



Photo by Linda Kirby

Status of MicroBooNE

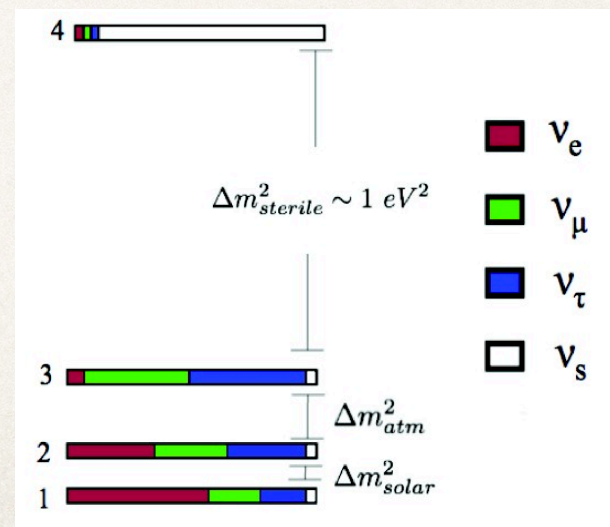
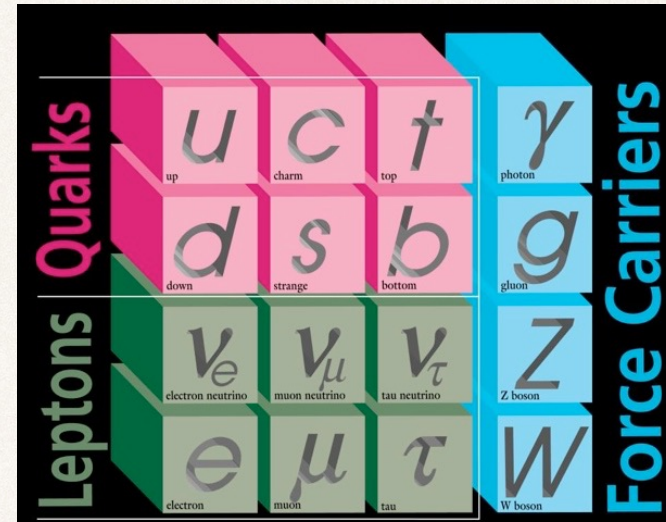
Michael Kirby, Fermilab

Status of MicroBooNE

- ❖ neutrinos in the Standard Model
- ❖ motivation for MicroBooNE at Fermilab
- ❖ physics goals of MicroBooNE
- ❖ detector design and performance goals
- ❖ where the experiment currently stands

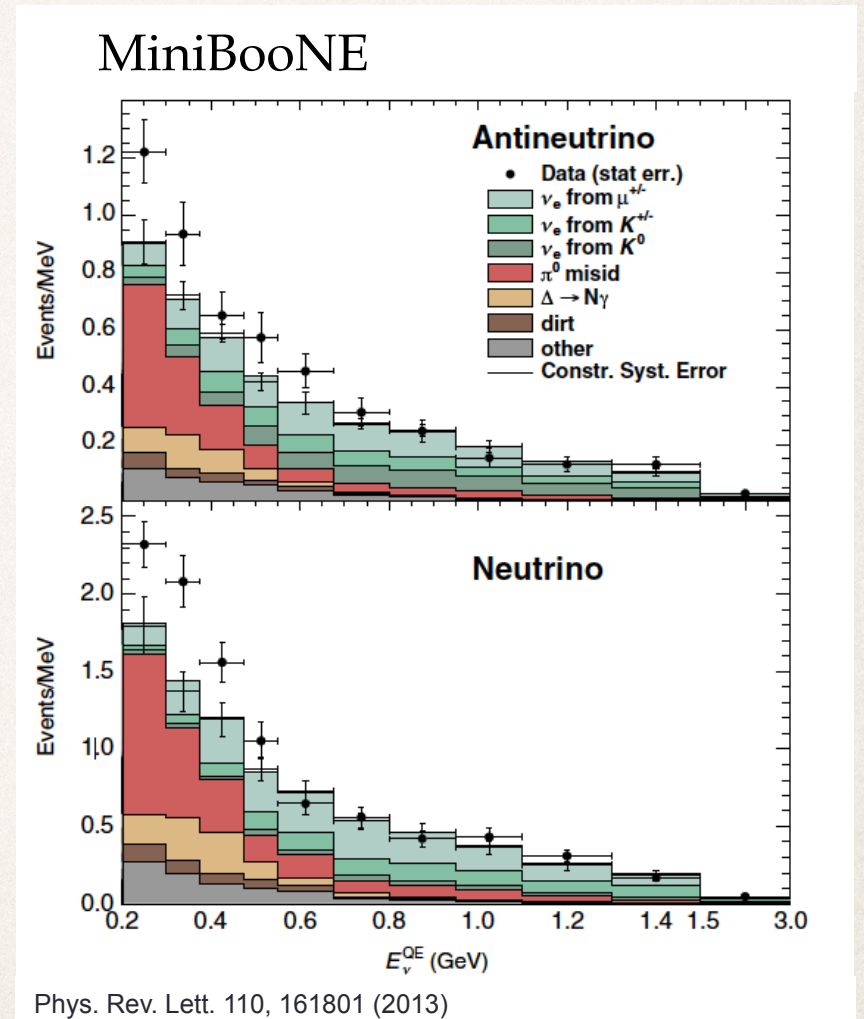
Neutrinos in the Standard Model and beyond...

- ❖ Neutrinos are a fundamental particles in the Standard Model of particle physics
- ❖ carry no electric charge
- ❖ only interact through Weak and gravitational force
- ❖ mass is extremely small
- ❖ know that it has a mass based on neutrino oscillations



