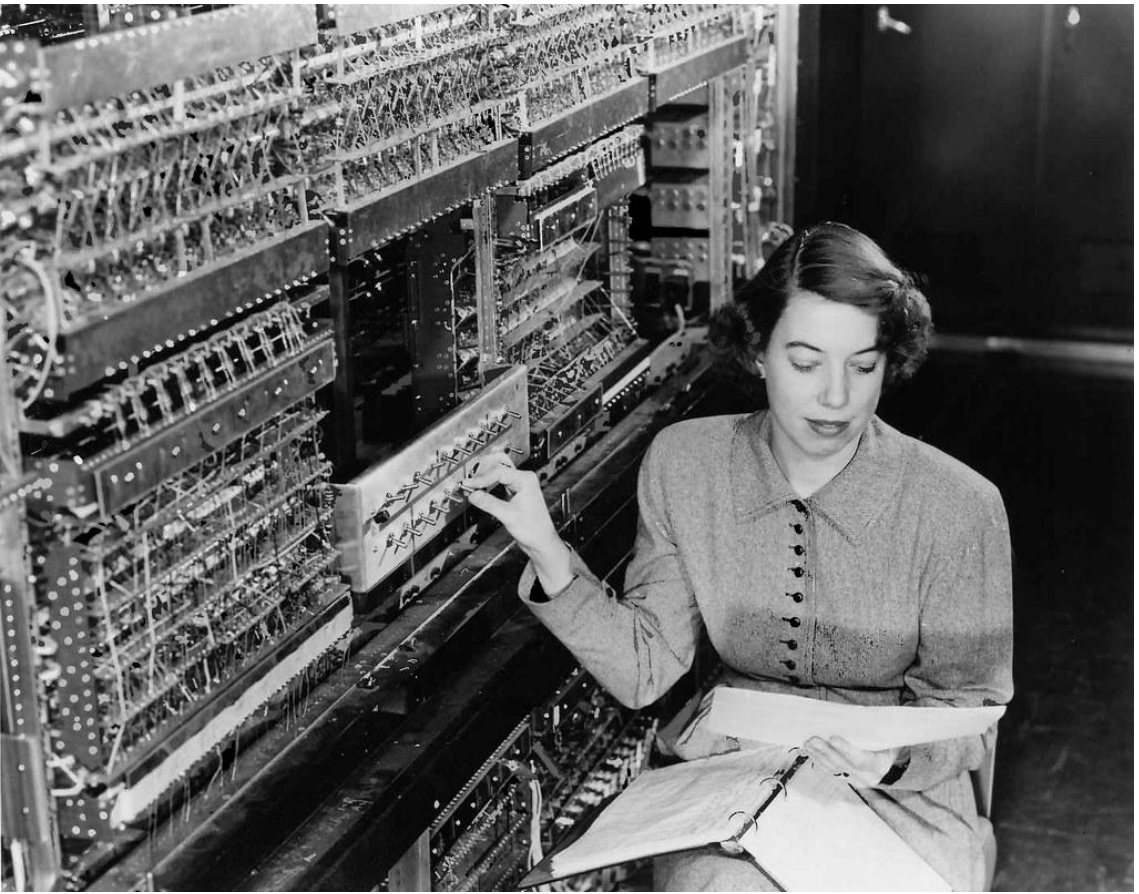


ATHENA

Bi-Weekly Collaboration Meeting

Thursday 2021-09-16

The Software and Computing WG Conveners:
Andrea Bressan (University of Trieste and INFN) ,
Dmitry Romanov (Jefferson lab) ,
Sylvester Joosten (Argonne National Laboratory) ,
Whitney Armstrong (Argonne National Laboratory) ,
Wouter Deconinck (The University of Manitoba)

Reconstruction status

Immediate TODO

- 🚧 revisit calorimetry digitization and reconstruction (with Calorimetry WG)
- 🚧 FF RP & OMD reconstruction (RP almost done!)
- ✅ In meantime: integrate fast FF reconstruction (algorithms ready)
- ❌ ZDC reconstruction?
- ❌ Proper neutral reconstruction.
- 🚧 In meantime: Link clusters with neutrals similar to what we do for tracking.
- 🚧 Fake/Fast PID based on actual PID detector hits instead of just MC truth.
- 🚧 Calculate kinematic variable in main reconstruction
- 🚧 Prepare to grow data model as need arises
- 🚧 Electron finder!
- 🚧 Propagate material map into ACTS

