

Go HYBRID!

The magazine for decision makers in image-guided therapy

December 2016 | International Version

EVAR Guidance:
A new world
opening up

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Prof. Dr.
E. Verhoeven

Clinical Trends

A new level of CO₂ imaging:
Automatic injector provides
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Sliding gantry solution brings CT
image quality to the operating
room and can optimize the cost-
benefit ratio

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Dear reader,

It's probably impossible to predict disruptive technologies or to say what new services will evolve in the future, right? But some of the technologies you can discover in the current issue of Go HYBRID! are already changing the way that healthcare is provided.

We met Professor Eric Verhoeven at Leipzig interventional Course (LINC). He is convinced that fusion technology will soon be the way to go for every EVAR procedure. He describes "a new world" opening up with EVAR guidance and is sure that the solution can help a lot of surgeons. We met him in Nuremberg where he told us about his experiences with the first automated workflow for endovascular repair.

And Alan Lumsden, an expert in navigating the C-arm in endovascular procedures, joined forces to tackle the challenges of minimally invasive lung cancer surgery. He thinks that using image guidance for a variety of surgical procedures will radically transform his specialty.

Prof. Bale and Univ.-Prof. Thomé from Medical University Innsbruck as well as Prof. Tonn, Prof. Schichor, and Prof. Zausinger from University Hospital Grosshadern in Munich share one belief – along different procedures they confirm that utilization of intraoperative CT is in the interests not only of the patients but also of the hospital administrators.

After collecting a number of success stories like these for the current issue, we hope that Go HYBRID! can contribute to the productivity and efficiency of your hospital by supporting you with useful firsthand experiences from healthcare decision makers like you.

Peter Seitz,
General Manager Surgery

We're always searching for the best hybrid success stories for Go HYBRID! Contact chief editor Dirk Sunderbrink and his team at dirk.sunderbrink@siemens.com and tell us yours.

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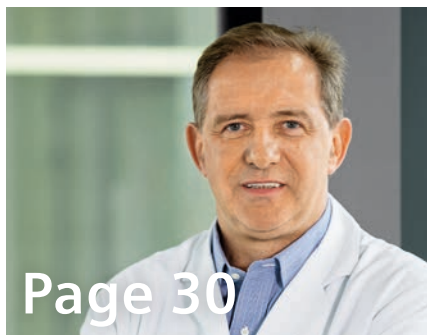


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At Innsbruck Medical University, intraoperative CT has become an essential component: Prof. Claudius Thomé uses intraoperative CT for trauma surgery when every minute counts.

Cover Story

A new world opening up



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Prof. Eric Verhoeven was recently honored for a very special record: He is most probably the first surgeon in the world to have performed more than 1,000 fenestrated and branched EVAR interventions with his team. We asked him for his experiences with the new syngo EVAR guidance.

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If you were a patient – what would you do?

How to convince administration about a Hybrid OR

1

“Surgical procedures have changed: from open techniques with a big incision and a lot of damage to the soft tissue, to the minimally invasive surgery of today.”

2

“If you were a patient – and you knew there is a better technique, something that can guarantee the result? If it was yourself, what would you do?”

Prof. Suthorn Bavonratanavech,
Senior Director
Bangkok Orthopedic Center
Bangkok Hospital, Thailand

Prof. Suthorn Bavonratanavech is an expert in orthopedics and trauma surgery and president of the AO Foundation. One focus of Prof. Bavonratanavech is the integration of research and technology, of surgical techniques and imaging to drive advances in trauma surgery.

"We want to be excellent – excellent in the treatment of musculoskeletal injuries and disorders. The key is: continuous improvement," says Prof. Suthorn Bavonratanavech, president of the AO Foundation, a nonprofit organization that educates surgeons and fosters high quality in the treatment of trauma and musculoskeletal disorders.

The surgeon from Bangkok is one of the world's leading specialists in trauma surgery, and for him, improvement means smaller cuts, better imaging, safer procedures, and ultimately the best possible outcome for the patient: *"As a patient I want a small incision and less pain – and a guarantee of the good quality of the operation."* Minimally invasive techniques are on the rise, because they fulfill these requirements, but there are groups of patients and certain diseases that demand special conditions for such procedures: *"For example, if you are aiming at a tumor of the spine, the target area is very small – so the precision [of the intervention] must be very high. Here, you need the next technology level: a Hybrid OR."*

Justifying the investment

A Hybrid OR, characterized by a high-performance imaging system that is applicable for a sterile and crowded environment, is a major investment. *"New technologies always cost money – you cannot avoid this,"* states Prof. Bavonratanavech. *"The decisive point is how we will use this investment in the most effective way."* The AO Foundation helps its members define which cases and procedures will benefit from the Hybrid space. But this is only one side of the story, as Prof. Bavonratanavech explains: *"I often have to convince administration: If you want to build a state-of-the-art OR with latest technology, if you want to go into minimally invasive techniques that give you the best outcomes and zero complications, then you need specific tools, and you have to invest."*

To kick off a convincing discussion with administration you should be able to explain why a Hybrid OR is needed – and why it makes sense from a business perspective. Prof. Bavonratanavech's three-point strategy might help get things started.

3 *"A Hybrid OR is not only valuable for one particular department. A multidisciplinary use of the Hybrid OR may help achieve break-even quite soon. It is worth the investment, because other departments can use it too."*

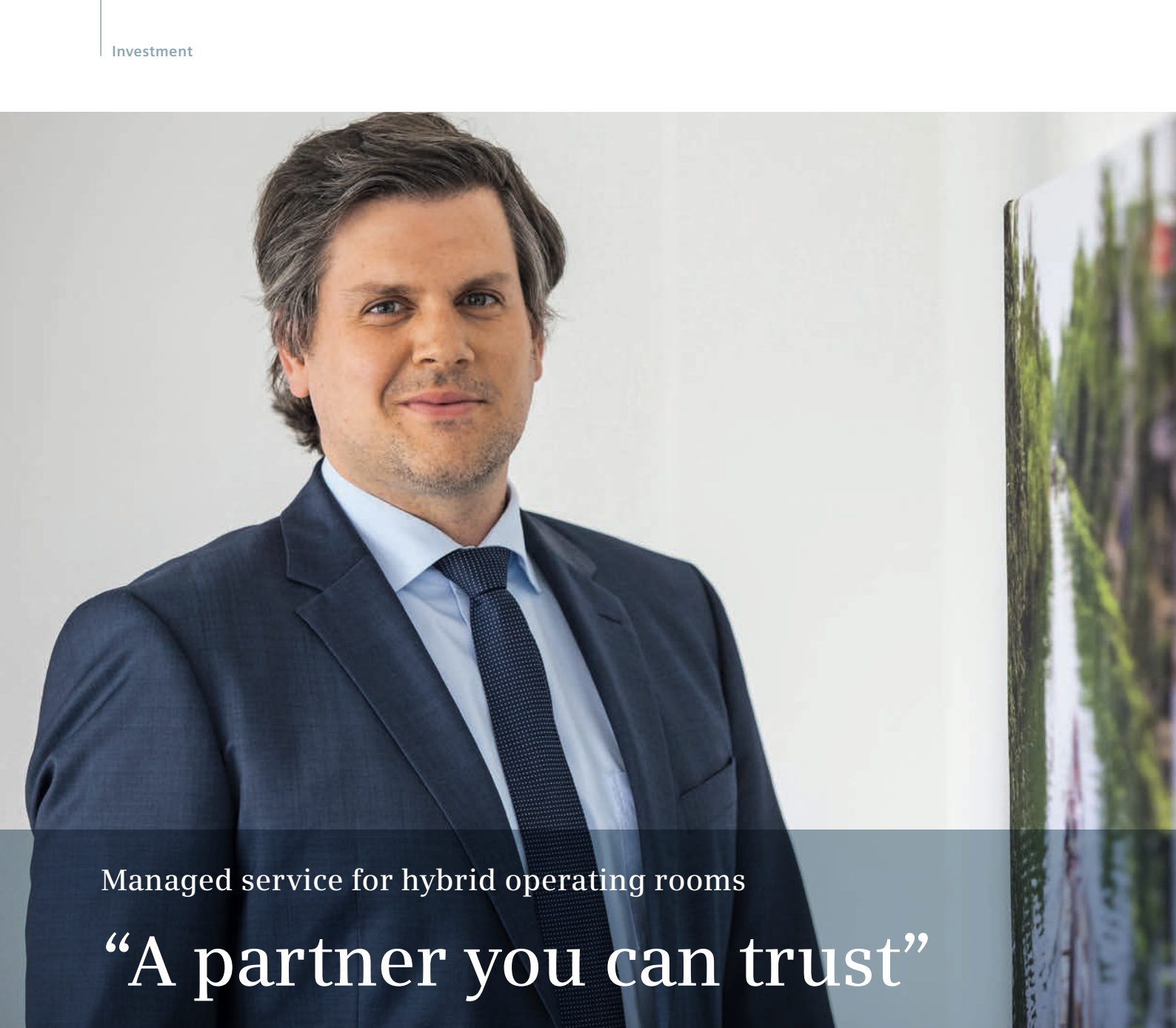
Watch the interview

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Prof. Suthorn Bavonratanavech on how to convince administration on a Hybrid OR

Watch the interview:
[siemens.com/you-tube/administration-hybrid-or](https://www.siemens.com/you-tube/administration-hybrid-or)

A portrait of Arne Greiner, a middle-aged man with dark hair, wearing a dark blue suit, light blue shirt, and dark tie. He is smiling slightly and looking towards the camera. The background is a light-colored wall with a framed picture of a forest scene on the right.

Managed service for hybrid operating rooms

“A partner you can trust”

For the Malteser St. Anna hospital in Duisburg, Germany, collaboration with an external partner proved to be a great success.

Arne Greiner is the managing director of Malteser Rhein-Ruhr GmbH. Right now he is working through a period of “hard upgrading,” as he calls it, at St. Anna’s Hospital, a major process for an entity with more than 100 years of history behind it. What that means, in detail, is that many projects have to be implemented simultaneously – and very swiftly, to make the entire business future-proof. Greiner is building, quite literally, on four areas of specialization: oncology; ear, nose and throat (ENT) medicine; cardiovascular surgery; and geriatrics. It goes without saying that professional support is welcome during such phases.



“We had experts on the job that we could never have afforded ourselves”

Arne Greiner,
Managing Director,
Malteser Rhein-Ruhr gGmbH

When it implemented three ENT suites, some of the most advanced in Germany, Medtronic IHS proved to be a partner that could keep up the pace: The work of converting the entire OR wing of the ENT hospital in Duisburg was completed in just six months. Greiner counted on Medtronic’s skills in the same way when it came to the new challenge, too. The question was, *“What’s the most efficient way to develop the*

Duisburg location even more?”

Medtronic IHS found answers in the portfolio of Siemens Healthineers.

Greiner says: *“It was clear that in some cases we lacked a broader perspective. That’s why we first approached Medtronic for consulting services.”* Florian Distler, Business Director for Integrated Health Solutions Germany at Medtronic, immediately set about developing a location strategy with

What’s behind the Duisburg managed service model?

