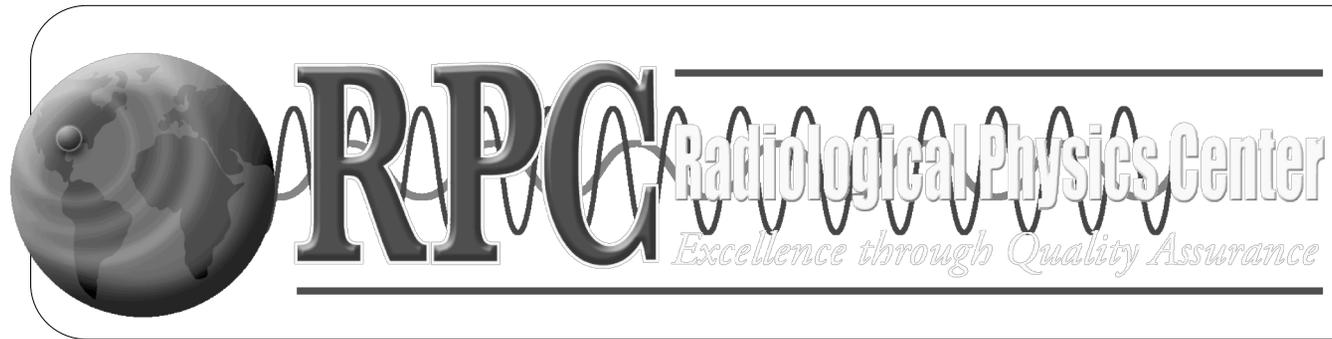


# The Radiological Physics Center's Experience with IMRT



RSNA

November 28, 2006

Geoffrey S. Ibbott, Ph.D.

THE UNIVERSITY OF TEXAS  
MD ANDERSON  
CANCER CENTER  
*Making Cancer History®*

# Acknowledgements

- RPC Staff, especially Andrea Molineu, Paola Alvarez, Jessica Lowenstein, Joye Roll and David Followill



- Supported in part by PHS grants CA10953 and CA81647 awarded by the NCI, DHHS.

# Purposes of Credentialing for IMRT Clinical Trials

- Education
- Evaluate ability to deliver dose
- Improve understanding of protocol
- **Reduce deviation rate**

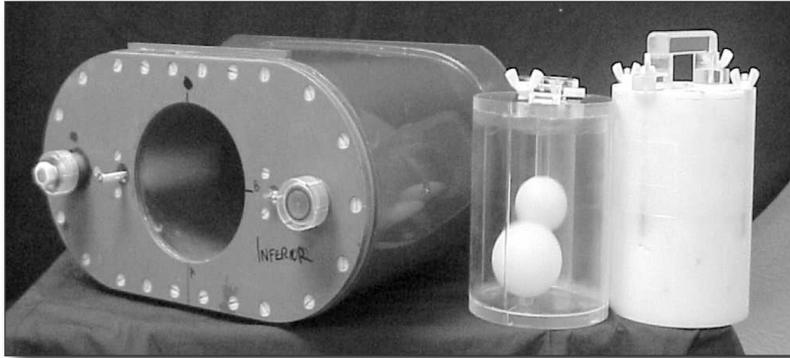
# General Credentialing Process

- Previous patients treated with technique
- Facility Questionnaire
- Knowledge Assessment Questionnaire
- Benchmark case or phantom
- Electronic data submission
- RPC QA & dosimetry review
- Clinical review by radiation oncologist

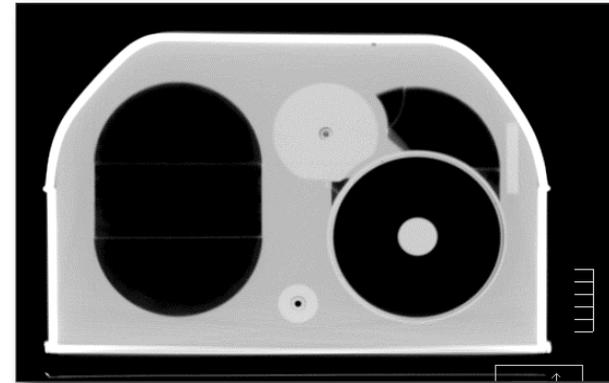
## Feedback to Institution



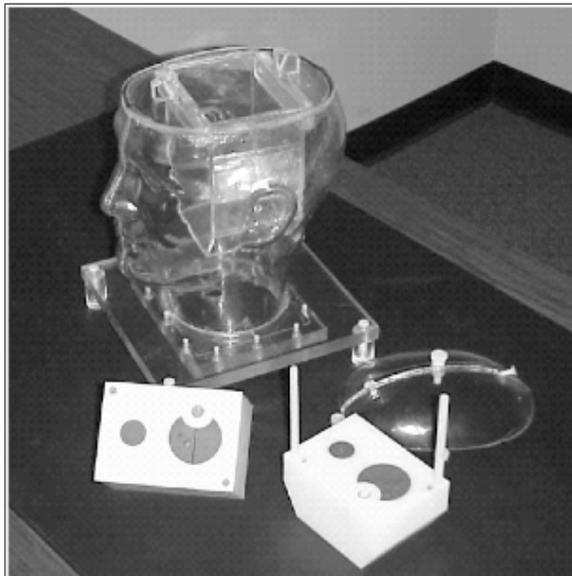
# RPC Phantoms



prostate IMRT: 4, incl. prosthesis



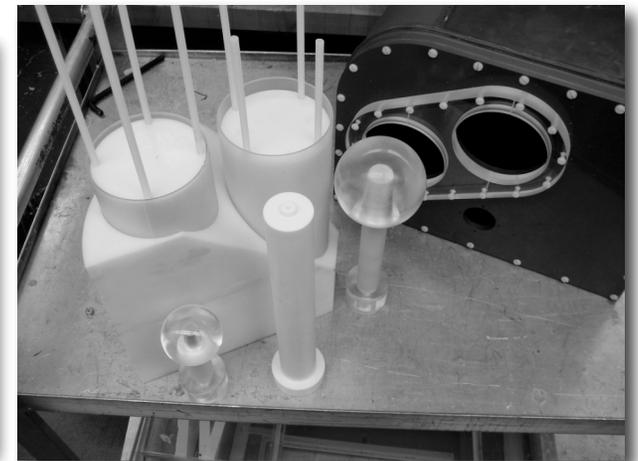
thorax IMRT/SBRT: 3  
phantoms, 6 constr., motion



H&N IMRT: 20 in  
service, 5 under  
constr.



