

OPERATION MANUAL

FOR

SUREVOLUME SYNTHESIS

(2B515-021EN*J)



IMPORTANT!

Read and understand this manual before operating the equipment. After reading, keep this manual in an easily accessible place.

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Introduction

This operation manual describes the operating procedures for the clinical application software SUREVolume Synthesis for VSTP-001A.

To ensure safe and correct operation of the product, carefully read and understand this manual and the operation manual for Vitrea before starting operation.

- * The displayed windows may differ depending on the version of the Vitrea workstation and the clinical application.

IMPORTANT!

1. No part of this manual may be copied or reprinted, in whole or in part, without prior written permission.
2. The contents of this manual are subject to change without prior notice and without legal obligation.
3. The contents of this manual are correct to the best of our knowledge. Please inform us of any ambiguous or erroneous description, missing information, etc.

Before Use

1. Indication for Use

The ^{SURE}Volume Synthesis application is intended to load volume images acquired by whole-body X-ray CT scanners, X-ray angiography systems, and MRI systems and displays fusion images.

⚠ CAUTION: Federal law restricts this device to sale by or on the order of a physician. This system is limited by law to investigational use for indications not specified in this section. This caution is for the USA only.
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Organization of the Operation Manuals

In this operation manual, the following word is used in addition to the signal words related to the safety precautions (refer to section 2 "General Safety Information"). Please read this operation manual before using the system.

NOTE: Indicates reference information that enables more efficient use of the equipment.
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Table of Contents

Before Use	3
Organization of the Operation Manuals	4
1. Application	7
2. General Safety Information	8
2.1 Meaning of Signal Words	8
2.2 Safety Precautions	9
3. About the ^{SURE}Volume Synthesis	12
3.1 Outline	12
3.2 Functions	12
3.3 Operating Principles	12
4. Operational Flow	13
5. Operating Procedures	14
5.1 Startup	14
5.2 Data Loading	15
5.3 Work Procedures	19
5.3.1 Fusion display	19
5.3.2 Setting the displayed conditions	24
5.3.3 Editing the domain	29
5.3.4 Image registration	37
5.4 Outputting the Results	42

5.4.1	Work details	42
5.4.2	Storage of movie images.....	42
5.5	Terminating the Application	43
6.	Descriptions of Windows and Buttons	44
6.1	Screen Layout	44
6.2	Basic Operation Window	45
6.3	Image Display Window	46
6.4	Display Condition Operation Window	49
6.5	Object Operation Window	49
6.6	Application Operation Window	50
7.	List of Displayed Messages	51

1. Application

This operation manual applies to the following product in which ^{SURE}Volume Synthesis (hereinafter referred to as "this application") is installed.

- VSTP-001A

2. General Safety Information

2.1 Meaning of Signal Words

In this operation manual, the signal words **DANGER**, **WARNING**, and **CAUTION** are used to indicate safety and other important instructions. The signal words and their meanings are defined as follows. Please understand their meanings clearly before reading this manual.

Signal word	Meaning
 DANGER	Indicates an imminently hazardous situation which, if not avoided, will result in death or serious injury.
 WARNING	Indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury.
 CAUTION	Indicates a potentially hazardous situation which, if not avoided, may result in minor or moderate injury.
CAUTION	Indicates a potentially hazardous situation which, if not avoided, may result in property damage.

2.2 Safety Precautions

To ensure the safety of patients and operators, observe the following safety precautions.

When "Canon Medical Systems" is selected from the Help (Central) menu, safety precautions are displayed in a language supported by VSTP-001A according to the language environment of the system. To confirm the supported languages, refer to the Language Matrix in the Help menu for Canon Medical Systems.

⚠ CAUTION: 1. Regions that are outside the reference volume image are not displayed even if they are present in the target images for fusion.

2. When 3D images are generated, image reconstruction is performed. Therefore, the resolution of the 3D images may be lower than that of the original image.

3. This application is intended for use only by a physician or under the supervision of a physician.

Analysis results must be interpreted by medical professionals for the purpose of clinical diagnosis and treatment planning.

4. The target images for loading are volume images acquired by a whole-body X-ray CT scanner, MRI system, or X-ray angiography system. The volume images should have any of the SOP Class UIDs specified below and should comply with DICOM standards.

1.2.840.10008.5.1.4.1.1.2
(CT Image Storage)

1.2.840.10008.5.1.4.1.1.2.1
(Enhanced CT Image Storage SOP)

1.2.840.10008.5.1.4.1.1.4
(MR Image Storage)

1.2.840.10008.5.1.4.1.1.12.1
(X-Ray Angiographic Image Storage)

1.2.840.10008.5.1.4.1.1.13.1.1
(X-Ray 3D Angiographic Image Storage)

5. Image distortion occurs in MRI acquisition.

- Distortion due to static field inhomogeneity
- Distortion due to the gradient field
- Distortion due to eddy currents
- Distortion due to other causes such as a ferromagnetic object

In general, distortion increases as the distance from the magnetic field center increases. In particular, greater distortion occurs in images acquired using EPI (Echo Planar Imaging) techniques such as DWI, brain perfusion imaging, and functional MRI. An increase in signal levels occurs in the regions where significant distortion occurs in the image. For details of such image distortion, refer to the imaging manual for Canon Medical Systems MRI systems.

- ⚠ CAUTION:**
6. Although Canon Medical Systems MRI systems employ an automatic function to correct image distortion due to the gradient field, acquisition may be performed without applying such image distortion correction. In general, image distortion correction is not performed for locator images. In addition, both an image that has undergone image distortion correction and an image that has not undergone image distortion correction can be reconstructed in a single acquisition. In Canon Medical Systems MRI systems, two types of correction for image distortion due to the gradient field are available: 2D and VMC (Volume Measurement Correction). In 2D, image distortion correction is performed only within the image plane, and correction in the slice direction is not performed. For details of the functions for image distortion correction (IDC, Intelligent Distortion Correction), refer to the operation manual for Canon Medical Systems MRI systems.
 - For images that have not undergone image distortion correction, significant errors may occur due to the image distortion in measurements such as distance, area, and volume.
 - For images that have not undergone image distortion correction, errors may occur in the positional relationships between two images.
Keep this in mind when using display functions in which image distortion may affect the intersection lines, the positional relationships between images, image fusion, etc.
 7. In Canon Medical Systems MRI systems, pixel value normalization is performed when images are exported or archived. As a result, the pixel values displayed in a Vitrea workstation are not exactly the same as those displayed in the MRI system.
If there is a significant difference between these values, the difference can be reduced by changing the setting for pixel value normalization, which is one of the reconstruction conditions in the MRI system. In addition, if receiver gain correction is applied in the reconstruction condition settings, the pixel values after receiver gain correction are always used in Vitrea workstations. For details, refer to the imaging manual for Canon Medical Systems MRI systems.
 8. The pixel interval displayed in Vitrea workstations indicates the image pixel interval, not the image acquisition resolution. This means that the pixel interval differs from the actual resolution. In addition, the slice interval indicates the slice interval of the reconstructed images, which may differ from the slice interval for image acquisition.
 9. The intensity of the image displayed on the screen differs from that displayed on the MRI system or other imaging systems due to differences in the display conditions such as gamma correction. The brightness of the image on the screen of a Vitrea workstation may therefore differ from that on the MRI system or other imaging systems.

- ⚠ CAUTION:**
10. If images are archived from a Canon Medical Systems MRI system to external media, the images may be stored in such a way that they can only be imported back to the MRI system. Such images cannot be handled by Vitrea workstations.
 11. If an image that has undergone IDC and an image that has not undergone IDC are generated simultaneously, the image that has not undergone IDC is stored as an intermediate image in the MRI system. These images are very similar to each other and it may be difficult to distinguish between them. It is therefore recommended that when image registration is performed in a Vitrea workstation, only the image that has undergone IDC should be registered (the intermediate image should not be registered).
 12. In order to use calculation processing functions such as ADC maps and tractography using DWI images, it is necessary to register not only $b = 0$ images but also all of the original images for the DWI images, including the images in all MPG directions, from the Canon Medical Systems MRI system. When DWI images are exported or archived, all of the original images for the DWI images must be selected and then exported or archived.
 13. In Canon Medical Systems MRI systems, images can be exported or archived in Enhanced DICOM format. In Vitrea workstations, however, there are some restrictions regarding the use of MRI images in Enhanced DICOM format. When images are exported or archived from a Canon Medical Systems MRI system to a Vitrea workstation, the Enhanced tab function must not be used.
 14. In Canon Medical Systems MRI systems, the "Send by Position", "Send by Phase", "Send by PS Image", and "Zoomed Img Transfer" menu items can be selected when images are exported or archived. However, these functions must not be selected for images to be used in a Vitrea workstation.

3. About the ^{SURE}Volume Synthesis

3.1 Outline

This application loads volume images acquired by a whole-body X-ray CT scanner, X-ray angiography system, or MRI system and displays fusion images.

This application is intended to display fusion images using volume data of the head acquired with multiple modalities.

3.2 Functions

- (1) Up to eight objects created from multiple loaded images are fused to display VR (volume rendering) images.
- (2) Two loaded volume images are fused to display MPR images.
- (3) Up to eight objects created from two loaded volume images are fused to display MIP images.

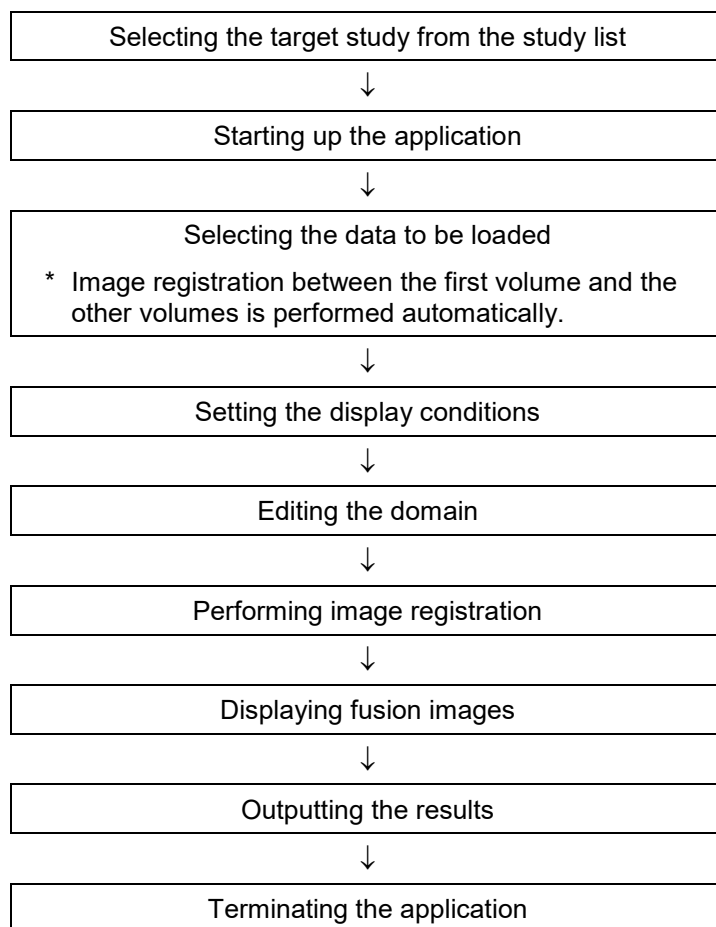
3.3 Operating Principles

References for the operating principles for registration of the multimodality image data are provided below.

