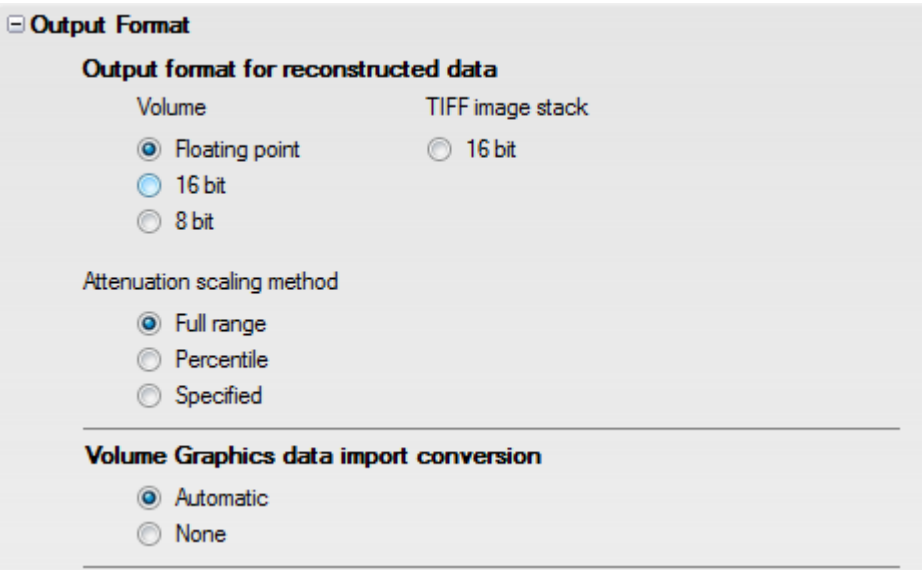
Re-Alignment (Registration) of CT Data using VGStudio MAX 2.2

Objective: If the plane at which your data is sliced is not how you would like to keep it, you can re-slice it using certain software such as Avizo, ImageJ or VGStudio MAX 2.2. This SOP will guide you through how to use VG Studio to re-slice or re-align your data.

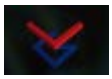
1. **Be sure scan has been reconstructed using CT Pro 3D**
    a. Make sure automatic VG Data Import is checked
        i. If shading of existing z-stack seems incorrect, re-reconstruct using Volume → Floating Point with full range scaling method in CT Pro 3D
            - Floating Point produces a non-normalized histogram whereas 16-bit tiff will lead to a defaulted normalization of the gray values to background which may lead to an omission of low density gray values in the reconstruction



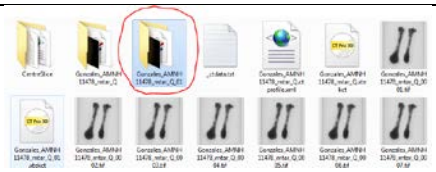
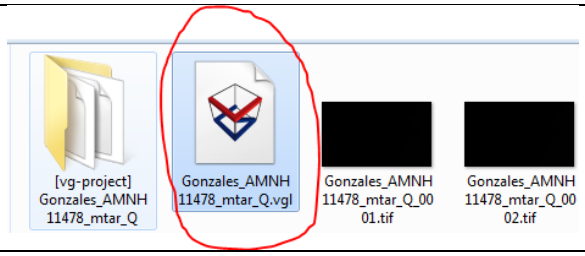
2. **Be sure the VG Dongle USB is plugged into the computer you will be using**

VG Dongle in the non-blue USB slot of either computer

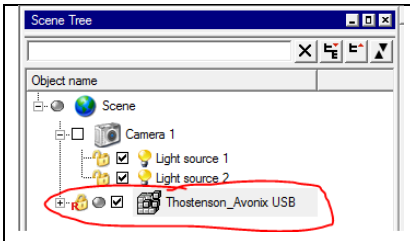
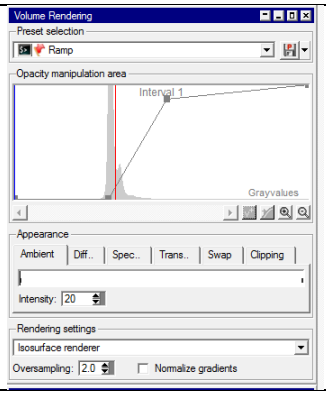
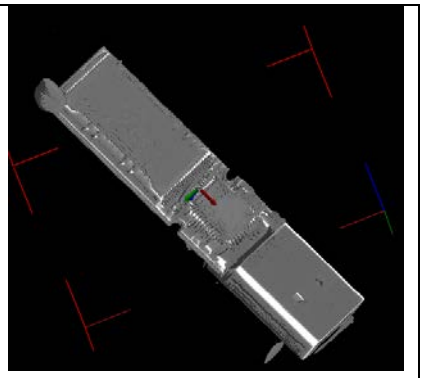
3. **Open the VG Studio MAX2.2 Program**
    a. Click on the VG icon in the task bar



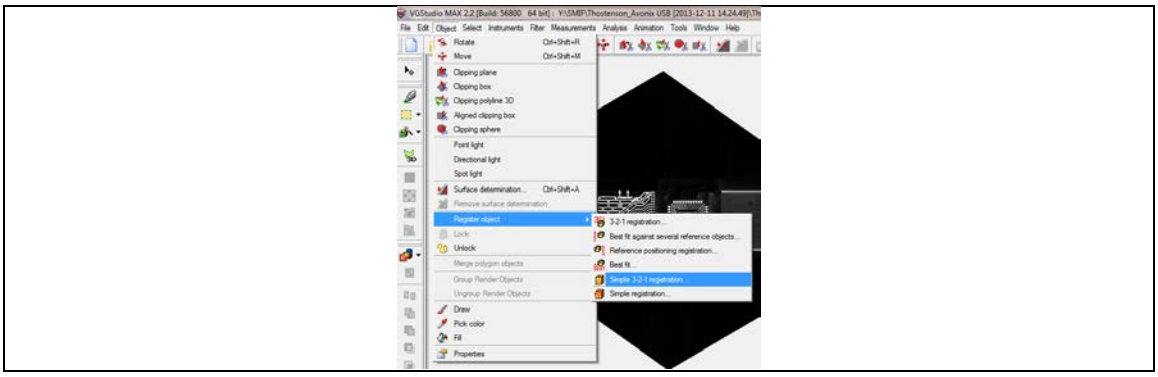
4. **Open Reconstructed Data in VG Studio**
    a. File -> Open
    b. Locate the .vgl file located in the reconstructed folder of the scan project which exists on the D-drive within the CT Data Directory
        i. i.e. an example directory listing is
            - D:\CT Data\Gonzales_AMNH11478_mtar_Q [2015-11-05 14.14.26]\Gonzales_AMNH11478_mtar_Q_01

	
Reconstructed Folder	.vgl file to be opened

    c. Open
5. Select your volume, change Render settings to 'Isosurface renderer' and adjust the red line to appropriately threshold your sample.
    a. You need to eliminate background to a certain degree from your 3D image so that you can assign a plane and points along the desired surface which you wish to slice along/through.

		
Select the volume object	Adjust the threshold and render settings to eliminate background	Should have a decent acuity of sample surface

6. Click on Object menu → Select Register object →**Simple** 3-2-1 Registration



7. Follow instructions for Registration provided in the window that pops up
    a. Ctrl+left click – 3 points on a plane
        i. Place them such that you construct at least 1 of the 3 perpendicular planes
    b. Ctrl+left click – 2 points on a line
        i. Place them along an axis of the new coordinate system you are trying to create for your sample
            - i.e. along the side of a box from between two adjacent corners
    c. Ctrl+left click – 1 point on an origin
        i. Try to place it at the center of your object or somewhere near the middle if the center is not reachable in the current render settings
    d. Click Finish
        i. The 4 viewing windows should resliced to the appropriate coordinate system.
    e.

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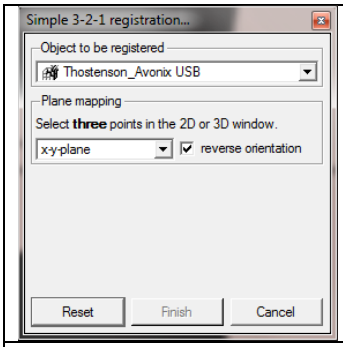
<td> 
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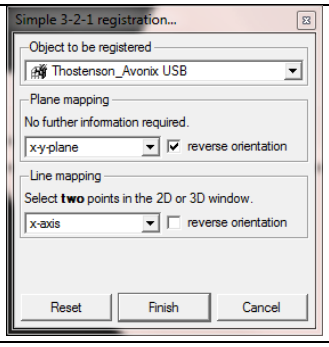
<td> 
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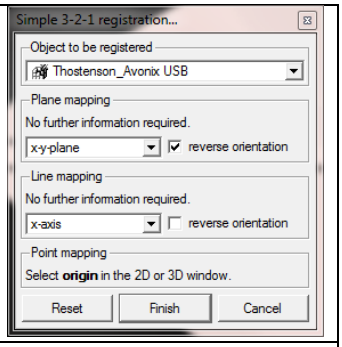
<td> 
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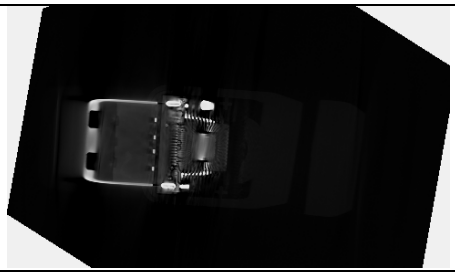
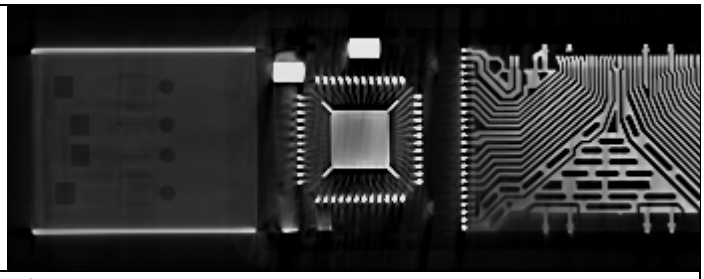
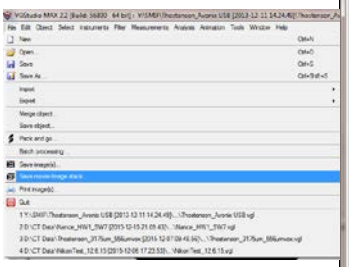
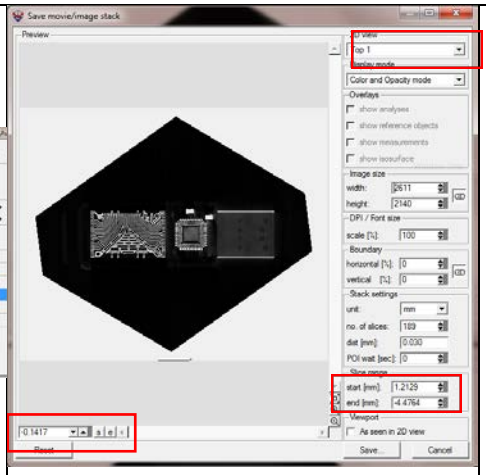
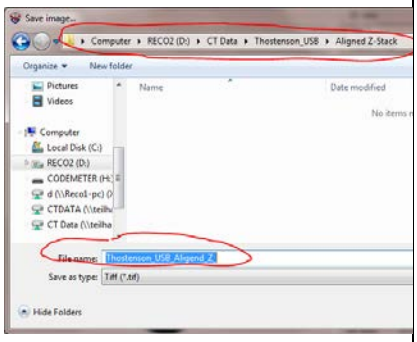
<tr><td>After 3-point selection</td><td>After 2-point selection</td><td>After 1-point selection</td></tr>
<tr><td colspan="3">Resultant windows from following step 7</td></tr>
</table>

8. Double check the resultant orthogonality (perpendicularity) of your slices and repeat steps 6-7 if the result is not adequate. See below image for example

	
Before 3-2-1 registration (sliced obliquely)	After 3-2-1 registration

9. File → save movie/save image stack
    i. Alternatively, you can use File → Export → Export Aligned Multiple/Multiple Volumes to preserve raw-ness of the data but this does not give you the option to crop down the slice range
    b. Select the appropriate 2D view corresponding with the slice view you wish to save
    c. Select start and end slice by clicking on the small gray patch next to the arrows and clicking ‘s’ and ‘e’ at the beginning and end of your sample, respectively
        i. The slice values are then copied into the Slice range fields
    d. Save
        i. BE SURE TO use an underscore following your filename since the saving will auto number sequential images
        ii. Please save into a new folder that is contained within your scan project folder
    e. Save

		
File -> Save movie/image stack	Setting slice view and range	Create aligned folder and name files with underscore

10. Images should save to designated folder (may take a few minutes) which can be then opened in the desired program. Please review and consult with SMiF Staff if there are further questions.

BE WARE OF MEASUREMENTS MADE ON THESE IMAGES – THOUGH THERE IS A SCALE BAR SOMETIMES THE SCALE BAR IS NOT ITSELF ACCURATE