Transverse leakage correction in ECAL

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Outlook

- Methodology
- Monte Carlo
- How much can we correct? (last pixel study)
- Can we use energy-independent corrections?
- Beam test data
- Summary

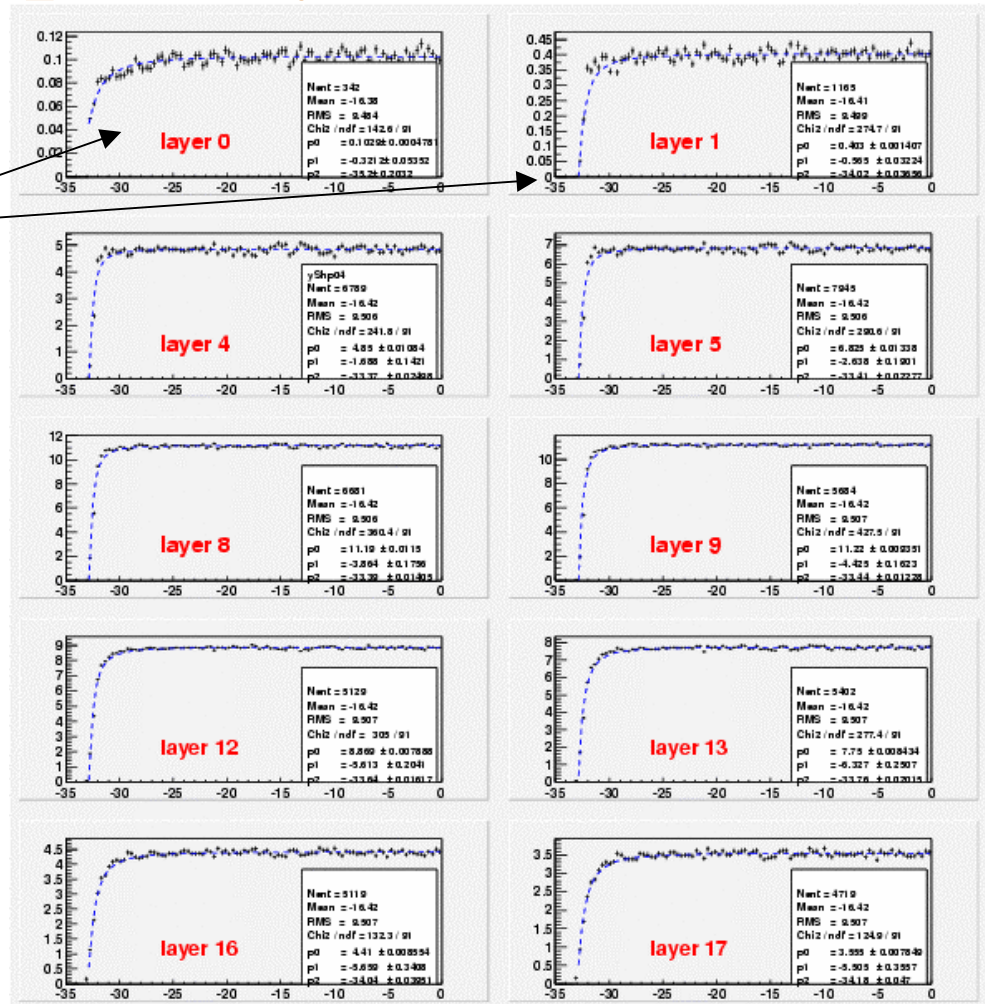
Methodology

- Correction per layer:
  (independent from incident angle)
- Fitted function $E_{layer}(y)=p0+p1/(y-p2)^2$
  p0-energy in layer if no leak
  p1-quadratic term
  p2-"asymptotic" edge of ECAL
- Look at layers in y-direction (slayers 1,3,5,7,9):
  (*more layers, beam more precise)*
- Energies: 10, 50 and 120 GeV, (at 0° & ±23º)

