Rectal Cancer Contouring Guide

eContour Team

You want to contour: **Rectal Cancer**

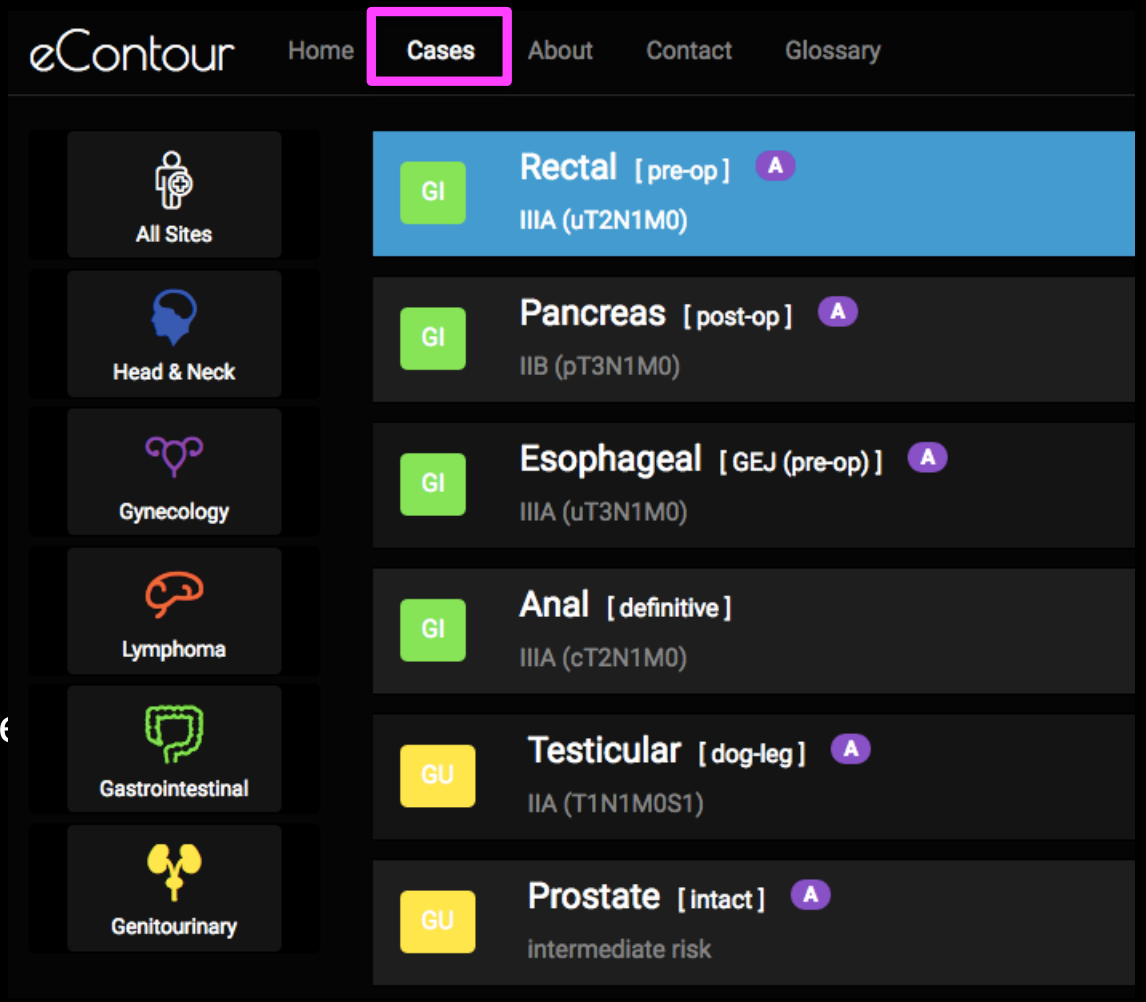
What now?

- Find your references
  - RTOG contouring atlas for anorectal:
    - https://www.rtog.org/CoreLab/ContouringAtlases/Anorectal.aspx
    - NOTE: this was created for *BOTH anal and rectal cancer*, which are treated quite differently, so pay attention!
    - Publication validating the above atlas: Myerson et al. IJROBP 2009: http://www.ncbi.nlm.nih.gov/pubmed/19117696
  - RTOG protocols?
    - RTOG 0822 actually showed no difference between IMRT and 3D-CRT. While this could still be a reference to guide contouring for 3D block placement per the 3D-CRT arm, let's stick with the published atlas.
  - ARROContour: CAUTION! not peer-reviewed, but a resident presentation created by ARRO (ASTRO's Resident Committee)
    - https://www.astro.org/uploadedFiles/_MAIN_SITE/Affiliate/ARRO/Resident_Resources/Educational_Resources/ARROcase/Content_Pieces/ARROContourRectal.pdf

**eContour.org aims to be your one-stop shop for contouring guidelines, with hyperlinks to above high-yield references!*

Let eContour.org help you!

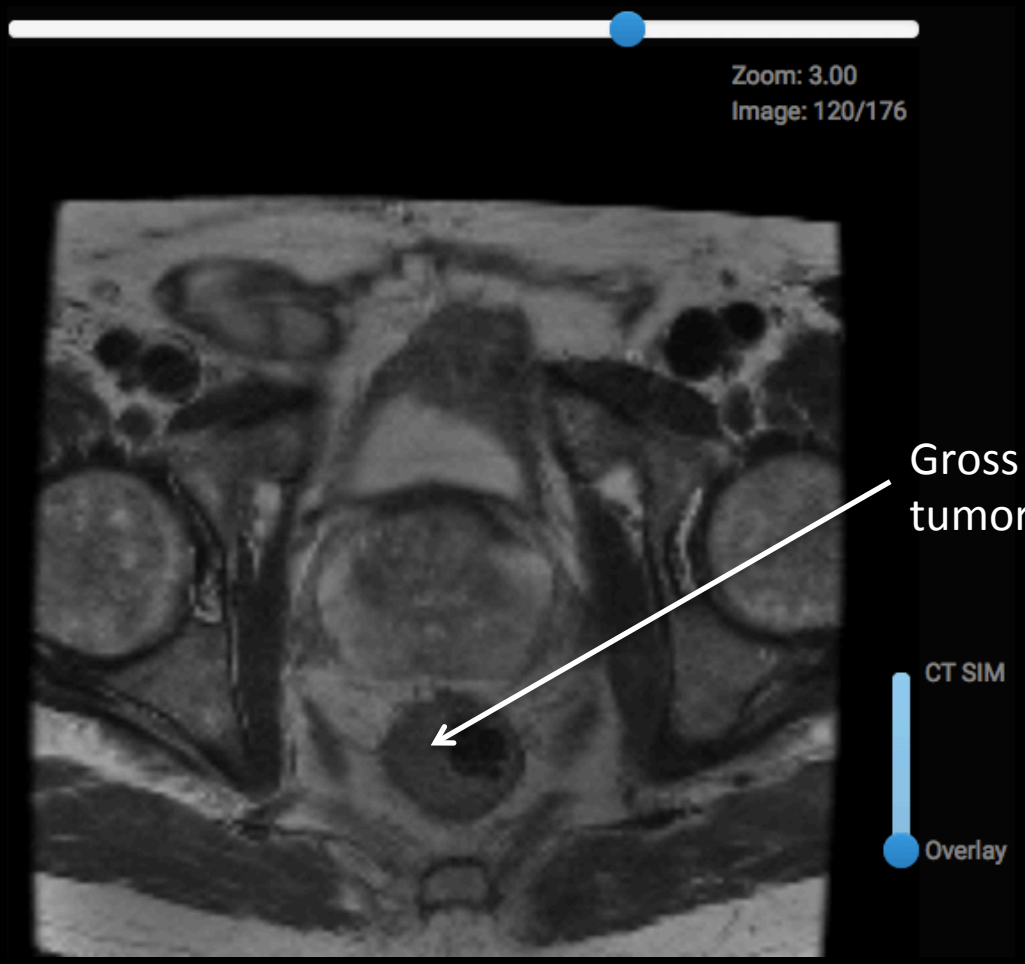
1. Select CASES
2. From dropdown case list:
   GI → Rectal → pre-op
3. Draw the GTV
4. Review pelvic anatomy
5. Draw CTV
6. Add margin/expansion to create final PTV for treatme planning
7. BONUS: Draw “blocks”



Step 1: Contour the GTV

In eContour:

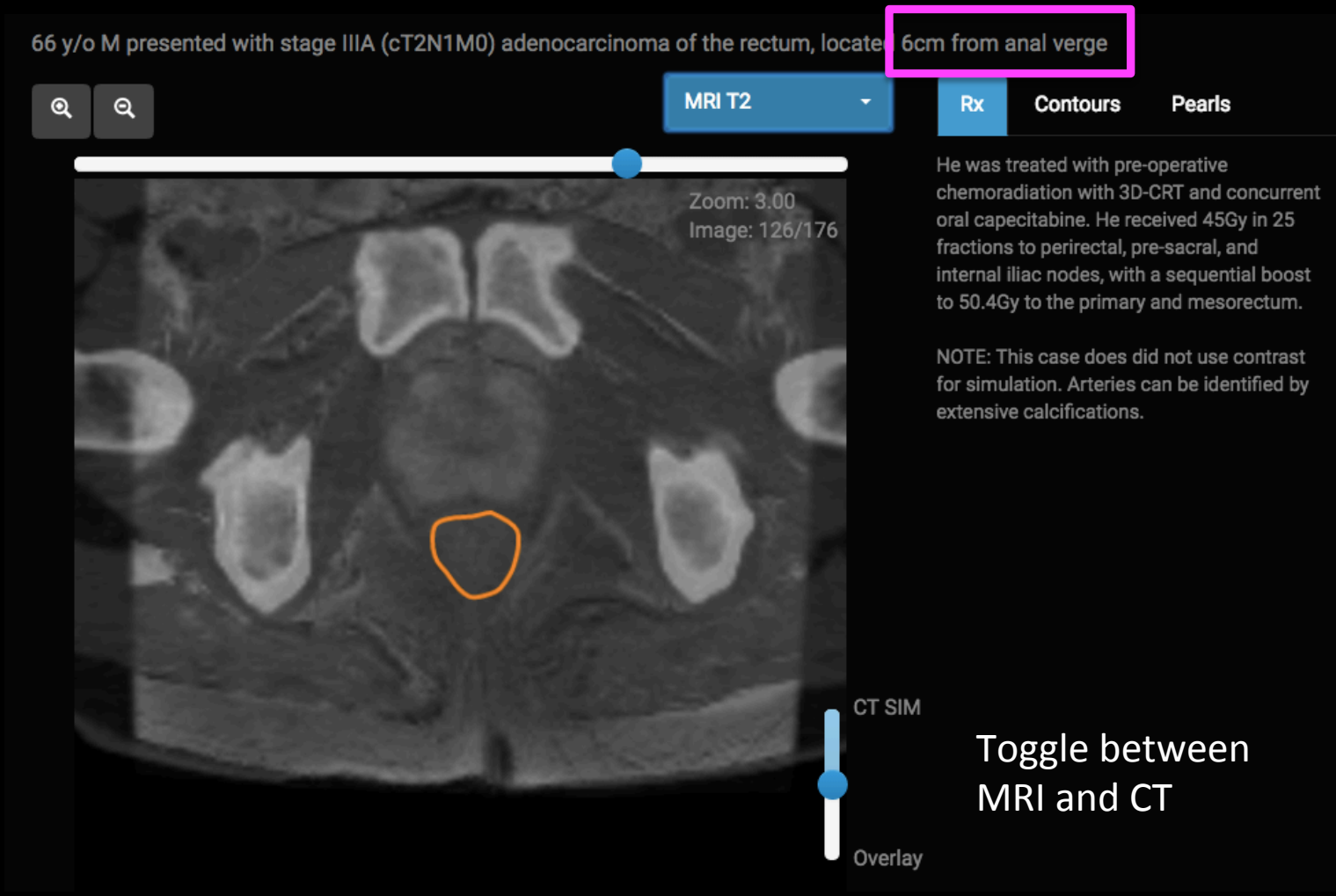
1. Turn contours OFF
2. Toggle overlay to MRI
3. Scroll through slices to view extent of tumor
4. Start your contour where the tumor is obvious



