Electron Global Fit
First ideas
First studies

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- Aim of the global fit
- First ideas : what kind of methods can we use ?
- First studies (E and p reconstruction) and first problems to solve

A Global Fit for the electron

- D0 detectors gives redondant information for electron characteristics
  - Calorimeter : E, eta, phi, positions
  - Preshowers : eta, phi, positions
  - Trackers : p, eta, phi, positions
- What do we need to know?
  - E, eta, phi
  - or px, py,pz
- What can we do with all these variables to reconstruct as precisely as possible our electrons

Some ideas

➔ Global fit (Serban) : minimizing a chi2

- Minimize global Chi2 =

  $(E_{pred}-E_{meas})^2/\sigma^2(E)+ (q/pt_{pred}-q/pt_{meas})/\sigma^2(pt)$

  + ...

  variables = E, q/pt, eta, phi, positions at EM3, PS ....

- Does not correct shifts (can correct before)
- Need a tool to minimize ... time consuming ?

➔ Neural Net

- Fast in reconstruction
- Should correct shifts
- ... no experience

➔ Simple method (waiting for more sophisticated ones)

- Weight E and p
- Quality of electron using matching and elike

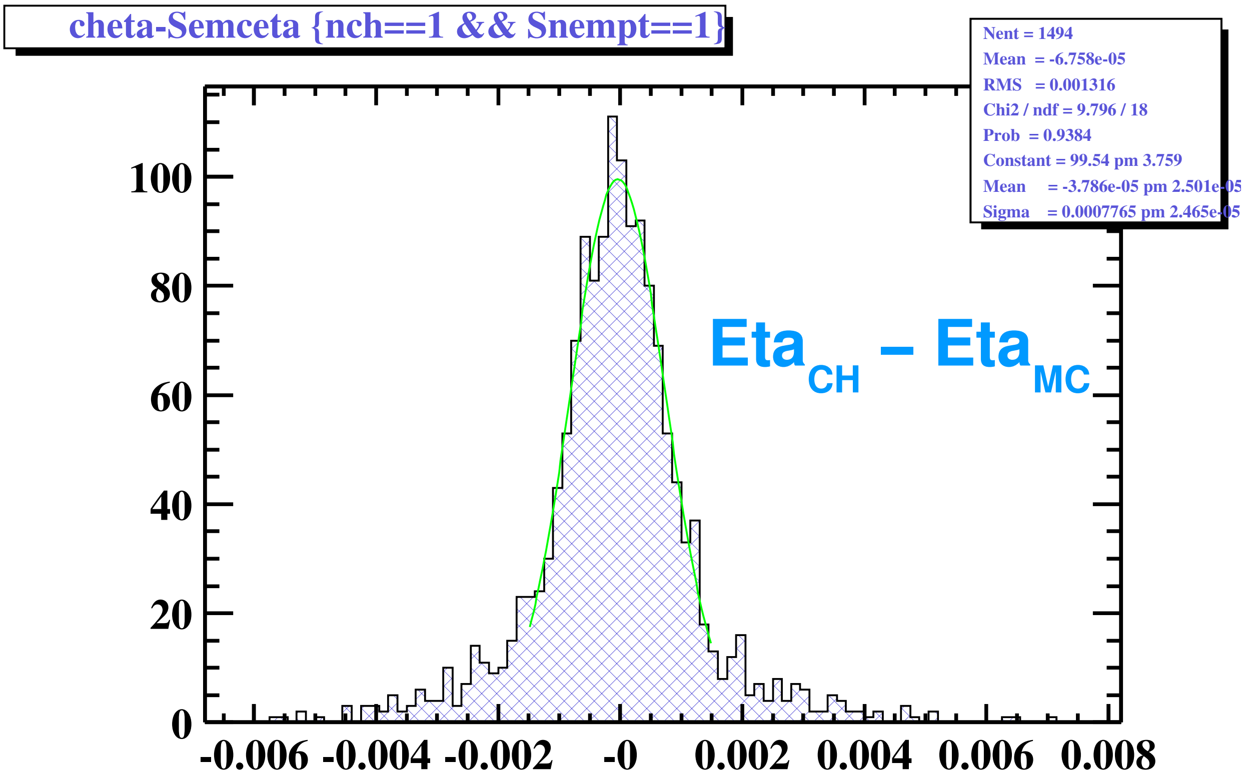
First Studies

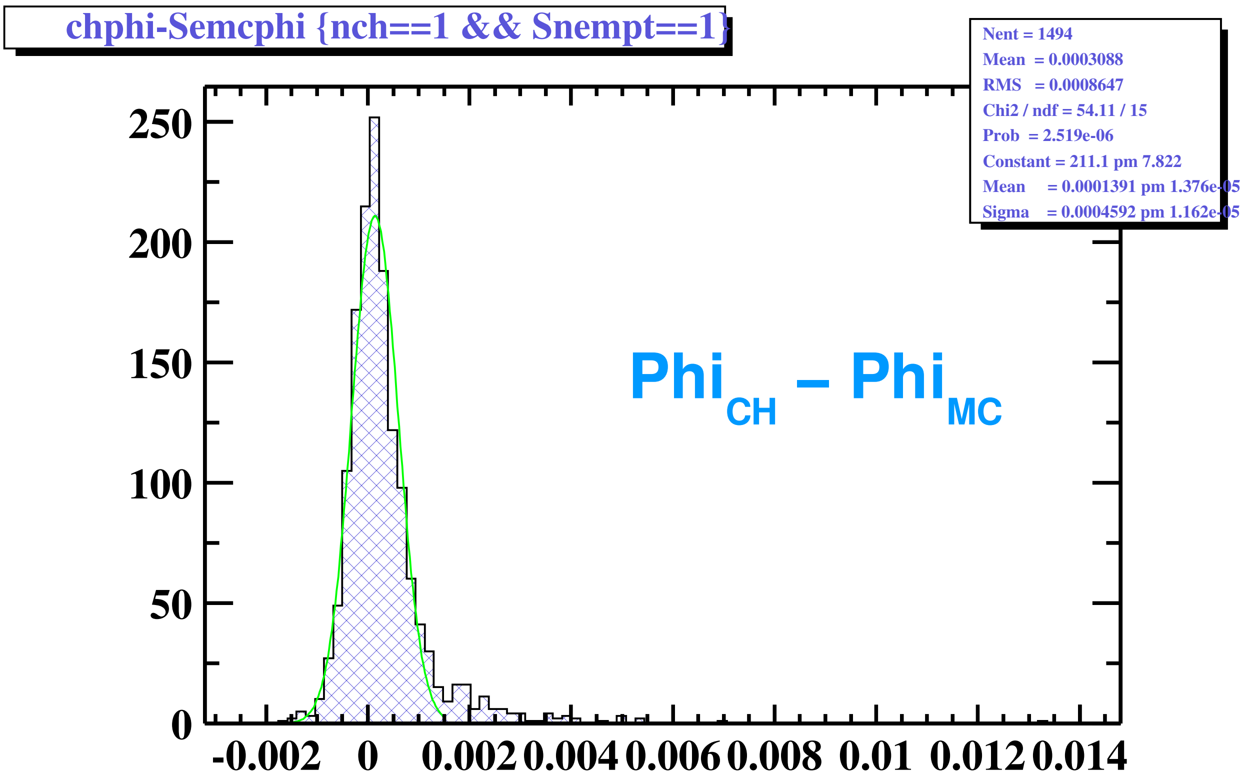
- Look at eta and phi from tracking
  - Should be already quite precise
- Look at E and p
  - Mean ? Shifts ?
  - Resolutions ?
- Look at matching
  - See Michel's presentation (EMID)
- Sample used : single electrons
  - Generated, simulated, reconstructed at CCIN2P3
  - MC : mcp06, reco : p08.11.00
  - E = 5, 10, 15, 20, 25, 50, 100 GeV
  - 2000 events / energy
  - $-1 < \text{eta} < 1$
  - Flat in energy

Eta and Phi study

- **From charged particles**
  - **No shift**
  - **Resolution : OK**
  - **Some tails**
- **See example : 5 GeV**

Eta and phi Study





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E and p study

➔ **E and p distribution**

- **E and p Tails : Bremstrahlung + ... ?**
- **E and P shifts (~3% and ~1–2 %) !**
- **E vs eta not flat !**
- **E and p resolutions**

