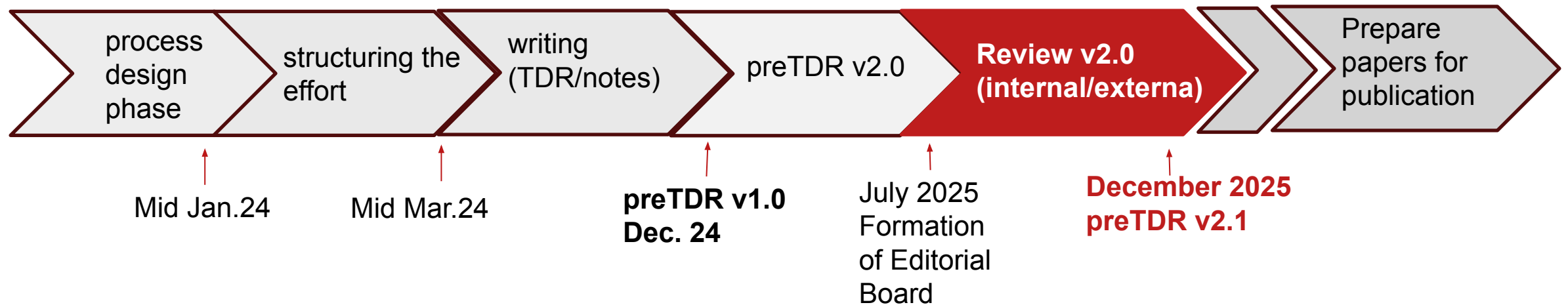


Status of Simulations



Dmitry Kalinkin (Brookhaven National Laboratory)

ePIC preTDR and Publication Plan



Recommendation (August 15th) - Use **October** (25.10) simulation campaign

Preferred deadline (September 9th) for contributions to **September** release deadline

Final deadline for finalizing (incl. review) of the contributions (October 7th)

Software development continues, but **November** campaign will not be ready in time for preTDR 2.0

Original plan vs Outcome

Feasibility of completing tasks was assessed based on feedback and level of activity of the contributors (October 2nd).

All expected items made it into the release (✓/■ is the current status).

Plans for October Software Release (25.10)

- **Geometry and Materials:** ✓ Updated silicon outer barrel geometry, ✓ revisions to MPGD geometry, ✓ and material map update for FTOF.
- **Reconstruction:** ⚠ ACTS patches to undo regressions with new material map generation, ✓ reworked low- Q^2 tagger momentum reconstruction, ✓ and clustering in TOF.
- **Ongoing Discussions:** ✓ EEEMCal performance to be addressed; ■ forward ECal geometry, ■ random noise injection, ■ secondary vertexing.

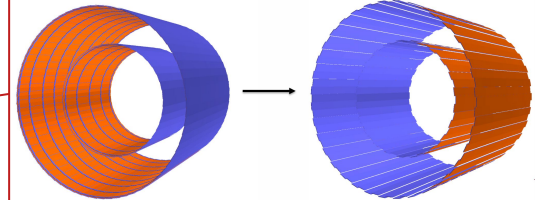
General Meeting (October 2nd)

Software Release 25.10 (Slide from Weekly Meeting's Software News)

Tagged ePIC 25.10.0 geometry, select notable changes:

- Updated refraction index for dRICH (Chandra)
- New Inner Barrel SVT geometry (Shujie)
- New Outer Barrel SVT geometry (Aditya and Sam)
- New SVT supports (Shujie)
- Reduced overlap check tolerances (Wouter)

Example illustration: SVT OB update



[SVT/MPGD changes discussed at Tracking/Vertexing meeting](#)

Tagged EICrecon 1.30.0, select notable changes:

- Clustering for TOF/LGAD implemented - not yet used in tracking (Tommy)
- Updated dRICH PID LUT (Ramandeep)
- Resolved bug with overflow bin being populated for pRICH PID LUT (Simon)
- Low Q-2 ONNX workflow used by default, old TMVA implementation removed (Simon)
- Reconfigured island clustering in ScFi to not use longitudinal hit position (Wouter)
- Resolved issue with embedded background events missing calorimeter hits due to arbitrary timing cut (Wouter)
- Enabled digitization for FTOF (Honey)
- New reference positions for light attenuation in ScFi (Minho)
- Updated SiPM and light yield parameters for EEEMCal (Dmitry)

