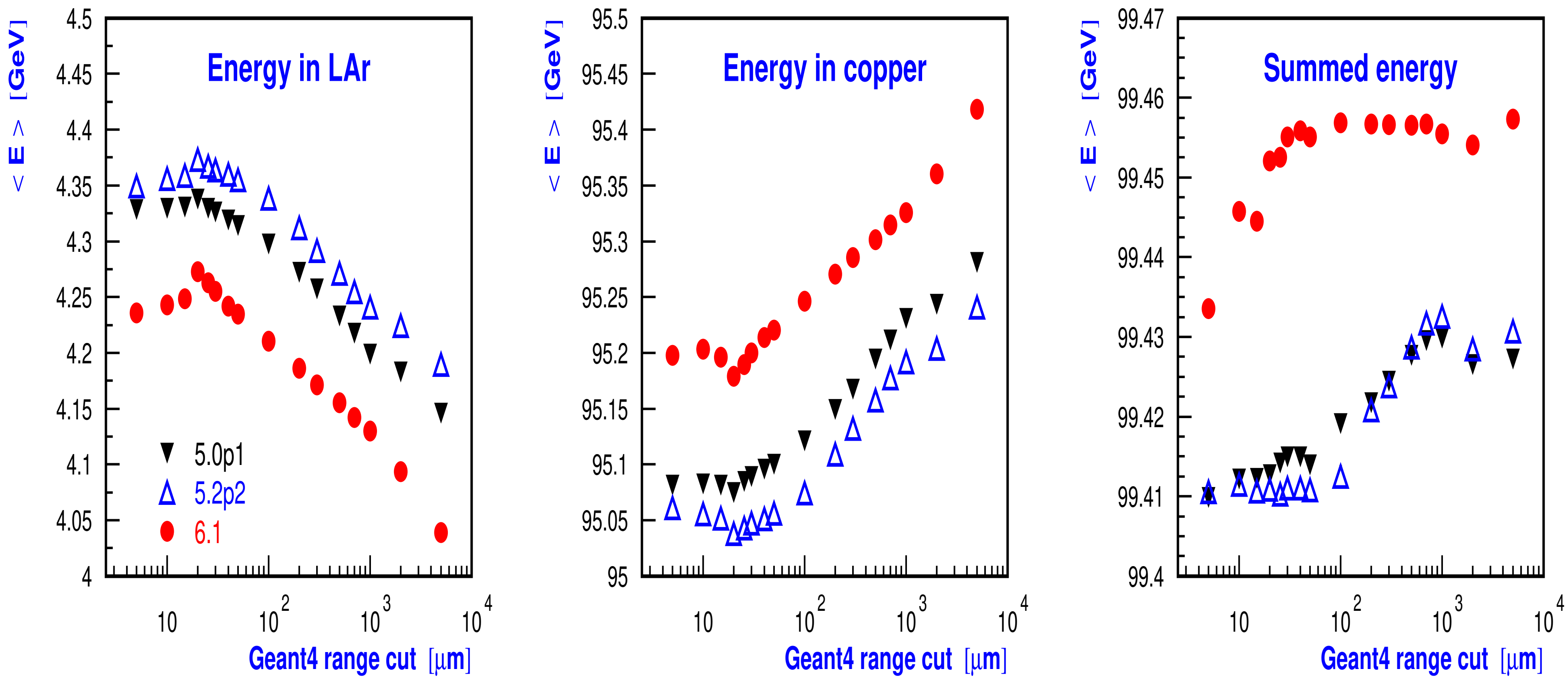
ATLAS HEC Stand-Alone Testbeam: First Results of Electron Simulations with Geant4-6.1

A. Kiryunin, D. Salihagić, P. Schacht, P. Strizenec

- Beam tests of HEC serial modules (2000, 2001)
- 100 GeV electrons (at impact point J)
- Compared samples
  - Geant4:
    - versions 5.0p1, 5.2p2 and 6.1
    - scan over the range cut (5 μm - 5 mm)
  - Geant3 (3.21)
    - 100 keV transport and 1 MeV production cuts
  - Experiment