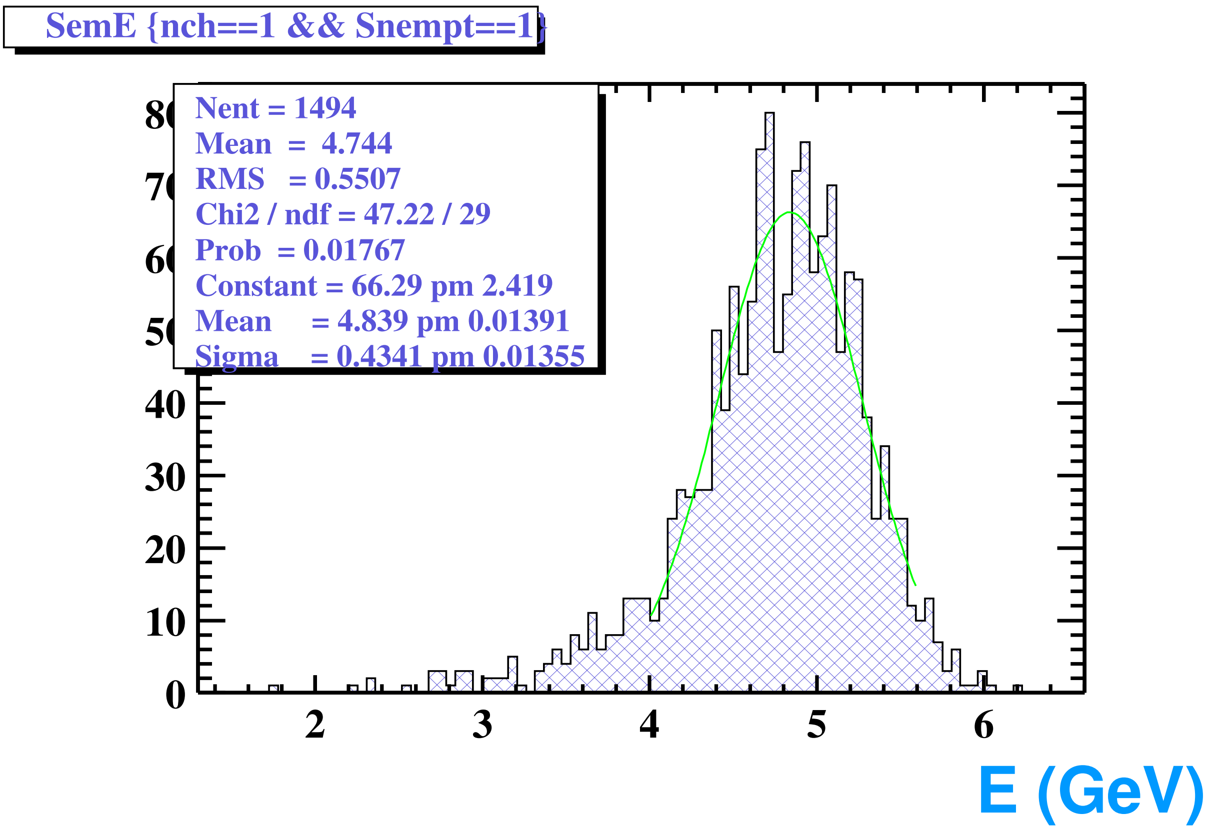
➔ **To do and questions**

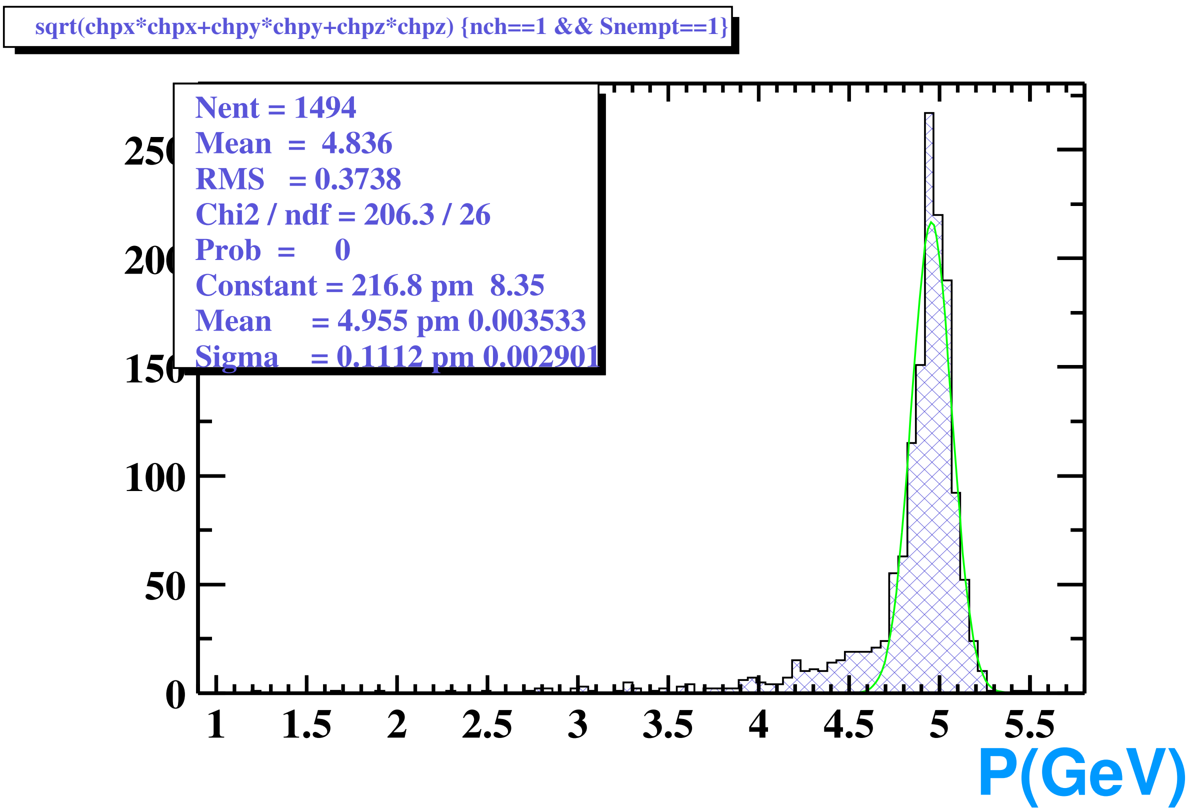
- **How to deal with Bremstrahlung ?**
- **Shifts : to be corrected**
- **E vs eta : to be corrected**

➔ **E resolution :**

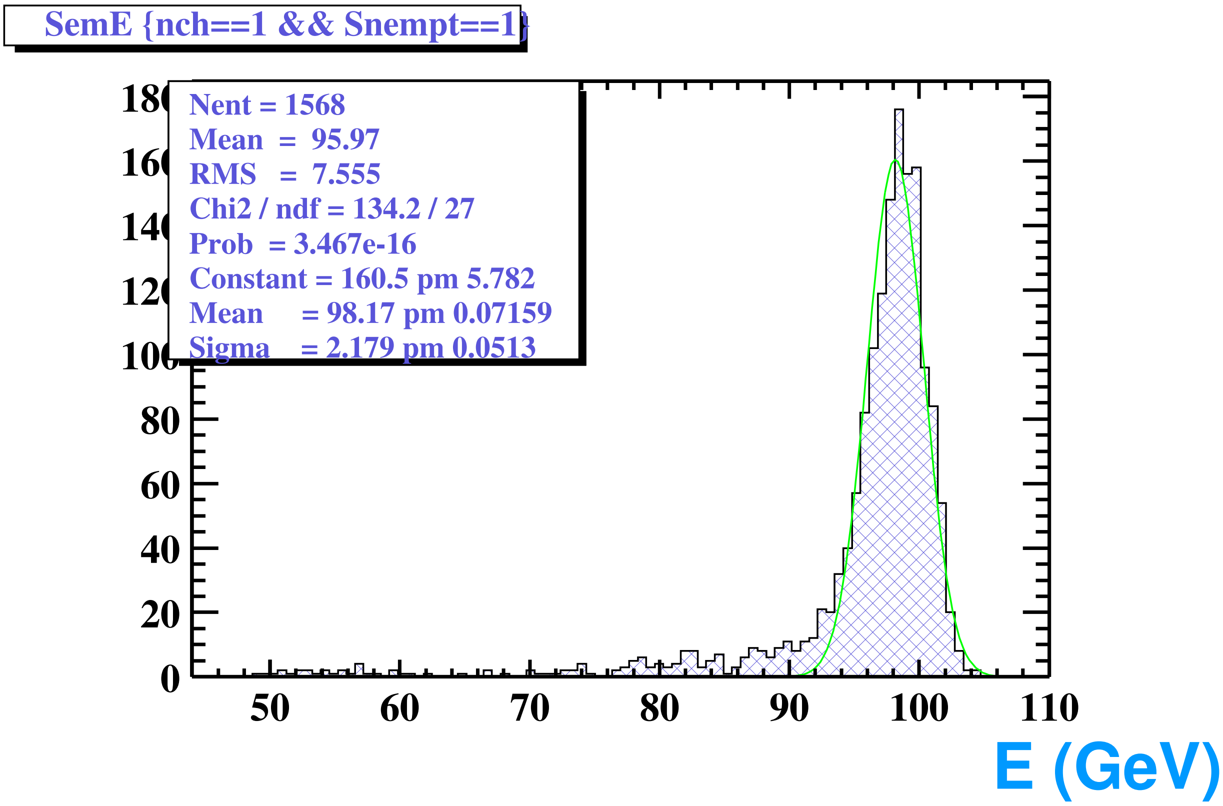
- $\sigma(E)/E = a/E \oplus b/\mathrm{sqrt}(E) \oplus c$
- **a=0.   (Run I a=0.14)**
- **b=0.20   (Run I b=0.16)**
- **c=0.011   (Run I c=0.003)**

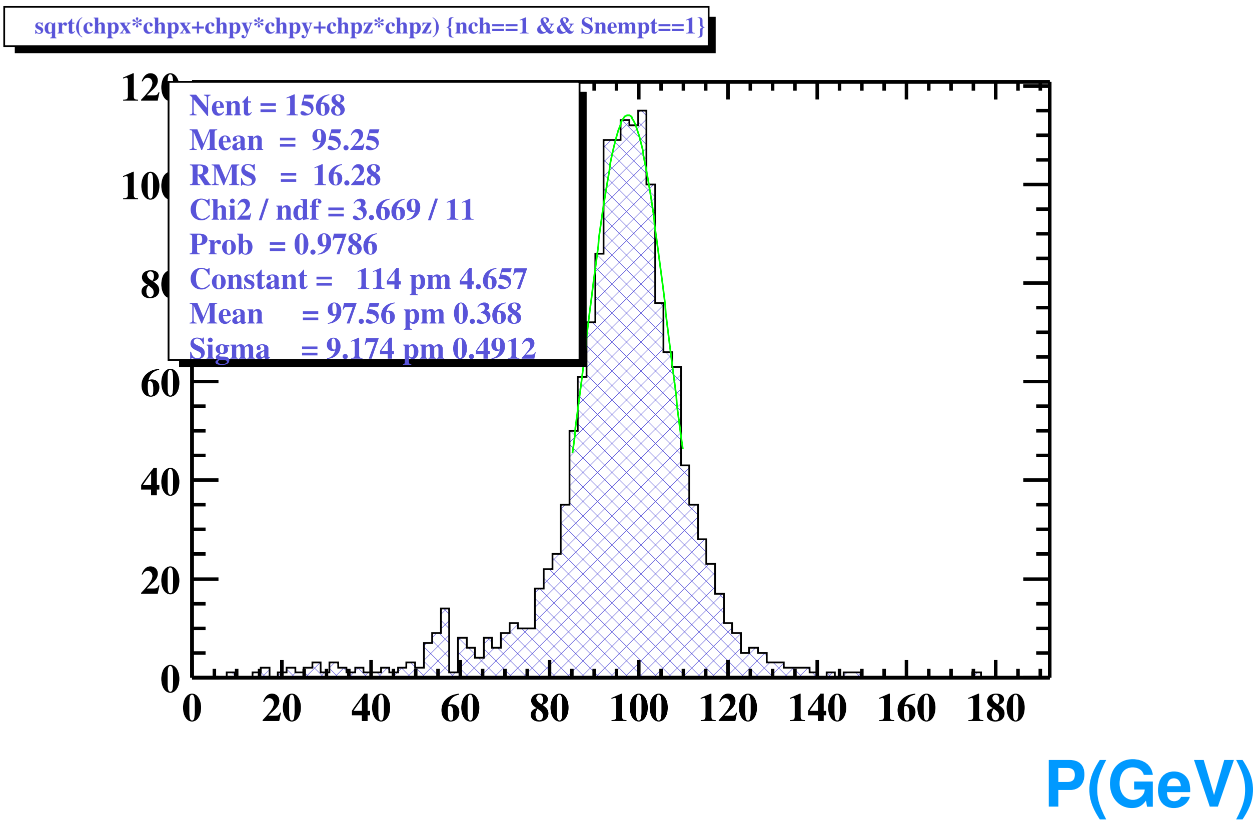
E and p distribution (5GeV)



