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Measuring muon antineutrino charged-current interactions without mesons in the final state, in the NOvA Near Detector

NOvA is a long-baseline neutrino experiment based at Fermilab in the US, with the primary aim of measuring neutrino and antineutrino oscillations. This will enhance our understanding of electroweak interactions by measuring the neutrino mixing angles, CP-violating phase and neutrino mass ordering. To measure these oscillations, we first need to have a deep understanding of how neutrinos and antineutrinos interact with matter. Antineutrino interaction cross sections are, at present, particularly poorly constrained, and processes such as meson exchange currents are not well understood in the antineutrino sector.

This analysis will develop a cross-section measurement of muon antineutrino interactions without mesons (e.g. pions or kaons) in the final state, in the NOvA near detector. A high-statistics, high-purity sample is obtained through a cut-based selection process implementing machine learning techniques. The sample is dominated by quasi-elastic and meson exchange current interactions which are sensitive to nuclear effects such as final-state interactions. The cross section will be extracted as a function of the incoming neutrino energy and the kinematics of the outgoing particles.

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