VX3D 2.8.2

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1 Introduction

VX3D is a software for analysis of volume data from CT (Computed Tomography) scan. VX3D is optimized for 3D visualization of the various industrial data such as circuit, chip, automobile components, and so on and provides the interface for 2D plane analysis.
VX3D focuses on basic visualization features for analyzing volume data. Advanced functions for analysis will be provided in add-on modules.

1.1 Key Features

VX3D incorporates the following key features:

- **VISUALIZES** CT volume data
- **SUPPORTS** various types of data
- **MEASURES** 3D object
- **ANALYZES** and filters volume data
- **PUBLISHES** various forms of report
- **ACCELERATES** 3D visualization by using GPU
- **LOAD / SAVE** the project file
- **RESTORES (Undo)** or **REPEATS (Redo)** tasks based on Operation History
- **SUPPORTS** a user-friendly interface

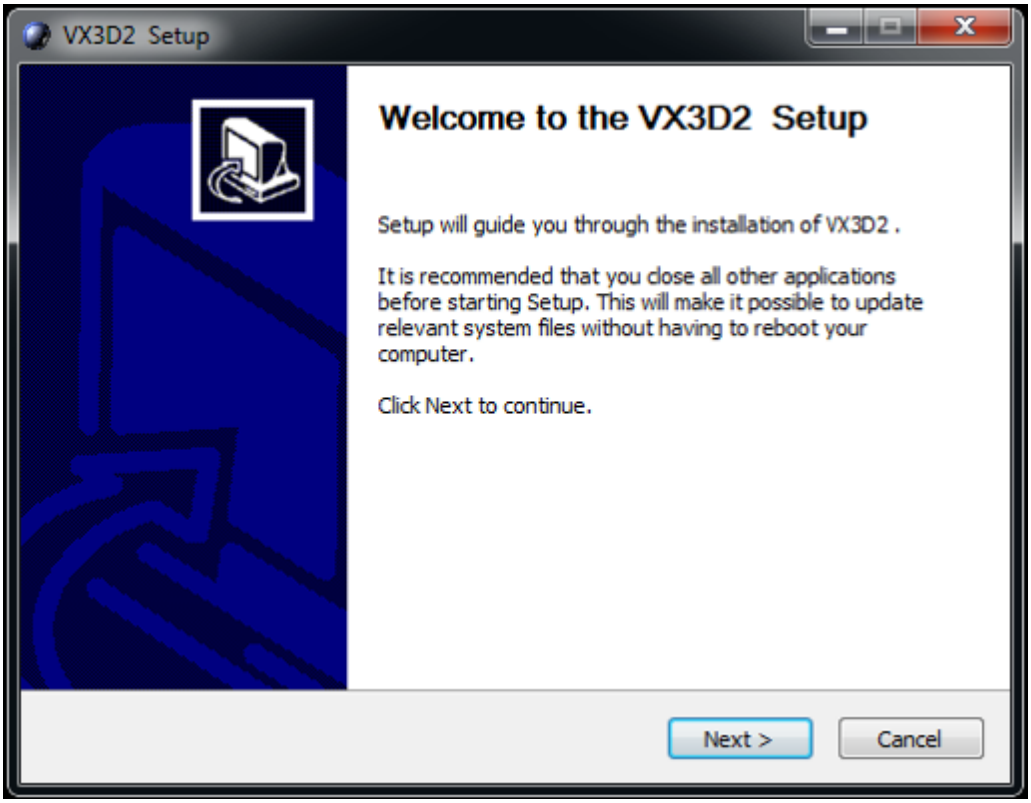
2 System Requirements and Installation

2.1 System Requirements

Components	Minimum System Requirements	Recommended
OS	Windows Vista, 7, 8, 10 (64-bit)	Windows Vista, 7, 8, 10 (64-bit)
RAM	2GB	6 GB or more and at least three times as big as the data size
Graphics Card	Graphics cards compatible with Direct X 10.1	High end graphics cards compatible with Direct X 11 or higher GPU-dedicated memory 1GB or more
CPU	Intel i3 Dual Core	Intel i5 Quad Core or higher
HDD	2GB free space	2GB free space and free disk space of more than three times of loaded data size

2.2 Installation

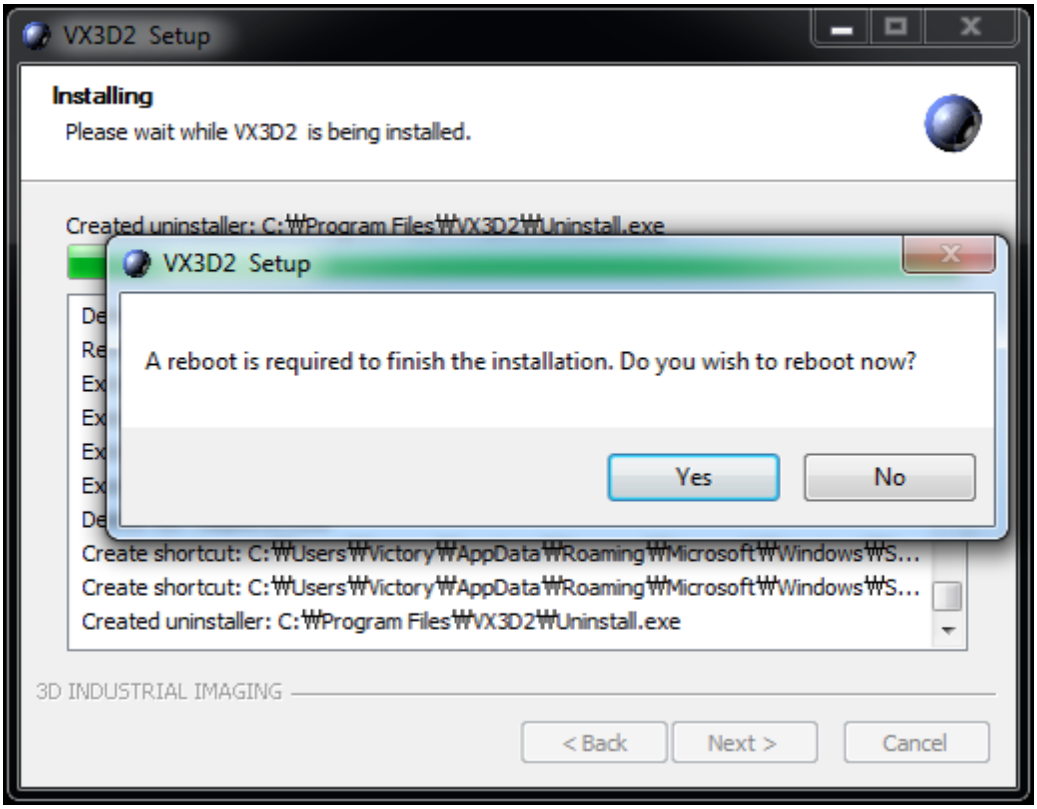
- Run the 'Setup' file to begin installation.



- During the installation, users will be asked to install other programs required to execute Dentiq3D.

  Click 'Next' to proceed.

- At the end of the installation process, users will be asked to reboot the PC. Click 'Yes' to reboot.



- After rebooting, insert the provided dongle key. If not, Dentiq3D will be shut down with a warning pop-up.
- When the dongle key is connected, execute Dentiq3D.

※ WARNING: If the 3DII software is already installed, users will be asked whether to install the software once again. Click 'Yes' to proceed.

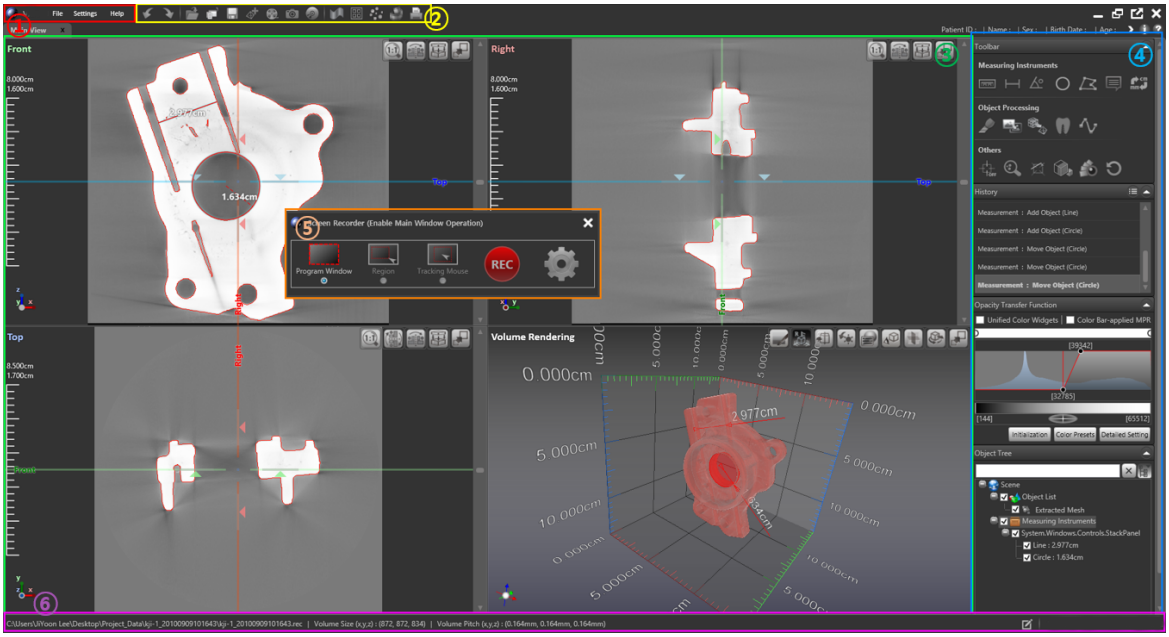
※ WARNING: This installation package does not include a graphics card driver. To use the GPU-based functions, install the latest graphics card driver by downloading files from the website of the graphics card manufacturer (ex. NVIDIA, AMD). For further information, please contact 3DII.

※ WARNING: The installation process of the driver can last up to several minutes. Run the program after installation.

2.3 Uninstall

- Click the Windows Start menu and select the Dentiq3D folder from All Programs.
- Click the 'Uninstall Program' button to delete the program.

3 Layout



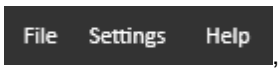
Layout

Layout	Description
① Title bar	The main menu contains File, Setting, Bug Report, and Help.
② Common Function Toolbar	Common Function Toolbar includes buttons to perform common

	functions like opening file, saving project, etc.
③ View Container	View containers include panels with MPR and 3D rendering visualization results.
④ Function Container	Function containers include function buttons, operation history, and the OTF panel.
⑤ Pop-up Window	A pop-up window shows up when additional information or options for specific functions are provided.
⑥ File Information / Help	The basic file information is shown. If a specific function is used, related details will be shown.

4 Title bar

There are several function buttons for on the title bar.

At the upper left side : 

, the upper right side :  .

- File
  - Open : 'Open file window' is displayed. See the tutorial 'Basic operations : Open file' for details.
  - Import / Export Configuration File : The information such as OTF preset, Shading preset, Layout (panel location), Background color are saved. Favorites, Monitor size and Screen record setting are not saved.
  - Exit : The program will be automatically shut down.
- Settings
  - Calibration : Sets Unit, Precision and Coordinate System in Calibration Window. See Calibration of this manual for details.
  - Language : Supports Chinese, English, Japanese and Korean.
  - Configuration : 'Configuration Window' is displayed. See Settings of this manual for details.
  - PACS configuration : 'PACS Configuration Window' is displayed. See PACS Configuration of this manual for details.
  - Select Service Provider (Server Host) : 'Network Key Manager Window' is displayed. See Service Provider of this manual for details.
- Help (F1) : Supports the Manual as PDF file.
- Update : Updates to new version. See 'How to update' for details.
- Click  button at the upper right side of the screen to fold the right tab of the screen and expand the view screen.

  Click  button at the upper right side of the screen to display 'DICOM Info. Window'.

5 Settings

The various settings can be set by the path Main Menu-Settings- 'Configuration Window'.

Settings for four categories and detailed settings for each category are provided. (Check each setting to activate it.)

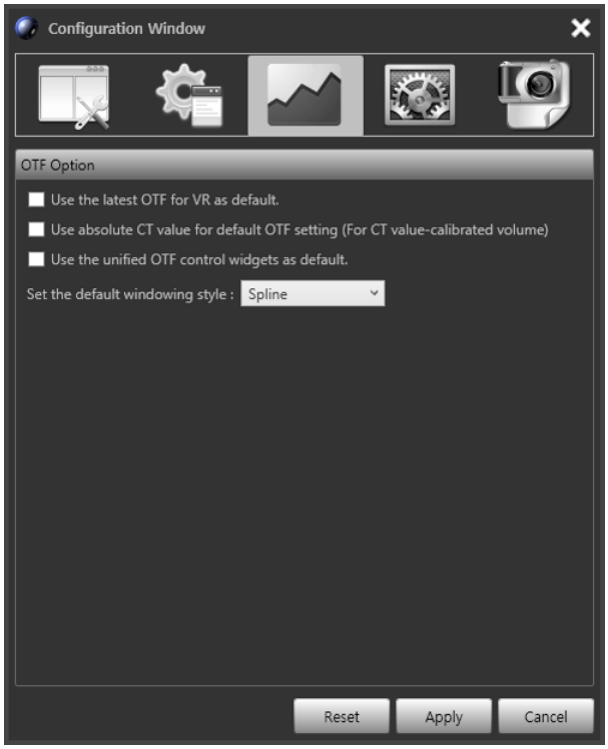
① Layout and GUI Option : Settings for layout and GUI.

- Use the latest layout of each view container as default : Sets the latest location of Sagittal, Coronal, Axial and Volume Rendering view as default. If the check box is unchecked, the default setting of the program is applied.
- Use the latest expander states of each function container as default : There are taps  that folds or unfolds the detailed contents at the function container. If the check box is checked, the latest states of each function container as default. If the check box is unchecked, the default states are applied.
- Use the latest background color of each panel window as default : Sets the latest background color as default. If the check box is unchecked, the default color is applied.
- Set as Otolaryngology mode : 'Iso-surface Mesh Extraction' and 'Insert Implant' of Object Processing are not included in Otolaryngology mode.
- Set Tile view as default : Use tile view as default view when running program.

② Visualization Option : Settings for visualization option.

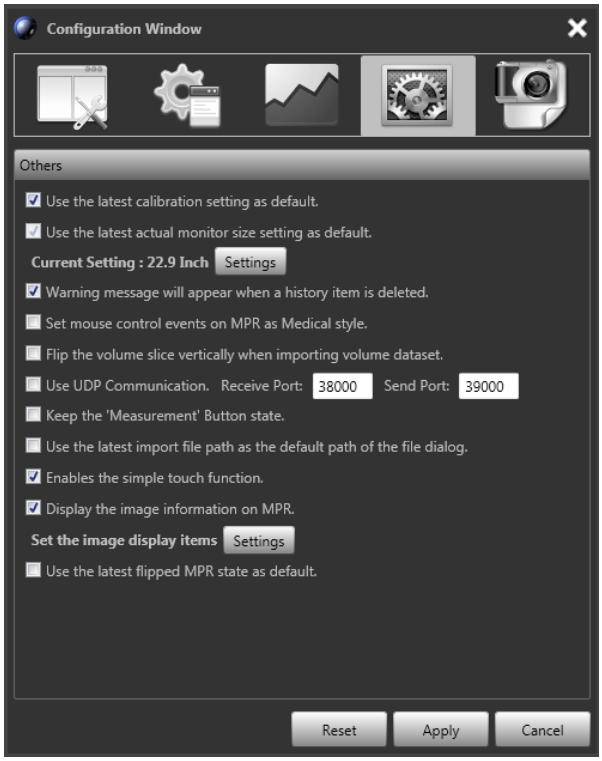
- Use the latest 3D rendering option as default : Sets the latest 3D rendering option of the panel button  as default. If the check box is unchecked, the default setting of default VR and perspective projection is applied.
- Use the latest 3D superimposed plane option as default : Sets the latest some 3D superimpose plane options (Clipping MPR planes with the bounding box, MPR Opacity) of the panel button  as default.
- Set Visualization Quality : GPU volume rendering is used in the recommended system environment. If the check box is unchecked, CPU volume rendering is used. When moving or processing a volume in CPU-based volume rendering CPU. You can set the quality and speed using the slider. The higher quality setting will increase the quality of the visualization related functions and lower the operation speed. Conversely, the higher speed setting will increase the operation speed and lower the quality.

③ OTF Option : Settings for OTF option.



- Use the latest OTF for VR as default : Uses the latest OTF as default. If the check box is unchecked, OTF that set automatically by volume information is applied.
- Use Absolute CT value is used for default OTF setting (For CT value-calibrated volume) : Uses the OTF value that is suitable for medical data by analyzing windowing value of DICOM Tag. If the check box is unchecked, proper OTF value is applied by analyzing volume data.
- Use the unified OTF control widgets as default : Uses the OTF that Unified Color Widget is applied as default. If the check box is unchecked, OTF that Unified Color Widget is not applied is used.
- Set the default windowing style: Set the one style among Spline, Linear, 3 Points Linear.

④ Others : Other general settings.



- Use the latest calibration setting as default : Uses the latest calibration at  .
- Use the latest actual monitor size setting as default. Set the 2D image of MPR panel appropriately to the actual monitor size. (Real Size Settings)
- Warning message will appear when a history item is deleted : If user do new working after returning to the previous working history, the existing history items are deleted. In such cases, 'Some history items will be discarded.' warning message box is appeared. If the check box is unchecked, some history items are deleted without warning message.
- Set mouse control events on MPR as medical style. (See below for How to use)
  - Click with the left mouse button
    - ❖ Drag horizontally: Both the starting and end line of the Windowing Bar move.
    - ❖ Drag vertically: The width of the starting and end line of the Windowing Bar changes.
  - Mouse wheeling
    - ❖ Wheeling: Relocate the image slice.

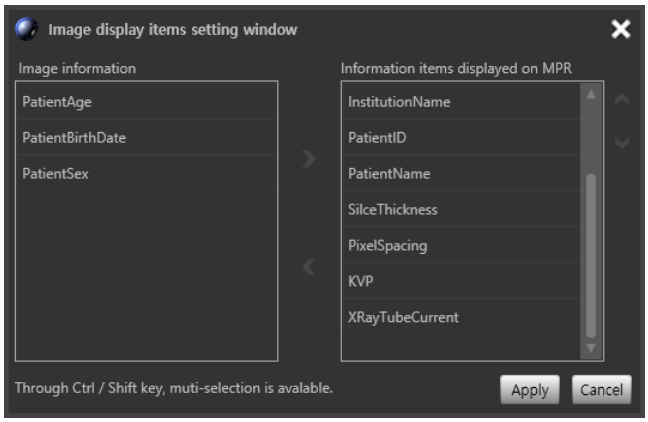
❖ Wheel-click and drag: Move the image slice.

▪ Click with the right mouse button

❖ Drag vertically: Zoom in/out the image.

- Flip the volume slice vertically when importing volume dataset : The Axial view is upside down. If the check box is unchecked, the volume slice appears intactly.
- Use UDP Communication. Set Receive/Send Port. See 8.Command Tutorial for details.
- Keep the 'Measurement' button state : The current measurement button state keep without selecting the measurement again. If the check box is unchecked, measurement tool must be selected on each time.
- Use the latest import file path as the default path of the file dialog : If the check box is unchecked, the root path of data file is used as the default path.
- Enable the simple touch function : Simple Touch menu is display on the right toolbar panel. Using simple touch, simple manipulation is possible in touch device.

- When loading DICOM file, image information items that is displayed on MPR can be added or deleted.



- Use the latest state of MPR flip button as default : The setting of Flip MPR Image vertically/ horizontally button can be maintained. Use the latest state of MPR flip button as default.

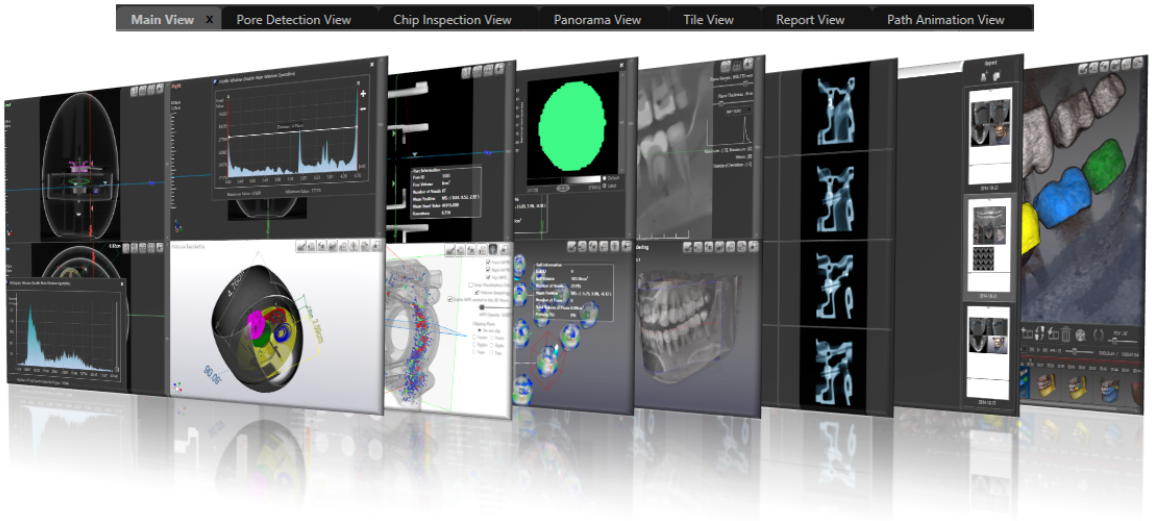
⑤ Filename Settings

- Double click to insert the selected item.
- Click 'Apply' button to set a Filename.
- Click 'Reset' button to reset the current saved setting.
- Click 'Cancel' button to return to the previous setting and close the window.

※ Click Menu-File-Export Configuration File of main menu tab to save the configuration as a .cvx file.

※ Click Menu-File-Import Configuration File of main menu tab to load the saved .cvx file and set the program.

6 View Container



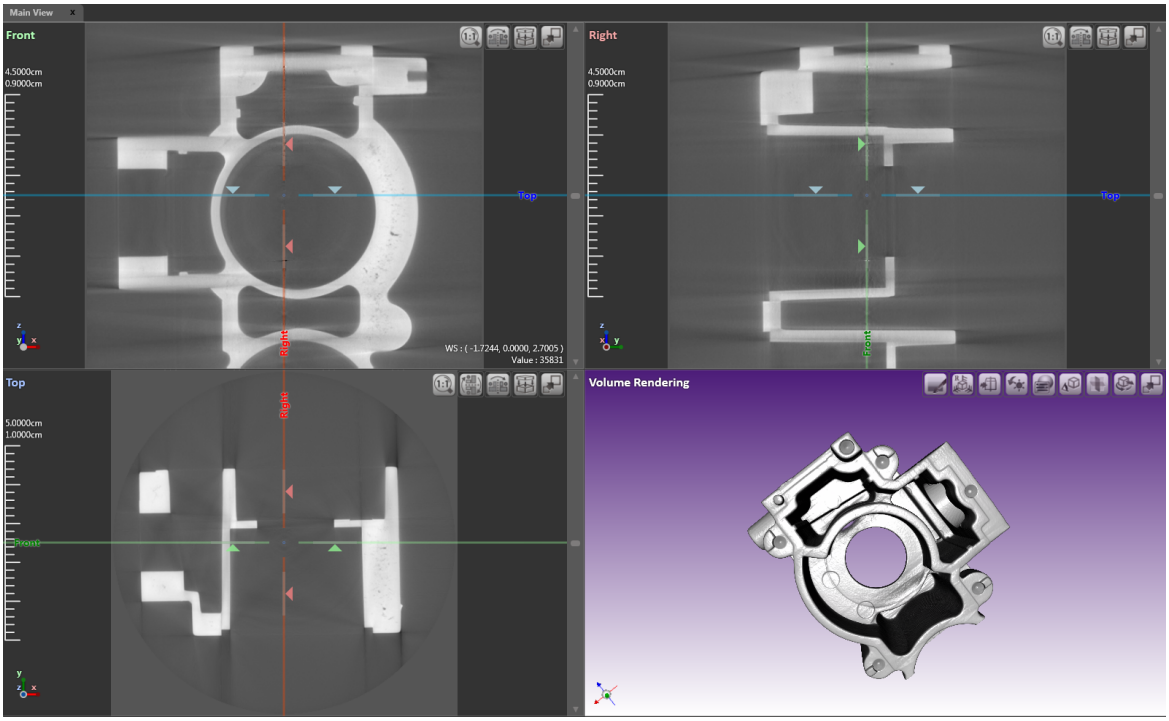
The view container contains panels which display visualization results of Dentiq3D. Dentiq3D supports various view containers for different purposes of use. Some view containers offering advanced features are provided in add-on modules.

6.1 Main View

The main view is the most basic view of Dentiq3D, allowing the operation of most of the functions. It also opens and interworks with other views.

The main view includes :

- Panel buttons
- View layout
- GUI components for the interaction between MPR panels and the 3D panel.

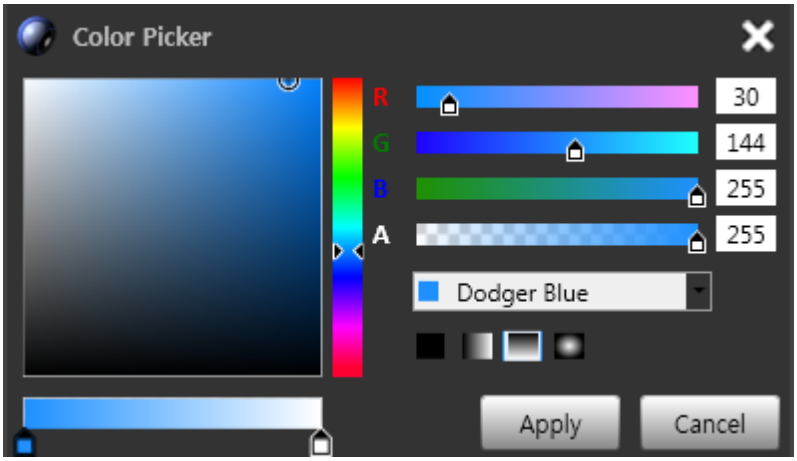


6.1.1 Panel Buttons

6.1.1.1 Changing Background Color

Click  at a panel to change the color of the background.

