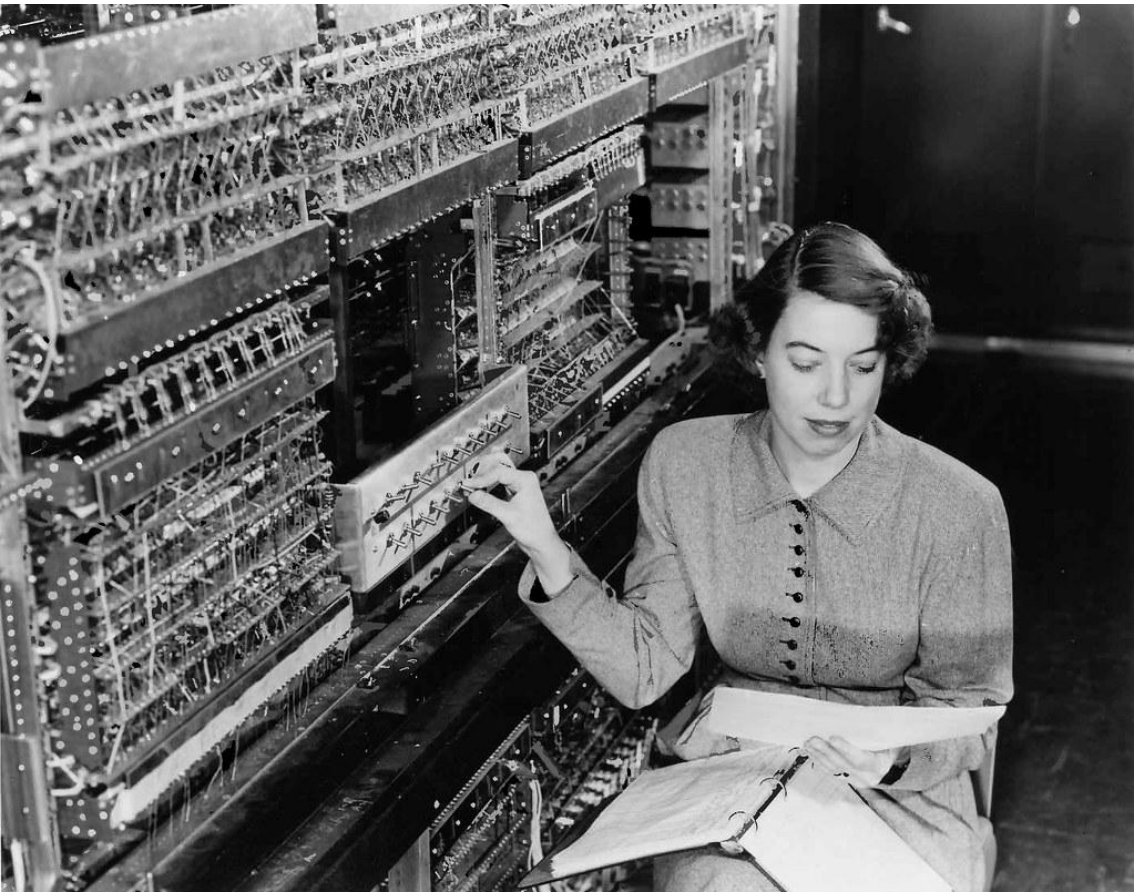


Software & Computing Meeting

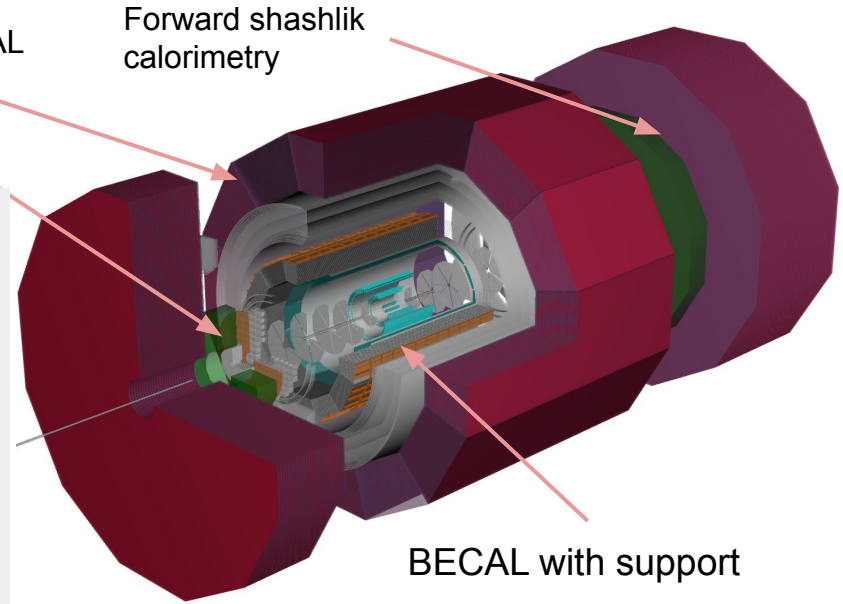
Thursday 2021-07-01

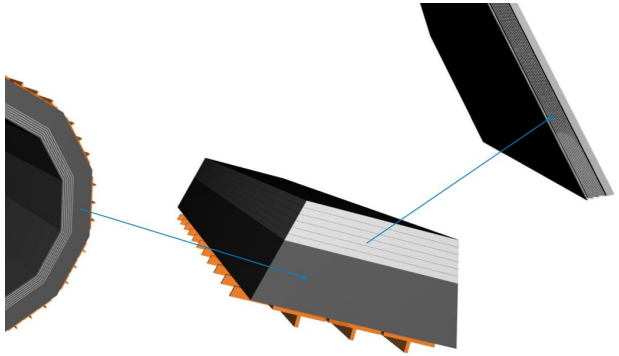
The Software and Computing WG Conveners:
Andrea Bressan (University of Trieste and INFN) ,
Dmitry Romanov (Jefferson lab) ,
Sylvester Joosten (Argonne National Laboratory) ,
Whitney Armstrong (Argonne National Laboratory) ,
Wouter Deconinck (The University of Manitoba)

