

Electron Finder Status

Tristan Protzman

Lehigh University

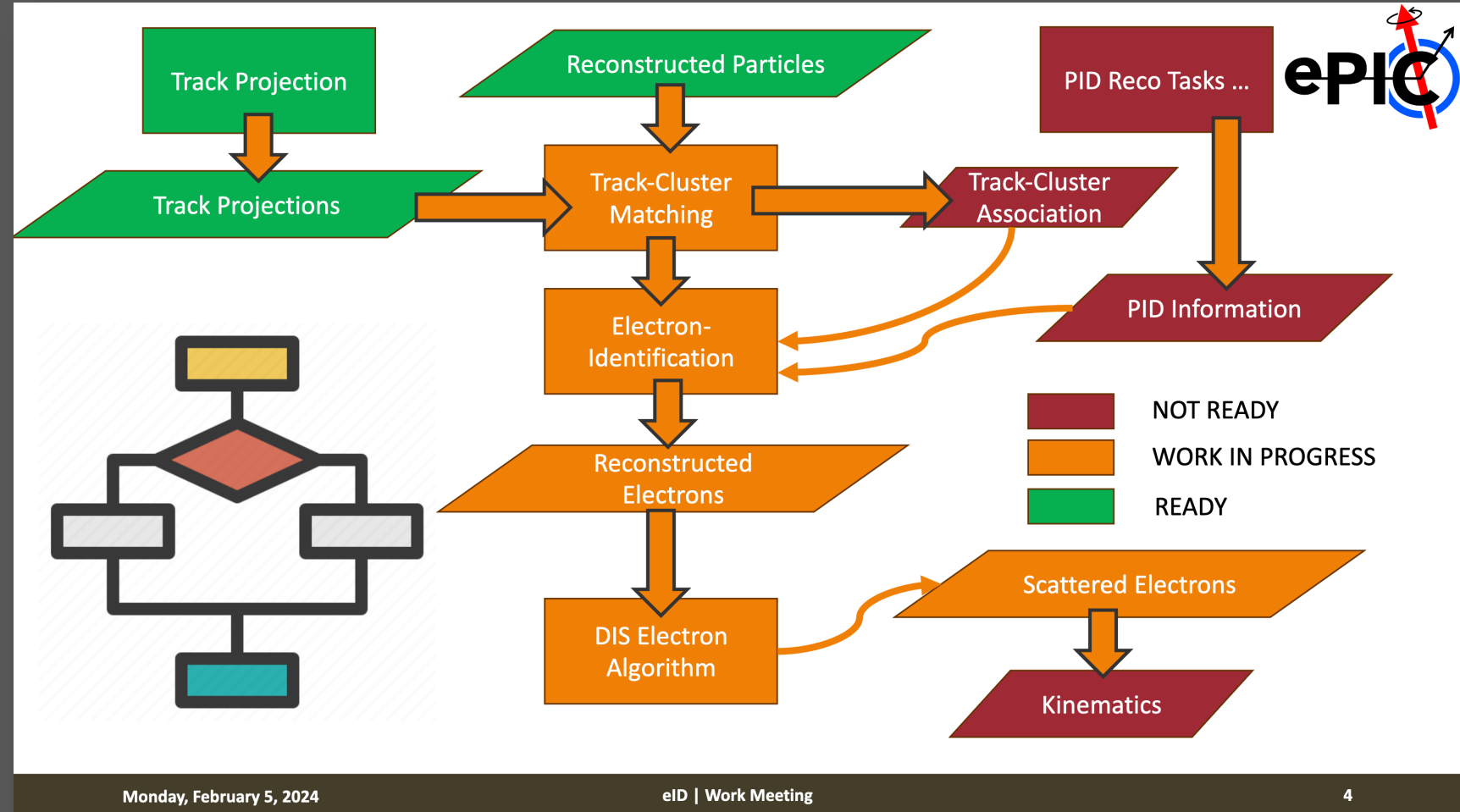
March 13, 2024

DIS Electron Identification

- ❖ Charge: To develop an efficient algorithm for identifying electrons and identifying the scattered DIS electron
- ❖ Realistic scattered electron information required for
 - Physics analyzers to perform benchmarks studies
 - Informing detector design
- ❖ **Critical to have for TDR!**

