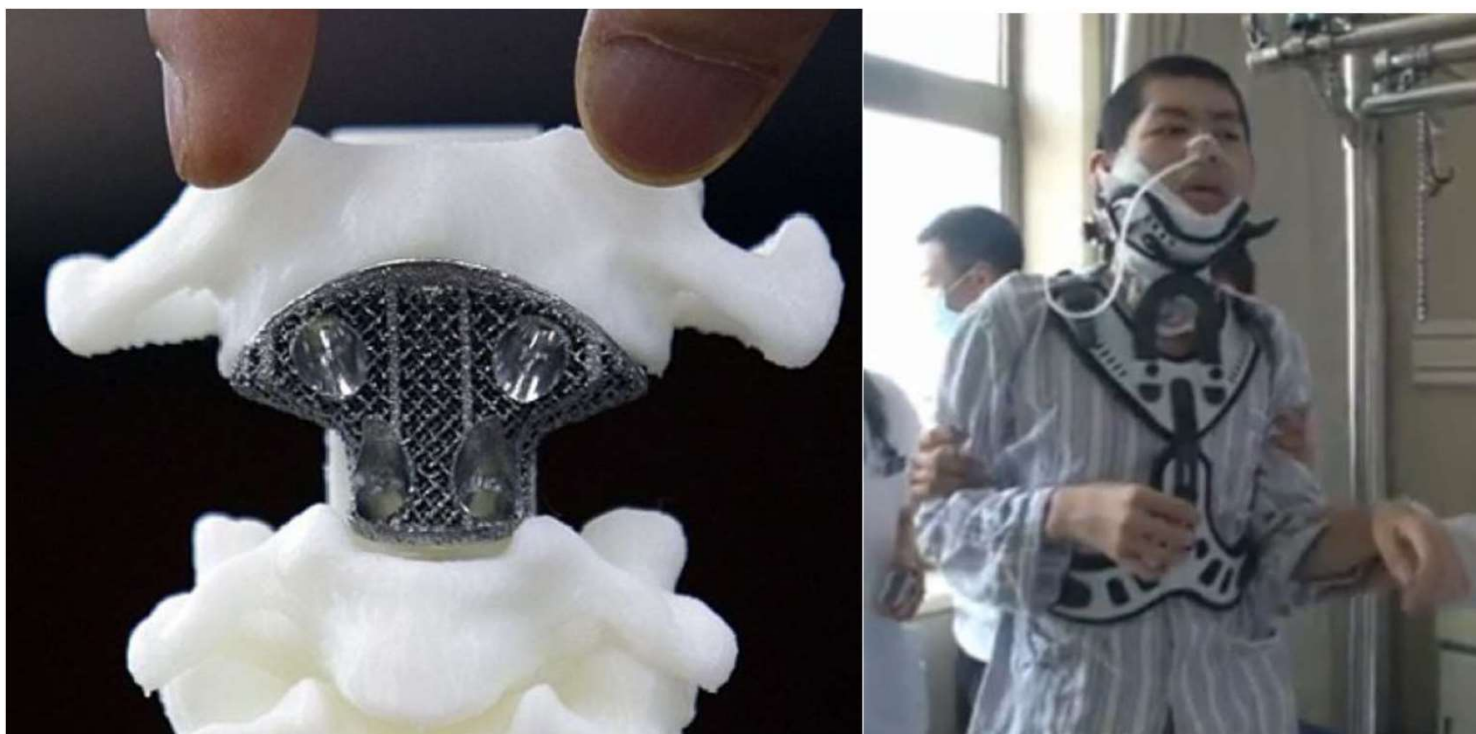


First-ever 3D-printed vertebra implanted in 12-year-old cancer patient's spine



Qin Minglin, 12, was diagnosed with Ewing's sarcoma after he suffered a neck injury while heading a ball in sports practice. Doctors implanted a 3D-printed device in his spine after removing a tumor from between his first and third vertebrae. REUTERS

<https://www.foxnews.com/health/first-ever-3d-printed-vertebra-implanted-in-12-year-old-cancer-patients-spine>



