

ePIC BHCal ClusteringU pdate

ePIC Clustering Task Force February 23rd, 2022 Derek Anderson (ISU)



Changes Made | summary



Changes to BHCal Readout

- <id>system:8, sector:5, tower:6, tile:3</id> →
 <id>system:8, barrel:3, sector:6, tower:6, tile:9</id>
- (+ changes to volume IDs in *geo.cpp)

Changes to BHCal Hit Merging

- u_fields = {"tower","tile"} → {"tile"}
- $u_refs = \{1, 0\} \rightarrow \{0\}$

Changes to Digitization

- $m_{capADC} = 256 \rightarrow 65536$
- m_dyRangeADC = 50 MeV → 1.0 GeV
- m_resolutionTDC = 1.0 ns → 1.0 ps
- u_fields = {} → {"tile"}
- $u_refs = \{\} \rightarrow \{0\}$
- m_geoSvcName = "ActsGeometryProvider" →
 "geoServiceName"
- m readout = "" → "HcalBarrelHits"
- (+ relevant changes to reco. hit parameters)

Changes to Clustering

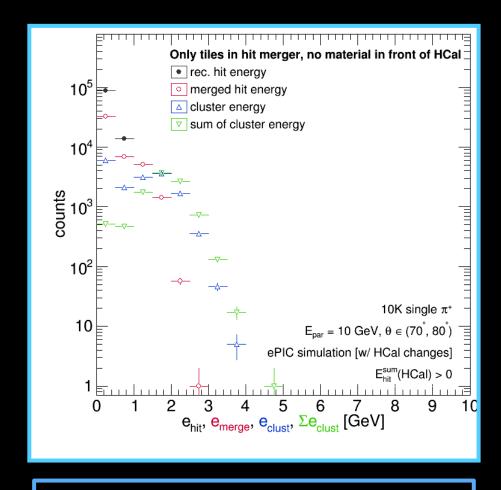
- m_input_tag = "HcalBarrelmergedHits" ->
 "HcalBarrelRecHits"

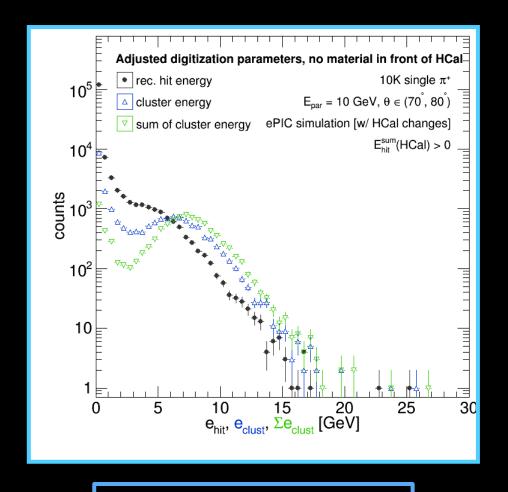
Changes to HCal.cc

comment out adding merged hits factory (line 48)

Changes Made | impact of digitization changes







With Changes to Volume ID/Hit Merging

With Changes to Digitization

Implementing Adjacency Matrix | some issues...



```
abs(tower_1 - tower_2) == 1
    ⇒ Evaluator::Object : syntax error
(abs(sector_1 - sector_2) + abs(tower_1 - tower_2)) == 1
    ⇒ Evaluator::Object : unpaired parenthesis
Modified SciGlass expression w/ row_i → sector_i
    \Rightarrow Runs!
        Expression is in backup
        (Not what we would want to cluster with, though)
Notes:

    This behavior is reproducible both in my local reposity

       w/ digitization changes and with ElCrecon/main (no
       changes)

    the following line is included after setting the adjacency

       matrix:

'std::remove(u_adjacencyMatrix.begin(),
            u_adjacencyMatrix.end(), ' ');
```



Backup | simulation parameters



Simulation Parameters

- gun.energy = 10*GeV
- gun.particle = "pi+"
- gun.distribution = "cos(theta)"
- gun.thetaMin = 70*degree [$\eta \sim 0.35$]
- gun.thetaMax = 80*degree [$\eta \sim 0.18$]
- 23.01.0 Geometry [Arches] + changes described

