

Investigating the NuMI beam focusing uncertainties for ν_μ flux at MINER ν A

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Abstract

MINER ν A is an experiment at Fermilab dedicated to investigate the nature of neutrino interactions with matter. It has already made novel and important measurements and is making significant progress towards achieving its physics goals. However, the uncertainties in neutrino flux at the detectors are larger than desired. The NuMI beam produces pions from 120 GeV protons. These pions are focused, and hence, when they decay as neutrinos, there is a wealth of neutrinos traveling towards MINER ν A and the other experiments set up along the beam. The systematic uncertainties in the NuMI flux arise due to a number of factors involved in creating the intense beam. By generating Monte Carlo data using a simulation program, G4NuMI, for various focusing parameters, one is able to study the effect of these parameters on the predicted neutrino flux at the detector. From this, one can ascertain the beam focusing uncertainties in neutrino flux. I investigate uncertainties in muon neutrino flux at MINER ν A, producing a plot of fractional uncertainty as a function of neutrino energy for several such focusing parameters related to the focusing of the beam.