Contour GTV inferiorly

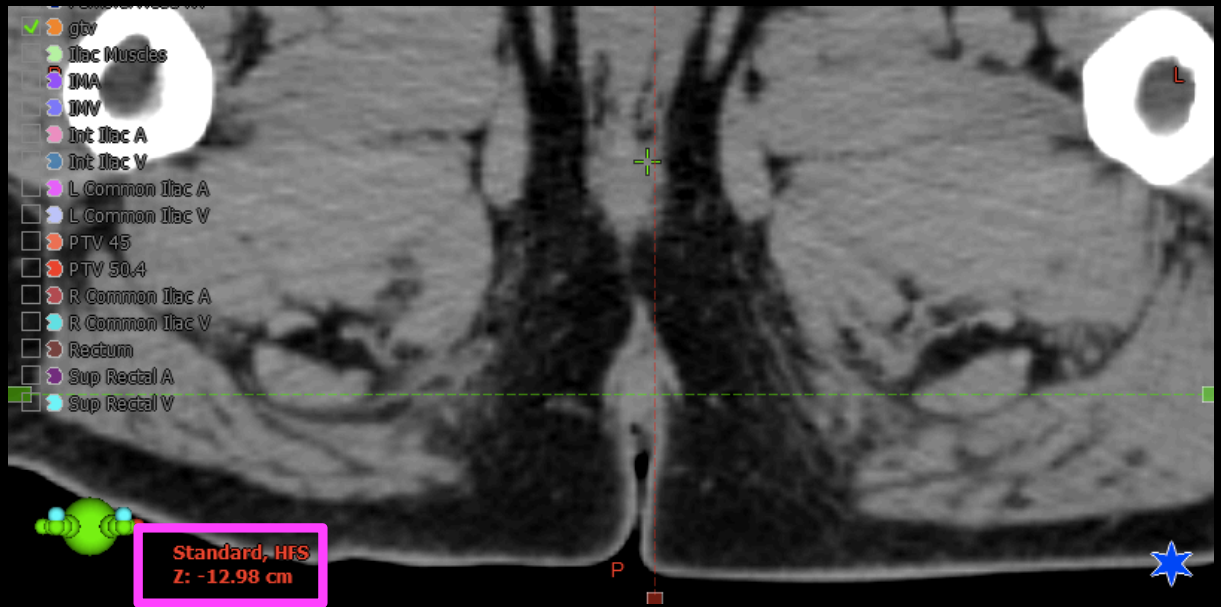
Assessment →

ALWAYS check your volume against exam/ colonoscopy findings since imaging is less sensitive



Toggle between MRI and CT

Measure distance GTV to anal verge (Option 1)

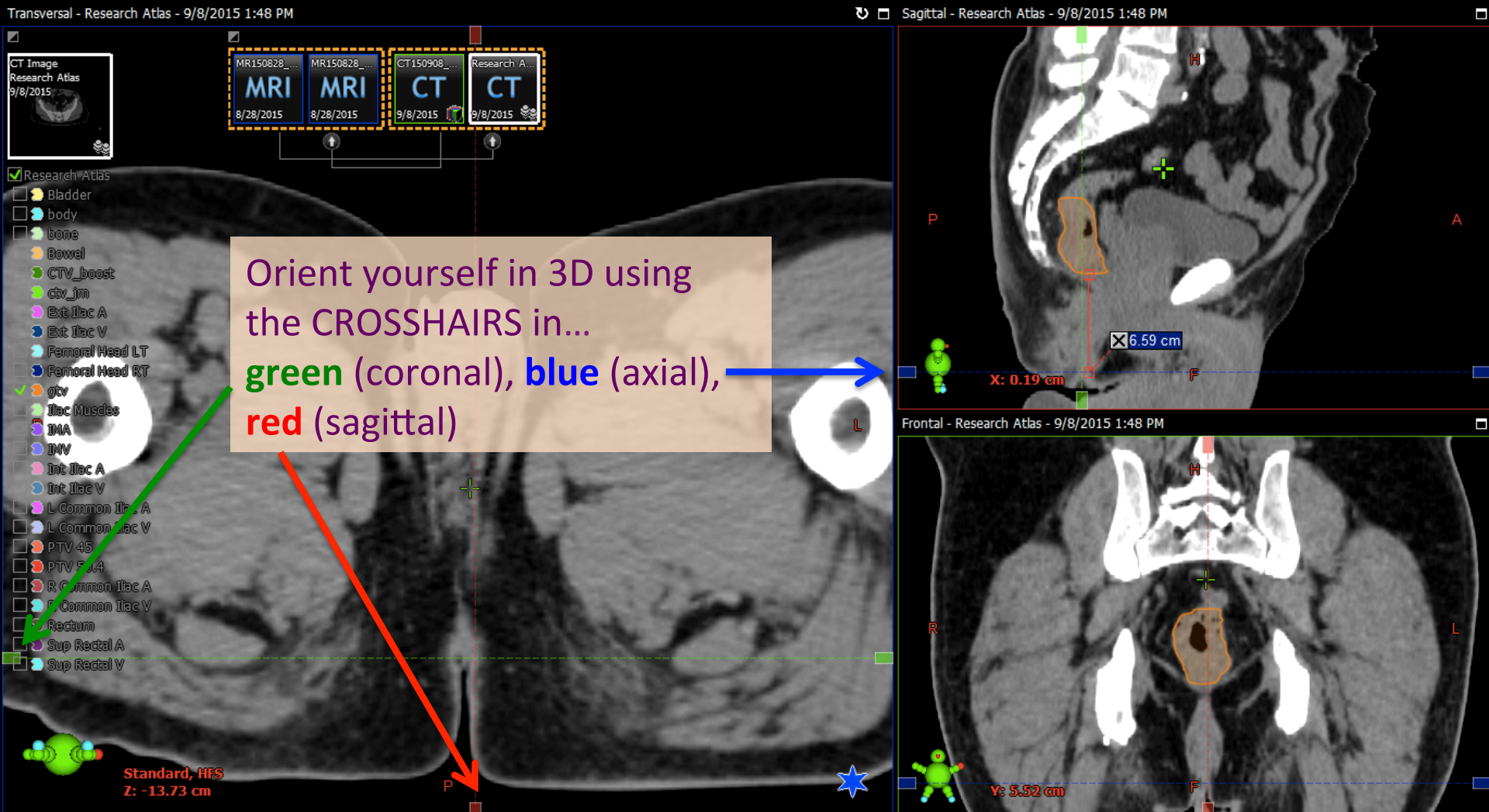


Look in lower left of your screen for the "Z" coordinate on last GTV slice (-6.98cm here).

Scroll down until you see the anal verge and again note the coordinate (-12.98cm here).

The difference is ~6cm, which was the distance noted on exam (which is better than imaging!).

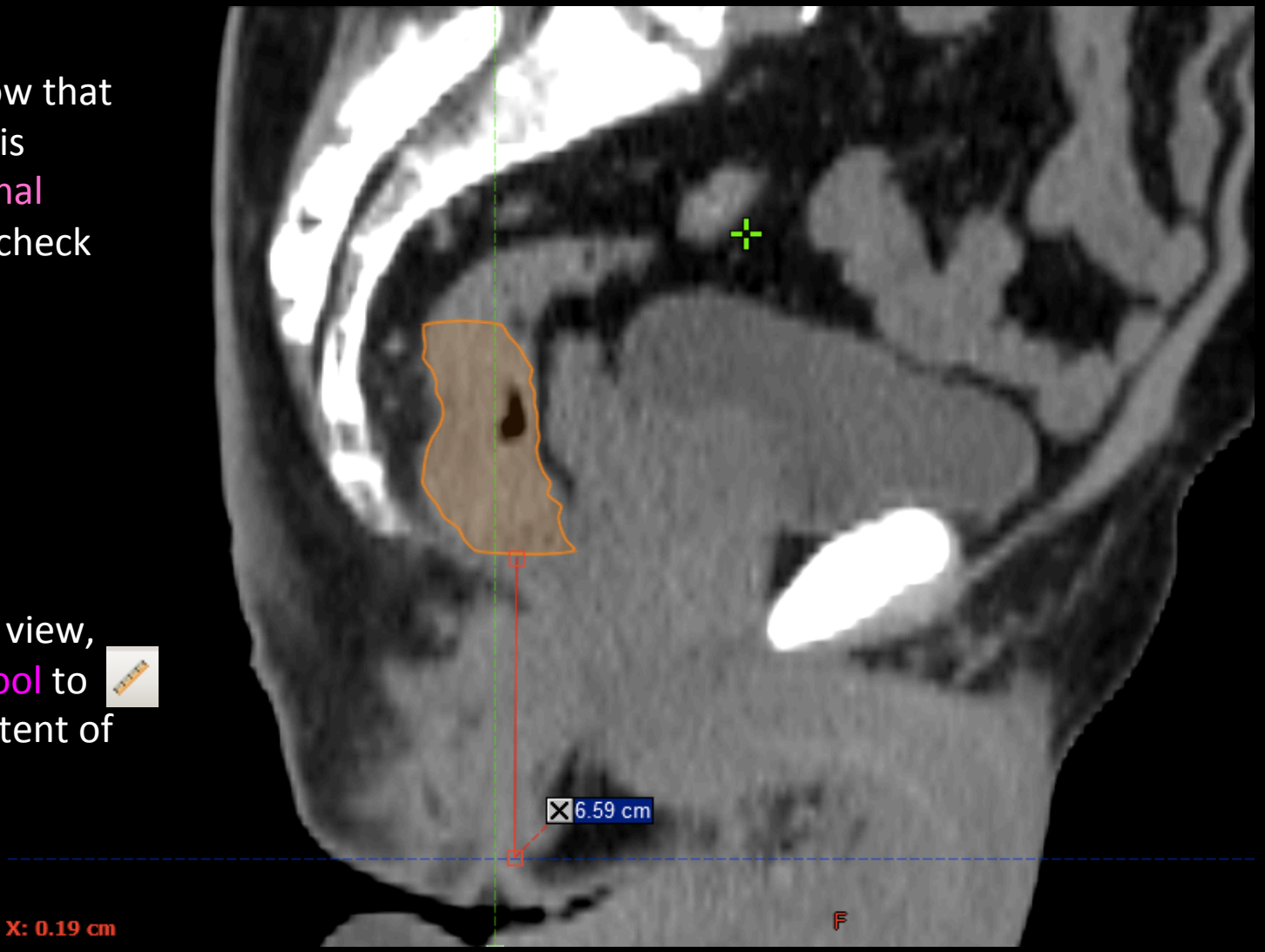
Measure distance GTV to anal verge (Option 2)



