Title:	Neutron measurements from antineutrino hydrocarbon reactions
Authors:	Fiza, N. (/jspui/browse?type=author&value=Fiza%2C+N.) Jena, Satyajit (/jspui/browse?type=author&value=Jena%2C+Satyajit)
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Abstract:	Charged-current antineutrino interactions on a hydrocarbon scintillator in the MINERvA detector are used to study activity from their final-state neutrons. To ensure that most of the neutrons are from the primary interaction, rather than hadronic reinteractions in the detector, the sample is limited to momentum transfers below 0.8 GeV / c . From 16 129 interactions, 15 246 neutral particle candidates are observed. The reference simulation predicts 64% of these candidates are due to neutrons from the antineutrino interaction directly but also overpredicts the number of candidates by 15% overall. This discrepancy is beyond the standard uncertainty estimates for models of neutrino interactions and neutron propagation in the detector. We explore these two aspects of the models using the measured distributions for energy deposition, time of flight, position, and speed. We also use multiplicity distributions to evaluate the presence of a two-nucleon knockout process. These results provide critical new information toward a complete description of the hadronic final state of neutrino interactions, which is vital to neutrino oscillation experiments.
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