


Simultaneous Beam Sampling and Aperture Shape Optimization for Station Parameter Optimized Radiation Therapy (SPORT)

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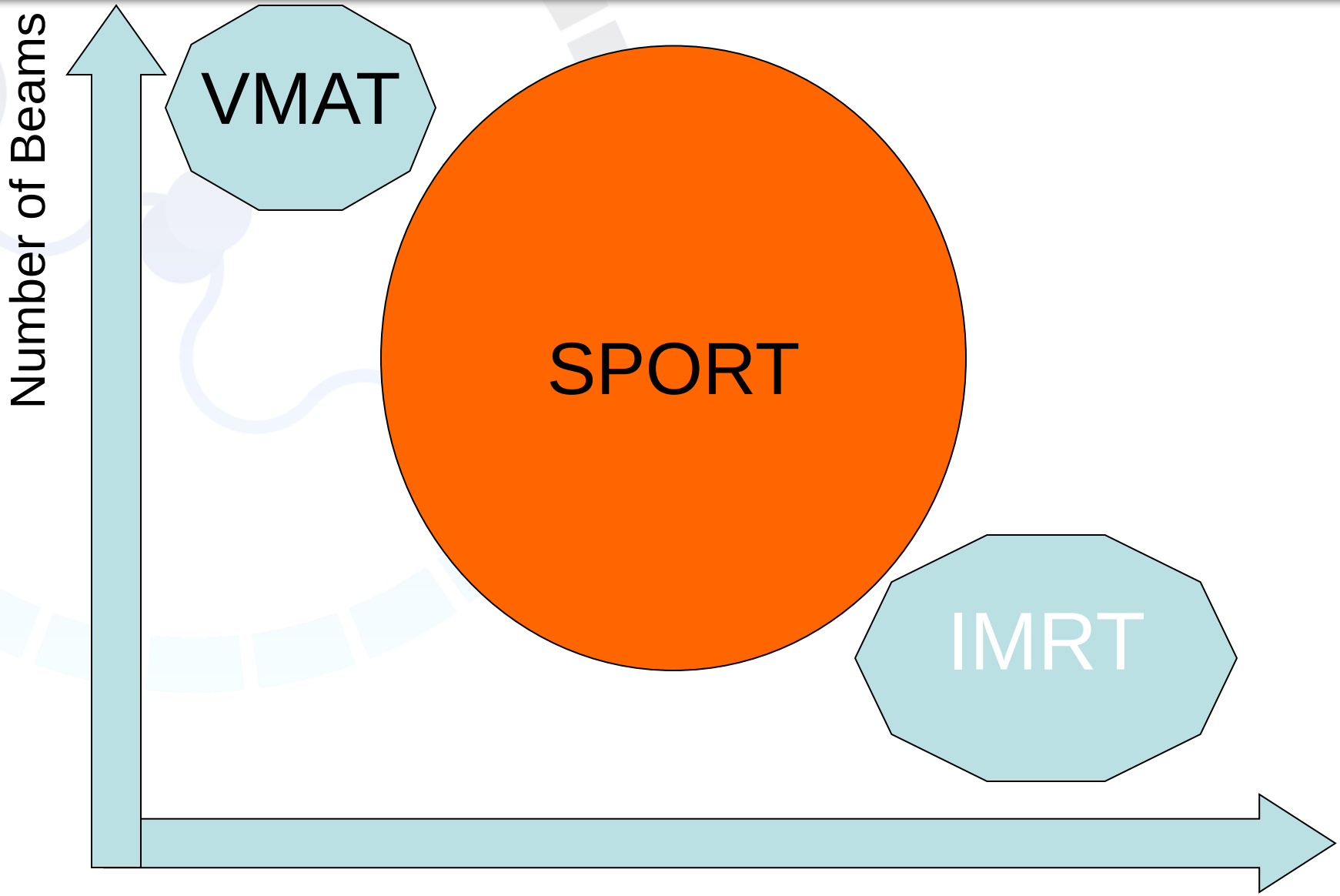
SPORT Bridges the Gap



