

VMersive

Congenital Heart Diseases Imaging

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About VMersive

What is VMersive?

VMersive is an imaging software dedicated for congenital heart diseases.

The application can be used for visualization of complex congenital anomalies and simulating a variety of surgical and percutaneous procedures in both pediatric and adult patients, including:

- **Sinus venosus defect**
- **TPVI**
- **CoA**
- **VSD**
- **DORV**
- **Complex TGA**
- **ToF**

VMersive allows for custom, patient specific, modeling and sizing of **medical devices** including:

- **Transcather pulmonary valves**
- **Stents with foreshortening tables**
- **VSD Occluders**
- **Conduits**

Why choose VMersive?

Standard methods of simulating congenital heart diseases often include manual segmentation and 3D printing. These methods can take hours to complete and have limited possibilities for quickly simulating different planning options.

- **VMersive** accelerates 3D imaging and simulation from hours to **minutes**.
- **VMersive** increases the quality of 3D imaging and simulation by giving you tools for custom modeling of medical devices.

VMersive democratizes 3D imaging and simulation for physicians. You no longer have to be an expert in 3D modeling. With VMersive you can import DICOM data and model implants in minutes!

Functionalities

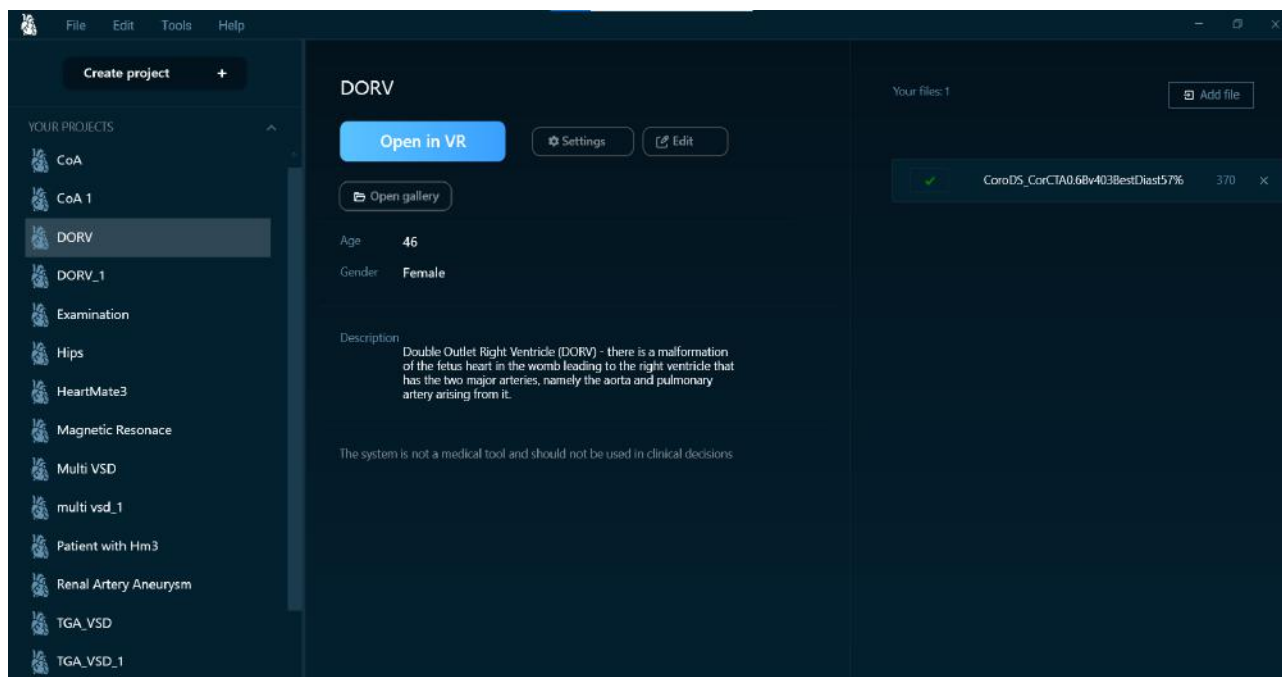
VMersive offers a complete workflow for imaging and simulating congenital heart diseases.

- Manage DICOM studies by importing CT, MR or 3D Echo data.
- Start simulation immediately by entering virtual reality thanks to automatic 3D reconstruction.
- Observe the entire context of anatomy by choosing different imaging profiles including heart vessels, airways and more.
- Observe dynamic, beating heart in different phases thanks to functional and multiphase studies support.
- Simulate using a variety of tools including measuring, cutting, slicing and more.
- Perform sizing of medical devices including valves, stents, VSD occluders and many more.

The following chapters explain each functionality in greater detail. Make sure to view the accompanying video demonstrations.

[VMersive - workflow playlist](#)

Manage DICOM studies



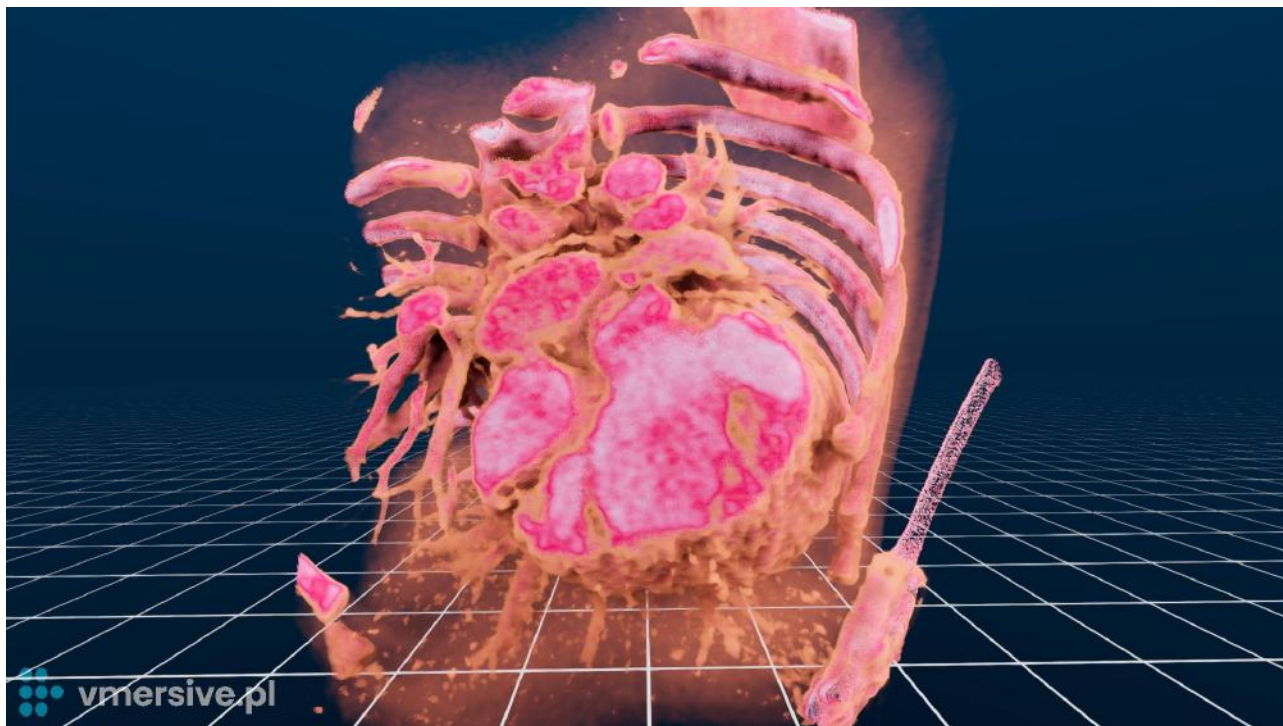
The first step in VMersive is to import DICOM studies (CT, MR or 3D Echo). You do it by creating a project and importing the data. Projects contain studies, description, saved reports and screenshots.

Projects features:

- Import patient studies.
- Start planning in virtual reality (VR)
- Contains several different saved variants of simulations.
- Access screenshots taken during simulation and use them in research publications.
- Export projects and share them with others to consult your simulations.

