UPDATE ON CALORIMETRY

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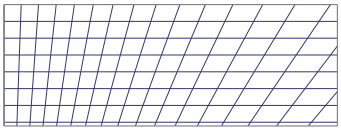
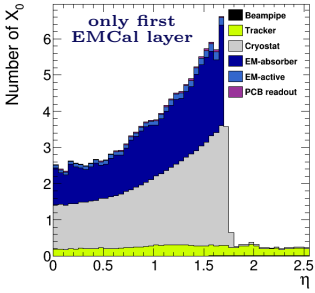
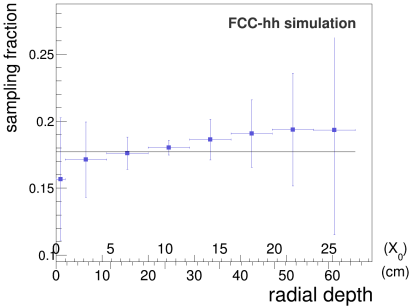
FCC hadron detector meeting

Electromagnetic calorimeter

- extending the study up to higher η
- correction for the upstream material using the energy deposited in the first layer:
  $$E_{rec} = E_{cluster} + E_{upstream}$$
- material correction dependent on η
- optimisation of longitudinal layers:
  - 1 x 2 cm
  - 7 x 9 cm





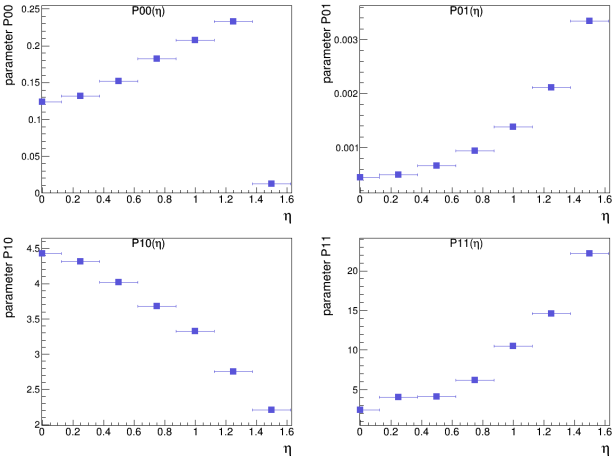


Correction for upstream material

Correction for the material in front of calorimeter:

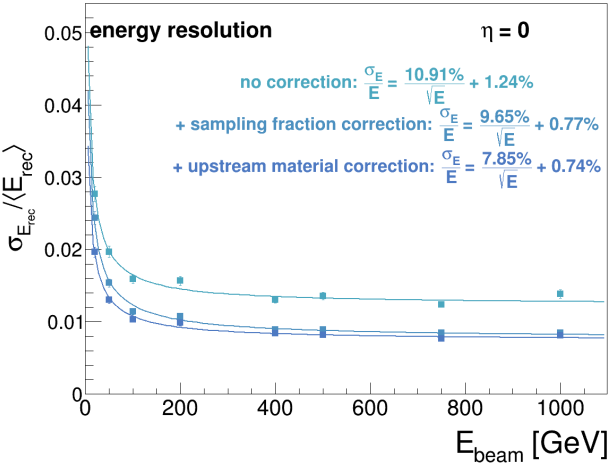
$$E_{rec} = E_{upstream} + E_{cluster}$$

$$\begin{aligned} E_{upstream} &= P_0 + P_1 \cdot E_{firstLayer} \\ &= P_{00} + P_{01} \cdot E_{beam} \\ &+ (P_{01} + \frac{P_{11}}{\sqrt{E_{beam}}}) \cdot E_{firstLayer} \end{aligned}$$



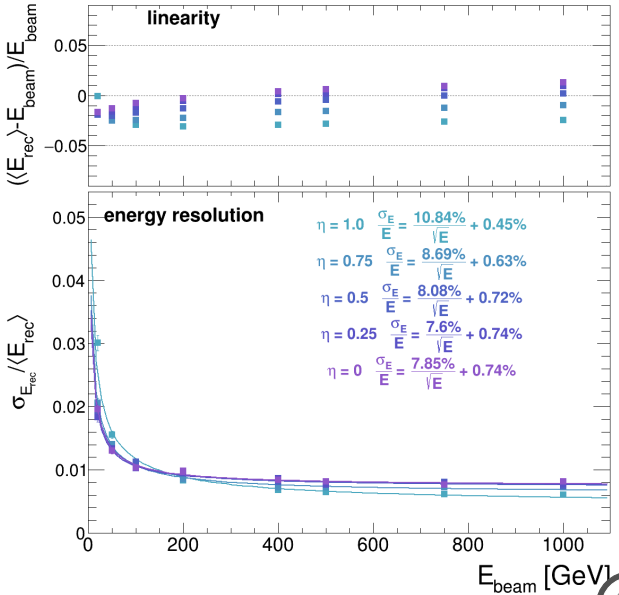
Impact of corrections on energy resolution

