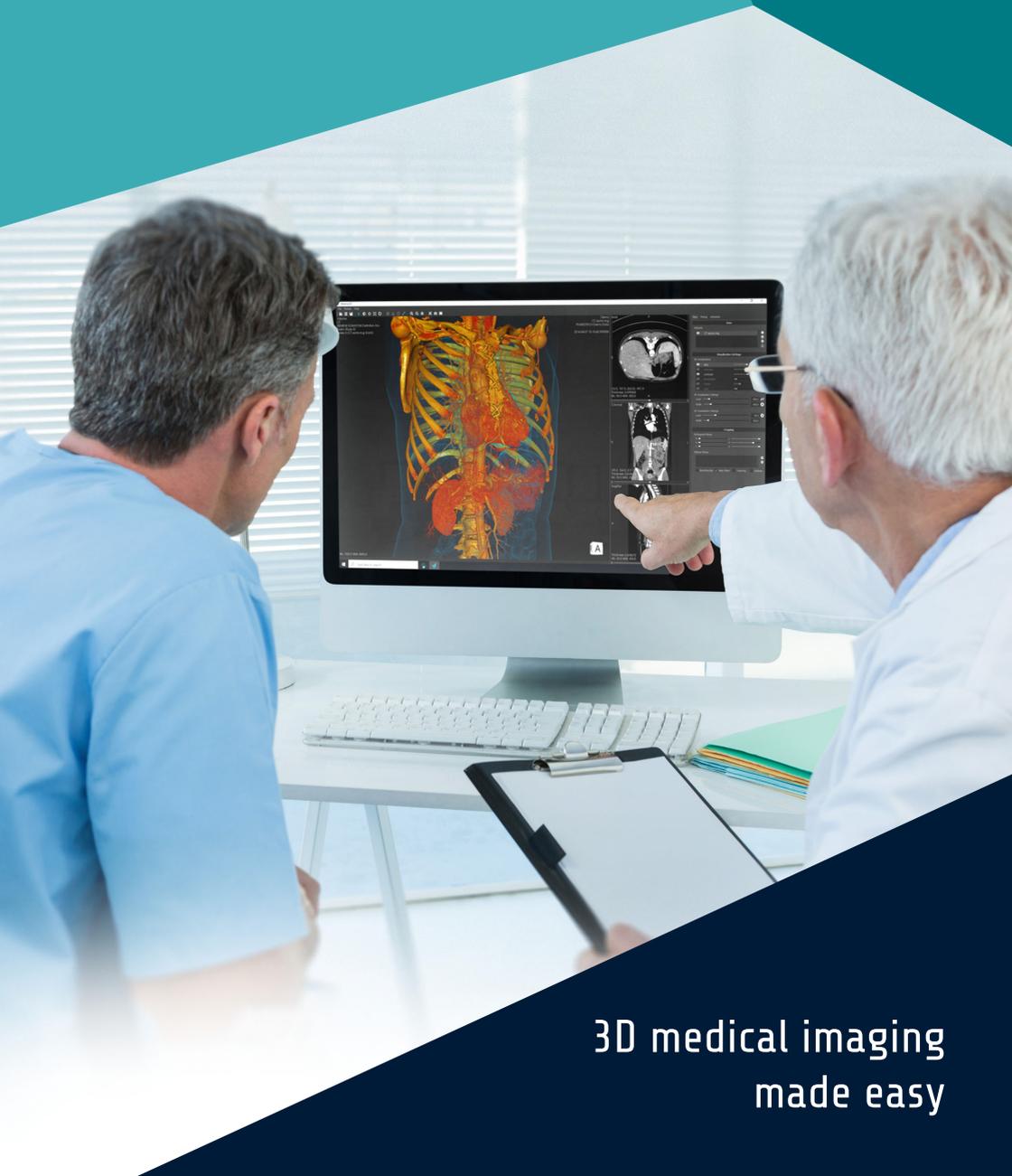




vesalius^{3D}

Getting up and running fast



3D medical imaging
made easy



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Intended use of Vesalius3D



The intended use of Vesalius3D is:

- the *visualization* of volumetric medical data for treatment planning purposes,
- to create a *personalized anatomy book* of a patient,
- to create a *maquette* (extraction) of a structure based on a medical volumetric dataset.

