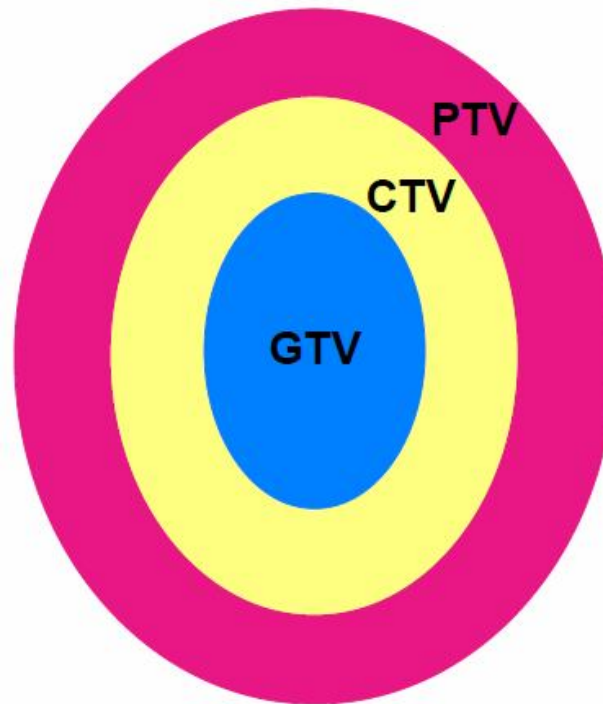


# **Robustnosť plánu voči geometrickým nepresnostiam nastavenia pacienta pri karcinóme prostaty**

Peter Muríň  
Univerzitná nemocnica Martin

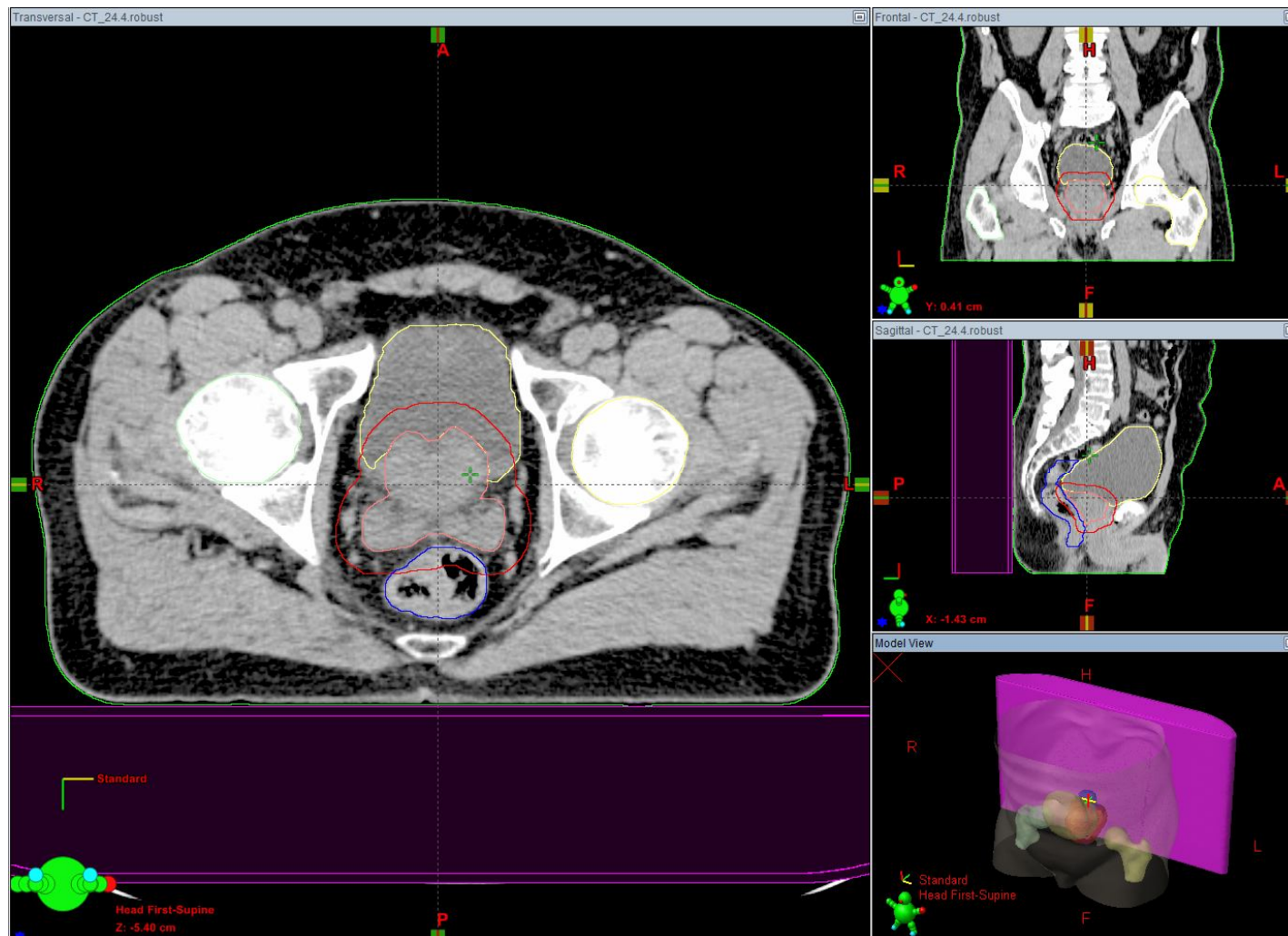
Bratislavské dni 2015 II., 26. – 27. 11. 2015

# Robustnosť plánu?



- Je vhodné použiť rovnaký PTV len pre každý plán?
- Nakoľko sa zmení DVH pri posune IC?

