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Capabilities of the DUNE Near Detector Complex

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Summary

Among the Deep Underground Neutrino Experiment's main goals are the precise measurement of neutrino oscillation parameters using a beam consisting primarily of ν_μ or $\bar{\nu}_\mu$ but with contamination from wrong-sign and wrong-flavor neutrinos. The uncertainties on the flux predictions and the interaction cross sections are large and they will require experimental constraints in order for the DUNE experiment to have maximal sensitivity. Furthermore, biases in the energy scale of the DUNE far detector are sensitive to cross sections, especially for neutron production, that are currently poorly understood. The proposed detectors at the Fermilab near site are described – the pixel liquid-argon time projection chamber, a magnetized high-pressure gaseous argon time projection chamber with an integrated electromagnetic calorimeter, and a 3D scintillator-tracker. Each of these three detectors provides unique capabilities necessary to constrain the flux and cross section uncertainties necessary to make precise oscillation measurements.

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