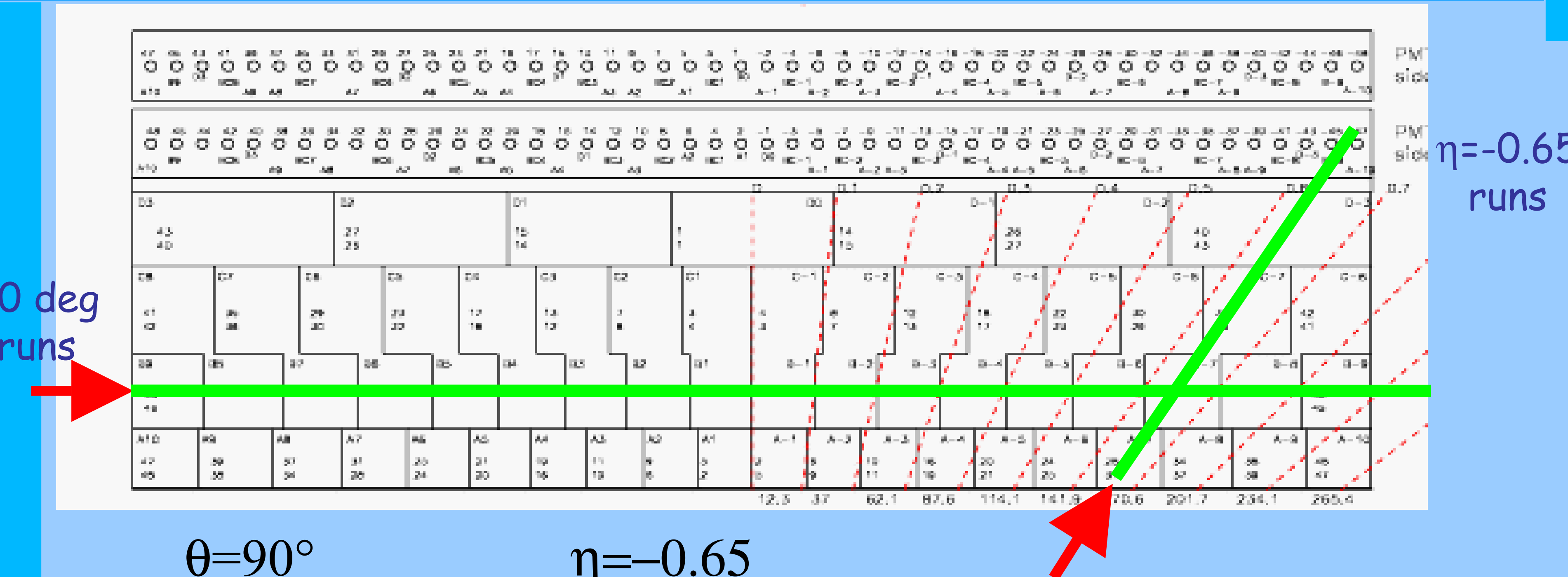
ATLAS Simulation with FADS/Goofy: electrons in TileCal

Andrea Dotti Anna Lupi
University and INFN Pisa

Physics Validation Meeting: 4th February 2004

Data sets



θ=90°

energy (GeV)	run number
10	210720
20	210563
50	210487
100	210551
180	210054

$\eta = -0.65$

energy (GeV)	run number
10	210731
20	210612
50	210479
100	210311
180	210121

- TestBeam data from July 2002
- Two different impinging directions have been analized for 5 different energies