# Prostata + SV



- CTV-PTV lem symetricky 1 cm

## 3D – 5 polí

- Eclipse / AAA 11.0.31
- Mriežka 0,25 cm
- 33 x 2 Gy v mean PTV

430521172

9763

Series 1

CT\_24.4.robust

plan robustness

3D

3D x+1

3D x-1

3D y+1

3D y-1

3D z+1

3D

CT\_24.4.robust

Registered Images

CT\_24.4.robust

Bladder

Bladder\_opt

BODY

CouchInterior

CouchSurface

Coxa DX

Coxa SN

CTV P+SV

Dose 95[%]

kalcifikat

PTV P+SV

PTVmargin

Rectum

Rectum\_opt

RectumPRV

RectumPRVopt

Shell

User Origin

Reference Points

PTV P+SV

Dose

Fields

Field 1

MLC

Field 2

MLC

Field 3

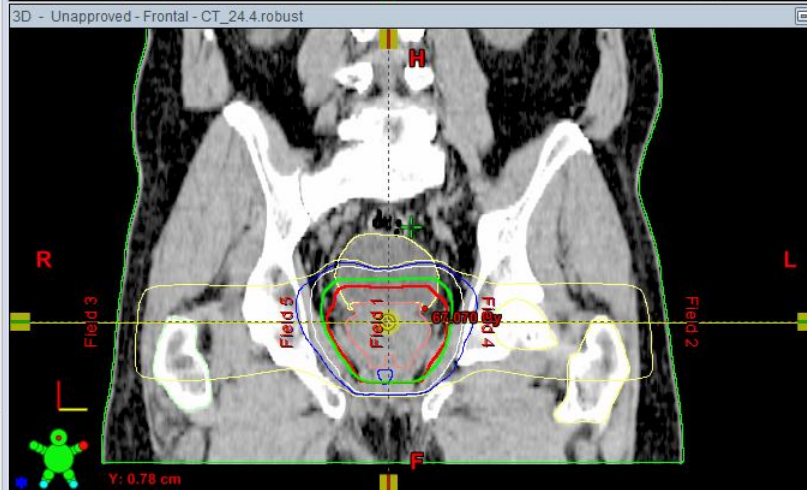
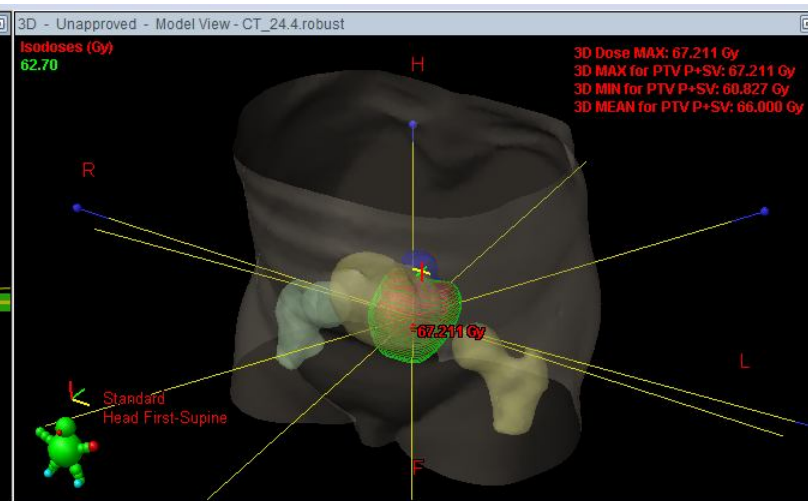
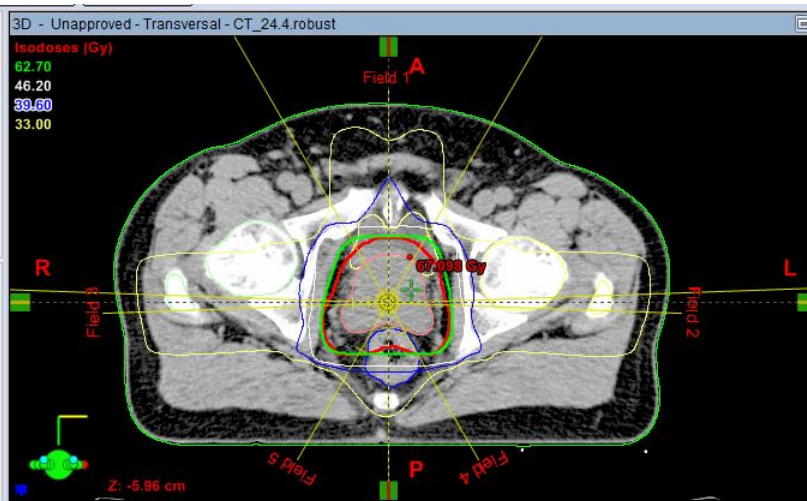
MLC