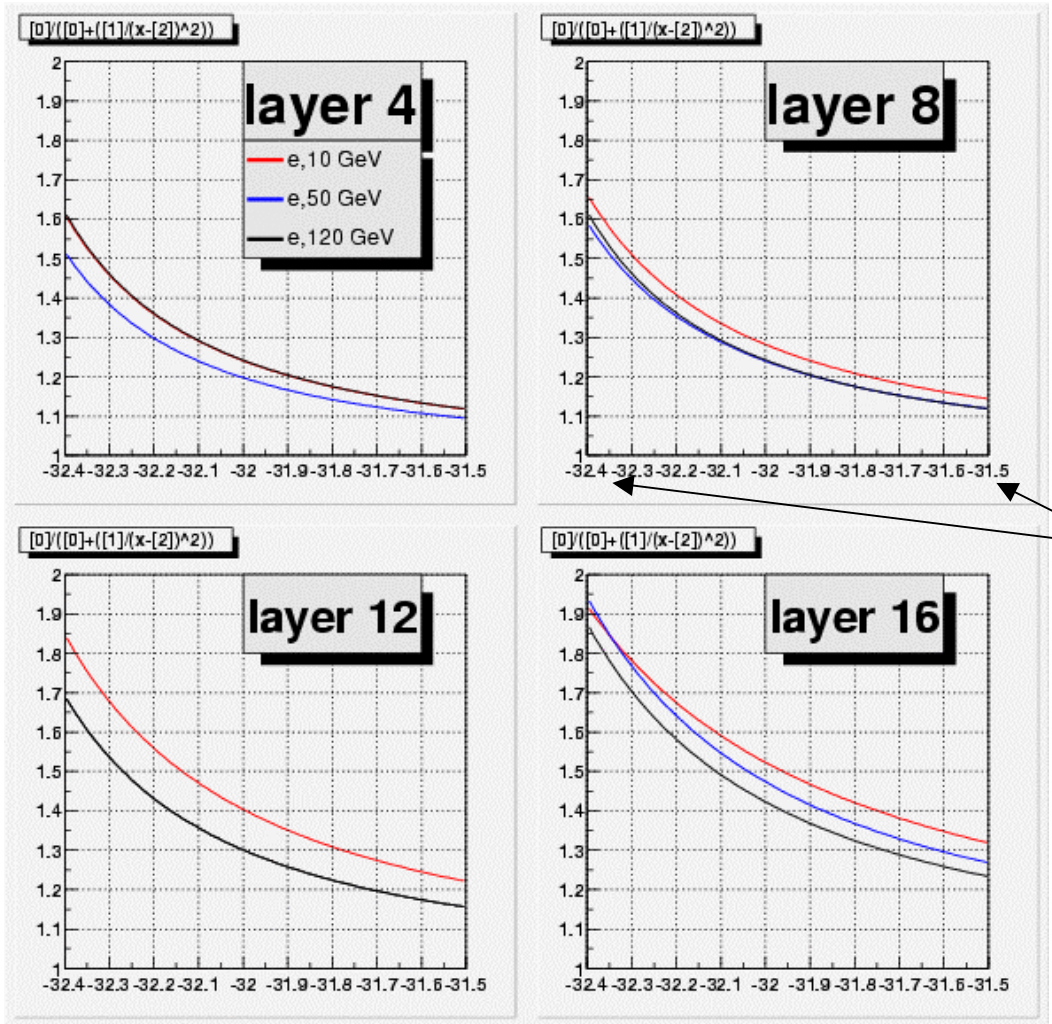
Fit per layer

MC, e 120 GeV

shower starts – low deposited energy – low stat – poore fit



Correction coefficients



corr=p0/E_{fitted}

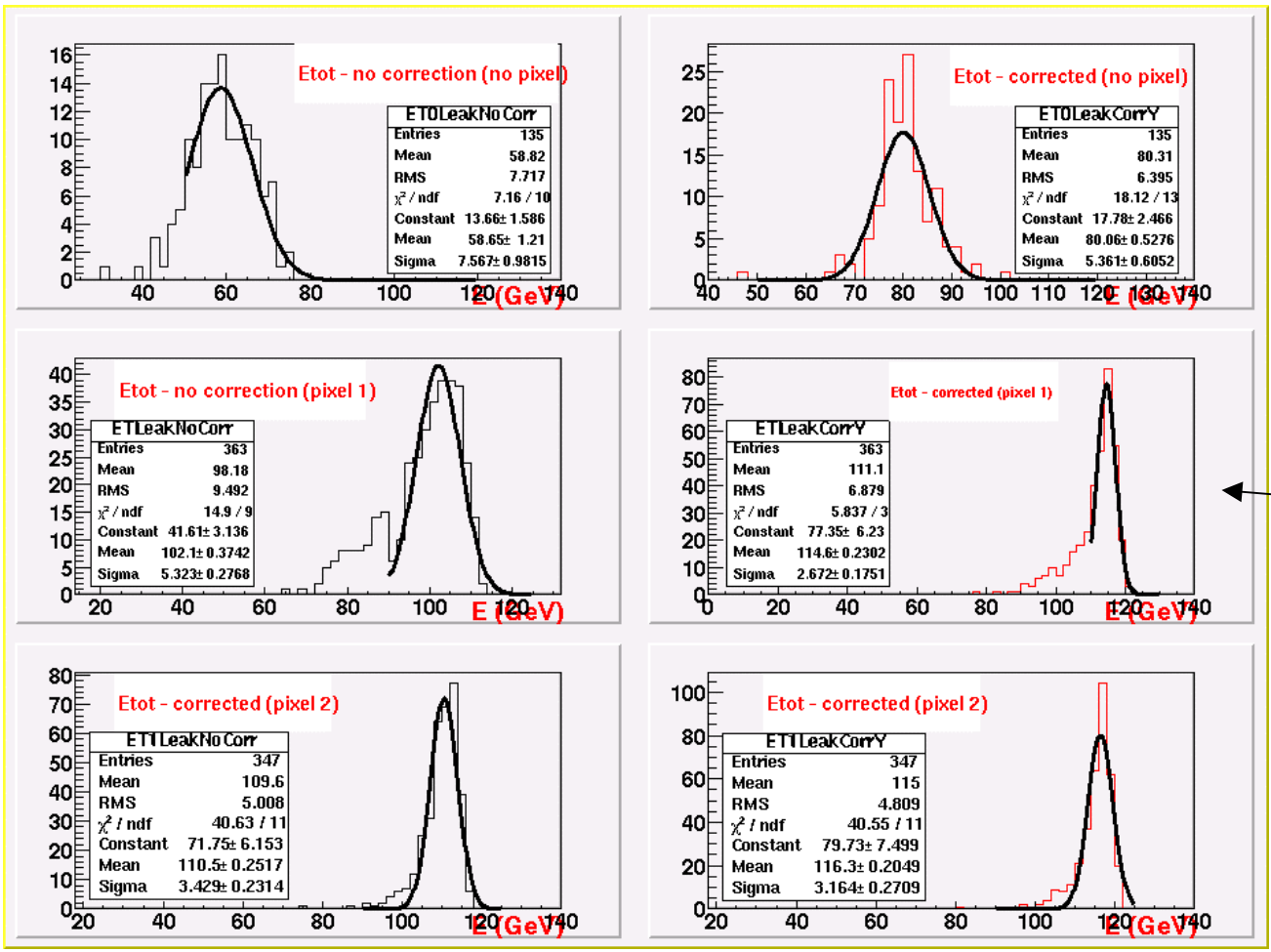
In the last pixel

the correction coefficients changes even by

about 40% within

first pixel !

Corrected energy



MC, electrons

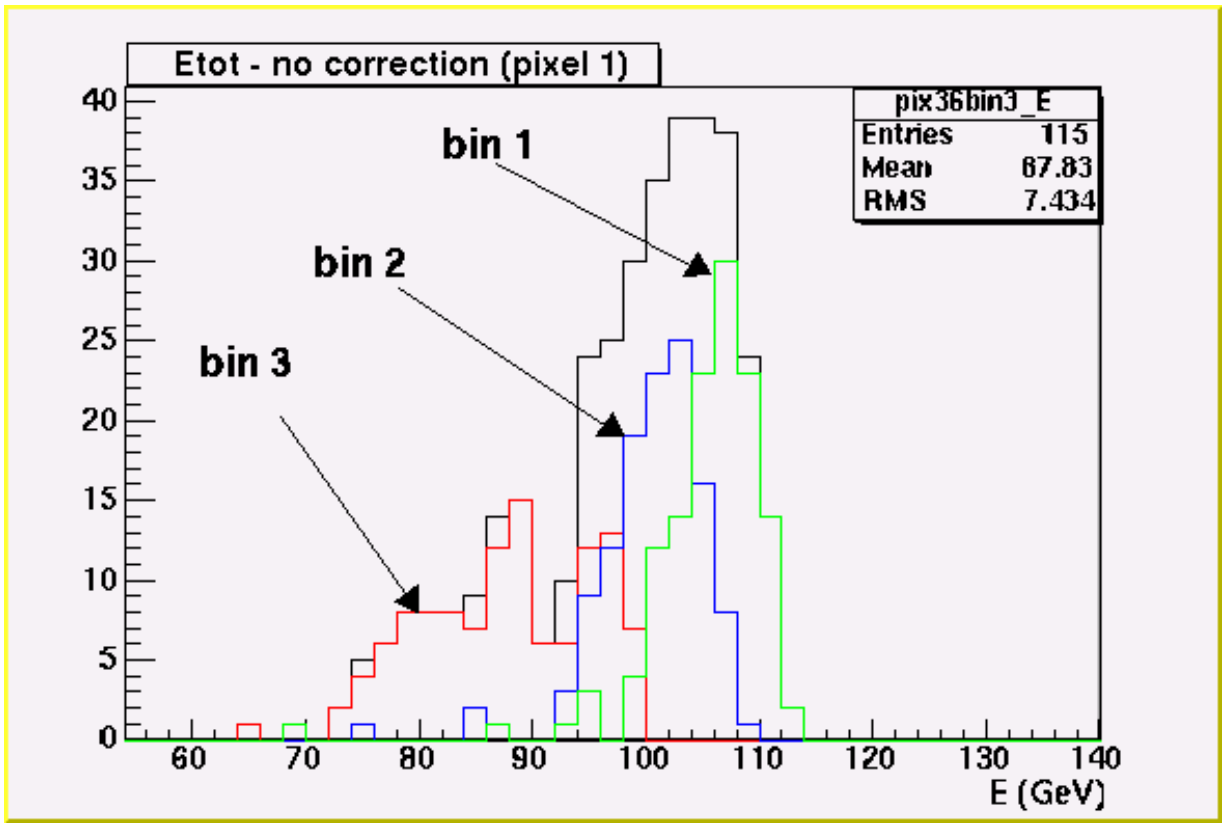
120 GeV

let's look more precisely on the last pixel...

MC, e 120 GeV

Last pixel

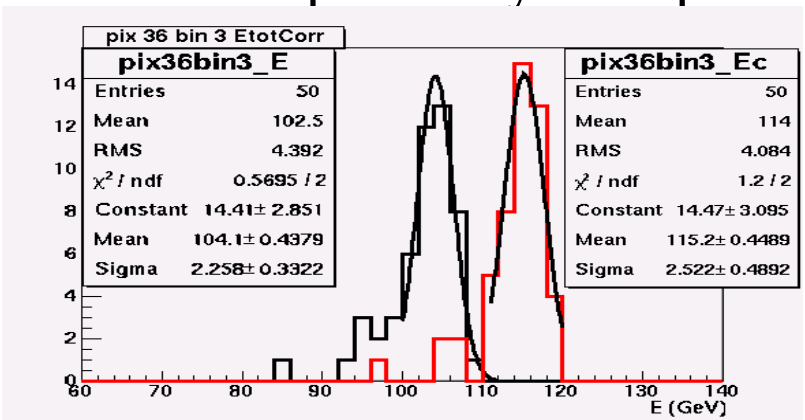
last pixel divided on 3 bins of 3 mm each