A pop-up window will show up to choose the background color. Whenever a pop-up window shows up, the main screen will be deactivated. Either a solid color or gradient are supported for the background.

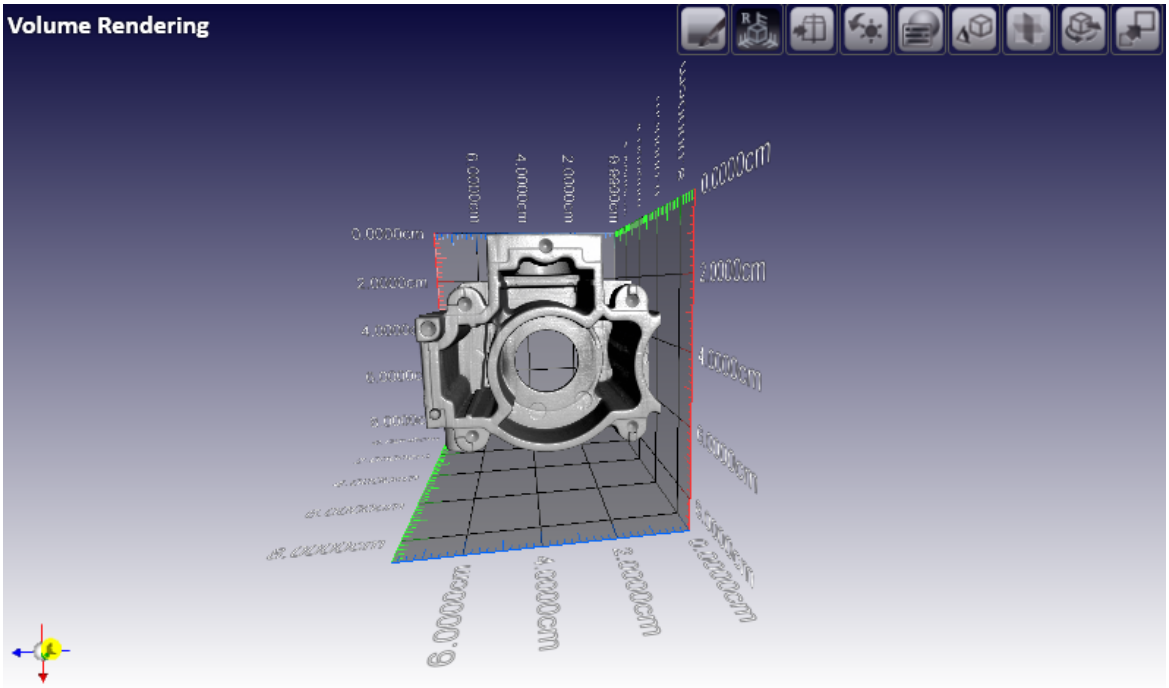


6.1.1.2 3D Ruler

Click  at a panel to utilize a 3D Ruler.

3D Ruler measures a length of the object. The location of 3D Ruler appeared on the boundary aspect is changed automatically as the object rotates.

3D Ruler button is still available while other panel buttons are used.



Warning : If the measurement is used for medical treatment, incorrect measurement may result in medical mistakes. Therefore, user need to fully understand measurement related matters.

The accuracy of measurement is based on the image resolution of CT data and the accuracy may be lower than the resolution of CT data.

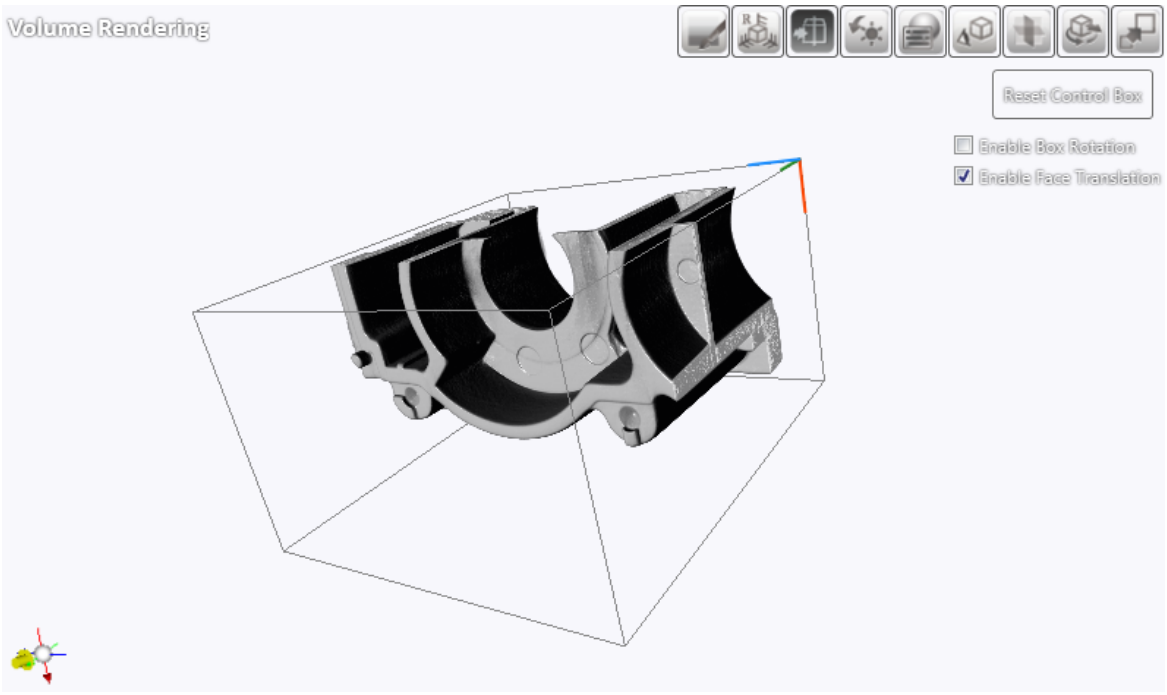
The measurement values are based on the location that is specified by user.

The form or boundary line of the object can be changed by the adjustment of the image brightness.

If you have software problems with measurement or questions, please contact us +82-70-8766-2395 (Phone) or threedii.service@gmail.com (E-mail).

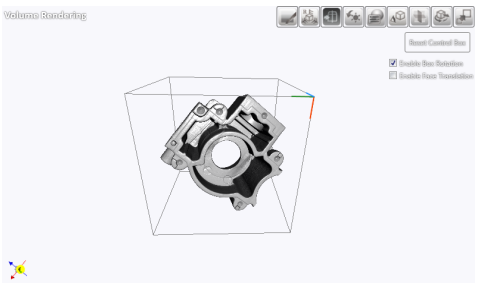
6.1.1.3 Clipping Box

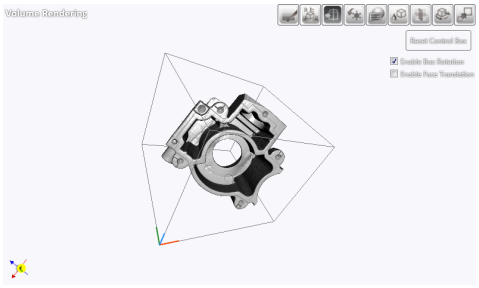
Click  at a panel to utilize a clipping box.



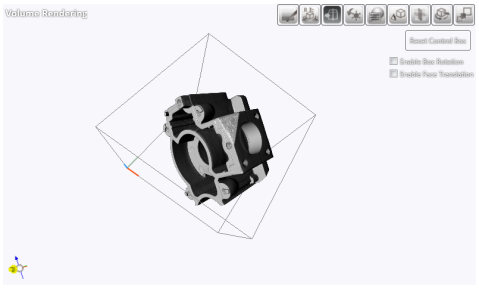
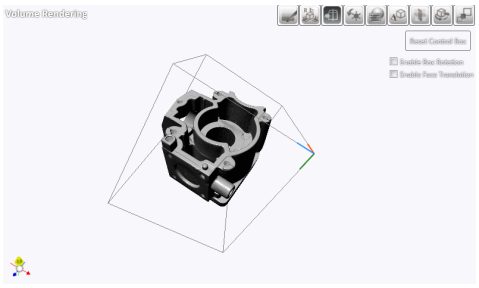
Clipping box visualizes occluded structures of the volume by cropping the object. Rotation of the clipping box as well as the parallel movement of the plane can be controlled by mouse control.

- Drag Clipping box with the right mouse button
  - Check 'Enable Box Rotation' to rotate only the clipping box.

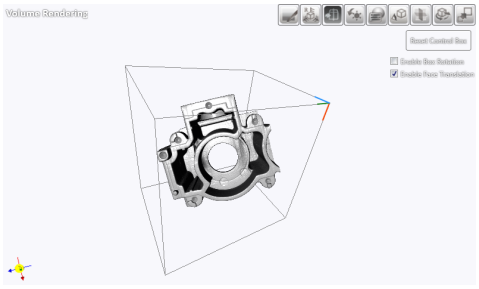
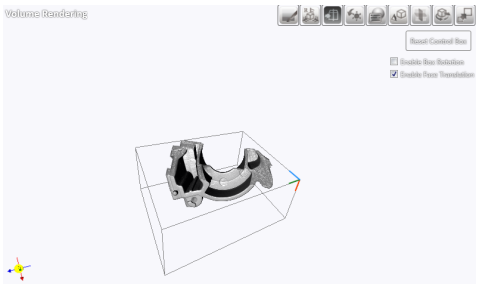




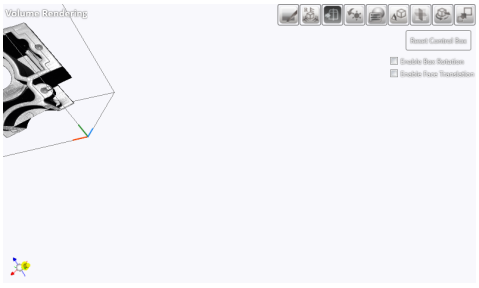
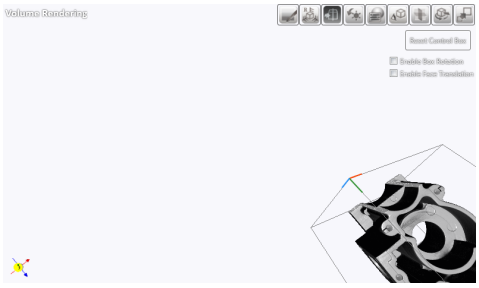
- Uncheck 'Enable Box Rotation' to move the entire volume with the clipping box.

- Drag Clipping box with the left mouse button
  - Check 'Enable Face Translation' to clip the volume along the box plane.

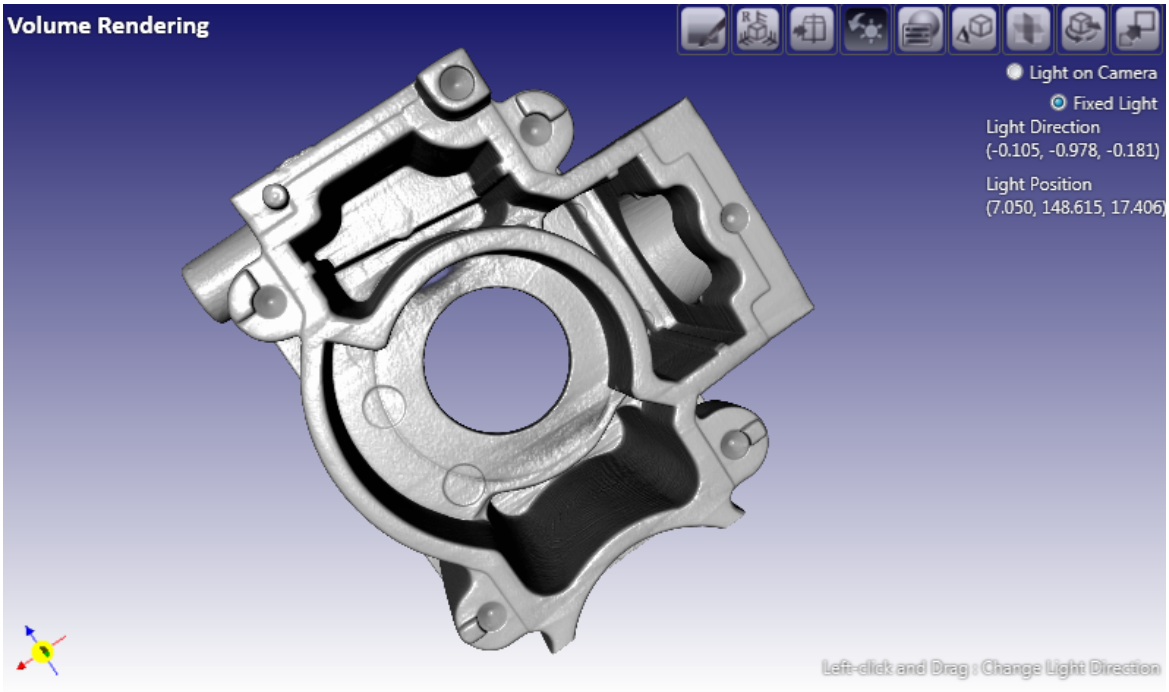
  - Uncheck 'Enable Face Translation' to move the entire volume with the clipping box.

6.1.1.4 Light Source Control

Click  at a panel to control the light source. Users can control the direction of light source.

Two options for the control of the light source are supported.



- Light on Camera: Fixes the direction of the light source to the viewing direction of the user.
- Fixed Light: Drag with the left mouse button to fix the light source in the intended direction on the 3D panel. The yellow arrow ( ) is shown at the left bottom side of panel indicates the current direction.

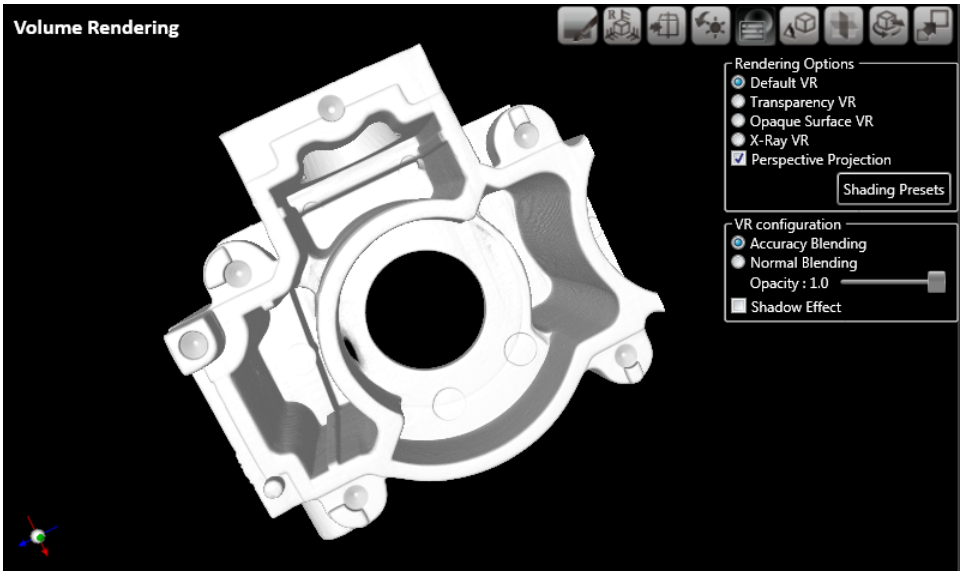
6.1.1.5 Rendering Options

Set the 3D rendering options. Dentiq3D visualizes the input data on a real-time basis by applying a GPU accelerating technique, presenting rendering images to users and thereby enabling intuitive understanding of the volume structure.

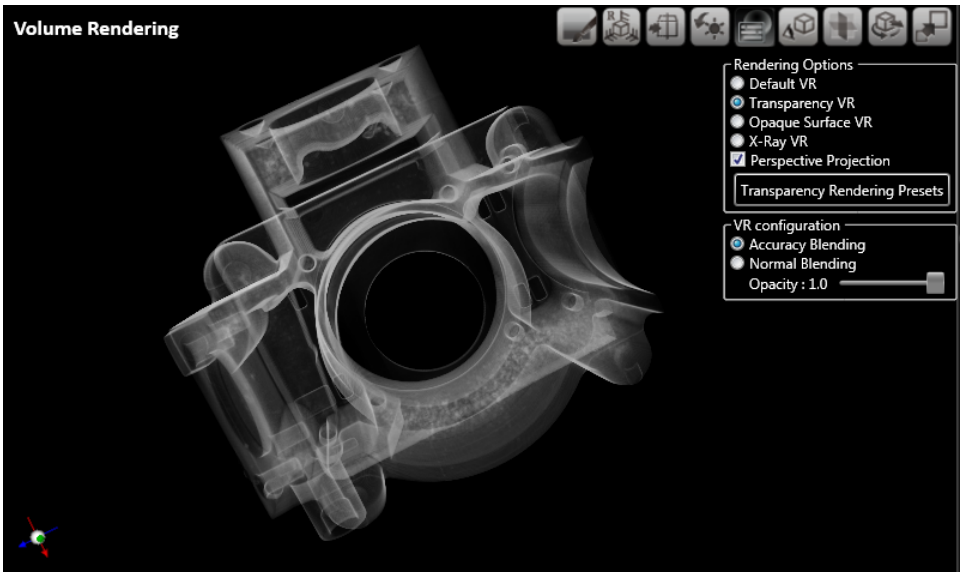
Click at a panel to apply 3D rendering options. Volume rendering (VR) options are as follows.

- Default VR : This option strictly applies Phong shading (interpolation technique for surface shading in 3D computer graphics) to volume rendering. If the volume is rendered transparent by OTF manipulation, it may require a longer processing time. Especially, rendering the massive volume

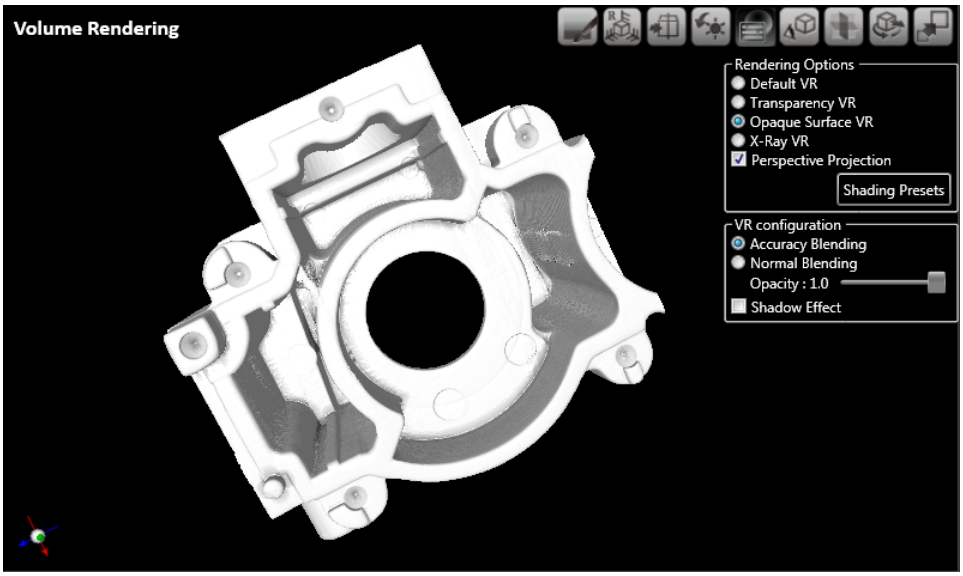
data (i.e. several hundred MB or several GB) will require a substantial amount of time on PCs with a low-performance GPU.



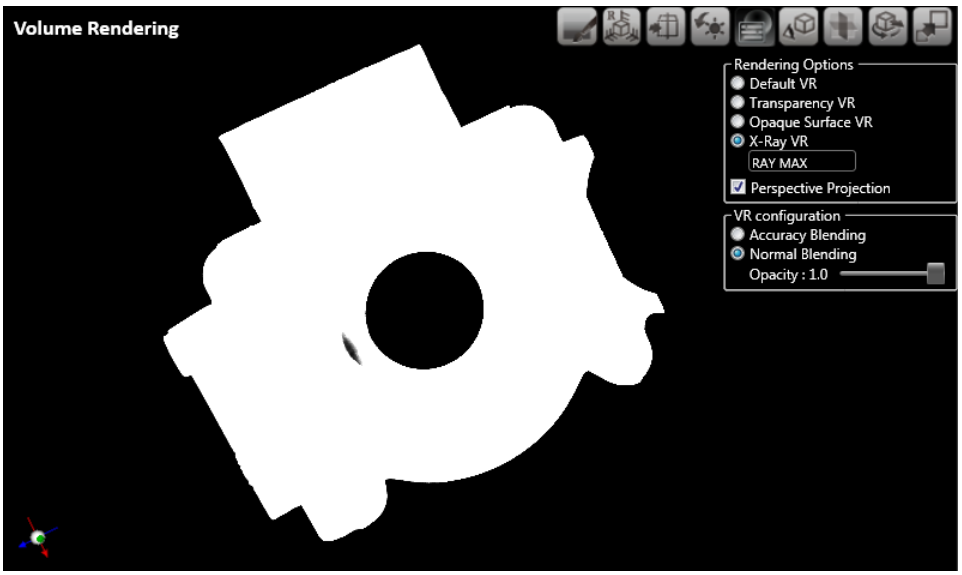
- Transparency VR : Users can set a number of parameters for visualizing both the occluded and occluding structure. Rendering a massive volume data (i.e. several hundred MB or several GB) will require a substantial amount of time on PCs with a low-performance GPU.



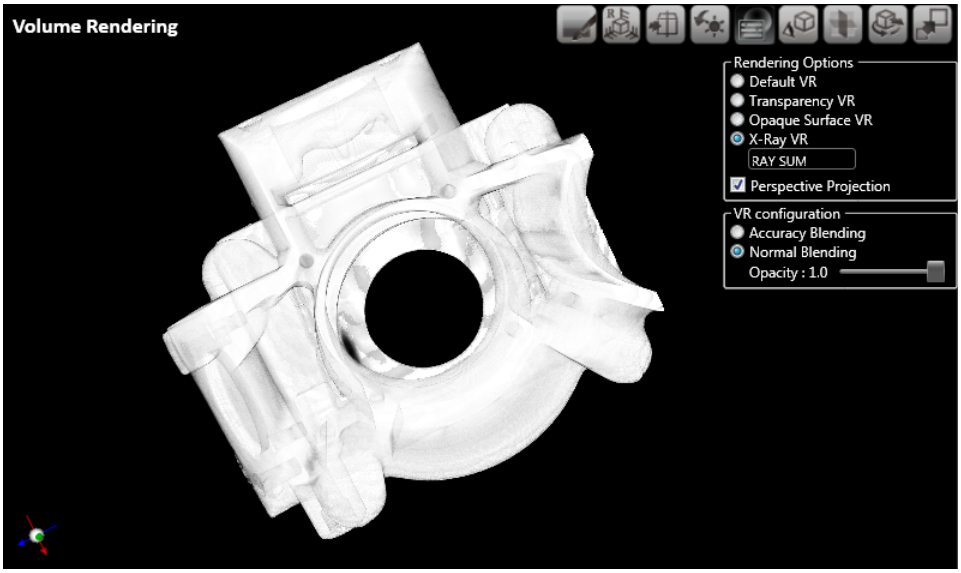
- Opaque surface VR : This option renders the surface of the object in detail by sampling more data. It can be used for a detailed depth analysis or a rapid 3D rendering.



- X-Ray VR
  - Ray MAX : This option displays the maximum volume value of voxels penetrated by the ray among the sampled ones.

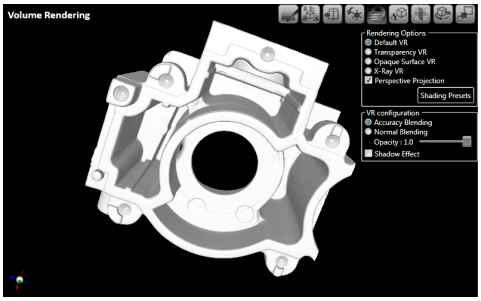


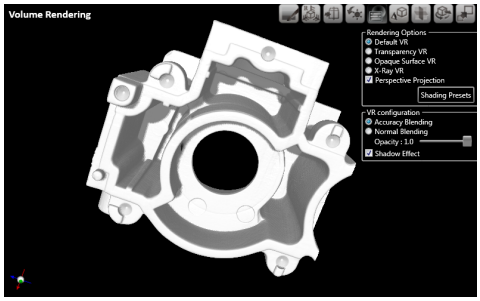
- Ray SUM : This option displays the mean volume value of voxels penetrated by the ray among the sampled ones.



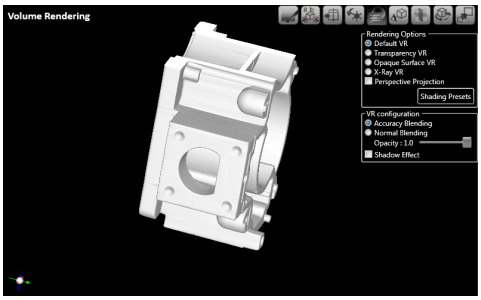
Additional Features are as follows.

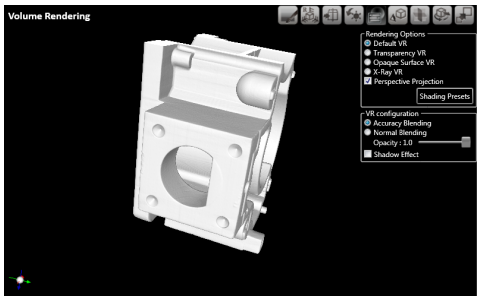
- Shadow effect : This effect applies shadows according to the manipulated direction of the light source, thereby enabling users to experience a powerful sense of depth in 3D space and to see a photo-realistic rendering image.





