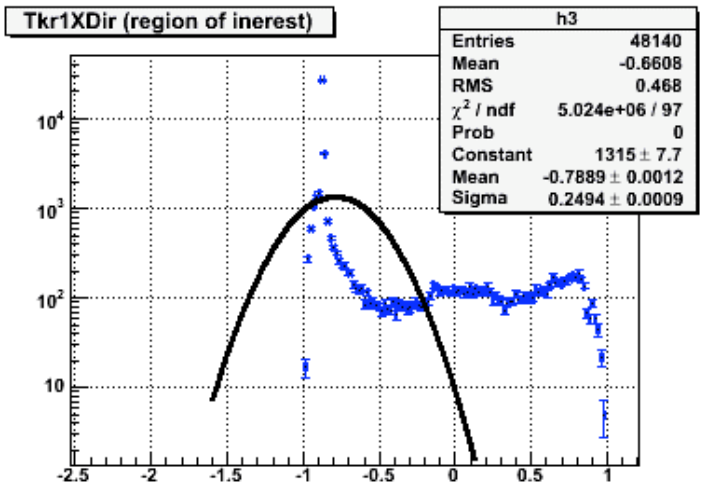
# First Comparison of BackSplash:
## GEANT4 *(4.8.2)*- EGS5

Backsplash observed in data is larger than that of MC, specially noticeable for electrons at high energies and at large angles. See presentation May 16 2007 for details

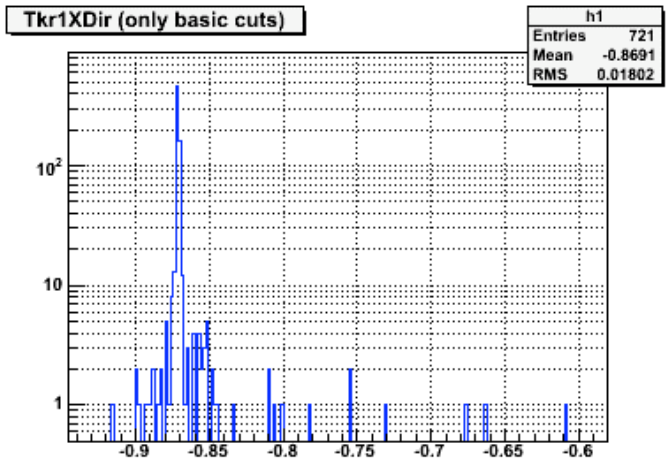
https://confluence.slac.stanford.edu/download/attachments/13893/Comp_BeamProfile_60degRuns_v3.pdf?version=1