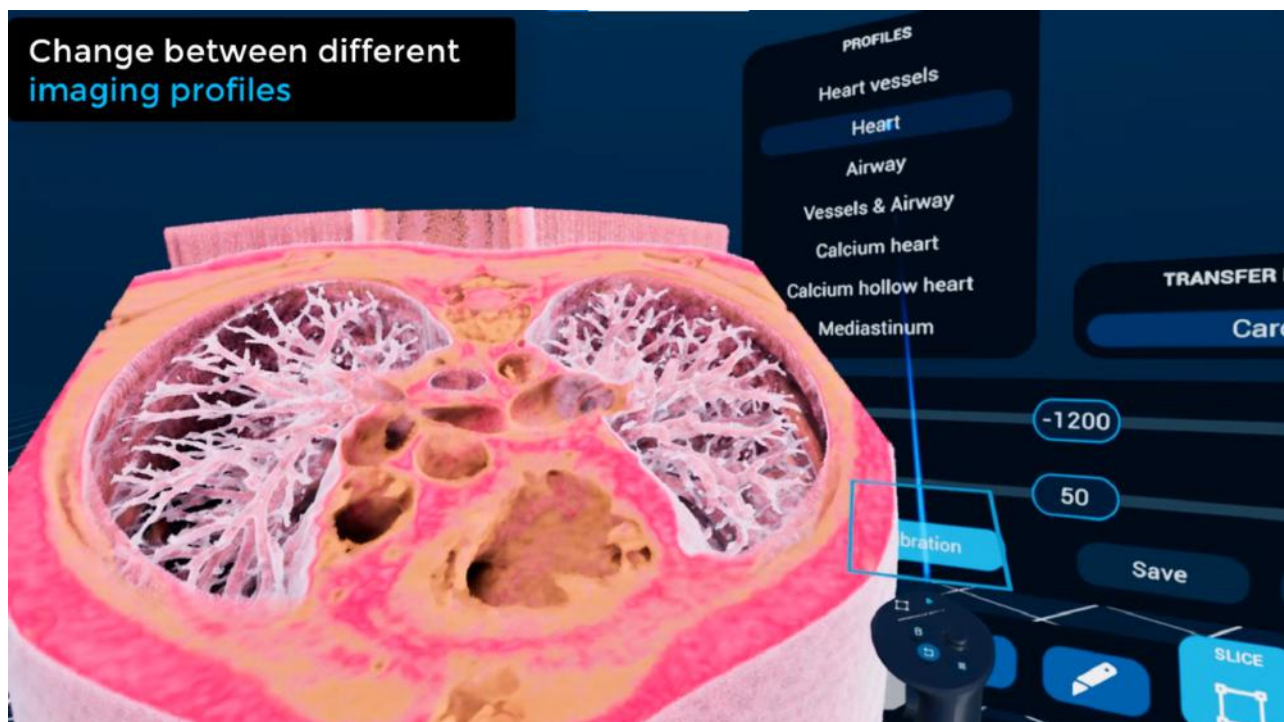
[Watch on Youtube](#)

Start simulation immediately



Once you have imported DICOM studies, you can begin simulating right away due to the automatic 3D reconstruction - without the need of manual segmentation. By utilizing a virtual reality headset and controllers, you can quickly diagnose and simulate congenital heart diseases. Physicians are no longer limited to a specific viewing angle, but can now clearly and accurately view a patient's anatomy as it exists.

Observe entire context of anatomy



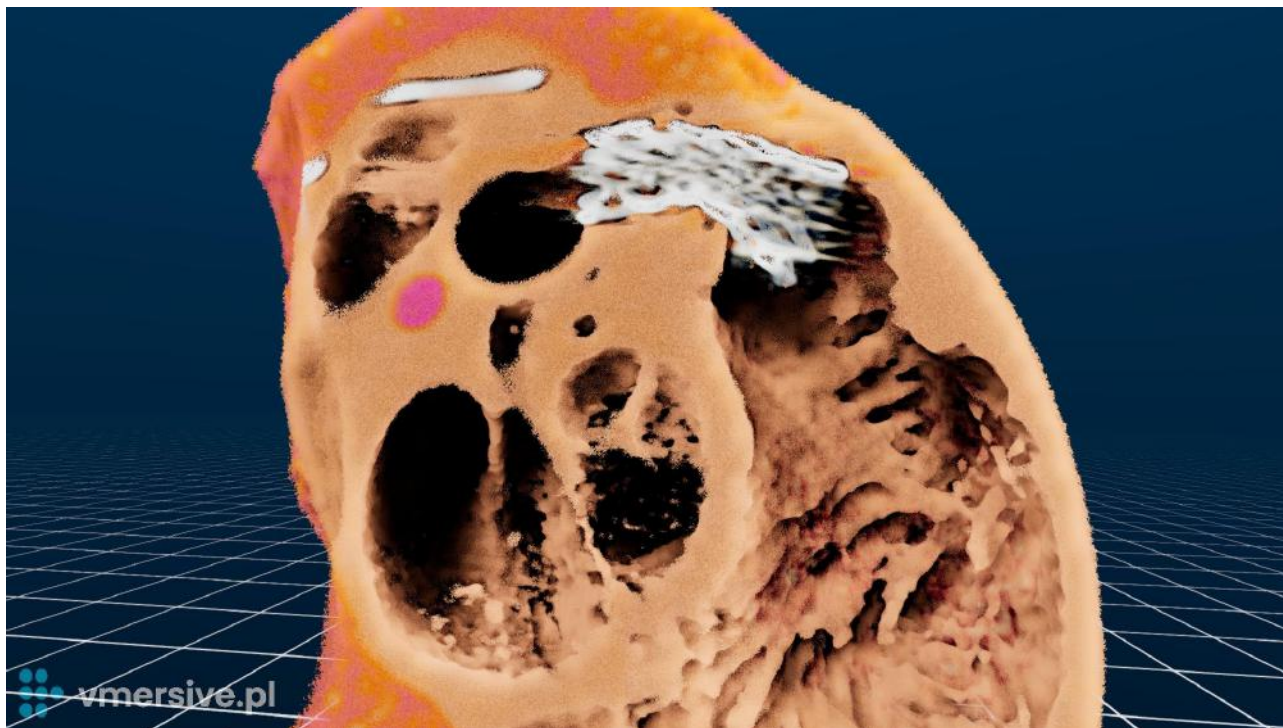
VMersive allows you to observe the entire context of anatomy thanks to the imaging profiles. You can quickly switch between different views like heart vessels, airways or implanted stents. There are already multiple predefined profiles to choose from and you can adjust them for your patient specific projects.

Sample predefined profiles:

- Heart vessels
- Heart interior
- Airway
- Calcium heart

[Watch on Youtube](#)

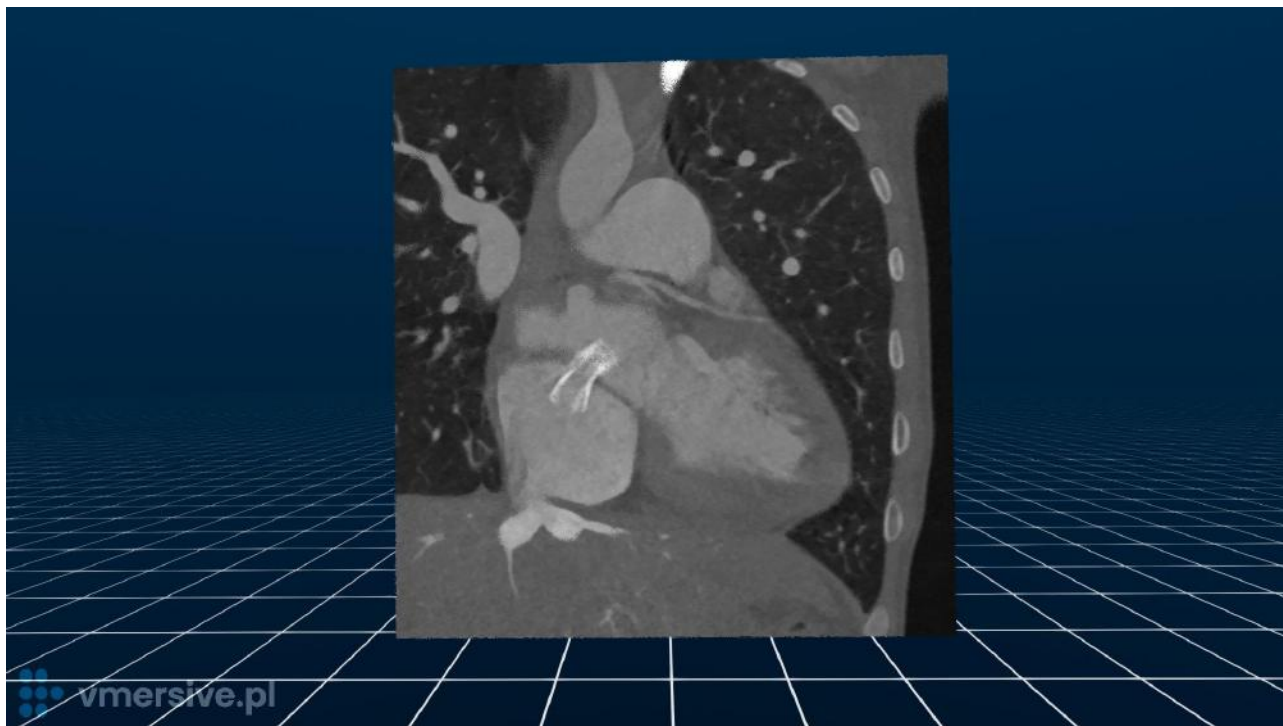
Observe implanted medical devices & calcifications



VMersive offers a dedicated imaging profile to visualize implanted medical devices in the hollow heart chambers view. You can easily observe implants like: stents, valves or occluders already implanted in the patient.

The same imaging profile can be used to observe calcified tissues.

Observe MPR & verify measurements

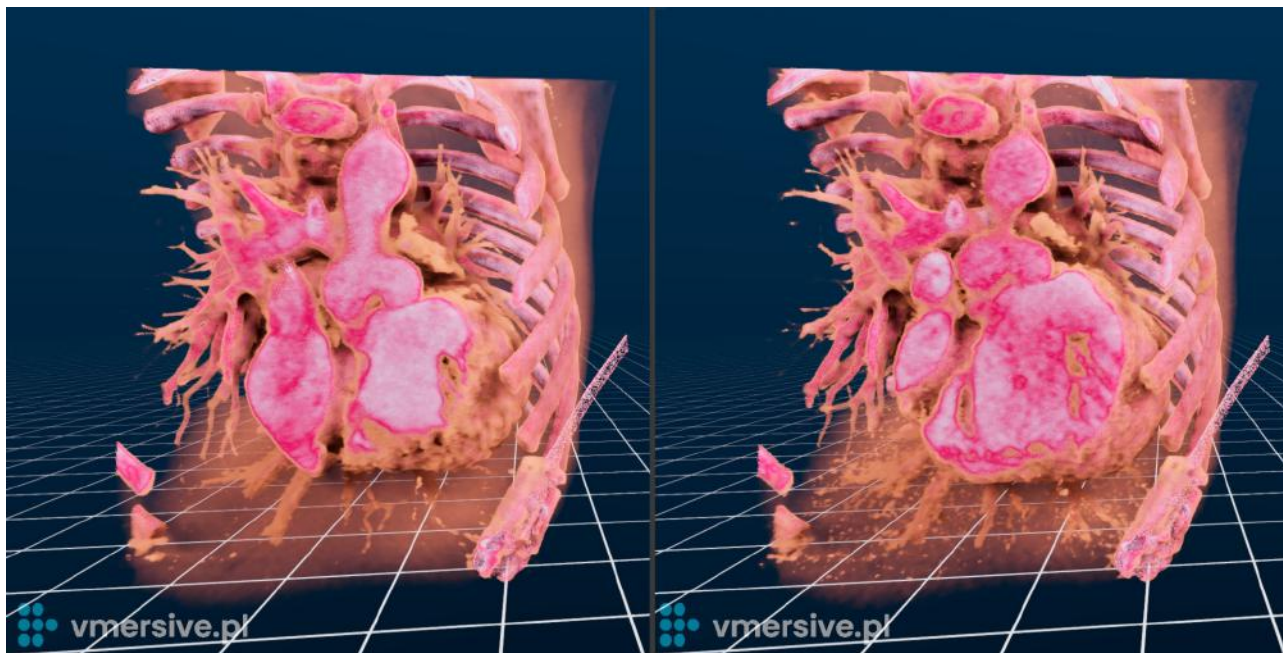


Observe the MPR simulation using traditional grayscale images. Easily modify angles of projection planes in 3D using the slice tool.

MPR simulation can be used to verify measurements applied in 3D. MPR is available for every supported modality CT, MR and 3D Echo

[Watch on Youtube](#)

Observe dynamic studies

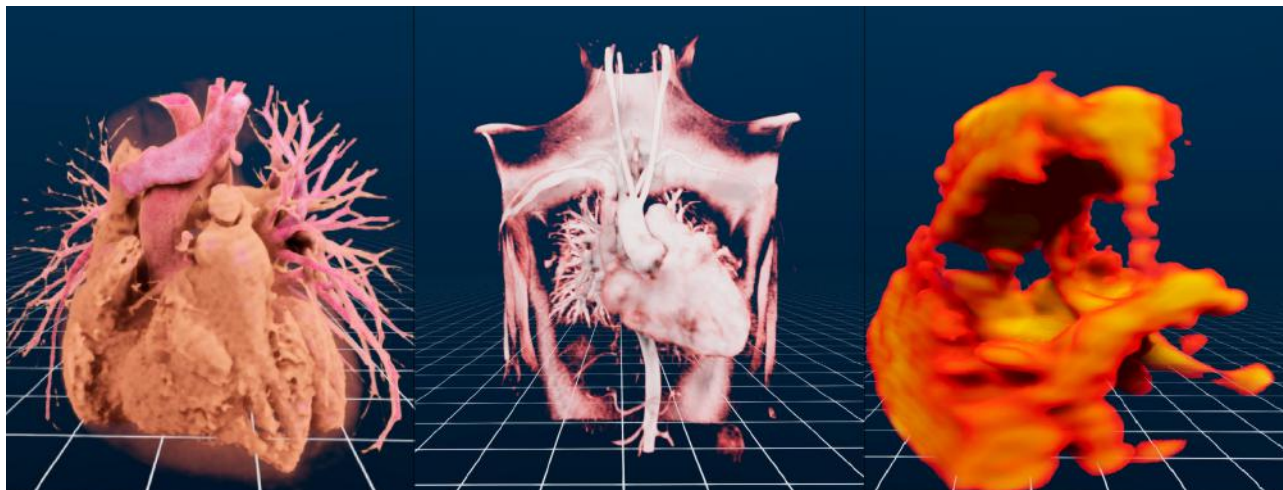


VMersive offers the ability to improve the realism of patient anatomy images by supporting functional and multi-phase studies which will display as a dynamic animation of a beating heart. The animation can be played at various speeds, paused, and each frame can be viewed individually and in different imaging profiles for a more detailed examination

[Watch on Youtube 1](#)

[Watch on Youtube 2](#)

Multimodality: CT, MR, 3D Echo



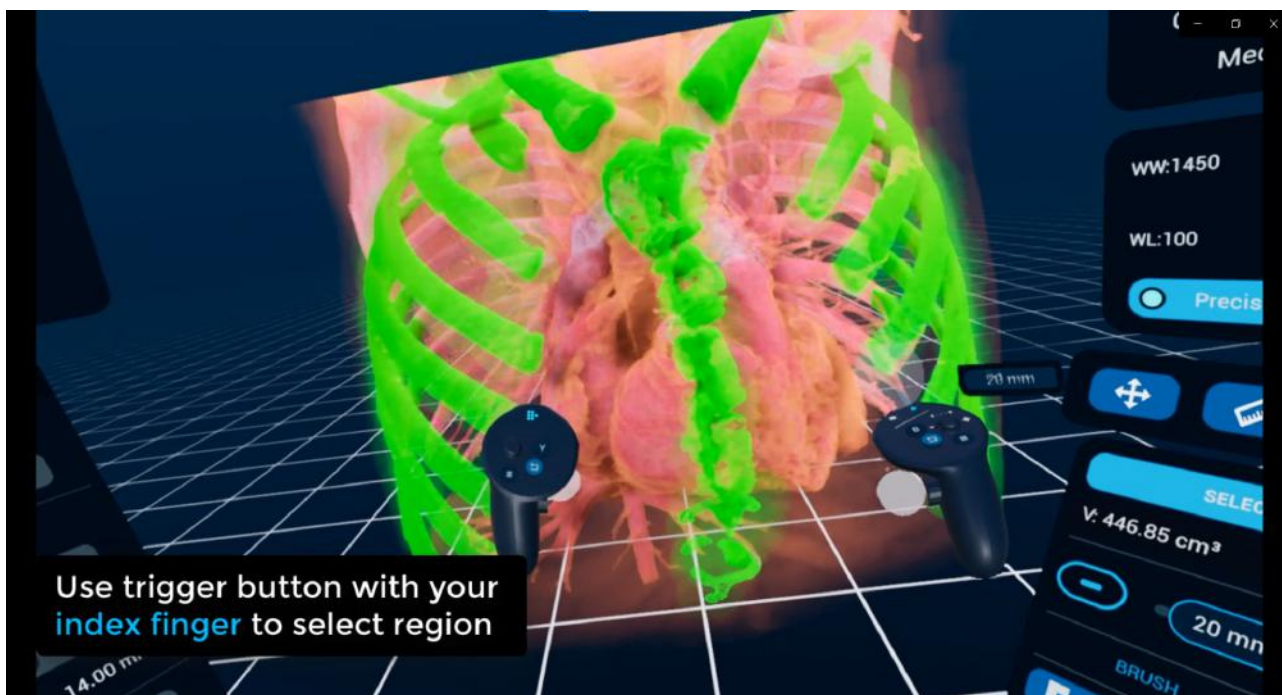
VMersive allows you import and observe multiple modalities: CT, MR and 3D Echo.

Dedicated imaging profiles are available for each modality to bring the highest quality of visualization even for low resolution images.

You can control the parameters of imaging to adjust the visualization for specific data. Default values are provided however you can easily adjust window level and width, opacity and smoothness of images.

