

Simulations for HCal insert

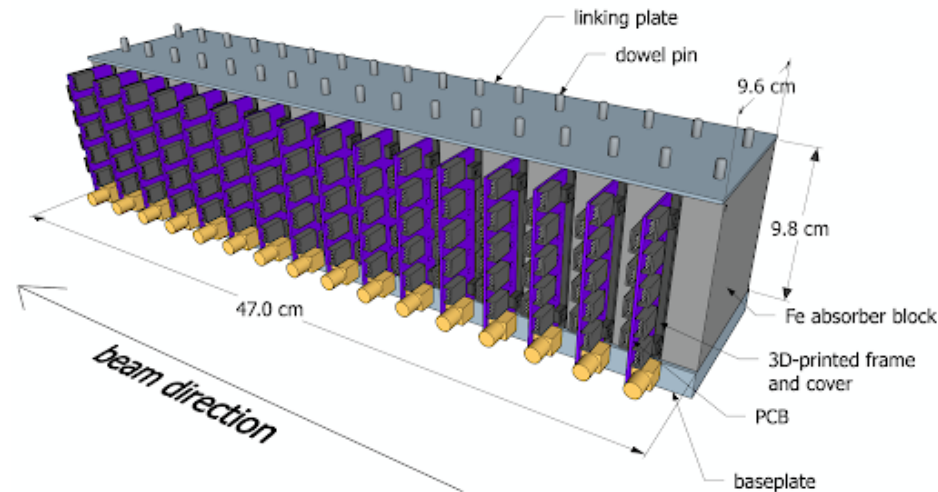
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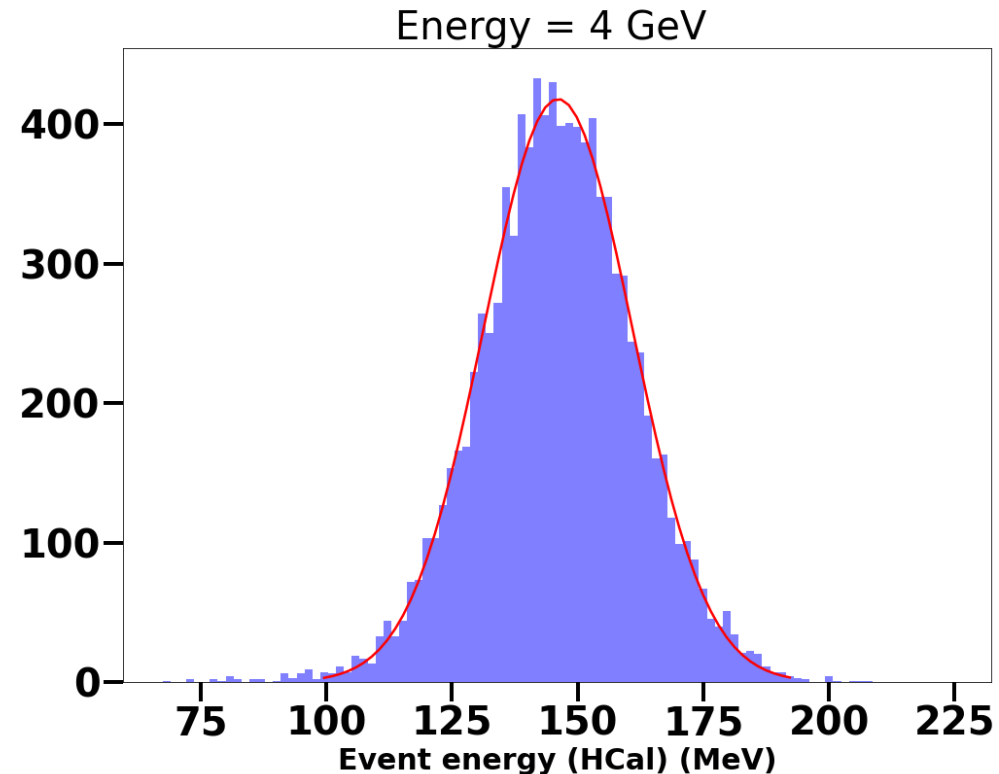
Motivation and simulation set up