References:

- W. M. Wells III, P. Viola, and R. Kikinis, "Multi-modal volume registration by maximization of mutual information," in Medical Robotics and Computer Assisted Surgery. New York: Wiley, 1995, pp. 55-62.
- Powell, M. J. D. (1964). "An efficient method for finding the minimum of a function of several variables without calculating derivatives". Computer Journal 7 (2): 155-162. doi:10.1093/comjnl/7.2.155
- Brent, R. P. (1973), "Chapter 4: An Algorithm with Guaranteed Convergence for Finding a Zero of a Function", Algorithms for Minimization without Derivatives, Englewood Cliffs, NJ: Prentice-Hall, ISBN 0-13-022335-2

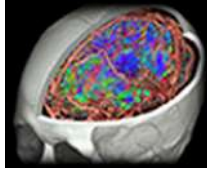
4. Operational Flow



5. Operating Procedures

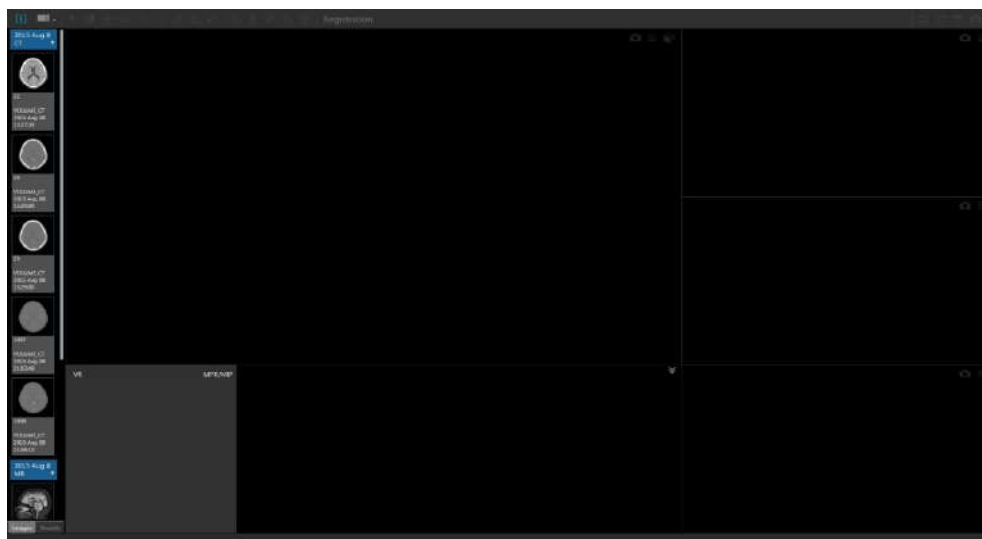
5.1 Startup

Select the target study from the study list, select the ^{SURE}Volume Synthesis icon



on the application tab, and click [Open].

The application starts up and the window shown in the figure below is displayed.



Startup window

Not only the selected study but also studies with the same patient ID as the selected study are automatically displayed in the carousel as shown in the figure below. The message is shown, when load volume has other patient information. Please check whether the patient is same before loading.

5.2 Data Loading

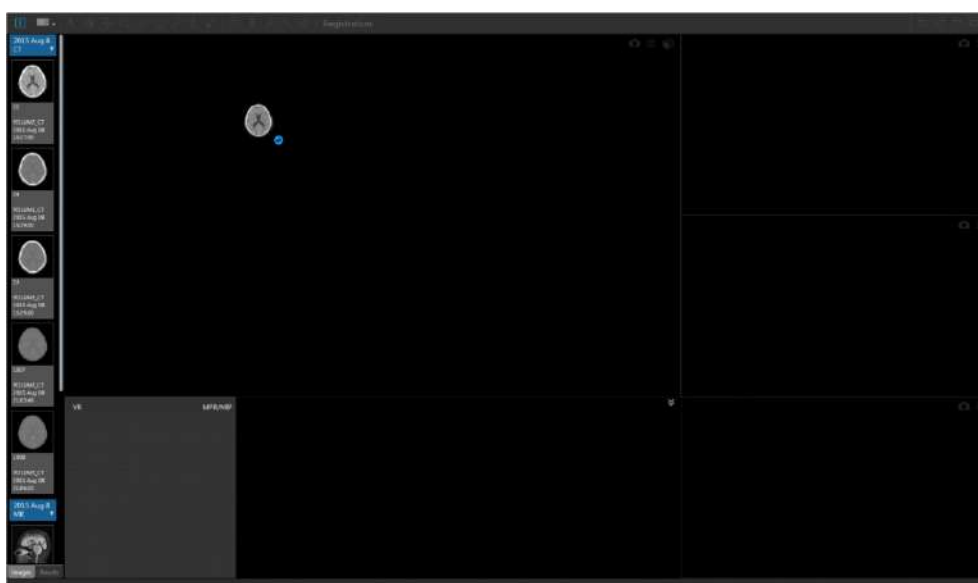
This application has several data loading methods as follows. Up to five volume images can be loaded at the same time.

⚠ WARNING: If multiple volume images are loaded, image registration is performed automatically. Be sure to confirm the image registration results. If the images are not displayed at the correct position, perform image registration manually. Especially the result of automated registration for X-ray angiography requires manual registration.

⚠ CAUTION: When loading volume images with different resolutions, perform data loading starting with the higher-resolution volume images.

Method 1: Loading volume images

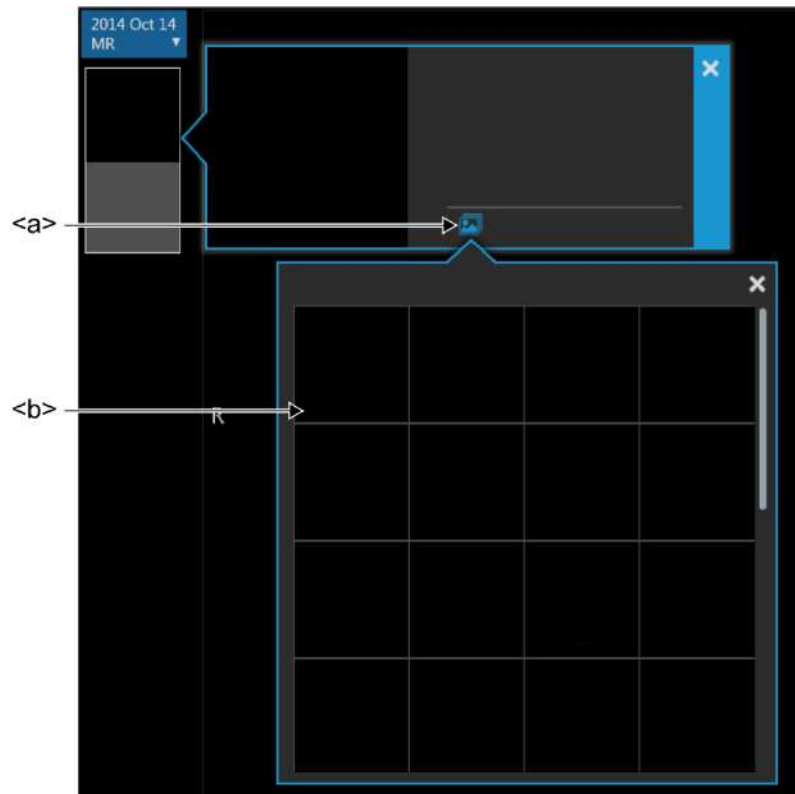
From the data displayed in the Image tab, use the mouse to drag-and-drop the target image data into the image display area. When selectable data is dragged into the image display area, the  mark is displayed.



Loading volume images

If the target image data is dragged in the area outside the image display area, the  mark is displayed. Drag the image data into the image display area.

NOTE: When a thumbnail is clicked, the following menu is displayed.



For a series with multiple volume images, clicking <a> displays the dialog . A thumbnail of each volume image is displayed in the dialog. When the displayed thumbnail of the volume image is dragged, the corresponding single volume image in the series is loaded.

Method 2: Loading the analysis result (application status data)

The analysis result is displayed in the Results tab. From the data displayed in the Results tab, use the mouse to drag-and-drop the target analysis result into the image display area. When the analysis result is loaded, the saved application status is reproduced.

When selectable data is dragged into the image display area, the  mark is displayed.

If the target image data is dragged in the area outside the image display area, the  mark is displayed. Drag the image data into the image display area.

NOTE: The maximum image file size that can be loaded differs depending on the product environment and software version of the Vitrea workstation. For this reason, the analysis results obtained using another Vitrea workstation cannot be loaded in some cases.

Method 3: Loading DTT (diffusion tensor tractography) data

DTT data generated by the DTI application (manufactured by Olea) installed in the Vitrea workstation is displayed in the Results tab. Data generated in Vitrea workstations with system software V7.3 or later can be loaded (loading of data generated in previous versions is not guaranteed).

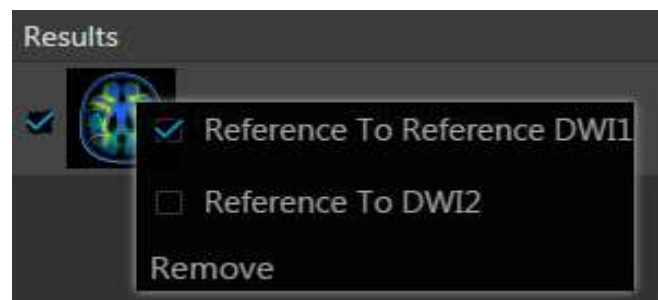
From the data displayed in the Results tab, use the mouse to drag-and-drop the target DTT data into the image display area.

When selectable data is dragged into the image display area, the  mark is displayed.

If the target data is dragged in the area outside the image display area, the  mark is displayed. Drag the data into the image display area.

⚠ CAUTION: When loading DTT data, first load the diffusion-weighted images used for generating the DTT data in order to set these images as the reference for the DTT data. Otherwise, the relative positions between images may be shifted, resulting in incorrect diagnosis.

The reference for the DTT data can be set by right-clicking the DTT data in the object operation window as shown in the figure below.



Method 4: Loading application status data

The status data for specific applications installed in the Vitrea workstation is displayed in the Results tab. Data generated in Vitrea workstations with system software V7.3 or later can be loaded (loading of data generated in previous versions is not guaranteed).

From the data displayed in the Results tab, use the mouse to drag-and-drop the target application status data into the image display area.

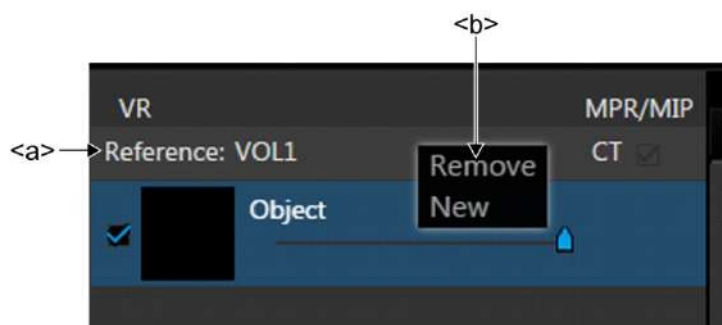
When selectable data is dragged into the image display area, the  mark is displayed.

If the target data is dragged in the area outside the image display area, the  mark is displayed. Drag the data into the image display area.

The image displayed when the application status data was generated is loaded and the domain status (refer to subsection 5.3.3) and display status (transparency, color) are reproduced.

NOTE: When loading the status data generated by loading multiple volume datasets, only the images displayed by the application at the time of generation of the status data can be loaded.

In addition, when "Remove" (in the figure below) displayed by right-clicking the upper part of the dialog (<a> in the figure below) is clicked, the volume image is unloaded. If the reference volume image is unloaded, all other loaded volume images are also unloaded.



