GLAST LAT project

Preliminary results from the GLAST CERN 2003 experiment

Study of hadronic interactions

Motivation and Goals

Issue : Background Rejection

- DC1 : from 1Million events down to a few hundreds !
- Interesting events are in the tails of distributions
- main rejection thanks to Tracker and ACD
- Hadronic cascades cover a wide energy range hard to simulate

$\Rightarrow$ Rejection algorithms are based on simulations...

Benchmarking hadronic cascade simulation

- CERN data : Energy deposit per log
- Basic Approach : Study these distributions

$\Rightarrow$Compare Geant4 simulations with CERN beam test data !

CERN 2003 setup

- Bordeaux **MiniCal** : 8 Layers $\times$ 6 Logs (+ 3 Layers $\times$ 5 NRL Logs)
- Italian Silicon Tracker : 2 $\times$ (X,Y) Layers
- $\simeq 1.4X0$ of **lead** to simulate GLAST tracker

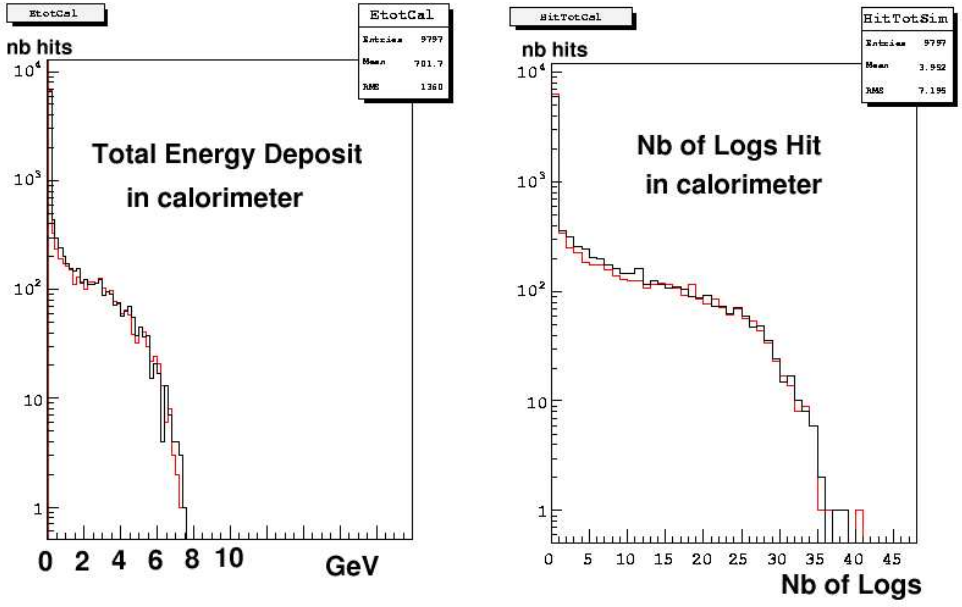
- SPS - H6 line : primary beam 450GeV protons
  - e+ 150, 120, 80, 50GeV : secondary beam <2% hadrons and muons
  - e- 20GeV and 10GeV : tertiary beam 30% hadrons and muons

Geant4_v6.2p01 simulation setup

- Geant4_v6.2p01 standalone... using GHEISHA model
- GRv4r6 still uses Geant4_v5.1 ...
- a GlastRelease unofficial version with Geant4_v6.2p01 exists but is still unstable...

Geometry

- 8 Layers $\times$ 6 Logs
- $0.04\,X0\,Si + 1.46\,X0$ Lead
- gaussian beam, restricted to a patch on one log
- pions or protons ?