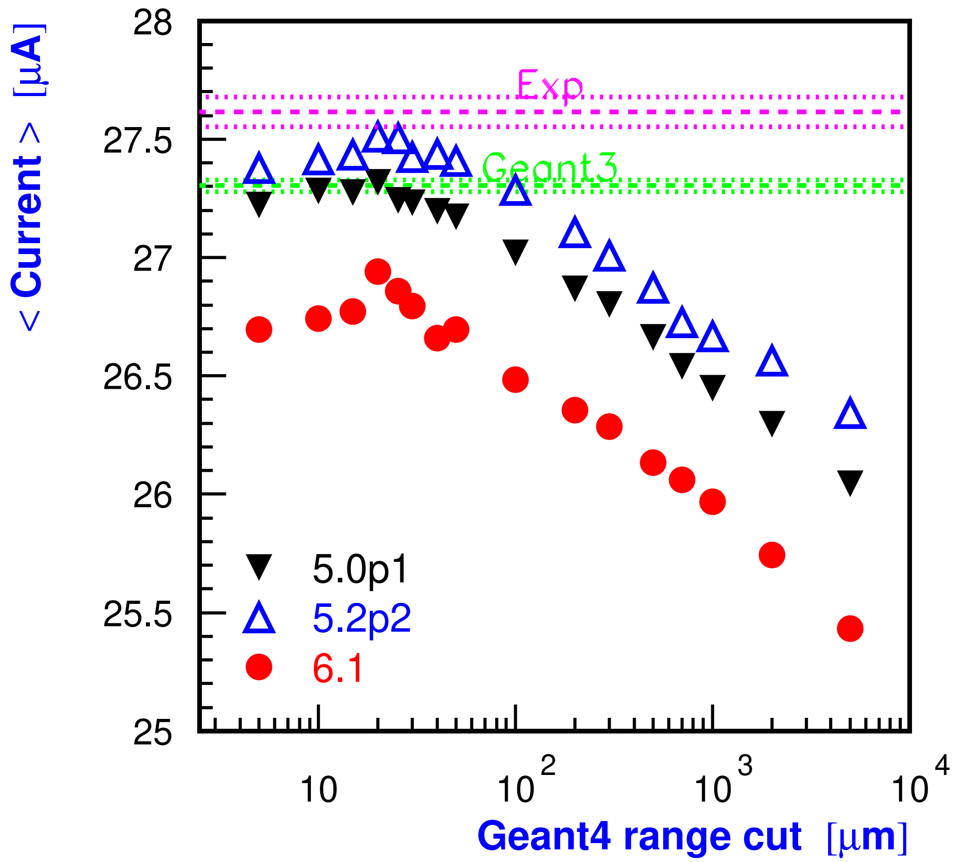
Average deposited energy



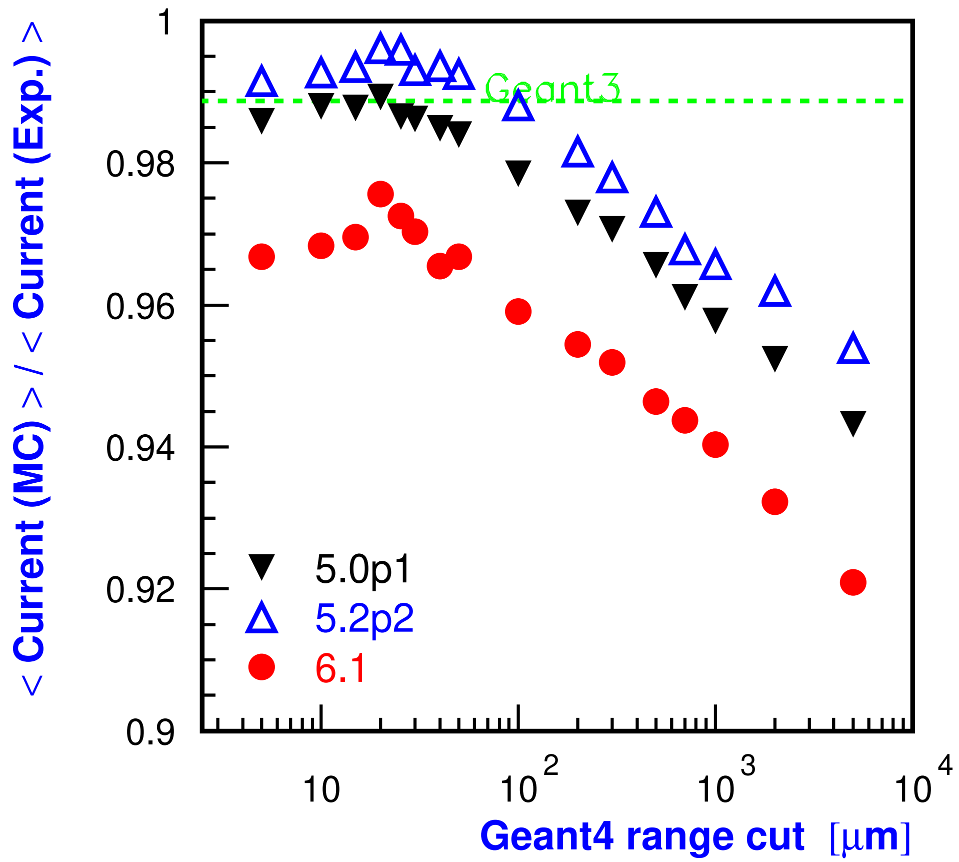
Signal in the most loaded cell

- Cell with the maximal average signal

- Current = Visible Energy $\times$ 7.135 μA/GeV



