

# ePIC CM Debrief | Day 1 | Priorities



## Indications for 2026 Collaboration priorities

**ePIC Detector**

- **Detector holistic performance** studying key physics channels
  - Move the weight from studies without background complement by a preliminary exploration of the results obtained with background to **making the studies with background**
- To this end, **continuing the coordination with the simulation campaigns** is needed
- The improvement in the subsystem simulation will also support more and more realistic studies of the detector holistic performance

**From TC Office talk**

ePIC meeting, January 20-23, 2026

## 2026 Reconstruction Priorities

**From PAC Office talk**

- Will keep pursuing 2025 priorities for 2026 as well!
- Holistic reconstruction
  - There has been a tremendous progress with our reconstruction software, which has enabled many physics performance studies over the past year!
  - Nevertheless, further development of a more realistic holistic treatment of information from different components is crucial
  - **Starting with 2026:** working together with S&C, we prioritize:
    - Development of our **electron finder** into a more complex tool, capable of identifying all electrons candidates and assigning to them a probability, via combining informations from calorimeters, trackers and PID systems
    - Complete the development of a **particle flow** algorithm
    - Development of a **true PID reconstruction**, using the information from all PID subsystems (we are currently using look-up tables)
    - Development of a **muon finder**, using tracker and veto from HCAL

**Day 1:** welcome, updates from management, and priorities

- Clear reconstruction priorities from all 3 offices!
- ☞ **Very Critical:** continuing + improving communication with PWGs + DSCs

## preTDR Priorities for 2026

**From SC Office talk**

In 2024, we defined preTDR readiness for software and simulations with the collaboration—and successfully met those goals. In 2025, we renewed our priorities at the Frascati Collaboration Meeting, with many topics already reaching an advanced stage and positioning us well for the next phase. **We will discuss priorities for 2026 during this collaboration meeting.**

**Production** Provide the simulation campaigns with background to finalize the ePIC detector design and validate its physics performance, roll out Rucio as the default system for finding and accessing simulation data, and automate production workflows.

We have reached a level of complexity in simulation production that necessitates a **workflow management system (WFMS)**. We have decided to use **PanDA** for our current simulation productions. This decision will be revisited in **FY28**, when we evaluate WFMS options for **streaming orchestration** and select one.

**Reconstruction** Coordinate the effort to address gaps in reconstruction. Work toward a holistic reconstruction approach, such as particle identification that integrates information from calorimeters, Cherenkov detectors, and time-of-flight systems.

**Simulation** Implement and operate a workflow between detector and simulation experts to track the status of the comparison between the simulation design and the engineering design, and to resolve any discrepancies in a timely and systematic manner.

**Streaming Orchestration** Define and test the interface between DAQ and computing to mitigate risks in the integrated DAQ-computing system. As part of the integration, test develop and deliver a functional testbed that validates a workflow management system for the autonomous calibration of a detector subsystem.

**Workforce** Foster a developer community within ePIC and support the careers of scientists focused on software & computing.

ePIC Collaboration Meeting, January 20, 2026.

# ePIC CM Debrief | Day 2 | Early Science (1/2)

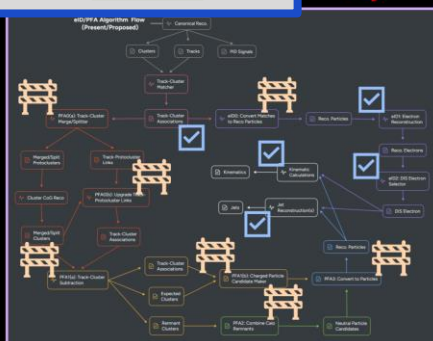


## PF Status | As of Today

- PFA0 now unblocked!
  - Introduced track-cluster associations, [EDM4elc#130](#)
  - Resolved bug with patch for JANA2 bug, [eic-spark#794](#)
- Now ALL stages have PRs ready for review or are in progress!
  - ➔ Huge thanks to Subhadip Pal (CTU) & Esteban Molina (UMich) for helping out!

