

Measurement of the Electron Neutrino Charged Current Inclusive Cross Section on Argon in MicroBooNE

[based on [arXiv:2101.04228](https://arxiv.org/abs/2101.04228)]

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Importance of the ν_e -Ar cross section

- Measurements of electron neutrinos (ν_e) appearing in a muon neutrino beam is the cornerstone of current and future based oscillation experiments

Measurements

- Only one other measurement made using argon as a target
 - ArgoNeuT [Phys. Rev. D 102,011101\(R\) \(2020\)](#)
 - Sample of 13 selected events
- Only a handful of measurements on other nuclei in the hundred MeV to GeV range
 - Gargamelle [Nuclear Physics B 133, 205 – 219 \(1978\)](#)
 - T2K [Phys. Rev. Lett. 113, 241803 \(2014\)](#)
 - MINER ν A [Phys. Rev. Lett. 116, 081802 \(2016\)](#)
- Current MicroBooNE result



[arXiv:2101.04228](#)

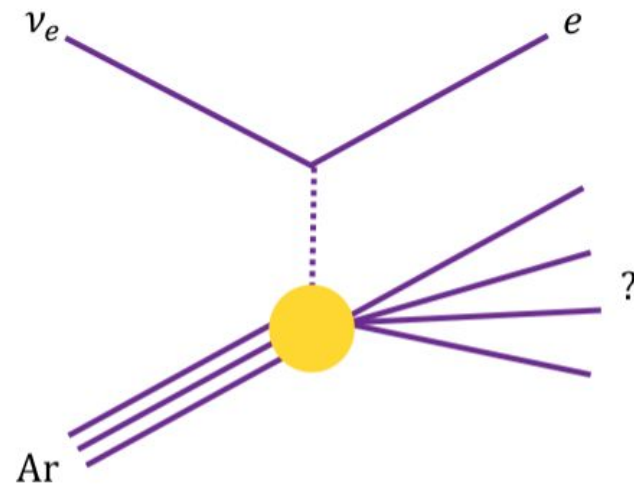
Important for physics programs

- Short baseline neutrino program (SBN)
 - Shed light on existence of sterile neutrinos
[arXiv:1503.01520 \[physics.ins-det\]](#)
- Appearance channel in long baseline experiments
 - CP Violation
[arXiv:2002.03005 \[hep-ex\]](#)



