A LAr Calorimeter for FCC-ee

Reconstruction algorithms and performance studies

Katinka Wandall
Supervisor: Mogens Dam

Niels Bohr Institute

FCC nordic day
March 22, 2021

A LAr electromagnetic calorimeter

Proposed geometry - Barrel

- Consists of sandwich-layers inclined by 50° from r-direction
  - → Absorber plates of steel and Pb
- Detector divided into 10 segments in r-direction

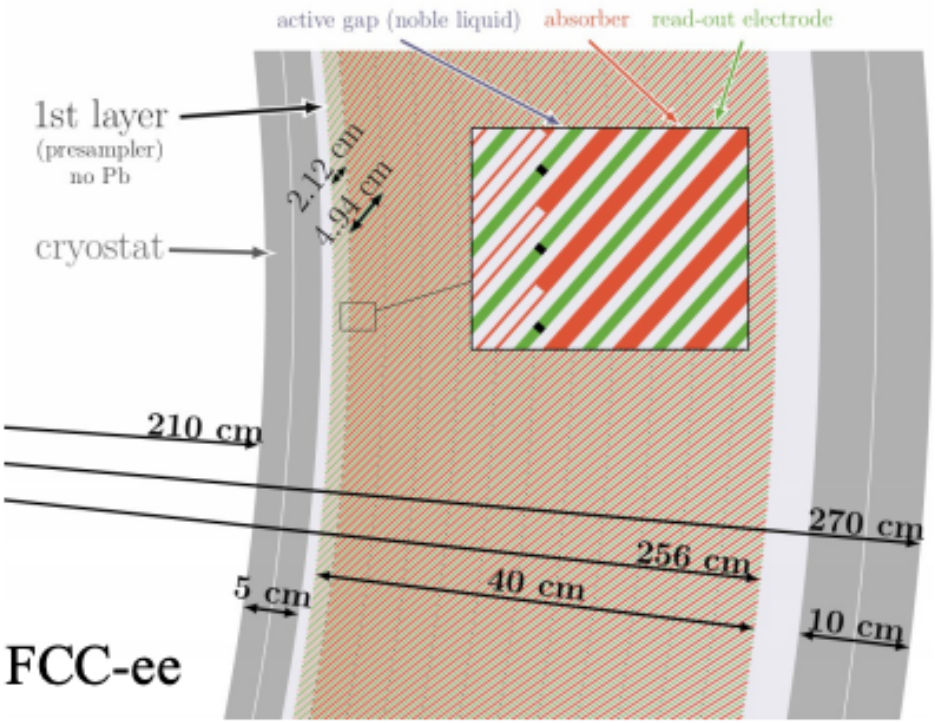


Figure by Brieuc François from 4th FCC Physics and Experiments Workshop, 10-13 November 2020