- Perspective Projection : This option affords two ways of projecting 3D-rendered objects, the perspective and orthogonal projection.

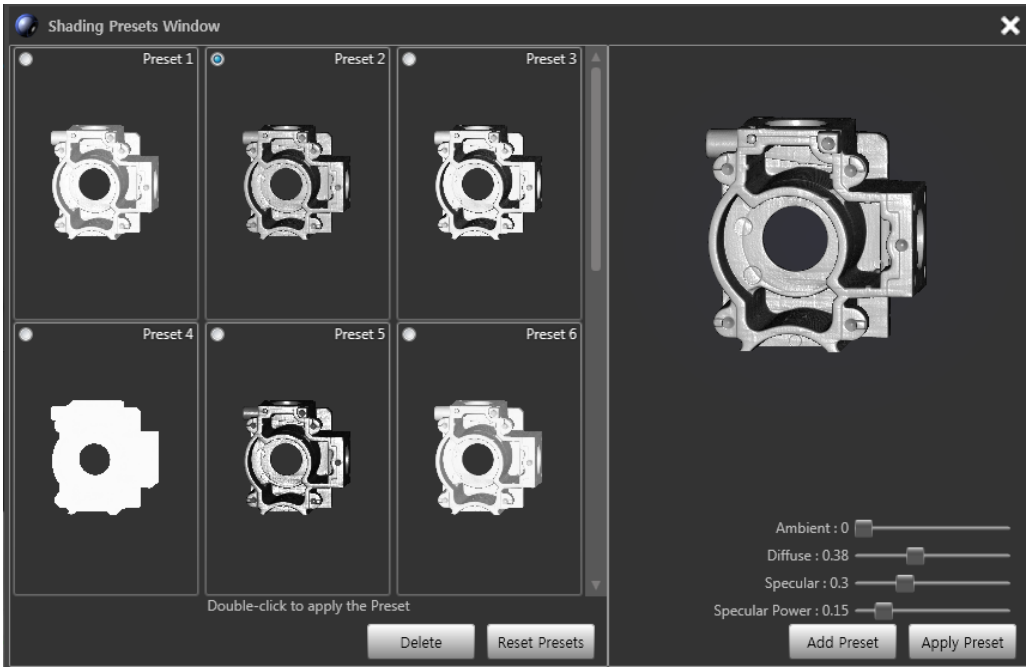




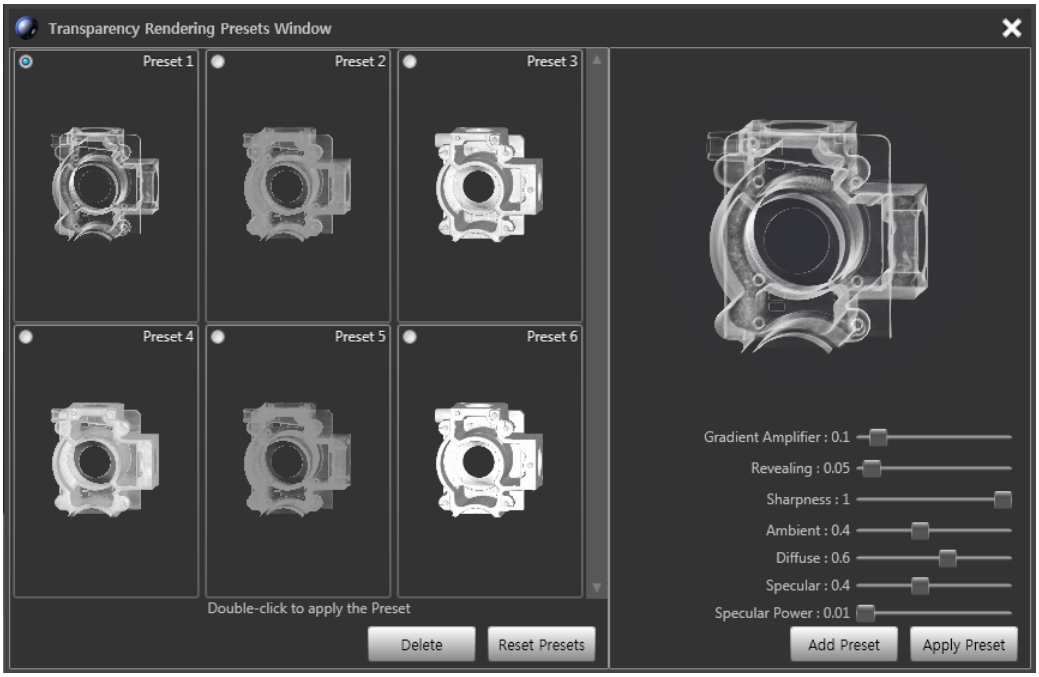
- Accuracy Blending : represents the depth information precisely when visualizing volume and mesh blending. (Only available for GPU volume rendering option)
- Normal Blending : Normal Blending is less precise, but has faster rendering speed than Accuracy Blending. You can adjust the opacity of the volume when setting the item.

※ Note: Action Items in the volume rendering settings are not saved in the History panel. (Accuracy Blending, Normal Blending, Shadow effect)

- Shading Preset : Click 'Shading Presets' to set parameters of Phong shading. A pop-up window with options for parameter setting will appear. Click 'add preset' to use the adjusted parameter afterwards as well.


Shading Presets Window
Preset 1
Preset 2
Preset 3
Preset 4
Preset 5
Preset 6
Double-click to apply the Preset
Delete
Reset Presets
Ambient : 0
Diffuse : 0.38
Specular : 0.3
Specular Power : 0.15
Add Preset
Apply Preset

- Transparency Rendering Preset : Click 'Transparency Rendering Presets' to set parameters of Transparent VR. A pop-up window with options for parameter setting will appear. Click 'Add Preset' to use the adjusted parameter afterwards as well.



※ Warning : It may require a significant processing time to render massive volumes with the Shadow effect and Transparency Rendering preset.

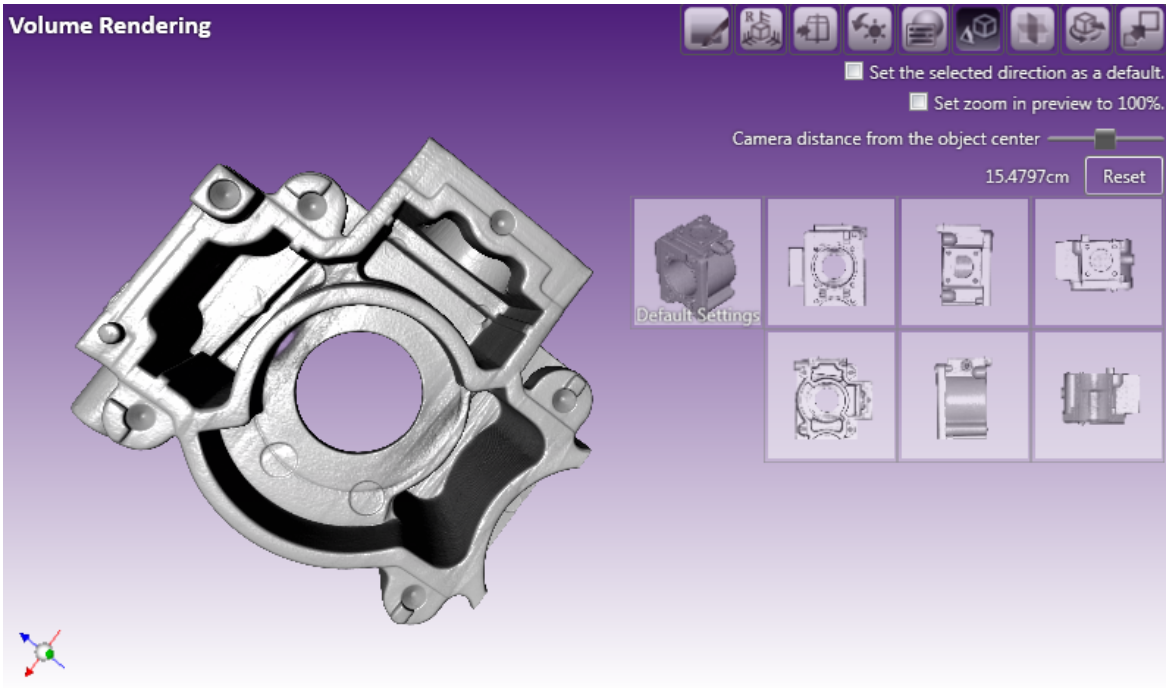
Additional Features / VR Options	Default VR	Transparent VR	Opaque surface VR	X-Ray VR
Shadow Effect	O	X	O	X
Perspective Projection	O	O	O	O

Shading Preset	O	X	O	X
Transparency Rendering Preset	X	O	X	X

6.1.1.6 Camera Orientation Setting

Click  at a panel to set the camera orientation.

The 3D screen movement of Dentiq3D is set by the location and orientation of camera. Camera Orientation Setting provides functions which set the location and orientation of camera easily.



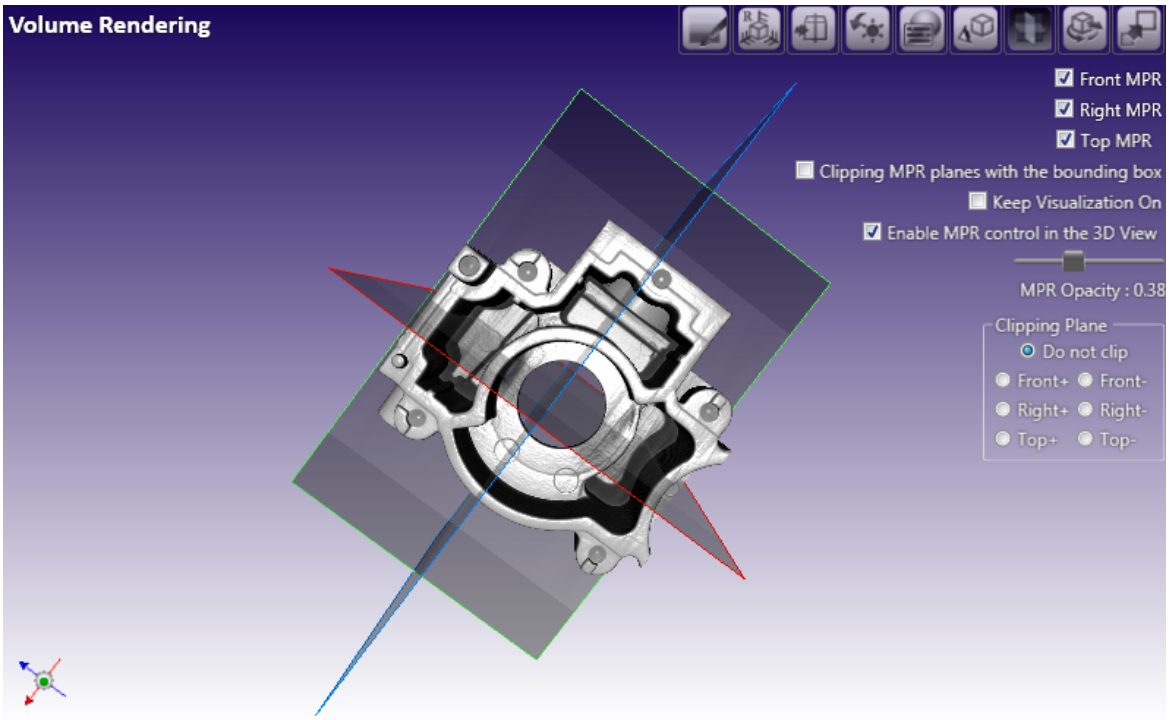
- Check 'Set the selected orientation as a default' to fix the current orientation as the default orientation.
- Check 'Set zoom in preview to 100%' to adjust the current zoom in ratio to the screen size.
- The radius of the 3D trace of the camera (Distance from the object center) is adjusted by the

camera distance setting. In case of utilizing Camera Preset, the radius of camera trace set by camera preset and the radius of default camera trace are max-minimum values of slider. Click 'Reset' to set the camera distance as the radius of default camera trace.

- The orientation of camera is set in accordance with the x- or y- or z-axis. The scene stage box for the camera orientation setting will be visualized. Click the scene stage box with the desired camera orientation to set the orientation.

6.1.1.7 3D Plane Options

Click  at a panel to set 3D planes.

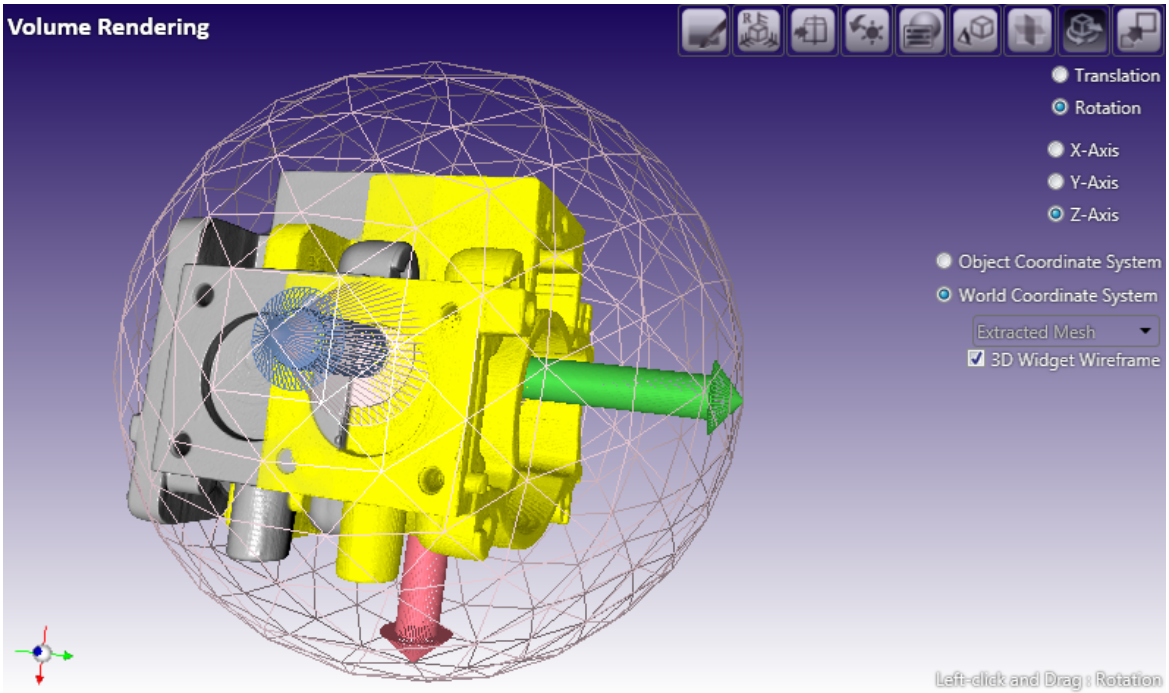


- Coronal / Sagittal / Axial MPR : Check the MPR planes to visualize the current placement of them on each panel with different color. Each of the three MPR planes can be translated on the volume rendering panel by mouse dragging. They can also be translated on a MPR panel, the result shown on the volume rendering panel window as well.
- Click 'Clipping MPR planes with the bounding box' to visualize the plane of MPR panel on 3D depending on the bounding box of the object. Deselect it to visualize the rectangular cross-section defined on MPR panel intactly without clipping.

- Check 'Keep Visualization On' to keep the plane visible on the volume rendering panel window.
- MPR planes displayed on the volume rendering panel window are called 'Superimposed Planes,' which can be operated and visualized as follows:
  - Place the mouse cursor on superimposed planes (the cursor will change its form) and drag it to translate the plane in parallel.
  - Check the GUI check box to set the visualization state of each superimposed plane.
  - Use the slider to adjust the opacity of superimposed planes (0.0~1.0).
  - A superimposed plane can also be used as a clipping plane.

6.1.1.8 3D Object Control

Click  at a panel to rotate or translate the object.



Dentiq3D offers a GUI to place the loaded object in 3D space.

When a mesh object is added, its possible placing options will be shown. Choose an object from the

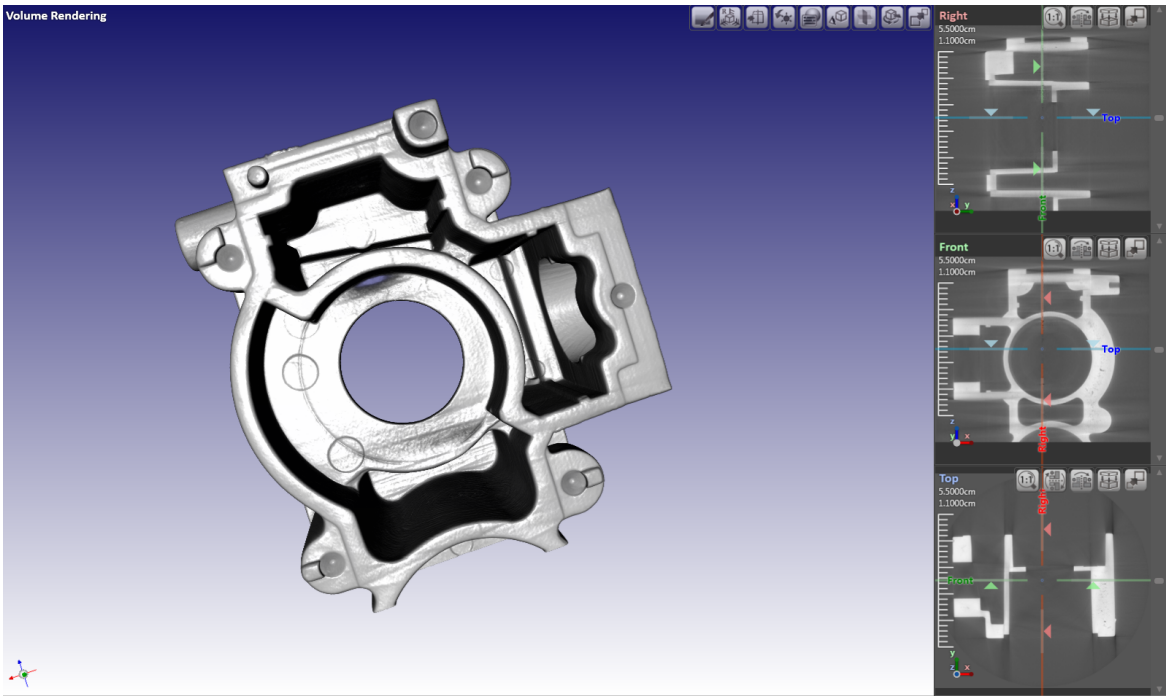
combo box.

Set the standard for transformation (translation/rotation) as either the world coordinate space or the object coordinate space.

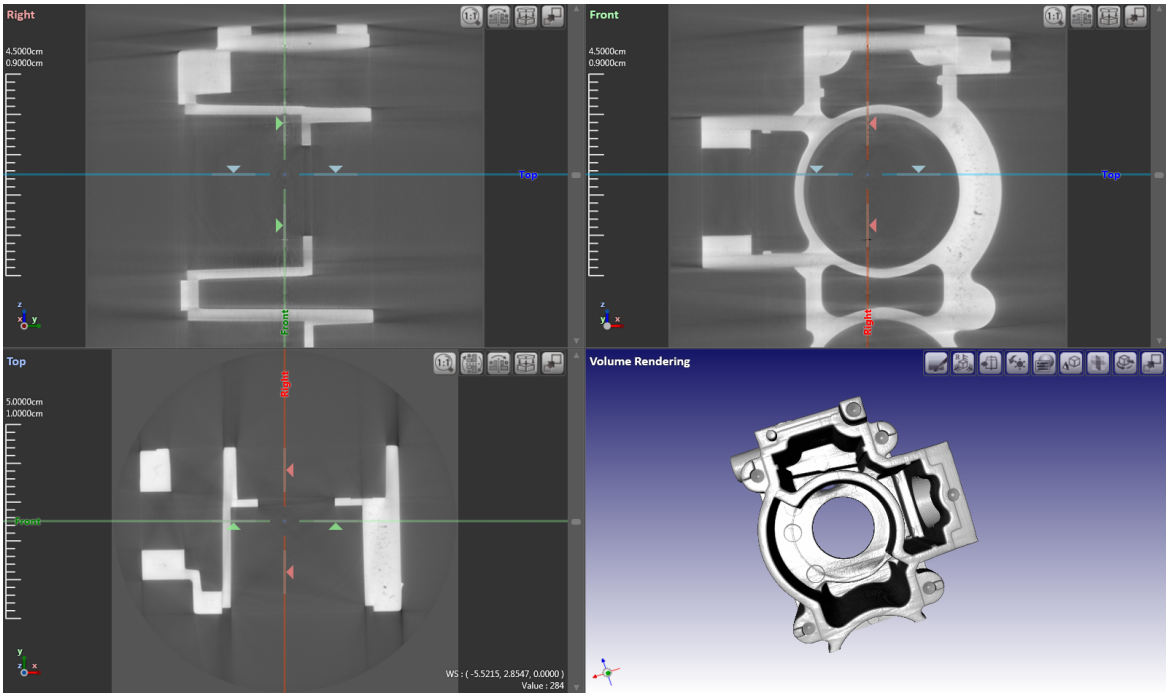
- Parallel translation : Click 'Translation'. Choose one of the axes (x,y,or z-axis). Left-click and drag the object to translate it.
- Rotation : Click 'Rotation'. Choose one of the axes (x,y,or z-axis) and the panel window will show both the chosen rotation axis penetrating the center of the object and the sphere representing the radius. Left-click and drag the object in the direction users want to rotate.

6.1.1.9 Panel Window Min/Maximization

Click  at a panel to maximize the panel window.



Click  at a panel to minimize the panel window.



6.1.1.10 Inverting MPR View Direction

Click  at a panel to flip the visualized image horizontally.

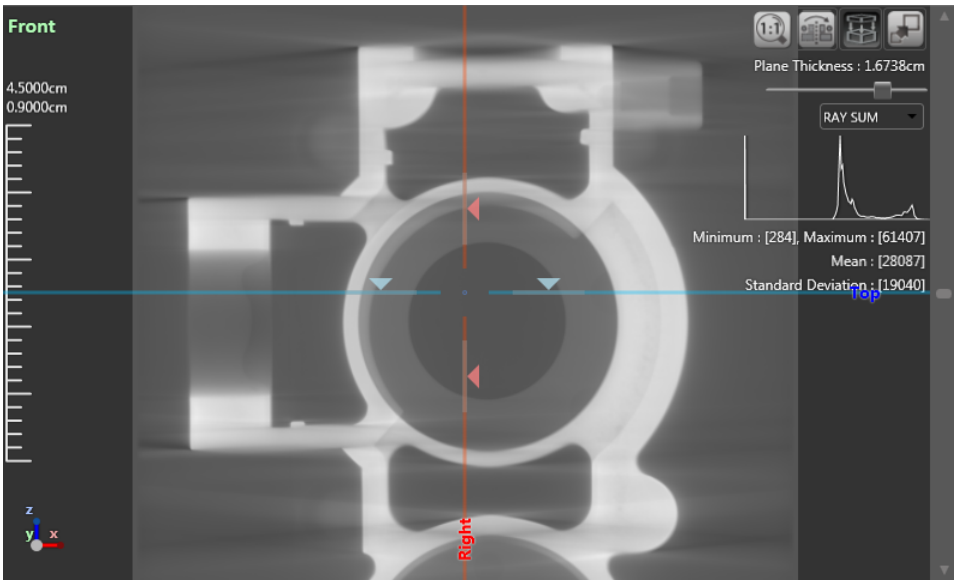
Click  at a panel to flip the visualized image vertically.

6.1.1.11 MPR Setting and Analysis

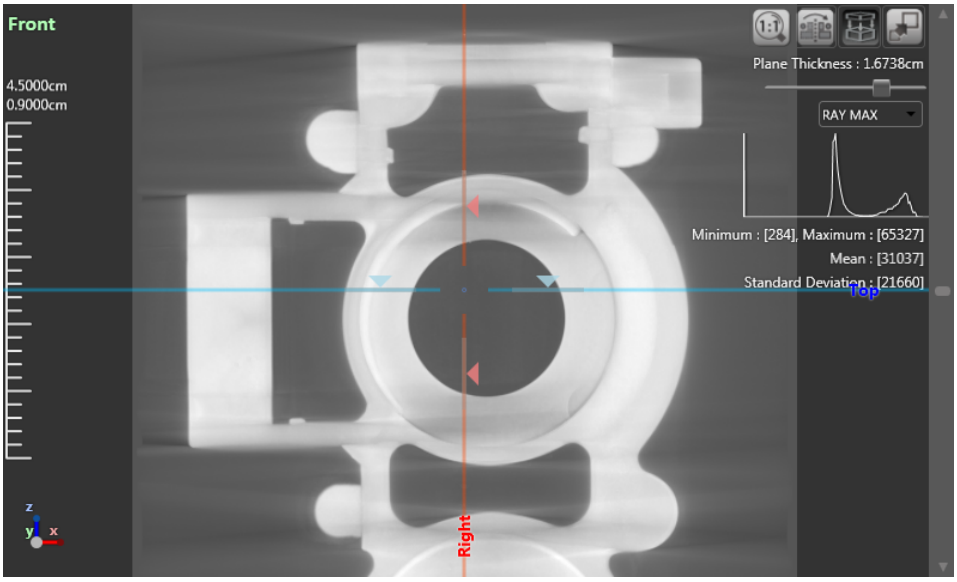
Adjust the scope of an MPR plane and use its sampled-data for visualization. Click  at a panel to observe the volume data in the adjusted range.

- Plane Thickness : Sets the thickness of the MPR panel.
  The thickness of this MPR panel is displayed as white dotted lines on other MPR panel window.