Dependencies

- ❖ Proper eID requires more complete track and PID reconstruction
- ❖ Goal: Initial version ready for April campaign
 - Shortcut full track and PID, use track projections
 - When more complete reconstruction is ready, transition to that
- ❖ 2 pull requests need to be merged for v1 of eID




Brandenburg, TRD Readiness Discussion

EDM4eic Objects

- ❖ PR #52 adds association between reconstructed particles and clusters
- ❖ Recently received comments
 - Bringing naming in line with EPIC conventions
 - Add comments about usage

Association between Reco Cluster and ReconstructedParticle #52

 Open

jdbrice wants to merge 3 commits into `eic:main` from `jdbrice:add-cluster-recoparticle-association` 

Conversation 1

Commits 3

Checks 3

Files changed 1



jdbrice commented on Sep 27, 2023 · edited

Member 

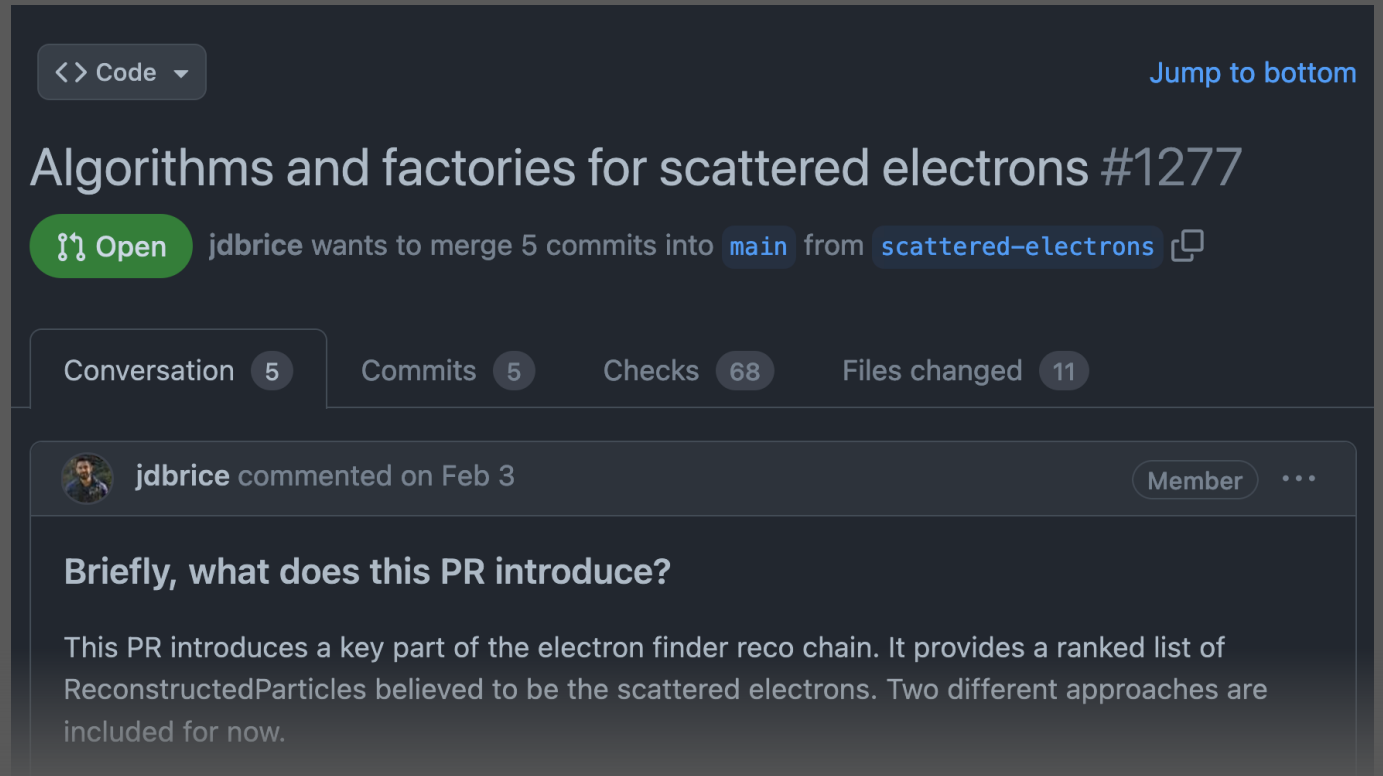
Briefly, what does this PR introduce?

