Reconstruction in sidloi2

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What is sidloi2

- Strawman implementation of LOI detector – subject to change.
- Features – more realistic detector description
- Tracking – much more realistic simulation of sensors. Bottom line for reconstruction: tracking package still works.
- Calorimeters – no more cylinders, polygonal modules instead. Bottom line for reconstruction: most of the tools developed will not work as is.

Endcap calorimeters

- Regular n-gons, layered in depth.
- Reconstruction problem: module borders.
- Tools using neighbor id capability work only within a module, fail at borders.
- Tools using hit densities fail at or near borders.

Barrel calorimeters: Hcal, Muon

- Regular n-gons, layered outward in R.
- Reconstruction problems: same as endcaps at borders, +
- Layer no longer represents a fixed radius. -> track extrapolation to a layer no longer works.

Barrel calorimeters: Ecal

- Overlapping staves:
- Reconstruction problems: all the problems of other calorimeters +
- Layer no longer represents depth in Ecal:

From Mark Thomson's writeup of PandoraPFA

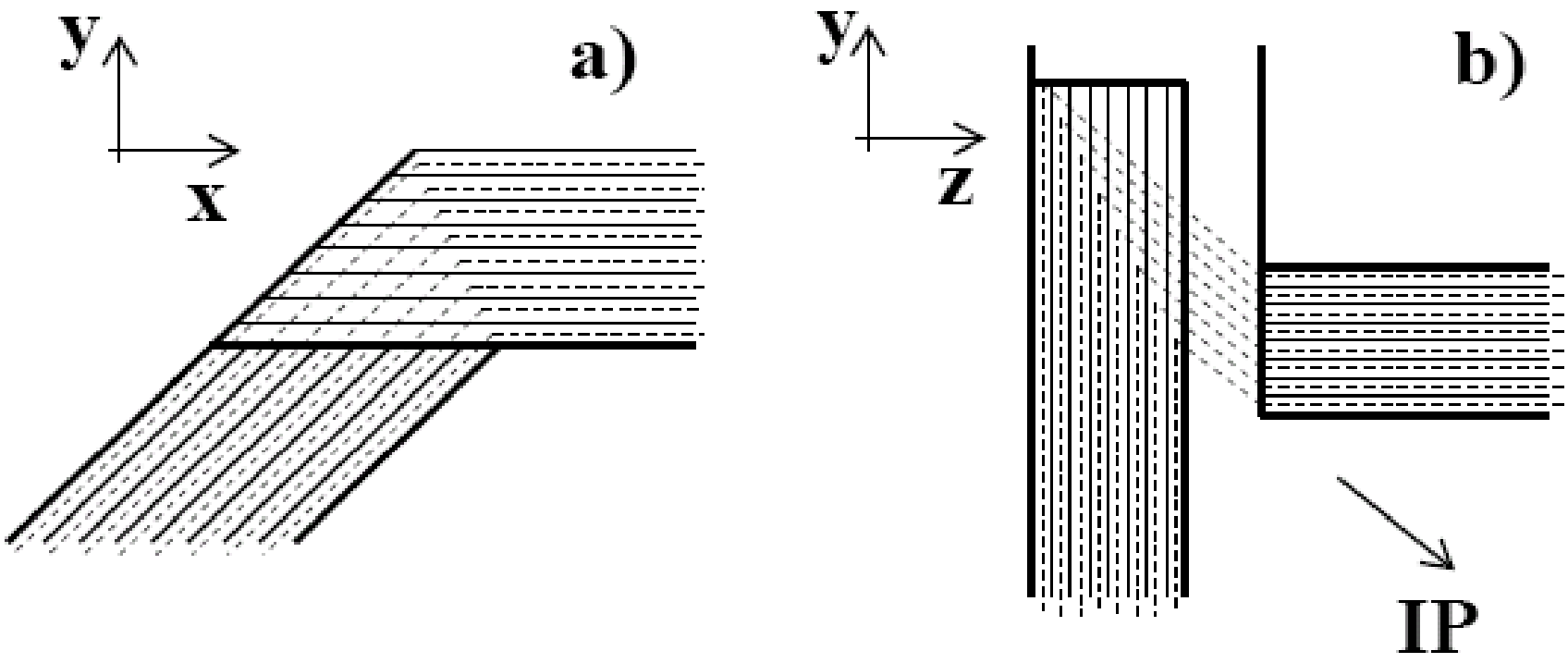

Figure 3: Schematic showing the definition of the pseudo-layer assignment for calorimeter hits. The solid lines indicate the positions of the physical ECAL layers and the dashed lines show the definition of the virtual pseudo-layers. a) The *xy*-view showing the CALICE stave structure for the ECAL. Here hits in the first layer of the stave can be deep in the overall calorimeter. b) The *xz*-view showing a possible layout for the ECAL barrel/endcap overlap region. Here the pseudo-layers are defined using the projection back to the IP such that the pseudo-layer is closely related to the depth in the calorimeter.

Sid/UI PFA: breakpoints

- DigiSim: Should work but doesn't: need to investigate. Can fake it for now, since we only use time and Edep thresholds. But do we really want to give up the other capabilities?
- DTClusterer: doesn't work. Uses neighbor capability of hits for density calculations. Breaks down across borders and near borders. Uses layer as radial increment: breaks down in Ecal barrel.
- Photon finder: uses DT clusterer. Uses NN clusterer to break up DT clusters. Uses HMatrix. Uses detailed cuts optimized for sid01.
- MuonFinder: need to remove MuonHit filtering and work from Muon collections. Need to modify Helix extrapolation.

Breakpoints: cont

- ShowerPointFinder: track extrapolation need modification. Extensive use of layer as depth parameter, as well as isolation criteria. Uses neighbor capability of hits.
- FindSubClusters:
  MipFinderCrossingBarrelEndcapBorder
  TrackClusterDriver
  NonProjectiveMipFinder
  ClumpFinder
  All use hits/layer. Most use neighbor capability for isolation/density criteria.
- Matching: findInnermostHit functions use layer

Breakpoints: cont

- Highlighted high-level drivers that will fail. Many subdrivers, functions with same problems.
- 3 basic problems:
  - Track extrapolation.
  - Layer -> depth in calorimeter
    - assumption.
  - Use of neighbor capability of hits.

Proposal

- New class: ExtCalorimeterHit -> implements SimCalorimeterHit.
- getLayer returns pseudoLayer.
- getNeighbors works across borders.
- Could feed IUPFA collections of ExtHits, and only Track extrapolation would need changing.

Proposal cont

- PseudoLayer should be straightforward.
- getNeighbors functioning across borders anything but straightforward. One possibility: map of border regions. Could be done once (for a detector) if not too large to store in memory.
- May be possible to maintain backward compatability.

Summary

- Many basic tools break with planar geometry.
- Many functions of the UIPFA break with planar geometry.
- May be able to fix most of it with new SimCalorimeterHit class.
- Otherwise, will need a branch in org.lcsim to develop PFA for planar geometry.