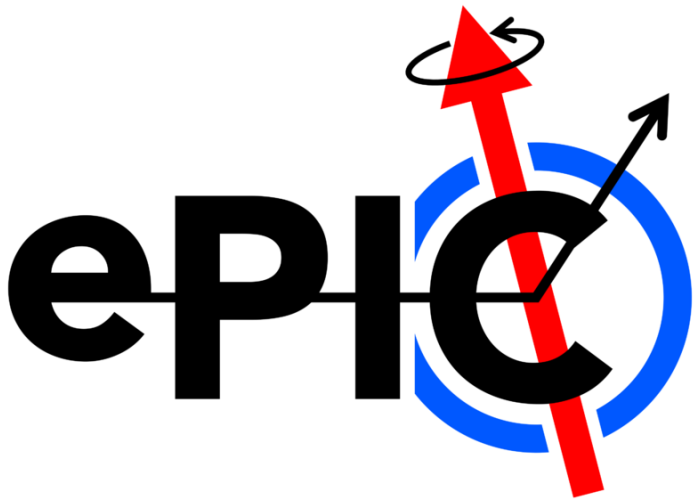
# Analysis Coordinators Report
# ePIC General Meeting

June 8th, 2023

Rosi Reed – Lehigh University

Salvatore Fazio – Unical



# SCC-AC Meeting – May 17th

- Indico at: https://indico.bnl.gov/event/19473/
- Live notes at: Live Notes
- Identified 4 priorities:
  - **Electron Finder**: Developing an efficient and accurate algorithm for identifying electrons and identifying the scattered electron of the DIS process
  - **Vertexing and PID**: Enhancing the vertexing capabilities and particle identification techniques to study heavy flavor physics
  - **Particle Flow**: Improving the jet reconstruction using particle flow information
  - **Low-$Q^2$**: Integration of the low-$Q^2$ tagger into the reconstruction framework for precise measurements of photo production and vector mesons

# SCC-AC Meeting – May 17th

## Point of Contacts for each task

- **Electron Finder**: Daniel Brandenburg (brandenburg.89@osu.edu)
- **Vertexing and PID**: Shujie Li (shujieli@lbl.gov)
- **Particle Flow**: Derek Anderson (dmawxc@iastate.edu)
- **Low-$Q^2$**: Simon Gardner (simon.gardner@glasgow.ac.uk)

**Contact the POC to get involved in activities ASAP!**

# Electron Finder

- Goal / Product: Provide identified (DIS) electron info
- Progress in May / early June (for June Sim Campaign)
  - PR #666: Provides association containers + truth associations (Wouter Deconinck et. al)
  - Identified immediate need, discussion of design / integration plan
- Major Tasks (June):
  - Electron-pion separation, implementation of E/p cuts using existing association information (volunteer?) (some studies for roughly optimal cuts needed)
  - Track Projection Factory: provide track projections at relevant detectors (Tyler Kutz)
  - Track Match Factory: Matching of projecting tracks to clusters (volunteer?)
  - DIS lepton identification (Andrii Verbytskyi) + implementation
  - Integrated Electron Finder Factory (Daniel Brandenburg)
- These tasks make progress towards two goals for July sim campaign
  - Setup complete framework: utilize existing association + simple electron id + existing DIS lepton finder -> output DIS lepton
  - First steps towards towards fully RECO level (track matching / compare to truth level)

# Reco WG Priority Activities | Vertexing and PID

**Coordinator:** Shujie Li, LBNL (shujieli@lbl.gov)

- **Three primary tasks:**
  1) Integrate primary vertexing in reconstruction
  2) Integrate vertex information in ePIC data model
  3) Survey common secondary vertex reconstruction packages

- **Task (1):**
  - **Done** and in for the July campaign!
  - Implemented by **Joe Osborne** and **Barak Schmookler**
- **Tasks (2) and (3) in progress**

# Reco WG Priority Activities | Particle Flow

**Coordinator:** Derek Anderson, ISU (dmawxc@iastate.edu)

- **Two primary tasks:**
  1) Survey existing implementations of **p**article **f**low (PF)
  2) Explore necessity of custom approach (rather than an existing package) in the barrel and backwards regions

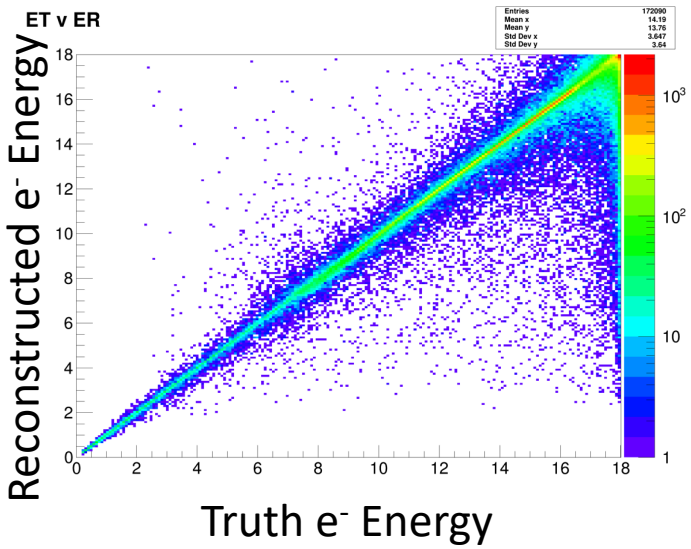
- **Towards (1):**
  - Survey is in progress!
  - Look for presentations by PF experts from other experiments once regular Reco WG meetings get started
    - Date & time of Reco WG meetings TBD
- **Towards (2):**
  - July campaign will see deployment of features prerequisite for PF (e.g. track-cluster matching)
  - ∴ Output of July campaign will serve as testbed for exploring implementations

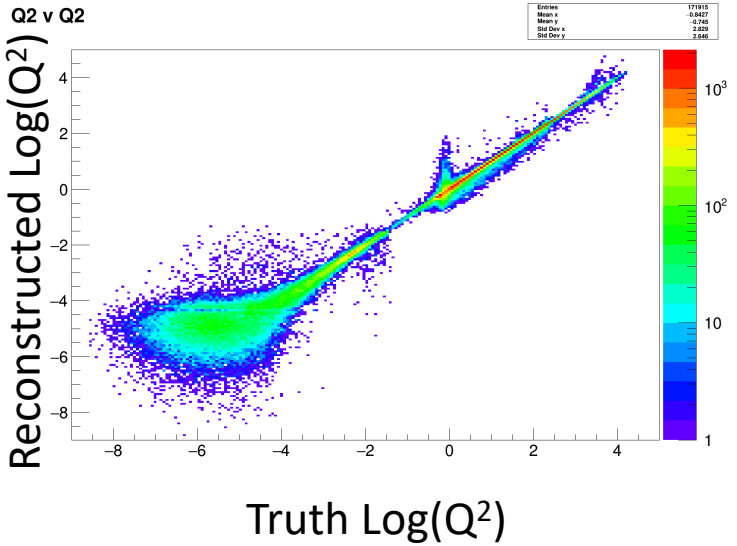
# Low-$Q^2$ Tagger hits in reconstruction

- Not included in current campaign
- Particle track reproduced with ROOT TMVA model
- Plots produced from addition into InclusiveKinematicsElectron factory
- Still some longer term issues to resolve but could be merged in (almost) current state
- Exploring other C++ neural networks tools for use in EICRecon which might have better long-term support.
- Keen to explore GraphNN to approach increased combinatorics when including backgrounds (Anyone with experience, please get in contact)

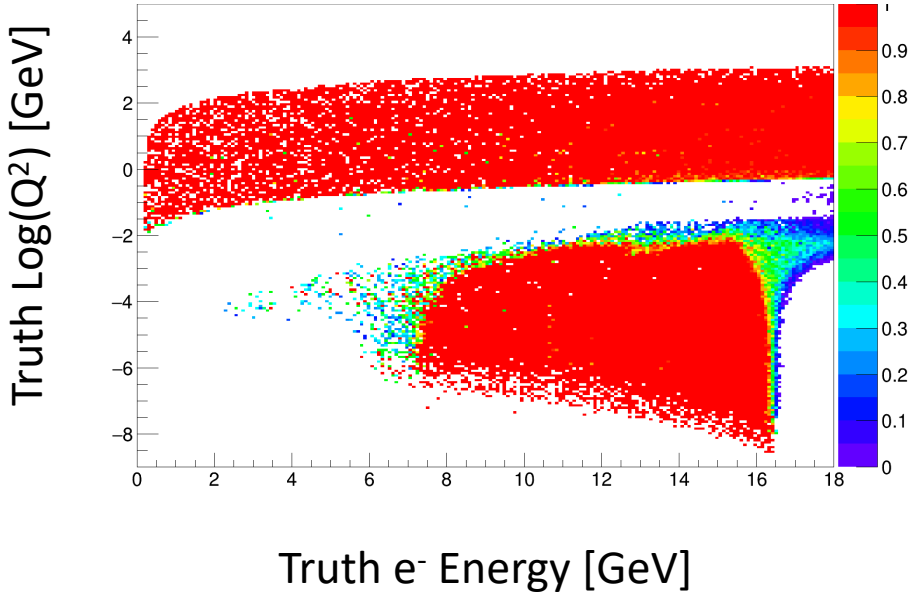
<u>Beamline setting integration into workflow</u>
Begun reaching out to relevant parties to try and understand how best to approach this at each stage.
Requires discussions and decisions with a wider group.