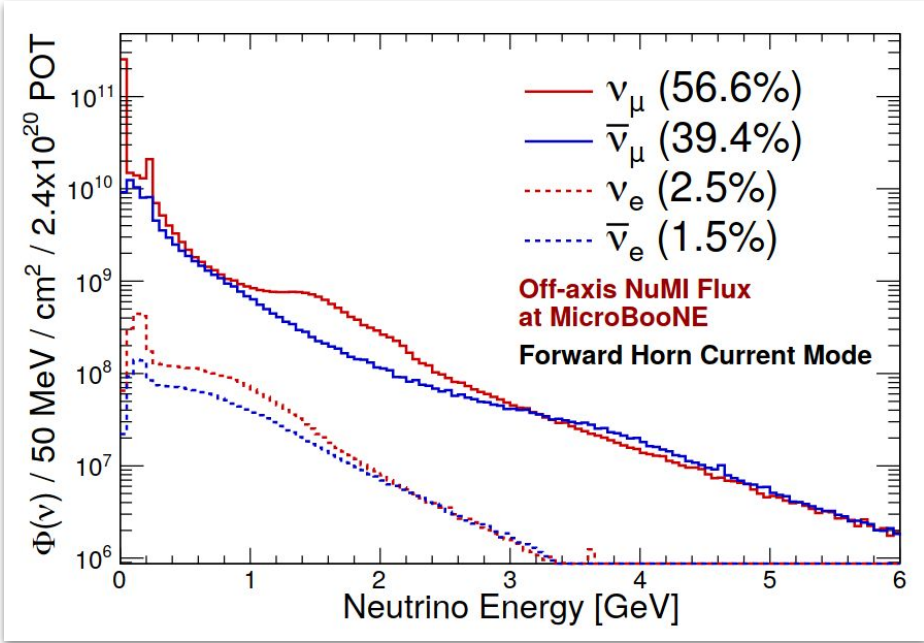
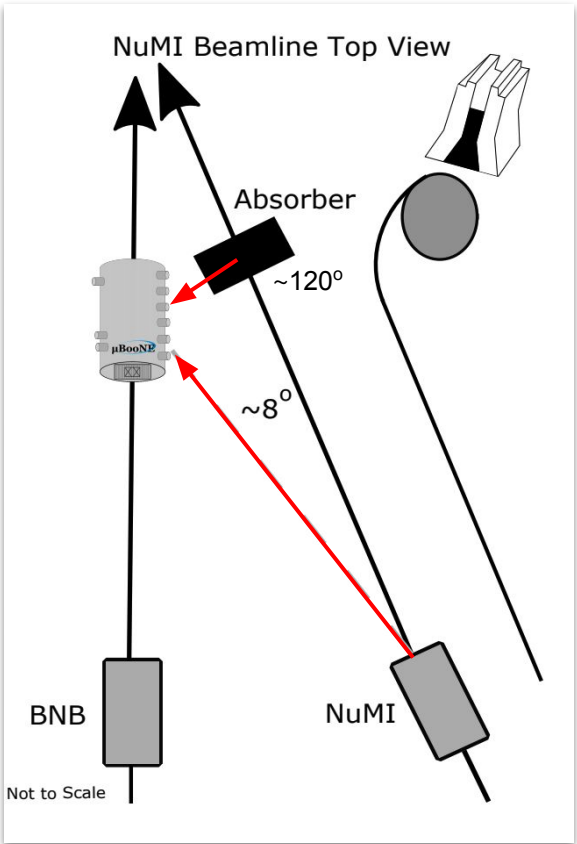
What are we measuring?

- Total $\nu_e + \bar{\nu}_e$ inclusive cross section using data from the off-axis NuMI beam
- Signature:
 - At least one electron-like shower
 - No requirements on the presence (or absence) or any additional particle
 - Include all $\nu_e + \bar{\nu}_e$ topologies
 - Do not differentiate between ν_e and $\bar{\nu}_e$
- Flux averaged measurement
 - Average $\nu_e + \bar{\nu}_e$ neutrino flux energy of 905 MeV integrating from 250 MeV



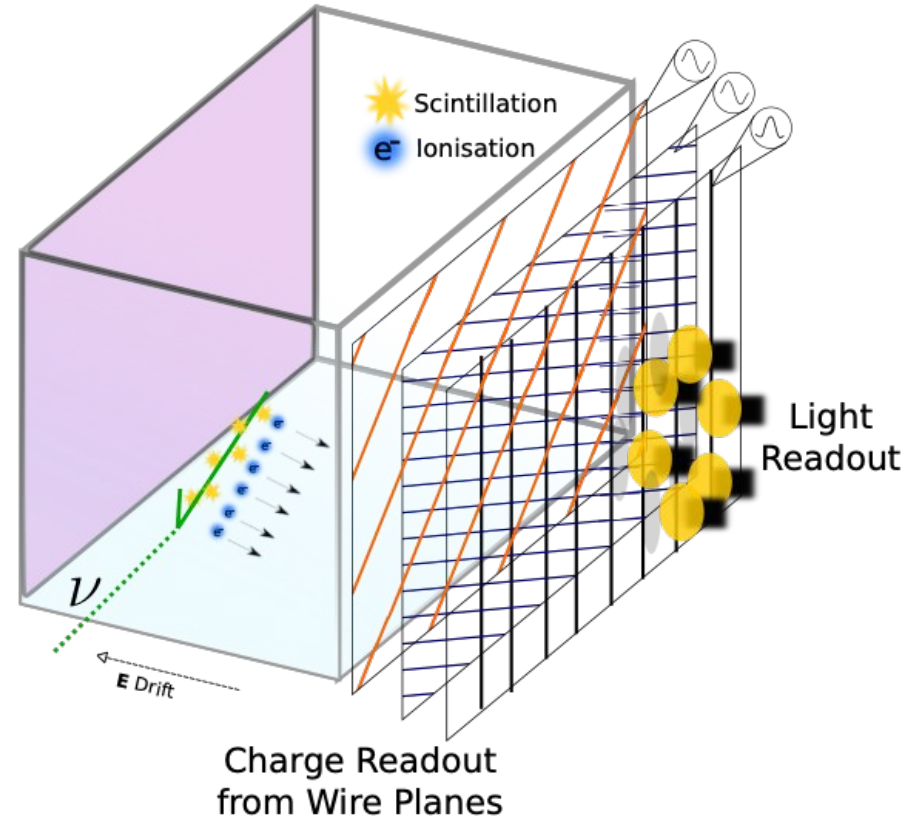
Inclusive channel is the most straightforward channel to compare to predictions

