Purpose: Characterization of the accuracy of the dose delivery for pelvic adaptive radiotherapy using cone-beam CT for post-planning.

Methods: A commercially available phantom (CIRS 062) was modified to allow for full scatter conditions in a cone-beam CT radiation field. Various density inserts were used to calibrate the Hounsfield Unit (HU) to electron density (ED) for all of our Varian linacs with installed On-Board Imagers (OBI). Different insert arrangements were explored. The calibration stability of six machines was monitored weekly over a time period of four to six weeks. The effect of different induced shifts from isocentre on the HU to ED calibration was examined along with different scan ranges (6 cm, 10.3 cm, and 20.8 cm). In order to test the dose calculation accuracy, a pelvic phantom with a hypothetical target and sensitive structures was used and identical plans were generated on a diagnostic quality, fan-beam CT (FBCT) image and the CBCT images using the Pinnacle treatment planning software. A number of prostate patients were selected for dosimetric comparisons using the FBCT and CBCT images acquired for patient positioning.

Results: We found that reproducible HU to ED numbers were obtained for the density inserts situated in the inner circular section of the phantom when additional tissue equivalent material was added to CIRS 062 phantom. The variance in HU to ED numbers across the six linacs was less than the spatial variation observed on a single unit, even for the high density bone insert. Therefore, a common calibration curve can be used across all OBI linacs at our institute. There were no significant changes in the HU to ED calibration curve over the observed period. The dosimetric analysis is in progress.

Conclusions: The performance of CBCT on Varian linacs is adequate to support a post-planning dosimetric study.