Vesalius3D is NOT intended for DIRECT diagnosis or for medical use. When working with Vesalius3D results in doubts regarding the direct diagnosis, the user has to return to the tools and responsible physicians for direct diagnosis for verification. In order to use Vesalius3D for medical purposes, the medically certified version of Vesalius3D, **Vesalius3D Medical**, should be used. Please contact support@vesalius-3d.com about using Vesalius3D Medical.

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Vesalius3D



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Getting up and running fast

This guide will assist the user in using the most common basic functionality of Vesalius3D. The focus is loading data and getting to the right Visualization and right point of view.

This guide describes the procedure for:

- starting Vesalius3D and first time use
- loading a dataset
- opening a dataset
- choosing a visualization
- navigating in the data
- changing a visualization
- additional handy visualization tools
- saving the work
- exporting a movie and screenshot

All images and examples were made using the free Demo Dataset:

- Demo Dataset: CT Cardio CHN, Series: 75%

The Screens

Vesalius3D contains 4 main screens and they user can easily switch between them:

- Start Screen
- First Time Use Screen
- Library Screen
- Vesalius3D Screen

The First Time Use screen is a special version of the Start screen and appears when there is no data in the Library.

Figure 0.1 shows the correlation between the screens

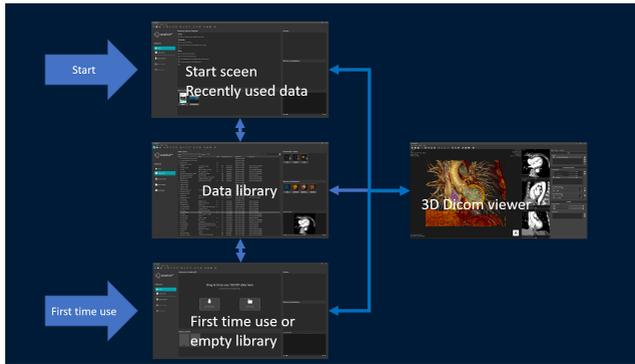


Figure 0.1: Vesalius3D Overview

Navigating between the Screens

The list button icon allows the user to switch between screens.



The list button in the menu bar (top-left on screen) switches between the Start/Library screens and the 3D DICOM Screen. Toggling between the Start and the Library Screen is done using the buttons on the left of those screens.

Getting Started

Getting Started - First Time Use

When opening Vesalius3D the program starts in the First Time Use screen. As there is no data in the Library the user first has to load data into Vesalius3D. The First Time Use screen assists the user to quickly locate and upload the data.

Two buttons are centrally placed on the screen; Import Demo Dataset and Choose your data.

The **Import Demo Dataset** button installs the Demo Dataset into the Library of Vesalius3D.

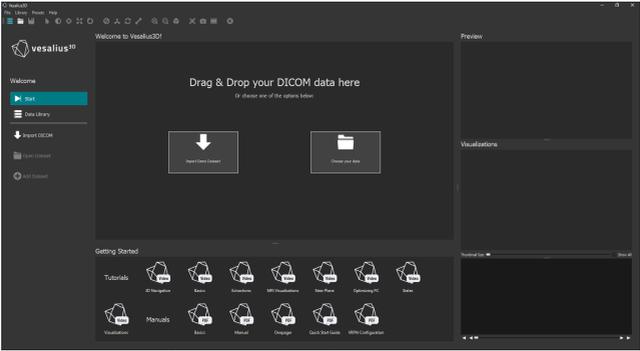


Figure 0.2: First Time Use Screen

The **Choose your data** button opens a popup file explorer. Locate the folder containing your data and click select folder. Vesalius3D will then import all relevant datasets from that file location and subfolders into the Vesalius3D Library.

After importing the data the Library screen is shown. A filter is set to only show the uploaded datasets.

Getting Started - Start Screen

When Vesalius3D is opened with data in the Library the standard Start Screen is shown. This screen shows the most recently used datasets.

