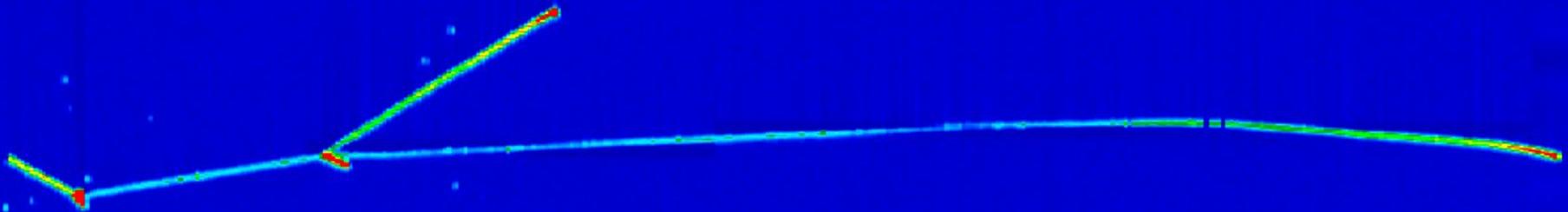




MicroBooNE in 10 Minutes: Progress thus far



Jessica Esquivel, Syracuse University
On behalf of the MicroBooNE Collaboration

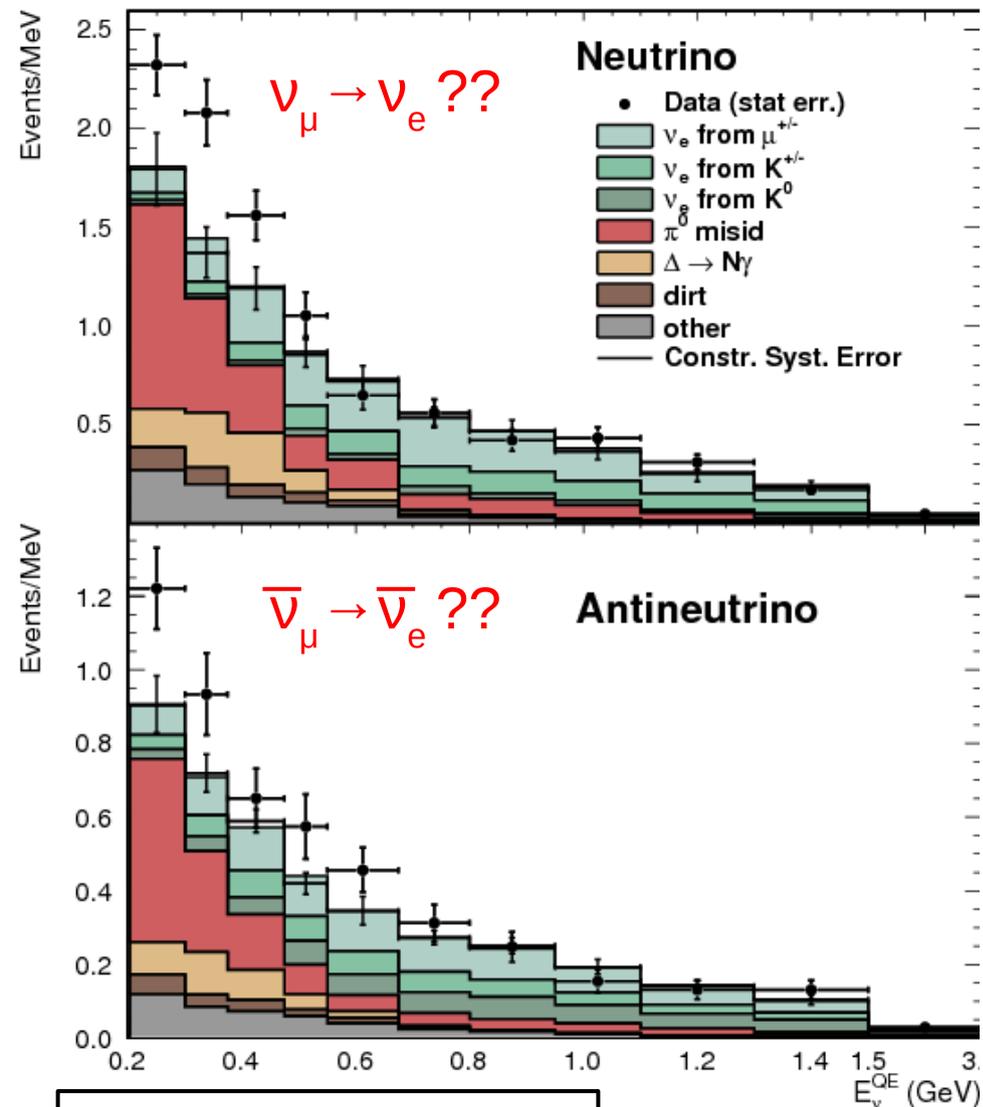
New Perspectives 2017

Outline



- Neutrino Oscillation
- MicroBooNE Goals
- LArTPC Technology
- MicroBooNE overview
- e/γ separation
- Cross section overview
- Detector physics and R&D overview

