Status of Topological Clustering

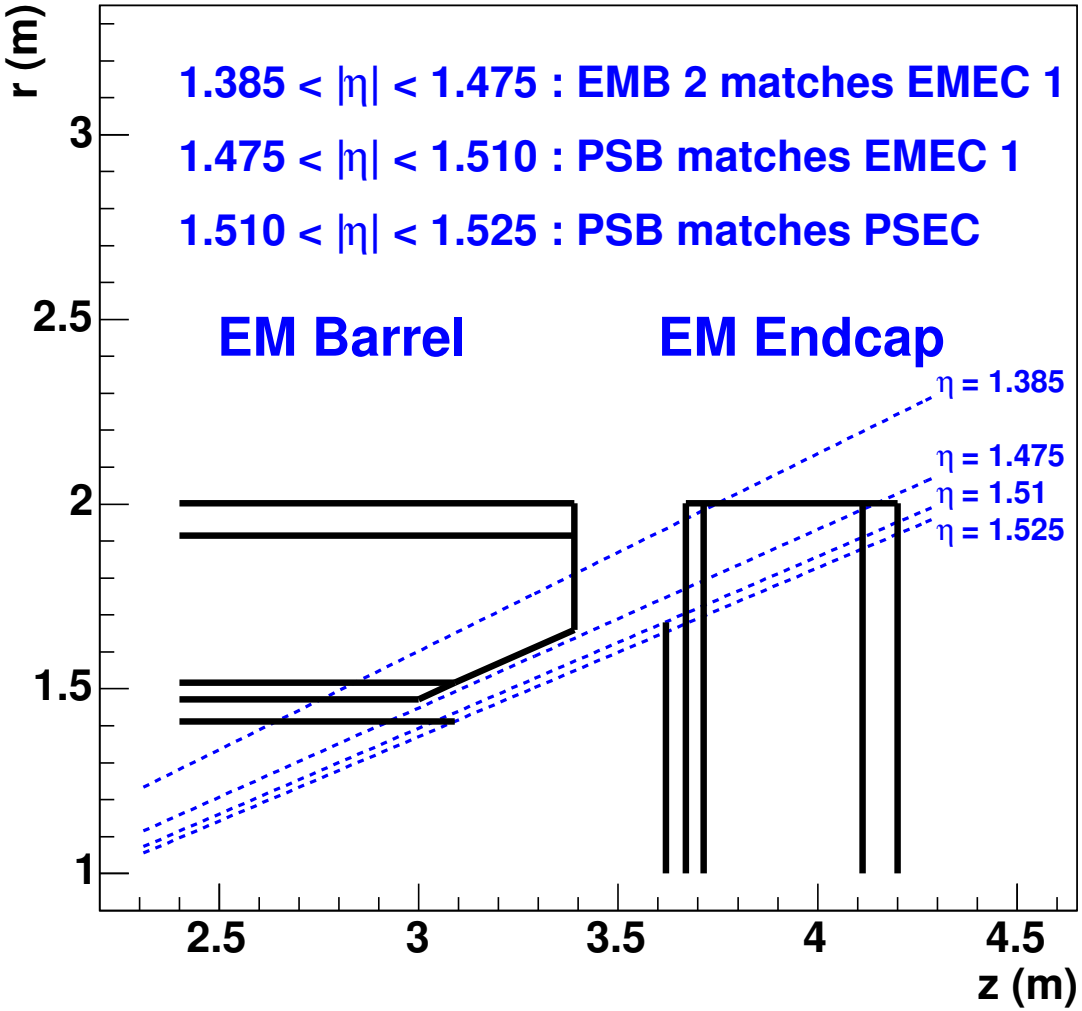
- Migration from `LArClusterRec` to `CaloRec`
- EM Barrel – Endcap Overlap Region
- Integration of the Tile Calorimeter
- Outlook
  - FCal Neighbors
  - Cluster Splitting

Migration from LArClusterRec to CaloRec

- new location for the code
  `Calorimeter/CaloRec/CaloTopoClusterMaker`
  - supports Tile Calorimeter
  - uses `CaloNoiseTool` for LAr and Tile noise
  - uses the new super calo hashing `CaloCell_ID` for the LAr (Tile is not yet supported by `CaloCell_ID`)
- `CaloRec-02-01-21` should go in 7.6.0
- `jobOptions.txt` should include:
  `#include "CaloRec/CaloTopoCluster_jobOptions.txt"`

