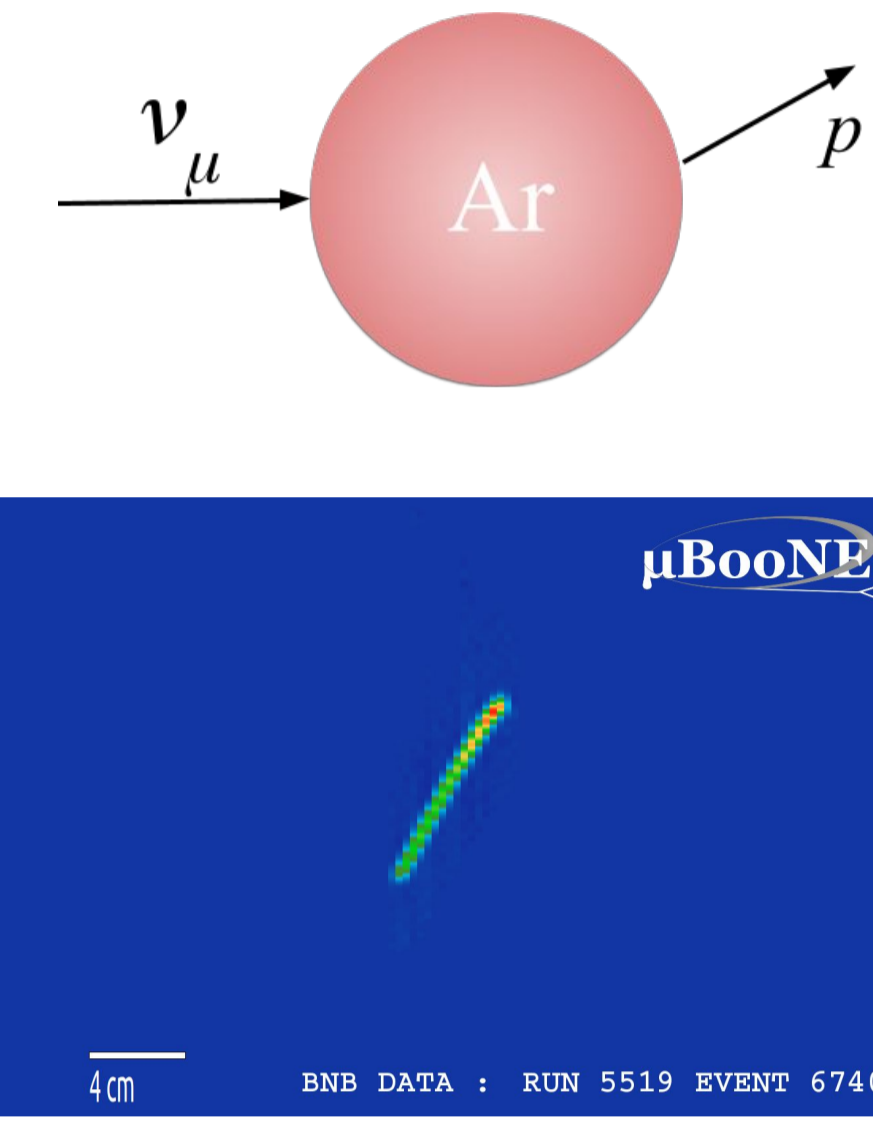


Introduction

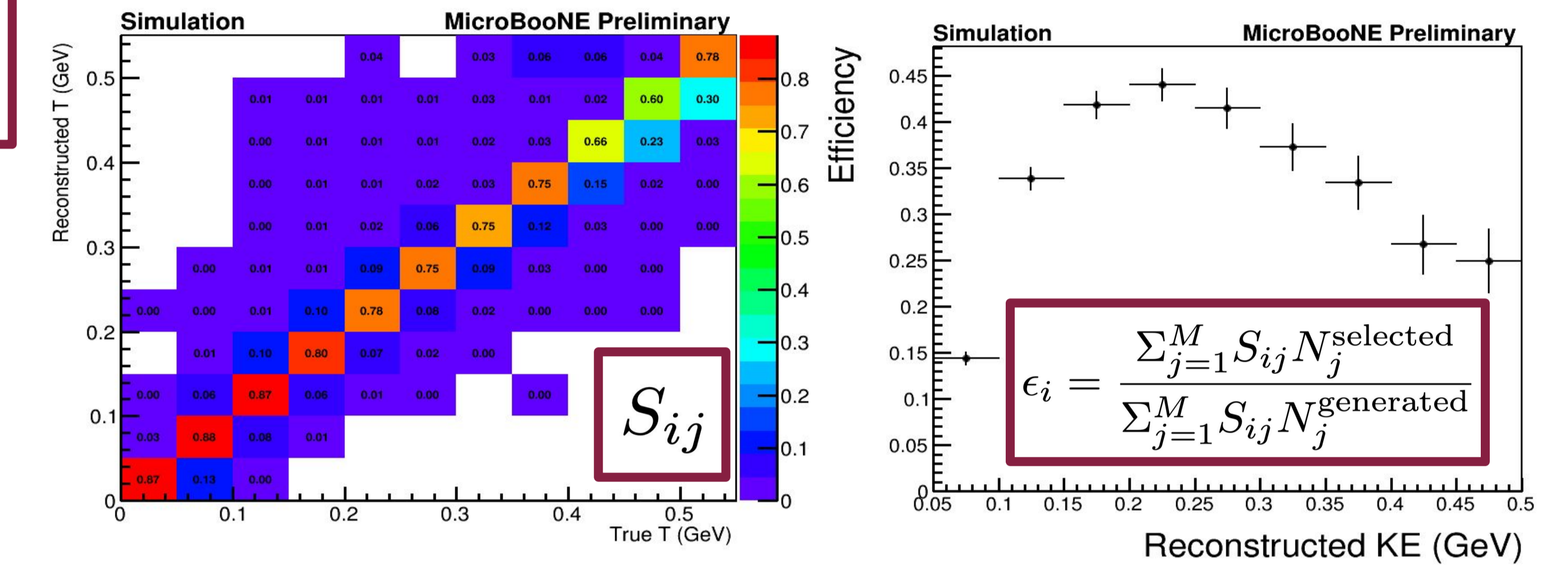
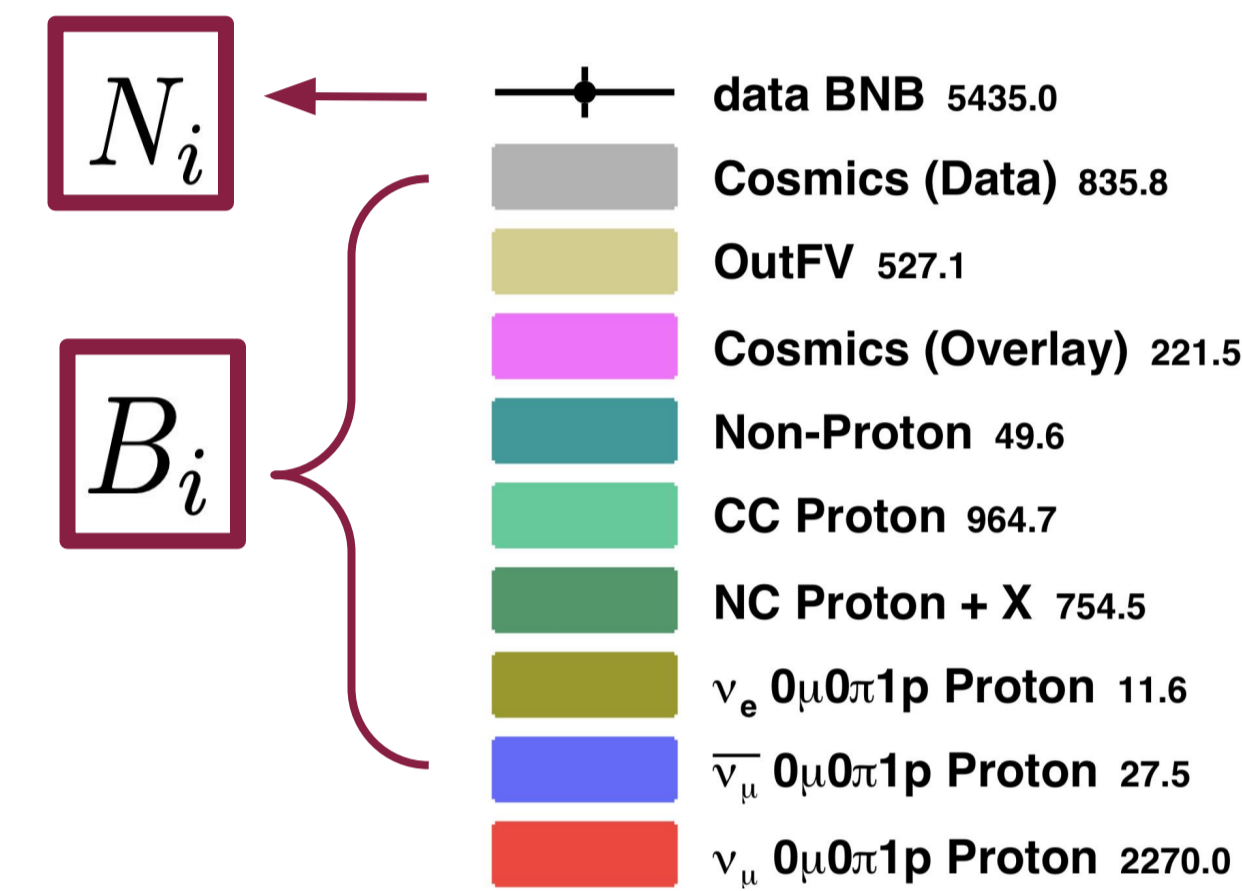
- Neutral-current (NC) cross section measurements are of great interest for future neutrino oscillation experiments
- Studying NC elastic (NCE) scattering is a useful tool to determine the strange quark contribution to the spin structure of the nucleon Δ_s
- This study focuses on the inclusive differential cross-section measurement of NC1p events
 - Only one proton above momentum threshold (200 MeV/c) in the final state
 - Main component is NCE events