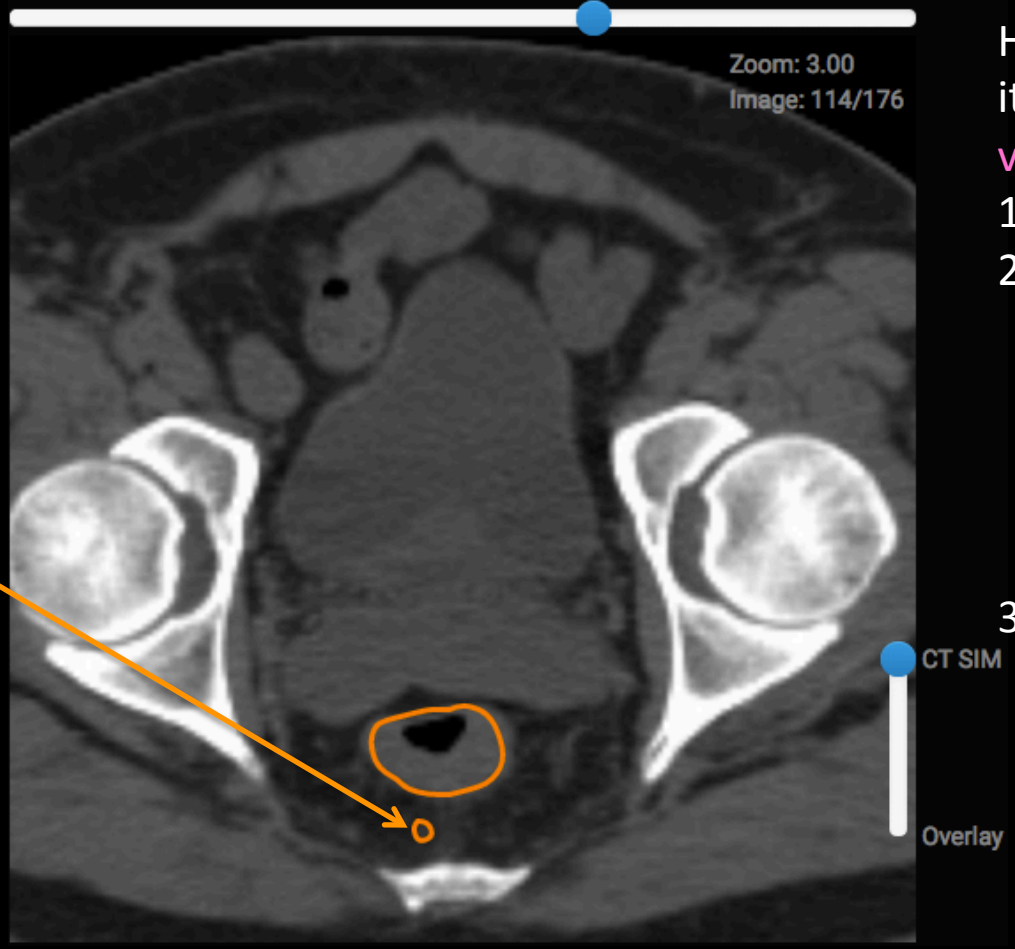
Try using the measuring tool

From this patient's *Assessment*, we know that on exam the tumor is located 6cm from anal verge…let's double check where we are at on SAGITTAL!

TIP: In the SAGITTAL view, use the measuring tool to check the vertical extent of your contour.



NOTICE: lymph nodes!*



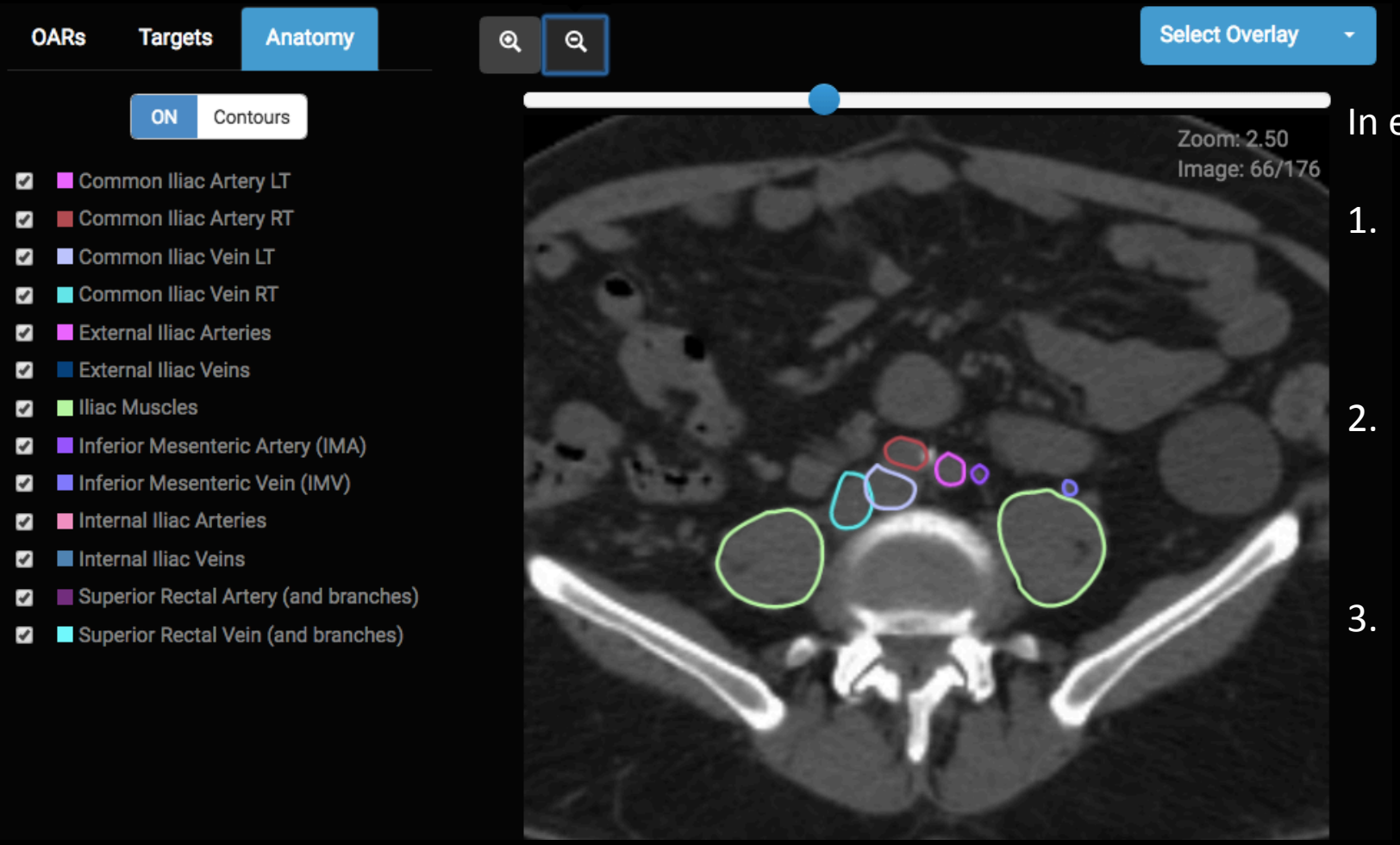
Enlarged perirectal lymph node

How do you know if it's a lymph node or a vessel?

1. Use MRI overlay
2. Scroll up and down: nodes will be rounded structures that disappear then reappear
3. Contour the vessels before contouring the GTV

**NOTE: These sub-centimeter perirectal nodes are contoured in the GTV to show you they are in the standard CTV. These DO NOT need to be contoured unless grossly enlarged.*

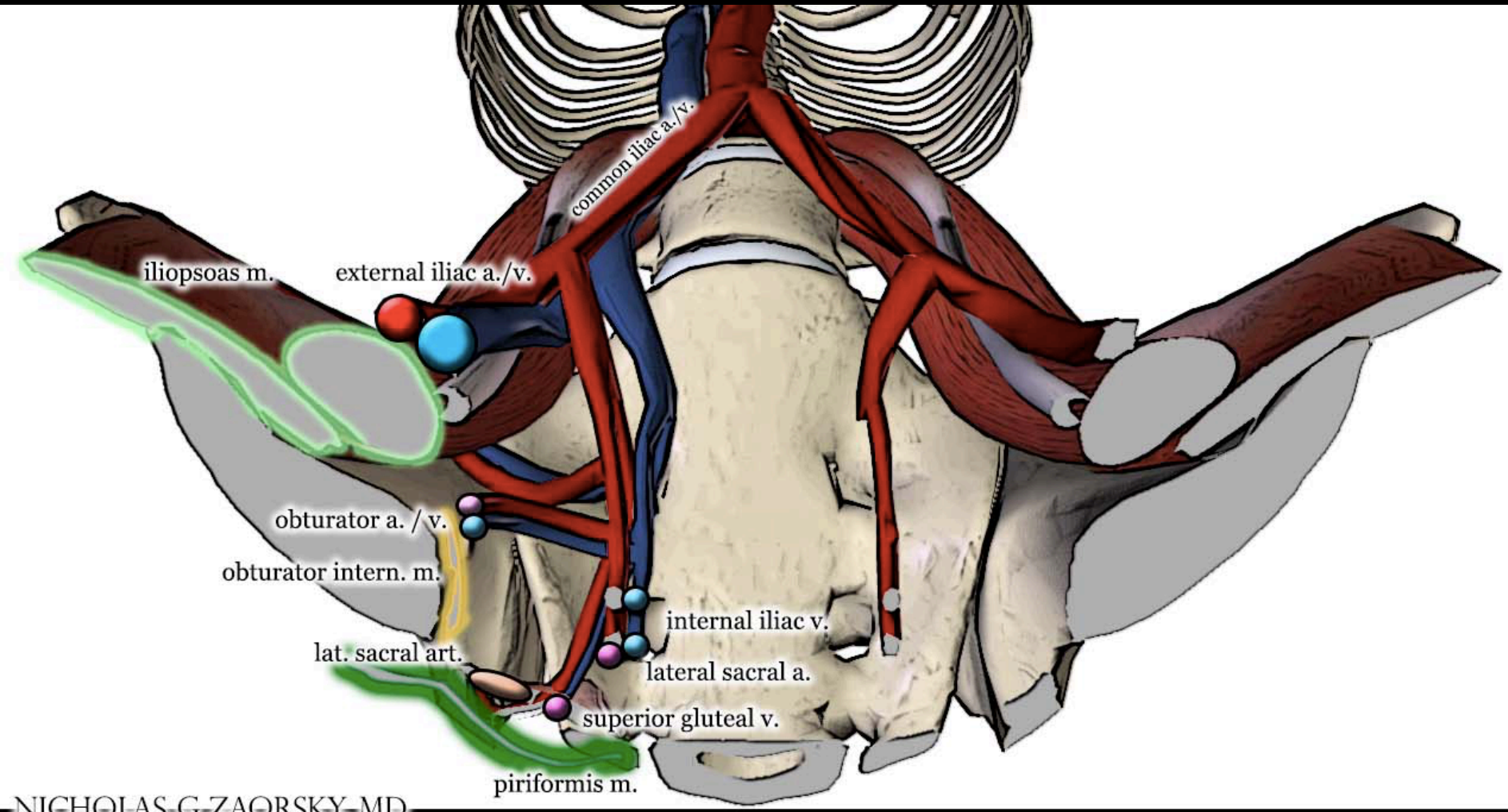
Step 2: Review anatomy of pelvic vessels (which will define lymph nodes at risk!)



