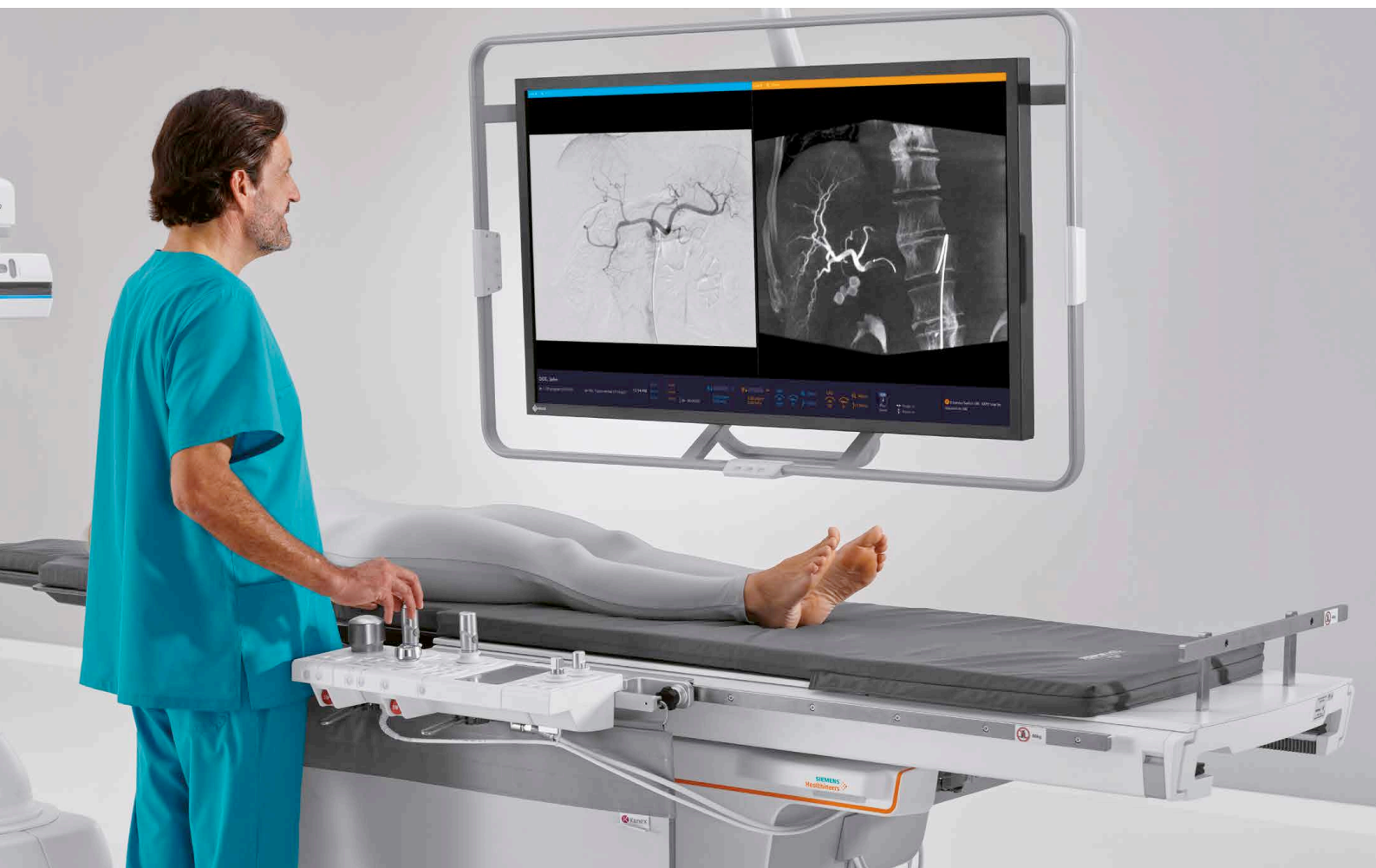


**Datasheet**

# *syngo* Application Software

Integrated image guidance  
for ARTIS icono and ARTIS pheno

[siemens-healthineers.com](https://www.siemens-healthineers.com)



# **syngo Application Software**

## **for ARTIS icono and ARTIS pheno**

The *syngo* Application Software includes real-time viewing, image manipulation, 3D-visualization, communication, and storage of medical images and data on exchange media.

It is used for diagnostic image viewing and post-processing before, after, as well as during interventional and surgical procedures.

### **Integrated into ARTIS icono and ARTIS pheno**

The *syngo* Application Software is tightly integrated into ARTIS icono and ARTIS pheno.

Dedicated image acquisition protocols implemented on the ARTIS systems are utilized by the workstation to reconstruct CT-like 3D images, to quantitatively analyze the measured image intensities, or to build enriched color-coded functional images. Continuous data exchange with the C-arm enables fusion of multimodal 3D information with live 2D fluoroscopic images.

Complex interventional and surgical workflows are supported by the *syngo* Application Software through dedicated applications that guide the operator through the procedure.

### **Dedicated applications**

The *syngo* Application Software contains various dedicated applications to serve

- Interventional radiologists
- Interventional neuroradiologists
- Interventional cardiologists
- Pediatric cardiologists
- Electrophysiologists
- Surgeons



### **Configurable**

The *syngo* Application Software can be configured to the needs of the specific disciplines and provides a large range of optional clinical applications, as described on the following pages.

Furthermore, it can also be configured with a variety of *syngo*- or Windows-based software options, which are intended to assist the physician in diagnosis, treatment planning and treatment control.

