# CT Viewer Volume Mode

The Volume mode is used to display CT scanner data in a full volume image. The data set can be rendered in various modes, including Volume Rendering, Photorealistic Volume Rendering (PRVR), Minimum and Maximum Intensity Projection (MIP and MinIP), Volume Intensity Projection (VIP), and Surface MIP. The Volume viewer opens in the Volume Explorer mode.
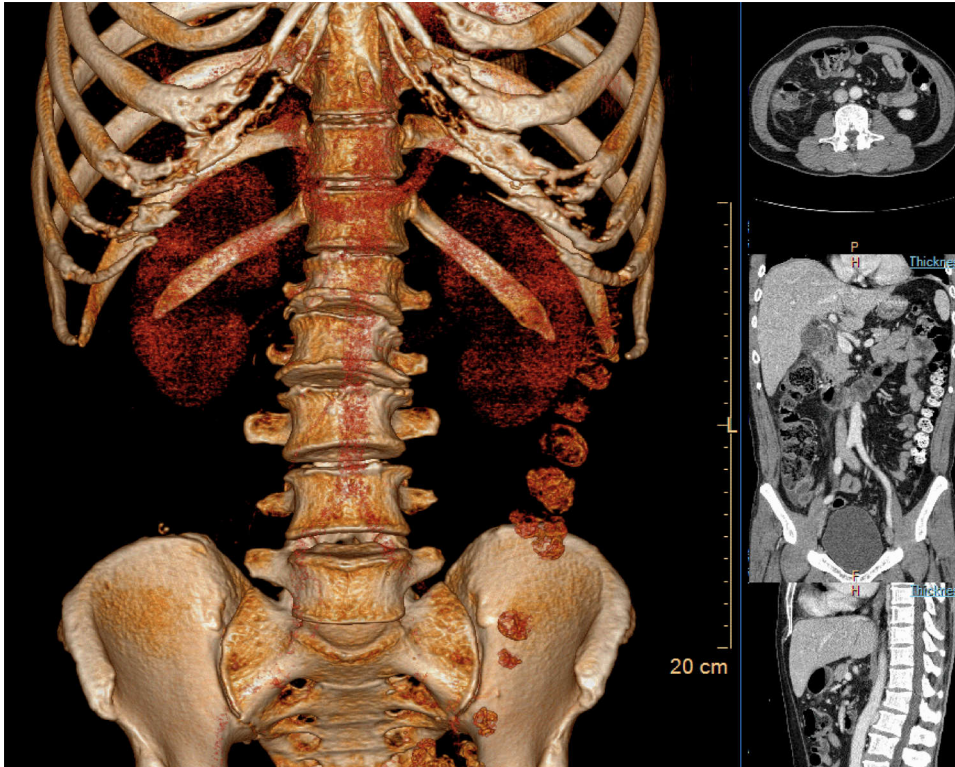
⚠ **WARNING**

Verify correct semi-automatic volume segmentation for bed, head holder, Bone and Skull removal operations.

Load Multiple Studies in Application

To load multiple studies in the application:

1. Use the **Ctrl** key when selecting studies from the Directory list.
2. Select the application from the Applications menu.
3. Confirm the studies are from the same patient.

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NOTICE

When loading data into an application, ensure the orientation shown on the images is consistent with the images' appearance. This precaution is required for data that contains wrong orientation information because the data will be incorrectly presented within the application.

Volume Viewer Tools

The tool panel of the Volume mode consists of a variety of buttons, boxes, and tabs that allow you to access the available functions.

The upper third of the panel provides functions for selecting and manipulating images, plus some Common Tools.

The middle third of the panel provides function tabs: Series, Volume Explorer, Bookmarks, Curve, Tissue Segmentation, Clip & 3D Segmentation, Batch, Tissue Management, and Fusion functions.

The lower third of the panel consists of the majority of Common Tools. Common tools provide many basic functions, including saving, filming, reporting, scrolling, measurements/annotations, panning, zooming, rotating, and windowing.

Orientation

Use these buttons to select the viewing orientation of the main viewport: axial, coronal, or sagittal.

Flip

Use this button to flip the image in the main viewport right to left.

Layout Manager

The Layout Manager allows you to perform various layout (display) management functions.

