Ecal Simulation

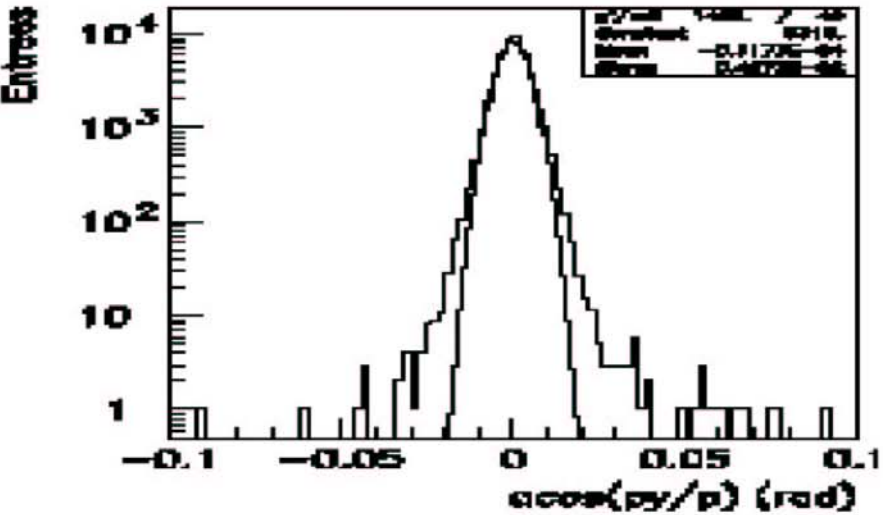
Estimation of Ecal Energy Resolution using standard AMS software:

J Pochon

Status of Ecal simulation within the Test Beam FrameWork

Corinne

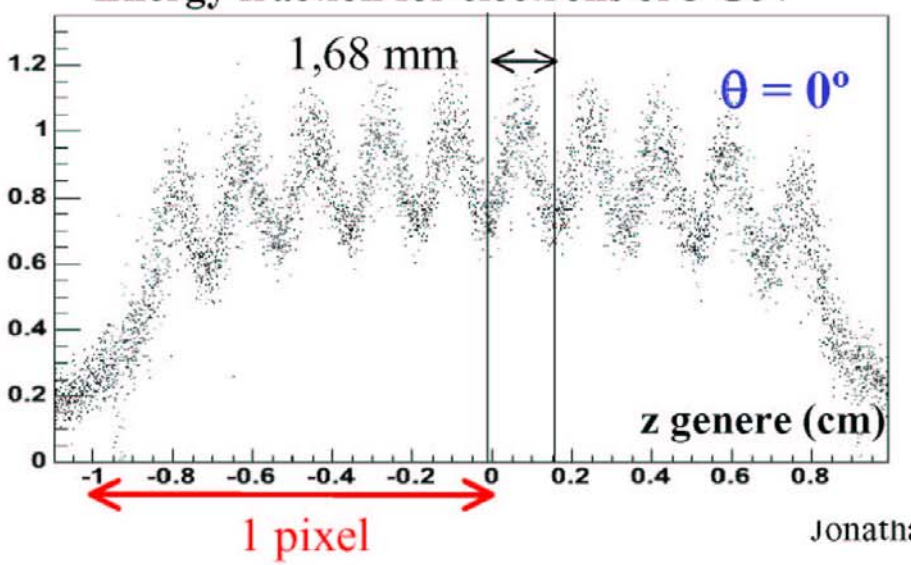
Reconstruction energie



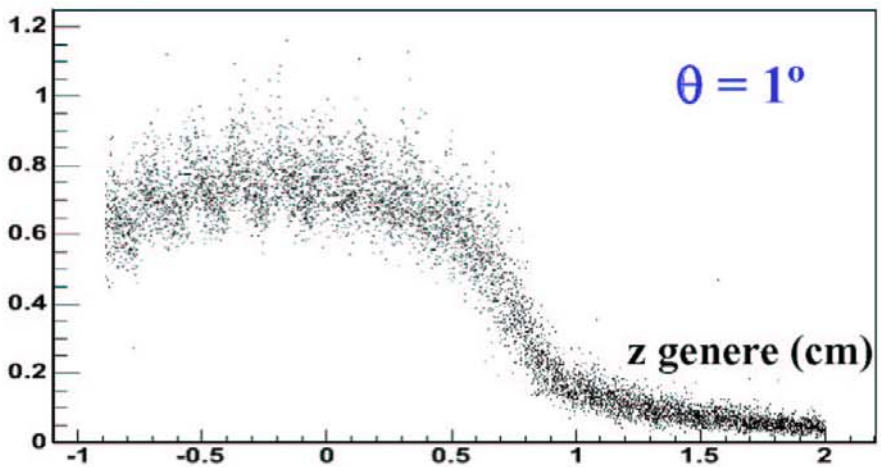
- D'apres les simulations de W.Burger, nous aurons une dispersion maximum de 0.02rad soit ~1°

- On a donc deux cas limites:
  le cas 0° ou on observe les vaguelettes
  le cas 1° ou on aura une moyenne
  pour la correction car vaguelletes diluees.