In eContour:

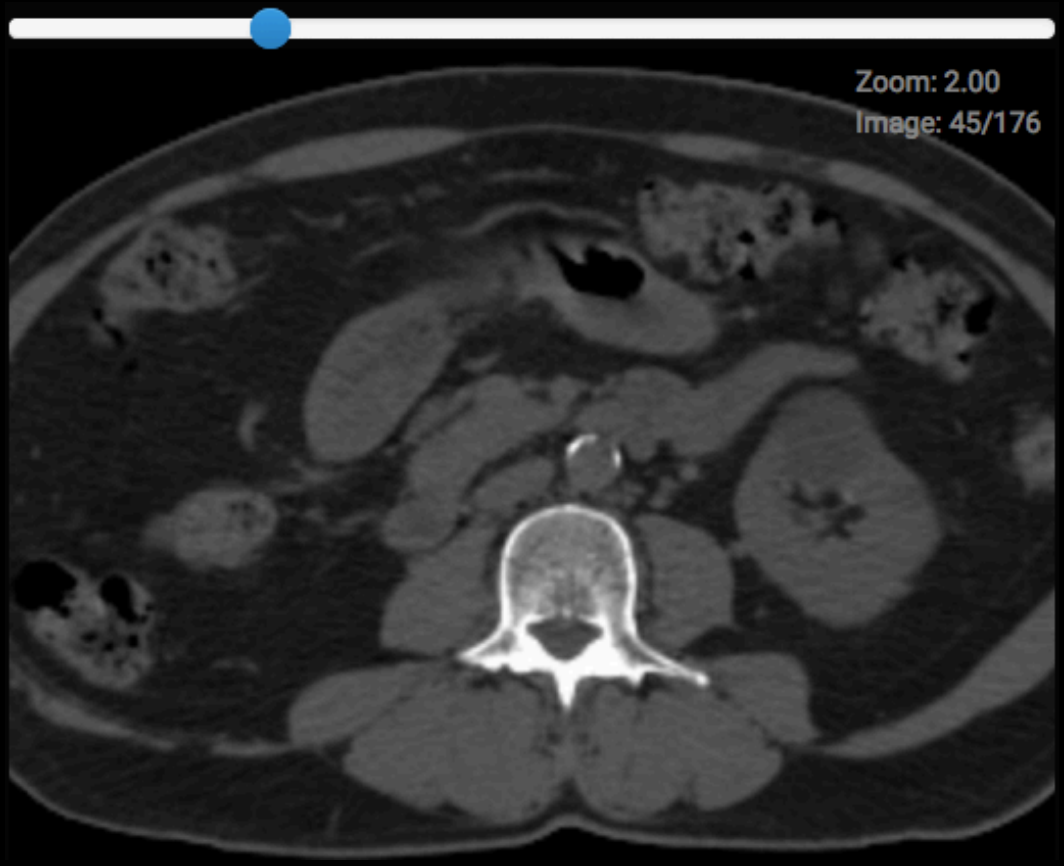
1. Turn off all contours EXCEPT "Anatomy"
2. Contours start where aorta and IVC branch
3. Scroll inferiorly, following branches

Axial view of vessels



Can you follow these vessels on CT?

1. Now turn off ALL contours
2. Start at abdominal aorta
3. Scroll inferiorly, following branches

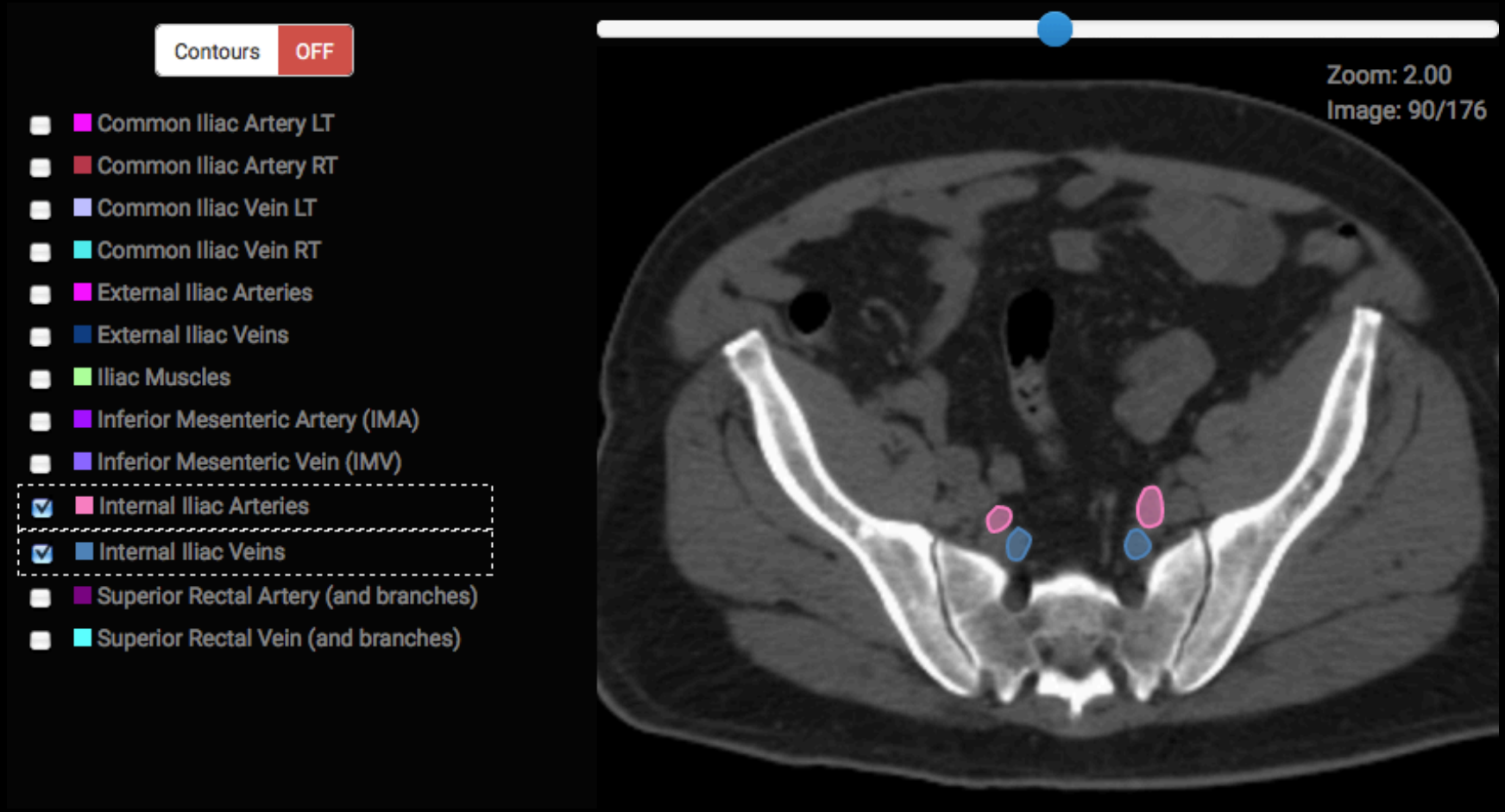


Lymph nodes sit on vessels (just can't see them when not enlarged).

This is why we contour vessels in nodal CTV

Aorta (artery) or IVC (vein) → Common Iliacs (R and L) → Internal iliac (go posterior/in front of sacrum) and External Iliacs (go anterior…become inguinal/femoral when exit pelvis)

Use anatomy contours



Confirm your findings by individually turning on the contours for each structure

Step 3: Contour your CTV

These are the consensus CTVs for anorectal cancer

CTVA: For this atlas, defined to be the regions that would always be treated for rectal cancer: internal iliac, pre-sacral, peri-rectal.

CTVB: external iliac nodal region

CTVC: inguinal nodal region

For anal cancers, the elective regional target volume would include all three. For rectal cancer, in most cases, CTVA would be the only volume to receive elective radiation. However, for certain presentations (e.g. extension into GU structures, extension to the peri-anal skin) one could consider adding the external iliac (CTVB) and even the inguinal regions (CTVC).

RTOG Anorectal contouring atlas

In rectal cancer, external iliac nodes (CTVB) and inguinal nodes (CTVC) are not at risk of tumor spread*, so we will only contour CTVA

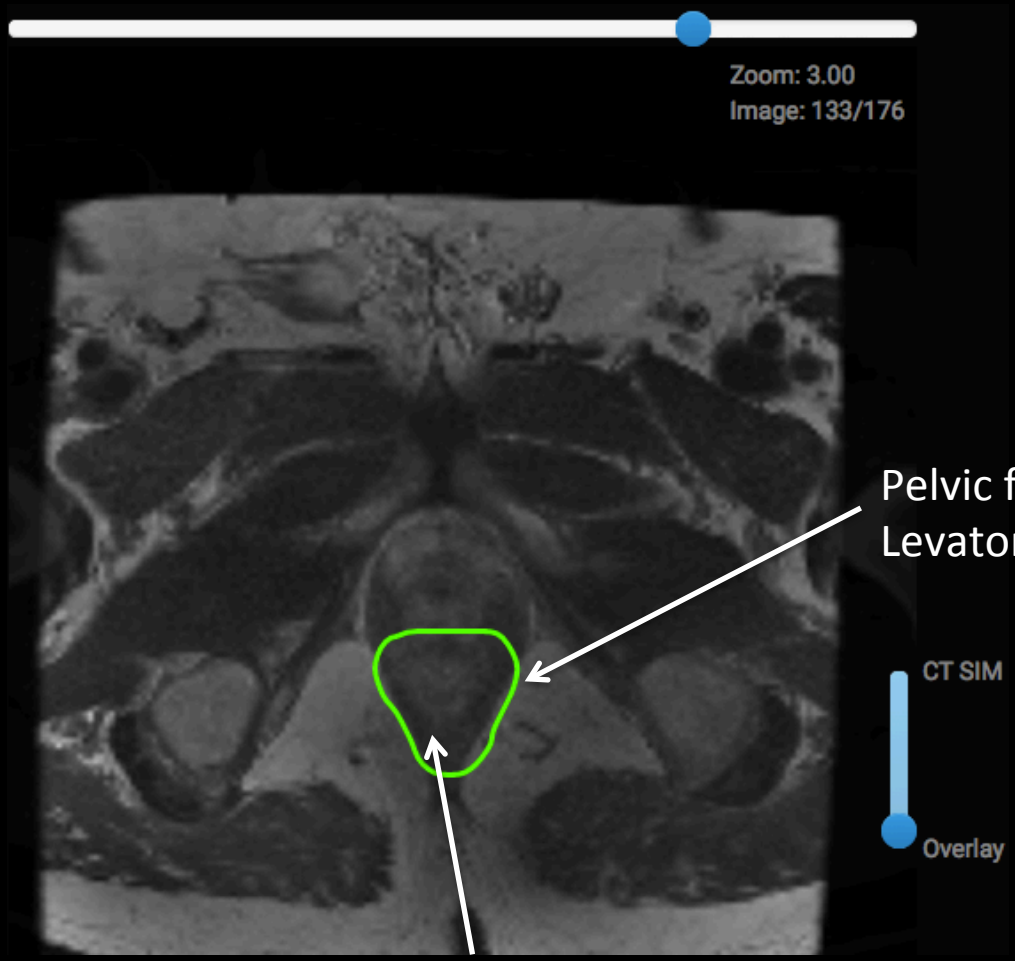
*(*FYI The anal canal drains to the inguinal nodes, which is why they are treated in anal cancer)*