- no correction → just scaled energy deposits (to E_{beam})
- sampling fraction correction → calibration of deposited energy with sampling fraction calculated for 8 layers
- upstream material correction → additional to sampling fraction correction

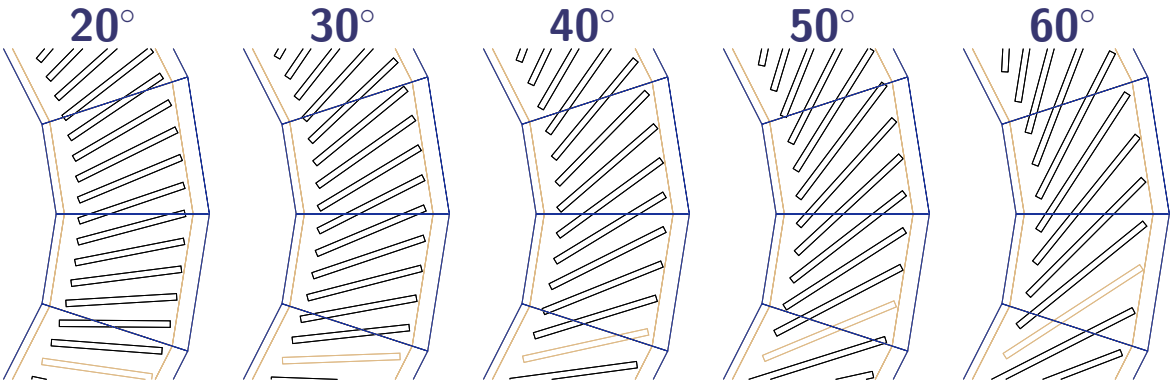


Energy resolution up to $\eta = 1$

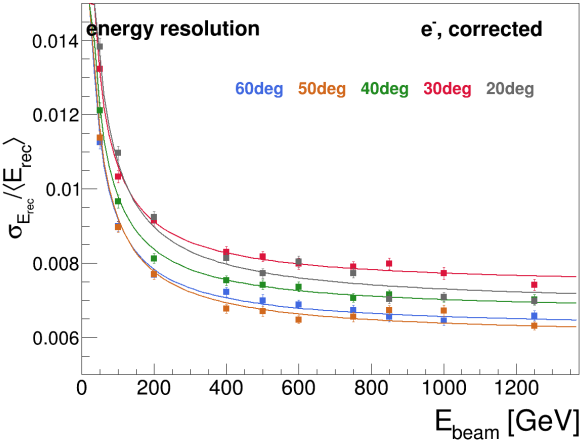
- correction for the varying sampling fraction and for the upstream material
- first layer of 2 cm for upstream material correction
  - + 7 layers of 9 cm,
  - making total of 65 cm.
- in magnetic field B = 4 T



Electromagnetic calorimeter design optimisation: inclination angle



Energy resolution for different inclination angles



60deg $\frac{\sigma_E}{E} = \frac{6.76\%}{\sqrt{E}} \oplus 0.62\%$

50deg $\frac{\sigma_E}{E} = \frac{7.0\%}{\sqrt{E}} \oplus 0.6\%$

40deg $\frac{\sigma_E}{E} = \frac{7.2\%}{\sqrt{E}} \oplus 0.66\%$

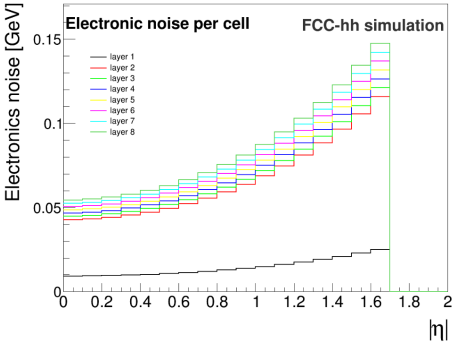
30deg $\frac{\sigma_E}{E} = \frac{7.64\%}{\sqrt{E}} \oplus 0.73\%$

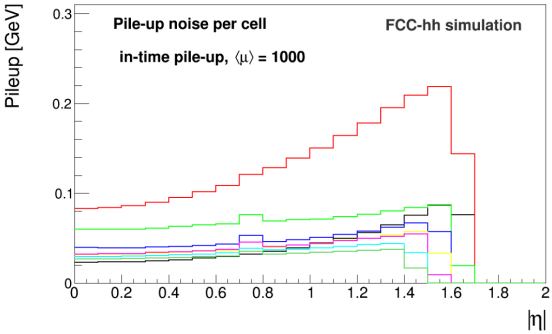
20deg $\frac{\sigma_E}{E} = \frac{8.25\%}{\sqrt{E}} \oplus 0.68\%$

Preliminary results indicate the higher the inclination angle the better (in 20° – 60° range).
On-going work on finding the optimal inclination angle.

