AbstractID: 13749 Title: Fast and Generalized Dose Reconstruction Method using Virtual Beamlet Dose Responses

Purpose: We have previously developed an accurate dose-reconstruction algorithm that is based on non-iterative inverse solution of deposited dose using Monte Carlo-generated responses for known multi-leaf collimator (MLC) positions. The method was time-consuming in generating the responses. The objective of this study is to develop a faster algorithm that does not require MLC positions by using pre-calculated virtual beamlet-specific dose responses for an open beam, and thus can be used at the end of radiation delivery on-the-spot. **Methods:** The success of the method is based on the hypothesis that the ratio of dose responses in phantom and electronic portal imaging device (EPID) of delivered beam intensities is approximated by the ratio of virtual beam intensities. The possibility is mathematically shown by convolving reconstructed intensities from EPID to both numerator and denominator of the latter ratio. The inversion algorithm for the reconstruction is unchanged. To test the hypothesis, we have calculated virtual beamlet dose responses in Rando phantom and EPID for intensity modulated beams determined for prostate treatment. We have measured in EPID under the phantom and performed dose reconstruction for the two cases. A 6MV photon beam from a Varian 2100EX accelerator and aS500 EPID (integrated acquisition) was used. **Results:** When compared with a forwardly calculated dose in an isocentric plane within the phantom for an IMRT beam, the reconstructed doses of the two showed similar pass rates of >94.7%, given 3% dose difference or 3mm distance-to-agreement. The calculation used 5 minutes per beam using four 2.8GHz Intel XEON CPUs. Automation and the use of a higher data processor can potentially reduce the calculation time to less than a minute. **Conclusion:** A fast method of dose reconstruction was developed and more results will be presented. This method is applicable to detect delivery error. In part supported by Varian Medical Systems.