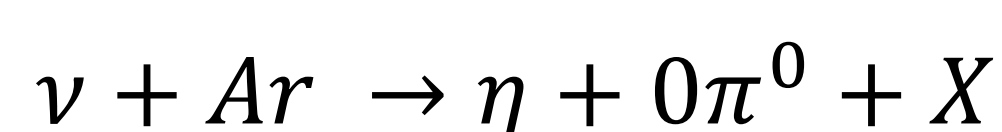


η production

(Paper published in Phys. Rev. Lett. 132, 151801 [1])



MicroBooNE has made the first cross-section measurement of η production in ν – Ar interactions via the reaction:

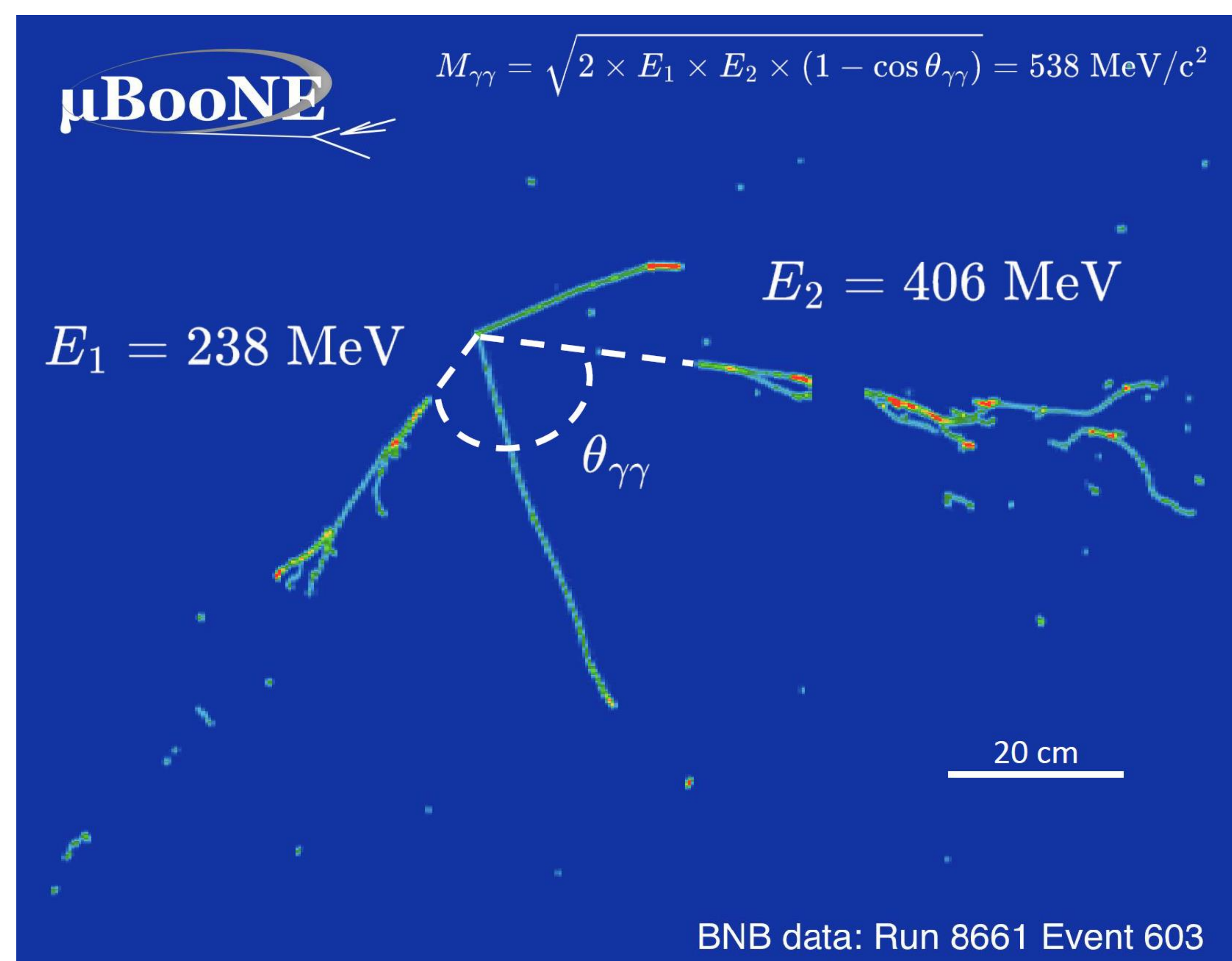
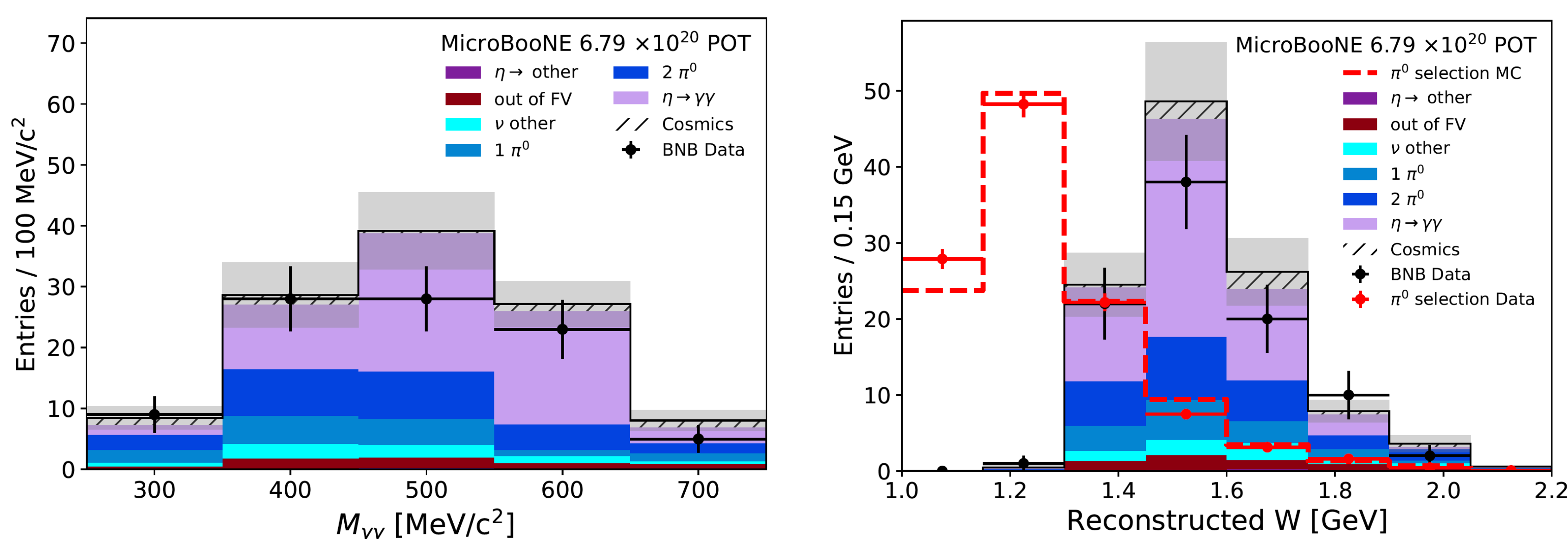


