AbstractID: 1481 Title: A detailed Monte Carlo simulation of the source term of neutron contamination from medical linear accelerators

The neutron contamination from medical linear accelerator was usually considered based on the data and methods recommended in the NCRP-79 report. A detailed Monte Carlo simulation of the neutrons produced from gantry components was presented to be a supplement of this report. The goal of this work was to investigate the characteristics of the neutrons produced from the accelerator head and to develop an accurate neutron source term for the following calculations of the shielding design. The FLUKA Monte Carlo simulations with an emphasis on the detailed modeling of the accelerator head were performed for estimating the neutron contributions from different components. The multi-leaf collimators used for 3D-conformal and IMRT treatments were also simulated. A full-scale Monte Carlo calculation of the room shielding was conducted and the neutron dose rate of the calculation outside the shielding door was compared to the measurements to verify the developed neutron source term. A high-efficiency moderated He-3 proportional counter was used to measure the neutron dose rate outside the treatment room under different operation conditions. The detector response to the calculated neutron spectra and the corresponding dose correction factor were also investigated. While the aperture of the beam outlet occupies only a small fraction of the spherical source term, it was found that neutron dose rates outside the treatment room decrease significantly for field sizes larger than about 10x10 cm^2. Small field sizes shaped by multi-leaf collimators for IMRT treatment wouldn't increase neutron contamination obviously after neutrons transport through out of the maze.