Studying the “confusion term”

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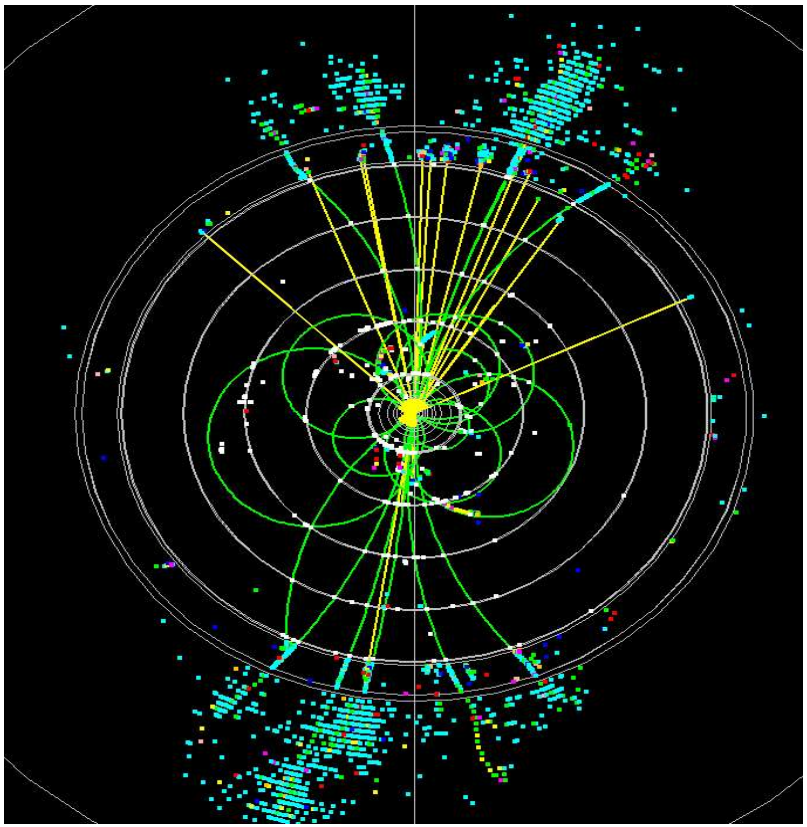
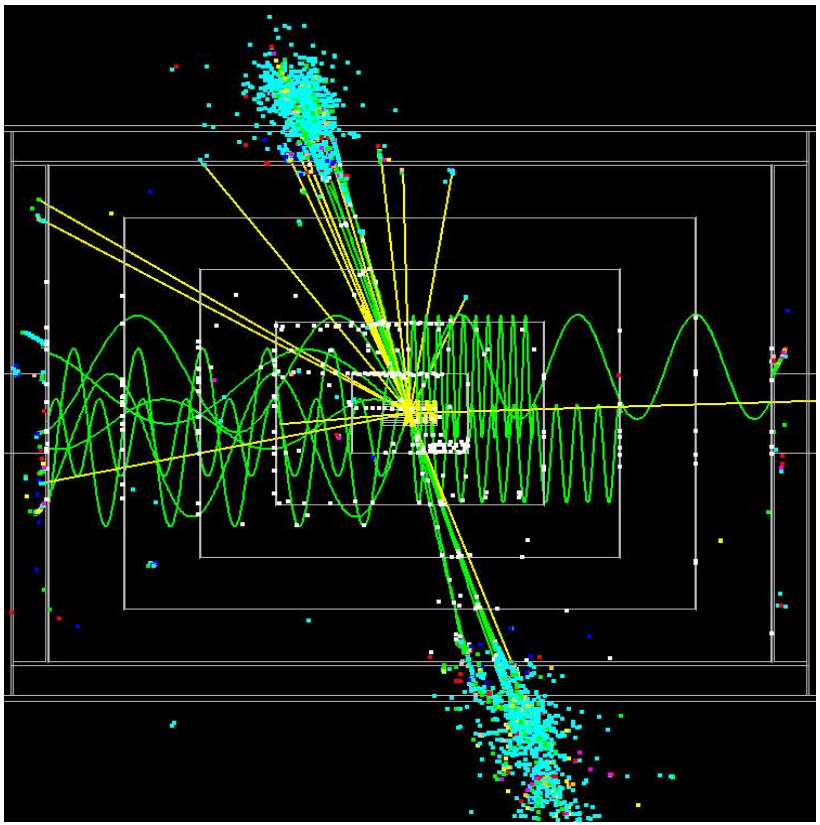
DHCal Meeting at NIU
September 22, 2004

What's the “confusion term”?

- Some hits are due to more than one particle depositing energy in a single calorimeter cell

