

Experimental Assignment 3

Medical Imaging Techniques

(EECS4640/5640)

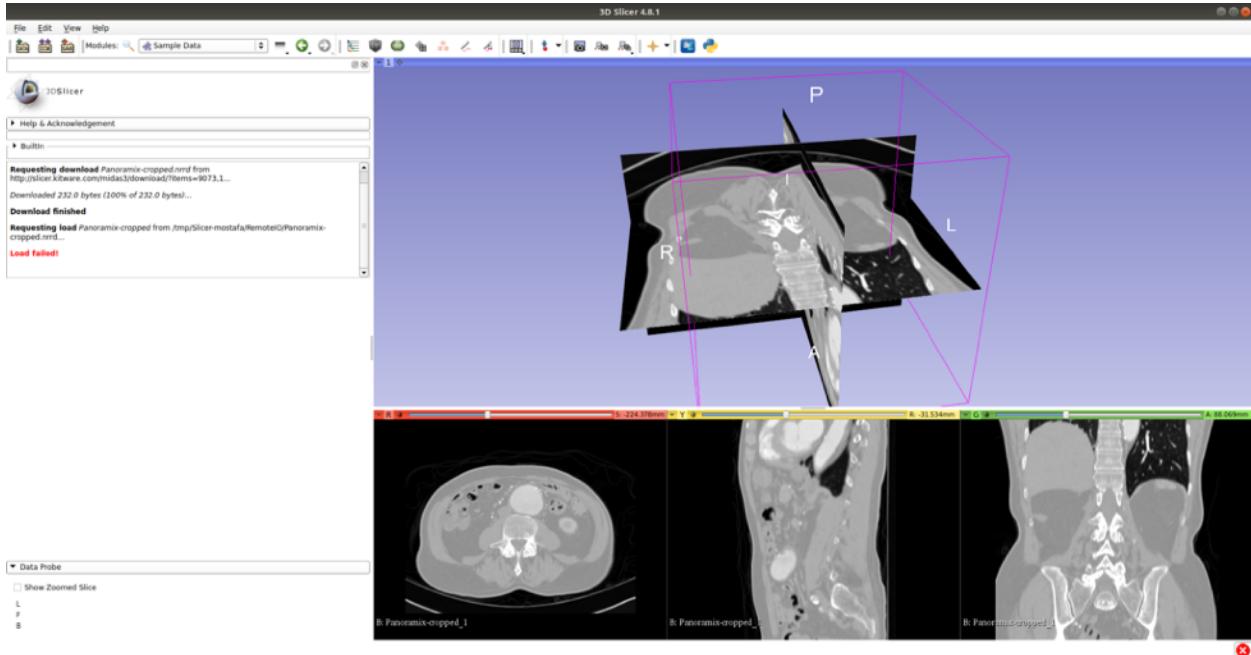
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March 2023

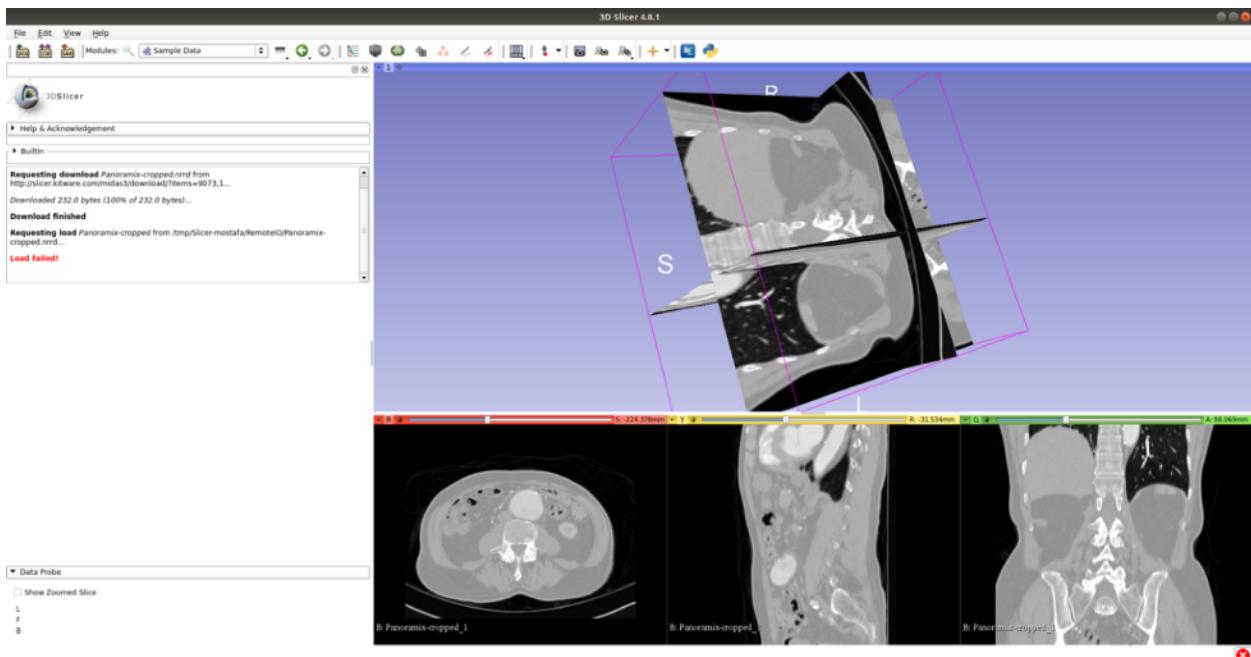
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Question 1

