

ASSESSMENT AND AUDIT OF CHARGED PARTICLE BEAM THERAPY IN CLINICAL TRIALS



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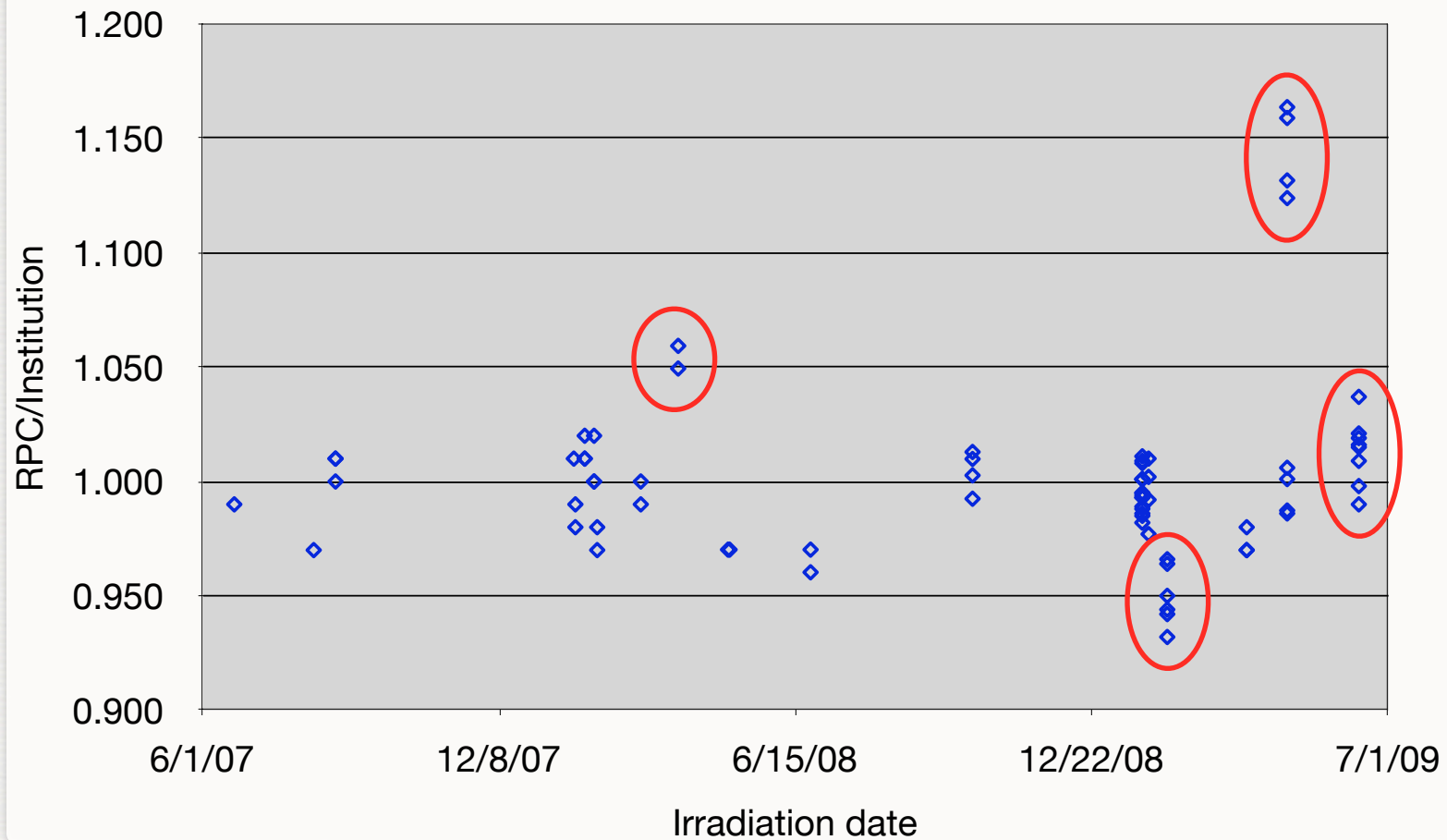
CHARGED PARTICLE BEAMS