This includes commercially available post-processing techniques and OEM options.

### **Heads-up Display**

#### **Allows the user to stay focused with context-sensitive on-screen menu**

- Intelligent in-room control of the *syngo* Application Software and heads-up display.
- Automatized pre-selection of relevant functions eases your workflow.
- On-screen menu on the heads-up display helps to simplify menu selection and handling.

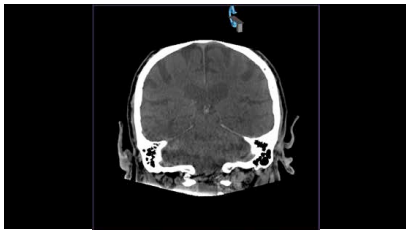
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# Highlights

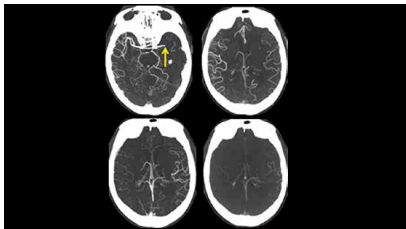
## Adding smooth to smart.

Increase your process efficiency in the angio suite, enable your staff members to get the full potential of the system, and expand your clinical capabilities – with an angio system that combines ease-of-use, integrated expert guidance, and tools providing better diagnostic information.



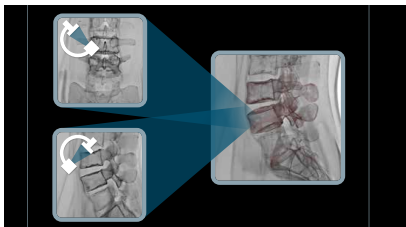
### **syngo DynaCT Sine Spin**

Homogeneous image quality over the entire brain



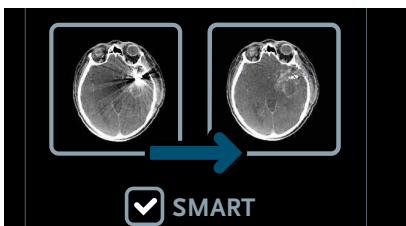
### **syngo DynaCT Multiphase**

Imaging of cerebral collateral vessels in the interventional suite



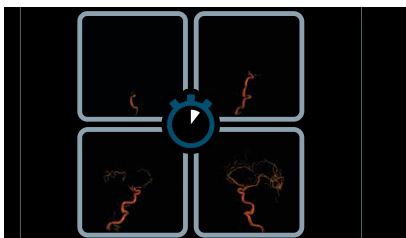
### **syngo 2D/3D Fusion**

Save 99 % dose when integrating pre-op volumes for live image guidance<sup>1)</sup>



### **syngo DynaCT SMART**

Reduce metal artifacts to see the unseen



### **syngo Dyna4D**

Welcome the 4th dimension to the angio suite

1) This measurement was performed with an Alderson phantom using Fluoroscopy with 10 images per 2D projection and a low-dose 6s DCT Body program. Results in actual clinical practice may vary.

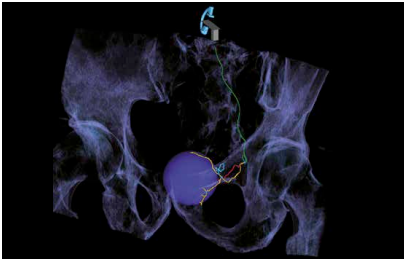
# Highlights

## Smooth interaction

Save time during procedures. Fewer steps. More efficiency.

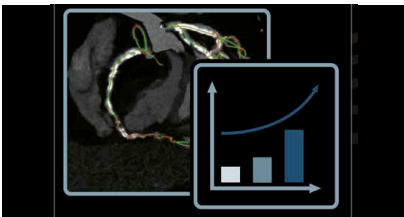
## Smart performance

Expand your capabilities. More confidence. Better outcomes.



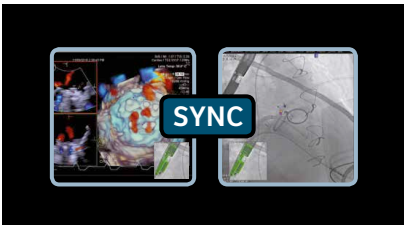
### ***syngo* Embolization Guidance**

Automatic tumor feeder detection



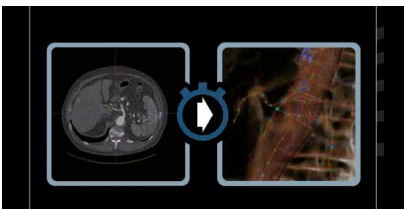
### ***syngo* CTO Guidance**

Expand your procedure mix by treating more CTO patients



### ***syngo* TrueFusion**

Navigate with confidence through integrated TEE guidance



### ***syngo* EVAR Guidance**

Reduce procedure time using automated vessel wall detection



### ***syngo* LA Segmentation**

Enhance AFib treatment with automated high-quality 3D results

# Basic features

## **syngo 4D Viewer**

Processes volume datasets from various modalities such as *syngo* Dyna3D, *syngo* DynaCT, *syngo* DynaCT Sine Spine, *syngo* DynaCT Multiphase, *syngo* DynaPBV, CT, MR, PET and provides reformatting functions, e.g. MIP, MPR, VRT, for quick and easy routine use. Provides superimposed datasets from different modalities and loads whole cardiac time sequences.

