
Evaluation of Lung Heterogeneity Corrections for Clinical Trials Using the RPC Lung Phantom

P. Alvarez

A.Molineu, N. Hernandez, F. Hall, D. Followill, G. Ibbott

UT. M.D. Anderson Cancer Center

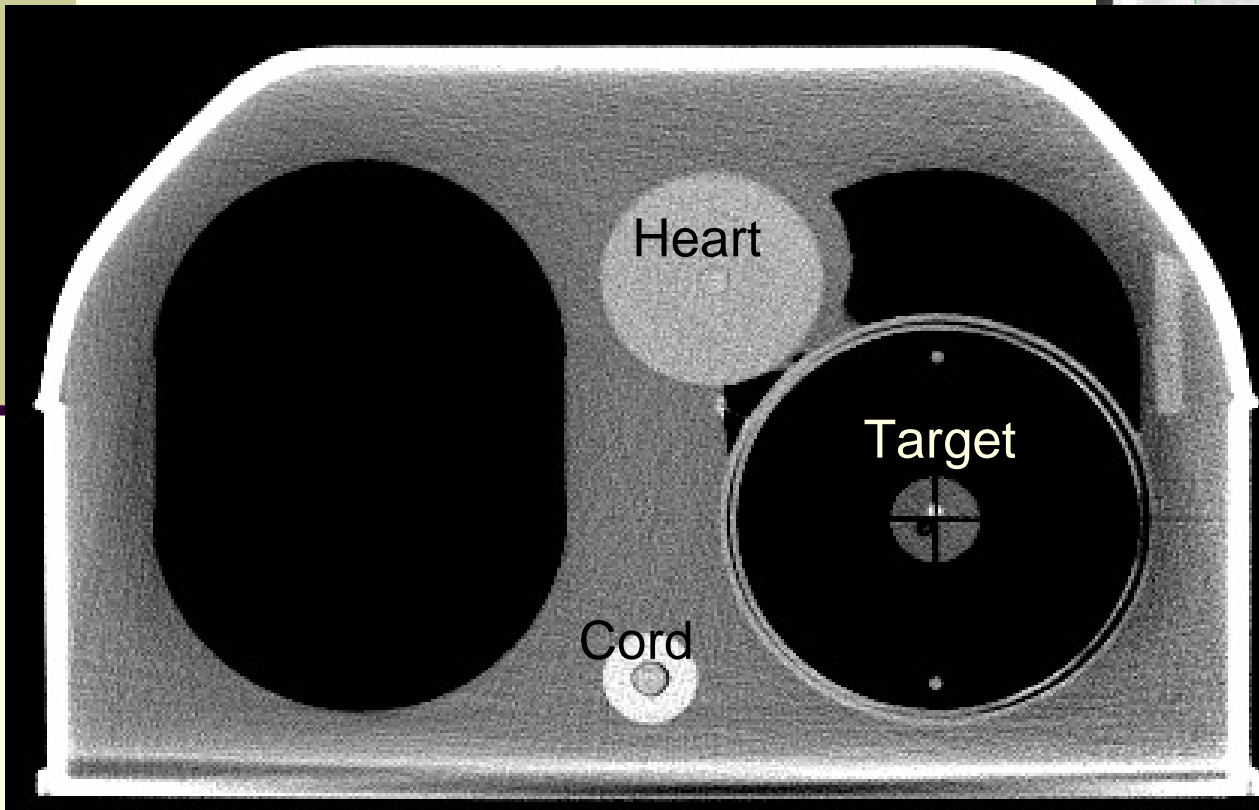
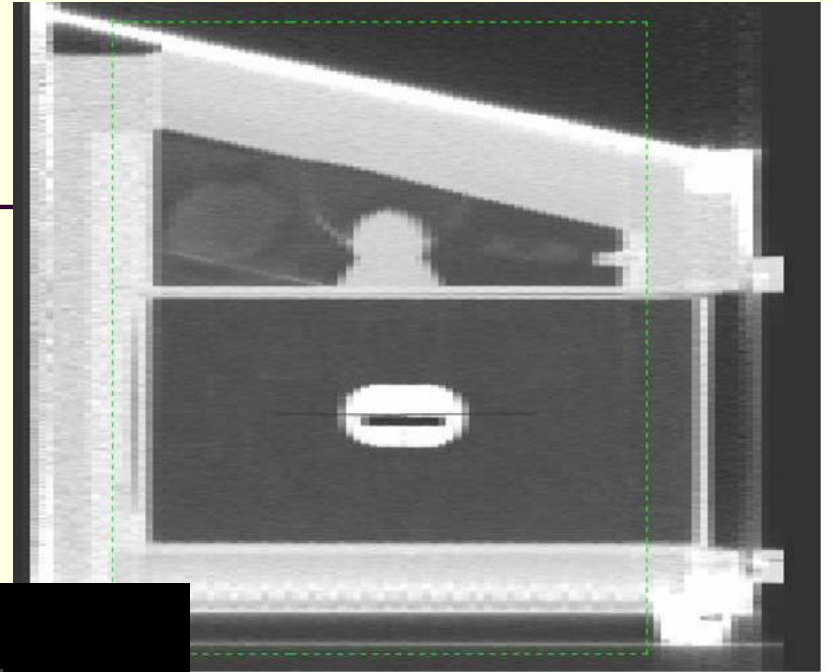
Houston - July 2008