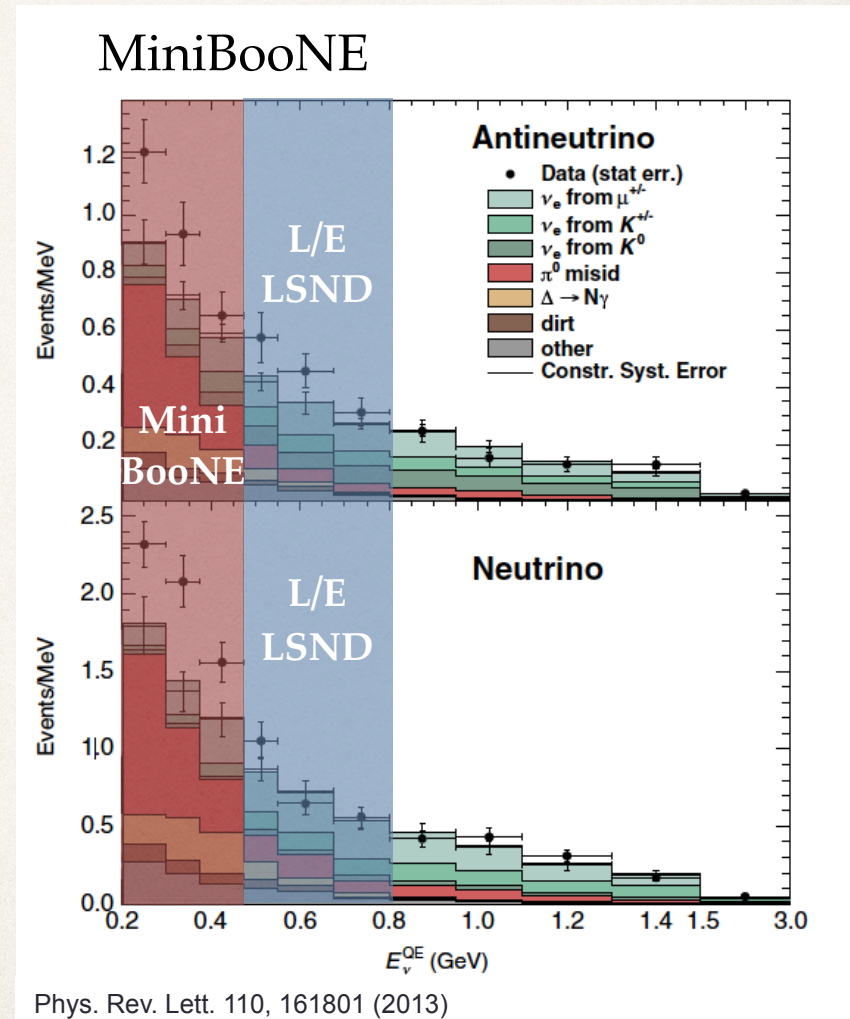
Motivation for MicroBooNE

- ❖ understand MiniBooNE excess in ν_e -candidates
 - ❖ started from the LSND excess
 - ❖ short baseline neutrino physics is extremely interesting right now
- ❖ measurements of ν -Ar cross sections
 - ❖ improved understanding of neutrino-nucleus interactions
- ❖ Liquid Argon detector research and development for future experiments
- ❖ Supernova neutrinos and proton decay bkg



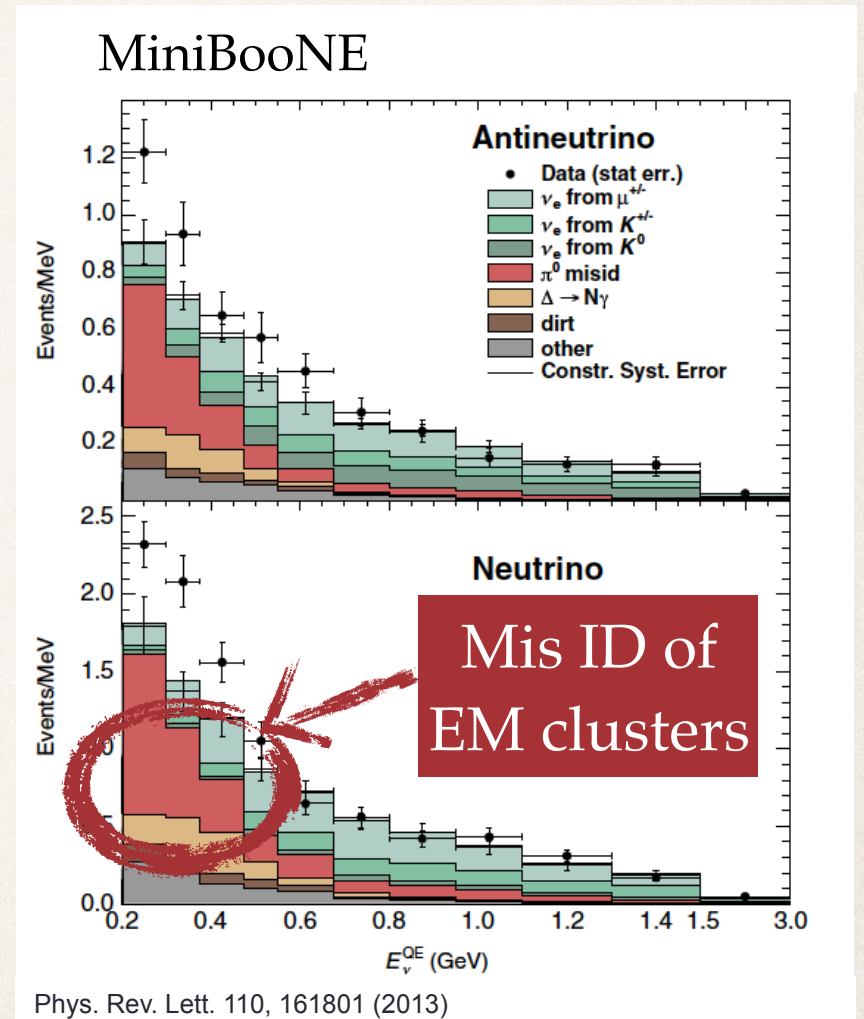
Motivation for MicroBooNE

- ❖ understand MiniBooNE excess in ν_e -candidates
 - ❖ started from the LSND excess
 - ❖ short baseline neutrino physics is extremely interesting right now
- ❖ measurements of ν -Ar cross sections
 - ❖ improved understanding of neutrino-nucleus interactions
- ❖ Liquid Argon detector research and development for future experiments
- ❖ Supernova neutrinos and proton decay bkg



Motivation for MicroBooNE

- ❖ understand MiniBooNE excess in ν_e -candidates
 - ❖ started from the LSND excess
 - ❖ short baseline neutrino physics is extremely interesting right now
- ❖ measurements of ν -Ar cross sections
 - ❖ improved understanding of neutrino-nucleus interactions
- ❖ Liquid Argon detector research and development for future experiments
- ❖ Supernova neutrinos and proton decay bkg



