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Status of the Measurement of the Elastic and Quasi-elastic Scattering of Protons on Carbon Nuclei in EMPHATIC

In long-baseline neutrino oscillation experiments, Monte Carlo (MC) simulations based on hadron interactions and decays are used to predict the neutrino flux. The 10%-level systematic uncertainty of the predicted neutrino fluxes from these simulations is dominated by uncertainties in hadron interaction cross sections due to limited hadron scattering data. EMPHATIC aims to reduce the neutrino flux uncertainty by providing additional data. Using a table-top-sized spectrometer located at the Fermilab Test Beam Facility (FTBF), its physics program includes precise measurements of hadron scattering and production cross sections at various beam momenta and target species that are relevant for GeV-scale neutrino production. Using simulation, we have developed a simple single-track reconstruction algorithm that has a momentum resolution of 3-4%. We will demonstrate the progress in developing one of EMPHATIC's first track reconstruction algorithms – an important step in making a new single-track forward scattering measurement ($p + C \longrightarrow p + C$ at several beam momenta) using Phase 1 data collected between 2022 and 2023.

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