

WHT Primary mirror reflectivity report 27th August 2018. Measurements and analysis by Neil O'Mahony.

WHT M1 was cleaned on August 2nd and again on 27th, both immediately following ending of calima dust episodes (ref. TNG monitor).

There were no measurements after the first cleaning on 2 Aug. The visual effect of both cleanings was minimal and M1 still appears quite dusty.

Conclusion: the improvements from the second cleaning were only half as large as those from the first, much less so in scattering in 2 blue bands.

Reflectivity & scattering in the red have been recovered to within 0.5 to 1% of levels of 16 mths ago, but in blue, scattering remains at critical level.

This fact and dusty appearance suggests that water washing of the Primary should be carried out, preferably after the first autumn rainfall occurs.

			Tempr. °C	Reflectivity (%R) wavelength of band (nm)							"Dust Indices" (DI) (scattering %, model dependent).						
				365	404	464	522	624	760	970	365	404	464	522	624	760	970
before cleaning																	
1417	02/08/2018 09:13:31	1 left	21.2	83.6	82.3	81.8	82.0	81.4	78.9	84.4	14.3	14.6	16.1	13.5	15.9	15.2	15.5
1418	02/08/2018 09:14:37	1 left	21.1	84.2	83.0	82.5	82.7	82.0	79.5	85.3	14.3	13.8	15.0	12.5	14.8	14.0	14.1
1419	02/08/2018 09:16:58	1 top	21.1	83.5	82.2	81.8	81.9	81.3	78.8	84.4	15.0	15.3	16.4	13.8	16.3	14.8	15.4
1420	02/08/2018 09:18:00	1 top	21.2	83.7	82.2	81.8	82.0	81.4	78.9	84.5	14.9	14.8	16.0	13.1	15.8	14.2	14.7
1421	02/08/2018 09:19:05	1 right	21.3	85.0	83.4	82.9	82.7	82.3	79.5	84.8	12.3	12.5	14.0	12.0	13.8	13.4	14.2
1422	02/08/2018 09:20:13	1 bottom	21.4	83.3	82.0	81.4	81.9	80.6	78.4	83.4	14.3	14.5	16.4	13.7	17.1	15.8	17.0
averages				83.9	82.5	82.0	82.2	81.5	79.0	84.5	14.2	14.3	15.7	13.1	15.6	14.6	15.2

These are the lowest values seen in 12 months. See graph below. No measurements taken after cleaning.

Immediately before CO2

1433	27/08/2018 10:45:24	1 left	19.9	85.8	84.6	84.3	84.6	83.9	81.8	87.8	13.4	12.9	13.8	11.0	12.7	11.0	11.2
1434	27/08/2018 10:46:35	1 left	19.9	86.6	85.4	85.2	85.4	84.8	82.5	88.6	12.0	11.3	11.8	9.4	10.7	9.3	9.6
1435	27/08/2018 10:47:39	1 top	19.9	85.4	84.1	84.0	84.0	83.7	81.3	87.2	13.9	14.2	14.3	12.3	13.2	11.9	12.3
1436	27/08/2018 10:49:45	1 bottom	20.1	86.0	84.6	84.3	84.6	84.0	81.7	87.7	13.1	13.1	13.9	11.0	12.4	11.2	11.3
1437	27/08/2018 10:50:52	1 right	20.2	86.9	85.6	85.1	85.4	84.6	82.1	88.1	11.4	11.2	11.6	9.4	10.9	9.8	10.1
averages				86.1	84.9	84.6	84.8	84.2	81.9	87.9	12.8	12.5	13.1	10.6	12.0	10.6	10.9
change since CO2, 3 weeks ago				2.3	2.3	2.5	2.6	2.7	2.9	3.4	-1.4	-1.7	-2.6	-2.5	-3.6	-3.9	-4.3

The change is still positive, confirming that CO2 on 2 Aug was effective and has not been undone by calima since then. Blue Dust Index smaller change.