- Motivation: Apply HCal Insert prototype simulation using the DD4HEP framework in the EIC software container to study the energy resolution for HCal insert and compare with the simulation and the real data (beam test).
- Simulation set up: the DD4HEP framework in the EIC software container.
- Simulation events: 10 k e- single events. Energy: 1, 2, 3, 4, 5, 6 GeV
- Geometry: 10 sets of layers for HCal insert. (same as beam test)
 - Absorber: 2 cm
 - Scintillator: 0.6 cm
 - Air gap: 0.52 cm

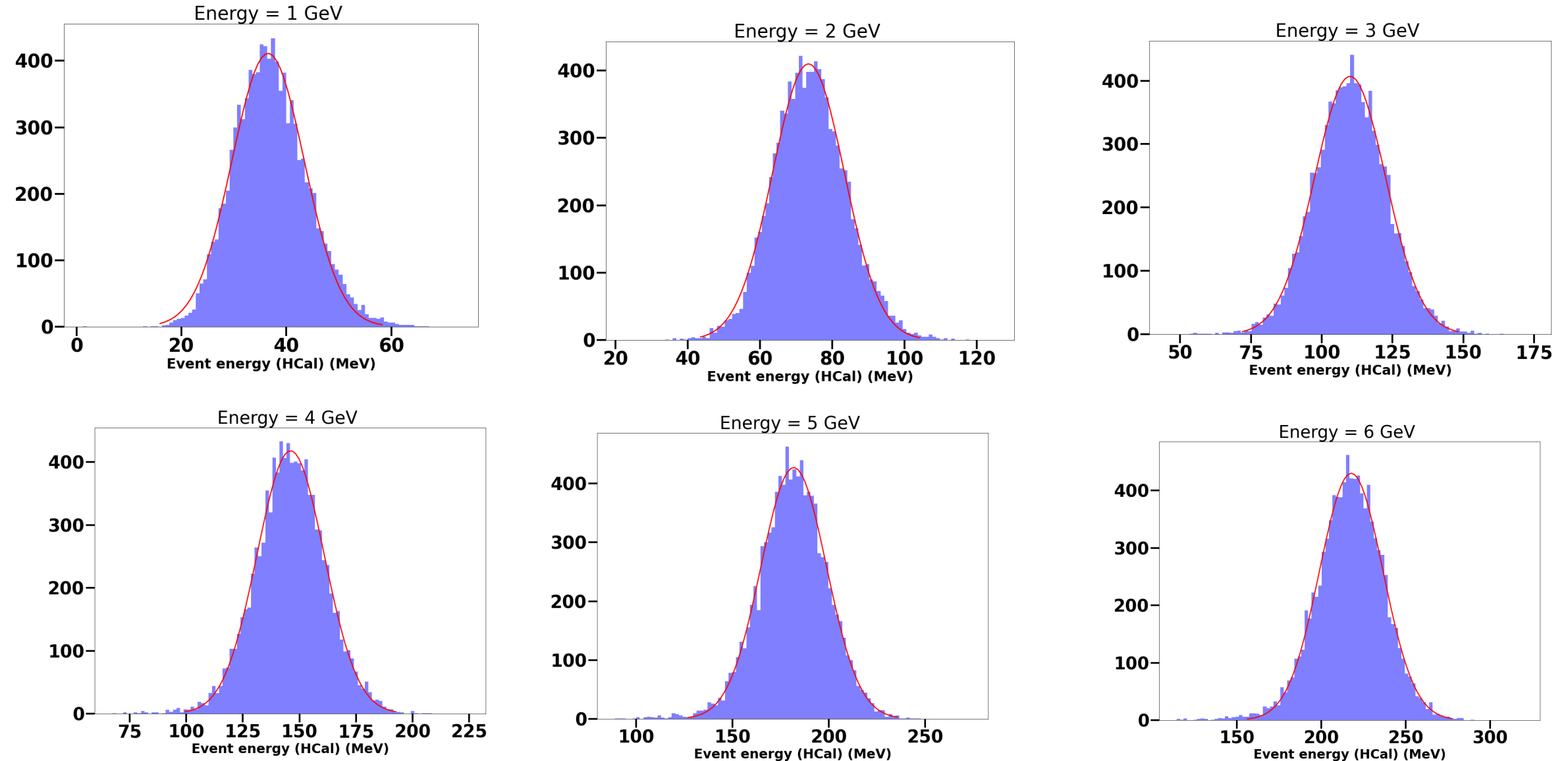


Example: Energy resolution for 4 GeV e-

- Generate 10 k events with e⁻ energy 4 GeV.
- Gaussian function to fit.
- Resolution: $10.13\% \pm 0.01\%$

