

Astrophysics and BSM Physics Capabilities and Results from MicroBooNE



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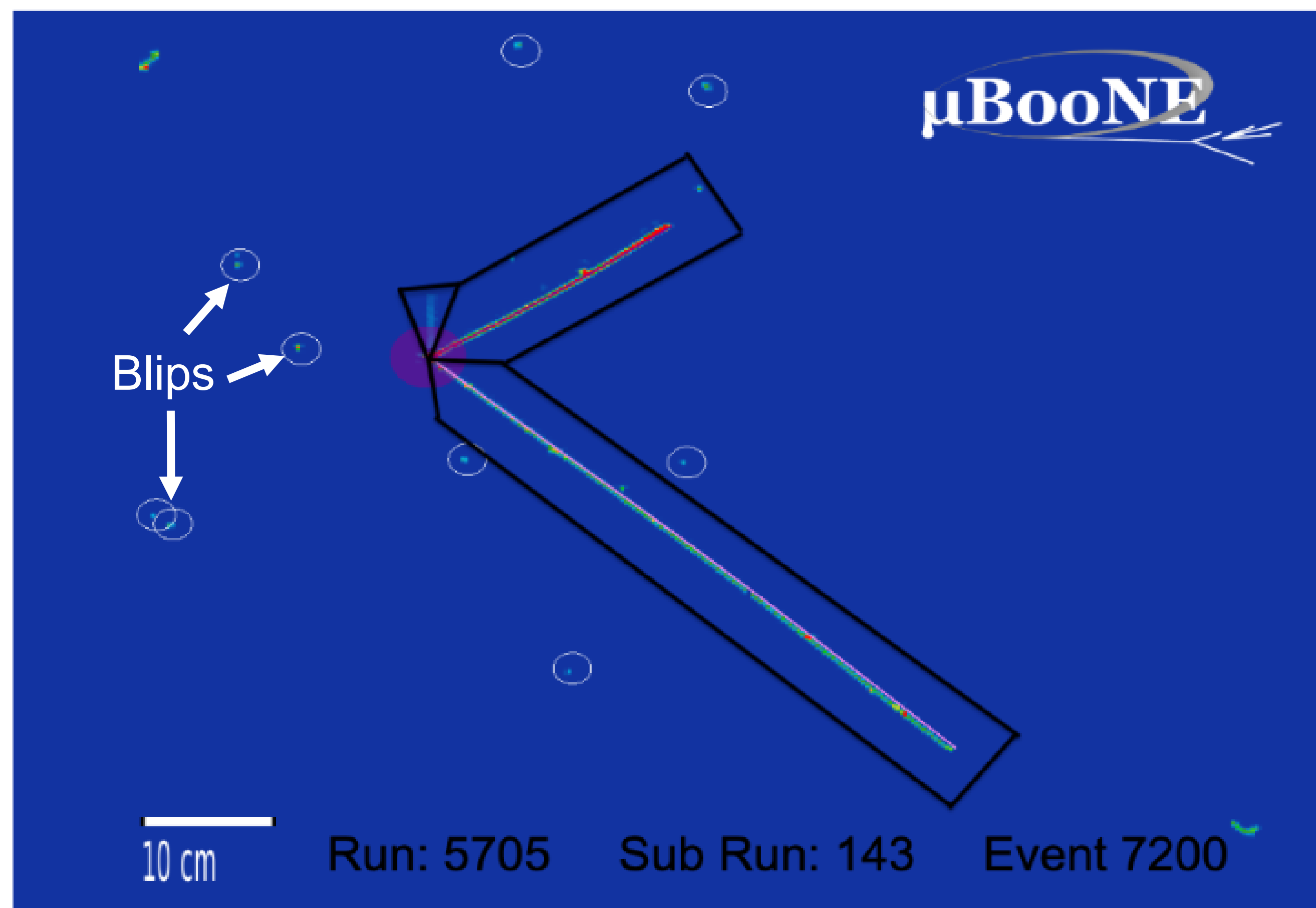


MicroBooNE

- [MicroBooNE](#) is an 85-ton active mass liquid argon time projection chamber with three wire planes, 3 mm spacing.
- MicroBooNE is exposed to two intense neutrino beams: BNB (8 GeV protons) and NuMI (120 GeV protons, 8° off-axis).
- High spatial resolution, low noise and excellent calorimetry make MicroBooNE an excellent detector for BSM studies.
- MicroBooNE has developed a continuous readout stream, a useful tool for detecting supernova neutrinos ([JINST 16, 02, P02008 \(2021\)](#)).
- Further studies are exploring the dark neutrino portal and searching for dark matter produced in the BNB.

