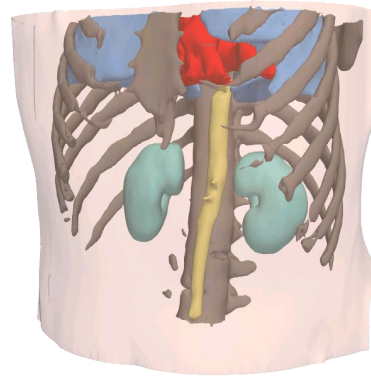
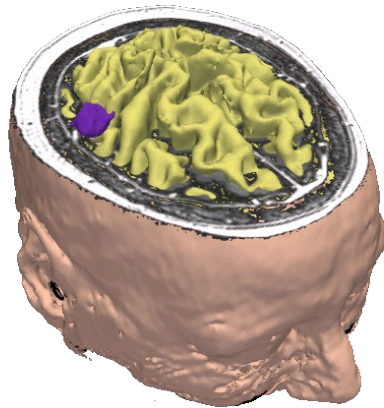




# EMSegmenter Tutorial (Simple Mode)

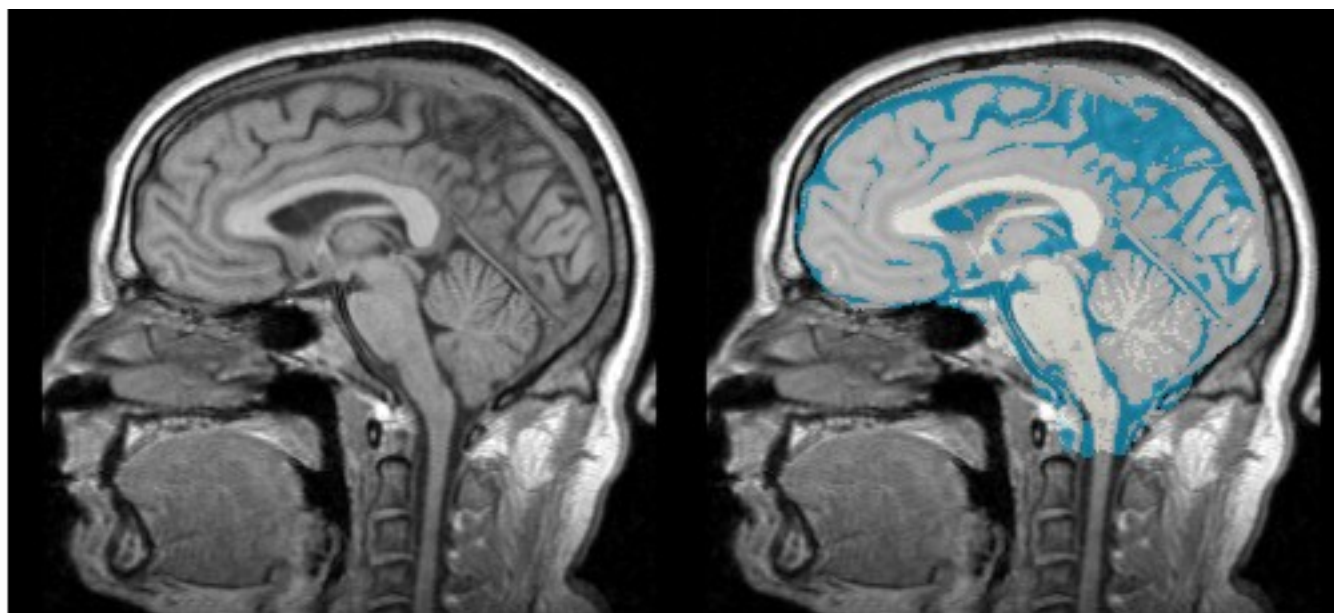


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Section of Biomedical Image Analysis  
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University of Pennsylvania

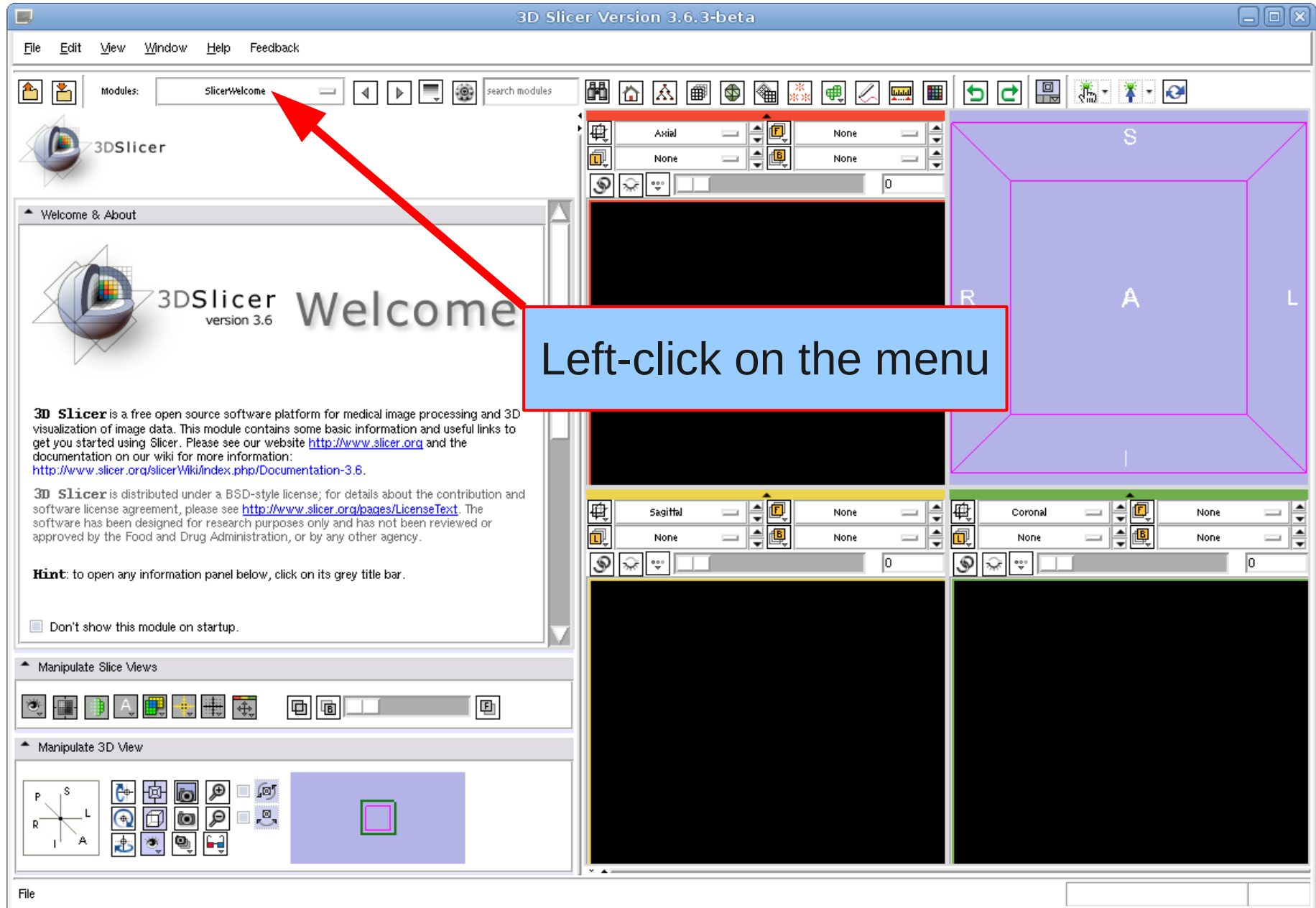
The goal of this tutorial is to apply the EMSegmenter to MRI brain scans. We will segment the clinical T1 scan shown below into **grey matter**, **white matter**, and **cerebrospinal fluid**.

