RPC Radiological Physics Center

Excellence through Quality Assurance

Data Collected During Audits for Clinical Trials

July 21, 2010

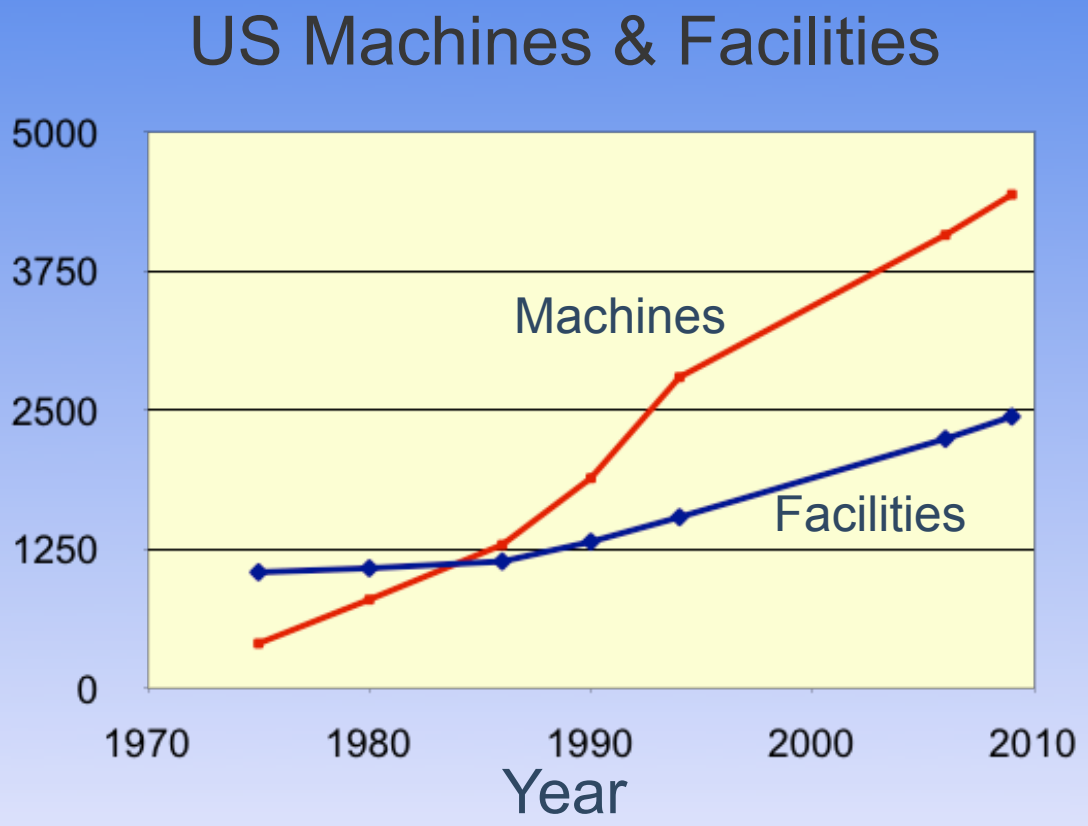
Geoffrey S. Ibbott, Ph.D.
and RPC Staff

RPC Programs Assure …

- Constancy of basic machine calibration *(TLD/OSLD Audits)*
- Validity of treatment planning data *(On-site dosimetry reviews)*
- Consistency of treatment records *(Chart reviews)*
- Understanding of advanced technology procedures *(Questionnaires, phantoms,, etc.)*

Constancy of Basic Machine Calibration

- RPC monitors 1,768 institutions, of which ~1,600 are in the US
- Increase from 1,338 in 2005 (32%)
- Number of radiation beams has increased more rapidly