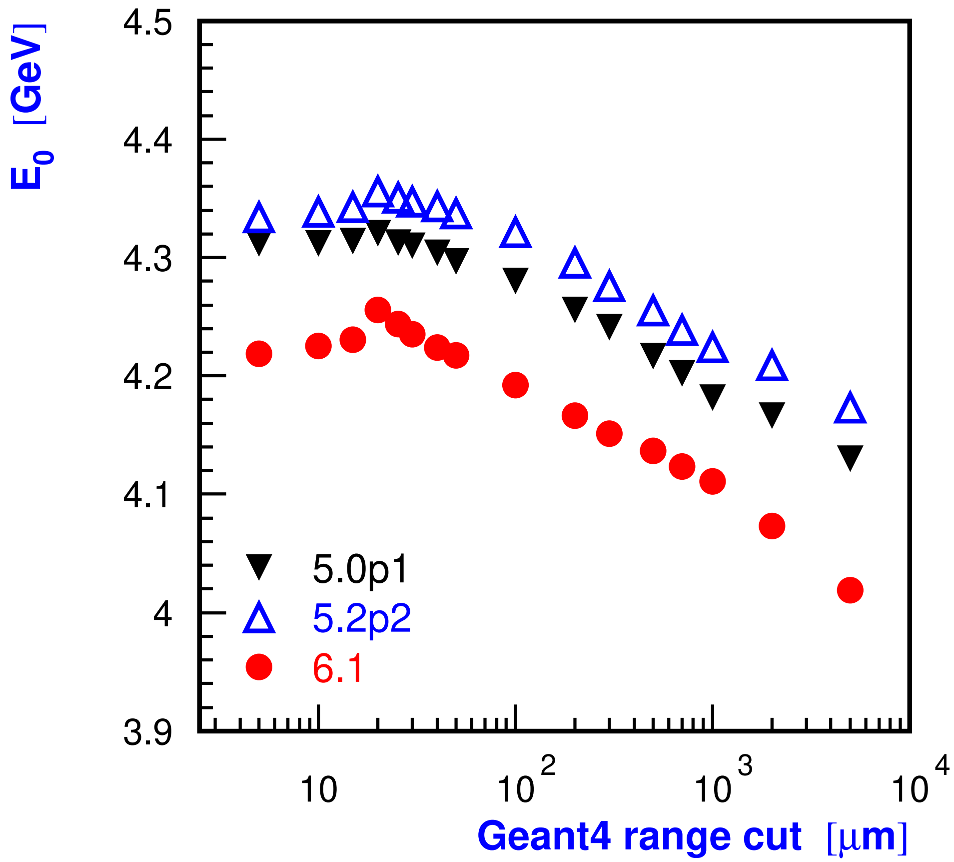
Signal in the most loaded cell



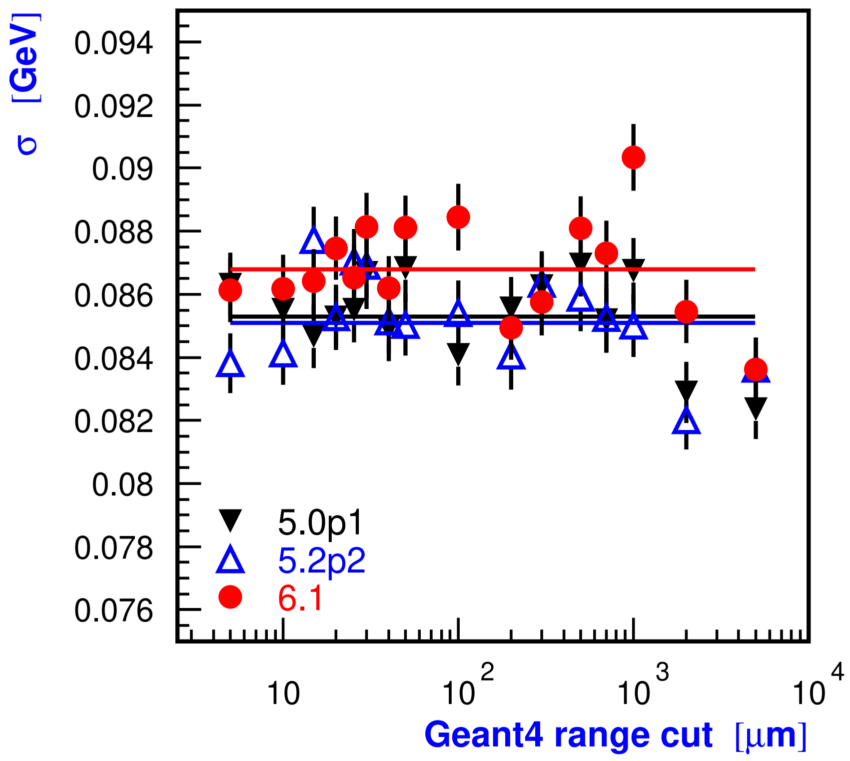
- 20 μm range cut selected for further simulations
- $\sim$2.5 % difference between experimental results and Geant4-6.1 predictions

