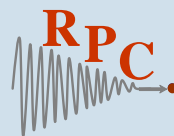# Credentialing Results from the RPC's Spine Anthropomorphic Phantom

Andrea Molineu, Paola Alvarez, Nadia Hernandez, Fang-Fang Yin, and David Followill
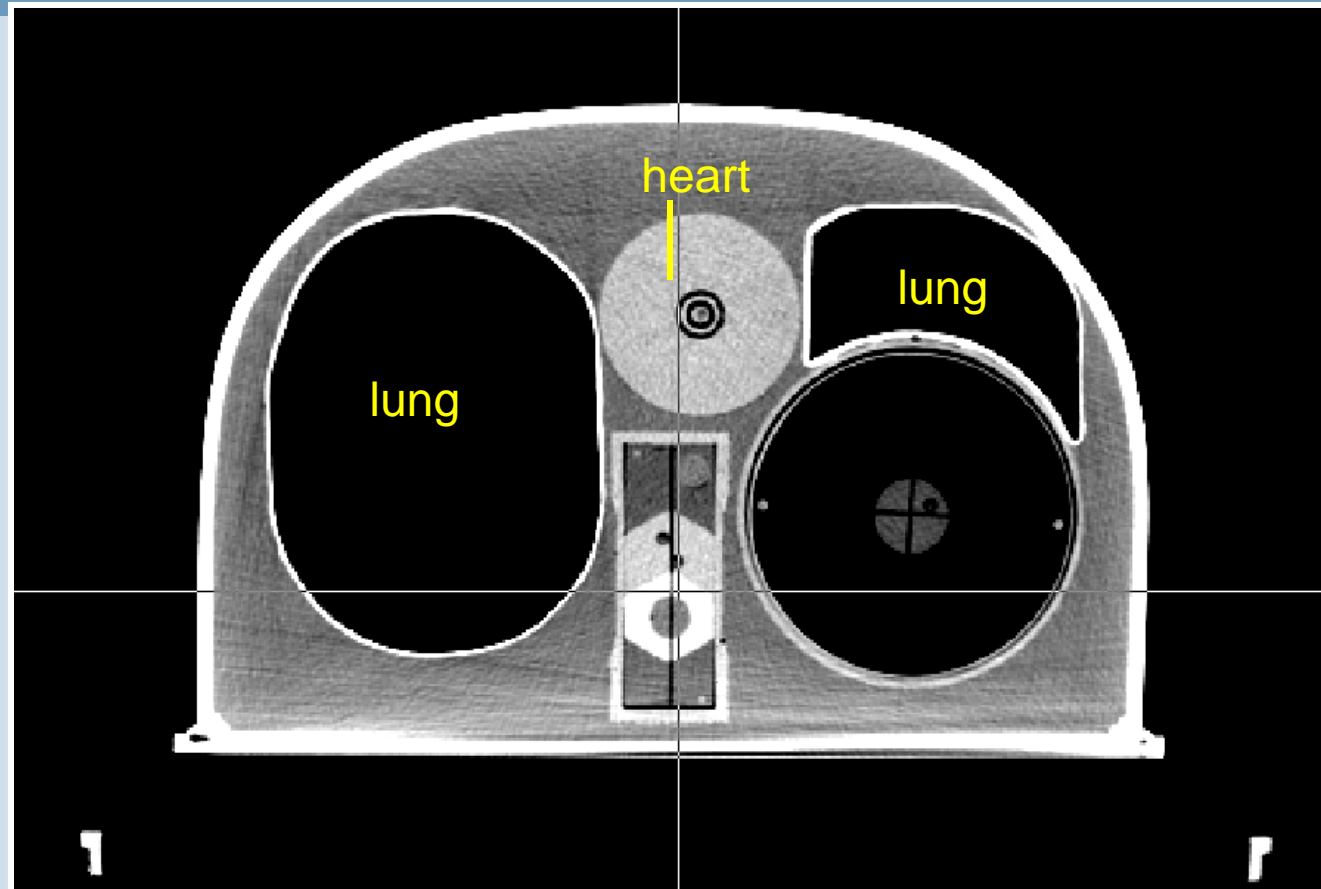
August 2012

