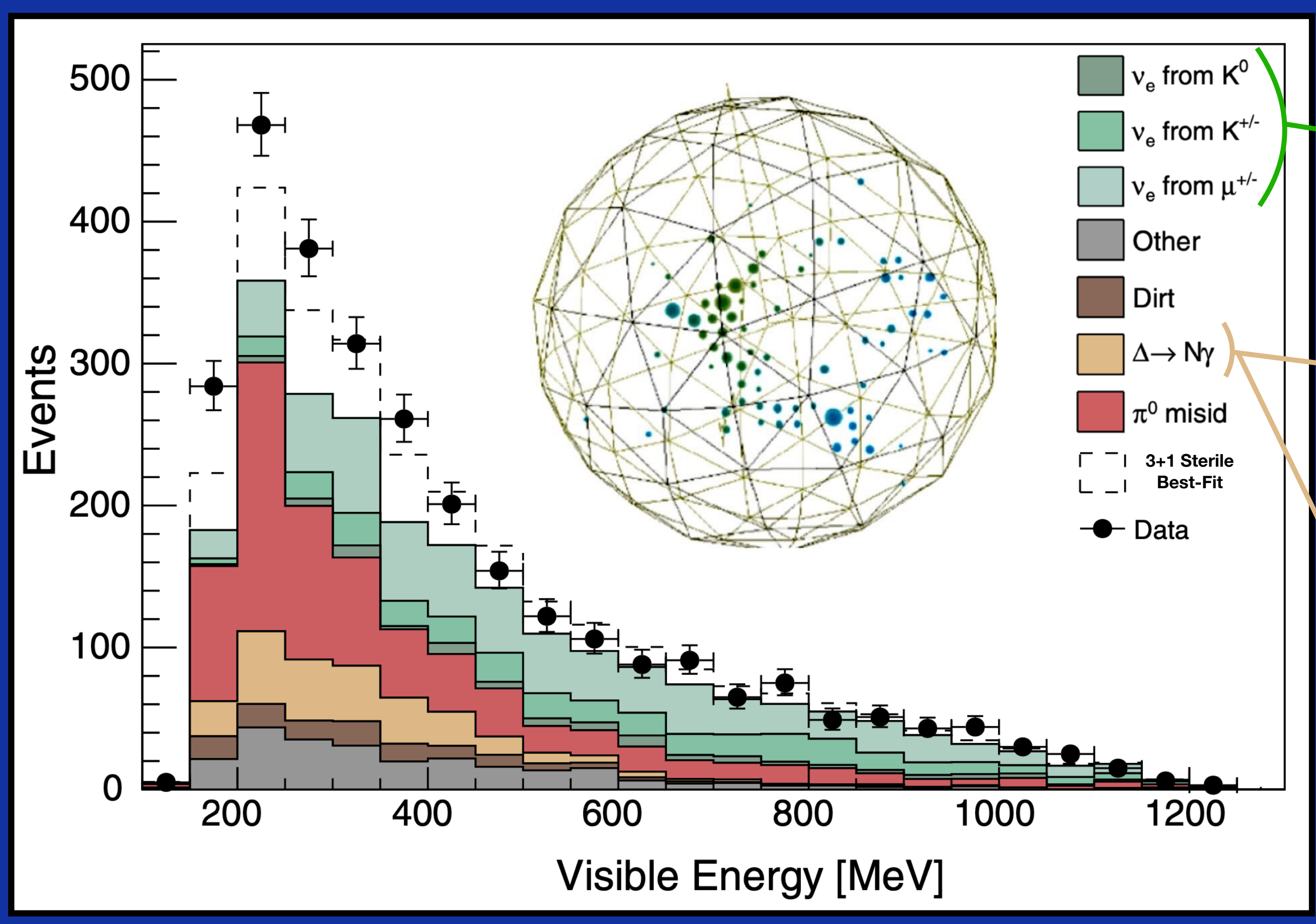
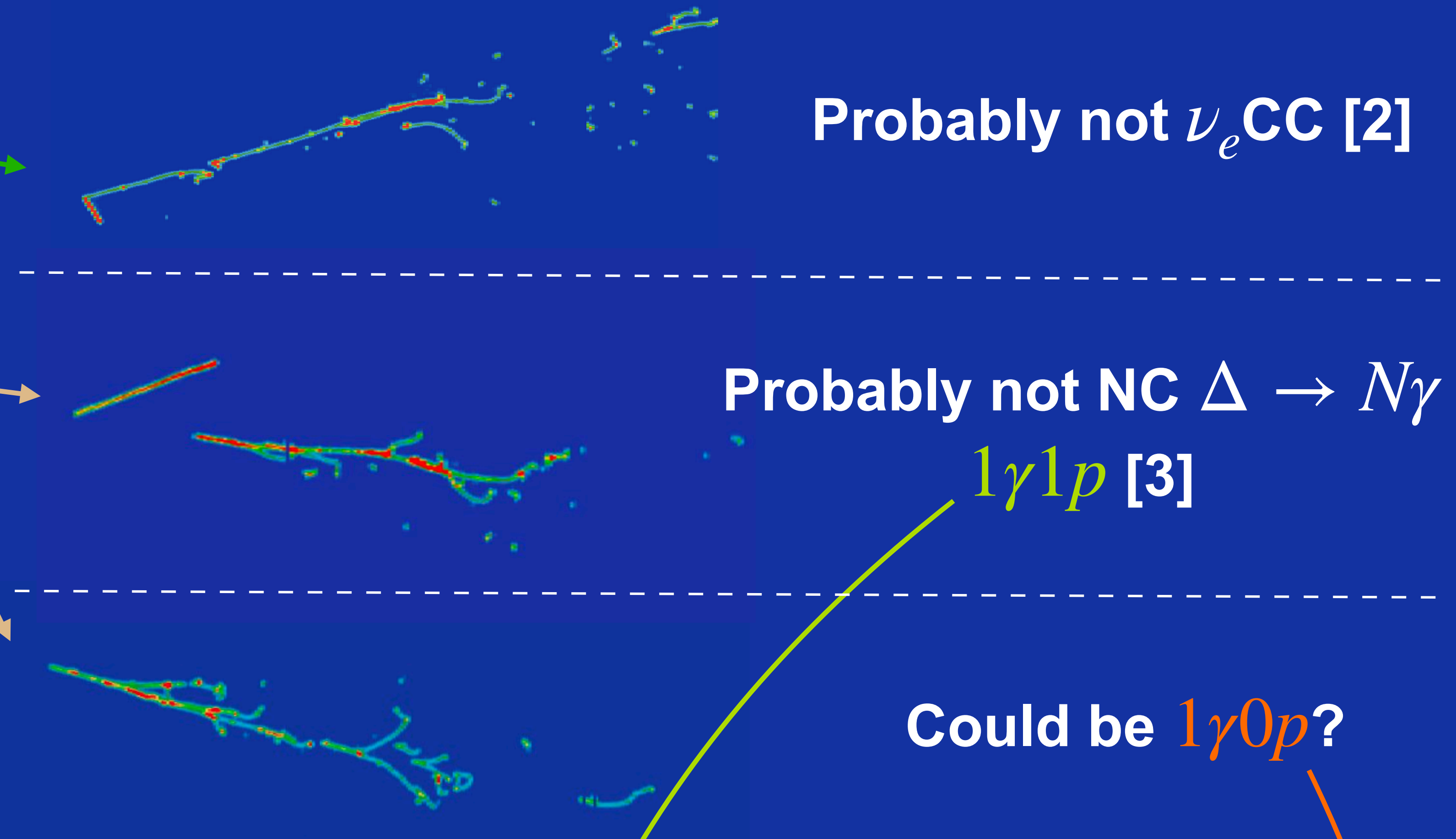


