Importance of the Auger electron emission in proton-induced interactions in biological medium: a *TILDA-V* Monte Carlo tracking

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Synopsis In the current work, we studied the contribution of the Auger electron emission in proton-induced interactions in biological matter. The homemade Monte Carlo code *TILDA-V* was then used for tracking protons of 10 keV-100 MeV in both water and DNA, where the main collisional processes are described by means of an extensive set of *ab initio* differential and total cross sections.

The current work aims at assessing the influence of the Auger electron emission in biological matter, when irradiated by proton beams, by means of a Monte Carlo simulation. We used the homemade track-structure code *TILDA-V* (an acronym for "Transport d'Ions Lourds Dans l'Aqua & Vivo" [1]) to analyze the production of secondary Auger electrons. *TILDA-V* is based on an extensive set of *ab initio* multiple differential and total cross sections for describing the main inelastic processes occurring during the track of protons in biological matter. In this context, we provided a more realistic description of the biological matter that takes into account water and DNA components, namely, adenine thymine, cytosine, guanine and the sugar phosphate backbone.

When a target inner-shell is ionized, the vacancy may be accompanied by non-radiative transitions including the emission of Auger as well as Coster-Krönig electrons that take place at a short time scale after the interaction itself. These various processes have been included into *TILDA-V* for all the targets investigated, namely, by considering the probability and the corresponding electron energy. For water, we used the data reported in Martin's thesis [2], while for DNA the Auger electron non-radiative probabilities and energies provided by the Livermore Evaluate Atomic Data Library [3] for the different atomic constituents involved in the biomolecular target description were implemented into the code.

In Figure 1, we show the influence of the Auger electron emission on both the deposited energy and the kinetic energy transferred to the secondary electron by considering *TILDA-V* proton tracking in water as well DNA [4].

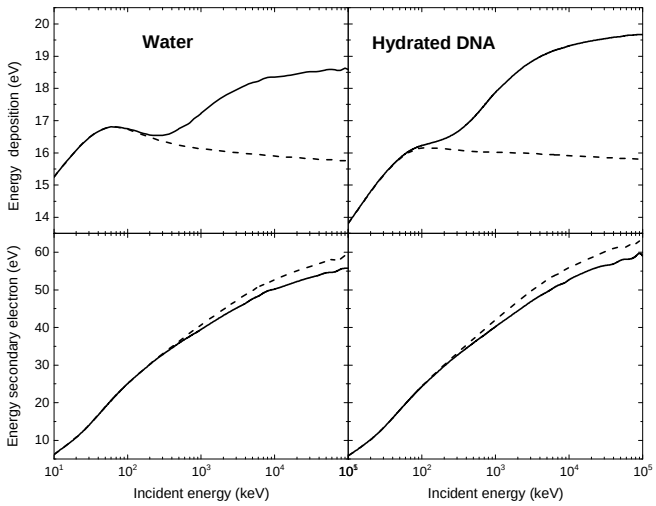

Figure 1. Influence of Auger electron emission in water and hydrated DNA. Energy deposit as well as kinetic energy transfer by considering (or not) the Auger emission (dashed and solid line, respectively).

References

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