

VMAT FULL ESOPHAGUS INCL. SCLAV

On this particular case the prescription called for 4140cGy@180, then boost to 5040cGy@180.

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)	Calculated SSD (cm)	MU	Ref. D (cGy)
I	CBCT	STATIC-I	D-2300CD - 6X		0.000	Varian IEC	0.0	0.0	0.0	None	15.0	+7.5	+7.5	15.0	+7.5	+7.5	0.00	3.00	4.00	90.1		
I	1 CW	ARC-I	D-2300CD - 6X	VMAT	0.638	Varian IEC	181.0 CW 179.0	7.0	0.0	None	15.0	+5.4	+9.6	27.3	+13.8	+13.5	0.00	3.00	4.00	89.7	115	
I	2 CCW	ARC-I	D-2300CD - 6X	VMAT	0.605	Varian IEC	179.0 CCW 181.0	353.0	0.0	None	15.0	+9.6	+5.4	27.3	+13.8	+13.5	0.00	3.00	4.00	89.7	109	
I	3 CW	ARC-I	D-2300CD - 6X	VMAT	0.764	Varian IEC	181.0 CW 179.0	90.0	0.0	None	14.2	+1.0	+13.2	16.4	+8.2	+8.2	0.00	3.00	4.00	89.7	138	
I	4 CCW	ARC-I	D-2300CD - 6X	VMAT	0.776	Varian IEC	179.0 CCW 181.0	90.0	0.0	None	14.6	+13.6	+1.0	16.4	+8.2	+8.2	0.00	3.00	4.00	89.7	140	
I	8 CW	ARC-I	D-2300CD - 6X	VMAT	0.462	Varian IEC	181.0 CW 179.0	95.0	0.0	None	14.7	+13.7	+1.0	17.3	+9.2	+8.1	0.00	3.00	4.00	89.7	83	
I	RLKV	STATIC-I	D-2300CD - 6X		0.000	Varian IEC	270.0	0.0	0.0	None	15.0	+7.5	+7.5	15.0	+7.5	+7.5	0.00	3.00	4.00	83.2		
I	APKV	STATIC-I	D-2300CD - 6X		0.000	Varian IEC	0.0	0.0	0.0	None	15.0	+7.5	+7.5	15.0	+7.5	+7.5	0.00	3.00	4.00	90.1		

