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Measurements of MeV-Scale Radon Progeny in the MicroBooNE LArTPC

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DUNE's ability to detect and study astrophysical neutrinos will critically depend on the capability of liquid argon time projection chambers (LArTPCs) to reconstruct particle interactions that deposit extremely small amounts of energy in the active LAr. MicroBooNE has demonstrated reconstruction capabilities for energy depositions at the ~MeV and sub-MeV scale, which manifest as isolated "blips" on the TPC wire planes spanning only a few readout channels. Using R&D data where MicroBooNE's LAr was doped with radon, new software tools were used to identify the beta and alpha decay products of progeny isotopes bismuth-214 and polonium-214. Measuring the rate of these correlated decays under different filtration configurations revealed that liquid-phase electronegative filters effectively mitigate radon contamination. Further studies using novel background subtraction techniques produced calorimetric energy spectra of these decay products, showcasing sensitivity down to ~100 keV in electron-equivalent energy. These tools were then applied to standard data-taking conditions to set a radiopurity limit for ambient bismuth-214, the first of its kind for a large single-phase liquid-filtered LArTPC.

Working Group

WG 6: Detectors

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