Differential Cross Section Extraction

$$\left(\frac{d\sigma}{dT}\right)_i = \frac{N_i - B_i}{\epsilon_i \cdot N_{\text{target}} \cdot \Phi_{\nu_\mu} \cdot (\Delta T)_i}$$

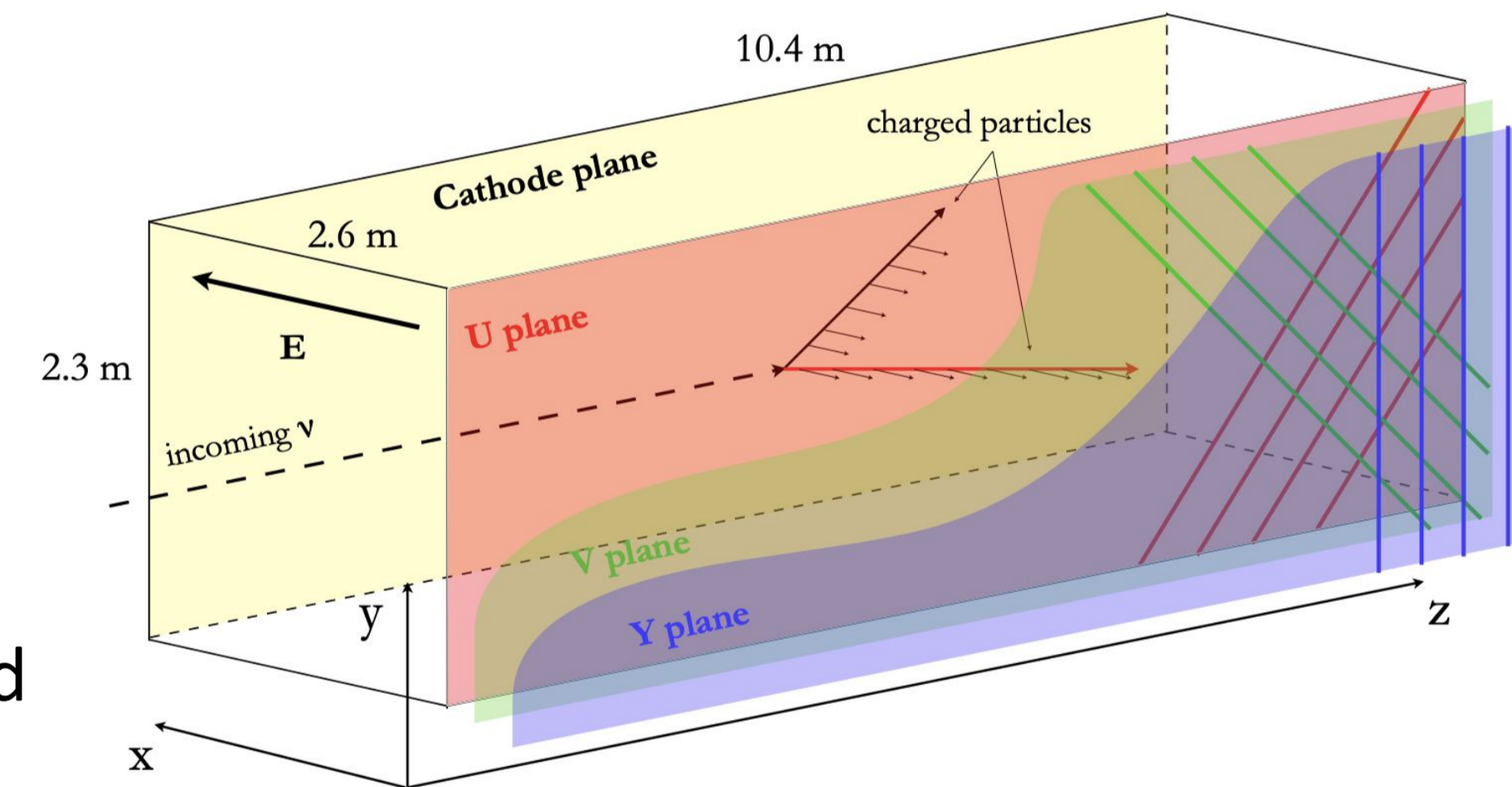
Background subtraction



- Follow a “forward folding” approach
- Report the result as a function of reconstructed kinetic energy

