

CEPC Hadron Calorimeters: layer thickness comparisons

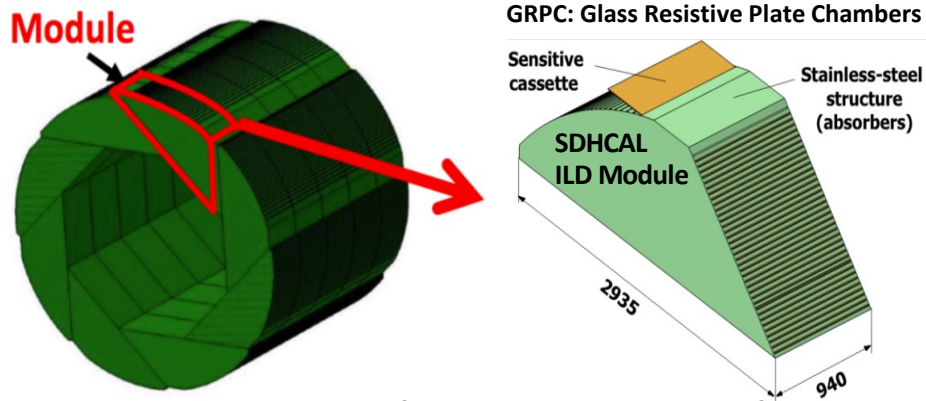
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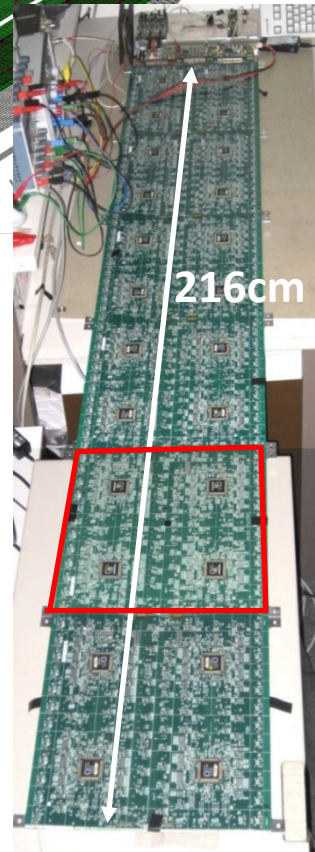
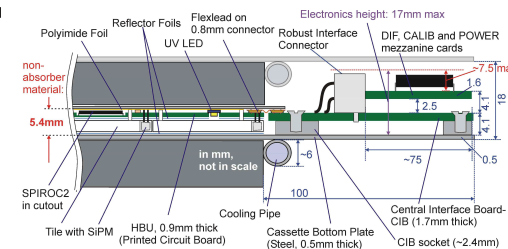
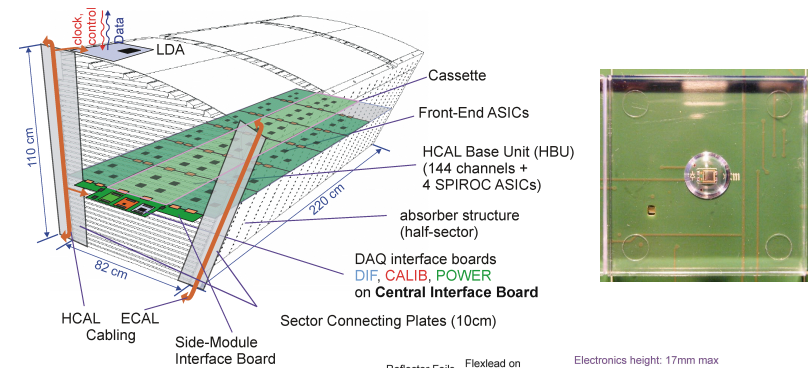
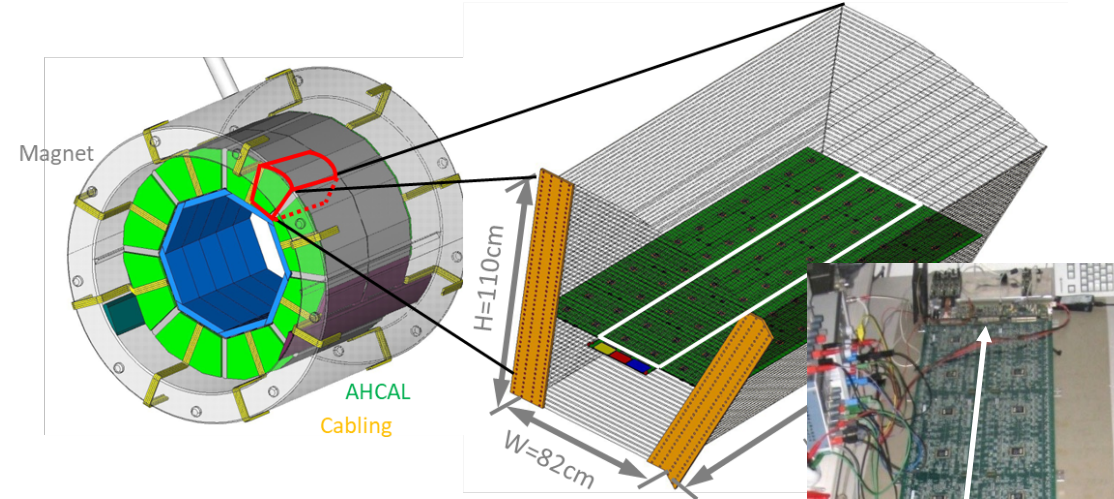
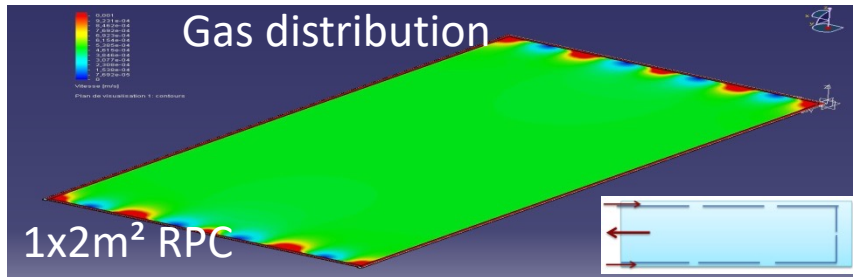
Hadron Calorimeter: two major options

