# Video tutorial for 3D display of microCT images

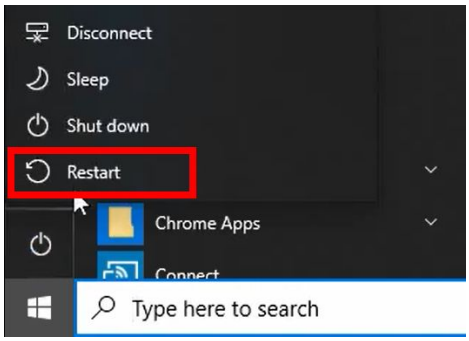
By PCMD MicroCT Imaging Core
(2020.03 updated)

Youtube link: https://www.youtube.com/watch?v=YdQS041rgR8

All our video tutorials and training documents are listed on our website:
https://www.med.upenn.edu/orl/uct/

**Before you begin, we strongly suggest you restart this computer!**

Click the Start button > select "Restart" in the menu.



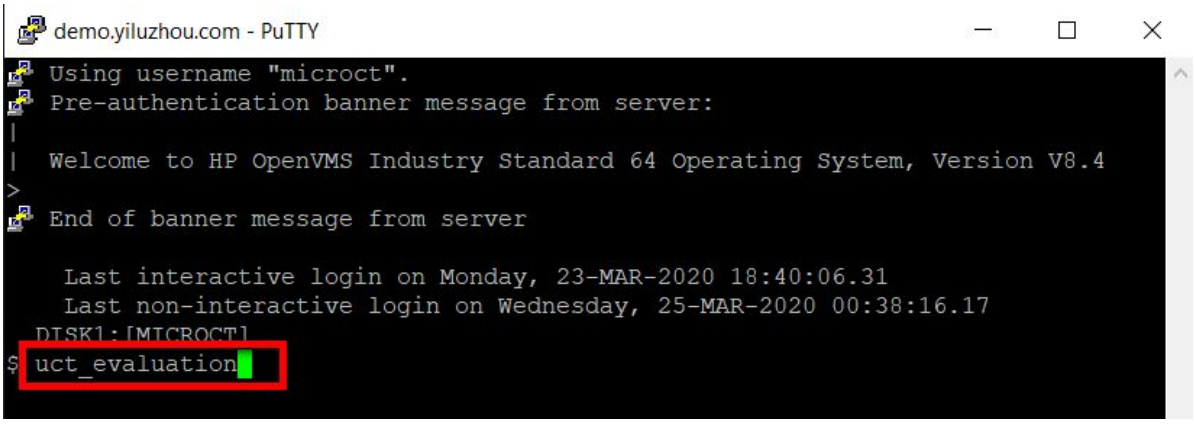

**Important! Please make sure Caps Lock, Num Lock, and Scroll Lock are all OFF on the keyboard!**


This is the video tutorial for 3D display of microCT images.

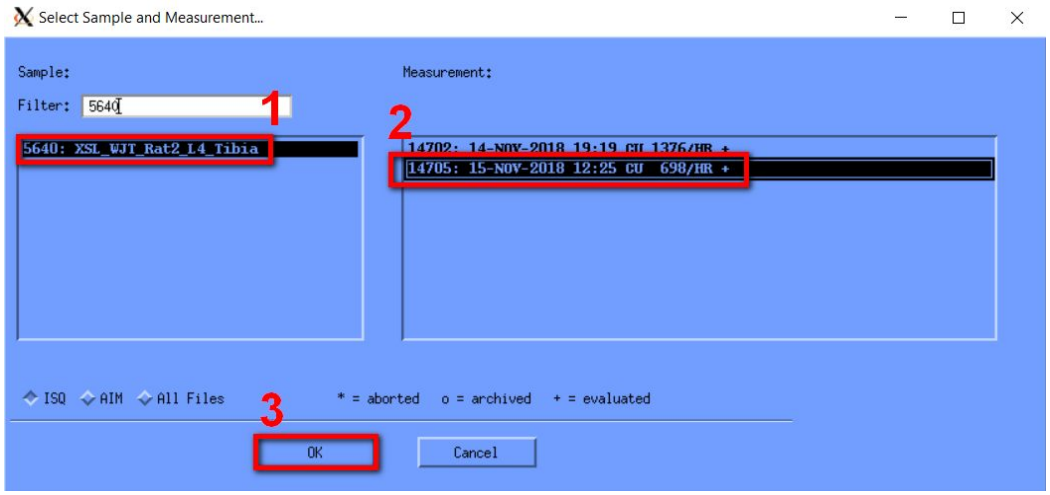
## Step 1: Crop your scanned images

The purpose of this step is to generate .AIM and SEG.AIM files for subsequent viewing.
Here is an example of how to do cropping on microCT35:
Double click "uCT 35" icon

Type uct_evaluation (Right click to paste). Press Enter




You will see "Select Sample and Measurement..." window: Sample(left), Measurement(right).
Sample#: 5640, and Measurement#: 14705
Click "OK"