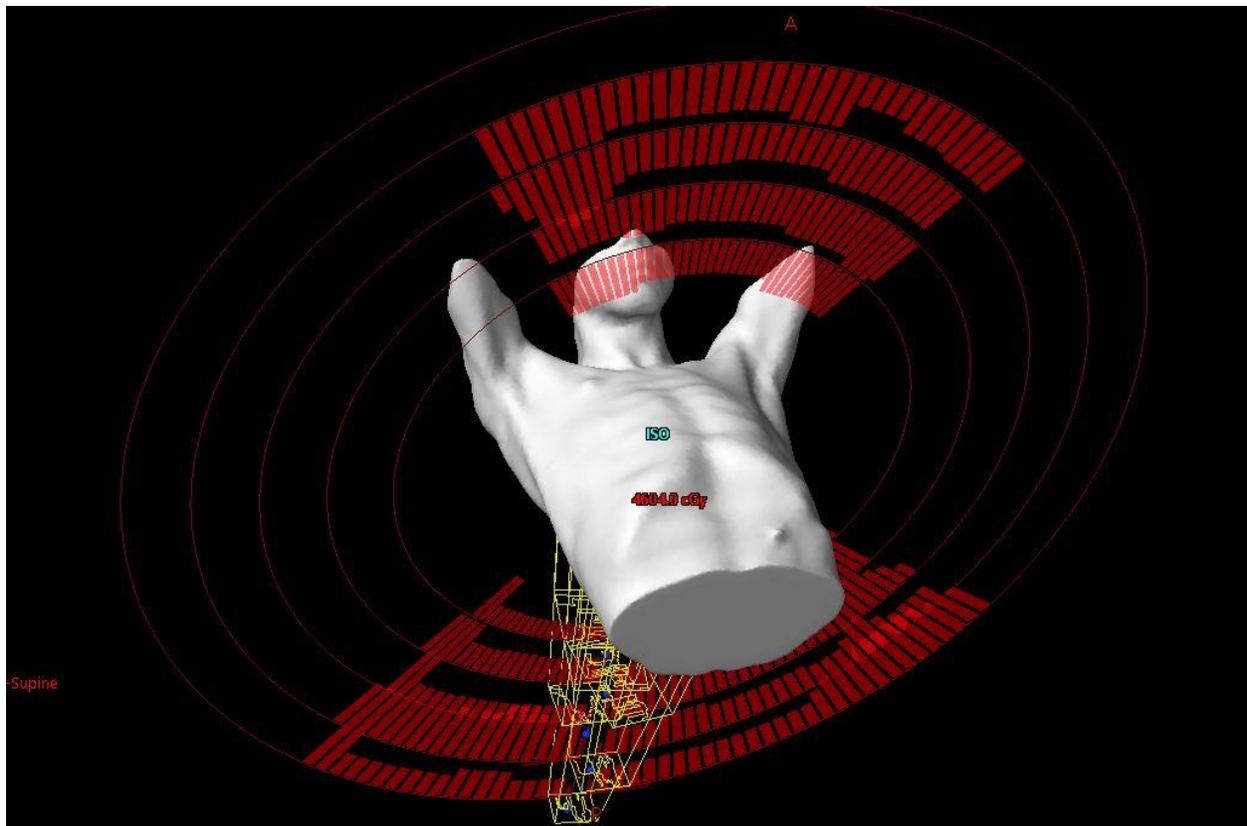
While everyone approaches these cases somewhat different, this is just my approach and I only mean to share another perspective with some tips and tricks included.

STRUCTURES:

On the PTV_OPT structure, I put a 1mm expansion sup/inf and .2 expansion in all other dimensions. I also create a Total Lung_OPT structure and I crop that 1.5 cm away from the PTV_OPT. On the spinal cord, my trick is to create 2 additional structures: cord_prv3 and a cord_prv5. I do that on every case where I need to control the cord. I have found that one objective on each cord structure helps move the dose off the cord more easily. And of course the heart needs and opt structure and I crop that 3 mm from the PTV_OPT.

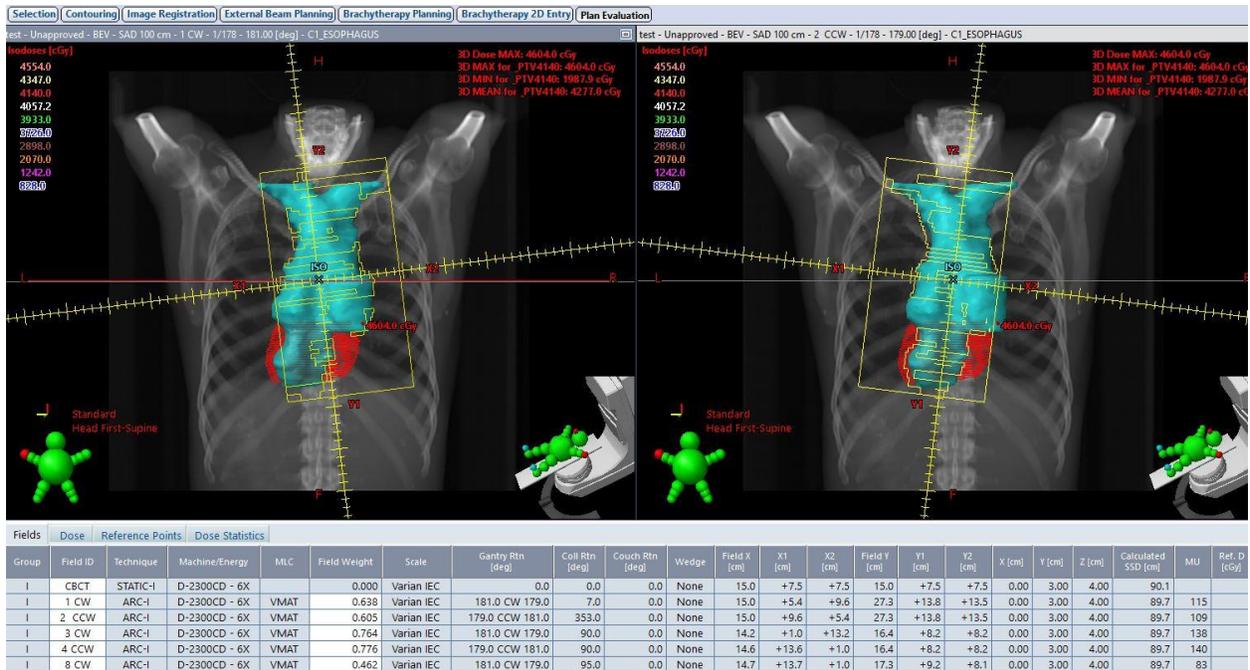
BEAMS:

Now let's talk about beam arrangement. Initially I did not have 5 beams, I had 4. My plan, while looking similar to above screenshot was over modulated. I then added another beam and the plan came together and passed QA.

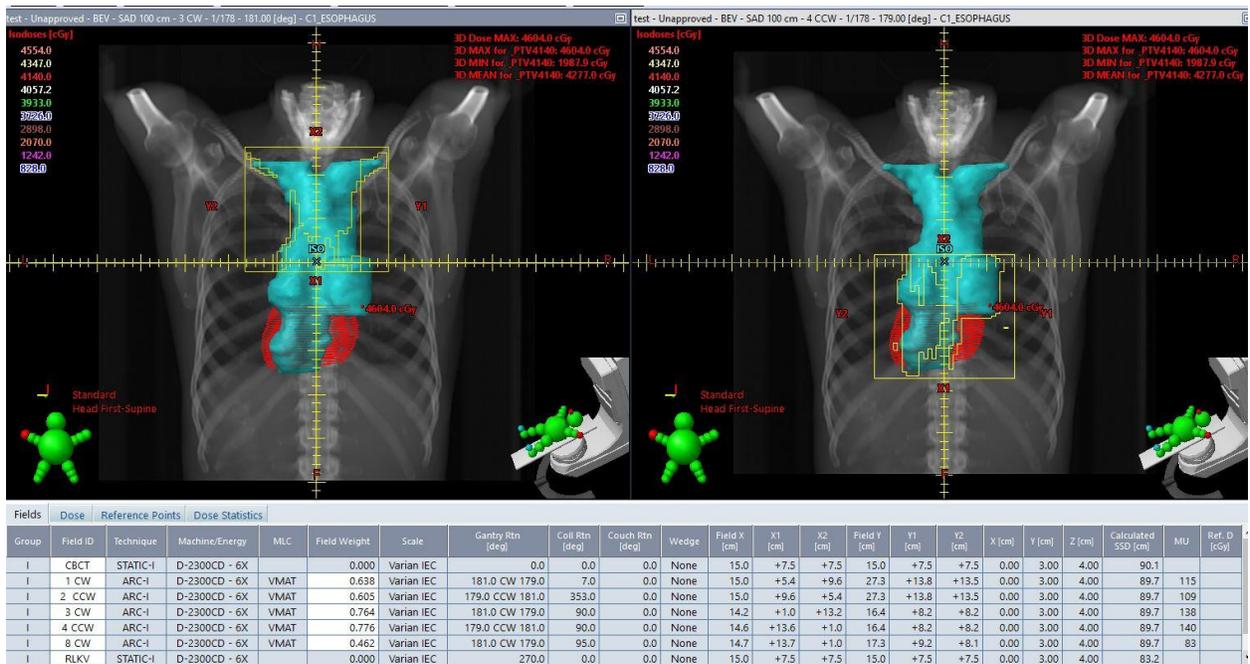


As you can see from the above screenshot, the first 4 arcs only treat anterior and posterior. The 5th arc (labeled beam 8) is treated just in the posterior. The reason for the posterior arc is to allow the algorithm another pathway for the target volume that is behind the heart. (I always try and help the algorithm to find the watering hole rather than have it struggle to understand which objectives are most important to you in order to get to the water...LOL) I'm a firm believer that structure creation and beam setup is every bit as important if not more important than optimizing.

