

Simulation Studies of a Total Absorption Dual-Readout Calorimeter

Andrea Delgado, June 2012

Goal

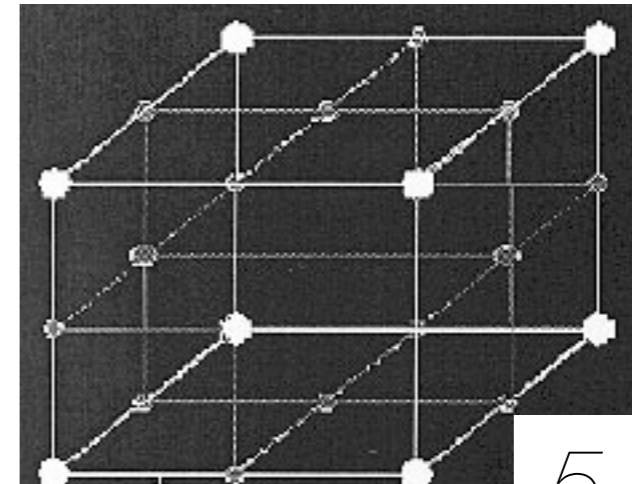
► *To study the energy resolution as a function of different sampling geometries, for a homogeneous (total absorption) calorimeter.*

How do we achieve this?

The Calorimeter

Lead Fluoride PbF_2
Homogeneous Calorimeter

50 layers of 5 cm crystals for
a total length of 2.5 m



*5 x 5 cm
crystals*

The Simulation Program

➔ Loop over the number of events (1000).

Event *a particle incident in the calorimeter (π^\pm , e^+ , e^- , etc).*

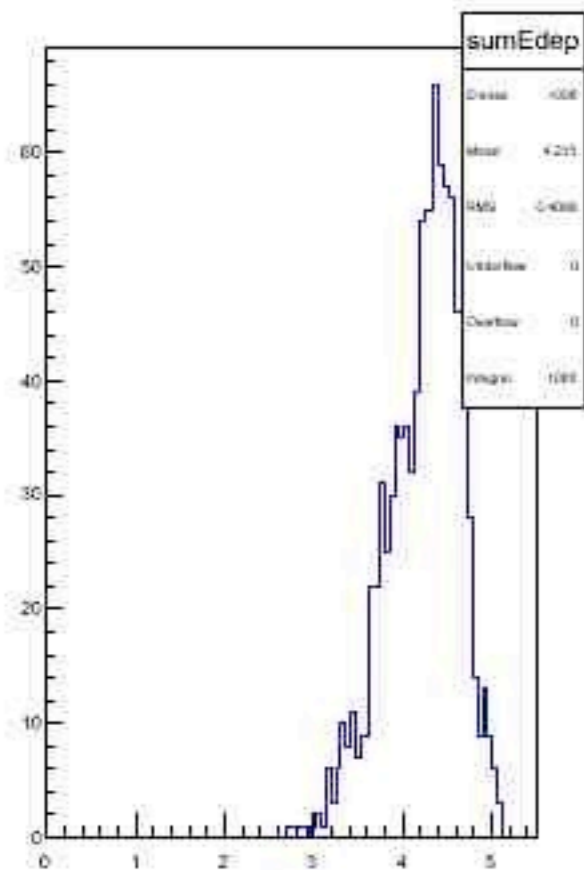
➔ Loop over the number of hits.

Hit *energy deposited in a cell as a result of particle interaction.*

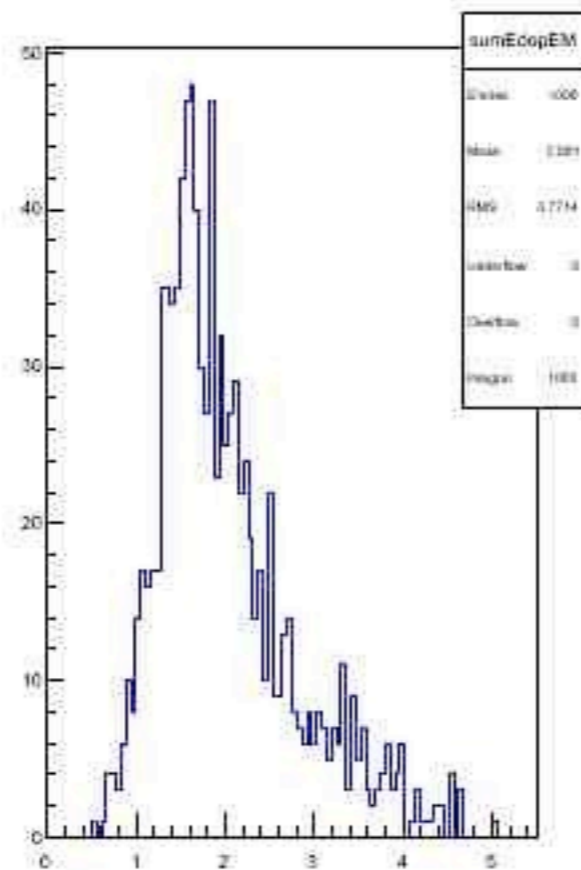
➔ Statistical information.

Sum of visible energy, EM fraction, Hadronic part, Number of hits, Longitudinal Profile, etc.

