



MDS Instructor

3D WBRT Treatment Planning



This course will give an overview of the radiation planning process for a whole brain radiation therapy treatment. We will use 3D treatment planning techniques and simple lateral opposed beam arrangements. We will also walk through some of the fundamentals of

≡ Simulation

≡ Contouring

≡ Beam Setup

≡ Treatment Planning

≡ Plan Evaluation

Simulation



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Simulation is a process that allows radiation treatment fields to be delivered in a reproducible manner. The simulator is a large-bore computed tomography (CT) scanner. The CT images are used to delineate targets as well as organs at risk, which allows the dosimetrist or physician to arrange the radiation beams and make a customized plan. It is here that special care is taken to make the patient as comfortable as possible, to ensure treatment can be delivered in the same position each day.

- Imaging: CT simulation, ≤ 0.3 cm thickness
- Position: Supine
- Immobilization: Head immobilization
- Technique: 3DCRT
- Image-guidance: At least weekly image verification (EPID On-board imaging)

CT Simulation

Immobilization

For WBRT treatment immobilization, there exist a variety of commercially available head immobilization devices, most commonly thermoplastic masks with a custom head-rest. To obtain more precise positioning, generally not required for whole-brain radiotherapy, a stereotactic thermoplastic mask may be used.

For CT scan simulation involving the brain, the patient is placed in the positioning device and scanned. The isocenter or reference markers are selected and marked on the thermoplastic mask.

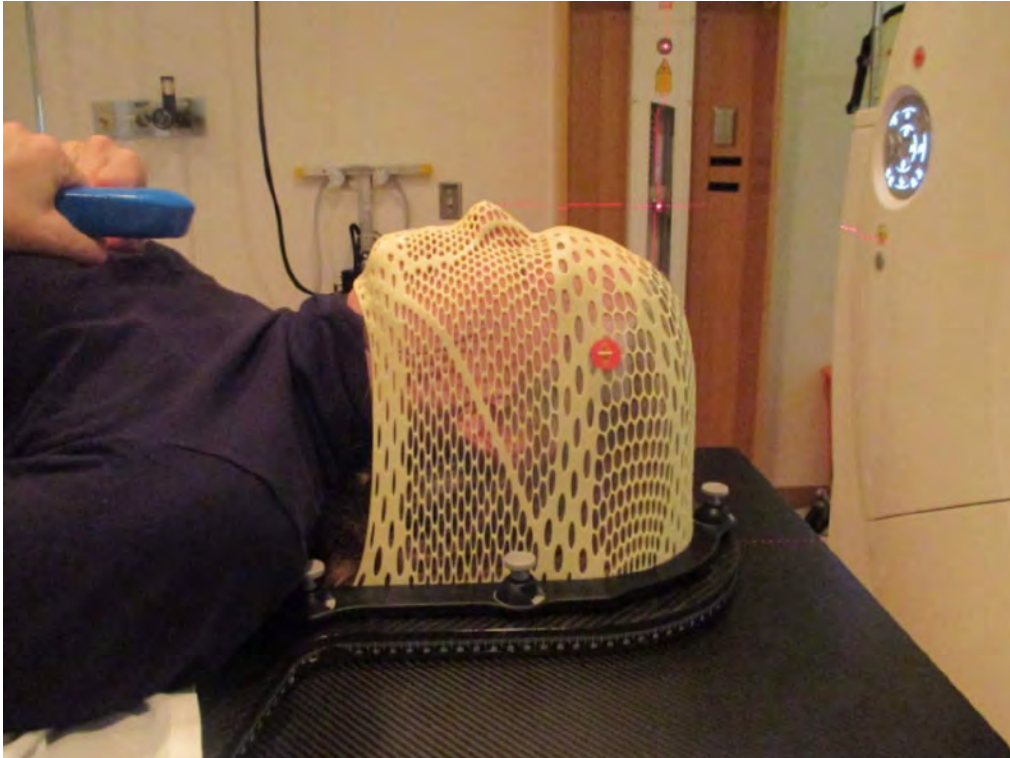


Simulation

Mask markings (bb)

After the markings on the mask are made, the therapists will take several photographs of the patient in the simulation position. The photographs and marks will be used as guides to position the patient correctly each day during treatment.

Markings are usually marked on the patient's mask as shown above.



Mask: 5 point mask

A five-point mask, reinforced along the chin.

Sometimes a five point mask is used to reinforce along the chin and help with shoulder placement.



Contouring



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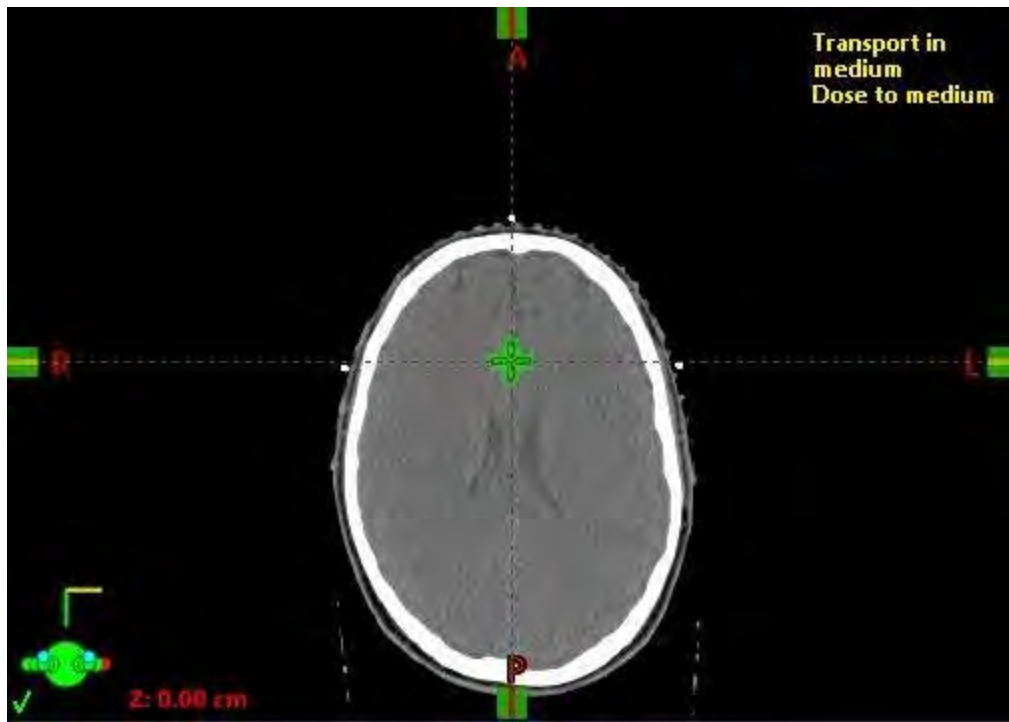


Import & Localization

There are many steps in generating a treatment plan. Each patient starts with the Importing and Localization of the CT images into the treatment planning system.

