

3D Slicer

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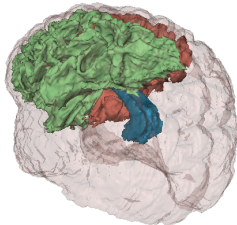
Department of Biostatistics



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What is Slicer

- <http://www.slicer.org>; 3.6.x
 - Mac, Linux, Windows
 - 3D slicer gallery: <http://www.slicer.org/publications/gallery>
 - SlicerWelcome is useful at the beginning
-



Step 1: Loading data

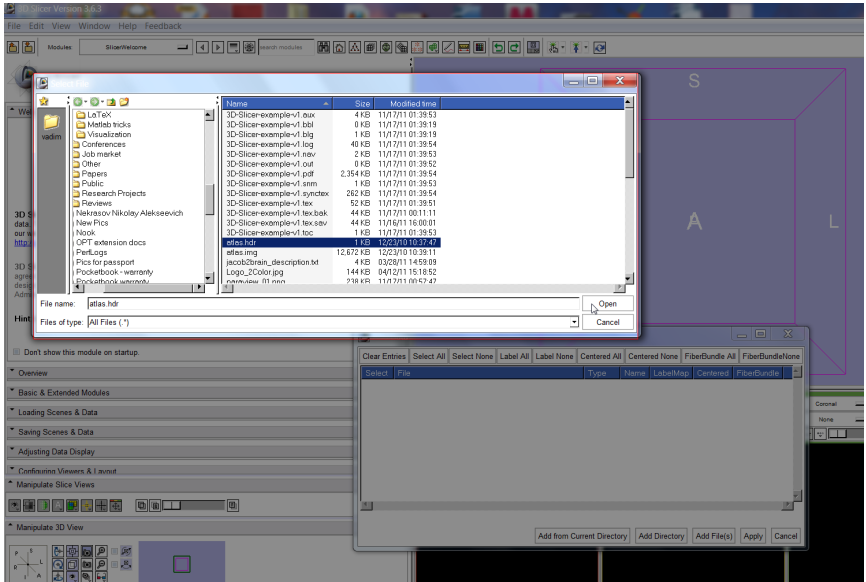
- Brain atlas atlas.img/hdr (Analyze)
- 91 labeled regions

1	medial front-orbital gyrus right	69	lingual gyrus left
2	middle frontal gyrus right	70	superior frontal gyrus left
3	lateral ventricle left	72	nucleus accumbens left
4	insula right	73	occipital lobe WM left
5	precentral gyrus right	74	postcentral gyrus left
6	lateral front-orbital gyrus right	75	inferior frontal gyrus right
7	cingulate region right	80	precentral gyrus left
8	lateral ventricle right	83	temporal lobe WM left
9	medial frontal gyrus left	85	medial front-orbital gyrus left
10	superior frontal gyrus right	86	perirhinal cortex right
11	globus pallidus right	88	superior parietal lobule right
12	globus pallidus left	90	lateral front-orbital gyrus left
14	putamen left	92	perirhinal cortex left
15	inferior frontal gyrus left	94	inferior temporal gyrus left
16	putamen right	95	temporal pole left
17	frontal lobe WM right	96	entorhinal cortex left
19	angular gyrus right	97	inferior occipital gyrus right
23	subthalamic nucleus right	98	superior occipital gyrus left
25	nucleus accumbens right	99	lateral occipitotemporal gyrus right
26	uncus right	100	entorhinal cortex right
27	cingulate region left	101	hippocampal formation left
29	fornix left	102	thalamus left
30	frontal lobe WM left	105	parietal lobe WM right
32	precuneus right	108	insula left
33	subthalamic nucleus left	110	postcentral gyrus right
34	PLICICPL*	112	lingual gyrus right
35	PLICICPR*	114	medial frontal gyrus right
36	hippocampal formation right	118	amygdala left
37	inferior occipital gyrus left	119	medial occipitotemporal gyrus left
38	superior occipital gyrus right	128	anterior limb of internal capsule right
39	caudate nucleus left	130	middle temporal gyrus right
41	supramarginal gyrus left	132	occipital pole right
43	anterior limb of internal capsule left	133	corpus callosum
45	occipital lobe WM right	139	amygdala right
50	middle frontal gyrus left	140	inferior temporal gyrus right
52	superior parietal lobule left	145	superior temporal gyrus right
53	caudate nucleus right	154	middle occipital gyrus left
54	cuneus left	159	angular gyrus left
56	precuneus left	165	medial occipitotemporal gyrus right
57	parietal lobe WM left	175	cuneus right
59	temporal lobe WM right	196	lateral occipitotemporal gyrus left
60	supramarginal gyrus right	203	thalamus right
61	superior temporal gyrus left	243	background
62	uncus left	251	occipital pole left
63	middle occipital gyrus right	254	fornix right
64	middle temporal gyrus left	255	subarachnoid cerebro-spinal fluid