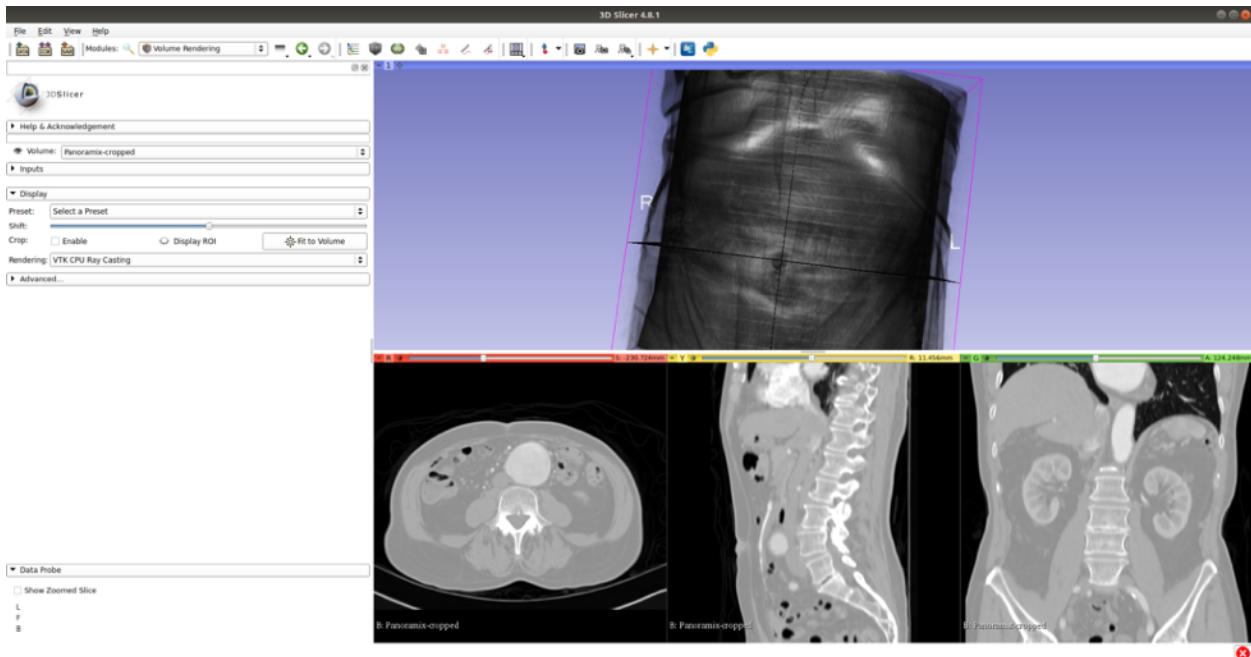
Item a



Item b

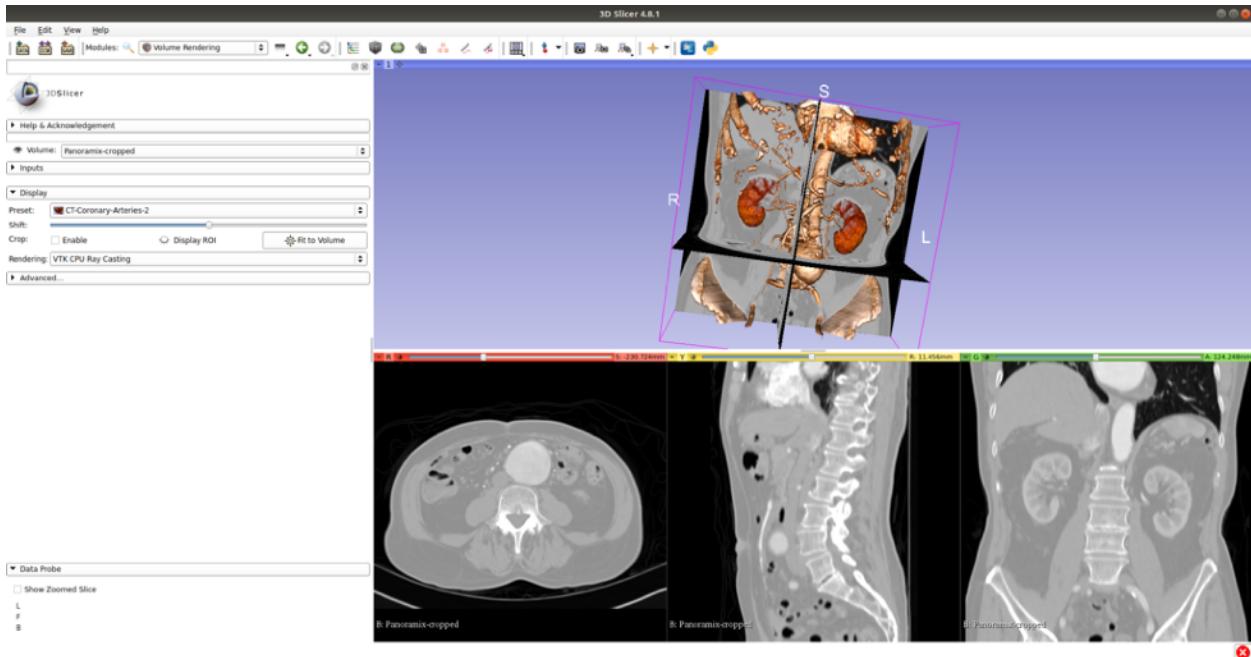


Item c

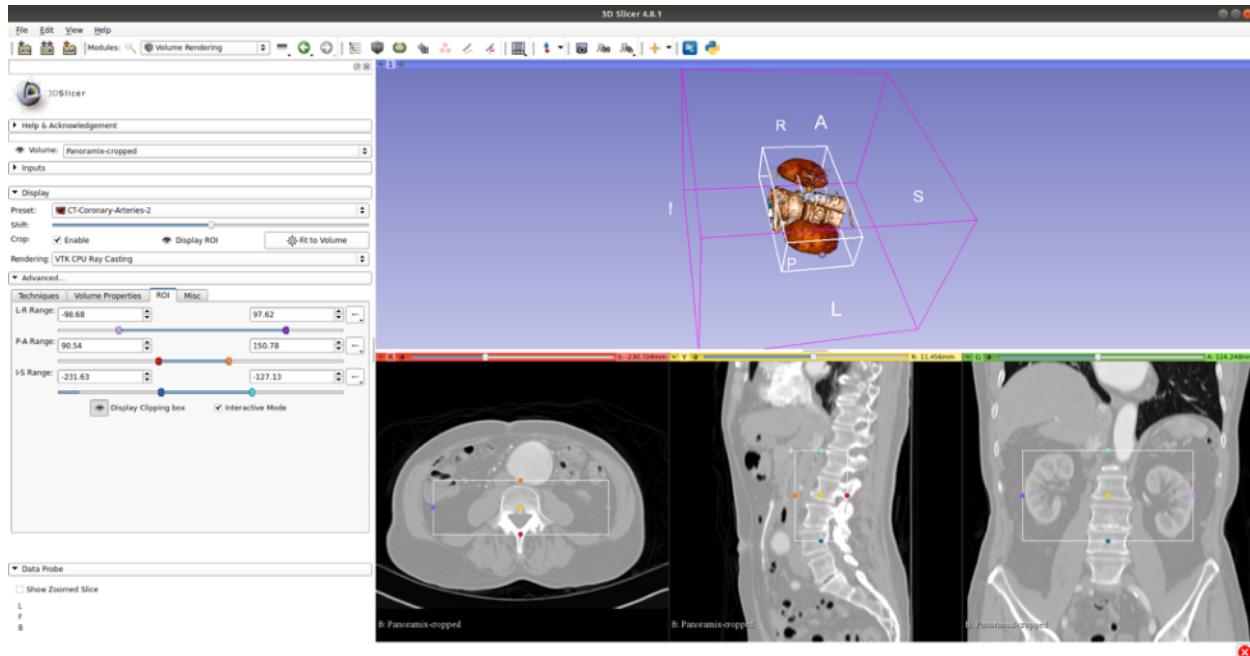


Item d

Now it shows the inner organs of the body! Amazing!

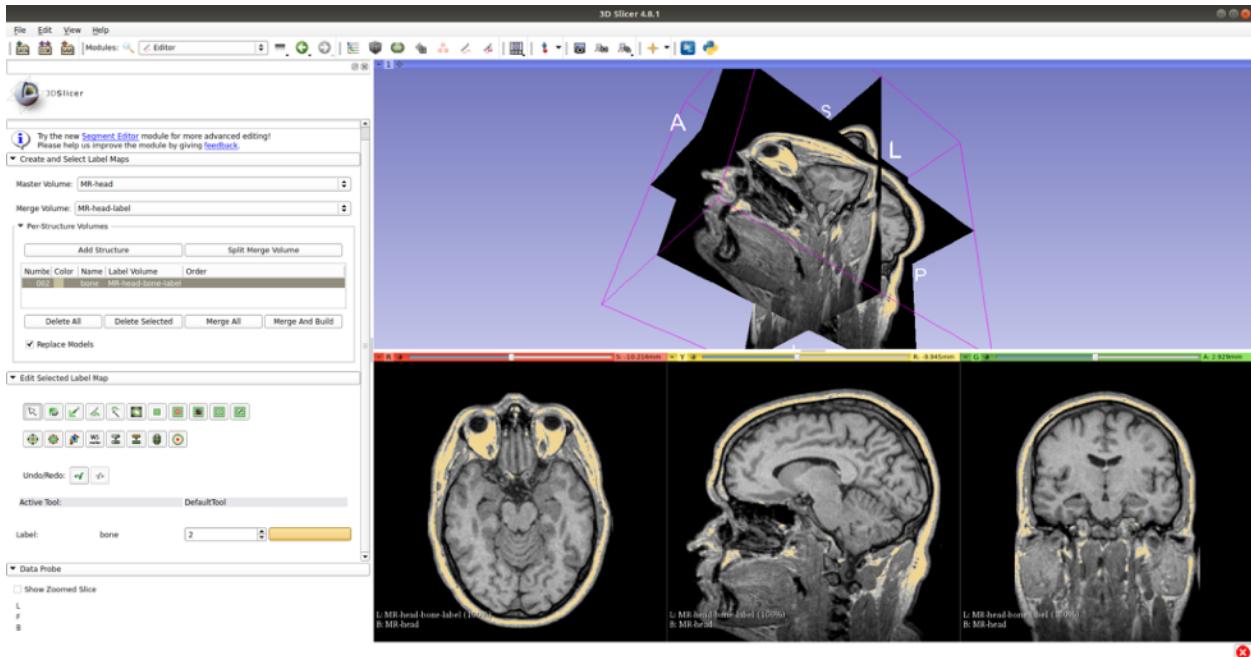


Item e



Question 2

Item a

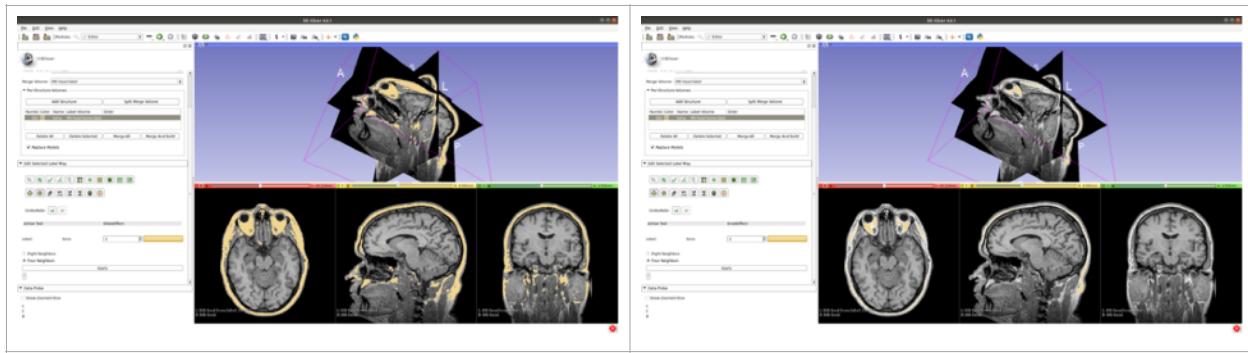


Item b

The DilateEffect expands the boundaries of the labeled regions and the ErodeEffect does the reverse; shrinks them. The DilateEffect is useful for filling in gaps between adjacent regions. While the ErodeEffect is for separating adjacent regions. To be specific, the ErodeEffect removes a layer of voxels from the boundary of each labeled region. All of which depends on the definition of neighbor voxels.

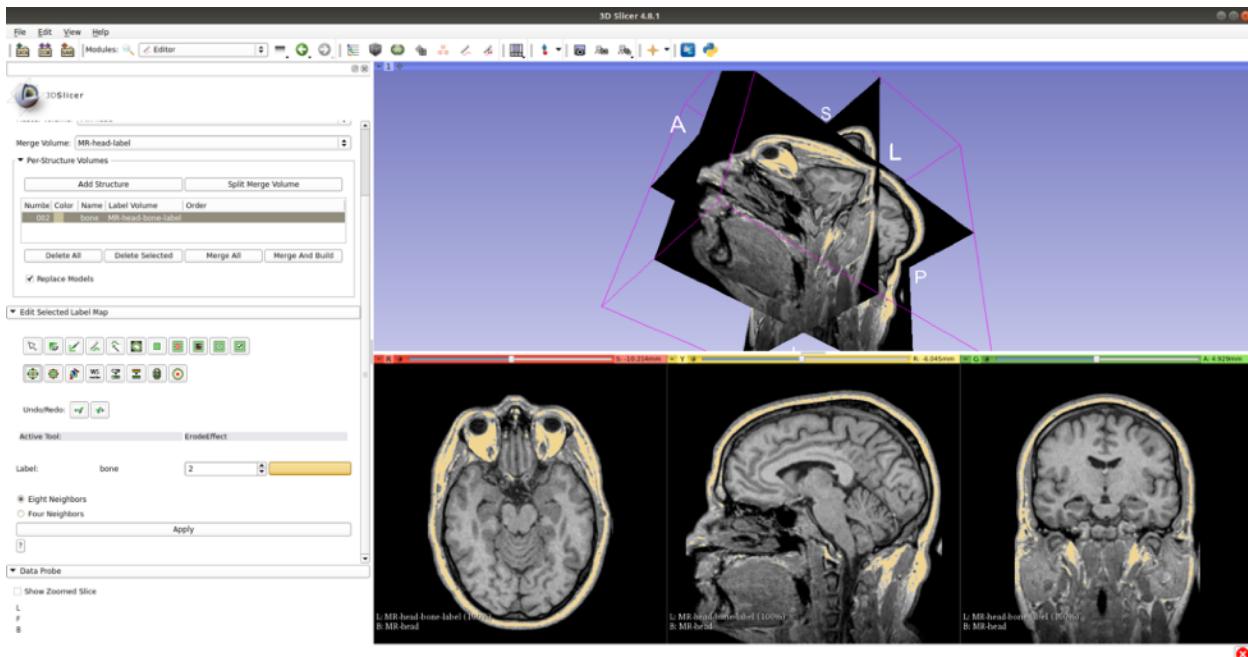
The one and only parameter used was the number of the neighbor voxels. The option is between 4 and 8. Four Neighbor only considers the direct neighbors having a shared side ($\leftarrow \uparrow \rightarrow \downarrow$). Eight Neighbor, on the other hand, considers the neighbors sharing a vertex ($\leftarrow \uparrow \rightarrow \downarrow \nwarrow \nearrow \downarrow \swarrow$). For example, the DilateEffect using eightneighbor, grows from a center to all the of its eightneighbors!

Although the images are small, they have the highest quality. Please zoom in.



Item c

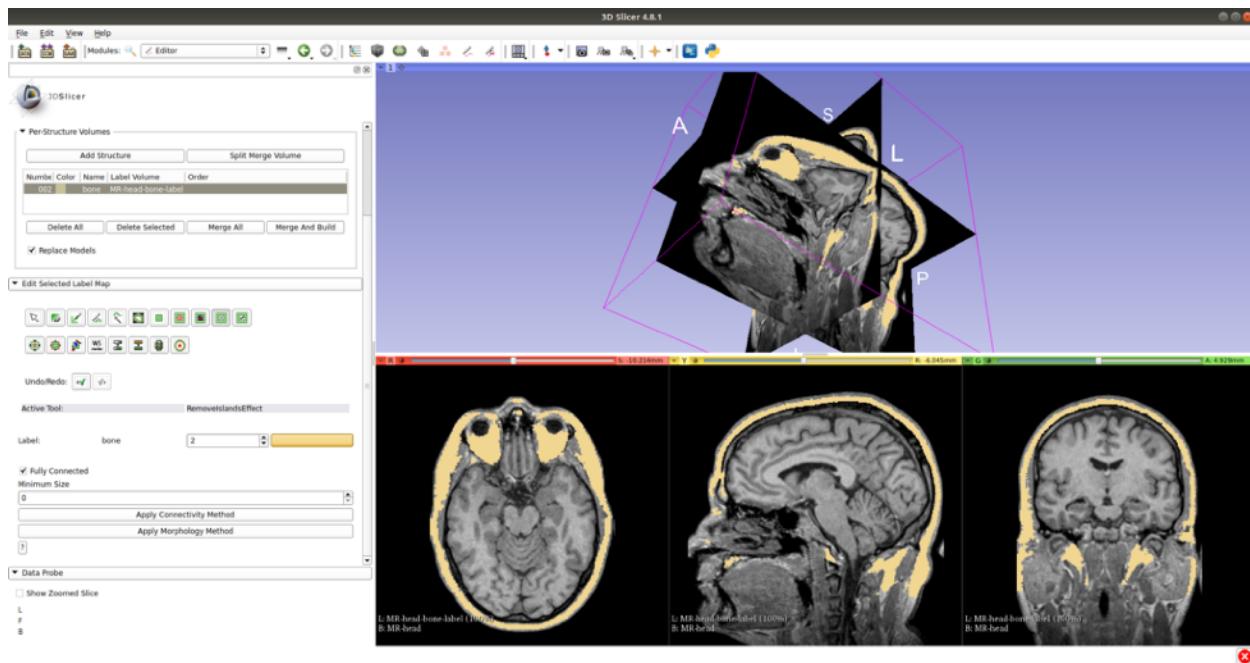
This is good, but I thought it could be better after another DilateEffect:



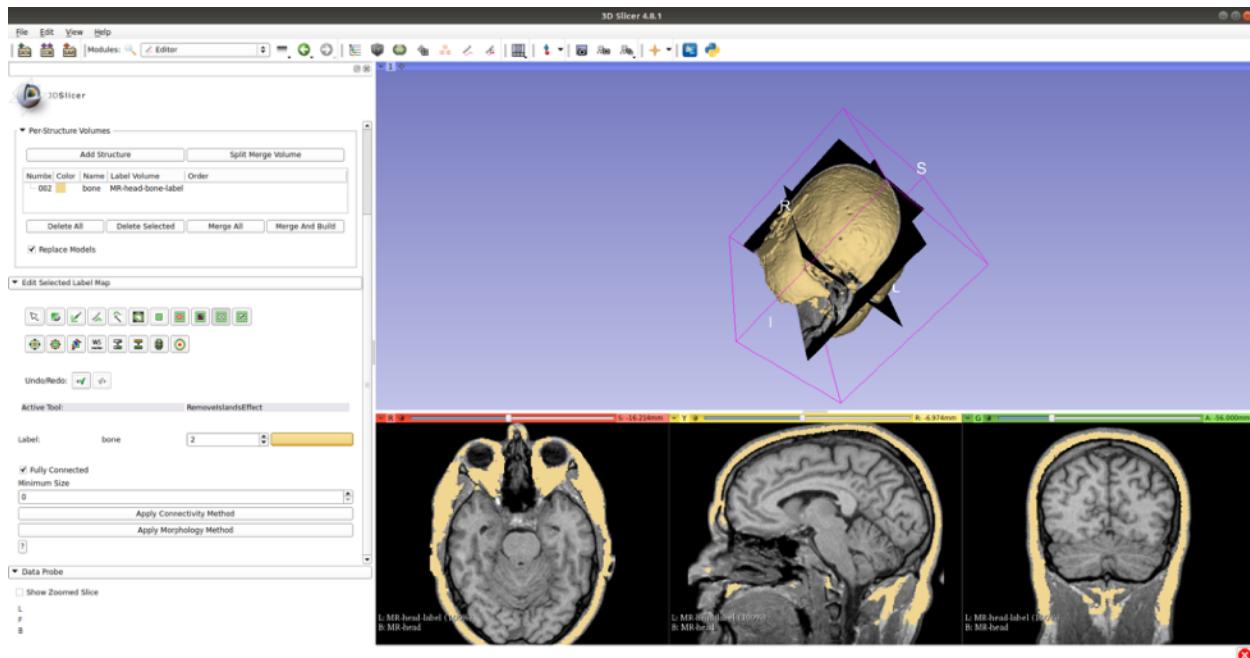
After Dilation:

After Connectivity Method:

After Morphology Method:

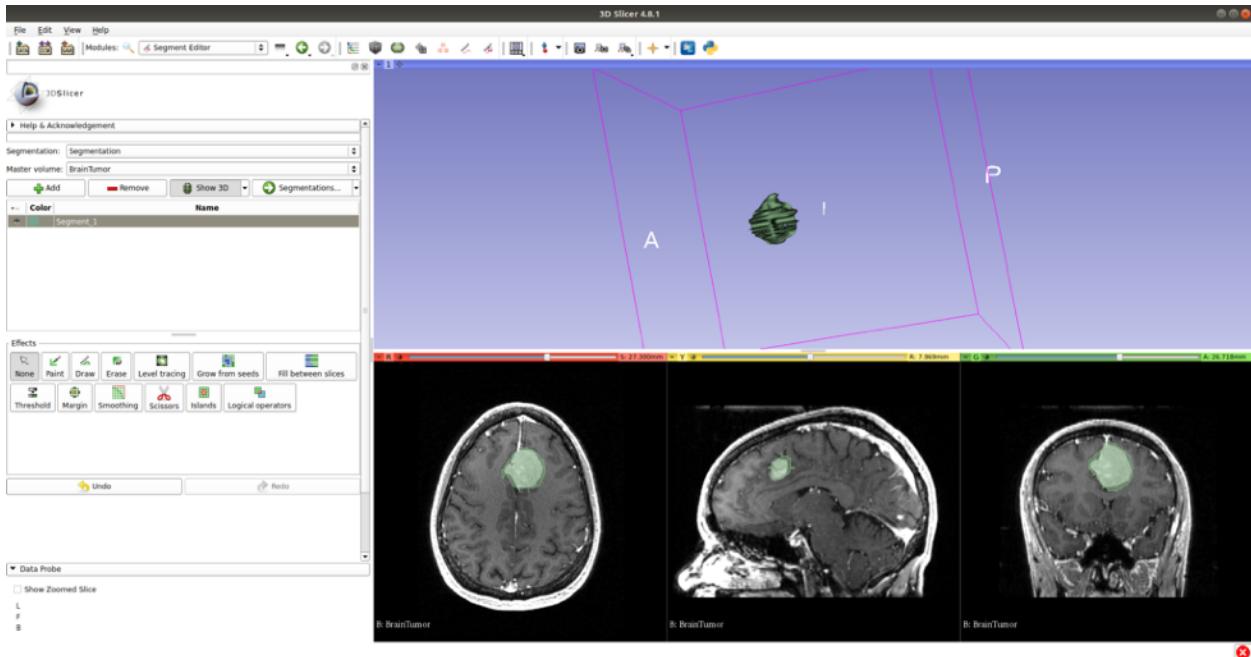


And the final 3D view:

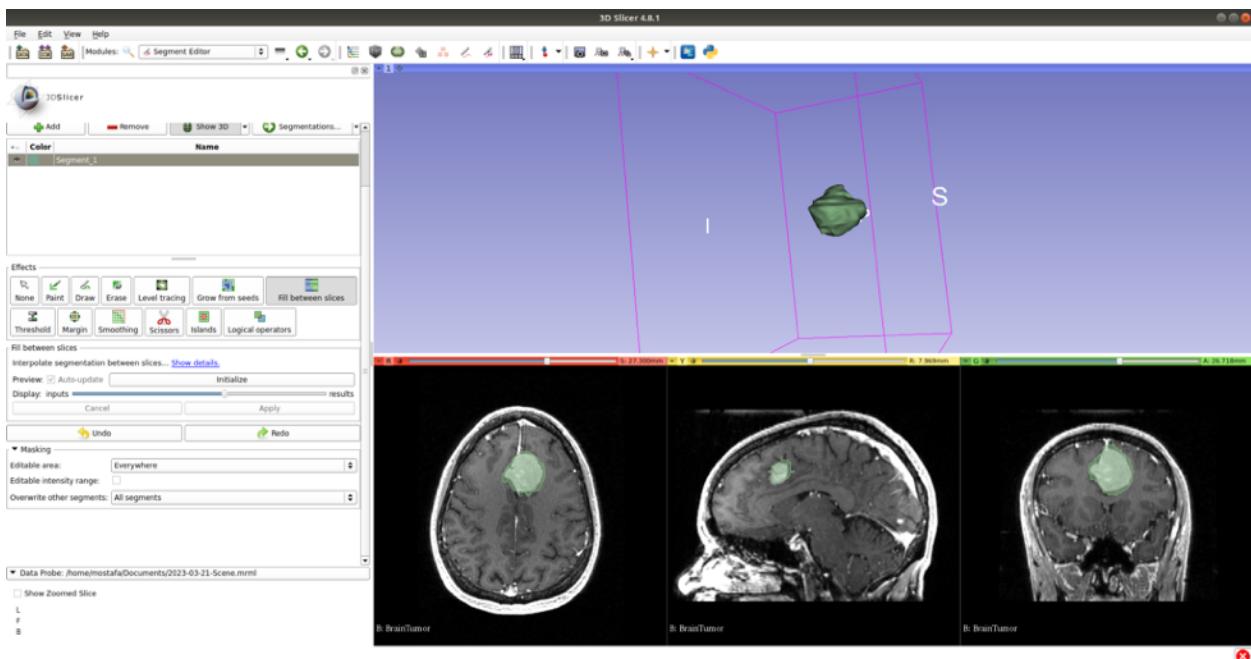


Question 3

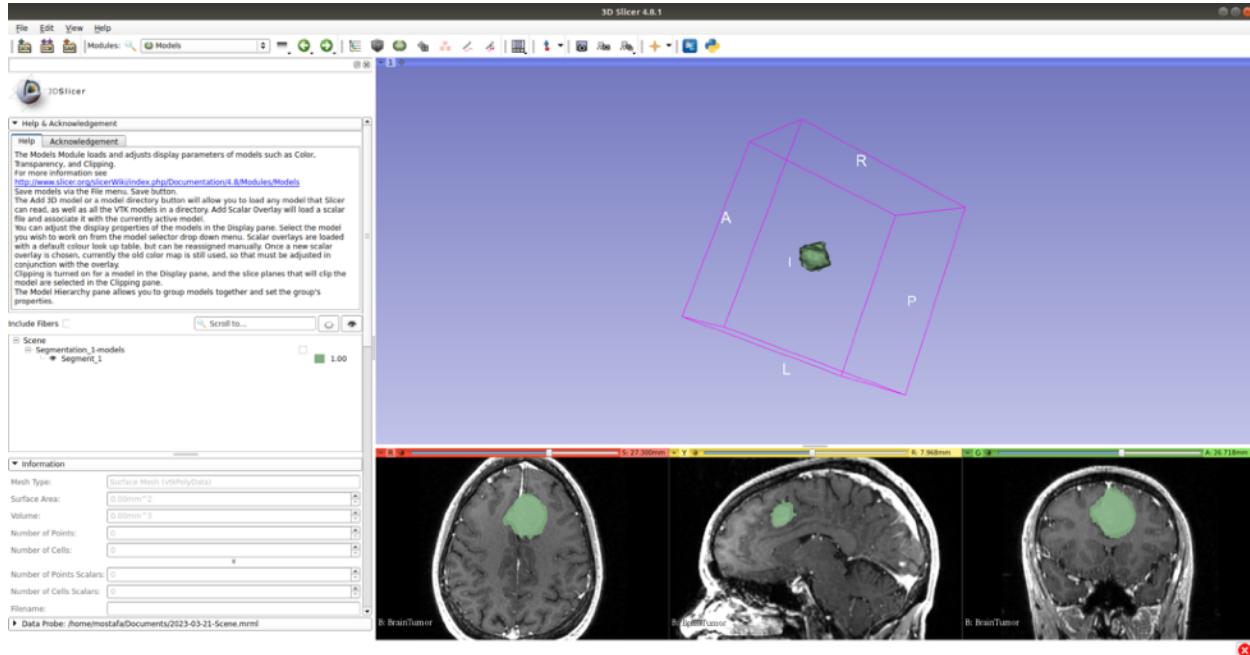
Item a



Item b

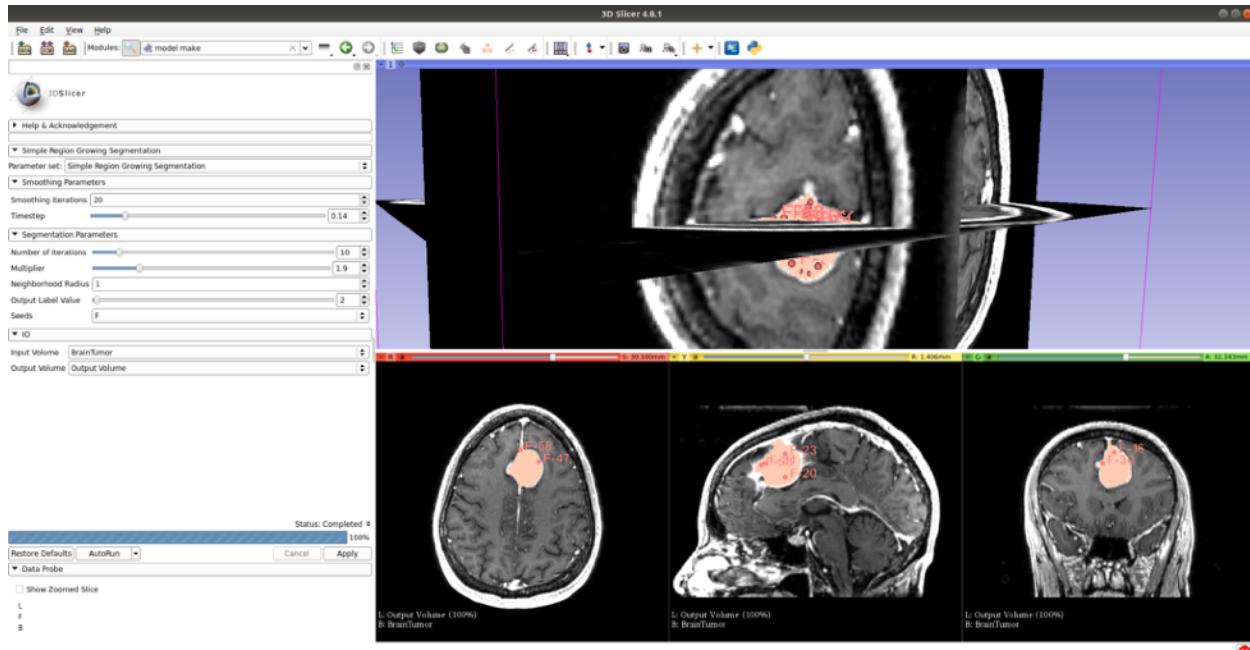


Item c

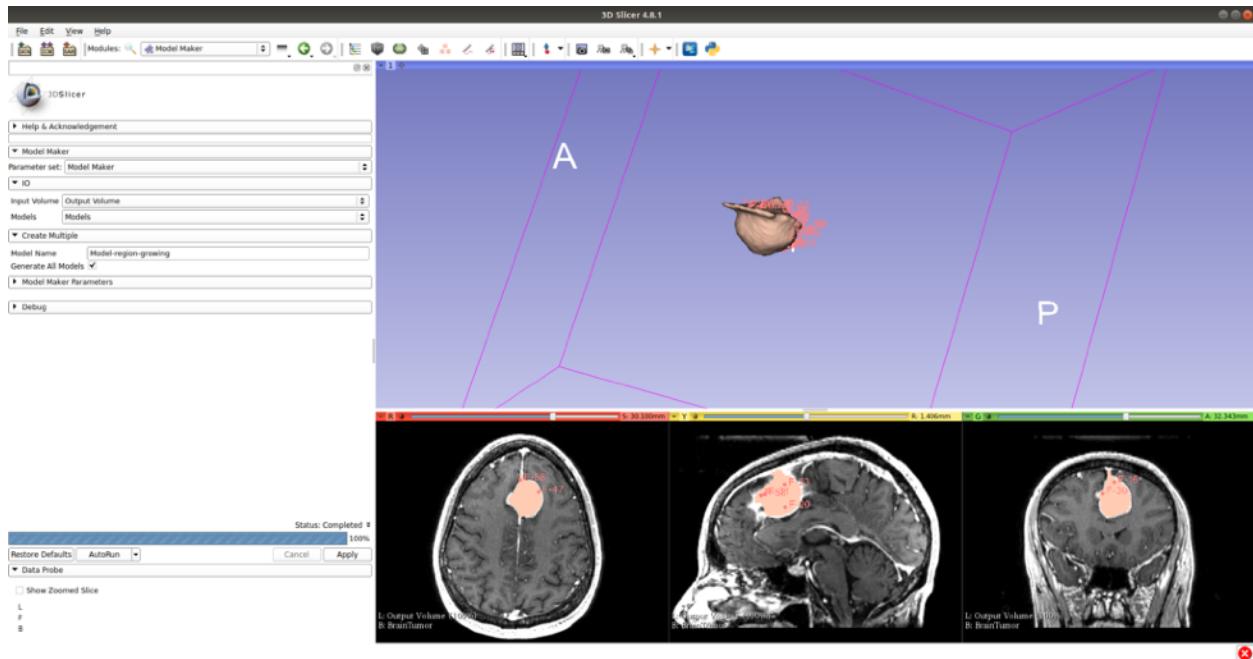


Item d

After the perfect model with parameters:

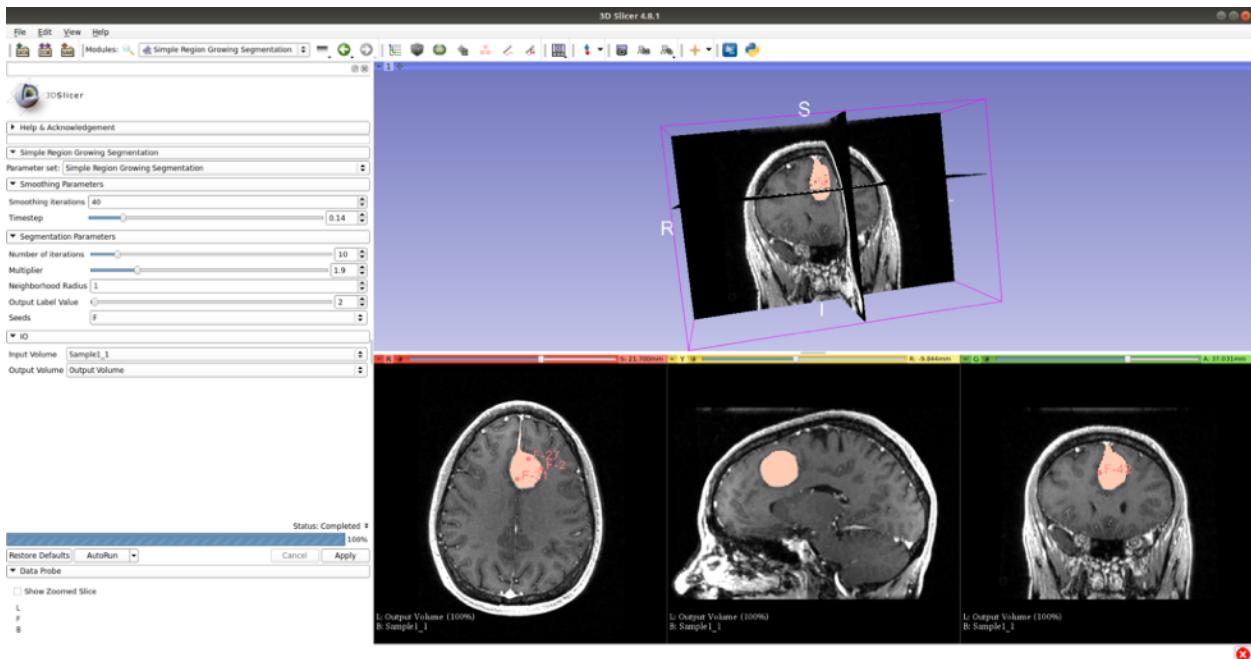


After using the Model Maker module:

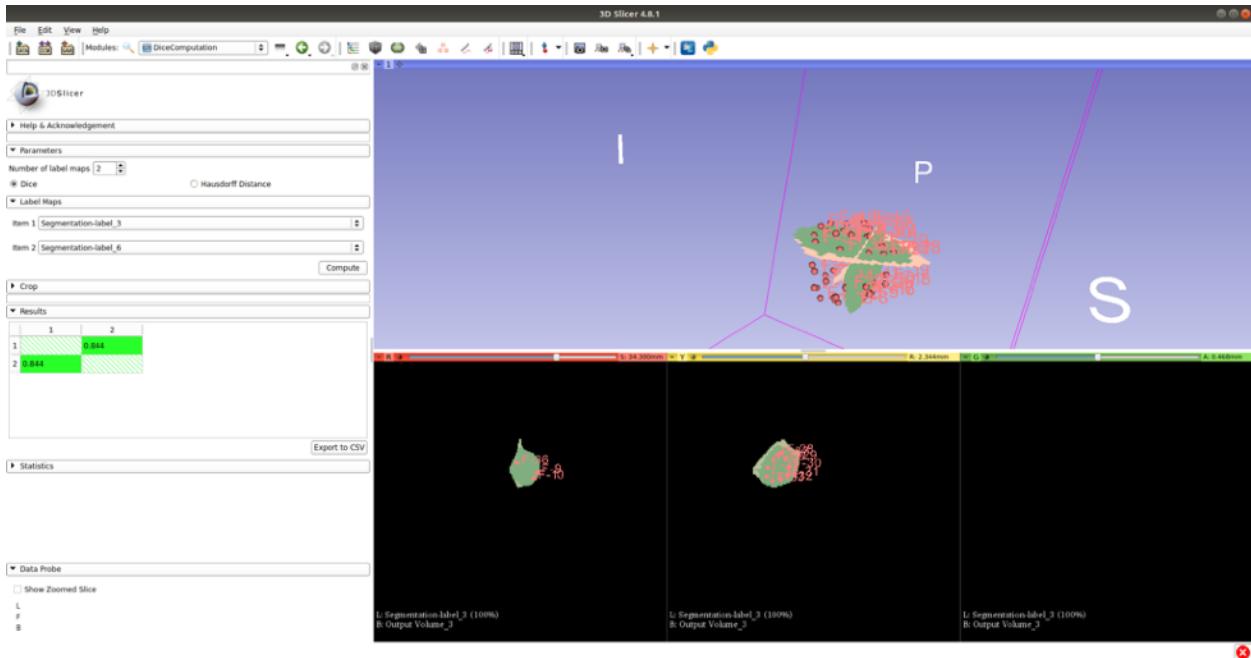


Question 4

Segmented using the simple region growing method:

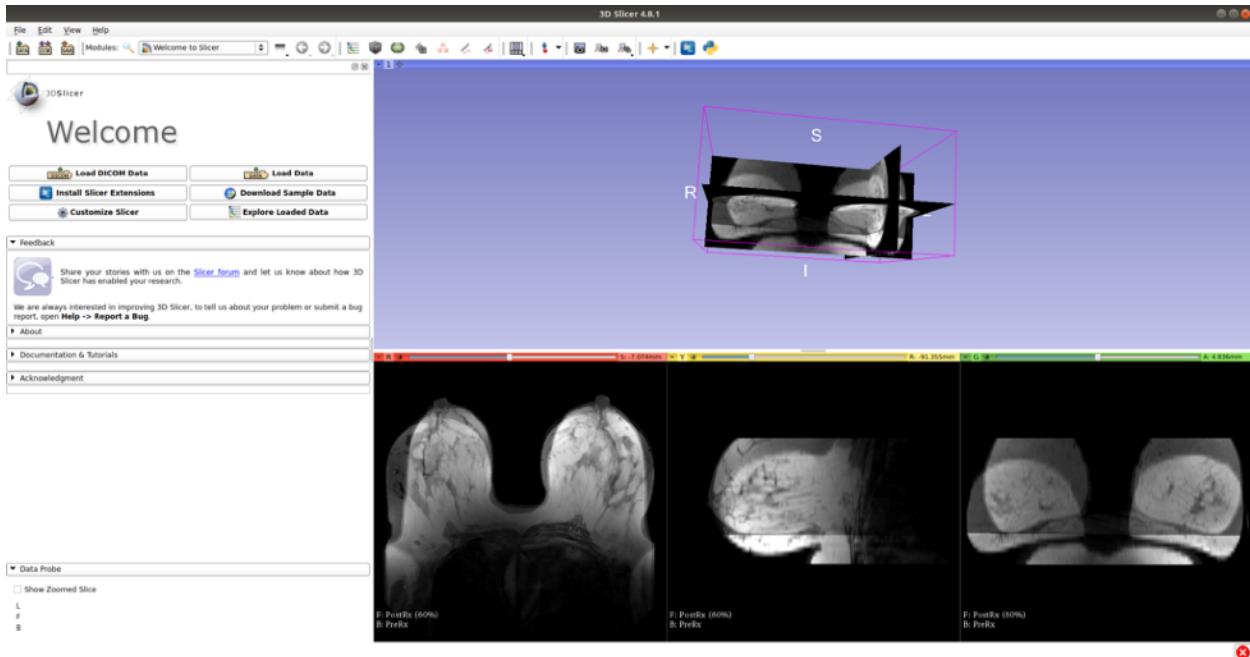


Dice similarity results:



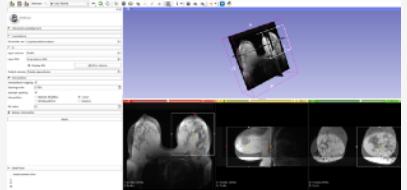
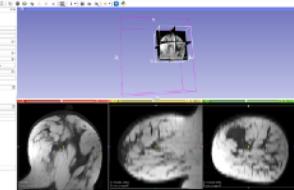
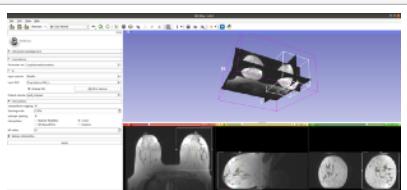
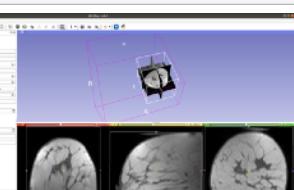
Question 5

Item a



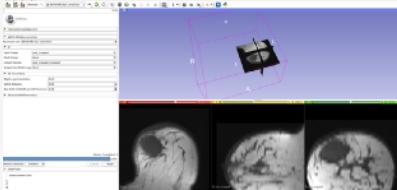
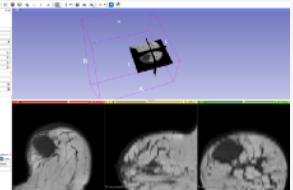
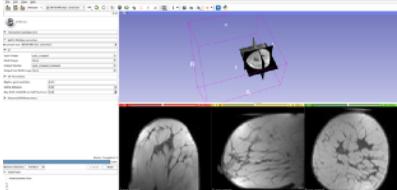
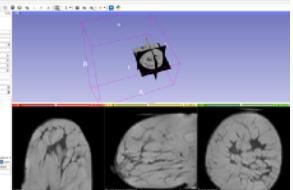
Item b

Although the images in the table seem small, they have the highest quality. Please zoom in.

	Before	After
PreRx		
PostRx		

Item c

Although the images in the table seem small, they have the highest quality. Please zoom in.

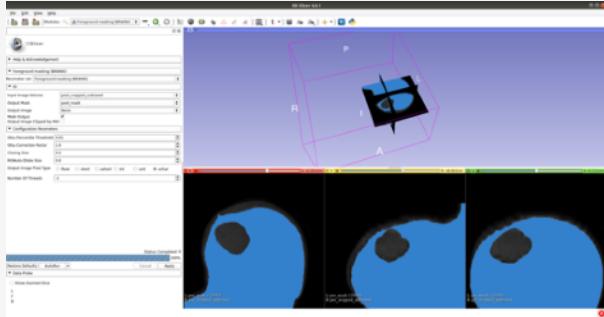
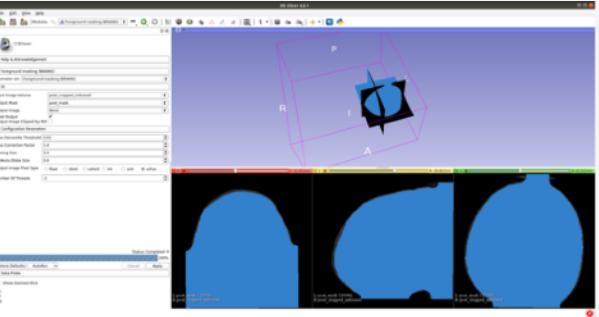
	Before	After
PreRx		
PostRx		

The difference between the corrected and original images is the removal of the bias field (as it is obvious from the name of the module! :D). The original images have regions with intensity variations due to the bias field, while the corrected images have more uniform intensity distributions. The module estimated the smooth spatial intensity variations across the images and removed them. The resulting images have more uniform intensity properties. The intensity variations can be caused by a variety of factors, such as scanner hardware or tissue properties.

Item d

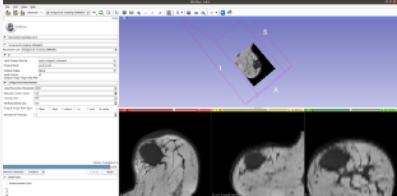
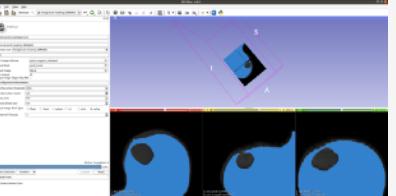
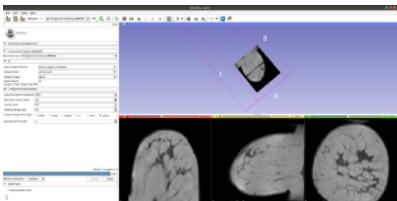
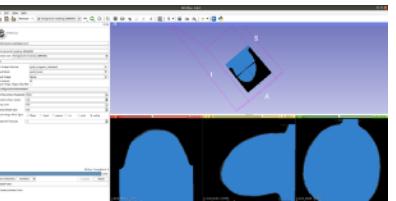
It created pretty decent masks:

(Although the images in the table seem small, they have the highest quality. Please zoom in)

PreRx	PostRx
	

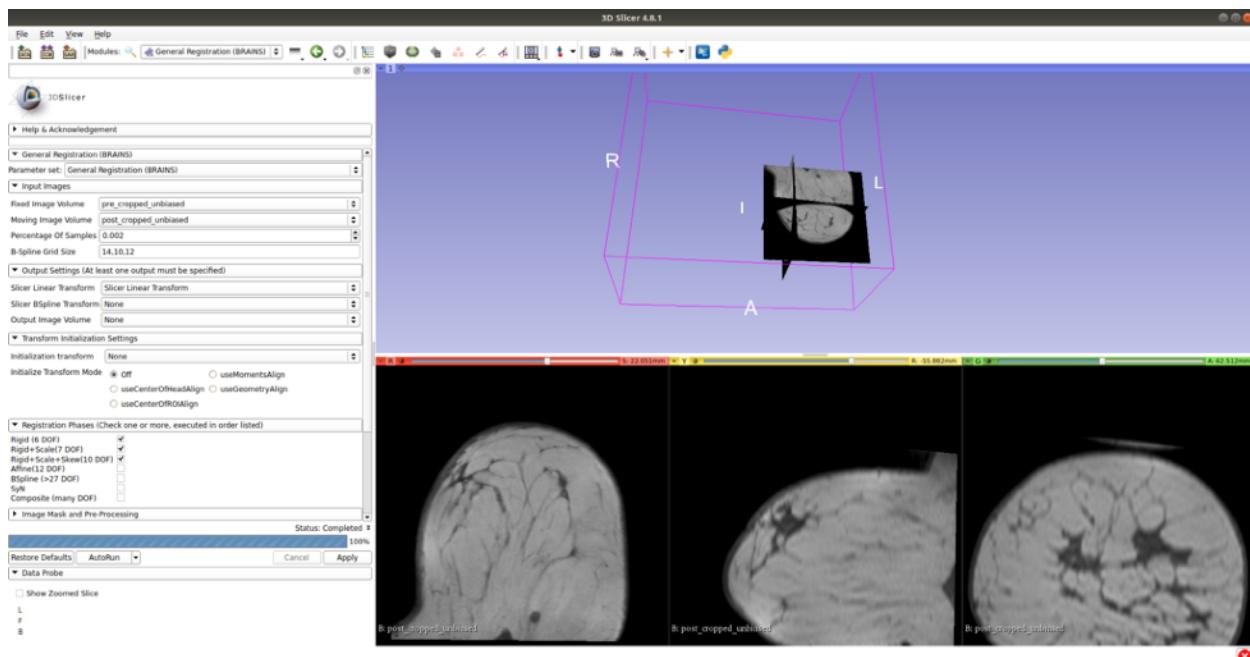
And If we compare with the original images (images in each row correspond to the exact same slices):

(Although the images in the table seem small, they have the highest quality. Please zoom in)

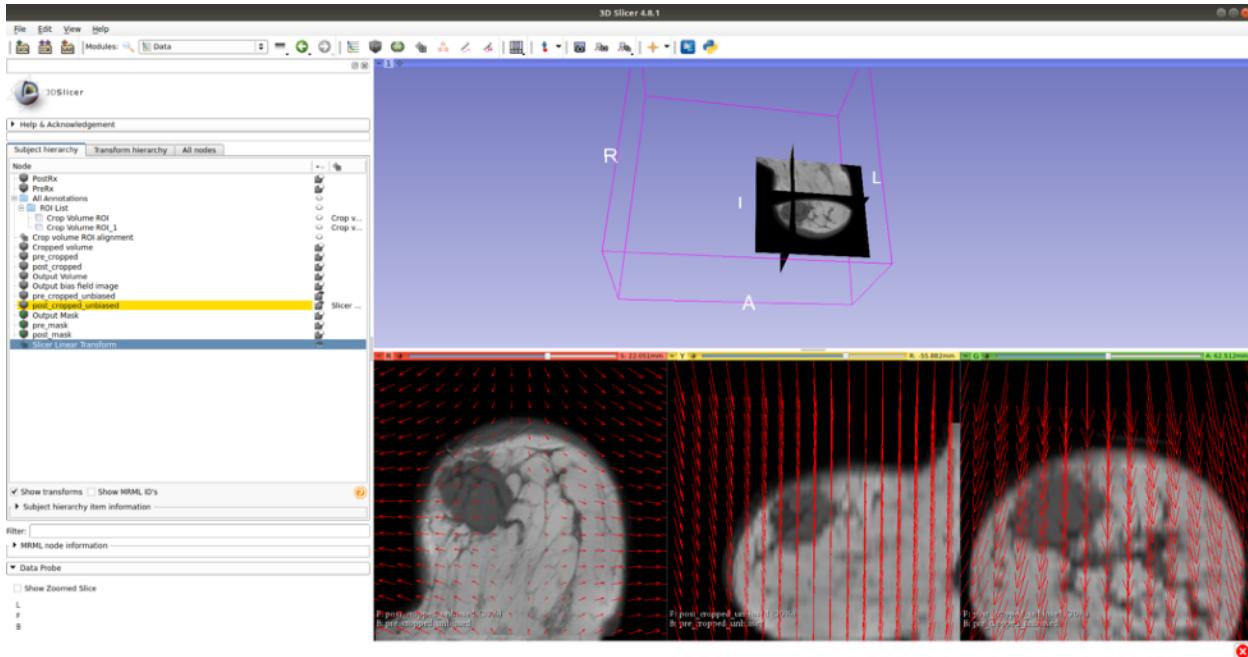
	Without the mask	Overlaid with the mask
PreRx		
PostRx		