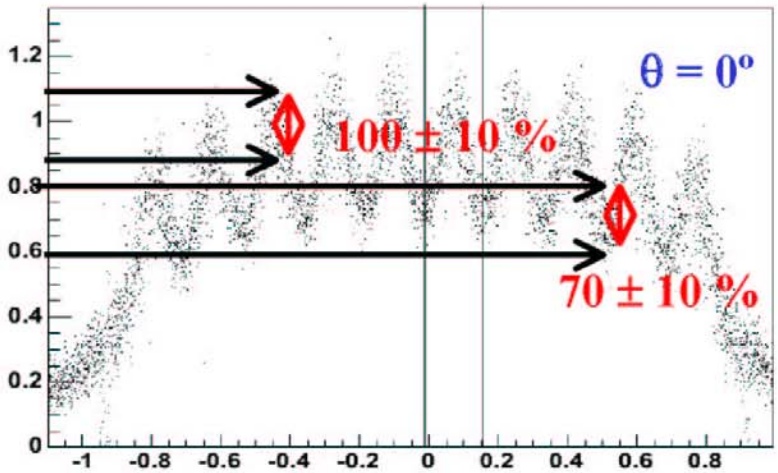
Energy fraction for electrons of 5 GeV

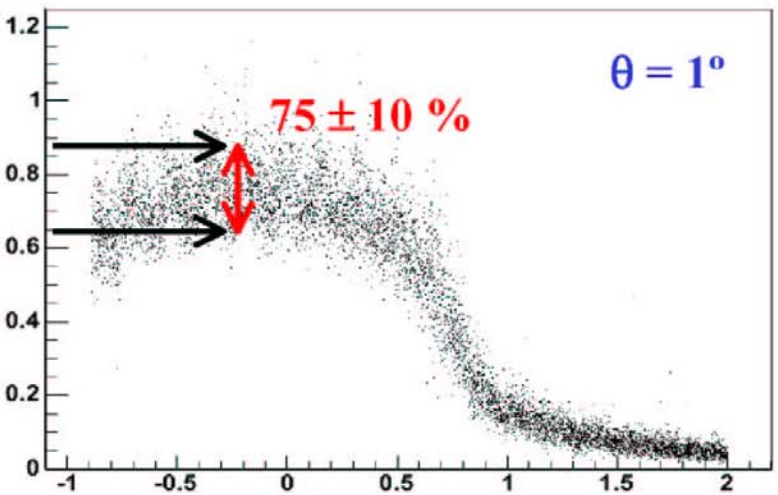


Energy fraction for electrons of 5 GeV



Reconstruction energie





- Concernant la reconstruction on a a peu pres les memes erreurs:
  ± 10 % d'erreur pour 0° et 1 °
- Erreur de 10% si l'angle et la position est connue sinon erreur systematique supplementaire.
- Il faut connaitre:

l'angle avec une precision < 1 °
resolution tracker ???

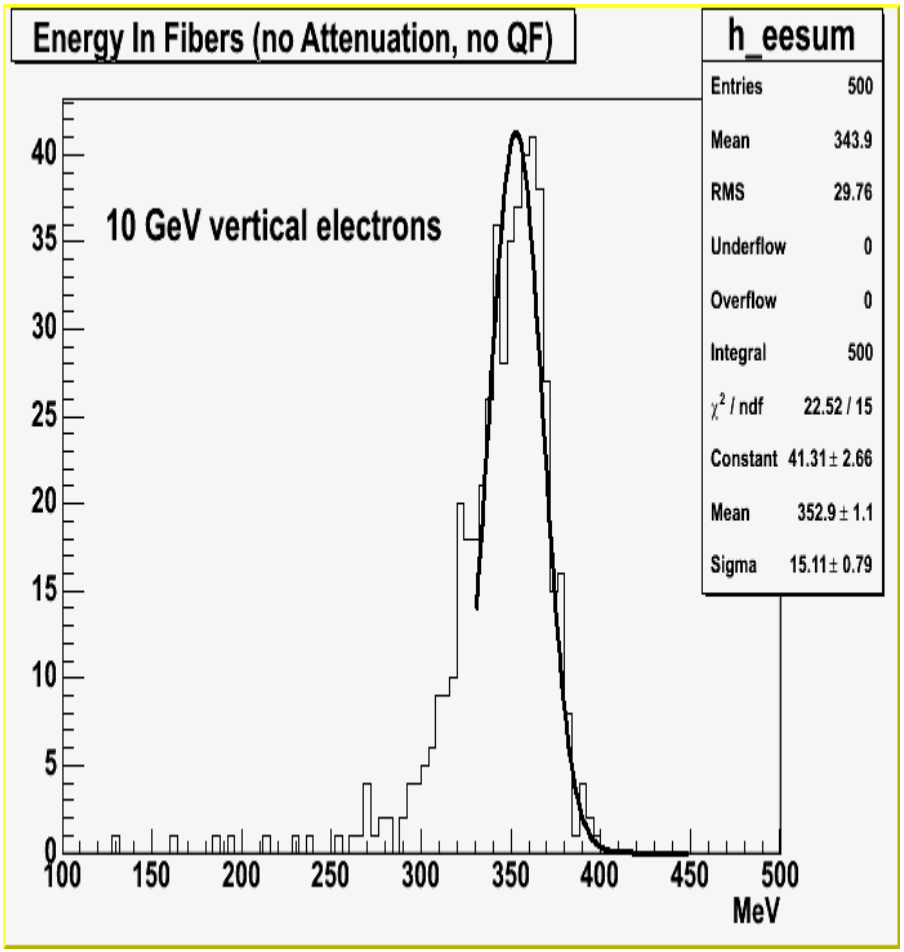
la position avec une precison < 0.5mm
resolution tracker OK!!