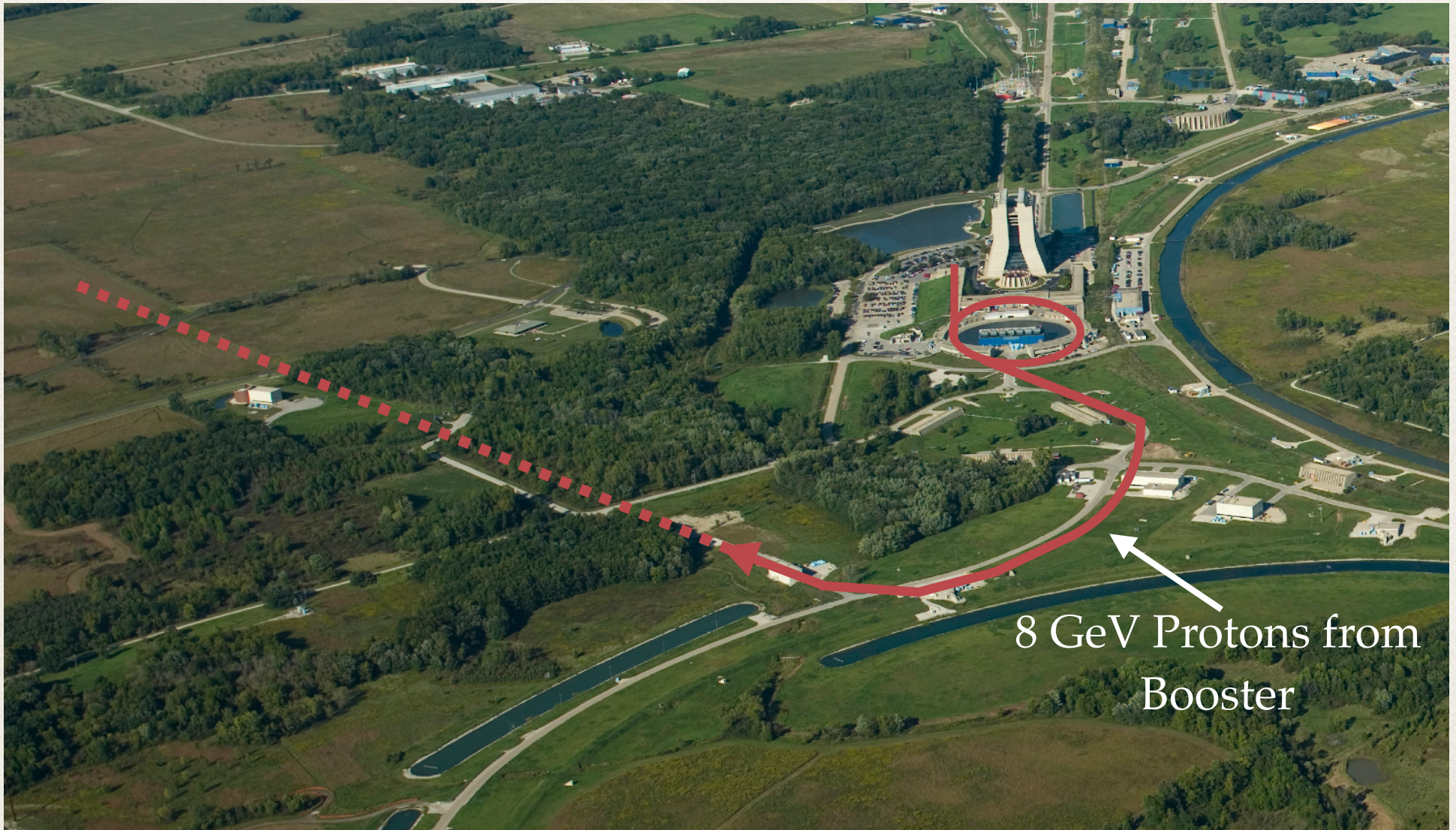
Motivation for MicroBooNE

- ❖ understand MiniBooNE excess in ν_e -candidates
 - ❖ started from the LSND excess
 - ❖ short baseline neutrino physics is extremely interesting right now
- ❖ measurements of ν -Ar cross sections
 - ❖ improved understanding of neutrino-nucleus interactions
- ❖ Liquid Argon detector research and development for future experiments
- ❖ Supernova neutrinos and proton decay bkg