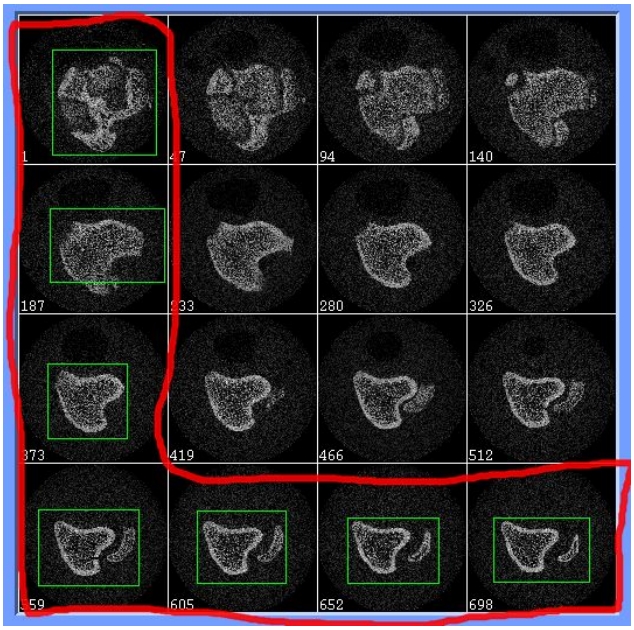



Click on the image corresponding to slice 1

Click the rectangular contour button 

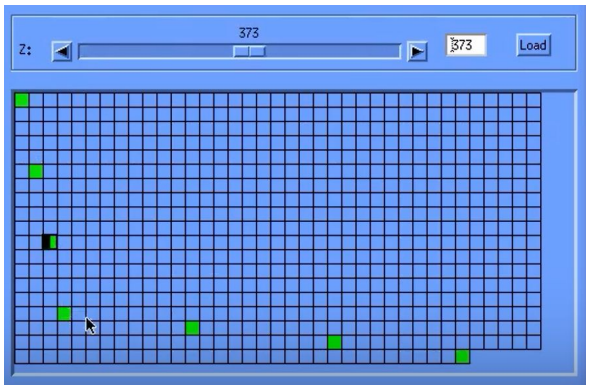
Draw a rectangular contour on slice 1, encompassing the whole sample while leaving ample space around the edges

Repeat this process and crop in an "L" shaped fashion (see below picture):

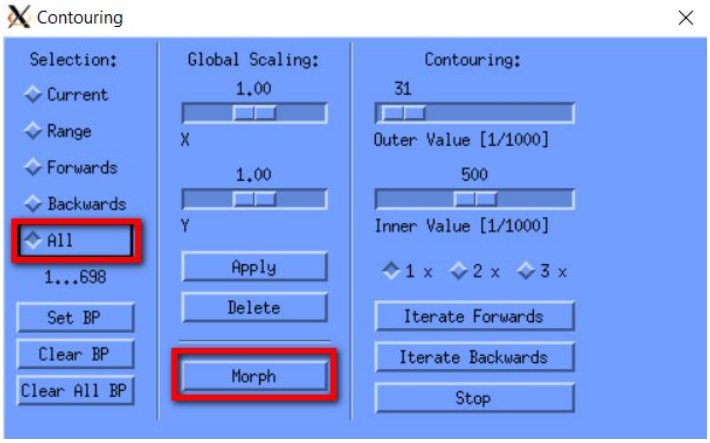



Click ‘C…”  to open the Contouring window

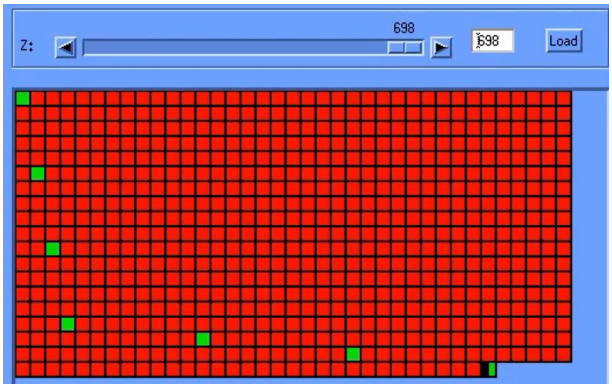
The green slices indicate the slices where you have drawn the rectangular contours



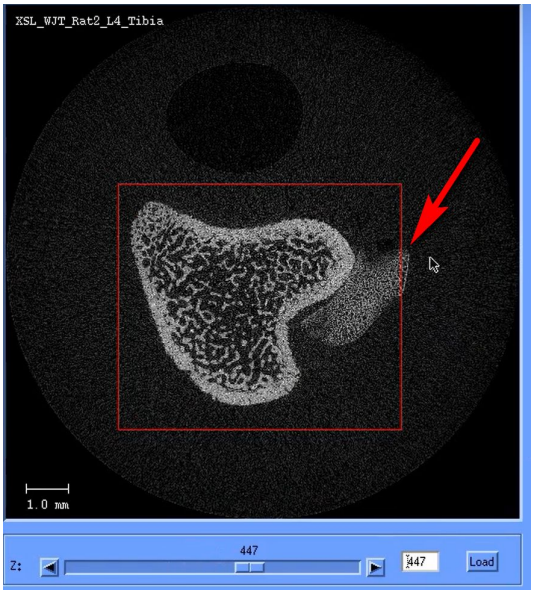

In the 'Selection': click ‘All’, then click 'Morph'.



