



Tutorial for using Slicer 3D

This presentation sums up the different steps with all the parameters used in the modules

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Step 1: Resampling

- Use the module "Resample Scalar Volume"
- Create a new CommandLineModule
- Set the spacing parameters as showed on the screenshot
- Tick the "lanczos" box in interpolation
- Choose your input volume
- Create a new Output Volume
- Rename all the new volume or transforms in the "Data" module with meaningfully names for more convenience

Resample Sca	alar Volume				
			Pa	rameter se	et e
				5	Status Completed
Resampling I	Parameters				
			Spacing	0.9375,0	.9375,0.9375
Interpolation	linear	earest	Veighbor	bspline	e 📃 hamming
	cosine	welch		Ianczo	os 🔲 blackman
n 10					
			I	nput Volun	ne s.2 🗖 🔻
			Outpo	ut Volume	Re2
Default			Canc	el	Apply







Step 2: Rotate the image

- Use the module "Transforms"
- Create a new LinearTransform
- Set the angle Θ in the box IS







Step 2: Rotate the image

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- Use the module "Resample Scalar/Vector/DW Volume"
- Choose the preoperative image as input volume and create a new output volume
- Select the previously created LinearTransform in "Transform Node"
- Select the interpolation parameters
 - Tick the box "ws" in Interpolation
 - Tick the box "I" in window Function







Step 3: Rigid Registration

Use the module "Fast Rigid Registration"

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- Let the parameters in default values
- Select the previously created LinearTransform in "Initial Transform"
- Select the rotated preoperative image as fixed
- Select the resampled intra-operative image as moving
- Create a new Output transform
- You don't need to create a new volume, we just need the transform now





Step 3: Rigid Registration

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- Return to the module "Resample Scalar/Vector/DW Volume"
- Choose the intra-operative image as input volume and create a new output volume
- Select the previously created "Fast Rigid registration transform" in "Transform Node"
- Use the same parameters as before
- As result after these 3 steps, you might have the preoperative and intra-operative image rotated and registered
- Save your work: scene, volumes, transforms...
- You're ready for the segmentation



Step 4: Segmentation

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- Use the module "Editor"
- The segmentation will be done on the pre-operative image
 - Put it in Master Volume
- Set the merge volume
 - Create new
 - Colour table: GenericAnatomyColors
- Add the different structures: brain, tumour, ventricles...
- To edit the label maps, just click on it in the table

 Create & Select Label Maps 					
Master Volu	me:	Rotate spgr1 🗖			
Merge Volume: Rotate spgr1-label1 Set					
Per-Structure Volumes — X					
Add Structure Split Merge Volume					
Number	Color	or Name LabelName 🖆			
38		brain	Rotate spgr1-brain-label		
107		ventricles_of_brain	Rotate spgr1-ventricles_of_br		
9		foreign_object Rotate spgr1-foreign_object-k			
Delete Structures Merge All Merge And Build					



Step 4: Segmentation

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> The tools useful in our cases are

- 🖸 : LevelTracing (more particularly for the ventricles)
- 🔚 : Threshold (can be use but the image has to be clean up after that)
- 🗹 : Draw (draws the edges and fills in with the chosen colour)
- 🗹 : Paint (useful for filling up the holes)

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• 🕼 : EraseLabel (set the colour in zero to erase the label)

 Edit Selected Label Map 	
Label 107 🚔	R 6
Active Tool:	2 💪 🖸 🔳
	•
	🏚 🖶 🛣
	4 ≫ ≫
	<√
	✓ Undo/Redo





Step 5: Smoothing

- Use the module "LabelMapSmoothing"
- Select the label (colour) to smooth
- Choose a value for sigma between:
 - 1 -> gives good result and is the maximum value
 - 0.2 -> is the default value
- Choose your input label map and a new Output volume

Label Map Smoothing			
	Parameter set g		
	Status Completed		
Label Selection Parameters			
Labe	I to smooth 107		
 AntiAliasing Parameters 			
 Gaussian Smoothing Parameters 	 Gaussian Smoothing Parameters 		
	Sigma 0.2		
▲ I 0			
	Input Volume RI		
	Output Volume e 🔄 🛋		
Default	Cancel Apply		





Step 5: Smoothing

- Use the module "LabelStatistics" to check your smoothed label map
- Put the original label map in the two input boxes
- Check the count of voxels and repeat the operation with the smoothed label map
- The count shouldn't decrease more than 3% If it's the case, repeat the smoothing with a decreased sigma

Label St	atistics			
Input Grayscale Volume: Resampln-label				
Input Labelmap: Resampln-label 🛁 🗮				
				Apply
Label	Count	Volume (mm^3)	Min	Max
<u> </u>	10459761	8618577.484131	0.000000	0.000000
107	25999	21422.515869	107.000000	107.000000
				Ŧ



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Step 5: Model making

- Use the module "ModelMaker"
- Choose your input label map and create a new ModelHierarchy
- Name your model
- Define the parameters as showed in the screenshot (max for smooth is 20)

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- Check the difference between the model and the label map by ticking the box "Slice intersections visible" in the module "Models"
 - If there is a big difference, recreate the model by decreasing the Laplacian parameter
- Save your models for the meshing









Step 6: Meshing (Block(s))

- Use the module "IA-FEMesh" or the independent software
- Load a surface which is your .vtk file
- Create a block from the chosen surface bond
- You can now built and edit this block
 - Manipulate the corners or faces from the block
 - 🕒 : Split the block to create new ones
 - Add a block to a face from an other
 - Image: Delete a block from the structure of blocks
 - 🔟 : Mirror a block or a structure (useful for symmetric parts like ventricles)
 - 🛐 : Merge two corners (useful after using the mirror)
- The block should be as close as possible from the original surface to mesh





Step 6: Meshing (Block(s))

Here you can see the blocks around the parenhyma and the ventricles













Step 6: Meshing (Mesh)

- Choose the size of the elements in the tab "Mesh" and the choice "Assign/Edit Mesh Seeds"
- Define the element length for the three direction
 - The values can be different for each direction
 - Try a first mesh with a default value of 3 in each direction
- You can improve the size after have had a look at the quality of the meshing

Assign/Edit Mesh Seeds	-
Building Block	×
Color Code Mesh Seeds	
Element Length	
Rx : 3 Gy : 3 Bz : 3	
Apply	Cancel

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Step 6: Meshing (Mesh)



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Step 6: Meshing (Mesh)

- You will now create the volumetric mesh on Building Blocks
- Choose the surface and the block you want to use. This is useful when you import the whole model of the brain (parenhyma, tumour, ventricles) in the same session
- Give a label to node and element (you can put what you want as here)
- Tick the case "Perform smoothing" off

Create
Volumetric Mesh
Surface Mesh
Building Block
Surface & Building Block ————————————————————————————————————
Surface: Rotate Ventricles_107_ventricles_of_brain
Building Block : Rotate Ventricles_107_ventricles_of_brain_BBb-1
Label
Node 1 a
Element 1 b
Interpolation: Elliptical
Perform Smoothing
Smoothing Parameters
Apply Cancel

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Step 6: Meshing (Quality)

- Choose "Evaluate/Display/Mesh Quality"
- Select the mesh and the type of metric you want to evaluate
 - Jacobian is the most important, no element should have a negative number
- The Summary Report gives you the count of element as well as the number of distorted elements and other stats.

Jacobian Summary	
# Elements 2693 # Distorted 207	Evaluate / Display Mesh Quality
Minimum -11.924 Maximum 37.545	
Average 4.901 Variance 21.996	Maph
Distorted Elements	X
ElementID: 055478, quality: -0.982 ElementID: 055484, quality: -3.554 ElementID: 055490, quality: -4.250 ElementID: 055530, quality: -4.250 ElementID: 055532, quality: -5.830 ElementID: 055538, quality: -1.358 ElementID: 055544, quality: -0.958 ElementID: 055607, quality: -2.442 ElementID: 055607, quality: -2.021	Mesh: Rotate Ventricles_107_ventricles_of_brain_VMesh-L Metric : Jacobian Summary Report Display Options Invert View
Save 🔁 Cancel	Cancel