UNIVERSITY OF BIRMINGHAM | SCHOOL OF PHYSICS AND ASTRONOMY

Update on kinematic reconstruction from FullSim output

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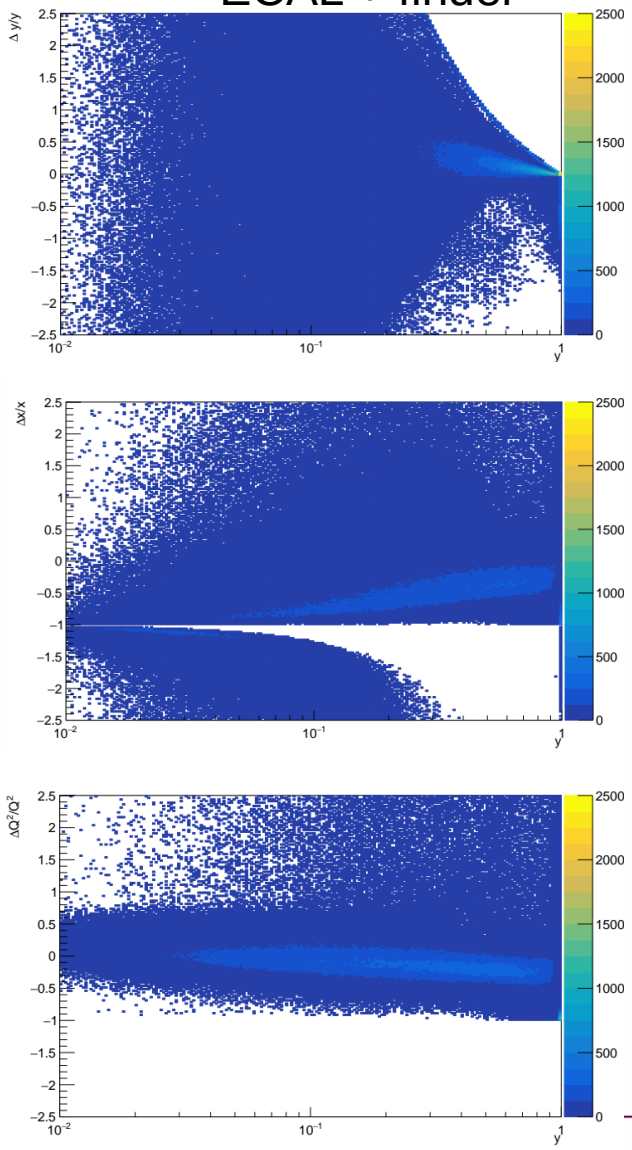
Investigating SIDIS framework reconstruction

- Electron method using ECAL + “electron finder” vs electron method using tracks + truth PID
- Σ_h seemingly defined as E_e-p_{ze}
- Progress towards a working hadronic reconstruction