Step 1

Importing and Localization



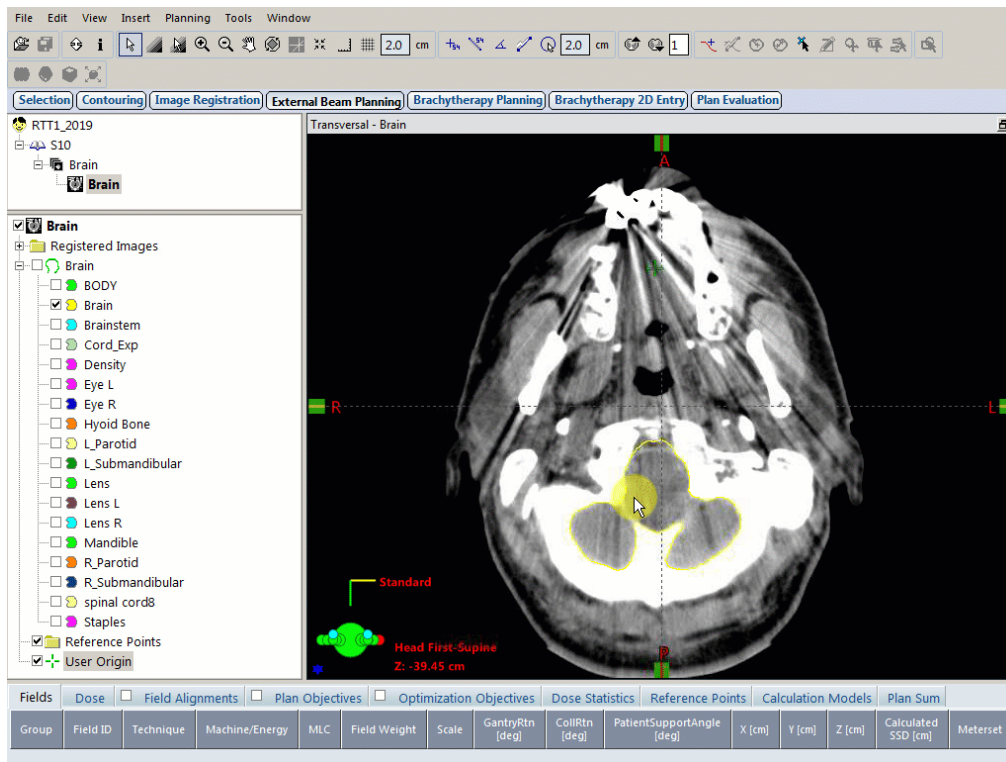
After a patient is simulated, the CT data set is imported into the Treatment Planning System. These images are in DICOM format and you may hear people referring to this folder as the DICOM import folder.

Once imported, the CT scan is used to localize the patient--a system of coordinates/markings is used to track the patient's geometric location in space.

At the time of sim, a patient is often marked to facilitate set up during treatment, BBs are often used to mark this setup location in a triangular fashion, generally 3 points (anterior and laterally). We will set the user origin or localization at this location.

Step 2

Set User Origin Eclipse (Localization)

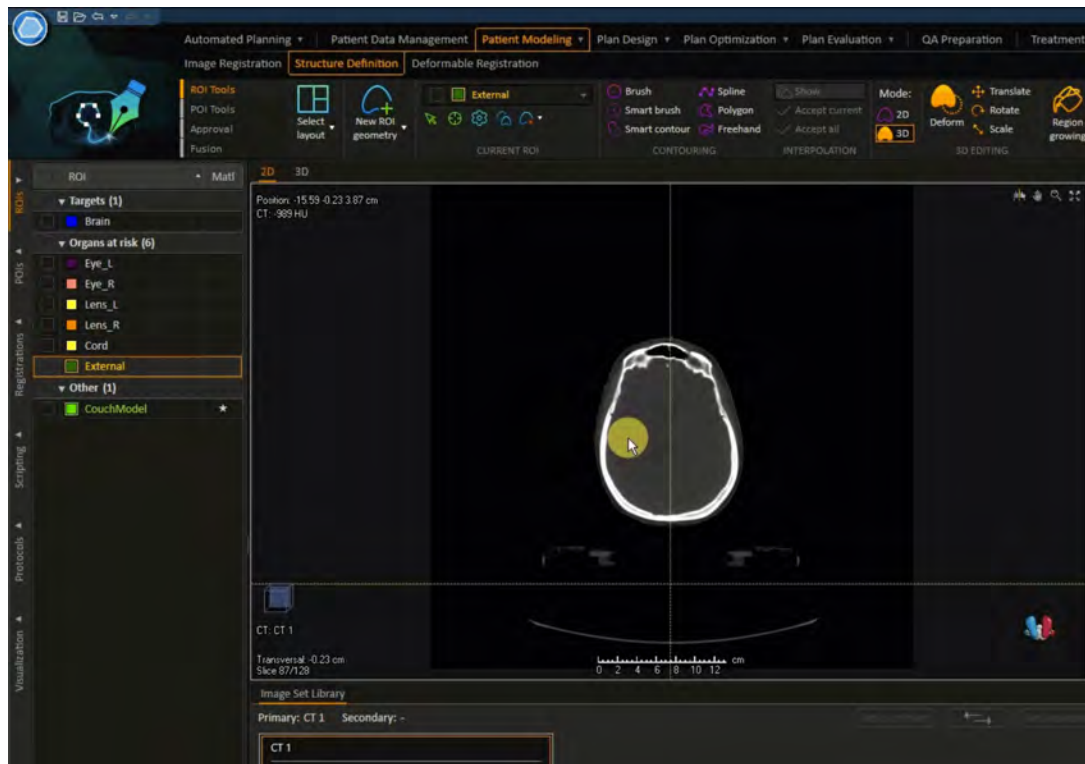


Next, we will set the user origin for the image. This will localize the coordinate systems to the TPS.

To Localize the patient, scroll to the slice of the bbs and set user origin to viewing plane intersection

Step 3

Set User Origin RayStation (Localization)

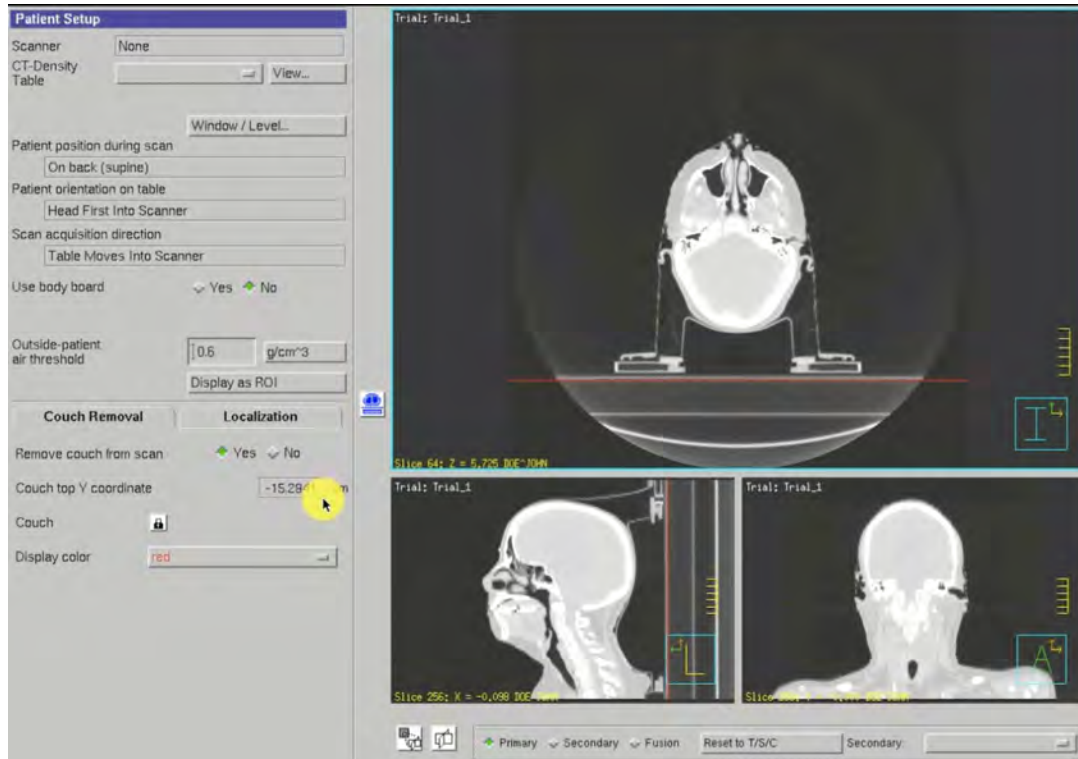


Set the Localization for the image. This will localize the coordinate systems to the TPS.