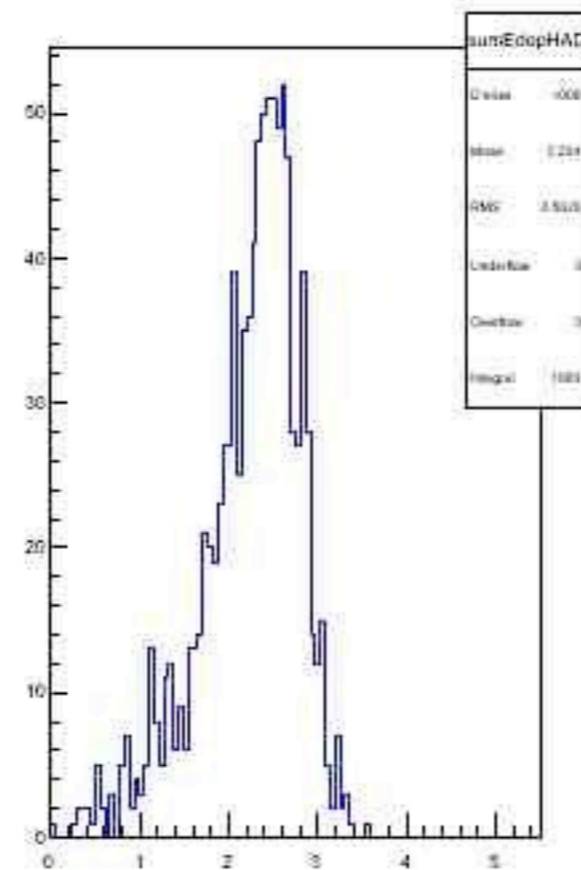
Energy deposition



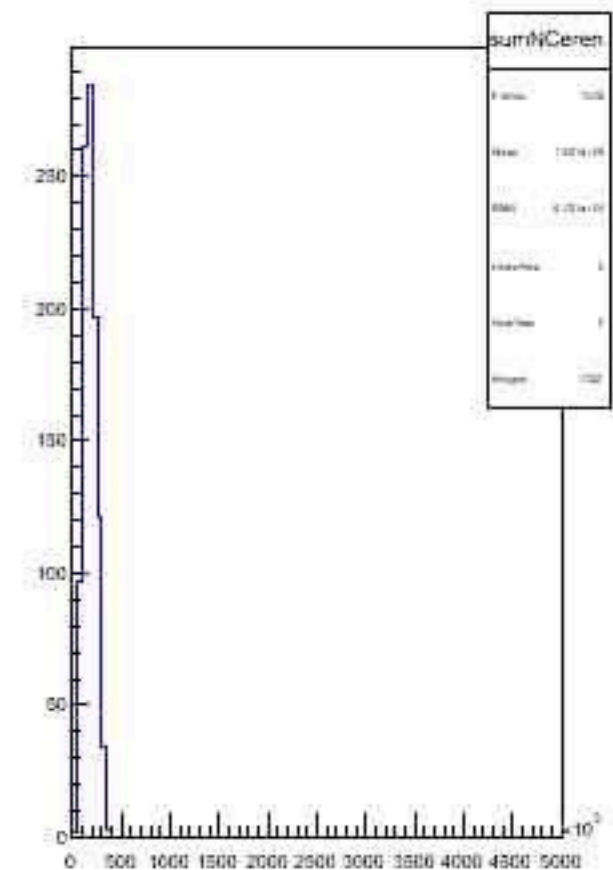
EM Energy deposition



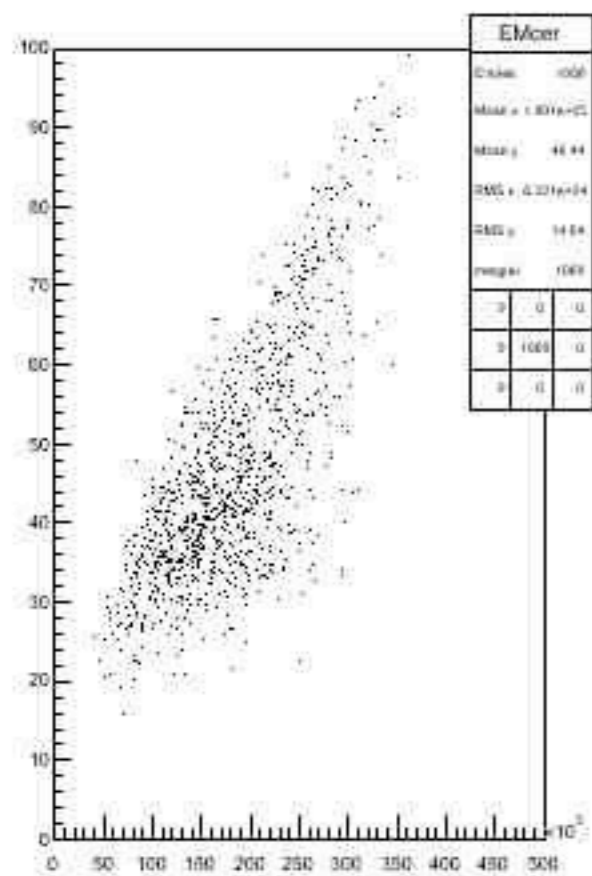
Had Energy deposition



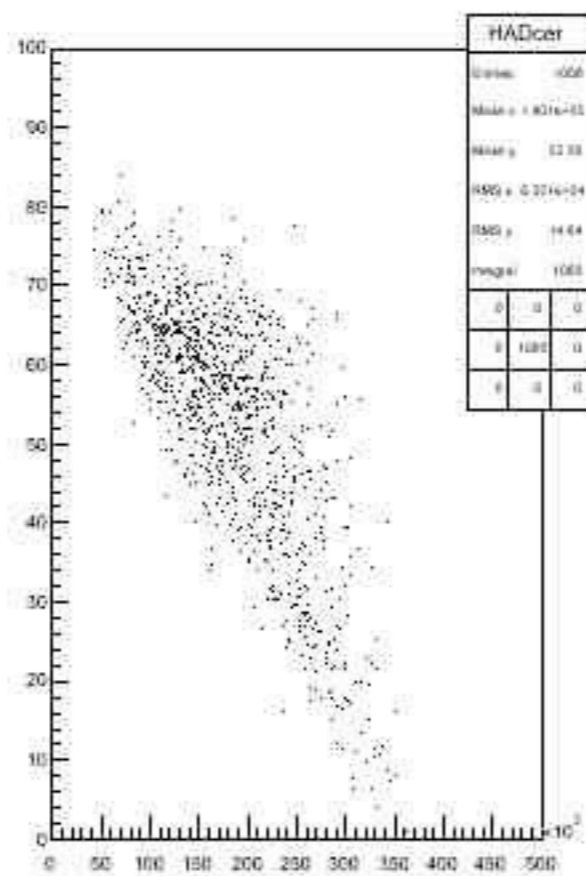
nr of C photons



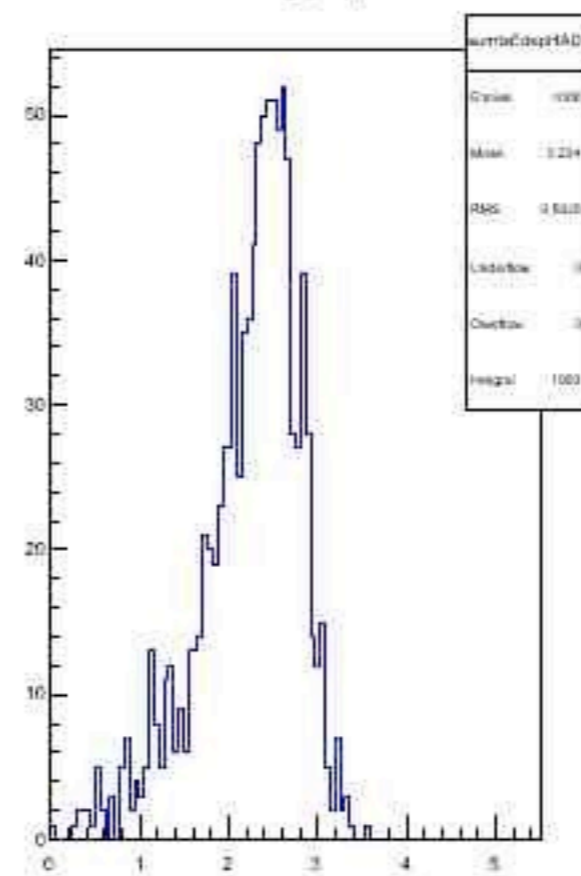
correlation between energetic photons and EM factor



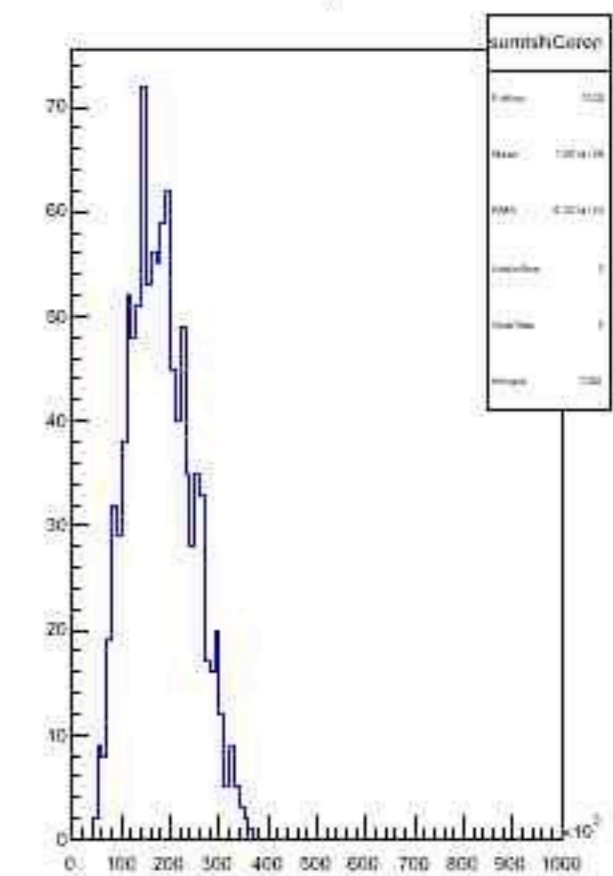
correlation between energetic photons and HAD factor

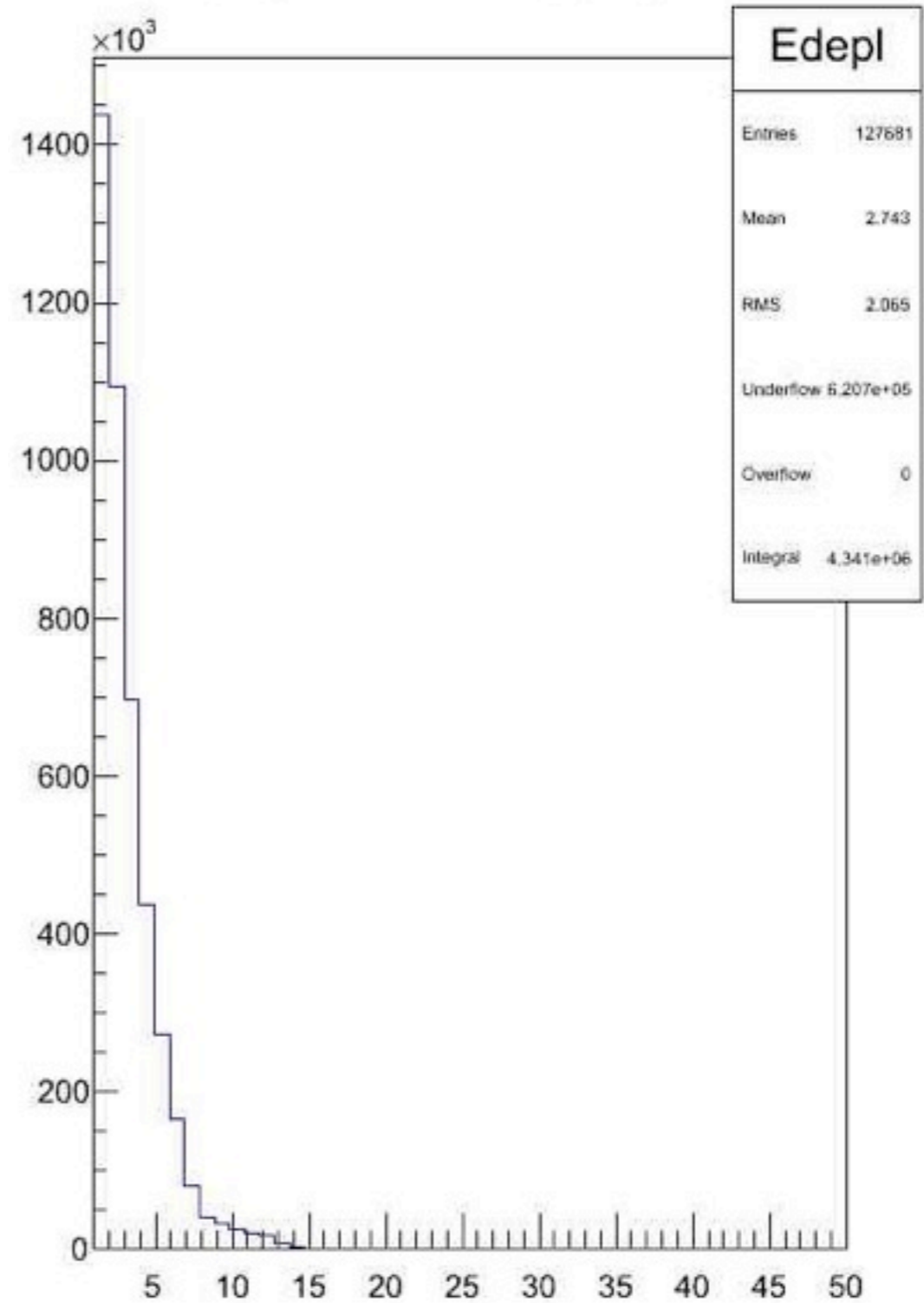
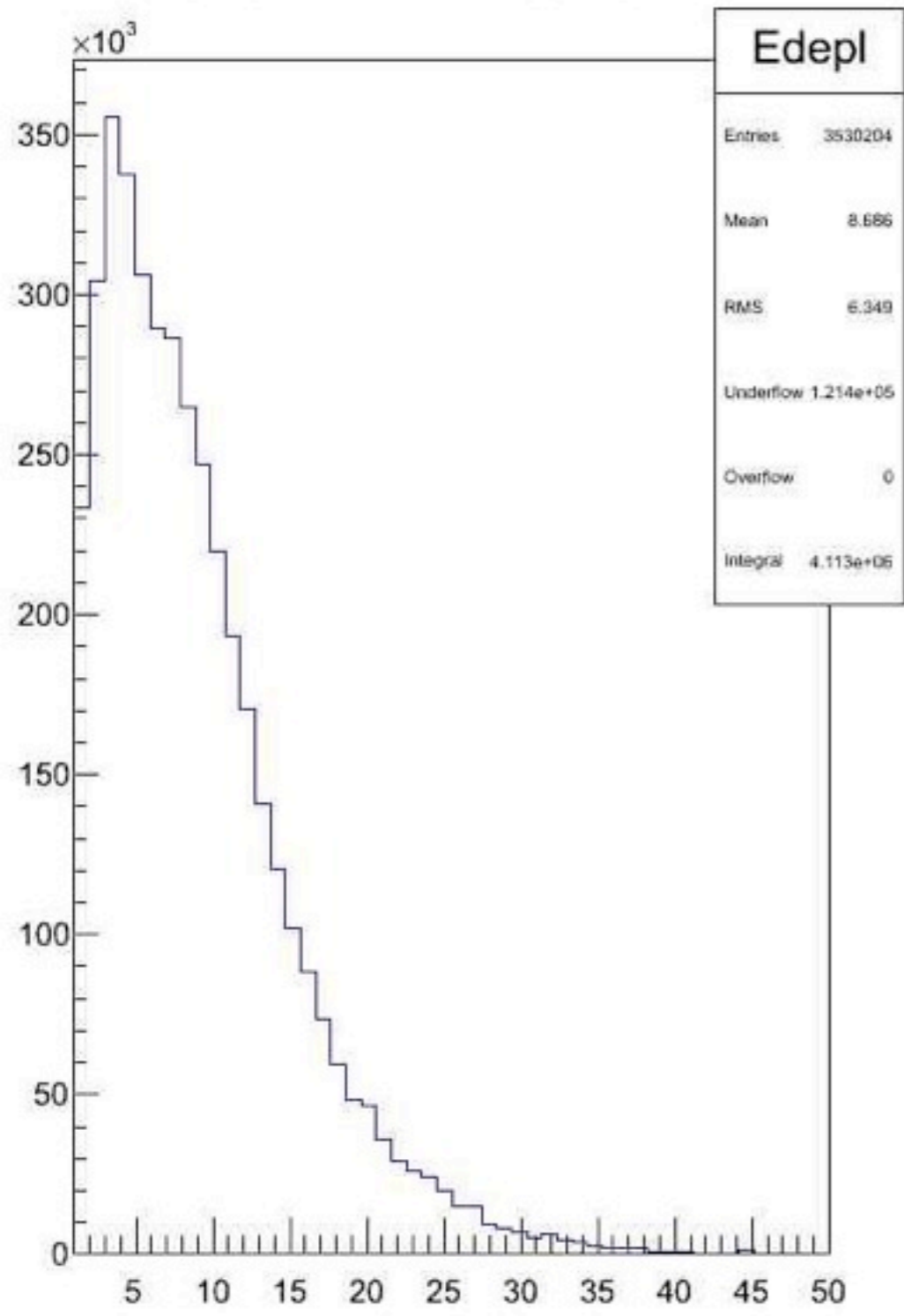