**Run 1949 (282 GeV, 60 deg)**

### DATA



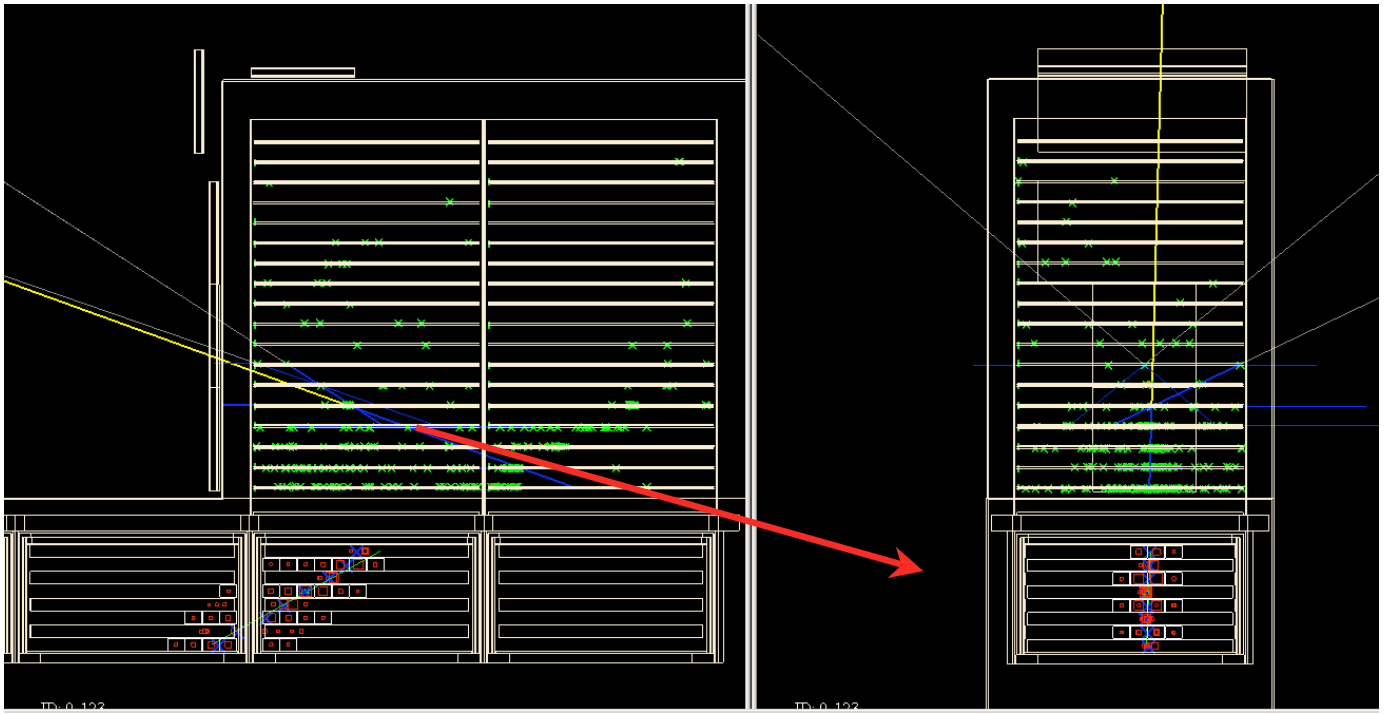

### MC (Custom, low statistics)




The wrong-angle reconstruction is due to backsplash

## Slide 26 of presentation May16 2007

## (280 GeV, 60 incid. angle)



WRONG (random) incoming angle and impact point calculation

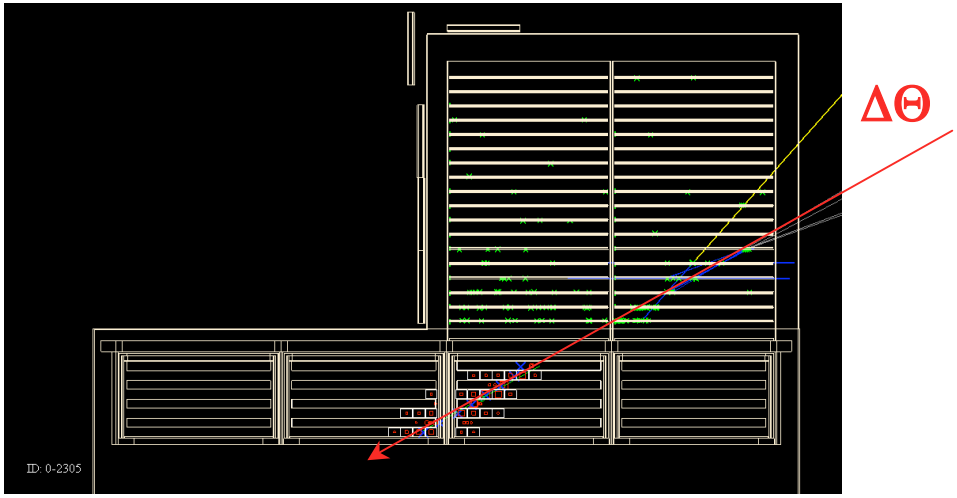
**“Recognized Track 1” is missing the calorimeter**