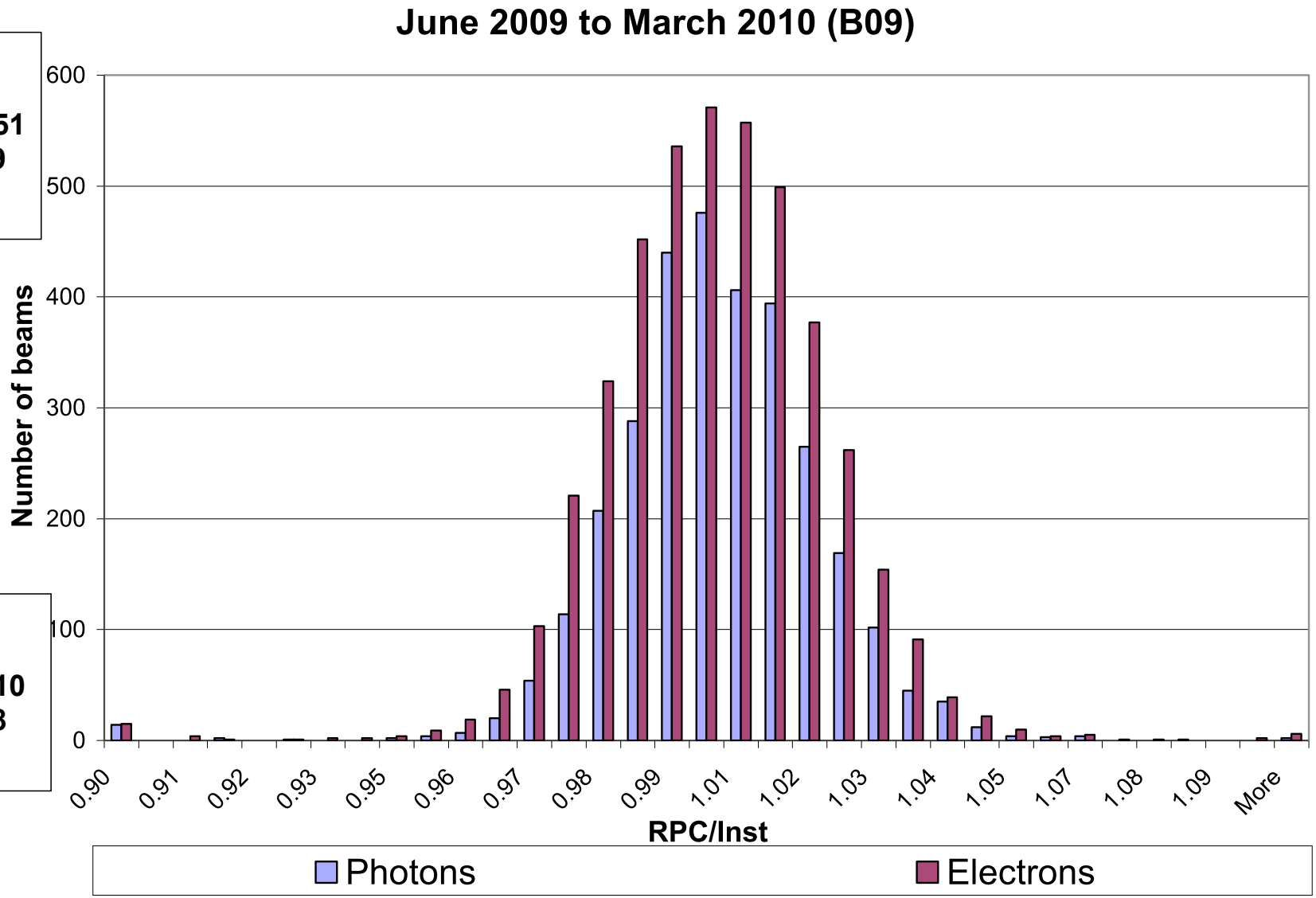
Annual TLD/OSLD Audits

- Monitor ~ 14,000 beams/yr
- Conversion from TLD to OSLD

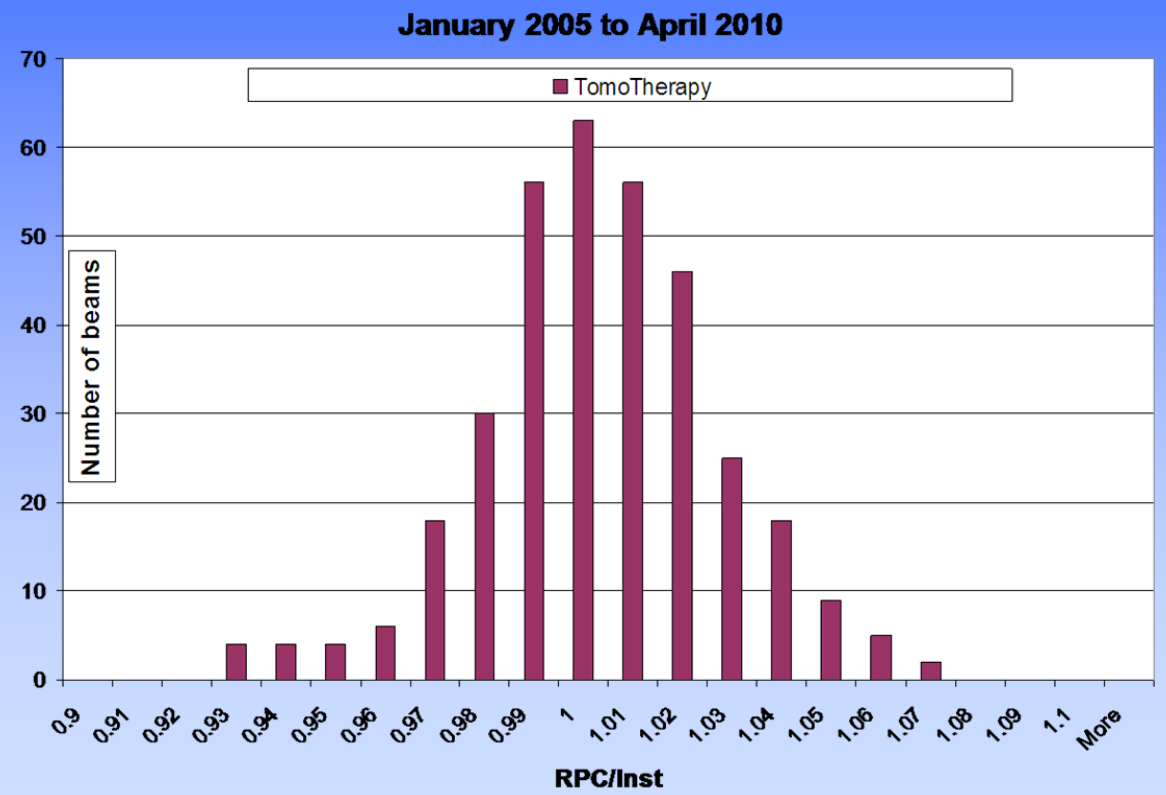
Distribution of TLD results

Photons beams within 7%
Number of beams: 3051
Avg. RPC/Inst.: 0.999
Stdev.: 1.6%

Electrons beams within 7%
Number of beams 4310
Avg. RPC/Inst: 0.998
Stdev.: 1.7%



Distribution of TLD results



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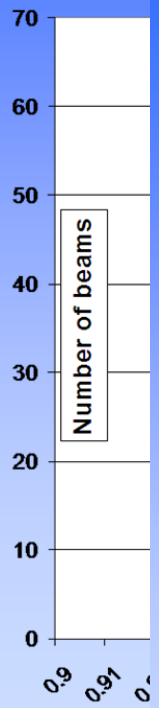

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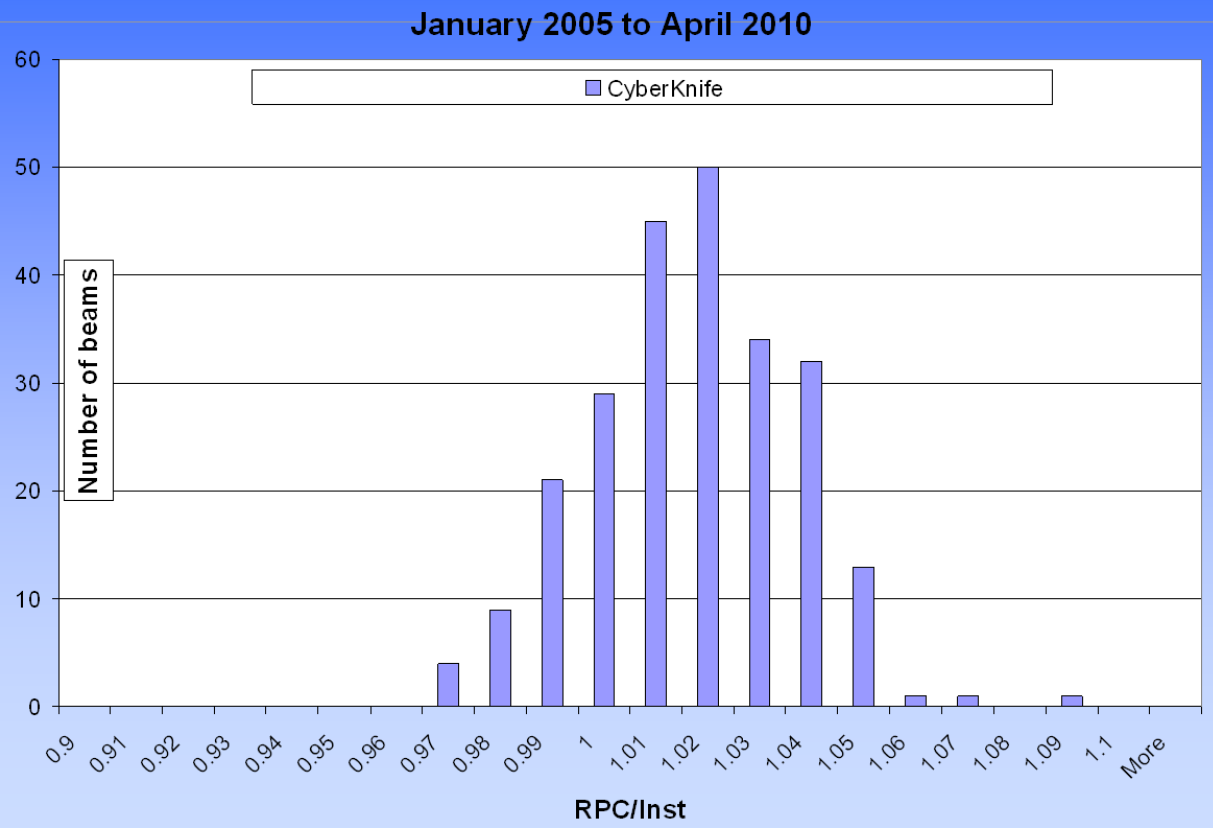

