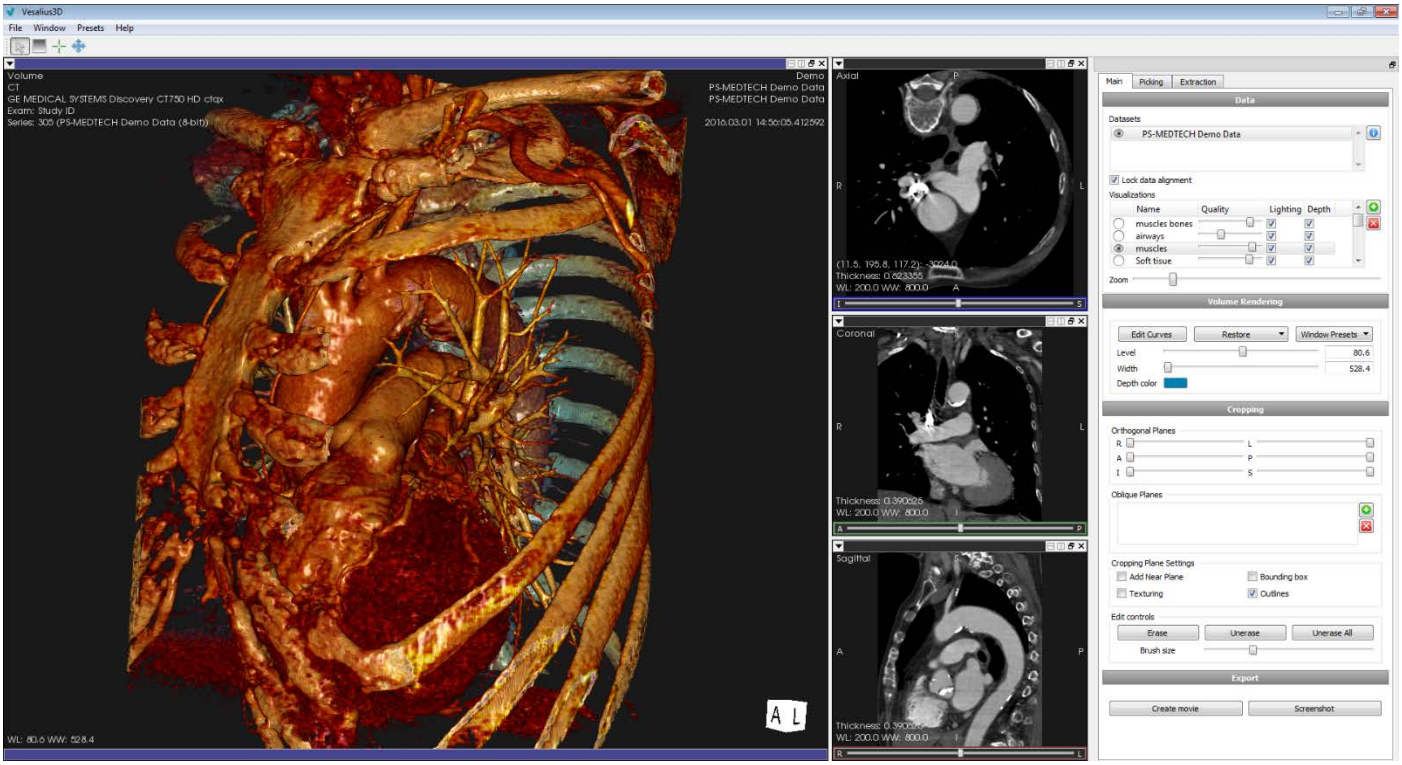
ps-medtech

Vesalius3D ®

Hands-on medical imaging

The toolkit for efficient and effective visualization and presentation of 3D medical volumetric data



3D and 4D volumetric data Visualization

Ultrasound, MRI, CT

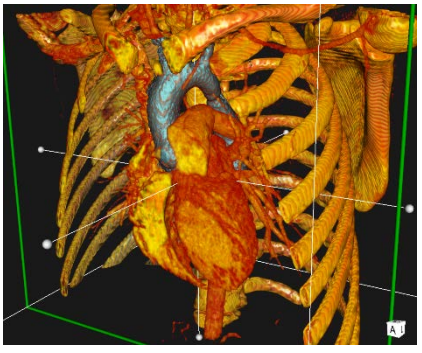
2D and 3D interfaces

3D Printing[i]

