Imperial College London

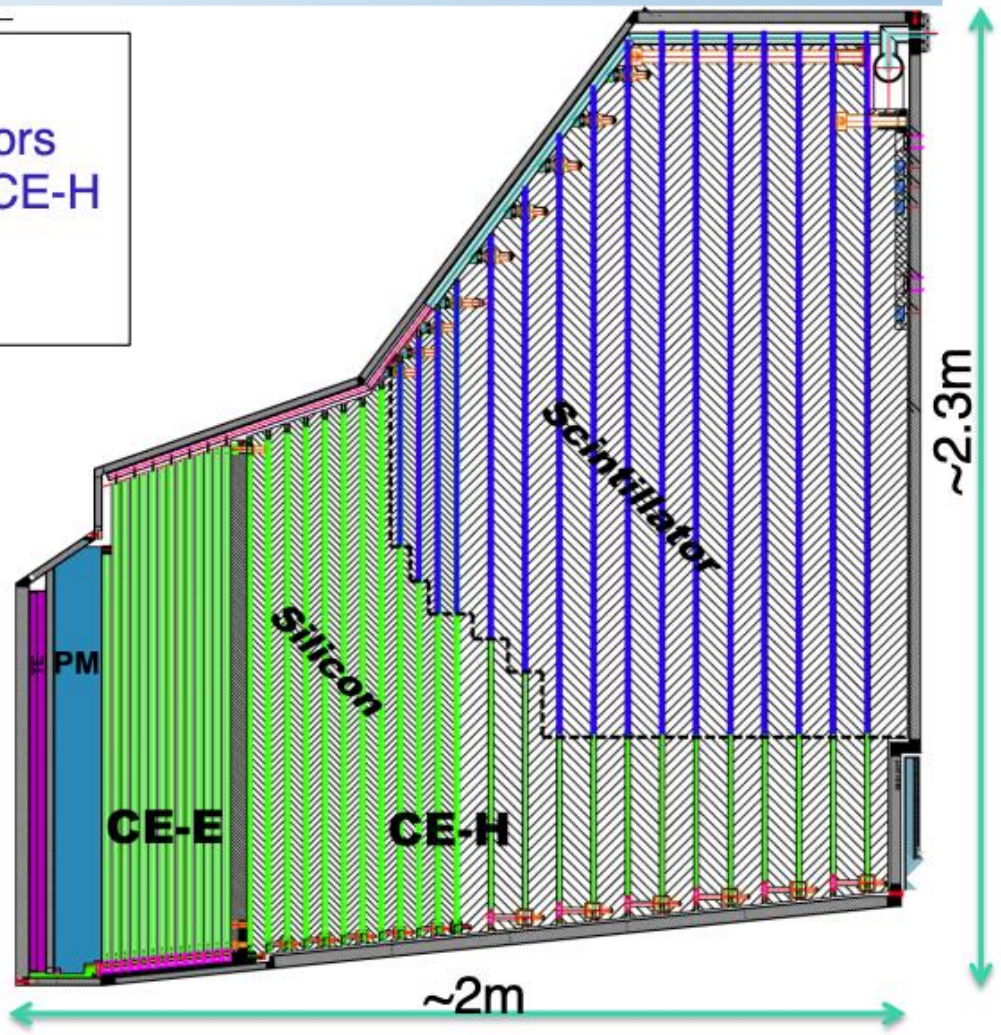
HGCAL in Numbers TDR

Active Elements:

- Hexagonal modules based on Si sensors in CE-E and high-radiation regions of CE-H
- Scintillating tiles with SiPM readout in low-radiation regions of CE-H

Key Parameters:

- HGCAL covers $1.5 < \eta < 3.0$
- **Full system maintained at -30°C**
- **~600m²** of silicon sensors
- **~500m²** of scintillators
- 6M Si channels, 0.5 or 1.1 cm² cell size, 400k scint-tile channels (η–ϕ)
  - Data readout from all layers
  - Trigger readout from alternate layers in CE-E and all in CE-H
- ~28000 Si modules (incl. spares)



Electromagnetic calorimeter (**CE-E**): **Si**, Cu/CuW/Pb absorbers, 28 layers, 26 X_0 & ~1.7λ
Hadronic calorimeter (**CE-H**): **Si** & **scintillator**, steel absorbers, 24 layers, ~9.0λ

Longitudinal Structure in the TDR (baseline)

