AXIOM Innovations

The Magazine for Interventional Radiology and Cardiology, Radiography and Fluoroscopy

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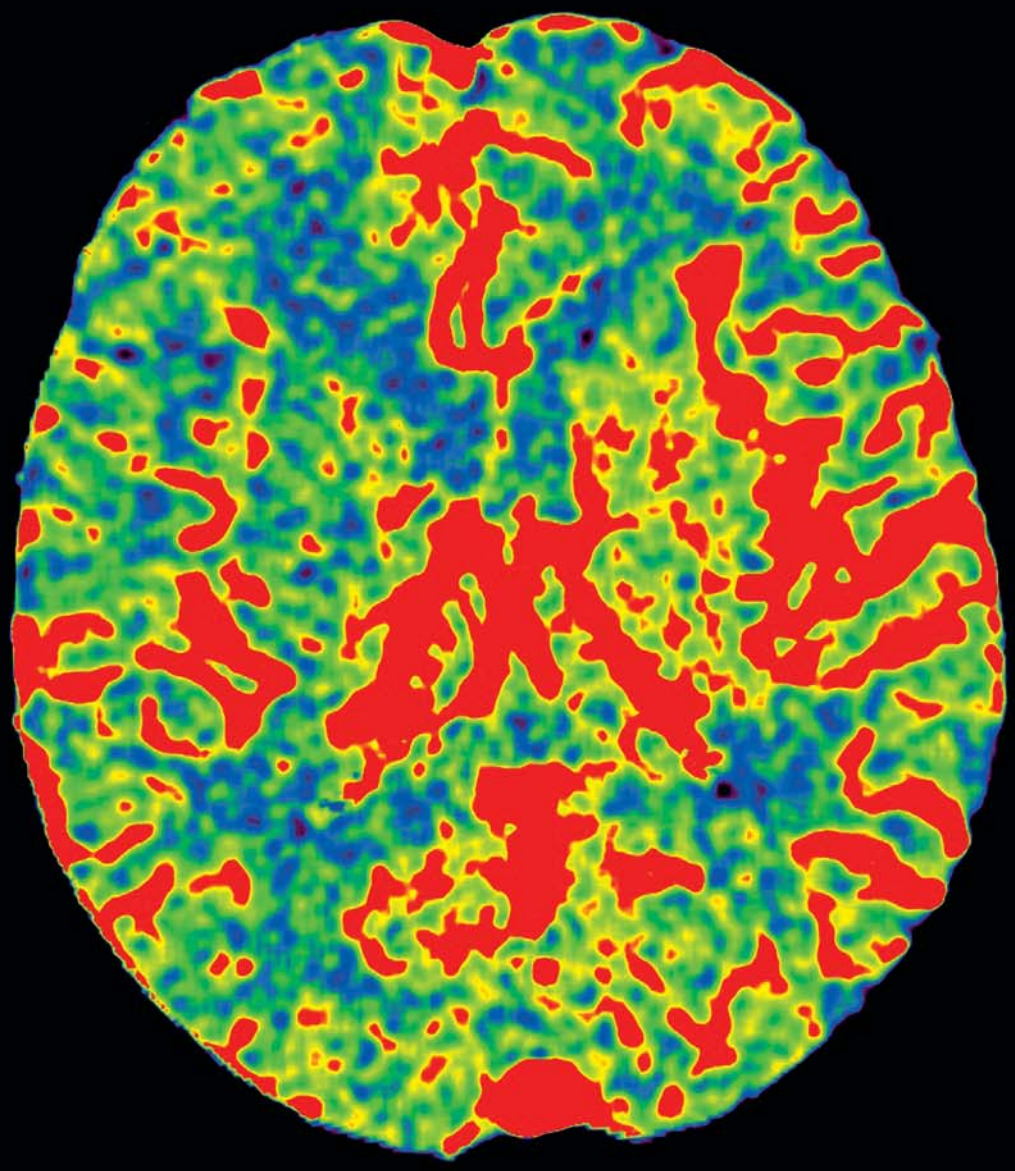
SIEMENS



From Structural to Functional

Functional Imaging Right in the Angio Suite

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"Innovations means for us to improve and innovate all aspects of our product portfolio while paying the utmost attention to our customers' needs to help them grow in clinical areas where they require it."

Dr. Heinrich Kolem, CEO of the Angiographic, Radiographic and Fluoroscopic Division (AX) at Siemens Healthcare

Dear Reader,

Dr. Heinrich Kolem
CEO AX Division

Innovating new features, making existing systems better and exploring new ways how medical technology can help treat patients faster, more efficiently and with greater care is what drives us in our daily work. Our goal is not only to innovate for the high-end market that requires cutting-edge technology, but also to improve workflow for daily routine examinations to help our customers grow in clinical areas where they require it.
For us, this means being innovative throughout all aspects of our product portfolio and paying the utmost attention to our customers' needs.

Looking at interventional neuroradiology, for example, many groundbreaking innovations from Siemens started here: in the neuroradiological interventional suite. *syngo* DynaCT, our cross-sectional soft tissue imaging application was, when introduced to the market in 2004, first used by interventional neuroradiologists. Today, with the introduction of *syngo* iFlow and *syngo* Neuro PBV IR*, we brought functional imaging to the angio lab. These applications offer the possibility to see more than just the vessel structure; they enable radiologists to add functional information about blood flow and blood perfusion to the procedure. This provides more information about the brain's status and the success of the intervention. We believe that such a feature can be very useful, e.g. in stroke treatment to evaluate tissue viability.

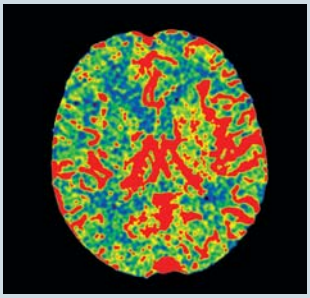
Innovation is not only about new imaging applications and systems. It is also about how to make existing workflows better and how to help hospitals utilize their rooms more efficiently and increase patient throughput without overworking their staff. The AXIOM Luminos dRF 2-in-1 fluoroscopy and radiography system is a brilliant example of how to achieve this. Customers using this system are very excited about the versatility and the impact on their daily routine. Their overwhelming positive feedback showed us that we truly met the demands of the radiology department, which faces challenges such as heavy workload, shortage of staff and high patient numbers.

These and many other topics on angiography, radiography and surgical hybrid rooms are covered in this brand new issue of AXIOM Innovations. I hope you enjoy reading it.

Dr. Heinrich Kolem

*Not commercially available in the U.S.

Content



Cover

Visualization of cerebral blood volume with *syngo* Neuro PBV IR.

Courtesy of Prof. Arnd Döfler, M.D., Department of Neuroradiology, University of Erlangen, Germany

*Not commercially available in the U.S.

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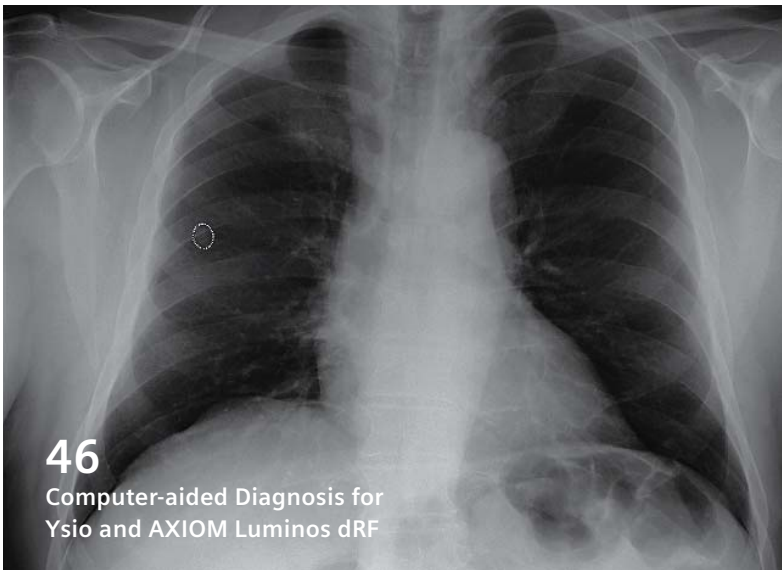
Hybrid Rooms Open up New Treatment Methods for Cardiac Patients



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Computer-aided Diagnosis for Ysio and AXIOM Luminos dRF

Enhanced Clinical Assurance & Quality Management Tools for Ysio

The Ysio digital radiography system with extended quality management tools addresses the need to facilitate the production of consistent, high-quality digital radiographic images at 'as low as reasonably achievable' patient doses. Reject analysis is a well-established method of quality control in diagnostic radiology. The aim with our 'Clinical Assurance Program' is to collect data of deleted or non-diagnostic images for evaluation to determine the reasons for the rejects and repeated exposures. Furthermore by correcting technical problems and improving skills of the staff, the number of repeated examinations can be reduced. The statistics can be easily generated with the 'Clinical Assurance Program'.

In digital imaging, brightness and contrast are often determined entirely by digital post-processing, therefore under- and overexposed images are not easily recognizable. The exposure index in digital radiography is the measure of the amount of exposure received by the image receptor and can be compared to film speed and blackening in film-screen combinations. The 'Exposure Index Monitoring' feature on Ysio gives feedback to users about the appropriate exposure level in clinical routines and allows a comparison with prescribed reference values for radiographic examinations. The "Exposure Index Monitoring" feature complies with the IEC 62494-1 standard.

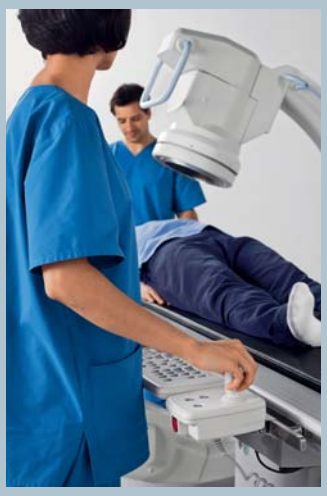
Ysio together with these enhanced quality management tools assures users that they will meet the future standards for digital radiography imaging. These new functions are also available for the AXIOM Luminos dRF digital 2-in-1 solution for fluoroscopy and radiography.

Siemens Donates 10,000 Euros to Charity for Cancer Care

Together with the launch of the new interventional oncology campaign at RSNA 2009, the Siemens Angiography, Fluoroscopy and Radiography (AX) business unit started the "blue band aid" charity campaign and was able to donate 10,000 euros to the UICC, the international union for cancer care.

The blue band aid symbolizes the minimally invasive procedure to treat tumors in patients that might not be treated before. These patients can return to their daily life earlier. Instead of leaving the hospital with a big scar, they only need to wear a small band aid. To show their commitment to the fight against cancer, the Siemens employees in Forchheim, Germany and Hoffmann Estates, USA as well as customers and other visitors at the RSNA had the chance to have their photo taken wearing the blue band aid. For every photo Siemens donated 5 euros or 5 dollars to the UICC. More than 1,800 people participated in the charity campaign resulting in a donation of 10,000 euros to cancer care. "We have created more awareness for cancer care among our employees and customers and are proud to donate to the UICC. Our systems and applications ideally support interventional radiologists who follow the trend towards minimally invasive cancer treatment," says Dr. Oliver Meissner, Head of Global Marketing for Interventional Radiology at Siemens.

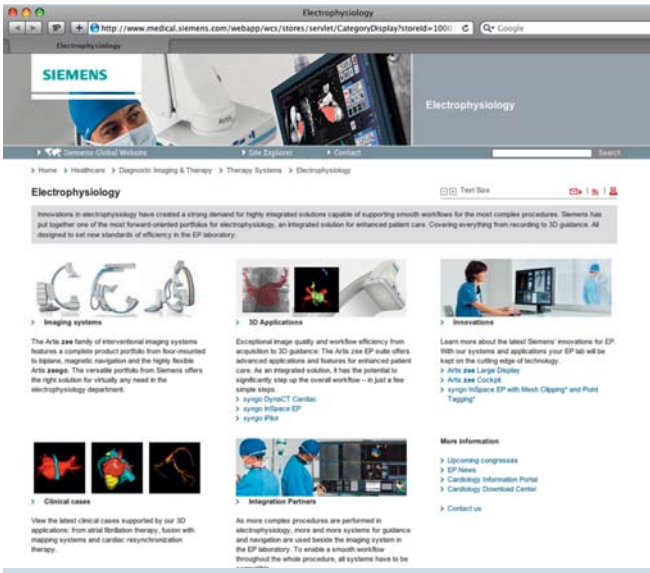
AXIOM Artis U with New Motorized C-Arm



Small, compact, room-mobile and easy-to-use. The latest version of our AXIOM Artis U comes with a motorized C-arm for more flexibility and user-friendliness, making interventions in radiology, cardiology and surgery easier and faster. Now, system operation is more comfortable than ever. The motorized C-arm movements greatly improve the workflow with the system, resulting in less manual work for the clinical staff and faster procedures for the patient. The movements can be controlled via a joystick which can be positioned either at tableside or away from the C-arm to even further reduce radiation dose to the operator. In addition to motorization, a sophisticated collision protection device completes this new C-arm concept. It prevents accidental collisions and takes more care of the patient.

Known for its room-mobility and thus high-power output, the AXIOM Artis U has become a flexible solution for cardiology, radiology and surgery departments. The high-power output of 65 or even 80 kW makes it comparable to a high-end fixed C-arm system. In addition, the high-power generator and high-capacity tube allow for long-lasting procedures. So physicians can work without wait times and constant overheating of the system.

AXIOM Artis U is the perfect solution to bridge the gap between a portable and fixed C-arm system and has an excellent price-performance ratio to also meet smaller budgets.



What is New in Electrophysiology

The new electrophysiology portal is now online in the Siemens Healthcare Internet featuring information dedicated to electrophysiologists and their procedures. In recent years innovations in electrophysiology have created a strong demand for highly integrated solutions capable of supporting smooth workflows for the most complex procedures. Siemens put together one of the most forward-oriented portfolios for electrophysiology, an integrated solution for enhanced patient care. With one of the industry's broadest system portfolio of C-arm systems, the Artis zee family, every EP department can find the system that best fits their needs and budgets. A variety of applications for 2D and 3D imaging, like *syngo* DynaCT Cardiac, that create CT-like images of a beating heart in seconds, cover virtually all treatment situations from simple diagnostics to complex atrial fibrillation procedures. The portal also provides clinical case examples, links to the latest innovations for EP, congresses, news and a download area for articles and videos.

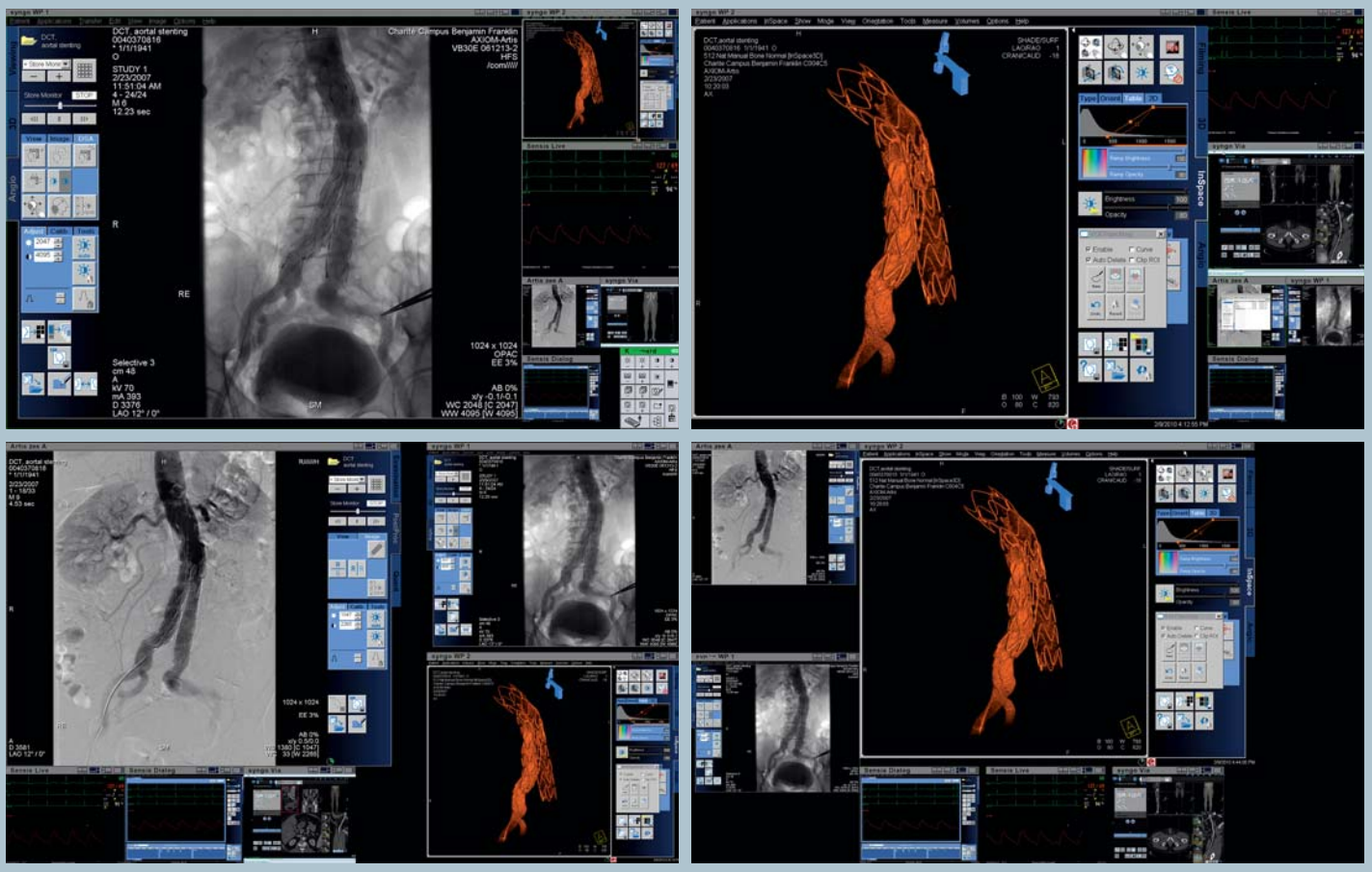
www.siemens.com/EP

Artis zee Cockpit

After the market introduction of the Artis zee Large Display for the examination room last year, Siemens now cleans up the control room with a new 30" display to control multiple systems during interventions.

Today's interventional control room is the hub for multiple data sources and systems. With this comes the need to visualize and interact with many different work consoles, leading to numerous monitors, keyboards and mice. The information these systems provide is vital to support the interventionalist during procedures but leads to many different points of control – sometimes resulting in more complex workflow and a cluttered environment.

The new Artis zee Cockpit can put an end to all this. It consolidates the various imaging and data signals routed to the control room into one 30" medical-grade display. Fast, simple and intuitive operation make the new cockpit solution an ideal tool for efficient workflow. The user can choose the layout of the display to meet the requirements of the procedure and move the sources around the screen as required. A double click in any screen displayed and the user takes complete control of that system, all with one mouse, one keyboard and one monitor. And even more important, Artis zee Cockpit clears up valuable space in the department.



One Mouse, One Keyboard, One Monitor: One Workplace. Complete Control.

