ZDC module discussion

ePIC Far-Forward Weekly Meeting

February 14th, 2023

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Module: 18 pad layers + 2 pixels layers

~16 cm

8 cm

45 cm

Pixel connections

PAD aggregator boards
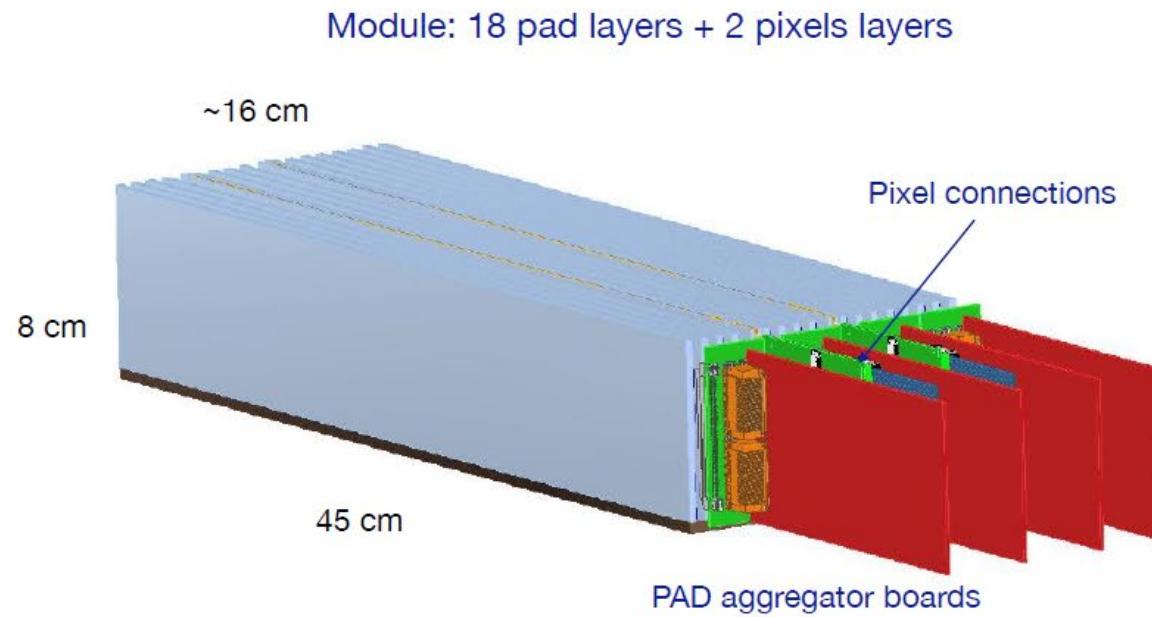
- PAD layers: aggregate groups of 4
- Pixel layers: individual readout

