

Requirements, Development Plans, and Requests

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Detector Developments and Simulation Requirements

MPE and MPI are developing detectors for:

- X-ray astronomy (e.g. XMM, eROSITA, ATHENA)
- High-energy particle physics (e.g. ATLAS, Belle II)
- Planetary science (e.g. ROSETTA, BepiColombo, Mars Rovers)
- Photon science (e.g. SLAC LCLS, European XFEL)
- Optical astronomy (e.g. European VLT)
- Detectors for X-ray spectrometers and transmission electron microscopes

⇒ Main simulation requirements for low-energy physics in Geant4:

- Photon interactions
- Electron energy loss and multiple scattering
- Atomic de-excitation
- PIXE
- Radioactive decay
- Complex geometries with thin ($< \mu\text{m}$) layers close to detectors
- Physics and software quality is critical

Development Plans

- We have joined a diverse, international group of dedicated colleagues with similar physics requirements for Geant4
- This working group is actively improving all Geant4 physics relevant for our needs
 - physics, software design, efficiency
 - documented in numerous publications and conference contributions (see <http://www.ge.infn.it/geant4/papers/>)
- EPDL/EEDL-based processes used in production until new, state-of-the-art developments are mature to replace them
- Our PIXE model has been released in the “pii package”
- More improvements are pending or in progress, including
 - Proton ionization (Batic et al., IEEE TNS, in press)
 - PIXE (Batic et al., Comp. Phys. Comm., in press)
 - Electron ionization (Seo et al., IEEE TNS, in press)
(Best Student Award, Monte Carlo 2011)
 - Atomic parameters (Pia et al., IEEE TNS, in press)
 - Photon interactions with matter
 - Performance accessing data tabulations

Requests

Geant4 electromagnetic working group wants to remove the original low-energy extension, which they consider “obsolete”, from future Geant4 releases.

Our requests:

- Keep original low-energy processes in future Geant4 releases.
- If Geant4 electromagnetic working group does not want to maintain them, move EPDL/EEDL based physics processes to “pii package”.

Together with our collaborators, we will maintain – and improve – these processes along with PIXE.