A Research Approach in Experimental Nanodosimetry for Radiotherapy and Beyond

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Abstract Text:

The state-of-the-art treatment planning system is based on absorbed dose and relative biological effectiveness (RBE) models related to linear energy transfer (LET). It is now well known that these concepts do not apply to the nanoscale and, therefore, cannot be used to model radiation effects on the most sensitive target, the DNA molecule.
Nanodosimetry is a fluence-based concept that includes the track structure of charged particles and specifies measurable stochastic quantities related to the frequency of complex DNA damage considered to be important for treatment planning and also radiation protection.
A sophisticated metrological system providing compact detectors is essential for this concept, which is advanced by the present work. The simulation and the further development of a compact Thick Gas Electron Multiplier (THGEM)—inspired nanodosimeter using the track structure Monte Carlo Code Geant4-DNA and the detector performance simulation toolkit Garfield++ is discussed.

Keywords:
Nanodosimetry, radiotherapy, radiation detection, Geant4, Garfield++