

# Characterizing the energy resolution of the MicroBooNE LArTPC at the MeV scale using monoenergetic features of $^{208}\text{Tl}$ decays

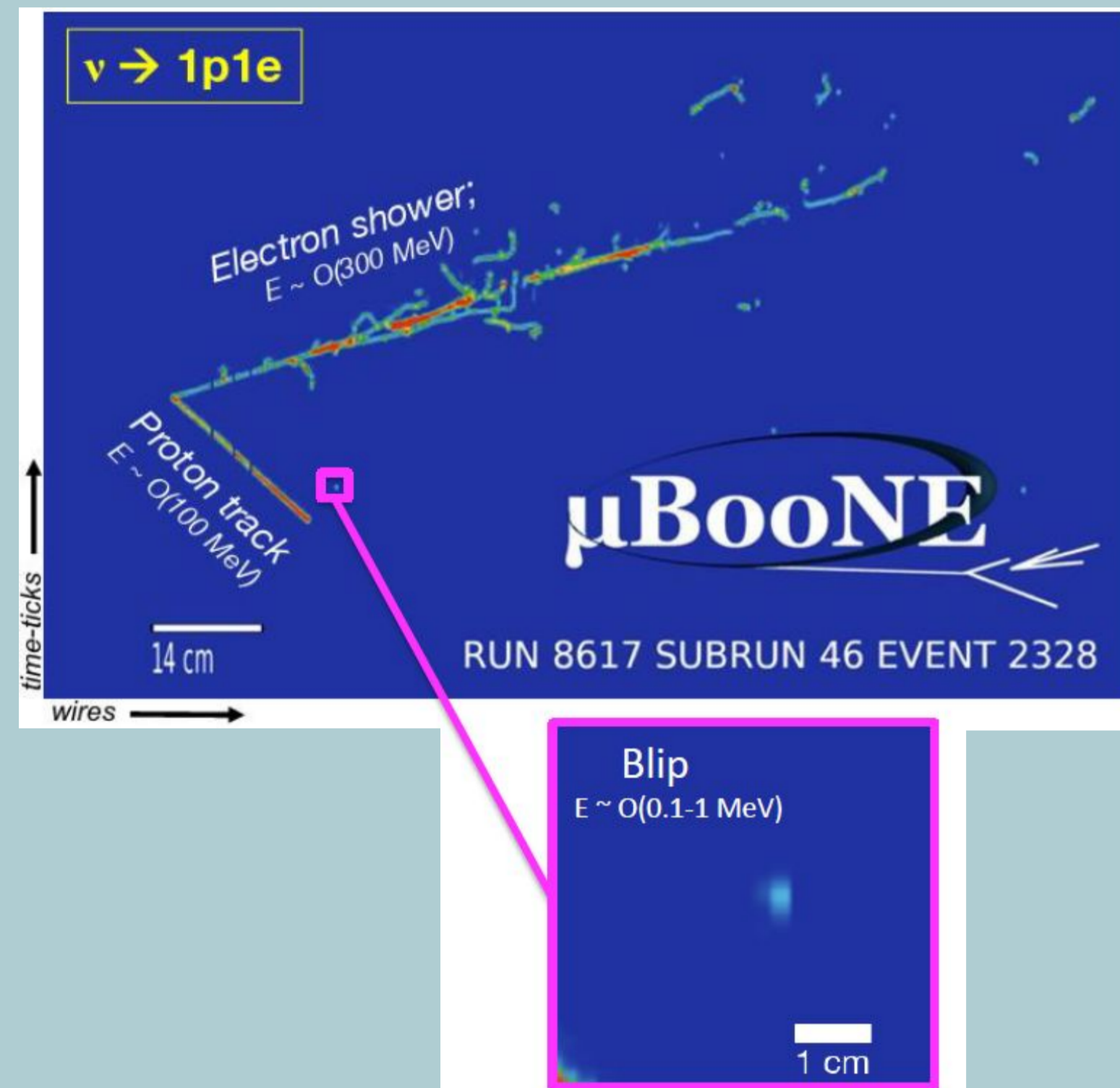
Maria Gabriela Manuel Alves (Illinois Tech), on behalf of the MicroBooNE Collaboration