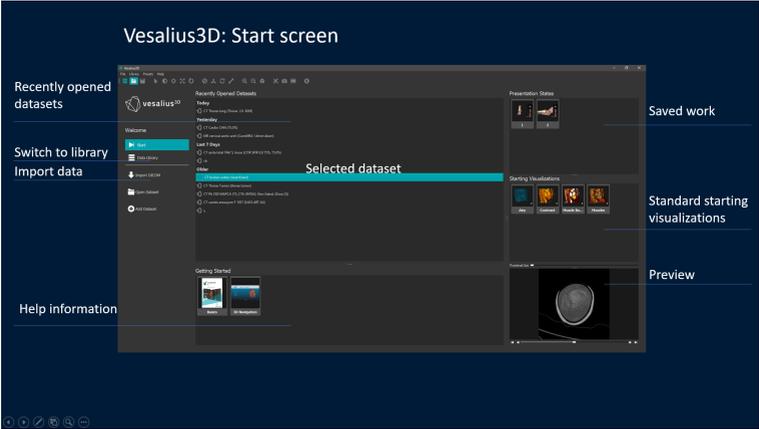


Figure 0.3: Start Screen

The main functionality of the dashboard layout is to:

- quickly find recently used datasets
- open a standard starting Visualization
- open a Presentation State (saved work of a dataset)
- switch to complete Library for other datasets
- import data

Select a dataset by clicking on it. The relevant standard Visualizations and States will then be shown.

Getting Started - Library Screen

The Library screen is opened after data is imported or when the user switches from the Start screen to the Library screen.

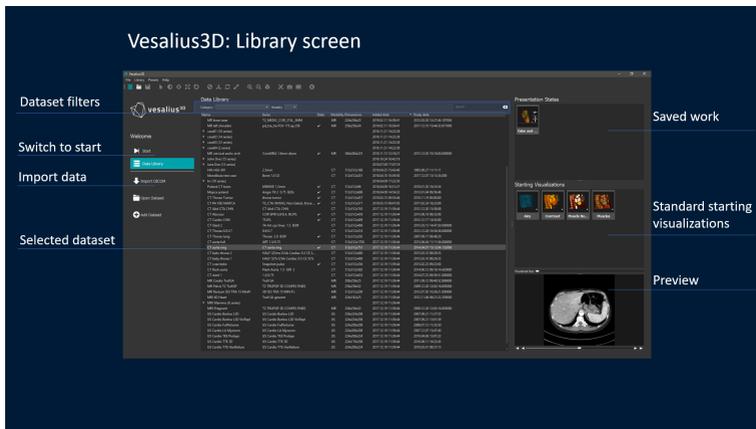


Figure 0.4: Library Screen

The functionality of this screen largely equal to the Start screen, however it is not limited to recently used data. The Library is used to:

- quickly locate the datasets
- open a standard starting Visualization
- open a Presentation State (saved work of a dataset)
- switch to complete library for other datasets
- import data

Getting Started - Open a dataset

Opening a dataset is done from the Library or start menu by selecting a dataset and:

- double clicking on a dataset. The data will open in the recently used standard Visualization
- right click and open while selecting the dataset. The data will open in the recently used standard Visualization
- double clicking on a standard visualization. The data will open in that specific Visualization
- double clicking on a presentation state. The data will open in the way this particular dataset was saved

The selected dataset will open in the Vesalius3D 3D DICOM Viewer, the main screen of Vesalius3D.