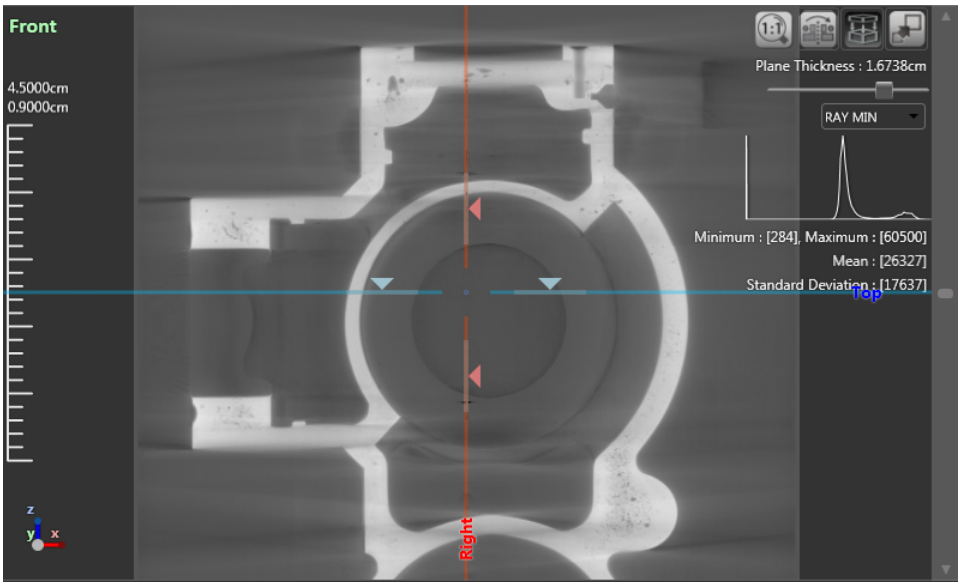
- RAY : Choose one among RAY SUM, MAX, MIN.
  - RAY SUM : The mean values are visualized when sampling the selected area.



  - RAY MAX : The maximum values are visualized when sampling the selected area.



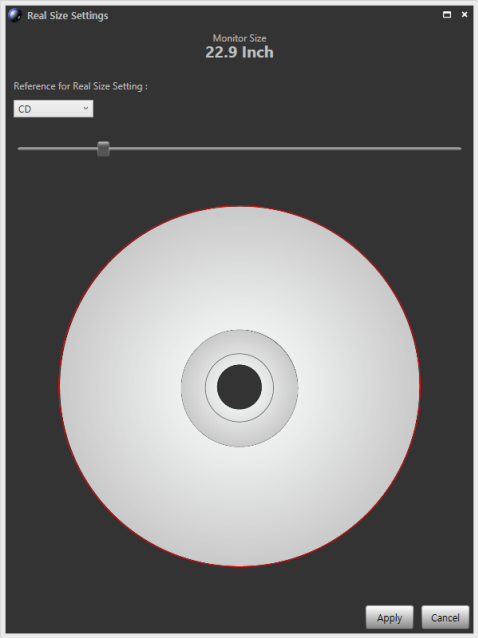
- RAY MIN : The minimum values are visualized when sampling the selected area.



- Additional information on volume values represented in pixel can be found on the MPR panel. It provides information about histogram, min/max values, and standard deviation.

6.1.1.12 Real Size Settings

Check 'Use the latest actual monitor size setting as default' from 'Settings - Configuration – Others', and click 'Settings'.



Select a object for reference (CD, Credit Card, Ruler) from the real size settings window.

(The standard size that program defines : The diameter of CD is 12cm, Credit Card width / height are 8.560cm / 5.398cm. If using the CD or Credit Card which is unsized, real size setting does not work.)

If a CD is selected, compare the real CD with the CD image on screen and adjust the size with the slide bar.

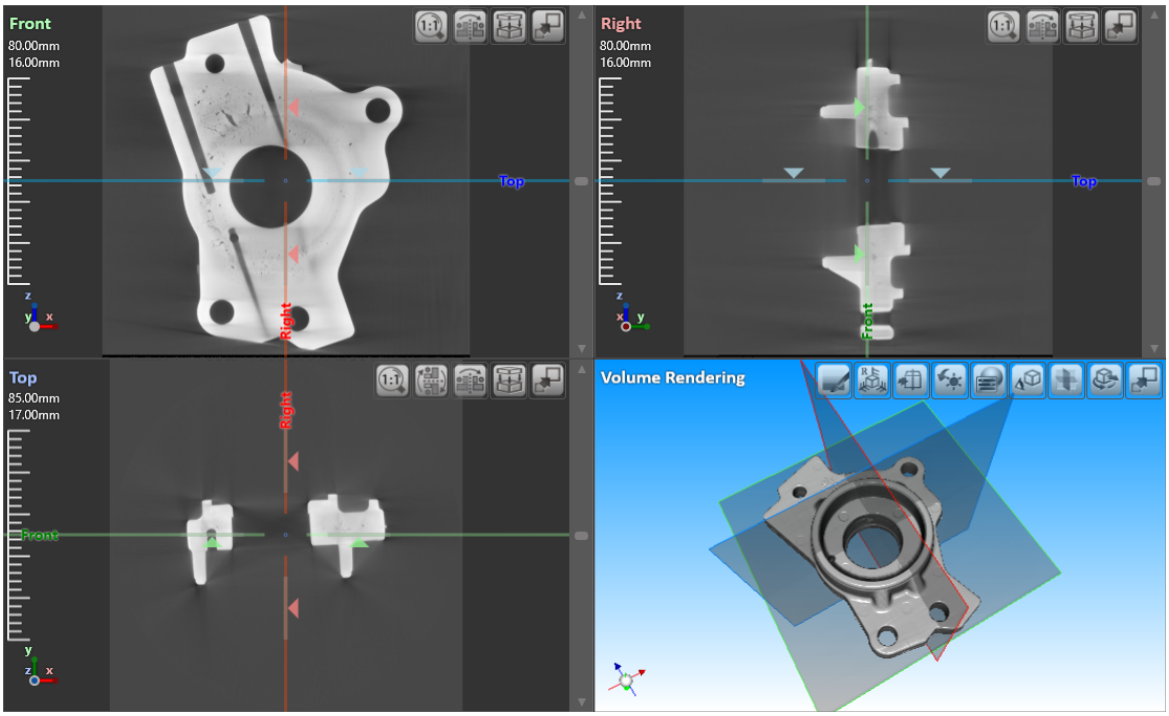
The accuracy depends on the CT resolution and the accuracy is lower than the CT resolution. If user set the real size without an error, the length for 1 pixel is a maximum permissible error.

The slide-bar can be operated either with the left mouse button or mouse wheel. Click 'Apply' after adjusting.

Click  at the MPR panel to set the 2D image of the MPR panel in real size.

6.1.2 View Layout

The basic view layout is like the following.



The three cross-sectional planes on the volume rendering panel indicate the MPR panels which are vertical to each other. When the data is first loaded, they penetrate the middle point of the volume and are perpendicular to x, y, and z-axis.

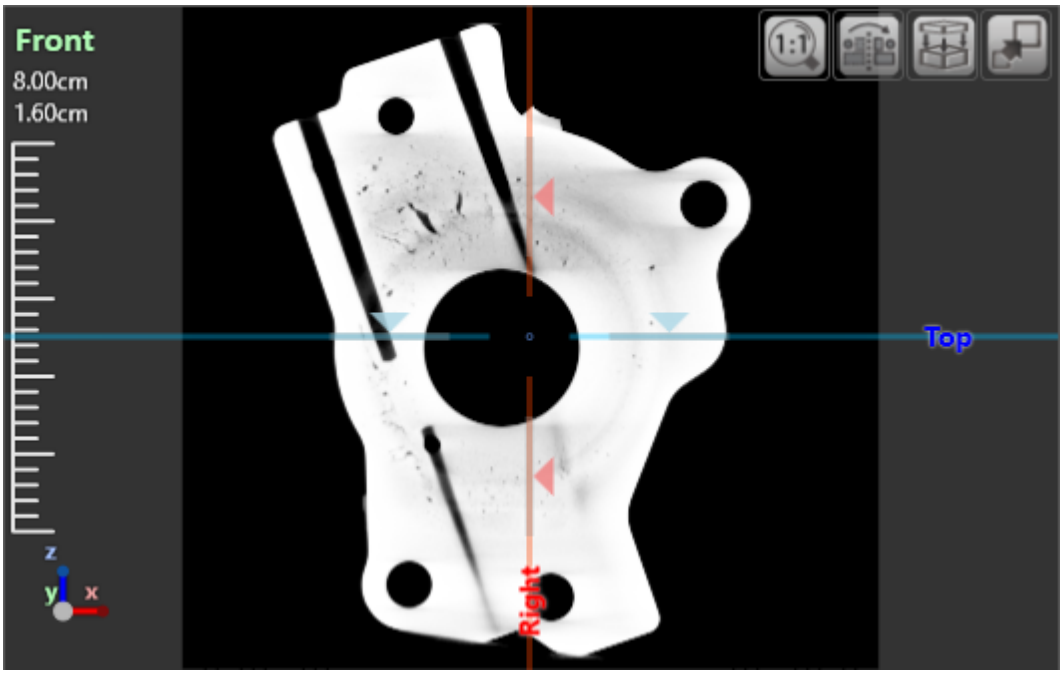
- The front panel (hereafter referred to as the 'panel') which is marked with green is vertical to y-axis when data is first loaded.
- The right panel which is marked with red is vertical to x-axis when data is first loaded.
- The top panel which is marked with blue is vertical to z-axis when data is first loaded.

The 3D panel shows the entire volume. Click  to visualize the superimposed planes. (See 3D Plane Options for details)

6.1.3 Layout Manager

Changes the location of MPR panel and the 3D panel from the view container. Click the name of the desired panel. Drag and drop it on the target panel, which turns to blue, to exchange the location of the two panels. Change the location of the panels of the function container in the same way. See 1.Basic Operations Tutorial for details.

6.1.4 GUI Components for Manipulating MPR Planes



- All of the four panels are interconnected, so any changes on one panel are applied automatically on the other panels in real time. On the 3D panel, click  to visualize the current placement state of planes.
- Right-click on one MPR panel and drag to zoom in and zoom out.
- The two colored lines crossing each other vertically show the current placement state of the other two planes. These are called MPR lines. In the image above, the red line indicates the right panel and the blue line indicates the top panel.

- With mouse scrolling or by using the slider on the right side of each MPR panel, translate the corresponding panel.
- Place the mouse cursor on the crossing point of one MPR panel. A circle which has the representing color of the panel will appear. Drag the circle to translate the two other planes. In this way, users can translate two planes at the same time.
- Place the mouse cursor on one of the MPR lines, which is marked in bold. Left-click and drag to rotate the two crossing planes. (Then the three planes will no longer be parallel to axis.) Right-click and drag to rotate only the 2D image of the plane. the placement state of planes remains the same.
- Place the mouse cursor on one of the MPR lines which is marked in bold and white, adjoining the crossing point. The white part will thicken. Left-click and drag to translate the plane of that MPR line. In this way, users can translate only one plane and see at the same time its placement state on the MPR panel.

See 1.Basic Operations Tutorial for details.

6.2 Panorama View

Users can visualize a 1D nonlinear curve plane of volume into a 2D image.

See Panorama View for details.

6.3 Pore Detection View (add-on module)

Users can manipulate and control the detected pores.

See Pore Detection for details.

6.4 Report View

Users can print reports in formats provided by Dentiq3D, with additional comments if needed.

See Report View for details.

6.5 Tile View

Tile View arranges MPR planes as images.

See Tile View for details.

6.6 Path Animation View

Path Animation View allows to create an animation using various functions Dentiq3D provides.

See Path Animation View for details.

6.7 Reformat View

Exports the image that is customized by using various options.

See Reformat View for details.

7 Function Container

Function containers on the right side of the screen include function buttons, operation history, OTF panel, etc.

7.1 Common Function Toolbar

Common Function Toolbar provides a list of function button commonly used in each of view containers.

Toolbar panel performs functions as follows:

- Open / Save a file
- Export/Save a movie file
- Create a Viewer
- Create a View Container

7.1.1 File

Imports / exports various volume data or mesh data (stl) such as x3d (Dentiq3D's own format), dcm (DICOM), raw (file without header), tif, jpeg and cad data (igs, iges, step).

If additional volume information is provided, Dentiq3D will automatically detect it while importing the data. Otherwise, set manually the required information to import the volume data.

Volume data can be exported in a number of formats and new volume data can be created by setting the region of interest (ROI). See 3.File Tutorial for details.

7.1.1.1 Save Project (Ctrl+S)

Click  at the common function toolbar to save the current operation as a project.

Check 'save original data' to copy original data and save it with its project file(*.vx3). Project file will not be loaded if original data is not copied and its path or the path of the project file is changed. If original data is copied and is in the same folder with its project file, the project file will be loaded no matter which path it has.

Storage policies for the volume and mesh data are as follows:

- Volume data : Volume data will be saved in *.x3d file format. x3d file format includes additional information like volume size or pitch and are used on project files (*.vx3) *.x3d files can be loaded by itself.
- Mesh data : Mesh data will be saved in *.stl file format (in binary).

Following information will be saved:

- 2D Plane state : MPR Line, MPR zoom state, position and direction of Planes, etc.
- 3D Camera state : Position and orientation of the camera, Zoom state, etc.
- 3D Rendering Options : Clipping box, Light source Control, Visualized state of superimposed planes, etc.
- Measurement : Add, Modify, Erase, Color Change, etc.
- OTF : Alpha, Color, Windowing state change, etc.
- Mesh data loading and Surface Extraction
- Captured image screen, Final result of report view

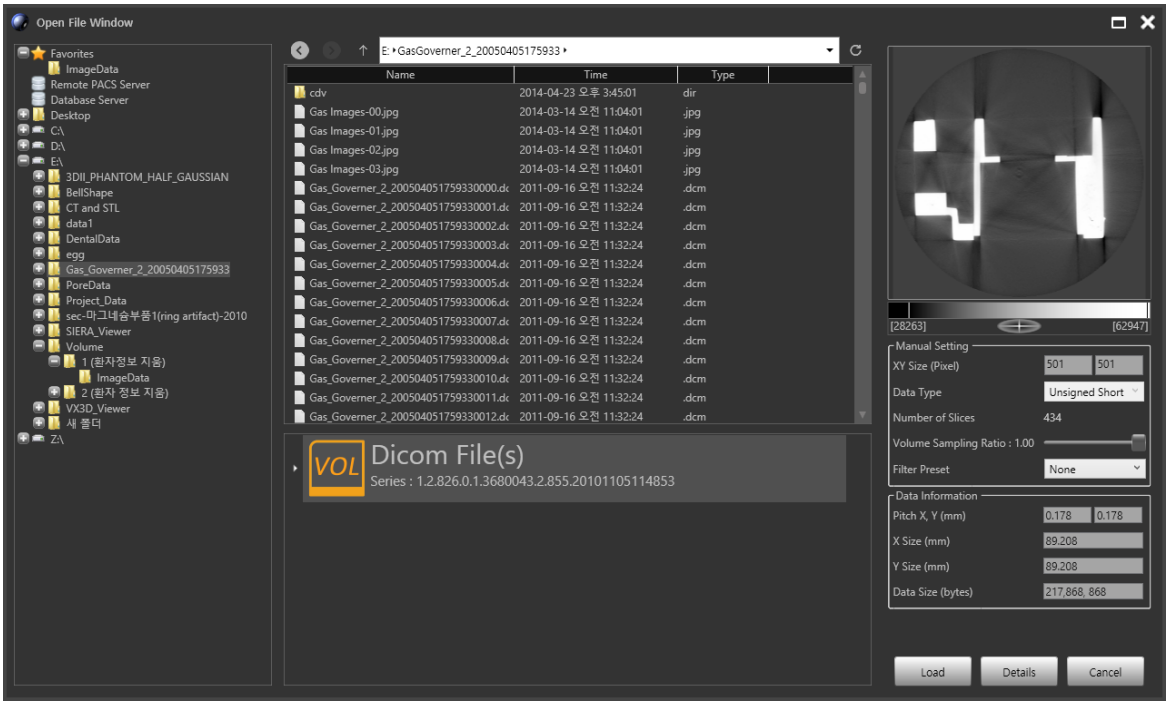
Following information will not be saved:

- Volume processing : Volume processing such as Sculpture or Filter, etc. will not be registered on the history panel. Only the final result of the volume processing is saved to the volume.
- Background Color
- Adjustment of the size of a panel.
- Unit transformation

- MPR Overlay Visible/Hidden
- File-related operations (i.e. Export, Save as AVI)

7.1.1.2 Open (Ctrl+O)

Click  at the common function toolbar to appear Open File Settings Window. See 2. Open File Settings Tutorial for details.



Choose from the folder list a folder containing files in supported formats (*.raw, *.DICOM, *.vgi, *.x3d, *.vx3, *.stl, *.igs, *.iges, *.step) to open the file list. At first every file in the directory will be selected. To load specific files only, select each file to load separately.

Add frequently used directories on the favorite tab by right-clicking a directory on the list. Added directories will be shown on the favorite list on the top left part of screen. Left-click the directory to unfold it.

The image of the selected file is shown on the top right part of screen. If multiple files are selected, the image of the file in the middle of the selected list is shown. Adjust the opacity using the

windowing bar.(See Opacity Transfer Function for details.)

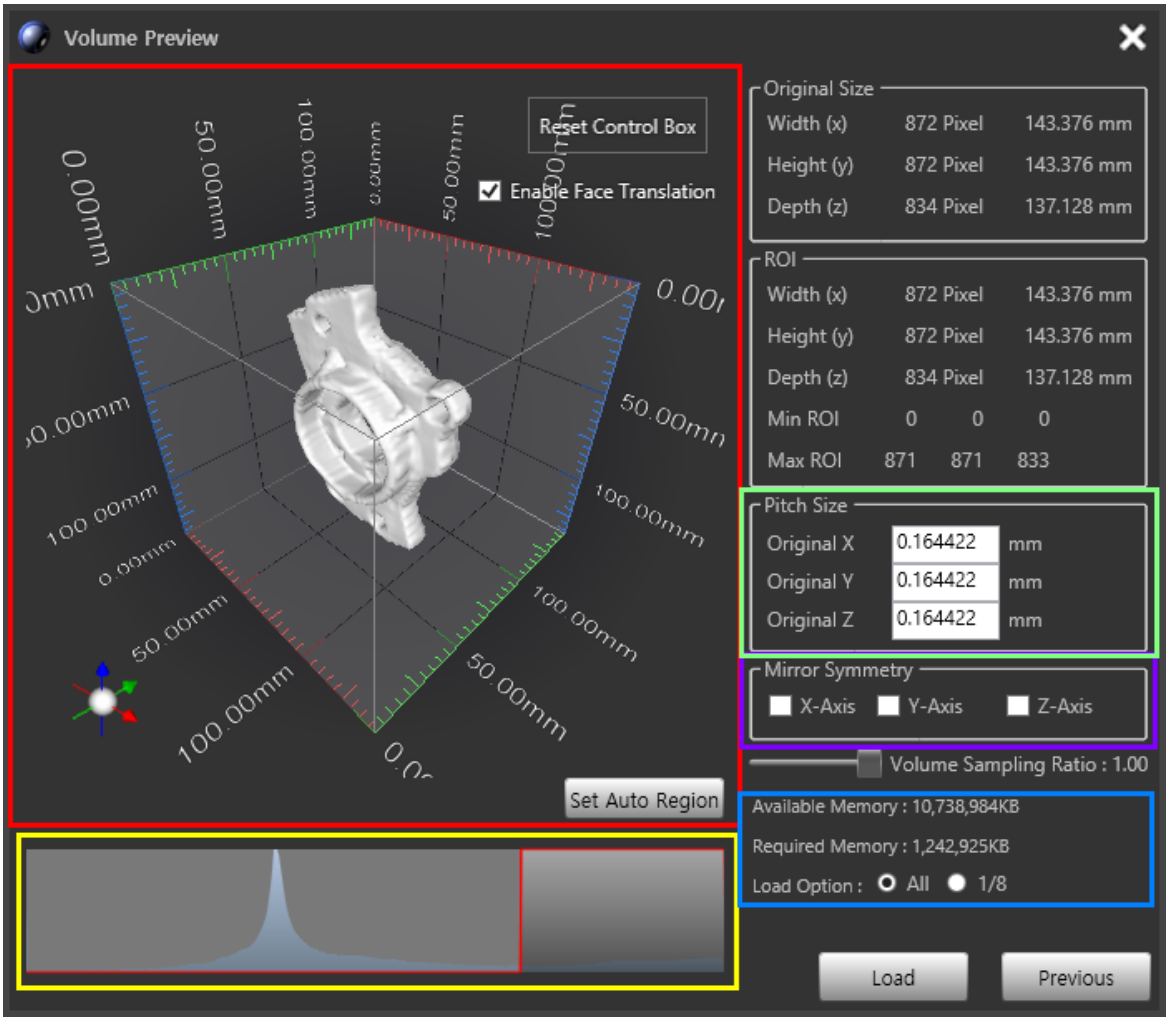
If a *.vx3 file is selected, the latest operation applied to it is shown on the top right part of screen. Users cannot manually modify the volume information for *.DICOM, *.vgi, *.x3d, and *.vx3 files, which already contain volume information. On the other hand, users can modify or input volume information to *.raw files which contain no information in advance. For mesh data (*.stl) and cad data (*.igs. *.iges, *.step), users can change the unit, mesh color and choose 'Central Alignment'.

Enter proper data format and XY dimension values to acquire the desired image. If the value is invalid, the image will be distorted.

Adjust the volume sampling ratio for reducing volume when loading. The original volume is loaded with the value of 1.0. The smaller the value is, the bigger is the reduction ratio. In this case, less memory is needed but detailed information of the volume is lost.

In case of file formats except project files, apply presets. (See Filter for details.)

Click 'Load' to load the volume data without setting any further details. In case of volume data, 'Detail' button will be activated. If the chosen volume data is floating point type, Click 'Load' or 'Detail' to show up the voxel value calibration window. After defined the calibrating function to convert floating type data to the integer type data, next operation will be performed . Click 'Detail' to load the volume data without air space visualization or to reduce volume data by down-sampling. The button to adjust ROI will be activated if volume data is chosen.



- **Yellow box** : Manipulate the OTF to set the visible region of volume.
- **Red box** : Manipulate ROI (Region of Interest) to remove unnecessary regions of volume. Click and drag left mouse button on the bounding box to change the ROI. Click Reset button to reset ROI. Click Auto Crop to remove air region and minimize the bounding box automatically without removing any part of the object. Click and drag the right mouse button to rotate the volume. Click and hold the left mouse button on an area outside of the bounding box, and drag the mouse to pan the camera. If modifying ROI is not necessary, uncheck 'Enable Plane Translation' to fix bounding box. The size and ROI of volume data is shown on the right panel.
- **Green box** : Adjust pitch size on the 'pitch size' part. The default pitch of raw data is 1 mm/voxel. Edit pitch to match the size of volume to that of the real object.

- **Purple box** : Select the check box in the 'mirror' option to flip the volume in the x,y,z-axis direction.
- **Blue box** : Check the available memory space and the required one to load new volume data. If memory space is insufficient to load the volume, its file name will appear in red. Click 'All' to load the full volume of ROI. The '1/8' button will reduce the volume size by one-eighth, also down-sampling the volume.

Click 'Previous' to go back to the former window. Click 'Load' to load volume set as ROI.

7.1.1.3 Export (Ctrl+U)

Click  at the common function toolbar to export the current volume and mesh data shown in the view container as files.

Volume data which is defined as a stack of slices is exported in the following three ways:

- Export volume data containing data size and sliced direction in accordance with the state of the clipping box.
  - Choose 'Volume applied with ROI box' volume with/without clipping box' to proceed.
  - Supported exporting file formats are x3d, dcm, raw, tif.
  - The size of volume size which is exported will be computed automatically. It can be found on the volume information section beneath.

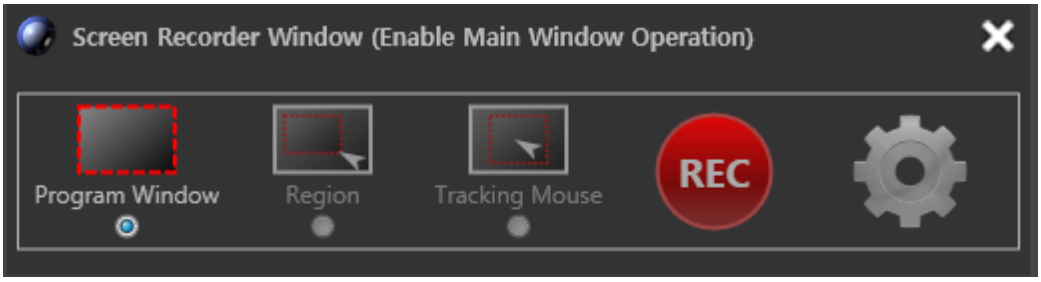
- Export volume data containing data size, sliced direction, and image formats in accordance with the rendering state including camera state (Up Vector and View Vector of camera), OTF application, etc.
  - Choose 'Volume determined by the Rendering Direction' to proceed.
  - Set one of the three MPR panels as sampling slice to use for rendering state.
  - Either export a single slice or the whole stack of slices in rendering direction of the chosen MPR panel window.

- Choose either to export slices represented with volume value or with opacity.

- Export mesh objects
  - If the activated view container contains mesh data, it is possible to activate 'Mesh Objects' option at the exporting window tab. Choose 'Mesh Objects' tab.
  - Select mesh to be exported. Selected mesh data is displayed on right preview screen.
  - Select the file type to save the *.stl file (Binary/ASCII).
  - Select the coordinate. If original coordinate is selected, the coordinate that is set when creating mesh is exported (If mesh data is loaded as file, the coordinate of original file is exported). If current coordinate is selected, the coordinate that is set by program is exported.

7.1.1.4 Export a movie as a file (Ctrl+M)

Click  at the common function toolbar to record Dentiq3D window panels.



The default for saving is 30 frames/sec.

Recording may not be smooth depending on volume data size or speed of hardware.