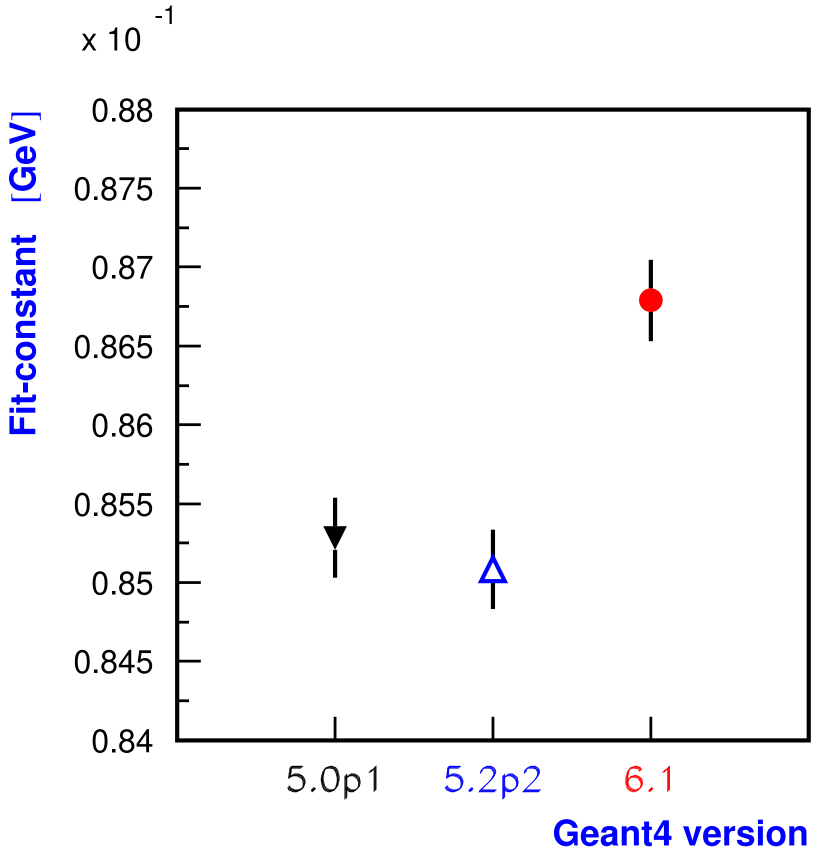
Energy in a cluster

- “Visible energy” scale
- Energy reconstruction in a cluster
- Gaussian fit: E_0 and σ
- Energy resolution:
  - σ
  - σ/E_0