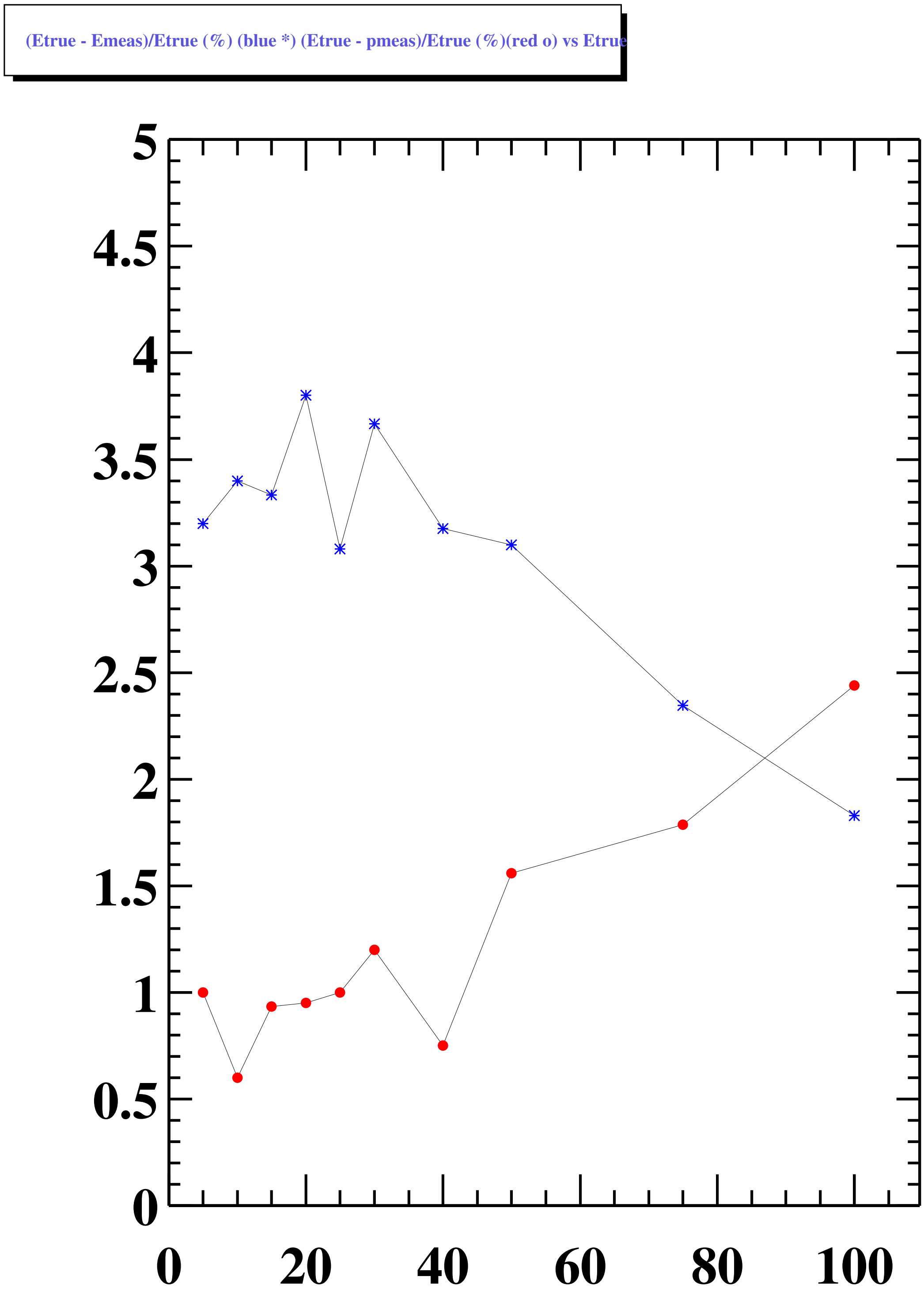


E and p distribution (100GeV)