Simulation status
(and “baseline” geometry implementation)

Calorimetry WG

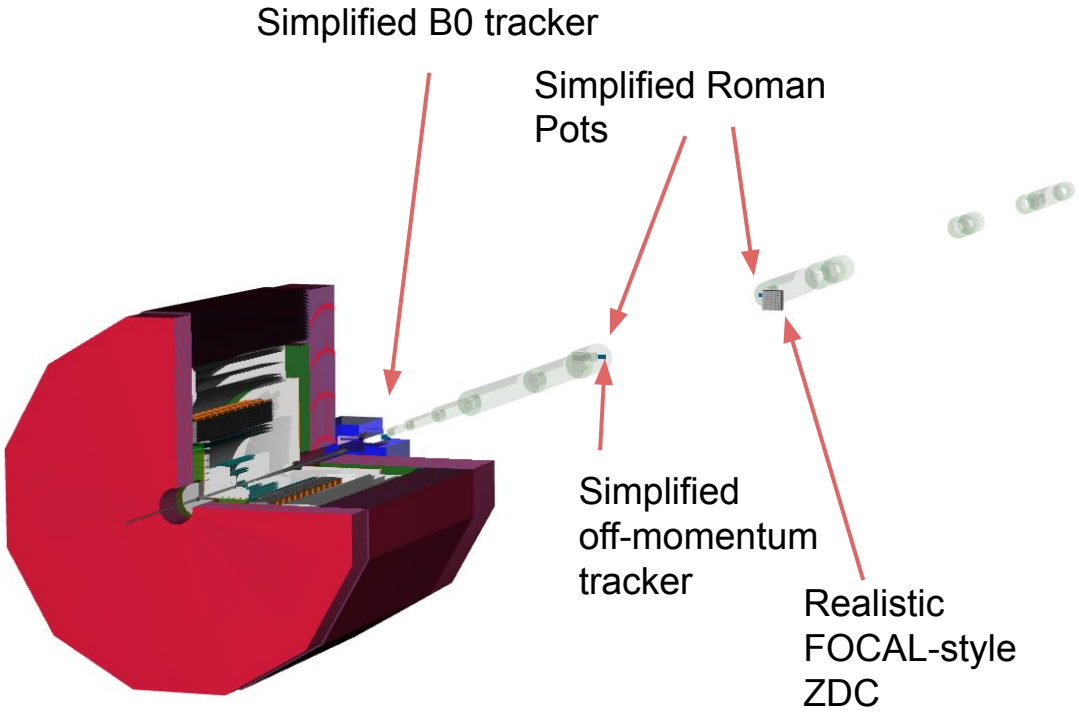
- Ready to study impact of magnet on HCAL:
  - ✅ Realistic HCAL geometry
  - ✅ Solenoid material
  - ❌ Helmholtz option to be added soon
  - ✅ HCAL clustering and energy calibration
- ECAL system well-developed:
  - Barrel ECAL:
    - ✅ Barrel SiW imaging calorimeter
    - ✅ Barrel hybrid SiW + WSciFi calorimeter
  - Electron-endcap ECAL:
    - ✅ Crystal calorimeter
    - ✅ Glass calorimeter
    - 🚧 Need decision from WG on “baseline”
  - Ion-endcap ECAL
    - 🚧 Shashlik calorimeter
  - ✅ Reconstruction (2D, 2+1D and 3D clustering)
- Geometry:
  - 🚧 Finalize geometry for “baseline” setup with longer barrel/smaller negative endcap ECAL





Calorimetry delegate: Vladimir Berndnikov
S&C WG contacts: Wouter Deconinck & Sylvester Joosten

Far-forward & Far-backward WGs



- FF being worked on by Alex Jentsch
  - 🚧 Magnets and detectors being updated to latest design
  - 🚧 Will add realistic beam-pipe model
- FB
  - ❌ Need to work with WG to add geometries

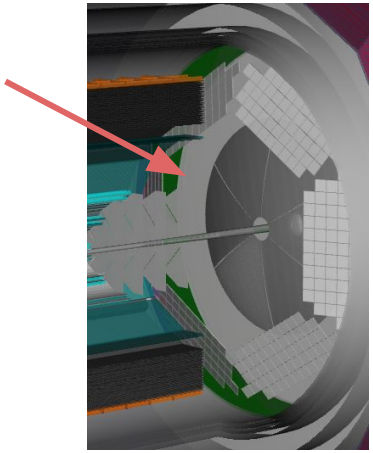
FF delegate: Alex Jentsch
FB delegate: TBD
S&C WG contact: Whitney Armstrong

PID WG

- dRICH (Christopher Dilks, Chao Peng)
  - ✅ functioning fuzzy-K ring-clustering
  - 🚧 geometry being adjusted by Christopher
  - ✅ have field maps for both magnet setups
- mRICH (Murad Sarsour, Whitney Armstrong)
  - ✅ received baseline realistic geometry (implemented in fun4All) from Murad
  - 🚧 implement realistic detector in DD4hep (80% complete)
- DIRC (Grzegorz Kalicy, Dmitry Romanov)
  - ✅ simplified geometry
  - 🚧 implement realistic detector in DD4hep
- TOF (Zhenyu Ye)
  - ✅ LGAD implementation with realistic services