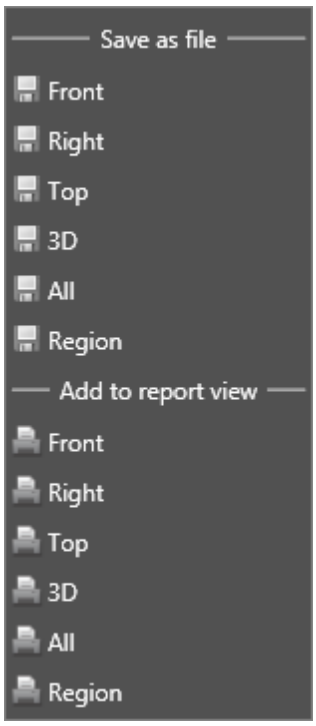
Click  again to cancel recording.

When the recording starts, a window to pause or finish recording is activated on the bottom right part of the screen. 

Click 'Stop' on the bottom right part to finish recording and open a new window to save as file.

7.1.1.5 Capture

Click  at common function toolbar to capture the screen.

	• Front, Right, Top, 3D : Captures and saves the each panel. • All : Captures and saves all panels. • Region : Sets and saves the region to capture. • Front, Right, Top, 3D : Captures and adds the each panel to report view. • All : Captures all panels and adds to report view • Region : Sets region to capture and adds to report view

By clicking a capture option, captured image will be saved or added to the report view.

Depending on the view container, regions possible to capture may vary.

7.1.1.6 Add STL (Ctrl+T)

Click  at the common function toolbar to add STL and cad (*.igs. *.iges, *.step) files.

Choose the STL and cad (*.igs. *.iges, *.step) file from the file list. The preview of selected file will be visualized on the right side.

- Manual Setting
  - Select the unit for the object (micro-, mili-, or centimeter).

- Rotate the mesh/cad data with the right mouse button or move it with the left mouse button on the preview.
- Click 'Central Alignment' to place the mach/cad data in the middle.
- Click Mesh Color to change the color of the object.

- Data Information
  - Check the type of STL file (binary/ASCII), data size, and the number of polygons comprising the data.
  - Click 'Load' to load the object.

7.1.1.7 Create one-project Viewer

Click  at common function toolbar to burn a CD of the project file with current operation history or save it in a mass storage device. A pop-up window to set the saving path of the one project viewer shows up.

The one project viewer can operate without a dongle key, but certain functions are restricted. Only project files of when the one project viewer is created can be loaded.

- Minimum System Requirements
  - Window version : Windows Vista, 7, 8, 10
  - System type : 32bit, 64bit Operating system

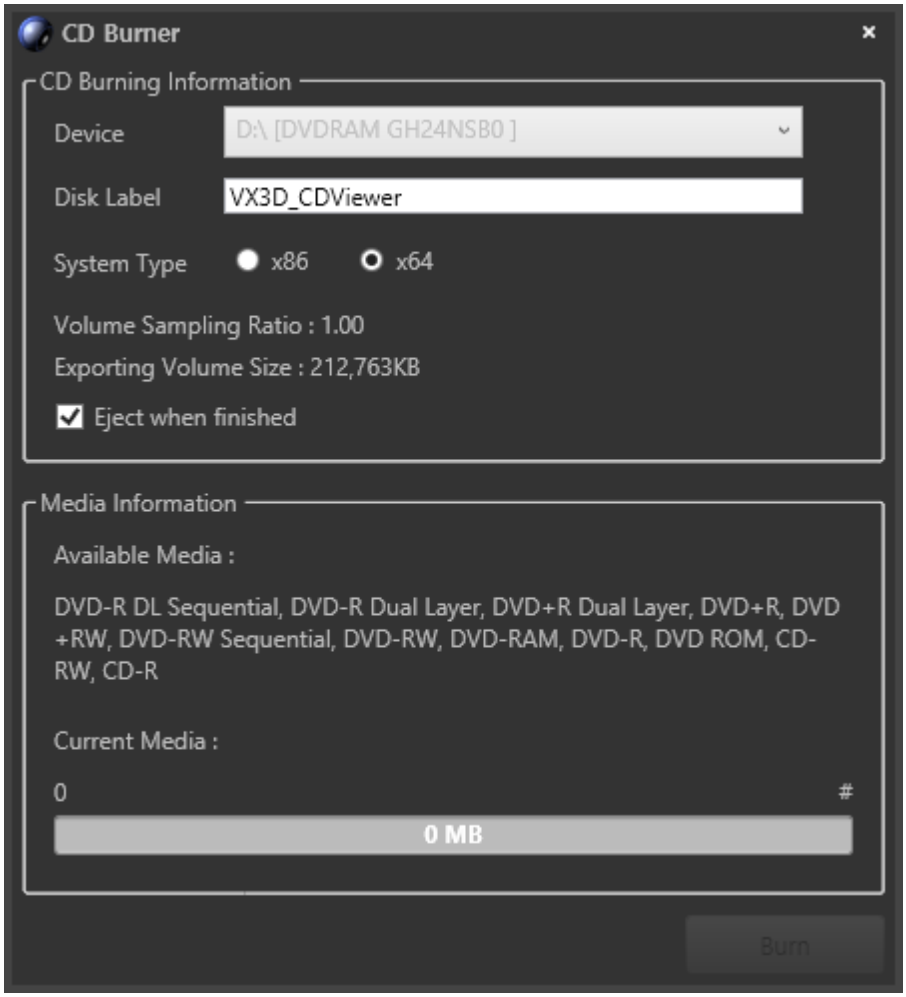
* Operating system has to be designated according to the actual running environment for an one project viewer. The one project viewer that is created by designating 64bit cannot be run in 32bit system, it is available in 64bit system only. The one project viewer that is created by designating 32bit can be run in 32bit, 64bit system but the volume that is saved in the project has low resolution.

  - Graphic card : DirectX 10 or higher

See 3.File Tutorial for details.

7.1.1.7.1 Export to CD

Click 'Export to CD' button to display the pop-up window like the following.



- **Media Information**

Choose the device to create the one project viewer. Write the disk label.

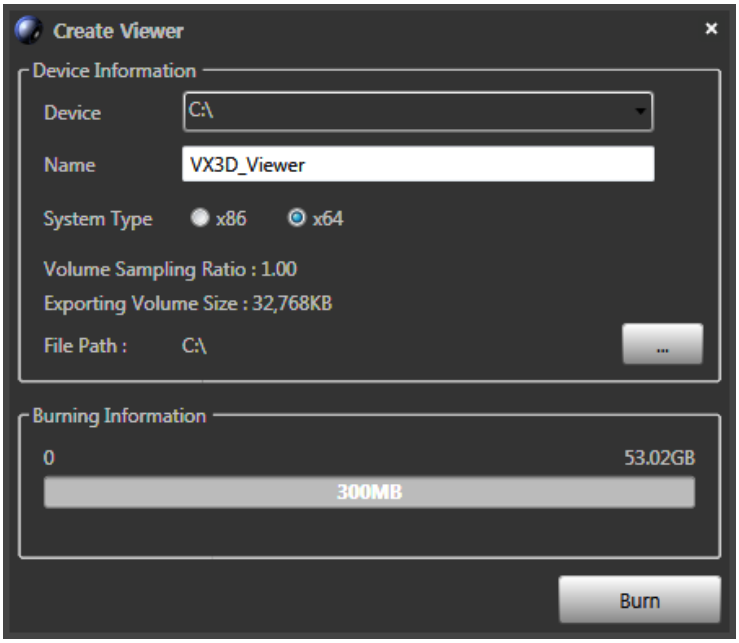
- **CD Burning Information**

Check 'Eject when finished' to eject the CD automatically when burning is finished.

The list of available media for the selected device is shown beneath. If the current media is not available, a warning message will show up. If the current media is available, the type of media will show up. Click 'Burn' to start burning. The burned CD incorporates install program, so it is possible to run and load the project, no matter whether Dentiq3D is installed or not and whether there is a dongle key or not.

7.1.1.7.2 Export to Mass Storage Device

Click 'Export to Mass Storage Device' button to display the pop-up window like the following.



- **Device Information**

Sets the name and file path of the drive to create the one project viewer.

Sets the name of the folder to save the one project viewer.

7.1.2 View

7.1.2.1 Pore Detection

Detects pores and shrinkage cavity.

Click  at Common Function Toolbar to detect pores.

See Pore Detection for details

7.1.2.2 Panorama

Panorama View converts the cross-sectional images of the created curve into 2D image.

Click  at Common Function Toolbar to start Panorama View.

See Panorama View for details.

7.1.2.3 Tile

MPR planes are arranged as images. Click  at Common Function Toolbar to use it.

See Tile View for details.

7.1.2.4 Report

User create a report based on template provided by Dentiq3D. Click  at Common Function Toolbar to use report view.

See Report View for details.

7.1.2.5 Path Animation

Path Animation View allows to create an animation using all the functions applied on the 3D panel.

Click  at the Common Function Toolbar to use path animation view.

See Path Animation View for details.

7.1.2.6 Reformat

Exports the images that customized by using various options.

See Reformat View for details.

7.1.2.7 Airway

Extracts the airway through simple operations on MPR screen.

See Airway View for details.

7.1.3 Others

7.1.3.1 Undo/ Redo

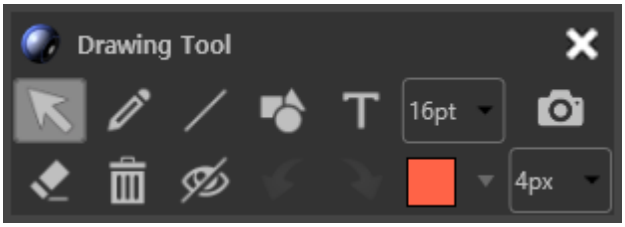
Click  at Common Function Toolbar to undo the current work and click  to redo the previous work.

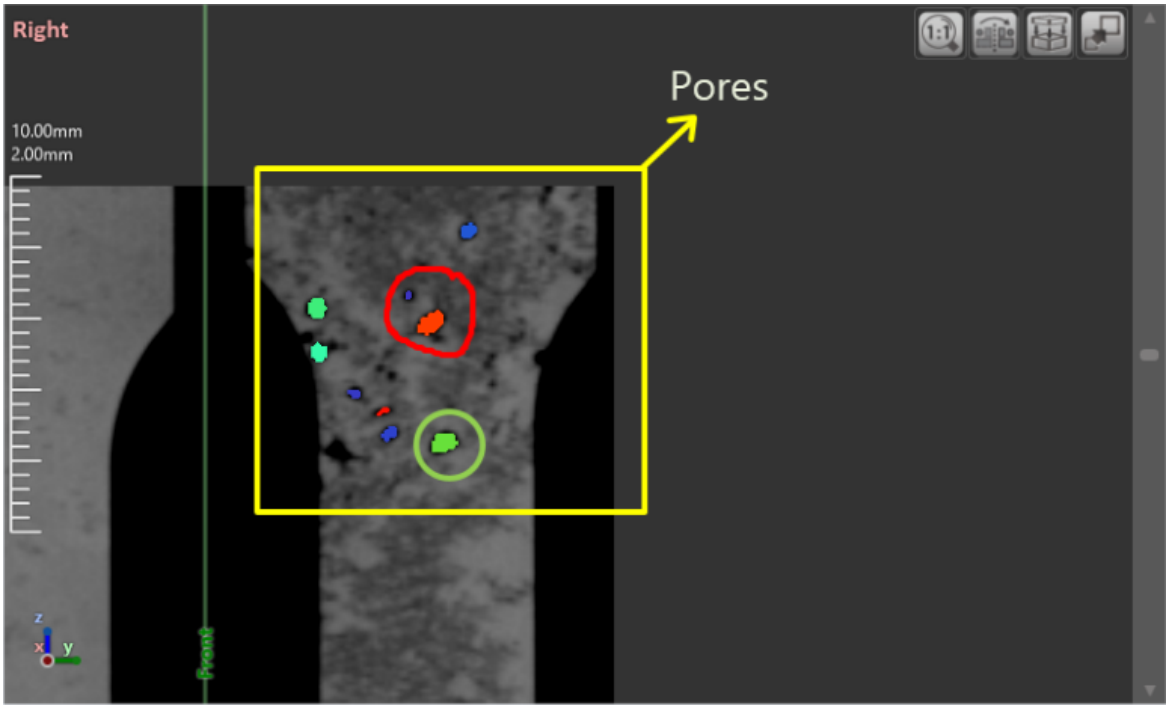
7.1.3.2 Drawing Tool

Click  at Common Function Toolbar to open Drawing Tool Window.

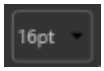
It is possible to draw or erase lines, figures and text by using Drawing Tool on each of views.

The drawn images can be saved and loaded.





- How to use
  - It will be a selection mode if all buttons are deactivated. Movement, control of size, change of color and thickness are available on drawn objects.
  - Drawing Mode: Activate the button to use functions of shortcut key of Dentiq3D or functions of each view. If the button is deactivated, the drawing mode is available. In this state, the functions of shortcut key of drawing tool and relevant functions with drawing tool are only available.
  - Pen : Draws various curves.
  - Line : Draws straight lines.
  - Figure : Draws quadrangles, circles, and polygons. Double click to finish drawing polygon.
  - Text : Inserts text box and writes text.
  - Capture : Saves the drawn screen on each view and captured images are saved at report view.
  - Eraser : Erases the objects by clicking or dragging after click.
  - Delete : Deletes all drawn objects.

-  Hide : Hides the drawn objects if buttons are activated. Deactivate buttons to show up the hidden objects.
-  Undo & Redo : Undoes or redoes operations.
- Combo box : Changes the  (Font size),  (Color) and  (Brush size).
- Push the 'Alt' key to read the tool tip of shortcut key of each function.
- Push the 'Ctrl+C'(copy), 'Ctrl+V'(paste) key to copy and paste the object at the same view or among other views.

7.2 Toolbar Panel

Toolbar Panel includes multiple icons for controlling various functions provided by Dentiq3D. Such functions are as follows :

- Measuring length, area, etc. of an object
- Processing Volume data (Filtering, Sculpting, etc.)
- Other miscellaneous functions (i.e. Undo/Redo, Reset Rendering)

7.2.1 Measuring Instruments

See 4.Measuring Instruments Tutorial for details.

7.2.1.1 Line / Distance (L)

Click  at the toolbar panel to measure the distance between two points by drawing a line. Lines can be drawn on MPR panels only, but they are visualized on MPR panels and on 3D panel as well.

- How to use
  - Click  and left-click the starting and end point at the MPR panel.
  - Right-click to cancel any drawings.
  - Place the mouse cursor on a line and drag it to move the line.
  - Click a line to see control points. Click and drag control points to modify the line.

- Drag the annotation with the left mouse button to move it.

- Pop-up menu
  - Place the mouse cursor on a line of an MPR panel and right-click to open the pop-up menu. (The pop-up menu will not appear on 3D panel.)
  - Profile : See the density graph by sampling the value from the starting to the end point. (See Profile for details)
  - Unit : Transforms units. (See Calibration for details)
  - Property : Changes the color of each line. (See Measurement Instrument properties for details)
  - Delete : Deletes a line.

Warning : If the measurement is used for medical treatment, incorrect measurement may result in medical mistakes. Therefore, user need to fully understand measurement related matters.
The accuracy of measurement is based on the image resolution of CT data and the accuracy may be lower than the resolution of CT data.
The measurement values are based on the location that is specified by user.
The form or boundary line of the object can be changed by the adjustment of the image brightness.
If you have software problems with measurement or questions, please contact us +82-70-8766-2395 (Phone) or threedii.service@gmail.com (E-mail).

7.2.1.2 Boundary-Fitting Line

Click  at the toolbar panel and draw a line to measure the distance between two edges of which the intensity value change rapidly. When user has drawn line, the both end points are placed automatically on the spot that has biggest intensity value gap by calculating intensity value. (The both end points depends on the windowing value because the intensity value of the image depends on the windowing value. Be sure to draw the line where the boundary line is clear.) Lines can be drawn on MPR panels only, but they are displayed on MPR panels and on 3D panel as well.

※ Caution

1. When there are many points where the brightness value of image changes between two points that user sets, the boundary-fitting line can be set unintentionally.

2. Even if user set same point, the result may be differ because the brightness value of image changes depending on the window setting value.

3. User can still adjust the end points for the line if the line drawn by the function is not what the user intends to measure, and the measured value will be adjusted right away. This function is just a user convenience feature and the user still need to check the drawn line and adjust when necessary, especially when there are multiple spots nearby where the intensity changes drastically.

- How to use (See Line for details)
- Pop-up menu (See Line for details)

Warning : If the measurement is used for medical treatment, incorrect measurement may result in medical mistakes. Therefore, user need to fully understand measurement related matters.
The accuracy of measurement is based on the image resolution of CT data and the accuracy may be lower than the resolution of CT data.
The measurement values are based on the location that is specified by user.
The form or boundary line of the object can be changed by the adjustment of the image brightness.
If you have software problems with measurement or questions, please contact us +82-70-8766-2395 (Phone) or threedii.service@gmail.com (E-mail).

7.2.1.3 Angle (A)

Click  at the toolbar panel to measure an angle in volume. Angles can be drawn on MPR panels only, but they are visualized on MPR panels and on 3D panel as well.

- How to use
  - Click  and set three points defining the angle on a MPR Panel.
  - Right-click to cancel any drawings.
  - Place the mouse cursor on an angle and drag it to move the angle.
  - Click an angle to see control points. Click and drag control points to modify the angle.
  - Drag the annotation with the left mouse button to move it.
- Pop-up menu

- Place the mouse cursor on an angle of an MPR panel and right-click to open the pop-up menu. (The pop-up menu will not appear on 3D panel.)
- Unit: Transforms units. (See Calibration)
- Property: Changes the color of the angle. (See Measurement Instrument Properties)
- Delete: Deletes the angle.

Warning : If the measurement is used for medical treatment, incorrect measurement may result in medical mistakes. Therefore, user need to fully understand measurement related matters.
The accuracy of measurement is based on the image resolution of CT data and the accuracy may be lower than the resolution of CT data.
The measurement values are based on the location that is specified by user.
The form or boundary line of the object can be changed by the adjustment of the image brightness.
If you have software problems with measurement or questions, please contact us +82-70-8766-2395 (Phone) or threedii.service@gmail.com (E-mail).

7.2.1.4 Circle / Radius (C)

Click  at the toolbar panel to draw a circle and measure its radius. Circles can be drawn on MPR panels only, but they are visualized on MPR panels and on 3D panel as well.

- How to use
  - Click  and set the starting point and the end point on the MPR Panel, which will define the bounding box of a circle.
  - Right-click to cancel any drawings.
  - Place the mouse cursor on a circle and drag it to move the line.
  - Click a circle to see control points. Click and drag control points to modify the circle.
  - Drag the annotation with the left mouse button to move it.

- Pop-up menu
  - Place the mouse cursor on a circle of an MPR panel and right-click to open the pop-up menu.

(The pop-up menu will not appear on 3D panel.)

- Unit : Transforms units. (See Calibration)
- Histogram : Checks the density graph in pixel by sampling the value of the volume. (See Histogram)
- Property : Changes the color of the circle. (See Measurement Instrument Propoerties)
- Delete : Deletes the circle.

Warning : If the measurement is used for medical treatment, incorrect measurement may result in medical mistakes. Therefore, user need to fully understand measurement related matters.
The accuracy of measurement is based on the image resolution of CT data and the accuracy may be lower than the resolution of CT data.
The measurement values are based on the location that is specified by user.
The form or boundary line of the object can be changed by the adjustment of the image brightness.
If you have software problems with measurement or questions, please contact us +82-70-8766-2395 (Phone) or threedii.service@gmail.com (E-mail).

7.2.1.5 Polygon / Area (R)

Click  at toolbar panel to draw a polygon to measure its area. Polygons can be only drawn on MPR panels, but they are visualized on MPR panels and on 3D panel as well.

- How to use
  - Click  and left-click on an MPR panel to add an apex. Double-click to finish adding.
  - Right-click to cancel any drawings.
  - Place the mouse cursor on a polygon and drag it to move the polygon.
  - Click a polygon to see control points. Click and drag control points to modify the polygon.
  - Drag the annotation with the left mouse button to move it.
- Pop-up menu
  - Place the mouse cursor on a polygon of an MPR panel and right-click to open the pop-up menu.

    (The pop-up menu will not appear on 3D rendering panel.)

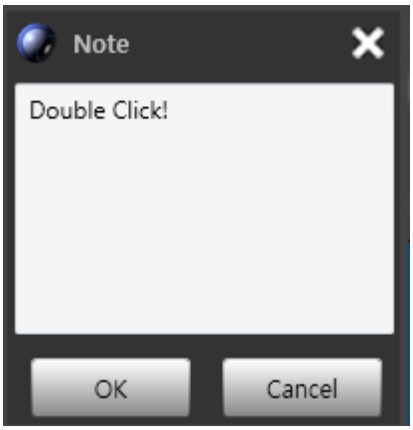
- Unit: Transform units. (See Calibration)
- Property: Change the color of the polygon. (See Measurement Instrument Properties).
- Delete: Delete the polygon.

Warning : If the measurement is used for medical treatment, incorrect measurement may result in medical mistakes. Therefore, user need to fully understand measurement related matters.
The accuracy of measurement is based on the image resolution of CT data and the accuracy may be lower than the resolution of CT data.
The measurement values are based on the location that is specified by user.
The form or boundary line of the object can be changed by the adjustment of the image brightness.
If you have software problems with measurement or questions, please contact us +82-70-8766-2395 (Phone) or threedii.service@gmail.com (E-mail).

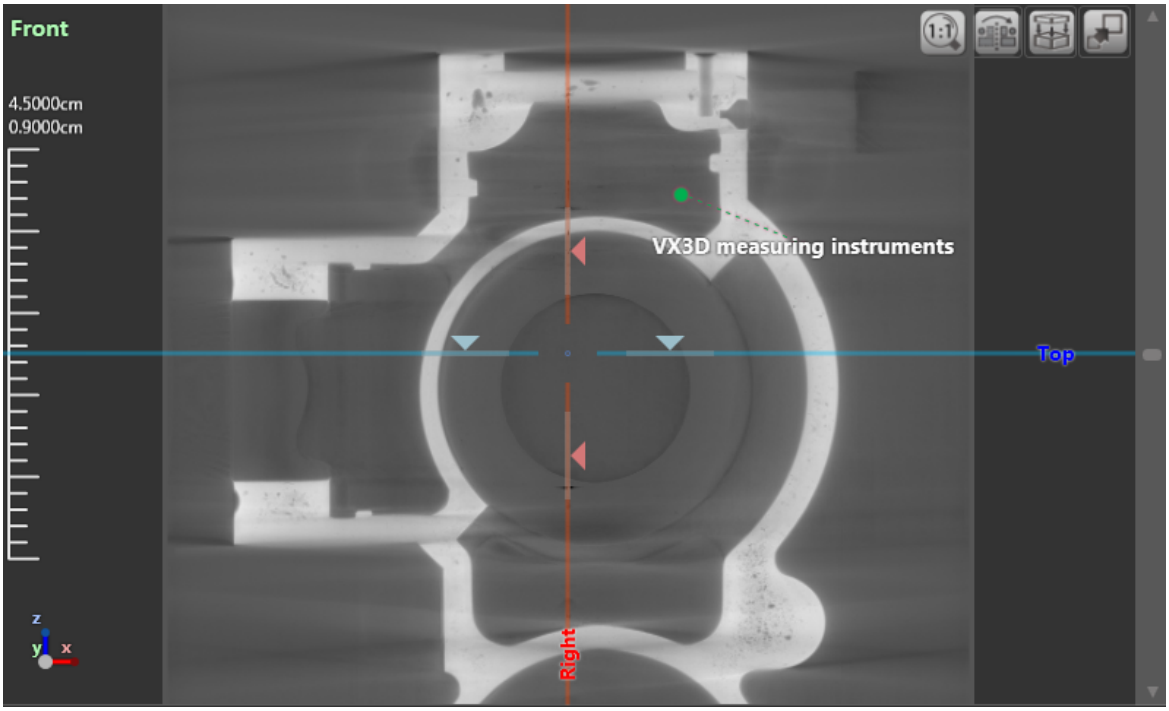
7.2.1.6 Note (N)

Click  at the toolbar panel to add a note. Notes can be added on MPR panels only and will be shown as a sphere on 3D panel.

- How to use
  - Click  and left-click on the MPR panel on the desired MPR panel and double-click to take notes.



  - Click 'OK' button after taking notes to adjust notes to MPR screen as below.



- A note consists of an annotation part and an control point. Place the mouse cursor on an control point and drag to move the note. Place the mouse cursor on the annotation part and drag to move it without relocating the control point.
- Place the mouse cursor on a note on an MPR panel and double click to open a pop-up window. Edit the content of the note.

- Pop-up menu
  - Place the mouse cursor on a note of an MPR panel and right-click to open the pop-up menu. (The pop-up menu will not appear on 3D panel.)
  - Property: Change the color and font size of the note. (See Measurement Instrument Properties)
  - Delete: Delete the note.

7.2.1.7 Calibration (U)

Click  at the toolbar panel to adjust units of length, area, and volume.

- Unit : Transforms units.

- Precision : Changes places of decimals. Length, area, and volume may have different places of decimals.
- Coordinate System : Chooses among Cartesian or Cylindrical coordinate system. Sets either as World Space(coordinate system with pitch information applied to voxel) or Object Space(coordinate system with voxel as standard).

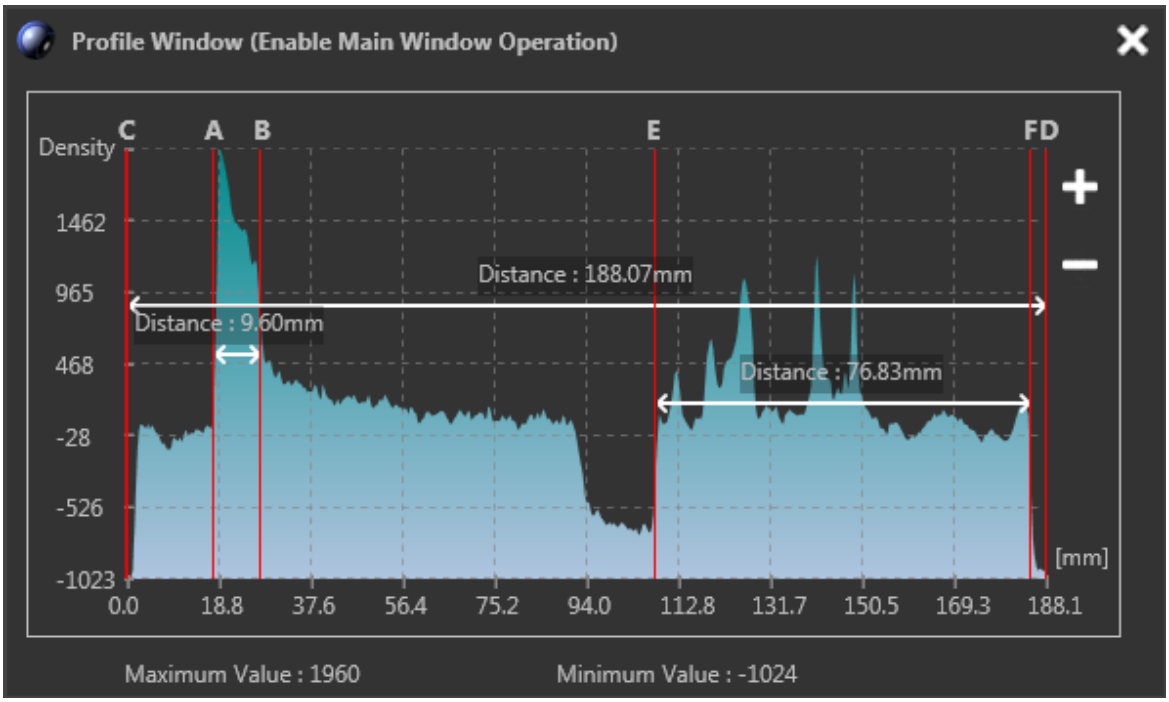
7.2.1.8 Property

Place the mouse cursor on a measurement tool, right-click and click 'Property' to open Measurement Instruments Properties. Set the color and font size of measurement tools.

- Apply : Applies selected color and font size to the measurement tool.
- Apply All : Applies selected color and font size to all measurement tools.
- Set as default : Applies selected color and font size to all measurement tools and defines them as default for upcoming tools.

7.2.1.9 Profile

Profile displays a density graph with length(x-axis) and density(y-axis) in a pop-up window. It samples the volume value of a line from the starting to the end point without any OTF application. The length of a line modified through profile line is shown in a pop-up profile window, and the starting and end points of the line is marked with alphabets on MPR panel.



- How to use
  - Click  to add profile lines at both ends.
  - Five pairs of profile lines can be added maximally, enabling an exact measurement.
  - Click  to delete the lastly added pair of profile lines.

※ Density: CT is based on the fundamental principle that the density of the tissue, blood and bone passed by the X-ray beam can be measured from the calculation of the attenuation coefficient. The measured density is normally expressed in Hounsfield unit (HU). The HU scale is a linear transformation of the original linear attenuation coefficient measurement into one in which the radiodensity of distilled water at standard pressure and temperature (STP) is defined as zero Hounsfield units (HU), while the radiodensity of air at STP is defined as -1000 HU.

※ Intensity: Intensity is brightness value that is adjusted by windowing while density is unique value of the image. When the specific area of the image brightens by adjusting windowing, the brightness

value changes but the density doesn't change.

※ DICOM file has PixelData tag that is used as Density value in this value is used as Density within the program. Intensity is comprised of Window Center, Window Width and PixelData of DICOM tag. (Refer to 'Intensity'.)

7.2.1.10 Histogram

Histogram shows the number of voxels(y-axis) to density (HU)(x-axis) as a graph. Histogram can help user to check the entire density distribution of the selected area (Refer to 'Circle/Radius' and 'Polygon/Area' of 'Measuring Instruments' in this manual for how to select area.) at a glance. In the histogram below, for example, part (a) is air, (b) is tissue and (c) is bone. In the histogram, the largest part is (b), followed by (a) and (c). Then the user can verify that the selected area is mostly consisted of tissue (b), followed by air (a) and bone (c). Use the slider on the right side to adjust the height of a histogram (Zoom in the graph by scaling down the y-axis, without changing the real value.).

7.2.2 Object Processing

See 6.Object Processing Tutorial for details.

7.2.2.1 Sculpting

Click  at the toolbar panel to sculpt volume. Sculpting refers to cleaving volume data by drawing polygons on 3D panel, which helps users to remove unnecessary parts or analyze the inner structure of the volume.

- How to use
  - Click 'Polygon'.
  - Left-click the 3D rendering panel to draw a polygon. Double click to finish drawing.

- Right-click to cancel any drawings.
- Use the 'Plane' button to remove the area above or below the center line.
- Use 'Remain region' , 'Remove region' button to remain or remove the surface.
- Left-click inner/outer region after drawing polygons to cut off volume data.
- Click 'Finish' button to apply the result to each panel and appear Original/Sculpted Volume on Volume Rendering panel.
- Click 'Remain region' button to remain the volume area that is connected to the selected area. (The unconnected area will be removed.)

7.2.2.2 Filter

Click  at the toolbar panel to use filter. It assists users to edit the volume data to their needs.

- How to use
  - Click a preview image to choose the filter type to apply.
  - Use the sliders on 'Parameters' to adjust filtered image and click 'Next' to proceed. The filter will be applied to the whole volume data, and the result is shown in the pop-up window for volume rendering.
  - Compare the original and filtered volume in the window, and click 'Finish' to confirm. The filter will be applied to the view container.
  - The adjusted filter preset can be used afterwards as well.
- Filter Types
  - Gaussian : Applies a Blur effect.
  - Median : Applies a median volume value of voxels in the mask. Used to remove Salt & Pepper noise.
  - Mean : Applies a mean volume value of voxels in the mask. It is effective in removing noises, but visualized data including its boundary lines may appear blurred.

- Erosion : Erodes boundaries of the object away (one of the basic morphological operations).
- Dilation : Enlarges boundaries of the object (one of the basic morphological operations).
- Sharpness : Makes boundary lines clear by increasing the sharpness of the volume.
- Adaptive Gaussian : Applies Gaussian adaptively to reduce distortion and remove noise.

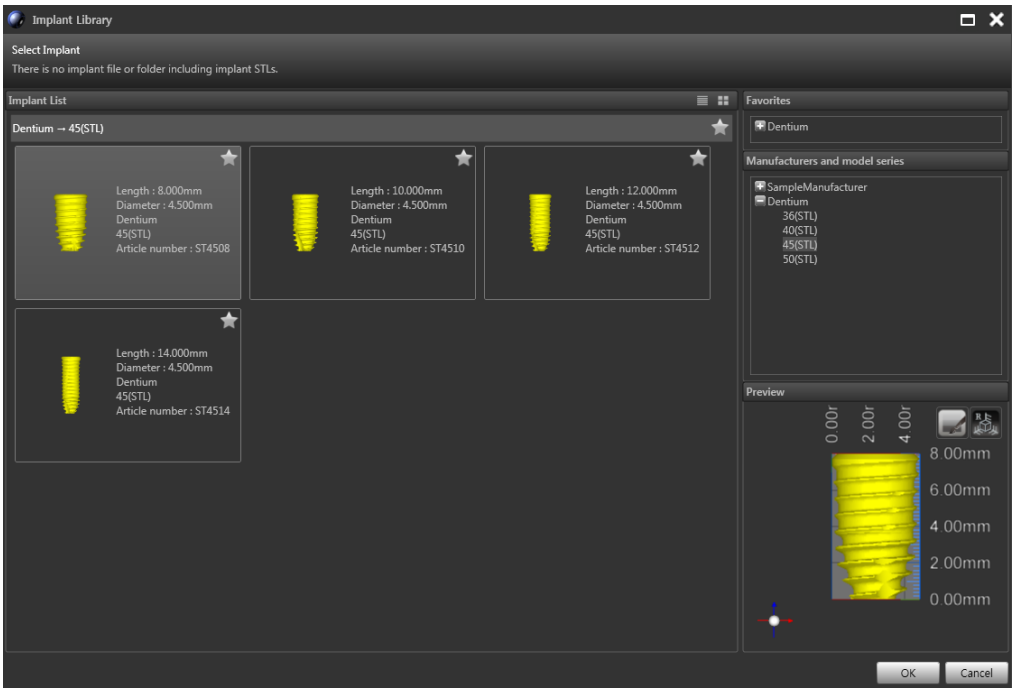
7.2.2.3 Mesh Extraction

Click  at the toolbar panel to extract mesh data from volume data.

- How to use
  - Select an area of volume data where you want to extract mesh data by using OTF control.
  - Set an interval for mesh sampling at 'options' to determine its precision level.
  - Click 'Extraction' to extract the mesh data.
  - Click 'Apply' to apply the result to the view container.

7.2.2.4 Insert Implant

Click  at the toolbar panel to open a pop-up window like the following.



Implants are grouped by company, group, and model name. Search for model names among registered implants through diameter, length, etc.

- Check and select implant model list of each manufacturer on the menu of the right side of screen.
- Right click company or corresponding model used often on the right side of screen to add as to Favorites.
- Check and select implant model information of selected company on the menu of the left side of screen.
- Click star button of implant model used often or each implant to add to Favorites.

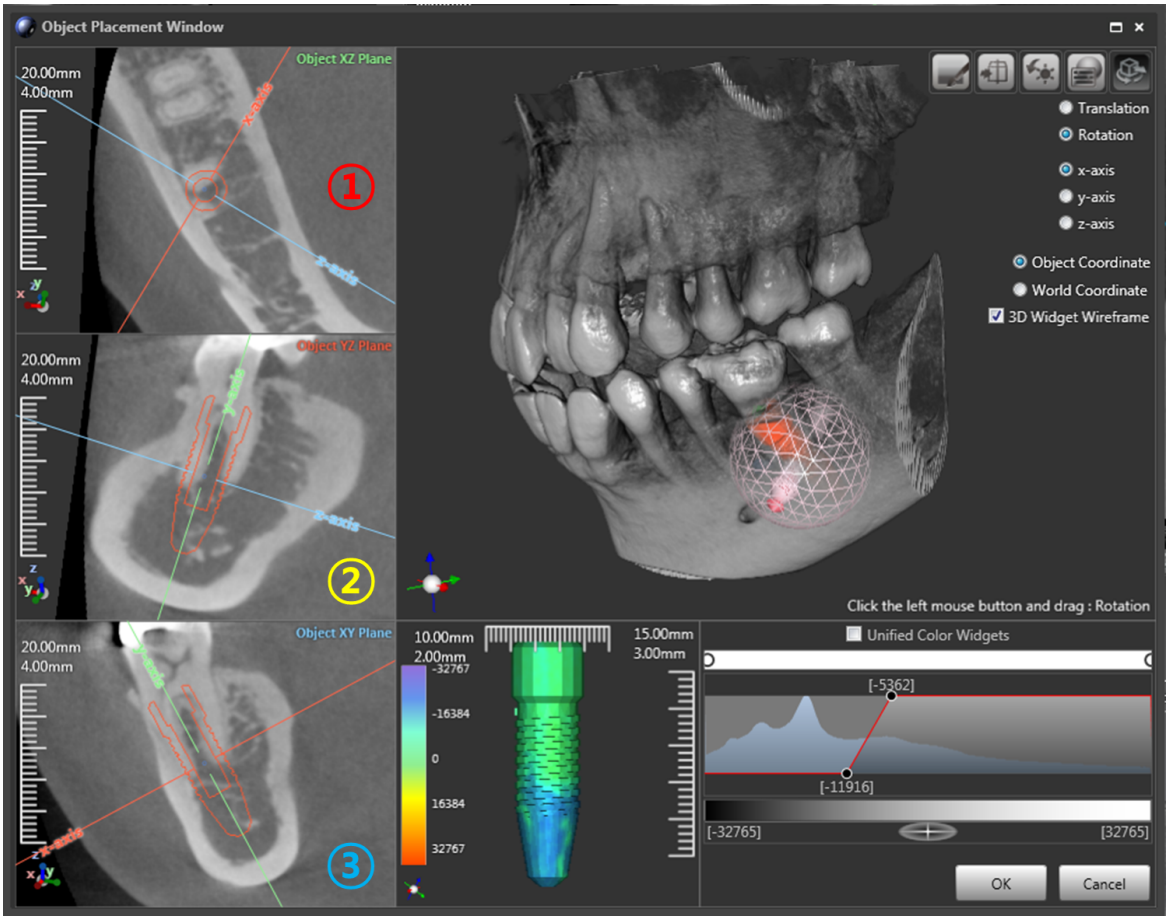
The implant models that Dentiq3D supports are listed as follows.

Company	Product name	Model
Dentium	Dentium Implantium	Platform 3.6
Dentium	Dentium Implantium	Platform 4.0
Dentium	Dentium Implantium	Platform 4.5
Dentium	Dentium Implantium	Platform 5.0

※ Dentiq3D got STL file and the information of each implant model by contacting the manufacturer directly.

Choose a panel from the main view to add the object. Click on a panel to set the starting point and drag to set the placement direction and end point of the object to add. On 3D panel, the starting point and placement direction must be in the region where the volume is defined. A warning message saying 'The starting point must be on the object.' shows up if users drag on air region.
A circle surrounding the object along with an imaginary line penetrating the center of the object will appear if mouse cursor is placed around the object on MPR panel. Drag the object to translate it on the corresponding plane. Left-click and drag the line penetrating the center of the object to rotate it.

Finish dragging or double-click to open a pop-up window like the following.



Each of the colored lines penetrating the object in length describes x-axis (red), y-axis (green), and z-axis (blue) of the object coordinate system.

- Panel 1 shows the beginning point and ending point of the object, and the visualized image according to the view direction of the xz-plane.
- Panel 2 shows the yz-plane which is vertical to Panel1 and at the same time vertical to the x-axis of the object.
- Panel 3 shows the xy-plane which is vertical to Panel1 and at the same time vertical to the z-axis of the object.

A circle surrounding the object will appear if mouse cursor is placed around the object on MPR panel. Drag the object to move it in parallel on the corresponding plane.

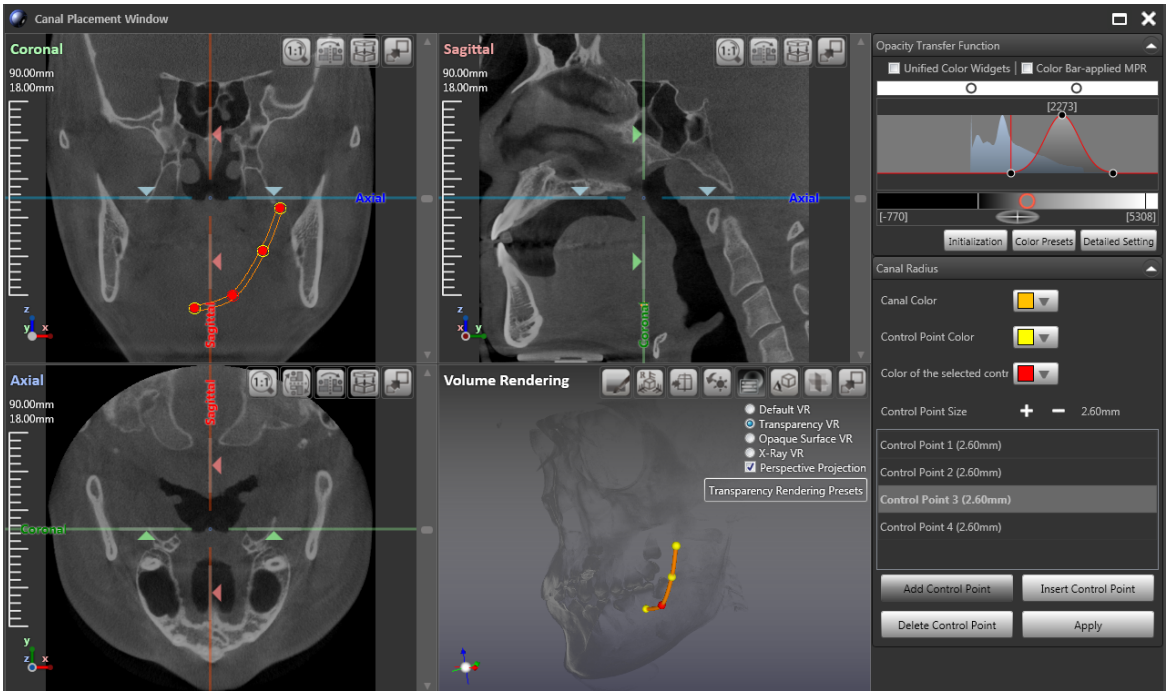
A panel to visualize the density of voxels on object edges is on the bottom center part of the window.

Click  to set '3D object control'. (See 3D Object Control for further details)

※ Caution: In the US, the physical surgical guide for endosseous dental implant placement is a medical device. Please contact your local regulatory agency for information regarding the regulatory status and requirements related to manufacture of these surgical guides.

7.2.2.5 Draw Canal

Click  at the toolbar panel to open a quad-view or panorama-view layout. Draw canals and check its result on 3D panels.



Click 'Add Control Points' and click on panorama panel or cross-sectional slices panel. The canal drawing mode is then activated.

Click at multiple spots where users want to add control points as 'Add Point' is a toggle key. Click the button once more to finish adding control points and deactivate the canal drawing mode. The

canal which is drawn along the control points is visualized on 3D panels.

Check the operation history regarding control points on the right side of the panel. To add a new control point between two already existing control points, click on the operation history panel among the two the one earlier defined. For example, to add a new control point between point 3 and point 4, click point 3 on the operation history panel. Click it to insert a new control point. Click 'Delete Control Points' to delete certain control points among the operation history panel. Set the color of the canal, of control points, of selected control points, and the radius of the canal on the right side of the panel. Place the mouse cursor around control points to adjust the radius of the canal with +,- buttons. Click 'Apply' to visualize the defined canal in view container.

7.2.3 Others

See 5.Toolbar Others Tutorial for details.

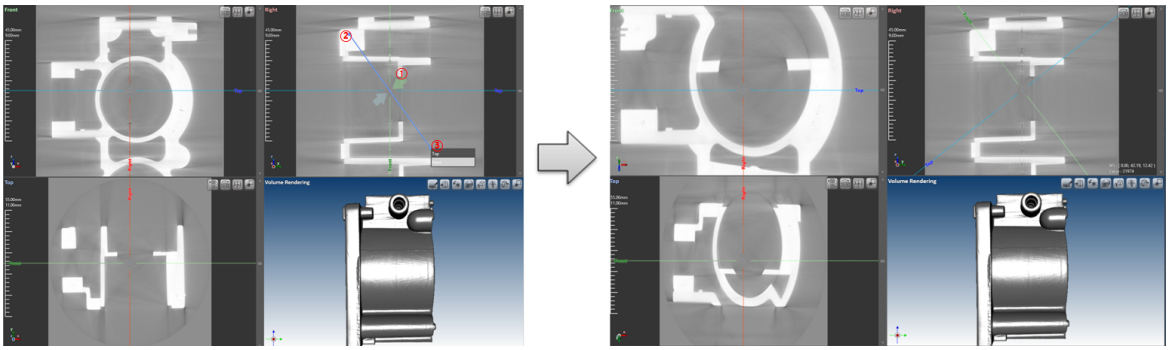
7.2.3.1 Show / Hide MPR Overlay

Click  at toolbar panel to hide MPR overlay like lines or measurement units of whole panel. Click it again to show.

Click a mouse on the panel and press the 'Space Bar' to show / hide the MPR line of the corresponding panel.

7.2.3.2 Oblique MPR Setting

Click  at toolbar to set oblique planes on a MPR panel and visualize the plane on other MPR panels.



Left-click and drag to draw a line (shown as blue line on the screenshot above, ②). An oblique MPR plane is defined as the plane which is drawn by the blue line(the line connecting 2 and 3) and is vertical to the currently visualized plane. It will be visualized on MPR panels except the one with the line. When dragging is finished, users can choose which MPR panel window (③) to visualize the oblique MPR plane. The direction of the oblique MPR plane can be identified by the two arrows along the line (①). There are green, blue, and red arrows, which signify the direction at the front, top, and right MPR panel window, respectively.

7.2.3.3 Zoom Cube

Click  at toolbar panel to use the zoom cube. Left-click and drag the area users want to zoom on one of the panel windows of view layout. A zoom cube window will show up.

It is still possible to use the main window after the pop-up.

Following functions are provided:

- Sculpt volume : Sculpt volume using 'Draw Region', 'Remain', and 'Remove' buttons.
- Export current zoom cube as file : Click 'Export' to export the current zoom cube as a file.
- Export to View : Exports the sculpted volume to the current activated view. OTF can be adjusted by choosing the exported volume on Object Tree.
- Extract Mesh : Extracts the mesh from the segmented data.

7.2.3.4 Camera Preset

Click  at toolbar to create or delete the camera locations of 2D and 3D panels and the locations and orientations of MPR line as each of presets.

Click the button to show up camera preset window.

The main window is still available, while the camera preset is shown up. The functions that camera preset window provides are as follows:

- Create, Delete, Modify: creates, deletes and modifies the camera locations of 2D and 3D panel and the locations and orientations of MPR line of the current view container.
- Rename: changes the name of selected preset.
- Save and Load preset file: saves the setting of camera presets as a file(*.vxcp) and loads the file.

7.2.3.5 Magnifier

Click  at toolbar panel to magnify the image that mouse pointer points on 2D panel.

- Enlarged image is displayed on thumbnail window on the right side of the mouse pointer.
- Center of the image is the current position of mouse pointer, and image is enlarged by around the mouse pointer.
- In case of using mouse-operating functions like measurement tool on 2D panel, magnifier can be used also.

7.2.3.6 Reset all

Click  at toolbar panel to reset volume and mesh data. Operation history will be also deleted.

7.3 History Panel

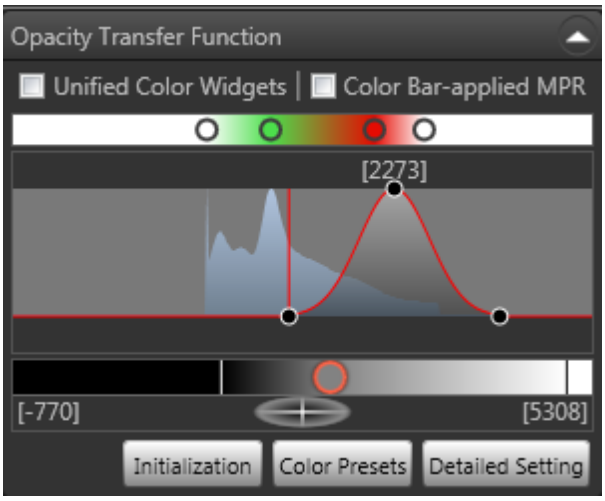
History Panel shows the list of operations and allows to undo (ctrl+z) / redo (ctrl+y) operations.

Operations are registered to the history automatically. Click a specific operation process from the history panel to restore the data to that state. Reload the volume data to clear operation history.

See 'Save Project' to check which operations are registered or not.

7.4 Opacity Transfer Function

Opacity Transfer Function consists of Color Bar, Alpha Bar, Unified Color and Alpha Bar, Windowing Bar.



- Color Bar : Manipulates color control widgets (the small circle of color bar), which applies color to volume value, often referred as density. Double-click the color bar or right-click to add the widget. Left-click and drag the widget to move it horizontally. Drag it vertically or right-click to delete the widget. ('X' will appear on color control widget if dragged vertically excessively.) Click 'Color Presets' to utilize color presets provided by Dentiq3D.
- Alpha Bar : Manipulates the opacity unit, which applies opacity (Alpha) to volume value. The x-axis of alpha bar refers to density, while its y-axis refers to opacity. Place the mouse cursor on a specific point of alpha bar to check its volume value, the histogram of which is shown in background in blue. Each figure written with a control point refers to its volume value. Following functions are operated through mouse events:
  - Left-click and drag control points to relocate them and thereby change the unit shape.
  - Left-click and drag inside the unit to translate it.
  - Left-click and drag outside the unit to move the OTF display horizontally.

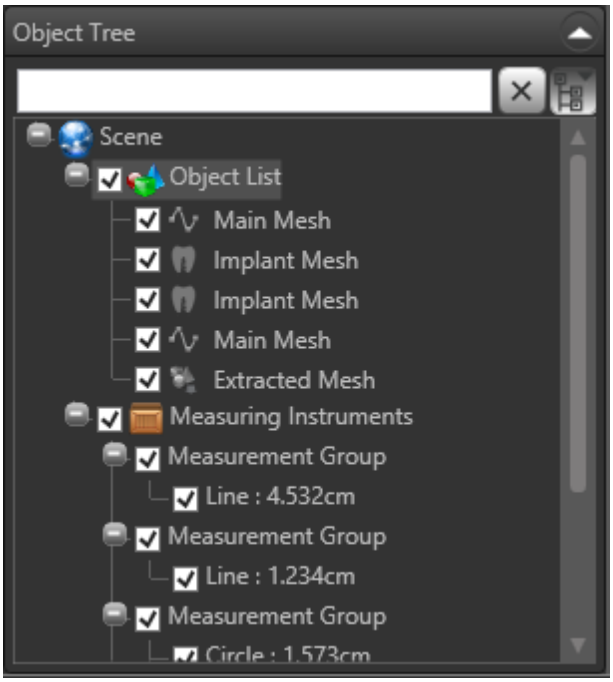
- Right-click on the OTF panel to add or delete a unit. To delete a unit, click where a unit is already defined.
- Right-click to add/delete control points in polygon-typed OTF units.

