TileCal-like detector

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on behalf of the WP3.2 team

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Overview

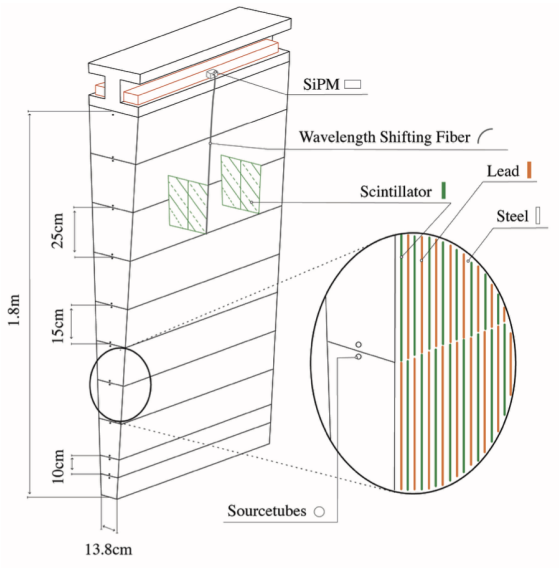
Changes in the person-power: Ana Henriques moved on, Henric Wilkens starting on the task; Michaela Mlynarikova started as FELL (April 2022)

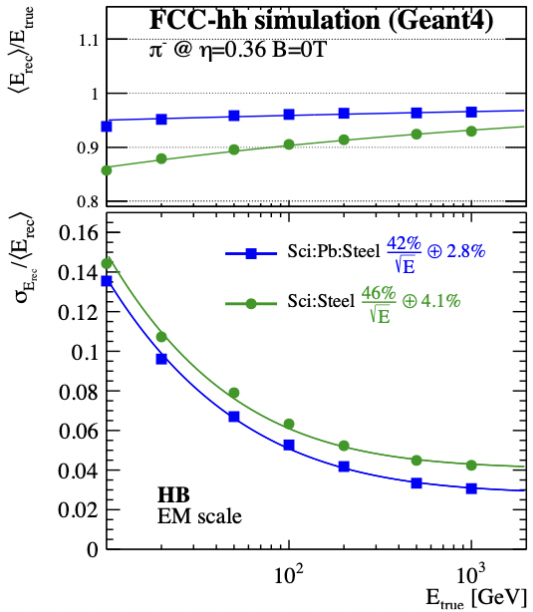
- Performance studies of TileCal-like HCAL for FCC-ee detector concept
- Tests of Sci tiles+WLS fibre+Silicon photomultiplier (SiPM) readout

Previously, HCAL for FCC-hh studies carried out by Coralie Neubuser (2016-2019)

- Design and performance studies of TileCal-like hadronic calorimeter for FCC-hh, summarized in Calorimeters for the FCC-hh

- 5 mm steel absorber plates, alternate w/ 3 mm Sci and 4 mm lead (Pb) tiles
- 128 modules in ϕ, 10 longitudinal layers
- 4× granularity of ATLAS TileCal, single tile readout
- SiPM readout at outer radius