RPC Lung Phantom

Target dimension

Ovoid shape

3 cm diameter / 5cm long



Densities

Lung = 0.33g/cm^3

Heart, cord = 1.1 g/cm^3

Cord = 1.31 g/cm^3

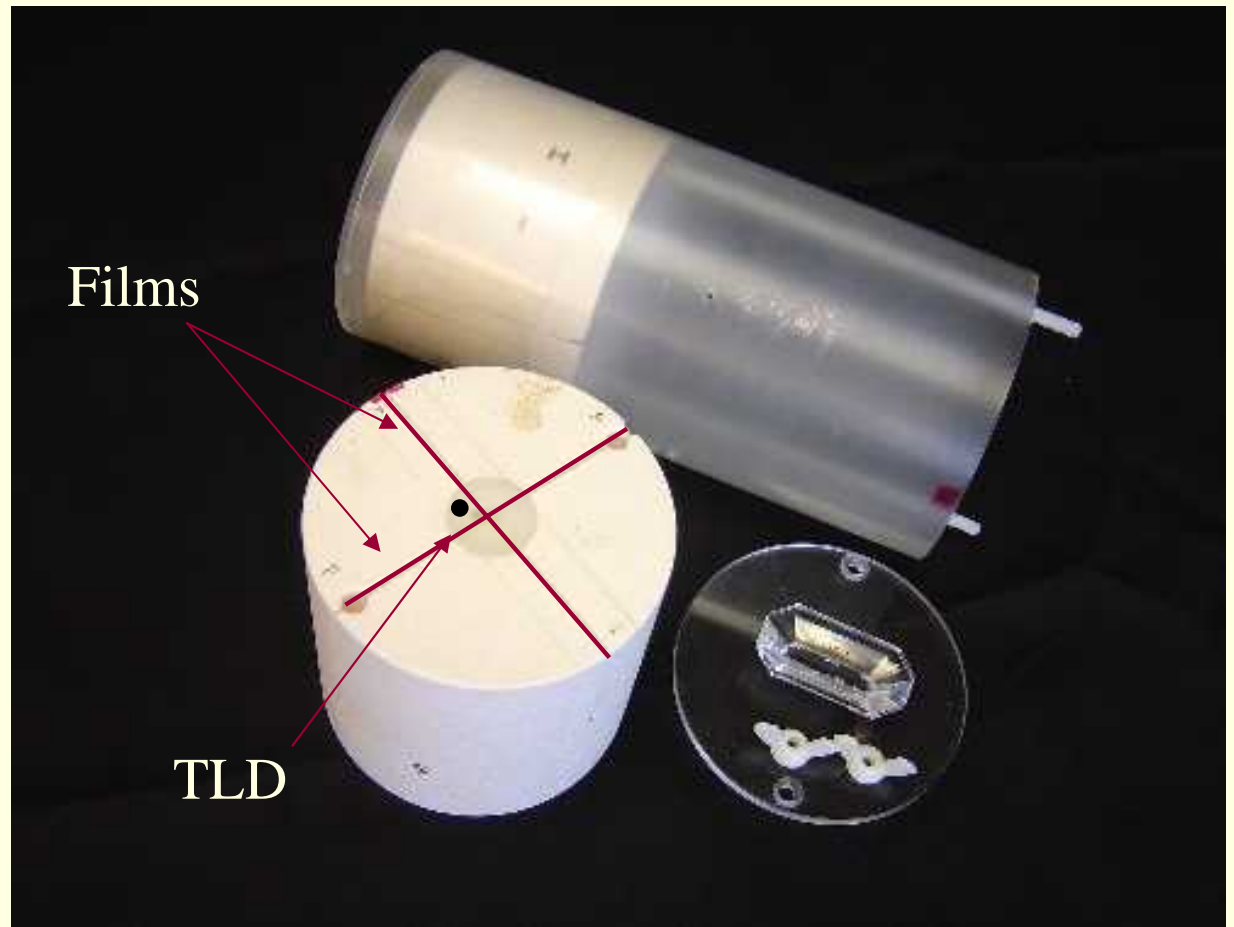
Tumor = 1.04 g/cm^3

RPC Phantom

Dosimeters

TLD

Gafchromic film



Disassembled Lung Insert

Phantom Process

- ✧ Phantom is imaged
- ✧ Treatment plan developed by institution per instructions
- ✧ Treatment is delivered to the phantom
- ✧ Phantom is returned to the RPC for data analysis
- ✧ Treatment plan is submitted electronically to the ITC for review by RPC staff

Criteria for Acceptability

✿ Dose criteria:

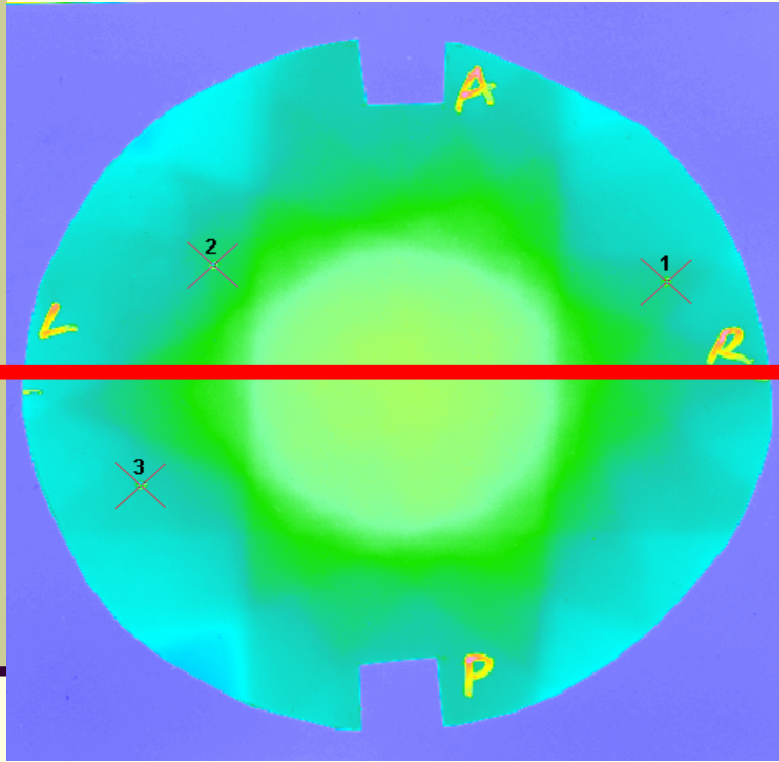
$D_{\text{TLD}}/D_{\text{Inst}}$ between 0.92 – 1.02

✿ 1D Profile analysis:

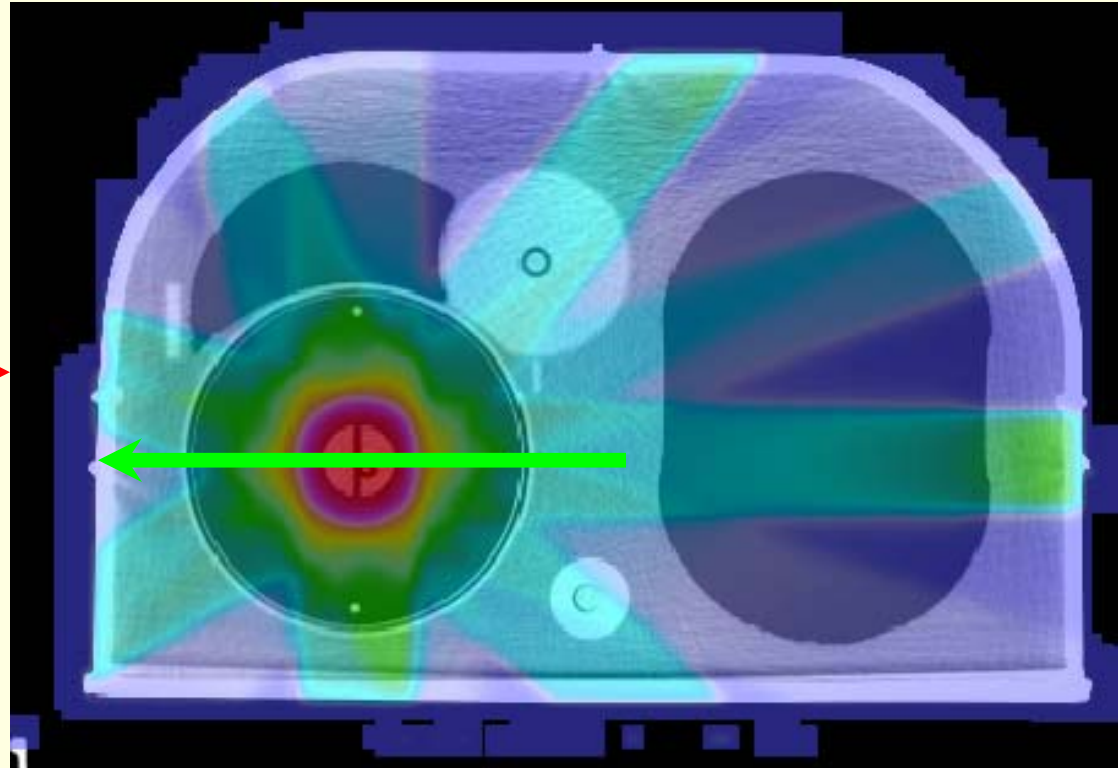
DTA \leq 5mm in high gradient region by the target

Criteria based on first group of institutions irradiating
the phantom

Profile Analysis

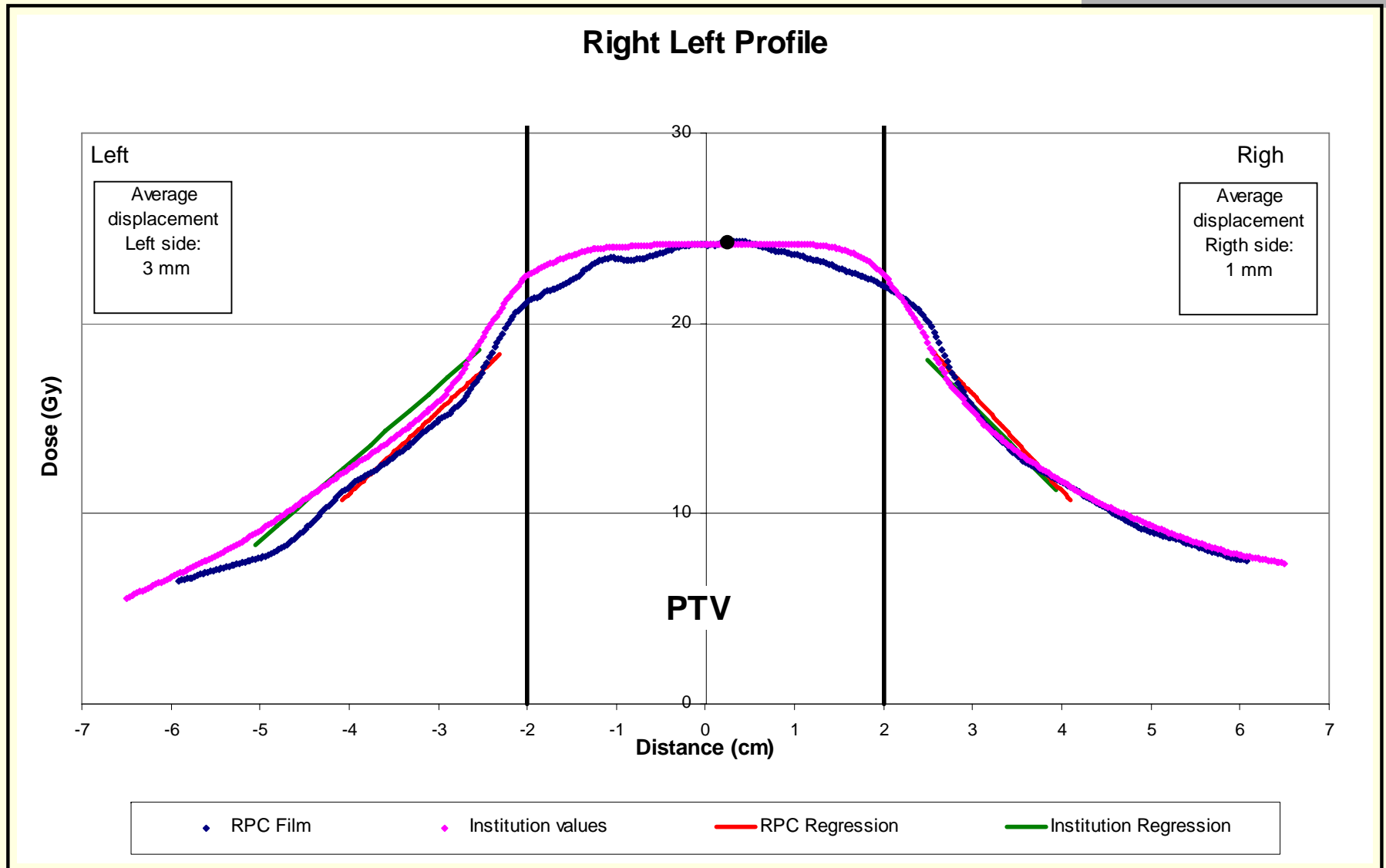


Film

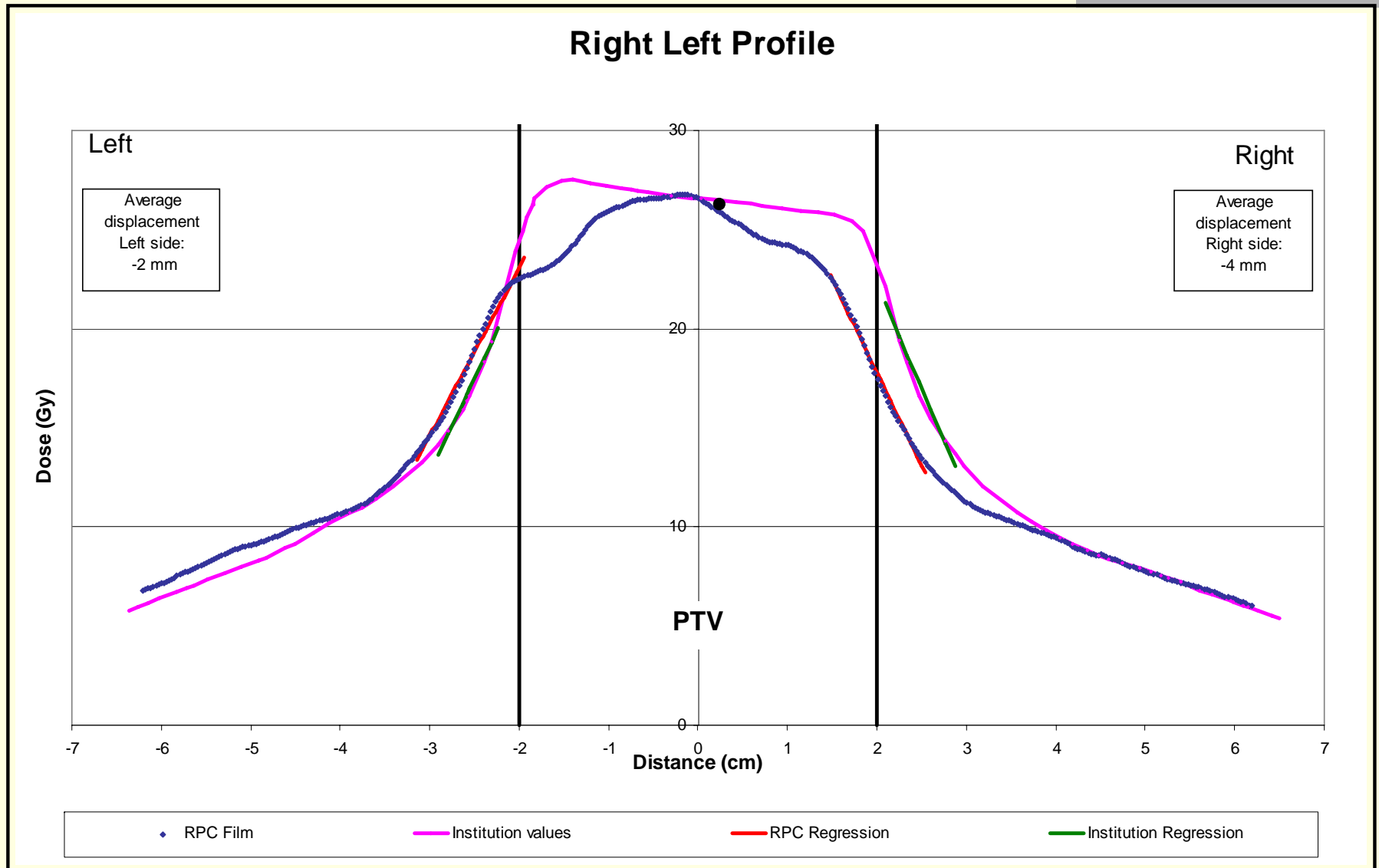


TPS data

Profile Analysis



