38	0 Normal	14.8	89.8	85.7	88.1	86.9	85.5	84.8	88.1	
251	02/09/2014 14:07:57	0 Normal	14.9	90.6	86.4	89.1	87.5	86.1	85.4	88.6	
252	02/09/2014 14:08:18	0 Normal	15.2	90.6	86.5	89.1	87.8	86.4	85.7	88.8	
253	02/09/2014 14:08:40	0 Normal	15.4	90.2	85.8	88.5	87.1	85.8	85.1	88.5	
average porthole 2				90.3	86.06	88.68	87.28	85.92	85.22	88.48	
254	02/09/2014 14:09:28	0 Normal	15.6	89.9	85.6	88.1	86.7	85.3	84.7	87.9	
255	02/09/2014 14:10:01	0 Normal	15.9	89.4	85.4	88	86.4	85.1	84.4	87.7	
256	02/09/2014 14:10:22	0 Normal	16.1	90.4	86.4	89.1	87.7	86.4	85.8	89.2	
257	02/09/2014 14:10:43	0 Normal	16.2	90.6	86.4	89.1	87.4	86.1	85.6	89.3	
average porthole 3				90.08	85.95	88.58	87.05	85.73	85.13	88.53	
258	02/09/2014 14:11:27	0 Normal	16.6	88.5	84.7	87.9	87.1	86.2	85.7	89.4	
259	02/09/2014 14:11:49	0 Normal	16.7	89.7	85.9	88.5	87	85.6	85.1	88.6	
260	02/09/2014 14:12:14	0 Normal	16.9	89.5	85.6	88.3	87	85.7	85.1	88.5	
261	02/09/2014 14:12:48	0 Normal	17.2	89.6	85.6	88.2	87	85.6	84.9	88.3	
262	02/09/2014 14:13:11	0 Normal	17.3	89.5	85.4	88.1	86.9	85.6	84.9	88.4	
average porthole 4				89.36	85.44	88.2	87	85.74	85.14	88.64	
After cleaning:											
averages				90.1	86.0	88.6	87.3	86.0	85.4	88.8	
std dev				0.9	0.7	0.7	0.6	0.6	0.6	0.7	
after - before comparison with June				-0.6	0.2	0.1	-0.1	0.1	0.2	-0.3	
				0.1	-4.1	-1.4	-2.7	-4.0	-4.7	-1.3	

Conclusion: the CT7 measurements do not register an increase in reflectivity.
Sucessive portholes give progressively lower averages (except for some wavebands)
This is surprising and may be due more to temperature dependence than real reflectivity changes
The samples before/after are very different in size and may not be comparable.
The averages after cleaning are singificantly lower than before - up to 4.5 %