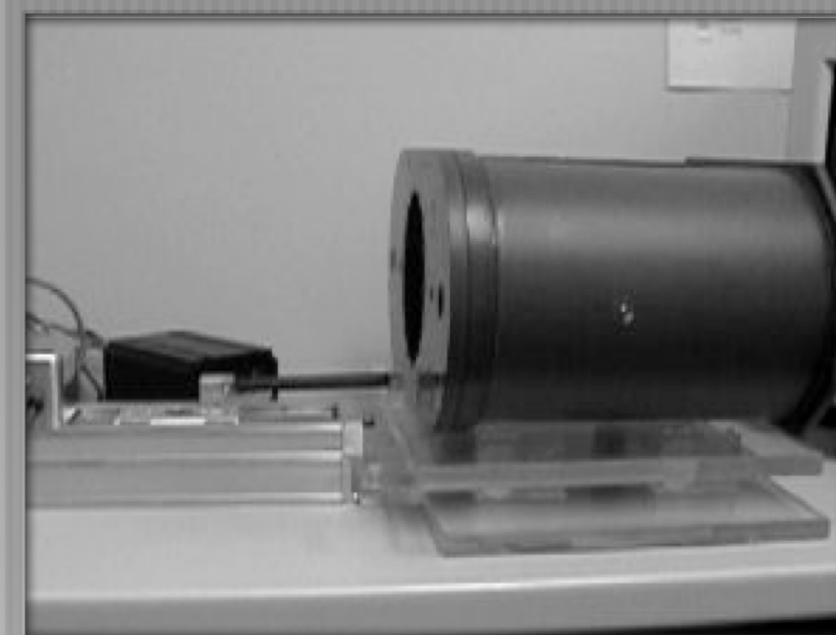
SRS: 2 in service, others  
sent by RDS



liver SBRT: 3,  
incl. motion



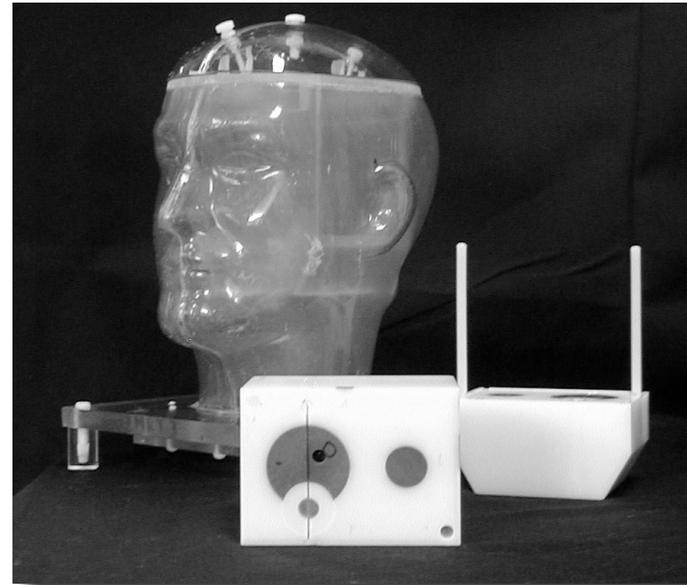
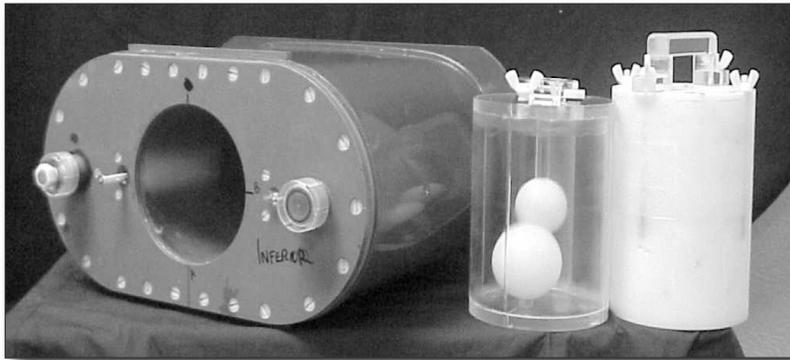
**Thorax IMRT/SBRT Phantom**