Association container for `edm4eic::Cluster` and `edm4eic::ReconstructedParticle`

What kind of change does this PR introduce?

Algorithms

- ❖ PR #1277 adds two podio output collections
 - ScatteredElectronsTruth – Based off truth information
 - ScatteredElectronsEMinusPz – Ranks electrons identified by ReconstructedElectron_factory by descending $E - p_z$, keeping those within a configurable threshold
- ❖ Separate **factories for truth and reco** objects allow performance to be easily benchmarked



The screenshot shows a GitHub pull request interface. At the top, there is a 'Code' button and a 'Jump to bottom' link. The title of the pull request is 'Algorithms and factories for scattered electrons #1277'. Below the title, there is a green 'Open' button and a description: 'jdbrice wants to merge 5 commits into main from scattered-electrons'. There are four tabs: 'Conversation' (5), 'Commits' (5), 'Checks' (68), and 'Files changed' (11). A comment from 'jdbrice' dated 'Feb 3' is visible, with a 'Member' badge and a three-dot menu. The comment text reads: 'Briefly, what does this PR introduce? This PR introduces a key part of the electron finder reco chain. It provides a ranked list of ReconstructedParticles believed to be the scattered electrons. Two different approaches are included for now.'

Once basic algorithms proved out, more complex algorithms may incorporate hadronic final state kinematics or semi-hard radiation from electron