Status

- ✅ Tracking working well in the central detector!
- ❌ No FF reconstruction
- ✅ MC truth PID
- ❌ No neutrals
- ✅ Reconstruction benchmarks working well

Reconstruction task list

Reconstruction **(C++, Gaudi, ACTS, Python)**

- Simple electron PID (medium/expert)
- Advanced electron PID (expert)
- Jet reconstruction (expert)
- Event subcomponent matching (medium/expert)
- RICH reconstruction (medium/expert)
- MRICH reconstruction (medium/expert)
- DIRC reconstruction (medium/expert)
- Holistic calorimeter reconstruction (expert)
- Track propagation and simple vertexing (medium/expert)
- Vertexing (medium/expert)
- Optimize tracking (medium/expert)
- Kinematic reconstruction (easy/medium)
- Far-forward reconstruction (easy/medium)
- Far-backward reconstruction (easy/medium)
- ML-accelerated algorithms (medium/expert)

Reconstruction Benchmarks **(ROOT, Python, ...)**

- Validate/optimize digitization algorithms (easy)
- Clustering performance (medium)
- Subsystem performance (easy/medium)
- Overall reconstruction performance (medium)
- Study reconstructed acceptance (easy)

Simulation status

All configurations

- ✅ Updated calorimetry (55cm glass blocks; WScFi endcap)
- ❌ TODO: Add services for negative ECAL as they can impact HCAL
- ❌ Minor: fix positive beam pipe rendering
- ✅ Added beam pipe material into ACTS
- 🚧 Add PID volumes into ACTS for improved tracking resolution
- 🚧 Fix WScFi endcap implementation as it triples the simulation/reconstruction memory requirements
- 🚧 **Prepare for next big simulation run over the weekend (with everything that's ready)**

✅ **Full simulation run can take as little as 4 days!**

- Much quicker than anticipated (plenty of resources available)
- ☝️ … if all goes well

Acadia (N0-B0-P0)

- 🚧 propagate latest changes from master and tag v1.0

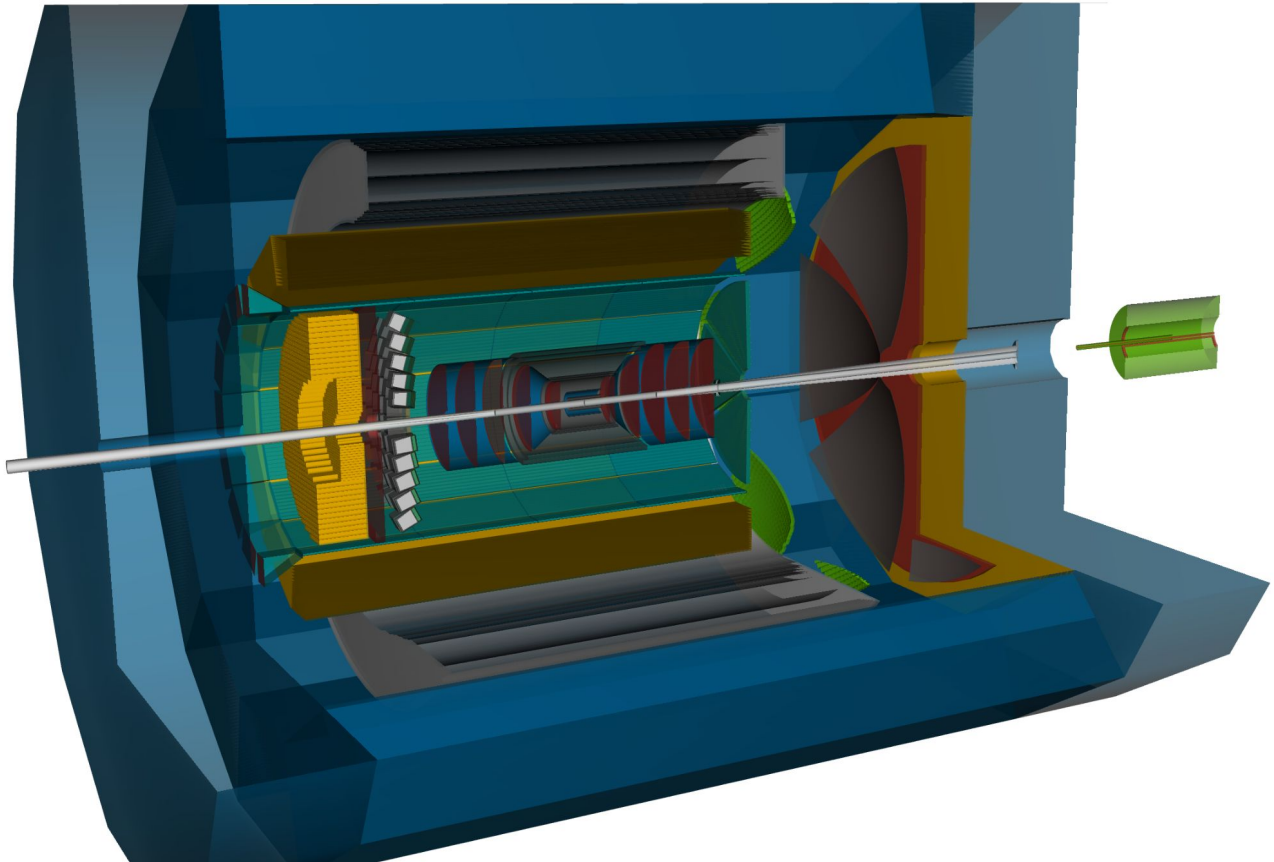
BigBend (N1-B1-P1)

