Preliminary Results on Non-Projective HCal Simulations

Dhiman Chakraborty, Guilherme Lima, Jeremy McCormick, Vishnu Zutshi

NICADD / Northern Illinois University

07/07/03

Status Summary

- Last week
  - overview, status and plans for short and medium term
- Today
  - Non-projective Hcal geometry
  - Geometry initialization
  - Preliminary results
  - ...

Why a non-projective HadCal?

- A projective geometry is
  - easy to analyze (cal towers)
  - easy to find cell neighbors, cones
- But it also
  - needs many different cell sizes
  - may have cells too big at outer layers
  - cells may be too large at lower angles

Why a non-projective HCal?

- Fabricating a small number of cell sizes is simpler, cheaper and maybe even better…
- Small cell sizes are nice for a digital calorimeter, but too many small cells may become a nightmare:
  - Hot cells / dead cells
  - Space for readout
  - Cost per channel
- Simulations are helpful to adjust cell dimensions in order to maximize performance/cost ratio.

First version of NP simulator

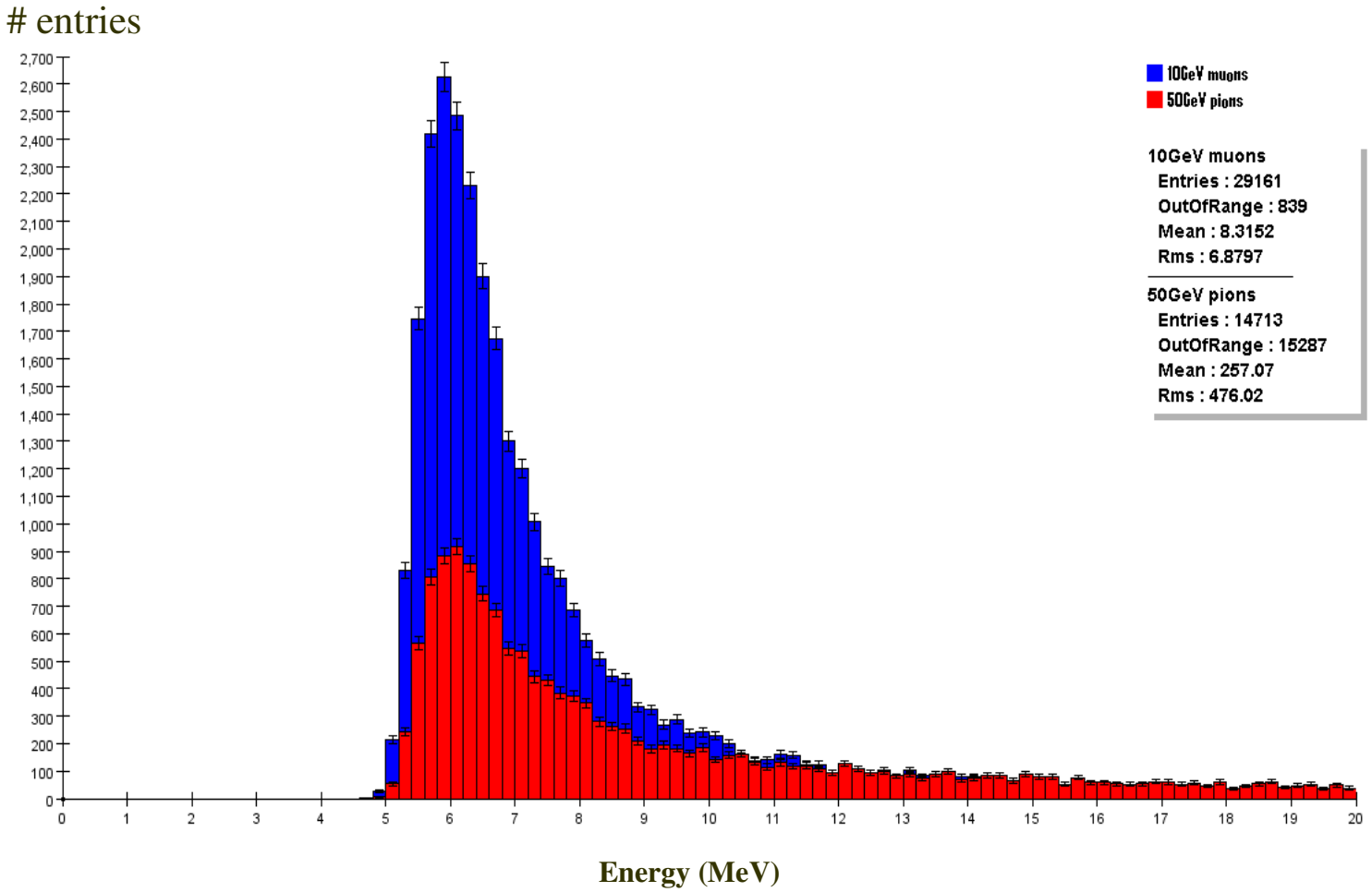
- Based on (projective) LCDG4
- Fixed cell sizes (rectangular for now)
- User provides cell dimensions, and simulator makes slight adjusts (few %) for integral numbers of cells along z, ϕ
- Only HCal for now, but plans for ECal

Preliminary tests

- Use single particles:
  - Muons, pions and electrons
  - Fixed directions in space
  - Different energies (2,5,10,20,30,50 GeV)
- Absolute energy deposition
- Comparison with projective geometry
  - Same energy deposition per layer
  - Number of hit cells reasonably scales with inverse of cell area (pions)
- Complex physics events