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Glass View/Show Transparent

Click Glass View to view all volumes removed by either bone removal or clipping. Click Show Transparent to view, in a semi-transparent mode, all volumetric anatomy that you have removed using various sculpting, clipping, or other tissue functions. (Bone is shown with less transparency than other tissues.)

High Quality

This function adjusts the rendering parameters to display a sharper image to enhance details.

Calculate Volume

Click this button to calculate the volume of the currently active tissue(s). Clicking the button changes the volume image so the protocol is at100% opacity. A blue highlight appears on the reference images. The calculated volume is that of the pixels colored blue on the reference images.

See **Report**, **Film**, **CT Common Processes** and **CT Common Tools** for information on using common options, tools, functions, and processes.

Volume Viewer Layout

Two default layouts are available, 1+3 and 2x2. The currently active layout is displayed as the icon. Click the down arrow to select the alternate layout.

In the 1+3 layout, the images consist of the volume image in the main viewport and the axial, coronal, and sagittal images from top to bottom in the reference viewports.

The 2x2 layout has the same views as 1+3, but is arranged differently, as shown in the diagrams at right.

Compare

The Compare function allows you to perform a side-by-side review of selected images.

See **Report**, **Film**, **CT Common Processes**, and **CT Common Tools** for information on using common options, tools, functions, and processes.

Rendering Modes

There are seven image rendering modes available in the Volume viewer:

- Average (not available with the volume image)
- MIP
- VIP
- MinIP
- Surface MIP
- Volume Rendering
- Photorealistic Rendering

See **Report**, **Film**, **CT Common Processes** and **CT Common Tools** for information on using common options, tools, functions, and processes.

Volume Rendering and Photorealistic Rendering Presets

To access the catalog of Volume Rendering and Photorealistic Rendering protocol presets: Click the Viewport Control protocol title.

Or click the **Change Preset** button in the Tissue Management tab.

The PRVR window opens at the left side of the main viewport. This window displays color icons representing the available rendering protocol presets. Click on an icon to activate the preset. The volume image updates accordingly.

The size and shape of anatomies can change when tweaking a protocol. To prevent wrong interpretation, follow the recommended protocol modification procedure in the Common Processes section.

NOTICE

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WARNING

When thick-slice Brain images are viewed in the slab mode some partial volume artifacts might occur.

Cross sectional images might rotate around the centerline. Please note orientation annotations on images.

In cases where the orientation annotations are not displayed on the image - you must not assume any specific orientation. For correct orientation information - use only the images which display such information.

One or more of the following image types may appear in this application: curved MPR, straightened MPR, volume images, and thick slab images. Measurements you make on such processed images can sometimes be misleading. When saving such images, make sure they are labeled properly.

Objects in thick curved MPR images may appear distorted. Use caution when making measurements on MPR images.

See **Report**, **Film**, **CT Common Processes**, and **CT Common Tools** for information on using common options, tools, functions, and processes.

Volume Viewer Functions
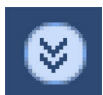
To access additional Volume Viewer functions, click the down arrow in the tab window, or hover the mouse over the tab window. See section "Volume Explorer" on page 42.

Instructions for using the Fusion function is provided in the CT Viewer - Fusion section (see section "CT Viewer Fusion Mode" on page 61).

The list of available functions displays. Instructions for using the Series, Bookmarks, Curve, Tissue Segmentation, Clip & 3D Segmentation, Batch, and Tissue Management functions are provided in the Common Processes section.

See **Report**, **Film**, **Common Processes** and **Common Tools** for information on using common options, tools, functions, and processes.

Volume Explorer

Volume Explorer allows you to define and visualize tissues in a user-interactive manner. It is ideal for targeting organs or lesions.

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NOTICE

The Volume Explorer function is effective in image layouts that have a 3D volume-rendered image, with three reference images.

Volume Explorer allows you to define and visualize tissues in a user-interactive manner. It is ideal for targeting organs or lesions.

Volume Explorer works whenever a 3D image is being displayed in one of the viewports:

- When you point and click the mouse button in specific location in a reference image, a tissue definition process is started.

  (From the sagittal or coronal reference viewport, the 3D image is displayed in the same (sagittal or coronal) orientation.)

  (From the axial reference viewport, the 3D image is displayed in an oblique axial-coronal orientation.)

- The longer you hold down the left mouse button in the reference image, the more tissue is defined.