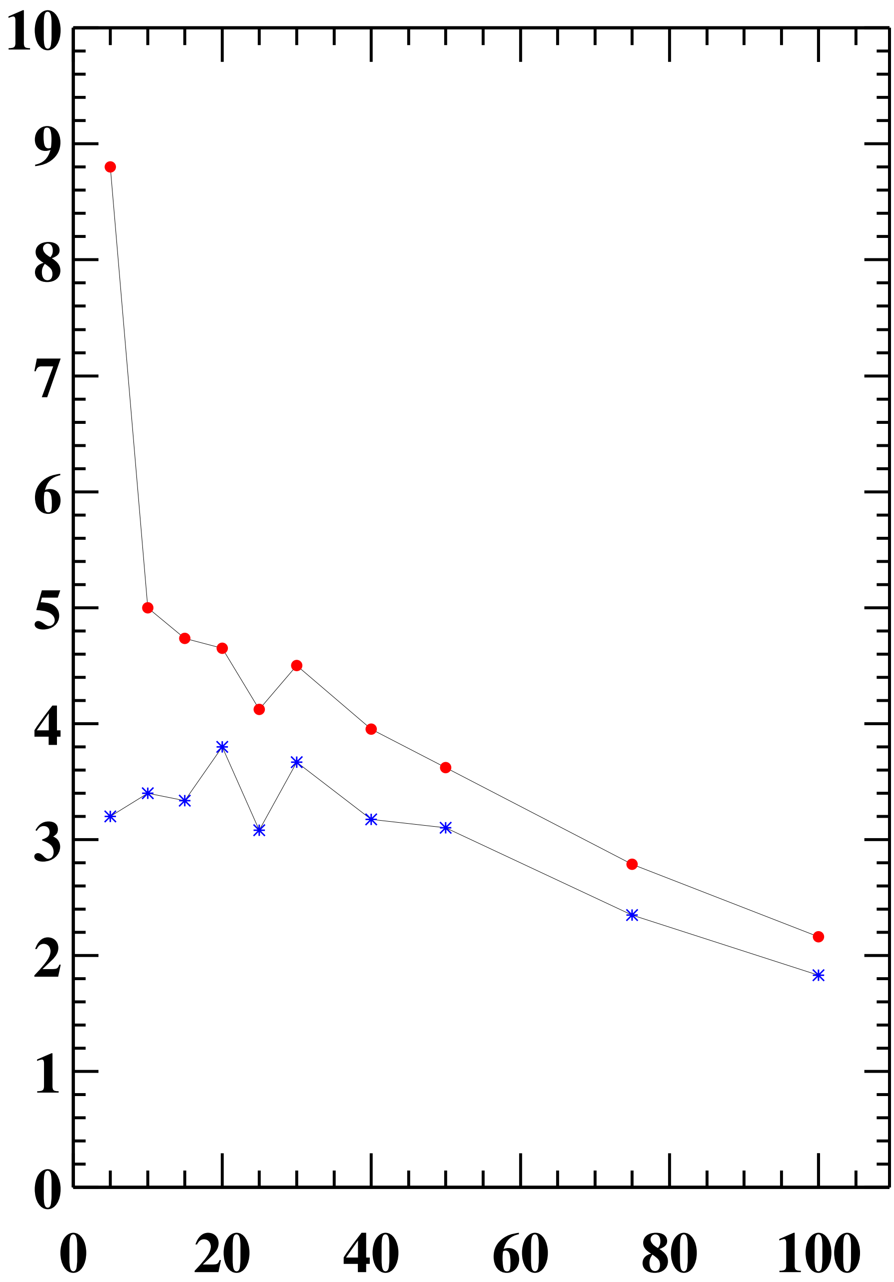


DeltaE/E and Deltap/E



DeltaE/E : Scone vs CellNN

(Etrue - Emeas)/Etrue (%) (scone blue * cellNN red o) vs Etrue



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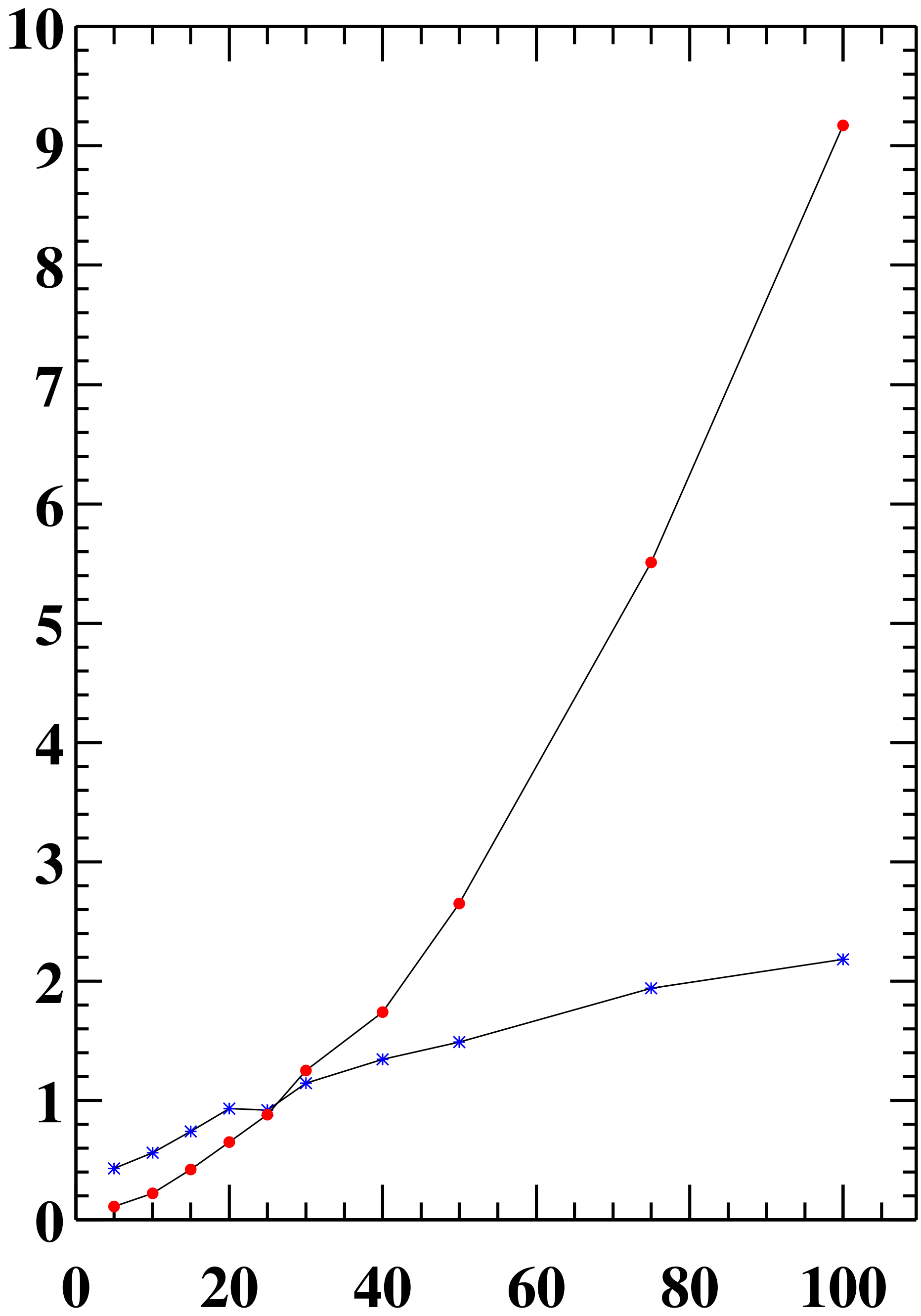
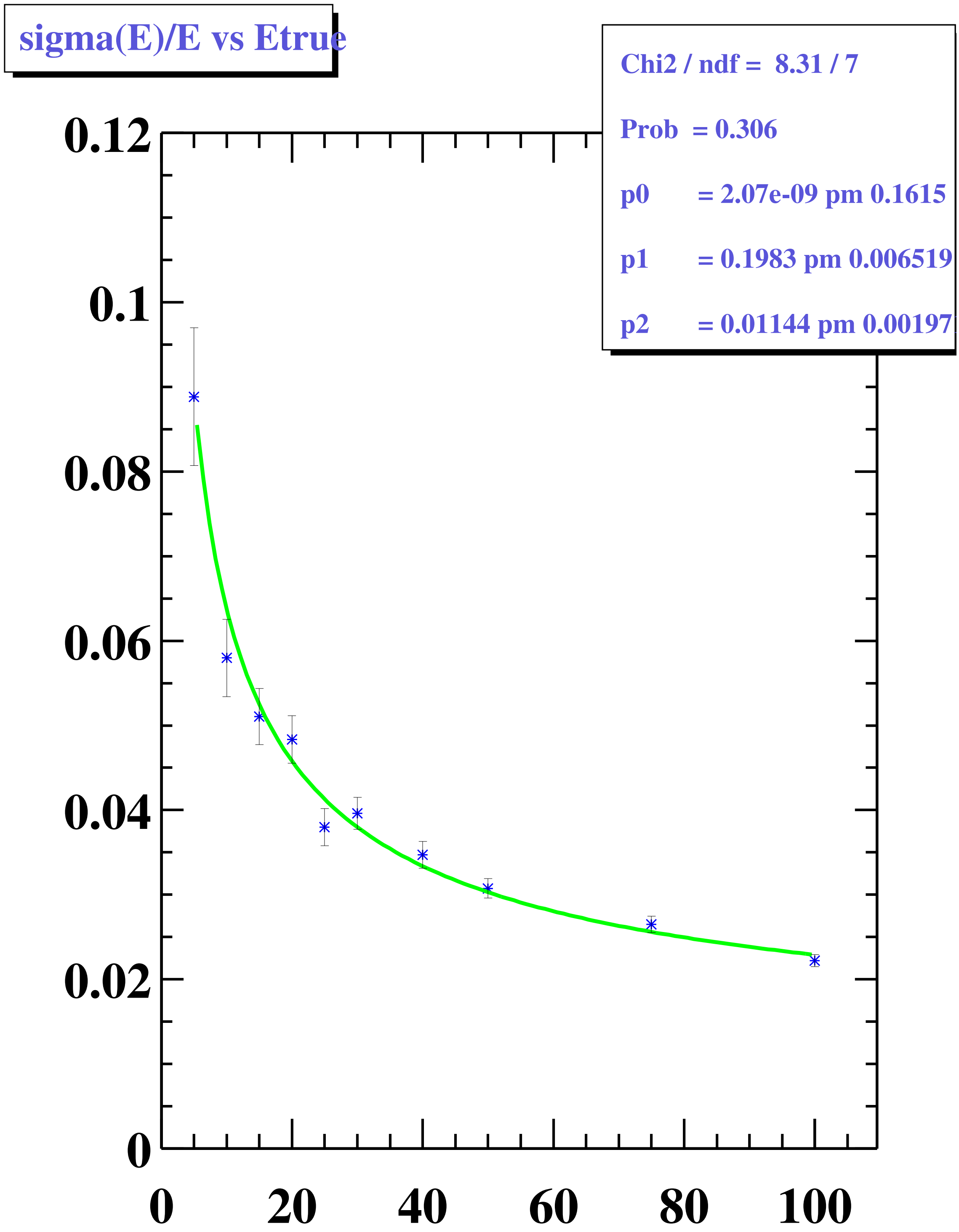
E and p resolution