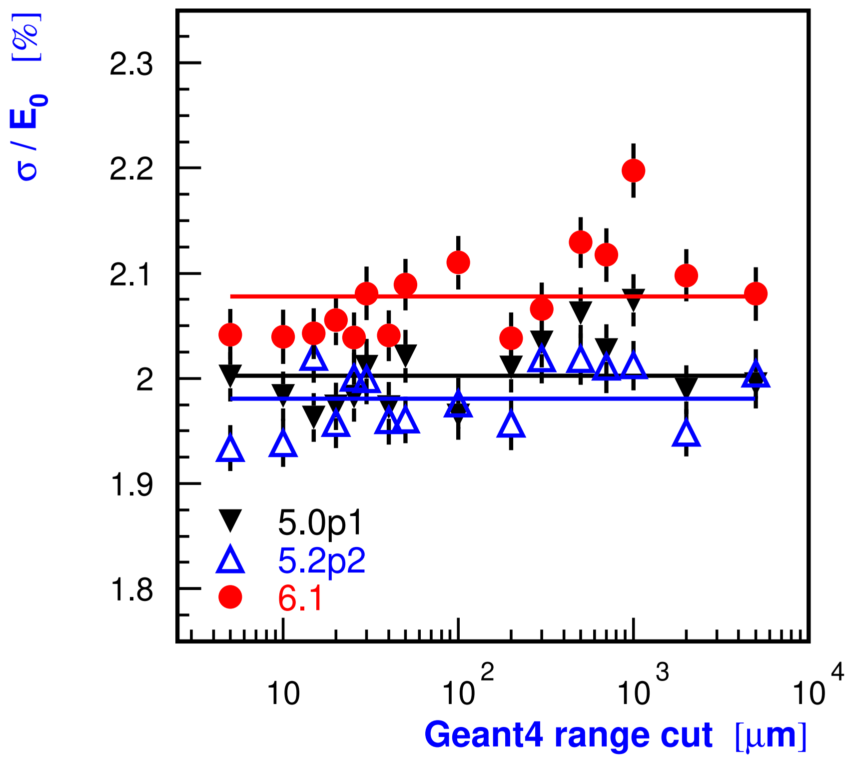


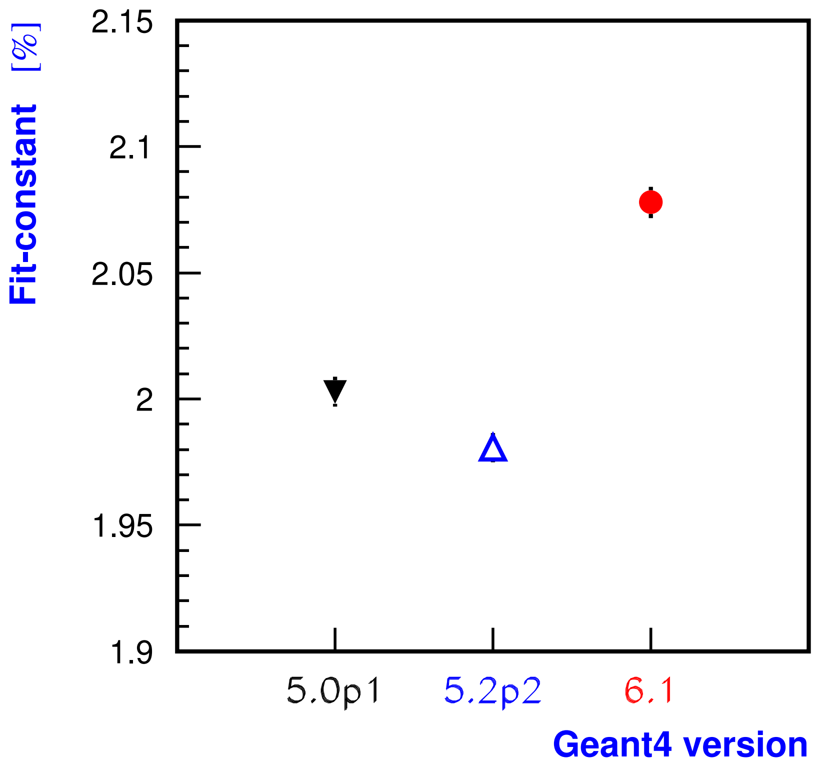
Energy in a cluster



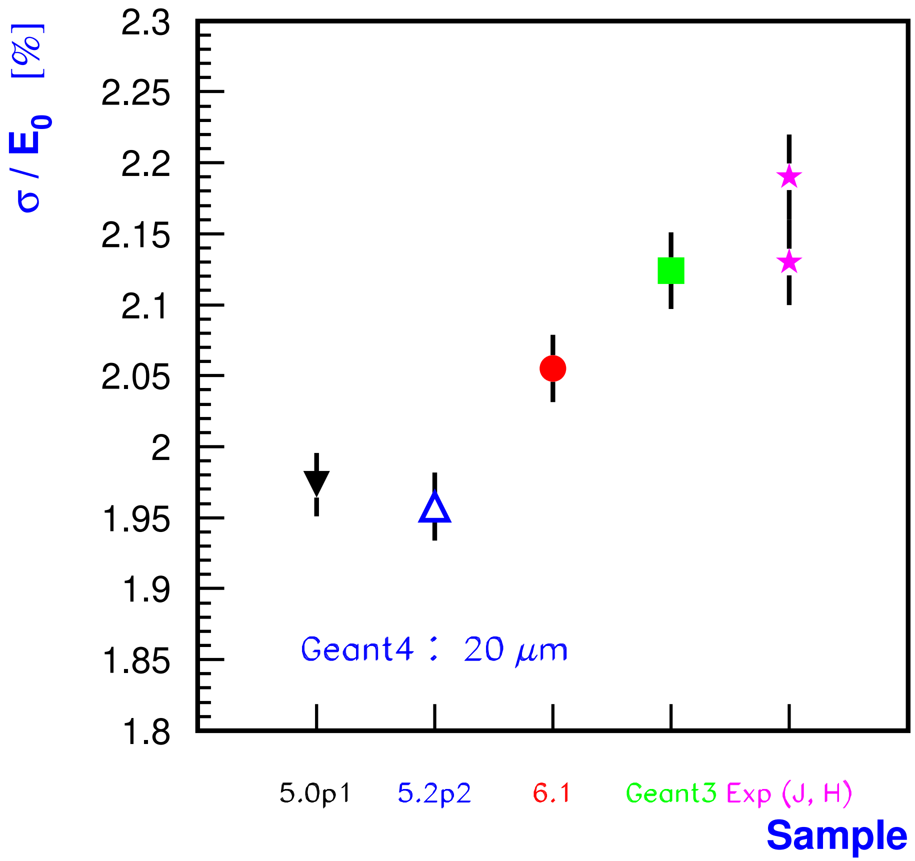


Energy in a cluster





Energy in a cluster



- Energy resolution, as predicted by Geant4 version 6.1, is closer to experiment (w.r.t previous Geant4 versions)
  - increase of fluctuations in LAr (σ)
  - decrease of visible energy (E_0)

Current conclusions, plans

- Scan over the range cut for 100 GeV electrons with Geant4 version 6.1 was simulated
- First results show:
  - amount of visible energy is smaller than expected from the experiment ($\sim$2.5 % difference)
  - energy resolution becomes closer to experimental values
- Range cut of 20 μm is selected for further simulations
- Further simulations (with Geant4 version 6.1):
  - energy scan for electrons (6 - 147.8 GeV)
  - energy scan for charged pions (10 - 200 GeV) with LHEP and QGSP hadronic physics lists