Status update of nHCal

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Operational Programme Research,
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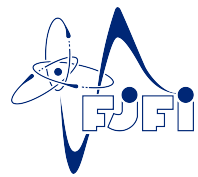

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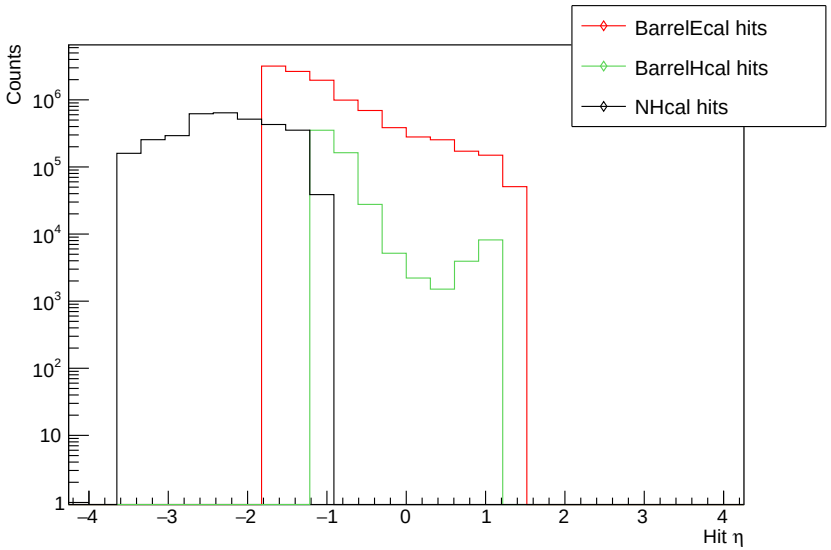
Outline

Status update

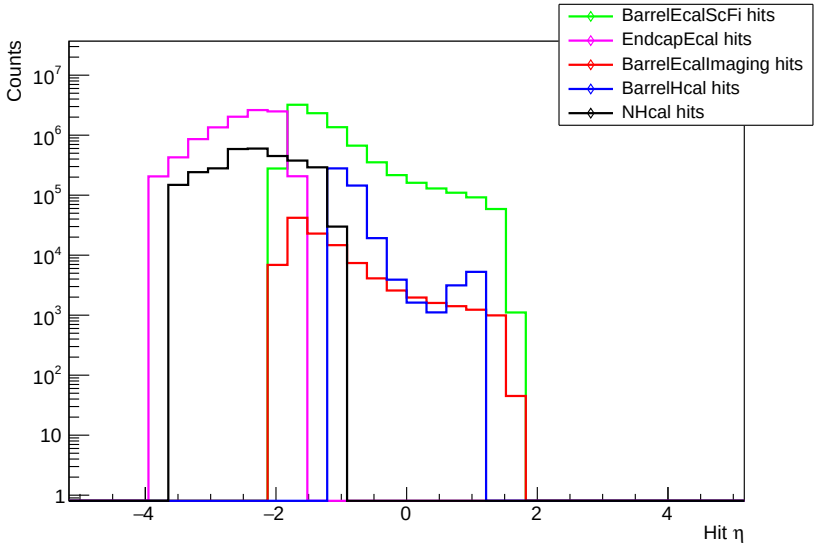
- With help of Alexander we prepared a WBS excel sheet and cost estimates
  - Used existing estimates and followed example of LFHCAL
  - Plan to unify electronics between nHCal an LFHCAL
- Looking for more people and institutions to join DSC.
  - Started discussions with potential groups
  - Maybe share work with LFHCAL group?
  - DSTC needed for nHCal
- Work in progress on position resolution study using combined backward HCal and EMCal (needs check before presenting)
- Work in progress on study of material an acceptance overlap between barrel and backward HCal and EMCal
- Need coordination on magnetic field interference from solenoid