The tutorial is based on Slicer 3.6.3 .



Before

After



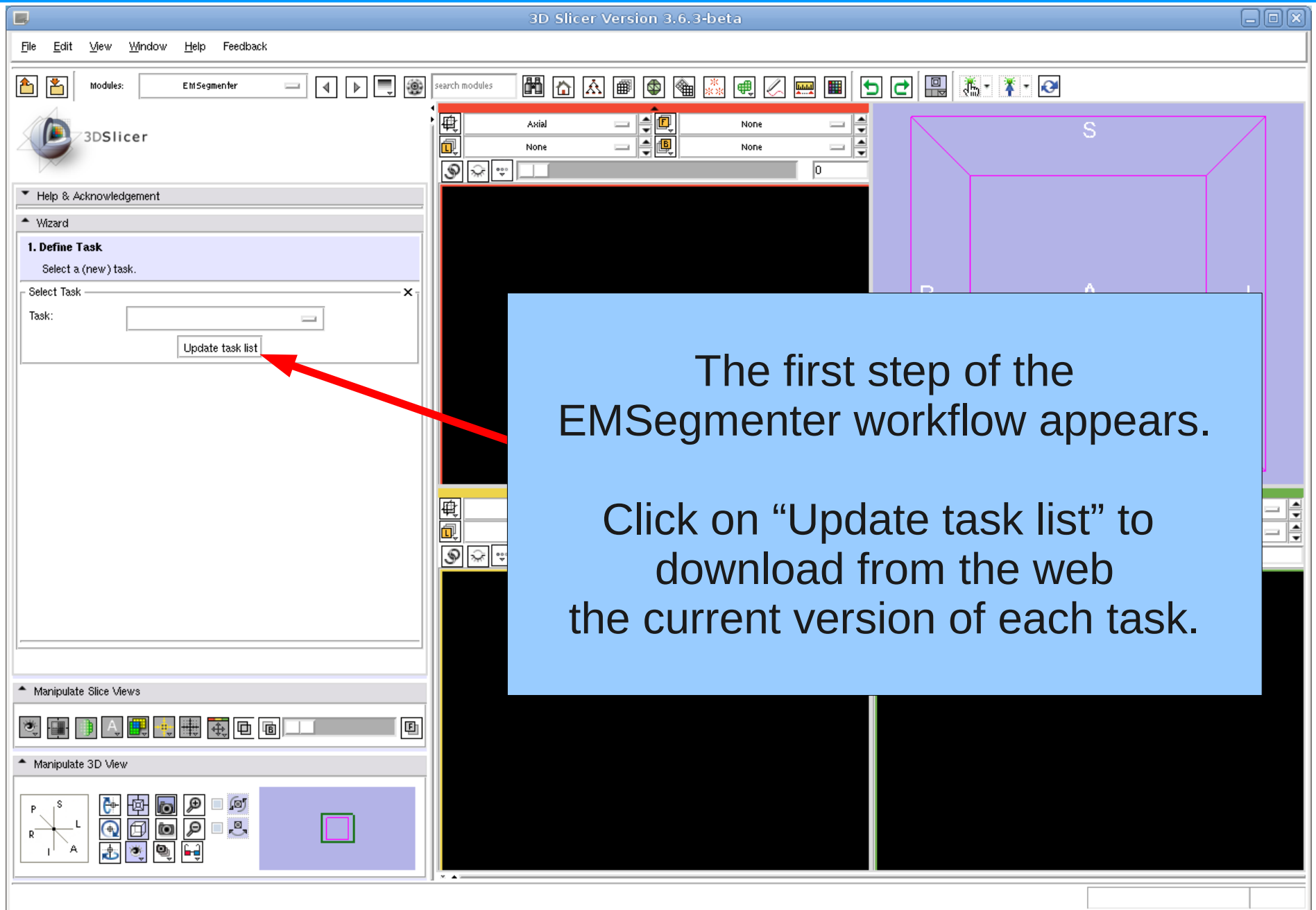


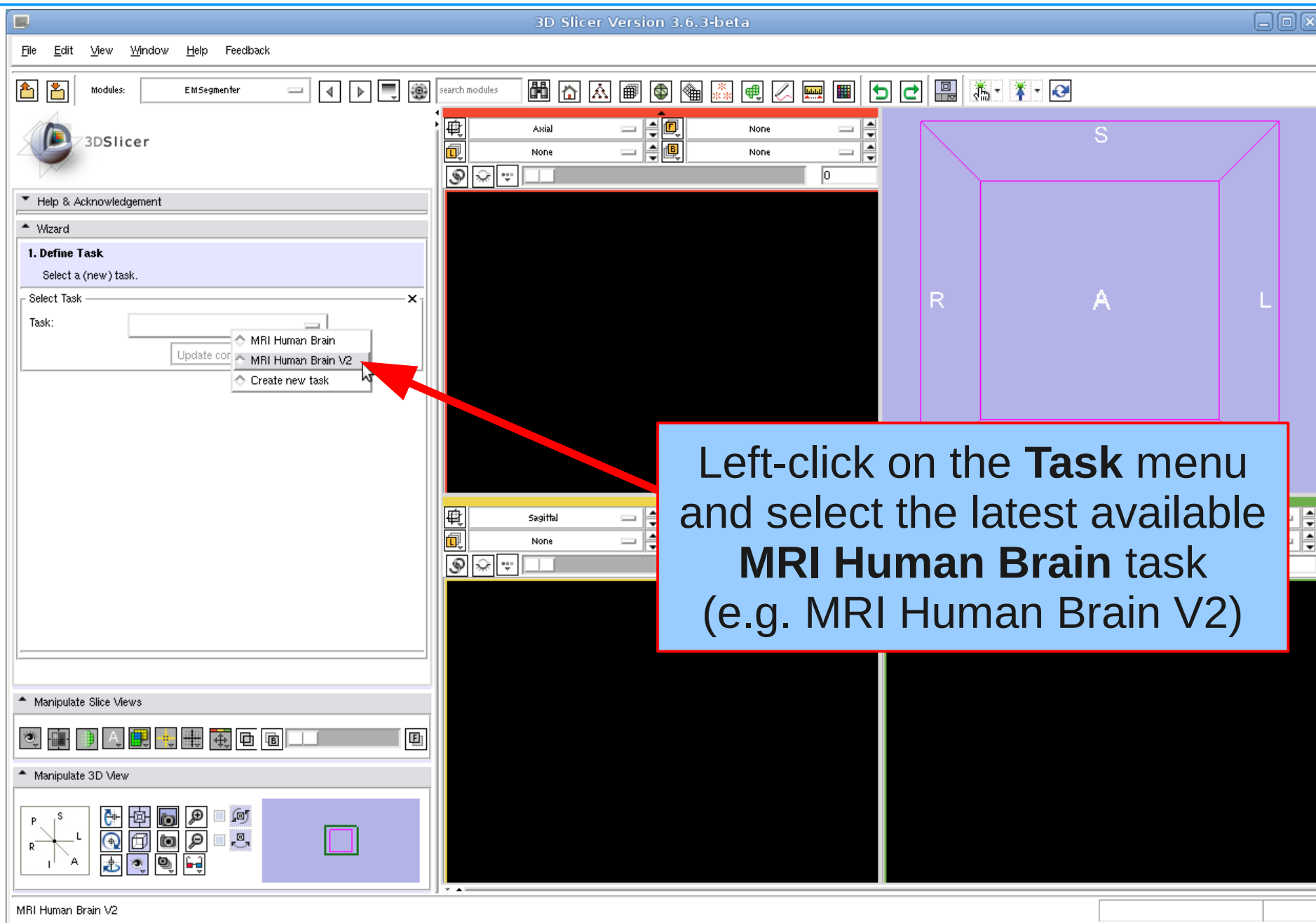
3DSlicer

# Select EMSegmenter module



The screenshot shows the 3D Slicer 3.6.3-beta interface. On the left, the 'Module' list is expanded to 'Segmentation', and the 'EMSegmenter' module is highlighted. A red arrow points from a blue callout box to the 'EMSegmenter' module. The callout box contains the text 'Select Segmentation → EMSegmenter'. The main window displays three orthogonal slice views: Axial, Sagittal, and Coronal. The Axial view is highlighted in red, the Sagittal view in yellow, and the Coronal view in green. The 3D view at the bottom shows a purple rectangular region on a black background.





3D Slicer Version 3.6.3-beta

File Edit View Window Help Feedback

Modules: EM Segmenter

search modules

3DSlicer

Help & Acknowledgement

Wizard

**1. Define Task**

Select a (new) task.

Select Task

Task:

- MRI Human Brain
- MRI Human Brain V2**
- Create new task

Update cor

Left-click on the **Task** menu and select the latest available **MRI Human Brain** task (e.g. MRI Human Brain V2)

Manipulate Slice Views

Manipulate 3D View

MRI Human Brain V2

# Select Task

3D Slicer Version 3.6.3-beta

File Edit View Window Help Feedback

Modules: EM Segmenter

search modules

3DSlicer

Help & Acknowledgement

Wizard

**1/9. Define Task**

Select a (new) task.

Select Task

Task: MRI Human Brain V2

Update task

**How do you want to proceed?**

In which mode do you want to proceed segmenting your data?

Note, downloading the default setting will reset your slicer scene and might take time depending on your network connection!