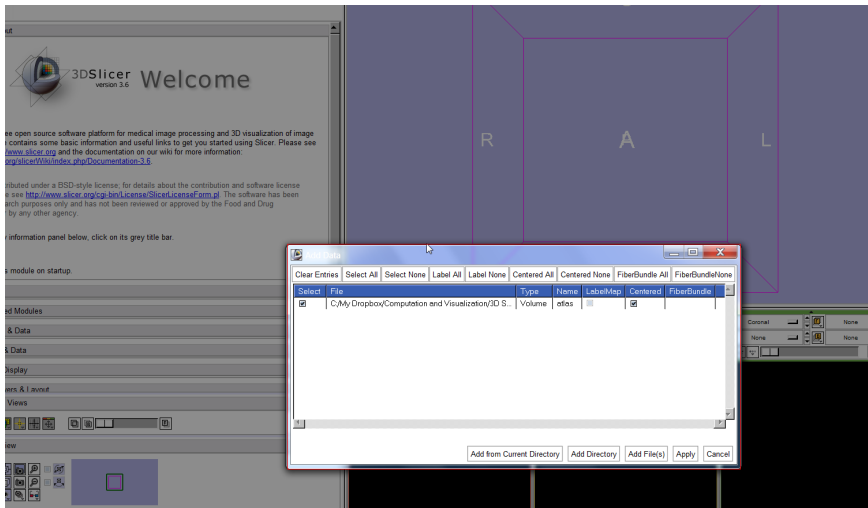
Step 1: Loading data

- **File** ⇒ **Add Data** ⇒ choose atlas.hdr (check Centered if applicable)
⇒ Click Apply.
note: .img files always go with .hdr, at this step .hdr should be chosen.
- *Result:* the data is loaded and you can see it in the three windows (directional)

