Development of Calibration System for NuDot: Demonstrating Cherenkov/Scintillation Separation in Large Liquid Scintillators

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As neutrinoless double-beta decay searches seek to reach into and beyond the inverted hierarchy regime, new strategies are needed to reject background events in kiloton-scale detectors. In monolithic liquid-scintillator-based detectors, otherwise-irreducible backgrounds like B solar neutrino scattering could be identified by their event topology using Cherenkov light signals. NuDot is a half-ton prototype that aims to demonstrate this technique with 1 to 2 MeV beta particles, using precision timing to distinguish the Cherenkov and scintillation signals. Following a successful demonstration of the separation technique in the FlatDot test-stand, the NuDot detector was built at Bates Research and Engineering Center. Preliminary results from the commissioning phase of the experiment will be shown. In the coming months, we will continue to conduct surface measurements demonstrating direction reconstruction of calibration source beta events. Following this phase of operation, NuDot will undergo upgrades and continue in an additional surface operation phase at Triangle Universities Nuclear Laboratory, followed by an underground measurement of two-neutrino double-beta decay with direction reconstruction.