

RECONSTRUCTING NEUTRINO INTERACTIONS

A NEAR-DETECTOR FITTER'S PERSPECTIVE

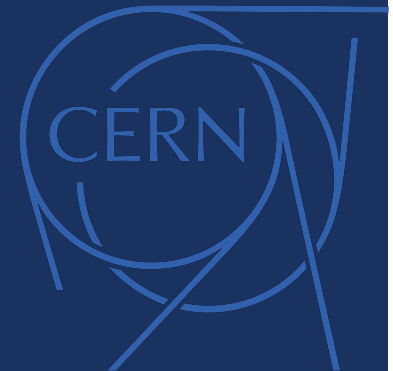
Neutrino–Nucleus Interactions in the
Standard Model and Beyond
Online Workshop
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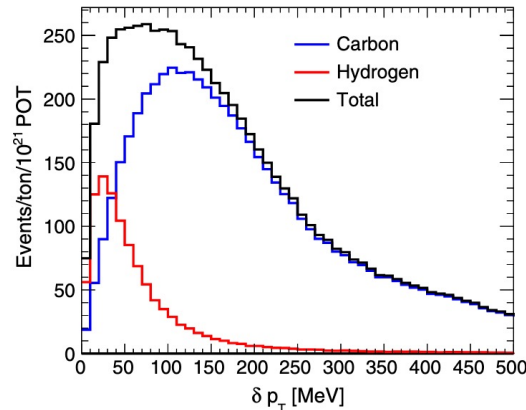
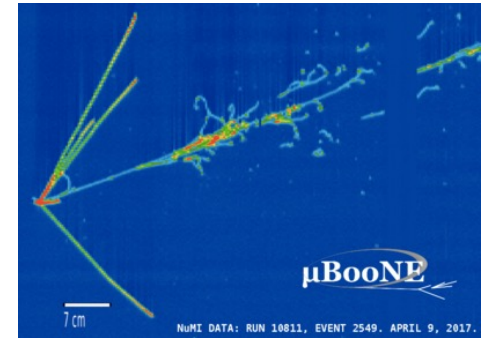
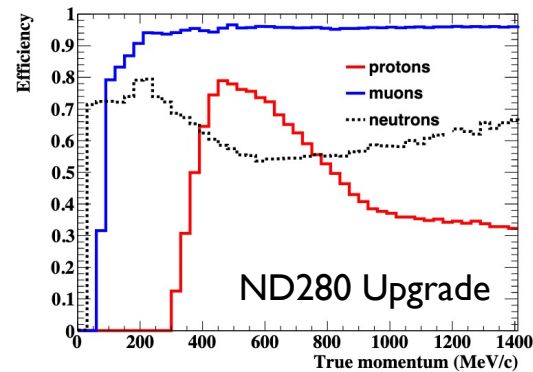
Challenges in reconstructing neutrino interactions for
oscillation analyses

- T2K Near Detector Analyzer
- Co-convenor of ND280 Upgrade Physics and Performance Working Group



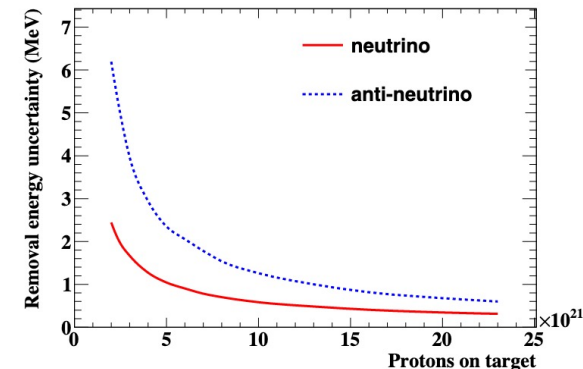
A BETTER PICTURE OF THE FINAL STATE

- Future (near) detectors will offer improved particle detection capabilities
 - Reduced thresholds for protons and pions
 - Improved acceptance for muons/electrons
- Exclusive final state reconstruction
 - Improved systematic error constraints
 - But also require new/improved models
- What we need to cope with this
 - Models offering exclusive predictions (SF, RI CRPA etc...)
 - A deeper understanding of the low Q^2 region
 - How do protons/neutrons undergo FSI?
 - How to correlate predictions for different targets (C, Ar, O)
 - Beyond factorization approach – currently adding FSI after the interaction



We can reconstruct neutrons!

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BEYOND CCQE: PIONS

- Pions are beginning to play an increasingly important role in oscillation analyses
 - Final state interactions affect topology/kinematic reconstruction (T2K/HK, DUNE)
 - Adding pion samples increases statistics and gives better handle on interaction systematics (e.g. 1π samples T2K/HK)
- Simplistic nuclear ground state models used in pion interactions
 - How do we model nucleon removal energy in resonant interactions?
 - How do pions undergo FSI and what is the effect on observables?
 - More sophisticated models (MK, etc...) and probing the multi- π /DIS transition region

