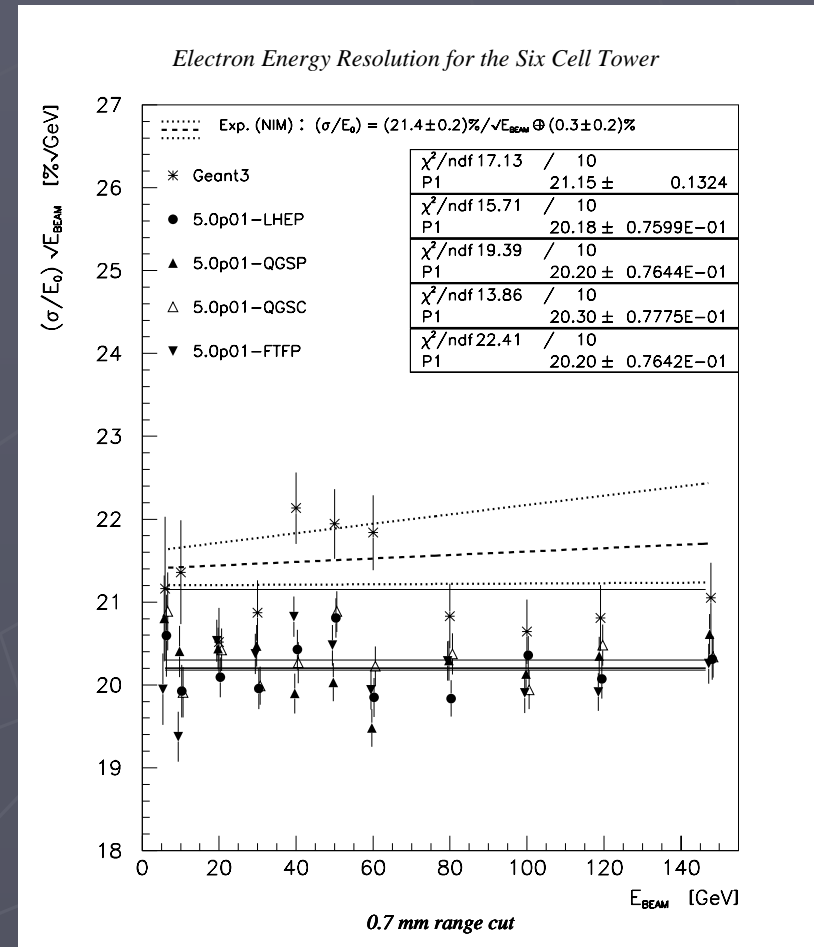# Geant4 simulation of ATLAS HEC TESTBEAM

V.Ivanchenko & M.Maire
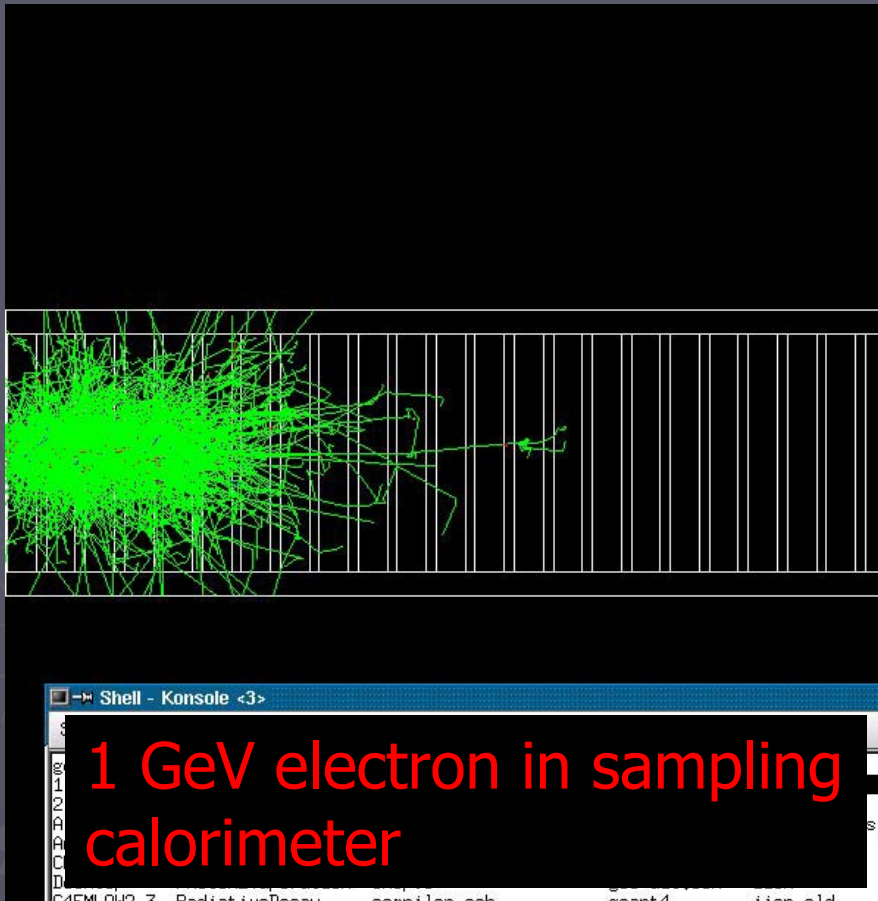
A look from outside

