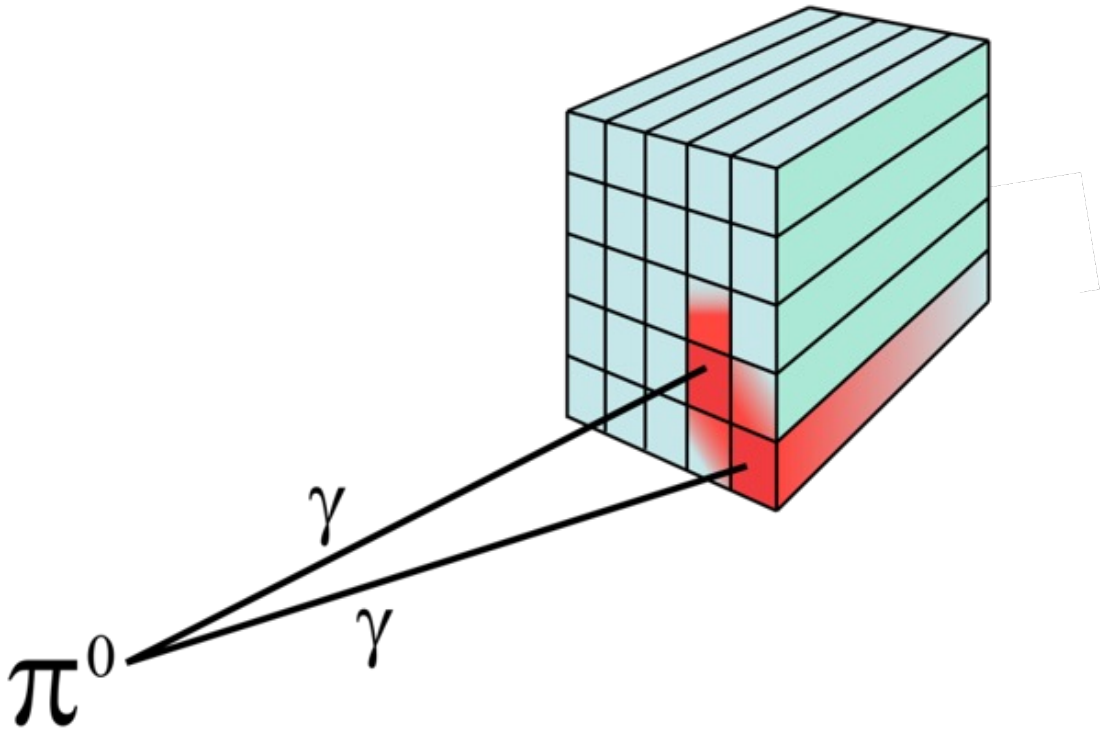

Update on Far-Forward Benchmarks

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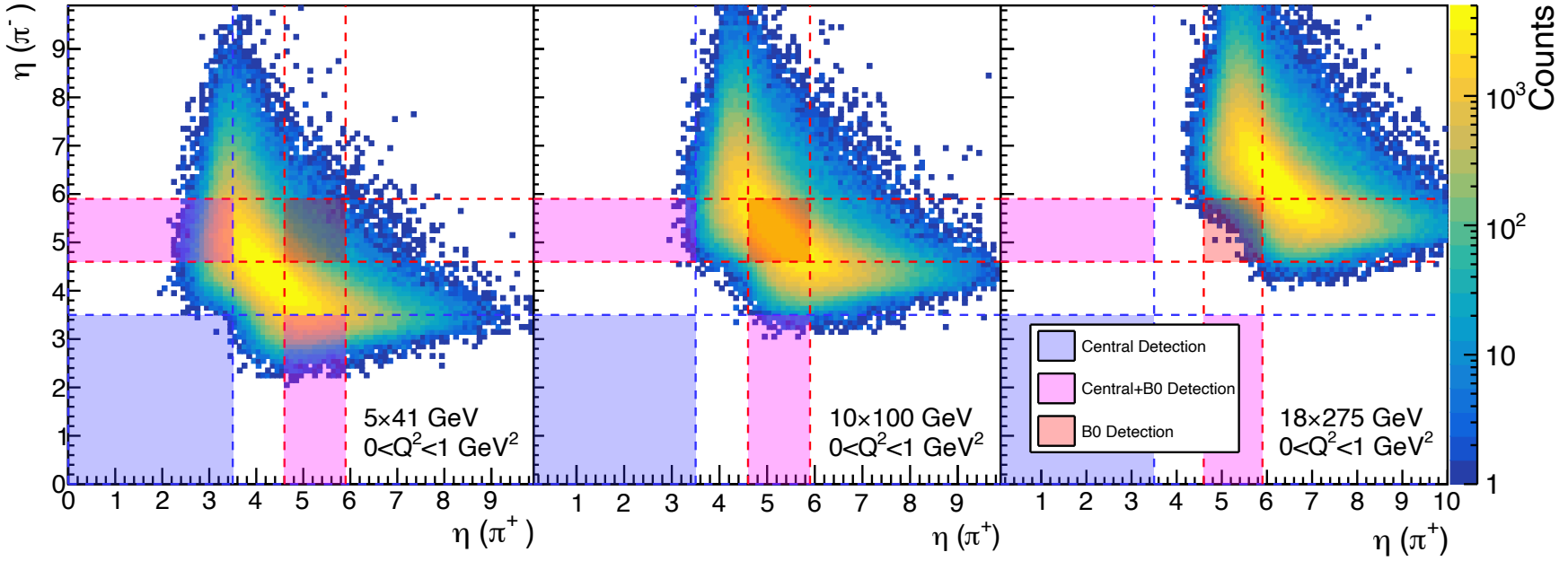
Supported in part by

