Inclusive PWG Update

Claire Gwenlan

Tyler Kutz

Paul Newman

Barak Schmookler

Outline

- ❑Attempt to analyze S3 DIS files
- ❑*DD4Hep+Juggler* DIS simulation kinematic reconstruction studies
- ❑Track projection implementation and testing
- ❑Ongoing work, task list, upcoming meetings

S3 DIS files

- We attempted to analyze the files located here:

  S3/eictest/EPIC/RECO/22.11.0/epic_arches/DIS

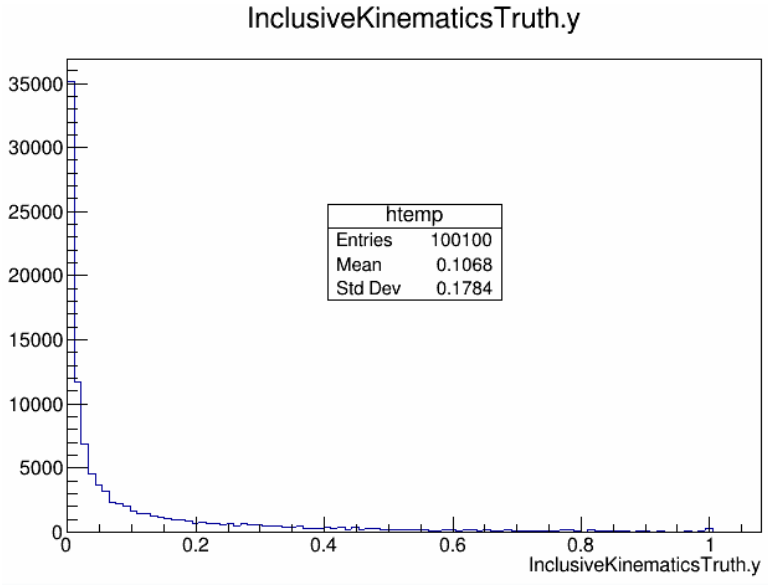
  S3/eictest/EPIC/RECO/22.11.0/epic_brycecanyon/DIS

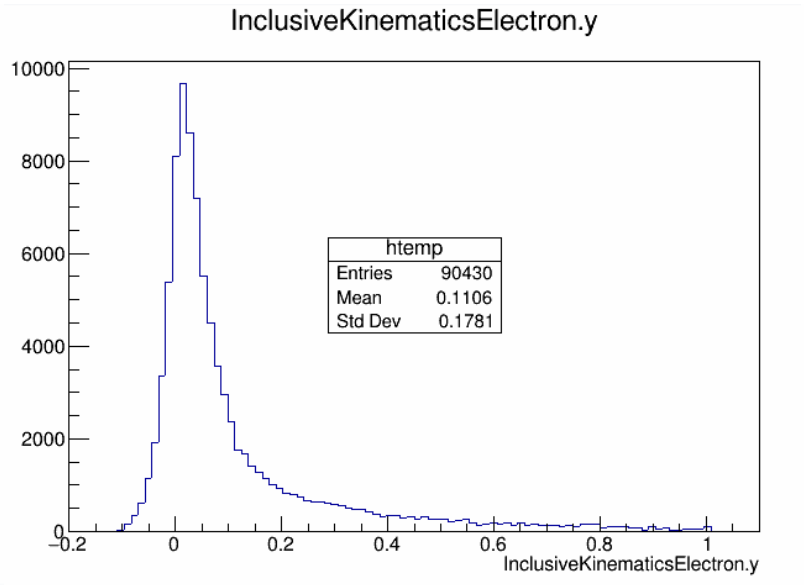
- We found the *ReconstructedParticles* branches which we used for previous analyses were not filled. We can quickly repeat prior studies once those branches are filled.

