Status of Standard EM Libraries

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Outline

- EM physics in Geant4 10.6beta

- Selected validation results for 10.6beta

- Work items for Geant4 10.6

- Conferences in 2019

EM physics in 10.6beta: utils+globals

- M.Novak introduced LogE member to G4DynamicParticle
  - Number of calls to G4Log was substatially reduced
  - Extra method G4PhysicsVector::Value(.....)
  - G4DynamicParticle was reorgaized
- G4EmParameters is splitted on 3 classes:
  - main, EmExtra, EmLow
  - Printout at initialisation is more compact
  - Extended list of parameters
  - User interface unchanged
- SetMaxEnergy() has now internal low-limit 9.99 MeV
- G4NIELCalculator helper class is added
  - Example of usage in TestEm1
- G4EmBiasingManager is fixed (D.Sawkey)
  - Bremsstrahlung splitting and other biasing options are recovered

EM physics in 10.6beta: standard + highenergy

- M.Novak added usage of LogE members in all models
- L.Urban improved lateral displacement sampling in the Urban msc model
- I.Semeniouk cleaned up 5D gamma conversion model by more use of CLHEP boost and rotation methods
- Fixed low-energy kinematics for elastic scattering models
- The model of gamma conversion to muon pair extended down to the threshold
  - gamma factory group request
- Added registration/de-registration mechanism for all high energy processes

EM physics in 10.6beta: misaleneous

- General gamma process
  - Switched to use LogE and logarithmic tables
- EM physics lists
  - In Opt4, Liv, Pen use RangeFactor=0.08, skin=3, UseSafetyPlus - all for GS
  - Opt1 uses general gamma process
  - WVI use 3-gamma annihilation model
  - D.Sawkey extended UI commands for optical physics
- Xray
  - Added registration/de-registration mechanism for all high energy processes

Results of EM tests for 10.6beta

- https://test-geant4-tools.web.cern.ch/test-geant4-tools/emtesting/
- Condor batch system is much more powerful than lxbatch
  - A.Bagulya make these tests be much faster
  - This set of tests may be improved
- Urban model predictions become closer to GS
- QGS crash for gamma-nuclear on Hydrogen target in the tileatlas test returned back
  - There is incorrect sampling when no nucleons left in the target
- Global gamma process provide the same results as the default for Opt1 physics