(RECAP) Far-Forward Benchmarks: Backward π^0

- Backward π^0 production is an excellent benchmark for ZDC
- This benchmark can measure three things:
  1. Missing mass $e\ p \rightarrow e\ p\ \pi^0$
     - ❑ Tests backward (electron) detectors
     - ❑ Tests forward (hadronic) calorimeter and PID
     - ❑ Tests ZDC (and B0) reconstruction capability
  2. π^0 mass reconstruction peak
     - ❑ If this changes, something may have changed with beam pipe, or ZDC
  3. Total photon yield
     - ❑ Tests effect showering

(RECAP) Far-Forward Benchmarks: Backward ρ^0

- Backward ρ production is an excellent benchmark for B0 tracking
- With $\rho \rightarrow \pi^+\pi^-$ we can test two things in the benchmark:
  1. Missing mass $e\,p \rightarrow e\,p\,\rho$
     - ❑ Tests backward (electron) detectors
     - ❑ Tests forward (hadronic) calorimeter and PID
     - ❑ Tests B0 reconstruction capability
  2. ρ mass reconstruction peak
     - ❑ If this changes, something may have changed with beam pipe, or B0 tracking resolution

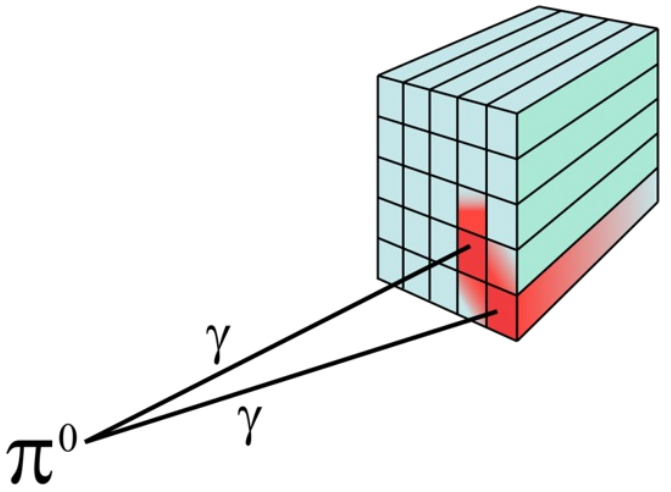


Backward π^0 at Generator-Level

- Backward π^0 events simulated with eSTARlight
- 18×275 GeV is best
- Generated 100k events of exclusive u-channel π^0 production at 18×275GeV with Q^2 from 1e-7 to 10 GeV^2
- Afterburned with the high-divergence configuration
- Ran 1000 test events through the ePIC simulation and reconstruction framework
- Many thanks to Kong Tu and Tyler Hague for teaching me how to process these!