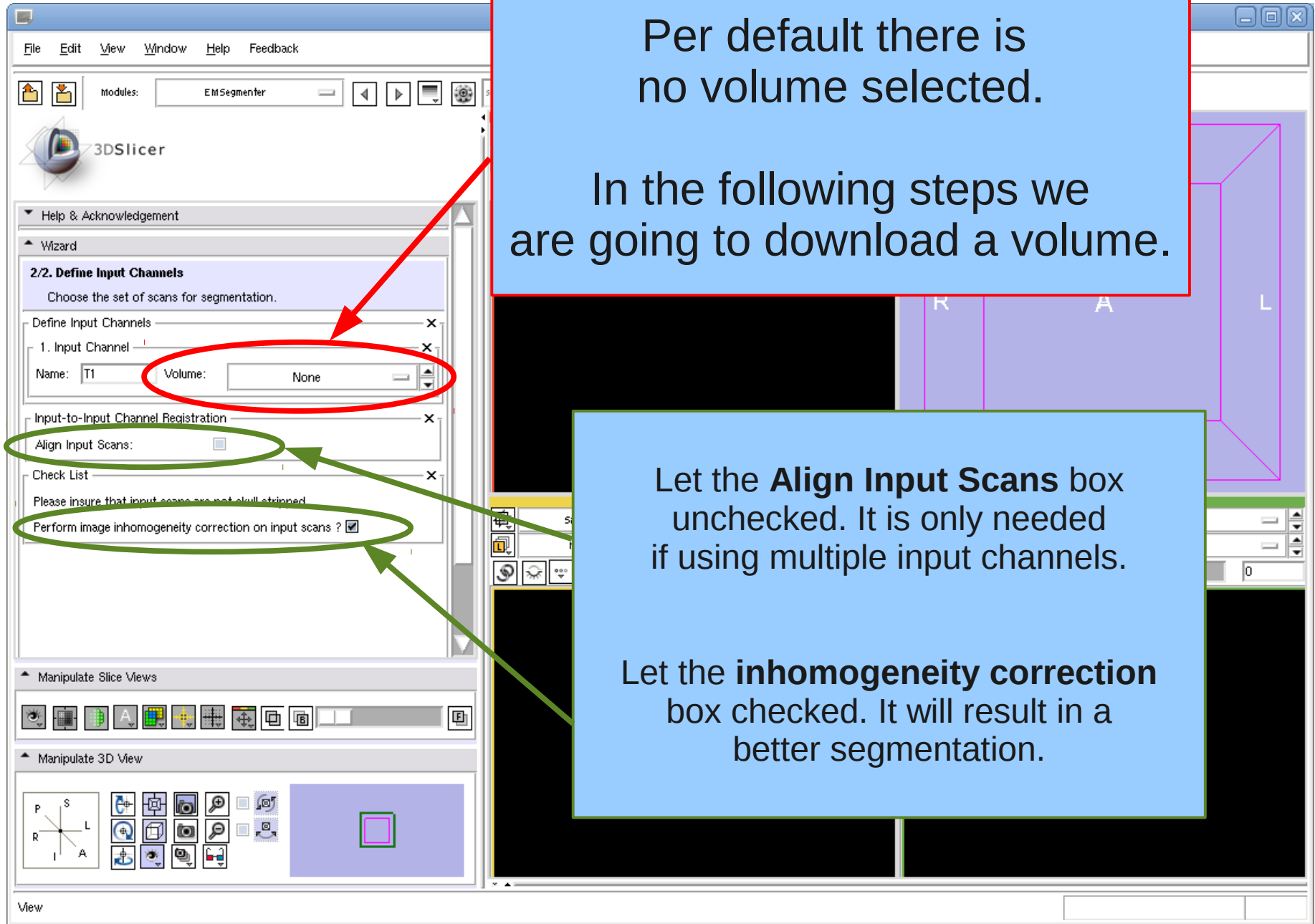
Adjust Parameters Use Existing Setting Cancel

Simply use predefined setting of the selected task for segmenting images

Click on Use Existing Setting

None RAS: (173.8, -16.4, -1.0)

# Define Input Channels



Per default there is no volume selected.

In the following steps we are going to download a volume.

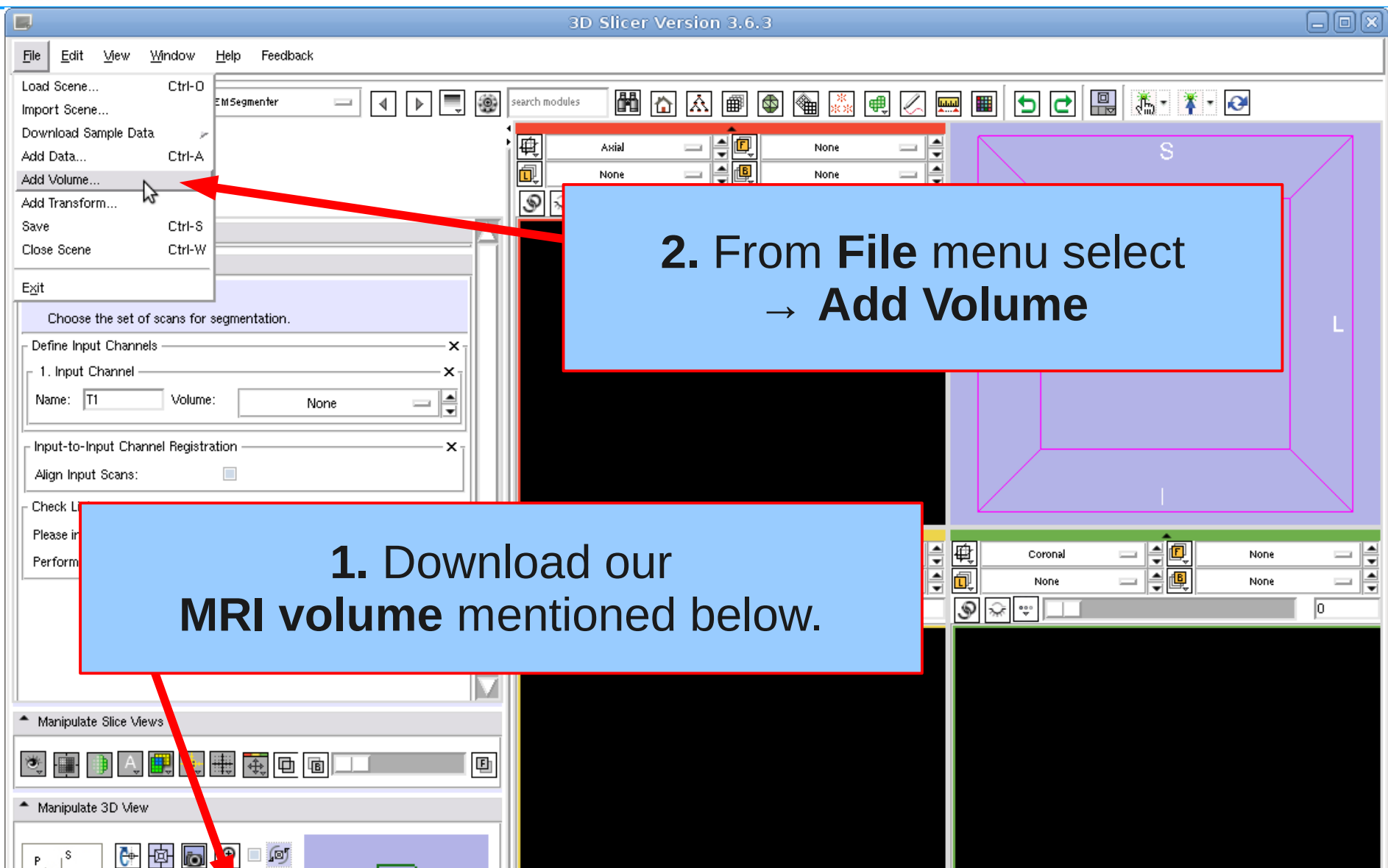
Let the **Align Input Scans** box unchecked. It is only needed if using multiple input channels.

