Neutral Pion Interactions in MicroBooNE
Aya Labnine, Binghamton University - SIST Program | Meghna Bhattacharya, Fermilab

MicroBooNE Experiment

The analysis conducted in MicroBooNE will aid experiments, like DUNE, that sit in other energy ranges.

Fig. 1: Liquid Argon Time Projection Chamber (LArTPC) has a cathode and anode plane to create an electric field in the liquid argon. Ionized electrons are generated when charged particles pass through the LAr volume of the detector.

Fig. 2: MicroBooNE sits in the quasi-elastic and resonance region for neutrino interactions, overlapping with DUNE’s lower energy area.

Fig. 3: These Feynman diagrams explain the different kinds of neutrino interaction and the particles found in the final stage.

Types of Neutrino-Nucleus Interactions

Two types of interactions are produced in the fiducial volume; Charged Current Events (CC) and Neutral Current Events (NC).

**CC Signal:** $\nu_e + Ar \rightarrow e^- + 1 \pi^0 + 0 \pi^\pm + X$ (nucleons)

**NC Signal:** $\nu + Ar \rightarrow 1 \pi^0 + 0 \pi^\pm + X$

Cosmic Background

**Original Cut-off:**

Topological Score > 0.1

**New Cut-off:**

Topological Score > 0.15

Fig. 6: The Topological Score variable classifies events as either neutrino-like event (1) or cosmic-like event (0).

Neutral Current Event Selection

• The neutral current signal definition will include events with no proton track
• Improvement in the purity through a new cut on the topological score
• The method of finding the start of the $\pi^0$ decay will be extrapolation

Next Steps: Calculate the CC/NC ratio for the MicroBooNE experiment

Reconstructing the Vertex for NC Events

Fig. 9: To reconstruct the vertex, the shower’s 3D positions are used to construct unique lines.

Conclusion

• The neutral current signal definition will include events with no proton track
• Improvement in the purity through a new cut on the topological score
• The method of finding the start of the $\pi^0$ decay will be extrapolation

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