

AbstractID: 3387 Title: Novel Geometric and Dosimetric On-line Correction Strategies: Can Chance Work in Your Favor?

Purpose: Investigate the efficacy of three novel geometric and dosimetric on-line strategies for adaptive radiotherapy in terms of workload and compliance with original treatment plan intent.

Method and Materials: The three proposed on-line strategies are: Selective setup corrections (S1), Combined dose-per-fraction adaptation and setup corrections (S2) and Optimal dose-per-fraction adaptation (S3). In S1, setup corrections will only be performed if the displacement is "unfavorable" in terms of a radiobiological score based on equivalent uniform dose. The score function encodes a clinical preference for maintaining dose to the target, the critical organs or an arbitrary combination. S2 combines the selective setup corrections of S1 with a change in daily dose-per-fraction. In S3, only dose-per-fraction is a variable and is determined using a rigorous constraint stochastic optimization procedure. In a retrospective study the efficacy of these strategies was investigated. They were applied to a displacement dataset of 5 prostate patients.

Results: For S1, maintaining the planned dose to the prostate is costly and requires many setup corrections. In contrast, a rectum-weighted score requires far less interventions and decreases the dose to the rectum on the order of 1.5 Gy, while approximately maintaining the dose to the prostate. Strategy S2 allows a considerable boost to the prostate dose for a preference to maintain the dose to the rectum. However, in this case, the bladder may exceed the dose limits. An equal-weighted preference is able to moderately boost the prostate dose while decreasing rectal dose and only moderately increasing bladder dose. S3 showed the biggest potential, however, it is computationally more involved.

Conclusions: Flexible correction strategies can be designed using information about treatment anatomy and planned dose distribution. Such radiobiologically motivated strategies can be made highly compliant with initial treatment plan intent while often significantly reducing the number of interventions.