THE UNIVERSITY OF TEXAS
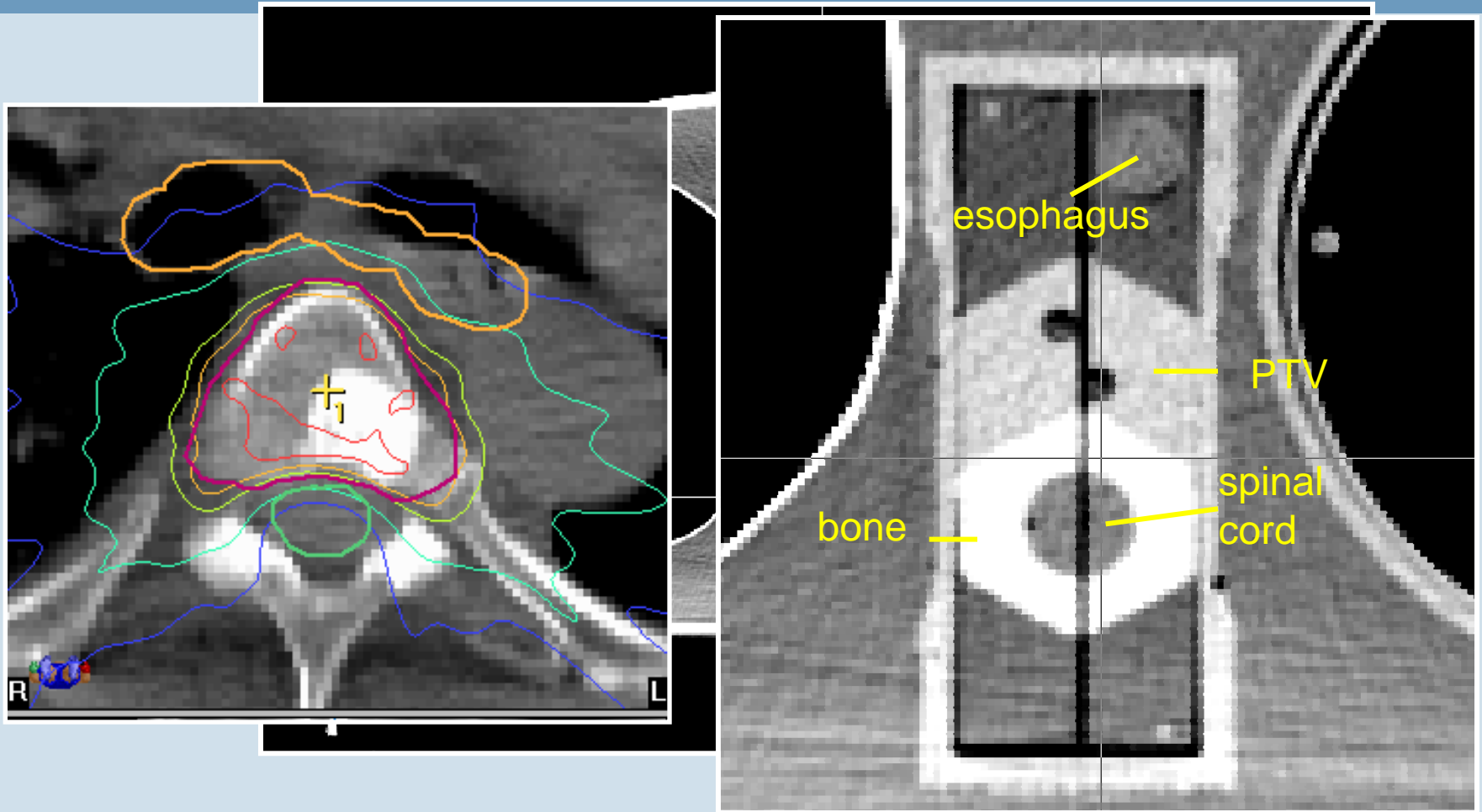MD Anderson
Cancer Center

Making Cancer History®

RPC MD Anderson
Radiological Physics Center

Spine phantom

# Spine phantom

RTOG 0631

- Phase II/III study of IGRT/SBRT for localized spine mets
- Facility Questionnaire
- IGRT credentialing
- Phantom credentialing

