

AbstractID: 6591 Title: Monte Carlo simulation for evaluating the matchline effect of IMRT technique

Purpose: To examine and diminish the IMRT matchline effect caused by curved leaf end design of MLC using a Monte Carlo simulation.

Method and Materials: The procedure is divided into four phases. The first is validating the Monte Carlo simulation using BEAMnrc, DOSXYZnrc, and EGSnrc code to reproduce a 6 MV beam of Varian machine with 120 leaves for a conventional technique of a standard field size $10 \times 10 \text{ cm}^2$. The results were compared to the measurement by IC 0.01 cm^3 . The second phase is testing the simulation for the geometry of MLC specifically a curved leaf end design compared with Kodak XO mat V film measurement. The third phase is applying the matchline situation which generated by Pinnacle treatment planning system (step & shoot technique) into the Monte Carlo simulation. The fourth phase is applying the overlapped values to the MLC files of the Monte Carlo simulation to decrease the matchline effect of IMRT dose distribution.

Results: The agreement between simulation and measurement for conventional technique was within 2% for depth dose and beam profile. The test of the geometry of MLC was done by comparison of closing leaf end of dose distribution. The result showed that the agreement was within 2%. The overlapped values were applied to the MLC leaf files and found that 0.09 cm was selected for the optimal overlapped value with some certain segment weights to compromise among matchlines.

Conclusion: The Monte Carlo simulation is able to investigate the matchline effect of IMRT dose distribution. The distance of the overlapped region of MLC 0.09 cm can reduce the IMRT matchline effect. However this value may possibly depend on the weighting dose of a segmented field of IMRT technique, further investigation should be required.