[Watch Echo on Youtube](#)

Variety of tools

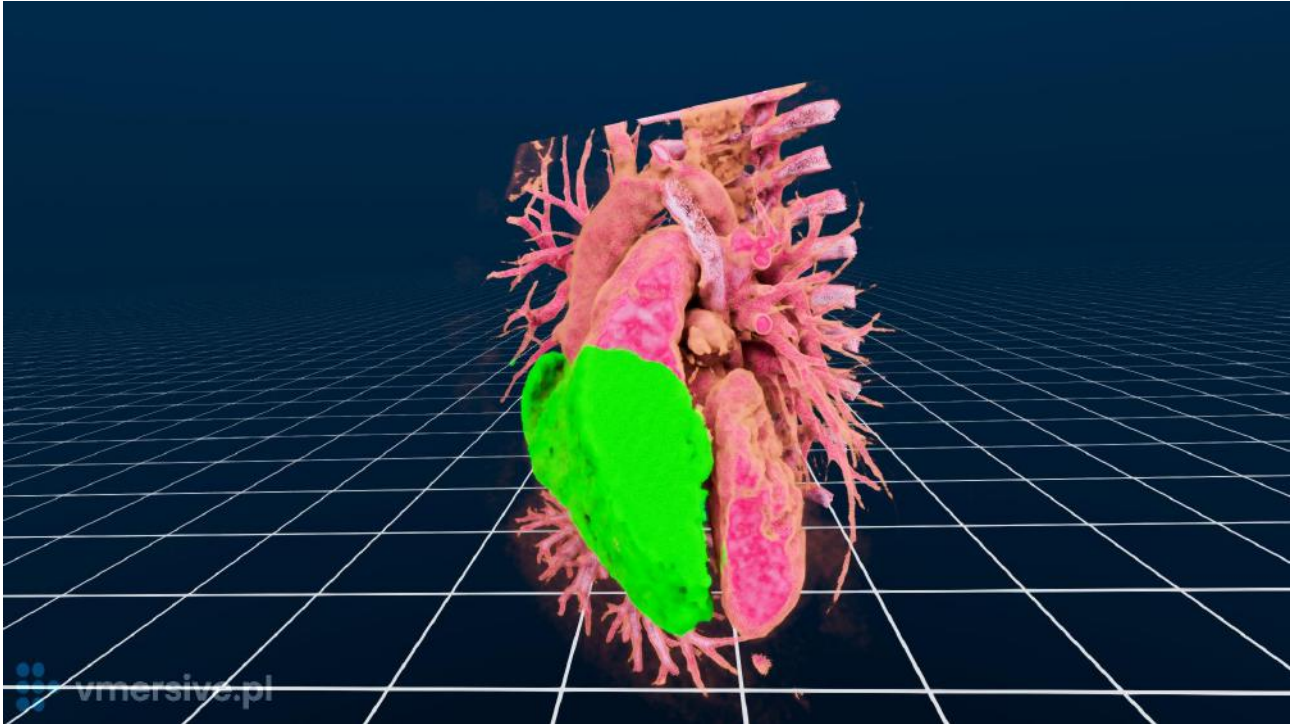


VMersive offers a variety of tools including:

- Measure - the length of a line, curve, contour or value of an angle
- Cut - quickly remove unnecessary tissues, simulate extraction or segment specific part of the examination e.g aorta
- Select volume - mark region of interest in a chosen range of image pixel intensity. Get information about the marked volume and min/max image pixel intensity. You can use the select tool to compute the volume of selected tissues including the heart ventricles.
- Slice - set a clipping plane to see the image in an arbitrary cross-section
- Angulation - simulate angulated views by selecting LAO/RAO and CAUD/CRAN angles.
- Photos - take HD screenshots in 16:9 or 4:3 format
- Report - create a report by saving the configuration of medical data, devices and measurements.

[Watch on Youtube \(videos 6-11\)](#)

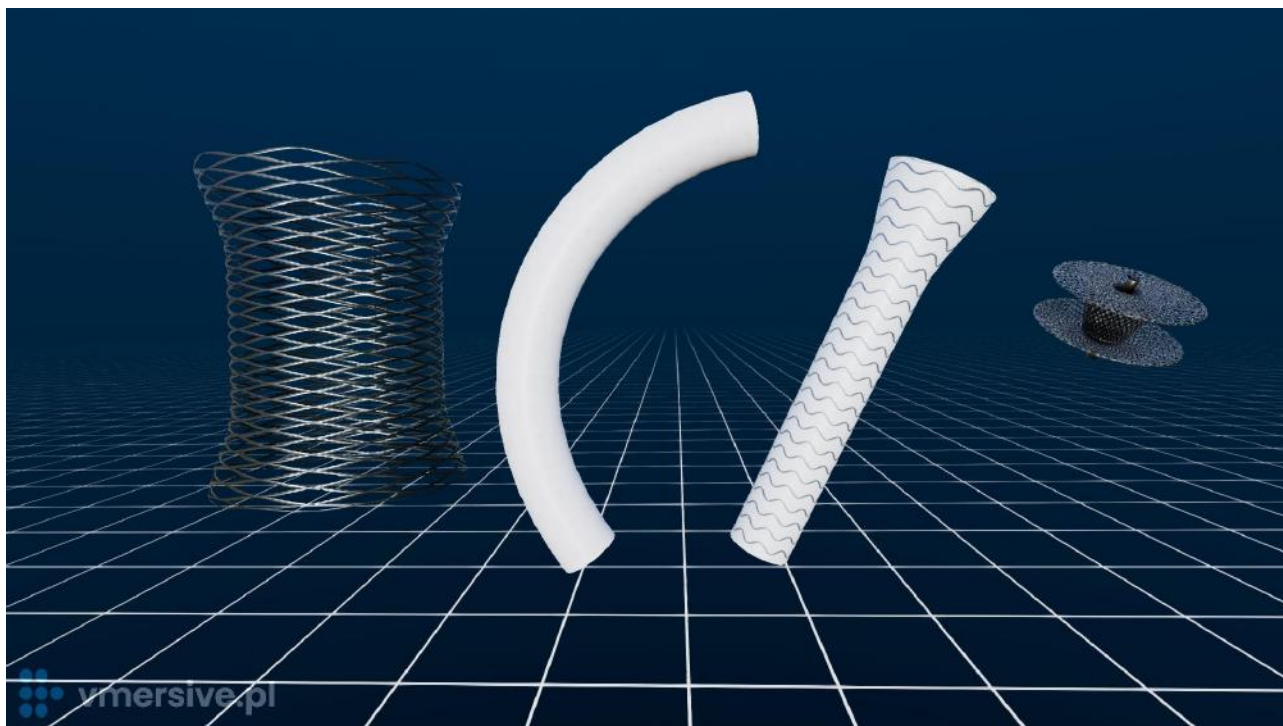
Volume measurement



Use the 3D select tool to mark regions of interest in a chosen range of image pixel intensity (e.g. Hounsfield scale). Get information about the marked volume and min/max image pixel intensity.

You can use these measurements to calculate the volume of the heart ventricle by marking the region enhanced by contrast.

Medical devices

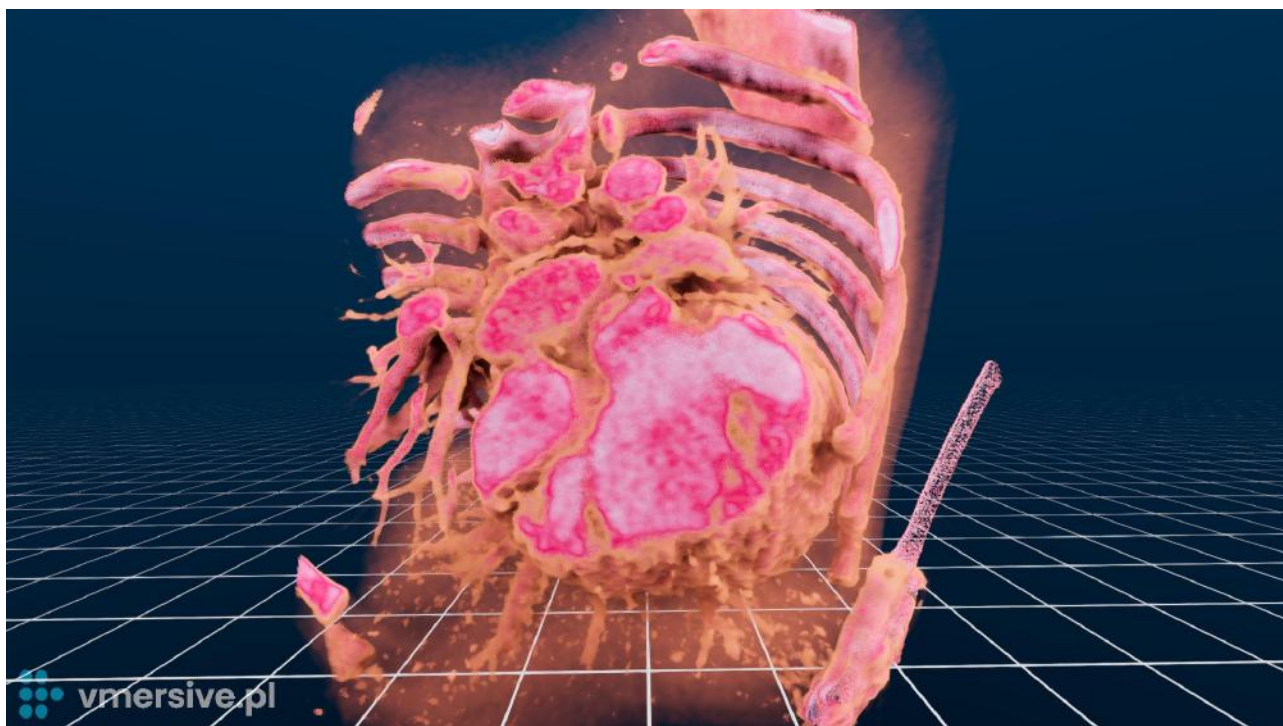


VMersive offers a range of specialized features that allow for the modeling and sizing of various medical devices.