To Localize the patient, scroll to the slice of the bbs and set user origin to viewing plane intersection

Step 4

Set User Origin Pinnacle (Localization)



Set the Localization for the image. This will localize the coordinate systems to the TPS.

To Localize the patient, scroll to the slice of the bbs and set user origin to viewing plane intersection

Summary

You can use this workflow for other treatment sites as well. (Brain, Thorax, Abdomen, Pelvis, and Extremities).

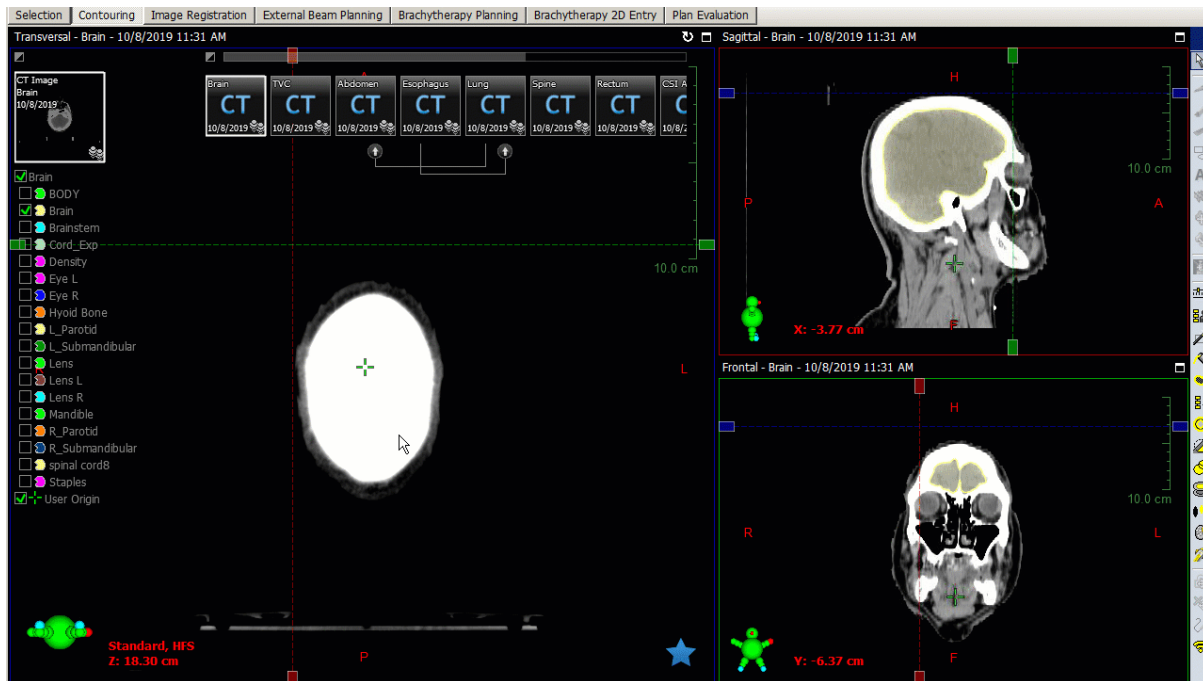
Just import the DICOM images, scroll to the setup marks and set the user origin to the triangulation location.

Contouring

Here we'll contour in the structures relevant to the WBRT treatment plan.

Step 1

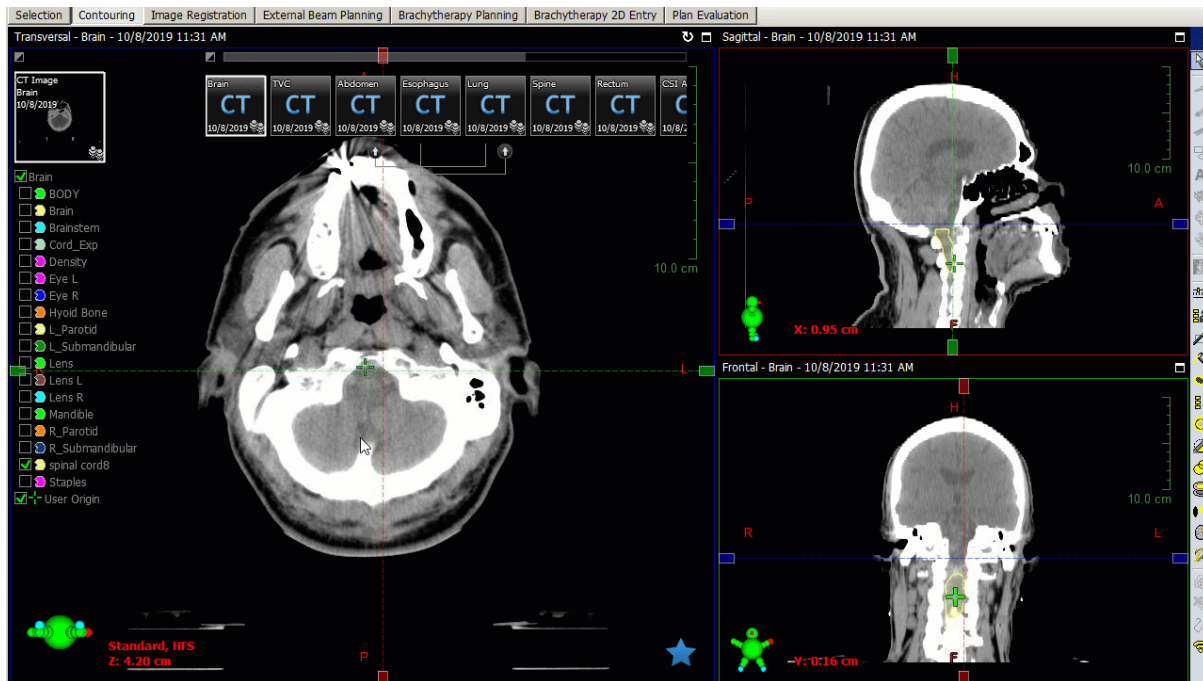
Brain



For the brain contour, we often use the segmentation wizard and clean the structure with post-processing