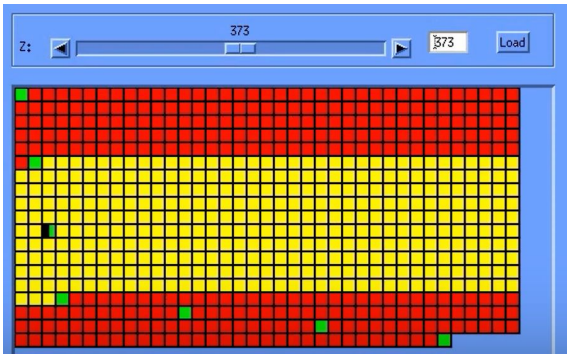

You will then see red slices appear, which indicate morphed contours.



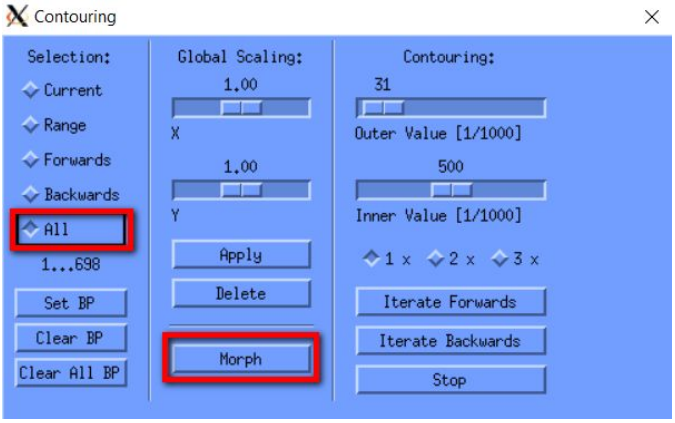

(By clicking ‘Morph’, the system draws interpolated geometry on the slices between your manually drawn contours.)
Click through the morphed slices and check to ensure that the contours encompass your sample entirely. See? This part of your sample falls outside the contour.




To make adjustments, select the closest manually drawn contour, delete the contour, and redraw a larger contour. You will see yellow slices appear, which indicates re-morphing is needed.



Click “All”, and click “Morph” again to do re-morph.

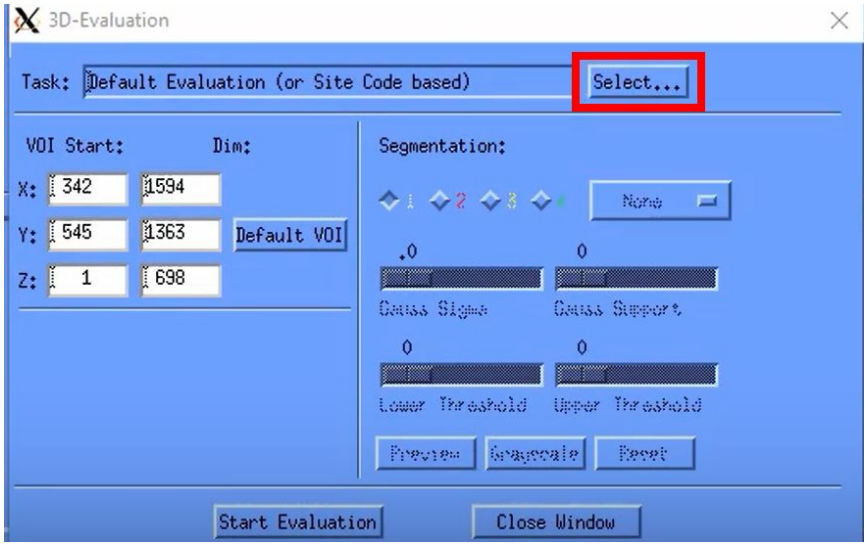



Now, every part of your sample is within the contour.

## Step 2: Exporting SEG.AIM & AIM files from cropping

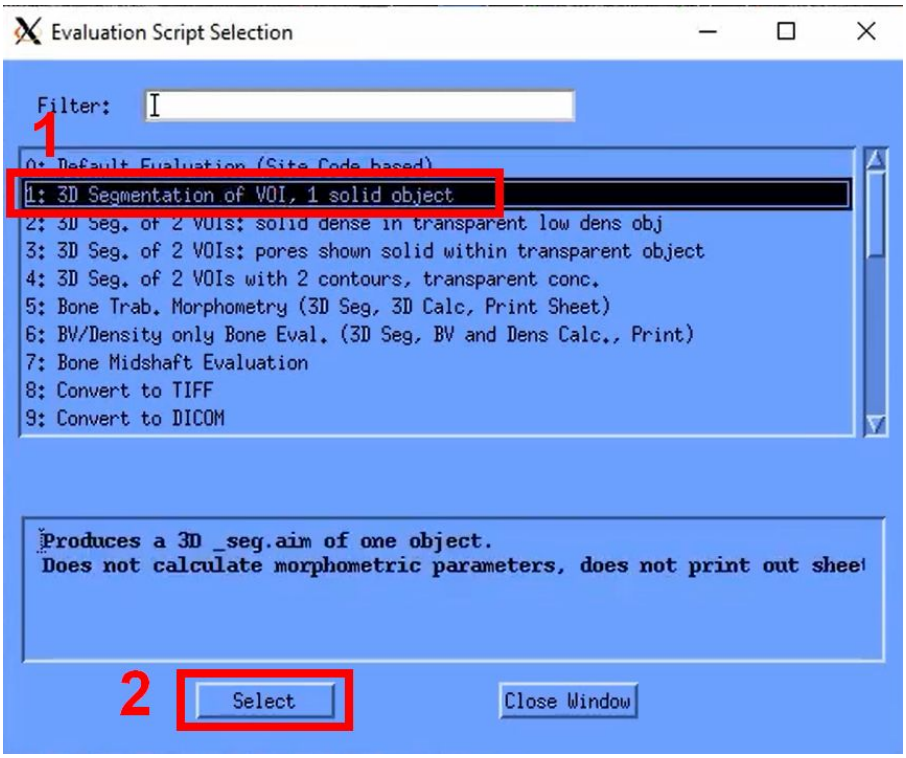
Click 'T...' 


