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Emulsion-based Measurement of the Production of Hadrons At a Test beam in Chicagoland [EMPHATIC] (G)

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Hadronic interaction uncertainty is a shared systematic uncertainty between many neutrino experiments. The reduction of this uncertainty would mean a furthering of the physics goals for these experiments. Hadronic interactions from the T2K and NuMI beamline can be separated into primary and secondary interactions. Primary hadronic interactions occur when high energy protons interact with a graphite target, producing hadrons that will then decay into neutrinos. Secondary interactions occur when the hadrons produced re-interact inside the target or surrounding material. Hadronic interaction uncertainty is reduced by existing hadron production experiments (NA61/SHINE, HARP, and MIPP), however these measurements are dominated by an uncertainty in the proton interaction length. To reduce this uncertainty an accurate measurement of the quasi-elastic and elastic scattering cross sections for 120GeV/c and 30GeV/c protons on carbon is required. Secondary pions of the order of 10GeV/c and lower also contribute to the hadronic interaction uncertainty. A previous hadron emulsion experiment (HARP) has taken data below the 10GeV/c limit, however a more accurate measurement is needed. The EMPHATIC group has taken data using the Fermilab test beam on carbon, aluminum, and steel targets for hadrons ranging from 2GeV/c to 120GeV/c. By using emulsion and silicon strip detectors an accurate measurement of both the vertex and scattering angle is obtainable, as well as significantly reducing the detection material. In addition, two upstream gas Cherenkov detectors and three downstream aerogel detectors are used for particle identification. A silicon telescope, consisting of silicon strips and pixel detectors, is used for timing information and additional tracking surrounds the emulsion target. A moving table was constructed to increment the emulsion target position for each spill to maintain a track density of 104 particles per cm2. Preliminary results from these measurements will be presented.

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