

Implementation of nitrogen cross-sections in Geant4-DNA

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Background: Tissue-equivalent gases as nitrogen (or propane) are often used in experimental micro and nanodosimetry. In this work [1] we present the first implementation of nitrogen cross sections in Geant4-DNA for track structure calculations of electrons, from the ionization threshold to 1 MeV.

Material and Methods: Cross section tables for impact ionization, electronic excitation and elastic scattering used in the PTB in-house PTra track structure code [2] have been implemented in Geant4-DNA through a modification of the Geant4DNAPTb model classes. In particular, the auto-ionization process was incorporated in the G4DNAPTbExcitationModel class in a similar manner to that in PTra. A comparison of simulated results obtained with both codes is presented.

Results: The simulated ionization cluster size distributions (ICSDs) obtained with Geant4-DNA and PTra were in good agreement, thus benchmarking the implementation of nitrogen cross section data in Geant4-DNA. These cross sections were also validated by comparing simulated ICSDs obtained using the new G4DNAPTb classes with those obtained experimentally (in nitrogen) [3], as well as with simulations of stopping power and range values from NIST ESTAR database and Gümüş model [4].

The new version of G4DNAPTb classes together with nitrogen cross section tables will be available to the public in the next Geant4 release. Further work is planned to include propane cross sections in Geant4-DNA.

[1] M. Pietrzak et al. Submitted to *Physica Medica* (under revision)

[2] M. Bug et al, *Physical Review E* 88 (4) (2013)

[3] A. Bantsar et al. *Nuc. Ins & Meth. A* 599 (2-3) (2009) 270–274

[4] H. Gümüş, *Radiation Physics and Chemistry* 72 (1) (2005) 7–12.