Step 2

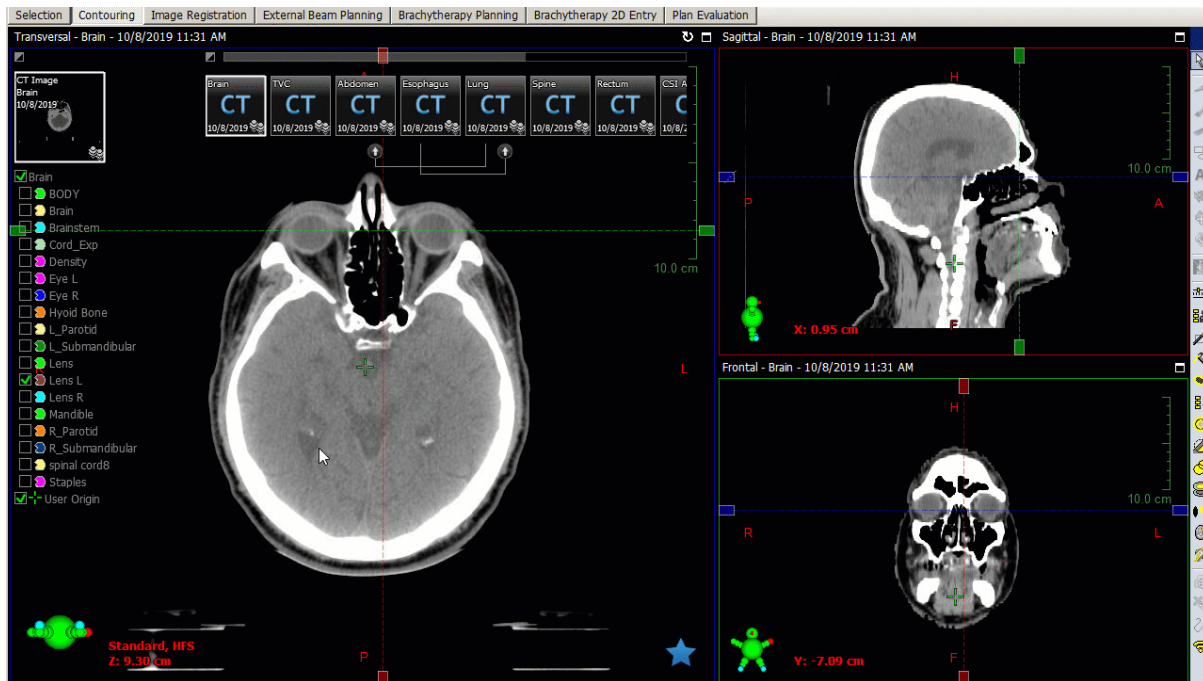
Cord



For the cord contour, we often contour the spinal canal from the last slice of the base of skull, and work our way down a few cm to about C3-c4. Skipping every other slice and interpolating may help speed things up. Remember to review the contour after automated help.

