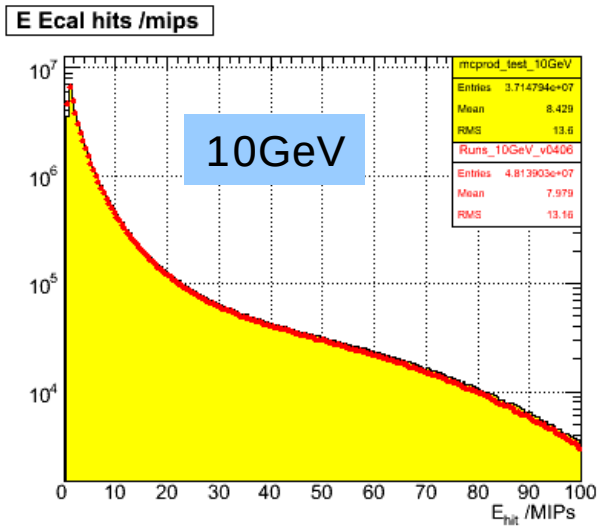
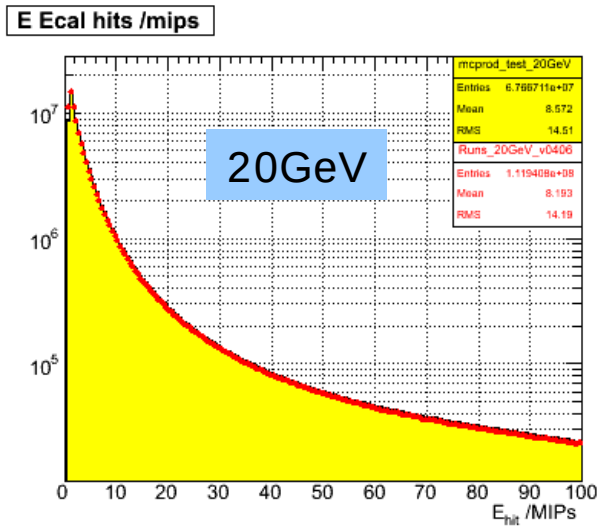
Thoughts on transverse energy profile for e/m showers

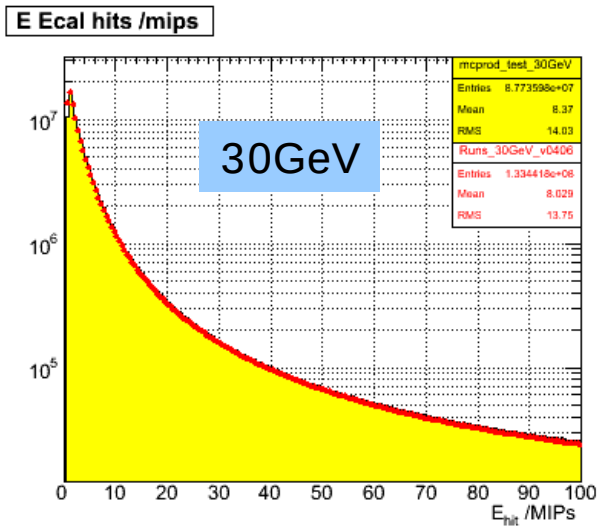
David Ward

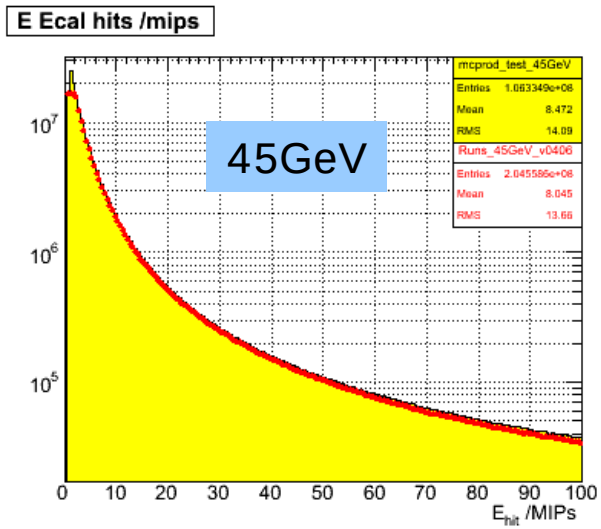
- We have work from G.Mavromanolakis on this topic.
- Hope to publish along with Valeria's longitudinal shower shape study.
- But George's work doesn't include any comparisons with MC. Try to address this.
- Has thrown up some issues, on which feedback would be appreciated.

Hit energies data c.f. MC.



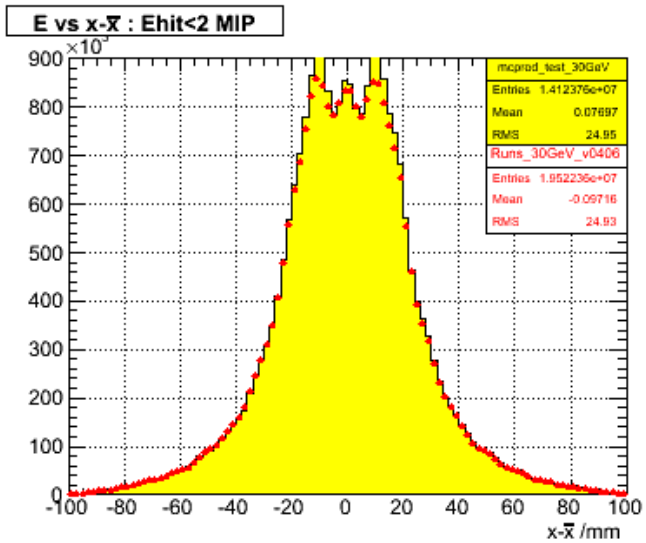


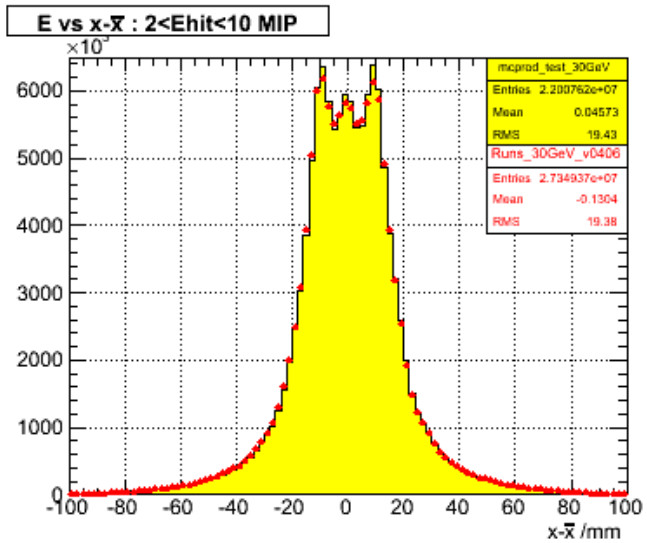


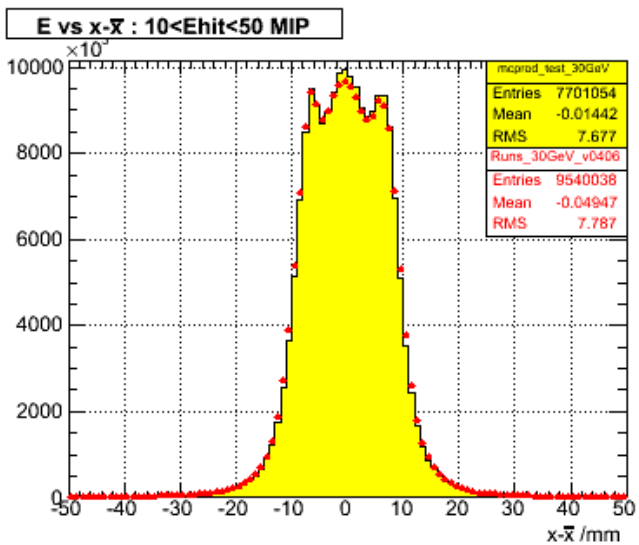


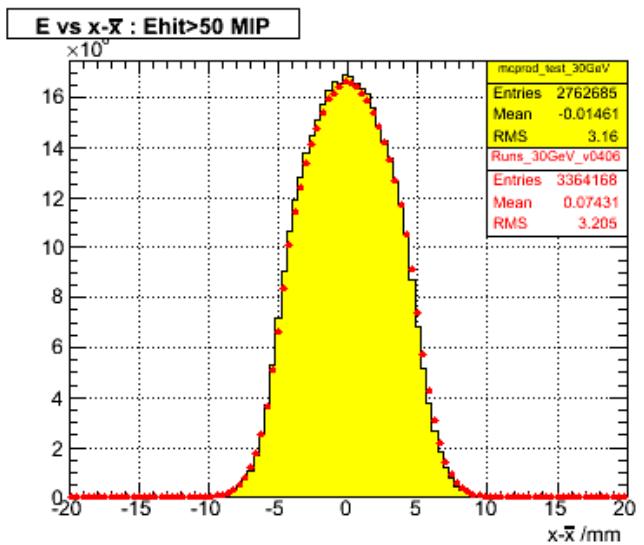
- Standard e^- data and MC samples @ four energies.
- Reasonable, but not perfect agreement.
- Follow George's method, and separate hits into four ranges:
  - Ehit<2MIP
  - 2<Ehit<10MIP
  - 10<Ehit<50MIP
  - Ehit>50MIP
- Select events in same central region of calorimeter @ all energies:
  - $|\langle x \rangle| < 15$ mm
  - $|\langle y \rangle| < 10$ mm