EM Barrel – Endcap Overlap Region

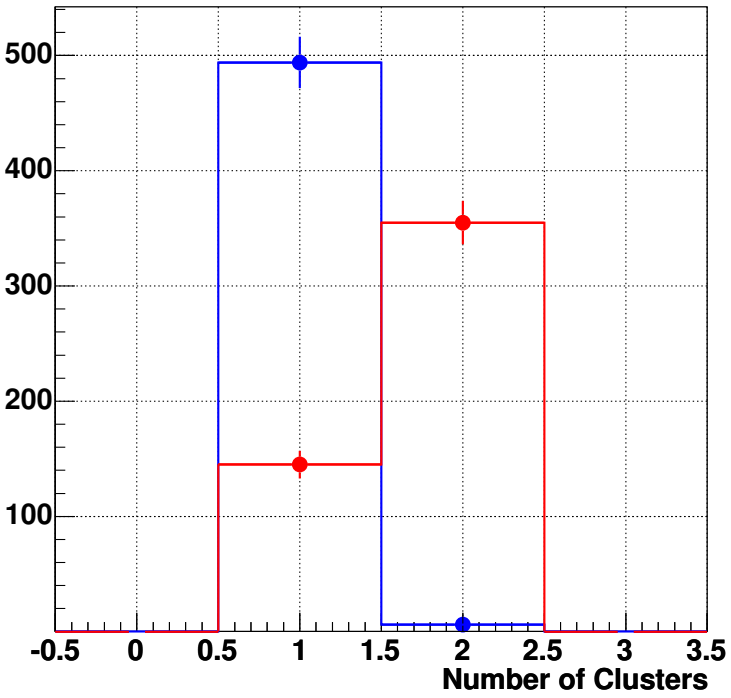
- up to now LAr EM Barrel and Endcap are not connected via the `get_neighbours` method
- the picture shows how they should be connected



EM Barrel – Endcap Overlap Region > Solution

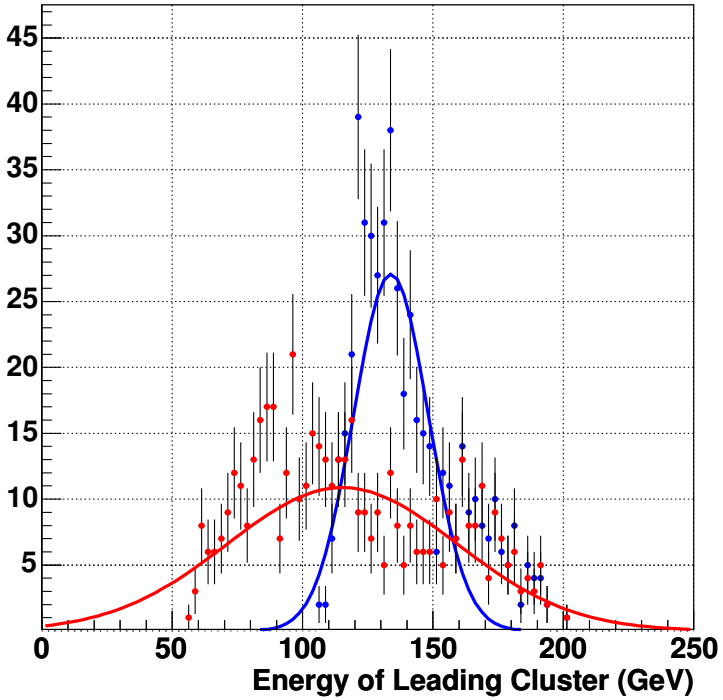
- Easy solution is to patch `DetectorDescription/IdDictParser/data/IdDictLArCalorimeter.xml`
  - add PS Endcap and EMEC Layer 1 to `next_samp` vector of PS Barrel
  - add EMEC Layer 1 to `next_samp` vector of EMB Layer 2
  - similar modifications to `prev_samp` vectors of PS Endcap and EMEC Layer1
- all cells overlapping in η will be neighbors
- slightly more neighbors than originally foreseen
  - PS Barrel will neighbor EMEC Layer 1 for $1.4 < |\eta| < 1.525$
  - not a problem though as tests with single pion and photon MC show

EM Barrel – Endcap Overlap Region > Results



- Single Photon DC1 MC with $E = 200\,\mathrm{GeV}$ for $1.47 < \eta < 1.53$
  - in red distributions without Barrel-Endcap neighbors
  - in blue distributions with Barrel-Endcap neighbors

- Number of Clusters often 2 before, mainly 1 after change
- E_{reco} Resolution from leading cluster 38 % before, 10.7 % after change

