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Perspectives for measuring NuMI neutrino-Ar cross-section @ ICARUS and cosmic background constraints in the muon neutrino inclusive selection

Content

Nowadays, experimental neutrino physics is going through an exciting moment due to the high-precision measurements, in huge detectors, expected from experiments to come, e.g. DUNE. At Fermilab in Chicago, Illinois there is a Short-Baseline Neutrino program (SBN) searching for sterile neutrino signatures. This program consists of three detectors that use the liquid argon time projection chamber technology (LAr TPC) positioned along the axis of the Booster Neutrino Beam (BNB). ICARUS is the far detector of the SBN program and has a broader wealth of physics, for example beyond standard model searches and cross-section measurements. ICARUS, in particular, is situated off-axis of the NuMI beam and will be sensitive to a large amount of muon and electron neutrinos interactions, from the order of a few hundred MeV to multi-GeV (an energy range close to the one we expect in DUNE). This will allow us to perform measurements of the neutrino-LAr cross-section and perform tests of models in the range of a few GeV of energy. Last summer 2022 ICARUS entered its data acquisition phase, thus having its first physics data run for one month during June 2022. Currently, ICARUS is collecting data from a second physics data run and is expected to stop the acquisition in early July of this year due to a shutdown scheduled to make some component updates. As part of the efforts to measure cross-section, we have studied the muon neutrino charge current inclusive channel, where we have focused on studying muons coming from muon neutrino interaction without putting any constraints on the hadronic system and try to distinguish these muons from the ones that come from cosmic interactions, which are our principal background. This work will discuss the status of these studies and will highlight the cosmic background rejection.

Summary

Primary author(s) :   MORENO GRANADOS, Guadalupe (Cinvestav)

Presenter(s) :   MORENO GRANADOS, Guadalupe (Cinvestav)