Caudal (inferior) extent of CTV

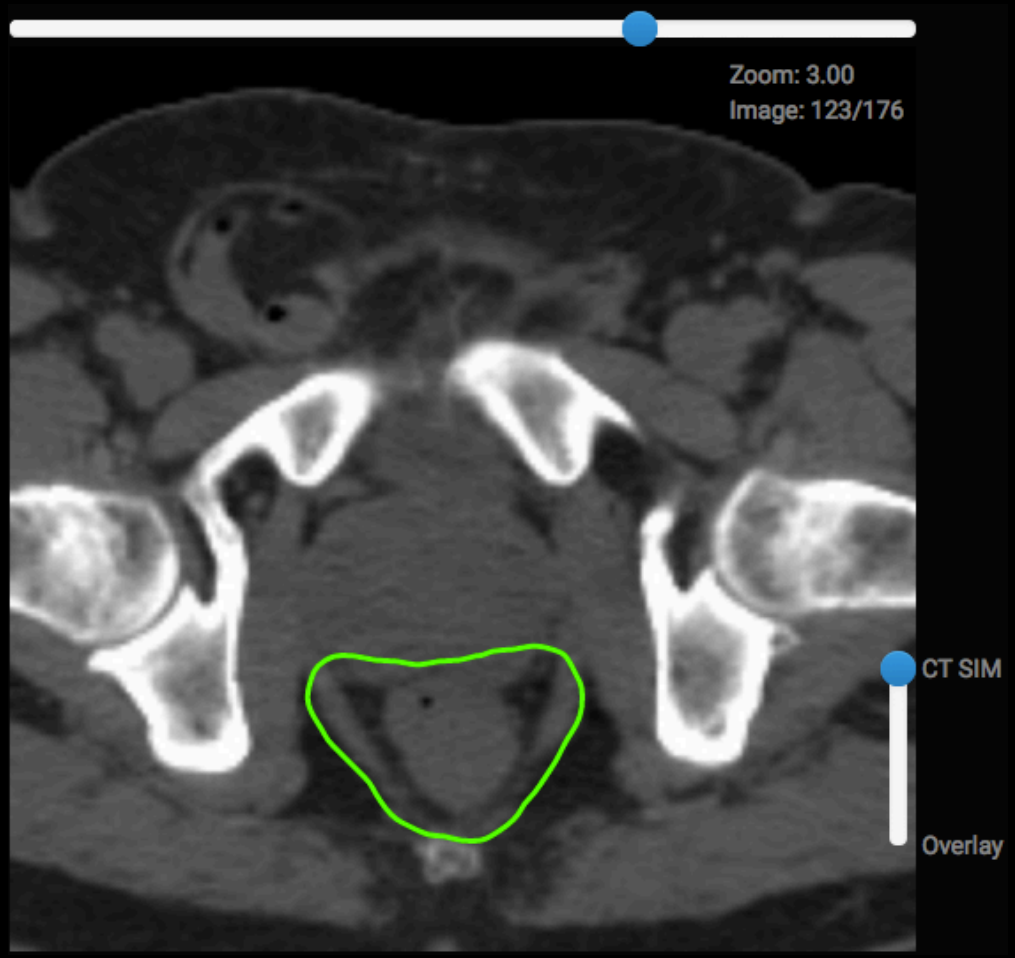
(Muscles and connective tissue of pelvic floor are better visualized with MRI)

1. CTV should extend at least to the pelvic floor, even if upper rectal cancer

2. Extend to a minimum of 2cm caudad to GTV



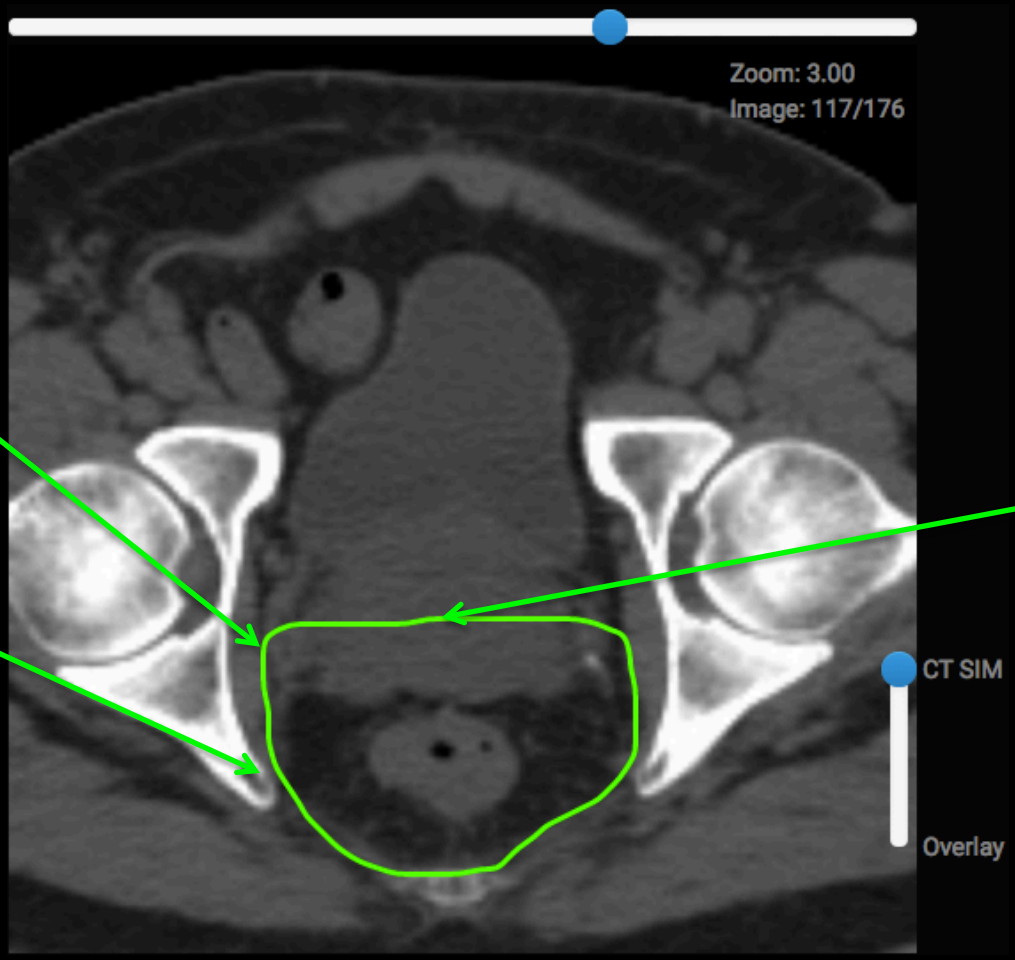
CTV in low pelvis



Scrolling through the CT images, moving superiorly

CTV in low pelvis

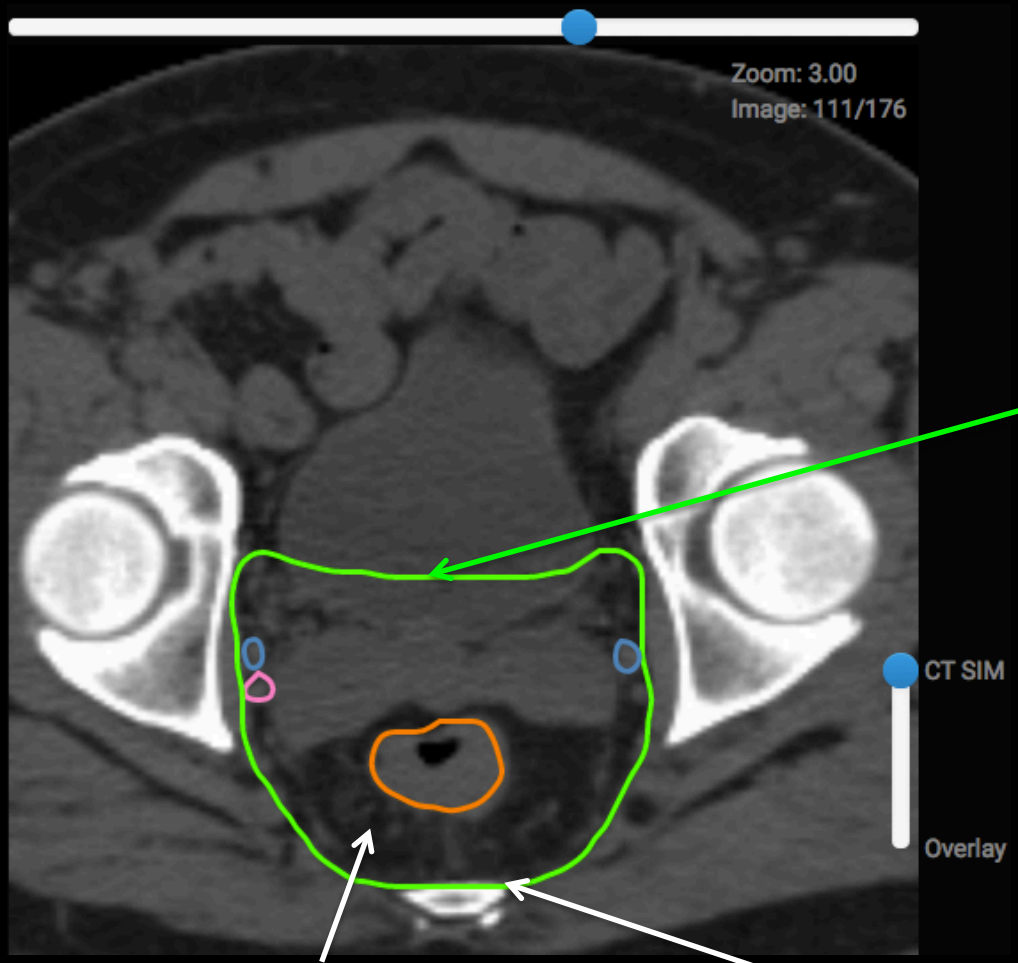
Posterior and lateral margins: Extend to lateral pelvic muscles or bone