Getting Started - Main screen / 3D DICOM Viewer

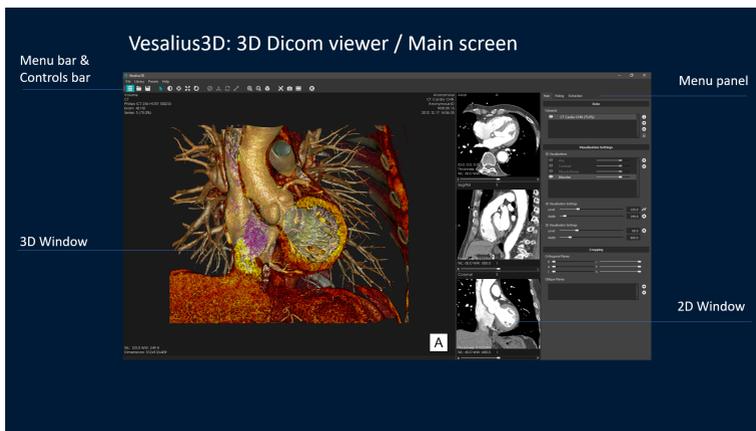


Figure 0.5: 3D DICOM Viewer / Main Screen

The 3D DICOM viewer is the core of Vesalius3D. This is where a user can navigate through the data and optimize Visualizations. Supported functionalities such as the creation of movies and extractions for 3D printing are all done from this window. The Main screen consists of:

- 3D Window
- 2D windows (three)

- Menu Panel
- Menu Bar
- Controls Bar

When selecting (clicking on) a 3D or 2D window the menu panel shows the available functionality for that window. In the image the 3D window is selected.

Importing data into the Vesalius3D Library

Screen: Start screen or Library screen.

Data can be loaded in the Vesalius3D Library by performing the following steps:

- Click Import DICOM button on the left side of the screen or
- Open the *Library* menu, Select *Import* and click on the *Directory* option.

A window appears to specify the name of an existing directory that contains the data. Locate the folder that contains the data (often a DICOM folder) and click on *Select Folder*.

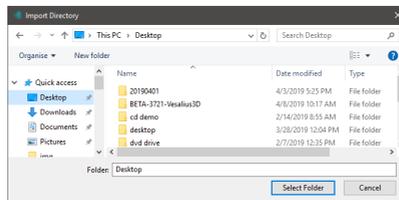


Figure 0.6: Identify source of data

Vesalius3D will import all relevant DICOM data into the Library.

After clicking the *Select Folder* option a window appears to show the progress of the data import.

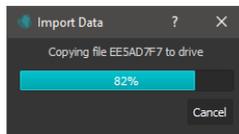


Figure 0.7: Data import progress

It is also possible to trigger this process by drag-and-dropping the data into Vesalius3D.

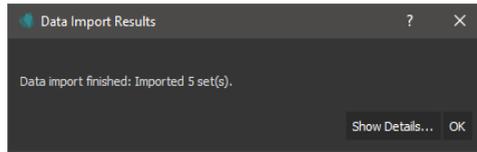


Figure 0.8: Summary of import

After the data has been imported into the database, a window appears to show the data import results. The data list is updated automatically to show the new data. The Library screen is opened and the imported data is shown.

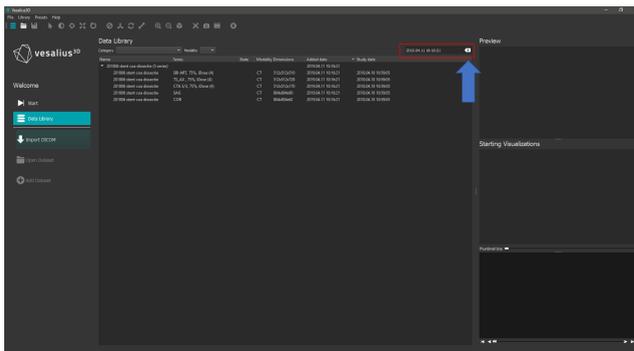


Figure 0.9: Library: Filtered by date and time

To see the entire content of the library, remove the filter. This filter used is the data and time of when the data was imported.

IMPORTANT: Medical data often consist of many individual files. Vesalius3D will automatically find the relevant data and import it into the Library. Vesalius3D searches into the selected folder and all subfolders making this an easy process.

Opening Datasets

Screen: Library screen or Start screen.

The process to open datasets is straightforward.

1. identify and select the desired dataset
2. choose how to open the data, standard Visualization or State
3. open the data

A dataset is selected by clicking on it.

Once a dataset is selected the applicable States and standard Visualizations are shown. Selecting a standard Visualization will open the dataset using that Visualization. Selecting a State will open the dataset in the way it was saved. States allow users to save their work and return to where they left off.