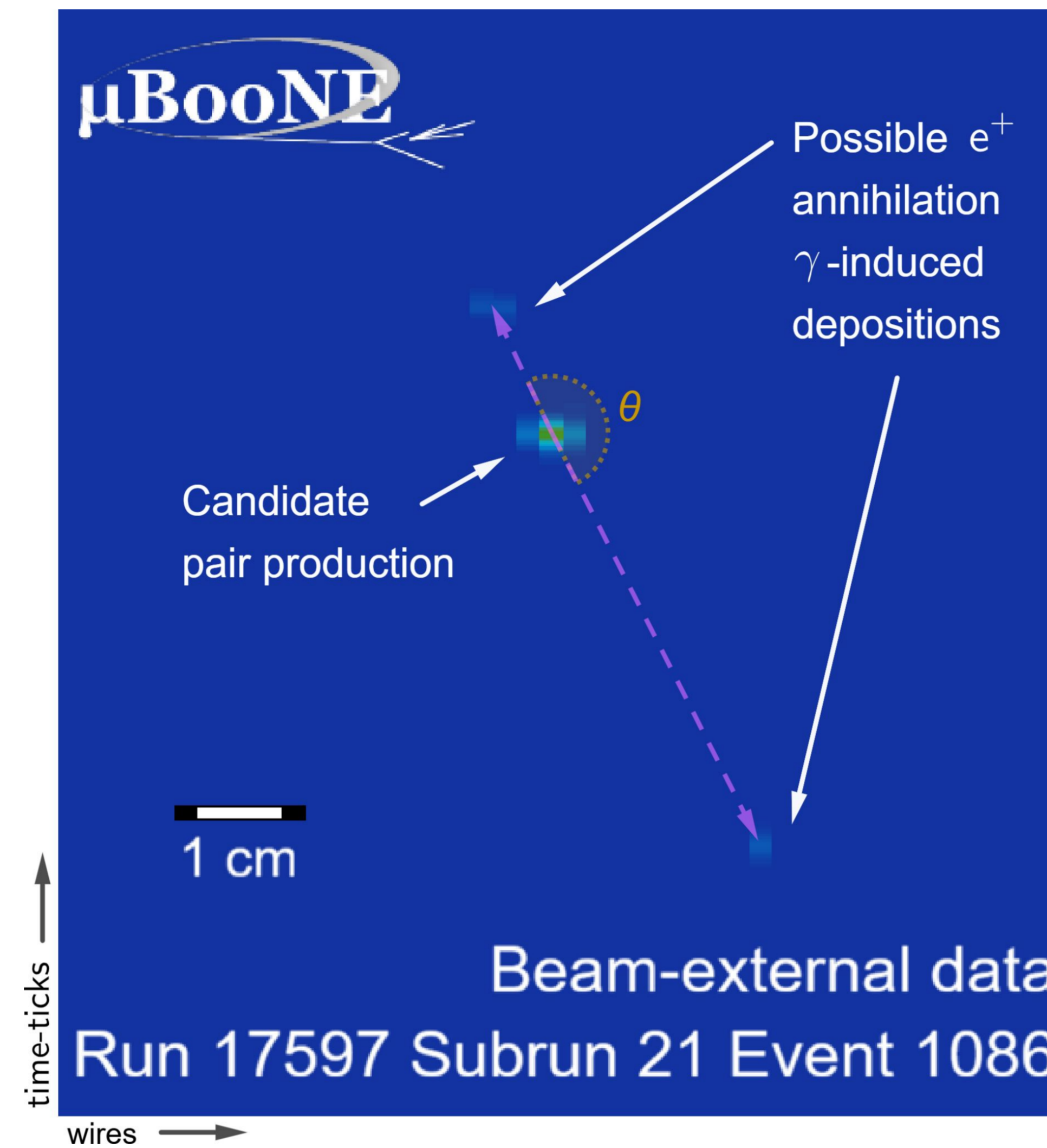
arXiv:2605.30709

## MeV scale in LArTPCs

- Opportunities: solar, atmospheric & supernova  $\nu$ , BSM, etc [1].
- Blips: isolated, compact, low-energy [2]; hit  $\rightarrow$  2D cluster  $\rightarrow$  3D blip.