With the Artis zee Cockpit, Siemens once again utilizes technological advances to support a cleaner, smoother and more efficient workflow in the healthcare environment.
The Artis zee Cockpit is available for use with the Artis zee portfolio of systems. Artis zee is the product family name of Siemens systems used for interventional radiology, cardiology, electrophysiology and surgery. These systems are available in biplane, multi-axial, ceiling-mounted, floor-mounted, and multi-purpose configurations.
With the Artis zee Cockpit, less becomes more in the future. Fewer control room monitors means more space and more efficient workflow. For the clinical team this means less time spent controlling systems and more time spent with the patient.

www.siemens.com/
artis-**zee**-cockpit

Benefits at a glance

- 30-inch medical-grade display
- More space in the control room
- Multiple screen layouts via mouse-click
- Combine up to six single monitors into one screen

syngo.via Creates Added Value for Diagnostic Imaging and Interventional Procedures

After the introduction of the new *syngo*.via[1] imaging software at RSNA 2009, the solution gained a lot of positive response from customers worldwide. It helps clinicians get their cases ready in less time and concentrate on what is really important: interpreting images and diagnosing their patients. *syngo*.via automatically takes over formerly cumbersome steps in case preparation and makes data from different modalities available for the radiologist, wherever he or she needs it[2]. X-rays and ready-processed DSA scenes can be displayed next to CT or MR images to evaluate nessecary aspects for a reliable diagnosis.

syngo.via during interventional procedures

During an interventional procedure in the angio lab, *syngo*.via provides additional pre-procedural information such as MR, CT or PET-CT on the patient case, which can be reviewed in one view side by side with interventional results, such as *syngo* DynaCT results. This multimodality information can be accessed when- or wherever needed, in the control or the exam room, in a general monitor setting or on the Artis zee Large Display. This additional diagnostic multimodality information can enhance a broad range of complex interventional

syngo.via can be displayed anywhere[2] in the control room, and in the exam room even on the Artis **zee** Large Display.

procedures, such as minimally invasive tumor treatment in the abdominal area or cerebral embolizations in the field of neuroradiology.
Furthermore, *syngo*.via provides additional flexibility for radiology or cardiology departments with various interventional labs. In order to facilitate multilab image management *syngo*.via allows easy access to preinterventional diagnostic results in the interventional room where they are needed. Cumbersome uploading of diagnostic results in each room where the case might be located becomes a thing of the past. When the case has been successfully completed, the imaging information and the case can be distributed throughout the entire hospital.

syngo.via enables easy viewing and access of CAD results in chest X-rays.

syngo.via during radiography imaging

For the evaluation of lung nodules on *syngo*.via, Siemens will offer *syngo*.CXR CAD[3] as a second reader tool that provides computer-aided detection (CAD). *syngo*.CXR CAD task flow provides an efficient reading workflow for chest X-ray as well as optimized visualization and navigation of CAD results. Once the clinician has performed the initial read, the pre-processed CAD results can be easily accessed through the CAD icon located at the bottom of the image. The CAD review gallery contains CAD-specific tools providing an enhanced workflow experience. The CAD results are displayed as an overlay on the original frontal view of the chest image; a simple mouse click will highlight a specific CAD mark for further evaluations. The clinician can zoom in the digital chest X-ray to take a closer look at the region of interest.
syngo.CXR CAD is optimized for the detection of lung nodules 8 to 30 mm. Digital chest X-ray images acquired with digital radiography systems like Ysio and the AXIOM Luminos dRF fluoroscopy system can be processed in future with *syngo*.CXR CAD on *syngo*.via.

www.siemens.com/
syngo.via

Images my way

syngo.via[1] is the new imaging software, creating an exciting experience in efficiency and ease of use – anywhere[2].

My cases – ready

syngo.via automatically prepares cases for reading and provides insightful disease-specific guidance step by step.

My places – networked

With *syngo*.via, my places are networked – making modalities and IT one within the hospital and beyond.

My needs – anticipated

syngo.via addresses my needs for ongoing business – and helps to ensure a continuous return on my investment.

[1] *syngo*.via can be used as a standalone device or together with a variety of *syngo*.via-based software options, which are medical devices in their own right. The displayed application features belong to *syngo*.via-based software options. The information about these software options is being provided for planning purposes. The products are pending regulatory clearances in some countries, and are Not commercially available in all countries, in particular not available for sales in the U.S. or Brazil.

[2] Prerequisites include: Internet connection to clinical network, DICOM compliance, meeting of minimum hardware requirements, and adherence to local data security regulations.

[3] Not commercially available in the U.S.

Functional Imaging Right in the Angio Suite

Functional imaging has reached the angio suite. Thanks to a new application, the momentary blood volume of the brain can soon be visualized just before, during or after an interventional procedure. And – what might be even more important – *syngo* Neuro Parenchymal Blood Volume (PBV) for Interventional Radiology (IR)* evaluates the tissue function of the whole brain.

By Wiebke Kathmann, Ph.D.

*Not commercially available in the U.S.

Stroke, be it due to stenosis or hemorrhage, is one of the most frequent emergency situations in the industrialized world. The key to diagnosis and treatment decisions is high-resolution imaging. This is usually performed via CT or MRI techniques outside the angio suite. The drawback: With about an hour between imaging and intervention, the perfusion state of the brain may have changed. The same holds true for complex, lengthy interventions. Therefore, the new *syngo* Neuro PBV IR* application holds potential for clinically relevant improvements.
The new software can calculate the parenchymal blood volume (PBV) from the contrast-enhanced 3D (*syngo* DynaCT) data set acquired with the state-of-the-art Artis zee flat detector angiography systems. The total time for the data acquisition, from injecting the contrast material to the on-screen imaging result, takes about 2 minutes, with data reconstruction taking less than 60 seconds of that. Using the dedicated software, Cerebral Blood Volume (CBV) maps are generated that can assist in clinical decision-making, including whether to apply thrombolysis or undertake endovascular procedures.

syngo Neuro PBV IR Is the Key

A great deal of the clinical expertise generated thus far in this exciting field comes from Prof. Arnd Dörfler, M.D., Head of Neuroradiology at the University of Erlangen, Germany, and his senior radiologist, Tobias Struffert, M.D. Dörfler and his team were the first in the world to use this dedicated perfusion software on their Artis zee angio machine in the clinical setting. By now they have examined over 30 patients with different cerebrovascular diseases, mainly acute stroke. In at least 20 of them, they have compared the perfusion data gained in the angio suite to conventional CT-perfusion data.
Blood volume imaging is already implemented in the clinical workflow in Dörfler's department, especially in the treatment of patients with acute stroke or vasospasms who are treated using endovascular means. It helps the physicians monitor and control therapy.
"I find it exciting that it is now possible to perform perfusion imaging in the angio suite and am impressed with the reliability and quality of the data," states the pioneer in the field. At the same time, Dörfler doesn't want expectations to fly too high. "So far we have only used it on 30 patients – not 300, not 3,000. Worldwide, we maybe have data

*Not commercially available in the U.S.

The neurointerventional team at the University of Erlangen-Nuremberg (from the left): Tobias Engelhorn, M.D., Prof. Arnd Dörfler, M.D., Tobias Struffert, M.D. and Philipp Gölitz, M.D.

"It is phenomenal that this application covers the whole brain, and that most likely it will reduce radiation exposure."

Professor Arnd Dörfler M.D., Head of Neuroradiology, University of Erlangen, Germany

on 100 patients now. So this is clearly preliminary data. We have to further evaluate the data, especially with regard to the high heterogeneity of the disease. It is important that university hospitals – that is, research institutions – collect more data and correlate it with the clinical data to find out how the PBV data influences patient selection, decision making and finally, outcome."

True Whole Brain Functional Imaging

Even now, some advantages of the new application are already evident: It gives the interventional neuroradiologist the ability to check brain viability right before, during or after an intervention without the need for patient relocation. And, what might be even more important, "One can truly map the whole brain. This is extremely valuable," says Struffert, "because – as is known – you might miss the stroke area with the three or four planes you choose in CT imaging." As he points out, tissue function of the brain can be viewed in any orientation with this application. Imaging the whole brain, of course, is possible only with intravenous injection of the contrast agent. "If the bolus is applied intra-arterially, it leads to imaging results for just one-half of the brain," explains Struffert, who performed the detailed experimental work on timing between bolus injection and imaging.

Changing Acute Stroke Management?

With his experience so far, Dörfler views *syngo* Neuro PBV IR as a valuable adjunct in his clinical practice. "As of today, it is not a modality to completely replace standard imaging in acute stroke patients. But in the future, we might end up doing only a plain CT and then move the patient immediately to the angio table for functional, vascular and perfusion imaging, where we can prepare the setup for the endovascular procedure in the meantime." Whatever the case, he views acute stroke as the main application in the future, also regarding numbers.

Struffert's vision for functional imaging in the angio suite goes a step further. From his perspective, in the future *syngo* Neuro PBV IR might change the management of stroke patients. "Why should we diagnose a patient on whom we want to perform an intervention in a setting where we can't treat him? It would be much more logical and convenient if the patient, who came in as an emergency, were sent directly to the angio suite instead of CT. There we can use *syngo* DynaCT to check whether he has a hemorrhage or not, whether he has a problem with brain perfusion, or whether he had a convulsion and there is nothing we need to do, so the patient can get off the table." In Dörfler's opinion, all the information needed to decide on the suitable intervention could be gained right on the angio table. The key benefit would be the time saved, which is now spent on patient relocation – time that is lost for the brain. "Therefore, it makes more sense to bring the patient directly to the angio suite," says Struffert.

Even though acute stroke will most likely be the main application of the new software, Dörfler can envision other indications. He already uses *syngo* Neuro PBV IR for patients with cerebral vasospasms after subarachnoidal hemorrhage.

Wiebke Kathmann, PH.D., is a biologist and medical journalist. She is a frequent contributor to medical magazines of German-speaking media.

Contact
alinejat.bengi@siemens.com

Cerebral Artery Occlusion
Supported *syngo* Neuro PBV IR*

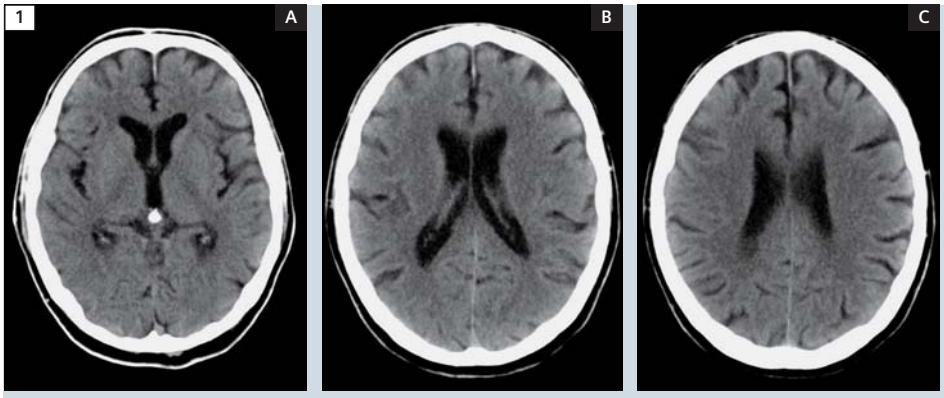
Courtesy of Prof. A. Dörfler, M.D., T. Struffert, M.D.,
Department of Neuroradiology, University of Erlangen, Germany

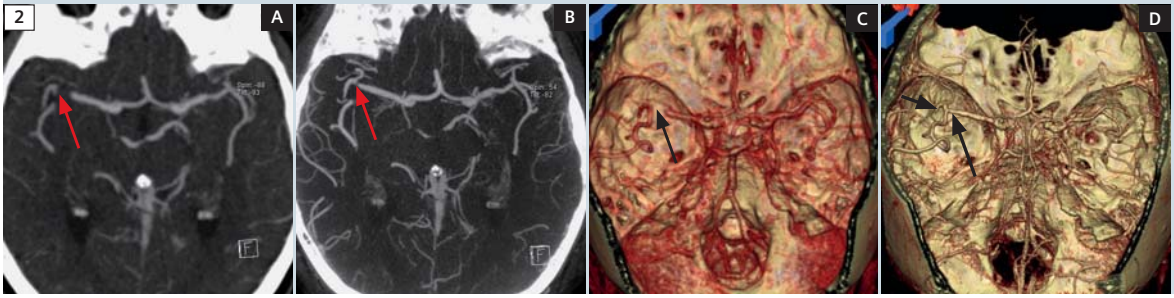
Patient history
75-year-old male admitted with acute symptoms of right middle cerebral artery occlusion.

Diagnosis
Initial CT scan (Fig 1, A-C) could rule out hemorrhage. In CT angiography occlusion (red arrow) of distal M1 segment (Fig 2 A, MIP) was visible.
VRT reconstruction (Fig 2 C, VRT) confirmed the occlusion (black arrow).
In CT perfusion the CBV mapping (Fig 3, A-C) showed no obvious lesion.

Treatment
Intra-arterial therapy with mechanical recanalization was initiated and performed successfully. *syngo* Neuro PBV IR was used to monitor the patient's condition. Vascular imaging (Fig 2 B, MIP) confirmed patency of the M1 segment (red arrow). VRT reconstruction showed additional still occluded M2 segment (black arrowhead). Now with *syngo* DynaCT and *syngo* Neuro PBV IR compared to initial CT evaluation, a small lesion (white arrows) was visible (Fig 3, D-F). Therefore further attempts to revascularize the occluded M2 branch were not initiated because brain viability of the affected region was no longer given. In CT follow-up 24 hours after therapy (Fig 4, A-C, red arrows) the stroke demarcation matched exactly with the CBV lesion visible with *syngo* Neuro PBV IR (Fig 3, D-F, black arrows).

Contact
alinejat.bengi@siemens.com

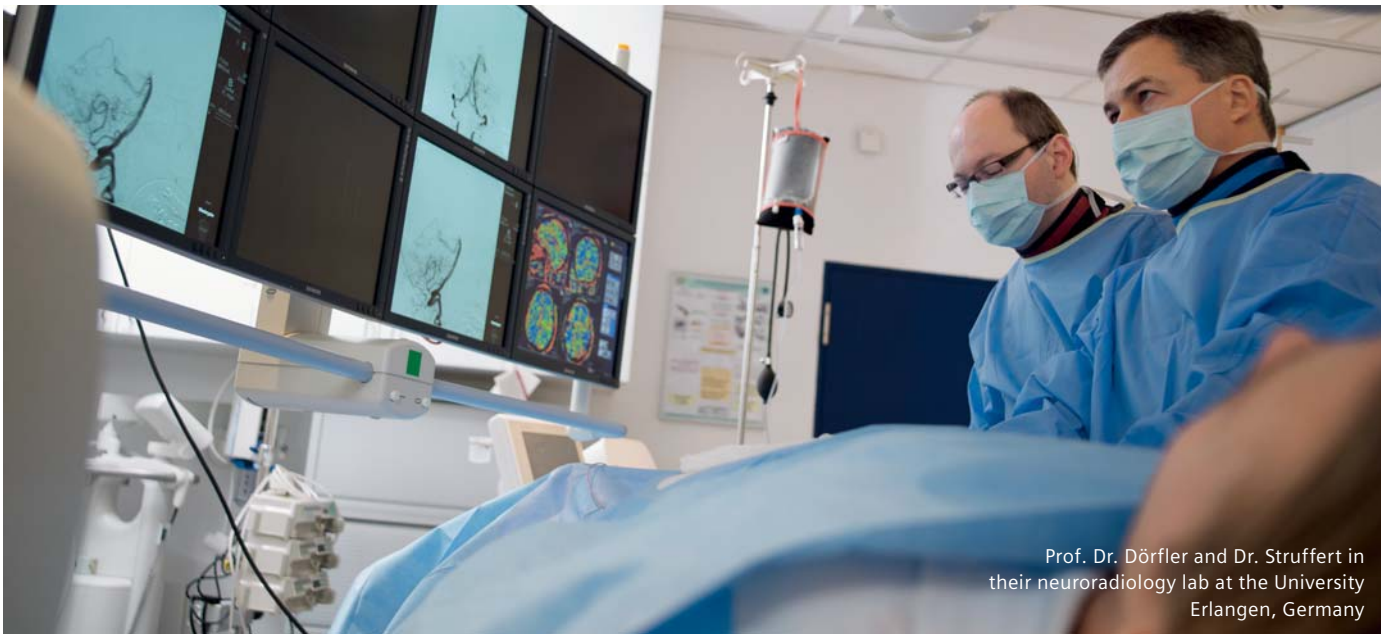




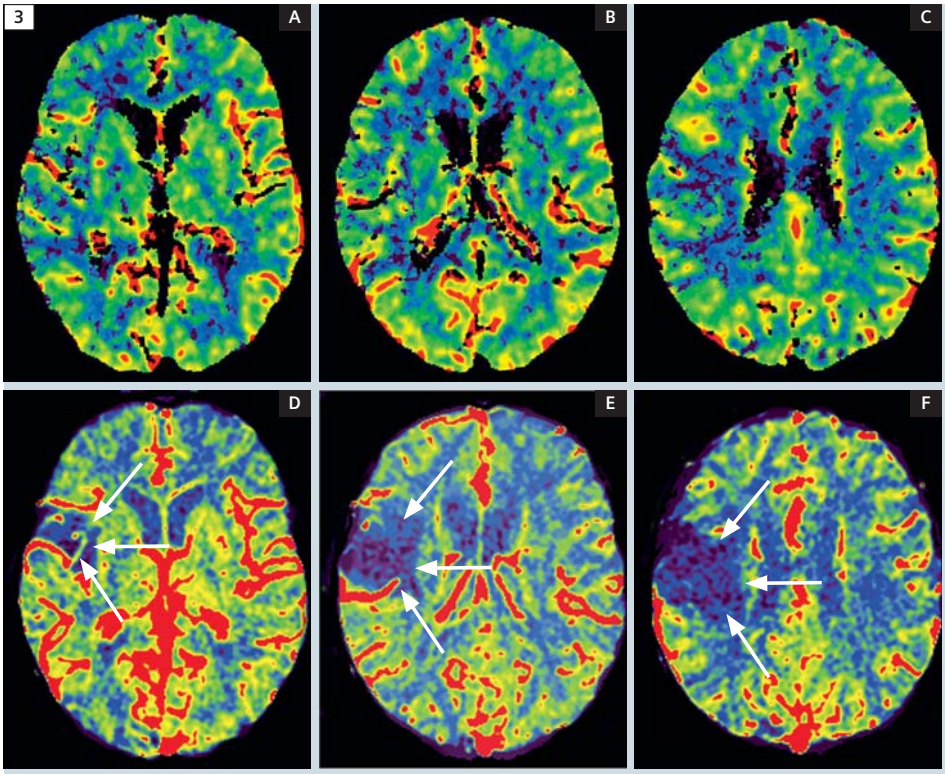
1 CT images (A-C) rule out hemorrhage.

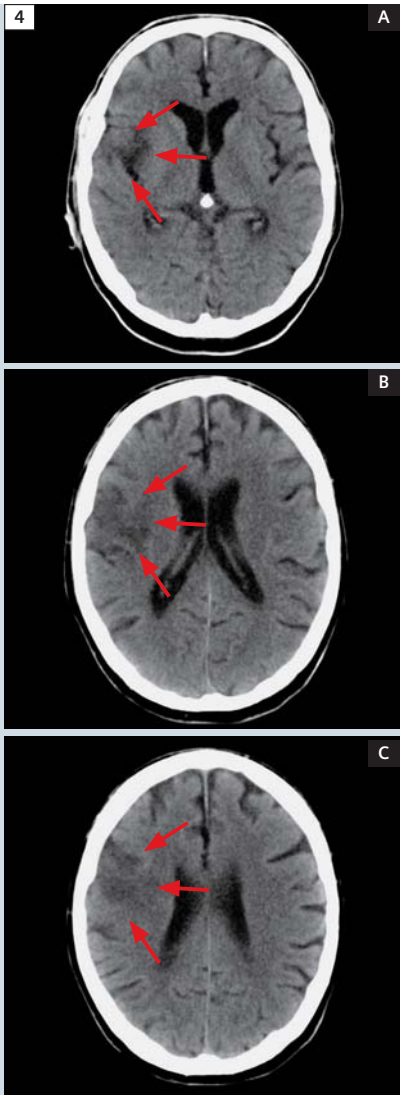
2 2A shows the occluded M1 segment.2B confirms patency after treatment. 2D shows occluded M2 segment (arrowheads).

*Not commercially available in the U.S.



Prof. Dr. Dörfler and Dr. Struffert in their neuroradiology lab at the University Erlangen, Germany



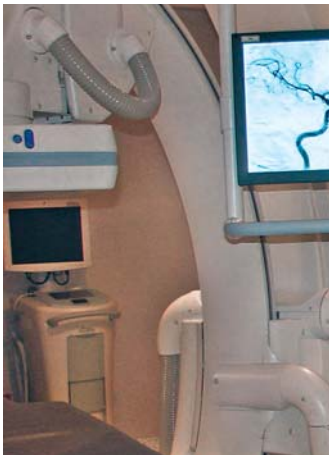


3 *syngo* Neuro PBV IR images (D - F, arrows) clearly show the CBV lesion.

4 (A-C) In CT follow-up the stroke demarcation matched exactly with the CBV lesion visible with *syngo* Neuro PBV IR.

Neurosurgical Clipping Supported by *syngo* iDentify

Courtesy of Hugo Ramirez Luna, M.D., T. R. Gilberto Cesar Calvo Garcia,
Oaxaca Regional Hospital, Oaxaca, Mexico



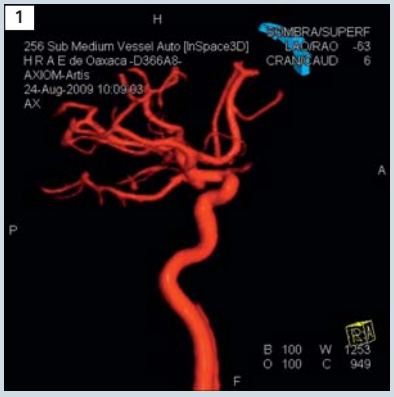
Case 1

Patient history
56-year-old female

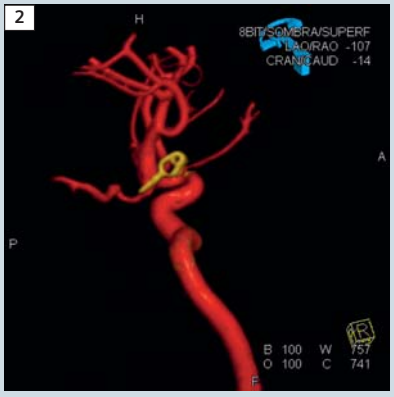
Diagnosis
Persistent hypertension; subarachnoid hemorrhage with Hunt & Hess grade 3, which includes drowsiness and confusion as well as mild focal neurologic deficit. The hemorrhage appeared to be more than 1 mm thick (Fisher III).

Treatment
DSA for visualization of a small, saccular aneurysm of the right posterior communicating artery. Morphological details of the vessel tree were generated by *syngo* InSpace 3D (Fig. 1) and enabled clipping of the cerebral aneurysm with a Yasargil clip under fluoroscopic intervention. Finally the clipped aneurysm was controlled by the use of *syngo* iDentify (Fig. 2).

Statements
The three-dimensional imaging of the LCA and the inflated balloon helped in deciding whether an interventional procedure would be possible. Additionally, no selective coronary injections were necessary because of the 3D visualization. Thus 25 cc contrast medium was enough for imaging during the whole procedure and *syngo* DynaCT delivered images in high resolution necessary for making the critical determination between interventional treatment and open heart surgery.



1 High-contrast 3D visualization of vessel tree with the help of *syngo* InSpace 3D.



2 High-contrast 3D visualization of vessel tree and clip with the help of *syngo* iDentify.

3 Single shot native.

Neurosurgeon and neuro-endovascular therapist Dr. Hugo Ramirez Luna (left) and T. R. Gilberto Cesar Calvo Garcia, hemodynamic technician in their angio suite.

Case 2

Patient history

18-year-old female

Diagnosis

Subarachnoid hemorrhage, which indicates a ruptured cerebral aneurysm. Moderate to severe headache, nuchal rigidity, no neurologic deficit other than cranial nerve palsy (Hunt & Hess II). The appearance of the subarachnoid hemorrhage on CT scan was non-evident (Fisher I).

Treatment

A small, saccular aneurysm of the left posterior-communicant aneurysm was shown by DSA. Three-dimensional imaging with *syngo* InSpace 3D for better visualization of the vessel tree and localization of the aneurysm (Fig. 1). Following a clipping (Yasargil clip) was performed to treat the aneurysm. *syngo* iDentify helped to confirm the successful clipping (Fig. 2).

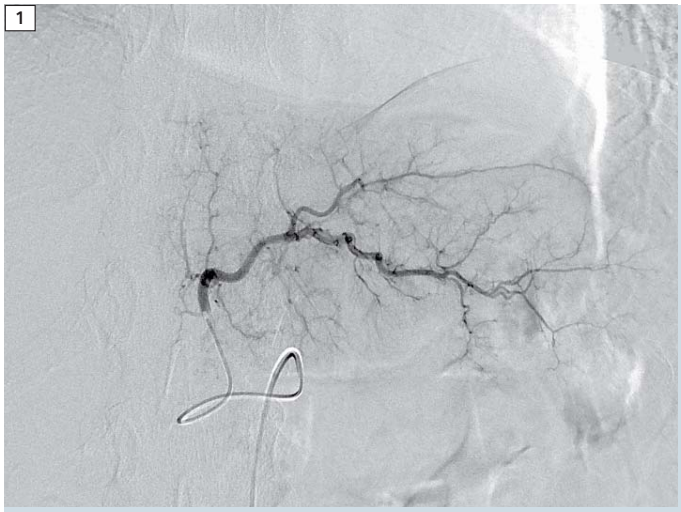
Contact
antonio.carlos@siemens.com

1 High-contrast 3D visualization of vessel tree and aneurysm with help of *syngo* InSpace 3D.

2 High-contrast 3D visualization of vessel tree and clip with the help of *syngo* iDentify.

Selective Internal Radiation Therapy (SIRT) Supported by Artis **zeego** and Large Volume *syngo* DynaCT

Courtesy of Tobias Jakobs, M.D.,
Department of Radiology,
Ludwig Maximilian University of Munich,
Grosshadern Campus, Munich, Germany



1 DSA image of the left hepatic artery.

2 Large Volume *syngo* DynaCT; transaxial slice.

Patient history

40-year-old female with otherwise treatment-refractory liver metastases from breast cancer.

Diagnosis

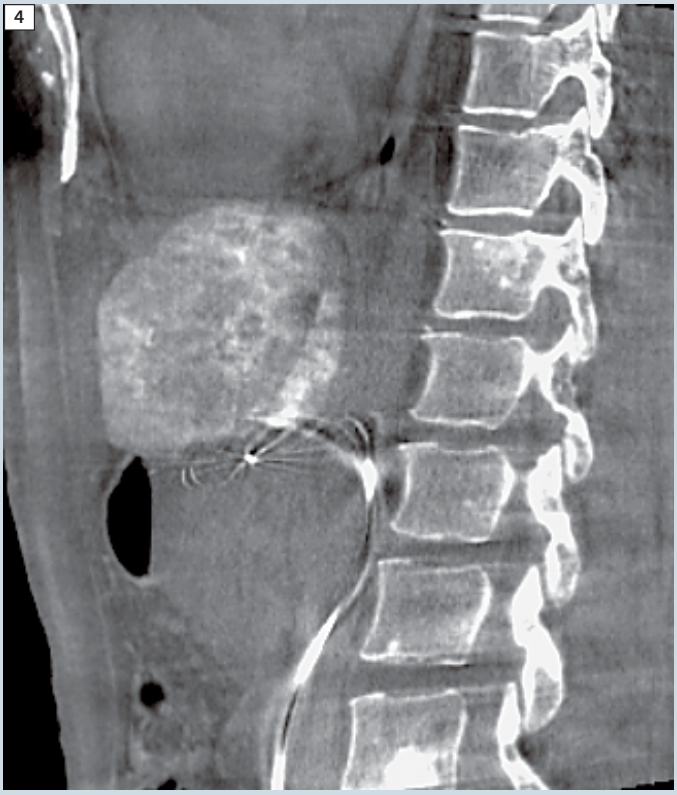
Liver metastases

Treatment

A DSA image of the left hepatic artery was performed. Arterial vessels are displayed reaching far to the left abdominal wall, therefore conspicuous for collateralization to the stomach. A Large Volume *syngo* DynaCT has been performed, which confirms that the suspicious arteries are all within the left liver lobe and no contrast uptake outside the liver can be detected. This increases the confidence of the treating radiologist that an injection of the yttrium 90 microspheres from this catheter position would not result in accidental deposition of the microspheres in the stomach wall.

Contact
vera.juennemann@siemens.com

3 Large Volume *syngo* DynaCT; frontal slice.



4 Large Volume *syngo* DynaCT; sagittal slice.

What is SIRT

Radioembolization (SIRT) is a relatively new palliative treatment option for primary and secondary liver tumors which combines the effects of interstitial high-dose radiotherapy and of arterial micro-embolization. The resin microspheres (SIR-Spheres®) are labeled with the isotope yttrium 90. The microspheres serve as a radiation source and are infused into the hepatic arteries, resulting in the selected targeting of very high doses of radiation to metastases via their arterial blood supply.

During SIRT prophylactic embolization of the gastroduodenal artery is done routinely. Furthermore, to avoid ectopic implantation of yttrium 90 microspheres into aberrant visceral vessels, a careful and meticulous angiography of the hepatic vasculature is mandatory. However, the differentiation between intrahepatic vessels and vessels leading into the GI region is not easy in all cases, especially where extensive tumor burden is present or in patients who previously underwent surgical resection of liver tumors. To avoid distribution or reflux of microspheres outside the liver, an identification and occlusion of those vessels is crucial for preventing side effects (e.g. gastric ulcers, pancreatitis and skin ulcerations) in the patient.

1 Lewandowski RJ, Sato KT, Atassi B, Ryu RK, Nemcek AA, Jr., Kulik L et al. Radioembolization with (90)Y Microspheres: Angiographic and Technical Considerations. Cardiovasc Intervent Radiol 2007

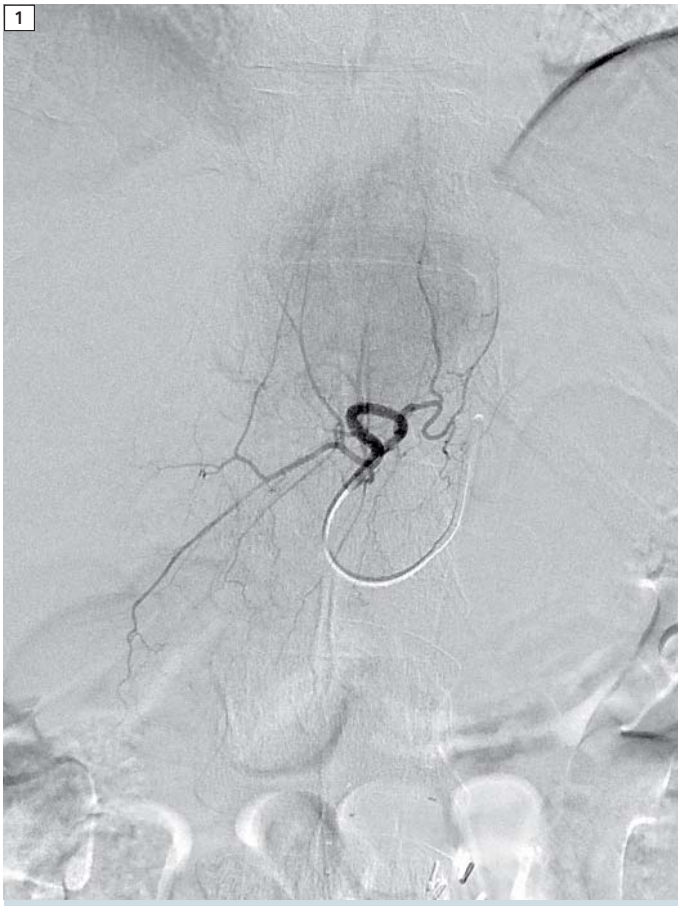
2 Orth RC, Wallace MJ, Kuo M.D. C-arm cone-beam CT: general principles and technical considerations for use in interventional radiology. J Vasc Interv Radiol 2009; 20(7 Suppl):S538-S544.

3 Wallace MJ, Kuo M.D., Glaiberman C, Binkert CA, Orth RC, Soulez G. Three-dimensional C-arm cone-beam CT: applications in the interventional suite. J Vasc Interv Radiol 2009; 20(7 Suppl):S523-S537

Selective Internal Radiation Therapy (SIRT) Supported by Artis **zeego** and Large Volume *syngo* DynaCT

Courtesy of Tobias Jakobs, M.D.,
Department of Radiology, Ludwig Maximilian University of Munich, Grosshadern Campus, Munich, Germany

Tobias Jakobs, M.D., Department of Radiology, Ludwig-Maximilians-University of Munich, Campus Grosshadern, Munich, Germany



1 DSA image shows a superselective injection into the segmental artery supplying liver segment 4.

Diagnosis

Treatment-refractory liver metastases from a neuroendocrine tumor (NET).

Treatment

A super-selective injection into the segmental artery supplying liver segment 4 was performed. A conspicuous vessel was identified showing a course which might reflect a falciform artery. To rule out a falciform artery a Large Volume *syngo* DynaCT was performed. The axial and coronal reformats clearly demonstrate that the suspicious vessel is not the falciform artery and no contrast uptake is seen within the abdominal wall.

Contact
vera.juennemann@siemens.com

2 Large Volume *syngo* DynaCT; transaxial slice demonstrates that no contrast uptake is seen within the abdominal wall.

3 Large Volume *syngo* DynaCT; coronal slice.

Selective Internal Radiation Therapy (SIRT) Supported by Artis **zeego** and Large Volume *syngo* DynaCT

Courtesy of Tobias Jakobs, M.D.,
Department of Radiology,
Ludwig Maximilian University of Munich,
Grosshadern Campus, Munich, Germany

Patient history
69-year-old male

Diagnosis
Intrahepatic cholangiocellular carcinoma

Treatment
A selective injection into the left hepatic artery was performed in a patient who previously underwent right lobe hemi-hepatectomy. No suspicious vessel was identified. However, Large Volume *syngo* DynaCT revealed contrast uptake within the lesser curvature of the stomach. Therefore the catheter position was altered and the tip was placed more distally. The following *syngo* DynaCT revealed that there was no more evidence for ectopic contrast uptake in the stomach but complete coverage of the tumors. This was confirmed by SPECT-CT after injection of technetium-99m macroaggregated albumin.

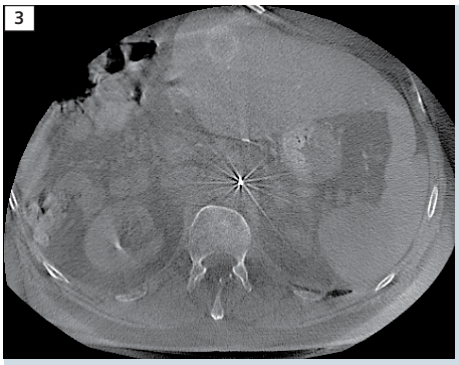
Contact
vera.juennemann@siemens.com

1 DSA image shows a selective injection into the left hepatic artery.

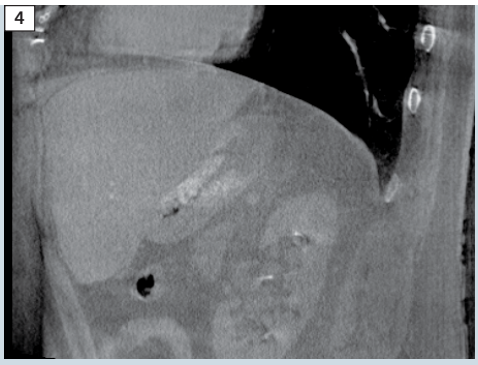
2 Large Volume *syngo* DynaCT; transaxial slice revealed contrast uptake within the lesser curvature of the stomach.

"With Large Volume *syngo* DynaCT certainty and confidence during SIRT is increased, particularly in heavily pretreated patients with a complex arterial anatomy, which is frequently observed in patients who are referred for SIRT".

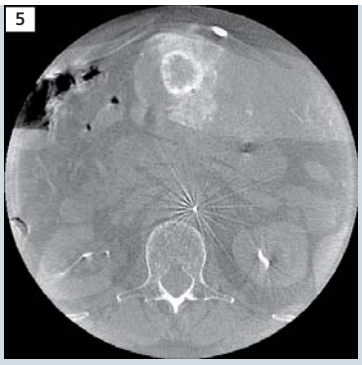
Tobias Jakobs, M.D., Department of Radiology,
Ludwig Maximilian University of Munich, Grosshadern Campus, Munich, Germany



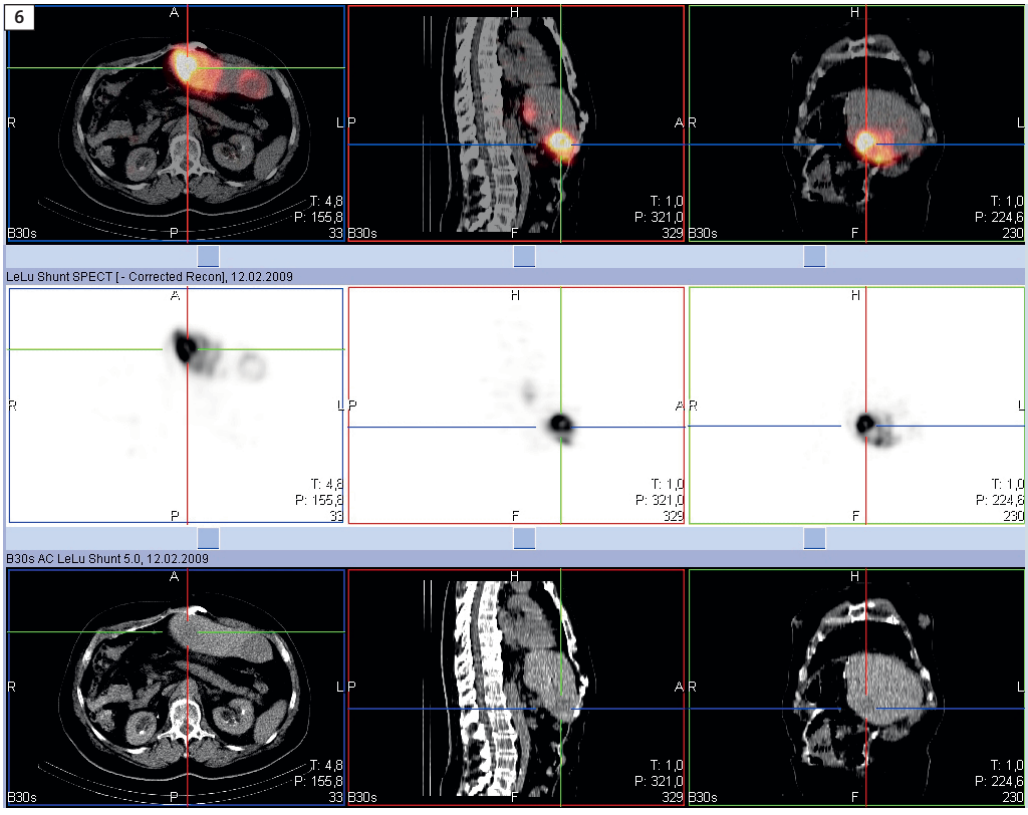
3 Large Volume *syngo* DynaCT; transaxial.



4 Large Volume *syngo* DynaCT; sagittal.



5 A second *syngo* DynaCT revealed that there is no more evidence for ectopic contrast uptake in the stomach but complete coverage of the tumors.



6 Confirmation with SPECT-CT after injection of technetium-99m macroaggregated albumin.

Therapy of Aorto-pulmonary Collaterals in Tetralogy of Fallot
Supported by *syngo* iPilot

Courtesy of Prof. Sven Dittrich, M. D,
Department of Pediatric Cardiology, University of Erlangen, Erlangen, Germany

Patient history
2-year-old girl

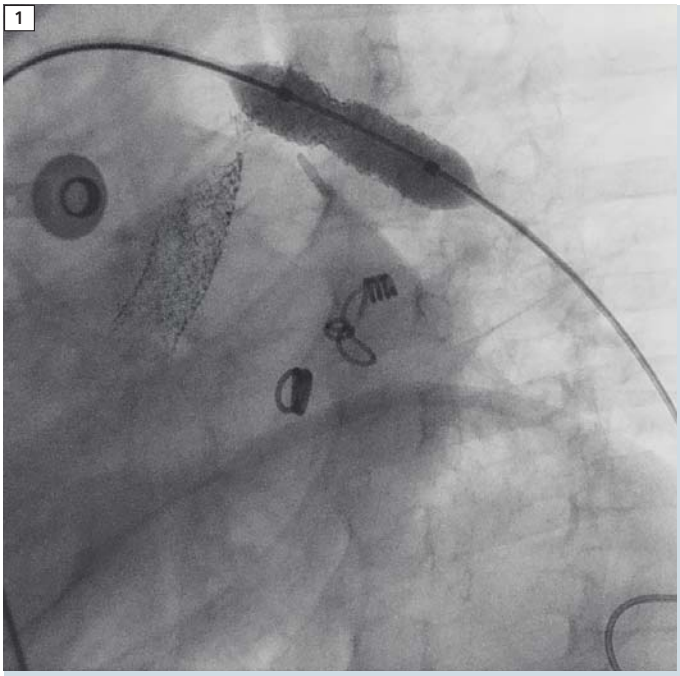
Diagnosis
Patient suffers from Tetralogy of Fallot and latest angiography shows a moderate pulmonary valve insufficiency.