Lee Hagaman on behalf of the MicroBooNE Collaboration, [leehagaman@nevis.columbia.edu](mailto:leehagaman@nevis.columbia.edu)

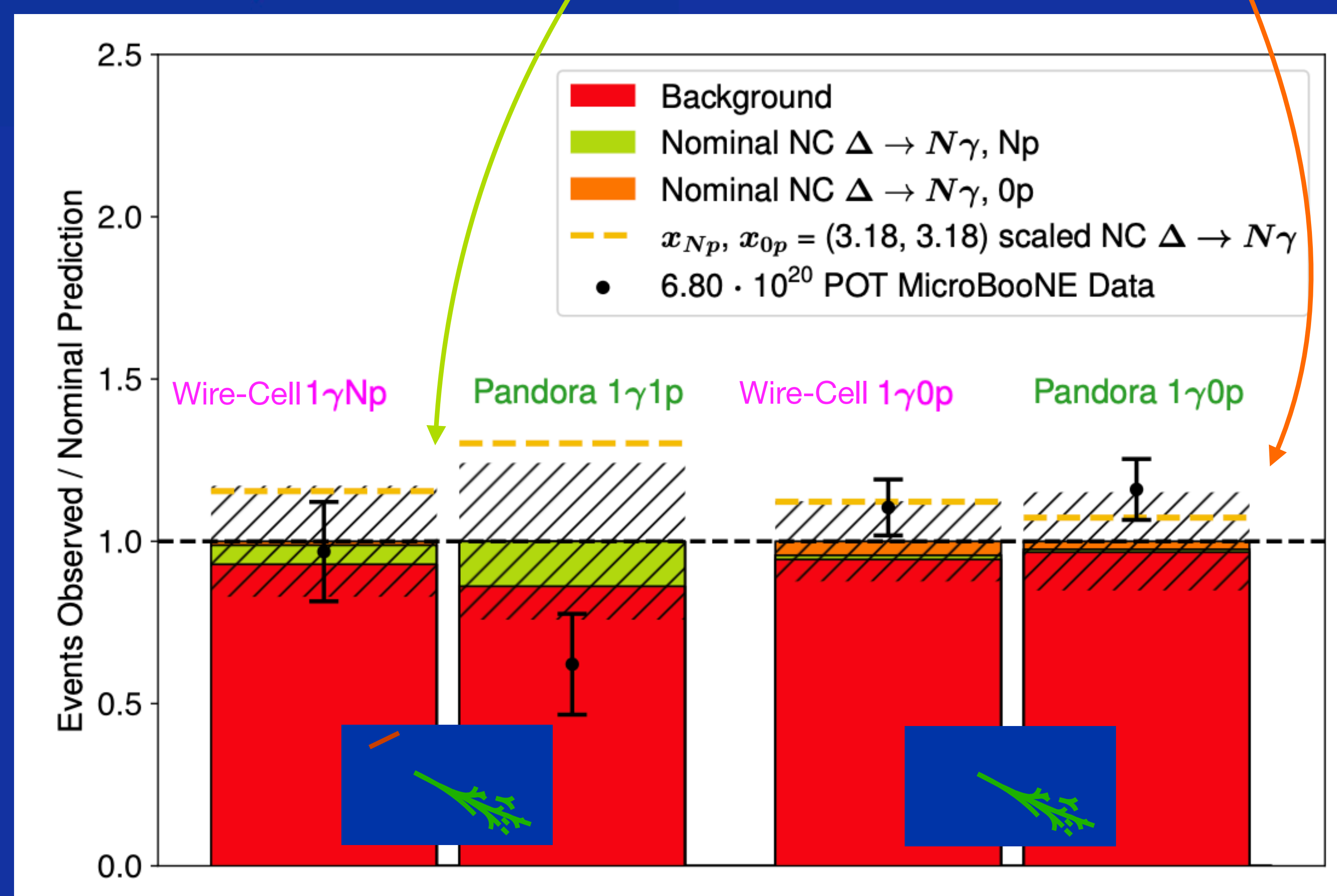
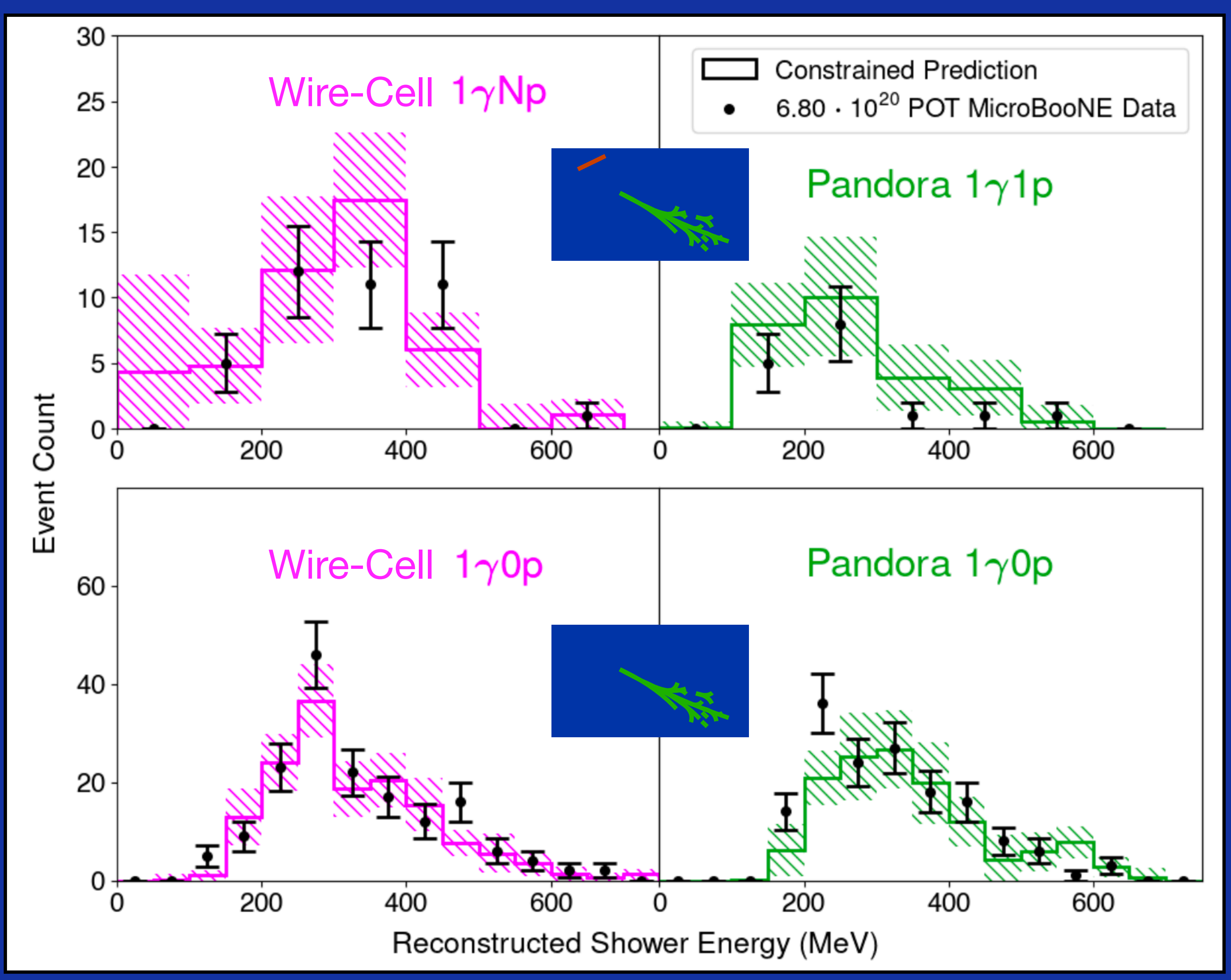