R. Li & L. Xing, Med Phys. 38, 4912-19, 2011.

The Purpose

- Introducing an optimization framework to implement SPORT

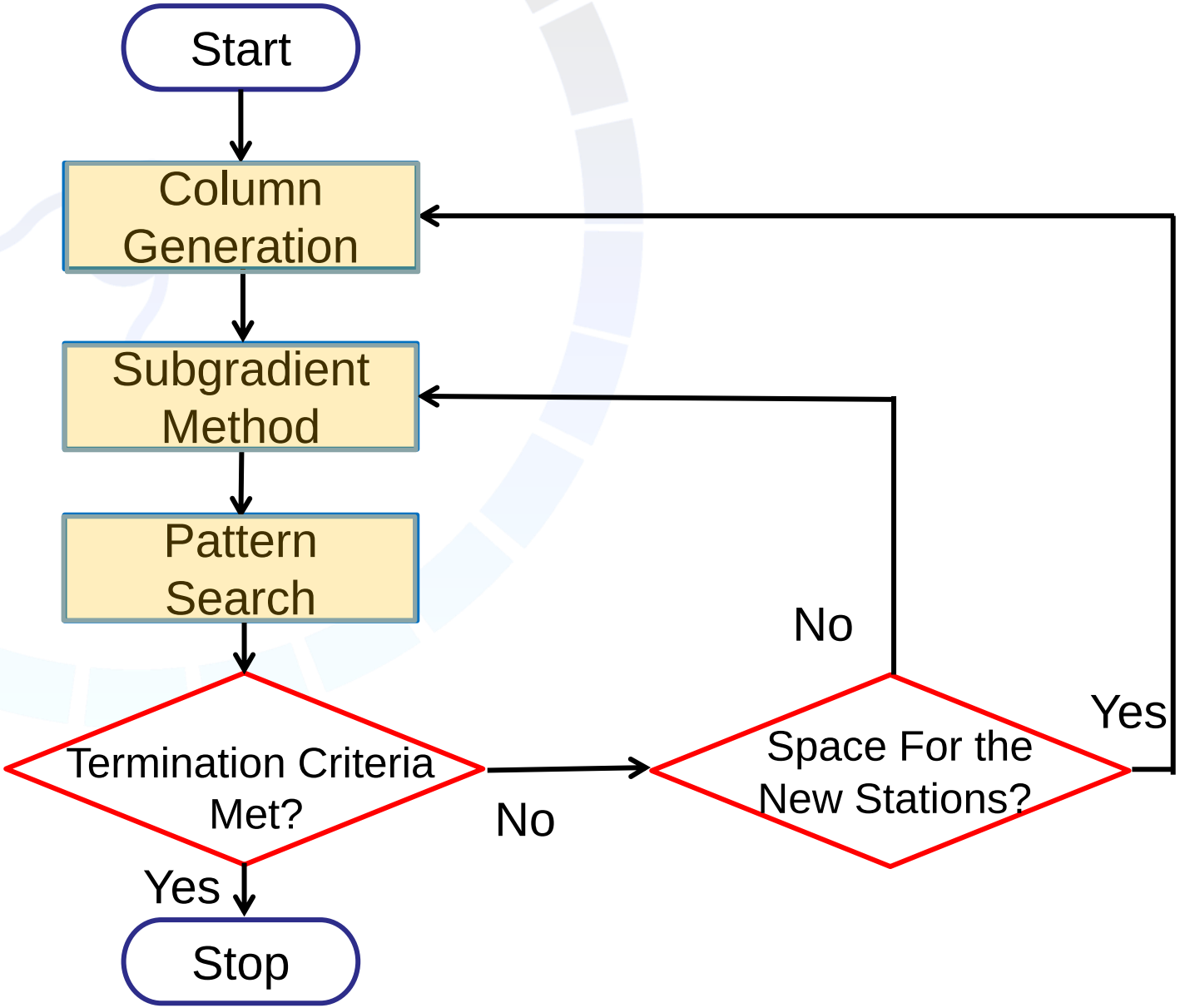
1- R. Li and L. Xing, Medical Physics **38**(9), 4912–4919 (2011).

2- L. Xing, M.H. Phillips, and C.G. Orton, Medical Physics **40**(2), 020601 (2013).

3- R. Li and L. Xing, Medical Physics **40**(5), 050701 (2013).