Shower profile in x : 30GeV







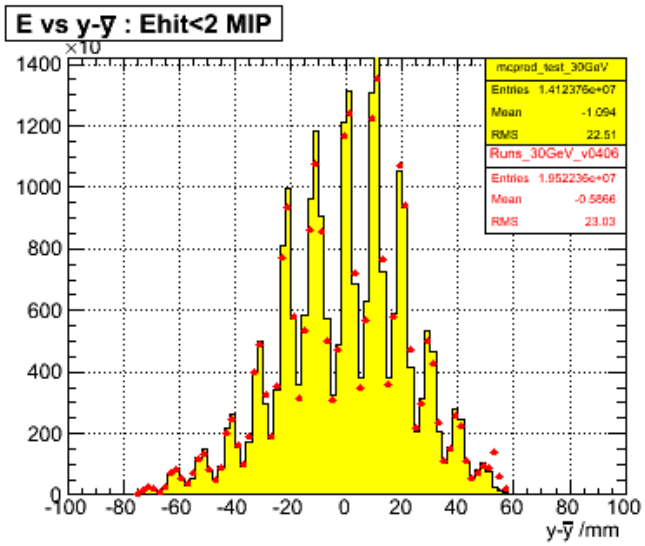


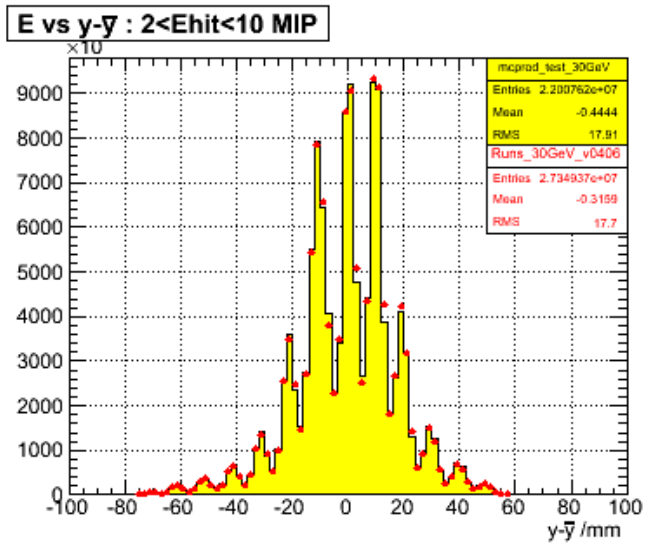
Symmetric

Narrower as we increase hit energy, of course.

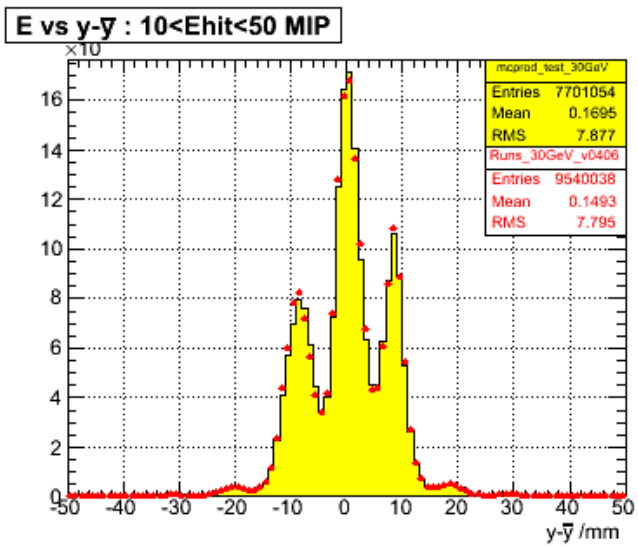
Small shift in highest energy hits – could reflect beam tilt in data

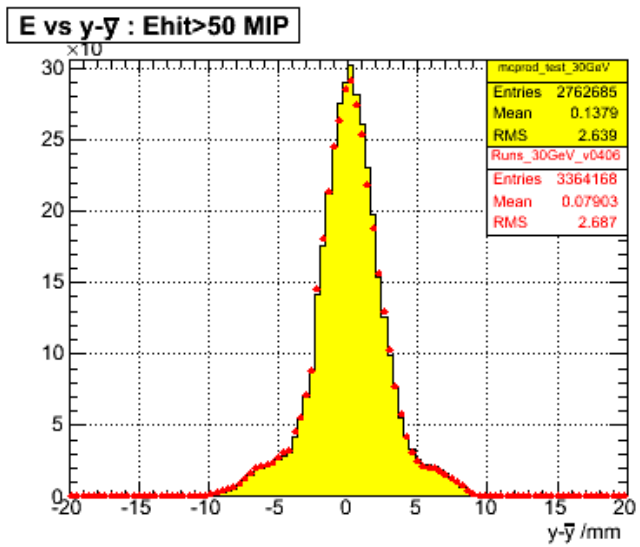
Shower profile in y : 30GeV



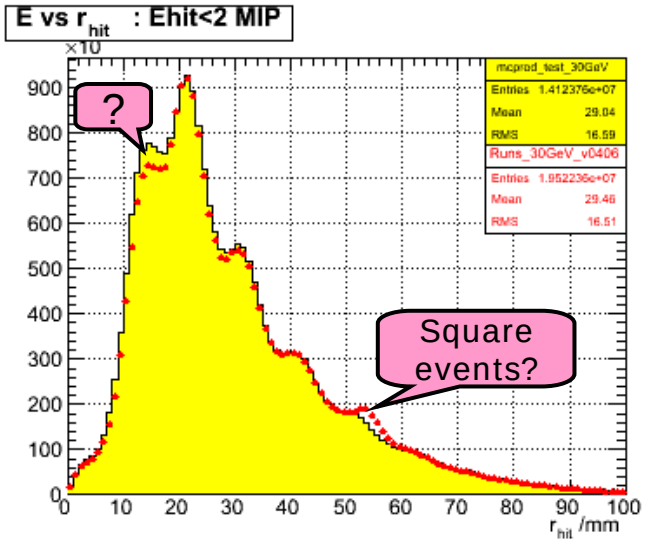


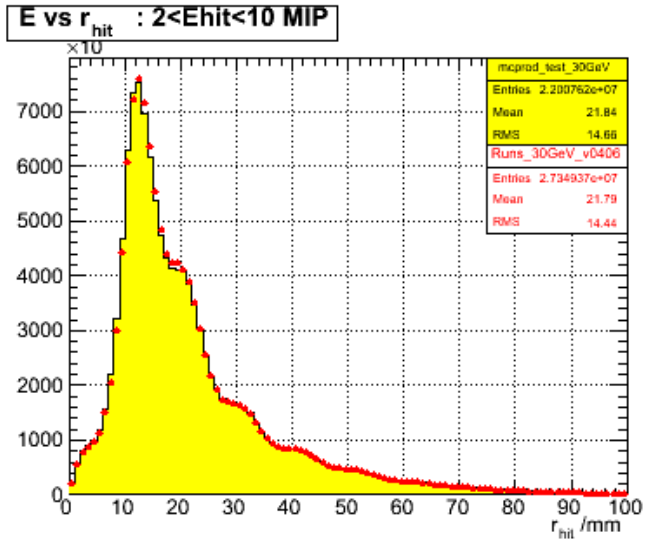
Slight aymmetry Attributable to interwafer gap.