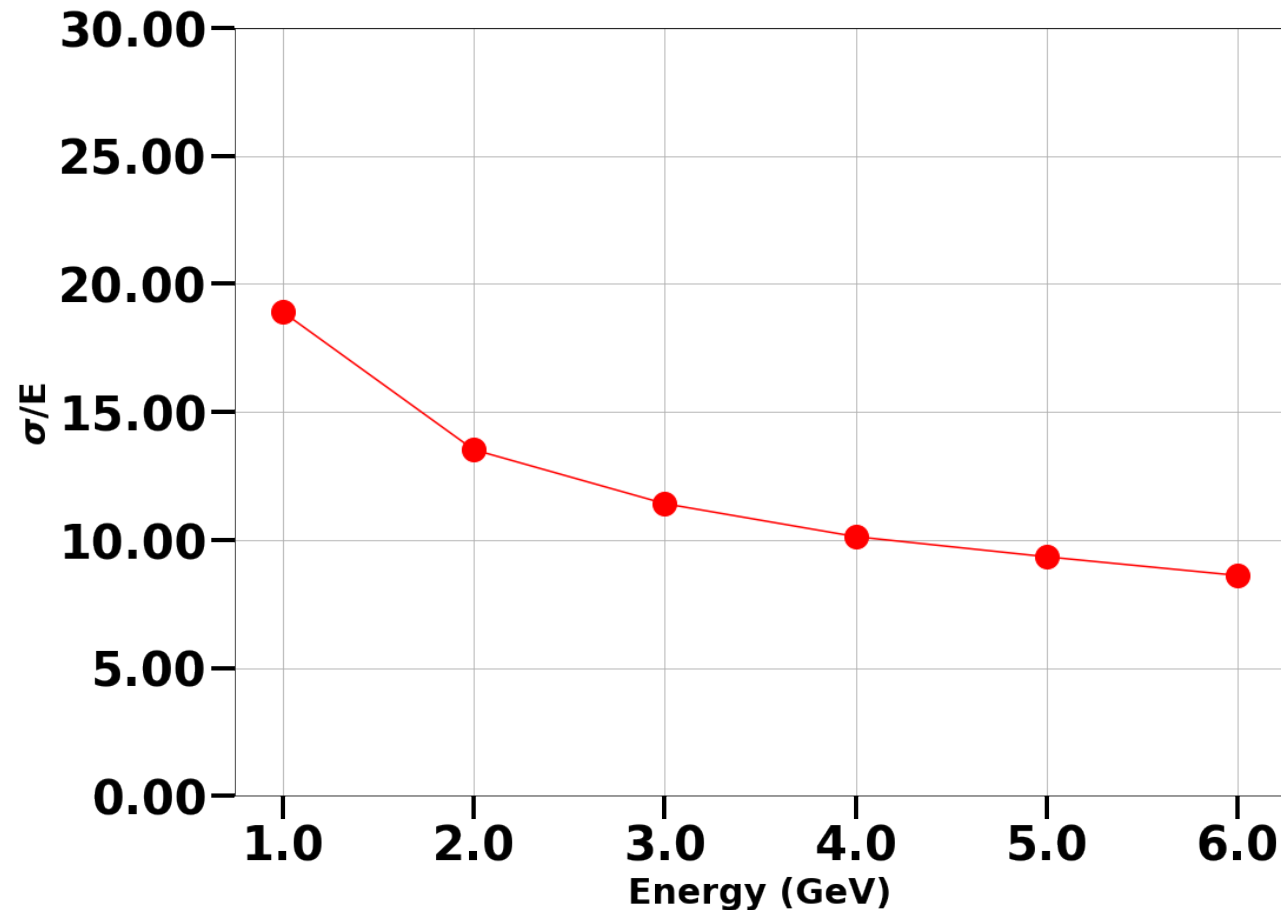


Energy distribution for each e- energy simulation



Energy resolution results

- Energy resolution of HCal insert for e- ranging from 1 GeV to 6 GeV

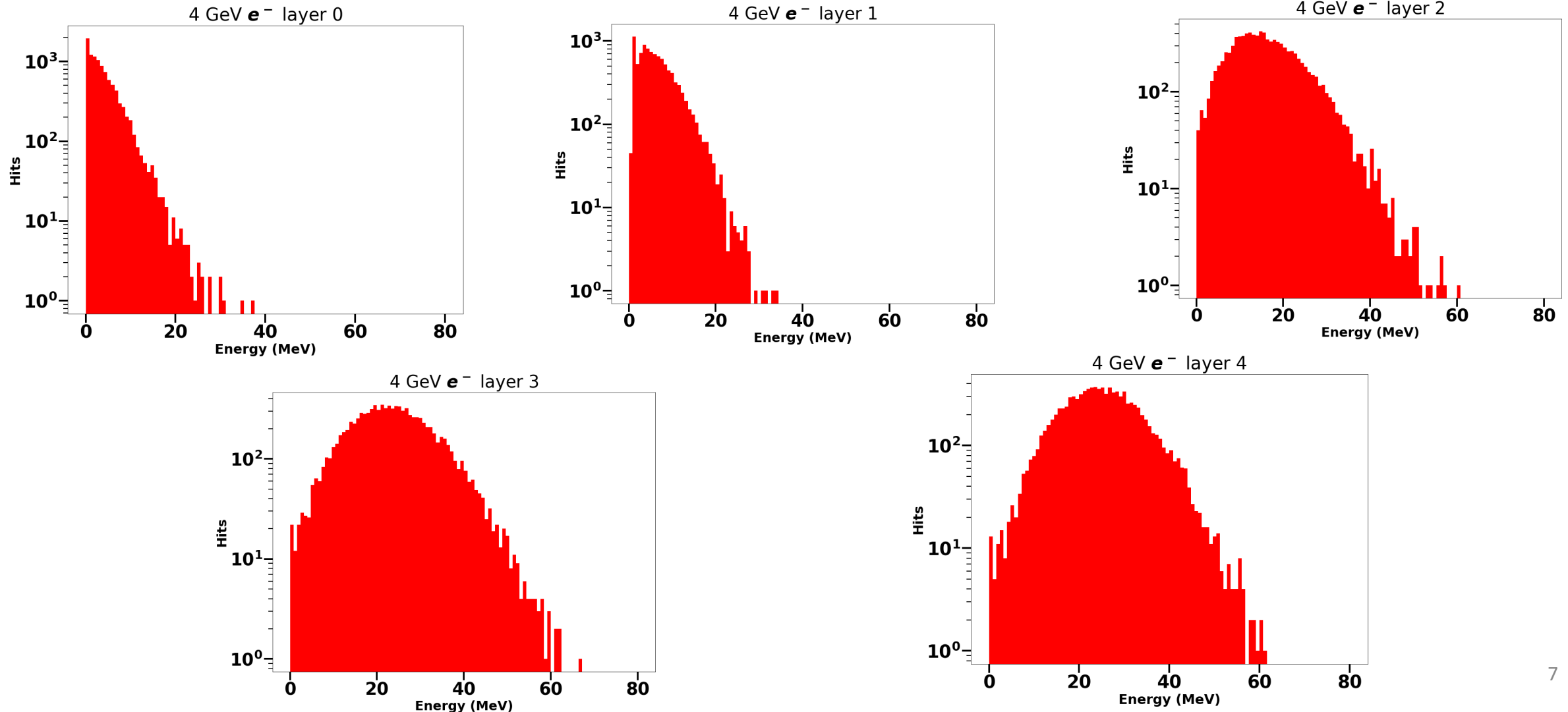


Investigate energy deposit for each layer

- Apply 10 k 4 GeV e- simulation as example.
 - Same geometry set up (slide 2)
- Apply 10 k 4 GeV mu- simulation to study MIP for each layer
 - Same geometry set up (slide 2)

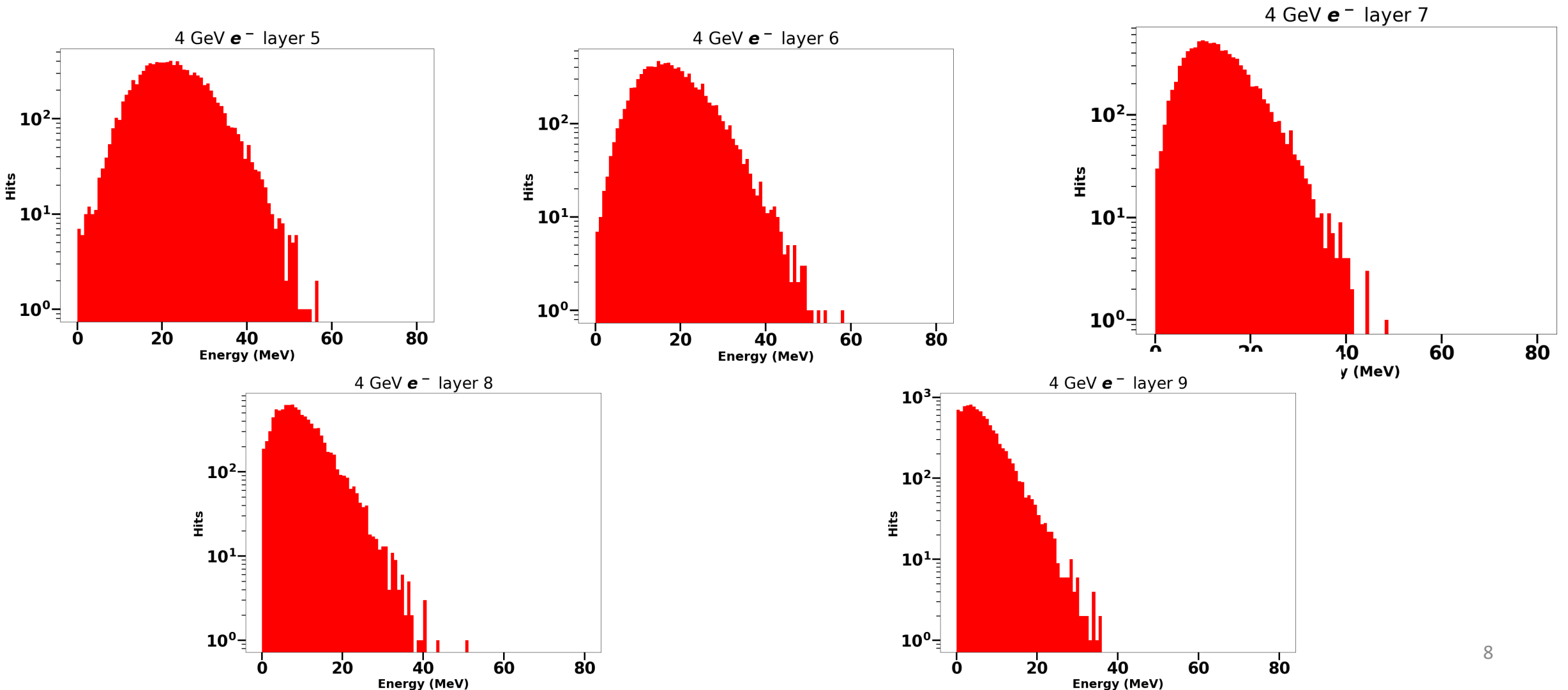
Each layer energy distribution (layer 0 – 4)