- Transcather and surgical valves - design shape & curvature, change size. Sizing sheets from major manufacturers are included.
- Stents - design shape, diameter, length and flares. Foreshortening table from major manufacturers are included
- VSD Occluders - choose occluders from sizing sheets from major manufacturers.
- Conduits - design shape & curvature, change diameter and length
- LVAD device - adjust the size of the ring and model the path of the outflow graft and driveline

The library of medical devices is constantly growing. Any 3D model can be added into the system on demand.

Workflow & use cases

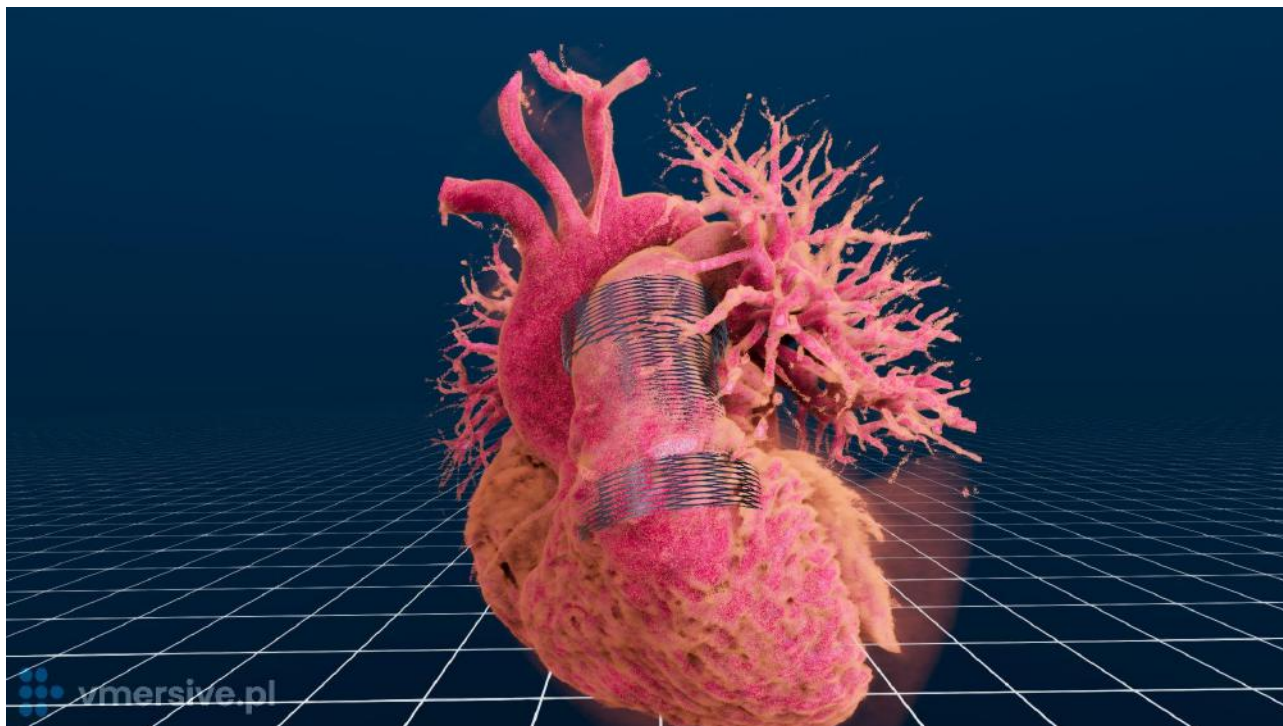


VMersive can be used for visualization of complex congenital anomalies and simulating a variety of surgical and percutaneous procedures in both pediatric and adult patients, including:

- TPVI
- Sinus Venosus Defect
- CoA
- VSD
- DORV
- Complex TGA
- ToF

The following sections give a specific workflow overview of selected applications.

TPVI – Transcather Pulmonary Valve Implantation



Full cardiac cycle analysis with entire context of anatomy

Analyze the Pulmonary Trunk in the full cardiac cycle. Choose imaging profiles to observe different anatomical contexts: vessels, hollow heart chambers, septal defects, calcified tissues and more! Observe the simulated implantable valve interaction with coronary vessels and calcified tissues.

Perform any three dimensional measurements including

- Pulmonary valve dimensions
- Pre/post bifurcation diameters
- RVOT dimensions

Select valve sizing and landing zone

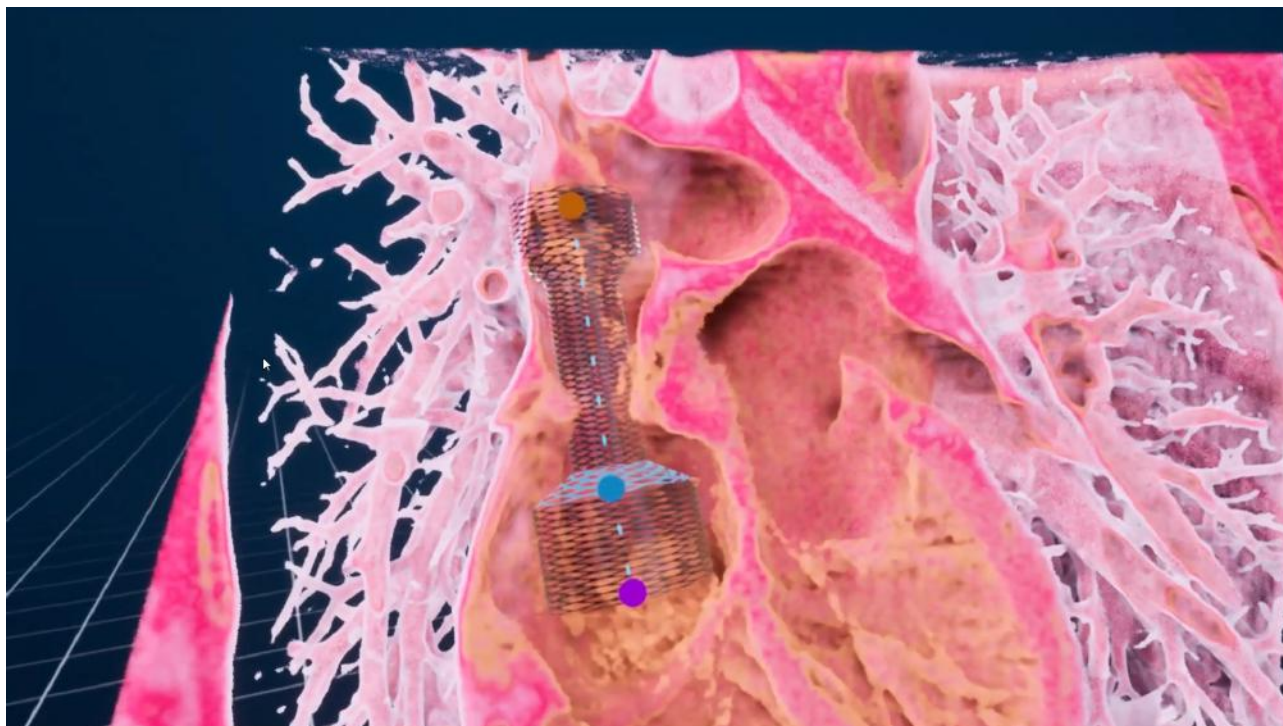
Choose a pulmonary valve from a sizing list of major manufacturers. Evaluate optimal landing zone with ease thanks to 3D virtual reality interactions.

Angulation angles in simulated angio

Simulate the angio view and observe RAO/LAO and CAUD/CRAN angles for optimum projections during the procedure

[Watch on Youtube](#)

SVD – Sinus Venosus Defect



Analyze the sinus venosus defect in the full cardiac cycle

Analyze how the virtual stent fits inside the vessel in full cardiac cycle. Observe the stent interaction with the entire context of anatomy including pulmonary veins.

Configure stent with foreshortening table

Select a stent model from a list of major manufacturers with included foreshortening tables. Adjust its shape, diameter, length and flares. The stent will adjust its length according to its foreshortening table.