Medtronic IHS prefunded the investment

For St. Anna’s Hospital, Medtronic Integrated Health Solutions (IHS) prefunded the entire investment cost of a state-of-the-art hybrid operating room, which involves a cost allocation across the eight-year contract term. This is a pay-per-use model in which the hospital will pay Medtronic’s investors a fixed amount per procedure during that period. If the analysis was correct when the partnership was created and the investment in the Hybrid OR pays off, both sides will be happy. And for St. Anna’s Hospital, there’s another vital benefit: It does not need to draw on third-party capital for the approximately €2 million investment in the Hybrid OR. For terms of contract, Medtronic IHS is responsible for the smooth

operation of the systems, and works closely with manufacturers like Siemens Healthineers.

Siemens Healthineers is the preferred imaging partner

For many institutions worldwide Siemens Healthineers is the preferred imaging partner for hybrid operating rooms with more than 1,000 high-end imaging systems installed in operating rooms. The vast experience of Siemens engineers in planning, installation and customer services for hybrid operating rooms guarantees a smooth ramp-up and reliable operation of high-end imaging in operating rooms. Surgeons can rely on the experience and passion of Siemens Healthineers and focus on treatment.



Artis zee floor

The Artis zee floor-mounted system fits rooms as small as 29 m² (less than 350 sq. ft.), much less than the ACC-recommended 45-55 m² (500-600 sq. ft.), due to its very small footprint. This means that there is enough space left for equipment, in-room storage, the patient, and the clinical team. Besides the small footprint, the Artis zee floor offers a high level of positioning flexibility and allows the steepest angulations.



ARTIS pheno*

Discover ARTIS pheno on pages 40-41.

his team for St. Anna's and performed a feasibility study: "We focused on innovation in vascular surgery, since this discipline was underrepresented in the region, and we wanted to make a rational decision as to whether investing in a Hybrid OR was a practical option. Managed service models like the one in Duisburg mean we take on the prefinancing, so we also have to believe it's going to work. As part of the analysis, we gather numbers, perform interviews, examine organizational processes, and take the company's infrastructure into account. This is where we in Duisburg work very closely with Siemens, which provides the imaging system that is at the heart of the Hybrid OR. Together we consider which device would work best, and what that decision will imply. We concluded that the Hybrid OR was exactly what was needed here."

And so Greiner found what he was looking for: in other words, a "partner we can trust," as he put it. That was the green light for phase two, the actual implementation.

Everyone involved has to believe

This is where quite a few more partners and hospital representatives came on board. Distler recalls: "The timelines were tight. The project needed to be finished within less than one year from the analytical stage to the first procedure. And it all worked out in the end." Greiner enthuses, "We had experts on the job that we could never have afforded ourselves." He recalls an incident that made the passion for the common goal tangible: "Once, when the project was already well advanced, we had to move the system another 17 centimeters – it was a quality requirement for reasons of radiation protection. Our colleague from Siemens was adamant, based on his experience. And I'm pleased that he insisted: It turned out to be absolutely necessary to move the system as he said." Distler is convinced: "The most important thing is simply to get everyone on board, from the technology experts from Siemens Healthineers to anesthesia to the chief surgeons and the senior

consultants, as well as the entire OR staff, building department, IT, and executive management." His task is to present the analysis results from the medical and business decision makers on both sides. "That takes time, and occasionally we decide to step back." Everyone has to agree that "this is how we're going to do it before we can take the project through to completion together."

Device of choice: Artis zee floor

The Hybrid OR has now been running for almost a year and is proving to be extremely effective.

"While we adopted a conservative approach in the planning stage, the entire project has turned out incredibly well. There are 17 hospitals within a radius of 10 kilometers – but there was little available in the way of vascular surgery. Now we are the first ones that really set up a state-of-the-art-system," says Greiner proudly. There was less than 50 m² available at St. Anna's to construct the Hybrid OR, so once again, Distler and Greiner put

“We cannot progress if we don’t work together and think about what will benefit the end customer”

Florian Distler
Business Director for Integrated Health
Solutions Germany, Medtronic



their faith in experienced partners: *“The most important thing is to get everyone on board.”*

Three good reasons for the managed service model

Greiner has some solid answers when he is asked about the three most important reasons why operator models like this should catch on: *“First, the financing model is attractive, and second, Medtronic IHS is a powerful partner when it comes to project management. Ultimately, we can’t deny the benefit of the marketing effect for the hospital – both in-house and externally. No sooner had we cut the tape to open the new Hybrid OR than applications came in from two senior consultants from other hospitals.”*

State-of-the-art technology for difficult procedures

Vascular surgery will change in the future – both Greiner and Distler are certain of that. *“Much will be done on an outpatient basis in the future. That’s why we’re retaining the complex procedures that use state-of-the-art*

technology here, and are dovetailing them with our outpatient services.”

Here, too, Medtronic IHS is assisting the Order of Malta Hospitals in collaboration with partners from Siemens Healthineers, as Distler explains: *“It’s all about working on an equal footing with our customers so we can offer patients even better medical care in the future while*

making the best possible use of in-house hospital resources. We cannot progress if we don’t work together and think about what will benefit the end customer. In that respect, the entire industry is changing.”

Medtronic beyond devices

Medtronic created Integrated Health Solutions (IHS) in 2013 to support health providers addressing today’s challenges, such as the high cost of care and changing demographics. At IHS, the goal is simple: to help customers optimize costs and outcomes while driving higher value and patient satisfaction. Taking advantage of its size, scale, and clinical technical, and operational expertise, Medtronic has built a dedicated team with a unique mix of skills. Today more than 200 experts can complement a hospital’s competencies in the following fields: consulting, hospital management, building and managed care, biomedical engineering, planning and scheduling, logistics and market development. Medtronic IHS has entered into more than 80 partnerships across Europe and the Middle East. In Germany, more than 13 Integrated Health Solutions projects have been implemented, one of which was for the Order of Malta in Duisburg.

“In a strong competitive environment in the region, we want to offer our patients less invasive and safer treatment.”

Dr. Damian Schubert
MD, Head of Vascular Center,
St. Anna's Hospital Duisburg

How does the vascular center in Duisburg work together with the other hospitals of the Malteser Clinics?

DR. SCHUBERT: In the St. Anna's Hospital we built an infrastructure to treat the more complex cases with endovascular and open surgical treatment. All complex cases like aortic aneurysms are referred to Duisburg, while more routine cases like venous diseases are treated in the other clinics. This allows us to increase the utilization of our new Hybrid OR where we perform all endovascular procedures.

Can you describe the key changes that are involved with the Hybrid OR?

DR. SCHUBERT: We now have excellent imaging in a highly sterile environment. The new technology allows us to perform complex endovascular procedures with less contrast medium and less radiation exposure for the OR team in a shorter operating time. Compared to the years before, we ordered only 50 percent of the contrast media and at the same time increased the number of complex procedures.

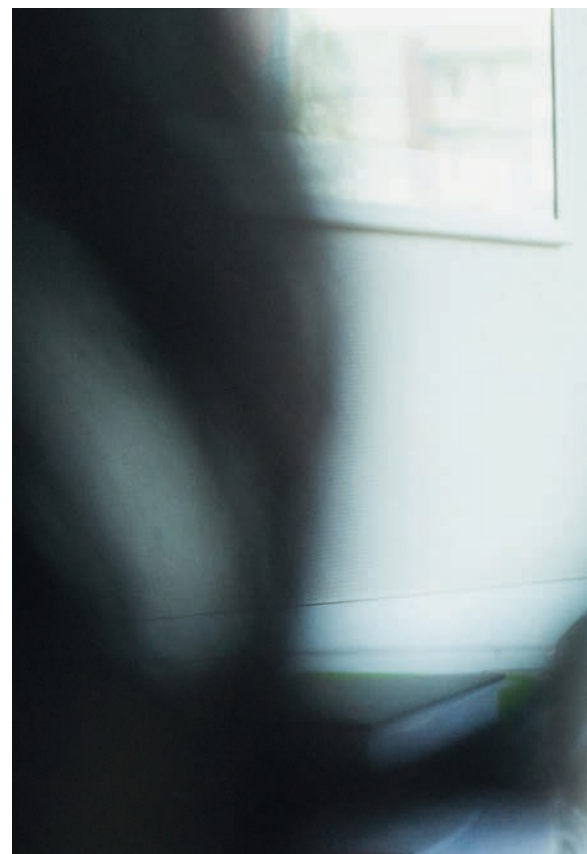
Has the Hybrid OR changed the external perception of the hospital?

DR. SCHUBERT: In a strong competitive environment in the region, we want to offer our patients a less invasive and safer treatment. To achieve this, we have a very well-trained professional team of surgeons working with the latest technology. Our patients are very well informed and feel better when the institution can offer treatment in a modern Hybrid OR. The feedback has been strikingly positive.

Does that have an impact on the number of patients you serve?

DR. SCHUBERT: The more complex procedures in our institution – like aortic aneurysms with branched stents – have increased. That can be directly attributed to the Hybrid OR. In terms of the case mix, we've recorded an increase of about 20 percent in the first four months. We perform about 100 aortic procedures annually. These procedures are not only faster: Most importantly, they put much less strain on the patients. We can now provide

“We now have excellent imaging in a highly sterile environment”





Dr. Damian Schubert has been the head of the hospitals for vascular medicine at Malteser Clinics Rhein-Ruhr since 2010. Since 2015 he has been using a modern hybrid operating room in the St. Anna's Hospital in Duisburg. In this interview he shares his experience and talks about the positive effects of this technology for the patient, the team, and the hospital.

more patients with support through intermediate care. The number of patients in the intensive care unit has declined compared to before the Hybrid OR, and that trend is expected to continue.

Why did you decide to go with a floor-mounted system?

DR. SCHUBERT: I would always advise going with a floor-mounted version because I think it gives us more space. The level of sterility is also higher than with a ceiling-mounted system, because the sterility level increases with every square meter. Unfortunately, we only have 50 m² here – an optimal size would be between 60 and 70 m².

Do you also use fusion imaging?

DR. SCHUBERT: This technology for placing stent grafts with 3D guidance is only available in hybrid rooms. Key benefits include tremendous savings in contrast medium and lower radiation exposure. We've been very impressed by it. With fenestrated

The Order of Malta Hospitals

The Order of Malta hospitals in the Rhine-Ruhr region are an example of a state-of-the-art interconnected hospital system, with two medical care centers, one radiotherapy unit, and three hospitals comprising 900 beds. One of these is the Malteser Krankenhaus St. Anna (St. Anna's Hospital), a state-of-the-art, patient-oriented hospital for acute and secondary care in the south of Duisburg, where more than 750 employees treat over 14,000 inpatients and 26,000 outpatients every year. The Malteser Vascular Center is a special department for the diagnosis and treatment of arterial, venous, lymphatic, and vascular diseases. Head Physician Dr. Schubert and his team operate on about 1,450 patients every year. The Hybrid OR at St. Anna's Hospital opened in September 2015.

prostheses, fusion imaging offers benefits that we'd never experienced before.

What tips would you give colleagues when planning the construction of a Hybrid OR?

DR. SCHUBERT: The close collaboration of everyone involved is very important. Care should be taken during planning to closely consult with

medical technicians, hygiene specialists, and architects. You have to get everyone together at one table for planning. If you accomplish that, you can get it installed in three months.

A low-angle photograph of the Houston Methodist Hospital building, featuring a modern glass facade and a brick section with the hospital's name. The sky is blue with some clouds.

How to improve lung cancer care – from screening to surgery

Methodist Hospital in Houston recently went hybrid in their treatment of lung cancer. Mahesh Ramchandani, who has extensive experience in video-assisted thoracoscopic surgery (VATS), and Alan Lumsden, an expert in navigating the C-arm in endovascular procedures, joined forces to tackle the challenges of minimally invasive lung cancer surgery. This is the story of their success, but also of how important screening programs and efficient one-stop workflows are for your hospital's profitability.

Methodist Hospital's hybrid operating room brought two specialists in different fields together to improve lung cancer surgery with their combined expert knowledge. By sharing their experience, *"We have the opportunity to see what each other is doing – to sort of look into each other's toolkit,"* Ramchandani explains. The main problem he always had to deal with when removing lung nodules was limited visibility. The tiny camera he inserts along with his special surgical tools through small incisions can only show nodules on the lung's surface – palpating the lung for deeper nodules

just isn't possible in this procedure. So he sought advice from his friend and colleague Lumsden. The chair of the department usually works with the Artis zeego to implant endovascular stent grafts and perform complex EVAR procedures using advanced 3D guidance technology.

Shorter procedure time. Fewer complications

It didn't take long for Ramchandani and Lumsden to team up and combine the VATS approach with the advantages of angiographic imaging.

Traditionally, the nodules are localized with a needle in the CT room. After the localization of the nodules the patient must wait for surgery in the OR on the ward. In the Houston approach both steps are combined in one session in one room. Having a Hybrid OR at hand spares the patient a visit to the radiology department prior to surgery – and that's not only more convenient for the patient, it's also better for accounting. Clinically, the combination of needle localization and VATS reduces the risk of dislodgement of the marker and the risk of a pneumothorax. And from an operational point of view the

coordination of just one room simplifies the overall process and frees up resources. Since Ramchandani and Lumsden are still working on a detailed cost-saving analysis, it can't be said for sure, but it's highly probable that the overall cost of lung cancer surgery can be significantly reduced using their new hybrid operating room.

The importance of lung cancer screening campaigns

Lung cancer seems to be under control, right? Not really. The problem is, lung cancer often is asymptomatic until the advanced stages. The moment, a patient begins to suffer the symptoms, in the majority of cases a surgical cure is no longer an option. Screening programs are steadily gaining momentum,

at least in the U.S. Many other regions are also taking this approach, but are still in a stage of trials and discussions.

A study in the U.S., the National Lung Screening Trial (NLST), enrolled about 53,000 current or former heavy smokers. The test subjects were screened for lung cancer either with standard chest X-ray or with low-dose computed tomography (LDCT). Six years into the trial, the mortality in the latter group was 20 percent lower – probably due to earlier treatment. As a result, in the U.S. the annual LDCT screening now is recommended and reimbursed for people between 55 and 80 with a long history of heavy smoking. Although the exact numbers may vary, this could lead to up to 8 million additional LDCT screens each year.

Still a long way to go

Early lung cancer screening is just one part of the story. What if the number of patients with small pulmonary nodules increases rapidly due to large-scale screening campaigns? There must be options available to analyze these small nodules with a high degree of diagnostic certainty. There also must be procedures for resecting them with a minimal loss of healthy tissue. Patient satisfaction and operational efficiency increase if treatments with many steps can be condensed down to one-stop workflows. The Hybrid OR offers the unique potential to combine diagnostic, interventional, and surgical tasks in one safe environment.

Today is a time of great change with respect to lung cancer – and hybrid operating rooms and new screening programs are the key drivers of this process. Or as Lumsden puts it: *"I think that the use of image guidance for a variety of surgical procedures is rapidly escalating, and I believe it will radically transform our specialty."*



"I think that the use of image guidance for a variety of surgical procedures will radically transform our specialty."

Alan Lumsden,
Chair of the department



"The advantage of this technique is that it combines the CT guided localization with the advantages of minimal-access surgery. And it does it in one procedure, in one place."

Mahesh Ramchandani,
Cardiothoracic surgeon at
Houston Methodist Hospital in Texas, U.S.

Watch the full story

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A new level of CO₂ imaging

Thanks to a new, automatic injector and optimized imaging protocols, optimal results in peripheral angiography can be achieved using CO₂ as contrast medium

CO₂ has been used as an intra-arterial contrast medium since the 1970s, as an alternative solution to the traditional iodinated contrast medium. As the technology continued to improve, CO₂ has evolved into a viable vascular imaging agent.

Although used initially to treat patients with renal failure or iodinated contrast allergy, the many unique properties of CO₂ yielded multiple advantages. It is now used in a multitude of scenarios, either alone or in combination with traditional contrast agents. It has been used with great success in both adults and children for more than three decades with only limited reportable complications. But still until now, it has only been possible to use CO₂ as a contrast medium in angiography by “manually injecting it.” This technique has significant issues: it is impossible to control the injection pressure, and there is a risk of air contamination. In addition, manually injecting CO₂ can be painful for the patient and therefore can result in poor image quality, especially in critical districts.

Prof. Dr. Ulf Teichgräber, Director of Radiology Department at the University Hospital of Jena, remembers: “We always tried to avoid CO₂, because of its technical limitations. In our daily business, it was rarely used, and only for patients with impaired kidney function.”

But thanks to the automatic CO₂ injector and specially optimized imaging protocols in the Artis zeego angio system, optimal results in peripheral angiography can now be achieved using CO₂ as the contrast medium. Teichgräber takes care of many cases with CO₂ imaging: “Today we use it in 10 to 20 percent of our cases, and we are increasing that – because the image quality is good – and it’s also easy to use.”



New CO₂ injector by Angiodroid

“If I give a colleague images with CO₂ contrast and normal iodine contrast it will be difficult for them to figure out what contrast medium has been used.”

Prof. Dr. Ulf Teichgräber
Director of Radiology Department
at the University Hospital of Jena



How to overcome the challenges in CO₂ imaging

There are still some challenges with this technology. First challenge: the position of the patient. Teichgräber explains: “The gas always goes up – that’s why the head of the patient has to point down to avoid gas embolism. This is still true for CO₂ imaging today. When you have a normal ceiling-mounted system, you have to move the table. And for safety reasons, you’re not really able to move the table. This is very uncomfortable for the operator as well as the patient.” But Teichgräber’s team found a solution: “We decided on Artis zeego. For one thing, the robot brings a big advantage: Once you’ve placed the patient head-down, you don’t have to move the table anymore. You just move the robotic C-arm wherever you want it to be. So you can cover nearly the entire body without moving the patient. That makes working with a robot a totally different experience.”

The second challenge was to convince the patient, because the CO₂ injection can be very painful.

Teichgräber solved this challenge in Italy with the Angiodroid CO₂ injector: “I tested it and was very impressed. Now the image quality using CO₂ contrast is higher, because the very constant soft injection fills the vessels continuously and provides an even better flow. The result: Because the CO₂ doesn’t pour suddenly into the vessel, the pressure release is very soft. That means less pain for the patient and a really big improvement in image quality.”

Watch the interview

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Prof. Dr. Ulf Teichgräber
about a new level of
CO₂ imaging

Watch the interview:
[siemens.com/you-tube/
co2-imaging](https://siemens.com/you-tube/co2-imaging)



CO₂ is a nontoxic, nonflammable, buoyant, compressible gas that has low viscosity. It is a natural bioproduct, and there are approximately

120 liters of CO₂

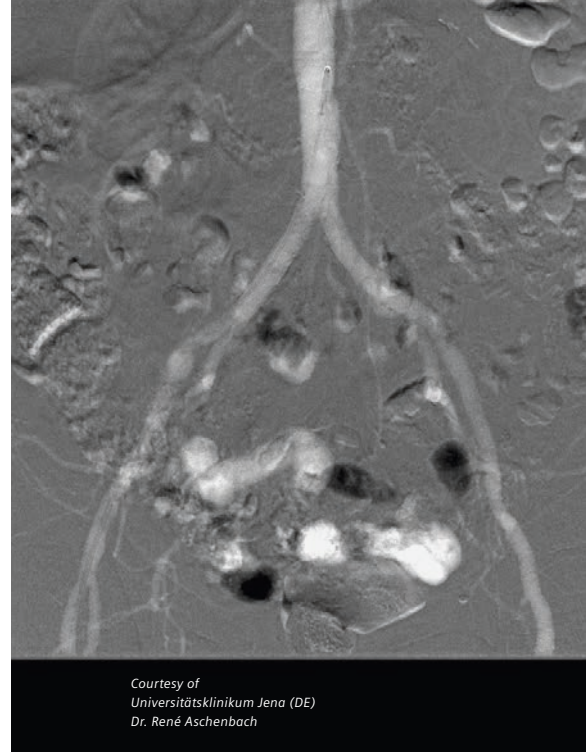
stored in the soft tissues at any given time.

Roussos C, Koutsoukou A.
Respiratory failure. *Eur Respir J*. 2003;
22: Suppl. 47, 3s–14s.



"We were able to design and realize the first machine that allows users to set very fine and accurate pressure parameters for the injection."

Sebastiano Zannoli
CEO Angiodroid



Courtesy of
Universitätsklinikum Jena (DE)
Dr. René Aschenbach

The Angiodroid injector provides a constant CO₂ injection adapted to the systolic blood pressure

Sebastiano Zannoli, CEO Angiodroid, on the new CO₂ injector generation:

What was your motivation to develop a new device for CO₂ injection?

SEBASTIANO ZANNOLI: CO₂ angiography is not a new technique. We decided to invest for two reasons: First, the technical advances in X-ray systems have enabled significantly better image quality using CO₂ contrast. There is now an algorithm for optimally visualizing the bolus of gas. The second reason is the increase in diabetes in the general population. As this patient group increases, the market needs a machine that allows you to push a button and inject the CO₂ contrast medium, and not have to use iodine.

What is the basic technical principle behind your development?

SEBASTIANO ZANNOLI: It's typically very difficult to inject a gas. When you inject a liquid, you only need to define the flow. But when you inject gas, you're also injecting under pressure. We were able to design and realize the first machine that allows users to set very fine and accurate pressure parameters for the injection. The result: The patient doesn't feel pain. With our injector, you set your parameters and push a button – and the machine does everything else.

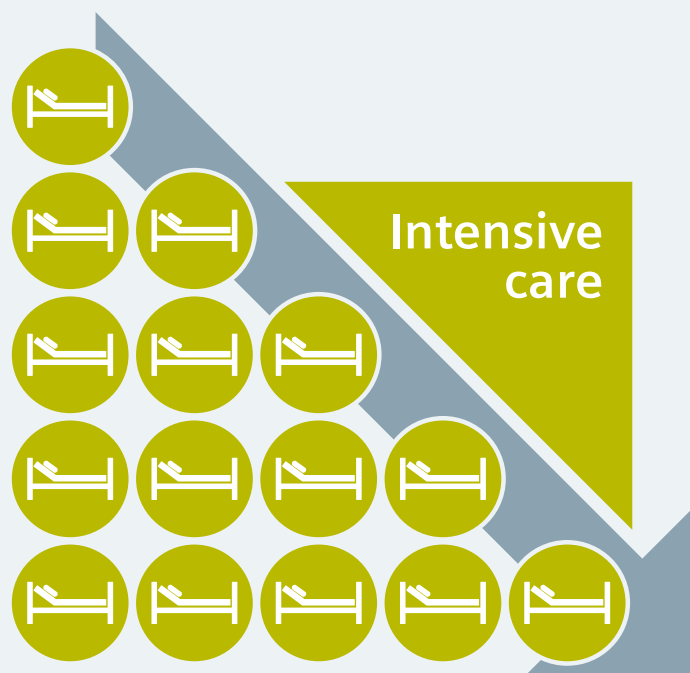
3 Facts about CO₂ angiography

1 CO₂ is less dense than iodinated contrast medium, and demands special acquisition protocols of the angio system.

2 CO₂ doesn't cause allergic reactions, and there is no renal toxicity: Even patients with diabetes or compromised renal function can be treated.

