

Measure

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Introduction

The AnalyzePro Measure module provides access to all the measurement tools needed by users to sample their image data. No tools are provided for the definition of objects. Instead, Measure samples object maps defined using other modules, primarily Segment.



1D Measurements

1D measurements include points, lines, trace, angles, intersecting lines and perpendicular lines. Coordinates, signal values, linear distances, line profiles and angles can all be generated using Measure. Full Width Half Max (FWHM) parameters can also be set to control sampling.



1. Sampling Points

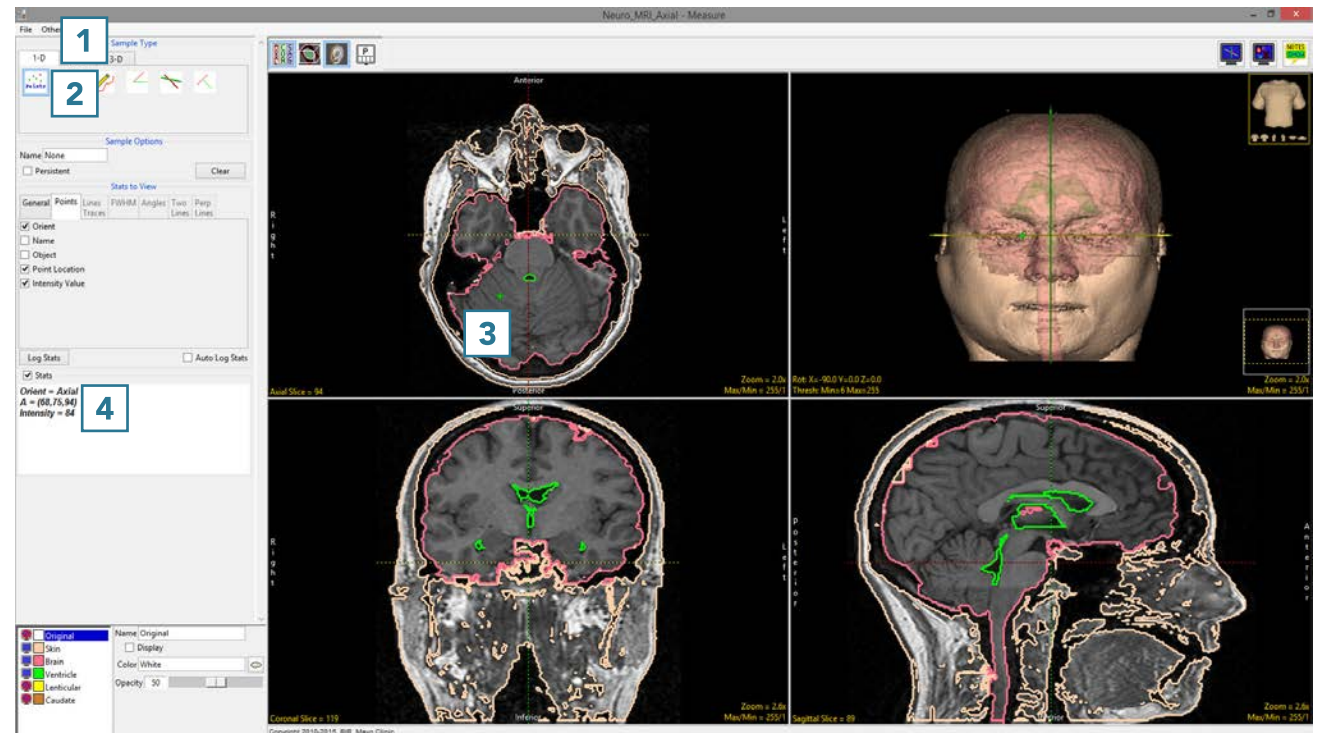
The Points tool allows users to select points on the 2D image data or 3D rendering. The tool will report the coordinates and intensity value of the selected point.

- Select MRI_3D_Head and open Measure.
- Select File > Load Object Maps and load MRI_3D_Head.obj.
- Select the 1D Sample Type **1** and choose Points. **2**
- Click on the brain in the axial orientation **3** to set a point.

Note that the coordinates and intensity of the point will be reported in the Stats review area. **4**



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- Check the Auto Log Stats option.

5 Each point selected will now be saved to a measurement log.

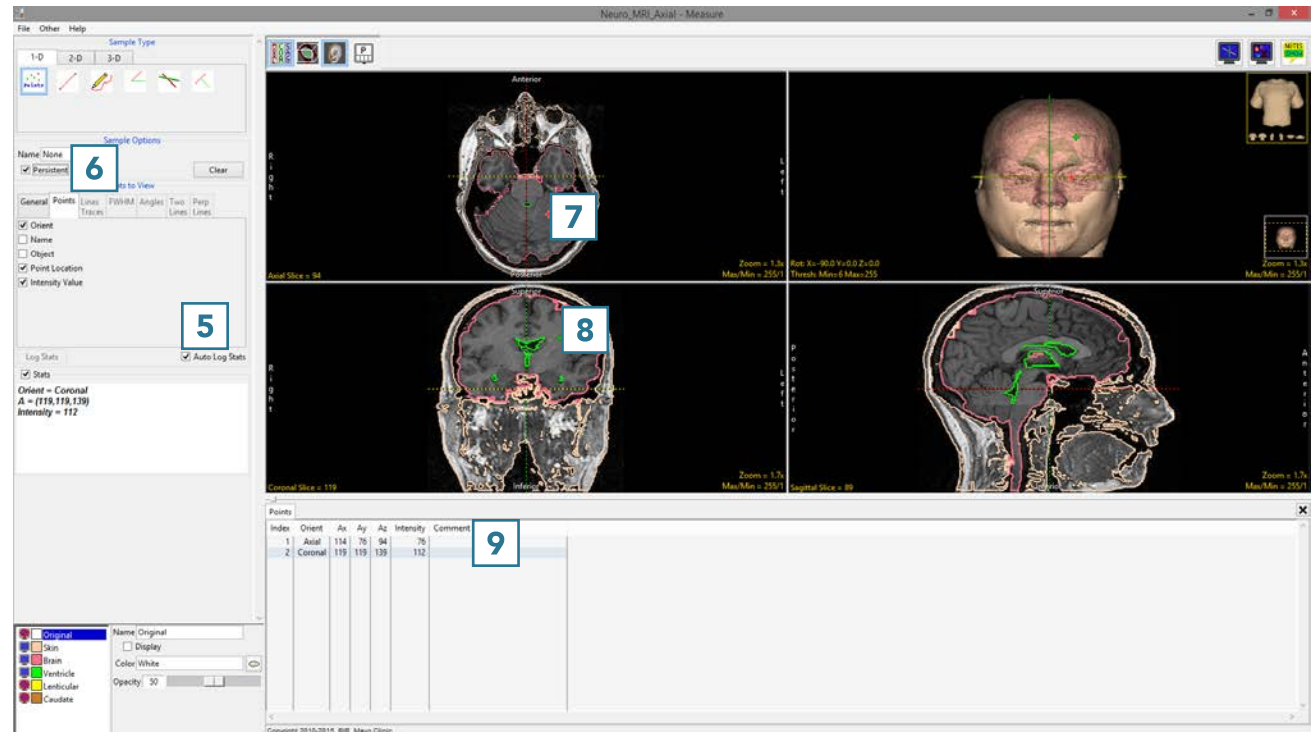
- Check the Persistent checkbox.

6 This will prevent points from being cleared from the display when a new point is selected.

- Set a new point in the axial orientation **7** and set another point in the coronal orientation.

8 The current point will display as green, while previous points will change to red.

- The coordinates and intensity values will be reported in the log. **9**



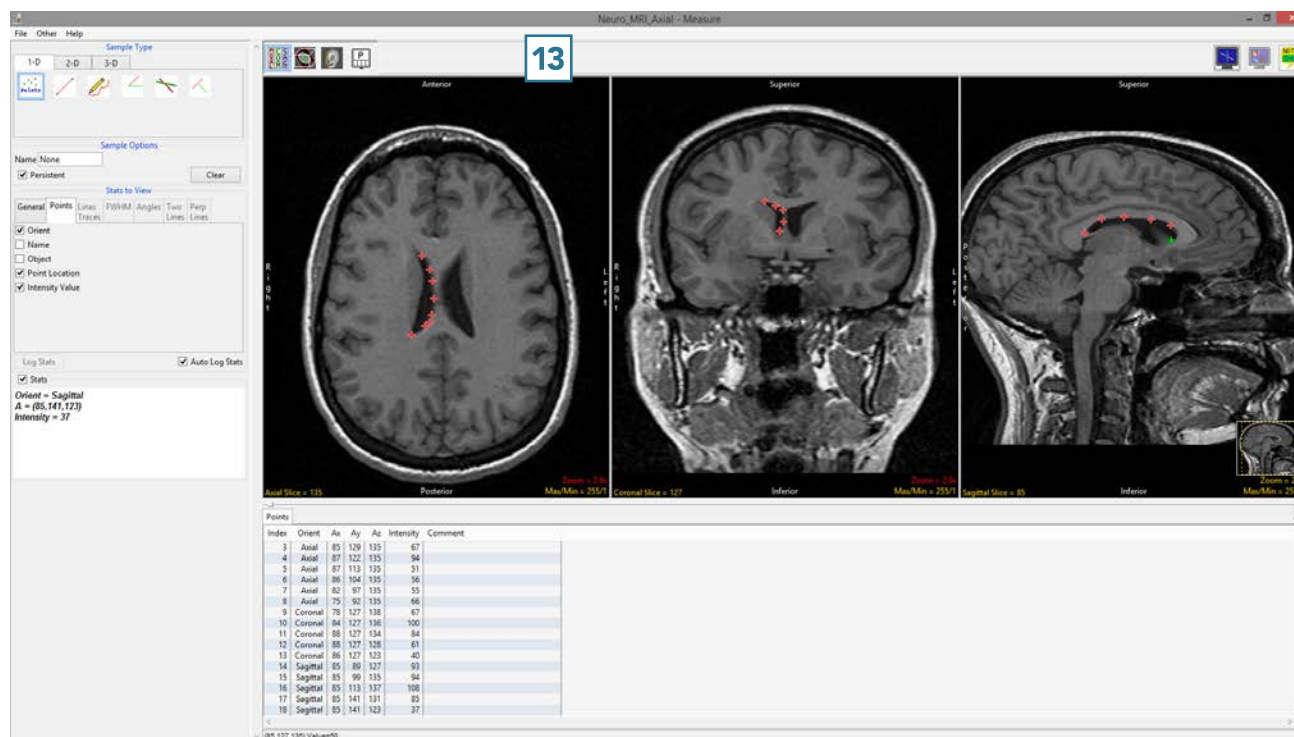


- Set several new points in the sagittal orientation **10** and on the rendering. **11**
- Right click on the log to save as a .CSV file. **12**





Note that point sampling does not require an object map to be loaded. **13**





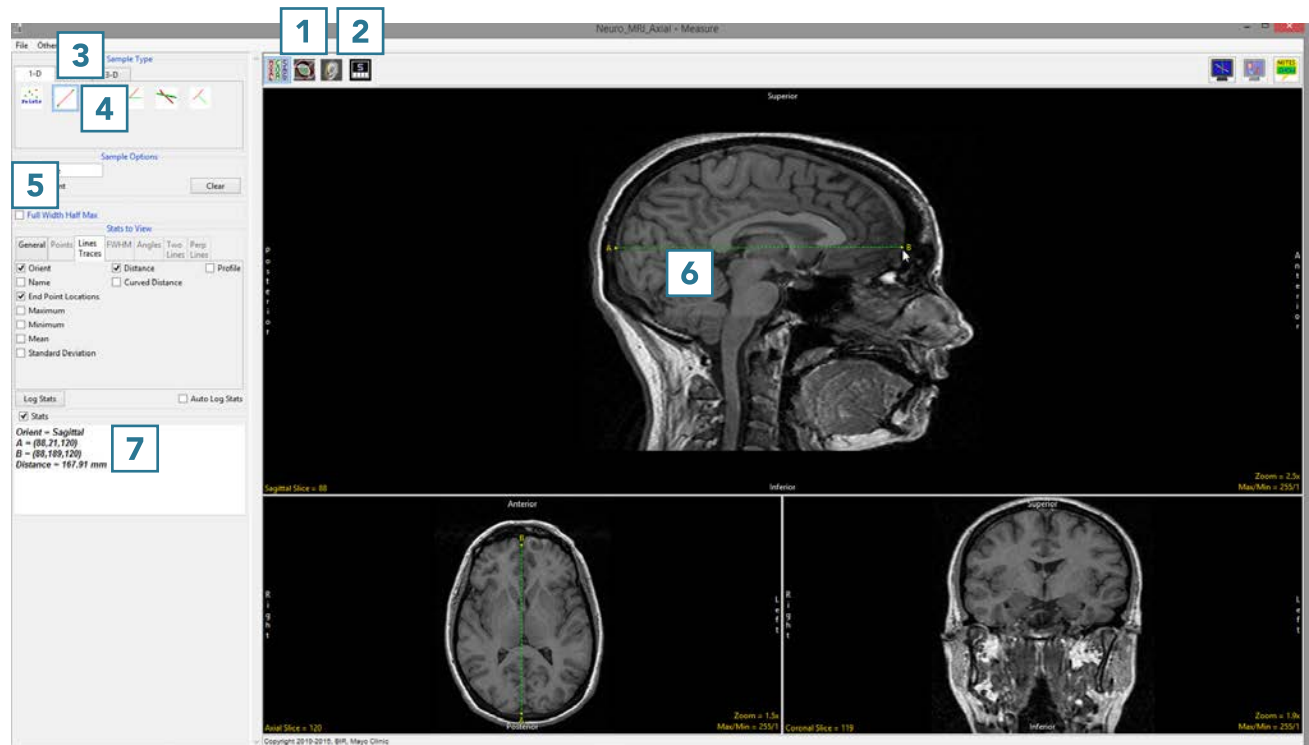
2. Making Line Measurements

The Line tool allows users to define a line on a 2D image or the 3D rendering. The tool will report distance measurements, line intensity profile and the coordinates of the line end points.