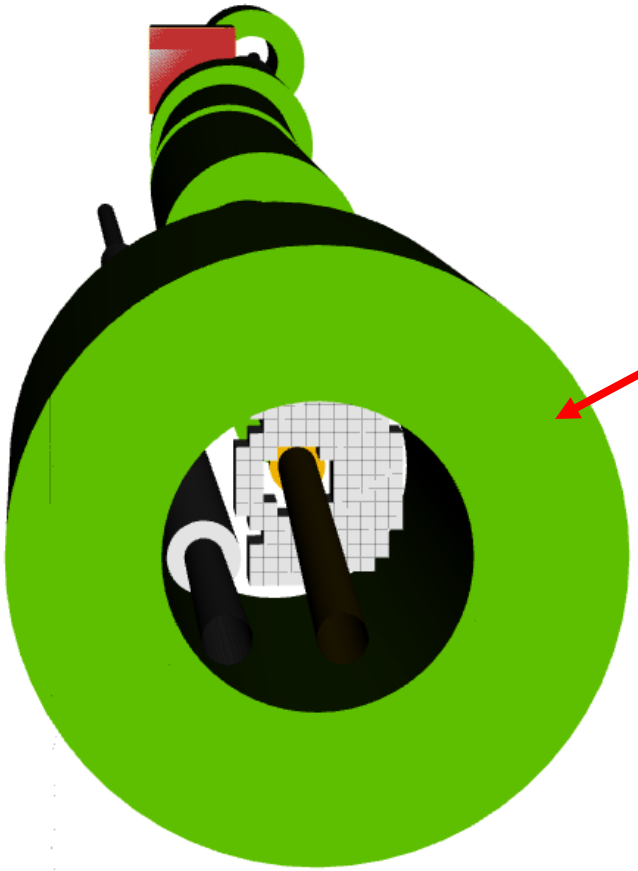
π^0 Both Photons in ZDC Acceptance

	5×41	10×100	18×275
$0<Q^2<1$ GeV^2	13%	72%	99%
$1<Q^2<10$ GeV^2	11%	69%	98%
$10<Q^2<20$ GeV^2	15%	79%	99%