Step 3

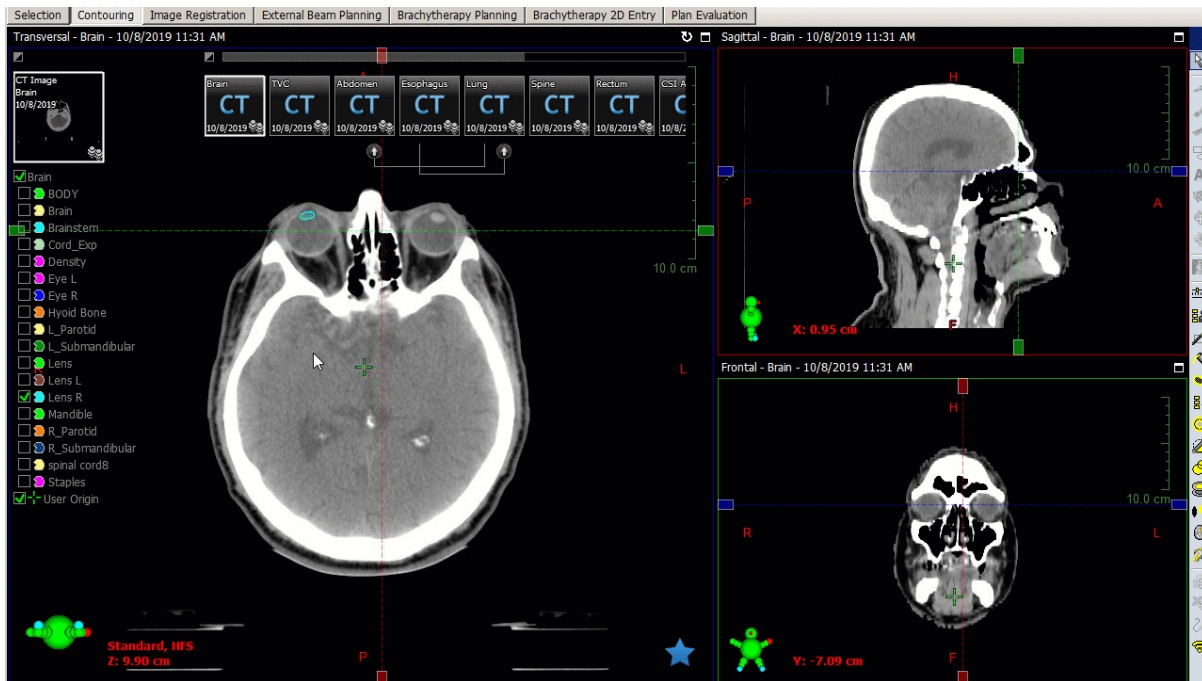
Lens_L



Contour the Left Lens

Step 4

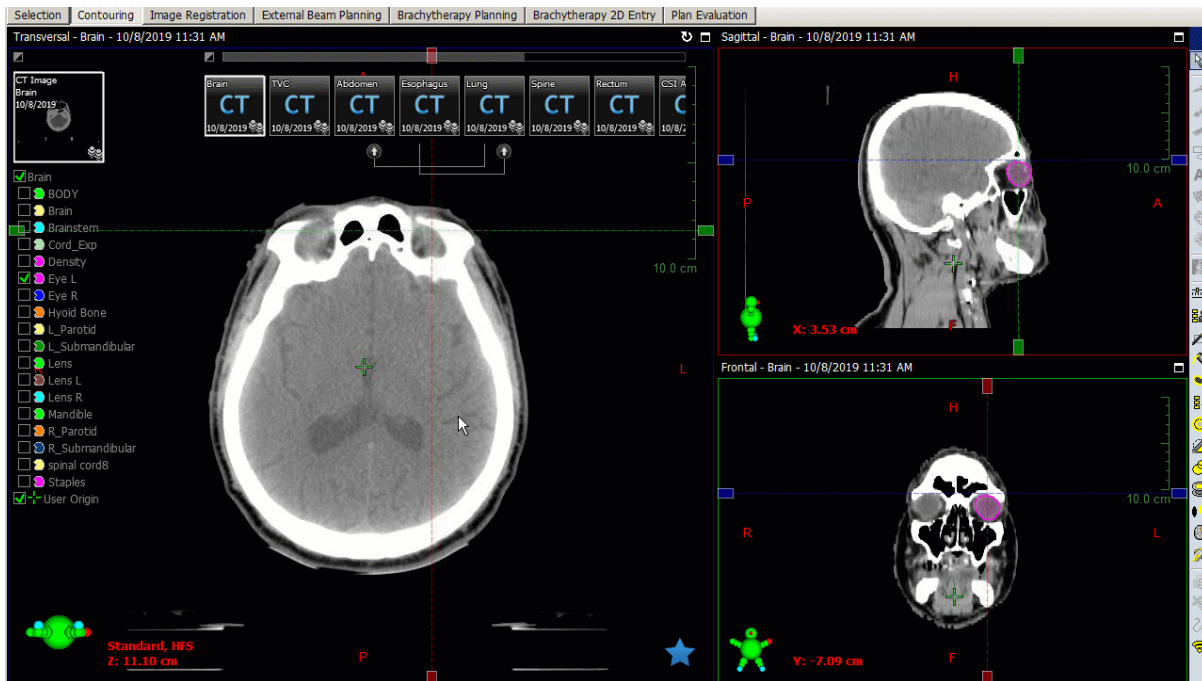
Lens_R



Contour the Right Lens

Step 5

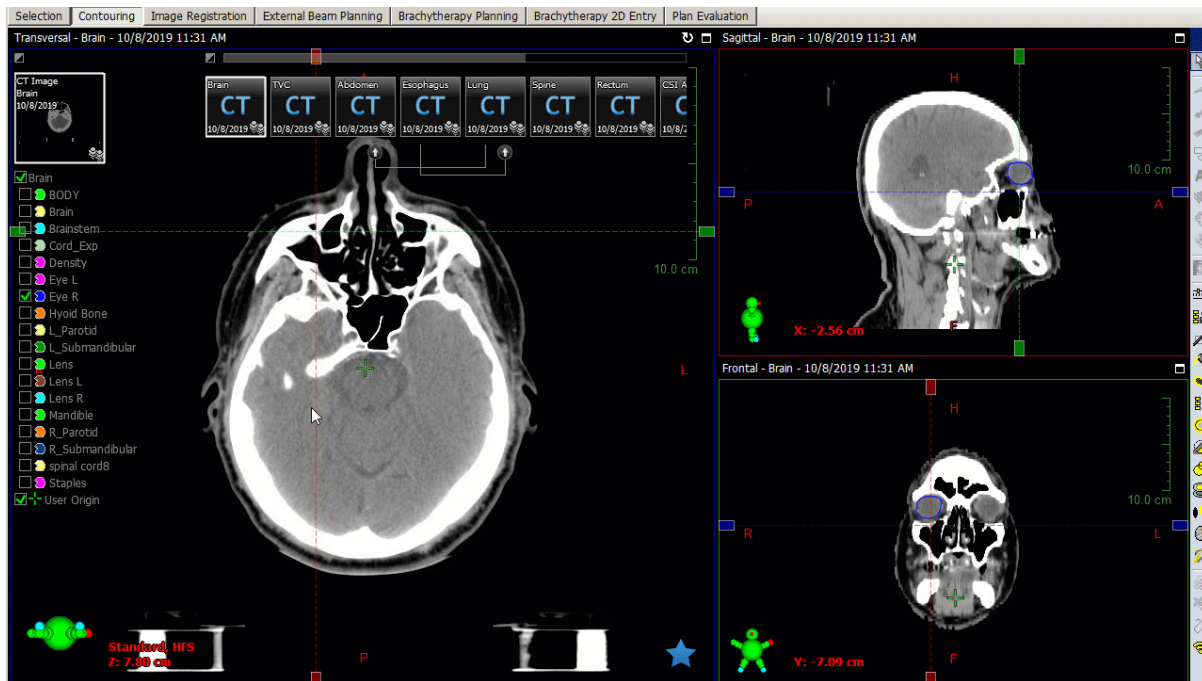
Eyes_L



Contour the Left Eye

Step 6

Eyes_R



Contour the Right Eye.

Step 7

BBs



Contour the BBs in the scan.

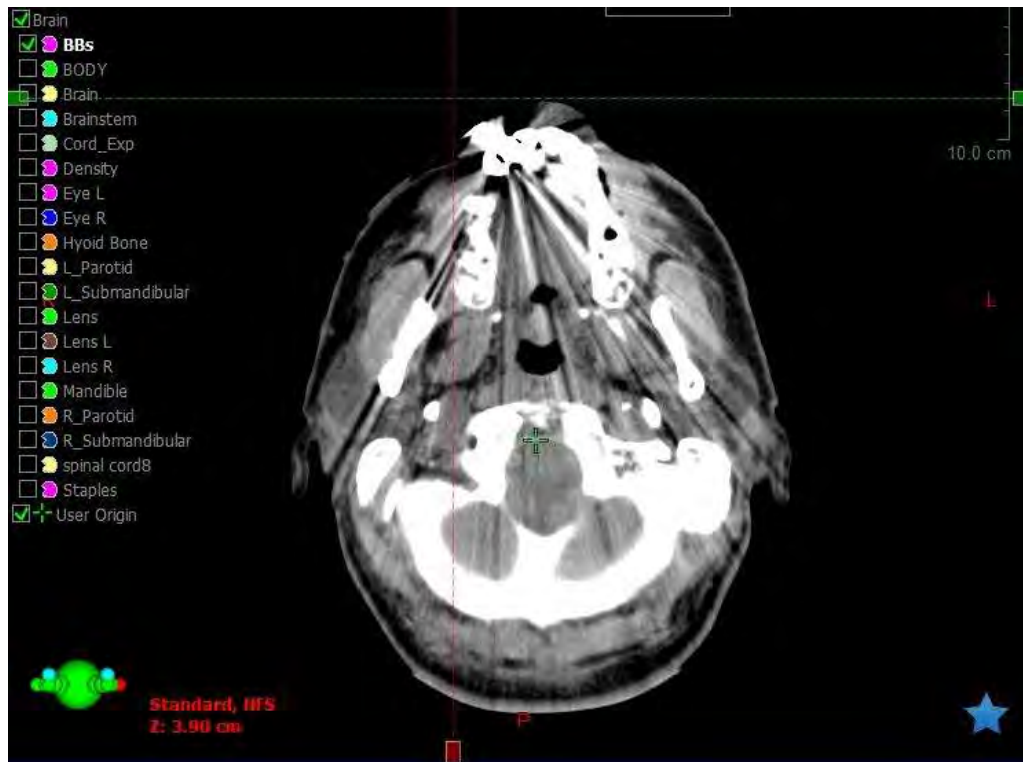
Step 8

Any Critical Structures?

Contour any additional critical structures relevant to the case.

Step 9

Density Overrides



If there are artifact, or materials that need to be overridden this is a good time to do so.

Summary

Ok now that we've completed our list of contours, We're ready to start planning.



Complete the content above before moving on.

Takeaway

Remember to review automated contours such as the Body and have a second pair of eyes review your contours.

Beam Setup



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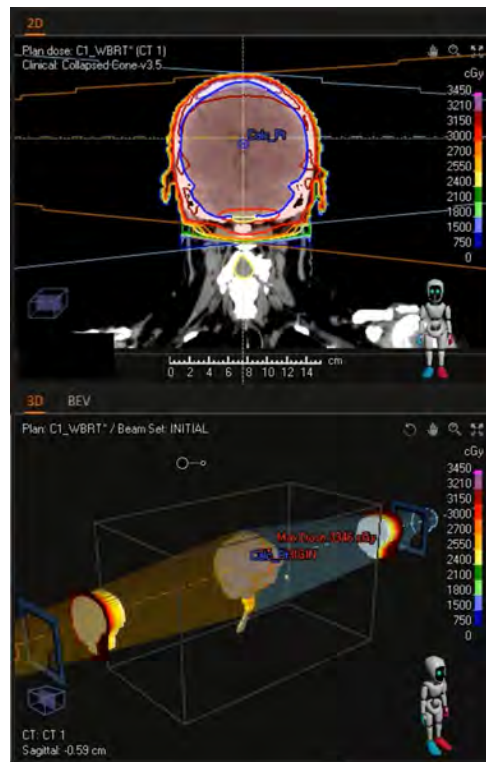


Beam arrangement and placement

WBRT uses lateral opposed fields to treat the entire brain. There are some variants of the lateral opposed and the field borders. We'll cover these options.

Step 1

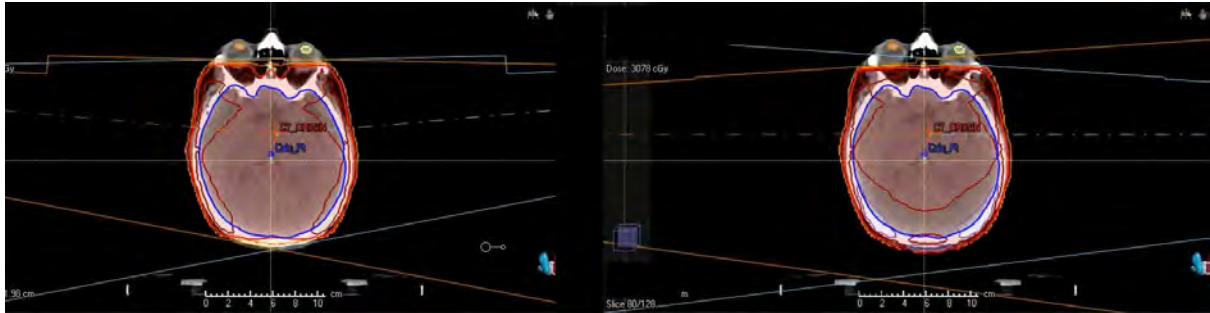
Lateral Opposed Fields



Field Arrangement Lateral Opposed. (R_Lat=270, L_Lat=90)

Step 2

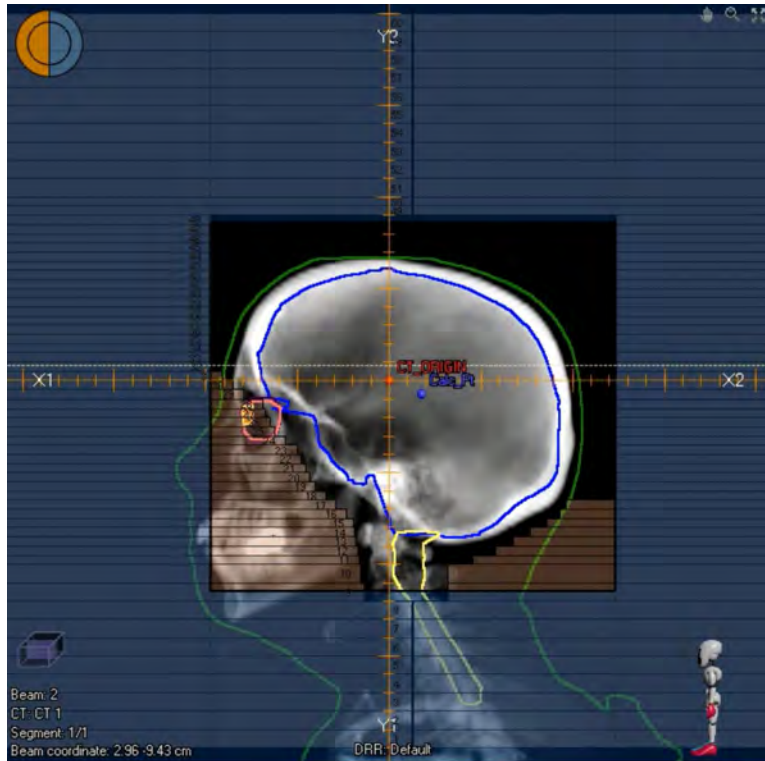
Lateral Opposed Fields (Continued)



In some instances the physician would like to spare the lens. To do this we would need to rotate the gantry ~ 5 degrees, (R_Lat=275, L_Lat=85) and match the divergence behind the lens. As shown on the left image.

Step 3

Field Blocking (Non-Scalp Sparing)

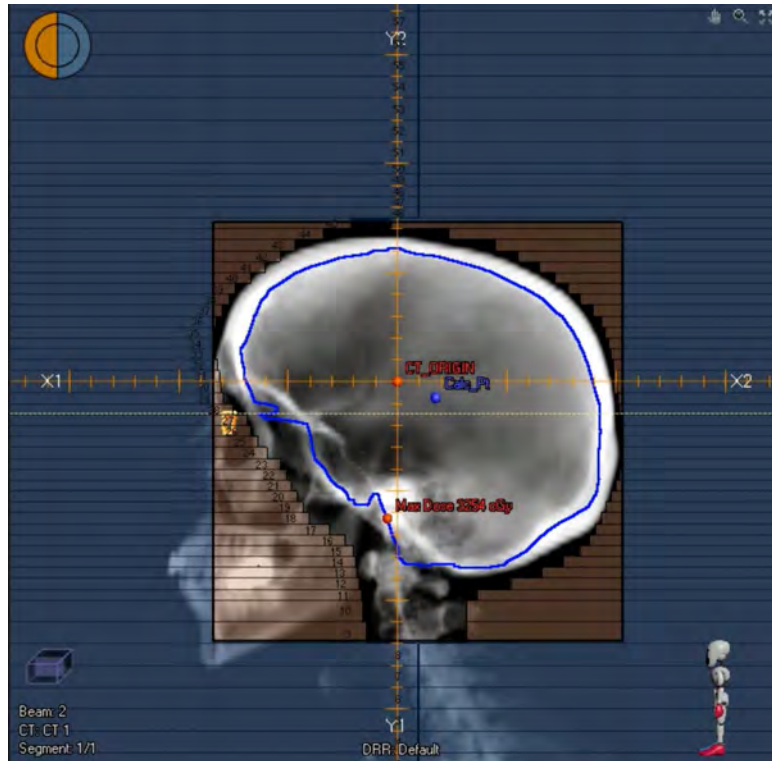


WBRT Field Blocking (Non-Scalp Sparing) is shown in the image. While setting up the field borders please keep these items in mind.

- Clearing skull superior, anterior, posterior
- Inferior: bottom of foramen magnum or inferior to C1 or inferior to C2
- Block eyes, nasal cavity, oral cavity with a margin on the skull
- Ensure adequate coverage of entire brain

Step 4

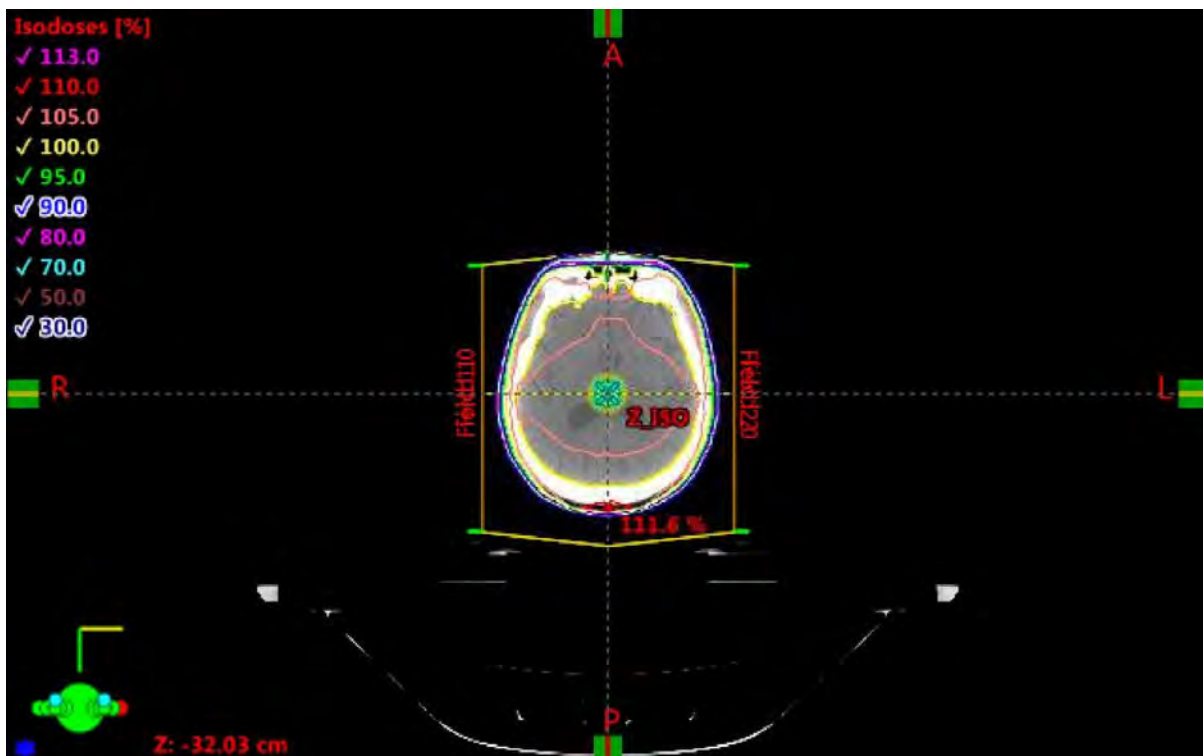
Field Blocking (Scalp Sparing)



Field Blocking (Scalp Sparing) is shown in the image. While setting up the field borders please keep these items in mind.

- Clearing skull superior, anterior, posterior
- Inferior: bottom of foramen magnum or inferior to C1 or inferior to C2
- Block eyes, nasal cavity, oral cavity with a margin on the skull
- Ensure adequate coverage of entire brain

Summary



Now things are setup and we'll create a plan similar to the one shown.

Treatment Planning



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Introduction

Once we place fields and set field blocking. We need to calculate the dose and look at the dose distribution.

Step 1

Calculation Point



For WBRT we calculate to the CalcPt located at mid-plane and usually at the widest separation of the head.

Step 2

Review Dose Distribution



Once complete a dose distribution is created. We will review dose distribution for coverage and conformity and make adjustments to our liking.

Step 3

Normalize the plan



Normalize plan to calc point and by isodose value. To ensure good coverage to the brain, the plan is normalized by a few % to get full coverage. Here's an example of plan normalization to a calculation point.

Step 4

Field Weighting



To improve the distribution apply field weighting to create a more even dose distribution.

Summary

Next let's evaluate the plan to see if it achieves the dose distribution we're looking for. We'll also check the max dose of the plan and OAR dose statistics.

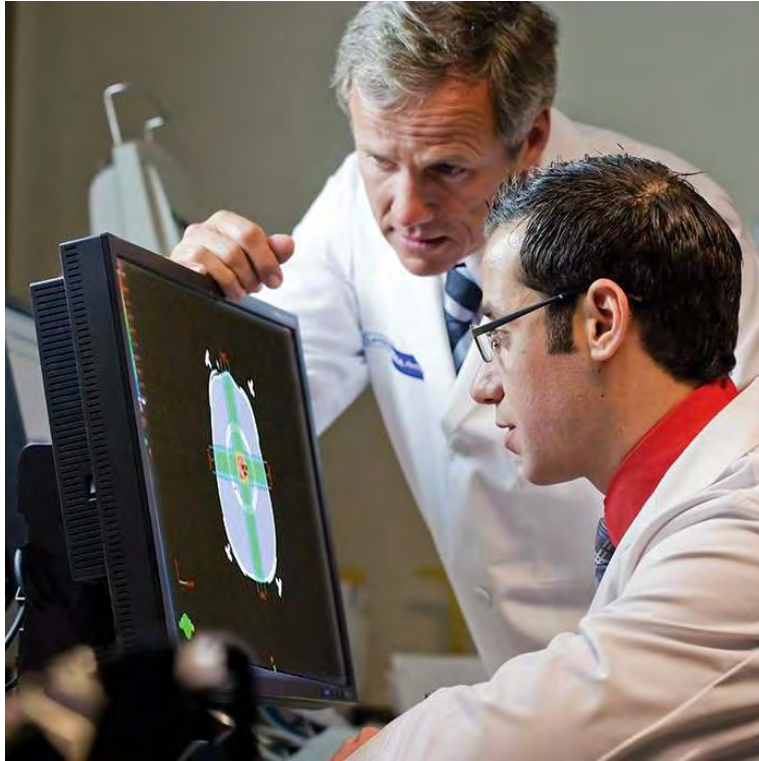
Plan Evaluation



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Introduction



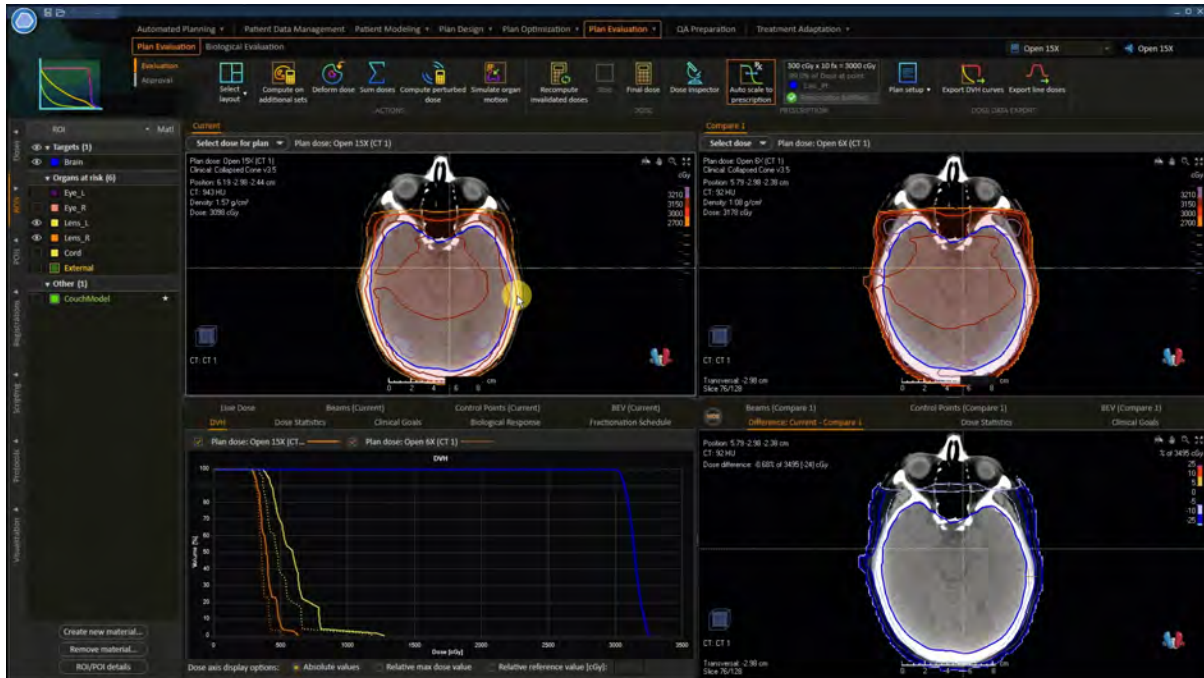
Once we have good plans for review, we'll begin the plan evaluation with the physician.

In most cases treatment planners will have multiple trials or plans for comparison. This ensures the patient receives the best plan possible.

While reviewing with the physician in some cases they may tweak the field borders, field blocking, lens block by moving a few MLCs.

Step 1

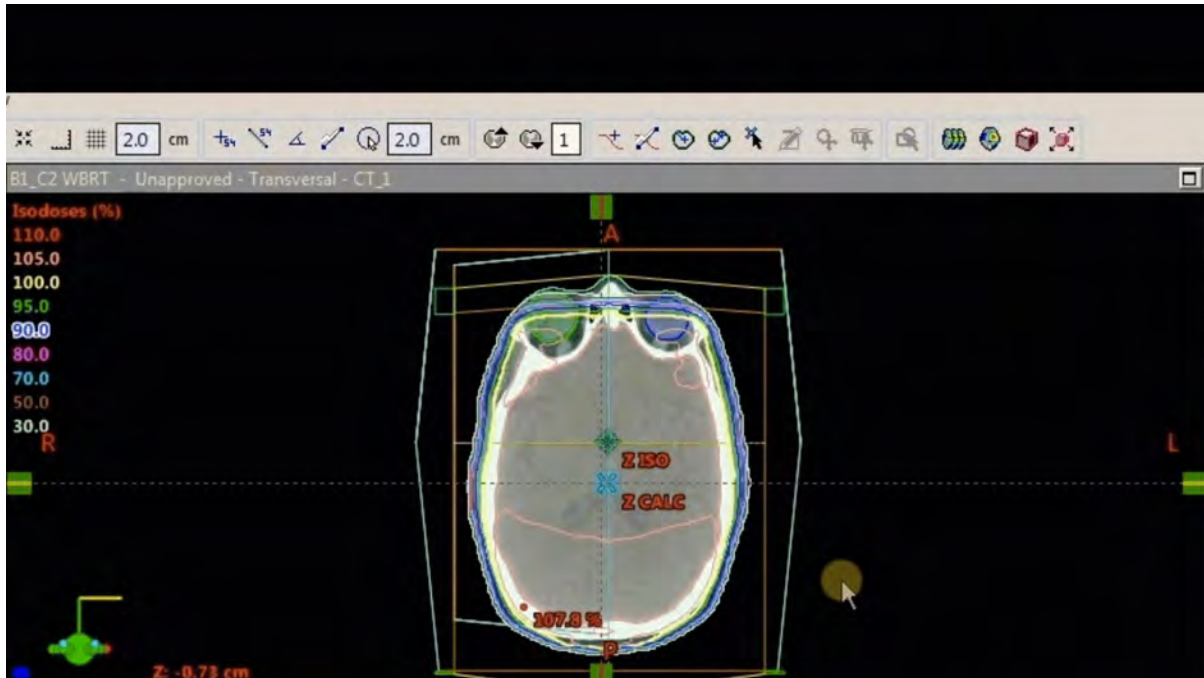
Dose Distribution RayStation



Here are some of the items we are looking for during the plan evaluation. This is done by scrolling up and down the scan and reviewing the dose distribution. While doing this we note hotspots, max dose of the plan, location of max dose, cold spots, Coverage of the isodose lines around the target.

Step 2

Dose Distribution Eclipse

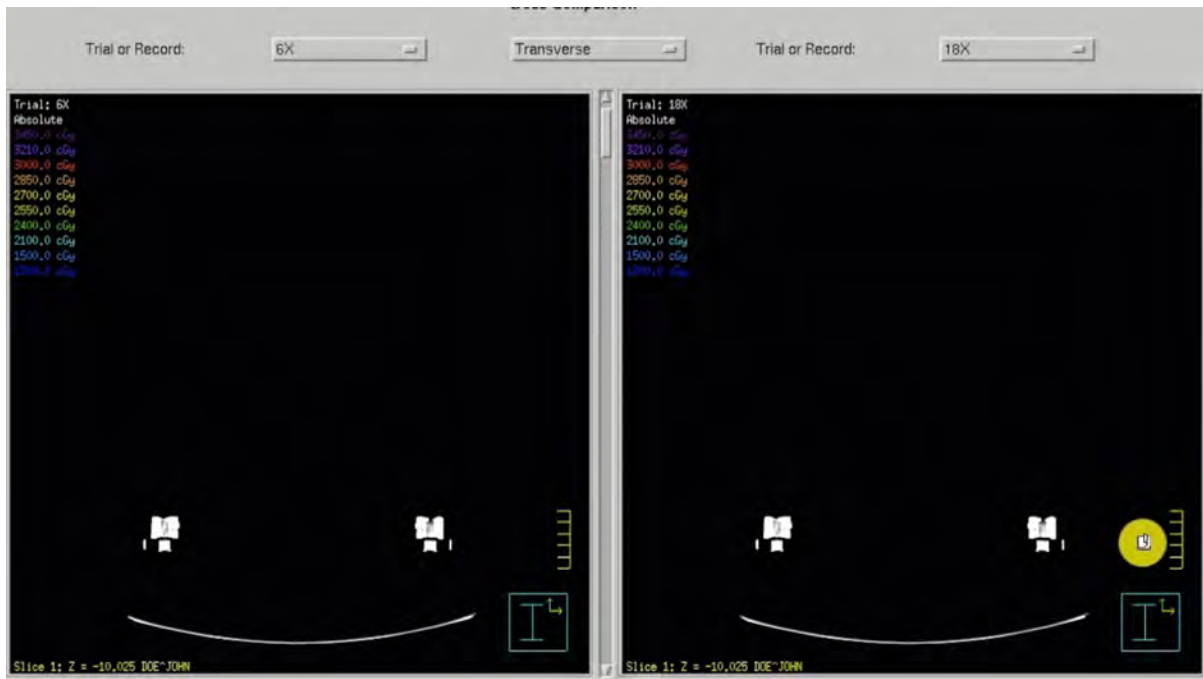


(Continued)

Look out for hotspots, max dose of the plan, location of max dose, cold spots, Coverage of the isodose lines around the target.

Step 3

Dose Distribution Pinnacle

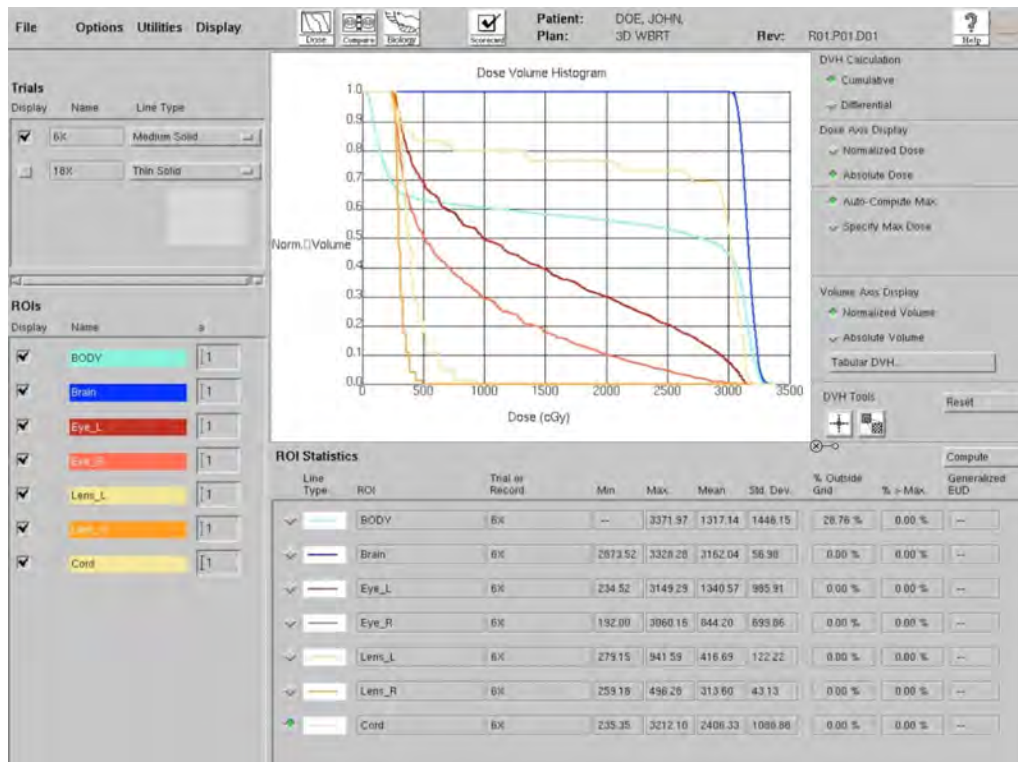


(Continued)

Look out for hotspots, max dose of the plan, location of max dose, cold spots, Coverage of the isodose lines around the target.

Step 4

Clinical Goals and Metrics



The Dose Volume Histogram (DVH) provides a quick review of clinical goals and metrics.

Brain >95% Coverage

Plan Max Dose <115%

Summary



This wraps up treatment planning for Whole Brain Radiation therapy.

We covered the simulation, beam arrangement, field borders and field blocking, field weighting and learned how to evaluate for a good plan.

Please watch the treatment planning video demonstration and take the post quiz to test what you've learned.