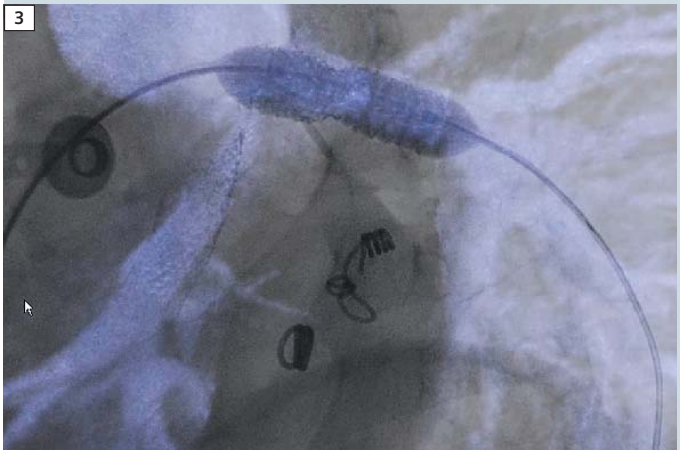
Treatment
Past medical history
The various pathological changes in Tetralogy of Fallot resulted in a right ventricular pressure just 10 mm Hg below systemic blood pressure. As the patient was suffering from severe infundibular and valvular pulmonary stenosis, six weeks after birth a pericardial patch graft was applied to the right ventricular outflow tract. In addition the central pulmonary arteries were severely hypoplastic, so that four months later 2 coronary stents (4 mm centrally, 3.5 mm peripherally) had to be implanted in a long and severe stenosis of the left pulmonary artery. This was followed by the implantation of a 15 mm long Herculink stent into the right pulmonary artery which was dilated to 4 mm. At the age of one year a coil embolization of major aortopulmonary collateral arteries (MAPCAs) between either the descending aorta or the right subclavian artery and the left and right pulmonary arteries was performed (Cook detachable coils, 5 mm 4 loops to the right and 2 x 3 mm coils each with 4 loops to the left). After this interventional cardiac catheterization, a second operation was planned in order to partially close the VSD (5 mm fenestration). Additionally, ASD closure, pulmonary artery graft using bovine pericardium, insertion of a valve prosthesis RV-PA conduit (16 mm Matrix-P-Plus), closure of the last patent MAPCA originating from the aortic arch were performed on the patient. Three months later the stent in the right pulmonary artery was re-stented (7 mm diameter, 18 mm long, Terumo-Tsunami) and two stents were implanted into the left pulmonary artery (Herculink, 6 mm diameter, 12 mm long peripherally and Herculink 6.5 mm diameter, 12 mm long centrally).

Present medical treatment
One year later the stents in the right and left pulmonary arteries were re-dilated with an 8 mm Cordis Powerflex Balloon (13 atmospheres). Here the catheterization was started with a *syngo* DynaCT Cardiac (5 sec C-arm rotation with 30 pictures per second) while injecting contrast agent into the central pulmonary artery. After 3D reconstruction, the 3D visualization of the complex anatomy could be used to choose appropriate guiding catheters to enter the pulmonary artery branches.

Comments
syngo iPilot was used for super-imposition of the 3D visualization on the live fluoroscopy images. Additionally, the three-dimensional imaging was helpful for the positioning of the X-ray tubes in an appropriate angulation without further contrast medium application. Thus the 3D picture helped extend the interventionalist's view of the anatomy and expedited the intervention significantly.

Contact
norbert.rahn@siemens.com





1 Fluoroscopy of the right pulmonary artery.

2 3D visualization for following intervention.

3 Overlay of 3D image onto live fluoroscopy for re-dilatation of the stent.

syngo DynaCT Cardiac supports Careful Treatment of Atrial Fibrillation

The Na Homolce Hospital in Prague is one of the most modern hospitals in Europe and delivers up-to-date healthcare for its patients. The hospital's Heart Centre provides a comprehensive program of care for patients suffering from cardiac diseases, both within the area of diagnostics as well as a wide range of state-of-the-art therapeutic procedures. The scale of activities places them among the top-ranking centers in Europe, particularly in the field of arrhythmology.

Atrial fibrillation (AF) is the most common irregular heart rhythm that starts in the atria and it behaves like an independent risk factor. AF occurs due to rapid, disorganized electrical signals in the heart's two upper chambers (the atria) which cause them to contract very fast and irregularly, forcing the atria to beat more than 300 times per minute in a chaotic fashion. Patients with AF may suffer from palpitations, shortness of breath, irregular heartbeat, chest discomfort and dizziness. Some have a feeling of weakness, caused by the heart's diminished pumping ability. Moreover, this can be the cause of ischemic stroke. The awareness of a rapid and/or irregular heartbeat also may cause some patients to feel quite anxious. People with an additional heart disease are generally less able to tolerate AF without complication. Once AF becomes symptomatic, it becomes more serious as it indicates that the heart is failing to pump adequate amounts of blood to the body.

syngo DynaCT Cardiac supports the Treatment of Atrial Fibrillation

Radiofrequency catheter ablation is an evolving minimally invasive and one of the most efficient treatment methods for atrial fibrillation. Until the introduction of *syngo* DynaCT Cardiac within the EP lab, when the operator uses the image integration technique to get ideal anatomical borders of the left atrium (LA), CT or MR images had to be acquired before performing ablation procedures. Due to the time lag between acquisition and procedure, the accuracy of positioning and topographic agreement between the CT image of the LA and the actual position of this anatomically very complex structure was likely to be compromised. *syngo* DynaCT Cardiac has the potential to replace pre-procedural CT or MR imaging as it provides sectional 3D images before the ablation procedure offering better

1 *syngo* DynaCT Cardiac integrated into CARTO. Right lateral view, green points represent calculated deviations from electro-anatomical map to the *syngo* DynaCT Cardiac surface which is on average around 1 mm or less.

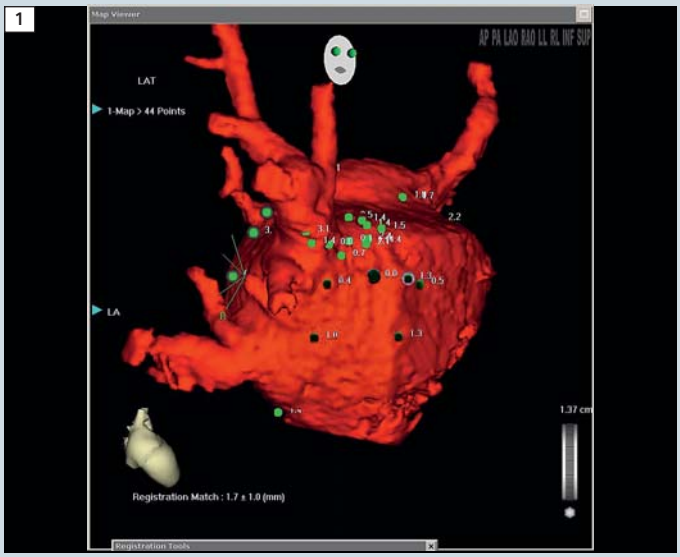
2 Modified PA view of atrial tachycardia with *syngo* DynaCT Cardiac with electro-anatomical CARTO activation map. Red points represent ablation sites.

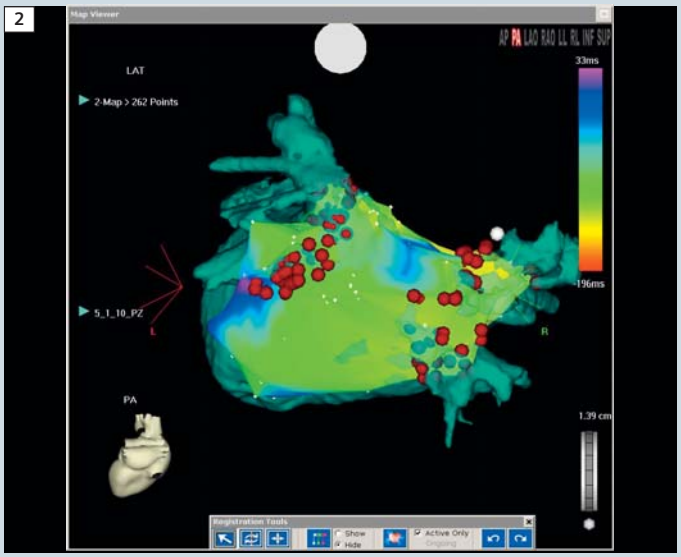
3 *syngo* DynaCT Cardiac map from AP view transferred to CARTO.

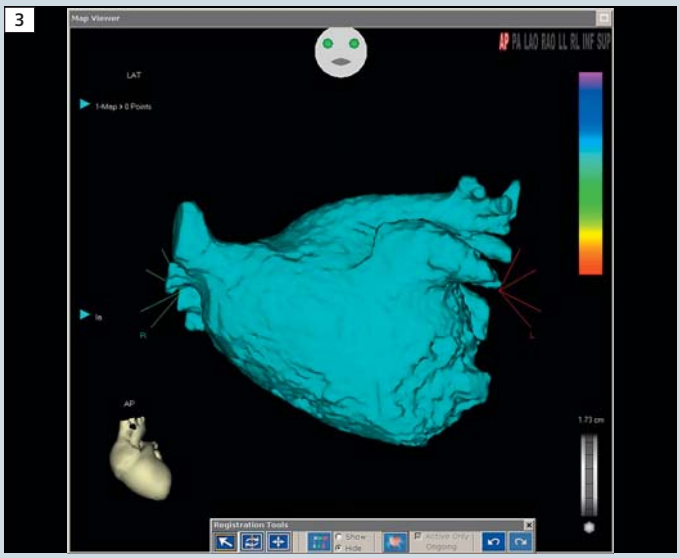
4 PA view after *syngo* DynaCT Cardiac mapping.

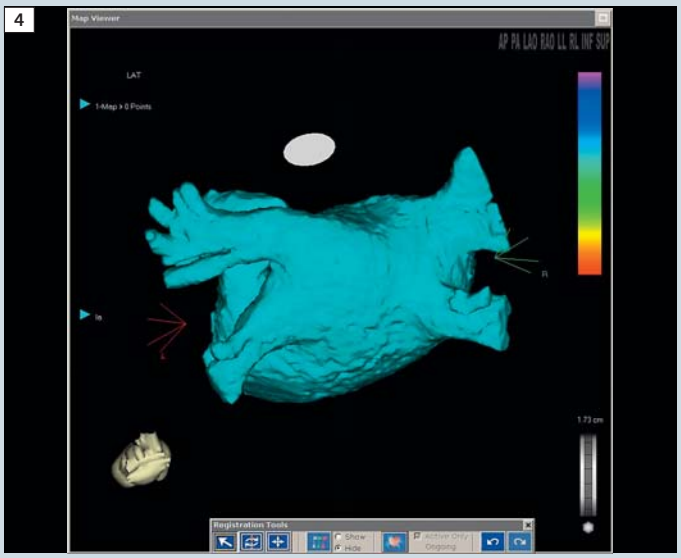
5 Regular MSCT integration with CARTO electro-anatomical map.

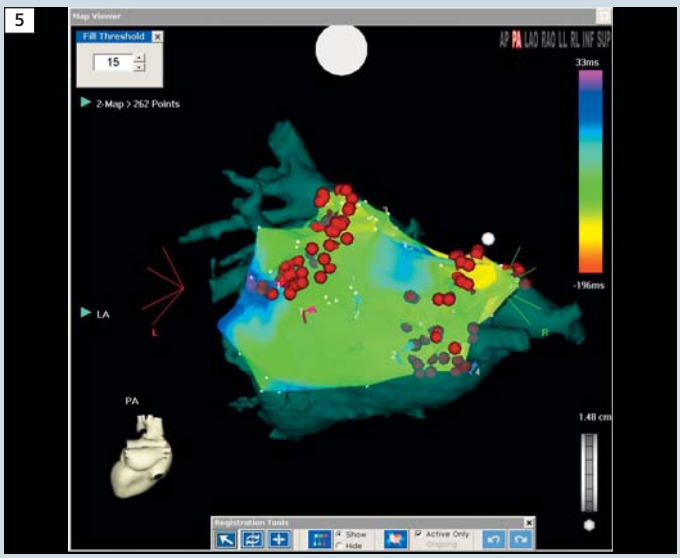
6 Navigant screen from Niobe magnetic navigation, overlay of *syngo* DynaCT Cardiac, MSCT and CARTO electro-anatomical map.

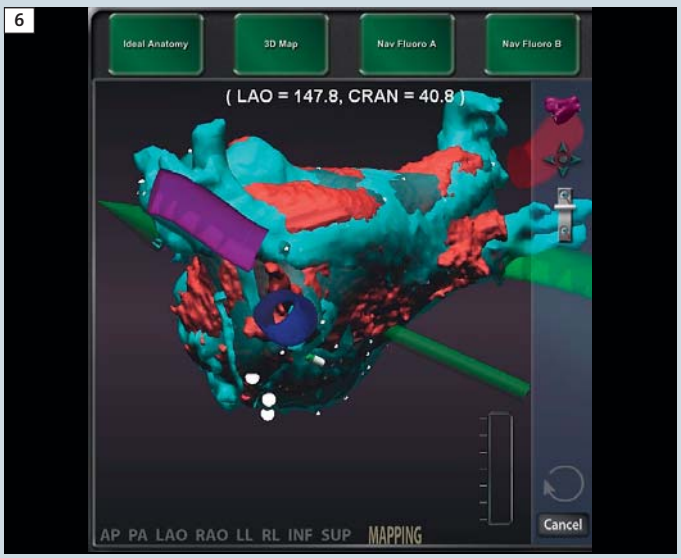

1
Map Viewer
AP PA LAO RAO LL RL INF SUP
LAT
1-Map > 44 Points
LA
Registration Match : 1.7 ± 1.0 (mm)
Registration Tools
1.37 cm


2
Map Viewer
AP PA LAO RAO LL RL INF SUP
LAT
2-Map > 262 Points
33ms
-196ms
5_1_10_PZ
PA
1.39 cm
Registration Tools


3
Map Viewer
AP PA LAO RAO LL RL INF SUP
LAT
1-Map > 0 Points
AP
1.73 cm
Registration Tools


4
Map Viewer
AP PA LAO RAO LL RL INF SUP
LAT
1-Map > 0 Points
1.73 cm
Registration Tools


5
Map Viewer
Fill Threshold
15
AP PA LAO RAO LL RL INF SUP
33ms
2-Map > 262 Points
-196ms
LA
PA
1.48 cm
Registration Tools


6
Ideal Anatomy
3D Map
Nav Fluoro A
Nav Fluoro B
(LAO = 147.8, CRAN = 40.8)
AP PA LAO RAO LL RL INF SUP
MAPPING
Cancel

Prior to start of the procedure Prof. Neuzil discusses the treatment strategy with his team.

Technician Lenka Plevkova segments the left atrium from the 3D data acquired with *syngo* DynaCT Cardiac.

visualization of the heart's anatomy when the patient is on the table in the EP lab for treatment. With *syngo* iPilot the segmentation result can additionally be overlaid with live fluoroscopy. This 2D/3D overlay facilitates orientation and catheter guidance during AF ablations. Additionally, structures like the esophagus can be visualized during the intervention, providing detailed morphologic information and visual guidance to perform ablations with more confidence.

Experience with *syngo* DynaCT Cardiac within the EP Lab

The 3D image is generated by a single 5-second rotational C-arm angiography during selected contrast injection into the pulmonary artery (PA) or direct bolus injection in the left atrium (LA). Prof. Petr Neuzil, Head of the Department of Cardiology, had very good experience with rapid pacing in both approaches for visualizing the left atrium (LA). The contrast stays within the LA and creates optimal conditions for excellent visualization of the atrium. Patients can easily tolerate this additional application of contrast medium, which lasts only 5 - 6 seconds during a single *syngo* DynaCT Cardiac acquisition run. Furthermore, it is important to capture the same anatomy in the proper position. "When we apply the contrast in either PA or LA", Prof. Neuzil explains "the arms of the patient can stay in a comfortable position beside the body or crossed on the patient´s belly during the *syngo* DynaCT Cardiac acquisition. This is critical for the registration accuracy of the *syngo* DynaCT Cardiac volume in regard to the Carto electro-anatomical map." Prof. Neuzil's team did verify that the "arms-up position" clearly elevates the chest of the patient by several centimeters. This results in a shift of the acquired 3D volume of the LA which will then have a negative effect on the registration accuracy. The high rate pacing guarantees a high contrast throughout the *syngo* DynaCT acquisition regardless of the position of the arms and minimizes the amount of the contrast medium as well. The acquired CT-like 3D images with *syngo* DynaCT Cardiac provide the morphology of the left atrium in real time. The surface of the left atrium can be segmented in 3D with *syngo* InSpace EP. This software enables detailed visualization of e.g. the current position of the esophagus or the pulmonary veins during ablation procedures. In the Na Homolce Hospital EP lab, AF procedures are done using the Niobe magnetic navigation system (Stereotaxis Inc.). Prof. Neuzil uses the imaging system with a 20 x 20 flat detector and considers 3D imaging with *syngo* DynaCT Cardiac as a fantastic way to get a quick and reliable overview of the left atrial anatomy. "Unlike electro-anatomical mapping, *syngo* DynaCT Cardiac acquires the volume without pushing the wall of the heart chambers with a catheter and supporting sheaths, and therefore avoids the deformation of the anatomy. This is a perfect starting point for magnetic navigation with the Niobe™ Stereotaxis system and makes us even more efficient". Furthermore Prof. Neuzil reports "we have worked hard for a direct implantation of a *syngo* DynaCT 3D reconstructed LA body to remotely control the catheters with the Niobe™ magnetic navigation software."

Time for training: Prof. Neuzil explains his treatment approach.

A great team: Assoc. Prof. Petr Neuzil, M.D., Ph.D., FESC.– Head of cardiology, Jan Skoda M.D., Jan Petru, M.D., Michal Ritoch (from right to left).

Less Dose with *syngo* DynaCT Cardiac

Radiation doses to patients undergoing radiological procedures should be kept as low as reasonably practicable consistent with the intended purpose. It is, however, relatively rare in general radiology that an examination protocol is selected that intentionally sacrifices image quality in order to reduce patient dose. The types of examinations that can use this strategy are limited to those where the requirement is only to adequately distinguish high contrast features. Procedures that could be considered to be in this category are, e.g. cardiac pacing and electrophysiology. In these procedures pacing or electrophysiology catheters are inserted via a vein or artery and guided into the heart using fluoroscopy and electrocardiographic monitoring. The demands on fluoroscopy during positioning of the mapping catheter and during RF ablation are significant. Siemens continually innovates for best patient care, which means a minimum level of radiation dose achievable with *syngo* DynaCT Cardiac. *syngo* DynaCT Cardiac offers images with high resolution but less dose for confident diagnosis and best visualization during electrophysiological interventions.