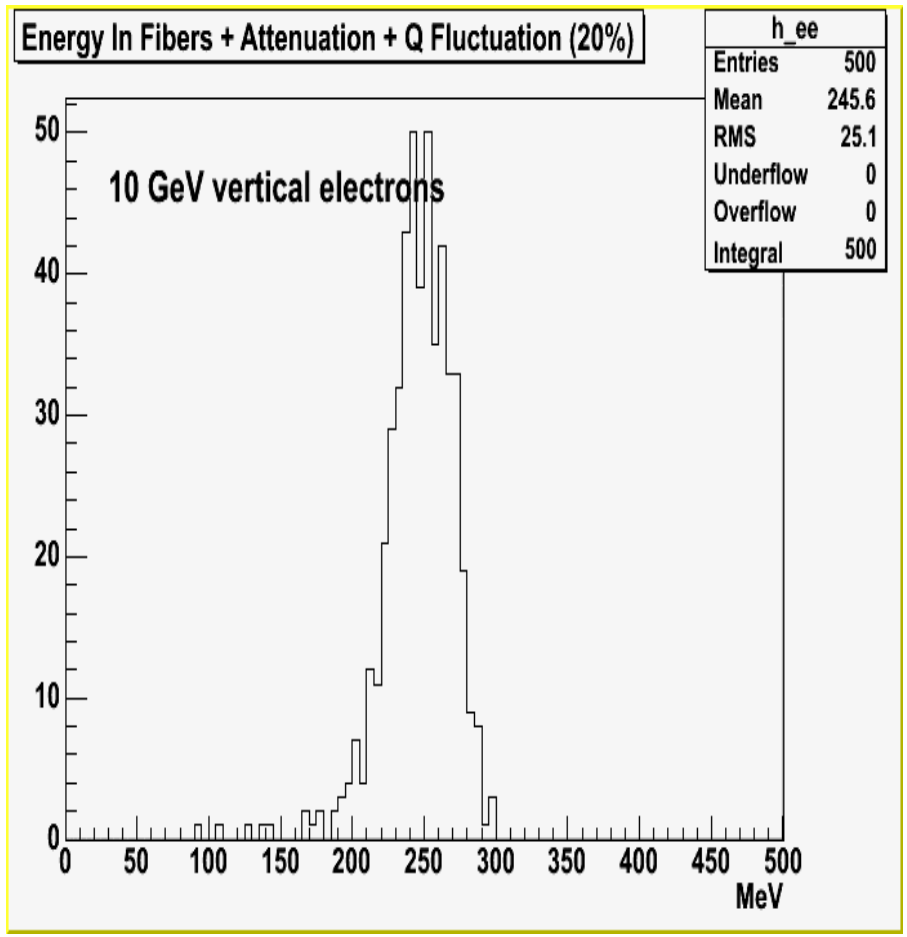
Y position

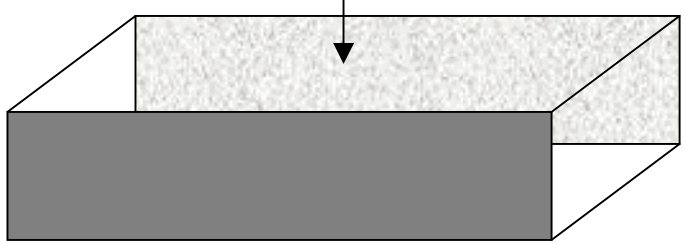
But, a pre-requisite

- **is to know the X position to correct for the attenuation in fibers**.
- In the AMS Standard Configuration & Software,
  - x in Even numbered layers is interpolated from Odd numbered layers by default.
- In the test-beam configuration,
  - only one layer : no X position
- A priori, OK :
  - Tracker extrapolation + Downstream telescope
- Correction for attenuation needs to be performed before all other effects (Y & incidence)