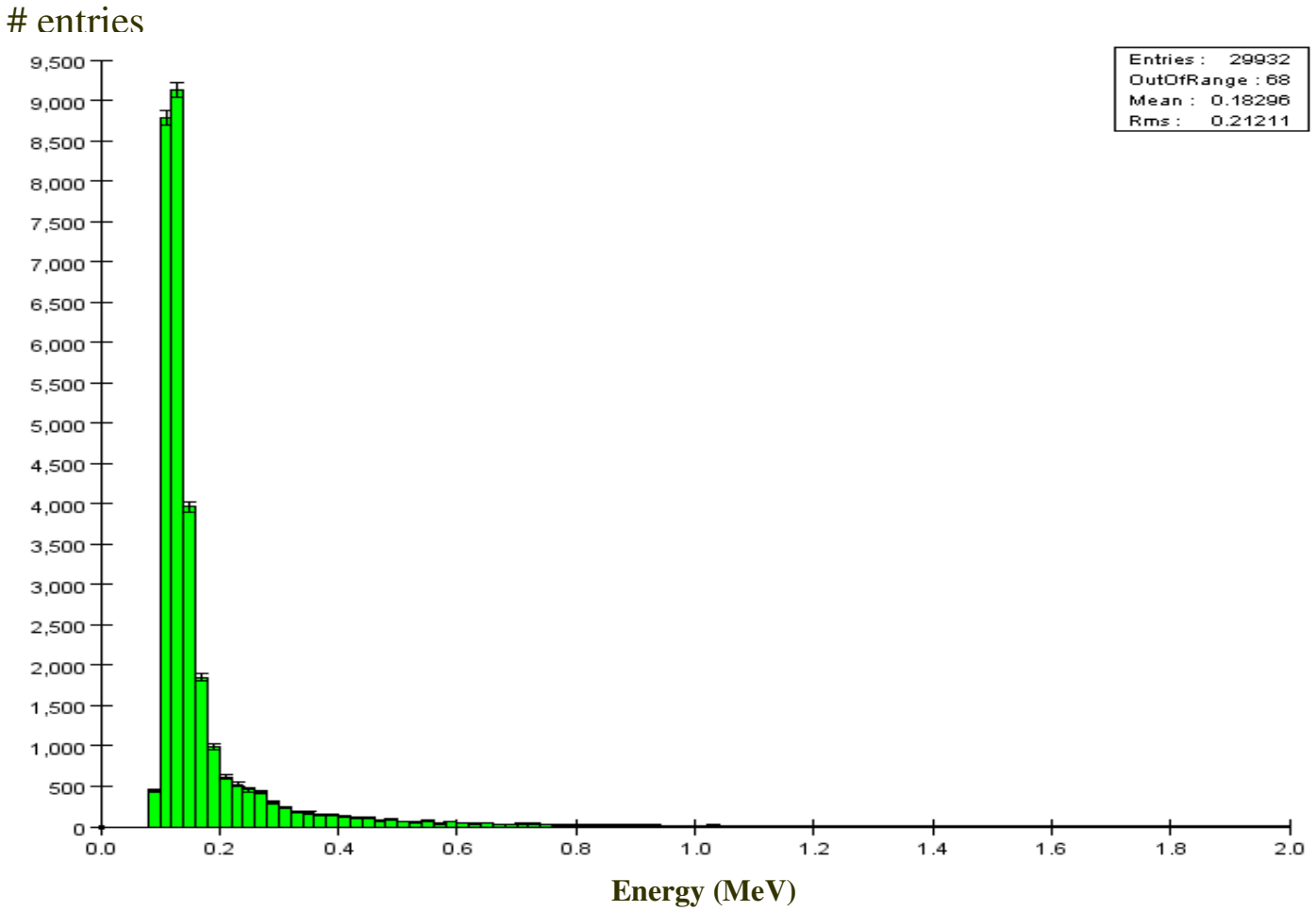
Energy in ECal absorber

Estimate approx 8.7 MeV for a MIP

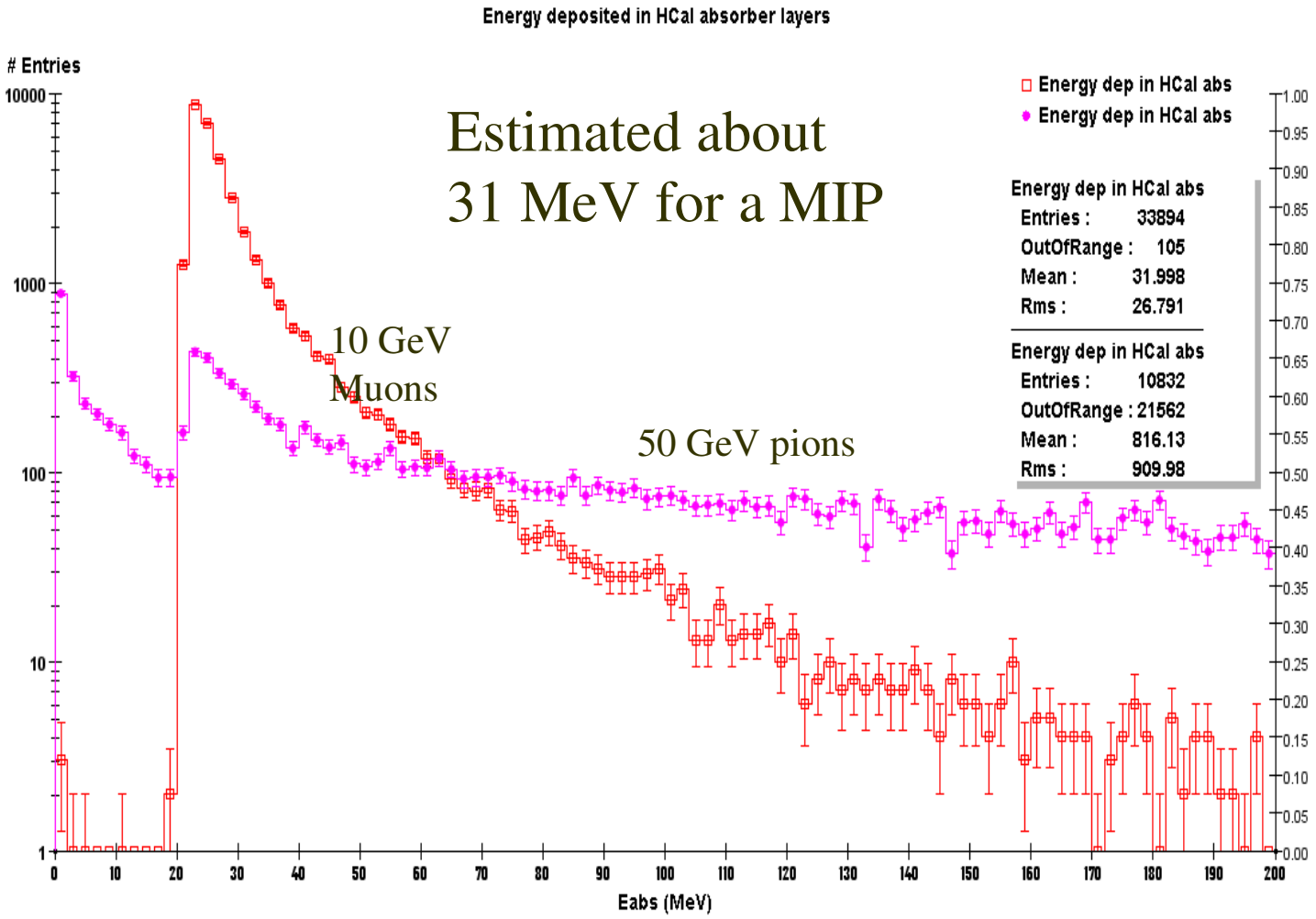


Energy in Ecal sensors

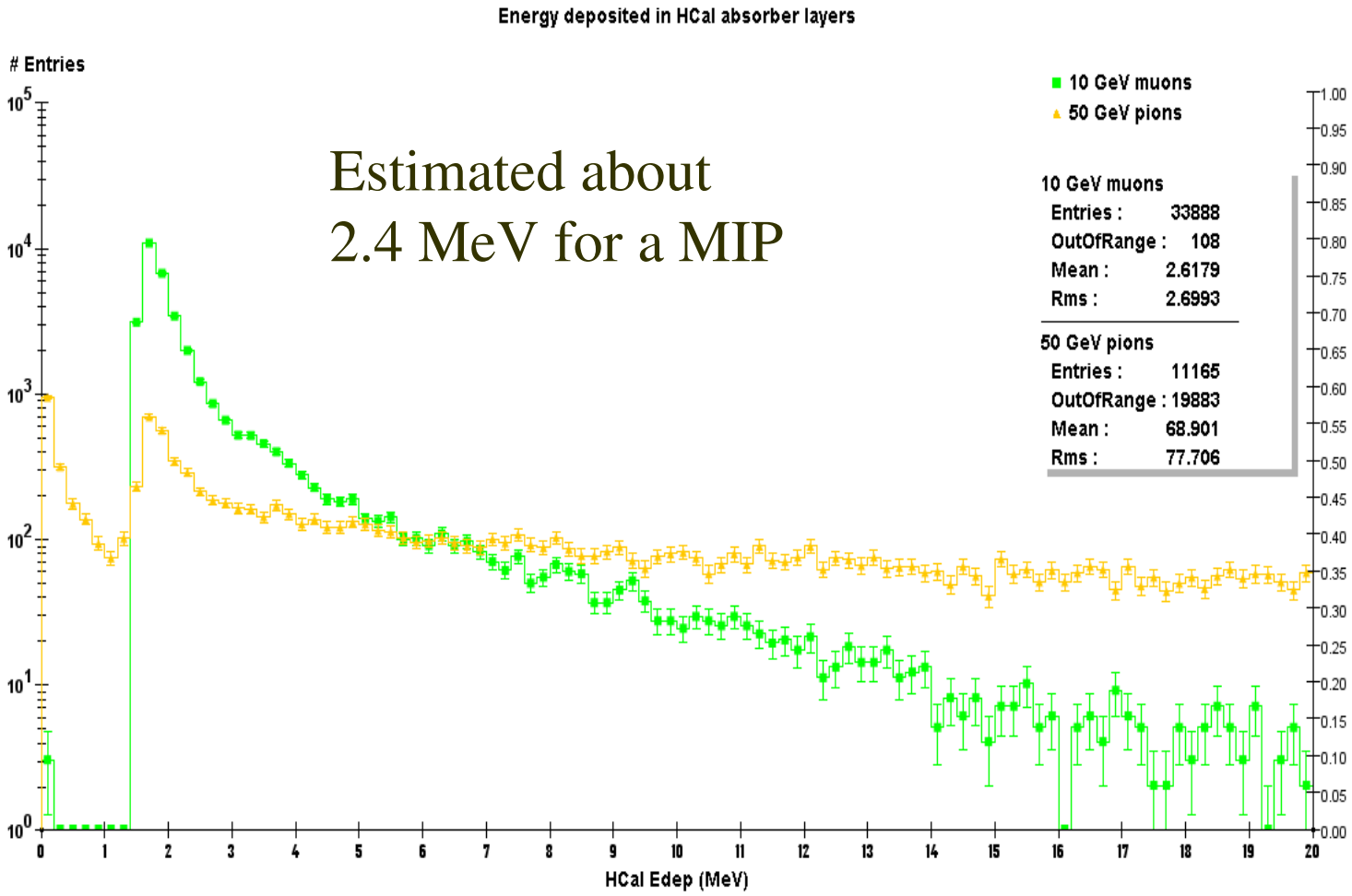
Estimate approx 0.2 MeV for a MIP