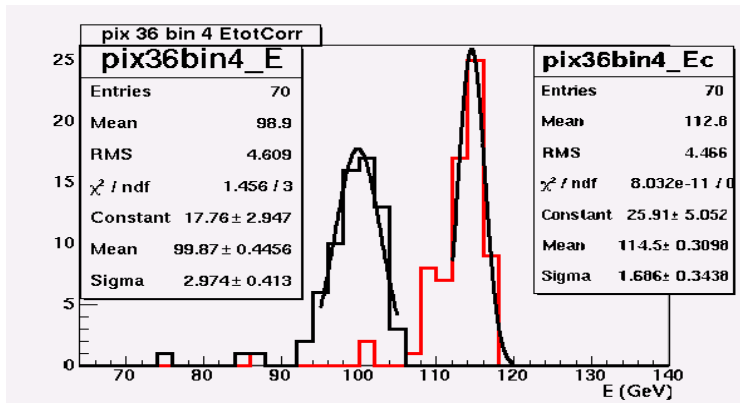


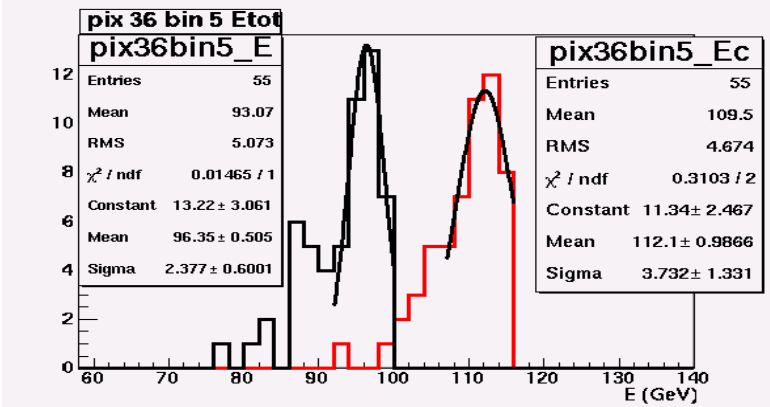
MC, e 120 GeV

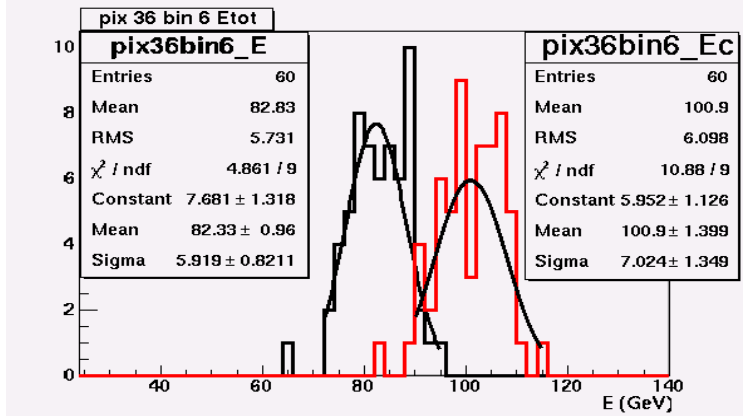
Last pixel

even more precisely: last pixel divided on 6 bins of 1.5 mm each





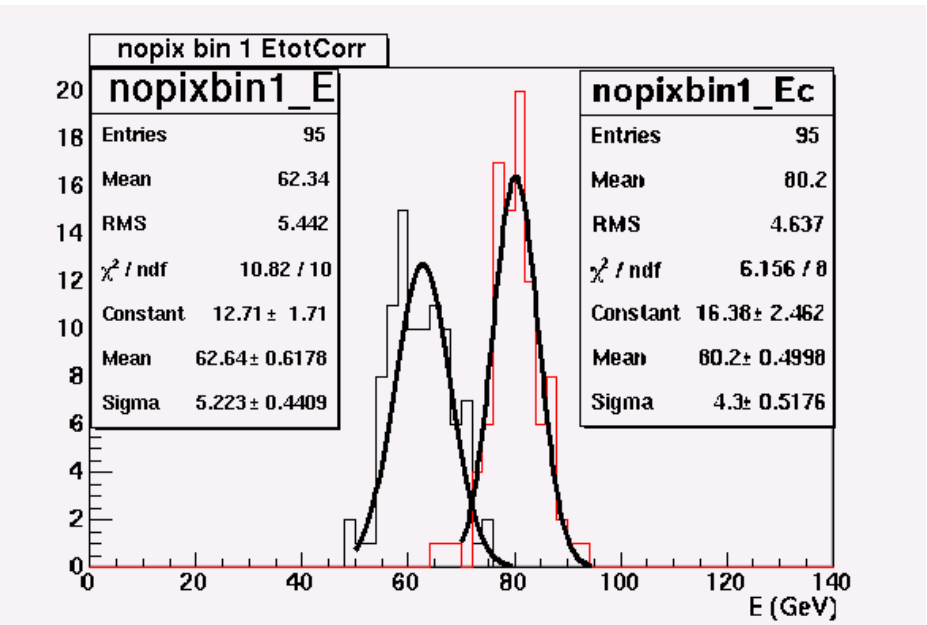


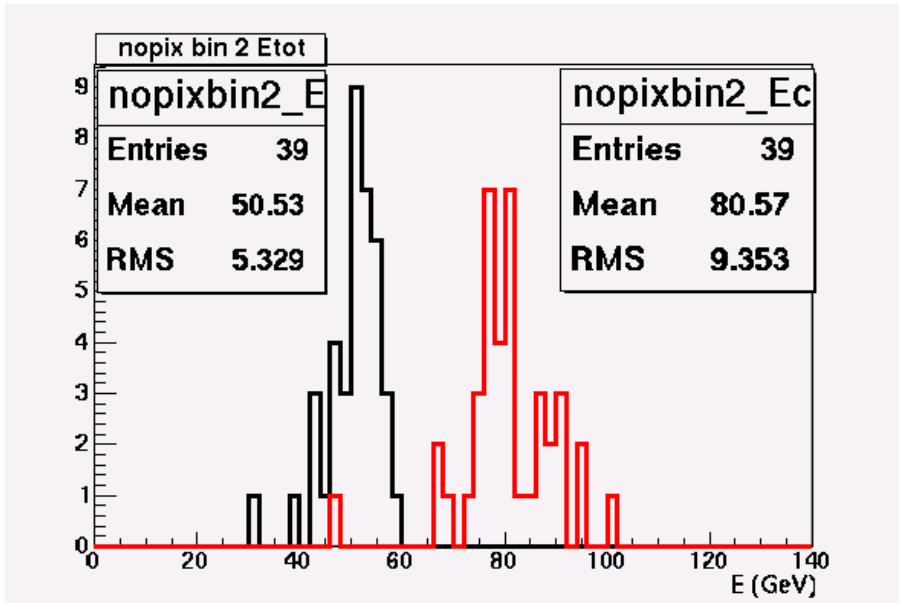


MC, e 120 GeV

After last pixel

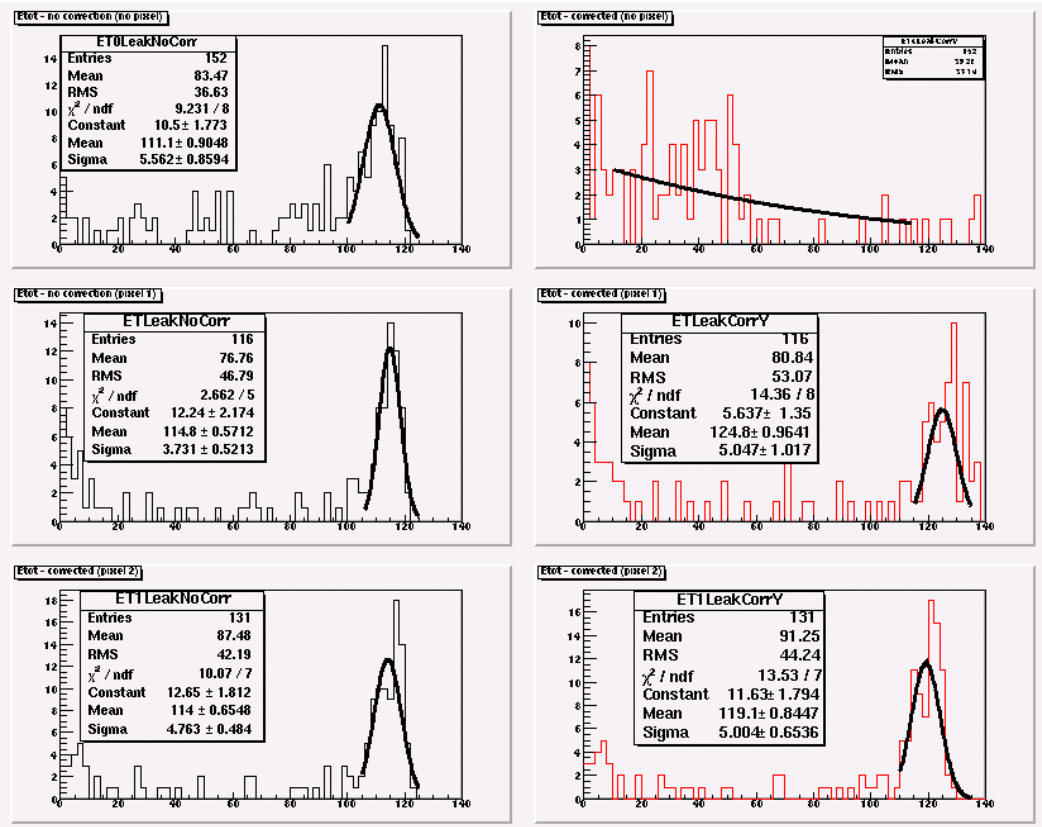
5 mm divided into 2 bins of 2.5mm each:





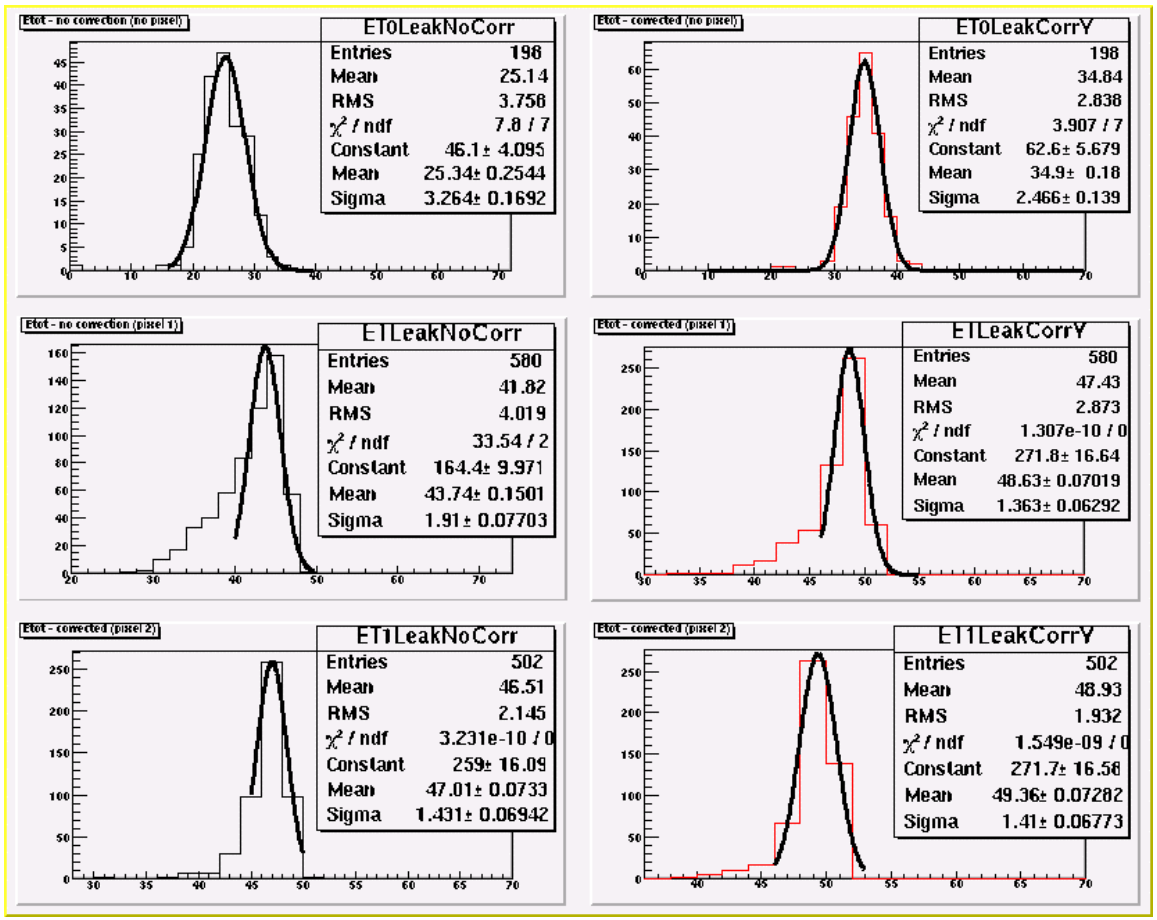
Corrected energy-with ±23 º incident angle

