Semi Inclusive Neutral Current Neutral Pion Production Selection At The NOVA (Numi Off-Axis Electron Neutrino Appearance) Near Detector Using Prong Level Convolutional Neural Networks

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The NOvA neutrino experiment based in Fermilab is designed to measure $\nu_\mu \rightarrow \nu_e$ neutrino oscillations. Neutral current (NC) muon neutrino events (events where there is no outgoing charged lepton) can mimic the muon neutrino to electron neutrino oscillation signal and therefore are an important background for NOvA to understand. Neutral pions decay into two photons which can fake a single electron shower (electron neutrino appearance signal) in two ways: either the 2 gamma’s can merge together or one of them may escape detection. In order to constrain this background, NOVA utilizes the Near Detector to measure neutral current $\pi^0$ neutrino interactions. In this analysis, neutrino-Nucleus (muon neutrinos to Nucleus) NC $\pi^0$ interactions with total pion energy greater than 0.3 GeV are studied by selecting 2 prong events with a final state $\pi^0$ as determined by prong based CVN (Convolutional Visual Networks). The analysis is performed on 3.54 x 10^21 POT (Protons On Target) of NOvA Near Detector data. Optimization of the selection based on fractional cross section uncertainty and energy resolution of the final sample are presented.