Field 4

MLC

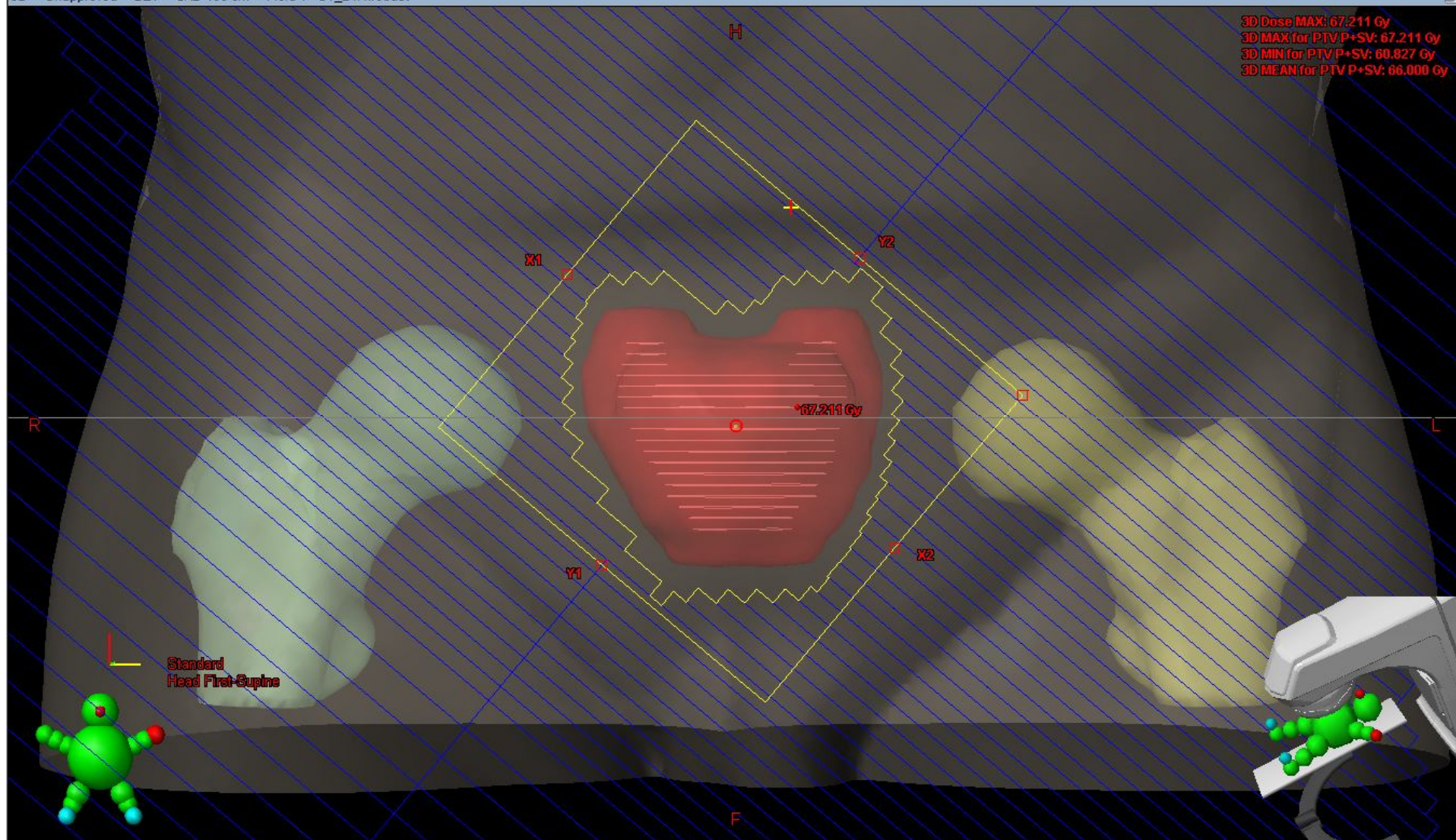
Field 5

MLC



Group	Field ID	Technique	Machine/Energy	MLC	Field Weight	Scale	Gantry Rtn [deg]	Coll Rtn [deg]	Couch Rtn [deg]	Wedge	Field X [cm]	X1 [cm]	X2 [cm]	Field Y [cm]	Y1 [cm]	Y2 [cm]	X [cm]	Y [cm]	Z [cm]	SSD [cm]	MU	Ref. D [Gy]
<input checked="" type="checkbox"/>	Field 1	STATIC-I	Clinac1 - 18X	Static	1.000	Varian IEC	0.0	320.0	0.0	None	11.6	+6.2	+5.4	10.9	+5.2	+5.7	-1.49	0.78	-5.96	87.4	73	0.970
<input checked="" type="checkbox"/>	Field 2	STATIC-I	Clinac1 - 18X	Static	0.700	Varian IEC	92.0	330.0	0.0	None	9.4	+5.2	+4.2	10.9	+5.2	+5.7	-1.49	0.78	-5.96	82.5	61	0.908
<input checked="" type="checkbox"/>	Field 3	STATIC-I	Clinac1 - 18X	Static	0.700	Varian IEC	268.0	320.0	0.0	None	11.8	+6.1	+5.7	8.4	+4.2	+4.2	-1.49	0.78	-5.96	83.0	60	0.880
<input checked="" type="checkbox"/>	Field 4	STATIC-I	Clinac1 - 18X	Static	0.300	Varian IEC	150.0	310.0	0.0	None	10.8	+5.6	+5.2	11.9	+5.2	+6.7	-1.49	0.78	-5.96	89.6	21	0.266
<input checked="" type="checkbox"/>	Field 5	STATIC-I	Clinac1 - 18X	Static	0.300	Varian IEC	210.0	320.0	0.0	None	11.9	+6.6	+5.3	10.4	+5.2	+5.2	-1.49	0.78	-5.96	89.6	21	0.266



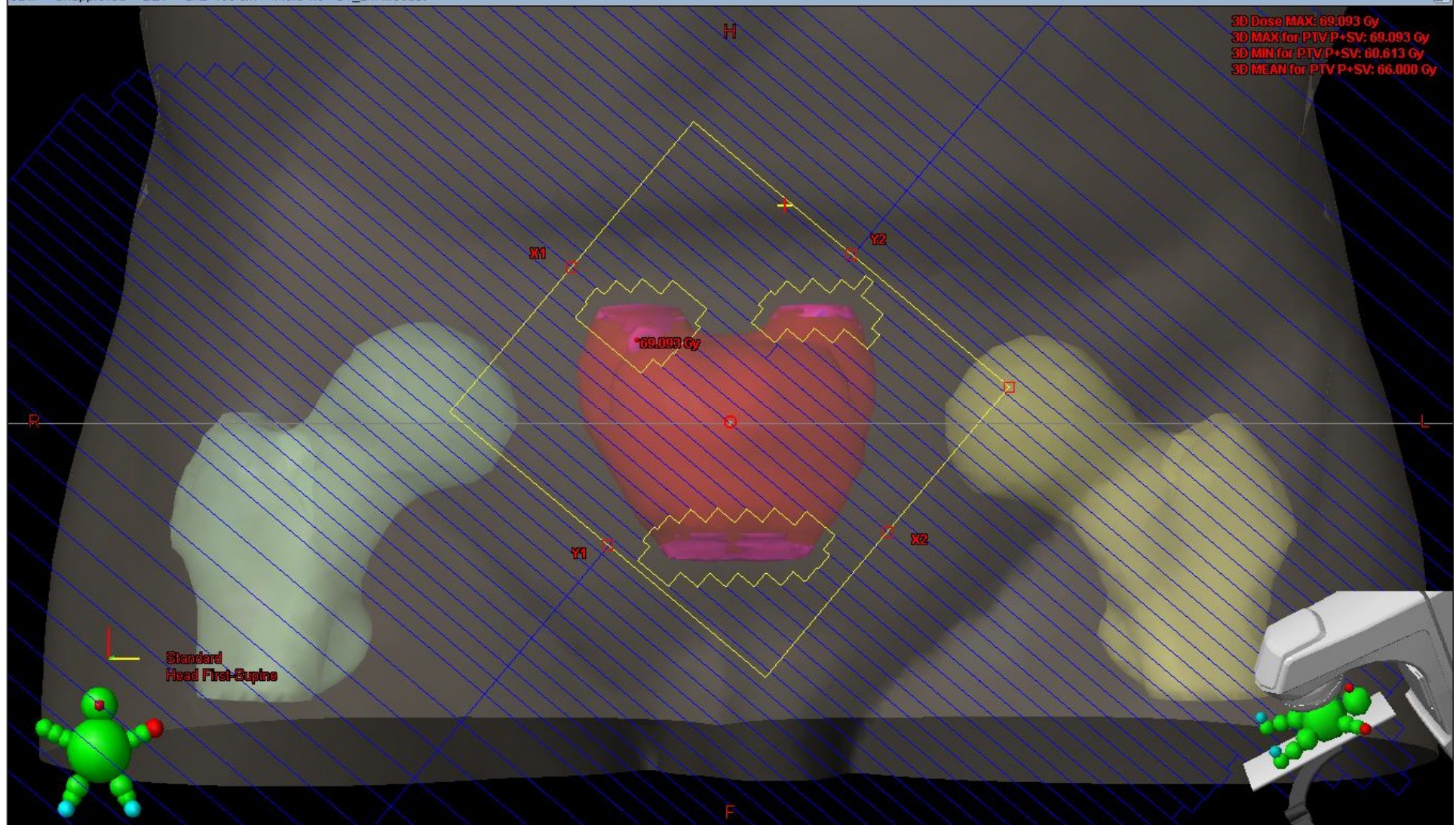


- BEV – lemy lat: 4 mm / SI: 8 mm



# 3D - FiF

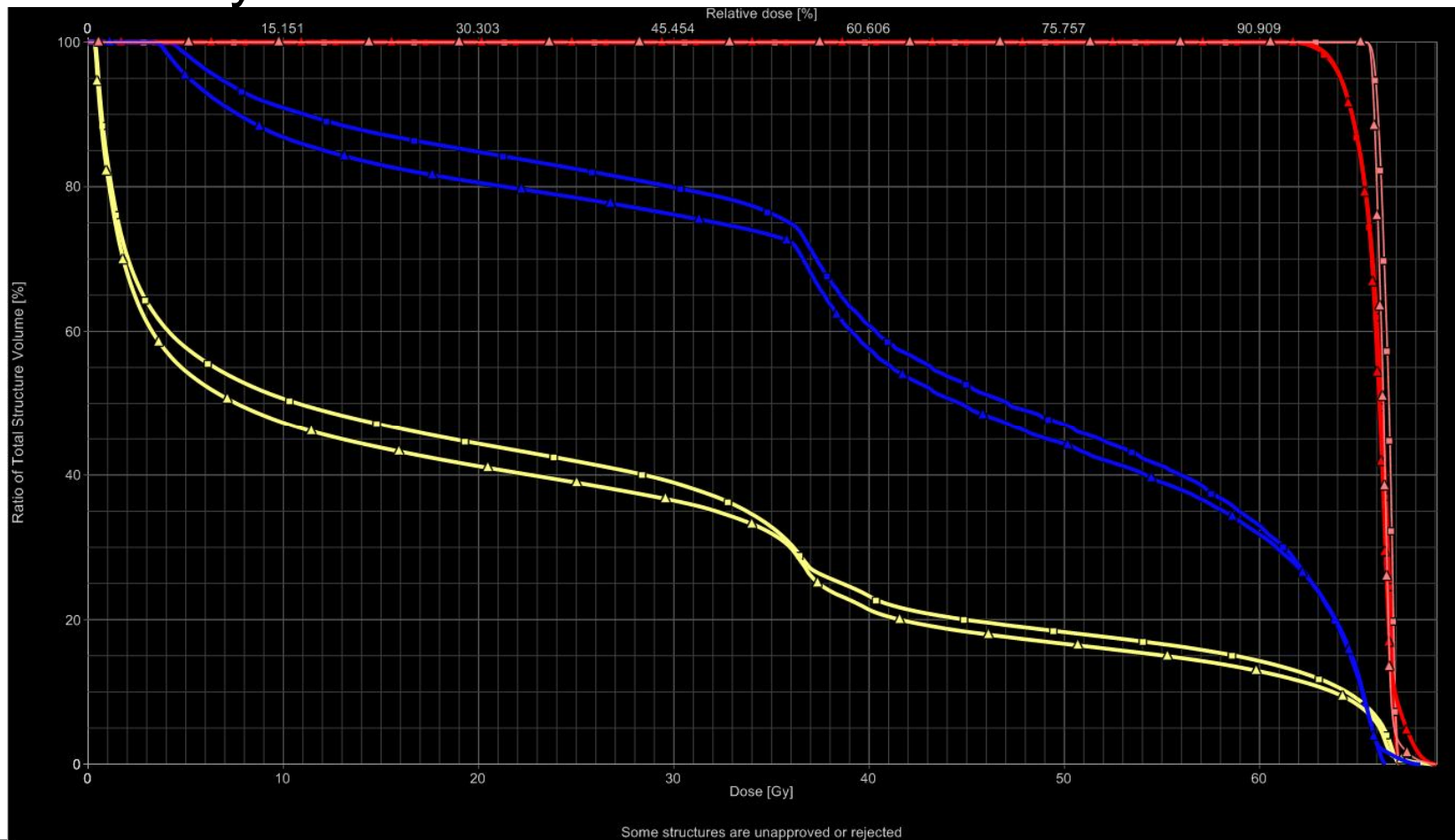
3Dfif - Unapproved - BEV - SAD 100 cm - Field 1.0 - CT\_24.4.robust



