

**Measurements of WHT Primary Mirror reflectivity before and after CO2 cleaning**

Taken by Neil O'Mahony using SMS micro-Scan reflectometer, both at AP3 and portholes

Last CO2 cleaning was on 20 April. No significant calima since then.

Successive measurements with similar scattering measurements are in same location

%R exceeding specification repeatability of 0.5% are marked "skip" & omitted from average

Ref are measurements of MG reference mirror, typically 91-93% using SMS

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

**Measurements on M1 before cleaning**

datum #	Scattering at angles $\Theta, \Phi$			Reflectivity	user comment	Roughness RMS(Å)	TIME	DATE
	$\Theta_s \rightarrow$	0	50					
	$\Phi_s \rightarrow$	0	180					
1	location 1	6.64E-03	2.30E-03	0.836		61.6	10:08:17	06/08/1912
2		6.64E-03	2.30E-03	0.835		61.7	10:08:22	06/08/1912
3	2	6.93E-03	2.99E-03	0.834		61.7	10:08:32	06/08/1912
4		6.94E-03	2.97E-03	0.835		61.7	10:08:37	06/08/1912
5	3	1.06E-02	6.85E-03	0.799		76.5	10:08:46	06/08/1912
6		1.07E-02	6.93E-03	0.8		77.1	10:12:55	06/08/1912
7		1.07E-02	6.93E-03	0.799		77.1	10:13:06	06/08/1912
8	4	6.64E-03	3.42E-03	0.834		59.7	10:14:24	06/08/1912
9		6.63E-03	3.42E-03	0.832		59.8	10:14:29	06/08/1912
10	5	7.15E-03	2.58E-03	0.838		63.6	10:14:37	06/08/1912
11		7.17E-03	2.58E-03	0.837		63.7	10:14:41	06/08/1912
12	6	8.04E-03	5.60E-03	0.811		66.2	10:14:50	06/08/1912
13		8.05E-03	5.60E-03	0.813		66.1	10:14:55	06/08/1912
14	7	5.34E-03	1.51E-03	0.84		56.8	10:15:05	06/08/1912
15		5.34E-03	1.52E-03	0.841		56.7	10:15:10	06/08/1912
16	8	5.36E-03	3.15E-03	0.835		53.4	10:16:07	06/08/1912
17		5.36E-03	3.16E-03	0.836		53.3	10:16:12	06/08/1912
18	9	7.88E-03	2.94E-03	0.825		67	10:16:23	06/08/1912
19		7.87E-03	2.94E-03	0.826		66.9	10:16:27	06/08/1912
20	10	5.88E-03	2.68E-03	0.839		56.5	10:16:36	06/08/1912
21		5.89E-03	2.67E-03	0.838		56.6	10:16:41	06/08/1912
22	11	5.46E-03	2.40E-03	0.84		54.5	10:17:28	06/08/1912
23		5.46E-03	2.40E-03	0.84		54.5	10:17:35	06/08/1912
24	12	4.92E-03	2.11E-03	0.84		51.8	10:17:44	06/08/1912
25		4.92E-03	2.11E-03	0.84		51.8	10:17:49	06/08/1912
26	13	5.15E-03	1.84E-03	0.823		54.5	10:18:00	06/08/1912
27		5.15E-03	1.85E-03	0.823		54.5	10:18:05	06/08/1912
28	14	5.86E-03	2.20E-03	0.837		57.4	10:19:24	06/08/1912
29		5.86E-03	2.20E-03	0.836		57.4	10:19:28	06/08/1912
30	15	5.51E-03	2.34E-03	0.837		55	10:19:41	06/08/1912
31		5.50E-03	2.34E-03	0.837		55	10:19:46	06/08/1912
32	16	5.47E-03	2.37E-03	0.831		54.9	10:20:05	06/08/1912
33		5.47E-03	2.37E-03	0.832		54.9	10:20:10	06/08/1912
<b>Mean values</b>		<b>6.56E-03</b>	<b>3.08E-03</b>	<b>0.830</b>		<b>59.997</b>		

Measurements on M1 straight after CO2 cleaning. Telescope at AP3, so locations in bottom half.