MC, e 120 GeV



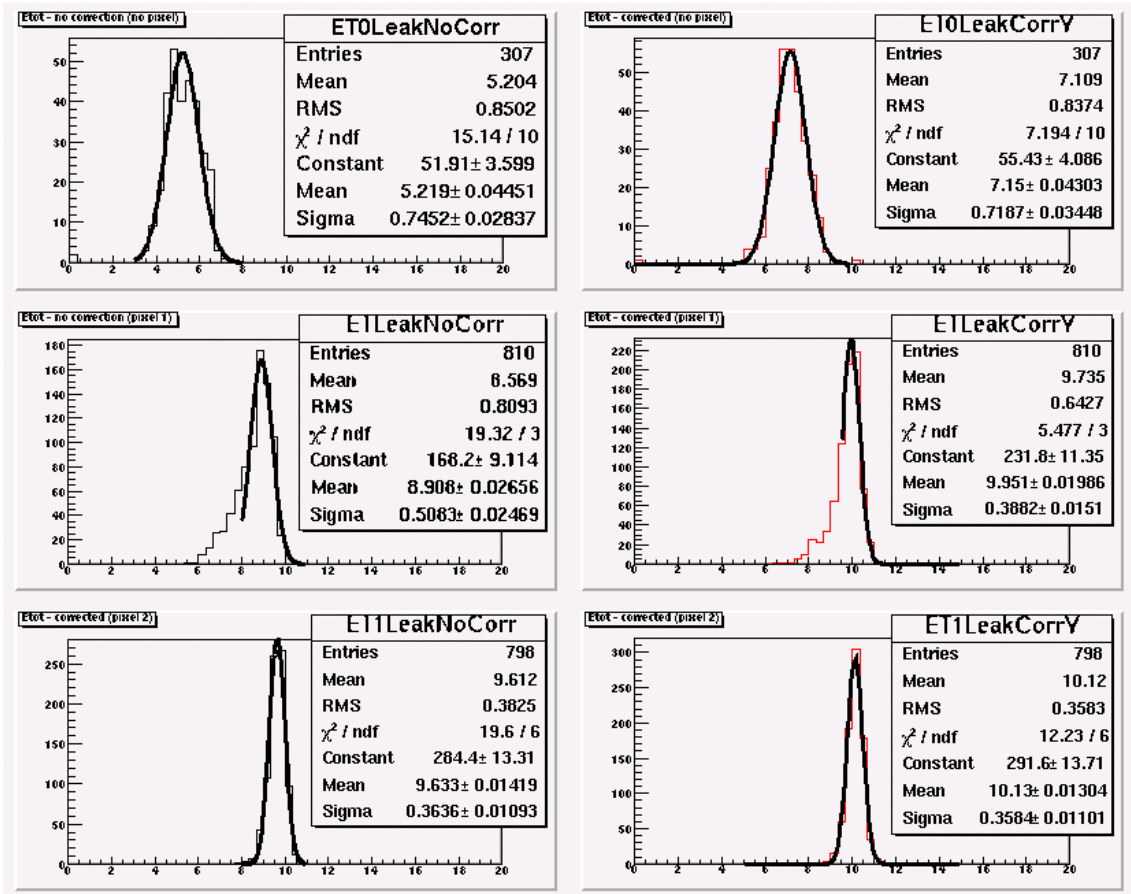
MC, e 50 GeV

Corrected energy



MC, e 10 GeV

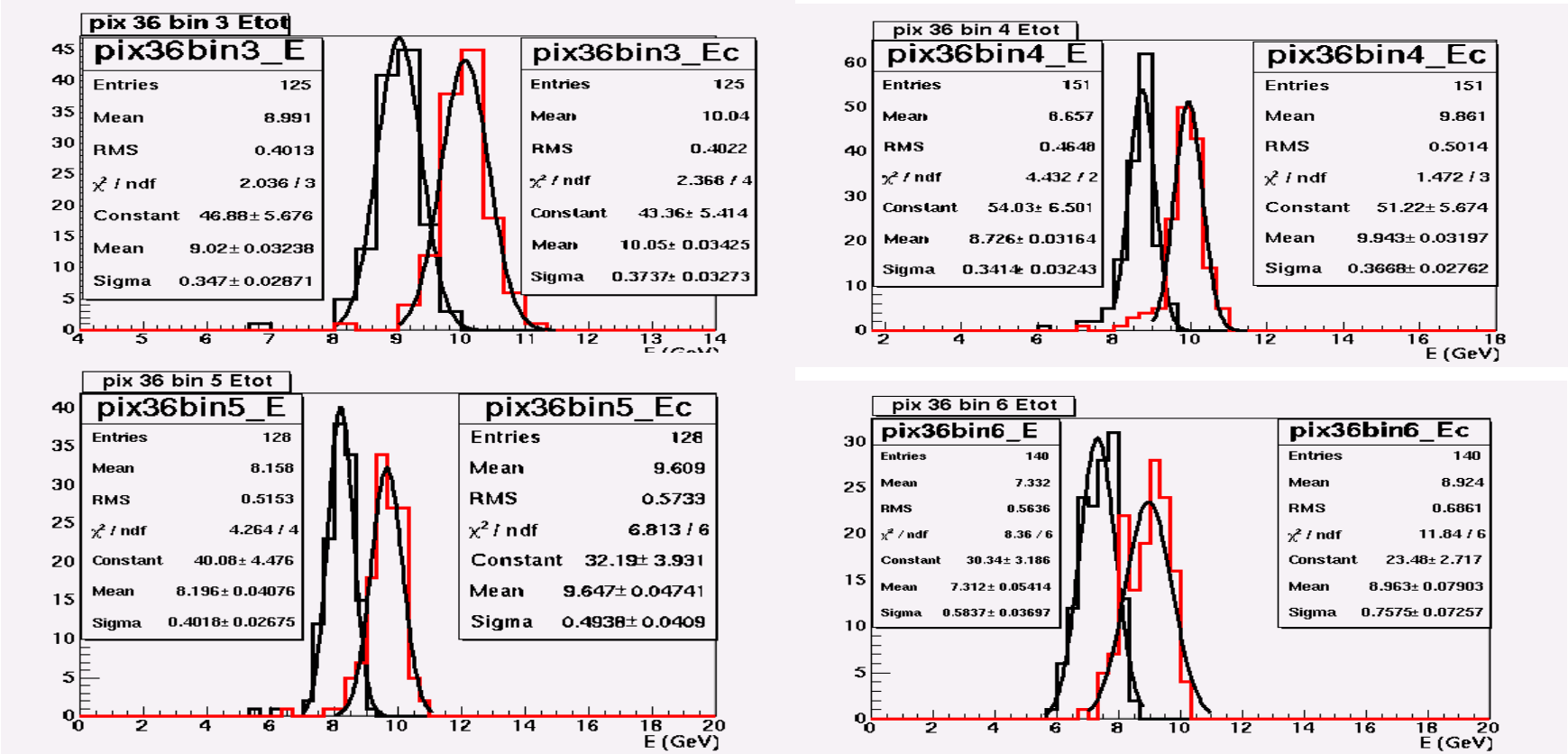
Corrected energy



MC, e 10 GeV

Last pixel 10 GeV

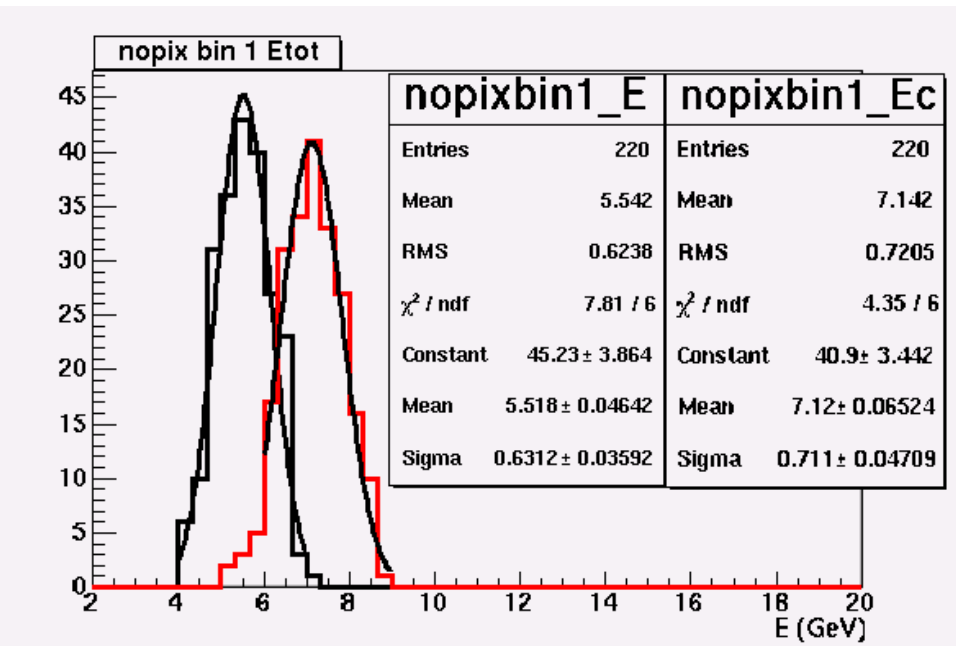
more precisely: last pixel divided on 6 bins of 1.5 mm each