After CO2:

1438	27/08/2018 11:52:57	1 left	22.3	85.9	84.7	84.5	85.1	84.1	82.3	88.1	13.5	13.0	13.7	10.4	12.6	10.3	10.9
1439	27/08/2018 11:54:46	1 left	22.3	86.4	85.1	84.8	85.4	84.4	82.4	88.8	13.0	12.6	13.2	10.2	12.0	10.1	9.7
1440	27/08/2018 11:55:42	1 left	22.4	86.9	85.8	86.0	86.0	85.5	83.5	89.4	13.0	12.1	11.8	9.6	10.5	8.4	9.0
1441	27/08/2018 11:57:39	1 top	22.5	87.1	85.9	85.7	86.1	85.6	83.4	90.0	13.0	12.2	12.5	9.7	10.1	8.4	7.8
1442	27/08/2018 11:58:28	1 top	22.6	87.1	85.9	85.8	86.2	85.7	83.5	89.8	13.1	12.5	12.3	9.7	10.3	8.4	8.0
1443	27/08/2018 11:59:37	1 bottom	22.7	87.8	86.6	86.3	86.8	86.0	83.9	90.2	11.8	10.9	11.1	8.3	9.4	7.5	7.4
1444	27/08/2018 12:00:34	1 bottom	22.8	86.6	85.3	85.3	85.3	85.0	82.6	88.5	12.8	12.1	12.6	10.3	10.9	9.5	9.9
1445	27/08/2018 12:01:37	1 bottom	22.9	88.3	87.4	87.1	87.5	86.9	84.5	90.4	10.7	9.4	9.4	7.3	7.7	6.2	6.7
1446	27/08/2018 12:02:34	1 right	23	85.8	84.2	84.9	84.1	84.5	81.7	87.7	14.1	14.4	14.5	12.4	13.0	11.8	11.5
1447	27/08/2018 12:03:31	1 right	23.1	89.5	88.3	87.9	88.4	87.5	85.3	91.6	8.7	7.9	8.0	5.8	6.6	5.1	4.6
27/08/2018 00:00:00 average				87.1	85.9	85.8	86.1	85.5	83.3	89.5	12.4	11.7	11.9	9.4	10.3	8.6	8.6
Improvement from CO2				1.0	1.1	1.3	1.3	1.3	1.4	1.6	-0.4	-0.8	-1.2	-1.3	-1.7	-2.1	-2.4
std error				0.4	0.4	0.3	0.4	0.3	0.4	0.4	0.5	0.6	0.7	0.6	0.7	0.7	0.7
range				3.7	4.1	3.1	4.3	3.1	3.6	3.9	5.4	6.5	6.5	6.6	6.4	6.7	6.9

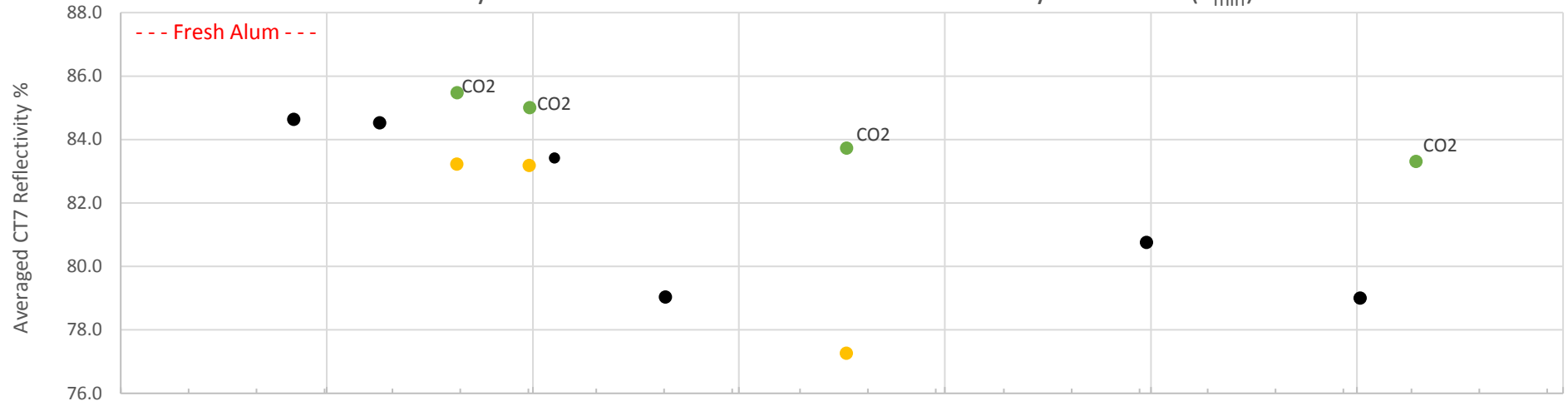
Orange highlight shows such a small improvement that scattering remains close to the critical level (above which reflectivity measurements are inaccurate).