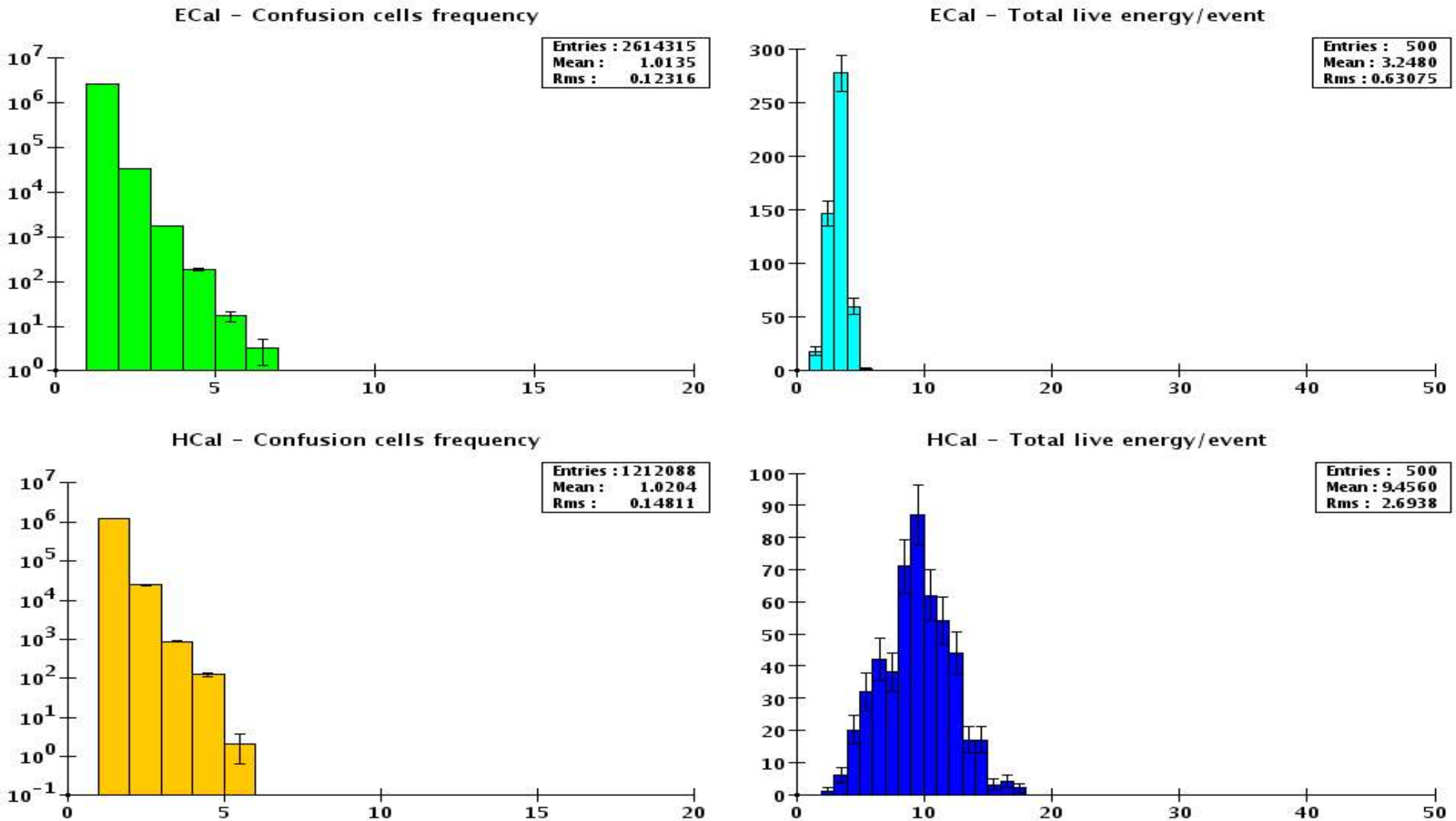




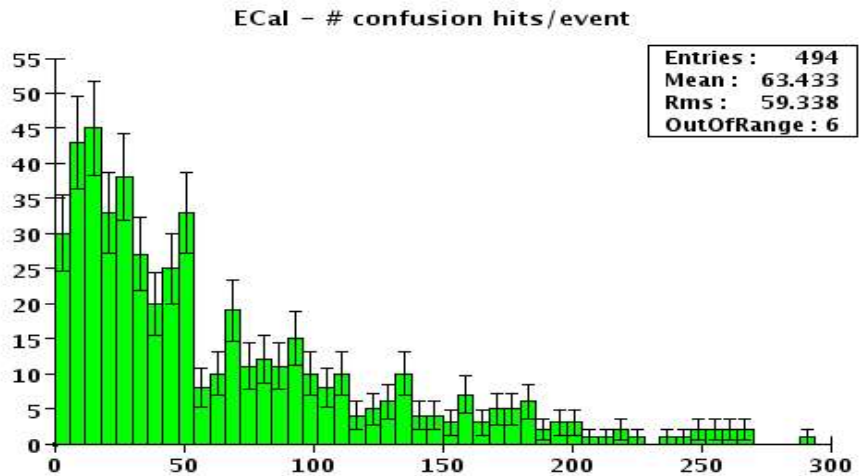
Studying the confusion term

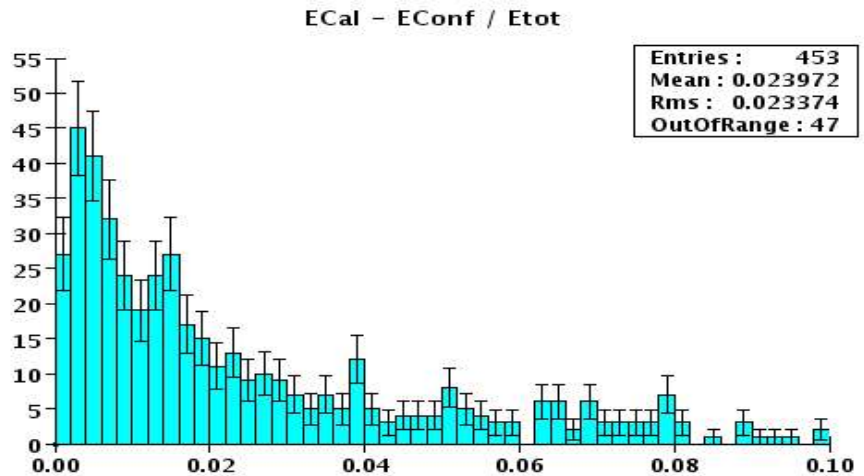
- total Edep / event
- total Econf / event (econf is confusion edep)
- # Econf cells / event
- confusion layers
- more than 2 contribs? How frequent?
- largest relative contribution
- same layer isolation: +/-1 layer, +/- 2 in theta, phi
- Em vs. had components, charged vs. neutral components

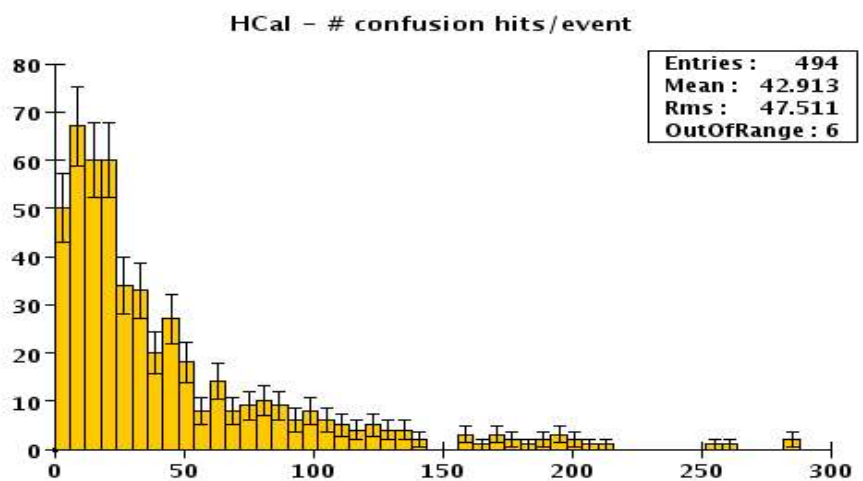
500 GeV ee -> ZH -> (qqbar)(bbar)