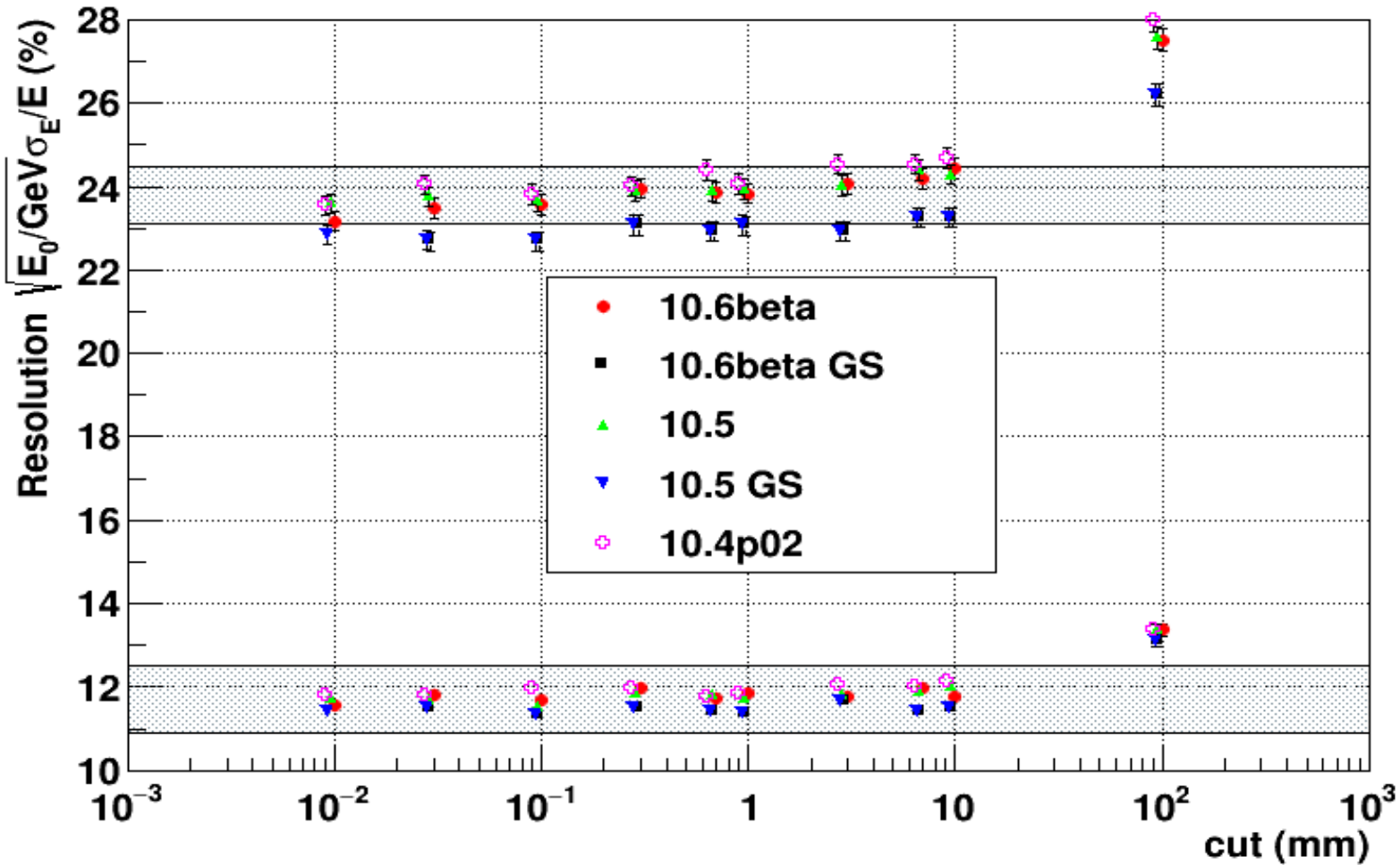# Selected Results

Simplified ATLAS barrel calorimeter
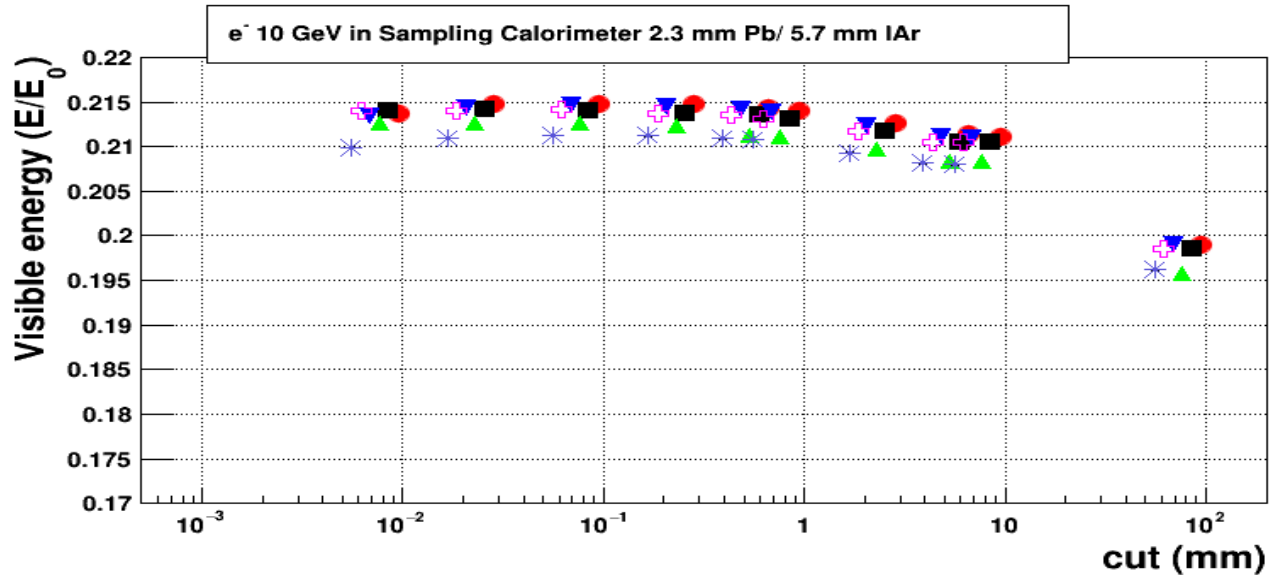