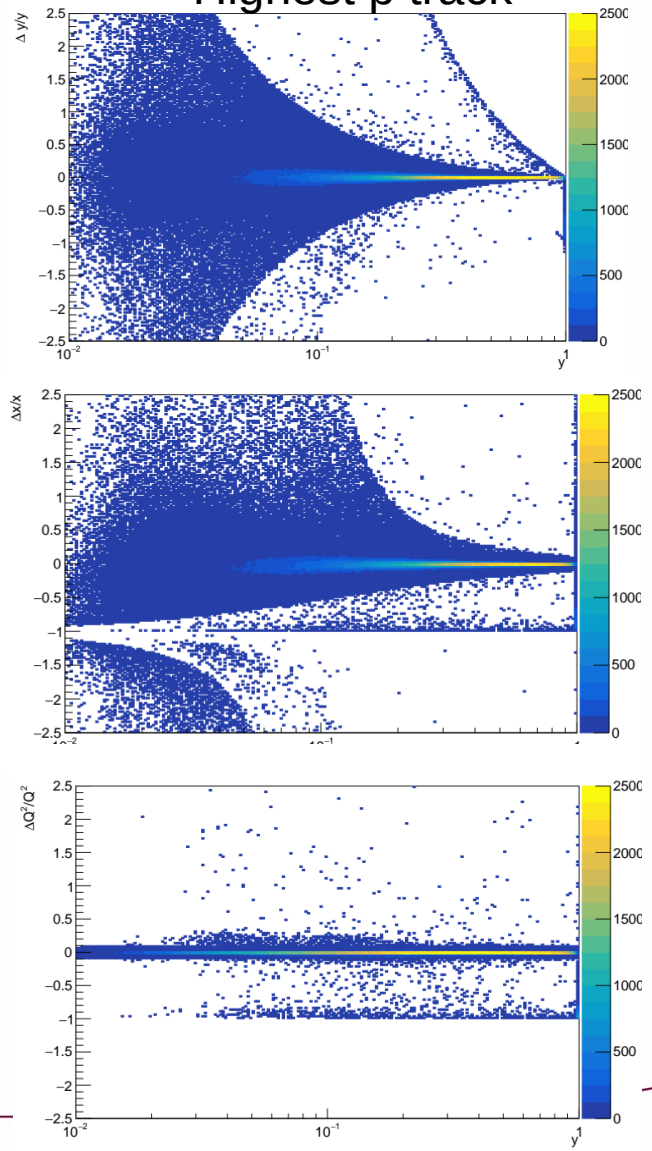
All studies used Full Simulation output files from https://dtn01.sdcc.bnl.gov:9000/minio/eictest/ATHENA/RECO/acadia-v1.0-alpha/DIS/NC/18x275/minQ2=100/

Electron-method ECAL (with e finder) vs tracks (highest momentum pid=11 track)