Effect of attenuation in fibers : 30 %



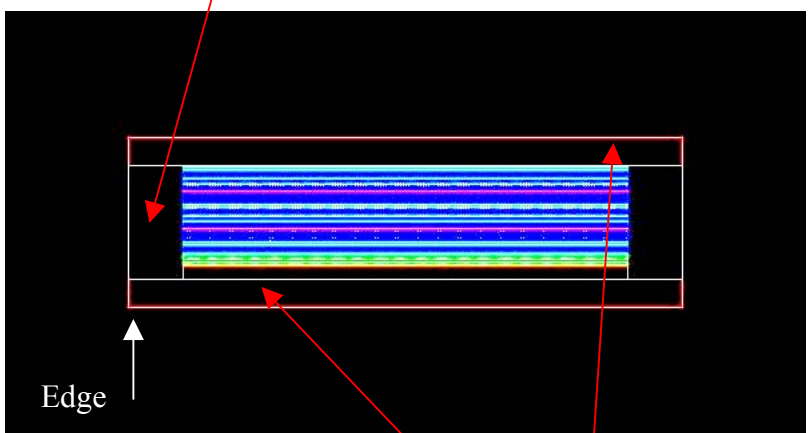




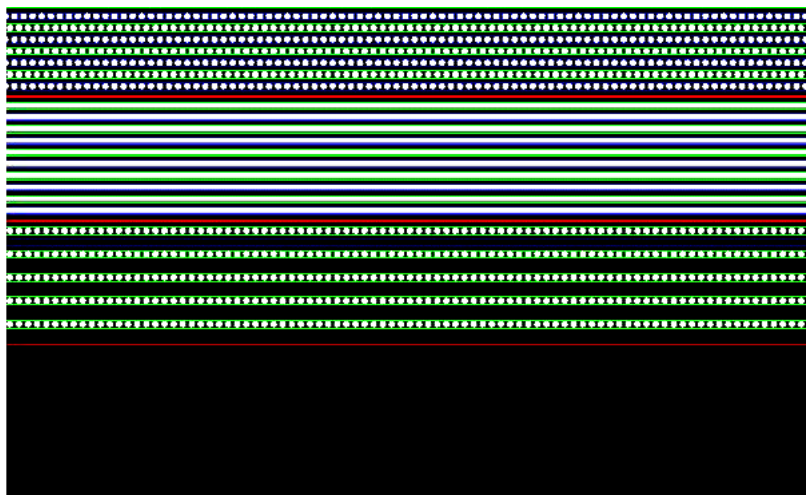
Steps in Ecal Simulation

- **Position :** Ecal edge @1.25 cm from the magnet Center
- **Geometry** : Inspired from AMS Software
  - same media (light lead, scintillator, …)
  - fibers are simulated

Average medium : PM + Support



Fibers structure

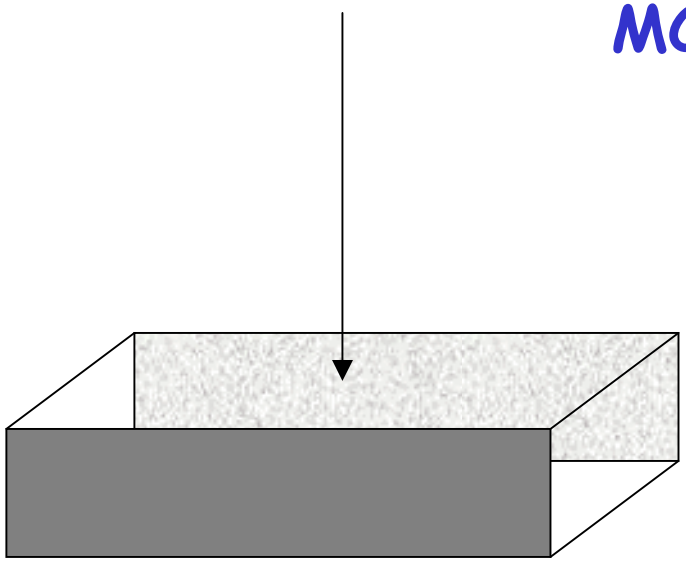


Top & Bottom Honey-combs

Steps in Ecal Simulation

- **Fibers are the sensitive medium** :
  - Attenuation to either ends from geant hit position
    - Test Beam 2002 measurement
  - Quantum fluctuations :
    - 20 % from specifications of PMs
  - From True Energy to ADC channels (TB 2002)
    - 1 Gev = 32 ADC channels (low gain)
    - High to Low gain ratio : 36
  - Dynode signal not treated so far
  - MC calibration :
    - Energy in fibers to True Energy (GeV)

