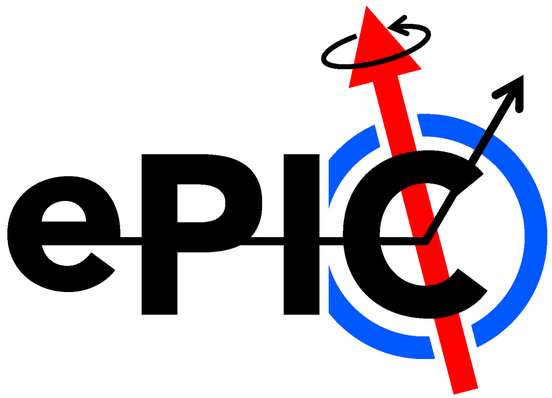
Electron ID update

Tyler Kutz

ePIC General Meeting

October 5, 2023



Impact of pion contamination $f_{\pi/e}$ on inclusive observables (B. Schmookler)

Unpolarized cross sections

$$\left(\frac{\Delta\left(\sigma^{r,NC}\right)}{\sigma^{r,NC}}\right)_{\pi^-} = \Delta f_{\pi/e}$$

$$\approx 0.1 \times f_{\pi/e}$$

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Asymmetries

$$\left(\frac{\sigma_{A^e}}{A^e}\right)_{\pi^-} = \sqrt{(\Delta f_{\pi/e})^2 + \left(f_{\pi/e}\frac{|A^\pi| + \Delta A^\pi}{A^e}\right)^2}$$

$$\approx 0.1 \times f_{\pi/e} - 1 \times f_{\pi/e}$$

Recent progress and current tasks

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- Track-cluster matching
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from September (campaign 23.09.1)

Pythia 8 NC DIS
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Caveats:

No background!

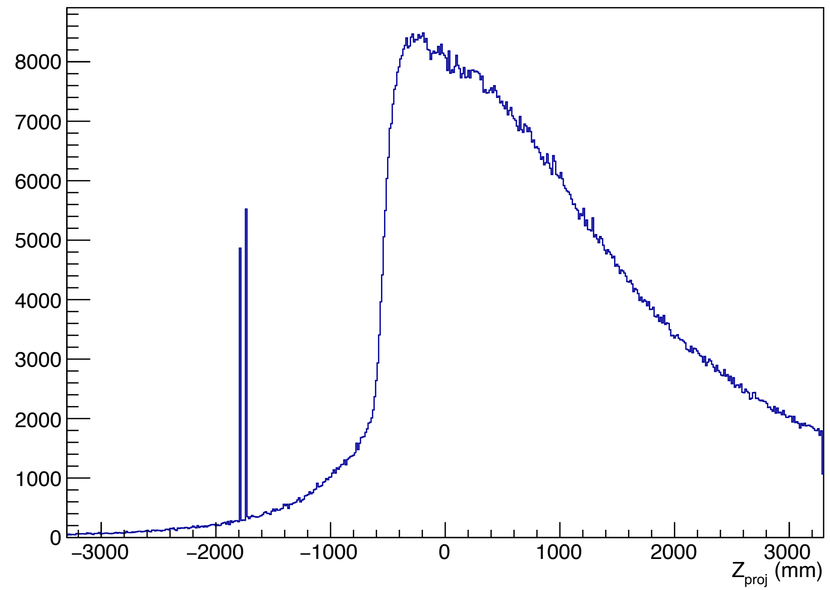
High Q^2!

Track projections

- Calorimeter track propagation factory implemented in EICrecon (included in September campaign)
- Propagate to two surfaces per calorimeter:
  - Innermost calorimeter surface (closes to IP)
  - Offset to average cluster depth (currently 5 cm for ECAL, 15 cm for HCAL)
- Propagated points identified by system & surface ID
- Open issues:
  - Add track association
  - Modify material map to account for calorimeter material (thanks to S. Li for providing resources)

