Allegro detector concept for FCC-ee

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Introduction

A **L**epton co**L**lider **E**xperiment with **G**ranular **R**ead-**O**ut

Main features

- Calorimeter system with excellent intrinsic energy resolution
- Drift chamber as a tracker
- Solenoid located between an electromagnetic (Ecal) and a hadronic (Hcal) calorimeter
- Note: The design of the detector is still being optimised

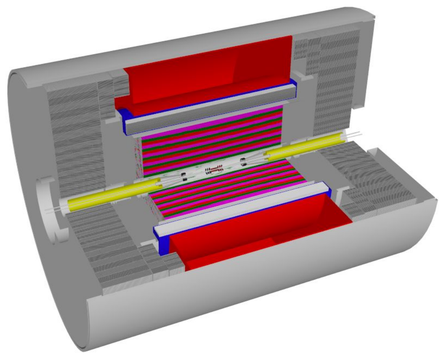

Figure 1. Allegro detector view in k4Geo

Subdetectors

Aiming to reuse existing technologies

- Vertex detector: e.g. (D)MAPS, Alice 3
- Tracker: Drift chamber
- Silicon wrapper and time of flight detector
- Calorimeter system (details below)
- Muon tagger: e.g. Micromegas

Electromagnetic calorimeter

High granular noble liquid calorimeter technology (DRD on Calorimetry, WP2)

- Readout by straight multilayer PCB electrodes
- Various options of absorbers (Pb, W) and active medium (LAr, LKr) under consideration
- Cryostat material: Al or carbon fiber
- Energy resolution with a **sampling term between 5% to 8%**
- Inclined straight absorbers in the barrel region, turbine-like layout in the endcaps

See talks by J. Pekkanen and E. Varnes for more details

Barrel region baseline geometry with straight Pb absorbers inclined by 50.4°

- 1536 absorber plates, thickness of 1.8 mm
- LAr gap of 1.2 – 2.4 mm
- 11 longitudinal layers
- Cell sizes of $\Delta\theta \sim 10(2.5)$ mrad for regular (strip) layer and $\Delta\phi \sim 8$ mrad

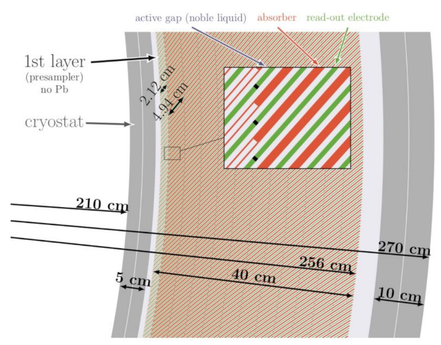

Figure 2. Noble liquid Ecal design in the barrel region

Endcap region baseline geometry with turbine-like situated Pb absorbers

- The design still to be optimised

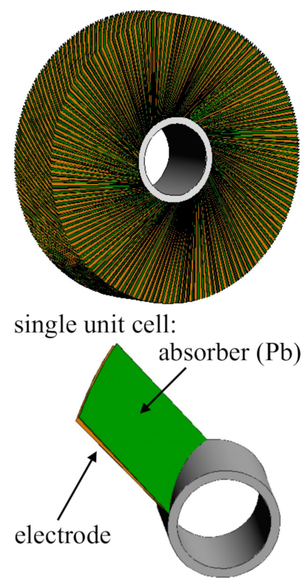

Figure 3. Noble liquid Ecal design in the endcap region

Hadronic calorimeter

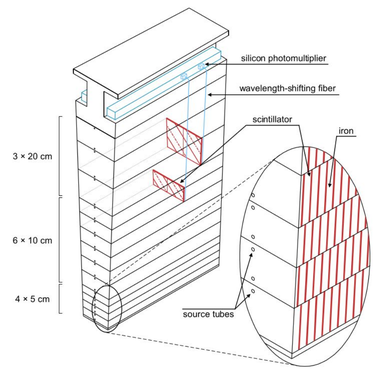

Figure 4. Tile hadronic calorimeter design

Hadronic calorimeter with scintillating tiles (DRD on Calorimetry, WP3)

- Tiles oriented perpendicular to the beam line
- Light readout by wavelength shifting fibres

Baseline geometry

- Steel absorbers (5 mm) alternating with scintillator plates (3 mm)
- 13 longitudinal layers
- Cell sizes of $\Delta\theta \sim 22$ mrad and $\Delta\phi \sim 25$ mrad

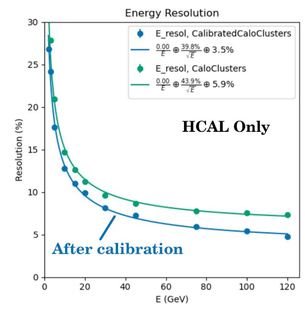

Figure 5. Standalone energy resolution to π^- in the Hcal barrel

Performance of the calorimetry system

Allegro detector under FCC software (k4Geo, k4RecCalorimeter)

- **See talk by B. Francois for more details**

Combined reconstruction using Ecal and Hcal

- Cell based calibration with correction for the lost in the cryostat (red curve)
- MVA calibration (blue curve)
- Topological clustering implemented recently

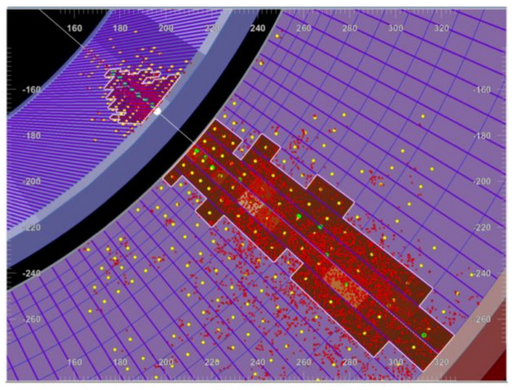

Figure 6. Example of a shower of 50 GeV π^+ in the Allegro detector

Energy resolution to single π^- with **a sampling term of 35% and a constant term of 3%** achieved

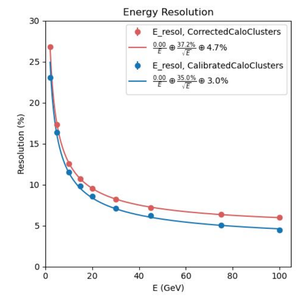

Figure 7. Energy resolution to the single π^-

Conclusions

- Rich detector R&D programme as a part of DRD on Calorimetery (DRD6)
- Allegro detector concept is fully integrated under FCC software
- Goal of the beam test prototype for both Ecal and Hcal in the coming years

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

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