MeV-Scale Physics

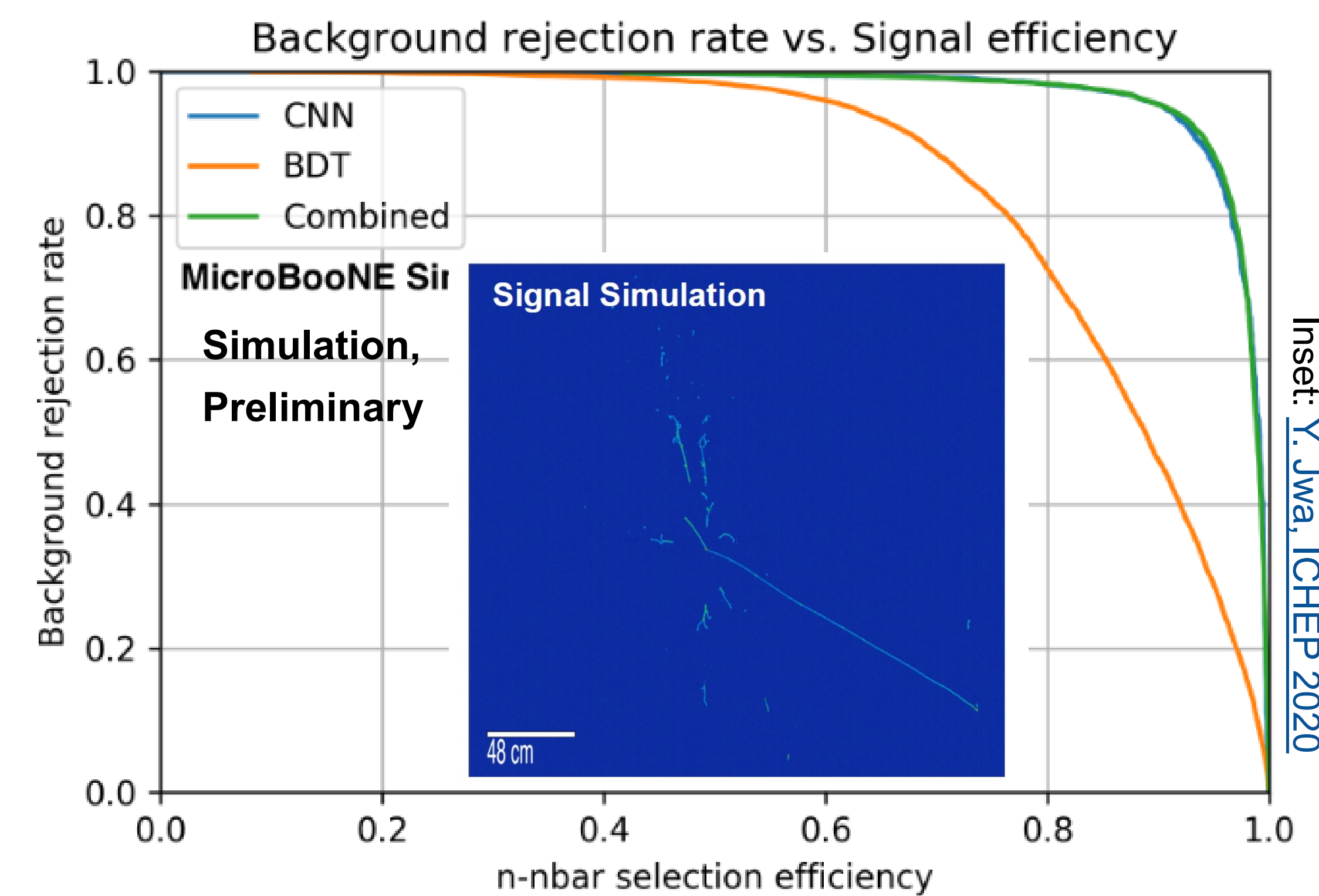
- Reconstructing MeV-scale activity is important for low-energy (e.g. supernova) neutrino studies.
- Algorithms have been developed for selecting and reconstructing activity as low as 100 keV, and thresholds are being lowered further.
- Example: blips from low-energy photons and neutrons