Overview

1. Load CT image
2. Segment vertebrae to be 3D printed
3. Save segment to STL file for 3D printing



1/1: Load CT Chest dataset



Welcome

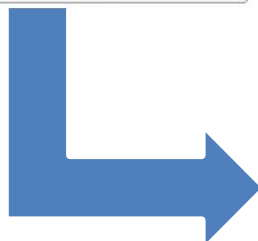
 **Load DICOM Data**


 **Load Data**

 **Install Slicer Extensions**

 **Download Sample Data**

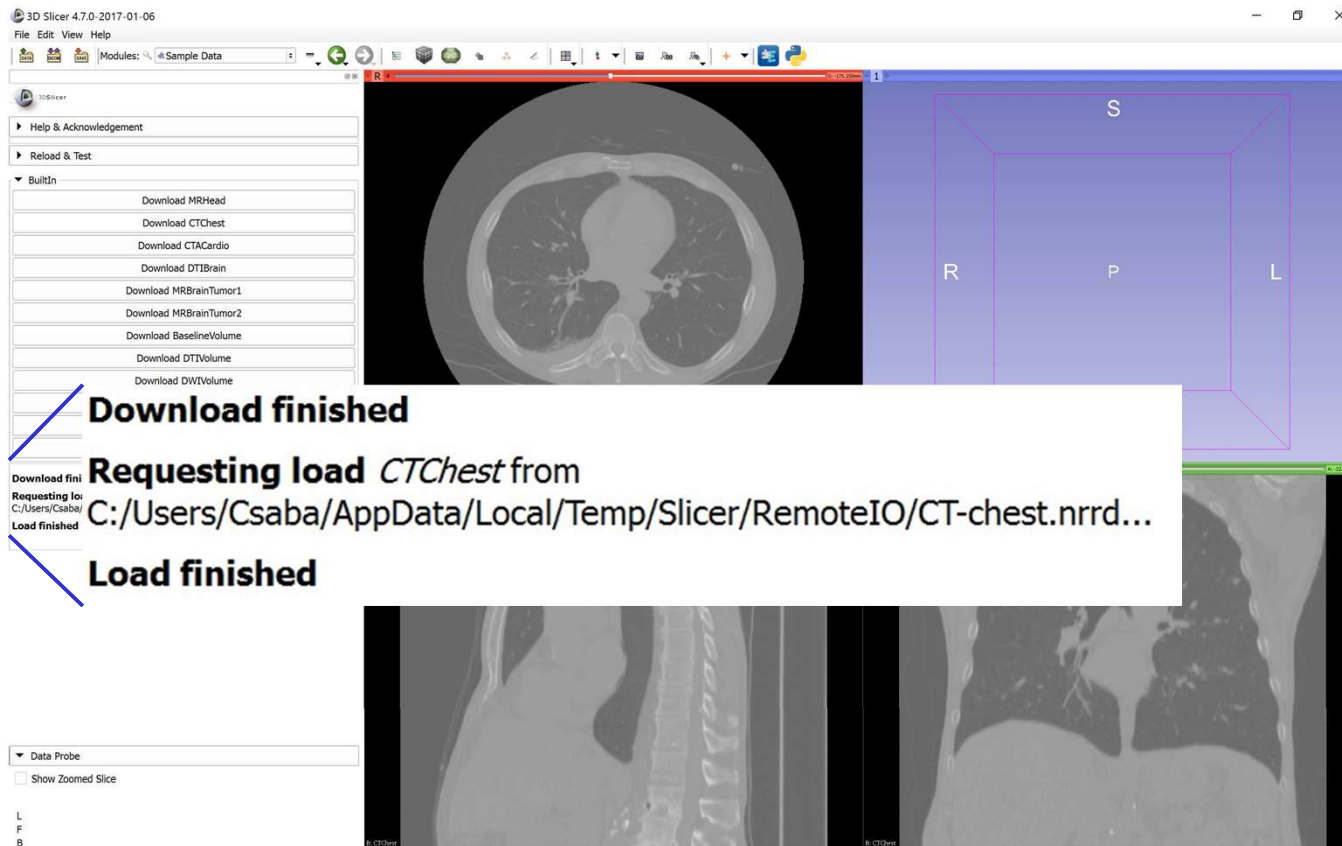
 **Customize Slicer**



- Download MRHead
- Download CT Chest 
- Download CTACardio
- Download DTIBrain
- Download MRBrainTumor1
- Download MRBrainTumor2



1/2: Sample CT loaded





1/3: Change contrast

The screenshot illustrates the steps to change the contrast of a volume in the NA-MIC software. On the left, the 'Modules' panel shows a list of modules. A red circle and a hand icon point to 'Sample Data', and another red circle and hand icon point to 'Volumes' at the bottom of the list. A large blue arrow points from this panel to the right-hand panel. The right-hand panel shows the 'Active Volume' set to 'CT Chest', with a red circle and hand icon pointing to it. A blue callout box above this says 'Select CT Chest as active volume'. Below, the 'Display' section shows the 'Lookup Table' set to 'Grey' and 'Interpolate' checked. Under 'Window Level editor presets', there are several icons. A red circle and hand icon point to the 'Abdomen: View Nominal CT volume.' preset. A yellow callout box points to this icon with the text 'Abdomen: View Nominal CT volume.'. Below the presets, the 'W: 4934' and 'L: -543' values are shown, along with a 'Threshold' slider set to 'Off'.