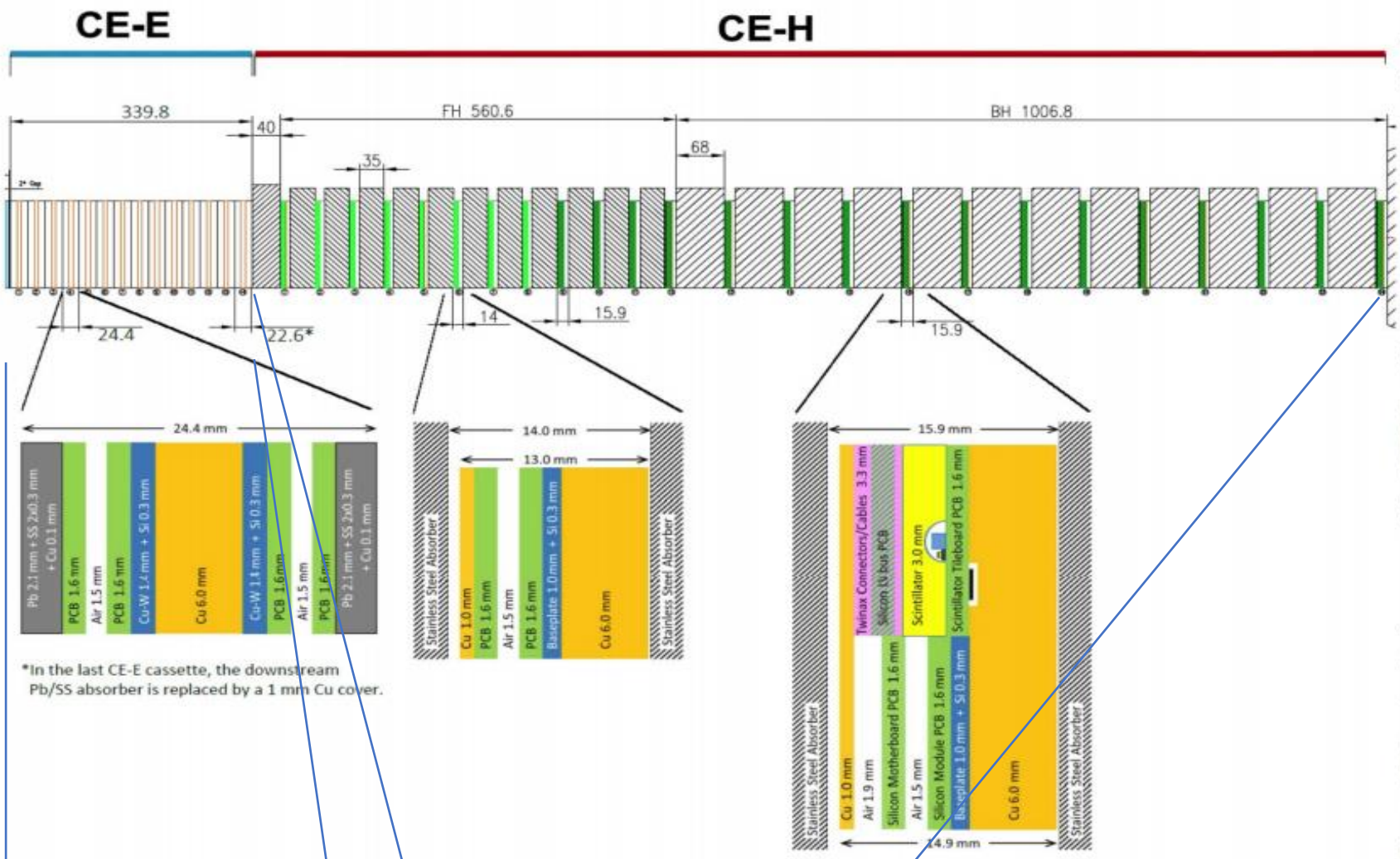


Figure 1.5: Longitudinal structure of the HGCAL, with schematic cross-sections of the three types of cassettes: CE-E cassettes, CE-H silicon sensor cassettes, and CE-H mixed silicon/scintillator cassettes. In the mixed cassettes the cross-hatched region is shared by the scintillator and silicon services in different angular regions.

+75 mm

-93 mm

total

$10.7\ \lambda \rightarrow 9.3\ \lambda = -1.4\ \lambda$??