Urban and GS models provide similar results
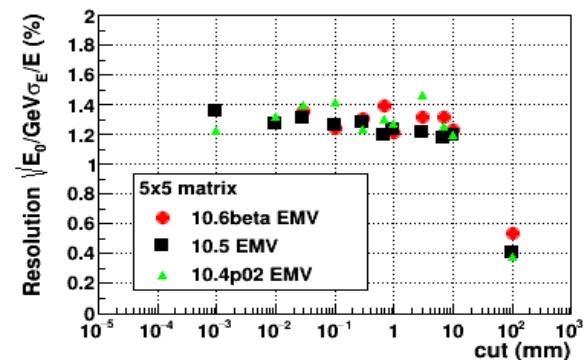
Opt3 and GS predict smaller resolution
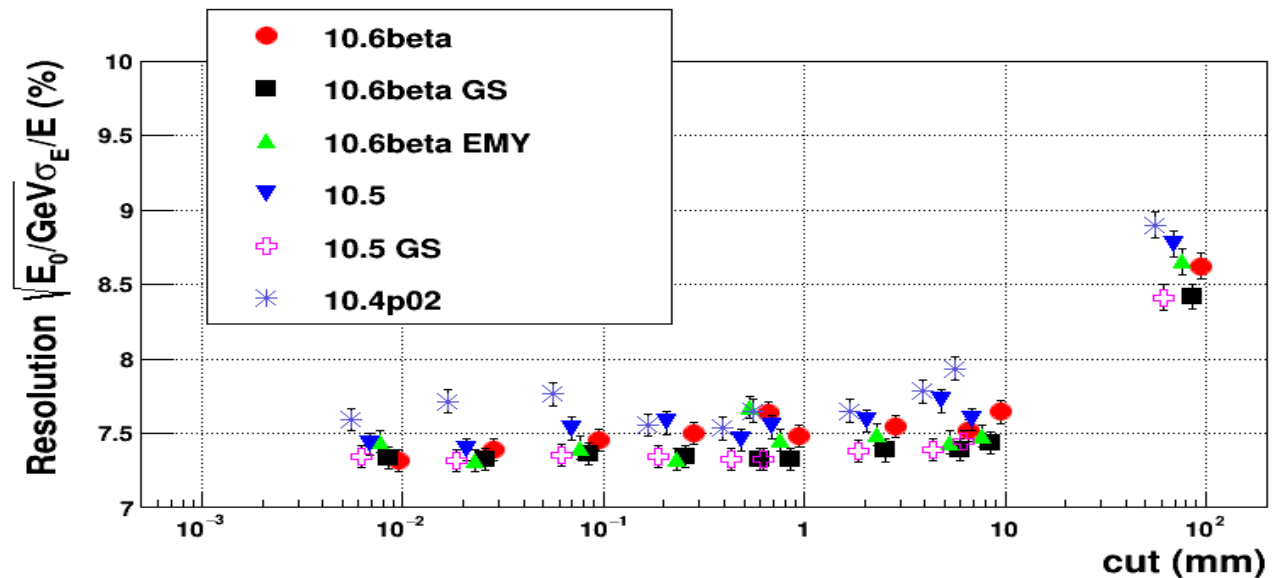