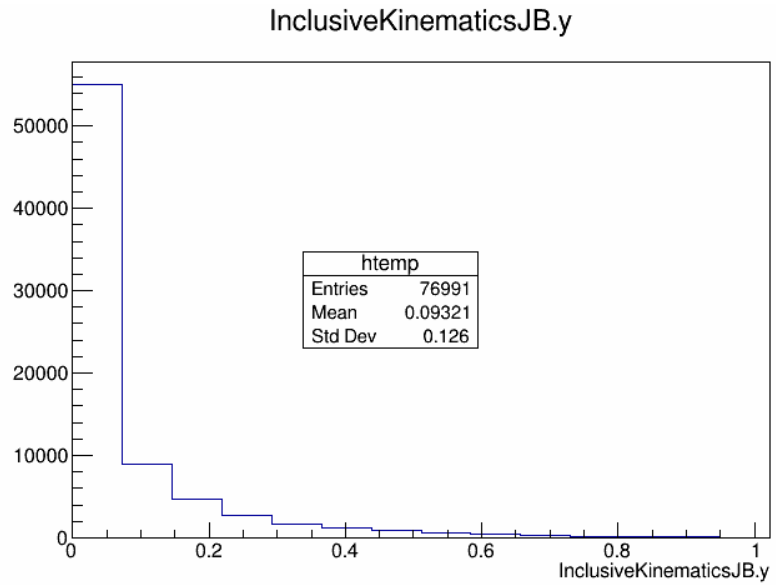
- What information goes into the ReconstructedParticles branches (as of the ATHENA proposal) is documented in section 1.1.1 here.

Reconstruction studies

- Ran 100.1k Pythia8 events (10x100 GeV2, Q2>1 GeV2) through *Arches* geometry and reconstructed with Juggler







Stephen Maple

Track projection (propagation) implementation

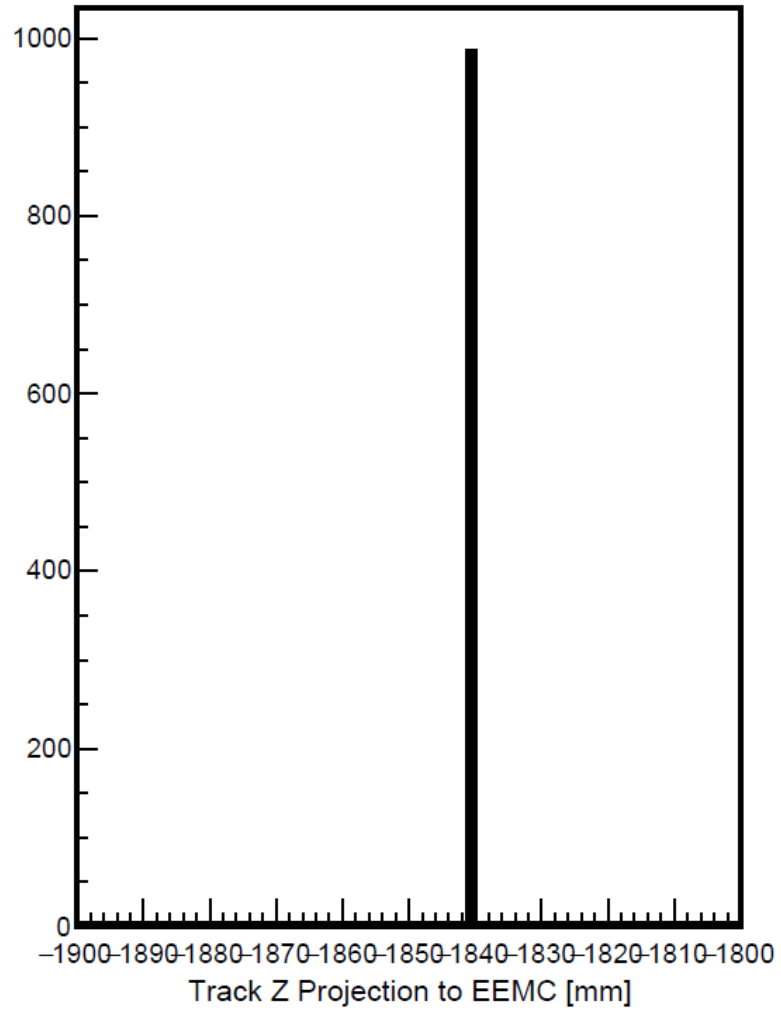
- We need to project the reconstructed tracks to other sub-detectors.
- A standalone code using *Juggler* output the ACTS::Propagator class was written by Wenqing Fan.
- This was then implemented into a new *Juggler* class by Barak Schmookler. Results shown on the next pages use this class.
- The class has now been ported to *EICrecon* by Dmitry Romanov, and is being generalized for projections to other detectors. This will hopefully go into the next simulation campaign.
- Additional work to associate projection to track (trajectory) in output ROOT is ongoing.