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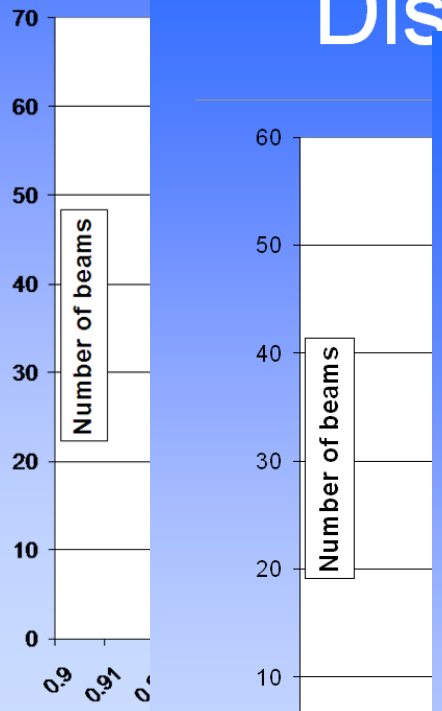

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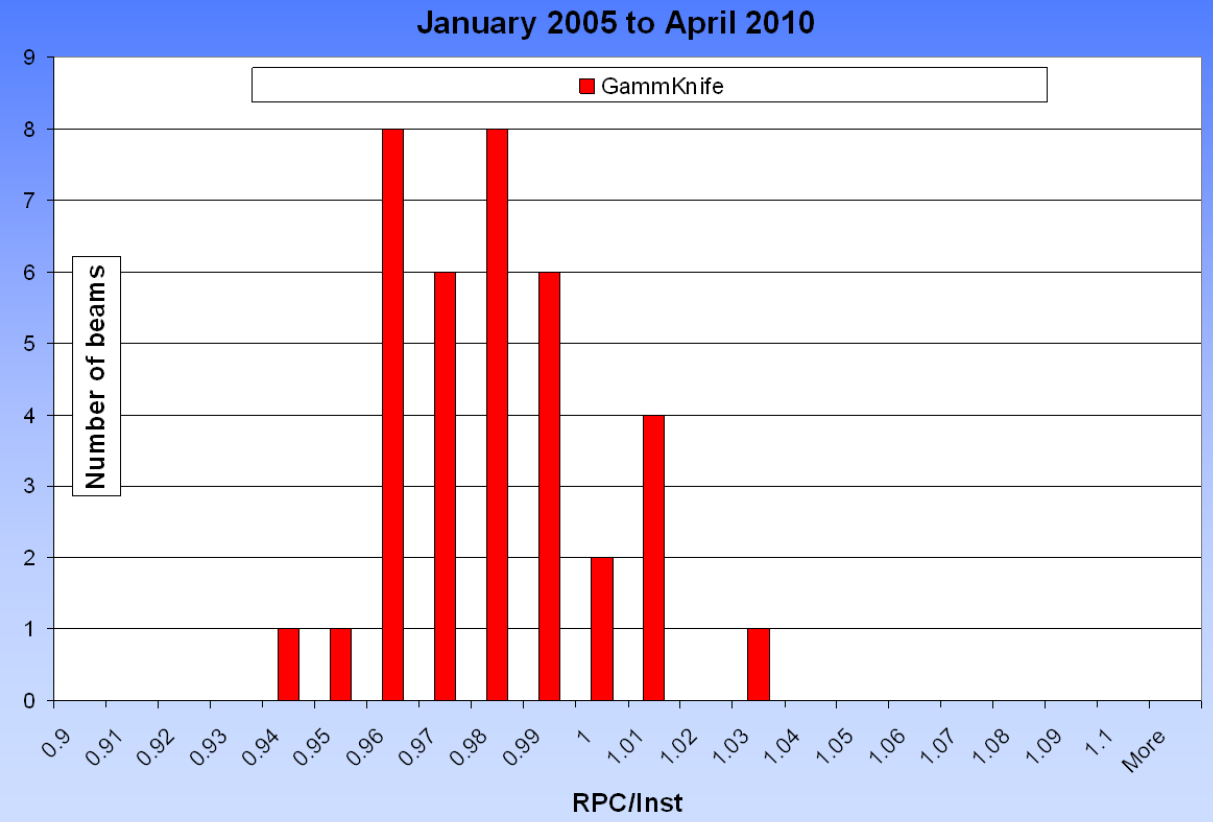
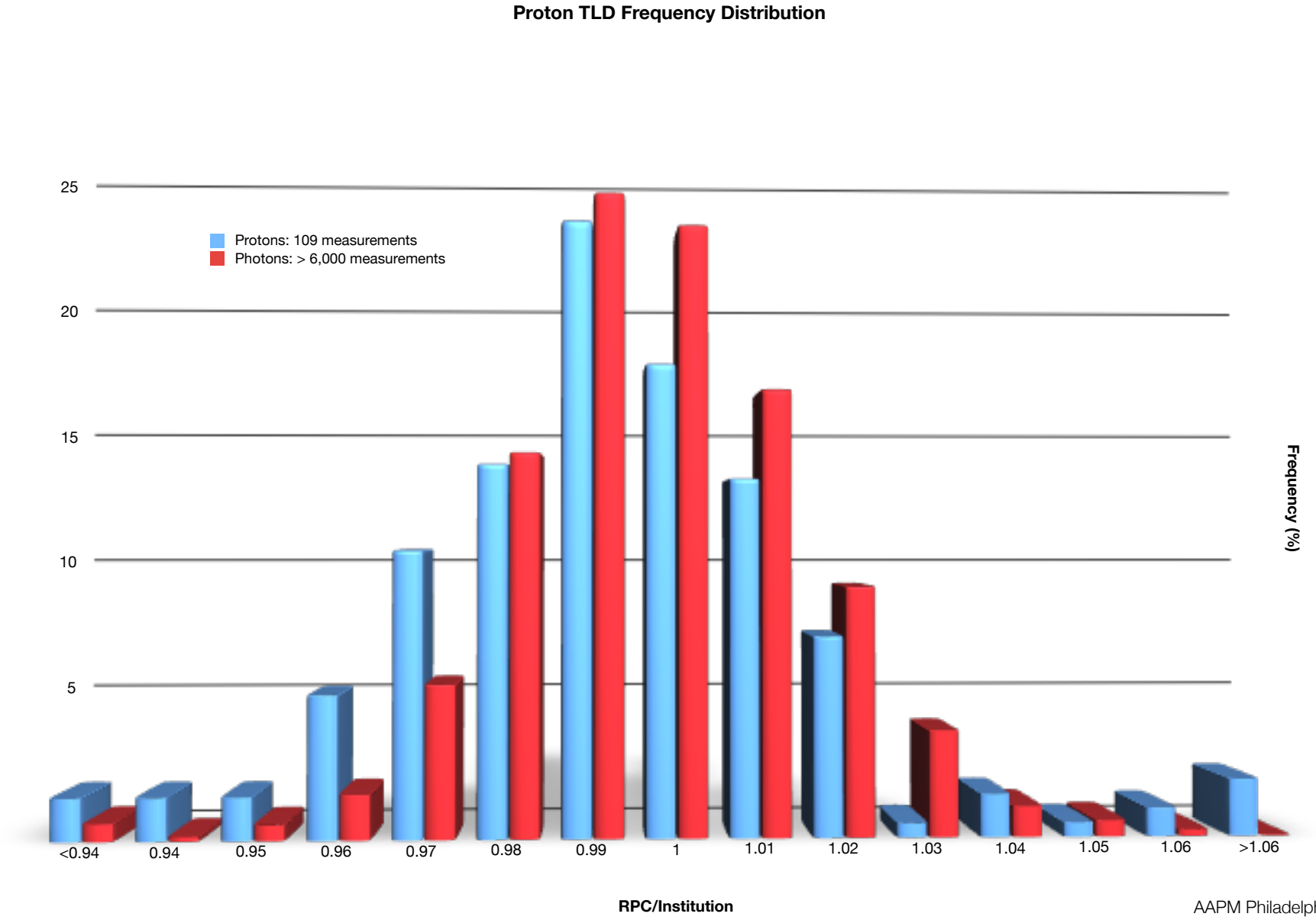


