AbstractID: 10661 Title: The interplay effect when treating moving targets with RapidArc

Purpose: We have investigated the dosimetric errors caused by the interplay between the motions of the LINAC and the tumor.
Materials and Methods: RapidArc plans were created to treat a 5cm diameter target in a lung phantom (200cGy fractions). The complexity of each field was controlled by adjusting the MU (300–950MU, ~50MU steps, giving 13 RapidArc plans). This covers the range of MUs found clinically (Mean: 540±220, range: 249-999MU). Each plan was delivered to a phantom, and a movie of the delivered dose (0.2sec frames) taken using a 2D ion chamber array. Patient motion was modeled by shifting each dose frame according to a respiratory trace, starting the motion at different phases. The expected dose distribution was calculated by blurring the static dose distribution with the target motion. The dose error due to the interplay effect was calculated by comparing the delivered dose with the expected dose distribution. Peak-to-peak motion of 0.5cm, 1.0cm, and 2.0cm were evaluated. Supporting data was taken using RapidArc plans for lung patients (348-966MU).
Results: The daily dose error due to the interplay effect was less than 10% for 99% of all pixels in the target for all plans investigated. The percentage of pixels for which the daily dose error could be larger than 5% increased with increasing plan complexity (field MU), but was less than 15% for all plans if the motion was 1cm or less. For 2cm motion the dose error could be larger than 5% for 40% of pixels, but was less than 5% for more than 80% of pixels for MU<550, and was less than 10% for 99% of all pixels. In all cases (phantom and patient plans), the dose error after many fractions was less than 1%.
Conclusions: RapidArc can be used to treat moving targets without large dose errors.