Range remains large indicating patchy nature of staining on mirror, which cannot be improved by CO2.

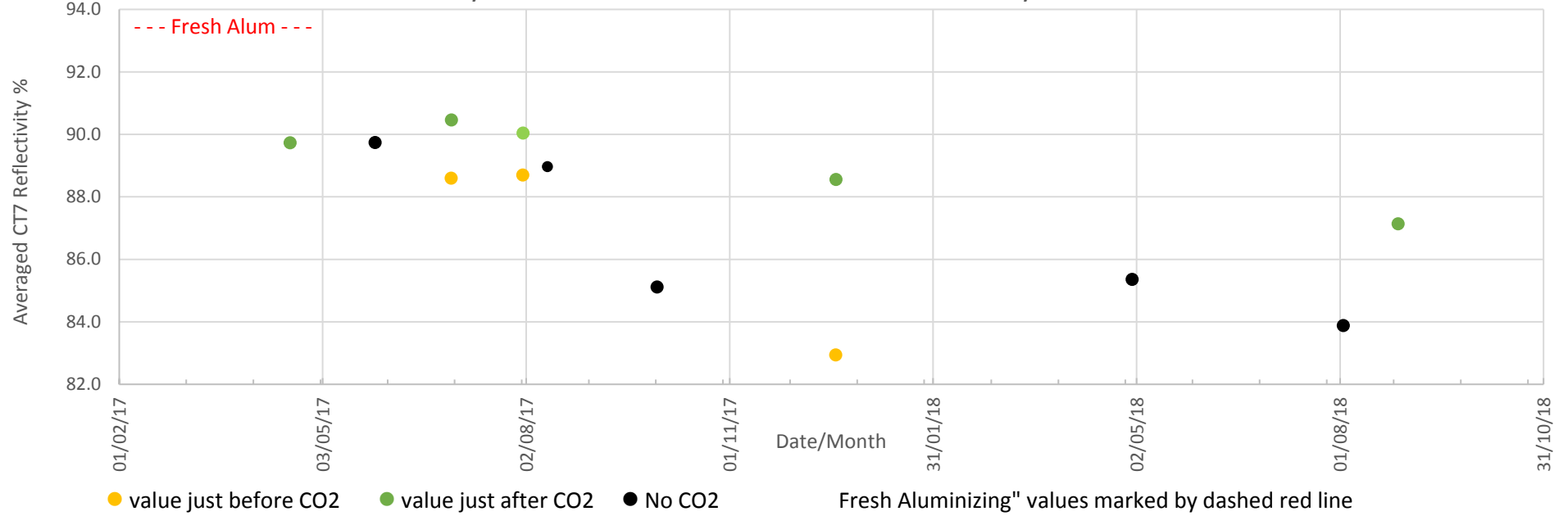
Change since December		-1.4	-1.4	-1.0	-1.0	-0.8	-0.4	-0.3	2.8	2.4	2.1	1.6	1.5	1.0	0.9
31/07/2017 00:00:00	avg 1 year ago	90.0	88.6	88.2	88.4	87.6	85.0	91.0	6.9	6.6	6.9	5.4	6.2	5.3	5.4
Change in 1 year		-2.9	-2.7	-2.4	-2.3	-2.0	-1.7	-1.5	5.5	5.1	5.0	4.0	4.1	3.3	3.2

Graphs overleaf show trend over the past 16 months

WHT Primary mirror: 16 months of variation in reflectivity at 760 nm (λ_{\min})