sig E (blue *), sig p (red circle) vs Etrue



sigma(E)/E



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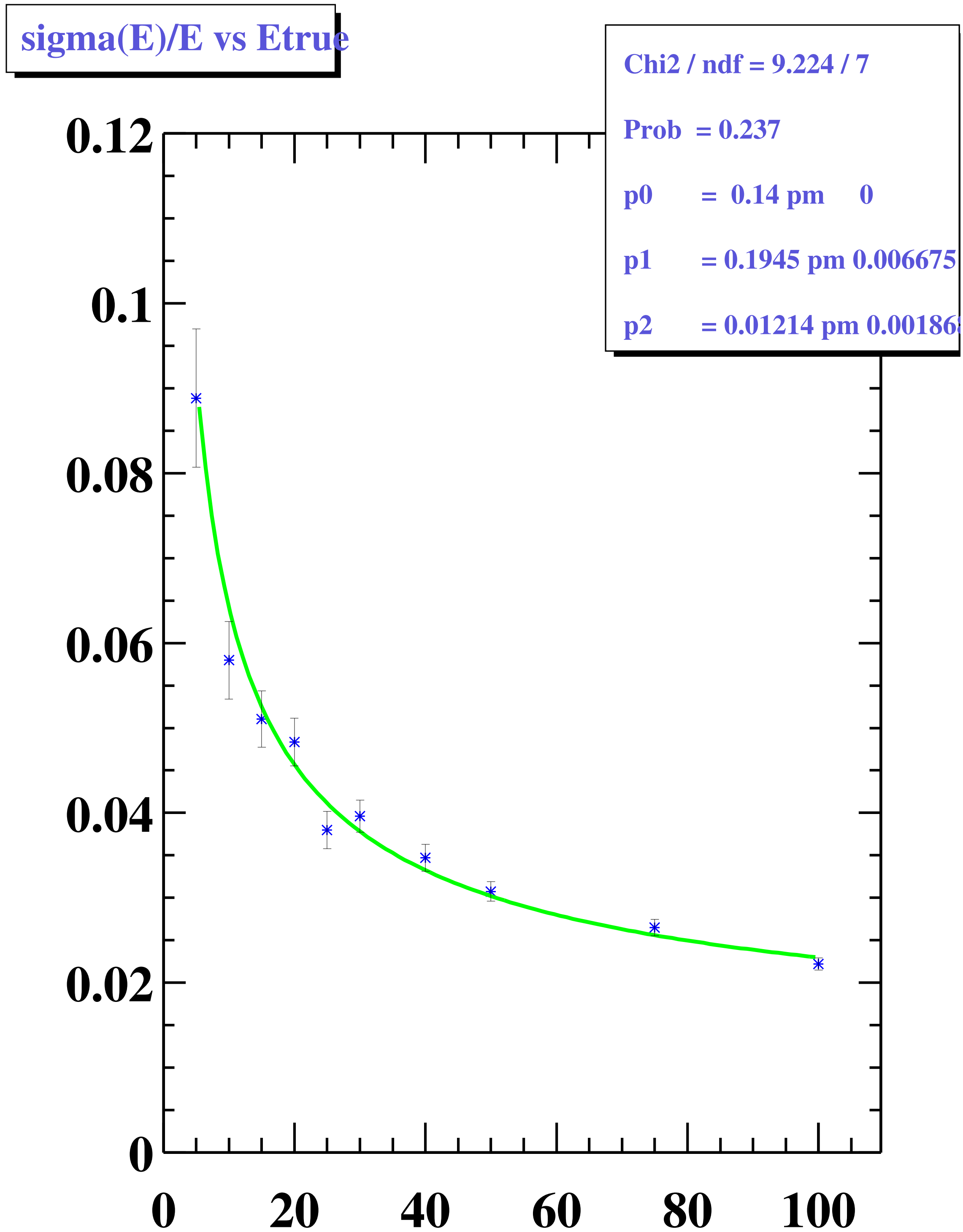
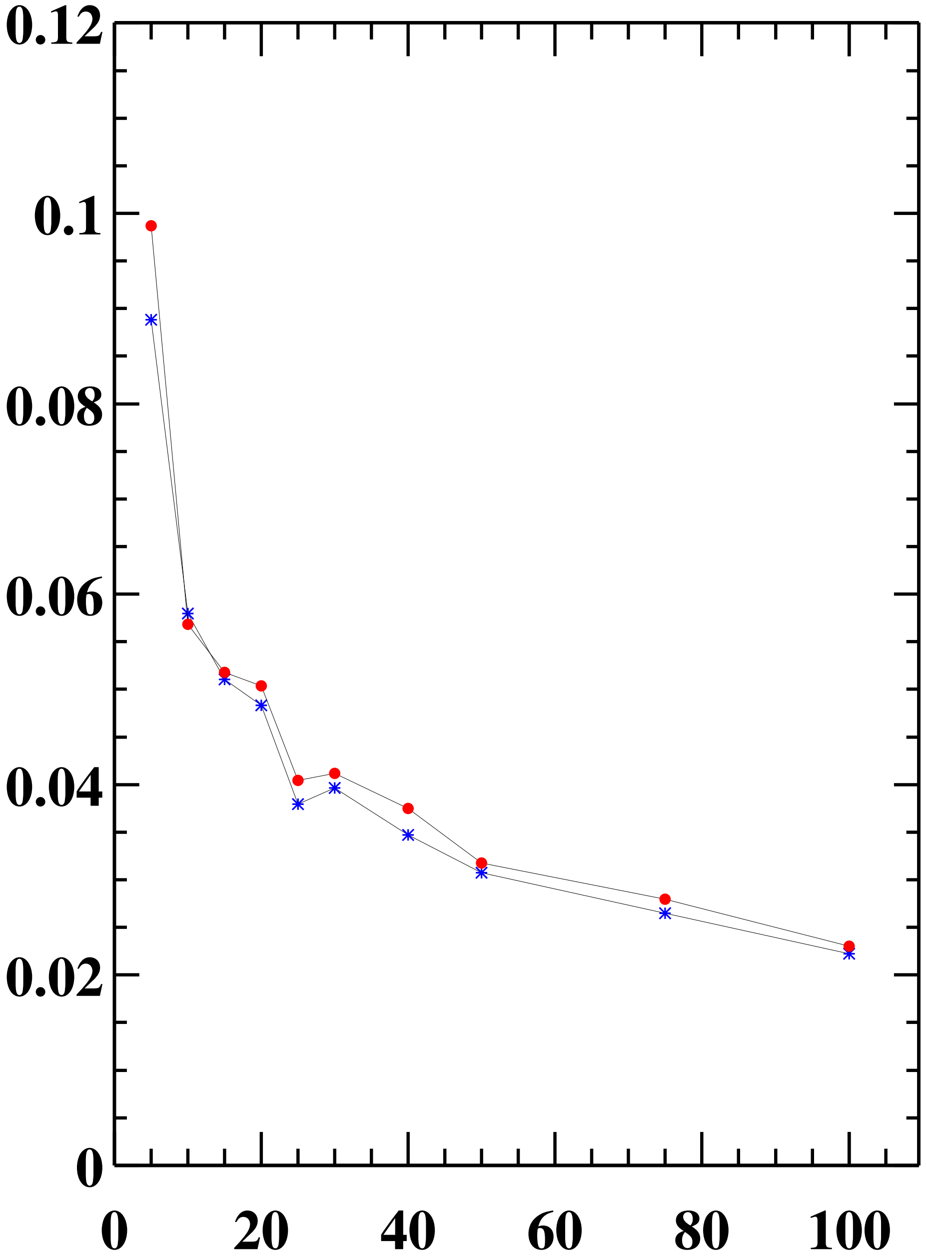
sigma(E)/E



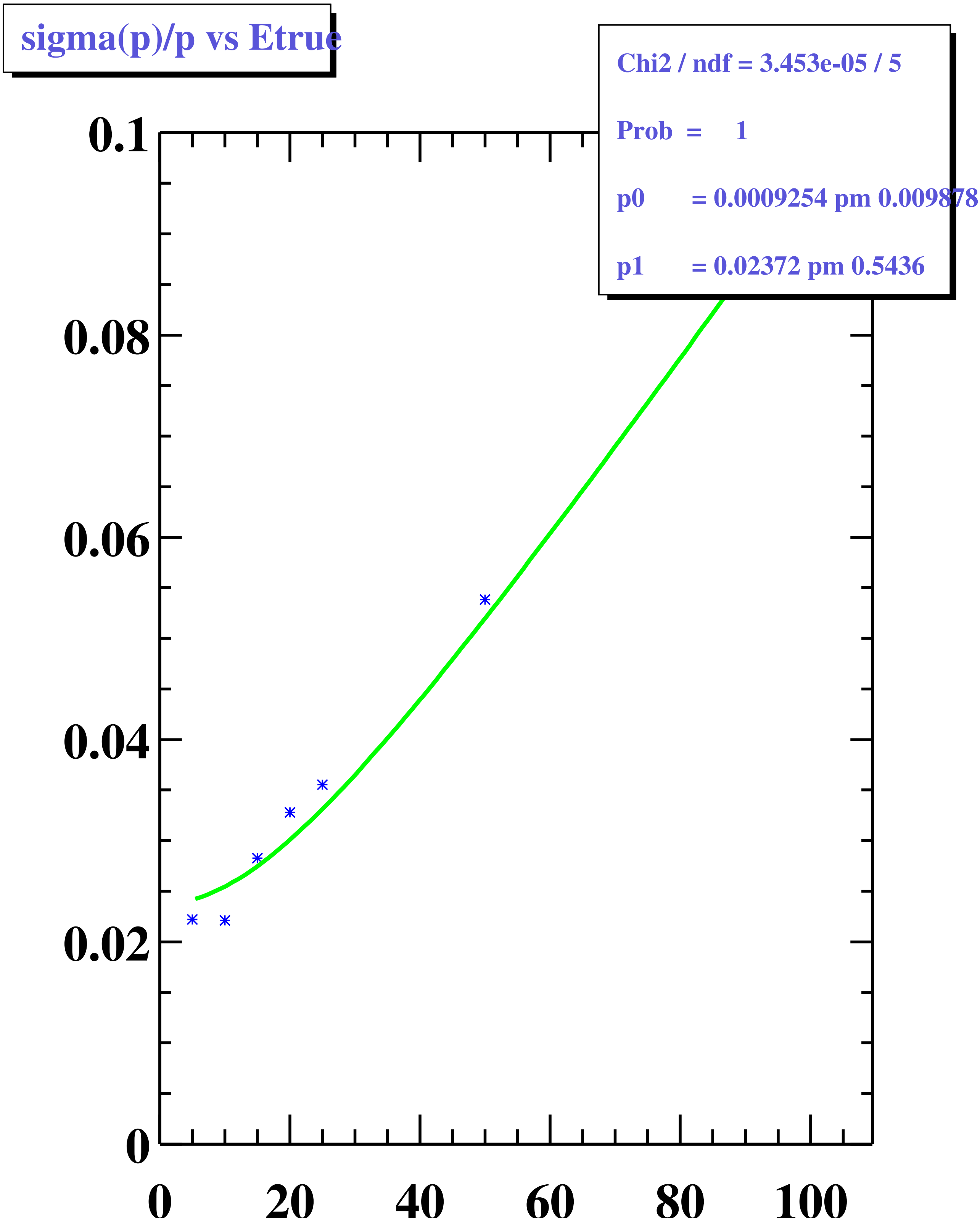
sigma(E)/E vs Etrue
Chi2 / ndf = 9.224 / 7
Prob = 0.237
p0 = 0.14 pm 0
p1 = 0.1945 pm 0.006675
p2 = 0.01214 pm 0.00186
0.12
0.1
0.08
0.06
0.04
0.02
0
0
20
40
60
80
100