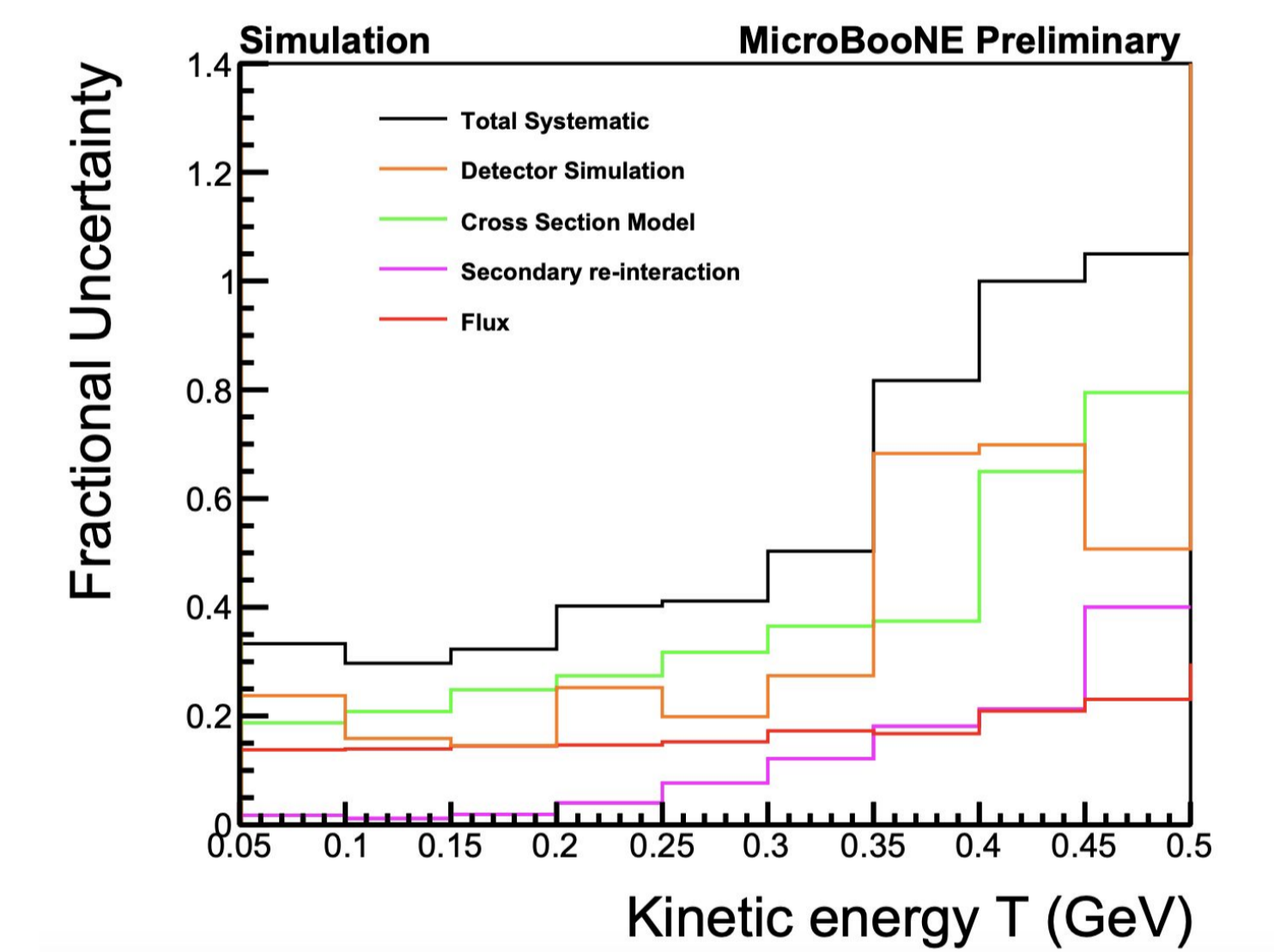
MicroBooNE

- A 85 ton active-mass liquid-argon TPC in the Booster Neutrino Beam (BNB) at Fermilab
- 32 PMTs collect fast scintillation light
- 8192 wires, wire spacing of 3mm provides excellent spatial resolution
- UV laser calibration system
- Started taking data in October 2015, has collected a total of 1.56×10^{21} protons on target (POT)



