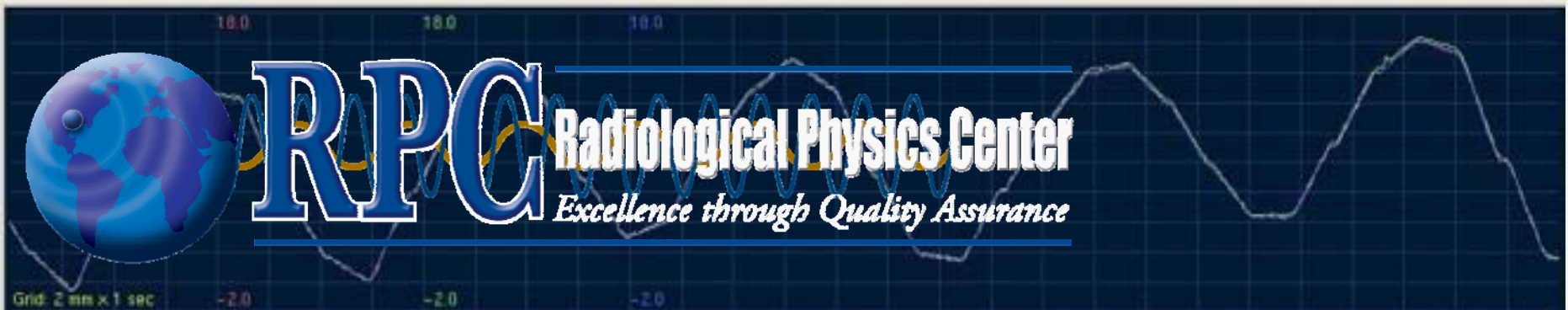


Requirements for Addressing Respiratory Motion in Cooperative Group Trials



Paige Nitsch, BS,
Nadia Hernandez, MS,
Paola Alvarez, MS,
Geoffrey S. Ibbott, Ph.D.

<http://rpc.mdanderson.org>

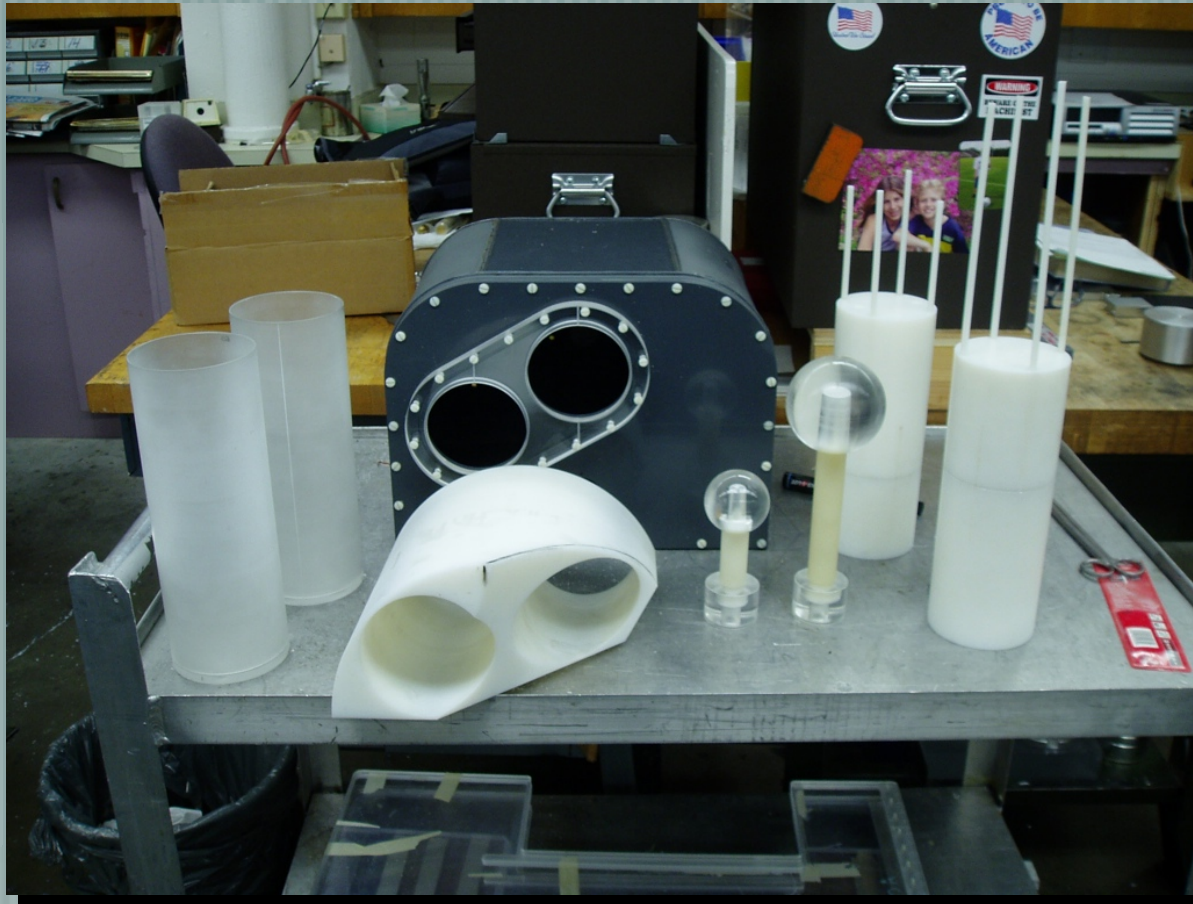
Supported by NCI grants
CA10953 and CA81647

RPC Role in Evaluating Respiratory Motion

- NCI protocols required to address respiratory motion when IMRT used
 - For intra-thoracic tumors and other locations
- RTOG 0438
 - Liver primary and metastases (no IMRT)
- RTOG 0618
 - SBRT lung (IMRT permitted with approval)
- Institutions required to demonstrate capability
 - RTOG has written requirements

RTOG 0438

- Organ motion due to breathing must be documented
- Tumor or diaphragm motion must be recorded
- If the cranial caudal motion of the diaphragm is < 5mm, shallow free breathing is permitted
- Active breathing control (ABC), voluntary breath hold or gating must be used. End exhale is preferred.
- Institutional reproducibility data regarding patient setup and tumor targeting must be provided to the physics and image guidance committees.