ts Had Energy deposition



ts nr of C photons



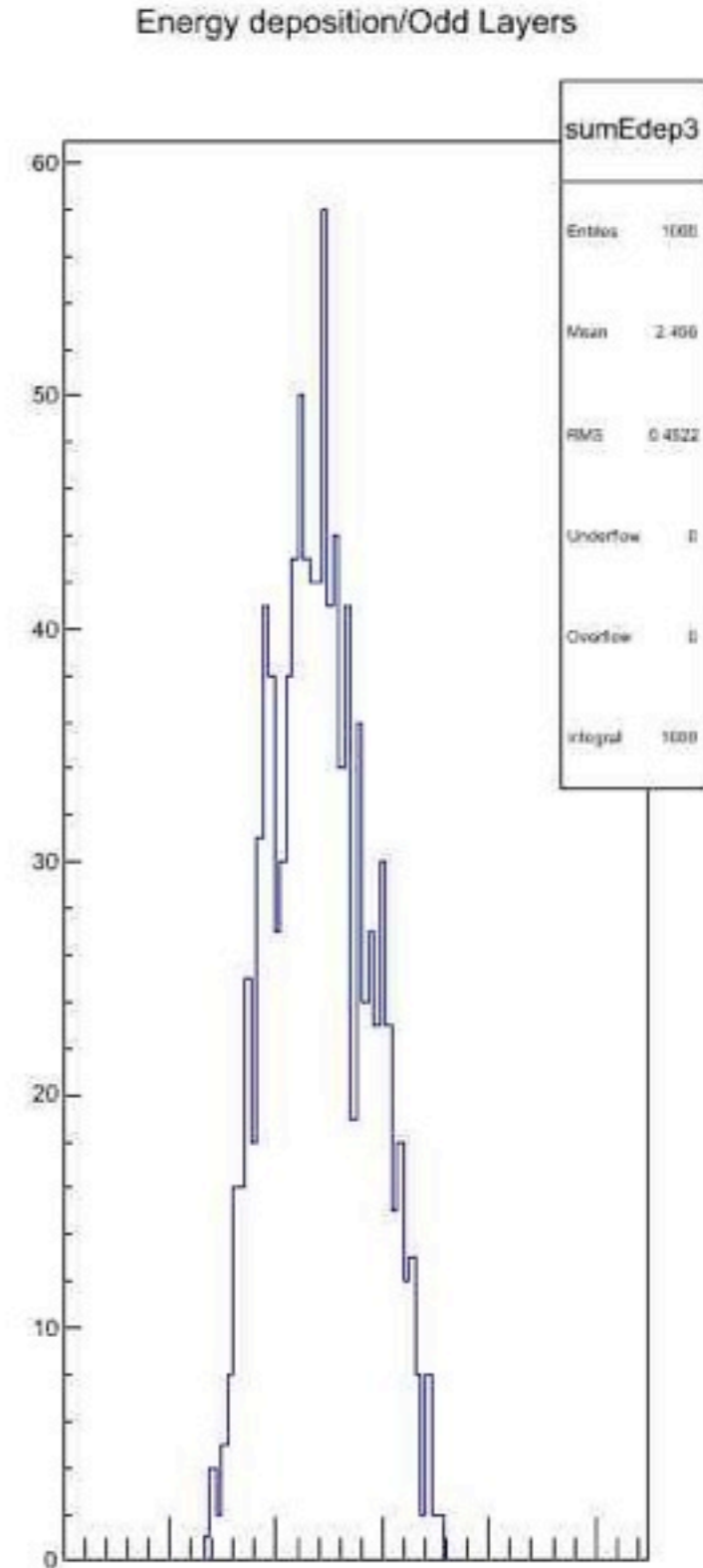
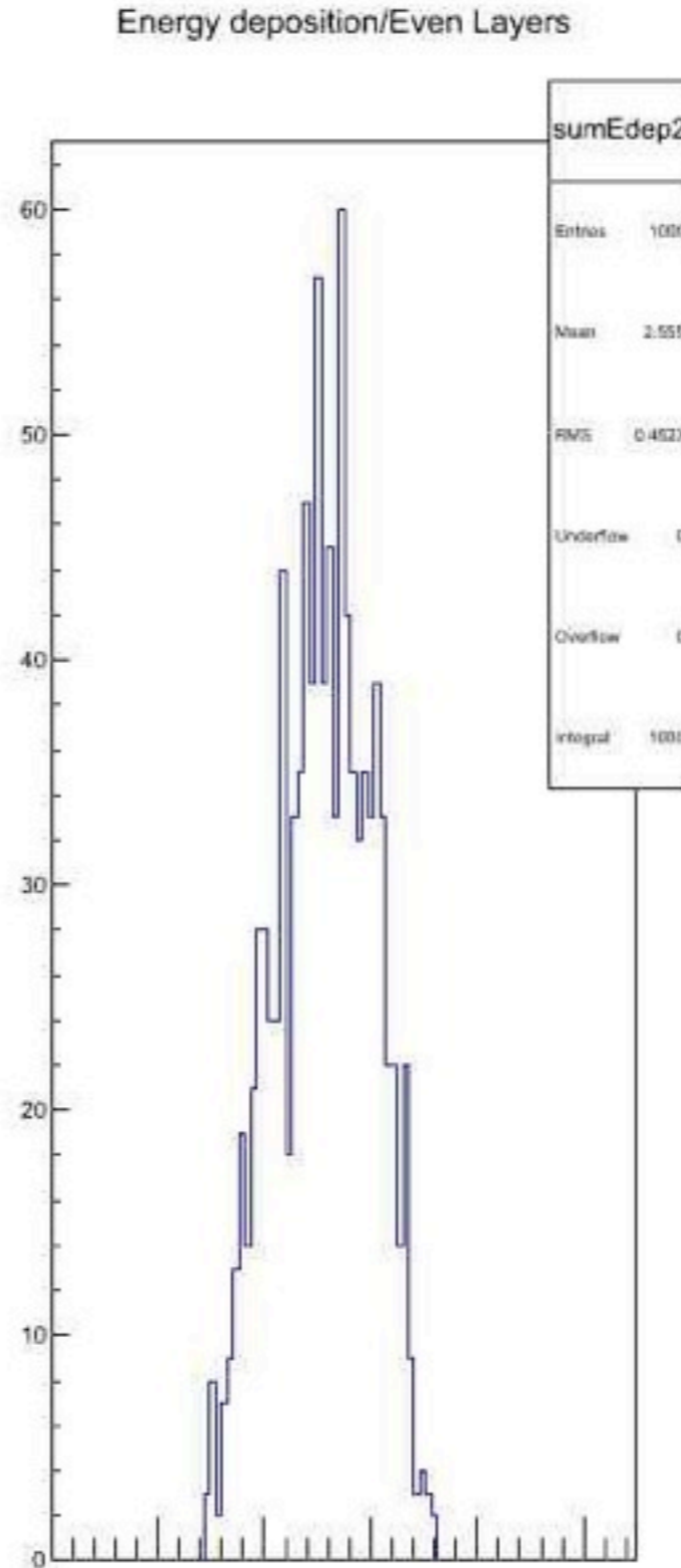
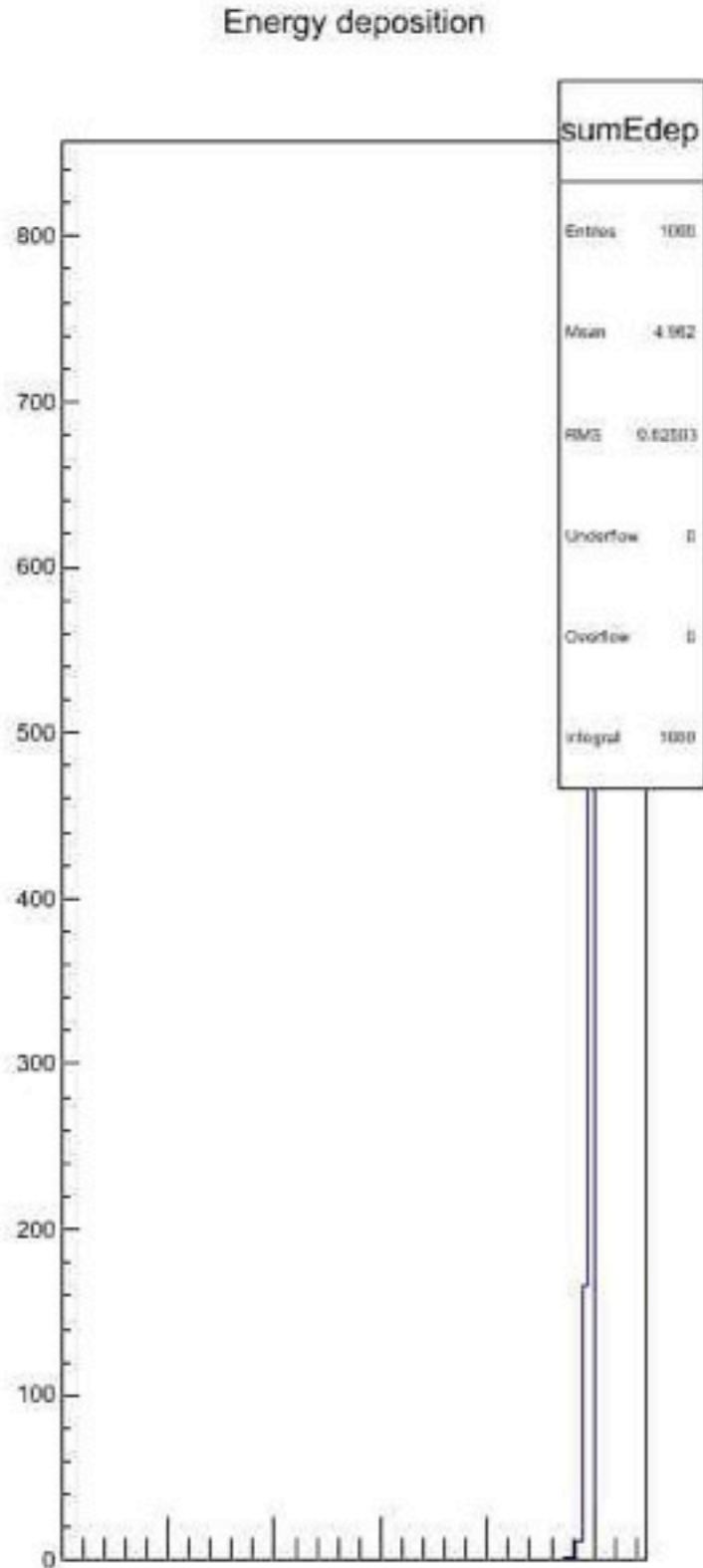
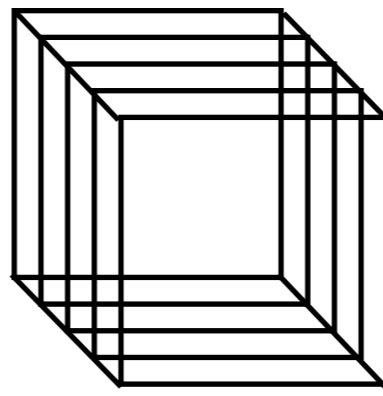