Let the **inhomogeneity correction** box checked. It will result in a better segmentation.





# Load subject volume



**2. From File menu select  
→ Add Volume**

**1. Download our  
MRI volume mentioned below.**

[http://www.slicer.org/slicerWiki/images/c/cd/MRIHumanBrain\\_T1\\_aligned.nrrd](http://www.slicer.org/slicerWiki/images/c/cd/MRIHumanBrain_T1_aligned.nrrd)



3DSlicer

# Load subject volume



3D Slicer Version 3.6.3

File Edit View Window Help Feedback

Modules: EMSegmenter

search modules

3DSlicer

Help & Acknowledgement

Wizard

2/2. Define Input Channels

Choose the set of scans for segmentation.

Add Volume

Name	Size
MRIHumanBrain_T1_aligned.nrrd	5,214 KB

DICOM Information

Parse Directory  Divide Subseries

Options

Centered  Ignore File Orientation  Label Map  Single File

Name: MRIHumanBrain\_T1\_aligned

Apply Cancel

Add Volume...

Browse to your download location,  
select **MRIHumanBrain\_T1\_aligned,nrrd**,  
And click on **Apply**.



3DSlicer

# Display MRI Head



3D Slicer Version 3.6.3

File Edit View Window Help Feedback

Modules: EMSegmenter

search modules

3DSlicer

Help & Acknowledgement

Wizard

2/2. Define Input Channels

Choose the set of scans for segmentation.

Define Input Channels

1. Input Channel

Name: T1 Volume: None

None

None

MRIRHuman Brain\_T1\_aligned

129 0

S

R A L

None

None

MRIRHuman Brain\_T1\_aligned

63 1.4211e-11

Manipulate 3D View

P S L

R I A

Help

The MRI volume shows up in the viewer section



3DSlicer

# Define Input Channel



3D Slicer Version 3.6.3

File Edit View Window Help Feedback

Modules: EM Segmenter

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Wizard

**2/2. Define Input Channels**

Choose the set of scans for segmentation.

Define Input Channels

1. Input Channel

Name: T1 Volume: **MRIHumanBrain\_T1\_aligned**

- None
- atlas\_skulneck
- atlas\_air
- atlas\_csf
- atlas\_greymatter
- atlas\_whitematter
- atlas\_t1
- MRIHumanBrain\_T1\_aligned**

Input-to-Input Channel Registration

Align Input Scans:

Check List

Please insure that input scans are not skull

Perform image inhomogeneity correction

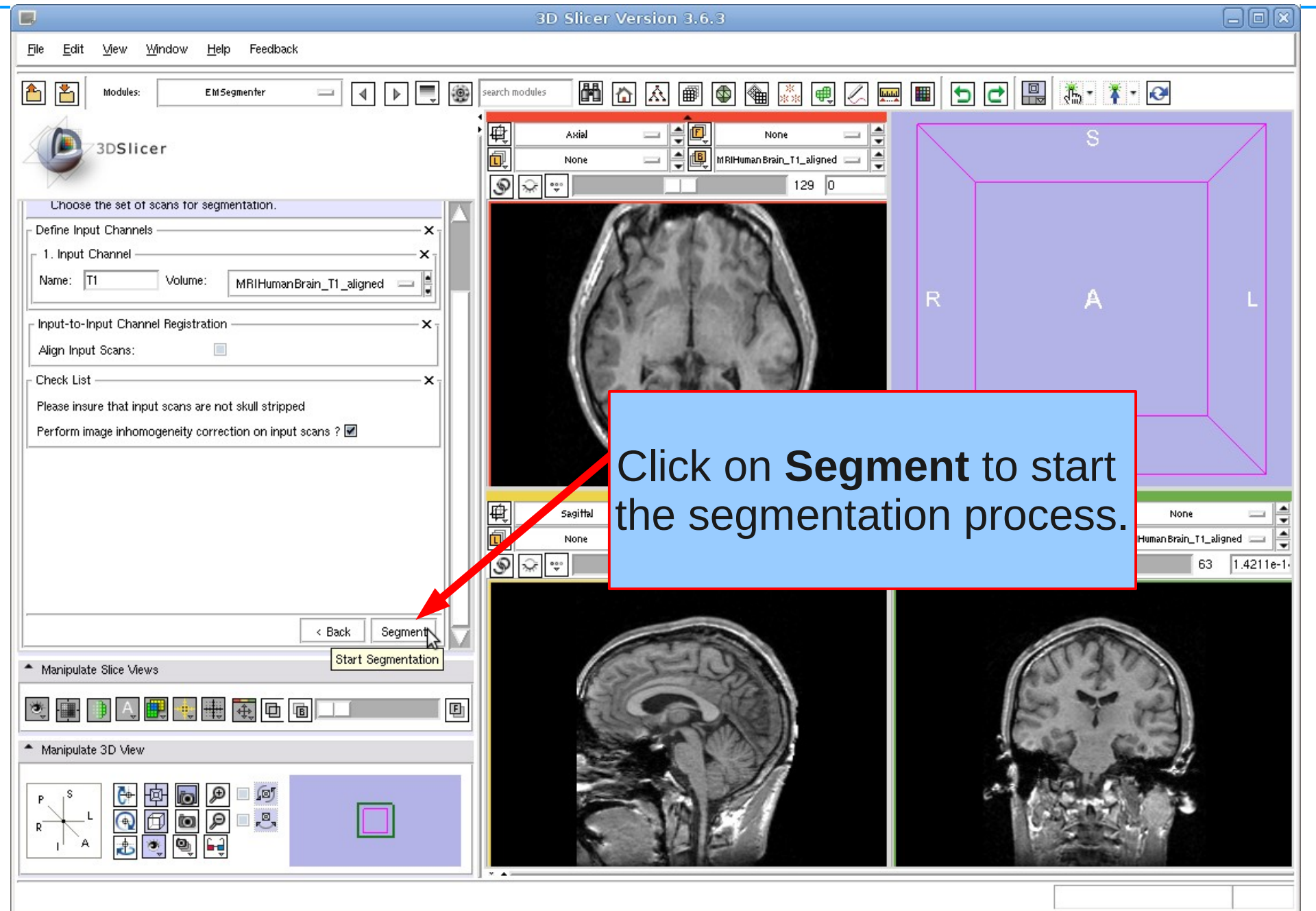
Manipulate Slice Views

Manipulate 3D View

MRIHumanBrain\_T1\_aligned

3D Slicer interface showing MRI brain scans in Axial, Sagittal, and Coronal views. A blue callout box with a red arrow pointing to the 'MRIHumanBrain\_T1\_aligned' volume in the 'Define Input Channels' panel contains the text: "Select the MRI volume as the volume we want to segment." The callout box also contains the text "S", "R", "A", and "L" positioned around the brain slices.

# Start Segmentation



3D Slicer Version 3.6.3

File Edit View Window Help Feedback

Modules: EM Segmenter

search modules

Choose the set of scans for segmentation.

Define Input Channels

1. Input Channel

Name: T1 Volume: MRIHumanBrain\_T1\_aligned

Input-to-Input Channel Registration

Align Input Scans:

Check List

Please insure that input scans are not skull stripped

Perform image inhomogeneity correction on input scans ?

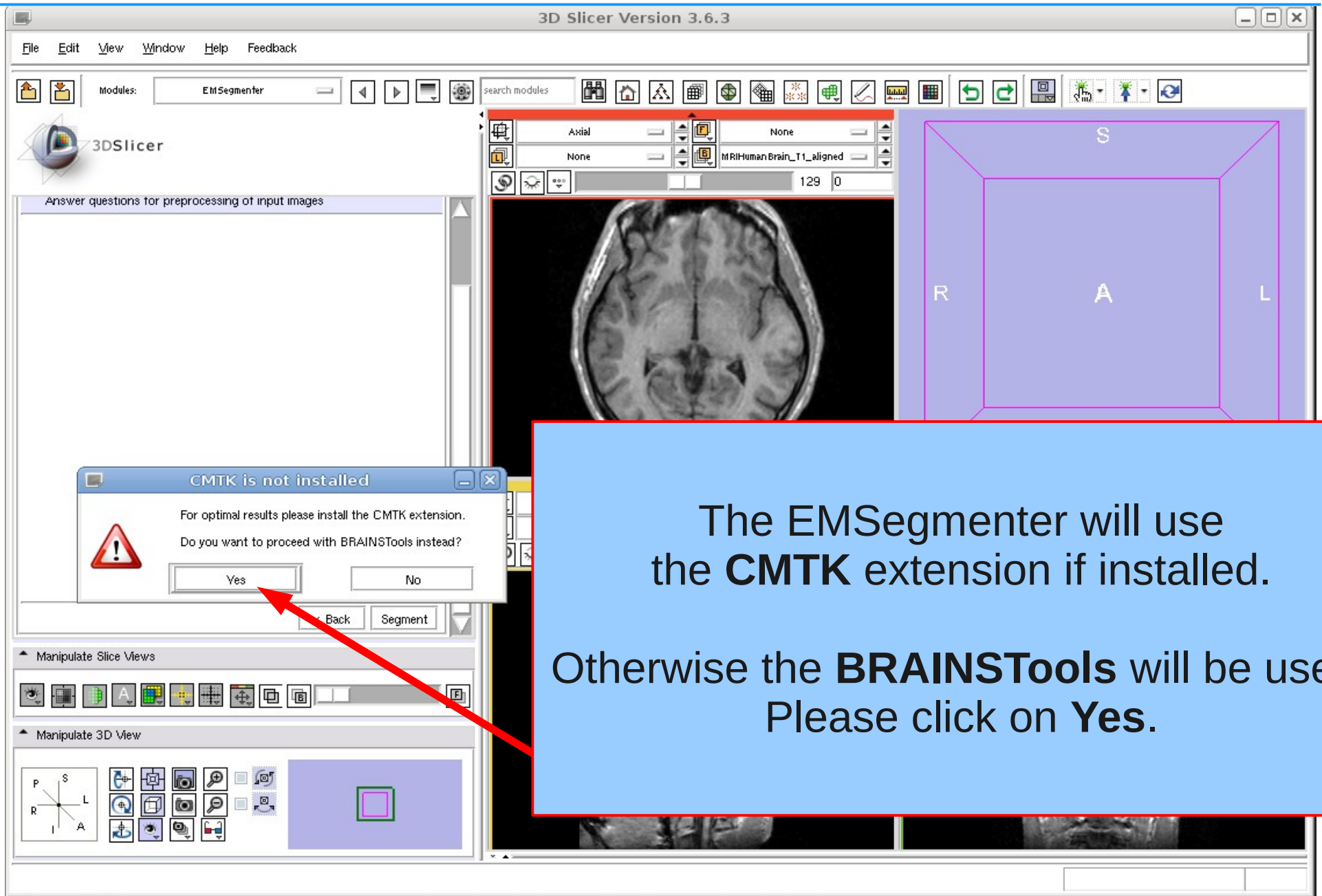
< Back Segment

Start Segmentation

Manipulate Slice Views

Manipulate 3D View

Click on **Segment** to start the segmentation process.