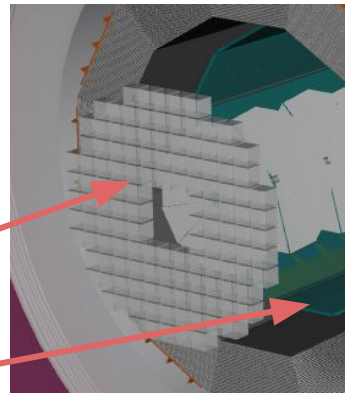
gas-RICH starting point for dRICH implementation

LGAD implementation ongoing (Zhenyu)



mRICH geometry changing quickly

DIRC needs the most work

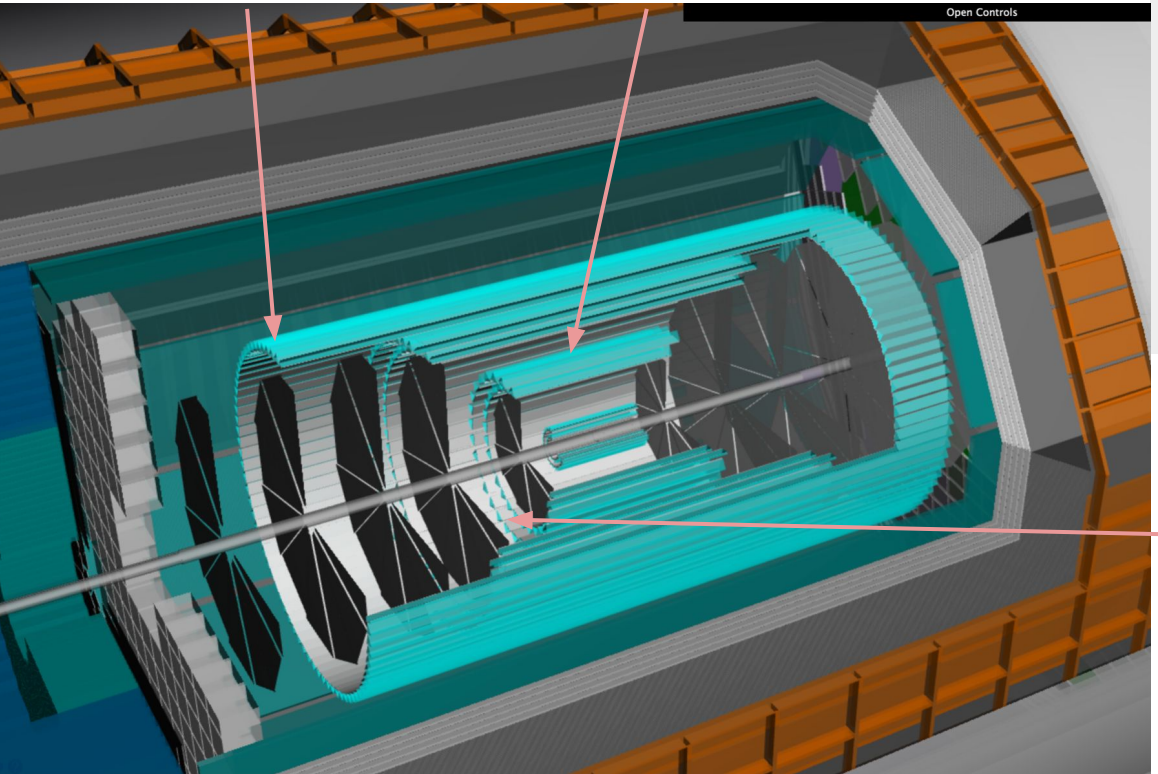


PID delegate: Zhenyu Ye
S&C WG contact: Dmitry Romanov

Tracking WG

Outer LGAD layer not part of the “0-0-0” setup

Barrel staves as in ITS2 TDR



- 🚧 silicon tracker
  - 🚧 Material validation (Shujie Li)
  - ❌ Vertex layers to be changed to cylindrical geometry
- ✅ barrel MPGD
- ✅ GEM
- Reconstruction:
  - ✅ geometries fully functional with ACTS
  - 🚧 updating algorithms for ACTS v8.3 (tracking benchmarks ongoing)

Disks are wedges with sensitive layer and average material backing. Needs better constraints from WG

Tracking delegate: Matt Posik
S&C WG contact: Sylvester Joosten

Physics WGs

- ✅ Generic (unvalidated) afterburner
- ❌ Update afterburner based on the presentation by Brian Page last meeting
- 🚧 Collect physics analysis portfolio

Exclusive & Tagging delegate: TBD
S&C WG contact: Sylvester Joosten & Whitney Armstrong

