Abstract ID: 14867 Title: Just-in-time tomography (JiTT): a new imaging technique for monitoring target motion during volumetric modulated arc therapy (VMAT)

Purpose: Volumetric modulated arc therapy (VMAT) is a new efficient way of delivering intensity-modulated radiation therapy (IMRT) on a conventional linear accelerator (Linac) in which the gantry rotates while the beam is on. Intrafraction target motion is still a concern for high precision VMAT treatments. In this work, we propose to apply a new concept --- just-in-time tomography (JiTT) to monitor target motion during a VMAT delivery.

Methods: Similar to the cone beam computed tomography (CBCT) approach, JiTT (Pang and Rowlands, Phys. Med. Biol. 50, N323 (2005)) uses a gantry mounted X-ray source (e.g., a kV source on a Linac) and an X-ray area detector to acquire projection data by simultaneously rotating them around the target. Differing from CBCT, JiTT can be performed during the treatment (i.e., imaging and treatment at the same time), and it takes less time to generate the needed tomographical, beam's-eye-view images of the treatment target in real time. A computer simulation using MATLAB has been conducted to investigate the feasibility of this new approach.

Results: JiTT images of the Shepp-Logan phantom with motion have been obtained. It has been shown that target motion can result in significant motion artifacts in JiTT images. These motion artifacts in the images could then be used to determine target motion and guide the VMAT treatment.

Conclusions: We have proposed to apply a new concept --- just-in-time tomography (JiTT) to image-guided VMAT delivery on a conventional Linac equipped with a kilovoltage cone beam computed tomography (kV-CBCT) system. A computer simulation has been conducted and it has been demonstrated that JiTT images are sensitive to target motion.