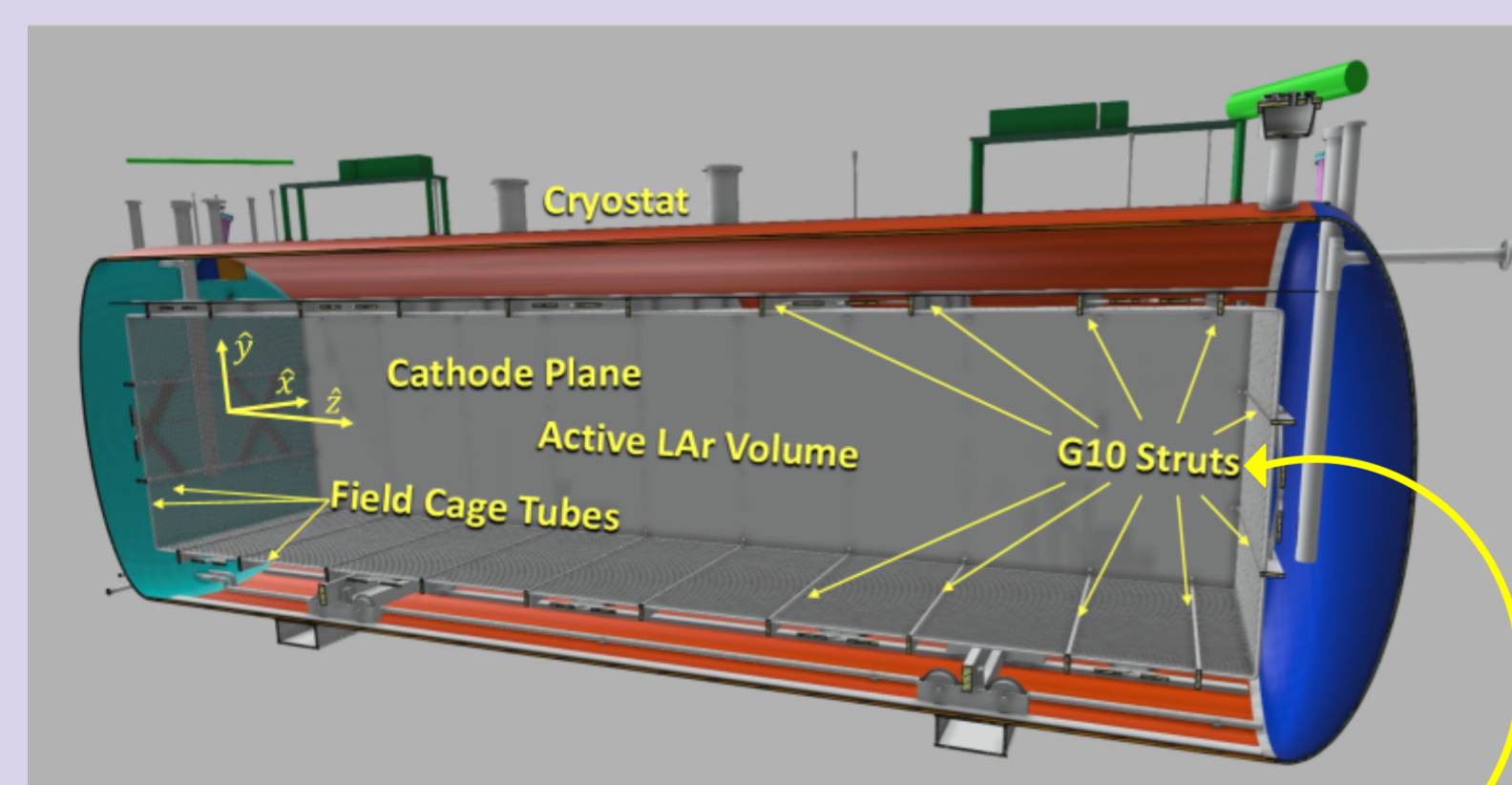


## First measurement of the energy resolution of a LArTPC at the MeV scale.



## First monoenergetic source identified in ambient data.