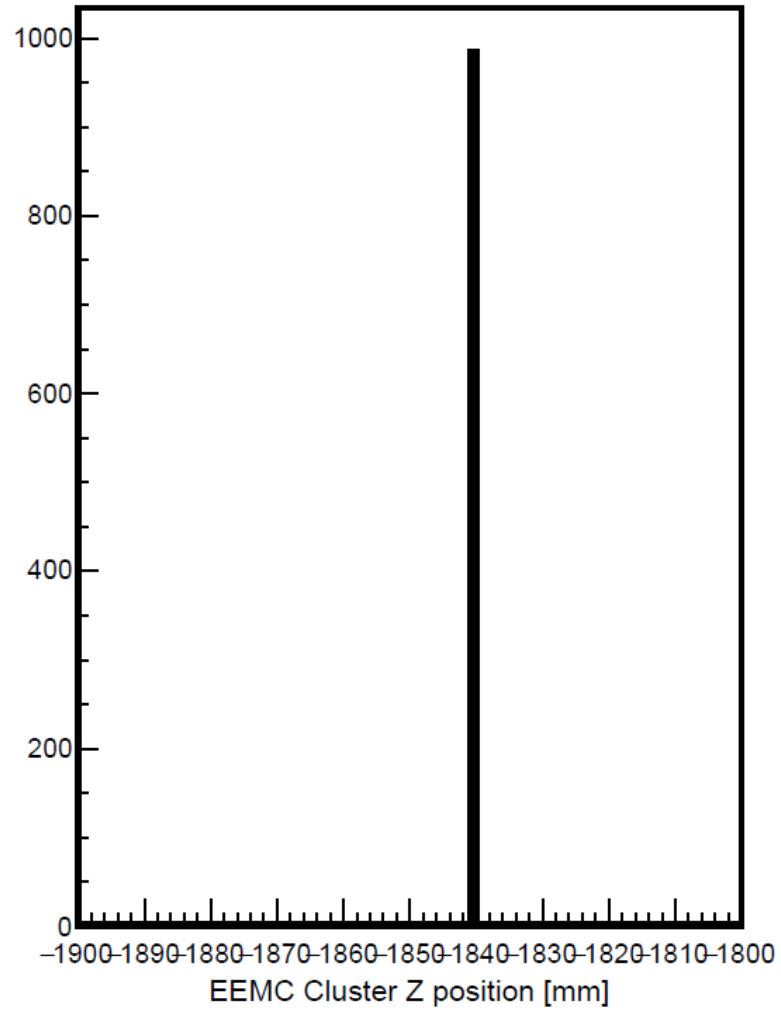
Track Projection test: EEMC

Single Electrons generated:

1 GeV < E < 20 GeV

160° < θ < 170°, 0° < ϕ < 360°





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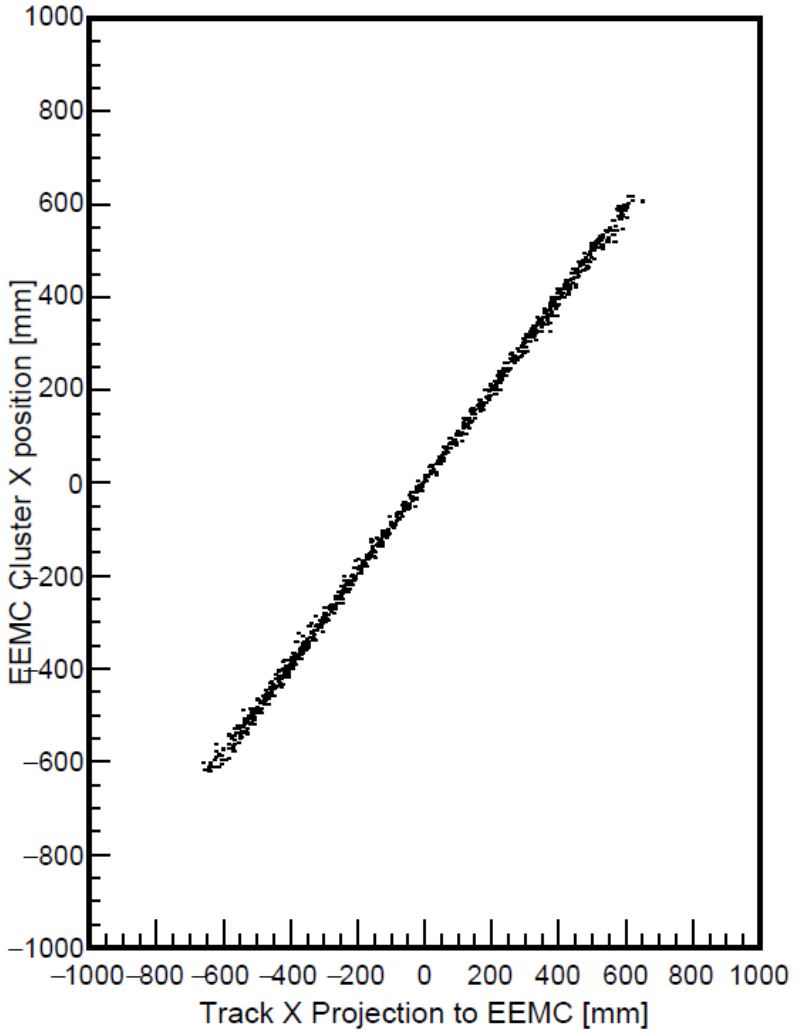

