Gauss/Ecal News

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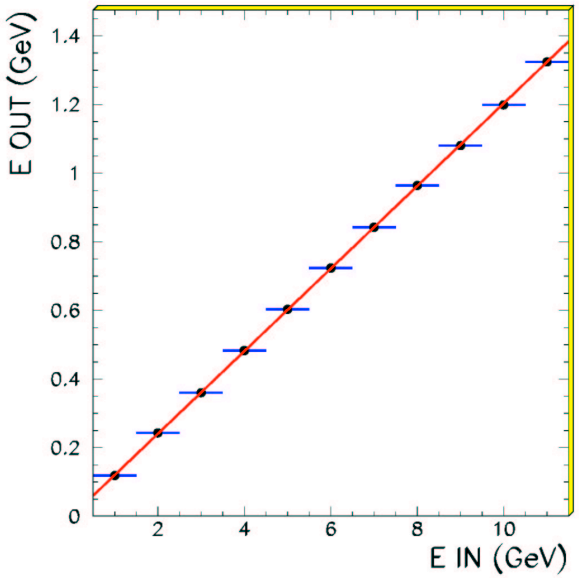
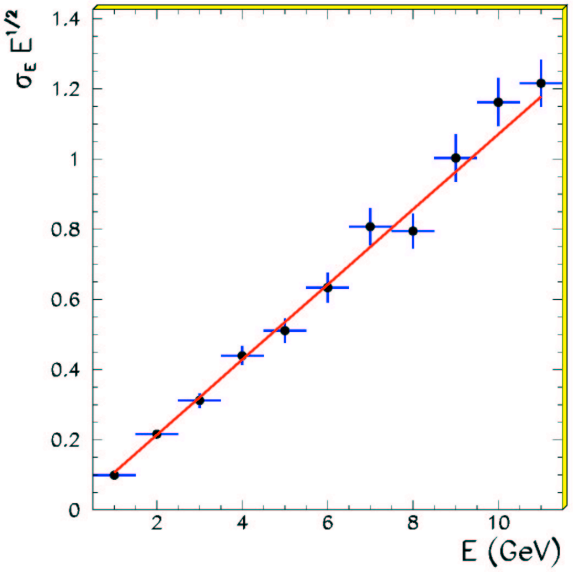
Specific Implementations

- Added effects which were not implemented in Geant4 :
  - ***Birk's saturation law*** (taken from Geant3)
  - ***Repartition of energy*** in different 25 ns time windows (implemented the same way than SICB for the moment)
  - ***Local non uniformity*** (light propagation to the fibers)

Tests with only Ecal in Gauss

- Photon orthogonal to the calorimeter surface :