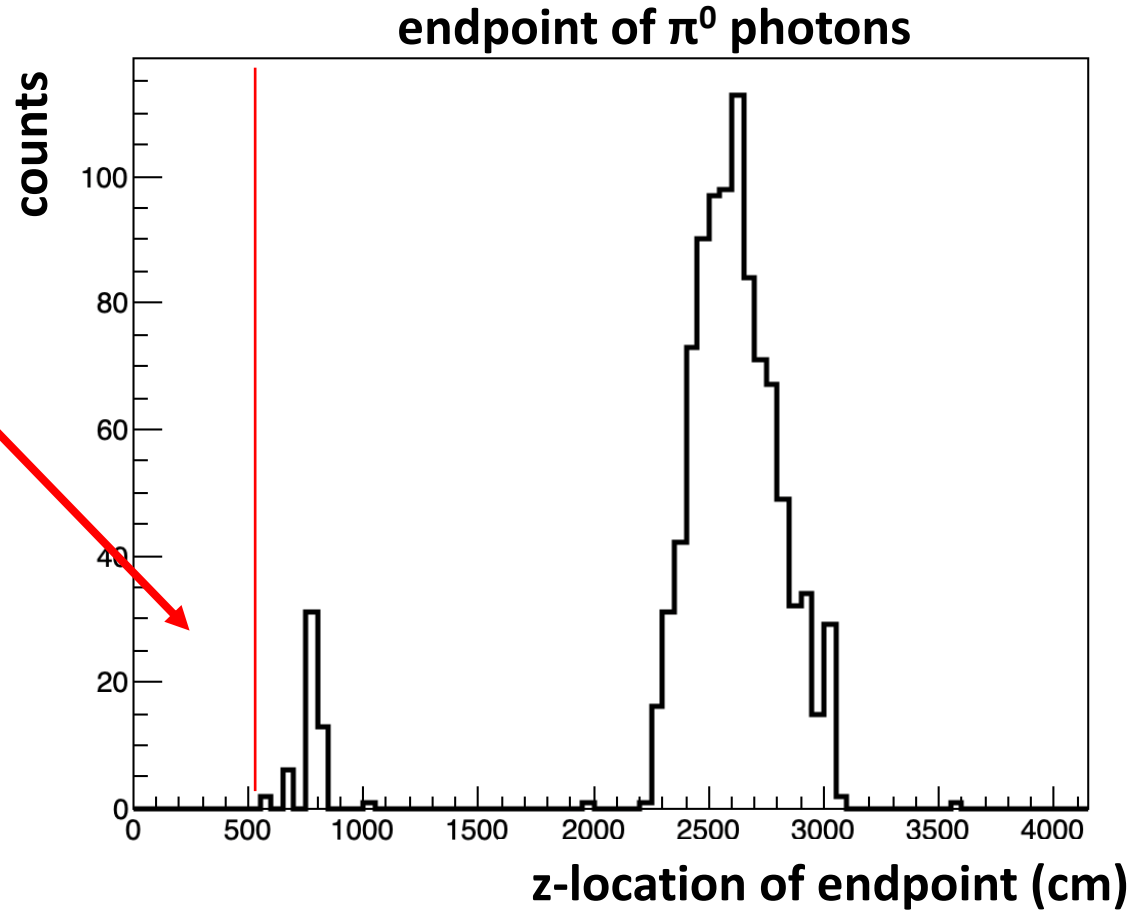


Backward π^0 in ePIC Simulations

Before 500 cm, photon hasn't had a chance to hit B0

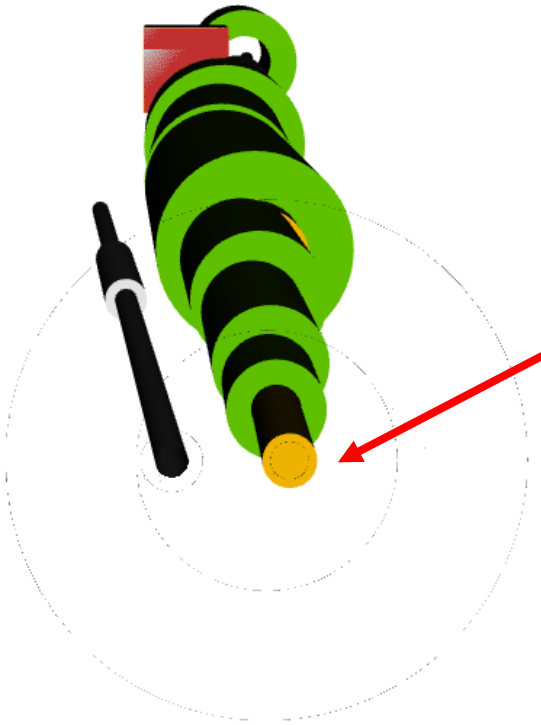