Treatment Plan

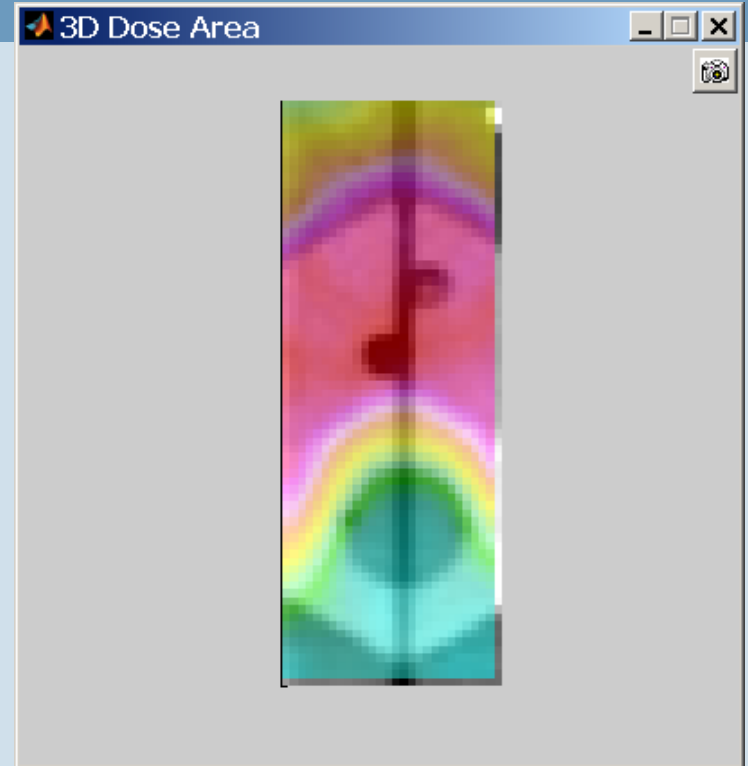- 6 Gy to at least 90% of PTV

- Min PTV dose at least 5.25 Gy

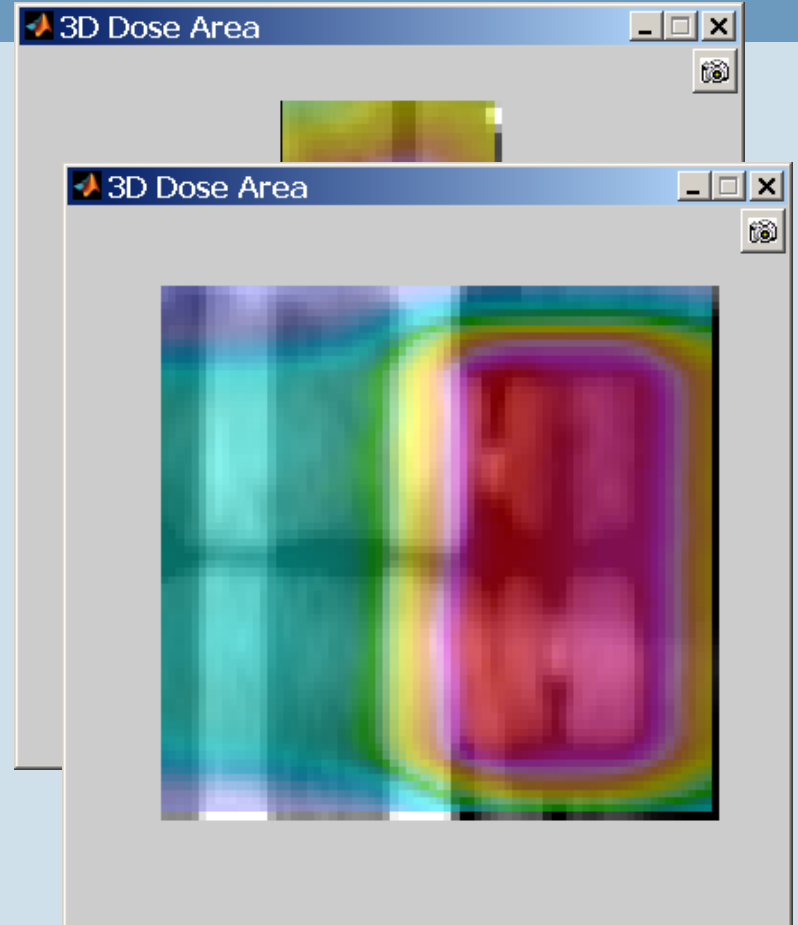| Normal structure	Volume	Volume Max (Gy)	Max Point Dose (Gy)
Spinal Cord	<0.35 cc <1.2 cc	3.75 2.63	5.25
Heart	<15 cc	6.00	8.25
Esophagus	<5 cc	4.46	6.00
Skin	<10 cc	8.63	9.75
Whole Lung	1000 cc	2.78	