Outline and motivation

- ► **Motivation**
- ► **TestEm3**
- ► **G4/G3 comparison**
- ► **Study on cuts**
- ► **Discussion**
- ► **All our results are very preliminary**
- ► **Thanks to A.Kiryunin for detailed information**

Electron Energy Resolution for the Six Cell Tower

Exp. (NIM) : $(\sigma/E_0) = (21.4\pm0.2)\%/\sqrt{E_{BEAM}} \oplus (0.3\pm0.2)\%$

	χ^2/ndf		
* Geant3	17.13 / 10	P1	21.15 ± 0.1324
● 5.0p01–LHEP	15.71 / 10	P1	20.18 ± 0.7599E–01
▲ 5.0p01–QGSP	19.39 / 10	P1	20.20 ± 0.7644E–01
△ 5.0p01–QGSC	13.86 / 10	P1	20.30 ± 0.7775E–01
▼ 5.0p01–FTFP	22.41 / 10	P1	20.20 ± 0.7642E–01

$(\sigma/E_0)\ \sqrt{E_{BEAM}}$ [%√/GeV]

E_{BEAM} [GeV]

0.7 mm range cut

TestEm3

1 GeV electron in sampling calorimeter

- ► Standard EM test
- ► G3 and G4 geometry are identical
- ► 24 layers of lAr/Cu
- ► 0.6 X_0 in front
- ► All energy deposition inside lAr is collected
- ► No detector effects

