



**RPC**

**Radiological Physics Center**

*Excellence through Quality Assurance*

# RPC REPORT



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March 27, 2008



# Ongoing Projects

- \* Imaging Physics Center status
- \* ACRIN QC Committee
- \* Monitoring of machine calibration
- \* On-site dosimetry review visits
- \* Credentialing with anthropomorphic phantoms
- \* Evaluation of phantom measurements
- \* Development of Monte Carlo calculation capability



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# AAPM Proposal for an Imaging Physics Center

- \* Per John Boone:
- \* No concrete efforts to form an IPC
- \* Boone has written a grant through AAPM to focus on quantitative imaging physics.
- \* Subcontractors: 5 universities including MDACC
- \* A “virtual” center, not envisioning on-going NCI funding

# ACRIN QA Committee

- \* Function is similar to RTOG QC Committee
- \* Committee reviews quality of data, timeliness of submissions
- \* Also reviews individual member institutions
- \* Discusses monitoring and auditing, and adverse events



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# TLD Monitoring of Output

- \* EORTC Agreement

- \* 19 European institutions are monitored under this agreement

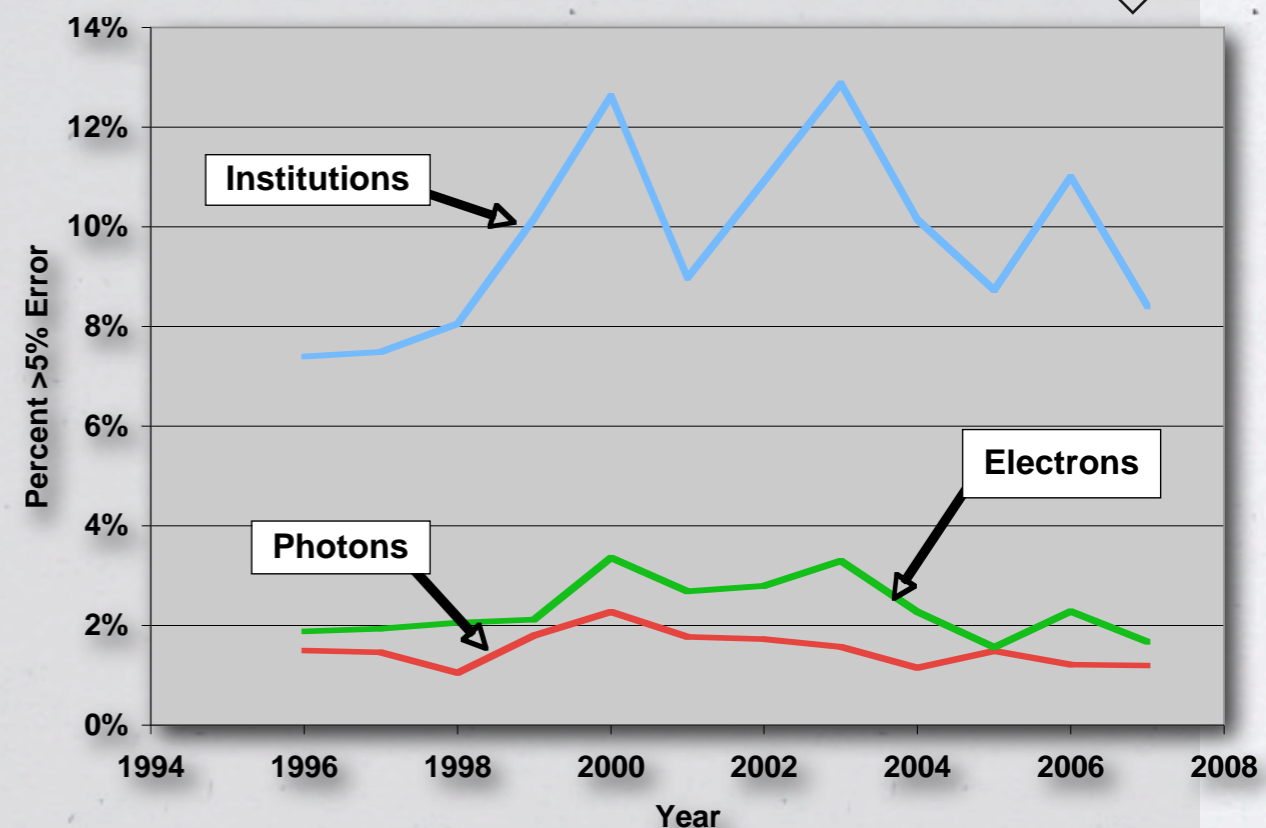
- \* Another 20 are monitored as part of NCI group participation

- \* Monitoring of Proton Therapy centers

- \* Routine monitoring started in January

- \* Received irradiated TLD from Houston, Loma Linda, Indiana

- \* Results within 2%



# Credentialing for Advanced Technology Protocols

- \* CT-based Benchmarks
  - \* Discontinued for 4 planning systems with superposition algorithm

- \* Phantoms
  - \* Availability
  - \* Data submission
  - \* Data analysis
  - \* Modifications for Protons