FoCal-E: 22 modules

~16 cm

88cm

90cm

FoCal-E module (5-sensor layers)
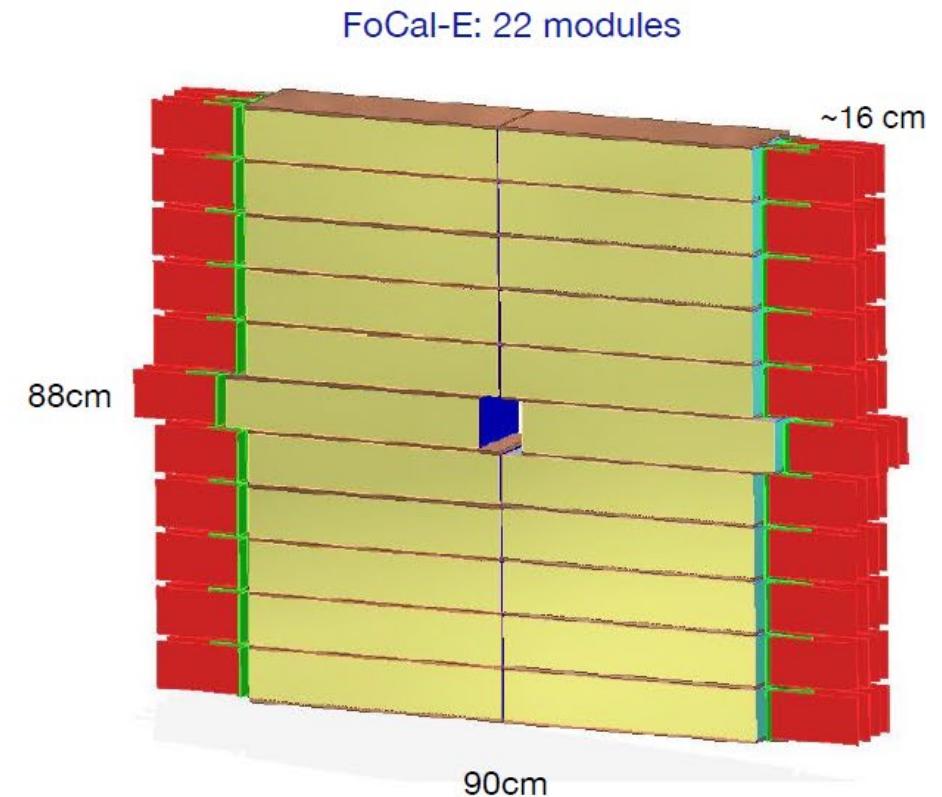
FoCal-E detector made by 22 modules

1) FoCal-E PAD: main sensor (8x9, p-type, 320um)

Hamamatsu S16211-0813

p-sub, 320 um, w/ Al,

1 cm² pad cell size
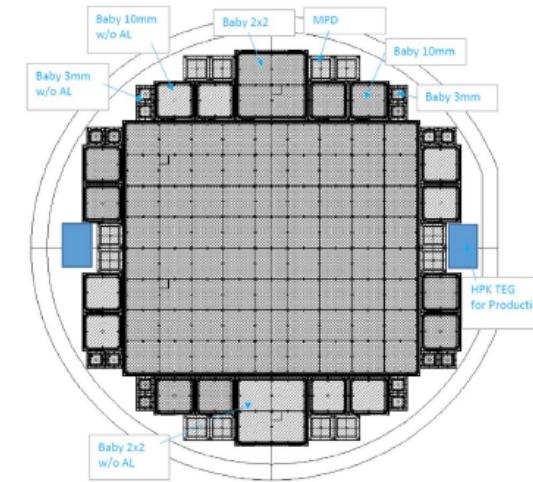
**First time use of p-type for FoCal**

- 8x9 cells + calibration cells (w/Al), produced 30, and delivered.

- Various type of test cells were also produced (next slides).

- More rad. hard than n-type.

- Compatible with HGCROC.

front side (w/ Al)

back side (Au)

(Tsukuba / RIKEN)

FoCal-E Pad sensor produced using Hamamatsu's 6" wafer line

HGCROC description

- 72 channels + 4 channels for common mode subtraction + 2 special calibration channels

- 32b Digital Data continuously stored in 512 length DRAM @40MHz
  - 72 ch. x 32b x 40MHz: **huge data volume**
  - → Only **Local-L1-triggered** data are read out

- Idle packet is continuously sent out when no L1-trigger is activated

- The data processing for the trigger "information" path
  - 32b: 4b header + 7b x 4
  - Sum of 4 or **9 channels** depending on the sensor