Backward vs. barrel acceptance

Arches

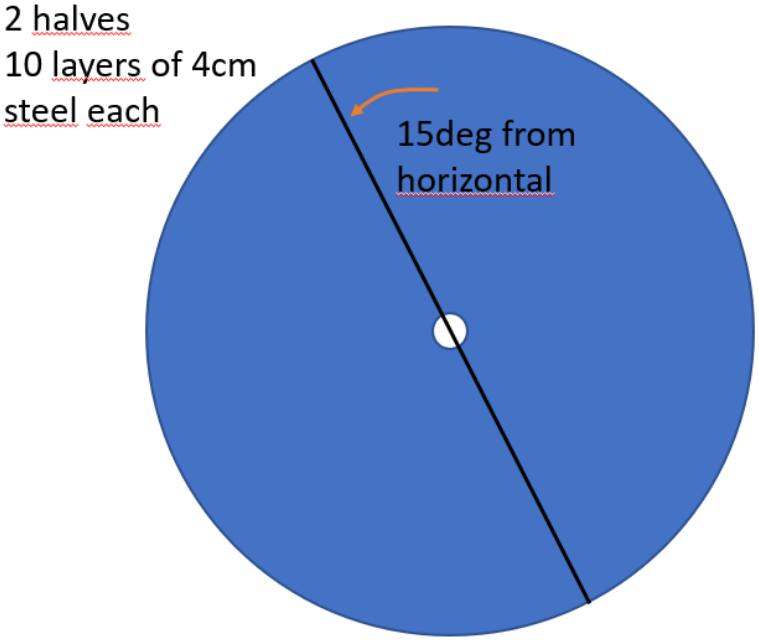


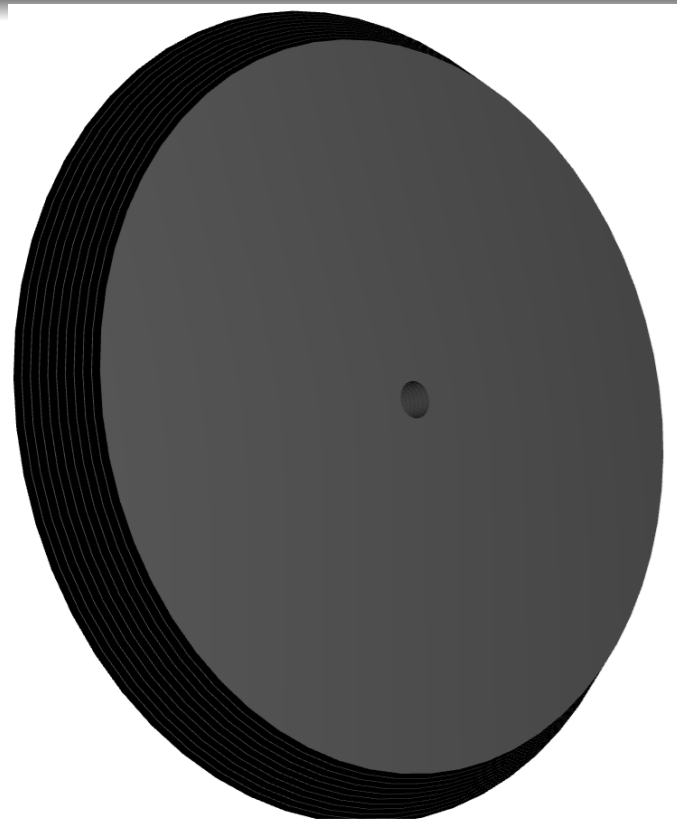
Brycecanyon



- Checked for both Arches and Brycecanyon with simulated hits from $p = 1\,\mathrm{GeV}$ neutrons
- No visible gap for both

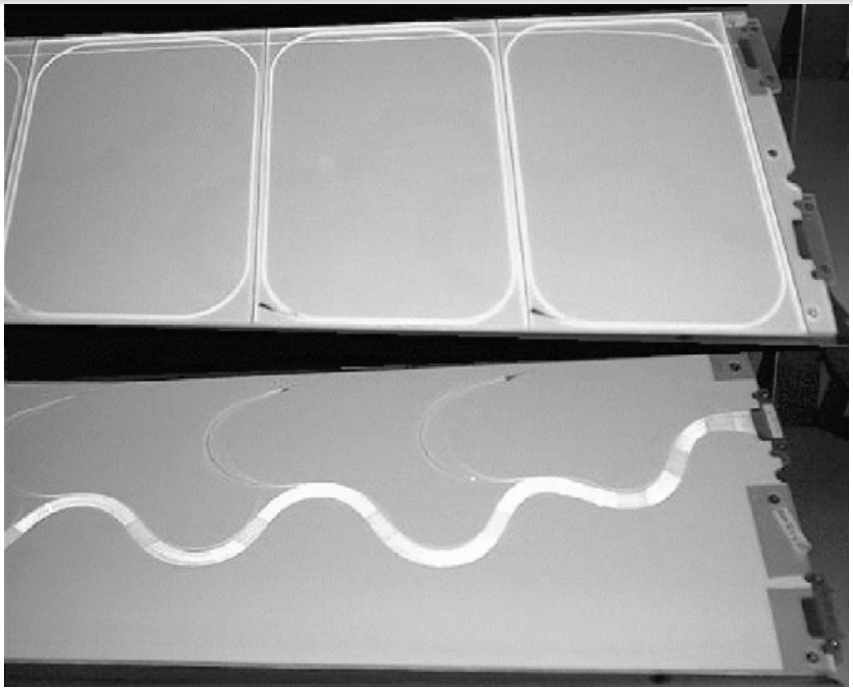
Steel assembly

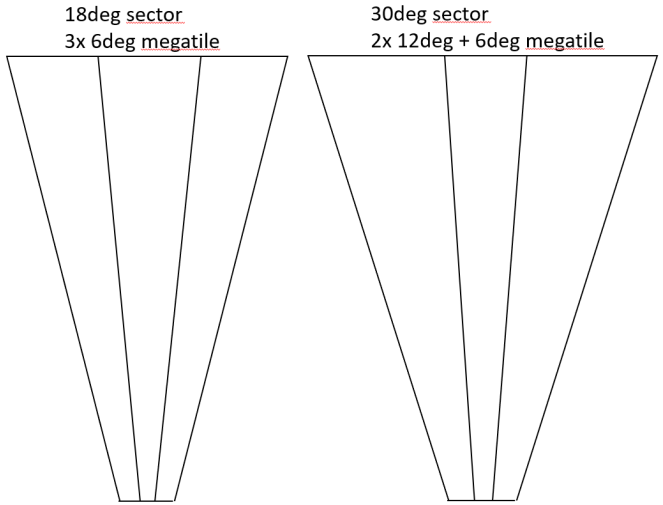




- Follows example of STAR EEMC
  - `https://doi.org/10.1016/S0168-9002(02)01971-X`
- Mechanical engineer at BNL will be available to partly work on the design (including tile mounts) starting in May
- Pushed cradle design to CD-3A
- Cost assumed at $20 \times 60k\$$
  - assumed no change of cost when extending inner radius to $12.4\,\mathrm{cm}$ from $19\,\mathrm{cm}$ or $70\,\mathrm{cm}$
- 2 options:
  - Cylindrical shape with a constant radii $r_{min} = 12.4\,\mathrm{cm}$ and $r_{max} = 275\,\mathrm{cm}$
  - Projective shape with $r_{min} = 12.4\,\mathrm{cm}$ and $r_{max} = 275\,\mathrm{cm}$ (each layer has different shape and extends outwards)