Item e

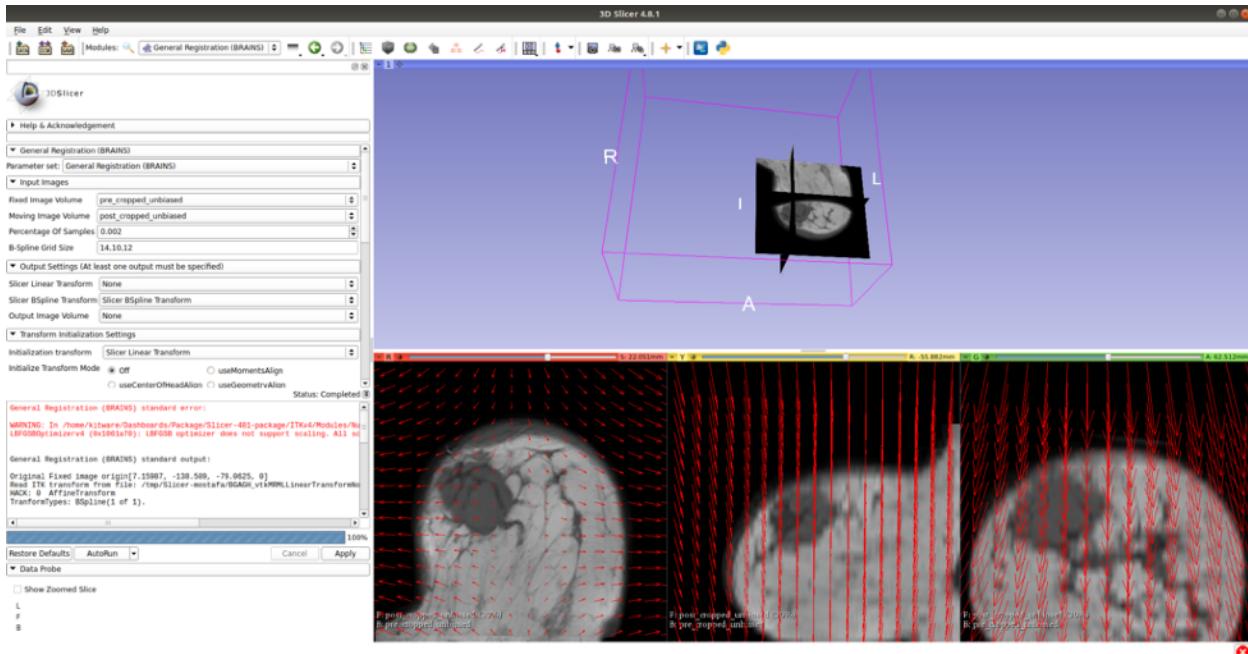
First screenshot for the setting:



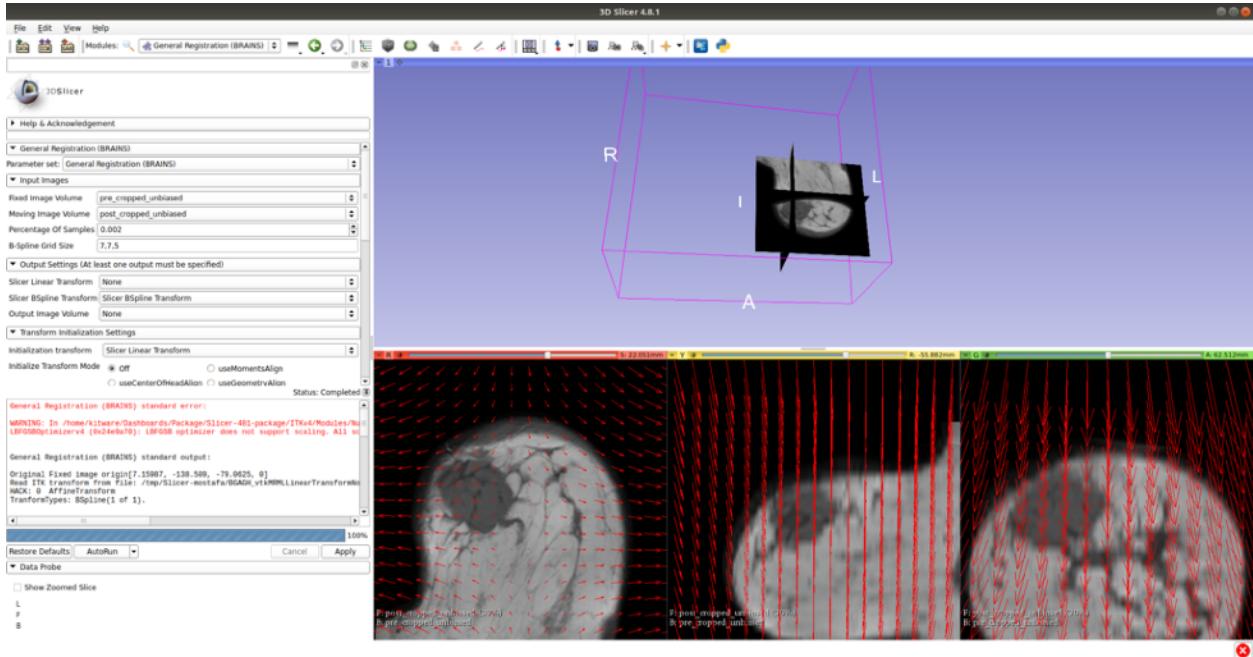
The visualization of the transform:



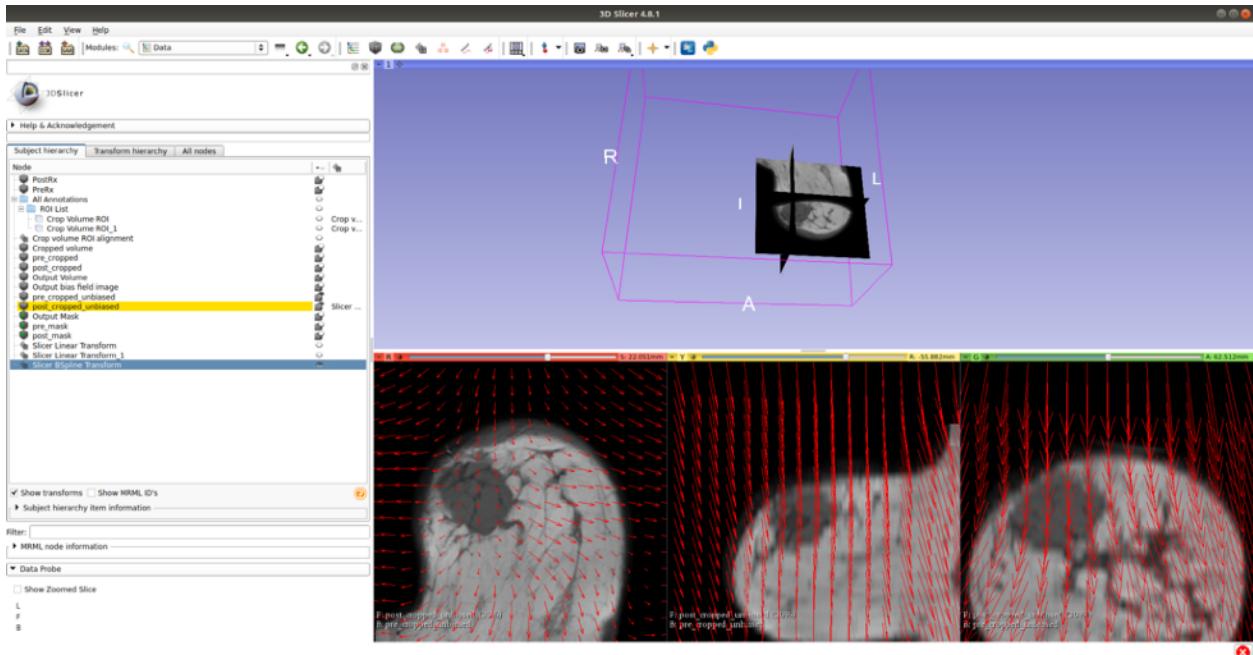
Slicer BSpline Transform generates results, but outputs some errors (I have attached the error message in **5/5-e-3.txt** file in the **ScreenShots.zip** file).



Changed the grid size and the error message changed (I have attached the error message in **5/5-e-4.txt** file in the **ScreenShots.zip** file). I think it is not my fault after I read the message. You can see the results:

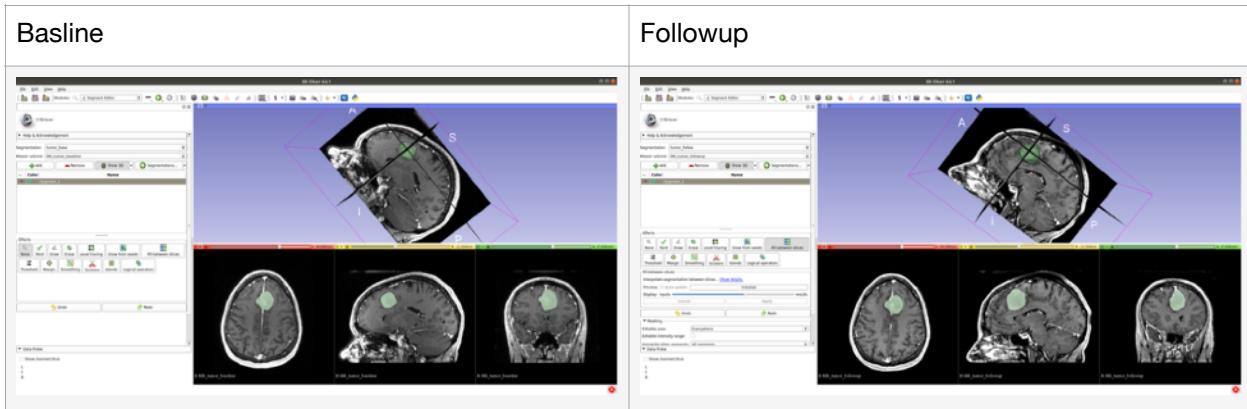


And this is the final visualization:

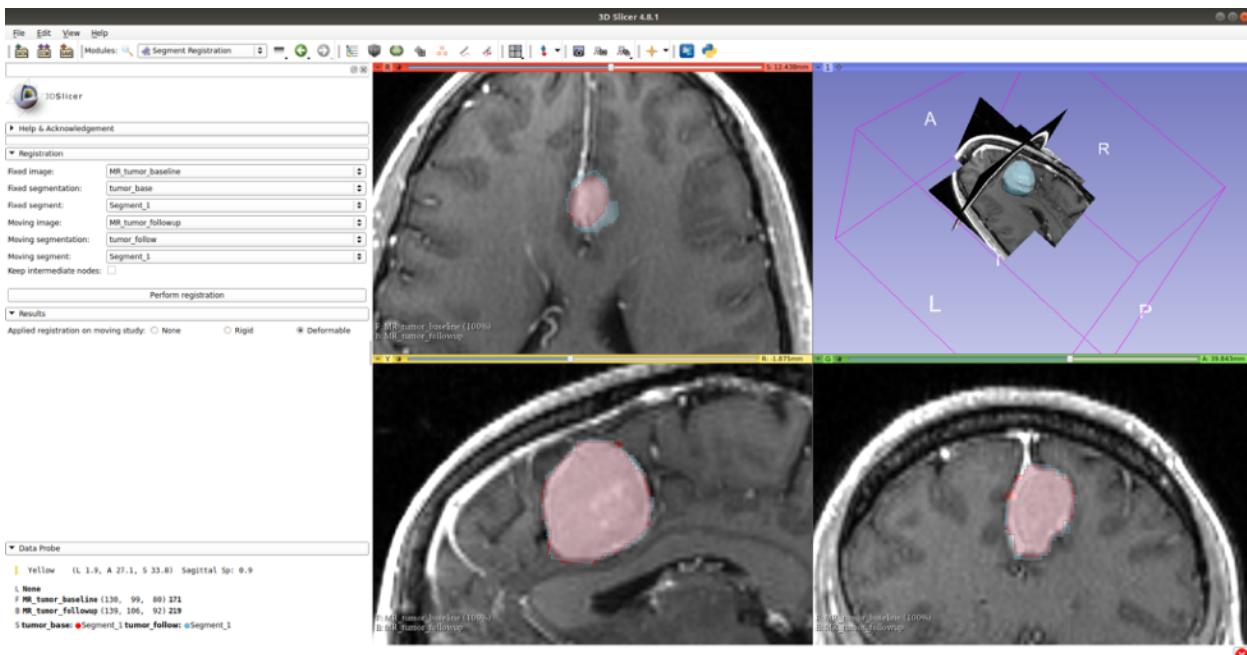


Question 6

Item a

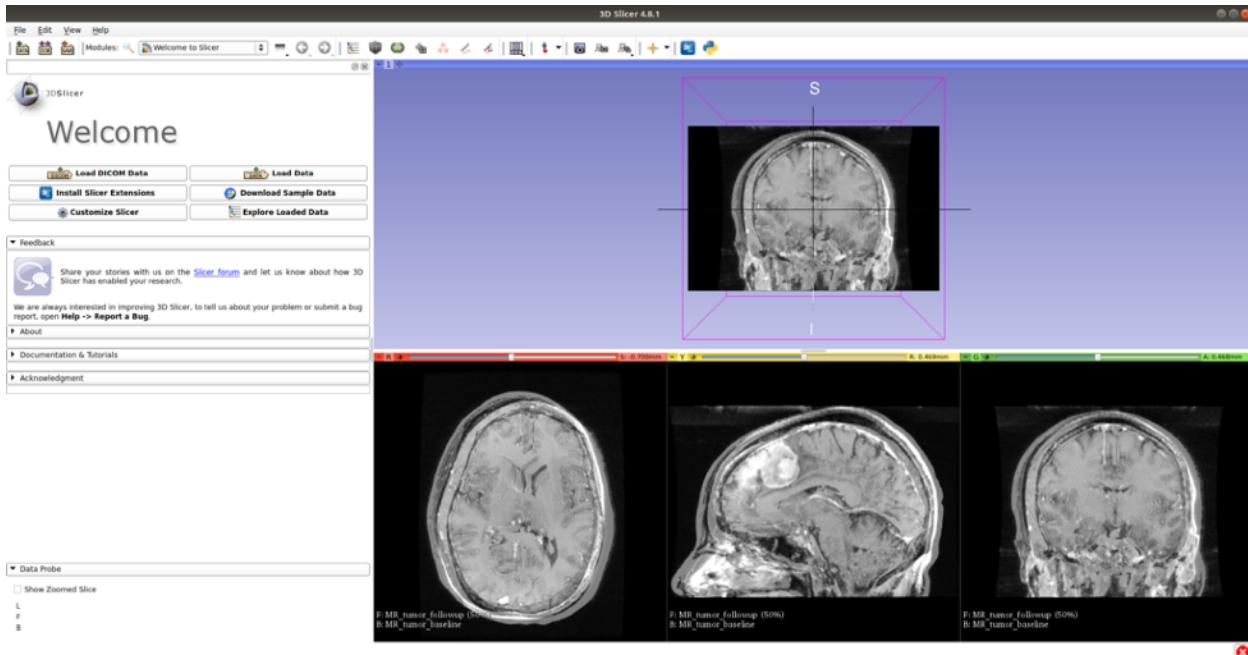


Item b

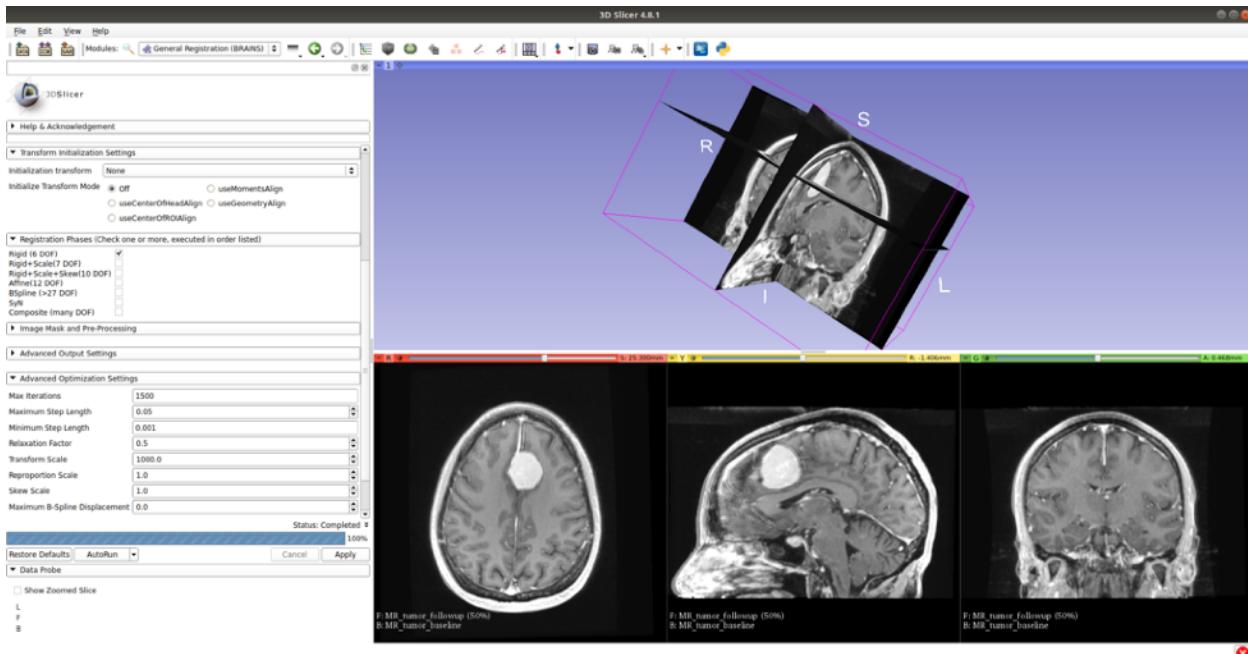


Item c

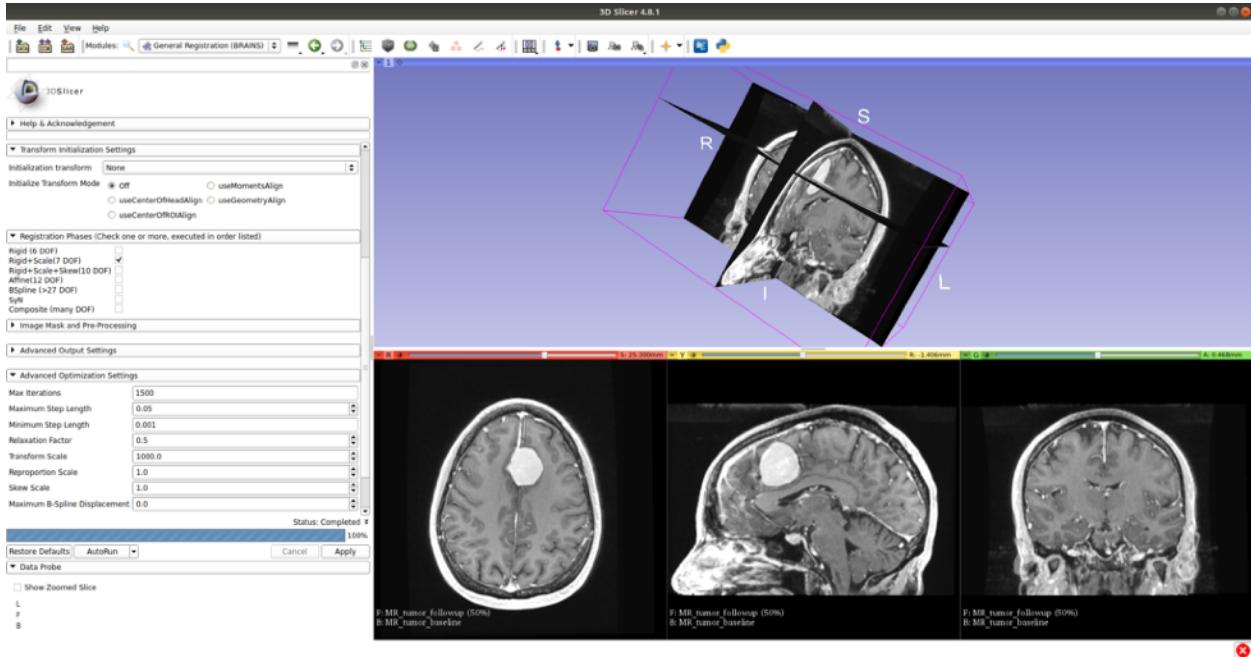
Before the registration:



After the registration with rigid:



But as you can see, there are some misalignments in the skull that causes the edges be blurry in the overlayed image (you need to zoom-in on the previous image). I solved this using the **rigid+scale** registration:



As you can see, the edges are much better aligned. This can be a result of the patient being closer or away from the detector of the different scanners.

Anyways, this is the result of dice similarity:

