AbstractID: 9114 Title: Monte Carlo Simulation of Elekta XVI Cone Beam System and Dose Distribution in CTDI Phantom

Purpose:
(1) To validate a Monte Carlo model for kV cone beam CT simulations. (2) To determine whether a bow-shaped radial dose distribution with equal weighting can be applicable for cone beam CT.

Method and Materials:
A BEAMnrcMP Monte Carlo package has been employed and modified to simulate the Elekta XVI system operated at 120 kVp with collimator M20 and bowtie filter F1. Percentage Depth Dose (PDD) has been measured with PTW Farmer and Roos chambers in a CNMC water tank as well as a GAMMEX Solid Water phantom at 100cm SSD with 10cm backscatter. Dose profile at depth of 1cm has been measured with a Wellhofer IC-10 chamber in Solid Water. Sample dose calculation is performed on a standard CDTI phantom aligned at Linac isocenter.

Results:
The simulated PDD curve agrees very well with both Farmer and Roos chamber measurements in water, but differ slightly with the Farmer chamber measurement in solid water at large depths and build-up region. This is due to the higher attenuation of solid water in kV range and the loss of scatter equilibrium at phantom surface. Excellent agreement has been shown between the measured dose profile and the Monte Carlo simulations along both in-plane and cross-plane directions. The CTDI calculations have indicated that equal weighting on both the center and the periphery can result in errors of -1.1% while unequal standard weighting (1/3 for center and 2/3 for periphery) can result in errors of up to 8.1%.

Conclusions:
Our Monte Carlo model has been validated by various measurements to simulate the kV cone beams from the Elekta XVI system. A bow-shape radial profile in CDTI phantom results in equal weightings for volumetric average dose calculations using only center and peripheral CTDI measurements. Investigation on patient dose deposition due to kV CBCT is in progress.