fFEX Overview

Julian Fischer
14/10/2020

Motivation

- fFEX new addition to L0Calo (eFEX, gFEX, jFEX) trigger system
  - EM trigger ($|\eta|>2.5$): interesting for fwd. electrons (e.g. $\sin^2\theta_W$)
  - Jet trigger ($|\eta|>3.2$): interesting e.g. for VBF processes
- Advantage: finer granularity than jFEX (cell level vs. supercell level)

Specifications & Input

- Receiving **full** detector granularity (longitudinal + transversal) in |η|>2.5
  - 0.1 x 0.1 (ηxϕ) EMEC inner wheel, 2 layers
  - 0.2 x 0.2 (ηxϕ) HEC, 4 layers
  - Irregular in FCAL (x-y geometry), 3 layers
- First robust SLW-like EM algorithms studied (Link)

Specifications & Input

EM trigger (|η|>2.5)

- Baseline needs: energy & isolation (em./had.) calculation
  - Calculation of more sophisticated variables conceivable
- Efficient EM trigger needing ‘environment’ below |η|<2.5
  - Potential lower limit at |η|=2.4-2.2 (to be studied in detail)

Jet trigger (|η|>3.2)

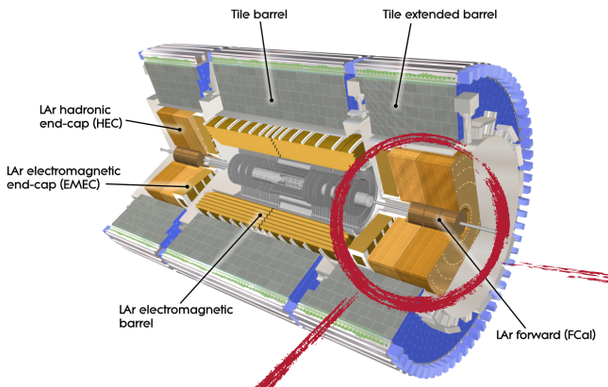
- Baseline needs similar: Calculation of appropriate energy criteria
- Precise method to be studied
  - Starting point similar to Phase I, but cells instead of supercells
- Flexibility in jet definition (and jet size) - possible due to "environment" needed for EM trigger