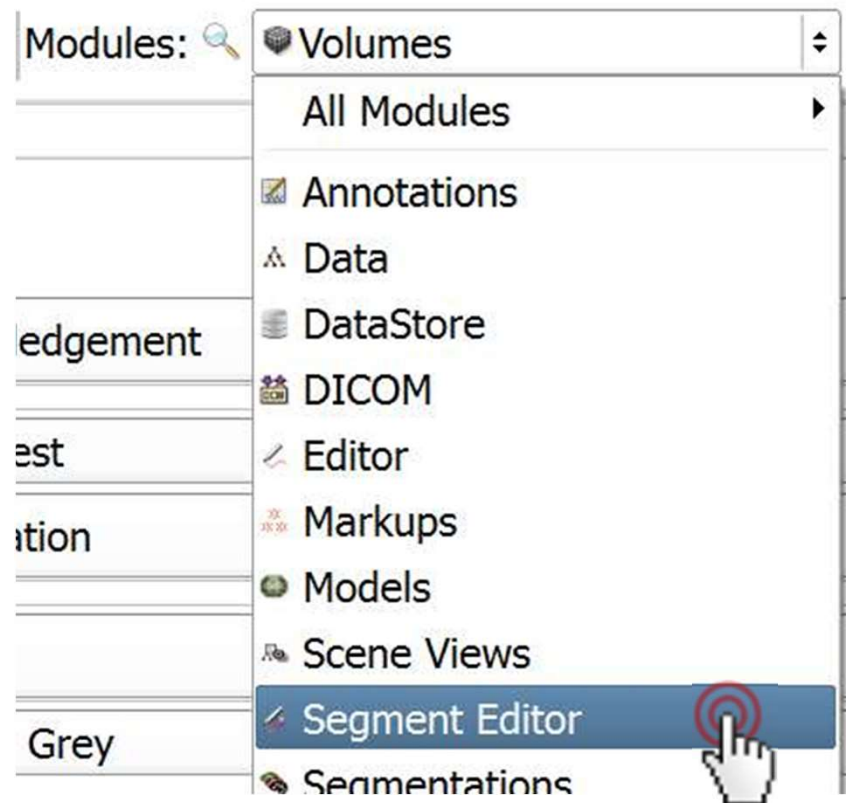
Part 2: Segment vertebrae

Overview:

- Add new segment
- Threshold bone
- Remove speckles with Islands
- Cut out vertebrae with Scissors



2/1: Switch to Segment Editor module





2/2: Add new segment

Segmentation: Segmentation

Master volume: CTchest

 Add segment  Remove selected  Create surface

Empty segmentation

	Color	Name
--	-------	------

-Segmentation automatically created
-CT volume automatically selected as master

(Master is the segmented volume that defines the resolution of the segments)



2/3: Threshold to get bone

Effects



Threshold

Set segment based on master volume intensity range. All previous contents of the segment is overwritten on Apply.

Threshold Range:



Set 100

Use For Paint

Apply



2/4: Remove speckle with the Islands effect

Effects



Select
Islands effect



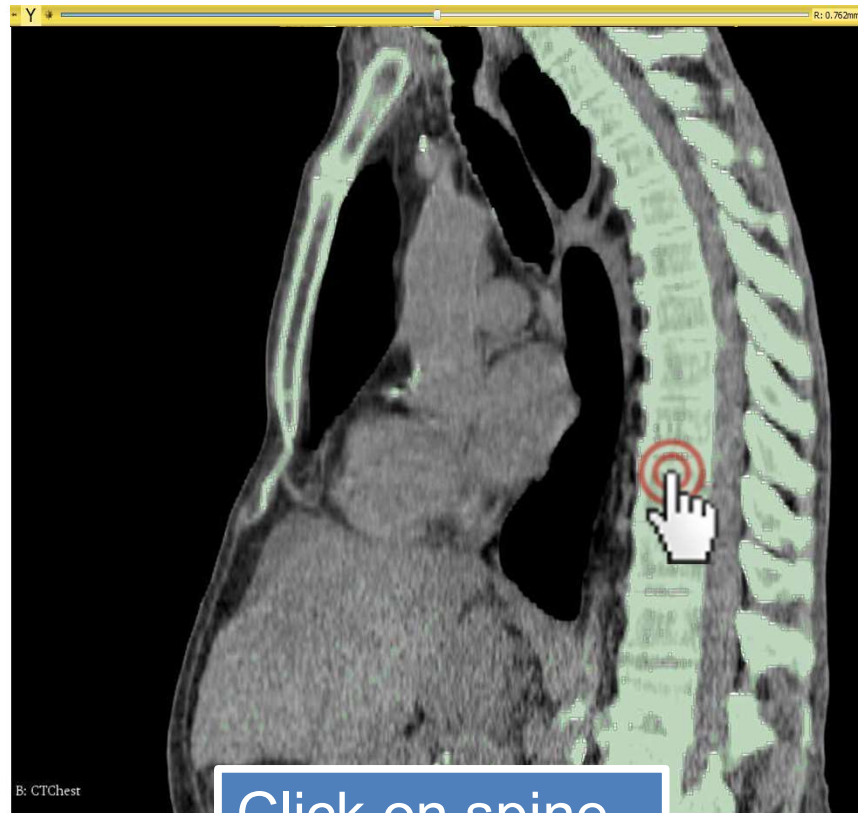
Islands

Edit islands (connected components) in a segment.

- ☐ Keep largest island
- ☐ Remove small islands
- ☐ Split islands to segments
- ☒ Keep selected island
- ☐ Remove selected island
- ☐ Add selected island



2/5: Remove speckle with the Islands effect



Click on spine



2/6: Cut out vertebrae with the Scissors effect

Effects



Scissors

Cut through the entire segment from the current viewpoint.

Left-click at

Operation:

Shape:

Erase inside

Erase outside

Fill inside

Fill outside

Shape:

Free-form

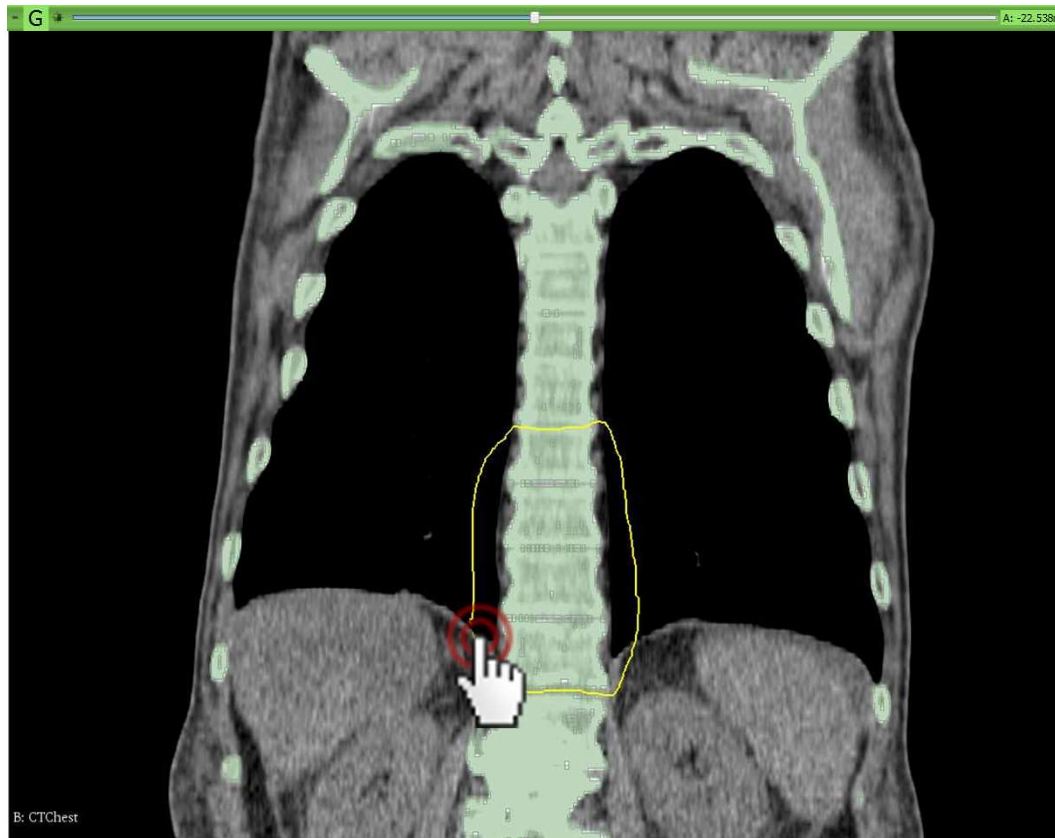
Circle

Rectangle

1. Select Scissors effect
2. Choose 'Erase outside' as operation
3. Choose 'Free-form' shape



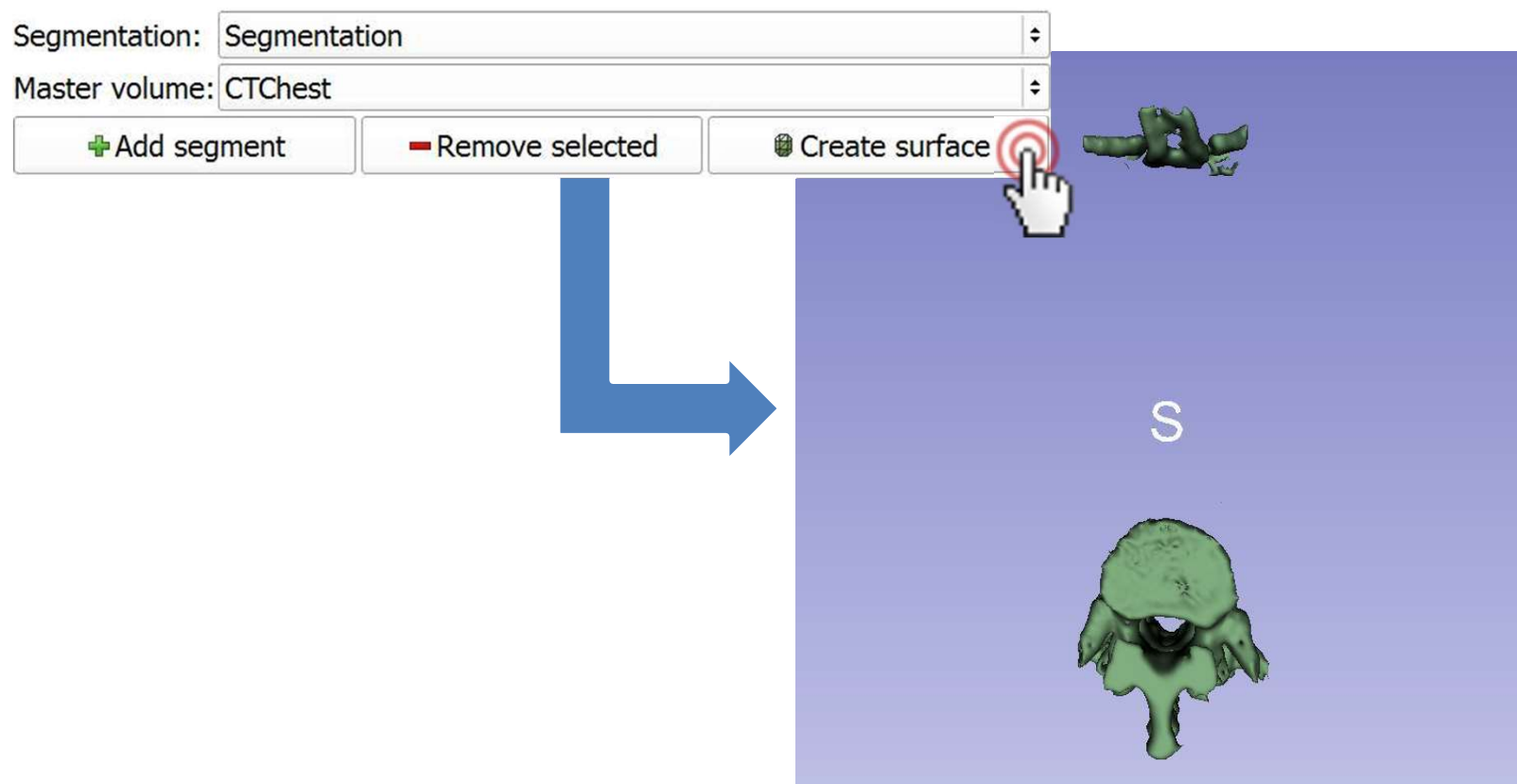
2/7: Cut out vertebrae with the Scissors effect