- Select MRI_3D_Head and open Measure.
- Switch the display of the Rendering off **1** and set the primary display to Sagittal. **2**
- Select the 1D Sample Type **3** and choose the Line tool. **4**
- Uncheck Full Width Half Max. **5**
- Define a line on a sagittal slice. **6**
- The coordinates for the line endpoints (A and B) and the line distance are reported in the Stats review area. **7**

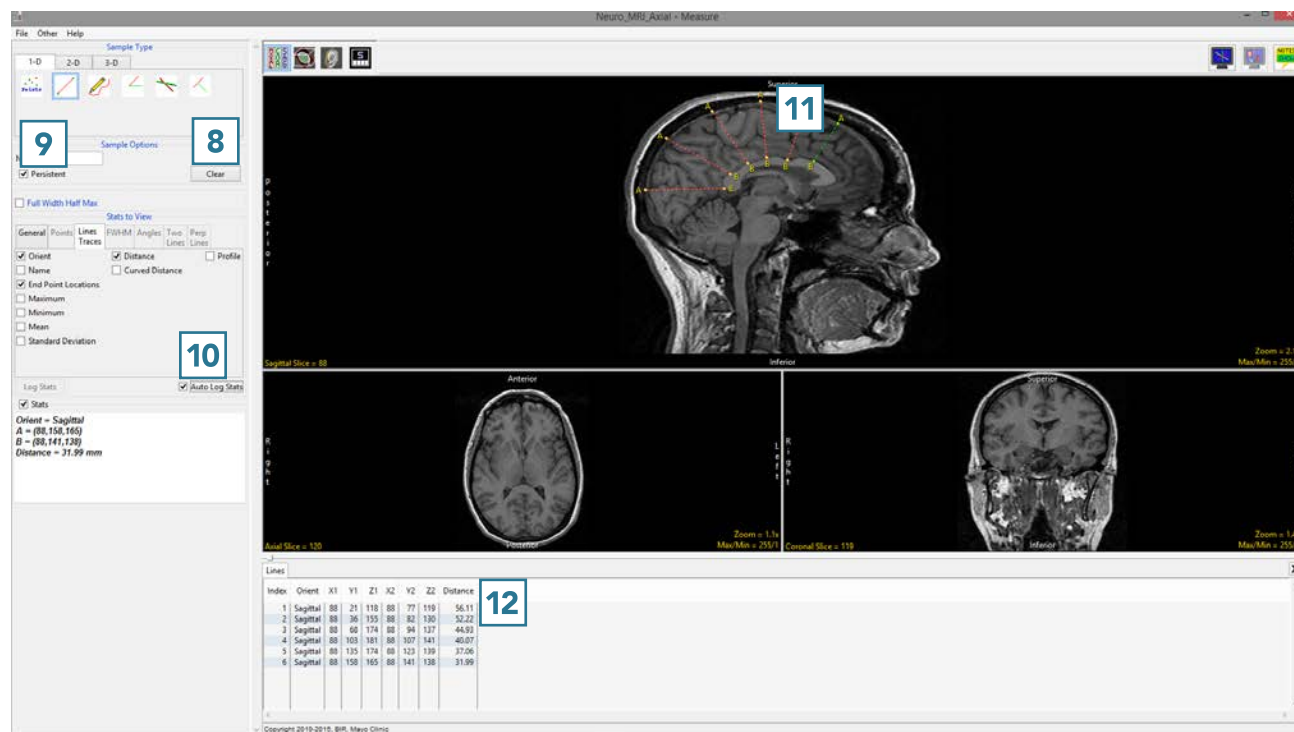


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- Press Clear **8** to reset.
 - Check the Persistent **9** and Auto Log Stats checkboxes. **10**
 - Define several lines on the sagittal slice. **11**
 - The coordinates for the line endpoints (A and B) and the line distances are reported in the log. **12**
- Right click to save the log as a .CSV file.





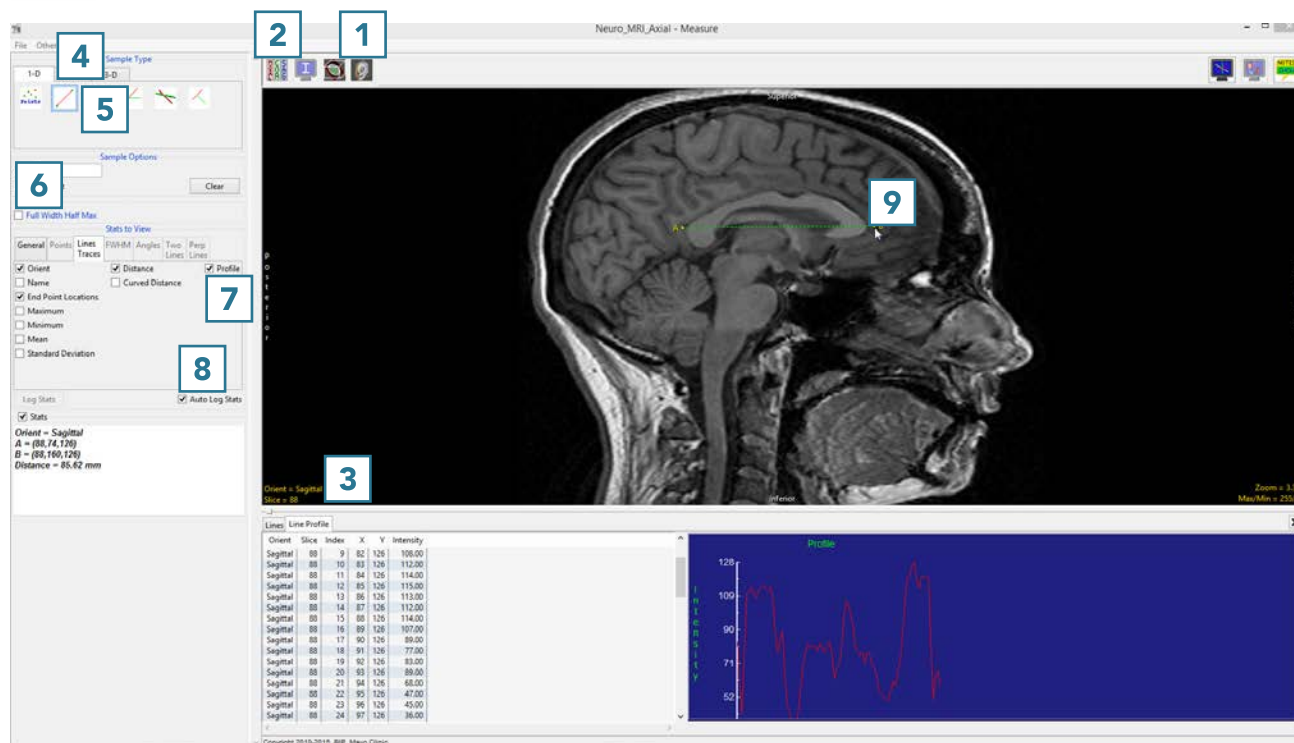
3. Generating Line Profiles

The Line tool allows users to sample and plot pixel intensity values for a defined line.

- Select MRI_3D_Head and open Measure. **1**
- Switch the display of the Rendering off **1** and toggle the display of all orientations off. **2**
- Use the Orient option to switch to Sagittal. **3**
- Select the 1D Sample Type. **4**
Choose the Line tool. **5**
- Uncheck Full Width Half Max. **6**
- Check the Profile option **7** and the Auto Log Stats checkbox. **8**
- Define a line on a sagittal slice to measure the posterior to anterior distance of the corpus callosum. **9**

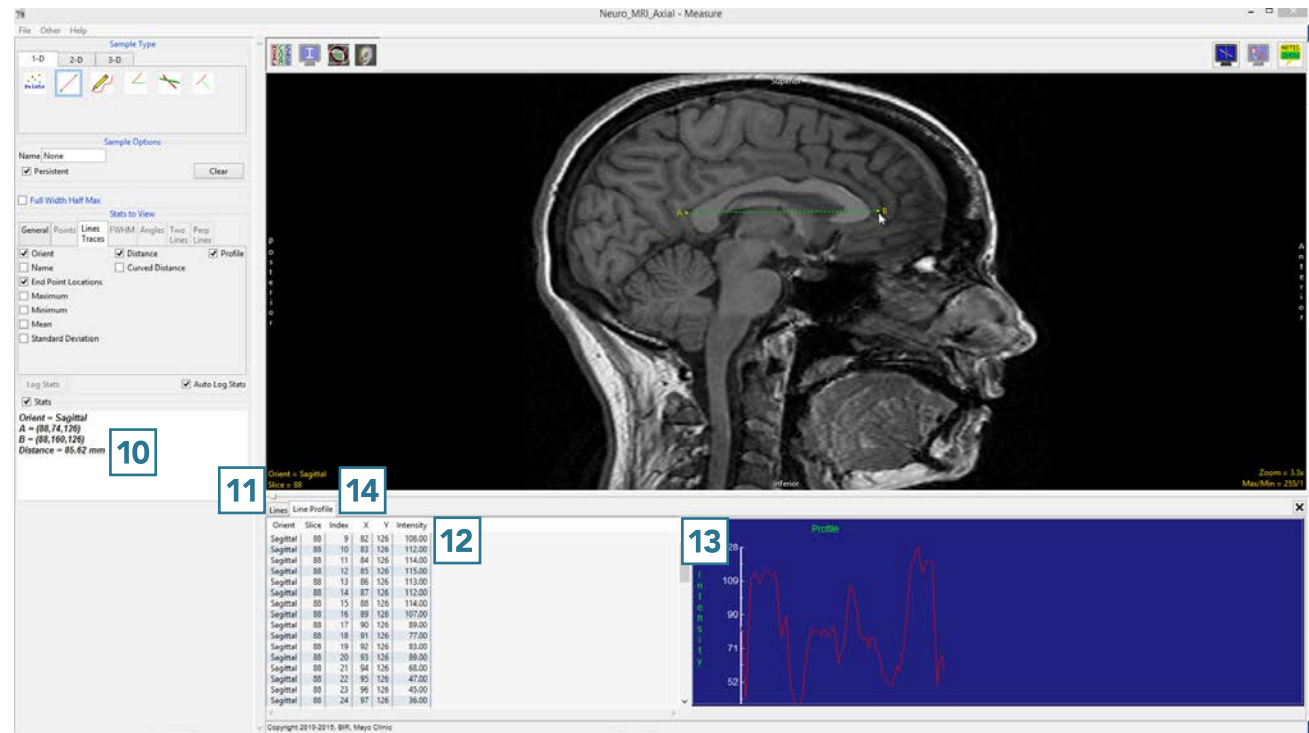


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- The coordinates for the line endpoints (A and B) and the line distance are reported in the Stats review area **10** and in the Lines tab. **11**
- The intensity profile of the defined line is logged **12** and plotted **13** in the Line Profile tab. **14**