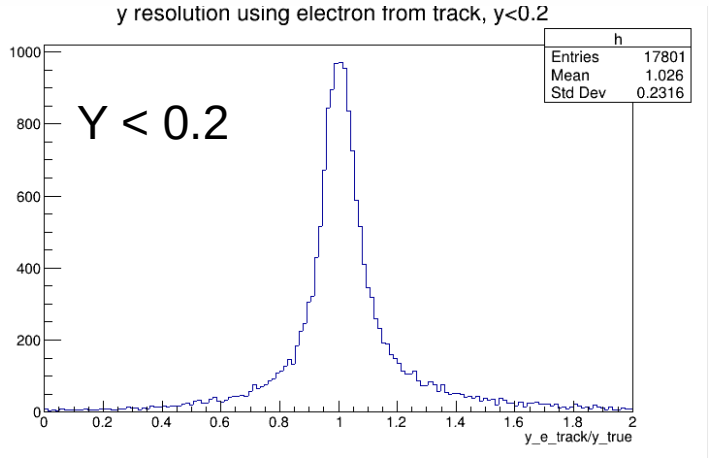
ECAL + finder

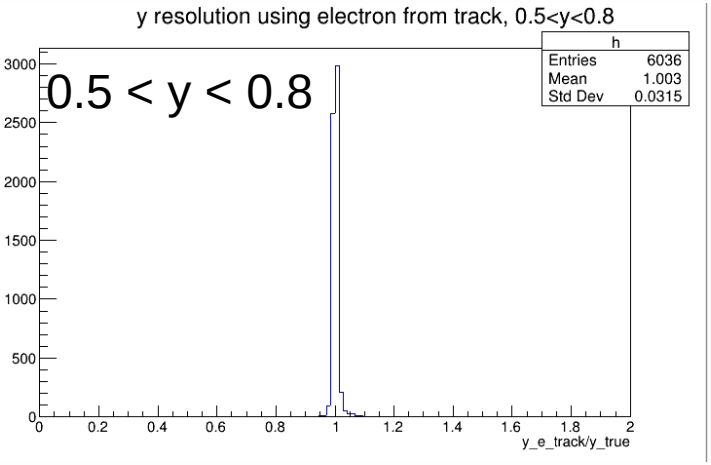


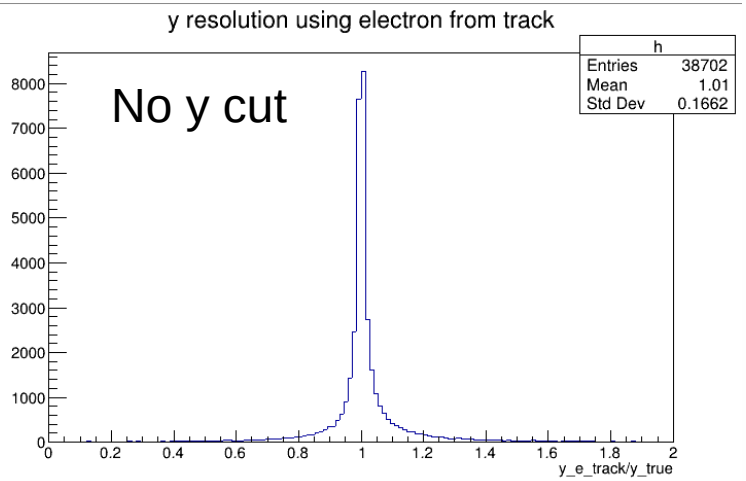
Highest p track

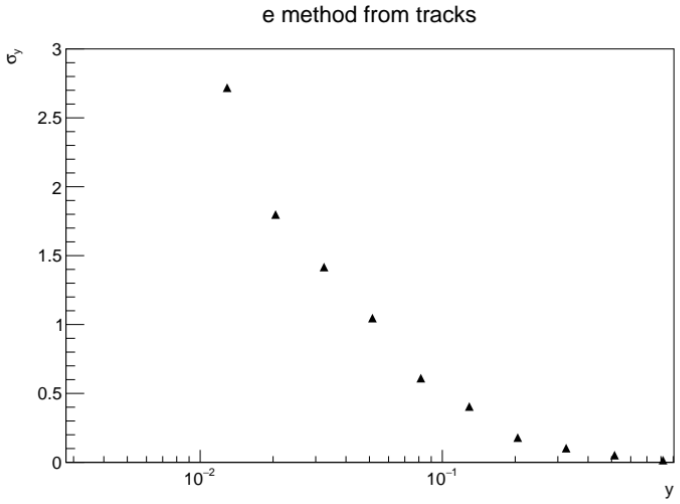


Y resolution (e method from track)









σ_y from standard deviation of $y_{true} - y_{rec} / y_{true}$ where μ=0

- Using calorimeter information and electron finder leads to dramatic differences when compared to track information

  → Some peaks seemingly offset from zero
- Problems occur at high y for calorimeter+finder → could the cut of scattered electron energy > 10% of beam energy be the culprit?

