AbstractID: 12846 Title: Development of Monte Carlo dose verification system for MHI-TM2000

Purpose:

MHI-TM2000 is an innovative image-guided radiotherapy system with a C-band X-ray head on an O-ring shaped gantry. We are developing an integrated Monte Carlo (MC) dose calculation system for four-dimensional radiotherapy using MHI-TM2000. The purposes of this study were to propose specific MC models of the X-ray head and the multi-leaf collimator (MLC) for MHI-TM2000 and to validate their accuracy.

Methods and Materials:

6 MV photon beam delivered by the MHI-TM2000 unit was implemented by EGSnrc/BEAMnrc and EGSnrc/DOSXYZnrc. Subsequently, the X-ray head composed of a target, a primary collimator, a flattening filter, a monitor chamber, a fixed secondary collimator, and a MLC was simulated based on the specification. Next, the central axis depth doses and the lateral doses at 15, 100, and 200 mm depth were simulated under the source to surface distance (SSD) of 900 mm. Then, Each of them was compared with the corresponding measurements using a CC06 ionization chamber and a water phantom.

For the MLC model, Tongue-and-Groove (100 mm depth, SSD 900 mm), leaf leakage (50 mm depth, SSD 950 mm), and round leaf effects (100 mm depth, SSD 900 mm) were simulated. Meanwhile film measurements were performed using EDR2 film and a solid water phantom under similar conditions. These doses were normalized to the corresponding doses for the open field at the isocenter. The differences between simulated and measured doses were calculated.

Results:

For the X-ray head, depth doses beyond the buildup region and lateral doses within the region of flatness showed agreement of within 1.3%. For each MLC test, the simulated and measured doses agreed less than 3.0%, respectively.

Conclusions:

We have demonstrated that the proposed MC models of the X-ray head and the MLC for MHI-TM2000 have reasonable accuracy.

Conflicts of Interest:

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