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| Title: | Use of neutrino scattering events with low hadronic recoil to inform neutrino flux and detector energy scale |
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| Abstract: | Charged-current neutrino interactions with low hadronic recoil ("low-ν") have a cross-section that is approximately constant versus neutrino energy. These interactions have been used to measure the shape of neutrino fluxes as a function of neutrino energy at accelerator-based neutrino experiments such as CCFR, NuTeV, MINOS and MINERvA. In this paper, we demonstrate that low-ν events can be used to measure parameters of neutrino flux and detector models and that utilization of event distributions over the upstream detector face can discriminate among parameters that affect the neutrino flux model. From fitting a large sample of low-ν events obtained by exposing MINERvA to the NuMI medium-energy beam, we find that the best-fit flux parameters are within their a priori uncertainties, but the energy scale of muons reconstructed in the MINOS detector is shifted by 3.6% (or 1.8 times the a priori uncertainty on that parameter). These fit results are now used in all MINERvA cross-section measurements, and this technique can be applied by other experiments operating at MINERvA energies, such as DUNE. |
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