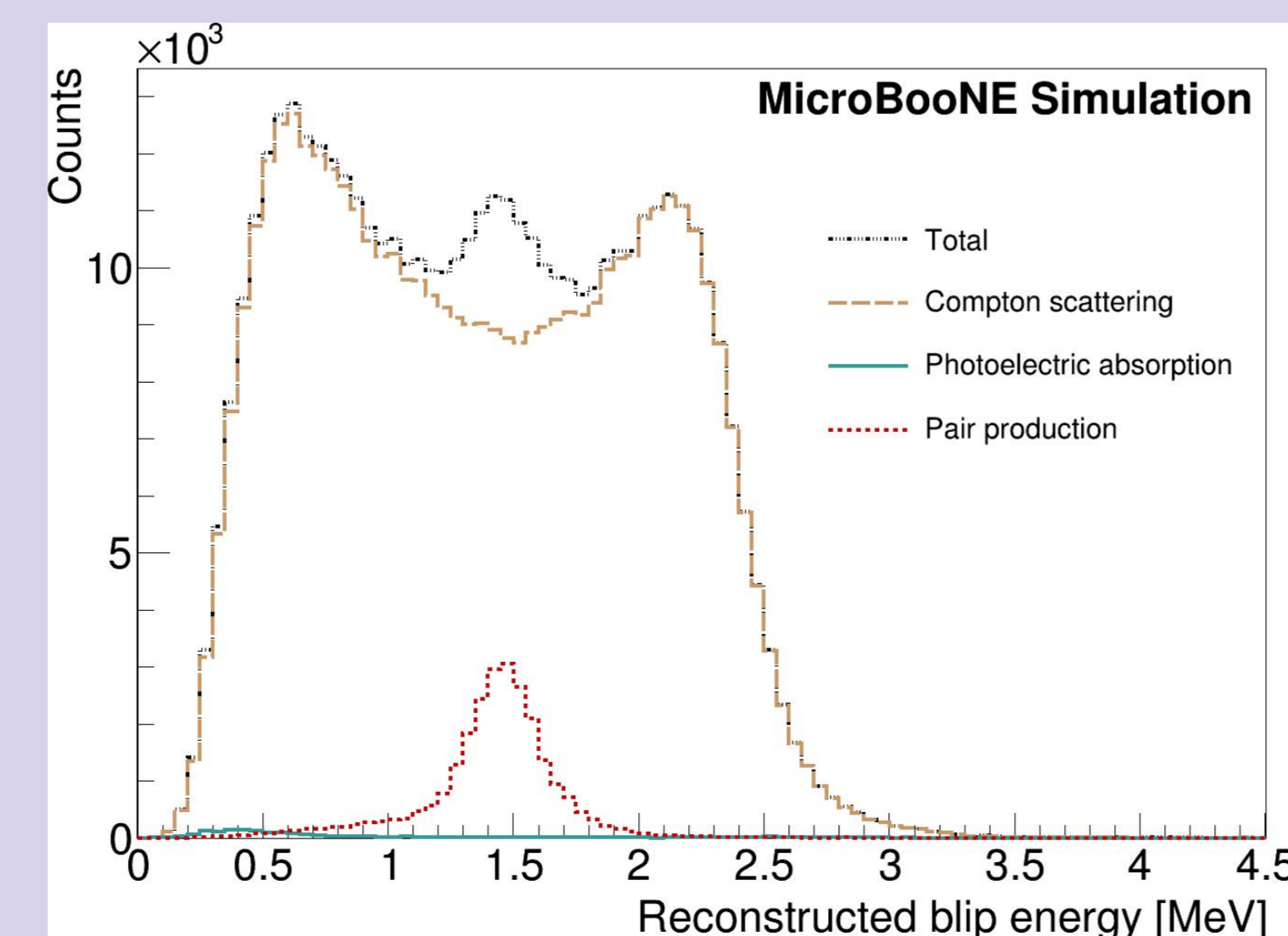
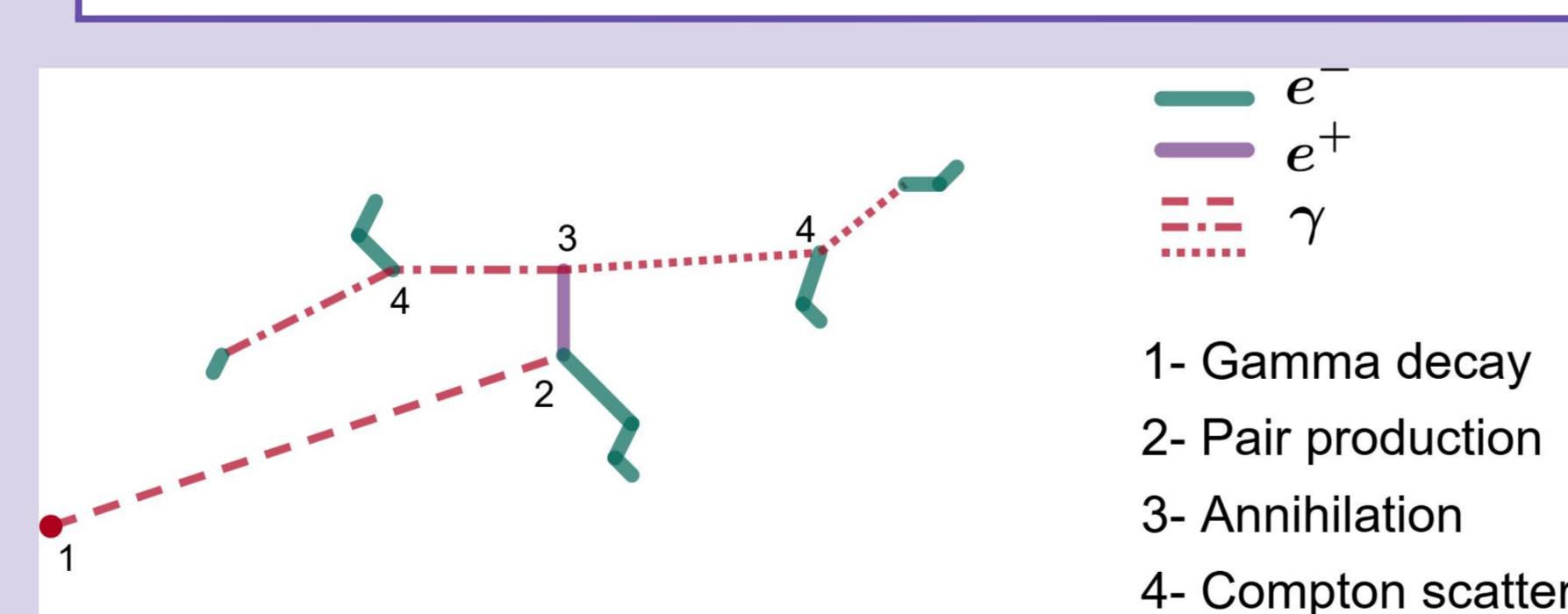
## $^{208}\text{Tl}$ $\gamma$ -rays in MicroBooNE