Reconstruction

ElCRecon

Backup | modified SciGlass expression



```
auto app = GetApplication();
m input tag = "HcalBarrelMergedHits";
m splitCluster=false;
m minClusterHitEdep=3.0 * dd4hep::MeV; // from https://eicweb.phy.anl.gov/EIC/detectors/athena/-/blob/master/calibrations/ffi zdc.json
m minClusterCenterEdep=30.0 * dd4hep::MeV; // from https://eicweb.phy.anl.gov/EIC/detectors/athena/-/blob/master/calibrations/ffi zdc.json
m geoSvcName = "GeoSvc";
uadjacencyMatrix = "(abs(tower 1 - tower 2) + (abs((sector 1 - sector 2) * 5 + tower 1 - tower 2) == 1) + (abs((sector 1 - sector 2) * 5 + tower 1 - tower 2) == (24 * 5 - 1))) == 1
std::remove(u adjacencyMatrix.begin(), u adjacencyMatrix.end(), ' ');
m readout = "HcalBarrelHits";
m sectorDist=5.0 * dd4hep::cm;
u localDistXY={15*dd4hep::mm, 15*dd4hep::mm};
u globalDistRPhi={}; //{this, "globalDistRPhi", {}};
u globalDistEtaPhi={};//{this, "globalDistEtaPhi", {}};
u dimScaledLocalDistXY={50.0*dd4hep::mm, 50.0*dd4hep::mm};// from https://eicweb.phy.anl.gov/EIC/detectors/athena/-/blob/master/calibrations/ffi zdc.json
app->SetDefaultParameter("HCAL: HcalBarrelIslandProtoClusters: splitCluster",
                                                                                       m splitCluster);
app->SetDefaultParameter("HCAL: HcalBarrelIslandProtoClusters: minClusterHitEdep", m minClusterHitEdep);
app->SetDefaultParameter("HCAL:HcalBarrelIslandProtoClusters:minClusterCenterEdep",
                                                                                       m minClusterCenterEdep);
app->SetDefaultParameter("HCAL: HcalBarrelIslandProtoClusters: sectorDist", m sectorDist);
app->SetDefaultParameter("HCAL:HcalBarrelIslandProtoClusters:localDistXY", u localDistXY);
app->SetDefaultParameter("HCAL:HcalBarrelIslandProtoClusters:localDistXZ", u localDistXZ);
app->SetDefaultParameter("HCAL:HcalBarrelIslandProtoClusters:localDistYZ", u localDistYZ);
app->SetDefaultParameter("HCAL:HcalBarrelIslandProtoClusters:globalDistRPhi", u globalDistRPhi);
app->SetDefaultParameter("HCAL:HcalBarrelIslandProtoClusters:globalDistEtaPhi", u globalDistEtaPhi);
app->SetDefaultParameter("HCAL:HcalBarrelIslandProtoClusters:dimScaledLocalDistXY", u dimScaledLocalDistXY);
app->SetDefaultParameter("HCAL:HcalBarrelIslandProtoClusters:adjacencyMatrix", u adjacencyMatrix);
                                                                                                                                                                  37,9
                                                                                                                                                                               Top
```

Backup | simple expression & error



```
m input tag = "HcalBarrelMergedHits";
m splitCluster=false;
u adjacencyMatrix = "abs(tower 1 - tower 2) == 1";
std::remove(u adjacencyMatrix.begin(), u adjacencyMatrix.end(), ' ');
m readout = "HcalBarrelHits";
// neighbour checking distances m_sectorDist=5.0 * dd4hep::cm; // from ATHENA reconstruction.py u_localDistXY={15*dd4hep::mm, 15*dd4hep::mm}; //{this, "localDistXY", {}};
u_localDistXZ={}; //{this, "localDistXZ", {}};
u_localDistYZ={}; //{this, "localDistYZ", {}};
u_globalDistRPhi={}; //{this, "globalDistRPhi", {}}; u_globalDistEtaPhi={};//{this, "globalDistEtaPhi", {}}
u dimScaledLocalDistXY={50.0*dd4hep::mm, 50.0*dd4hep::mm};// from https://eicweb.phy.anl.gov/EIC/detectors/athena/-/
app->SetDefaultParameter("HCAL:HcalBarrelIslandProtoClusters:splitCluster",
                                                                                                       m splitCluster);
app->SetDefaultParameter("HCAL: HcalBarrelIslandProtoClusters: minClusterHitEdep", m minClusterHitEdep);
 app->SetDefaultParameter("HCAL:HcalBarrelIslandProtoClusters:minClusterCenterEdep", m minClusterCenterEdep);
app->SetDefaultParameter("HCAL:HcalBarrelIslandProtoClusters:localDistXZ", u localDistXZ);
app->SetDefaultParameter("HCAL:HcalBarrelIslandProtoClusters:localDistYZ", u localDistYZ);
app->SetDefaultParameter("HCAL:HcalBarrelIslandProtoClusters:globalDistRPhi", u globalDistRPhi);
app->SetDefaultParameter("HCAL: HcalBarrelIslandProtoClusters: qlobalDistEtaPhi", u qlobalDistEtaPhi);
app->SetDefaultParameter("HCAL:HcalBarrelIslandProtoClusters:dimScaledLocalDistXY", u dimScaledLocalDistXY);
app->SetDefaultParameter("HCAL:HcalBarrelIslandProtoClusters:adjacencyMatrix", u adjacencyMatrix);
app->SetDefaultParameter("HCAL: HcalBarrelIslandProtoClusters: geoServiceName", m geoSvcName);
m geoSvc = app->te
                         ate GetService<JDD4hep service>();
AlgorithmInit(m log);
```

```
[2023-02-23 11:13:06.257] [HcalBarrelIslandProtoClusters] [6
[2023-02-23 11:13:06.268] [HcalBarrelIslandProtoClusters] [e [2023-02-23 11:13:06.268] [HcalBarrelIslandProtoClusters] [e
```

