

Finding cell neighbors in non-projective endcaps

Guilherme Lima



NORTHERN ILLINOIS
UNIVERSITY

Simulation/reconstruction phone meeting

December 06, 2005

Simulating the tail catcher in a full detector model

- New detector model: `sidaug05_tcmt`
 - **sidaug05**: projective SiW ECal, SS/RPC HCal and muon system.
Muon layers are 5cm Fe + 0.64cm RPC + 0.86cm air
 - **sidaug05_tcmt**: non-projective 0.4x0.4(cm²) Ecal,
1x1 cm² SS/Scint Hcal and 3x3 cm² SS/Scint TCMT
tail catcher layers are 2cm SS + 0.5cm scint + 0.3cm air
 - Several single-particle samples simulated
muons, photons, charged pions, neutrons, Klongs (perpendicular to beam)
b- and c-jets : energy = 1 .. 250GeV, theta = 1 .. 179 deg

Neighbor finding

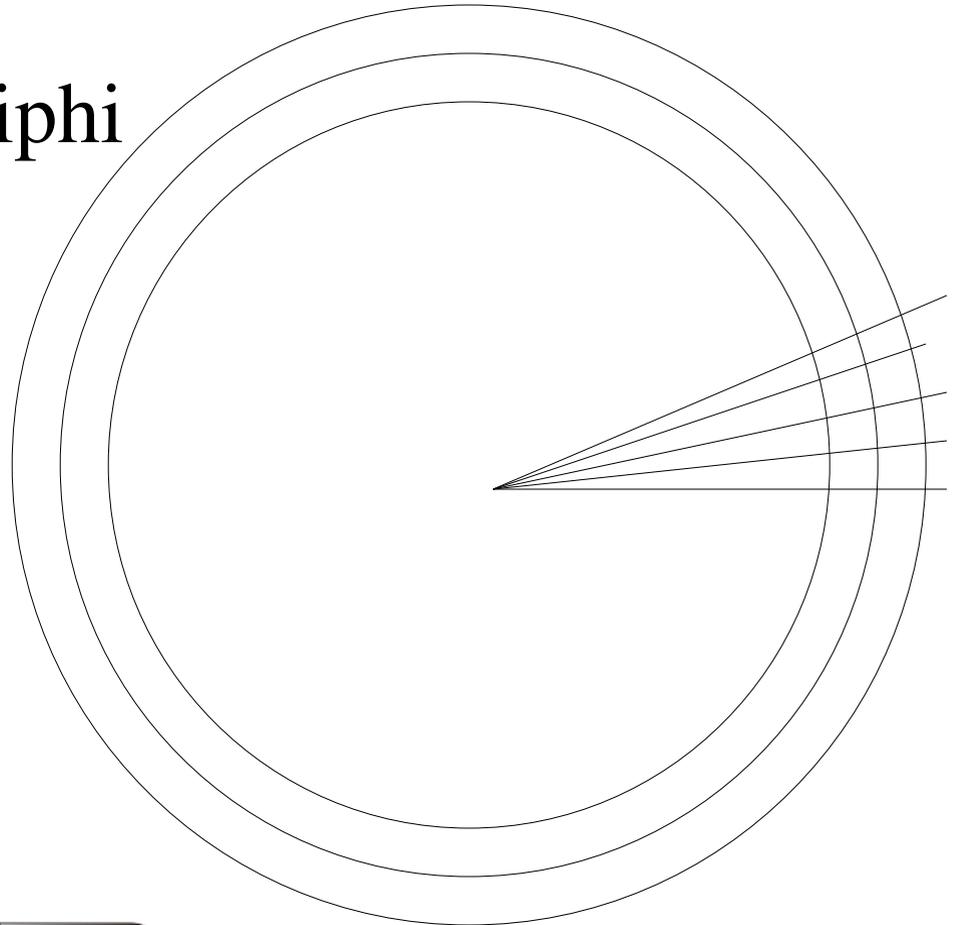
- The org.lcsim geometry framework defines a segmentation interface with a method to find the neighbors of a cell:

```
CalorimeterIDDecoder dec = (CalorimeterIDDecoder)event.getMetaData(coll).getIDDecoder();  
long[] neighbors = decoder.getNeighbourIDs(dLayer, dU, dV);  
for( i=0; i<neighbors.length; ++i ) {  
    CalorimeterHit hit = hitmap.get( neighbors[i] );  
    //... do something with neighbors...  
}
```

- NearestNeighbors clustering uses it.

Neighborhood in projective geometry

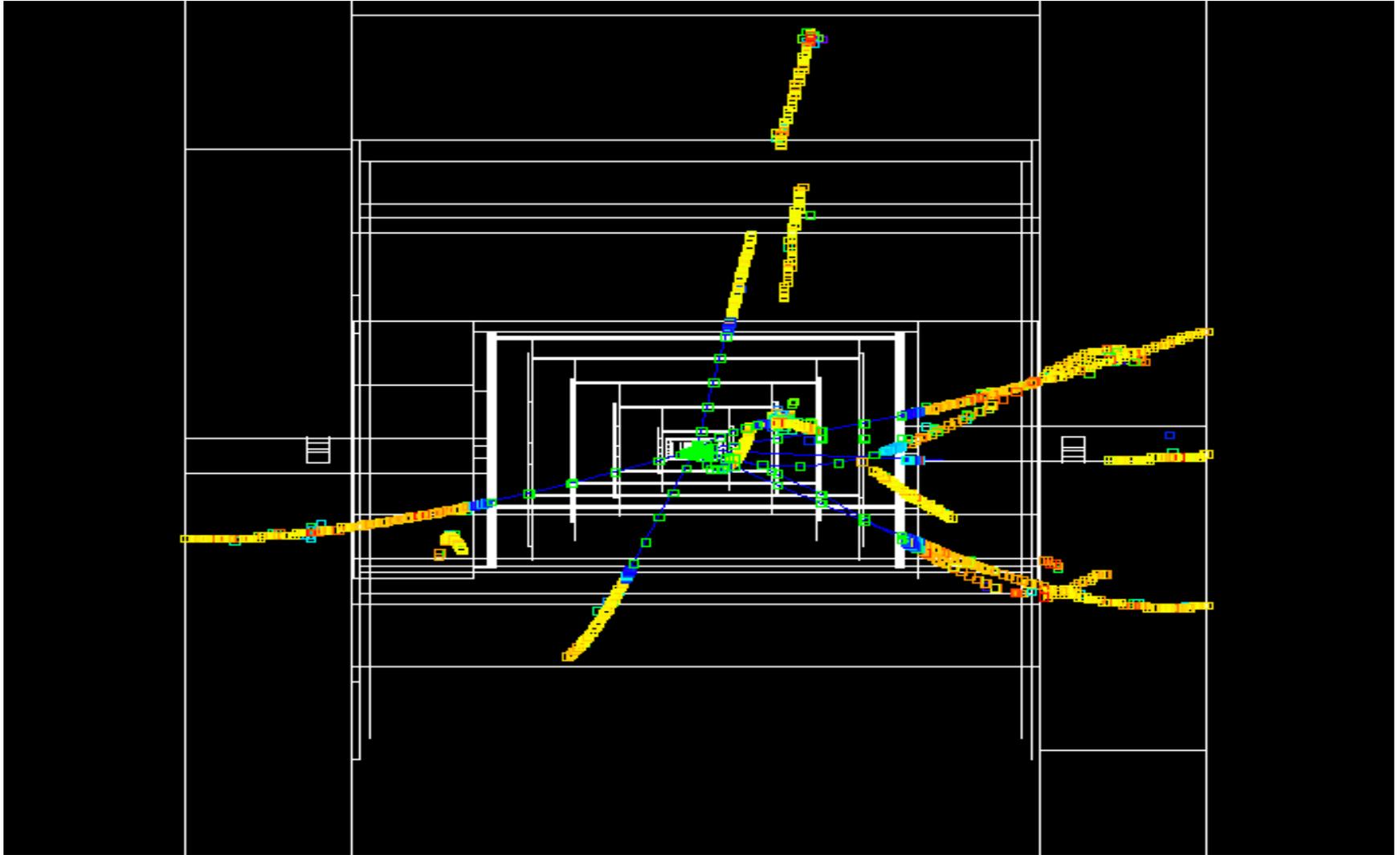
- Cell indices:
ref. cell: i_{layer} , i_{theta} , i_{phi}
- Neighborhood:
 $i_{\text{layer}} \pm d_{\text{layer}}$
 $i_{\text{theta}} \pm d_{\text{theta}}$
 $i_{\text{phi}} \pm d_{\text{phi}}$



Neighborhood in non-projective geometry

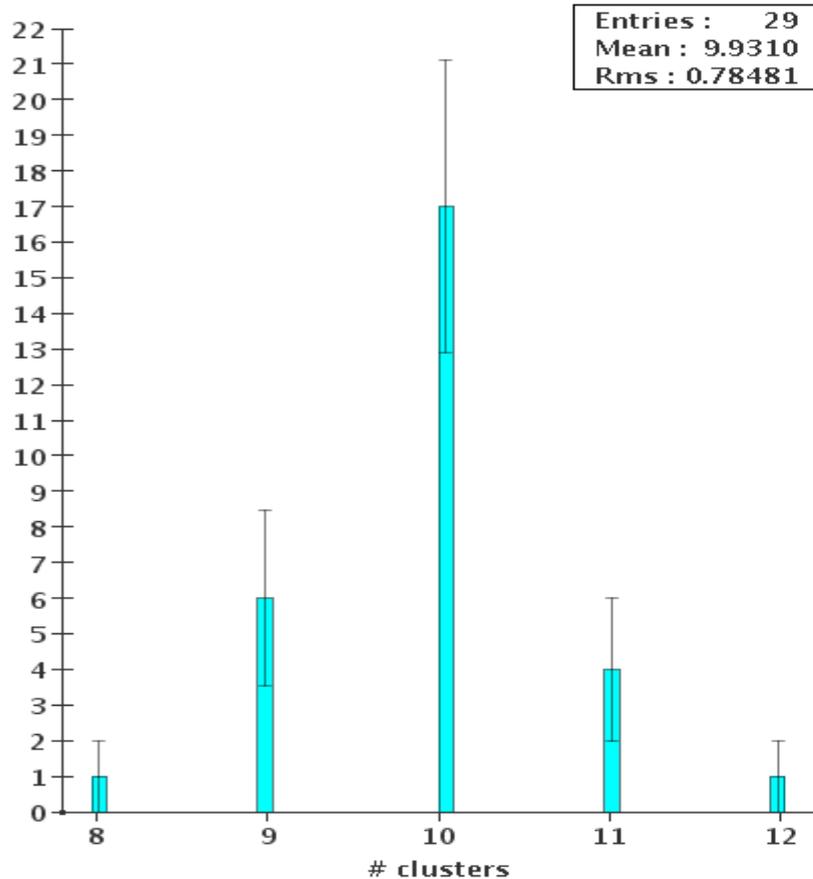
- Cell indices:
 - $i_{\text{layer}}, i_z, i_{\phi}$ (barrel) or $i_{\text{layer}}, i_x, i_y$ (endcaps)
- Neighborhood definition:
 $i_{\text{layer}}, i_z, i_{\phi} \rightarrow i'_{\text{layer}}, i'_z, i'_{\phi}$, with fixed (θ, ϕ)
 $i_{\text{layer}} \pm d_{\text{layer}}; i'_z \pm dz; i'_{\phi} \pm d\phi$
and similarly for endcaps.
- Implementation:
`org.lcsim.geometry.segmentation.NonprojectiveCylinder` (barrel)
and `org.lcsim.geometry.segmentation.GridXYZ` (endcaps)

Checking nearest neighbor clustering

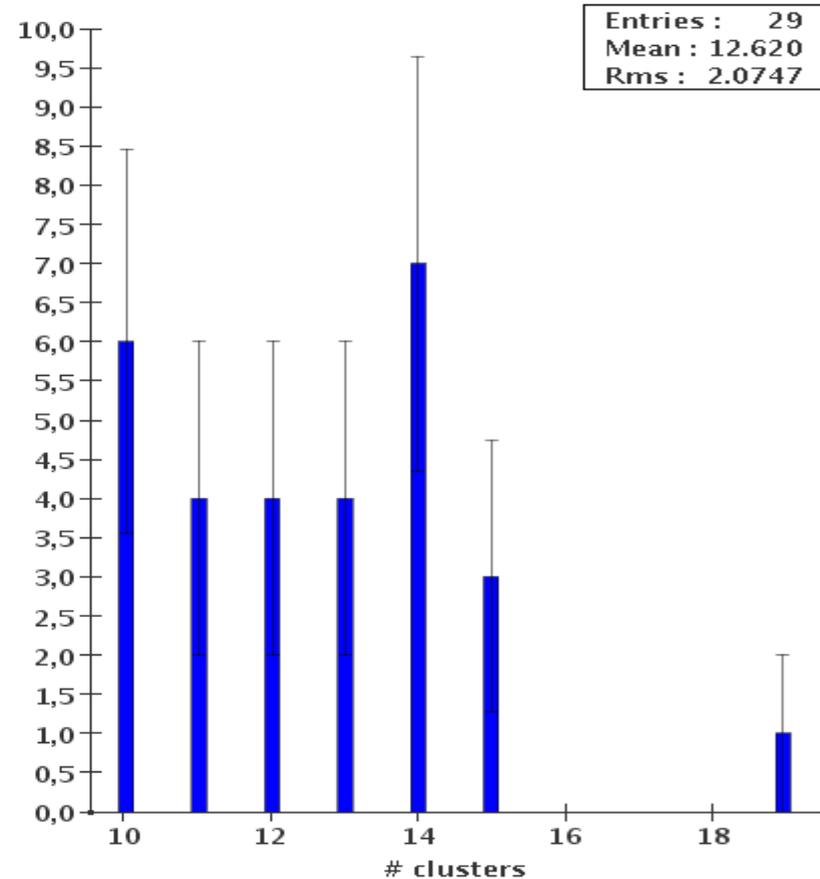


Expected 10 clusters per event

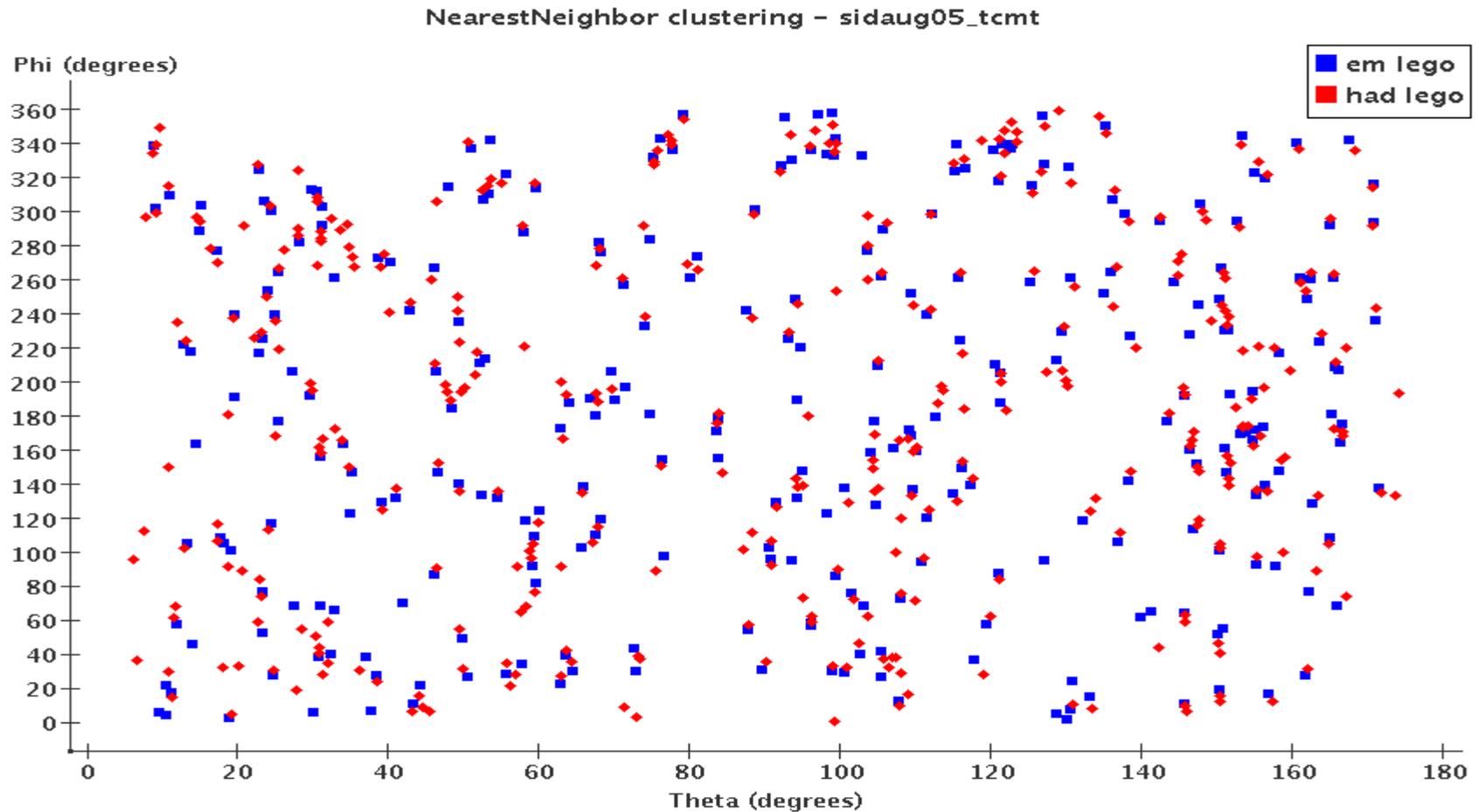
NN clusters in non-projective ECal



NN clusters in non-projective HCal



NN clustering in sidaug05_tcmt



Summary

- Neighbor-finding has been implemented in non-projective geometries, both barrel and endcaps
- Theta vs. phi plot shows nearest neighbor clustering works fine for non-projective geometries (sidaug05_tcmt)
- To be committed to CVS soon (tomorrow?)