3 Costs are reduced in cases where CO₂ is used as contrast medium instead of conventional iodine contrast medium.

Number of patients in intensive care declined



Over the last two years, the more complex procedures – like aortic aneurysms with branched stents – have increased in number at the Order of Malta Hospital in Duisburg. Dr. Damian Schubert explains: *“That can be directly attributed to the Hybrid OR. These procedures are not only being performed faster: most importantly, they put much less strain on the patients. We can now provide more patients with support through intermediate care. The number of patients in the intensive care unit has declined compared with the time before we acquired the Hybrid OR, and that trend is expected to continue.”*

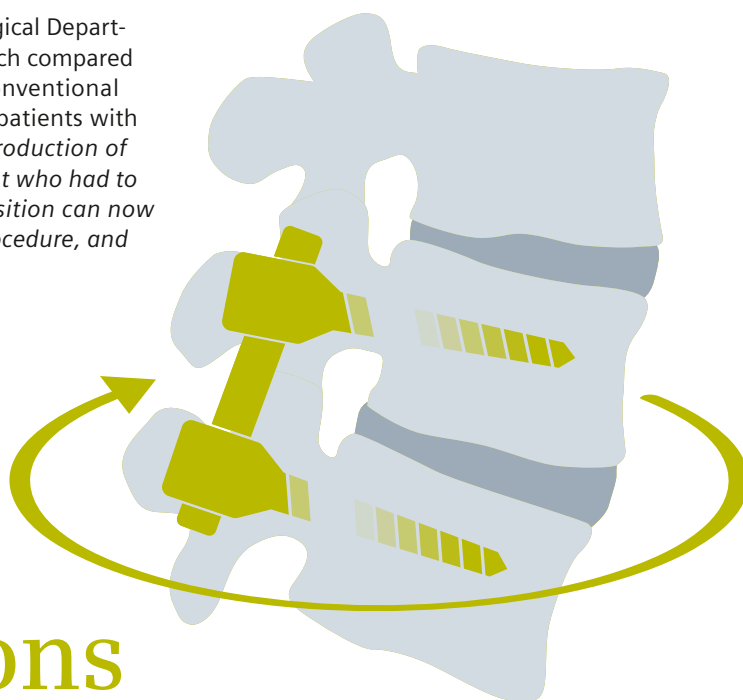
Less strain

A new era for spinal fusion surgery

Stefan Zausinger and his colleagues in the Neurosurgical Department at the University Hospital Grosshadern in Munich compared intraoperative CT-assisted neuronavigation with conventional neuronavigation based on preoperative imaging in patients with spinal fusion surgery. Says Zausinger: *“Since the introduction of intraoperative CT, there has not been a single patient who had to be reoperated on to reposition the screws. Their position can now be shown in intraoperative CT images during the procedure, and can be corrected immediately if necessary.”*

Read more on page 24

ZERO reoperations





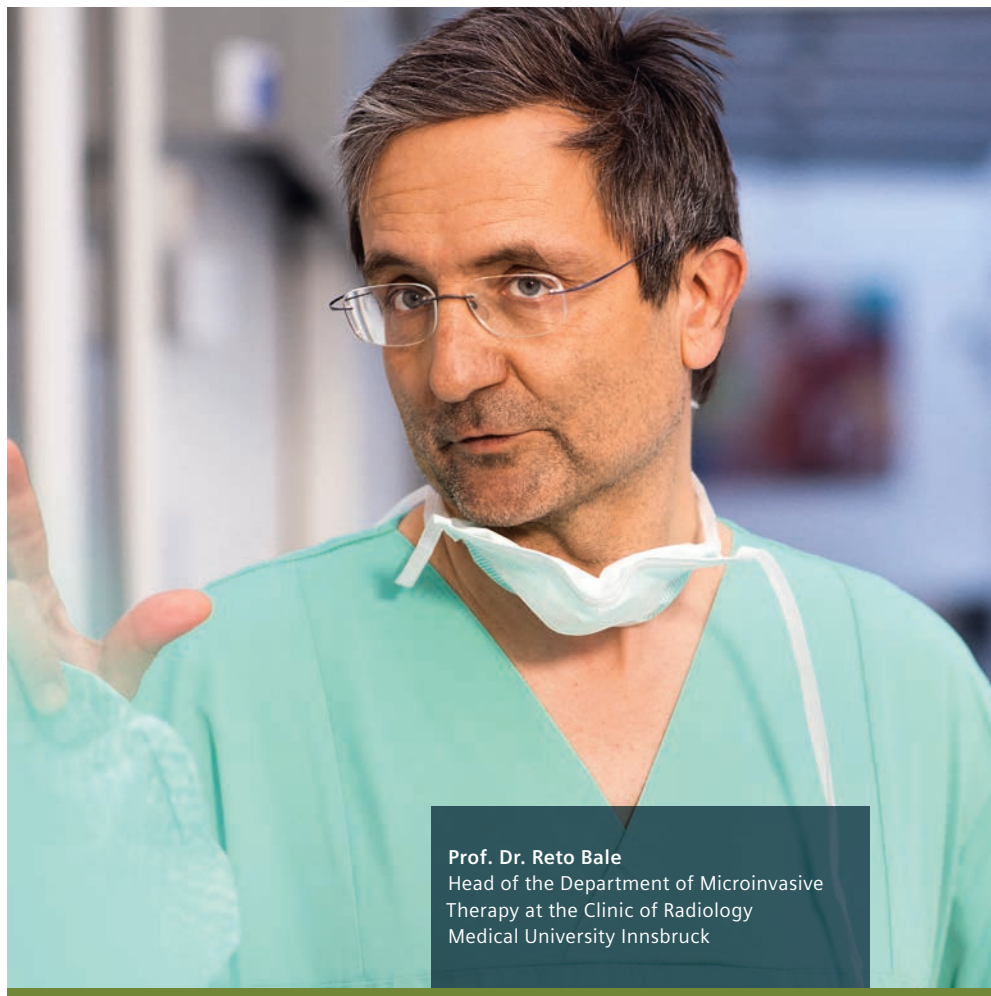
Sliding Gantry

Intraoperative computed tomography on rails

A sliding gantry solution brings CT image quality to the operating room and can optimize the cost-benefit ratio

When Siemens first introduced CT technology in the 1970s, the engineers did not even dream of putting a CT on rails for high-quality 3D imaging in the operating room. But 40 years later, an intraoperative CT scanner from Siemens has

been designed with the needs of the surgeons in mind: Rather than moving the table with the patient into the CT gantry, the intraoperative CT's large gantry slides on rails over the patient on a standard surgical table.



Prof. Dr. Reto Bale
Head of the Department of Microinvasive
Therapy at the Clinic of Radiology
Medical University Innsbruck

Innsbruck: Unconventional thinkers

At Innsbruck Medical University, intraoperative CT has become an essential component: The Section of Interventional Oncology (SIP) was one of the first institutions to use the sliding gantry CT regularly path planning of percutaneous image-guided treatments. The

SIP is known around the world for performing complex percutaneous tumor and pain interventions. And the colleagues from the Department of Neurosurgery use intraoperative CT for trauma surgery when every minute counts.

Watch the interviews

Read the QR code with the QR code reader in your mobile phone!



Reto Bale has treated more than 700 patients with liver tumors by stereotactic radiofrequency ablation.

Watch the whole interview:
[siemens.com/you-tube/stereotactic-radiofrequency-ablation](https://www.siemens.com/you-tube/stereotactic-radiofrequency-ablation)



"We have not revised a single patient who had a CT intraoperatively" says Claudius Thomé.

Watch the whole interview:
[siemens.com/you-tube/intraoperative-ct](https://www.siemens.com/you-tube/intraoperative-ct)



“The effect: The rate of correctly positioned implants is higher than in the past. This means, in general, improved quality and increased safety and comfort for the patients.”

Univ.-Prof. Dr. med. Claudius Thomé
Full professor and Chairman
Dept. of Neurosurgery
Medical University Innsbruck



Sliding Gantry

Dr. Claudius Thomé's surgical specialties are cerebrovascular surgery, skull-base surgery, and complex spine surgery. Especially for trauma patients, every minute counts. Because intraoperative CT allows him to update the dataset for the neuro-navigation system whenever necessary, Dr. Thomé can spend his time focusing on the patient and not on the technology. The result is that it becomes easier to preserve delicate structures, which enables him to be more confident: “Previously, we worked with CT images from before the operation. Now we can navigate every instrument throughout the entire operation. And if we need an intraoperative image during surgery, we do not need to move the patient – the CT moves over the operating table. This is a big advantage, particularly for trauma patients.”

Increased accuracy

3D reconstruction based on high-resolution images from the CT are the prerequisite for modern navigation software to function. During the operation, the markings on the fixed head of the patient are the only additional thing that is necessary. Another advantage: “You don't have to indicate the position of the patient – the CT does everything. So during the operation, I know with millimeter precision exactly where I am,” says Dr. Thomé. “In spinal instrumentation, for example, we see on the navigation system's monitor exactly how the instrument that is drilling the channel for the screw is entering the vertebra, and we can make corrections while we are operating. The effect: The rate of correctly positioned implants is higher than in the past. This means, in general, improved quality and increased safety and comfort for the patients. Another very important factor is that the spine surgeons in the operating room are no longer exposed to X-rays. Usually

we do another CT scan in the treatment room when we are done with our work. If a screw or another implant is not in position, we can revise right then, which makes another operation unnecessary.”

“We have not revised a single patient who had a CT intraoperatively, because you can see whether the screws are correct or not.”

And to date, the team has not revised a single patient who had a CT intraoperatively. Because word about this high quality has gotten around, the Innsbruck team now has more referrals of patients with very complex deformities. Dr. Thomé meets the challenges by continuously improving the workflow: “After the learning period, we are faster than without navigation. We anticipate that, in the future, we can further reduce the time needed for screw positioning during an operation.”



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Intraoperative navigation systems may help reduce the risks

It is no surprise that Dr. Reto Bale – director of the section of minimally invasive therapy in Innsbruck and one of the early adopters in integrating the sliding gantry into the treatment room – is an unconventional thinker: “You don’t need an MR gantry for MR-guided interventions – you just do it in the CT gantry by using image fusion,” he says. In his opinion, increasing use of intraoperative navigation systems may help reduce the risks of minimally invasive surgical techniques.