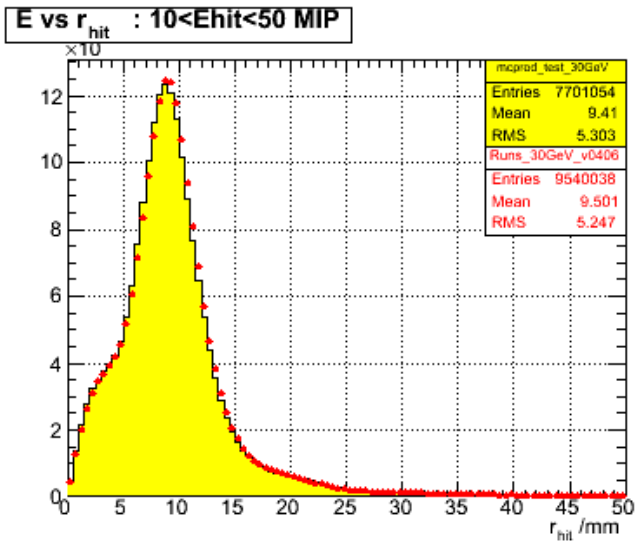


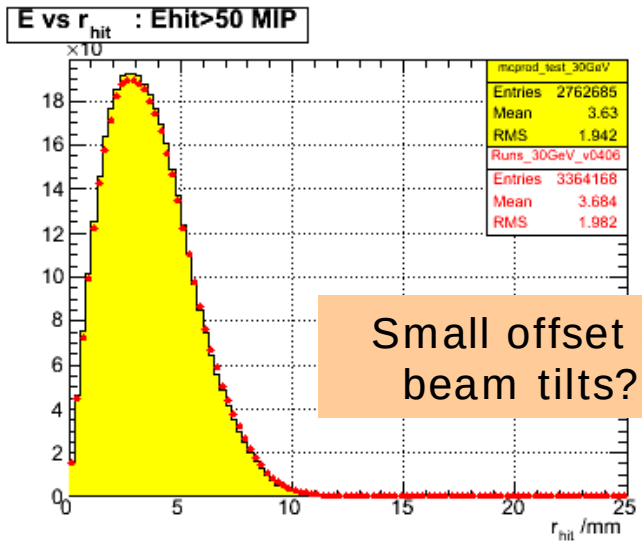


Radial shower profile : 30 GeV



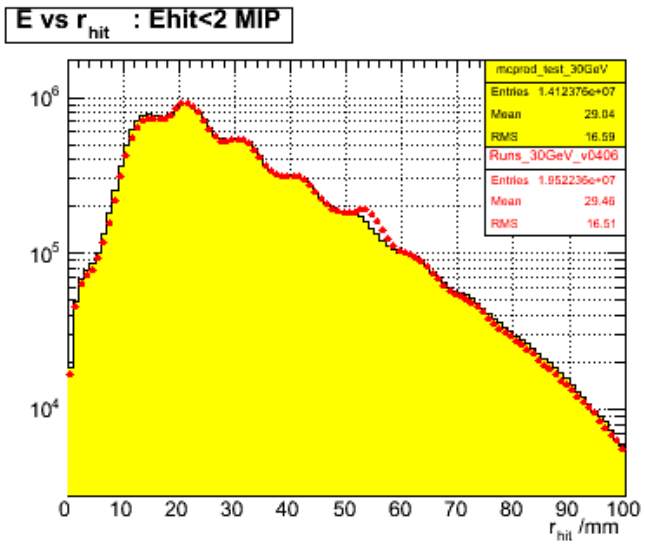


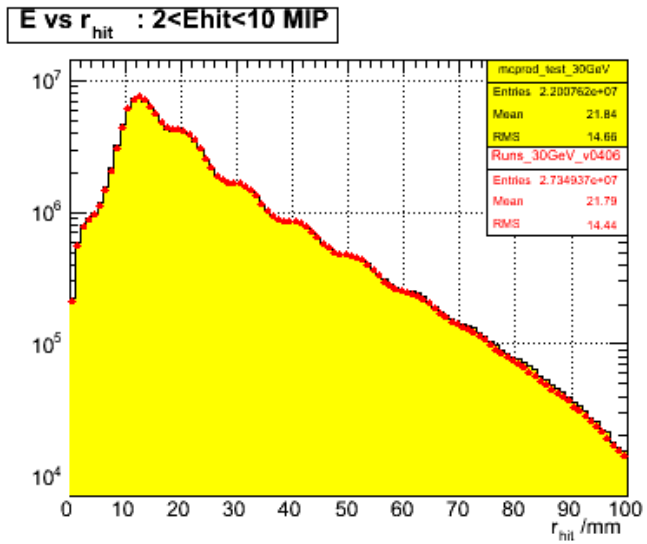


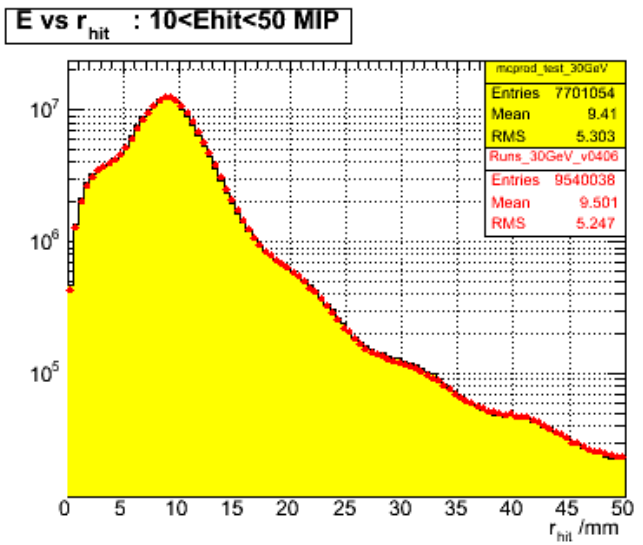


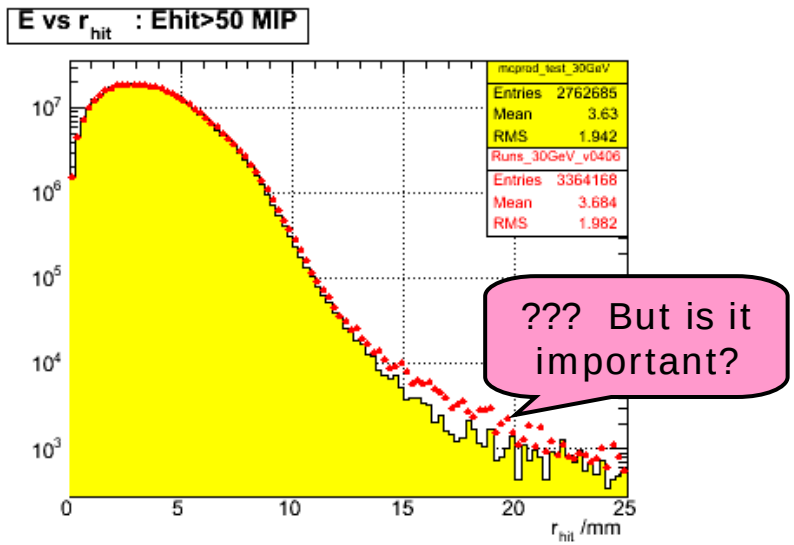
Small offset – beam tilts?