Click "Select..."

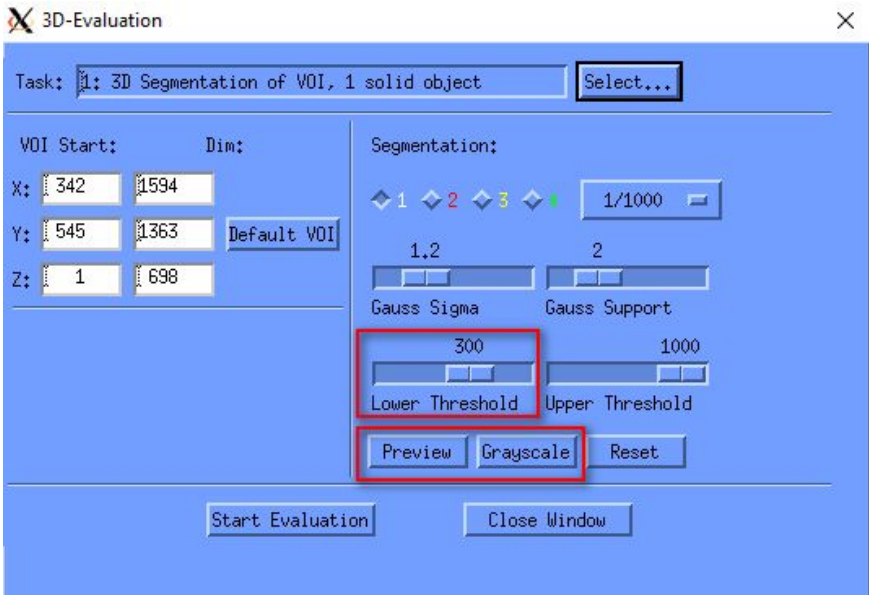



Select Task: '3D Segmentation of VOI, 1 solid object'

Click "Select"




**Pay attention to the "Lower Threshold"!**

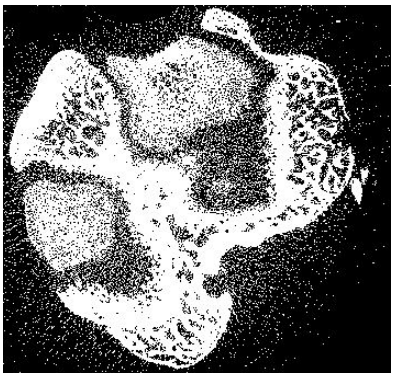
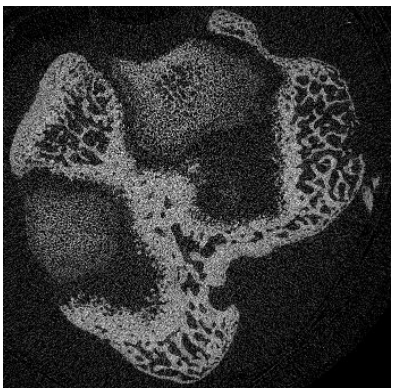
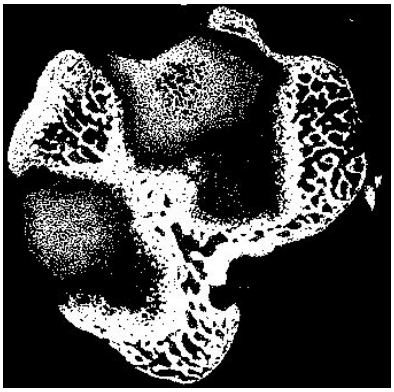
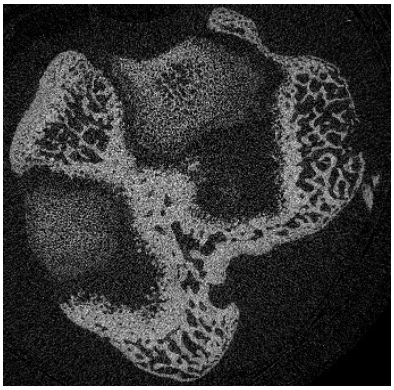
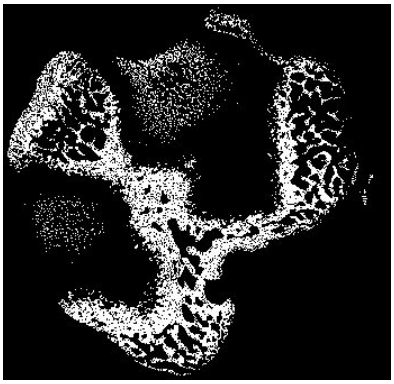
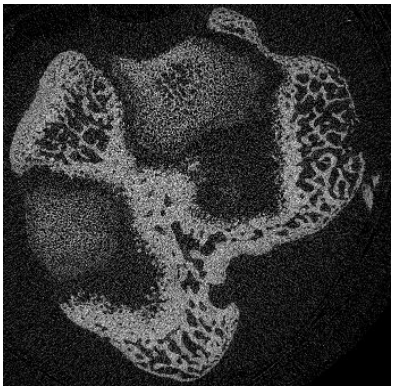



By default, it is set to "300", which satisfies most users' needs.
In some cases (e.g.: the bone density is too low), please adjust the "Lower Threshold" to an appropriate level.

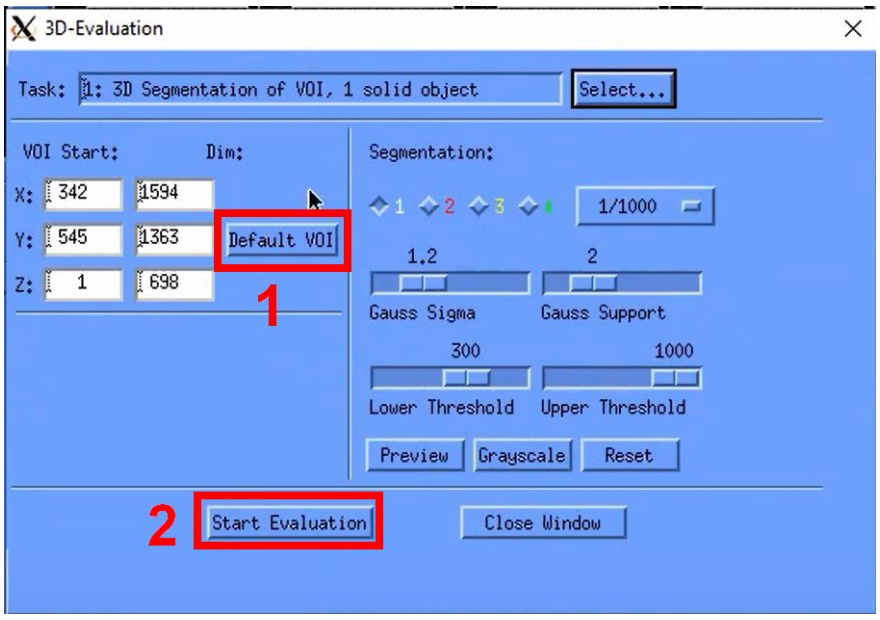
**How do I determine the "Lower Threshold" that is appropriate?**

To adjust the "Lower Threshold", move the bar by dragging your mouse or using the keyboard arrow key. Alternate clicking "Preview" and "Grayscale" to visualize the images.

E.g.:

| Threshold | Threshold Image (Preview) | Grayscale Image |
|---|---|---|
| Lower Threshold = 150 (This threshold is **too low**, generating too much noise.) |  |  |
| Lower Threshold = 300 (This threshold is at an **appropriate** level.) |  |  |
| Lower Threshold = 450 (This threshold is **too high**, too much tissue is missed.) |  |  |

After the Lower Threshold is selected, click "Default VOI" (**VERY IMPORTANT!**)
Click "Start Evaluation".

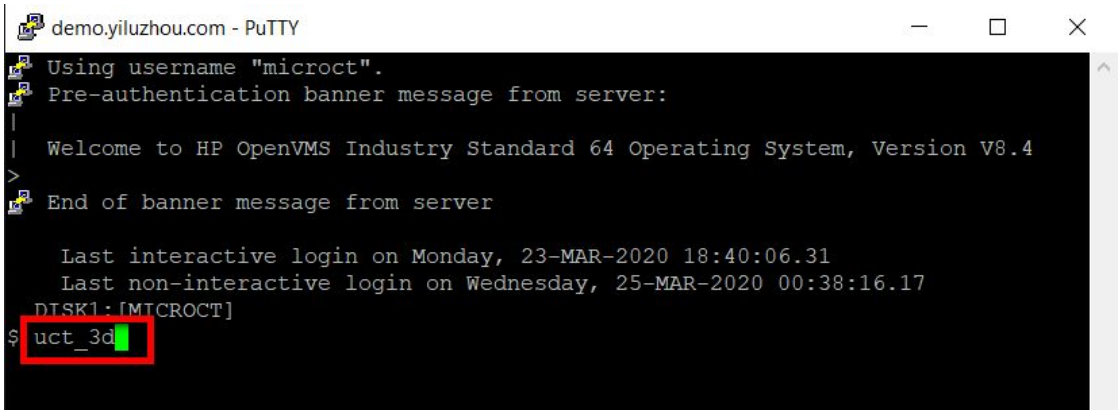



This process will run in the background and can take up to 1 hour depending on your image size. You may proceed to crop other images.

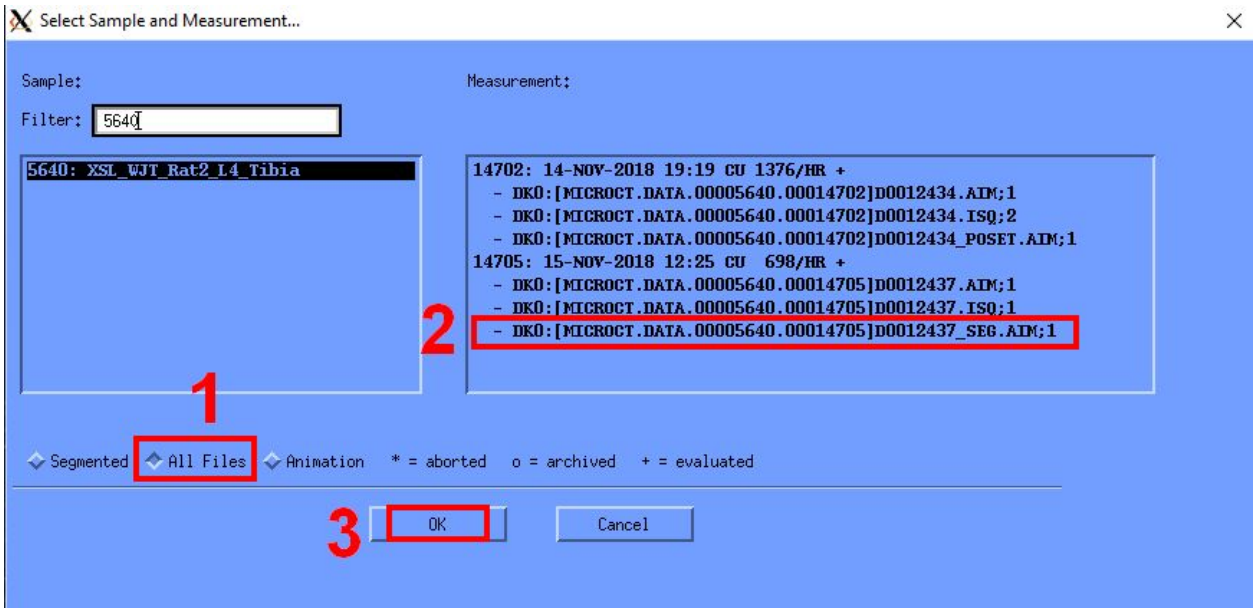
Note: In some cases, the Upper Threshold may need to also be tuned. Please follow the same steps as previously described for adjusting the Lower Threshold.

## Step 3: 3D display

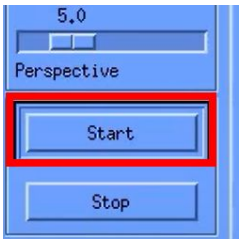
Type uct_3d in the command window, then press Enter.




Sample#: 5640, and Measurement#: 14705
Click the “All Files” option, select the generated SEG.AIM file, and click “OK”.

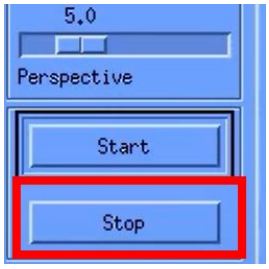



Be patient! It may take up to 2 minutes to load the SEG.AIM file, depending on the image size. If you do not see the 3D image appear, click the "Start" button.




Now, you can adjust the orientation of your sample:

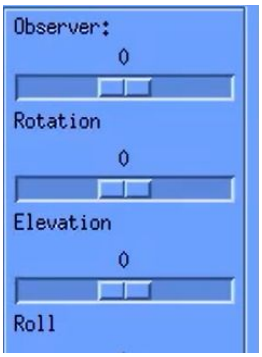
If you prefer to use computer mouse,
(Tip: You can click the "Stop" button to stop the rendering anytime.)



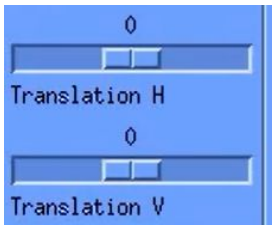

- Adjust sample orientation (rotation only): **Left click** and hold down the mouse, drag to your desired orientation, then release the mouse.
- Move sample position (translation only): **Right click** and hold down the mouse, drag to your desired position, then release the mouse.
- Enlarge or shrink the image size (scale factor): **Middle click** and hold down the mouse, drag to your desired size, then release the mouse.

If you prefer to use the left panel for image control:
(Tip: You can click the “Stop” button to stop the rendering anytime.)

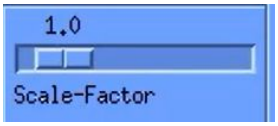
- Adjust sample orientation (rotation only):
  Drag the bars “Rotation”, “Elevation”, “Roll”



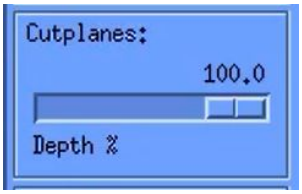

- Move sample position (translation only):
  Drag the bars “Translation H”, “Translation V”