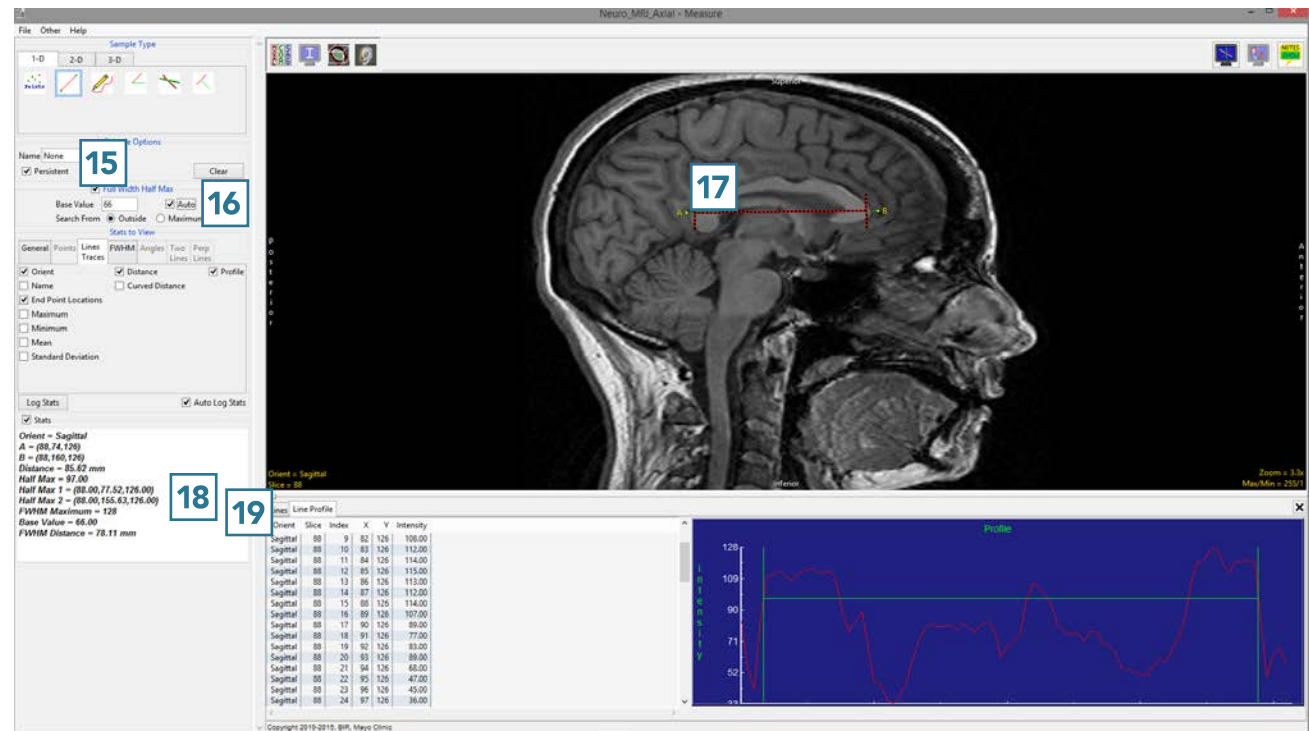
Using FWHM to Aid with Line Measurements

The Line tool allows for measurement of FWHM (Full-Width, Half-Max) distance on a line that crosses a structure of sufficient contrast to produce edges which cross the half-max value, which represents half the difference between the minimum and maximum intensity values along the line.

- Check the Full Width Half Max checkbox **15** and check the Auto option to have the tool calculate the FWHM Base Value. **16**
- Note that the FWHM is overlaid in red on the line. **17**
- The Stats review area will update reporting the FWHM information. **18**

Note any differences between the linear line distance value and the FWHM distance value. FWHM can help increase accuracy of such measurements.

- FWHM measurements will also be reported in the Lines log. **19**
- Right-click on the log to save as a .CSV file.





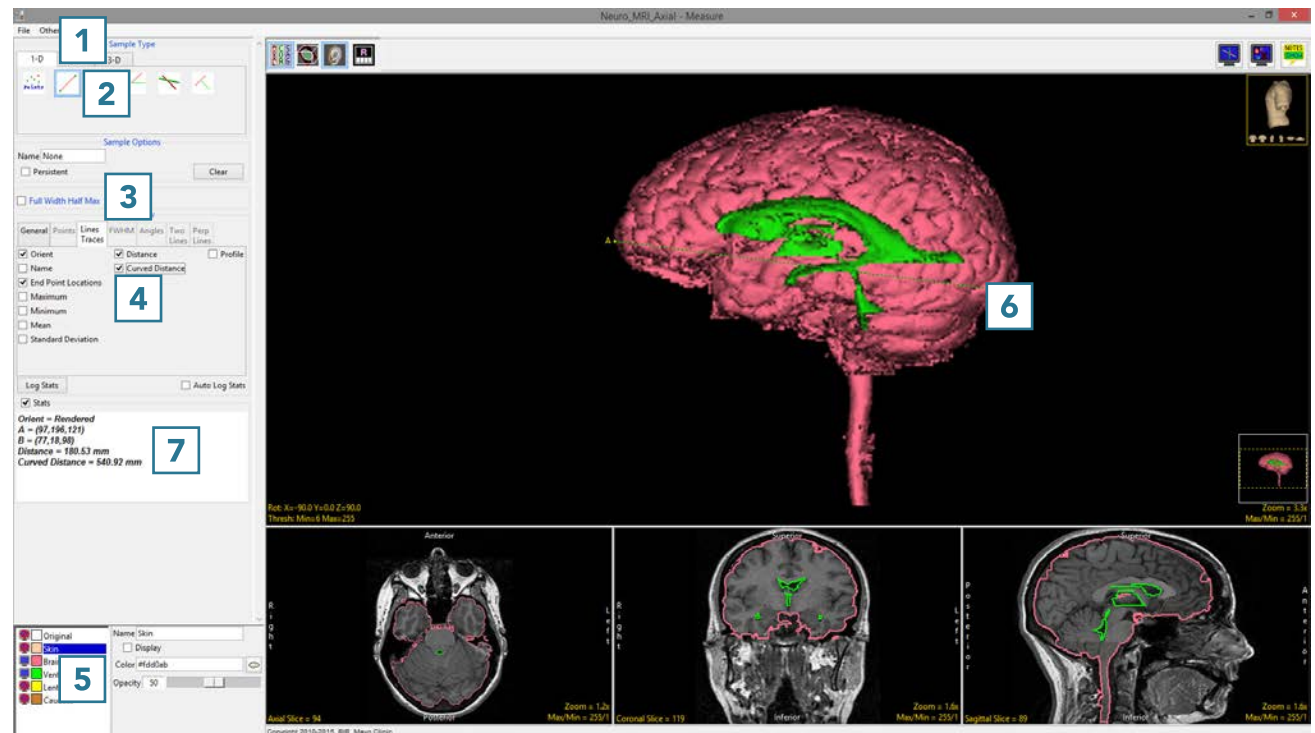
4. Making Line Measurements on the 3D Rendering

Like the Points tool, the Line tool can also be used to make measurements on the 3D rendering.



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- Select MRI_3D_Head and open Measure. **1**
- Select File > Load Object Maps and load MRI_3D_Head.obj.
- Select the 1D Sample Type **2** and choose Line. **2**
- Uncheck Full Width Half Max. **3**
- Under Line Traces check the Curved Distance option. **4**
- Disable the Skin object. **5**
- Define a line on the Rendering. **6**
- The coordinates for the line endpoints (A and B) and both the linear and curved line distances are reported in the Stats review area. **7**
The curved distance represents the distance from A to B following the surface of the brain. **7**



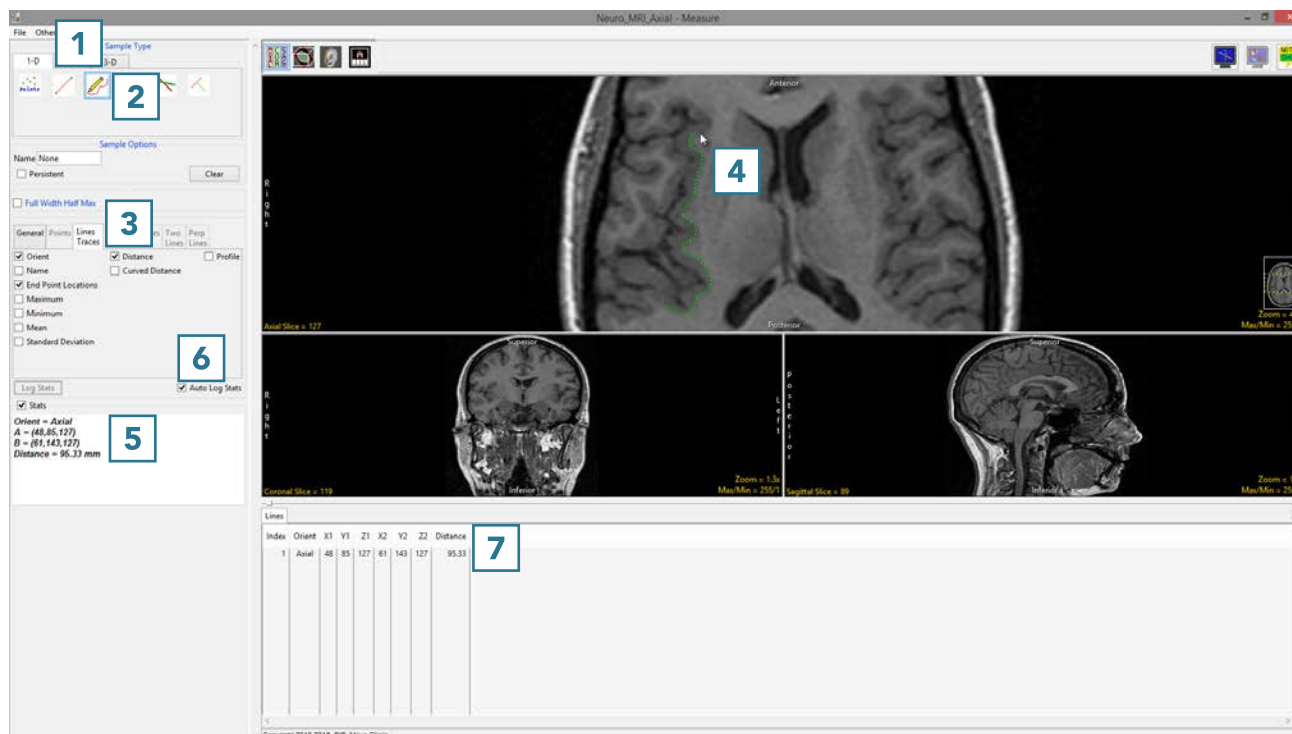
5. Making Freehand Trace Measurements

The Trace tool provides all the functionality of the Line tool, while allowing the user to define a curved trace.

- Select MRI_3D_Head and open Measure. **1**
- Select the 1D Sample Type. **1**
- Choose Sample Trace. **2**
- Check any measurements you want to make from the Lines Traces tab. **3**
- Define a freehand trace on the data. **4**
- The measurements selected will be returned to the Stats review area **5** once tracing is completed.
- If the Auto Log Stats **6** checkbox is selected, the measurements will be added to the Lines log **7** which can be saved as a .CSV file.



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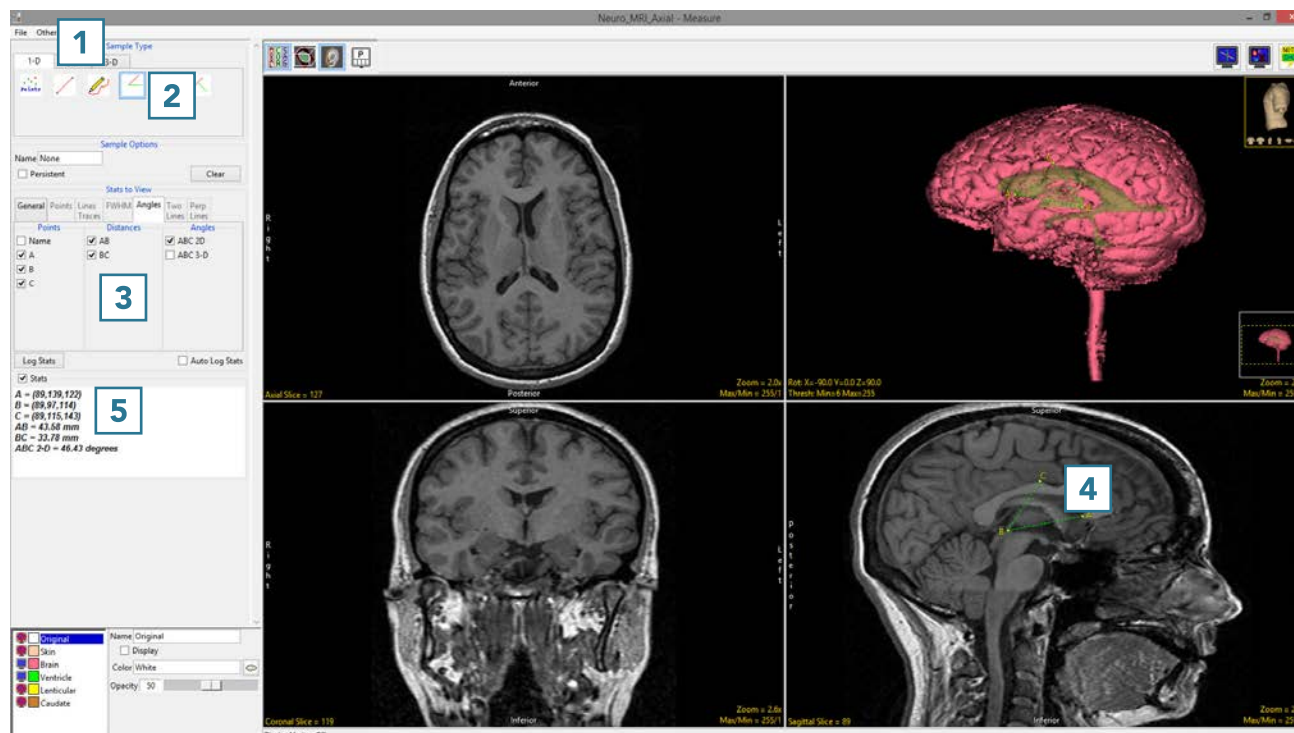
6. Making Angle Measurements

The Angles tool allows users to make distance measurements between points and angle measurements between defined lines.