RPC is monitoring 41 protocols

RTOG	20
NSABP	11*
NCCTG	5
GOG	6
CALGB	1*

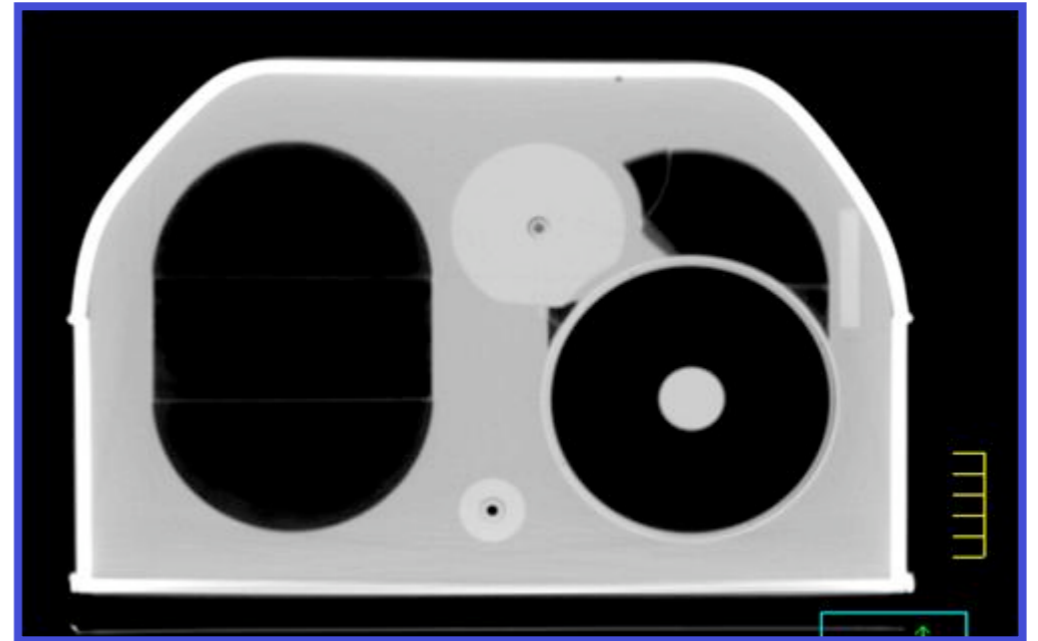


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# RPC Phantoms



**Pelvis (8)**



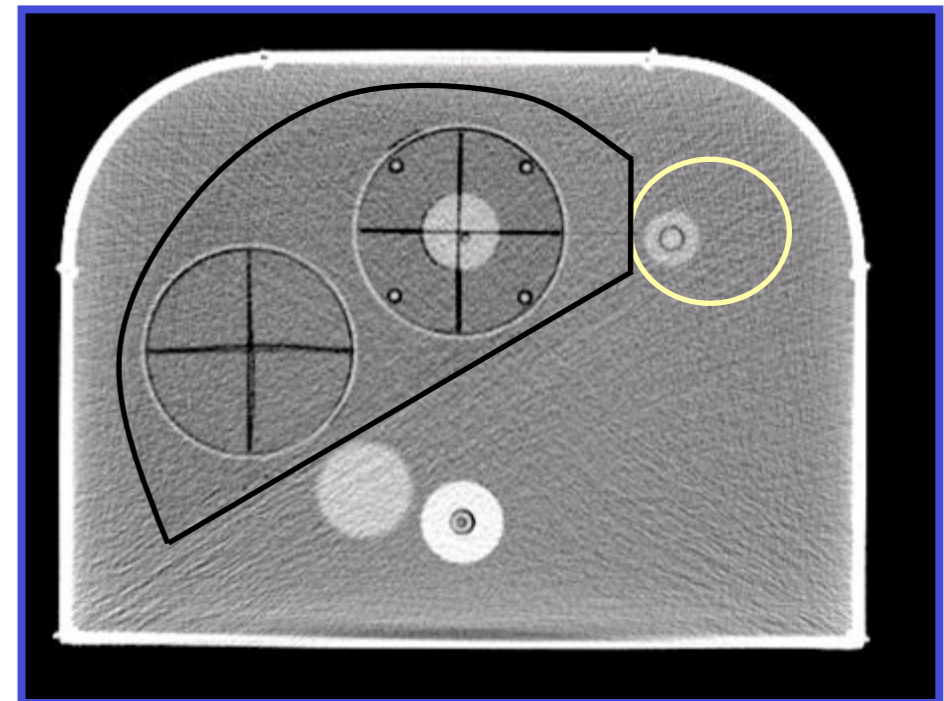
**Thorax (9)**



**H&N IMRT (30)**



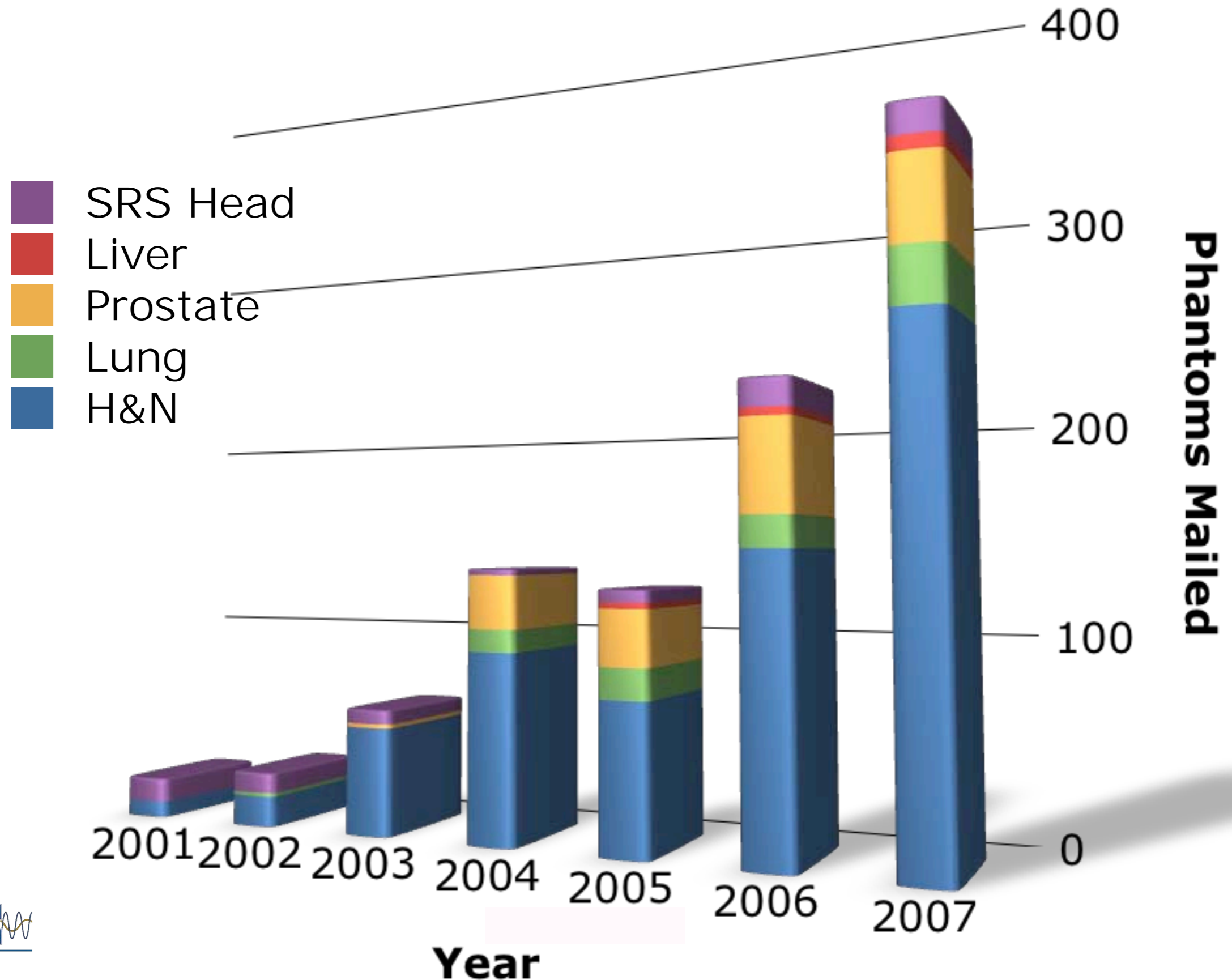
**SRS Head (4)**



**Liver (2)**



# Number of phantom mailings





# Phantom Results

Comparison between institution's plan and delivered dose.  
Criteria for agreement: 7% or 4 mm DTA (5%/5mm for lung)