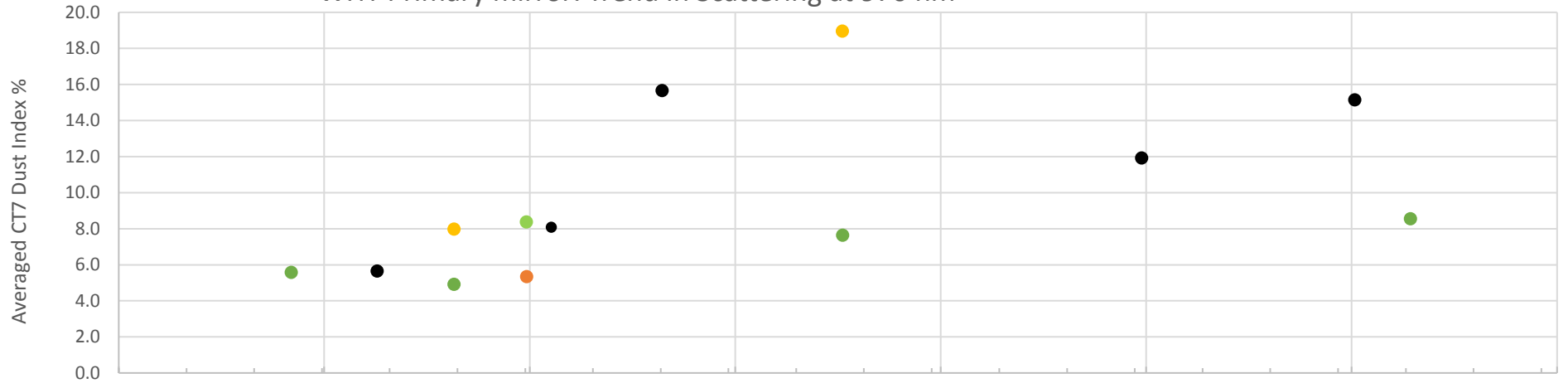


WHT Primary mirror: 16 months of variation in reflectivity at 405 nm

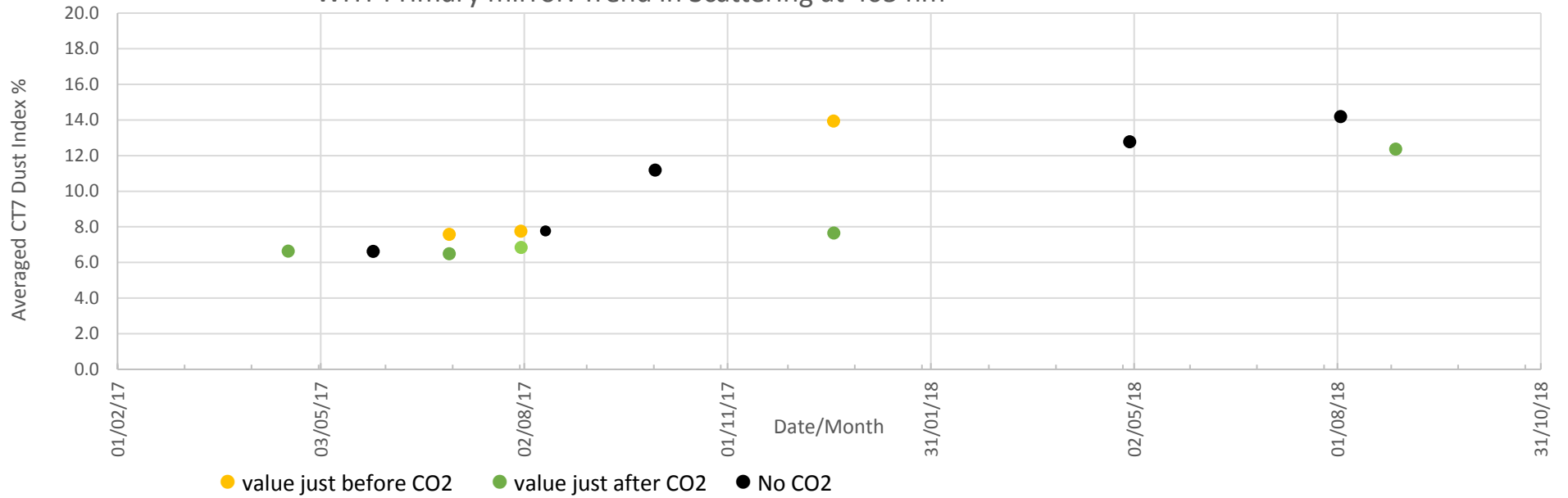


● value just before CO2 ● value just after CO2 ● No CO2 Fresh Aluminizing" values marked by dashed red line

WHT Primary mirror: Trend in Scattering at 970 nm



WHT Primary mirror: Trend in Scattering at 405 nm



Note: graphs show that recovery by CO2 of earlier values is good, but a 3% loss of reflectivity has accumulated in blue. Scattering (Dust Index) starts below 1% after aluminizing. In the blue bands it is no longer being recovered by CO2 cleaning.