TLD measurements in proton beams



On-Site Dosimetry Review Visit

Parameters Measured

Review QA Program

Implementation of TG-51

Review Temp/Press Correction

Photon Calibration

Photon FSD (incl. small field)

Photon Depth Dose

Off-axis Factors/Beam symmetry

Electron Calibration

Electron Depth Dose

Electron Cone Ratios

Wedge Transmission

Consistent use of Data

Comprehensive On-Site Audit Improvements and Additions

In response to new radiotherapy treatments in trials, new audit techniques have been implemented such as:

1. TomoTherapy
2. CyberKnife
3. Proton therapy
4. Small field dosimetry
5. 2D water scanner and electrometers
6. Electronic transfer of Visit data (2010)
7. Incorporate new AAPM TG-142 QA review (2010)
8. Image guidance (in development)

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As radiotherapy treatment techniques change, so do the visit audit techniques

Measurement of small-field output factors

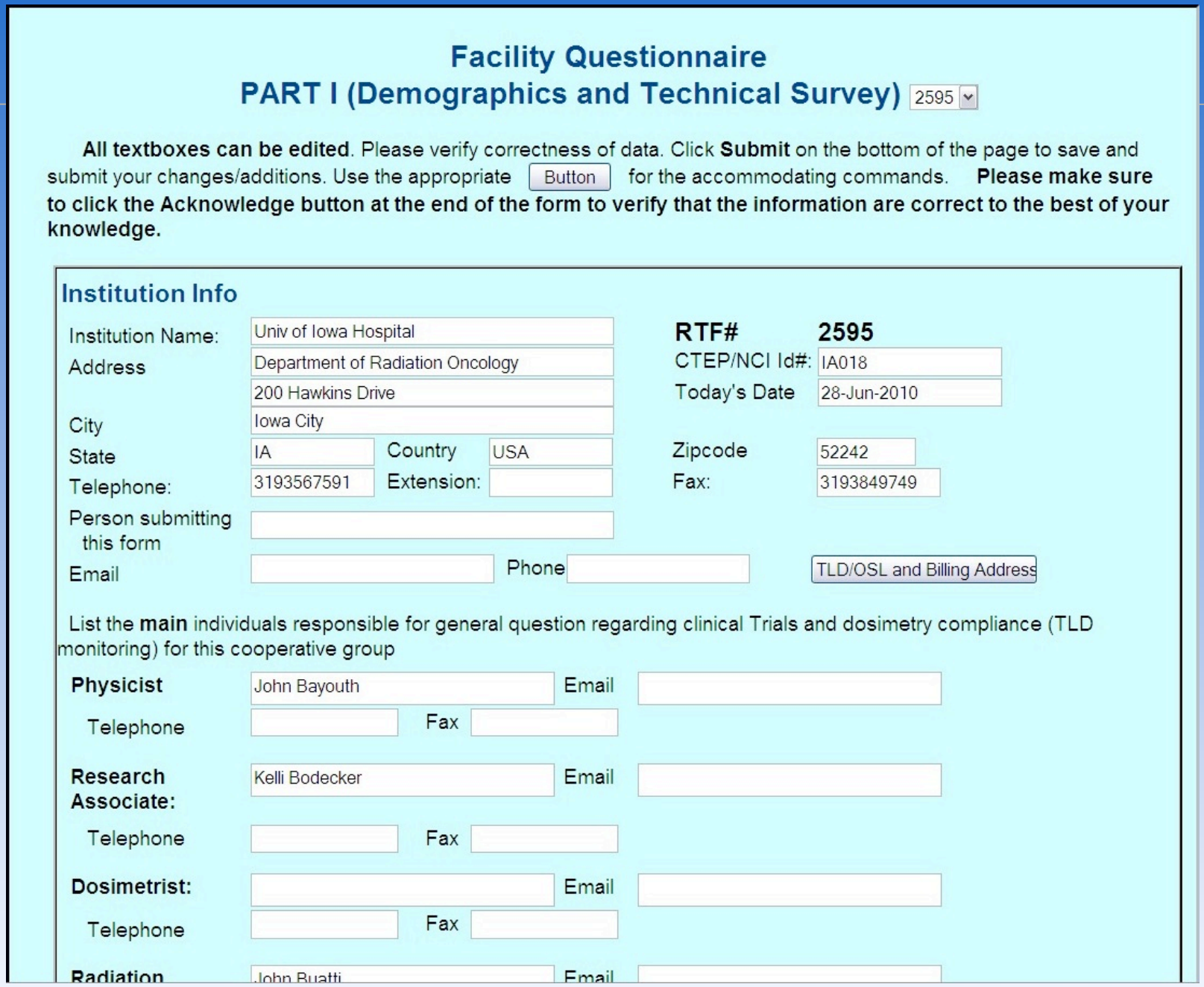
6 MV, d = 10 cm

Field Size	Varian(64)	Siemens(4)	Elekta(10)
10 x 10	1.000	1.000	1.000
6 x 6	0.922 (0.012)	0.910 (0.004)	0.924 (0.004)
4 x 4	0.866 (0.019)	0.851 (0.004)	0.869 (0.007)
3 x 3	0.833 (0.025)	0.817 (0.003)	0.837 (0.005)
2 x 2	0.785 (0.013)	0.757 (0.014)	0.793 (0.007)
1 x 1	0.694 (0.042)	-	0.659 (0.025)

Virtual Dosimetry Review Visit

- Use of the RPC's standard data
  - Compilation of RPC measured avg. data
    - 2700 photon beams and 81 linac model/ energy combinations
  - Specific to make/model/energy with ≥ 5 sets of RPC measured data
  - Analyses of these data indicate that machines of same make/model/energy have same radiation characteristics.
  - Successful at predicting "specific" errors 88% of the time.
  - Available to Med. Phys. community upon request.

Web-Based Facility Questionnaire



Facility Questionnaire
PART I (Demographics and Technical Survey) 2595

All textboxes can be edited. Please verify correctness of data. Click **Submit** on the bottom of the page to save and submit your changes/additions. Use the appropriate Button for the accommodating commands. **Please make sure to click the Acknowledge button at the end of the form to verify that the information are correct to the best of your knowledge.**

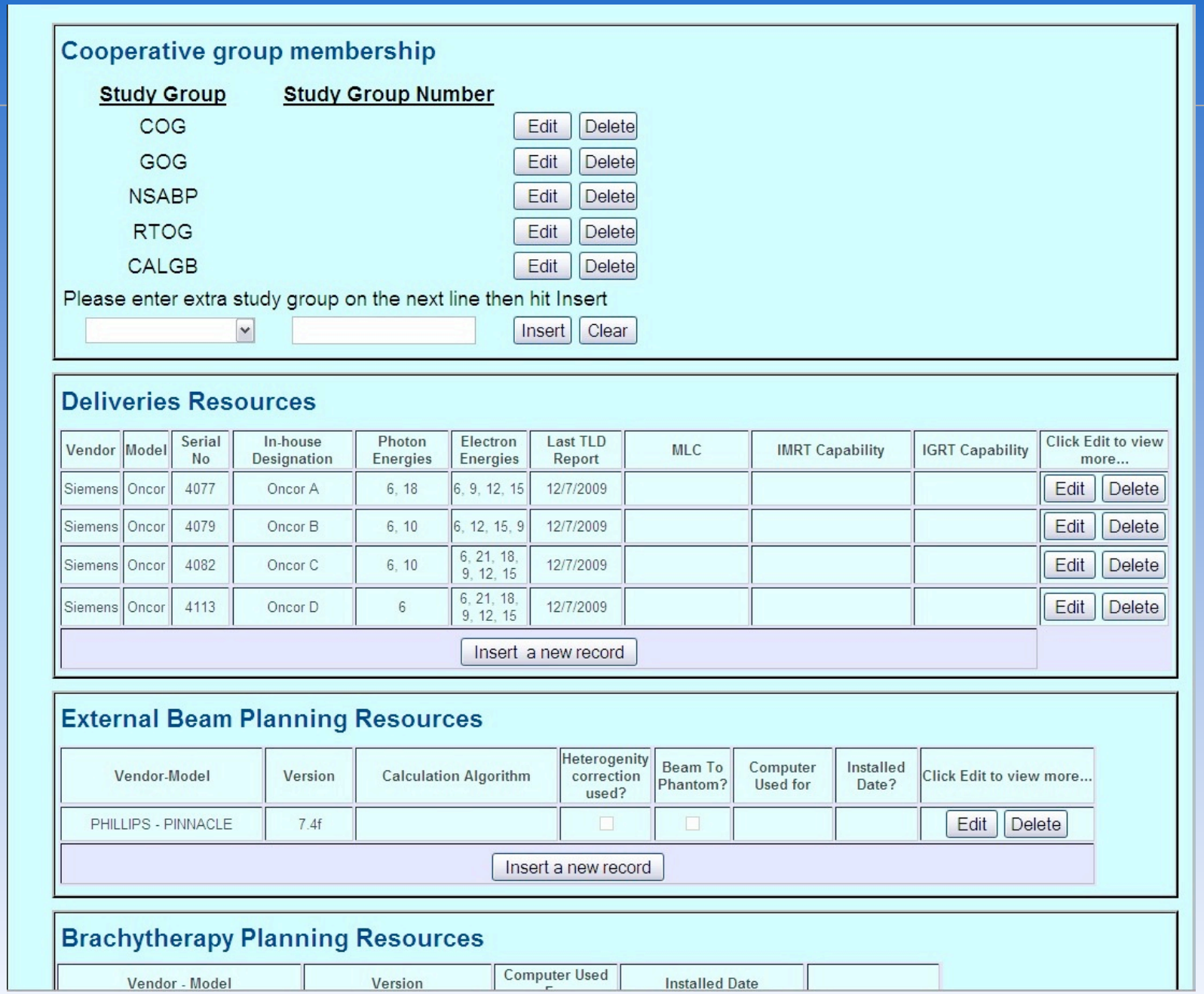
Institution Info

Institution Name:	Univ of Iowa Hospital			**RTF#**	**2595**
Address	Department of Radiation Oncology			CTEP/NCI Id#:	IA018
	200 Hawkins Drive			Today's Date	28-Jun-2010
City	Iowa City				
State	IA	Country	USA	Zipcode	52242
Telephone:	3193567591	Extension:		Fax:	3193849749
Person submitting this form					
Email		Phone		TLD/OSL and Billing Address	