MicroBooNE's Purpose

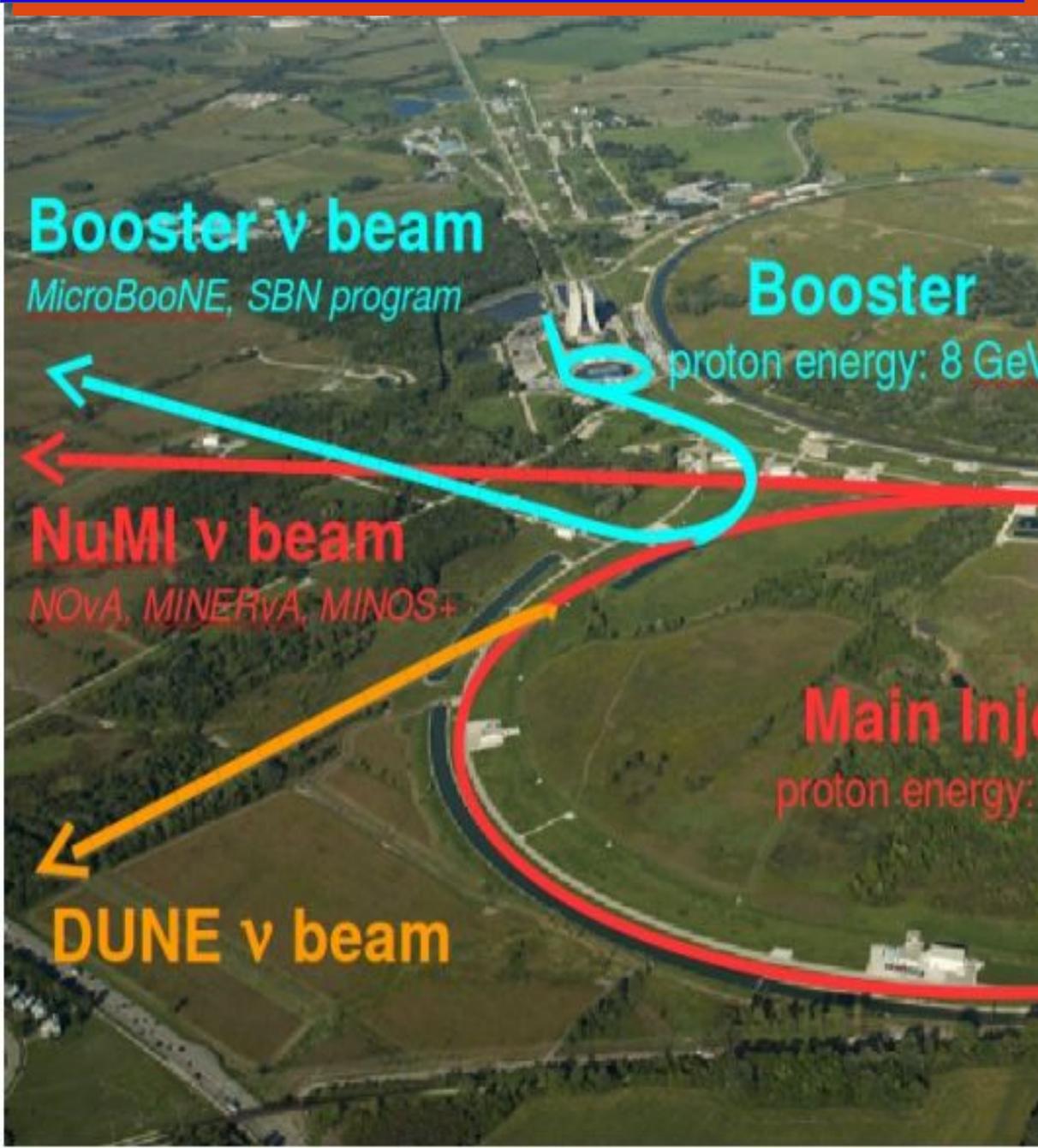


PRL110 (2013) 161801

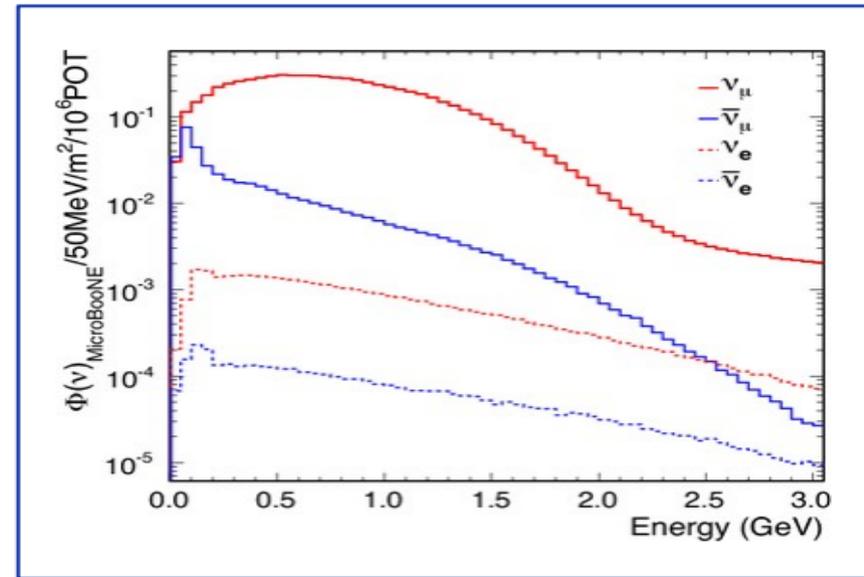
- Study MiniBooNE's Low Energy Excess
 - Mineral Oil Cherenkov detector can't separate e/ γ