Projections to barrel

BEMC ~~BIC~~



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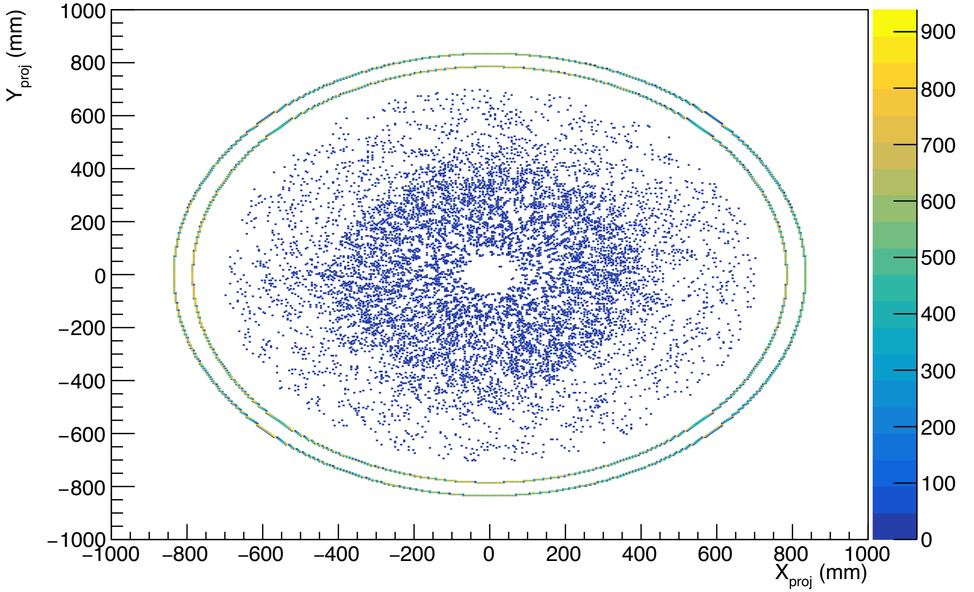
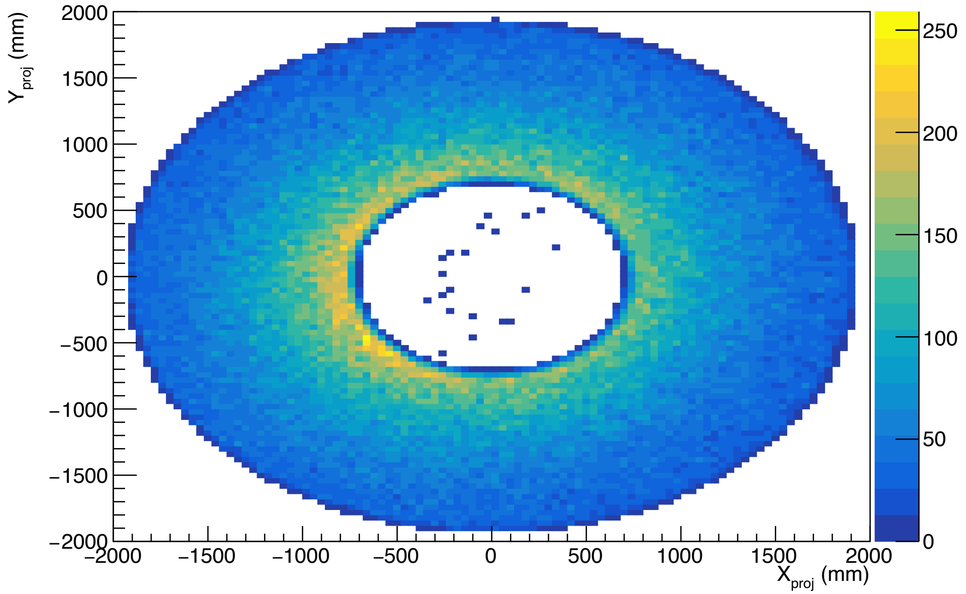
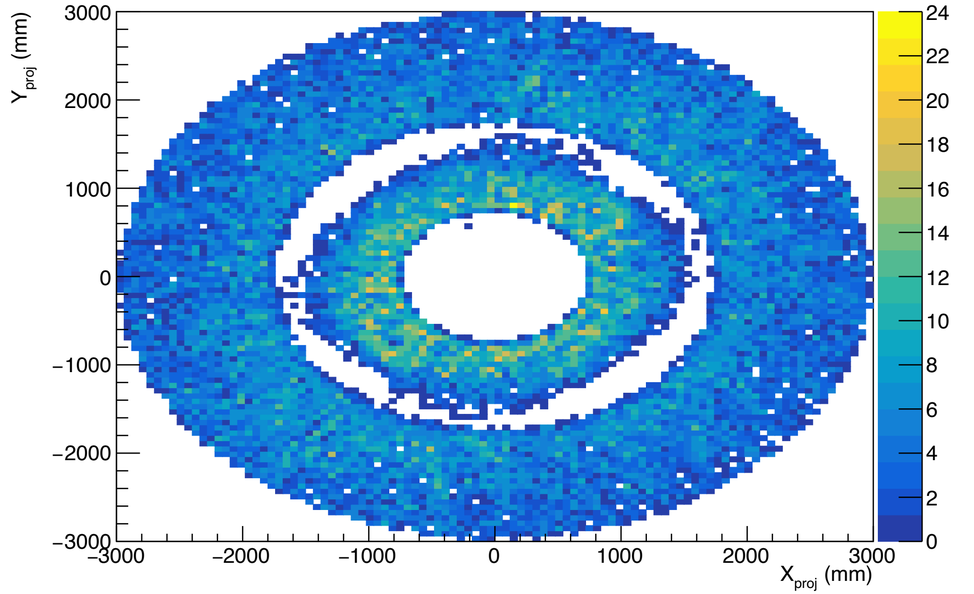