The NuMI Beamline



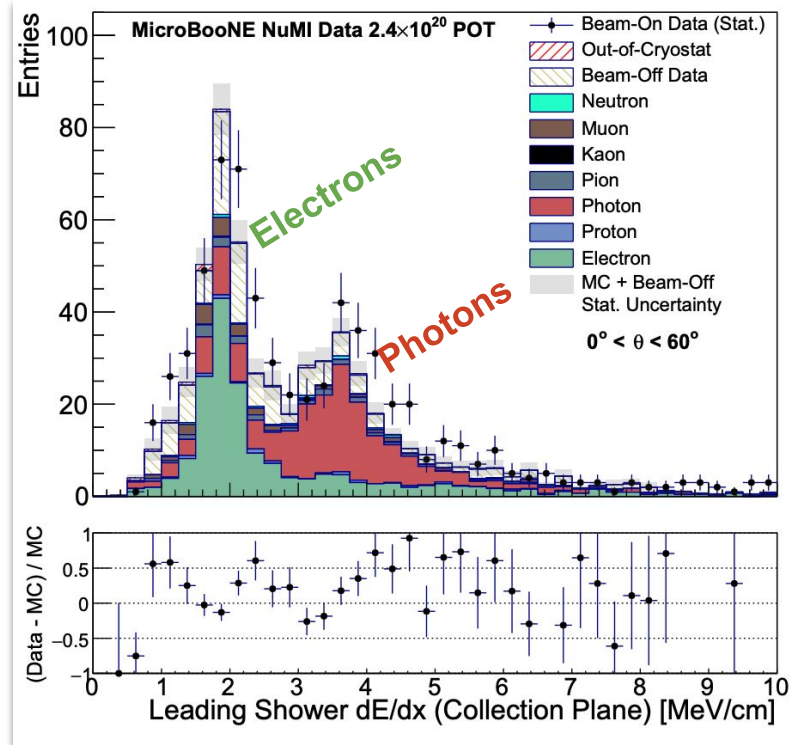
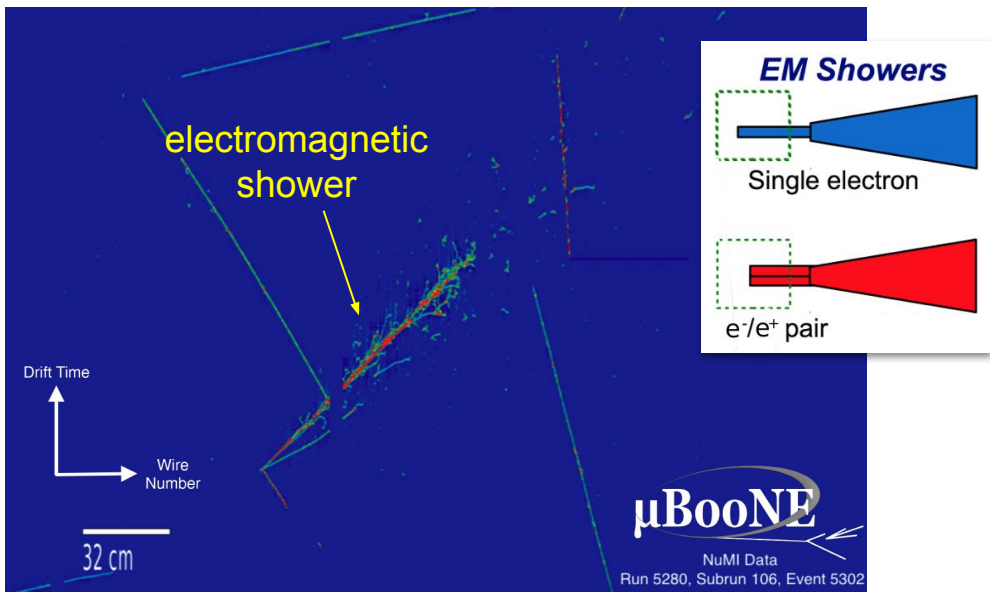
MicroBooNE