- Gain a cross section measurement ~ 1 GeV range
- LArTPC R&D and Detector Physics

FNAL Neutrinos

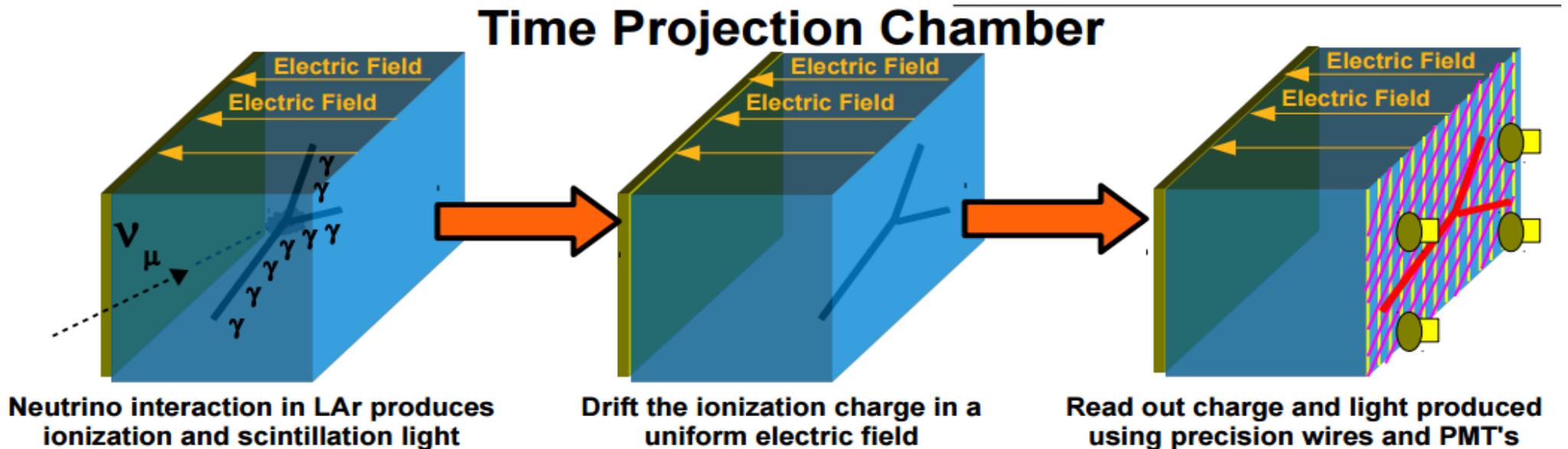
 **MicroBooNE**



BNB Neutrino Flux [simulation]