Pion vs Proton

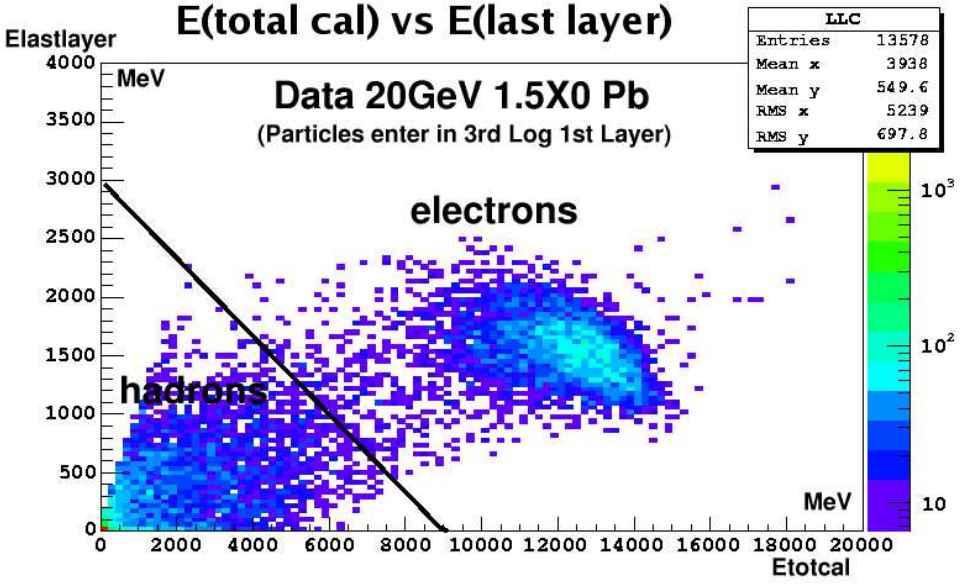
Data Analysis

Getting Prepared

- Muon calibration and amplifier cross-calibration
- Detector centered, 1.4X0 Pb
- $E_{Log} = \frac{L+R}{2}$, if E_{Log}>50MeV else 0.
  - Threshold because of ADC non linearities : Gain = 1MeV/channel
  - Low Gain amplifiers : main goal was high energy EM showers

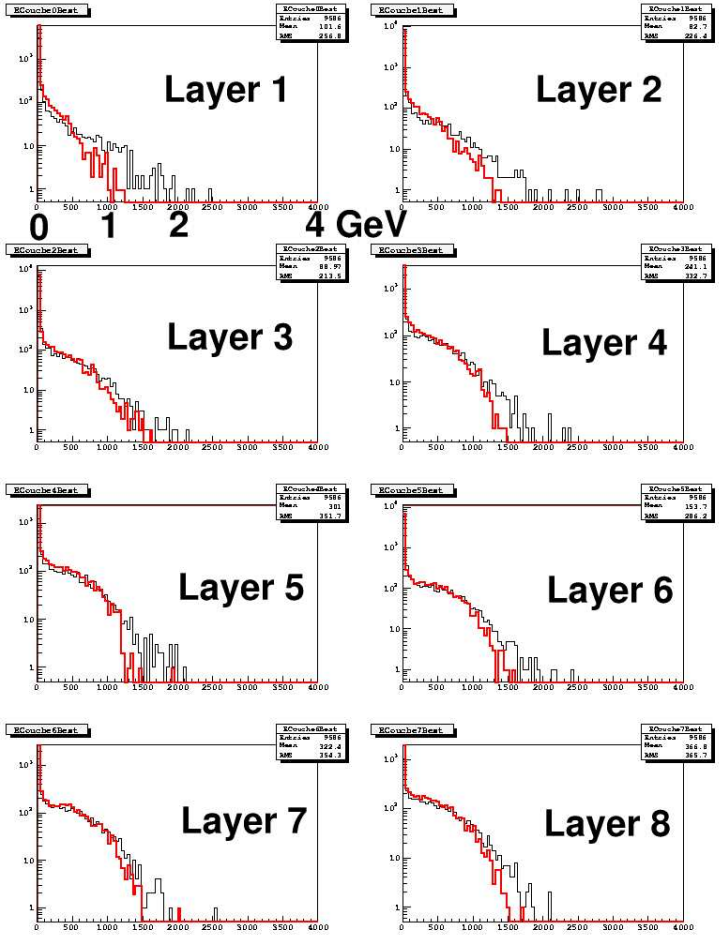
Hadron selection

- Select Position thanks to tracker :keep events in a patch on one log...avoid gaps...
- (E_{TotCal}, $E_{LastLayer}$) plane