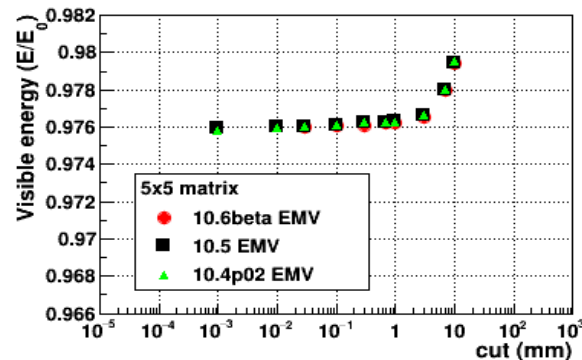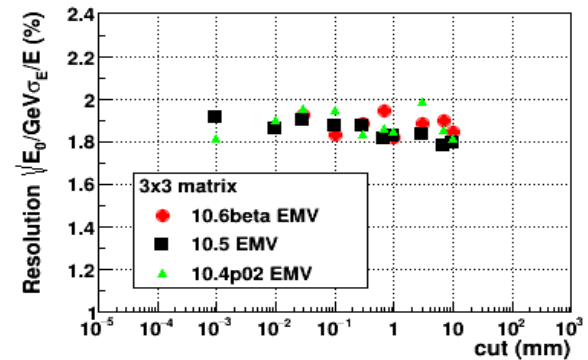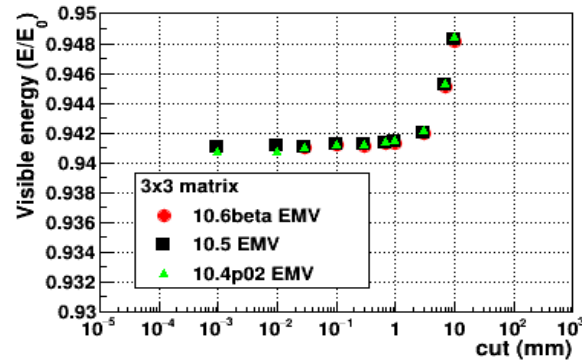# ZEUS test-beam