Projections to endcaps

FEMC



EEMC



Track-cluster matching (D. Brandenburg)

- Matching coordinates:
  - $\Delta\eta$, $\Delta\phi$ in barrel
  - Δx, Δy in endcaps
- For factory development, currently taking cluster closes to projection (matching thresholds to be added later)
- Optimize matching thresholds individually based on track, calorimeter resolutions
- Output of factory will be collection of new TrackClusterMatch datatype
  - Data model addition presented in October 4 S&C meeting (pull request)
- EICrecon matching factory in-progress, to be validated with truth-based matching

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  - Reconstructed E and p, but truth-level association
- Initial requirement of $0.9 < E/p < 1.2$ (needs to be optimized)

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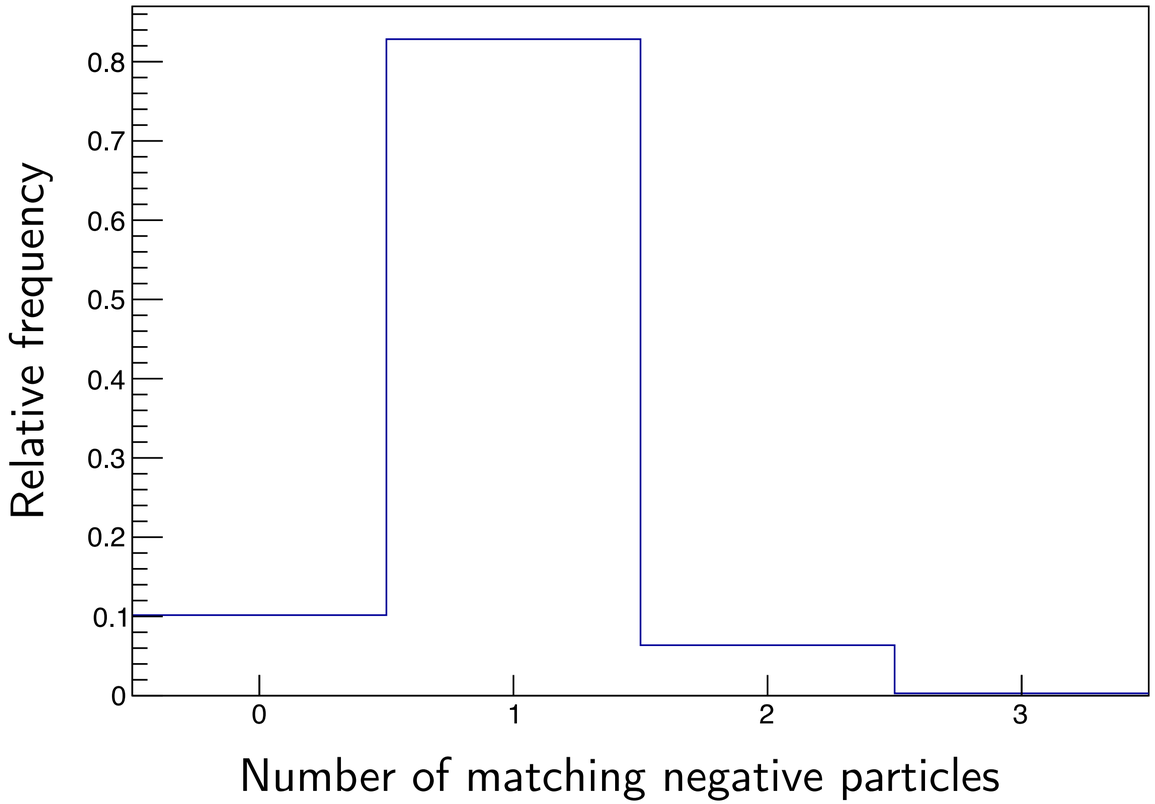

