AbstractID: 13780 Title: Methods to Account for Imaging Doses from Diagnostic MDCT or Kilovoltage CBCT in Prostate Treatment Planning: Monte Carlo Studies Using Scanner Models and Patient-Specific Anatomy

Purpose: MDCT and kilovoltage CBCT are increasingly used in IGRT. AAPM TG-75 has made a series of recommendations on imaging doses. Recent studies have focused on an inclusion of imaging doses using a radiation treatment planning (RTP) system. This paper describes the use of Monte Carlo methods to calculate imaging dose for a prostate IGRT treatment case.

Methods: An IMRT treatment plan, per RTOG 0126, for a prostate carcinoma was used, involving 28 initial fractions and a boost in 16 fractions. Constraints to rectum, bladder, and femoral heads were enforced. A total of 40 imaging procedures were considered involving a MDCT or a KVCBCT scanner that is operated at 250 mAs. A GE LightSpeed 16-MDCT scanner and a Varian On-Board Imager (OBI) were modeled, with parameters reported in the literature. Planning CT images were used to construct a patient phantom within the MCNPX simulation environment. OARs and background voxels were categorixed into six tissue types.

Results: For a total of 40 scans, rectum received 69.7 cGy and 68.2 cGy from MDCT and KVCBCT, respectively. The bladder received slightly greater doses, 73.3 cGy and 69.3 cGy, while the femoral heads received much higher doses, 161.9 cGy and 125.7 cGy, respectively. To investigate the impact, MDCT imaging doses are added to those from the original treatment plans, and dose-volume histograms evaluated. Among notable findings: the rectum dose, after adding the imaging doses, may increase to or above the maximum acceptable level.

Conclusion: Imaging doses can reach the level that may require the adjustment of original planning in order to still satisfy the constraints. RTP systems may not be suitable for low-energy X-rays especially for bones and lungs. The data are expected to be useful to the newly formed AAPM TG-180.