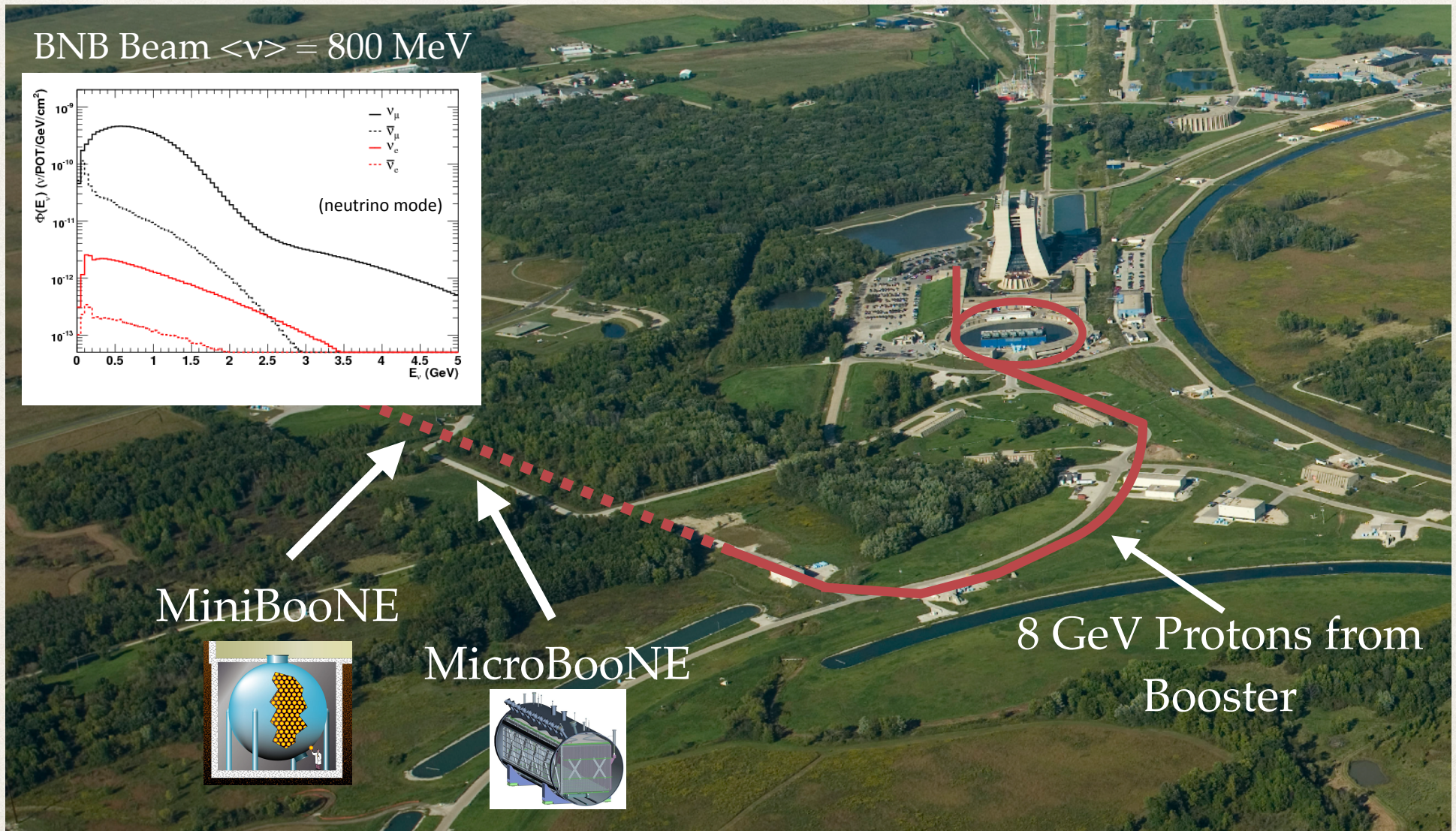


Photo by Reidar Hahn

Booster Neutrino Beam at Fermilab



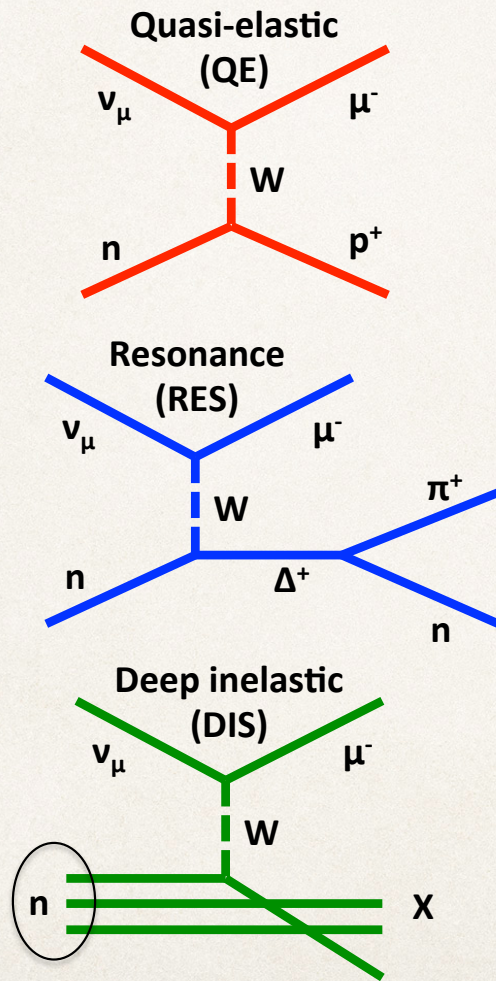
Booster Neutrino Beam at Fermilab



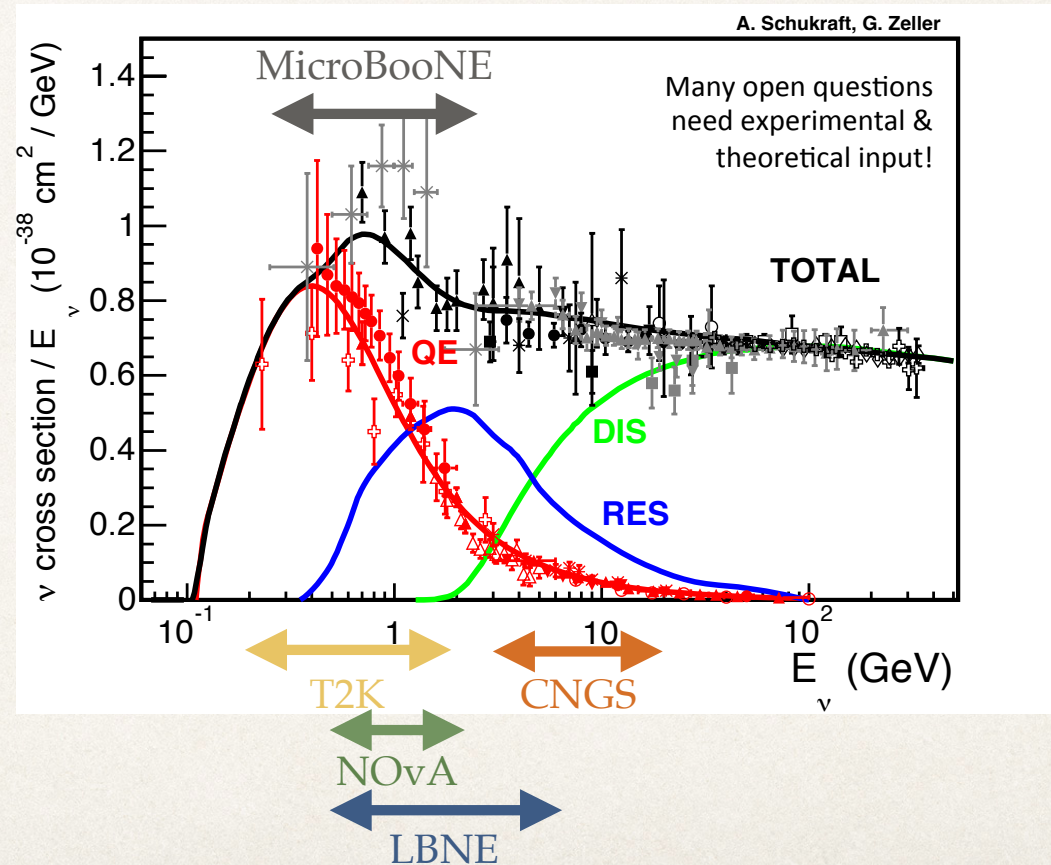
Utilize the same beam line for MicroBooNE, 470m baseline

neutrino interacting with nucleons

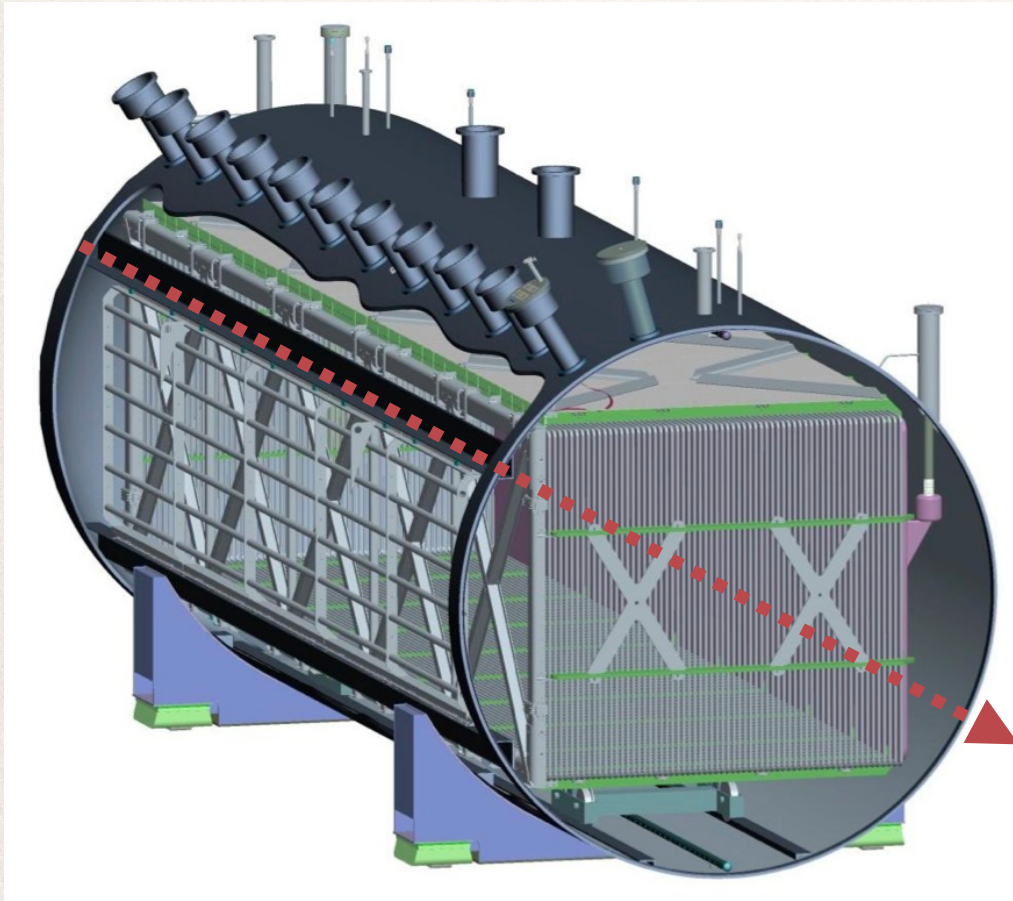
Slide courtesy of Anne Schukraft



Lots of interesting (nuclear) physics over all energy ranges.

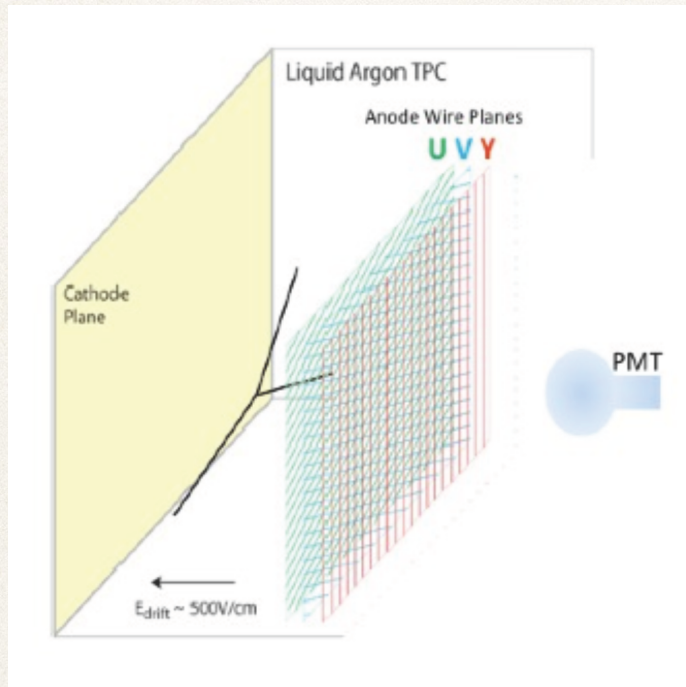


MicroBooNE Detector Design



- ❖ 170 ton Liquid Argon TPC
- ❖ 89 ton active volume
- ❖ 8256 readout wires in 3 anode planes
- ❖ 128 kV HV across 2.56 m drift distance
- ❖ 32 PMTs
- ❖ 2 UV lasers for calibration

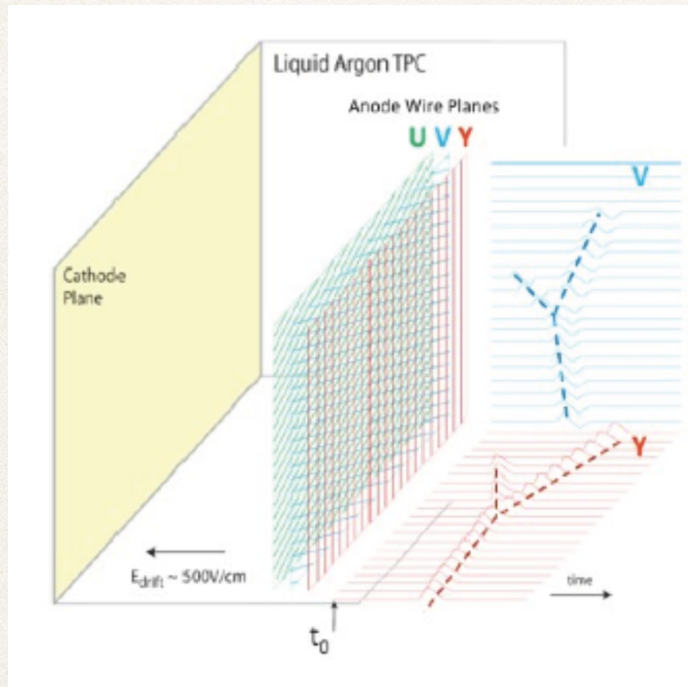
MicroBooNE Detector Design



Like a ship that speeds past instantaneously,
you see the flash of the bow light,
and eventually the waves on the shore

- ❖ 170 ton Liquid Argon TPC
 - ❖ building on ICARUS technology
- ❖ 89 ton active volume
- ❖ 8256 readout wires in 3 anode planes
- ❖ 128 kV HV across 2.56 m drift distance
- ❖ 32 PMTs
- ❖ 2 UV lasers for calibration

MicroBooNE Detector Design

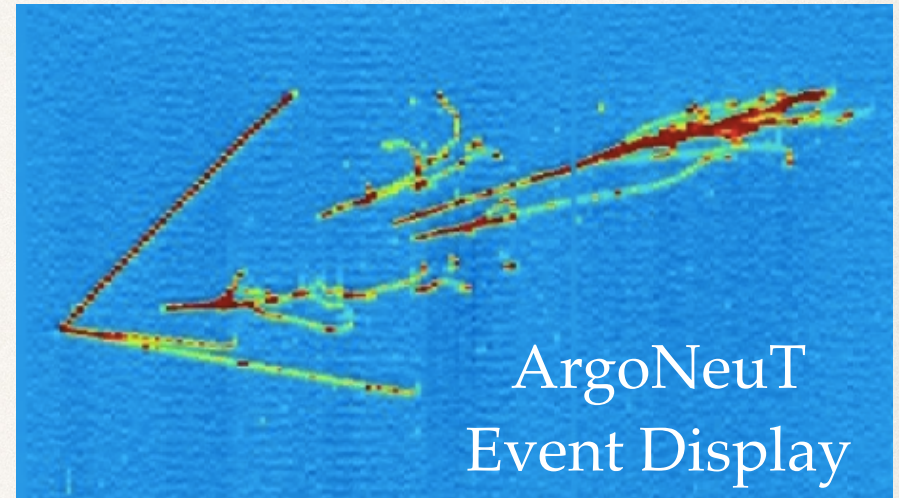


Like a ship that speeds past instantaneously,
you see the flash of the bow light,
and eventually the waves on the shore

- ❖ 170 ton Liquid Argon TPC
 - ❖ building on ICARUS technology
- ❖ 89 ton active volume
- ❖ 8256 readout wires in 3 anode planes
- ❖ 128 kV HV across 2.56 m drift distance
- ❖ 32 PMTs
- ❖ 2 UV lasers for calibration