Inclusive delegate: TBD
S&C WG contact: TBD

Jets, HF & EW-BSM delegate: Brian Page
S&C WG contact: Wouter Deconinck

SIDIS delegate: Christopher Dilks
S&C WG contact: TBD

DAQ WG

- ❌ Assign SWG contact for DAQ WG

DAQ delegate: TBD
*S&C WG contact: Andrea Bressan (**tentatively**)*

Jets, HF & EW-BSM

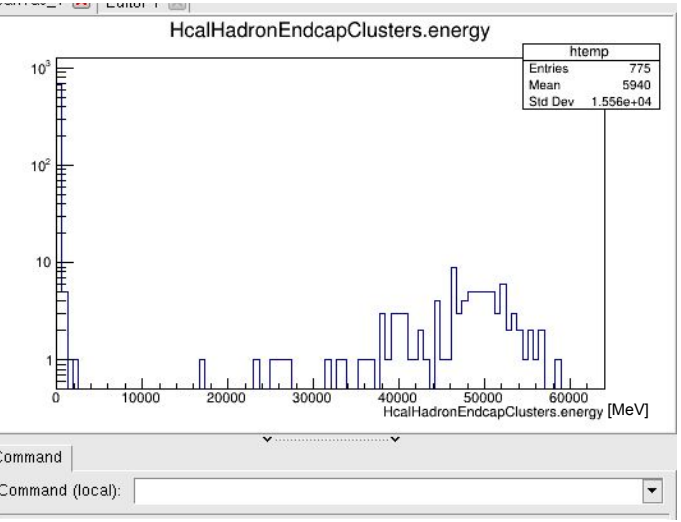
- Generator benchmarks
  - ✅ Pythia8 DIS CC and NC
    Samples ran through entire chain, from G4 to digi/reco, clustering.
  - 🚧 Efficient filter for events
- Detector benchmarks
  - 🚧 Calorimetry resolutions under study
  - ❌ HCAL sensitivity
- Reconstruction benchmarks
  - ✅ ECAL clustering
  - ✅ HCAL clustering
  - ✅ Jet reconstruction (calorimetric)
  - ❌ Energy flow (requires tracking)

Reconstruction Status and Examples of ***using*** DD4hep for Physics Benchmark Studies

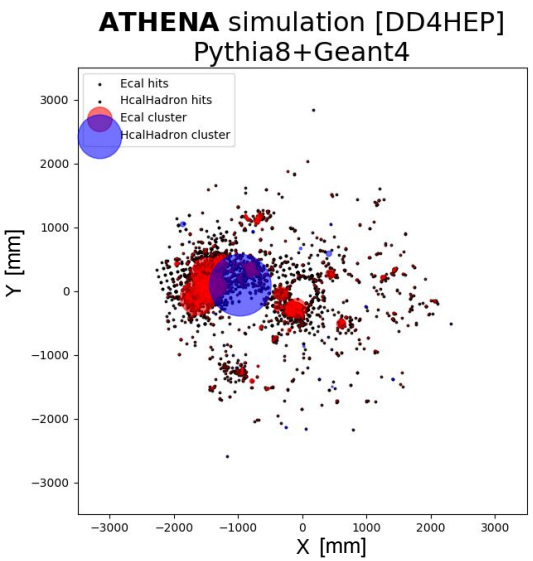
With thanks to Chao Peng, Miguel Arratia and Stephen Sekula

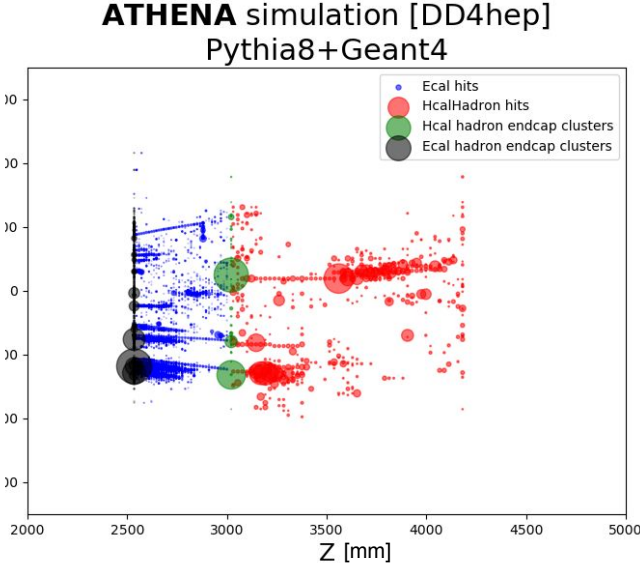
Calorimetry Clustering fully functional

50 GeV pions in forward HCAL:

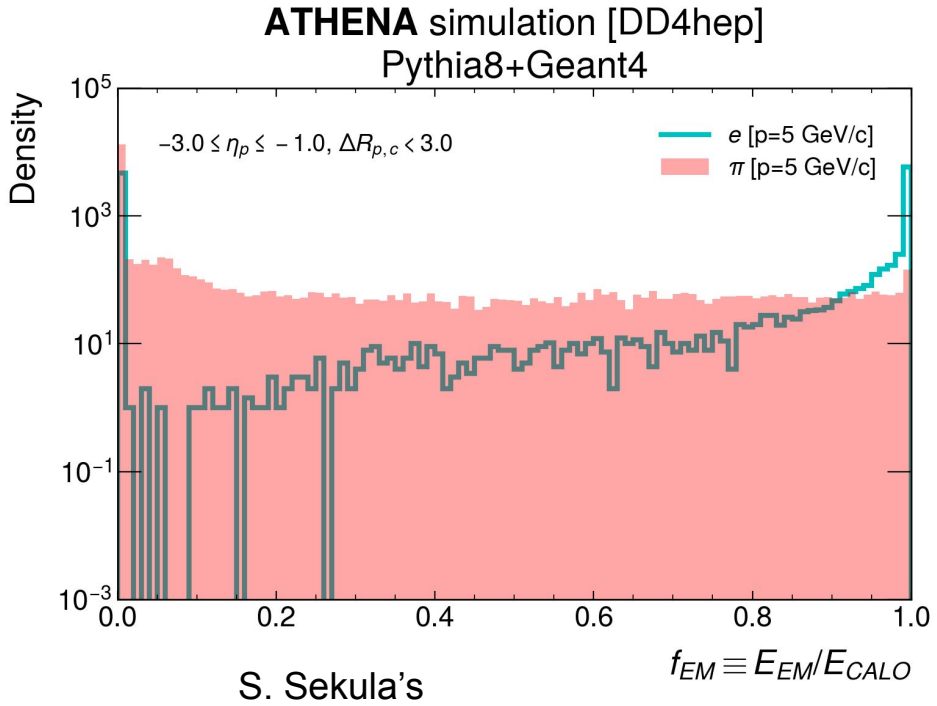


Pythia8 DIS events:

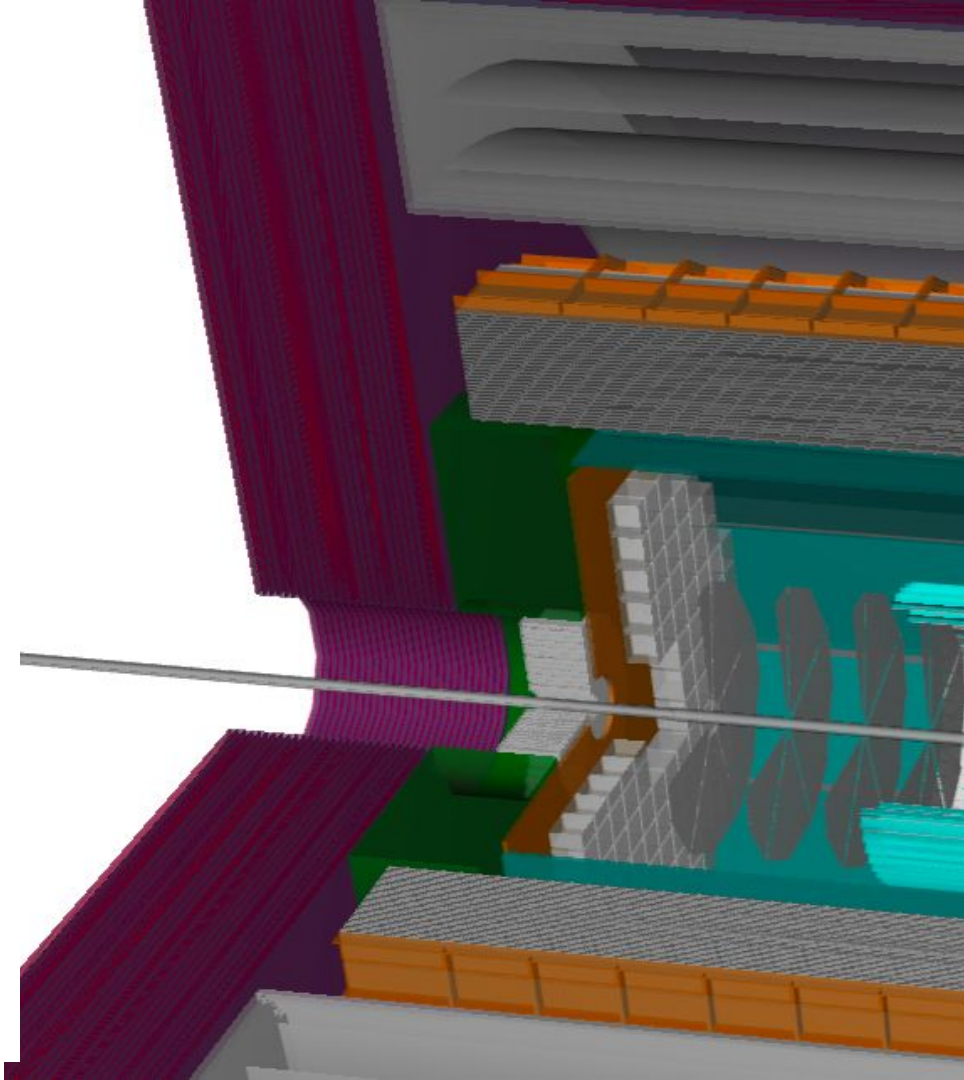




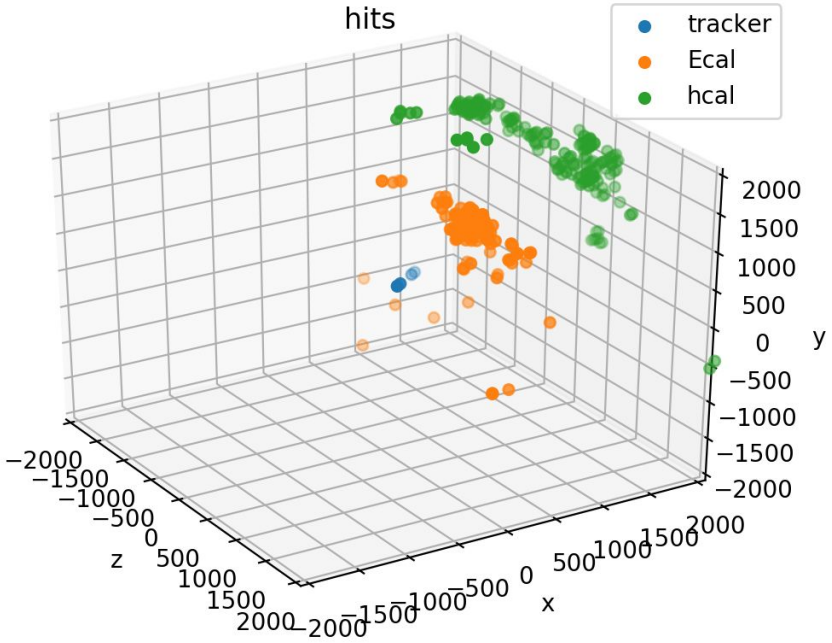
Electron-pion separation With HCAL

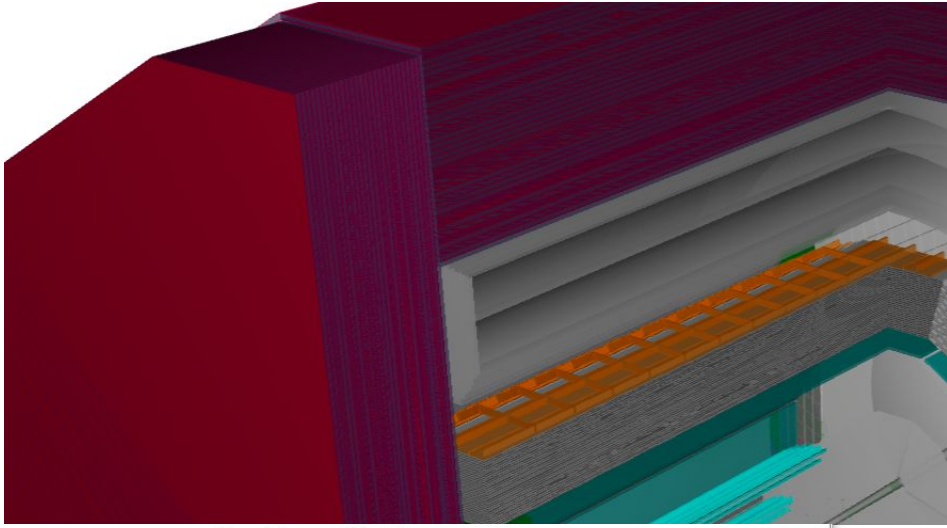


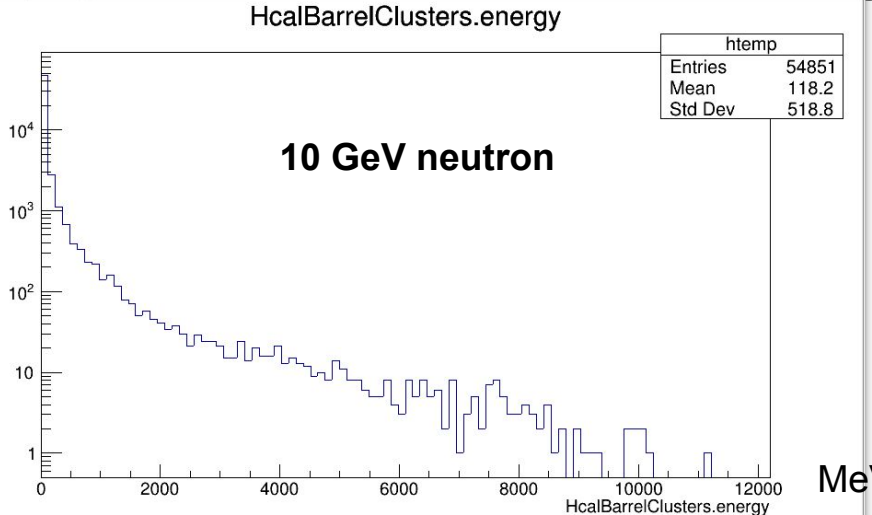
S. Sekula's



Impact of magnet on barrel HCAL



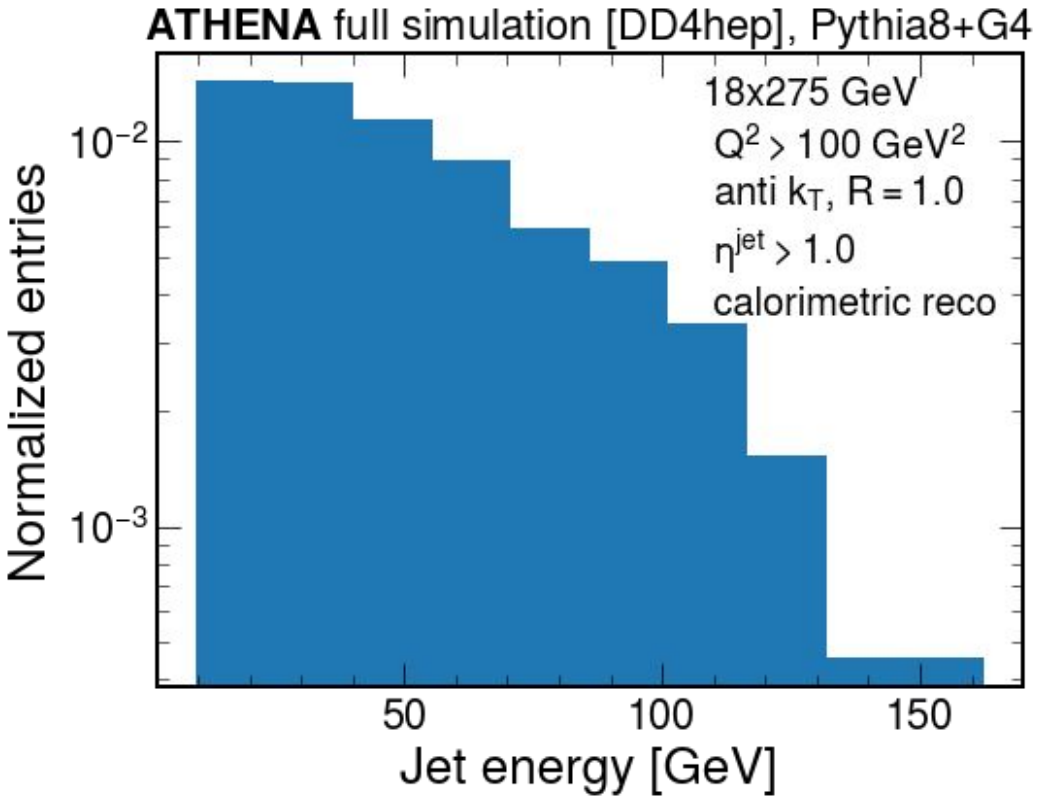


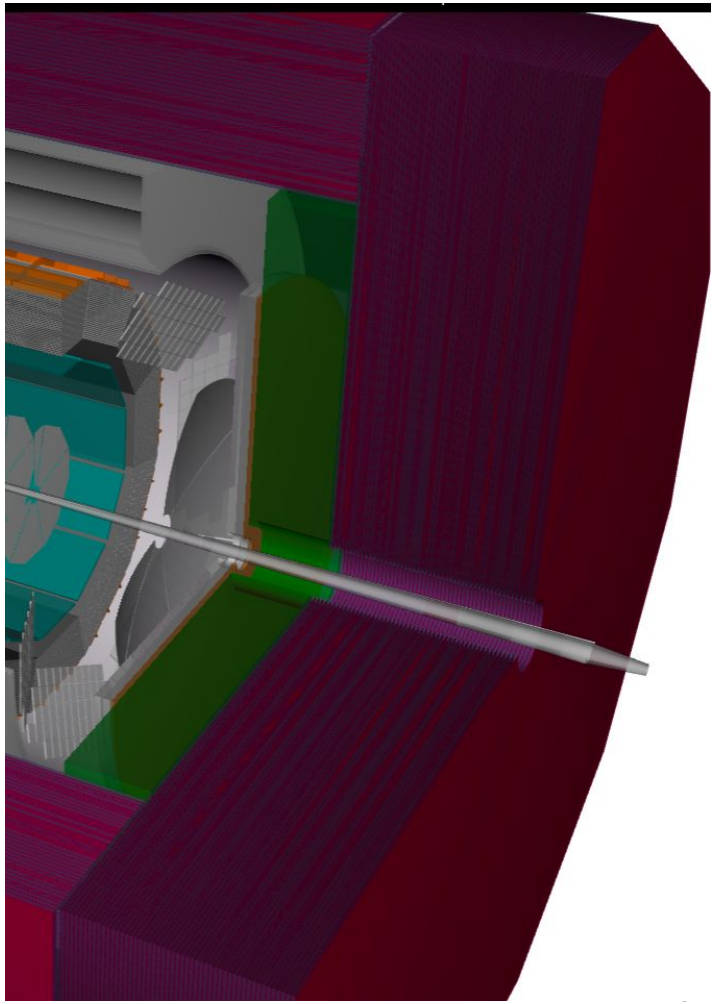


MeV

Jet reconstruction

With forward calorimeter system

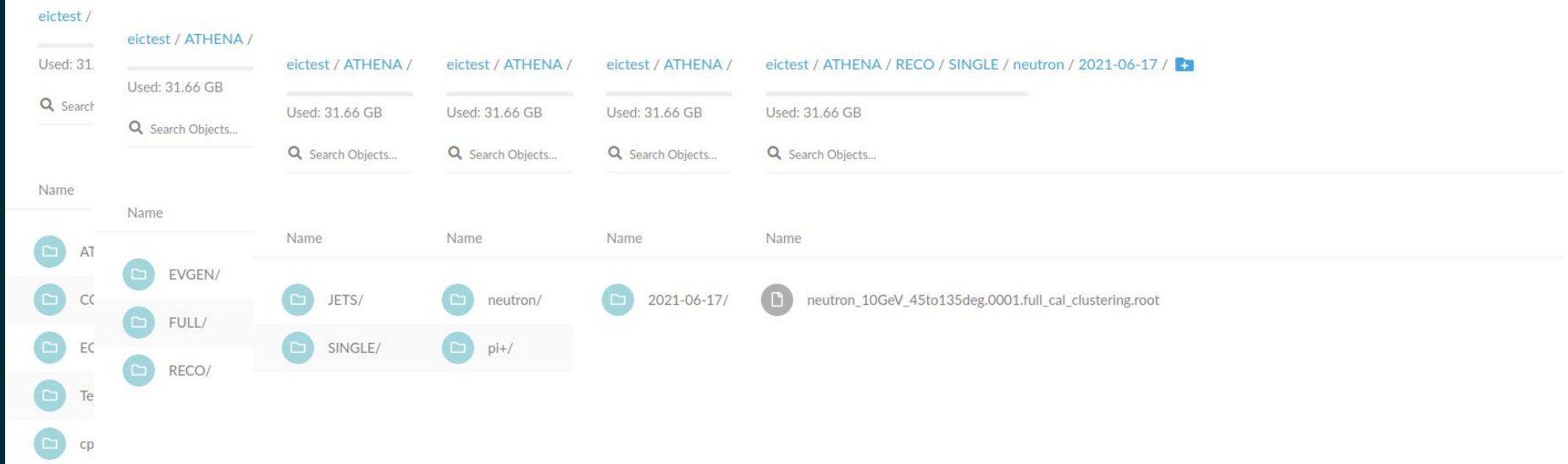




Quick Instructions on Accessing S3

Accessing Large Data Productions: From the Web