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- Select MRI_3D_Head and open Measure. **1**
- Select File > Load Object Maps and load MRI_3D_Head.obj. **2**
- Select the 1D Sample Type **1** and choose Angles. **2**
- Check the Points, Distances, and Angles to be reported. **3**
- Define the angles on any of the 2D slices or the 3D rendering. **4**
- The selected measurements will be reported in the Stats review area. **5**





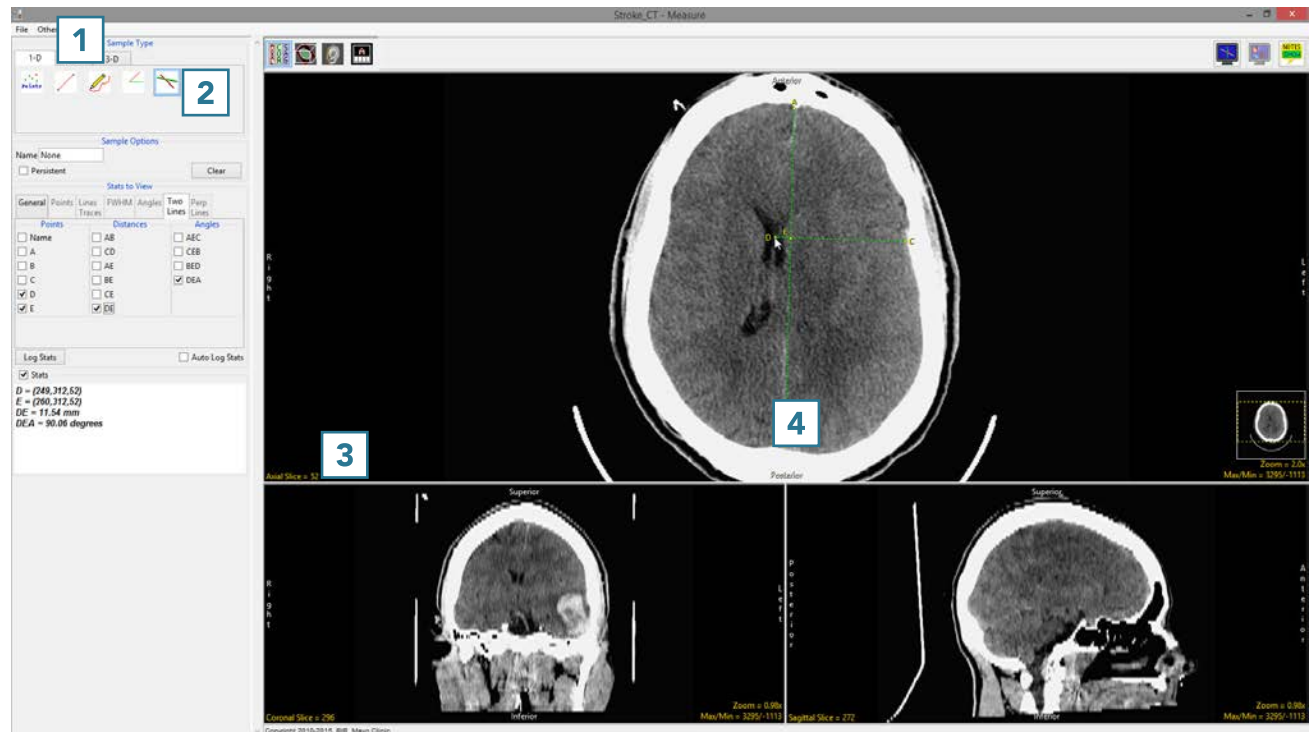
7. Making Distance Measurements with the Two Lines Tool

The Sample Two Lines tool provides users with an interactive tool for making line and angle measurements. The tool is useful for applications such as measuring midline shift in stroke CT images.

- Select a data set and open Measure.
- Select the 1D **1** Sample Type and choose Sample Two Lines. **2**
- To measure the displacement of the septum pellucidum from the midline at the level of the foramen of Monroe, set the primary display to Axial **3** and find a suitable slice.
- Click on the image to set the first point, A, and drag the end point of the first line, B, to the desired location. This is the midline. **4**

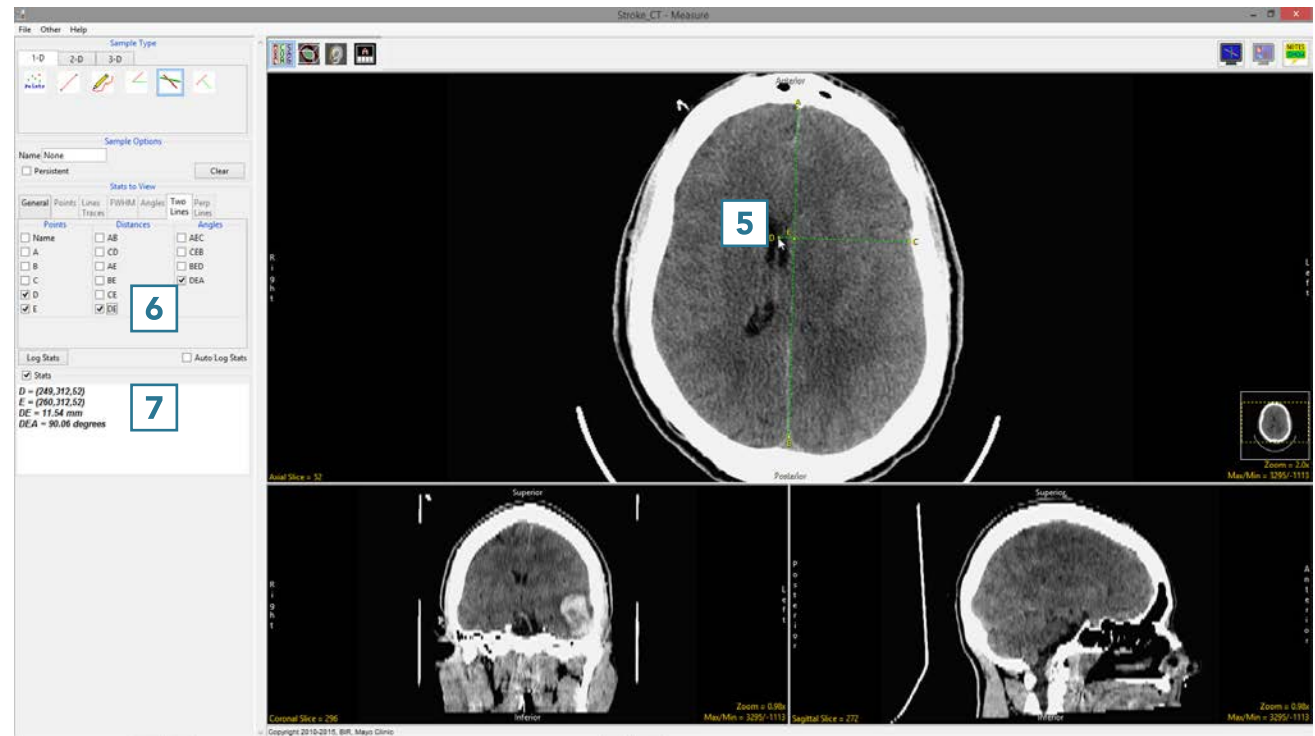


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- Once the midline is set, the next line will automatically appear. To define the second line, move point D perpendicular to the midline of the septum pellucidum. **5** Point C may need adjusting to make the second line perpendicular to the first. **6**
- Check the Points, Distances, and any Angles you want to measure. **6** In this example, the midline shift measurement is between point D and point E. Reviewing angle DEA will confirm whether the second line is perpendicular to the first line. The angle should be 90 degrees.
- Measurements will be reported in the Stats review area. **7**





2D Measurements

The 2D sampling options in Measure allow users to derive measurements from interactively defined rectilinear or elliptical regions or from objects that exist on a specific slice. Measurement options available include spatial context measurements as well as signal value measurements, including Max/Min, mean, standard deviation, area, volume, 2D shape characteristics and more.

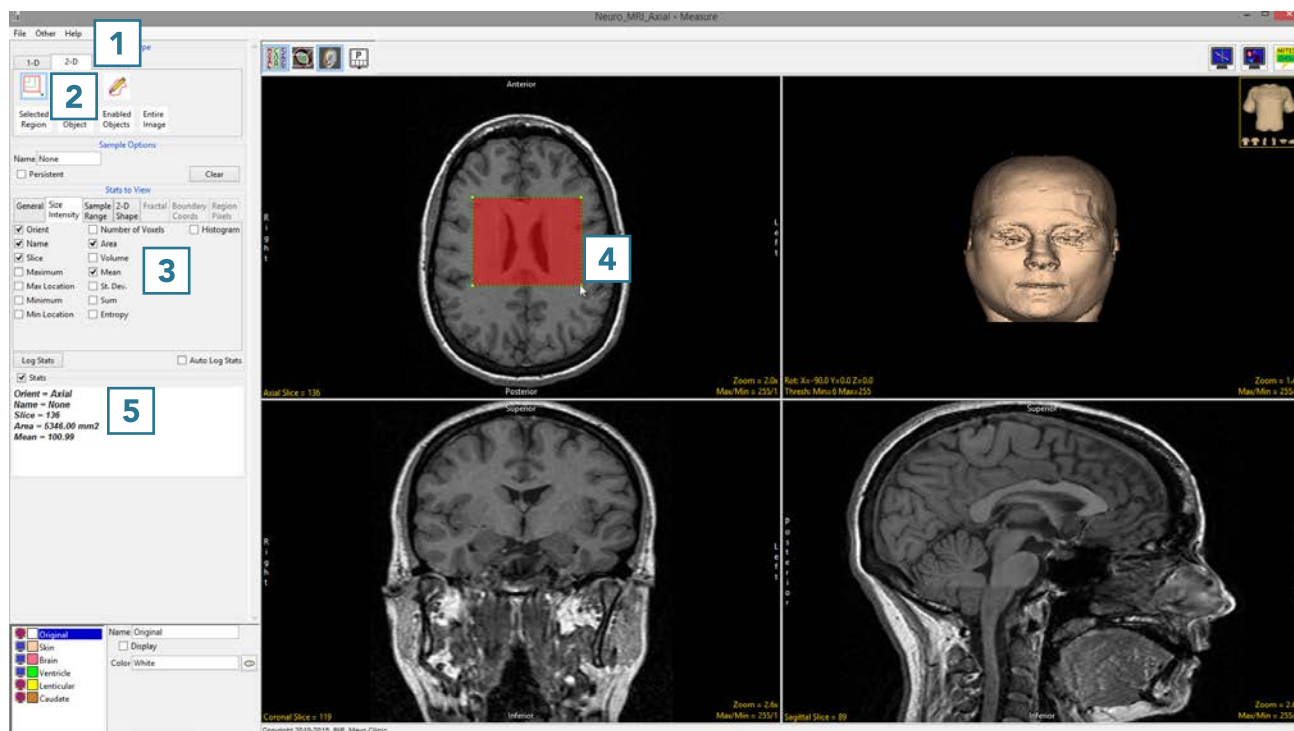


8. Making 2D Rectangular Measurements

- Select MRI_3D_Head and open Measure.
- Select File > Load Object Maps and load MRI_3D_Head.obj.
- Select the 2D Sample Type **1** and choose 2D Rectangles. **2**
- Set the measurements you want to make. **3**
- Define a rectangle on the data. **4**
- Selected measurements will be reported for the region in the Stats review area. **5**