## **QuickZoom**

Focus and zoom with just one click – in the control room or at tableside. Interacting with 3D volumes at tableside can be cumbersome. QuickZoom helps you save time and speed up your workflow. Click on your region of interest, and QuickZoom centers and zooms automatically, and even provides high-resolution refinement of your 3D volume.

## **Bookmarks**

Save and recall procedure planning data easily.

## **Parallel Patient Processing**

Share system capabilities between exam and control rooms to, for example, make procedure planning possible without interfering with an ongoing one.

## **Heads-up Display**

Stay focused with context-sensitive on-screen menu.



\* Option

Not all features shown are necessarily standard and available in all countries.



# Application for angiography



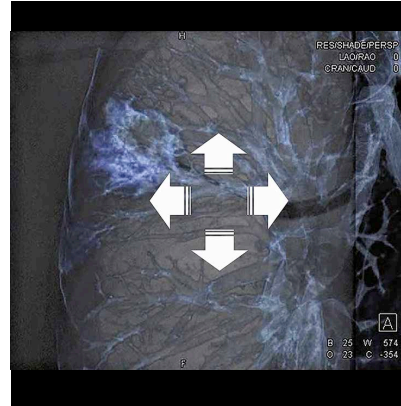
## syngo 3D Roadmap

The close integration of the syngo Application Software with the

ARTIS pheno provides an inherent registration of the 3D image in the workstation with the live 2D X-ray acquired continuously on the ARTIS pheno. Even preoperatively acquired images can be used for 3D Roadmap by image-to-image registration of the preoperative image with an intraoperatively acquired syngo Dyna3D or syngo DynaCT using syngo 3D/3D Fusion or by using only using 2 fluoroscopy images and syngo 2D/3D Fusion, respectively.

syngo 3D Roadmap superimposes the 3D image color-coded on top of the live X-ray. Any change of the angulations of the C-arm or any change of the table position will cause the workstation to recalculate in real time the view on the 3D image to exactly match the view of the live 2D X-ray image. Without additional contrast agent injection the physician can observe device movements simultaneously with the 3D overlay of the vessel contours in the fluoroscopy image.

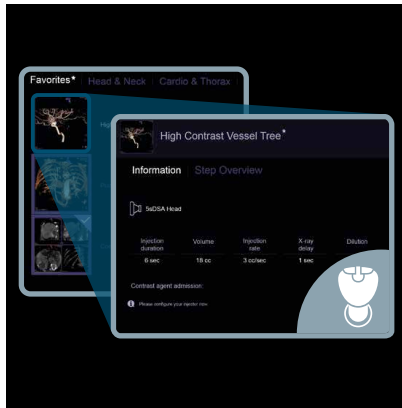
The 3D image can be interactively faded in and out of the X-ray image. syngo 3D Roadmap provides real-time guidance to the physician to deliver more information in one display.



## syngo Adjust 3D Roadmap

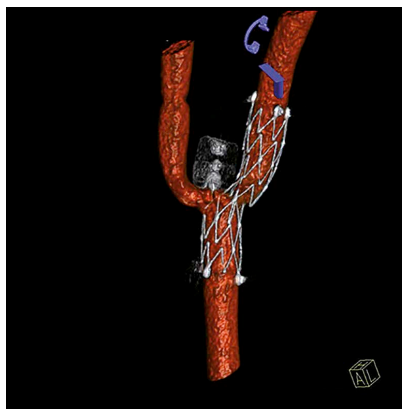
Patient movement might cause a mismatch of the 3D image and the live 2D X-ray during syngo 3D Roadmap. The syngo Adjust 3D Roadmap function re-aligns the 3D image with the X-ray. The realignment can be performed interactively by the operator or automatically based on the image intensities.

# 3D



## 3D Wizard

Choosing an optimal 3D protocol is not always easy. For all parts of the body, the 3D Wizard provides a set of example images. When selected, the system loads the corresponding program and provides recommendations for injection parameters. With this step-by-step expert guidance the desired imaging results are getting achieved, your confidence gets increased when using 3D, and you get the full benefits from your system.



## syngo Dyna3D

The syngo Dyna3D acquisition protocol performs a rotation around the patient, acquiring from different angles.

The syngo Application Software reconstructs a high-contrast three-dimensional image from these projections, visualizing solid structures like bones in 3D. In combination with injected contrast agents, vessels are clearly depicted in the 3D image, in particular if a digitally subtracted angiography (3D DSA) protocol is used.

Organ-specific visualization presets can be selected from a catalog of default and user-specific settings and linked to the individual acquisition protocol.

## syngo DualVolume

Simultaneous visualization of dual-volume imaging (e.g. stent and contrast-enhanced vessels).

The workstation provides a special reconstruction algorithm that takes the mask image as well as the subtracted image into account and displays both 3D images simultaneously. In this DualVolume mode, bones, solid materials (e.g. aneurysm clips, coils, stimulation electrodes, or hooks) and vessels can be visualized in one 3D rendering at the same time.

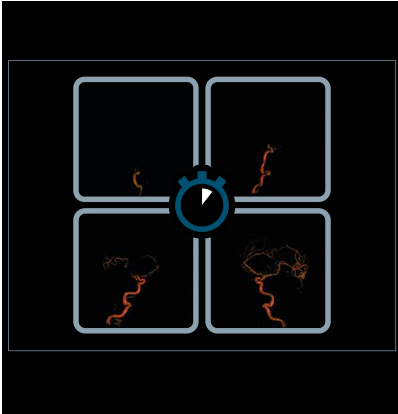


## syngo Dyna3D HighSpeed

syngo Dyna3D HighSpeed provides the fastest 3D high contrast protocol on the market.