- SDHCAL: glass-RPC option

- AHCAL: scintillator-SiPM option



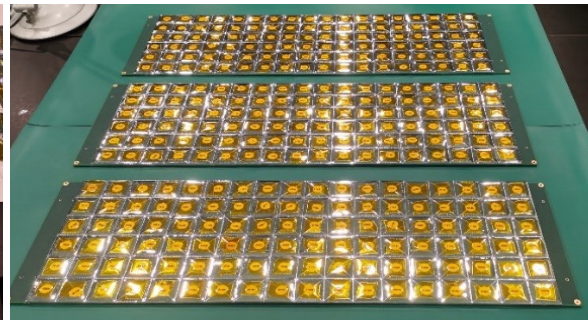
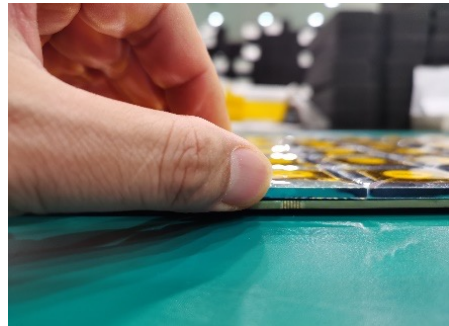
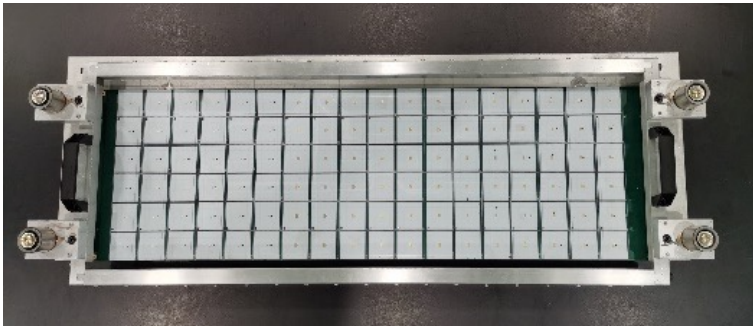
Assembled $1 \times 2 \text{m}^2$ large RPC, $1 \times 0.33 \text{m}^2$ PCBs



CEPC AHCAL prototype



其中闪烁体（包含ESR包装膜）厚度为3.5 mm，读出电子学板是2.5 mm，电子学元器件最大厚度为3 mm，为了防止盒子上盖板与元器件接触，预留1 mm的冗余设计。整个灵敏层盒子内部厚度为10 mm，考虑盒子的底板和上盖板，整个盒子厚度为14 mm。



Projection to the Scintillating Glass HCAL option

Components	CEPC-AHCAL Prototype	Scintillating Glass HCAL
Electronics Components	3mm (max. height) + 1mm (gap)	3mm (max. height) + 1mm (gap)
Readout PCB	2.5 mm	2.5mm
Scintillator Tiles	3mm scintillator + 0.5mm wrapping	10mm glass tile + 0.2mm wrapping
Sensitive Layer	10mm	16.7
Absorber Layer	20mm	13.8
One HCAL Layer	30mm	30.5mm
40-layer HCAL	1200mm	1220mm
48-layer HCAL	1440mm	1464mm

Remarks and personal considerations

- 3mm is majorly for tantalum capacitors (from Yunlong) → can be thinner
- 1mm gap is too large, especially reserved for better insulation → <0.1mm (Kapton)
- 0.5 mm ESR wrapping seems too conservative → 0.2 mm or thinner likely to achieve

HCAL total depth is set to 1470mm after rounding up 1464mm

HCAL options for ILD

Hereby schematics of HCAL designs are summarised, with a focus on thickness estimates