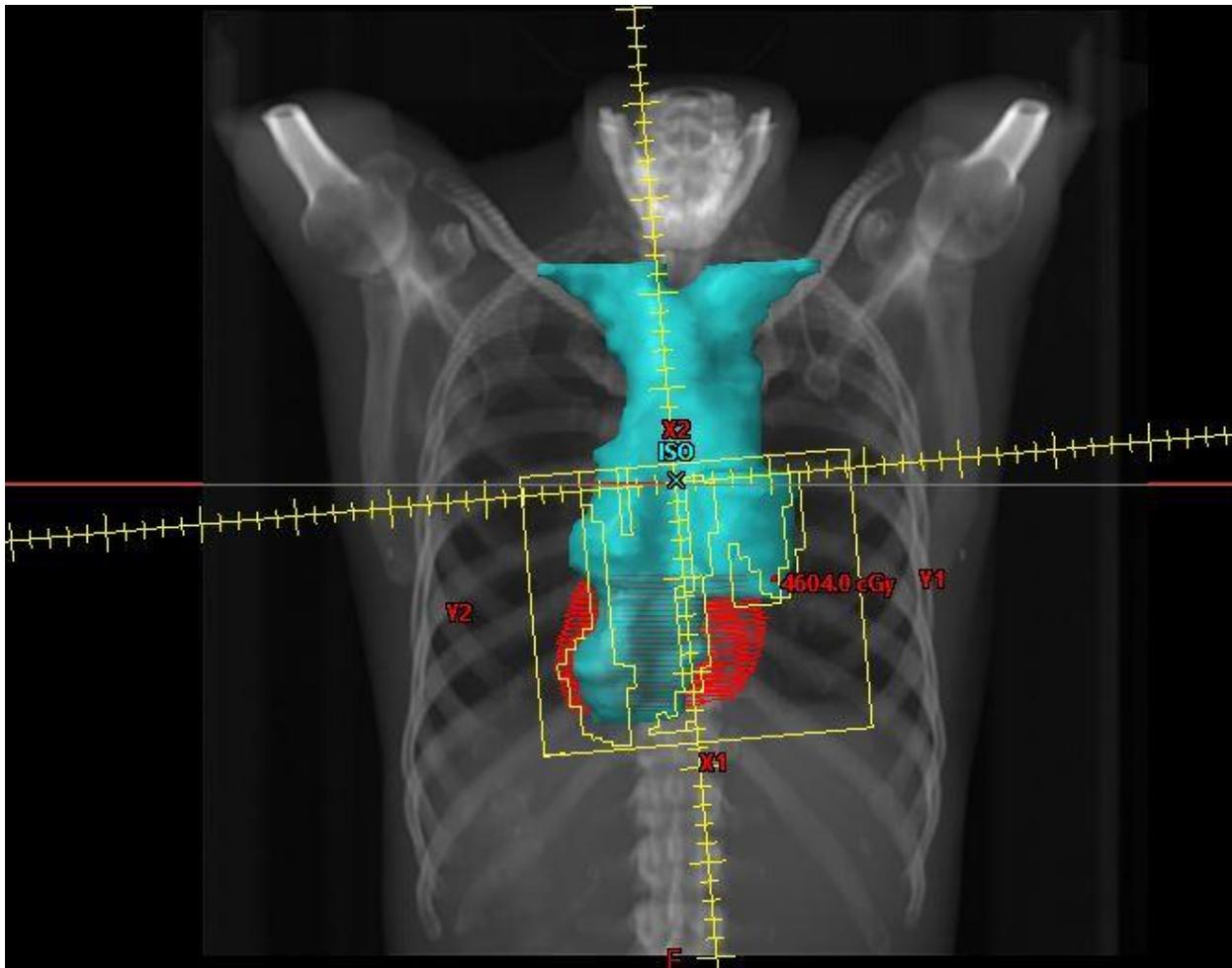
The jpegs below show each beam covering the target.



