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NRG Lung Proton SBRT & Hypofractionation Survey

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02-24-2022

Response Ratio: 19/30

- About 63%
- 9/19 centers treat SBRT and/or Hypofraction
- 1 center is going to implement (Beaumont)
- 1 center provided some info even though not treating SBRT or Hypofraction (Provision)
- 7/19 have IROC lung credentialing
- 11 centers don’ t respond

Institute	Response	Treat or Not	Institute2	Reponse
MCA	Y	Y	UFPTI	N
UHC	Y	N	OKC	N
Emory	Y	Y	Northwestern	N
Inova Schar	Y	N	LLUMC	N
John Hopkins	Y	N	Hampton	N
MCR	Y	Y	CA Protons	N
MDA	Y	N	RWJ	N
MGH	Y	N	TX CPT	N
Procure NJ	Y	N	UF Orlando	N
UOHSC	Y	Y	CASE	N
UPenn	Y	N	Miami Cancer Inst	N
Provision	Y	Y		
Willis Knighton	Y	Y		
Beaumont	Y	N		
Cinncinatti	Y	N		
NYPC	Y	Y		
SCCA	Y	N		
Maryland	Y	Y		
Wash Univ	Y	Y		

Proton SBRT/Hypo		
YES	9	47%
NO	10	53%
Total	**19**	

IROC lung		
YES	7	37%
NO	12	63%
Total	**19**	

Survey Question Summary

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- In total 83 survey questions, divided into 7 groups
  - **Vendors, Delivery Techniques, and TPS (1-4)**
  - **Patient Selection (5-19)**
  - **Simulation and Motion Management (20-26)**
  - **Treatment Planning and QA (27-63)**
  - **Motion and IGRT (64-79)**
  - **Follow Up (80-81)**
  - **General (82-83)**

Only survey questions with the most volatile answers will be discussed here.

Vendors, Delivery Techniques, and TPSs: 19 effective surveys

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Vendors	Count #	%
IBA	8	40%
Mevion	3	15%
Varian	4	20%
Hitach	4	20%
Protom	1	5%
Total	**20**	

Techniques	Count #	%
PBS	16	80%
Passive Scatter	2	10%
Uniform scanning(SCCA)	1	5%
hyperscan	1	5%
Total	**20**	

TPS	Count #	%
Raystation	11	58%
Eclipse	6	32%
Pinnacle	1	5%
Astroid	1	5%
Total	**19**	

- MGH has two vendors (IBA and Protom)
- MDA has two delivery techniques (PBS and Passive Scattering)

Discussion Point: Sim and Motion management

Survey Question	Response	# Responses	% Responses
What CT scan slice thickness is typically used?	1.0 mm	1	10%
	1.5 mm	1	10%
	2.0 mm	5	50%
	2.5 mm	2	20%
	3.0 mm	1	10%

Discussion Point: Sim and Motion management

Survey Question	Response	# Responses	% Responses
What motion management methods are used?	4DCT	6	60%
	Breath Hold	5	50%
	Compression	5	50%
	Rescanning	5	50%
	Gating	3	30%
	Large Spots	1	10%
	Increased Min MU	1	10%

Discussion Point: Planning and QA

Survey Question	Response	# Responses	% Responses
How many beams are typically used?	2-3 beams	3	30%
	2-4 beams	1	10%
	3 beams	1	10%
	3-4 beams	3	30%
	4-5 beams	1	10%
	No answer	1	10%

Discussion Point: Planning and QA

Survey Question	Response	# Responses	% Responses
What is the dose volume criteria for target evaluation for robustness evaluation?	D95≥95%Rx	6	60%
	D98≥95%Rx	1	10%
	V100≥95%	1	10%
	D95 changes less 3%	1	10%
	No answer	1	10%

Discussion Point: Motion Management and IGRT

Survey Question	Response	# Responses	% Responses
What equipment is used for DIBH?	ABC	1	10%
	No answer	3	30%
	RPM	2	20%
	SDX	4	40%

Discussion Point: Motion Management and IGRT

Survey Question	Response	# Responses	% Responses
If rescanning is used, it is in-layer or volumetric?	Both	1	10%
	In-layer	3	30%
	No answer	2	20%
	Volumetric	4	40%

Discussion Point: Motion Management and IGRT

Survey Question	Response	# Responses	% Responses
What types of IGRT are used?	CBCT	1	10%
	CT on-rails	2	20%
	Orthog kV	4	40%
	Orthog kV & CBCT	4	40%
	Other, please comment	1	10%

Discussion Point: General

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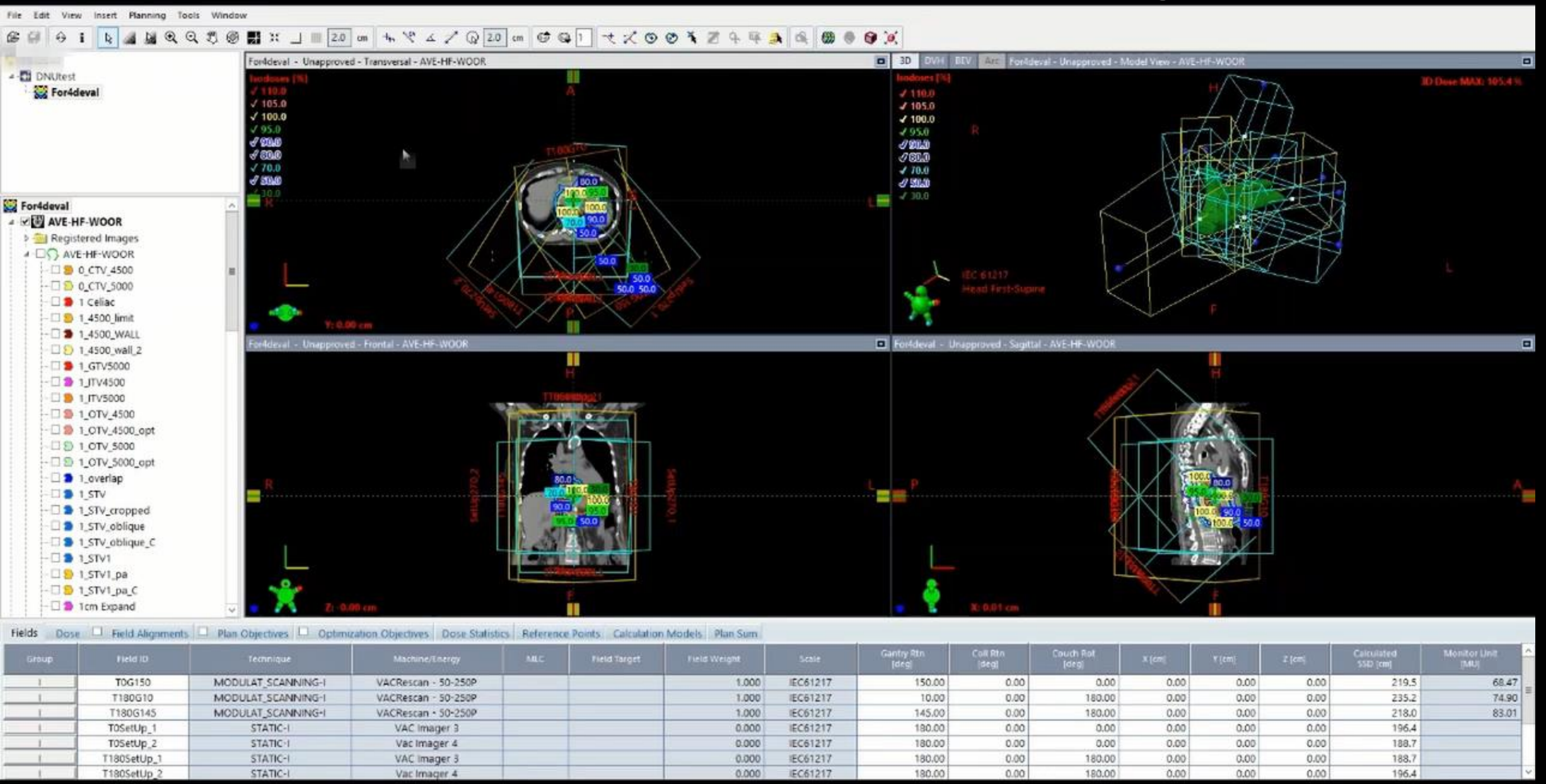
Survey Question	Response	# Responses	% Responses
What motion management methods are used?	Volumetric IGRT	10	59%
	motion management	7	41%
	robust optimization	5	29%
	CBCT	2	12%
	fast treatment	7	41%
	online adaptive planning	5	29%
	Automated repainting	2	12%
	Incorporation of Monte Carlo in planning	3	18%
	aperture-based PBS	1	6%
	improved gating/breath hold integration	5	29%
	real-time tumor (or surface surrogate) tracking	2	12%
	proton arc	1	6%
	RBE based planning	1	6%

Motion Management in Mayo Clinic Arizona

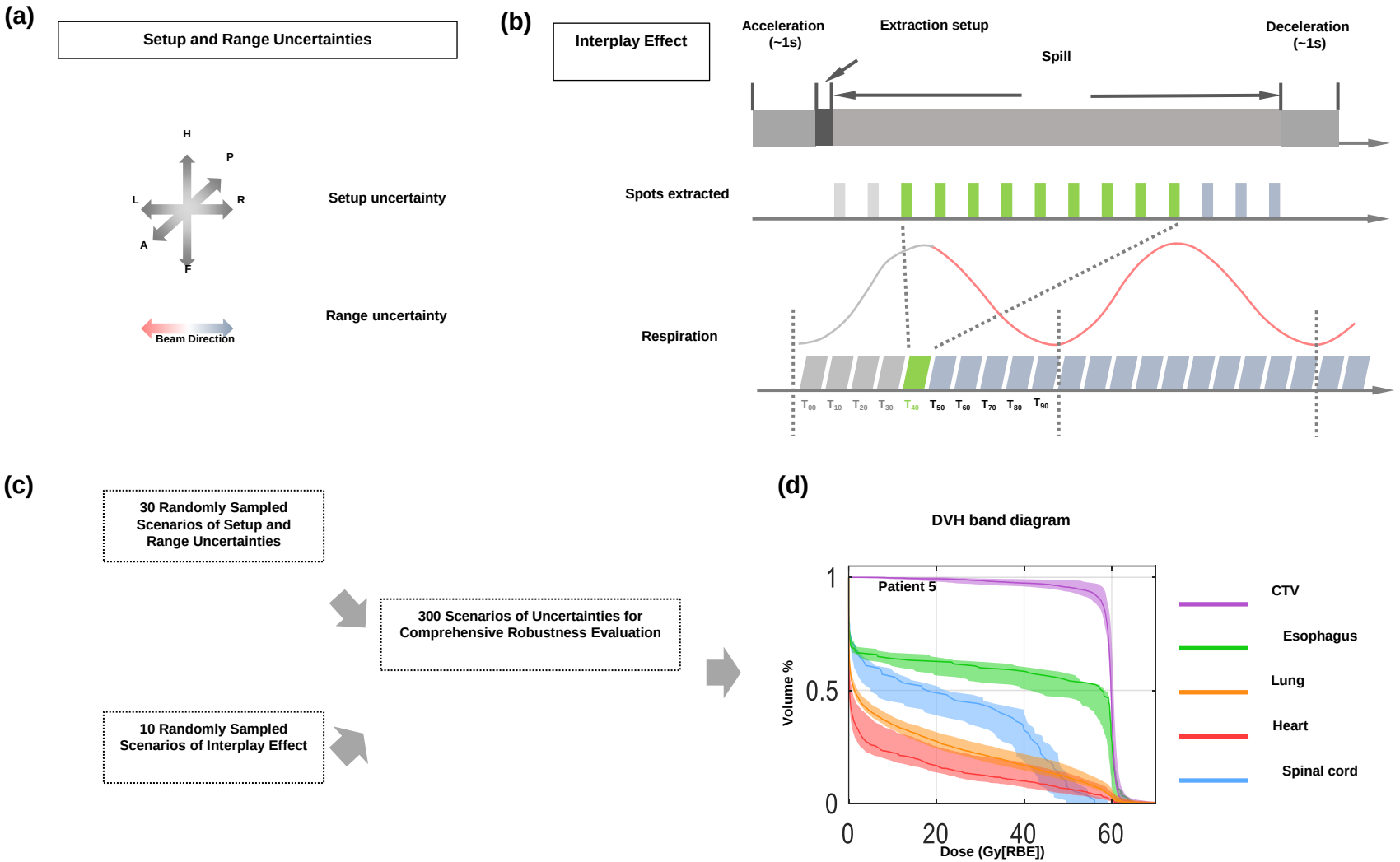
- If the respiratory motion amplitude is larger than 10 mm, some kind of motion management is needed:
  - DIBH (fiducial and fluoro to get the right breath hold)
  - Gating
- If the respiratory motion amplitude is between 5 mm and 10 mm, rescanning machine will be used (max MU limit = 0.01 MU).
- Evaluation of Interplay effects if the respiratory motion amplitude is larger than 5 mm.

Demo: Increase the number of repainting



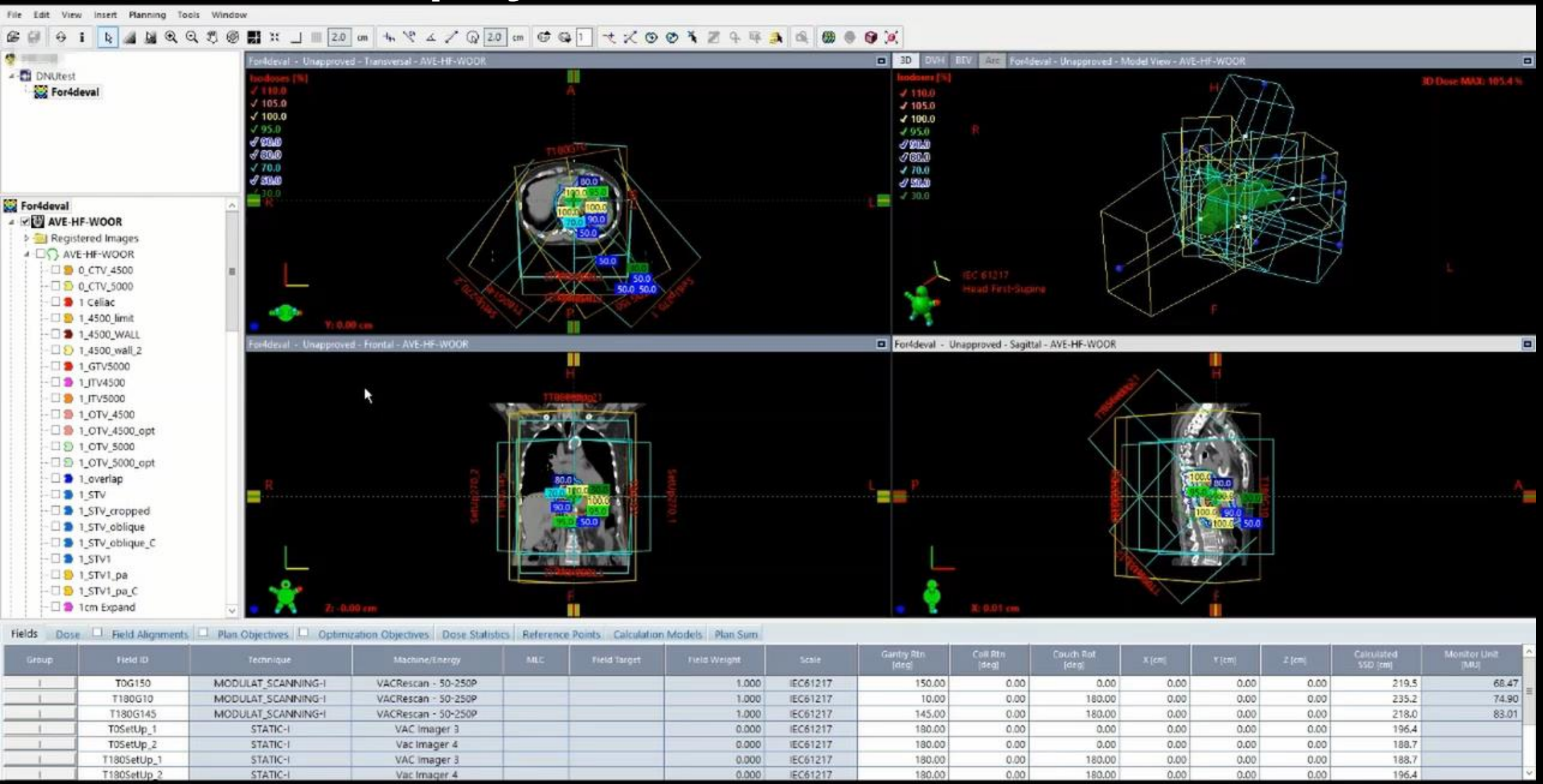
Group	Field ID	Technique	Machine/Energy	MLC	Field Target	Field Weight	Scale	Gantry Rtn [deg]	Coll Rtn [deg]	Couch Rot [deg]	X [cm]	Y [cm]	Z [cm]	Calculated SSD [cm]	Monitor Unit [MU]
1	T0G150	MODULAT_SCANNING-I	VACRescan - 50-250P			1.000	IEC61217	150.00	0.00	0.00	0.00	0.00	0.00	219.5	68.47
1	T180G10	MODULAT_SCANNING-I	VACRescan - 50-250P			1.000	IEC61217	10.00	0.00	180.00	0.00	0.00	0.00	235.2	74.90
1	T180G145	MODULAT_SCANNING-I	VACRescan - 50-250P			1.000	IEC61217	145.00	0.00	180.00	0.00	0.00	0.00	218.0	83.01
1	T0SetUp_1	STATIC-I	VAC Imager 3			0.000	IEC61217	180.00	0.00	0.00	0.00	0.00	0.00	196.4	
1	T0SetUp_2	STATIC-I	Vac Imager 4			0.000	IEC61217	180.00	0.00	0.00	0.00	0.00	0.00	188.7	
1	T180SetUp_1	STATIC-I	VAC Imager 3			0.000	IEC61217	180.00	0.00	180.00	0.00	0.00	0.00	188.7	
1	T180SetUp_2	STATIC-I	Vac Imager 4			0.000	IEC61217	180.00	0.00	180.00	0.00	0.00	0.00	196.4	