Opening the dataset is done by means of double clicking the dataset, the state, or the visualization, right clicking the dataset and select open, or the open dataset button.

Recently used files can also be opened from the Main screen. *File, Open* shows a list of the most recently used datasets.

IMPORTANT: *When no State or standard Visualization is selected. Vesalius3D will use the last used standard Visualization to open the dataset.*

IMPORTANT: *While standard Visualizations apply to all datasets that match the rules of the standard visualization (e.g. all CT), States apply only to the datasets that were used to create them.*

Visualizations

Screen: Main screen. Part on screen: Menu panel - Visualization Settings

The Visualization Settings in the menu panel are used to manage the Visualizations. Users can add Visualizations, change Visualizations and create new Visualizations.

Toggleing between standard Visualizations

The Visualizations that are active are shown with a marked eye  checkbox in front of it. Other standard Visualizations are shown with the eye checkbox unmarked. Marking and unmarking the eye checkboxes will activate and deactivate a Visualization.

Toggleing between Visualizations is done by means of selecting and deselecting the eye checkbox. Multiple Visualizations can be shown at the same time.

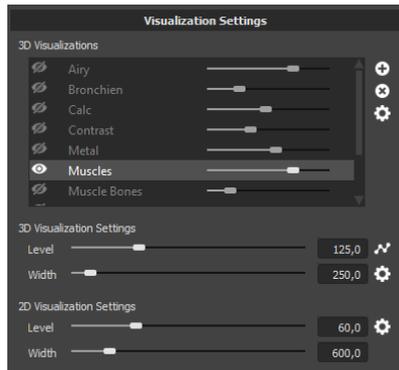


Figure 0.10: Menu Panel: Visualization Settings

Adding new Visualizations

Visualizations can be added by clicking the  button on the Visualization Settings panel. A list of additional Visualizations appear and when selected it is added to the list of Visualizations in the panel.

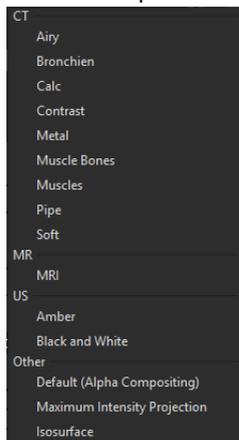


Figure 0.11: Add Visualizations

Changing a Visualization

Active Visualization Only one of the shown Visualizations is active. The active Visualization (in the example: **Airy**) is highlighted in the listing displayed in Figure 0.12. Changes to Visualization settings are only applied to the active Visualization.



Figure 0.12: Active Visualization: Airy

Different tissues have different density values in a dataset. A Visualization in Vesalius3D is based on selecting a range of these values. This selection is called the range. Optimizing an image means showing relevant values and filtering out the irrelevant ones.

Vesalius3D has controls to allow a user to easily expand or reduce the range as well as tools to move the range through the entire range of density values. These controls are called **Level** And **Width**. These settings are found in the *Menu Panel* on the *Main* page.

The window level and width parameters are used to select an area of interest in the data.

- **Width:** Defines what **percentage of the data** is used
- **Level:** Where the **center of the range** is

or

- **Size of Range:** **Width**
- **Location of Range:** **Level**

Navigating

Next to Visualizations, getting to the correct point of view is core to Vesalius3D.

Navigating through the data is done using mouse and keyboard or with the use of 3D navigation tools.

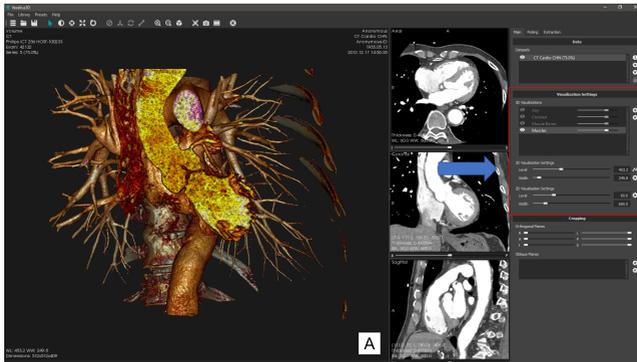


Figure 0.13: Level: Set higher, more dense values



Figure 0.14: Width: Increased - Wider Range

Mouse and Keyboard navigation

The most important are:

- Rotate: Left Drag
- Dolly (move dataset in and out of screen): Left + Right Drag
- Dolly (alternative): Left Drag + CTRL
- Spin: Left Drag + ALT
- Translate: Left Drag + SHIFT
- Zoom: Right Drag

A listing of all navigation possibilities can be seen by pressing the  icon on the controls bar.