Trace around the desired vertebrae with the scissor on the coronal view (green slice)

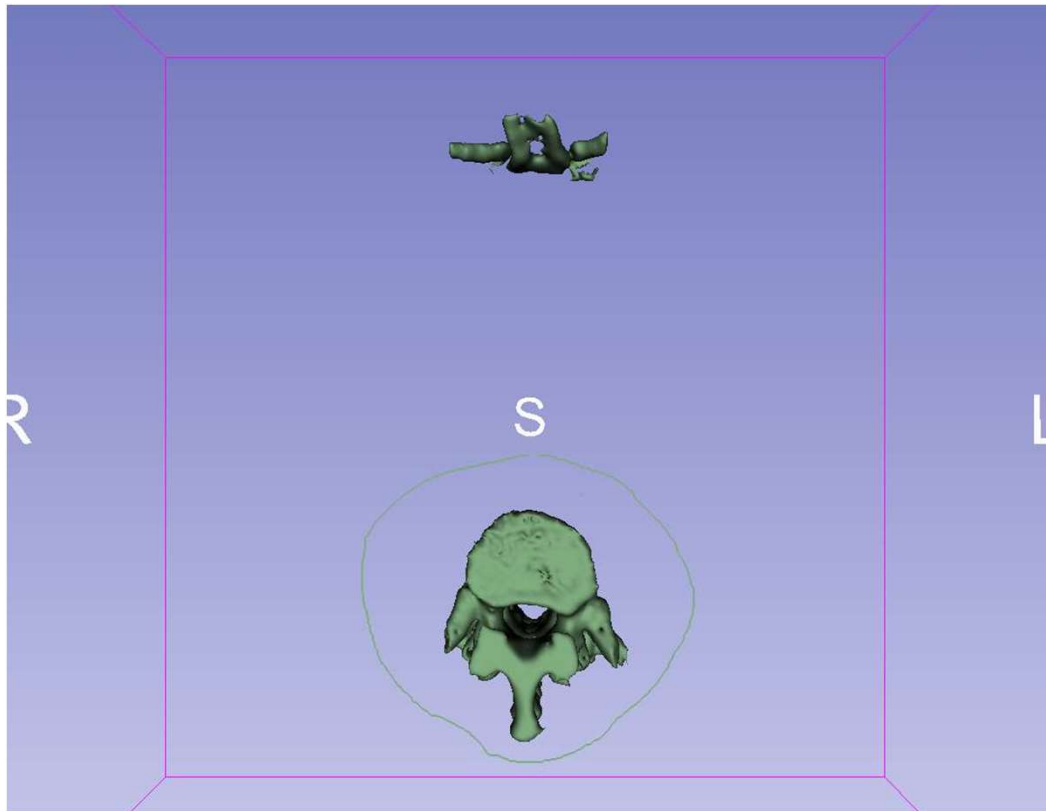


2/8: Show segment as surface in 3D view





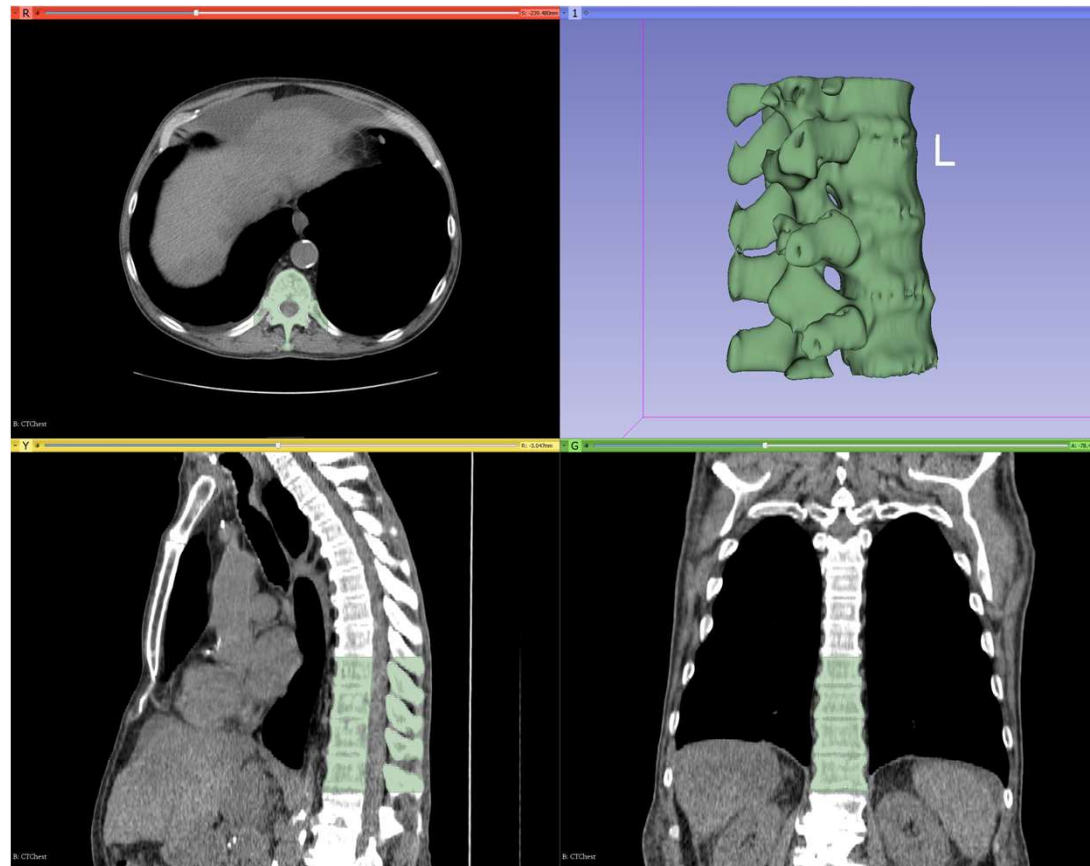
2/9: Remove remaining parts with Scissors