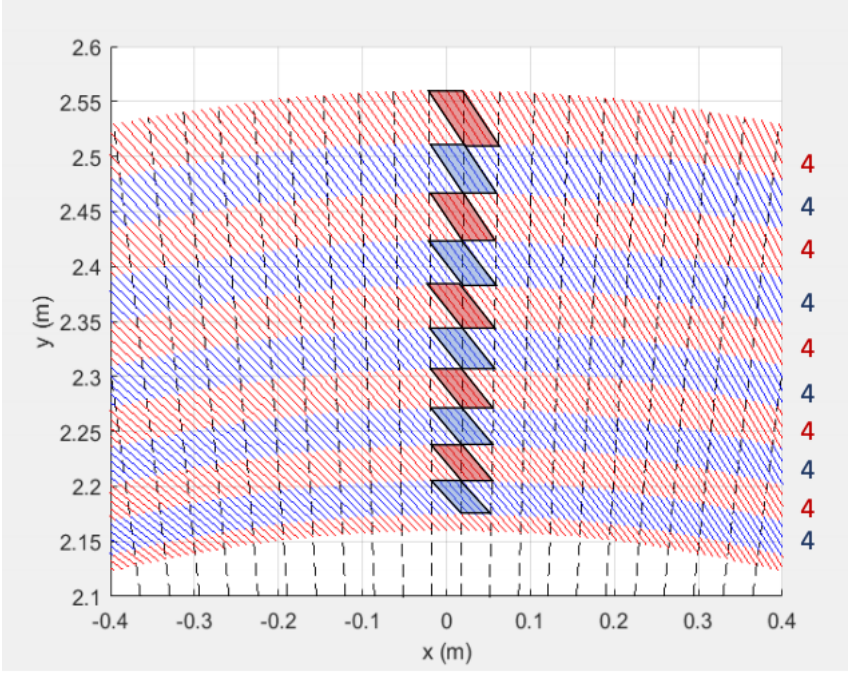


Figure by Ronic Chiche from Noble Liquid Calorimeter Meeting, 17 December 2020

τ decay mode identification

Project goal:

Develop an algorithm in FCCSW for distinguishing different decay channels of the τ lepton in a LAr electromagnetic calorimeter

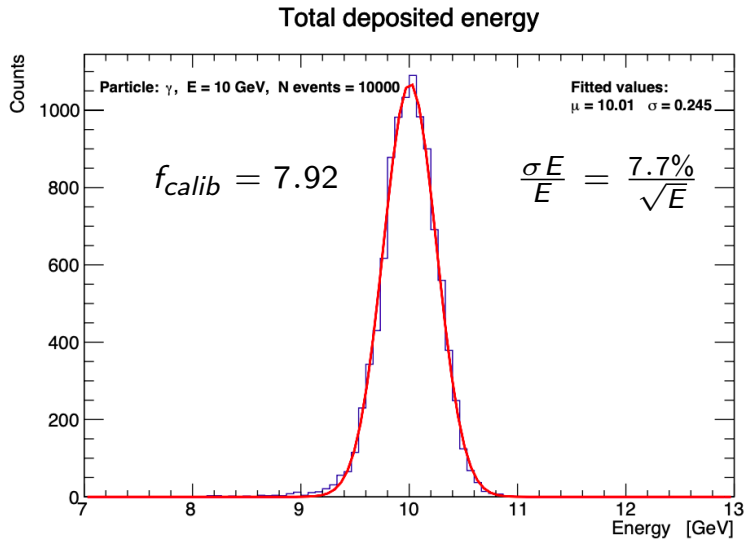
Steps:

- Build π^0 reconstruction algorithm based on fast simulation (Delphes)
- Set up full detector geometry and clustering algorithm
- Study and develop algorithm for photon reconstruction in full simulation
- Develop method for separating photons from (merged) π^0's
- Minimizing the off-diagonal terms of the migration matrix by forming a separation mechanism for different τ decay channels