The same on log scale : 30 GeV

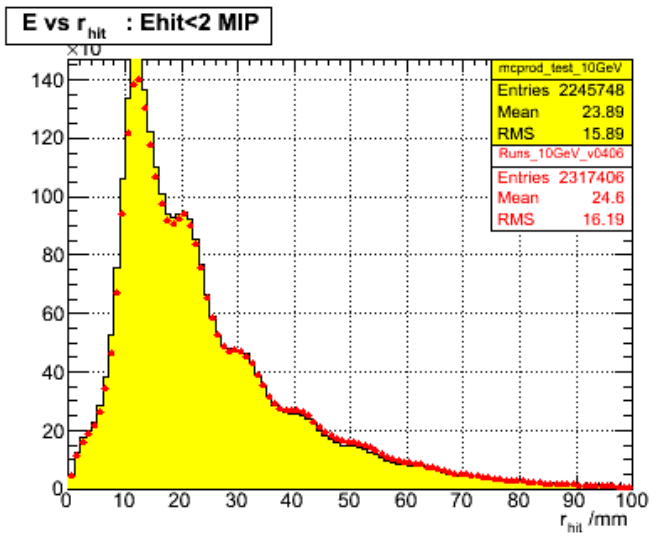


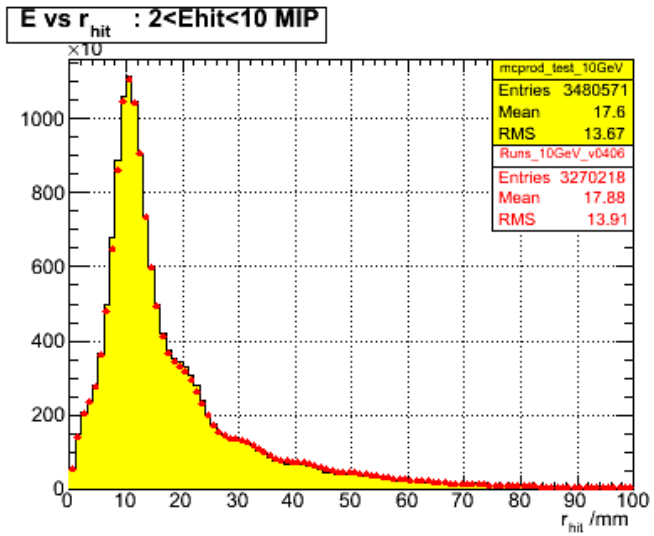


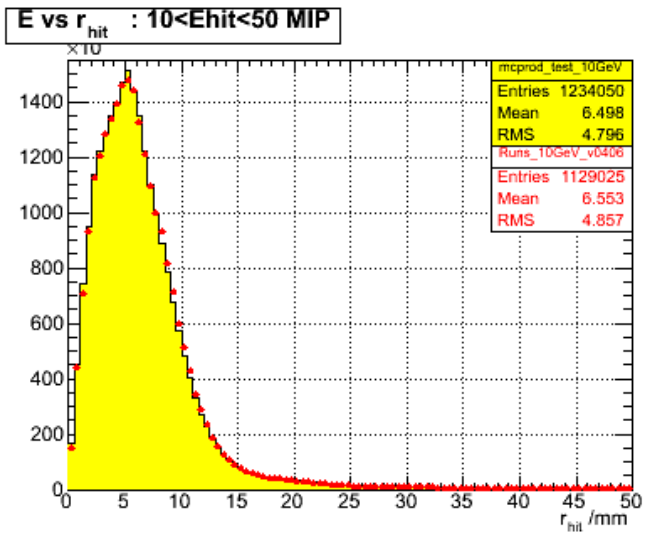


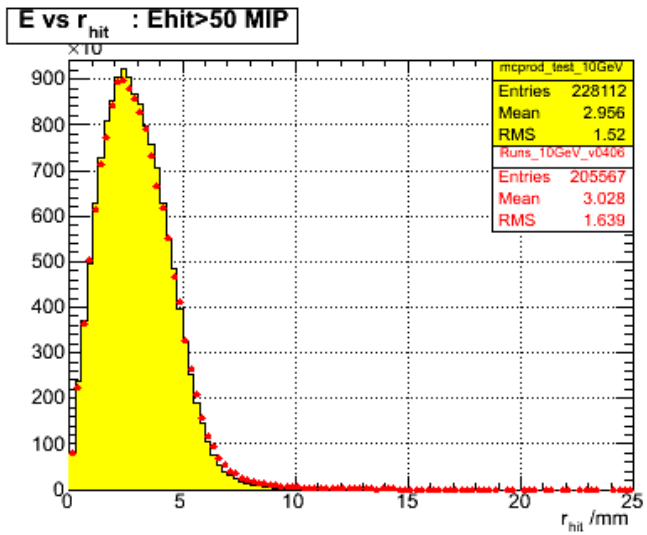


Radial shower profile : 10 GeV

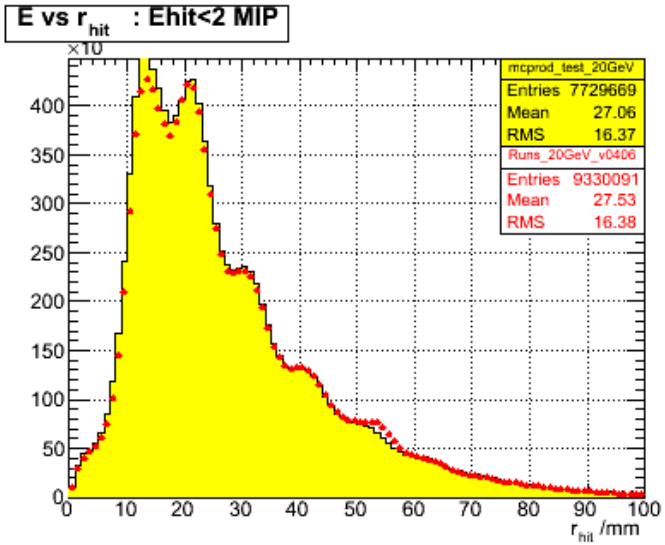


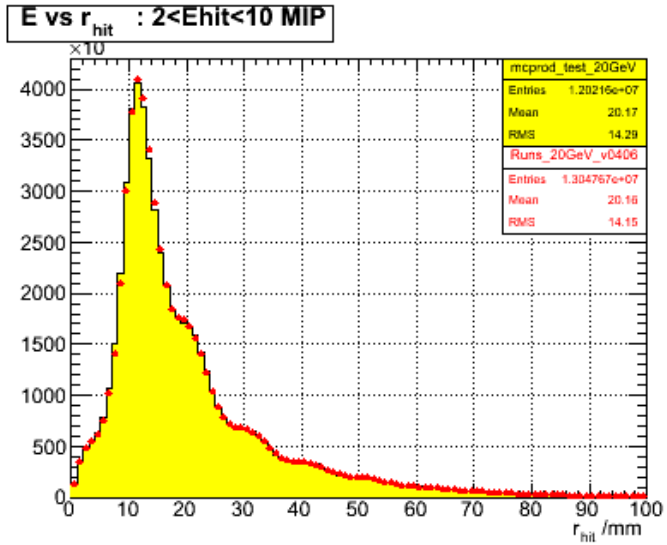


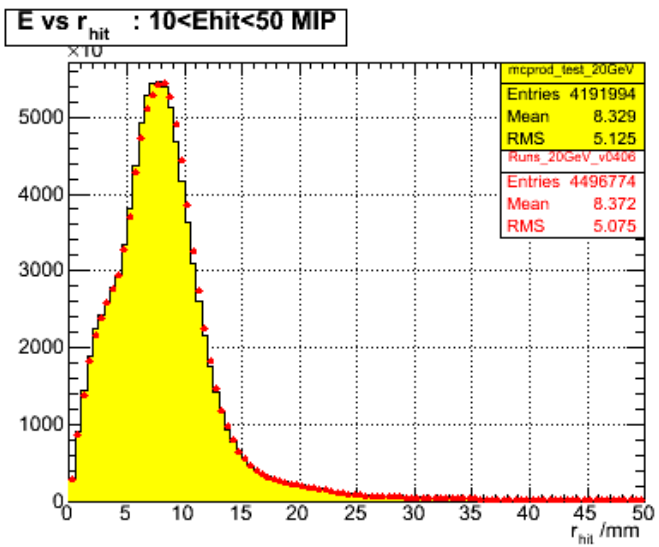


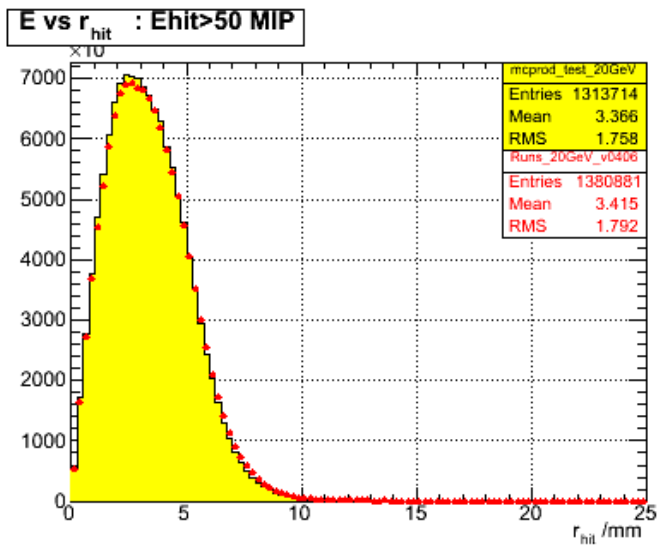