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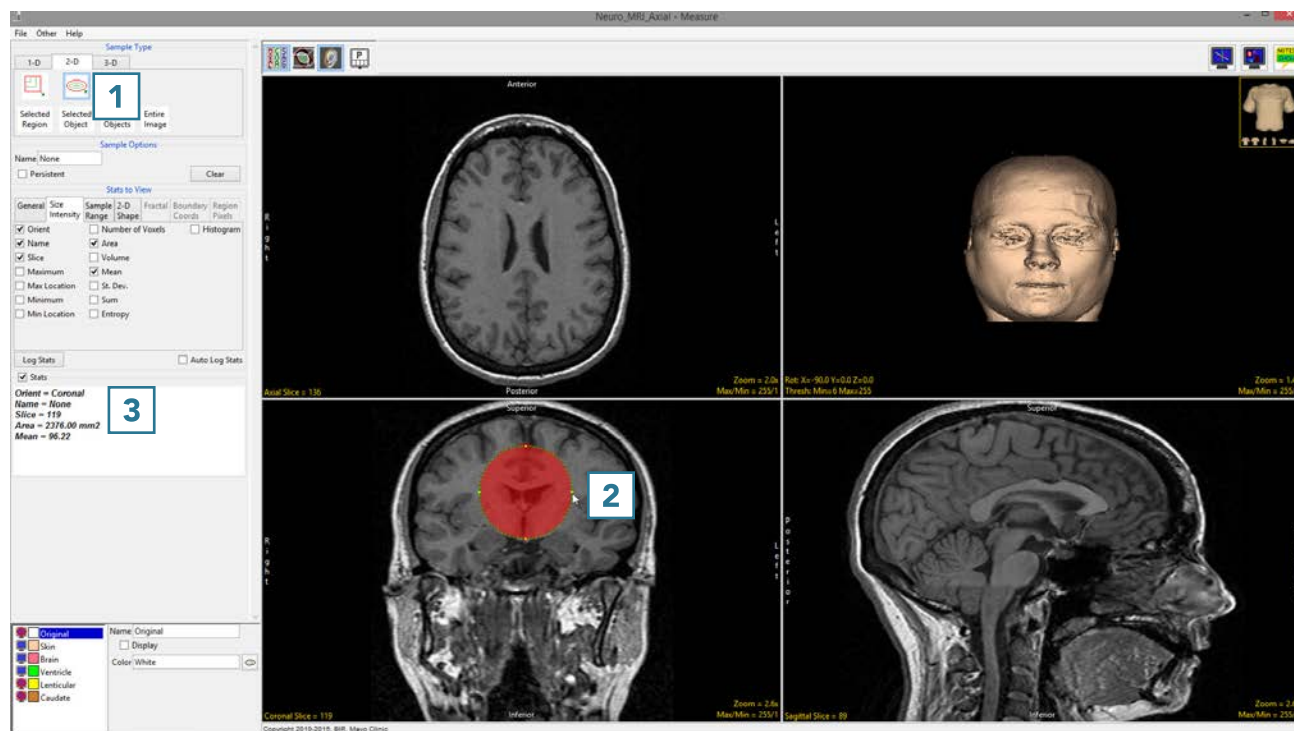


9. Making 2D Oval Measurements

- Select the 2D Oval tool. **1**
- Define an oval region to sample. **2**
- Selected measurements will be reported for the region in the Stats review area. **3**



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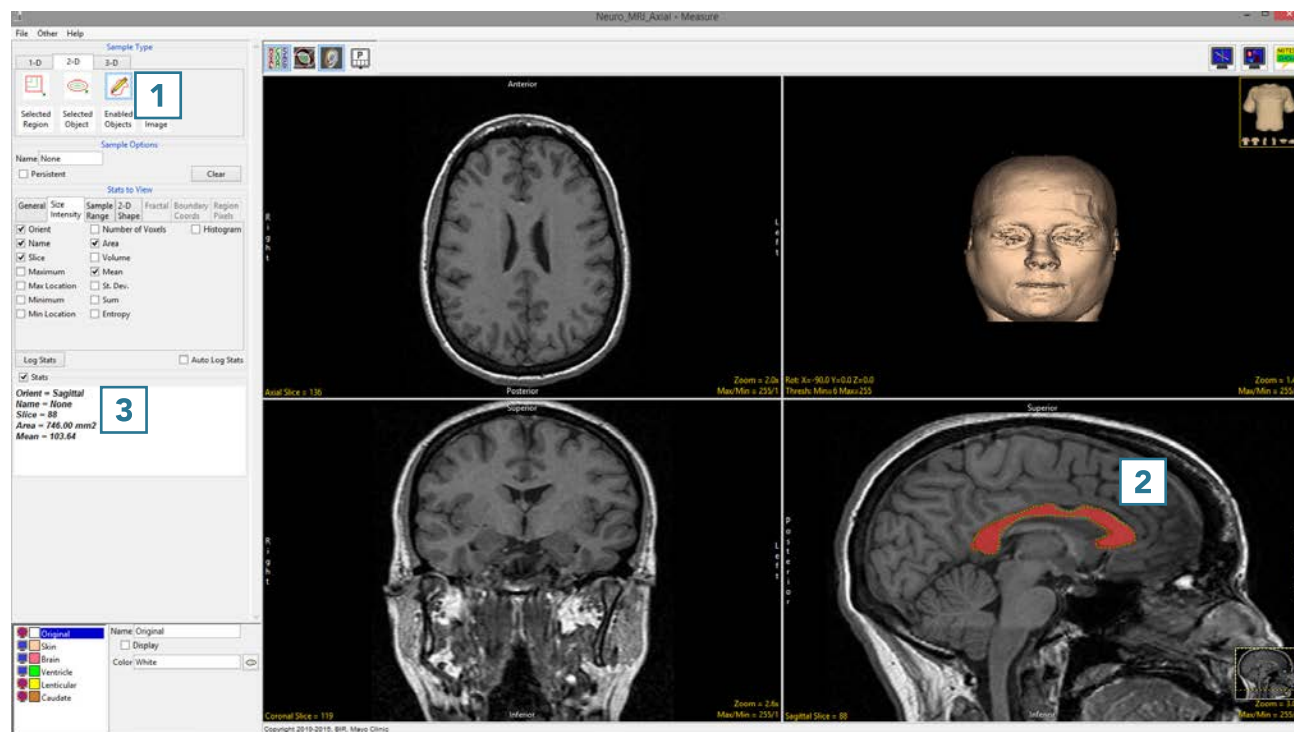


10. Making 2D Closed Trace Measurements

- Select the 2D Closed Trace tool. **1**
- Define a region to sample. **2**
- Selected measurements will be reported for the region in the Stats review area. **3**



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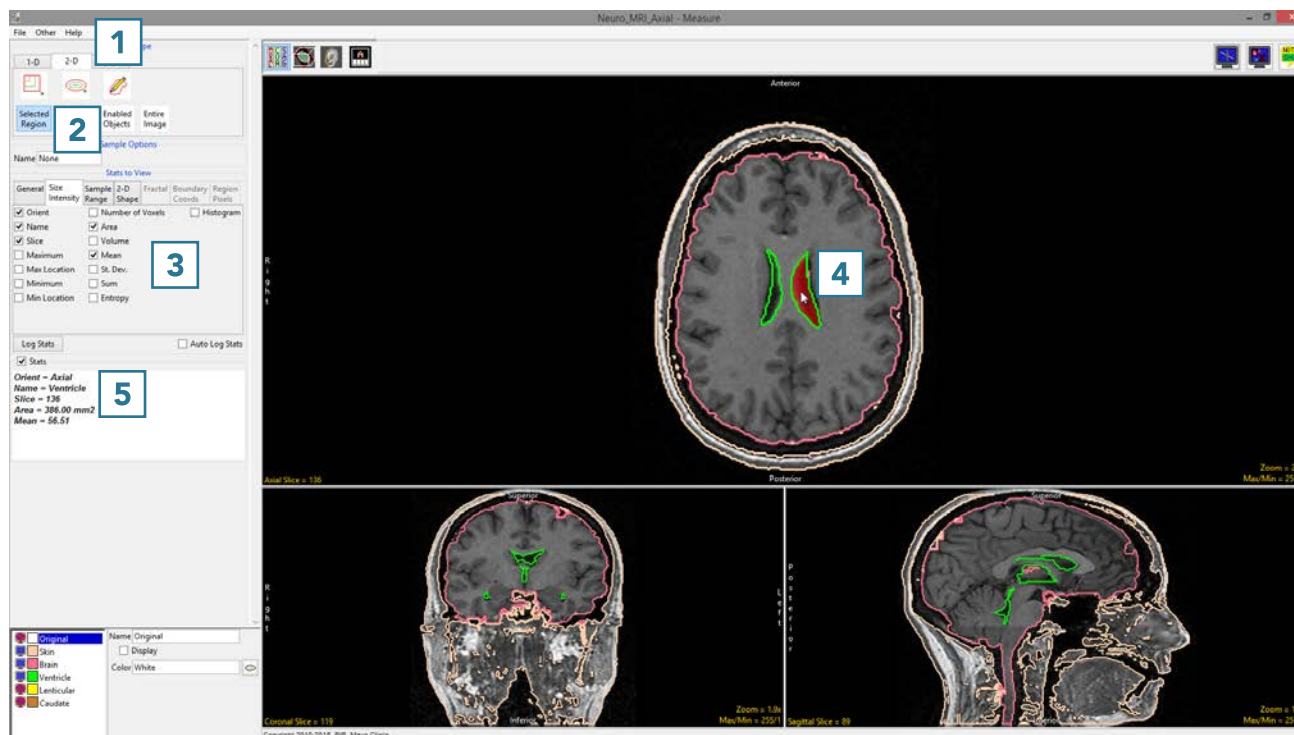
Additional 2D Sampling Options

Selected Region

- Select MRI_3D_Head and open Measure.
- Select File > Load Object Maps and load MRI_3D_Head.obj.
- Select the 2D Sample Type. **1**
- Choose Selected Regions. **2**
Regions selected by clicking on the image will be sampled.
- Select the desired measurements **3** and click on a region. **4**
- Selected measurements will be reported. **5**



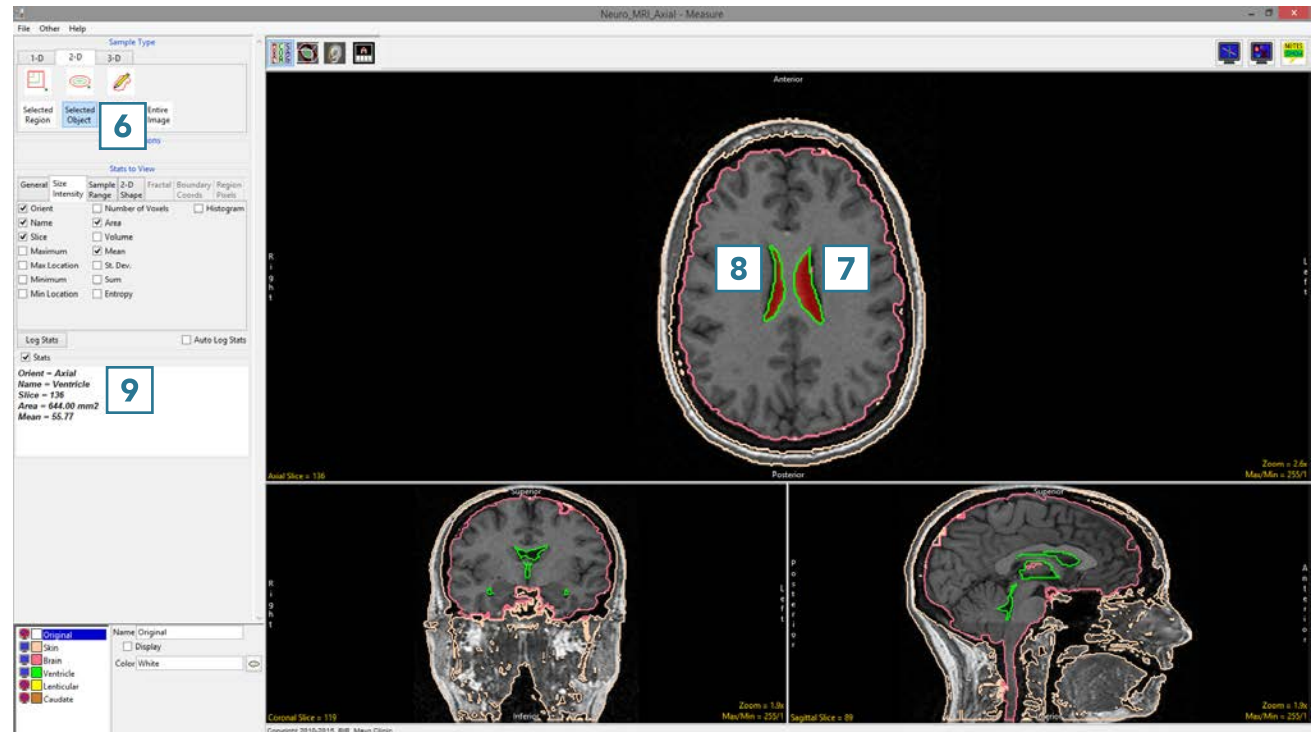
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Selected Object

- Choose Selected Object. **6**
All voxels representing the selected object (even if spatially disconnected on the slice) will be sampled.
- Click on a region. **7** In this example, the region of the ventricle on the left was selected. However all voxels assigned to the ventricle object are sampled. **8**
- Selected measurements will be reported. **9**