Stereotactic Liver Phantom

QuickTime™ and a
Cinepak decompressor
are needed to see this picture.

MDACC: M. Fitzpatrick, T. Guerrero

QuickTime™ and a
Photo - JPEG decompressor
are needed to see this picture.

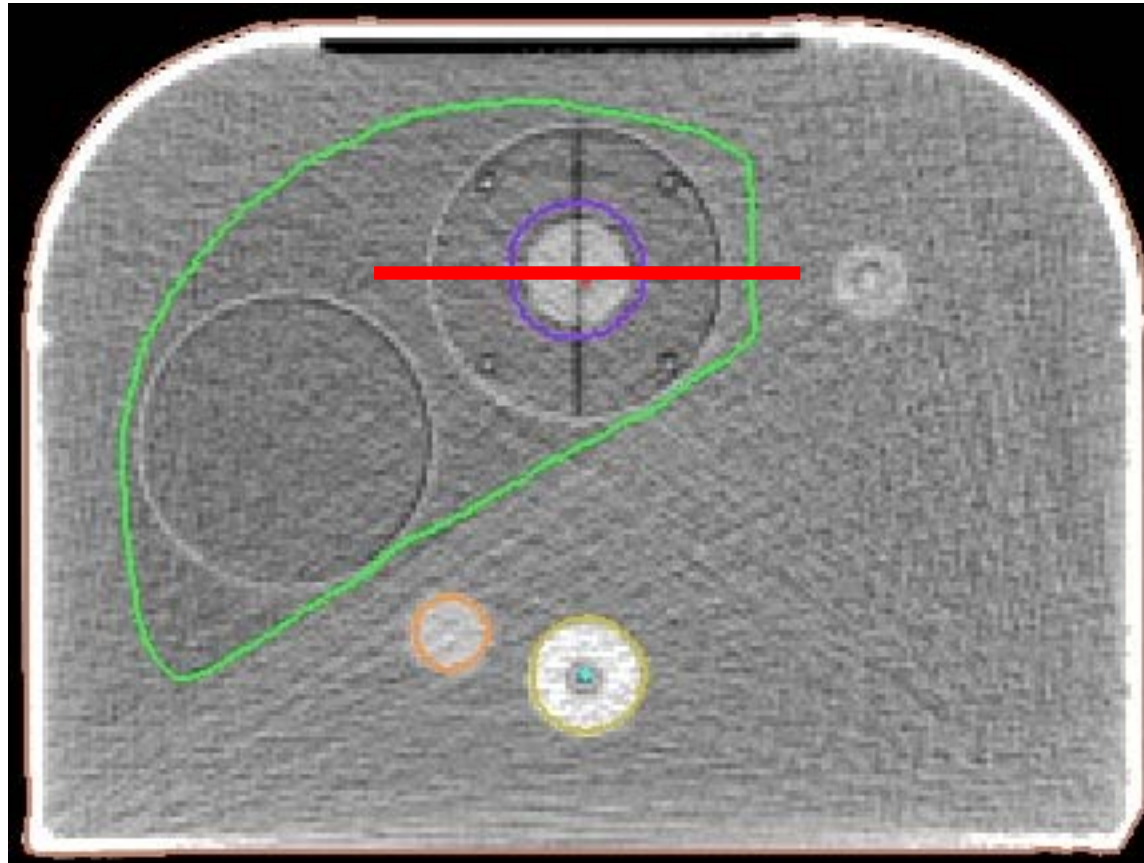
Credentialing Procedure

- Institution requests phantom
 - Priority based on several factors
- RPC ships phantom/moving platform
 - Institution fills with water
 - Performs imaging
 - Prepares treatment plan
 - Delivers plan
 - Drains water
 - Returns phantom
- Institution sends data electronically to ITC
- RPC compares measurements with plan

Dynamic Liver Phantom Irradiations (for RTOG 0438)

- 6 institutions requested for credentialing
 - 2 received phantom twice
- 4 have passed
- 2 failed due to sup/inf shifts
 - Both using free-breathing limited to 5 mm

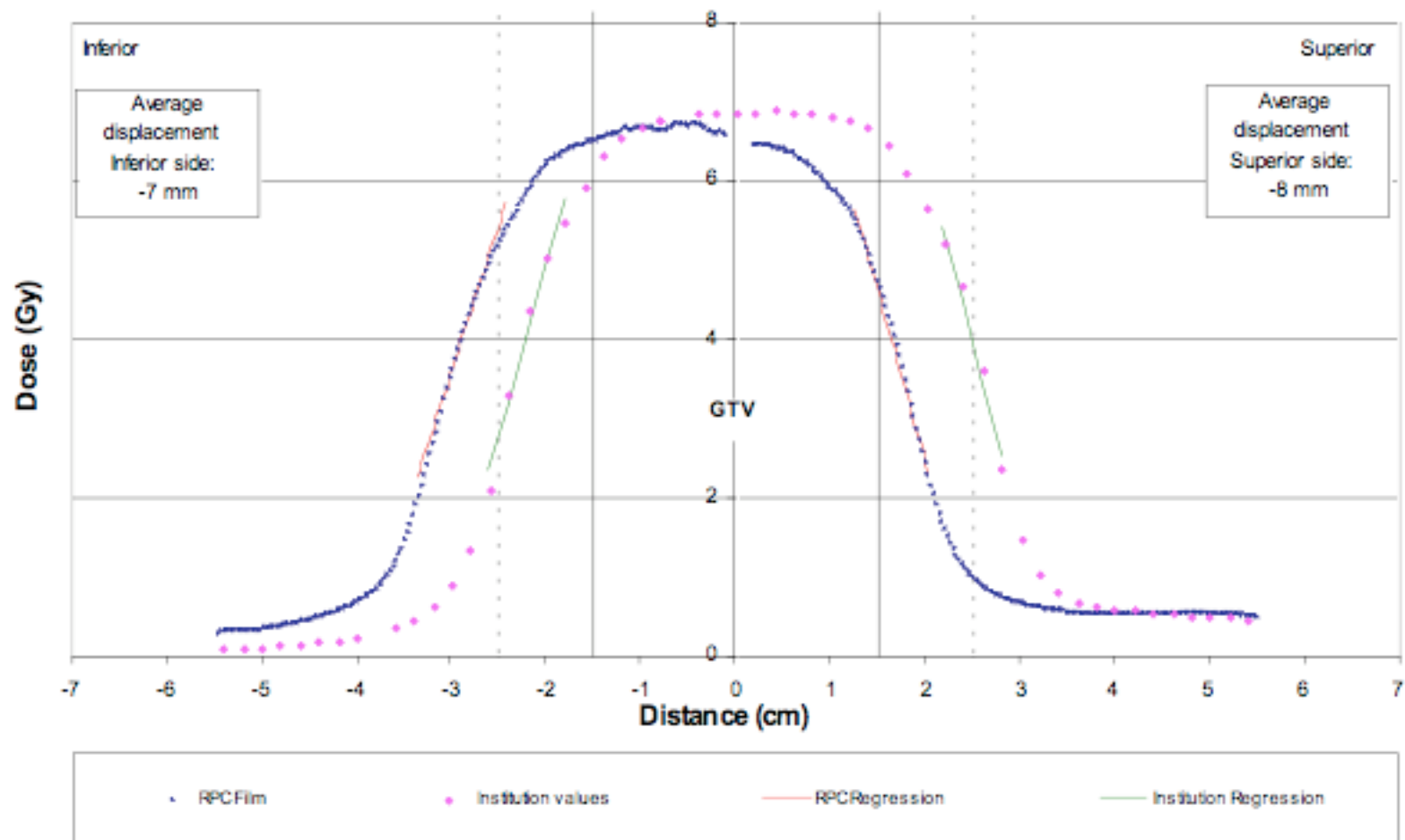
Liver Phantom Delivery Using Free Breathing (5 mm) L-R



