Combined energy reconstruction –benchmark method–

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ATLAS benchmark reconstruction
of combined LArCal and TileCal system

in ATLAS:

$$E_{ATLAS} = E_{em} + a \cdot Q_{had}^{\pi} + b \cdot \sqrt{|E_{em,lastL} \cdot a \cdot Q_{had,firstL}|} + c \cdot E_{em}^2 \quad (1)$$

- $a = 0.172\,\text{GeV/pC}$, converts measured charge (π) in HCAL to GeV
- $b = 0.44$, weights the energy deposited in last ECAL+ first HCAL layer to correct for lost energy between Calos
- $c = -3.8 \times 10^{-4}\,\text{GeV}^{-1}$, corrects for non-compensation of LArCal

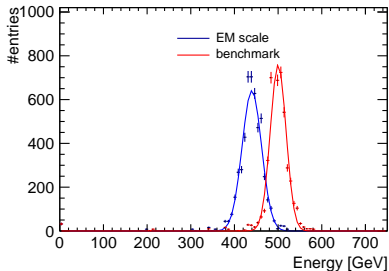*parameters determined by minimising energy resolution for 300 GeV pions*

in FCC:

$$E_{benchmark} = E_{em} + E_{had}^{\pi} + b \cdot \sqrt{|E_{em,lastL} \cdot E_{had,firstL}|} + c \cdot E_{em}^2 \quad (2)$$

- E_{em}, layer calibration to EM scale of ECAL
- E_{had}^{π}, HCAL calibrated to π's

minimising χ^2 function: $\chi^2 = \sum_i^{events} \frac{\left(E_{true,i} - E_{benchmark,i}\right)^2}{E_{true,i}}$ for 500 GeV pions
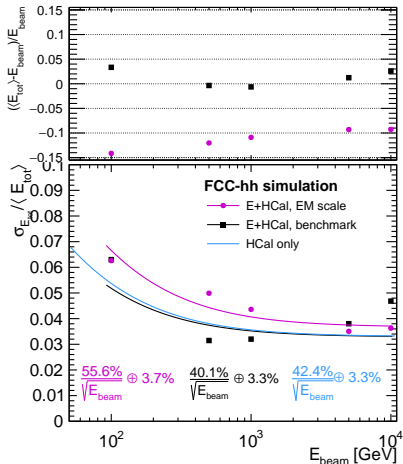
First results of benchmark reconstruction

- using 5,000 500 GeV π events for parameter determination

- effect on the reconstruction for other 5,000 events

$\rightarrow b = 4.68$ and $c = 4.4 \times 10^{-5}\,\text{GeV}^{-1}$

- b larger due to smaller layers

- c small due to mostly "tracks" in ECAL

$\rightarrow \frac{\sigma_E}{E}$ improves from 5.1 % to 3.6 %

- non-linearities corrected < 5 %

- reconstruction parameters not optimal for other energies

First results of benchmark reconstruction

- using 500 10 TeV π events for parameter determination
- effect on the reconstruction for other 5,000 events

–> $b = 14.23$
–> $c = -1.98 \times 10^{-6}\,\text{GeV}^{-1}$

- these paramters only work for highest energy points