Anterior margin: Extend into prostate/seminal vesicles in a male (vagina for female)

CTV in mid-pelvis

CTVA covers:
Rectum
Mesorectum
Internal iliac vessels
Presacral space



Anterior margin:
Extend 1 cm into posterior bladder wall

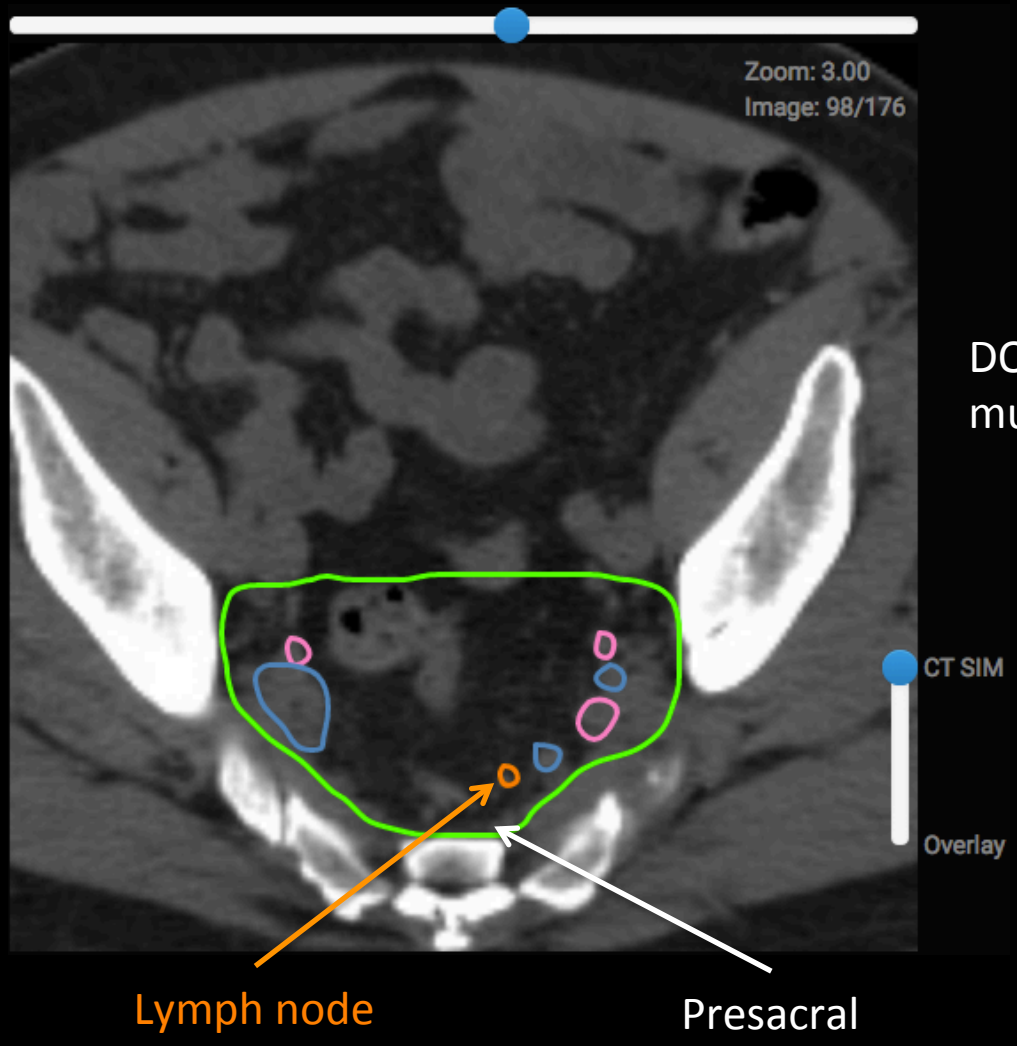
Mesorectum (peri-rectal)

Prsacral

Moving superiorly in CTV

Include internal iliac arteries and veins

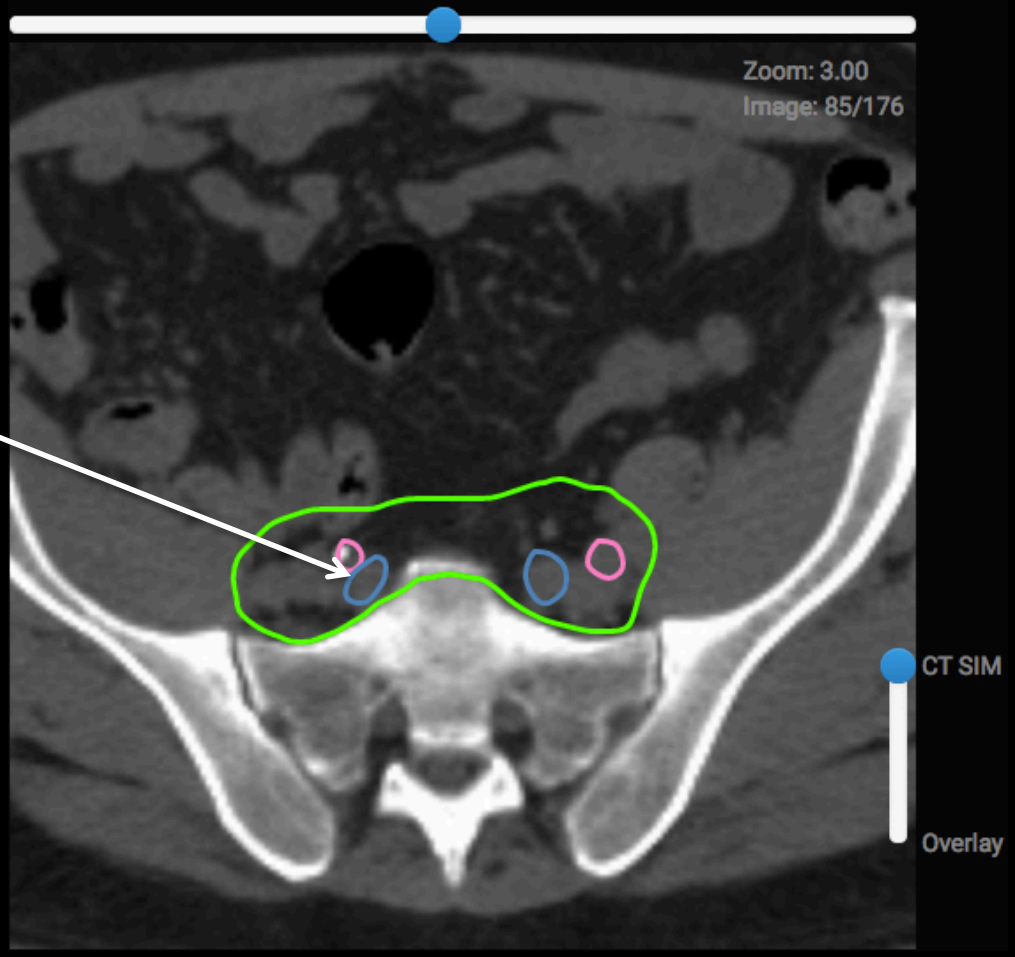
NOTICE: posterior border of CTV abuts external iliac vessels (which we do NOT include unless T4 tumor invading prostate or vaginal anteriorly)



DO NOT include muscle or bone

Cephalad (superior) extent of CTV

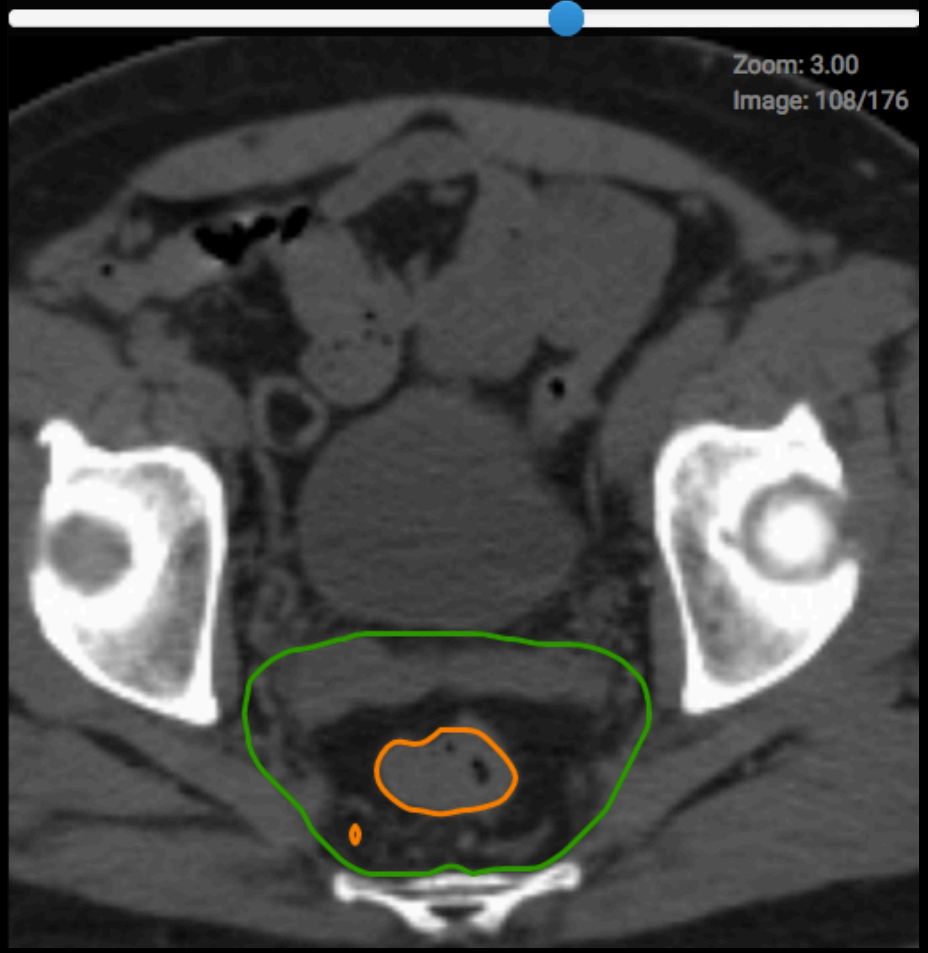
Continue contour up to where the common iliacs bifurcate OR L5/S1 interspace*



*Rad onc is amid a transition away from bony anatomy to guide contours (instead contouring soft tissue), but it still pervades in many ways – including pelvic nodal upper borders (ie L5/S1).