# Thorax Phantom with Motion

# IMRT Credentialing

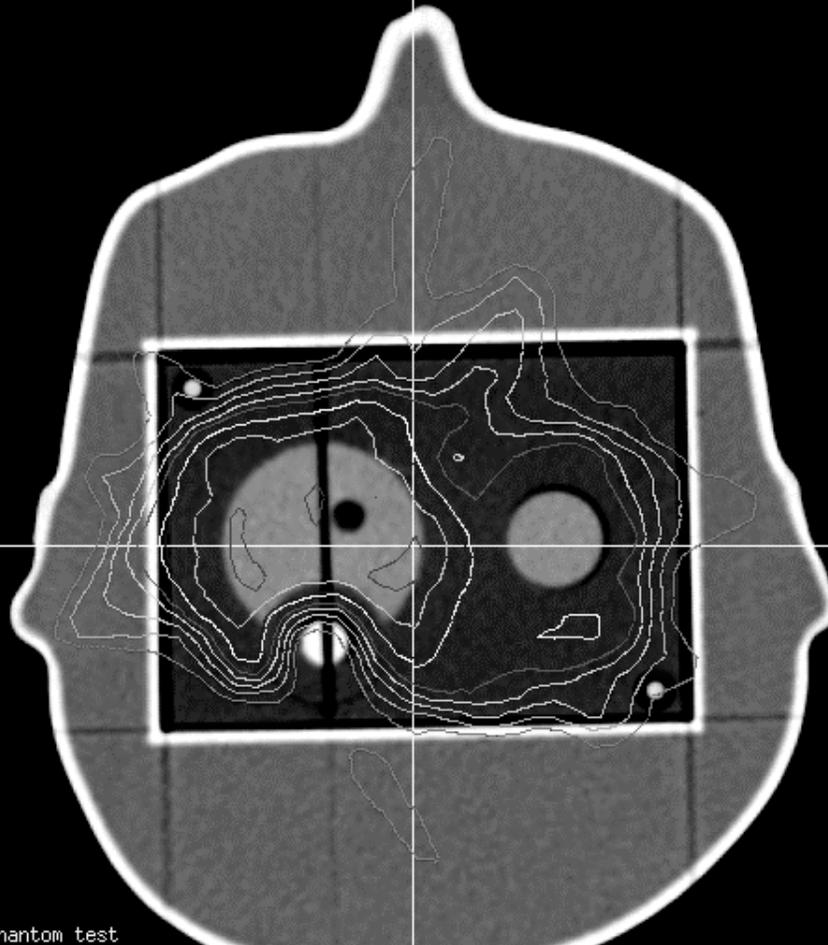
- 196+ institutions have successfully irradiated an RPC IMRT phantom



**Scan, Plan,  
Treat a  
phantom**

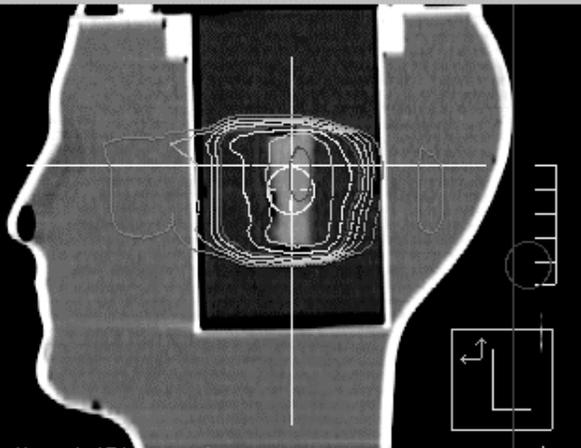


Absolute  
700,0 cGy  
660,0 cGy  
614,0 cGy  
600,0 cGy  
540,0 cGy  
502,0 cGy  
450,0 cGy  
400,0 cGy  
350,0 cGy

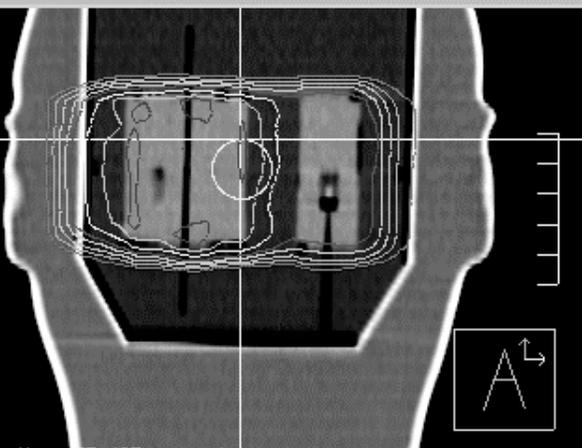


Slice 83: Z = -1,400 phantom test

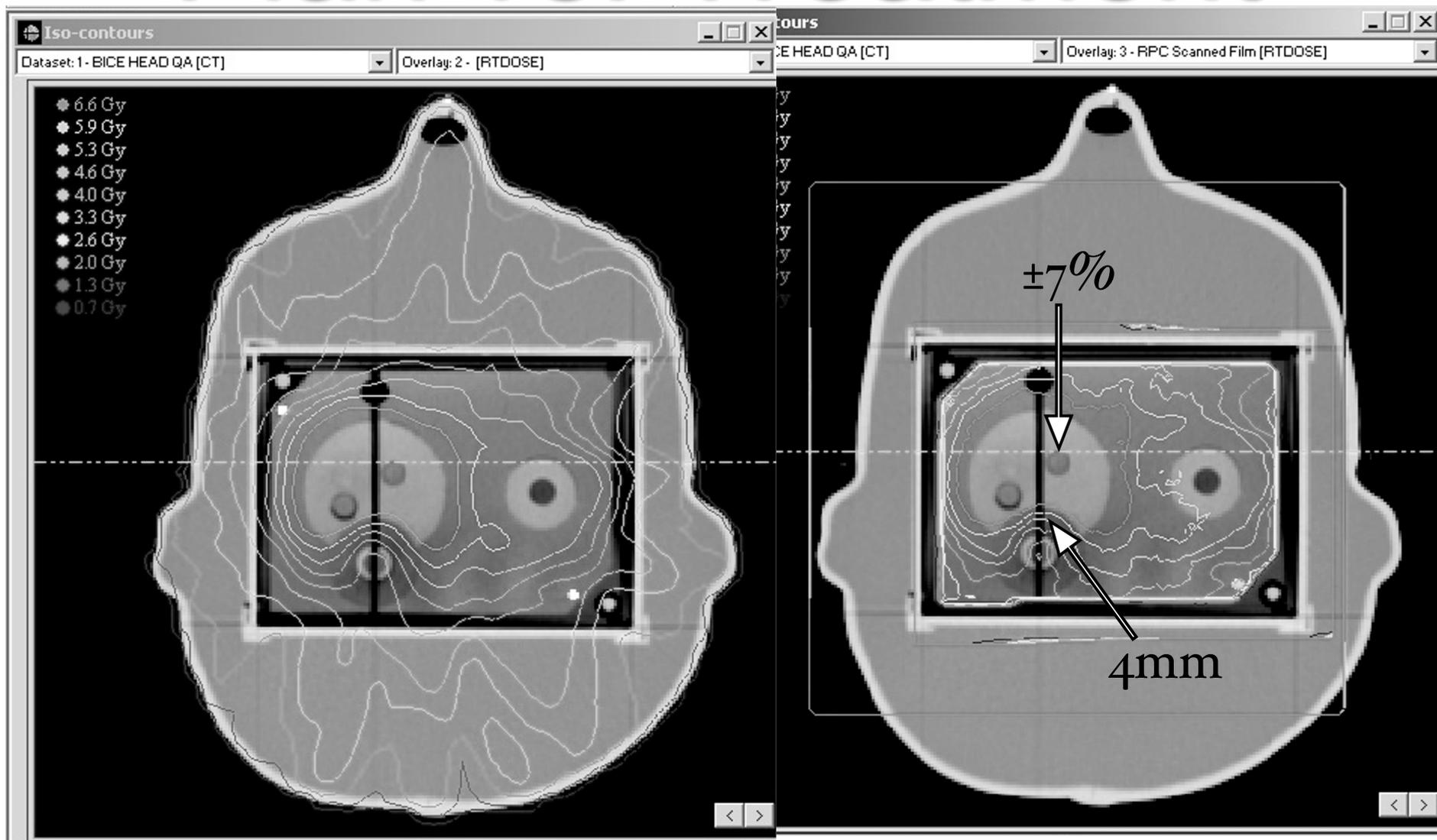
Absolute  
700,0 cGy  
660,0 cGy  
614,0 cGy  
600,0 cGy  
540,0 cGy  
502,0 cGy  
450,0 cGy  
400,0 cGy  
350,0 cGy