Existing STAR EEMC megatiles



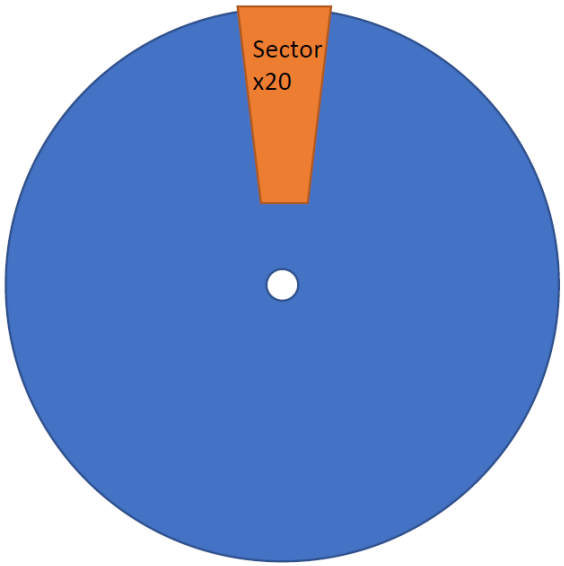


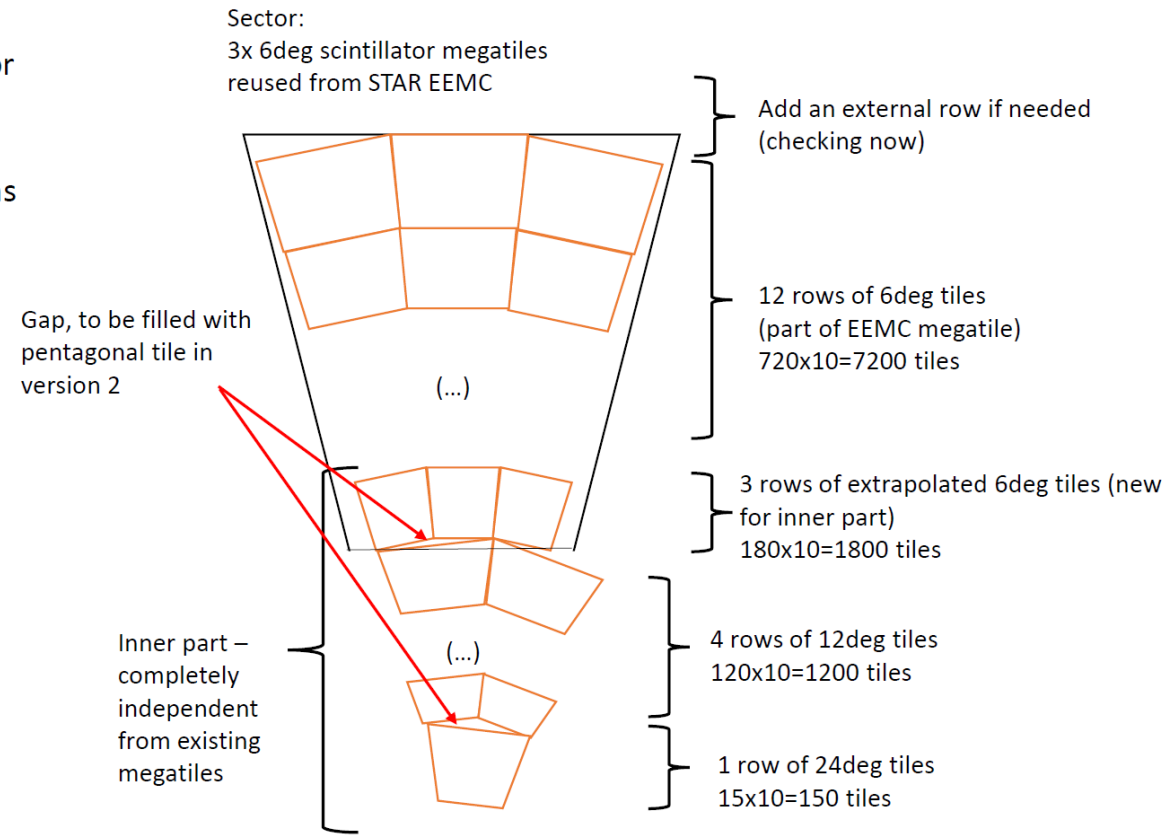
- STAR EEMC 30deg sector is made of 2x outer 12deg megatiles and 6deg "keystone" megatile
  - Each megatile has 12 tiles
  - Can 12deg megatile be cut into 2x 6deg megatiles?
- Option 2: Make 18deg sector out of 3x 6deg megatiles
  - Are megatiles the same shape? Any technical drawings available?
- Tiles are optically isolated via machined isolation grooves (follow the same principle for new extended tiles)
- WLS fibers attached in σ-shaped grooves, leading optical signal to the back of the megatile and in the outer direction
- May rotate each layer by a small angle so that gaps between the tiles are covered

Options for sector/tile arrangement - version 1

Layout version 1 – implemented now

1. 3 EEMC megatiles per outer sector
2. Independent inner part with tiles merged 4->2->1
3. Triangular gap between transitions