Beams 1 and 2



Beams 3 and 4



Beam 5 (labeled as 8)_You might ask why the beam extends above the heart? I did that because on the axial view there was less lung to go through if you were to dose posteriorly rather than anteriorly. (I'll get that horse to water yet!_ha!)

So now you may ask, how do I determine my avoidance sectors? It is not an exact science. Every patient's anatomy is different and so is the target volume. (In this case, I altered the avoidance sectors twice to get to this final plan. Why? ...on my first go around the lung DVH was too high. Normal thinking, I increased my arc avoidance. The plan was getting way too hot. Humm... If you ever watched Stienfeld, there is an episode where George decides to do opposite of what he does normally and see how his life goes! In this case, I pulled a George and decided to decrease my avoidance angles! **Note:** In many of the cases I do with lateral avoidance I don't even use the Lung_Opt I created. The lateral avoidance takes care of it nicely. But in this case I thought that because the target is variable in the axial view and of course the lung volume changes dramatically sup to inf, maybe its best to incorporate the avoidance with the Lung_Opt objectives.. My thinking was if I decrease the avoidance then the optimizer will respond when I

put objectives on the Lung Opt. Give the optimizer freedom to do its thing. So, like George, opposite can work!

Now let's look at **optimizing**. As I mentioned above, it took a couple of times till I found the sweet spot for the arc avoidance. As I optimized, I noticed the shoulder of the PTV was very rounded and I was not getting the enough coverage. Of course, we all know the lung dosing is a problem. There is a trick I learned from colleagues in Saudi Arabi. This trick is called Ghosting!

Years ago they took an award in the international challenge plan and I pocketed this tip! When you normalize the plan to cover 95%, let's say the plan normalization goes down to 93%. Humm...very low indeed. So, set the plan normalization to 100%. Convert the 95% line to a structure. Save and then go into contouring. Create a new structure as a PTV. In this case I labeled it "PTV_LUNG_OPT". I copied my PTV_OPT into this PTV_Lung_OPT. Then I did the following Boolean operation. Choose the 95% line as the first structure, choose the icon that says "keep the nonoverlapping regions of the first and second structures", then choose PTV_LUNG_OPT as the second structure, apply. So now you see the low dose of the PTV_OPT filled in. On a case like this, I took it one step further. I expanded the PTV_LUNG_OPT 1 mm around in all directions and then I cropped the portion outside the PTV_OPT.