It permits an extremely short acquisition time of less than 3 s, thus, moving organs like the lungs can be represented with minimal motion artifacts and less contrast media.

# Advanced 3D



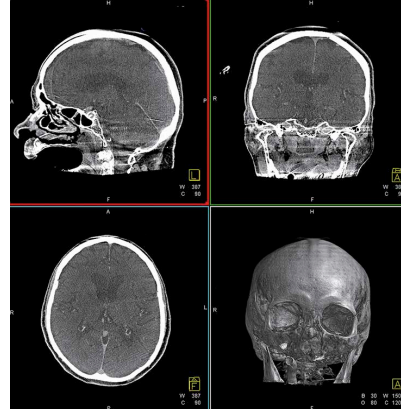
## **syngo Dyna4D**

Welcome the 4th dimension to the angio suite.

Direct 3D flow information was limited to CT, MRI and ultrasound – yesterday. With *syngo Dyna4D*, you can now see flow patterns in 3D.

This allows saving contrast and dose by providing an unlimited series of views with just one image acquisition and contrast admission at no additional dose and contrast media<sup>1)</sup>.

With an acquisition, very similar to *syngo Dyna3D*, *syngo Dyna4D* helps you expand your clinical capabilities in the angio suite by optimizing patient selection and individualizing treatment strategies.



## **syngo DynaCT**

During a *syngo DynaCT* acquisition the C-arm rotates around the area of interest, which is placed in the isocenter. The combination of generated projections of the patient and dedicated enhanced cone-beam reconstruction algorithms enables the *syngo* Application Software to reconstruct a low-contrast three-dimensional image, visualizing soft tissue.

Various acquisition protocols designed for specific body regions and different dose levels are implemented.

The imaging chain for 3D-imaging enables intra-operative, cross-sectional imaging to visualize object contrast down to 5 HU.

Intraoperative *syngo DynaCT* is the basis for many advanced interventional and surgical workflows. It has been used, for instance, for procedure planning, for the identification of hemorrhages and endoleaks after treatment, and for guidance in conjunction with e.g. *syngo Needle Guidance*.

*syngo DynaCT* includes *syngo DynaCT High Speed*, allowing up to 2.5 times faster acquisition times while maintaining the number of projection images.

*Not all features shown are necessarily standard and available in all countries.*

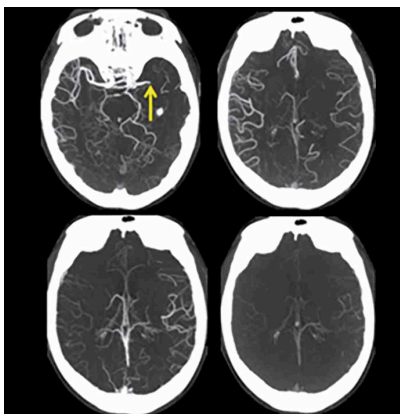
*1) This is the experience of individual users. Results may vary.*

# Advanced 3D



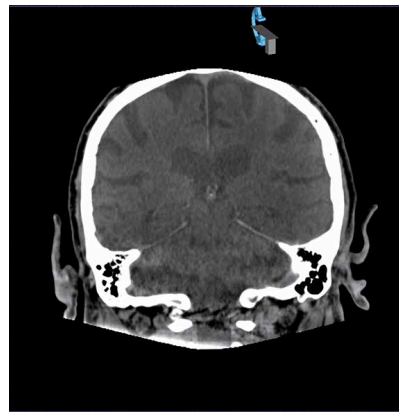
## **syngo DynaCT SMART**

Reduce metal artifacts to see the unseen.  
Important diagnostic information can be obscured by metal artifacts.  
Reduce these artifacts with *syngo DynaCT SMART* (Streak Metal Artifacts Reduction Technology) through a secondary reconstruction.  
This helps to increase diagnostic confidence and increases the chance for visualizing complications such as bleedings close to metallic objects.



## **syngo DynaCT Multiphase**

*syngo DynaCT Multiphase* allows to visualize cerebral collateral vessels with time resolved DynaCT, depicting 10 different timepoints within a period of 60 seconds.



## **syngo DynaCT Sine Spin**

*syngo DynaCT Sine Spin* is using a new acquisition trajectory adding a CRAN/CAUD movement to the LAO/RAO spin. It reduces cone beam CT artifacts, specifically in the basal part of the brain and close to the skull.

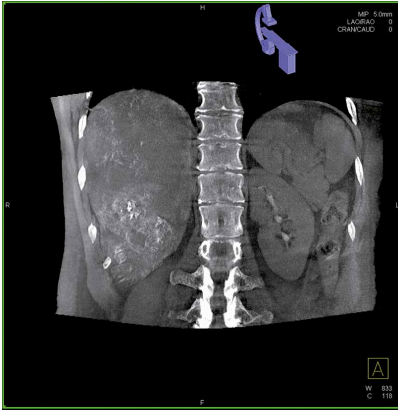


## **syngo DynaCT Cardiac**

The *syngo DynaCT cardiac* protocol provides acquisition parameters specifically designed for cardiac imaging with up to 248 projections.

Dedicated injection protocols for applications in electrophysiology, structural heart disease, and congenital heart disease are available.

