Calculation of electron dose point kernel in water with GEANT4 for medical applications

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The rapid expansion of the medical physics in the last years, especially the nuclear medicine, has been followed by a great development of faster Monte Carlo algorithms. As an important alternative to solve complex problems in dosimetry, Monte Carlo method allows to calculate beta-sources dose with accuracy of 1-2 % in a simple way. GEANT4 is a Monte Carlo toolkit, based on object-oriented technique and C++ language, that contains the tools to simulate problems of particle transport through matter. In this work, GEANT4 was used to calculate a dosimetric quantity commonly used in nuclear medicine, the dose point kernel (DPK), for monoenergetic electrons and beta emitters in water, which is an important reference medium for nuclear medicine. The DPKs are calculated considering the energy deposited in concentric spherical shells around a punctual source of radiation. The three different physical models of electromagnetic interactions provided by GEANT4 - Low Energy, Penelope and Standard - were employed. To verify the adequacy of these models, the results were compared with widely adopted references published by the International Commission on Radiation Units and Measurements (ICRU Report 72). For all energies and physical models, the agreement between calculated DPKs and reported values is satisfactory. These preliminary results suggest that GEANT4 code may be useful for nuclear medicine applications.