The Sampling

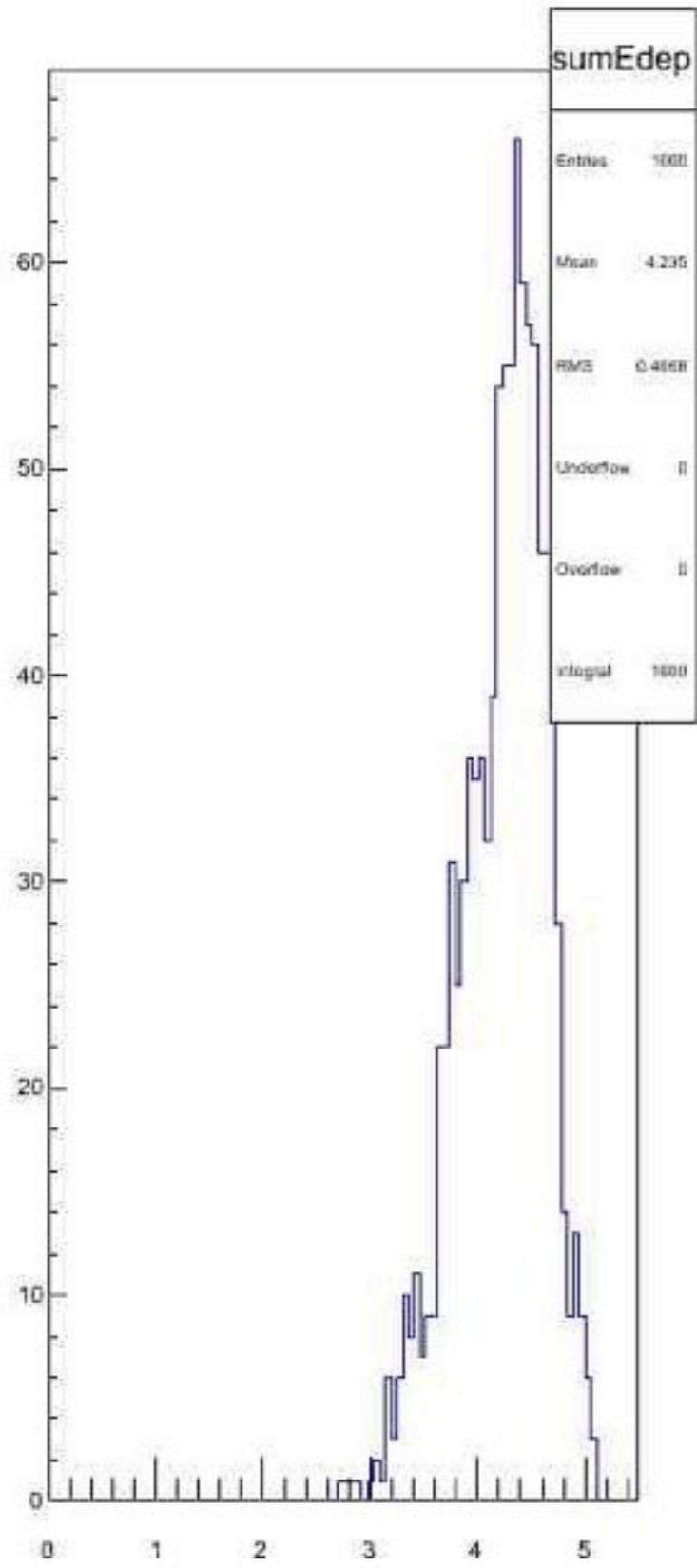
All geometries read exactly half the cells in the calorimeter...

- ▶ Every other layer,
- ▶ Every other column,
- ▶ Checkerboard pattern,
- ▶ Alternate checkerboard,
- ▶ Random?

