AbstractID: 8290 Title: Characterisation of a Linac Cone-beam-CT option: What is the future potential for treatment planning?

Purpose: For image-guided radiotherapy (IGRT) the different vendors of linear accelerators offer new kV imaging tools with Cone-Beam-CT functionality. The aim of this study was to evaluate the future potential of such a cone beam CT option for therapy planning purposes.

Method and materials: With the Varian On-Board Imager (OBI) Cone Beam CT (CBCT) option in a single 360° rotation a volumetric CT data set with 14 cm scan length and a 25 or 45 cm field-of-view (FOV) can be acquired. In order to calibrate the system with regard to hounsfield units (HU) a special phantom has been designed to include the whole imager area. Removable inserts allow flexible positioning of the probes (in the center/middle/border of the FOV) and the measurement of central axis doses. A planning study was carried out to determine the usability of CBCT data and compare these with diagnostic CT data.

Results: Comparisons of data between a diagnostic CT scanner and the 3D-calibrated CBCT with regard to image quality and HU representation for an humanoid phantom (RSD Alderson) indicate good accordance. Within the field of view the HU variation is up to 5%. Towards the imager edges hounsfield units show small deviations relative to the imager center (max. 8%). Relative dose distributions in CBCT-based plans show minor differences to plans calculated using a diagnostic CT image dataset ($p=0.002$) and absolute dosage deviations are within 1% ($p=0.001$). Central axis doses applied during the acquisition of one volumetric data set are between 0.8 and 1.8cGy depending on the geometry. Results with real patient data show excellent image quality.

Conclusion: A properly calibrated CBCT option allows off-line treatment planning based on CBCT data. Dose distributions and absolute MU's are equivalent to dosimetric calculations based on diagnostic CT data. The image quality is sufficient for contouring of target outlines.