Energy in HCal absorber

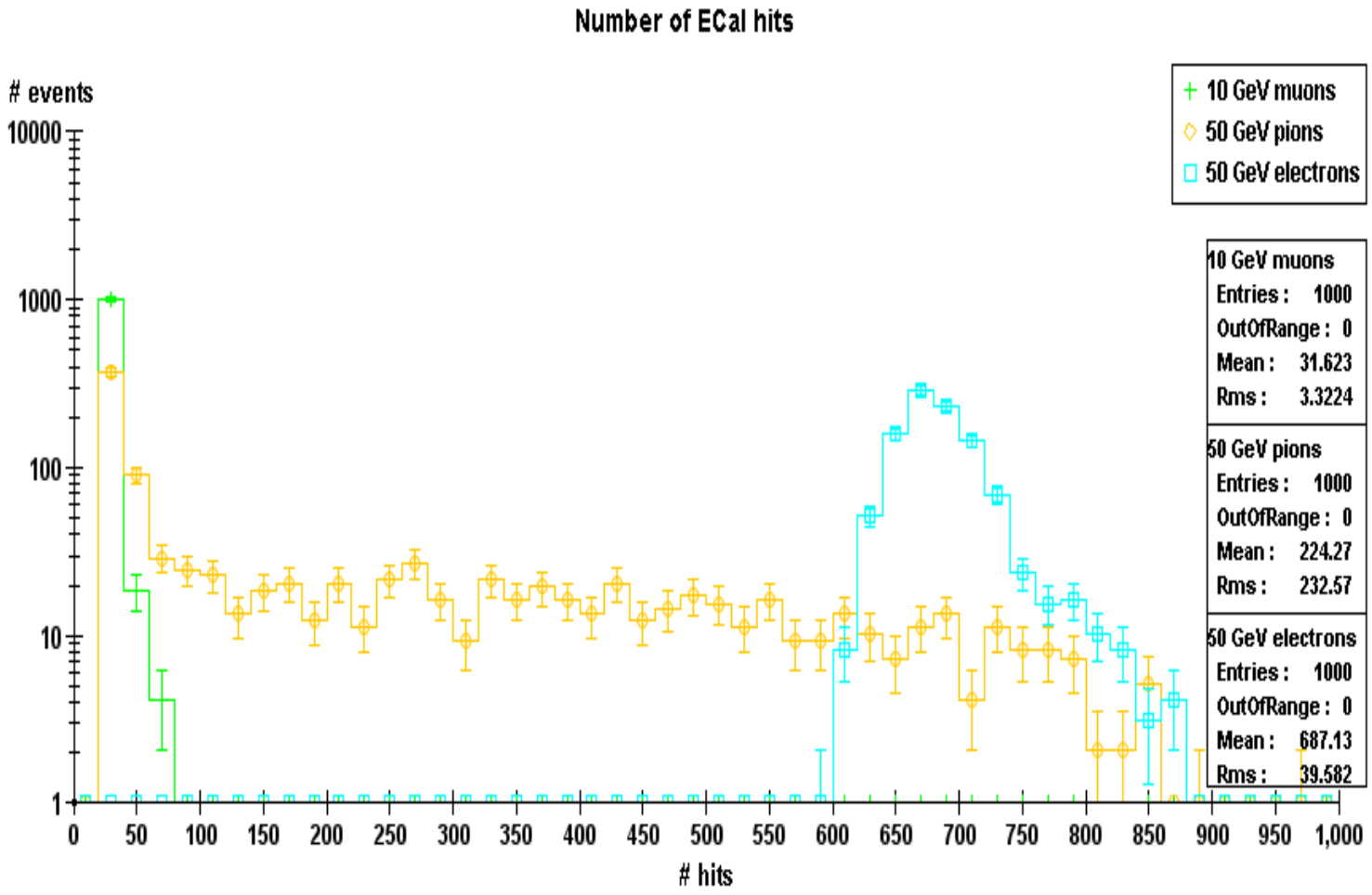


Energy in HCal sensitive layers

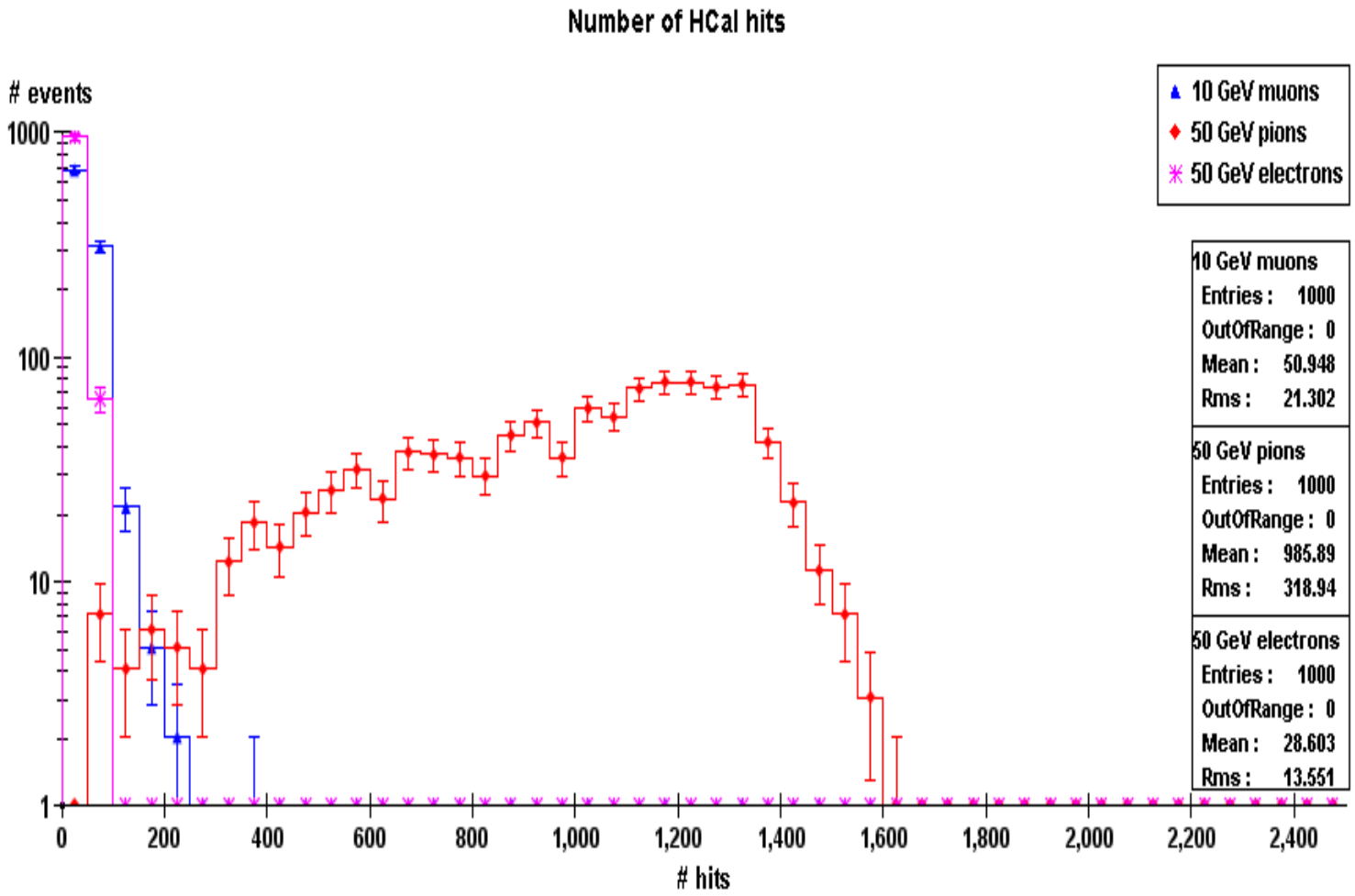


Estimated about
2.4 MeV for a MIP

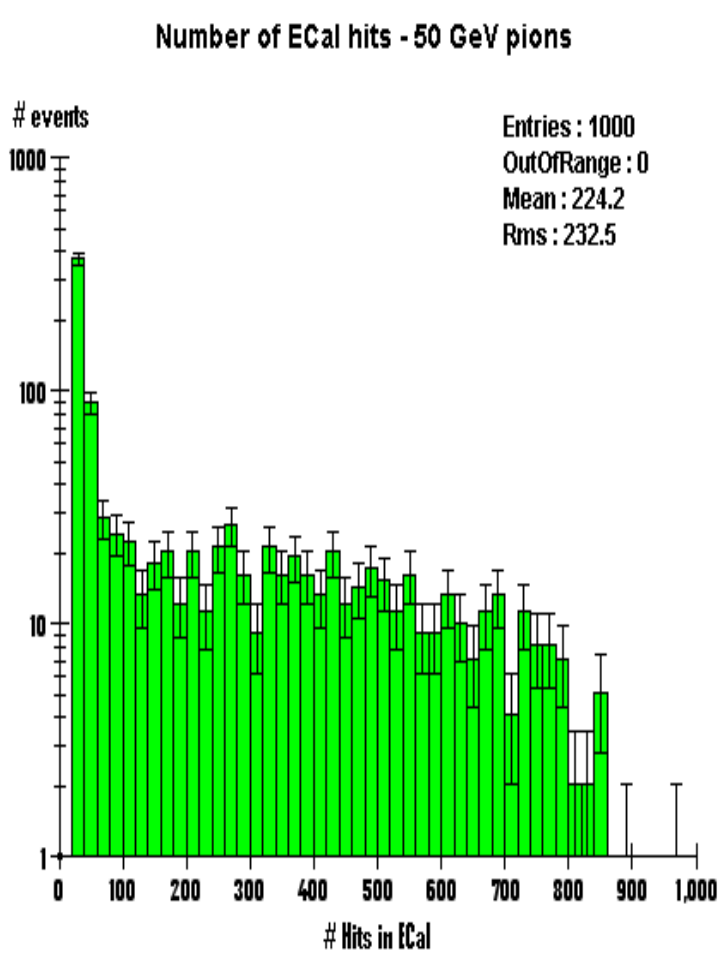