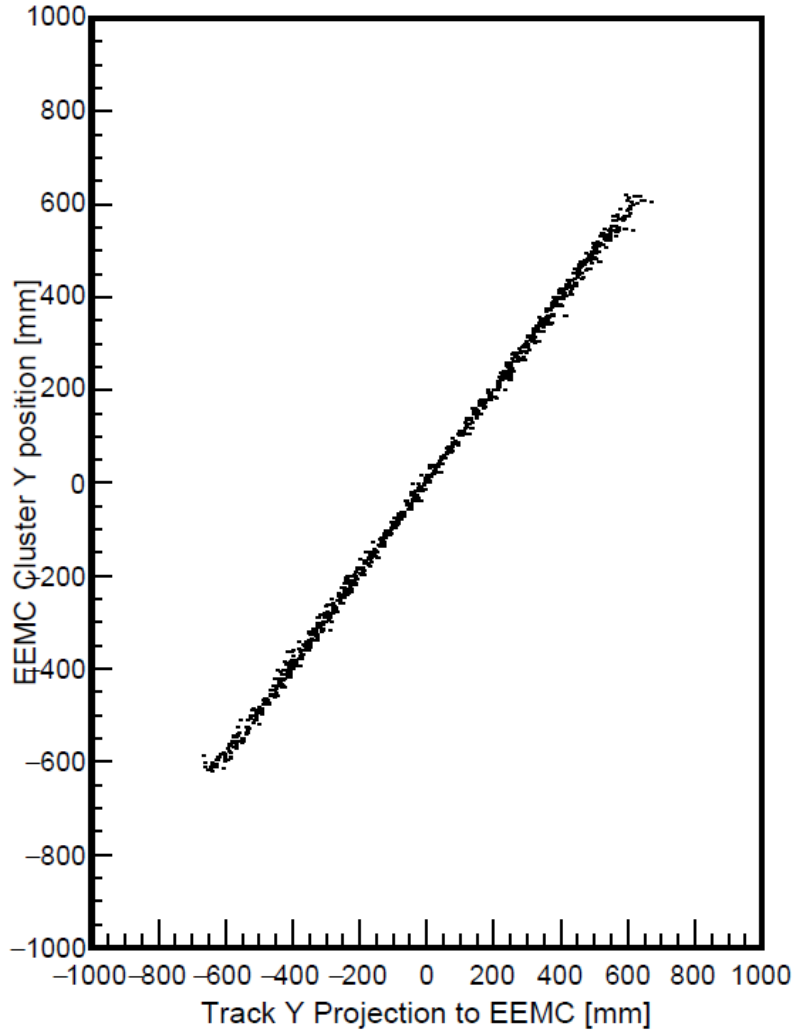

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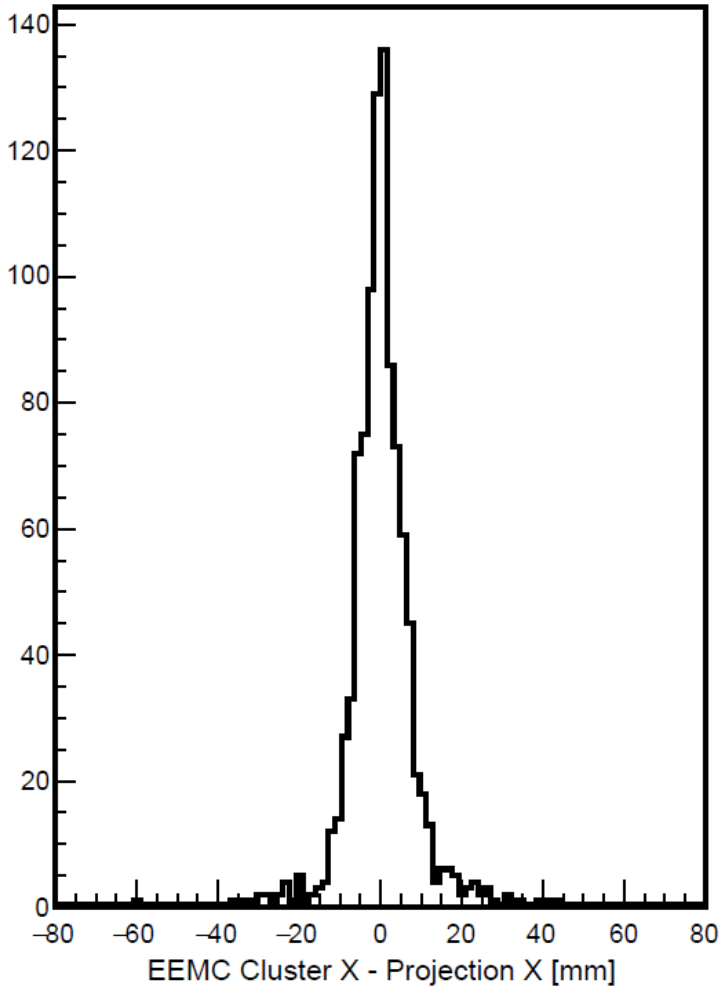