## Slide 30 of presentation May16 2007

## Comparison with MC data: Custom BT-1949(280GeV, 60deg)

### Events with worse mis-reconstructed angle

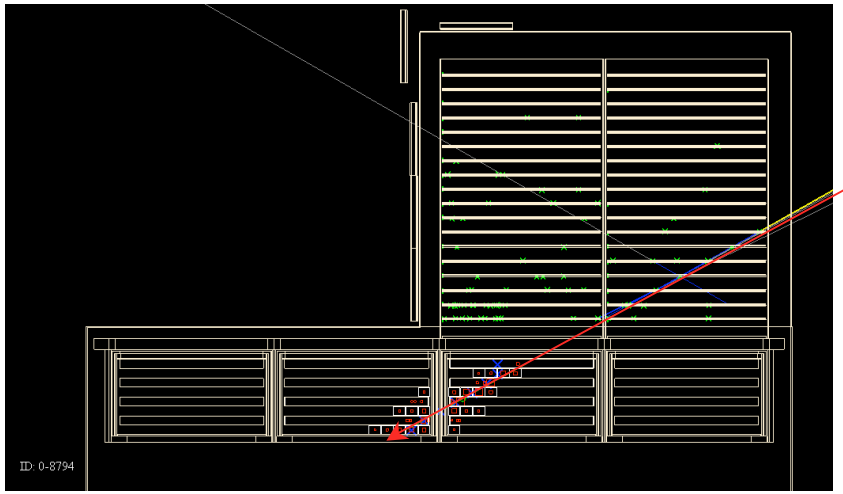
Evt 2905



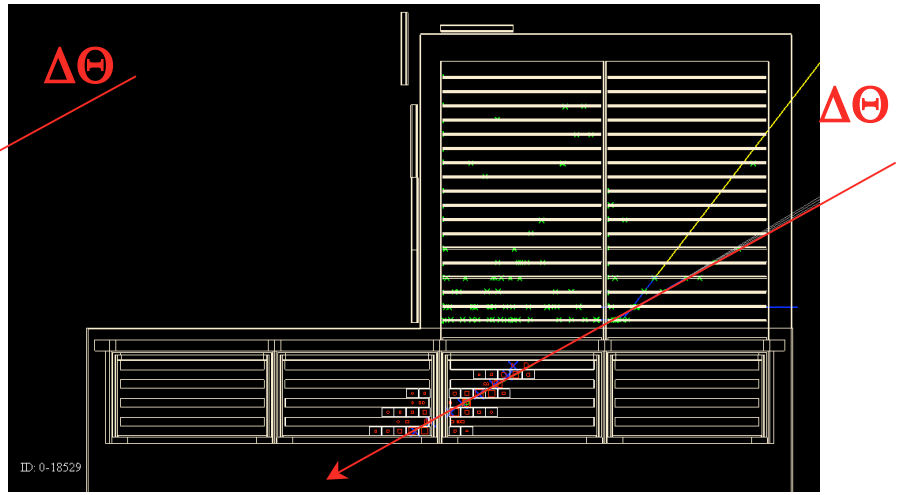

**Amount of backsplash in MC seems to be smaller than in real data**

**Tracker reconstruction is most of the times correct**

Evt 8794 (see next slide)




Evt 18529



# First Comparison of BackSplash: GEANT4 *(4.8.2)*- EGS5

**Goal of this work:**

Find out whether the data-MC disagreement is due to not accurate physics in the MC simulations

**Methodology:**

Compare **Geant 4** predictions with a well tested MC code to simulate Electromagnetic showers, **EGS5**

# First Comparison of BackSplash:
# GEANT4 *(4.8.2)*- EGS5

## Simple CsI calorimeter + Simple Tracker:

8 layers (1.99cm) along -Z direction

*8.6 radiation lengths (1.85 cm)*

24 columns (2.67 cm) along +Y direction

1 piece (34.4 cm) along X direction

Gaps of 2 mm in Z and Y direction (vacuum)

36 Si layers of 0.04 cm thickness

4 W alloy (92.5% W, 5% Ni, 2.5% Fe) layers of 0.0720 cm

12 W layers of 0.0097 cm thickness

*Location of Si layers with respect to CAL is the same as in reality (Z pos. extracted from GlastRelease-v13r5p2)*

## Some details of the simulation

1 - Production thresholds

**GEANT4 Dist cut = 1mm**

Energy thresholds (MeV): gamma 0.038 e- 0.692 e+ 0.658

EGS5

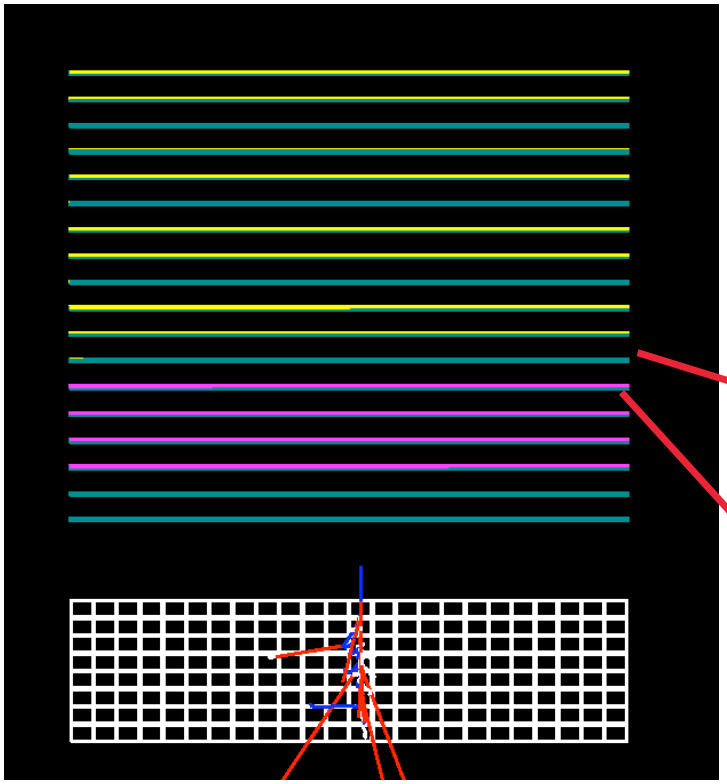
Energy thresholds (MeV): gamma 0.04 e-/e+ 0.70

2 - Location of W planes is right on the top of the first Si layer of a tray. This could be updated to be more realistic, but I do not think it will have a significant impact.

3 - The space between Si layers or Si layers and W layers is vacuum. We could update that… but I do not think it will modify the outcome of this comparison.