[A] HGCROC datasheet from OMEGA group
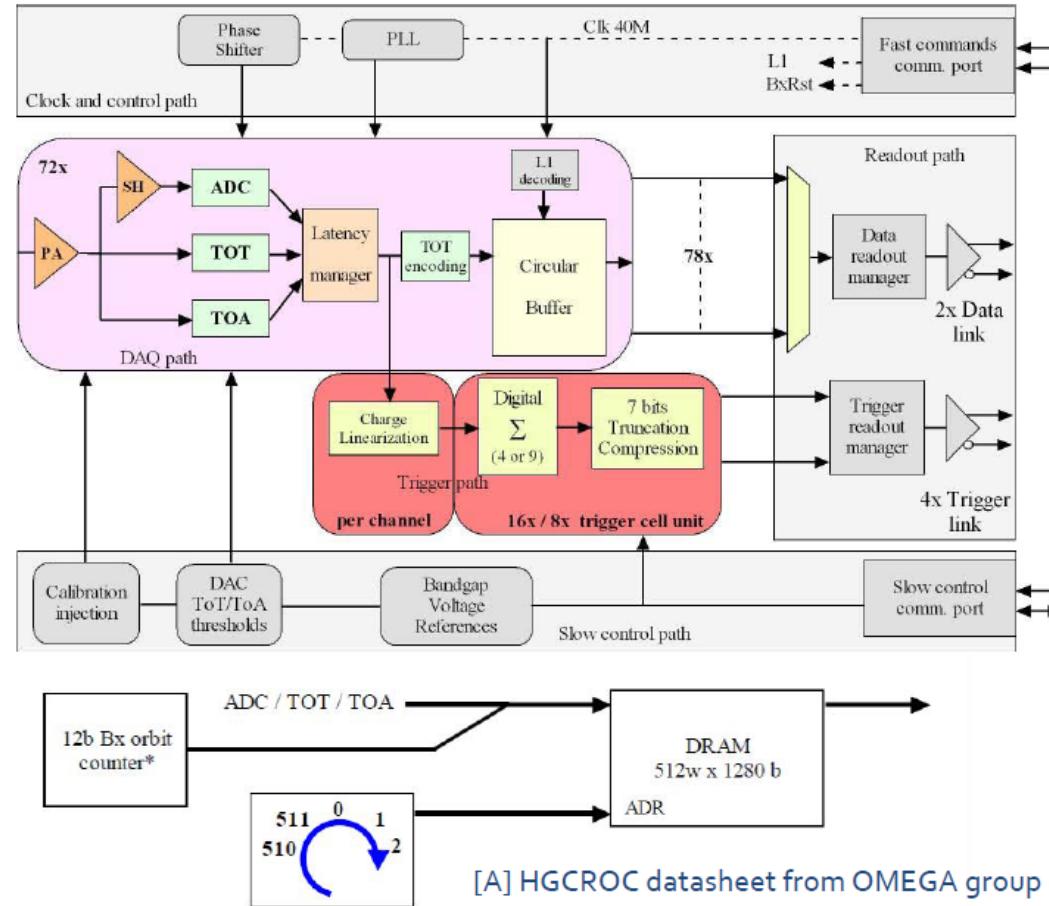
ADC (10 bits), TOT (12 bits), TOA (10 bits)

