

AbstractID: 6615 Title: Monte Carlo Investigation of the Effects of an IMRT Compensator on Linear Accelerator Beam Output

Purpose:

A comparison between Pinnacle calculated and Monte Carlo dose distributions was performed for patient treatments implementing physical compensators to deliver intensity modulated radiation therapy (IMRT).

Method and Materials:

Two 3D conformal radiation treatment (CRT) plans were created in Pinnacle using targets placed in the head and neck region of an anthropomorphic phantom. Compensators were generated in Pinnacle and were also modeled in DOSXYZnrc. Dose was calculated in both Pinnacle and Monte Carlo for cases with and without the compensator, and the dose distributions were compared using the chi-comparison test with tolerances set to a 3% dose difference and a 3 mm distance-to-agreement. The dose distributions in the presence of a compensator were also compared for one beam of a five-field IMRT treatment plan generated using actual patient CT data.

Results:

For the two 3D CRT plans, the number of voxels which failed the chi-comparison criteria increased when the compensator was included in the simulations. In a $(15 \times 15 \times 15)$ cm³ volume centered on the target, the percentage of voxels in disagreement rose from 4.99% to 9.46% for the first plan and from 4.60% to 5.19% for the second plan. For the IMRT plan with a compensator, the number of voxels failing the chi-comparison test in a $(10 \times 10 \times 10)$ cm³ volume centered on the target was 4.14%.

Conclusion:

The results demonstrate that dose calculations performed by Pinnacle in the presence of compensators are not necessarily representative of the dose delivered to the patient. This can be attributed to the fact in calculating the dose through the compensator during the compensator thickness optimization, Pinnacle accounts only for the attenuation of the primary fluence and does not consider scatter or beam hardening effects.