- ❖ Presently 5 clinically-active US proton therapy centers
- ❖ At least 2 new centers expected to open this year, perhaps 5 more in next 2 years
- ❖ No heavy particle beam centers anticipated today
 - ❖ RPC anticipates that by 5th year of next grant cycle, will need to prepare to audit helium / carbon ion beam facilities

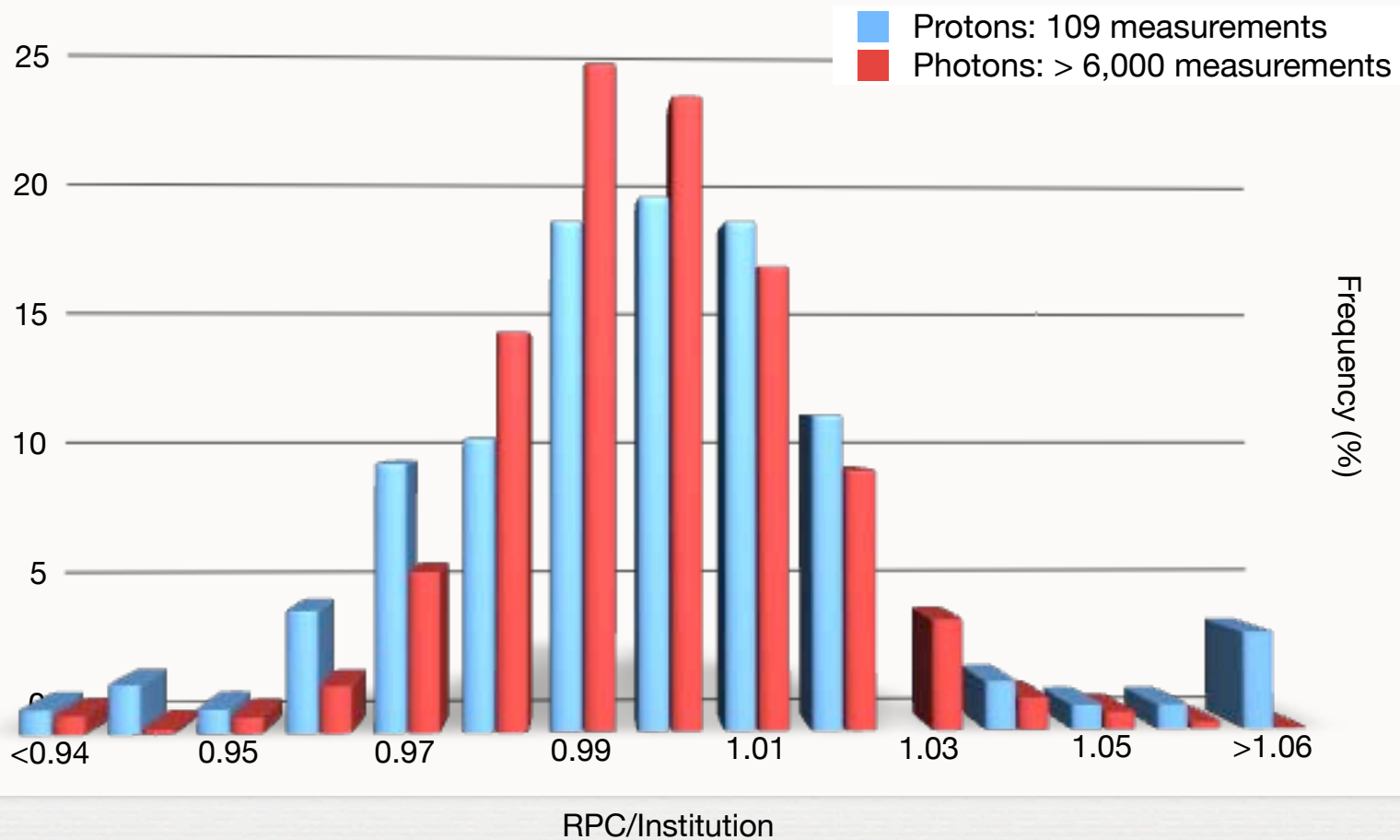
PROTON FACILITY CREDENTIALING

- * NCI Guidelines mandate –
 - * Questionnaire - sent to facilities by QARC
 - * Completed by 4 of 5 centers
- * TLD monitoring
 - * Mailed to all 5 US centers + 1 Japanese center
- * On-site dosimetry review visits
 - * 1st visit completed
- * Anthropomorphic phantom
 - * Modified existing pelvis phantom