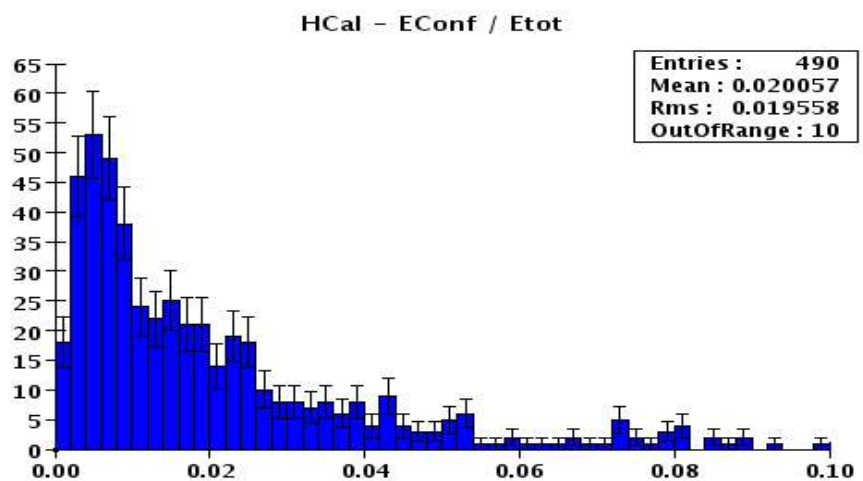


General features: $NHits_{conf}$ and E_{frac}

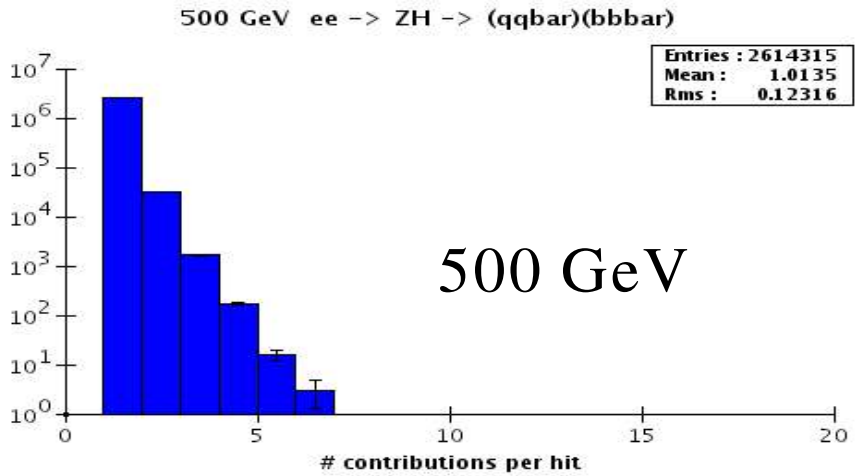


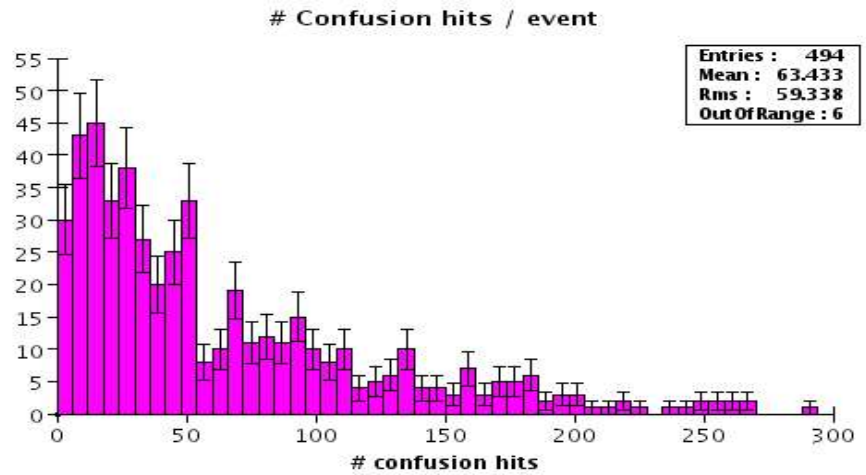


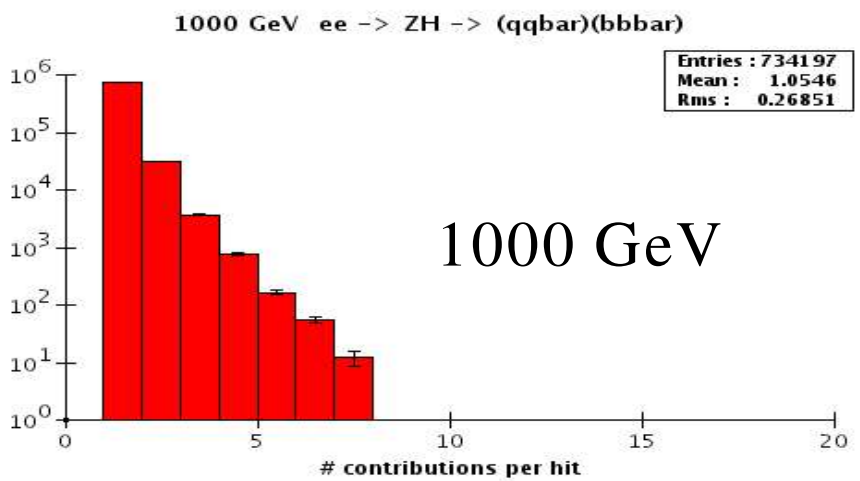


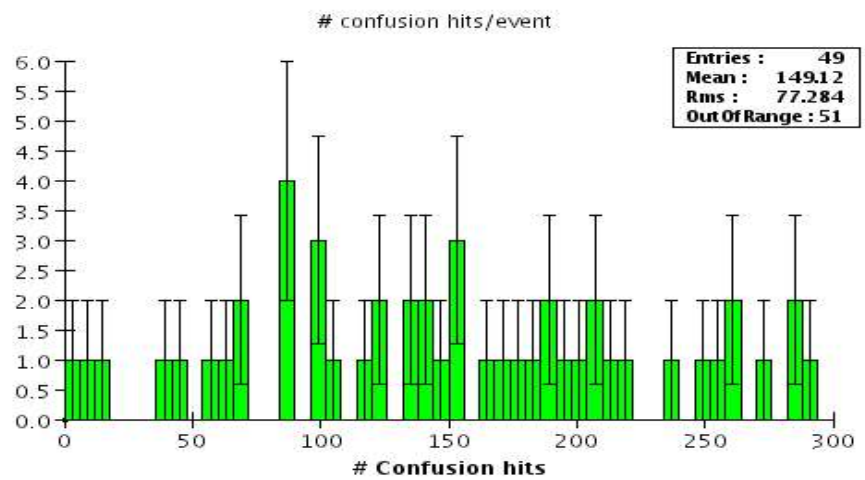


Confusion hits in ECal: general features

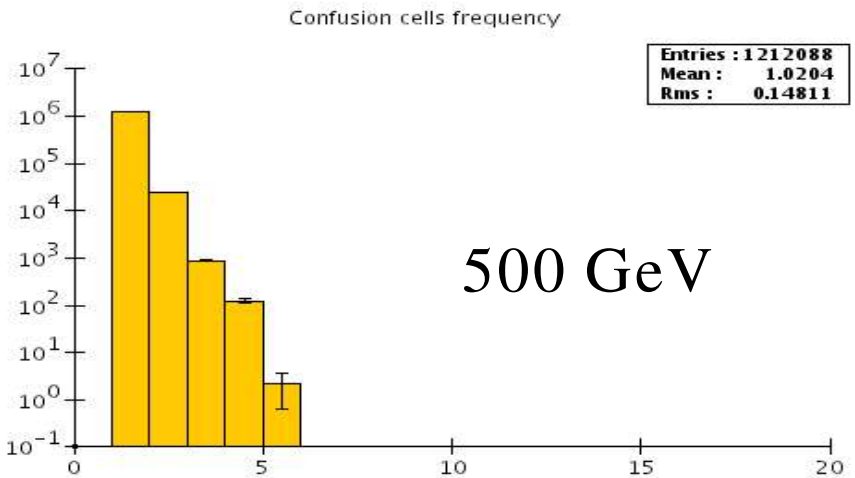