Radial shower profile : 20 GeV

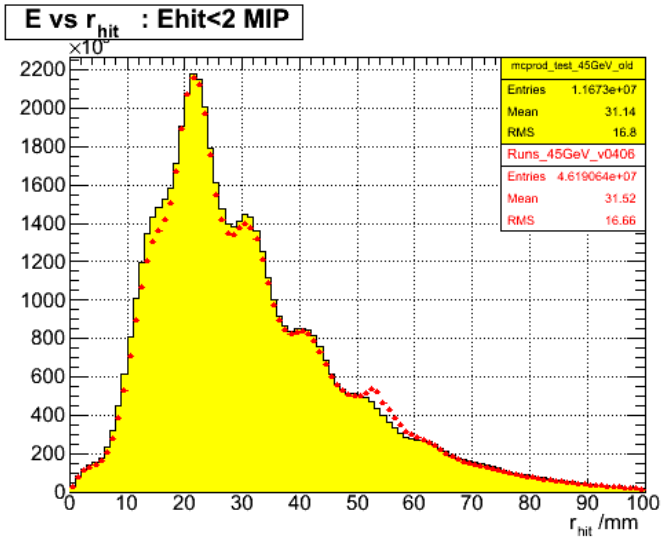


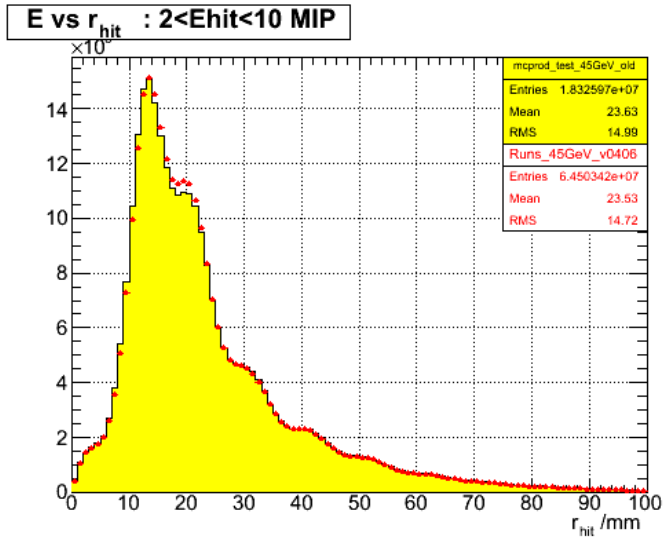


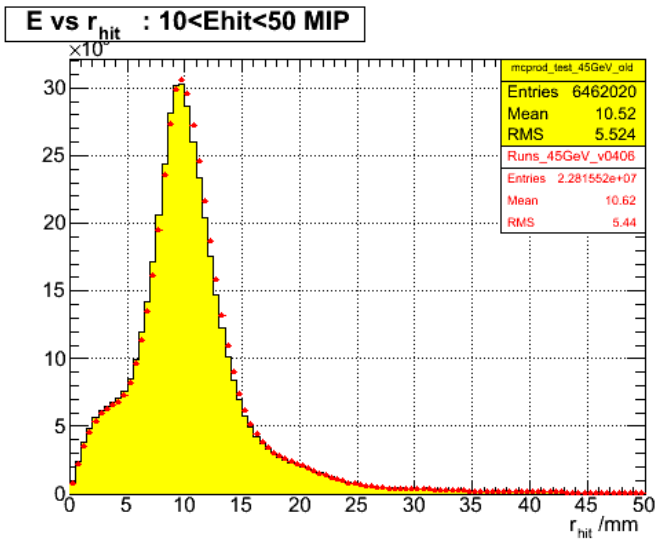


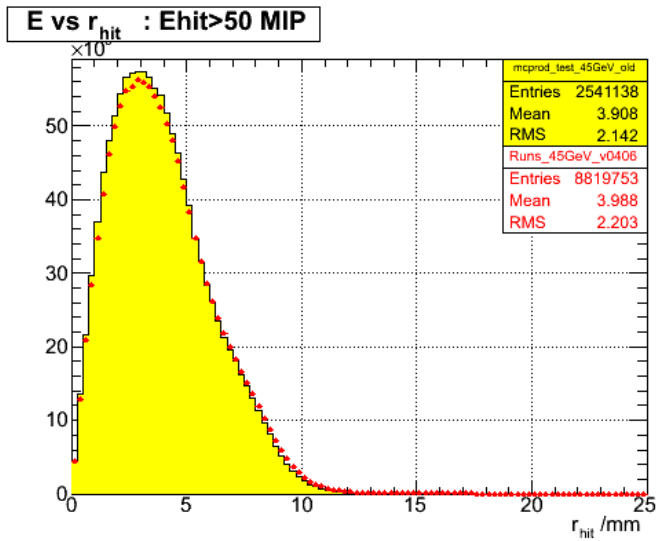


Radial shower profile : 45 GeV

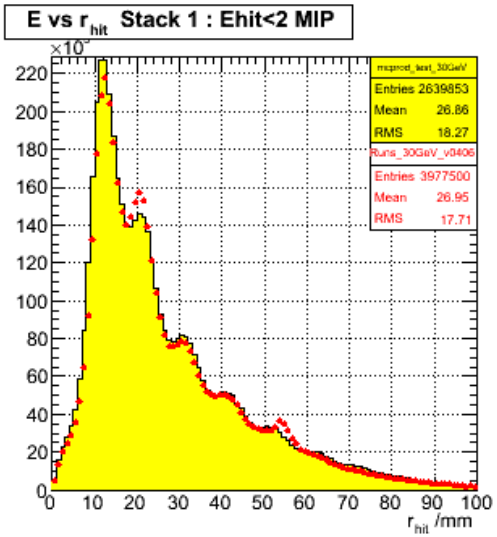


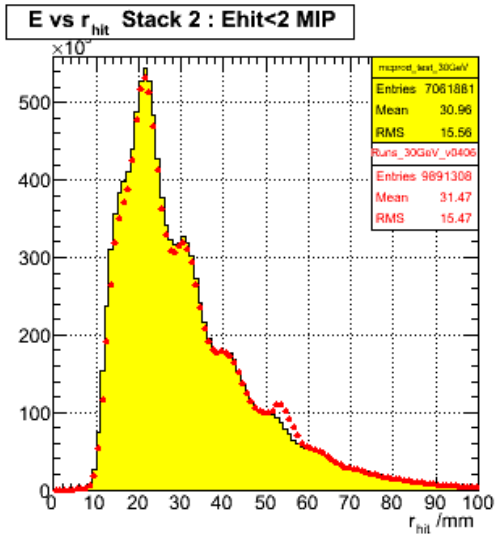


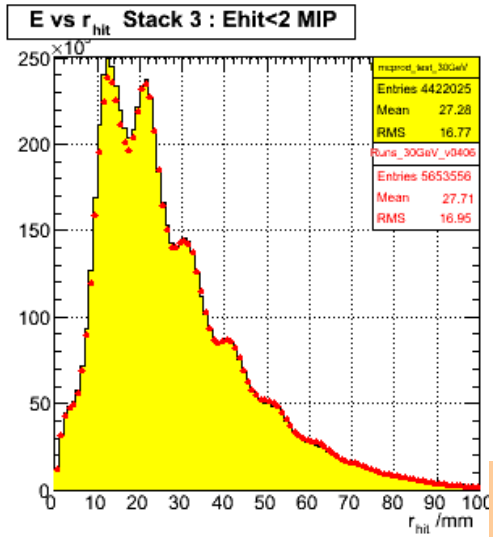


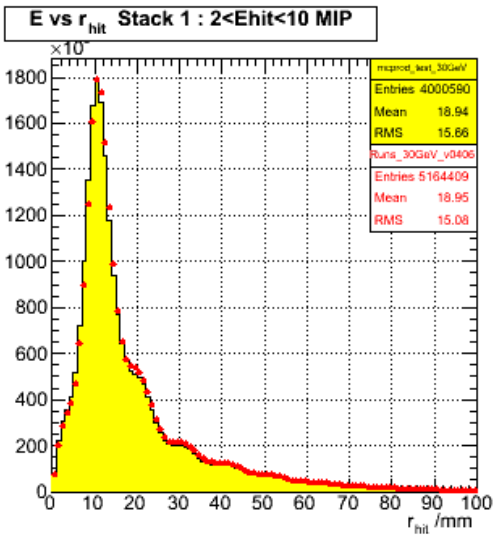