Comments to TestEm3 simulation

► G4 releases 5.2 or 6.0 were used

► EM physics in 6.0 was significantly updated

  ► Model design of energy loss processes

  ► Integral approach

  ► Precise range feature

  ► Multiple scattering updated

► The main difference between 5.0 and 5.2 is in multiple scattering

1 GeV e⁻ simulation G3/G4 for different cuts in range (G4 6.0)
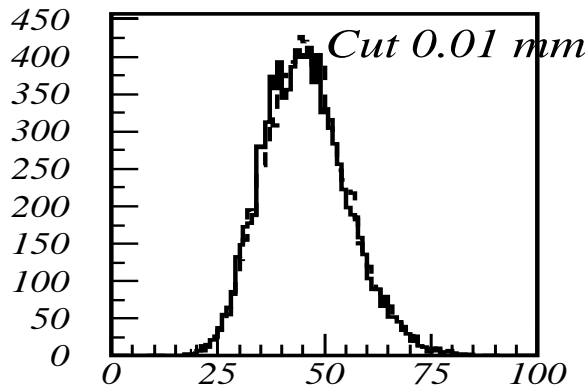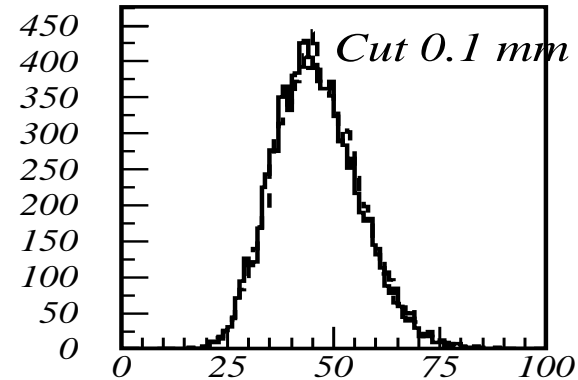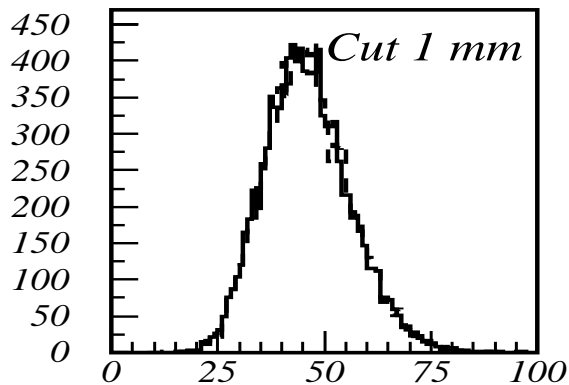