Study of Nuclear Effects in ν_μ-CC Interactions in Resonance Region Using the NOMAD Data

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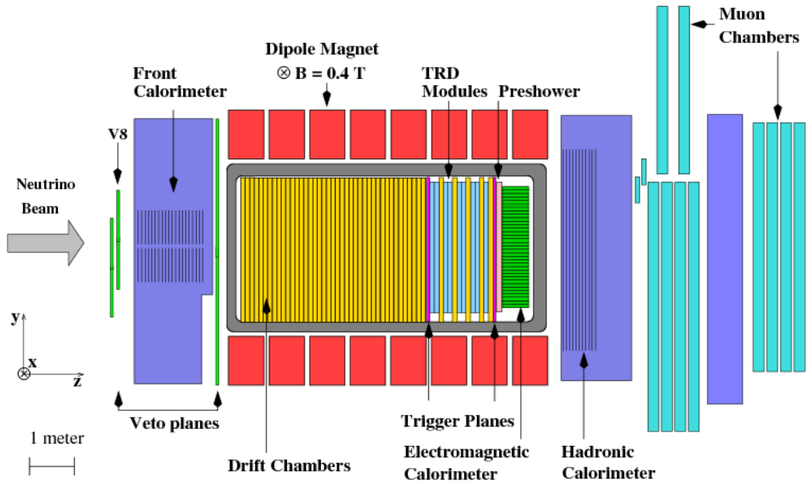
1. Introduction

- ν_μ-CC in the resonance region (W < 2.0 GeV) is the dominant channel for neutrino oscillation experiments at few-GeV energy region, including DUNE.
- Final state hadrons from resonance are sensitive to nuclear effects, which alters the final state topology and affect neutrino energy reconstruction.
- Resonance interactions and nuclear effects need to be understood correctly for correct neutrino energy reconstruction.
- Oscillation probability is measured as function of neutrino energy!

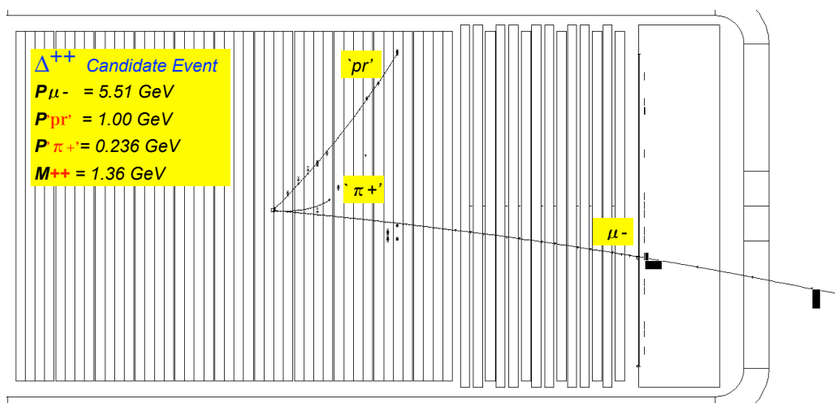
2. The NOMAD Detector

The **N**eutrino **O**scillation **MA**gnetic **D**etector (NOMAD, WA-96), was designed to search for numu to nutau oscillation in the CERN SPS wide band neutrino beam (2.5 GeV ~ 300 GeV)

- 2.7 ton
- 0.4 T dipole magnetic field.
- Mostly carbon target.
- Low-density, low-threshold.
- High precision data.
- ~2M neutrino events.



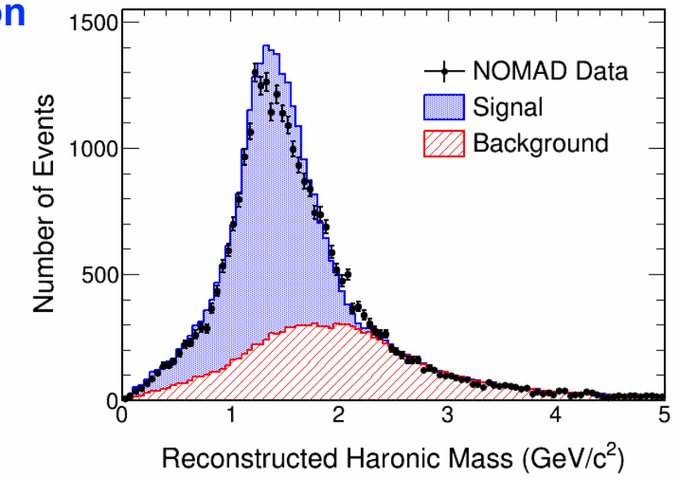
3. Event Topology



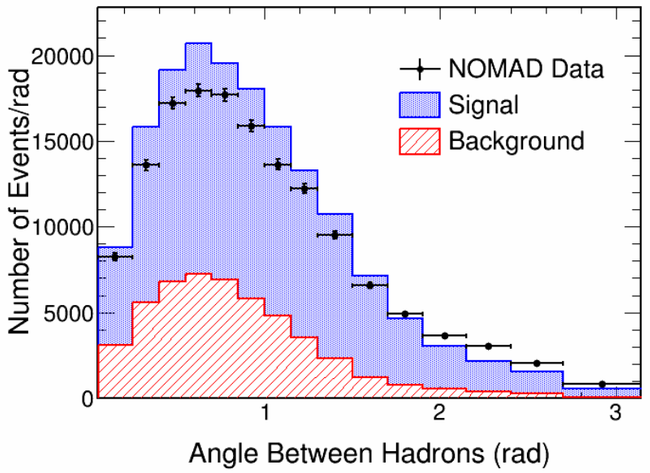
- Looking for events with one reconstructed muon and two positive hadrons (proton, pi+).
- The correlations between the hadrons and transverse variables (missing pT and so on) give constraint of nuclear effects.

4. Background Normalization

- Focusing on the resonance region (W<2.0 GeV)
- W>2.0 background is normalized by the sideband (reconstructed W>2.2 GeV)
- Simulation reproduces sideband shape well.
- Some discrepancy in signal region is observed.



5. Work in Progress



- Aming to report total cross-section as function of neutrino energy, as well as flux-averaged differential cross-section as function of muon and hadron kinematics.
- Differential cross-section of angle between hadrons and transverse variables which are sensitive to nuclear effects.

Some data excess is observed at large hadron-hadron angles, provide hints of nuclear effects producing back-to-back hadrons

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