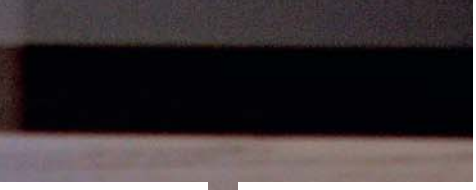
Enhanced workflow for atrial fibrillation procedures

The target of the Na Homolce Hospital EP team is to minimize the time for *syngo* DynaCT Cardiac acquisition and they were able to achieve approximately 20 minutes for indirect PA contrast injection and not more than 15 minutes for direct LA contrast injection.
For logistics and organization of the catheter ablation procedures, it is very important to reduce the number of regular pre-procedure CTs." As we have referals from all parts of the country we can now organize patients better with only one stay for the ablation procedure and reduce the cost of AF ablation. And last but not least, we can spontaneously decide to perform an AF catheter ablation procedure when it is needed and the patient agrees. Even in those cases where only an atrial flutter procedure was originally planned". After less than one year experience we made great progress. In conclusion, *syngo* DynaCT Cardiac is virtually the routine approach in our lab despite several ongoing research programs."
Approximately 500 patients with atrial fibrillation are treated at the Na Homolce Hospital per year. This requires good planning for the best workflow and the system requirements for electrophysiological treatment are accordingly high. To meet all these demands they plan the installation of a third remote navigation system. This exemplifies the philosophy of Na Homolce hospital: To invest in the best technology for hybrid procedures, combining cardiac surgery and interventions. Additionally, the daily use of *syngo* DynaCT Cardiac will be standardized for interventional cardiology managed by an interdisciplinary team.

Contact
erik.busch@siemens.com

Hybrid Room Revolutionizing Trauma Treatment in Sweden

By Nils Lindstrand



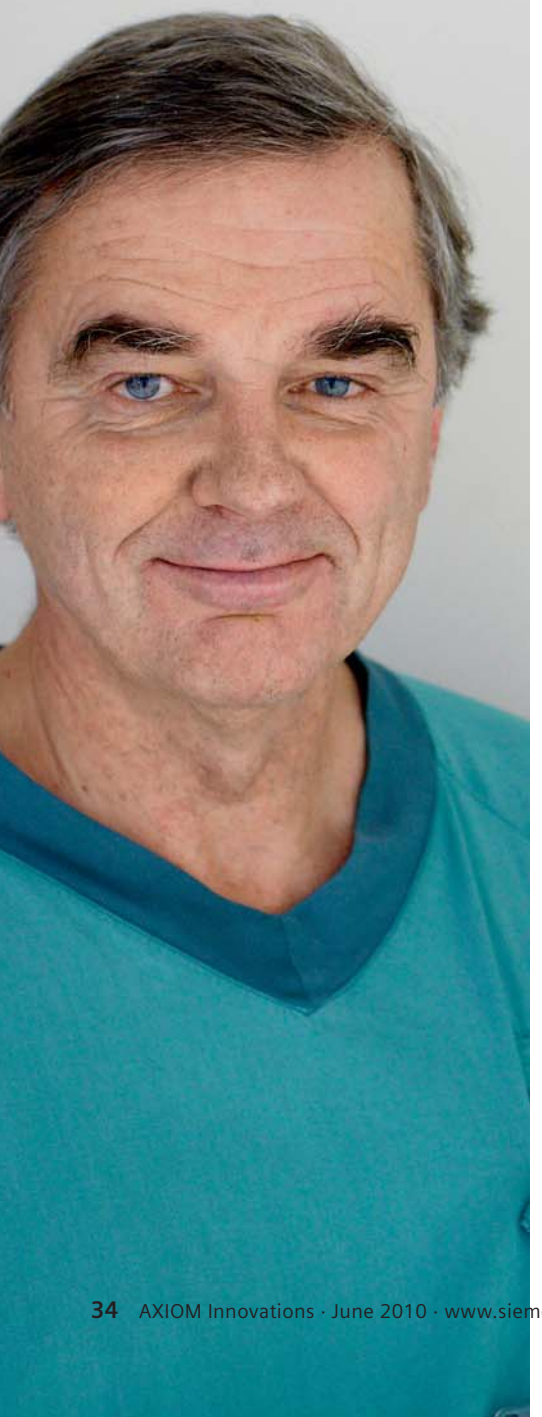
Karolinska University Hospital in Stockholm built the world's first hybrid room with a Siemens Artis **zeego** system dedicated to treating trauma patients. The project was linked to the decision from the Stockholm region to concentrate trauma treatment to this hospital. The only system available that met all the criteria set up by the hospital was the Artis **zeego**, the multi-axis C-arm system based on robotic technology from Siemens Healthcare.

Dr. Linus Blohmé, you are Head of Trauma Surgery at Karolinska University Hospital in Stockholm. Why did you first choose to work with Siemens and Artis **zeego** when you started planning this project in 2006?

We had three critical demands for the hybrid room. We needed high-quality advanced imaging in combination with open floor space to make it possible for all involved personnel to move around freely. Further, we decided we needed to create an extremely clean atmosphere. To achieve this we needed to keep the ceiling clear of equipment. The solution with the robot-based multi-axis C-arm of Artis zeego, which is a floor-mounted system, was the only solution to give us all this. This way we could build a hybrid room without compromise. The bar for hybrid rooms has been raised.

You have now worked in the hybrid room for some months since the startup in summer of 2009. What are your experiences so far? How is the room used today?

The room functions very well. We believe we have achieved all the goals we were aiming for. Surgeons and other staff can move around the room without risk of hitting the C-arm. The



imaging systems are working very well, and the environment for the entire staff involved in procedures is very good. Images are distributed to a number of screens, providing up-to-date information visible all over the hybrid room. We are also very satisfied with the communication between the hybrid room and the control room, and also with an observation room close by. This system gives anyone coming into an ongoing procedure the chance to get up-to-date information without entering the room. One can also get additional expert advice from people outside the room. In this way, we avoid a lot of traffic in the hybrid room during procedures. The laminar air flow system provides an extremely clean atmosphere without the risk of contamination that any equipment attached to the ceiling would bring.

Have you had a lot of attention from other hospitals?
Yes, quite a lot. We have had visits from many other hospitals. There are a number of hospitals in Sweden already using hybrid rooms, but we are the first to use it with a focus on trauma treatment.

Why did you choose to build a hybrid room in the trauma center? So far, hybrid rooms were far away from emergency cases and have mainly been used for treatment and research in well-planned cases.
Using a hybrid room for trauma treat-

Continuing to improve hybrid interventional methodology in Oslo

The hybrid room at Rikshospitalet in Oslo, Norway, one of the first Artis **zeego** installations in a hybrid environment, continues to focus primarily on developing methods for treating patients within a wide range of needs, and on testing devices (e.g., stents or valves for endovascular use, etc).
"Testing methods and devices is made more efficient using the advanced imaging possibilities provided by Artis zeego," says Per Kristian Hol, M.D., Manager of Radiology Research at the Interventional Center. "We get fuller and more detailed information by using this technology."
The Interventional Center at Rikshospitalet is a cutting-edge imaging department and a reference facility for a number of hybrid rooms built in recent years, including the Karolinska University Hospital.
"Yes, we've had a lot of interest from other hospitals," says Dr Hol. "We've had guests from all over the world, mainly from Scandinavia, Europe and the USA, but also from China and Japan."
Dr. Hol is very pleased with the functions of the Artis **zeego** and the enhanced support advanced imaging means for critical decisions.
"Today we're using this equipment and the hybrid room to develop a large number of procedures. Cardiology and angioplasty are still in focus, but we get a lot of interest from other fields such as audiology, where imaging technology is very useful for developing methods for cochlear implants in the inner ear for example." Examples can be given for most medical areas, and the hybrid room at Rikshospitalet is still being further developed in many ways. One is the "stage light" OR lighting system, in which the center is developing software to provide perfect lighting at any moment of any treatment. "The next challenge will be to develop methods within neurology," says Dr. Hol.

ment has advantages that may very well save many lives. People with trauma injuries often have major damage to blood vessels. Getting the optimal treatment for injuries like this is vital, and time is often of absolute critical importance. When a patient is bleeding inside we need to find the optimal treatment as fast as possible. The expression "the golden hour" holds true, and the hybrid room means we have a much better chance of saving patients' lives, and to minimize their suffering, by using advanced imaging to get a picture of the damage and a reasonable chance to choose exactly the right treatment. And we maintain this chance throughout the procedure.

What has been the major challenge in this project?

Probably the education and training task. We are in the process of teaching 300 of the hospital staff to work in the hybrid room. Obviously all of these 300 will not be able to do everything a specialist can do; the aim is to make all these people confident working within the hybrid room, helping the patient to breathe and to limit bleeding. This way we can push the time limit forward for specialists to arrive, and can also provide these doctors with a better chance to get detailed information about the case as they approach the hospital.

How is the hybrid room with the Artis **zeego** used today? Is it focused solely on trauma care, or is it used for other purposes as well?

The hybrid room at Karolinska University Hospital is focused on trauma patients; this is the major task for us. But to make the work in the hybrid room efficient, the staff needs to use it as much as possible. This is, of course, also important to reach a good level of economic efficiency, and to use the advantages of the hybrid room to give patients the optimal treatment.

In the future, we also have other possible ways to use this technology. One is to use it in maternity care, for example to treat problems with the placenta. By using the hybrid room, we may solve these problems more easily and without using dramatic solutions such as removing the uterus.

Dr. Pär Olofsson, you were Head of Surgery during the whole planning and implementation phase, and you were also the project leader in building the hybrid room. How would you describe the difference in trauma treatment, if you compare the situation with the hybrid room and the way you worked before you built this room?

The trauma center at Karolinska University Hospital was designed according to earlier standards: a helicopter pad, a triage room with a CAT scan unit and an OR. The distance to the operating suite was 20 meters, which is quite good. The distance to the intervention suite, however, was about 600 meters. This distance may still be okay. The problem is that with this distance you want to be very sure that's where you need to go. You don't want to push a severely traumatized patient that distance and then back again, which might be necessary if you don't have the imaging equipment to make a definite decision between interventional treatment and a surgical one. In practice, this meant that we sometimes probably chose surgery to save a life, when we should have chosen a less invasive procedure given more information. With a hybrid room we can use minimal-impact procedures in every single case.

Nils Lindstrand is a freelance business and technology writer based in Stockholm, Sweden.

Contact
anne.figel@siemens.com

Linus Blohmé, Head of Trauma Surgery (right) and Pär Olofsson, retiring Head of Surgery (left) recognized the advantages of a hybrid OR for trauma treatment.

In the interest of improved patient outcomes, increased workflow efficiency, and implementation of cutting-edge technology, The Prince Charles Hospital in Brisbane, Australia has embraced the benefits of a Siemens hybrid catheterization lab for cardiovascular procedures.

By Tim Thwaites

The Hybrid Cath Lab: A Revolution in Cardiac Care

What happens when a closed operation suddenly becomes open – when a catheter perforates an important blood vessel, for instance, and a routine procedure suddenly becomes life threatening? It's a potential problem associated with the increasing sophistication of transcatheter procedures, and it's often brought up by the cardiologists, surgeons and radiographers at The Prince Charles Hospital in Brisbane, Australia – because they have faced it.

"One of the recommendations that came out of our safety committee was that we must get into a hybrid lab as soon as it becomes available," says Darren Walters, M.D., Director of Cardiology at the Prince Charles. "If you have to move people in the middle of an emergency from a catheterization lab to a main operating theater up three floors, it's an enormous logistical undertaking, and it puts the patient at risk." The hybrid room – an integration of cath lab and operating theater – takes a significant amount of risk out of such an emergency by enabling an instant switch from a percutaneous procedure to surgery. The fact that this was used in Brisbane as an argument for the operation of a hybrid room shows how far the technology has come in less than a decade. Even though the concept is still novel, its potential benefits are so apparent already that expense is now just one factor among many to be addressed in the business case and the decision to go ahead. And certainly for a large public hospital, such as the Prince Charles, it was probably not the most important. "If you're a major teaching hospital and a cardiovascular center of excellence, then you really are not going to be able to continue to provide the highest levels of care if you don't have these sorts of facilities," Walters says. "It's not so much about an instant return on dollars and cents, as about placing yourself strategically so that you

can be involved in the development of cutting-edge techniques that ultimately improve patient outcomes."

The Need for Integration and Coordination

Moving a catheter laboratory inside an operating theater is no easy matter. It creates a complex environment in which each piece of technology has to be carefully integrated. How can adequate high-end imaging be provided, for instance, without getting in the way of surgical lights and ventilation? What sort of surgical table do you install to service the needs of both open and closed surgery? What sort of space is required for surgical teams sometimes amounting to ten or more people? When the equipment for anesthesia is added, how do you ensure that lights, monitors, tubes, movable X-ray equipment, lead plate protection and people do not get in each other's way?
The hybrid room that Siemens built for The Prince Charles Hospital is large, above 80 square meters. It is fitted with an operating table, above which is a ceiling-mounted track running lengthwise. Along this track a Siemens Artis zee ceiling-mounted C-arm system can be moved in and out to provide sophisticated imaging during procedures. Around the operating environment are groups of surgical lights and monitors attached to arms extending from the ceiling that can be moved into any position manually. And there are also mobile stations for standard connections to medical gases and suction.

New Procedures Demand New Equipment

The budget for the whole hybrid unit was almost 3 times the budget for a classic interventional cath lab. "It's not just the imaging technology, it's all the additional equipment – the hemodynamic monitoring, the refit of the room, the upgrade of the audiovisual capability – there's quite a bit of money involved," says Walters. "The business case flagged the move to increasing endovascular treatment of conditions that had previously been managed with open surgery, conditions for which neither the existing catheter labs nor the operating theater were an ideal environment," he adds. "When catheter labs and OR theaters were designed, these new procedures did not even exist. For the cath lab, the issues include factors such as available space, sterility and access to OR theater facilities. In the operating theater, on the other hand, there's no access to acceptable imaging, and there's an increasing need for catheter-based technologies."
Walters continues, "In looking forward, it is very clear that procedures are becoming less invasive and that imaging is becoming increasingly critical to the interventions. All sorts of endovascular work, from cardiac surgery to cardiothoracic surgery, such as aortic stent grafts, and to vascular surgical procedures, as well as percutaneous aortic valve replacement, insertion of biventricular pacemakers, removal of chronically implanted devices – all of these are areas in which you really require a hybrid environment."
Walters believes that one area this has opened up – the development of percutaneous valve replacement – is the next great step forward in interventional cardiology after coronary stenting. It is a significant component of a revolution in cardiac care. "If you don't have these sorts of facilities, you really cannot be involved in the clinical trials of these technologies," he says, "and it's going to make it very difficult for you to implement these techniques into routine practice."
Such techniques are opening the way to heart valve replacement for elderly patients in Australia who are at high risk from open surgery. In fact, at Prince Charles, only 15 percent of patients referred for percutaneous aortic valve replacements were deemed ultimately eligible for open surgery. But a further 40 percent were able to go on and have the replacement done using catheter-based techniques.
These particular patients suffer from conditions that lead to a relatively rapid death if not treated quickly, Walters says. And the early trial figures show that with percutaneous intervention, they have shorter hospital stays and significantly less morbidity and mortality. Those in this group who undergo open surgery often take more than six months to recover, he says, and even then can still be at relatively high risk of dying.

Dosage Reduction in Valve Replacement Surgeries

There are also new operations that could not easily take place in any other environment but the hybrid room. Although access for most percutaneous heart valve replacements is through the femoral artery, in some people – small, elderly women for example – that blood vessel is too small to use for access. For patients such as these, the operation can only be done by means of sub-clavian or transapical approach. The latter requires about a 5-centimeter surgical incision on the side of the chest, thus demanding a hybrid operating room in addition to catheterization. If undertaken in a standard operating room, where there would be no fixed imaging equipment, the catheter part of the operation would have to be undertaken using a mobile X-ray unit, which would involve relatively high doses of radiation and poor image quality. For such interventions, the Artis zee imaging systems, with their dose reduction programs, reduce the dose of X-rays significantly. It may be able to reduce dose in other ways too, as Prince Charles radiographer Jim Crowhurst is beginning to find out. The flexible C-arm on the Siemens Artis zee allows X-ray images to be taken from up to 290 degrees around a patient's body. And using Siemens *syngo* DynaCT software, three-dimensional images can be constructed. Crowhurst and Walters have found such images useful for a critical part of the aortic valve replacement operation – profiling the aorta to determine the right

angle at which to align the new valve. The 3D image produced using *syngo* DynaCT is easily good enough to use as an overlay on a real-time 2D roadmap image to determine the best angle for deployment of the valve. And this has some significant advantages, as the clinical researchers argue in the abstract of a paper they are submitting for publication. It can all be done while the patient is on the operating table, so that he or she does not have to move between image acquisition and valve implantation. Interestingly, the 3D profiling of the aorta turns out to be more accurate with the live *syngo* DynaCT Cardiac 3D data than on previously acquired CT scan images to determine the correct projection angles. Not only does this help in placing the valve more precisely, but the image can also be constructed with fewer X-ray shots, so a smaller volume of contrast agent can be used, thus additionally reducing the risk to the patient. Traditional pre-operation CT scans may even be waived in some cases, according to Walters.

The acquisition of increasing expertise and the ability to conduct research at the cutting edge means that the hybrid room at the Prince Charles will begin to attract even more skilled medical professionals to Brisbane. "I think that once this technology starts to become more widely disseminated, we can play a teaching role," says Walters. "You have to have the skill set to do these procedures. Before this facility became available, there was only myself and maybe one other doctor in Queensland who were regularly treating aortic valves percutaneously – in the catheter lab using balloon valvuloplasty. Over time, as hybrid room procedures become routine, you'll get more people coming back here who've been trained in these techniques. And the hybrid room also allows our people to go elsewhere to get training. Because if you want to go to the top medical centers in the world, you can't come from some tin shack."

"If you're a highly specialized center, a cardiovascular center of excellence, then you really are not going to be able to continue to provide the highest levels of care if you don't have these sorts of facilities."

Darren Walters, M.D., Director of Cardiology
at The Prince Charles Hospital, Brisbane, Australia

Learning to Manage the Learning Curve

Walters freely admits that learning to operate in the hybrid room is still a work in progress – a delicate ballet of equipment and people. "We've had to work through the inevitable glitches that can be both technical and workforce-related. Bringing surgery and anesthetics and cardiology together for the first time, there's a certain amount of sorting out to do. Initially it can be hard, because you've got people from different backgrounds, different cultures, not used to working together. The teams take a little while to storm and form, and to work out who's who in the zoo. But if you can get through that, you start to deliver the benefits that teamwork and collaboration can bring." Clear role definition is critical, he says, determining who is in charge of what and where, for instance, where the theater nurses' responsibilities begin and end. Having a disaster plan is very important. "Rather than learn by experience, you really need to role play and try to anticipate. That's what we've done."

Around the world, colleagues told Walters of several places where hybrid rooms had been established but were underutilized. "They've encountered these sorts of issues and retreated back to their own environment. It has been a failed experiment for them, and I think it may be that perhaps they don't have the right approach toward developing a collaborative, team-based effort. You've got to know where people will stand, who's going to move what. That's part of the whole role play."

Collaborative Planning Pays Off

Careful planning extends to each procedure. Setting up the room for a day's work, deploying the C-arm, monitors, lights and all the other equipment, can involve considerable discussion beforehand between radiographers, theater staff, cardiac surgeons, cardiologists and anesthetists, so that all moves like clockwork during surgery.

Even before the hybrid room at the Prince Charles began operating in June 2009, staff from every discipline in the hospital, along with the companies supplying the equipment, were deeply involved in the decision-making, design and planning process. "There were up to 30 people sitting around the table consulting with Siemens," says Crowhurst. It was an iterative process with designs being drawn up, submitted, considered, modified and brought back time and again. In fact, after the decision to go ahead, the whole process of designing and constructing the room took about six months.

Siemens is one of only a couple of high-end providers of such technology, Walters points out, "And there's a yawning gap to the rest." The company was selected on a whole range of criteria because of its total package, including cost, he says, but particularly because of the high level of its image quality, its reliability, the fact that it had a proven track record, and, just as important, Siemens product support. Also, two catheter laboratories built only a year before the hybrid room at the The Prince Charles Hospital are equipped

with a Siemens Artis zee biplane imaging system, so the hospital had already had experience working with the company.