Step 4: Add a CTV Boost volume

Sequential boost means additional treatments to give higher dose to smaller volume



Extend CTV to cover entire mesorectum and presacral region at level of GTV, with a minimum 2cm margin on GTV cephalad and caudad

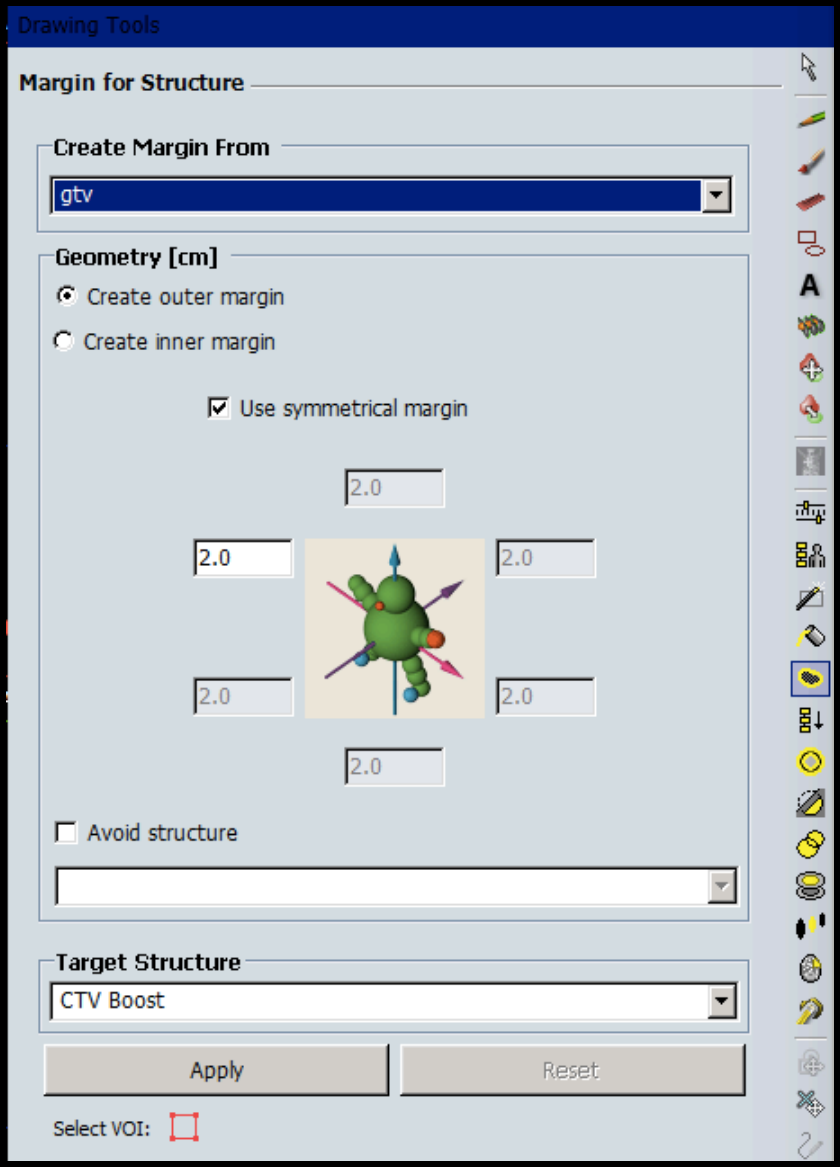
But how do I do this?? Next slide…

Add margin for CTV Boost

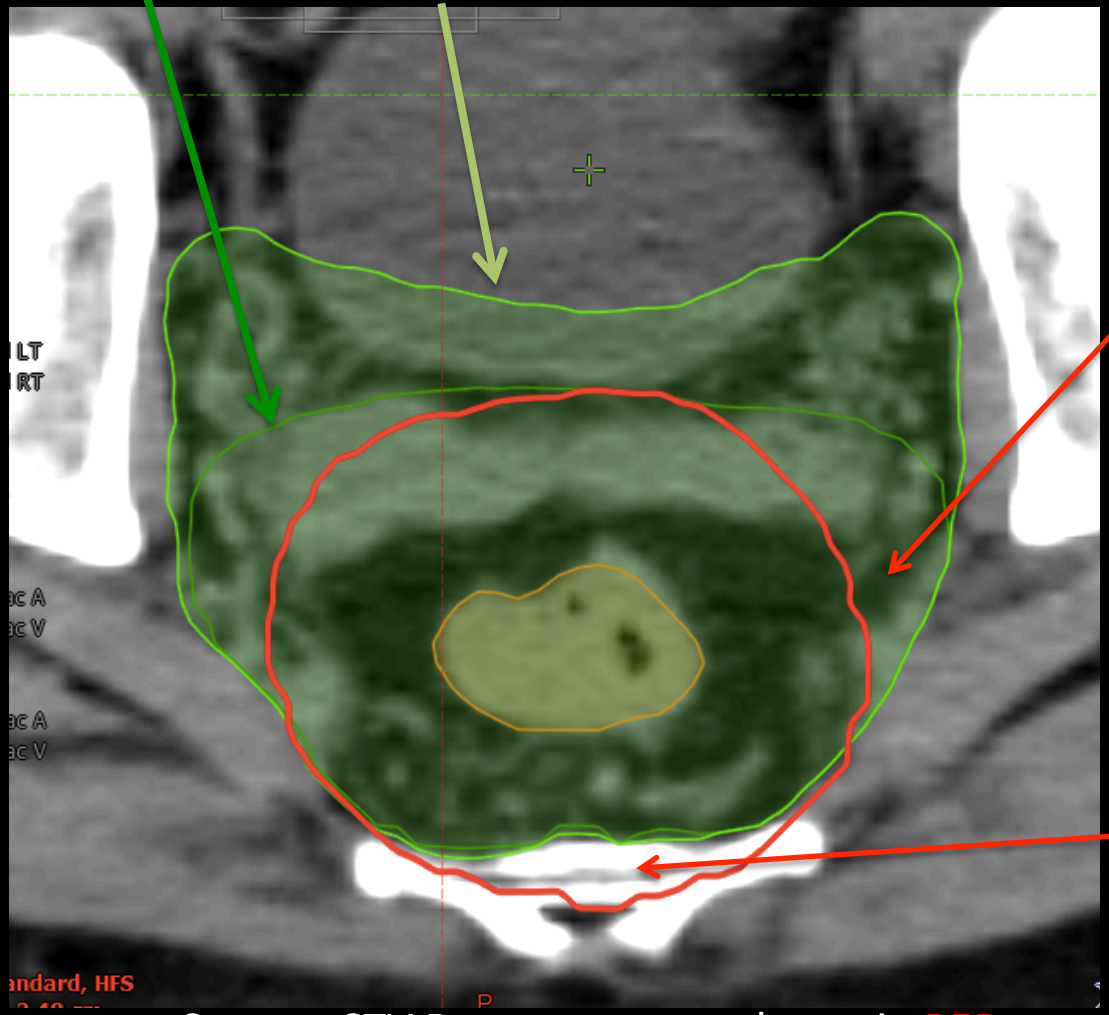
1. Start with 2cm margin from GTV using "Margin for Structure" →

2. If entire mesorectum and presacral area is not included in this 2cm expansion, use brush/pen to expand contour (next slide)

3. "Crop" contour that extends outside CTV (next slide)



Editing CTV Boost



Current CTV Boost structure shown in RED

Now we have 2 problems:

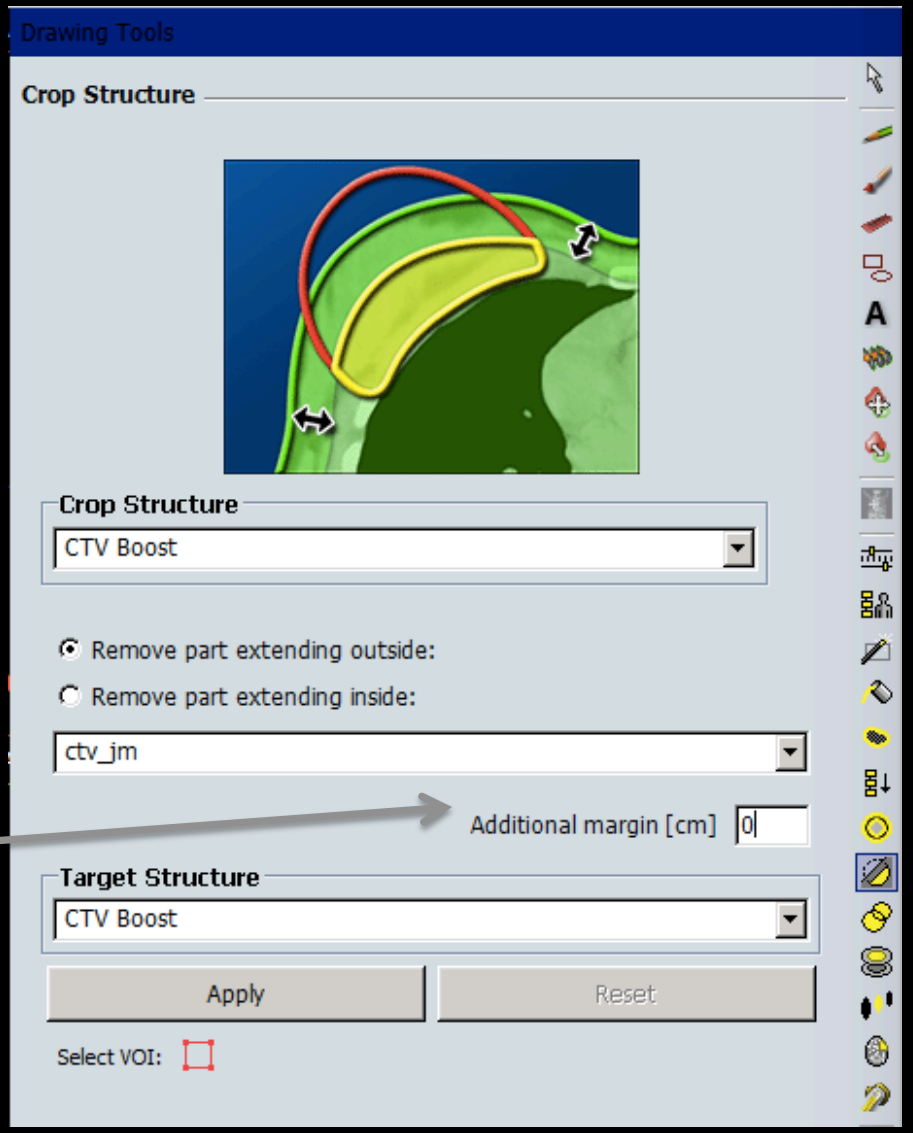
1. The entire mesorectum is not included in our volume
   - SOLUTION: Use pen/ brush to expand the volume (final CTV Boost in dark green)

