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Cross-section Measurements with the NOvA ND

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Merged the following:

The observation of neutrino oscillation provides evidence of physics beyond the standard model, and the precise measurement of those oscillations remains an important goal for the field of particle physics. NOvA will soon be one of the foremost experiments in that field. Taking advantage of a tightly focused off-axis view of the NuMI neutrino beam, and a finely instrumented liquid scintillator detector, NOvA has an excellent opportunity to make high precision measurements of neutrino interactions using its Near Detector. This presentation will explain how the design of the NOvA experiment enables a wide program of neutrino interactions research, describe the broad range of cross section and final state interactions which we are able to measure, and show early results from the NOvA Near Detector.

The NOvA experiment is a long-baseline neutrino oscillation experiment designed to measure the rate of electron neutrinos appearance in a muon neutrino beam. It consists of two finely segmented, liquid scintillator detectors at 14 mrad off-axis in the NuMI beam. The NOvA Near Detector, located at Fermilab, provides an excellent opportunity to study neutrino-nucleus interactions which are important for neutrino oscillation measurements. This presentation will present one of the first such measurements from NOvA: neutrino-induced coherent-$\pi 0$ production. Neutrinos can coherently interact with the target nucleus via neutral current exchange and produce a single, forward $\pi 0$, which makes background to the νe appearance measurement. The analysis measures the coherent-$\pi 0$ kinematics and cross-section and compares to model predictions, and also provides a data constraint on $\pi 0$ production in the neutral current resonance and deep-inelastic interaction.

NOvA is a long-baseline neutrino oscillation experiment optimized to observe $\nu\mu \rightarrow \nu e$ transition in the 97% pure muon-neutrino NuMI beam originating at Fermilab. It consists of two functionally identical, nearly fully-active liquid-scintillator tracking calorimeters. The Near Detector at Fermilab is located 1 km from the NuMI beam target and is used to measure the neutrino energy spectrum before standard oscillations occur. Due to its proximity to the neutrino source, the detector records neutrino interactions with high statistics. The off-axis location of the detector results in a beam neutrino energy peak close to 2 GeV, an energy regime of particular interest to neutrino cross section modeling and future neutrino oscillation experiments. In this talk, I will present the measurement of the muon-neutrino charged current inclusive cross section using the first two years of the NOvA Near Detector data.

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