○ = To-do  
🚧 = In progress  
✅ = Done/already in EICrecon  
❌ = Blocked

## From Derek's talk



January 21st, 2026

Derek Anderson (JLab), ePIC Collaboration Meeting 2026

5/14

## eID Tasks | Toward M

## From Derek's talk

Task	Description	Notes	Assignees
eID0	Resolve missing EMCal-track associations		Barak, Win, Help
eID1	Resolve issues with boost.h	<a href="#">EICrecon#2331</a>	Win
eID2	Add isolation cut to ElectronReconstruction	<a href="#">EICrecon#2332</a>	Help
eID3/PFA-1	Deprecate MatchClusters, replace with pure reco equivalent	<a href="#">EICrecon#1956</a>	Tristan
eID4	Wire reco DIS electrons into kinematic calculations (step 1)	<a href="#">EICrecon#2333</a>	Help

**Milestone 1:** there are well-defined steps to bring EICrecon e<sup>-</sup>finder to next level, meaning that

1. Updates are integrated from Inclusive PWG's prototype code, and
2. Use of truth information is removed.

**ETA:** end of CY26.Q1 (*cond. on workforce*)

- Help indicates where additional workforce is needed
- Tasks are decoupled and can proceed independently
- eID4 has synergy with **Event Kinematics** reconstruction priority
- **Note:** reco kinematics *do not* have to be made default until collaboration is ready

January 21st, 2026

Derek Anderson (JLab), ePIC Collaboration Meeting 2026

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## Implementation to EICrecon

- Fix boost.h ...
- More flexible beam energy selection in kinematic reconstruction
- Update selection algorithm in ElectronReconstruction
- Store HFS information for later analysis
- Benchmark
- See Derek's slides for detailed plan

## From Win's talk

[EICrecon/src/algorithms/reco/InclusiveKinematicsElectron.cc](#)

```
79 // Get incoming electron beam
80 const auto el_coll = find_first_beam_electron(ncparts);
81 if (el_coll.empty()) {
82     debug("No beam electron found");
83     return;
84 }
85 const PwPyVector eiround_beam_four_momentum(el_coll[0].getMomentum(),
86                                              m_particleSec.particle(el_coll[0].getPDG()).mass,
87                                              {-5.0, -10.0, -10.0, 0.0});
88
89 // Get incoming hadron beam
90 const auto pl_coll = find_first_beam_hadron(ncparts);
91 if (pl_coll.empty()) {
92     debug("No beam hadron found");
93     return;
94 }
95 const PwPyVector pirlound_beam_four_momentum(pl_coll[0].getMomentum(),
96                                              m_particleSec.particle(pl_coll[0].getPDG()).mass,
97                                              {41.0, 100.0, 275.0, m_crossingAngle});
```

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- **Day 2:** parallel sessions
  - Esp. relevant for the Reco WG was the Early Science Workfest
  - Had reports from all PWGs, discussions on backgrounds + systematics, and focused updates on infrastructure (PF + eID)

- **Key points:** from infrastructure updates
  - PRs now open for all stages of PFAAlpha except PFA3 (see slides for links)
  - Now developing work plan to better integrate eID + EICrecon
    - ➔ Work on [eID1](#) and [eID2](#) already started!

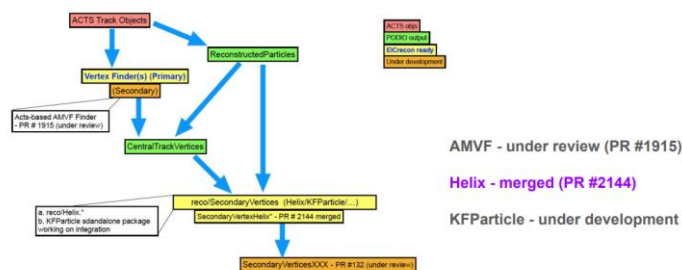
# ePIC CM Debrief | Day 2 | Early Science (2/2)



## From Jet/HF talk

### Software update: Secondary Vertex finders

X. Dong (LBNL)  
B. Dongwi (SBU)



## From Jet/HF talk

### Software update: SV data structure

X. Dong (LBNL)

- Current vertex data structure does not contain topological variables
- Propose new SV structure to facilitate offline analysis (PR #132)

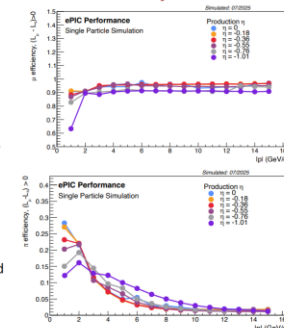


## Muon Identification Performance at ePIC

- Reliable muon identification significantly enhances BSM sensitivity and improves background control in multiple channels.
  - Muon ID based on a likelihood approach, using:
    - Track momentum
    - Calorimetric variables (E/p and shower radius).
    - Discriminator defined as log-likelihood difference  $L_{\mu} - L_{\pi}$
- Based on single-particle simulations;
  - Muon efficiency remains high and uniform, typically 90–98% for  $|p| > 3$  GeV.
  - Pion mis-identification rate remains low, below ~10% in the central region.
- Impact
  - Demonstrates that muon ID in ePIC is robust in the central barrel.
  - Directly supports CLFV searches, sterile-neutrino studies, and EW/BSM measurements requiring clean muon final states.