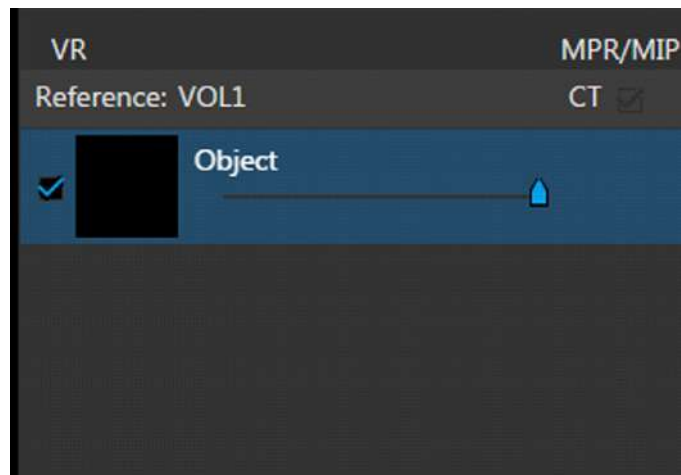
5.3 Work Procedures

5.3.1 Fusion display

Volumes are displayed in the order of loading, and the first loaded volume image is handled as the reference volume image.

⚠ CAUTION: For the second and subsequent volumes loaded, reconstruction is performed based on the pixels of the reference volume image, and the resolution of the reconstructed images may therefore be reduced.

NOTE: If the resolution of the currently displayed image is lower than that of the original image, the message indicating that the image is displayed at low resolution is displayed in the image display area.

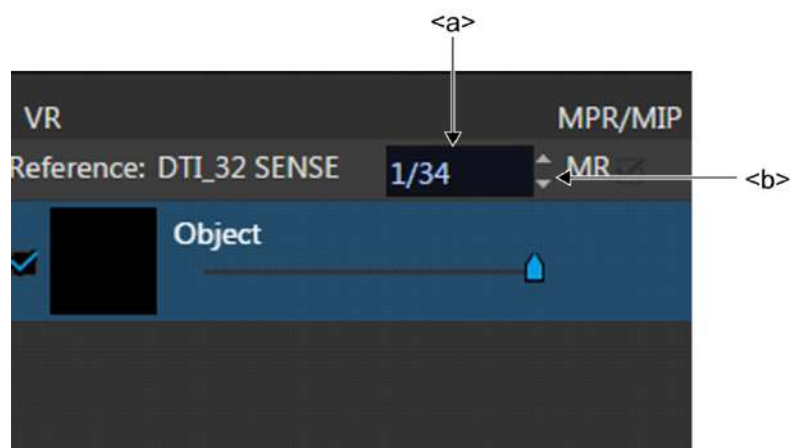


The analysis results and movie images are stored in the study containing the reference volume image.

5.3.1.1 Selecting the display volume image

If a series containing multiple volume images is loaded, the number of volumes of the currently displayed volume/the number of volumes of the loaded volumes are displayed (<a> in the figure below).

Click the arrow buttons (in the figure below) to select the volume image to be displayed.



⚠ CAUTION: Domain information and display information are carried over between volume images. If the target volume image is changed, check the display conditions.

5.3.1.2 Selecting the target objects

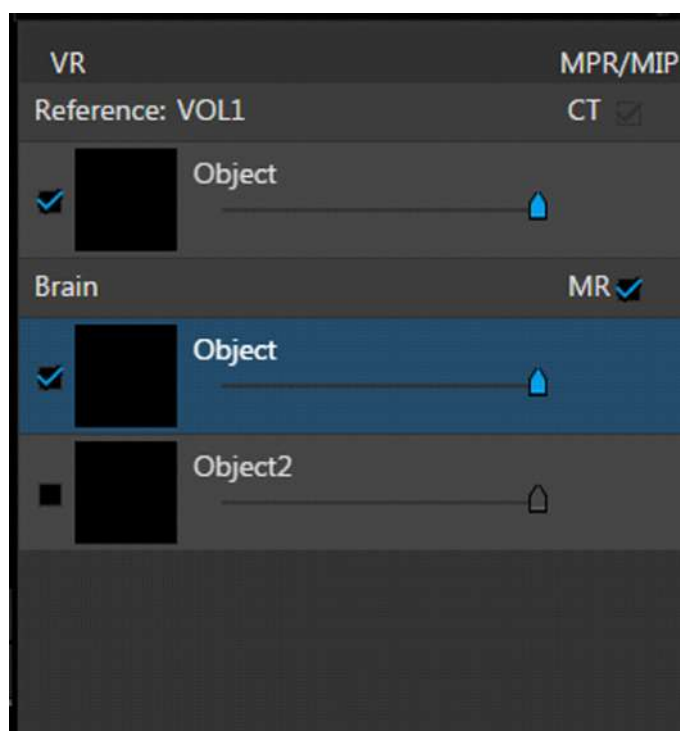
Multiple display conditions and domains (refer to subsections 5.3.2 "Setting the display conditions" and 5.3.3 "Editing the domain") can be set for a single volume image loaded in this application. The set conditions are displayed as a list for each loaded volume image. These listed conditions are referred to as "objects", and display or non-display of the objects in 3D images can be set individually.

When a check box at the left of the following dialog is selected, the corresponding object is fused on the VR images.

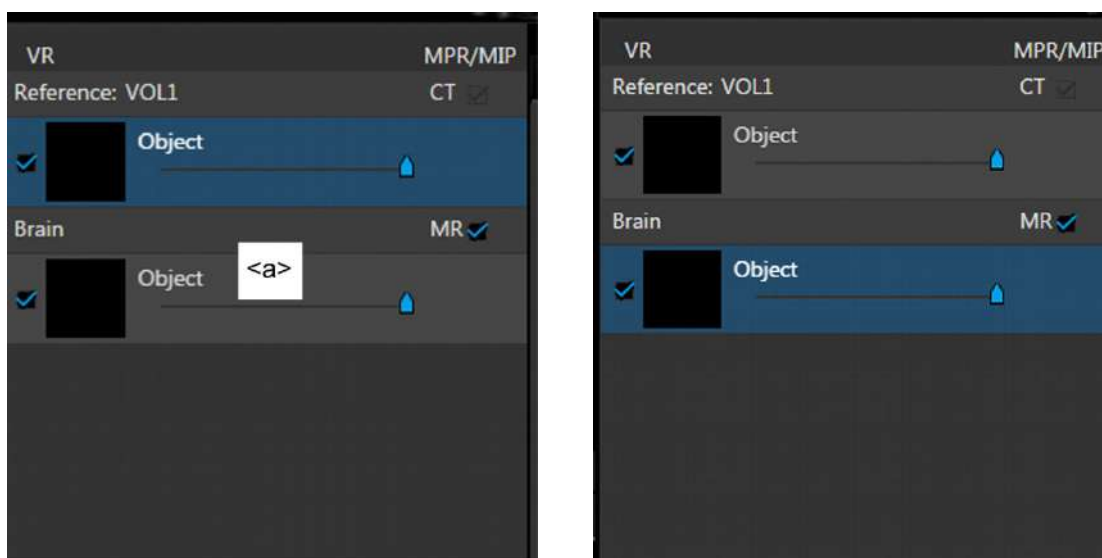
Note that the check boxes for up to eight objects can be selected at the same time for each of up to five volume images in order to display fusion images.

When a check box at the right of the following dialog is selected, the corresponding object is fused on the MIP/MPR images.

Note that the check boxes for up to eight objects can be selected at the same time for each of the reference volume image and another volume image in order to display fusion images. In addition, the transparency can be set using the slider.

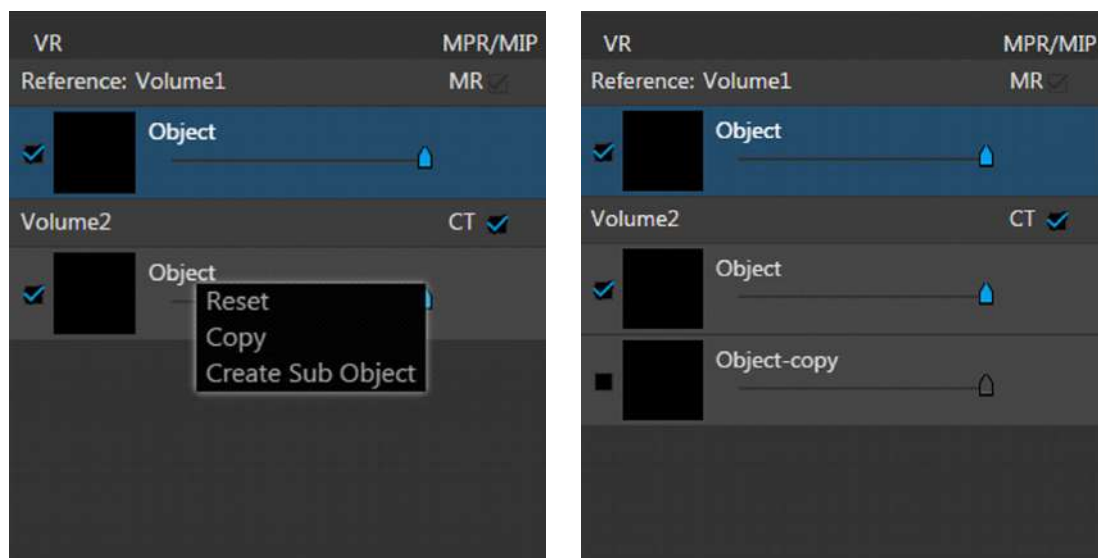


When an object (<a> in the figure below) in display status is clicked, it is displayed in deep blue and placed in the selected status as shown in the right-hand figure below. Setting of the display conditions (subsection 5.3.2) and editing of the domain (subsection 5.3.3) are possible for an object placed in selected status.



5.3.1.3 Copying an object

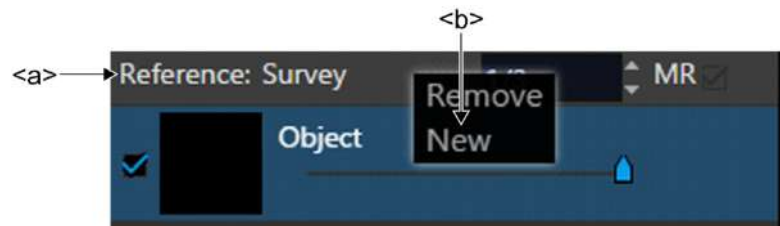
When an object is right-clicked and "Copy" is selected, an object with the same displayed conditions is newly added as shown in the figure below.



Up to six objects can be created for a single volume image.

5.3.1.4 Creating a new object

If the area indicated by <a> in the figure below is right-clicked and "New" in the displayed menu (in the figure) is clicked, a new object is created in the initial status.

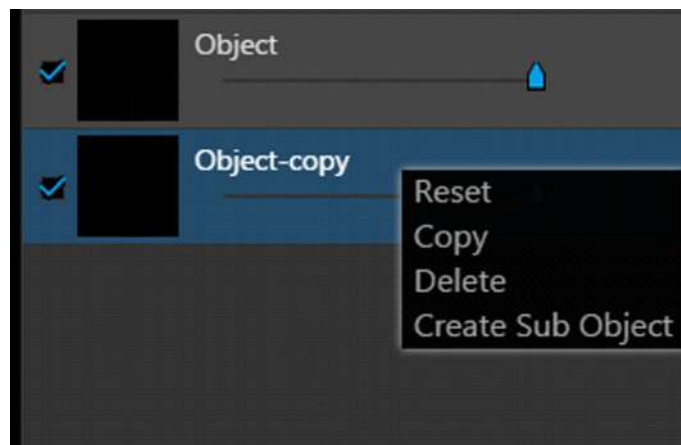


5.3.1.5 Initialization of the object

If an object is right-clicked and "Reset" is selected, the domain information and display conditions of the object are initialized.