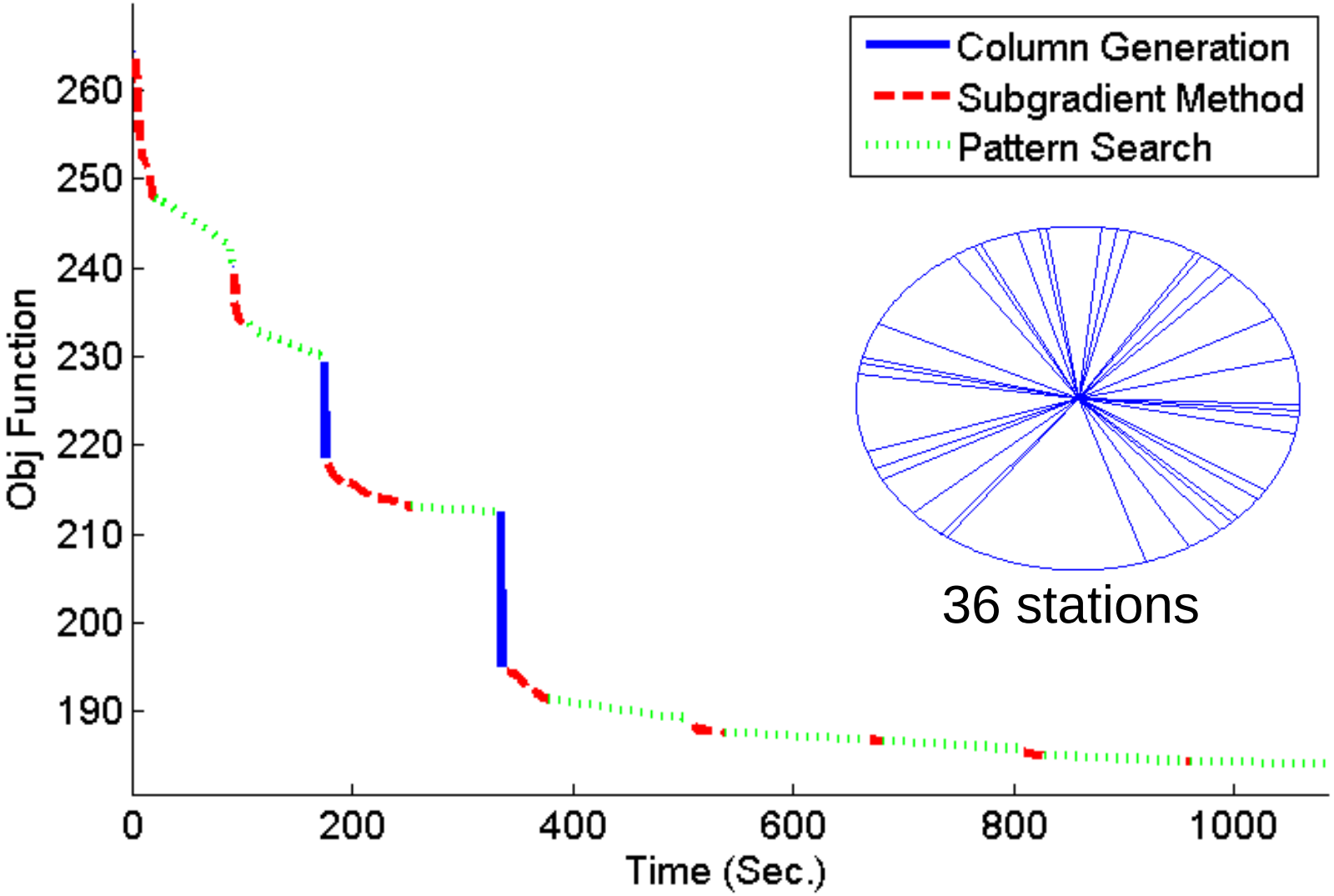
4- L. Xing and R. Li, J. Phys.: Conf. Ser. **489**(1), 012065 (2014).