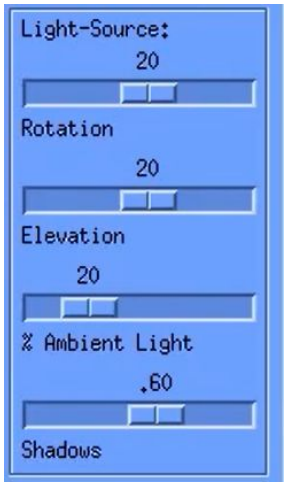

- Enlarge or shrink the image size: Drag the bar “Scale-Factor”



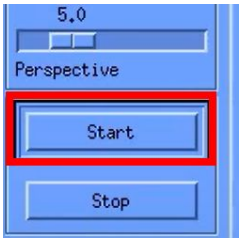

- View the cross sectional plane: Drag the bar “Depth %”




- Light source: Drag the bars in “Light-Source”



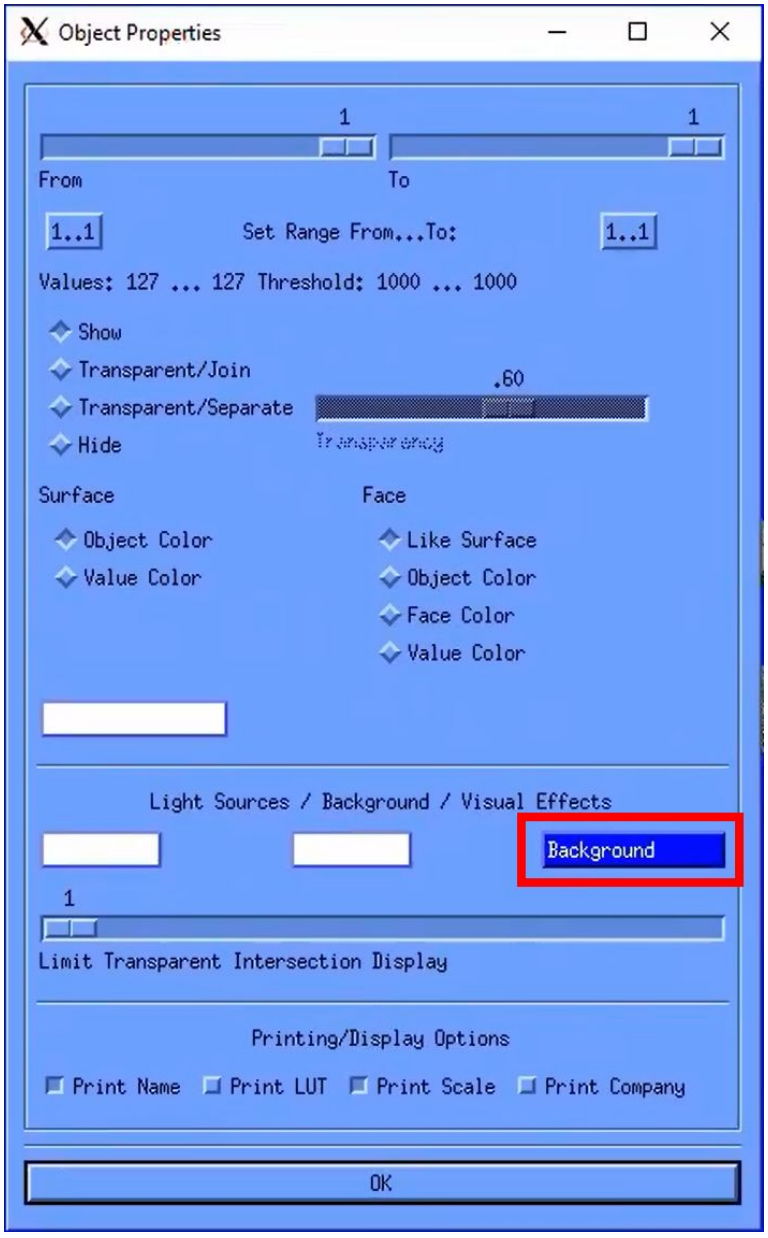

Note: Click the “Start” button for the adjustment(s) to take effect.




## Step 4: Save the 3D rendered image

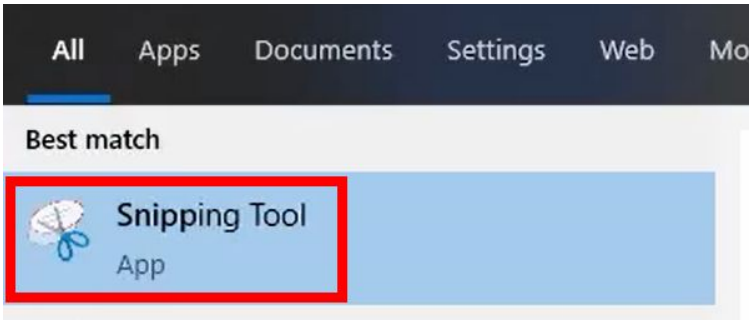
By default, the background of the 3D rendered image is blue. If you would like to change the background (e.g., white, black, none, etc.) Click the “Options” tab in the menu, select “Object/Display Properties”.


Then click “Background” and select your desired color and click “OK”.



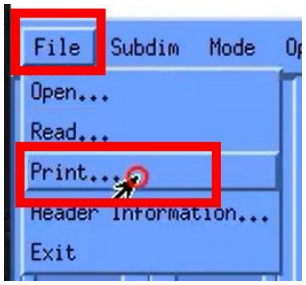

The 3D rendered image may be saved by EITHER:

(1) Using “Snipping Tool” to take a screenshot (the easiest way!)



