AbstractID: 6735 Title: Dose calculation on megavoltage cone-beam CT images corrected for cupping and missing data artifacts

Purpose: Megavoltage cone-beam CT (MVCBCT) using a 6 MV treatment beam provides routine 3D images of patients that can be used for dose calculation. However, artifacts reduce the accuracy of dose calculation based on these images. The objective of this work is to develop correction methods for the artifacts caused by scatter, the polyenergetic beam and the limited field of view.

Method and Materials: Monte-Carlo simulations of the linac beam and flat panel imager were carried out to ascertain the causes of the cupping artifact. Scatter contribution to the image was characterized using a superposition of pencil kernels. The effects of depth hardening and off-axis softening of the beam were also quantified. MVCBCT images with missing data artifacts were corrected with completion of the image with a kVCT image and a correction algorithm for the MVCBCT part of the composite image. The cupping artifact corrections were tested with dose calculations on an anthropomorphic head phantom, and missing data artifacts corrections were tested on a calibration phantom for kVCT. Dose calculations were also obtained with kVCT images and gamma index analysis was used to compare the dose distributions.

Results: For dose calculation on an anthropomorphic head, the corrected images had 97% of the voxels within the criteria of [3%, 2mm], and 95% for the uncorrected images. Dose calculations on the composite corrected images of the calibration phantom matched for 94% of the voxels, with a criteria of [5%,2mm]. This percentage fell to 72% when the MVCBCT part of the composite image was uncorrected.

Conclusion: Dose calculation on head-and-neck patients using MVCBCT images is accurate within [3%,2mm], and [5%,2mm] for regions that suffer from missing data artifacts. This level of accuracy should be sufficient to study dose variations during the course of a treatment.

Conflict of Interest: Research supported by Siemens.