Algorithm Flowchart



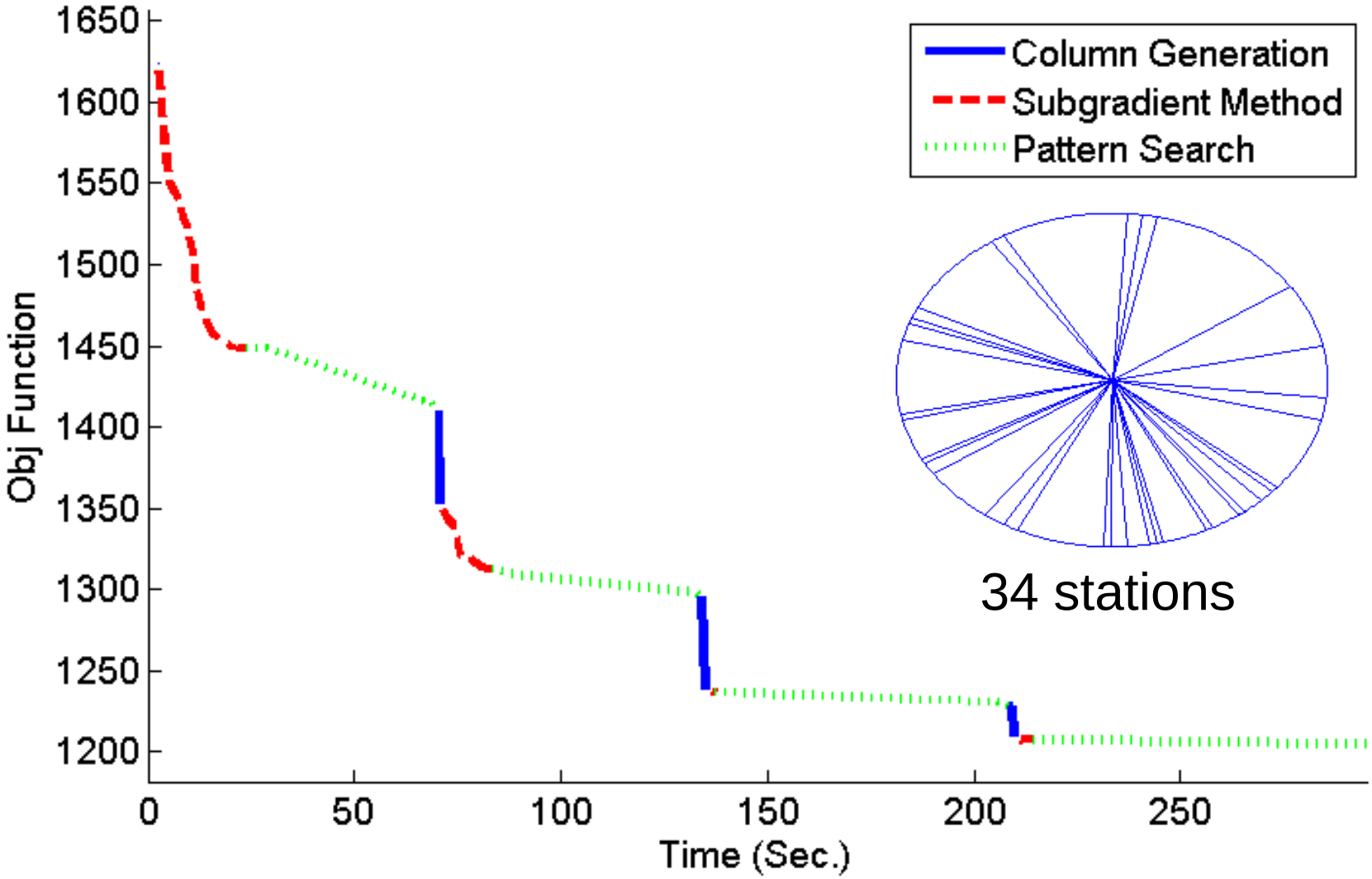
Convergence: Head & Neck

Head & Neck



Convergence: Prostate

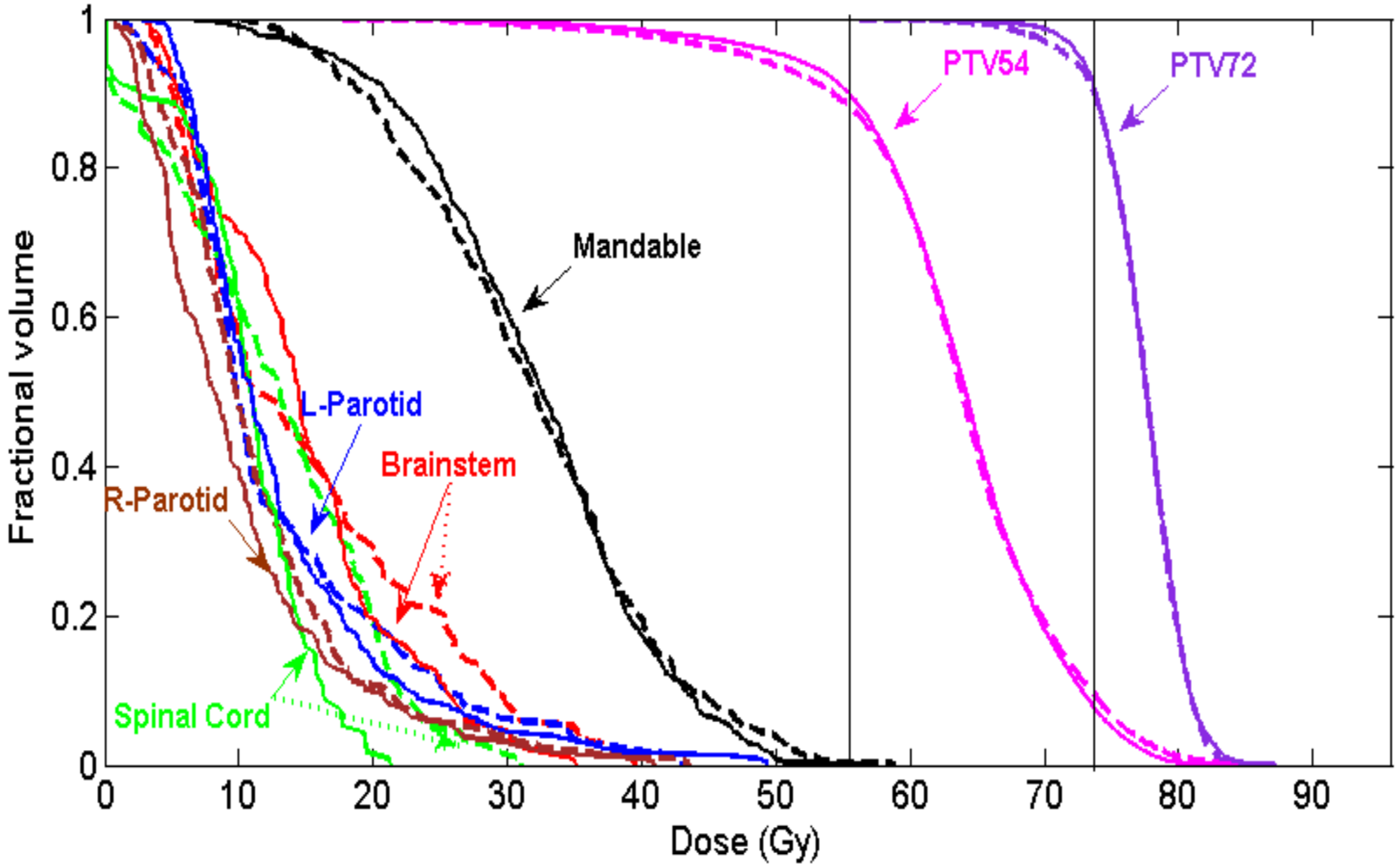
Prostate



SPORT V.S. IMRT

Head & Neck

SPORT
IMRT



SPORT V.S. IMRT

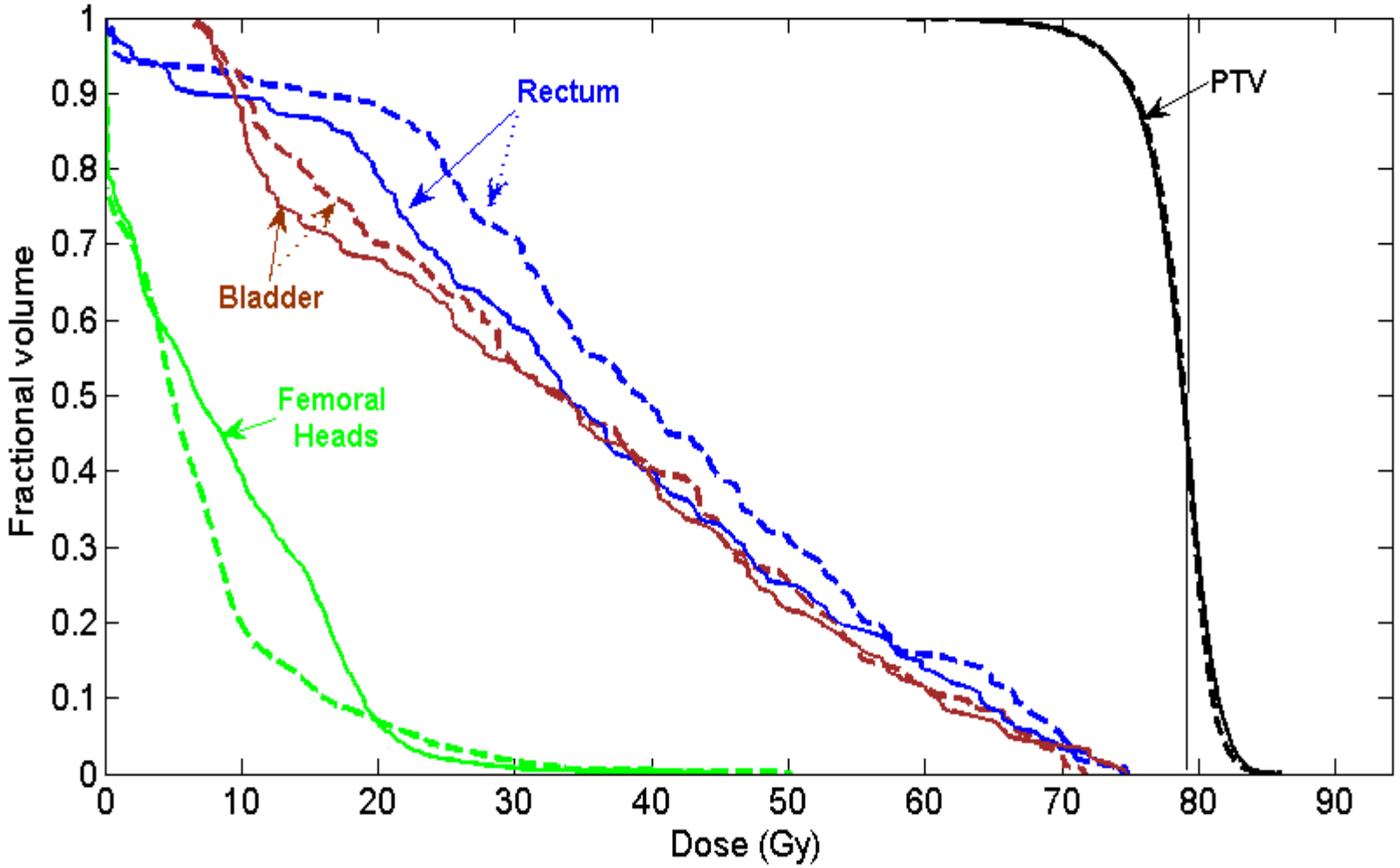
Head & Neck

Organ	Specific interest	SPORT	IMRT	Rel. diff.
PTV72	D (5%)	81.8	**81.6**	0.2%
	D (99%)	**69.4**	66.6	4.1%
PTV 54	D (5%)	**75**	75.9	1.2%
	D (99%)	**35.9**	32.2	10.8%
Cord	Max	**21.2**	30.9	37.2%
Brainstem	Max	**34.9**	39.4	12.1%
Mandable	Mean	31.9	**31.7**	0.6%
L-Parotid	Mean	13	13	0%
R-Parotid	Mean	**9.7**	11.4	16.1%