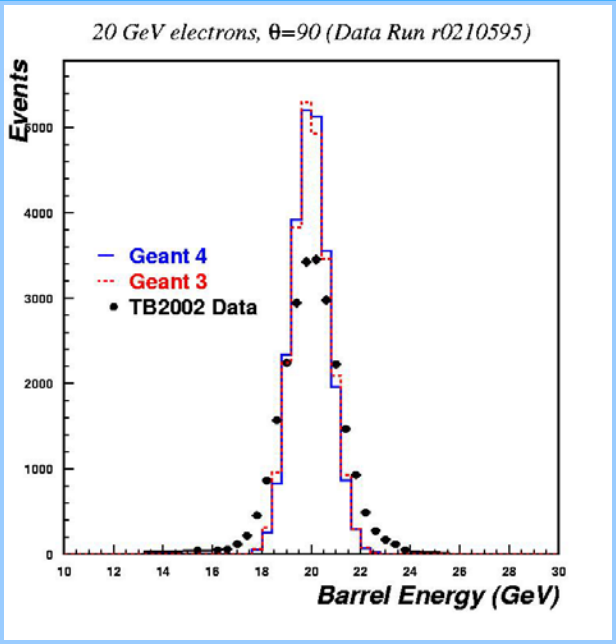
MC Simulations

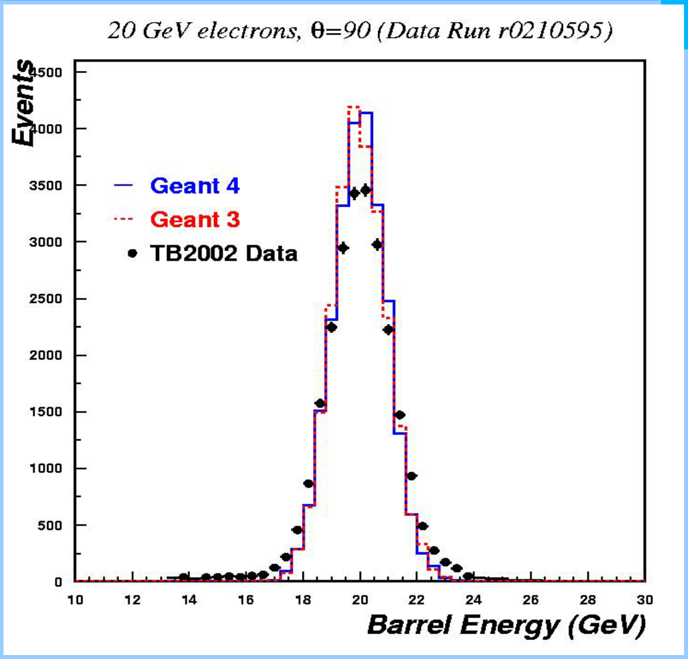
- A detailed study of signal shape showed that the contribution of eletronic noise and photostatistic fluctuations are important (in particular at low energies) for a correct simulation of the calorimeter response
- These two effects have been added in the analysis steps
- TB data have been compared with G4 TileCal simulation (FADS/Goofy, V. Tsulaya) using the two physics lists QGSP 2.7 LHEP 3.6

Calibration and noise smearing

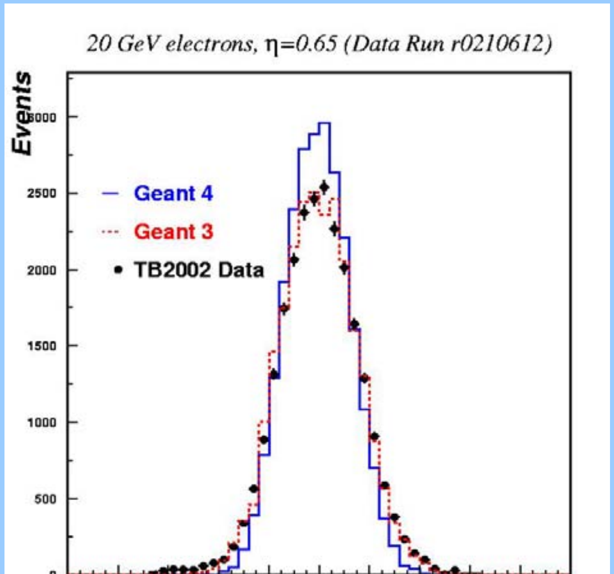
- Both Data and MC have been calibrated to the beam energy: average visible energy normalized to beam energy
- Electronic noise has been measured from data and added to simulation as a gaussian smearing
- Photostatistic fluctuations have been added as an additional source of noise in simulations (current value 53pe/GeV). Approximated as another gaussian smearing added to simulated data

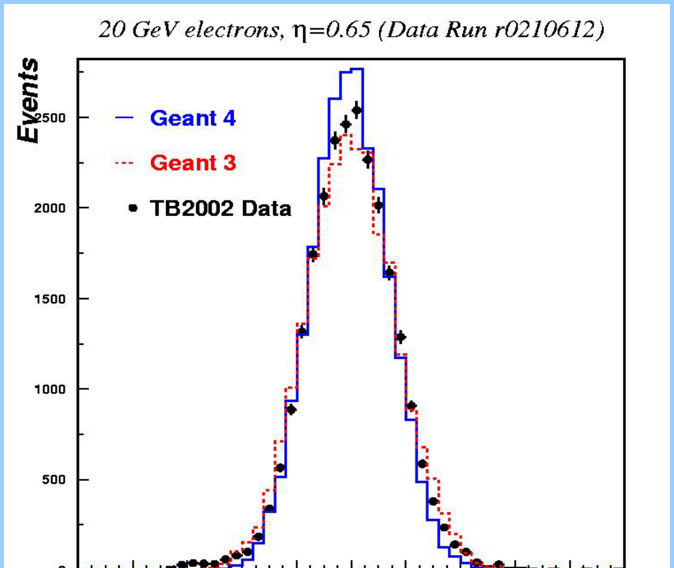
Noise and photostatistic contribution (1/3): electrons $\theta=90°$ and $\eta=-0.65$



