

# **Muon-neutrino charged-current cross sections from MicroBooNE: first simultaneous measurements of final states with and without protons for Muon-neutrino scattering on argon**

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A detailed understanding of muon neutrino charged-current interactions on argon is crucial to the study of neutrino oscillations in current and future experiments using liquid argon time projection chambers. To help fill this need, MicroBooNE has produced a comprehensive set of cross section measurements which simultaneously probe the leptonic and hadronic systems by dividing the inclusive channel into final states with and without protons. Data-driven model validation utilizing the conditional constraint formalism is employed to detect mismodeling that may bias the nominal flux averaged cross section results, which are extracted with the Wiener-SVD unfolding method. The results are compared to widely used event generator predictions revealing significant mismodeling of final states without protons, possibly due to insufficient treatment of final state interactions. These are first differential muon neutrino-argon cross section measurements made simultaneously for final states with and without protons, and provide novel information that will help stimulate the improvement of event generator modeling.

## **Working Group**

WG 2: Neutrino Scattering Physics

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