# Display of a 1 GeV electron shower in this Detector

*Geant 4 simulation, visualized with HepRapp browser*

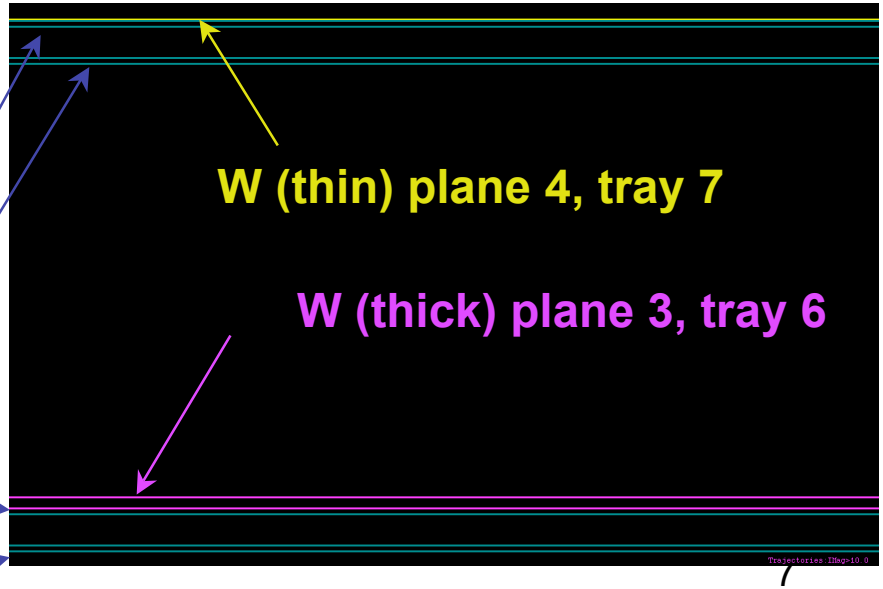


**Blue - Si planes**

**Magenta - Thick W**

**Yellow - Thin W**

**White - CsI**



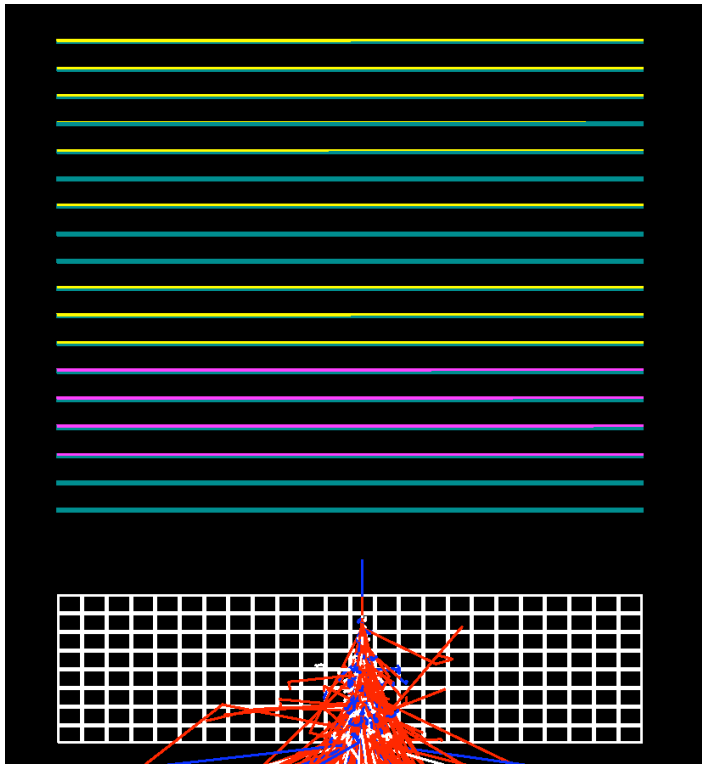

**Si layer 13, tray 7**

**Si layer 12, tray 6**

**Si layer 11, tray 6**

**Si layer 10, tray 5**

# Display of a 100 GeV electron shower in this Detector



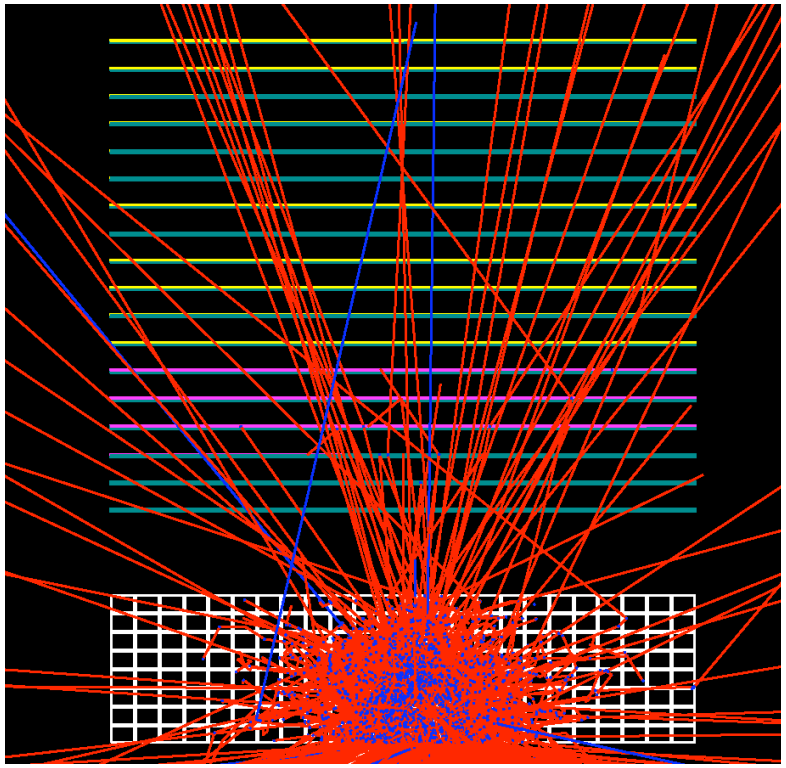
Only particles with P > 10 MeV/c are displayed