Design a custom stent

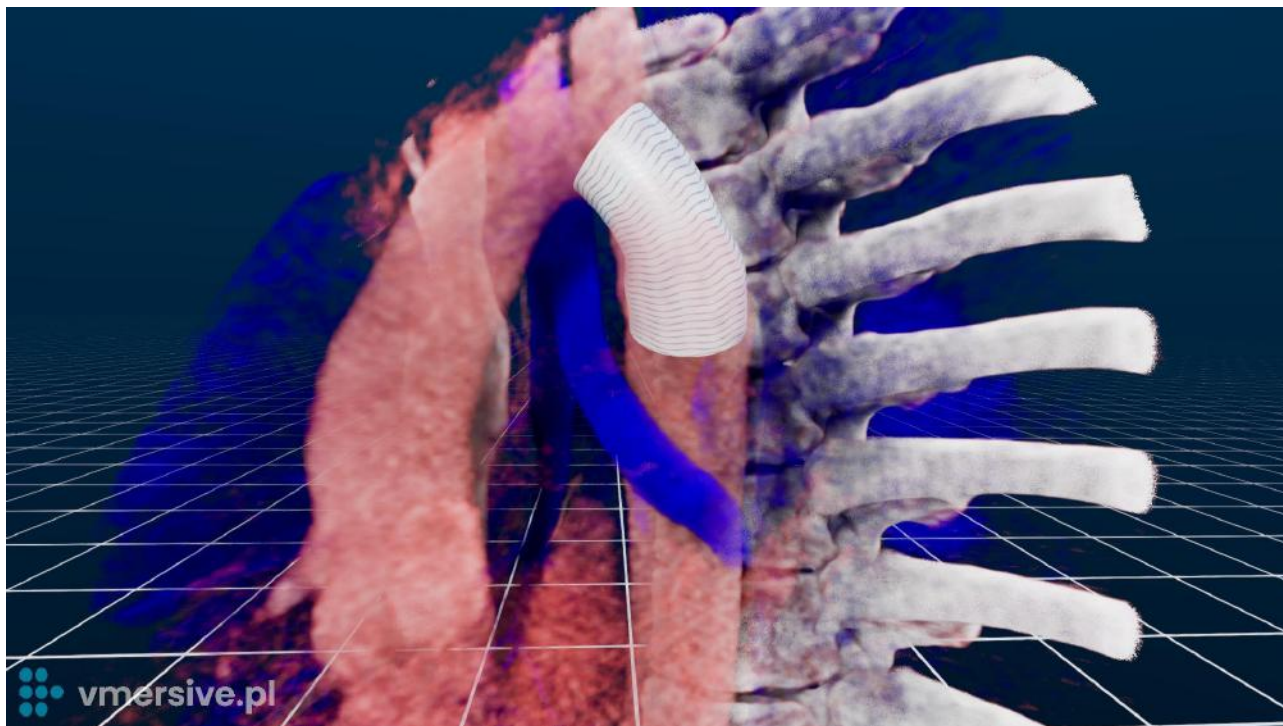
You can design a custom stent to simulate the most optimal solution. Draw a stent of any shape inside the vessel and adjust its shape, diameter, length and flares.

Angulation angles in simulated angio

Simulate the angio view and observe RAO/LAO and CAUD/CRAN angles for optimum projections during the procedure.

[Watch on Youtube](#)

CoA - Coarctation of the Aorta



Analyze the coarctation in the full cardiac cycle

Analyze how the virtual stent fits inside the vessel in full cardiac cycle. Observe the stent interaction with the entire context of anatomy including the airway system.

Configure stent with foreshortening table

Select a stent model from a list of major manufacturers with included foreshortening tables. Adjust its shape, diameter, length and flares. The stent will adjust its length according to its foreshortening table.

Design a custom stent

You can design a custom stent to simulate the most optimal solution. Draw a stent of any shape inside the vessel and adjust its shape, diameter, length and flares.

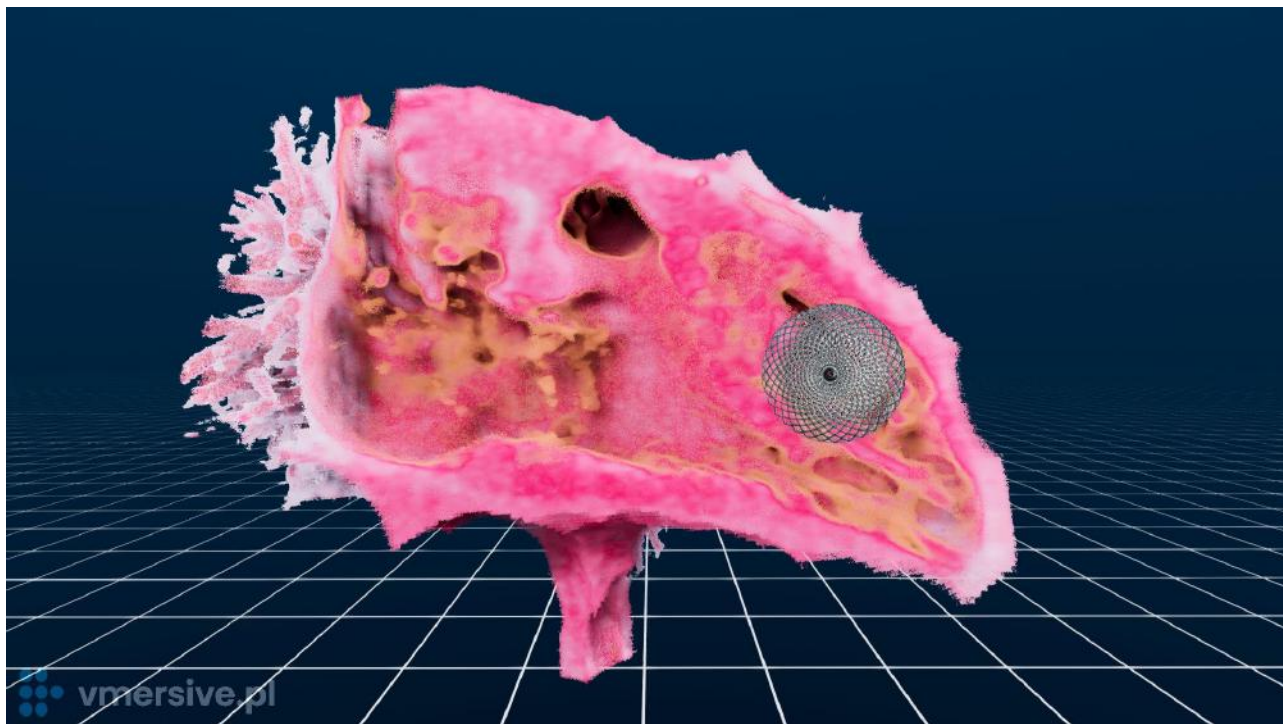
Angulation angles in simulated angio

Simulate the angio view and observe RAO/LAO and CAUD/CRAN angles for optimum projections during the procedure.

[Case presentation](#)

[Watch on Youtube](#)

VSD – Ventricular Septal Defect



Analyze VSD in the full cardiac cycle

With the use of multiphase heart images you can observe the vertical septal defect in different heart phases. This allows for a more accurate assessment of the occluder's fit and performance within the heart structure.

Perform three dimensional measurements

Measure dimensions of VSD in full cardiac cycle.

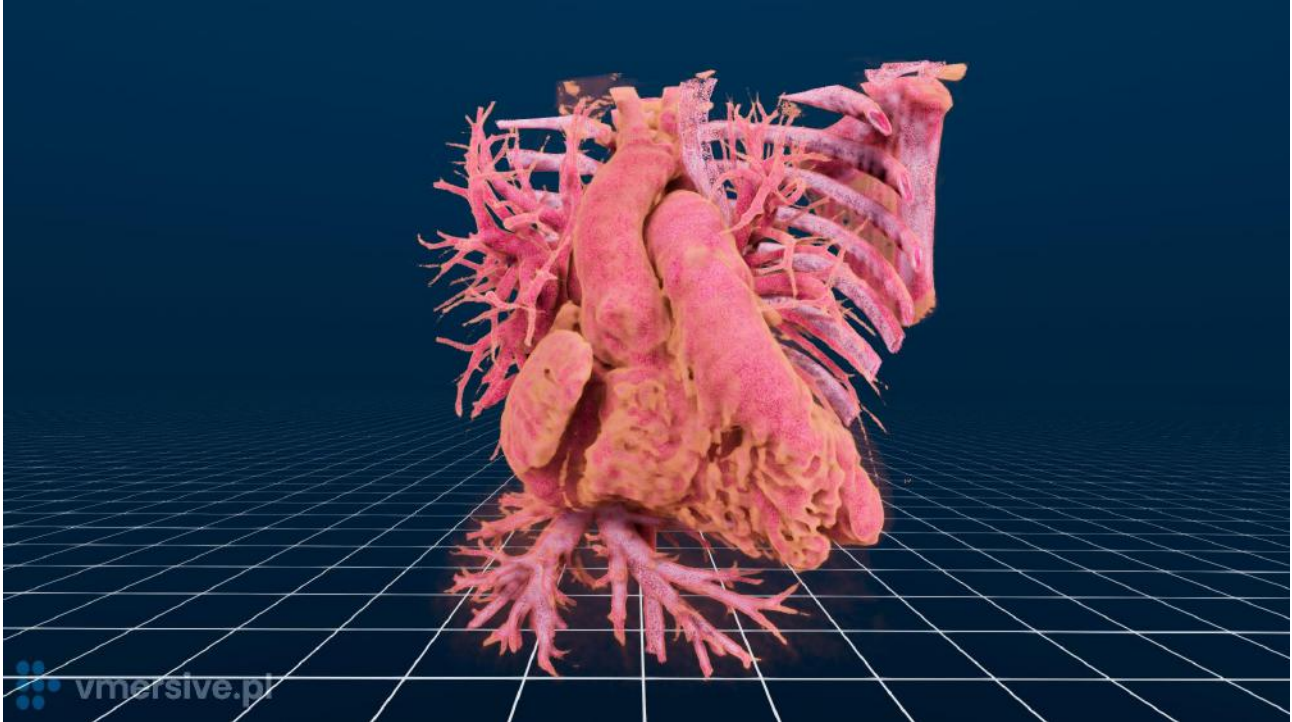
Select VSD occluder

Select one of the virtual VSD occluders with sizing sheets from major manufacturers. Adjust its size, and evaluate how it fits within the heart structure.