Select the vertebrae in the 3D view to erase the remaining parts (ribs on the anterior side in this case)

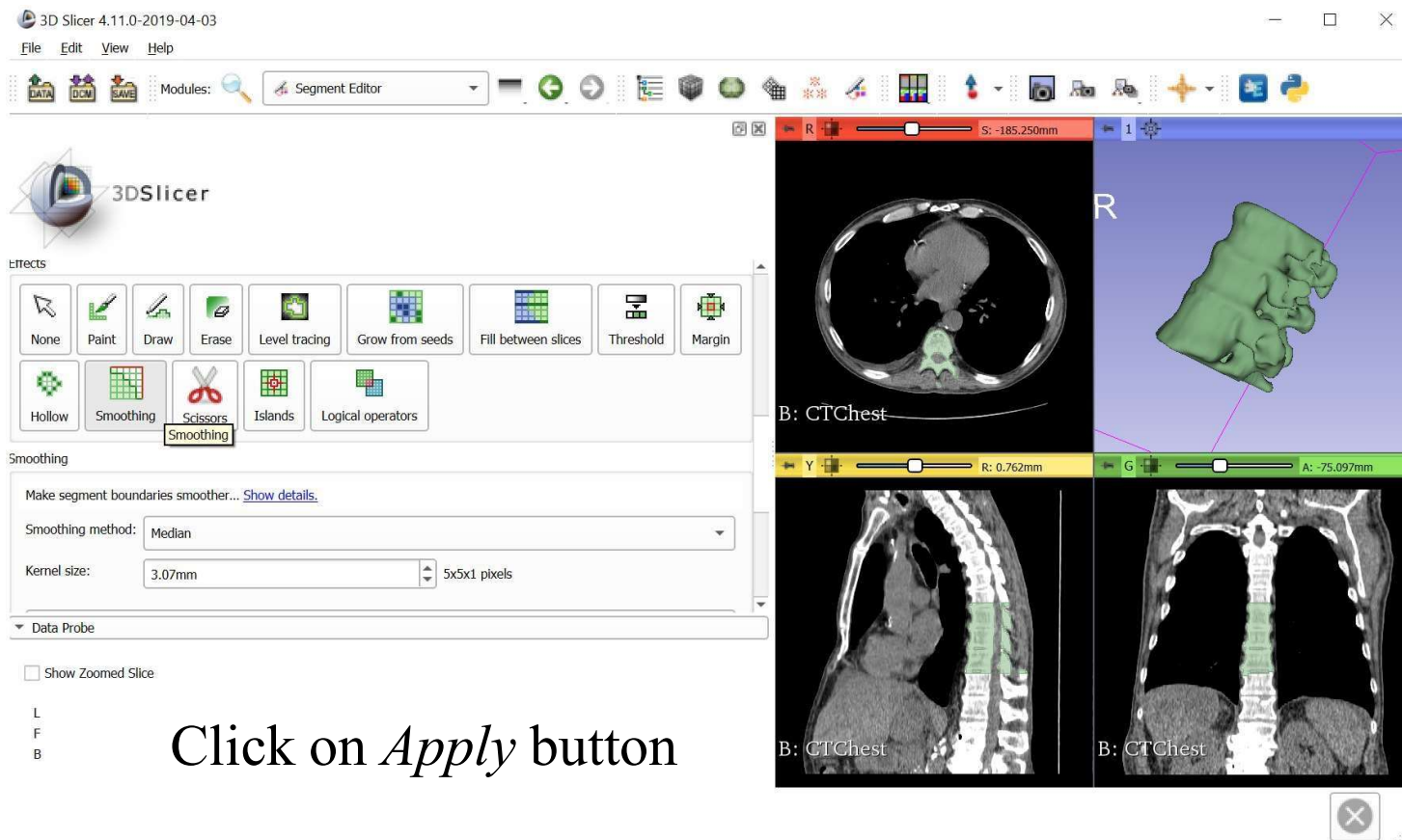


2/10: Vertebrae are segmented