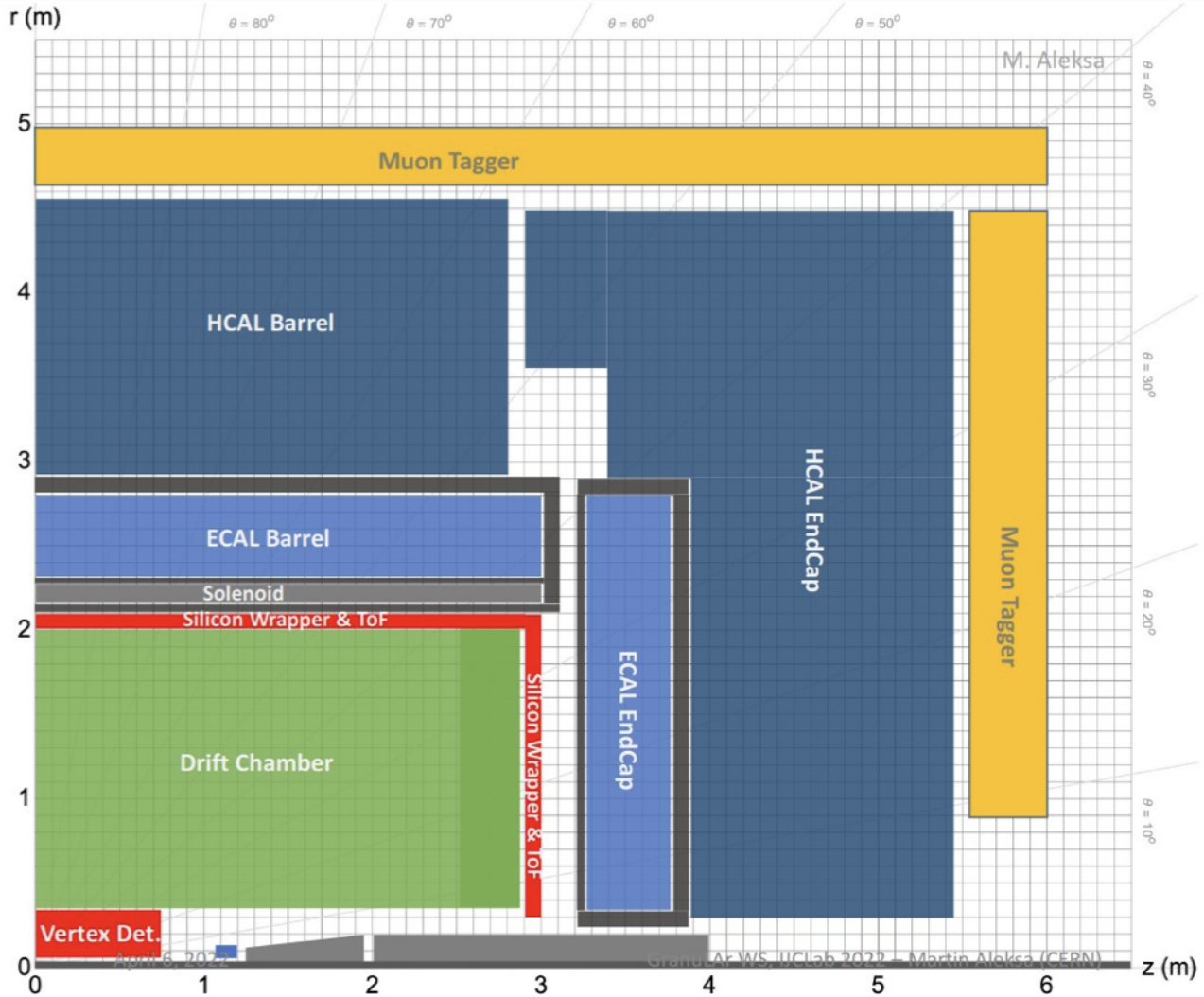




- Optimised absorbers for hadronic performance

FCC-ee detector concept

Full detector concept prepared by Martin



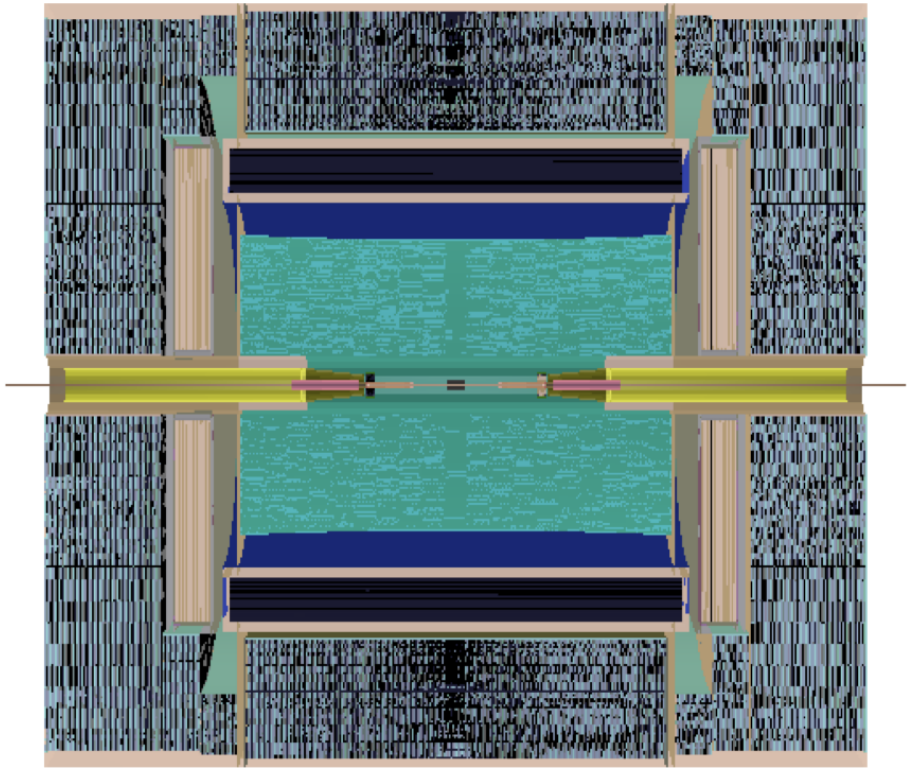
Detector Concept 1

- Vertex Detector:
  - MAPS or DMAPS possibly with timing layer (LGAD)
  - Possibly ALICE 3 like?
- Drift Chamber (±2.5m active?)
- Silicon Wrapper + ToF:
  - MAPS or DMAPS possibly with timing layer (LGAD)
- Solenoid B=2T, sharing cryostat with ECAL
- High Granularity ECAL:
  - Noble liquid + Pb or W
- High Granularity HCAL / Iron Yoke:
  - Scintillator + Iron
    - SiPMs directly on Scintillator or
    - TileCal: WS fibres, SiPMs outside
- Muon Tagger:
  - Drift chambers, RPC, MicroMegas

April 6, 2022 — Granular Ar WS, IJCLab 2022 – Martin Aleksa (CERN) — 14

HCAL for FCC-ee - status and plans

Barrel and EndCaps geometry implemented in the FCC software



HCAL Barrel

- Segmentation in $\eta \times \phi$: 0.024 x 0.025
- Material: Iron + scintillator (sequences of 18 mm)

