AbstractID: 13296 Title: Adaptive projection weighting in CBCT using laser profilometry

PURPOSE: Laser profilometry is a three-dimensional surface reconstruction technique which bases volume delineation on data acquired using a laser range-finding system. Fusion of such a system with cone-beam CT (CBCT) imaging systems shows promise in improving imaging fidelity without imaging dose escalation. In filtered back-projection (FBP), the algorithm most commonly used in computed tomography, images are formed by smearing projection pixel intensities throughout the reconstruction volume. Image contrast and edge definition can suffer as a result of pixel incrementation outside of where the imaged objects actually lie. By providing information on imaged object location (such as table and body location), laser profilometry can be used to design per-projection adaptive weighting filters which result in the accentuation of object image data (the patient) and deemphasize non-object data (the imaging table). **MATERIALS AND METHODS:** A laser profilometry system was developed and attached to a Nucletron Digital Integrated Brachytherapy Unit (IBU-D), orthogonally offset from axis where the kV source and digital flat-panel detector lie. This system is able to detect surfaces with +/-1.5 mm uncertainty. Imaging proceeds on a water-filled Jaszczak Phantom containing spheres of varying contrasting materials using reduced-image-set CBCT (18-images). Surface data and kV imaging are acquired in immediate succession. **RESULTS:** A comparison of laser-weighted FBP-based reconstructions with nonweighted FBP-reconstructions shows that the laser-weighted techniques yield higher uniformity of voxel-intensity values. **CONCLUSION:** In CBCT, voxel nonuniformity in an image reconstruction (especially near the surface) is usually reduced with the use of a bowtie filter; an accessory which requires more dose to the patient. This increased dose can possibly be reduced with the used of weighted projection data acquired using laser profilometry. **Research supported in part by NIH T32-CA113267 and Nucletron, B.V.**