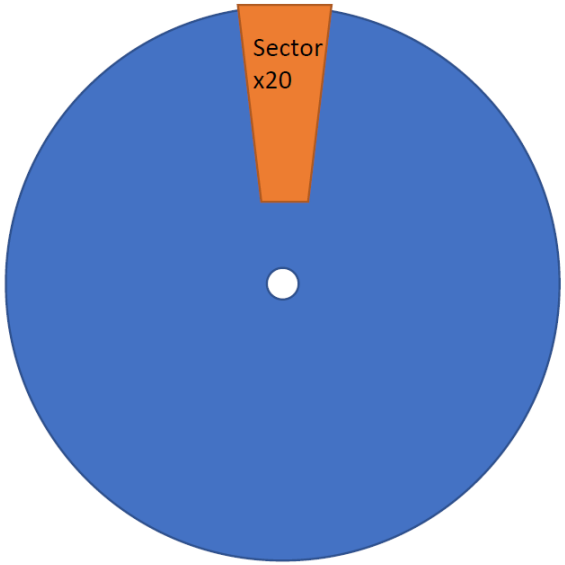
Total tiles:
7200 existing ones + 3150 inner tiles = 10350 tiles
8 rows x 10 layers = 80 different shapes of new tiles to be manufactured

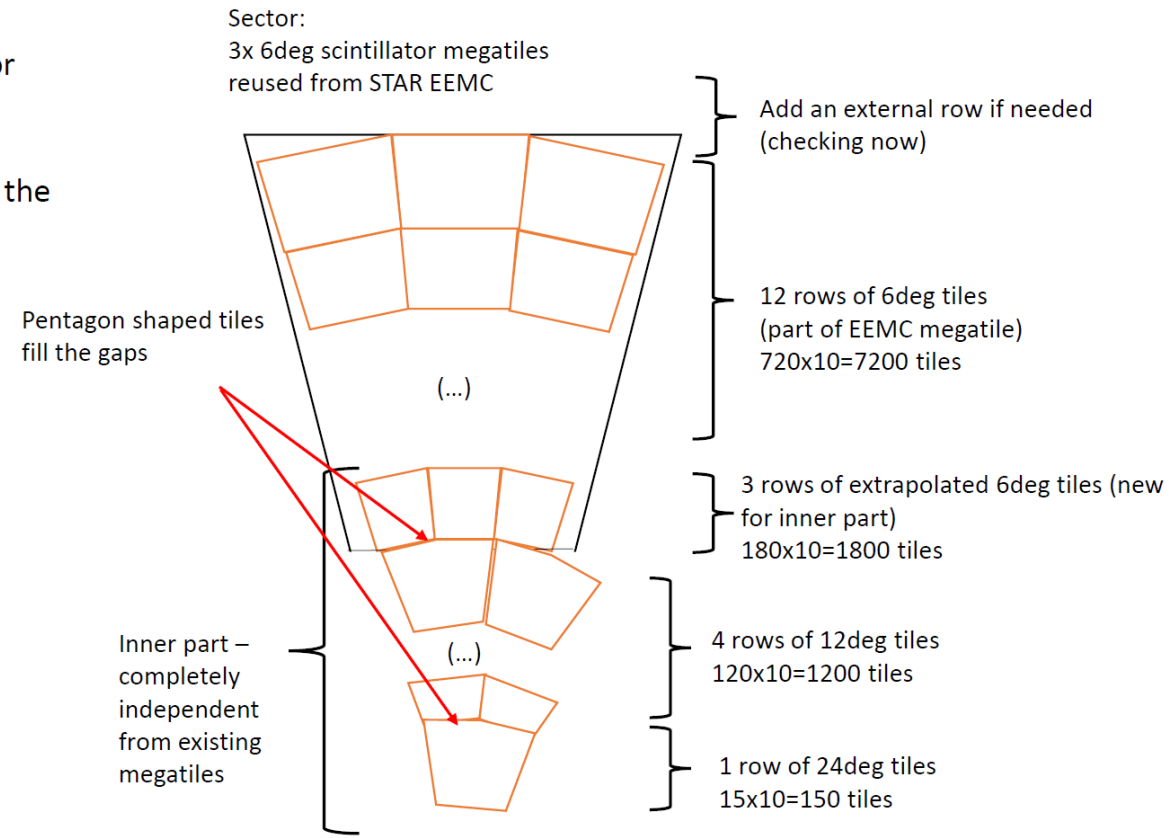
1

Options for sector/tile arrangement - version 2

Layout version 2 – improved version

1. 3 EEMC megatiles per outer sector
2. Independent inner part with tiles merged 4->2->1
3. Pentagon-shaped tiles used to fill the gaps





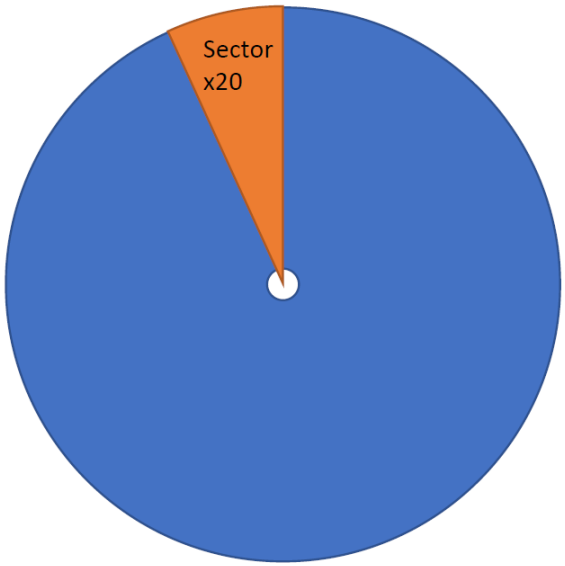
Total tiles:
7200 existing ones + 3150 inner tiles = 10350 tiles
8 rows x 10 layers = 80 different shapes of new tiles to be manufactured

