AbstractID: 12672 Title: Monitor unit calculation for electron arc therapy using Monte Carlo simulations

Purpose: This study reported a monitor unit (MU) calculation method for electron arc therapy. This MU calculation was carried out using Monte Carlo simulation and verified by measurement.

Methods and Materials: The 9 MeV phase space electron beam (2.6×21 cm^2) attached to the block tray holder of a Varian 21 EX linac was generated using the EGSnrc-based BEAMnrc code, and was verified by dosimetric measurements using ionization chamber and radiographic film. The relative output factor (ROF), source-to-surface (SSD) offset and dwell factor (DF), required in the MU calculation, were determined using measurement and Monte Carlo simulation. Solid water rectangular and cylindrical phantom made of polystyrene were used in the measurements.

Results: Deviations of ROF, SSD offset and DF between measured and Monte Carlo results were 1.2%, 0.18% and 1.5% respectively. Our results show that the DF decreased with an increase of the treatment arc angle (α), and such decrease of DF was more significant in the α range of 0 - 60 deg than 60 - 120 deg. Comparing the DF determined using the rectangular and cylindrical phantom through measurement and Monte Carlo simulation, we found that the DF determined by the rectangular agreed well with that by the cylindrical phantom within ±1.2%. It shows that a simple setup of solid water rectangular phantom was sufficient to replace the cylindrical phantom to determine the DF associated with the electron arc.

Conclusions: Monte Carlo simulation was proved to be an alternative way to determine the MU for electron arc therapy. Since Monte Carlo simulation can generate pre-calculated database of ROF, SSD offset and DF for the MU calculation with a reduction of human effort and linac beam-on time, it is suggested to integrate Monte Carlo simulation into the commissioning of electron arc therapy.