AbstractID: 9064 Title: Development of Megavoltage Cone Beam Image Guided Radiation Therapy (IGRT) for mini-multileaf Collimator (mMLC) based IMRT and Radiosurgery Applications

Purpose: The purpose of this work was to investigate the technical feasibility of using the widely deployed Megavoltage Cone Beam CT (MVCBCT) for 3D IGRT applications with mMLC based treatment delivery.

Method and Materials: In most clinical applications of MVCBCT IGRT, the largest possible field of view (FOV) is sought for evaluating adjacent organs-at-risk. However, an add-on mMLC with maximum field size of 10cmx12cm is preferred for precise small-field hypofractionated treatments. mMLC based treatments utilizing 2.5mm leaf widths are usually performed for SRS, SRT and SBRT applications, where the higher accuracy of 3D IGRT localization is also warranted. Current clinical systems do not allow restricting the field size of CBCT acquisition in the X direction. Performing imaging with the mMLC mounted and the field size opened to ~27cm results in major truncation artifacts rendering the images unusable, as well as the irradiation of the mMLC electronics during image acquisition, which is undesirable. The current study was conducted with MVision™ and Moduleaf™ mMLC (Siemens Medical Systems), using anthropomorphic head and neck, and chest phantoms. A custom cerrobend aperture block was fabricated to shield the mMLC from radiation damage during imaging with the X Jaw open. The clinically used reconstruction algorithm was set to only reconstruct a smaller field of view corresponding to the clinically useful restricted treatment field size, although the data acquisition field size was set to the required 27.4 cm in the X direction.

Results: With the changes described above, we were able to accomplish high quality images with the mMLC. The image quality was better than images obtained for the full field acquisition in the clinical mode for the same phantoms.

Conclusion: We believe this to be the first study demonstrating high quality 3D IGRT through a small mMLC collimator designed for SRT.