

Perturbation of the electron-fluence by parallel-plate air ion chambers

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The dosimetry of an electron beam by measurement of cavity ionization is influenced by the perturbation of the fluence due to the ion chamber. The perturbation effect depends on the shape and size of the chamber, electron energy, phantom and wall materials, and the position of the chamber in phantom. This study presents a comprehensive evaluation of the fluence perturbation due to parallel-plate chambers in a Lucite phantom irradiated by clinical and Monte Carlo modeled electron beams.

User-written MAIN programs utilized the EGS4 Monte Carlo code to perform simulations. Calculations included dosimetric parameters such as fluence, energy and average energy deposited. Simulation of the Varian Clinac-2500 linear accelerator was carried out to model the electron and the bremsstrahlung energy spectra and angular distribution. Parallel-plate chambers were also simulated to evaluate the fluence perturbation due to these chambers in phantom.

The results of Monte Carlo calculations are in good agreement with measured data. Additionally, this study demonstrates that the EGS4 Monte Carlo code is a powerful and practical tool to generate accurate clinical dosimetric data.