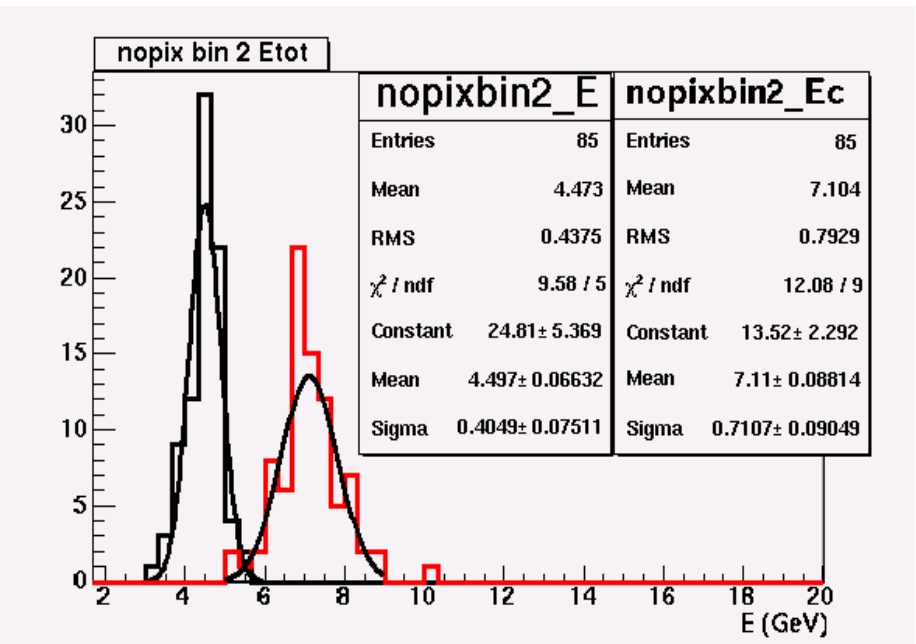


MC, e 10 GeV

After last pixel (10 GeV)

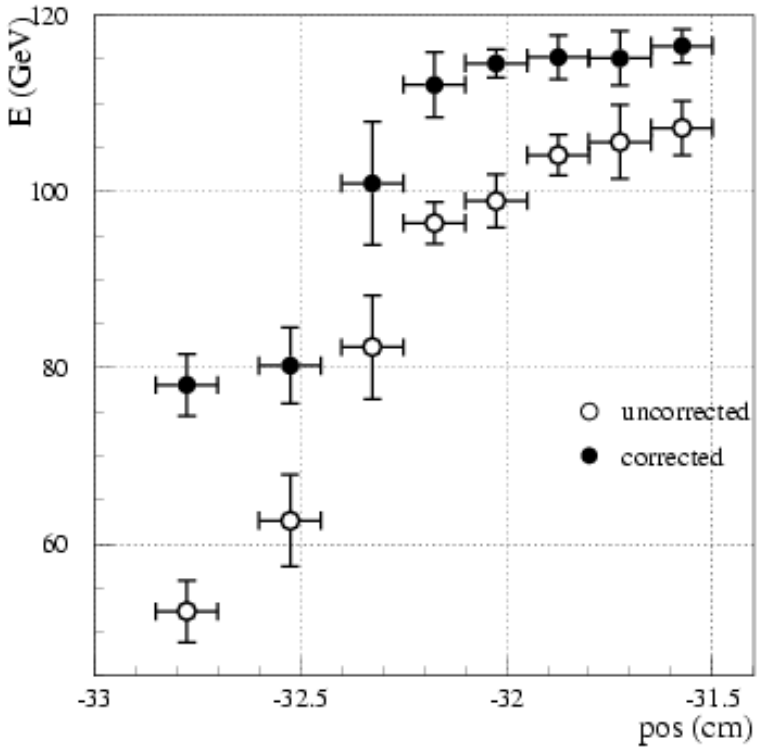
5 mm divided into 2 bins of 2.5mm each:



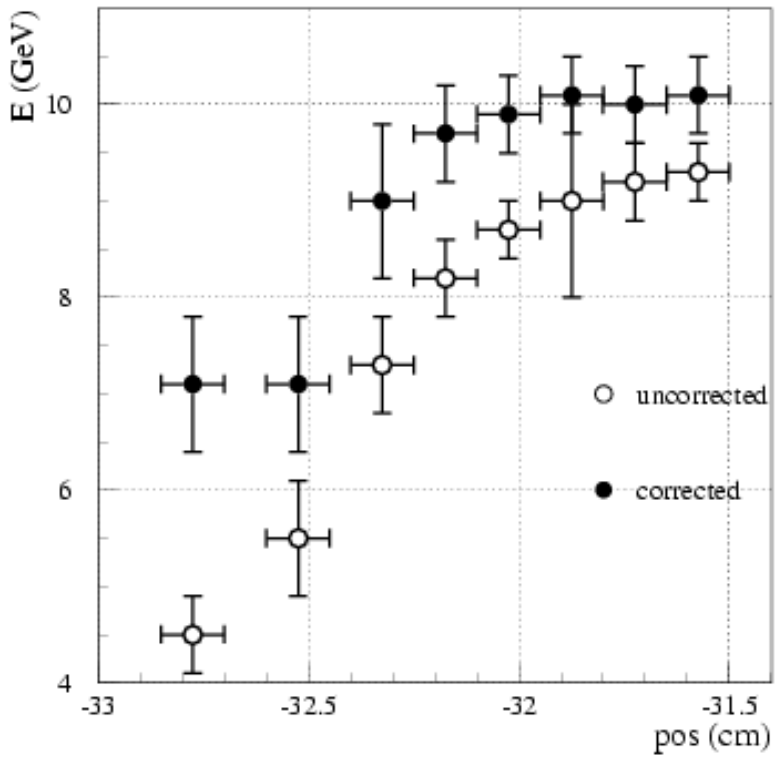


Reconstructed energy as a function of distance

120 GeV

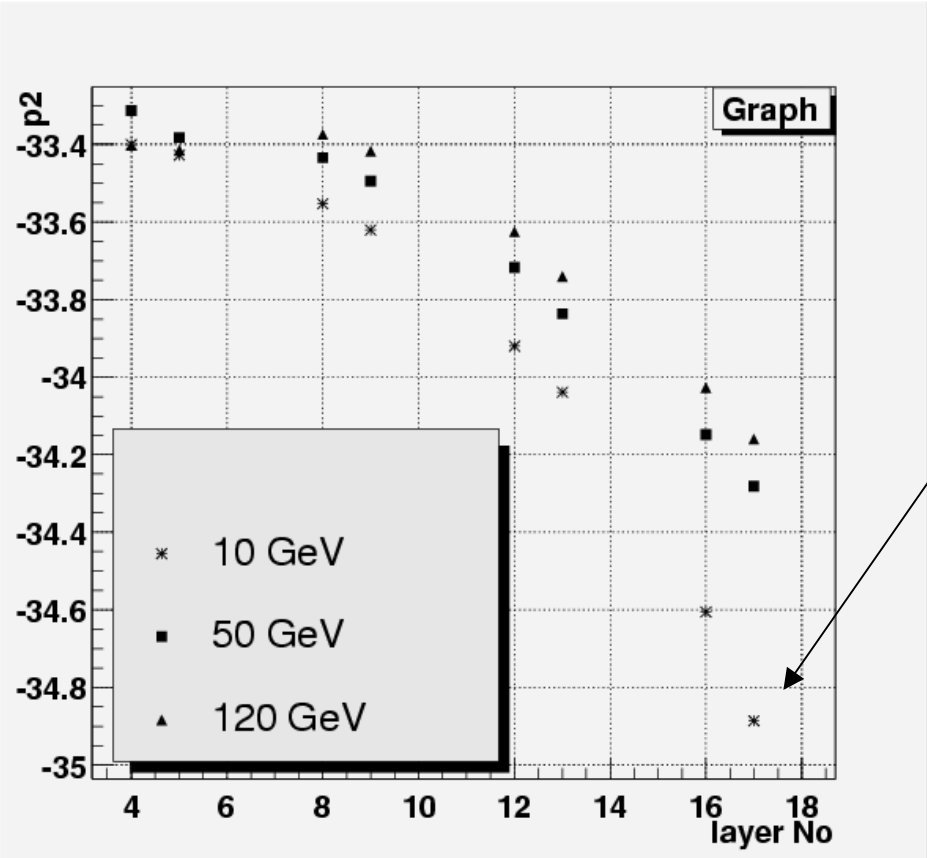


10 GeV



‘asymptotic’

