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P3.034 Reconstruction of low momentum protons with Fine-Grained Detector of the T2K experiment

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At the T2K energies (~ 1 GeV) the dominant process are charged-current neutrino interactions with no pion in the final state (CC0 π). Lowering the detection threshold for nucleon (proton) detection will improve the current CC0 π studies in the T2K Near Detector ND280 through: i) increasing the efficiency for CCQE signatures, ii) making it possible to study signatures of multi-nucleon interactions (n π h) with more than one proton leaving the nucleus, iii) increasing the efficiency for the study of final state interactions. It is worth pointing out that multinucleon injection leads to an important systematic error in the oscillation analysis which should be reduced to improve the accuracy for future analysis. Track-based reconstruction algorithms currently used allow us to reconstruct protons only if their momentum is above ~ 450 MeV/c. This poster will show a study based on the information related to the energy deposited around the neutrino interaction vertex, the so-called vertex activity. It will be demonstrated that based on vertex activity information, it is possible to detect a signature of low momentum protons down to 100 MeV when the proton is accompanied by a reconstructed muon track (a sample dominated by CCQE interactions). Vertex activity allows us to search for low momentum protons in the sample which already contains two reconstructed tracks: muon and proton. An attempt to find the second proton, with too low momentum to be reconstructed as a track, will be discussed. This is of interest in the light of the search for signatures of multinucleon interactions.