- At any time you can press **Accept Tissue** to create a new tissue.


- The tissue you define with Volume Explorer is listed in the Tissue Management tab, and can be edited with tissue management tools.

- You can define a new tissue by point and click again on the desired point of interest.
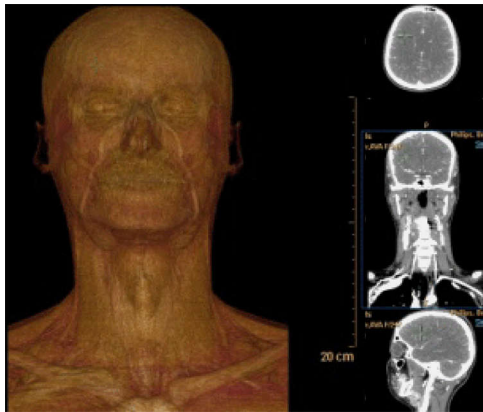
Fly-over

Use this mode to show the selected tissue from outside, as if by flying over its surroundings. The selected point is analyzed according to its local value. The 3D volume rendering protocol automatically adjusts the display as follows:

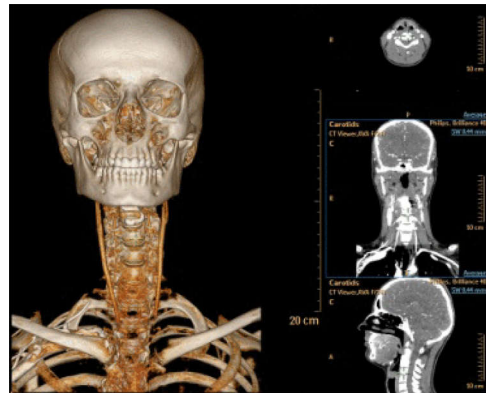| outer-air -shows body contours	inner air - shows lungs and trachea
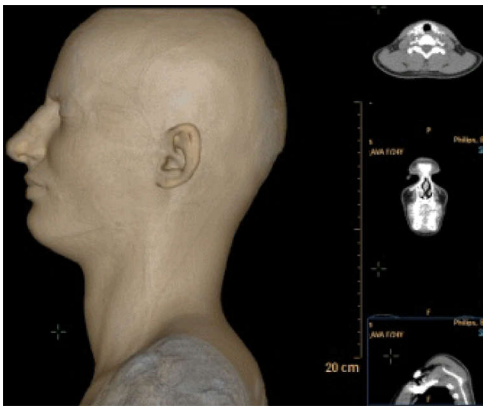
soft tissue - shows brain, muscles, etc.	bone and vessels with contrast media - shows the neck, skull, carotid arteries

NOTICE

The Fly Over protocols are shown to the experienced user in a special family of VR protocols named OO.

Close Inspection

Use the Close Inspection mode for close viewing of an object. Two viewing modes are available for close inspection:

- a cutting plane display (activate plane); and
- a bounding cube display (activate cube).
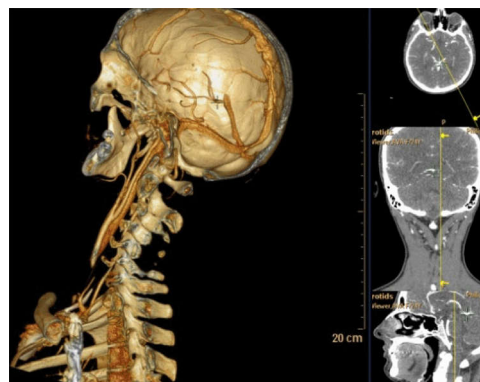
Activate Plane

Use this feature to apply a cutting plane to the image, 1cm away from the selected object on the 3D PRVR image. When active, the tool does not change the currently selected volume rendering protocol during clipping.