Three-dimensional planning of positioning of multiple probes

Today, Dr. Bale is embarking once again on new paths using a special technology for tumor treatment through radiofrequency ablation. “The difference between this and conventional radiofrequency ablation is that we use the 3D navigation system for three-dimensional planning of posi-

tioning of multiple probes to cover the entire tumor with overlapping ablation zones.” In order to completely cover the tumor, Dr. Bale uses the CT data three times: “First we do a planning CT and send the data to the 3D navigation system. After we have planned all the pathways, we use the navigation system to place the needles.” With a second CT, the team checks the position of the needles with respect to their plan with image fusion. “After ablation, we need a third contrast-enhanced CT to check if the tumor is completely covered by the ablation zone.” The result of his method speaks for itself: “We have two to three times less morbidity and two to three times less mortality than resection, and the same local recurrence rate and similar long-term survival rates.”

Hospital portraits

The Department of Neurosurgery at Innsbruck Medical University covers general neurosurgery but has a focus on the spine (about 60 percent spine cases). In cranial cases, the Innsbruck team treats regular brain tumors, skull base tumors, and vascular cases as well as deep brain stimulation. An intensive care unit is covered by neurosurgeons.

The Department of Radiology (Director: Prof. Werner Jaschke) is at the Innsbruck Medical University. The Section of Interventional Oncology – Minimally Invasive Therapy (SIP) covers 3D navigated percutaneous thermal ablation of tumors in various body locations. Another important focus of the SIP is percutaneous pain treatment by infiltration and radiofrequency ablation.



Sliding Gantry

The benefits of intraoperative CT

Illustrated with typical patient scenarios from the early adopters in Grosshadern and Innsbruck



Tumor surgery

Professor Jörg-Christian Tonn uses a neuronavigation system to resect brain tumors, with the goal of preventing further brain damage. But a neuronavigation system is only as reliable as the images that it can draw upon. *"We usually have preoperative MRI images," he says. "However, during surgery, many things change. Using intraoperative CT allows the dataset for the neuronavigation system to be updated whenever necessary. With intraoperative CT imaging, it becomes easier to preserve delicate structures, and we can be more certain that we have removed the tumor as completely as possible."*



Spinal fusion

The challenge with spinal fusion is that the screws need to be placed as accurately as possible. Professor Stefan Zausinger uses intraoperative CT for spinal fusion surgery. The first examination is performed right before the screws are to be placed. The dataset is fed directly into the neuronavigation system. Once all the screws are in



place, a second intraoperative CT is performed in order to check their positions. Zausinger says there are two major advantages to this setup: *"First, the images are generated in the final surgical position of the patient. This results in more accurate images and thus improved navigation. The second advantage is that we can see during surgery whether the screws or the rods are compressing any structure, and we can also see hematomas right away."* If a problem is identified, it can be corrected immediately. Not only is this efficient, it can also spare the patient a potential reoperation.



Clipping of aneurysms

In aneurysm surgery, there is no navigation. Nevertheless, intraoperative CT can make a big difference. Professor Christian Schichor started using intraoperative CT in patients in need of aneurysm-clipping surgery. *"Patients with complicated vessel lesion benefit most from intraoperative CT,"* says Schichor. *"In CT angiography, we see whether the vessel patency is preserved. And with CT perfusion scans, we can look at the distant perfusion in order to evaluate whether the*

clipping has some detrimental effect on other brain regions." Schichor says that no other imaging modality is capable of providing this kind of information intraoperatively: *"With MRI and ultrasound, you are always dealing with the problem of visual artifacts produced by the clips. And conventional angiography tells us nothing about distant brain perfusion."*



Tumor ablation

Stereotaxy means *"navigating in 3D space,"* in a Cartesian coordinate system. The problem is, you cannot fix a stereotactic frame on an organ. The liver, for example, moves up and down. Thus, it was necessary to develop a frameless stereotactic navigation system. This requires registration of the liver to a 3D space and correlating the virtual volume to the real patient. Most medical professionals only ablate tumors less than three centimeters, but Dr. Reto Bale's approach has enabled his team to treat tumors up to 19 centimeters with good results. The intraoperative CT check with the sliding gantry is a huge advantage for his approach,

since he can be more certain – right in the treatment room – of having completely destroyed the tumor.



Trauma surgery

When it comes to treating spinal cord traumas, precision and speed are equally important. The intraoperative CT offers both, as Claudius Thomé explains: *"With the sliding gantry, the imaging can be repeated during the operation at any time, without having to move the seriously injured patient. If something is not right, it can be corrected immediately, saving the patient from the need to have a second operation. This can be extremely helpful in case of traumatic cerebral or spinal hemorrhage, as the completeness of hematoma evacuation can be checked at the end of the operation."* And if unexpected complications should arise, the team from the Innsbruck hospital can react immediately – *"in some circumstances, a time savings that is crucial for survival and neurological recovery,"* according to Dr. Claudius Thomé.



“I am convinced that adoption of intraoperative CT will increase, and this is certainly in the interest not only of the patients but also of our hospital administrators.”

Professor Jörg-Christian Tonn, MD,
Director of the Department of Neurosurgery
at the University Hospital Grosshadern

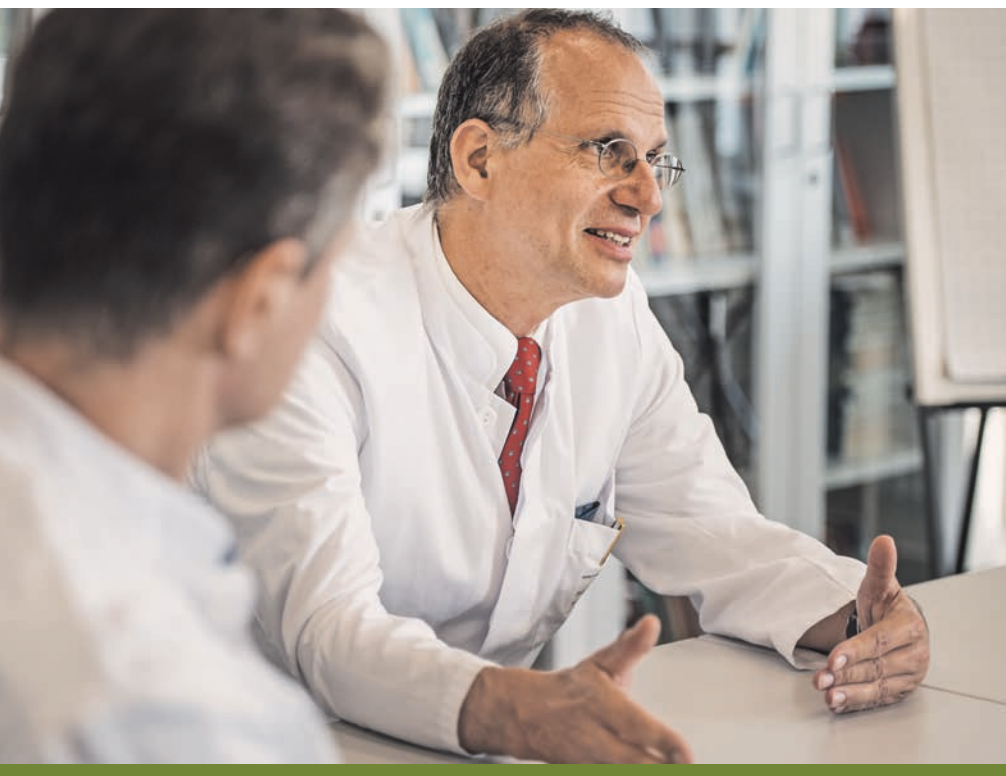


Sliding Gantry

Grosshadern: a smoother neuronavigation workflow

The Neurosurgical Department at the University Hospital Grosshadern in Munich, Germany, was one of the first to introduce intraoperative CT imaging in neurosurgery. The department contends that intraoperative CT can increase patient safety and has a reasonable cost-benefit ratio.

When Professor Jörg-Christian Tonn, MD, Director of the Department of Neurosurgery at the University Hospital Grosshadern, is resecting a brain tumor, he needs to know exactly where the malignancy is located. *“This means we have to perform imaging up front. And we also need to check the result of our resection,”* he says. His colleagues, the spinal surgeon Professor Stefan Zausinger, MD, and the neurovascular surgeon Associate Professor Christian Schichor, MD, are also *“imaging-driven guys,”* as Tonn puts it. When Zausinger places screws into the vertebral bodies of a patient with instabilities of the spine, he relies on neuronavigation – which is heavily dependent on up-to-date imaging material. And Schichor needs imaging not only to visualize the aneurysm, but also to verify whether his clipping procedure was a success.



Watch the interviews

Read the QR code with the QR code reader in your mobile!



"We can be more certain." – Jörg-Christian Tonn on Neurosurgery using intraoperative CT

[siemens.com/you-tube/intraoperative-ct-neurosurgery](https://www.siemens.com/you-tube/intraoperative-ct-neurosurgery)



Stefan Zausinger on intraoperative CT during spine fusion surgery.

[siemens.com/you-tube/intraoperative-ct-spinal-fusion](https://www.siemens.com/you-tube/intraoperative-ct-spinal-fusion)



Christian Schichor uses intraoperative CT for clipping surgery of brain aneurysms

[siemens.com/you-tube/intraoperative-ct-spine-surgery](https://www.siemens.com/you-tube/intraoperative-ct-spine-surgery)

No interference with surgical workflows

At Grosshadern, the neurosurgeons became interested in using the SOMATOM Definition AS in a sliding gantry configuration as an intraoperative CT system some years ago. And they had good reasons: Compared to MRI, CT is cheaper and requires less maintenance; it does not need shielding and thus major construction activities; there is almost no interference with surgical workflows; and conventional surgical instruments can be used.

Success can now be proved

Tonn, Schichor, Zausinger, and their colleagues have gathered data from several prospective patient series in order to analyze the benefits of intraoperative CT scientifically. In one of these studies, the experts compared intraoperative CT-assisted neuronavigation with conventional neuronavigation based on preoperative imaging in patients with spinal fusion surgery. *"We found that repositioning was necessary in about 7 percent of screws,"* says Zausinger. This percentage is very similar to the percentage of patients who

had to be reoperated on the era before intraoperative CT was available. Since the introduction of intraoperative CT, there has not been a single patient who had to be reoperated on due to repositioning of the screws. Screw position can now be checked by intraoperative CT images during the procedure and can be corrected immediately if necessary. Another patient series was related to meningioma patients. Surgeons at the university used intraoperative CT to visualize tumor tissue for resection. These might otherwise have been missed – without the images from intraoperative CT for assessing the tumor resection success during surgery.

The hospital saves money

Reducing postoperative complications is also a concern for surgeons; having access to reliable images during surgery is thus important. Tonn explains that, by reducing complications, the likelihood of readmission decreases, which means that the hospital saves money. *"Intraoperative CT can thus actually help a hospital be more cost-efficient,"* he concludes.