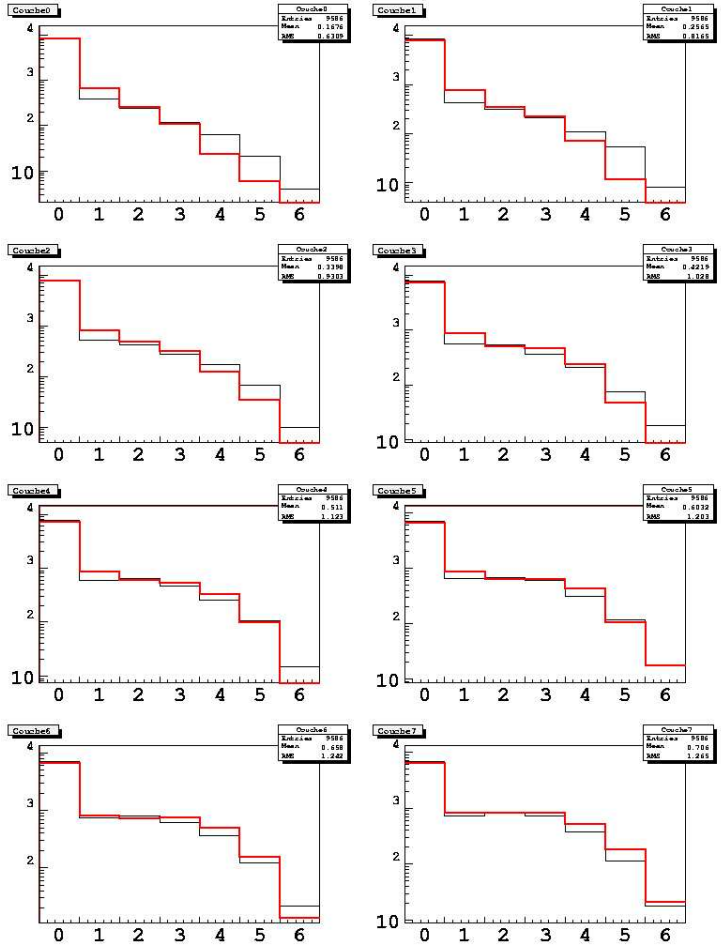


Results 20GeV(1)

Simulation in RED (Threshold 50MeV)



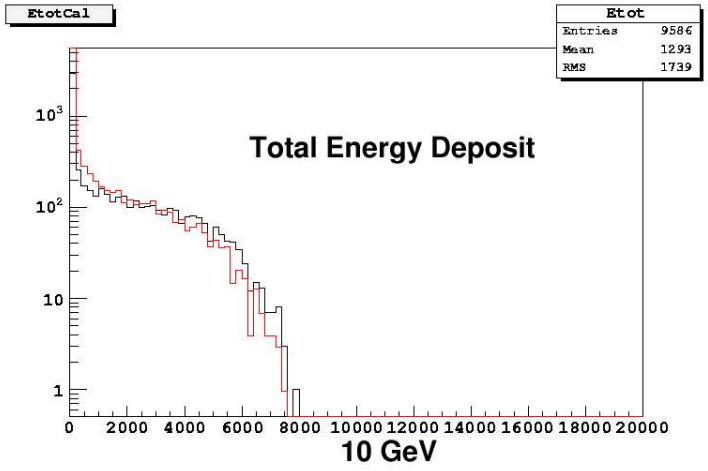
Energy deposit per layer

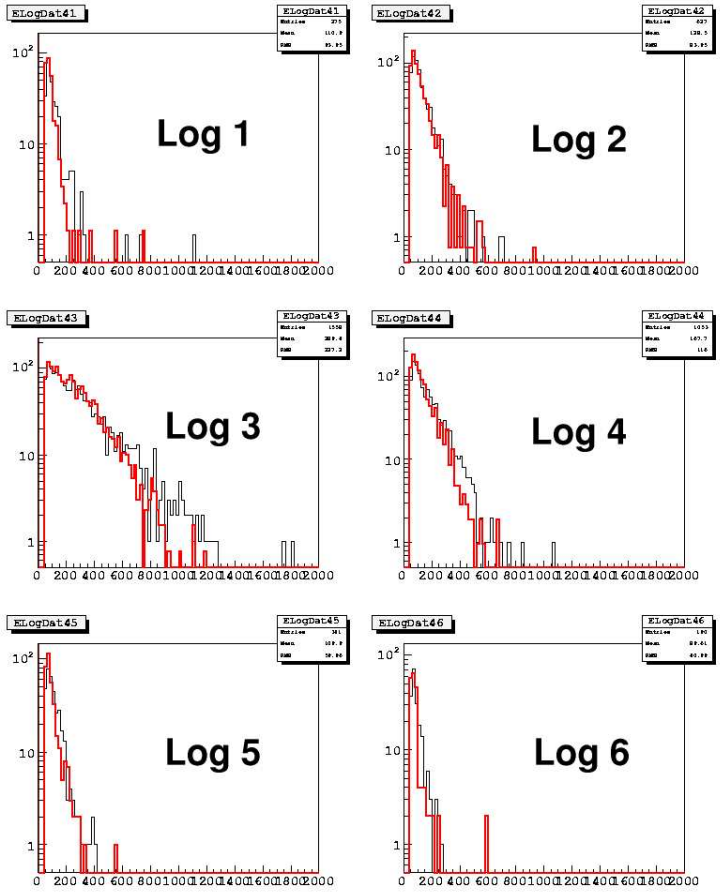


Number of Logs Hit per layer

Results 20GeV(2)