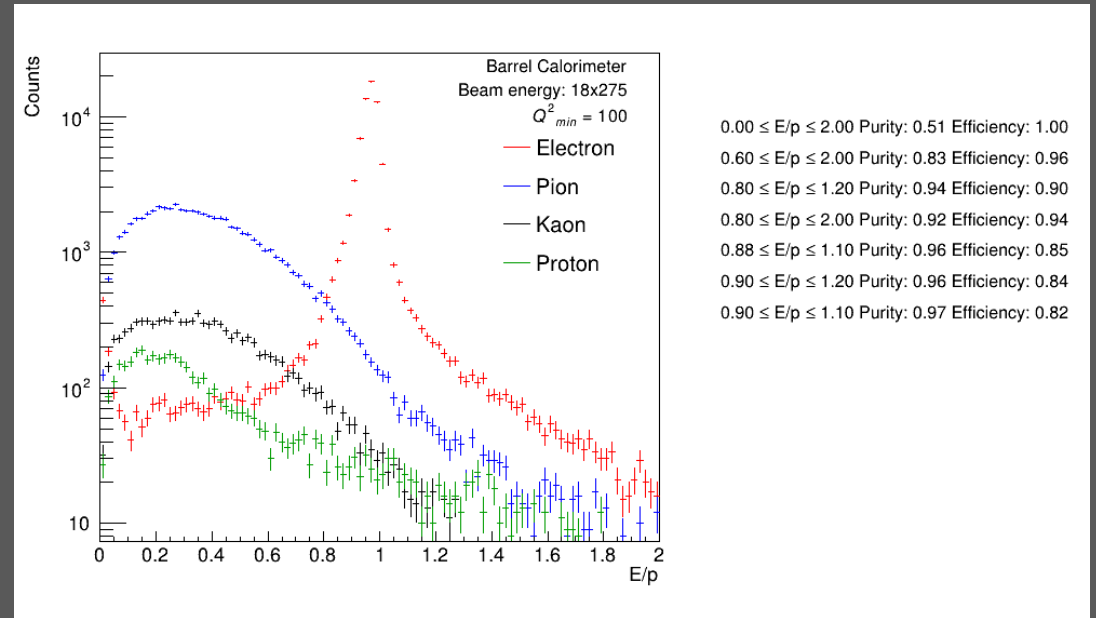
Algorithm - Comments

- ❖ Working to address comments and implement for April campaign
- ❖ E/p cut:
 - Need to balance electron efficiency and hadron contamination
 - Early study on next slide
- ❖ $E - p_z$ selection:
 - What is its discriminating power?
- ❖ Charge symmetric background
 - Positrons, electrons from pair production may be identified as DIS lepton
 - Need to keep positive charged candidates as well to characterize background

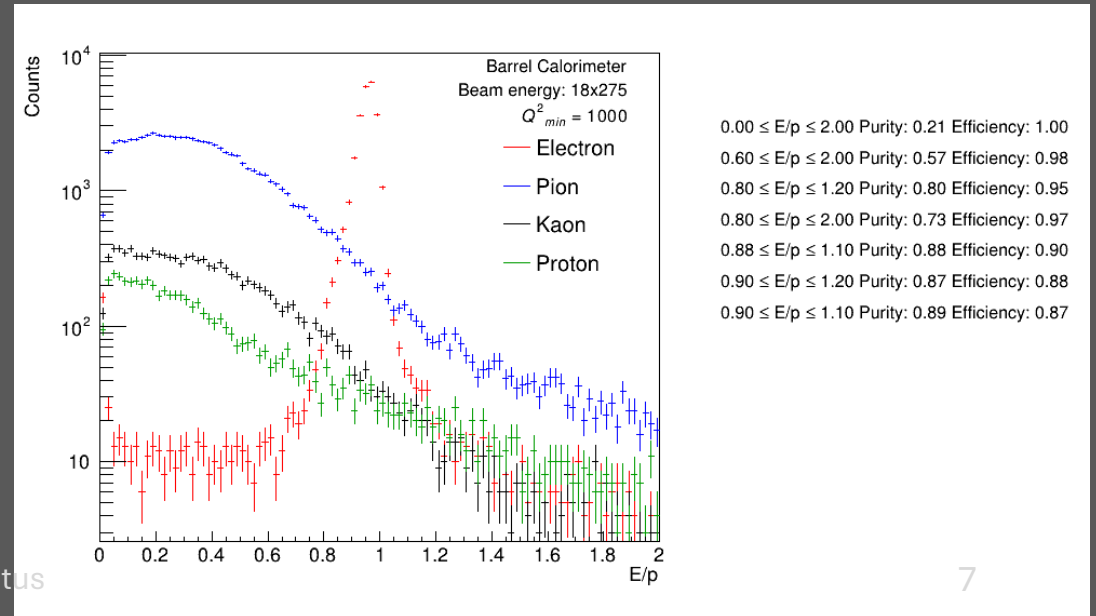
E/p study

- ❖ NC DIS events from December campaign
- ❖ Electron identified by **matching to truth**
- ❖ With tight $0.9 < E/p < 1.1$ cut, good purity without too much of a hit to efficiency
- ❖ Dominated by pion contamination