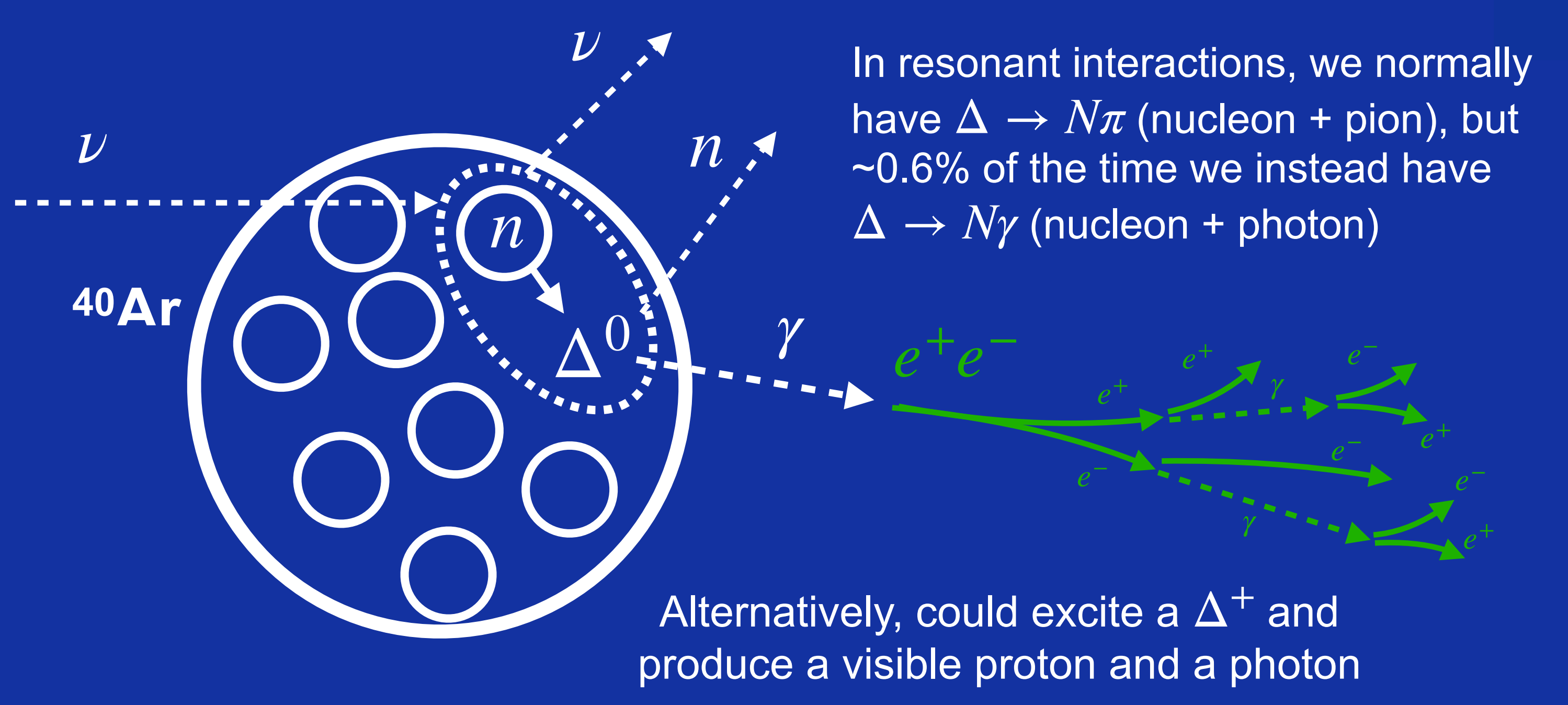