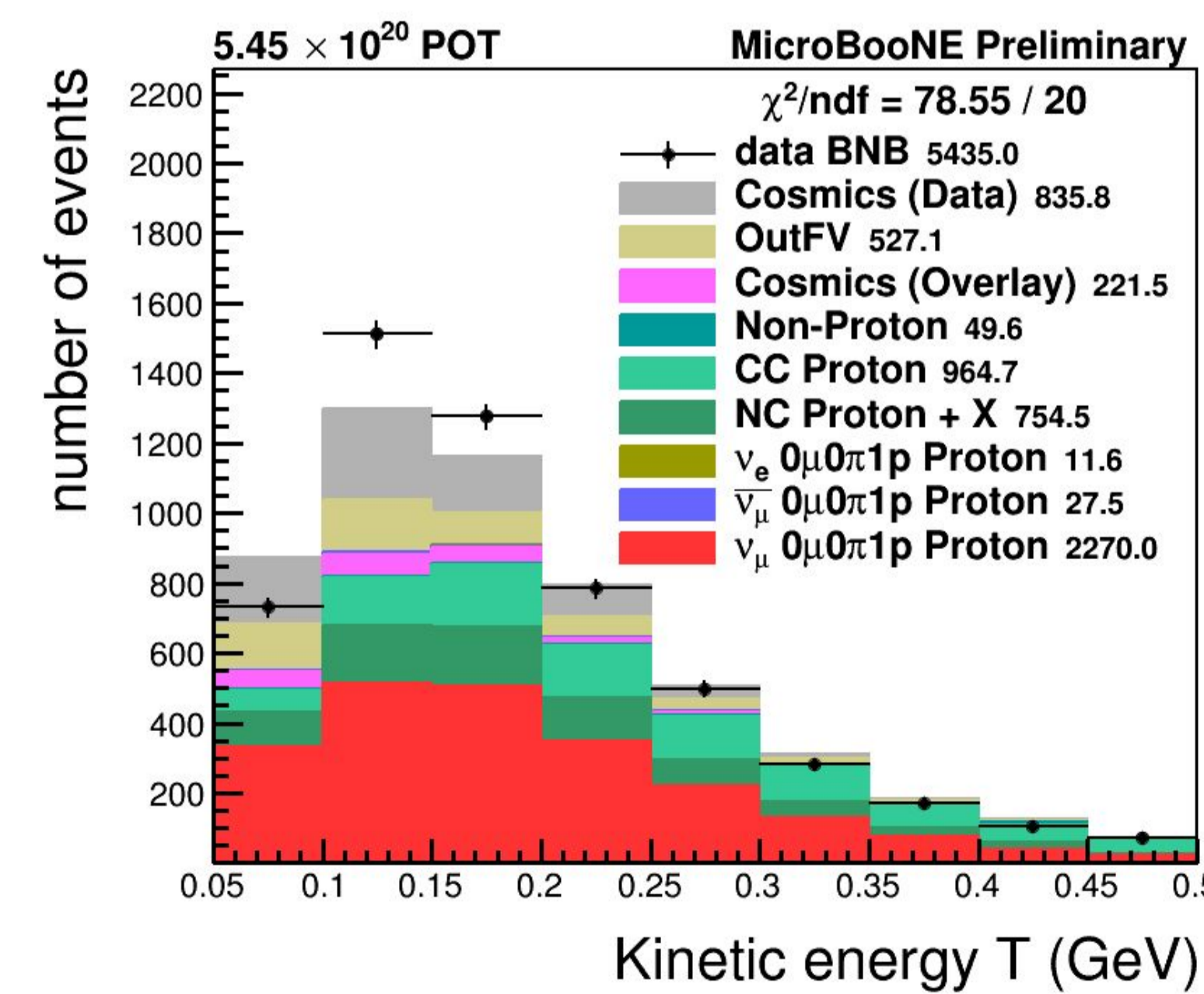
Systematic Uncertainties

- **Cross section model uncertainty** is dominated by NC model uncertainties overall, and large charged-current cross section model uncertainties at high energy
- **Detector simulation uncertainty** is dominated by light yield modeling and detector's response in x direction
- **Flux uncertainty** is dominated by uncertainties from π^+ production and horn current skin effect
- **Secondary re-interaction uncertainty** is dominated by proton re-interaction
- Uncertainties are expected to be reduced with improved MC statistics



