AbstractID: 13141 Title: A Setup for Patient Individual kV CBCT Scatter Prediction using Monte Carlo Simulations

Purpose: To use Monte Carlo simulations for scatter subtraction on cone-beam CT projection images to improve the Hounsfield Unit constancy. **Materials and Methods:** To accurately simulate the scatter contribution for the kV detector a detailed modeling of the entire OBI geometry is performed. We calculated the bremsstrahlung spectrum using MCNPX (v2.7b). A patient voxel model was created using CT images. The detector was accurately defined in MCNPX, including filtering, the anti-scatter grid and other important structures. To separate the primary and scattered photons, we used the tally tagging functionality. In an alternative method we saved the phase space information at the detector after transport through the object of interest. Afterwards we applied energy response functions to better predict the contribution of scatter in the active layer of the detector. Soft tissue modification was used to study the possibility of scatter subtraction after weight loss for a head-and-neck patient. **Results:** Simulations of the bremsstrahlung spectrum were in good agreement with chamber measurements. The patient voxel model was used to determine the patient individual scatter characteristics. After weight loss the scatter increased due to the larger contribution of the scatter originating from the bowtie filter. The scattered photons was dominated by the primary photons and subtraction errors are believed to be small. Scatter estimates corrected for detector response were calculated using the phase space information for a flood field. The flood field simulation included the heel effect and scatter estimate of the flood field increased towards the unfiltered part of the beam. **Conclusion:** We provided an initial setup for patient individual scatter prediction using Monte Carlo simulations. When acquiring the phase space at the detector, we can apply detector response functions to approximate the scatter response in an physical kV OBI detector. **Conflict of Interest:** Research supported by a Varian research grant.