One aspect of the planning stage is to ensure that the equipment supplied fits the future purpose of the hybrid room. At The Prince Charles Hospital, that involved flexibility – since the room is also being used for vascular surgery as well as cardiac and coronary procedures. Because of the room's dual nature, the planning group decided to specify a larger, 30 x 40-centimeter flat detector on the Artis zee imaging system, instead of the 20 x 20-centimeter typically used in coronary interventions. It was partly a compromise, Walters explains: "A big detector allows you to cover larger organ systems, so if you are doing thoracic endovascular stenting work, for instance, a large detector will work well for you. But if you are doing very small coronary work, you do lose a degree of sharpness. It's quite a subtle difference."

Although The Prince Charles Hospital deliberately started slowly, the hospital is rapidly working towards full utilization of the hybrid room as vascular surgery comes on line. "I think it takes at least a good six months to get it right," Walters says. It also takes persistence. But at The Prince Charles doctors, nurses and radiographers have resisted going back to how they worked in the past, because they see the hybrid room clearly as the way of the future.

Tim Thwaites is a veteran freelance science writer, editor, university teacher and broadcaster based in Melbourne, Australia. As a foundation member of Australian Science Communicators, he was national president from 2007-2009, acting as co-chair of the program committee for the 5th World Conference of Science Journalists in Melbourne in 2007 and convening the ASC National Conference in February 2010. Tim currently works for Science in Public, a science communication company based in Melbourne.

Contact
anne-eloise.cournut@siemens.com

Revision of an AAA Endograft
Supported by Artis **zeego** and *syngo* DynaCT

Courtesy of Amit V. Patel, M.D.,
Morristown Memorial Hospital, Morristown, NJ, USA

Patient history
An elderly man was found to have a large infrarenal aortic aneurysm. He was treated and an endograft was placed. Annual CT scans were performed, and for five years the device maintained its position and exclusion of the aneurysm. The CT scan at year six noted that the device had collapsed into the aneurysm sac, and the aneurysm was again pressurized.

Diagnosis
Further examination of the CT scan revealed that with collapse of the device, there was a large amount of metal just above the aortic bifurcation that might hinder any endovascular attempt at repair. As such, a plan was made to treat the patient in a hybrid Artis zeego room. The advanced imaging would allow more options endovascularly, as well as allow conversion to an open repair, if necessary.

Treatment
Access to the arterial system was obtained from both femoral arteries. *syngo* DynaCT images were obtained which clarified the position and structural position of the old stent (Fig.1). A 3D angio was also performed which shows the position of the migrated device and the endoleak (Fig. 2). Another endograft system, with suprarenal fixation, was advanced from the right, positioned, and then deployed in position. The contralateral gate to this device was obstructed by the prior device's stent structure, which had created a mass of wire at the aortic bifurcation (Fig. 3).
Ultimately, a large balloon was used to deform the old stent, and then appropriate access to the new stent from the left was performed. The new stent system was completed and completion studies show an excellent result with exclusion of the aortic aneurysm. Another *syngo* DynaCT acquisition shows the relationship of the two devices, as well as the integrity of the repair, with no evidence of an endoleak (Fig. 4).

Comments
The patient is now six months post procedure and follow-up CT scans show the new device in appropriate position and the aneurysm excluded.

Contact
sudhir.kulkarni@siemens.com

1 *syngo* DynaCT showing position of old stent.

2 3D Angio clearly showing the endoleak.

3 Visualization of mass wire at the aortic bifurcation.

4 *syngo* DynaCT image of the repaired stent without endoleak.

Aortic Valve Implantation
Supported by *syngo* DynaCT Cardiac and new segmentation and guidance software*

Courtesy of Gernot Brockmann, M.D., Domenico Mazzitelli, M.D., Sabine Bleiziffer, M.D., Prof. Robert Bauernschmitt, M.D. and Prof. Rüdiger Lange M.D., Department for Cardiology, German Heart Center, Technical University Munich, Munich, Germany

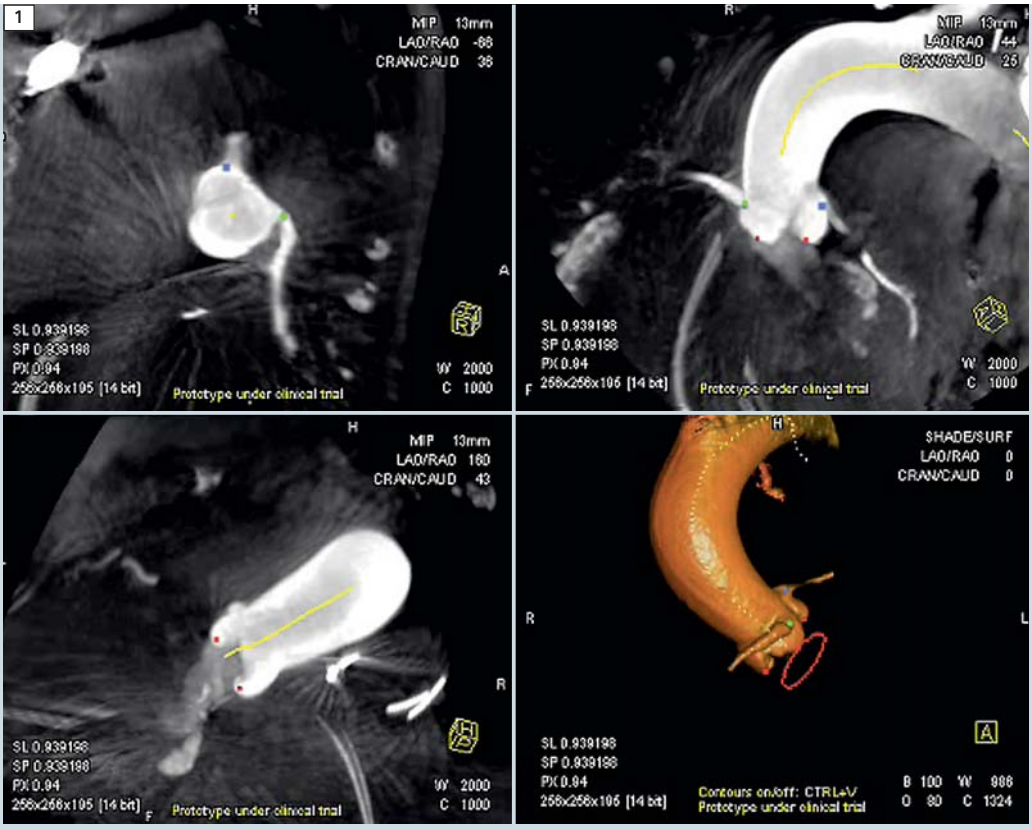
*WIP. The information about this product is preliminary. The product is under development and not commercially available in the U.S., and its future availability cannot be ensured.

Patient history
A 52-year-old female

Diagnosis
Patient with high-grade aortic valve stenosis (EOA: 0.5 cm^2, pmax: 91 mm Hg, pmean: 48 mm Hg) was scheduled for transfemoral catheter valve implantation because of a highly increased operative risk (EURO Score 28 %, STS Score 11.9 %) due to the following comorbidities: pulmonary hypertension (p systolic: 65 mm Hg), severe chronic restrictive pulmonary disease, scleroderma, renal insufficiency (creatinine: 5 mg/ml), and chronic dialysis. She has undergone previous interventional ASD closure.
In addition, a mild mitral and tricuspid valve insufficiency were diagnosed.

Treatment
The procedure was performed under general anesthesia to assure stable hemodynamics and to avoid patient movement during valve implantation. *syngo* DynaCT Cardiac images were acquired during cardiac arrest with adenosine (1mg/kg). Contrast dilution 1:5 (Imeron 300 Schering, Germany) was injected into the aortic root via a pigtail catheter. The contrast agent remains in the aortic root during cardiac arrest and *syngo* DynaCT Cardiac imaging.
The new segmentation software based on the *syngo* platform automatically segments the aortic root in only a few seconds (Fig. 1). Furthermore, it detects and marks the coronaries and hinge points of the aortic cusps. The hinge points are connected and appear as a red oval ring 1 cm below the aortic valve. Guided by an overlay of the 3D segmentation results on the real-time fluoroscopic images, the C-arm can be placed in a position orthogonal to the aortic valve plane (Fig. 2).
For preparation of the annular landing zone a balloon valvuloplasty (22 mm) of the stenotic aortic valve was performed under rapid ventricular pacing at 180 beats/min.
Under fluoroscopy control, the prosthesis (CoreValve 26 mm), crimped on the delivery catheter, is placed in the aortic annulus. Positioning was confirmed by angiography and 3D overlay (Fig. 3). Implantation height was adjusted considering the hinge point oval ring. Intraoperative echocardiography and angiography revealed good valve position and no relevant aortic insufficiency. The patient had an uneventful post-operative course and was discharged on the seventh post-operative day in good clinical condition.
In summary, the new automatic *syngo* based software facilitates catheter valve positioning and deployment by exact C-arm adjustment orthogonally to the aortic valve plane. The automatic detection and marking of the coronaries may prevent coronary flow impairment by the device. Thus, it improves accuracy of catheter valve implantation procedures.

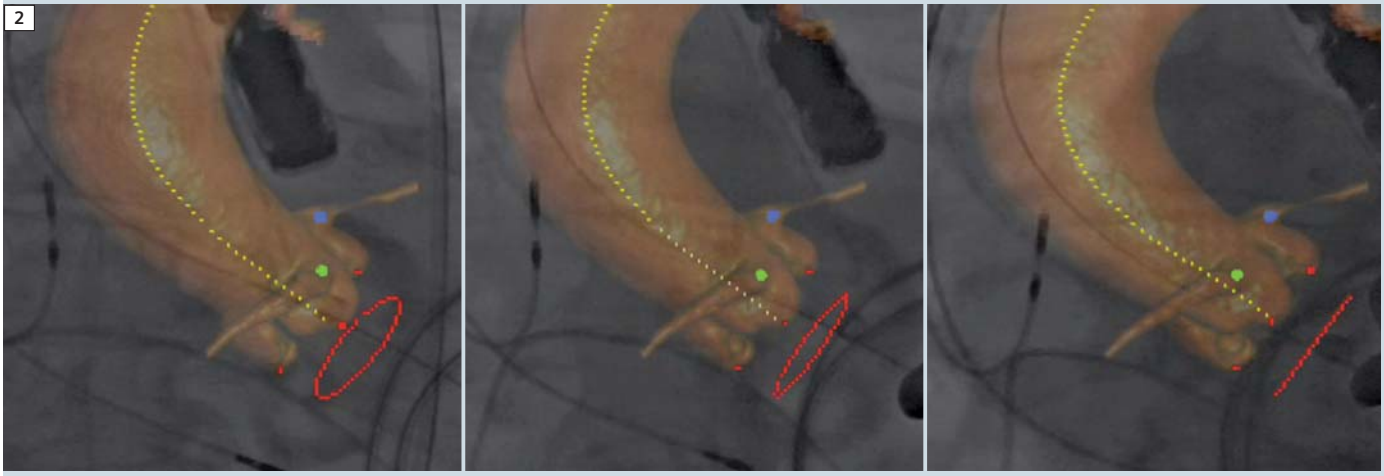
Contact
anne.figel@siemens.com

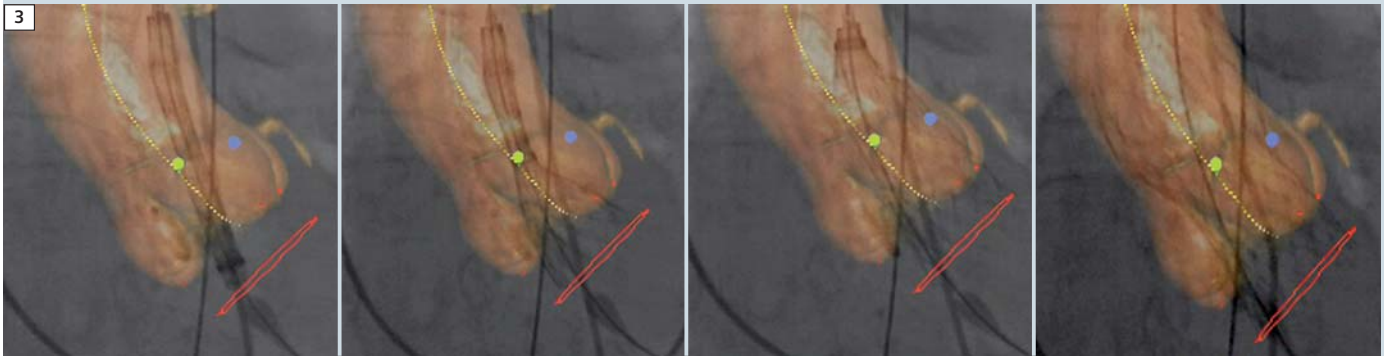


1 Correct marker detection in three orthogonal planes (green: right coronary artery, blue: left main stem, red: hinge points of the aortic cusps); right lower image: 3D volume rendering.

2 C-arm adjustment according to the computed red ring which should be visualized as a line for orthogonal view of the aortic valve plane.

3 From left to right: stepwise CoreValve deployment with overlay of 2D fluoroscopy real-time image and automatic 3D aortic volume rendering achieved by the new *syngo* based software.





Computer-Aided Detection for Digital Radiography

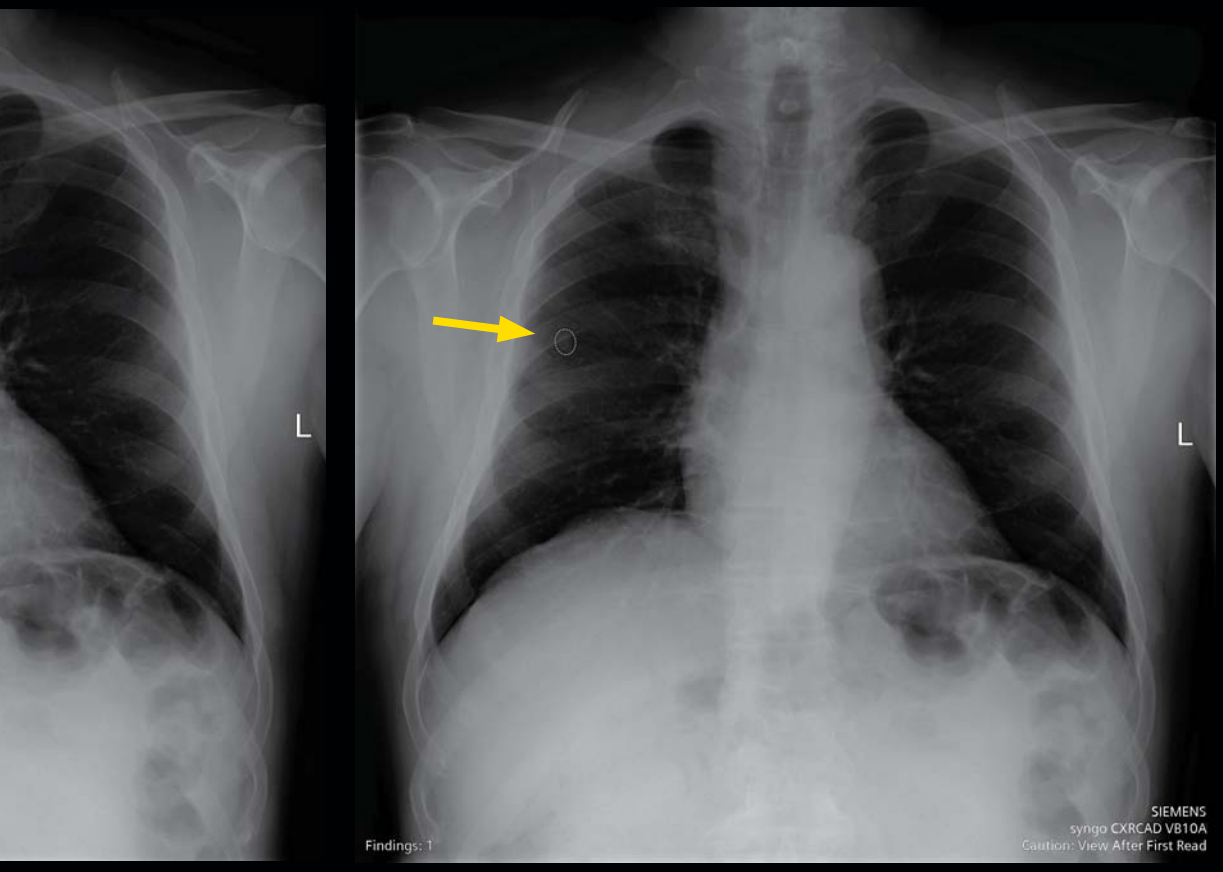
X-ray image without CAD

With the volume of data clinicians analyze every day, using computer-aided detection (CAD) for chest X-ray (CXR) can provide diagnostic confidence and workflow enhancements.

syngo® CXR CAD* is an algorithm that processes digital radiographs to help doctors detect potential nodules in the lungs. *syngo* CXR CAD is used as a second reader tool during the review and interpretation of digital chest radiography and has been validated for use with digital radiography (DR) systems. *syngo* CXR CAD has been optimized to identify possible lung lesions between 8 and 30 millimeters in diameter, and then displays the CAD results on Picture Archiving Communications System (PACS) workstations across the healthcare enterprise.

"When reviewing a chest X-ray, CAD helps identify larger nodules that are partially obscured by superimposed structures," said Peter Herzog, M.D.,

*Not for sale in USA. For availability in other countries, please check with your Siemens representative.



X-ray image with CAD

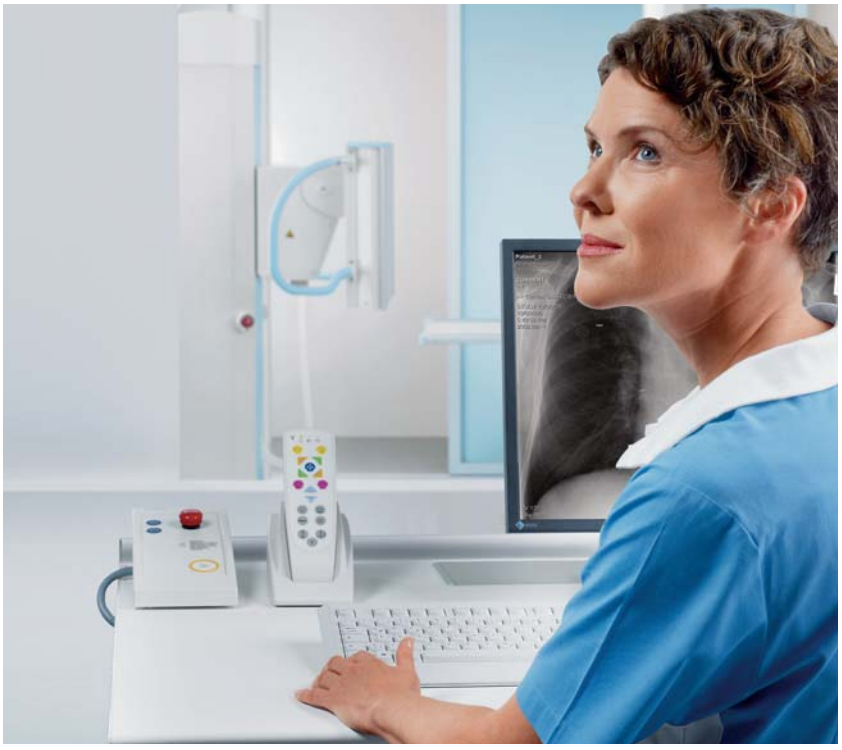
attending physician, Amper Kliniken AG Dachau, Germany. "The usage of CAD tools can substantially help reduce the number of lesions missed during routine X-ray readings."
The *syngo* CXR CAD algorithm uses advanced image processing, feature computations and pattern recognition technology to analyze the images for suspicious regions of interest. Regions marked by the software device are visually perceptible structures exhibiting generally accepted characteristics of solid nodules.

Innovative processing workflow

Siemens has combined an innovative software-as-a-service (SaaS) solution concept with the *syngo* CXR CAD algorithm to present a new paradigm. Similar to receiving an online subscription for a medical journal, *syngo* CXR CAD Subscription, is a solution that automatically and seamlessly provides the user with the latest CAD algorithms and features*. *syngo* CXR CAD Subscription customers with the Ysio digital radiography system and with the AXIOM Luminos dRF digital fluoroscopy system can receive CAD results via remote processing. For the initial deployment, access to the *syngo* CXR CAD Subscription is possible directly from the Siemens systems Ysio, AXIOM Aristos and AXIOM Luminos dRF with the Ysio option, for a seamless CAD workflow experience.

"*syngo* CXR CAD Subscription is the next step toward a fully integrated, virtualized imaging environment."

Peter Herzog, M.D.
Department of Clinical Radiology,
Amper Kliniken AG,
Dachau, Germany



"*syngo* CXR CAD Subscription helps save investment costs, energy and server room space in clinical institutions."

Prof. Reinhard Loose, M.D., PH.D.,
Head of Radiology at Klinikum Nürnberg-Nord in Nuremberg, Germany

The Klinikum-Nord in Nuremberg, founded in 1897, is a teaching hospital at the University of Erlangen with 2500 patient beds and one of the largest community hospitals in Europe. Since mid-April, close to 3000 cases have been processed using *syngo* CXR CAD Subscription, at a processing time of 4.5 minutes per exam on average.**
Off-site servers, managed by Siemens, utilize the CAD algorithm to process the CAD Image Signature (CIS) and deliver the CAD results back to the client located at the customer site. The client software links the patient to the CAD results, and sends the CAD image data to the PACS or another configured system. The CAD results are then added to the patient's study as a new image or series and are ready for review, providing a "second read" for the clinician.
Only the CIS is processed through the client software. The CIS does not contain any private information. Patient data never leaves the customer site. To further guarantee the integrity of the CAD results, the data is then encrypted adding an additional layer of security. Siemens regularly updates the CAD algorithms on its servers, without the need for customer interaction, to provide improved detection performance. The date of the algorithm release is shown next to the version number on the radiographic image, and can be referenced by the clinician to confirm the update.

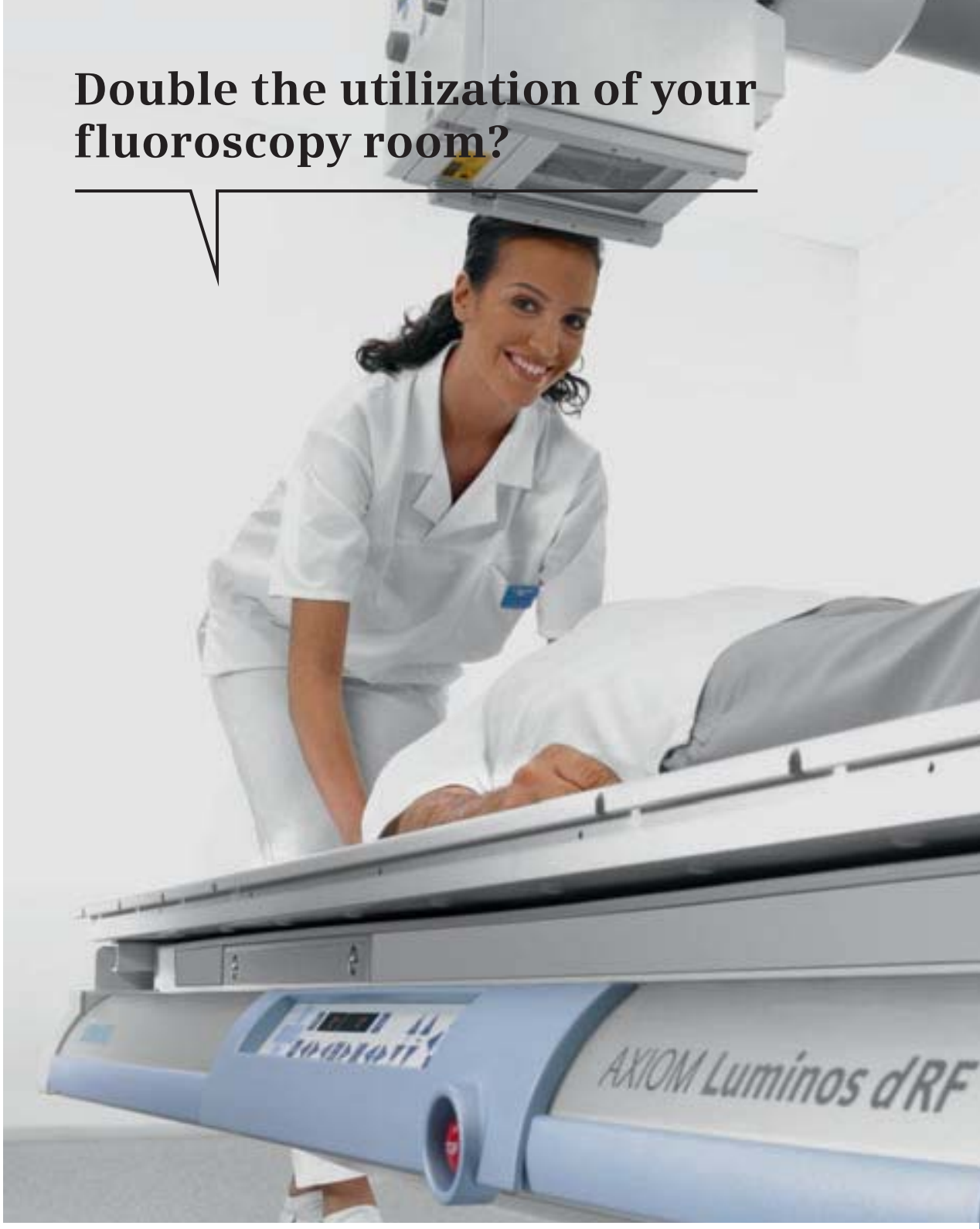
Security and privacy

To support confidentiality of the patient's data, Siemens follows a multi-layer concept to optimize patient privacy and security of all the data and systems involved. The CIS is at the core of the security privacy concept. The CIS contains only the data that is sent from the customer to the off-site Siemens' managed servers. The CIS is highly compressed to keep the amount of data to be transferred small and to obtain the results quickly.
To further protect the integrity of the data, the client software encrypts the CIS using highly secure industry-standard public/private key encryption technology. The public key is used for encryption by the client. The private key that is necessary to decrypt the CIS is kept by Siemens in a secure location and is not made available at the customer site. This key is used on the Siemens servers only at the moment the data is read to process the CIS.
The lightweight client contacts the server when new data is available for processing, and the client also retrieves the resultant data from the server when processing has completed. The client-initiated communication concept enables easy installation of the lightweight client at the customer site without creating security risks for the customer's existing IT environment.
Siemens utilizes the HTTPS protocol that ensures the data is encrypted during any data transfer between the client and the server. Furthermore, it protects the integrity of the data by preventing any third party from tampering with the data. The HTTPS protocol also ensures that the client will be communicating only with the genuine Siemens' servers and cannot be deceived into providing information to any malevolent third-party servers.

**Results may vary. Data on file.

Contact
ericssmith@siemens.com

Double the utilization of your fluoroscopy room?



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As a fully digital, 2-in-1 solution for radiography and fluoroscopy (R/F), AXIOM Luminos *d*RF is exceptionally versatile and fast. Thanks to its 43 cm × 43 cm flat detector, time-consuming cassette handling is a thing of the past. The system easily accommodates the full range of R/F applications as well as various interventional procedures – all in one room.
What's more, with its low table height of 48 cm, AXIOM Luminos *d*RF is also tremendously comfortable for patients and convenient for staff. Outstanding image quality, fully digital workflow, exceptional ergonomics – when you add it all up, you have optimal resource allocation and improved utilization.
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AXIOM Luminos dRF – A smashing hit

'Versatility' is what AXIOM Luminos dRF stands for. That is why it is also known as 'the 2-in-1 solution for fluoroscopy and radiography'. Future challenges within radiology departments and private practices already had a significant impact on the system design and capabilities during its conception phase.

With its digital imaging capabilities and the integrated 43 x 43 cm flat detector for both dynamic and static imaging, the AXIOM Luminos dRF can be easily integrated into clinical networks and enables digital image archiving and image exchange with other parties.
It easily masters different patient profiles, handling an impressive range of examinations from traditional fluoroscopy studies to general radiography, but also from the fields of angiography, orthopedics, urology, gynecology, and much more.
As such the AXIOM Luminos dRF is a great long-term investment for any imaging facility and can easily handle increasing numbers of patients or changes to the department's examination range or capacities.
Already more than 400 AXIOM Luminos dRF systems are installed worldwide and the community of users is increasing each day, making FD technology an established technology for fluoroscopy systems. Use of the system is expected to grow further as it shows significant impact on efficient utilization of the fluoroscopy suite.
Continue reading to see how it affects the daily challenges of many of our users in their environments such as in a high throughput suite, the ER department, for orthopedic imaging, for elderly patients, etc. and see for yourself.


C.H.U. de Charleroi, Belgium; Department of Radiology, Hospital André Vésale, Civil Hospital (> 1000 beds)
Major task of AXIOM Luminos dRF:
Wide range of general X-ray and traditional fluoroscopy examinations partially with contrast media.
Hospital of Barmherzige Brüder, Vienna, Austria; Department of Radiology and Nuclear Medicine (> 400 beds)
Major task of AXIOM Luminos dRF:
Sinograms, fistulography, cystograms, ERCP, gastrointestinal stents, such as colon and esophagus stents, urology exams, bone X-rays, gastrointestinal studies with double contrast.
2
5
4
Henri Mondor hospital (900 beds) Créteil, France; Department of Medical Imaging
Major task of AXIOM Luminos dRF:
Bone X-rays, orthopedic imaging
3
1
Fondazione Ca´Granda, Maggiore Policlinico Hospital (1.088 beds), Milan, Italy; Radiology Department
Major task of AXIOM Luminos dRF:
All radiological examinations (bones, chest, etc.), GI studies, urological and gynecological exams.
Padova Hospital (1,694 beds), Italy, ER Radiology Department
Major task of AXIOM Luminos dRF:
ER radiological exams including skeletal X-rays, GI studies, urological exams, long spine acquisitions, etc.

"The system's versatility, speed and output quality have allowed us to increase the number of exams."

Giorgio De Conti, M.D., ER Radiology Department, Padova Hospital, Italy

1 Dr. Giorgio De Conti, Padova, Italy

An impressive number of 800 exams per week are performed in the ER radiology department of Italy's Padova Hospital with AXIOM Luminos dRF. Dr. De Conti emphasizes the "outstanding workflow" since the "elimination of the cassettes have translated into better quality, low dose for the patient and time saving". Moreover he highlights that "the 2-in-1 solution provides excellent image quality in two environments (fluoroscopy and radiography)."
A major benefit seen is increased patient coverage with the 43 x 43 cm detector for both static and dynamic imaging. Dr. De Conti points out that "more precisely dynamic visceral exams can be now performed without using other rooms and radiological systems. This has an obvious positive impact on the physician's time"

"Simple and user-friendly for both our medical and technical staff"

And he adds "the ergonomics of the table with a lowest height of just 48 cm from the floor help both the operators and the patient in terms of comfort". Another great benefit is seen in Siemens' intuitive user interface, which is known from the other Siemens systems installed in the hospital. The user interface is "simple and user-friendly for both our medical and technical staff" and he adds this is of great importance "since the system is being used by more than 40 technicians and medical doctors".

"We do appreciate the reliability of the system"

On a final note Dr. De Conti adds, "We have been working with AXIOM Luminos dRF for over a year and we do appreciate the reliability of the system."

"We were able to increase workflow, throughput and ease of use for patients and radiologists"

Christian Delcour, M.D., Department of Radiology, CHU Charleroi, Belgium

"Everybody appreciates its speed, its ergonomics and most of all, the quality of the images"

Pietro Biondetti, M.D., Head of Radiology Department,
Fondazione Ca'Granda, Maggiore Policlinico, IRCCS Hospital, Milan, Italy

2 Dr. Christian Delcour, Charleroi, Belgium

At CHU in Charleroi, Belgium, two AXIOM Luminos dRF systems have been installed, replacing four analog remote-controlled tables with the goal "to increase workflow, throughput and ease of use for patients and radiologists", according to Dr. Delcour.
Workflows are significantly improved thanks to fully digital imaging with the flat detector and therefore the elimination of cassette use. But also the system's remarkable ergonomics and automated workflows had a positive impact "as the table height is extremely low, patient transfer is easy. Most of the technologist's commands are automated, thus reducing the duration of the examination and increasing the patient's comfort", says Dr. Delcour

"An impressive number of patients can be handled per table"

Clear advantages with AXIOM Luminos dRF are also seen in the image quality it delivers for both high-resolution exposures and dynamic contrast-media studies as well as the low levels of radiation. A comparative study between AXIOM Luminos dRF and the former fluoroscopy tables shows "much less radiation for conventional examinations, but also in all dynamic examinations in which very low pulsed fluoroscopy frequencies provide the lowest possible radiation". "This is very important for all examinations on adult patients as well as pediatric patients", adds Dr. Delcour.
To work with two AXIOM Luminos dRFs instead of the formerly installed four units brought considerable savings in terms of resources and indisputable cost benefits, and moreover Dr. Delcour adds that "an impressive number of patients can be handled per table".

3 Dr. Pietro Biondetti, Milan, Italy

With the installation of AXIOM Luminos dRF, the ER department of Ca'Granda Policlinico Maggiore Hospital in Milan, Italy, made a major step both for operators as well as its patients in several aspects. First of all the system design significantly improved comfort thanks to the low table height of just 48 cm. "In the ER we often deal with patients who are difficult to move such as obese or elderly patients or those unable to cooperate", says Dr. Biondetti, and adds, "The low table height also permits the examination of wheelchair-bound patients without having to move them from the chair."
But examination times are also drastically reduced thanks fully digital imaging with flat detector, which makes cassette-use obsolete and makes images available virtually immediately.
The large coverage of the detector of 43 x 43 cm allows us "to easily perform exams of anatomical areas such as thorax and abdomen within a single image instead of a series of images". Moreover we can "get a whole single image of both the kidneys and the bladder, or in case of esophagus examinations, we can get the entire organ from the pharynx to the cardia in just one acquisition", Dr. Biondetti points out.

"X-ray dose is significantly reduced both in radiography and in fluoroscopy"

Clinical imaging in the ER is improved because the "image quality is impressive", and also the "X-ray dose is significantly reduced both in radiography and in fluoroscopy". This is also supported by the low-dose fluoroscopy that is available with the unit. "The AXIOM Luminos dRF has been a smashing hit"; it "has been performing outstandingly in all radiological procedures", Dr. Biondetti shared with us enthusiastically. He also mentions the greatly improved patient

"The transition between patients is much smoother"

Gerhard Gruber, M.D., Senior Physician, Department of Radiology and Nuclear Medicine, Barmherzige Brüder, Vienna, Austria

comfort and the "high level of satisfaction expressed by doctors and technicians using the system both in the area of ergonomics and ease of use."

4 Dr. Gerhard Gruber, Vienna, Austria

The challenges to AXIOM Luminos dRF in the hospital of Barmherzige Brüder in Vienna, Austria, are manifold. Therefore, according to Dr. Gruber, AXIOM Luminos dRF is seen as a powerful tool to fulfill the rising demands in medical imaging. "The "2-in-1" solution, meaning the combination of radiography and fluoroscopy, is of great importance. This is especially so in connection with interventional radiology, where we work together with internists, urologists and surgeons where, for instance, gastrointestinal stents are inserted under fluoroscopy as well as under radiographic control."
"The biggest advantage of this system lies in its digital image processing. The images are generated very fast with excellent quality, thus speeding up the examination considerably. Additional X-rays, including images of other regions of the body, can be taken immediately after surgical interventions using one

"The image quality of bone X-rays is outstanding"

and the same system", says Dr. Gruber. Moreover the system is well integrated into the clinical IT network and as such it's easy to share images with colleagues, e.g., from other disciplines in the hospital and to get them on board.
"Another big advantage of this system lies in its ergonomics. Especially elderly patients can be positioned on the examination table very well due to the height to which the tabletop can be lowered."
And Dr. Gruber emphasizes: "The transition between patients is much smoother, and of course a lot of time is saved for the physician and for all employees concerned if patient changeover can be performed faster and the available time can be utilized more efficiently."
In conclusion Dr. Gruber adds: "We therefore believe that this system will be able to cover a large percentage of our radiological demands in the near future. So we will be performing the majority of our radiological examinations using this system in the broader sense of 'one-stop shopping'."

5 Remy Raymond, Créteil, France

The major task of AXIOM Luminos dRF at Henri Mondor Hospital in Créteil, France, is bone X-rays and full spine exams since the hospital has a large orthopedic and rheumatology service. According to Mr. Raymond, senior manager of the Department of Medical Imaging, the examination range of AXIOM Luminos dRF increased over to the former equipment.
"Major axis and full spine examinations are the types of examinations that we carry out in this room, but that we didn't carry out before", says Mr. Raymond. The "very heavy cassette trol-

"The heavy cassette trolleys are a thing of the past"

leys" formerly used are a thing of the past. Thanks to the digital acquisition a "much more significant flow of patients" is achieved and "the image quality is excellent", states Mr. Raymond.
With regards to handling comfort Mr. Raymond sees a big plus for radiographers and patients. The table design has

"Major axis and full spine examinations have been added"

Remy Raymond, Senior Manager, Henri Mondor Hospital, Créteil, France

caused "a mini-revolution in the ergonomic approach", he mentions enthusiastically, which is especially beneficial when dealing with elderly and immobile patients and adds: "An extra benefit we have discovered is the tube travel as well as the longitudinal travel of the table, which enables greater comfort for patients without having to move them." Thanks to the easy-to-understand interface, which is already known from other Siemens modalities, the team experienced "quick initial familiarization" and another "benefit that we can mention is reliability, because since the room has been installed [in January 2009], nothing has ever broken down".

Learn more about AXIOM Luminos dRF and how it can better meet your imaging demands:
www.siemens.com/luminos-drf

Contact
andrea.mueller@siemens.com

Siemens' AXIOM Luminos TF (tableside-controlled fluoroscopy system) with mobile Flat Detector (mFD): a digital system combining fluoroscopy and radiography functionalities that can accommodate a broad spectrum of patients of virtually all ages and sizes, from infants to large or obese adults. Compared to digital fluoroscopy with analog radiography technologies, AXIOM Luminos TF offers a range of benefits for pediatric imaging. These include low radiation dose, enhanced patient comfort, high image resolution, efficient workflow, and cost-effective utilization of the radiography and fluoroscopy (R&F) room and imaging staff.

Keep dose always on your mind

In response to the growing demand for pediatric imaging services, recent advances in imaging technology, and its goal of providing excellent patient care, Children´s Hospital of Wisconsin made the decision to convert its fluoroscopy room to a dual-function digital R&F room. The hospital is one of the leading pediatric healthcare centers in the United States. A key component of this effort has been the implementation of a Siemens AXIOM Luminos TF (tableside-controlled fluoroscopy system) with mobile Flat Detector (mFD).

Fluoroscopic and digital radiographic (DR) imaging technologies have become an essential tool in medical care, making it possible to accurately image and diagnose a wide range of conditions in both adults and children. However, digital imaging examinations cannot be successfully conducted using a "one size fits all" approach. In particular, imaging pediatric patients poses a unique set of challenges requiring specialized methods and technology.

Perhaps the most critical concern associated with the use of ionizing radiation in pediatric imaging studies is radiation dose. Pediatric patients, whose tissues and organs are still developing, are significantly more sensitive to radiation than adults.[2,8] In addition, the cancer risk for a given radiation dose is higher for children compared to adults; one reason for this is the longer life expectancy of children, which allows more time for a latent cancer to develop.[2] Data published in the last decade suggest that even low levels of radiation exposure increase a child's risk of eventually developing a cancer by a small but statistically significant amount.[2,3,4,5,6]

A review of the literature on radiation safety in pediatric patients supports the view that the benefits of imaging studies in children almost certainly outweigh the risks of exposure to ionizing radiation.[1,2] However, the small

"Our physicians now have digital radiography capability combined with the fluoroscopy system, and they are able to select from a range of series and settings right on the monitor, that means they can conduct all studies in the same room and patients can have their exams completed faster."