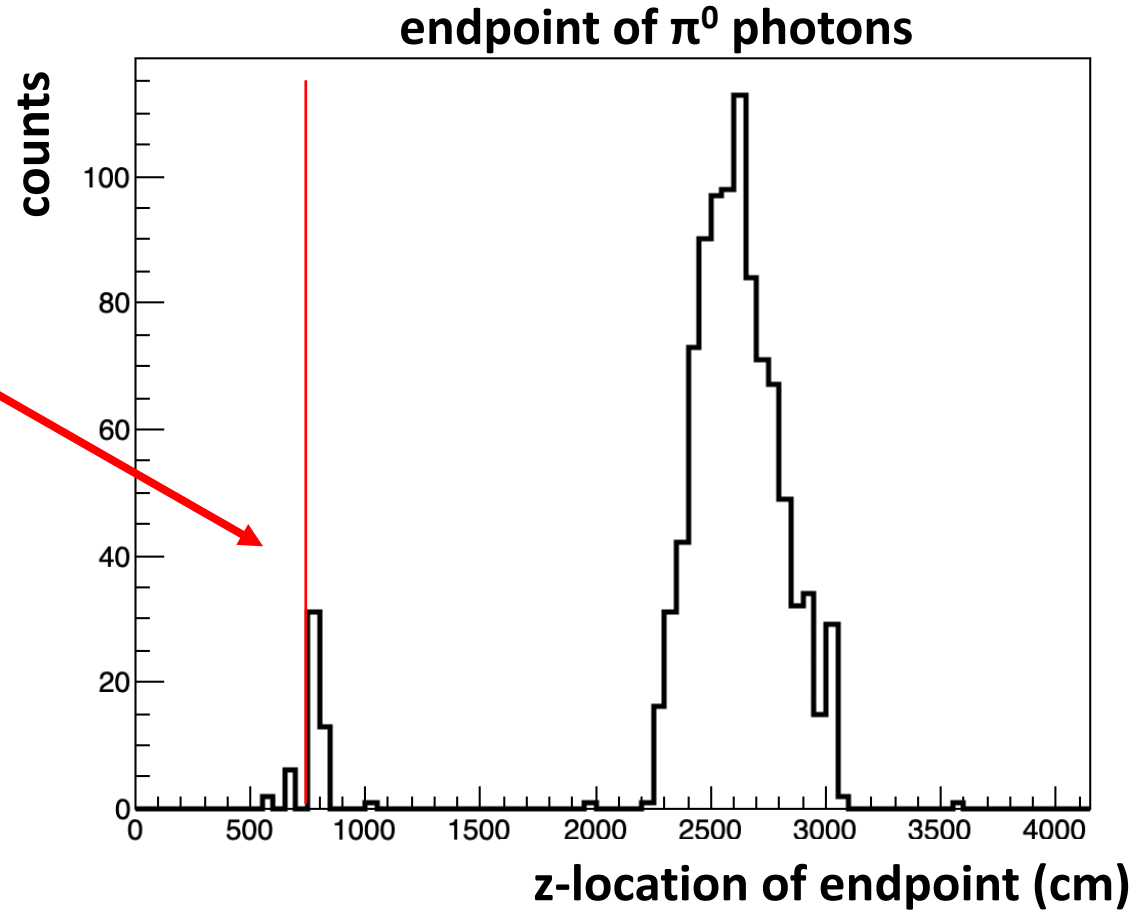
500 cm



Backward π^0 in ePIC Simulations

By 700 cm, we passed the B0 and only a few photons hit it