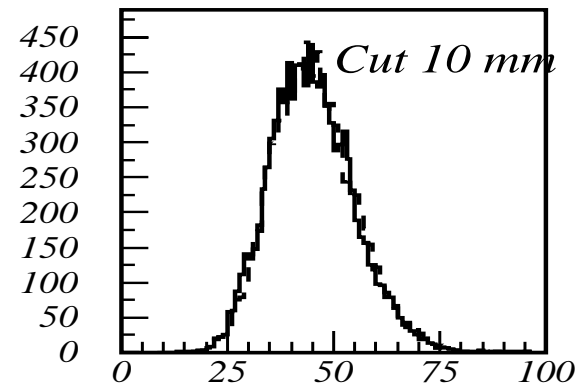
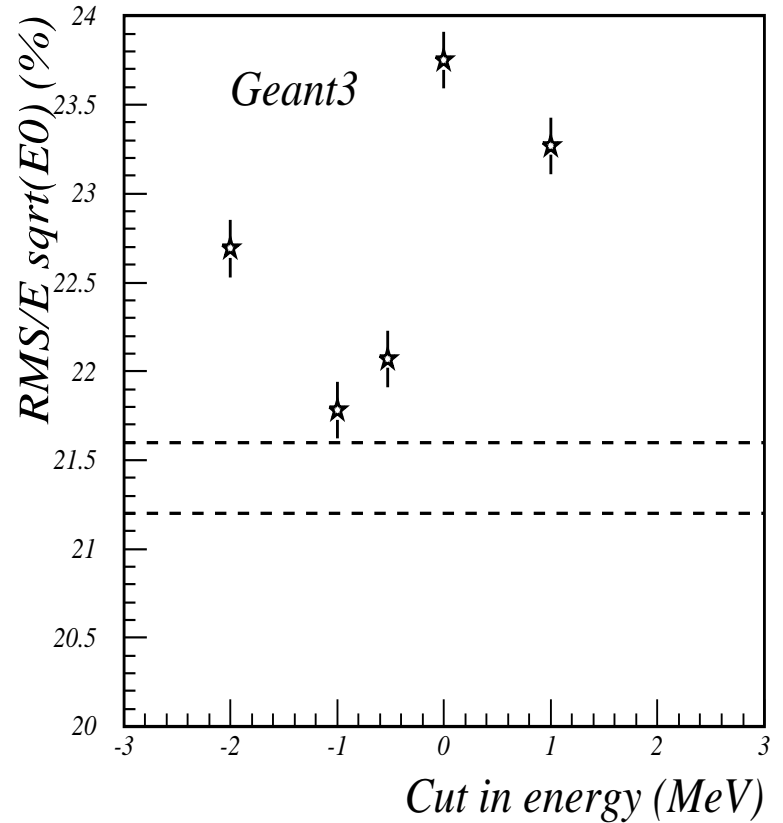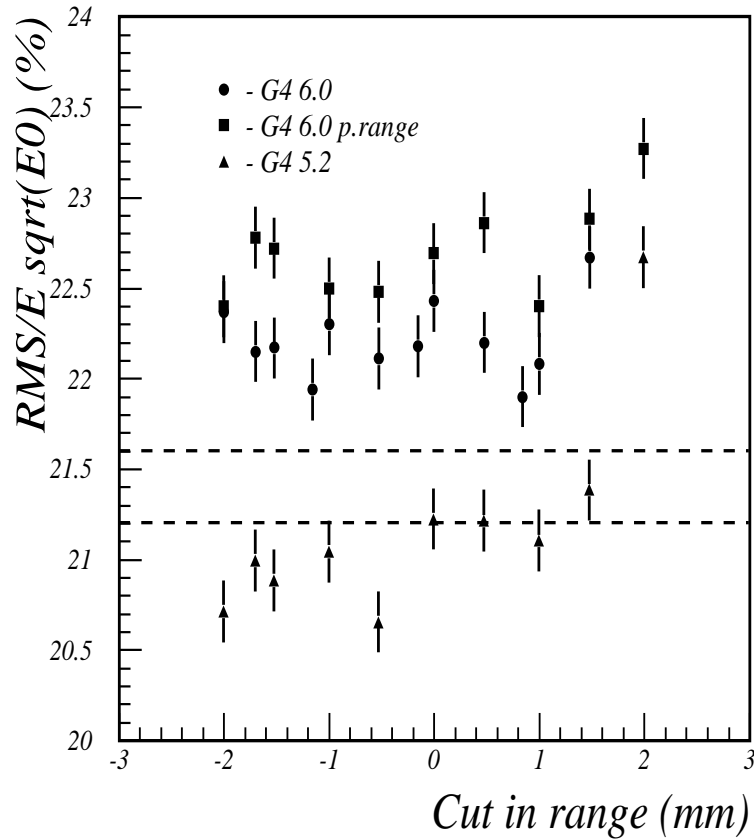# Peak energy deposition for 1 GeV e⁻
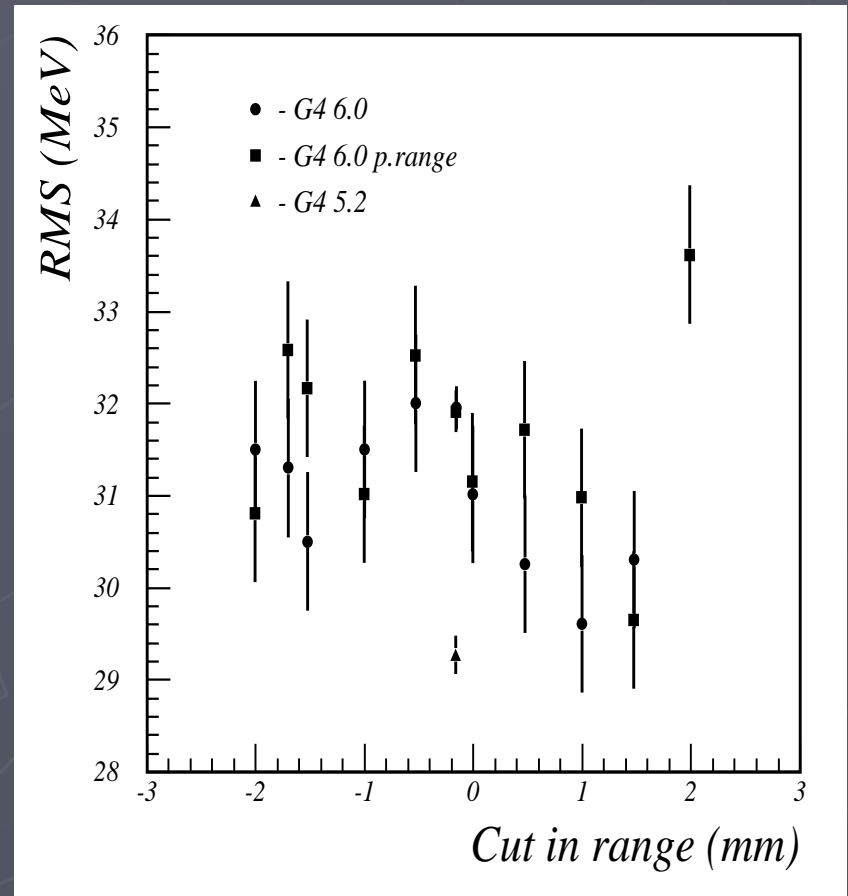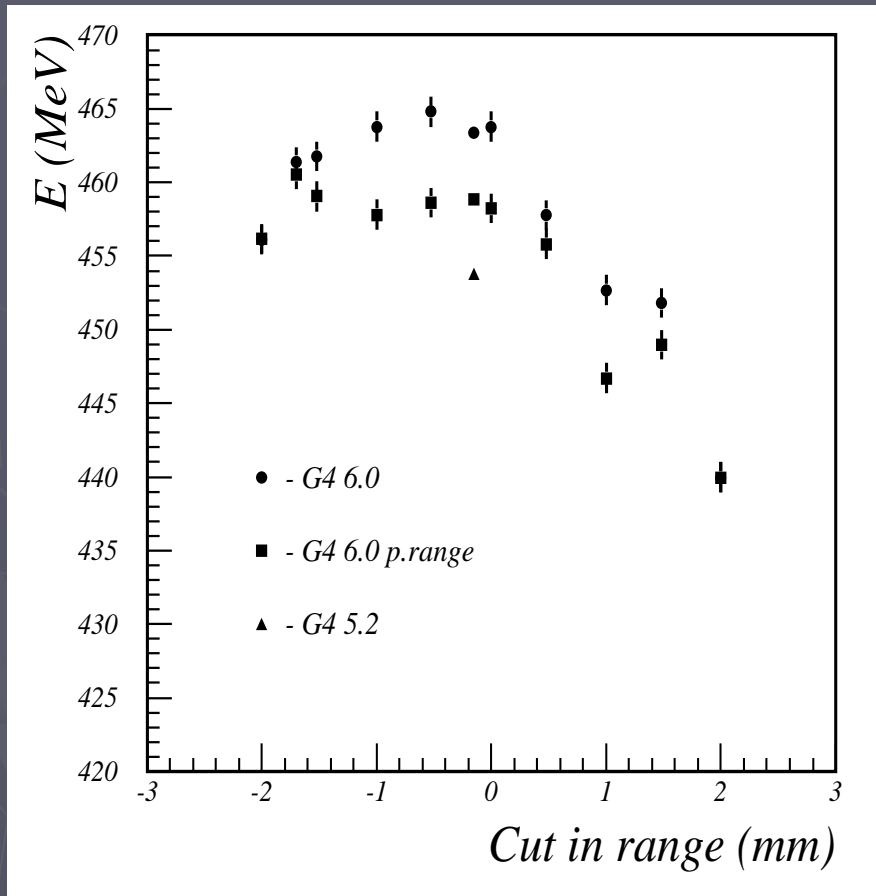## (fit