$$Q_{\min}^2 = 100 \text{ (GeV/c)}^2$$

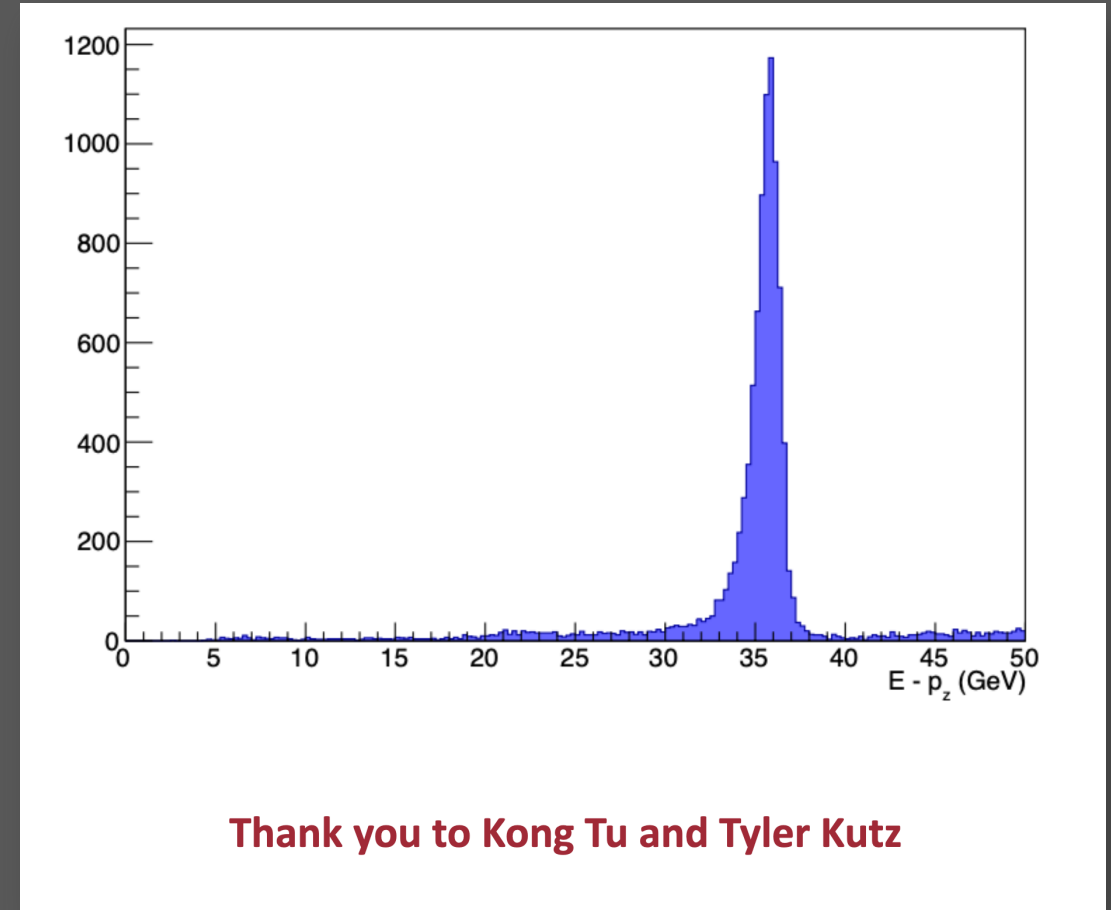


$$Q_{\min}^2 = 1000 \text{ (GeV/c)}^2$$



$E - p_z$ cut

- ❖ Simple algorithm for ranking DIS lepton candidates
- ❖ Distribution peaks at twice the e^- beam energy
- ❖ Studies underway to determine discrimination power



Priorities

- ❖ Dedicated eID meeting to finalize PR ahead of April campaign
- ❖ Need to get in eID in hands of analyzers
 - How do the simple algorithms perform?
 - Where does it fail?

Summary

- ❖ First pass of eID **nearly ready** for April campaign
 - Dedicated meeting soon to discuss open points
- ❖ **Two pull requests** open adding functionality
 - Will work to address comments and merge shortly
- ❖ **Two algorithm** to compare performance
 - One using **truth information**
 - One using **reconstructed information**
- ❖ **Studies** underway to optimize selections on E/p and $E - p_z$