**Blue - electron**

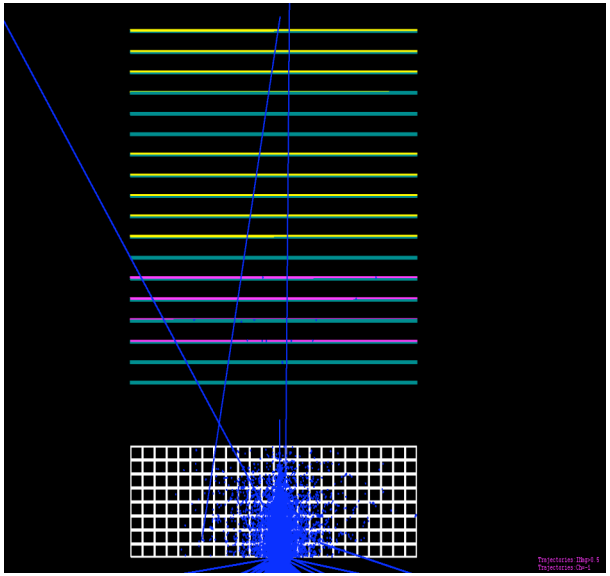
**White - positron**

**Red - photon**

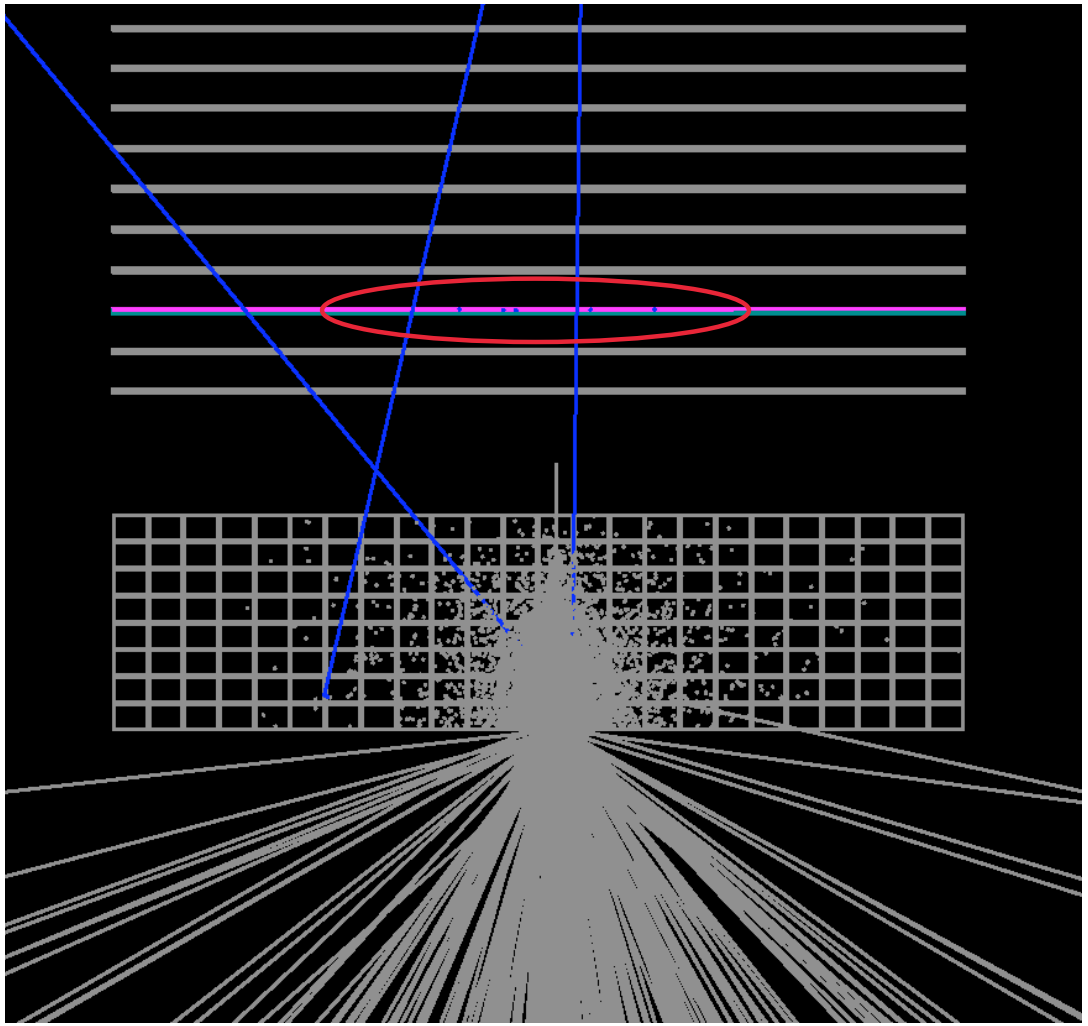
Particles with P > 0.5 MeV/c are displayed