Number of hits in ECal

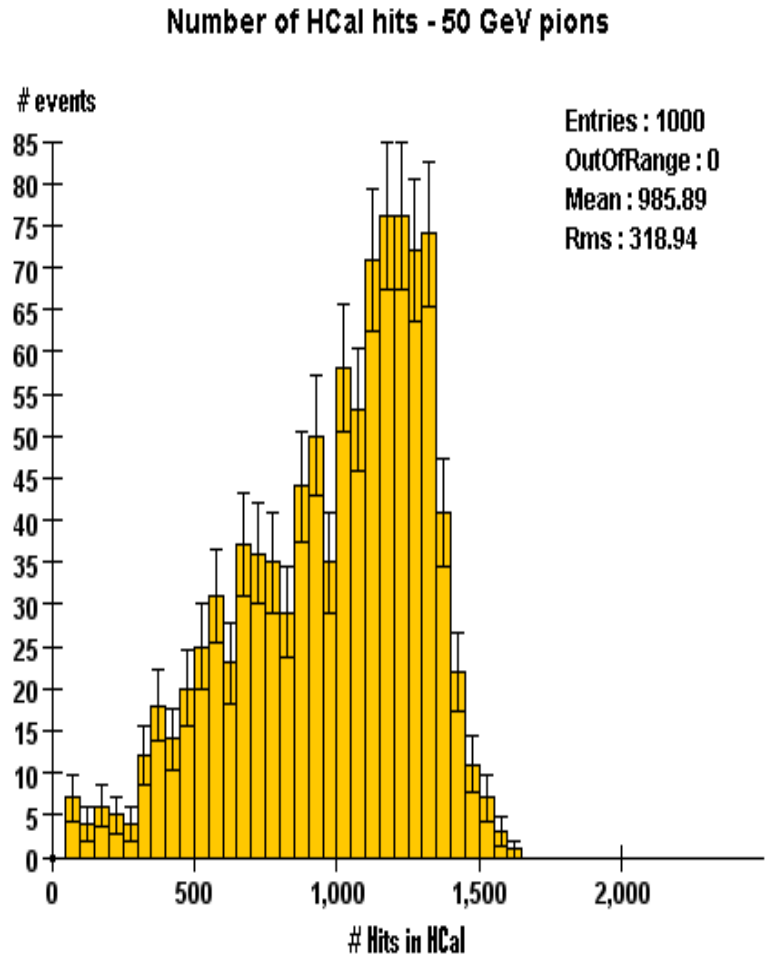


Number of hits in HCal

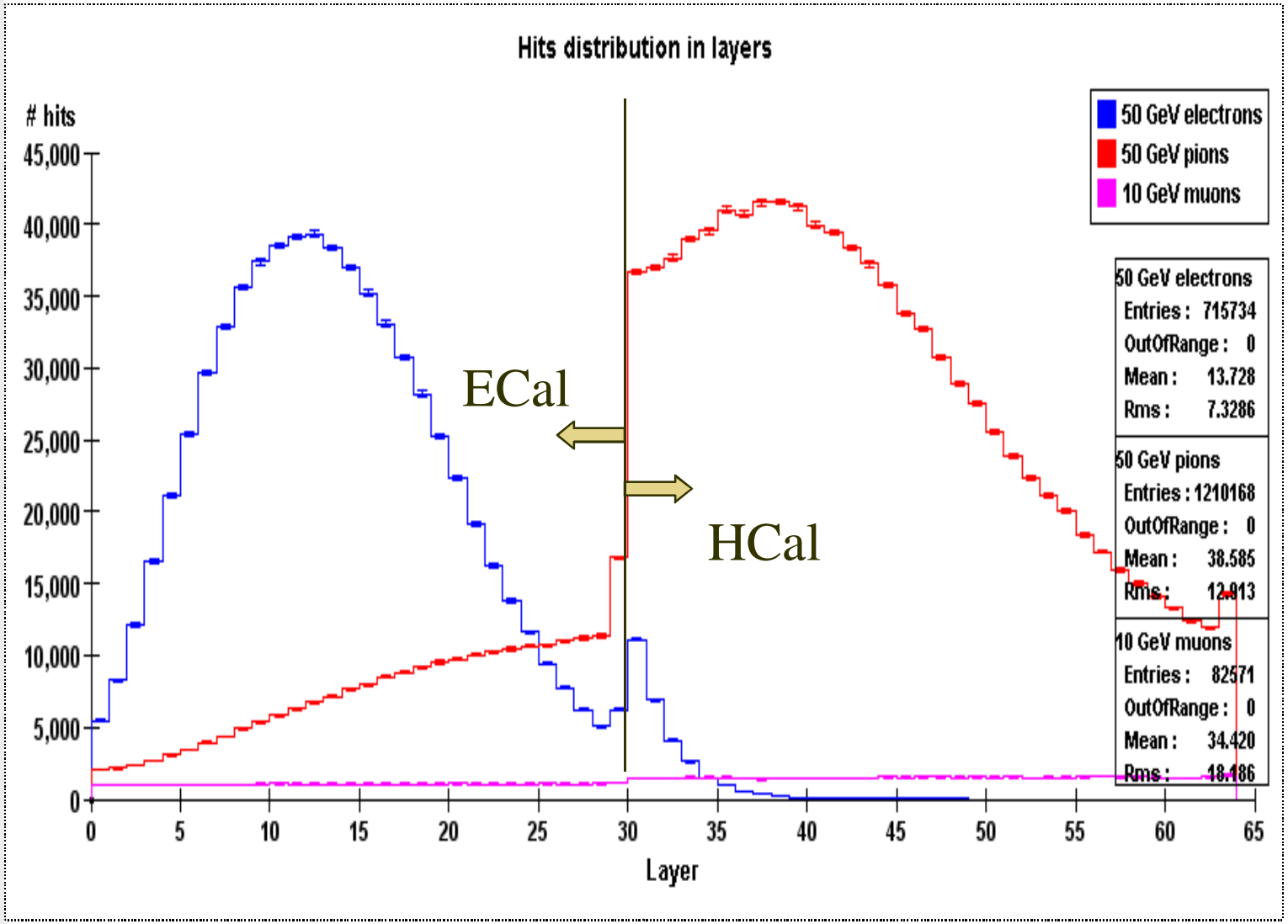


Comparison to LCDG4proj and GISMO

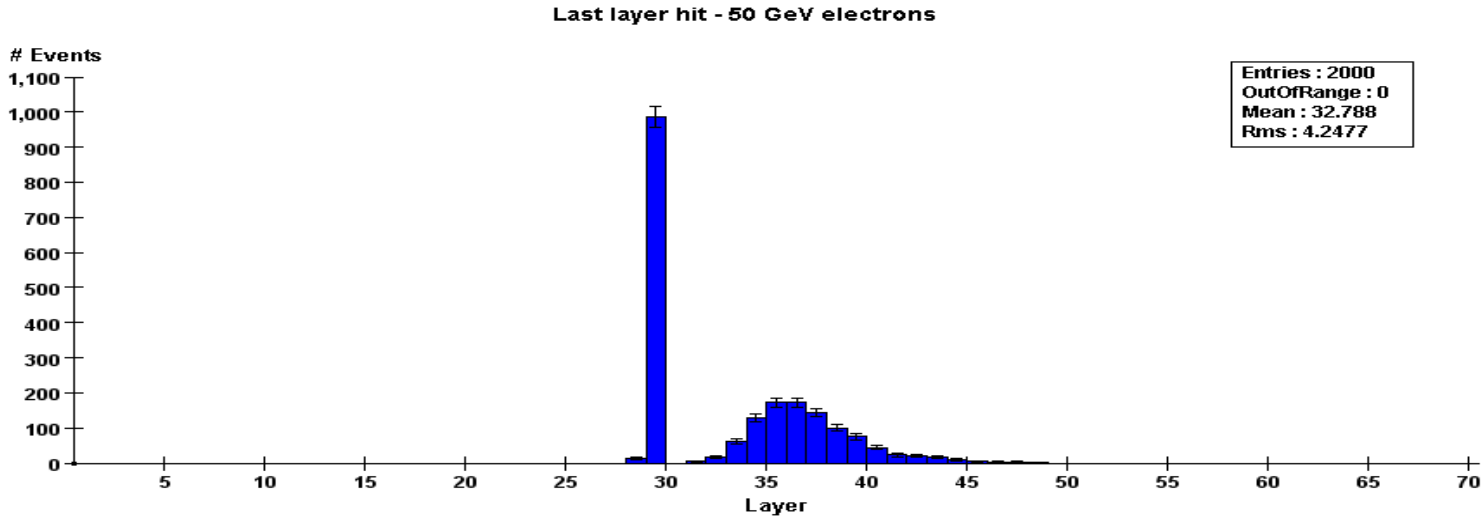


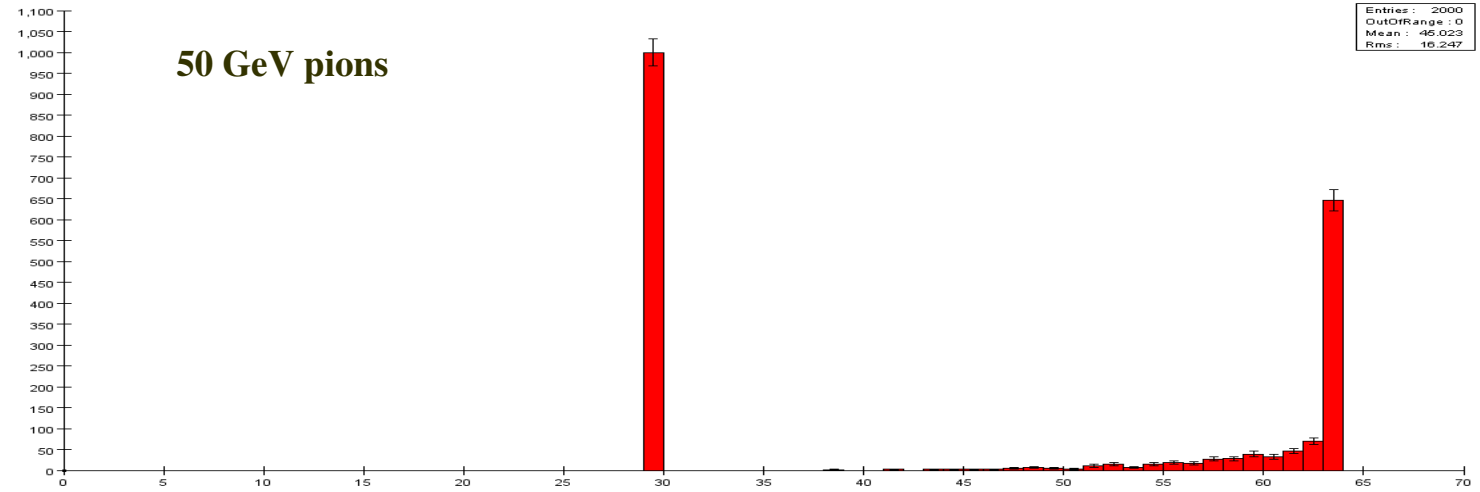