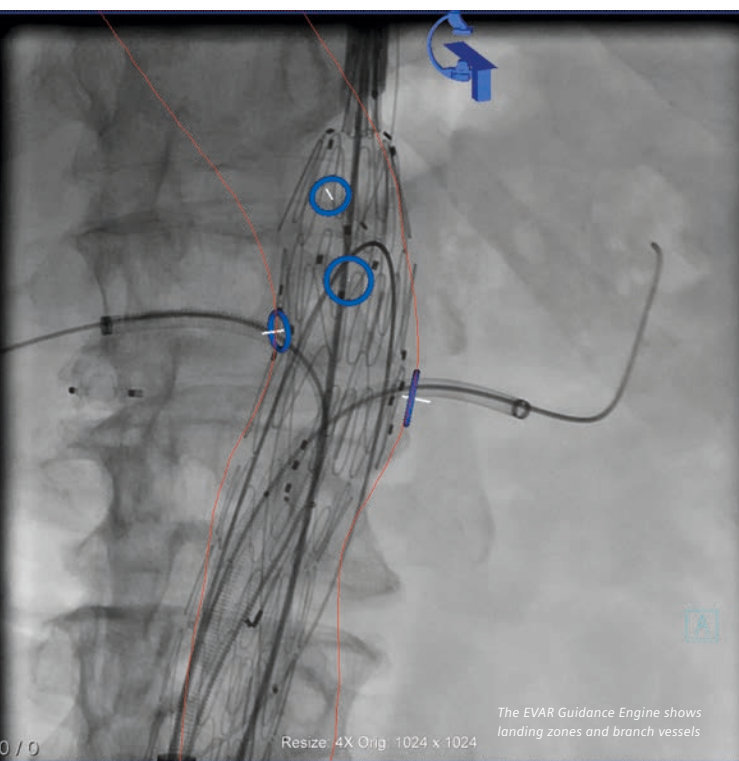
Hospital portrait

The new Surgical Center, directly adjacent to Grosshadern Hospital's main building, is an eye-catcher architecturally. But even more important, it is designed to meet the demands of the increasingly interdisciplinary nature of surgery. The building, which required an investment of €196 million, features 32 brand-new operating theaters, equipped with state-of-the-art medical technology. The Center's intraoperative CT is a modern SOMATOM Definition AS+ with 128 slices. It is a dual-room solution that is mounted on rails between two operating theaters, separated by two sliding doors. This enables surgeons in both rooms to use the CT.



“Everything
became very
easy”

The EVAR Guidance Engine provides automated support before, during, and after stent deployment



Dr. Giuseppe Panuccio
Vascular surgeon
University Hospital Muenster

Repairing aortic aneurysms is precision work that requires unwavering concentration. With the EVAR Guidance Engine, Siemens Healthcare offers a solution for expanding surgical capabilities and improving clinical outcomes. The first automated workflow for stent deployment with fusion imaging aims to take the hassle out of all standard EVAR procedures.

At the 2016 Leipzig Interventional Course (LINC), Prof. Dr. Eric Verhoeven, Head of Vascular Surgery from Nuremberg Hospital, Dr. Giuseppe Panuccio, vascular surgeon from University Hospital Muenster, and Dr. Philipp Geisbuesch, vascular surgeon from Heidelberg University talked about their experiences with the technology.

CT data for fusion imaging prepared within minutes

With syngo EVAR Guidance, all steps to prepare the CT dataset are automated for the first time. Based on the mesh modeling of the aortic wall, the EVAR Guidance Engine supports experts by providing automated segmentation of the aorta and side branch vessels. The ostia of all main vessels are automatically visualized, landing zones for the stent are proposed, and a possible optimum C-arm angulation for the procedure is calculated. This can lead to significant time savings and reduced workload. Giuseppe Panuccio particularly appreciated the significant time savings and reduced workload offered by the automation. He agrees, "Contrast agent is lower, radiation also. And, with only one click, you can find the precise position you need. What's more, procedure accuracy increased, and the operator is more comfortable during the procedure."

Watch the interview

Read the QR code with the QR code reader in your mobile!



GoHYBRID!@LINC 2016:
Philipp Geisbuesch on
EVAR Guidance Engine

Watch the whole interview:
[siemens.com/you-tube/ev-ar-procedure-in-the-hybrid-or](https://www.siemens.com/you-tube/ev-ar-procedure-in-the-hybrid-or)

“It allows you constantly to have all the critical landmarks right in front of your eyes.”

Dr. Philipp Geisbuesch
Vascular surgeon
Heidelberg University



Preparation

Automated preparation of CT data for fusion imaging



Registration

Automated



Deployment

Automated guidance during stent deployment

Assessment

Immediate assessment of stent position

Automated registration for fusion imaging: the advantage is obvious

Once preparation is finished, the registration of the preoperational 3D CT data set to the angio system requires two fluoroscopy projections. According to Eric Verhoeven, the benefits of automated registration are obvious:

“With the EVAR Guidance Engine, the alignment of the fluoroscopes to the CT volume is supported by automated registration of anatomical landmarks such as the spine or the contrast-filled aorta. This is very user-friendly and doesn’t cost extra time. A big advantage!”

Prof. Eric Verhoeven,
Head of the University Department of
Vascular Surgery at Nuremberg Hospital

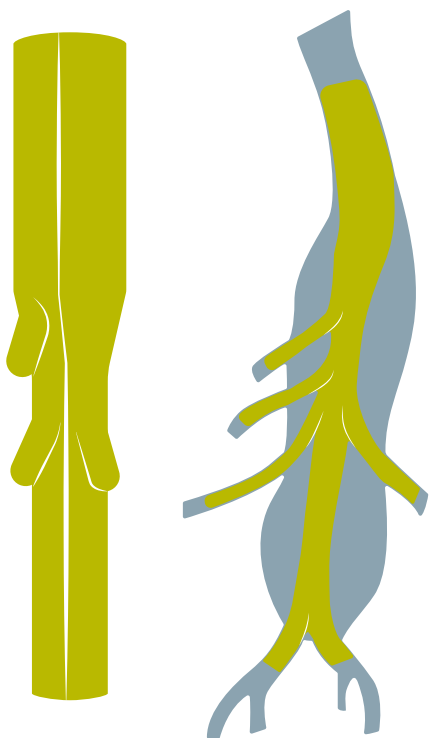
Automated guidance during stent deployment

Fusion imaging provides surgeons with continuous guidance throughout the procedure. The optimal viewing projection for each side branch has already been calculated during preparation, and, after the target vessel is selected on the heads-up display, the C-arm can be moved easily to the calculated angulation, saving radiation dose and contrast for the patient.

Philipp Geisbuesch says: “It’s absolutely striking to see because it allows you constantly to have all the critical landmarks right in front of your eyes. You always know where the renal artery is, you always know the angulation that you have to choose. So the fusion imaging gives us the chance to exactly place the endograft in the correct angulation right on the spot. And we are using it with very low contrast.”

For peace of mind: immediate 3D assessment

Last but by no means least, surgeons can assess results right away – using intraoperative 3D imaging with syngo DynaCT. Image acquisition in lateral or head side position is completed in only five seconds to discover associated complications with the endograft right in the OR while the patient is still on the table. Eric Verhoeven recognizes another advantage of doing a syngo DynaCT acquisition at the end of the procedure. His team in Nuremberg, Germany, has long been offering individually tailored follow-up to patients. “We now can add syngo DynaCT to our algorithm to determine how soon we need to see our patients for follow-up.” He also points out that the technology itself has taken a step forward: “The new application is much easier to use, with the automated registrations of the aorta and target vessels, and with manual corrections possible during the procedure. These small changes are so important in practice. There is no doubt that, for EVAR procedures, today’s version of this fusion technology already offers a huge advantage.”



Multi-branched stent graft

20% increase in terms of case mix

Case Mix Index (CMI) is a relative value assigned to a diagnosis-related group (DRG/MSDRG) of patients in a medical care environment. The CMI of a hospital reflects the diversity, clinical complexity, and the need for resources in the population of all the patients in the hospital. The CMI value of a hospital can be used to adjust the average cost per patient for a given hospital relative to the adjusted average cost for other hospitals. The adjusted average cost per patient would reflect the charges reported for the types of cases treated in that year. Dr. Damian Schubert from St. Anna's Hospital in Duisburg observed:

“The more complex procedures in our institution – like aortic aneurysms with branched stents – have increased. That can be directly attributed to the Hybrid OR. In terms of the case mix, we’ve recorded an increase of about 20 percent in the first four months.”

Read more on pages 10–11.



The “Sliding Gantry 1-2-3”



Tumor surgery



Spinal fusion



Sliding Gantry



Clipping of aneurysms



Trauma surgery




Tumor ablation

SOMATOM CT Sliding Gantry features a CT-on-rails that can be installed in the treatment room. You can minimize patient transport using **1 Sliding Gantry** for **2 operating rooms** and expand your clinical capabilities with **3D imaging** solutions.

Read about typical patient scenarios on pages 22–23.

A new world opening up

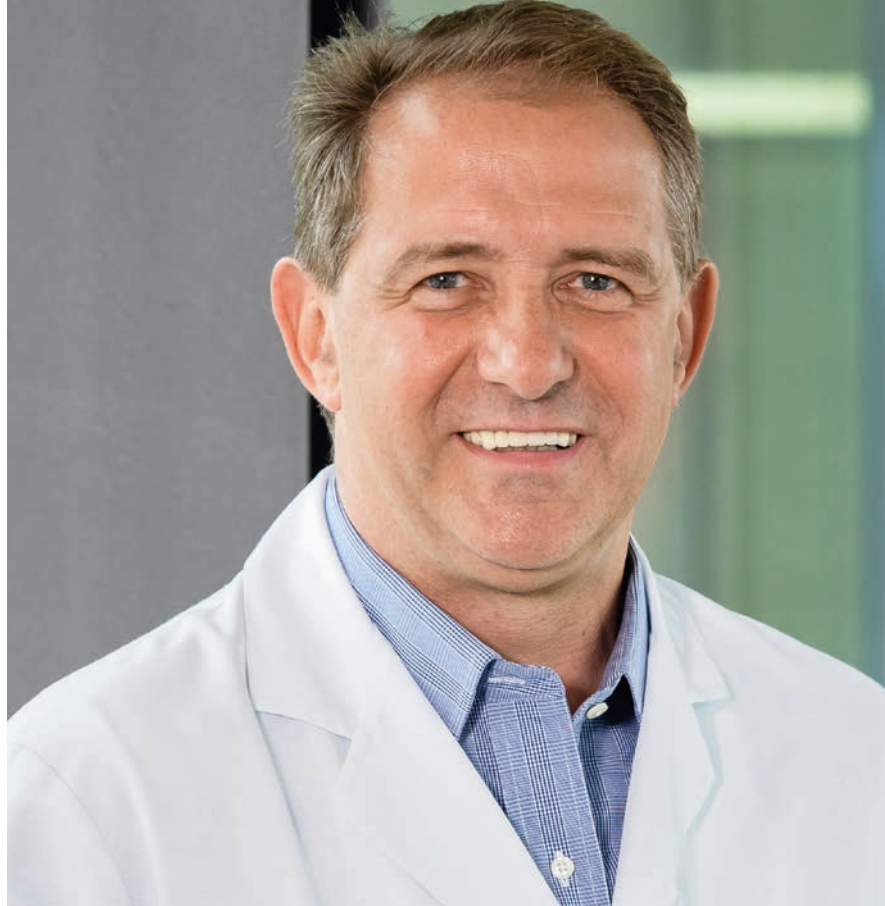
Prof. Eric Verhoeven is Head of the University Department of Vascular Surgery at Nuremberg Hospital, Professor of Vascular Surgery at the University in Leuven, and Guest Professor of Surgery at the University of Lisbon. He was recently honored for a very special record: He is probably the first surgeon in the world to have performed more than 1,000 fenestrated and branched EVAR interventions with his team.