# Display of a 100 GeV electron shower in this Detector



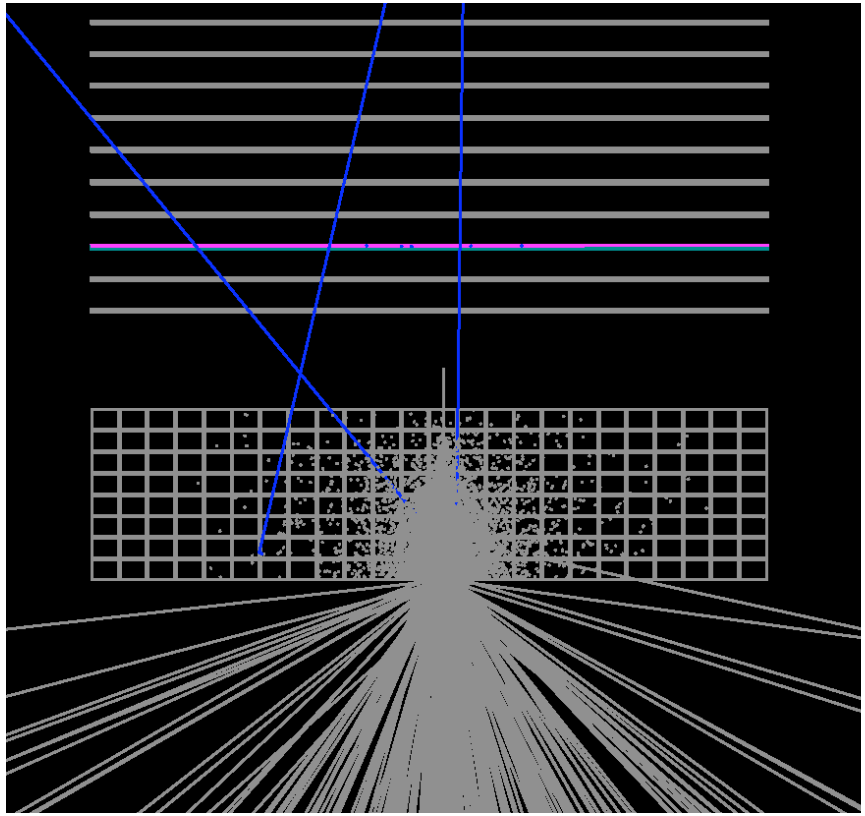
ONLY ELECTRONS with P > 0.5 MeV/c are displayed

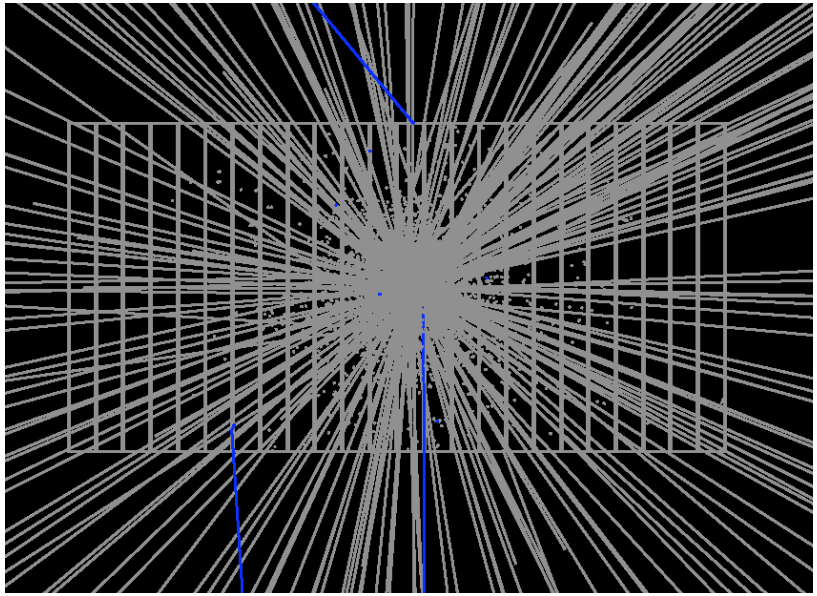


**Photons (mostly in E range 0.5-5 MeV) produce electrons in the W and Si planes (Photoelectric or Compton) which can deposit energy in the Si planes (also W planes, of course…)**

# Display of a 100 GeV electron shower in this Detector

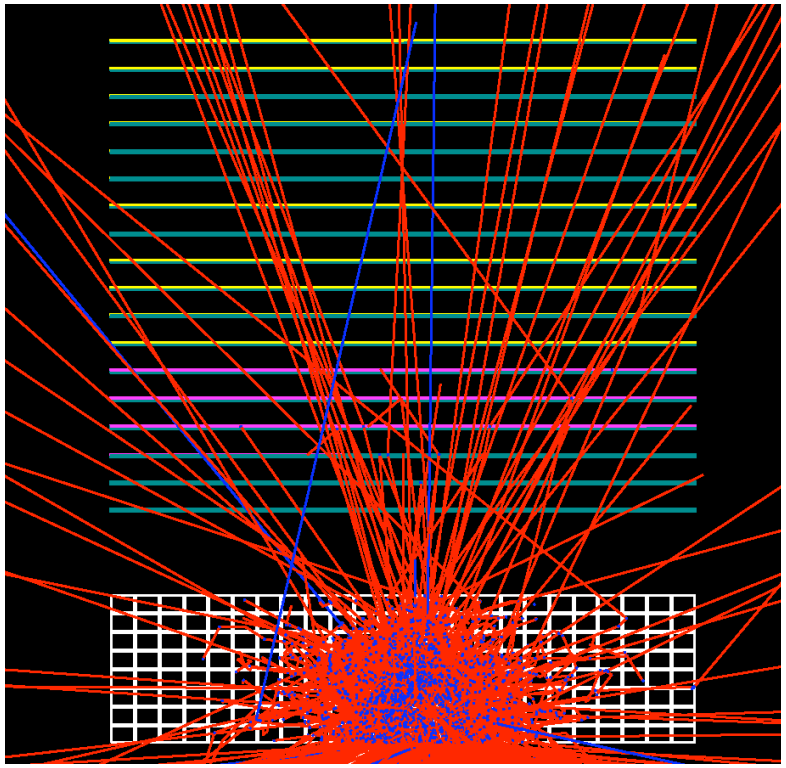
The 3 electrons exiting the calorimeter (“backwards”) have large angles and do not go much over the tracker





# Display of a 100 GeV electron shower in this Detector

**Particles with P > 0.5 MeV/c are displayed**



**Backsplash can be quantified by computing the energy deposited in the Si and W planes.**

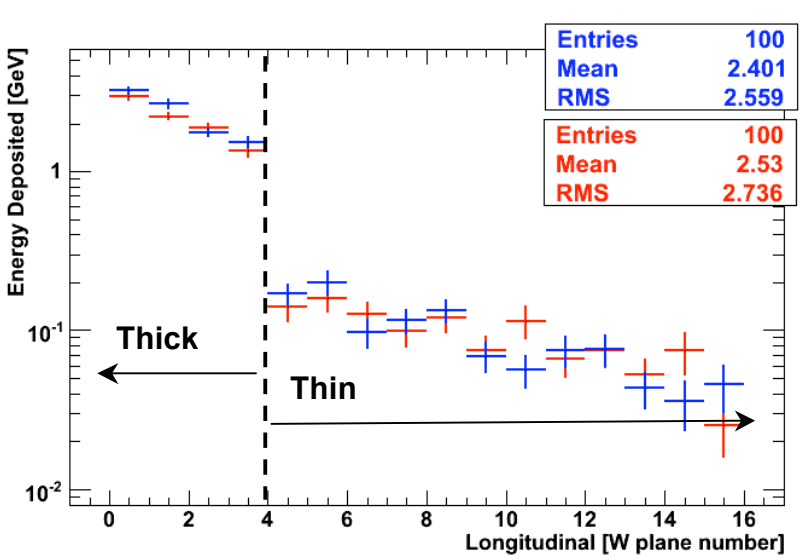
**This is the quantity that will be used in the G4-EGS5 comparison**

Yesterday I finally managed to get the EGS5 simulation working… EGS5 might be very reliable… but defining geometries is painfully tedious, and easy to make mistakes…
**FIRST comparisons are shown in the next slides**

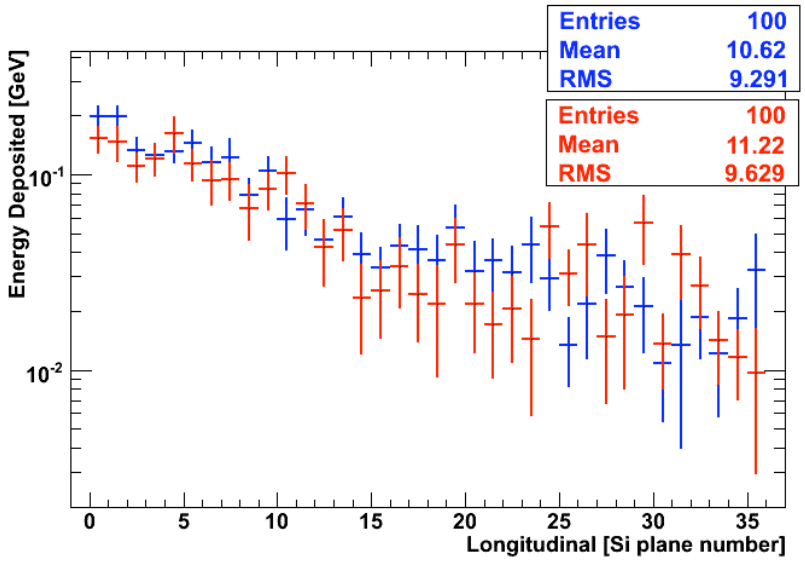
# Electrons 100 GeV

Energy deposited in Tracker GEANT 4 EGS 5

## W planes




## Si planes

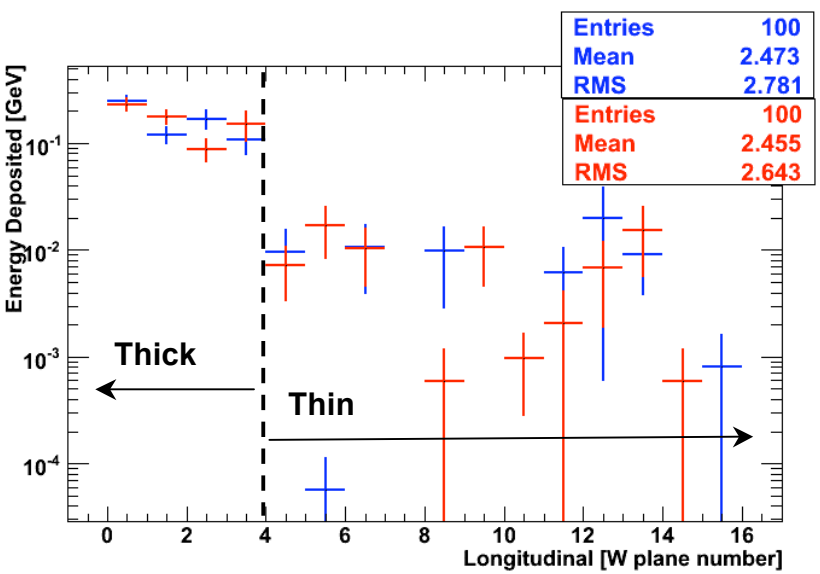



**It seems a very good agreement in energy deposited in both W and Si planes**

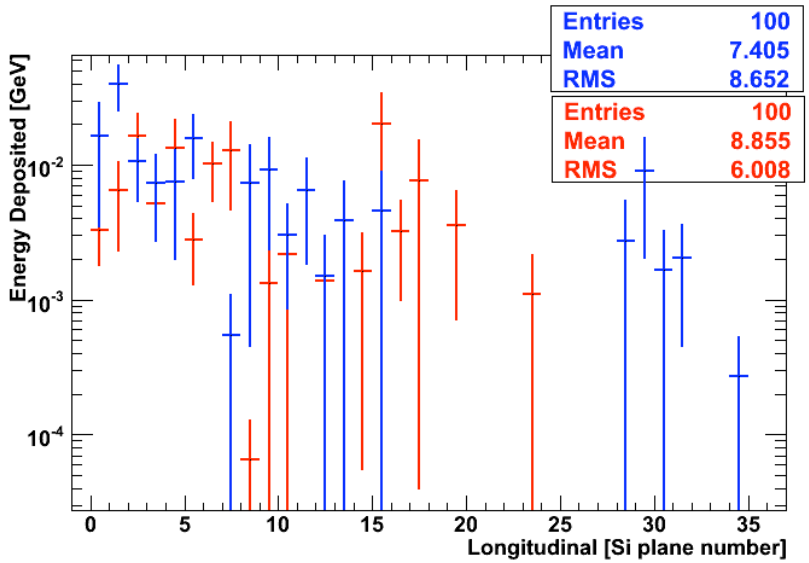
# Electrons 1 GeV

Energy deposited in Tracker **GEANT 4** **EGS 5**

## W planes




## Si planes




**It seems a very good agreement in energy deposited in both W and Si planes**

REMARK: Bin errors come from the profiles; RMS/sqrt(N) of the distribution of energy deposited in that layer by the 100 events. That distribution MIGHT NOT be gaussian for these few event, hence meaning NOT trustable errors



**I should increase statistics for a better comparison**

# Conclusions

**Setup to compare backsplash in G4 and EGS5 is ready**

**First comparisons show good agreement**

# Outlook

**- Increase number of simulated events**
**- Perform the comparison at several energies and angles:**
**E =1,100, 280, 500 (GeV)  Angles : 0, 30, 60, 80 (deg)**