https://dtn01.sdcc.bnl.gov:9000/minio/login



Accessing Large Data Productions: Command Line

Download the Minio client:

```
wget https://dl.min.io/client/mc/release/linux-amd64/mc
```

Register your S3 instance:

```
./mc config host add S3 https://dtn01.sdcc.bnl.gov:9000 $u $p
```

Copy files (recursively):

```
./mc cp -r S3/eictest/ATHENA/RECO/SINGLE/neutron/2021-06-17 .
```

Full docs: http://doc.athena-eic.org/en/latest/howto/s3_file_storage.html

Direct Access to Files on S3 or XRootD

- Direct access: `TFile* file = TFile::Open("s3https://dtn01.sdcc.bnl.gov:9000/eictest/ATHENA/RECO/JETS/crossDivNrgCrab/DIS_NC_Q2gt10_crossDivNrgCrab_25mRad_18x275_v1.0001.root","AUTH=eicS3read:eicS3read")` or use `export S3_ACCESS_KEY=eicS3read S3_SECRET_KEY=eicS3read`
- Using xrootd on the copy mirrored at JLab: `TFile* file = TFile::Open("root://sci-xrootd.jlab.org//osgpool/eic/ATHENA/RECO/JETS/crossDivNrgCrab/DIS_NC_Q2gt10_crossDivNrgCrab_25mRad_18x275_v1.0001.root")` (no authentication needed; public access)

This avoids the need for large data transfers.