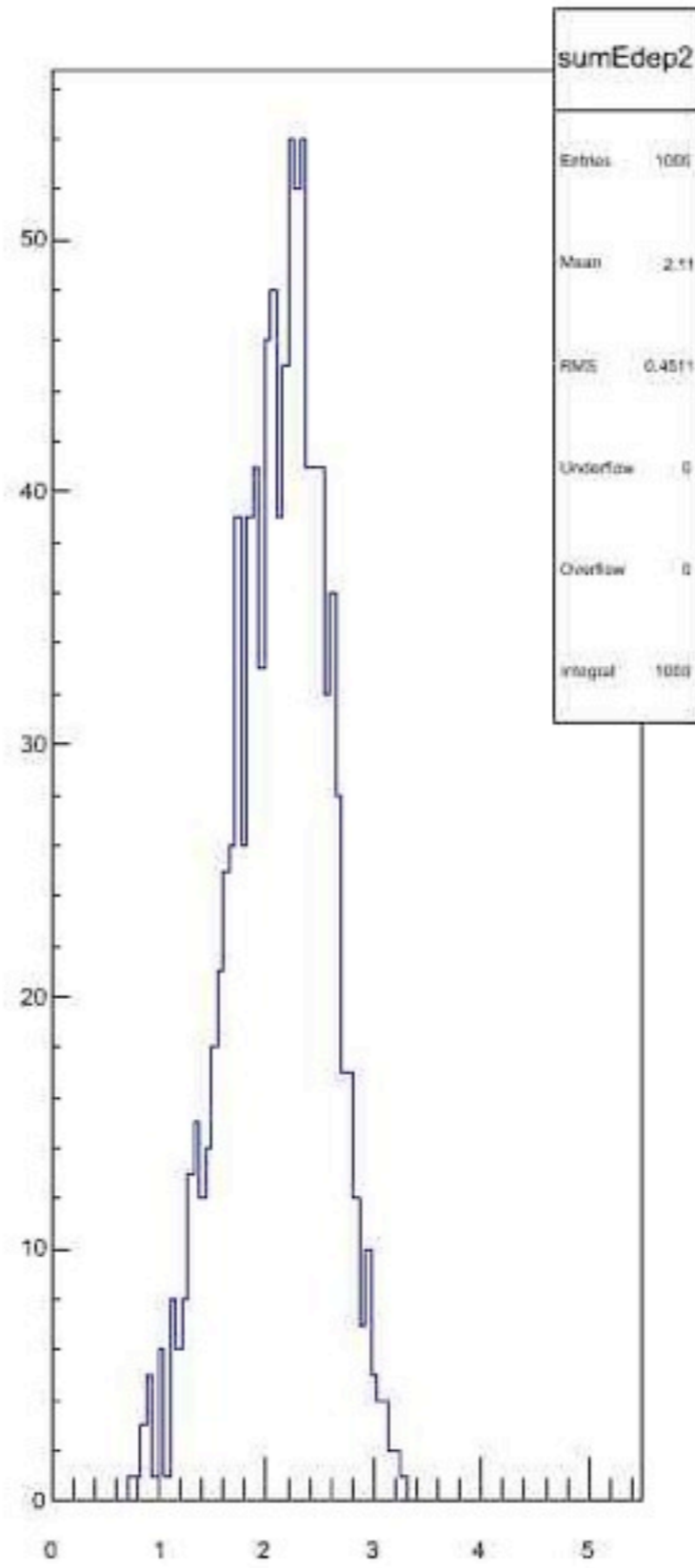
Sampling by layer



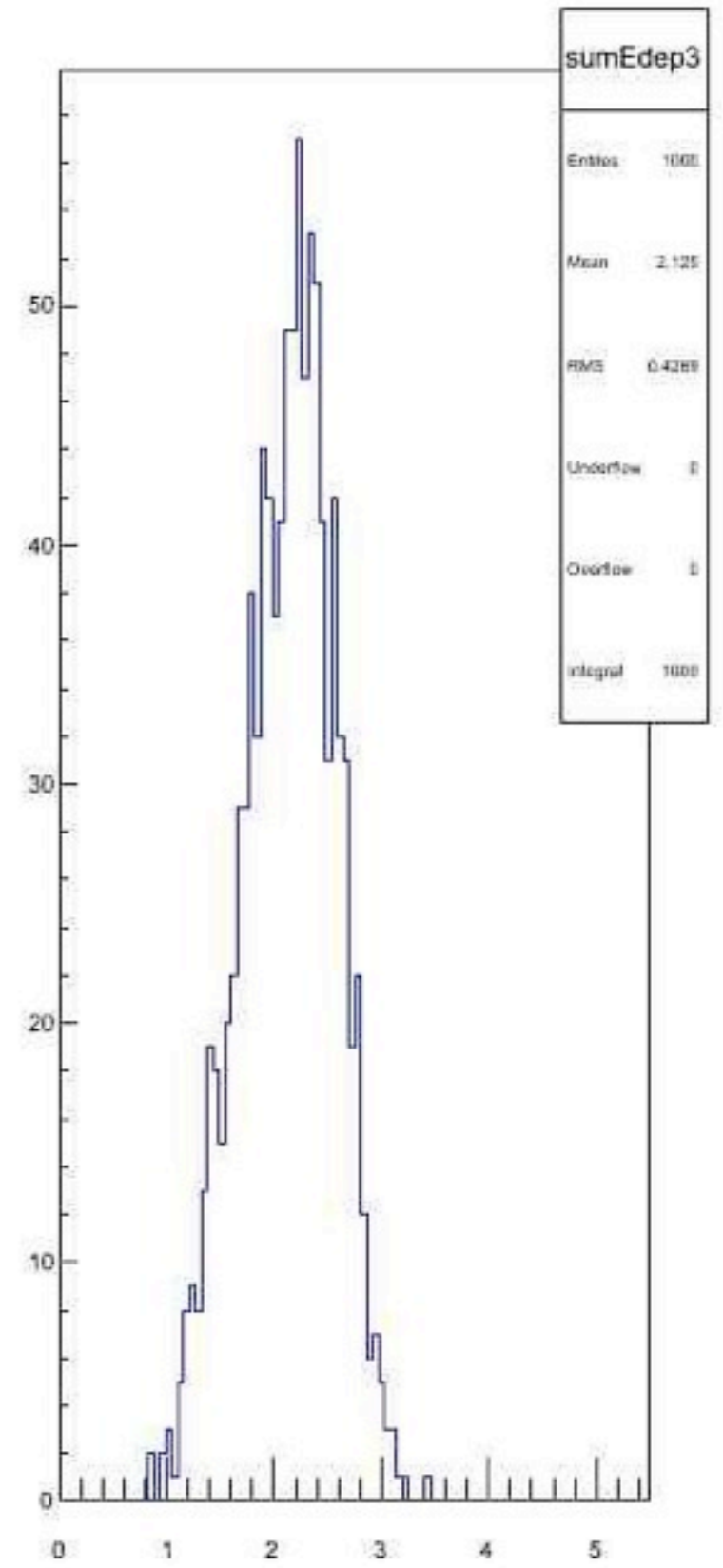
Energy deposition



Energy deposition/Even Layers

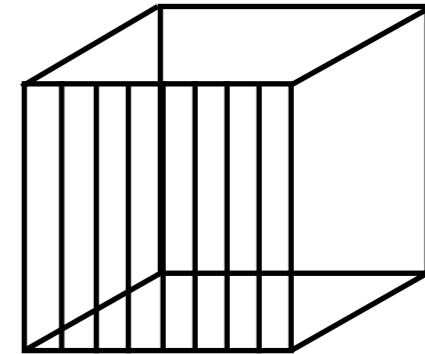
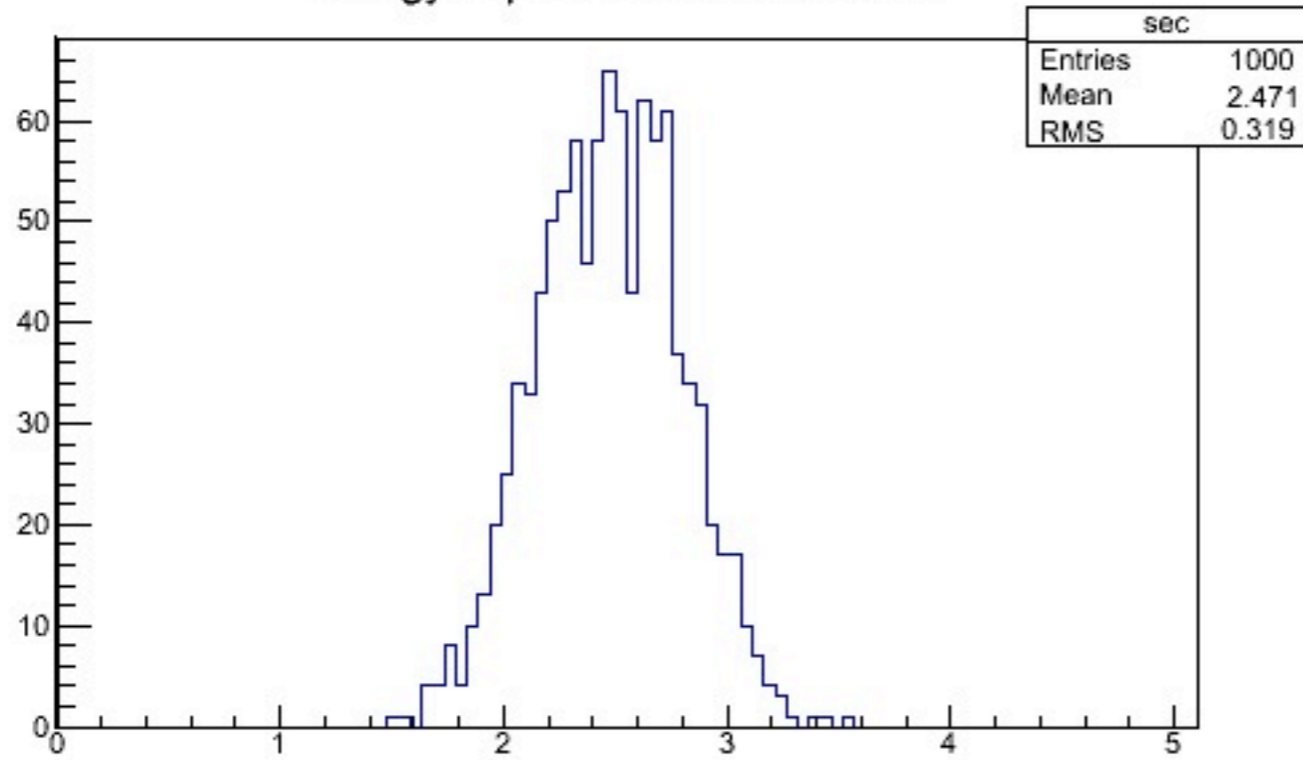


Energy deposition/Odd Layers

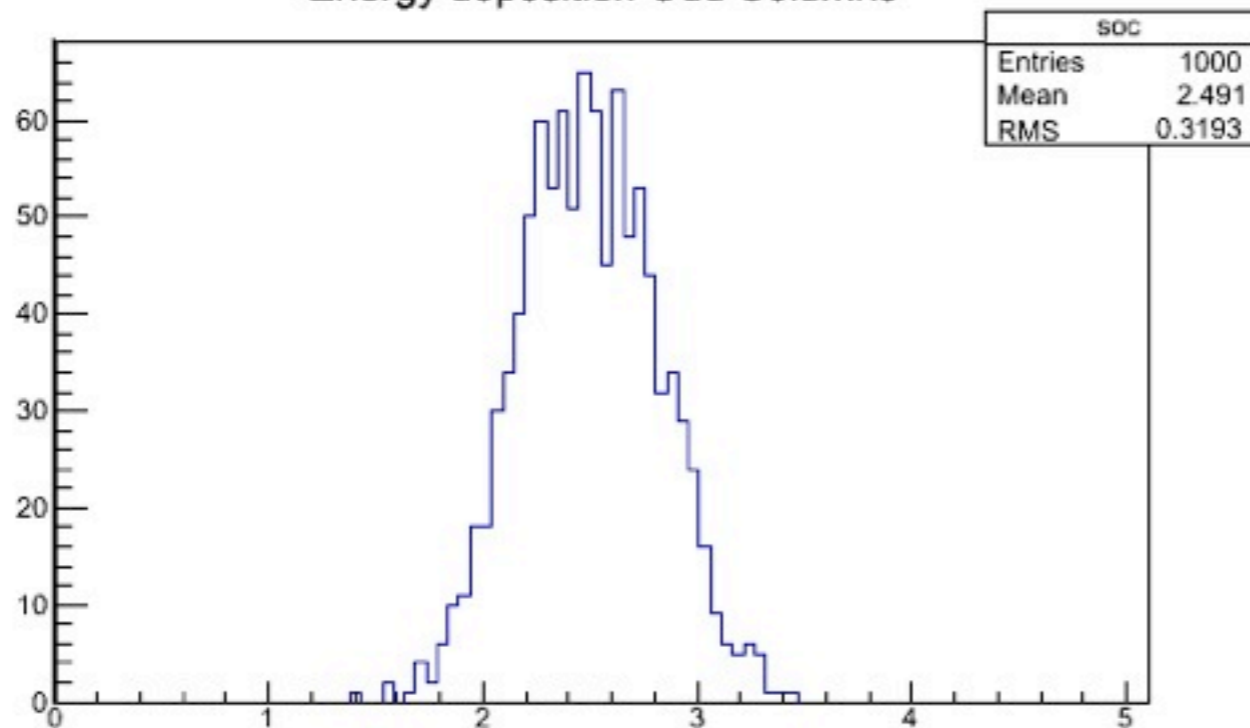


Sampling by column (5GeV electrons)