Liver Phantom Delivery Using Free Breathing (5 mm) S/I

PTV 1

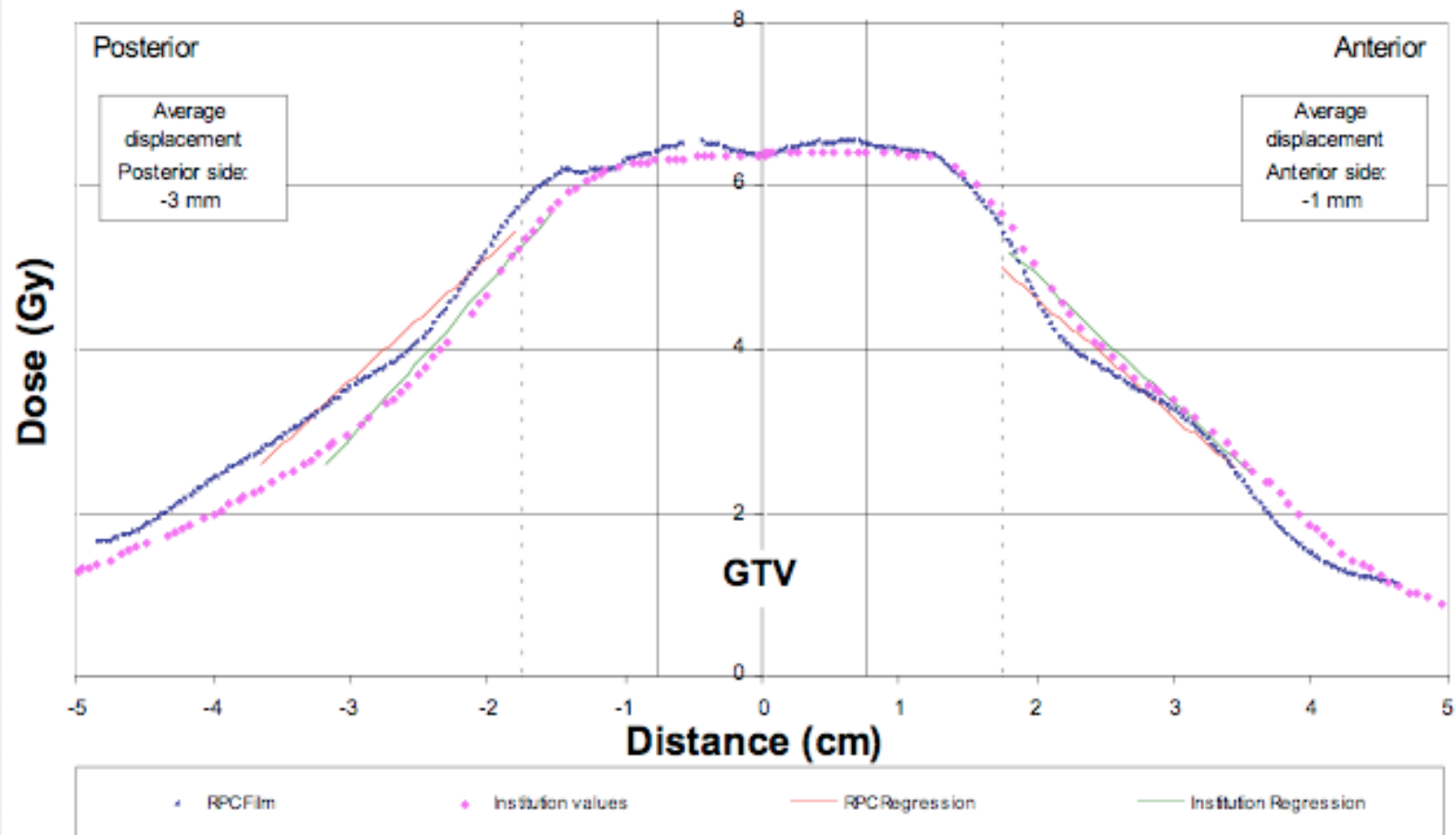
Superior Inferior Profile



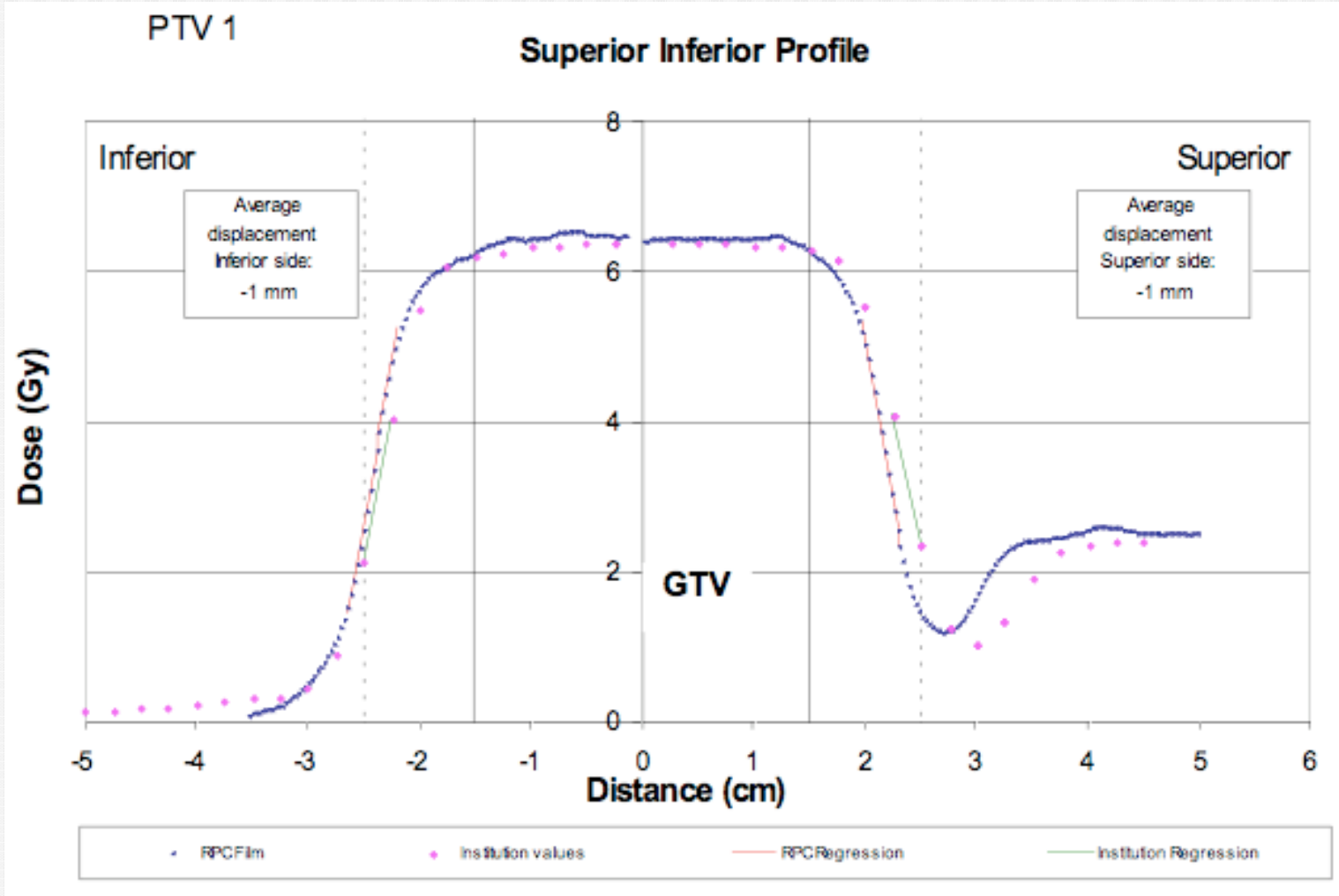
Liver Phantom Delivery Using Gating: A-P