where a ν interacts with Ar and produce one η, X other hadrons and leptons, and no neutral pions in the final state.

The importance of observing η decays in LArTPC include:

- Studies to inform proton decay searches in channels like $p \rightarrow e^+ + \eta$ and $p \rightarrow \mu^+ + \eta$ for the upcoming DUNE experiment.
- Valuable probe of resonances above Δ(1232).
- Provides a novel tool for the calibration of the electromagnetic (EM) energy scale through η decay to photon pairs.

- The top right figure shows a η event candidate decaying into the γγ.

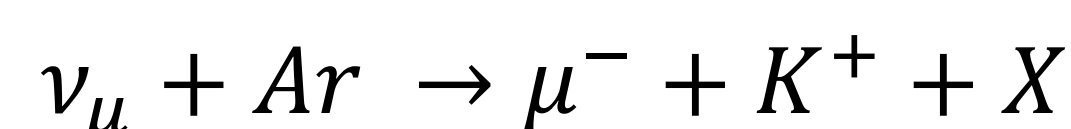


- The bottom left picture shows the γγ invariant mass from η decay, consistent with prediction. This analysis reports an efficiency of 13.9% and a purity of 49.9%
- The bottom right picture shows the η selection (black line and data points) compared with the π⁰ selection (red line and data points). Here is clearly observed how the η selection is picking out events at ~1500 MeV resonance rather than the more common Δ(1232).
- The flux-integrated cross-section for η production in ν – Ar interactions [1] was measured to be:

$$3.22 \pm 0.84 \text{ (stat.)} \pm 0.86 \text{ (syst.)} 10^{-41} \text{ cm}^2/\text{nucleon}$$