More about this study: [MICROBOONE-NOTE-1076-PUB](#)

Neutron-Antineutron Oscillation

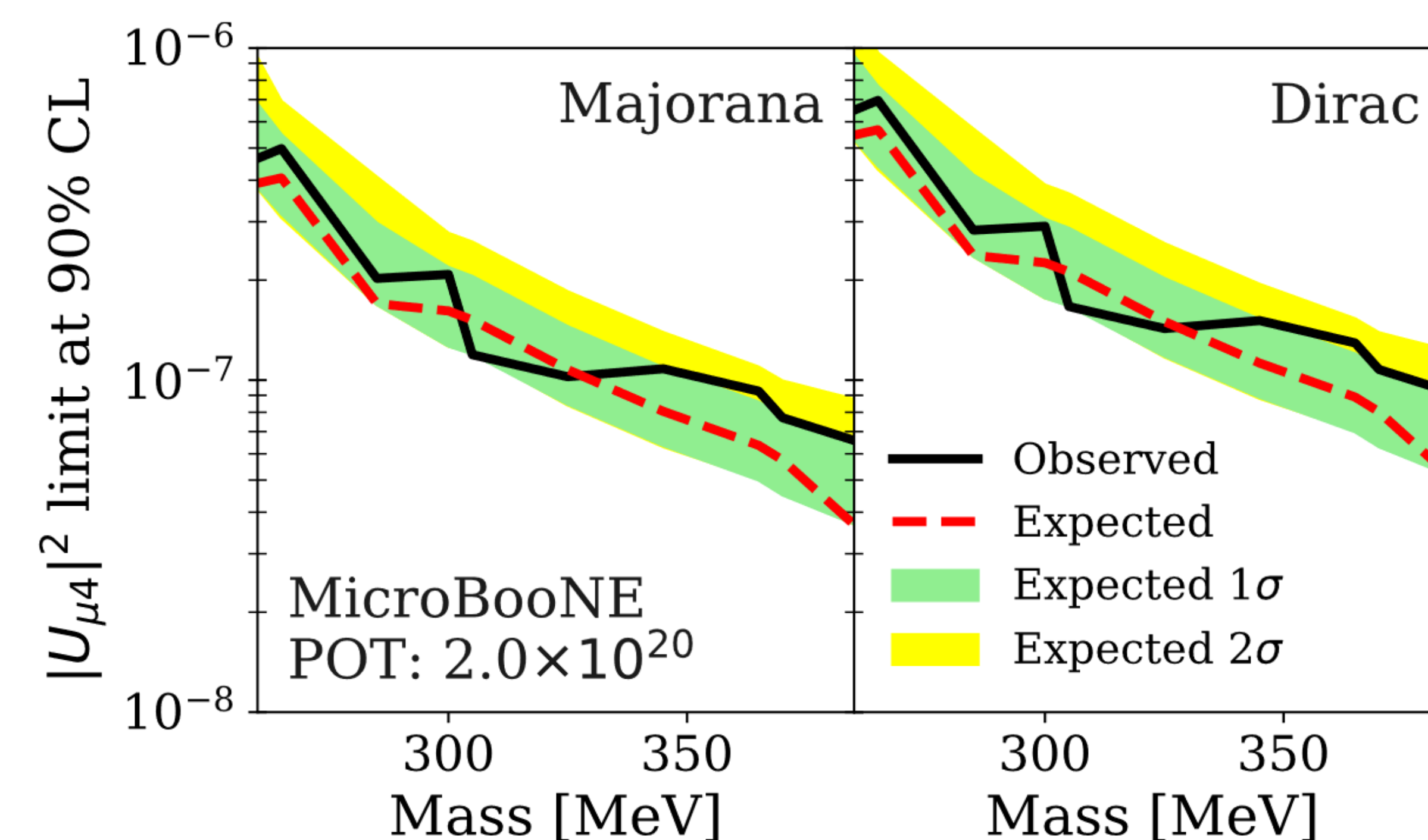
- MicroBooNE is developing techniques to search for neutron-antineutron oscillation, a baryon-number violating process.
- Using a convolutional neural network to identify signal
- Useful input for DUNE in its search for nucleon decay



More about this study: [MICROBOONE-NOTE-1093-PUB](#)

Heavy Neutral Leptons

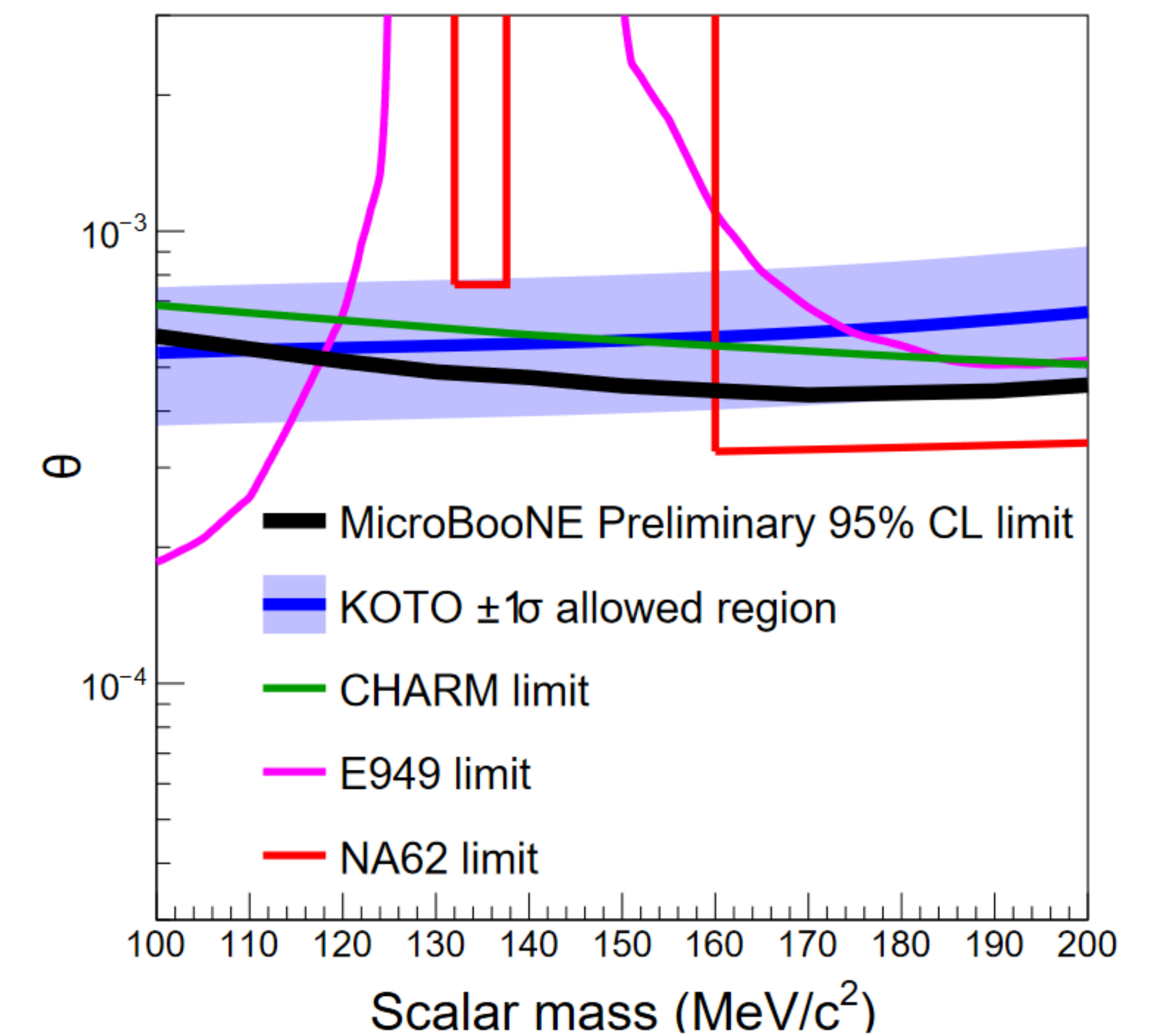
- Neutral leptons with mass $O(100 \text{ MeV})$
- Arise from mixing with neutrinos
- Produced in BNB target
- Decay via weak interaction into $\mu + \pi$
- Currently exploring more decay modes and NuMI data



More about this study: [Phys. Rev. D 101, 052001](#)