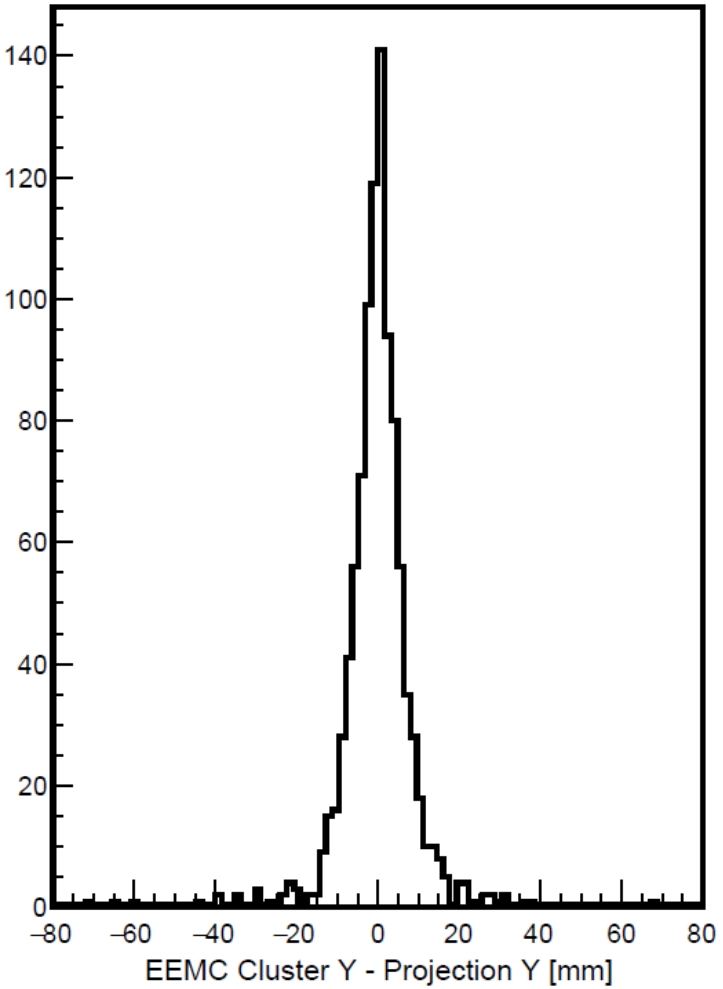

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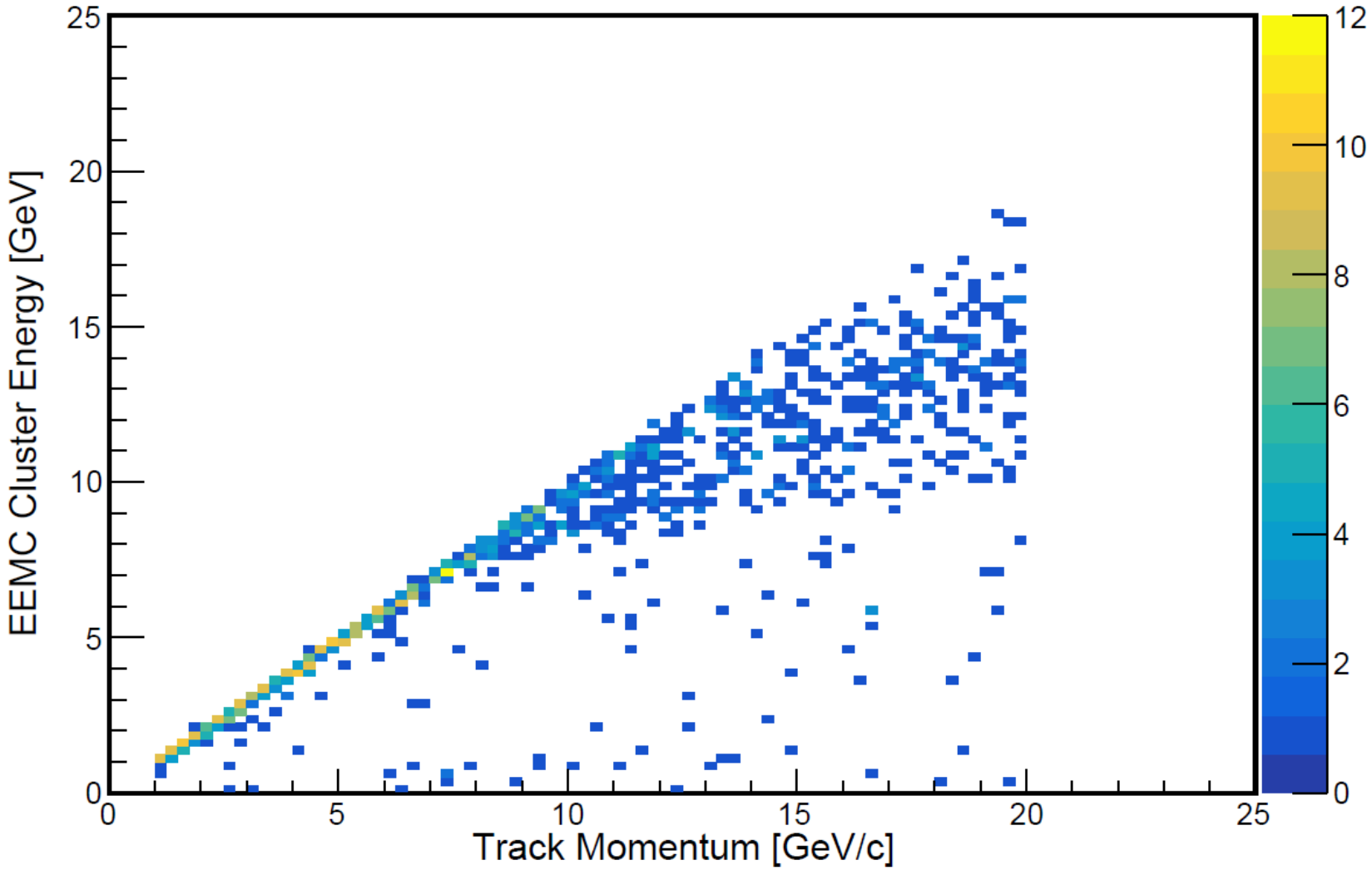