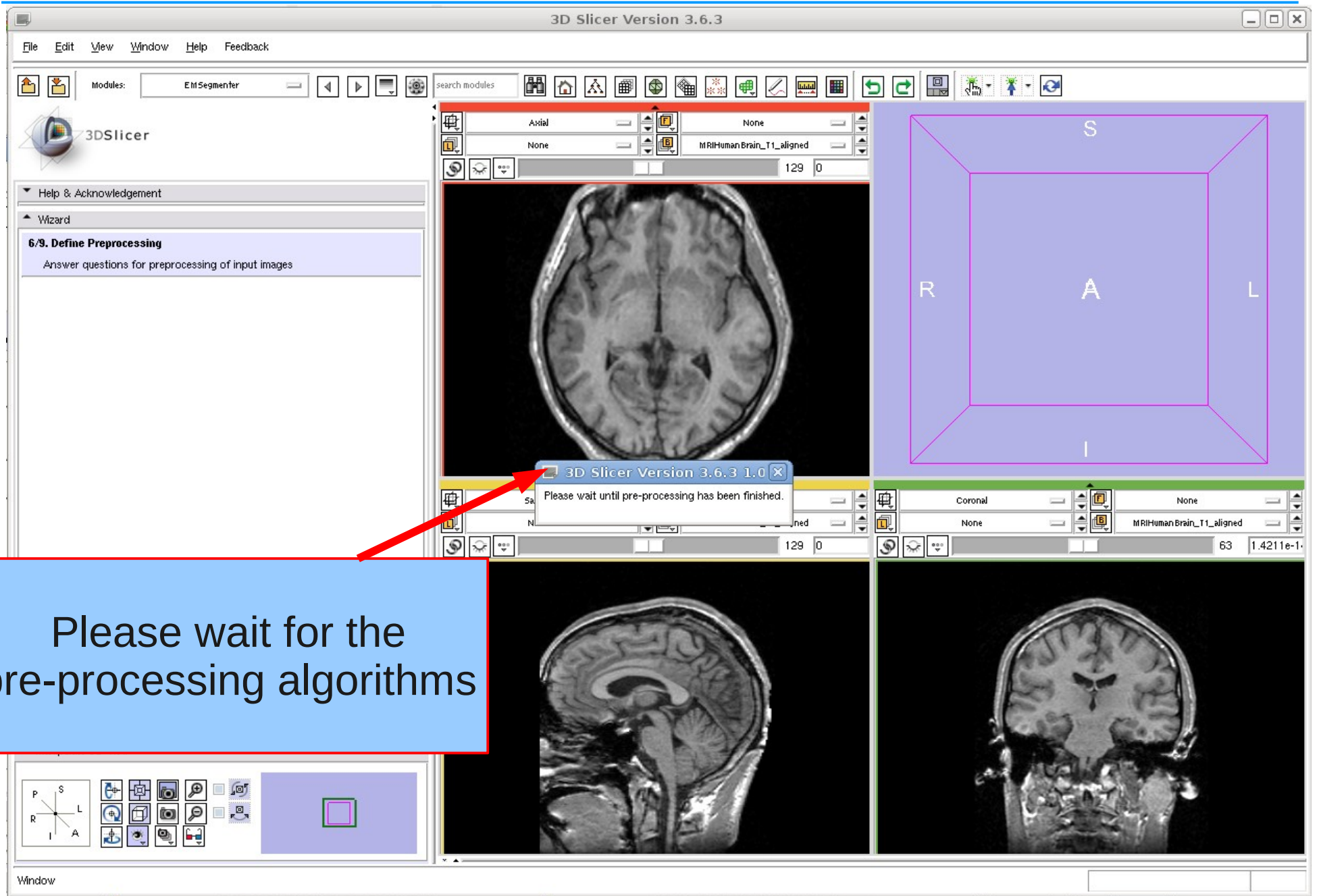
The screenshot shows the 3D Slicer Version 3.6.3 interface. The 'EM Segmenter' module is active. A dialog box titled 'CMTK is not installed' is displayed, asking: 'For optimal results please install the CMTK extension. Do you want to proceed with BRAINSTools instead?'. The 'Yes' button is highlighted with a red arrow. The main window shows an axial MRI slice of a brain with a purple bounding box and labels 'S', 'R', 'A', and 'L'.

The EMSegmenter will use the **CMTK** extension if installed.

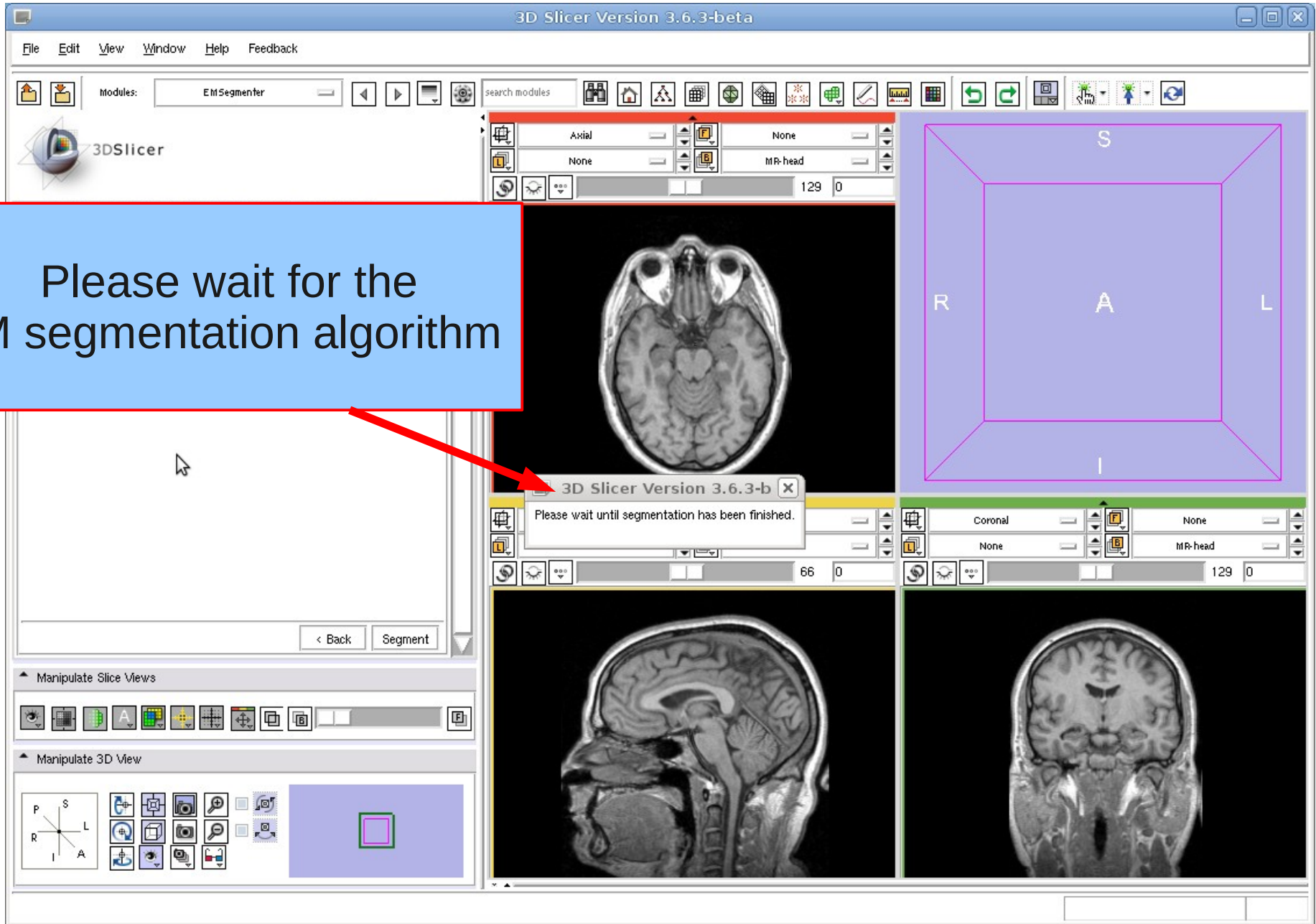
Otherwise the **BRAINSTools** will be used. Please click on **Yes**.