5.3.1.6 Deleting an object

When an object is right-clicked and "Delete" is selected, the object is deleted.



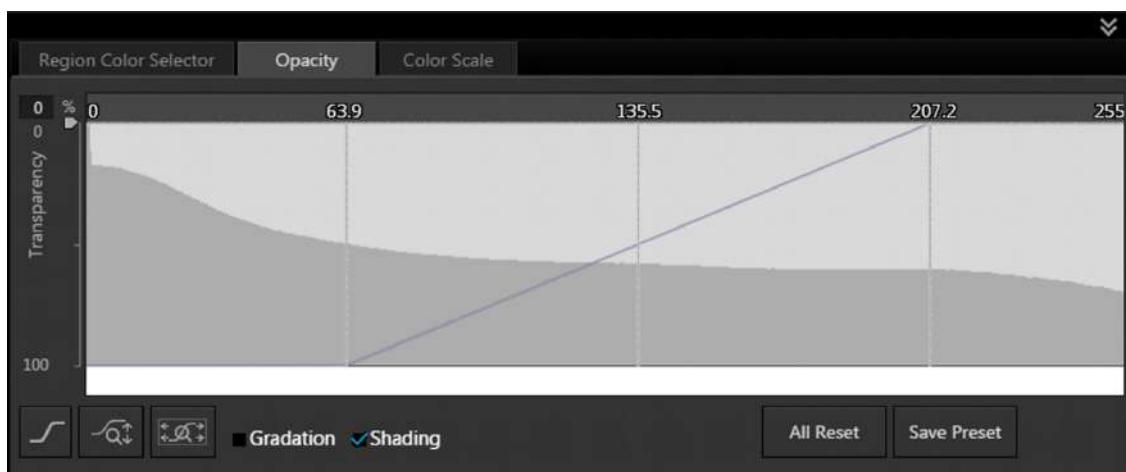
5.3.1.7 Changing a volume name/object name

When a volume name or object name is double-clicked, the volume or object name can be changed.

5.3.2 Setting the displayed conditions

NOTE: The displayed conditions are not applied to DTT objects.

The color and transparency are changed for volume rendering.



5.3.2.1 Operating the histogram

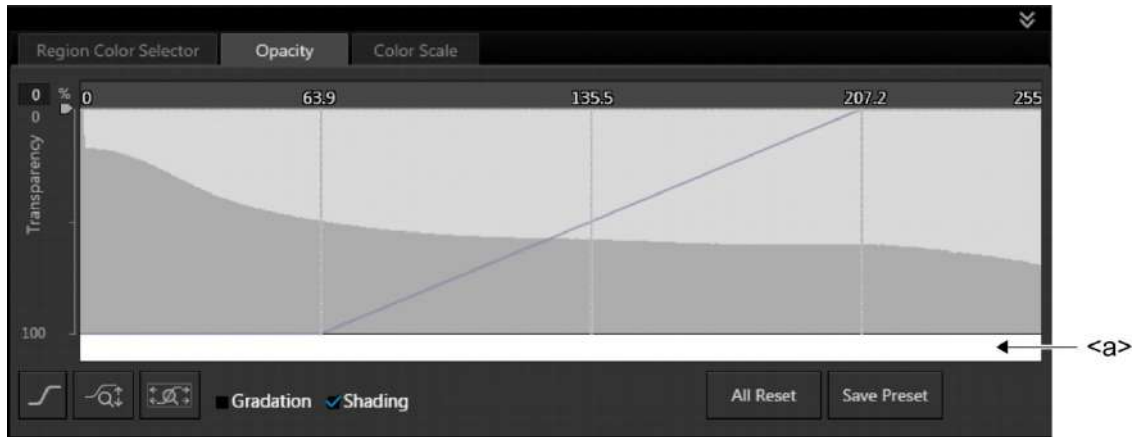
The histogram of the selected object is displayed in the histogram display area (<a> in the figure below) (refer to subsection 5.3.1.2 "Selecting the target objects"). When the mouse is dragged vertically after clicking on the Zoom button (in the figure below), the histogram can be magnified or reduced. When the Reset button (<c> in the figure below) is clicked, the display conditions of the histogram are returned to the initial status.



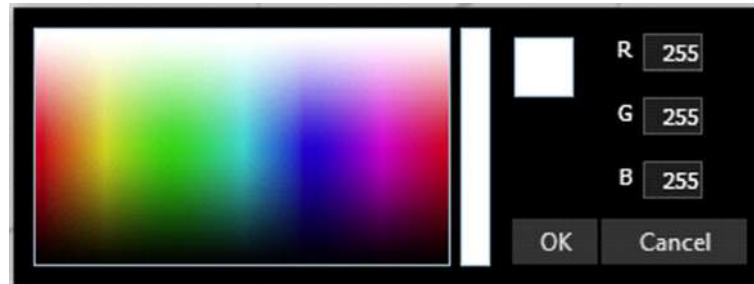
5.3.2.2 Color setting

Color setting is applied to the currently selected objects (refer to subsection 5.3.1.2 "Selecting the target objects").

Double-click the area below the histogram (<a> in the figure below) to create color control points.



When control points are newly created or the currently set control points are selected, the following dialog is displayed.



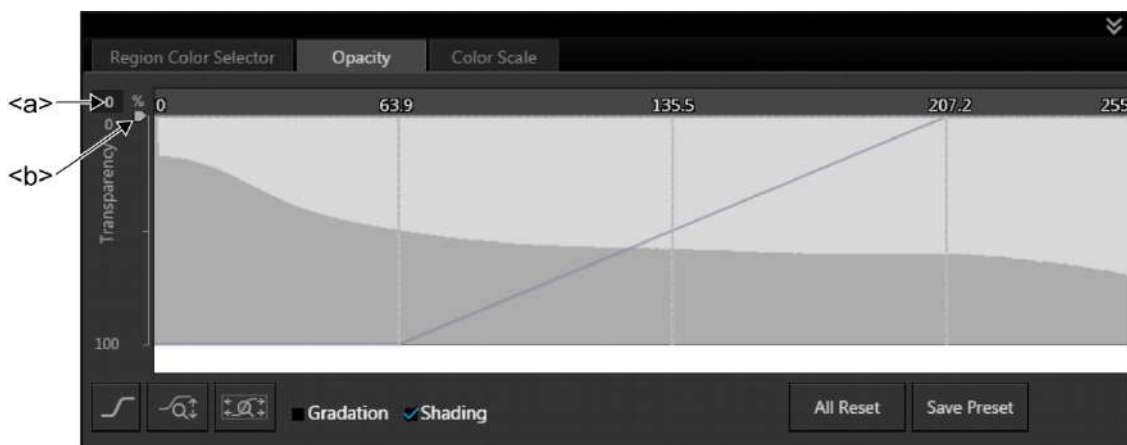
Colors can be specified by clicking the desired location in the color map or entering the desired values for RGB.

If the "Gradation" check box is selected and two or more control points are specified, interpolation is performed between the two control points based on the gradation. In addition, when the [Color Scale] tab is clicked and the displayed color bar is clicked, the color scale can be changed.

5.3.2.3 Transparency setting

Transparency setting is applied to the currently selected objects (refer to subsection 5.3.1.2 "Selecting the target objects").

Enter a value (0 to 100) in the edit box (<a> in the figure below) to set the transparency. Alternatively, drag the slider (in the figure below) to set the transparency.



5.3.2.4 Transparency curve setting

The transparency curve setting is applied to the currently selected objects (refer to subsection 5.3.1.2 "Selecting the target objects").

When  in the dialog is clicked and the desired curve is selected, the shape of the transparency curve is changed. It can also be changed by dragging  displayed in the histogram.  can be added as desired by double-clicking the window width range on the histogram.

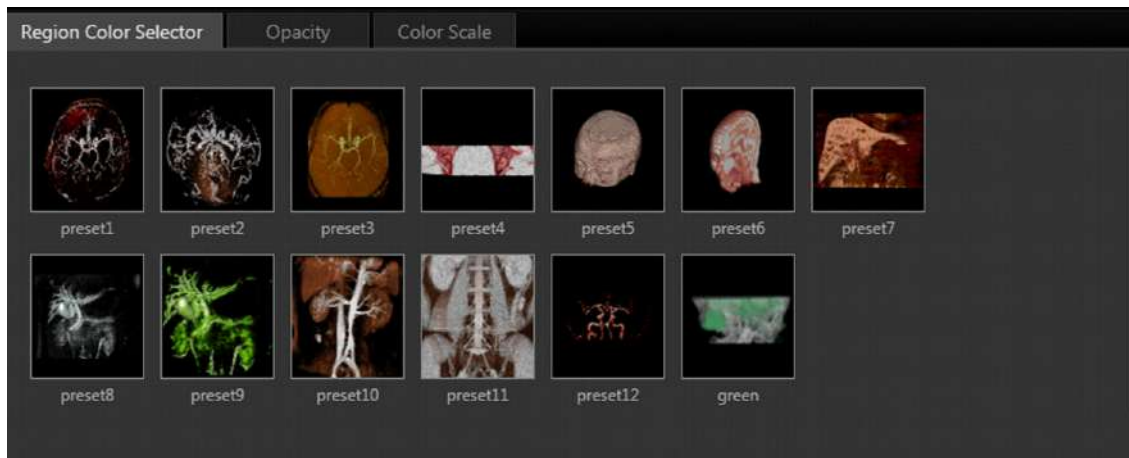
In addition, changes made by mouse operation in the VR image display area are applied to the transparency curve.

5.3.2.5 Shading setting

If a checkmark is placed, shading is applied to the VR image.

5.3.2.6 Preset setting

When the [Region Color Selector] tab is selected, the following GUI is displayed.



When one of the displayed icons is clicked, the corresponding display conditions are set.

The created unique display conditions can be saved by clicking the [Save Preset] button in the [Opacity] tab. The saved display conditions are displayed as presets in the [Region Color Selector] tab.

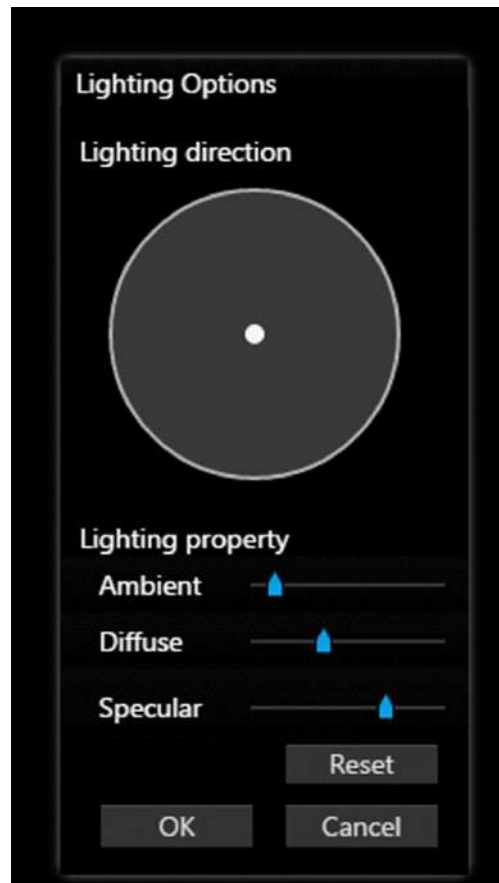
5.3.2.7 Resetting of opacity

If "All Reset" is clicked in the [Opacity] tab, the current display conditions are returned to those when the preset display conditions were last applied. If the preset display conditions have not been applied, the current display conditions are returned to those when the image data was loaded.

5.3.2.8 Setting the light source

Select "Light Options" from  in the Volume Rendering display area. The following dialog is displayed, allowing setting of the light source for Volume Rendering.