Software Release 25.10.1

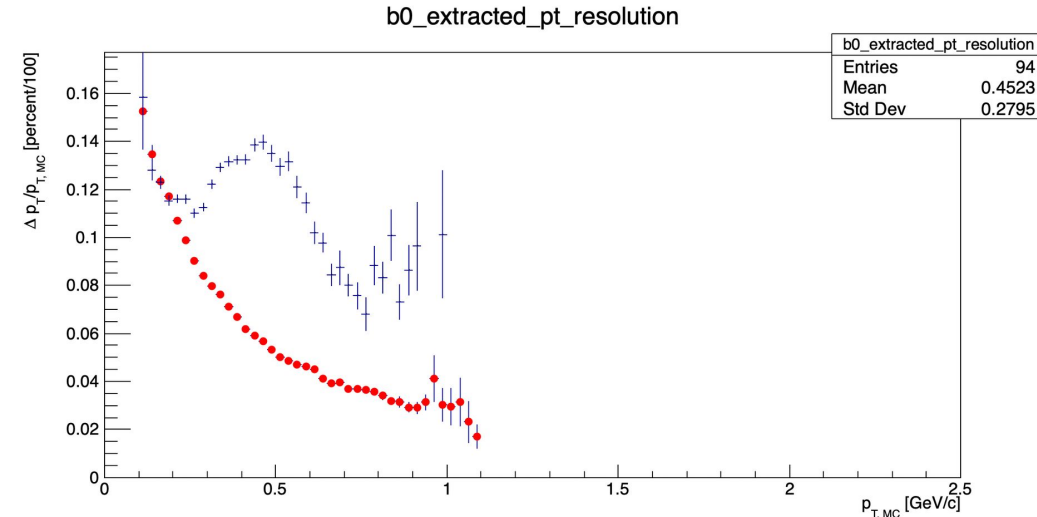
Minor releases are meant for bug fixes. We typically allow for minor additions as long as they are well localized and meaningfully improve the campaign.

Tagged (TODO) EICrecon 1.30.1, changes are:

- Implemented the FF reconstruction using numerical interpolation, also uses that for, the old method is available as ForwardRomanPotStaticRecParticles (Alex)

Change to branches:

- Before:
 - ForwardRomanPotRecParticles – matrix method
- New
 - ForwardRomanPotRecParticles – new matrix interpolation method
 - ForwardRomanPotStaticRecParticles – matrix method (kept for reference)



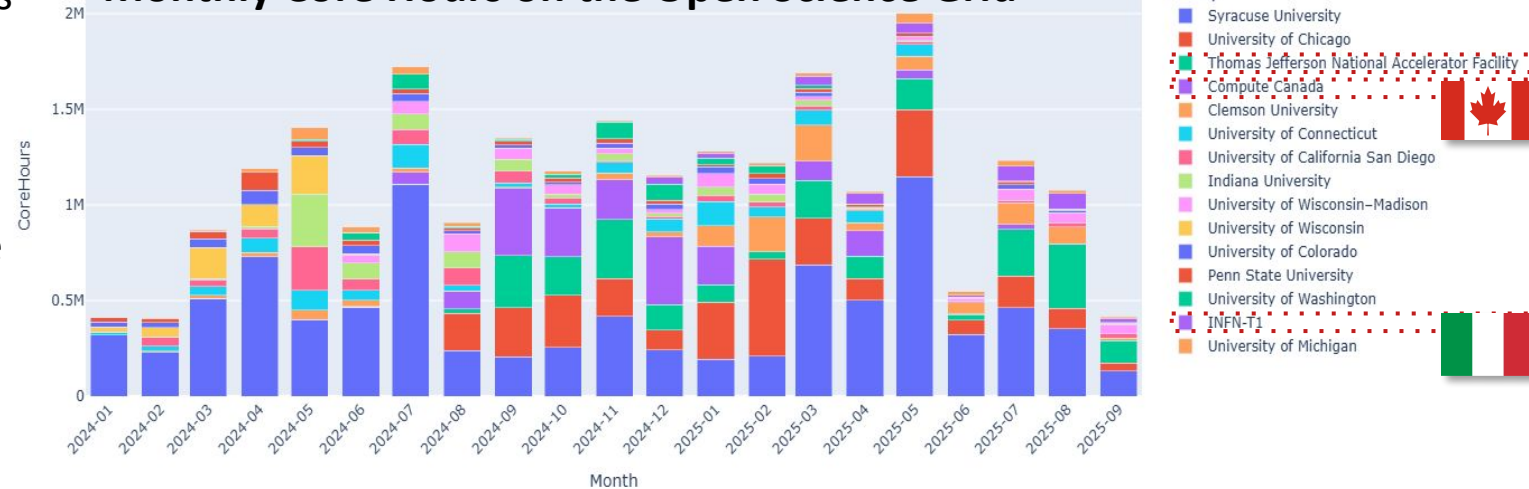
Performance improvement (Plot provided by Alex)

