Geant4 and ANU Auger-electron cascade Monte Carlo model comparison

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The extreme radiotoxicity of Auger electrons and their exquisite capacity to irradiate specific molecular sites has prompted scientists to extensively investigate their radiobiological effects [1]. In radiotherapy Auger-electron emitting radionuclides are of great interest because of their short range, which is a very important feature to protect normal tissue adjacent to the targeted tumour [2]. This unique feature offers some distinct advantages compared to the more commonly used long-range beta electrons, such as a reduced cross-fire irradiation of non-target healthy cells and a higher ionisation density within the immediate vicinity of the decay site, which is generally associated with high(er) biological effectiveness [2][3][4][5][6][7]. Auger-emitting radionuclides have shown very promising effects in vitro and in vivo in animal studies over the last decade [8][9]. Emission spectra of Auger-electron emitting radionuclides are essential for dosimetric calculations to quantify the biological damage delivered to the target [6]. In the past three decades several authors published calculated emission spectra of selected radionuclides using either deterministic or Monte Carlo computational methods [10][6][11].

Geant4.10.04 extended example (radioactive decay 01) have been used in this study [12][13][14]. We compared results obtained with Geant4 and the ANU model to other data sets for I-123, I-124 and I-125 [2]. Yield ratios of Geant4 and other data sets to ANU are plotted. Performance of Geant4 and a recently developed Monte Carlo model of Auger cascades have been compared. Good agreement with the published data is found [15].

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