# Advanced 3D



## **syngo DynaCT Large Volume\***

By rotating twice around the patient with a small shift of the C-arm, ARTIS pheno is able to cover a larger field of view than a standard syngo DynaCT protocol.

The syngo DynaCT Large Volume protocol provides a diameter of 43 cm and 17.5 cm height in landscape mode. Since this extended field covers the abdomen including the skin, syngo DynaCT Large Volume is especially important to treat liver tumors via chemo-embolization, to image obese patients, to plan biopsies and to perform radiofrequency ablations.

In portrait mode, this protocol can acquire volumes with a 32 cm diameter and 23.5 cm height, that covers the whole thoracic spine. Portrait mode is also a valuable acquisition protocol for carotid stenting, since the cerebral vessels as well as the carotid artery can be seen in one image.



## **syngo DynaCT 360 \***

For better image quality, fewer motion artifacts, greater patient comfort, less contrast agent, and less radiation exposure, syngo DynaCT 360 provides a fast large-volume acquisition protocol in only six seconds. Instead of rotating twice around the patient, like syngo DynaCT Large Volume, this protocol rotates the C-arm by 360 degrees once along an elliptical path.



## **syngo DynaCT Micro**

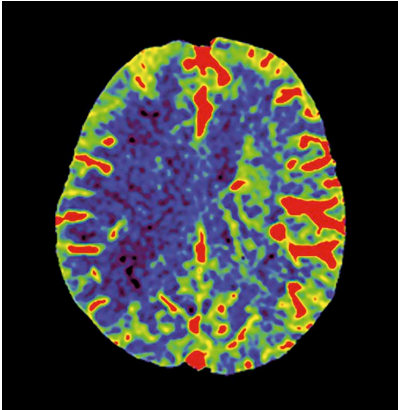
syngo DynaCT Micro provides high spatial resolution 3D imaging, boosting the level of detail by using each detector pixel.

The 40 % higher resolution compared to a standard syngo DynaCT enhances the visualization of smallest structures like flow diverters or stapes prostheses in order to check correct placement and proper function. Moreover, syngo DynaCT Micro enables the visualization of the inner structures of bones to detect e.g. fractures. It is particularly beneficial for temporal bone imaging.

\* Unique feature of ARTIS pheno

Not all features shown are necessarily standard and available in all countries.

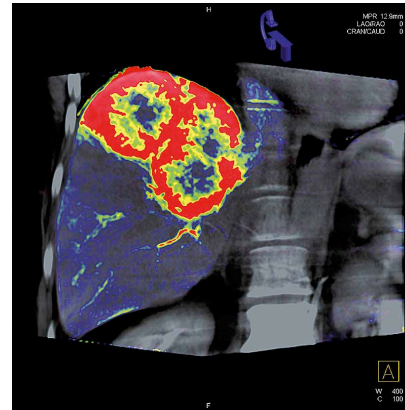
# Advanced 3D



## **syngo DynaPBV Neuro / Body**

The DynaPBV applications of the *syngo* Application Software are 3D functional imaging acquisition protocols that provide physiological information of the patient intraoperatively. The software indicates the distribution of blood in lesions and surrounding tissue by means of color-coded cross-sectional blood volume maps. Furthermore, it allows measurements of parenchymal blood volume (PBV) in order to assess changes in perfusion caused by treatment or biological processes such as angiogenesis.

**syngo DynaPBV Neuro** enables intraoperative assessment of the current perfusion status of cerebral blood volume (CBV) similar to traditional measurements in CT scanners. This supports interventional procedures such as interventional stroke treatment.



**syngo DynaPBV Body** is an imaging protocol specifically designed for the abdomen and provides functional information before and after interventional therapy. It supports identification of the optimal end point during embolization and potentially identification of non-responders.

The reconstruction and visualization is automatically triggered based on the acquisition protocol.

Using ROI measurements, the blood distribution in different regions e.g., the left and right hemisphere, can be compared.



# 3D processing – Advanced tools and workflows

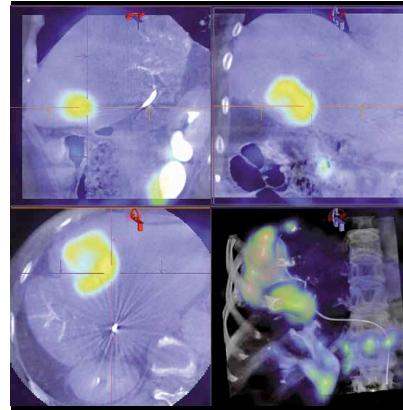


## ***syngo* Toolbox**

*syngo* Toolbox is a generic application to interactively mark anatomical structures of interest in a 3D volume, e.g. a *syngo* DynaCT image, using points and lines. Analogously to *syngo* 3D Roadmap, these markings are projected onto the live 2D X-ray illustrating the position of the 3D anatomical structure within the live X-ray. Any change of the angulations of the C-arm or any change of the table position will cause the workstation to recalculate in real time the projection of the 3D markings to exactly match the view of the live 2D X-ray image.

This function can be used to guide the operator with his or her instruments to a target structure as the markings in the 3D image can serve as a plan that is displayed in the X-ray image during the procedure.

*syngo* Toolbox has been applied to many advanced clinical procedures including biopsies and placement of fenestrated and branched endografts.