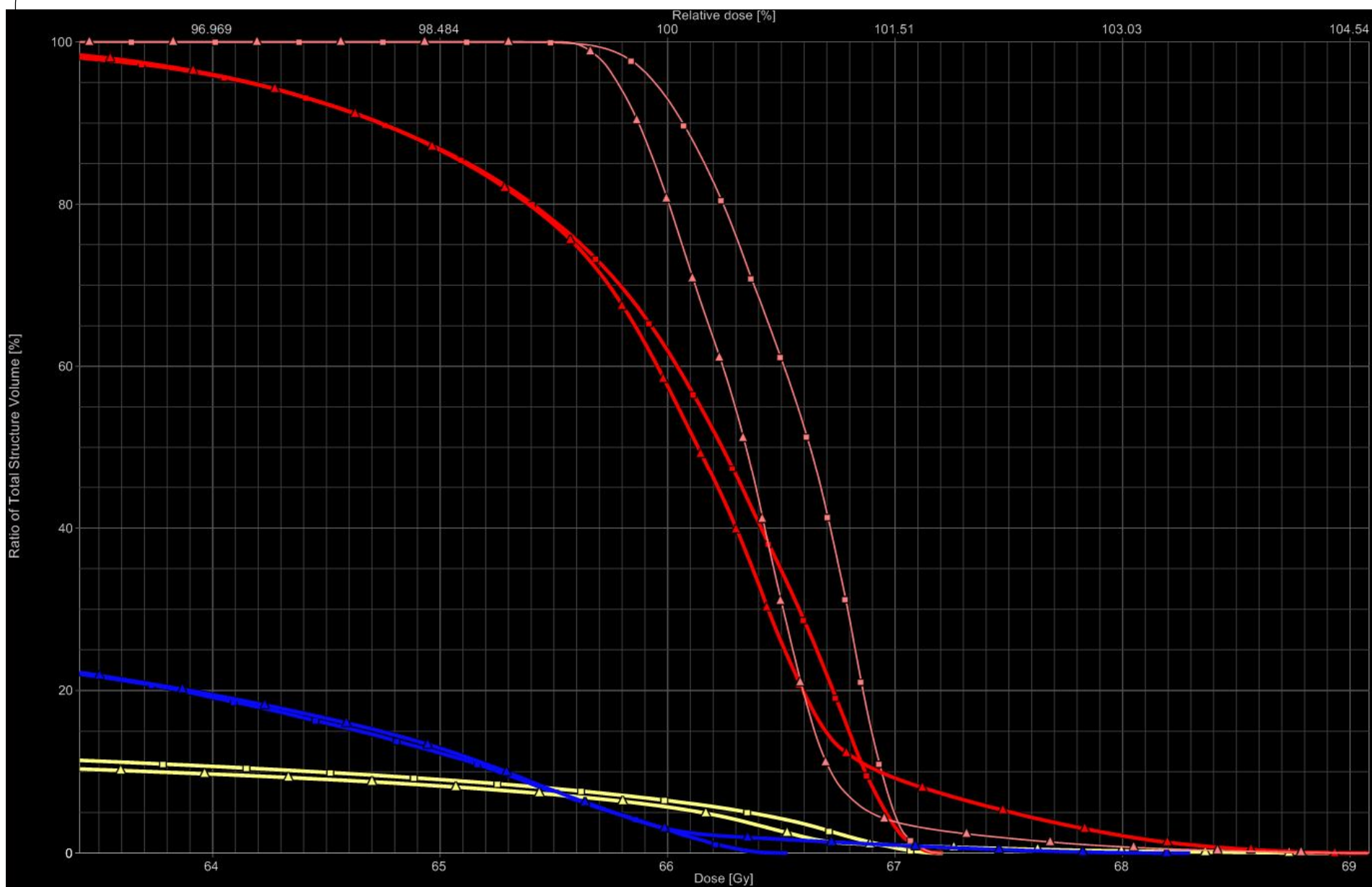
- BEV – lemy lat: 4 mm / SI: 5 mm, váha: 7%