- 🚧 replace tracker with hybrid setup
- 🚧 replace MRICH with cylindrical setup
- 🚧 swap GEM in front of MRICH, not behind
- ✅ update BECAL with 9 imaging layers (vs 6)
- Tentative tag BigBend early next week

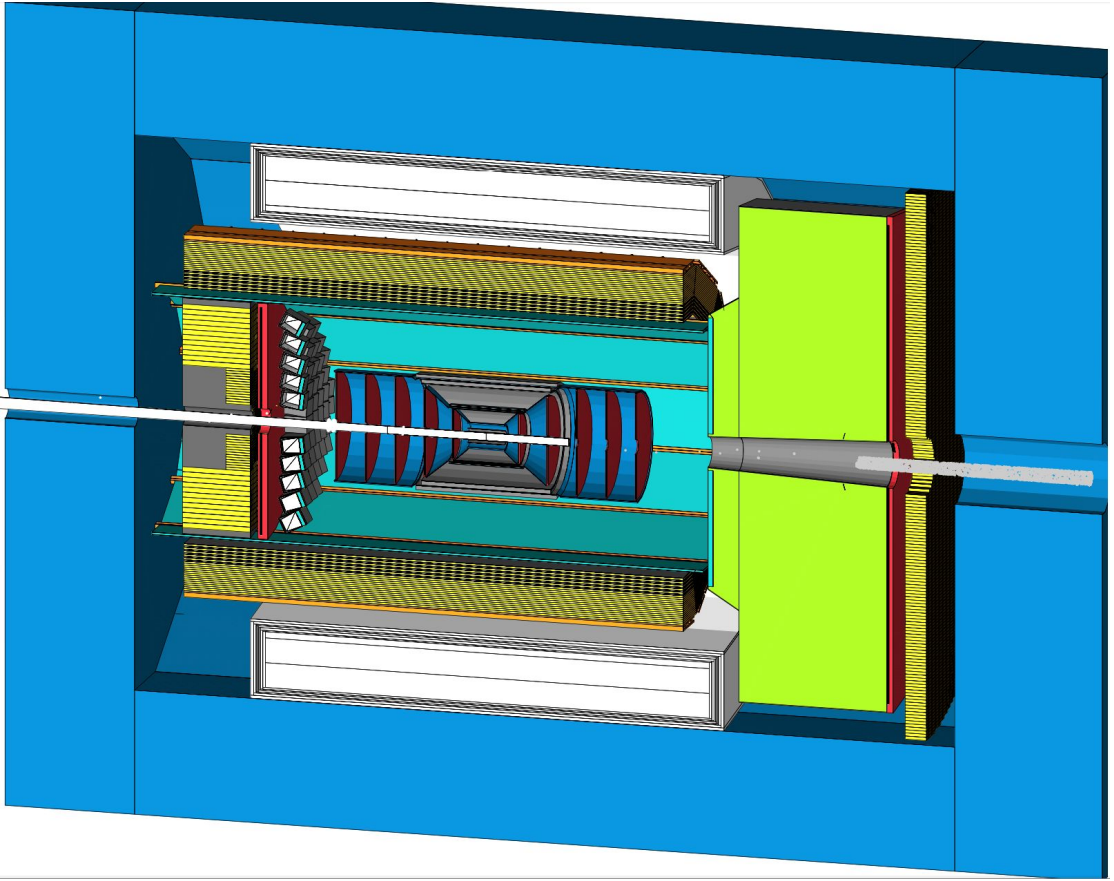
CanyonLands (N2-B2-P2)