PTV 1

Anterior Posterior Profile



Liver Phantom Delivery Using Gating: S/I

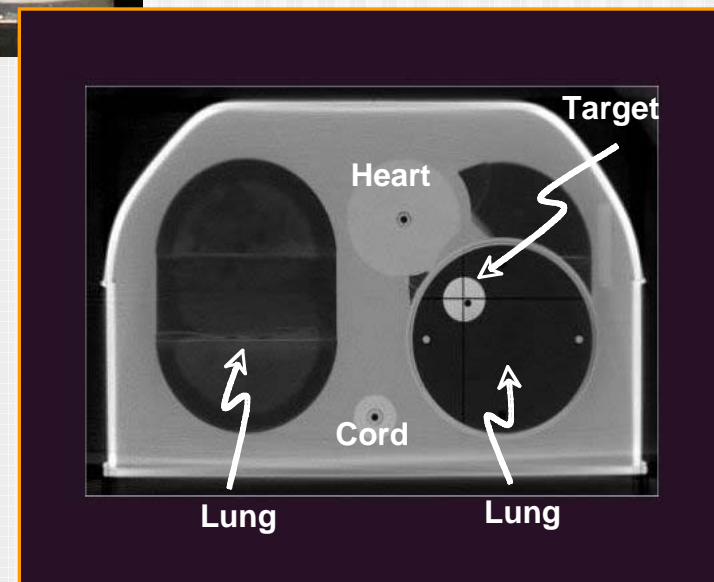
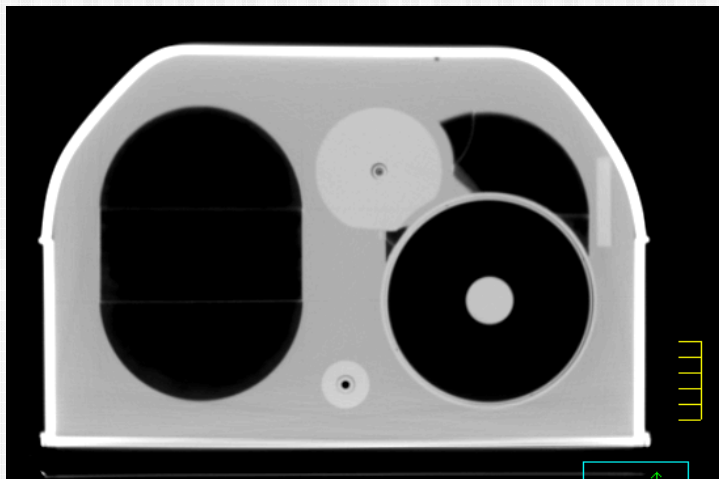
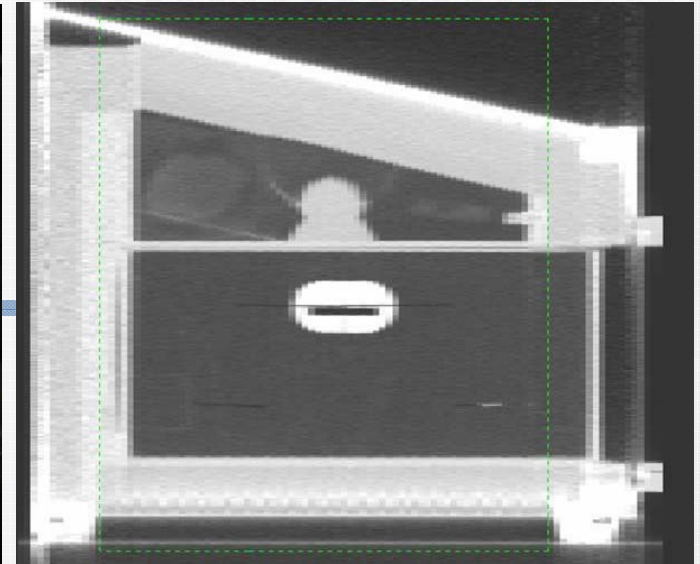
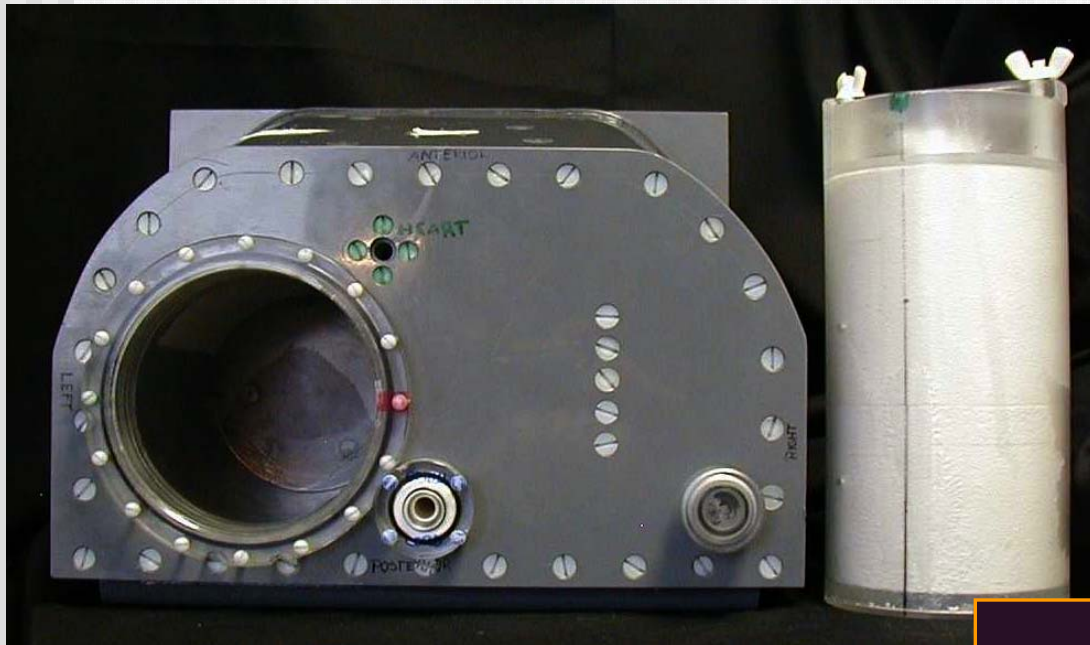