Motivation for MicroBooNE

- ❖ understand MiniBooNE excess in ν_e -candidates
 - ❖ started from the LSND excess
 - ❖ short baseline neutrino physics is extremely interesting right now
- ❖ measurements of ν -Ar cross sections
 - ❖ improved understanding of nucleon interactions
- ❖ Liquid Argon detector research and development for future experiments
- ❖ Supernova neutrinos and proton decay



- ❖ topological cuts
 - ❖ gap between vertex and EM shower
 - ❖ electron-position shower pair
- ❖ dE/dX at start of shower

Current status of MicroBooNE

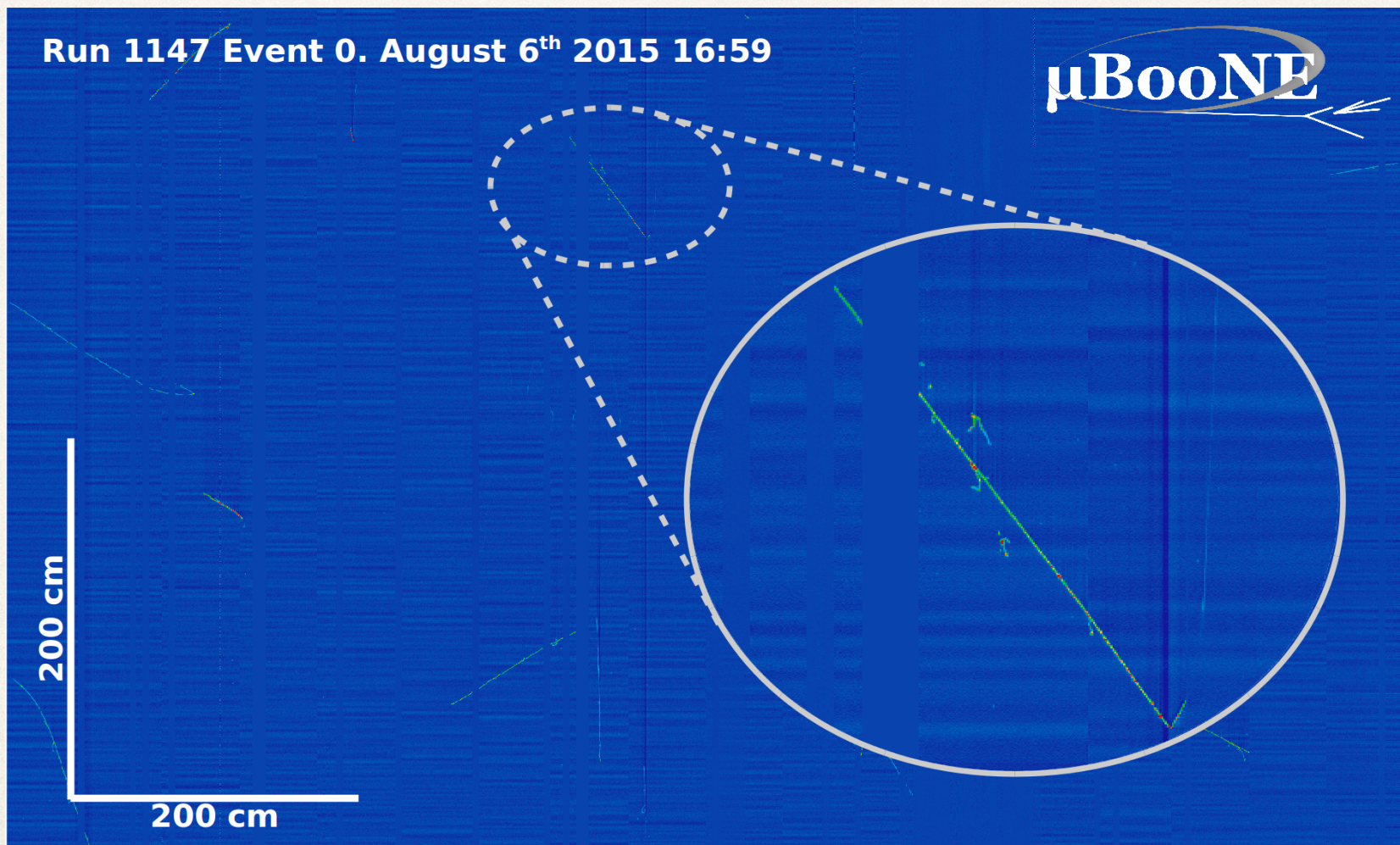


- ❖ TPC installed in cryostat in Dec 2013
- ❖ TPC / Cryostat was installed in June 14
- ❖ liquid argon fill and purification completed with good purity
- ❖ first cathode HV ramp August 6
- ❖ first beam Oct 15, 2015
- ❖ have recorded almost complete requested initial dataset, will continue to run during SBN

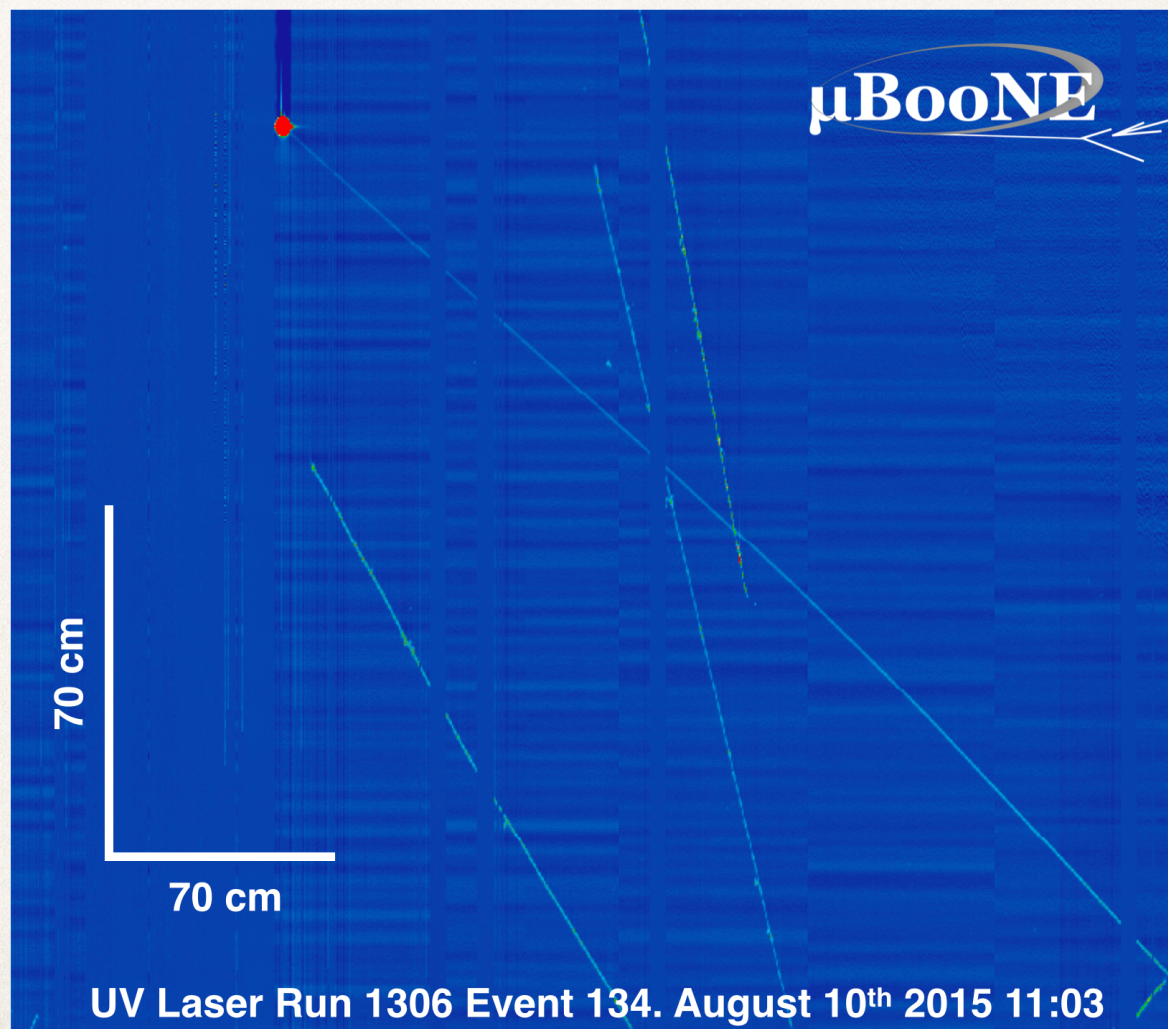
Oct 15, 2015 got first beam!