First Structure
95%

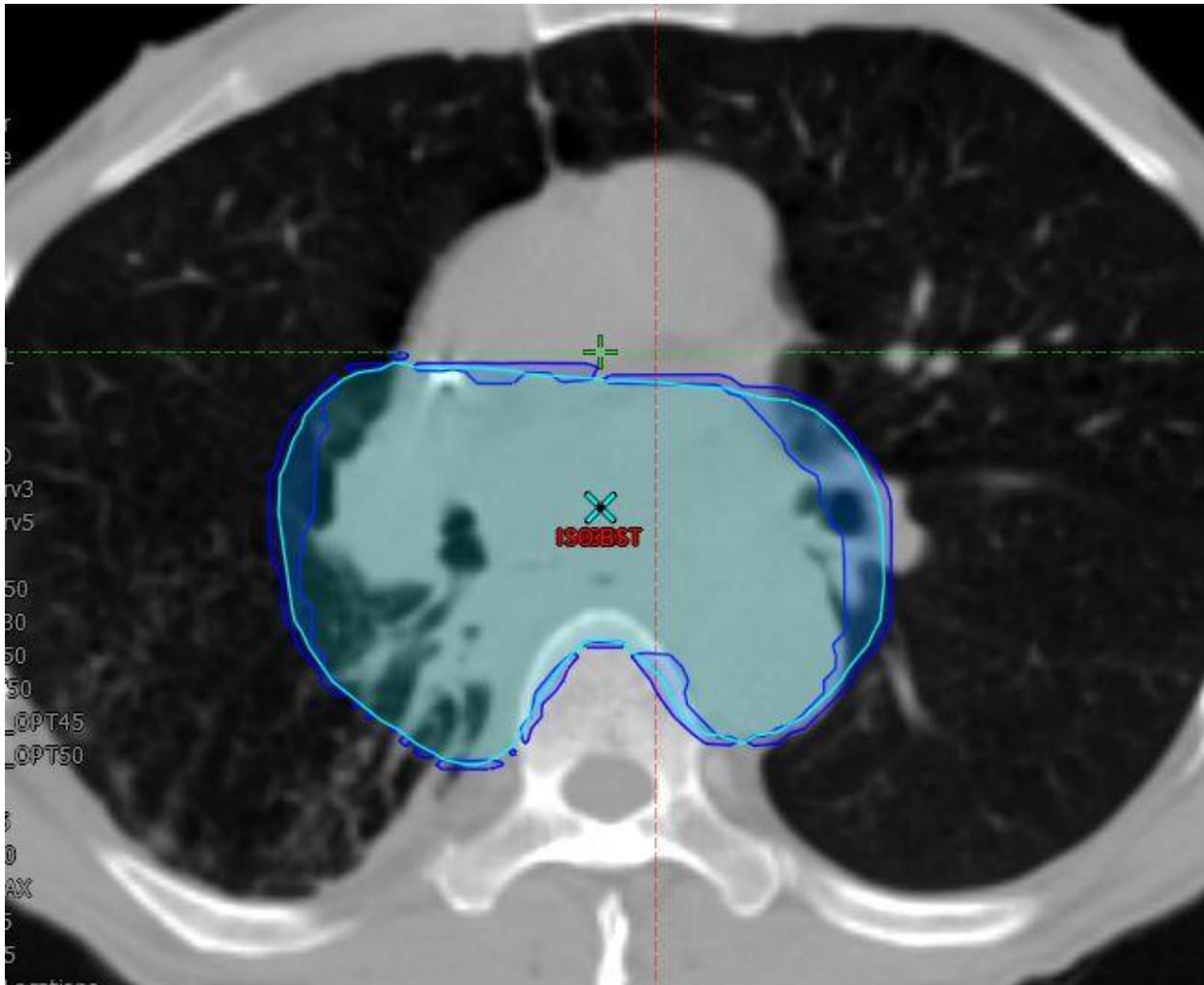
Operator

Second Structure
z PTV_LUNG_OPT45

Create a binary expression by selecting two structures and one of the operators.

Target Structure
z PTV_LUNG_OPT45

Apply Reset



Blue area is the PTV_LUNG_OPT....the GHOST!

Copy the plan, remember to set “no plan normalization”. (I forget sometimes when I’m 5 steps ahead in my mind) Always take a breath and smell the roses on these difficult plans!

Go back into the optimizer. Put objectives on the PTV_LUNG_OPT which of course are about 4 or 5 % higher than the lower objectives on the PTV_OPT. Resume the previous plan optimization. Looks like the shoulder is getting straighter ...oh ...but not enough! Darn...Mel told me this would work. (Patience grasshopper....) I got another trick! By now...you probably have a lower objective on the PTV opt structures at 95% to try and get that shoulder straight. I then add a lower objective of 93% and 94%. As the optimizer tries to obtain 94 and 93% coverage...(which it may not), it does inadvertently push that 95% coverage into place. Again..don’t think of the optimizer on these difficult cases as just responding to high priorities. At times, it needs more direction! Again...lead it to the watering hole!

I would like to add one last trick to keep the hot spot not so bad and small in volume. What I do is in level 1 when I feel my lower objectives are in place I use my only upper objective on the

PTV's and double the highest lower objective value. If for example my highest lower objective is 215, my one and only upper objective value I would make 315. This is so much greater than the lower objectives that it is a clear message to the optimizer to minimize the hot spot volume and the overall heat of the plan.