The light source settings apply to all objects.



Lighting direction

Drag or click the white dot to change the lighting direction.

Ambient

Use the slider to adjust the ambient lighting.

Diffuse

Use the slider to adjust the diffuse lighting.

Specular

Use the slider to adjust the specular lighting.

[Reset]

Used to reset the light source settings to those at the time of image loading.

[OK]

Used to apply the changed settings.

[Cancel]

Used to cancel the changes and return to the previous settings.

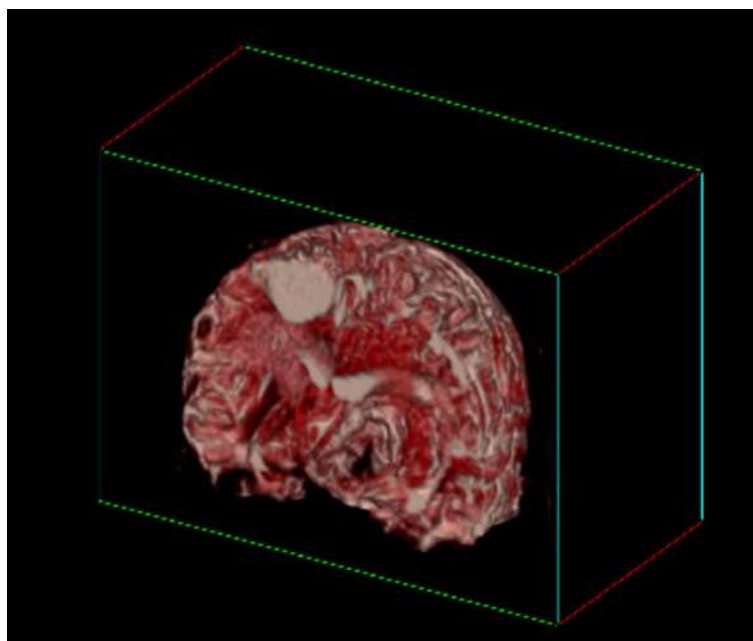
5.3.3 Editing the domain

NOTE: DTT objects cannot be edited.

In this application, display or non-display can be set for each region regardless of the transparency curve. The information concerning display or non-display is referred to as the "domain".

5.3.3.1 Clipping

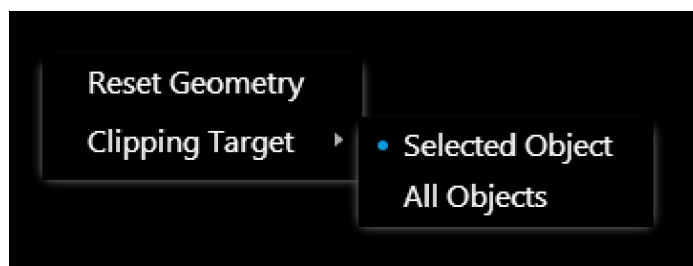
When  is set to ON, a rectangle indicating the display region of a volume is displayed on the VR image as shown in the figure below.



The display region can be changed by dragging each side or plane of the displayed rectangle.

If  in the volume rendering display area is selected and the "MPR Fusion" check box is selected, the MPR image is fused on the plane.

The clipping target can be changed in the following GUI displayed by right-clicking in the image display area.



If "Selected Object" is selected, the selected object is set as the clipping target. If "All Objects" is selected, all of the objects are set as the clipping target.

5.3.3.2 Front clipping

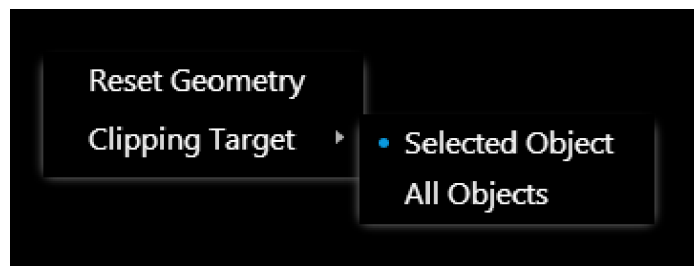
When  is set to ON, a slider is displayed on the right side of the volume rendering display area. The display region can be changed from the rear toward the front or from the front toward the rear of the screen using the slider.

When  is set to OFF, the slider is hidden and the target plane for clipping is set.

To change the plane, set  to ON and click [Reset] displayed on the slider.

If  in the volume rendering display area is selected and the "MPR Fusion" check box is selected, the MPR image is fused on the plane.

The clipping target can be changed in the following GUI displayed by right-clicking in the image display area.



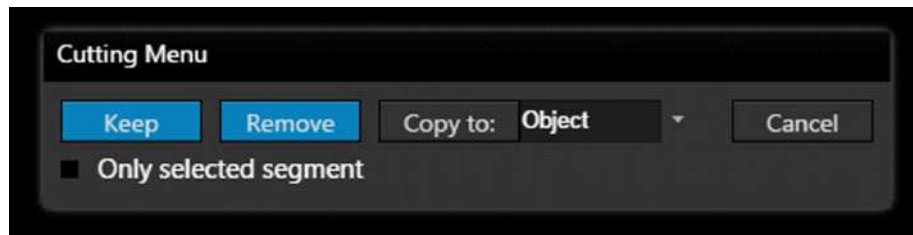
If "Selected Object" is selected, the selected object is set as the clipping target. If "All Objects" is selected, all of the objects are set as the clipping target.

5.3.3.3 Cutting

If  is set to ON, an ROI can be drawn in the VR/MPR display area using the procedures described below.

- When the mouse is dragged, a freehand ROI is drawn. The ROI is set when the mouse button is released.
- When the first point is clicked (set), a polygonal ROI is drawn. The ROI is set by double-clicking it.

When the ROI is set, the following menu is displayed.



[Keep]

Deletes the region outside the drawn ROI.

[Remove]

Deletes the region inside the drawn ROI.

[Copy to]

Adds the region inside the drawn ROI to the object selected from the edit box on the right of [Copy to]. If an object name that is not shown in the edit box is specified, a new object is created with the specified name.

[Cancel]

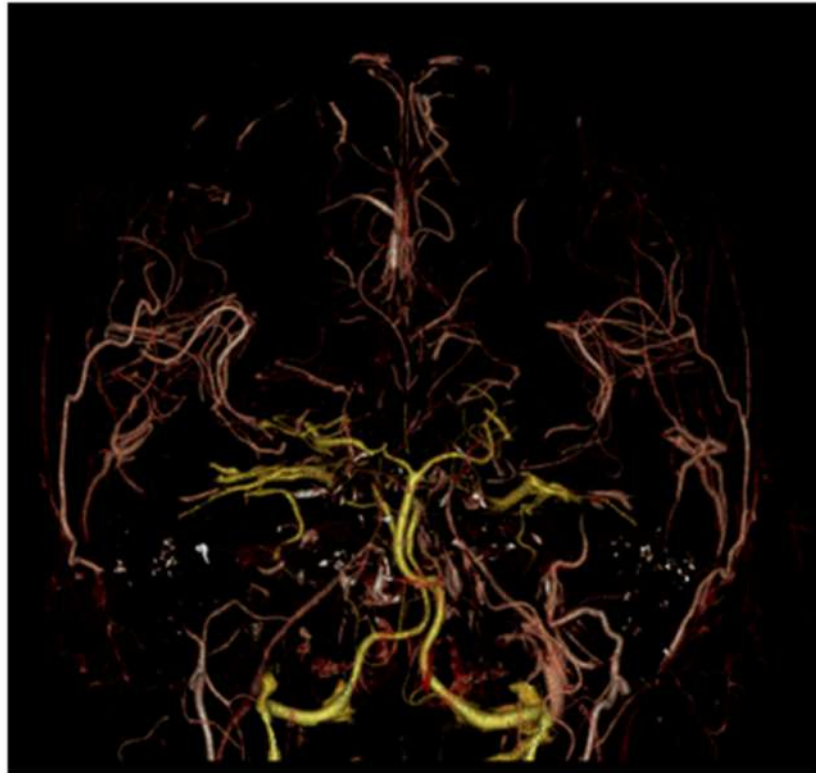
Deletes the drawn ROI.

If the check box for Only selected segment is selected, only the regions of the objects in selected status are deleted. If the check box for Only selected segment is not selected, the regions of all of the currently displayed objects are deleted.

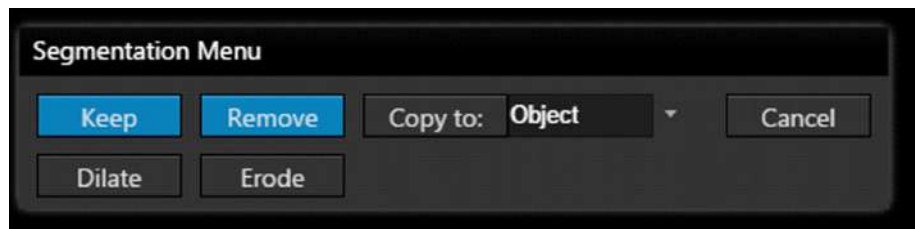
NOTE: The drawn ROI can be edited by dragging a line of the ROI.

5.3.3.4 Segmentation

If  is set to ON and the region displayed in the VR image is clicked, the region contiguous with the clicked point is extracted. The extracted region is displayed in yellow as shown in the figure below.



After clicking, the following GUI is displayed.



[Keep]

Retains the extracted region and deletes regions other than the extracted region.

[Remove]

Deletes the extracted region.

[Copy to]

Adds the extracted region to the object selected from the edit box on the right of [Copy to]. If an object name that is not shown in the edit box is specified, a new object is created with the specified name.

[Cancel]

Cancels the information for the extracted region.

[Dilate]

Expands the extracted region.

[Erode]

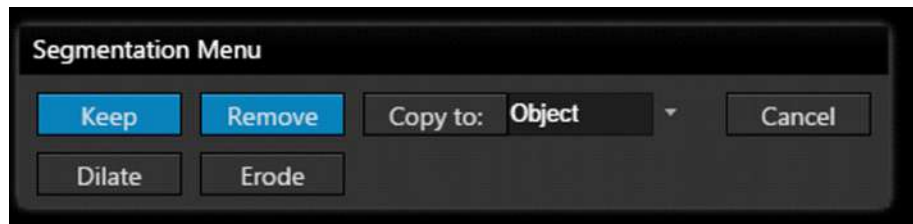
Reduces the extracted region.

5.3.3.5 Line segmentation

If  is set to ON, an ROI can be drawn in the MPR display area using the procedures described below.

- When the mouse is dragged, a freehand ROI is drawn. The ROI is set when the mouse button is released.
- When the first point is clicked, a curve ROI is drawn. The ROI is set by double-clicking it.

When the ROI is set, the following menu is displayed.



[Keep]

Deletes regions outside the ROI.

[Remove]

Deletes the region within the ROI.

[Copy to]

Adds the region within the ROI to the object selected from the edit box to the right of [Copy to]. If an object name that is not shown in the edit box is specified, a new object is created with the specified name.

[Cancel]

Deletes the drawn ROI.

[Dilate]

Expands the extracted region.

[Erode]

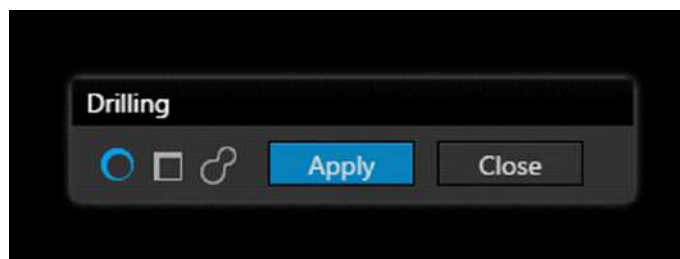
Contracts the extracted region.

NOTE: The drawn ROI can be edited by dragging the line of the ROI. A new ROI can be drawn while the menu is displayed.

5.3.3.6 Drilling

Drilling is applied to the selected objects (refer to subsection 5.3.1.2 "Selecting the target objects").

When  is clicked, an ROI is drawn in the volume rendering display area and the dialog shown below is displayed.



The region within the ROI is deleted to the specified depth.

Select ,  or Free to set the shape of the ROI.

If  or  is selected, an ROI is automatically drawn on the screen.

If Free is selected, an ROI can be drawn using the procedures described below.

- When the mouse is dragged, a freehand ROI is drawn. The ROI is set when the mouse button is released.
- When the first point is clicked (set), a polygonal ROI is drawn. The ROI is set by double-clicking it.

When the shape of the ROI is  or , the ROI can be moved by dragging it, or the size of the ROI can be changed by dragging the vertex of the ROI. In addition, the ROI can be turned by dragging  displayed outside the ROI. For the freehand ROI, the ROI can be moved by dragging it, and the shape of the ROI can be changed by dragging the edges of the ROI.

[Apply]

Deletes the specified area from the domain.
The deleted area remains deleted when drilling is terminated.

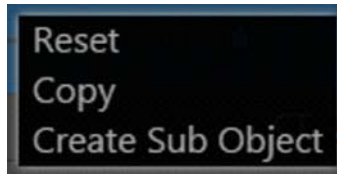
[Close]

Clears the ROI and returns the domain to the original status.

The depth to be deleted can be set by operating the mouse wheel in the ROI or dragging  on the ROI displayed on the MPR.

5.3.3.7 Subtraction

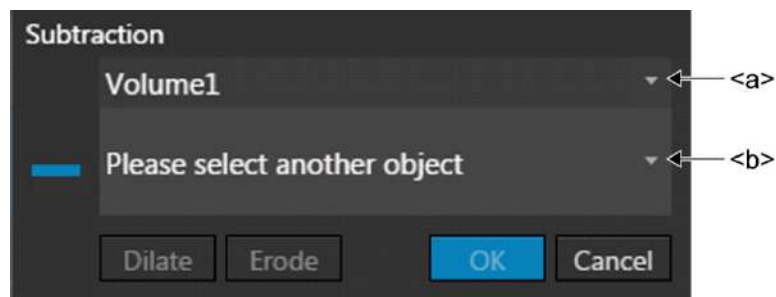
Right-click the target object in the object list. The following dialog is displayed. Click "Create Sub Object" in the dialog.



The following dialog is displayed and domain subtraction is performed between the objects (subtraction of values is not performed).

The subtraction result is stored as a new object.

The region to be deleted is displayed in yellow on the 3D MPR image.



<a> The volume containing the object to be subtracted is selected from the pull-down menu.

 The object to be deleted is selected from the pull-down menu. The thumbnails of the objects are displayed on the left of the pull-down menu.

[Dilate]

Expands the region to be deleted.

[Erode]

Reduces the region to be deleted.

[OK]

Executes subtraction.

[Cancel]

Cancels subtraction.

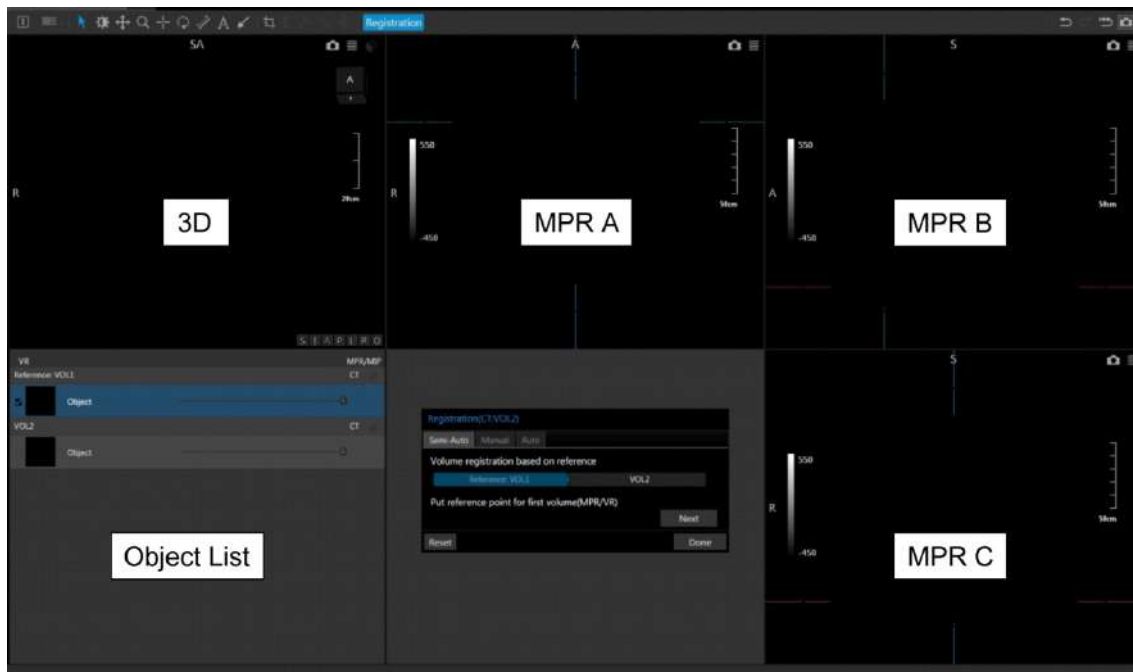
5.3.4 Image registration

Registration for two volume images is performed.

Perform image registration with two or more volume images loaded.

Perform image registration for two volume images to generate MPR fusion images (selection of the display volume image).

Click [Registration] in the application operation window to switch to Registration mode.



The image registration mode is selected by clicking the Semi-Auto, Manual, or Auto tab at the lower center of the screen.

5.3.4.1 Manual

When the Manual tab is selected, the window shown below is displayed.



[Reset]

Returns to the original status before the system entered Registration mode.

[Done]

Terminates Registration mode.

Set  to ON and drag the MPR image to move the target image relative to the reference image for image registration.

Set  to ON and drag the MPR image to rotate the target image relative to the reference image for image registration.

In manual Registration mode, the following GUI is displayed in each display area.



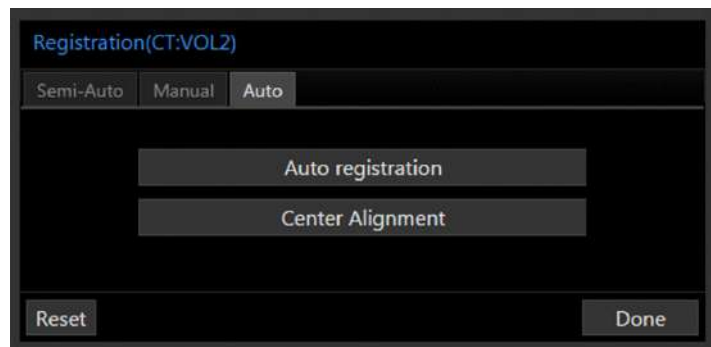
Click the arrow buttons to move the target image relative to the reference image for image registration. Each time the button is clicked, the target image is moved by the specified distance (displayed at the center of the GUI).

Click the   buttons to rotate the target image relative to the reference image for image registration. Each time the button is clicked, the target image is rotated by the specified angle (displayed at the center of the GUI).

The movement distance can be changed by clicking [+] or [-] or entering a value in the dialog displayed by right-clicking in the movement distance display area. In addition, clicking the movement distance display switches between parallel movement and rotation of the target image for display and change.

5.3.4.2 Auto

When the Auto tab is selected, the window shown below is displayed.



[Auto registration]

Performs image registration automatically.

[Center Alignment]

Performs image registration by aligning the centers of two volumes.

[Reset]

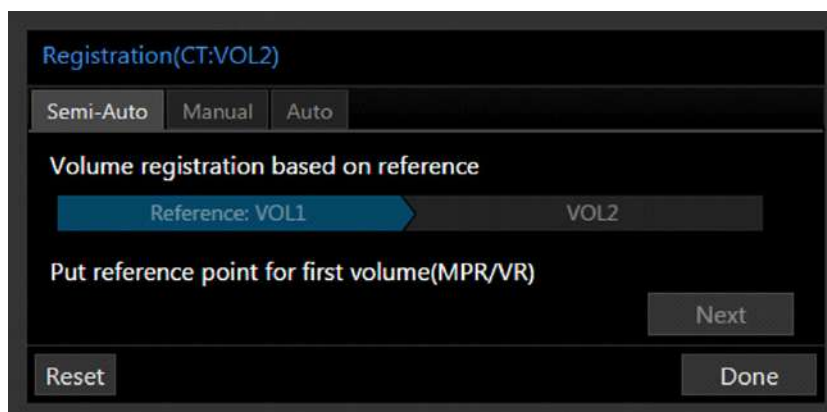
Returns to the original status before the system entered Registration mode.

[Done]

Terminates Registration mode.

5.3.4.3 Semi-Auto

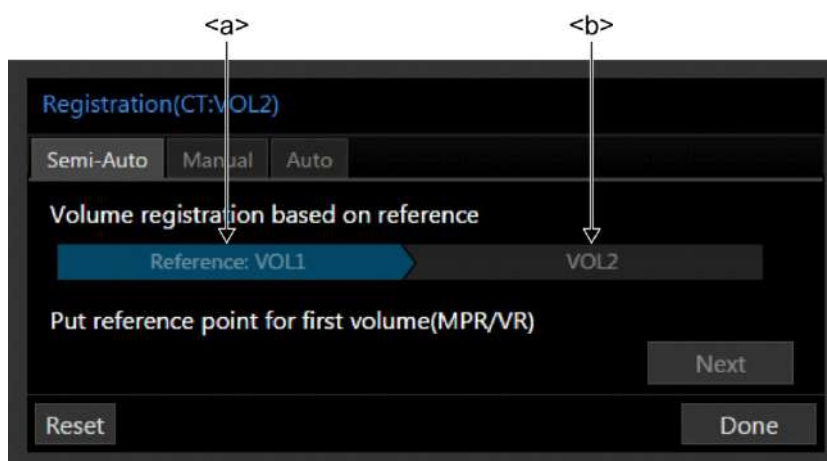
When the Semi-Auto tab is selected, the window shown below is displayed.



Set  to ON and click the reference point for registration on an MPR or VR image.

The set reference point is displayed on the VR or MPR image and can be moved by dragging it.

Confirm the point set on the reference volume image and click [Next].



After [Next] is clicked, a volume image for which the reference point is set can be changed by clicking <a> or shown in the above figure.

On the target volume image, set the reference point in the same manner as for the reference volume image and in the same region as for the reference volume image.

Confirm the point set on the target volume image and click [Execute] to perform registration based on the two points that were set.

[Reset]

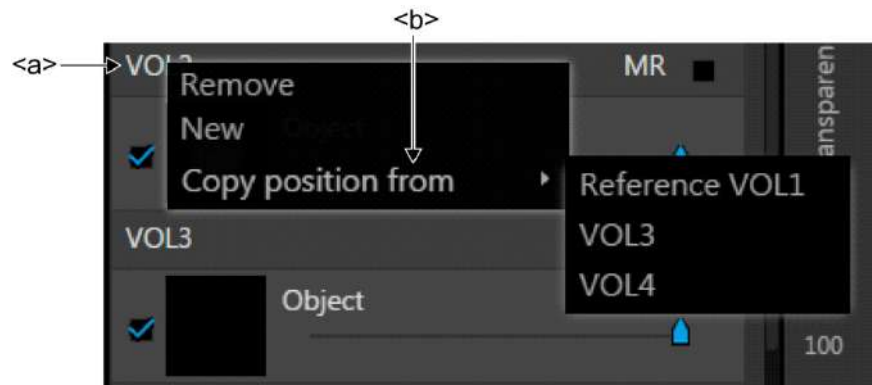
Deletes the set points.