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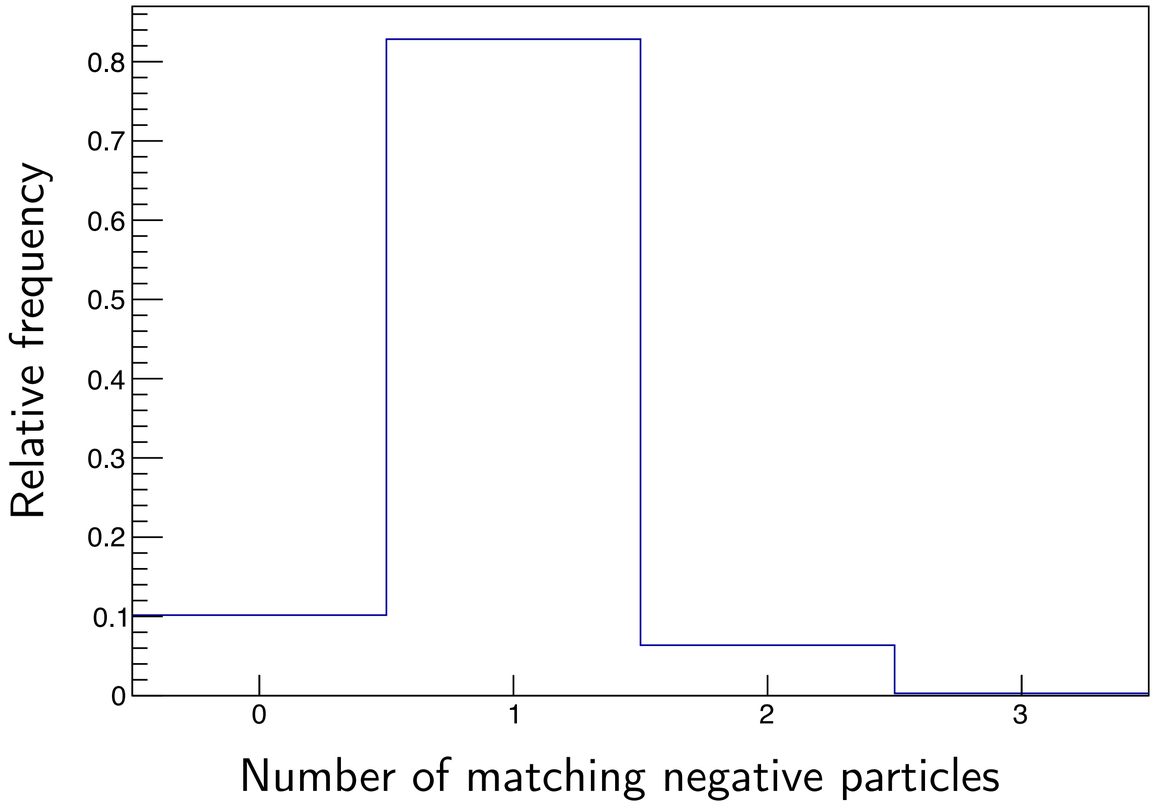