- You can swivel around the object (marked with a green cross at center of rotation) and inspect it carefully.
- The cutting plane can be moved to get far or close to the object of interest.
- A yellow line appears in each reference image indicating the cutting plane and an arrow to show the direction of the eye.
- Every plane can be edited by grabbing it with the mouse.
- When getting very close to the reference point, press CTRL on the keyboard to restore the required functionality.
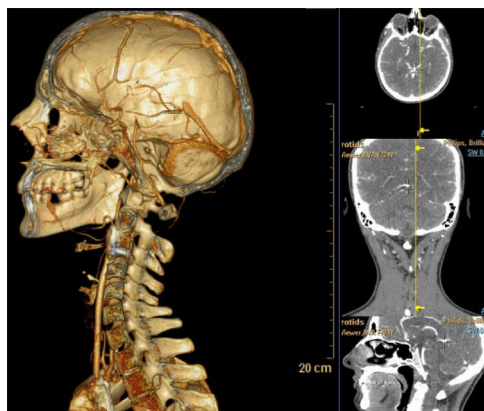
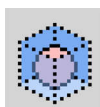| Activate plane	... after Swivel

Adjust VR and Photorealistic Rendering Protocol when Activating Clipping Plane

Use to change the currently selected volume rendering and Photorealistic Rendering protocol during clipping. See also section "Activate Plane" on page 44.
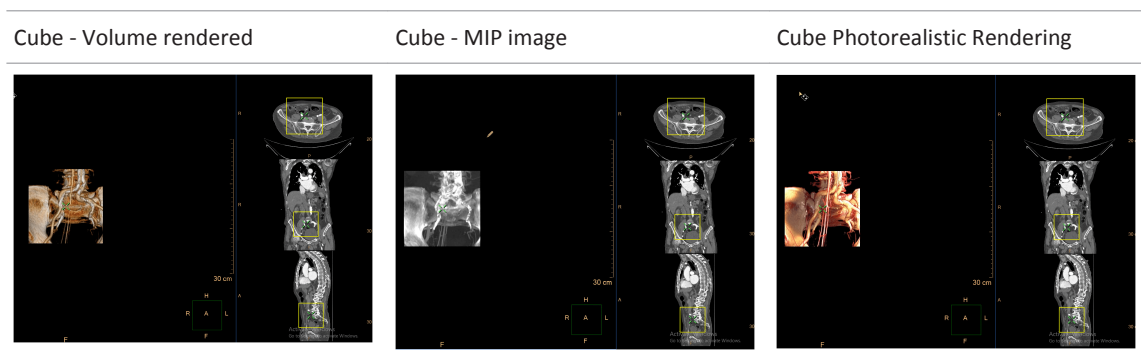
Activate Cube

Use this feature to concentrate the volume display on the anatomy of interest and the surrounding areas. The tool is useful in Volume Rendering, Photorealistic Rendering and MIP rendering modes.

• After activating the feature, move the mouse over one of the reference images. The pointer changes to a pencil shape.

• Click on the anatomy of interest to place a seed point. A yellow frame appears on each of the reference images, locating the boundaries of the cube.

• The volume cube surrounds the location where you placed the seed, centered on the point where you placed the seed.

• The default size of the cube is 5 cm. You can change the cube size with the middle mouse wheel or adjusting the yellow rectangles on the reference images.

• You can move the cube by dragging the center point in any image.

• After placing the seed on the reference image - continuously pressing the left mouse will add more anatomy to the volume rendering image.

Examples of activating the cube in Volume rendering, Photorealistic Rendering and MIP modes:

Cube - Volume rendered	Cube - MIP image	Cube Photorealistic Rendering

Activate Cube and Adjust VR and Photorealistic Rendering Protocol

Use to change the currently selected volume rendering and Photorealistic Rendering protocol when defining a cube. See also section "Activate Cube" on page 45.
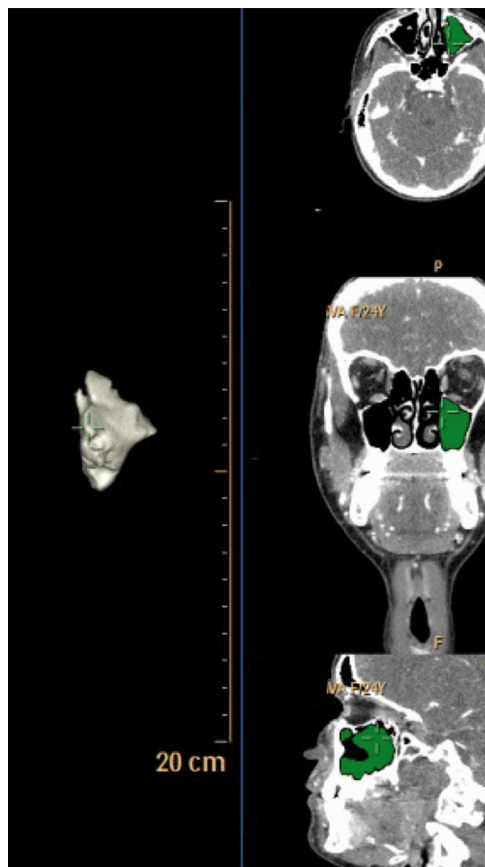
Create Tissue (Mark Tissue)