# Pre-Processing is running



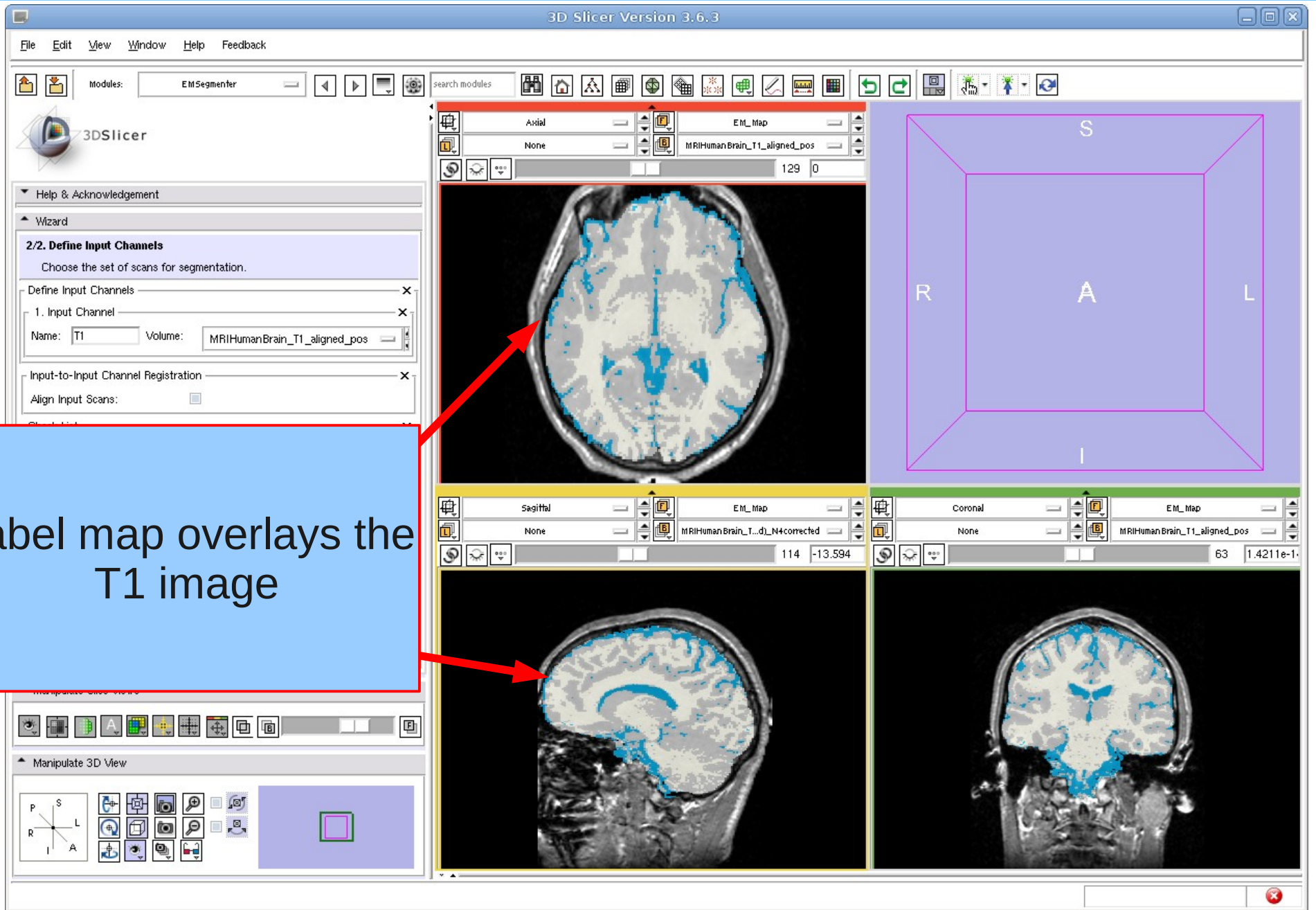
Please wait for the pre-processing algorithms



Please wait for the EM segmentation algorithm



# Result: Label map



Label map overlays the T1 image



3DSlicer



# Further Info & Acknowledgments

## EMSegmenter Wiki Page:

<http://www.slicer.org/slicerWiki/index.php/EMSegmenter-Overview>

## The EMSegmenter technology behind was reported in:

K.M. Pohl et. A hierarchical algorithm for MR brain image parcellation. IEEE Transactions on Medical Imaging, 26(9), pp 1201-1212, 2007.

## We thank the following institutions for their support:

