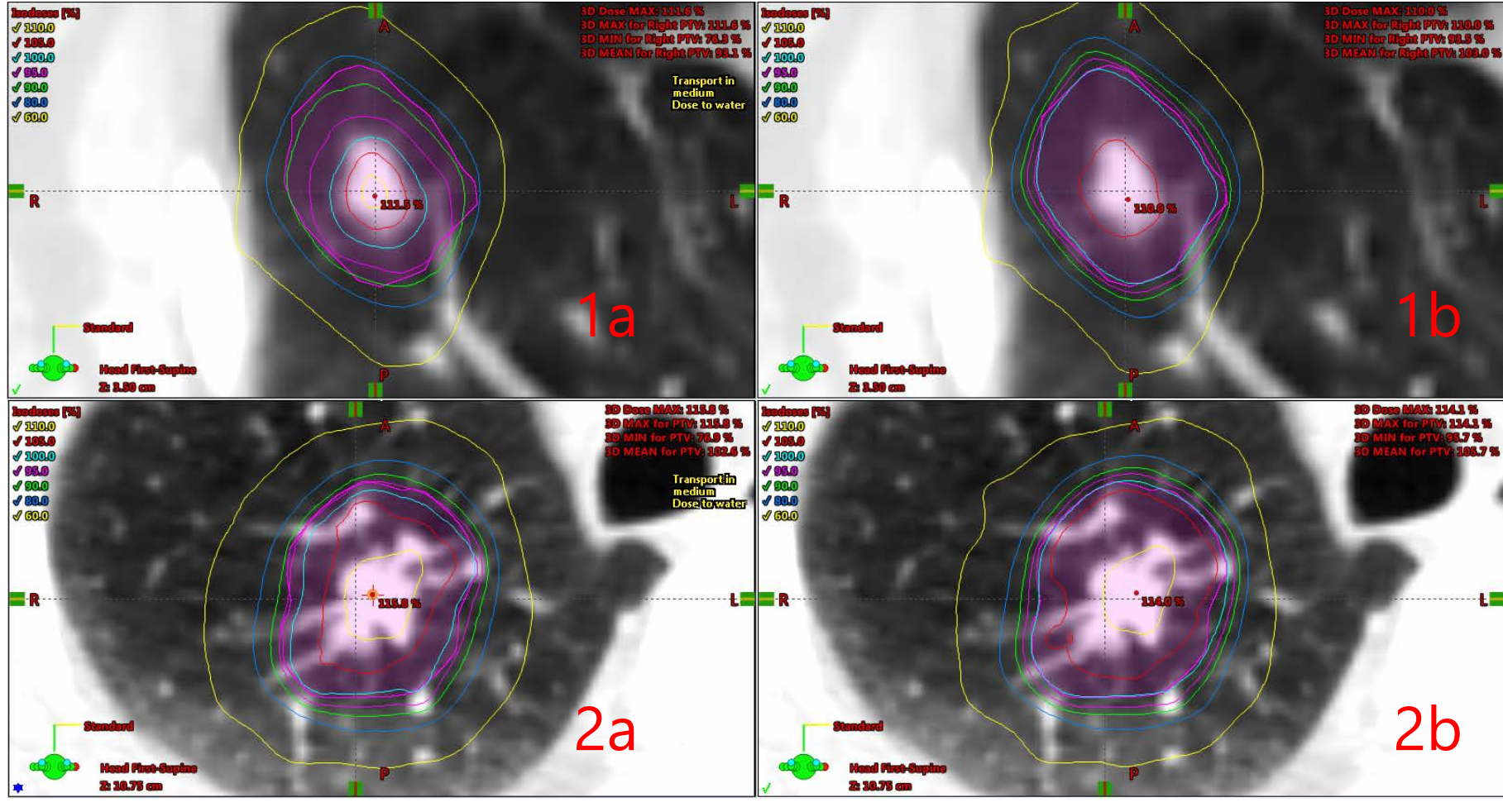


# Predicting Significant Acuros-AAA Coverage Differences for Lung SBRT Based on Treatment Volume Characteristics

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- Intro**
- AAA has been shown to overestimate dose to small lesions within lung tissue
  - AXB demonstrates greater accuracy but guidance for AXB dose evaluation is limited
  - Treatment planning with AXB can be challenging when significant differences between AAA and AXB are apparent

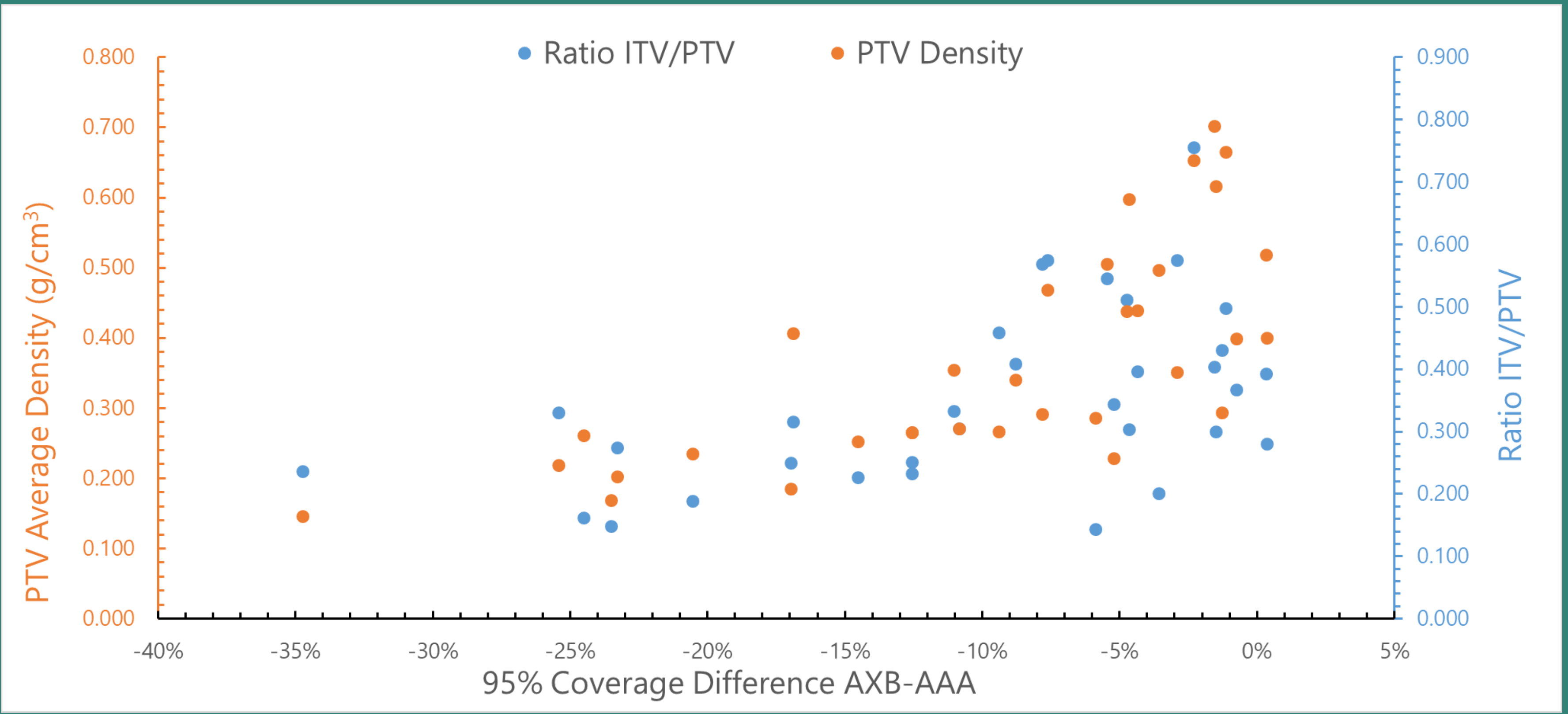


Top row: dose distributions for (1a) Acuros calculation and (1b) AAA calculation of patient exhibiting PTV mean density 0.208 g/cm<sup>3</sup> and ITV/PTV volume ratio 0.222. Bottom row: dose distributions for (2a) Acuros calculation and (2b) AAA calculation of patient exhibiting PTV mean density 0.383 g/cm<sup>3</sup> and ITV/PTV volume ratio 0.363.

