Input/Output
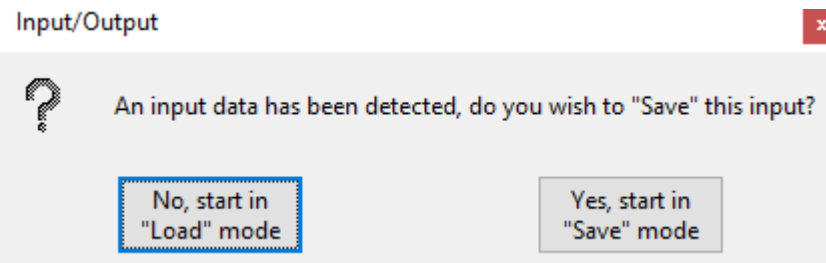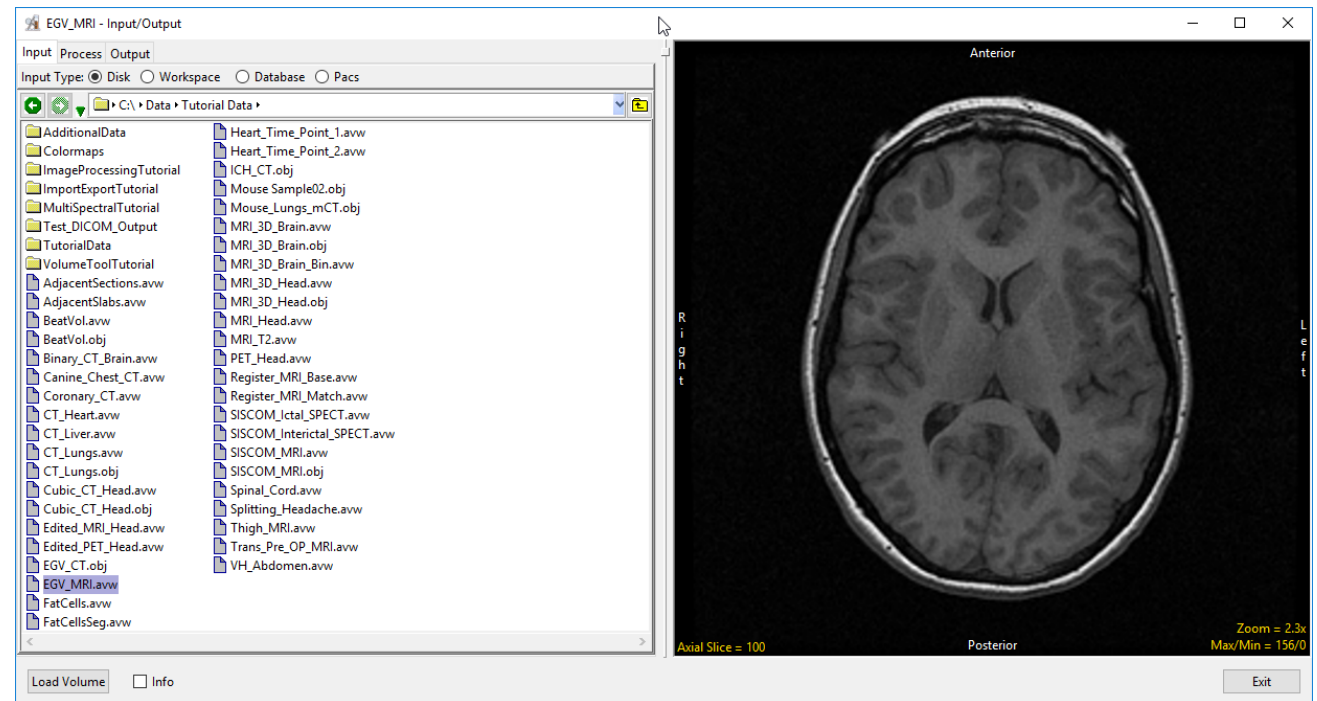
Introduction

The Input/Output module centralizes the loading and saving of image data in Analyze 14.0. Input/Output supports the loading of 51 file formats including standard Analyze file formats, common radiological and neurological formats, vender specific file formats, 2D desktop publishing formats, and video formats (see table on next page). For unsupported data Input/Output offers a raw data tool to facilitate loading if the pixels are uncompressed and in contiguous images within the file, see the Raw Data tool for further information.

The Input/Output module has two modes; Load mode and Save mode. Load mode is the default mode for the module while Save mode is enabled when a data set is selected in the workspace when Input/Output is opened.

If a data set is selected in the workspace when Input/Output is opened the module will prompt you to choose to start in Load mode or Save mode. Selecting Yes, will start the module in Save mode enabling the saving of the selected image.

File Formats and Attributes Supported by Analyze 14.0

Formats	AnalyzeAVW	OBJMAP	AVW_VolumeFile	AnalyzeImage(7.5)	AnalyzeScreen	UNKNOWN	DICOM	NIFTI	JPG	SunRaster	CTI	CTIECAT7	GE 9800	GEADVANCE	GE Advantage	GESigna	GESTARCAM	INTERFILE	TIFF	PBM	PGM	PPM	TARGA	XBM	PIC	PICKERMRI	SiemensCT	SIEMENSMAGVIS	YUV	ACRNEMA	GIF	ANIMATEDGIF	PAPYRUS2	PAPYRUS3	SGIrgb	SGIlb	BMP	PostScript	SMIS	PNG	XWD	IMATRON	BIORAD	QUICKTIME	ITK	AVI	MPEG1	VARIANFDF	vox	VSI
Read	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Write	X	X	X	X	X	X	X	X	X	X								X	X	X	X	X	X	X	X				X	X	X	X			X	X	X	X	X	X	X				X					X
2D	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
3D	X	X	X	X		X	X	X			X	X	X	X	X	X	X	X							X	X	X	X		X			X	X					X			X	X	X	X	X	X	X	X	X
4D	X		X	X		X	X	X																																		X		X	X			X	X	X
Unsigned 8-bit	X	X	X	X	X	X	X	X	X	X								X	X	X	X	X	X	X	X				X	X	X	X			X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Signed 8-bit	X		X	X		X	X	X										X												X									X						X					X
Unsigned 16-bit	X		X	X		X	X	X										X	X						X					X									X	X		X	X		X			X		X
Signed 16-bit	X		X	X		X	X	X			X	X	X	X	X	X	X	X	X						X	X	X	X		X			X	X					X			X	X		X			X		X
Unsigned 32-bit	X		X	X		X	X	X																						X									X						X			X		X
Signed 32-bit	X		X	X		X	X	X																	X					X									X						X			X		X
Float	X		X	X		X	X	X			X	X		X											X					X									X						X			X		X
Double	X		X	X		X	X	X																						X															X			X		X
Complex	X		X	X		X	X	X																																					X			X		X
RGB	X		X	X	X	X			X	X									X			X	X		X				X		X	X			X	X	X		X	X	X			X		X	X		X	X

The Input/Output Window

The Input/Output windows consists of the following nine sections:

1. Mode tabs: Allows user to select the mode for the Input/Output module from the following:

Input: Sets Input/Output to load mode for loading data into the software.

Process: Provides tools for processing of image data (see process tab), available for both load and save modes.

Output: Sets Input/Output to save mode for exporting data from the software.

2. Input Types: Select the location to load data from or save data to.

Disk: Allows data to be selected and loaded from the systems local disks or network drives.

Workspace: Allows data to be selected and loaded from a workspace.

Database: Allows DICOM data to be imported into a database, selected and loaded into the software. For save mode allows DICOM data to be stored in the database for export out of the software.

PACS: Allows for the configuration of Query/Retrieve (Q/R) of DICOM image data from PACS.
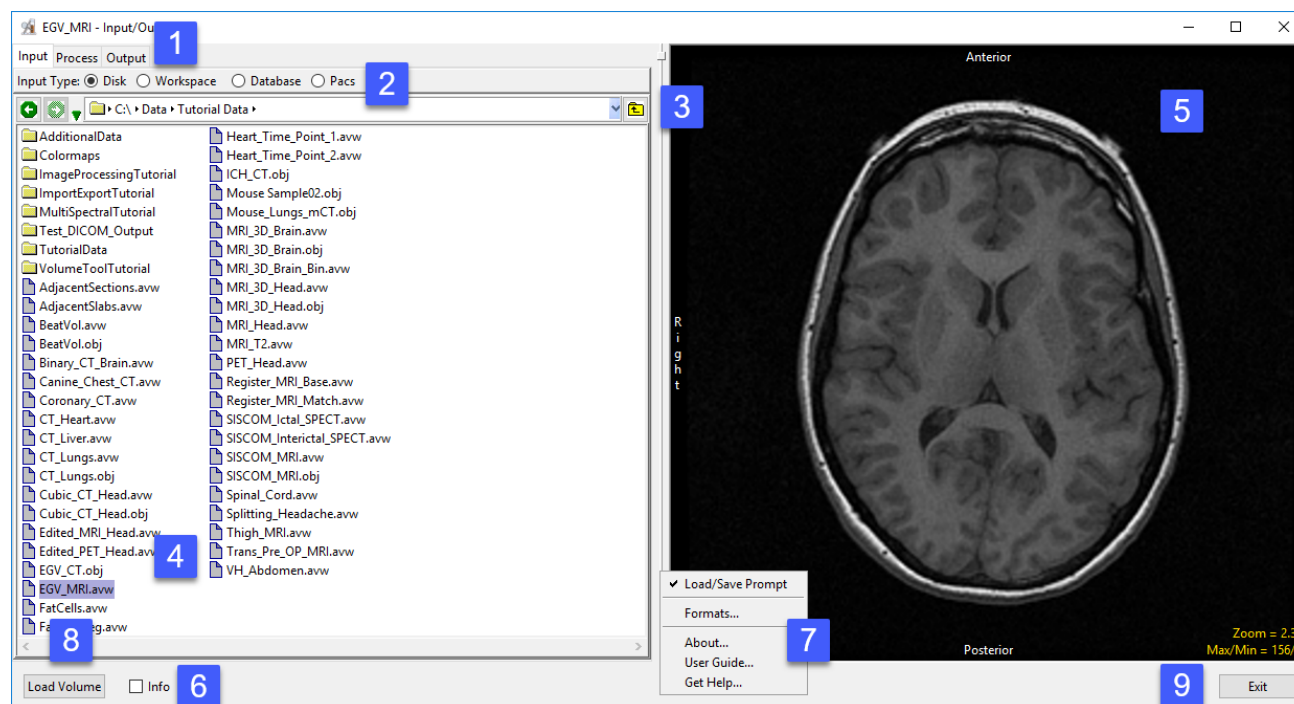
3. Directory selector: Enables users to navigate to the location of the data to be loaded.

4. File selection area: Allows users to select the desired data sets for loading.

5. Image display: Provides a display for data review of the selected image file prior to loading.

6. Info option: When checked displays the header information for the selected file.

7. Right-mouse options:

Load/Save Prompt: Enable/Disable Load/Save Prompt (Figure 3.2)

Formats: Displays list of supported file formats and associated properties.

About - The About option opens the Analyze 14.0 About window. The About window provides detailed information about the system and the Analyze software. Selecting Done will close the About window.

User Guide - The User's Guide option opens this User Guide.

Get Help - Directs you to the AnalyzeDirect website support pages.

8. Load Volume: Loads the selected file into the current workspace.

9. Exit: Closes the Input/Output module.
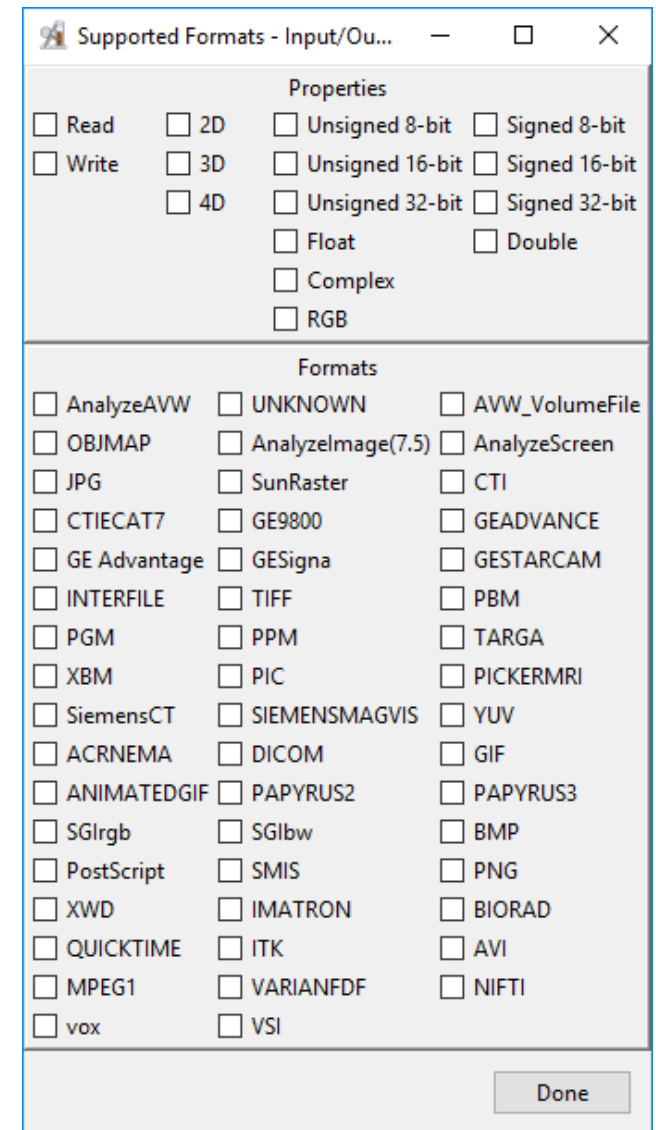
Input: Loading Data

Loading a Dataset

Input type: Disk

To load a single 2D image, a 3D volume, or 4D multivolume into the software:

Open Input/Output.

Navigate to the data [1] and select the data set you want to load [2]. See table at beginning of this chapter for supported file formats.

Note that the data will be displayed. [3]

Click Load Volume [4] to load the data. The selected data set will be loaded into Analyze 14.0.

Click Exit [5] to close Input/Output.
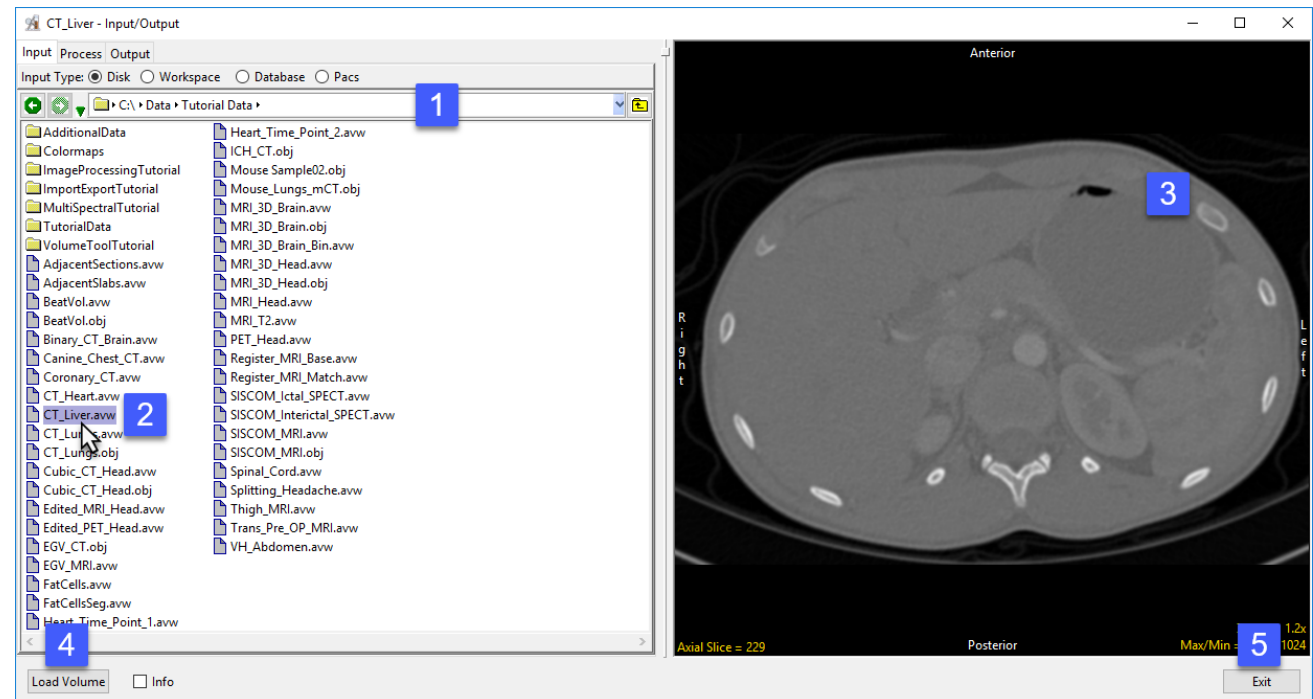
Loading Multiple 2D Files as a 3D Volume

Frequently, scanner vendors do not support exporting data in a single 3D format and choose instead to export data as a series of 2D images such, as TIFF or BMP. To load a series of 2D images into the software as a single 3D volume:

Open Input/Output.

Navigate to the series of 2D image files. [1]

To select a range of Image files, first choose the first Image in the series, then press the Shift key and finally select the last data set in the range [2]. Alternatively, select ctrl + a to select all files in the directory.

By default, all selected images will be treated as a single volume [3]. Other load options, such as loading a series of 2D images individually, are available from Process > Organize.

Click Load Volume [4] to load the data into the software as a single 3D volume.

Click Exit [5] to close Input/Output.
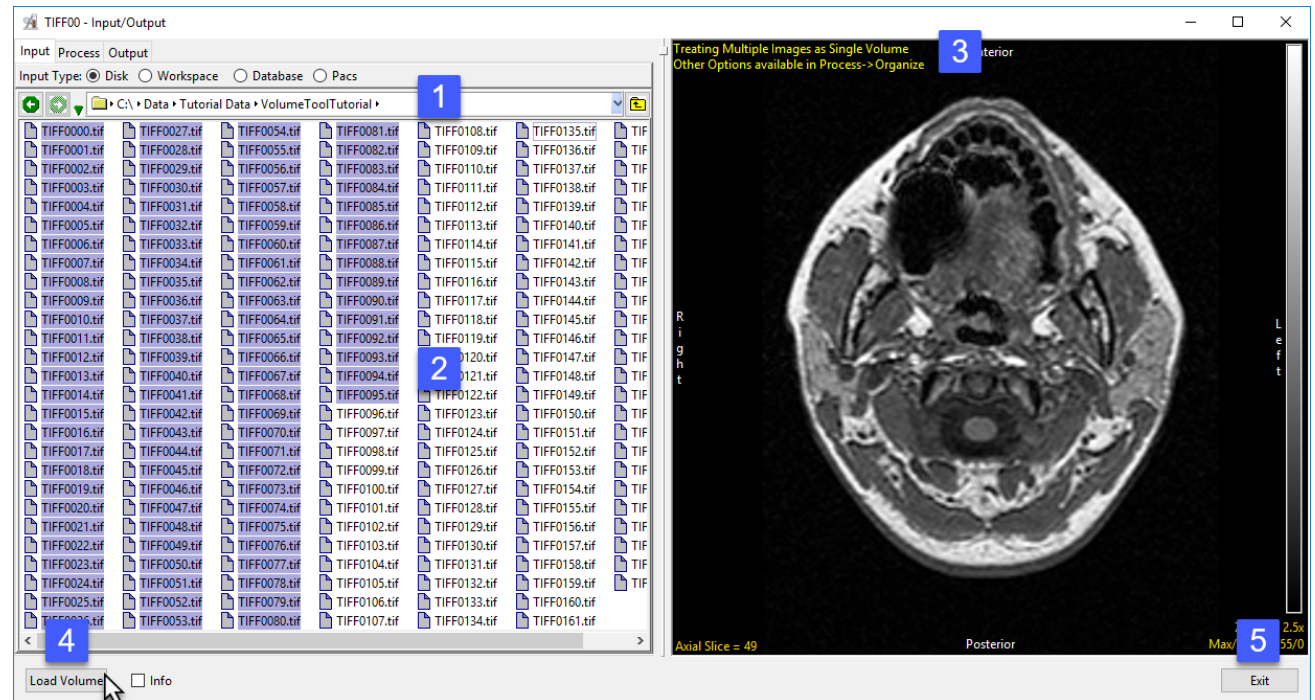
Loading Multiple 3D Volumes

To load multiple 3-D volumes into the program simultaneously:

Open Input/Output.