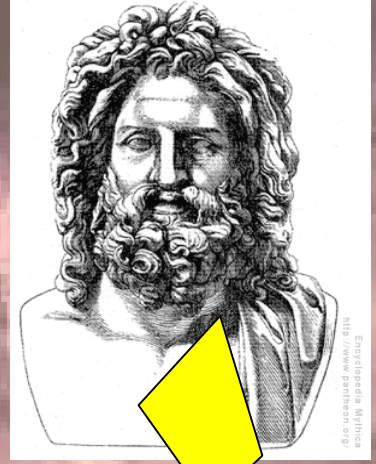
MC Calibration



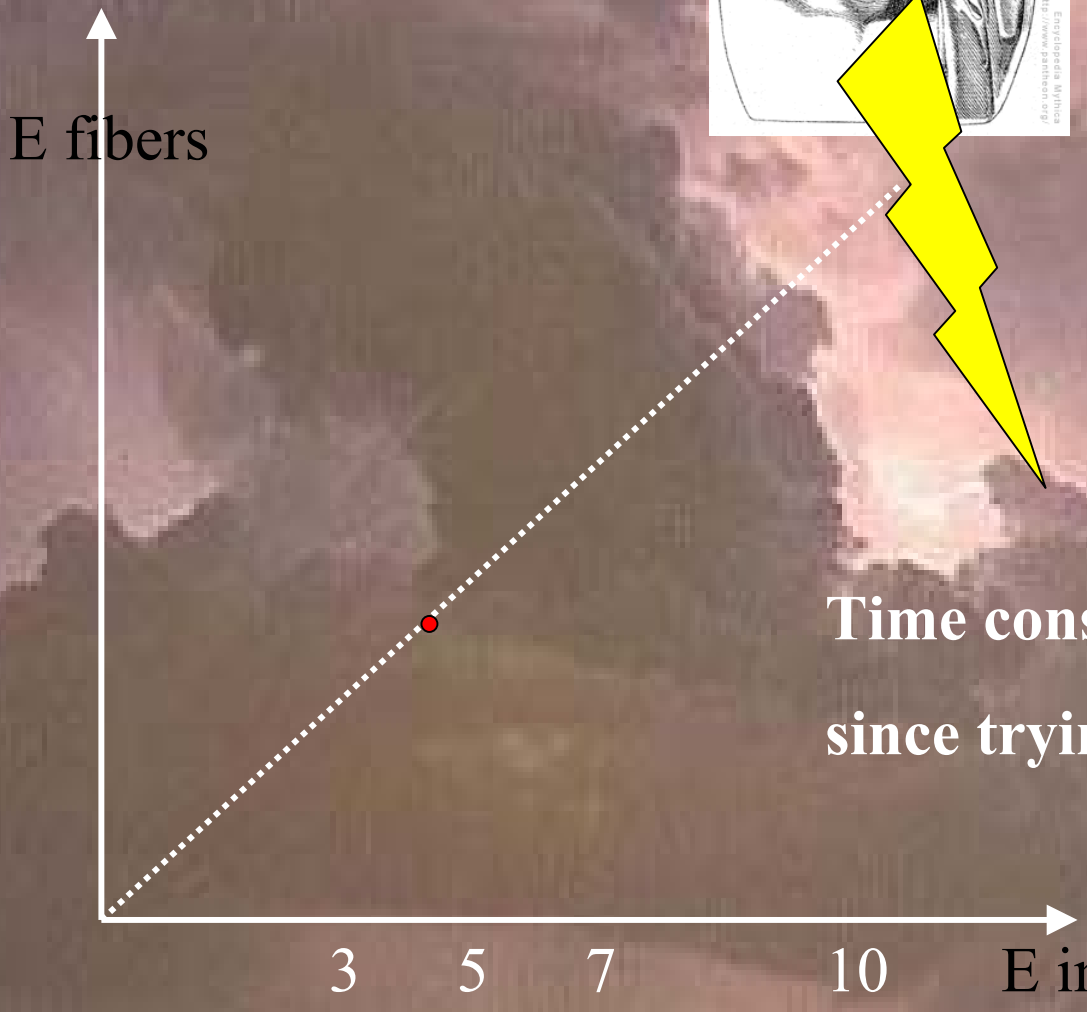
- E in Fibers to true Energy
  - 10 GeV :
  - 5 GeV :
  - 7 GeV :
  - 3 GeV

- Check with horizontal incidence

A greek story



(I did not find Alexei's picture)