- SDHCAL: glass-RPC option

Also as a baseline option in the CEPC CDR

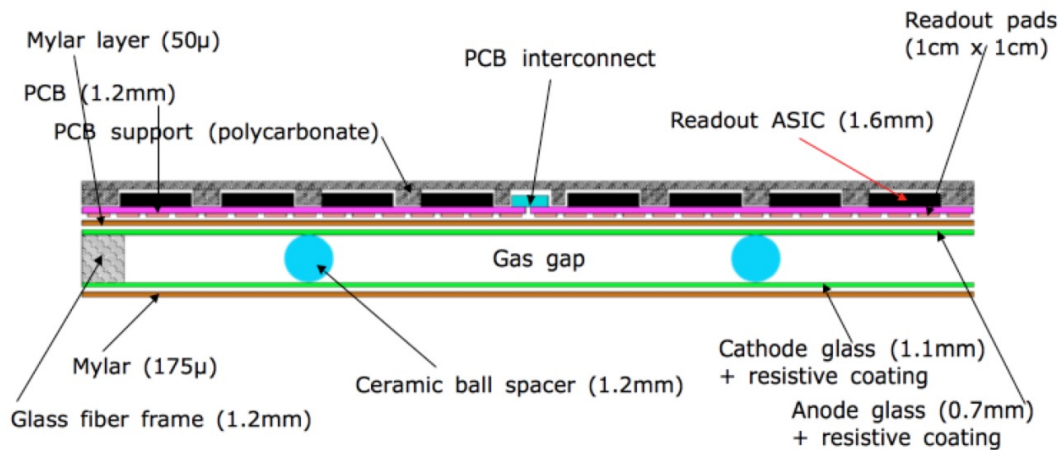


Figure 1. A schematic cross-section of a SDHCAL active layer (not to scale).

One active layer: 6 mm (3mm glass RPC + 3mm electronic board)

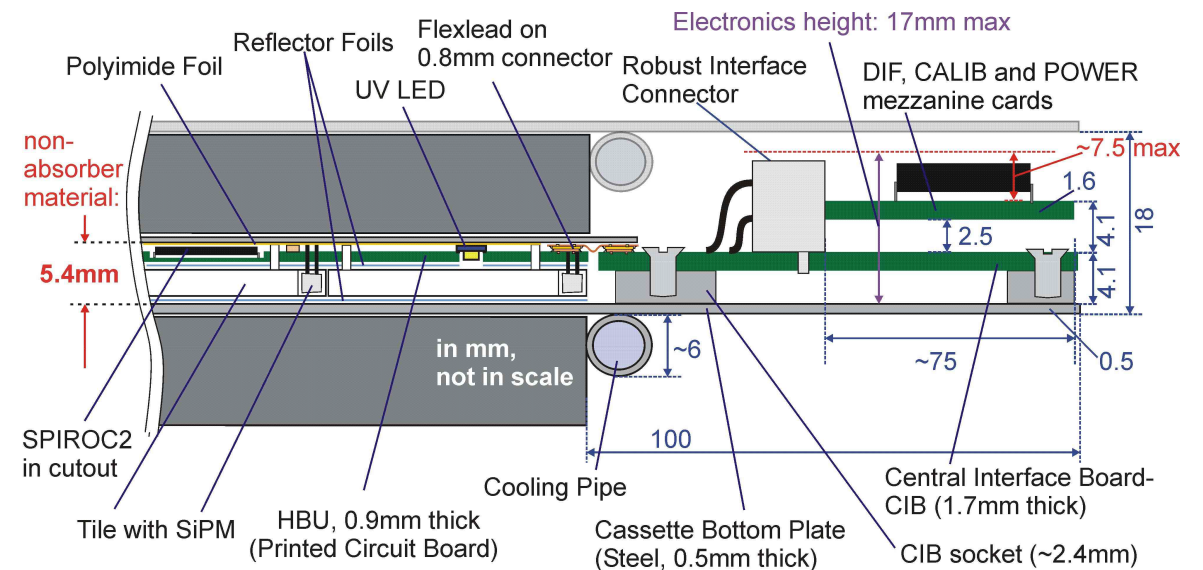
A cassette: two 2.5 mm thick stainless steel walls

The total thickness of a cassette is 11 mm

Ref1: "First results of the CALICE SDHCAL technological prototype"

doi:[10.1088/1748-0221/11/04/P04001](https://doi.org/10.1088/1748-0221/11/04/P04001)

- AHCAL: scintillator-SiPM option



Based on ILC TDR Volume 4

HCAL options for ILC: based on ILC TDR Volume 4

Components	ILD-SDHCAL: RPC + steel	ILD-AHCAL: Scintillator + Steel
Electronics Components	3 mm for PCB + components	2.4 mm for PCB + components
Readout PCB		
Scintillator Tiles	3mm RPC	3mm scintillator + wrapping
Sensitive Layer	6 mm	5.4 mm
Absorber Layer	20 mm	20 mm
One HCAL Layer	26 mm	25.4 mm
40-layer HCAL (<i>note: no such design in ILD; comparison only</i>)	1040 mm	1016mm
48-layer HCAL	1248mm	1220mm