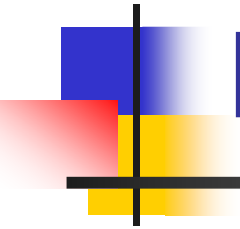

Parallel Session VI – Low-energy EM

Sébastien Incerti

Session overview

- 3 talks on microdosimetry
  - Future developments and validation of G4LowE extensions: proposed projects by CMRP, by S. Guatelli, CMRP - Wollongong U.
    - Verification and validation of Geant4-DNA models, compared to PTB MC code
    - Plans to collaborate with G. Garcia (Madrid) for additional comparison and experimental validation in liquid water
  - Very low energy activities at AIT, by M. Latocha, AIT
    - Expertise group in microdosimetry, usage of several MC Codes (FLUKA, Geant4, …), aim at nanodosimetry
    - Express their wish to collaborate with Geant4-DNA
      - First with S. Guatelli for Geant4-DNA models verification, validation in microdosimetry
  - Extended cross sections for microdosimetry, by Z. Francis, IRSN
    - Overview of extended models (wider energy range coverage) that will become available in Geant4 9.3
    - Workplan for sub-eV processes & models in liquid water was presented
- 1 talk on Medical applications
  - Compression of Voxelised Patient-Based Phantoms, by Brad Oborn CMRP – Wollongong U.
    - Proposed a method to reduce the number of voxels in a CT dataset patient-based phantom via conversion of similar voxels into new volumes.
    - Proposals were made for benchmarking the technique against modern alternate methods such as G4RegularNavigation.
- Activity overview and workplan

What will be available in Geant4 9.3 ?

- Low energy Physics models (Livermore unpolarized and polarized, Penelope, Geant4-DNA) have been migrated to the standard EM software design for a coherent approach of EM interaction modelling in Geant4
- New interpolation method improves significantly CPU performance of models
  - Total running time reduced by 33.5% (a speed-up factor of 1.5)
  - G4LogLogInterpolation::Calculate method
    - spends now 56% less amount of time
    - only one log10 and pow10 is required per iteration step
- Extensive testing & validation of migrated models and new interpolation method based models
- Several bug fixes, thanks to
  - new design
  - systemmatic testing
- Full documentation in web site

Expected developments

- Physics
  - deliver additional photon processes for space applications
    - polarized photoelectric
    - polarized gamma conversion
    - triple conversion (gamma -> e+e-e-)
  - Geant4-DNA
    - Extensive workplan (ESA-AO6041 & ANR fundings till 2013)
      - New Physics models (e- down to 0.025 eV, C, O for microdosimetry)
      - Chemistry prototype (production, diffusion and mutual interaction of molecular radicals)
      - Biological targets modelling (DNA)
      - Verification, validation
  - migration of anti-proton interaction model
  - finalise PIXE integration with new models (analytical, interpolated)
  - design iteration of atomic de-excitation package for integration in standard EM category
- Other items
  - cleaning of code (removing obsolete, unused, buggy classes)
  - revise full handling of data used by low-EM processes
  - update documentation & web sites
  - preparation of common paper standard EM / low energy EM
  - organize monthly phone meetings with standard EM