Multimodality imaging

Customizable

Measurement



Extraction for 3D Printing

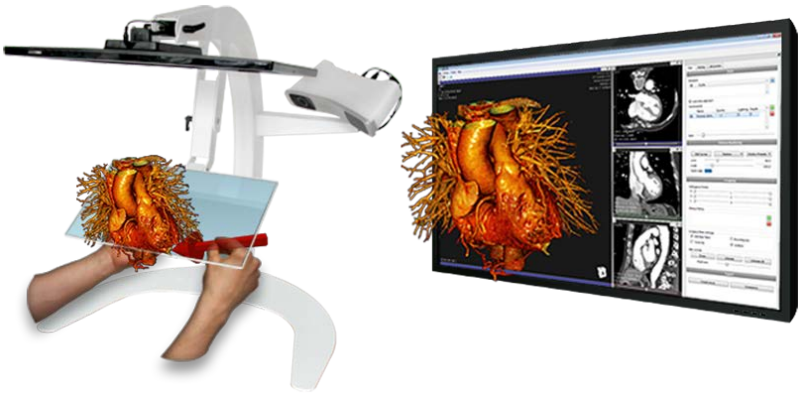
Vesalius3D® : PS-Medtech's intuitive medical image visualization application

Vesalius3D combines high quality volumetric visualization with easy navigation. This combination allows for fast and efficient visualization and understanding of complex volumetric data.

Vesalius3D is specifically designed for use in workstations that support 3D interaction such as the C-station and PSS but can also be used on any regular PC with mouse and keyboard. Vesalius3D features advanced and high quality volumetric rendering techniques and can render to both conventional and stereoscopic displays.

Vesalius3D picks up where other applications fall short; "really looking at the data and analyzing it easily and quickly in 3D".

Most 3D analysis software packages evolved from 2D analysis software and are built upon a 2D foundation. They cannot deal with two handed interaction and if 3D interaction is offered it is an add-on. This does not result in a lifelike experience and the 3D functionality is often too difficult to use and time consuming.



Vesalius3D in the C-station

Vesalius3D is different; it supports two handed interaction and at the core is a unique 3D rendering engine.

Seamless integration of 2D and 3D interaction tools

Vesalius3D was created to give the user the right tools for the task at hand. Access to both 2D and 3D interaction tools is therefore an integrated part of working with Vesalius3D. Standard classical operations like menu selecting, scrolling and typing are done using interfaces such as a mouse and keyboard. For complex 3D tasks, 3D interfaces are used. One hand is used to position and orient the data, this way utilizing the wrist and hand functionality of the user to the fullest. The other hand is used for activities such as pointing, slicing, measuring, selecting, erasing and cropping.

Data viewing

Vesalius3D offers both 2D and 3D windows side by side and customizable to the user's requirements. All views have full screen support, are detachable, and can be arranged on multiple monitors and screens.

2D windows

Traditional planes are offered in Planes in conventional axial, coronal, sagittal directions. Mouse/keyboard interaction is used for moving and zooming in/out, window level and center manipulation, and resetting the view settings.

Sample layout with 2D windows, a 3D window and the control panel

3D windows

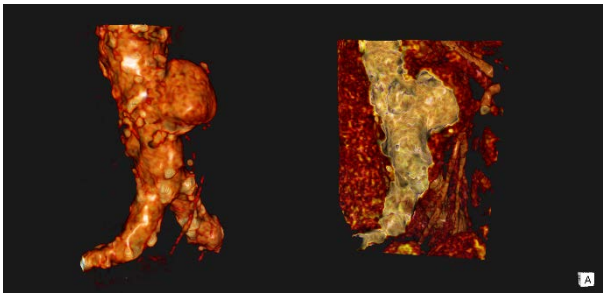
The 3D windows have been designed with ease of use. The 3D windows have several strong benefits that allow for the use of Vesalius3D in many environments.