- 4 GeV e^- as example



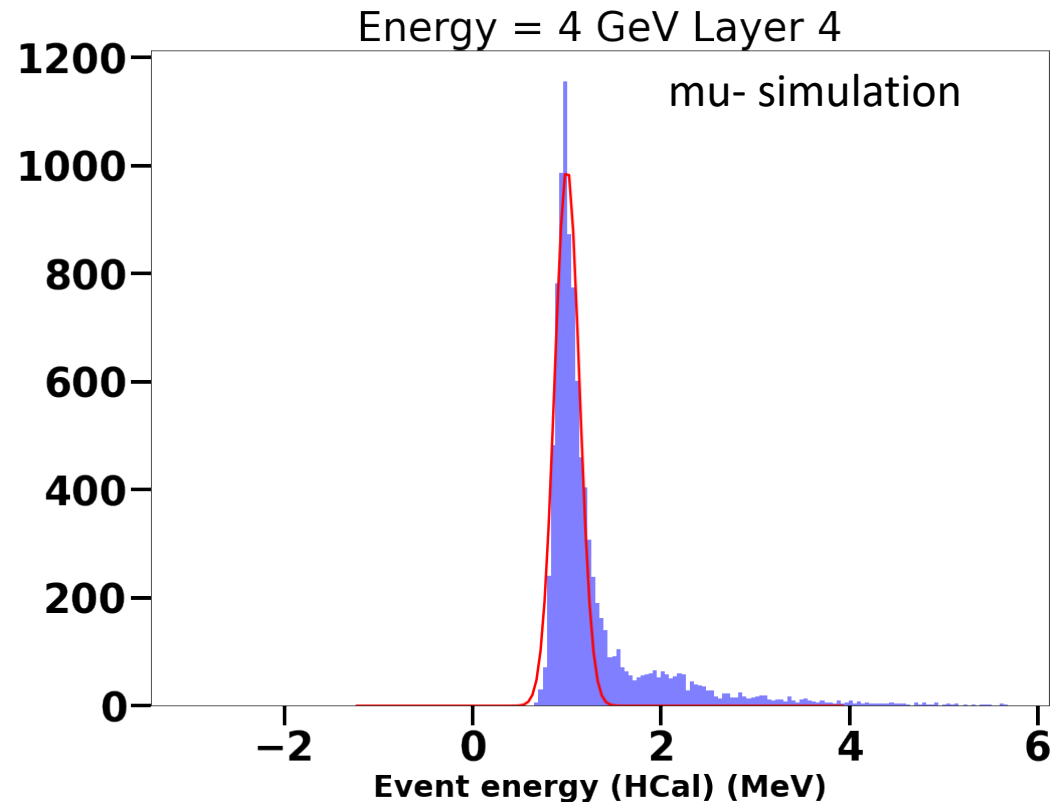
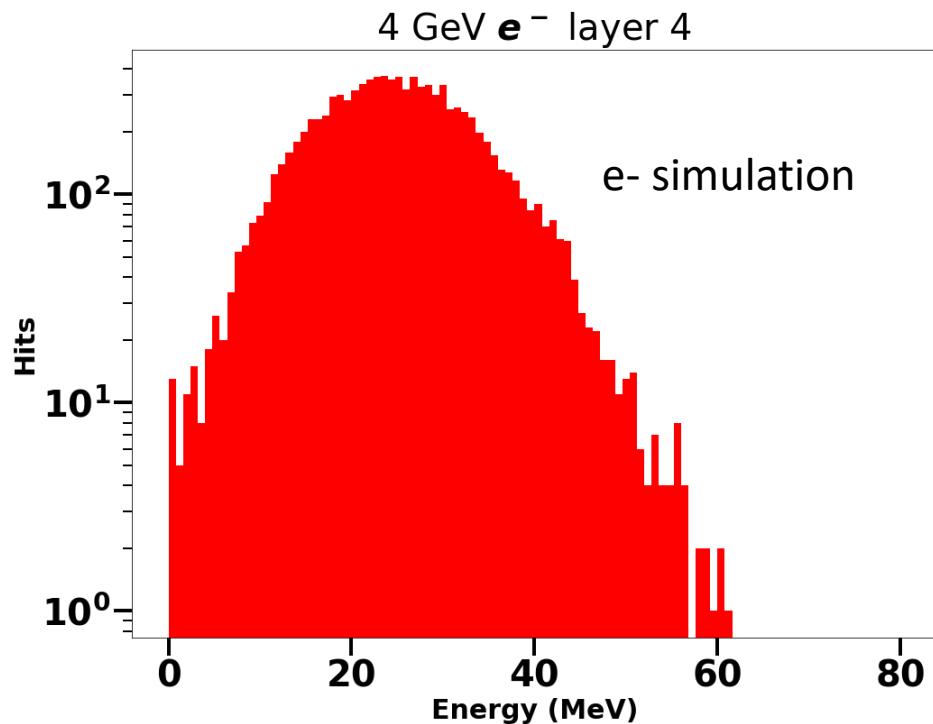
Each layer energy distribution (layer 5 – 9)