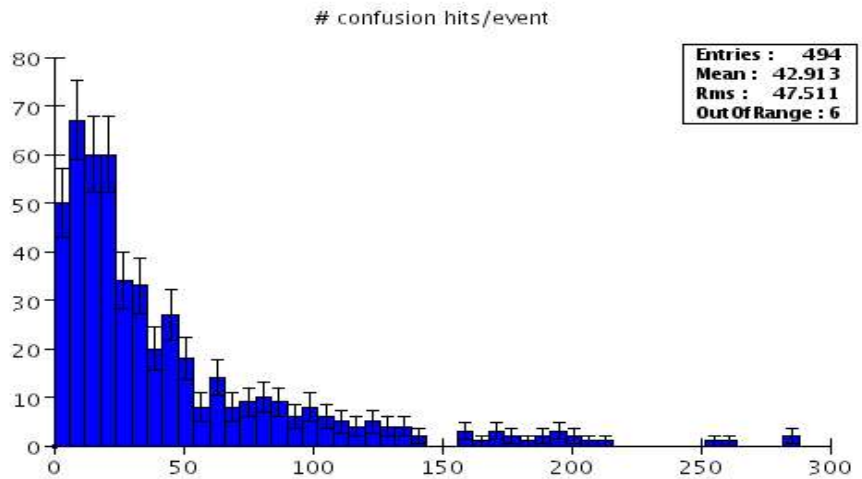


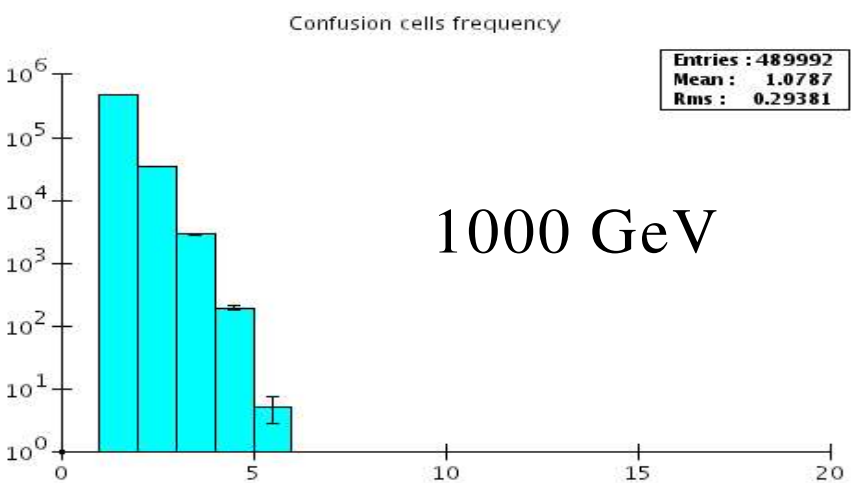


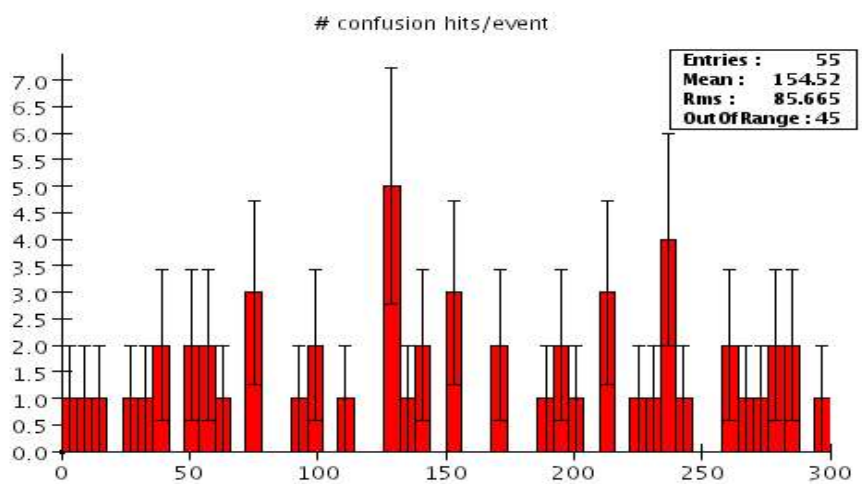


Confusion hits in HCal: general features

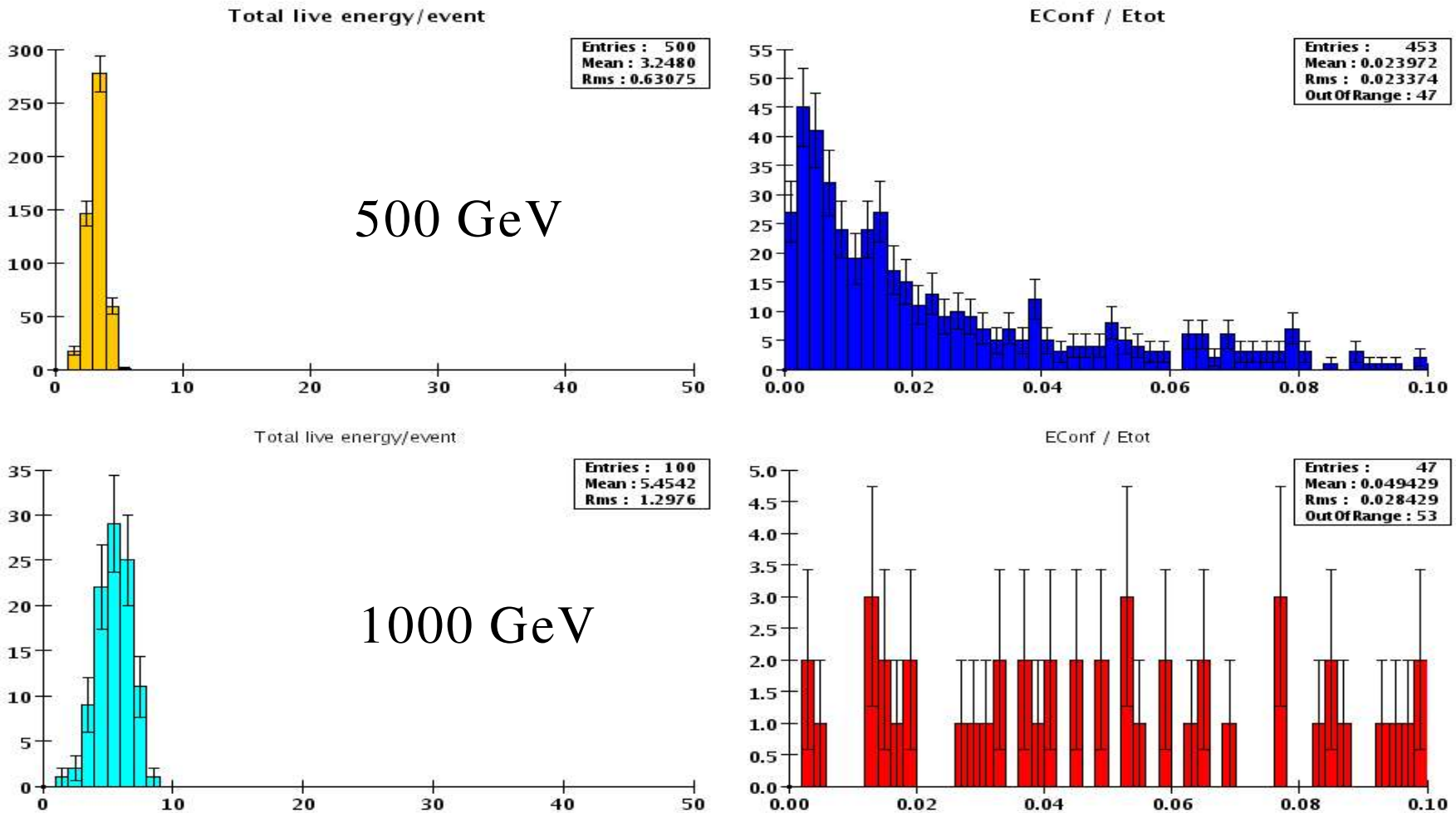




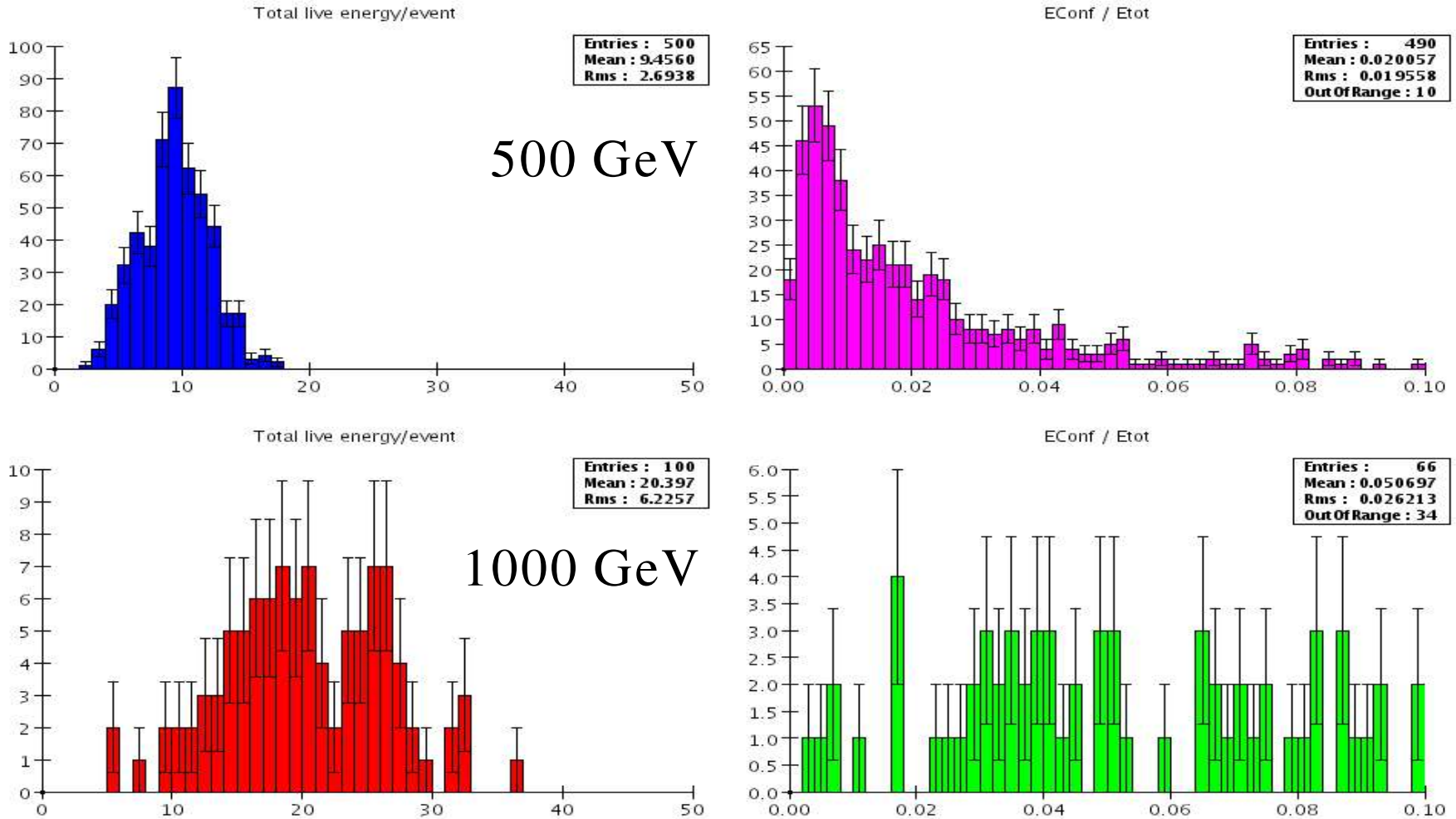




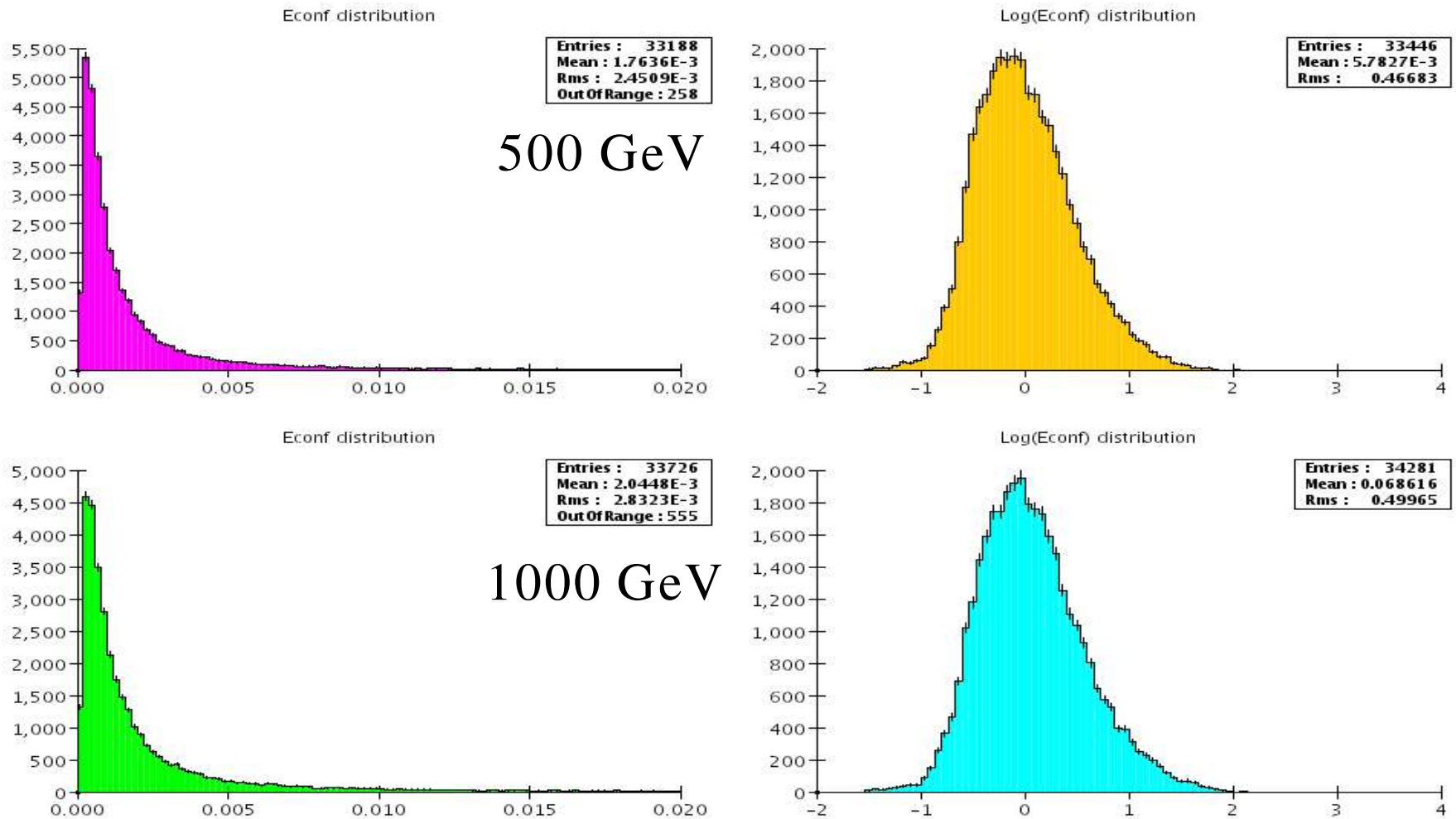
ECal: total E_{live} and fractional E_{conf}