Irradiations with CyberKnife



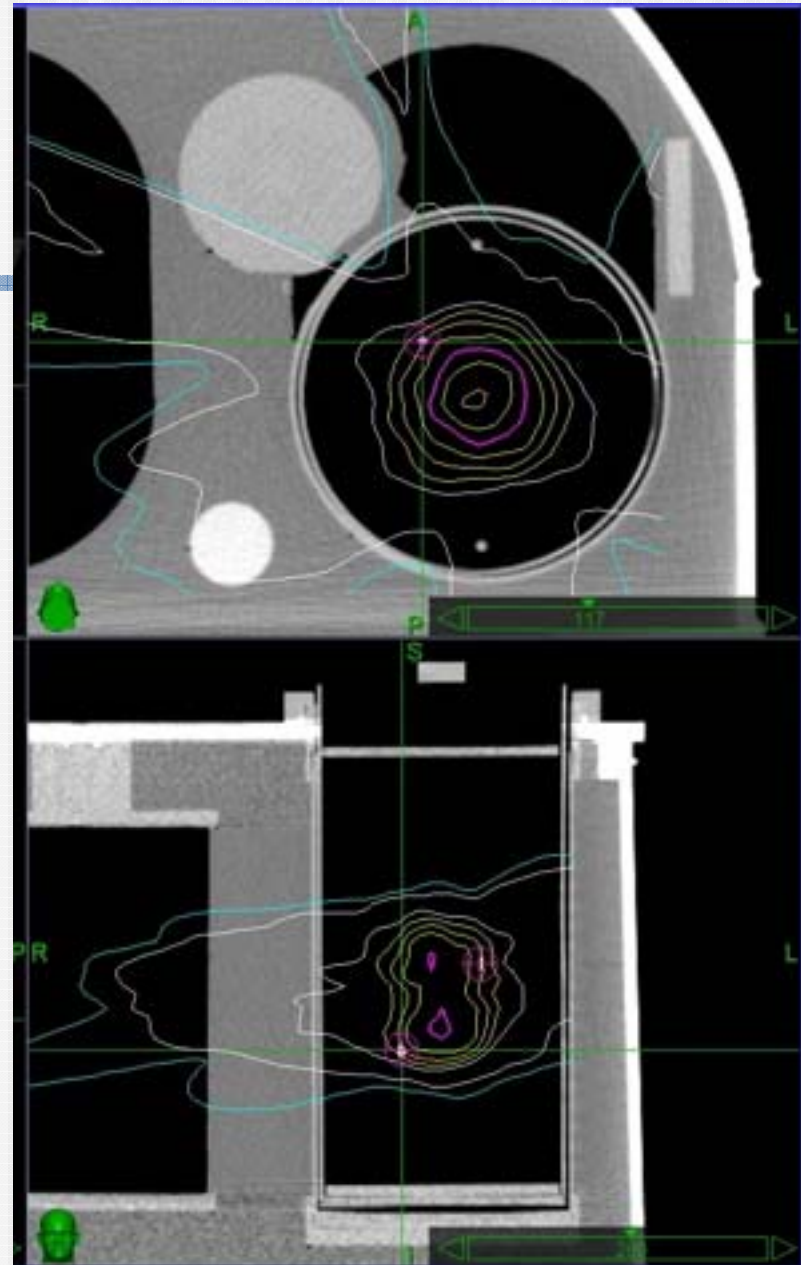
P. Nitsch, TH-D-Aud-5: 2:18 pm

RPC Lung Phantom



Modifications to Phantoms for IGRT

- Two phantoms modified to add fiducials, investigating methods to add anatomical structures for image guidance



