Reflectivity measmts. of WHT Primary Mirror from SMS and CT7 before & after CO2 cleaning on 8 July 2014, following strong calima event 1 week previously.
SMS measmts. usually in pairs to check 0.05% repeatable & bracketed by Reference measmts.
Measurements, CO2 cleaning and and Report by Neil.

Summary of SMS results:

Improvement in Reflectivity:	0.3 %	±	0.4 %	i.e. NEGLIGIBLE	
Improvement in Scattering:	factors of	1.3	(0 deg), to	1.7	(50,180 deg)
Improvement in Roughness	13 %				

Improvements in reflectivity CT7 measurements following CO2 cleaning and since 18 June:

	wavelength of band (nm)							avg. 7 bands
	365	404	464	522	624	760	970	
%R (CO2)	1.8	1.0	0.8	0.4	0.7	0.7	0.5	0.8
%R (18 Jun)	0.8	0.1	-0.1	-0.2	0.1	0.1	0.0	0.1

Conclusion: CT7 suggests CO2 has recovered the pre-calima reflectivity,
SMS only sees improved scattering

Detail of measurements and statistics follows:

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

SMS Measurements at zenith 1 day before cleaning and 1 week after calima finished

	Scattering at angles Θ,Φ			Reflect-	user	Rough-		
	Θs->	0	50	ivity	comm- ent	ness		
datum #	Φs->	0	180			RMS(Å)	TIME	DATE
32	location 1	6.75E-03	2.92E-03	0.83		61.1	11:06:31	07/09/2014
33		6.73E-03	2.92E-03	0.83		60.9	11:06:35	07/09/2014
34	2	1.34E-02	1.06E-02	0.798	stain	86.1	11:06:46	07/09/2014
35		1.32E-02	1.06E-02	0.798	(omit)	85.4	11:06:52	07/09/2014
36	3	5.91E-03	1.98E-03	0.847		58	11:07:00	07/09/2014
37		5.92E-03	1.98E-03	0.847		58.1	11:07:05	07/09/2014
38	4	5.08E-03	2.45E-03	0.848		52	11:07:15	07/09/2014
39		5.08E-03	2.45E-03	0.846		52.1	11:07:20	07/09/2014
40	5	6.64E-03	2.86E-03	0.843		60.1	11:08:08	07/09/2014
41		6.65E-03	2.86E-03	0.842		60.2	11:08:12	07/09/2014
42	6	5.84E-03	2.79E-03	0.847		55.8	11:08:22	07/09/2014
43		5.84E-03	2.79E-03	0.845		55.9	11:08:28	07/09/2014
44	7	6.64E-03	2.57E-03	0.841		60.7	11:08:37	07/09/2014
45		6.64E-03	2.57E-03	0.841		60.7	11:08:42	07/09/2014
46	8	7.74E-03	4.04E-03	0.835		64.5	11:09:46	07/09/2014
47		7.74E-03	4.04E-03	0.837		64.4	11:09:51	07/09/2014
48	9	6.22E-03	3.64E-03	0.839		57.4	11:10:02	07/09/2014
49		6.22E-03	3.63E-03	0.841		57.3	11:10:07	07/09/2014
50	10	5.48E-03	2.61E-03	0.842		54.3	11:10:19	07/09/2014
51		5.48E-03	2.61E-03	0.845		54.2	11:10:24	07/09/2014

52	11	6.86E-03	4.02E-03	0.84		60.2	11:11:18	07/09/2014
53		6.85E-03	4.03E-03	0.837		60.3	11:11:24	07/09/2014
54	12	7.80E-03	3.19E-03	0.838		65.6	11:11:34	07/09/2014
55		7.80E-03	3.18E-03	0.838		65.6	11:11:39	07/09/2014
56	13	6.56E-03	3.04E-03	0.839		59.6	11:11:50	07/09/2014
57		6.55E-03	3.04E-03	0.839		59.5	11:11:54	07/09/2014
Averages		6.46E-03	3.01E-03	0.841		59.1		
std deviations		7.99E-04	6.13E-04	0.005		3.8		
std error				0.002				
		Scattering		%R		RMS		

Reference measurements immediately before and after M1, before cleaning:

31		4.09E-03	1.58E-03	0.936		45.2	10:46:07	07/09/2014
58		3.57E-03	5.05E-03	0.929		41.8	11:20:05	07/09/2014
59		3.57E-03	5.05E-03	0.929		41.8	11:20:10	07/09/2014
60		1.90E-03	1.93E-03	0.902		30.5	11:20:19	07/09/2014
61		3.00E-03	2.06E-03	0.915		38	11:20:27	07/09/2014
62		6.56E-03	2.93E-03	0.905		57.5	11:20:34	07/09/2014
63		7.15E-03	1.99E-03	0.907		63.4	11:20:40	07/09/2014
64		4.97E-03	1.29E-03	0.937		52.6	11:21:16	07/09/2014

Sensitivity of 93% was reached both before & immediately after M1 measurement.
Some contamination seems to have occurred for data 60-63, but air blowing removed this.

