AbstractID: 2839 Title: Inhomogeneity correction in IMRT beamlets: Significance in lung treatments

Introduction:
To examine the efficacy and accuracy of pencil beam (PB) and collapsed cone convolution (CC) algorithms that are commonly used in IMRT optimization and dose calculation. The magnitude of error is also estimated with measurement for small IMRT beamlets.

Materials and Methods:
The CT scan of a specially designed lung phantom was used in the dose calculations, with and without inhomogeneity correction, for both algorithms. The inhomogeneity correction factor; CF=Di/Dh, where Di and Dh are the doses at the same depth with and without inhomogeneity, respectively, was calculated for 6 MV and 15 MV beams. Small volume ion chamber and Gafchromic films were used for the measurement, with varying depths and field sizes ranging from 1x1 - 10x10 cm^2. Dosimetry was also performed with various other detectors to study the accuracy of the dose algorithms in homogenous water phantom.

Results: Small volume chambers and diodes provided similar results in homogenous phantom for small fields. The PB algorithm is relatively insensitive to field size whereas collapsed cone is field size dependent. The CF with PB and CC has wide variations (up to 60%) for 6 and 15 MV beams for small fields. As field size increases, the difference decreases. For 10x10 cm^2 fields the two algorithms differ by only 4-5%. CF is dependent on the distance of inhomogeneity, field size and beam energy, and the effect is more pronounced for 6 MV than for 15 MV beams. Both ion chamber and Gafchromic films are in better agreement with CC calculation.

Conclusion: Significant differences between PB, CC and measurements are noted that disappear for large fields, however, CC should be preferred for IMRT. Faster optimization and calculation hardware should be implemented since CC takes 10 times longer time than PB calculation. Special care is needed for validations of these complex algorithms.