Use this mode for instant segmentation and tissues creating volumes. This mode is, in effect, an interactive seed-growing 3D segmentation.

1. Click on the starting point in the reference image to begin segmentation.

2. Hold down the left mouse button while observing the "growth" of the desired tissue volume. The "segmented pixels" will be displayed as a green overlay on the reference e images.

3. When finished, release the mouse button.

4. Click the Calculate Volume button to display the tissue on the 3D viewport.

Target Tissue - left maxillary sinus	Trachea and maxillary sinuses
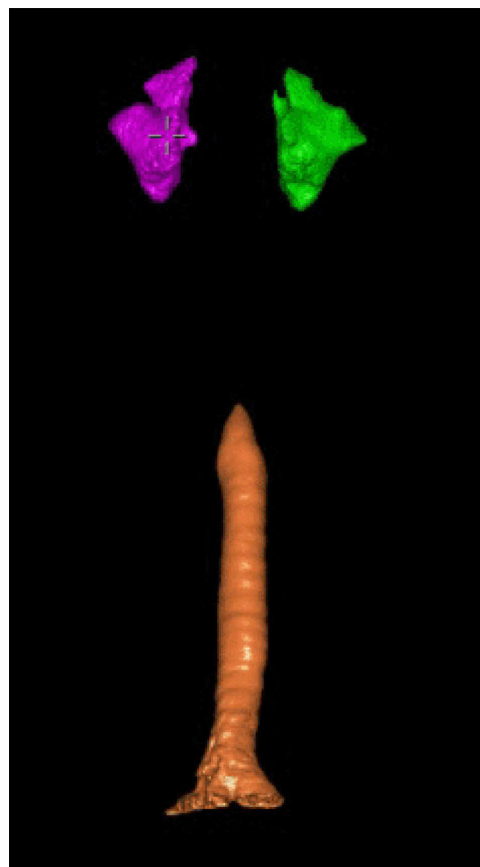
Bone Removal

Bone removal is a threshold-based tool. It defaults to 350HU (Hounsfield Units). Bone Removal affects connectivity between objects. When you click on a point, all areas connected to the object that have a HU value greater than the threshold are removed. The extent of the removal function depends also on the volume rendering protocol.

See **Report**, **Film**, **CT Common Processes** and **CT Common Tools** for information on using common options, tools, functions, and processes.

Volume Viewer Common Tools

The common tools area provide many basic functions, including measuring, saving, panning, zooming, rotating, and windowing.

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NOTICE

In the Volume viewer the Invert function is replaced by the Color to BW function.

Common tools are, in general, common to all the CT Viewers, and are shared with many other applications of IntelliSpace Portal. If a common tool has a special function in the Volume mode, that function is described in this section.

See **Report**, **Film**, **CT Common Processes** and **CT Common Tools** for information on using common options, tools, functions, and processes.


WARNING

When performing distance or angle measurements on the volume rendered perspective image, the position pointed to must be well defined in the image.

The line end-points of your measurement must lie on data points that are sufficiently opaque so that no ambiguity exists regarding the depth of these points within the volume. Otherwise, the distance or angle does not display.

NOTICE

Perform volume measurements carefully, taking time to manually verify each point of reference.

Save Volume as STL Model
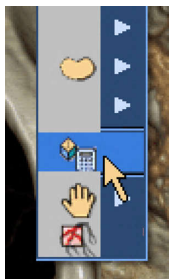
The "Save volume as STL Mode" option is available for the volume images in the CT Volume Viewer. To export, right-click on the volume image and select **Save volume as STL model**. This saves an STL file into the Patient Directory on the Files tab.

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NOTICE

If you are not using the IntelliSpace Portal Workstation, you must install the Object Studio software on your machine to enable STL mode export from the Patient Directory.

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