Representative Treatment Plan
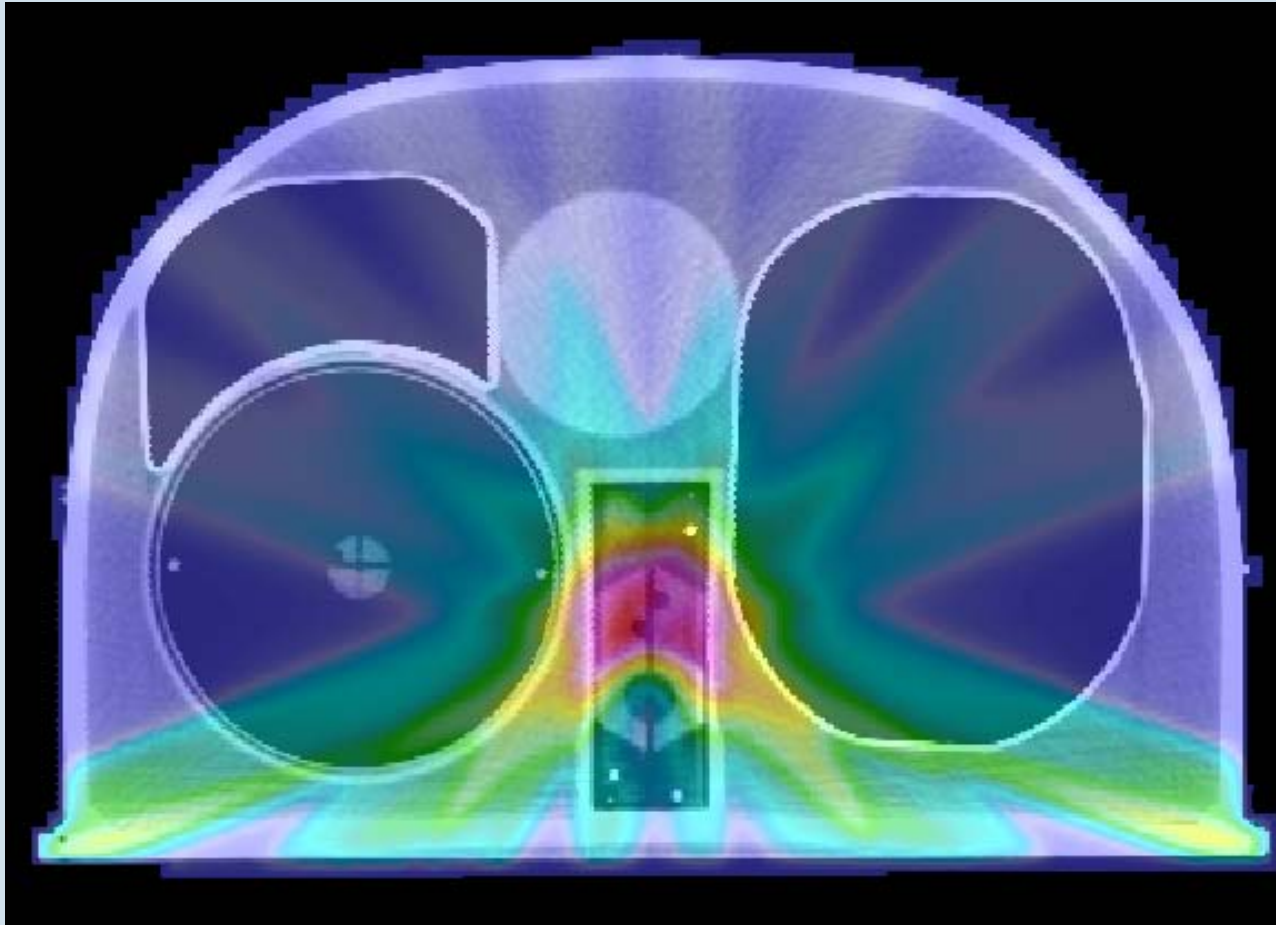
Criteria

- TLD
  ±7%

- Film (axial and sagittal planes)
  85% meet 5%/3mm

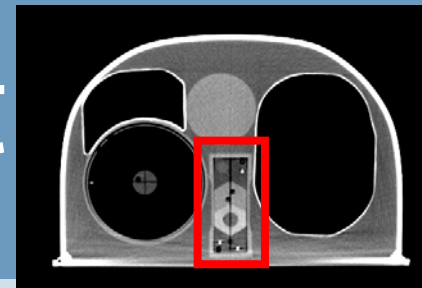- Plan DVH
  must comply with protocol

Criteria

- TLD
  ±7%

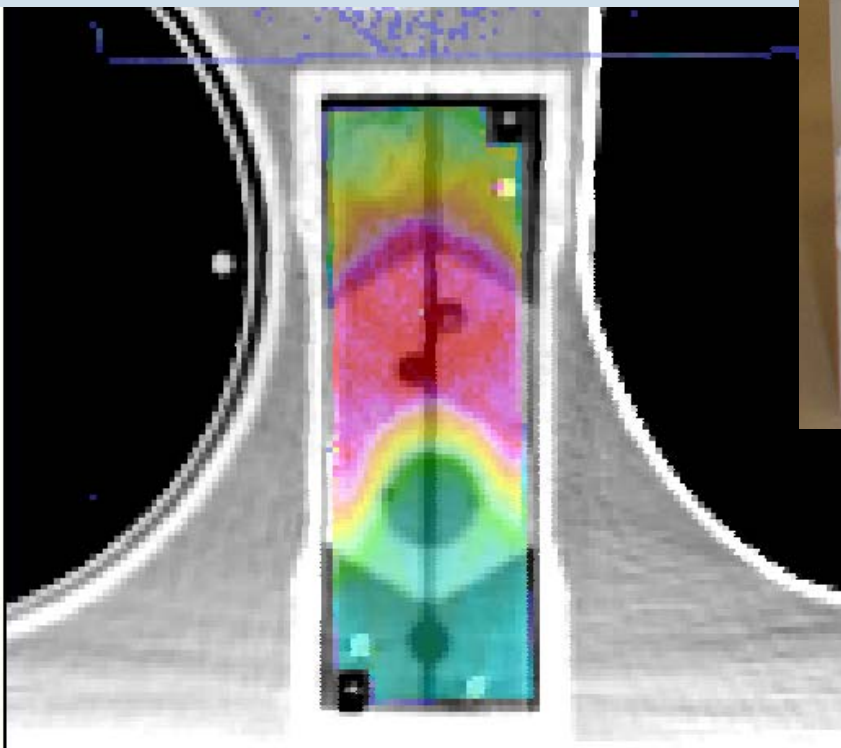- Film (axial and sagittal planes)
  85% meet 5%/3mm