The plan is to produce the full campaign with 25.10.0 except for exclusive samples that will use 25.10.1

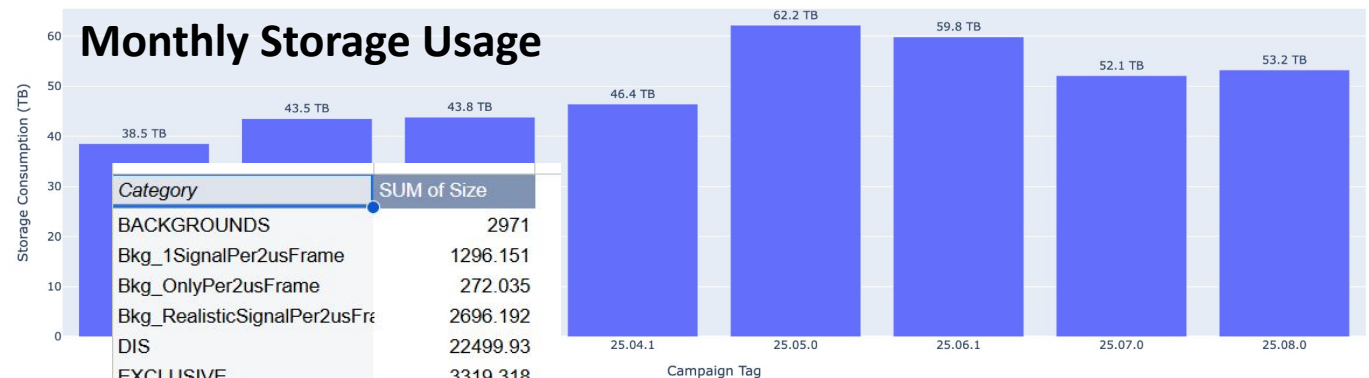
Production Resources

- We anticipate a ~2x storage increase (simulations with backgrounds), and are in talks with institutions in Japan, Taiwan, Italy and UK for additional resources.
- Given uncertainty regarding near-term availability of computing and storage from the national labs, it is a good opportunity to improve redundancy and exercise distributed computing model.
 - Backup input HepMC files from JLab to BNL site
 - Exercise writing of the campaign files to available BNL storage
 - Have a plan distributing a complete campaign without relying on JLab XRootD (e.g. storage at OSG)
 - Investigate options to implement cross-site redundancy of existing Rucio deployments
- Manpower: Currently, we have 3 production submitters – divided responsibility between Inclusive, Exclusive and Heavy Flavor. Inclusive jobs are submitted from JLAB submit node and the rest are submitted from BNL submit node

Monthly Core Hours on the Open Science Grid



Monthly Storage Usage



25.06.1 Storage Data (GB)

October campaign datasets

Central Spreadsheet with Dataset Priority Levels: 58 datasets requested

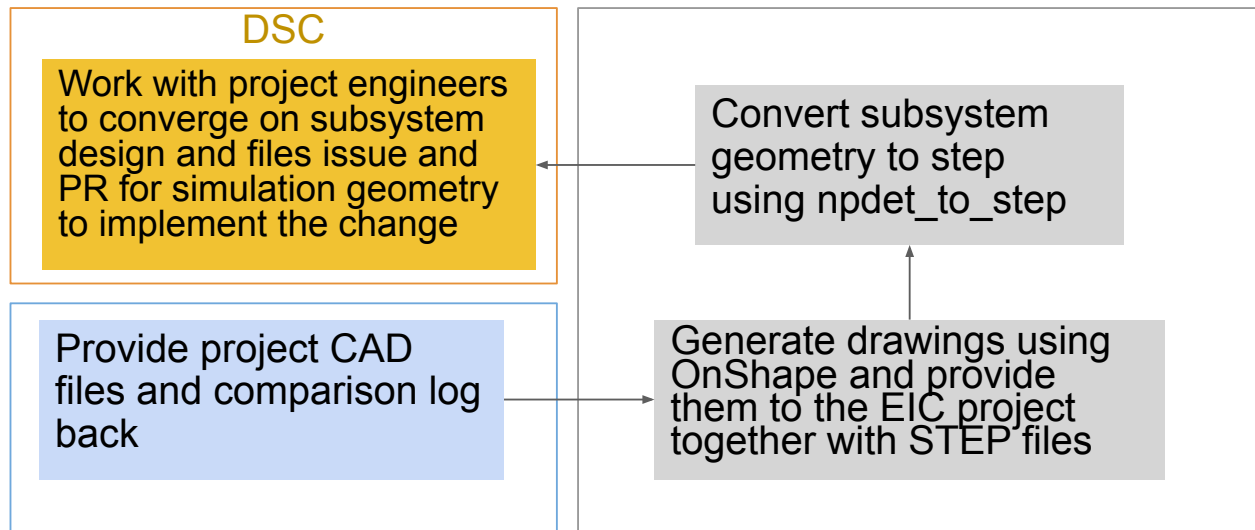
Run Plan:

1. Inclusive sets with and without backgrounds
 - a. 18x275 and 10x100 (1 signal per Integration Window, Realistic Signal Per Integration Window and Only Backgrounds Per Integration Window)
2. Exclusive sets with and without backgrounds (1 signal per Integration Window)
3. All datasets with Priority Level 1
4. All datasets with Priority Level 2
5. Rest of the datasets

Status as of October 23rd:

- Production of the DIS $Q^2 > 1$ samples in progress
- Due to an issue in BeAGLE related to assigning the same timestamp to both primary and secondary vertices, two Heavy-Flavor productions for those are on hold for now

Geometry validation

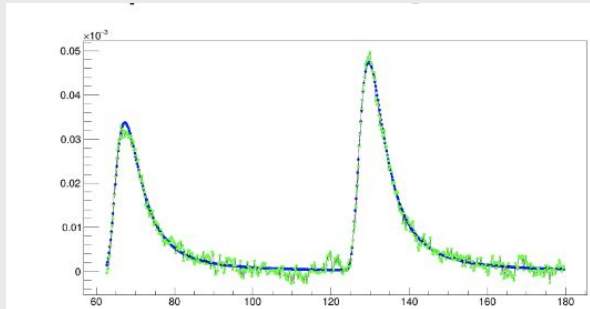


System	Validated Against Envelope from March, 2025?	Validated Against Envelope from September, 2025?	Validated Against Detailed CAD?
Beampipe	Yes		No changes expected before October
SVT Inner Barrel			Yes
SVT Outer Barrel			Yes
SVT Disks Forward	?	?	No changes expected before October
SVT Disks Backward	?	?	No changes expected before October
SVT Support and Services			Yes
MPGD Inner Barrel	Differences are Understood and Addressed		
MPGD Outer Barrel	Differences are Understood and Addressed		
MPGD Disks Forward	Differences are Understood and Addressed		
MPGD Disks Backward	Yes		
Ecal Barrel (BIC)	Differences are Understood and Addressed		No changes expected before October
Ecal Forward (FEMCAL)	?	?	Work in Progress
Ecal Backward (EEEMC)	Yes		Work in Progress
HCal Barrel	Not in Agreement		Work in Progress
HCal Forward	Differences are Understood and Addressed		Work in Progress
HCal Backward	Not in Agreement		Work in Progress
AC-LGAD Barrel	Not in agreement		Work In Progress
AC-LGAD Disk Forward	Yes	Yes	
PFRICH	Yes		No changes expected before October
hpDIRC			Work in Progress
DRICH	Differences are Understood and Addressed		No changes expected before October

- September 2025 Envelopes received and sent out to DSCs. Previously, we had sent out the March 2025 Envelopes. Now doing a systematic survey of status for different DSCs.
- Validation done and any necessary changes made it into October campaign: Beampipe, SVT, MPGD, BIC, EEEMCal, LFHCal, PFRICH, DRICH, Forward TOF
- Validation done but WIP Pull Request: FEMCal, Barrel TOF
- Action Plan:
 - Bring all systems in line with September 2025 Envelopes
 - Track additional systems outside the central detector (Far forward/Backward, IR magnets)

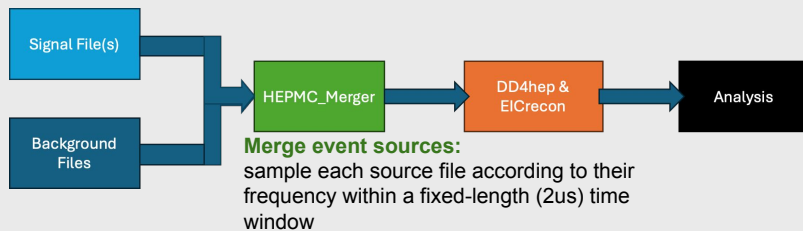
Future plans

The development doesn't stop with 25.10.