SPORT V.S. IMRT

Prostate

SPORT
IMRT

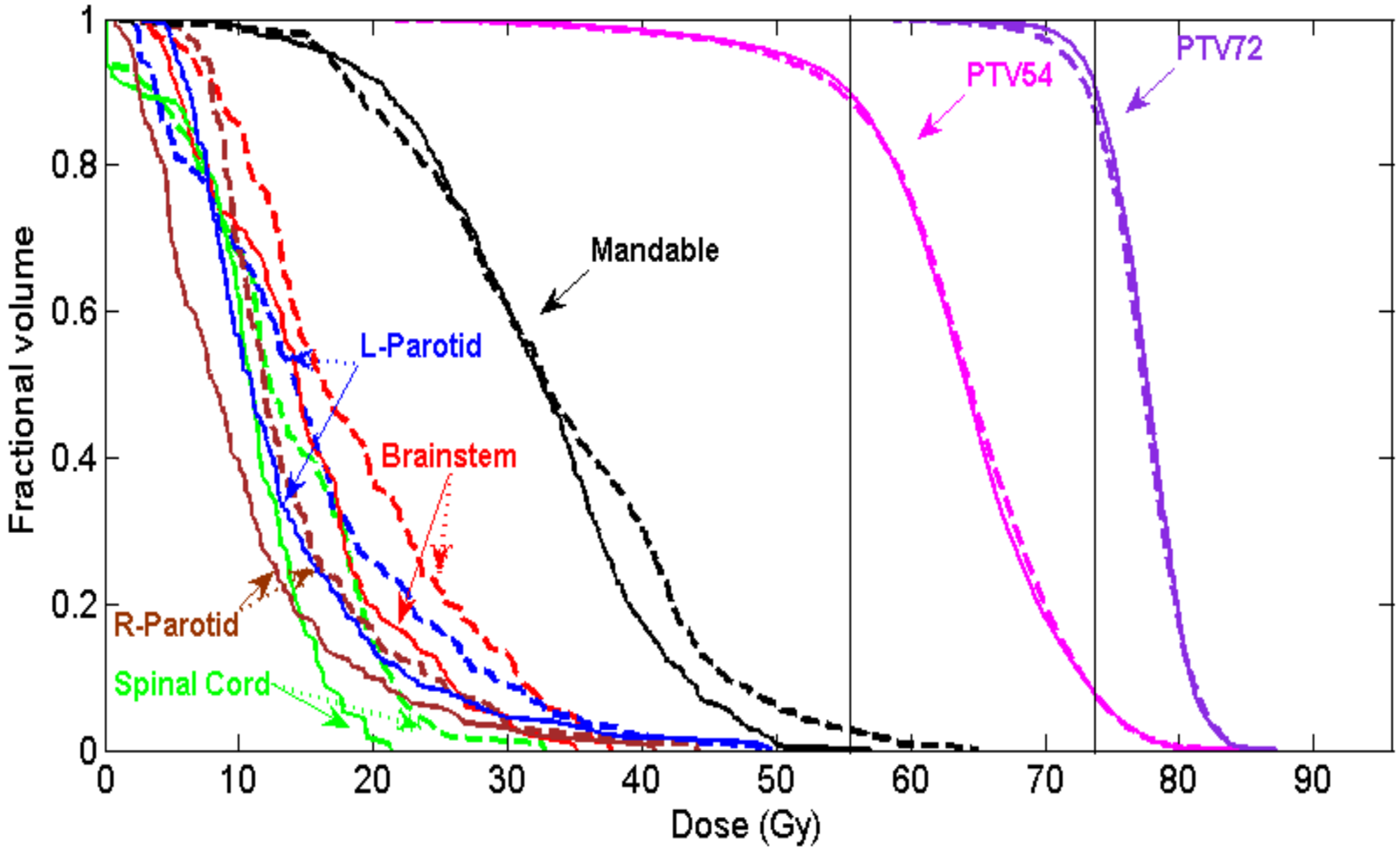


Optimized Angles V.S. Uniform

Head & Neck

SPORT-Optimized angles

Uniform beam sampling



Optimized Angles V.S. Uniform

Head & Neck

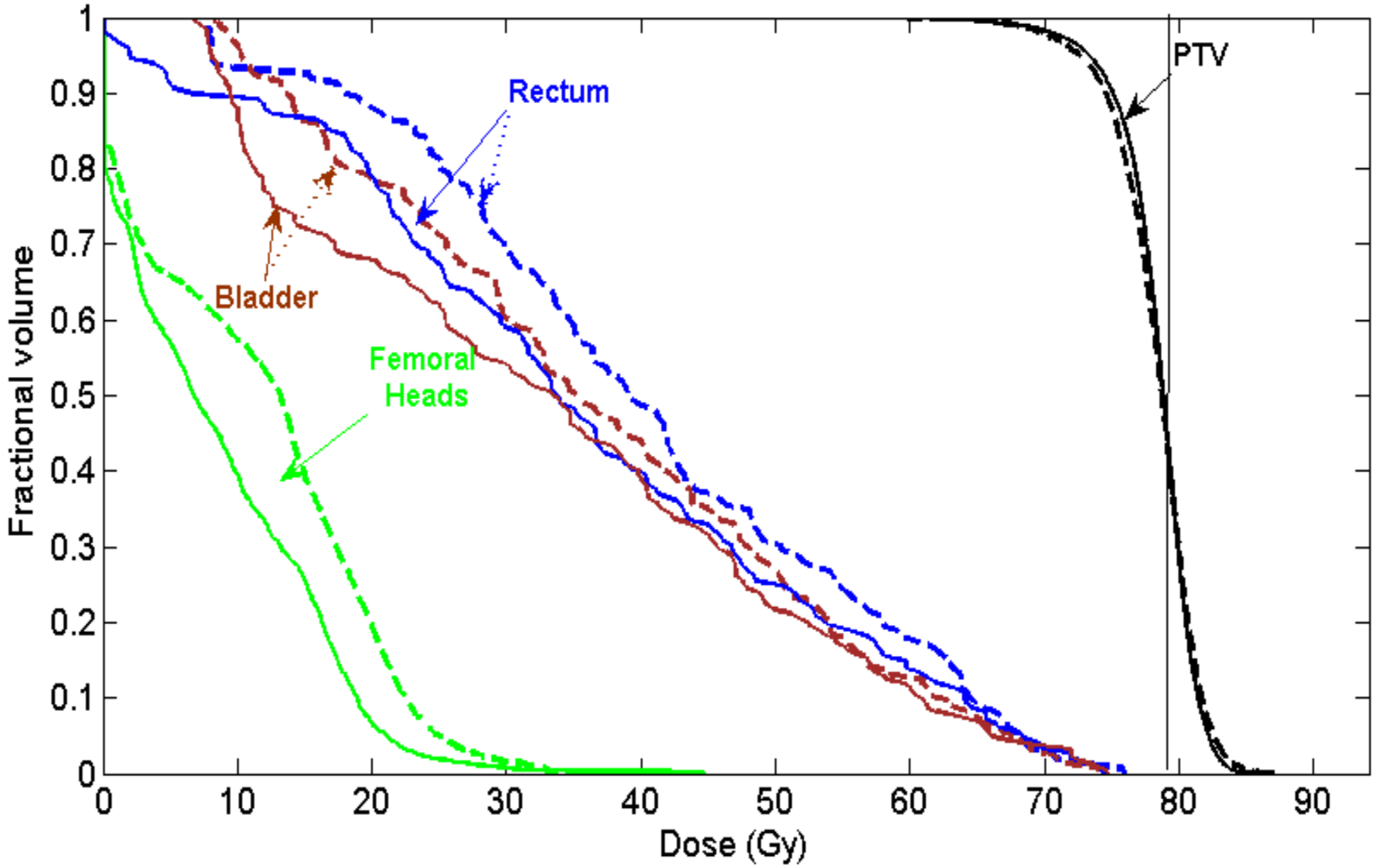
Organ	Specific interest	SPORT	Uniform Angles	Rel. diff.
PTV72	D (5%)	**81.8**	82	0.2%
	D (99%)	**69.4**	66.8	3.8%
PTV 54	D (5%)	75	**74.9**	0.1%
	D (99%)	**35.9**	34.7	3.3%
Cord	Max	**21.2**	32.6	42%
Brainstem	Max	**34.9**	37.5	7.1%
Mandable	Mean	**31.9**	33.3	4.3%
L-Parotid	Mean	**13**	15.3	16%
R-Parotid	Mean	**9.7**	14	36.3%

Optimized Angles V.S. Uniform

Prostate

SPORT-Optimized angles

Uniform beam sampling



Summary & Future Research

- SPORT optimization framework with integration of three complementary algorithms
- Automatically determines the number of the stations & optimizes simultaneously the involved station parameters
- The optimal stations (control points) can be efficiently delivered with the new digital Linacs (.xml file & TrueBeam developer mode)
- SPORT with collimator modulation, non-coplanar and/or even no-isocentric beams

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  - Department of Radiation Oncology
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  - Department of Radiation Oncology