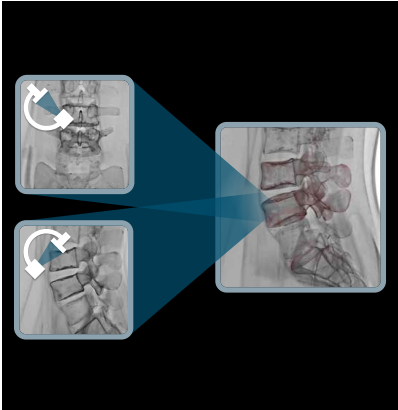


## ***syngo* 3D/3D Fusion**

This application spatially aligns two 3D volumes from the same or different modality in such way that the anatomical structures overlay each other. Any *syngo* DynaCT or *syngo* Dyna3D image can be fused with datasets from e.g., CT, MR or PET.

Besides an improved diagnostic workflow, *syngo* 3D/3D Fusion becomes in particularly powerful in conjunction with *syngo* 3D Roadmap or *syngo* Toolbox. For example, a fused CT, MR or PET image can be overlaid with live fluoroscopy in combination with *syngo* 3D Roadmap. If anatomical structures have been marked in the CT, MR or PET image using *syngo* Toolbox, then such markings can be also superimposed on the live X-ray, providing information during endovascular procedures that are available neither in 2D X-ray or in *syngo* DynaCT images.

# 3D processing – Advanced tools and workflows



## **syngo 2D/3D Fusion**

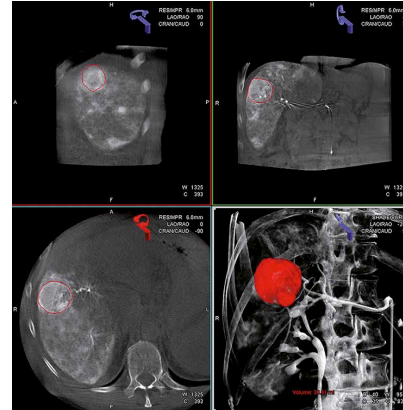
Saves 99 % dose when integrating pre-op volumes for live images guidance.<sup>1)</sup>

Pre-op CT, MR or PET data is often available, but remains unused in the angio suite. With *syngo* 2D/3D Fusion, only two fluoro projections are required to easily fuse 3D volumes from other imaging modalities for live image guidance.

Expand your capabilities while saving radiation dose and contrast media.

### **syngo Fusion Package including:**

*syngo* Toolbox  
*syngo* 3D/3D Fusion  
*syngo* 2D/3D Fusion



## **syngo 3D Segmentation**

Segmentation is an image-processing algorithm for extraction of anatomical structures.

The *syngo* 3D Segmentation application creates a graphical overlay that represents an anatomy of interest, e.g. soft tissue lesion, fibroid, or tumor, to overlay with live X-ray or for computational analysis, e.g., volume measurement.

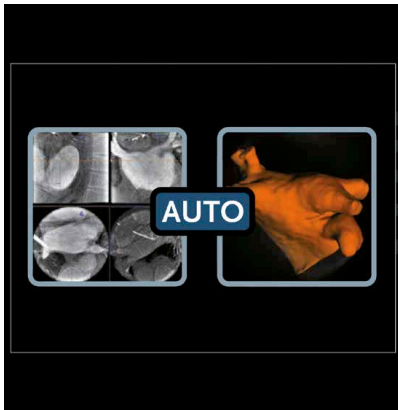
The anatomy of interest is marked interactively by simple strokes inside and outside of the structure in multiple MPRs.

Based on the coarse strokes the workstation automatically segments the anatomy of interest, e.g. the tumor or tissue lesion. The user can fine-tune the segmentation result by using additional strokes or a 3D sculpting sphere in an MPR to indicate areas to be included or excluded. This results in a very precise segmentation of the structure of interest.

<sup>1)</sup>This measurement was performed with an Alderson phantom using Fluoroscopy with 10 images per 2D projection and a low-dose 6s DCT Body program. Results in actual clinical practice may vary. Not all features shown are necessarily standard and available in all countries.



# 3D processing – Advanced tools



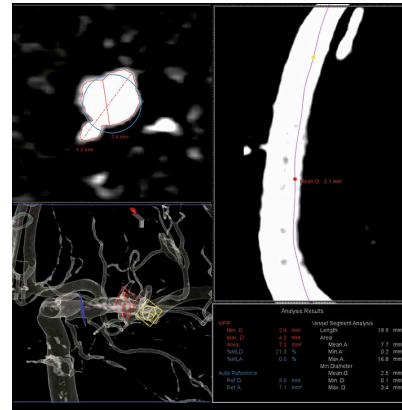
## syngo LA Segmentation

The application syngo LA Segmentation is an algorithm specifically designed to segment the left atrium (LA) of the heart. Based on a pre-operative CT, MR, or an intra-operative syngo DynaCT Cardiac, the syngo Application Software calculates the segmentation automatically. The segmentation can also be performed manually by the user with just one click inside the left atrium. The segmentation might be applied during electrophysiologic procedures and is utilized by syngo Electrophysiology Guidance.

## syngo Congenital Heart Disease Guidance

3D module for planning and guidance during congenital heart disease procedures.

syngo Congenital Heart Disease Guidance is an integrated workflow to perform congenital heart disease interventions. The workflow bundles the relevant tools to handle 3D volumes in the context of congenital heart disease interventions. The 3D volume as well as important markings or measurements can be overlaid on the live fluoroscopy image for easier orientation and guidance through the procedure.

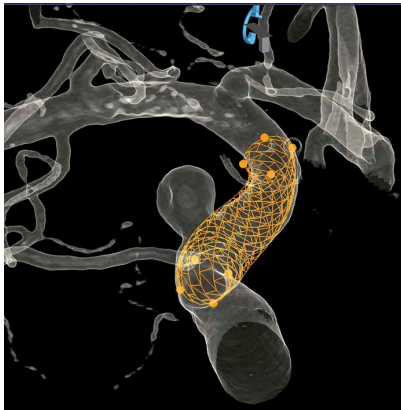


## syngo 3D Stenosis Measurement

The application syngo 3D Stenosis Measurement allows analyzing a vessel segment using 3D views, e.g. MPR, VRT. Based on a 3D volume the user marks the vessel of interest with two mouse clicks. The vessel is automatically segmented and the center-line of the vessel is calculated.

The vessel can be displayed with a curved MPR along this centerline and key stenosis parameters are calculated such as mean, smallest, and biggest area of all cross sections along the vessel's course in the analyzed range. Additionally, the users can "scroll" interactively along the vessel while detailed stenosis parameters are calculated for each MPR such as minimum diameter, maximum diameter, and area of the vessel's stenosis cross-section as well as minimum luminal diameter and minimum luminal area.

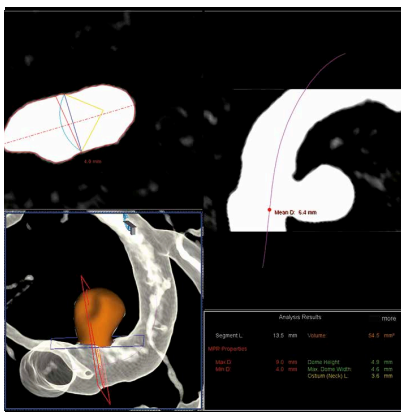
# Integrated 3D workflows



## syngo Neuro Virtual Stent

The syngo Neuro Virtual Stent application is a planning tool that provides a 3D virtual intracranial stent, which can be sized to a vessel during pre-stent deployment and can provide a 3D overlay onto a live X-ray or 2D roadmap image. The live 3D overlay of the stent can also be used post-stent deployment to provide guidance during coiling of intracranial aneurysms.

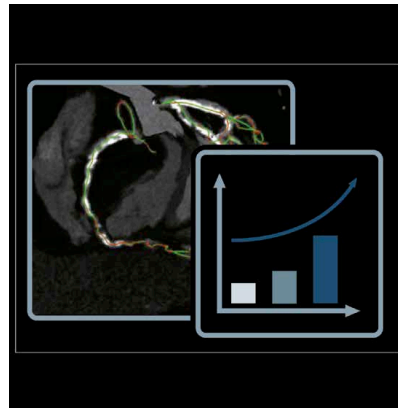
syngo Neuro Virtual Stent is part of the syngo Aneurysm Guidance Neuro application.



## syngo Aneurysm Guidance Neuro

With three simple mouse clicks, a cerebral aneurysm and its parent vessel are segmented in the syngo DynaCT or syngo Dyna3D image. Based on this segmentation, a complex analysis of the aneurysm is performed by the workstation and the aneurysm dome height and width,

the ostium neck, angle, and length, as well as the ostium area and cutting plane are measured automatically. The application also determines the centerline of the parent vessel and displays the vessel as a curved MPR along this centerline.

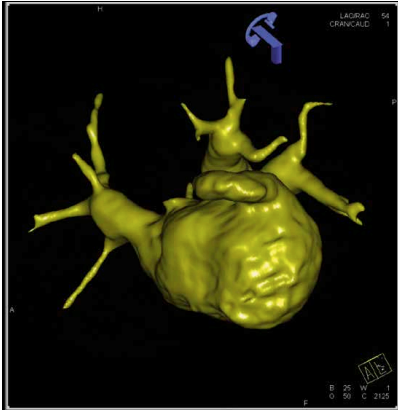


## syngo CTO Guidance

syngo CTO Guidance enables better planning based on automatic segmentation of coronary CTAs. The extracted vessel centerlines (result of the automatic segmentation) help to get a better understanding of the length and shape of the lesion. Furthermore it provides guidance during the procedure by using COROWave – a color-coded visualization demonstrating the best C-arm angulation to avoid vessel foreshortening. syngo CTO Guidance supports complex CTO cases and thus helps to expand the hospital's procedure mix.

*Not all features shown are necessarily standard and available in all countries.*

# Integrated 3D workflows



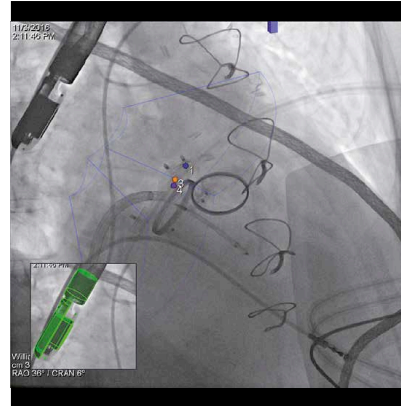
## syngo Electrophysiology Guidance

Based on syngo LA Segmentation, syngo Electrophysiology Guidance enables “one-click” and automatic model-based segmentation and provides a virtual endoscopic view of the left atrium based on syngo DynaCT Cardiac, CT or MR images for planning of atrial fibrillation procedures in 3D.

Clipping functionality allows a view inside the left atrium.

The pulmonary ostia, the ridge, the left atrium appendage, and the anterior and posterior veins can be clearly visualized.