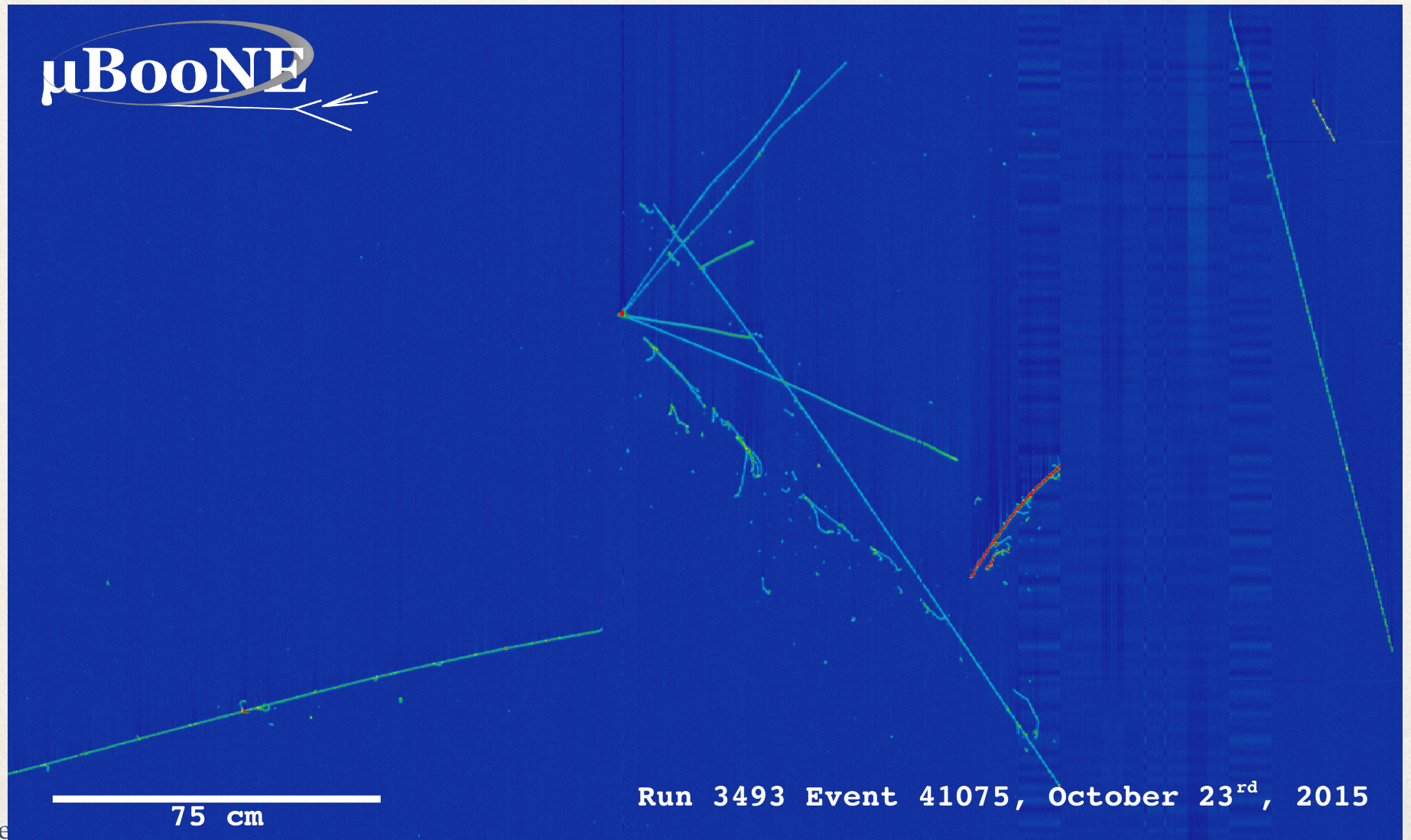
The first event



laser runs



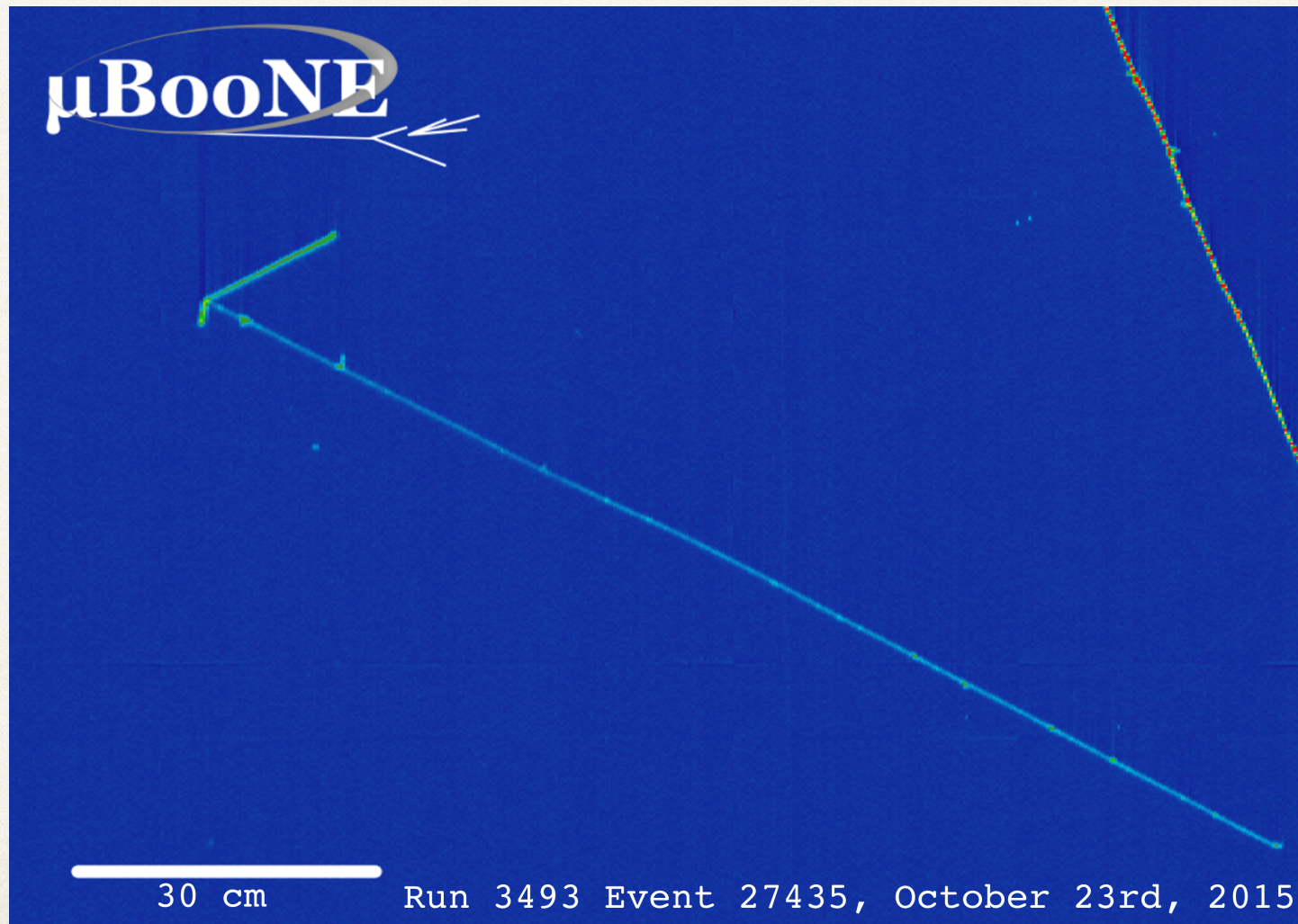
first Booster Neutrino Beam events



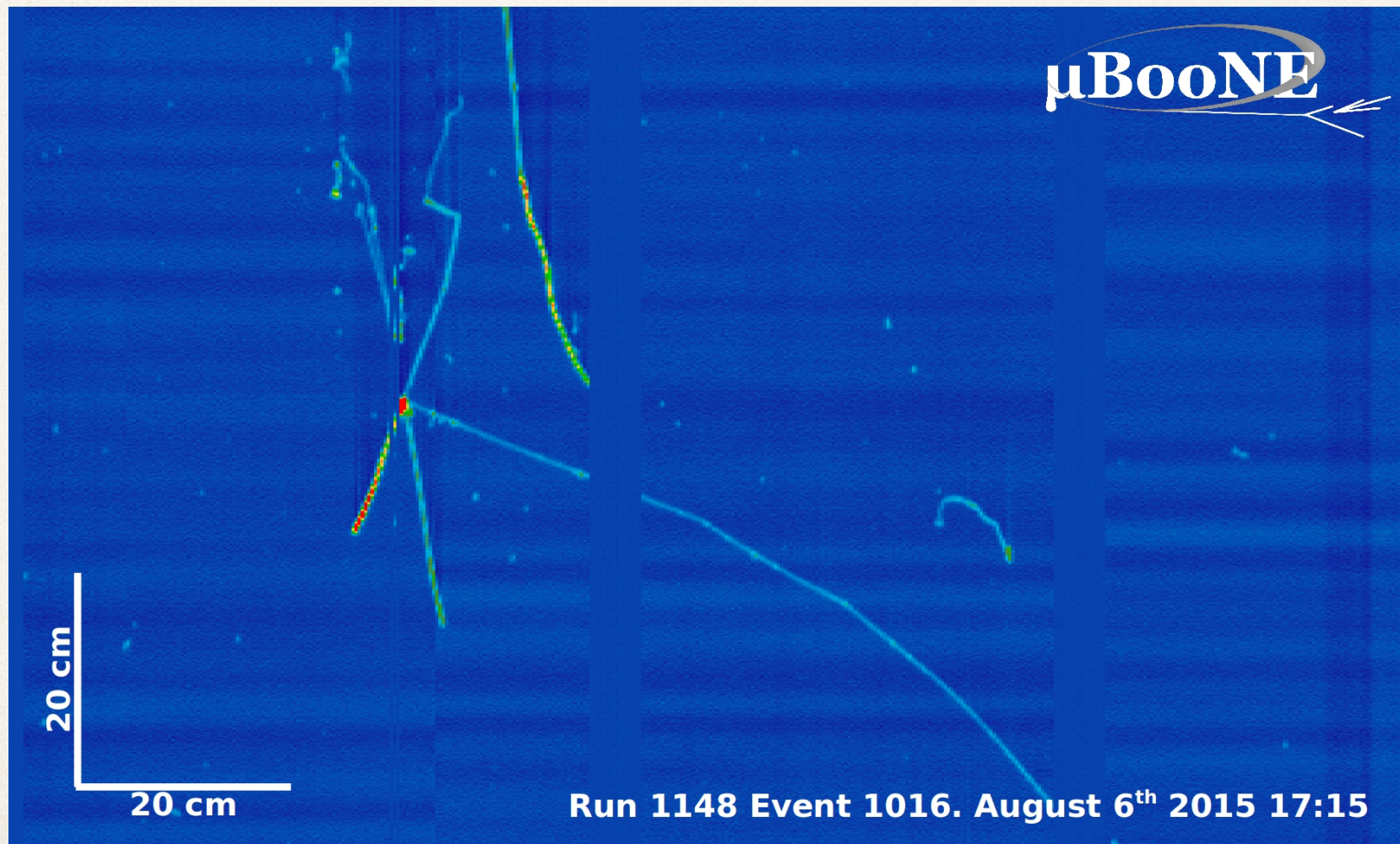
MicroBooNE Virtual Reality Demo

- ❖ Developed by an undergraduate and graduate student for both the Oculus Rift and the google cardboard VR platforms
- ❖ Written in the Unity SDK using JavaScript and C#
- ❖ Allows users to be submersed inside the LAr TPC and see the interaction of simulated neutrino events
- ❖ Can move in all three directions and change direction of view
- ❖ use your head to change direction of view, use the joystick to move within the detector
- ❖ buttons cause another neutrino event to be simulated

first Booster Neutrino Beam events



additional events



additional events