Specifications & Input

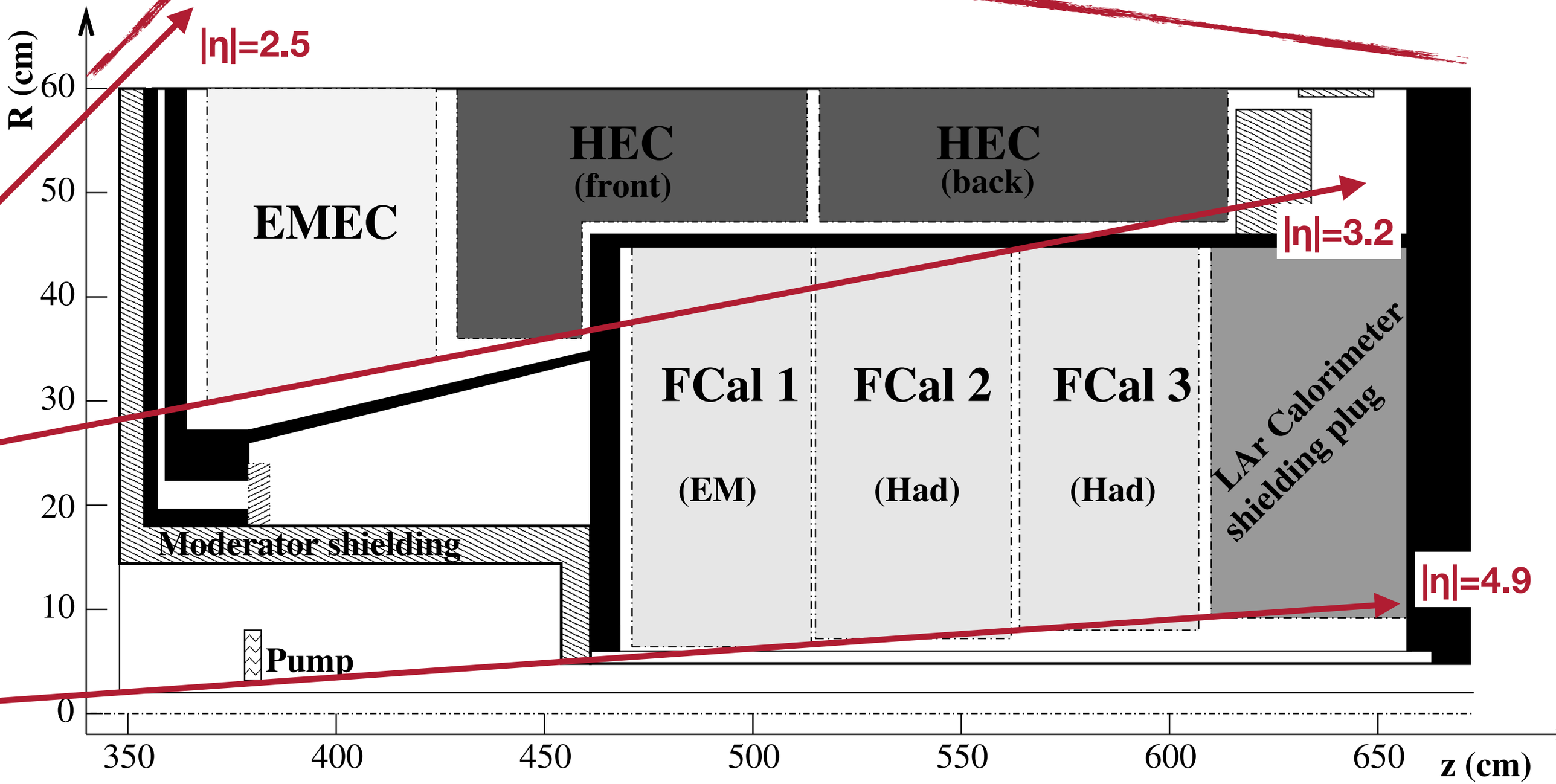
- Two modules planned for fFEX (one each side)
- For efficient algorithms from |η|=2.5 information in |η|<2.5 needed
- Number of fibres per module needed* (with upstream duplication) for full granularity |η|>2.5 (+ summation to 0.1x0.1 (ηxϕ) for 2.2<|η|<2.5): **246**
- Using jFEX-inspired design with 4 FPGAs (each covering $\pi/2$ and 2.5<|η|<4.9)
  - Assuming constant no. of fibres per $\pi/2$
  - 62 fibres/FPGA (+ no inter-FPGA communication needed)

*courtesy A. Straessner

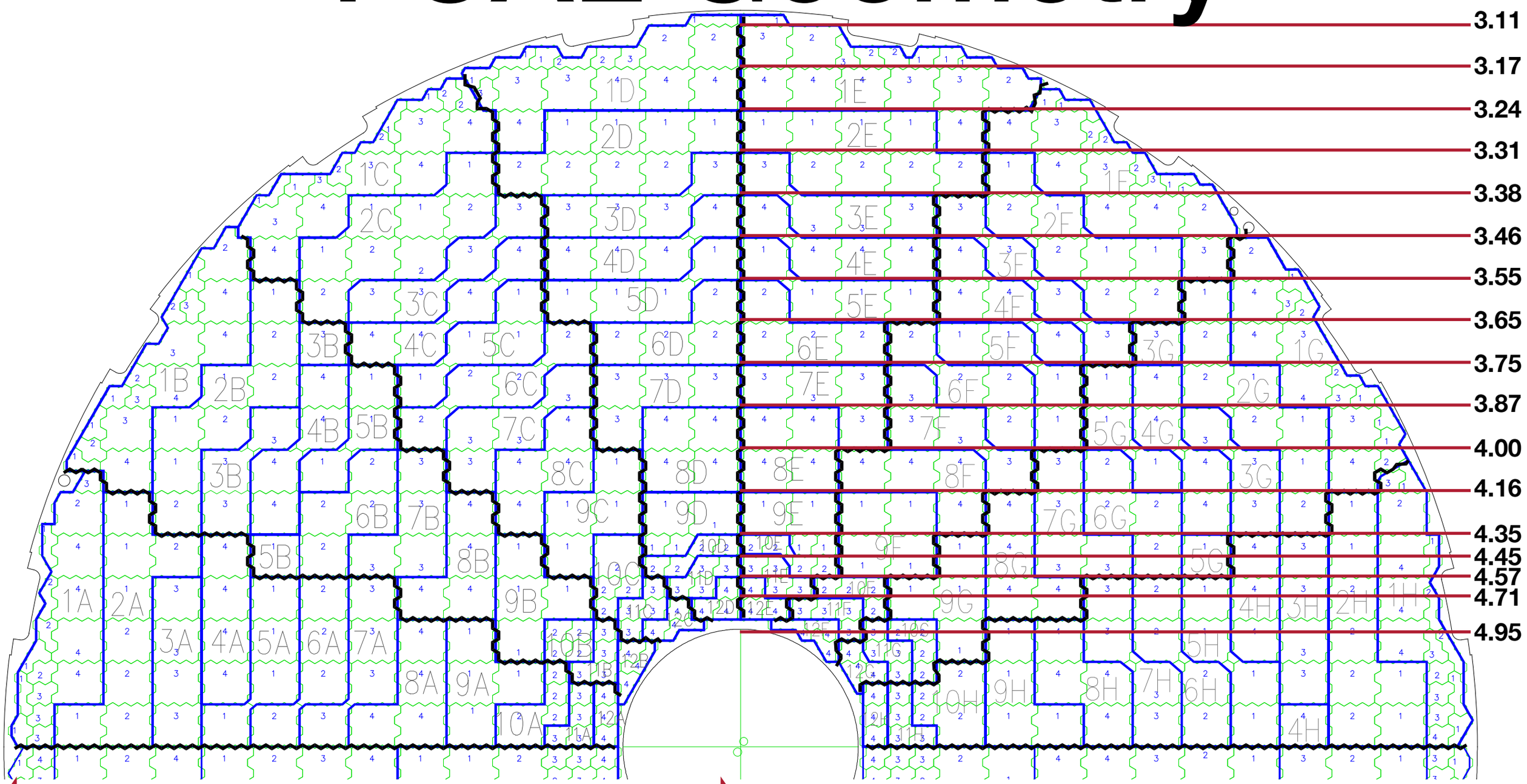
Backup


Tile barrel
Tile extended barrel
LAr hadronic
end-cap (HEC)
LAr electromagnetic
end-cap (EMEC)
LAr electromagnetic
barrel
LAr forward (FCal)

ATLAS


|η|=2.5
|η|=3.2
|η|=4.9
R (cm)
z (cm)
EMEC
HEC
(front)
HEC
(back)
FCal 1
(EM)
FCal 2
(Had)
FCal 3
(Had)
LAr Calorimeter
shielding plug
Moderator shielding
Pump
0
10
20
30
40
50
60
350
400
450
500
550
600
650

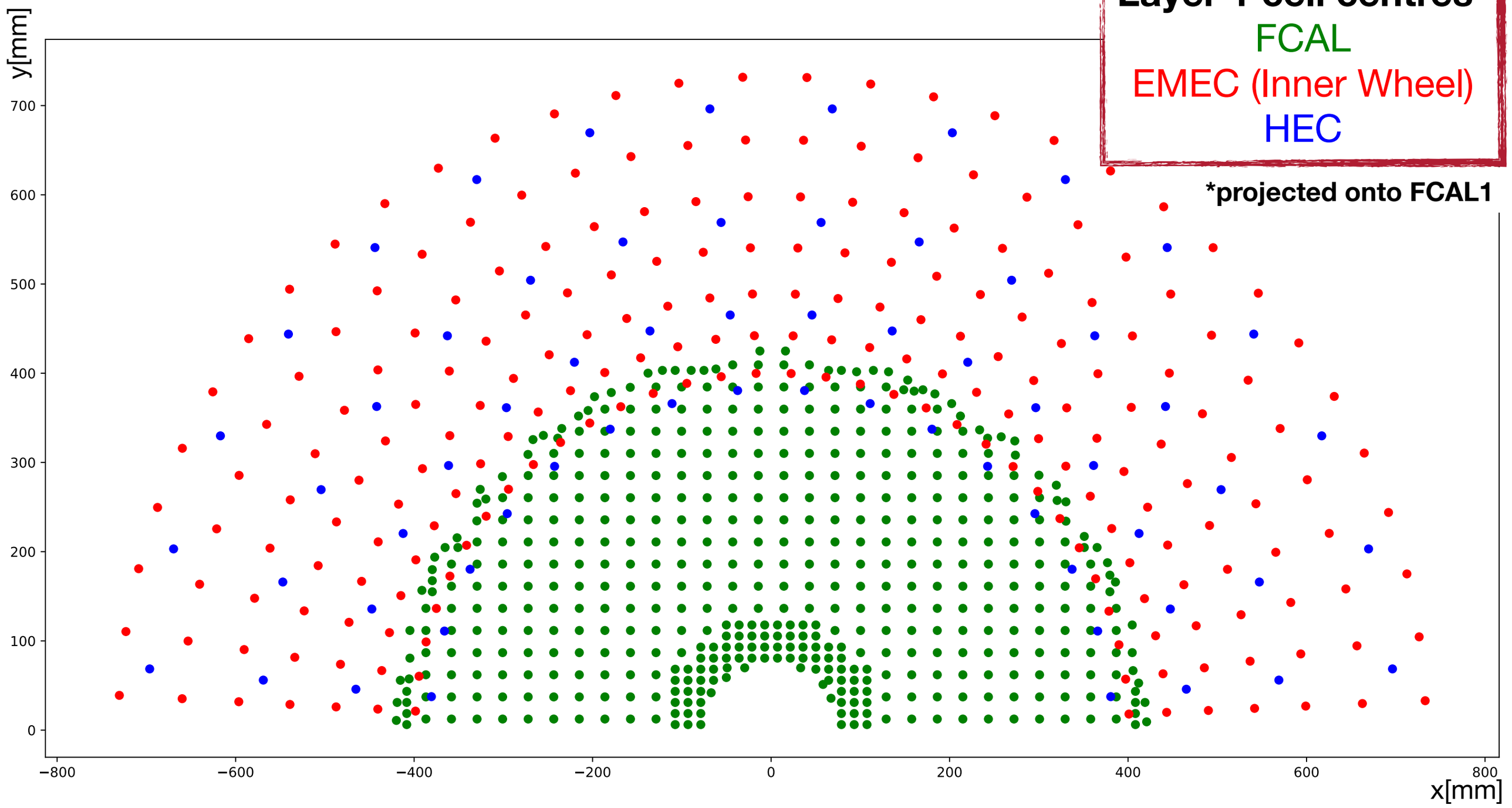
FCAL Geometry



One cell: 3.0 cm x 2.6 cm

FCAL1

Geometry


Layer 1 cell centres*
FCAL
EMEC (Inner Wheel)
HEC
*projected onto FCAL1
y[mm]
x[mm]
700
600
500
400
300
200
100
0
−800
−600
−400
−200
0
200
400
600
800