Collimator Size Table

PTV

Size	TmP1	TmP2	TmP3
5.0	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
7.5	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
10.0	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
12.5	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
15.0	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
20.0	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
25.0	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
30.0	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
35.0	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
40.0	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
50.0	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
60.0	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

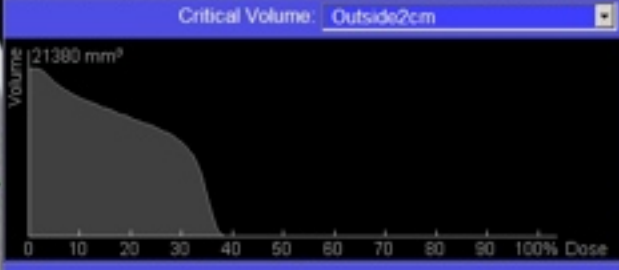
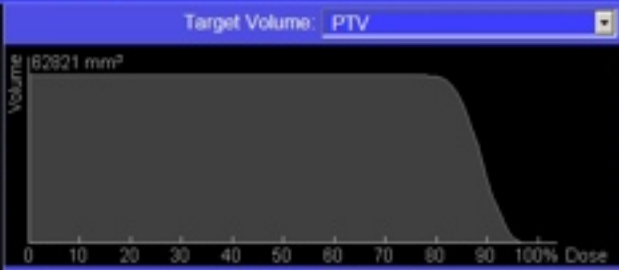
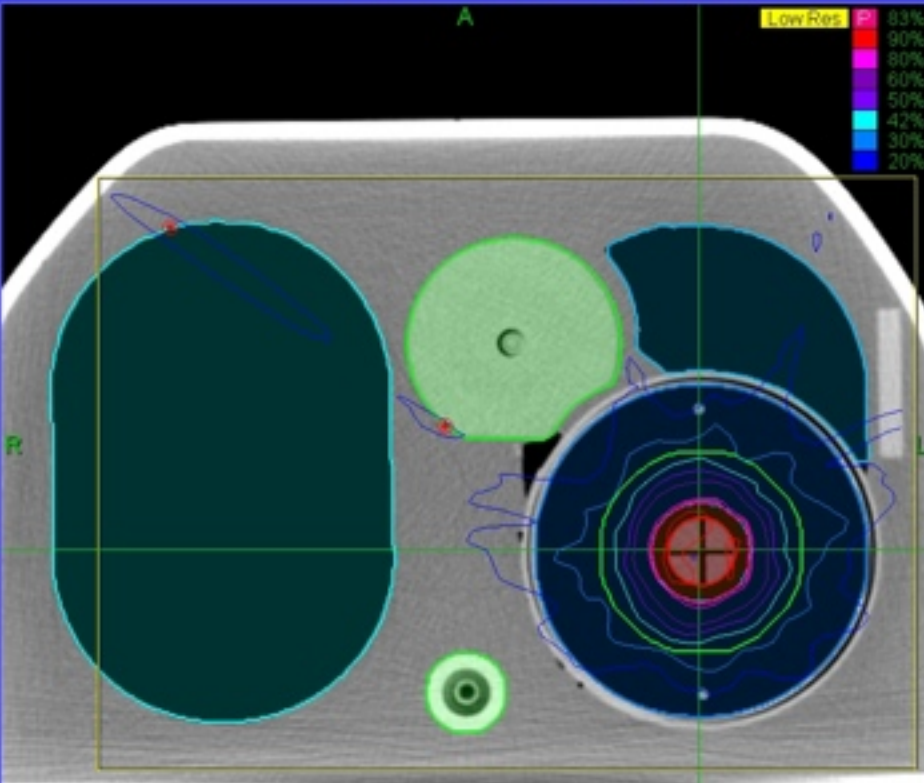
Min. MU
 Max. MU

Target Boundary Distance
 mm

Planning Algorithm

Max MU/Node
 Use High Resolution

Show Collimator overlay



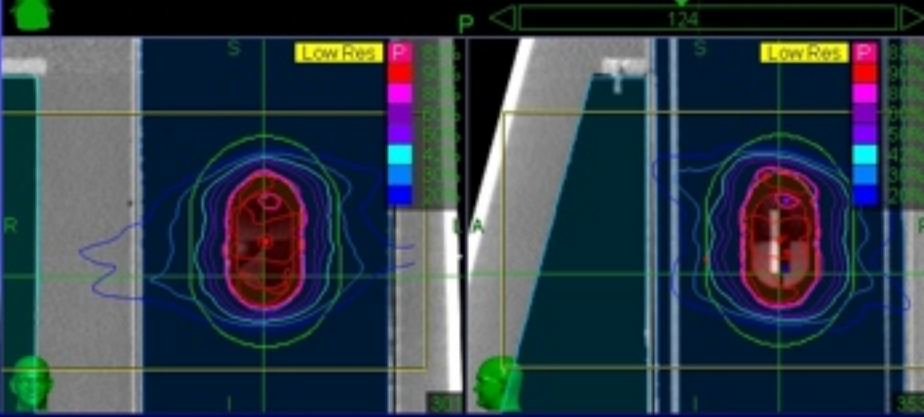
Nodes	60	Total MU	61808.46
Beams	182	Min. MU	76.65
Max. Dose(cGy)	7244.21	Max. MU	994.48

VOI	Min(cGy)	Min Weight	Max(cGy)	Max Weight
TumorSite	0.00	0	5000.00	0
PTV	6000.00	100	7200.00	99
BeamBloc1	n/a	n/a	5000.00	0
BeamBloc2	n/a	n/a	5000.00	0
SpinalCord	n/a	n/a	180.00	0
Outside2cm	n/a	n/a	2800.00	100
TLD1	0.00	0	5000.00	0
TLD2	0.00	0	5000.00	0
TLD3	0.00	0	5000.00	0
TLD4	0.00	0	5000.00	0
Heart	n/a	n/a	300.00	0
LungR	n/a	n/a	200.00	0
LungL1	n/a	n/a	200.00	0
LungL2	n/a	n/a	200.00	0