- The 3D data is always presented in patient coordinate system
- Multiple datasets can be visualized simultaneously. For instance pre and post procedure data or a geometrical model of a prosthesis inside a CT.
- Live rendering during interaction. This results in a lifelike experience of the data, avoids strain and makes the analysis easier as resolution is kept at high levels at all time
- Stereo viewing of 3D windows can be switched on and off
- Any type of 3D interaction can be linked to Vesalius3D as Vesalius3D uses the standard interface VRPN
- Toggling between visualization modes to see structures from the inside and out.
- Support for mouse, keyboard and 3D interfaces interaction.

Multiple view support

Vesalius3D is a very flexible environment. It is easy to adjust to the specific needs of the user. For example Vesalius3D has:

- A fully customizable view layout, simply by splitting views horizontally or vertically
- Views that have full screen support, are detachable and can be arranged on multiple monitors and screens
- An automatically adapting UI, showing only panels and settings that apply to the active view and type of visualization
- A view system architecture is extendible to support other types of views (e.g. for ECG/EEG data or measurements)
- A native Windows appearance is customizable through normal Windows settings/themes (font sizes, colors, etc.)



Outside and inside visualization

Advanced volumetric rendering engine

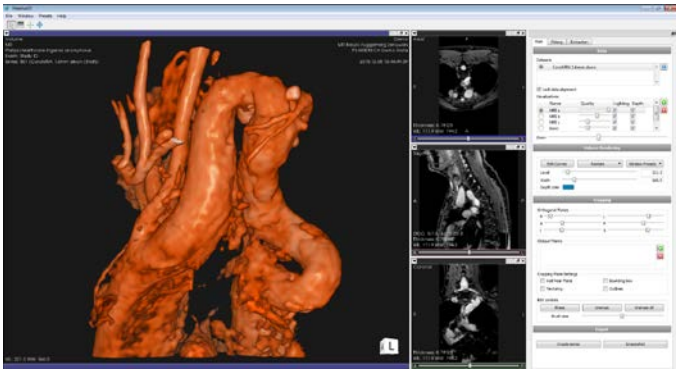
For Vesalius3D a dedicated 3D rendering engine was developed that renders volumetric data in 3D, in Real-time. This engine maintains a high frame rate during live 3D interaction without sacrificing quality. Some features:

- 8 and 16 bit 3D rendering support
- Real time and frame sequential animation (4D rendering)
- Multiple rendering modes: alpha compositing and maximum intensity projection
- Pre-integrated rendering for improved quality, especially when using steep transfer functions
- Multi-modality rendering. Vesalius3D supports rendering multiple (overlapping) data sets at interactive rates. The number of data sets that can be visualized simultaneously limited only by GPU memory
- Full control over render settings (transfer functions, lighting, depth shading, etc.) for each independent data set
- Stereoscopic rendering support (interlaced, side-by-side, frame-sequential, anaglyph)
- Real-time data animation plays the data at the same rate as it was recorded
- Frame sequential data animation tries to play real-time, but slows down if necessary to ensure playing each frame
- Support for orthogonal cropping planes relative to patient coordinate system
- Memory management including a caching mechanism to increase speed when memory is available
- Support for an arbitrary number of oblique cropping planes that operate on all data sets simultaneously

Presets (protocols and state saving)

Protocols are descriptions of the view layout and visualization parameters for datasets with predefined properties. Upon opening a dataset, all protocols and presentation states that apply to this dataset are listed, such that physicians can efficiently view the data in the way most suitable for their needs.

The state saving functionality stores all settings with a specific data set: view layout, render objects and settings, cropping planes, transfer functions, measurement objects, etc. .



a state

Transfer Function editor

Vesalius3D's transfer function editor supports multiple curves that can be independently edited to highlight different tissues. It supports to map densities to colors and transparencies. It can be used to quickly filter out certain parts of the data while highlighting other parts.

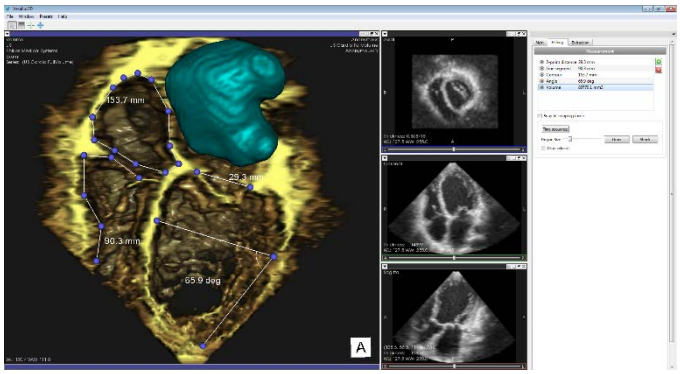
Screenshots and movies

To support the transfer of information between users of 3D medical data Vesalius3D has the functionality to record movies of the actions taking place in Vesalius as well as making screenshots.