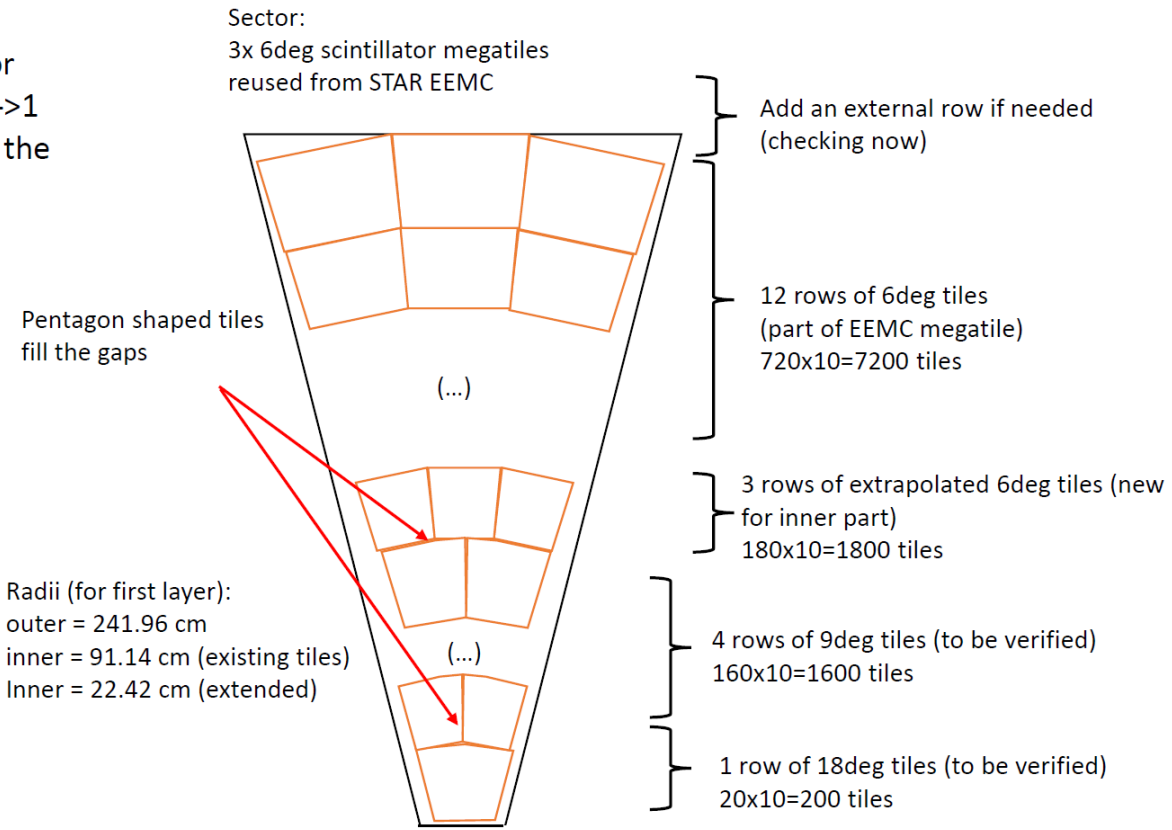
2

Options for sector/tile arrangement - version 3

Layout version 3 – full length sector

1. 3 EEMC megatiles per outer sector
2. Inner part with tiles merged 3->2->1
3. Pentagon-shaped tiles used to fill the gaps

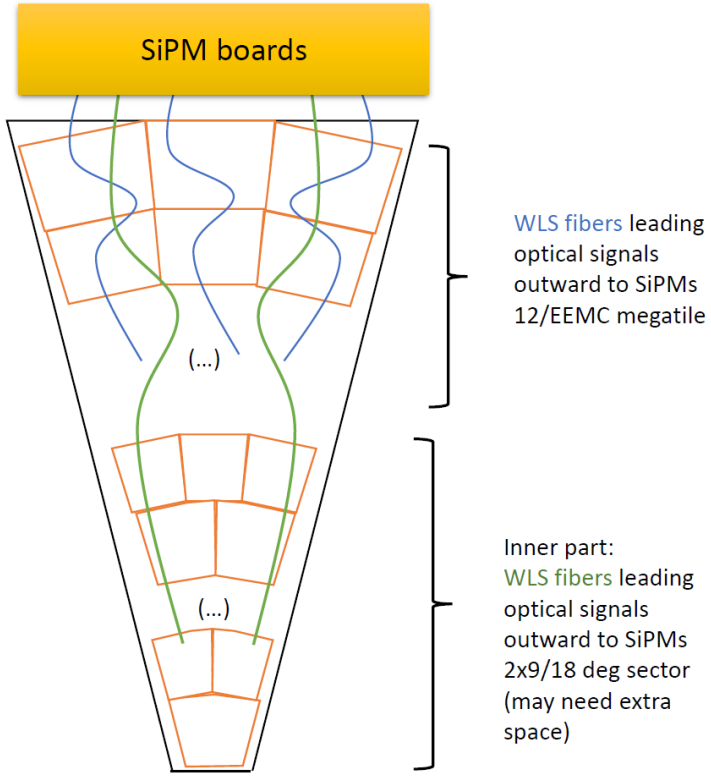




Total tiles:
7200 existing ones + 3600 inner tiles = 10800 tiles
10 types x 10 layers = 100 different shapes of new tiles to be manufactured