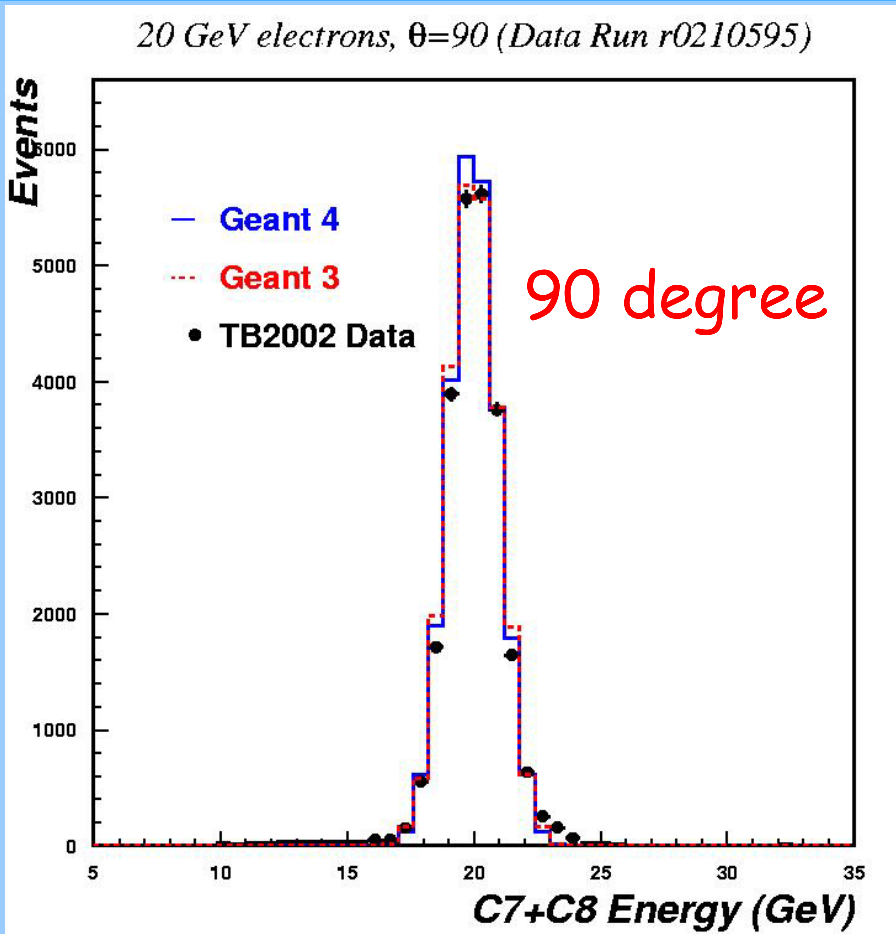


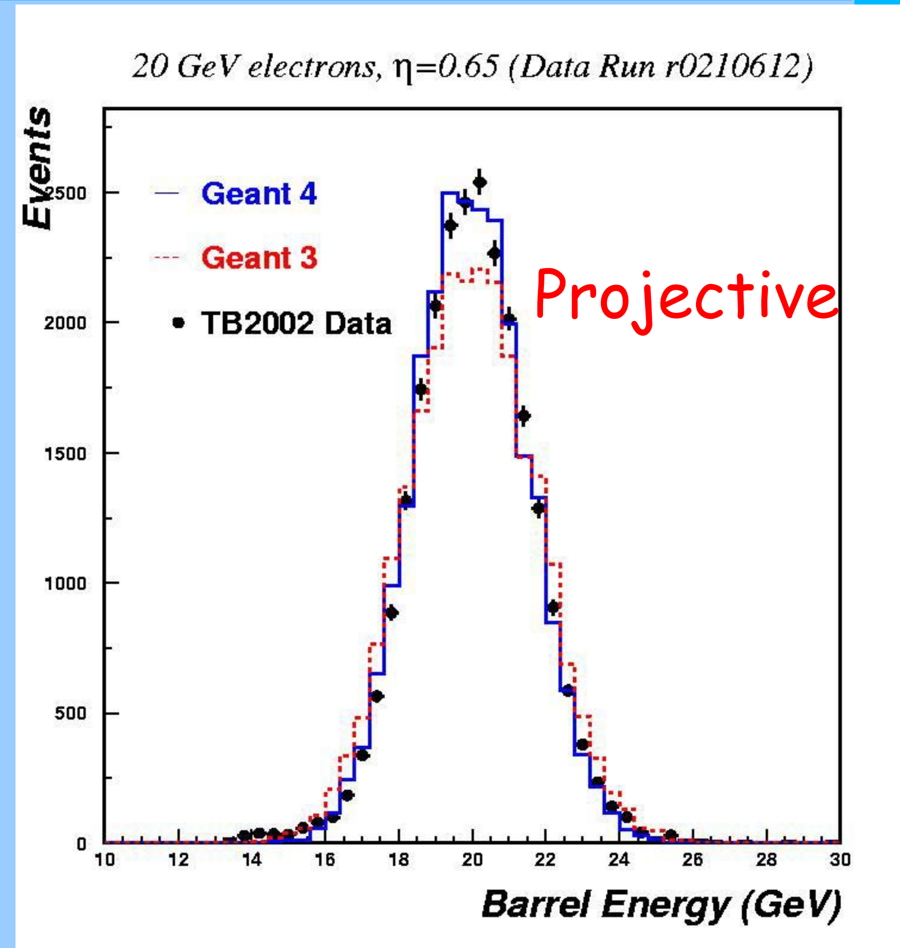
Only electronic noise added: agreement improves in both geometries