List the **main** individuals responsible for general question regarding clinical Trials and dosimetry compliance (TLD monitoring) for this cooperative group

Physicist	John Bayouth	Email	
Telephone		Fax	
Research Associate:	Kelli Bodecker	Email	
Telephone		Fax	
Dosimetrist:		Email	
Telephone		Fax	
Radiation	John Buatti	Email	

Web-Based Facility Questionnaire



Cooperative group membership

Study Group	Study Group Number		
COG		Edit	Delete
GOG		Edit	Delete
NSABP		Edit	Delete
RTOG		Edit	Delete
CALGB		Edit	Delete

Please enter extra study group on the next line then hit Insert

Insert Clear

Deliveries Resources

Vendor	Model	Serial No	In-house Designation	Photon Energies	Electron Energies	Last TLD Report	MLC	IMRT Capability	IGRT Capability	Click Edit to view more...
Siemens	Oncor	4077	Oncor A	6, 18	6, 9, 12, 15	12/7/2009				Edit Delete
Siemens	Oncor	4079	Oncor B	6, 10	6, 12, 15, 9	12/7/2009				Edit Delete
Siemens	Oncor	4082	Oncor C	6, 10	6, 21, 18, 9, 12, 15	12/7/2009				Edit Delete
Siemens	Oncor	4113	Oncor D	6	6, 21, 18, 9, 12, 15	12/7/2009				Edit Delete

Insert a new record

External Beam Planning Resources

Vendor-Model	Version	Calculation Algorithm	Heterogenity correction used?	Beam To Phantom?	Computer Used for	Installed Date?	Click Edit to view more...
PHILLIPS - PINNACLE	7.4f						Edit Delete

Insert a new record

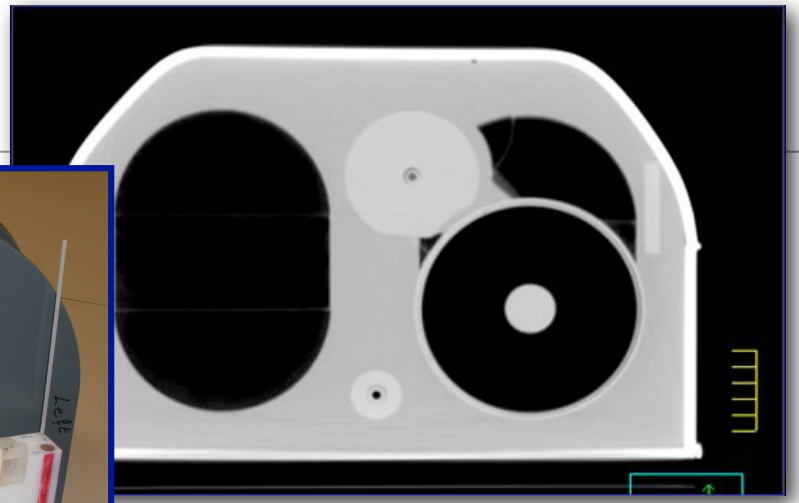
Brachytherapy Planning Resources

Vendor - Model	Version	Computer Used	Installed Date	

RPC Phantoms

Pelvis (10)

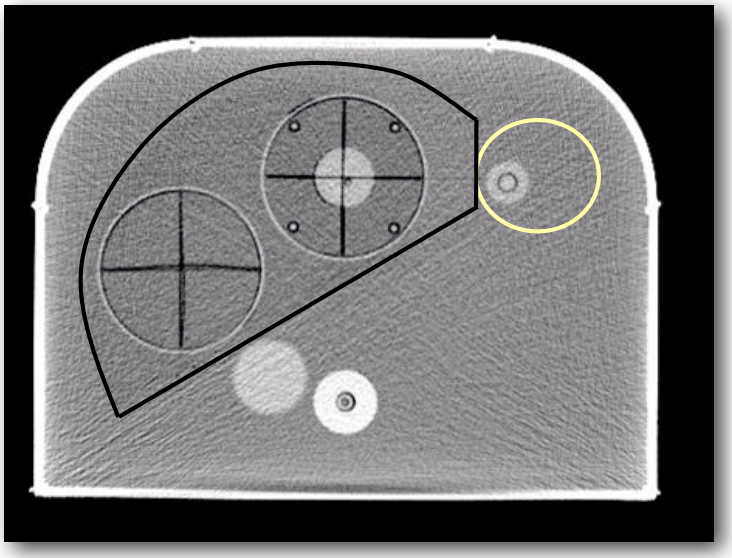
Spine (3)



Thorax (13)

H&N (31)

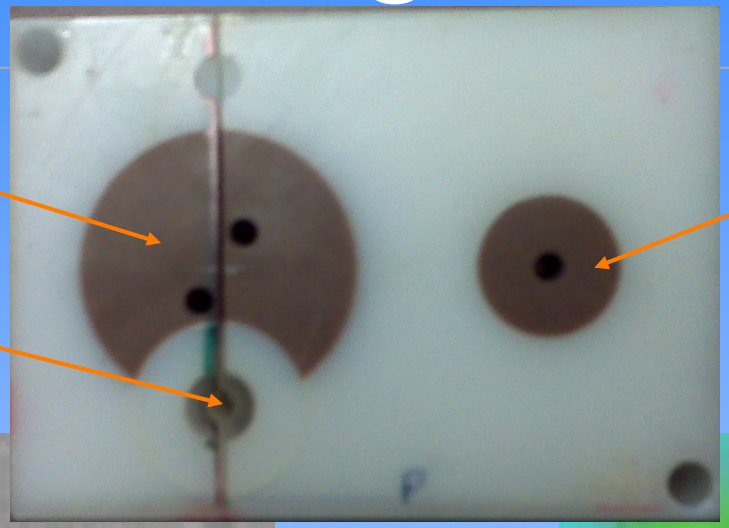
SRS Head (4)