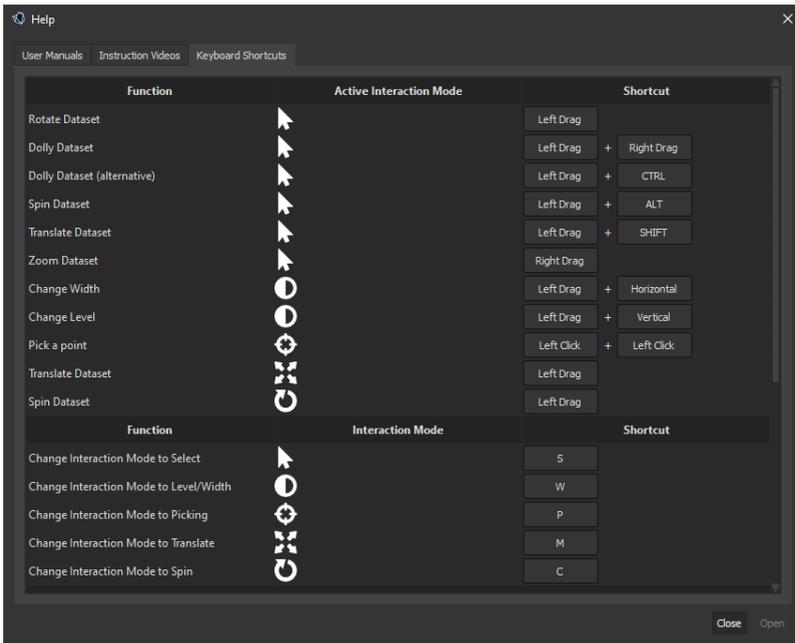


Figure 0.15: Navigation controls

3D Controllers (Vesalius3D Workstations)

The most intuitive and effective control of the 3D data can be achieved using 3D interaction devices combined with stereo vision. This is for instance available in the Vesalius3D 3D workstations (<https://www.vesalius-3d.com/vesalius3d#stereo-visualization/>). When the devices are moved, Vesalius3D shows a 3D representation of a dodecahedron and a pointer. These objects are controlled using the 3D interaction devices. The motions of the interaction devices are directly translated to movements of the virtual dodecahedron and pointer.

In the Vesalius3D Workstations the default setup is:

- Controlling the dataset - Large Device.

By clicking the left pedal, the dodecahedron defines a center of rotation for the 3D volume. Subsequent motions of the dodecahedron are directly translated to movements of the 3D volume. This way, the user gets the experience of holding the 3D volume directly in his hands.

- Controlling the instrument - Small Device

By clicking the right pedal, the instrument is activated. For instance erasing data or manipulating cropping planes. The type of instrument is dependent on the chosen functionality in the Menu Panel. By default it is a pointer.

Cropping Data

Cropping planes are used to cut away parts of the 3D data in the 3D view. In the 2D views the position of the cropping planes is displayed as a line in the corresponding color of the plane. If a plane is visible in the 3D view and at least in one 2D view, the plane will be highlighted in all the views during interactions.

Near Plane - First World Perspective

This is a special plane for the 3D window. It allows users to traverse (fly through) the dataset. It is a cropping plane between the user and the 3D dataset. The plane is fixed and the user can drag the data through the plane creating a first world perspective.

It can be enabled by clicking the *right mouse button* in the 3D view and selecting the *Add Near Plane* functionality.

