GRINCH Mirror Alignment/Acceptance Test

Bradley Yale

January 11, 2021

1 Introduction

While the cylindrical mirrors of the GRINCH had been previously aligned and tested to direct light into the PMT array, the alignment had not been checked for several years (as of November 2020). This note describes how this test was performed, and an angular acceptance vs. window position was obtained.

2 Angular Acceptance

In order to ensure that the GRINCH mirrors are aligned and able to direct light within the PMT acceptance, a laser was mounted onto an aluminum frame, and installed just inside the GRINCH's entrance window.

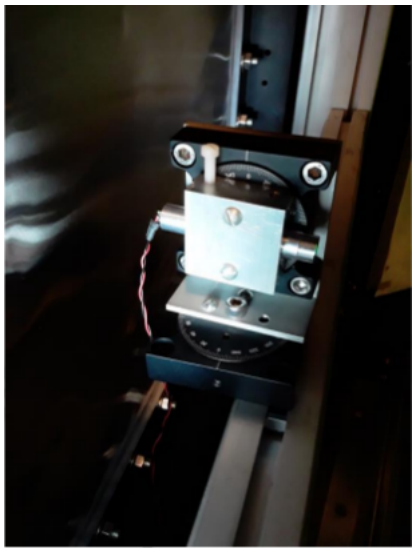

Figure 1: The laser used to make angular acceptance measurements on the aluminum frame placed inside the GRINCH.

For 13 different heights, and 3 different horizontal positions at the center and both ends of the frame, the maximum and minimum angles at the edge of the PMT array were measured such that the laser was seen at the four boundaries.

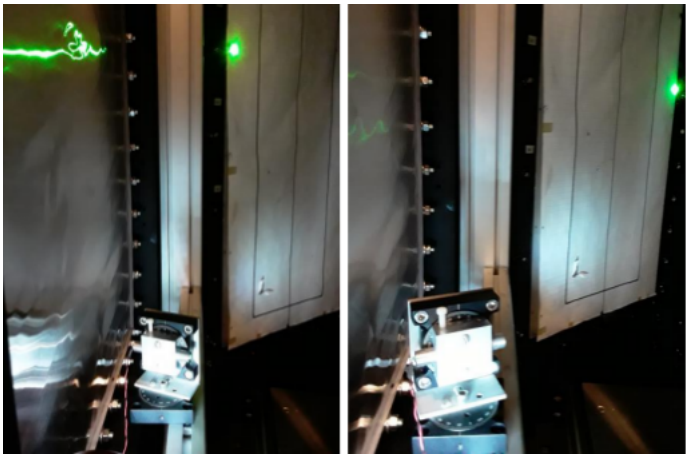

Figure 2: Horizontal PMT boundary measurements.

Figure 3: Vertical PMT boundary measurements.

Figures 4 and 5 show the results of the measurements, where the horizontal axis is the horizontal or vertical distance from the center of the entrance window, and the vertical axis is the measured angle. Overlain on these plots is the maximum acceptance region obtained from GEANT4 simulation [1]. The positions have been corrected to account for the 11cm distance between the window and the laser (figure 6).

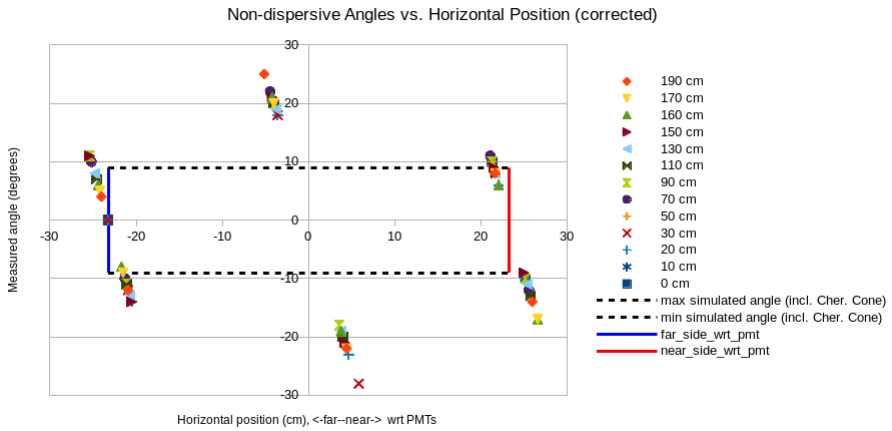

Figure 4: The results of the horizontal PMT boundary measurements.

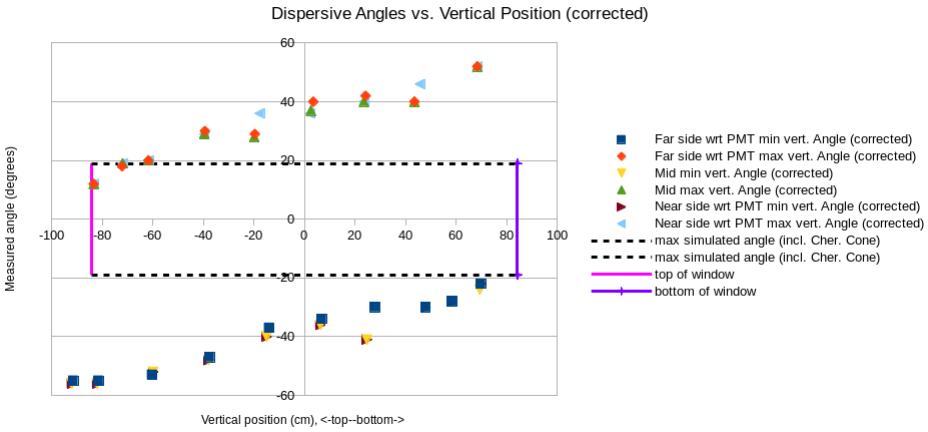

Figure 5: The results of the vertical PMT boundary measurements.

3 Conclusion

From the preceding plots, the entire PMT region that was measured fully encompasses the simulated region of acceptance, even when accounting for an additional 3 degrees for the Cherenkov cone. The mirrors, as currently installed and aligned within the GRINCH interior, should therefore be capable of directing all Cherenkov radiation seen by simulated acceptance into the PMT array for detection.