Backup | sector+tower expression & error



```
[2023-02-23 11:40:18.032] [HcalBarrelIslandProtoClusters] [error] Evaluator::Object : unpaired parenthesis [2023-02-23 11:40:18.032] [HcalBarrelIslandProtoClusters] [error] Evaluator::Object : unpaired parenthesis
 023-02-23 11:40:18.0561 [HcalBarrelIslandProtoClusters] [6
                                                                     orl Evaluator::Object : unpaired parenthesis
        -23 11:40:18.0561 [HcalBarrelIslandProtoClusters] [
        -23 11:40:18.1391 [HcalBarrelIslandProtoClusters]
 023-02-23 11:40:18.1391 [HcalBarrelIslandProtoClusters]
                                                                     or] Evaluator::Object : unpaired parenthesis
or] Evaluator::Object : unpaired parenthesis
         23 11:40:18.177] [HcalBarrelIslandProtoClusters] [
                                                                       [ Evaluator::Object : unpaired parenthesis
      2-23 11:40:18.205] [HcalBarrelIslandProtoClusters] [
22-23 11:40:18.236] [HcalBarrelIslandProtoClusters] [
                                                                       | Evaluator::Object : unpaired parenthesis
         23 11:40:18.253] [HcalBarrelIslandProtoClusters]
      02-23 11:40:18.2941 [HcalBarrelIslandProtoClusters]
 023-02-23 11:40:18.2941 [HcalBarrelIslandProtoClusters] [
                                                                       [] Evaluator::Object : unpaired parenthesis
                                                                       | Evaluator::Object : unpaired parenthesis
         23 11:40:18.294] [HcalBarrelIslandProtoClusters]
 023-02-23 11:40:18.2941 [HcalBarrelIslandProtoClusters] [
                                                                      rl Evaluator::Object : unpaired parenthesis
 023-02-23 11:40:18.2951 [HcalBarrelIslandProtoClusters] [
                                                                       el Evaluator::Object : unpaired parenthesis
       2-23 11:40:18.3271 [HcalBarrelTslandProtoClusters]
                                                                       Evaluator::Object : unpaired parenthesis
          3 11:40:18.327] [HcalBarrelIslandProtoClusters]
  23-02-23 11:40:18.3271 [HcalBarrelIslandProtoClusters] [
                                                                       el Evaluator::Object : unpaired parenthesis
        -23 11:40:18.3401 [HcalBarrelIslandProtoClusters]
      2-23 11:40:18.341] [HcalBarrelIslandProtoClusters]
                                                                       el Evaluator::Object : unpaired parenthesis
        -23 11:40:18.3411 [HcalBarrelIslandProtoClusters] [
      02-23 11:40:18.3421 [HcalBarrelIslandProtoClusters]
                                                                       l Evaluator::Object : unpaired parenthesis
 023-02-23 11:40:18.342] [HcalBarrelIslandProtoClusters] [
                                                                      r] Evaluator::Object : unpaired parenthesis
       2-23 11:40:18.346] [HcalBarrelIslandProtoClusters]
                                                                      r] Evaluator::Object : unpaired parenthesis
      02-23 11:40:18.3641 [HcalBarrelIslandProtoClusters]
                                                                       rl Evaluator::Object : unpaired parenthesis
 023-02-23 11:40:18.4181 [HcalBarrelIslandProtoClusters]
        -23 11:40:18.418] [HcalBarrelIslandProtoClusters] [
-23 11:40:18.418] [HcalBarrelIslandProtoClusters] [
                                                                      r] Evaluator::Object : unpaired parenthesis
r] Evaluator::Object : unpaired parenthesis
  23-02-23 11:40:18.419] [HcalBarrelIslandProtoClusters] [
                                                                       rl Evaluator::Object : unpaired parenthesis
 023-02-23 11:40:18.4271 [HcalBarrelIslandProtoClusters] [
         23 11:40:18.427] [HcalBarrelIslandProtoClusters]
        -23 11:40:18.444] [HcalBarrelIslandProtoClusters] [
 023-02-23 11:40:18.444) [HcalBarrelIslandProtoClusters] [
                                                                       rl Evaluator::Object : unpaired parenthesis
  23-02-23 11:40:18.4761 [HcalBarrelIslandProtoClusters] [6
 ghtly> danderson@sphnx02:~/eic/EICrecon$
```

Backup | copy+paste SciGlass expression & error



Backup | copy+paste SciGlass expression & error



Backup | SciGlass+Floors expression & error



```
// Initial control of the Composition of the Compos
```

```
[2023-02-23 11:31:33.712] [HcalBarrelIslandProtoClusters] [e
       [2023-02-23 11:31:33.712] [HcalBarrelIslandProtoClusters] [en
    [2023-02-23 11:31:33.712] [HcalBarrelIslandProtoClusters] [e [2023-02-23 11:31:31:33.712] [HcalBarrelIslandProtoClusters] [e [2023-02-23 11:31:31:31.712] [HcalBarrelIslandProtoClusters] [e [2023-02-23 11:31:31.712] [HcalBarrelIslandProtoClusters] [e [2023-02-23 11:31:31.712] [HcalBarrelIslandProtoClusters] [e [2023-02-23 11:31:31.712] [HcalBarrelIslandProtoClusters] [e [2023-02-23 11:31.712] [e [2023-02-23 11:31] [e [2023-02-23 11:31] [e [2023-02-23 11:31] [e [2023-02-23 11:31] [e [2
       [2023-02-23 11:31:33.727] [HcalBarrelIslandProtoClusters]
                                                                                                                                                                                                                                                                                                                              | Evaluator::Object : systax error
           2023-02-23 11:31:33.739] [HcalBarrelIslandProtoClusters]
           2023-02-23 11:31:33.7391 [HcalBarrelIslandProtoClusters]
         [2023-02-23 11:31:33.740] [HoalBarrelIslandProtoClusters] [6] [2023-02-23 11:31:33.740] [HoalBarrelIslandProtoClusters] [6]
           2023-02-23 11:31:33.7611 [HcalBarrelIslandProtoClusters]
                                                                                                                                                                                                                                                                                                                              1 Evaluator::Object : systax error
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               023-02-23 11:31:33.836] [HcalBarrelIslandProtoClusters] [e
                 023-02-23 11:31:33.836] [HcalBarrelIslandProtoClusters]
              2023-02-23 11:31:33.8731 [HcalBarrelIslandProtoClusters]
            2023-02-23 11:31:33.952] [HcalBarrelIslandProtoClusters] [e: 2023-02-23 11:31:33.972] [HcalBarrelIslandProtoClusters] [e: 2023-02-23 11:31:33.972] [HcalBarrelIslandProtoClusters]
            2023-02-23 11:31:34.028] [HcalBarrelIslandProtoClusters]
                                                                                                                                                                                                                                                                                                                              | Evaluator::Object : systax error
           2023-02-23 11:31:34.028] [HcalBarrelIslandProtoClusters]
         [2023-02-23 11:31:34.066] [HcalBarrelIslandProtoClusters] [
         [2023-02-23 11:31:34.066] [HcalBarrelIslandProtoClusters] [ex
[2023-02-23 11:31:34.066] [HcalBarrelIslandProtoClusters] [ex
           2023-02-23 11:31:34.083] [HcalBarrelIslandProtoClusters] [error] Evaluator::Object : systax error
    [2023-02-23 11:31:34.083] [HcalBarrelIslandProtoClusters] [e: [2023-02-23 11:31:34.083] [HcalBarrelIslandProtoClusters] [HcalBarrelIslandProtoClusters] [HcalBarrelIslandProtoClusters] [HcalBarrelIslandProtoClusters] [HcalBarrelIslandProtoClusters] 
       [2023-02-23 11:31:34.084] [HcalBarrelIslandProtoClusters] [error] Evaluator::Object : systax error
       [2023-02-23 11:31:34.084] [HoalBarrelIslandProtoClusters] [e: [2023-02-23 11:31:34.085] [HoalBarrelIslandProtoClusters] [HoalBarrelIslandProtoClusters] [HoalBarrelIslandProtoClusters] [HoalBarrelIslandProtoClusters] [HoalBarrelIslandProtoClusters] 
    [2023-02-23 11:31:34.085] [HoalBarrelIslandProtoClusters] [error] Evaluator::Object : systax error [2023-02-23 11:31:34.086] [HoalBarrelIslandProtoClusters] [error] Evaluator::Object : systax error
       [INFO] JArrow: Finalized JEventProcessor 'JEventProcessorPODIC
nightly> danderson@sphnx02:~/eic/EICrecon$
nightly> danderson@sphnx02:~/eic/EICrecon$
   nightly> danderson@sphnx02:~/eic/EICrecon$
```