FoCal-E PAD readout
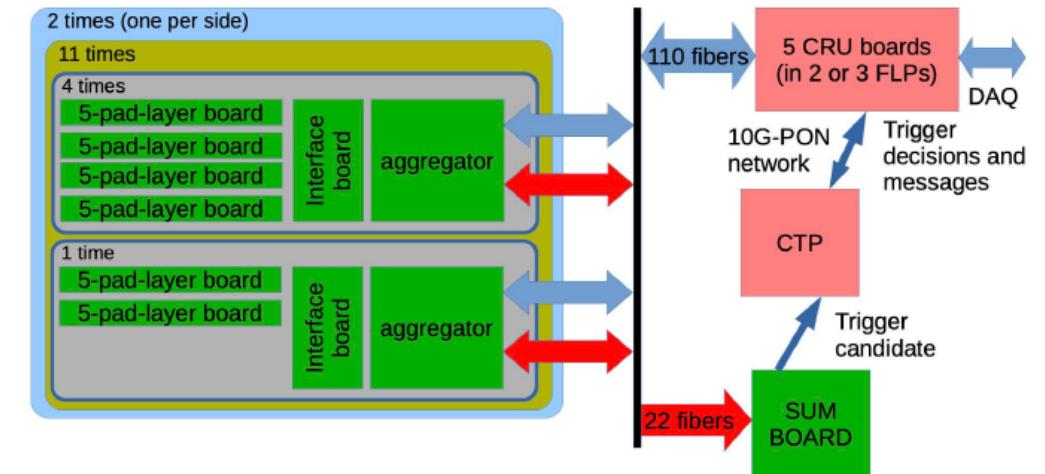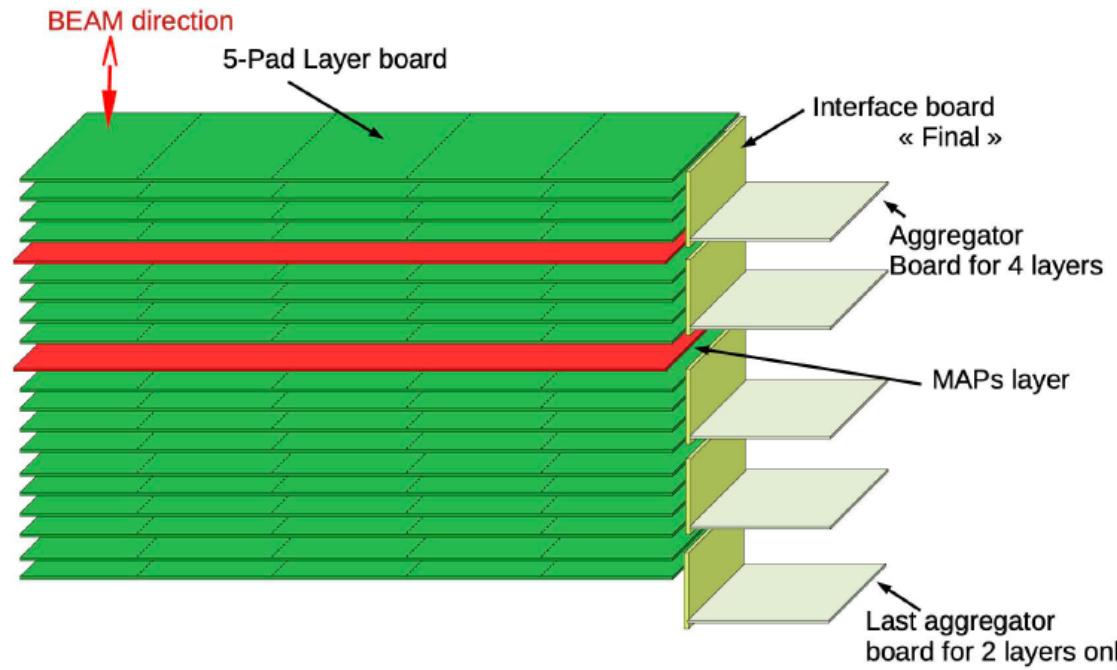
- 5-pad-layer PCB for 5 HGCROCs, each HGCROC connects to one PAD sensor (72 cells, 4 CMN, 2 calib.)

- Aggregator board to efficiently readout out data from 4 boards

- Sum board to provide trigger decision based on parts of the shower (under consideration)

(Grenoble)

4 layers readout by 1 readout board

W/Si EMCal

- This is an design example using 8cm x 9cm ALICE-FoCal-E Pad Sensor
  - 1 pad = 1cm x 1cm
  - 1 sensor = 9 cm x 8cm = 72 pads
  - 1 tower = 20 layers
  - 1 module = 7 towers
  - ZDC W/Si = 7 modules
- 1 sensor is readout by 1 HGCROC (72 ch)
- 3 layers readout by 1 readout board in this design
- Similar design possible for the Pb/Si HCal