- $^{208}\text{Tl}$  decays in the G10 struts  $\rightarrow$  2.614 MeV  $\gamma$ -rays [3].
- Prominent interactions:

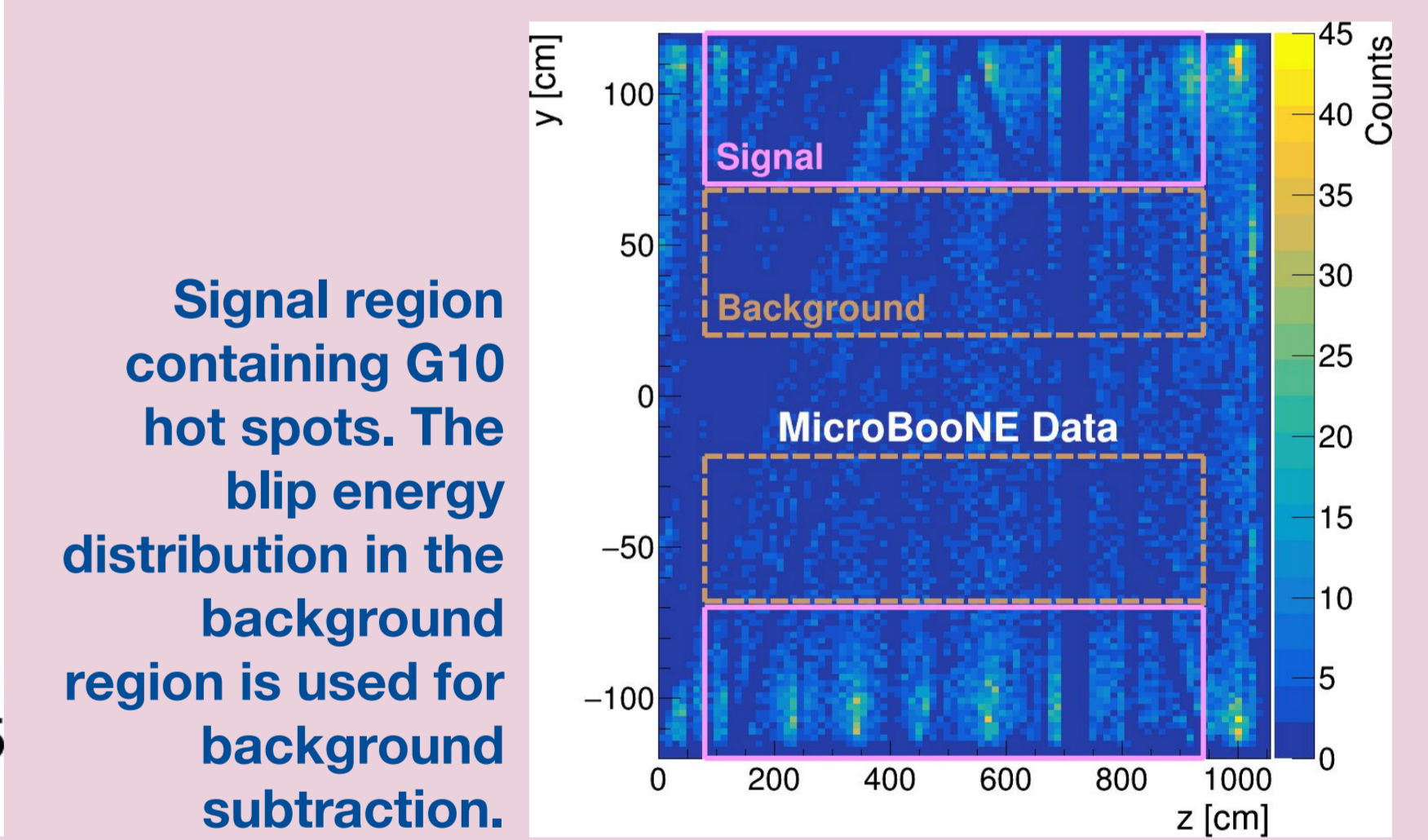
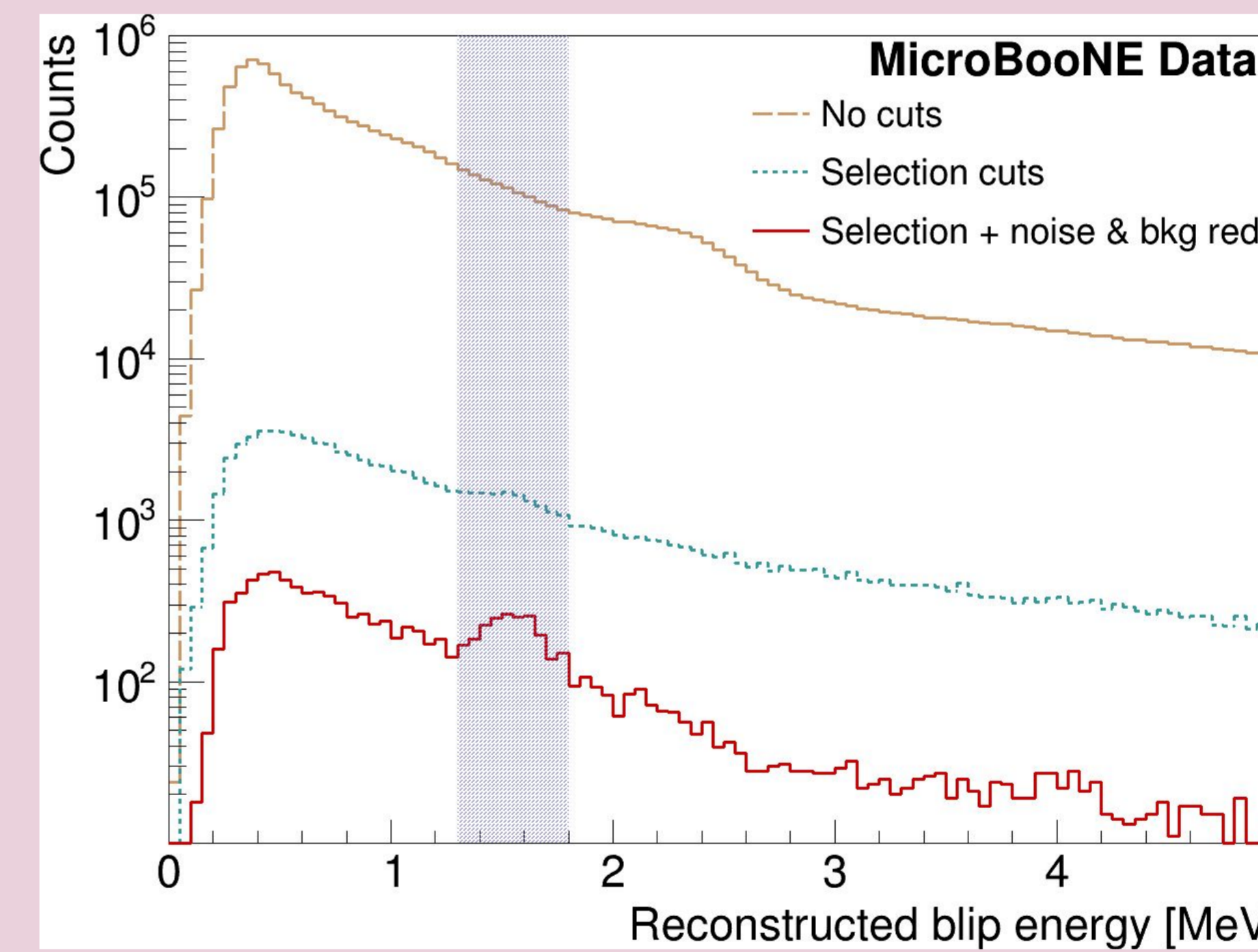
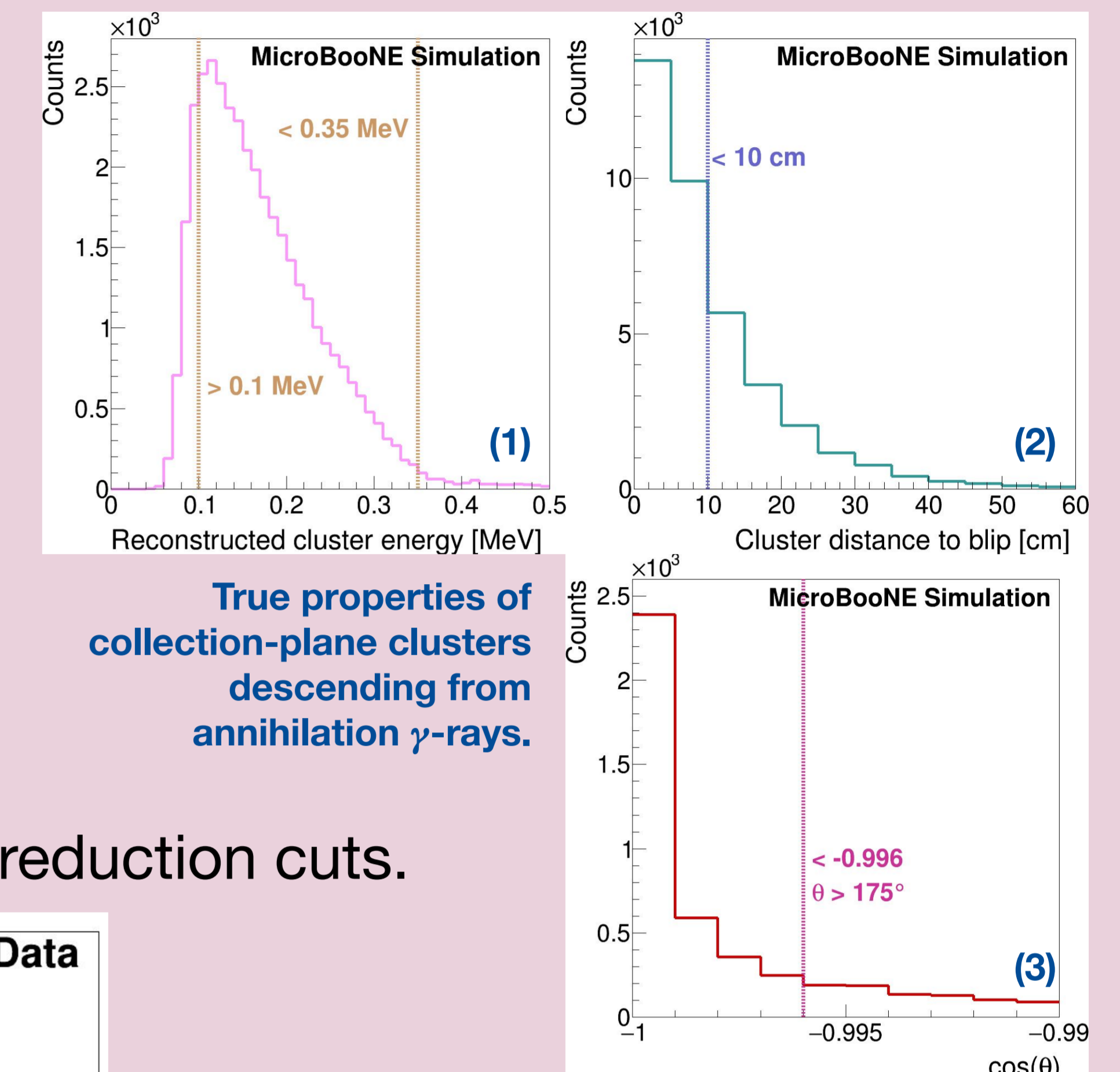
Compton scattering	94.6%
Pair production	5.24%

- Pair production:
  - Monoenergetic  $e^+e^-$  pair: 2.614 -  $2 \times 0.511 = 1.592$  MeV
  - Characteristic topology:  $e^+$  annihilation  $\rightarrow$  back-to-back  $\gamma$ -rays.



## Signal selection

- Samples:
  - Beam-off data: 35-minute cumulative exposure.
  - Monte Carlo: 2.614 MeV  $\gamma$ -rays at the G10 hot spots.
- Pair-production blip candidate: two accompanying collection-plane clusters complying to (1), (2), and (3) (selection cuts).
- Additional noise and background reduction cuts.



## MeV-scale energy resolution

- Expectation:  $\approx 9\%$  [2]
- Results:  $p_2/p_1$ 
  - Data:  **$(7.52 \pm 0.78$  (stat)  $\pm 0.92$  (syst))%**
  - Monte Carlo:  $(9.70 \pm 0.65$  (stat))%
  - Consistency level:  $1.6\sigma$

References:

- [1] *J. Phys. G* **50** (2023) 033001
- [2] MicroBooNE, *Phys. Rev. D* **109** (2024) 052007
- [3] MicroBooNE, *Phys. Rev. D* **111** (2025) 032005



This manuscript has been authored by Fermi Forward Discovery Group, LLC under Contract No. 89243024CSC000002 with the U.S. Department of Energy, Office of Science, Office of High Energy Physics.

