

Supplementary Materials

# Selecting Optimal Proton Pencil Beam Scanning Plan Parameters to Reduce Dose Discrepancy between Discrete Spot Plan and Continuous Scanning: A Proof-of-Concept Study

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**Table S1.** Simulated DDCS Dose Discrepancy and Fraction of Break Spots.

MU/spot minimum, mMU	Spot spacing, sigma	Dose, GyRBE	Stop ratio constraint	Break spots fraction, %	CTV DVH RMSE, %	2%/2-mm gamma passing rate, %	1%/1-mm gamma passing rate, %
0.1	0.5	0.5	1	90	0.0	100.0	100.0
0.1	1.0	0.5	1	78	0.3	98.0	91.1
0.1	1.5	0.5	1	71	0.2	98.5	90.9
3.0	0.5	0.5	1	49	0.6	98.2	89.9
3.0	1.0	0.5	1	39	1.0	98.4	87.8
3.0	1.5	0.5	1	49	0.3	99.6	96.7
6.0	1.0	0.5	1	25	1.9	93.3	78.8
0.1	0.5	2.0	1	63	0.0	100.0	100.0
0.1	1.0	2.0	1	43	0.1	100.0	99.4
0.1	1.5	2.0	1	25	0.1	100.0	100.0
3.0	0.5	2.0	1	29	0.1	100.0	100.0
3.0	1.0	2.0	1	23	0.1	100.0	100.0
3.0	1.5	2.0	1	14	0.0	100.0	100.0
6.0	0.5	2.0	1	11	0.9	99.4	91.3
6.0	1.0	2.0	1	8	0.4	100.0	97.7
6.0	1.5	2.0	1	6	0.1	100.0	99.9
0.1	0.5	0.5	0	75	0.0	100.0	100.0
0.1	1.0	0.5	0	58	0.6	98.0	91.1
0.1	1.5	0.5	0	40	0.3	98.5	90.9
3.0	0.5	0.5	0	22	2.5	86.5	74.2
3.0	1.0	0.5	0	16	1.6	95.2	82.9
3.0	1.5	0.5	0	21	1.0	96.3	84.9
6.0	1.0	0.5	0	7	4.5	81.4	63.5
0.1	0.5	2.0	0	39	0.0	100.0	100.0
0.1	1.0	2.0	0	29	0.1	100.0	99.7
0.1	1.5	2.0	0	19	0.1	100.0	99.8
3.0	0.5	2.0	0	9	0.2	100.0	99.9
3.0	1.0	2.0	0	8	0.2	100.0	99.8
3.0	1.5	2.0	0	5	0.1	100.0	100.0
6.0	0.5	2.0	0	3	3.7	79.3	65.4
6.0	1.0	2.0	0	3	1.1	97.0	87.9
6.0	1.5	2.0	0	0	0.2	100.0	99.4
3.0	0.5	5.0	0	2	0.1	100.0	100.0

3.0	1.0	5.0	0	2	0.1	100.0	100.0
3.0	1.5	5.0	0	2	0.0	100.0	100.0
6.0	0.5	5.0	0	1	0.2	97.9	80.6
6.0	1.0	5.0	0	0	0.1	100.0	100.0
6.0	1.5	5.0	0	1	0.0	100.0	100.0
3.0	0.5	10.0	0	0	0.1	100.0	100.0
3.0	1.0	10.0	0	1	0.1	100.0	100.0
3.0	1.5	10.0	0	2	0.0	100.0	100.0
6.0	0.5	10.0	0	0	0.2	100.0	100.0
6.0	1.0	10.0	0	0	0.1	100.0	100.0
6.0	1.5	10.0	0	0	0.0	100.0	100.0

Abbreviations: CTV, clinical target volume; DDCS, dose-driven continuous scanning; DVH, dose-volume histogram; GyRBE, relative biological effectiveness of physical dose in Gray; MU, monitor unit; RMSE, root mean square error.