

AbstractID: 9282 Title: Automatic Detection of MLC Errors in VMAT Delivery

Purpose: The purpose of this study was a) to characterize the effects of deviations in MLC leaf positions and velocity on Intensity Modulated Arc Treatment (IMAT) delivery, b) to detect MLC leaf pre-collision events.

Methods and materials: MLC position errors were measured performing IMAT delivery sequences produced by a planning system. The MLC delivery files were converted into a single arc using “in-house” software. Each test plan was delivered with three different beam-on times. The dose rates for the plans were adjusted accordingly. MLC leaf positions were recorded using the MLC controller at a sampling rate of 20 sec⁻¹.

Results: In the test sequences the MLC leaves exhibited a number of positional errors greater than 0.3 cm when moved from or to the “under-jaw” position. The MLC leaf position errors arose from the discrepancy between the planned and the maximum velocity the leaf was able to attain. Deviations in the leaves positions may cause the leaves to get closer than 0.5 cm to each other, which was considered as a potential collision. Performing the IMAT delivery we were able to detect leaves which had the interleaf distance of 0.15 cm. A possible cause of the detected pre-collision events was the degraded performance of the leaf motor.

Conclusions: Leaf position errors caused by the rapid leaf movements from or towards the “under jaw” position tend to induce errors in the segments where the leaf is expected to assume a certain position different from the “under jaw”. An algorithm has been developed to reveal segments that are prone to leaf position errors caused by “slow” leaves. A method to detect segments where there is a high risk of leaf collisions has been developed and applied to the performed delivery sequences. An analysis of relative positional errors has been performed.