Site	Institutions	Irradiations	Pass	Fail
H&N	355	475	76%	24%
Pelvis	97	104	82%	18%
Lung	43	51	76%	24%
Liver	11	13	45%	55%

**2D Gamma-index analysis in progress**



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# Data Submission Issues

- \* **Request** ATC send 150 sets of H&N data from 2007
  - \* To establish criteria for 2D analysis
- \* **Request** ATC send phantom data routinely to RPC
- \* **Propose** that institutions send data directly to RPC
  - \* Only institutions that have met dry-run requirements
  - \* May request assistance when data must be down-sampled, etc.



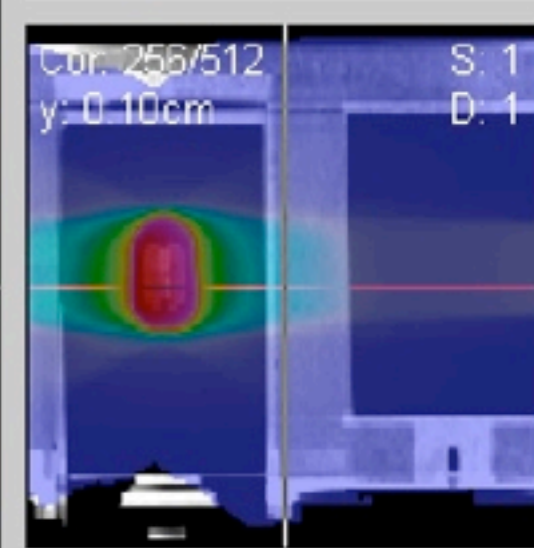
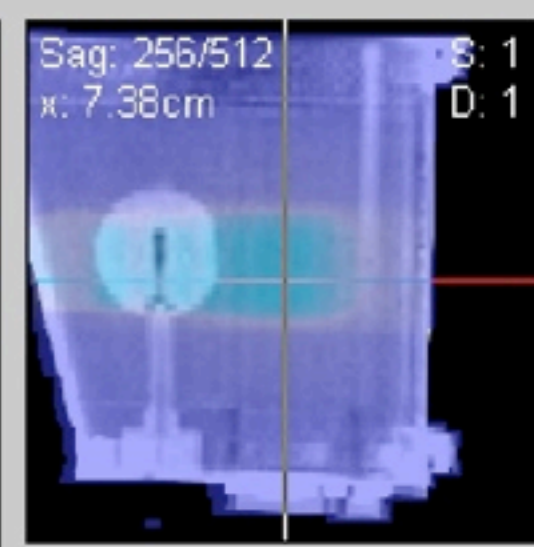
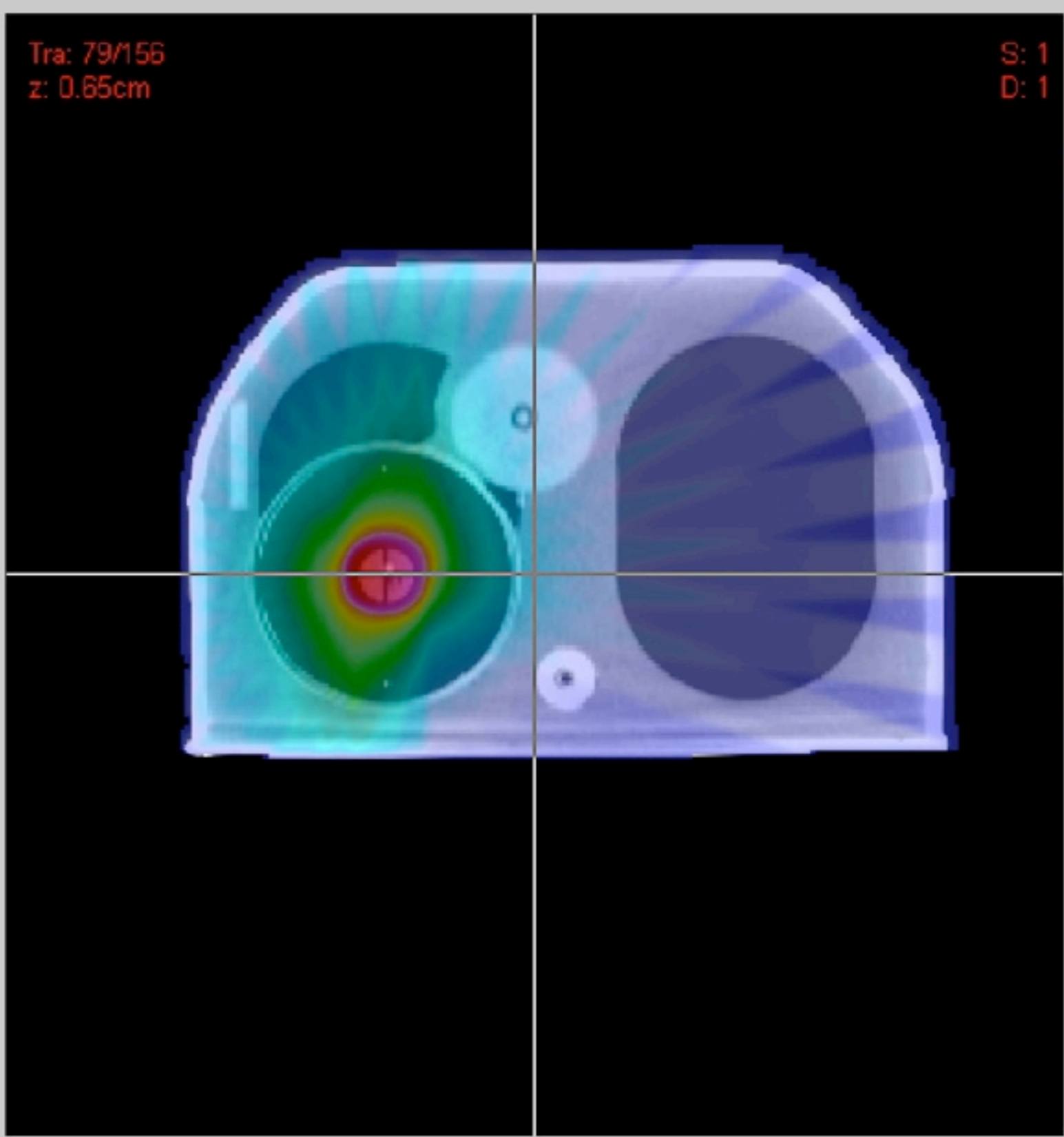
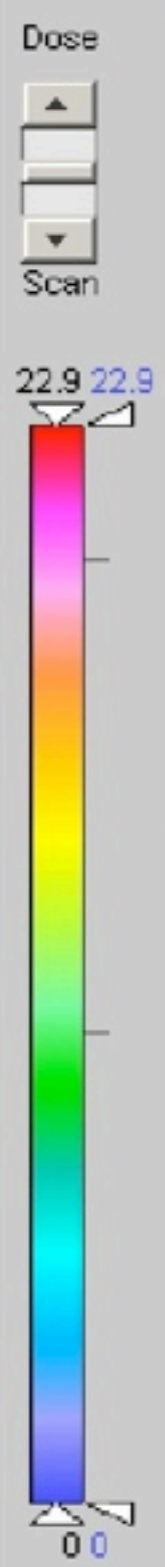
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Not for clinical use