SMS Measurements of M1 at zenith, 5 days after CO2, follow:

	Scattering at angles Θ,Φ			Reflect-	user	Rough-		
	Θs->	0	50	ivity	comm- ent	ness		
datum #	Φs->	0	180			RMS(Å)	TIME	DATE
1	location 1	3.40E-03	9.89E-04	0.853		44.7	10:18:08	07-16-2014
2		3.40E-03	9.91E-04	0.85		44.8	10:18:14	07-16-2014
3	2	2.89E-03	7.77E-04	0.85		41.9	10:18:23	07-16-2014
4		2.89E-03	7.77E-04	0.849		41.9	10:18:27	07-16-2014
5	3	5.14E-03	1.29E-03	0.842		56.9	10:18:36	07-16-2014
6		5.12E-03	1.29E-03	0.839		56.9	10:18:41	07-16-2014
7	4	4.60E-03	1.66E-03	0.84		51	10:19:46	07-16-2014
8		4.61E-03	1.65E-03	0.84		51	10:19:51	07-16-2014
9		4.61E-03	1.65E-03	0.839		51	10:20:23	07-16-2014
10		4.61E-03	1.65E-03	0.841		51	10:20:28	07-16-2014
11	5	6.18E-03	2.29E-03	0.84		58.9	10:20:39	07-16-2014
12		6.17E-03	2.29E-03	0.842		58.7	10:20:44	07-16-2014
13	6	4.23E-03	1.28E-03	0.849		49.7	10:20:55	07-16-2014
14		4.24E-03	1.28E-03	0.85		49.8	10:21:00	07-16-2014
15	7	5.81E-03	2.49E-03	0.841		56.3	10:22:00	07-16-2014
16		5.83E-03	2.50E-03	0.841		56.4	10:22:05	07-16-2014
17	8	3.37E-03	1.01E-03	0.85		44.4	10:22:15	07-16-2014
18		3.36E-03	1.01E-03	0.85		44.3	10:22:20	07-16-2014
19	9	4.84E-03	1.91E-03	0.847		51.6	10:22:31	07-16-2014
20		4.83E-03	1.91E-03	0.847		51.5	10:22:36	07-16-2014
21	10	3.97E-03	1.34E-03	0.849		47.4	10:23:24	07-16-2014

22		3.97E-03	1.34E-03	0.848		47.5	10:23:29	07-16-2014
23	11	9.73E-03	5.08E-03	0.825		72.7	10:23:37	07-16-2014
24		9.73E-03	5.07E-03	0.825		72.7	10:23:43	07-16-2014
25	12	4.86E-03	1.42E-03	0.848		53.6	10:23:51	07-16-2014
26		4.88E-03	1.43E-03	0.849		53.6	10:23:57	07-16-2014
27	13	4.58E-03	1.60E-03	0.846		50.8	10:24:07	07-16-2014
Averages		**4.88E-03**	**1.78E-03**	**0.844**		**52.3**		
std deviations		**0.002**	**0.001**	**0.007**		**7.7**		
std error				**0.002**				
		Scattering		%R		RMS		

Reference measurements immediately before and after M1, after cleaning:

1		1.14E-02	9.11E-03	0.937		73.2	09:56:35	07-16-2014
28		8.59E-03	3.04E-03	0.943		65.8	10:25:16	07-16-2014

Repeat measurements were identical, but not recorded for some reason. Sensitivity > 93.5%

Improvement in Reflectivity: 0.3 % ± 0.4 % i.e. NEGLIGIBLE
Improvement in Scattering: factors of 1.3 (0 deg), to 1.7 (50,180 deg)
Improvement in Roughness 13 %

CT7 Reflectivities before/after CO2 (CT7 calibration as on 18.06), calima 1 week ago

				Tempr. °C	wavelength of band (nm)							mean over 7 bands
					365	404	464	522	624	760	970	
219	09/07/2014 10:40	0	Normal	22.9	89.3	86.3	89.5	88.8	87.4	86.6	90.7	88.4
220	09/07/2014 10:40	0	Normal	22.9	89	86.2	89.3	88.6	87	86.2	90.1	88.1
221	09/07/2014 10:45	0	Normal	22.4	89.5	86.6	89.8	89	87.4	86.6	90.3	88.5
222	09/07/2014 10:46	0	Normal	22.4	89.5	86.4	89.8	88.8	87.3	86.5	90.2	88.4
223	09/07/2014 10:47	0	Normal	22.3	88.3	85.5	88.7	88.0	86.6	85.8	89.6	87.5
	average reflectivity before cleaning				**89.1**	**86.2**	**89.4**	**88.6**	**87.1**	**86.3**	**90.2**	88.1
	maximum				89.5	86.6	89.8	89.0	87.4	86.6	90.7	
	minimum				88.3	85.5	88.7	88.0	86.6	85.8	89.6	
	range				1.2	1.1	1.1	1.0	0.8	0.8	1.1	
	averages before calima (18 June))				90.1	87.1	90.3	89.3	87.7	86.9	90.8	
	loss resulting from calima				-0.9	-0.9	-0.8	-0.6	-0.6	-0.6	-0.6	
	differences between maxima				-1.2	-1.1	-1.0	-0.7	-0.7	-0.6	-0.5	
conclusion: these two estimates of loss of reflectivity are simlar in magnitude and trend												