- Plan DVH
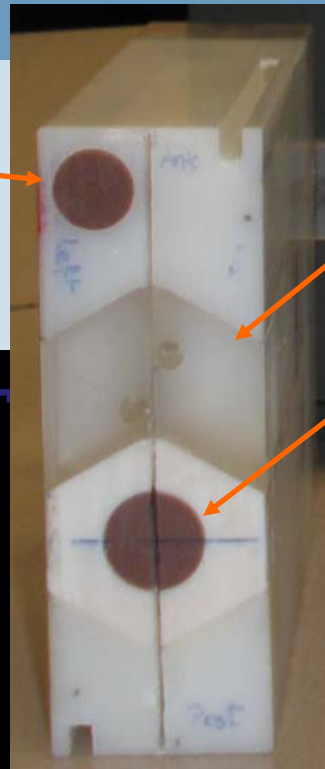 must comply with protocol

Good Agreement

OAR

PTV

Cord/bone
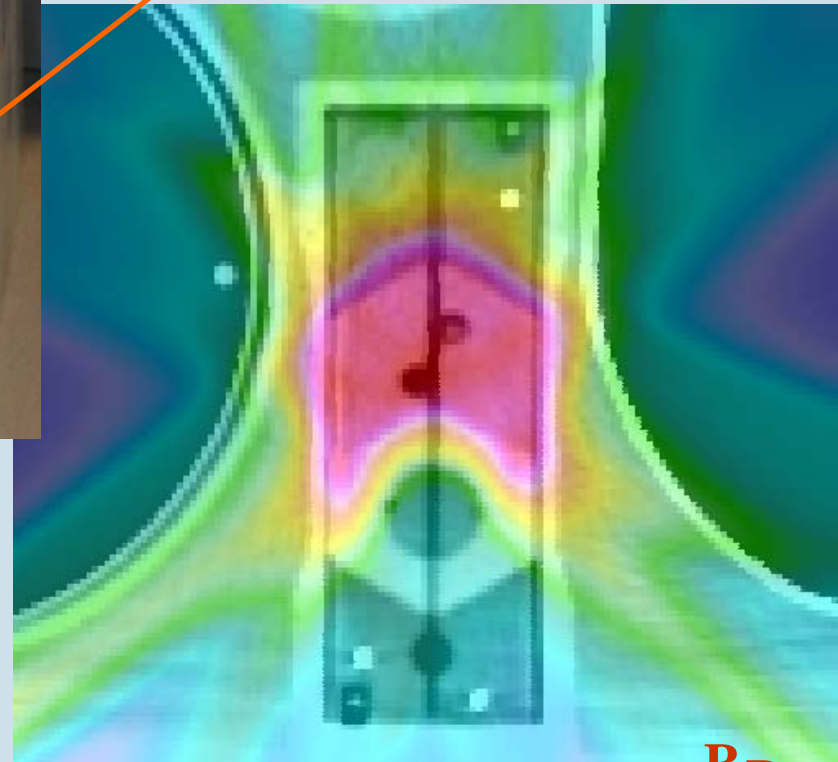
Measurement

Plan

Good Agreement

Measurement

axialGamma 2D

Fail = 0.44%

Pass = 99.56%

100% passing

Pass < 1   Fail > 1

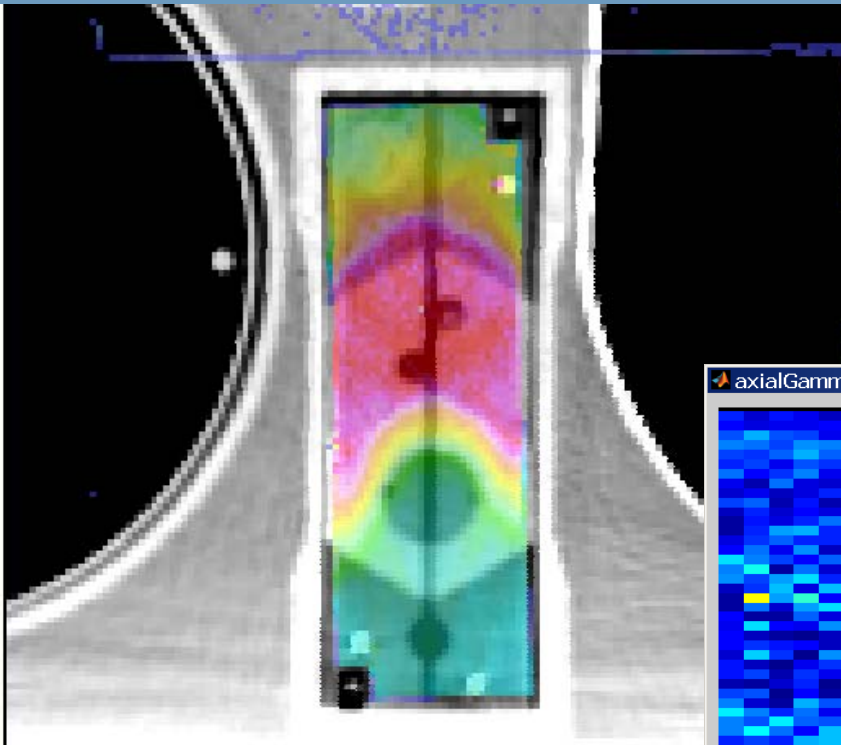Gamma above 2 is snapped to 2
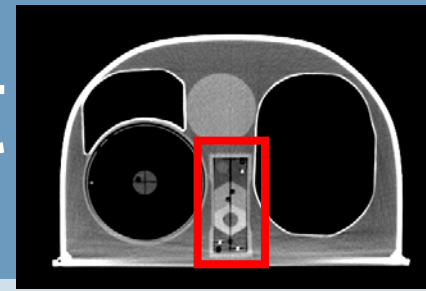
Gamma