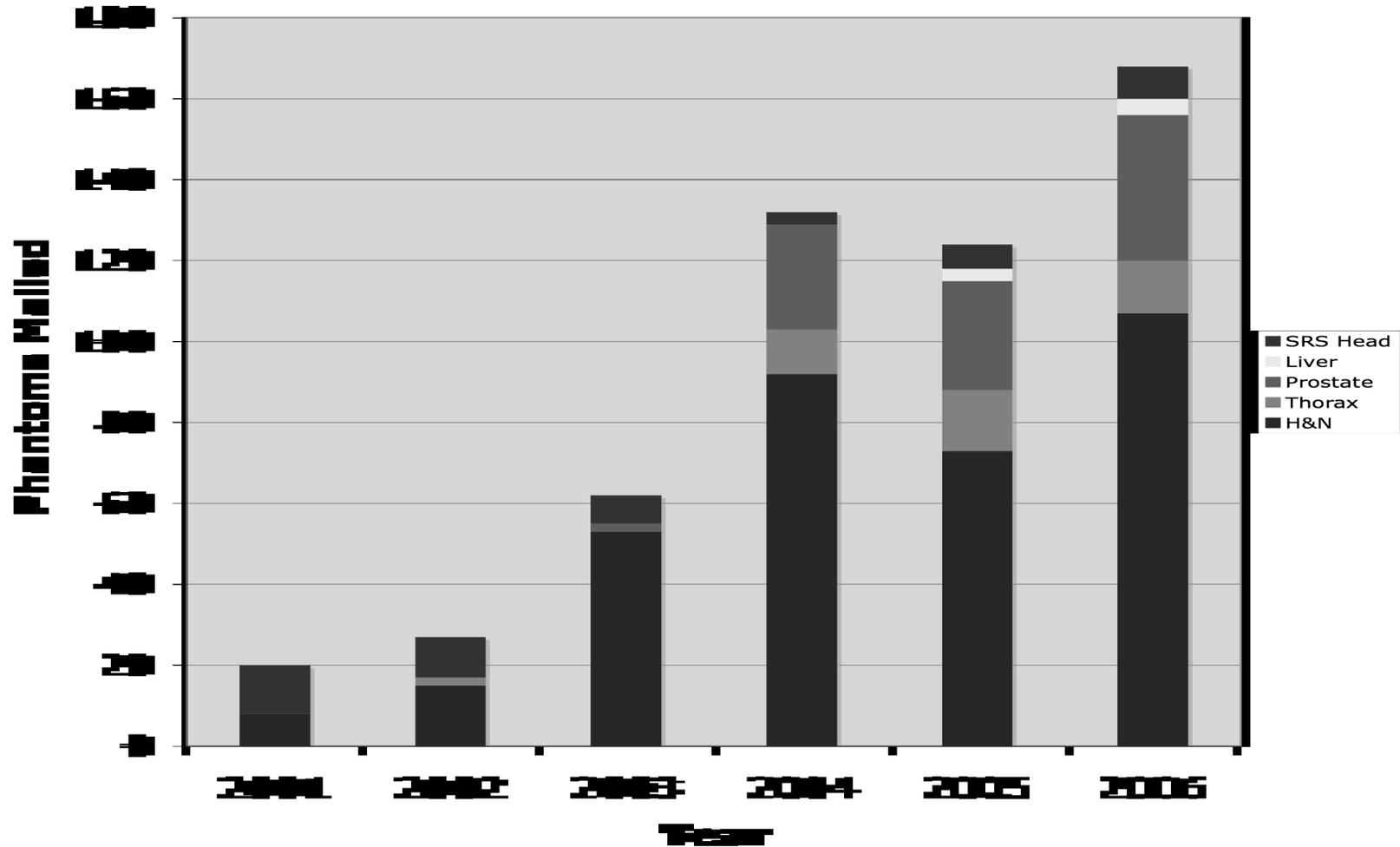
Absolute  
700,0 cGy  
660,0 cGy  
614,0 cGy  
600,0 cGy  
540,0 cGy  
502,0 cGy  
450,0 cGy  
400,0 cGy  
350,0 cGy



