ePIC pECal SiPM size study

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Motivations

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- Question: Low average energy in pECal $\rightarrow$ 50 μm SiPM at low η?
- Requirement to avoid saturation: Number of SiPM pixels $\gtrsim 3 \times$ Highest light yield.
- Counting of SiPM pixels:
  - Each tower has four 6$\times$6 mm^2 SiPMs.
  - 50 μm SiPM has $\sim$57k pixels.
  - 20 μm SiPM has $\sim$356k pixels.
- Calculation of the highest light yield:
  - Calculate the highest energy $\gamma/e^{\pm}$:
    - Requirement: Number of events $N = \sigma\mathcal{L} \gtrsim 100$.
    - Use Pythia to calculate the cross section σ.
    - Suppose EIC has integrated luminosity $\mathcal{L} = 100$ fb^{-1}.
  - Calculate the energy deposit in one tower for the highest energy $\gamma/e^{\pm}$:
    - Use single π^0 in DD4hep.
  - Highest light yield = Highest energy deposit in GeV $\times$ 1000 LY/GeV.
- Conclusions:
  - $\gtrsim$50k light yield at $\eta \sim 1.5$.
  - Need 20 μm SiPM for all η ranges.

DIS in Pythia8: $d\sigma/(dEd\eta)$ (fb/GeV) for $\gamma/e^{\pm}$

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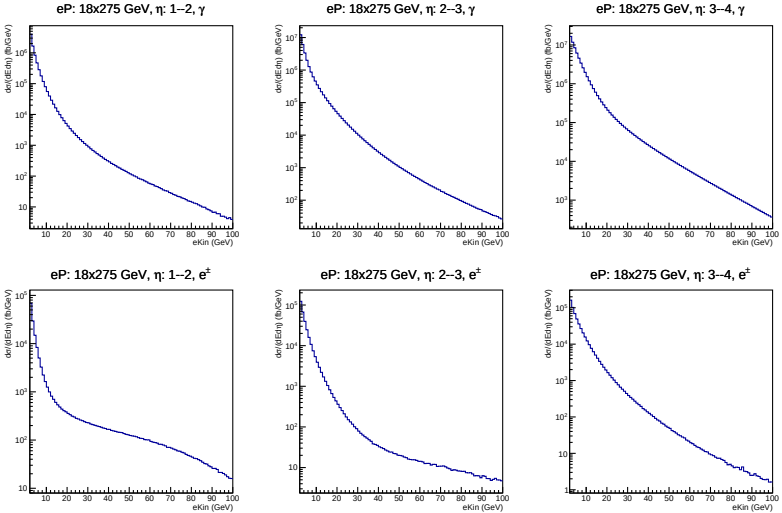
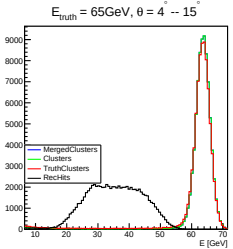
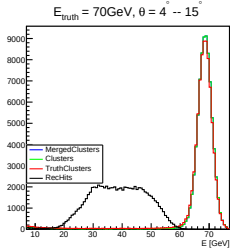
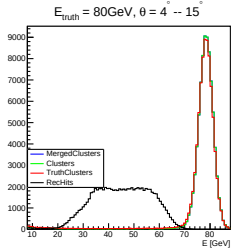
- $\frac{d\sigma}{dEd\eta} > 10$ fb/GeV at 100 GeV at $\eta = 1 - 2$.
- $\gtrsim$100 events in this range.

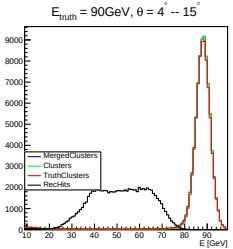


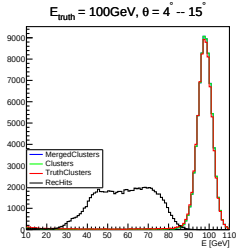
Single π^0 energy deposit in one tower in DD4hep











Single π^0 energy deposit in one tower in DD4hep

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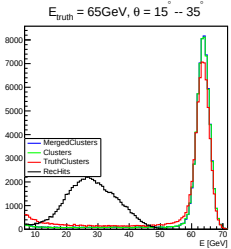
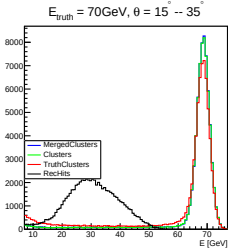
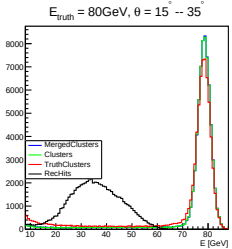
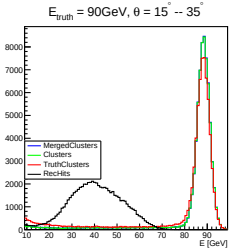
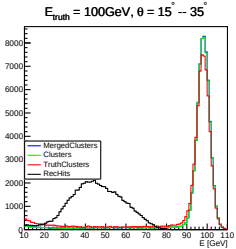


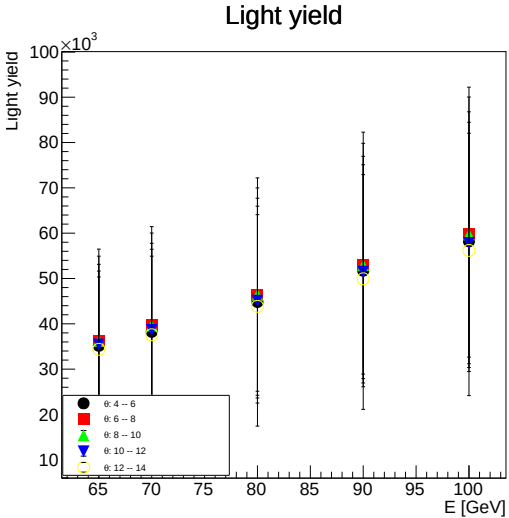


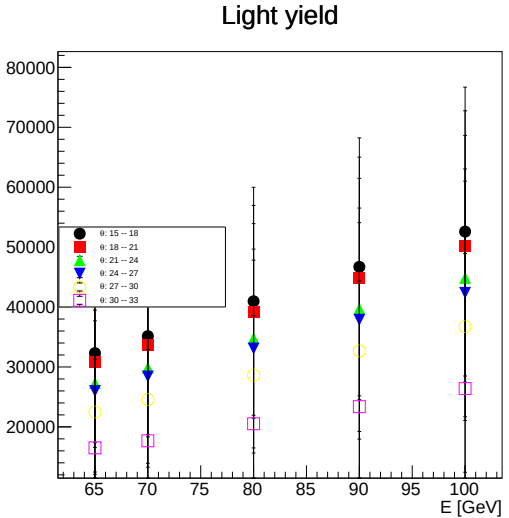






Light yield in one tower in DD4hep





Summary

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