Angulation angles in simulated angio

Simulate the angio view and observe RAO/LAO and CAUD/CRAN angles for optimum projections during the procedure.

DORV – Double Outlet Right Ventricle



Observe the anatomy

Observe origins and connections of aorta and pulmonary and easily locate the VSD and determine its type:

- Subaortic VSD
- Subpulmonary VSD
- Doubly committed VSD
- Non-committed VSD

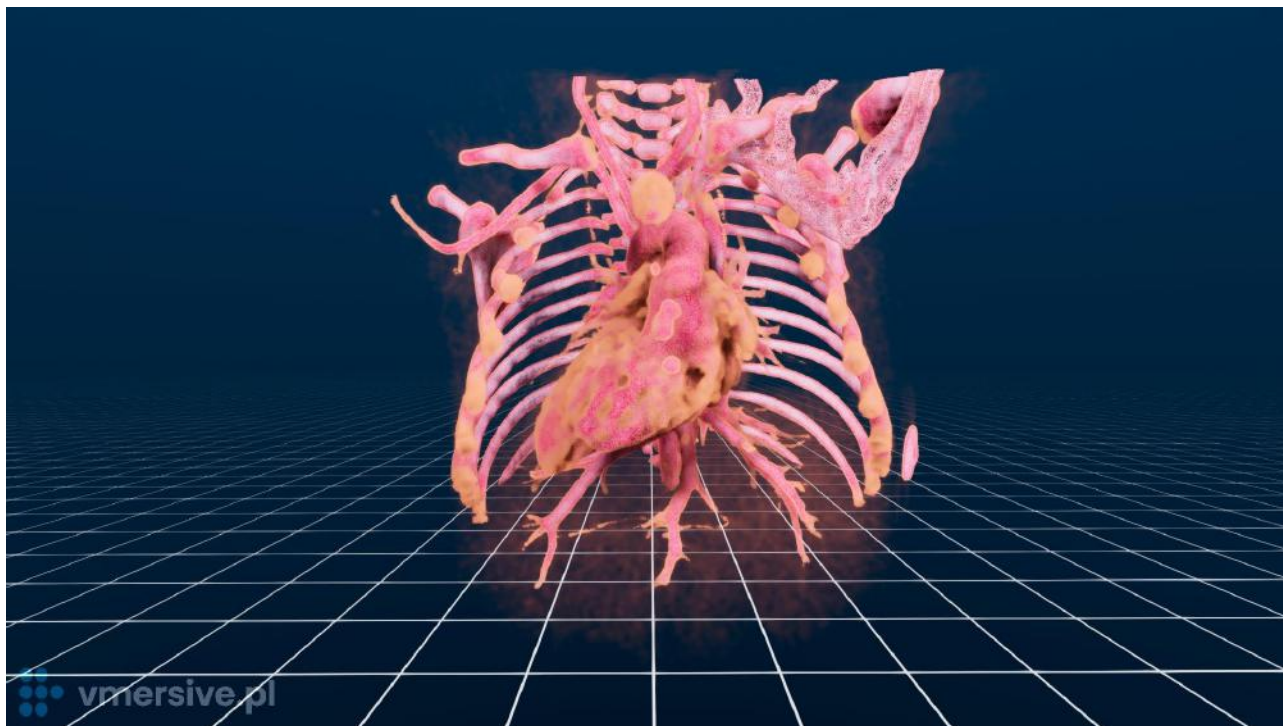
Simulate procedure

Simulate different alternatives including the Blalock-Taussig shunt using conduits

Verify with full context of anatomy

Verify simulated implants with full context anatomy including the airway system

Complex TGA - Complex Transposition of the Great Arteries



Observe the anatomy

Observe origins and connections of aorta, pulmonary trunk, pulmonary arteries and ductus arteriosus. Easily locate the VSD and its relative position to the great arteries.

Simulate procedure

Simulate different alternatives including:

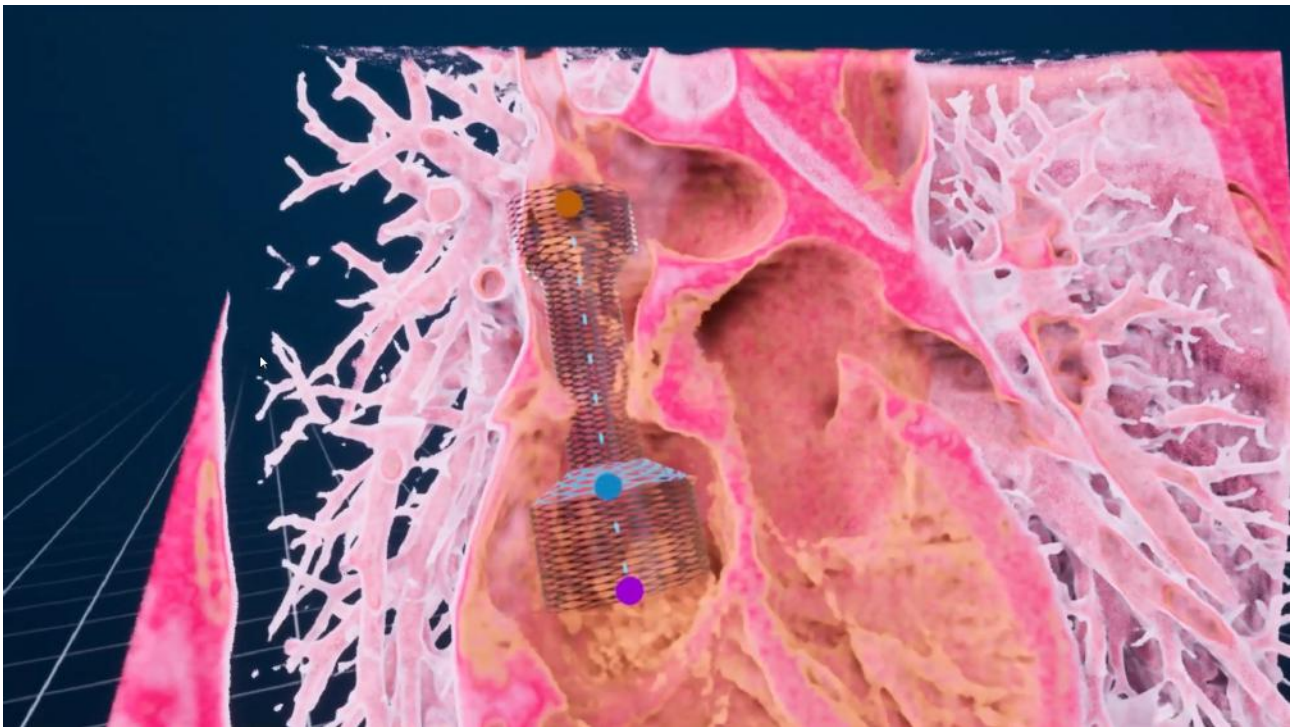
- Blalock-Taussig shunt using conduits
- Ductus arteriosus transcatheter stenting