Sigma(E)/E : Scone vs CellNN

sigma(E)/E (scone blue * CellNN red o) vs Etrue



sigma(p)/p



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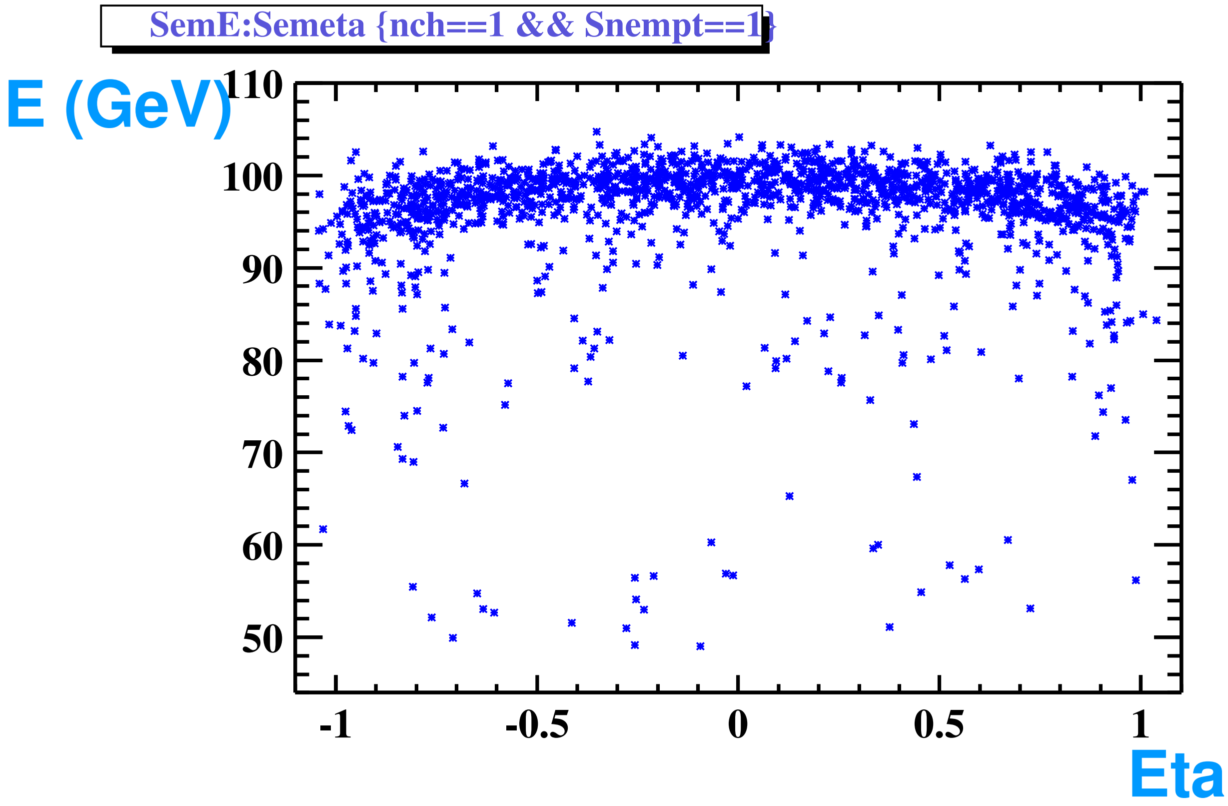
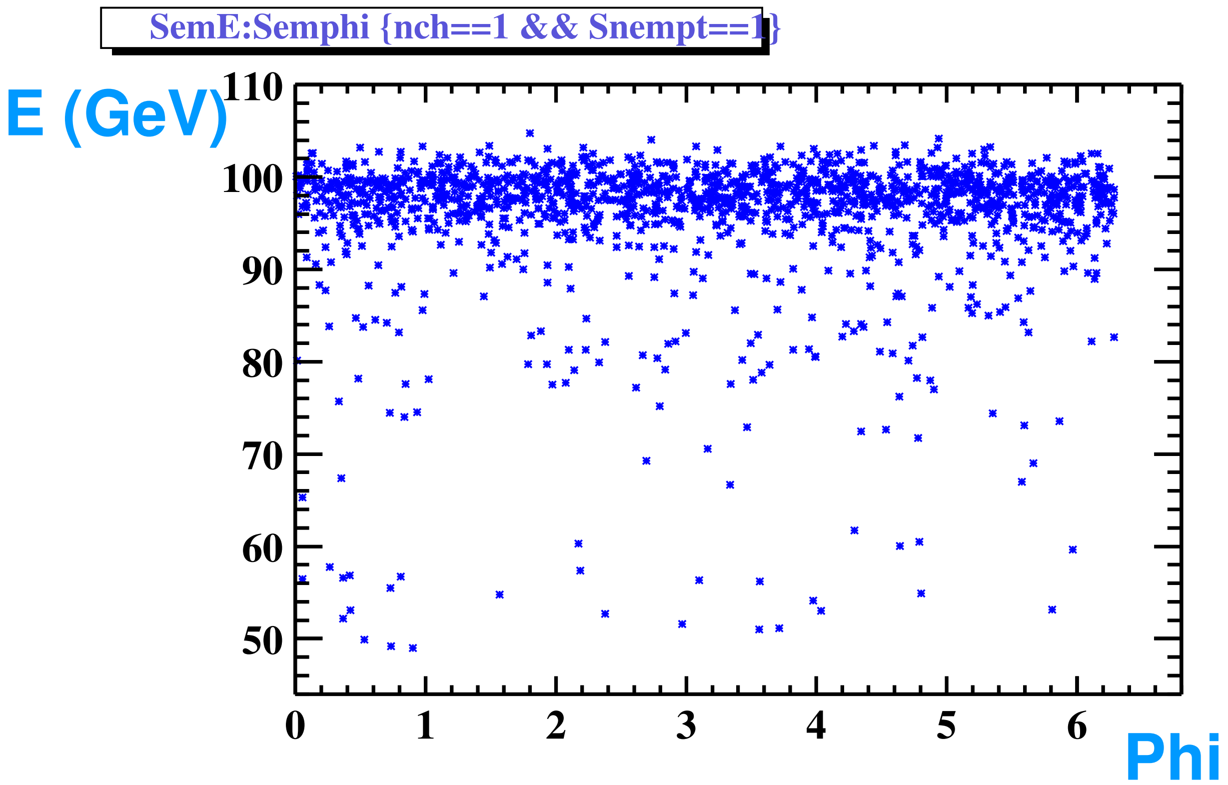
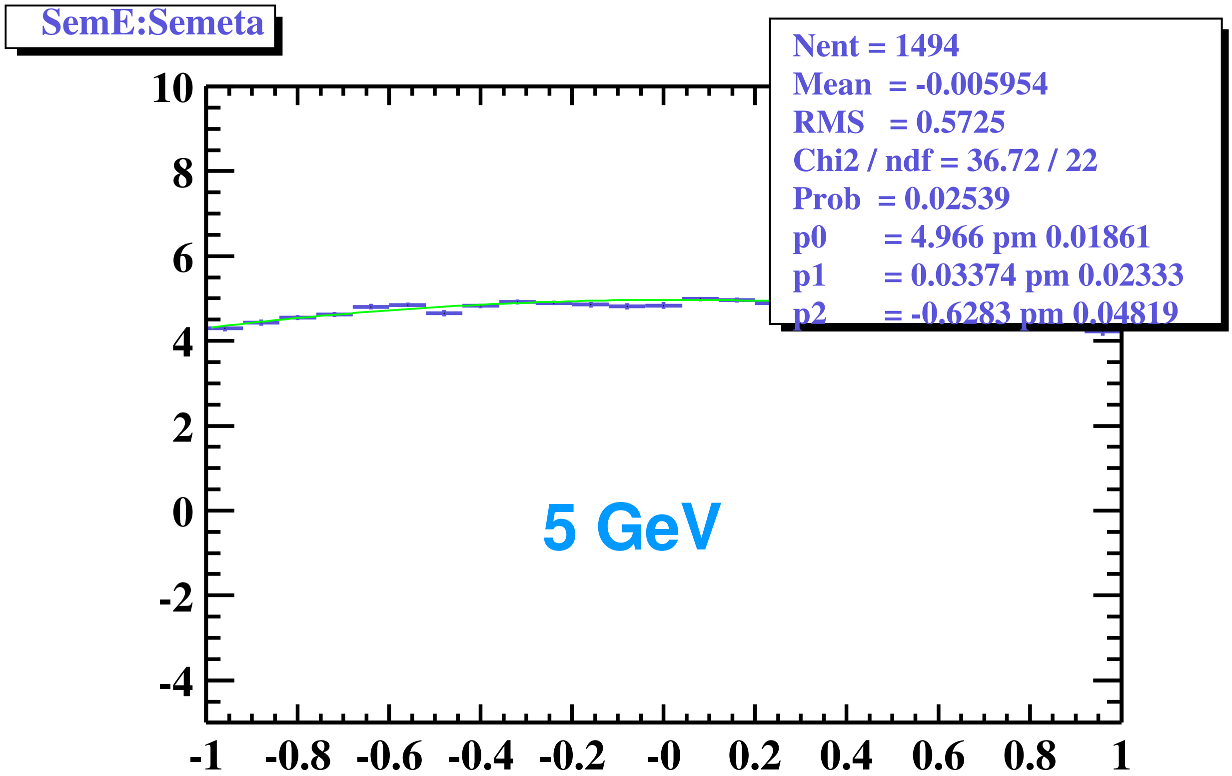
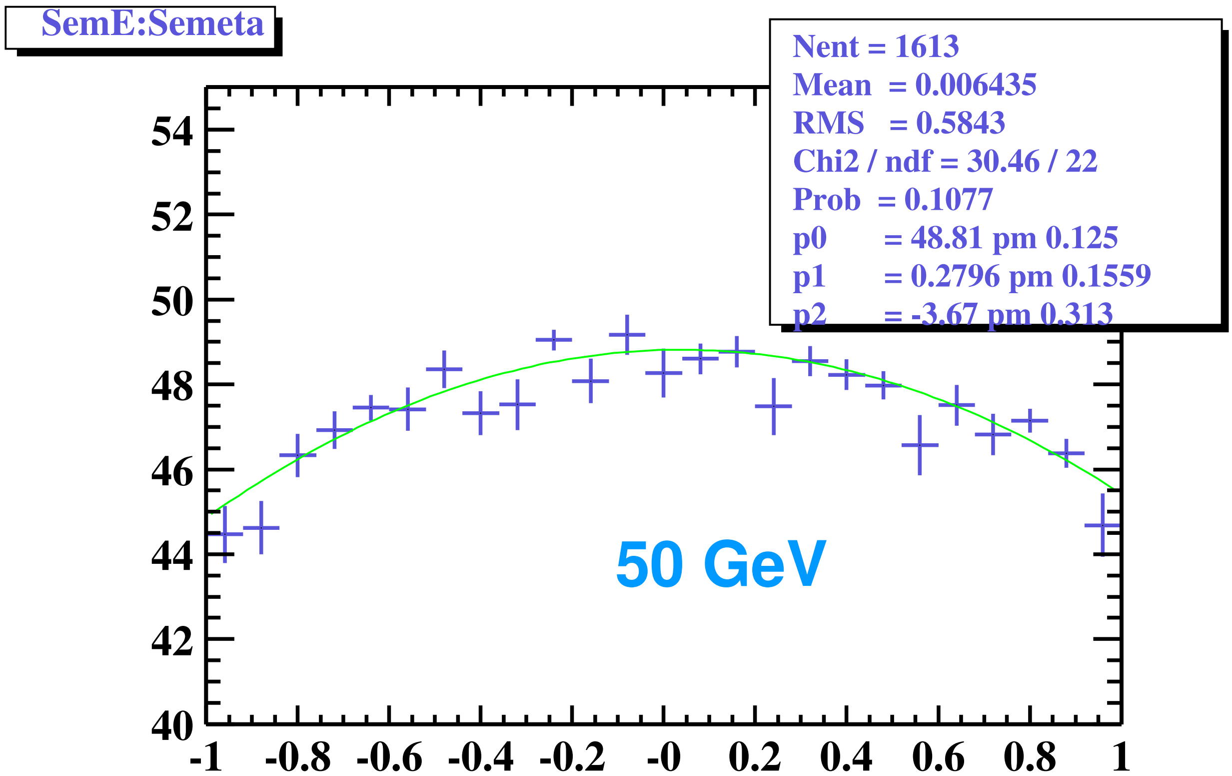
E vs eta, phi (100 GeV)





E vs eta : correction ?