The MicroBooNE Detector: How LArTPC Works

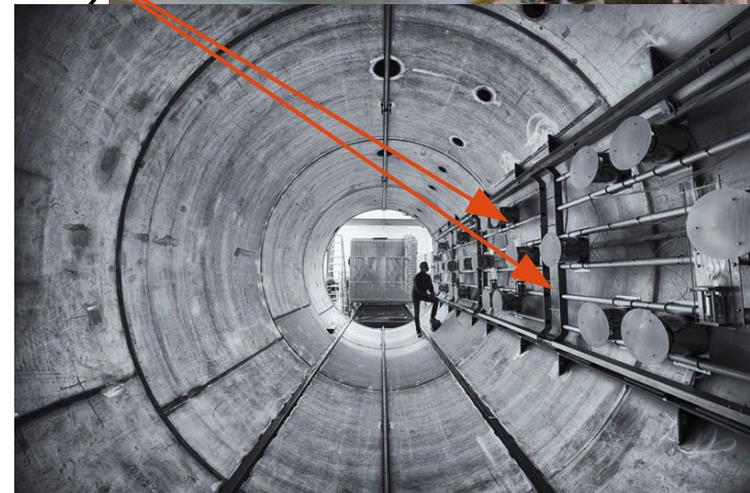
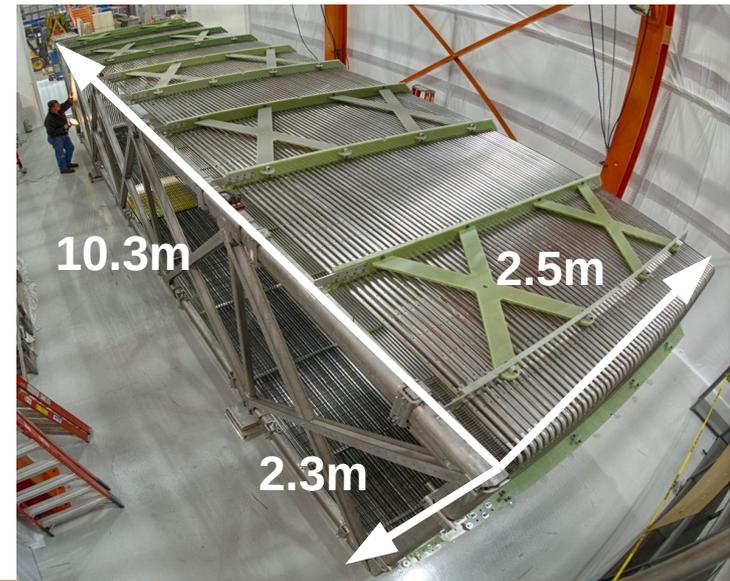


- Ionization drifts towards wire planes
 - Used for Particle Identification, calorimetry and tracking
- Scintillation collected by PMT
 - Used for triggering of data and t0 of events