# DVH - 3D vs FiF

- FiF zníženie priemernej dávky / zvýšenie max. dávky rekta / MM

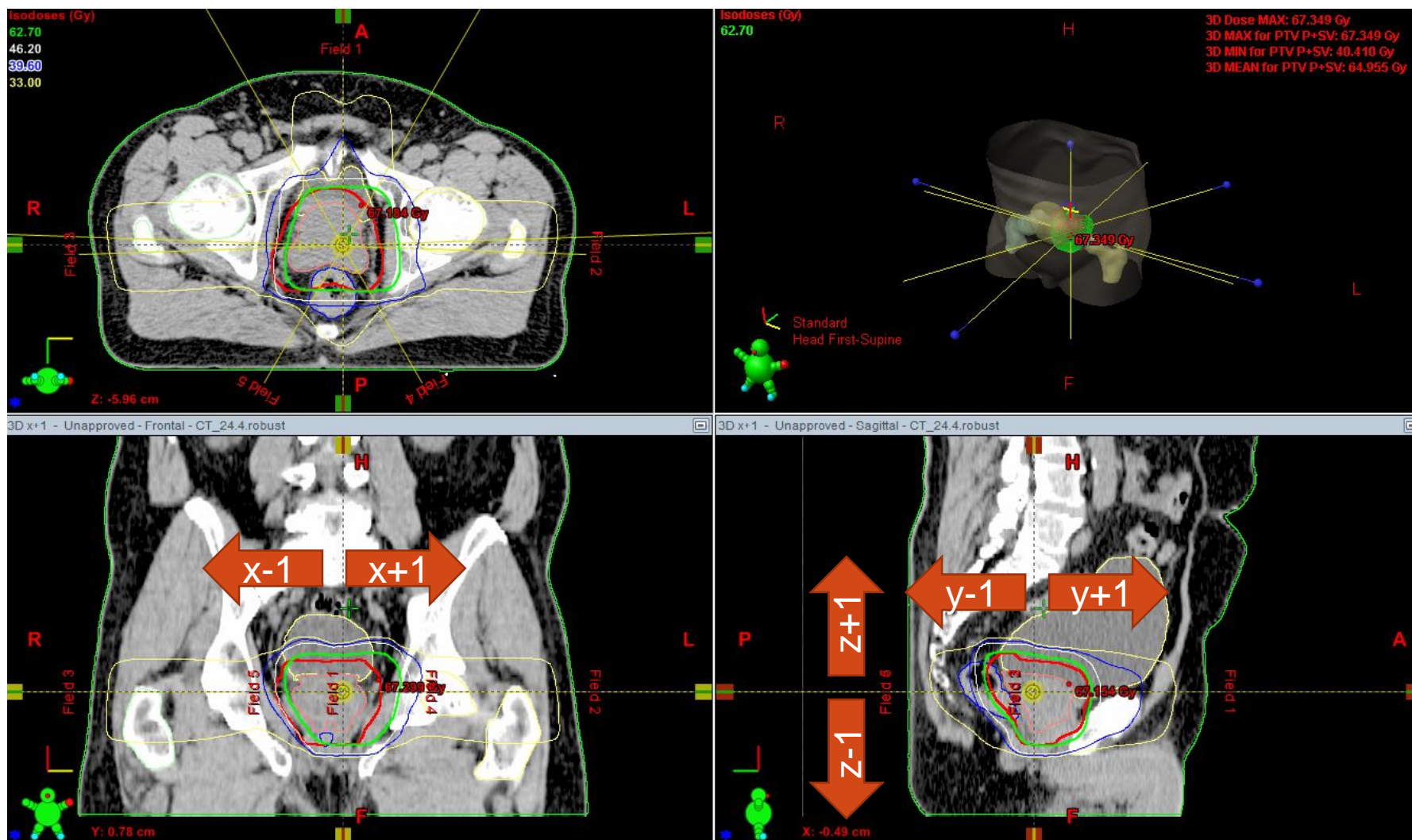




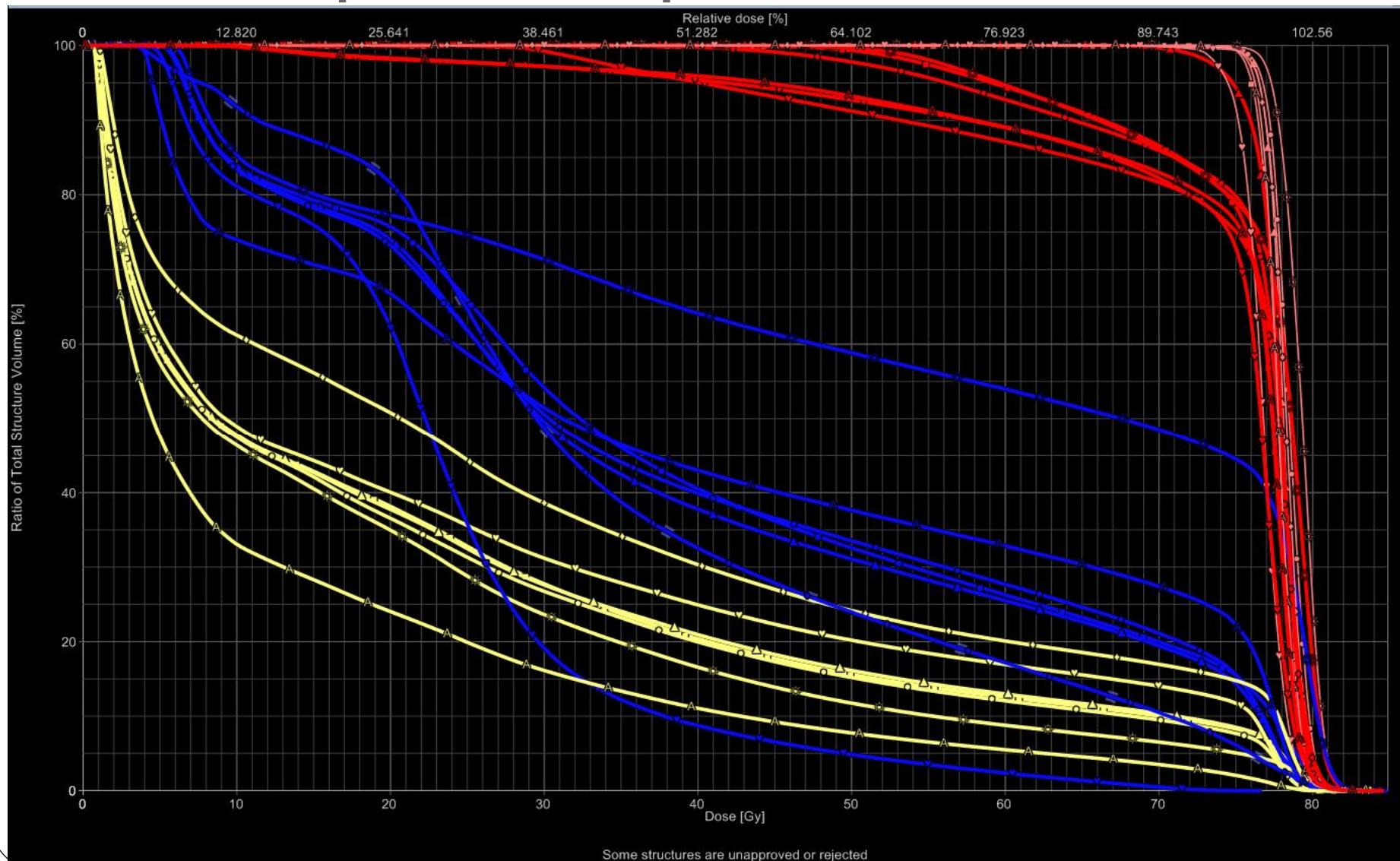


Some structures are unapproved or rejected

# Výpočet plánov s posunom



# DVH plánov s posunom





# Robustnosť 3D / FiF - CTV

3D	CTV	x			3D	CTV	y			priemerná zmena
D98%		-1	0	1	D98%		1	0	-1	
z	1		-2,03%		z	1		-2,03%		-1,36%
	0	-1,13%	<b>99,7237</b>	-1,21%		0	-0,43%	<b>99,7237</b>	-2,38%	
	-1		-0,97%			-1		-0,97%		
FiF	CTV	x			FiF	CTV	y			
D98%		-1	0	1	D98%		1	0	-1	
z	1		-0,95%		z	1		-0,95%		-1,49%