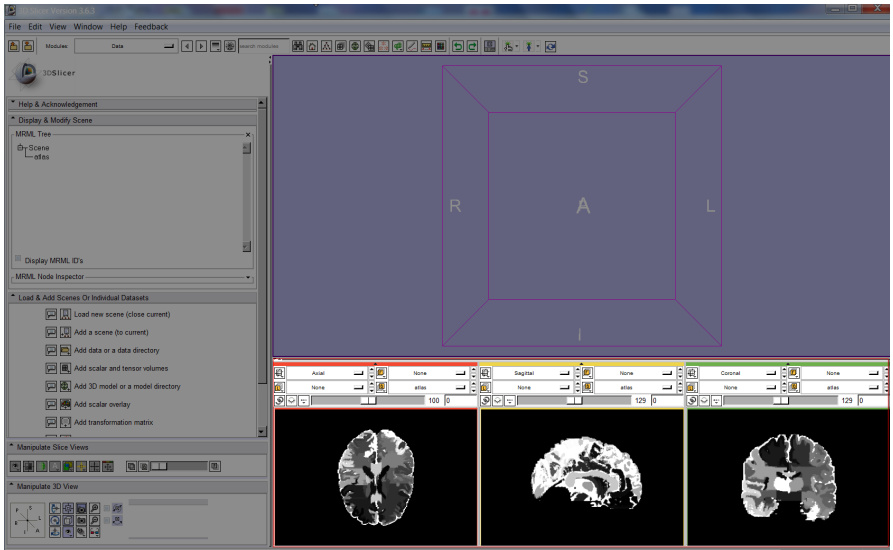
Step 1: Loading data



Step 1: Loading data



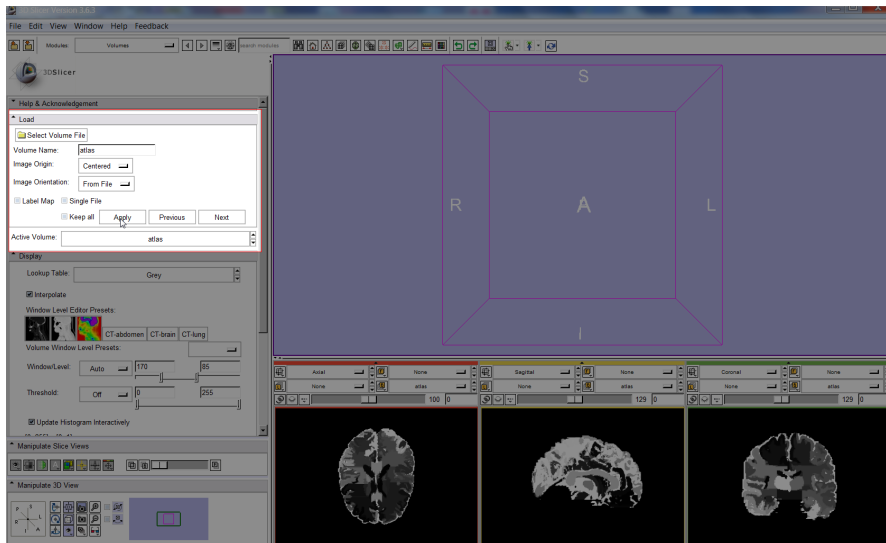
Step 1: Loading data



Step 2: Creating Volume

- **Volumes** module $\Rightarrow$ choose volume name: atlas $\Rightarrow$ Apply
- *Result:* the volume created

Step 2: Creating Volume



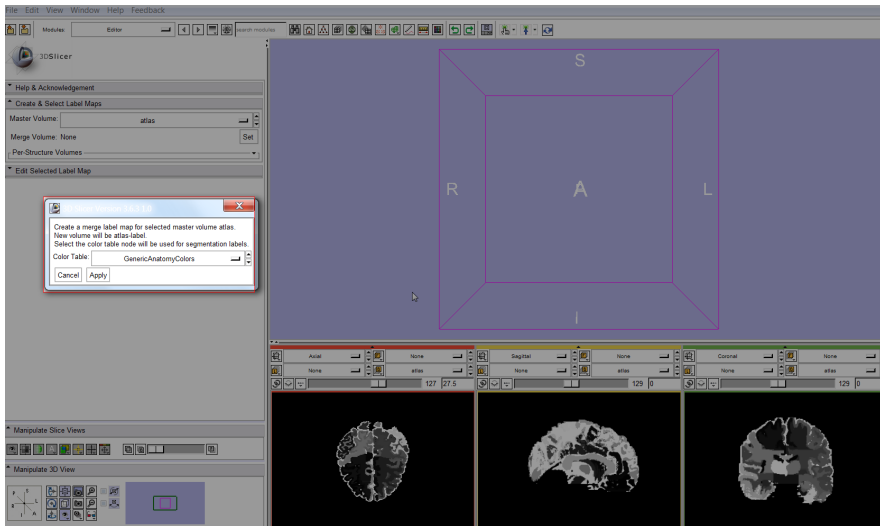
Step 3: Creating Models

- **Editor** module $\Rightarrow$ choose **Master Volume** (depends on Slicer version)
- in **Edit Selected Label Map** window choose Level number and color
- click **Threshold** $\Rightarrow$ choose range (on the right you can see what areas are within this range) $\Rightarrow$ click **Apply**
- click **MakeModel** $\Rightarrow$ choose **Name** $\Rightarrow$ check **Smooth Model** (if applicable)
- *Result:* The model is built with the pre-chosen color.

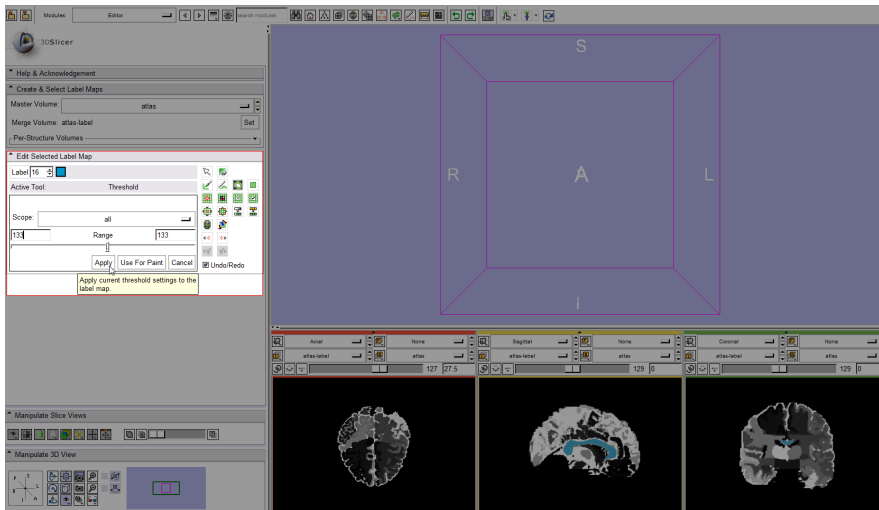
Step 3: Creating Models

- The first model is corpus callosum labeled 133 (Threshold: 133:133), color: blue
- The second model is frontal lobe WM right labeled 17 (Threshold: 17:17), color: green
- The third model is frontal lobe WM left labeled 30 (Threshold: 30:30), color: red
- The last model is the whole brain (Threshold: 1:255), color: grey

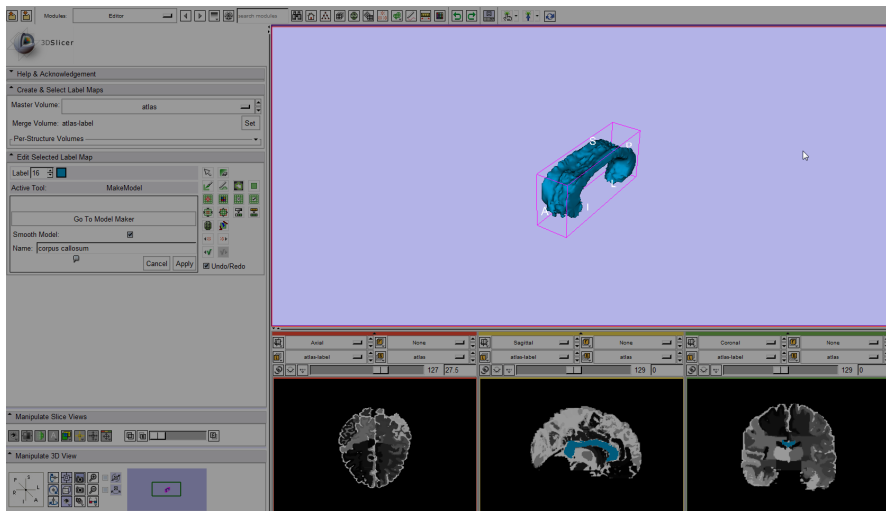
Step 3: Creating Models



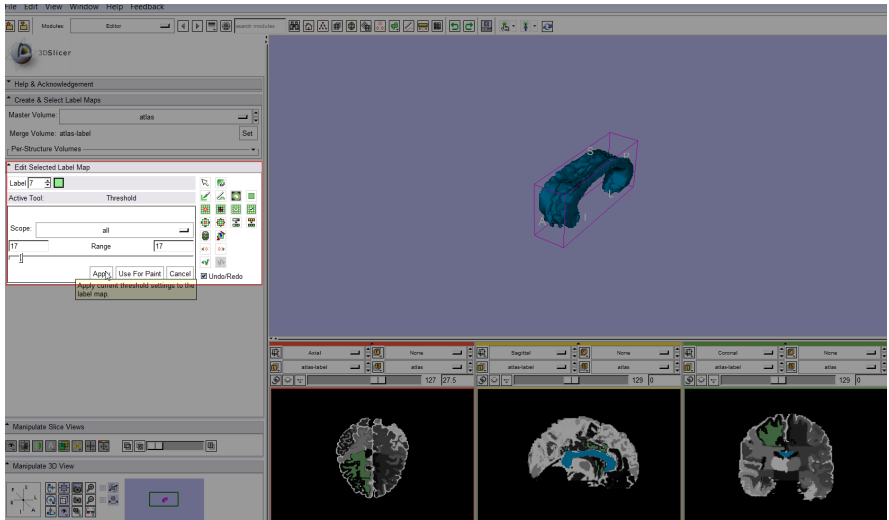
Step 3: Creating Models



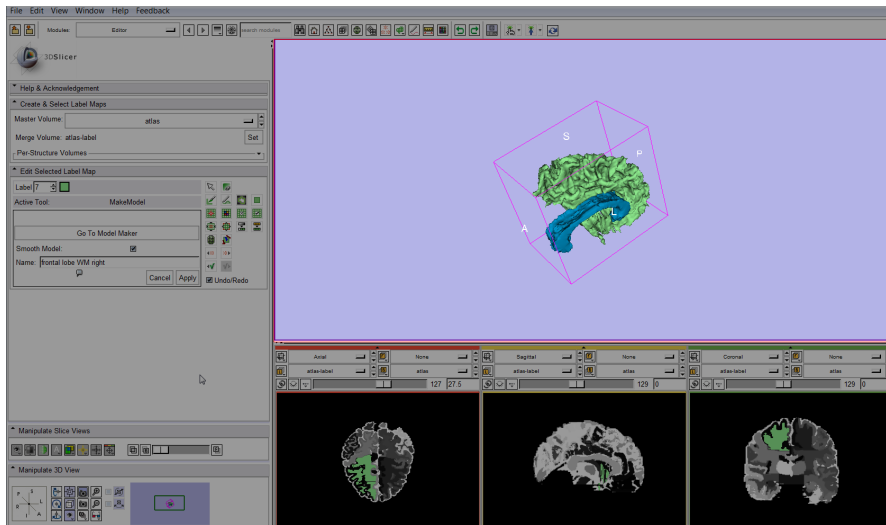
Step 3: Creating Models



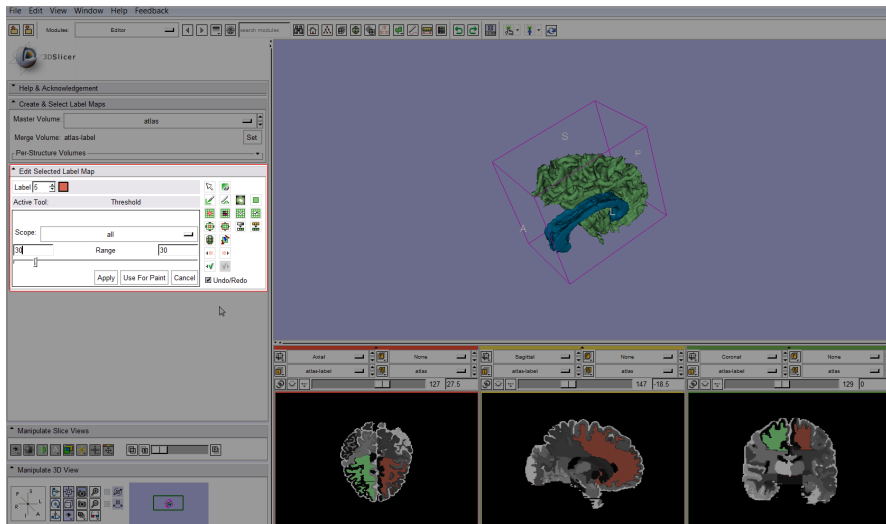
Step 3: Creating Models



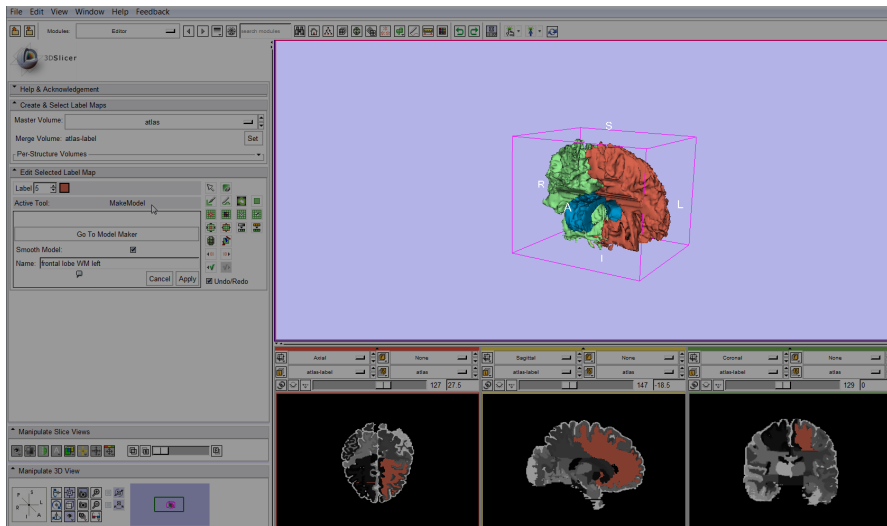
Step 3: Creating Models



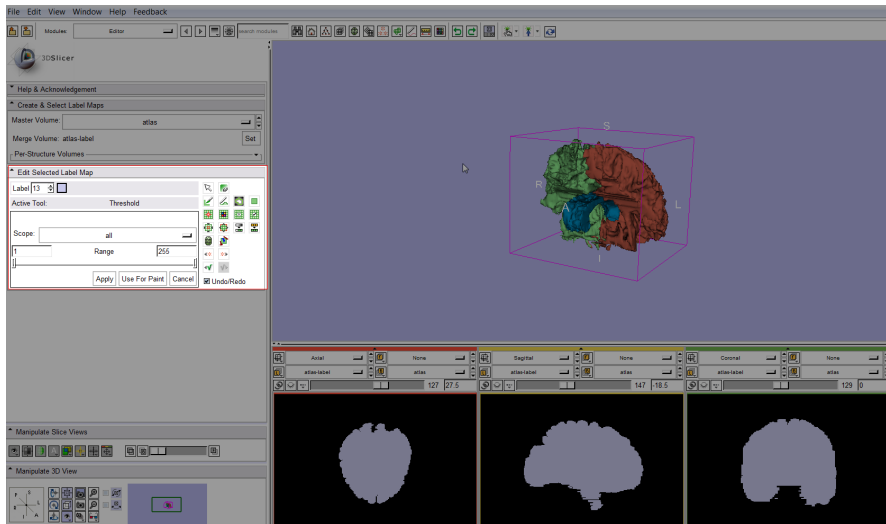
Step 3: Creating Models



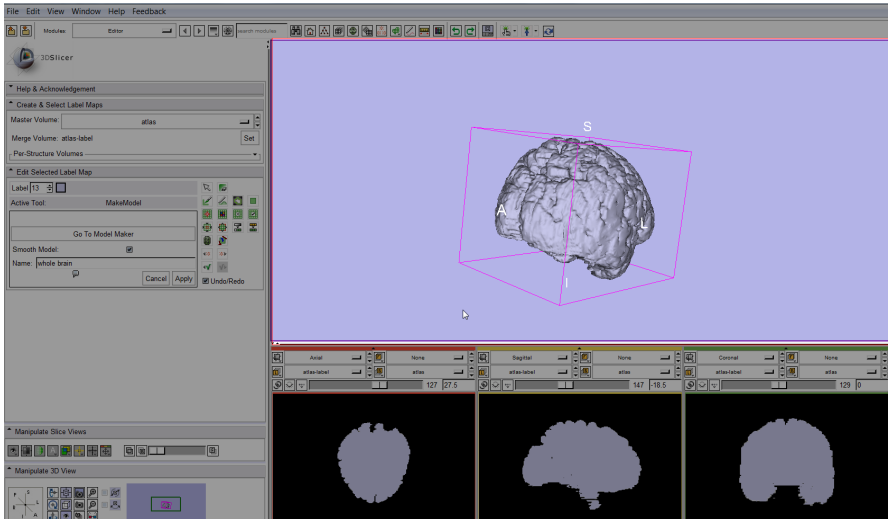
Step 3: Creating Models



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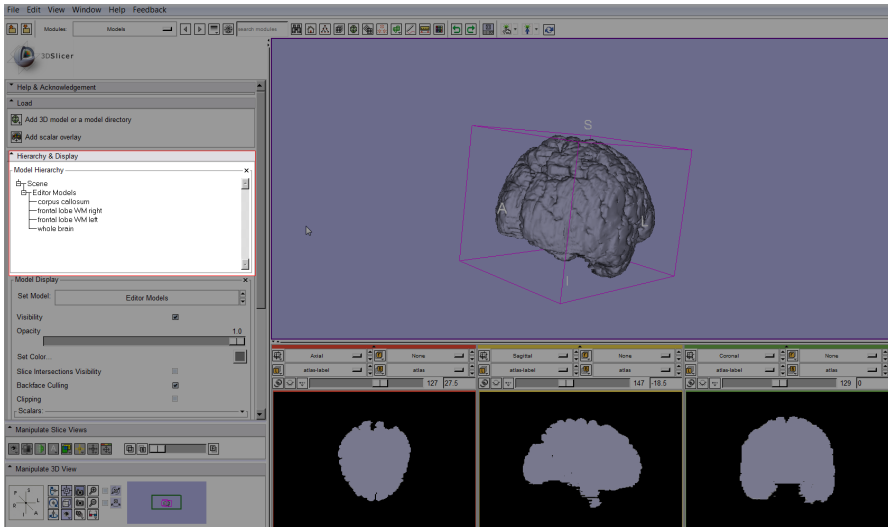
Step 3: Creating Models



