

AbstractID: 8653 Title: Using Treatment Beam Imaging to Monitor Prostate Motion In Near Real-time on a Conventional LINAC

Purpose: To directly use MV treatment beam imaging to monitor tumor motion represents an ideal realm for IGRT because it does not require additional hardware and delivers no extra radiation dose to patients. Here we report a method of obtaining the positions of implanted fiducials in near real-time from cine EPID imaging of prostate IMRT beams.

Methods: A Clinac 21EX is used for the study. During IMRT beam delivery, EPID imaging of the treatment MV beam is acquired in cine mode. The framed images are captured and transferred to a PC, where a fully automated marker detection algorithm is developed to extract the coordinates of the implanted fiducials on the images of IMRT apertures that include the fiducials. The automated algorithm matches cross sections of cylindrical fiducials and evaluates multiple criteria to analyze the MV images. From an EPID image, only the coordinates of a fiducial on the plane perpendicular to the beam can be derived. The position of the marker in the direction parallel to the beam is then estimated from the pre-treatment portal images and previous treatment beam(s) at different direction(s). This novel MV image guidance procedure is evaluated by using motion phantom experiments and five prostate patients with three implanted gold fiducials.

Results: The phantom study suggests that the system is capable of detecting any motion greater than 1.2 mm. The variation of all fiducials from their planned positions was calculated on every image and the maximum variation was 4 mm with a standard deviation of 1.8 mm. The 3D positions of fiducials were calculated. The standard deviations of fiducial 3D position distributions were found to be 2.2 mm or less.

Conclusions: This fully automated method provides prostate position during treatment without extra costs