Simulations of the calorimetry system for the ALLEGRO FCC-ee detector concept

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ALLEGRO introduction

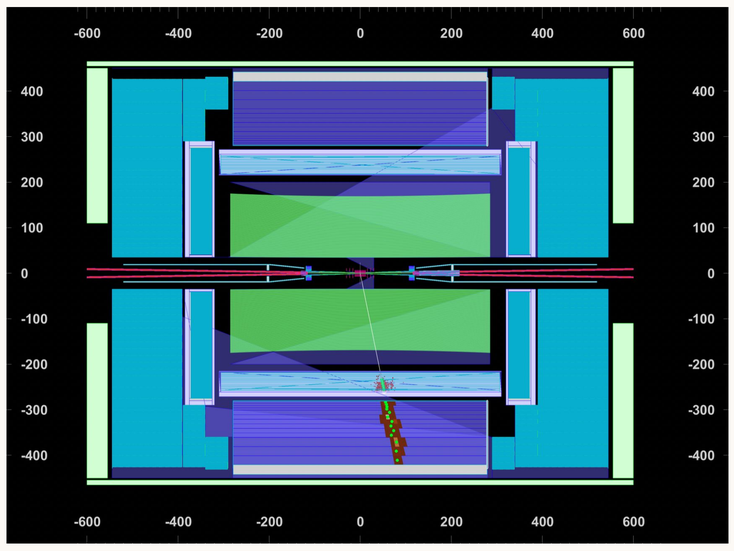

Figure 1. Example of a response to 50 GeV pion in ALLEGRO calorimetry system

Main features

- **A** **L**epton co**L**lider **E**xperiment with **G**ranular **R**ead-**O**ut
- General purpose detector for FCC-ee
- Drift chamber as a tracker
- Solenoid located between an electromagnetic (Ecal) and a hadronic (Hcal) calorimeter
- Vertex detector, drift chamber and Ecal inside 2 T solenoid magnet, sharing cryostat
- Note: The design of the detector is still being optimised

Figure 2. Scatch of ALLEGRO detector

Calorimetry system

High granular noble liquid calorimeter

- Readout by straight multilayer PCB electrodes
- Pb/W as absorbers and LAr/LKr as active medium
- Cryostat material: Al or carbon fiber
- Inclined straight absorbers in the barrel region, turbine-like layout in the endcaps

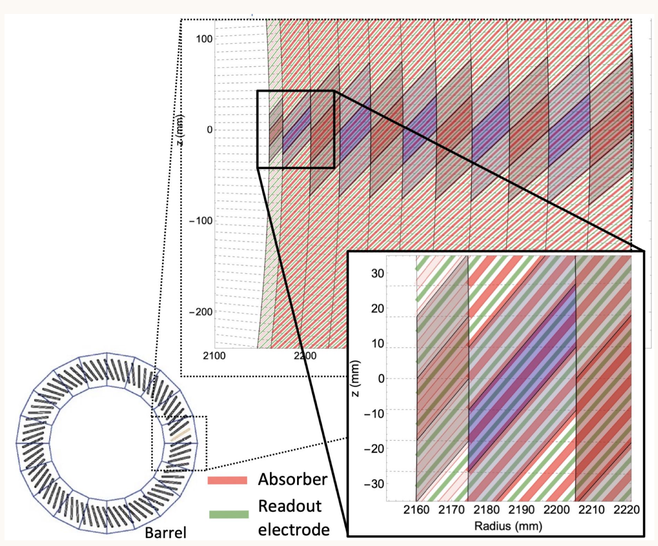

Figure 3. Noble liquid Ecal design in the barrel region with 11 longitudinal layers

Barrel region baseline geometry

- straight Pb absorbers inclined by 50.4°
- 1536 absorber plates, thickness of 1.8 mm
- 11 longitudinal layers

Endcap region baseline geometry

- Turbine-like geometry
- $\sim$ 240 absorbers and electrodes each
- electrode thickness of 1.3 mm, absorber thickness of 3 mm, 2 mm noble liquid gap

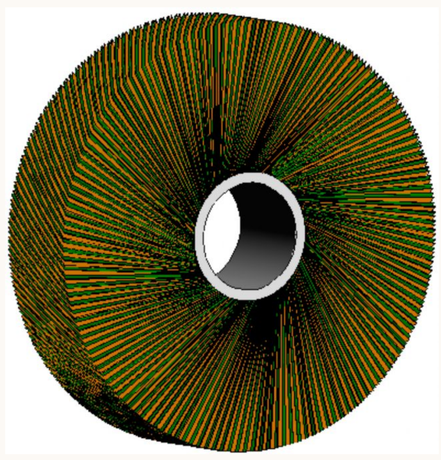

Figure 4. Noble liquid Ecal design in the endcap region with the full set of absorbers and electrodes

Hadronic calorimeter with scintillating tiles

- Tiles oriented perpendicular to the beam line
- Light readout by wavelength shifting fibres
- Steel absorbers (5 mm) alternating with scintillator plates (3 mm)
- 13 longitudinal layers

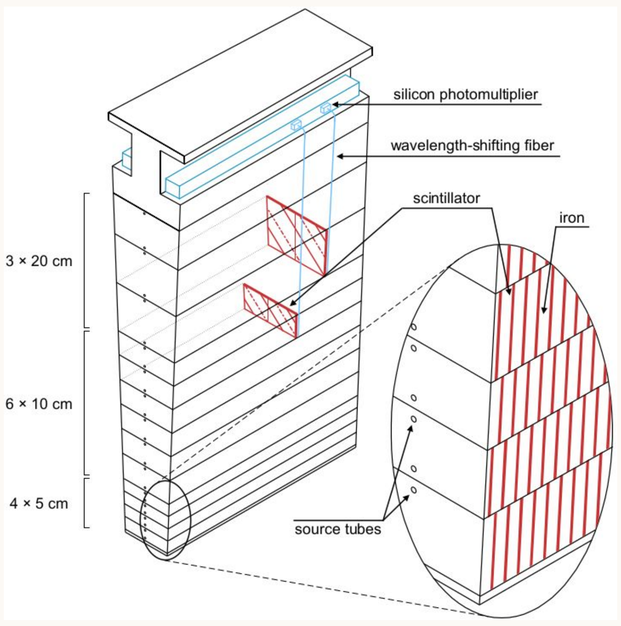

Figure 5. Hcal barrel baseline geometry

Performance of the calorimetry system

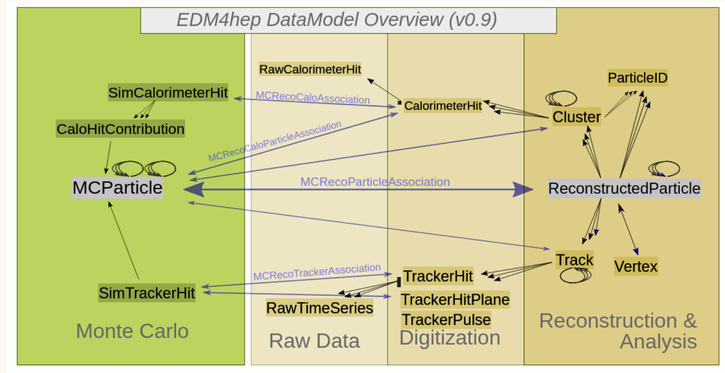

Figure 6. Diagrammatic overview of EDM4hep with all the available data types

FCC software relies on Key4hep

- Allegro detector fully under FCC software (k4Geo, k4RecCalorimeter)
- Migrate from k4SimGeant4 to ddsim for the Geant4 interface
- Chains of algorithms (Gen, Sim, Digi, Reco) operated with Gaudi
- Detector geometry description based on DD4hep
- Ecal barrel fully available in Key4hep
- Ecal endcaps under validation

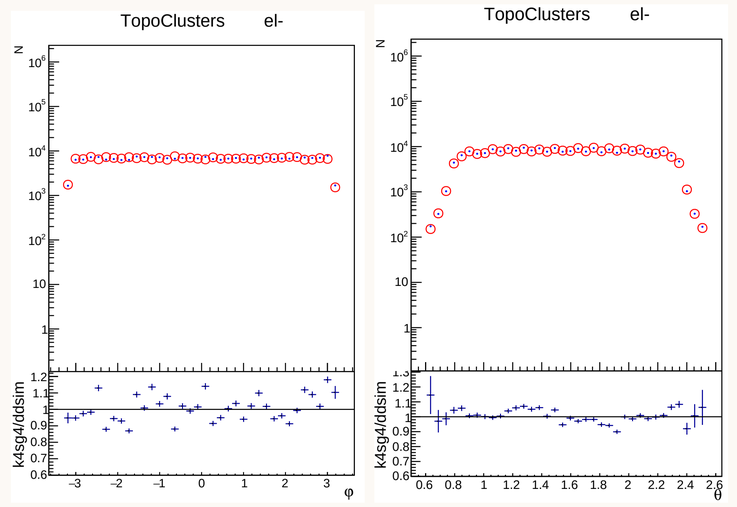

Figure 7. Validation of TopoClusters for k4SimGeant4(blue) and ddsim(red)

Conclusions

- General purpose FCC-ee detector
- Rich detector R&D programme as a part of DRD on Calorimetery (DRD6)
- ALLEGRO detector concept is fully integrated under FCC software

Many challenges in front for us, come and join our team!

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