Simulation in RED (Threshold 50MeV)



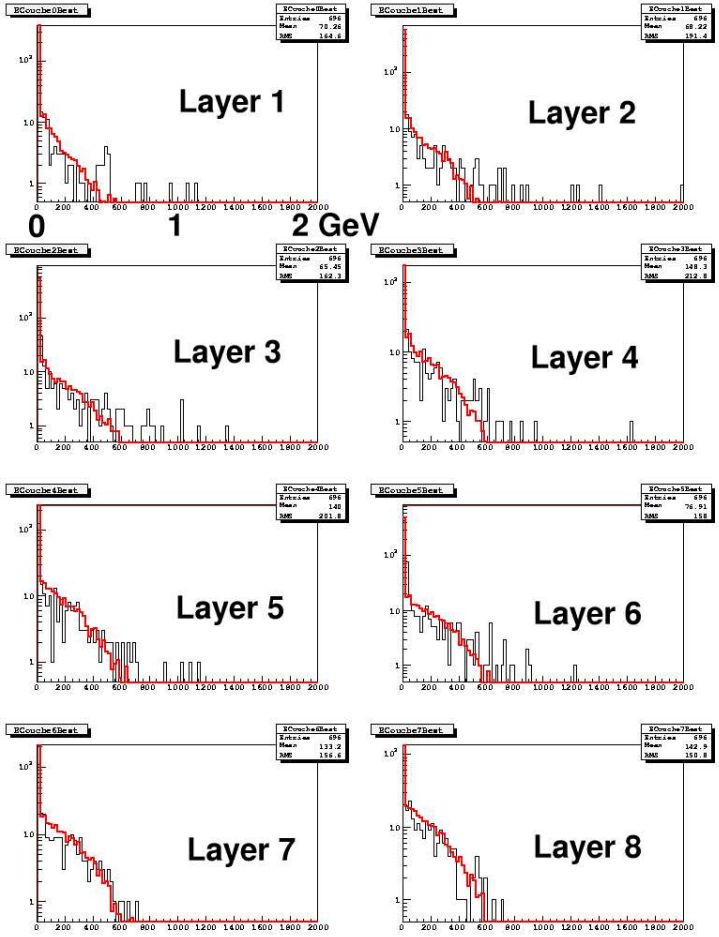


Total Energy deposit and Total multiplicity

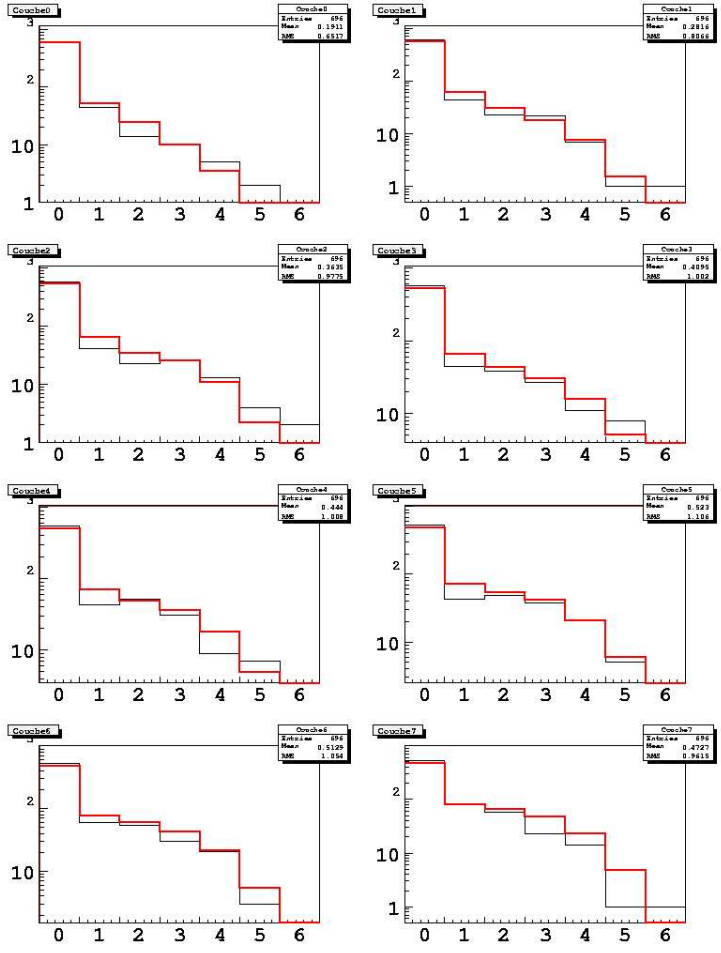
Energy deposit per **Log** in layer 4

Results 10GeV(1)

Simulation in RED (Threshold 30MeV)



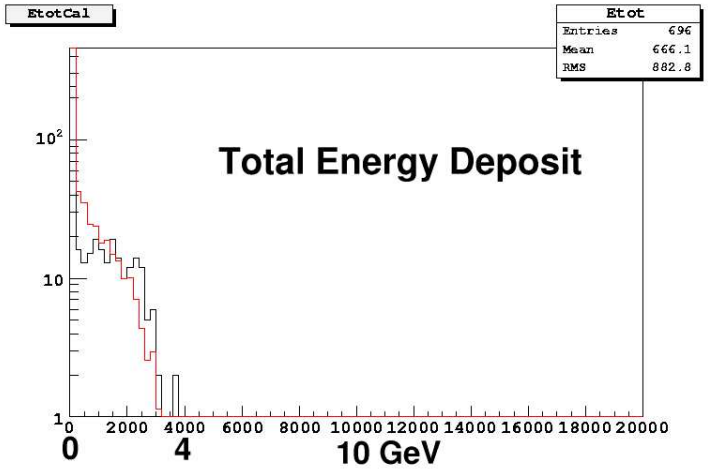
Energy deposit per layer

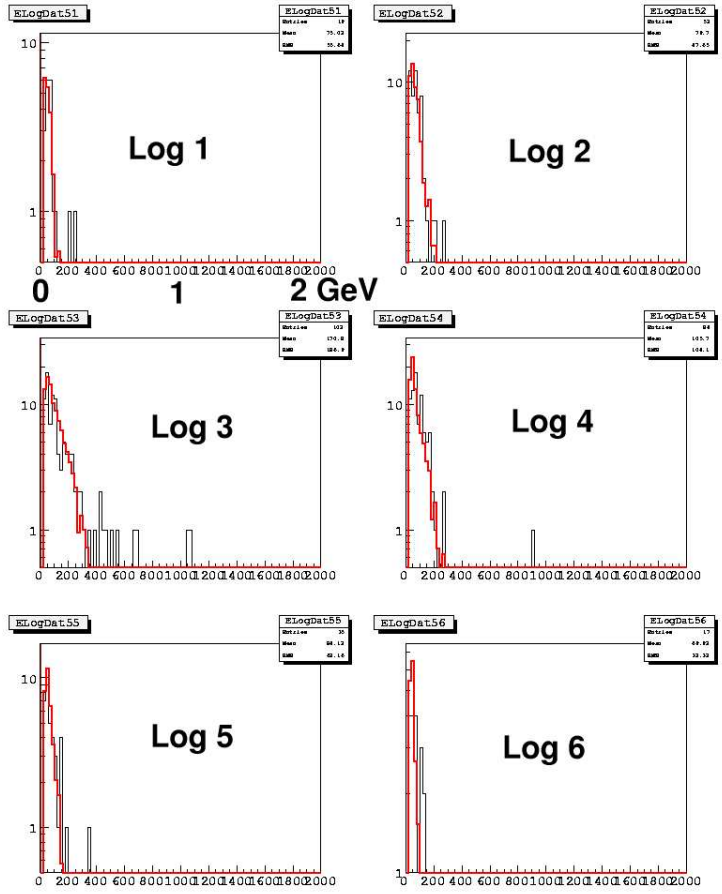


Number of Logs Hit per layer

Results 10GeV(2)

Simulation in RED (Threshold 30MeV)





Total Energy deposit and Total multiplicity

Energy deposit per **Log** in layer 5

Conclusion

- Geant4 simulation of hadronic cascades reproduces our data very well at 10GeV and 20GeV
- The same simulation also gives good agreements for EM showers
- Need to test Geant4 at lower energy :

$\Rightarrow$GSI beam test data : protons 1.7GeV, deuterons 3.4GeV