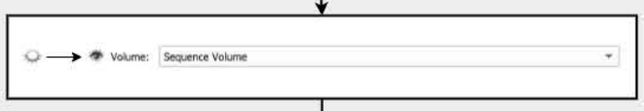
## Data Input

Import DICOM data in 3D Slicer's DICOM browser

Examine and Load DICOM

**Critical Step**
It is important to determine if the DICOM quality is sufficient. Never create a model that has more information than the starting images.

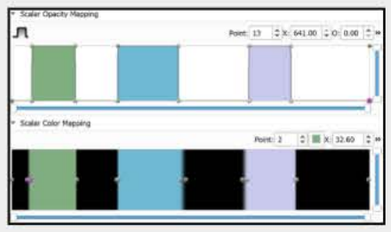
Open Volume Rendering Module




Open the Advanced menu and select 'Volume Property Tab', this opens controls for modifying the color channel.

From the 'Scalar Opacity Mapping' menu, right click to create points where intensity values will be defined by opacity.

**Tip**
'Scalar Color Mapping' menu is modified to specify colors at various intensity values along the Hounsfield scale. A single left click will create a new point and a double click will open the 'Select Color' menu.




**Critical Step**
User should be satisfied with how the model looks virtually at this point before preparing to print it.

Are surrounding tissues and extraneous data still present after modifying the 'Volume Properties'?

Yes, Masking Step is required

No, Masking Step is not required

### Manipulation Modification Series

From the 'Module List', select the 'Segment Editor' module.

In the 'Segmentation' dropdown, select 'Create New Segmentation As' and create a custom name for the segmentation.

In the 'Master Volume' dropdown, select the active volume which has the same name as your 'Volume Rendering and click the 'Add' button.

Use the 'Scissors' tool in the effects tool panel in order to cover the extraneous data.

Scissors

Once all areas of the segment are created, select the 'Mask Volume' tool.

Mask volume

Check 'Select Inside', which will modify all image data covered by segment. Next, modify the 'Fill Value' in order to ensure that the data will be masked. Finally, hit apply.

**Tip**
Using either '0' or '-1000' as the 'Fill Value' will work best for most cases.

## Slicing

From the 'Modules List' select the 'Slicerfab' module.

Under the 'Printer Parameters' menu, modify 'X' and 'Y' resolution numbers as well as the 'slice thickness' to meet the requirements of the 3D printer.

Does the scale need to be modified?

Yes

**Modification**
Open the 'Output Parameters' menu and change the scale parameter.

No

Select an output file location in the 'Output Parameters' menu and click 'Generate'.

## Dithering

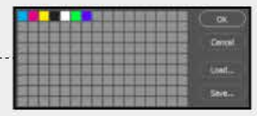
Open Photoshop CS 2021 or later. From the 'File' menu select ' Open' and navigate to the first image of the stack of .PNG from the previous step and click the 'Open' button.

Navigate to 'Window>Actions'. In Actions, click New Action (⊞), enter a name, and click OK.

**Tip**
Check that the action is recording by seeing the record button switch to red.

Navigate to 'Image > Mode > Index'. In the 'Index' window select from the dropdown menu 'Local Perceptual' and specify the number of colors to be 8.

In the forced menu select 'Custom'. The 'Custom Color' window will pop up and a custom color pallet can be selected. Create a color pallet with 100% C,M,Y, and K.




In the Options Menu, for Matte, selected Custom. For Dither, select Diffusion and for Amount, select 100%. Click OK.

**Critical Step**
Compete this step before creating a background layer to represent the locations where transparent material needs to be placed.

Navigate to 'Window>Actions'. In Actions, click the square button to stop recording. Close the active window and click No in the save change pop up.

**Tip**
Check that the action stopped recording by seeing the record button switch back to grey.

Navigate to 'File>Automate>Batch'. In the Batch window, navigate to the Action menu and select the created action. Under source, click Choose to select the folder with the images. Under Destination, click Choose and select the output folder. Click OK.

Does the 3D printer require images to be saved as 32bit files?

Yes

**Modification**
Open a code editor that runs the python library and ensure that that PIL library is installed. Load the '32-bit converter' python script and ensure the directory is pointed to the file location of the image stack produced.

No

Text Fie Creation

## Voxel Printing

Open GrabCAD Print. Click Apps and Launch Voxel Print Utility.

In the Slice Files' Prefix box, enter the prefix for the image stack. Click Select and input the folder with the images and click OK.

Under Slice Range, check that the first slice and number of slice match the images in the folder.

Under Slice Range, check that the first slice and number of slice match the images in the folder.

Under Slicing Parameters, ensure that Sliced Thickness matches printer parameters and that the Slicer Width/Height matches the images.

Under Background Color, ensure the background color matches the one in the images.

Click Next. On the Tools page under Material Mapping, s elect the materials that correspond to each color. Click 'Finish>OK' on the pop up window.

Click 'File>Import File' from the dropdown menu. Navigate to Gcvf file and click Load.

Select Print