Profile Analysis

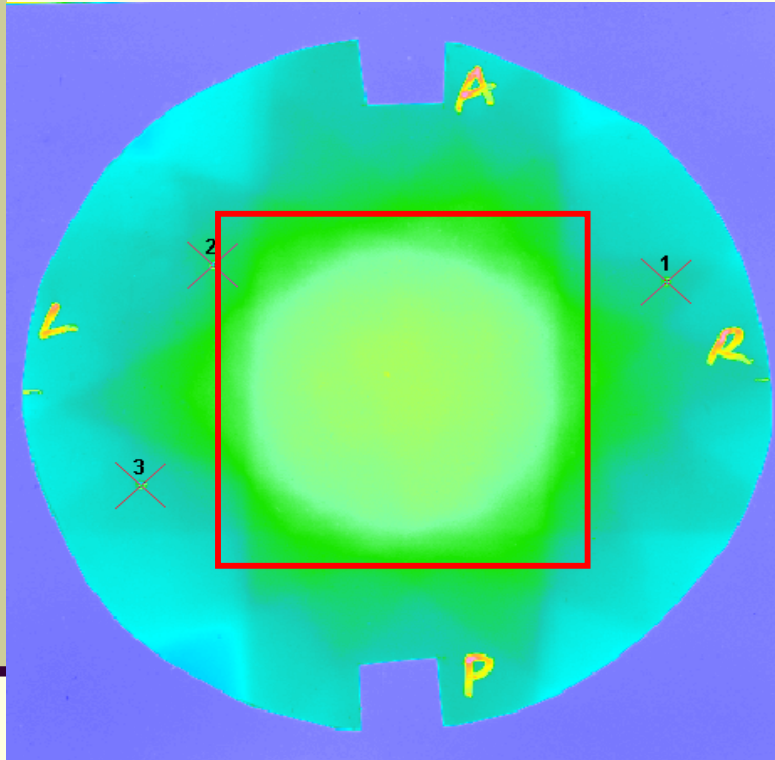


Acceptable by previous criteria

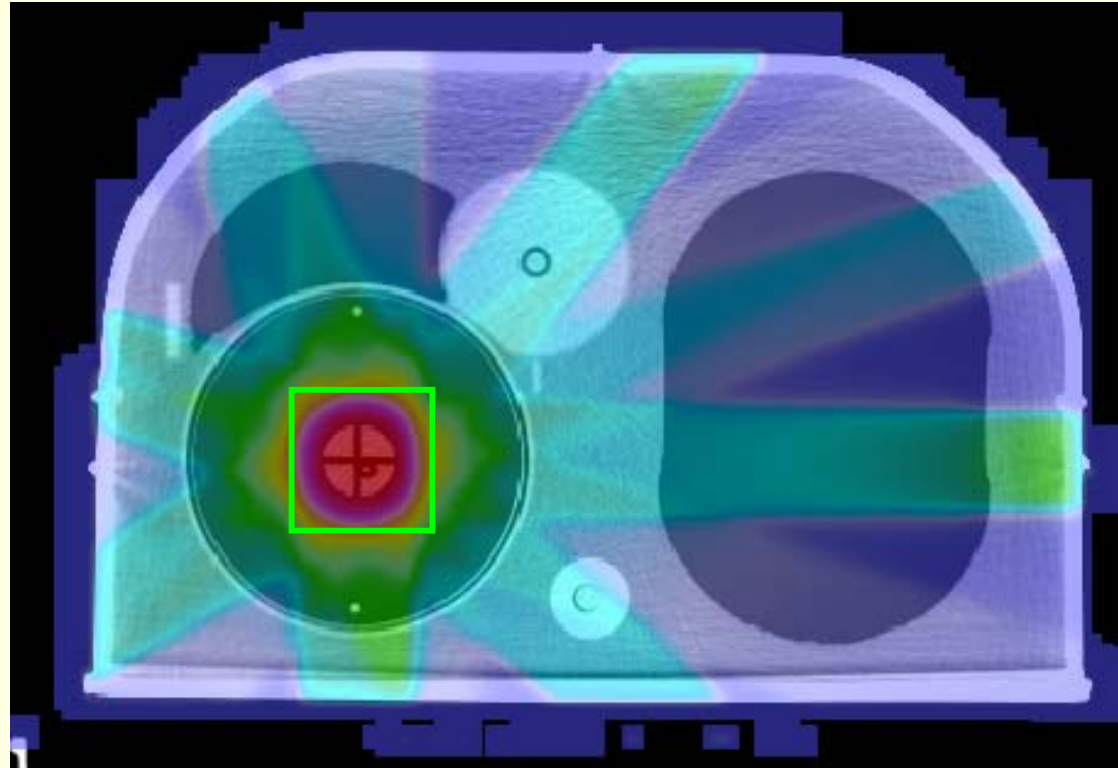
Phantom Results

- ✿ A total of 45 “approved” lung irradiations were reanalyzed
- ✿ The TPSs used to plan the 45 cases included:
 - BrainLab
 - Precise
 - Eclipse (AAA/PB)
 - Pinnacle (CC Convolution/Adaptive Convolve)
 - XiO (Superposition/Fast Superposition)
 - Hi-Art

