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Fast Neutron Measurements at the Booster Neutron Beamline for Future Coherent Elastic Neutrino-Nucleus Scattering (CENNS) Experiment at Fermilab

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Low energy neutrinos (E < 50 MeV) have a predicted, but unobserved, coherent elastic scattering channel on nuclei. Coherent neutrino scattering has important physics reach for supernovae, standard model tests, and nuclear physics. The CENNS collaboration will deploy a liquid argon detector in a far off-axis configuration at the Booster Neutrino Beam (BNB) in order to produce a flux of low-energy neutrinos from decay-at-rest pions. A major concern for the first measurement of CENNS is beam-correlated fluxes of neutrinos that give the same signal as coherently scattered neutrinos. To understand these fluxes, the Indiana-built SciBath detector was deployed to measure fast neutron fluxes 20 m from the BNB target in the MI-12 target building. The SciBath detector is a novel 80 liter liquid scintillator detector read out by a three dimensional grid of 768 wavelength-shifting fibers. The fiber readout allows SciBath to measure neutral particle fluxes by tracking the recoiling charged particles with uniform efficiency in all directions. In this talk, I describe the SciBath detector and summarize our measurement of the flux of 10 to 200 MeV neutrons at the BNB. I will also highlight additional neutron measurements that are planned for this Fall at the BNB with the SciBath detector with a new prototype shielding configuration.

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