Contribution ID: **264** Type: **Poster**

Cosmic Background Rejection with Wire-Cell LArTPC Event Reconstruction in MicroBooNE

For a surface Liquid Argon Time Projection Chamber (LArTPC) to detect neutrino interactions, the rejection of the cosmic background is challenging and critical. We introduce a superior cosmic background rejection procedure applied in MicroBooNE based on the Wire-Cell 3D event reconstruction techniques. The foundational reconstruction techniques include the 3D imaging and clustering of the TPC activity, reconstruction of the PMT light signal, and the many-to-many matching of the TPC clusters and PMT flashes. Based on the selected in-beam TPC activity, a 3D trajectory fitting and dQ/dx determination are applied to identify various cosmic-ray backgrounds using additional geometrical and topological information. This method is able to select 3D images of largely intact high-purity neutrino activity with high-efficiency.
These techniques mark an important milestone towards realizing the full capability of single-phase LArTPCs to reconstruct neutrino interactions.

Mini-abstract

A superior cosmic background rejection in MicroBooNE using Wire-Cell 3D event reconstruction

Experiment/Collaboration

MicroBooNE

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Session Classification: Poster session 4