AbstractID: 9272 Title: Comparison of megavoltage imaging modalities and spatial effects for dose calculations.

Purpose:
To investigate spatial effects of differing physical densities in megavoltage imaging with cone-beam computed tomography (MVCB) versus helical tomotherapy (MVCT) for dose calculation.

Method and Materials:
Image value-to-density tables (IVDT) were created for MVCB and MVCT against standard kilovoltge computed tomography (KVCT) using a solid-water phantom and varying tissue equivalent inserts. The spatial independence of the different physical densities of the image was tested by generating two sets of IVDT for each modality: one with the inserts in the peripheral locations in the phantom and another with the inserts in the inner locations. Scans of an anthropomorphic head phantom for each modality were imported into a treatment planning system; contours of anatomy were created and a seven field IMRT plan was developed to simulate treatment to a target in the brain. The dose was then calculated for each imaging modality scan corrected with its given IVDT.

Results:
The IVDT sets for KVCT were nearly identical to each other; the IVDT sets for MVCT were practically equal also. Such similarity was confirmed by comparing the dose volume histograms of treatment plans; average coverage of the target was 95.5±0.2%. However, the IVDT sets for MVCB exhibited an appreciable difference as the central region of the images had a lower value inaccurately reducing the density. This was reflected in the MVCB treatment plans as the prescription covered 17.75% of the target using IVDT with tissue equivalent inserts in the inner locations. This coverage was increased to 98.65% using the outer locations.

Conclusion:
KVCT and MVCT modalities provide images suitable for dose calculation of differing physical densities that is independent of their spatial location. However, the artifacts introduced by MVCB imaging can lead to notable differences in image values and its corresponding densities that render current MVCB unsuitable for dose calculation.