Window:

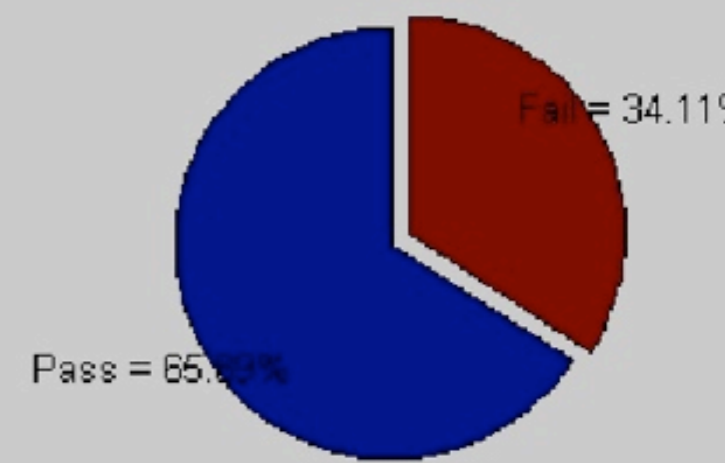
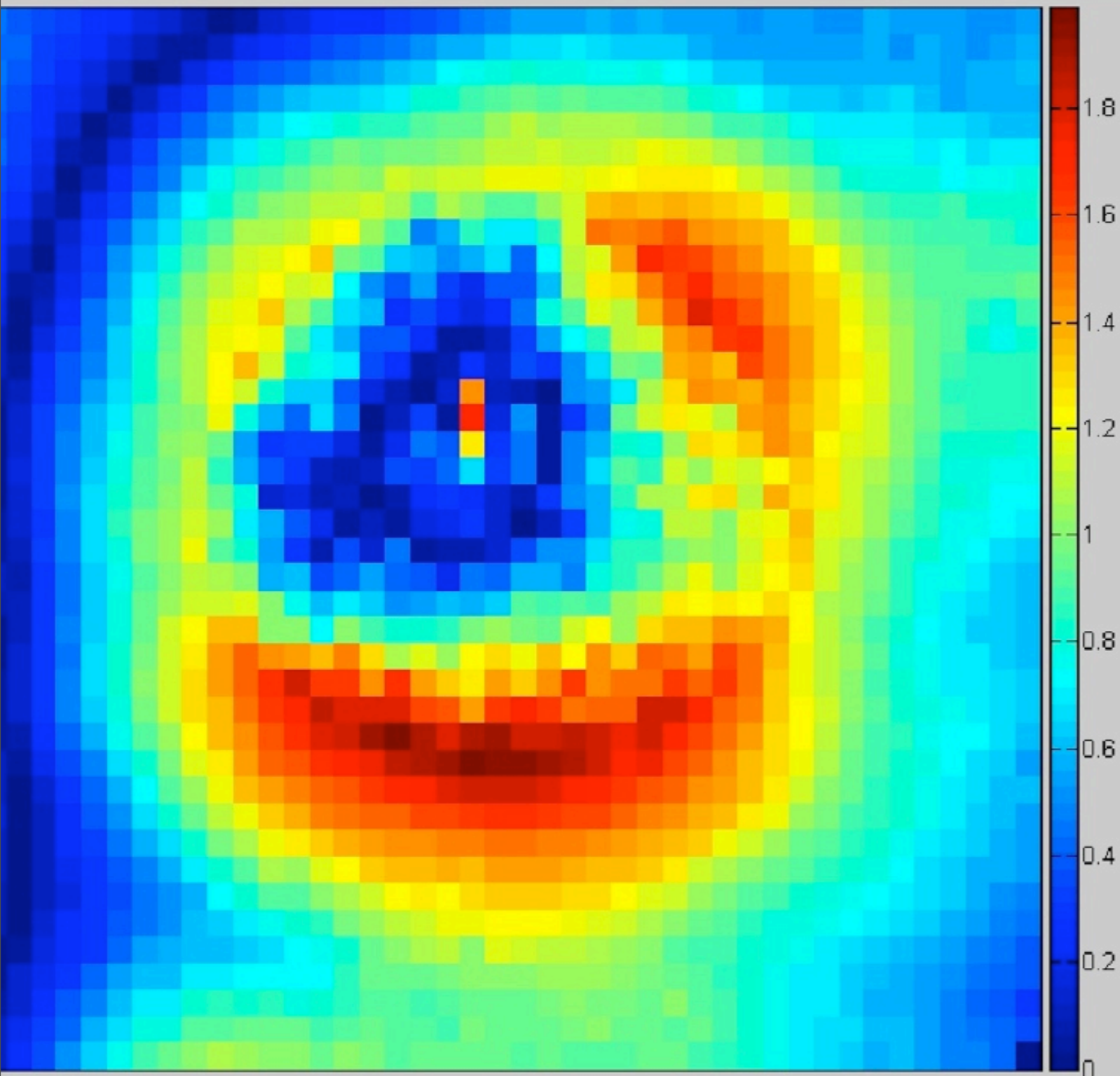
Center:  Width:

Ruler



Legend

Command:



Color Scale     Binary

DTA = 5 mm

Dose Diff = 5 %

Ref Dose = 26.29 GY

Pass = 65.89%    Fail = 34.11%

Pass < 1    Fail > 1

Gamma above 2 is snapped to 2



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not for clinical use

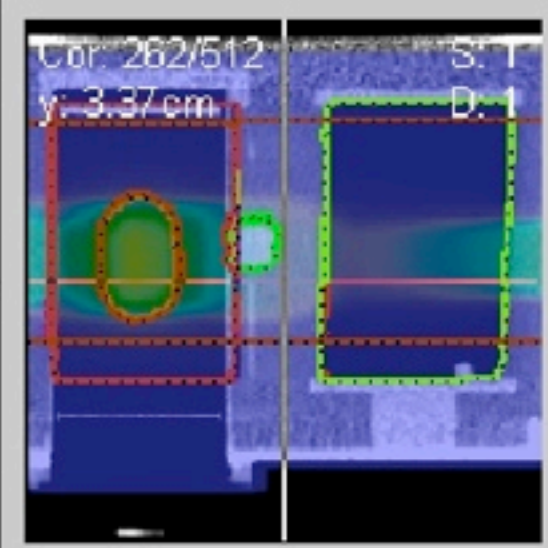
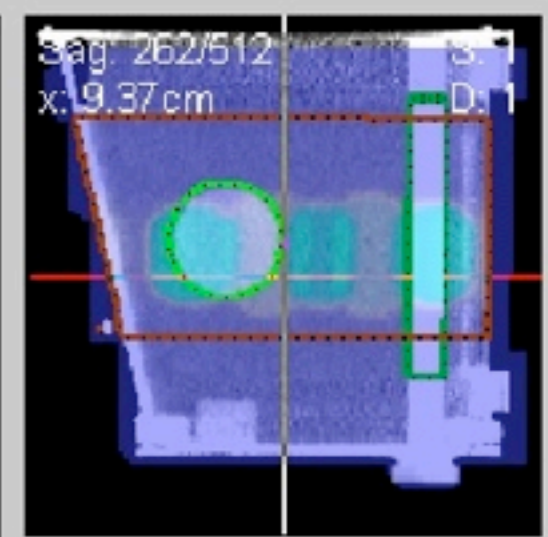
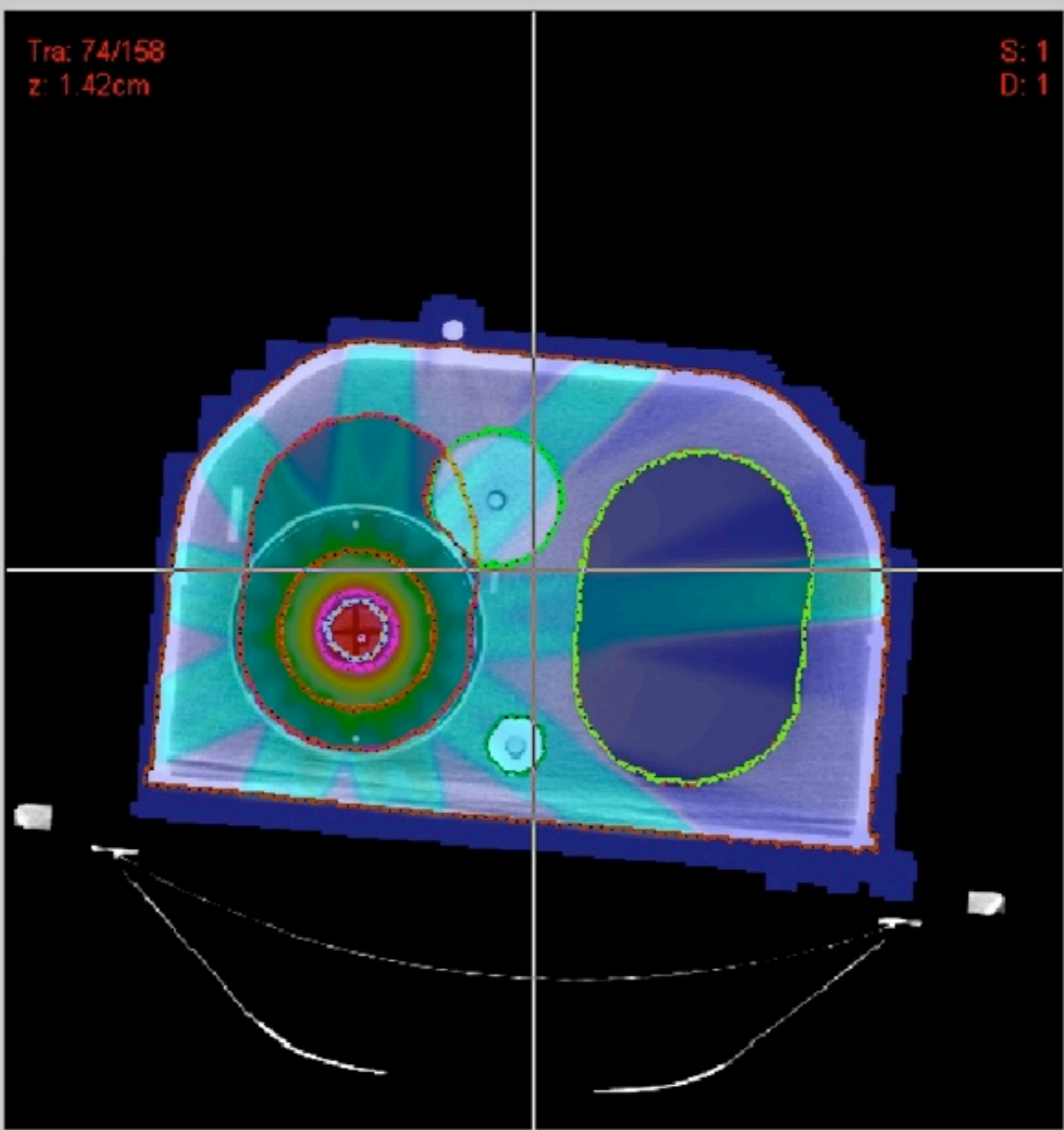
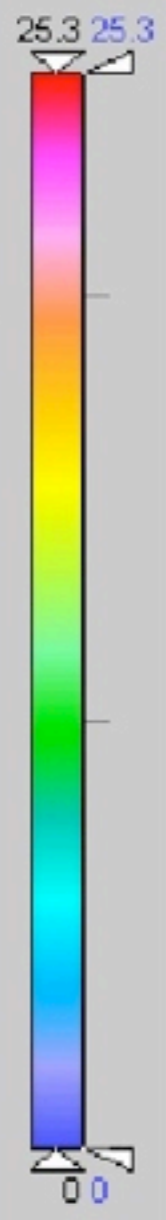
Window:

Center:

Ruler

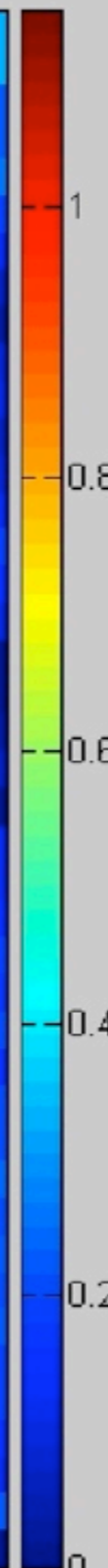
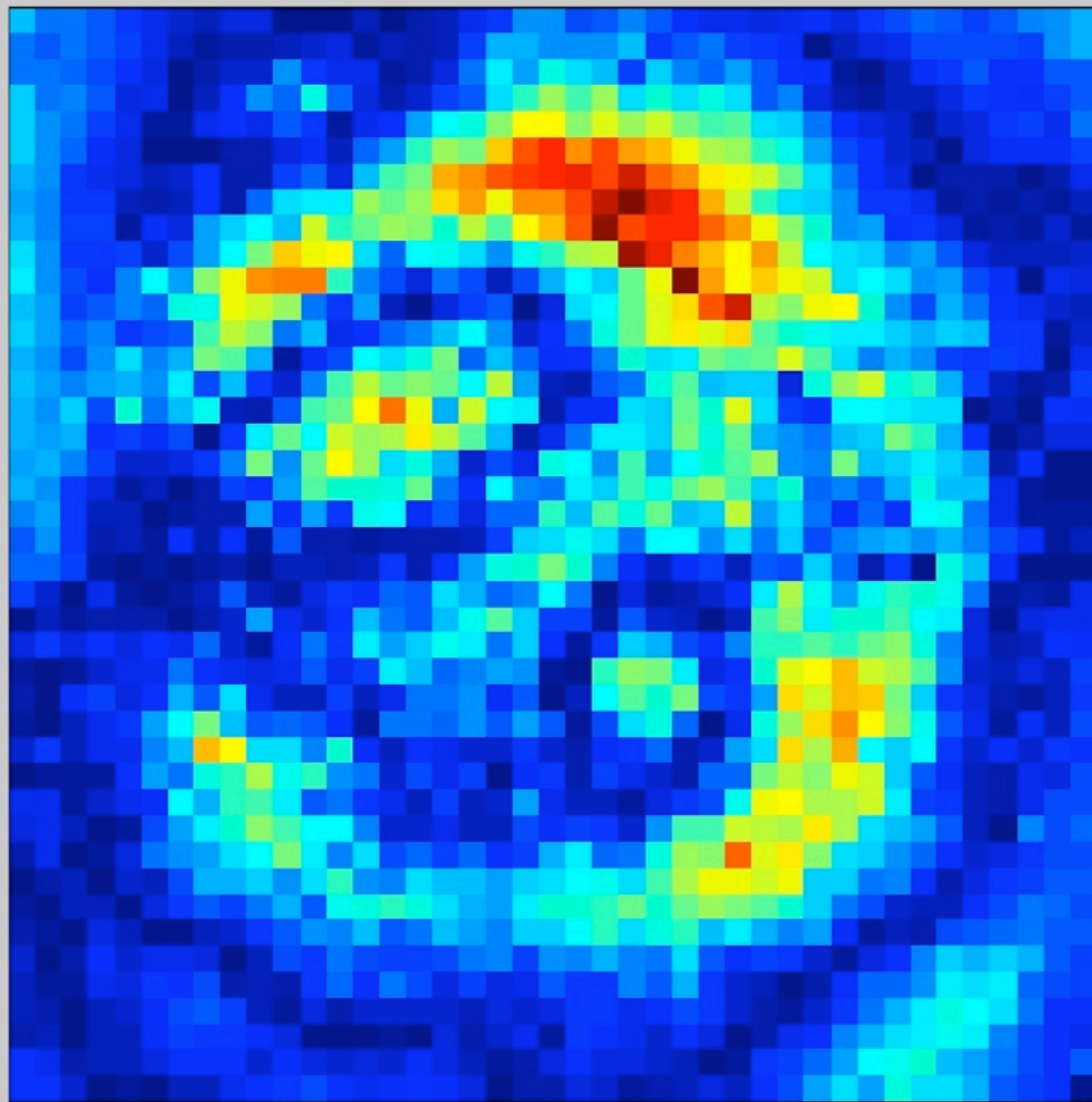
Dose

Scan



- Legend
- GTV
  - HEART
  - LT Lung o
  - LT Lung w
  - LUNG\_TOT
  - Lung W'hol
  - Lung W'hol
  - PTV
  - PTV\_2CM
  - PTV\_TLDV
  - RT Lung
  - SKIN
  - SPINAL\_C
  - skin-(PTV)

Command:



Color Scale     Binary

DTA = 5 mm

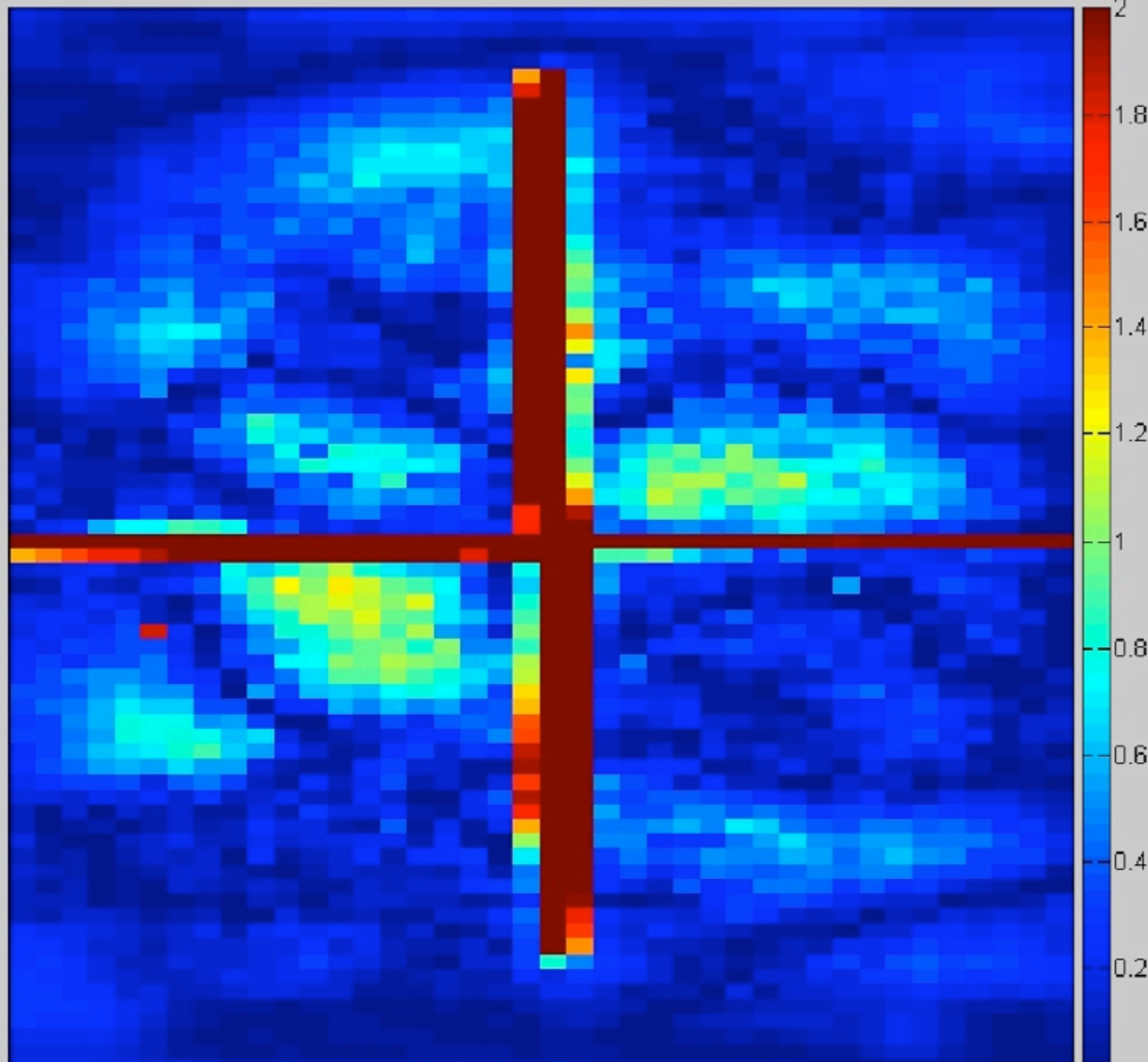
Dose Diff = 5 %

Ref Dose = 25.4 GY

Pass = 99.42%    Fail = 0.58%

Pass < 1    Fail > 1

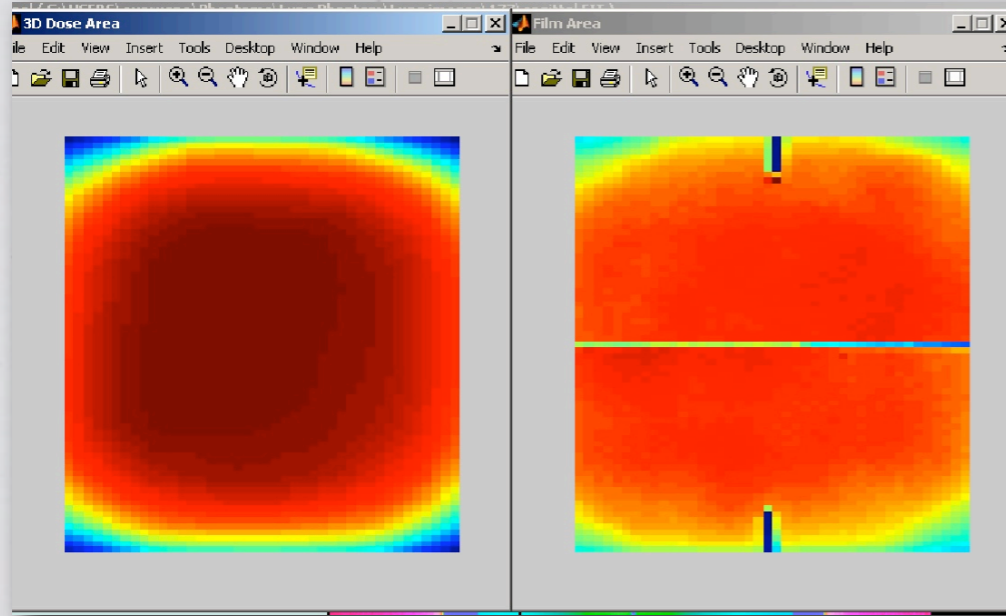
Gamma above 2 is scanned to 2



Color Scale     Binary

DTA = 5 mm  
Dose Diff = 5 %  
Ref Dose = 25.4 GY  
Pass = 92.01%    Fail = 7.99%  
Pass < 1    Fail > 1

# Lung Phantoms - Status



Algorithm	Number of Institutions	Number Evaluated	Average Percentage of Pixels Passing 5% / 5 mm*		
			Axial	Coronal	Sagittal
Pencil Beam	12	8	74±25	62±25	53±25
Superposition	21	15	92±12	75±21	79±22

\* Percentage of TLD dose measurement

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# Development of Monte Carlo Calculations

- \* Collaboration with Joe Deasy to develop MC code
  - \* General source model
- \* Evaluated Varian 6X
  - \* IMRT with H&N phantom
  - \* IMRT with lung phantom
- \* RPC intends to use to evaluate IMRT plans
- \* Will use carryover funds to purchase upgraded PC