- Liquid Argon Time Projection Chamber (LArTPC) based at Fermilab
- A neutrino interaction generates charge and light that are read out by wire planes and a PMT system
 - Time and position of the interaction
- Advantages of LArTPC
 - Very precise calorimetry
 - Topology down to mm precision



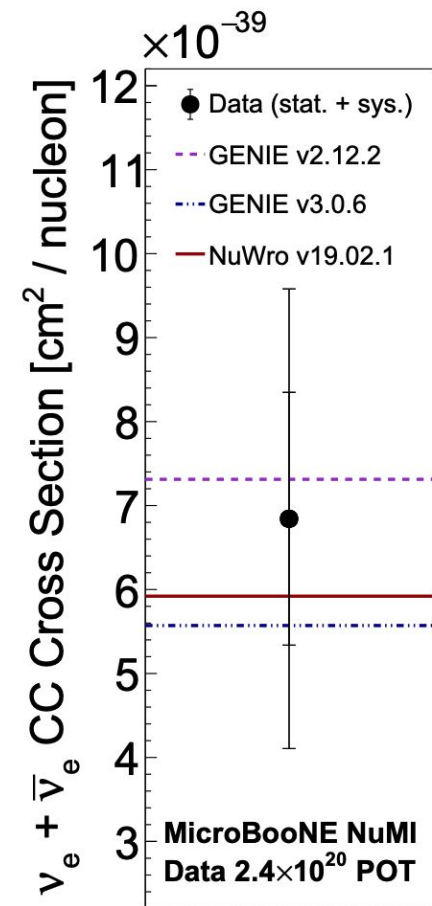
Electron-Photon Separation

Able to demonstrate the first fully automated discrimination of electron and photon induced showers in a LArTPC



Cross Section Measurement

- First $\nu_e + \bar{\nu}_e$ measurement using NuMI beam from MicroBooNE
 - 214 selected events in 2.4×10^{20} protons on target (POT)
 - 6.84 ± 1.51 (stat) ± 2.33 (sys) $\times 10^{-39}$ cm²/nucleon
- Final selection purity of 39% and efficiency of 9%
 - Cosmic rays form the largest part of the backgrounds, abated in the next iteration
- Cross section is in agreement with different generators
- Next generation of analyses in progress using improvements to simulation
 - Reduce uncertainties, improved purity and efficiency
 - Differential cross section in variables such as the outgoing lepton energy will be coming soon!



Check out **Krishan's talk** for recent results in MicroBooNE!

Thanks for Listening!

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