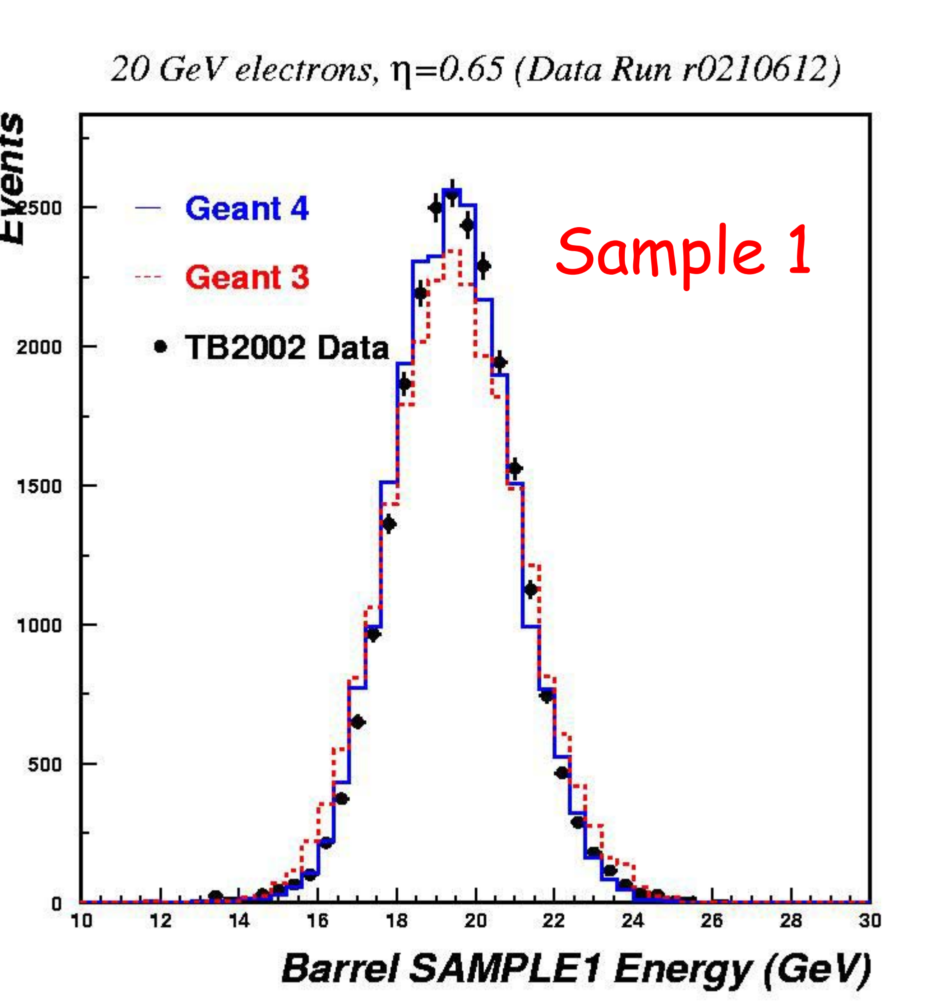
Noise and photostatistic contribution (2/3): electrons θ=90° and η=-0.65