*OR*

(2) Clicking “File” tab in the menu, then “Print...”.



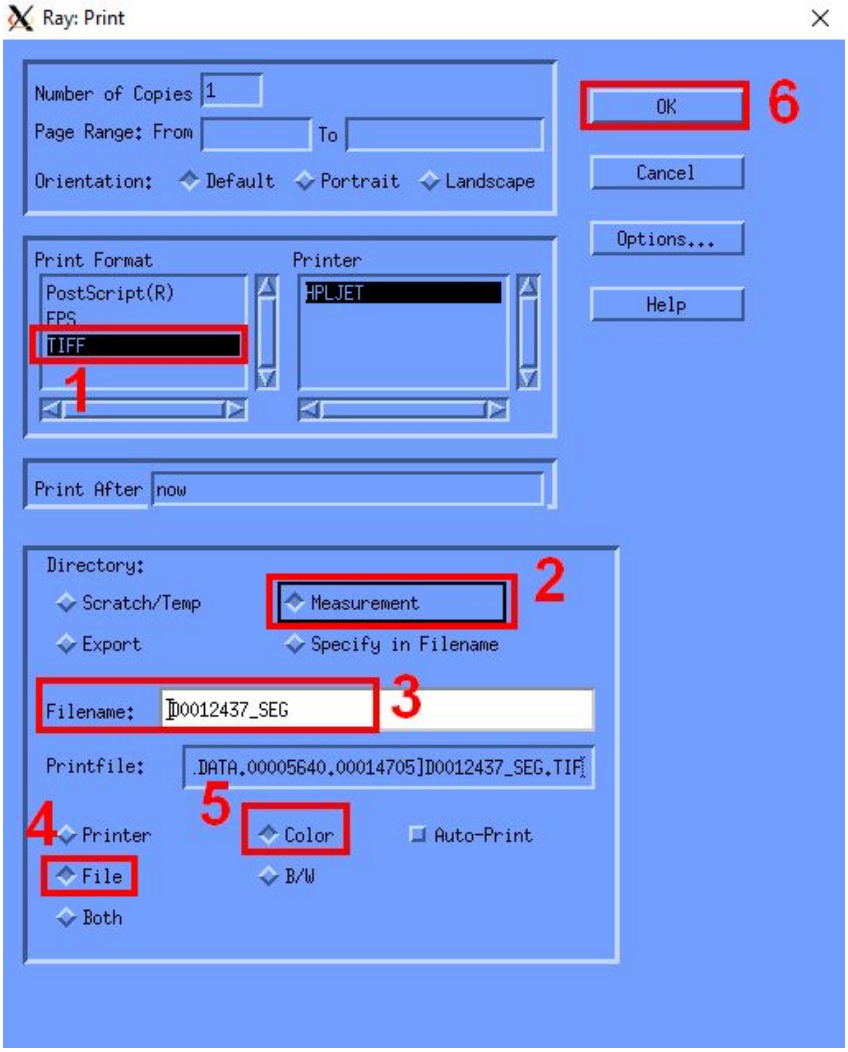

In “Print Format”, select “TIFF”.

In “Directory”: Select “Measurement”, “File”, “Color”.

For the “Filename”: **ONLY use numbers, letters, hyphen, underscore**.

**DO NOT use special characters, including ( ) [ ] / **

**DO NOT exceed 12 characters!**




Here, there are 12 characters in “D0012437_SEG”, which is acceptable. Click “OK”.

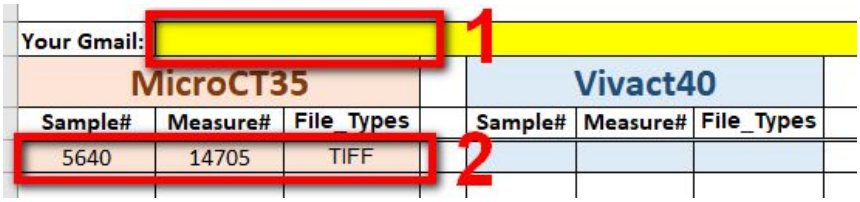
## Step 5 (Optional): Retrieving the “TIFF” files

Please complete the 'User_file_request" Excel spreadsheet. You may find the 'User_file_request" Excel spreadsheet:

- If you are on our analysis computer in Room 315, you can open the folder "For_MicroCT_Users" on the desktop. There is an Excel file with the name "User_file_request".
- You may download it at https://www.med.upenn.edu/orl/uct/data-access.html

Open the "User_file_request" Excel spreadsheet,

1) Enter your Gmail. (Files will be later shared to the Google Drive associated with this account.)
2) Make sure you enter the Sample# and Measure# under the correct scanner!
   For example, you would like to retrieve files from the microCT 35:
   Sample#: 5640, Measurement#: 14705
   Enter 5640 at the Sample# column, Enter 14705 at the Measure# column.
   ➔ If you want to request the TIFF file, enter TIFF at the File_Types column.




3) Save this Excel spreadsheet, and send it to pcmd.microct@gmail.com
4) Our system will automatically process your request. You will receive a notification email from Google Drive with a shared folder containing the files you have requested.