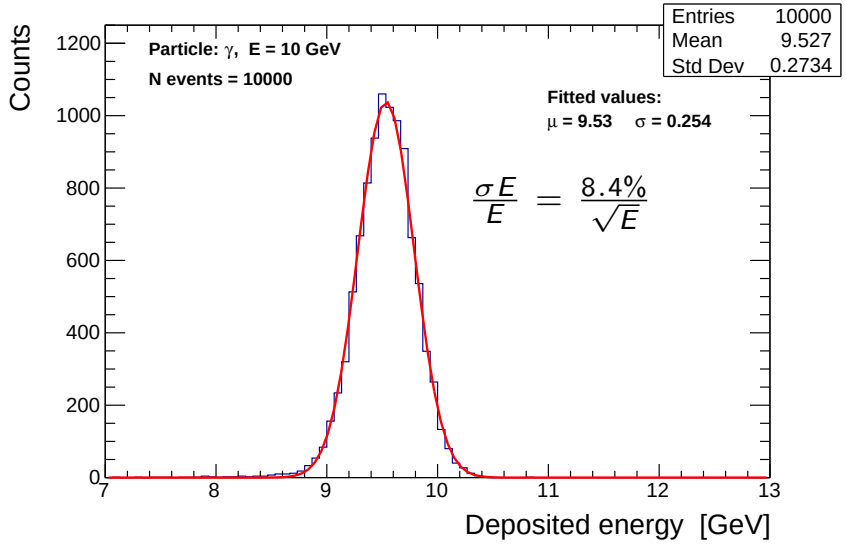
Ongoing work - Clustering

- Simple (unrealistic) LAr geometry has been set up
  - concentric cylinders instead of tilted layers
  - cuboid cells of size $\sim$ 2 cm$\times$2 cm$\times$4 cm
- Clustering with two thresholds, LOW (12.5 MeV) and HIGH (25 MeV)
  1. For seeding of cluster, cell energy exceeds HIGH and is local max
  2. Collect all neighbours above LOW
  3. At edge of cluster collect "one more layer" of neighbours irrespective of energy
  4. Join clusters which have neighbouring cells above LOW

Before clustering:

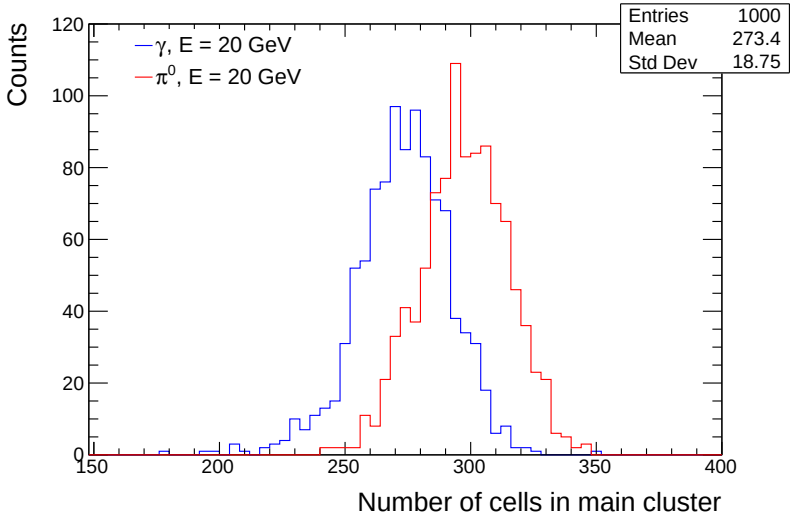


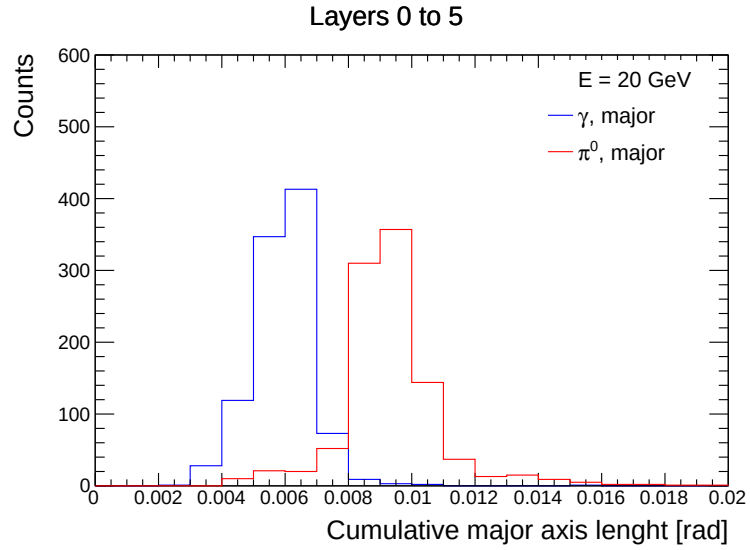
After clustering:



Ongoing work - Particle identification

Separation of single photons from π^0's based on shape





Method:

Comparisons the major and minor axis of clusters. This is calculated by diagonalizing the covariance matrix for each layer of the ECAL