AbstractID: 3560 Title: Monte Carlo Simulations of the Dosimetric Characteristics of a new Multileaf Collimator

Purpose

The aim of the work was to investigate the dosimetric characteristics of a new multileaf collimator (160MLC™, Siemens) with the help of Monte Carlo (MC) simulations during the design phase.

Materials and Methods

The MLC was implemented in the MC code Geant4. For the simulation of the 6 MV treatment beam an experimentally validated phase space and a virtual source model were used. For the simulation of the geometry in Geant4 the jaws and the two leaf packages were implemented with the help of CAD data. First, transmission values for different tungsten sinters were extracted using the simulation codes Geant4 and BEAMnrc and compared to experimental measurements. In a second step, high resolution simulations were performed to detect the leakage at depth of maximum dose. The 20%-80% penumbra along the leaf travel direction was determined for different 10x10 cm^2 fields shifted along the x-axis. The simulated results were compared with measured data obtained with a prototype.

Results

The simulation of the transmission values for different tungsten sinters showed a good agreement with the experimental measurements (within 2.0%). This gave an accurate estimation of the absorption coefficient for various leaf materials. Simulations with varying source sizes showed that the leakage and the penumbra depended very much on this parameter: e.g. source sizes of 2 mm and 4 mm result in the interleaf leakages below 0.3% and 0.75% respectively. The results for the leakage and the penumbra are in good agreement with the measurements.

Conclusions

This study showed that Geant4 is appropriate for the investigation of the dosimetric characteristics of a multileaf collimator. In particular we could quantify the leakage and the penumbra and evaluate the influence of the beam parameters such as the virtual source size.

Conflict of Interest

Research supported by Siemens Oncology Care Systems.