Navigate to the location of the image data. [1].

To select multiple data sets, hold down the Ctrl key and select each data set to load. [2].

If the data select has different properties (spatial dimensions, volume sizes, data types, etc.) the module will recognize this and treat the selected data sets as separate volumes [3]. Note that if the properties of the selected data sets are the same the module will default to load as a single multivolume.

Click Load Volume to load all selected volumes.

Click Exit to close the module [4].
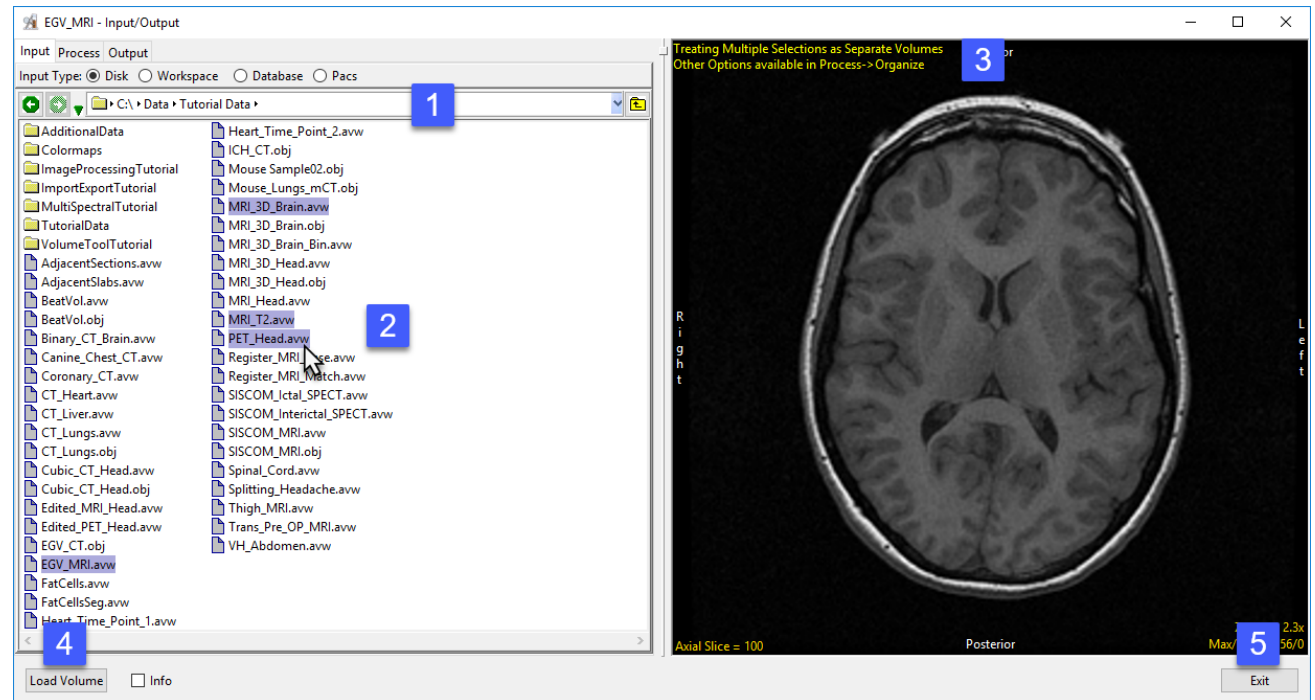
Loading Multiple 3D Volumes as a 4D Volume

Analyze 14.0 supports 4D image data sets or multivolumes. Multivolumes are data sets that that consist of multiple 3D volumes. Multivolume loading is automatically enabled when loading multiple volumes that have the same Voxel Dimensions and Datatype. To load a series of volumes as a multivolume:

Open Input/Output.

Navigate to the location of the image data. [1].

To select multiple data sets, hold down the Ctrl key and select each data set to load. [2].

As these data sets have the same properties the module will default to loading the data as a single multivolume [3].

Click Load Volume to load all selected volumes [4].

Click Exit to close the module [5].
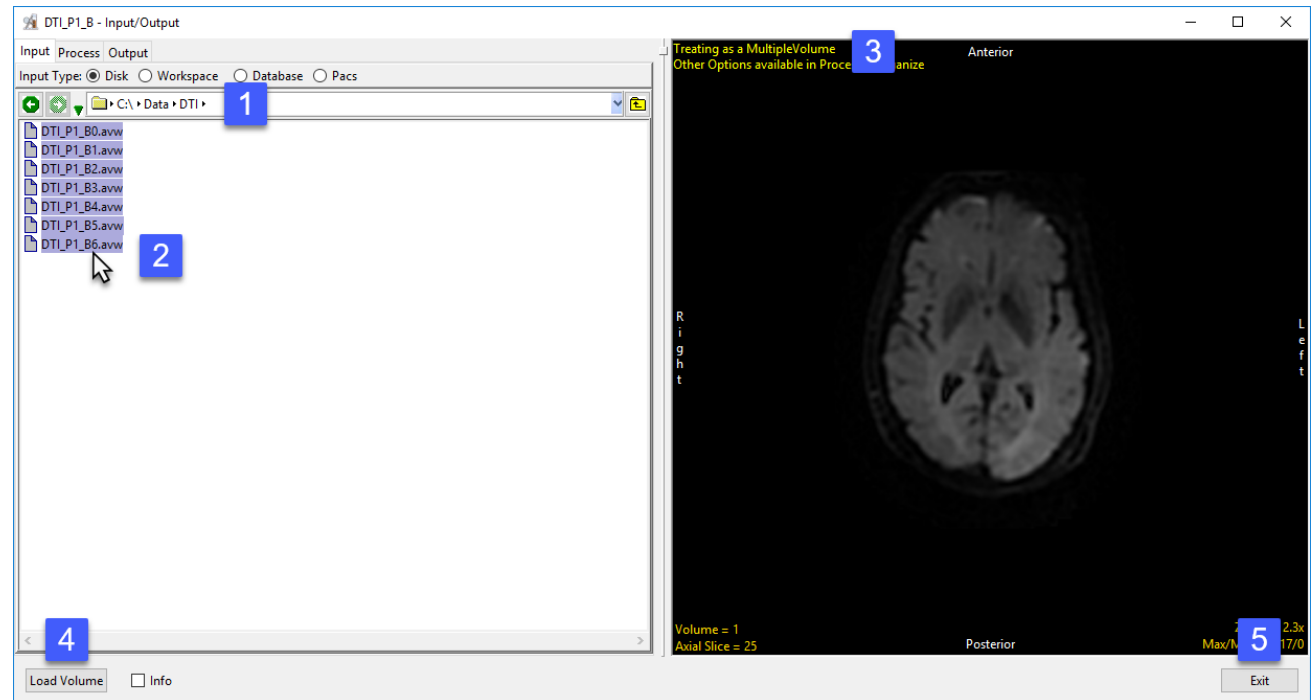
Loading Data From A Workspace

Input Type: Workspace

Input/Output supports the loading
of image data from one workspace
to another. To load data from a
workspace into the current workspace
(the workspace selected when Input/
Output was opened):

Open Input/Output.

Use the Workspace drop-down menu
to select a Workspace. [1].

Use the File drop-down menu to
select a data set [2].

The selected data to be previewed in
the Display window [3].

Click Load Volume to load the
selected file to the current workspace
[4].

Click Exit to close the module [5].
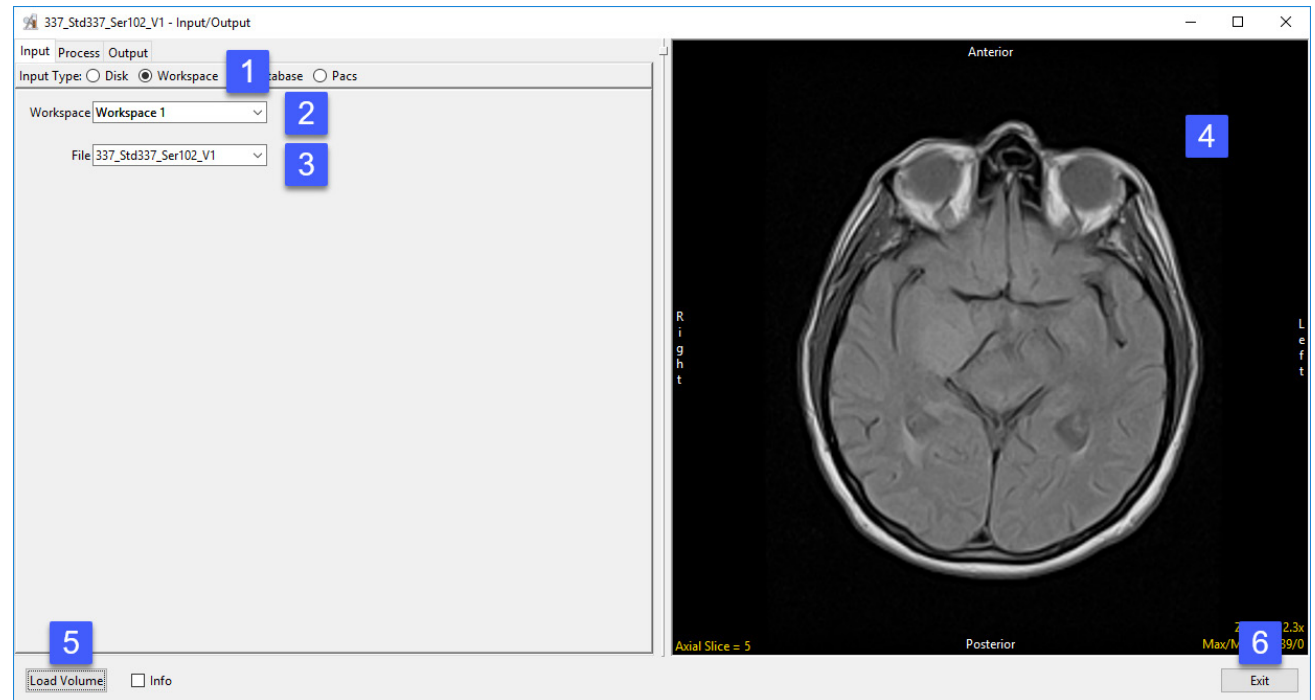
Importing DICOM Data

Input Type: Database

The Database input option is for the import of DICOM image data into Analyze 14.0. The Database option enables the indexing of collections of DICOM images through a local database file. To create a database and for DICOM data import:

Open Input/Output.

Set Input Type to Database [1].

The first time the Database option is selected, a window will be displayed, asking:

'There is no input database connection. What would you like to do?'

Select Create a new database. [2].

Note: If you have used previous versions of Analyze or AnalyzePro and have created DICOM databases you can use the 'Browse filesystem for an input database' to navigate to and select a .adb file. If this window is not returned or if this is not the first time you have opened the Database option, select Admin button [3] to open the Administer Databases window and create a new database.
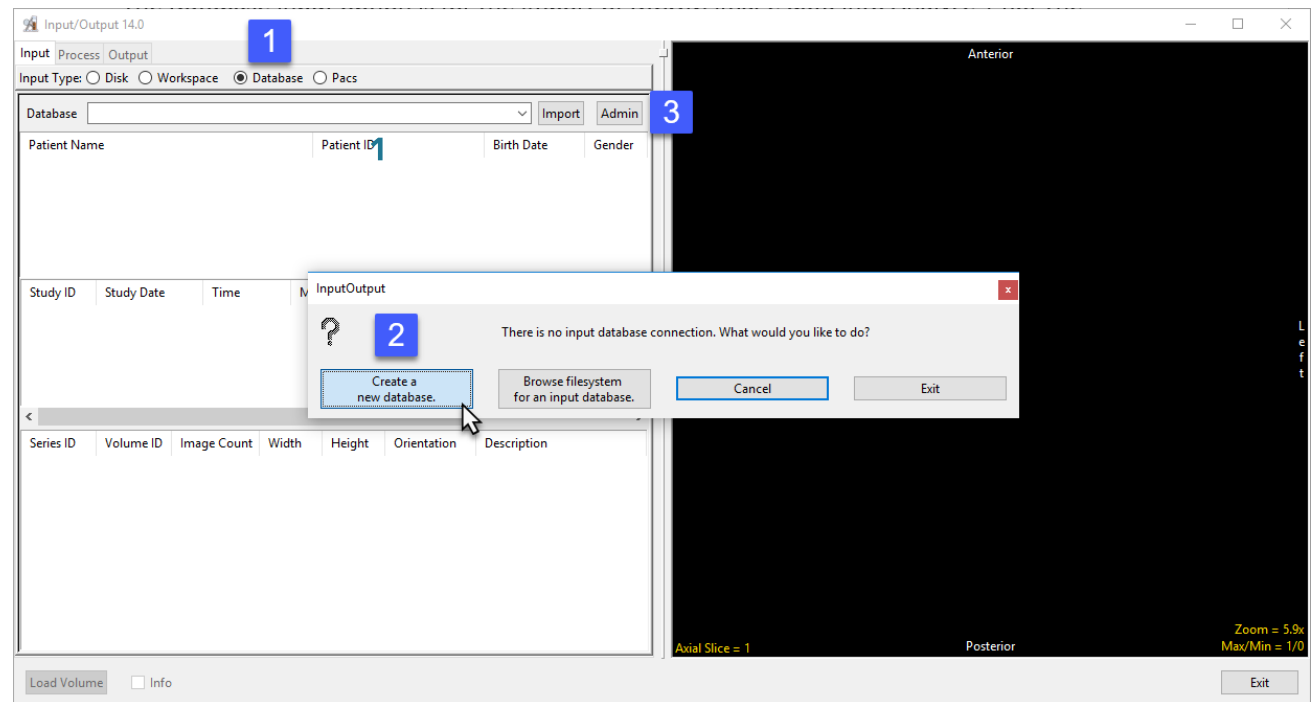
Importing DICOM Data (continued)

The Administer Database(s) window will open.

Name the database [3] and set the location where the database will be saved. [4].

Importing DICOM Data (continued)

Enabling DICOM Communications (optional)

A DICOM receiver can be configured for the database. The receiver will run as a Windows service or Unix daemon and will actively listen on a specified port for DICOM image data to be pushed to it from PACS or any other DICOM node. To set up a DICOM receiver:

Set the DICOM Communication to Enable. [5].

Set the Port number [6] and Application Entity Title (AET) Name. [7]

Note that the AET Name should not go over 16 alphanumeric characters.

Make a note of the Port number and AET Name. Your PACS administrator will need this information along with the systems IP address to configure DICOM push from PACS.

Once configured on PACS you will be able to push DICOM image data from PACS to the Analyze 14.0 database. Note that if DICOM data is not being received after pushing from PACS you may need to open the port number for the Receiver on your system's firewall.

Click Create. [8].

Importing DICOM Data (continued)

For Windows users an informational window will be returned informing your that a system prompt will follow to install services for the database. Click OK. [9]

In the Windows User Account Control prompt returned click Yes [10] to allow the program to install the receiver service.

Dismiss the service installed confirmation message by clicking OK [11].

Details about the receiver, as well as the associated database server, configured for the database are displayed at the bottom of the Administer Database(s) window [12]. Close the window.
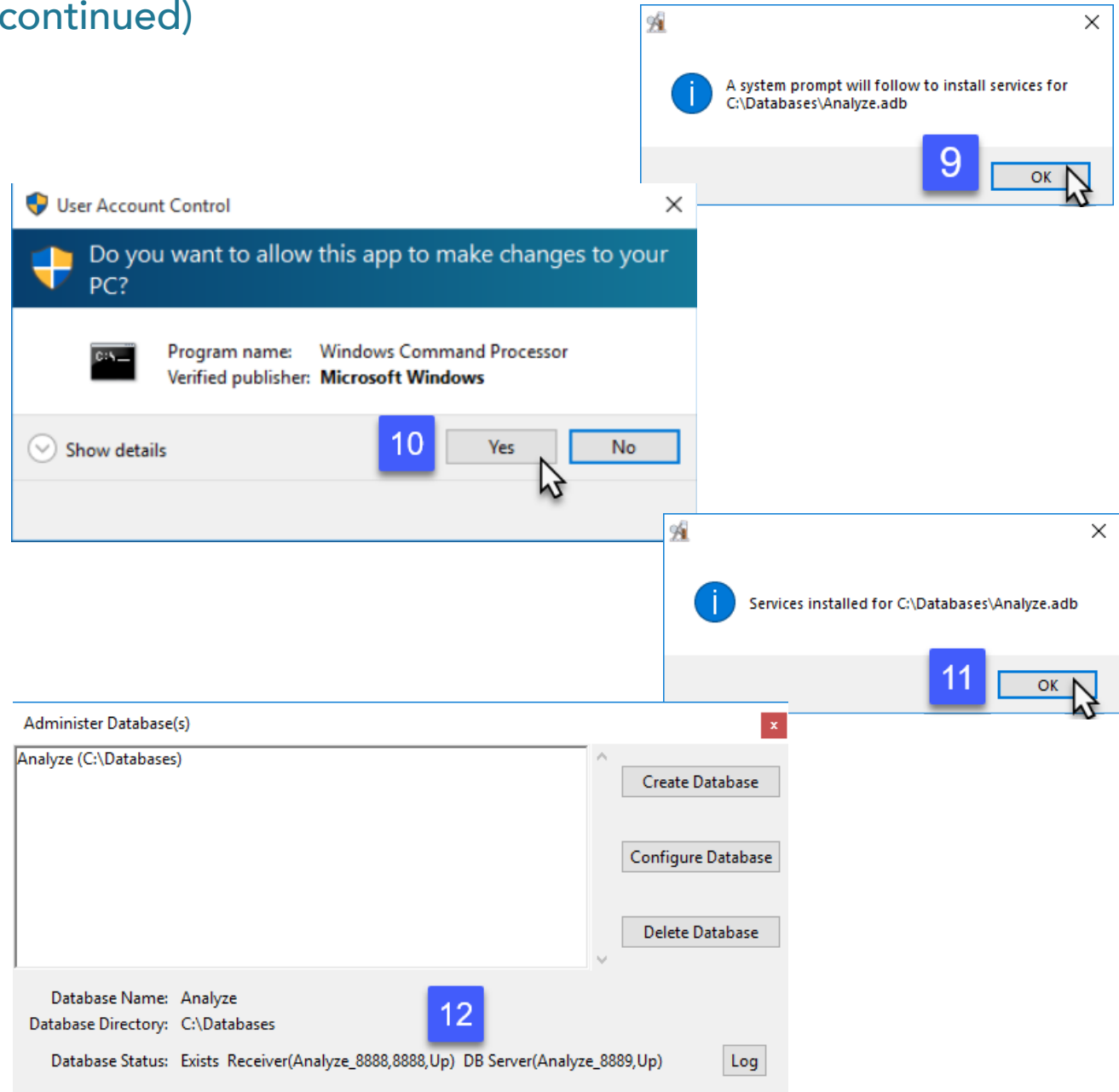
Importing DICOM Data (continued)

Importing Images

Once the Database is configured you can now start importing DICOM image data.

Click the Import button [13] or right-click in the window and select Import DICOM Images. [14]

Use the Directory Selector to navigate to the location of the DICOM images to import and click OK. [15]

A window will open stating Import all DICOM files found below <the specified folder>; click Yes. [16]
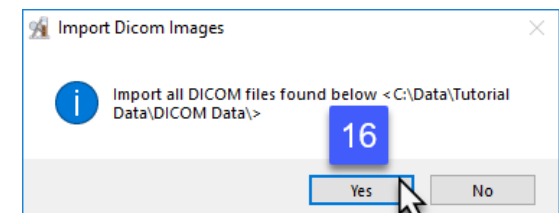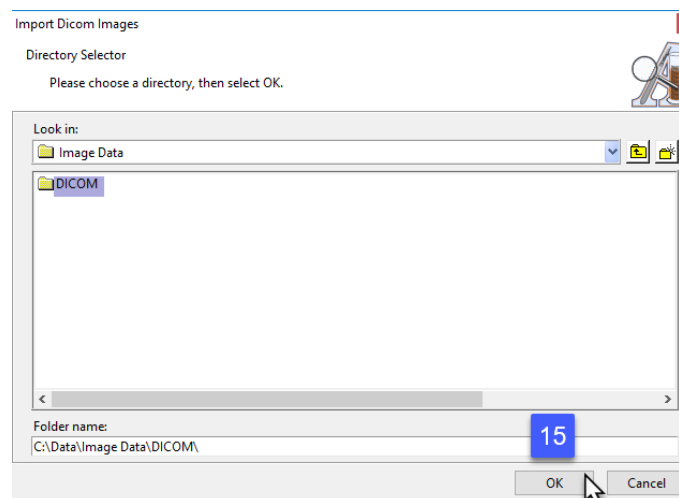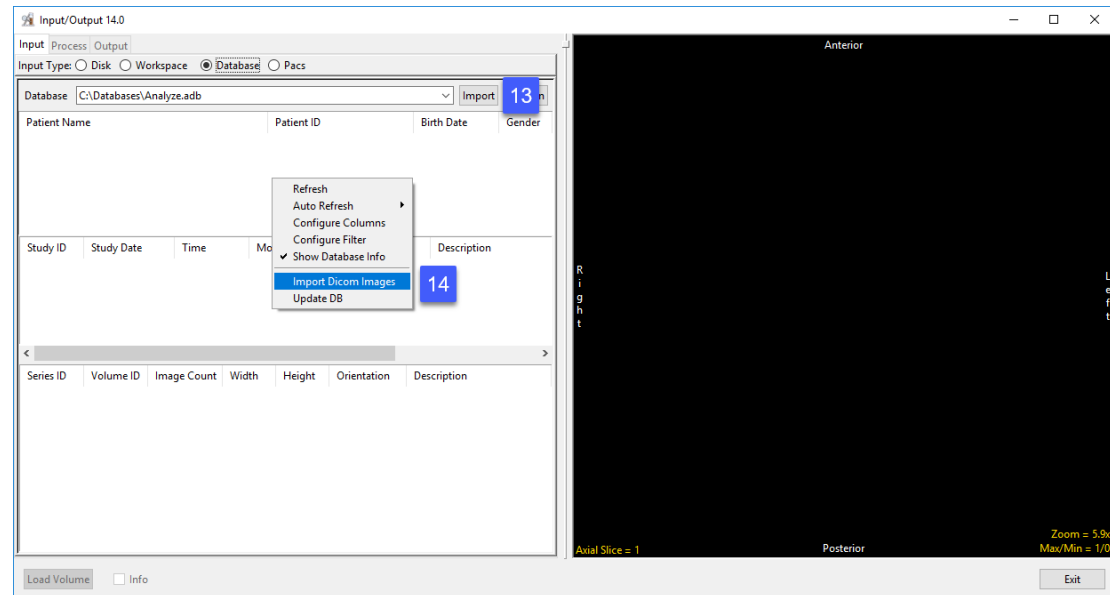
Importing DICOM Data (continued)

Loading DICOM Images

Once import is complete, the image data will be available in the database.

To load a data set into Analyze 14.0, select a data set and then click Load Volume. [17]
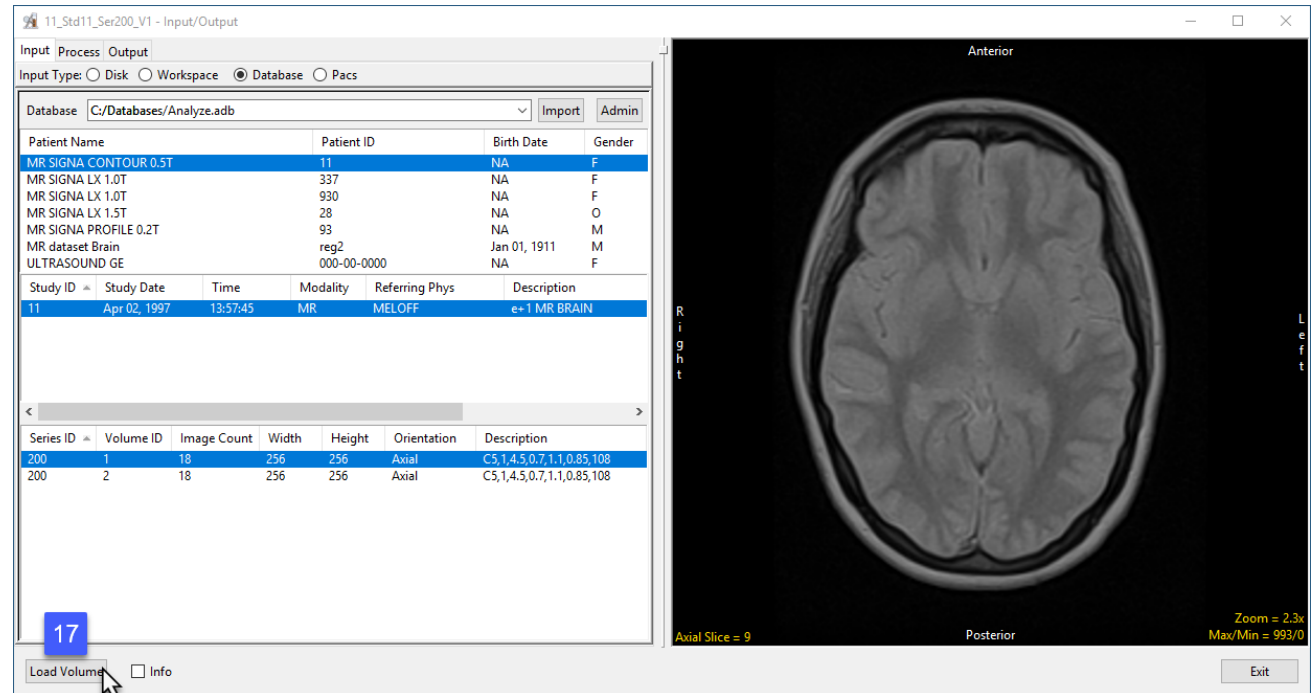
Configuring PACS Communications

Input Type: PACS

The PACS Input Type option allows users to configure Query and Retrieval of DICOM data from PACS. To set up communications to allow Query and Retrieval of DICOM data from PACS, first create a database, see previous section: Importing DICOM Data > Creating a Database, then:

Remote AET Configuration

Open Input/Output.

Set Input Type to PACS [1]. Under Remote AET, click Edit [2]. In the Input/Ouput Administer PACS (AET) list window that opens, click New [3]

The window will update showing AET, System, Port, and Description fields. Enter the PACS information into these fields [4] and click Apply [5].

Note that you will need to contact your PACS administrator to obtain the relevant PACS information.
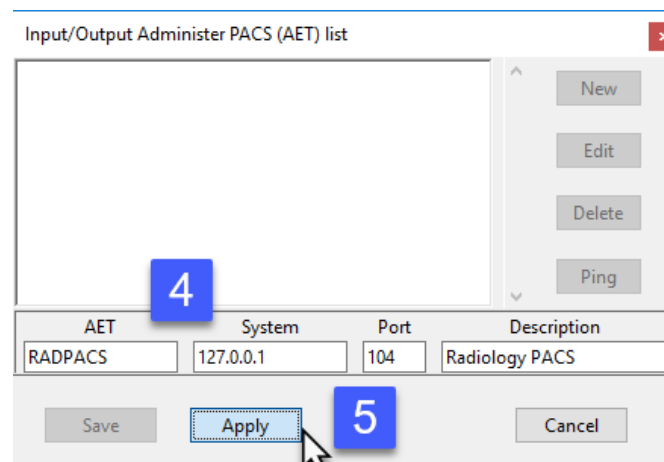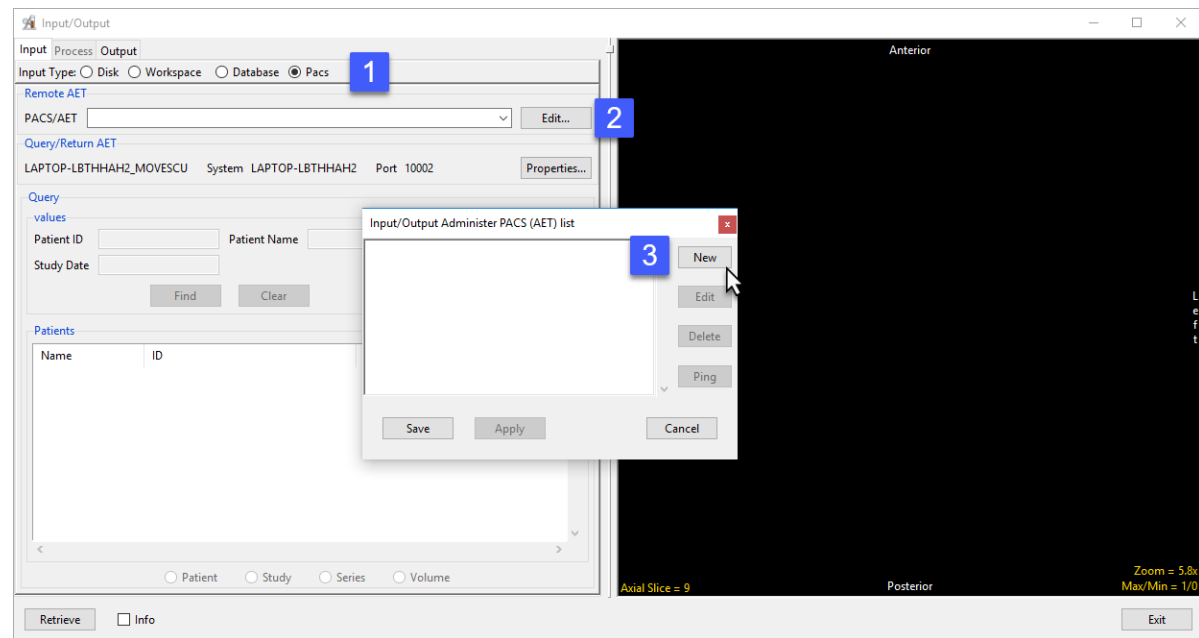
The window will update and the PACS information will be available in the main window. [6].

Click Save to close the window [7].

Local Query/Retrieve AET Configuration

For Analyze 14.0 to successfully query and retrieve DICOM image data from PACS a local MOVESCU service needs to be configured.

Under Query/Return AET click the Propertied button. [8]

In the window returned enter the Q/R AET.

Note: The AET should not be over 16 alphanumeric characters.

Enter the Port number Q/R will use and then click Apply. [10]

Make a note of the Q/R AET and Port number. Your PACS administrator will need this information along with the systems IP address to configure Q/R on PACS.

PACS is now configured on Analyze 14.0.
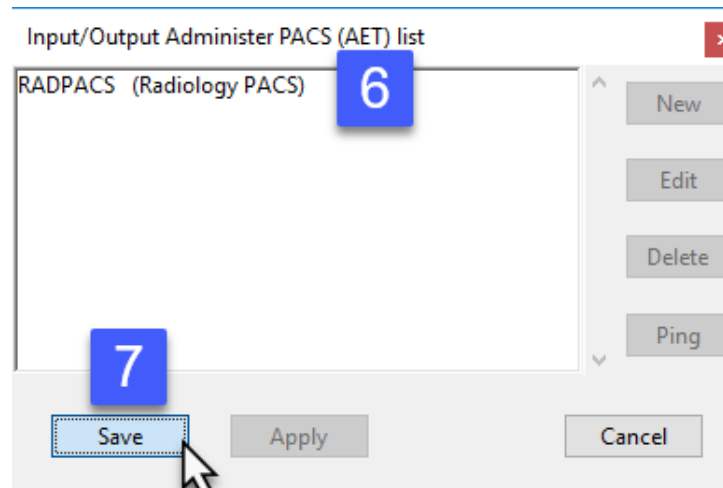
Note: There may be additional configuration required on the PACS side by your PACS admin. Also, your systems Firewall may need to be configured to allow Inbound and Outbound communication for the Remote AET port and local Query/Return AET port prior to successful Q/R of DICOM image data from PACS.
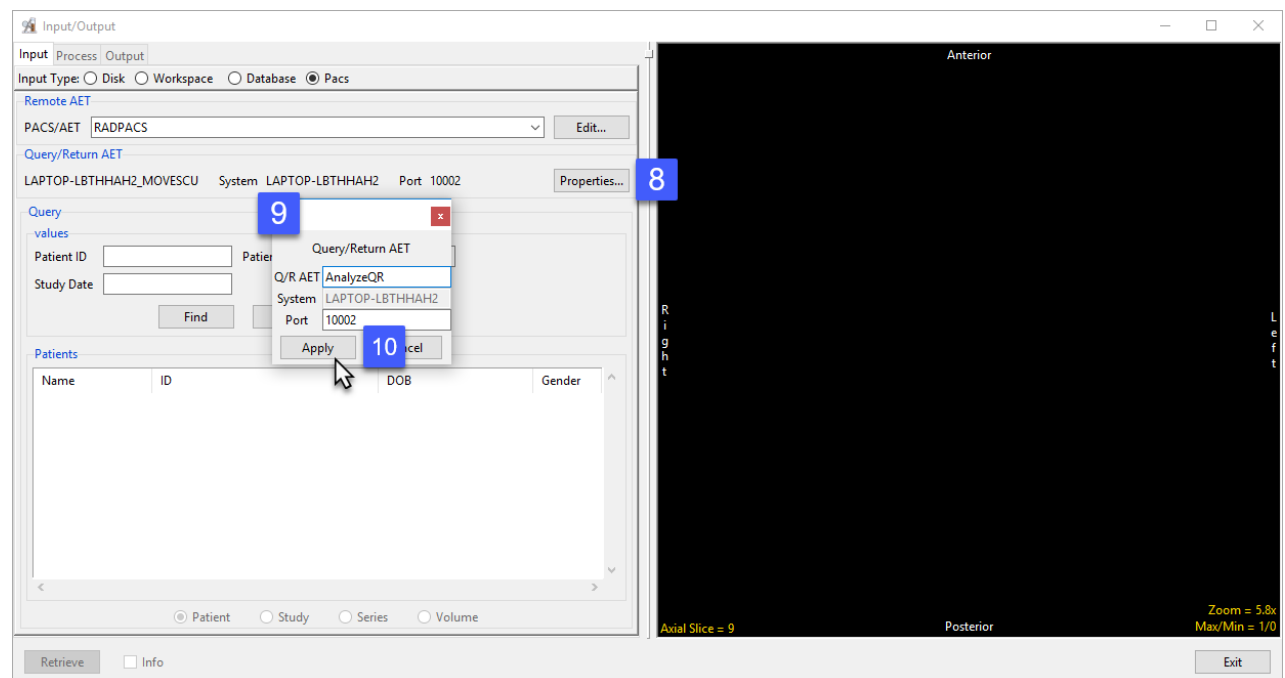
Note: There may be additional configuration required on the PACS side by your PACS admin. Also, your systems firewall may need to be configured to allow Inbound and Outbound communication for the Remote AET port and local Query/Return AET port prior to successful Q/R of DICOM image data from PACS.

Querying and Retrieving DICOM data from PACS

To Query PACS, choose which PACS to query using the drop-down menu under Remote AET [1]. Under Query enter the Patient ID, Patient Name or Study Date [2] and click Find [3]. The relevant patient data will displayed under Patients. [4].

Select the patient and click Retrieve/Load Volume(s) [5] to load the selected data into the current workspace.
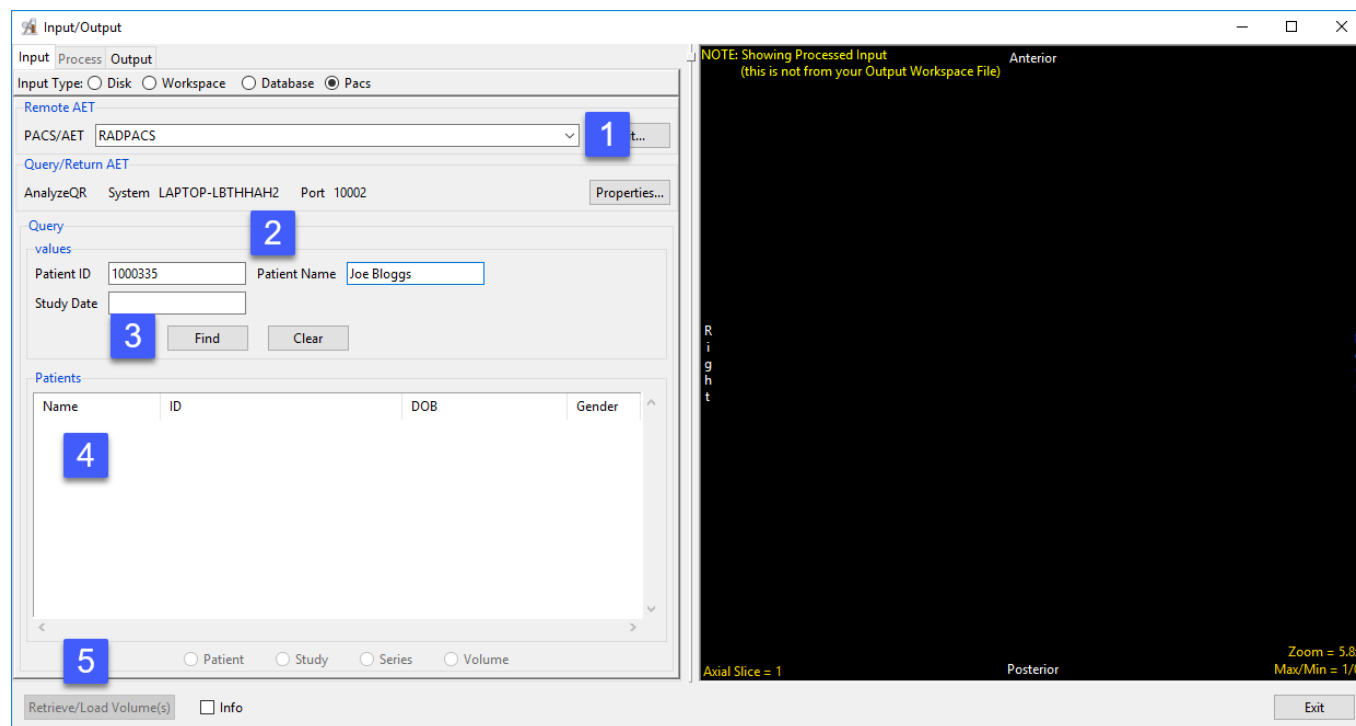
Process: Transforming Data

Spatial- and intensity-based transformations can be applied to the data while loading to or saving from Analyze 14.0. These transformation options are available from Input/Output > Process, once a data set is selected.

Organize

MultiVolume Override

Sometimes image data may not be organized as expected. For example, two 3D data sets may be concatenated into a single 3D data set, requiring the data to be split into two volumes. Furthermore, the data may be interleaved. The MultiVolume Override options provide a utility to efficiently reorganize such problematic data while loading.

Organize (continued)

- Open the Input/Output module.
- Navigate to the data and select the data set you want to load and transform.
- Note that the data will be displayed [1].
- Select the Process tab [2].
- Under Organize, check the MultiVolume Override option. [3] All possible data reorganization options will be available from the drop-down menu.

We know that in this example the 54-slice data set is comprised of a T1 and a T2 data set, each containing 27 slices. Select the appropriate option from the drop-down menu: 2 Volumes of 27 Slices [4].

