

AbstractID: 7727 Title: Dosimetric uncertainties in IMRT QA in plastic phantoms due to CT calibration

Purpose:

IMRT QA involves the use of heterogeneous plastic phantoms where measurements can be performed and compared to dose predictions by Monte Carlo (MC). The accuracy of these calculations is significantly influenced by the conversion scheme, used to assign an elemental composition to a voxel. Therefore the CT number scale is divided into a certain number of subsets. The purpose of this study is to find an optimal number of subsets so that uncertainties caused by miss-assignment of media are minimized while accurately modeling the plastic composition. The energy dependence of this number is investigated.

Method and Materials:

A Gammex-CT phantom with 17 different plastic inserts was scanned at 3 different scan energies. Based on these CT images different calibration curves were generated, using different numbers of subsets. The materials associated with these subsets were the materials of the inserts or materials whose weights were determined by interpolation. The dose delivered by 5 beams was calculated and compared insert-wise to the dose delivered in the exact geometry of the Gammex phantom. The dependence on the scan energy was studied.

Results:

Results show that a division of the CT number scale into 14 dosimetrically equivalent subsets associated with materials whose elemental compositions were generated by interpolation, minimized dosimetric uncertainties. The maximum difference between the dose calculated with the CT based phantoms to the exact phantom was 3% for all scan energies.

Conclusion:

We conclude for dose calculations in IMRT QA that the materials used in the conversion scheme should not be the actual materials of the phantom inserts, but materials with elemental weights generated by interpolation. For the Gammex phantom, using 14 dosimetrically subsets led to minimal uncertainties caused by miss-assignment of media. It turned out that the optimal number of subsets is independent of the scan energy.