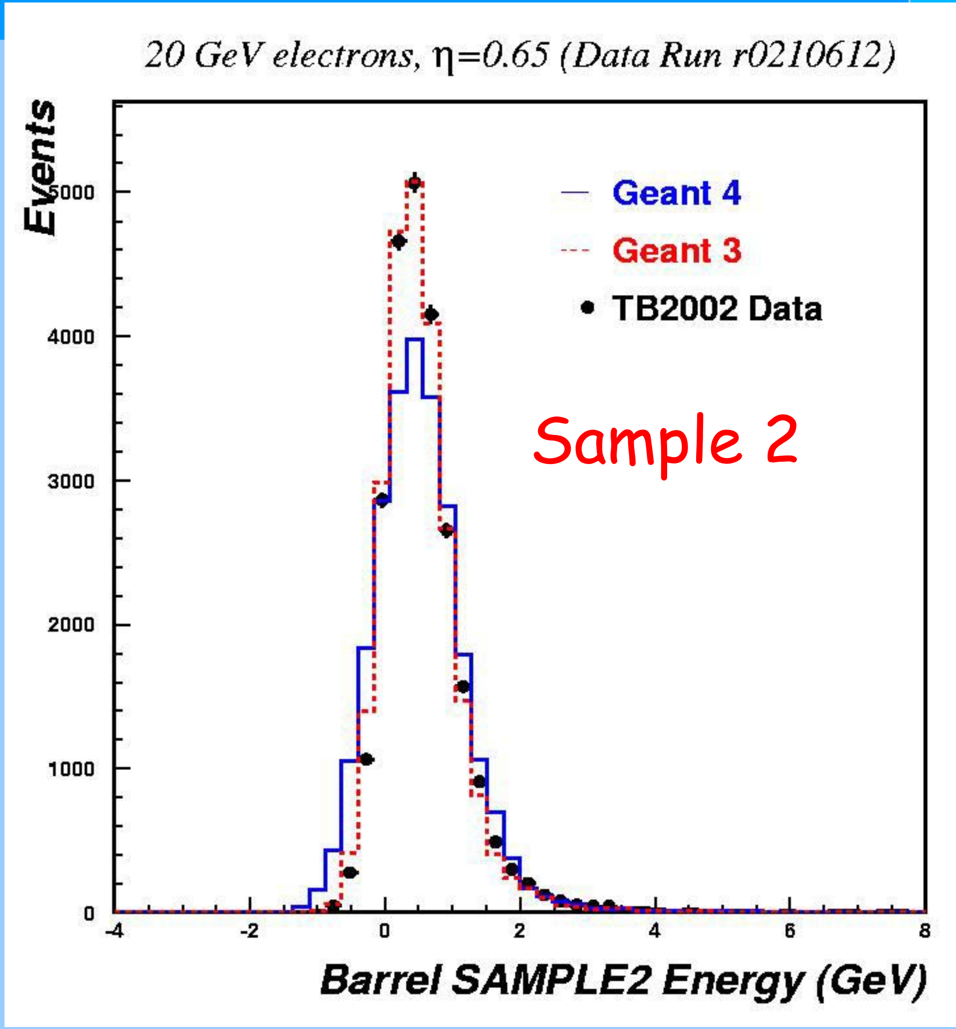




Including noise and photostatistic fluctuations the agreement is even better for both the geometries

