

Data Analysis of Reflectance Measurements Performed on the Winston Cones of the CLAS12 Low Threshold Cerenkov Counters

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January 20, 2015

This note presents the results of the analysis of the Low Threshold Cerenkov Counter (LTCC) Winston cone reflectivity data.

The LTCC is part of the CLAS12 detector system in Hall B, consisting of six sectors, U1–U6. Each sector has 36 Winston cones, 1–18, left and right.

Reflectivity of the cones was measured, twice per cone, for wavelengths from 210 nm to 300 nm in 10 nm steps. For each test, the average reflectance over the measured range was computed. If the absolute difference in the reflectance between the two averages was greater than or equal to 0.2, the cone was retested; otherwise the higher average was recorded in the spreadsheet, Table I.

		0 ≤ R < 0.3 = Terrible 0.3 ≤ R < 0.5 = Bad 0.5 ≤ R < 0.7 = So-So 0.7 ≤ R < 0.8 = Good 0.8 ≤ R < 1 = Excellent											
		Sector 1		Sector 2		Sector 3		Sector 4		Sector 5		Sector 6	
		Left	Right	Left	Right	Left	Right	Left	Right	Left	Right	Left	Right
1		0.67	0.30	0.67	0.70	0.56	0.56	0.51	0.81	0.40	0.44	0.72	0.80
2		0.26	0.36	0.62	0.59	0.64	0.63	0.86	0.65	0.37	0.37	0.77	0.38
3		0.70	0.45	0.64	0.65	0.38	GOOD	0.42	0.51	0.33	0.39	0.50	0.47
4		0.33	0.27	0.79	0.76	0.57	0.76	0.75	0.64	0.32	0.81	0.46	0.41
5		0.32	0.27	0.70	0.72	0.71	0.51	0.73	0.69	0.45	0.65	0.89	0.241
6		0.57	0.45	0.69	0.65	0.59	0.61	0.55	0.78	0.33	0.42	0.44	0.57
7		0.31	0.49	0.68	0.65	0.71	0.81	0.75	0.83	0.40	0.41	0.37	0.54
8		0.33	0.46	0.53	0.56	0.76	0.76	0.78	0.74	0.43	0.50	0.52	0.32
9		0.69	0.54	0.47	0.78	0.67	0.75	0.74	0.72	0.45	0.47	0.55	0.47
10		0.33	0.30	0.68	0.71	0.71	0.75	0.68	0.83	0.08	0.39	0.42	0.44
11		0.78	0.59	0.79	0.80	0.77	0.76	0.64	0.74	0.77	0.68	0.77	0.75
12		0.77	0.72	0.56	0.77	0.76	0.71	0.73	0.74	0.60	0.90	0.75	0.80
13		BAD	0.73	0.72	0.69	0.46	0.48	0.72	0.68	0.69	0.75	0.50	0.64
14		0.51	0.59	0.59	0.44	0.43	0.53	0.63	0.46	0.62	0.68	0.44	0.66
15		0.47	0.70	0.49	0.71	0.63	0.48	0.82	0.64	0.65	0.70	0.67	0.42
16		0.72	0.66	0.72	0.77	0.75	0.66	0.71	0.52	0.70	0.70	0.57	0.62
17		0.66	0.74	0.78	0.43	0.59	0.64	0.52	0.71	0.54	0.69	0.19	0.66
18		0.77	0.54	0.78	0.74	0.76	0.63	0.63	0.66	0.69	0.55	0.69	0.59

TABLE I. Average reflectivity of Winston cones, color-coded for acceptability.

To easily identify cones with a reflectance less than ~60% that needed to be returned to Evaporated Coatings Inc. for re-coating, spreadsheet cells were conditionally-formatted so that when a value was entered, the cell background became a particular color, based on the range in which the value belonged.

Data from both tests were plotted together for comparison of the reflectance from the two tests, as shown in Fig. 1 for U18L.

Re-coated cones were tested, and the data analyzed. Fig. 2 shows the plot of the results of the two tests performed on the re-coated cone U18L. The plot indicates that U18L has an acceptable reflectance, greater than 80%, with a measurement error of ~5%.

For each set of two tests done, before and after re-coating,

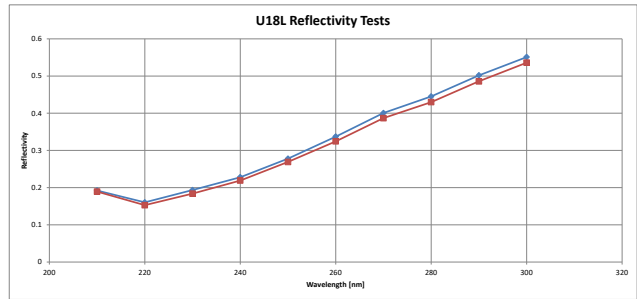


FIG. 1. Reflectivity test results for Winston cone U18L.

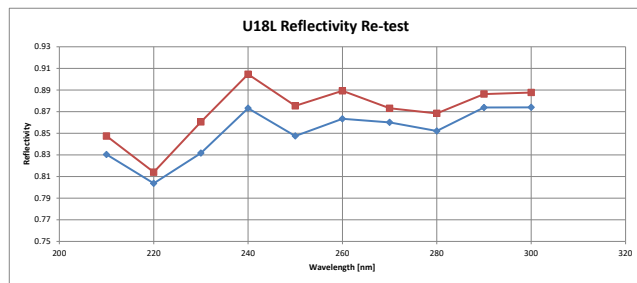


FIG. 2. Reflectivity results for the re-test of U18L.

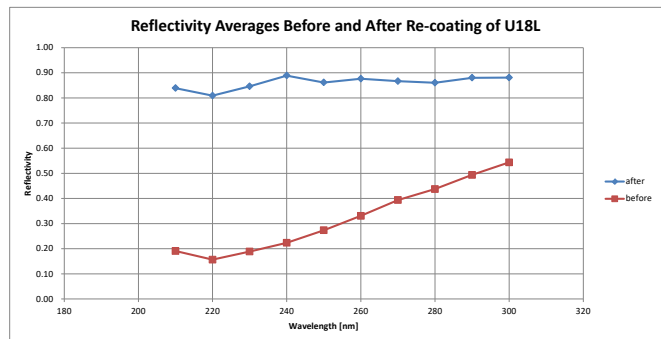


FIG. 3. Comparison of the reflectivity averages before and after re-coating of U18L.

average reflectance was calculated for each measured point and plotted, Fig. 3. The average reflectivity of the re-coated cone has improved—better than 80%.

In all, 216 Winston cones were tested and their data analyzed. Based on the analysis of the reflectivity tests, Winston cones with unacceptable reflectance were identified and returned for re-coating to Evaporated Coating Inc. Analysis of the data from re-coated cones shows an improvement of the reflectance after re-coating.