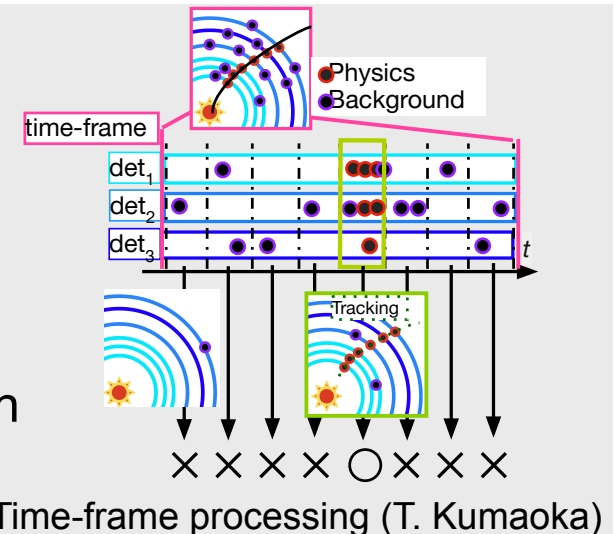
Example simulated pulse shapes with added noise by Simon Gardner

- Waveform generation implemented for Low- Q^2 taggers, BTOF, FTOF, BIC ScFi.
- Still need to do careful work on accurate digitization (thresholds, conversion to time/amplitude, dead times, etc).
- Still need work on compute-optimal implementation of the noise hits.



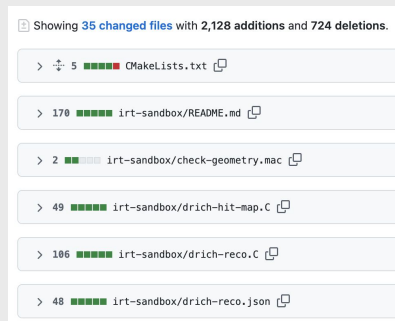
More and more datasets with backgrounds merged, but reconstruction will have to improve.

Ongoing work to implement event building from time-frames to physics events, already shows good results. Prototype needs to be integrated with mainline EICrecon (late 2025 – early 2026)



Future plans

The development doesn't stop with 25.10.



■ ■ ■

IRTV2 implements detector-agnostic reconstruction for RICH, it has a great potential to become new baseline method for pfRICH and dRICH.

It will take some work and coordination to have this properly integrated into the mainline ePIC software stack. Community is excited to work on this. Contact Reconstruction WG, [Chandradoy Chatterjee](#) to join!

Work on particle-flow is of great interest for hadronic calorimetry and Jet/HF physics.

The effort is organized into bite-sized tasks ideal for newcomers.

We are looking for people interested in joining the effort!
Contact Reconstruction WG, [Derek Anderson](#) to get involved!

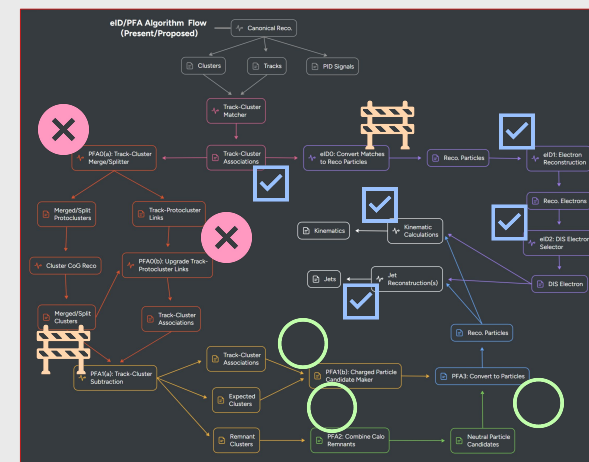


Chart by D. Anderson

Simulation priorities for TDR

Production Provide the simulations required by the DSCs and PWGs to finalize the ePIC detector design and validate its physics performance, enhance integration of Rucio within detector and physics analysis workflows, and automate production workflows.

Reconstruction Coordinate the effort to address gaps in reconstruction, e.g., dRICH, hpDIRC, and pfRICH. 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 the DSCs and the (Physics and) Detector Simulation WG 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.

Conclusion

- Our simulation geometries for the October campaign are brought in alignment with envelopes published in March
- October campaign is tagged and campaign production is underway (full delivery by mid-November)
- We are proactively provisioning computing resources and developing procedures in case of possible outages
- Upcoming changes outlined in the talk, and longer-term planning is underway