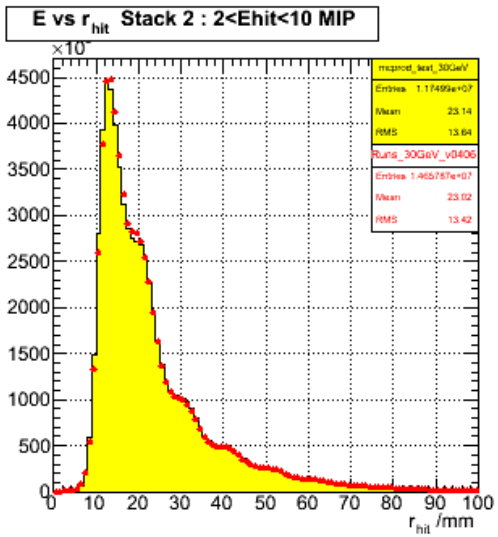
Radial profile vs depth : 30 GeV

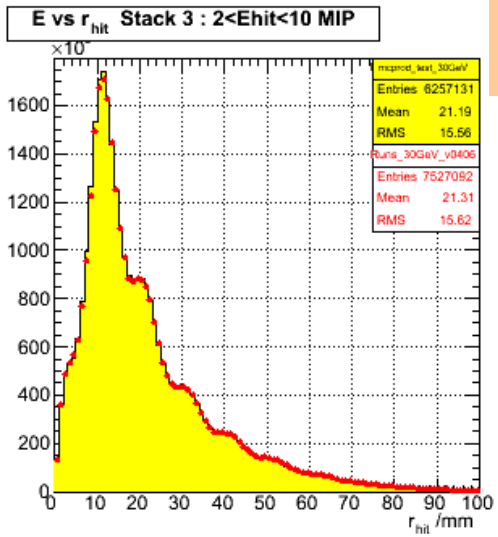






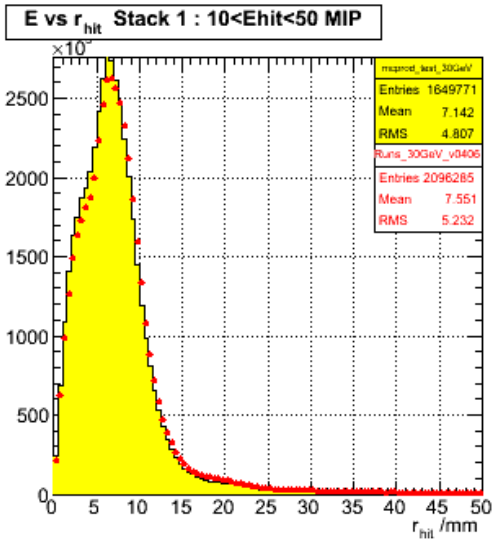


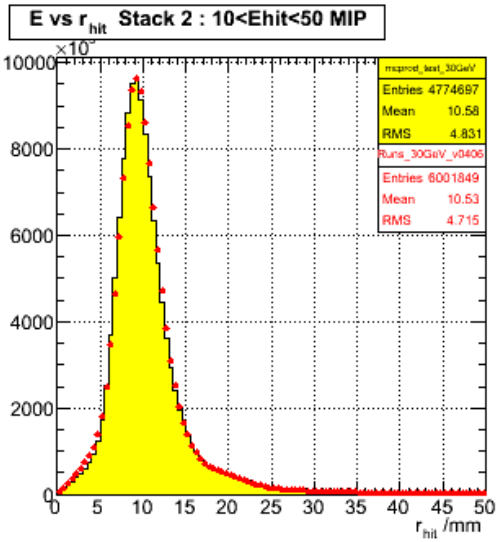


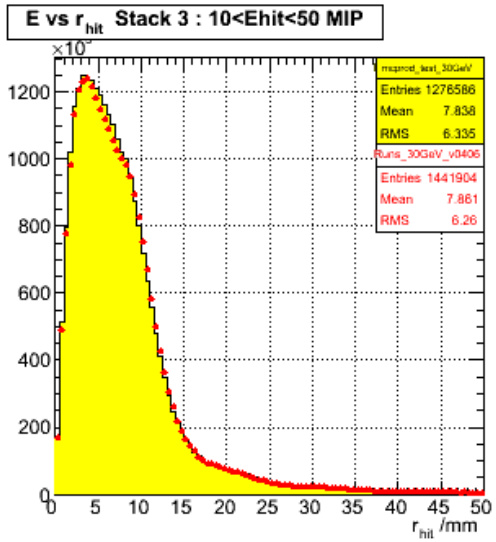


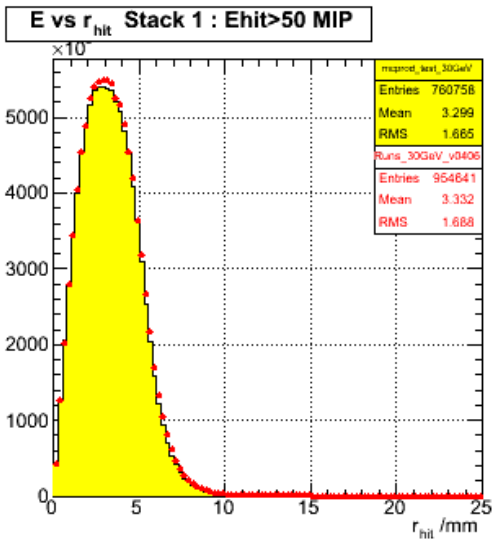
Shower tail broadens with depth, as expected.

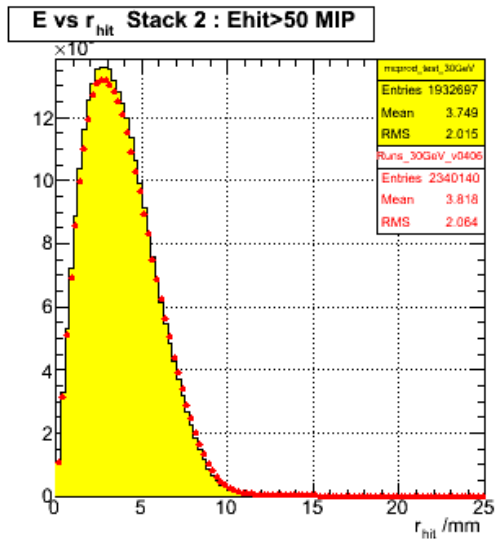
Radial profile vs depth (contd.) : 30 GeV