2D Gamma Index Analysis

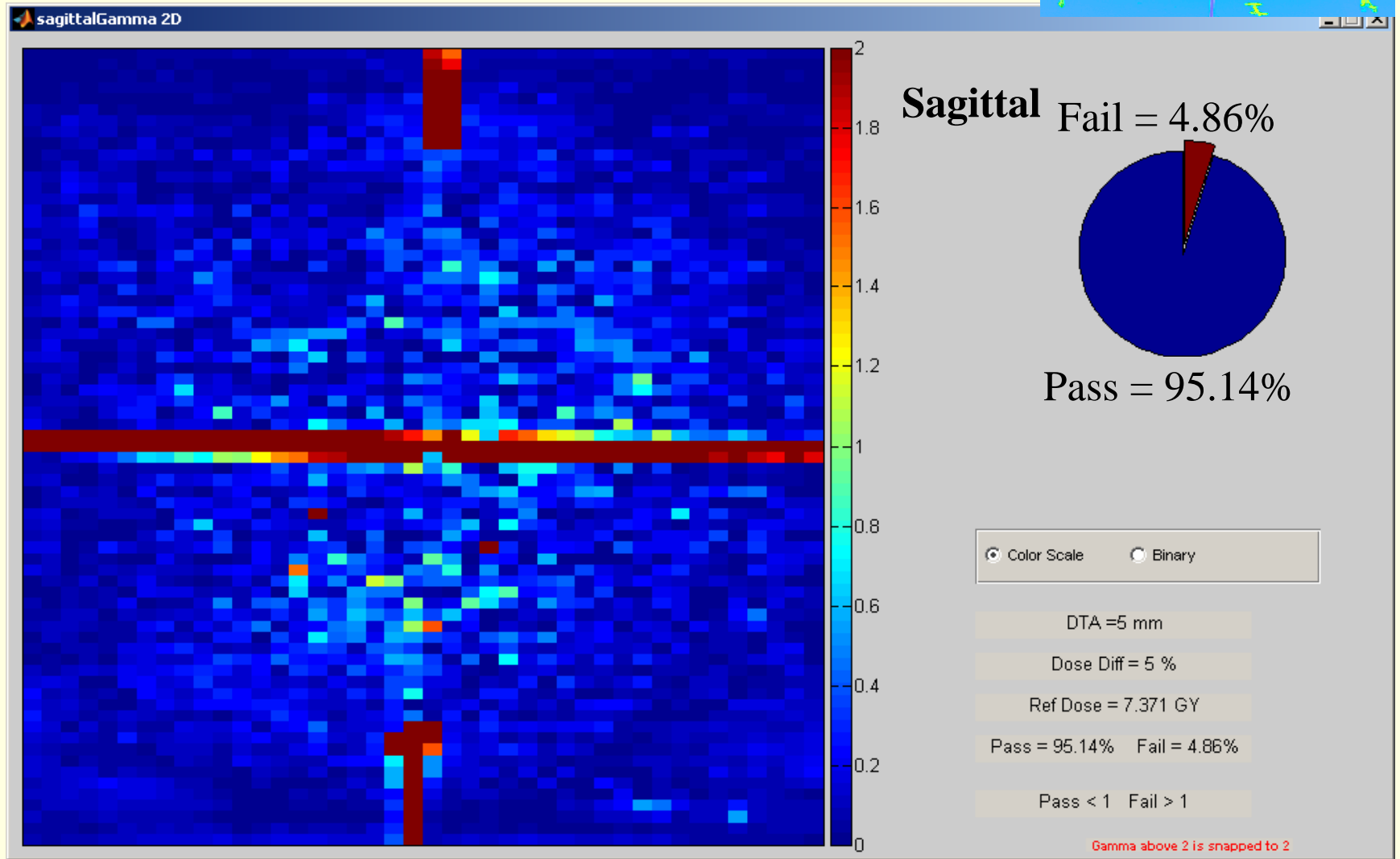
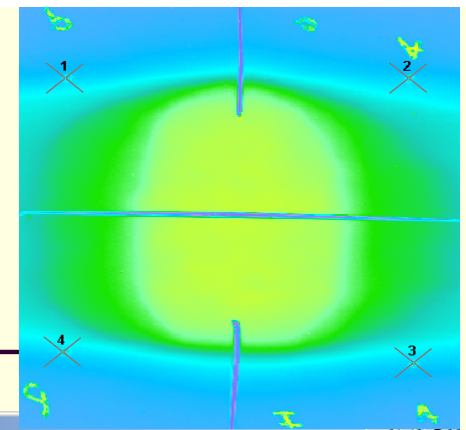