Measurement

The measurement tools assist users to perform specific measurements during the analysis of volumetric medical images. There are 2D and 3D measurement tools.

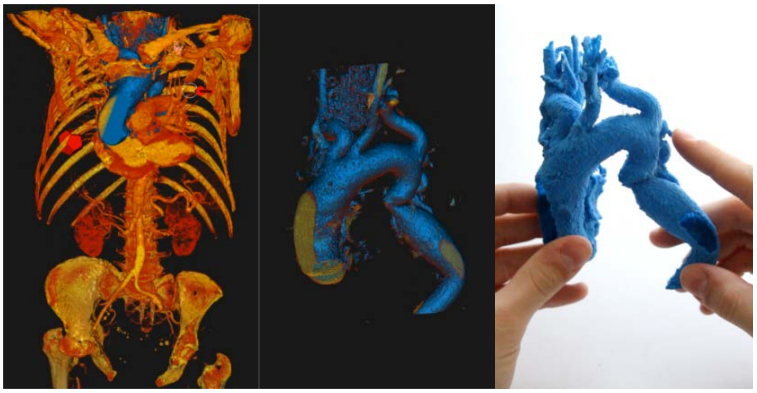
- 2D measurement tools include distances, angles, and contour areas
- 3D measurement tools include distances, contours, angles, and volume segmentations



Measurements

3D Printing – a 3D visualization tool[i]

3D prints are extractions of volumetric medical images. Any medical image modality can be made into a 3D printable structure with Vesalius3D. The structures are extracted in minutes.



3D Print extraction

Data Library

Vesalius3D features a DICOM viewer that reads a variety of 3D image formats, including 2D image stacks in most common formats, various RAW formats, and DICOM images (".dcm" extension). Vesalius3D is compliant with the DICOM standard for image communication and image file formats. The PACS module allows for query and retrieve of image files from PACS. Features include:

- Multiple data types support (including: Philips DICOM in Cartesian format (US), GE VolDICOM (US), DICOM sliced 3D data (MR, CT, etc.), Sliced 3D data in all major image formats, including png, jpg, bmp, tiff, gif, etc, ICS format, MRC format, Tomtec DAT format), etc.
- PACS support to integrate within hospital workflow
- Imported data is kept in the original state (no conversion), so no information is lost

From a cardiologists point of view

A use case

Situation

We work on a daily basis in a multidisciplinary team, consisting of cardiologists and cardio-thoracic surgeons, to diagnose and treat complicated heart valvular diseases. To this end, adequate visualization of anatomy and pathology is mandatory to determine diagnosis, and formulate a surgical strategy. 2D echocardiography is up to now the cornerstone in this process.

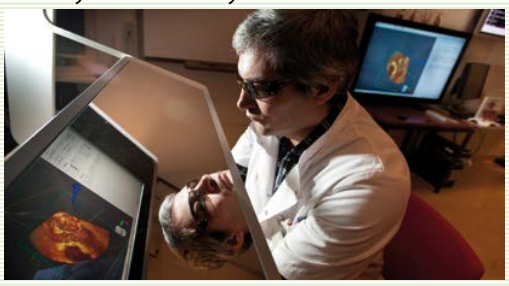
Complication

Each individual specialist creates a virtual 3D image of the valve, based on the presented 2D images, in his own mind. However, there is no way to determine if all members of the team have identical views of the valve in mind which is essential for clinical decision making.

Recently, 3D echocardiography has entered the clinical arena, but post processing these images on a 2D screen is laborious and sometimes even counterintuitive, and thus not a definite solution.

Solution

In specific: the actual 3D images using the C-station allow all members of the team to actually see the valve. By using the free-hand plane, every desired cross section through the valve is easily obtained. Ultimately, quantification of severity (e.g. planimetry, volume rendering) might further improve the diagnostic accuracy of this modality.



3D workstations are the new stethoscopes of the cardiologist-of-the-future!

[i] Optional module