Poor Agreement

OAR

PTV
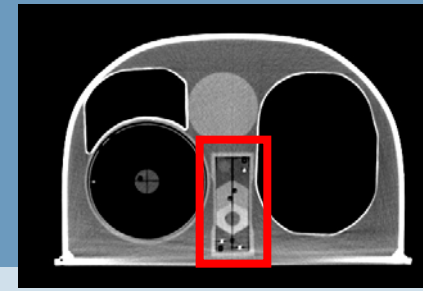
Cord/bone

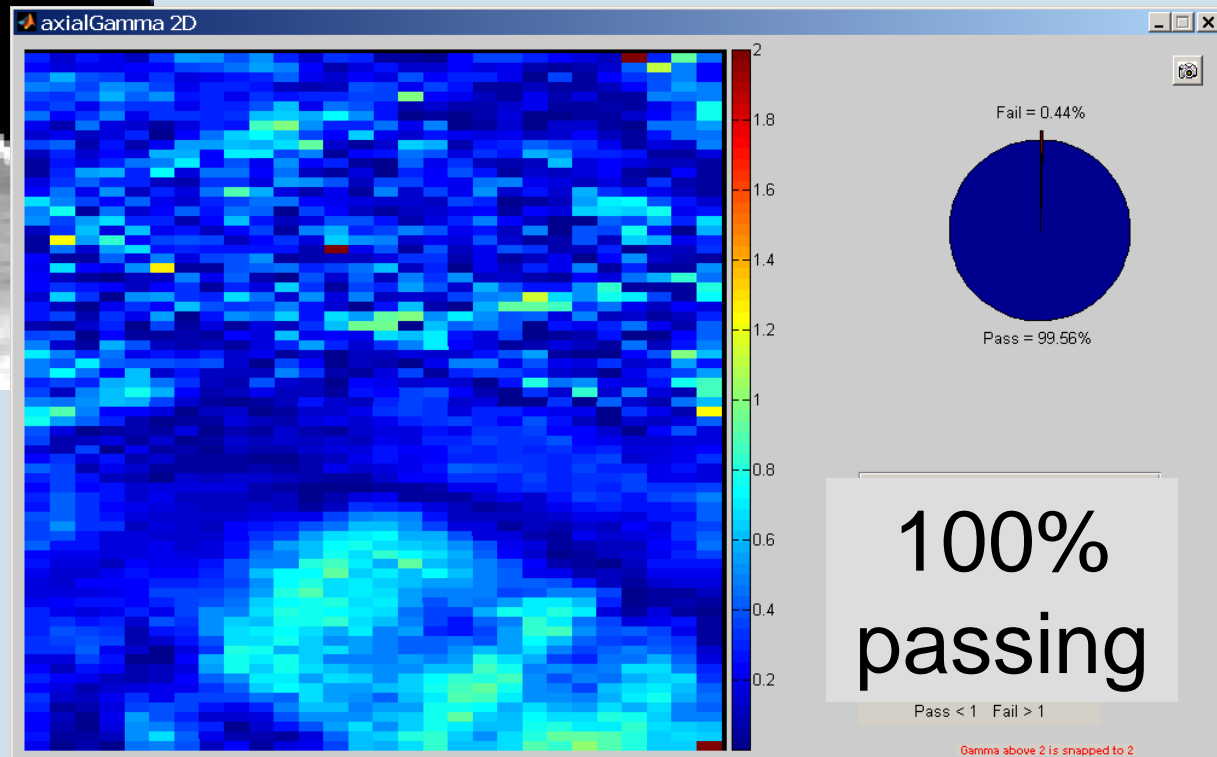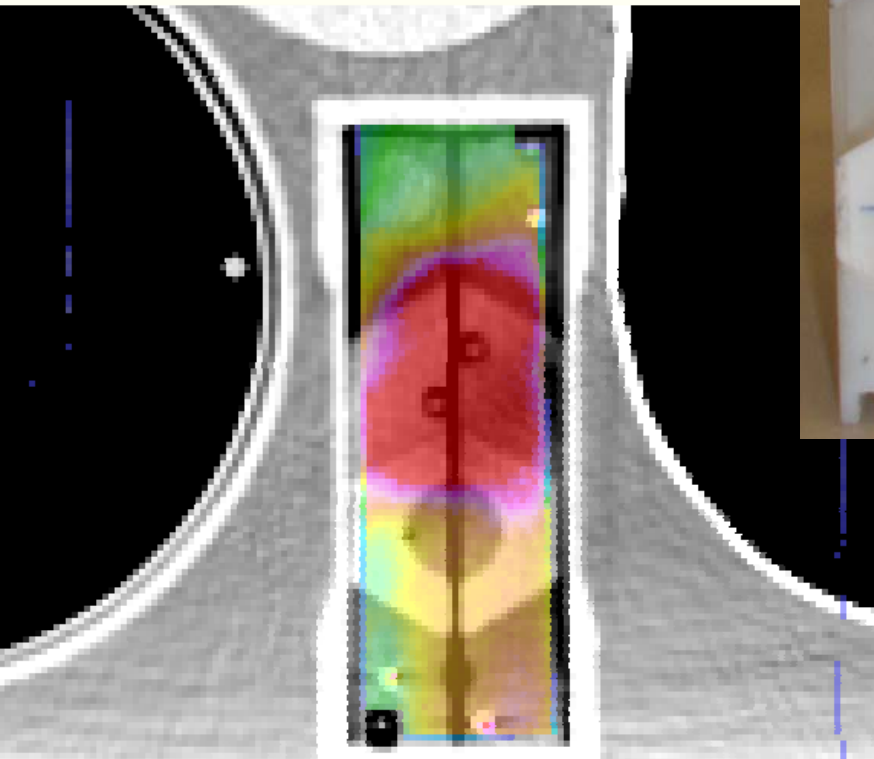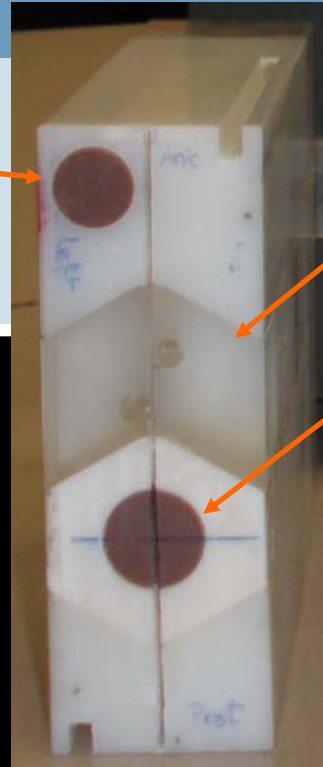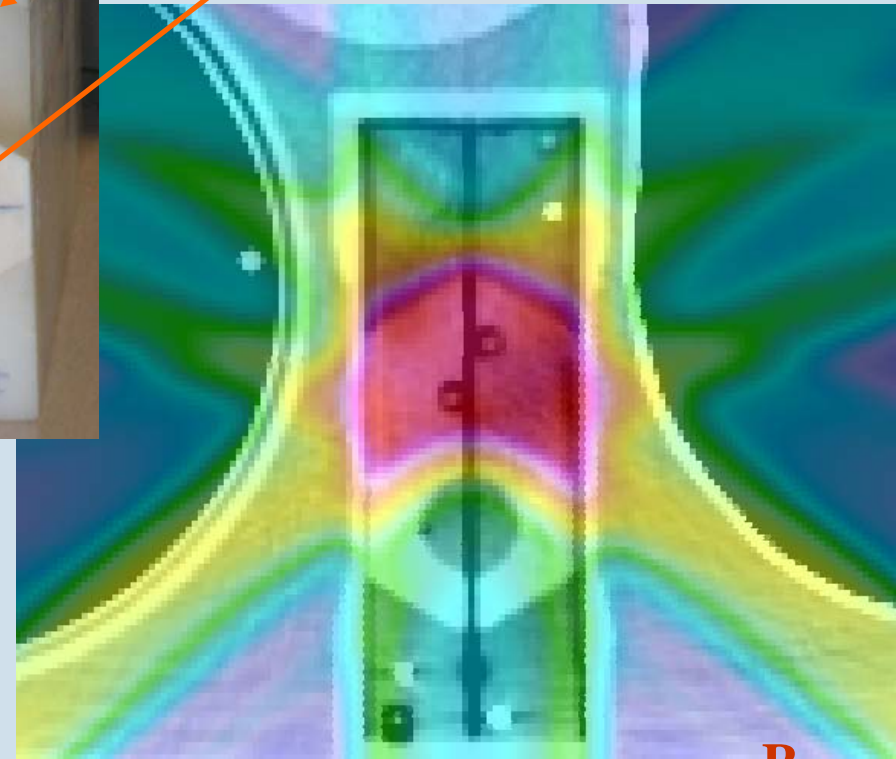**Measurement**