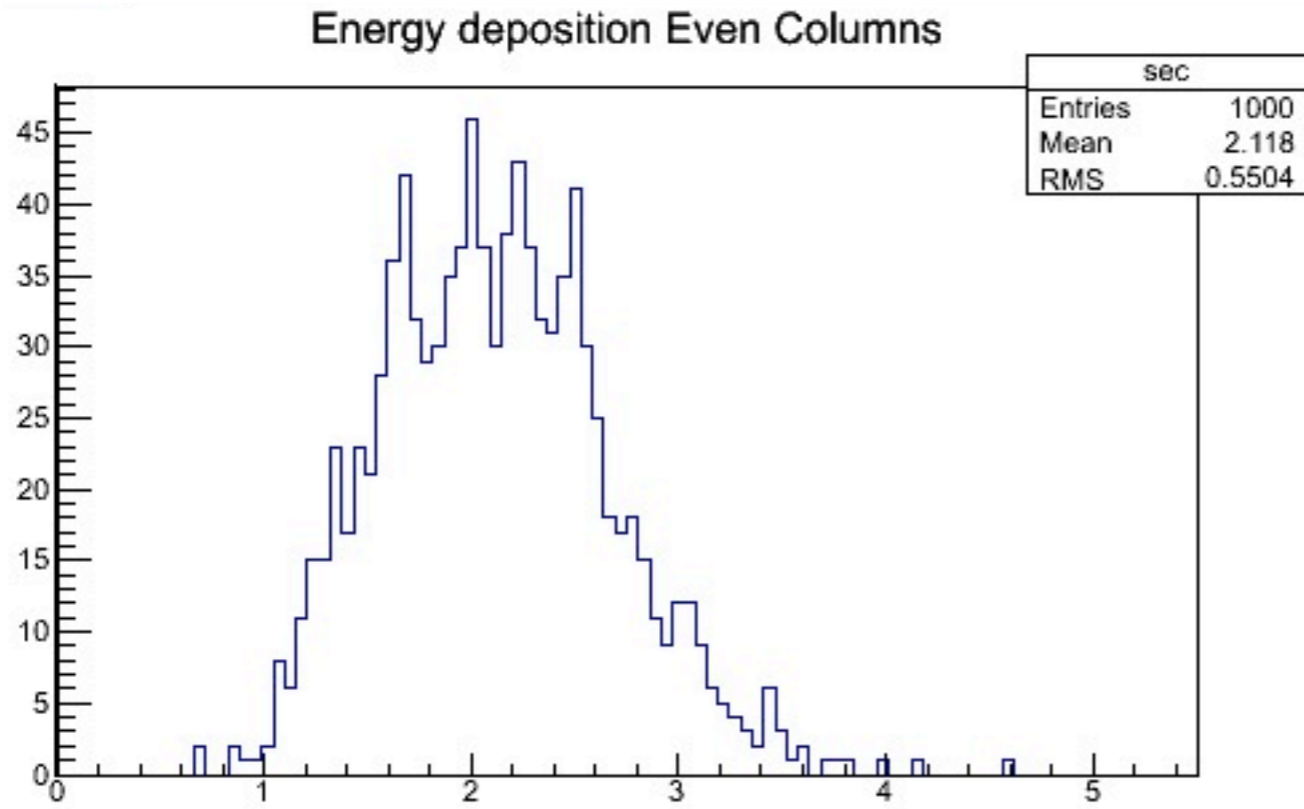
Energy deposition Even Columns



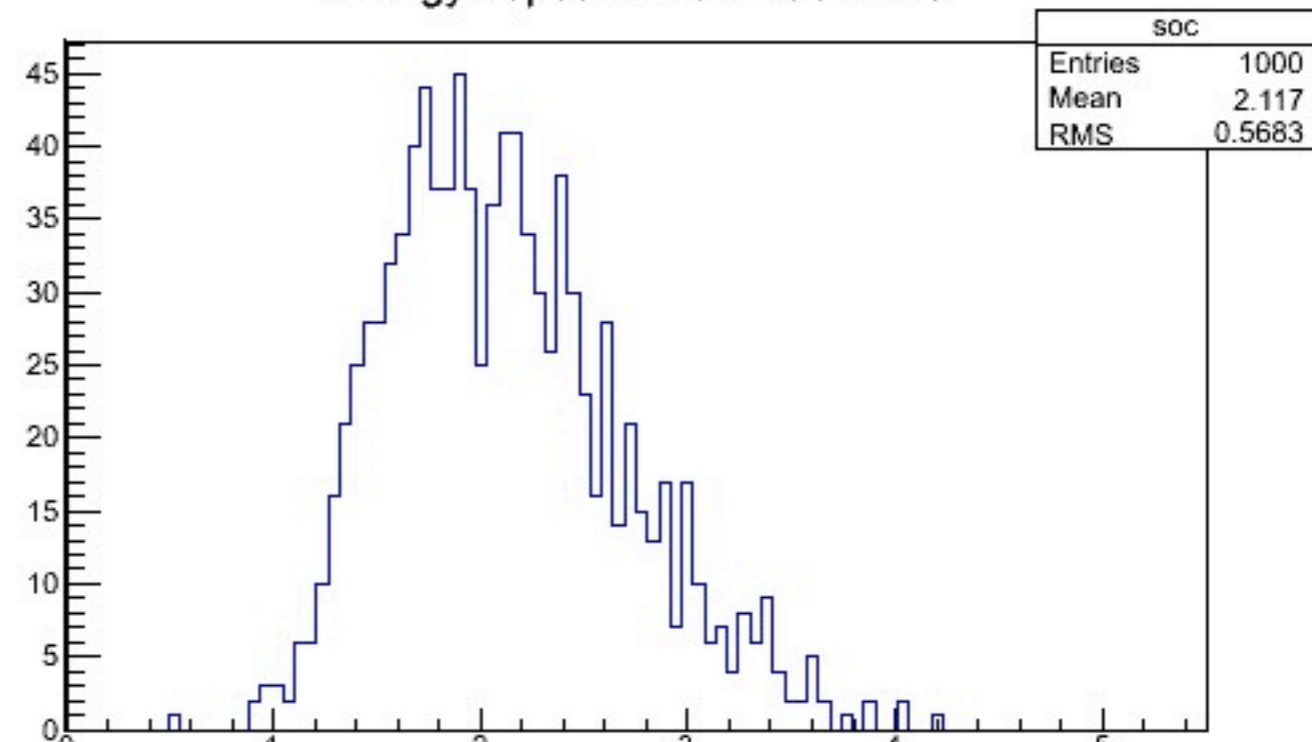
Energy deposition Odd Columns



Sampling by column (5GeV pi-)

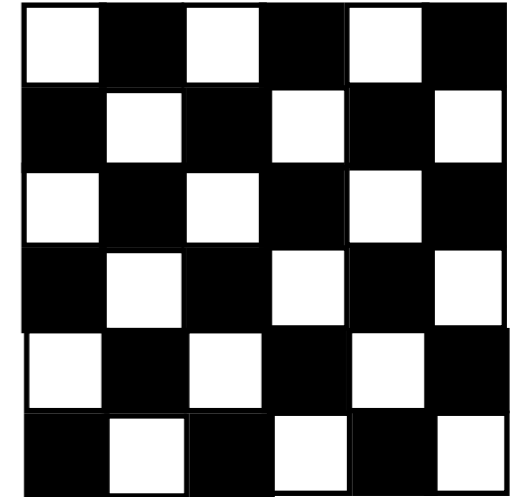
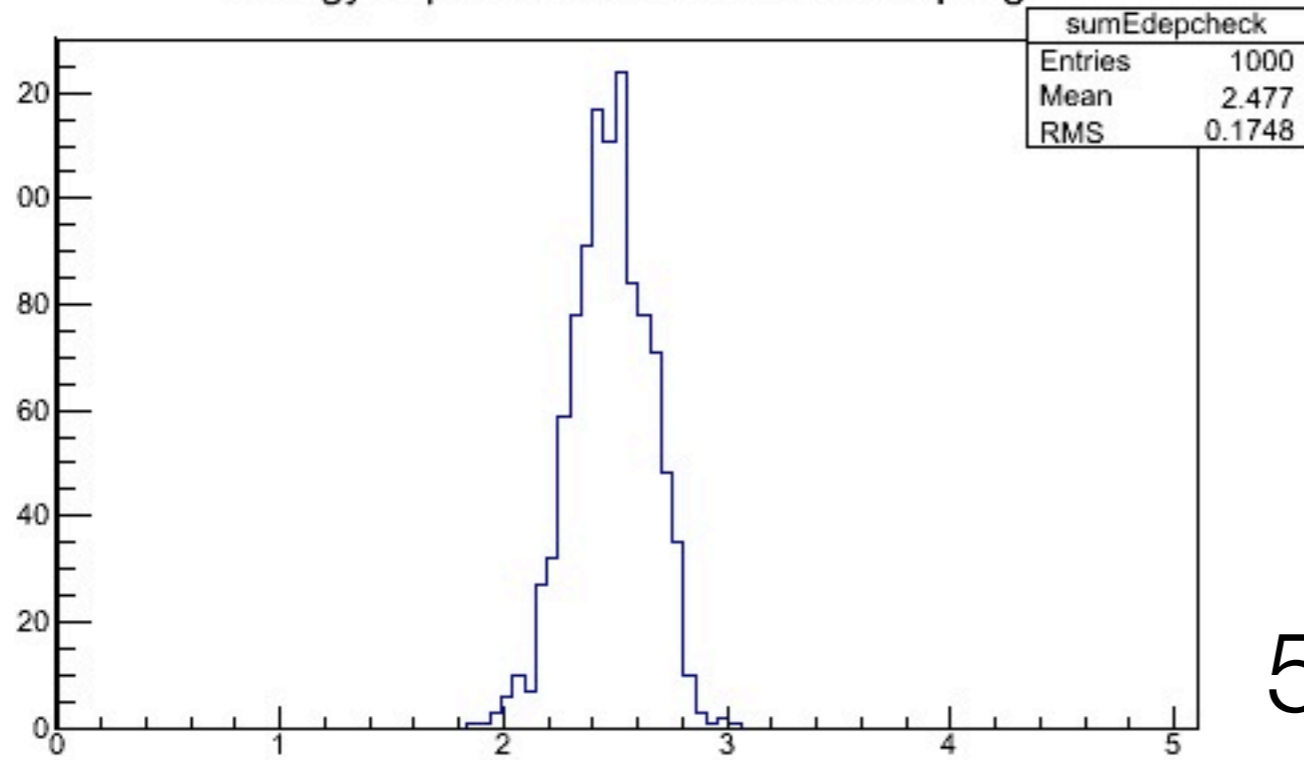