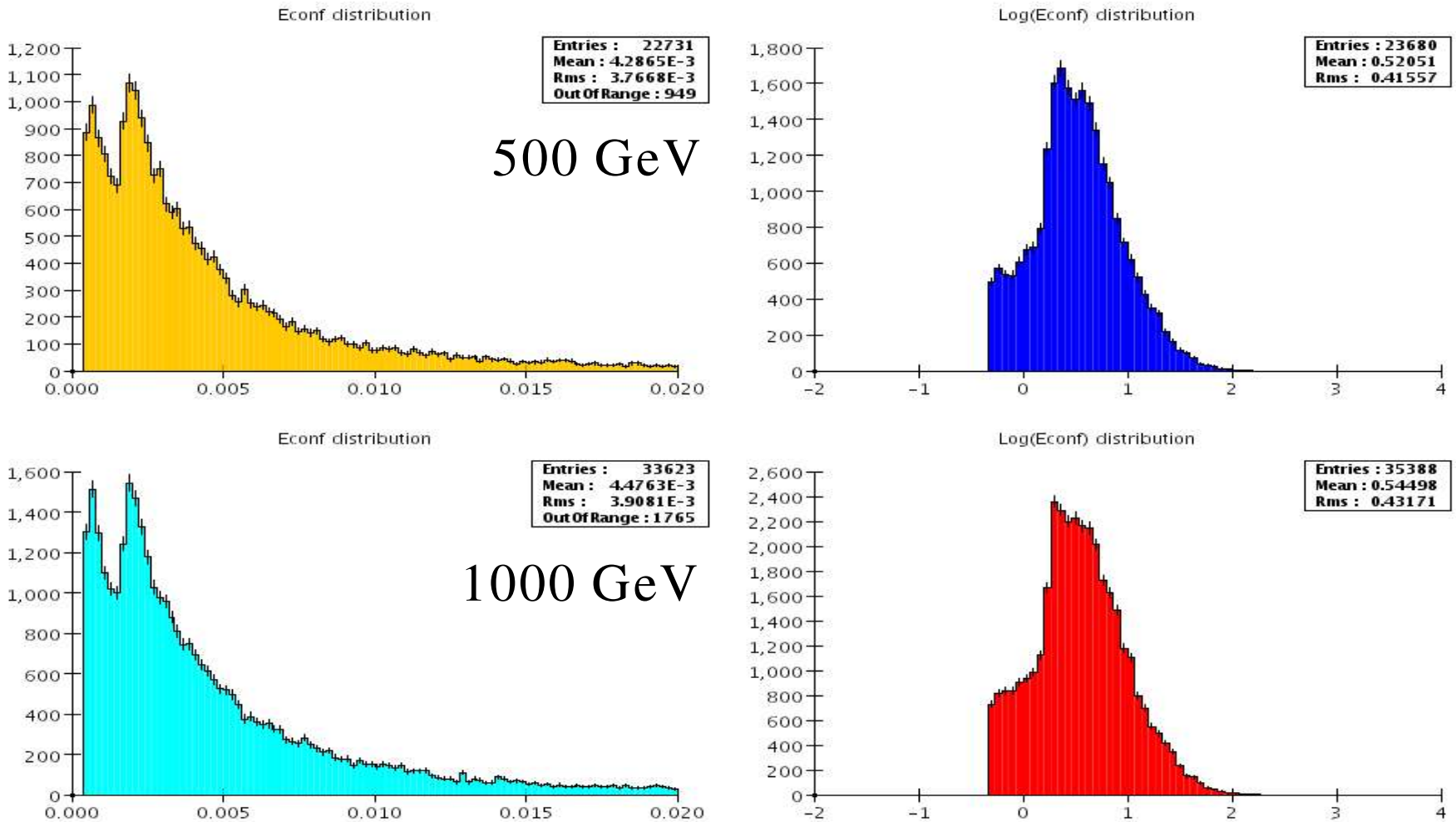
HCal: total E_{live} and fractional E_{conf}