- Methods**
- Retrospective study for 33 patients planned with AAA and recalculated with AXB with fixed MU
  - The dependence of D(95%) coverage difference on the following factors was evaluated for statistical significance:
    - Number of fractions
    - ITV volume
    - PTV volume
    - Ratio of ITV/PTV volumes
    - PTV mean density
    - Bilateral lung mean density
    - MU
    - MU/cGy

# A simple test based on treatment volume size and density can predict significant dose overestimation by AAA for stereotactic lung planning as compared with AcurosXB.

A combination of **ITV/PTV volume ratio <0.3** and **PTV mean density <0.31 g/cm<sup>3</sup>** shows statistically significant dose coverage differences between AAA and AXB.



Coverage difference for AXB-AAA as a function of PTV mean density and ITV/PTV ratio

- Results**
- Average AAA-AXB D(95%) coverage difference was 9.9% ± 9.0%
  - 13/33 cases showed >10% coverage difference
  - Statistical significance found for: ITV/PTV ratio (p=0.0027), PTV mean density (p<0.0001), and bilateral lung mean density (P=0.0033)
  - 11/13 cases with >10% coverage difference had both ITV/PTV ratio <0.3 and PTV mean density <0.31 g/cm<sup>3</sup>

Patient	ITV (cm <sup>3</sup> )	PTV (cm <sup>3</sup> )	Ratio ITV/PTV	PTV Density	D(95%) Difference AXB-AAA	ITV/PTV <0.3	PTV Density <0.31	Both?
1	2.5	11.9	0.210	0.164	-34.75%	x		x
2	5.2	17.7	0.294	0.246	-25.42%	x	x	x
3	0.84	5.84	0.144	0.294	-24.50%	x	x	x
4	0.68	5.15	0.132	0.190	-23.51%	x	x	x
5	3.91	16	0.244	0.228	-23.28%	x	x	x
6	1.1	6.56	0.168	0.264	-20.56%	x	x	x
7	2.95	13.3	0.222	0.208	-16.97%	x	x	x
8	2.43	8.65	0.281	0.458	-16.88%	x		
9	1.94	9.61	0.202	0.284	-14.54%	x	x	x
10	2.03	9.08	0.224	0.299	-12.57%	x	x	x
11	1.99	9.61	0.207	0.299	-12.56%	x	x	x
12	6.27	21.2	0.296	0.399	-11.03%	x		
13	6.66	24.6	0.271	0.305	-10.85%	x	x	x
14	15.5	38	0.408	0.301	-9.40%		x	
15	9.62	26.5	0.363	0.383	-8.80%			
16	26.6	52.6	0.506	0.328	-7.81%			
17	26.1	51.1	0.511	0.527	-7.64%			
18	1.16	9.07	0.128	0.322	-5.89%	x		
19	34.8	71.7	0.485	0.569	-5.46%			
20	5.35	17.5	0.306	0.257	-5.23%		x	
21	20.2	44.4	0.455	0.493	-4.75%			
22	4.73	17.5	0.270	0.672	-4.66%	x		
23	8.93	25.3	0.353	0.495	-4.35%			
24	1.29	7.21	0.179	0.560	-3.57%	x		
25	23.5	46	0.511	0.396	-2.92%			
26	137	204	0.672	0.734	-2.31%			
27	5.64	15.7	0.359	0.789	-1.57%			
28	4.27	16	0.267	0.693	-1.50%	x		
29	8.62	22.5	0.383	0.330	-1.27%			
30	23.4	52.9	0.442	0.748	-1.14%			
31	7.34	22.5	0.326	0.449	-0.74%			
32	15.1	43.3	0.349	0.583	0.34%			
33	3.81	15.3	0.249	0.450	0.35%	x		

Sensitivity of a combined ITV/PTV ratio (<0.3) and PTV mean density (<0.31 g/cc) test criteria in determining AAA dose overestimation compared to AXB dose calculation

**A combined criteria to evaluate SBRT treatment volumes can predict AAA dose overestimation.** This evaluation can be performed immediately following physician contouring of treatment volumes to help guide treatment planning.



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