# Plan vs. Treatment



# Number of Phantom Mailings



# Phantom Results

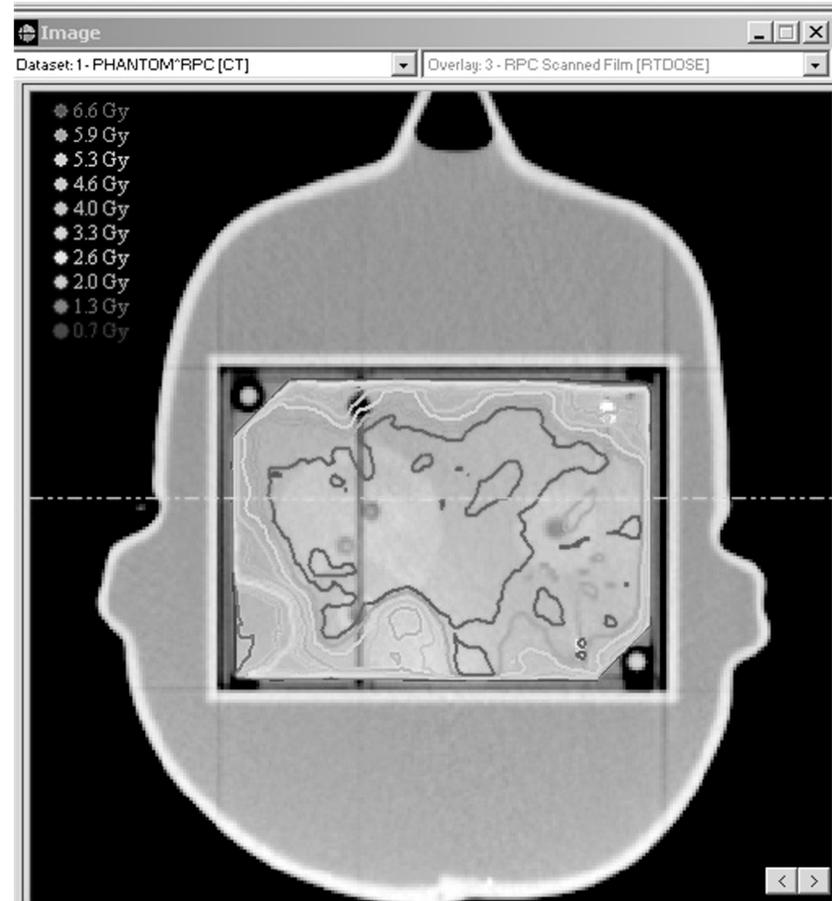
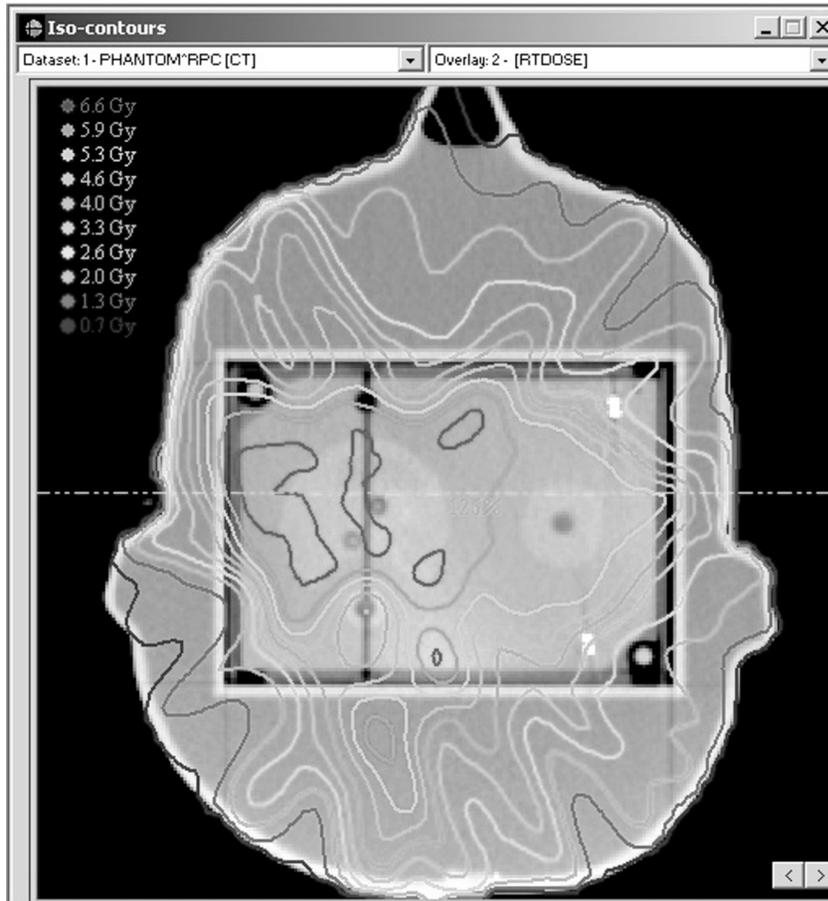
<b>Phantom</b>	<b>H&amp;N</b>	<b>Prostate</b>	<b>Thorax</b>	<b>Liver</b>
<b>Irradiations</b>	<b>254</b>	<b>73</b>	<b>30</b>	<b>6</b>
<b>Pass</b>	<b>179*</b>	<b>55</b>	<b>17</b>	<b>3</b>
<b>Fail</b>	<b>71</b>	<b>9</b>	<b>7</b>	<b>1</b>
<b>Under analysis or at institution</b>	<b>30</b>	<b>6</b>	<b>6</b>	<b>1</b>
<b>Year introduced</b>	<b>2001</b>	<b>Spring 2004</b>	<b>Spring 2004</b>	<b>Spring 2005</b>