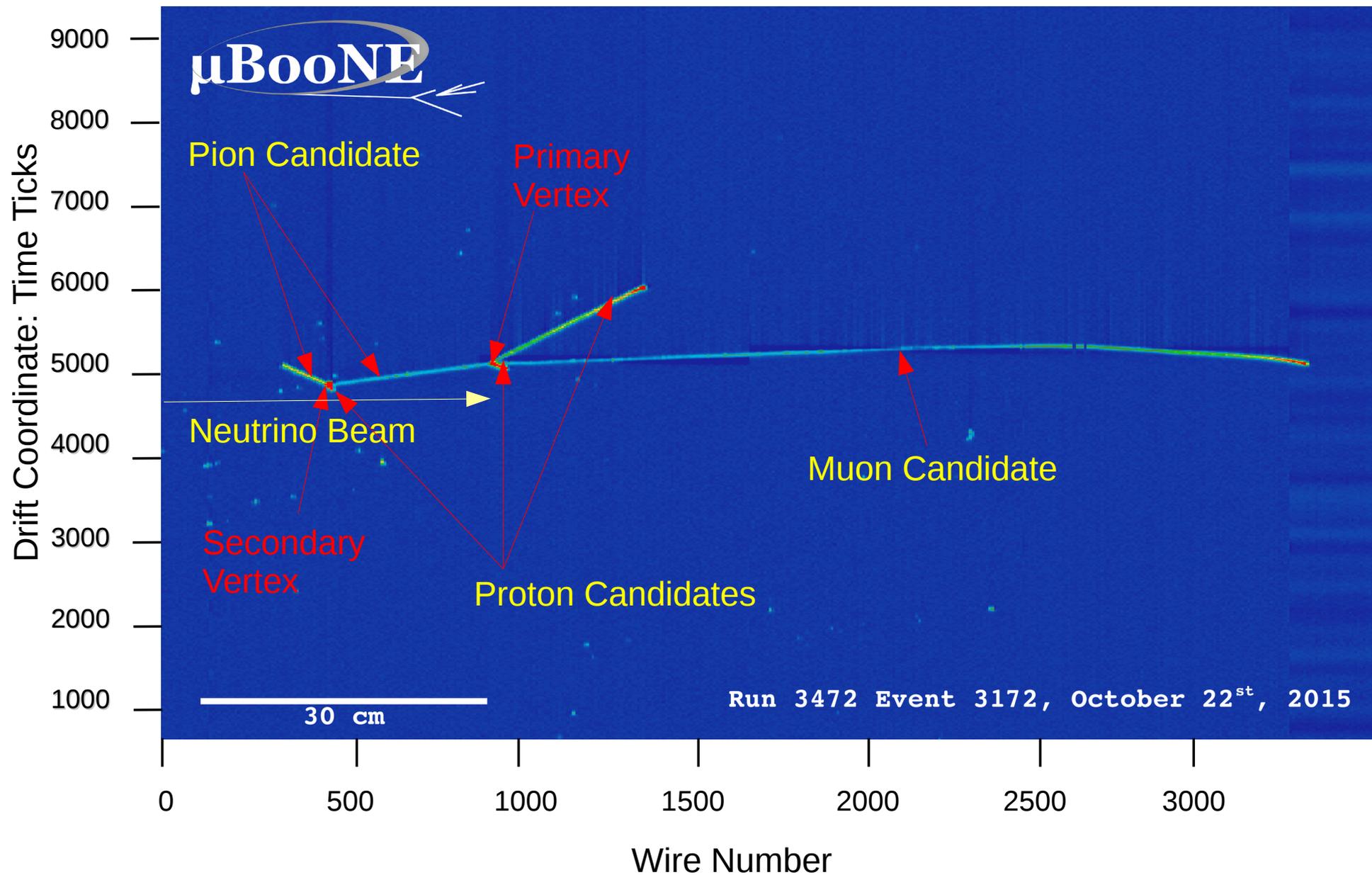
The MicroBooNE Detector



- Liquid Argon Time Projection Chamber
 - 3 Planes of wires at 3mm pitch
 - 1 Collection plane at 0 degrees from vertical
 - 2 Induction planes at +/- 60 degrees
 - 8256 Channels
 - 10.3m long*2.3m tall*2.5m wide (drift length)
- Optical system
 - 32 Cryogenic photomultiplier tubes (PMT)
- UV Laser calibration system
- Cosmic Ray Tagging (CRT) system
 - Completed installation this year!