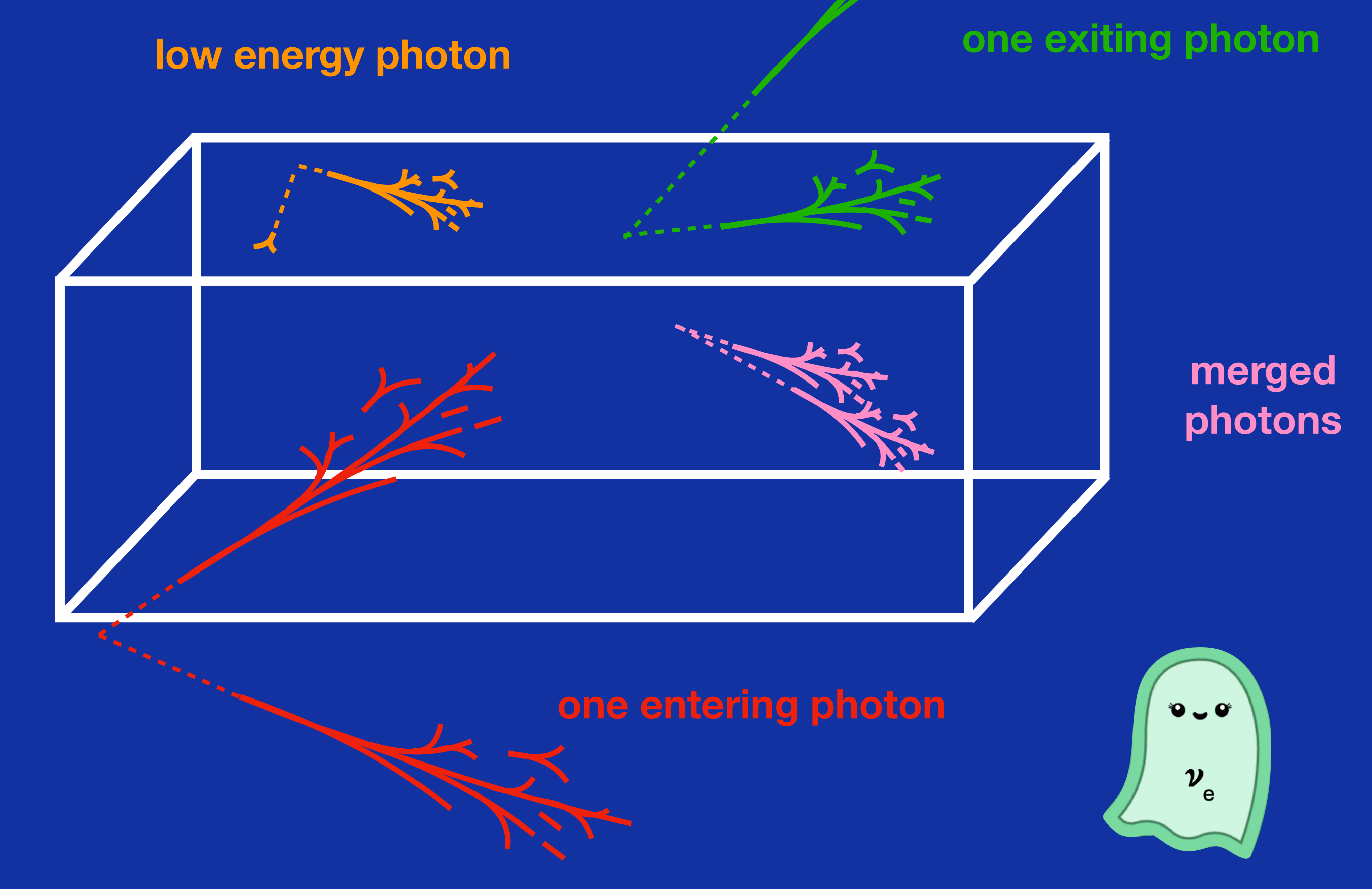
# MiniBooNE Saw A Big Excess! [1]