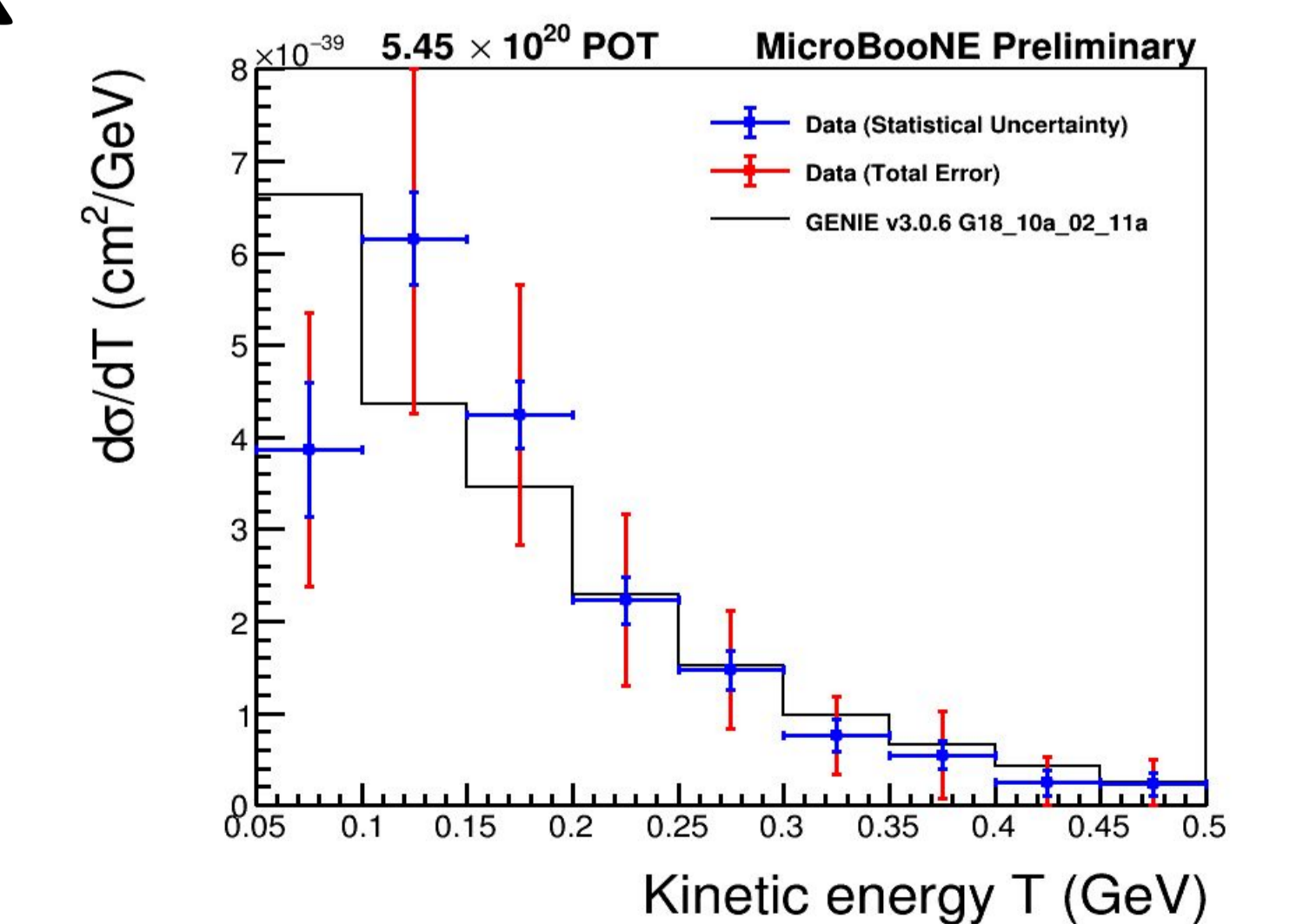
Single Proton Event Selection

- Track is contained within 10 cm (20 cm) from the border of the TPC in x, z (y) direction
- Identify only one track and no shower in an event
- Satisfy light-related requirements of neutrino-hypothesis
- Track angle with respect to the incident neutrino beam direction $\theta < 90^\circ$
- Deposited energy profile consistent with a proton
- Cosmic background reduced by applying a BDT cut
- **Overall efficiency is 29.8%, overall purity is 42.1%**



Result and Outlook

- First NC1p inclusive differential cross section $d\sigma/dT$ on argon using 5.45×10^{20} POT data
- Data-MC difference at low energy is being studied. Could be due to physics?
- It includes interactions down to $Q^2 \approx 2MT = 0.1 \text{ GeV}^2$, which is significantly lower than previous measurements [1][2]
- Will reduce CC background and systematic uncertainties in the near future
- Ultimate goal is to extend to a measurement of the NC elastic scattering cross section and the extraction of Δ_s



References

- [1] L.A. Ahrens et al. Phys. Rev. D, 35:785, 1987.
 [2] A.A. Aguilar-Arevalo et al. Phys. Rev. D, 82:092005, 2010.