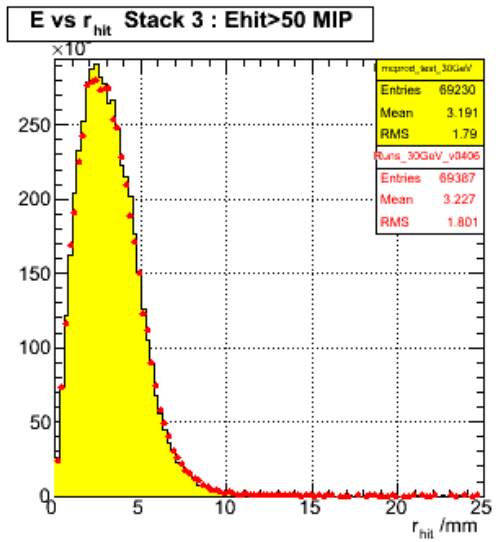










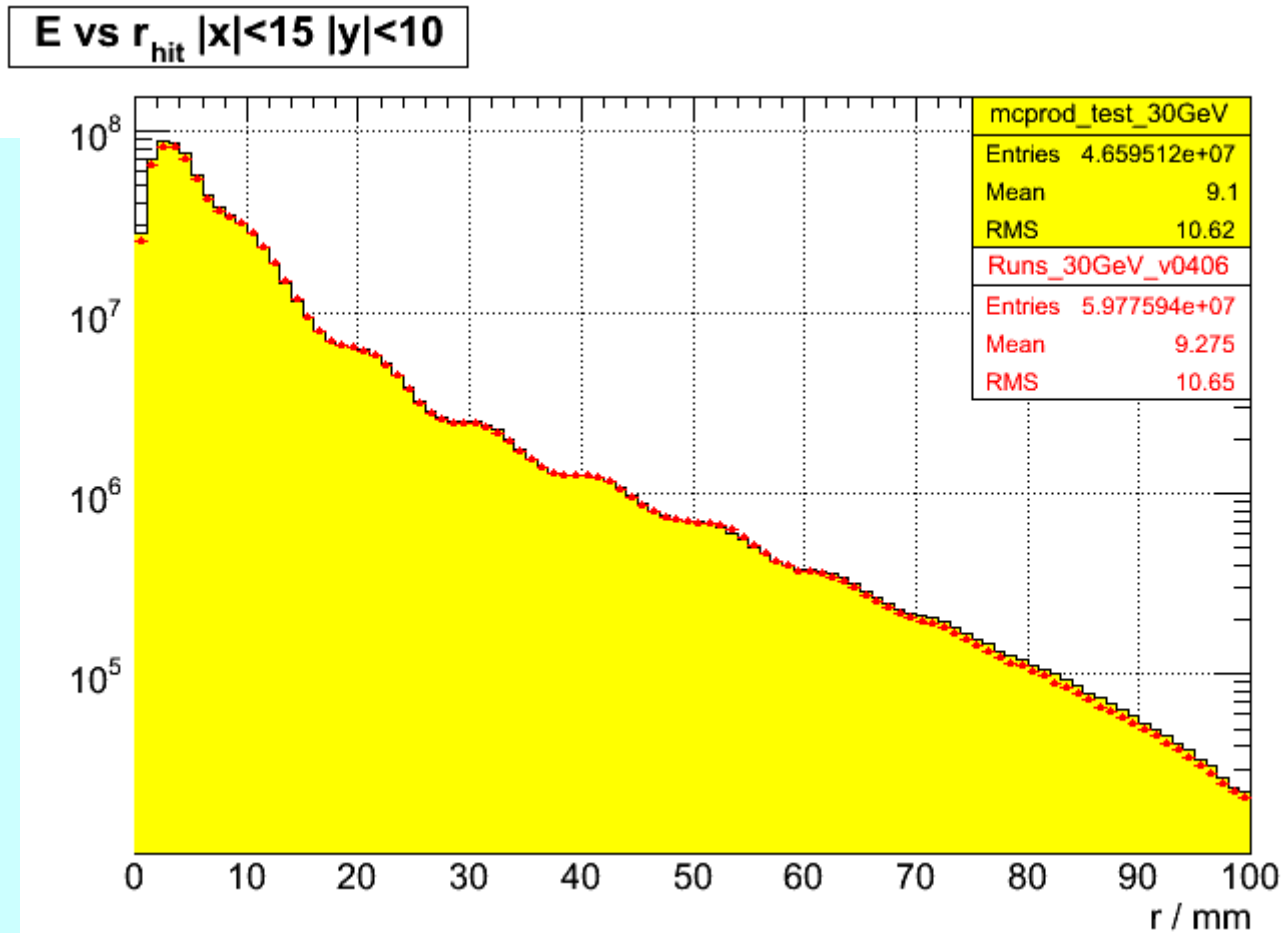


“Effective Molière radius”

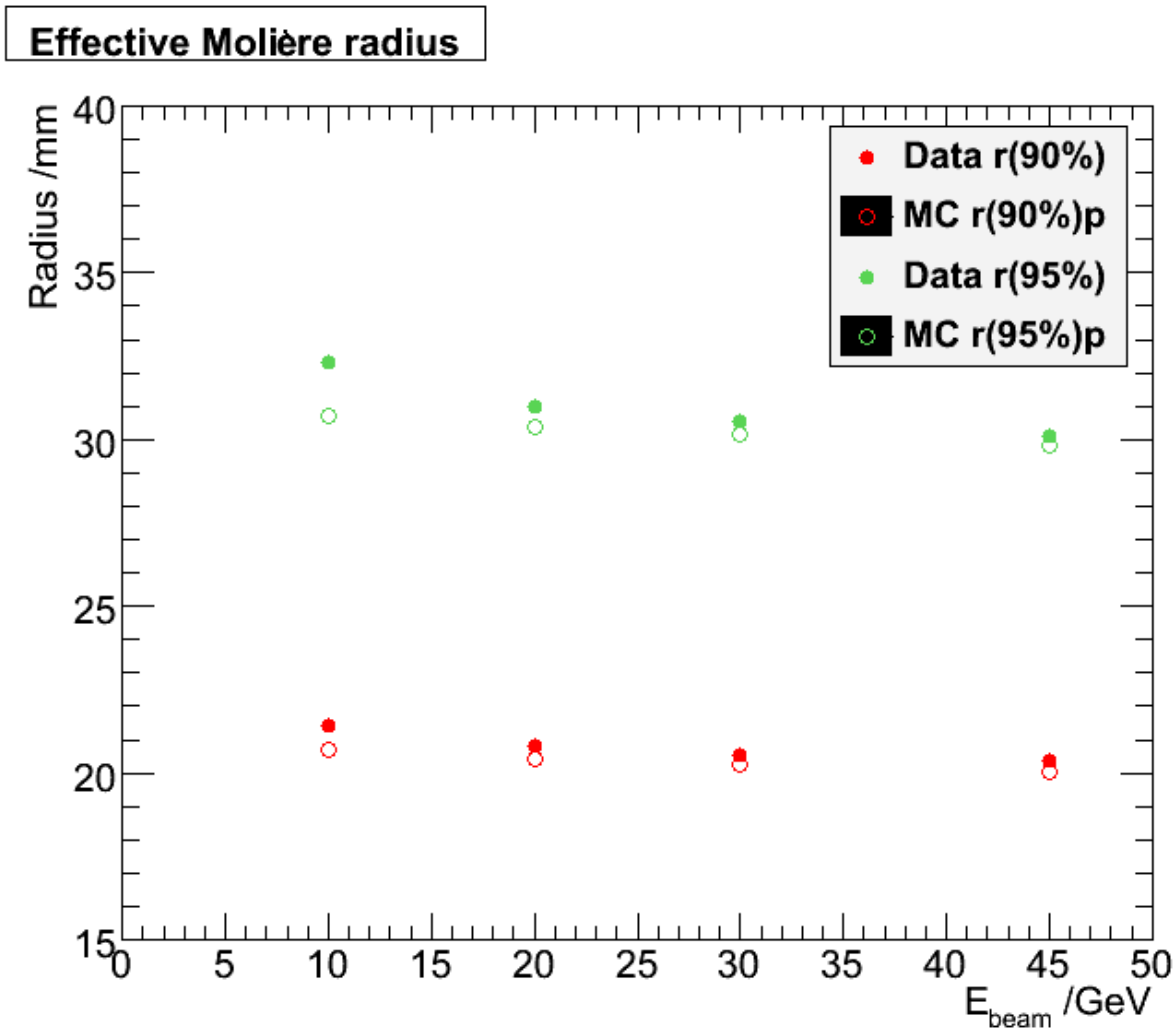
Method:

Take energy-weighted r_{hit} distribution and find the radii at which 90% or 95% of the shower energy is contained: r_{90} and r_{95}.

Stacks all weighted equally. Maybe this isn’t right?



Effective Molière radius vs e^- energy

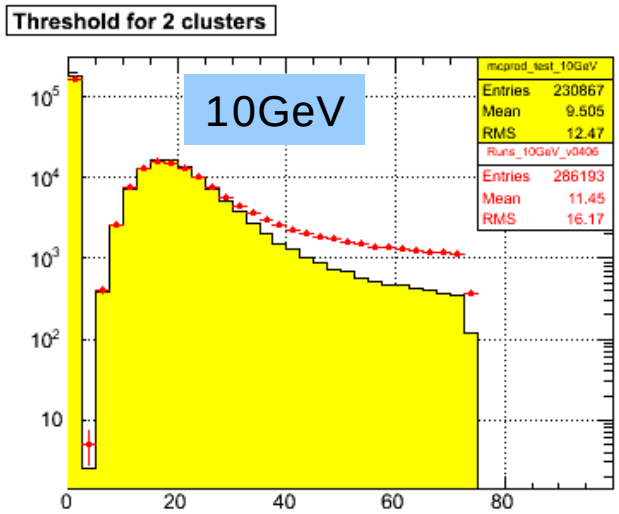


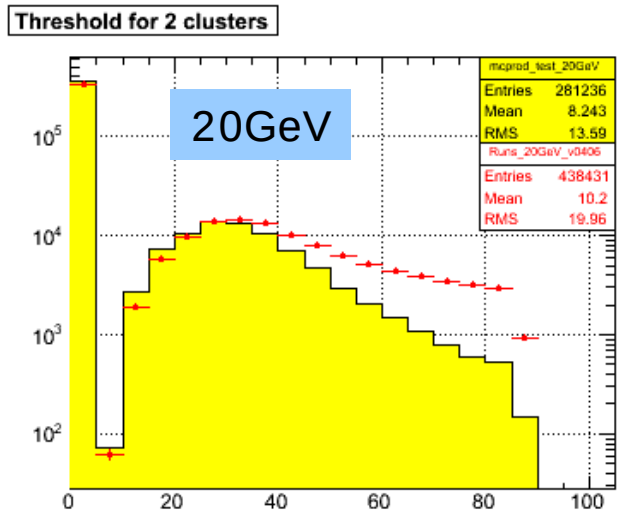
Pretty good agreement, to ~2%, except at 10 GeV.