After CO2 and weekend M1, followed by gauge(x1)

224	14/07/2014 13:33	0	M1 r	22.1	90.1	86.1	88.9	87.8	86.4	85.5	88.8	87.7
225	14/07/2014 13:34	0	M1 r	22.3	91.1	87.3	90.3	89.2	88.1	87.3	91.1	89.2
226	14/07/2014 13:35	0	M1 b	22.3	91.6	87.8	90.9	89.7	88.5	87.7	91.6	89.7
227	14/07/2014 13:35	0	M1 b	22.4	91.8	88.0	91.0	89.9	88.7	87.9	91.6	89.8
228	14/07/2014 13:36	0	M1 L	22.6	91.2	87.5	90.5	89.3	88.0	87.2	90.9	89.2
229	14/07/2014 13:36	0	M1 L	22.6	91.2	87.5	90.5	89.2	88.0	87.1	90.9	89.2
230	14/07/2014 13:37	0	M1 t	22.7	89.8	86.5	89.8	88.9	87.8	87.1	90.9	88.7
231	14/07/2014 13:38	0	M1 t	22.8	90.2	86.8	89.8	88.6	87.2	86.4	90.0	88.4
	average refl. after cleaning				**90.9**	**87.2**	**90.2**	**89.1**	**87.8**	**87.0**	**90.7**	89.0
	maximum				91.8	88.0	91.0	89.9	88.7	87.9	91.6	
	minimum				89.8	86.1	88.9	87.8	86.4	85.5	88.8	

	wavelength of band (nm)							avg. 7 bands
	365	404	464	522	624	760	970	
change in averages following cleaning	**1.8**	**1.0**	**0.8**	**0.4**	**0.7**	**0.7**	**0.5**	0.8
change in averages since 18 June	**0.8**	**0.1**	**-0.1**	**-0.2**	**0.1**	**0.1**	**0.0**	0.1
difference in maxima following cleaning	2.3	1.4	1.2	0.9	1.3	1.3	0.9	
difference in maxima since 18 June	1.1	0.3	0.2	0.2	0.6	0.7	0.4	
difference in minima following cleaning	1.5	0.6	0.2	-0.2	-0.2	-0.3	-0.8	

Reference mirror checks before/after											
	24/07/2014 13:22		Gauge	21.6	85.8	82.6	89.7	90.2	88.8	84.4	86.3
232	14/07/2014 13:53	0	Gauge	22.1	85.3	82.5	89.8	90.5	89.0	84.5	86.5
	Change in reference				**0.5**	**0.1**	**-0.1**	**-0.3**	**-0.2**	**-0.1**	**-0.2**

Conclusion: CO2 has recovered the pre-calima reflectivity
However some minima are lower than before cleaning, indicating a patchy result from CO2

Dust Indices before							
	9	6.8	6.8	6.6	6.2	5.7	11.6
	8.8	6.4	6.5	6.5	6.2	5.9	12.5
	8.2	5.8	5.9	6.1	5.8	5.5	12.5
	7.9	5.8	5.8	6.2	5.8	5.4	11.5
	8.3	6	6.1	6.1	5.9	5.6	12
average before	8.44	6.16	6.22	6.3	5.98	5.62	12
Dust indices afterwards	8.6	6.1	6.3	6.2	5.9	5.7	12.1
	8.3	6	5.9	5.3	5.1	4.4	9
	7.7	5.1	4.8	5	4.4	3.8	10.3
	7.4	4.9	4.8	4.8	4.3	3.8	9.7
	8.1	5.6	5.6	5.5	5.2	4.8	10.1
	7.4	5	5	5.3	4.9	4.6	10.6
	8.5	5.8	5.5	5.5	5	4.5	10.7
	7	4.9	5	5	5.2	4.8	9.3
	4.9	3.4	3.3	3.1	3.1	2.4	6.5
average afterwards	7.54	5.2	5.13	5.08	4.79	4.31	9.81
percentage change	**89.4**	**84.4**	**82.5**	**80.6**	**80.1**	**76.7**	**81.6**