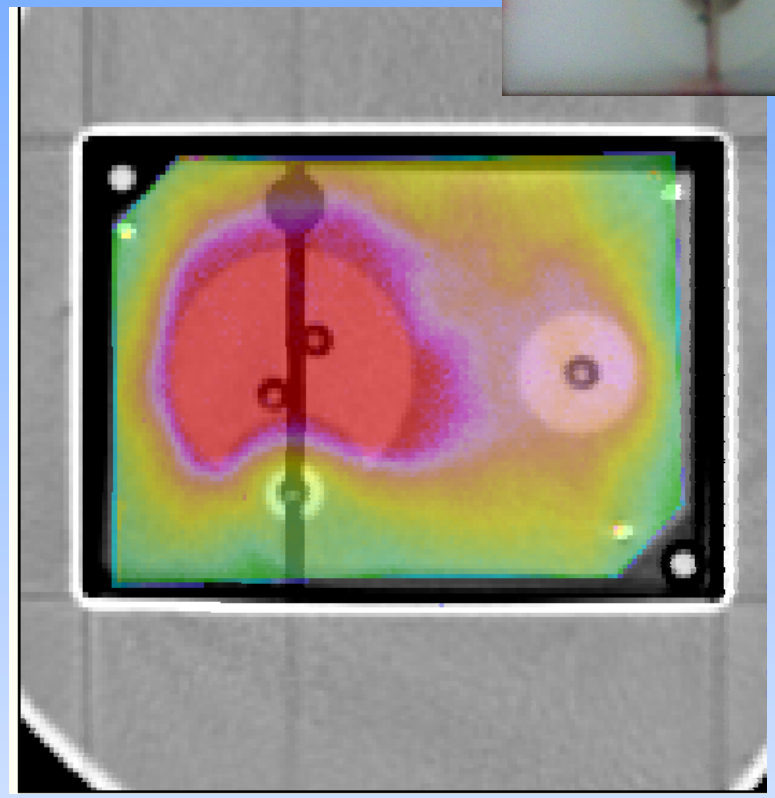


Liver (2)