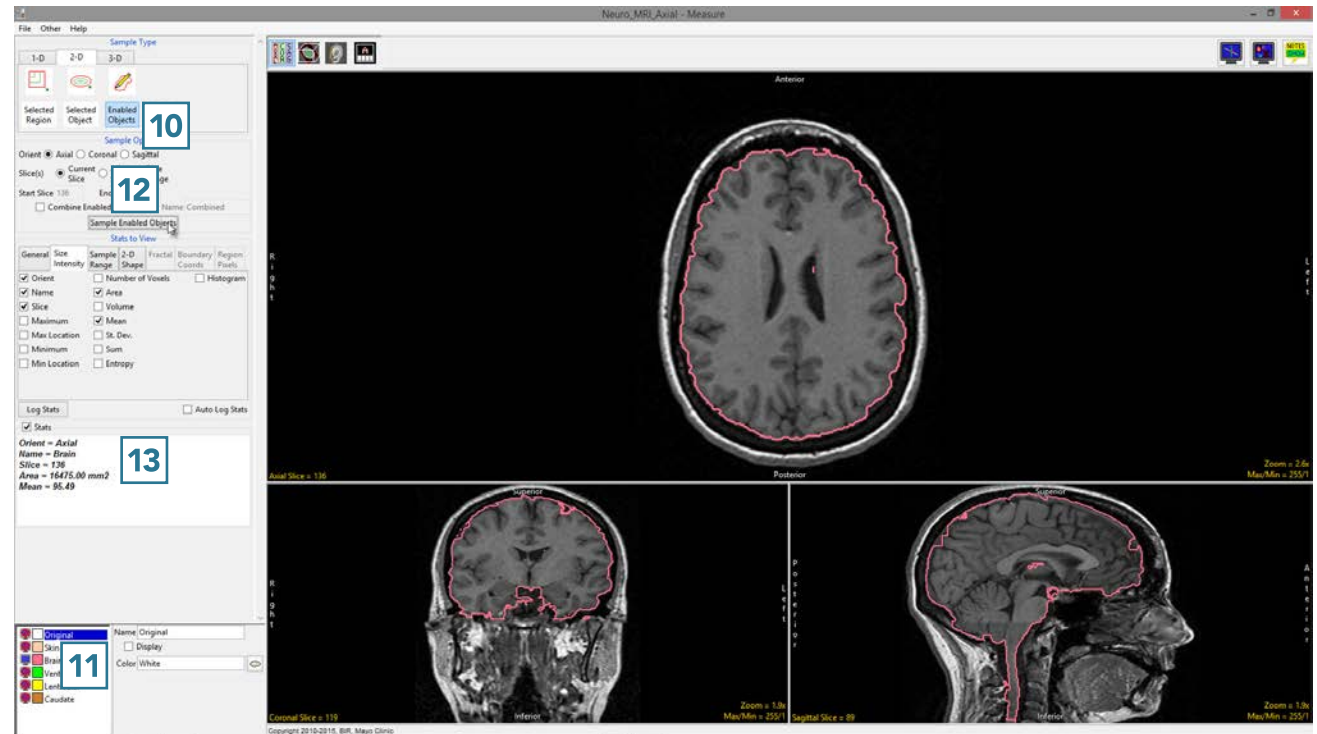




Enabled Objects

Sampling the Current Slice

- Choose Enabled Objects. **10**
Objects enabled in the Object control window will be sampled. Disable all objects apart from the Brain. **11**
- Click the Sample Enabled Objects button. **12**
- Selected measurements will be reported for the enabled object **13** for the current slice.





Sampling All Slices

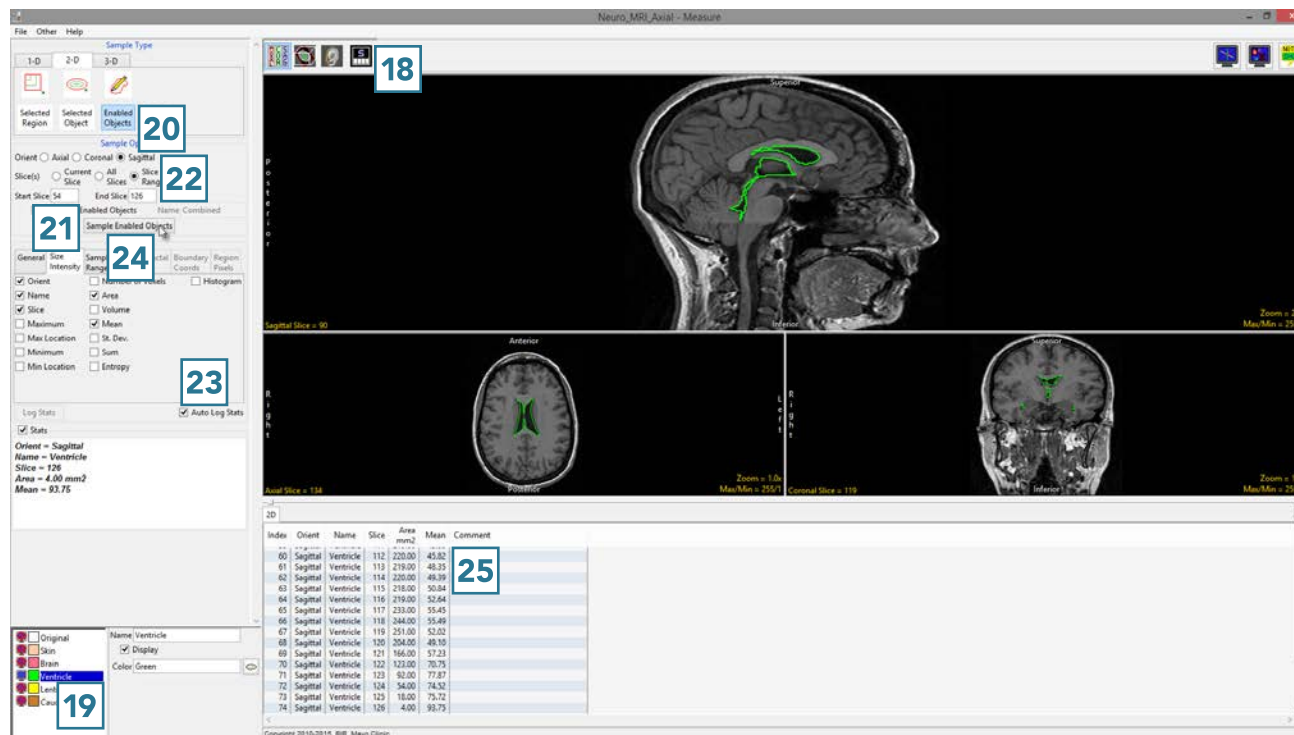
- Change Slices(s) to All Slices **14** and check the Auto Log Stats checkbox. **15**
- Click the Sample Enabled Objects button. **16**
- Selected measurements will be reported for the enabled object in the 2D log **17** and can be saved as a .CSV file.





Sampling a Range of Slices

- Change the primary display to Sagittal. **18**
- Disable the Brain object and enable the Ventricle object. **19**
- Change Slices(s) to Slice Range. **20**
- Set the Start Slice **21** to the first slice where the Ventricle object appears in the data, slice 54.
- Set the End Slice **22** to the last slice where the Ventricle object appears in the data, slice 126.
- Check the Auto Log Stats checkbox. **23**
- Click the Sample Enabled Objects button. **24**
- Measurements will be reported for the enabled object in the 2D log **25** and can be saved as a .CSV file.





3D Measurements

3D measurements are derived from the loaded object map for the data set. Spatial size, signal intensity information and 3D shape characteristics can be derived from an object or collection of objects.



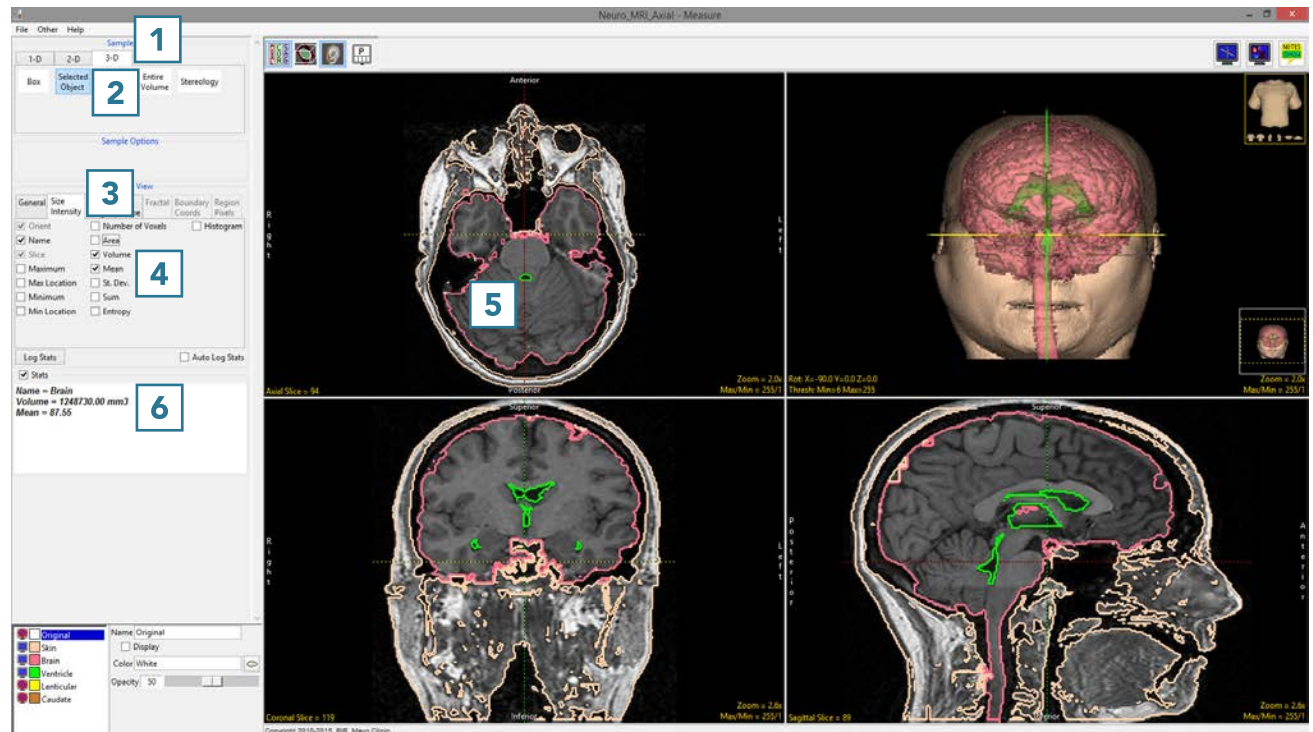
11. Making Size and Intensity Measurements

Using Selected Objects to make a Volume Measurement

- Select MRI_3D_Head and open Measure.
- Select File > Load Object Maps and load MRI_3D_Head.obj.
- Select the 3D Sample Type **1** and choose Selected Object. **2**
- Select Size Intensity **3** and make sure that Name, Volume and Mean are checked. **4**
- Uncheck Area. **4**
- Click on the brain. **5**
- The selected measurements for the brain will be reported. **6**

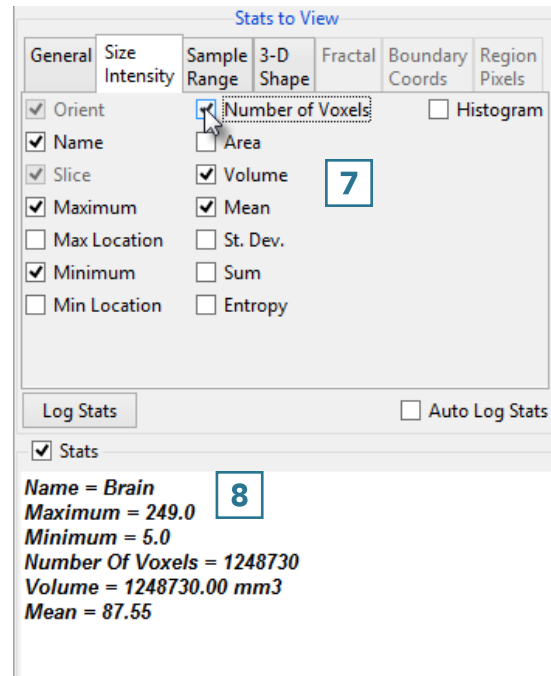


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Checking additional measurement options **7** will automatically update the Stats area with the selected measurement. **8**





- To report the selected measurements to a log file that can be saved from Measure, check the Auto Log Stats option **9** and click on the brain again. **10**
- The selected measurements will be returned to a file below the image display area. **11**
- To save the measurements log file, right-click in this area and select Save Log. **12** The log file will be saved as a .CSV file.