Interplay Effects Evaluation



*Shan J, *Yang Y, Schild SE, Daniels TB, Wong WW, Fatyga M, Bues M, Sio TT, Liu W, Intensity-modulated proton therapy (IMPT) interplay effect evaluation of asymmetric breathing with simultaneous uncertainty considerations in patients with non-small-cell lung cancer, Med Phys. 2020 Sep 22;. doi: 10.1002/mp.14491. (Cover Letter Article of Medical Physics)

Demo: interplay eval



Group	Field ID	Technique	Machine/Energy	MLC	Field Target	Field Weight	Scale	Gantry Rtn [deg]	Coll Rtn [deg]	Couch Rot [deg]	X [cm]	Y [cm]	Z [cm]	Calculated SSD [cm]	Monitor Unit [MU]
1	T0G150	MODULAT_SCANNING-I	VACRescan - 50-250P			1.000	IEC61217	150.00	0.00	0.00	0.00	0.00	0.00	219.5	68.47
1	T180G10	MODULAT_SCANNING-I	VACRescan - 50-250P			1.000	IEC61217	10.00	0.00	180.00	0.00	0.00	0.00	235.2	74.90
1	T180G145	MODULAT_SCANNING-I	VACRescan - 50-250P			1.000	IEC61217	145.00	0.00	180.00	0.00	0.00	0.00	218.0	83.01
1	T0SetUp_1	STATIC-I	VAC Imager 3			0.000	IEC61217	180.00	0.00	0.00	0.00	0.00	0.00	196.4	
1	T0SetUp_2	STATIC-I	Vac Imager 4			0.000	IEC61217	180.00	0.00	0.00	0.00	0.00	0.00	188.7	
1	T180SetUp_1	STATIC-I	VAC Imager 3			0.000	IEC61217	180.00	0.00	180.00	0.00	0.00	0.00	188.7	
1	T180SetUp_2	STATIC-I	Vac Imager 4			0.000	IEC61217	180.00	0.00	180.00	0.00	0.00	0.00	196.4	

Demo: 4D robust optimization

Group	Field ID	Technique	Machine/Energy	MLC	Field Target	Field Weight	Scale	Gantry Rtn [deg]	Coll Rtn [deg]	Couch Rot [deg]	X [cm]	Y [cm]	Z [cm]	Calculated SSD [cm]	Monitor Unit [MU]
1	T0G150	MODULAT_SCANNING-I	VACRescan - 50-250P		STV	0.500	IEC61217	150.00	0.00	0.00	0.00	0.00	-2.00	223.3	138.14
1	T180G150	MODULAT_SCANNING-I	VACRescan - 50-250P		STV	0.500	IEC61217	150.00	0.00	180.00	0.00	0.00	-2.00	223.3	146.47
1	T0 Setup_1	STATIC-I	VAC Imager 3			0.000	IEC61217	180.00	0.00	0.00	0.00	0.00	-2.00	195.6	
1	T0 Setup_2	STATIC-I	Vac Imager 4			0.000	IEC61217	180.00	0.00	0.00	0.00	0.00	-2.00	193.5	
1	T180 Setup_1	STATIC-I	VAC Imager 3			0.000	IEC61217	180.00	0.00	180.00	0.00	0.00	-2.00	193.5	
1	T180 setup_2	STATIC-I	Vac Imager 4			0.000	IEC61217	180.00	0.00	180.00	0.00	0.00	-2.00	195.6	
1	Setup 270_1	STATIC-I	VAC Imager 3			0.000	IEC61217	180.00	0.00	270.00	0.00	0.00	-2.00	193.5	

Questions for Physicists Discussion

1. Patient CT simulation
    I. What CT scan slice thickness is typically used for lung SBRT/hypofractionation?
2. Treatment Planning
    I. How many beams are typically used?
    II. What is the dose volume criterion for target evaluation for robustness analysis?
3. Motion Management and IGRT
    I. What motion management methods are used?
    II. What equipment is used for DIBH?
    III. What rescanning techniques is used (in-layer or volumetric)?
    IV. What types of IGRT are used?
4. What are the 3 most important technologies to improve lung treatment quality (Volume Imaging CBCT vs. In-Room CT, Motion Management, Robust Plan Evaluation, Adaptive Plan Timing)?