# What Was The Excess?

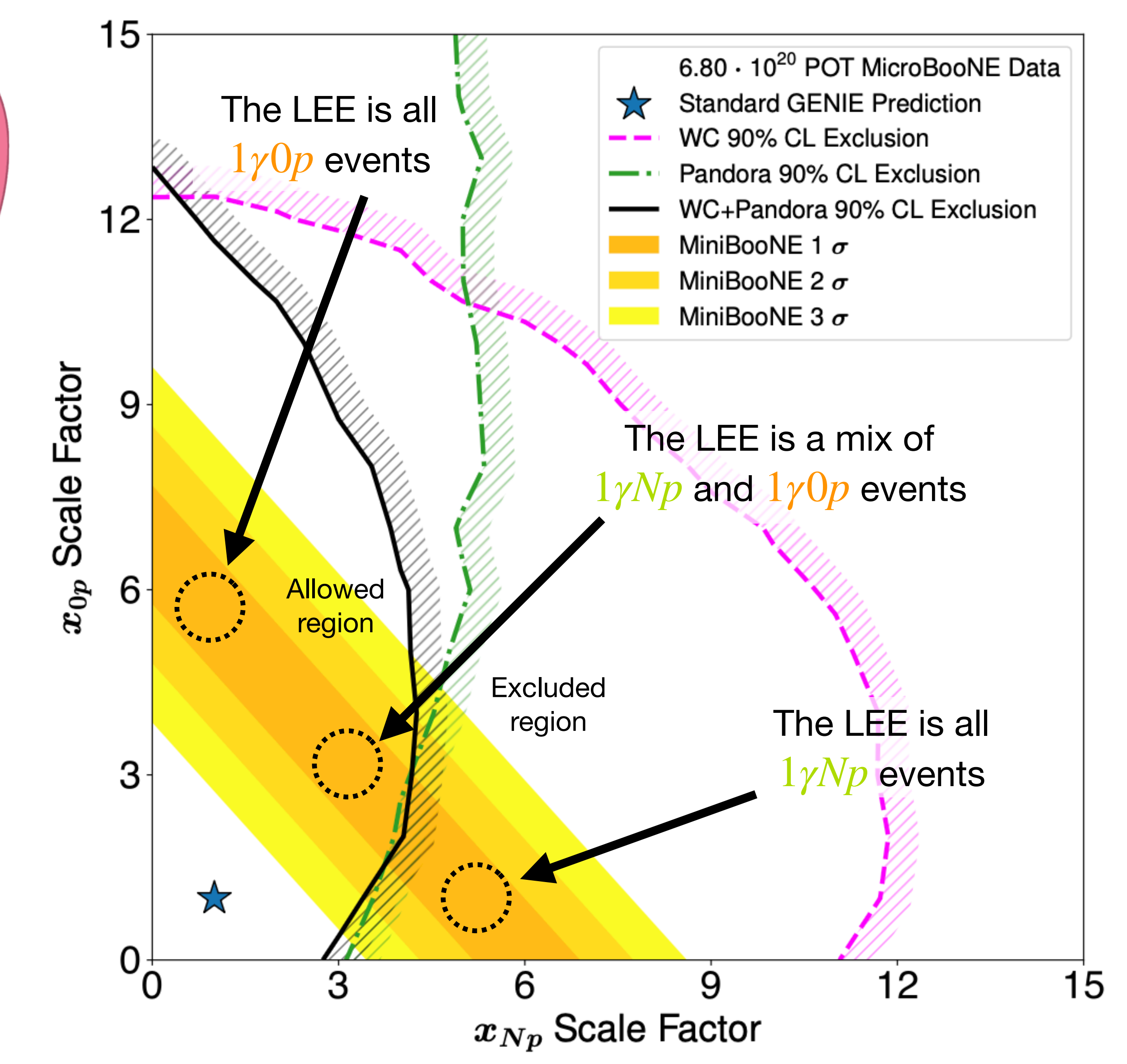
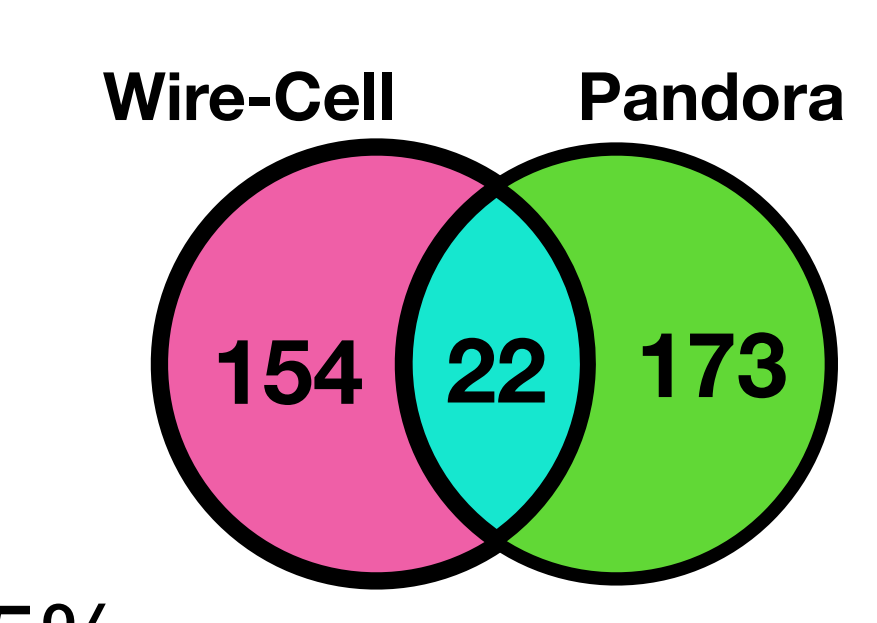


Single photons are hard to identify!  
Many ways for  $\pi^0 \rightarrow 2\gamma$  events to look like  $1\gamma$



- NC  $\Delta \rightarrow N\gamma$  events are the only significant expected source of true single photons
- This process has never been observed, and MiniBooNE concluded that a 3.18x scaling of these events could explain their Low Energy Excess (LEE) fairly well [1]
- Our previous search [3] was consistent with standard model expectations and **excluded a 3.18x scaling of the NC  $\Delta \rightarrow N\gamma$  rate**, mostly driven by the  $1\gamma1p$  channel

- New: adding additional selections using Wire-Cell 3D reconstruction
  - Doubled total efficiency! 9.8%  $\rightarrow$  19.6%
  - Much better  $1\gamma0p$  selection!
    - Efficiency: 5.5%  $\rightarrow$  8.8%, purity: 4.0%  $\rightarrow$  7.5%
- We expand to a 2D excess hypothesis, different scaling rates of NC  $\Delta \rightarrow N\gamma$  with and without protons,  $x_{Np}$  and  $x_{0p}$
- In this broader space of NC  $\Delta \rightarrow N\gamma$  MiniBooNE LEE hypotheses, **we exclude models with large  $1\gamma Np$  excesses, but not all models with large  $1\gamma 0p$  excesses.**
- Work is ongoing towards improved  $1\gamma 0p$  selections!



Supporting MicroBooNE publication:  
Phys. Rev. D 112, L091101 (2025)  
[1] Phys. Rev. D 103, 052002 (2021)  
[2] Phys. Rev. Lett. 128, 241801 (2022)  
[3] Phys. Rev. Lett. 128:111801 (2022)

