Monte Carlo calculation of dose rate distributions around the Amersham CDCS-M ^{137}Cs source

CDCS-M Amersham type stainless-steel encapsulated source is widely used in low dose rate brachytherapy with manual afterloading. However there is a lack of complete dosimetry data about it. In this work we present simulations of absolute dose rate in water with the Monte Carlo GEANT code around this source.

All the physical processes for low energy photons are implemented in GEANT: photoelectric effect, Compton dispersion, pair production and Rayleigh scattering. For electrons, multiple scattering and continuous energy loss were assumed.

The source was fully modeled from information provided by Amersham. In order to reach full scatter conditions, a cylinder of water 40 cm in height and 40 cm in diameter was assumed where a grid system with a score volume of $0.5\times0.5\times0.5$ mm^3 up to 20 cm away from the source has been established. Up to 10^9 histories were simulated. To estimate air-kerma strength the source was located in a $6\times6\times6$ m^3 dry air cube and kerma was scored with 2×10^{10} histories.

Absorbed dose rates in water, normalized to 1 μGym^{2}h^{-1}, are presented in the form of away-along table at distances up to 10 cm. In order to use the simulated data in the treatment planning programs based on TG43 formalism we have extracted from our simulation results the necessary dosimetry parameters, these are: the dose rate constant Λ, the radial function $g(r)$ and the anisotropy function $F(r,\theta)$.