AbstractID: 7182 Title: LINAC cone-beam-CT option for treatment planning: A possible approach for Dynamic Adaptive RadioTherapy?

Purpose: For image-guided radiotherapy (IGRT) the different vendors of linear accelerators offer new kV imaging tools. These systems include - besides a radiographic and fluoroscopic mode – CT functionality. The aim of this study was to evaluate the future potential of such a cone beam CT option for therapy planning purposes allowing dynamic adaptation for target volume changes.

Method and Materials: The Varian On-Board Imager™ (OBI) Cone Beam CT (CBCT) option consists of a kV-source and kV-Imager mounted on robotic arms perpendicular to the MV therapy beam. In a single 360° rotation a volumetric CT data set can be acquired with a 25 or 45 cm field-of-view. In order to calibrate the system with regard to HU a special phantom has been designed to include the whole imager area. Removable inserts allow the measurement of central axis doses. A planning study has been carried out to determine the usability of CBCT data and compare these to with diagnostic CT date.

Results: Comparisons of data between a diagnostic CT scanner and the 3D-calibrated Cone Beam CT with regard to image quality and hounsfield units representation for an humanoid phantom (RSD Alderson) indicate good accordance. Central axis doses applied during the acquisition of one volumetric data set are between 1 and 3 cGy depending on the geometry. Results with real patient data show appropriate image quality. 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% ($p=0.001$).

Conclusion: This work illustrates that a properly calibrated Cone Beam CT option allows off-line treatment planning. Furthermore the image quality is sufficient for contouring of target outlines. CBCT can serve as control CT in order to adapt the target volume and resize the treatment fields and/or optimize the treatment plan.