

AbstractID: 11525 Title: Investigation of a diamond x-ray target for use with megavoltage cone-beam CT

Purpose. Compare images and spectra using a dual energy diamond x-ray target for megavoltage cone-beam CT (MVCBCT) with those of carbon and tungsten targets.

Materials and Methods. A Siemens Oncor linac with megavoltage cone-beam CT was modified to use either a tungsten, carbon, or diamond target for imaging. The carbon target was used with an accelerating potential of 4.2 MV. The diamond target had a higher density than the carbon, thus reducing electron leakage and allowing the linac waveguide to operate at the same accelerating potential as the treatment beam, namely 6 MV. For this study, the diamond target was operated at both 4.2 and 6 MV. With both diamond and carbon targets, the flattening filter was out of the beam path. Images were acquired both of phantoms, to determine contrast-to-noise ratio (CNR), and patients.

Results. CNR measured with the phantom were nearly the same with the diamond target and the carbon target when both were operated at 4.2 MV. At 6 MV, CNR with the diamond target was degraded, especially for tissue. The highest quality images of head and neck patients were with the diamond target at 4.2 MV. As compared to the carbon target, there were fewer scattering artifacts, and tissue resolution was better. At 6 MV, there were even fewer artifacts but the contrast was reduced.

Conclusions. The diamond target is a viable alternative to the carbon target for the IBL. It can be used at either the same energy as the treatment beam, which simplifies commissioning and QA, or at reduced energy for enhanced contrast.

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