PROTON BEAM MONITORING



PROTON BEAM MONITORING



AUDITS

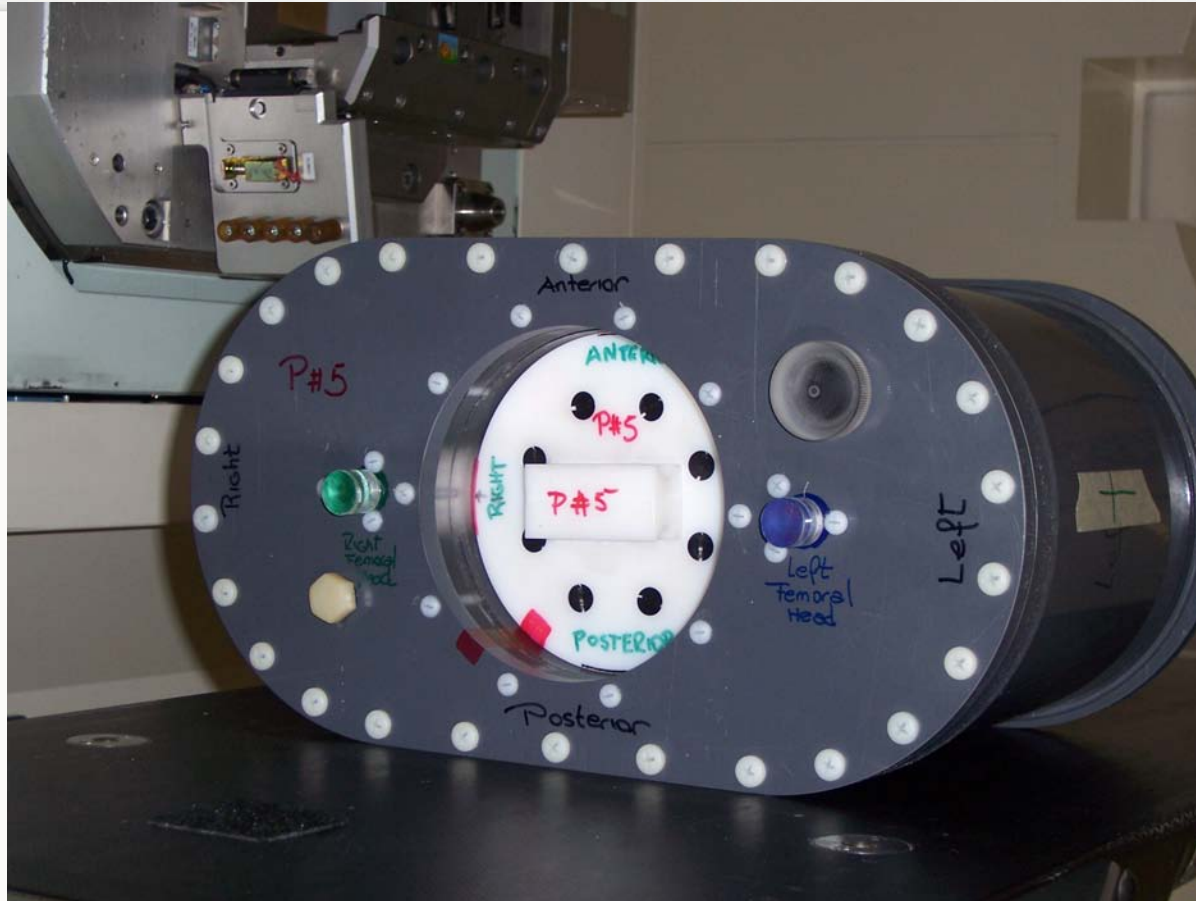
- ❖ Evaluation of OSL for audits of proton beams will begin this summer
- ❖ Program of evaluation likely to extend into next grant cycle



