Modeling of GeV Neutrino-Argon Interactions with No Pions in the Short-Baseline Neutrino Program

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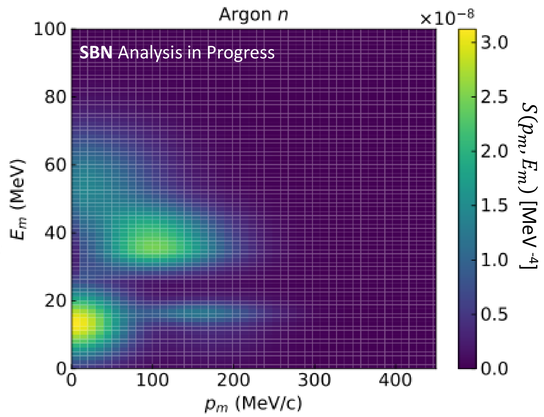
Introduction

The multi-detector search for short-baseline oscillations in SBN puts stringent requirements on the interaction model to simultaneously constrain near and far detector data.

We have developed a new neutrino interaction systematic model to underlie SBN analyses. Some of the new developments are highlighted here.

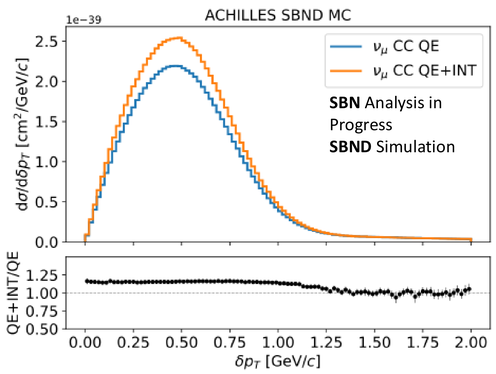
Spectral Function

A measurement of the argon spectral function at J-Lab[1,2] provides a model of the nucleus ground state in its full detail.

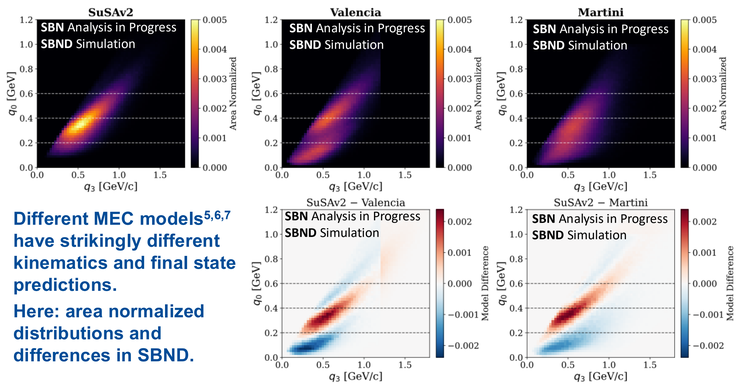


Quasi-Elastic Interference

New theoretical results[3] indicate the impact of one-particle two-particle interference in neutrino interactions.



Meson Exchange Current Model Spread



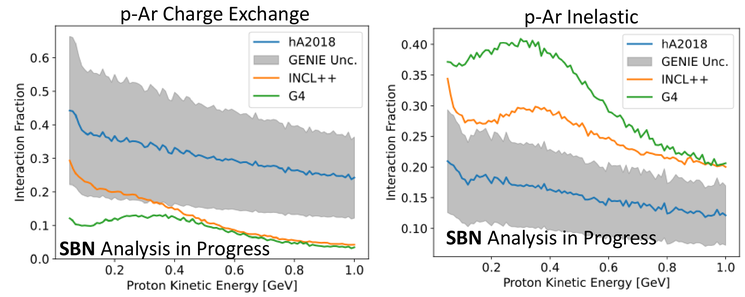
Different MEC models[5,6,7] have strikingly different kinematics and final state predictions.

Here: area normalized distributions and differences in SBND.

Effects in neutrino-nucleus interactions driving systematic uncertainty.

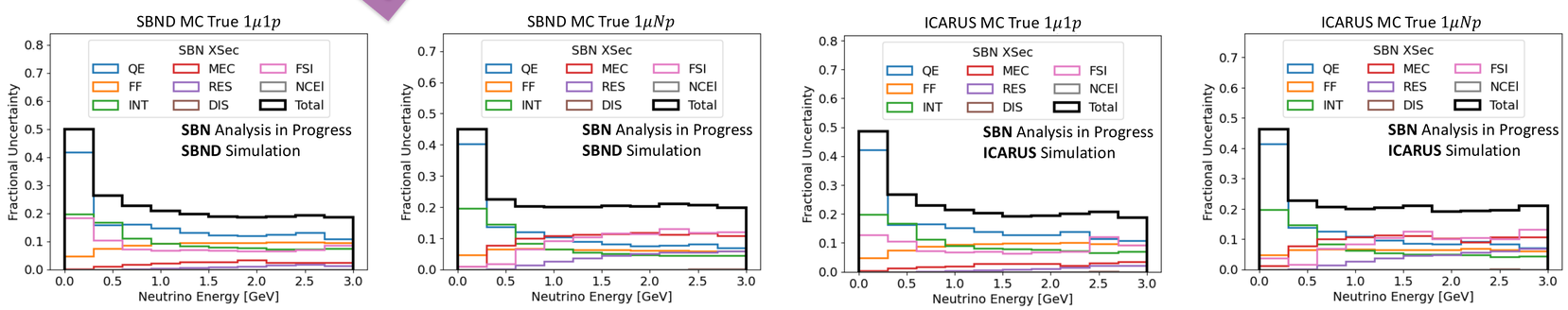
Final State Interaction (FSI) Model Spread

A model comparison study of nucleon-argon exclusive interaction rates informs the corresponding uncertainty on FSI in neutrino interactions.



Spread of model predictions for nucleon-argon scattering exclusive final states, mapped onto GENIE FSI modes[4].

Impact on SBN



Impact of systematic uncertainties on SBND+ICARUS event distribution priors for SBND+ICARUS $1\mu 1p$ and $1\mu N(\geq 1)p$ final states.

References:

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