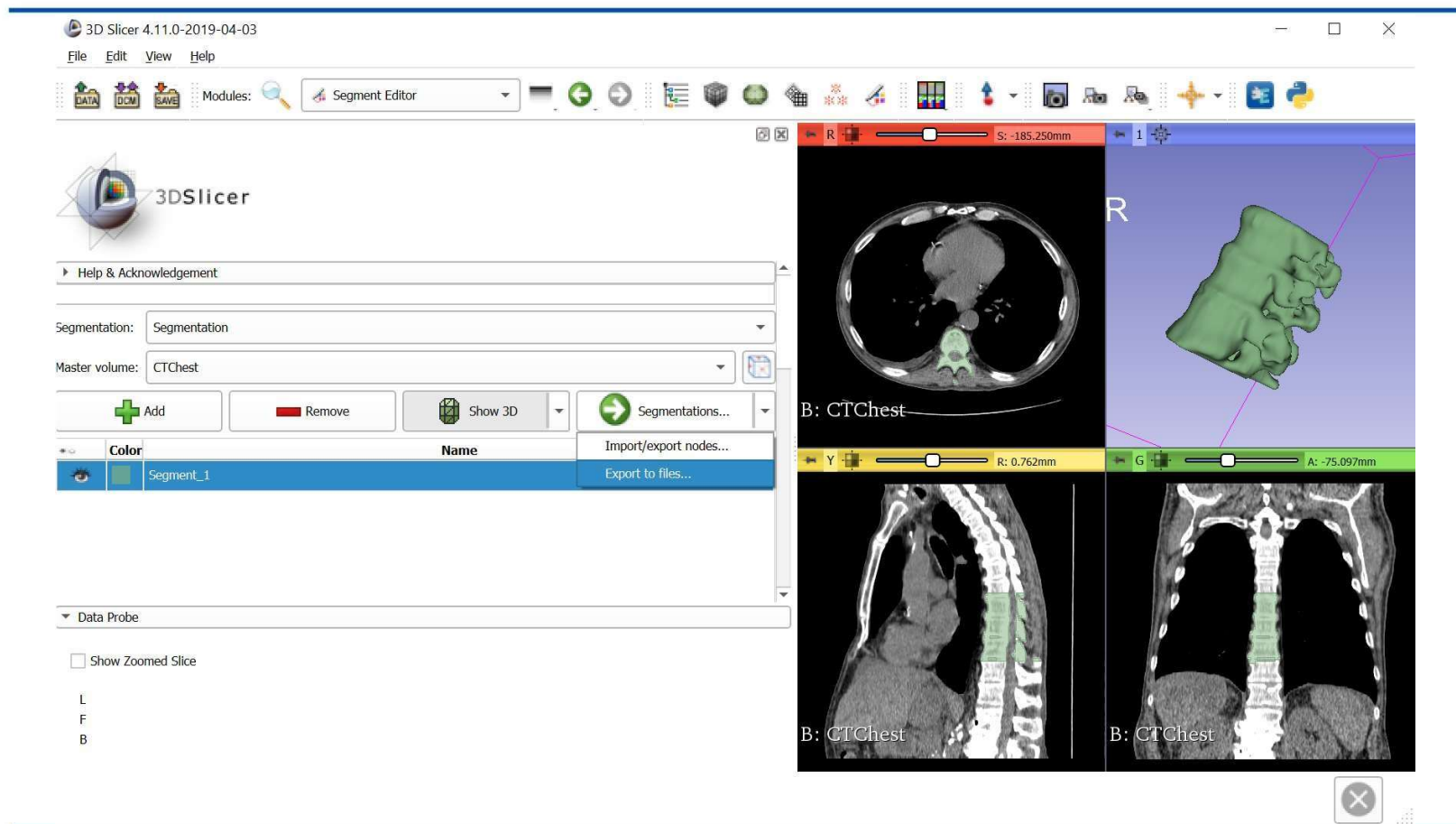




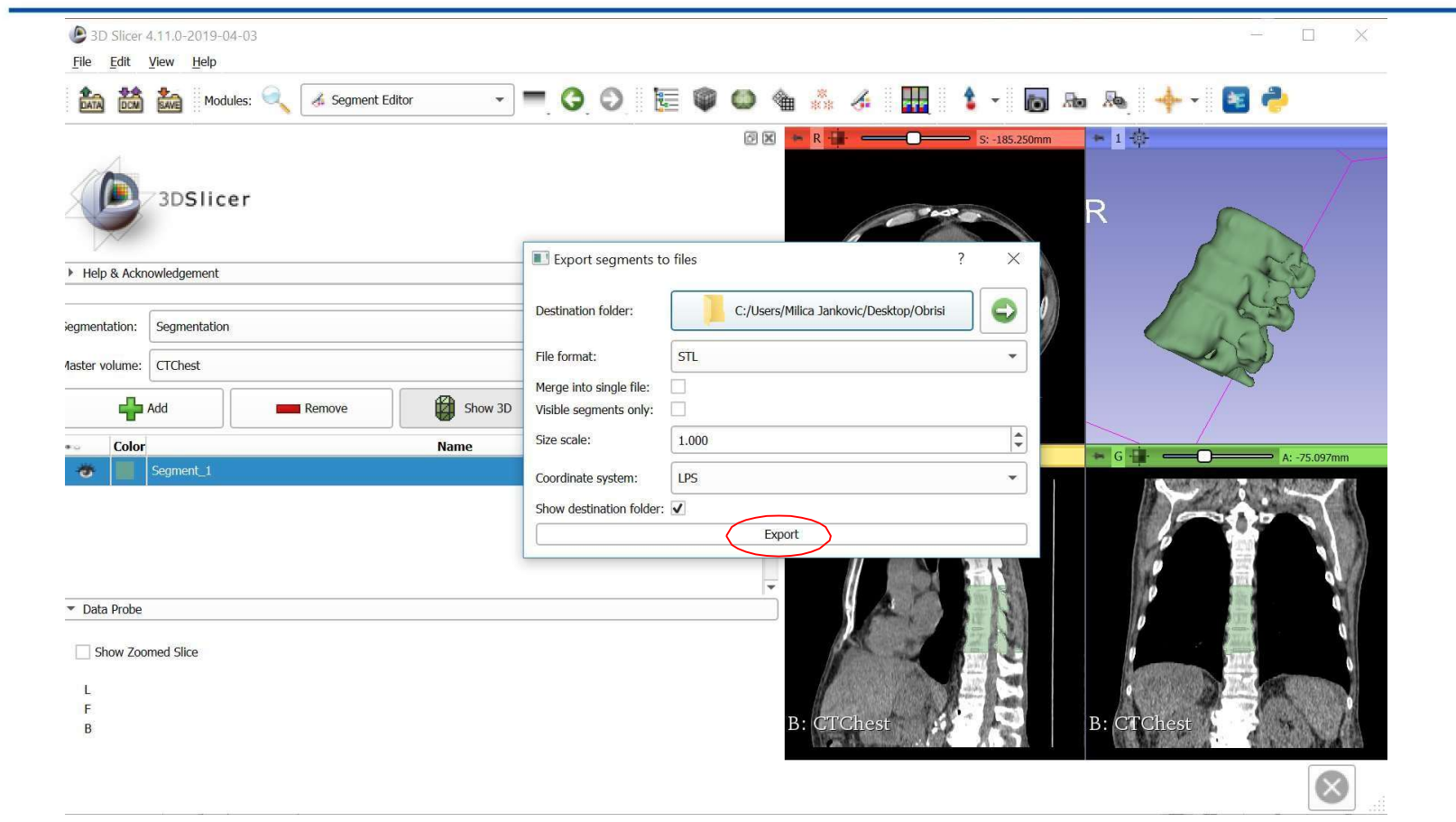
2/11: Vertebrae are smoothed



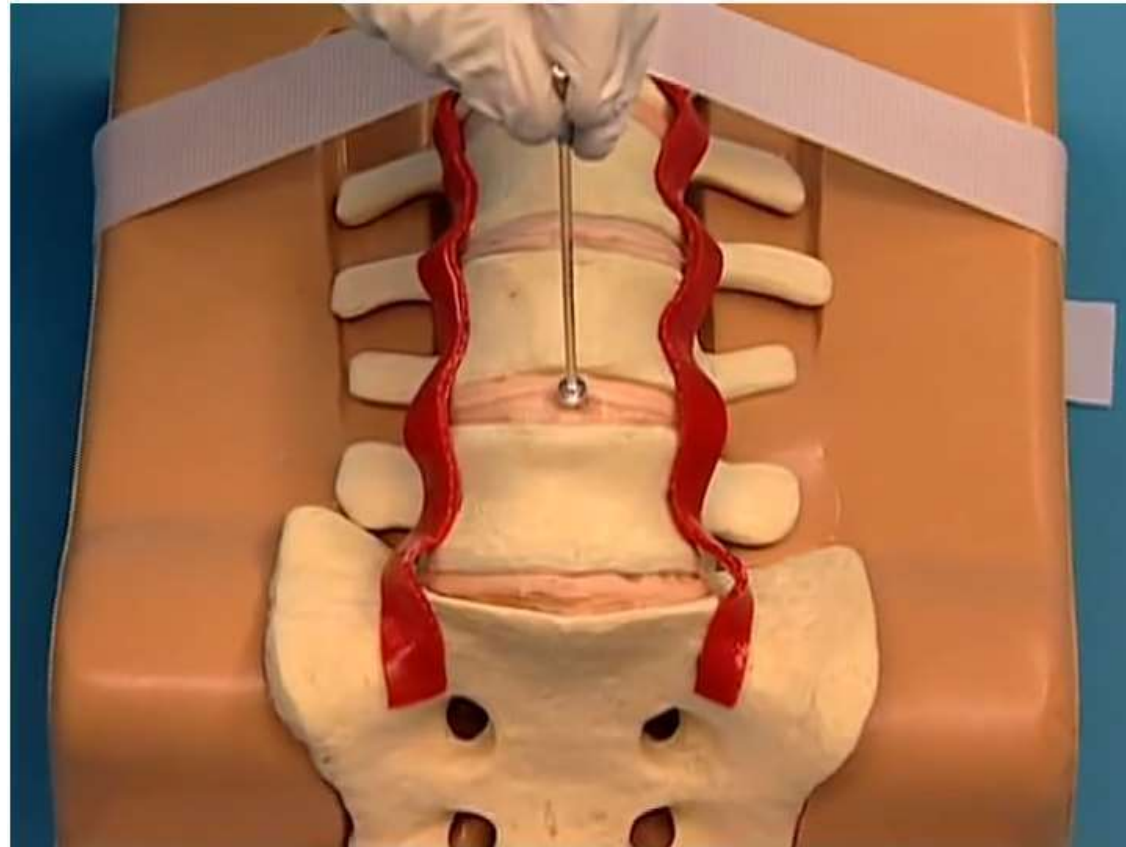
Part 3: Save to STL



Part 3: Save to STL



Synthes Spine ProDisc-L Lumbar Total Disc Replacement



<https://www.youtube.com/watch?v=WH5phRh89Go&feature=youtu.be>