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## Study of the influence of optimisation parameters on the Pareto front for prostate cancer

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**Purpose:** To study the influence of objective functions and weights, as well as mean doses to secondary organs at risk (OAR) on Pareto front robustness.

**Methods:** We wrote and validated a python script that controls RayStation (RaySearch) treatment planning system (TPS) and calculates Pareto fronts. Then, we randomly chose thirty-one prostate cancer patients treated at our clinic and generated reference Pareto fronts for each of those patients for a given set of objective functions and weights. Hereby, we varied the planned target volume (PTV) coverage and rectum mean dose, and blocked the bladder and femoral heads mean doses. Afterwards, we calculated Pareto fronts for each patient using different optimisation parameters, and compared those fronts to the reference Pareto fronts using a validated metric (clinical distance)[1].

**Results:** The in-house script calculates a good approximation of the Pareto front. The relative PTV-rectum-overlap volume correlates with the clinical distance of those Pareto fronts. The Pareto fronts are different for different optimisation parameters. Hereby, the parameters most influencing the front and leading to clinically significant differences are the dose gradient around the PTV, the weight of the PTV objective function and the mean dose to the bladder.

**Conclusions:** We found out which anatomic trait and which optimisation parameters most affect the position of the Pareto front and gained insights into the interplay between the rectum and bladder mean dose optimisation criteria.

**References:**

1. Petersson K, Kyroudi A, Bourhis J, et al. A clinical distance measure for evaluating treatment plan quality difference with Pareto fronts in radiotherapy. *Physics and Imaging in Radiation Oncology*. 2017;3:53–56. <https://doi.org/10.1016/j.phro.2017.09.003>

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