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Demonstrating MeV-Scale Physics Capabilities of Large Neutrino LArTPCs with Ambient Blip Activity in MicroBooNE

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Current and future large neutrino liquid argon time projection chamber (LArTPC) experiments can broaden their physics reach by incorporating isolated MeV-scale features present in their data. In this study, we use data from the MicroBooNE detector, an 85 tonnes LArTPC exposed to Fermilab neutrino beams from 2015 until 2021, to demonstrate new calorimetric and particle discrimination capabilities for isolated ~O(1 MeV) energy depositions referred to as "blips." We observe a concentration of blips near fiberglass mechanical support struts along the TPC edge, with an energy spectrum indicative of specific gamma-ray decay lines. These and other blip sources are being used to validate the energy-scale calibration in MicroBooNE's data leveraging specific spectral features from the detector's MeV-scale sources. This work further reports on the progress towards demonstrating the ability of large LArTPCs to distinguish between low-energy proton and electron energy depositions above 3 MeV in electron-equivalent reconstructed energy using cosmogenic-produced activity. Furthermore, The composition of proton-like blips selected using this new technique is being studied to evaluate the accuracy of the cosmic ray flux model commonly used in LArTPCs.

Working Group

WG 6: Detectors

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