3

Readout and electronics



- WLS fibers lead optical signal to SiPM boards (preferably of equal length)
  - 12 SiPM (S14160-1315PS) per board - corresponding to existing megatile
    - `https://www.hamamatsu.com/eu/en/product/optical-sensors/mppc/mppc_mppc-array/S14160-1315PS.html`
  - Inner part: 18 tiles, 9 per board (2 boards)
- 2 options for mounting FEEs:
  - Outside, parallel to each layer (covered by material from barrel)
  - Behind nHCal (covered by less material, need longer fibers)

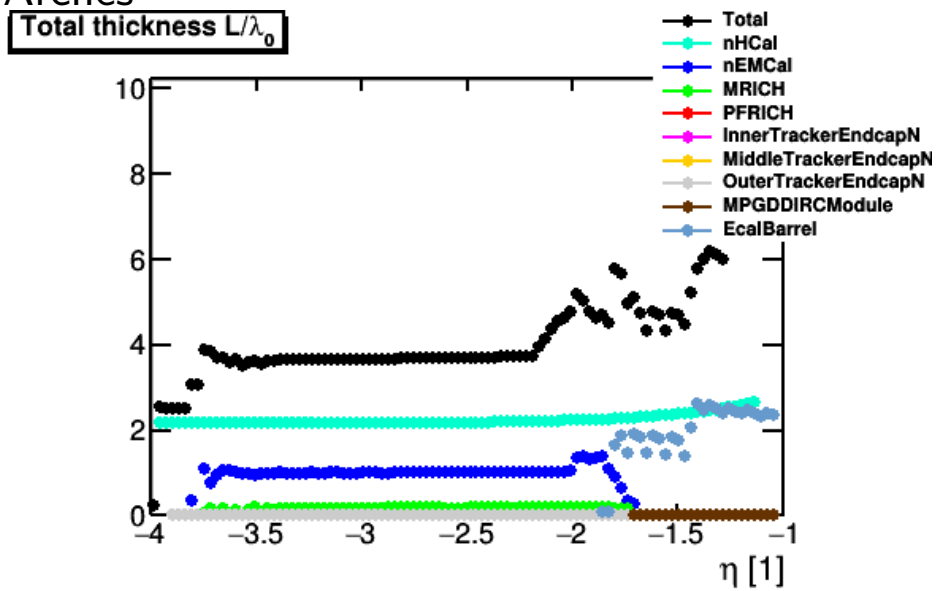
Summary

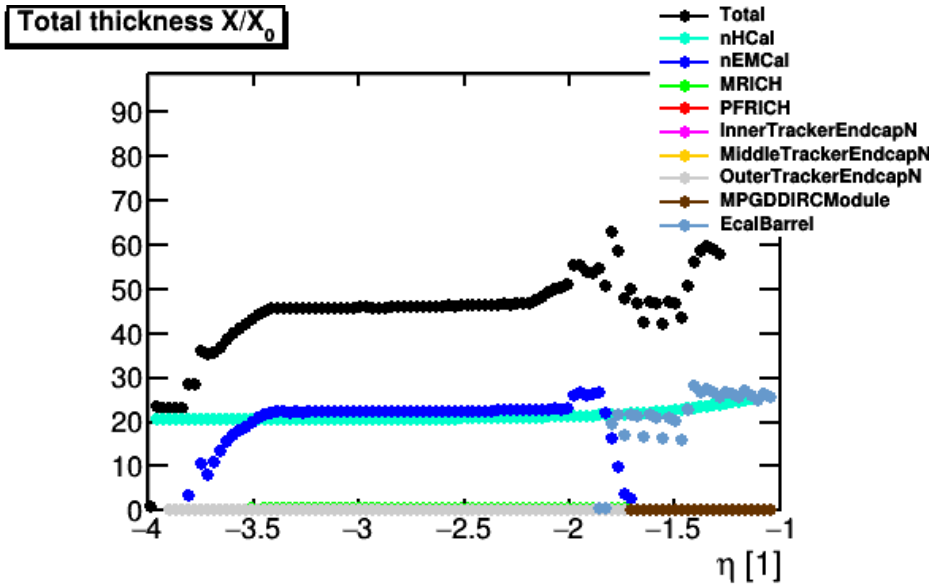
- Revise the design of the tiles and sectors
  - A few solutions proposed an discussed
- More studies coming soon!

