

Magnetic Shielding Tests for MicroBooNE Photomultiplier Tubes in a Cryogenic Environment: First Results and Future Plans

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The MicroBooNE detector, a liquid argon time projection chamber (LArTPC) positioned in the Booster Neutrino Beam (BNB) line at Fermilab, tracks charged particles produced by interactions of those neutrinos and uses large (eight-inch diameter) photomultiplier tubes (PMTs) to detect liquid argon scintillation light. Magnetic fields, even those as small as those from the Earth, can adversely affect the performance of these tubes. The location of the PMTs inside the liquid argon cryostat poses the additional challenge of shielding within a cryogenic environment. This presentation discusses procedures developed and carried out using a cryogenic test stand at Fermilab. Results from these tests demonstrate the effectiveness of shields manufactured from a cryogenic magnetic material in greatly reducing the impact of geomagnetic fields on PMT operation. Further tests to complete this study will also be discussed.

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Summary

Geomagnetic fields can degrade the performance of unshielded large diameter PMTs, and shielding tubes at cryogenic temperatures has not been extensively done. Our data show that the shields we employ work at both room and liquid nitrogen temperatures; consistency and other follow-up tests are planned for summer 2012.

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