HCAL Endcaps

- Three disks in z
- Material: Iron + scintillator

We're starting the performance studies and HCAL design optimisation

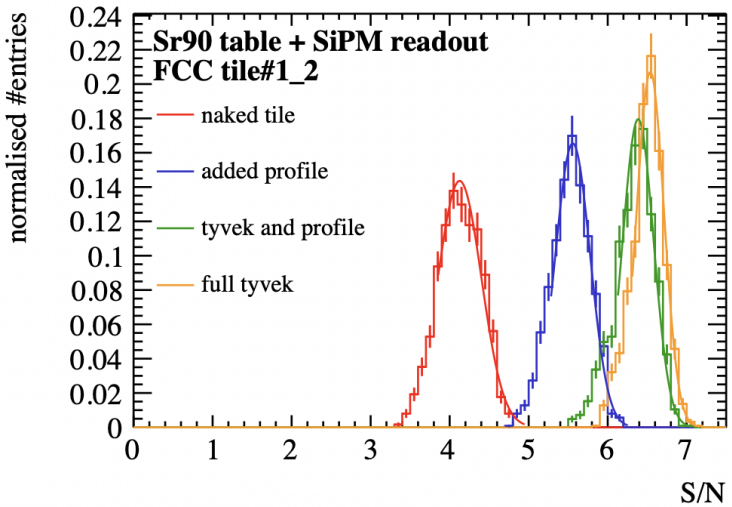
R&D on scintillator material and SiPM technology

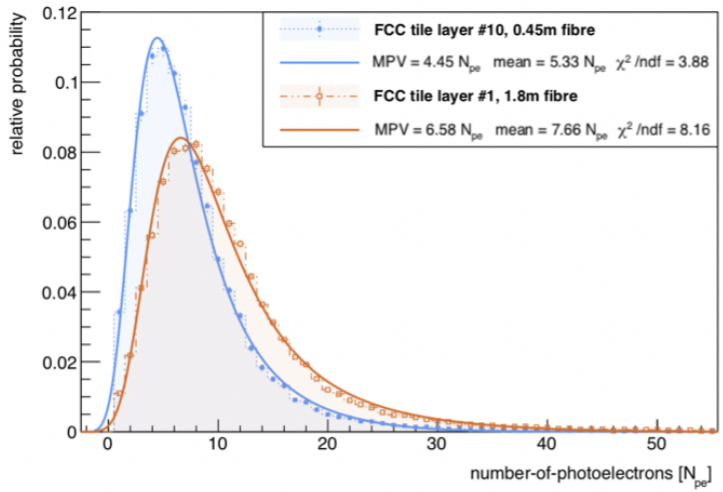
Tests of Sci tiles+WLS fibre+SiPM readout done in b175 by Coralie Neubuser (2016-2019) and Julian Schliwinski (summer 2019)

- Light response study of FCC-hh plastic-scintillator tiles with silicon plotomultipliers (SiPM) readout → studies summarized in Internship report

ATLAS tiles were cut into FCC tile size, various wrapping materials and two SiPM types from Hamamatsu (different pixel pitch, different integration windows) **were tested**

1. Scan with Sr^{90} to study response distributions for different tile configurations
2. Study energy loss distribution of cosmic muons in the smallest and largest FCC-hh tile





Plan to resume these studies and build a small prototype of Tile-like HCAL module