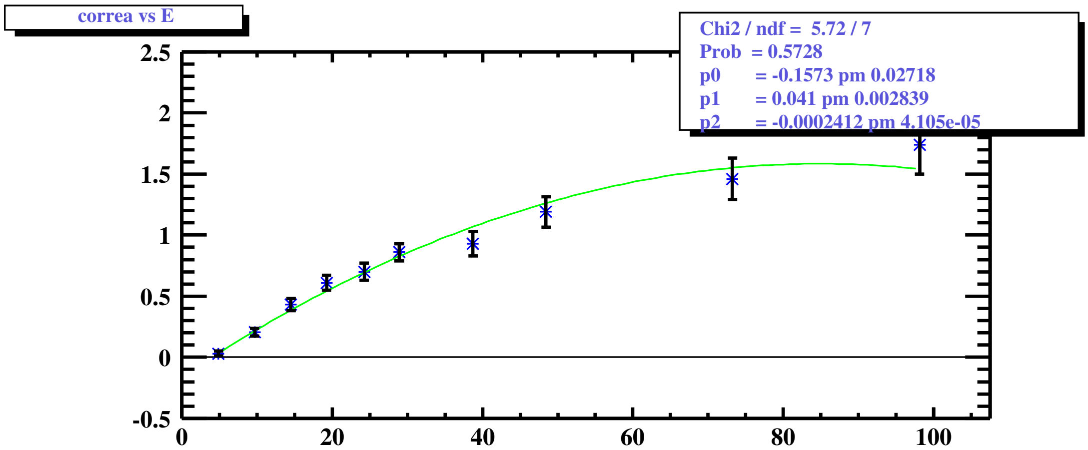


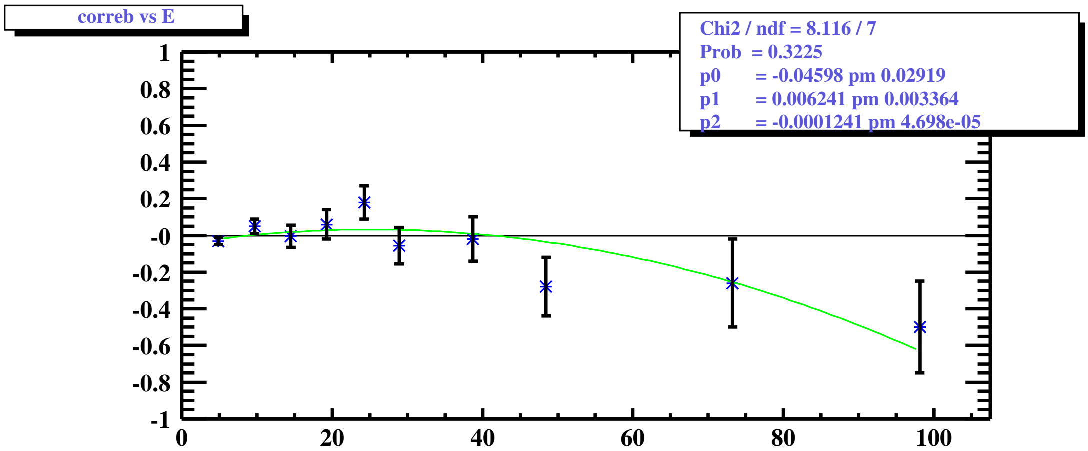


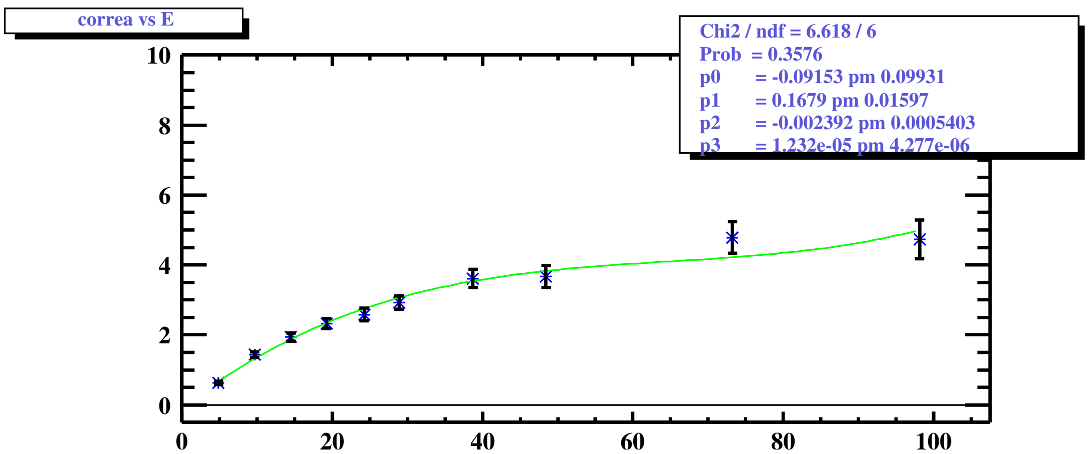
E vs eta : correction

- Fit E vs eta with parabola at each energy
- Fit variations of parabola parameters as a function of energy
- Correct the energy using eta and E measured

Parabola parameters variation with energy

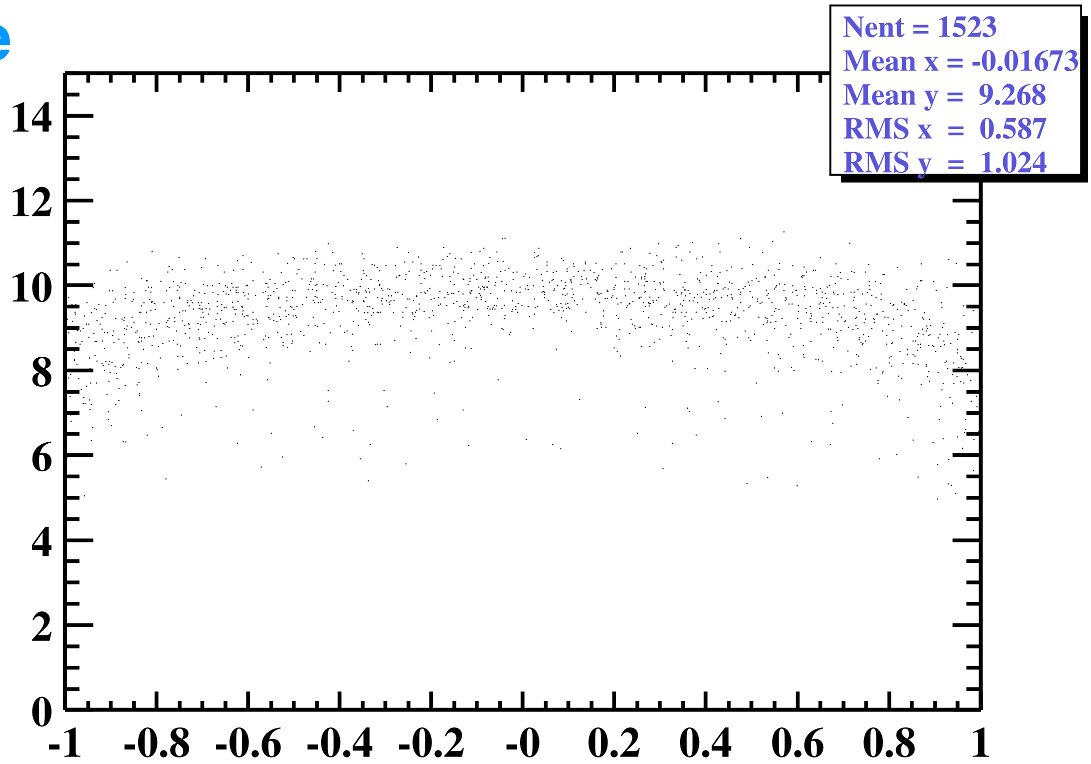




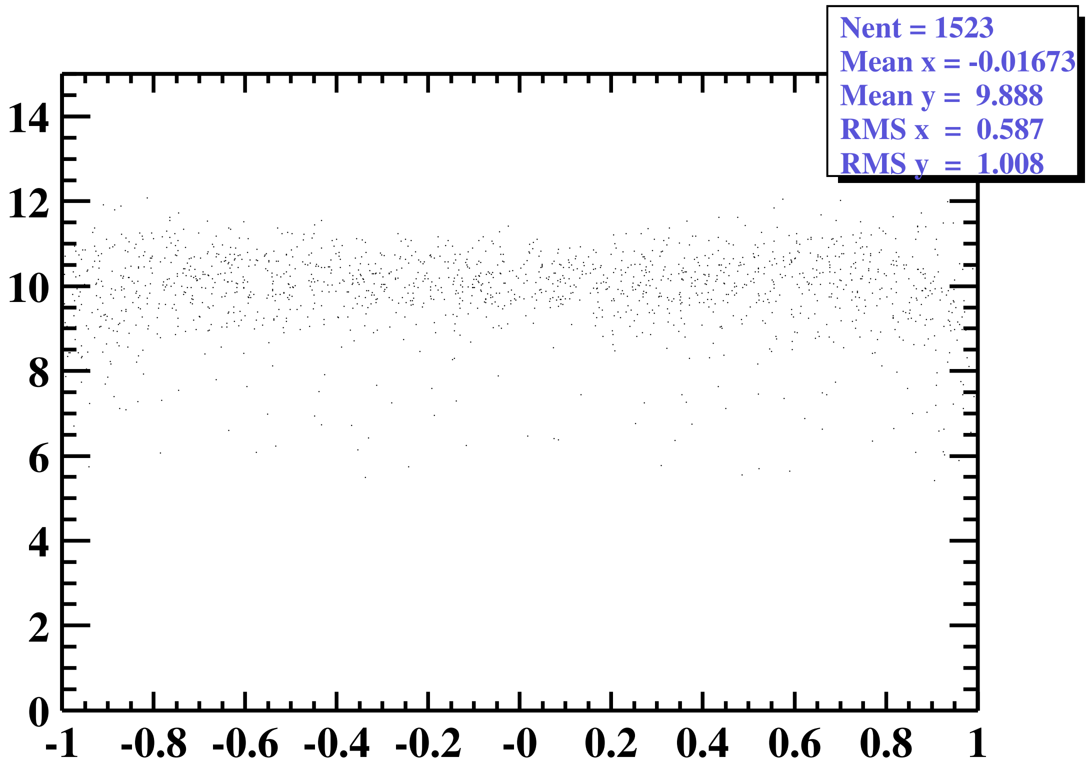


Energy vs eta
(10 GeV)