Energy deposition Odd Columns



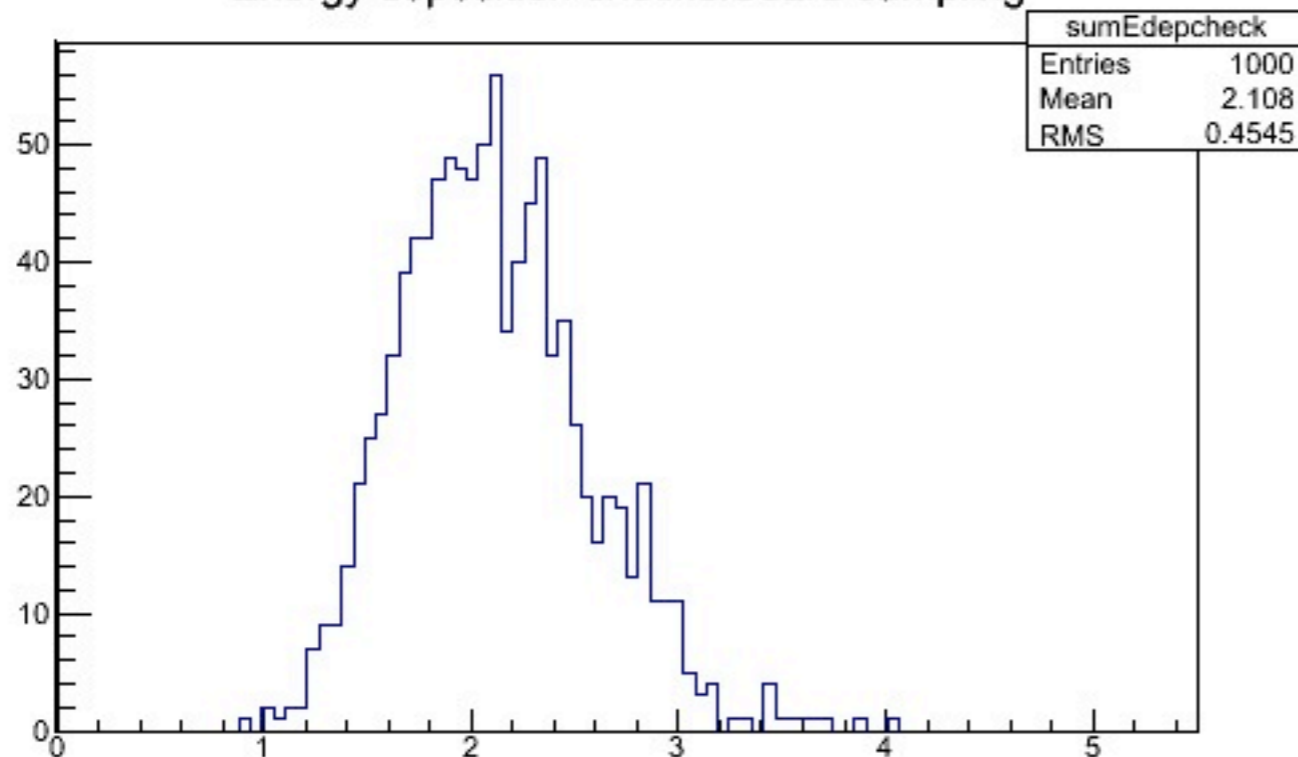
Checkerboard

Energy deposition checkerboard sampling



5 GeV electrons

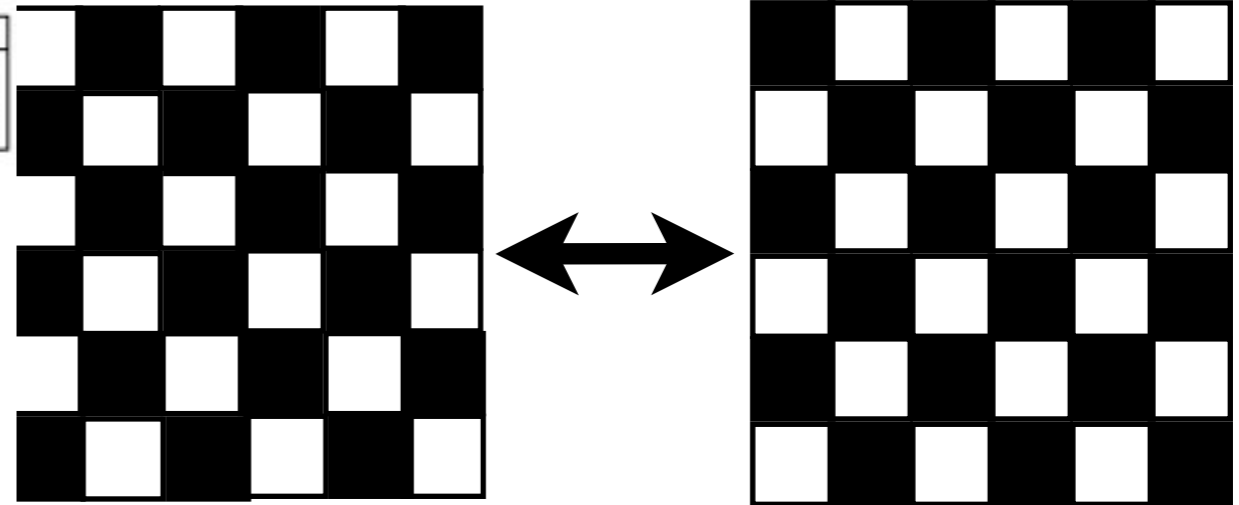
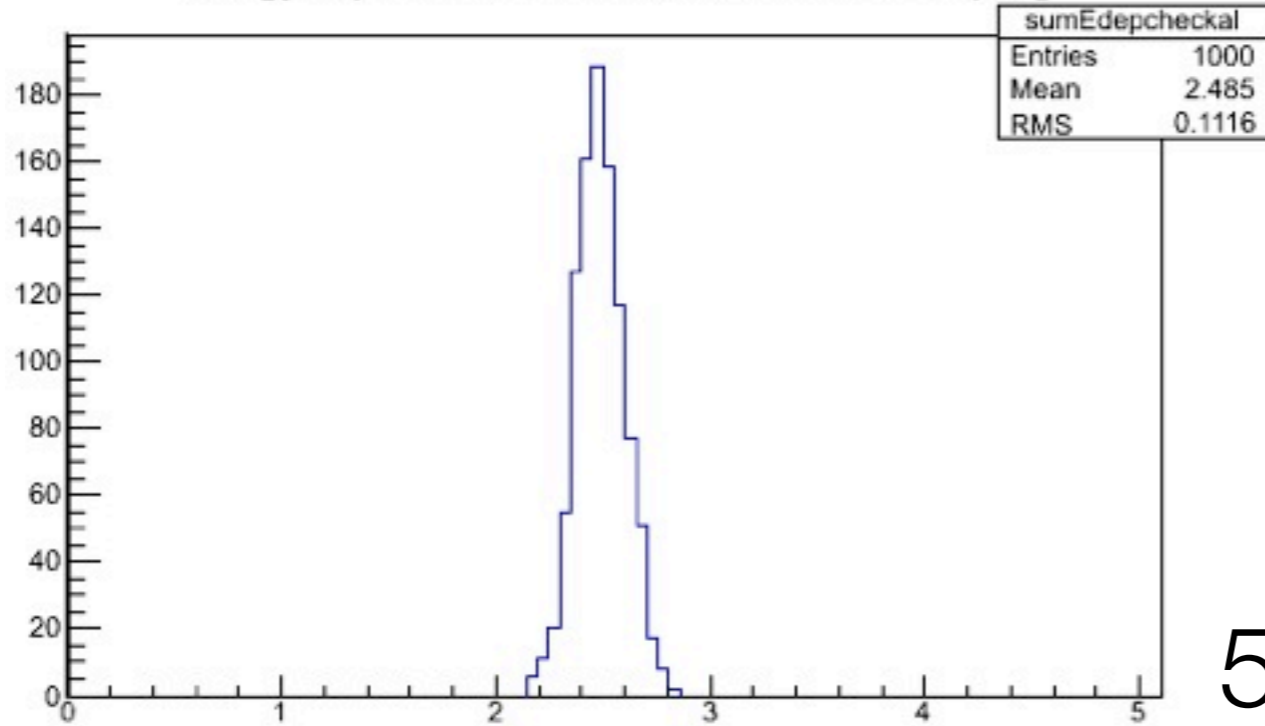
Energy deposition checkerboard sampling