by logarithmic Gauss)
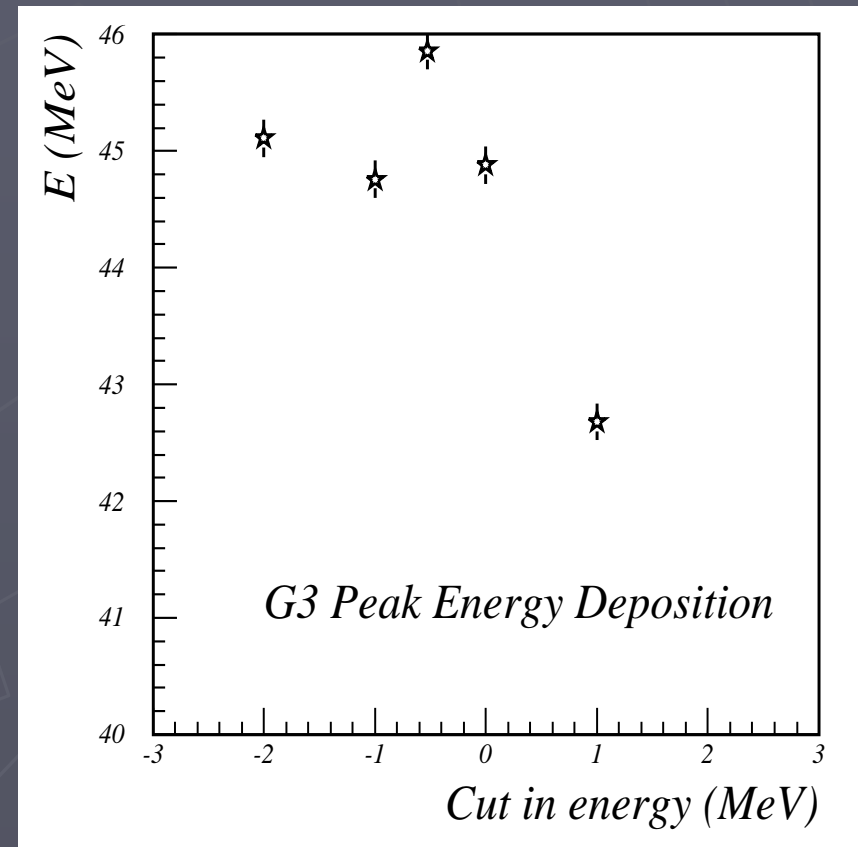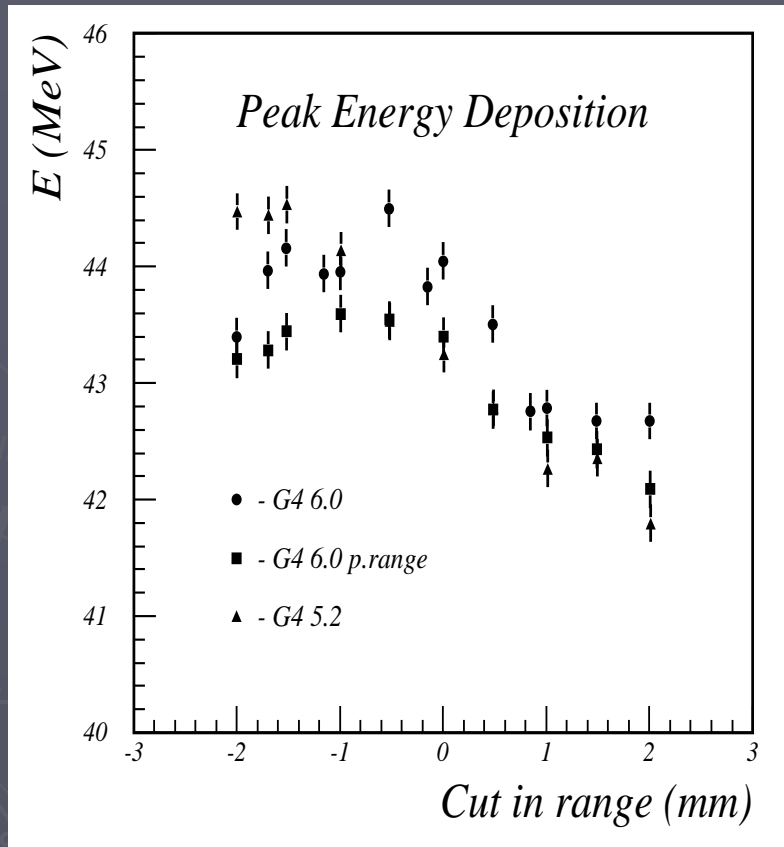
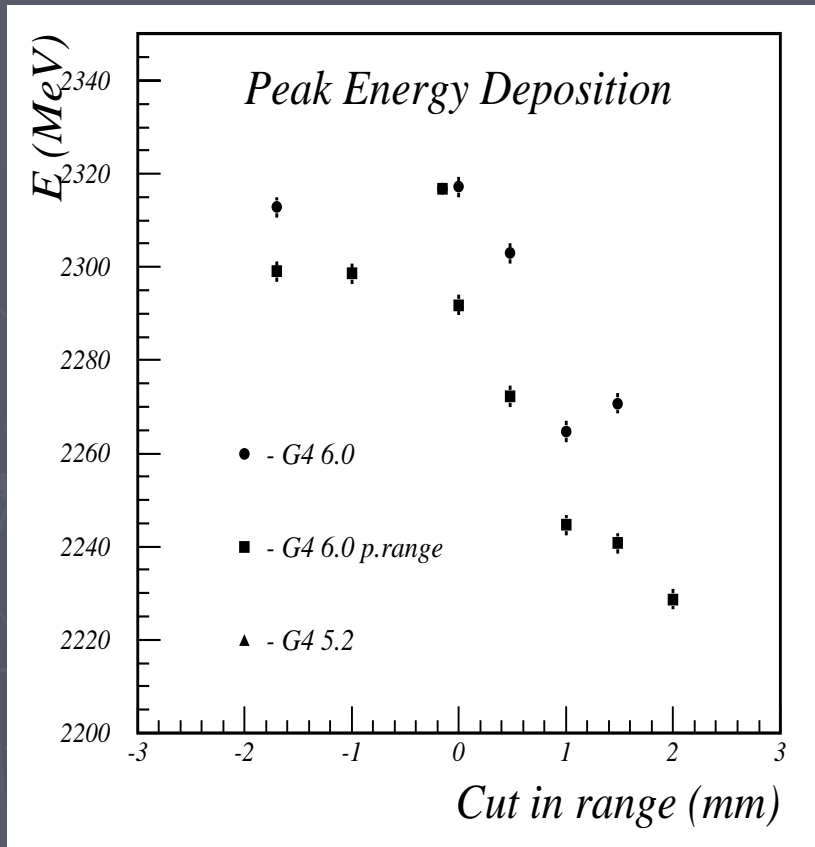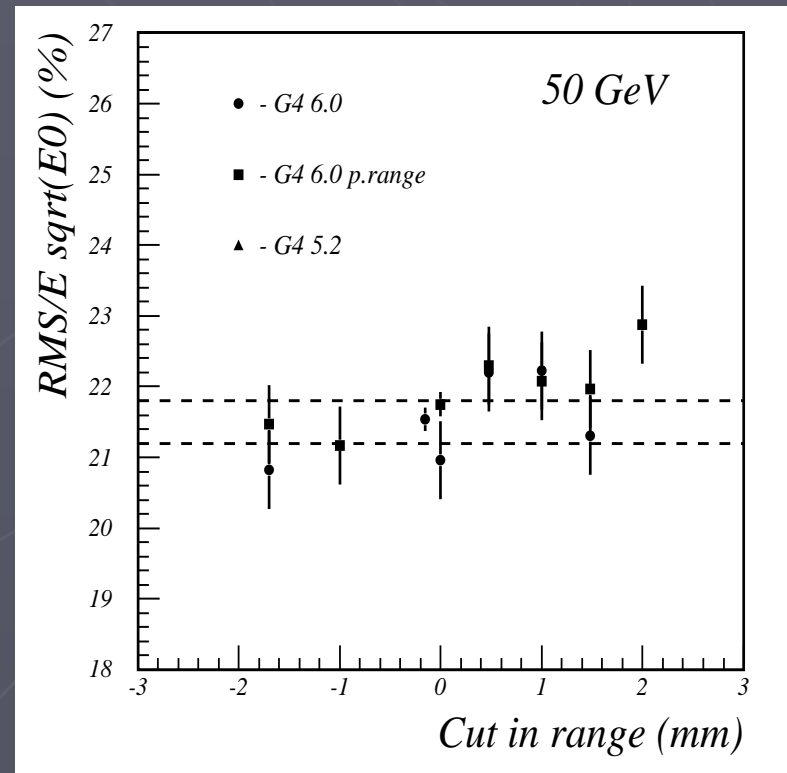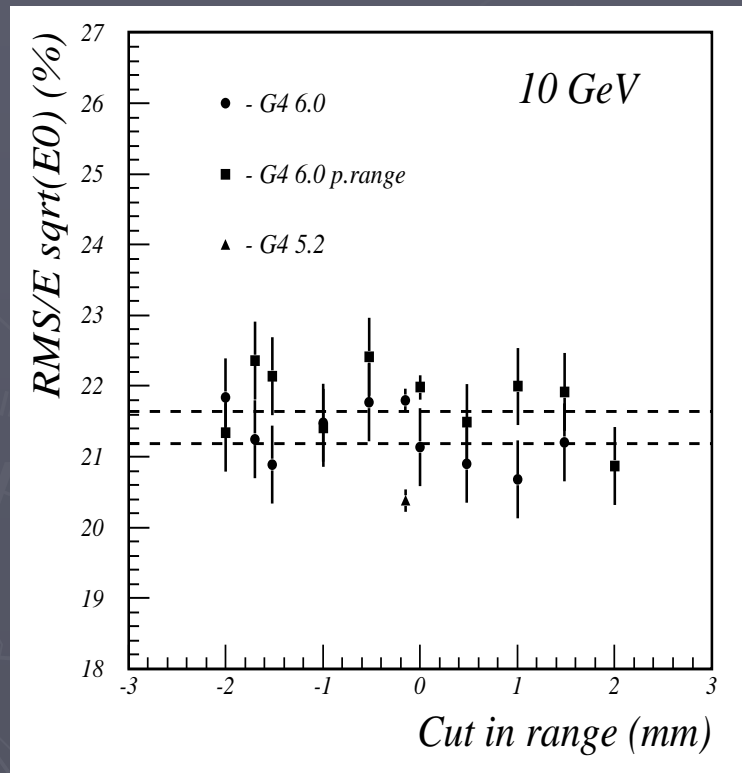# FWHM/2.36 of energy deposition for 1 GeV e⁻
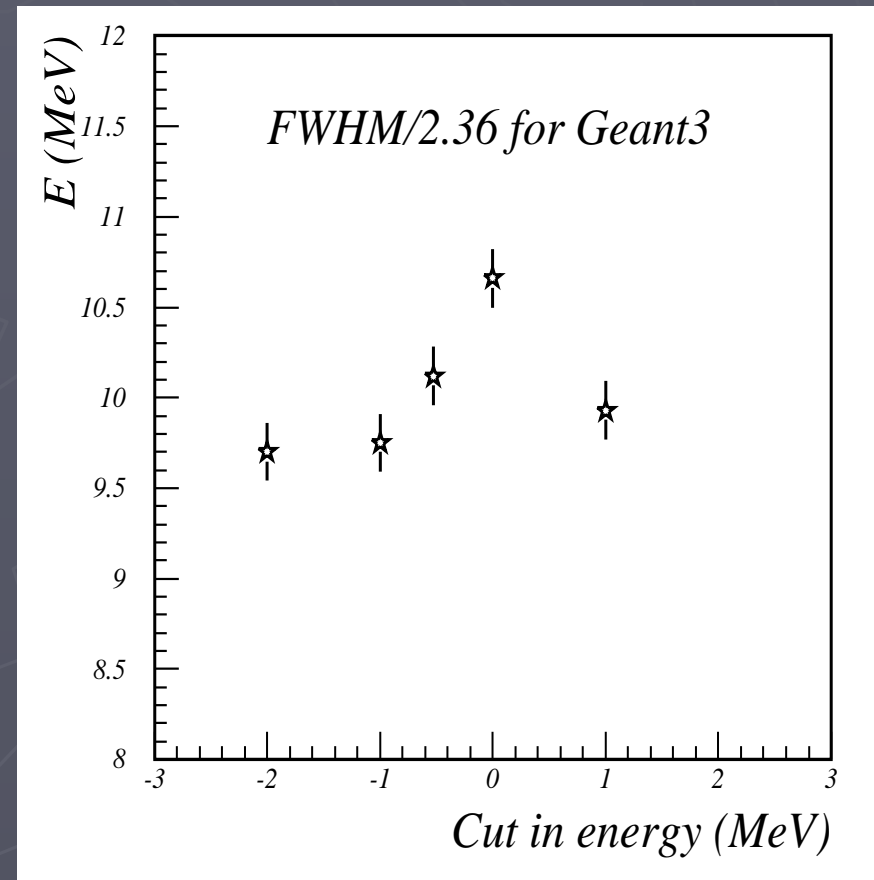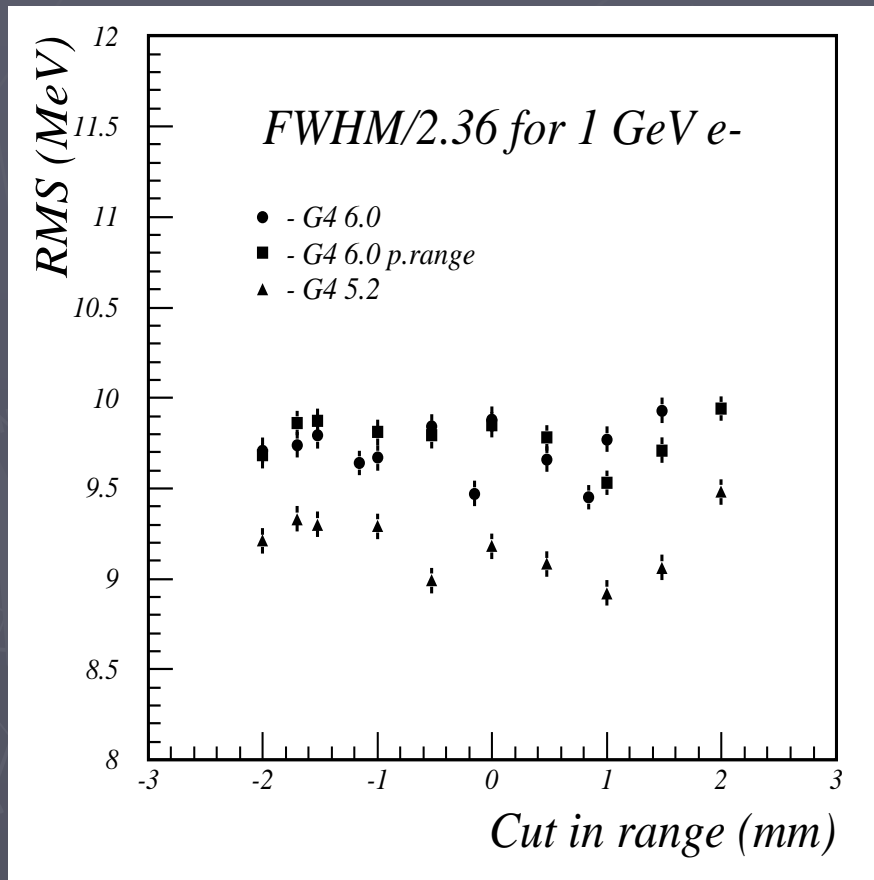
Resolution for 1 GeV e⁻
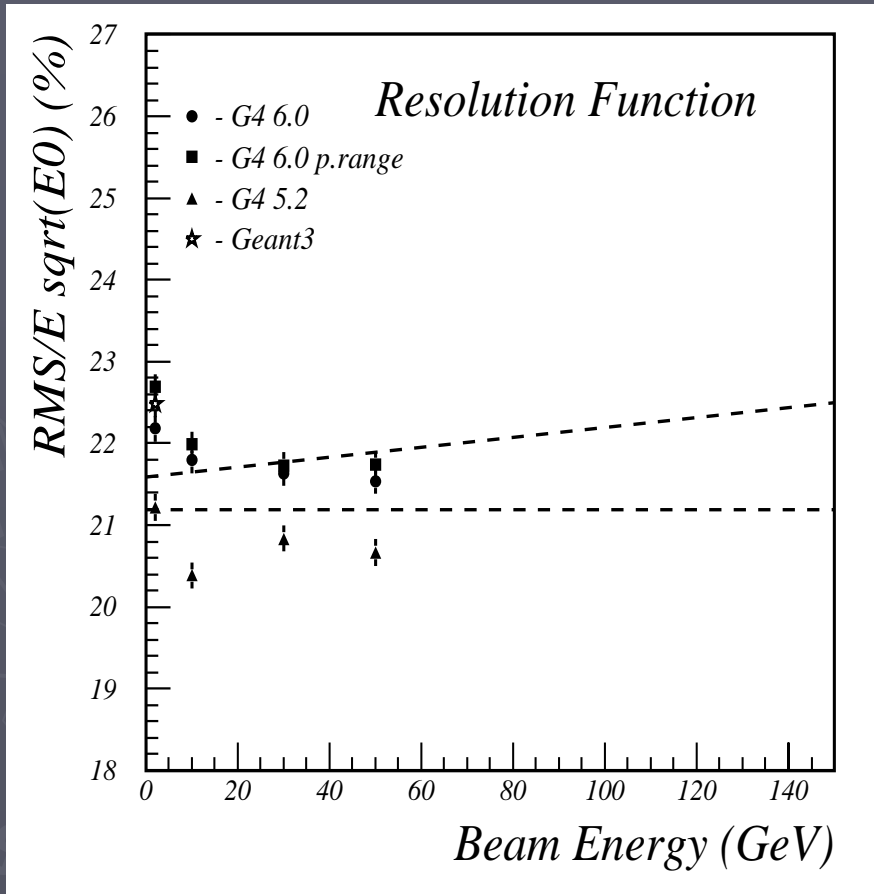
G4 simulation for 10 GeV e⁻

Geant4 simulation for 50 GeV e⁻
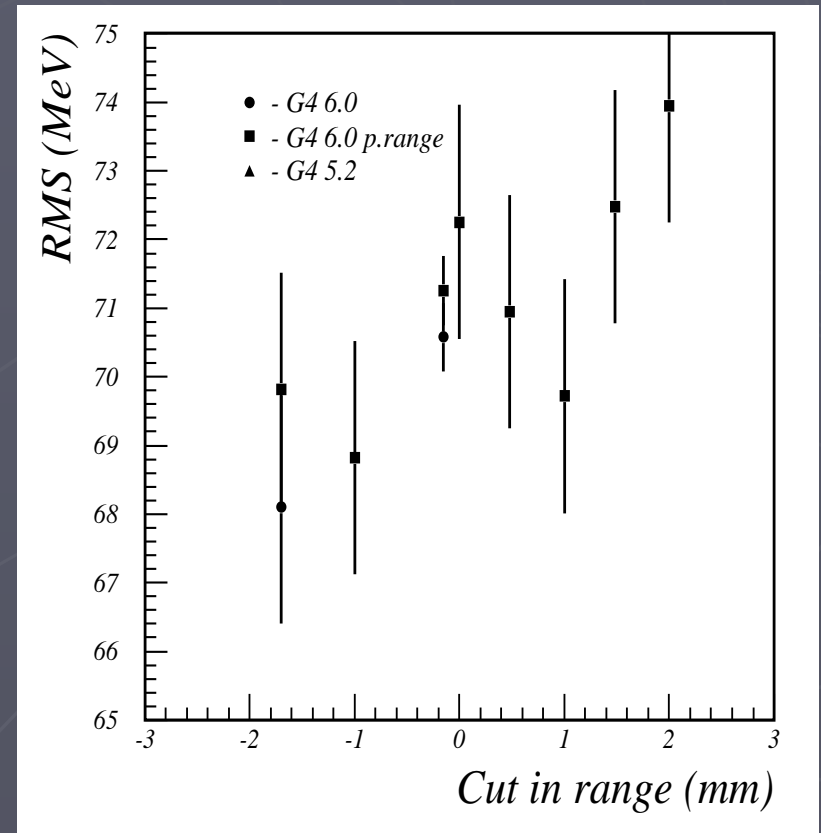
Resolution for high energy e⁻ by G4 (dashed lines – testbeam data)

Very preliminary results

► There is a trend to better agreement between testbeam resolution and G4 simulation from version 5.0 to 6.0

Very preliminary conclusions

► TestEm3 can used as benchmark on sampling calorimeter

► G4 6.0 is in a reasonable agreement with G3 and data

► G4 6.0 is more stable against cut in range

► There are still open issuers to be investigated

To Do list

► We need to study several problems effects results on level 1-2% in energy deposition

  ► Fluctuations of energy loss
  ► Boundary crossing
  ► Multiple scattering

► Effect of gamma-neucleus, electro-nucleus interactions on EM shower parameters to be studied

► It will be desired if ATLAS experts will try G4 6.0 with new hadronic PhysicsList and with pure EM PhysicsLists