BACKUP

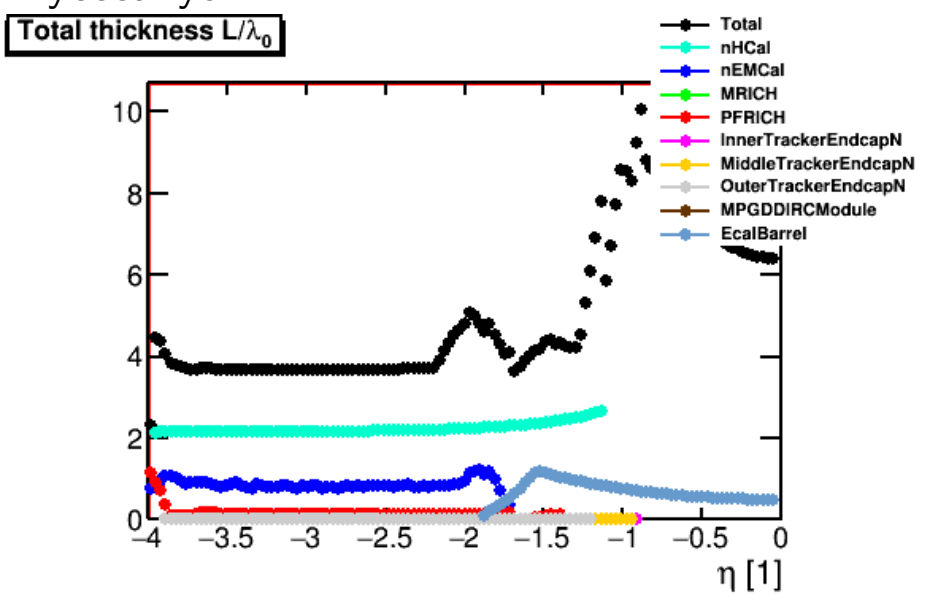
Material check - need more work

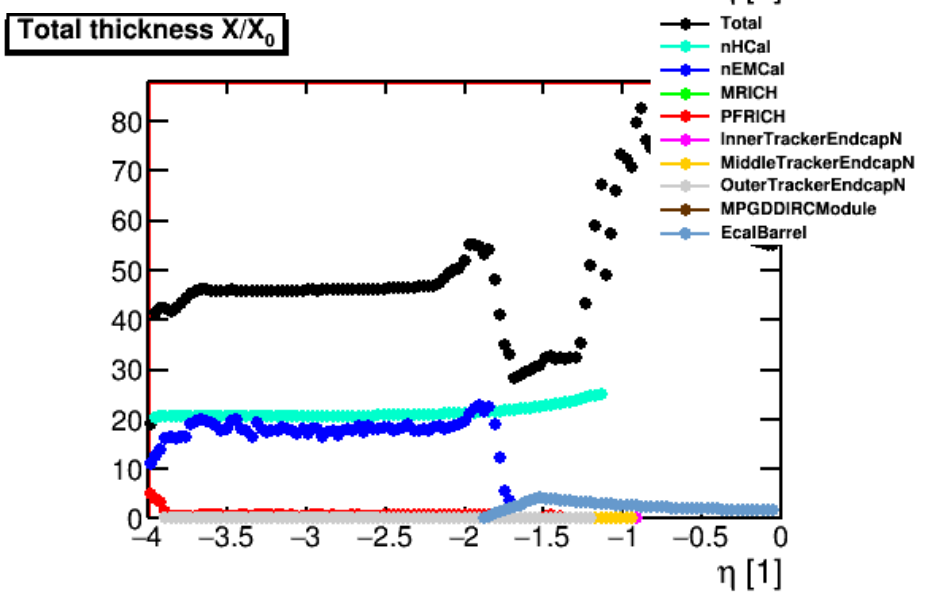
Arches



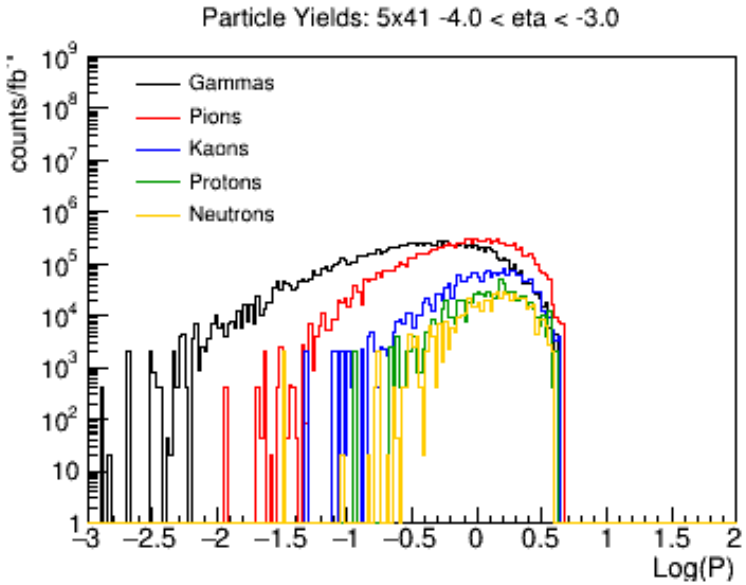


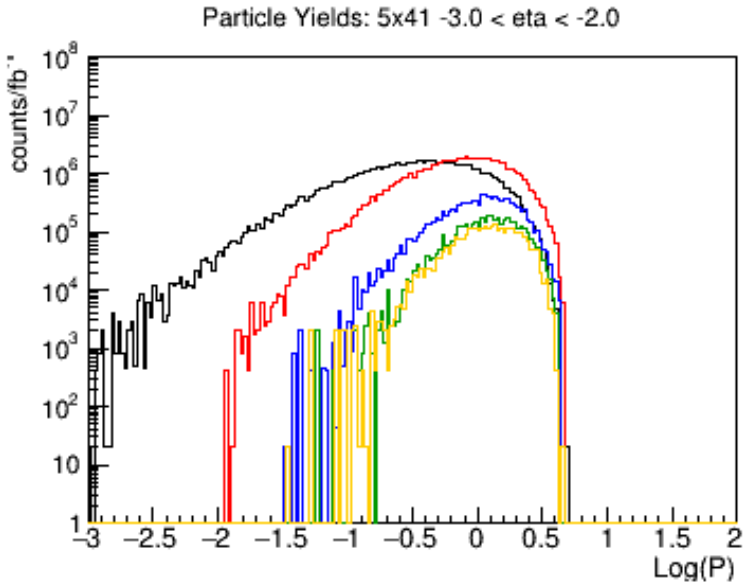
Brycecanyon

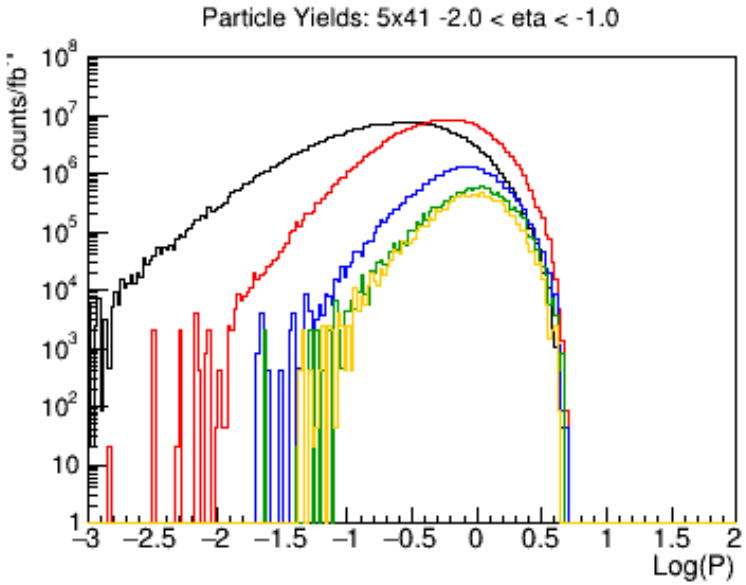