2. The contour extends outside CTV (and into bone!)
   - SOLUTION (next slide)

Editing CTV Boost

"Crop" contour that extends outside CTV →

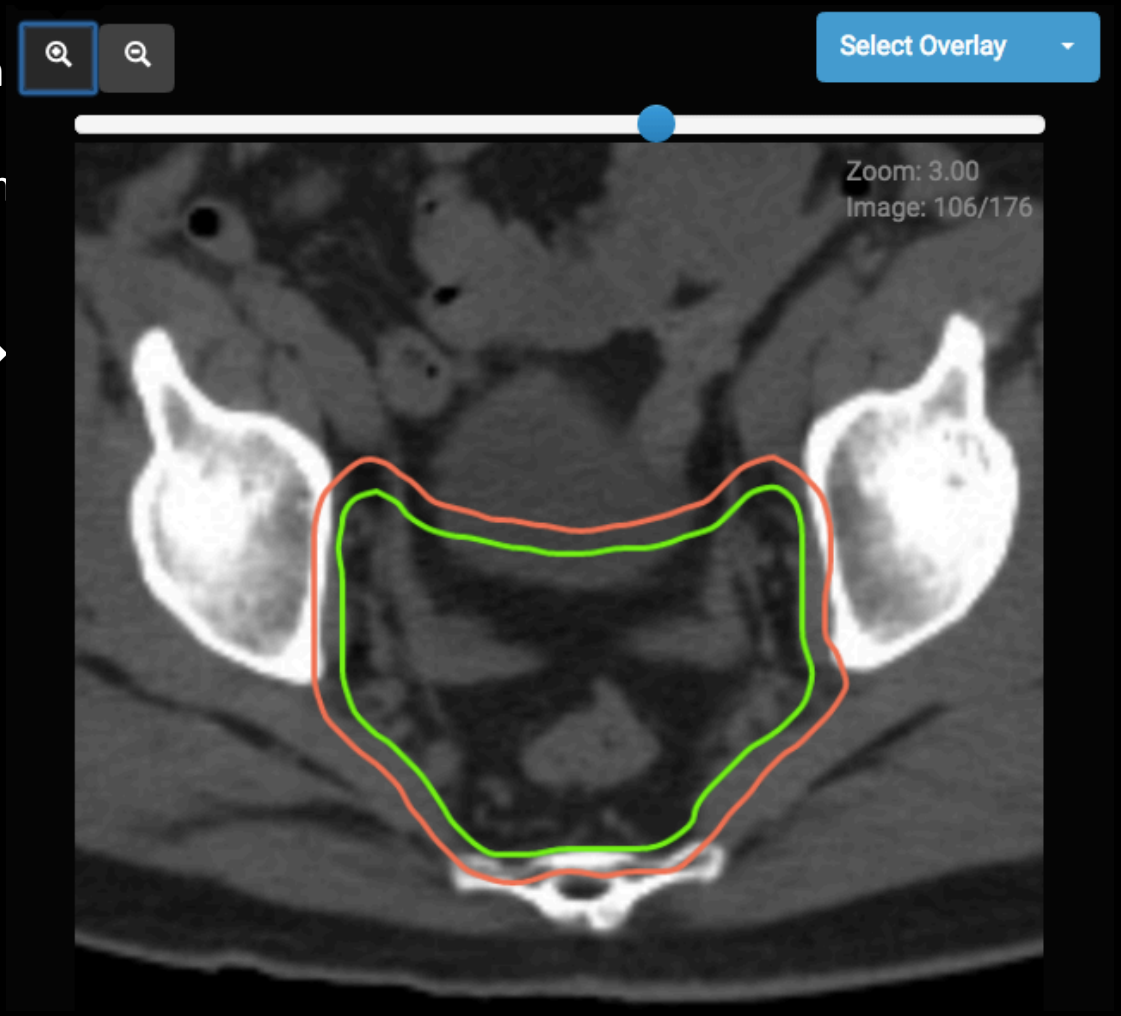
NOTE: Sometimes you will want to crop with an additional margin (ie 0.3cm margin PTV to skin in H&N)



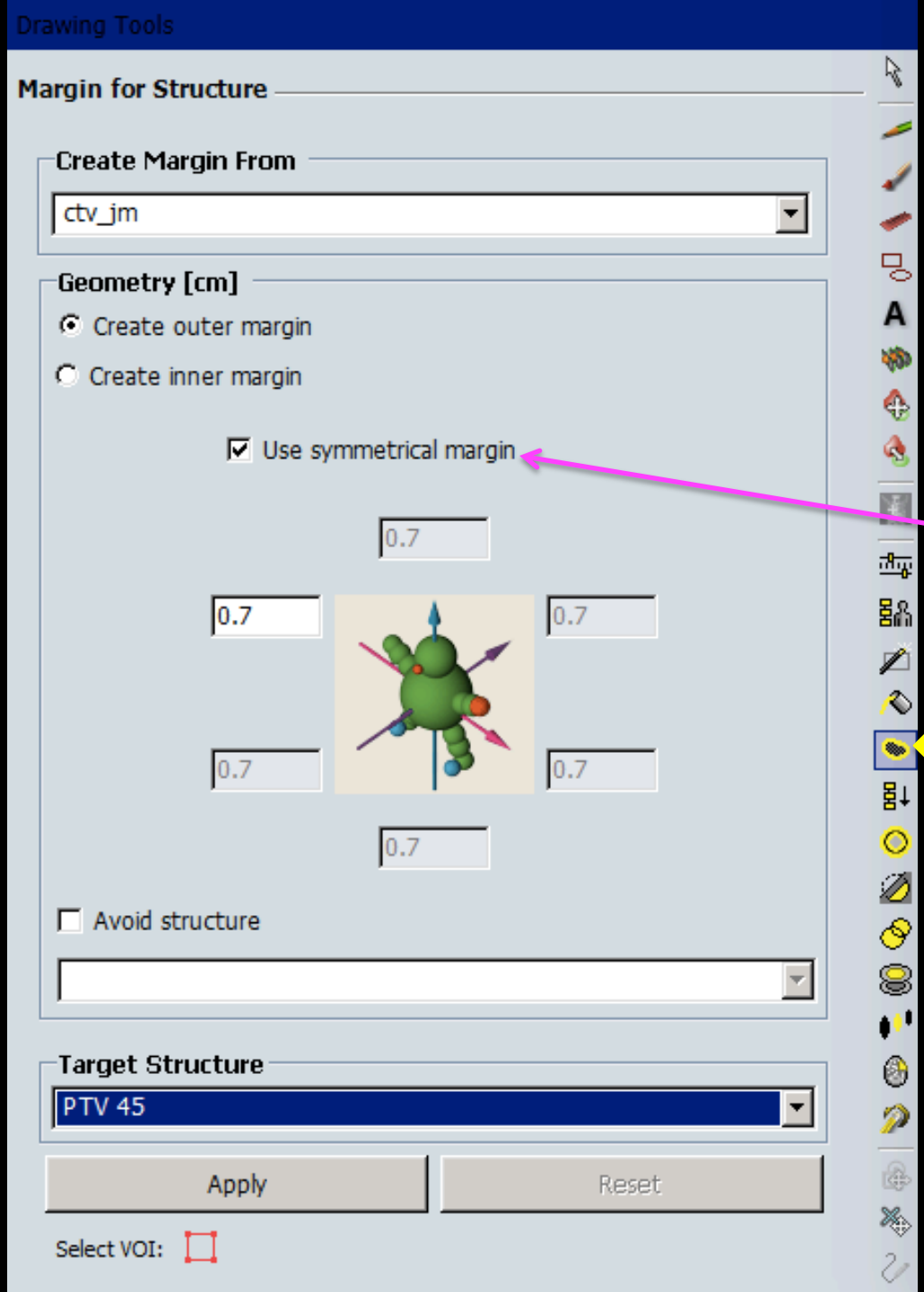
Step 5: Add a margin for PTV

7-10mm margin on CTV is usually sufficient to accoun for pelvic motion

CTV+7mm = PTV →



We've done this before …



Add a margin for PTV

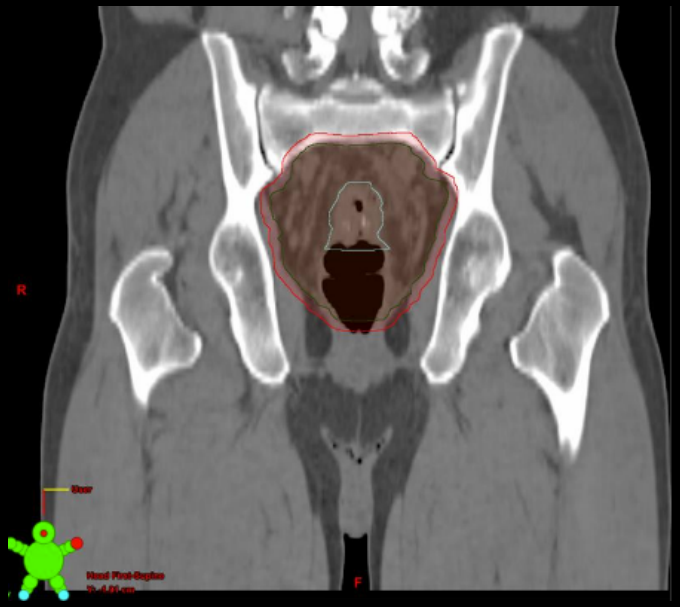
NOTE: all margins same

"Margin for structure"

REPEAT this step for CTV boost

Sagittal

Coronal



Always check your final volumes in sagittal and coronal views to make sure you have contoured a volume that makes sense in 3 dimensions!

BONUS: You can compare your volumes to "bony anatomy" blocks (next slide)

Images reproduced from:
https://www.astro.org/uploadedFiles/_MAIN_SITE/Affiliate/ARRO/Resident_Resources/Educational_Resources/ARROcase/Content_Pieces/ARROContourRectal.pdf

FOR FUN: Draw blocks/MLCs!

You will need to go to "External Beam Planning" in your treatment planning system

eContour → "Pearls" tab describes borders for 3D conformal blocks

NOTE: classic borders for a 3-field beam arrangement were based on BONY ANATOMY. With CT simulation, we can contour areas at risk, and decrease our margins. However, fancy treatment planning (with **IMRT**) did not improve outcomes on RTOG 0822 (which is DIFFERENT from anal cancer).

The margin from PTV to "block edge" (meaning, the shape of you MLCs) is suggested to be about 7mm because the dose at the end of the field is ~50% (requires some build-up in tissue to get to 100% prescription dose).

Rx | Contours | **Pearls**

- CT simulation:
  - some institutions use prone position
  - consider placing flexible endorectal tube and radiopaque skin markers
- Anatomy:
  - Aorta –> IMA –> superior rectal artery (per Radiopaedia)
  - Superior rectal vein –> IMV –> splenic vein which joins with SMV (at pancreas) to form portal vein (per *e-Anatomy* and wikipedia)
- OARs:
  - femoral head and neck
  - bowel (tight margins on bowel with ~1cm above PTV)
  - rectosigmoid largely included in CTV so not an avoidance structure
- Fields and Blocks:
  - 3-field (opposed laterals + PA)
  - PTV + 0.5-1cm to block edge
  - *Posterior border:* traditionally entire sacrum included
  - *Anterior border:* traditionally T3 to back of symphysis and T4 to front of symphisis (includes external iliacs)

References

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  - RTOG 0822 actually showed no difference between IMRT and 3D-CRT. This could still be a reference to guide contouring and placement of 3D blocks per the 3D-CRT arm.
  - https://www.rtog.org/ClinicalTrials/ProtocolTable/StudyDetails.aspx?study=0822
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