Recommended new segmentation

CE-E

- 14 cassette layers -- 28 sampling layers (*same as TDR)*
- Standard cassette thickness (envelope) = 29.7 mm (*5.3 mm larger than in TDR*)
  First / last cassette thicknesses (envelopes) = 27.5 / 30.7 mm
- Total thickness (envelope) = 414.6 mm (*75 mm larger than in TDR*)
- 25.3 X_0 (*0.4 X_0 less than in TDR … and 0.1 X_0 less than in TP*)

CE-H

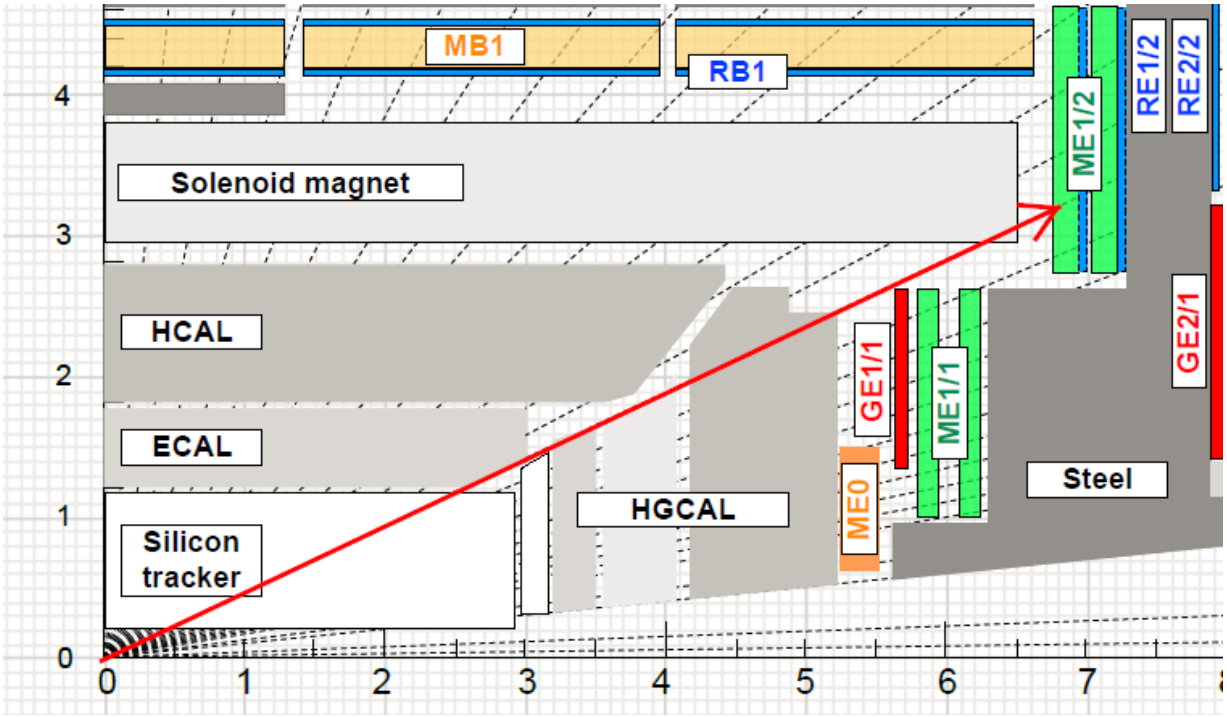
- 12 absorbers 35 mm thick (*same as TDR*)
- 10 absorber layers 66 mm thick (*2 fewer, each 2 mm thinner than TDR*)
- Gaps for cassettes = 19.5 mm (5.5 (3.6) *mm more for first 8 (remaining) layers in TDR*)
- Total thickness (envelope) = 1474 mm (*93 mm less than in TDR*)
- 9.3 λ_I (including CE-E) to the last cassette (*1 λ_I less than in the TDR*)

Specifying envelopes allows CE-E and CE-H designs to proceed independently.

Details in
https://indico.cern.ch/event/774480/contributions/3218302/attachments/1754689/2844984/Cassette Thicknesses-3b20181119.pdf

How the muon system is affected?

About ~1 λ (or more?) means that the probability for pions to cross the calorimeter without hadronic interaction will be 2.7 times higher



We need to understand the background and radiation level (Bril group involded)
Evaluate the performance (in particular trigger)

- new geometry in CMSSW need to be provided centrally→ new samples.
- redo all our performance studies (local recontruction, trigger)
- understand implication on aging.