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Testing the Supernova Pointing Resolution of DUNE with ICEBERG

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The Deep Underground Neutrino Experiment (DUNE), a 40 kt fiducial mass liquid argon time projection chamber (LArTPC), will be unique among supernova (SN) neutrino detectors due to its ability to measure the electron neutrino flavor component of a SN burst. Crucial to achieving a good pointing resolution is the ability to discriminate the directionality of primary electron tracks via a process known as daughter flipping. The daughter flipping algorithm takes the vertex of an electron track and determines whether this vertex is the "head" or "tail" of the track via the angle between it and daughter particles produced, such as ionization tracks from bremsstrahlung gammas. Studies are ongoing to understand DUNE's SN pointing ability with daughter flipping, however, the daughter flipping reconstruction algorithms have only been used on simulated data. The ICEBERG detector, a small ~1-ton LArTPC located at Fermi National Accelerator Laboratory, is equipped with the DUNE DAQ system and thus permits the testing of reconstruction algorithms on data. Due to their similar energy scale compared to SN neutrinos, Michel electrons can be used as a proxy to study the reconstruction algorithms of SN neutrino produced electrons. Therefore, Michel electrons will be simulated in the ICEBERG detector along with detector responses to produce selection criteria for Michel candidates in the ICEBERG data. Once Michel electron candidates are identified, the daughter flipping algorithm can be applied to the data to test its performance. A data driven noise model will also be developed in ICEBERG, permitting testing of the daughter flipping algorithm as a function of noise. By characterizing the daughter flipping algorithm through data, DUNE's SN pointing performance can be better understood. This poster will describe the concept and current status of this study.

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