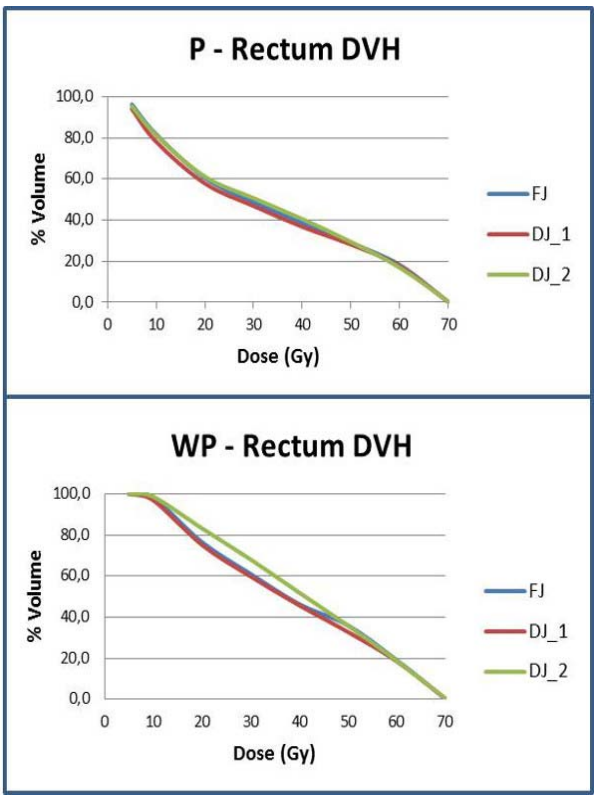

Conclusions: The use of DJ reduced irradiation of OARs positioned in the cranio-caudal border of PTVs. The sparing was significant for a small organ (penile bulb) but limited to low-dose DVH region for the others. A larger field width (5.0 vs. 2.5 cm) has led to a significant reduction of delivery time, a slightly reduced dose homogeneity in the PTVs, a quite similar OARs sparing when only prostate and seminal vesicles were treated. A lower sparing for all OARs resulted for WP plans DJ_2, but differences were in the range 1.4-2.9 Gy.

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Analysis of delivered dose differences due to MLC errors using dynamic MLC log files

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Purpose/Objective: Pre-treatment verification of Volumetric Modulated Arc Therapy (VMAT) is a common practice. MLC trajectory records analysis has been suggested as a method to appropriately control modulated beam delivery day-to-day. These trajectory logs consist in a binary file generated on a TrueBeam (Varian Medical Systems), containing the position expected and actual of many machine parameters, such as gantry angle, jaws and leaves positions and fraction of overall treatment delivered. These data are collected and saved every 20 ms.

This study analyses the effect of day-to-day MLC position on the final dose distribution based on the trajectory log files.

Materials and Methods: 10 VMAT plans (4 head and neck and 6 prostates) irradiated with 6MV on a TrueBeam were selected. For each plan, trajectory logs for all fractions (ranging from 23 to 35) were analyzed and two trajectory logs were selected. First the trajectory log with maximum root mean square (RMS) of the difference on the position of a leave between expected and real position along the fraction (from now PosMax) and second, the trajectory log with maximum RMS of the difference between expected and real gap generated by opposed leaves (GapMax). Using MATLAB (v 7.12), two new plans were created with the MLC positions, gantry angle, and Monitor Units delivered in each control point, recorded on PosMax and GapMax files and new dose distributions were calculated and compared with the original by using Eclipse V.13 (Varian Medical Systems) treatment planning system (TPS).

Results: On table 1 is presented the maximum dose difference between plans generated by using the 'PosMax' and 'GapMax' trajectory logs and the original plan (set as a reference). For all dose distributions maximum differences were found on the external part of the body. Differences on PTV doses were smaller than 2% of the prescribed dose in all treatments studied. In all prostate cases dose differences were higher on healthy tissue than on PTV, that was not observed on the head and neck cases.

		PosMax		GapMax	
Patient #	Presc. Dose (Gy)	Max. diff. body (Gy)	Max. diff. PTV (Gy)	Max. diff. body (Gy)	Max. diff. PTV (Gy)
1 (H&N)	50	0,985 (1.97%)	0,073 (0.15%)	1,048 (2.10%)	0,129 (0.26%)
2 (H&N)	50	0,928 (1.86%)	0,628 (1.26%)	0,813 (1.63%)	0,118 (0.24%)
3 (H&N)	50	0,559 (1.12%)	0,069 (0.14%)	-0,531 (-1.06%)	-0,062 (-0.12%)
4 (H&N)	69,9	-0,792 (-1.13%)	0,22 (0.31%)	0,920 (1.32%)	0,875 (1.25%)
5 (PRS)	55	2,755 (5.01%)	0,366 (0.67%)	2,758 (5.01%)	0,367 (0.67%)
6 (PRS)	46	2,455 (5.34%)	-0,466 (-1.01%)	2,455 (5.34%)	-0,517 (-1.12%)
7 (PRS)	70	1,735 (2.48%)	-0,202 (-0.29%)	-1,432 (-2.05%)	-0,064 (-0.09%)
8 (PRS)	67,5	3,097 (4.59%)	-0,454 (-0.67%)	3,097 (4.59%)	-1,077 (-1.60%)
9 (PRS)	60	-1,526 (-2.54%)	0,4711 (0.79%)	-1,522 (-2.54%)	0,483 (0.81%)
10 (PRS)	70,8	-1,161 (-1.64%)	0,184 (0.26%)	-1,161 (-1.64%)	0,0184 (0.03%)

Table 1

Conclusions: Assuming we can rely on trajectory logs as a treatment actual delivery (what has to be assured independently) no meaningful differences were found between planned and delivered dose distributions, although the worst scenario was considered. Similar differences were found independently of using PosMax or GapMax log files to recalculate the dose distributions. Although in all cases studied organs at risk met the dosimetric constraints, further investigations could be needed to study the actual delivered dose in normal tissue. The software developed generates a plan with the applied treatment parameters and can contribute to a better estimation of the delivered dose on the patient. Next stage in our studies will be the calculation of these plans on the CBCT images recorded during the treatment.

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Optimal dose junction gradient creation for intensity modulated fields

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