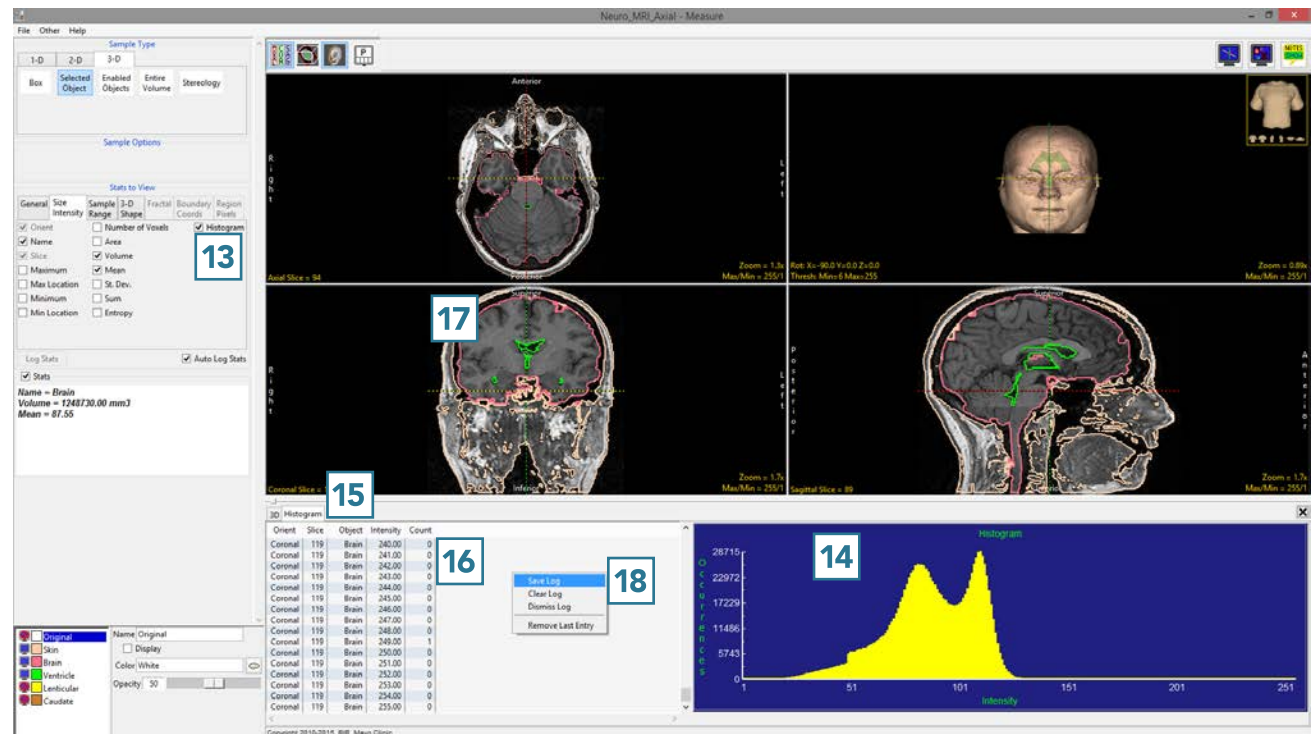


Using Selected Objects to Generate a Histogram for an Object

- Check the Histogram checkbox.
13 The histogram for the sampled object will be displayed below the display area 14 in a new Histogram tab 15 in front of the other statistics tabs.
- To generate the histogram statistics (intensity and count information) 16 click on the brain. 17

Note that objects with the view disabled can accidentally be selected and sampled when using the Selected Object tool. Be aware when selecting an object to sample.

- The histogram information can be saved as a .CSV file by right-clicking and selecting Save Log. 18

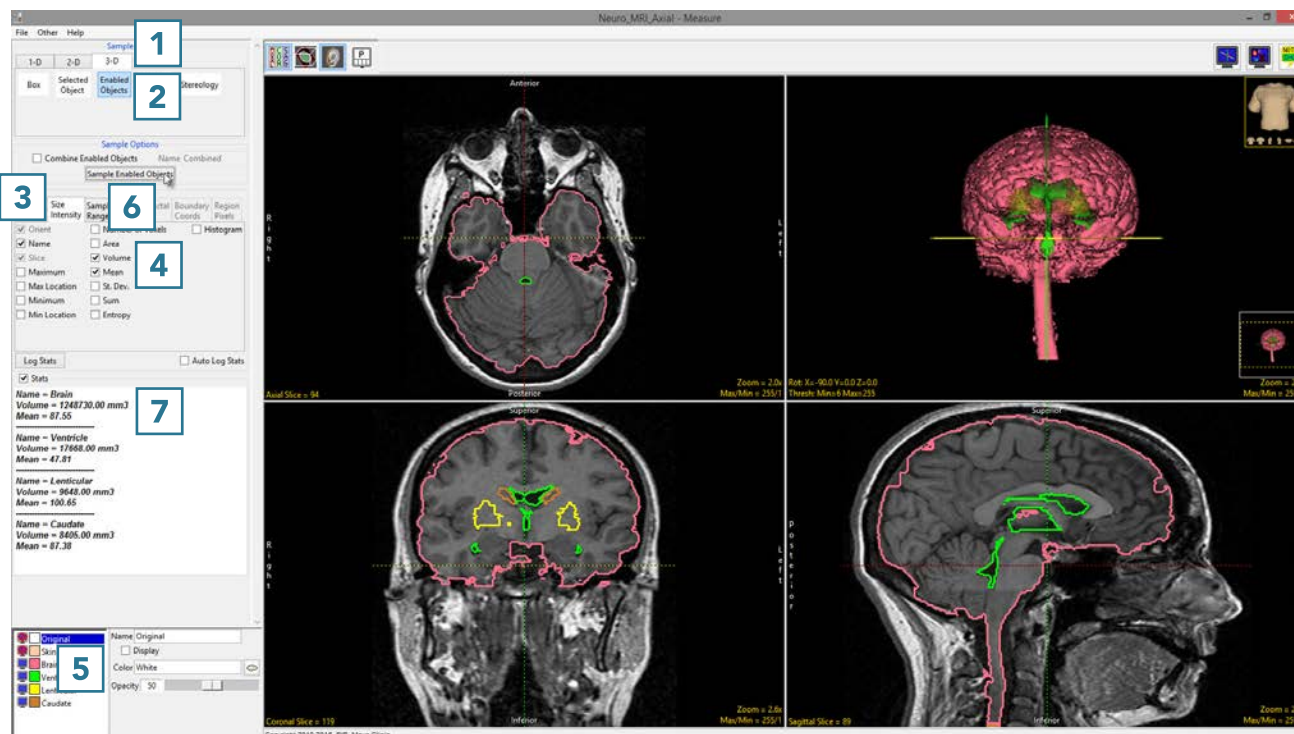


12. Using Enabled Objects to make Volume Measurements for Multiple Objects

- Select MRI_3D_Head and open Measure.
- Select File > Load Object Maps and load MRI_3D_Head.obj.
- Select the 3D Sample Type **1** and choose Enabled Objects. **2**
- Select Size Intensity **3** and make sure that Name, Volume, and Mean are checked.
- Uncheck Area. **4**
- Switch the display of the Skin object off **5** by clicking on the monitor icon next to the object in the object list.
- Switching the display of an object off disables the object so it won't be sampled. Switch on the Lenticular and Caudate objects.
- Click Sample Enabled Objects. **6** The selected measurements for the enabled objects will be reported. **7**

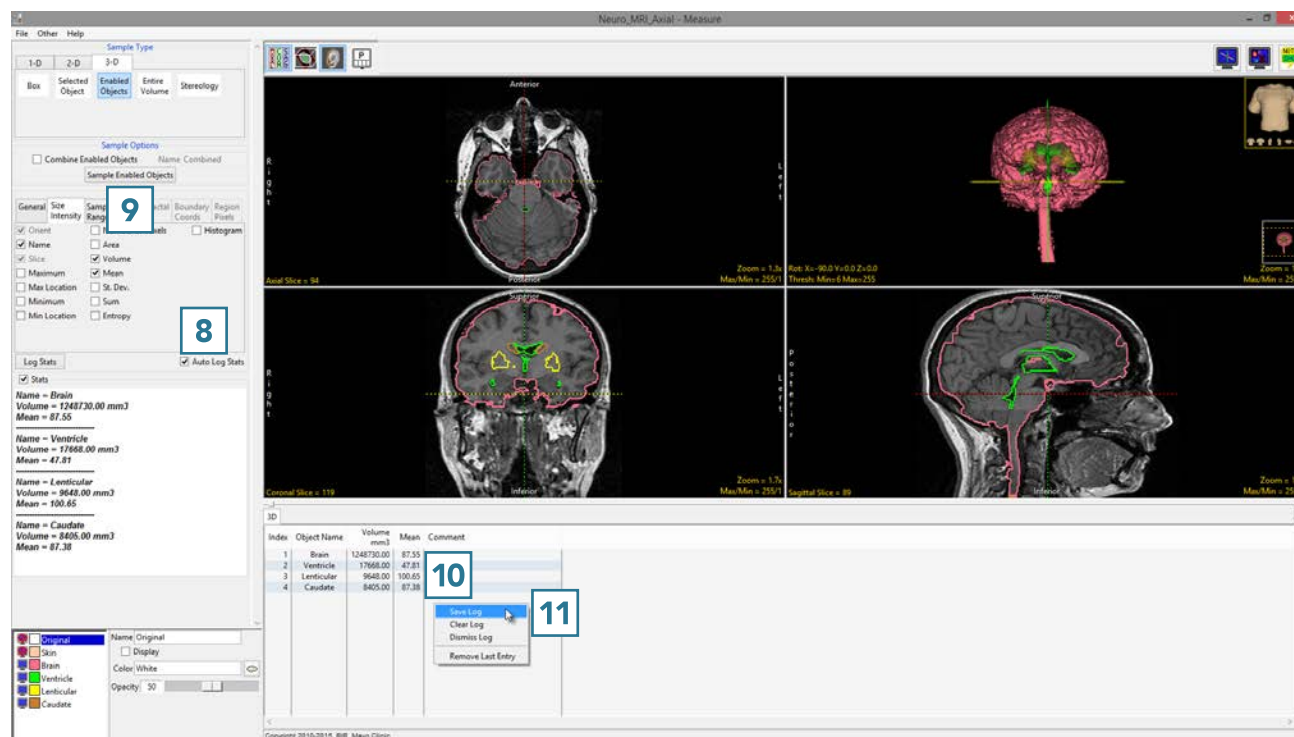


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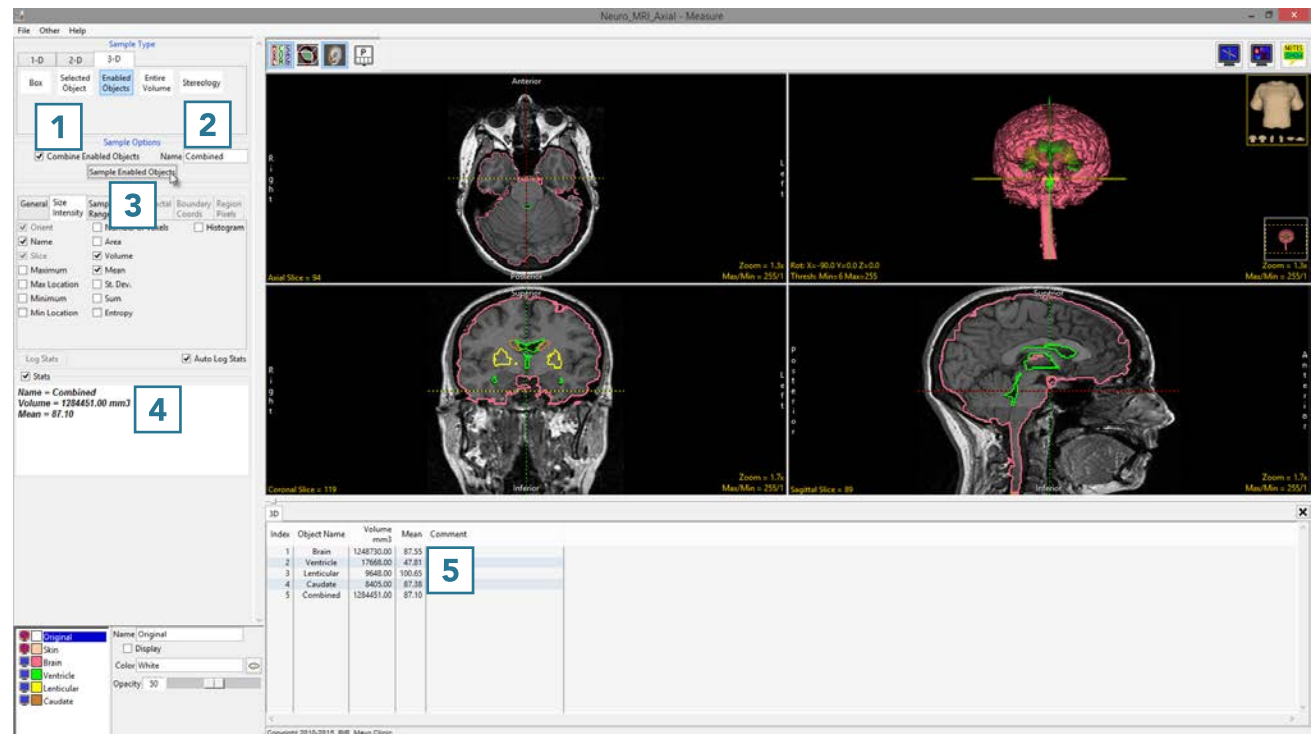
- To report the selected measurements to a log file that can be saved from Measure, check the Auto Log Stats option **8** and click Sample Enabled Objects. **9**
- The selected measurements for the enabled objects will be returned to a file below the image display area. **10**
- To save the measurements log file, right-click in this area and select Save Log. **11** The log file will be saved as a .CSV file.