Plan

Poor Agreement
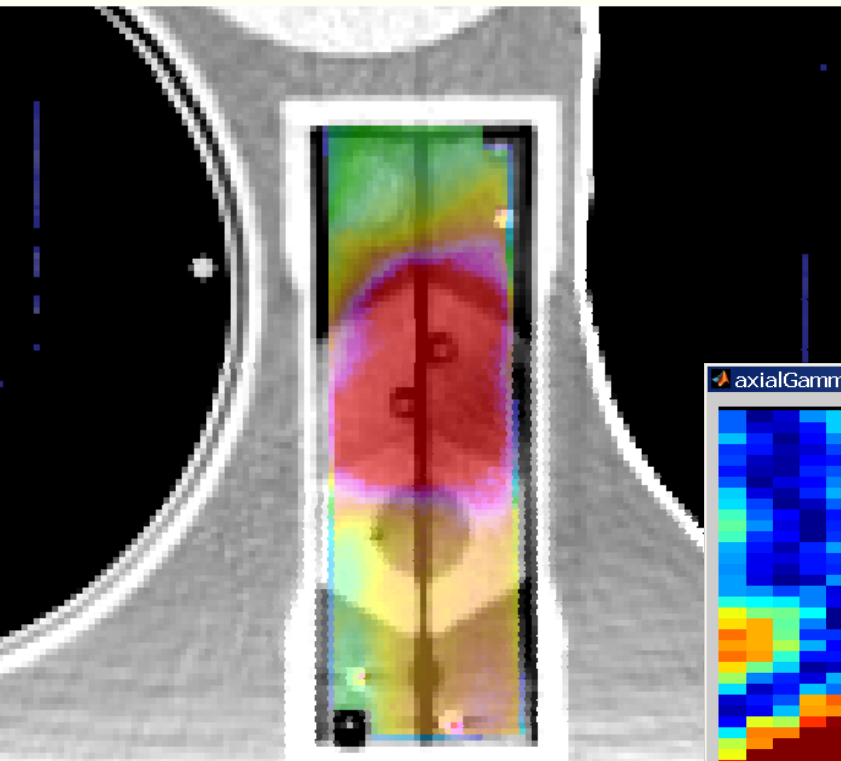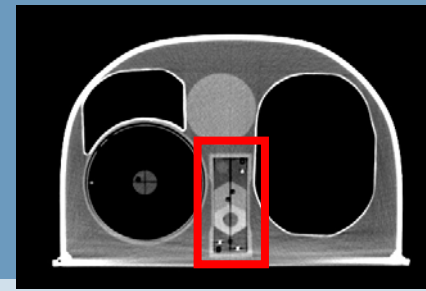
Measurement