e⁻ 10 GeV in Pb/Scin Sampling Calorimeters

V. Ivanchenko, EM Standard Status   7/12/2019
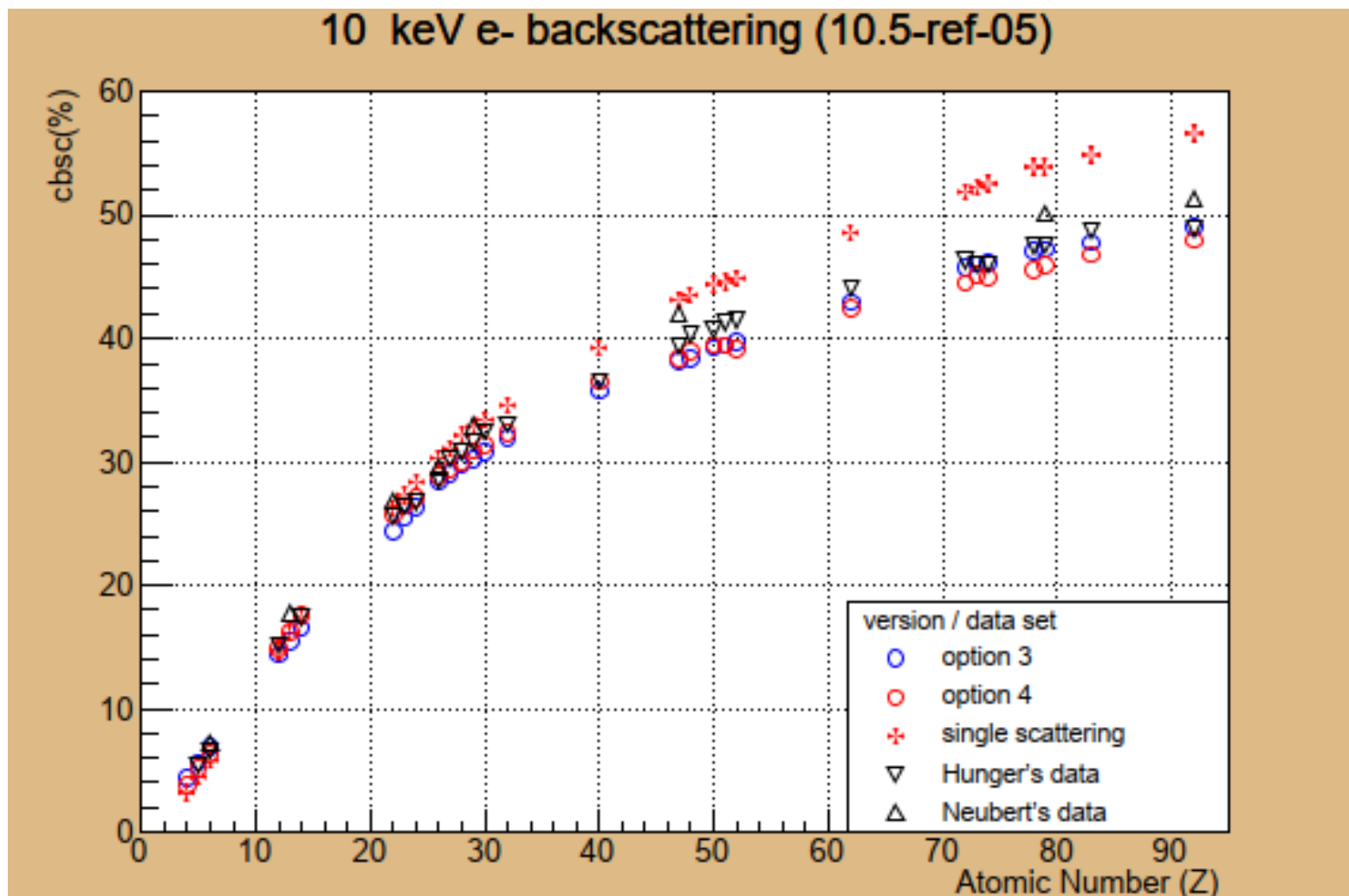
CMS-type simplified calorimeter

General Gamma Process provides Stable results
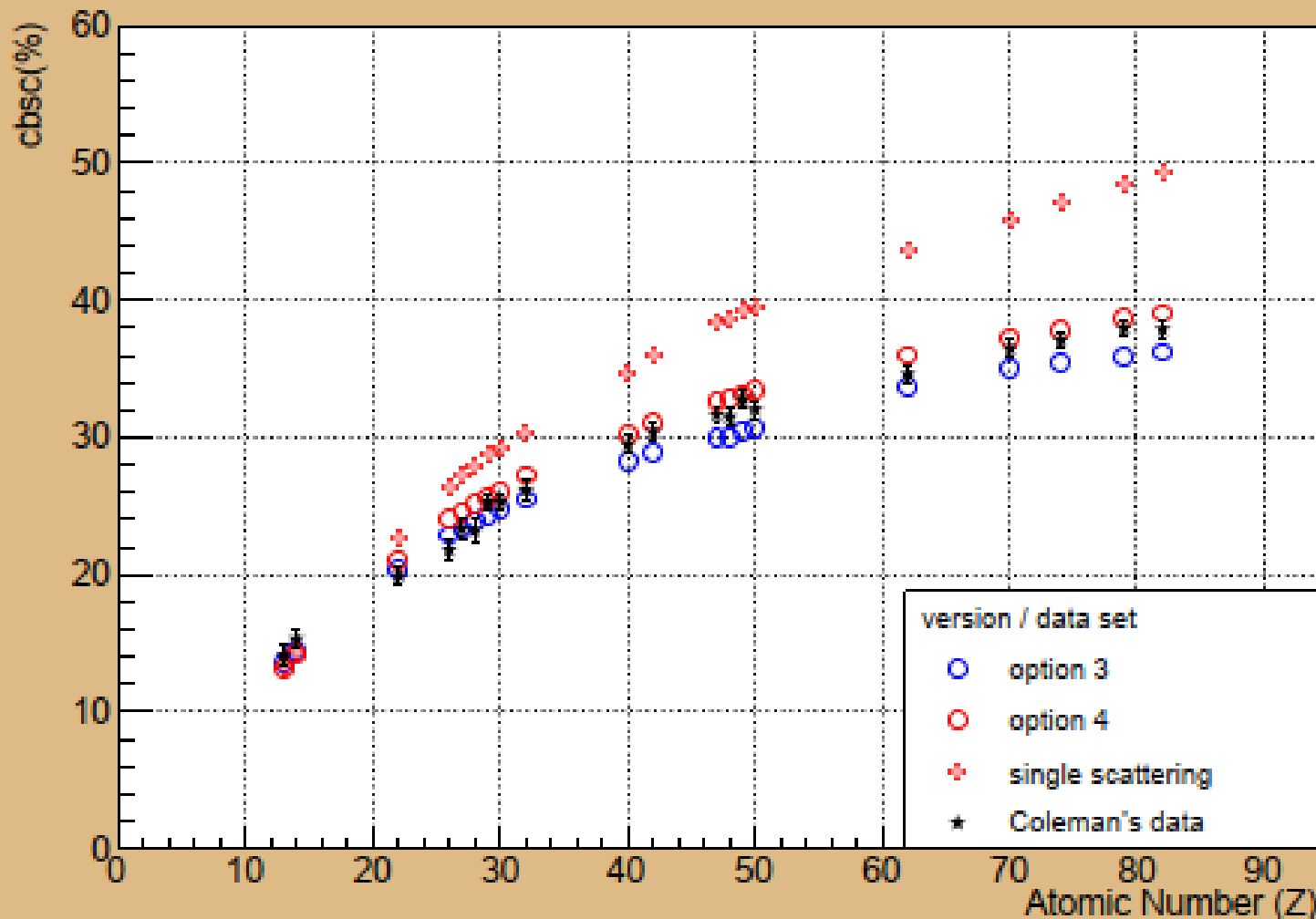
L.Urban Results
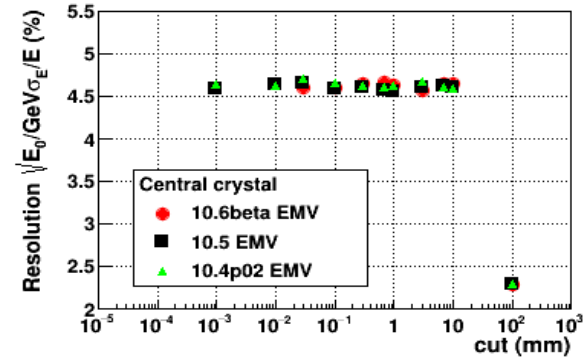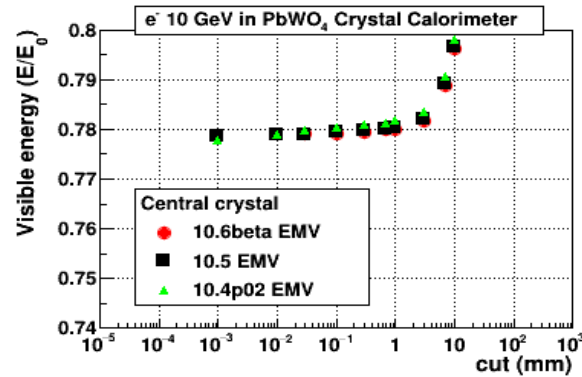
10 keV e- backscattering (10.5-ref-05)

L.Urban Results

30 keV e+ backscattering (10.5-ref-05)

Work items for Geant4 10.6

- Evaluation of "global process" approach
- introduction of detailed test of stepping for EM calorimeters triggered by ATLAS
- Enabling of linear gamma polarization via UI commands
- Further development of the GS model
- Extend relativistic gamma conversion down to the threshold
- Introduce triplet production for bremsstrahlung
- Evaluation of 3 gamma annihilation model
- Addition of tau pair production by positrons
- improve Synchrotron radiation in quadrupole field
- validation of the transition radiation model for ATLAS
- extended and clean-up optical examples
- addition of a new example with more realistic human phantoms for radiation protection and medical purposes
- extension of dark matter particle interactions

Conferences 2019

- Geant4 Collaboration workshop in JLAB (USA)
  - Two parallel sessions requested
  - Susanna and Daren confirmed participation
- Geant4 Space User Workshop, October, Korinthia (Greece)
  - I have registered
- CHEP'19 November, Adelaide (Australia)
  - EM progress talk is accepted as oral
  - Who can make it?
- CHEF'19 December, Kyushu (Japan)
  - Abstract is not sent yet