## From BSM/EW talk

Andrew Hurley (UMass Amherst)



## ○ Day 2: parallel sessions

- Esp. relevant for the Reco WG was the Early Science Workfest
- Had reports from all PWGs, discussions on backgrounds + systematics, and focused updates on infrastructure (PF + eID)

## ○ Key points: from PWG reports

- Wrapping up SV tasks (AVMF, data model) key effort for Jet/HF PWG
  - ☞ Aim for UGM?
- Muon ID efforts advancing well, should start thinking about EICrecon integration
  - ☞ Eg. How will this fit into holistic PID?

# ePIC CM Debrief | Day 4 | PID CCWG-Reco WG Session



## From Shubham's talk

**SOFTWARE TASKS**

- Currently
  - Comparing performance between eicrecon and the standalone framework
  - Digitization based on either the standalone or dRICH approach (DIRCRawHit / RawTrackerHit → cell ID → position → PMT ID & pixel ID → DIRC tree)
  - Reimplementation of geometric and time-imaging PID reconstruction within eicrecon
- Near term
  - Repeat multiple-hits-per-bar studies using the full ePIC geometry
  - Quantify performance with Pythia using the latest ePIC geometry, including realistic sensor background rates
- Far term
  - Implementation of alternative ML-based reconstruction method

*hpDIRC in ePIC simulation*

*Stand-alone hpDIRC simulation*

© 2024, SLAC | ePIC hpDIRC Simulations | Joint Reco PID CCWG Workshop | ePIC Collaboration Meeting | January 28, 2025

## From Kentaro's talk

**Simulation team & tasks**

Task Category	System	Assignee	Progress
PID performance	BTOF	Kentaro + Kyohei	Done (Jul 2025)
	FTOF	Abdelghani	Result (New)
Material Budget	BTOF	Kyohei	Done (Jul 2025)
	FTOF	Honey + Abdelghani	Started
Effect on Tracking	FTOF	Tommy	Ongoing
Digitization	BTOF	Tommy	Done (July 2025)
	FTOF	Honey	Ongoing
Geometry	BTOF/FTOF	Tommy	Up-to-date

- Important note
  - Performance studies and digitization works run in parallel with own framework
  - Need to rerun everything after full digitized simulation will be available

TaP Simulation 23 Jan 2026

## Discussion points

### From SIDIS talk

- What are the aspects we need:
    - Flexibility: Some analyzers will need to sacrifice statistics in favor of purity while others optimize statistics → need variable PID selection choices (ie likelihoods from each detector)
    - Unfolding capability: Obtain data-based PID efficiency matrices in relatively fine lab  $P - \eta$  binning for people to unfold efficiencies/fake rates
    - Holistic PID: not only  $\pi/K/p$  separation from dedicated PID detectors, but also include  $e/h$  and  $e/\mu$  ID information from calorimeter(+tracking)
    - Systematics: have uncertainties on PID effi matrices to be able to assign systematic uncertainties due to PID on physics measurements
  - For early systematic estimates, have tables of  $\pi/K$  widths and centers as a function of lab  $P - \eta$
- 09/16/2025 R. Seidl: SIDIS analysis 5

- **Day 4:** closeout + parallel sessions
  - Important for Reco WG was the joint PID CCWG-Reco WG workfest on PID SW
  - Consisted of updates from RICH, DIRC, and TOF DSCs + open discussion on holistic/global PID
  - Starting point for prototyping global PID reco: have enough for unit tests, except workforce...

- **Key points:**
  - Need to seriously consider compromises/mitigations to balance (1) integrating SW and (2) hitting deadlines
  - DIRC and TOF DSCs in transition period, but expecting this semester to be productive
  - Should consider “pincer maneuver” with PWGs for global PID reco