

AbstractID: 10672 Title: Visibility study of fiducial marker for real-time MLC beam tracking delivery using MV fluence video

Purpose: The objective of this study was to assess the visibility of fiducial marker for beam tracking delivery using MV fluence video.

Method and Material: Target visibility in MV images is crucial in real time tracking. The assessment of visibility become complicated as marker visibility may be affected by many factors. Our work focused on the dependence on fiducial marker size, dose rate and video frame rate. A dynamic phantom was used to mimic patient respiratory motion. Three sizes (3 mm in length, 0.8, 1.2 and 1.6 mm in diameter) of fiducial markers were implanted in the phantom insert. Dose rates of 160, 240 320 and 400 MU/min were used with various video frame rates at 6.5, 8.33, 12.5 and 25 frames per second. Contrast-to-noise ratio was calculated to assess the quality of MV fluence video. Two prostate patients participated in the fiducial marker visibility study for beam tracking delivery. An optimized combination of the three factors is to be selected for patients study.

Results: The fiducial marker visibility was observed to be closely related to marker size, dose rate and video frame rate. The bigger diameter markers, 1.2 and 1.6 mm, provided better video quality as a result of a higher contrast-to-noise ratio. A high contrast-to-noise ratio exists when dose rate and frame rate belong to a certain zone. After selecting frame rate of 8.33 FPS and dose rate of 240 MU/Min, we operated the tracking functionality for the prostate patient with acceptable quality of fiducial marker.

Conclusion: Fiducial marker visibility in tracking systems turns out to be complicated as it depends on many factors. Among the three factors investigated, the marker size was observed to have a predominant impact on the image visibility. Appropriate combinations of video frame rate and dose rate are necessary for high quality visibility.