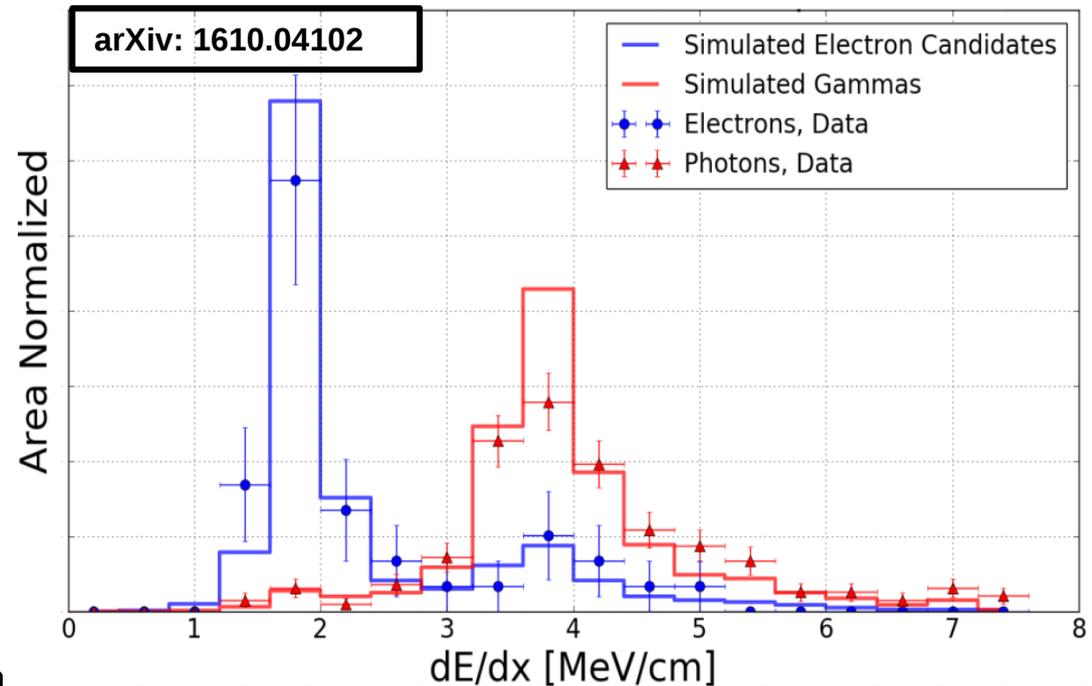
The MicroBooNE Detector: LArTPC Image



e/ γ separation



- MiniBooNE's significant background was from photons.
- Electrons and photons are indistinguishable in Cherenkov detectors
- Using topology and calorimetry LArTPCs can do electron/photon separation



- New Perspectives/Users Meeting poster dedicated to low energy excess
 - Electron Neutrino Reconstruction in MicroBooNE Using Deep Learning Technique – Victor Genty
 - Systematic Studies for MicroBooNE's Deep-Learning-Based Low-Energy Excess Analysis – Lauren Yates
 - Low Energy Single-Photon Search in MicroBooNE – Robert Murrells