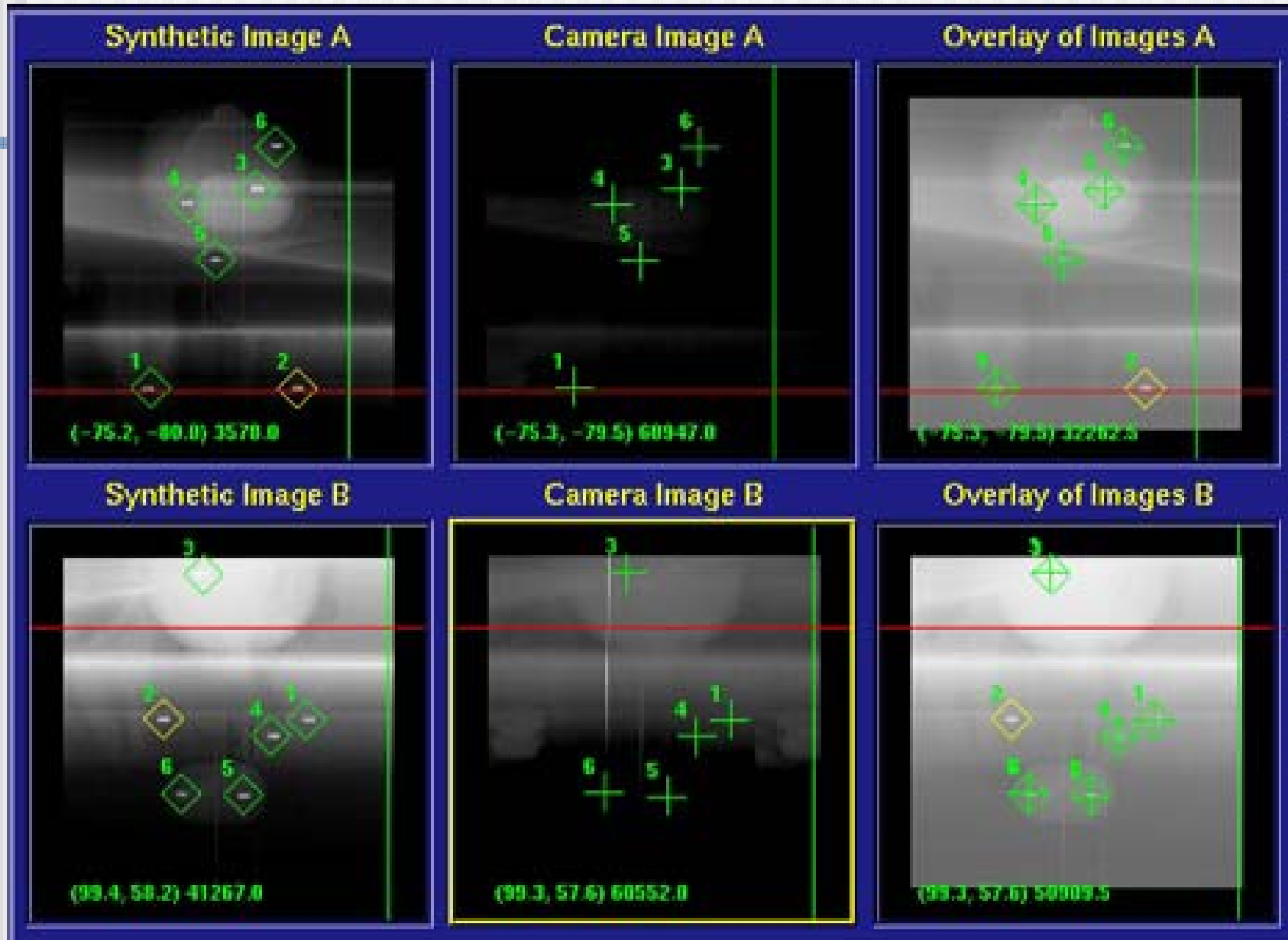
Patient
 rpc RPC_LUNG
 RPC_LUNG

Plan
 RPC_thorax_wk2
 2007-05-08 11:47:55

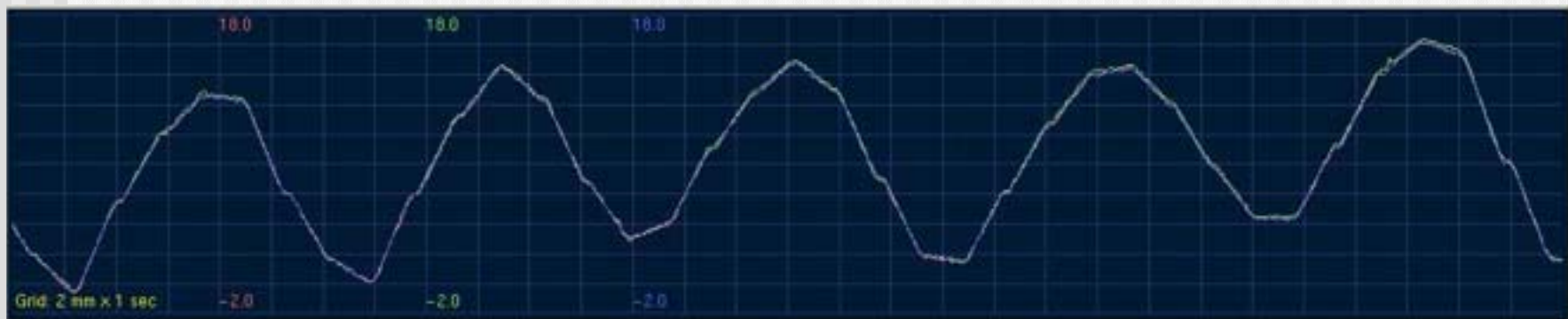
Rx
 83%, 6000.00 cGy



Phantom Alignment

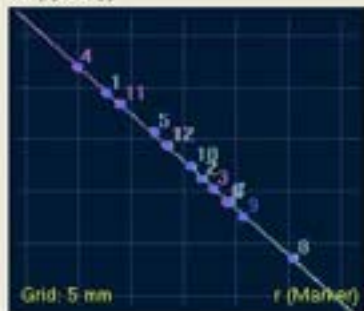


Model of Respiratory Motion

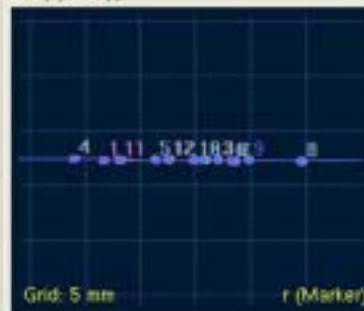


Correlation Graphs

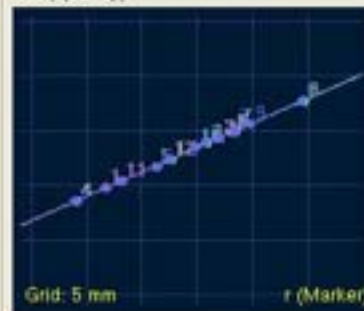