Verify with full context of anatomy

Verify simulated implants with full context anatomy including the airway system

Research reports

Colorado Children's Hospital – Stent modeling



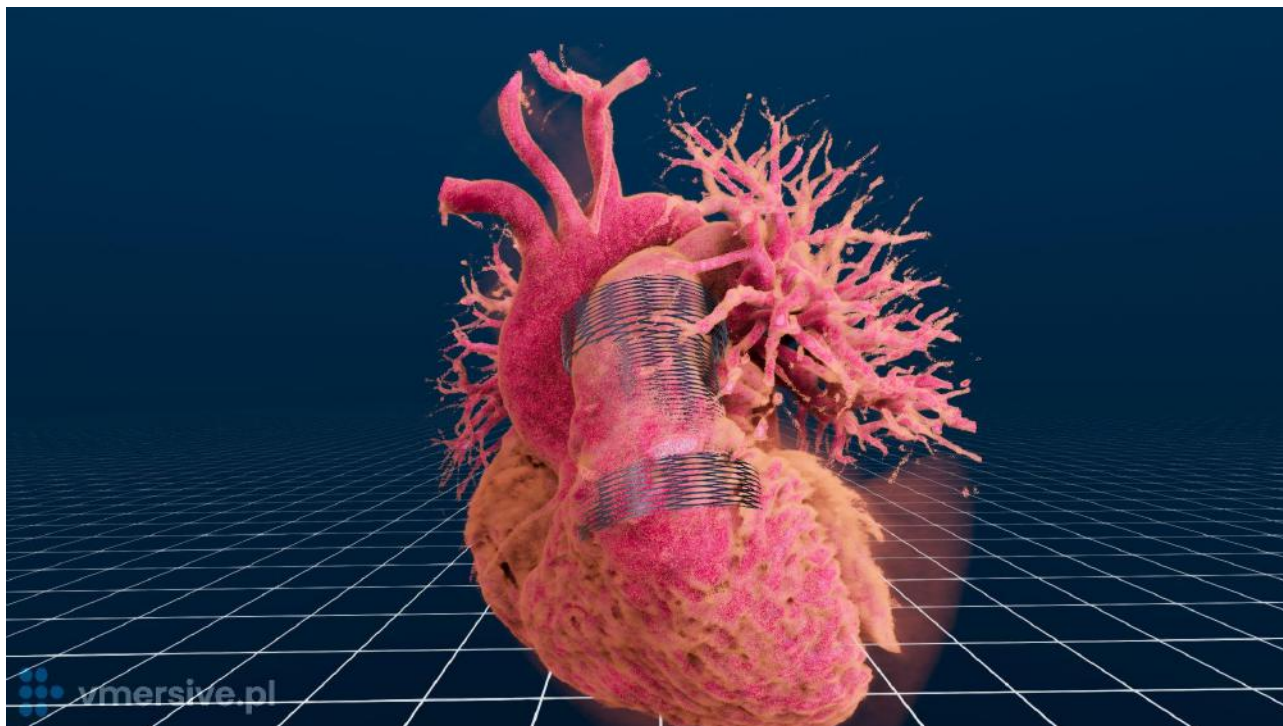
Research published by **Dr Jenny Zablah** together with **Dr Gareth Morgan** from Colorado Children's Hospital, USA presents the use of VMersive for stent development and simulation in congenital heart disease.

Please check the links below to learn more.

[Youtube](#)

[LinkedIn](#)

CSI Asia Pacific 2022 in Bangkok – Live case report of TPVI

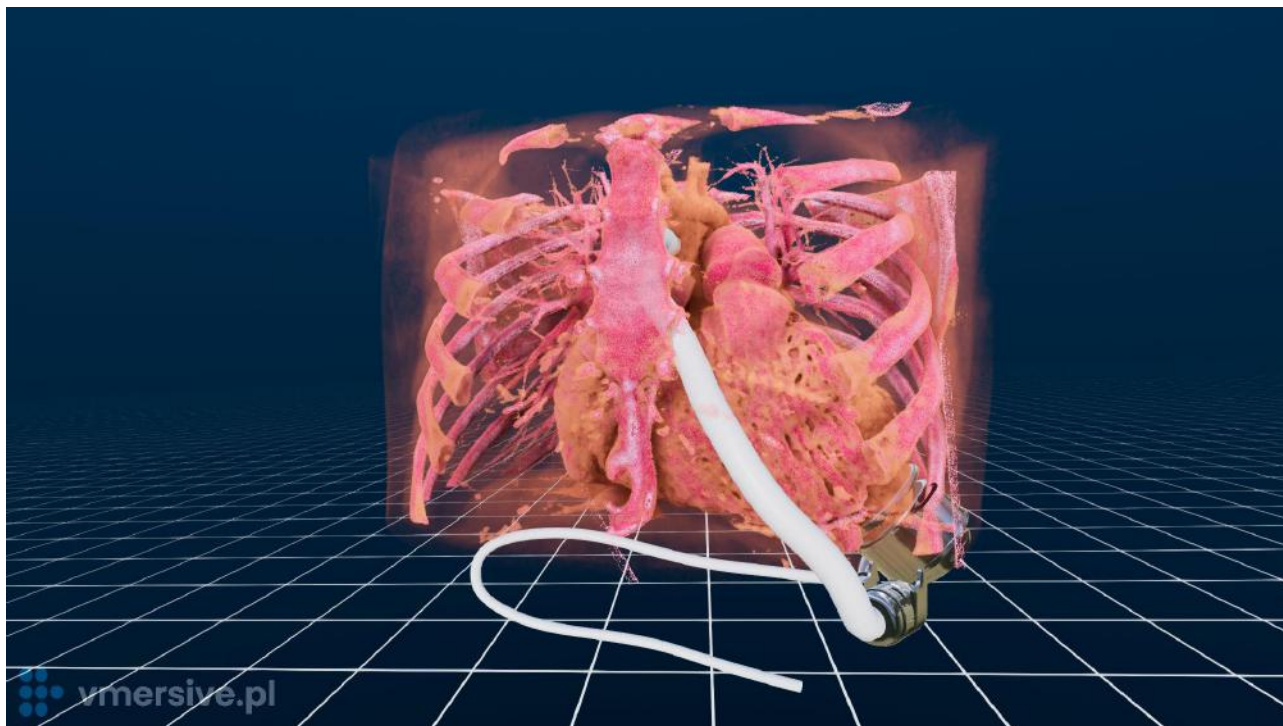


During CSI Asia Pacific 2022 in Bangkok, **Dr. R Sivakumar** from Medical Mission Hospital in Chennai, India performed the TPVI procedure which was simulated with the use of VMersive together with **Dr Adam Koleśnik** from Children's Memorial Health Institute, Warsaw, Poland. Click the links below to see the recording from the simulation and the live case.

[Youtube](#)

[CSI Congress](#)

Heart Failure – HeartMate 3 LVAD



Abbott Medical has implemented the VMersive solution in Poland where HeartMate3 LVAD implantation is performed. The pump offers a second chance at life to people with advanced heart failure.

VMersive includes the integration of the LVAD HeartMate3 device, which allows cardiac surgeons to simulate the implantation process before surgery. The system includes all of the medical devices required to implant the HeartMate 3. Users can observe how the device fits within the heart anatomy, adjust the size of the ring, and model the path of the outflow graft and driveline. This allows surgeons to have a better understanding of the device's placement and performance before proceeding with the actual surgery.

[Watch on Youtube](#)

FAQ

Product questions

- 1. Question:** I'm already using other applications for my work. What's the difference?

Answer: VMersive is a solution specifically designed for congenital heart diseases. It allows you to model custom implants like TPV, stents, occluders and conduits without the need of any third party software. In VMersive you can begin planning right away due to the automatic 3D reconstruction - without the need of manual segmentation
- 2. Q:** Can I import STL format?

A: VMersive team can create a custom version of the software and import STL files into the program for you. However we recommend using the build in library of medical devices
- 3. Q:** How reliable are the measurements?

A: The application uses a well established DICOM format for the input of CT, MR and 3D Echo scans. The images and measurements are calibrated based on the data included in DICOM files which are imported straight from diagnostic medical imaging equipment
- 4. Q:** Does the application allow for physical simulations of implant and tissue interactions and CFD simulations?

A: VMersive does not allow for physical simulations yet.
- 5. Q:** Can you observe the structure of the mitral valve?

A: Observing the structure of the mitral valve is a known issue in imaging. We support CT and 3D Echo data which combined together helps to overcome that issue.
- 6. Q:** Is the image quality of 3D Echo good enough?

A: To overcome the limitations of low resolution images we have created echo specific filtering and smoothing algorithms to enhance the 3D images. The

application suggests default parameters but you can easily adjust them for patient specific echo images.

Implanted medical devices are clearly visible in 3D. Moreover, the application also allows viewing 3D echo in traditional MPR (grayscale) images.

7. **Q:** Can VMersive be used for planning in other areas of cardiology?

A: Yes, VMersive can be used for structural heart and vascular cases including TAVI or LAAo

8. **Q:** What are other potential use cases of the application?

A: VMersive could be applied in other fields including: structural heart & vascular, orthopedic surgery, cranio-maxillofacial surgery, abdominal surgery and neurosurgery

Research questions

1. **Q:** Was VMersive used in any research publications?

A: Yes, VMersive has been presented in "*Congenital Cardiology Today*" in a study "*Computer Modeling and Virtual Reality for Stent Development and Case Planning in Congenital Heart Disease*" by Dr Gareth Morgan and Dr Jenny Zablach from Colorado Children's Hospital, USA. See the article [here](#)

2. **Q:** Was VMersive used during any conferences?

A: Yes, During CSI Asia Pacific 2022 in Bangkok, **Dr. R Sivakumar** from Medical Mission Hospital in Chennai, India performed the TPVI procedure which was planned with the use of VMersive. See the case report [here](#).

Sales and integration questions

1. **Q:** Is medical data used in the VMersive system safe?

A: Yes, the VMersive operates in offline mode. No medical data is being transferred to remote servers. The computer can be disconnected from the internet. The internet connection is used only once to register the license key. Optionally the

internet connection can be used for automatic updates or manual log gathering (only at user's request).

2. **Q:** Can I purchase the entire hardware required for the workstation directly from the VMersive team?

A: Yes, VMersive team provides an offer for the entire workstation hardware and its setup in onsite location.

3. **Q:** I never had any VR experience before. Do you provide workshops to help users operate VR applications?

A: Yes, the VMersive team provides onsite and online workshops as well as different tutorial materials to help users operate VR headsets and the VMersive application smoothly.

Contact

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