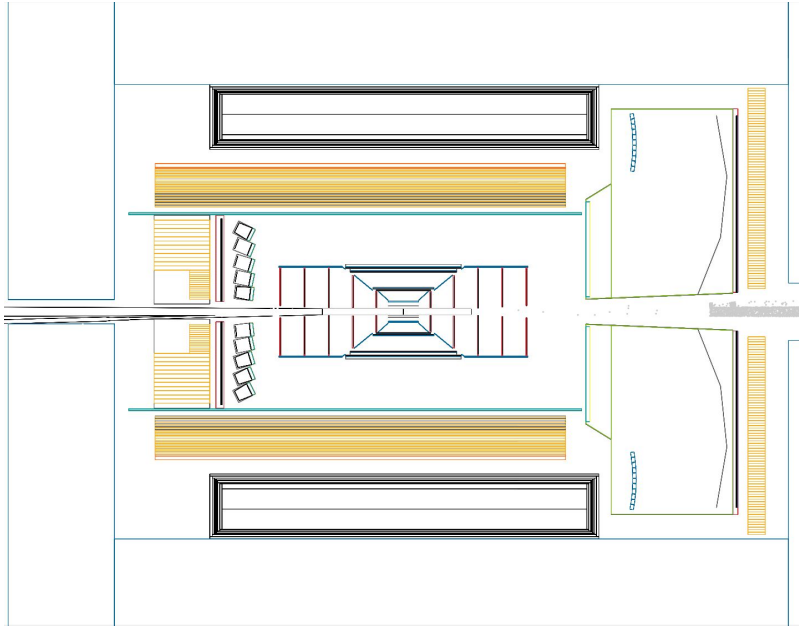
- ❌ Implement more optimized hybrid tracker, has to be well-connected with updated/more realistic endcap design
- 🚧 Prepare to implement updated design including 25cm magnet shift
- ❌ BECAL with higher density back portion?
- ❌ Backward aerogel RICH with mirrors?

Simulation status



Simulation status





Simulation task list

Geometry/full simulation **(XML, C++, DD4hep, GEANT)**

- Detector color scheme (easy)
- Automatic marketing/publication figures (easy/medium)
- Optimize parametrization of subsystems (medium)
- Implement additional technology options (easy/medium/expert)
- Add extra support & service material (easy/medium)

Detector Benchmarks **(ROOT, Python)**

- Validate hit multiplicities in subsystems (easy)
- Energy calibrations for calorimeters (easy/medium)
- Validate optics in DRICH (medium/expert)
- Study raw acceptance (easy)
- Validate detector material budget (easy/medium)
- Render results on dashboard webpage (all benchmarks)

Physics Benchmarks

- 🚧 Afterburner almost ready (see next talk)
- ✅ Can we introduce crossing angle (but HepMC samples need to store the beam particles!)

Physics Benchmarks (ROOT, Python)

- Integrate analyses from PWGs into CI framework (easy)
- Validation figures on kinematic variables (easy)
- Collect and integrate available event samples (easy)

Full Simulation Production Status

Since last meeting:

- ❗ All generators to be required to provide incoming beam particles, status code 4 (crossing angle, beam energy for afterburner)
- ✅ Now running directly on OSG as well

Current dev focus: debugging and resiliency

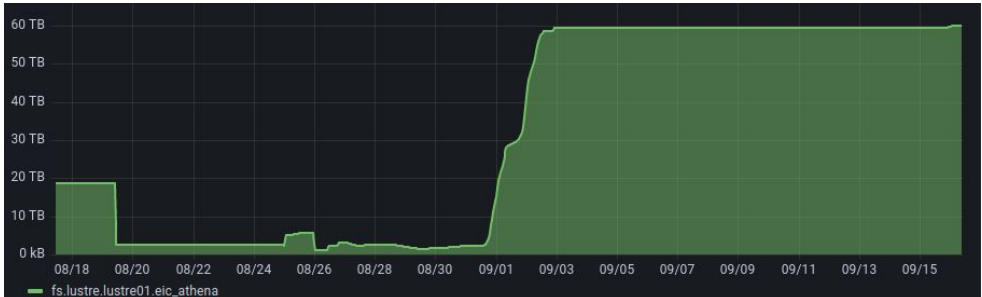
- Debugging:
  - 🚧 Include RICH materials in ACTS
  - ❌ Event weights and “A” records
- Resiliency: Automatic flagging/resubmit
  - 🚧 Timeouts on stuck tracks (MRICH)
  - 🚧 Automatic timing estimates in CI
  - 🚧 Automatic overview plots for all files
- Efficiency: Multithreaded simulations
  - 🚧 Memory use now ~ 2.5 GB / core

Questions? → #software-helpdesk

Data on S3 and XRootD (synced upon generation):

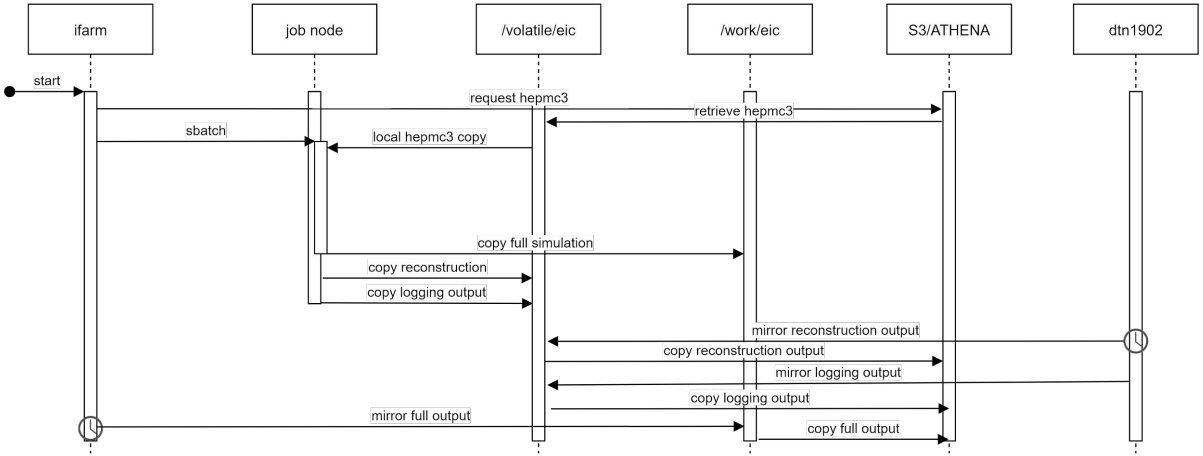
- https://dtn01.sdcc.bnl.gov:9000/~~minio~~/eictest/ATHENA/RECO
- `mc mirror S3/eictest/ATHENA/RECO RECO`
- `TFile::Open(“s3https://dtn01.sdcc.bnl.gov:9000/eictest/ATHENA/RECO”)`
- `TFile::Open(“root://sci-xrootd.jlab.org//osgpool/eic/ATHENA/RECO/…”)`
- Geometries: master, acadia-v1.0-alpha

Storage usage (currently cycling through ~60 TB):



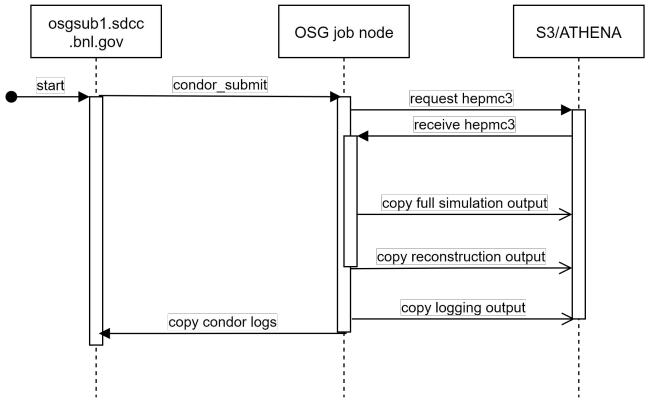
Operational Benefits of OSG Jobs

Running at JLab (capacity 25k job slots, 14% for EIC)



Now 500 TB each on /work/eic{2,3}; larger EIC xrootd service

Running on OSG (capacity ~∞)



Still mirroring S3 to xrootd at JLab

Full simulation production run currently takes about 4 days.

Tutorials and office hours

Documentation portal:
doc.athena-eic.org

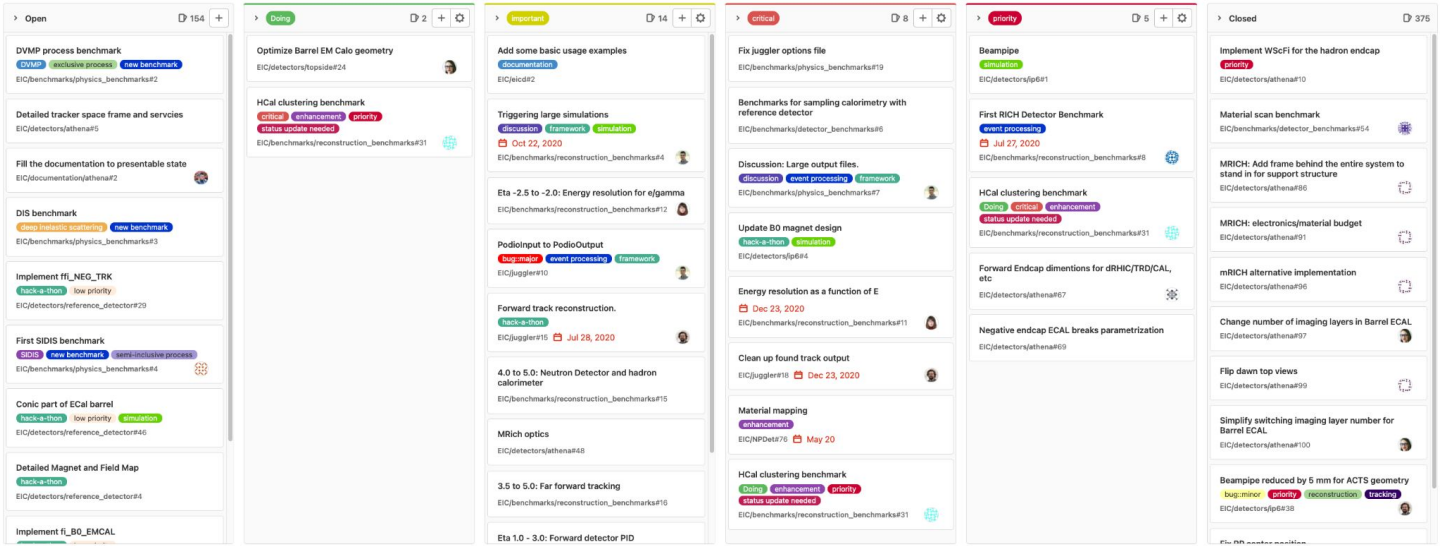
Full simulation tutorials

eic-ip6-software-l@lists.bnl.gov
#software-helpdesk on Slack

1. Have organized dedicated tutorial/Q&A sessions aimed at various PWGs
2. **#software-helpdesk office hours every week: Mo-We-Fr at 2:00pm EDT** https://zoom.us/j/93744567735.
3. *Looking to replace one helpdesk session with a morning timeslot to better overlap with Asian colleagues*
4. Will keep close contact with PWGs to support swift development of analyses

Development board on eicweb

- https://eicweb.phy.anl.gov/groups/EIC/-/boards
- Working to polish/integrate task list to make it easier for people to find/check out a task



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Reconstruction Status

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✅ **Calorimetry**
- ✅ Algorithms
  - ✅ Simple Clustering, Island Clustering (2D), 2+1D Clustering, Topological Clustering (3D)
  - ✅ Hybrid cluster merging
- ✅ Clustering benchmarks

🚧 **PID**
- 🚧 Algorithms
  - ✅ Fuzzy-K ring clustering
  - 🚧 MRICH, DIRC, DRICH reconstruction
  - ✅ Truth PID
- ❌ PID benchmarks

🚧 **Far Forward & Far Backward**
- ❌ Integrate B0 with tracker, low Q2 tagger
- 🚧 Matrix transform for Roman Pot & OMD
- ✅ Simple FastMC reconstruction for FF
- 🚧 Use registered hits for FastMC

🚧 **Tracking**
- 🚧 Algorithms
  - ✅ Decent performance in barrel region
  - ✅ Improved tracking efficiency in endcaps
  - 🚧 Tracking benchmarks
  - 🚧 Incorporate B0 in ACTS
  - 🚧 Beampipe material in ACTS
  - ❌ Setup realistic vertex reconstruction
- 🚧 Tracking Benchmarks
  - ✅ Basic benchmarks working
  - ❌ Tracking with realistic background

🚧 **Global**
- Event builder (produces ReconstructedParticle)
  - ✅ Dummy event builder to test reco chain
  - ✅ Simple tracking + truth PID event builder
  - 🚧 Fast parametrized reconstruction for missing algorithms (e.g. dRICH) based on registered hits.
- ✅ Stable data model
- ✅ Cleanup/consolidate reconstruction flow