“Using the technique, we see a number of advantages that we didn’t expect. Now I’m completely convinced that fusion technology is the way to go for every EVAR procedure.”

Prof. Eric Verhoeven
Head of University Department of
Vascular Surgery Nuremberg Hospital
Paracelsus Medical University Nuremberg

“The Hybrid OR environment takes care of both the patient and the personnel in the room.”



How many EVAR cases have you performed here in Nuremberg so far?

E. VERHOEVEN: Nuremberg Hospital is a very large municipal hospital with about 2,500 beds, and it has a very big endovascular center. Upon my arrival in 2009, I instituted advanced endovascular techniques: fenestrated and branched grafting. We witnessed a compound annual growth rate of 20 percent. And today we do about 250 cases a year, including up to 130 complex cases. If you compare us with other hospitals, we have a much larger number of advanced cases because a lot of patients are referred to us.

You just performed your 1,000th EVAR case, right?

E. VERHOEVEN: Yes, we've now achieved that number. I started doing this procedure in 2000 in Groningen. The technology was slowly emerging, and I was allowed to be part of the research team. We were able to move forward slowly. We did four cases in 2000, 10 cases in 2001, and we now do 130 a year.

How many people are in the “club” of those who’ve performed 1,000 EVAR cases?

E. VERHOEVEN: Over the last few years, the technology has really boomed. Today there are a number of bigger centers – but at the moment, we are probably one of the largest centers in the world. According to Cook, having performed 1,000 EVAR cases may be a world record, if you relate it to just one person. But I like to see it as a team effort.

What is the main benefit of a hybrid room for these EVAR cases?

E. VERHOEVEN: In Nuremberg, we're lucky to have two hybrid rooms featuring Artis zeego systems, which is a very advanced technology. Not everyone needs an Artis zeego, but the zeego is certainly the Rolls-Royce of fixed imaging systems. It gives you the ideal setup for each case. We are using the robots for all our cases, and I realize that the Hybrid OR environment takes care of both the patient and the personnel in the room. It's certainly safer and quicker, and we can also achieve higher quality.

You had the opportunity to test the new syngo EVAR guidance. What is your experience?

E. VERHOEVEN: In the beginning, I was a bit skeptical because it took a few more steps, and I had the impression that we didn't need it. But in using the technique, we see a number of advantages that we didn't expect. Now I'm completely convinced that fusion technology is the way to go for every EVAR procedure!

How frequently do you use EVAR guidance today?

E. VERHOEVEN: We're moving quickly to 100 percent. And the reason for that is training. I'm conservative, and I still think, “I can do without.” But it's not about me: It's about the team! It's about taking the next step for the patients and the staff working in the room.

Is EVAR guidance a technology for advanced procedures only?

E. VERHOEVEN: We thought of doing fusion for only the most advanced cases, but we quickly started to use



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DE/paracelsus-universitaet](http://www.klinikum-nuernberg.de/DE/paracelsus-universitaet)

fusion imaging for standard EVAR procedures as well, because it's so quick and now also automated. So now we use fusion imaging for every case. At this point it's probably more valuable for advanced procedures, but it also offers advantages for standard procedures. It's a fantastic tool, and it's moving forward so quickly that it will soon help a lot of surgeons who don't have the chance to do many cases, or those who are at the beginning of their career, or who have somewhat less experience.

Can you highlight the main advantages of fusion imaging?

E. VERHOEVEN: The greatest advantage is that you have a 3D image all the time without having to strain your brain. The second is that it allows you to do a number of steps without having to do additional angios. It's showing that you can reduce OR time, you can reduce radiation, and you can reduce contrast dose. Considering that we're only at the beginning of fusion technology, it's a new world that's opening up.

What has to be done to prepare for fusion imaging?

E. VERHOEVEN: We can register the preoperational CT dataset with two simple fluoroscopic images to the zeego. To increase the precision of the overlay, we now do the registration images with the stiff wire in the aorta to avoid reregistration later. This is really only a 10- to 15-second job.

What is your experience with the automated preparation of the CT dataset?

E. VERHOEVEN: It's moving so quickly and becoming so easy that I don't have to look at it anymore, because our radiology technicians have been well trained by Siemens Healthineers. In one to five minutes the preoperational CT dataset is prepared for fusion imaging and we can get going. The only thing that's needed during the procedure is the "fine-tuning," to get the perfect adjustment.

Hospital portrait

With about 2,500 beds and over 100,000 patients per year, the general Hospital in Nuremberg (Paracelsus Medical University Nuremberg) is one of the largest municipal hospitals in Europe. It offers first-class diagnostic and therapeutic medicine in 38 specialized departments and institutes, with world-famous specialists from different fields working together under one roof. The department for vascular surgery offers the whole range of operative, minimally invasive, and interventional therapy for vascular diseases – including about 250 EVAR cases every year.



How does fusion imaging support you during stent deployment?

E. VERHOEVEN: In many ways! During deployment it's all about orientation. In fenestrated procedures, you deploy the graft in orientation to one or two of the target vessels. With fusion we can look at all vessels. If you have a branched graft, it's very important that all four branches land above the target vessels. Without fusion technology, we chose the most critical vessel and planned to land the branch above it and hoped for the other branches to be fine. With fusion during the deployment, we can look at all four vessels at the same time. It just takes the touch of a button, you turn your C-arm, and you can see where your branches land in relation to the target vessels. So again, it gives you a safer deployment.

What about contrast use?

E. VERHOEVEN: We certainly use less contrast, because we know where to go. For the deployment we still do one angiogram. This is the reference for the whole procedure. With fusion you don't need additional angiograms

while catheterizing the target vessels: You can reposition your graft according to the fusion. The big advantage is that you can adjust the angle to each target vessel much more easily, and you can rely on the position to be correct. But we always control to be in the correct branch of the correct vessel with a little injection of contrast under fluoroscopy.

“There's no doubt that vascular surgery now is at an important crossroads.”

What about radiation exposure?

E. VERHOEVEN: If you can prepare everything in a standardized way, if you know that your wires are in the correct position and the position of your C-arm is optimized – you can do all the repositioning without radiation. This is a very big advantage for everyone.

Where is vascular surgery headed? What are the trends?

E. VERHOEVEN: There's no doubt that vascular surgery is at an important crossroads. From one perspective, we have fantastic endovascular techniques to treat our patients. But these techniques are also becoming more complex, and they need to be used on patients with good indications and by well-trained teams, and also in the perfect environment. The hybrid rooms give us the option to control our work, to adapt our work, and to extend our work. In a few years, every endovascular procedure will be performed in a dedicated hybrid room. But the most important thing is to always have the correct indications, the correct planning, and the correct execution. That makes vascular surgery more suited for centralization, because we need larger teams with more experience to do it.

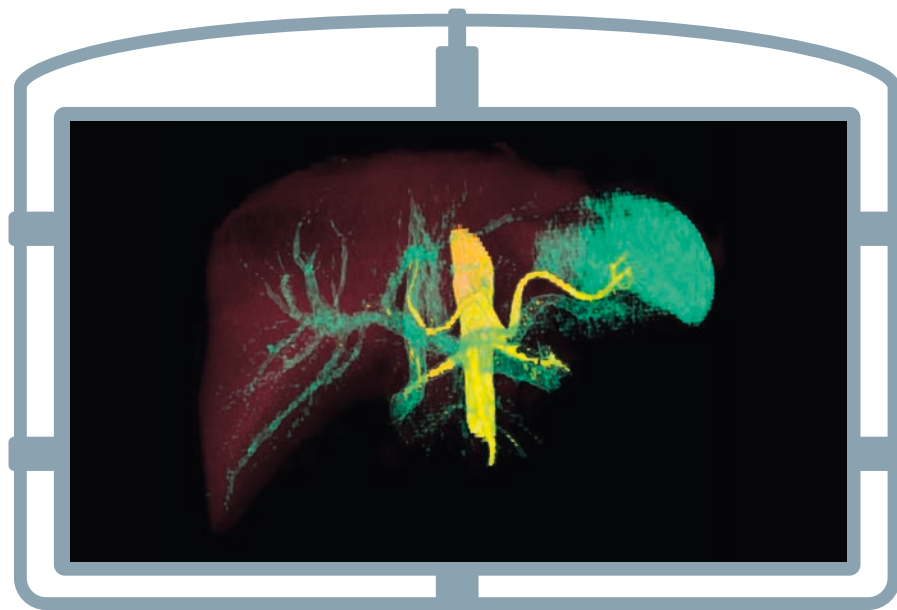
What about open surgery?

E. VERHOEVEN: Open surgery will always be needed. But open surgery is also becoming more complex. What remains for open surgery are those really “ugly” cases that can't be treated with endovascular procedures, or cases that go wrong with endovascular surgery. And these cases are probably being seen by a dwindling number of people who still have the vast experience that surgeons had in the past. We will continue to see centralization – but probably even more

in open surgery than in endovascular surgery. I think it's important that everybody knows their limits. We should help the somewhat smaller centers to master the techniques that they want to master. That's why I regularly go outside my hospital to help people when they're confronted with more difficult cases.

Faster and more accurate:

Minimally invasive liver resection in a hybrid room



The team working with Medical Manager Dr. Rodrigo Gobo Garcia of the Hospital Albert Einstein in Brazil has performed a minimally invasive liver resection for the first time in a Hybrid OR using a da Vinci® surgical robot in combination with Artis zeego. The fusion of a variety of image sources and imaging techniques paved the way for this innovative procedure: intraoperative 3D imaging and guidance with Artis zeego supported a sound minimally invasive removal of the tumor. The team used the combined 3D syngo DynaCT dataset to locate and highlight the tumor along with its feeding arteries. It's safe to say that everyone was surprised by how seamlessly these different data sources worked together. The team is impressed with the enhancements and time-savings offered by this new workflow and plans to extend the method to other types of procedures in the future, including kidney resections and lung cancer surgery. This may lead to an even higher utilization of the hybrid operating room.

It's possible to create a new preset to support segmentation in other procedures

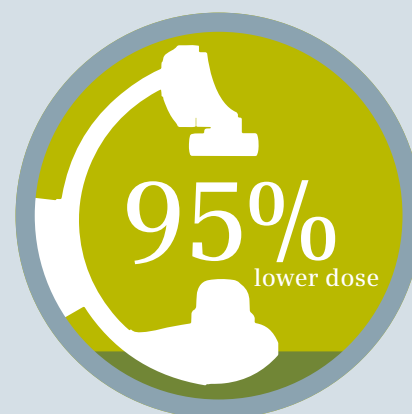
EVAR xCARE

Low-dose acquisition protocols for endovascular treatment

Before, during, and after EVAR procedures, patients undergo extended exposure to X-ray and iodinated contrast, and the clinical staff is also exposed to scattered radiation on a daily basis. Special attention must be given to the relevant regulations for radiation dose reduction and to monitoring patients and personnel. To ensure safe and efficient EVAR procedures, engineers from Siemens Healthineers and experienced customers like Eric Verhoeven worked together to optimize the Artis systems'

imaging protocols, especially for image guidance during fenestrated EVAR. The result: the EVAR xCARE protocols, which allow the surgeon to perform procedures in strict accordance with the ALARA principle, using the lowest achievable dose.