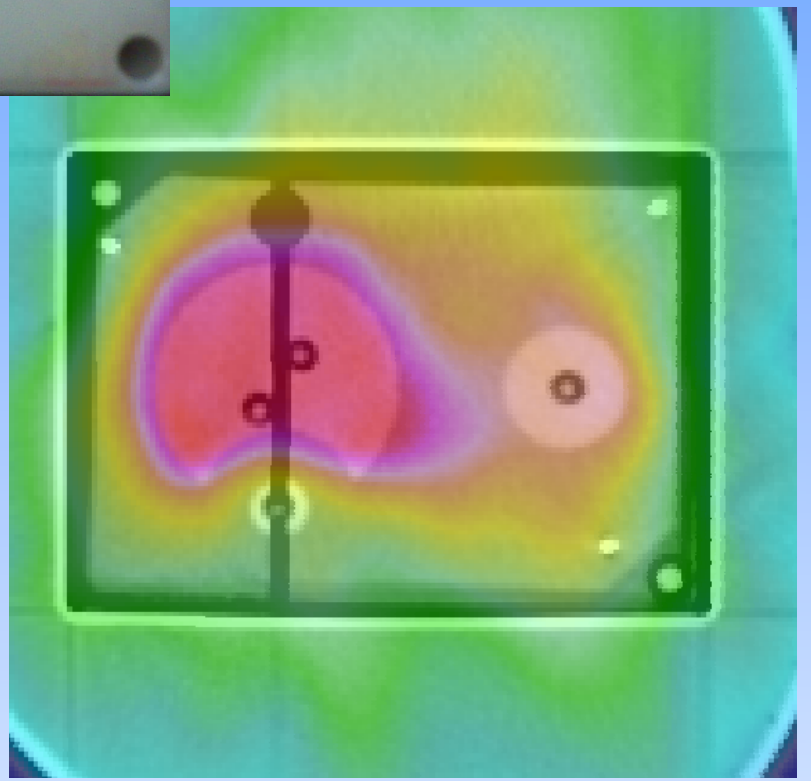
Treat phantom as if it were a patient

Good Agreement





Measurement



Plan

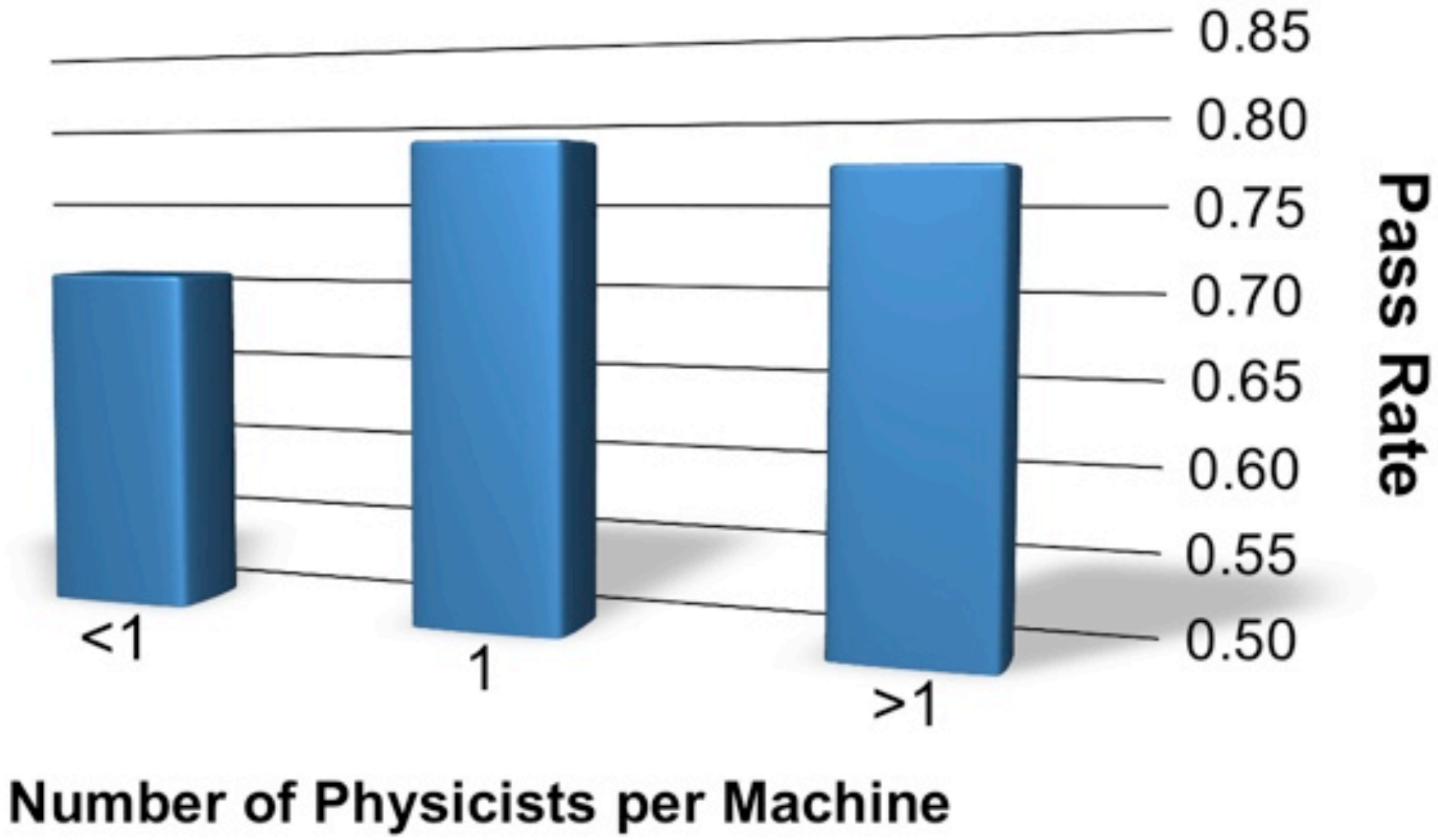
Phantom Results

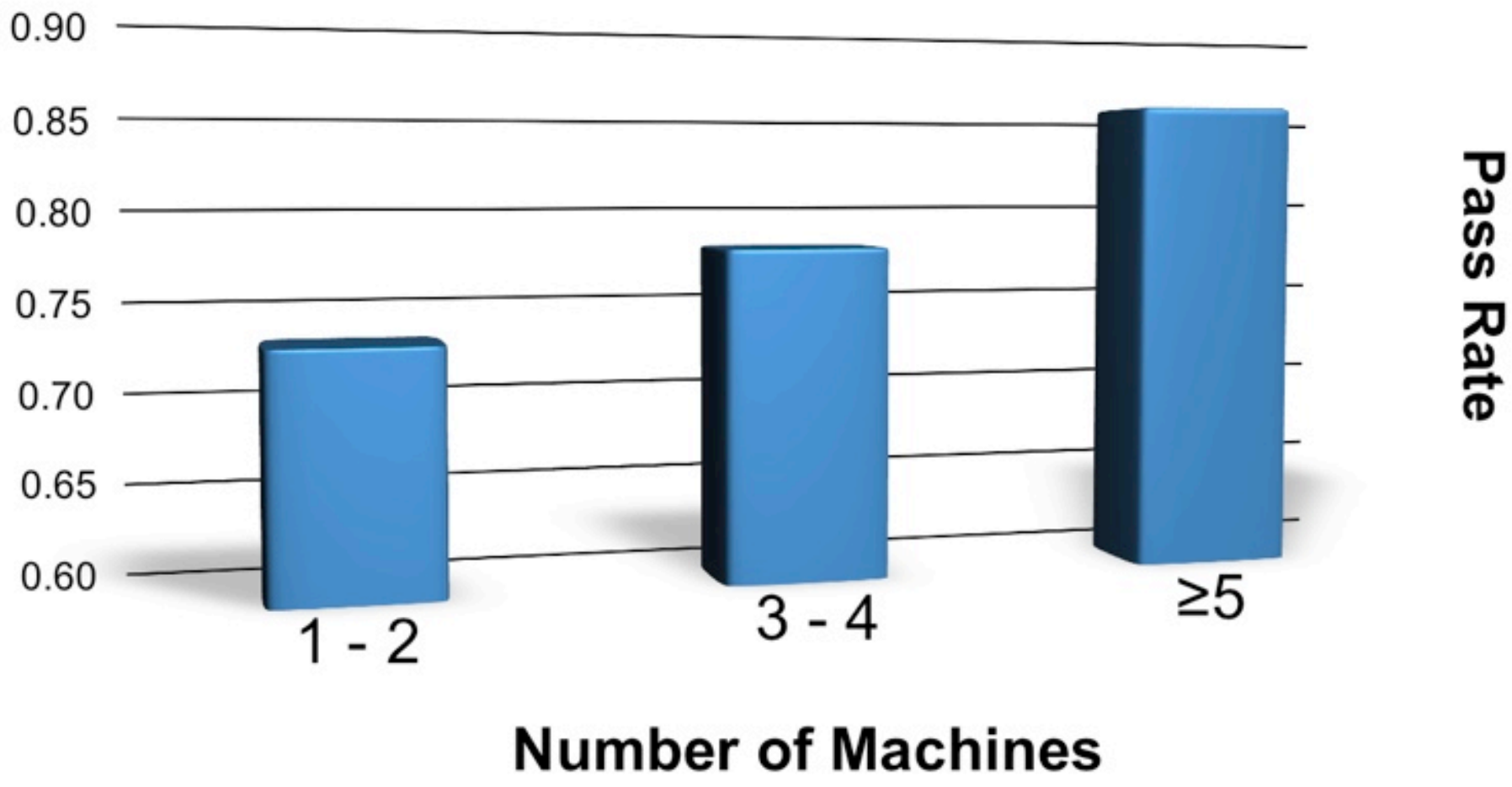
Comparison between institution's plan and delivered dose.

Phantom	H&N	Prostate	Spine	Lung	Liver
Irradiations	752	174	19	174	23
Pass	585	143	13	124	12
Pass %	78%	82%	68%	71%	52%
Criteria	7%/4mm	7%/4mm	5%/3mm	5%/5mm	7%/4mm
Year introduced	2001	2004	2009	2004	2005

HN results grouped by TPS

Treatment planning system	Pass Rate (%)	Attempts	Criteria Failed		
			Dose	DTA	Dose and DTA
Corvus	75	32	7	0	1
Eclipse	85	114	10	4	3
Pinnacle	73	168	33	4	8
TomoTherapy	73	22	5	1	0
XiO	73	59	7	4	5
Other	79	24	3	0	2
Total		419	65	13	19


0.85
0.80
0.75
0.70
0.65
0.60
0.55
0.50
Pass Rate
<1
1
>1
Number of Physicists per Machine


0.90
0.85
0.80
0.75
0.70
0.65
0.60
1 - 2
3 - 4
≥5
Number of Machines
Pass Rate

Explanations for Failures

Explanation	Minimum # of occurrences
incorrect output factors in TPS	1
incorrect PDD in TPS	1
IMRT Technique	3
Software error	1
inadequacies in beam modeling at leaf ends (Cadman, et al; PMB 2002)	14
QA procedures	3
errors in couch indexing with Peacock system	3
equipment performance	2
setup errors	7

http://rpc.mdanderson.org

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