AbstractID: 12909 Title: Dose reconstruction using helical tomotherapy detector data

Purpose: To reconstruct dose delivered to head-and-neck patients using detector signals from a helical tomotherapy machine.

Methods: Data from five nasopharyngeal cancer patients treated on a Hi-Art Helical TomoTherapy unit with daily MVCT scans were analyzed. Each patient received a total of 25 treatment fractions. Nine evenly distributed fractions were selected in this analysis. During treatment, X-rays penetrated the patient and deposited energy on the same CT detectors used for imaging and the signal was back-projected to entrance fluence by removing attenuation using a dose verification tool provided by TomoTherapy. The fluence was then projected on the patient's CT to calculate delivered radiation dose. The method was first validated on quality assurance (QA) plans delivered on a cylindrical phantom and then applied on patient treatment plans.

<u>Results:</u> Point check on the phantom for QA measurement resulted in an average error of 1.36% (range -0.22% to 3.73%). A 2.1% systematic error on patients was observed by comparing the average reconstructed dose and the planned dose. Random errors of PTV mean dose were between -1% and 2.1%. The variation of max doses to optical nerves, chiasm, brain stem, spinal cord, larynx, right eye and lens were within 5% of the planned dose but the reconstructed doses to the left eye and lens was more than 5% higher than the planned dose for 4 out of 5 the patients with a maximum percentile error of 16% and absolute error of 1.5 Gy in the entire treatment.

<u>Conclusions</u>: Dose verification using detector data offers comparable accuracy to ion chamber measurement on the phantom plans. The error on patients is larger but still within 5% for most organs. Therefore, dose reconstruction based on MVCT images and detector data can be used to effectively detect any gross deviation from the treatment plan.