Computing Update

Large scale data productions

- Input: HepMC files preferred (`pip install mcconv` for other formats)
- Full simulation with current detector model, all bells and whistles:
  - Typical: 0.25 to 3.0 s/event, <500MB RAM RSS, 30 kB to 750 kB output size/event
  - Slightly decreasing performance as geometry features are added
  - Full ROOT files on S3 under `ATHENA/FULL/`
- Reconstruction
  - Focus on full calorimetry clustering (Ecal and Hcal), tracking will be added next
  - Reco ROOT files on S3 under ATHENA/RECO/
- Full simulation: ~weekly repetition; reconstruction: every few days
- Written to work on any slurm batch system; performed at Compute Canada
  - Currently also working on trial runs on OSG at the ~2k job scale for single particle events)

Overview of Available Productions

- JETS: {5x41, 18x275} ⊗ {CC, NC} ⊗ {Q2 > 10, 100, 1000 GeV} (1M each)
- EXCLUSIVE:
  - eslight rho test production in progress
  - pi-neutron, K-Lambda, K-Sigma in progress
- SINGLES
  - {3 to 50 deg, 45 to 135 deg, 130 to 177 deg} ⊗ {e-, pi+, kaon0L, neutron, gamma} ⊗ {1, 2, 5, 10, 20, 50 GeV} (1M each)

Dashboards in progress...

RECO	hEndcap (3 to 50 deg)						Barrel (45 to 135 deg)						eEndcap (130 to 177 deg)					
	1	2	5	10	20	50	1	2	5	10	20	50	1	2	5	10	20	50
e-	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☑	☑	☑	☑	☑	☑
gamma	☐	☐	☐	☐	☐	☐	☑	☑	☑	☑	☑	☐	☐	☐	☐	☐	☐	☐
kaon0L	☑	☑	☑	☑	☑	☐	☑	☑	☑	☑	☑	☐	☐	☐	☐	☐	☐	☐
neutron	☐	☐	☐	☐	☐	☐	☑	☑	☑	☑	☑	☐	☐	☐	☐	☐	☐	☐
pi+	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☐	☐	☐	☐	☐	☐
pi0	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐

Software & Computing WG

Bi-weekly software meeting: Thursday 12:00pm EDT

Software & Computing Conveners:

Whitney Armstrong, Andrea Bressan(*), Wouter Deconinck, Sylvester Joosten, Dmitry Romanov (*)- liaison to EICUG software group

Day 0 WG support:

Kolja Kauder, Miguel Arratia, Stephen Sekula, Dmitry Romanov, Yulia Furletova, Andrea Bressan

Full simulation/reconstruction team

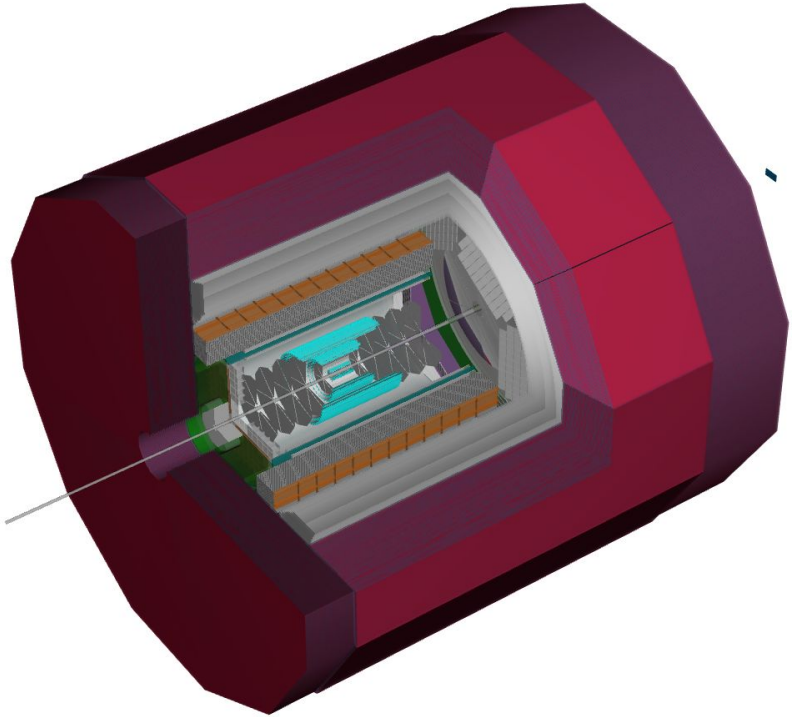
Whitney Armstrong, Miguel Arratia, Wouter Deconinck, Sylvester Joosten, Jihee Kim, Chao Peng, Tomas Polakovic, Dmitry Romanov, Marshall Scott, Zhenyu Ye, Ziyue Zhang, Maria Żurek

...and a rapidly growing amount ATHENA collaborators!

Documentation portal:
doc.athena-eic.org

Full simulation tutorials

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



ATHENA central detector