Before

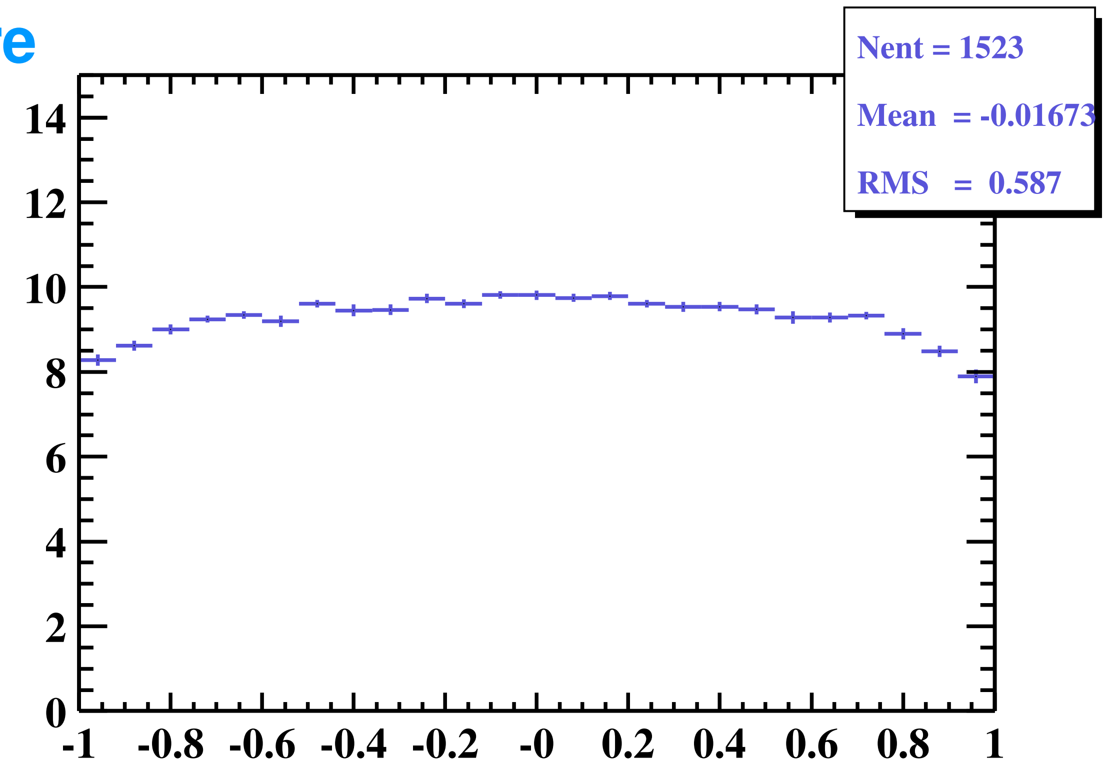


After



Energy vs eta
(10 GeV)

Before



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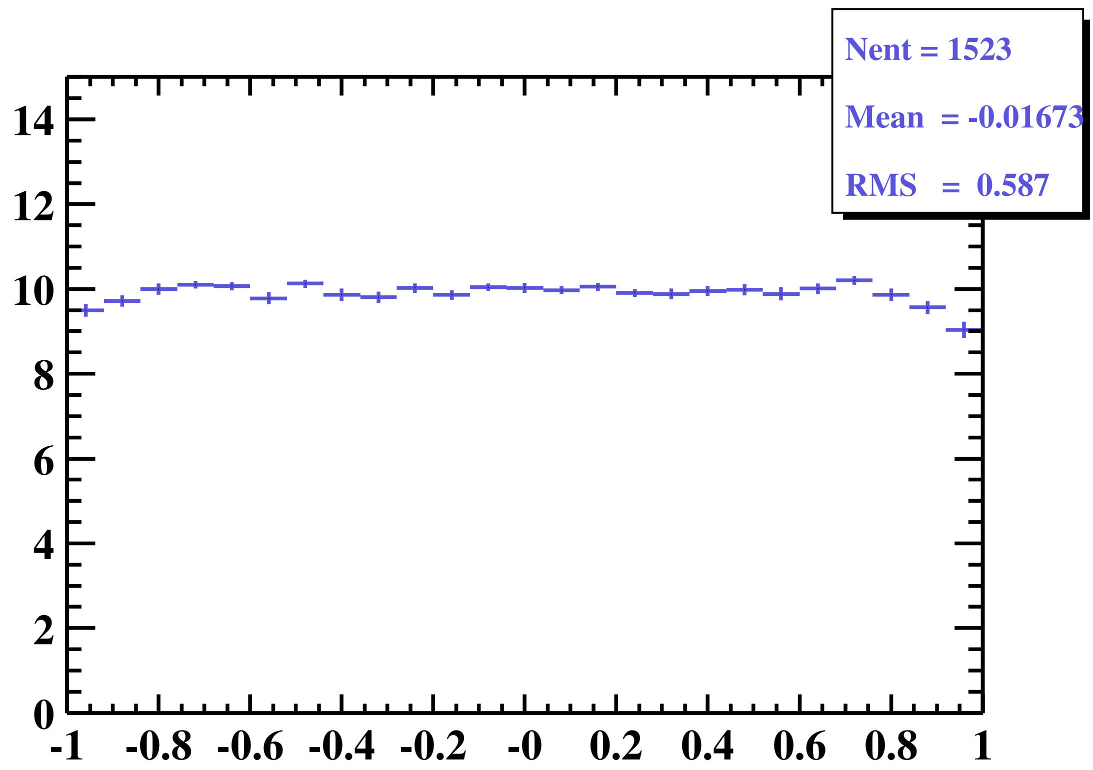
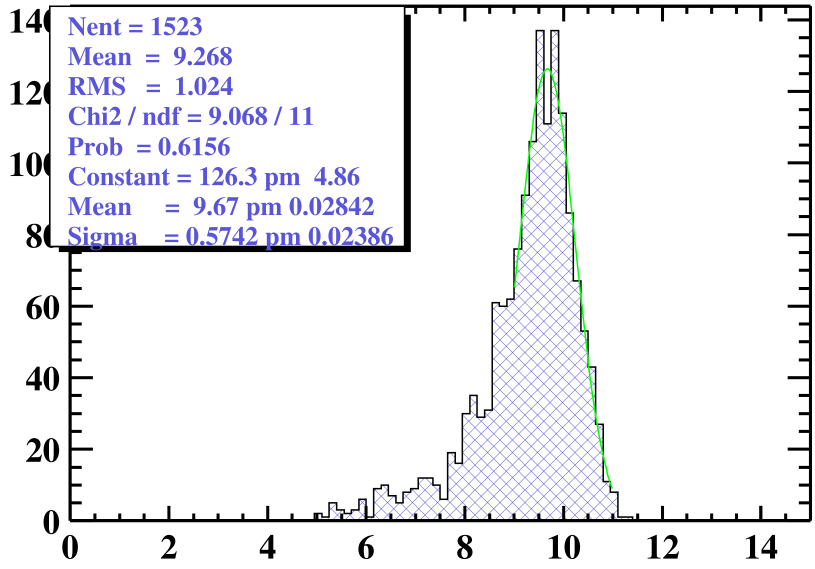
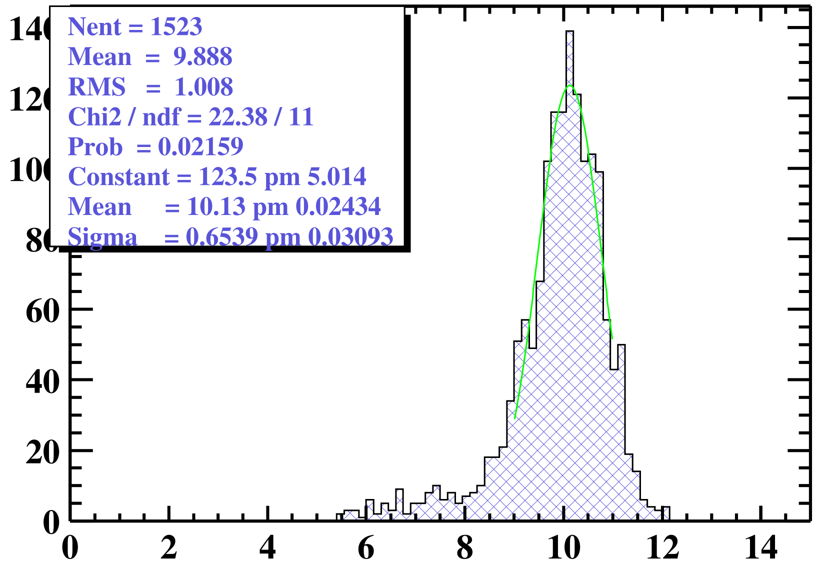


Energy distribution (10 GeV)

Before



After



Conclusion

- Please don't hesitate if you have suggestions about :
  - Methods to compute E and p of electron in a clever way
  - Neural Net
- Next
  - E, p corrections
  - Simple fit
  - How to deal with Bremstrahlung ?