IMPORTANT: By default the near plane plane is on. This default can be changed through the Settings Dialog of Vesalius3D

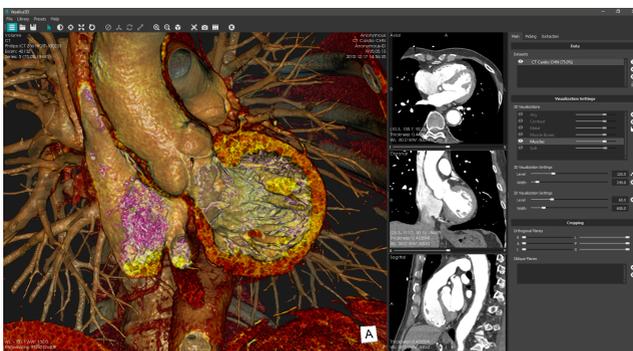


Figure 0.16: Near Plane

Cropping Planes - Standard Planes

While the *Near Plane* is fixed and the data is pulled through, the standard planes are connected to the dataset.

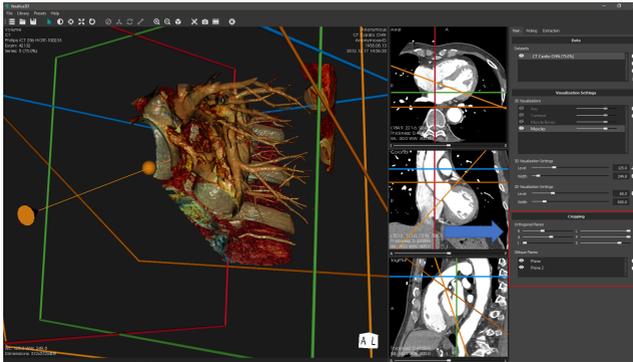


Figure 0.17: Cropping Plane Panel

Two types of cropping planes exist.

- **Orthogonal Planes**

Orthogonal planes move along the 3 axis of the data. The planes that share an axis have similar colors. The left and right cropping planes are red, the anterior-posterior planes green and the inferior superior planes are blue.

Controlling orthogonal cropping planes:

1. *(Mouse)* Move the sliders in the Cropping panel
2. *(Mouse)* Center the plane by right-clicking the slider and clicking on Center Slider
3. *(Mouse)* Move the plane in a 2D view by dragging it with a mouse
4. *(3D controllers)* Selecting a plane with the 3D pointer by pointing at it, pressing the right pedal and moving the 3D pointer. When the pointer is near a plane, that plane will highlight and a small circle will appear on the selected plane

- **Oblique Planes**

Oblique planes can be positioned and oriented freely in the 3D view. Oblique planes are shown in a brown-ochre color. When additional oblique planes are added, these planes get a different color.

Adding an oblique plane is done by clicking on the green plus button in the Cropping panel.

Controlling Oblique Planes:

1. (*Mouse*) Move the mouse pointer into the 3D window, a widget appears on all oblique planes.
Selecting the line or endpoint and moving it changes the angle of the oblique plane.
Selecting the center and dragging it will move the oblique plane through the data.
2. (*Mouse*) Move the plane in a 2D view by dragging it with a mouse.
3. (*3D controllers*) Selecting the oblique plane with the 3D pointer by pointing at it, pressing the right pedal and moving the 3D pointer. When the pointer is near a plane, that plane will highlight and a small circle will appear on the corresponding plane.

Saving your work - States

States are a powerful tool to store your work and show it to others. States contain the information needed to restore Vesalius3D to the situation of Vesalius3D at the moment of saving the state.

Presentation States can be opened by opening the *States* menu and selecting *Open Presentation State*. To save a presentation state, open the States menu and select the Save Presentation State option. When saving presentation states, only a name and description or notes have to be entered. Exporting and importing a presentation state is also possible from the States menu.

To show a state on a different computer, both the dataset and the state need to be transferred. When exporting a state from the Data Library within Vesalius3D, a question is asked whether the corresponding datasets should be exported as well (Figure 0.18). Choosing this option will result in a state containing all necessary datasets and the chosen state. This file can be imported in Vesalius3D again.