Noise and photostatistic contribution (3/3): longitudinal shower profile

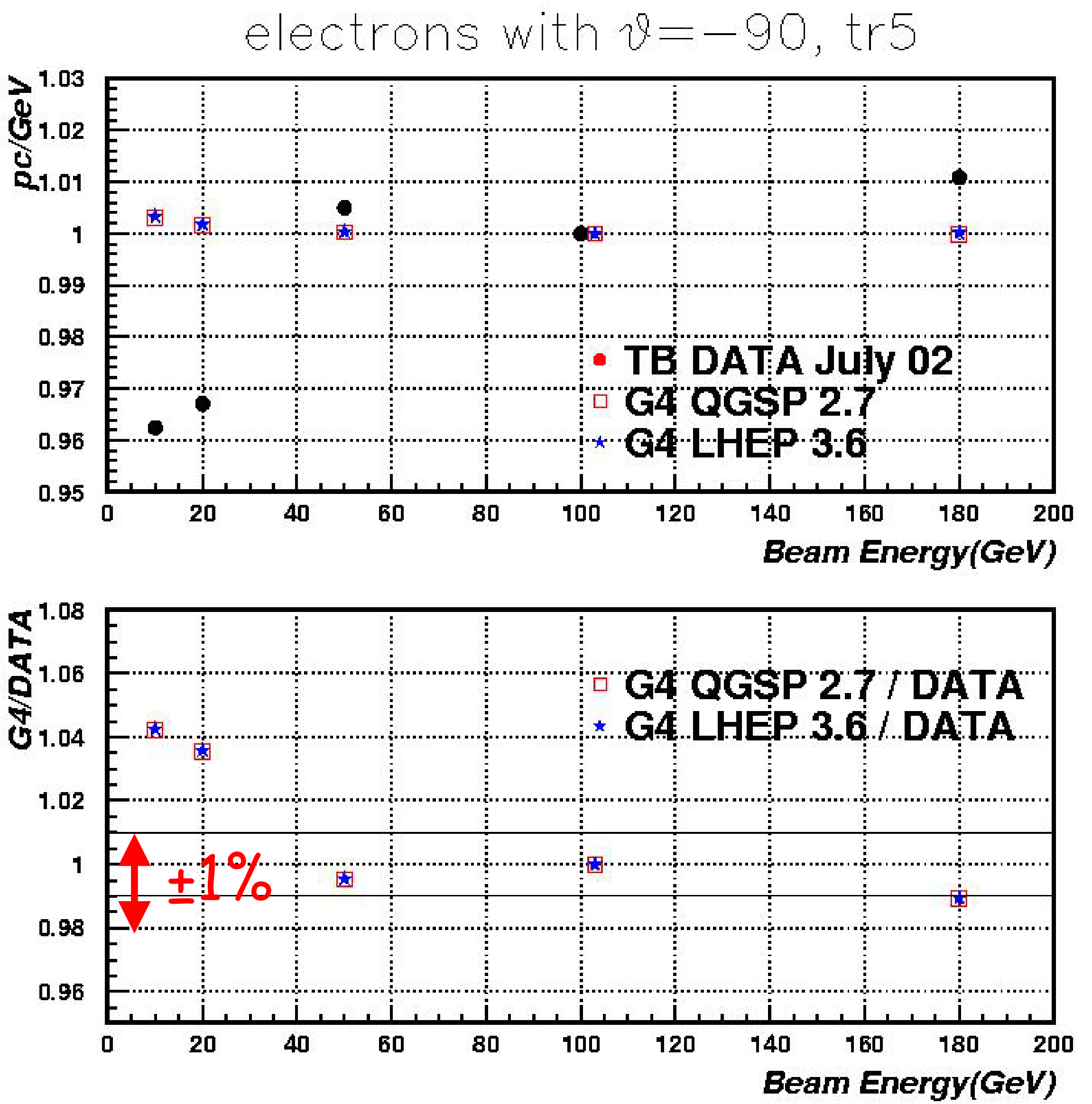




In G4 the shower tail (sample2) is less precisely simulated.

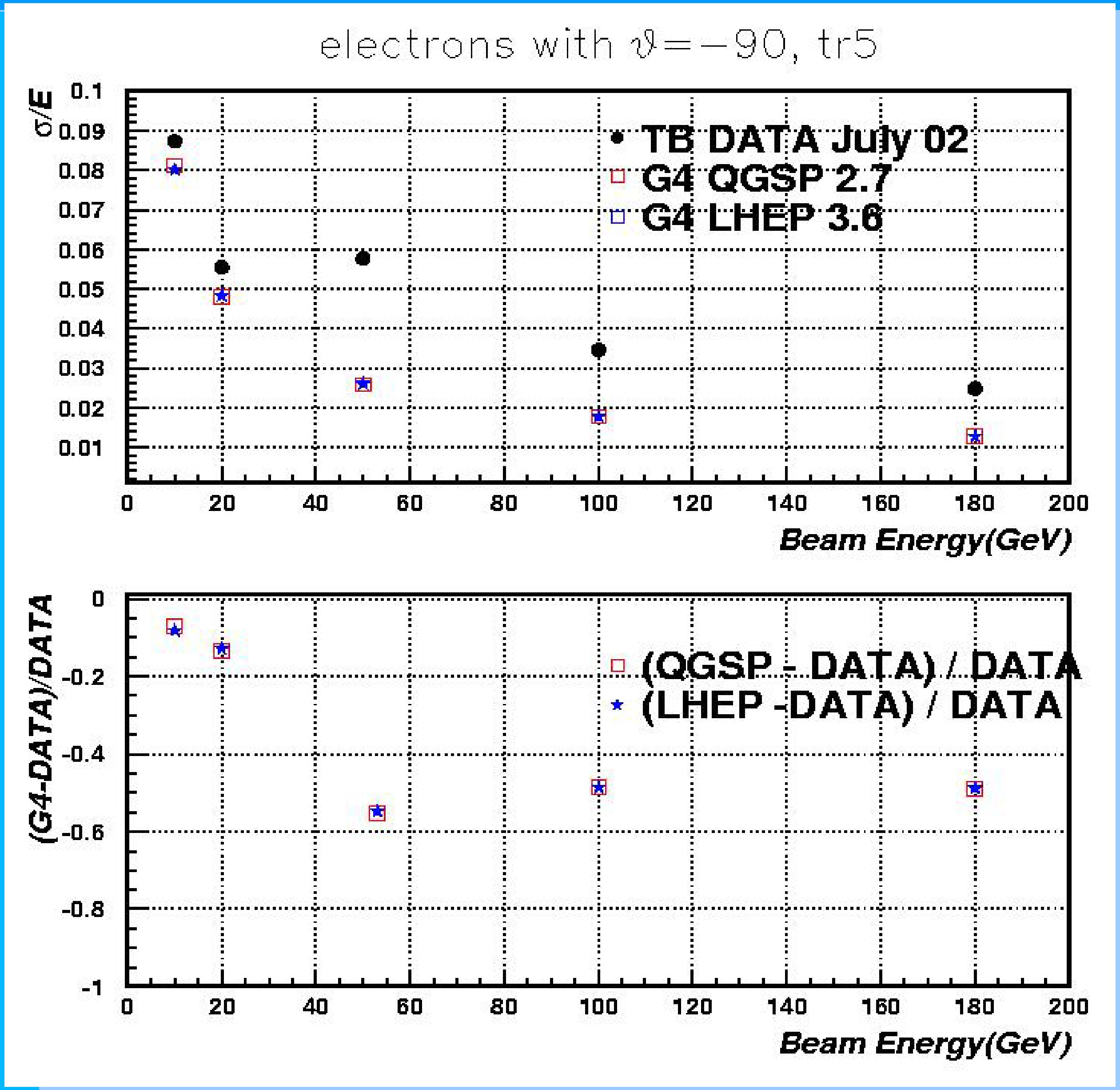
θ=90° (tile row 5)