Kati Roepke, R.T., Lead Technologist, Children's Hospital of Wisconsin, WI, USA

but significant increased cancer risk associated with X-ray imaging studies in children highlights the importance of minimizing radiation exposure in pediatric patients. This is consistent with the "as low as reasonably achievable" (ALARA) concept of radiation safety endorsed by the Society for Pediatric Radiology: radiation doses should be as low as reasonably achievable to obtain accurate diagnostic information.[2,7,8] The number and frequency of pediatric imaging studies using ionizing radiation should be minimized, and radiographic imaging conducted only when necessary.[2,7]

Studies indicate the AXIOM Luminos TF imaging chain and table configuration lead to improvements in radiation dose values when compared to other systems.[12] The system incorporates a series of combined applications to reduce exposure (CARE) designed to achieve radiation exposure levels that conform to the ALARA principle while achieving optimal image quality. These include dose-saving features such as automated copper pre-filtration, pulsed fluoroscopy, and radiation-free patient positioning. The system also features a large source-to-image distance (SID), with the radiation source located as far away from the patient as possible.

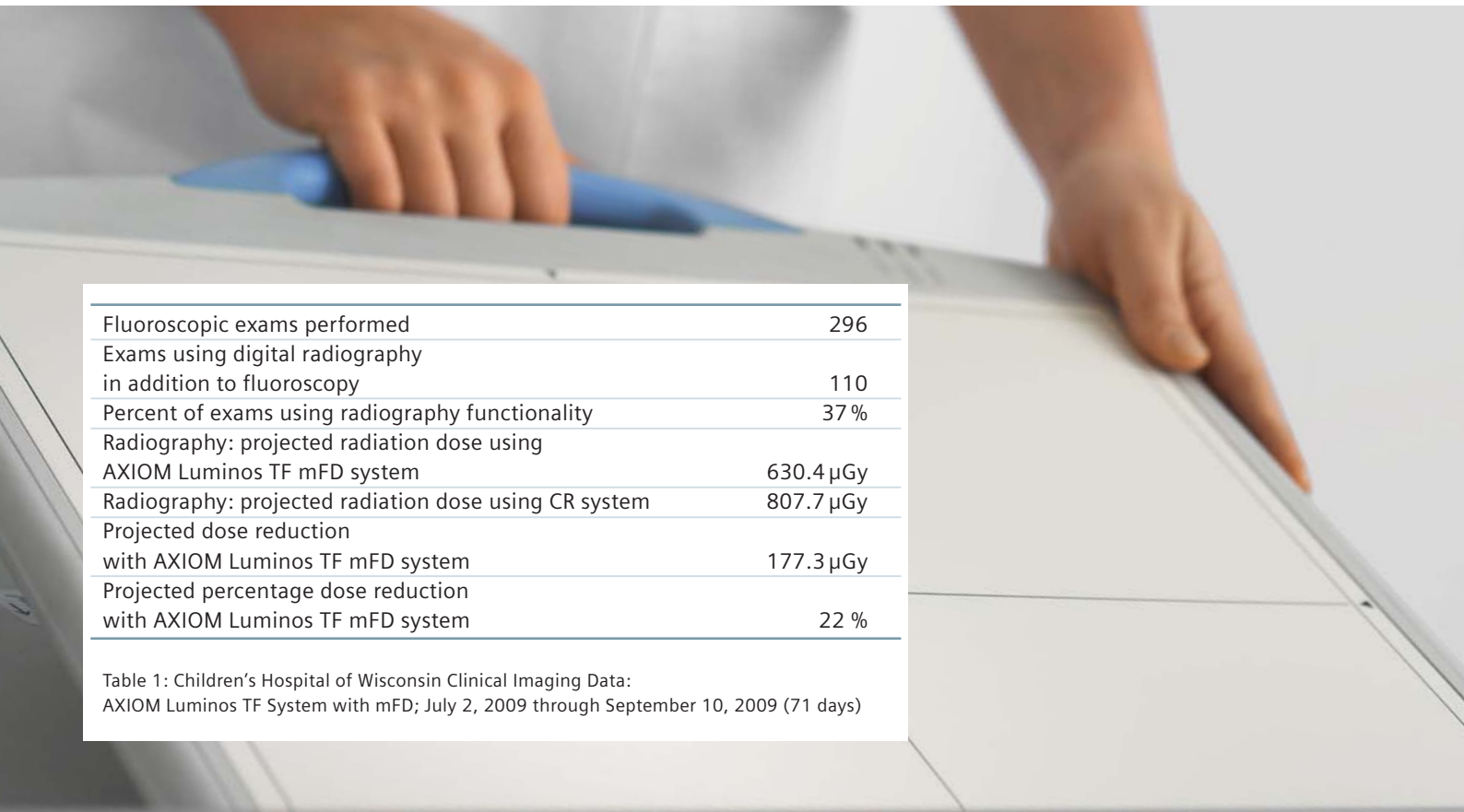
Evaluation studies on radiation dose

A review of clinical data provided by Children's Hospital of Wisconsin suggests that implementation of the AXIOM Luminos TF system in the dual-function digital R&F room has enabled the hospital to significantly reduce its patients' exposure to radiation and improve workflow processes. Based on clinical information provided by the hospital, the radiology department performed 296 digital fluoroscopy studies (4,318 images) over a time period of 71 days in 2009. Of these, 110 exams (37 % of patients) also required digital radiographic imaging using the mFD. 197 radiographic images were taken during these exams.

While the majority of the radiation dose patients receive is from the fluoroscopy portion of the exam, dose savings realized from the implementation of a digital radiography system should also be considered. To identify the dose savings, the total radiation dose patients received from the AXIOM Luminos TF system was compared with the dose these patients would have received from a CR system. The target radiation dose used by the AXIOM Luminos TF's flat detector mFD is 3.2 µGy at 400 speed equivalent and an average CR target dose of approximately 4.1 µGy at 400 speed equivalent was assumed.[13, 14] Based on these parameters, it is estimated that the patients requiring radiographic imaging during this time period received a total radiation dose of 630.4 µGy from the AXIOM Luminos TF system. If the same radiographic imaging exams had been performed using a CR system, the projected dose would have been 807.7 µGy, a dose 177.3 µGy (28 %) higher than that associated with the AXIOM Luminos TF system. Thus, it can be projected that by using a DR system rather than CR, the hospital reduced its patients' radiation exposure by 177.3 µGy (22 %). This radiation dose comparison is summarized in Table 1. In the case of a healthcare facility such as Children's Hospital of Wisconsin, where more than one-third of all imaging exams during the sample time period utilized the AXIOM Luminos TF system's radiography function, this reduction is a significant benefit for pediatric patients.

Requirements for pediatric patients

Pediatric patients are not simply small adult patients. Children may be especially fearful of medical equipment, may be unwilling or unable to remain still during the imaging process, and may not understand or be able to follow all directions given by healthcare professionals. In addition, workflow considerations for accommodating clinical apparatus (e.g., catheters or other medical devices) that often accompany a child into the examination room can have a significant impact on the steps needed to complete an imaging procedure. Consequently, digital imaging equipment designed for adults may not necessarily be comfortable or provide sufficient security for pediatric patients. Moreover, children of different age groups also have different needs: For example, infants (3 years and younger) have traditionally been imaged using a variety of methods to immobilize the child for the duration of the examination. These methods are designed to prevent movement that could cause the child to slip off the table or negatively impact the quality of the image. While these immobilization methods are generally effective for achieving higher image quality and reducing the amount of time needed for imaging studies, they may be uncomfortable and/or distressing for a child. Children from 3 to 10 years may also



Fluoroscopic exams performed	296
Exams using digital radiography in addition to fluoroscopy	110
Percent of exams using radiography functionality	37 %
Radiography: projected radiation dose using AXIOM Luminos TF mFD system	630.4 µGy
Radiography: projected radiation dose using CR system	807.7 µGy
Projected dose reduction with AXIOM Luminos TF mFD system	177.3 µGy
Projected percentage dose reduction with AXIOM Luminos TF mFD system	22 %

Table 1: Children's Hospital of Wisconsin Clinical Imaging Data:
AXIOM Luminos TF System with mFD; July 2, 2009 through September 10, 2009 (71 days)

experience fear and anxiety about imaging procedures and are generally more active and mobile, which raises additional concerns. Side rails that help protect the patient while offering the technologist free access to comfort or reposition the child are a critical feature for this group. The ability for patients to see parents or caregivers throughout the procedures may also help to increase patient comfort.

Our solution with AXIOM Luminos TF

In addition to the benefits of radiation dose reduction, the Siemens' AXIOM Luminos TF system with mobile Flat Detector features a wide (31"), highly robust table with raised side rails that accommodates a broad spectrum of patient sizes and weights without discomfort or the risk of slipping off the table. The open design gives the operator, physician and caregivers continual visual contact and free access to the patient for added security. To help minimize patient anxiety, the AXIOM Luminos TF system features a mobile flat detector for faster patient positioning, an ergonomic tableside user interface to lessen the time needed to complete imaging studies, dual fluoroscopic and radiographic functionality so patients can remain on the table for both types of imaging studies, which helps speed the exams and relieve patient stress. In combination, these features enable the clinician to stay with the patient throughout the examination while reducing the overall length of the patient's stay in the R&F room.

Implementing the AXIOM Luminos TF in the new room offers:

- extensive dose-saving features
- an open design to relieve stress for pediatric patients
- a mobile flat detector for faster patient positioning and dose savings in radiography

Conclusions

As demonstrated by the experience of Children's Hospital of Wisconsin, the AXIOM Luminos TF with mFD offers many benefits for pediatric patients and their healthcare providers. The system offers the advantages of digital radiography combined with a multifunctional digital fluoroscopy system. By using a DR system rather than a CR, the hospital reduced its patients' radiation exposure by 177.3 µGy (22 %).

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Contact
kelly.obrien@siemens.com

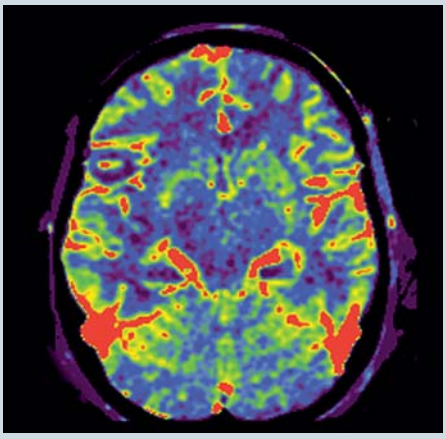
Understanding the potential of interventional imaging

New and existing *syngo* DynaCT users gather to share best practices.

Siemens Healthcare's first *syngo* DynaCT User Meeting gave delegates the opportunity to share best practices and enhance their knowledge of the interventional software application.

Building on knowledge, sharing experiences and obtaining practical advice were some of the benefits taken away by delegates at Siemens Healthcare's inaugural *syngo* DynaCT User Meeting.
The forum covered the basics of the software for interventional imaging as well as specialist applications, plus delegates were given hands-on experience of the workstations. Customers were also able to see how accompanying software can enhance diagnosis and treatment to improve clinical workflow using the latest software packages including *syngo* Embolization Guidance and *syngo* Neuro PBV IR* (Parenchymal Blood Volume, Interventional Suite). All delegates felt that the meeting had a beneficial effect on their clinical practices.
Delegates also heard user experiences from customer speakers from the UK and Europe. Dr. Hacking from Southampton University Hospitals NHS Trust talked about his work with *syngo* DynaCT in transarterial chemoembolization (TACE), portal vein embolization (PVE) and complex biliary stenosis, while Dr. Hughes from Buckinghamshire Hospitals NHS Trust relayed his initial experiences with *syngo* DynaCT and spinal interventions. Bringing a European perspective, Dr. Binter of Groupe hospitalier Sud Réunion in France and Dr. Struffert from the University of Erlangen in Germany discussed their experiences with *syngo* DynaCT and *syngo* Neuro PBV IR software.
"The meeting was very useful," said Beverly Hudson, Superintendent Radiographer at Queen Elizabeth Hospital, part of University Hospitals Birmingham NHS Foundation Trust. "Having used *syngo* DynaCT now for two years, it gave us useful tips to further enhance the way we use the technique to benefit patients and the department."
"It is vital that we share knowledge and practical tips with our customers to help ensure they are gaining the best value from equipment and application investment," said Susie Guthrie, AX Product Manager at Siemens Healthcare. "*syngo* DynaCT has wide ranging use in clinical procedures and this meeting explored its potential in a number of areas plus gave useful background information for new users."
syngo DynaCT is compatible with Siemens' Artis zee range of interventional angiography systems and enables CT-like cross-sectional imaging by creating 3D soft tissue data sets. It can be used directly in the angio suite without loss of time and additional risk to the patient. Aside from visualizing high-contrast objects, the application also makes it possible to obtain soft tissue information while performing interventional procedures for improved decision-making.
The meeting was held at the Warwick HRI Conference Centre and Siemens representatives and European advocates to were invited to relay knowledge on how to gain the most value from *syngo* DynaCT.
Departments interested in understanding the potential of *syngo* DynaCT for interventional imaging can contact **anna.pomeroy@siemens.com** for further information and registration for the next workshop.

* Not commercially available in the U.S.



syngo Neuro PBV IR (Parenchymal Blood Volume, Interventional Suite) provides a quantitative measurement of perfused blood volume visualizing infarcted areas of the whole brain in 3D.

Contact
tom.hartley@siemens.com

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Title	Location	Short Description	Date	Contact
AICT	Singapore	6th Asian Interventional Cardiovascular Therapeutics Congress	July 01 - 03	www.aict2010.org
CSI	Frankfurt, Germany	Congenital & Structural Interventions	July 08 - 10	www.csi-congress.org
PICS-AICS	Chicago, IL, USA	Pediatric & Adult Interventional Symposium	July 18 - 21	www.picsymposium.com
SNIS	Carlsbad, CA, USA	Society of Neurointerventional Surgery	July 26 - 30	www.snisonline.org
ESC	Stockholm, Sweden	European Society of Cardiology Congress	August 28 - September 01	www.escardio.org
ESVS	Amsterdam, Netherlands	European Society for Vascular Surgery	September 16 - 19	www.esvs.org
ESMINT	Nice, France	European Society of Minimally Invasive Neurological Therapy	September 09 - 11	www.esmint.com
EACTS	Geneva, Switzerland	European Association for Cardio-Thoracic Surgery	September 11 - 15	www.eacts.org
TCT	Washington DC, USA	Transcatheter Cardiovascular Therapeutics	September 21 - 25	www.tctconference.com
CIRSE	Valencia, Spain	Cardiovascular and Interventional Radiological Society of Europe	October 02 - 06	www.cirse.org
Neuro-radiologicum	Bologna, Italy	19th Symposium	October 04 - 09	www.esnr.org
DGNR	Köln, Germany	Deutsche Gesellschaft für Neuroradiology	October 07 - 09	www.dgnr.org
JFR	Paris, France	Journées Francaise de Radiologie	October 22 - 26	www.sfrnet.org
Radiologie-KongressRuhr	Bochum, Germany	Radiologie und Nuklearmedizin	October 23 - 25	www.radiologiekongressruhr.de
Medica	Düsseldorf, Germany	Trade Show	November 17 - 20	www.medica.de
RSNA	Chicago, IL, USA	96th Annual Meeting	November 28 - December 03	www.rsna.org

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AXIOM Innovations

Publisher
Siemens AG
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Angiography, Fluoroscopic
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Siemensstr. 1,
91301 Forchheim, Germany

Responsible for contents
Heinrich Kolem, Ph.D

Chief editor
Sabine Wich
sabine.wich@siemens.com

Co-editor
Nadine Meru, Ph.D.
nadine.meru@siemens.com

Editorial board
Ali-Nejat Bengi, Anne Figel,
Vera Jünnemann, Andrea Müller,
Prof. Georg Nollert, M.D.
Alexandra Pröll, Kathrin Schindler,
Dirk Sunderbrink

Contributors to this issue
Thomas Hartley, Erik Busch,
Kelly O'Brien, Norbert Rahn
All Siemens Healthcare

Pietro Biondetti, M.D.,
Department of Radiology,
Fondazione Ca' Granda, Maggiore
Policlinico, IRCCS Hospital, Milan, Italy

Linus Blohmé, M.D.,
Pär Olofsson, M.D.,
Department of Surgery, Karolinska
Hospital Stockholm, Stockholm, Sweden

Giorgio De Conti, M.D.,
ER Radiology Department,
Padova Hospital, Padova, Italy

Christian Delcour, M.D.,
Senior Physician, Department of
Radiology, Hospital André Vésale,
C.H.U. de Charleroi, Belgium

Sven Dittrich, M.D.,
Department of Pediatric Cardiology,
University of Erlangen,
Erlangen, Germany

Arnd Dörfler, M.D.,
Tobias Struffert, M.D.,
Head of Neuroradiology, University of
Erlangen, Erlangen, Germany

Gerhard Gruber, M.D.,
Department of Radiology and Nuclear
Medicine, Hospital of Barmherzige
Brüder, Vienna, Austria

Peter Herzog, M.D.,
Department of Clinical Radiology,
Ludwig Maximilian University of Munich,
Munich, Germany

Tobias Jakobs, M.D.,
Department of Radiology,
Ludwig Maximilian University of
Munich, Campus Grosshadern,
Munich, Germany

Rüdiger Lange, M.D.,
Gernot Brockmann, M.D.,
Domenico Mazzitelli, M.D.,
Sabine Bleiziffer, M.D.,
Robert Bauernschmitt, M.D.,
Department of Cardiology,
German Heart Center and the Technical
University Munich, Munich, Germany

Hugo Ramirez Luna, M.D.,
T. R. Gilberto Cesar Calvo Garcia,
Oaxaca Regional Hospital,
Oaxaca, Mexico

Petr Neuzil, M.D.,
Head of cardiology,
Na Homolce Hospital Prague,
Prague, Czech Republic

Amit V. Patel, M.D.,
Morristown Memorial Hospital,
Morristown, NJ, USA

Remy Raymond
Department for Medical Imaging
Henri Mondor Hospital,
Créteil, France

Darren Walters, M.D.,
Director of Cardiology
The Prince Charles Hospital,
Brisbane, Australia

Production
Michael Brumme
Siemens Healthcare

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Satzwerker – Jäger & Tuppi
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www.siemens.com/healthcare-magazine

Global Siemens Headquarters

Siemens AG
Wittelsbacherplatz 2
80333 Muenchen
Germany

Global Siemens Healthcare Headquarters

Siemens AG
Healthcare Sector
Henkestr. 127
91052 Erlangen
Germany
Phone: +49 9131 84-0
www.siemens.com/healthcare

Legal Manufacturer

Siemens AG
Wittelsbacherplatz 2
DE-80333 Muenchen
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Siemens AG
Medical Solutions
Angiography, Fluoroscopic and Radiographic Systems
Siemensstr. 1
DE-91301 Forchheim
Germany
Phone: +49 9191 18-0
www.siemens.com/healthcare

Local Contact Information

Asia/Pacific:
Siemens Medical Solutions
Asia Pacific Headquarters
The Siemens Center
60 MacPherson Road
Singapore 348615
Phone: +65 9622-2026
www.siemens.com/healthcare

Canada:
Siemens Canada Limited
Medical Solutions
2185 Derry Road West
Mississauga ON L5N 7A6
Canada
Phone: +1 905 819-5800
www.siemens.com/healthcare

Europe/Africa/Middle East:
Siemens AG
Medical Solutions
Henkestr. 127
DE-91052 Erlangen
Germany
Phone: +49 9131 84-0
www.siemens.com/healthcare

Latin America:
Siemens S.A.
Medical Solutions
Avenida de Pte. Julio A. Roca No 516, Piso 7
C1067ABN Buenos Aires Argentina
Phone: +54 11 4340 8400
www.siemens.com/healthcare

USA:
Siemens Medical Solutions U.S.A., Inc.
51 Valley Stream Parkway
Malvern, PA 19355-1406
USA
Phone: +1-888-826-9702
www.siemens.com/healthcare