**\* 30% of institutions failed H&N phantom on the first attempt**

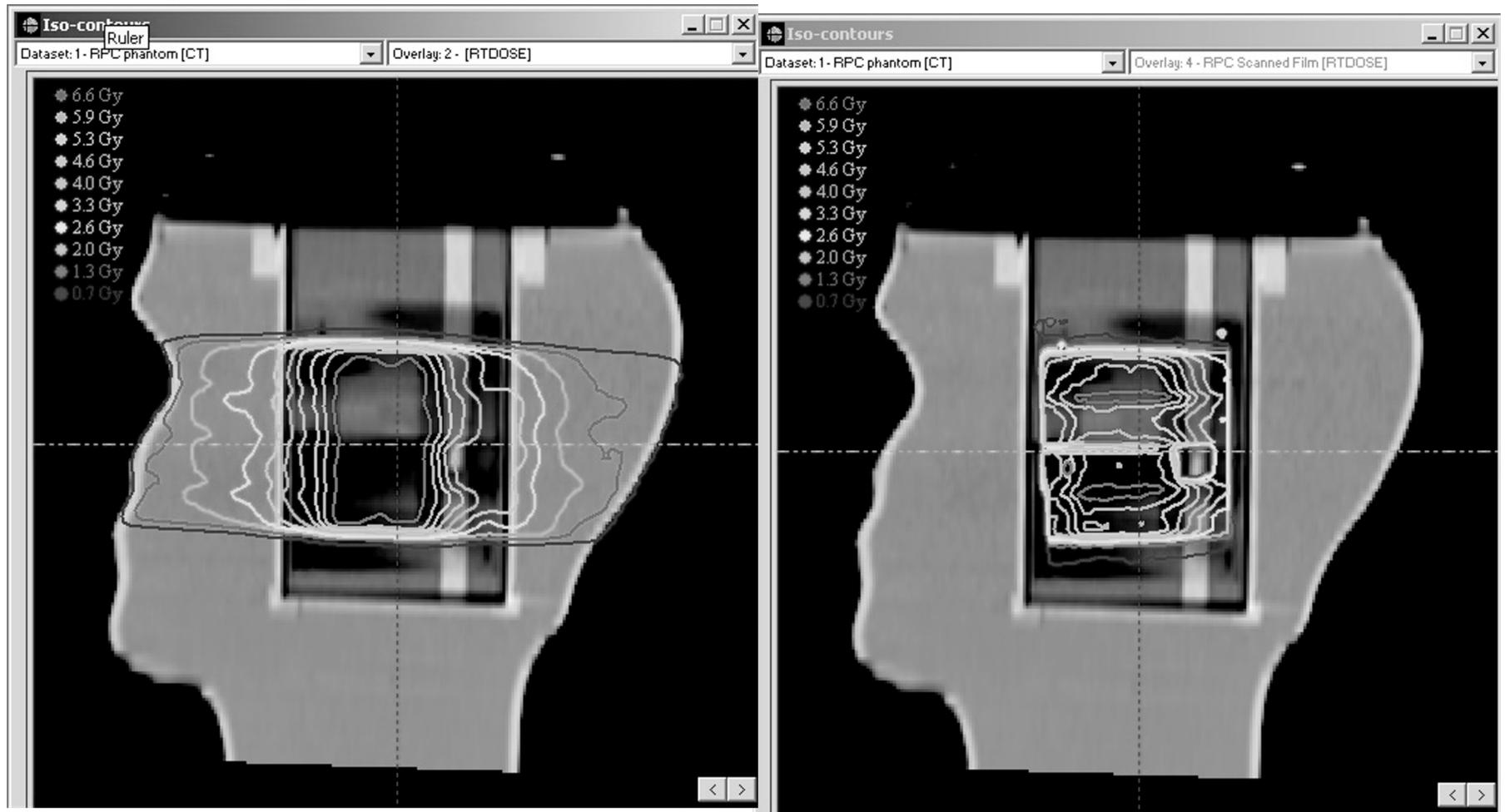
# Explanations for Failures

<b>Explanation</b>	<b>Minimum # of occurrences</b>
<b>incorrect output factors in TPS</b>	<b>1</b>
<b>incorrect PDD in TPS</b>	<b>1</b>
<b>inadequacies in beam modeling at leaf ends (Cadman, et al; PMB 2002)</b>	<b>14</b>
<b>not adjusting MU to account for dose differences measured with ion chamber</b>	<b>3</b>
<b>errors in couch indexing with Peacock system</b>	<b>2</b>
<b>2 mm tolerance on MLC leaf position</b>	<b>1</b>
<b>setup errors</b>	<b>7</b>
<b>target malfunction</b>	<b>1</b>