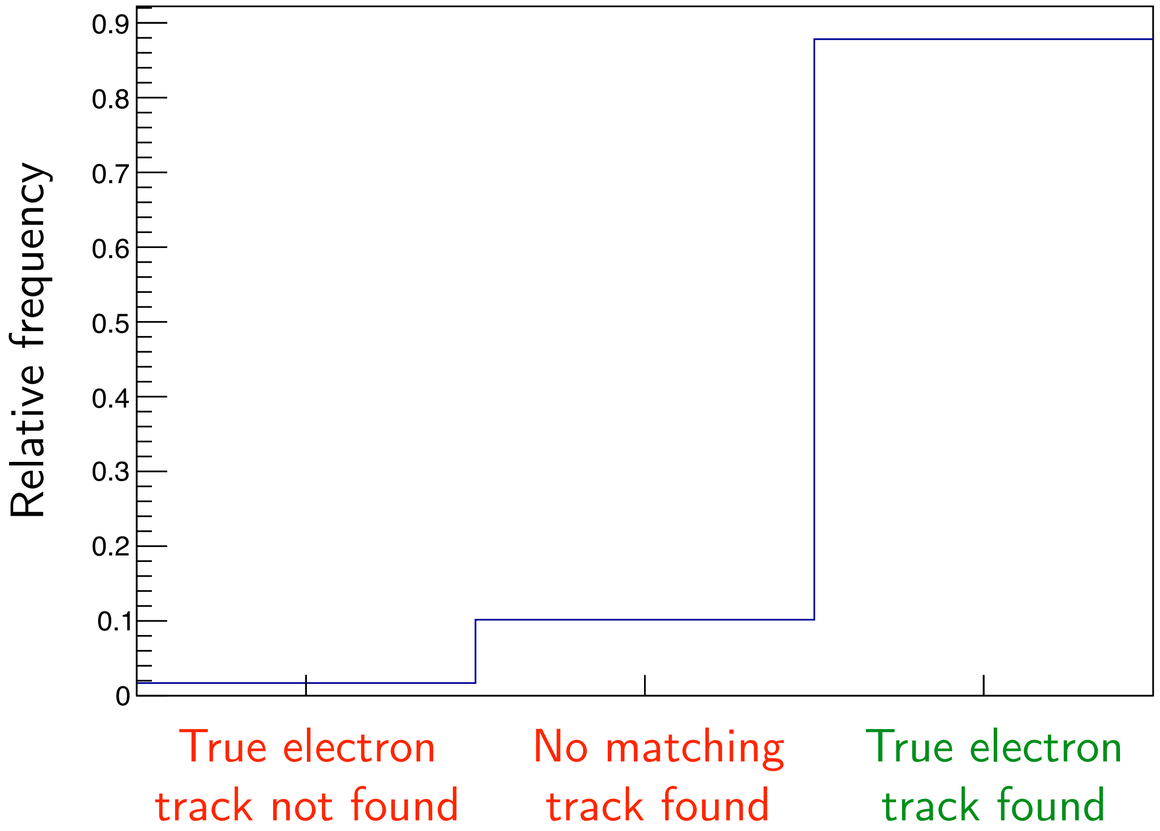

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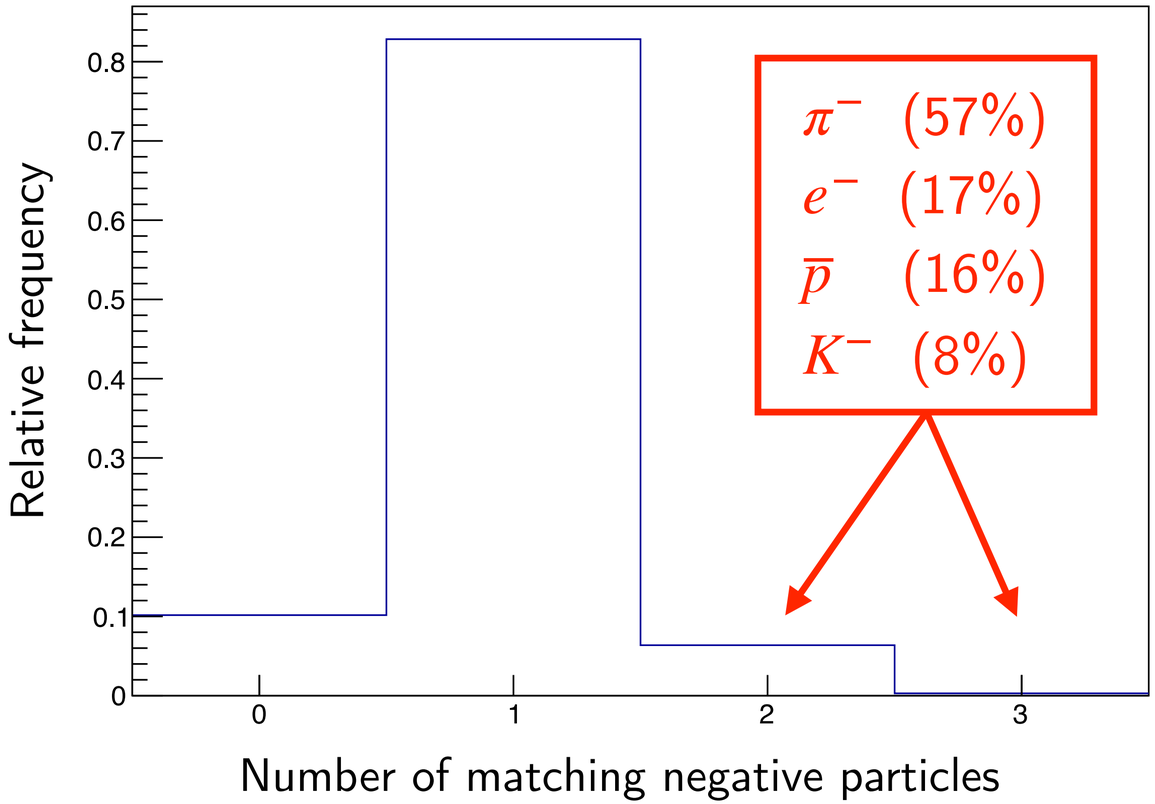
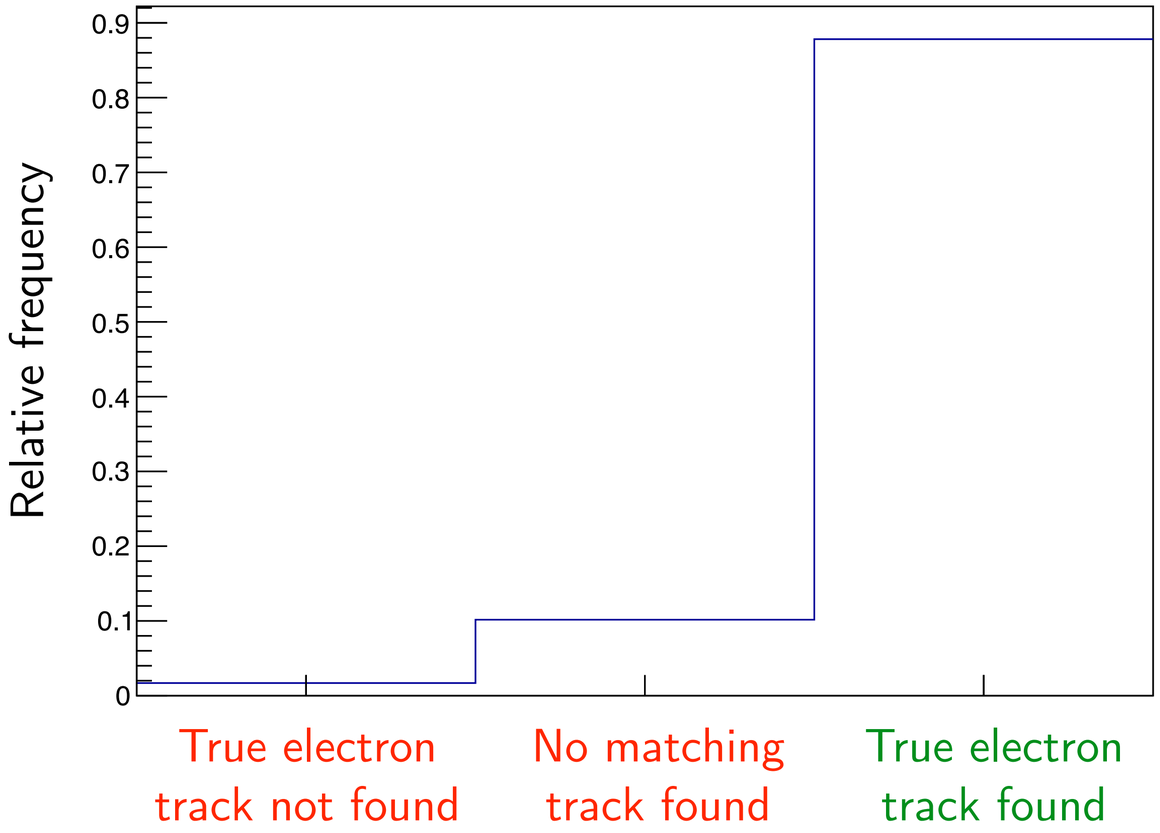
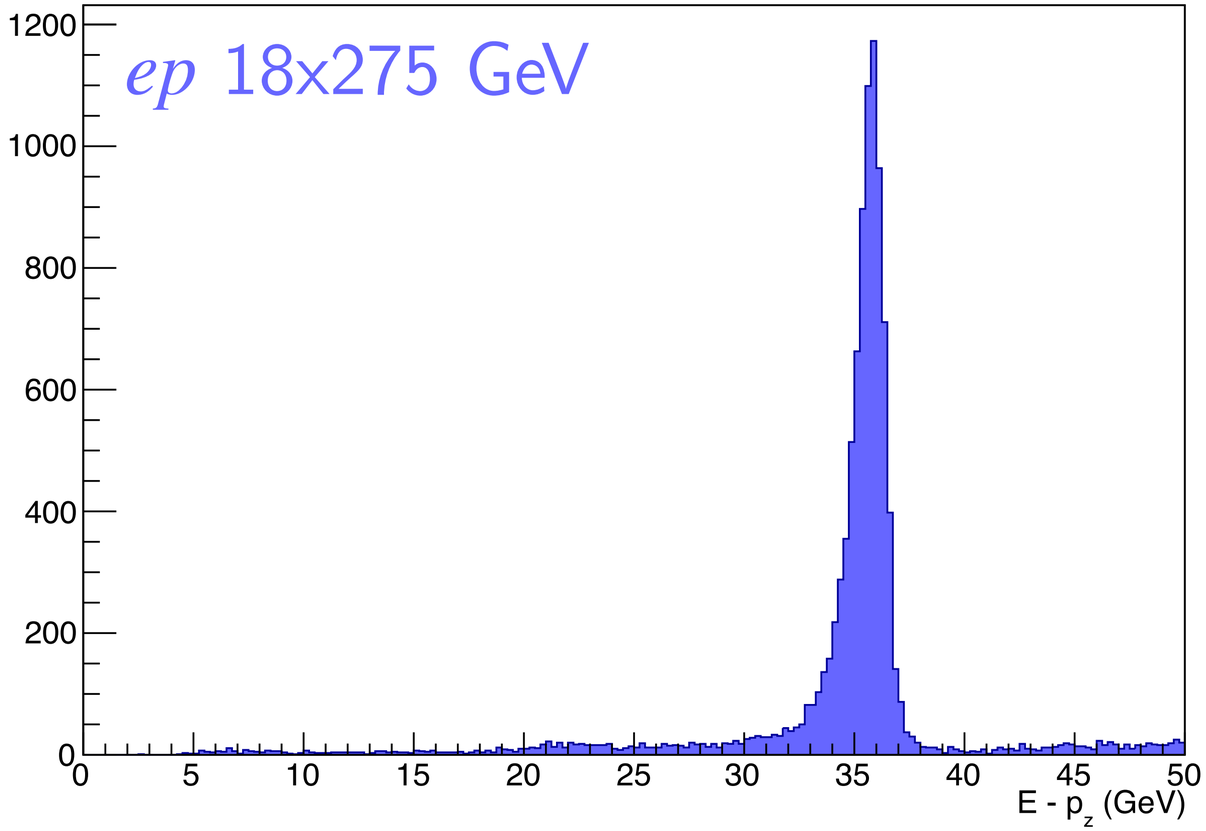




Towards fully reconstruction-based electron ID (D. Brandenburg)

- Track matching next milestone for fully reconstruction-based E/p cut
- Further ePID refinement with addition of $E - p_z$ cut (thanks to K. Tu for help on implementation)
- Implementation of EICrecon algorithm/ factory underway
- Still considering best output format, how to handle multiple DIS electron candidates, etc.



Summary and outlook

- Slowly but surely developing the necessary ingredients for reconstruction-based electron ID
  - Track projections (done)
  - Track-cluster matching (in-progress)
  - Electron ID (in-progress)
- Require optimization studies and implementation in EICrecon
- Contact Daniel or me if you want to get involved
  brandenburg.89@osu.edu
  tkutz@mit.edu
- Electron ID working meeting soon, contact Daniel for more details