- 4 GeV e^- as example



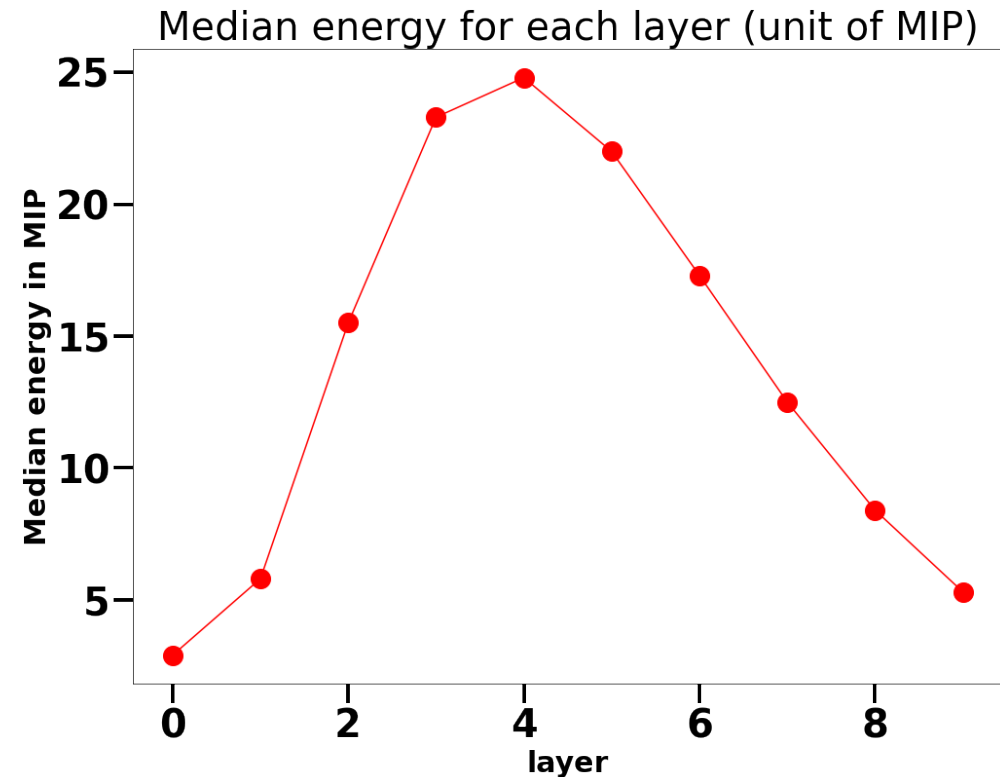
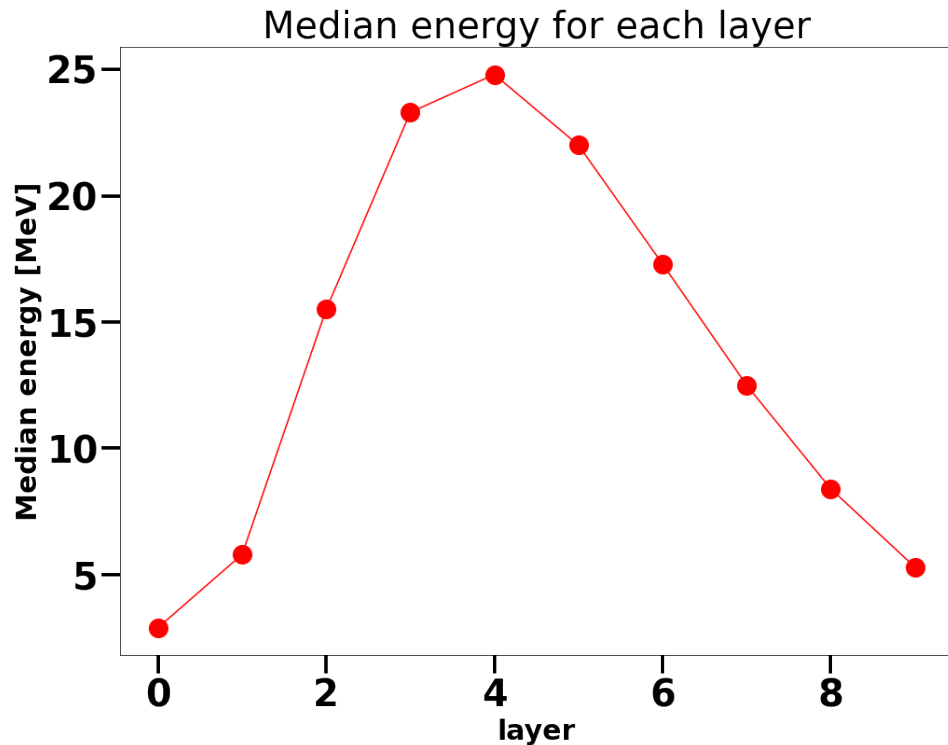
Energy deposit for each layer (layer 4)

- Energy deposit for each layer (layer 4 as example)
- Get MIP position at 1 MeV.
 - Same MIP position for other layers



Median energy for each layer

- Median energy for each layer (4 GeV e- as example)
- Convert them into unit of MIP.



Conclusions and outlook

- Good energy resolution are observed for HCal insert in the simulation.
- Need to combine with the test beam data to investigate and understand their behavior for each layer.

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