Hit distributions per layer

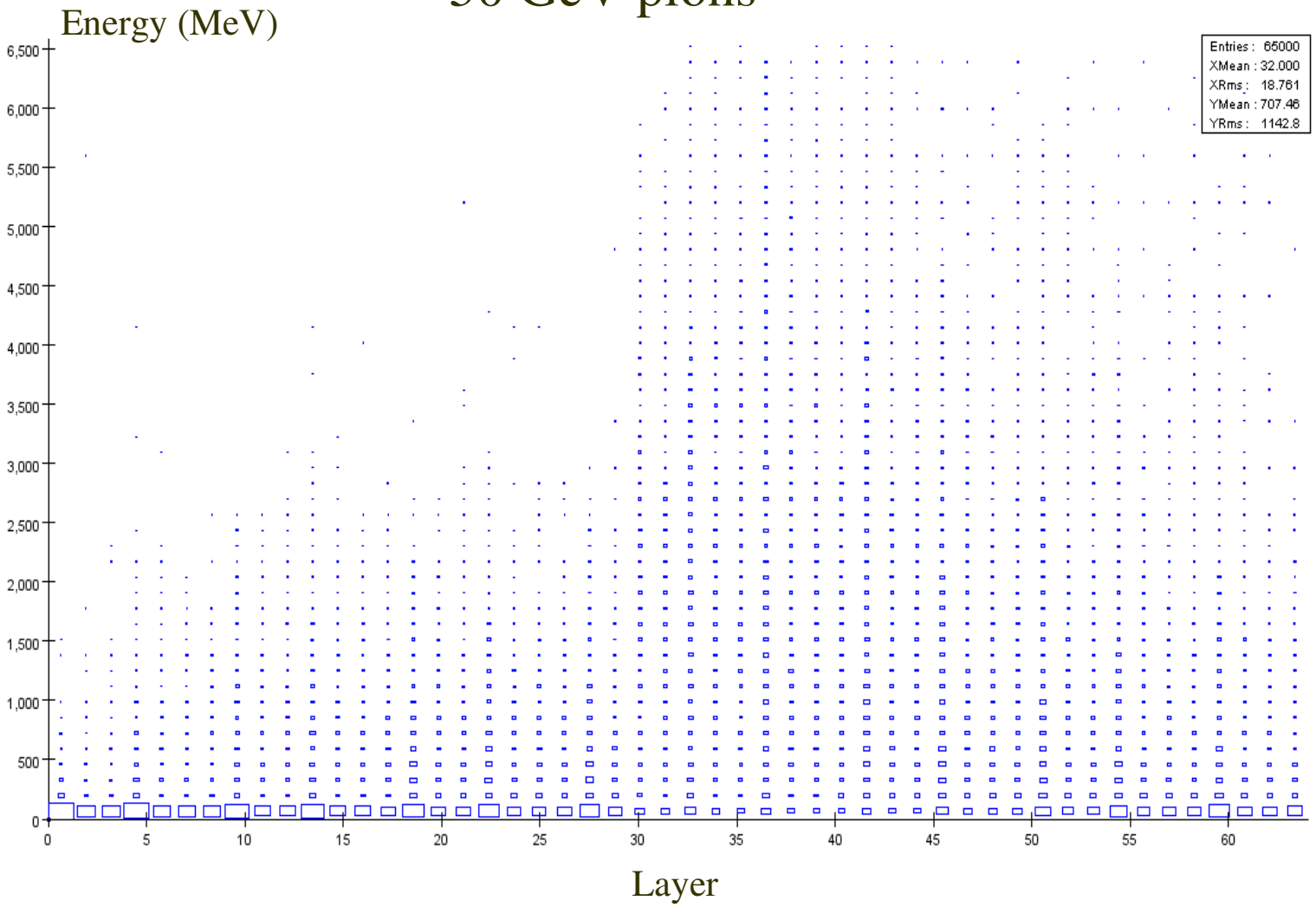


Last layers hit in each event

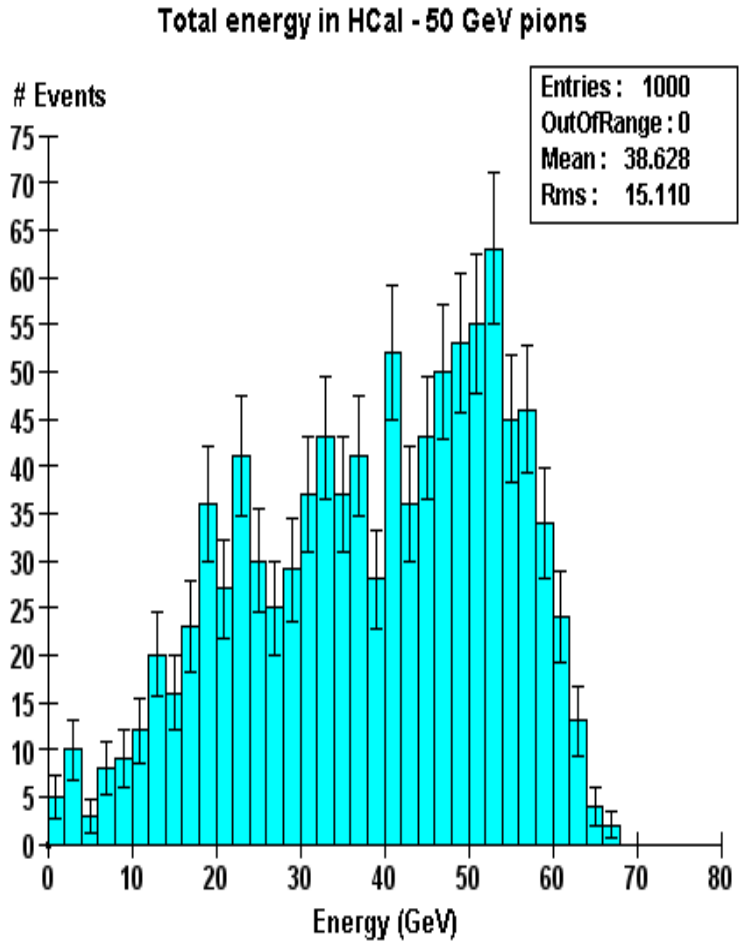


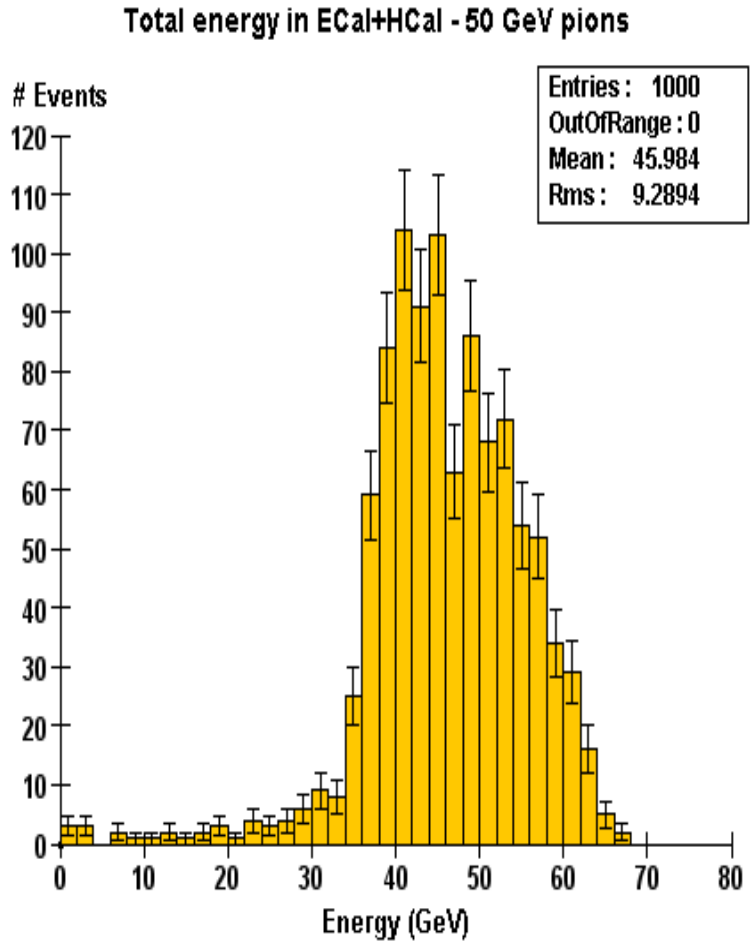


Total energy per layer