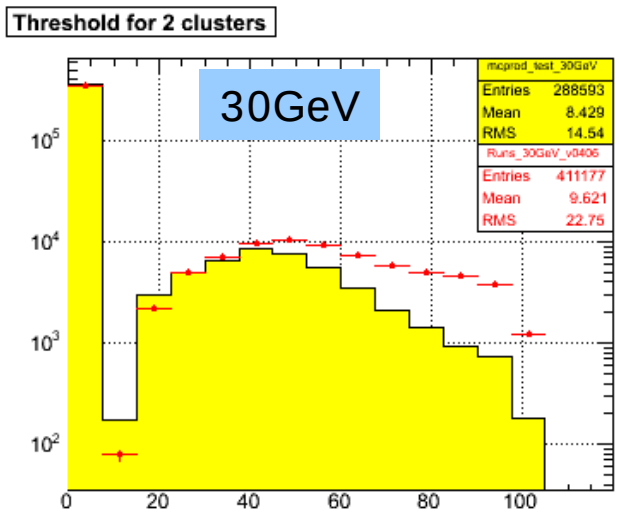
But MC is systematically lower.

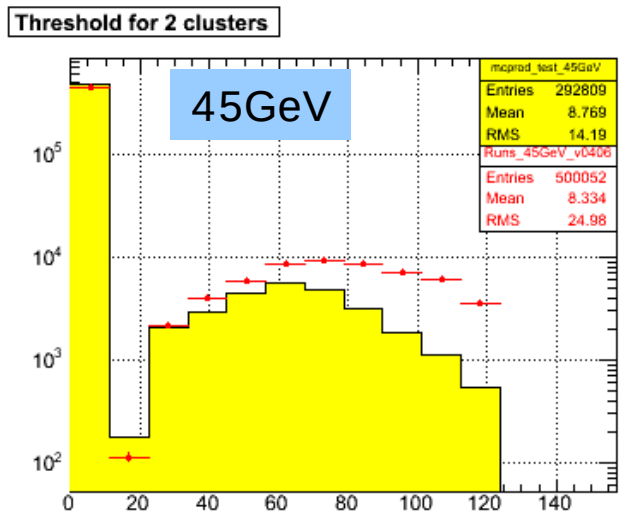
Likely to be linked with cut used for removal of double showers (upstream showering).

T_{max} is parameter used to remove double showers

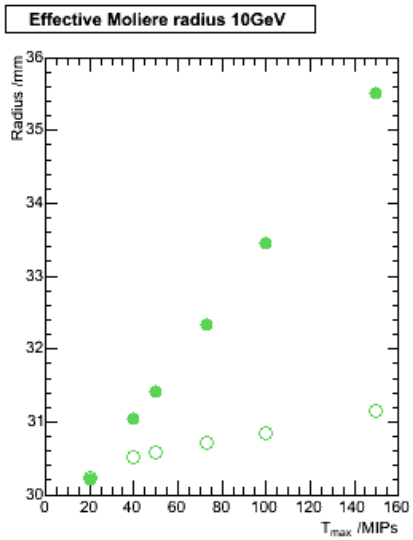


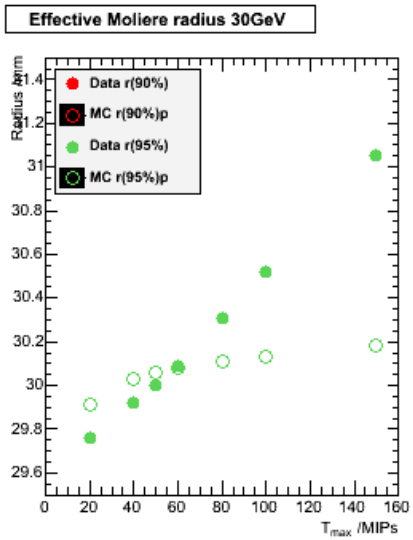


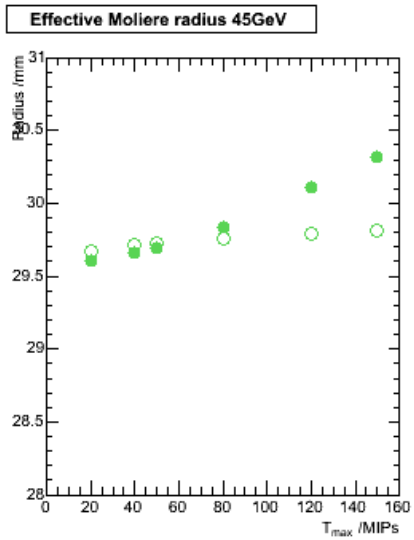


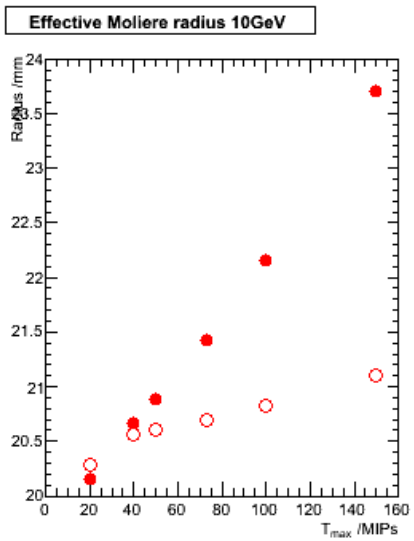


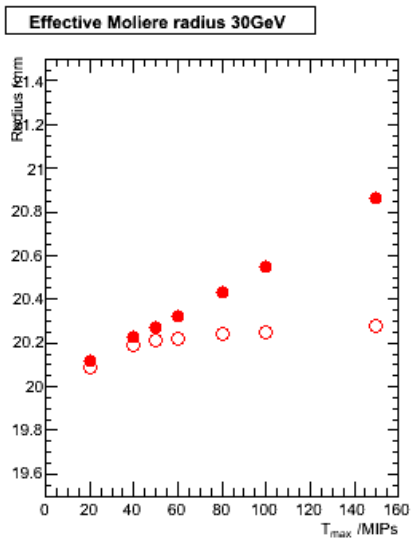
Effective Molière radius vs T_{max}

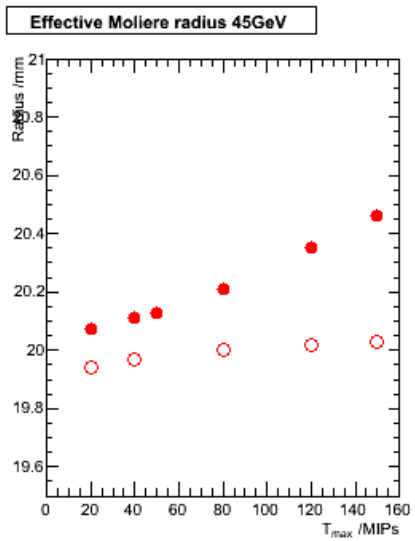












Largely confirms that data/MC discrepancy is associated with residual double showers present in data.

Should we cut lower? But then biasing the result (though not much, if we believe MC).

However…..

- So far so good.
- All this was based on the same data and MC samples as used for Cristina's paper.
- But, since Mokka 06-07 we have a revised G10 density for the ECAL.
- This has a significant impact on the shower width, and reduces both r_{90} and r_{95} by ~1mm at all energies.
- This destroys the agreement between data and MC ☹
- (But I believe it improves Valeria's longitudinal analysis).
- Not sure what to do about this.