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DUNE-PRISM: Removing neutrino interaction model dependence with a movable neutrino detector

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The Deep Underground Neutrino Experiment (DUNE) is a next-generation long-baseline neutrino oscillation experiment designed to make precision measurements in the world's most powerful neutrino beam. Neutrinos are measured at two detector facilities: a near detector located at Fermilab close to where the beam is produced and a far detector at SURF. A key component of the near detector is the Precision Reaction Independent Spectrum Measurement (PRISM) system, which allows for the measurement of different neutrino energy spectra by moving the detector away from the central axis of the neutrino beam. These off-axis neutrino energy spectra provide a new degree of freedom that can be used to develop a deeper understanding of the relationship between the observable energy deposits in the detector and the energy of the interacting neutrino. This can benefit DUNE in significantly reducing the impact of systematic uncertainties in the neutrino interaction model, which has historically been the largest source of systematic uncertainty in long-baseline neutrino oscillation experiments. One possible use of the PRISM system is to perform a novel neutrino oscillation analysis that linearly combines off-axis neutrino energy spectra at the near detector to produce data-driven predictions of the far detector energy spectrum. This presentation will explain the role of the PRISM system in the DUNE physics program and demonstrate its utility to DUNE.

Working Group

WG 1: Neutrino Oscillation Physics

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