Download the Neuro_Interleaved_T1_2_MRI data set to follow along
http://analyzedirect.com/data/
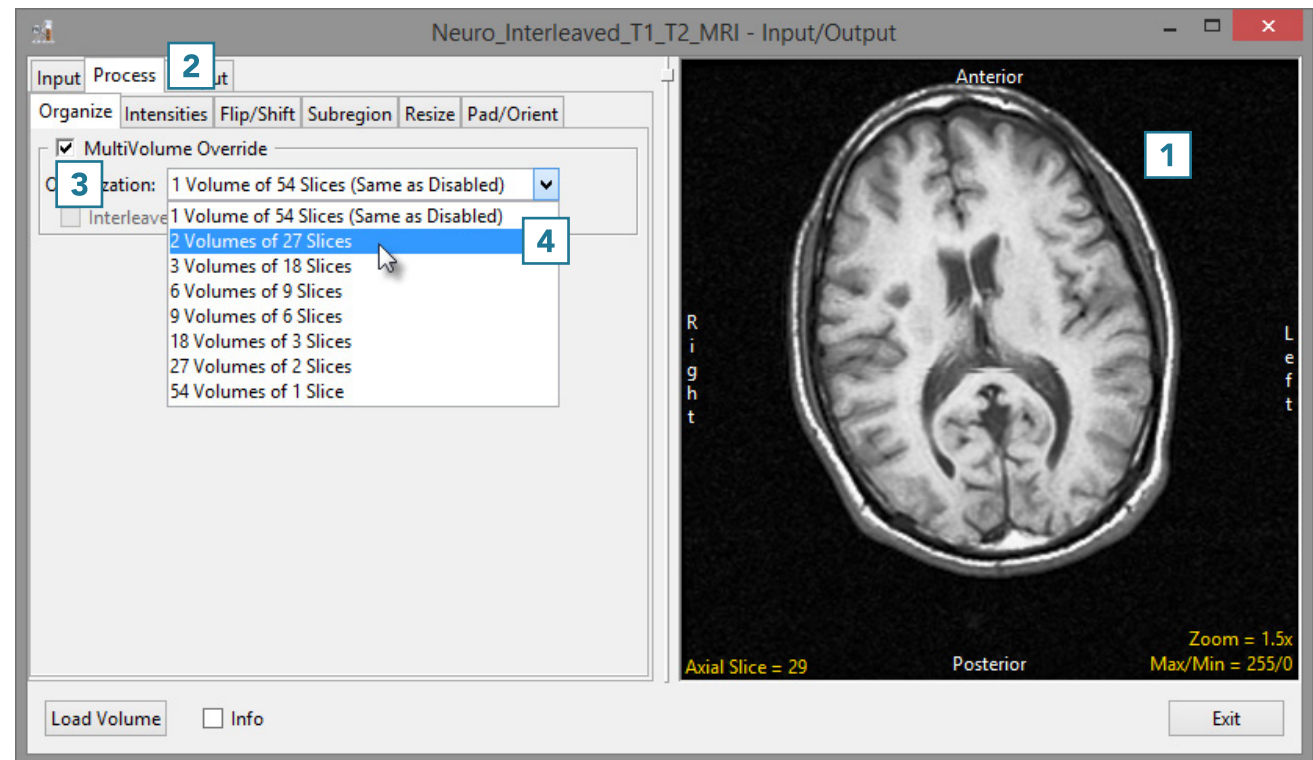
Organize (continued)

- The data has now been changed from a single 3D data set containing 54 slices to a 4D multivolume made up of two 3D data sets, each containing 27 slices. Hold the cursor over the image and use the middle mouse wheel to scroll through the data. Note that in this example, the T1 and T2 image data is interleaved so the current volume will alternate between T1 and T2 slices.

- To correct for the interleaved image data, check the Interleaved option [5].

- Scroll through the image data for volume 1. This will now display only the T1 image data.

- Use the Volume option [6] to change to volume 2 and scroll through the data. Only T2 image data will be displayed.

- Click Load Volume [7] to load the corrected image data.
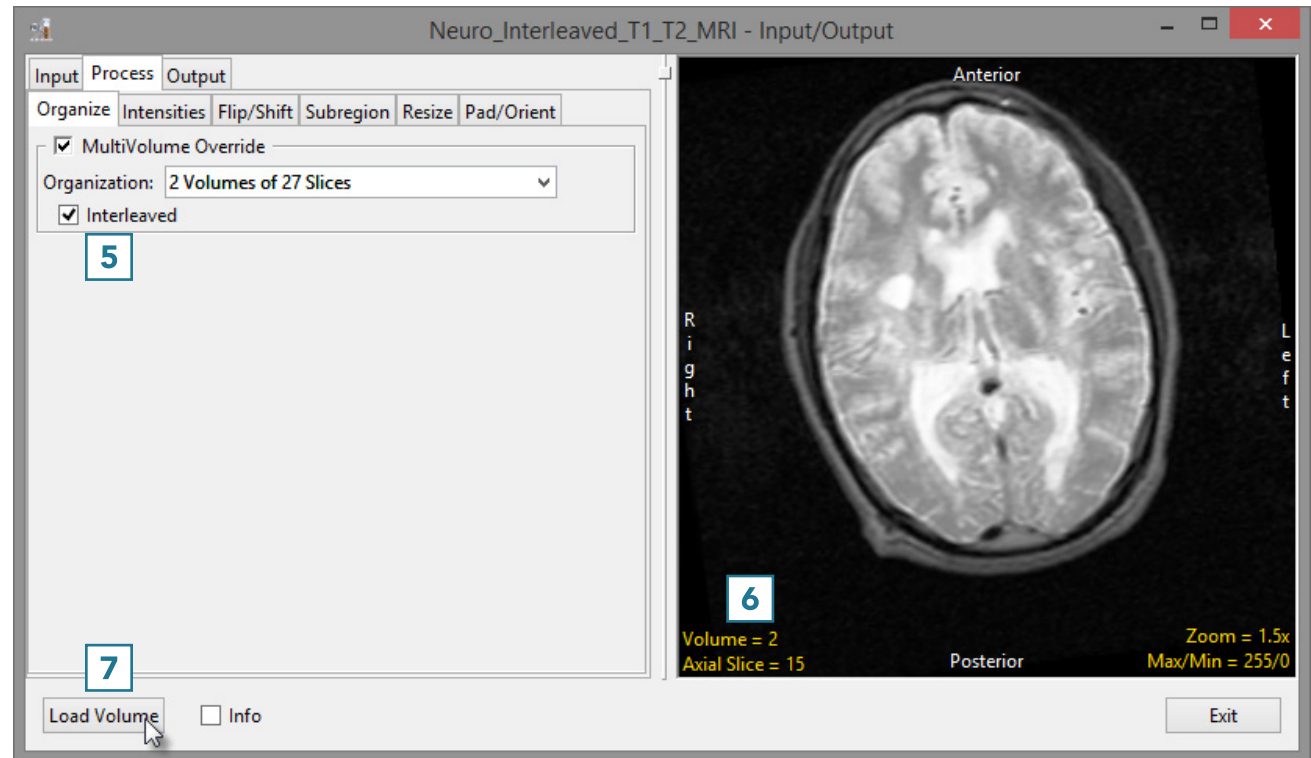
Intensities

The Intensities option allows for intensity scaling or threshold-based manipulations to be applied to the data.

Intensity Scaling

Intensity scaling allows for the adjustment of the voxel value information in the data. Image data can be scaled by adjusting the output Data Type. Values can also be linearly scaled using the Input Maximum and Minimum scale options.

Modifying Image Data Type

Changing the image data type can reduce the size of the data on disk. In this example, a microCT data set has a data type of Float. The size of the image data when loaded into AnalyzePro is 92.71 MB. Changing the data type to Signed 16-bit reduces the size of the data set by about 50% to 46.35 MB when loaded.

Intensities (continued)

- Open Input/Output.
- Navigate to and select the data set you wish to load and transform.
- Select Process [1] and Intensities [2].
- Make a note of the Input Maximum and Minimum values [3].
- Select Load Volume. [4]. This will load the volume to the workspace as a Float data set.

Download the Bone_Sample_mCT data set to follow along
http://analyzedirect.com/data/
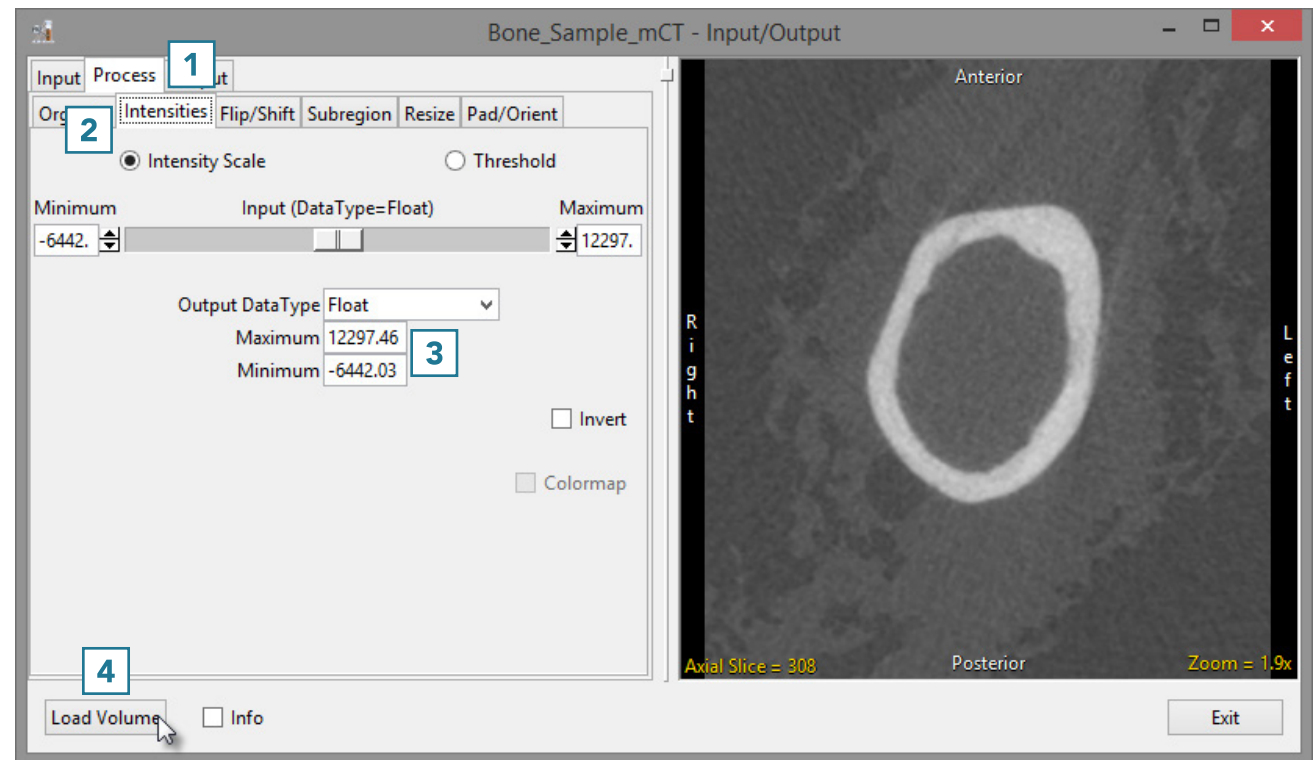
Intensities (continued)

- Set the Output DataType to Signed 16-bit [5].
- Enter the Output Maximum and Minimum values [6] by copying the input maximum and minimum values and rounding to the nearest whole number.
- Select Load Volume [7] and select Create New when prompted.
- Exit Input/Output [8].
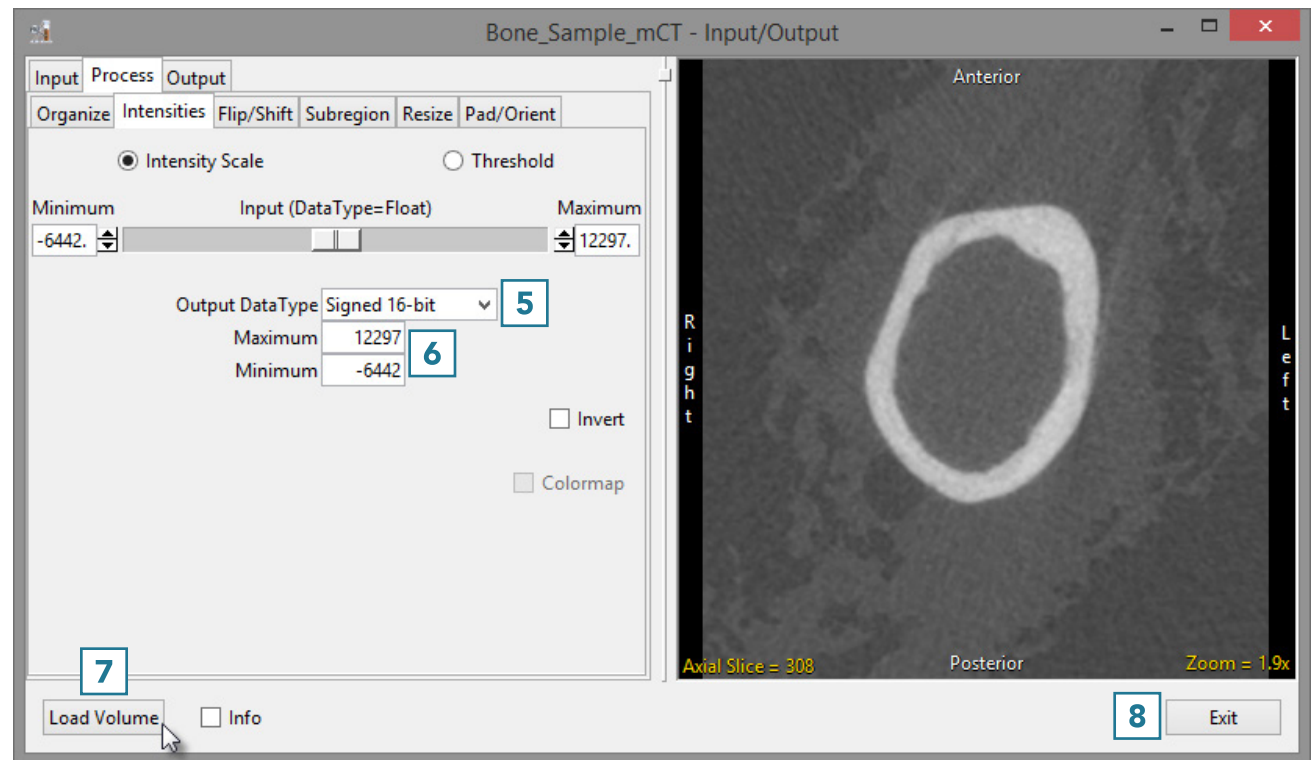
Intensities (continued)

- Right-click on the first data set and select Info [9]. Repeat for the second data set.
- In the info panel beneath the data, note the size of the original and scaled data set.


```
Bone_Sample_mCT    Bone_Sample_mCT0

FileName=C:\temp\APRO\Michael\Bone_Sample_mCT.mmap
DataType=AVW_FLOAT (32-bit float)

Width=190
Height=208
Depth=615

NumVols=1

Size=92.71 Mb

Info:
        0002|0002="1.2.840.10008.5.1.4.1.1.2"
        0002|0003="2.16.756.5.23.5050.67.3003.3.2014
        0002|0010="1.2.840.10008.1.2.1"
        0002|0012="2.16.756.5.23.1.2"
        0002|0013="SCANCO_V1.2a"
        0008|0008="ORIGINAL\PRIMARY\AXIAL"
        0008|0016="1.2.840.10008.5.1.4.1.1.2"
        0008|0018="2.16.756.5.23.5050.67.3003.3.2014
        0008|0020="20140107"
        0008|0021="20140107"
        0008|0023="20140107"
```

```
Bone_Sample_mCT    Bone_Sample_mCT0

FileName=C:\temp\APRO\Michael\Bone_Sample_mCT0.mmap
DataType=AVW_SIGNED_SHORT (16-bit signed)

Width=190
Height=208
Depth=615

NumVols=1

Size=46.35 Mb

Info:
        0002|0002="1.2.840.10008.5.1.4.1.1.2"
        0002|0003="2.16.756.5.23.5050.67.3003.3.2014
        0002|0010="1.2.840.10008.1.2.1"
        0002|0012="2.16.756.5.23.1.2"
        0002|0013="SCANCO_V1.2a"
        0008|0008="ORIGINAL\PRIMARY\AXIAL"
        0008|0016="1.2.840.10008.5.1.4.1.1.2"
        0008|0018="2.16.756.5.23.5050.67.3003.3.2014
        0008|0020="20140107"
        0008|0021="20140107"
        0008|0023="20140107"
```

Intensities (continued)

Threshold Scaling

Threshold scaling allows a range of voxels from the input volume to be loaded as a binary data set. All voxels greater than or equal to the Input Minimum and less than or equal to the Input Maximum are set to 1. All other voxels are set to 0.

- Open Input/Output.
- Navigate to and select the data set to which you want to apply a threshold scaling.
- Select Process [1] and Intensities. [2].
- Check the Threshold option [3].
- Use the Input sliders to set the threshold minimum and maximum [4].
- Note the image display will update, showing a binary image for the selected voxels [5].
- Click Load Volume [6] to load the binary volume.

Download the EGV_Post_Op_CT data set to follow along http://analyzedirect.com/data/
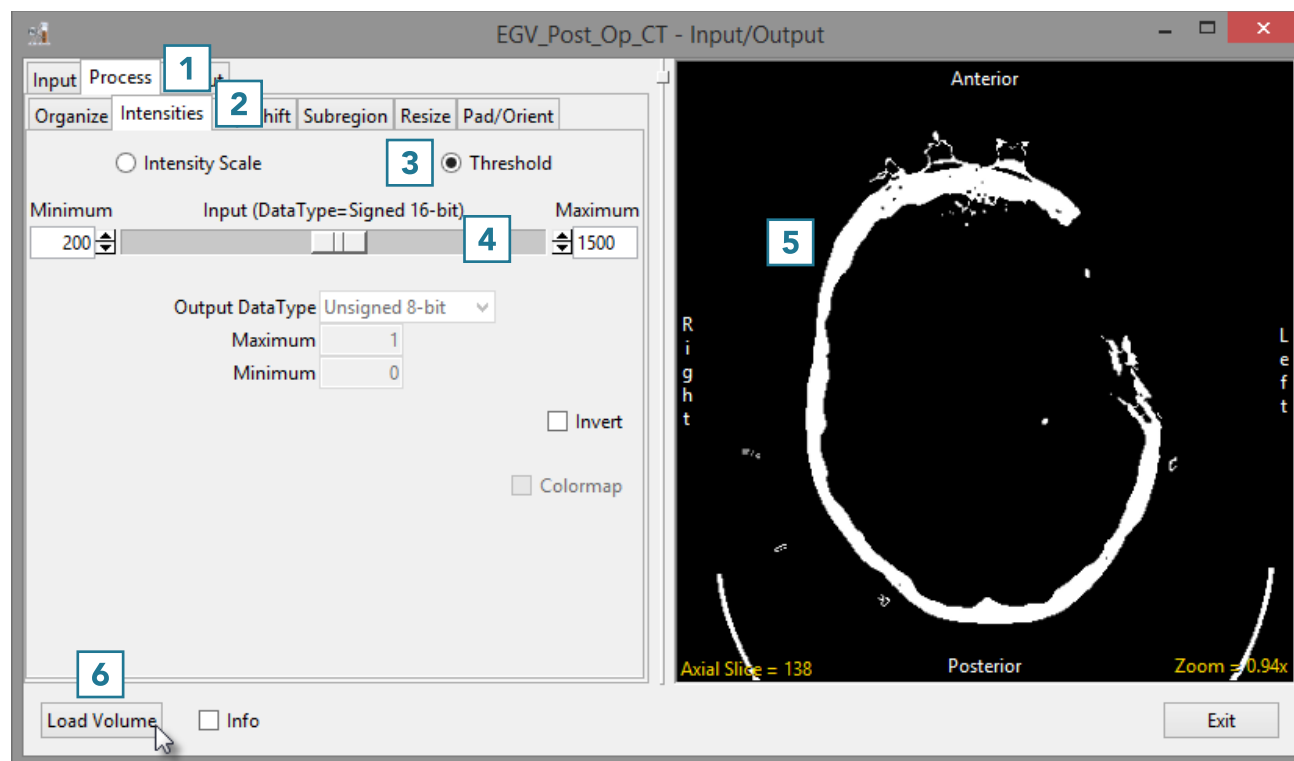
Intensities (continued)

Inverting Data

For certain applications, such as the segmentation of the thalamus, it is beneficial to view an inverted copy of the image data alongside the original grayscale data to improve visualization of the thalamus. Reviewing the original and inverted image data aids with manual delineation of the structure.

- Open Input/Output.
- Navigate to and select the data set you want to invert.
- Select Process [1] and Intensity [2].
- Select Load Volume [3] to load the data into Analyze.
- Next, check the Invert option [4]. Note that the display of the data will update [5].
- Click Load Volume [3] and select Create New.

A grayscale and inverted version of the data are now available for use within the program. These two data sets can be simultaneously loaded into Segment.