Readout boards

9cm

63cm

8cm

20 layer W/Si

1 W/Si module

Readout boards

63cm

56cm

20 layer W/Si

W/Si EMCal
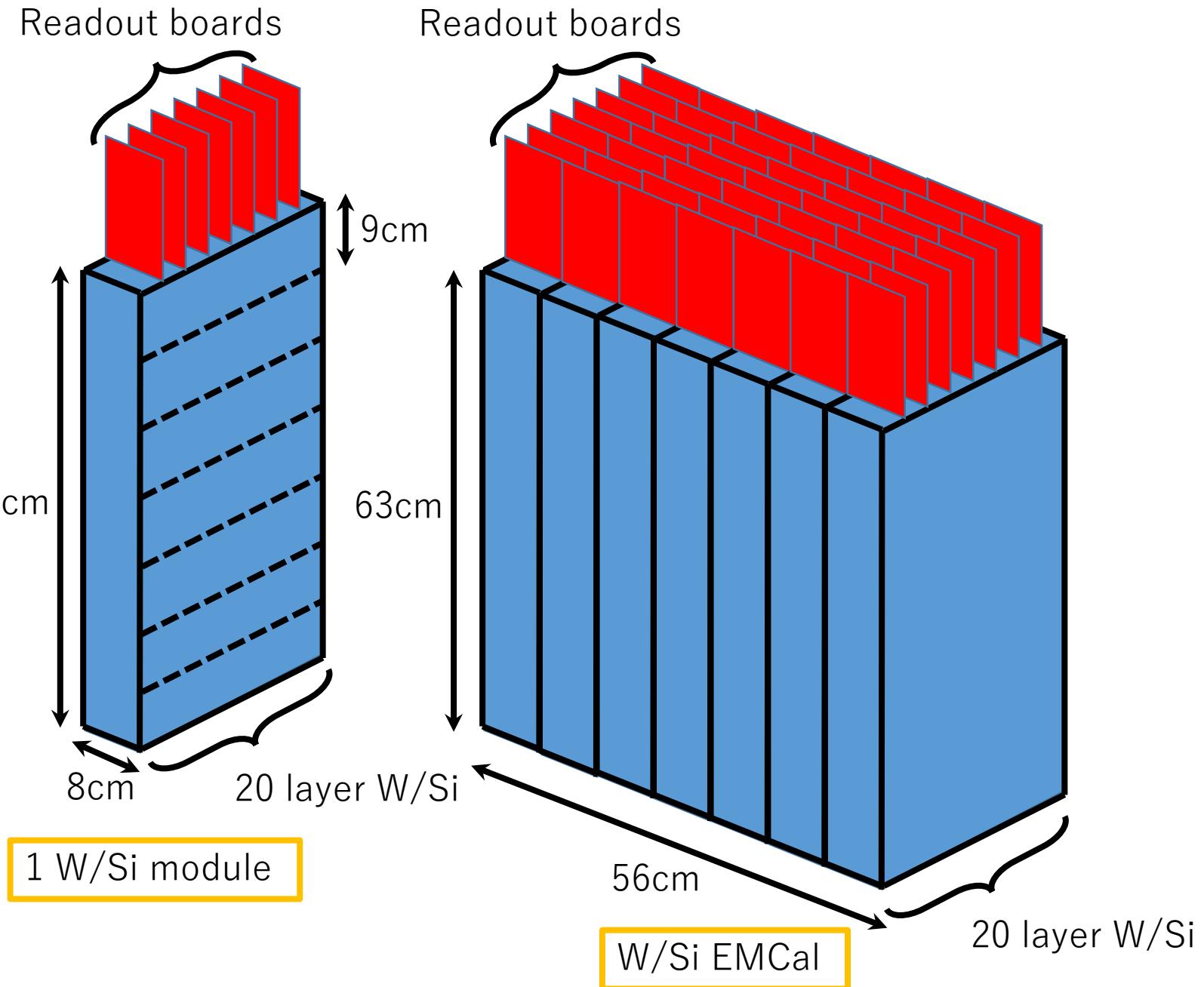
Possible issues

- Readout may need both top side and bottom side
  - Signal transfer may be difficult with 7-sensor design
- Size of the detector 63cm x 56cm instead of 60cm x 60cm
  - Pad sensor size may be optimized
- Dynamic range adjustment with HGCROC (or other ASIC)