*Please let me know if you can help with the tasks!*
*Simon Gardner – Simon.Gardner@Glasgow.ac.uk*




Total ePIC Quasi-Real Photoproduction Acceptance



# Interplay between Software & Computing and Physics

**Physics Working Groups**: For the physics analysis of simulated data, the reconstruction needs to be improved.

**Software & Computing Effort**: We need physics benchmarks for the continuous assessment of the physics reach of the ePIC detector.

Report from Software and Analysis Joint Meeting

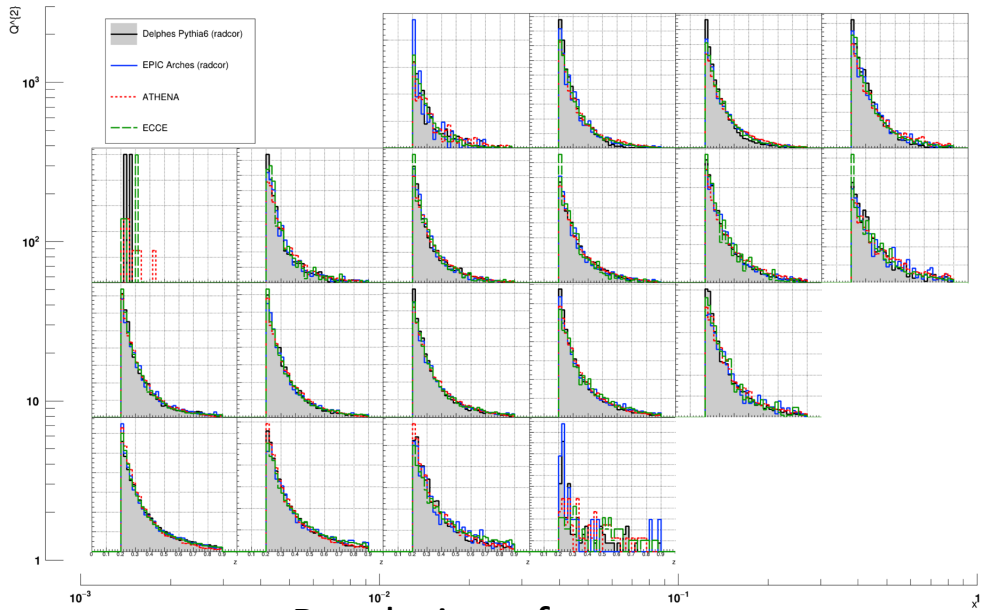
# Analysis Coordination Meeting

- Details at: AC Meeting
- Meeting with PWG conveners (but open to everyone) every other Friday (staggered with the General Meetig)
- Recent topics: Discussion of Benchmarks, Communications
- Each PWG proposes some Benchmarks
  - Should test performance and physics
  - Automatized macros that will run at each simulation campaign
    - more advanced observables being also considered
  - First discussions with the PWGs ongoing…

# Benchmarks (1/2)

https://indico.bnl.gov/event/19616/

- **Inclusive**
  - Resolutions (electron, hadronic final state, kinematic variables)
  - Electron purity and efficiency
  - Reduced NC cross sections
  - Double-spin asymmetry $A^p_1$
- **SIDIS**
  - (SI)DIS resolutions (xB, $Q^2$, z, P T )
  - PID quality (e/π K/π separation)
  - $A_{LL}$ measurements → Sea-quark helicity PDFs
  - Unpolarized cross sections → Spin-independent TMD PDFs/FFs
  - Sivers/Collins asymmetries → Sivers TMD, Collins FF
  - Dihadron asymmetry → Transversity and tensor charge via collinear dihadron FF
  - Back-to-back di-hadron asymmetries → Saturation
  - Lambda Polarization → Polarized FFs