Film

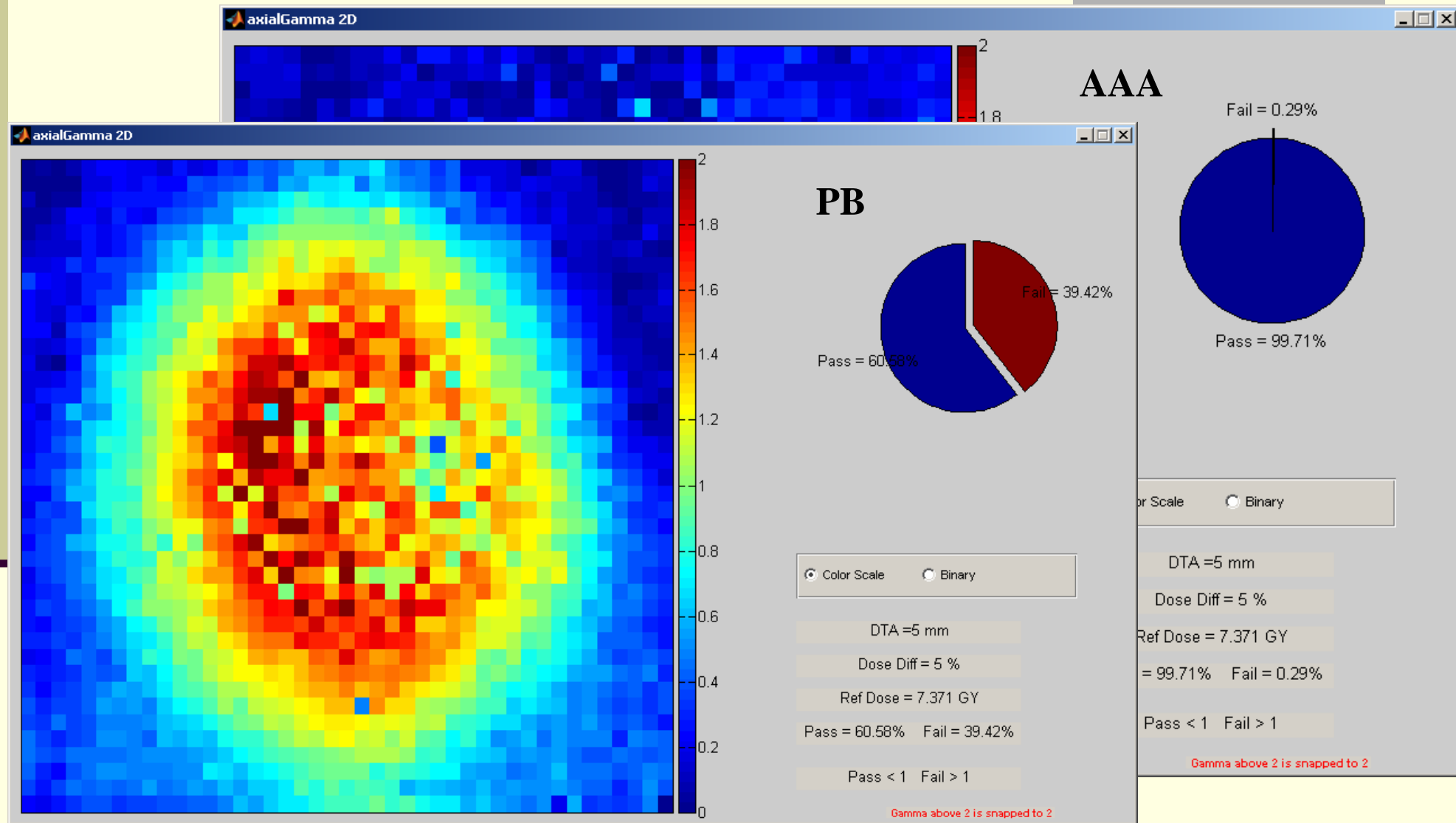


TPS data

2D Analysis Gamma Index



2D Analysis - Eclipse Case AAA vs. PB



Phantom Analysis

TPS	Dose Calc. Algorithm	# irradiation
BrainLab	Clarkson & Pencil beam	2
Precise	Scatter Int. Clarkson	2
Eclipse	Pencil Beam	11
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Eclipse	AAA	11
Pinnacle	Adaptive convolve / CC Convolution	14
XiO	Superposition/Fast Superposition	6
Hi-Art	Superposition Convolution	1

2D Analysis Results – Axial Plane

Dose Calc. Algorithm	# cases	<u>DTLD</u> D _{Inst}	% pixel passed 5%/5mm		
			Axial	Coronal	Sagittal
Clarkson-PB	15	0.96 ± 3%	84% ± 16%	73% ± 20%	67% ± 24%
SC-AAA	30	0.97 ± 3%	99% ± 4%	88% ± 6%	92% ± 7%

Conclusions

- ✿ The Convolution Superposition / AAA algorithm calculations show better agreement in dose distribution over the PTV compare to pencil beam or Clarkson cases.
- ✿ Next step is to extend the area of analysis to include area irradiated to 20% of prescribed dose or higher which will include more points within the lung itself.

Thank you