Creating Screenshots and Movies

The tools for movies and screenshots are part of the control panel above the 3D window. Vesalius3D captures the active 2D or 3D window. Vesalius3D captures the 3D window in the standard non stereo format.

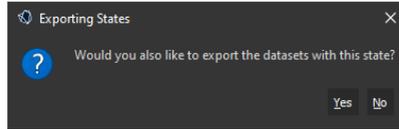


Figure 0.18: Exporting a state

For full screenshots the standard Microsoft Windows **Snipping Tool** is recommended.

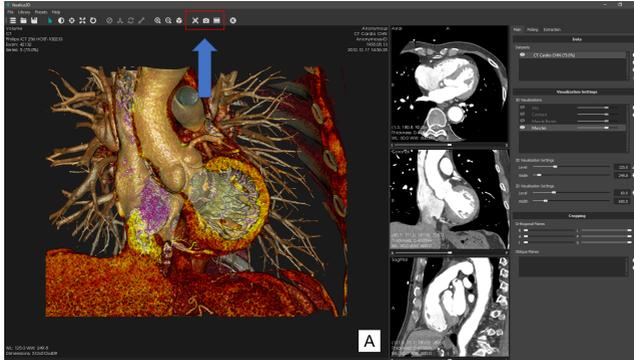


Figure 0.19: Snapshot And Movie

Clicking the  button creates a screenshot instantly, and opens up a window to save the snapshot to disk. The  button opens up a window to enter a movie file name and location. After the name is entered and the window is closed, the system immediately starts recording everything that is displayed in the active window into the selected movie. During recording, the software can be used normally and all normal functionality is available. During recording the  button changes into .

Note: Any action that causes the view that is being recorded to be resized or closed will automatically stop movie recording. To manually stop recording and finish the movie, click the  button. When trying to close Vesalius3D while a movie is still being recorded, a message is shown asking to continue. Choosing to continue closing Vesalius3D will end the recording and save the movie to the specified file location.

Maximized and Fullscreen views

- Each 2D and 3D view in Vesalius3D can be maximized and set to Fullscreen. **Maximize View:** Use **CTRL-M** to maximize the selected view.

Clicking CTRL-M again will return the view to its default size.

The Maximize view functionality is also available via *Right Click - Views - Maximize* from a selected view.

- **Fullscreen View:** Use **CTRL-F** to show the selected view full screen. Clicking CTRL-F again will return the view to its default size. The Fullscreen view functionality is also available via *Right Click - Views - Fullscreen* from a selected view.

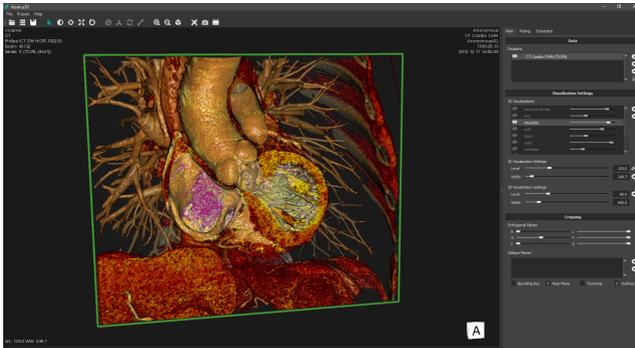


Figure 0.20: Maximize: CTRL-M

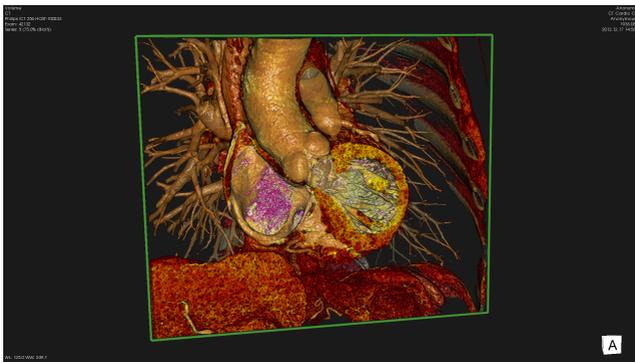


Figure 0.21: Fullscreen: CTRL-F