AbstractID: 14325 Title: Feasibility of Co-60 Cone Beam Computed Tomography for Image Guidance in Modern Co-60 Therapy

Purpose: Accessibility is an essential component of providing quality health care. Our research work has shown that Cobalt-60 can be modernized to provide IMRT and IGRT. The use of Co-60 as a radiation source could make advanced radiation therapy available in parts of the world with limited infrastructure to support linac therapy. On-board image guidance is necessary to ensure target localization for precise IMRT treatment. Imaging using the therapy source would permit accurate patient position verification via image guidance without the need of an additional imaging source. We have investigated the feasibility of megavoltage cone beam CT (CBCT) using a Co-60 therapy source and an electronic portal imaging device (EPID).

Method and Materials: An amorphous silicon PortalVision aS500 (Varian Medical Systems, Palo Alto, CA) EPID was placed 100 cm from a Co-60 therapy radiation source (Best Theratronics T780C, Kanata, ON) and used to acquire projection images through various phantoms. An equivalent gantry rotation was performed using a computer controlled rotation stage placed 80 cm from the radiation source. Projection images were acquired with a 1 second exposure every 1.5°. CBCT reconstructions were performed using an in-house implementation of the FDK filtered back-projection algorithm.

Results: The complex internal fine-bone structure of an anthropomorphic head phantom could be resolved using Co-60 CBCT. A 'half-scan' reconstruction (180° + cone beam angle) showed comparable quality to a 'full-scan' (360°). Image contrast and resolution in this phantom were comparable to previous Co-60 fan-beam CT results. Co-60 CBCT values responded linearly to electron density and provided sufficient contrast to discern objects with electron density contrasts of ±2.9% from water. An expected 'cupping' artifact was observed.

Conclusion: Co-60 CBCT was demonstrated to be clearly feasible from these preliminary results. Low-contrast material discrimination, a linear electron density response, and the ability to resolve fine-featured bone structure were observed.