	0	-1,48%	<b>99,5445</b>	-1,72%		0	-0,92%	<b>99,5445</b>	-2,22%	
	-1		-1,63%			-1		-1,63%		

# Robustnosť 3D / FiF - Rektum

3D	Rectum	x		
V60Gy		-1	0	1
z	1		-23,04%	
	0	-1,51%	<b>33,0023</b>	-1,25%
	-1		16,23%	

3D	Rectum	y			priemerná zmena bez y-posunu
V60Gy		-1	0	1	
z	1		-23,04%		-2,39%
	0	83,16%	<b>33,0023</b>	-77,87%	
	-1		16,23%		

FiF	Rectum	x		
V60Gy		-1	0	1
z	1		-25,65%	
	0	-2,63%	<b>31,787</b>	-0,63%
	-1		20,19%	

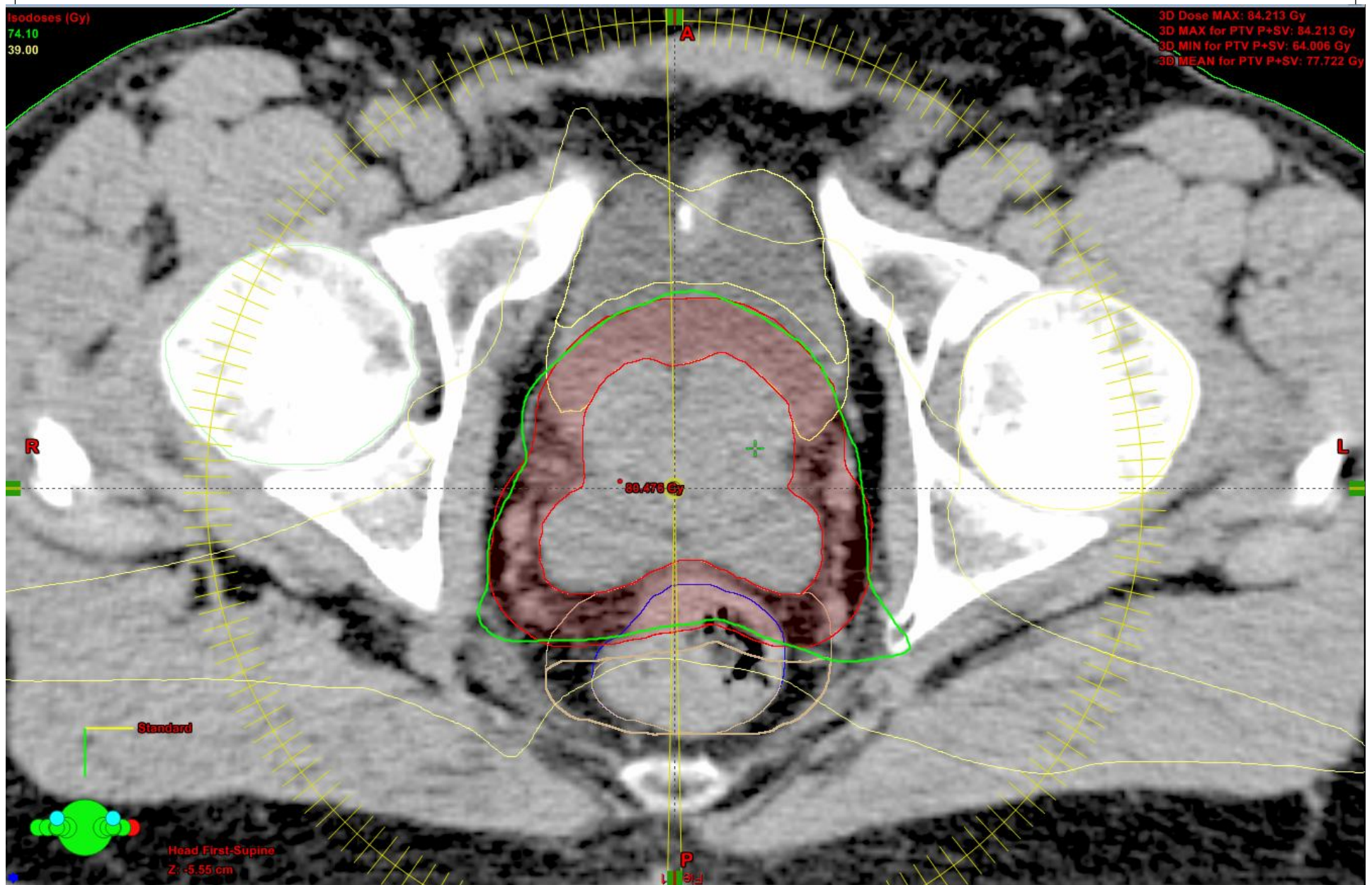
FiF	Rectum	y			
V60Gy		-1	0	1	
z	1		-25,65%		-2,18%
	0	85,40%	<b>31,787</b>	-81,23%	
	-1		20,19%		

