

Status of CalorimeterHit clustering in polyhedral detectors

Ron Cassell

9/10/09

Status of slic generation

- Sidloi: initial simulation data used global xy grid in endcap detectors -> confusing and unphysical hit positions. Fixed by applying grid to individual modules (Jeremy)
- IDs: encoding OK, but decoding (java side) gives incorrect cell positions. Jeremy has fixed this for barrel, not sure if finished for endcaps.
- Neighbor cellID capability: being worked on by Jeremy for “within single module” capability.
- Digisim doesn't work.

Existing clusterers

- NearestNeighbor(NN)
- MinimumSpanningTree (MST)
- FixedCone(FC)
- DirectedTree(DT)
- Look at functionality for cylindrical detectors
- Implement at least the same functionality for polyhedral detectors.

NN (cylindrical)

- Critical parameters - #cells in layer, θ , Φ to consider hit adjacent.
- Works on CalorimeterHit collections from single subdetector.
- Fast (cpu)
- Depends completely on neighbor functionality of hits.

NN (polyhedral)

- Replace with DistanceClusterer. (Code written, untested)
- Problems: slow, close to NN functionality when cell segmentation close to layer separation (Ecal) but different otherwise (Hcal). In principal doesn't depend on origin of hits, but in practice only works on single detector. (distance metric changes)
- With neighbor functionality of hits within module, can use NN clusterer within module and Distance clusterer across module borders. Code to cluster across module borders in progress.

MST

- Critical parameters: metric and value
- Clusters hit collection or cluster collection
- Effectively limited to single detector, since need different value of metric for different detectors.
- No use of neighbor capability.
- Slow
- Should work on polyhedral detector as is.

FC

- Critical parameters: $\theta\Phi$ distance and metric
- No use of neighbor functionality.
- Should have worked as is on polyhedral detector. Didn't.
- Current modification – Use hit positions instead of IDDecoder positions.
- Added FCClusterClusterer – implemented with single metric and parameter.
- Clusters clusters in a single collection.
- Clusters clusters in collection A to clusters in collection B.

DT

- Critical parameters: ?? Always used defaults.
- Limited to single subdetector, uses neighbor functionality
- For polyhedral detectors, could use as is within modules, then use Distance or FC across borders. However, density calculations probably incorrect near borders.

Plan

- Finish fixing IDDecoder (Jeremy, may already be done)
- Fix digisim.
- Finish writing the additional underlying clusterers needed to cross borders
- Write next level drivers that combine clusterers with parameters set to give similar performance as standard clusterers on cylindrical detectors.
- Make Iowa PFA work.
- Improve and document performance of clustering.