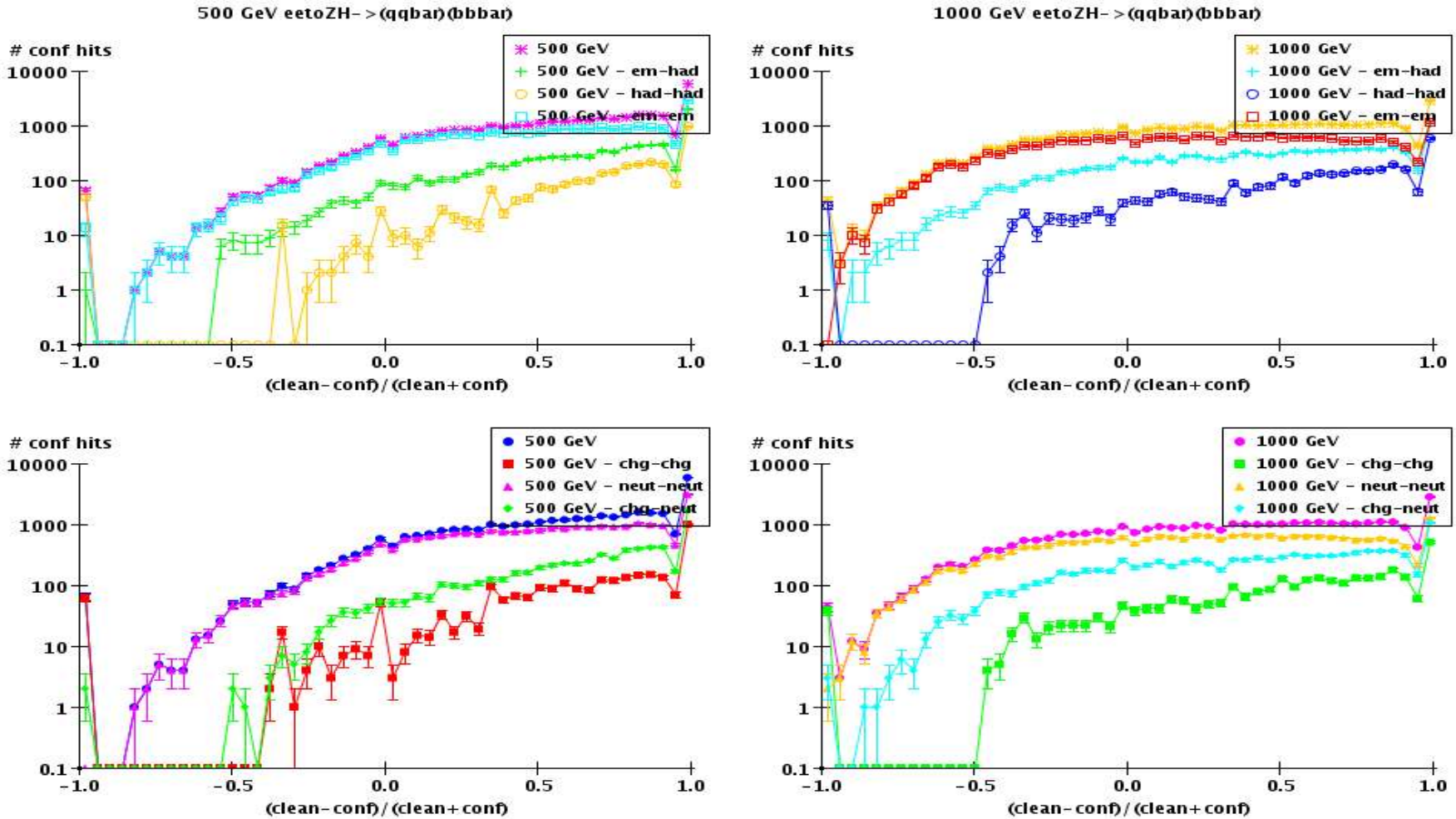
Confusion energy distributions in ECal



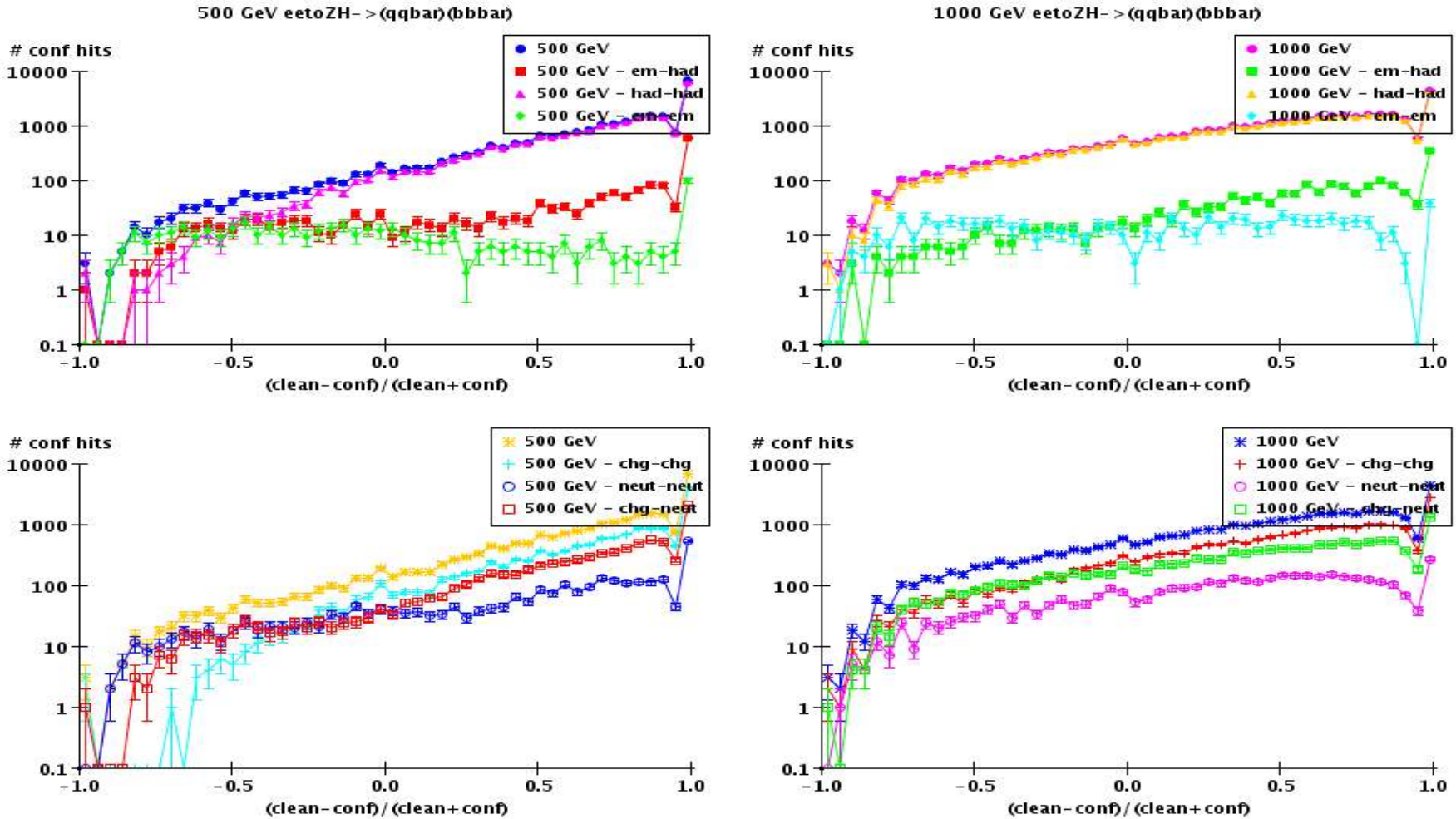
Confusion energy distributions in HCal



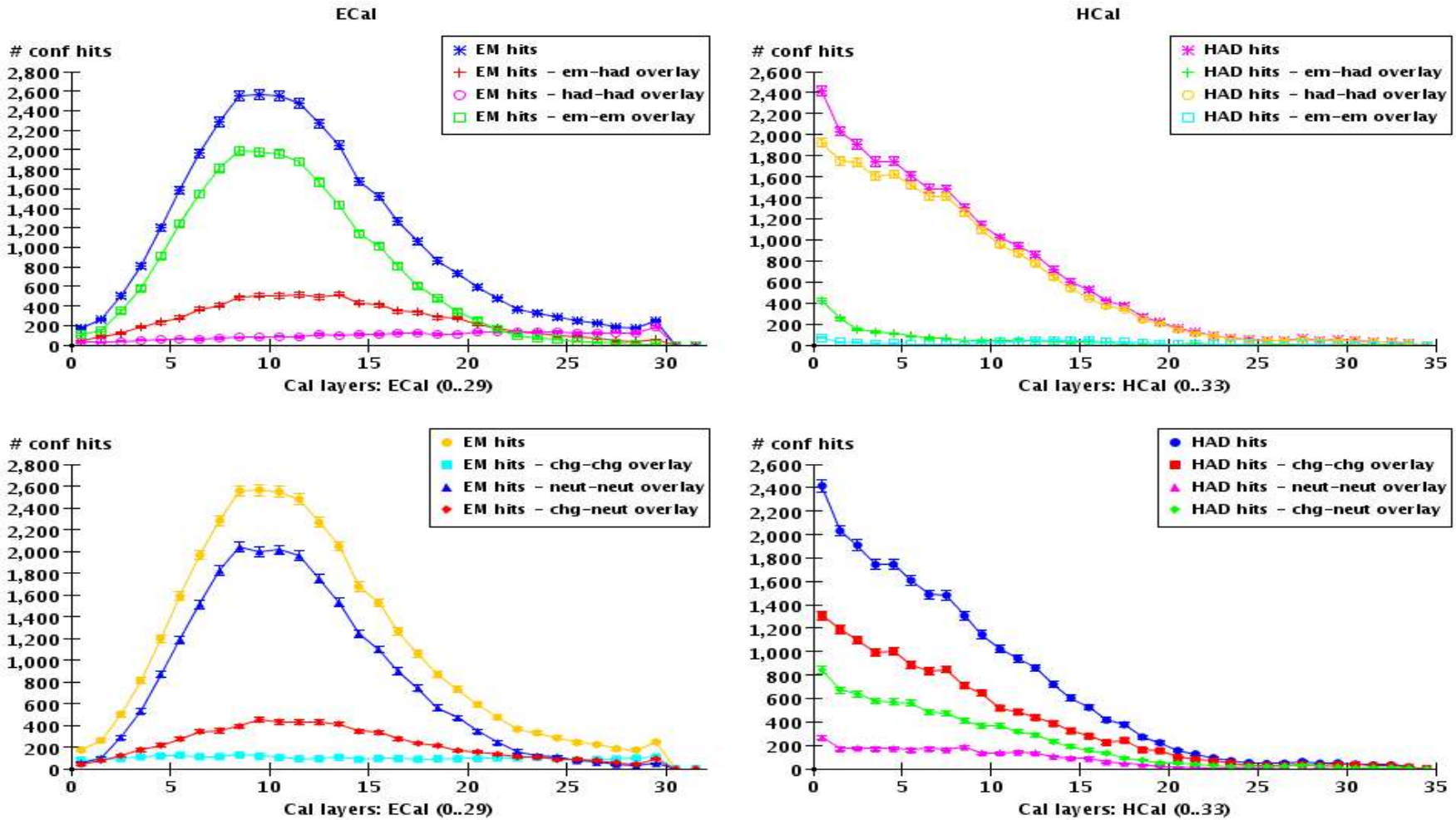