# RA

- 39 x 2 Gy
- Rôzne plány podľa optimalizačných cieľov:
  - **RA** – 1 celý oblúk ( $179^{\circ}$  -  $181^{\circ}$ )
  - **RA avoid** – čiastočný oblúk ( $150^{\circ}$  -  $210^{\circ}$ )
  - **RA CTV** – pridanie lower objective na CTV a upper objective na PTVmargin
  - **RA PRV** – rectumPRV – 1 cm lem lat. a ventrálne, odrezané od CTV
  - **RA2** – 2 oblúky



# RA – optimalizačné štruktúry



# Robustnosť RA vzhľadom na CTV

RA	CTV	x		
D98%		-1	0	1
z	1		0,42%	
	0	0,12%	97,485	-0,43%
	-1		-0,62%	

RA_avoid	CTV	x		
D98%		-1	0	1
z	1		-0,16%	
	0	-1,11%	97,9975	-0,57%
	-1		-0,59%	

RA_CTV	CTV	x		
D98%		-1	0	1
z	1		-0,57%	
	0	-0,83%	<b>98,9078</b>	-0,96%
	-1		-1,24%	

RA_PRV	CTV	x		
D98%		-1	0	1
z	1		-0,18%	
	0	0,16%	97,508	-0,70%
	-1		-0,42%	

RA2	CTV	x		
D98%		-1	0	1
z	1		-0,14%	
	0	0,07%	98,2013	-0,08%
	-1		-0,57%	

RA	CTV	y			priemerná zmena
D98%		1	0	-1	
z	1		0,42%		-0,34%
	0	0,91%	97,485	-2,41%	
	-1		-0,62%		

RA_avoid	CTV	y			priemerná zmena
D98%		1	0	-1	
z	1		-0,16%		-0,80%
	0	-0,76%	97,9975	-1,64%	
	-1		-0,59%		

RA_CTV	CTV	y			priemerná zmena
D98%		1	0	-1	
z	1		-0,57%		-1,25%
	0	-0,65%	<b>98,9078</b>	-3,29%	
	-1		-1,24%		

RA_PRV	CTV	y			priemerná zmena
D98%		-1	0	1	
z	1		-0,18%		-0,58%
	0	<b>0,94%</b>	97,508	-3,30%	
	-1		-0,42%		

RA2	CTV	y			priemerná zmena
D98%		-1	0	1	
z	1		-0,14%		-0,59%
	0	-0,52%	98,2013	-2,31%	
	-1		-0,57%		

1

4

5

2

3

# Robustnosť RA vzhľadom na rektum

RA	Rectum	x		
V70Gy		-1	0	1
z	1		-41,66%	
	0	14,87%	19,4075	11,33%
	-1		41,64%	

RA avoid	Rectum	x		
V70Gy		-1	0	1
z	1		-39,33%	
	0	3,03%	19,9248	7,98%
	-1		40,11%	

RA_CTV	Rectum	x		
V70Gy		-1	0	1
z	1		-44,22%	
	0	9,79%	19,3184	9,23%
	-1		42,04%	

RA_PRV	Rectum	x		
V70Gy		-1	0	1
z	1		-46,01%	
	0	8,62%	19,4386	2,94%
	-1		40,99%	

RA_2	Rectum	x		
V70Gy		-1	0	1
z	1		-39,96%	
	0	9,78%	19,9584	14,36%
	-1		39,60%	

RA	Rectum	y			priemerná zmena bez y-posunu
V70Gy		-1	0	1	
z	1		-41,66%		6,54%
	0	151,27%	19,4075	-97,68%	
	-1		41,64%		

RA avoid	Rectum	y			
V70Gy		-1	0	1	
z	1		-39,33%		2,95%
	0	148,19%	19,9248	-96,53%	
	-1		40,11%		

RA_CTV	Rectum	y			
V70Gy		-1	0	1	
z	1		-44,22%		4,21%
	0	150,94%	19,3184	-97,53%	
	-1		42,04%		

RA_PRV	Rectum	y			
V70Gy		-1	0	1	
z	1		-46,01%		1,64%
	0	149,51%	19,4386	-97,44%	
	-1		40,99%		

RA_2	Rectum	y			
V70Gy		-1	0	1	
z	1		-39,96%		5,95%
	0	147,65%	19,9584	-97,05%	
	-1		39,60%		

5

2

3

1

4



# Robustnosť RA

	Zmena CTV	Poradie	Zmena rektum	Poradie
RA	-0,34%	1	6,54%	5
RA avoid	-0,80%	4	2,95%	2
RA_CTV	-1,25%	5	4,21%	3
RA_PRV	-0,58%	2	1,64%	1
RA2	-0,59%	3	5,95%	4



Ďakujem za pozornosť