AbstractID: 9582 Title: Improved planar and megavoltage cone-beam imaging using low-Z linear accelerator targets

Purpose: to examine the effect of using low atomic number (Z) target materials on megavoltage portal and cone-beam CT (CBCT) image quality. **Methods and materials:** for experimental measurements, four low-Z targets were installed in a linear accelerator carousel (Varian 2100EX) for the generation of experimental spectra for imaging. The targets were composed of beryllium or aluminum with thicknesses set to approximately 60% of the CSDA range of either 4 MeV or 6 MeV electrons. For CBCT acquisition, the beam and detector were fixed, and a rotation stage was controlled by software to acquire multiple angular projections of phantoms. To examine photon energy spectra and to provide a means for optimizing the imaging system, the beam generation and detector panel were modeled using BEAMnrc/DOSXYZ Monte Carlo package. For 6MV, the beam/detector model was validated by comparing experimental and MC-generated images of open fields. **Results:** The modeled, experimental spectra demonstrate the recovery of photons below 150 keV. For the 4 MeV/Be beam, for example, approximately 1/3rd of photons have energies below 60 keV. MC models of planar imaging show significant improvement of image contrast compared to the standard 6MV beam, and suggest that i) of the four energy/target combinations studied, the 4 MeV/Be combination provides the greatest contrast improvement and ii) a modest additional increase in contrast is achieved by removing the copper buildup layer from the detector. Initial low-Z target CBCT images show improved image contrast; full quantitative results will be presented. **Conclusion:** The use of megavoltage electron beams combined with low-Z targets offers the potential for improved image quality, particularly in terms of image contrast. This approach may be promising for improved and highly-integrated on-board megavoltage imaging.

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