Cross Section Program

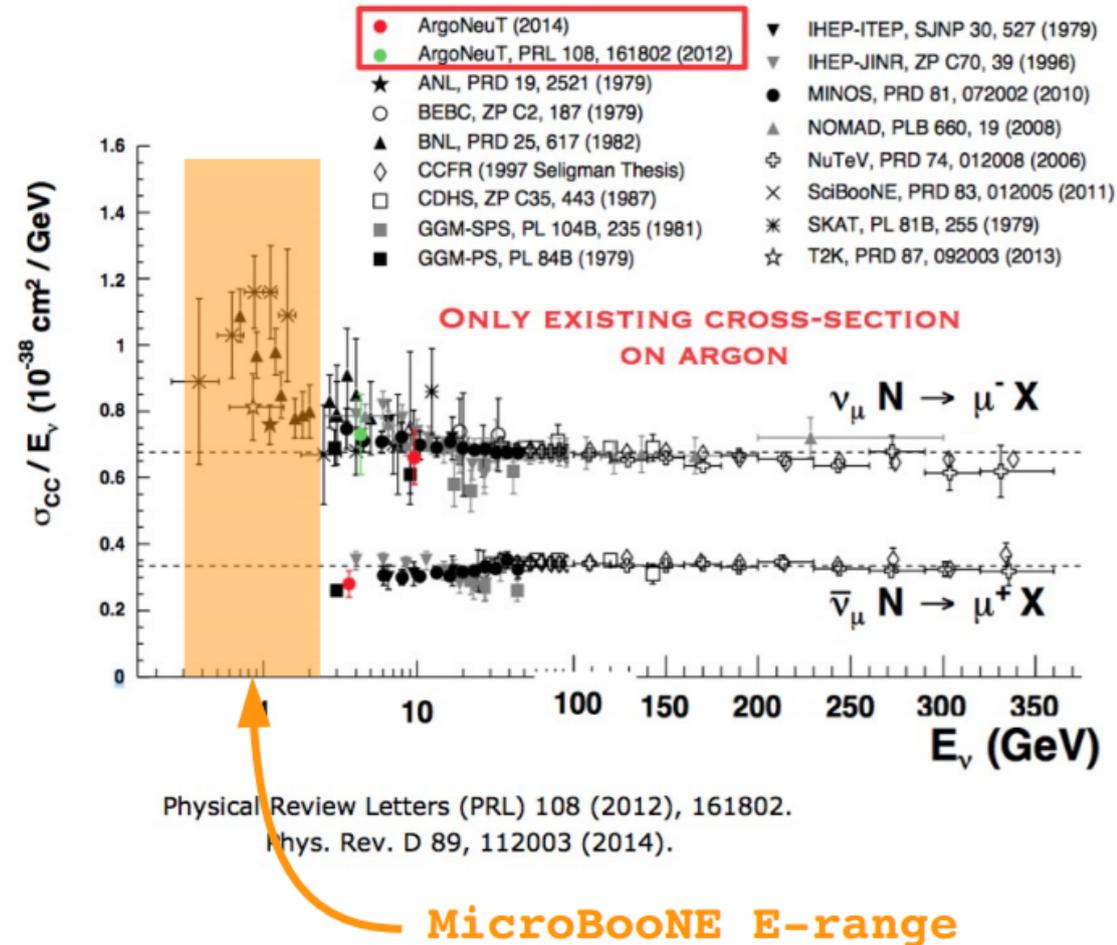


- Standard Candle Measurement

- MicroBooNE can make contributions in the $\sim 1\text{GeV}$ range
- MicroBooNE will be the first ν -Ar cross section measurement in that energy range!
- Relevant for DUNE and future experiments studying CP violation

- 5×10^{20} POT on tape

- Fully automated neutrino event selection requiring candidate muon tracks



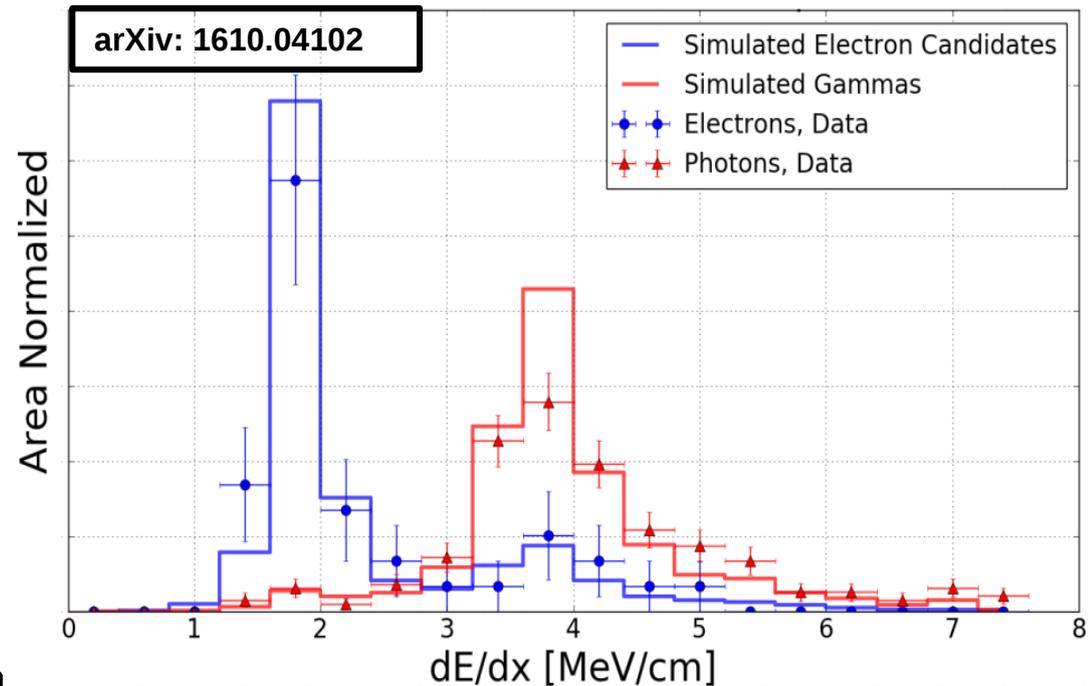
- New Perspectives/Users Meeting poster dedicated to Cross Sections