[Done]

Terminates Registration mode.

5.3.4.4 Copying the positional information

Right-click in area<a> shown in the window, which indicates the volume other than the reference volumes in the object list. In the displayed menu, select "Copy position from" (in the following figure) and then select the desired volume image. The positional information of the selected volume image is copied.



The positional information can be copied in modes other than Registration mode.

5.4 Outputting the Results

The results are stored in the study containing the reference volume image.

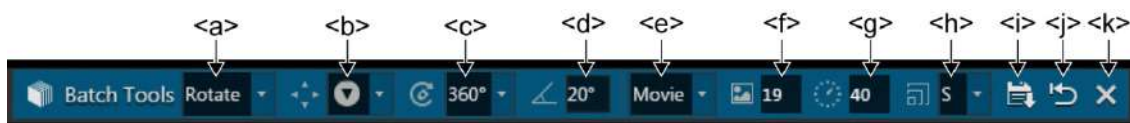
5.4.1 Work details

When  or  is clicked, the displayed window and the current application status data are saved. When  in the header of each image (such as the axial image) is clicked, the single window of the specified image and the current application status data are saved. When  on the tool bar at the upper part of the image display area is clicked, the entire screen and the current application status data are saved.

Note that the application status can be reproduced by loading the saved application status data (refer to subsection 5.2 "Data Loading").

5.4.2 Storage of movie images

Click  to open the Batch/Movie menu. The following GUI is displayed in the upper part of the screen.



The display mode is selected in <a> in the above figure. "Rotate" mode is selected by default. Batch images or movie images can be generated by specifying the rotation direction, rotation angle, and number of images to be saved.

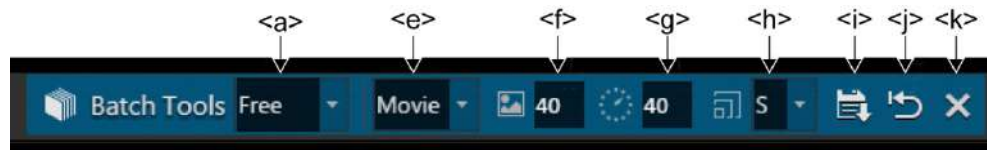
Select the rotation direction from the pull-down menu (in the above figure). Select the rotation range from the pull-down menu (<c>). Specify the pitch angle (<d>). Select "Batch" or "Movie" as the save format (<e>). Specify the total number of images to be saved (<f>). Note that the total number of images (<f>) and the pitch angle (<d>) are linked with each other. When either value is changed, the other value changes accordingly. Specify the matrix size of the images to be saved (<h>). Specify the movie length (<g>). The movie length (<g>) is displayed only when "Movie" is selected. After setting is completed, click the Save icon (<i>).

When "Movie" is set as the save format and the Save icon is clicked, the movie images are saved as files in a general movie image format.

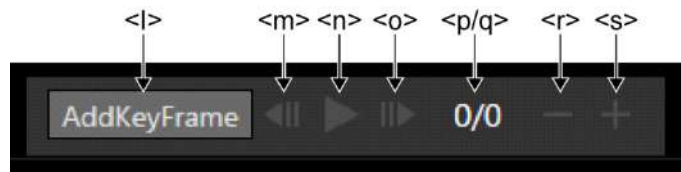
The saved files can be downloaded from the study list.

When the Reset icon (<j> in the above figure) is clicked, the setting values are returned to the initial values. When the Close icon (<k>) is clicked, the Batch/Movie menu is closed.

When "Free" is selected from the pull-down menu (<a> in the above figure), key frame movie images can be generated. The Batch/Movie menu is displayed as shown in the figure below. Note that menu items <e> to <k> are the same as described above for "Rotate" mode.



In addition, the following Key Frame menu is displayed in the lower part of a VR image when [Free] is selected.



When the [AddKeyFrame] button (<l> in the above figure) is clicked, the currently displayed 3D image is set as a key frame and registered. The registered key frame is displayed as a thumbnail below the Key Frame menu.

At the time of image saving, if the number of frames specified in <f> exceeds the number of registered key frames, movie images are created by automatically interpolating the frames between the key frames.

Preview display can be performed using menu items <m> to <s> in the above figure.

<m> Displays the previous frame.

<n> Starts/stops playback of the preview image. The button changes according to the playback status.

<o> Displays the next frame.

<p> Displays the currently displayed frame number.

<q> Displays the total number of frames.

<r> Slows down the preview playback speed.

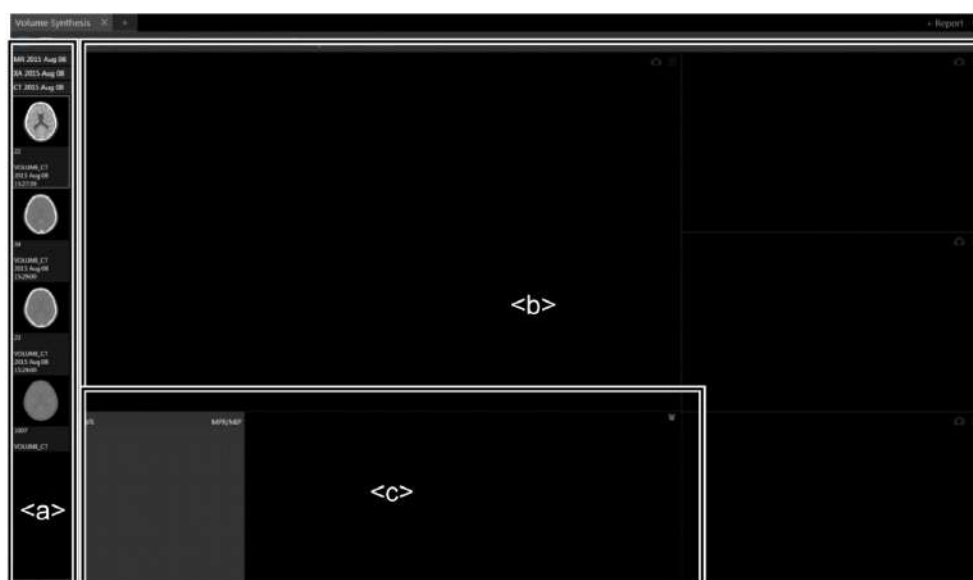
<s> Speeds up the preview playback speed.

5.5 Terminating the Application

Click the [x] button in the ^{SURE}Volume Synthesis tab to terminate the application.

6. Descriptions of Windows and Buttons

6.1 Screen Layout



<a> Carousel area

Thumbnails of the images and results that can be loaded are displayed.

The thumbnails can be switched between the images and results by selecting the tab at the bottom of the area.

 Image display area

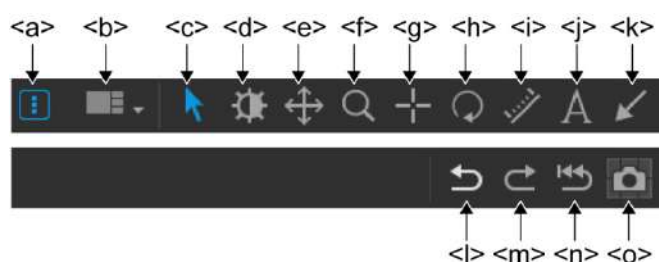
The loaded volume image is displayed.

<c> Opacity/object operation area

The GUI used in operation in the Opacity/object operation area is displayed.

Clicking  closes the area. Clicking  opens the area again.

6.2 Basic Operation Window



<a> Sets display or non-display of the carousel.

 Changes the image layout.

<c> Sets  to ON for dragging the MPR image to set the display plane.

<d> Sets  to ON for changing the window level and window width by dragging the mouse.

<e> Sets  to ON for image roaming (panning). The other planes are moved accordingly in the same direction relative to the body.

<f> Sets  to ON for changing the magnification ratio by dragging the mouse.

<g> Sets  to ON and moves the intersection of the MPR images to the clicked point.
If the region in which an object is displayed on a VR image is clicked, the intersection of the MPR image is moved to a point corresponding to the clicked point.

<h> Sets  to ON for dragging the MPR or 3D image to adjust the image display angle.
When the mouse is dragged on a 3D image while holding down the Ctrl key, the 3D image is turned in the clockwise or counterclockwise direction.

<i> Sets  to ON and measures the distance on a VR image. The measurement point is not set in 3D space but in 2D space.

<j> Sets  to ON for entering text on a VR or MPR image.
When the entered text is right-clicked, the size of the text can be changed.

<k> Sets  to ON for drawing an arrow on a VR or MPR image.

When the drawn arrow is right-clicked, the length of the arrow can be changed.

<l> Cancels the previous operation (Undo).

<m> Cancels the previous Undo operation (Redo).

<n> Returns the application to the original status when the first volume image or results are loaded.

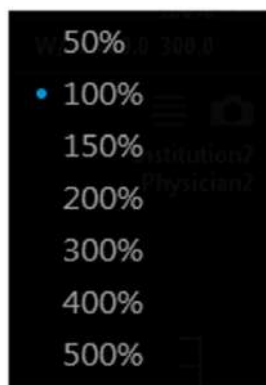
<o> Sets  to ON for saving the application status data and a screen capture image of the entire displayed screen as a DICOM SC image.

6.3 Image Display Window



Click the projection mode displayed in the image display area. The menu shown in the above figure is displayed.

The MPR projection mode can be changed from the menu. The projection mode can be selected from among "Minimum", "Average", and "Maximum".



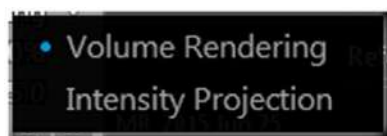
Click the magnification ratio displayed in the image display area. The menu shown in the above figure is displayed.

The magnification ratio can be changed from the menu.



Click the window width and window level displayed in the image display area. The menu shown in the above figure is displayed.

The window width and window level can be changed from the menu.



Click the rendering mode displayed in the image display area. The menu shown in the above figure is displayed.

The display mode can be switched between Volume Rendering and Intensity Projection from the menu.

⚠ CAUTION: The target objects for fusion differ between Volume Rendering and Intensity Projection. Be sure to confirm the target objects for fusion.

SIAPLRO

Rotates the 3D image so that it can be viewed from the specified direction.

S : From the head

I : From the foot

A : From the front

P : From the back

L : From the left

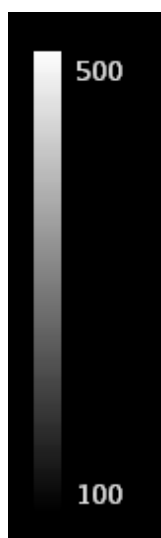
R : From the right

O : From an oblique direction



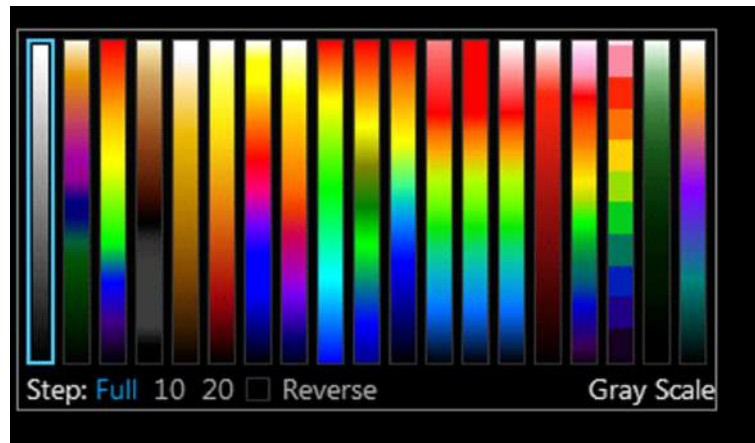
The fusion ratio of the reference image to the target images for fusion in MPR or MIP can be changed using the slider.

In addition, the targets for brightness change (by mouse operation etc.) can be changed by clicking the volume name.

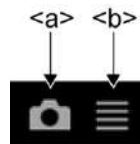


The LUT for MPR and MIP is changed.

If the right mouse button is clicked, the following dialog is displayed. The LUT type, number of steps, and reverse setting can be changed.



If the mouse button is clicked, the LUT target can be changed. The target set here corresponds to the target to be changed by the fusion ratio slider.

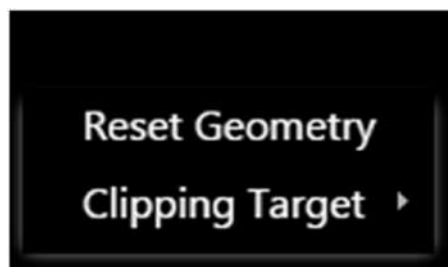


<a> The system saves the application status data and a screen capture image of the single window of the specified image as a DICOM SC image.

 The following items can be set.

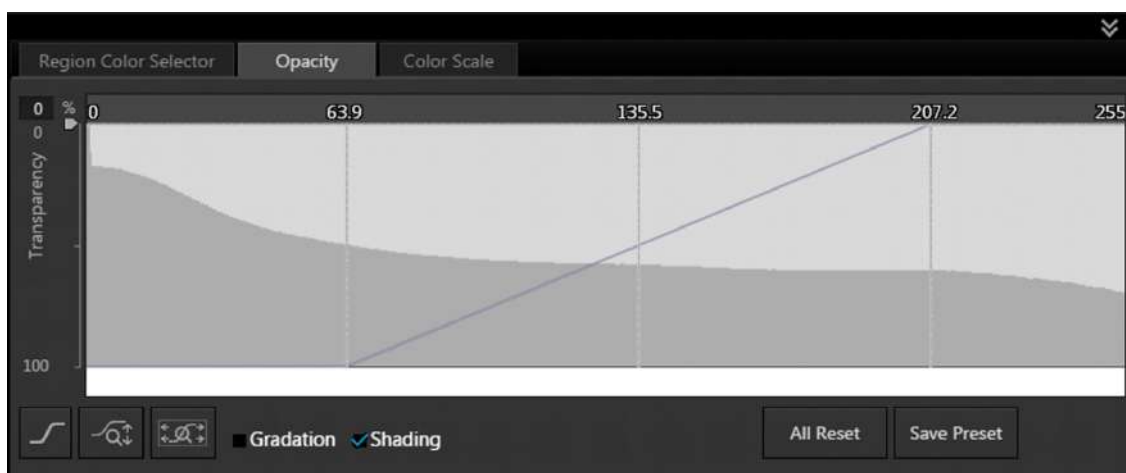
- Display or non-display of demographics
- Display or non-display of the intersection lines (MPR only)
- Display or non-display of an MPR fusion image on the target plane for clipping (VR only)
- Switching ON/OFF of high-resolution display (VR only)
If the corresponding check box is selected, a VR image is displayed at high resolution. If processing such as image rotation is performed, image resolution is returned to the standard state.
- Changing the background color (VR only)
- Changing the Lighting Option (VR only)

If the right mouse button is clicked in the volume rendering image display area, the following dialog is displayed.



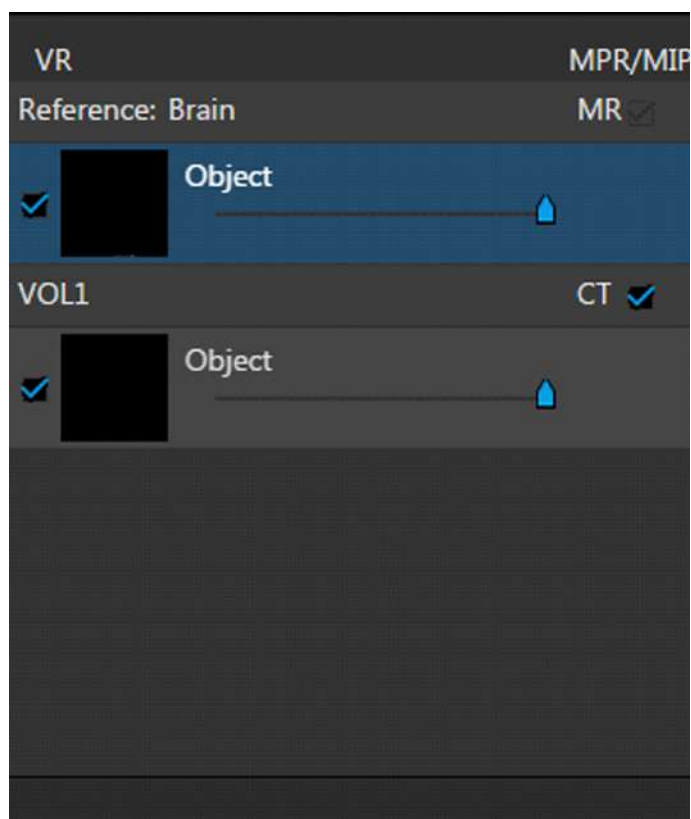
- Reset Geometry
3D image operations (zoom, pan, rotate) can be reset.
- Clipping Target
The clipping target can be changed. For details, refer to subsections 5.3.3.1 "Clipping" and 5.3.3.2 "Front clipping".

6.4 Display Condition Operation Window



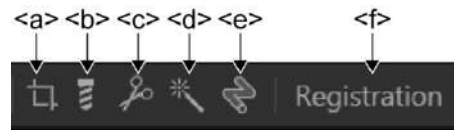
In this window, the display conditions are set. For details, refer to subsection 5.3.2 "Setting the displayed conditions".

6.5 Object Operation Window



In this window, operations are performed on objects. For details, refer to subsection 5.3.1 "Fusion display".

6.6 Application Operation Window



<a> Sets  to ON for clipping. For details, refer to subsection 5.3.3.1 "Clipping".

 Sets  to ON for drilling. For details, refer to subsection 5.3.3.6 "Drilling".

<c> Sets  to ON for cutting. For details, refer to subsection 5.3.3.3 "Cutting".

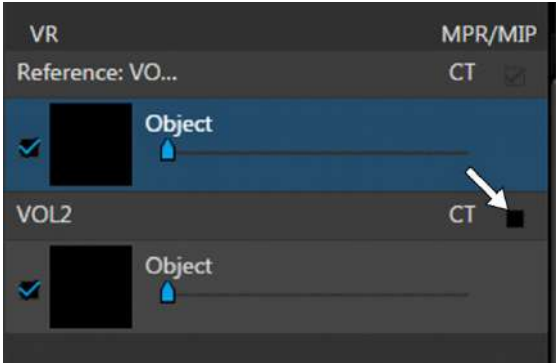
<d> Sets  to ON for segmentation. For details, refer to subsection 5.3.3.4 "Segmentation".

<e> Sets  to ON and performs line segmentation. For details, refer to subsection 5.3.3.5 "Line segmentation".

7. List of Displayed Messages

The following messages may be displayed in an application. If any of the following messages is displayed, take corrective action as necessary according to the displayed message.

Message	Action to take
The registration result is wrong probably. Please do registration manually.	This message is displayed when X-ray angiographic images have been loaded. Confirm the image registration results and perform image registration manually if required.
Fail to load this data. The number of loaded volumes has reached the limit. Please remove one volume before loading new data.	The number of volumes that can be loaded at one time is up to 5 volumes. From the object list, remove unnecessary volumes from among the volumes that have already been loaded and then perform image loading again.
All objects will be removed. continue?	If a volume is removed from the object list, all objects created from the volume are also removed from the object list. If the analysis results are required, save them before deleting the volume.
If remove reference volume, all volumes will be removed. continue?	If the reference volume is removed from the object list, all of the subsequently loaded volumes and objects created from them are also removed from the object list. Save the required volumes and objects using the snapshot function etc. before deleting the reference volume.
Fail to load this data. This data is already loaded.	A volume that has already been loaded cannot be loaded again in this application. If it is necessary to copy an object, use the object copy function.
Patient name or birth date is different from master volume. Do you still want to load this data?	This message is displayed if the patient name or date of birth of the loaded volume differs from that of the reference volume. Confirm that the volume is for the same patient and then continue image loading.
Application is still loading data.	This message is displayed if an attempt is made to perform image loading while another image is being loaded. Wait until the other image has been loaded and then perform image loading again.
Loading selected series will exceed image size limitation.	The upper limit for loaded volumes is exceeded. Delete unnecessary volumes and then perform image loading again.
The current finding will be replaced. Continue?	Yes : The current application display status is switched. No : Operation is canceled.
Semi-auto registration is not done. The point information will be lost if you exit semi-auto mode now. Continue?	This message is displayed if the Auto tab or Manual tab is clicked before semi-auto image registration is completed. To continue semi-auto image registration, click [No]. To interrupt semi-auto image registration, click [Yes].

Message	Action to take
Please display one more volume by MPR/MIP checkbox for Semi-Auto Registration.	This message is displayed if the [Execute] button on the Semi-Auto tab is clicked when only one MPR/MIP volume is displayed. Place a checkmark in the MPR/MIP checkbox shown in the figure below to display another volume for semi-auto image registration. 
Please load and select reference data for registration.	This message is displayed when a BOLD image has been loaded. Load the original image of the BOLD image and set it as the reference for image registration.
The application state will be reset. Continue?	Yes : The current application display status is reset. No : Operation is canceled.
The application cannot be started. There are no valid images.	This message is displayed if the selected study contains no images that can be loaded into this application.
The fiber has been loaded.	This message is displayed if an attempt is made to load DTT data that has already been loaded.
No volume is shown, Please show at least one volume.	This message is displayed if no objects are selected for batch saving. Select the objects to be saved.
Reference name might not match. Please relink bold data to reference data for registration.	This message may be displayed when an old analysis result containing a BOLD image has been loaded. Set the original image of the BOLD image as the reference for image registration.
The images cannot be loaded. Please select other images.	Confirm that the loaded image data complies with DICOM standards. In addition, terminate the application and then start up the application from the study list again.
Information about the application state cannot be saved. An unknown error has occurred.	Perform saving again.
Information about the application state cannot be loaded.	Load the results again.
Failed to check license. Please confirm whether there is valid license	This message is displayed if the license is not installed or the license expiration date has passed. Contact the system administrator.

Message	Action to take
The movie(s) cannot be saved. The files size of created movie is too big.	This message is displayed if the file size of the created movie exceeds the upper limit for storage. Adjust the image size and/or the movie length to reduce the movie file size, and save the movie file again.
After this operation, most of the regions will not be overlapped with reference volume. Continue?	This message is displayed when the positional information is copied and (as a result of image alignment processing) most or all of the regions of the target volume image cannot be overlapped on the reference volume image. Check the volume images.
Failed to save image. Please add at least two key frames.	Take action as instructed in the message.
The movie(s) cannot be saved. Please add at least two key frames.	Take action as instructed in the message.

For Europe:

This equipment meets the requirements of the Restriction of the Use of Certain Hazardous Substances (RoHS) directive (Directive 2011/65/EU) and the Medical Devices directive (Directive 93/42/EEC). Note that compliance with the RoHS directive is ensured under the sole responsibility of the manufacturer.



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