Electromagnetic calorimeter: noise estimation

- Electronic noise scales linearly with the capacitance $C_d = \varepsilon A/d$
- Distance $d = 0.1$ mm $\Rightarrow$ larger noise than for the simple geometry ($d = 2$ mm)
- Noise increases with pseudorapidity and longitudinal layer

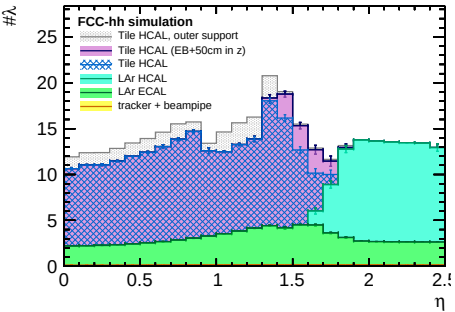


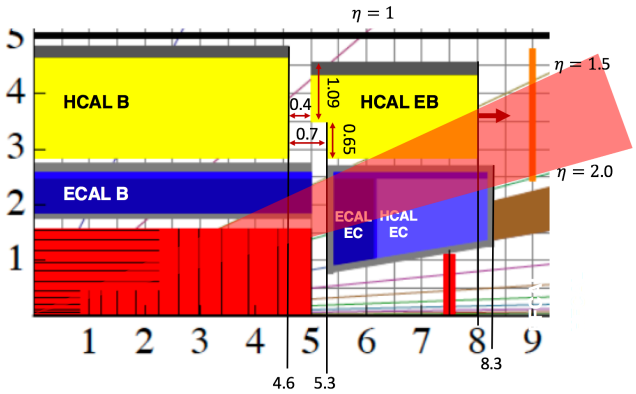


- Electronic noise in cells considered as uncorrelated - added at digitisation
- Pile-up noise in neighbouring cells highly correlated - pile-up noise contribution added to reconstructed objects

Hadronic calorimeter: η coverage

- good η coverage, dip $\#\lambda$ between η =1.5 – 2.0 requires optimisation
- longer HCal EB for better η coverage
- proposition of extending HCal EB by 50 cm in Z (both in FCCSW and FLUKA)
- still 50 cm distance to muon wheel after enlargement



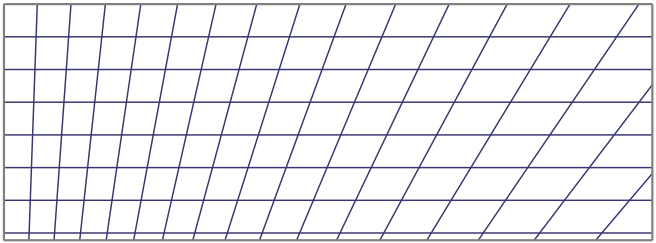


Summer students

- Revathy Alagaraisamy - working on the PCB readout for the electromagnetic calorimeter
- Hamad Alhendi - working on $\pi^0 \to \gamma\gamma$ reconstruction, later on $H \to \gamma\gamma$

Plans

- Electron reconstruction with the noise in EMCal
- Further segmentation optimisation
- Topo-clustering algorithm for hadron (jet) reconstruction



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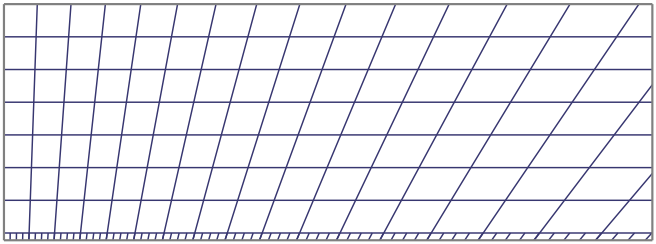

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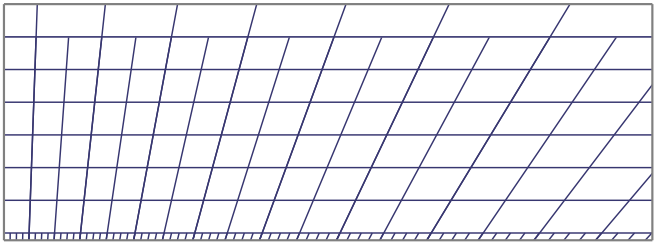

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