Download the EGV_Pre_Op_MRI data set to follow along
http://analyzedirect.com/data/
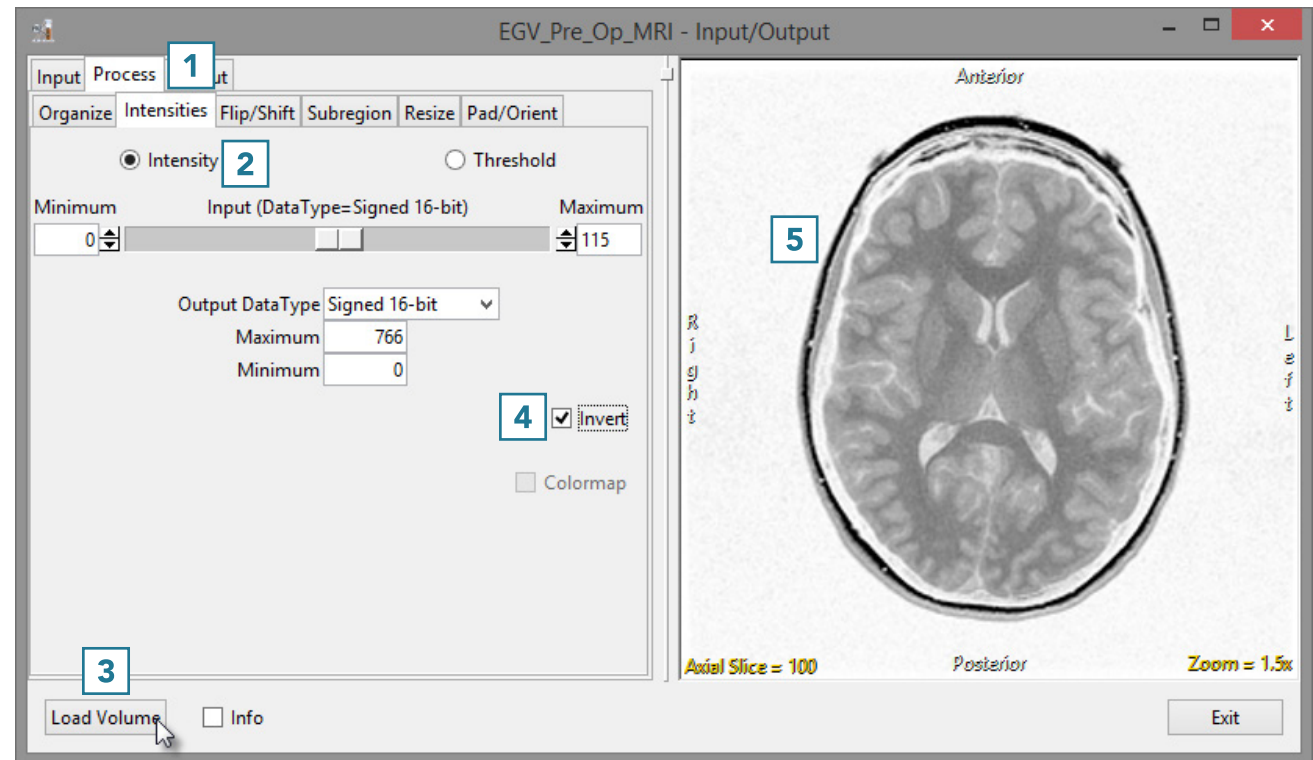
Intensities (continued)

Colormaps

When loading a data set that has an associated colormap [1], the Colormap checkbox will be selected [2].

Download the Neuro_PET data set to follow along
http://analyzedirect.com/data/
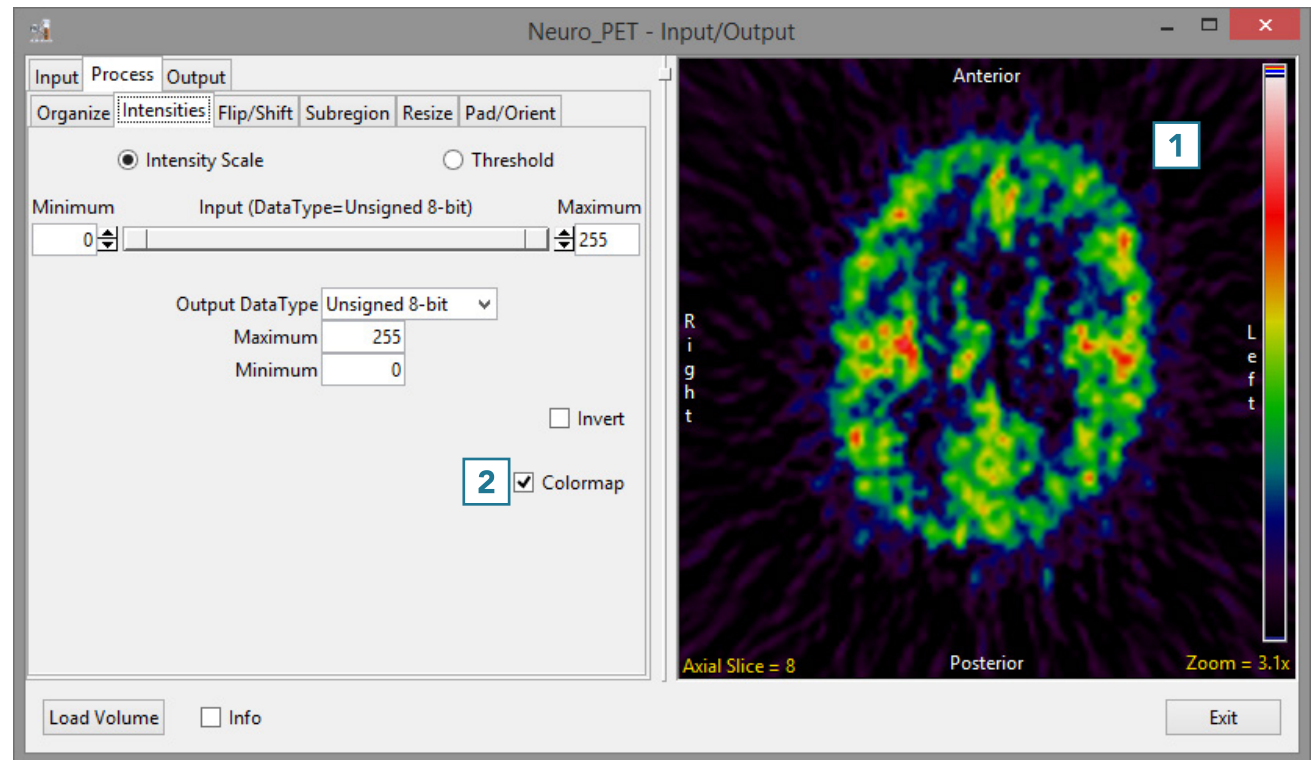
Intensities (continued)

- To load the grayscale data without the associated .lkup colormap file, uncheck the Colormap checkbox [3]

Note that the image display will update to show the grayscale data [4].

- To load the data, click Load Volume [5].
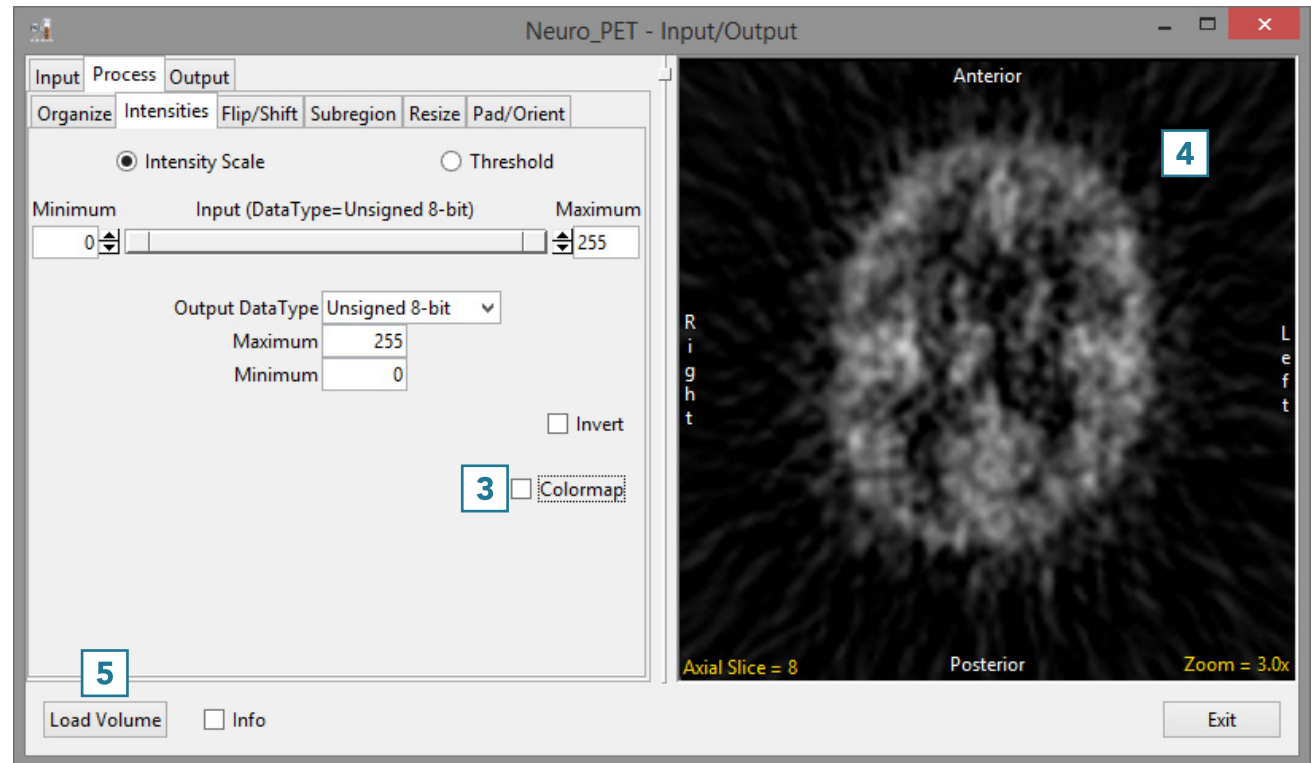
Intensities (continued)

Standard Uptake Value Conversion

The Standard Uptake Value (SUV) in PET data is defined as the ratio of activity in tissue per millimeter to the activity in the injected dose per patient body weight. When PET data is loaded into Analyze via the Input/Output Database a new Intensity option 'SUV Conversion' appears, [1] the scale factors present in the DICOM header information with the PET data are used to automatically scale the data into units of activity per millimeter. [2] Any sampling of the PET data conducted in Analyze, such as ROI analysis, will provide values in this calibrated range.
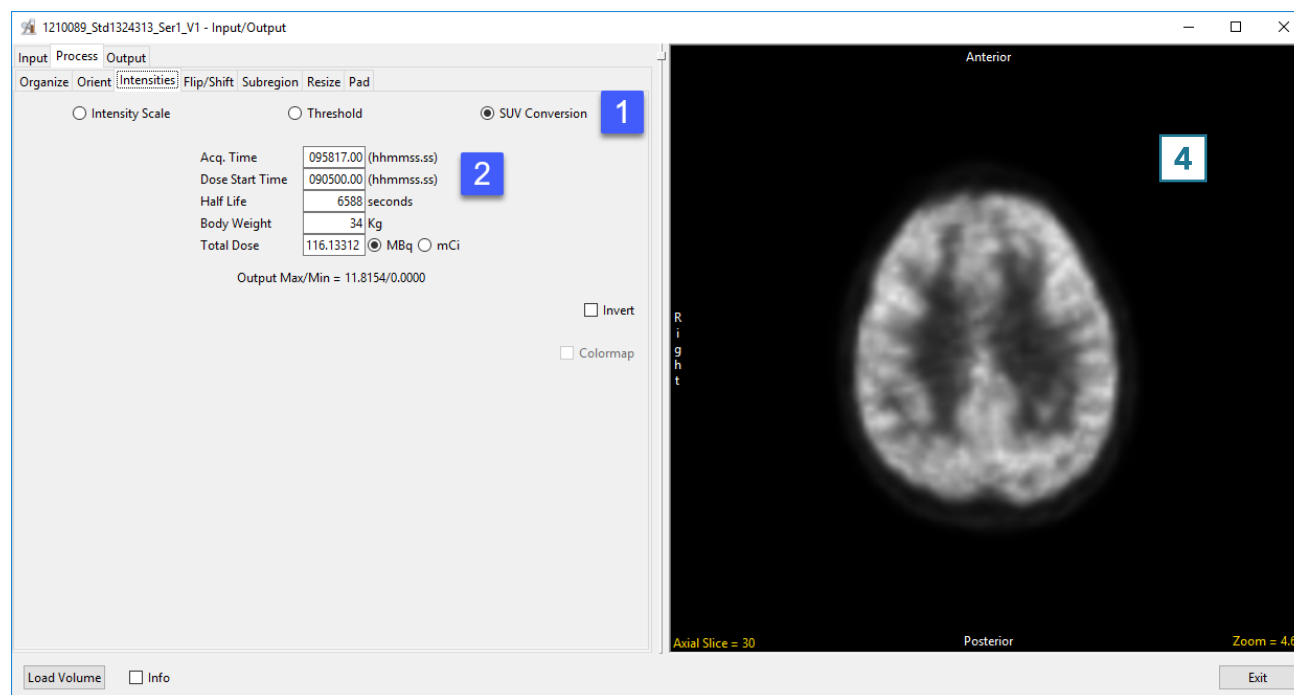
Flip/Shift

Data Flipping

It may be necessary to flip data in order to orient it correctly. The Flip/ Shift > Flip options allow users to flip data along any single axis or combination of axes.

Once a flip checkbox is selected, the flip will be applied to the data and the display panel can be used to review. Unchecking the option will undo the flip. Flipping the data in only the X or Y direction will create a mirror image. If this is not the desired result, the data can be flipped in both the X and Y directions at once to prevent a mirror image from being created. To apply a flip:

- Open Input/Output.
- Navigate to and select the data set to be flipped and loaded.
- Select Process [1] and Flip/Shift [2].

Download the EGV_Pre_Op_MRI data set to follow along http://analyzedirect.com/data/

Axis	OUTCOME
X	Flips data horizontally, rotating about the vertical (Y) axis.
Y	Flips data vertically, rotating about the horizontal (X) axis.
Z	Changes the order of the slice data.
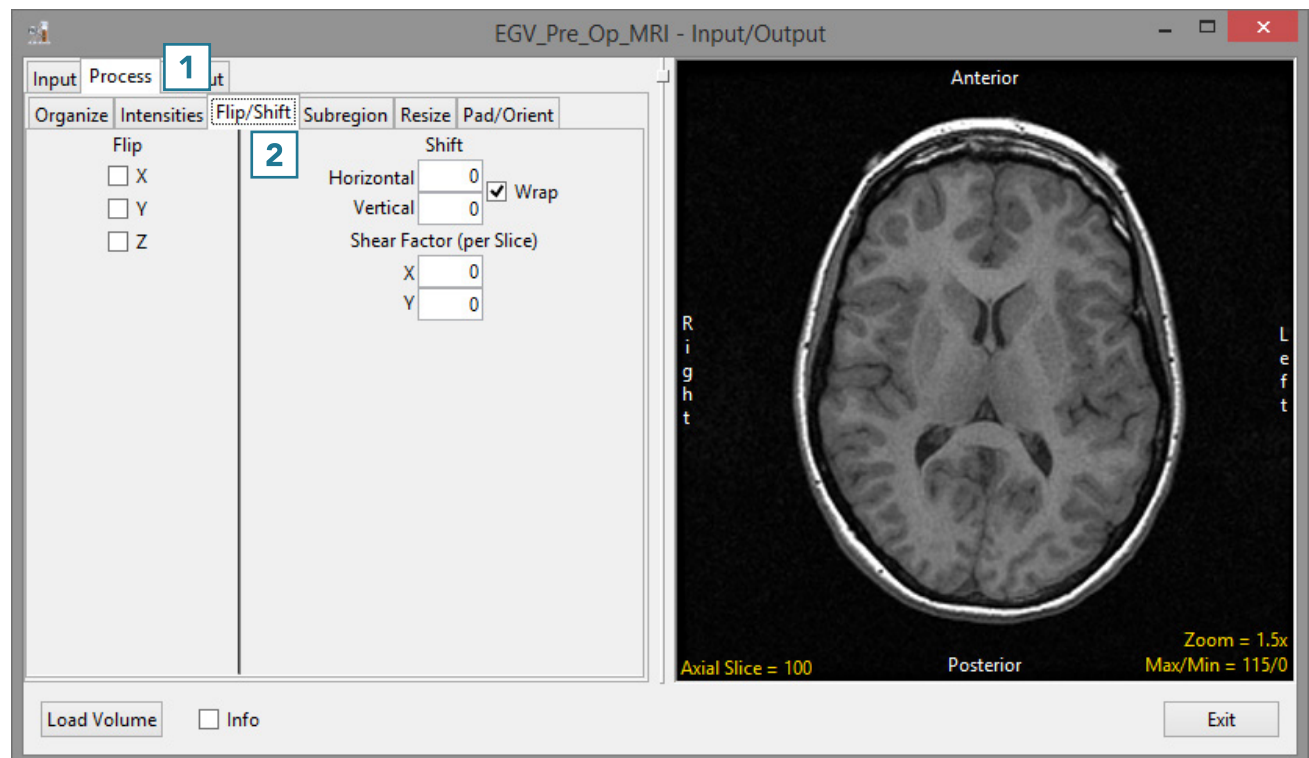
Flip/Shift (continued)

• Check the X Flip option [3].