Time consuming ! interactively

since trying to run in batch

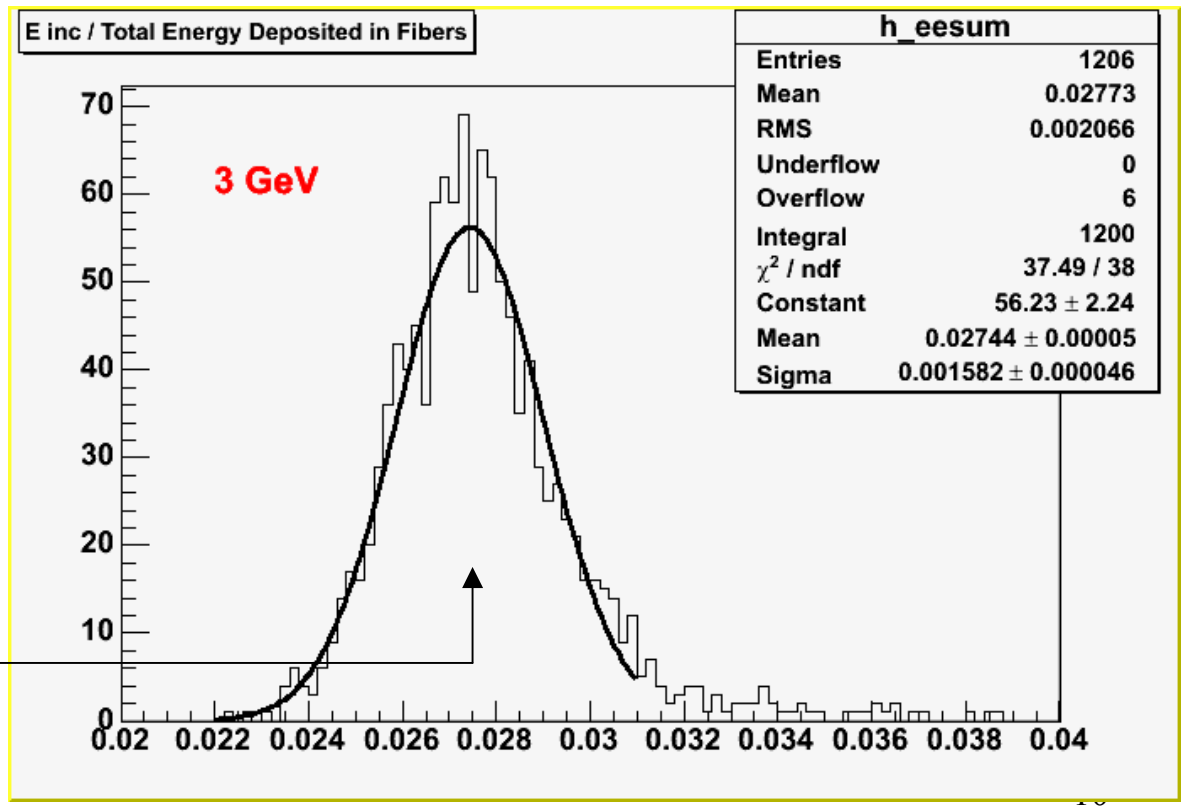
MC Calibration

Thanks to Juan, batch jobs now are running ….
but usual problems of space, time limit, job killed, etc ….