5 GeV pi-

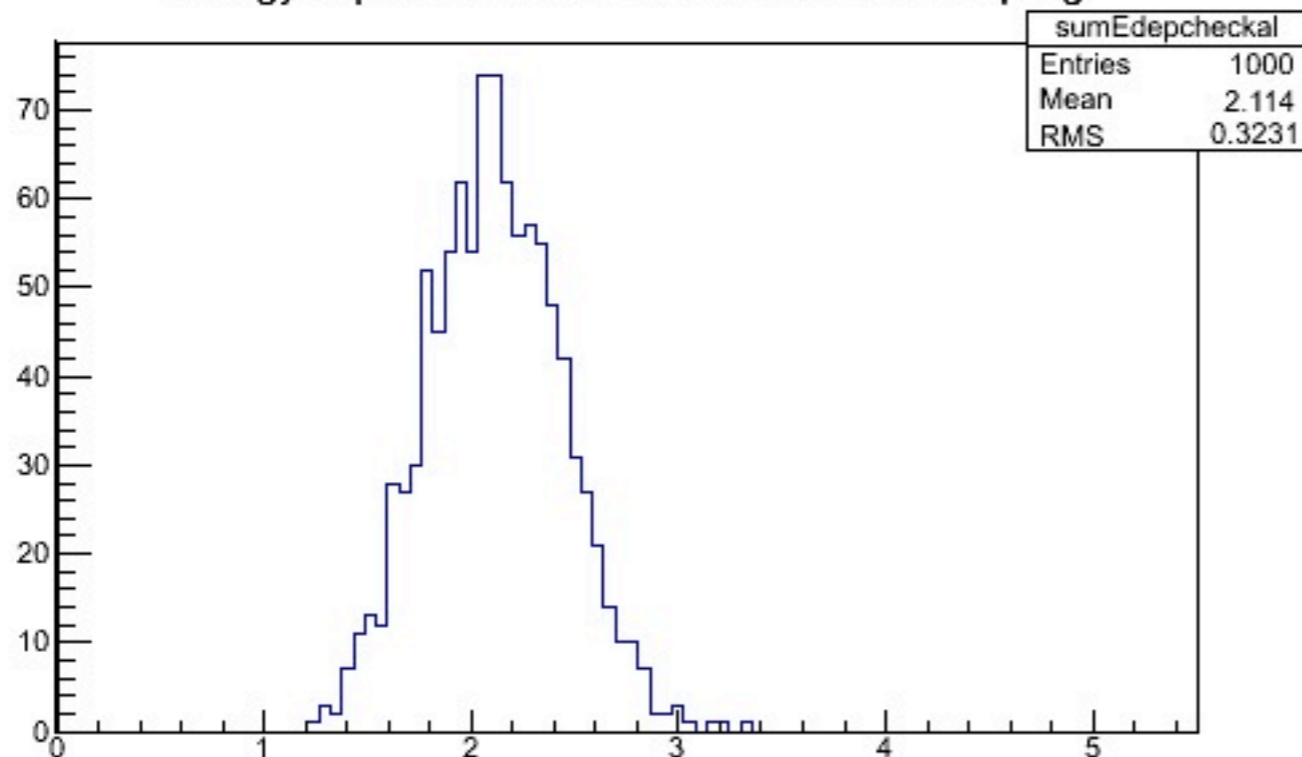
Alternating Checkerboard

Energy deposition checkerboard alternate sampling



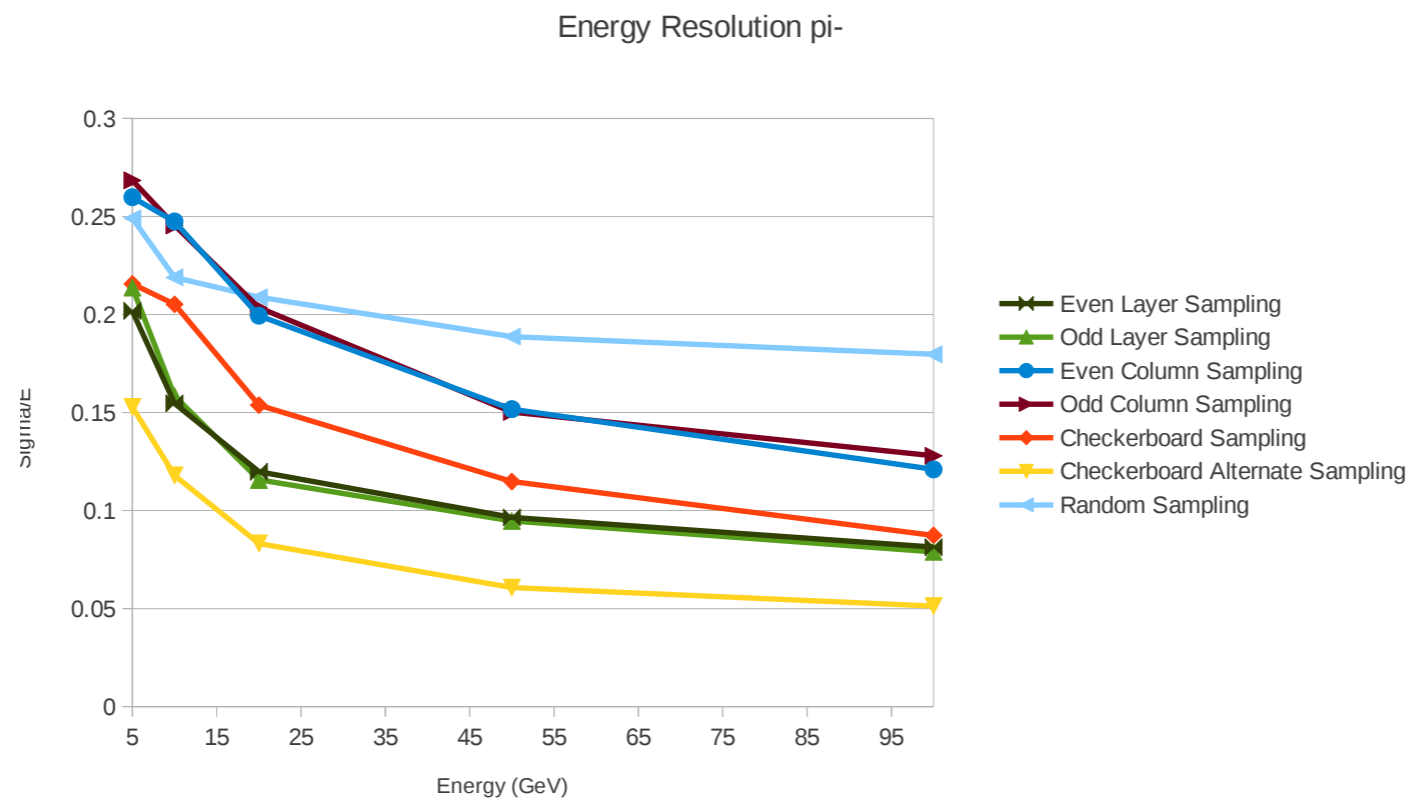
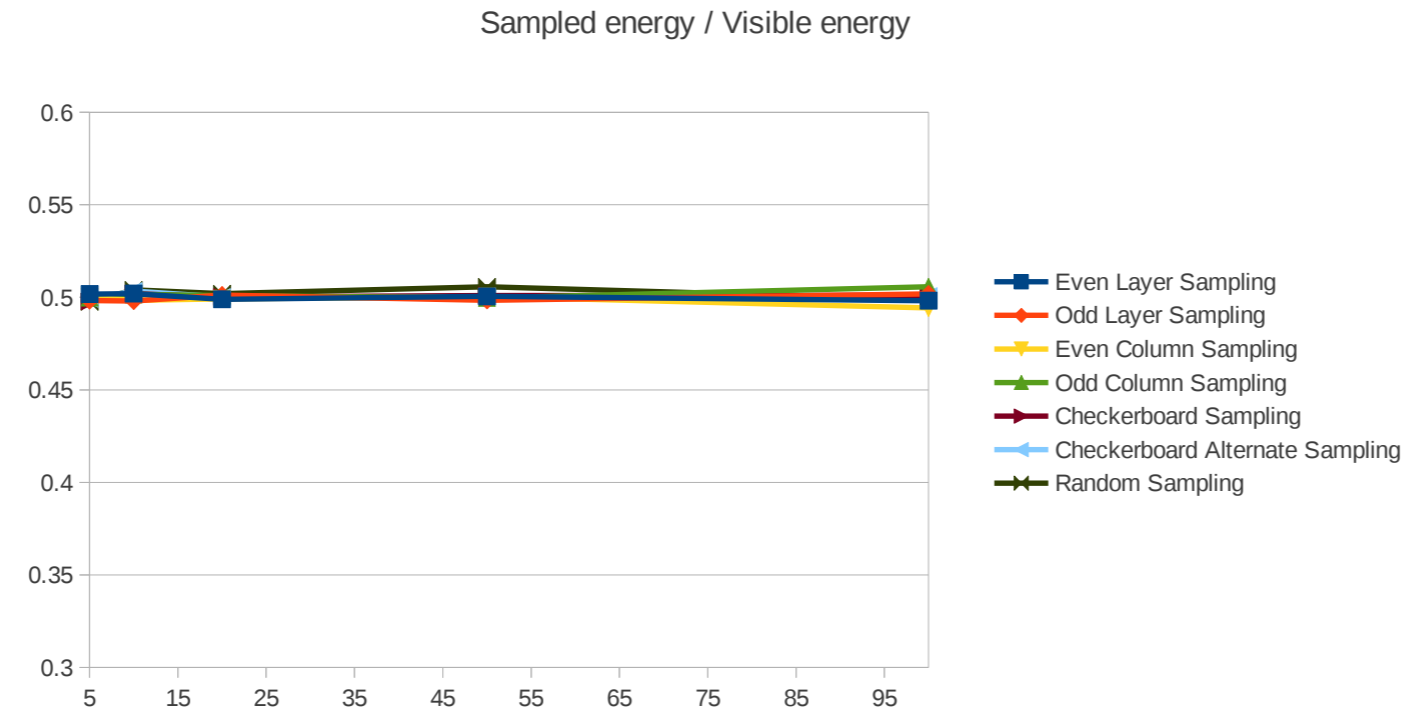
5 GeV electrons

Energy deposition checkerboard alternate sampling

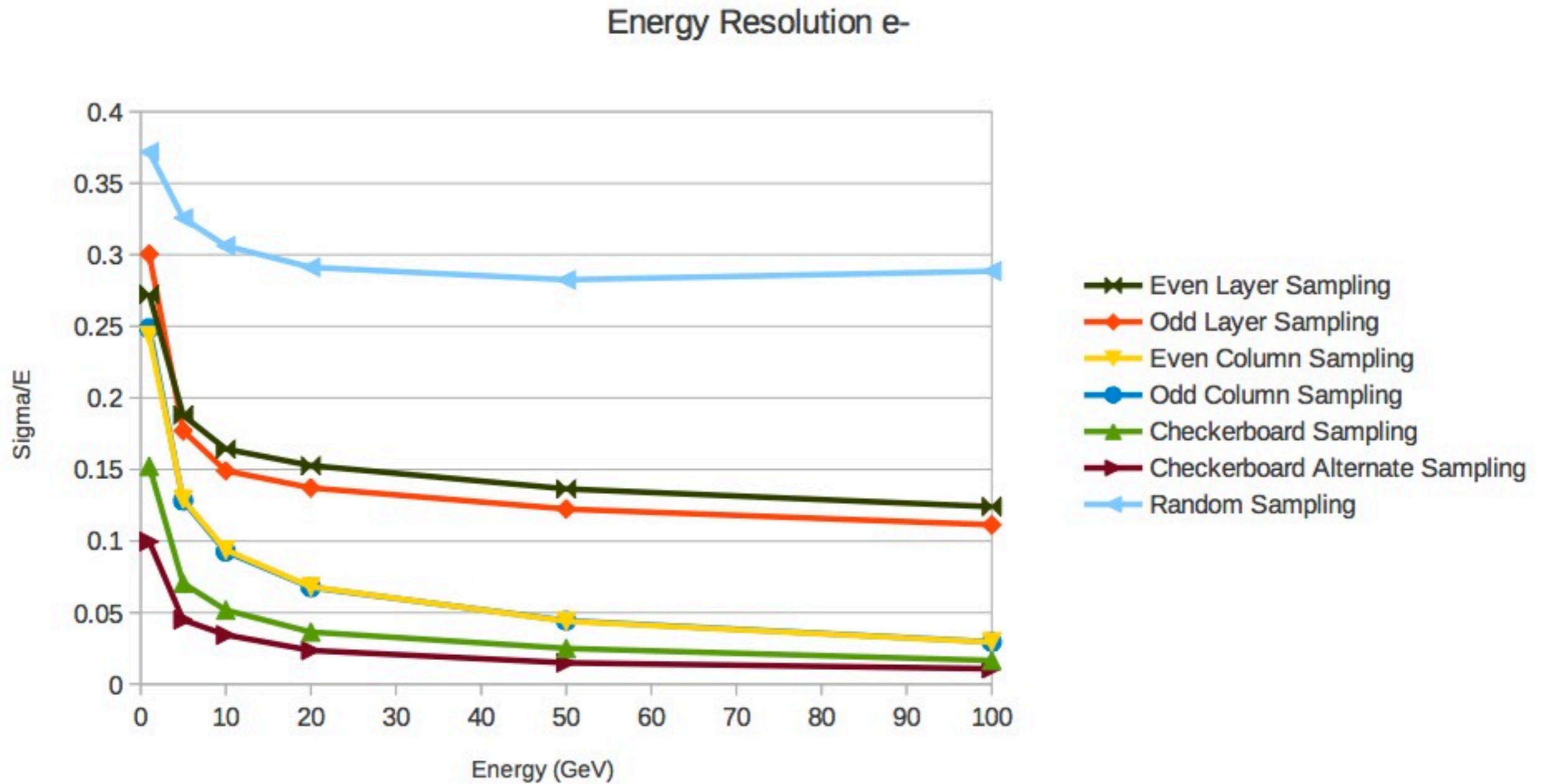


5 GeV pi-

pi- overall results



electron results



electron results