34	location 1	3.33E-03	1.71E-03	0.846	skip	42.1	12:27:32	06/08/1912
35		3.37E-03	1.70E-03	0.826		42.8	12:27:37	06/08/1912
36		3.37E-03	1.71E-03	0.829		42.7	12:27:43	06/08/1912
37	2	2.54E-03	6.19E-04	0.852		40	12:27:54	06/08/1912
38		2.54E-03	6.18E-04	0.851		40.1	12:27:59	06/08/1912
39	3	2.52E-03	6.30E-04	0.862		39.4	12:28:15	06/08/1912
40		2.51E-03	6.33E-04	0.861		39.3	12:28:21	06/08/1912
41	4	3.13E-03	8.38E-04	0.859		43.4	12:28:36	06/08/1912
42		3.13E-03	8.37E-04	0.857		43.4	12:28:41	06/08/1912
43	5	3.11E-03	7.13E-04	0.846		45	12:29:10	06/08/1912
44		3.10E-03	7.13E-04	0.846		44.9	12:29:20	06/08/1912
45	6	3.29E-03	8.29E-04	0.824		45.9	12:29:34	06/08/1912
46		3.30E-03	8.38E-04	0.831	skip	45.7	12:29:39	06/08/1912
47		3.29E-03	8.46E-04	0.82		45.9	12:29:45	06/08/1912
48	7	3.68E-03	9.51E-04	0.85		47.6	12:29:54	06/08/1912
49		3.67E-03	9.47E-04	0.851		47.6	12:29:59	06/08/1912
50	8	3.84E-03	8.15E-04	0.855		50.8	12:30:14	06/08/1912
51		3.84E-03	8.16E-04	0.856		50.7	12:30:19	06/08/1912
52	9	4.55E-03	1.08E-03	0.825	skip	54.7	12:30:34	06/08/1912
53		4.55E-03	1.09E-03	0.843		54	12:30:39	06/08/1912
54		4.54E-03	1.09E-03	0.849	ok	53.8	12:30:44	06/08/1912
55	10	4.78E-03	1.22E-03	0.853		54.3	12:31:04	06/08/1912
56		4.77E-03	1.23E-03	0.855		54.2	12:31:10	06/08/1912
57	11	3.06E-03	6.83E-04	0.86		44.6	12:31:22	06/08/1912
58		3.06E-03	6.85E-04	0.844	skip	45	12:31:27	06/08/1912
59		3.04E-03	6.83E-04	0.862		44.4	12:31:34	06/08/1912
60	12	3.85E-03	1.01E-03	0.853		48.5	12:31:53	06/08/1912
61		3.84E-03	1.01E-03	0.854		48.3	12:31:58	06/08/1912
62	13	3.60E-03	7.00E-04	0.83		51.1	12:32:30	06/08/1912
63		3.59E-03	7.03E-04	0.836		50.8	12:32:36	06/08/1912
64	14	3.61E-03	7.33E-04	0.852		49.9	12:32:41	06/08/1912
65		3.62E-03	7.35E-04	0.848		50	12:32:47	06/08/1912
66	N/A	1.97E-08	2.25E-08	0.001	skip	3	12:32:53	06/08/1912
67	15	2.12E-02	4.81E-03	0.806		120.9	12:33:01	06/08/1912
68		2.13E-02	4.82E-03	0.807		121.1	12:33:06	06/08/1912
69	16	3.40E-03	7.35E-04	0.855		47.5	12:33:14	06/08/1912
70		3.39E-03	7.33E-04	0.854		47.5	12:33:19	06/08/1912
71	17	2.52E-03	4.14E-04	0.857		44.6	12:33:28	06/08/1912
72		2.52E-03	4.14E-04	0.858		44.5	12:33:33	06/08/1912
73	18	2.85E-03	6.17E-04	0.857		43.4	12:33:54	06/08/1912
74		2.85E-03	6.11E-04	0.857		43.5	12:33:59	06/08/1912
75	19	3.45E-03	8.60E-04	0.852		46.4	12:34:35	06/08/1912
76		3.45E-03	8.59E-04	0.851		46.4	12:34:40	06/08/1912
77	20	3.58E-03	9.82E-04	0.845		46.6	12:34:53	06/08/1912
78		3.59E-03	9.86E-04	0.842		46.7	12:34:58	06/08/1912
79		3.62E-03	9.93E-04	0.843		46.9	12:35:04	06/08/1912
80	21	4.91E-03	1.14E-03	0.846		56.5	12:35:33	06/08/1912

81		4.91E-03	1.14E-03	0.848		56.4	12:35:38	06/08/1912
82	N/A	1.97E-08	2.25E-08	0.001	skip	3	12:35:46	06/08/1912
83	22	5.06E-03	9.10E-04	0.848		61.4	12:35:58	06/08/1912
84		5.06E-03	9.11E-04	0.847		61.5	12:36:03	06/08/1912
85	23	3.73E-03	7.79E-04	0.851		50.3	12:36:12	06/08/1912
86		3.73E-03	7.77E-04	0.85		50.4	12:36:18	06/08/1912
87	24	2.73E-03	6.36E-04	0.852		41.9	12:36:26	06/08/1912
88		2.73E-03	6.36E-04	0.852		41.9	12:36:32	06/08/1912
89	25	2.76E-03	7.21E-04	0.844	skip	41.3	12:36:42	06/08/1912
90		2.75E-03	7.13E-04	0.858		40.9	12:36:48	06/08/1912
91		2.76E-03	7.15E-04	0.854		41.1	12:36:55	06/08/1912
92	26	3.29E-03	7.32E-04	0.848	skip	46.6	12:37:11	06/08/1912
93		3.29E-03	7.35E-04	0.841	skip	46.7	12:37:16	06/08/1912