- Unified Color and Alpha Bar : Unified Color Widgets of the Color Bar are combined to the control points of Alpha Bar. Following functions are operated through mouse events:
  - Double-click or right-click a control point to apply color to its volume value.
- Windowing Bar : Manipulates the opacity unit, which applies opacity (Alpha) to volume value. Its operation result will be shown on MPR panels only. The opacity unit is defined by the starting line (Opacity=0) on the left side, end line (Opacity=1) on the right side, control point in case of 3 points linear interpolation, and interpolation type(linear, non-linear, and 3 point linear interpolation). Left-click the starting line or end line and drag to move it. Place cursor between the starting line and the end line to move them both. Adjust the control point in case of 3 points linear interpolation. Left-click and drag the control point horizontally to adjust opacity, and drag vertically to adjust the color contrast. Adjust opacity through the control widget beneath the center of Windowing Bar. Left-click and drag horizontally to move the starting and end line simultaneously, and drag vertically to adjust the distance between the two lines.
- Unified Color Widgets : Changes the Color Bar and Alpha Bar into Unified Color and Alpha Bar.
- Color Bar-Applied MPR : Applies colors defined by color bar to MPR windowing.
- Detailed Setting : Click 'Detail Setting' to open a window to save and load OTF. Move Color Bar and Alpha Bar or move the Unified Color and Alpha Bar to apply the result to 3D panel.

Preview images of volume object represented with volume values are in the center of the detailed setting window. Inside the box beneath are OTF presets, along with their preview rendering images. Double-click the preview to apply the preset to 3D panel. Click 'Add Preset' to add the adjusted OTF as preset, and click 'Delete Preset' to delete a preset.

See 7.OTF Tutorial for details.

7.5 Object Tree



Object List and Measuring Instruments are shown as tree diagram on the basis of Scene for each view.

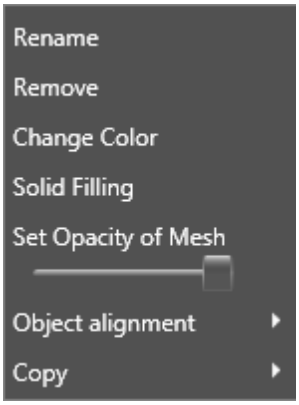
Input the item to search in the text box, corresponding item is shown as tree diagram only. Click 'Cancel' to undo search history. Use toggle button  (Expand all),  (Collapse all) on the top right side to expand/collapse the tree.
Check / Uncheck the check box to show / hide corresponding item. If the check box of any item is unchecked, its child items are hidden.

- Object List

'Object list' lists added or created mesh data.

Right-click 'Object list' to display the pop-up menu that can synchronize the added mesh data on current view with other views.

Right-click on each item of object list to display the pop-up menu.



- Rename : Changes the name of object.
- Remove : Removes the object.
- Change Color : Changes the color of object.
- Wire frame / Solid Filling : Displays mesh with wire frame. / Displays mesh with solid filling.
- Set Opacity of Mesh : Sets the opacity of mesh.
- Object alignment : Aligns mesh data and volume data. See 10.Alignment Tutorial for details.
- Copy : Copies object to other view.

- Measurement Group

Measurement tools in the same measurement group are classified according to their located MPR panel and the camera state. Those which are drawn on the same panel but vary in camera state will be registered in different measurement groups. Click measurement group or measurement tools in the tree diagram to restore the initial camera state. Right click on the measurement group to display pop up window for changing group name.

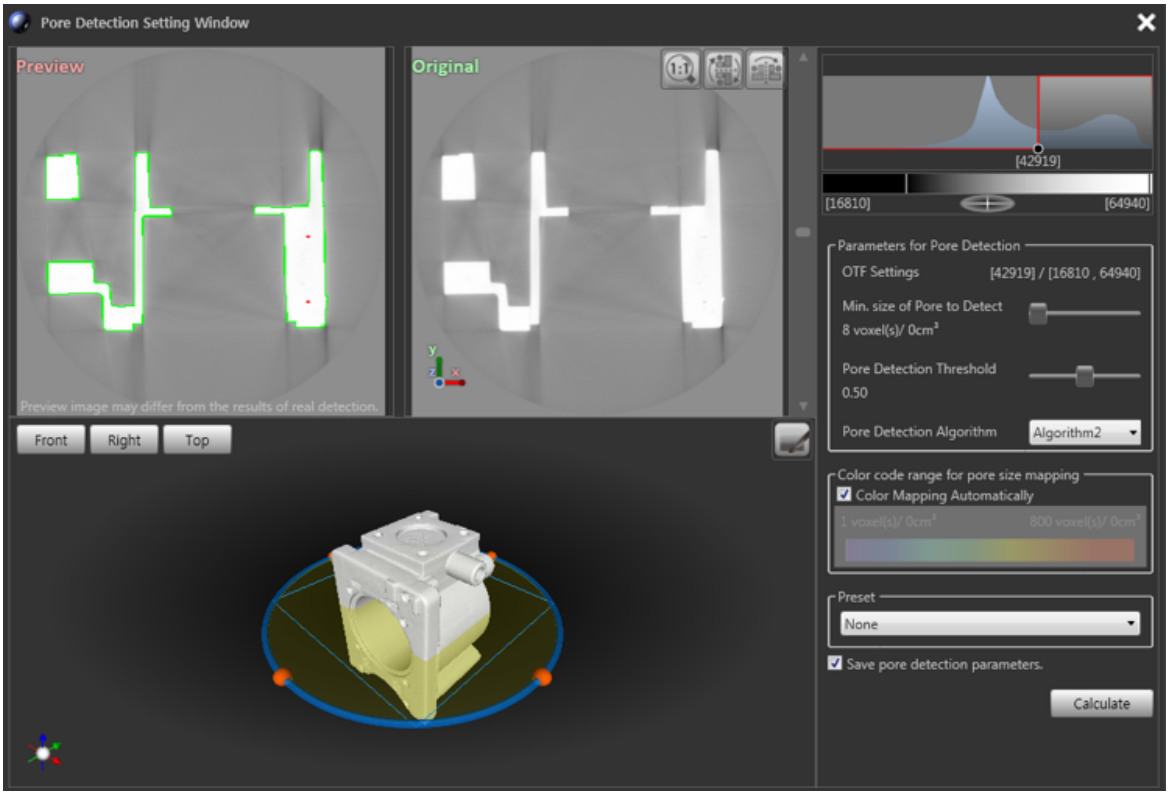
8 Pore detection (add-on module)

Detects pores from volume data and analyzes results as an add-on module.

Click  from the main view or pore detection view to open a window for pore detection. Set parameters for pore detection and analysis. See 16.VXPI Tutorial for details.

8.1 Pore Detection Setting Window

Sets the various parameters for pore detection in Pore Detection Setting Window.



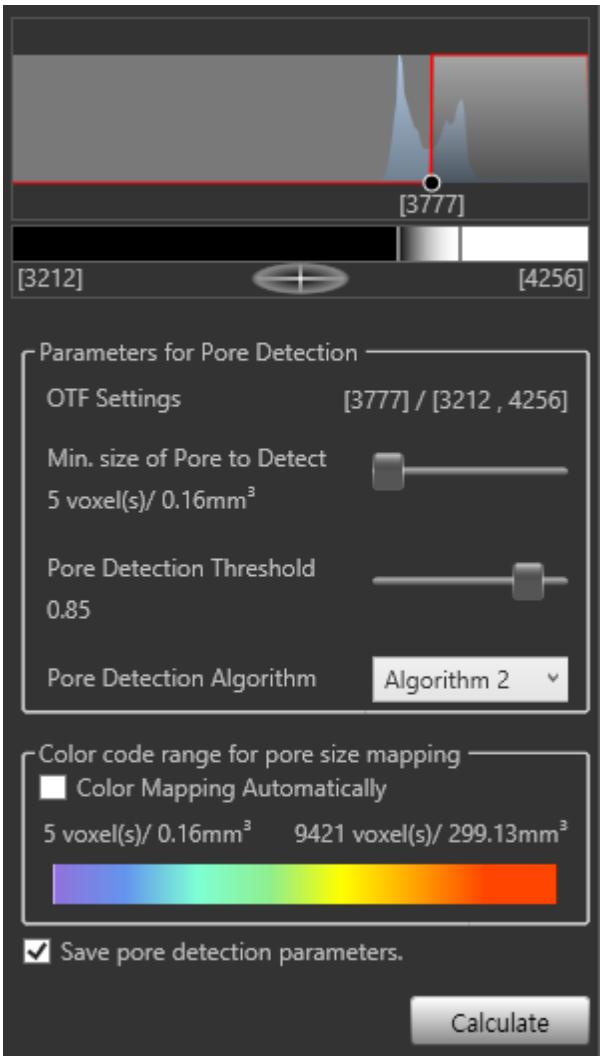
- Set the OTF and the parameters for pore detection on the pore detection parameter panel.
- The MPR image are shown at the top of the window and the left image is the pore-detected preview result of MPR image through the current parameters.
  - Through the preview, the tendency of the result of the pore detection by the change of parameter is predictable.
  - The color of the air area is blue, the color of the object contour is green and the detected pore is red in color.
  - The result of the pore detection for the current MPR image is shown as a preview. It could be different from a final result of the pore detection for a whole volume data.
- Drag the blue outline of the circle to spin the cross section and drag the yellow inner part of the circle to move the cross section in a direction perpendicular to the plane at the bottom of 3D

panel.

- Use the buttons of the bottom of 3D panel to move to the target cross section.
- Click 'Calculate' to start pore detection. After detection, a pore detection view is created or the new detection result is applied to the pore detection view.

8.1.1 Pore Detection Parameter Panel

Sets the parameters for pore detection.



- Parameters for Pore Detection
  - OTF settings: It shows the value that is set in OTF.
  - Minimum size of Pore to Detect (Voxel/mm3): Detects the bigger pore than the setting value. Adjust slider bar or double-click then enter the value to set the minimum size of pore to detect.
  - Pore Detection Threshold: Sets the sensitivity of pore detection.

※ As the Pore Detection Threshold gets closer to 1, many pores as possible are detected. The noise region, not the real pore, are more likely to be detected.

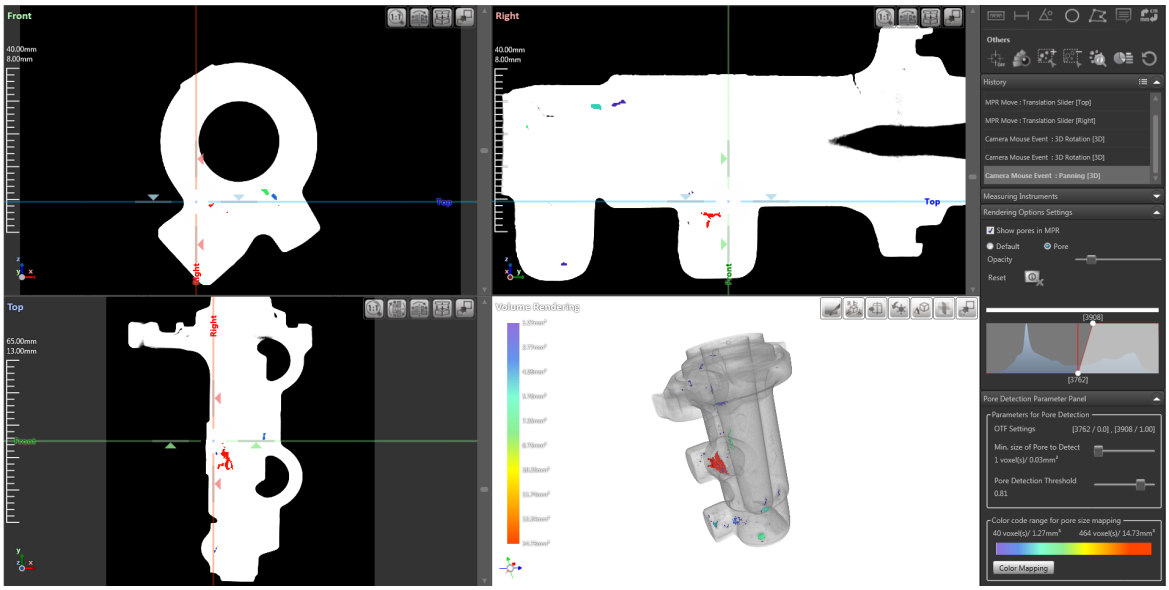
※ As the Pore Detection Threshold gets closer to 0, pores are detected strictly. Things unseen in the real pore wouldn't be detected.

- Pore Detection Algorithm: Choose the algorithm for pore detection. 'Algorithm 1' detects the pores by brightness value. 'Algorithm 2' detects the pores by voxel value of the volume data.
- Color code range for pore size mapping: The detected pores are displayed with different colors according to pore size. Adjust slider bar or double-click and then enter the value to set the range. Check 'Color Mapping Automatically' and calculate to adjust the range for color mapping by the max/min size of detected pore.
- Save pore detection parameters: Saves the pore detection parameters.

※ Color mapping and the minimum size of pore are not applied to the preview result.

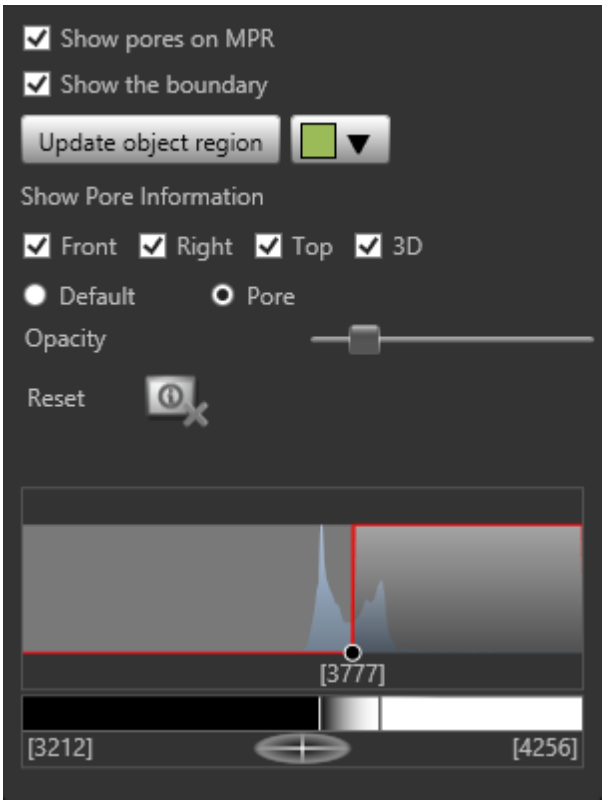
8.2 Pore Detection View

After pore detection calculation, detected pores and original volume are visualized on each panel.



8.2.1 Pore Detection Rendering Option

Changes the rendering options of pore detection view.



- Show pores in MPR: Check to show pores in MPR panel.
- Show the boundary: Check to display the boundary in MPR panel.
- Update object region: Sets the object region to detect pore accurately.
- Show Pore Information: Check to show pore information on the panel.
- Default: Default rendering option.
- Pore: Rendering option to see pores.
- Opacity: Sets the opacity of the volume data.
- Reset: Delete all pore information.
- OTF: Adjusts the region of voxel value to visualize and the brightness of MPR panel.

8.2.2 Pore Detection Report

The result of pore detection is summarized in a report window, including detailed information of detected pores and of detection parameters.

Click  at toolbar to generate the report window, which displays brief information about detected pores.

Pore Detection Report (Enable Main Window Operation)

Summary

Image Settings | Export Excel

Number of Pores	Total Volume of Pores	Total Visualized Volume	Porosity (%)	Mean Volume of Pores	Mean Pore Voxel Value	Mean Roundness	Mean Diameter
102	21.66mm³	79731.52mm³	0.027169%	0.21mm³	48082.000	0.1915	1.24mm

Parameters

OTF Settings	Pore Detection Threshold	Min. size of Pore to Detect	Color code range for pore size mapping	Pore Detection Algorithm
42857 / 31990 , 58823	0.5	8 voxel(s) / 0.05mm³	9 voxel(s) / 0.05mm³ ~ 1241 voxel(s) / 7.01mm³	Algorithm2

Pore Information

Preset None | Update

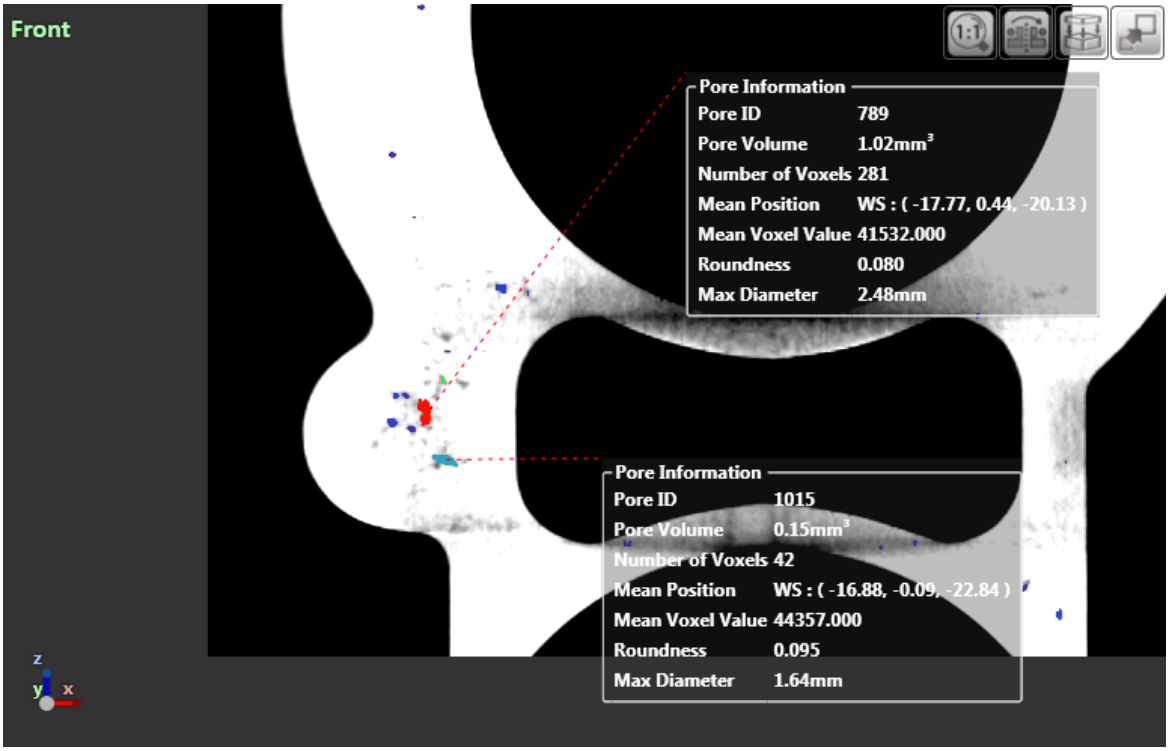
Pore ID	Pore Volume	Surface Area	Number of Voxels	Mean Position	Mean Voxel Value	Roundness	Max Diameter	Defect
1	0.05mm³	1.11mm²	9	WS : (17.41, -12.37, -32.67)	45565.000	0.2581	0.7mm	
2	0.09mm³	1.52mm²	16	WS : (19.85, -14.53, -32.30)	46532.000	0.2224	1.02mm	
3	0.08mm³	1.49mm²	15	WS : (19.54, -13.62, -31.81)	45308.000	0.3346	0.83mm	
4	0.05mm³	1.2mm²	9	WS : (19.43, 9.06, -31.59)	46408.000	0.1982	0.88mm	
5	0.11mm³	1.74mm²	19	WS : (24.15, -2.38, -31.25)	45563.000	0.3283	0.88mm	
6	0.06mm³	1.43mm²	11	WS : (21.74, -2.96, -30.83)	45840.000	0.1497	1.1mm	
7	0.1mm³	2.09mm²	17	WS : (-15.59, 12.64, -29.17)	49955.000	0.0495	1.56mm	
8	0.06mm³	1.27mm²	11	WS : (20.74, -14.36, -29.08)	49012.000	0.2604	0.93mm	
9	0.26mm³	4.47mm²	46	WS : (21.38, -12.63, -27.82)	49400.000	0.1117	1.69mm	
10	0.11mm³	1.78mm²	20	WS : (22.31, 2.00, -27.78)	45924.000	0.2371	0.93mm	
11	0.06mm³	1.3mm²	10	WS : (20.96, -12.00, -26.92)	48509.000	0.1759	0.86mm	
12	0.05mm³	1.01mm²	9	WS : (23.76, -17.37, -26.42)	50207.000	0.2535	0.7mm	
13	0.11mm³	1.74mm²	19	WS : (21.82, -15.24, -25.68)	48380.000	0.2390	0.93mm	
14	0.11mm³	1.71mm²	19	WS : (25.30, -18.75, -25.39)	47893.000	0.3063	0.91mm	
15	0.19mm³	2.89mm²	33	WS : (21.09, -11.12, -24.94)	47459.000	0.2165	1.24mm	
16	0.07mm³	1.33mm²	12	WS : (20.46, 3.89, -24.48)	47020.000	0.2303	0.8mm	
17	0.36mm³	3.87mm²	63	WS : (23.05, -17.70, -23.66)	44330.000	0.3749	1.36mm	
18	0.19mm³	2.73mm²	34	WS : (19.78, -10.12, -22.85)	48072.000	0.1018	1.42mm	
19	0.08mm³	1.81mm²	15	WS : (19.98, -9.19, -22.50)	49211.000	0.0837	1.36mm	
20	0.18mm³	2.57mm²	31	WS : (21.81, -12.59, -21.37)	47228.000	0.1702	1.24mm	

- Pore Detection Report Window
  - When the pore information item is selected in 'Pore Information', the camera position moves to the center of the selected pore and a bounding box is shown up in 3D Panel.
  - Click the column header of each item of 'Pore Information' to rank them in descending/ascending order.
  - Use the Ctrl or Shift key in 'Pore Information' to select multiple items.
  - Use 'Minimum defect size' on the right of the title 'Pore Information' to set minimum defect size.
  - Click Delete key after selecting pore item to delete pore.
  - Click an item and then press the Delete key to delete it.

- Click an item and then click right button to show the menu which is for deleting pore and showing pore information.
- 'Parameters' represents the pore detection parameter which is used in the first pore detection.
- Click 'Image Settings' button to add images at the top of the excel file which will be exported.
- Click 'Export Excel' to export the result to Excel if the operation system supports MS Excel.
- Set Min/Max value for each item to update report according to setting.
- Save filter value for each item as preset to use.

8.2.3 Pore Information

Checks the pore information on MPR panel.



- Click  at the toolbar panel.
- Place the mouse cursor on a specific pore to see its information.

- A red box surrounding the region of pore is created.
- Click the red box to open a pop-up box with the pore information.
- Click right button to appear the menu that transfer MPR to selected pore and menu to remove pore.

- **Pore Information Pop-up Box**
  - Pore ID : Number of the pore.
  - Pore Volume : Volume of the pore.
  - Number of Voxels : Number of voxels of the pore.
  - Mean Position : Mean position of the pore in volume.
  - Mean Voxel Value : Mean voxel value of the pore.
  - Roundness : Roundness of the pore. The closer the value is to 1, the rounder is the pore (resembles a sphere).
  - Max Diameter: Diameter of the circumscribed sphere of the pore

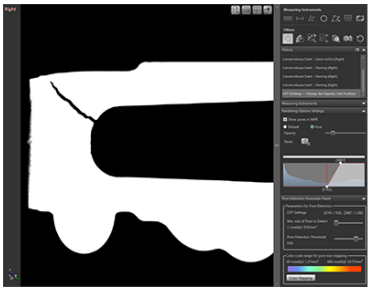
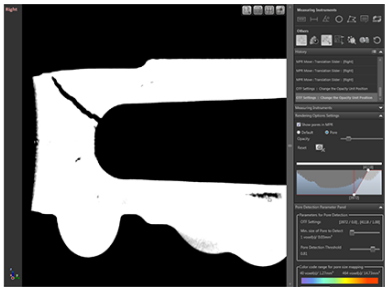
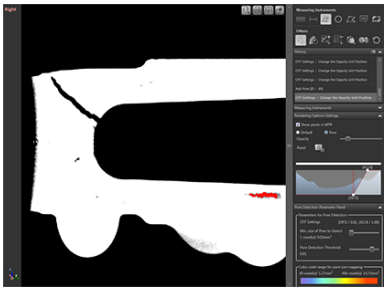
※ Click  at the toolbar panel to hide all the pore information pop-up boxes.

8.2.4 Add Pores

Sets ROI to add pores on MPR panel.

- Click  at the toolbar panel.
- Place the mouse cursor on a specific area of MPR panel to add a pore.
- Left-click to detect pore at the target spot.
- In case of failing to detect pores at the target spot, following message appears.
  - The outside of object(air region) is set as the starting point of detection.
  - The detected region are connected to the outside of object(air region).
  - The size of detected pore is smaller than minimum size set in parameter.
- Pores come together when the detected pores are in contiguity with existing pores.

※ Adjust OTF and the detection parameter to set to distinguish pores clearly and improve accuracy when adding pores, if the target pore is not detected in initial detection result.

8.2.5 Remove Pores

Removes pores on MPR panel.

- Click  at the toolbar panel.
- Place the mouse cursor on a specific area of MPR panel to remove a pore.
- In case of no pores, error message appears.

9 Panorama View

Click  at toolbar of main view to use panorama view. The cross-sectional images of the created curve are sampled and converted into 2D image. The accuracy depends on the CT resolution and the accuracy is lower than the CT resolution. See 11.Panorama View Tutorial for details.

9.1 Panorama Curve Generation Window

- How to use
  - Choose among Front, Right or Top MPR panels. A pop-up window shows up.
  - Select the area of curve on volume. This area of curve will be visualized as a 2D image.
  - Click with the left mouse button to create control points. At least two control points must be chosen to use panorama view.
  - Delete control points with the right mouse button.
  - Double click to finish drawing a curve. The curve is created along the dotted line which connects the control points.
  - Red arrows along the dotted line identify user's point of view on the panorama panel.