$$E_{out} = \alpha . E_{in} + \beta$$

$$\alpha = 0.120 \pm 0.001$$

$$\beta = (-0.9 \pm 8.8) \, . \, 10^{-4} \text{ GeV}$$

$$\sigma_E E^{1/2} = a . E + b$$

$$a = (10.7 \pm 0.2) \text{ \% GeV}^{1/2}$$

$$b = (0.0 \pm 0.3) \text{ \% GeV}^{3/2}$$

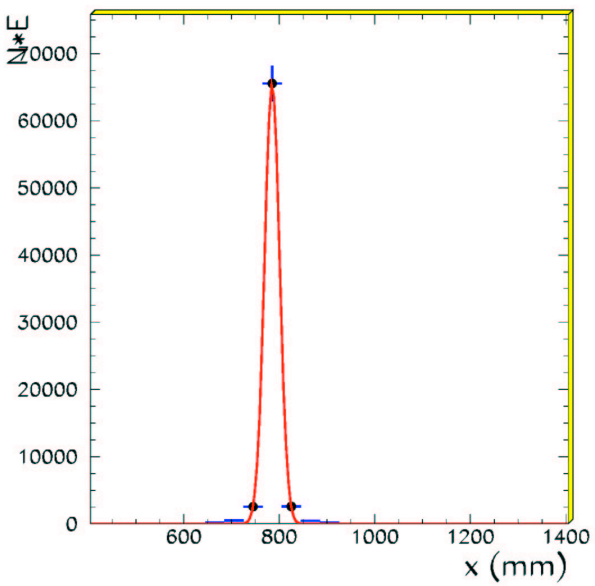
$\Rightarrow$ *ActiveToTotal = 8.3*

Tests with all detectors in Gauss

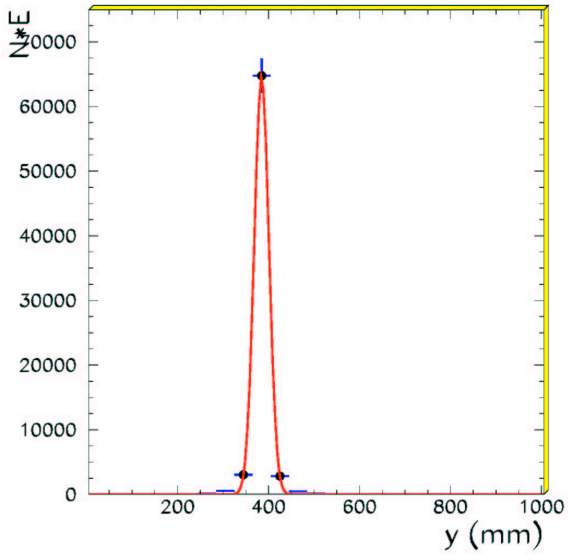
- DST produced and processed with Brunel reconstruction sequence : everything works fine.
- BUT it takes a ***long time to generate events*** in Gauss because of the calorimeter :
  - ~ 30 s / event without the calorimeters,
  - ~ 300 s / event with the calorimeters, saving most of the particles produced in the showers,
  - ~ 180 s / event when *not saving particles* with a vertex inside the calorimeter,
  - ~ 90 s / event with *no magnetic field* in calorimeter.

Magnetic Field (1)

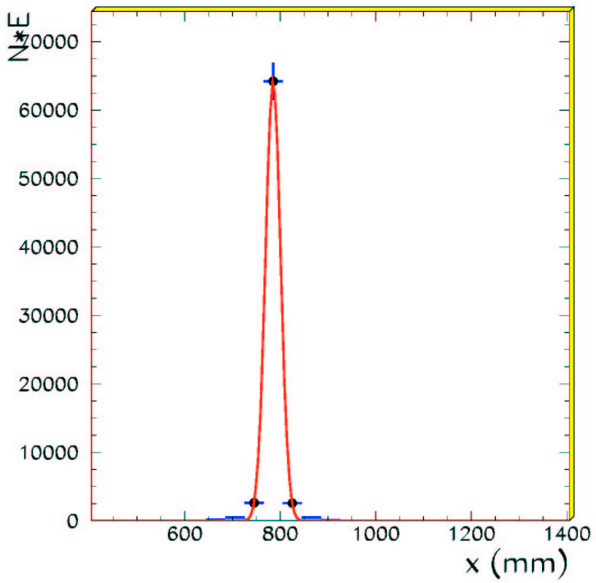
- To check that the magnetic field can be removed inside the calorimeters:
  - plot *x* and *y* distribution of the position of hits, weighted with energy deposition.
  - perpendicular 5 GeV photon in the center of a cell of inner part of Ecal.



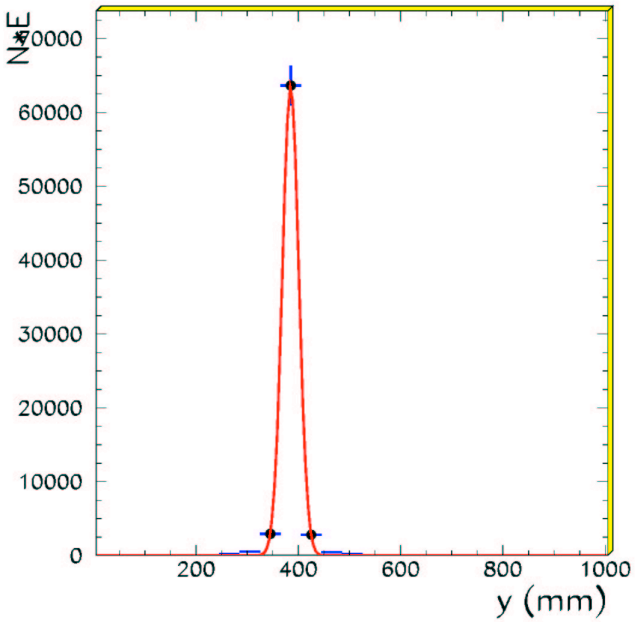
With Field



Magnetic Field (2)



Without Field



With Field
$\sigma_x = 15.72 \pm 0.13$ mm
$\sigma_y = 16.09 \pm 0.17$ mm
$\langle E \rangle = 0.593 \pm 0.003$ GeV
$\sigma_E = 0.032 \pm 0.003$ GeV

Without Field
$\sigma_x = 15.80 \pm 0.14$ mm
$\sigma_y = 16.07 \pm 0.13$ mm
$\langle E \rangle = 0.591 \pm 0.003$ GeV
$\sigma_E = 0.027 \pm 0.003$ GeV

Local Non Uniformity

- Two contributions :
  - ***Detailed geometry*** of the calorimeter : holes of the fiber, …
  - ***Propagation of light to the fibers*** : “by hand” correction, sin function with :
    - period = distance between fibers,
    - amplitude = 4 %

Conclusions

- Geant4 simulation is working and giving sensible results,
- But it is very slow :
  - Drop shower particles in MC truth,
  - Drop magnetic field in calorimeters,
  - Study effect of the details of the geometry on the processing time *versus* physics.