(comparison to LCDG4proj and GISMO)
50 GeV pions

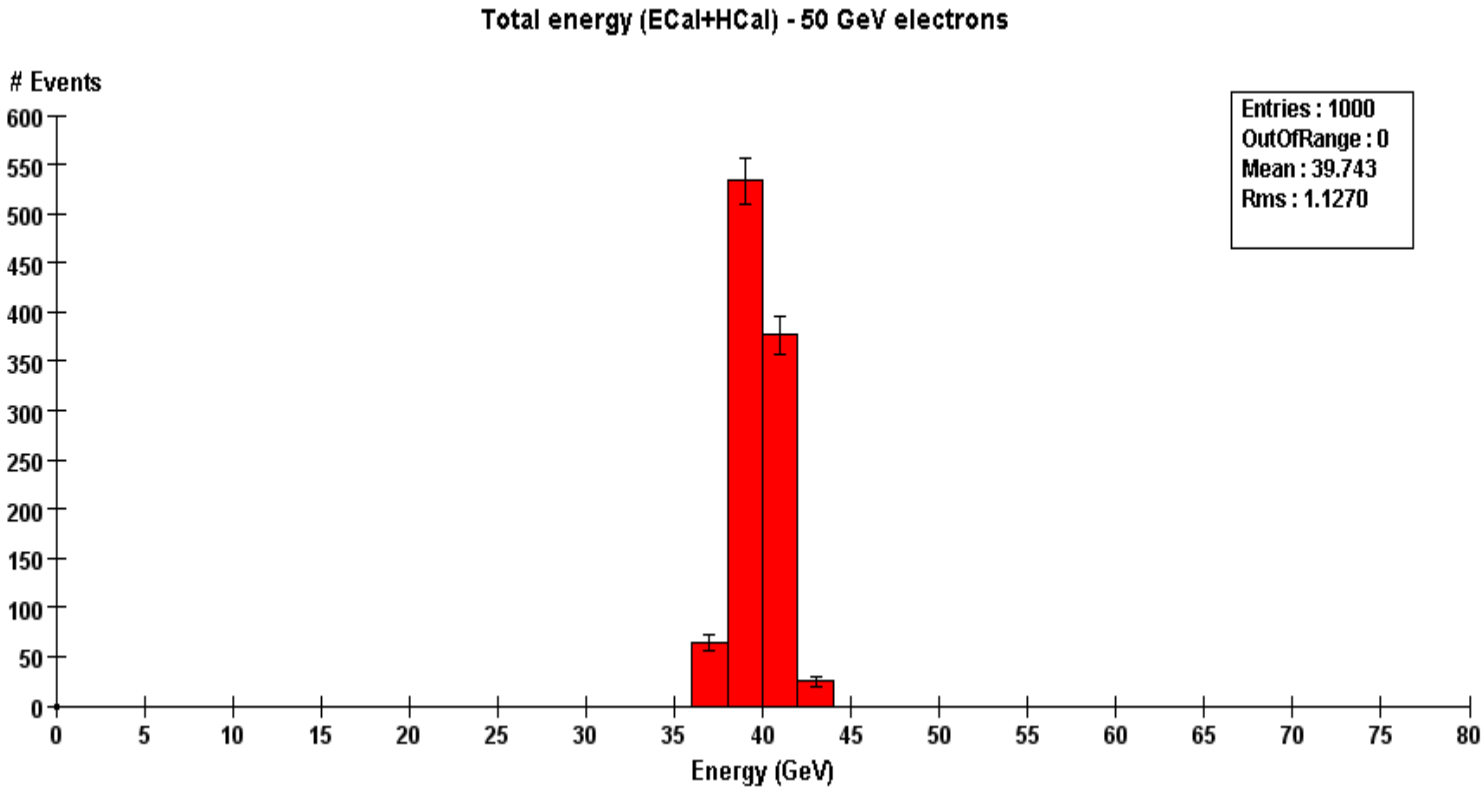


Total energy
(based on GISMO sampling fractions)





Checking EM sampling fraction



Based on GISMO sampling fractions
(a reevaluation is needed!)

Conclusions

- JAS3 analysis classes available* for general use
- Preliminary results look very encouraging
- Projective vs. non-projective values for energy depositions per layer are in good agreement
- Sampling fractions need to be reevaluated
- Next steps include:
    - replace SDJan03 for SDMar01
    - analyze complex physics events in NP geometry (Vishnu?)
    - extend NP geometry into EMCal
    - use hexagonal cells
    - whatever else is necessary to certify NP simulation…(?)