- Cosmic Background suppression for a NuMI electron-neutrino cross-section measurement in MicroBooNE – Colton Hill
- Measurement of Reconstructed Charged Particle Multiplicities of Neutrino Interactions in MicroBooNE – Aleena Rafique

e/ γ separation



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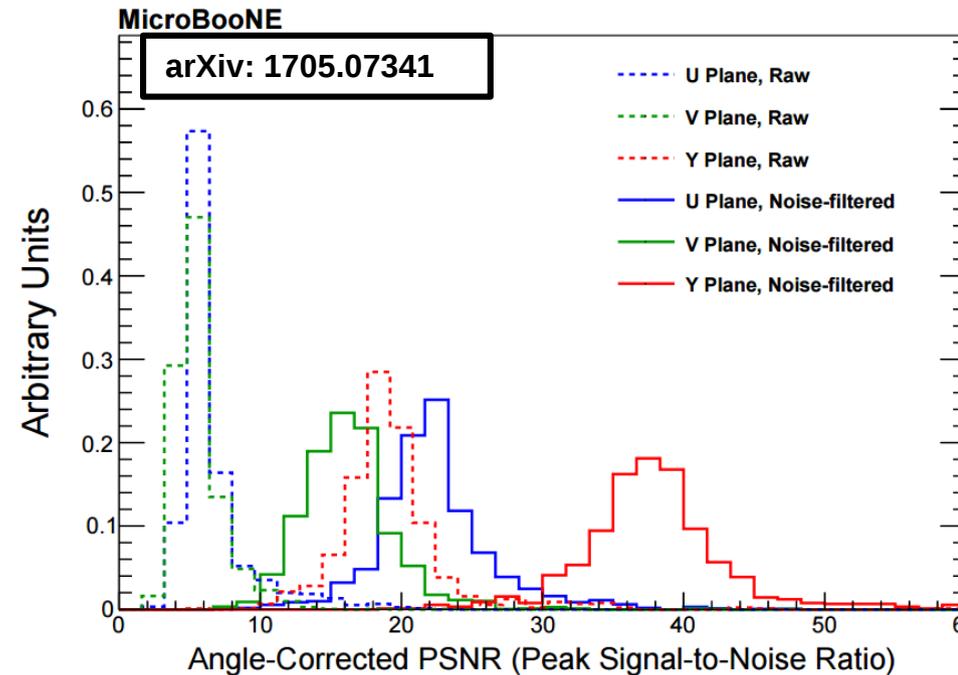


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Detector Physics and R&D



- Understanding LArTPCs is important for the SBN program and DUNE
 - Detector Physics, e.g.
 - Signal processing & Noise characterization
 - Electron lifetime and Recombination
 - Detector R&D, e.g.
 - Cold electronics
 - LAr Purity



- New Perspectives/User's Meeting posters dedicated to Detector Physics and R&D
 - Electron attenuation measurement using cosmic ray muons in MicroBooNE – Varuna Meddage
 - Towards a Longitudinal Electron Diffusion Measurement at MicroBooNE – Adam Lister
 - Using Multiple Coulomb Scattering to Measure Muon Momentum in the MicroBooNE Experiment – Polina Abratenko

MicroBooNE Publications & Public Notes



5 Publications!
17 Public Notes!

- [Public Notes](#)
- “Noise Characterization and Filtering in the MicroBooNE Liquid Argon TPC”, [arXiv:1705.07341](#), submitted to JINST
- “Michel Electron Reconstruction Using Cosmic Ray Data from the MicroBooNE LAr TPC”, [arXiv:1704.02927](#), submitted to JINST
- “Determination of Muon Momentum in the MicroBooNE LAr TPC Using an Improved Model of Multiple Coulomb Scattering”, [arXiv:1703.06187](#), submitted to JINST
- “Convolutional Neural Networks Applied to Neutrino Events in a Liquid Argon Time Projection Chamber”, [JINST 12,P03011 \(2017\)](#)
- “Design and Construction of the MicroBooNE Detector”, [JINST 12, P02017 \(2017\)](#)

μ BooNE

THANKS FOR LISTENING & STAY TUNED FOR MORE!