Isolation parameter



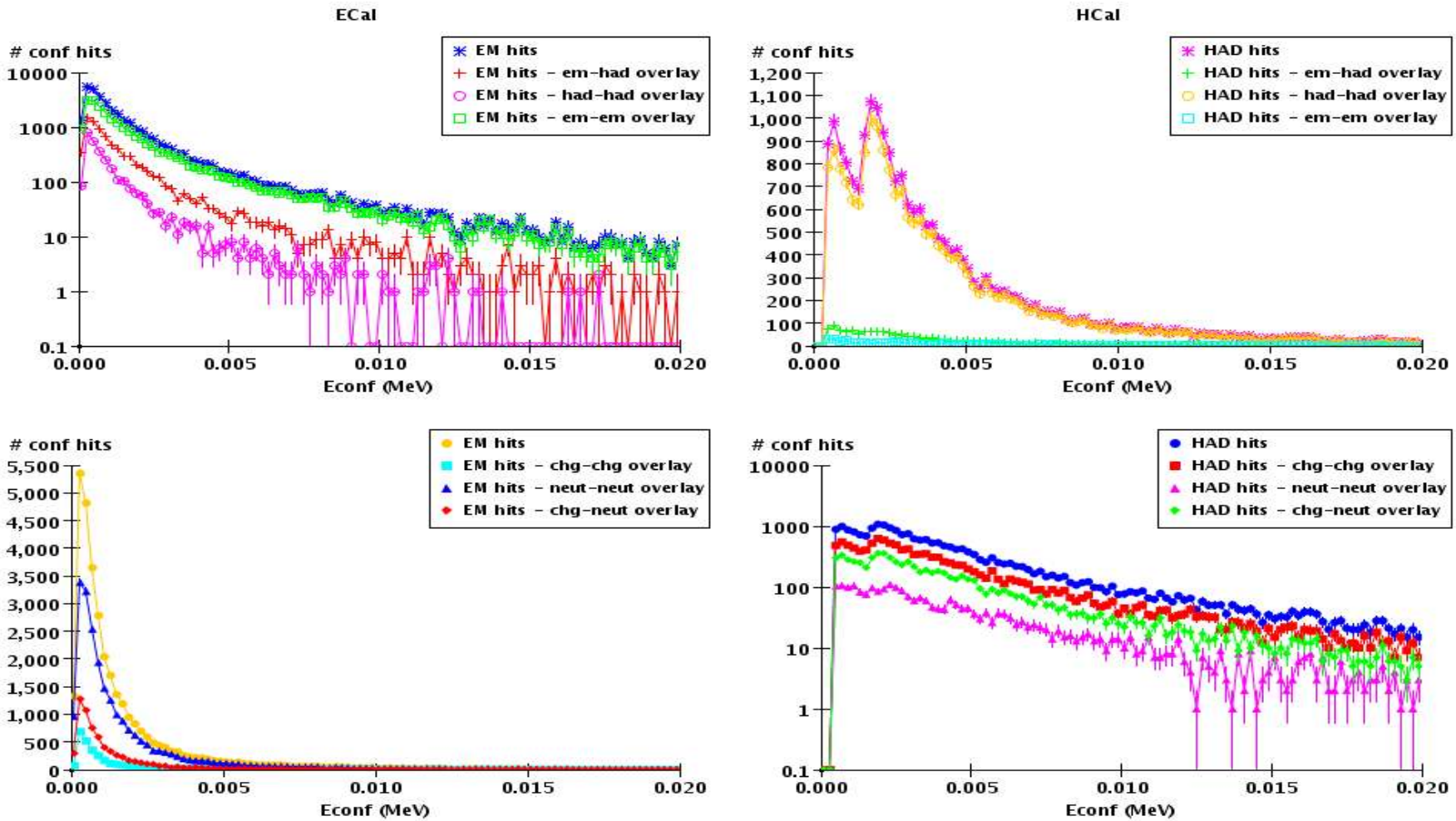
HCal: isolation of confusion hits



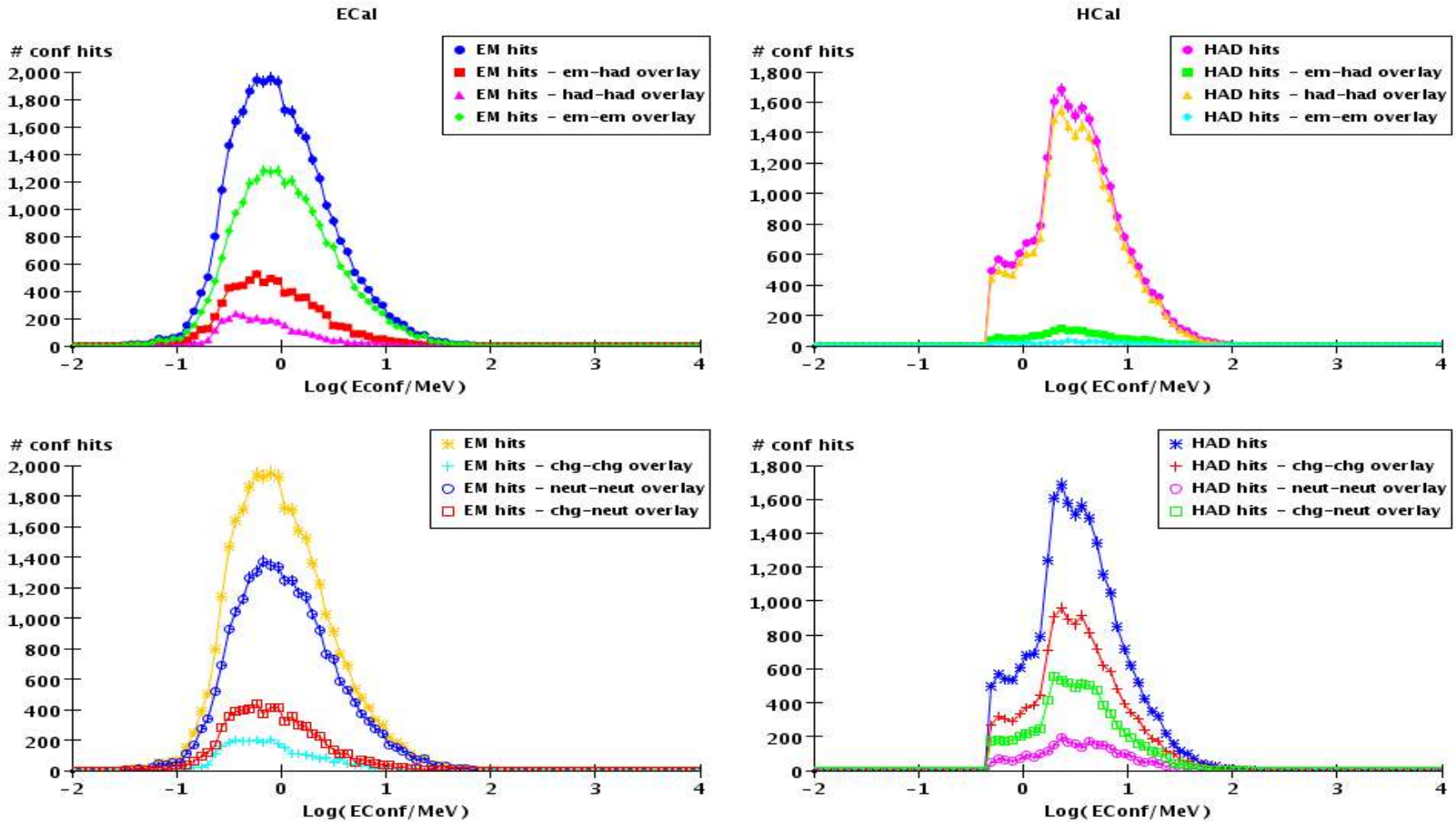
Confusion hits: longitudinal distribution



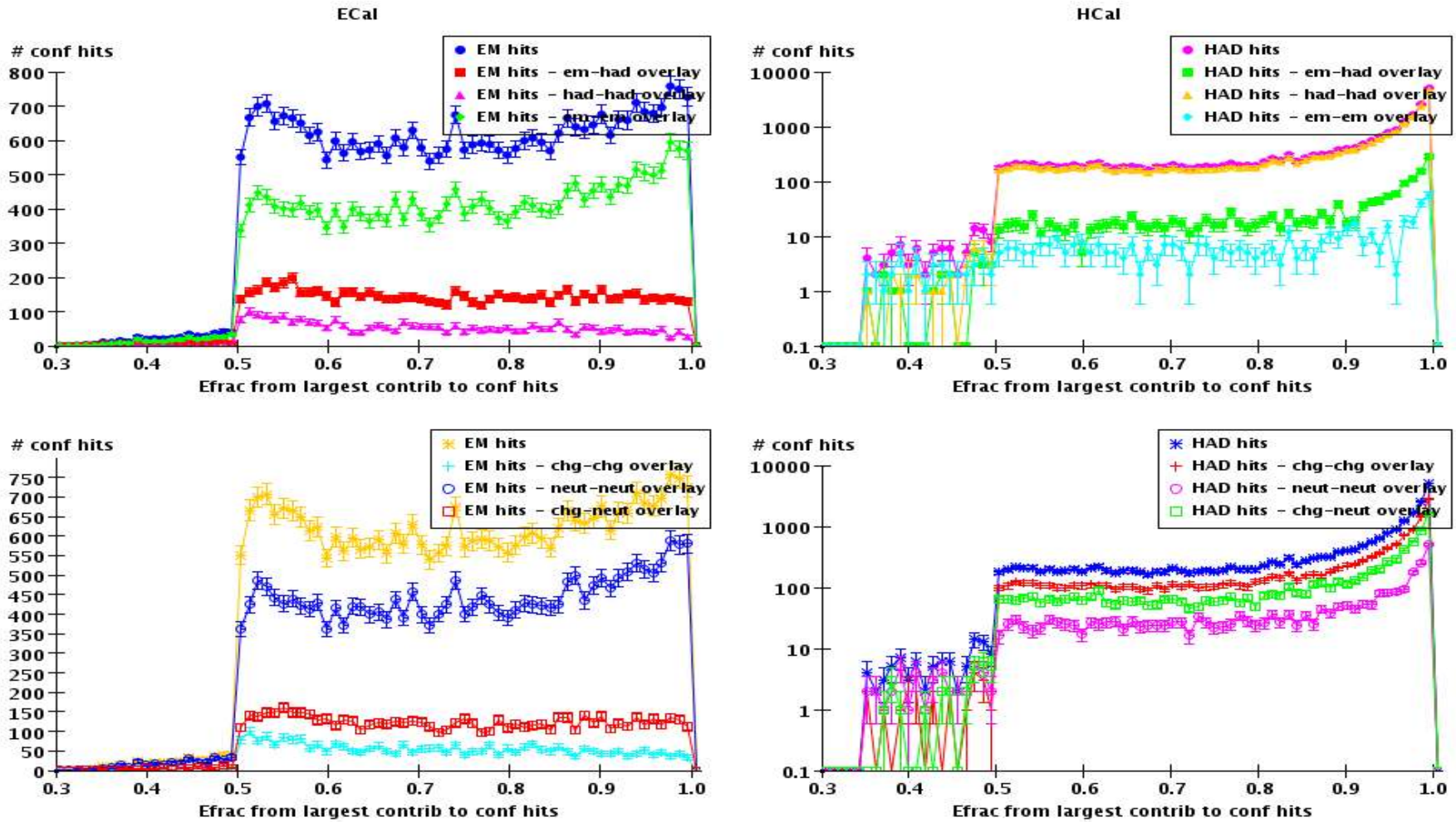
Confusion energy distribution



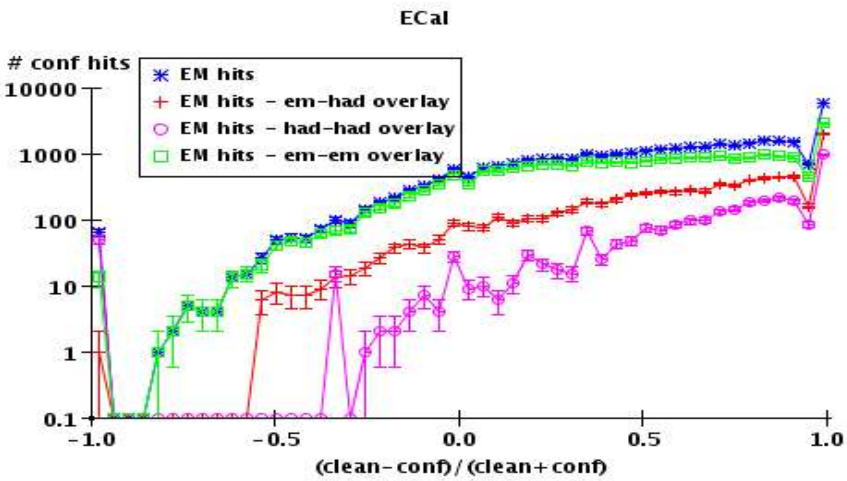
Confusion energy distributions

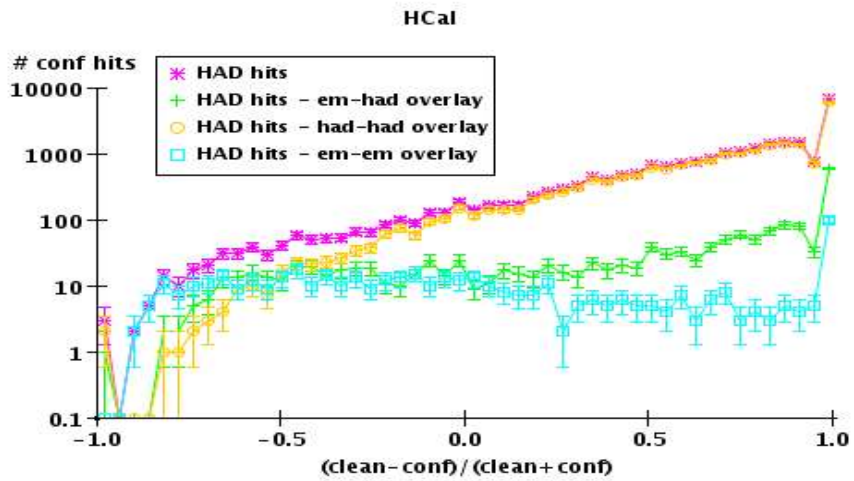


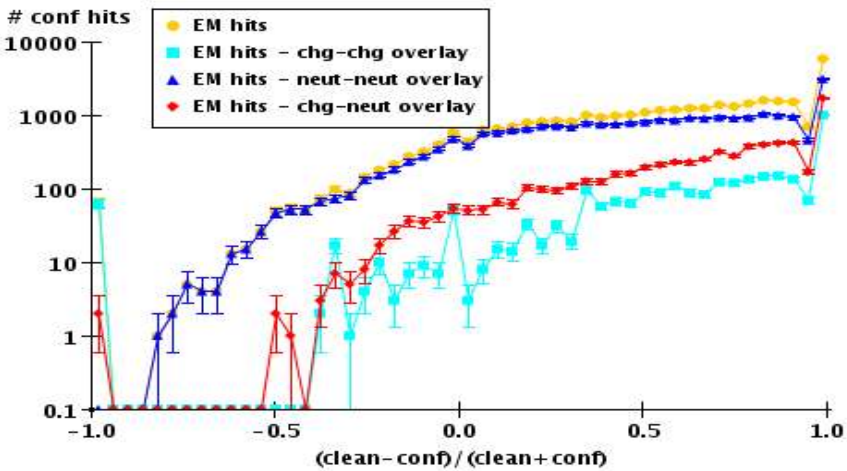
Largest contribution to confusion hits

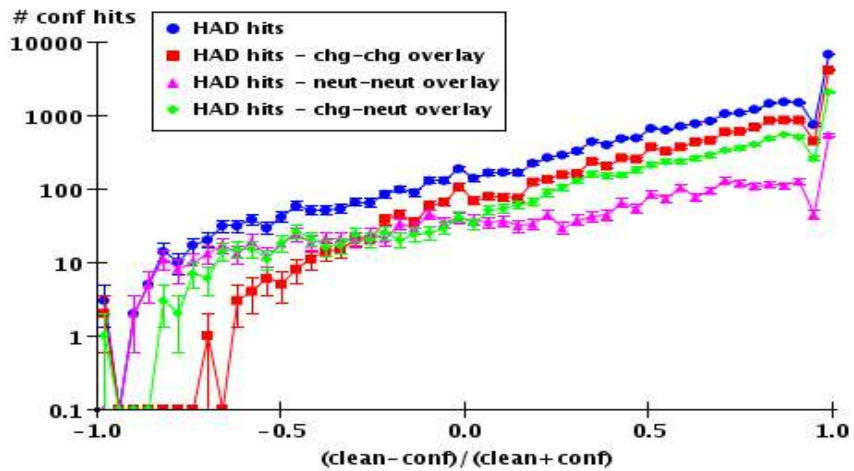


Isolation of confusion hits

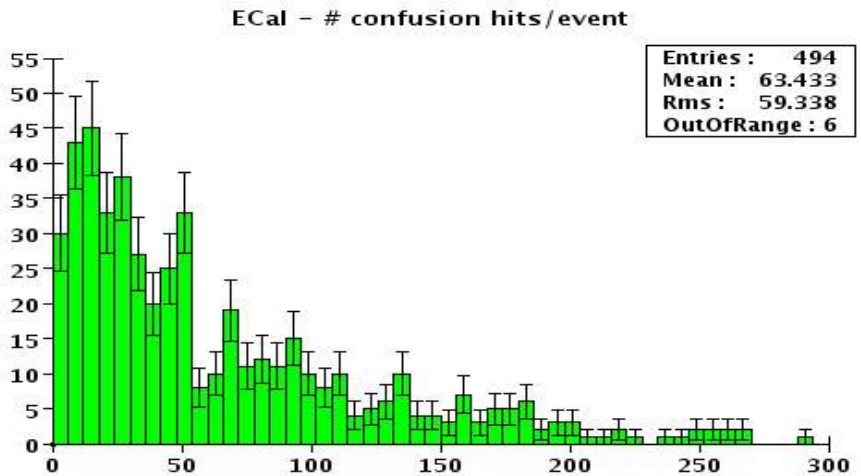


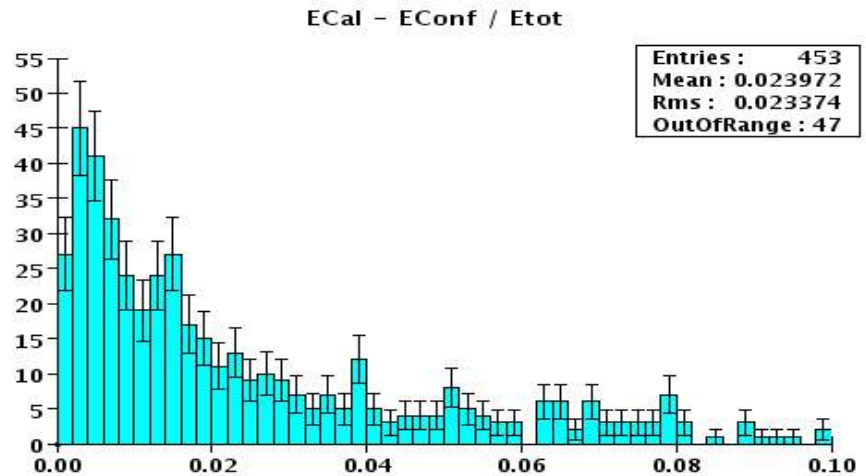


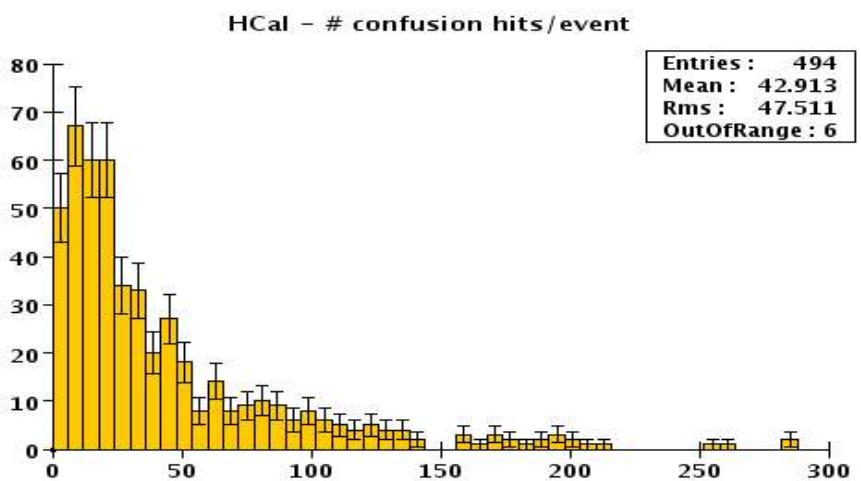


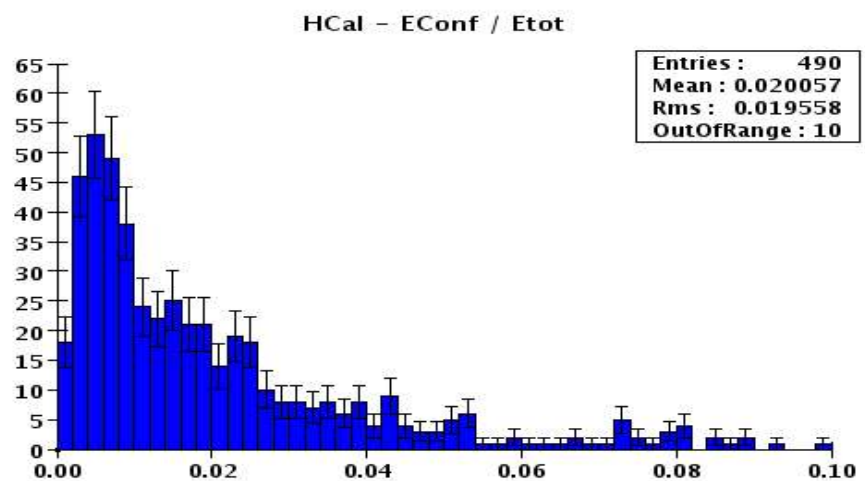


Number of hits and fractional energy









That's all, folks!

Motivations for a PFA

- Linear Collider ⇒ precision studies of new physics at the TeV scale
- Goal: Significant improvement on Z- and W-mass resolution using multijet final states (~30%/√E)
  Typical energy resolution: 20%/√E (ECal), 80%/√E (HCal)
- Typical jet composition:
  - charged hadrons (~64% with $\sigma_p/p < 2\%$)
  - Photons (~25% with $\sigma_E/E < 15\%/\sqrt{E(\mathrm{GeV})}$)
  - neutral hadrons (~11% with $\sigma_E/E < 60\%/\sqrt{E(\mathrm{GeV})}$)

Particle Flow Algorithm

- A significant improvement on mass resolution can be reached if we can associate CAL energy depositions to each photons and to charged or neutral hadrons
- The association can be done using the so-called *Particle Flow Algorithms (PFA)*
- *PFA* requires high calorimeter granularity, to a point we can do particle tracking in the calorimeters

Plans

- For next week, a first look at the confusion term
- Generation of LCDG4 samples

```
1) Default SiD geometry
2) Default SiD geometry w/ non-proj hcal
3) SiD geometry w/ non-proj hcal, B=4.5T, Ecal Inner R = 1.32m
4) SiD geometry w/ non-proj hcal, B=4.0T, Ecal Inner R = 1.4m
5) SiD geometry w/ non-proj hcal, B=3.5T, Ecal Inner R = 1.49m
6) SiD geometry w/ non-proj hcal, B=3.0T, Ecal Inner R = 1.61m
7) SiD geometry w/ non-proj hcal, B=3.5T, Ecal Inner R = 1.61m
8) SiD geometry w/ non-proj hcal, B=4.0T, Ecal Inner R = 1.61m
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Many others to follow...