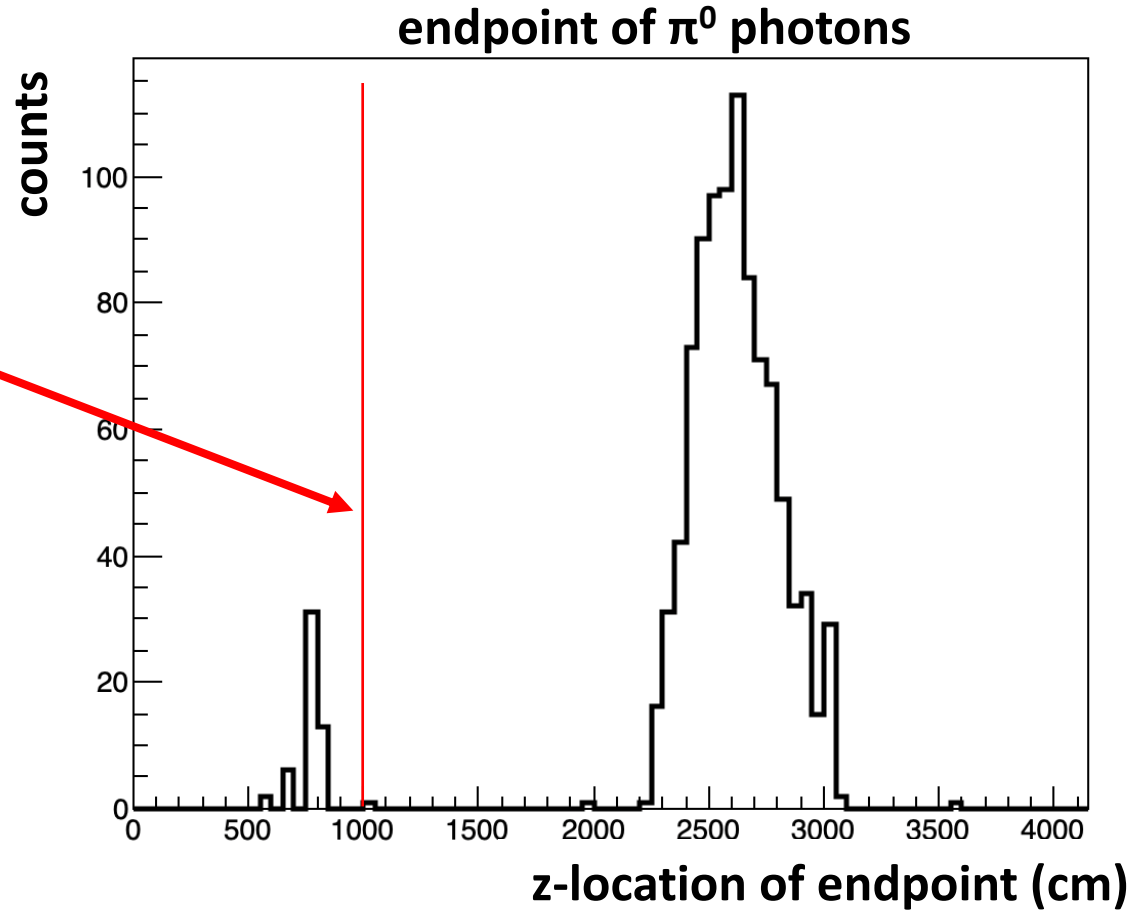




Backward π^0 in ePIC Simulations

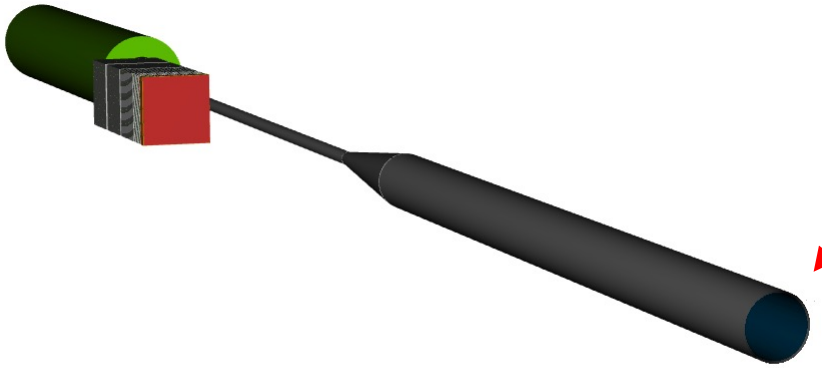
By 1000 cm a few photons strike beam pipe and magnets