Jet particle distributions

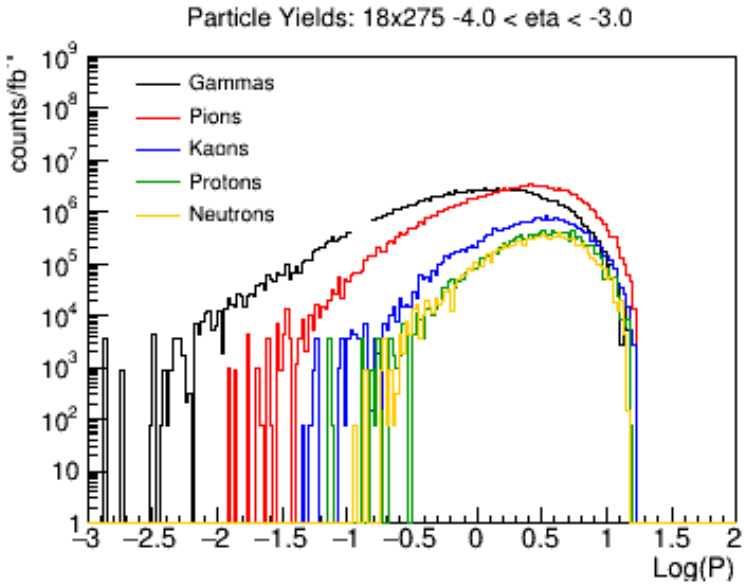


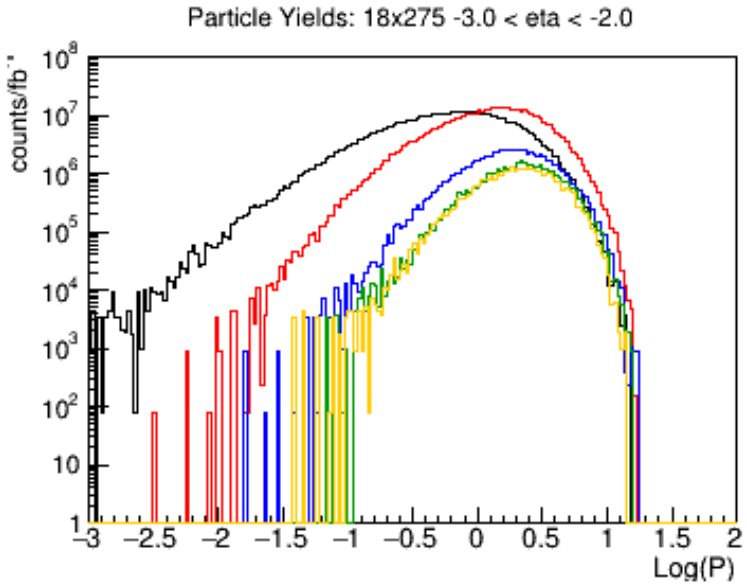


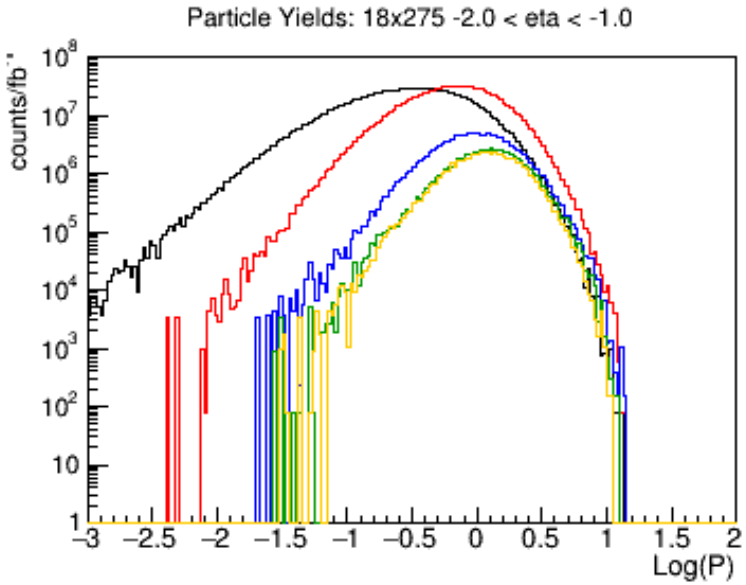


- Pythia simulation by Brian Page

Jet particle distributions







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