Note the update to the data [4].
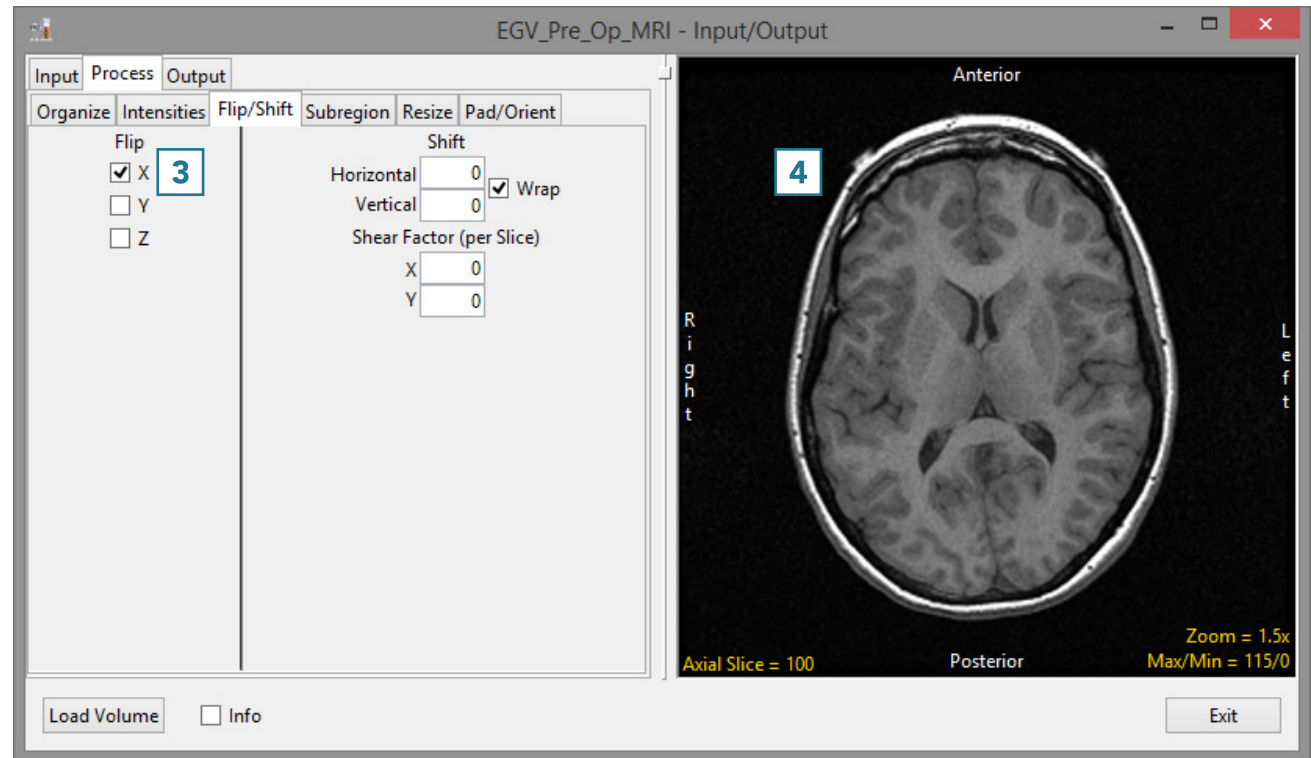
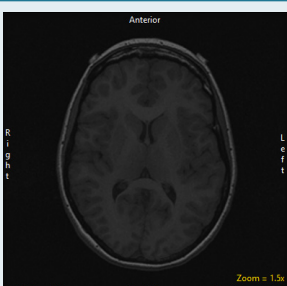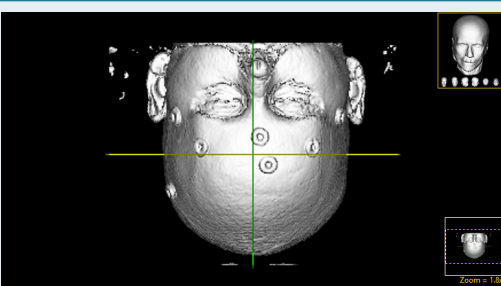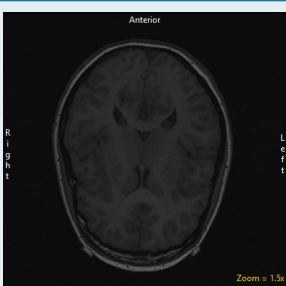# Flip/Shift (continued)
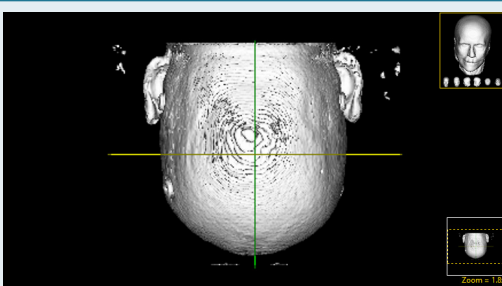
• Check the Y Flip option [5].
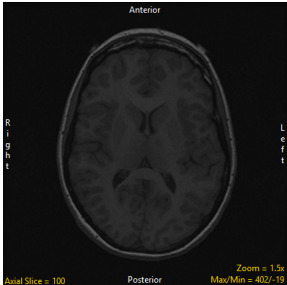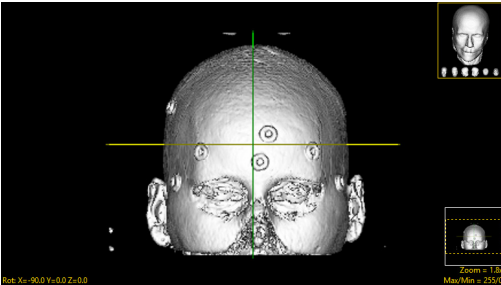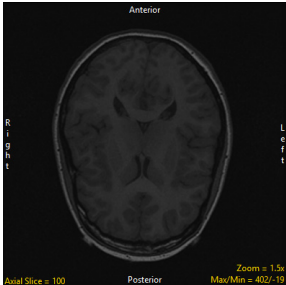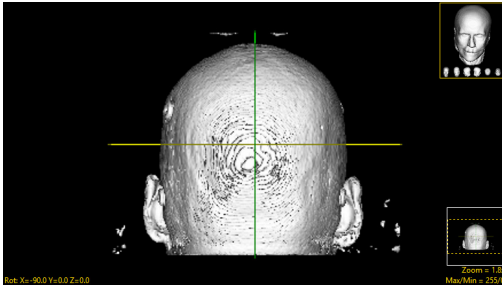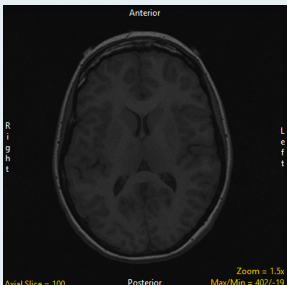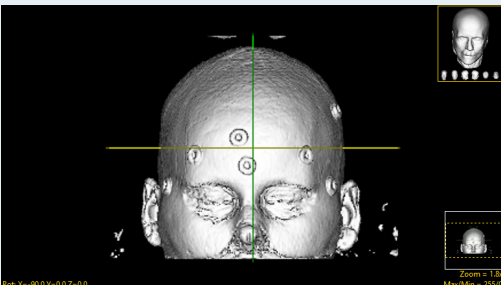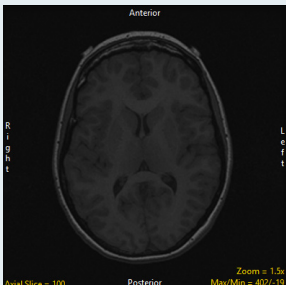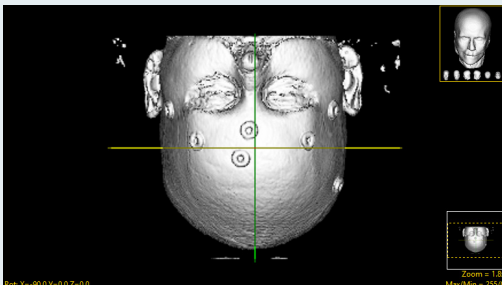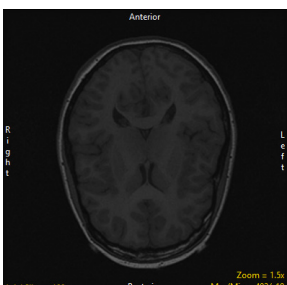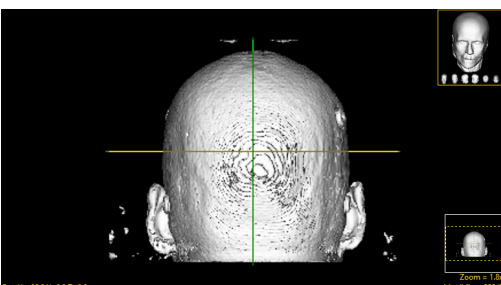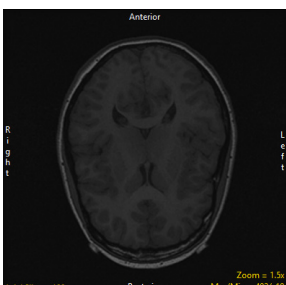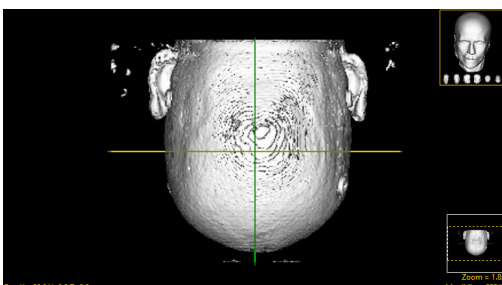
Note the update to the data [6].

• To load the data, click the Load Volume button [7].
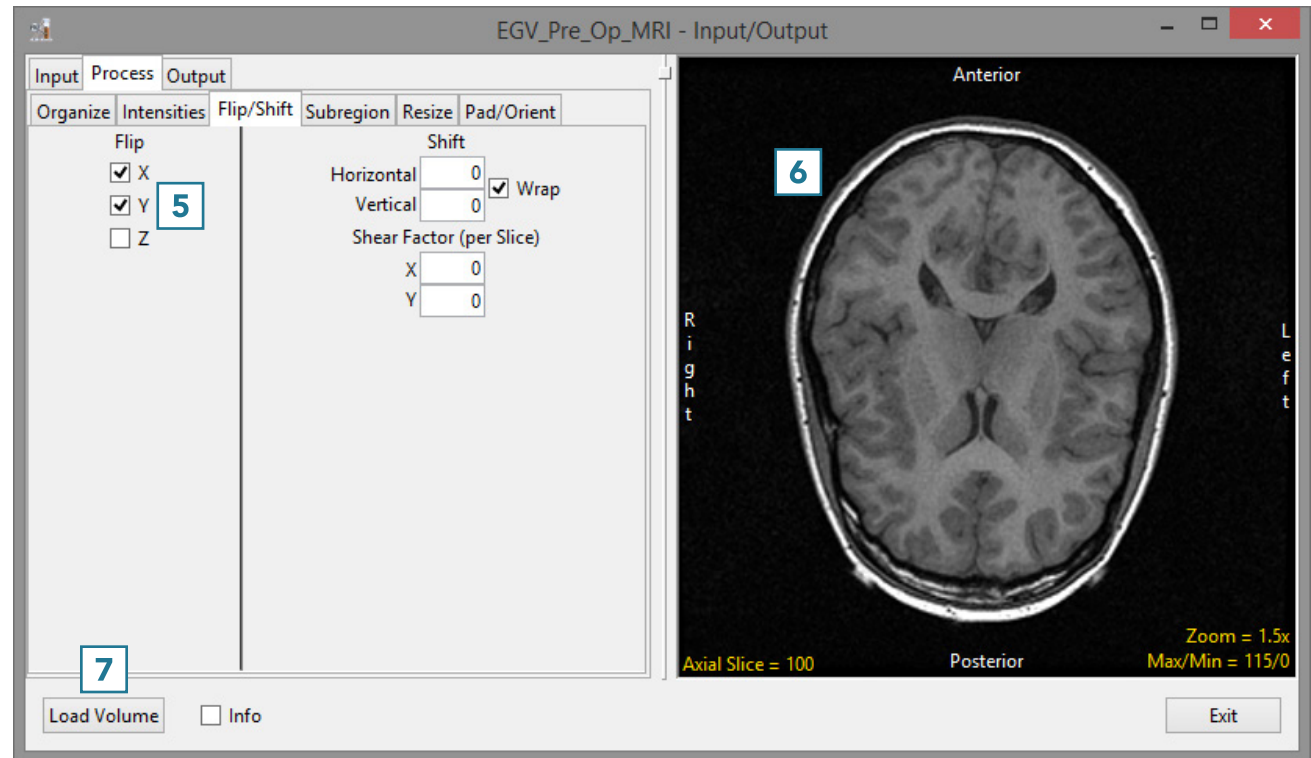
Results of Flipping Data Along Any Combination of Axes

Flip	2D	3D	Flip	2D	3D
No flip			XY		
X			XZ		
Y			YZ		
Z			XYZ		

Flip/Shift (continued)

Shifting Data

The shift option allows data to be shifted horizontally or vertically. Data shift may be necessary to correct for slice wraparound. In this example, the front slices of a sagittally-acquired MRI data set have wrapped around to the posterior side of the data set [1]. and there are slices from the inferior side of the volume that have wrapped around to the superior side of the volume [2].

Download the Neuro_MRI_Sagittal data set to follow along
http://analyzedirect.com/data/

Flip/Shift (continued)

- To correct for the horizontal shift in slices, enter -25 in the Horizontal Shift field [3].

Note that the data will be shifted back 25 slices. The last 25 slices will automatically wrap around from the posterior side of the data set to the anterior side of the data set [4].

- To correct for the vertical shift in slices, enter 6 in the Vertical Shift field [5].

Note that the data will be shifted up 6 slices. The top 6 superior slices will automatically wrap around to the inferior side of the data set, since the Wrap checkbox is checked [6].
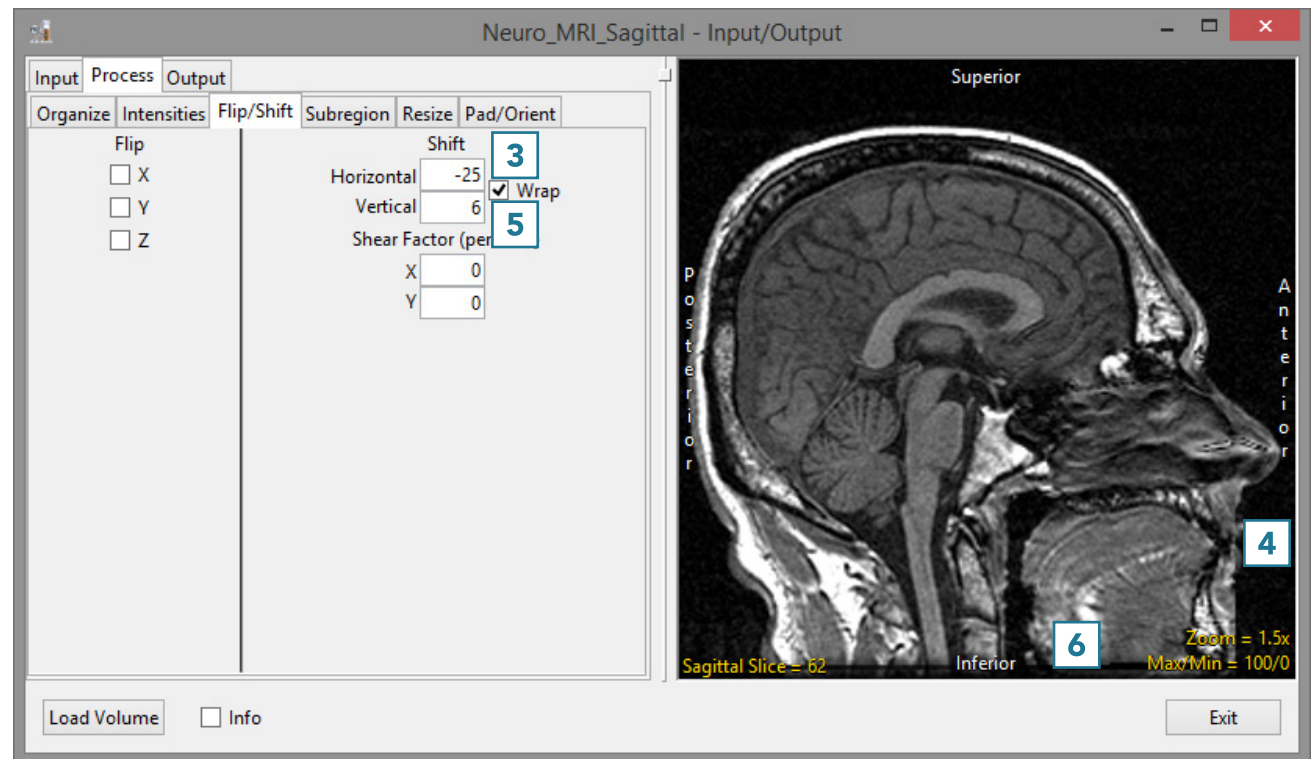
Shift Options Quick Reference

| Shift	Axial	Coronal	Sagittal
Horizontal +	To left	To left	To anterior
Horizontal -	To right	To right	To posterior
Vertical +	To anterior	To superior	To superior
Vertical -	To posterior	To inferior	To inferior

Flip/Shift (continued)

- To shift data interactively, click on the image data. Note that the cursor will update; drag the data to a new location [7].
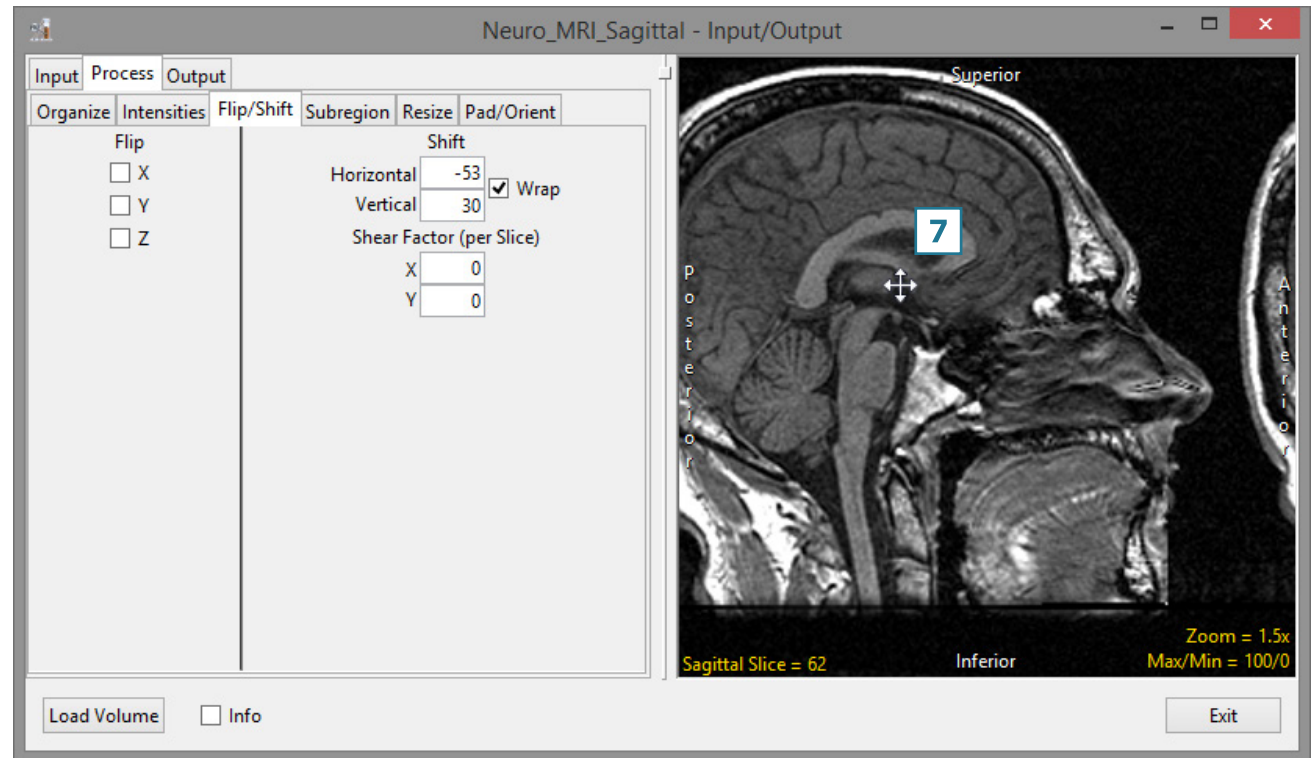
Flip/Shift (continued)

• Unchecking the Wrap checkbox
[8] will prevent slices from being
wrapped. [9].
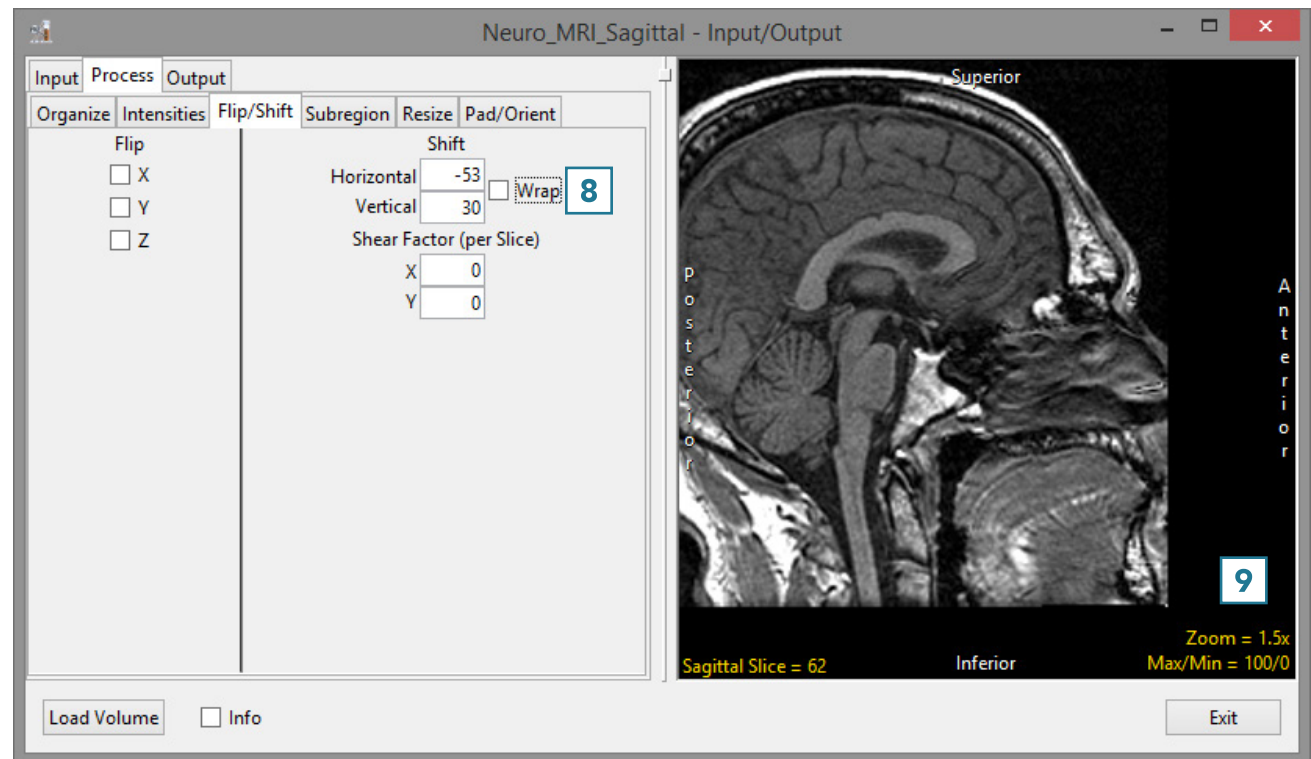
Flip/Shift (continued)

Shear Factor Correction

Sometimes CT images are acquired with the gantry tilted obliquely (non-orthogonally) relative to the direction of the table movement. If the volume is constructed by stacking the image slices, the volume will appear sheared or skewed. Analyze will automatically detect and apply the gantry tilt shear correction and the appropriate shear factor values will be populated in Shear Factor (per slice) fields. If desired, the Shear Factor (per slice) values can be manually entered.

Subregion

Cropping Data

The Subregion tool in Input/Output > Process can be used to reduce the size of a data set without the need to interpolate the original voxel data. The tool can also be used to crop data to a specific region of interest.

Subregion (continued)

- Open Input/Output.
- Navigate to and select the data set you want to crop.
- Select Process [1] and Subregion [2].
- To crop the data, click on the green box [3] in the display panel and adjust to the desired position.
- To define the crop in the Z range, click on the Slice option [4]. With the left mouse button held down, move the mouse up or down to navigate through the slice data. You can also use the scroll wheel to move through the slice data. When you reach the lower limit for the crop, enter the slice number in the Z Low box [5]. Enter the upper limit slice number in the Z High box.
- Click Load Volume to load the cropped data [6].

Download the Neuro_ACPC_Aligned_MRI data set to follow along
http://analyzedirect.com/data/
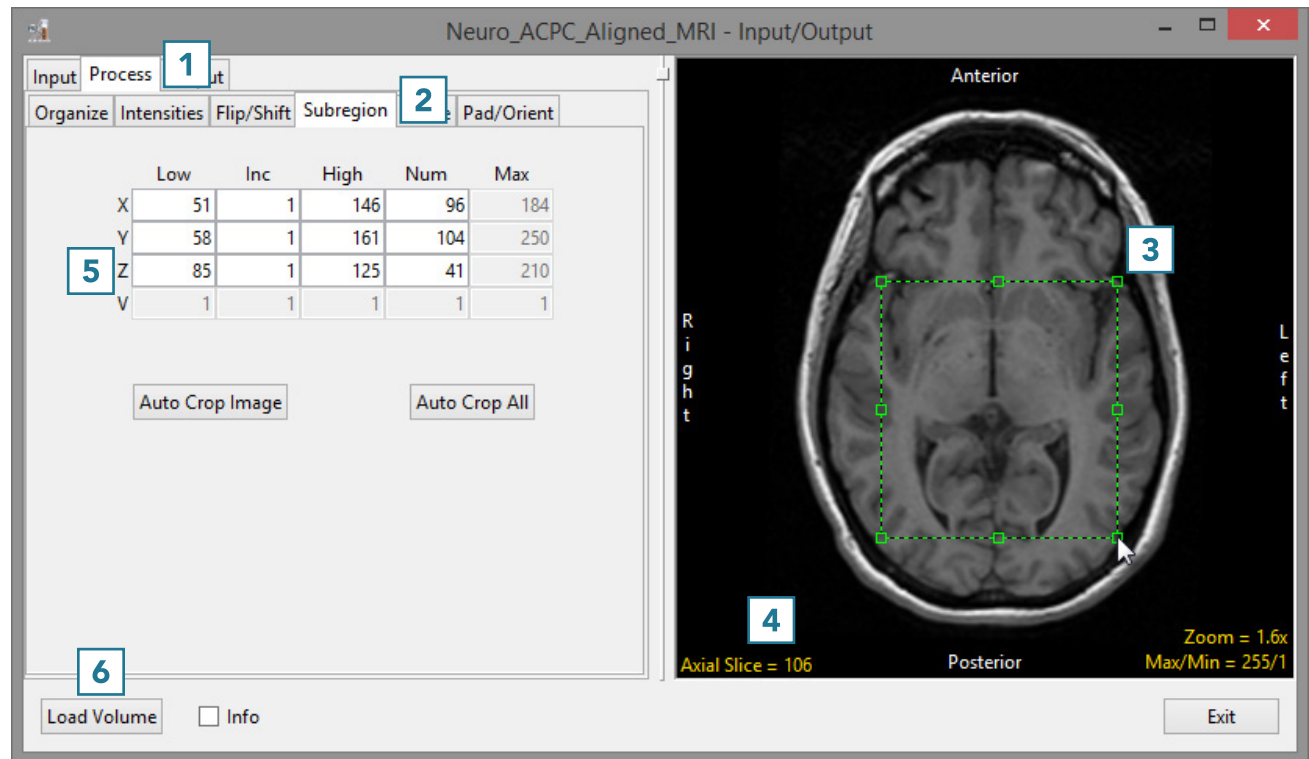
Cropping 4D Data

4D image data can also be cropped to remove time points from the data prior to loading. When a 4D data set is selected, a fourth dimension V (volume) will be enabled [7]. To crop a 4D data set:

- Select the Volume option [7] and use the cursor to navigate through the volumes in the data, just like you would use the Slice option to navigate through the slices in a single volume.
- Determine the volumes you want to remove from the multivolume and enter the corresponding lower and upper volume limits in the V Low and/or V High boxes [8].

Download the 4D_Cardiac_CT data set to follow along
http://analyzedirect.com/data/
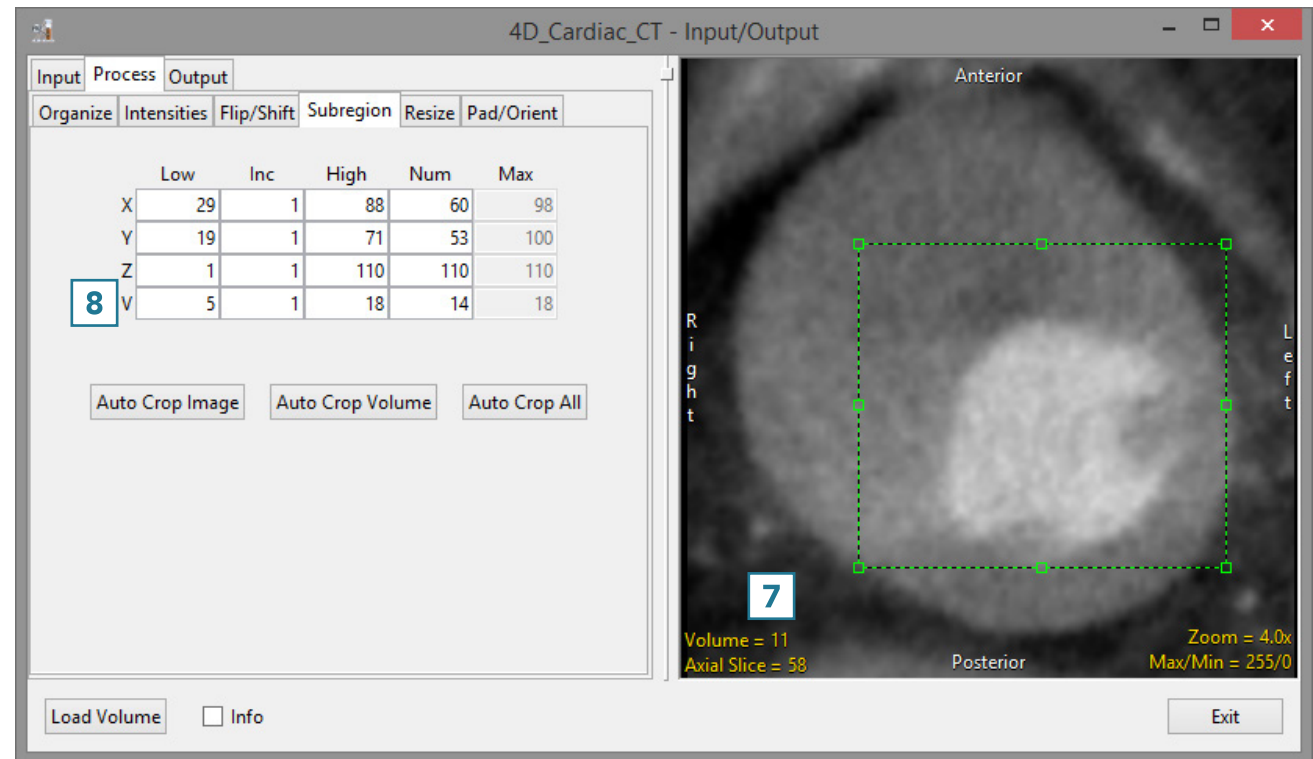
Resize

Resize can be used to resample image data. If data is acquired with anisotropic (non-cubic) voxels, resize can be used to resample the data to create an isotropic (cubic) data set.

Resampling Anisotropic Data

- Open Input/Output.
- Navigate to and select the data set to be resampled.
- Select Process [1] and Resize [2].
- Click Load Volume [3] to load the data set without resampling.

**Download the Neuro_MRI_Sagittal data set to follow along http://analyzedirect.com/data/**
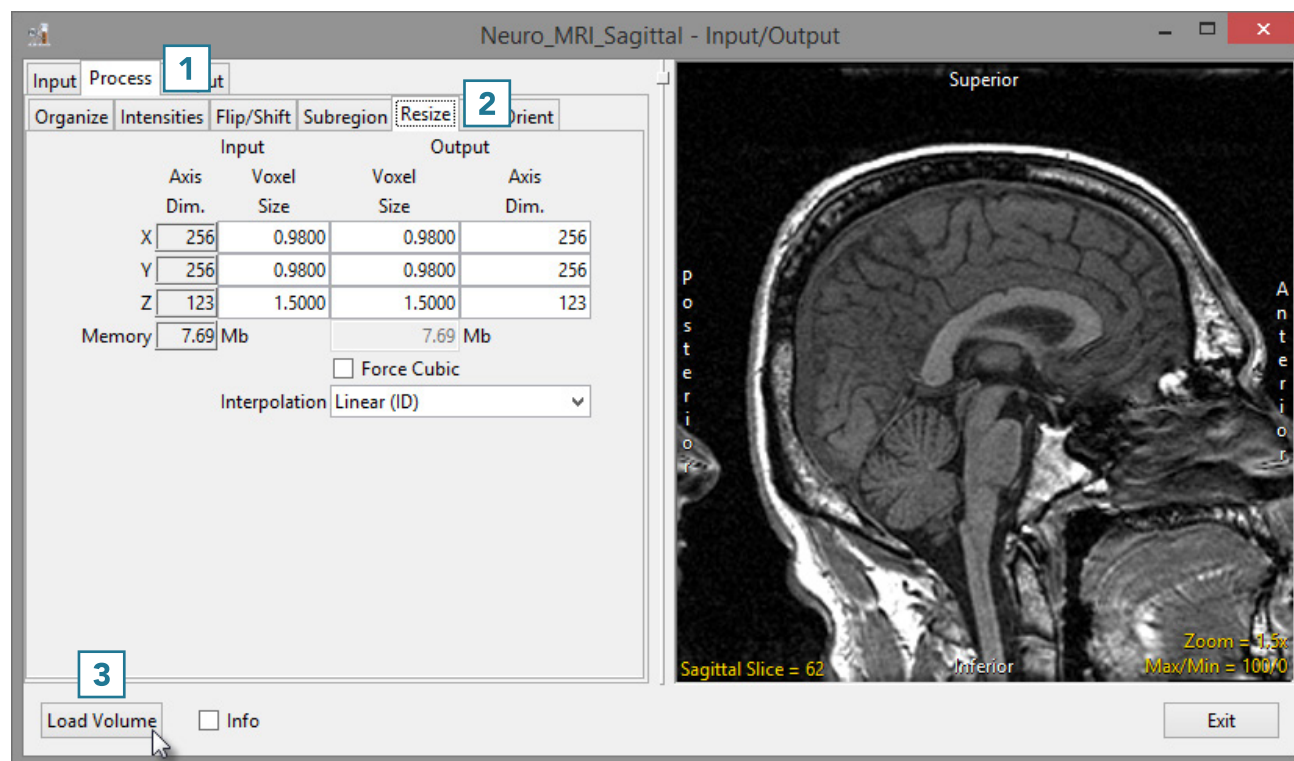
Resize (continued)

• Check the Force Cubic checkbox [4].

Note the input and output voxel size and the input and output axis dimensions [5]. The data has been resampled at the highest spatial resolution (0.98). The Z dimension which originally had a voxel size of 1.5 has now been resliced to 0.98. To accommodate this, the number of slices in the Z dimension has increased from 123 to 188 (123*1.5/0.98 = 188).

• The interpolation option used to create the new slice data can be selected from the interpolation drop-down menu [6].
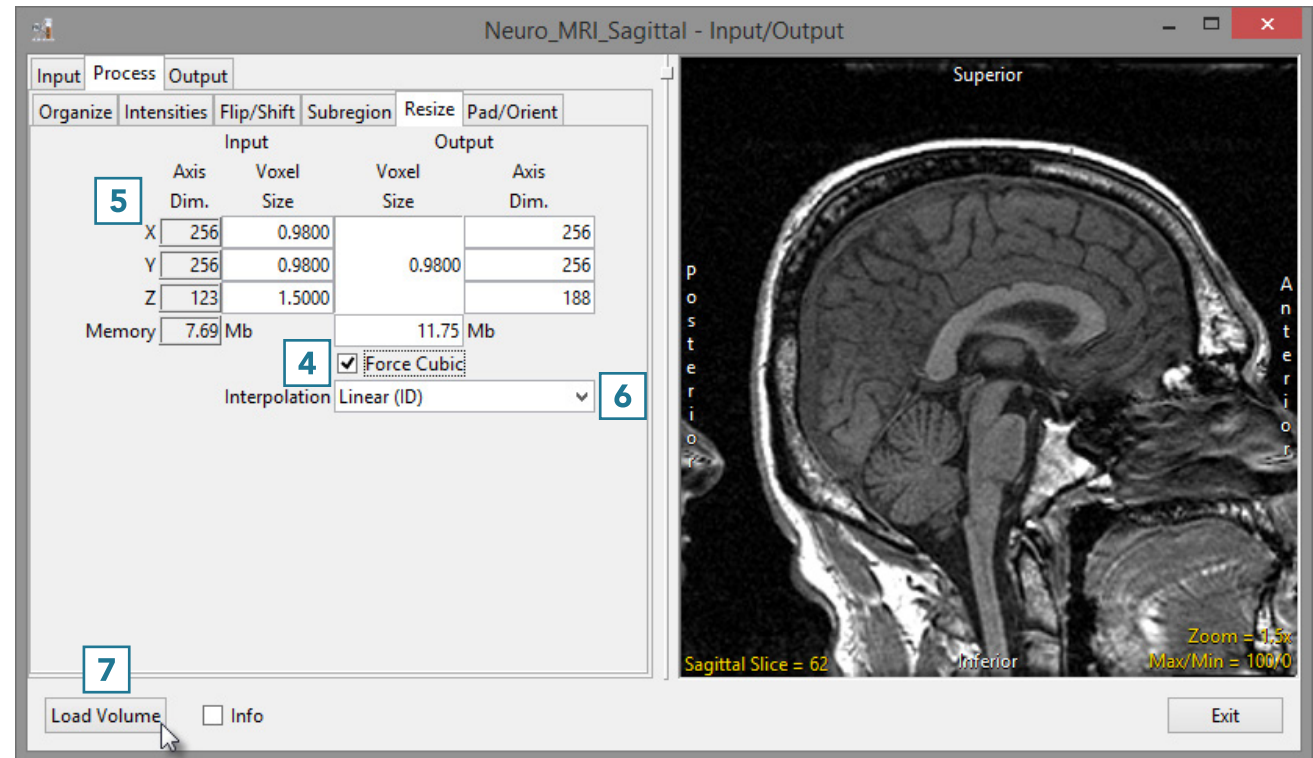
For information about various interpolation types, see Table 3.4 or 6.1.

• Click Load Volume [7] and select Create New. Compare both the original and resampled data sets using Display.

Resize (continued)

Each interpolation type is either input driven (ID) or output driven (OD).

Input driven interpolation algorithms process each voxel in the input volume and map each input voxel into the output space. The actual interpolation takes place in the output space, given the projected contributions of each input voxel into that space. Input driven algorithms will always use every voxel in the input volume as part of the interpolation process.

Output driven algorithms step through each voxel in the output data set and find the corresponding set of voxels in the input data set that map into the output. The interpolation of voxels takes place in the input space, depending on the type of interpolation selected. Output driven algorithms are more common in image processing as they guarantee that every voxel in the output data set will be filled with an interpolated value.

Interpolation Types

Interpolation Type	Description
Nearest Neighbor*	selects the value of the closest voxel to which the interpolation resampling maps
Linear*	applies a linear interpolation of grayscale intensity based on the distance of neighboring voxels from the interpolated voxel
Cubic Spline**	uses a cubic spline function to determine interpolated value
Windowed Sinc**	uses windowed sinc function sin(x)/x to determine interpolated value
Shape Based	only available for binary data; calculates Euclidean distance, then performs linear interpolation between distance images

*The Nearest Neighbor and Linear interpolation types can be specified as ID or OD.

**The Cubic Spline and Windowed Sinc interpolation types are both OD. Since they use higher-order functions, they account for more neighboring voxels and thus may provide a better estimate for the interpolated value. These algorithms are also more compute-intensive.
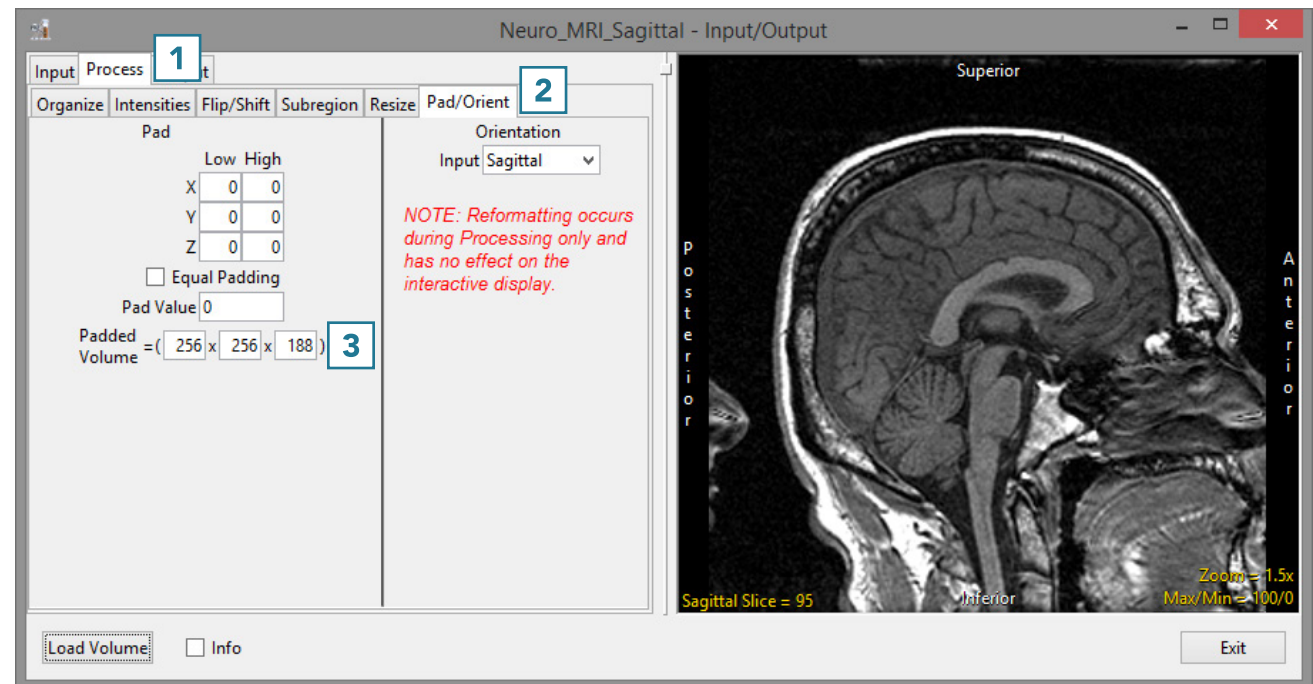
Pad/Orient

Padding Data

The Pad/Orient option can be used to pad image data. This may be necessary to create a data set with certain dimensions or to make a data set isovolumetric (equal number of slices in each orientation).

- Open Input/Output.
- Navigate to and select the data set to be padded.
- Select Process [1] and Pad/Orient [2]
- Note the slice dimensions for the data are reported in the Padded Volume fields [3].

Download the Neuro_MRI_Sagittal data set to follow along http://analyzedirect.com/data/

Pad/Orient (continued)

- To make the data set isovolumetric, update the appropriate Padded Volume field [4]. The Pad tool will try to apply an equal number of slices to pad the data in the pad axis [5].
- Users can also choose to pad all slices to either the Low or High field for the appropriate axis.
- Click Load Volume [6] to load the data.
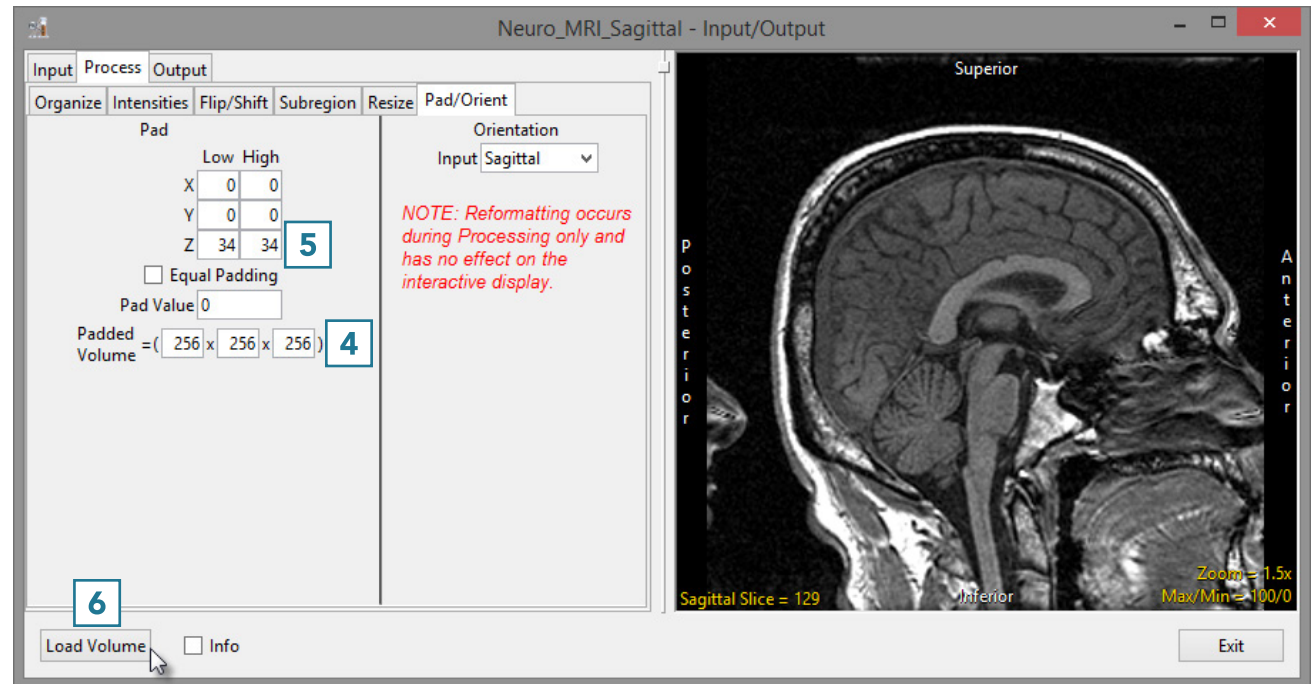
Pad/Orient (continued)

Correcting an Orientation Flag

If a data set is loaded with an incorrect orientation flag, it will not orient correctly in other AnalyzePro modules. The Orientation option can be used to correct this.

- Open Input/Output.
- Navigate to and select the data set to be padded.
- Select Process [1] and Pad/ Orient [2].

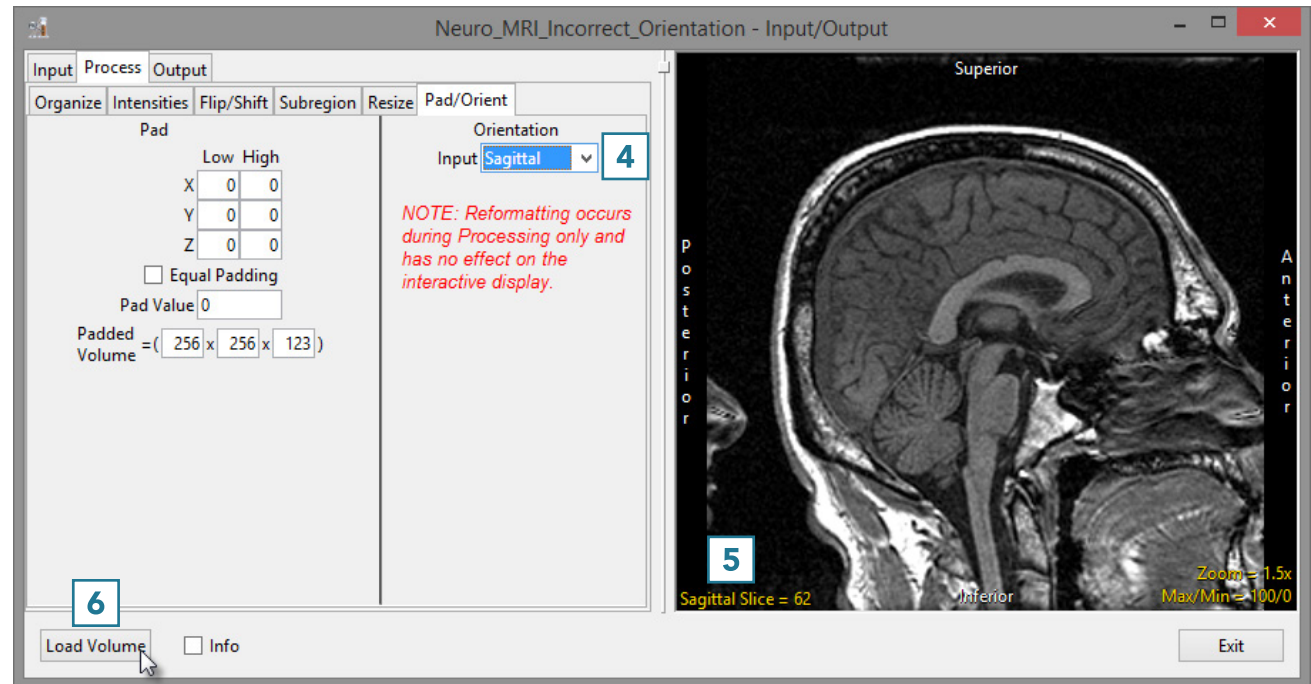Note that the orientation of this sagittally-acquired data set is marked as axial. [3].

Download the Neuro_MRI_Incorrect_Orientation data set to follow along
http://analyzedirect.com/data/
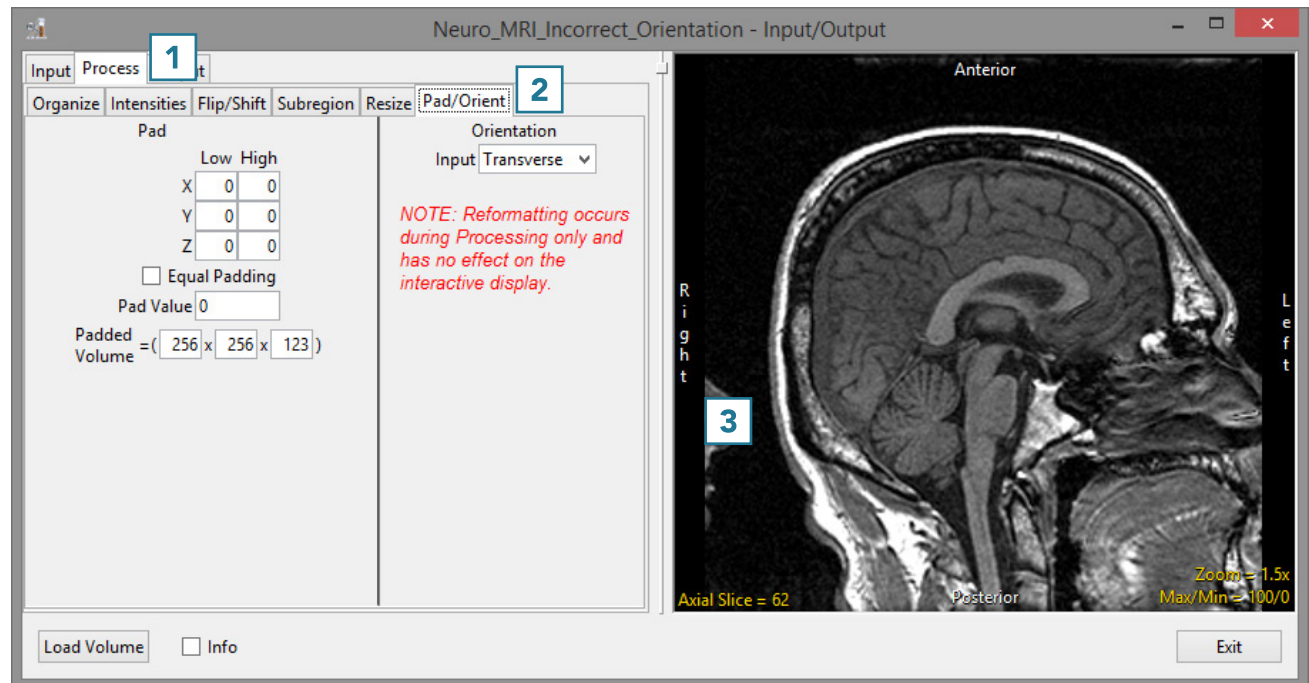
Pad/Orient (continued)

- To correct this, set the Orientation Input option to Sagittal [4].
- Note that the axis labels in the preview are corrected [5].
- Click Load Volume [6] to load the data.

Output: Saving Data

Data can be exported from Analyze 14.0 as easily as it can be loaded into the program. Input/Output will open in Save mode when a data set is selected.
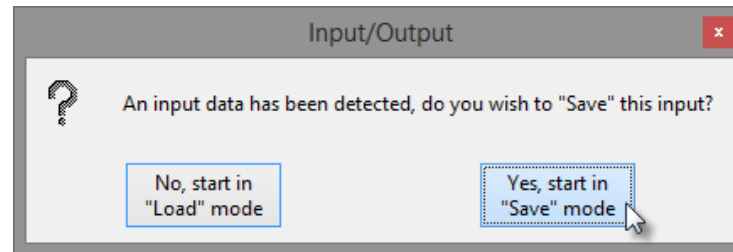

Opening Input/Output in Save Mode

- Select a data set and open Input/Output.
- A window will open, prompting you to open in Load or Save mode. Select Save mode.

Saving a Data Set

- Input/Output will open with Output selected and the Output Type set to Disk [1].
- Choose to save the data as a 3D Volume [2] (default) or as multiple 2D images. The selection will determine the formats you can select for saving the data.
- Use Directory [3] to select the location where you will be saving the data.
- Use File [4] to rename the data.
- Use Format [5] to specify the file format for the saved data.
- Select Save Volume to save the data.
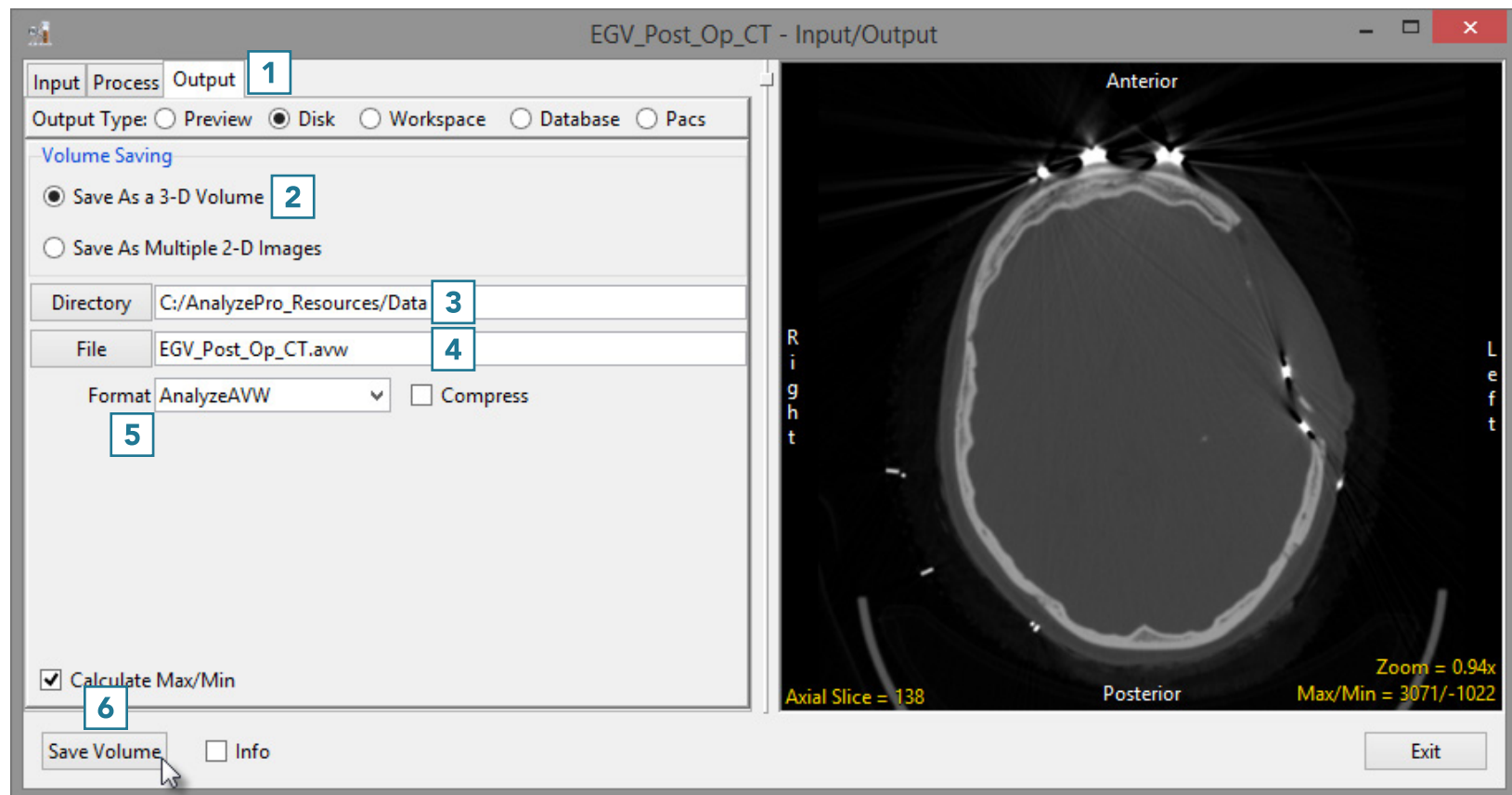
Storing Data in a Database

- Select the Database option [1].
- If required, select a database from the drop-down [2].
- Click Store Volume [3].
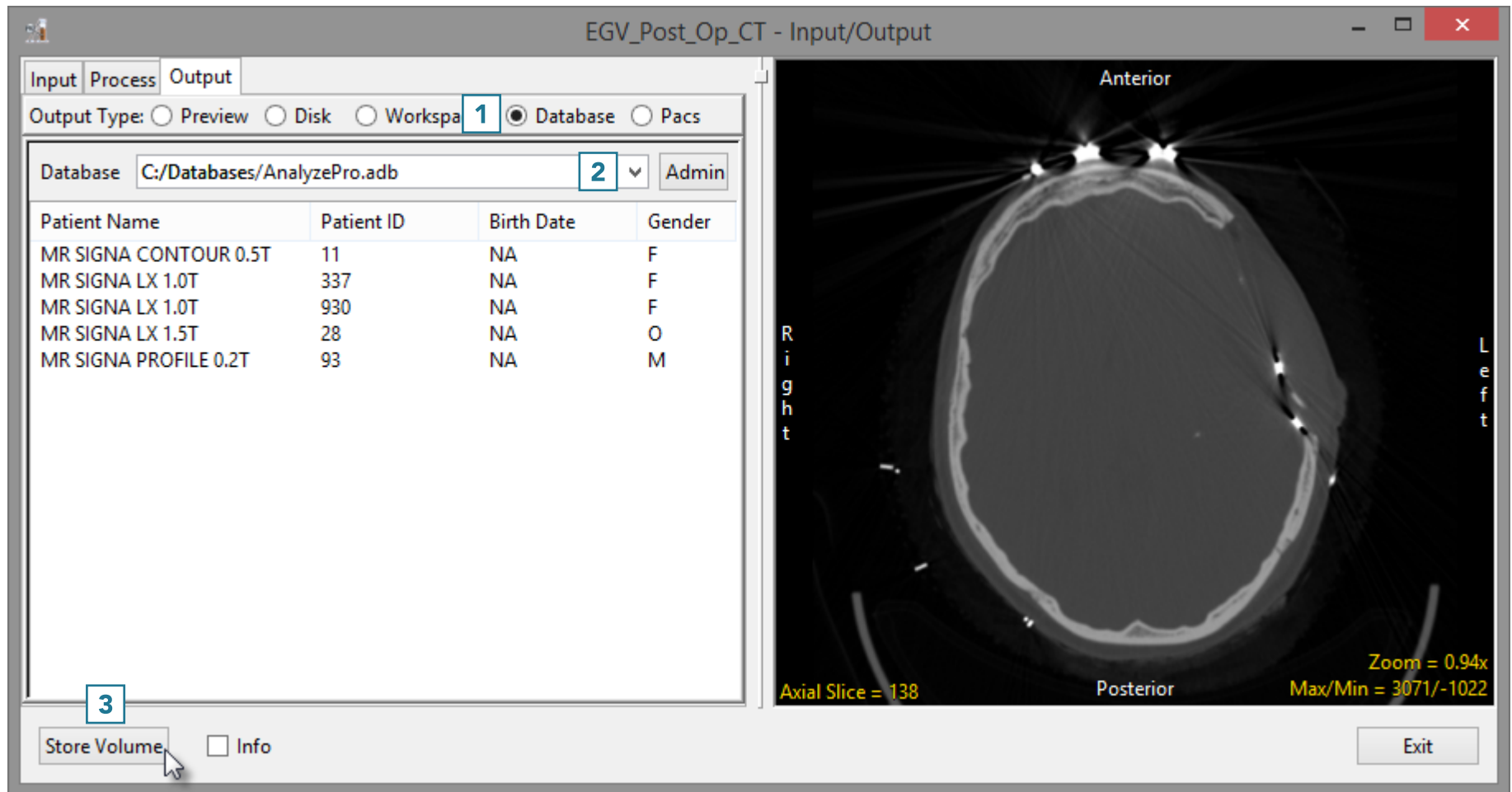
Storing Data in a Database (continued)

- The Edit/Add DICOM tags window will open. Use this tool to add or edit any DICOM tag information.
- Click Apply Tags and Continue [4].
- The data will be exported to and merged into the database.

Sending Data to PACS

- Right-click on the data to send to PACS [5].
- Select Send Patient [6] and choose the PACS AET where you want to send the data [7].
- To configure PACS, see Configuring PACS Communications.