By PCMD MicroCT Imaging Core (2020.03 updated)

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

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

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 <u>.AIM</u> and <u>SEG.AIM</u> files for subsequent viewing. Here is an example of how to do cropping on microCT35: Double click "<u>uCT 35</u>" 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 "<mark>OK</mark>"

X Select Sample and Measurement			×
Sample: Filter: 5640 5640: XSL_WJT_Rat2_L4_Tibia	Measurement: 14702: 14-NOV-2018 19:19 CH 1376/HR + 14705: 15-NOV-2018 12:25 CU 698/HR +		
	ted o = archived + = evaluated Cancel		

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

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

		×
Global Scaling:	Contouring:	
1.00	31	
X	Outer Value [1/1000]	
1.00	500	
Y	Inner Value [1/1000]	
Apply		
Delete	Iterate Forwards	
	Iterate Backwards	
norph	Stop	
	Global Scaling: 1.00 X 1.00 Y Apply Delete Morph	Global Scaling: Contouring: 1.00 31 X Outer Value [1/1000] 1.00 500 Y Inner Value [1/1000] Apply \$1 × \$2 × \$3 × Delete Iterate Forwards Morph Stop

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 " <mark>Select</mark> "					
	X 3D-Evaluation				\times
	Task: Default Evalu	ation (or Site	Code based)	Select	
	VOI Start: I)im:	Segmentation:		
	X: 342 1594		♦: ♦2 ♦3 ♦	None 🗖	
	Y: 545 1363	Default VOI	.0	0	
	Z: 1 (698				
			Gettas Signe G.	NUSS Support	
			Lower Threshold U	oper Threshold	
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		Start Evaluatio	n Close W	indow	

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

X Evaluation Script Selection	-		×
Filter: I			
0+ Default Evaluation (Site Code based)			
1: 3D Segmentation of VOI, 1 solid object			
2: 3D Seg. of 2 VUIS: solid dense in transparent low dens o 3: 3D Seg. of 2 VOIS: pores shown solid within transparent 4: 3D Seg. of 2 VOIS with 2 contours, transparent conc. 5: Bone Trab. Morphometry (3D Seg, 3D Calc, Print Sheet) 6: BV/Density only Bone Eval. (3D Seg, BV and Dens Calc., P 7: Bone Midshaft Evaluation	bj object rint)		
8: Convert to TIFF			
9: Convert to DICOM			
Produces a 3D _seg.aim of one object. Does not calculate morphometric parameters, does not calculate morphometric parameters.	not print	t out s	heel
2 Select Close Window			

Pay attention to the "Lower Threshold"!

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OI Start:		Dim:	Segmentation:
Ĩ 3 42	1594		
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	ł	-	Gauss Sigma Gauss Support
			300 1000
			Lower Threshold Upper Threshold
			Lower mileshotd opper mileshotd
			Preview Grayscale Reset
		-	

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.

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

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

🗙 3D-Evalua	ation			×
Task: 1: 3	D Segment	ation of VOI, 1	L solid object Select	
VOI Start:		Dim:	Segmentation:	
X: 342	1 594			
Y: 545	1363	Default VOI	1.2 2	
Z: 1	Ĩ 698	1		
			Gauss Sigma Gauss Support	
			Lower Threshold Upper Threshold	
			Preview Grayscale Reset	
	2	Start Evaluati	on Close Window	

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".

Measurement:
14702: 14-NOV-2018 19:19 CU 1376/HR + - DK0:[MICROCT.DATA.00005640.00014702]D0012434.ATM;1 - DK0:[MICROCT.DATA.00005640.00014702]D0012434.TSQ;2 - DK0:[MICROCT.DATA.00005640.00014702]D0012434_POSET.ATM;1 14705: 15-NOV-2018 12:25 CU 698/HR + - DK0:[MICROCT.DATA.00005640.00014705]D0012437.ATM;1 - DK0:[MICROCT.DATA.00005640.00014705]D0012437.ISQ;1 - DK0:[MICROCT.DATA.00005640.00014705]D0012437_SE6.AIM;1
* = aborted o = archived + = evaluated

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.)

5.0 Perspective
Start
Stop

- 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): **<u>Right click</u>** and hold down the mouse, drag to your desired position, then release the mouse.
- Enlarge or shrink the image size (scale factor): <u>Middle click</u> 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 "Detetion" "Floyedian" "Poll
 - Drag the bars "Rotation", "Elevation", "Roll"

Observer:
0
Rotation
0
Elevation
0
Roll

 Move sample position (translation only): Drag the bars "Translation H", "Translation V"

0	
	1
Translation H	
0	
	1
Translation V	

- Enlarge or shrink the image size: Drag the bar "Scale-Factor"
 - 1.0 Scale-Factor
- View the cross sectional plane: Drag the bar "Depth %"

Cutplanes:	
	100.0
Depth %	

• Light source: Drag the bars in "Light-Source"

Light-Source:
20
Rotation
20
Elevation
20
% Ambient Light
. 60
Shadows

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

5.0 Perspective	J
Start	
Stop	

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...".

File	Subdim	Mode	0
Open	•		Γ
Read			
Print.			
Header	Informa	t10n	
Exit			

In "<mark>Print Format</mark>", select "<mark>TIFF</mark>".

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!

Aumber of Copies 1	ок б
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Print Format Printer	Operons
PostScript(R)	Help
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Directory:	2
Specify in Filename	
Filename: 100012437_SEG 3	
	TIE
Printfilet DOTO COCCECIO COCCIATORIDOCIO/27 CEC	
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Printfile: DATA.00005640.00014705]D0012437_SEG.	
Printfile: .DATA.00005640.00014705]D0012437_SEG. 5	

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.)
- 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.

our Gmail:			Ľ			
N	/licroCT3	35		-	Vivact4	0
Sample#	Measure#	File_Types	-	Sample#	Measure#	File_Types
5640	14705	TIFF				

- 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.