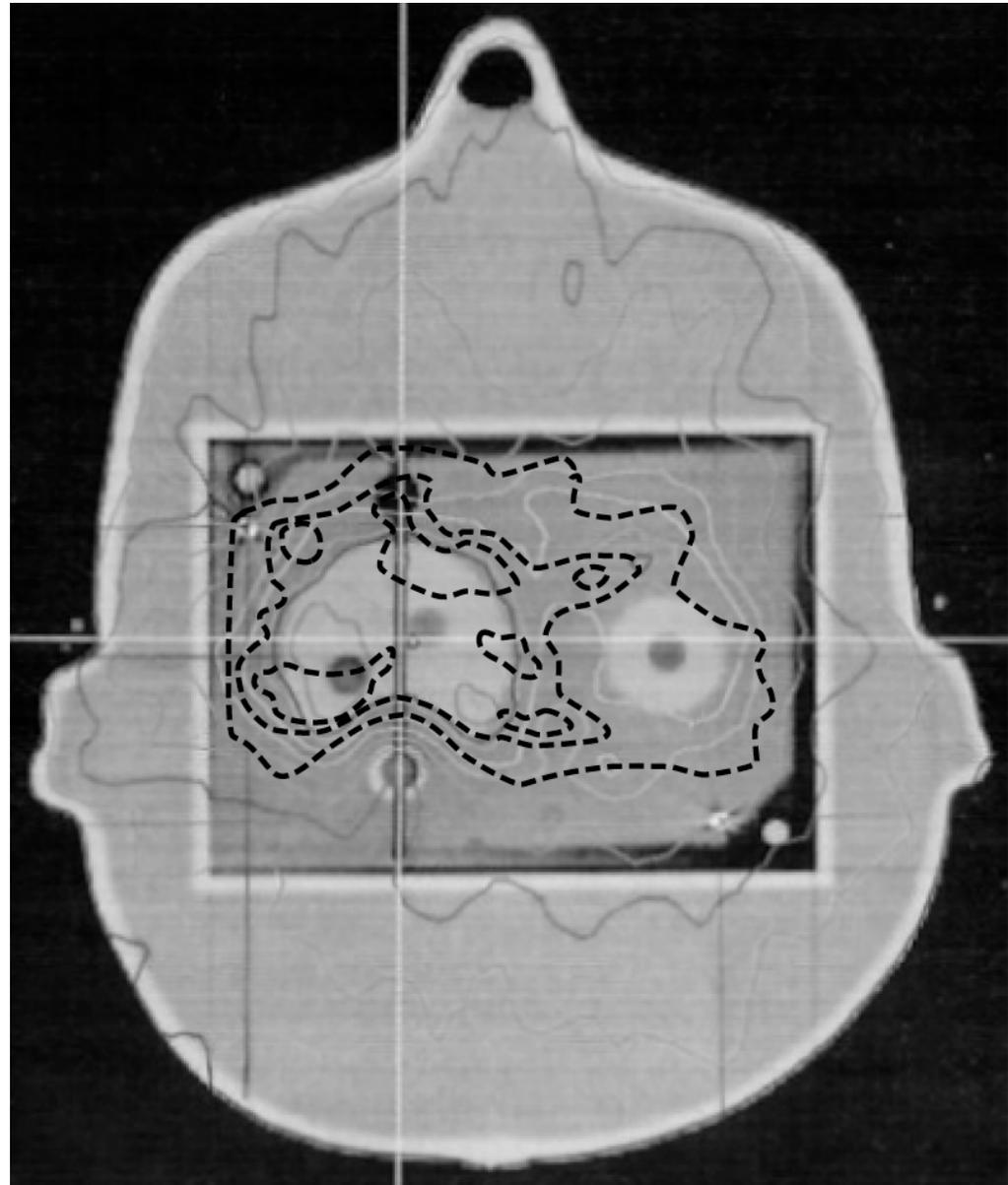
# Examples of Failures



# Peacock Indexing Error

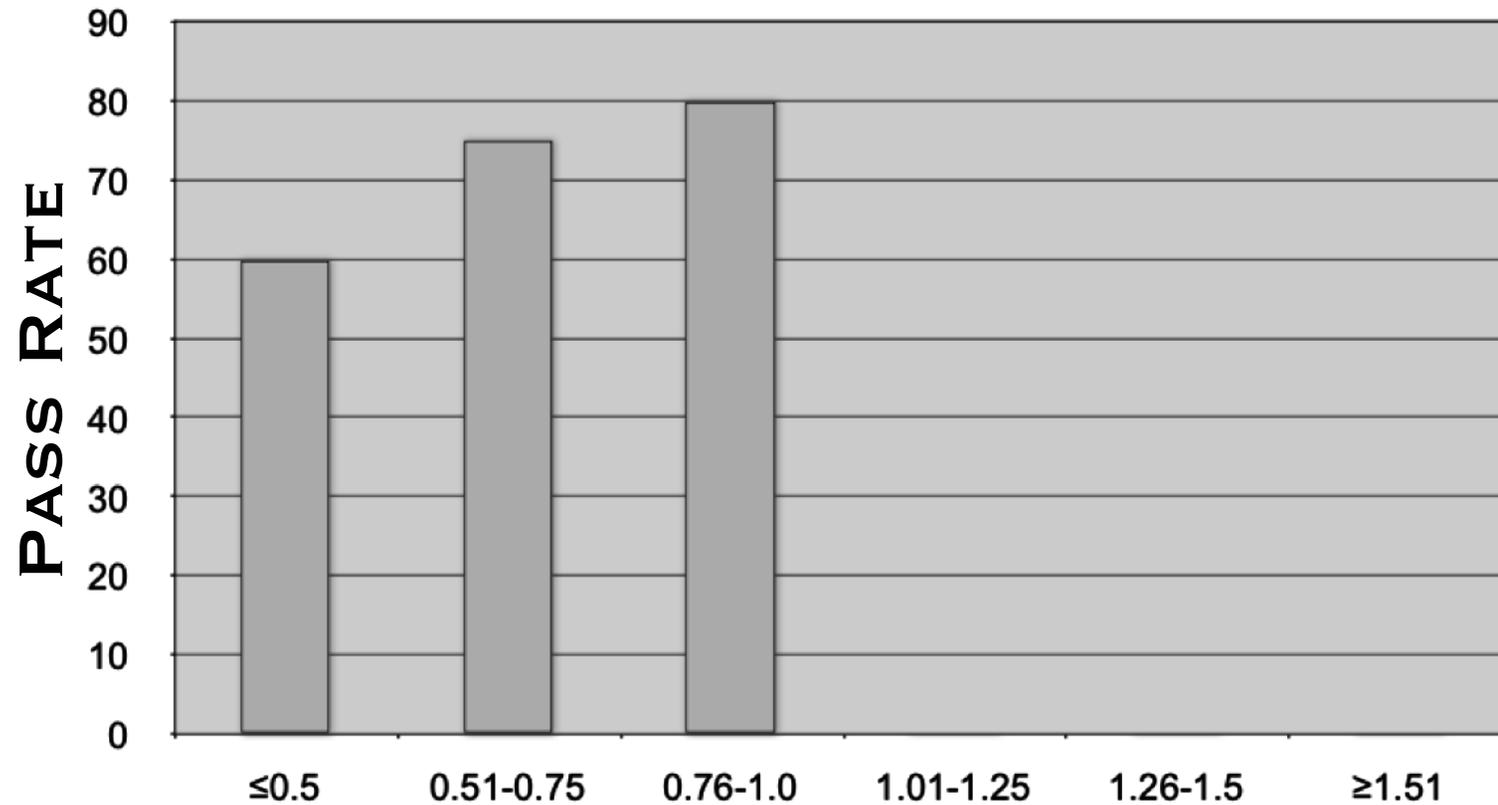


# Comparison: Planned vs. Delivered Distribution

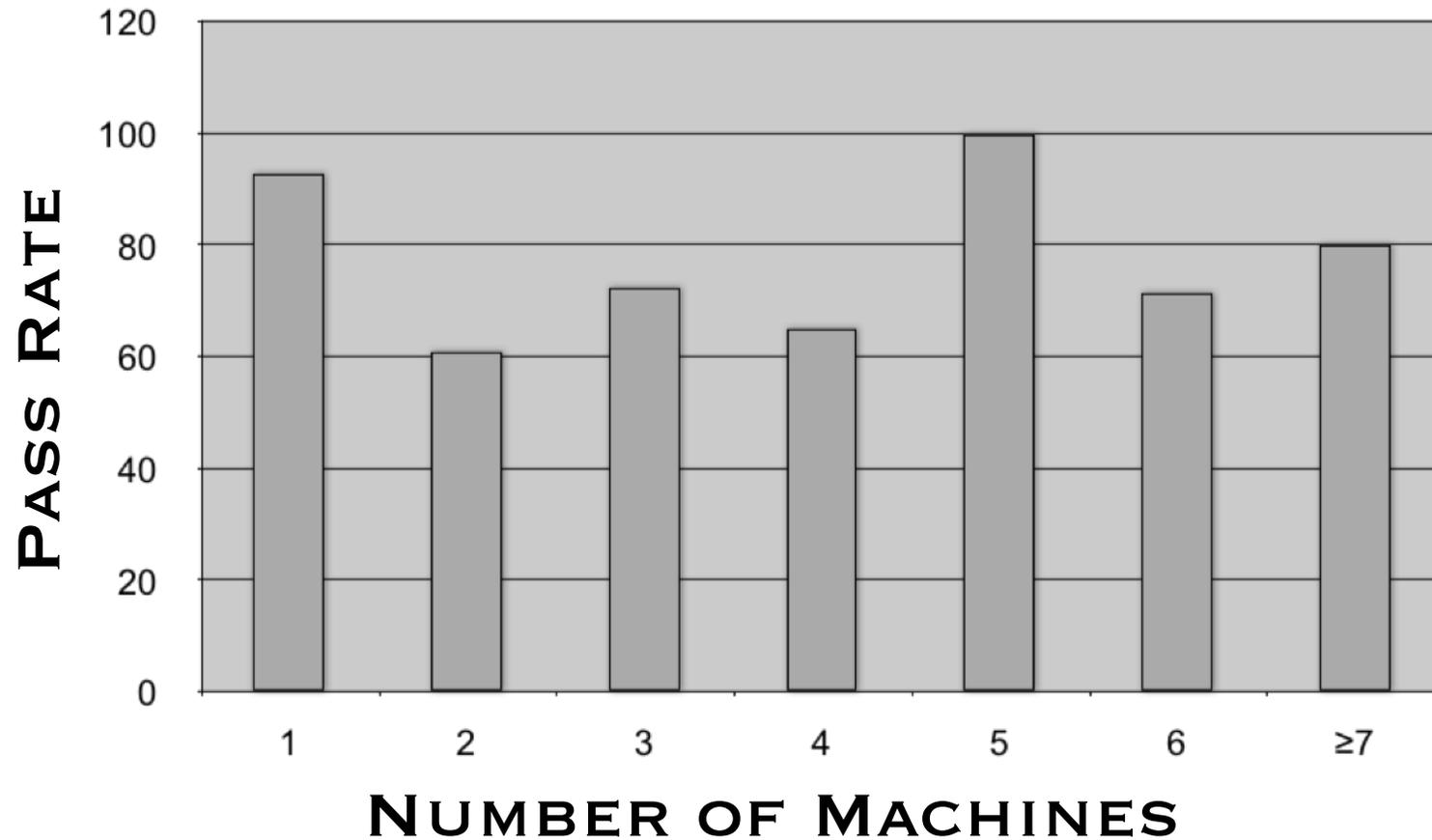


RSNA 2000

# Physicists per machine



# Number of Machines



# Results grouped by TPS

Treatment planning system	Pass Rate (%)	Attempts	Criteria Failed		
			Dose	DTA	Dose and DTA
BrainScan	100	4	0	0	0
Cadplan	67	3	1	0	0
CMS XiO	76	17	1	1	2
Corvus	73	26	6	0	1
Eclipse	84	32	2	2	1
Helax	100	2	0	0	0
Pinnacle	61	69	16	4	7
Radionics XKnife	100	1	0	0	0
Theraplan Plus	0	2	0	0	2
TomoTherapy	67	3	1	0	0
Inst. developed TPS	75	4	1	0	0
total		163	28	7	13



*Thank you!*