MC Calibration is still approximate but on its way

From MeV

to GeV



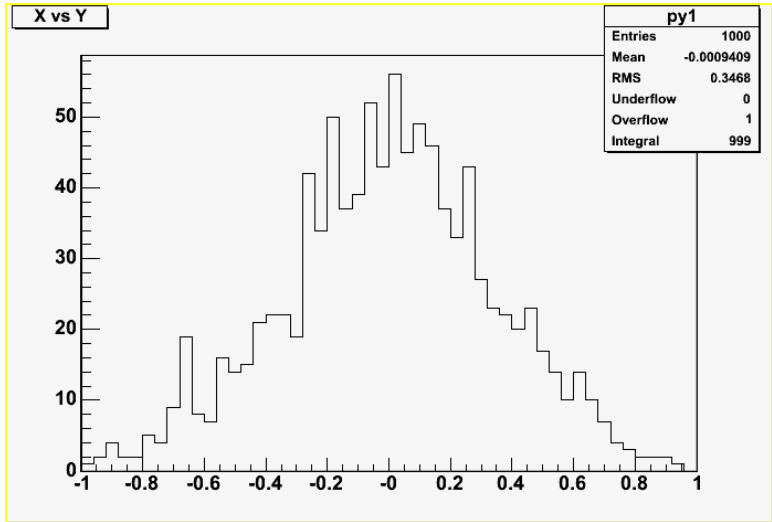
The nordic version of the story

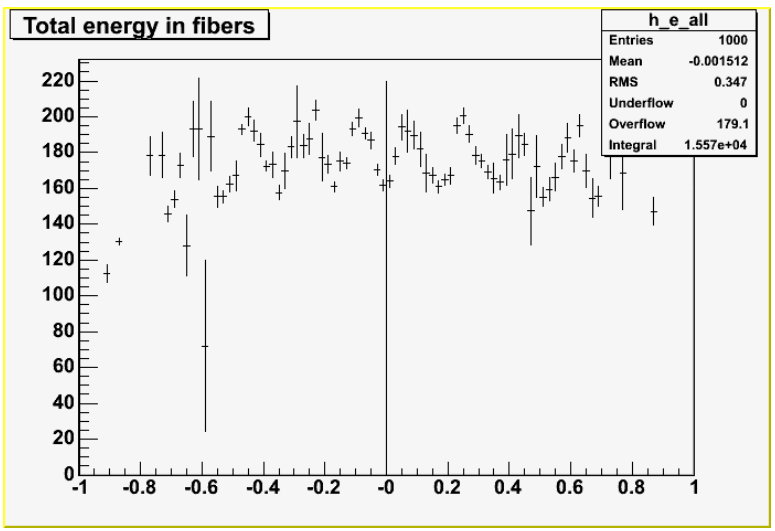
Debugging & Studies

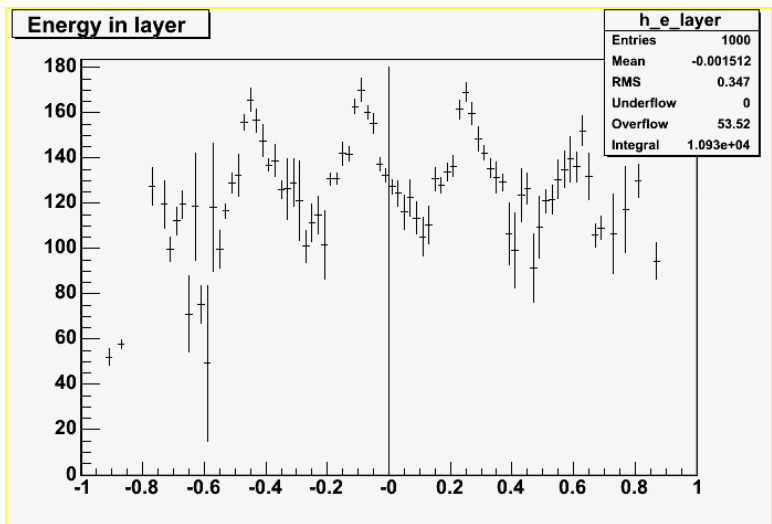
"Beam" profile just in front of Ecal:

X = 0 , Y +/1 cm

cm



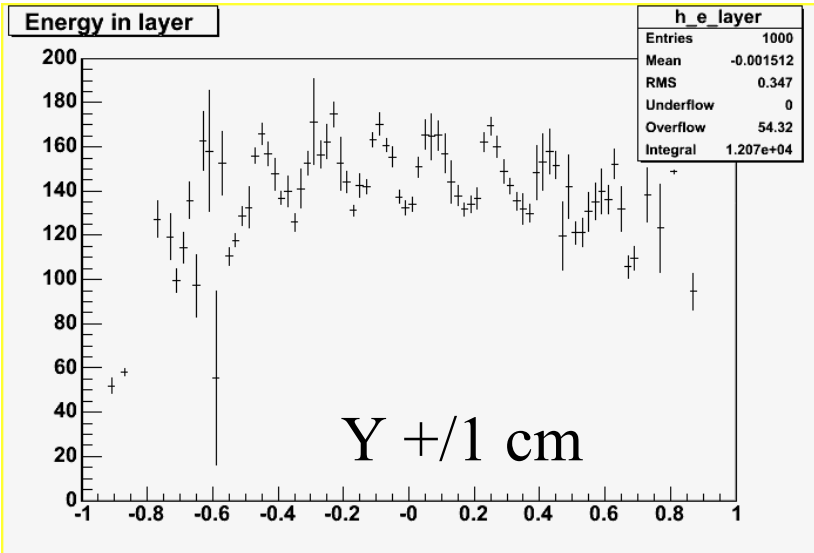


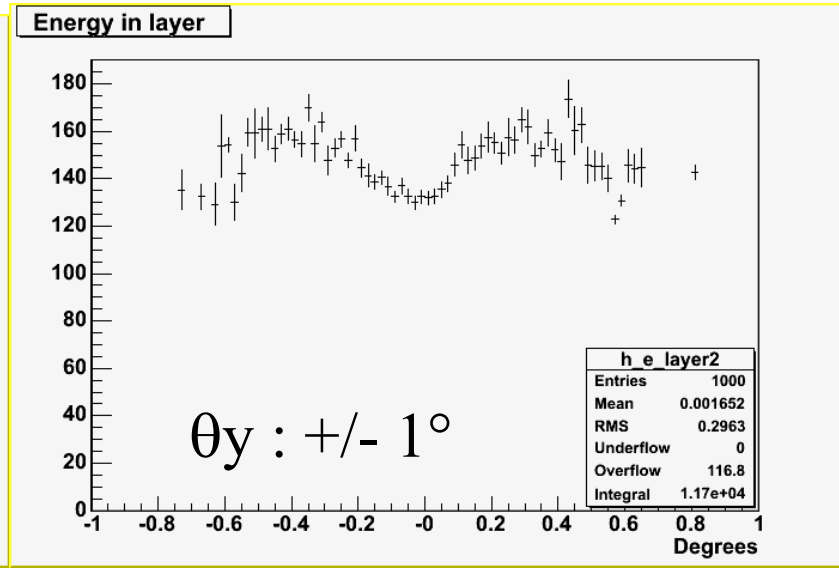


middle layer + 18 PMs

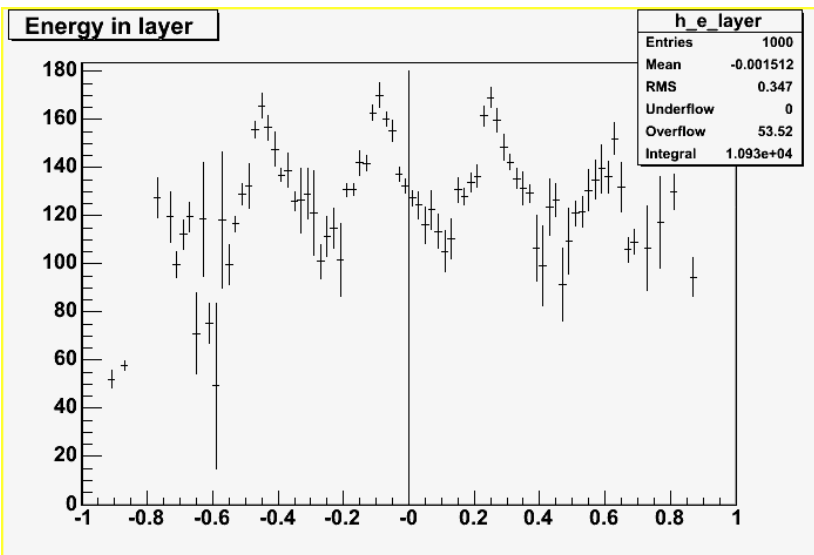
More obvious

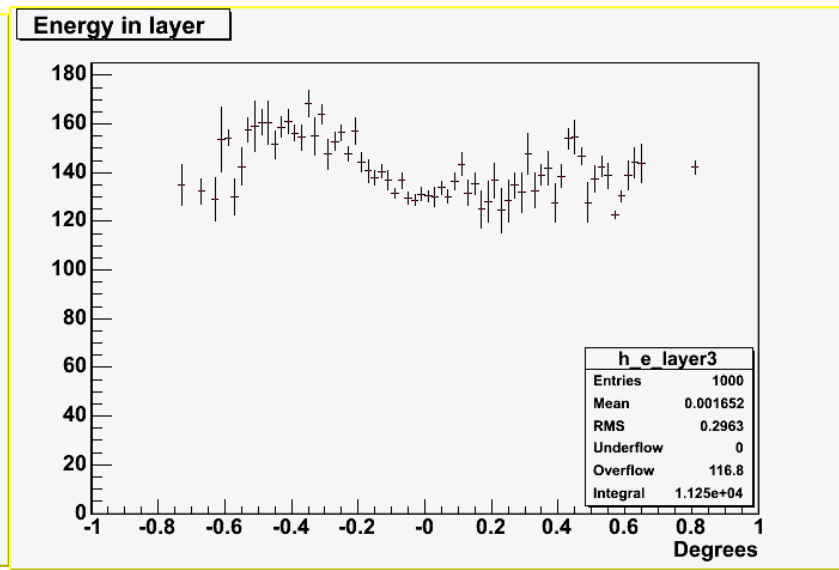
36 PMs





18 PMs



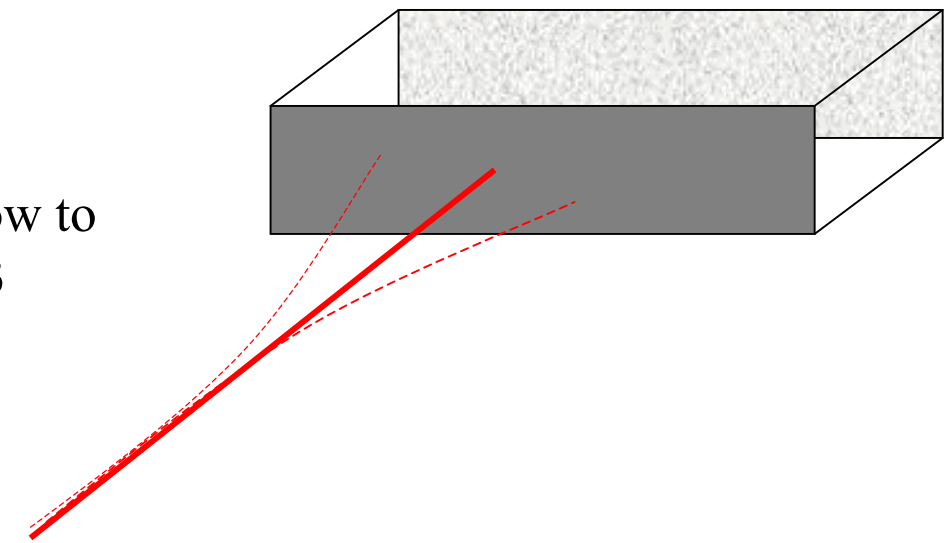


Not symmetric any more !

Reconstruction

- From ADC to Energy (GeV):
  - Raw energy only (no correction)
    - Per anode
    - Total energy
- 3 corrections :
  - Attenuation (X position)
  - Y position
  - Incidence angle

Some thinking needed to know how to correct for the 3 effect in case of 3 particles



Conclusion

- Many thanks to Juan & Nacho
- The framework to incorporate ECAL simulation was really user friendly
  - no prior knowledge of C++ and Geant4 was needed
- But, now I need to understand what I wrote !