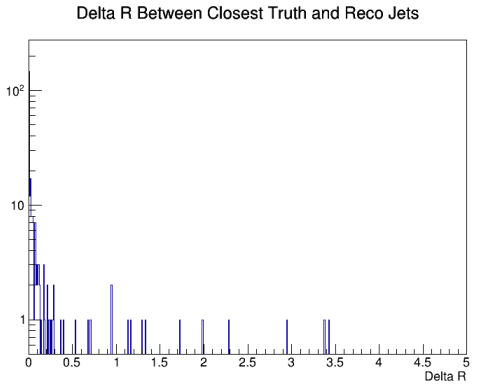


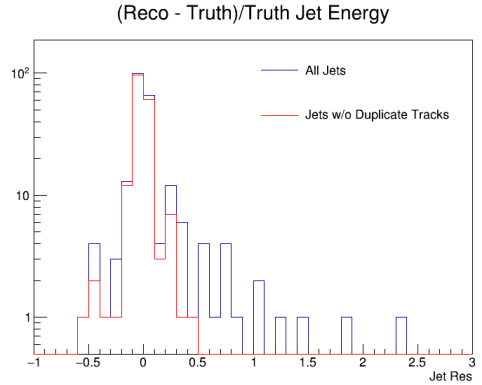

Resolution of z

# Benchmarks (2/2)

https://indico.bnl.gov/event/19616/

- **Jets/HF**
  - Kinematic Distributions (Jet $p_T$, Eta, Phi, E, correlations)
  - Reconstructed / Generator Jet Delta R
  - Duplicate Track Plots
  - Jet Energy Resolution / Scale (Vs Eta and E)
  - DCA & Secondary Track Efficiency + DCA




- **Exclusive + Diffraction + Tagging**
  - Deeply virtual $\pi^0$ production e.g. from neutron in $D_2$ with tagging in FF region (important background, more challenging than DVCS)
  - Deeply virtual meson production decaying into charged pair
  - Additional Benchmarks under discussion…
- **BSM + precision EW**
  - Electron Identification
  - Charge Lepton Flavor Violation (CLFV) → Tau ID, Muon ID

# PWG Meeting Times

- **Inclusive** (conveners: Claire Gwenlan , Tyler Kutz)
  - Meeting time: Mondays (biweekly) at 12pm ET
  - Mailing list: eic-projdet-Inclusive-l@lists.bnl.gov
  - Indico: https://indico.bnl.gov/category/417/
  - Mattermost: https://eic.cloud.mattermost.com/main/channels/inclusive-physics
- **SiDIS** (conveners: Charlotte Van Hulse, Stefan Diehl)
  - Meeting time: Tuesdays (biweekly) at 8:30am ET
  - Mailing list: eic-projdet-semiincl-l@lists.bnl.gov
  - Indico: https://indico.bnl.gov/category/418/
- **JETS + HF** (conveners: Olga Evdokimov, Brian Page)
  - Meeting time: Wednesdays (biweekly) at 12:00pm ET
  - Mailing list: eic-projdet-jethf-l@lists.bnl.gov
  - Indico: https://indico.bnl.gov/category/420/

# PWG Meeting Times

- **Exclusive + Diffraction + Tagging** (Raphael Dupre', Rachel Montgomery)
  - Meeting time: Mondays (biweekly) at 12pm ET
  - Mailing list: eic-projdet-excldiff-l@lists.bnl.gov
  - Mattermost: https://indico.bnl.gov/category/419/
- **BSM + Precision EW** (conveners: Ciprian Gal, Michael Nycz)
  - Meeting time: Tuesdays (biweekly) at 8:30am ET
  - Mailing list: eic-projdet-semiincl-l@lists.bnl.gov
  - Indico: https://indico.bnl.gov/category/421/
  - Mattermost: https://eic.cloud.mattermost.com/main/channels/ew-bsm

# Wrapping up…

- 4 “task squadron” priorities: Electron Finder, Vertexing and PID, Particle Flow, Low-$Q^2$
  - Need volunteers to join efforts
  - How do I join: email the Point-of-Contact for your favorite task!
- Initial list of PWG Benchmarks being discussed
- HOW do I join a PWG?
  - step 1: email the conveners of your favorite PWG and subscribe the mailing list!
  - step 2: join the (bi)weeky meetings
  - step 3: actively engage in studies and efforts

WE WANT YOU