Value of p2 – size of ECAL



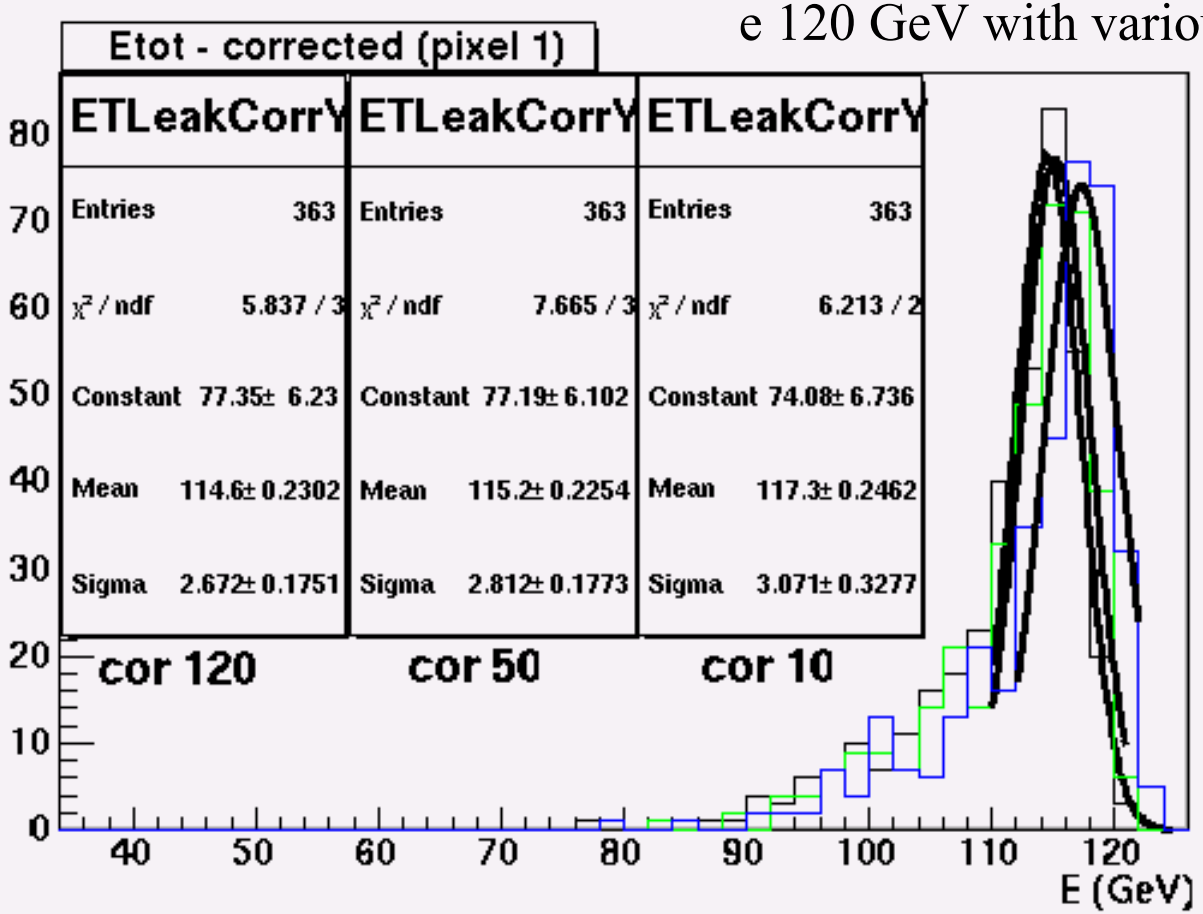
ECAL is larger

for lower energies

(however for 10 GeV we got large error here – already low stat because no more shower)

Can we use the same coeffs?

e 120 GeV with various sets of coeffs



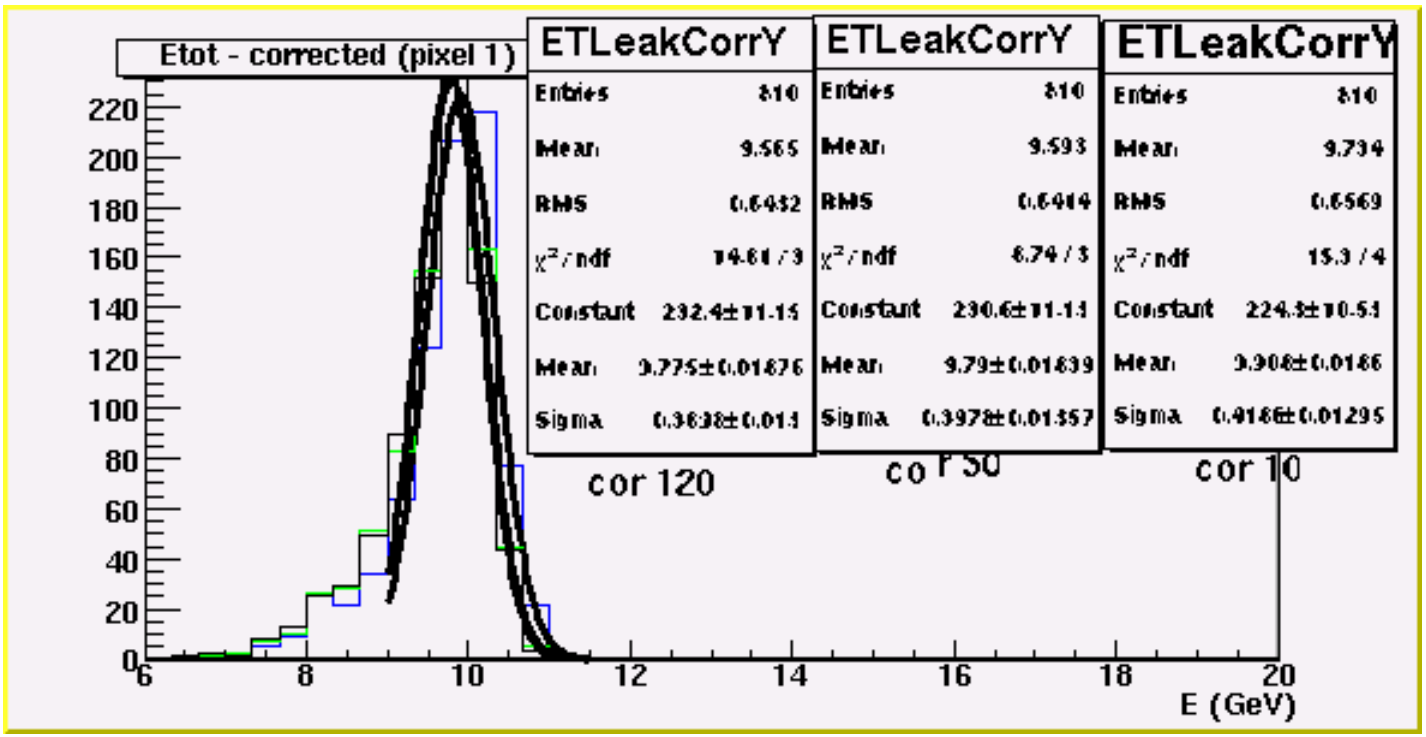
2% error!

But increase of width

MC, e 10 GeV

Can we use the same coeffs?

e 10 GeV with various sets of coeffs

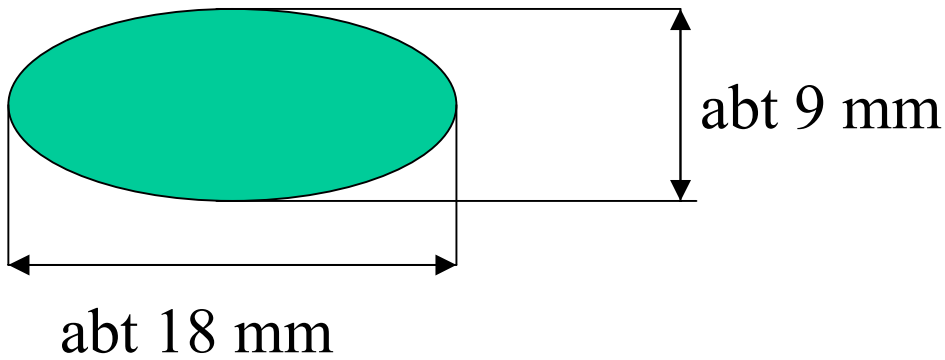


less then

1% error!

Beam test

- Beam size:



• use coeffs from the middle of the pixel (not center of gravity this time)

Beam test data

- Runs analysed:

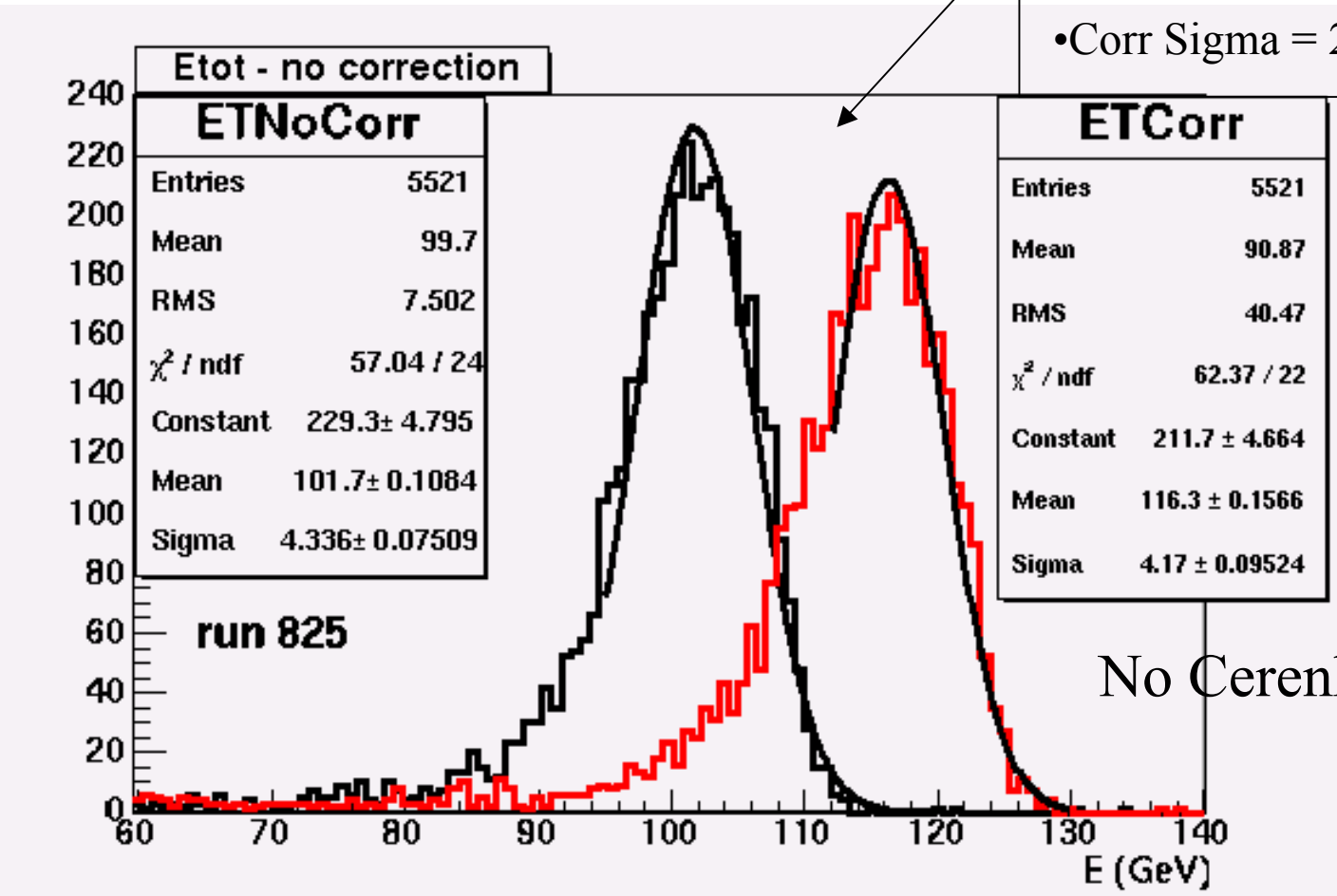
Run No	E (GeV)	y pos(cm)	pixel	Ped run
825	120	80	1	829
826	120	89	2	829
1222	50	80	1	1223
751	10	89	2	754

data, e, 120 GeV

Run 825

in MC, pixel 1:

- NoCor Mean = 102.1
- NoCor Sigma = 5.32
- Corr Mean = 114.8
- Corr Sigma = 2.7 GeV



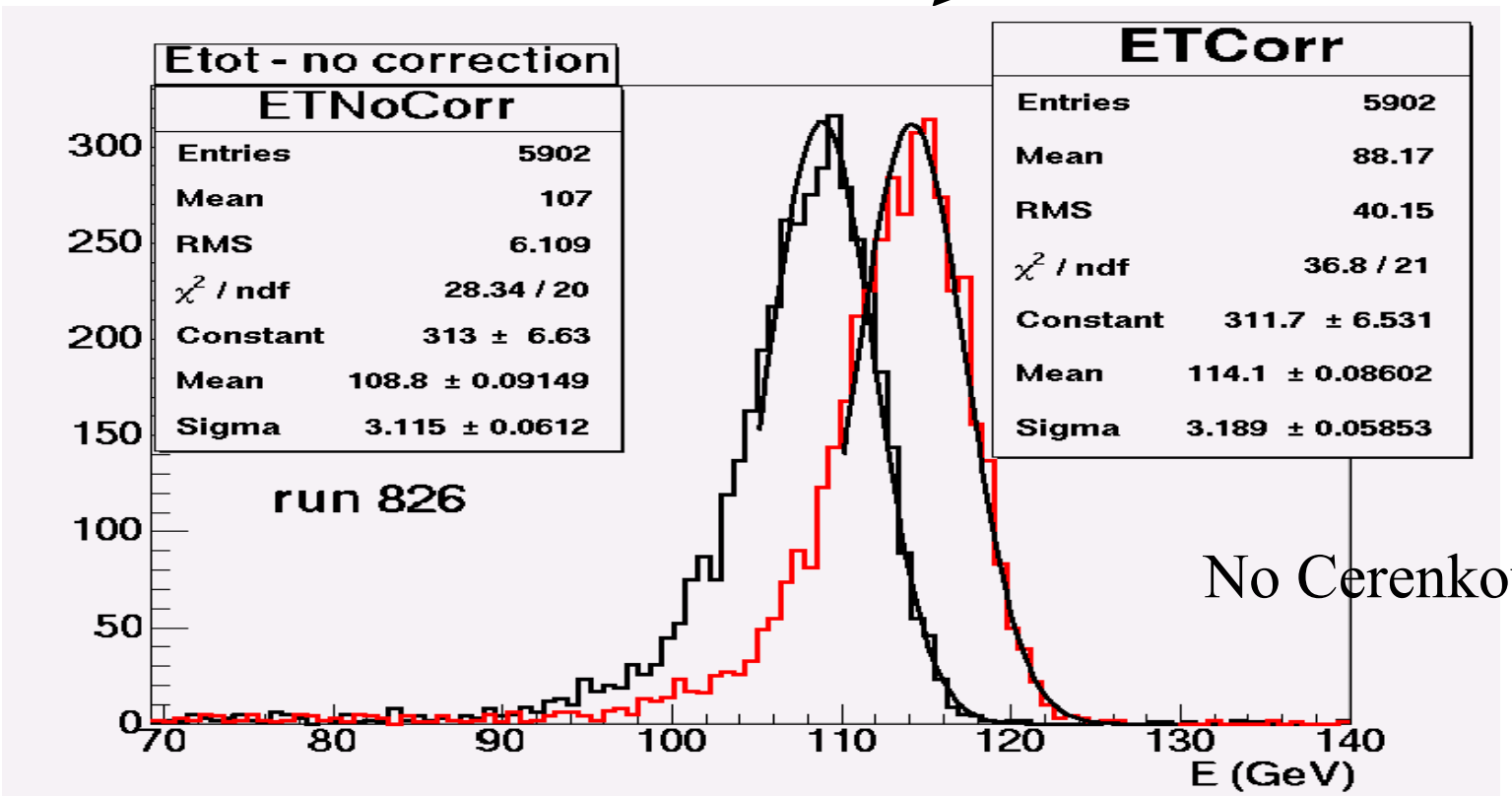
No Cerenkov

data, e, 120 GeV

Run 826

in MC, pixel 2:

- NoCor Mean = 110.5
- NoCor Sigma = 3.4
- Corr Mean = 116.3
- Corr Sigma = 3.2 GeV

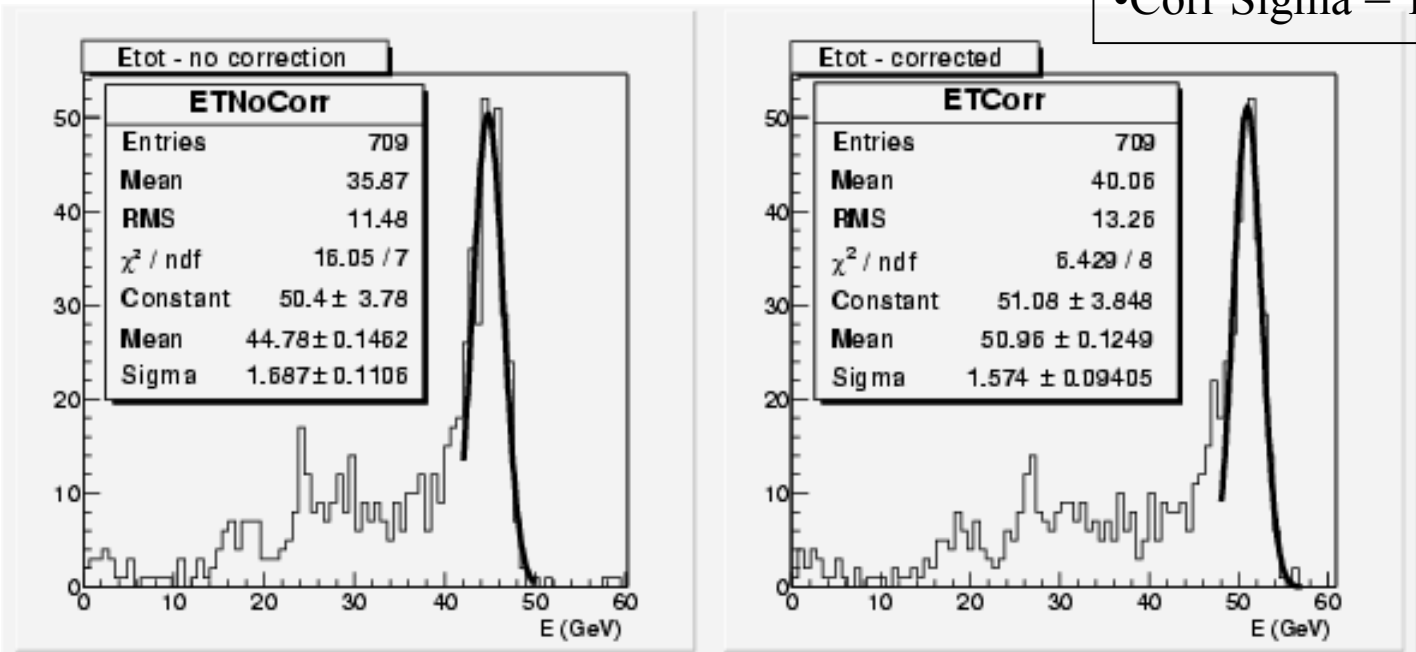


data, e, 50 GeV

Run 1222

in MC, pixel 1:

- NoCor Mean = 43.7 GeV
- NoCor Sigma = 1.9 GeV
- Corr Mean = 48.6 GeV
- Corr Sigma = 1.4 GeV



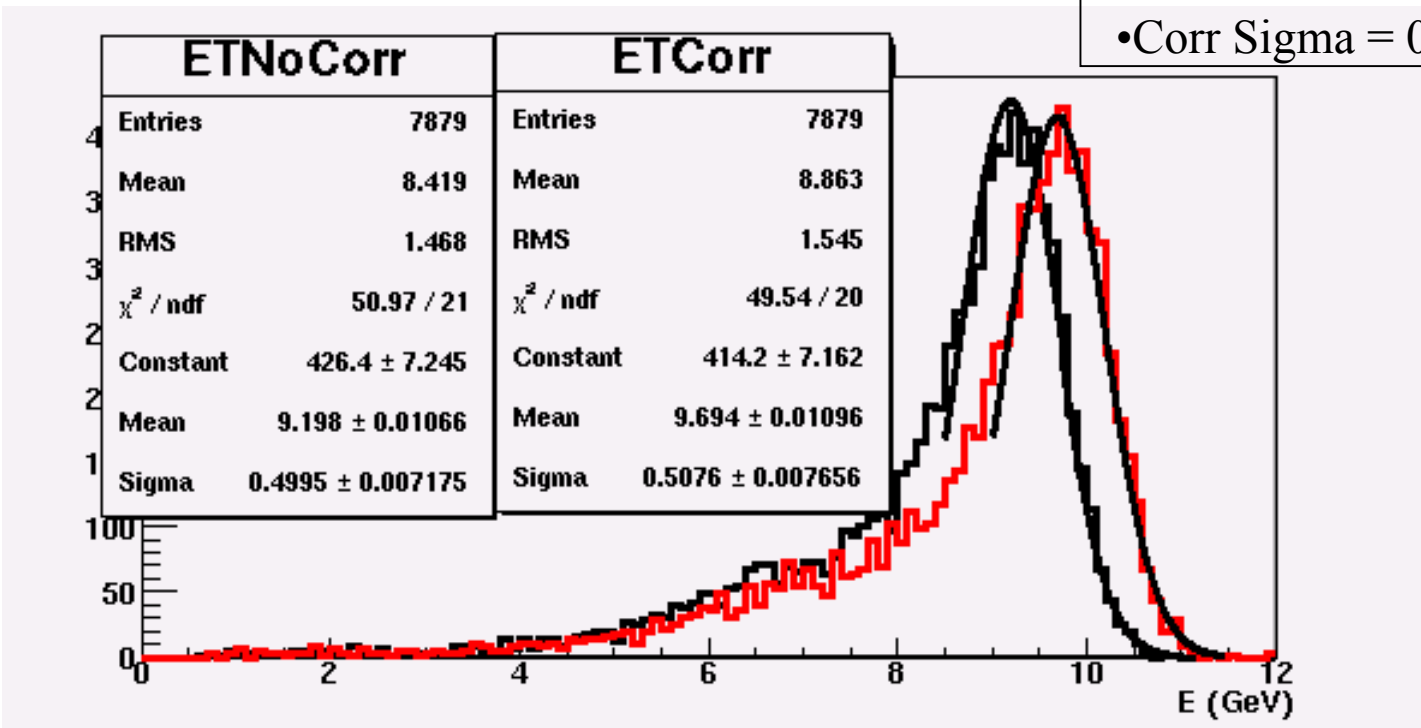
Cerenkov selection included

data, e, 10 GeV

Run 751

in MC, pixel 1:

- NoCor Mean = 8.9 GeV
- NoCor Sigma = 0.5 GeV
- Corr Mean = 10.0 GeV
- Corr Sigma = 0.4 GeV



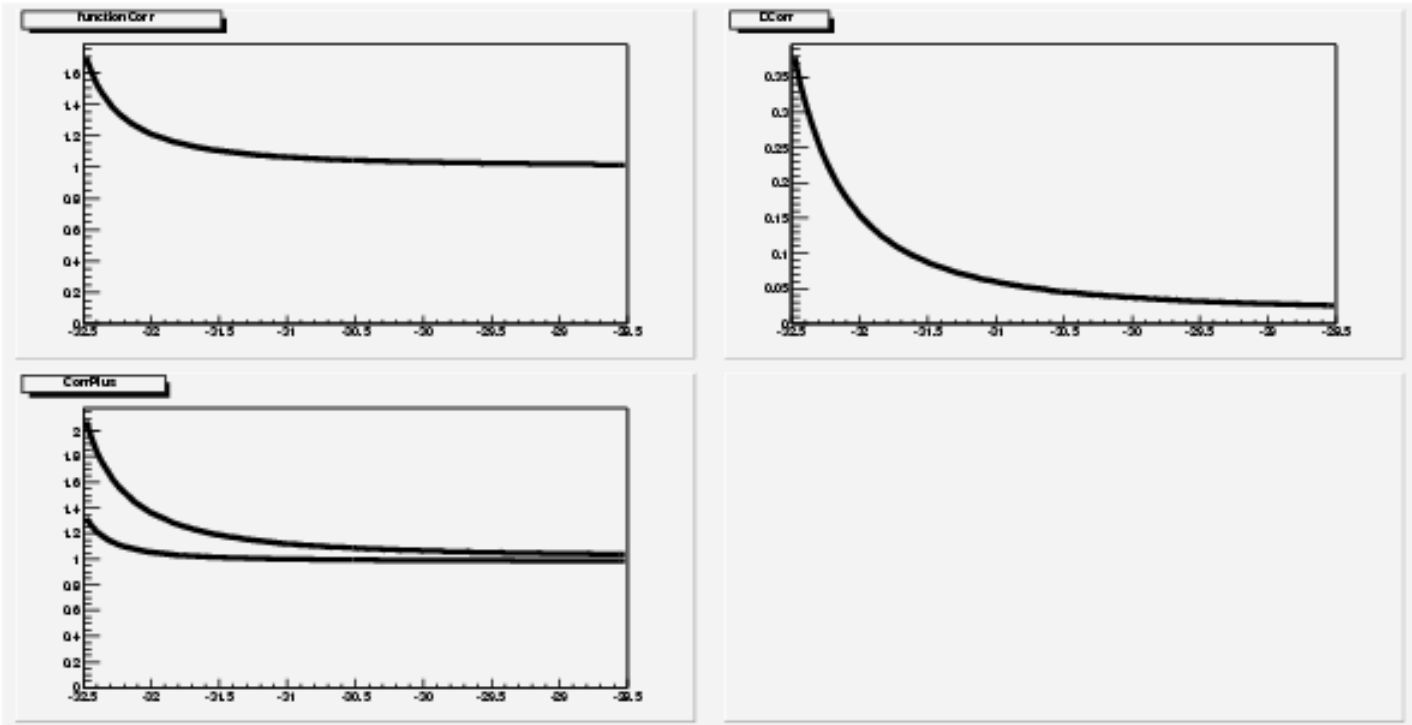
Cerenkov selection included

Conclusions

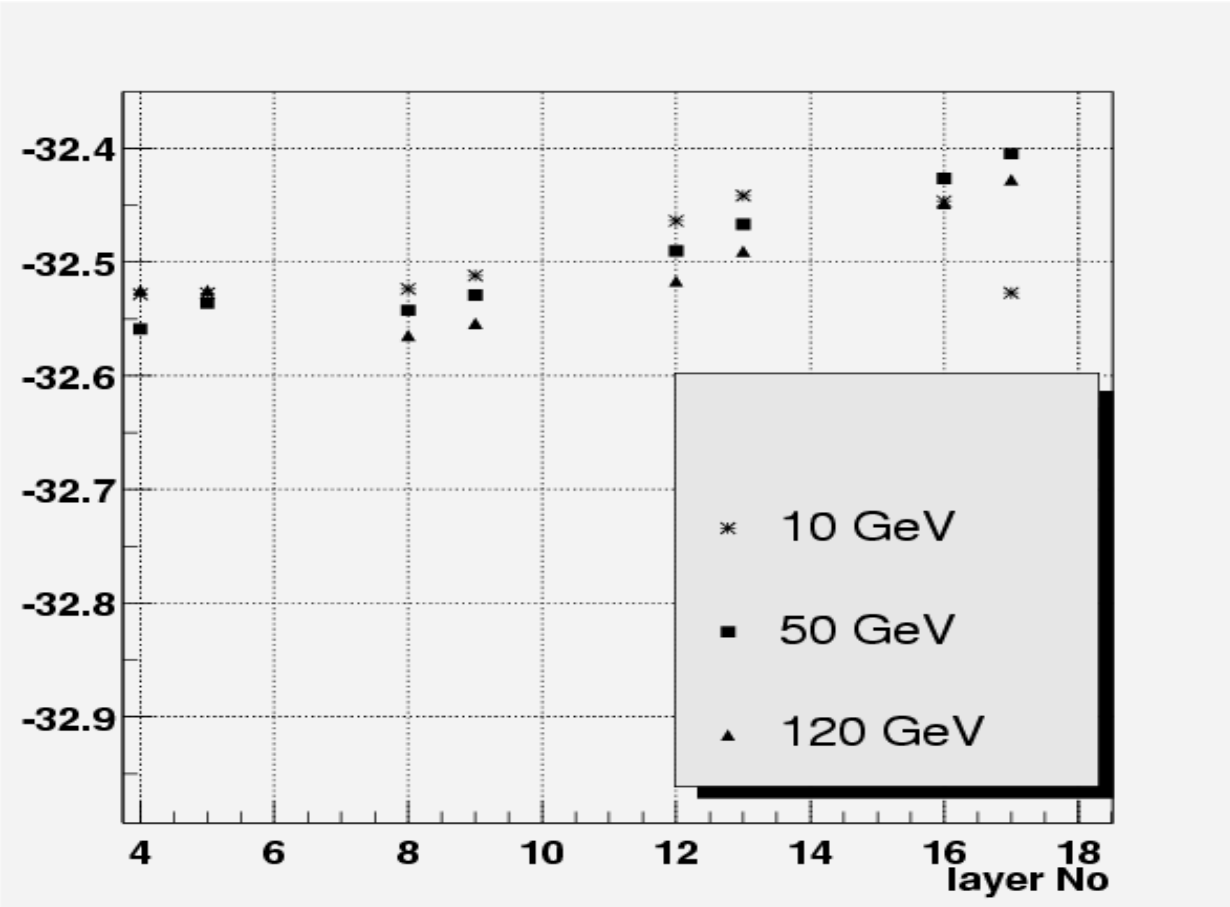
Consequences different for gamma and charged

- For energy of 120 GeV we can still reconstruct events with entry point at least in the middle of the last pixel
- Error on total reconstructed energy due to use of the energy-independent correction factor is about 2% for 120 GeV
- Can we conclude about MC-data comparison?

Error on correction coeffs



Half Energy


-32.4
-32.5
-32.6
-32.7
-32.8
-32.9
4
6
8
10
12
14
16
18
layer No
10 GeV
50 GeV
120 GeV