K⁺ production

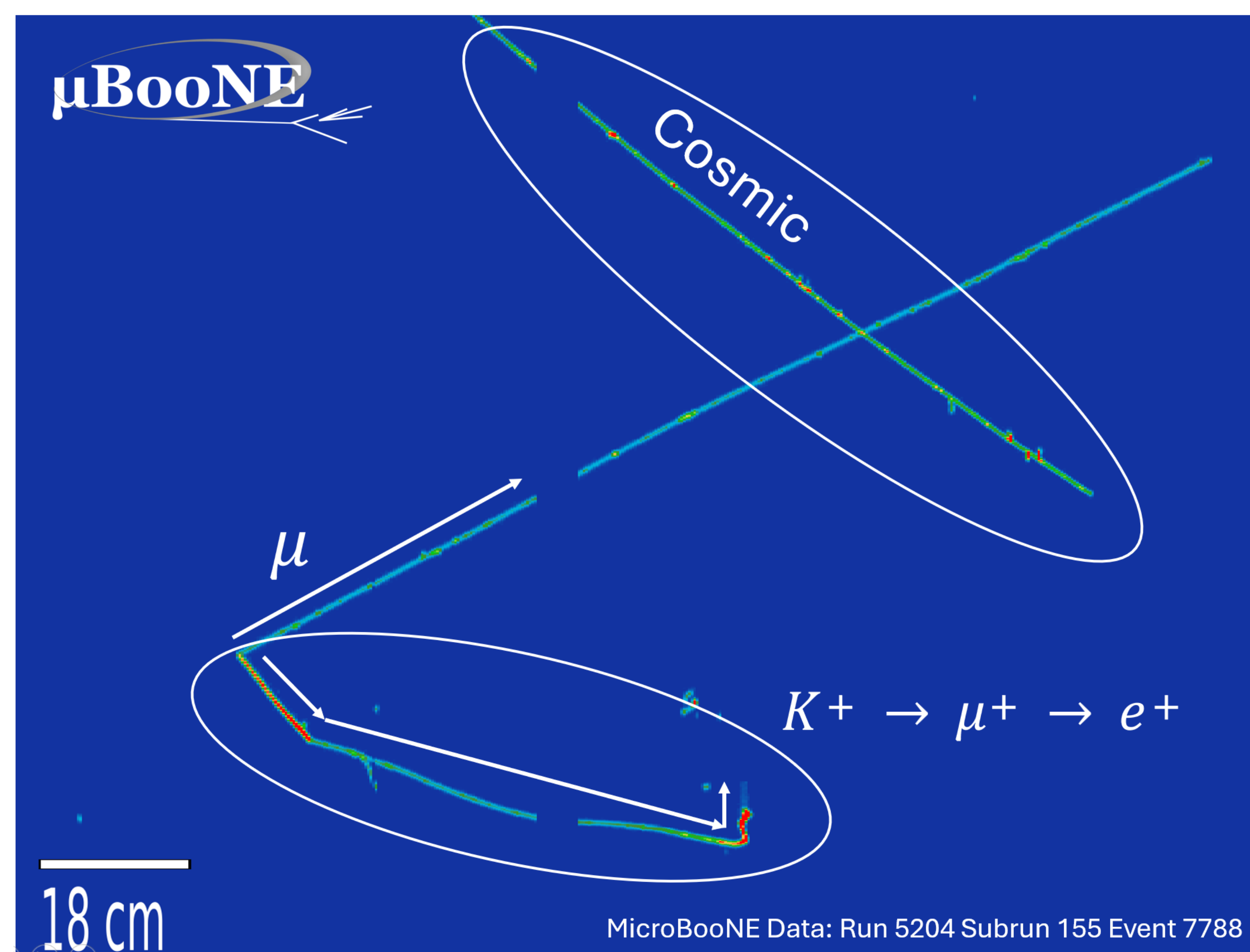
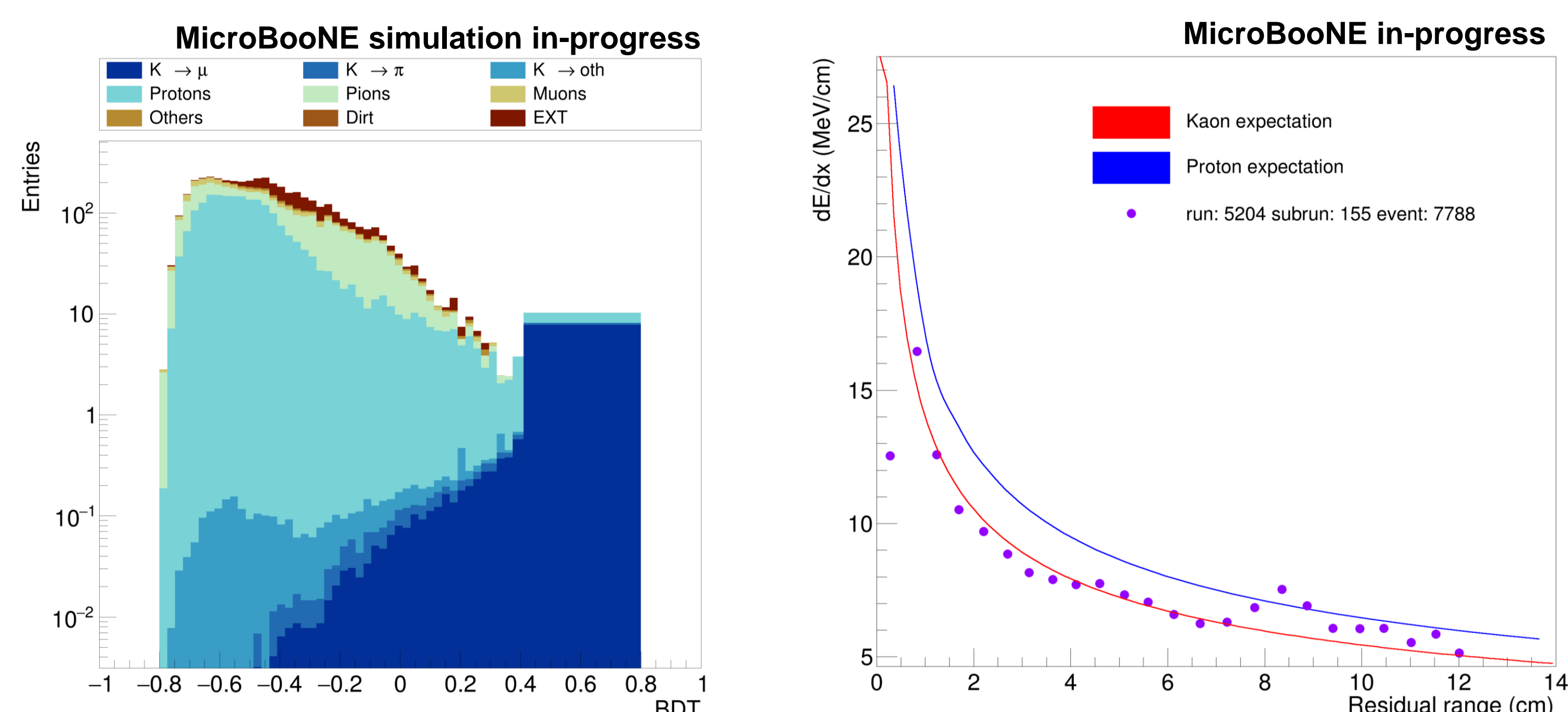
MicroBooNE is also looking for K⁺ production in charged-current ν – Ar interactions through the process:



where a νμ interacts with Ar and produce one K⁺, one μ⁻, and any number of other hadrons in the final state.

As the first quantitative measurement of K⁺ production on argon nuclei, this analysis will significantly impact nuclear physics, neutrino studies, and proton decay research, particularly in:

- Background constraint for proton decay searches in channels like $p \rightarrow K^+ \nu$, for example, atmospheric neutrinos reactions with a K⁺ in the final state $\nu_\mu + n \rightarrow \mu^- + K^+ + p$ and $\nu + p \rightarrow \nu + K^+ + \Lambda$.
- Validation and improvements of neutrino generator models providing the first measurement of the cross-section K⁺ production in charged-current ν – Ar interactions.



- The left picture shows the Boosted Decision Tree's (BDT) distribution for the Monte Carlo (MC) sample used in this analysis. The last bin at the right side represents the proposed signal region, with BDT score > 0.41. This selection cut predicts to identify 10.2 K⁺ event candidates in the dataset, with an expected background of 2.2 events.
- The right picture shows the dE/dx profile from data points and the expectation (red line) of the K⁺ candidate in the event display above.

More results to come, stay tuned!