Calibration Constant (pC/GeV) vs E



- *As expected no changes* ...
- em physics in the two list...
- Data are normalized to th...
- 100 GeV point (for real da...
- pC/GeV=1.2)
- *At low energy (10,20 GeV...*
- electrons have lower signa...
- (not in MC), probably a
- problem related to: beam
- energy, electronic
- amplification... (under
- investigation)
- Excluding these points th...
- agreement is ±1%

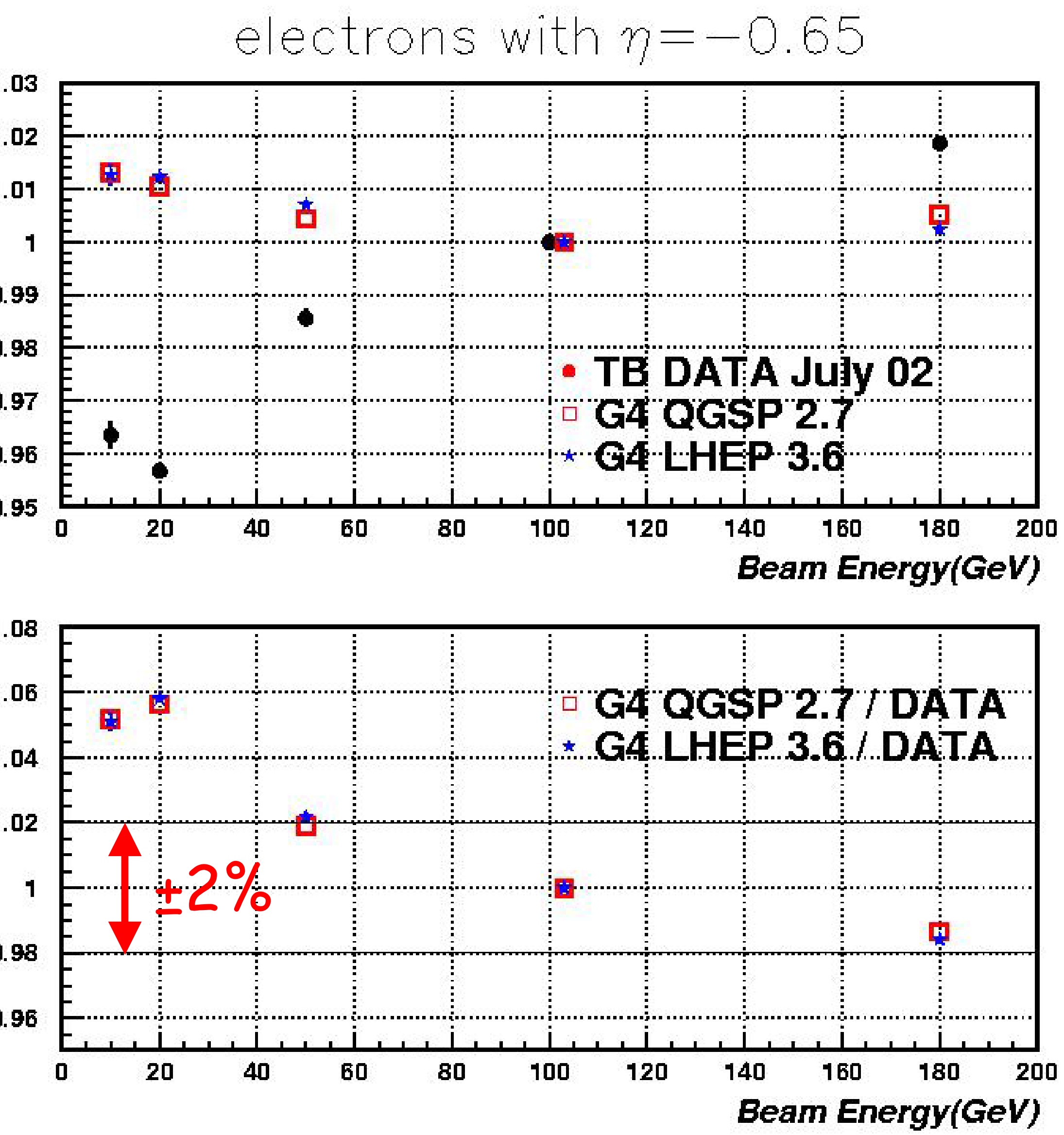
σ/E vs E



- The agreement in this geometry is not satisfactory

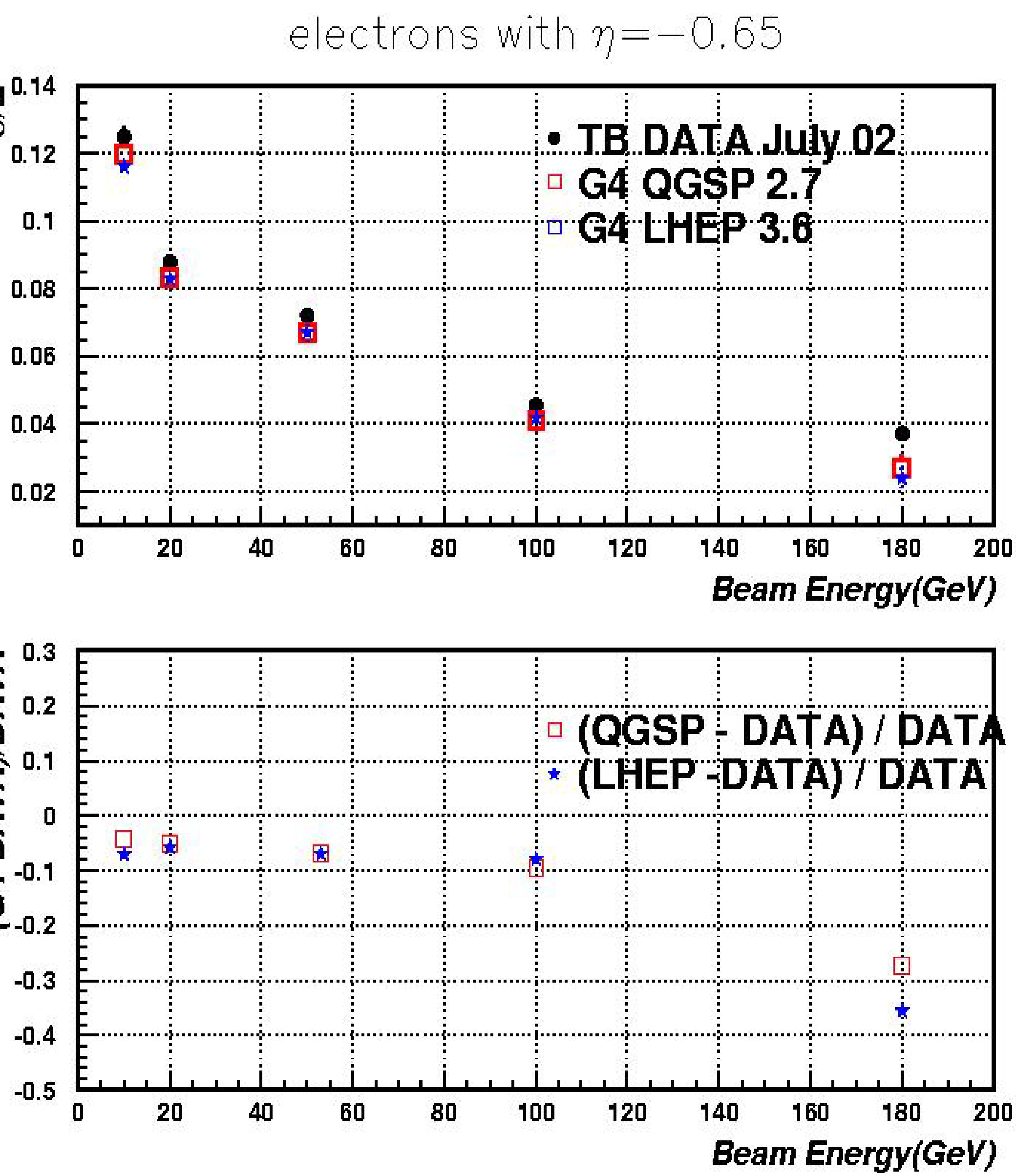
$\eta = -0.65$

pC/GeV vs E



- Here a dependence on E in data is visible (~6%) not visible in G4. The problem is under study
- Again at low energies with TB data response is lower than expected
- For E>20GeV the agreement is ±2%

σ/E vs E



- Very Good agreement between data and simulations

Fit results

	a/sqrt(E)	b
QGSP	(34±1)%	(0.9±0.2
LHEP	(34.5±0.8)%	(0.7±0.1
DATA	(35±1)%	(1.1±0.1)

Conclusions

- The electronic noise and photostatistic is important to be included to correctly simulate the shapes
- Total energy deposit is correctly simulated in G4, energy deposit in single samples seem to show larger distributions in shower tails
- pC/GeV constant is well described for high energies (>20GeV)
- σ/E for electron is well simulated at all energies for projective data while at 90° data show a worst resolution (by a factor ~50%)