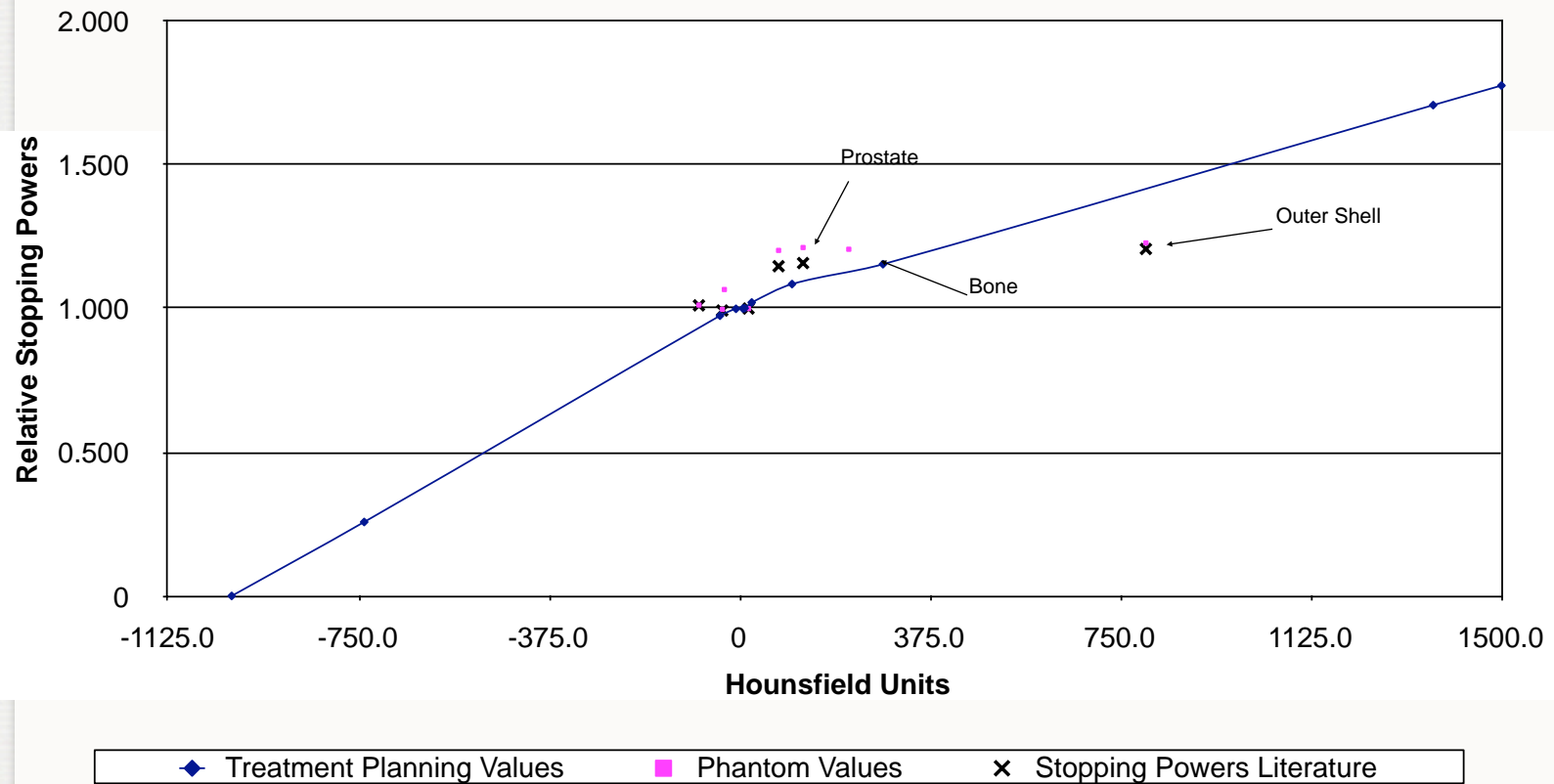
PHANTOMS

- ❖ Pelvis phantom has been developed
 - ❖ Evaluation is under way, will be completed this summer
- ❖ Lung phantom evaluation will begin this fall
 - ❖ Evaluation of materials will be considerably more complex
 - ❖ Likely to extend into next grant cycle

PROTON PELVIS PHANTOM

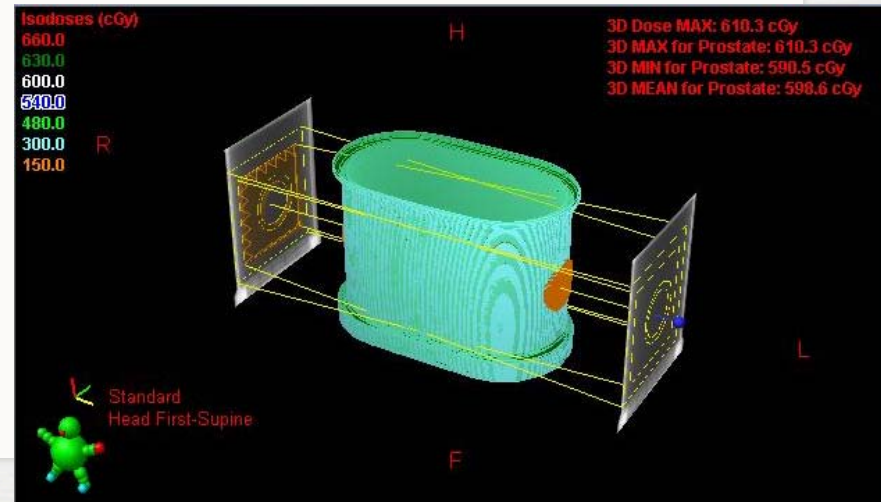
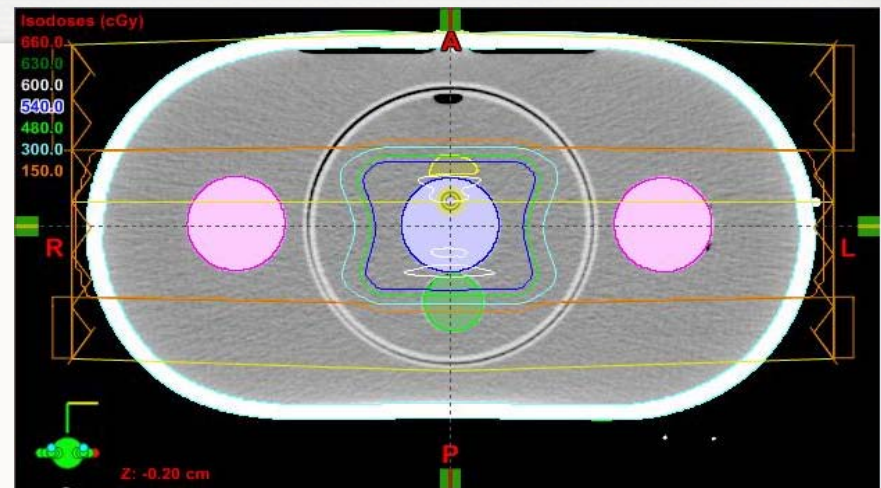


MATERIAL STOPPING POWERS



PHANTOM TREATMENT

- ❖ Treatment plan created with a prescription of 6 Gy to the prostate
- ❖ Plan delivered 3 times with film and TLD inserted in phantom
- ❖ Plan accounting for difference in patient and material SP to be delivered in near future



TLD RESULTS

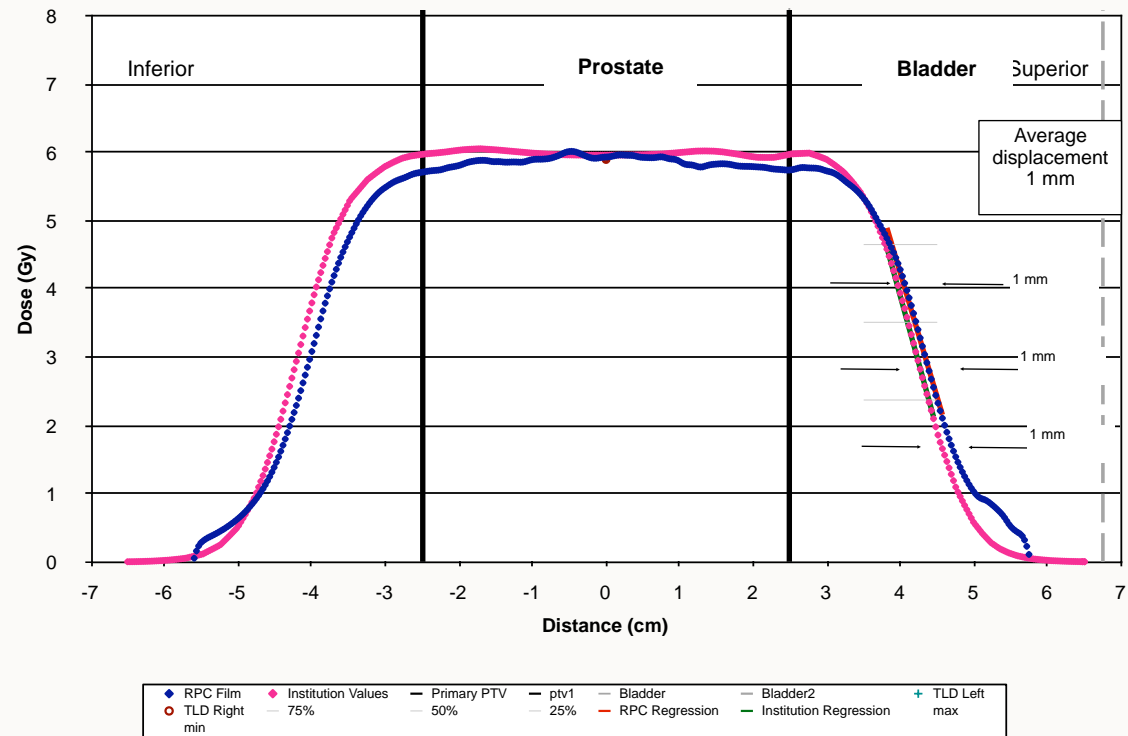
	PTV Right	PTV Left	Femur Right	Femur Left
Institution Predicted Dose (cGy)	600.2	600.2	247.3	243.8
TLD Measured Dose (cGy)	589.8	595.1	242.1	240.4
Measured / Predicted Dose	0.983	0.992	0.979	0.986

- ❖ PTV within 1.7% of predicted value
- ❖ Femur within 2.1% of predicted value

FILM RESULTS

Feb. 19 2009 Trial 1

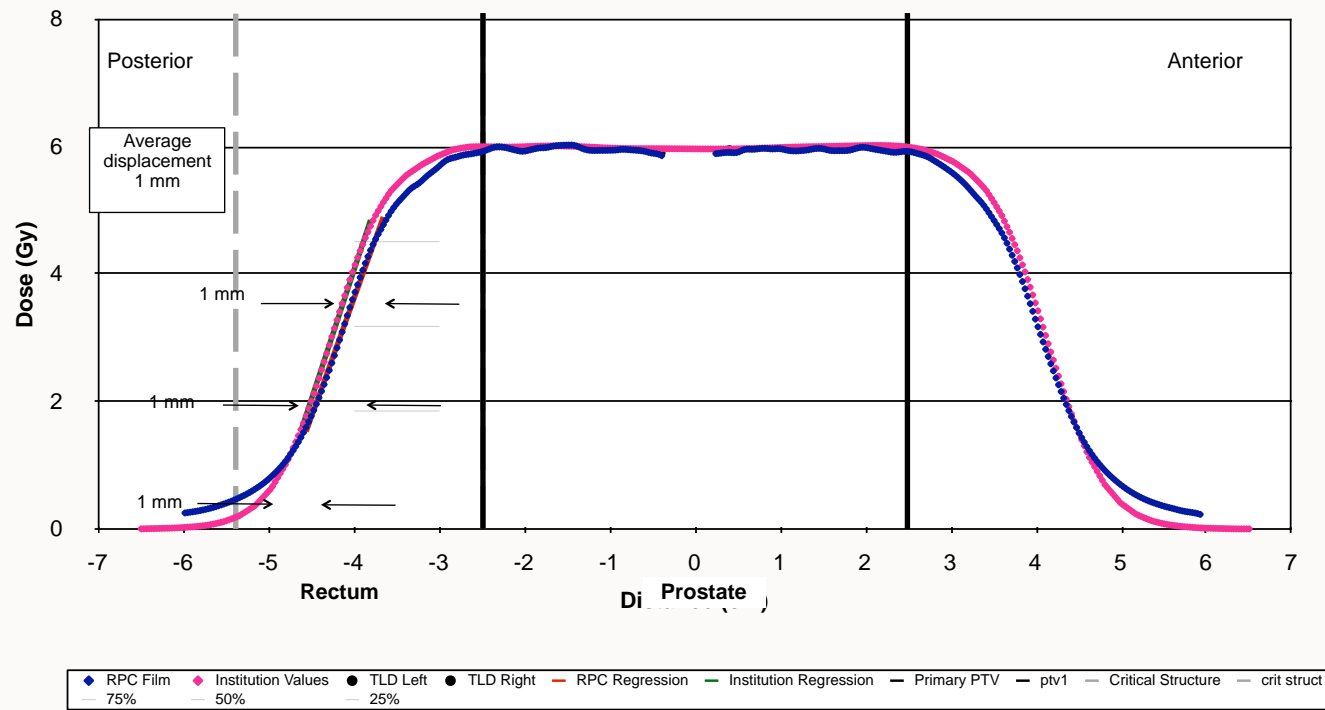
Superior Inferior Profile - Coronal Plane



FILM RESULTS

Feb 19 2009 Trial 1

Anterior Posterior Profile- Sagittal Plane



REPRODUCIBILITY

PTV Right:		PTV Left:	
Predicted Dose (cGy):	600.2	Predicted Dose (cGy):	600.2
Measured Dose (cGy):	590.4	Measured Dose (cGy):	592.5
Std. Deviation	0.202%	Std. Deviation	0.463%
Meas/Pred	0.984	Meas/Pred	0.987

- ❖ Measured Dose averaged over 3 trials
- ❖ Film profiles show max difference of 2 mm shift between trials

VISITS

- ❖ Visit procedures have been developed at PTC-H
- ❖ First full visit conducted weeks of April 20 & June 8
 - ❖ F. H. Burr Proton Therapy Center @ MGH
- ❖ Measurements made:
 - ❖ Mechanical tests, x-ray imaging / patient alignment
 - ❖ Output, depth dose, range (for variety of beam energies, modulation, field size, etc.)
 - ❖ Review of treatment planning procedures

MEASUREMENTS

Condition	Range	SSD	SOBP	Field size	Snout	Measurements
1	Reference	Reference	Reference	Reference	Reference	%dd, output, k_s , k_{pol}
2	Reference	Shorter	Reference	Reference	Reference	%dd, output
3	Greater	Shorter	Reference	Reference	Reference	%dd, output
4	Smaller	Shorter	Reference	Reference	Reference	%dd, output
5	Reference	Reference	Greater	Reference	Reference	%dd, output
6	Reference	Reference	Smaller	Reference	Reference	%dd, output
7	Reference	Reference	Reference	Smaller	Reference	%dd, output
8	Reference	Reference	Reference	Larger	Reference	%dd, output
9	Prostate case					%dd, output
10	Pediatric (e.g., spine) case					%dd, output
11	Reference	Reference	Reference	Reference	Reference	Profiles