9.2 Panorama Panel

On panorama panel the 2D image corresponding to the area of the generated curve is visualized. The curve is defined by the control points users have chosen on panorama curve generation window. Move the curve within the possible movement area (within the blue boundary lines on MPR panel). The plane is marked red on other interworking panels. Drag with the right mouse button on panorama panel to zoom in or zoom out. The white dotted line drawn vertically shows the location of the cross-sectional image. If two or more cross-sectional images are created, the two dotted lines indicate the location of the first and last cross-sectional image. (See Cross-sectional Image Panel for details)

Click  to flip the image horizontally. It has the effect of changing the viewpoint of the user.

Click  to adjust the height and thickness of the plane. If the height of the plane is adjusted the result will be shown on the cross-sectional slices panel and on the 3D panel.

If the thickness of the plane is adjusted the result will be shown on the cross-sectional slices panel and MPR panel, marked as a semitransparent red area.

9.3 Cross-sectional Slices Panel

Cross-sectional image panel visualizes the cross-sectional images of the curve- slices which can be seen when the curve is cut width-wise.

Click  to adjust the the interval and number of slices. The number of cross-sectional slice images depends on the current size of cross-sectional panel window. Set slice interval with the slider.

Rearrange the location of the slices along the curve with the scroll bar on the right side or mouse wheeling. The change in location is visualized on panorama panel as well as on MPR panel.

When the mouse cursor is placed on one of the cross-sectional slices, its location will be shown on the other interworking panels. Drag with the right mouse button one of the slices to zoom in or zoom out. The height of the curve will change according to the current zoom in/zoom out state.

Drag with the left mouse button to translate the cross-sectional slice image by moving the curve.

9.4 MPR Panel

MPR panel shows the control points and the possible movement area of the curve which users have adjusted on panorama curve generation window.

Place the mouse cursor on the yellow line connecting the control points. The cursor changes its form and shows the location of new possible control points. Click the yellow line to create a new control point. Place the mouse cursor on a control point and right-click to delete it. Left-click and drag an existing control point to rearrange it. Left-click inside the curve and drag to move the whole curve on MPR panel. By using the scroll bar or mouse wheeling on the MPR panel, move the plane to be visualized along the view direction. The yellow curve also moves along the translation direction. Drag either the red arrow on the starting point of the curve or the blue arrow on the end point of the curve to rotate the curve. The new location of the plane will be visualized on all the other interworking panels.

10 Tile View

Click  to use tile view. MPR planes are arranged as images. See 12.Tile View Tutorial for details.

10.1 Tile View Panel

Double-click a MPR plane to open a new window and zoom in.

- Color Presets : Apply the default color preset to the MPR panel.
- MPR Mode : Check the maximum, minimum, and the mean value of the volume values. (See MPR Setting and Analysis for details.)
- Thickness : Adjust the thickness of MPR planes. (See MPR Setting and Analysis for details.)
- Slice Interval : Set the slice interval of the image tiling.
- Orientation : Select the initial direction of the MPR plane (Top, Front, Right) for the tile view.
- Image Tiling : Adjust the tiling of displayed images.
- Position : Set the location of the MPR on volume.

11 Path Animation View

Click  at the toolbar panel to use path animation view. It allows to create an animation using all the functions applied on the 3D panel. Create keyframes and play the animation or save it as a video file. The path of the camera is calculated automatically through quaternion interpolation and cannot be edited manually.

Create a keyframe by setting the camera view and clicking 'Create a new keyframe'. Repeat the process to create animation. See 13.Path Animation View Tutorial for details.

11.1 Overview Panel

The overview panel shows the location and state (Field of View(FOV)) of the camera, which visualizes the volume data displayed on the camera view, in 3D space.

11.2 Camera View Panel

The camera view panel allows to capture key frame images to create an animation. The same functions as the 3D panel from the main view are supported.

11.3 Timeline Panel

Timeline panel supports various functions for creating and operating path animation and offers information related to keyframes. Supported functions of the timeline panel are as follows.

- Add, replace, insert, and delete keyframes
- Adjust the FOV of the camera view and rotate the camera-up vector
- Create Video Files
- Operate and play animation

11.3.1 Keyframe

A keyframe shows in 2D images the camera view state of the moment the keyframe is created.

Place the mouse cursor on the right end of each keyframe to see the control for adjusting the total number of keyframes.

11.3.2 Timeline

The timeline includes the created keyframes. Zoom in / out the timeline through mouse wheeling.

11.3.3 Panel Buttons

11.3.3.1 Add Keyframes

Click  at the panel window to add a new keyframe with the current camera view saved.

11.3.3.2 Replace Keyframes

Select a keyframe from the timeline and click  at the panel window to replace the selected keyframe with the current camera view.

11.3.3.3 Insert Keyframes

Select a keyframe from the timeline and click  at the panel window to insert a new keyframe with the current camera view saved after the selected keyframe.

11.3.3.4 Delete Keyframes

Select a keyframe from the timeline and click  at the panel window to delete it.

11.3.3.5 Create Video Files

Click  at the panel window to save the created animation as a video file.

11.3.3.6 Play Animation

Click  at the panel window to play the animation.

12 Report View

Click  at Common Function Toolbar to use report view.

An image list on the left capture image panel provides thumbnails of printable images, and the image list on the right report view panel provides thumbnails of images to be printed.

To add an image to the capture list, click  at toolbar or capture an image with  button.

See 14.Report View Tutorial for details.

12.1 Capture Image Panel

Click  on Capture Image panel to export the selected image as a file and click  to export all capture images as files.

12.2 Edit Report Panel

It is possible to adjust the location or size of an image in a printout. Multiple images can be printed out on a single screen. Register multiple reports to use and modify style of the text using the toolbar if needed. Change the title or content size using the size control line of the report view if needed.

Use the left mouse button to drag images from each list and drop them onto the print screen to make images appear on the print screen.

Use the left mouse button to drag and move an image. Click an image to show a bounding box. It is possible to adjust the size of the bounding box with left mouse button. Press delete key after the

bounding box is drawn to delete the image or use the pop up menu with right clicking.

12.3 Report View Panel

Click on  Report panel to add a new report and click  to export all reports as a PDF file.

13 Reformat View

Click  button to use reformat view. With Reformat view, It is possible to customize by using various options and export. Adjust spacing and thickness of slice to export 2D image. For exporting 3D image, adjust degree and direction of rotation. It is possible to export as DICOM file and exported file can be saved on local PC or external server. See 15.Reformat View Tutorial for details.

13.1 Reformat manager

- Set export panel

Choose panel to export among Front, Right, Top and 3D.

- Set region

Adjust slider bar to set region for exporting, Red slider bar represents start point, blue is end point and green slider bar represents center point.

- 2D options

Click combo box to set spacing and thickness of slice.

- 3D options

Click combo box to set an angle among slices. Choose the rotation direction between horizontal and

vertical. Click 'Fit to screen camera direction of the VR' button to set camera direction of start, current and end point as camera direction of VR panel.

- Exporting file format

It supports JPEG, DCM, PACS, WMV file format. If user chooses DCM, DICOM file can be saved on local PC. If chooses PACS, DICOM Store window is displayed and the file can saved to external server.

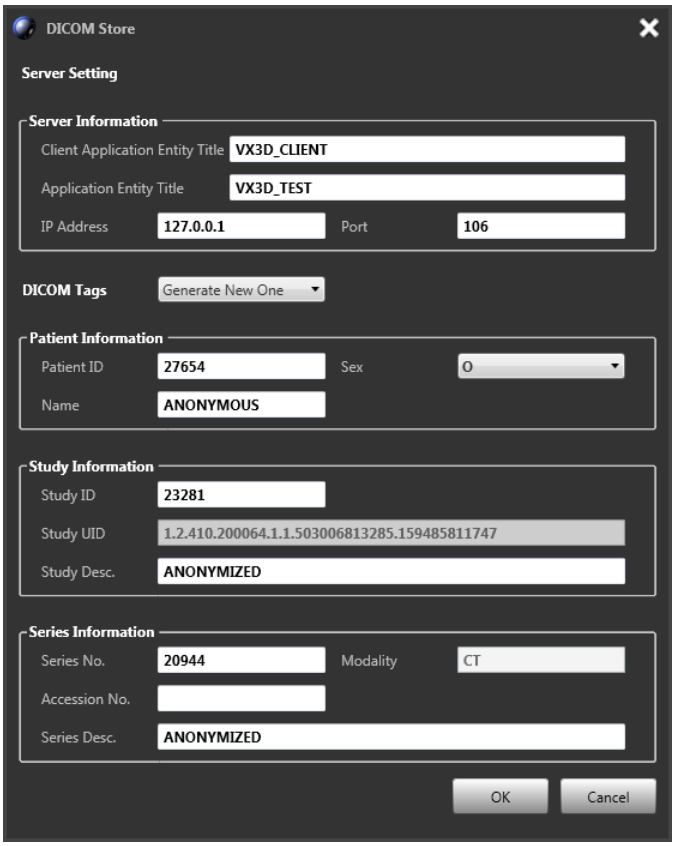
- Preset

Click Preset tab and then click 'Add' button to save current reformat option and camera setting as one preset. If user clicks saved preset, corresponding reformat option and camera setting are applied to screen.

- Capture

Click Capture tab and then click 'Add' button to add thumbnail of file to export. Activate the check box at the bottom of thumbnail to export all at once. Click the thumbnail and then choose delete to delete thumbnail.

13.2 Dicom store window



- Server information

Input the information including Client Application Entity Title, Application Entity Title, IP Address and Port.

- DICOM Tags

Set the DICOM tags as 'Use Original' or 'Generate New One'.

If 'Use Original' is selected, only Series Information can be changed.

- Patient information

Input the patient information that are saved to DICOM file header.

- Study information

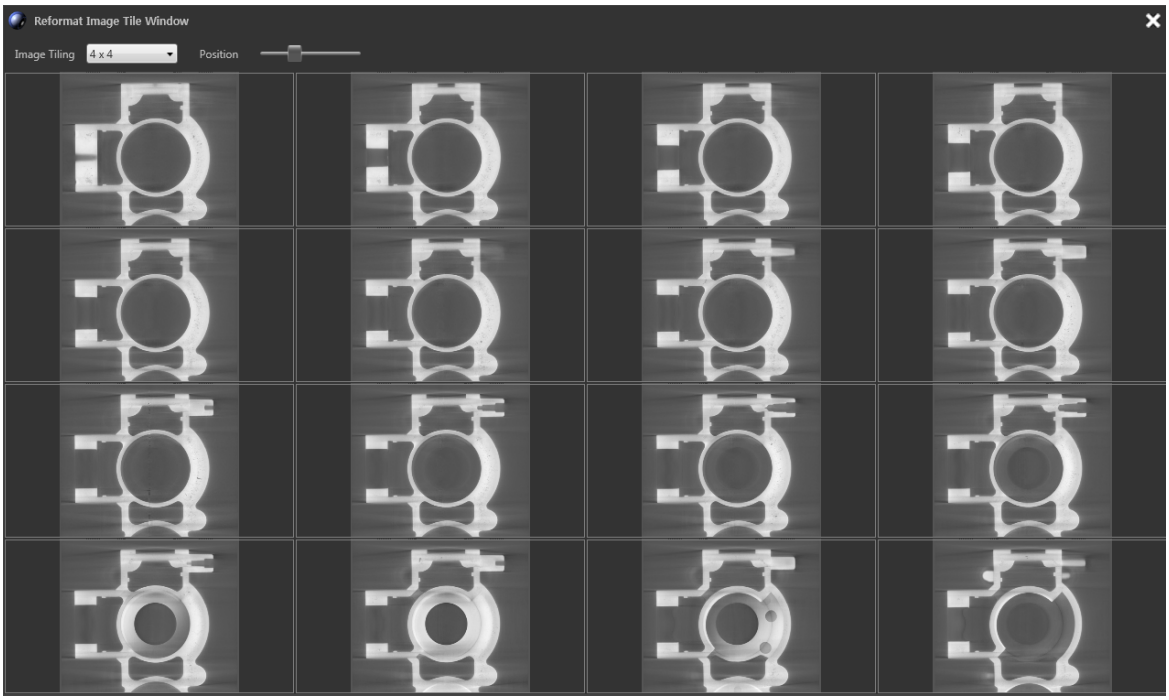
Input the study information that are saved to DICOM file header.

- Series information

Input the series information that are saved to DICOM file header.

After input all information and then click OK button to send DICOM file to relevant server.

13.3 Reformat image tile window



Click Preview button that is added on capture list to display reformat image tile window that shows image to export in detail.

Choose 'Image tiling' to rearrange images and adjust 'Position' slider bar to rotate images.

14 PACS

PACS provides functions to transfer / search / receive DICOM images to server.

14.1 Use PACS

User can search and load data by selecting Database Server and Remote PACS Server on the left panel of Open File Window.

- Database Server

- It is used to save data from remote server or in mass storage device. (※ Important: Only DICOM file is possible to input.)
  It is possible to search saved data by using DICOM tag information (Patient ID / Patient Name / Date / Sex).
  The capacity of database file (.accdb) is restricted to 2GB (about two million image slices).
  ※ The capacity of actual image file does not affect to the capacity of database file (.accdb).
- How to use
  - Select Database Server on the left panel of Open File Window.
  - Type the necessary conditions like Patient ID / Patient Name / Date / Sex / Modality and click Search button.
  - If there is data that is corresponding to search conditions, Study list and corresponding Series list are displayed.
  - Select Series to open file.
  - Data is transmitted to other Remote PACS Server or deleted from database and exported to mass storage device by using pop up menu with mouse right button.
  - It is possible to search and load data of database server in program only (Outside access is not available).

- Remote PACS Server
  - Provides functions to store / transmit / search by connecting to remote PACS server. (※ Important: Only DICOM file is possible to save / transmit /search.)
  - How to use
    - Select Remote PACS Server in Remote PACS Server tree on the left panel of Open File Window.
    - Type the necessary conditions like Patient ID / Patient Name / Date / Sex / Modality and click Search button.
    - If there is data that is corresponding to search conditions, Study list and corresponding Series list are displayed.
    - Double click Series information to display preview by loading corresponding file from server.
    - After displaying preview, click load button to open file.
    - After displaying preview, save data to database server or export data to mass storage device by using pop up menu with mouse right button.
    - Delete function is not provided.

14.2 PACS Configuration

Sets various options for using PACS.

PACS configuration window consists of two parts.

1. Client

Sets the neccessary information for using as client. See 9.PACS Client Tutorial for details.

- Client Information
  - Application Entity Title : Unique identifier for client.
  - Receive port : Port number that is used to receive file from client after requesting file to server.

- Server list
  - Server name : Name of server. (Duplication is allowed.)
  - AETitle : Application Entity Title of server.
  - IP Address : IP Address of server.
  - Port : Port number of server.
  - Commitment : Server uses commitment when providing service. It is possible to check if data is transmitted well, when transmitting data to server that provides this service.

2. Path

Sets the path to store database file / image.

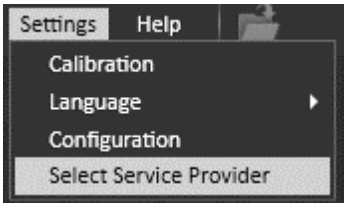
- Storage information

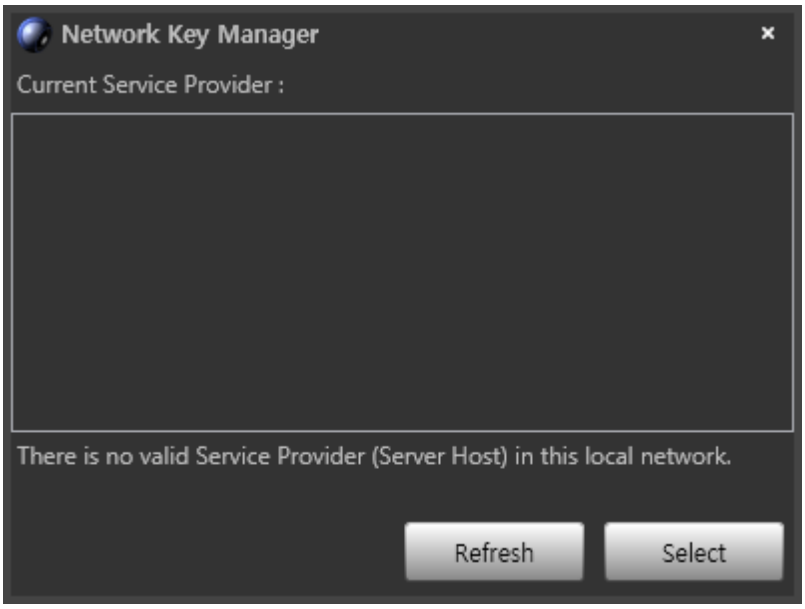
  Sets database file path and image date save directory to use PACS.
  - Database file path : Sets database file path.
  - Image file path : Set image file path that is entered in database.
  - Temporary file path : Set temporary file path for data that is not saved in database when using remote PACS server.

※ Important: PACS is available by using fixed IP only.

15 Service Provider

Dentiq3D network key allows multiple users to access the program simultaneously using a single dongle key. Opening the service provider on the dongle key-connected PC, the connected computers are able to access the service and execute Dentiq3D. A maximum of five people can have access simultaneously. If a service provider was previously used and still exists, use it to get access. In case it does not exist anymore, the dongle key connected to the PC still allows to execute Dentiq3D. If previously used service providers or the dongle key is absent, open the network key administration window and search for other service providers manually. Use the service provider after registration. In case nothing is found, the program will be shut down. See 8.Command prompt and Networking Tutorial for details.





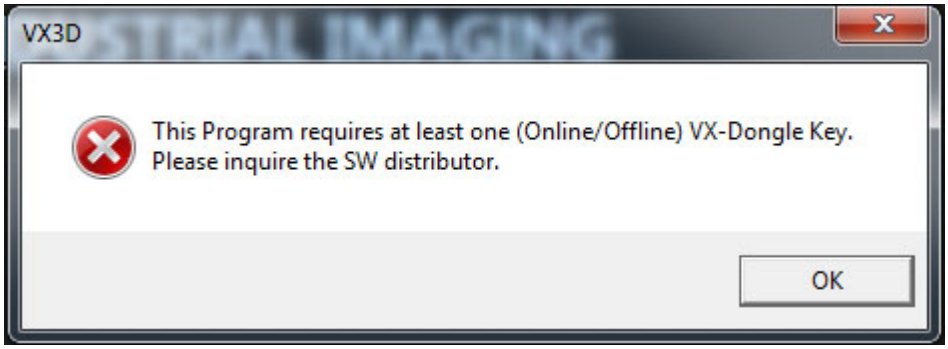
16 Glossary of Abbreviations

- CD: Compact Disc
- CPU: Central Processing Unit
- CT: Computerized Tomography

- DICOM: Digital Imaging and Communications in Medicine
- FOV: Field Of View
- GB: Gigabyte
- GPU: Graphics Processing Unit
- GUI: Graphical User Interface
- HDD : Hard Disk Drive
- HU: Hounsfield Unit
- LOD: Level Of Detai
- MB:Megabyte
- MPR: Multi-Planar Reconstruction
- OS : Operating System
- OTF: Opacity Transfer Function
- PACS: Picture Archiving and Communication System
- PDF: Portable Document Format
- RAM : Random Access Memory
- ROI: Region Of Interest
- STL: STereoLithography
- UDP: User Datagram Protocol
- USB : Universal Serial Bus
- VR: Volume Rendering
- WMV: Window Media Video
- 3D/2D :3Dimension/2Dimension

17 FAQ

- Dongle Key Problems
  - The following message appears when the dongle key is disconnected.



- After inserting dongle key and run again to operate normally.

- Out of memory
  - An error message is appeared if the system is out of memory.
  - If other programs are closed and Dentiq3D is restared, an error message is disappeared.

- Program Crash Problems
  - If Dentiq3D or Viewer is running, other Viewers or Dentiq3D cannot be reopened.

- Required Program
  - To run Dentiq3D, following programs are required.
    - .net framework 4.5
    - visual studio 2013 redistributable packages
    - directX 2010 june
  - The Dentiq3D installation file includes installation files of these programs. Those programs are installed together with Dentiq3D installation.
  - Even if these programs are deleted, Dentiq3D examines whether they are installed and installs required programs automatically.

18 User Manual Information

Copyright

Program / Manual Version

Program / Manual Release Date : 2016.12.06

Program / Manual Version : V_2.8.2

Produced by 3D Industrial Imaging (3DII) CO., Ltd.

Product Constitution

USB that includes install program, manual, tutorial

1 Dongle USB key

If you have any further questions about this product or service, please contact us.

For pricing and licensing question,

Phone : +82 - 70 - 8766 - 2390

E-mail : threedii.service@gmail.com

For any questions or inquiries regarding our program and manual,

Phone : +82 - 70 - 8766 - 2395

E-mail : threedii.service@gmail.com

For further information,

Phone : +82 - 70 - 8766 - 9192

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Homepage : http://www.3dii.net

Address : (Sillim-dong, Institute of Computer Technology), 138-412,1, Gwanak-ro, Gwanak-gu, Seoul, Korea

19 Revision History

Revision Number	Revision Date	Summary of Changes	Author
V.2.7.0	2015.07.02	New Functions and Improvements 1. Highlight effect for the activated window. 2. Capture operation supposed to register the capture image in Report View. 3. Flip option refinement to synchronize MPR line movement. 4. Configuration option for free placement of MPR plane. 5. Optimized rendering speed of path animation play 6. [Dental] Implant information label on MPR panel and object management panel. 7. Additional log for user operations in communication.txt	Ayeon Baek
V.2.7.1	2015.07.04	New Functions and Improvements 1. Adding pore have become faster. 2. When selecting pore, the selected pore is highlight-displayed to check on 3D panel. 3. Option for saving the pore detection parameter has been added. 4. Pore Information has been displayed on four panels (Front, Right, Top, 3D) at the same time. 5. ‘Move to selected pore’ has been added to pop-up menu of pore information.	Ayeon Baek
V.2.7.2	2015.07.10	New Functions and Improvements 1. Detecting pore have become faster. 2. 'Diameter’ has been added to Pore information. Diameter means a diameter of the smallest sphere	Ayeon Baek

		that contains pore and major axis length of pore. 3.'Pore information' has been added to pop-up menu for right-clicking in pore report.	
V.2.7.3	2015.07.24	New Functions and Improvements 1. Display the Parameter for pore detection on the pore report. 2. Change the term from 'Diameter' to 'Max Diameter' in pore information	Ayeon Baek
V.2.7.4	2015.07.30	List of bugs that are fixed 1. Shutdown problem when using video function. 2. Button problem for function toolbar when using video function. 3. Problem overlaying pores 4. Miscalculation of pore midpoint 5. Problem that the position of cross-sectional slices is not displayed.	Ayeon Baek
V.2.7.5	2015.08.10	New Functions and Improvements 1. Import CAD DATA (support igs, iges, stp, step file) 2. Improvement: Loding speed for file preview	Ayeon Baek
V.2.7.6	2015.08.12	New Functions and Improvements 1. Export multi slice image : Functions that sets direction, range, distance, thickness of slice and exports image. 2. Improvement : Accuracy when adding pore. 3. Add the function that exports MPR plane to video(*.WMV). (Export Data => Volume determined by the Rendering Direction => Rendering Image through OTF => WMV) 4. Improvement: File Preview progress bar	Ayeon Baek

		5. Add the color mapping graph for pore size on MPR plane.	
V.2.7.7	2015.09.01	New Functions and Improvements 1. Display the boundary line of object on Pore Detection View. 2. Add the setting button for object area on Pore Detection View. 3. Improvement: Speed for adding pores. 4. Use about four times memories of maximum volume when extracting pores. (For extracting 2G volume, 8G memory is needed.) 5. Add the function for setting the cross section (Front, Right, Top) on Pore Preview. 6. Change pop-up menu order of right-clicking for pore information. ('Delete', 'Move to selected pores' => 'Move to selected pores', 'Delete') 7. Add the function for selecting the pore information display on Pore Detection View. : It is possible to decide whether to display the pore information on each panel (Front, Right, Top, 3D). 8. Improvement: View loading screen 9. Add a Dicom information view. : When clicking 'i' button on right upper of the screen after loading Dicom file, Dicom information is displayed.	Ayeon Baek
V.2.7.8	2015.09.22	New Functions and Improvements 1. Object Tree : Pre-existing Object List and Measuring Instruments have integrated into Object Tree. Object List and Measuring Instruments have show/ hide function. 2. Magnifier : MPR screen image around the mouse pointer is	Ayeon Baek

		enlarged. 3. Add the function for hiding MPR line. : Click a mouse on MPR panel and press the Space Bar to hide MPR line of corresponding panel. Press the Space Bar again to display it. 4. Add the function for PDF: 'Export as PDF' button.	
V.2.7.9	2015.10.27	New Functions and Improvements 1. Reformat View : It is possible to export MPR slice and 3D Rendering image. User can customized spacing and thickness of slice, camera direction and range for exporting. Customized image can be exported to Jpeg, Wmv, Dicom file or sent to PACS.	Ayeon Baek
V.2.8	2016.03.02	New Functions and Improvements 1. Database and PACS Client : Using database, it is possible to store and manage volume and it is possible to retrieve and transfer volume by connecting remote PACS by using PACS Client. 2. Volume segmentation function : By segmenting volume, it is possible to visualize using different OTF. 3. Alignment mesh and volume 4. Pore filter function : By setting conditions, the result of pore detection is displayed in real time according to conditions.	Ayeon Baek
V.2.8.1	2016.09.30	New Functions and Improvements 1. The automatic synchronizing feature of main view and panorama view is added. 2. In Settings, it is possible to keep the state of MPR flip button. 3. When saving project, 'Save Project As' feature is	Ayeon Baek

		added. - The existing 'Save Project' feature is overwriting. 4. Reformat view - The result of pore detection is included in reformat view. - When exporting as video, it is possible to set the play speed of video. - The minimum unit of the interval of slide is changed.	
V.2.8.2	2016.12.06	New Functions and Improvements 1. Volume and MPR rendering speed. 2. The Progress Bar UI has been changed. Bug fix : a bug that has minus value in 'total visualizaed volume' and 'porosity' after sculpting volume.	Ayeon Baek