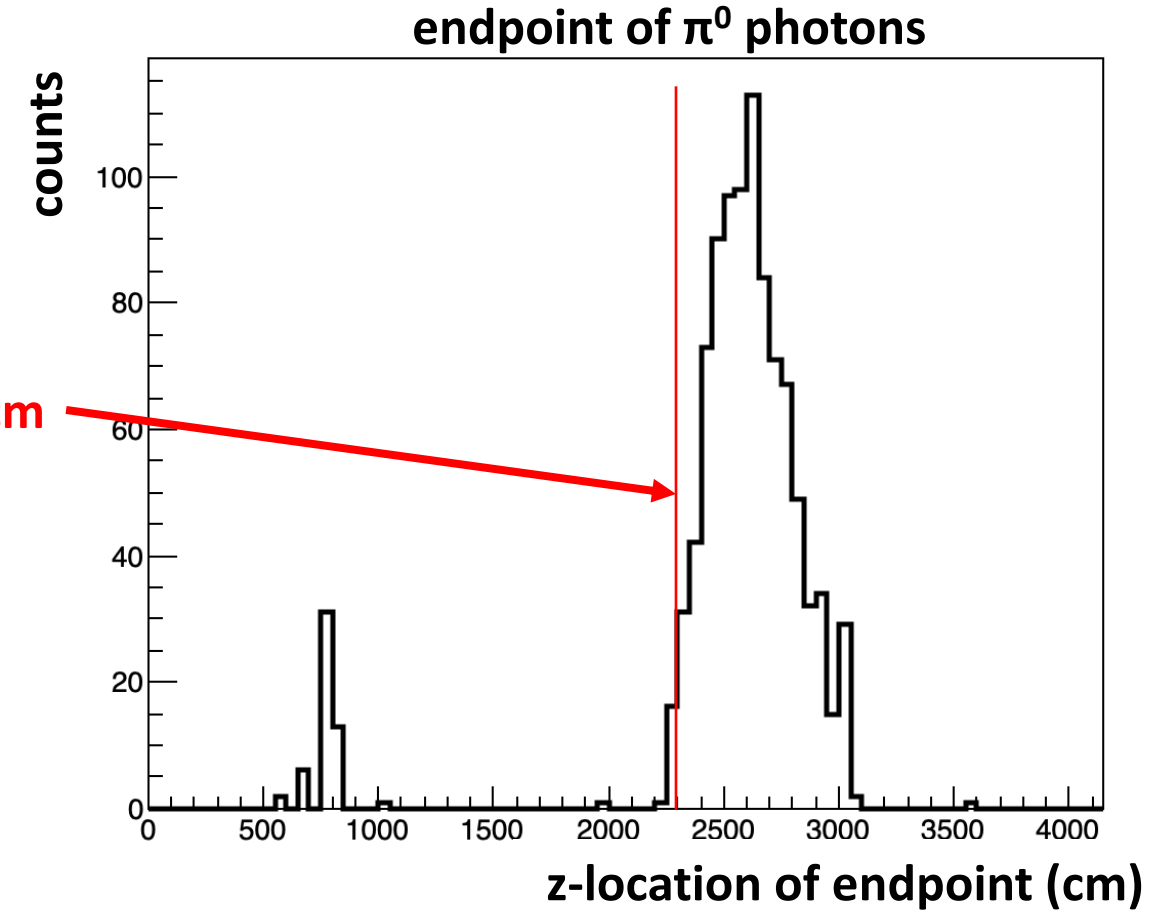
1000 cm



Backward π^0 in ePIC Simulations

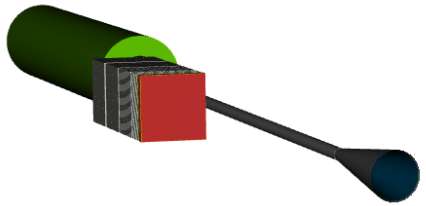
Not much interaction before 2300 cm



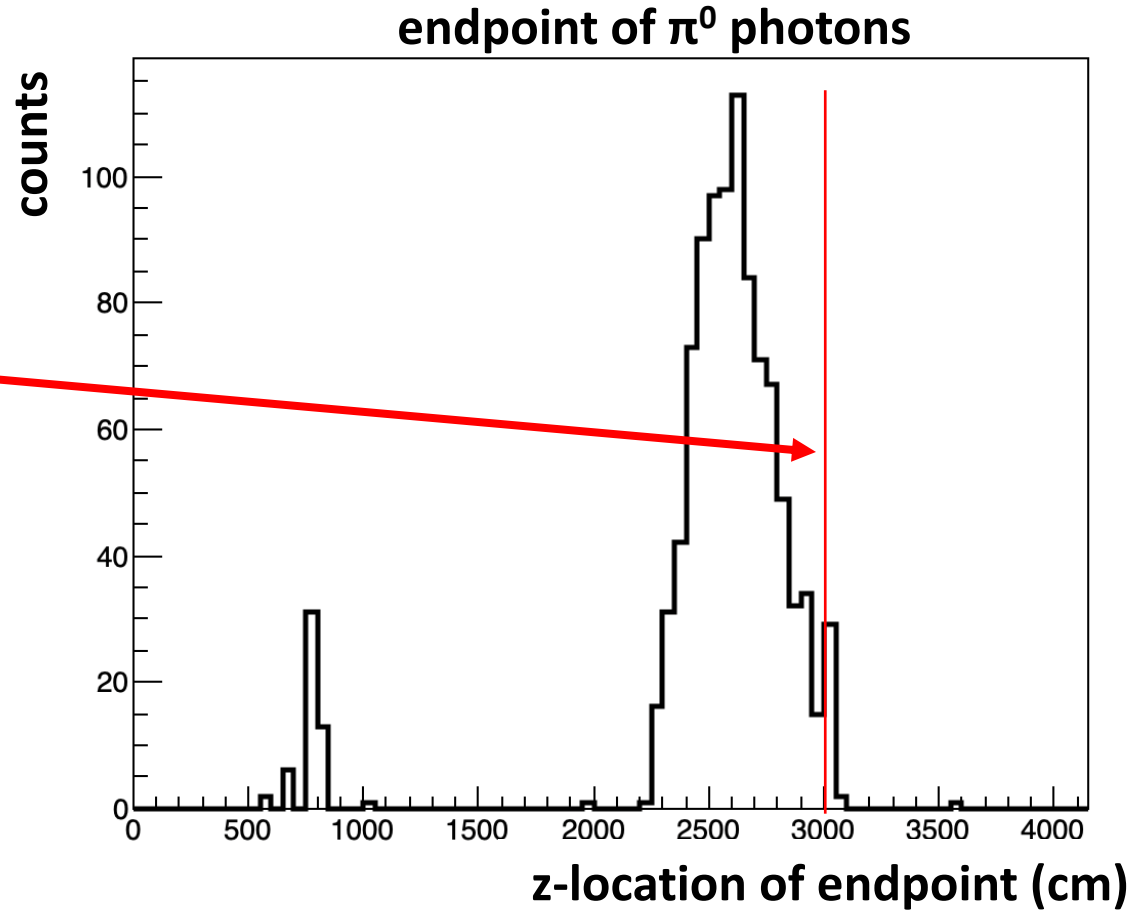


Backward π^0 in ePIC Simulations

The majority of photons hit the beam pipe between 2300 and 3000 cm

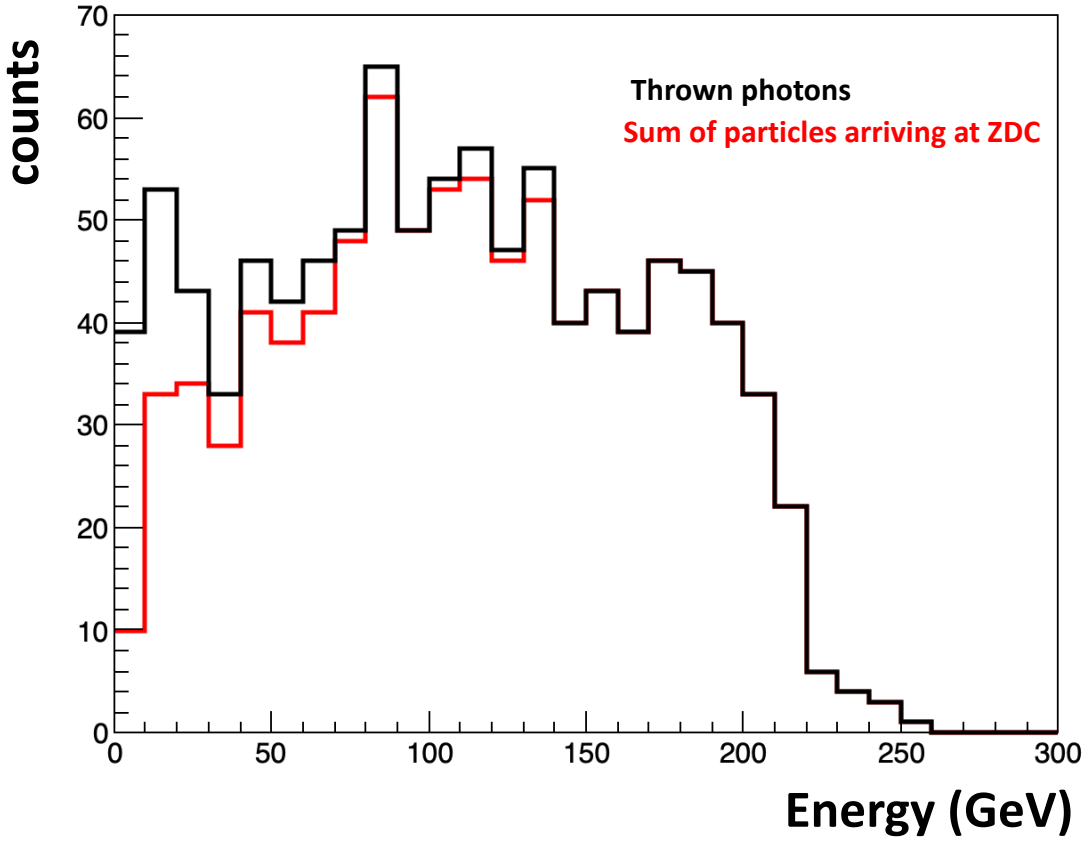


3000 cm



Toward Reconstruction in ZDC

- Next we can compare the energy distribution of
  - photons thrown at the ZDC (black)
  - the sum of particles that arrive at the ZDC (red)



Next Steps

- We don’t have ZDC clustering currently so for now I want to see if we can reconstruct the π^0 mass from the photons which arrive at the ZDC
- Next I’ll work on simulating the $\rho \rightarrow 2\pi$ (in B0) in ePIC

Thank you for your attention!

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