**Mean values at AP3**      **4.09E-03**    **9.96E-04**      **0.848**                      **50.461**  
std deviations            3.35E-03    7.75E-04      0.013  
std error                    6.70E-04    1.55E-04      0.003

Measurements on Reference mirror

94		5.05E-03	2.84E-03	0.923		49.4	13:12:44	06/08/1912
95		5.05E-03	2.80E-03	0.923		49.4	13:12:54	06/08/1912
96		1.91E-03	1.23E-03	0.928		30.2	13:13:01	06/08/1912
97		1.92E-03	1.22E-03	0.928		30.3	13:13:07	06/08/1912
98		4.23E-03	2.34E-03	0.915		45.4	13:13:13	06/08/1912
99		4.23E-03	2.34E-03	0.914		45.4	13:13:18	06/08/1912
100		6.54E-03	2.22E-03	0.908		58.8	13:13:46	06/08/1912
101		6.43E-03	2.38E-03	0.907		57.8	13:13:51	06/08/1912
102		4.13E-03	2.17E-03	0.908		45.1	13:14:01	06/08/1912
103		4.31E-03	2.19E-03	0.909		46.1	13:14:06	06/08/1912
104		3.97E-03	2.25E-03	0.89		44.6	13:14:15	06/08/1912
105		3.95E-03	2.25E-03	0.891		44.4	13:14:21	06/08/1912
106		1.76E-03	1.43E-03	0.932		28.9	13:14:35	06/08/1912
107		1.77E-03	1.44E-03	0.933		28.9	13:14:40	06/08/1912
108		2.62E-03	1.87E-03	0.932		35.2	13:14:46	06/08/1912

**Comment: a few low readings of %R but maximum 93% measured implies SMS is behaving**

Measurements of M1 with telescope at zenith, through port holes

109	1	2.67E-03	4.88E-04	0.859	port 1	44.2	13:30:40	06/08/1912
110		2.68E-03	4.89E-04	0.859		44.2	13:30:46	06/08/1912
111	2	1.49E-02	3.78E-03	0.812		98.4	13:30:57	06/08/1912
112		1.49E-02	3.79E-03	0.812		98.4	13:31:01	06/08/1912
113	3	3.78E-03	9.07E-04	0.845		49.1	13:31:11	06/08/1912
114		3.78E-03	9.09E-04	0.844		49.1	13:31:16	06/08/1912
115	4	3.04E-03	5.95E-04	0.858		46.1	13:31:26	06/08/1912
116		3.05E-03	5.93E-04	0.858		46.3	13:31:31	06/08/1912
117	5	3.18E-03	7.80E-04	0.846	port 2	44.8	13:36:13	06/08/1912
118		3.18E-03	7.80E-04	0.846		44.8	13:36:18	06/08/1912
119	6	3.47E-03	7.43E-04	0.848		48.4	13:36:25	06/08/1912
120		3.48E-03	7.39E-04	0.847		48.5	13:36:30	06/08/1912
121	7	2.88E-03	5.82E-04	0.846	skip	44.8	13:36:40	06/08/1912
122		2.89E-03	5.83E-04	0.839		45.1	13:36:45	06/08/1912

123		2.90E-03	5.86E-04	0.837		45.2	13:36:54	06/08/1912
124	8	2.74E-03	5.22E-04	0.844	port 3	44.5	13:37:14	06/08/1912
125		2.74E-03	5.20E-04	0.843		44.6	13:37:19	06/08/1912
126	9	3.26E-03	8.13E-04	0.845		45.2	13:38:04	06/08/1912
127		3.26E-03	8.13E-04	0.847		45.2	13:38:09	06/08/1912
128	10	4.24E-03	1.26E-03	0.843		50.1	13:38:19	06/08/1912
129		4.25E-03	1.26E-03	0.843		50.2	13:38:23	06/08/1912
130	11	2.81E-03	5.91E-04	0.852	skip	43.6	13:38:37	06/08/1912

**Mean values at zenith**      **4.28E-03**    **1.01E-03**      **0.844**                      **51.62**  
**std deviations**                      **3.61E-03**    **9.58E-04**      **0.013**

<b>Global mean M1/CO2</b>	<b>0.847</b>
<b>std dev</b>	<b>0.013</b>
<b>std err</b>	<b>0.002</b>

	<b>scattering</b>		<b>%R</b>	<b>RMS</b>	<b>Final Result</b>
<b>% Improvement</b>	<b>153.457</b>	<b>306.150</b>	<b>1.623</b>	<b>13.962</b>	