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# Proton Beam Monitoring

## \* 2008:

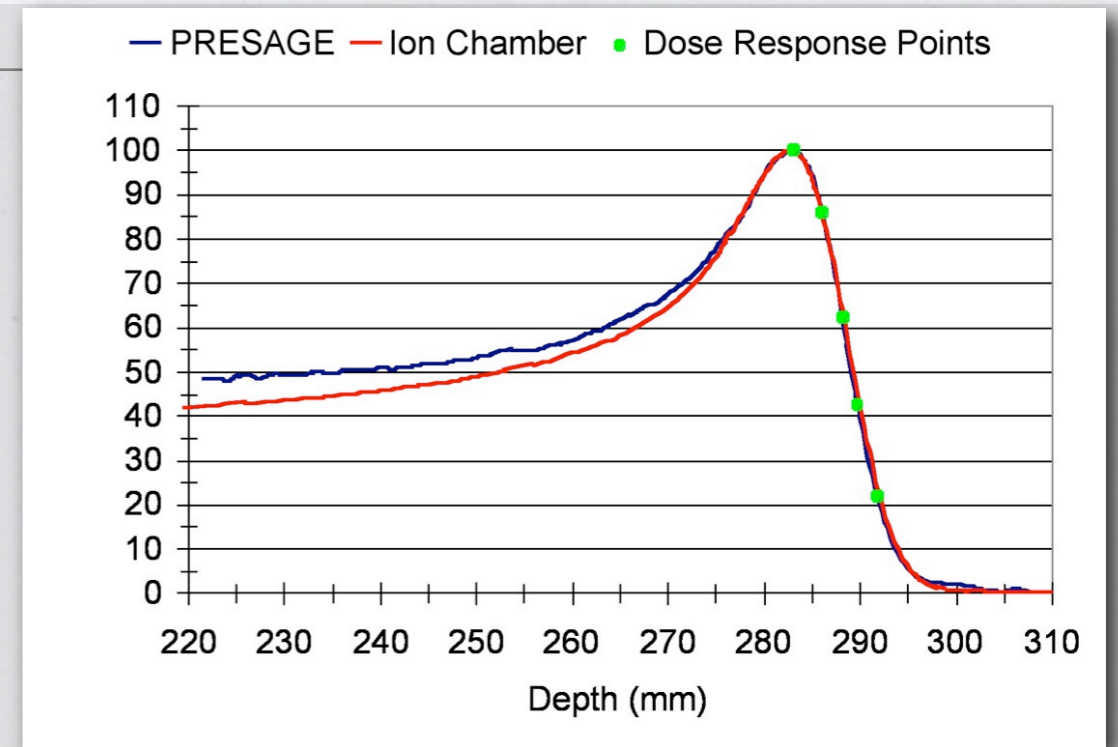
- \* Routine TLD monitoring *[done]*
- \* Institute program of dosimetry review visits to proton facilities
- \* Undertake redesign of pelvis phantom for proton beams
- \* Complete evaluation of BANG® gels, Presage™ dosimeters

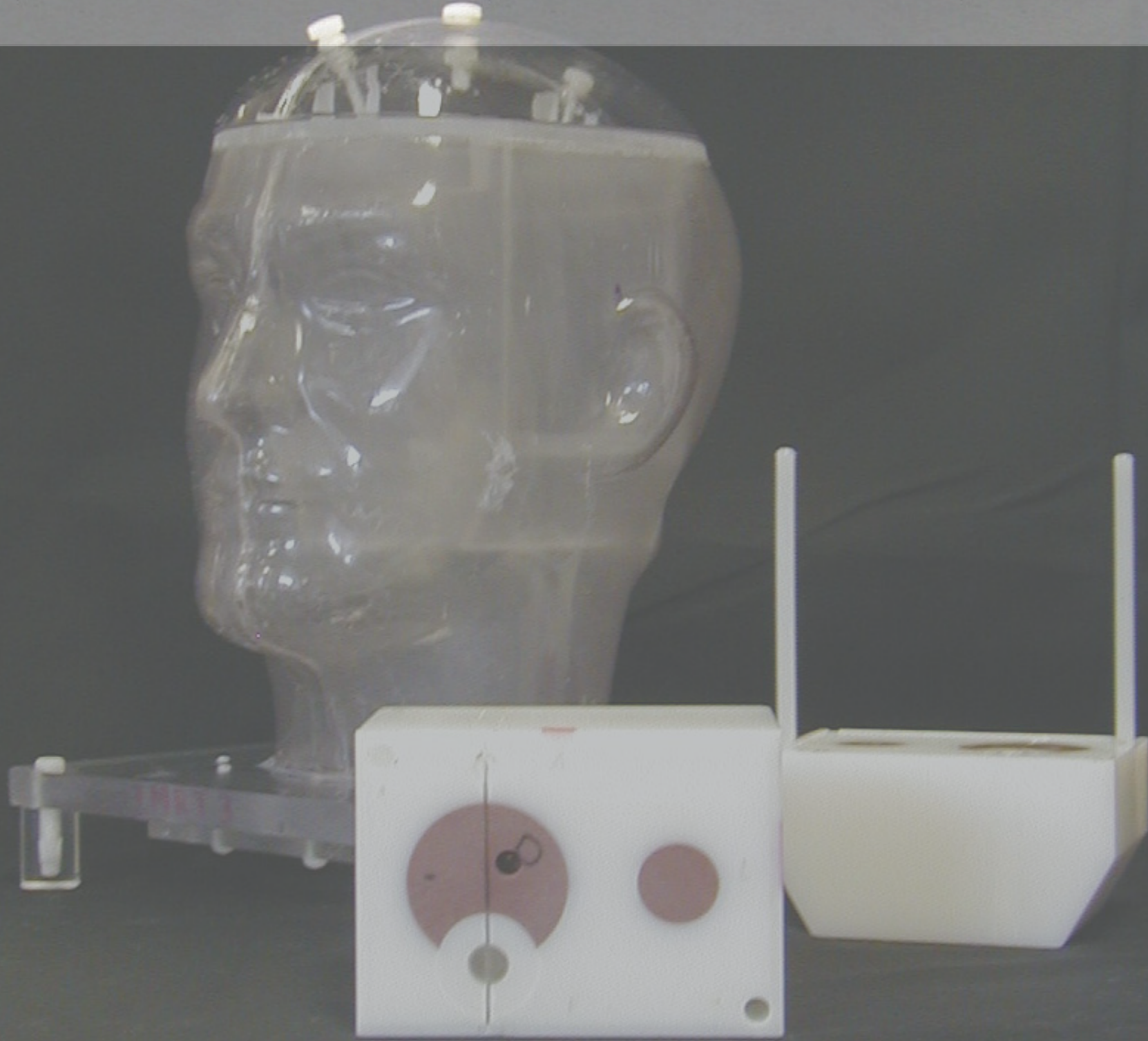
## \* 2009:

- \* Undertake redesign of H&N and thorax phantoms for proton beams
- \* Through AAPM, pursue adoption of uniform calibration protocol, traceability to NIST

## \* 2010+:

- \* Accumulate database of representative beam data
- \* Develop capabilities to independently recalculate patient plans





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