Gamma

26% passing
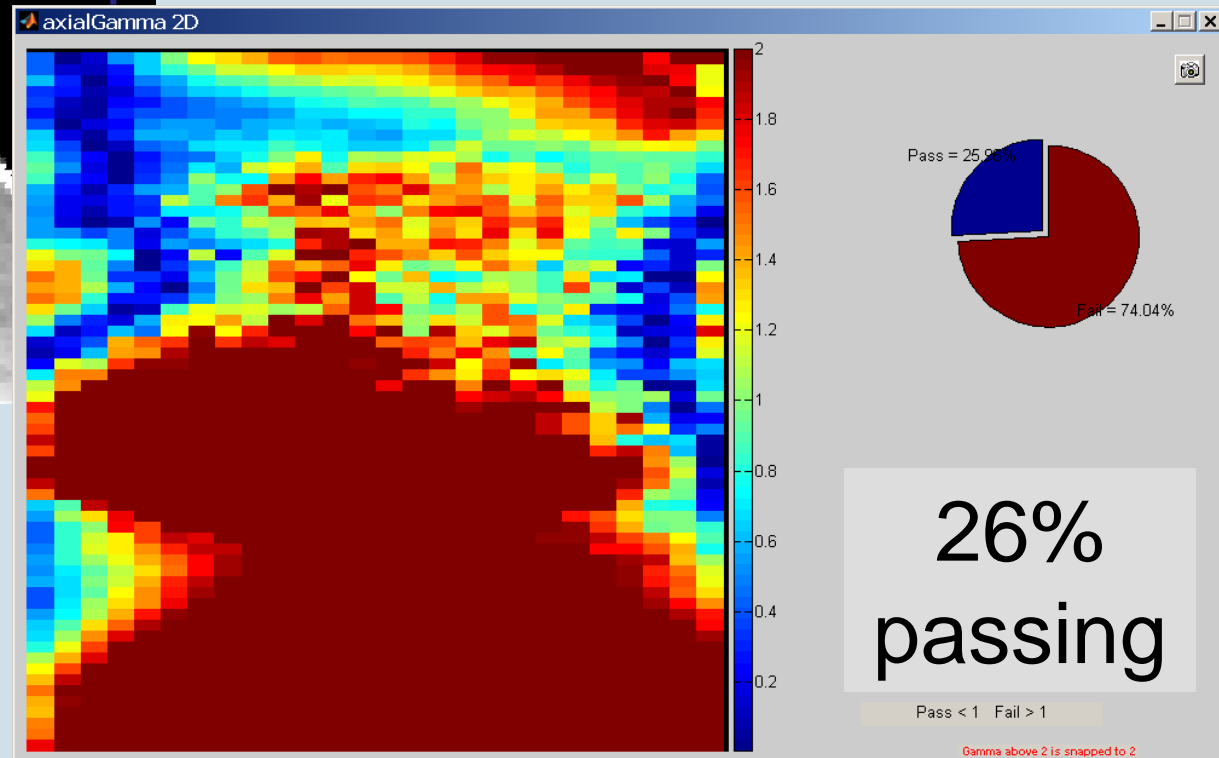
Overall results

- 138 irradiations at 98 institutions

- 44 irradiations failed

- 1 failed TLD criteria only

- 29 failed gamma criteria only

- 14 failed both TLD and gamma

- 64 sites credentialed for IGRT by RTOG

Spine Results

	PTV	Heart	Axial Gamma	Sagittal Gamma
mean	0.99	0.94	87.7	88.4
std dev	0.04	0.15	13.8	13.2
range	0.88 – 1.23	0.67 – 1.51	22 - 100	36 - 100

Results by Machine

Machine Manufacturer	Pass Rate (%)	Attempts	TLD Dose	Criteria Failed	
				Gamma	Dose and Gamma
CyberKnife	64	22	1	3	4
Elekta	56	18	0	3	5
Novalis	69	13	0	3	1
Siemens	67	3	0	1	0
TomoTherapy	79	14	0	3	0
Varian	71	68	0	16	4
Total		138	1	29	14

Results by TPS

TPS	Pass Rate (%)	Attempts	Criteria Failed		
			TLD Dose	Gamma	Dose and Gamma
CyberKinfe	64	22	1	3	4
Eclipse	68	53	0	14	3
Hi-Art	79	14	0	3	0
iPlan	71	17	0	3	2
Monaco	100	1	0	0	0
Pinnacle	68	25	0	4	4
XiO	50	6	0	2	1
total		138	1	29	14

Results by Algorithm

Algorithm	Pass Rate (%)	Attempts	Criteria Failed		
			Dose	Gamma	Dose and Gamma
AAA	69	48	0	13	2
adapt conv/cc conv	74	23	0	4	2
Monte Carlo	67	21	0	4	3
pencil beam	74	19	0	3	2
raytracing	40	5	1	0	2
superposition	64	22	0	5	3
total		138	1	27	14

Conclusions

- Challenging credentialing process

- Treatment couch should be considered in these treatments

- Cannot make generalizations with regard to machine, TPS, or algorithm

Conclusions

- Important QA tool

- Aids improvements to IMRT delivery

- All major linear accelerator and planning systems have ability to pass

Thank you!

The investigation was supported by PHS grants CA10953, CA81647 and CA21661 awarded by the NCI, DHHS.