13. Using Enabled Objects to make Combined Volume Measurements for Multiple Objects

- Check the Combine Enabled Objects checkbox. **1**
- Name the combined result or leave with the default name Combined. **2**
- Click Sample Enabled Objects. **3**
- The combined measurements will be reported in the stats review area **4** and added to the log file. **5**



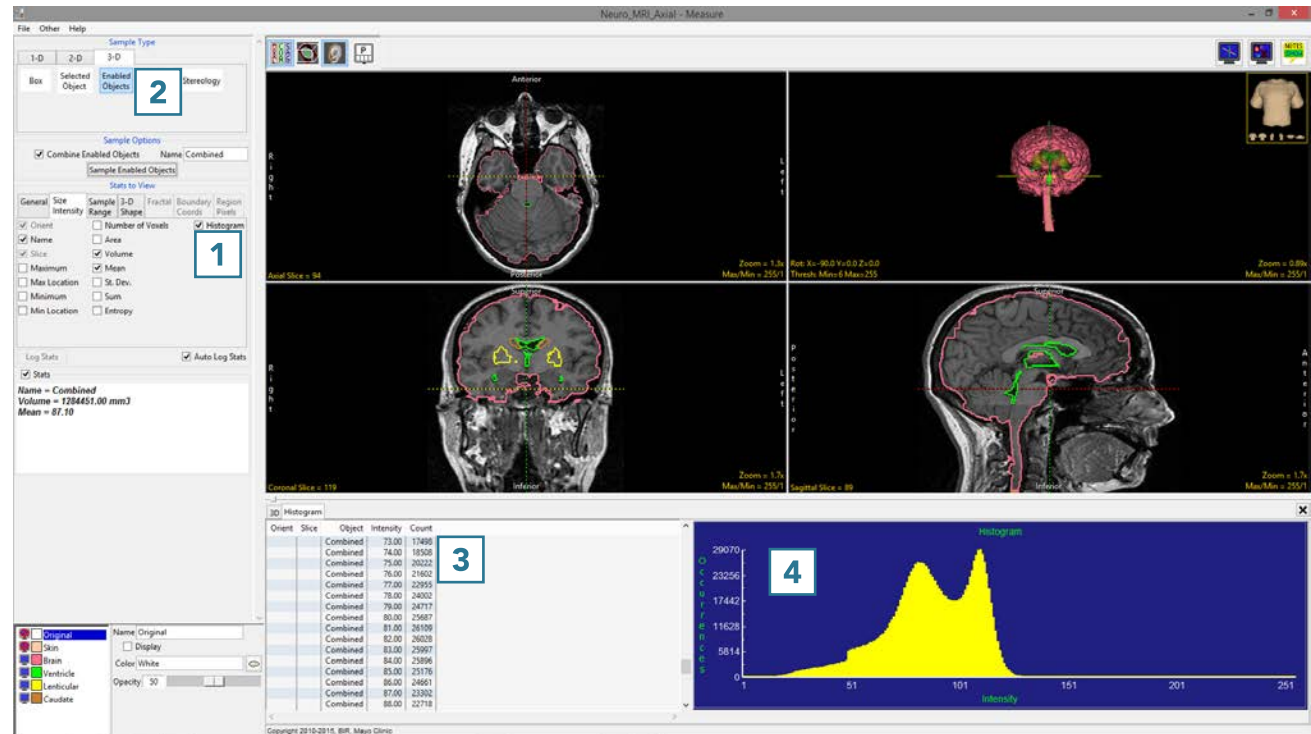
- Checking additional measurement options **17** will automatically update in the Stats review area with the selected measurement for the combined object. **18**
- The measurements for the individual and combined objects will automatically update in the log. **19**





14. Using Enabled Objects to Generate a Combined Object Histogram

- Check the Histogram check box **1** and select Sample Enabled Objects. **2**
- The histogram measurements will be reported **3** and the histogram plotted **4** in a new tab. Right-click to save the histogram log.



15. Sampling the Entire Data Set

Sometimes it is necessary to obtain statistics for the entire data set.

- Select MRI_3D_Head and open Measure.
- Select File > Load Object Maps and load MRI_3D_Head.obj.
- Select the 3D Sample Type. **1**
Choose Entire Volume. **2**
- Select Size Intensity **3** and make sure that Name, Volume and Mean are checked. Uncheck Area. **4**
- Check Auto Log Stats **5** and click Sample Entire Volume. **6**
- The selected stats for the entire volume will be reported in the Stats review area **7** and log file. **8**



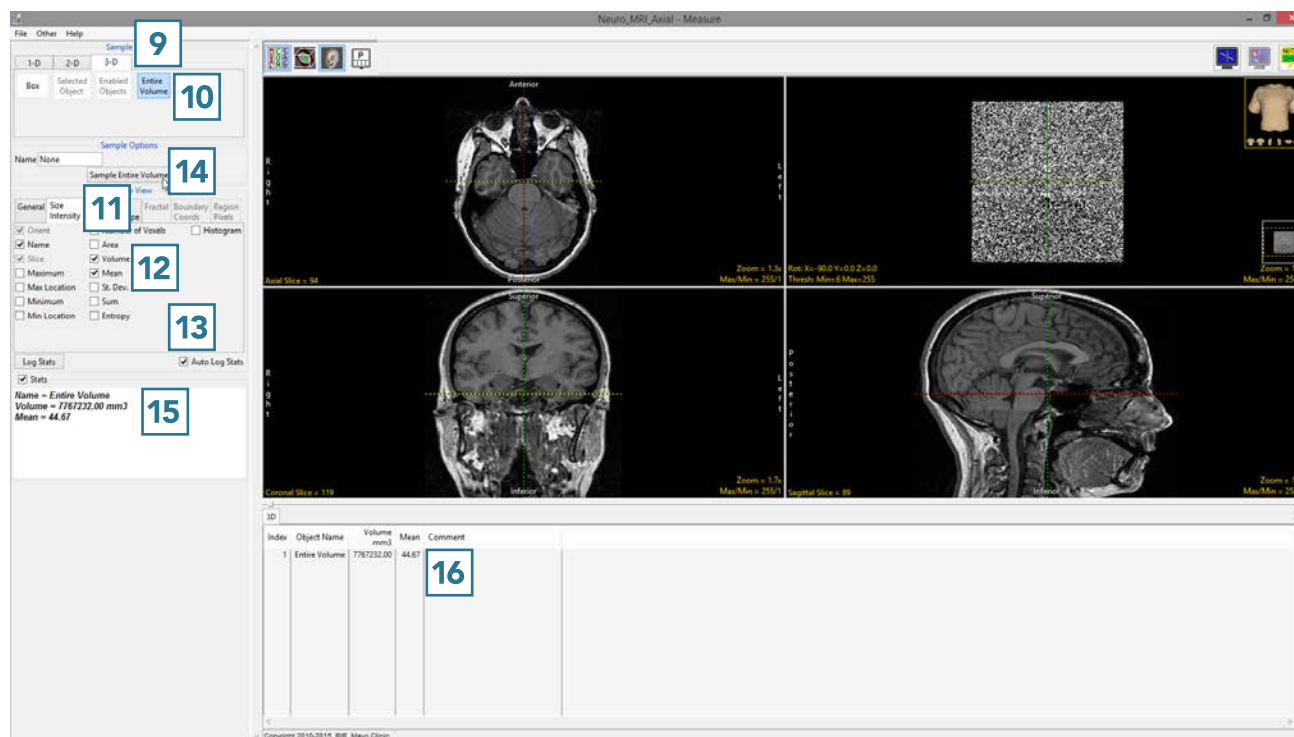
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Technically, to sample stats for the entire volume, an object map is not required.

- Select MRI_3D_Head and open Measure.
- Select the 3D Sample Type **9** and choose Entire Volume. **10**
- Select Size Intensity **11** and make sure that Name, Volume, and Mean are checked. Uncheck Area. **12**
- Check Auto Log Stats **13** and click Sample Entire Volume. **14**
- The selected stats for the entire volume will be reported in the Stats review area **15** and log file. **16**





16. Measuring 4D Multivolumes

- Select 4D_Cardiac_Cycle and open Measure.
- Select File > Load Object Maps and load 4D_Cardiac_Cycle.obj.
- Select the 3D Sample Type **1**
- Choose Enabled Objects. **2**
- Select Size Intensity **3** and make sure that Name, Volume and Mean are checked.
- Uncheck Area. **4**
- Check Auto Log Stats. **5**
- Select the Blood Pool object from the object control window. **6**
- Make sure Sample All Volumes is checked. **7**
- Click Sample Enabled Objects. **8**
- The total volume of the blood pool for each of the 18 3D volumes in the 4D multivolume will be reported in the 3D log. **9**
Right click to save the log as a .CSV file.

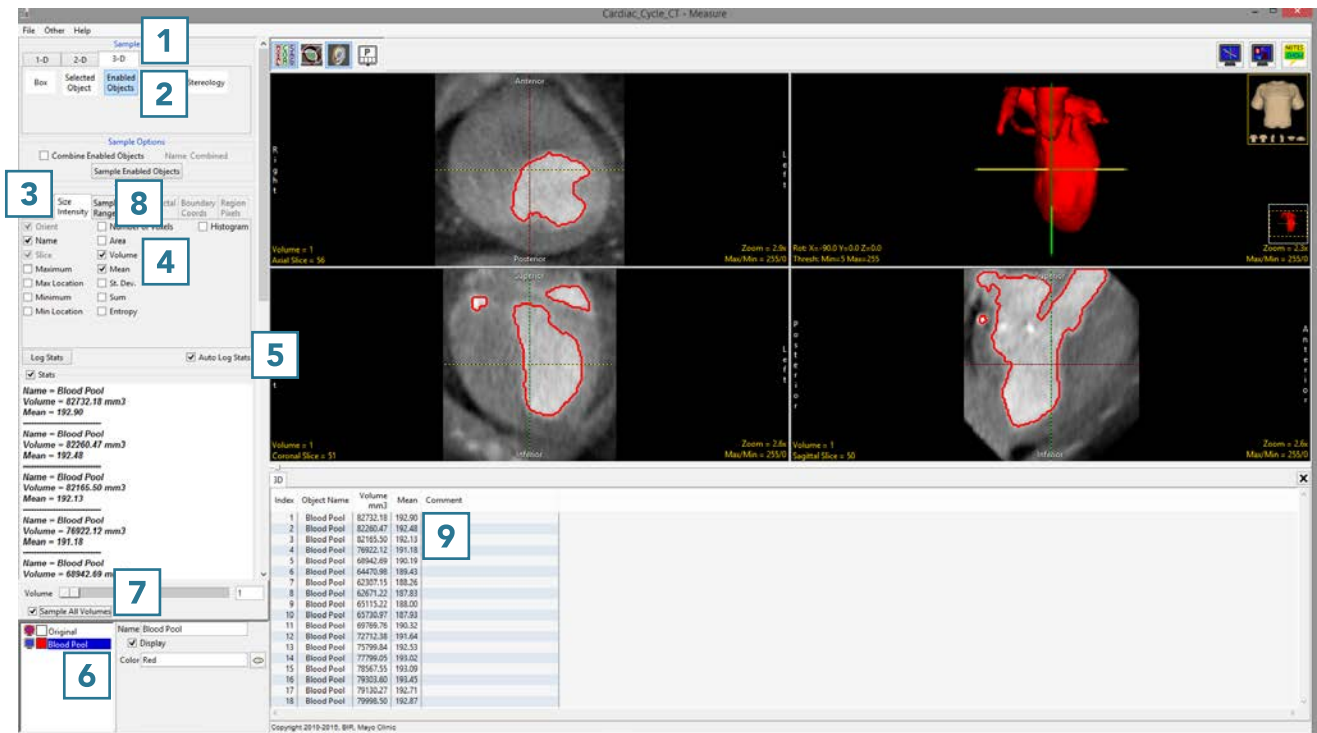


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