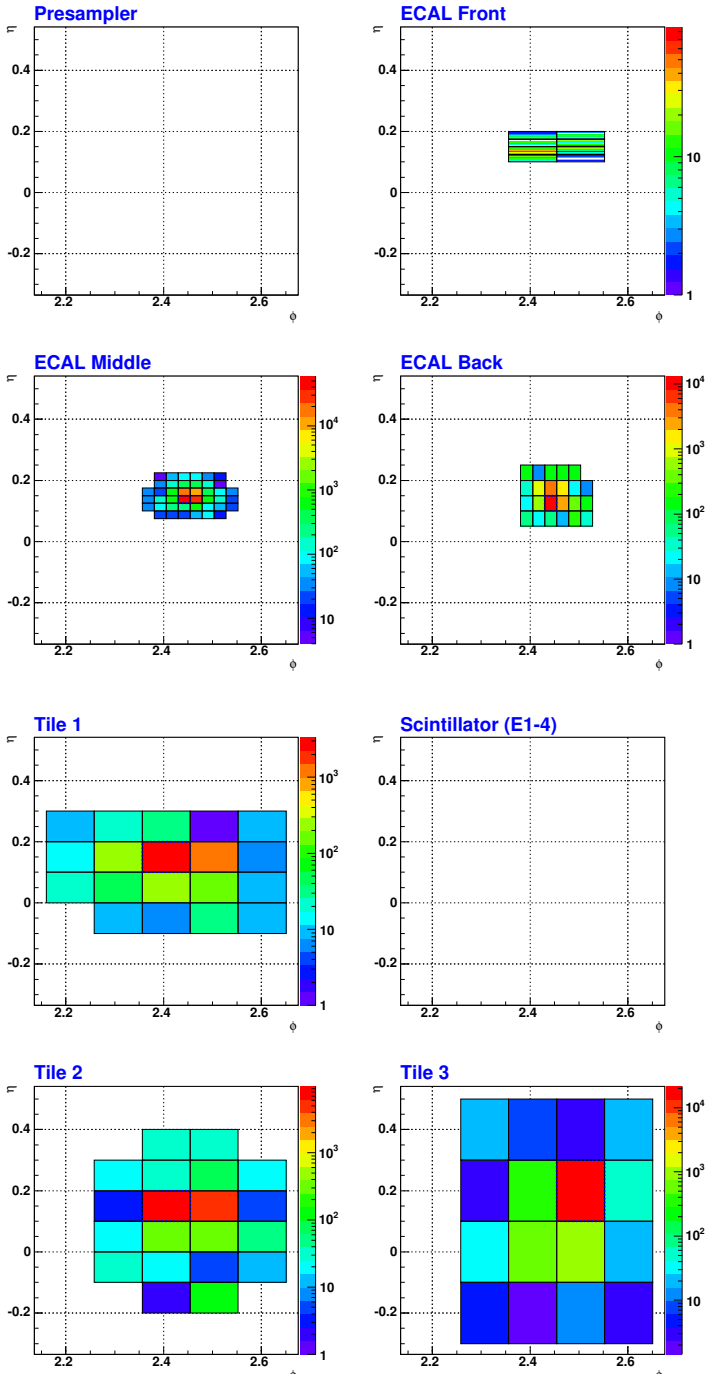


Integration of the Tile Calorimeter

- correct Tile neighbors are implemented by Sasha since `CaloIdentifier-00-07-01`
  - neighbor options identical to LAr
  - all regions (Barrel, Gap, Extended Barrel) are connected
  - Gap cells are treated as “transparent” cells by default (`TileNeighbour.txt`) – i.e. in addition to the neighbor cell in the Gap, cells beyond the Gap are considered for neighboring
  - A “reduced” definition of neighbor cells can be chosen (`TileNeighbour_reduced.txt`) – i.e. Gap cells are treated as “normal” cells and “shield” cells beyond the Gap for neighboring purposes
- noise/pile-up based cuts and threshold are defined like for the LAr calos

Integration of the Tile Calorimeter > Event Display

- single π^- DC1 MC, $p_\perp = 200\,\mathrm{GeV}$, $|\eta| < 2.7$
- upper four plots show the reconstructed 3D cluster in the EM
- lower four plots show the reconstructed 3D cluster in the Tile
  - same $\eta - \phi$ region is shown for all samplings; ϕ on x-axes; η on y-axes
  - z-axes show cell energies in MeV on logarithmic color-coded scale
  - default neighboring scheme is chosen for the Tile



Outlook

- FCal neighbors need to be implemented
  - difficulty: non-projective in either η and ϕ
  - P. Loch will provide a list of neighbors
- Cluster Splitting
  - needed for Cluster classification (Particle ID)
  - first step is a local maximum finder
  - I'm currently testing a 2D local max finder (the dotted blue lines around cells on prev. slide are the local maxima found . . .)
  - distance/energy based association of cells to the maxima is next