Ablation points can be marked on the mesh for treatment planning or documentation. The segmentation and the ablation points can be used for superimposition via syngo 3D Roadmap and for transfer to electro-anatomical mapping systems.



## syngo TrueFusion

Fusion of TEE (transesophageal echo) information and live fluoroscopy adds guidance to structural heart disease procedures and the potential to save fluoro time.

Based on the co-registration of an Artis angiography and an ACUSON SC2000 PRIME ultrasound system syngo TrueFusion enables fusion of TEE landmarks and valve models with live fluoroscopy for target-oriented device navigation.

The relevant TEE structures are selected and marked directly on the PRIME US system. These structures can be dots or circular shapes with labels, or valve models automatically generated with the eSie Valves™ analysis tool. Additionally the co-registration information can be used to synchronize the image orientation of X-ray and echo images.

# Integrated 3D workflows



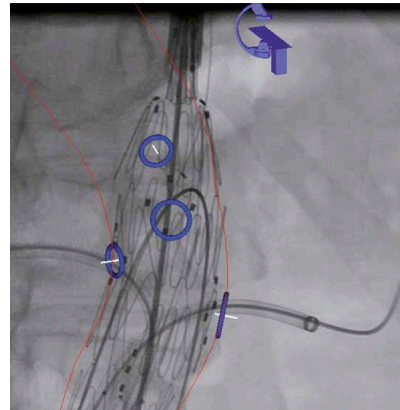
## syngo Aortic Valve Guidance

Starting with syngo DynaCT Cardiac or pre-operative CT images as the basis, syngo Aortic Valve Guidance supports physicians in performing transaortic heart valve implantations (TAVI). The aortic root is automatically segmented in the intra-operative 3D syngo DynaCT Cardiac volume or in a pre-interventional CCTA volume and the anatomical landmarks are automatically detected. Based on these landmarks, an optimal angulation of the C-arm is calculated that guarantees a perpendicular view of the annulus.

The annulus can be evaluated using dedicated annulus measurement. Accordingly to the result of the segmentation and detection the C-arm can be moved automatically to this optimal angulation and the segmented aorta and the anatomical landmarks can be overlaid and superimposed on live X-ray.

Starting with the 3D acquisition, the entire process is automated and the C-arm is positioned in the optimal view within seconds, which allows the operator to instantly start implanting the heart valve.

The automatic workflow saves dose and contrast medium due to 3D guidance based on syngo DynaCT Cardiac acquisition and ideal automatic C-arm positioning without additional fluoroscopy.



## syngo EVAR Guidance

syngo EVAR Guidance automates all steps in the preparation of a pre procedural CT dataset for 3D guided stent deployment.

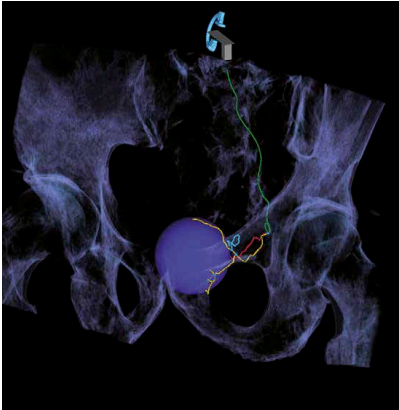
Based on an intelligent mesh modeling of the aortic wall, vessel centerlines are calculated automatically.

The ostia of the main branching vessels are visualized and landing zones for the stent are proposed.

### Benefits:

- Fast and automated preparation CT data set for fusion imaging
- Automated calculation of centerlines with distance marks that allows for sizing of stent length
- Significant time savings compared to manual preparation

# Integrated 3D workflows



## syngo Embolization Guidance

syngo Embolization Guidance is an application for advanced embolization planning and guidance. For liver embolization procedure as well as prostate artery embolization planning it automatically computes a vessel tree starting at a distinct catheter position consisting of vessel branches that feed a user defined lesion: The catheter, positioned in a hepatic artery, is detected automatically.

The treatment area is defined with just one user input, a line that defines the diameter of a sphere.

The automatic feeder detection is based on contrast-enhanced cone-beam CT (e.g. syngo DynaCT) and MDCT datasets.

syngo Embolization Guidance automatically calculates a safety margin around the user-defined lesion. It allows the user to delete or prune vessels from a computed vessel tree by selecting the respective vessel branch in an MPR, MIP or VRT visualization of a 3D dataset. Vessels can be added manually to a vessel tree, independent of the body region.



## syngo Needle Guidance

With syngo Needle Guidance, the operator can plan a needle-based procedure in a 3D volume at the workstation by specifying a target and multiple trajectories for needles or any other rigid instruments. The planning can be performed based on an intraoperative syngo DynaCT image or based on a preoperative 3D volume or in a pre-interventional CCTA volume of any modality in combination with syngo 3D/3D Fusion or syngo 2D/3D Fusion. During the intervention the target and the trajectories are projected and superimposed on the live 2D X-ray depending on the angulation of the C-arm. Using live X-ray and the corresponding overlaid projections, the operator is able to align the instrument with the planned trajectory and is guided precisely to the target. Control scans are automatically registered with the planning volume without interrupting the needle guidance workflow. The integrated laser crosshair is automatically positioned along the planned trajectory and indicates the entry point on the patient as well as the planned angle of the needle or instrument. Thus, the operator is navigated to the target without additional dose. The progression of the instruments can be observed in orthogonal X-ray views.

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