Comment on analysis code

- For both the kinematic reconstruction and track projection studies, we have analyzed the output files using array ‘readers’. Either *TTreeReaderArray* in *ROOT* or *Uproot* analysis using *Awkward* arrays.
- The Inclusive PWG plans to contribute to a common analysis framework in the future, which will be based on the framework developed by the SIDIS group. For our preliminary studies, however, we will probably use the simpler analysis methods above.

Calorimeter clustering in EICrecon

- Clustering methods implemented as common algorithms in: src/algorithms/calorimetry/
- Algorithms called by calorimeter detectors, e.g. in: src/detectors/EEMC/
- Currently implemented:
  - Protoclusters from island clustering
  - Cluster position calculated with center of gravity method

Tyler Kutz

Calorimeter clustering in EICrecon – ongoing work

- Implement “MA” clustering from fun4all-era afterburner (in progress)
  - Cluster splitting including diagonal cells with threshold
- MA clustering used for ECCE inclusive studies…make apples-to-apples comparison with new ePIC simulations
- Add MA clustering to EEMC

Tyler Kutz

Task list (on wiki page)

EICrecon

- **Description:** Implement reconstruction algorithms in EICrecon that are necessary for inclusive physics analyses:
  - Calorimeter clusterization
  - Track and track projection
  - Matching truth/MC information
  - PID detector parameterizations
- **Work Start:** October 2022
- **Expected Duration:** 1-2 months
- **Required Expertise:** Medium/High
- **Contact:** Tyler Kutz (tkutz@mit.edu)
- **Notes:** Official task list for EICrecon is maintained under "Projects" in the GitHub repository
- **Links:**
  - EICrecon on GitHub
  - EICrecon tasks

Inclusive Physics in the Photoproduction Limit

- **Description:** Investigate EPIC capabilities in the Q2->0 limit
  - Understand beam-line detector capabilities and background sources (liaison with far backward group)
  - Investigate, benchmark and optimise Monte simulations
  - Simulate inclusive photoproduction and evaluate achievable precision
- **Work Start:** Anytime
- **Expected Duration:** 6-12 months
- **Required Expertise:** Medium
- **Contact:** Paul Newman (paul.newman@cern.ch) & Claire Gwenlan (claire.gwenlan@physics.ox.ac.uk)

Kinematic Reconstruction Development

- **Description:** Work towards better methods of (x,Q2) reconstruction as appropriate to the EIC:
  - Optimised hadron treatment (particle flow?) in Jacquet-Blondel, Double angle and (e)-Sigma methods
  - Kinematic fitting methods
  - Machione learning methods
- **Work Start:** Anytime
- **Expected Duration:** Open-ended
- **Required Expertise:** Medium
- **Contact:** Paul Newman (paul.newman@cern.ch), Stephen Maple (scm@hep.ph.bham.ac.uk), Barak Schmookler (barak.schmookler@stonybrook.edu) & Claire Gwenlan (claire.gwenlan@physics.ox.ac.uk)

Next Inclusive PWG meeting

Inclusive reactions (EPIC)

Monday 21 Nov 2022, 12:00 → 13:15 US/Eastern

Description Zoom link: https://mit.zoom.us/j/92661341001

12:00 → 12:20 **Tests of simulation output with EICrecon and Juggler** — 20m
Speaker: Stephen Maple (University of Birmingham)

12:20 → 12:35 **Track projections to calorimter** — 15m
Speaker: Barak Schmookler (UC Riverside)

12:35 → 12:45 **Photoproduction generators** — 10m
Speaker: Paul Newman (University of Birmingham, UK)

12:45 → 13:00 **Discussion of future plans** — 15m
Speakers: Barak Schmookler (UC Riverside), Claire Gwenlan (Oxford), Paul Newman (University of Birmingham, UK), Tyler Kutz (MIT)