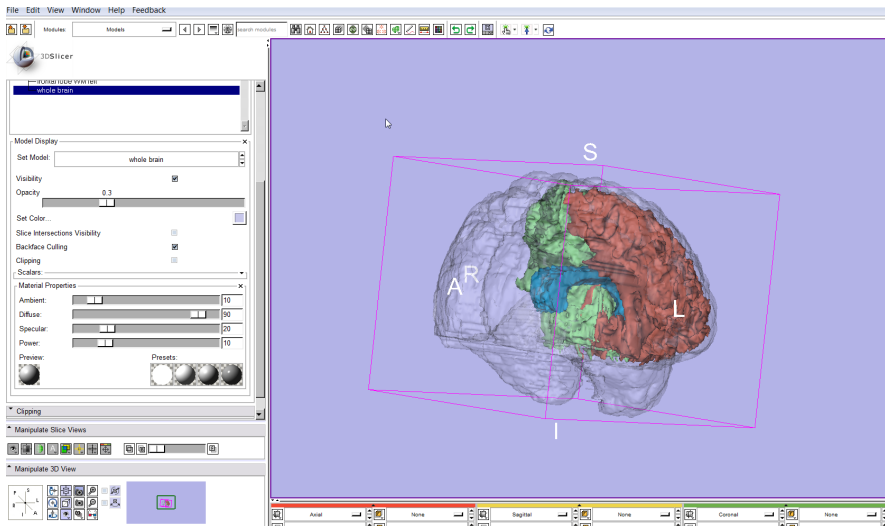
Step 4: Playing with the Models

- **Models** module shows the created models
- you can change visibility, opacity, set new color(in a much more convenient way), play with other things
- The brain opacity can be set to see the other regions

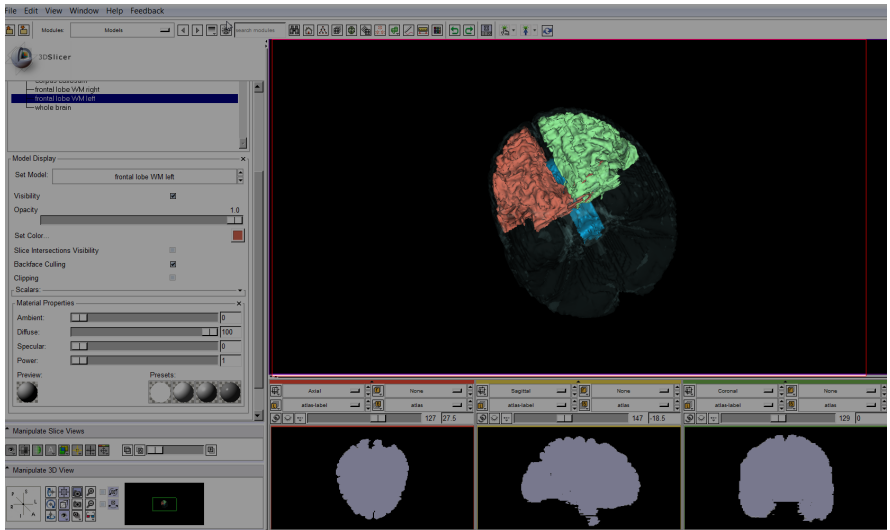
Step 4: Playing with the Models



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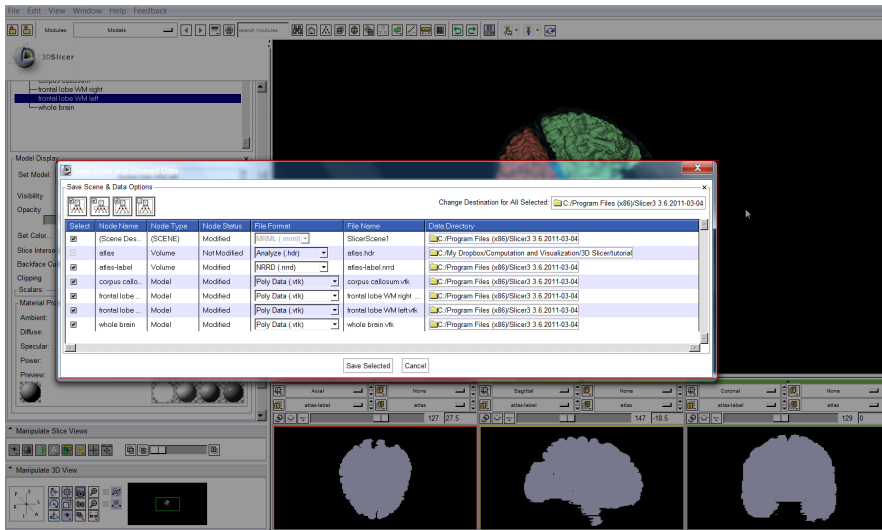
Step 4: Playing with the Models



Step 5: Saving the Scene

- **Save** $\Rightarrow$ Select scene (.mrml) and the volumes(.vtk) included into the scene
- Once the scene is saved you can load it later

Step 5: Saving the Scene



What is Slicer

- Awesome, duh.

Getting Data in

- Bring in data
 - ▶ DICOM/Analyze/NIFTI : File → Add Volume
 - ▶ NIFTI : File → Add Data
 - ▶ You can bring in Analyze with Add Data if selecting .hdr file
- Generally need a brain image (structural / functional / template) - needs to be in same space as labels
- This makes up a scene (pretty much a project)

Labels

- Label map is surprisingly a map of labels.
- We'll be looking at categorical labels (thresholded or different structures)
- We need to construct a “model”, which essentially is a 3D construction of the data.
- We go to Editor Module (upper left of panel, around 10 o'clock)

Labels: Structures

- Go to Editor Module (upper left of panel, around 10 o'clock)
- Select the label map image in the data
- A pop-up dialog will ask you what label map (let's just try generic colors - which are not that good, but default)
- Click structures (if not expanded)
- **Add Structures** and pick a color
- Go to **Threshold** button (Picture)
- Provide a range: if categorical, just make range 1 to 1 if label is coded as 1, for example

Labels: Make some models

- Once you're done adding all your structures, then let's build the model!
- **Merge all**
- **Merge and Build**: there should be an image now in the 3D viewer.

Zombie it up: give me brains!

- **Modules** (where Editor is) → **Surface models** → **Grayscale Model Maker**
- Select New Model, brain image (not the label), defaults, and then run (at the bottom).
- Mmm Brains
- It's so dark!?!#\$\$#

Tweak me

- **Modules** (where Editor is) → **Models**
- Grayscale Model (Scroll down)
- Change opacity/diffusion
- Try some presets, they are the shades spheres (come on, try it).
- Bottom left corner - click the axes for different views
- Click the eye to take off / put on axes and such
- Click two check boxes to see things spin!

Feeling Saucy? Record movie

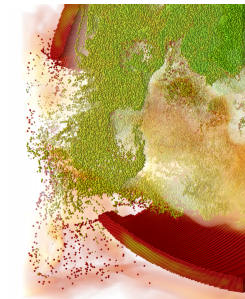
- gtk-recordMyDesktop for Linux
- Jing for Mac
- Windows? - google

More applications: BOO

- Slicer can read in 4D data, but I haven't explored.
- bioImageSuite - if trying to record a 4D movie, this does it
- Originally for Cardiac 4D movies - so pretty good.
- If you find something better, tell me!

Other visualization tools:

- Most of the existing visualization tools are collected at:
<http://www.idoimaging.com>
- **VisIt** <https://wci.llnl.gov/codes/visit/>; open source, scalable to petascale visual data analysis.
- VTK - Visualization ToolKit: 3D Slicer, VisIt, ParaView.

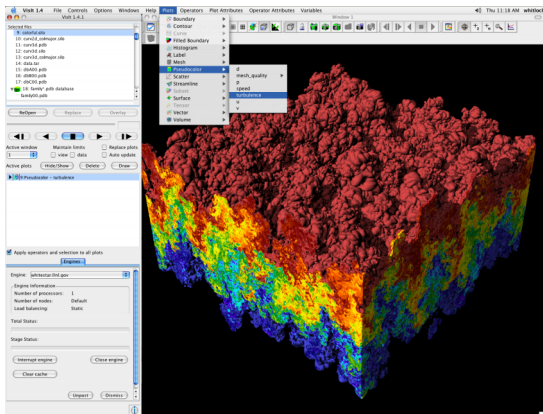


Visualized is a sectional view of the rupturing of a steel container that is filled with a plastic bonded explosive and heated by a fire.

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Other visualization tools:

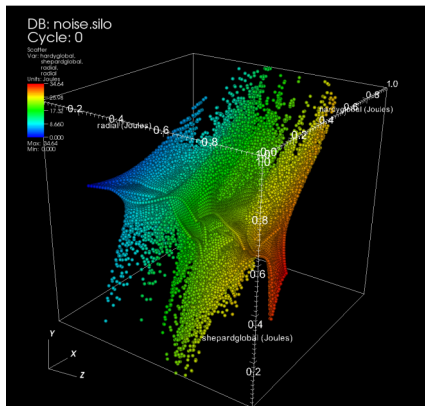
- **VisIt** <https://wci.llnl.gov/codes/visit/>



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Other visualization tools:

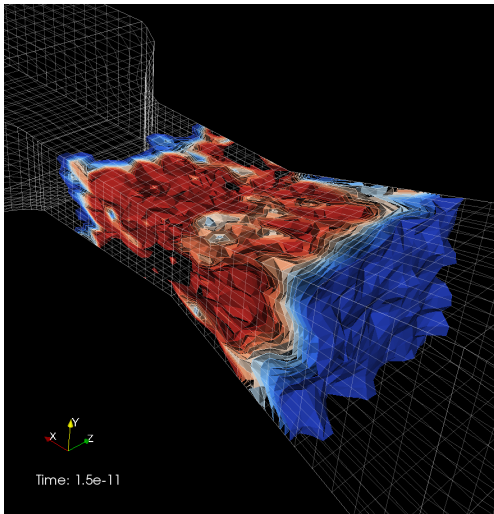
- **VisIt** <https://wci.llnl.gov/codes/visit/>



copyright: VisIt manual

Other visualization tools:

- **ParaView** www.paraview.org; open source



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