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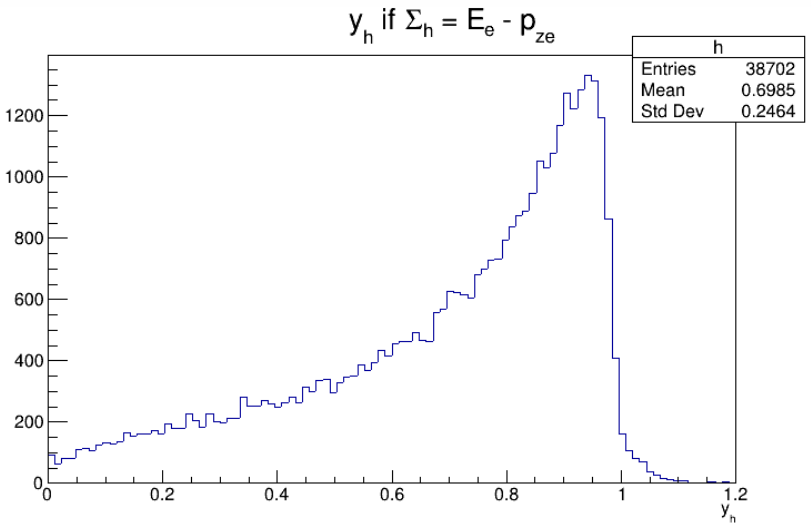
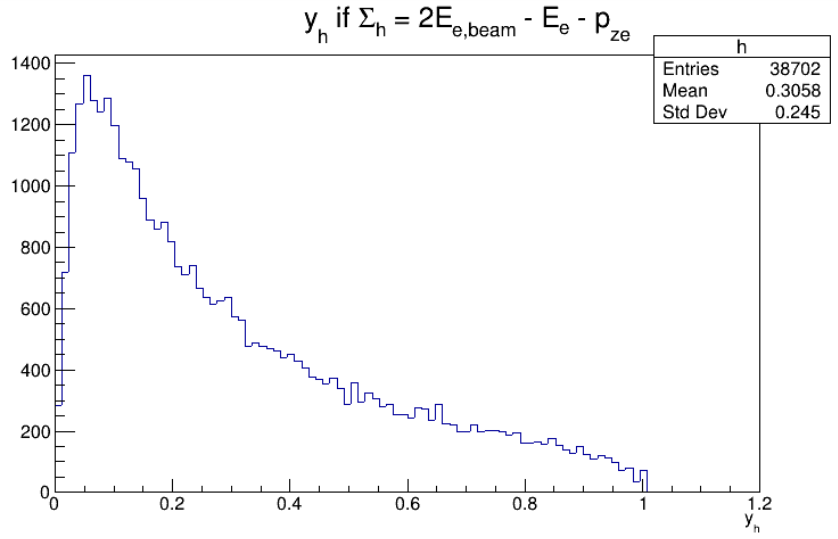
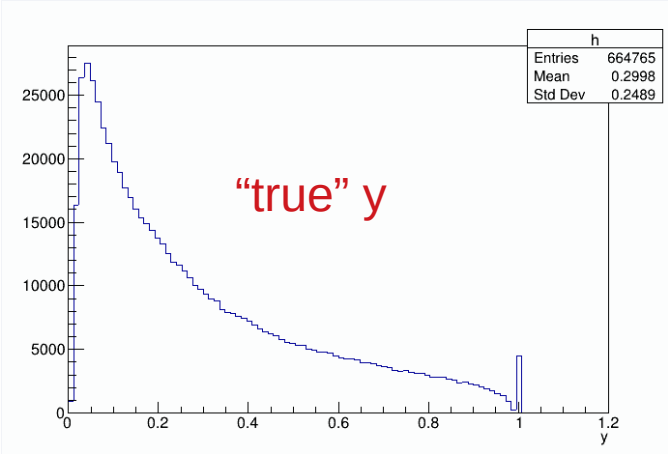
$\Sigma_h = E - p_z$ (electron)

E, p from track information

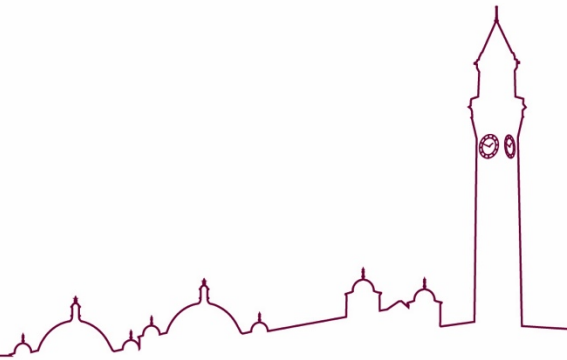




Y distribution more accurate if $\Sigma = 2E_e - \Sigma_e$



- Clearly Σ_h needs to be found using a different approach
- Issue has been opened at https://github.com/c-dilks/largex-eic/issues/44



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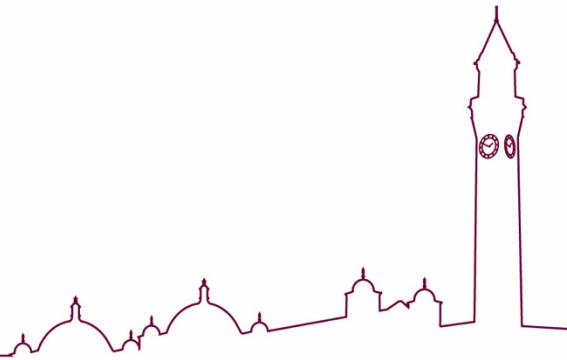
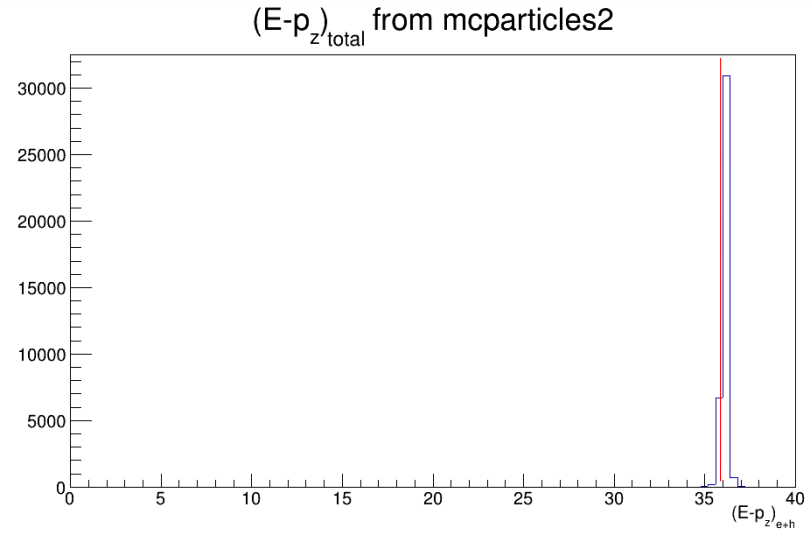
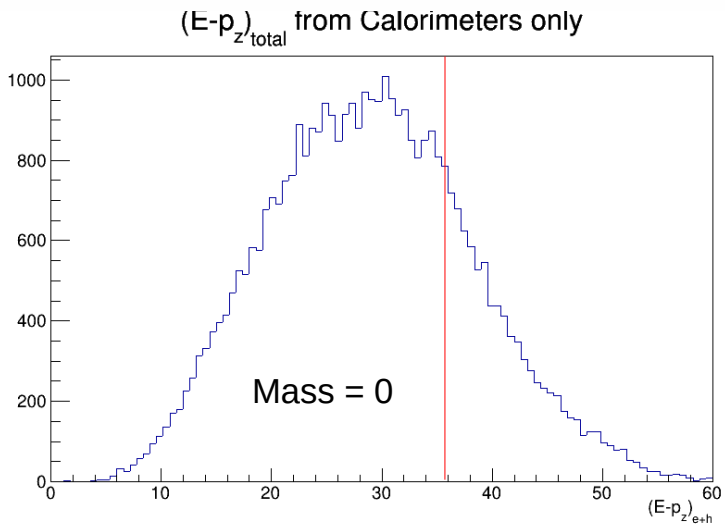
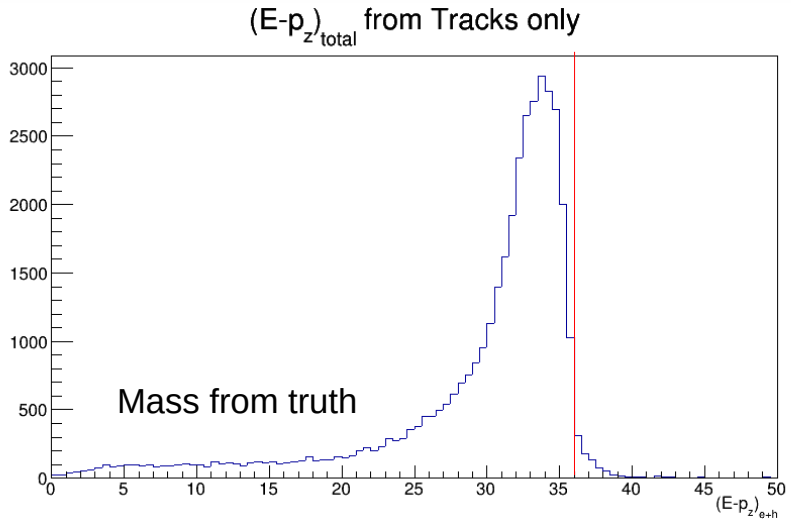


$(E\text{-}p_z)_{total}$



Expect total of $2E_{ebeam}$
~36GeV for 18x275

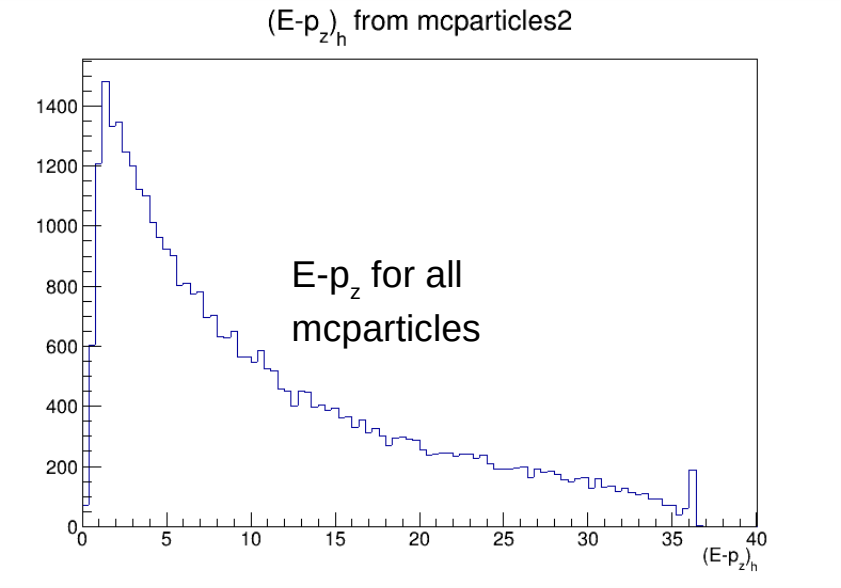


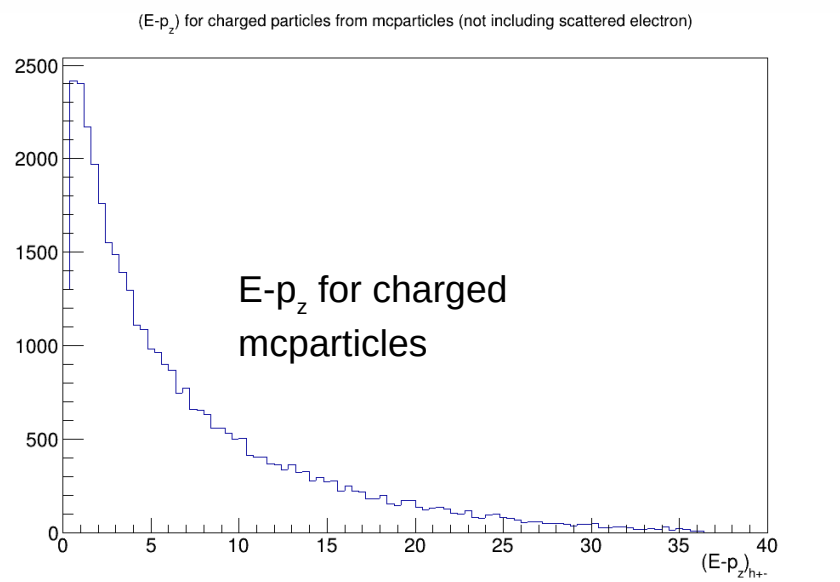


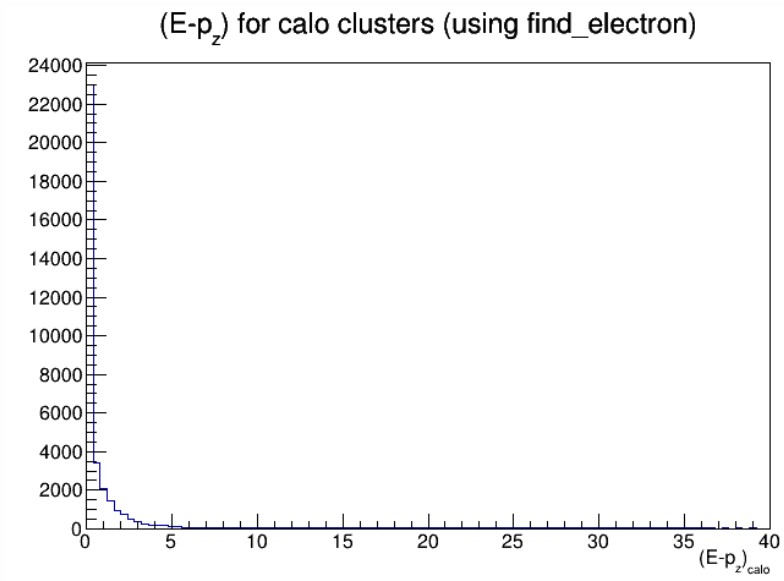
$P_z = E\cos(\theta)$

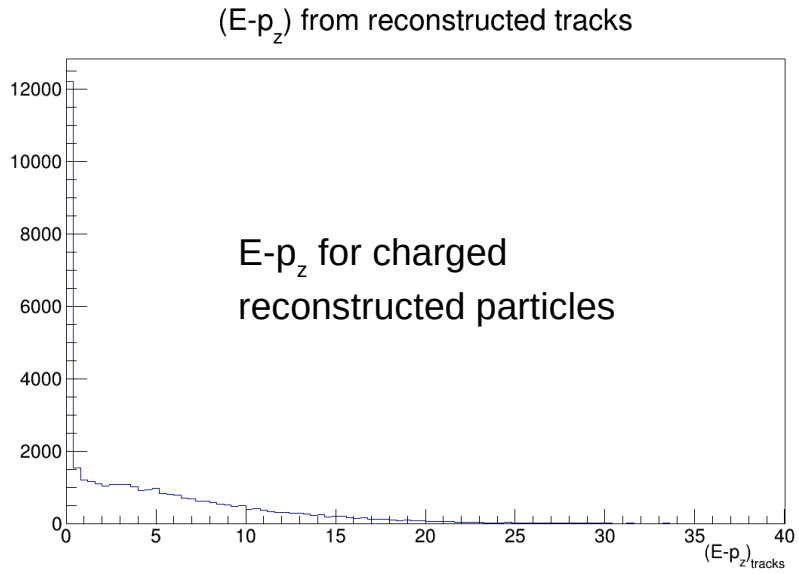
$E = \sqrt{m^2 + p^2}$

$\Sigma=(E-p_z)_h$

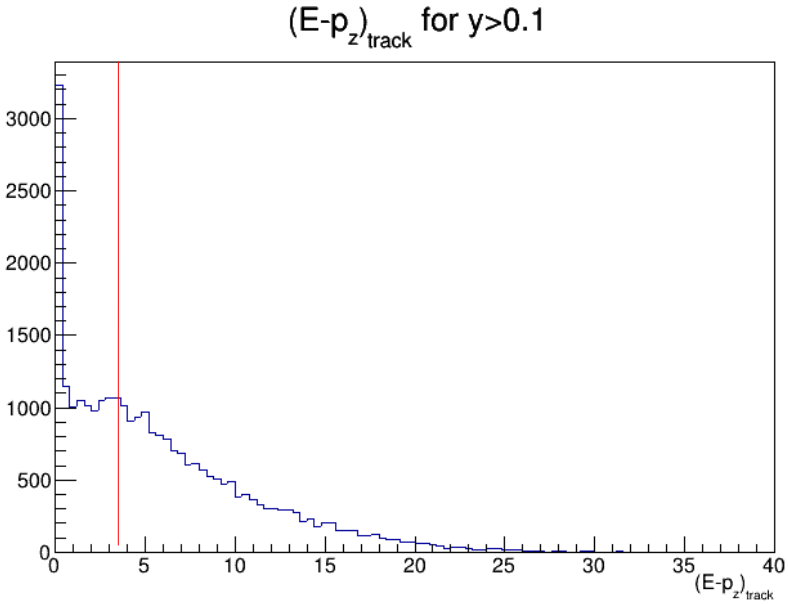

$(E-p_z)_h$ from mcparticles2
E-p_z for all mcparticles
$(E-p_z)_h$

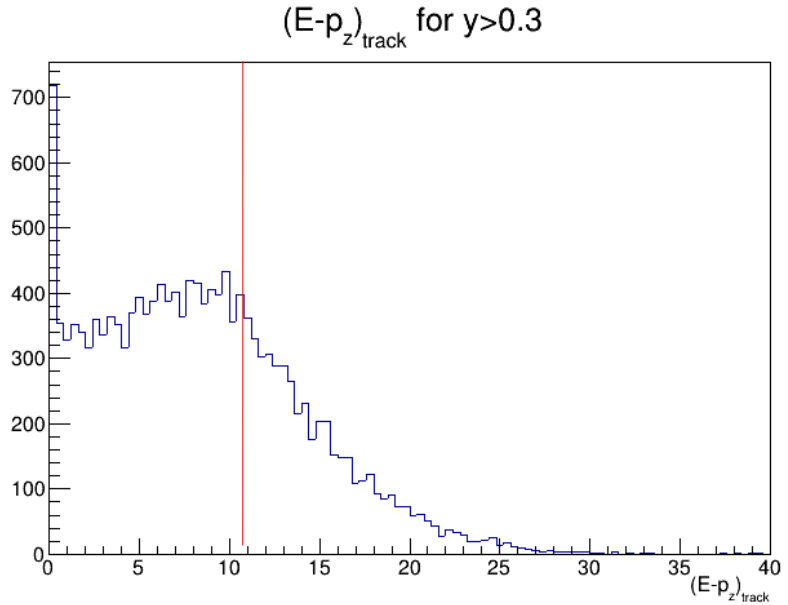

$(E-p_z)$ for charged particles from mcparticles (not including scattered electron)
E-p_z for charged mcparticles
$(E-p_z)_{h+-}$


$(E-p_z)$ for calo clusters (using find_electron)
$(E-p_z)_{calo}$


$(E-p_z)$ from reconstructed tracks
E-p_z for charged reconstructed particles
$(E-p_z)_{tracks}$

$(E\text{-}p_z)_{tracks}$





Does the spike at zero come from events where no charged particles are seen? (excluding scattered electron)

Summary

- Electron method using tracks instead of calorimeters gives a reasonable reconstruction
- Σ_h currently not correctly implemented in largex-eic → ideas on how to resolve this are welcome!*
- Hadronic reconstruction with tracks only consistently underestimates E-p_z → alternative approach may be needed

*Issue at
https://github.com/c-dilks/largex-eic/issues/44