INF(+)/SUP(-)



LFT(+)/RGT(-)



ANT(+)/POST(-)



Summary Info

Average	INF/SUP	LFT/RGT	ANT/POST
Model Type :
Standard Error [mm] :	0.16	0.05	0.10
Correlation Error [mm] :	0.09	0.07	0.06
Coverage :	100%		

Evaluation of Synchrony

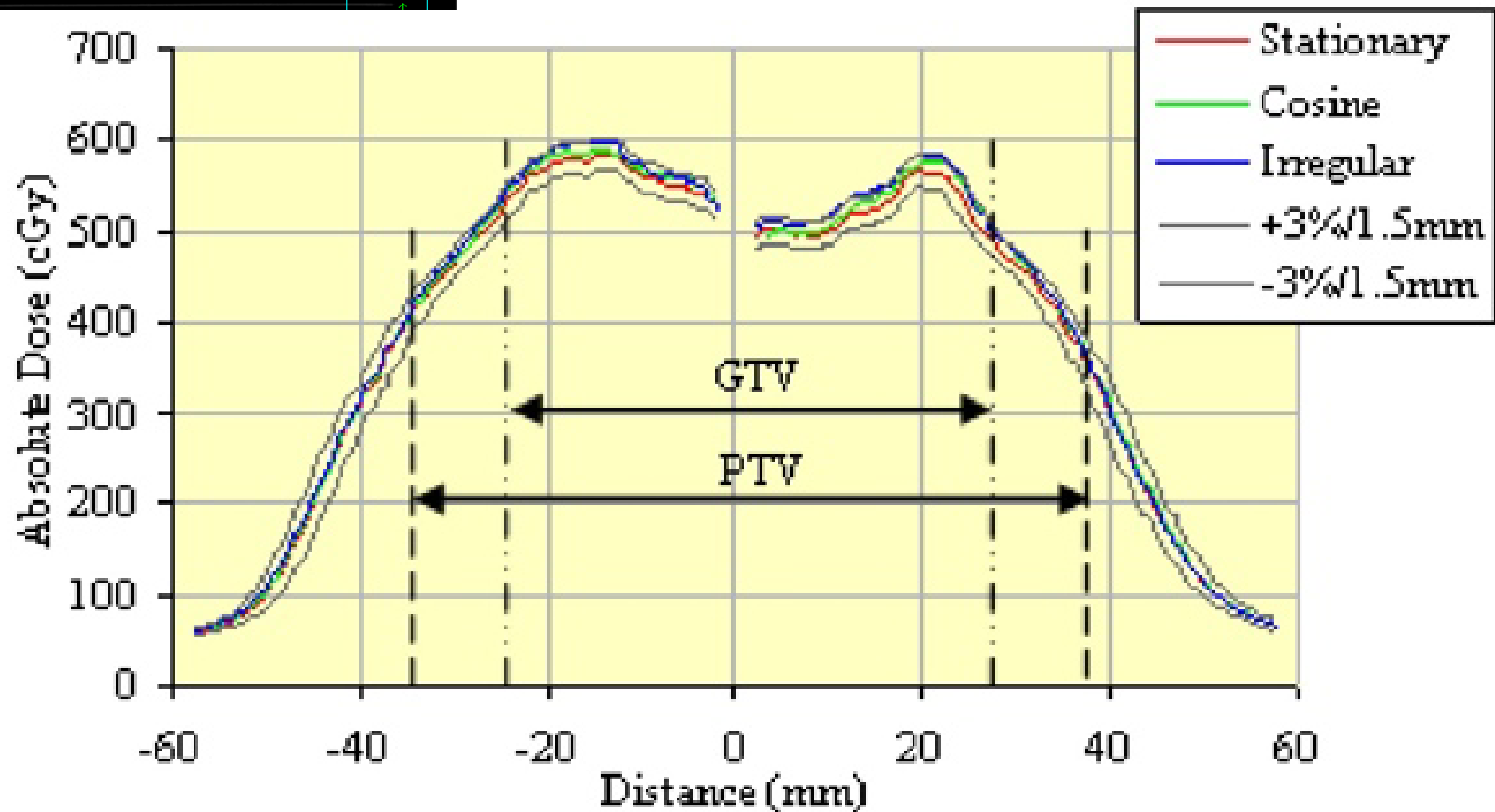
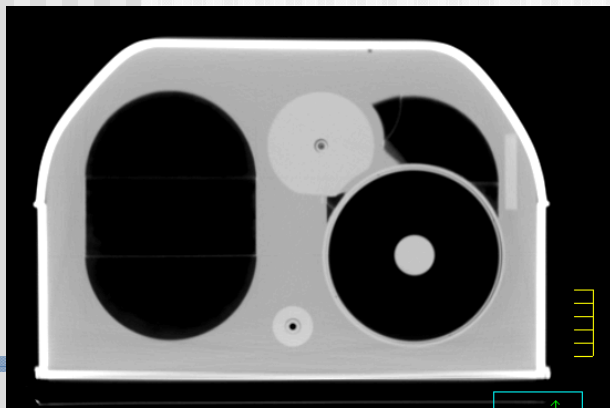


Figure 5. Superior-Inferior Dose Profiles