Higgs Portal Scalars

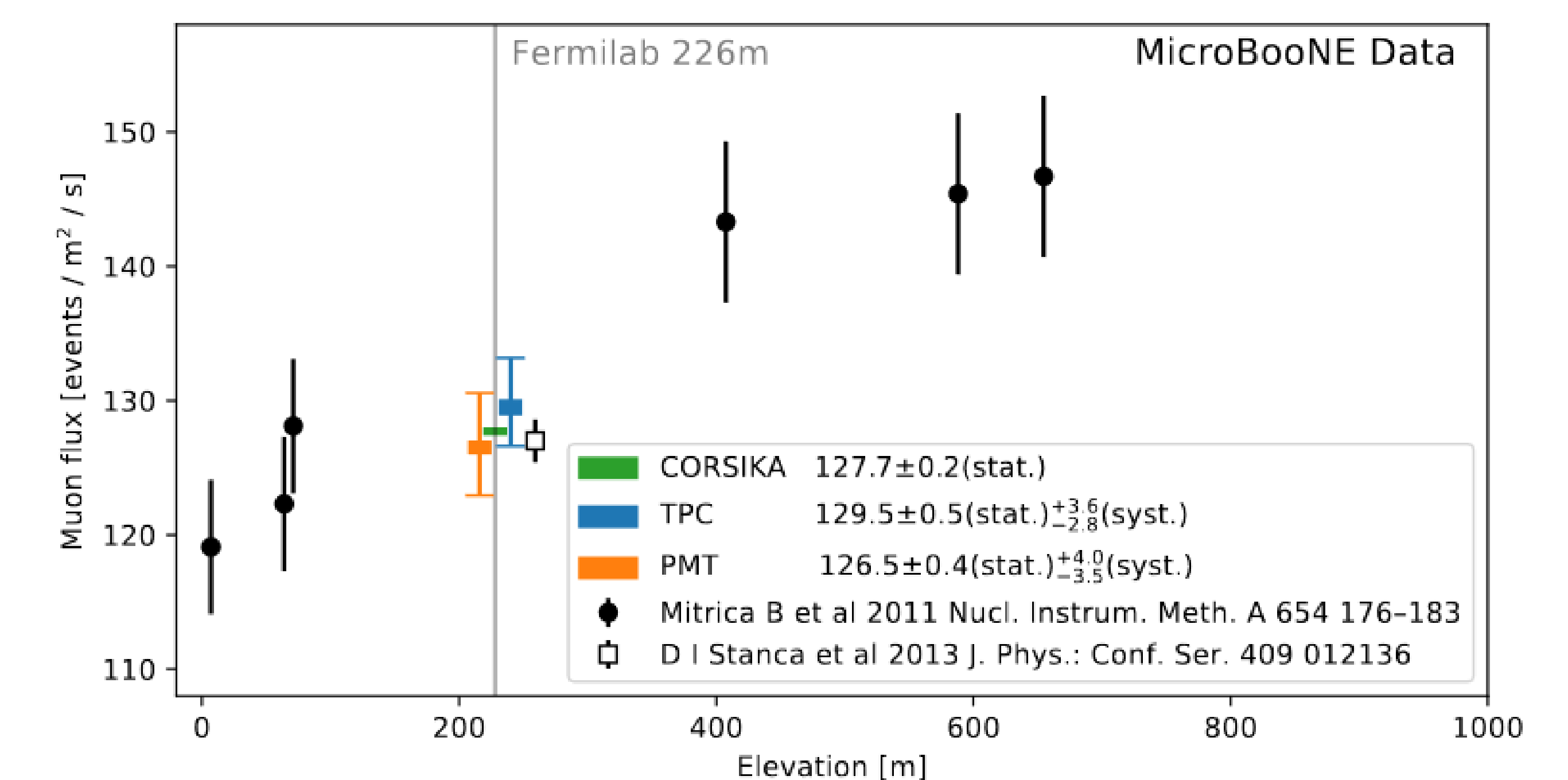
- Dark scalar which mixes with the Higgs, decays into ll or $\pi\pi$
- Possible explanation for the KOTO anomaly
- Search performed for e^+e^- pairs, excludes KOTO central value.



More about this study: [MICROBOONE-NOTE-1092-PUB](#)

Cosmic Rate Rates

- MicroBooNE has measured the rate of cosmic rays on the surface at Fermilab, and found good agreement with simulation.
- This study has benefits to simulation improvement and future surface experiments at Fermilab, e.g. SBND and ICARUS.



More about this study: [JINST 16, P04004 \(2021\)](#)