Compared with the standard Artis systems' settings for diagnostic imaging, which require optimal image quality, image guidance can be performed with a 95 percent lower dose.*



* 33 mGy/min high-quality Fluoro versus 1.8 mGy/min with EVAR xCARE

Next-level precision Hybrid OR proves major benefits for orthopedic surgery

Intraoperative 3D imaging reassures traumatologists at the University of Virginia Medical Center (UVA)



“Using the Artis zeego the 2D imaging is most helpful when we’re looking at long bones. It has a very large field of view, which gives us the ability to image the entire bone. So if we’re looking for any angular deformity, and to make sure that we’ve restored that appropriate alignment, that’s particularly helpful.”

Seth R. Yarboro, MD
Assistant Professor,
Department of Orthopaedic Surgery
University of Virginia Health System,
Charlottesville, Virginia, USA

Surgical standard procedures requiring treatment control utilizing postoperative CT scans can be enhanced regarding both procedural and ultimately economic outcome if possible complications can be disclosed while the patient is still on the table. Intraoperative real-time rotational imaging as provided in a hybrid operating room has already proven to be key to making this happen. This technological advance can result in a decrease in complications associated with limb malalignment and the ability to provide fracture treatment in a more individualized and cost-effective manner.

UVA medical center has been involved with computer-assisted orthopedic surgery since the early '90s. Orthopedic Traumatologist David Kahler is a pioneer in the field. Seth Yarboro specializes in pelvis and lower extremity trauma including bone non-unions and malalignment surgery. Bobby Chhabra is the Chair of Orthopedic Surgery at the University of Virginia Health System.



David M. Kahler, MD
Professor,
Department of Orthopaedic Surgery
University of Virginia Health System,
Charlottesville, Virginia, USA

How would you define a hybrid operating room?

B. CHHABRA: There are three different types of hybrid rooms, but in our case the hybrid operating room is an imaging suite as well. With Artis zeego it's like having a CT scanner right in the OR, so we have full imaging capability to provide the highest level of care.

Can a Hybrid OR really increase quality of care?

D. KAHLER: The goal of minimally invasive surgery is to get better imaging. Since we aren't seeing as much of the patient's anatomy we have to rely on the imaging to give us the information we need.

“One of the goals of an institution like mine is to be an innovative leader in the newest technologies that will advance patient care.”

A. Bobby Chhabra,

MD Lillian T. Pratt Distinguished Professor and Chair Department of Orthopaedic Surgery University of Virginia Health System Charlottesville, Virginia, USA



B. CHHABRA: The technology in the hybrid room allows you to get a true 3D representation, a complete picture of a long bone, the pelvis, or the spine so that you can repair an injury and place your implants exactly where they need to be. You can feel confident that you are obtaining a precise result, because the imaging is performed in real time intraoperatively. You do not have to wait for X-rays after surgery in the recovery room to make sure that your fracture alignment and implant placement is correct.

D. KAHLER: Just having the confidence when you leave the operating room, knowing you did exactly what you planned to do, and have confirmation of that is a major advance in our field. Even to look at the leg lengths of the patient and the rotation of the hips compared to the knees to make sure that the alignment is correct.

These are things we simply couldn't do before in the operating room. Precision is what's provided with the hybrid operating room: you can place your implants exactly where you want them and be confident that they are accurately placed. This precision allows you to limit your surgical incisions. You don't

have to make large incisions where there's more potential for blood loss, more potential for muscle stripping and muscle dissection, which could impact the pace of rehab. There are several complications you can avoid with this technology.

“Precision is what's provided with the Hybrid OR: you can place your implants exactly where you want them and be confident that they are there.”

David M. Kahler

Specifically what procedures use the intraoperative 3D at UVA?

S. YARBORO: We use intraoperative 3D imaging for pelvis and acetabulum surgeries where we have a difficult time determining exactly where implants should be placed. Two other procedures we use the technology for routinely are intra-articular fractures where we want to have the three-dimensional imaging after all the implants are in place to confirm anatomic alignment of the joint surface and appropriate position of the implant. Also syndesmotic injuries of the

ankle where the fibula is displaced relative to the tibia can be difficult to treat with precise alignment without 3D imaging.

B. CHHABRA: 2D imaging is limited because you are looking at a bone in two planes and you do not get the exact information that is needed to treat many injuries. Often fracture patterns are in three planes and if you're only getting two images, you're not getting a full picture of the fracture and you cannot align it as perfectly as possible when you're limited by your image quality.

And then how do you think this affects the patient outcome?

B. CHHABRA: You can obtain 3D images so that you know that your fractures are aligned well, that your implants are in the right position, with the goal of doing the perfect surgery with minimal incisions. It is really a phenomenal advance in treatment of these orthopedic trauma injuries.

D. KAHLER: It's one-stop shopping. We try to get everything done in one trip to the operating room. There are no surprises when we get a post-op CT scan: when we see a screw that's



University of Virginia Medical Center

UVA Health System
1215 Lee Street,
Charlottesville, VA, 22903, USA
www.uvahealth.com

a little bit too long or perhaps one that's malpositioned that has to be changed. Up to 20 percent of the time, we are going to make a change if we have that information in the operating room. So it's a huge advantage to the patient.

We guess, some people have been against the 3D imaging ...

S. YARBORO: I can certainly understand some resistance to the change that would be involved with adopting this new technology. But there are cases that present particular imaging difficulties and that's where we found it to be most helpful. It's not to be used necessarily routinely but for certain instances it can really make a dramatic difference in outcome.

B. CHHABRA: I think one of the goals of an institution like mine is to be an innovative leader in the newest technologies that will advance patient care. It will be a great benefit to any institution to learn how to use high-level technologies like this that have a major potential for improving the outcomes of surgical intervention and reducing complications.

What is your vision for orthopedic trauma surgery?

B. CHHABRA: There are so many opportunities to improve our patient outcomes, particularly in the trauma population. Having information is crucial in the treatment of any patient. I think the Hybrid OR is a step in that direction that provides us the information we need to best treat complex injuries.

D. KAHLER: I think the real Holy Grail is the ability to do a fracture reduction in the operating room, confirm the position with 3D imaging, and once we're satisfied with the result, to be able to actually navigate and place an implant and lock it in place with screws to hold the fracture in place while it heals. And we're very close to achieving this level of precision in fracture care.

What advice can you give to a decision maker planning to integrate a hybrid OR at the hospital?

B. CHHABRA: Radiation safety is a very important issue that needs to be addressed. Everyone in the room has to be safe from excessive radiation exposure. Having the right equipment and having surgeons who are trained on this technology are both very critical in optimizing the use of a Hybrid OR.

Hospital portrait

UVA Health System in Charlottesville, Virginia, includes a hospital, nationally recognized cancer and heart centers, and primary and specialty clinics throughout central Virginia.

Its level-one trauma center has a large referral basis from all over the state and treats some of the more significant injuries in the area.

S. YARBORO: The main thing that I would recommend is from a very early point involving multiple disciplines – the vascular teams, the cardiothoracic team, neurosurgery, orthopedics – so that you can have multiple services that use the new technology.

D. KAHLER: Having an integrated Hybrid OR in the operating room setting, I think is a real advantage. And I can't say with any certainty at this time that the investment will pay for itself, but we are seeing benefits now for our patients.

B. CHHABRA: If these technologies are shown to result in better patient outcomes, then the surgeons who adopt them will be leaders in their fields.

Performance to Go with the Cios Family

With four mobile systems and numerous configuration options, the Cios family can be used for image guidance in a wide range of surgical procedures.

How the customers decide:

“Partners in Performance” is the promise offered by the Cios family, and the four mobile C-arms (Cios Select, Cios Connect, Cios Fusion, and Cios Alpha) fulfill this promise in quite individual ways. Cios Select, for example, sets the entry barrier for powerful, smart imaging very low, while the 25 kilowatts offered by the Cios Alpha make it easily one of the best available on the market.

Today, however, a state-of-the-art medical imaging device must offer more than just performance, especially when its partnership is a top priority. Partners are always close by when they’re needed – both physically and in terms of mental processes. With an optional touch control panel right at the table* and fully intuitive operation, the Cios family helps doctors and system operators keep their focus entirely on their patients. The four Cios systems thus create the perfect basis for medical performance – and economic performance, too.



Cios Alpha

86%

The flat detector on the Cios Alpha is available in two different sizes: 20 × 20 cm and 30 × 30 cm. In 86 percent** of cases, buyers opt for the larger detector, which provides up to 25 percent more image information.

8^{out of} 10

And as for X-ray tube power, the Cios Alpha is one of the most powerful mobile C-arms on the market – at least if you join eight out of 10** buyers in choosing the 25 kW option instead of the 12 kW generator.

* Only available for Cios Alpha and Cios Fusion

** Source: Siemens Healthcare GmbH, data on file

ARTIS pheno*

As individual as your patients

Cutting-edge robotic imaging to drive minimally invasive procedures.

Patients come in all shapes and sizes: Today, obesity is a greater problem than ever before. Approximately 39 percent of adults 18 years and older are overweight, and 13 percent are already considered obese. The number of older patients with multiple morbidities is rising too. The proportion of the world's population over 60 years will nearly double by the year 2050. Fragility due to old age, coupled with an increase in BMI or lifestyle diseases such as diabetes, is producing a patient population that needs access to a wide range of therapies – not all of which are easy to manage. In some cases, treatment may even be impossible.

Engineered to be truly patient-oriented, ARTIS pheno is a unique floor-mounted robotic C-arm system for individualized preprocedural

planning, intraoperative guidance, and immediate checkout – regardless of patient condition or procedure complexity.

No matter which patient

ARTIS pheno allows you to optimally treat any patient in your interventional suite or hybrid operating room – virtually regardless of patient size, condition, or positioning needs. Optimize intraprocedural quality control and confidently handle each individual patient – thanks to a wide-space C-arm, a flexible isocenter, the short syngo DynaCT scan times, and a permitted patient load of 280 kg (617 lbs) on the multi-tilt table.

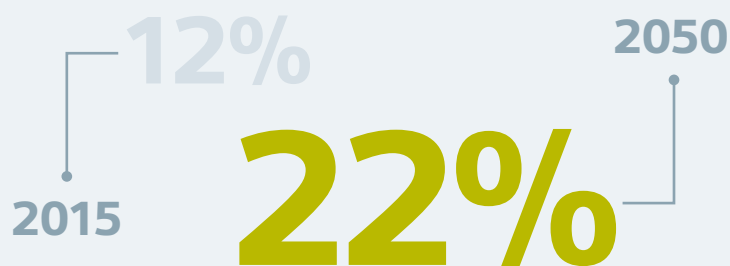
Because infection control matters

ARTIS pheno helps you maintain a sterile work environment as it is the most "hygienic" system of its kind.

Seamless covers, antimicrobial surfaces, sealed tableside modules, an uninterrupted air flow due to no ceiling mounted components, and a comprehensive cleaning concept help you maintain the highest standards for infection control – so you can be at the forefront of this important topic.

No matter which procedure

The robotic C-arm system helps you take on the most complex procedures, reduce complication rates, and improve the outcomes of procedures. Excellent imaging capabilities, optimal integration into hybrid operating rooms or interventional suites, and unmatched features not only help you make procedures safer and technically easier – they also increase patient satisfaction and enhance the visibility and reputation of your institution.



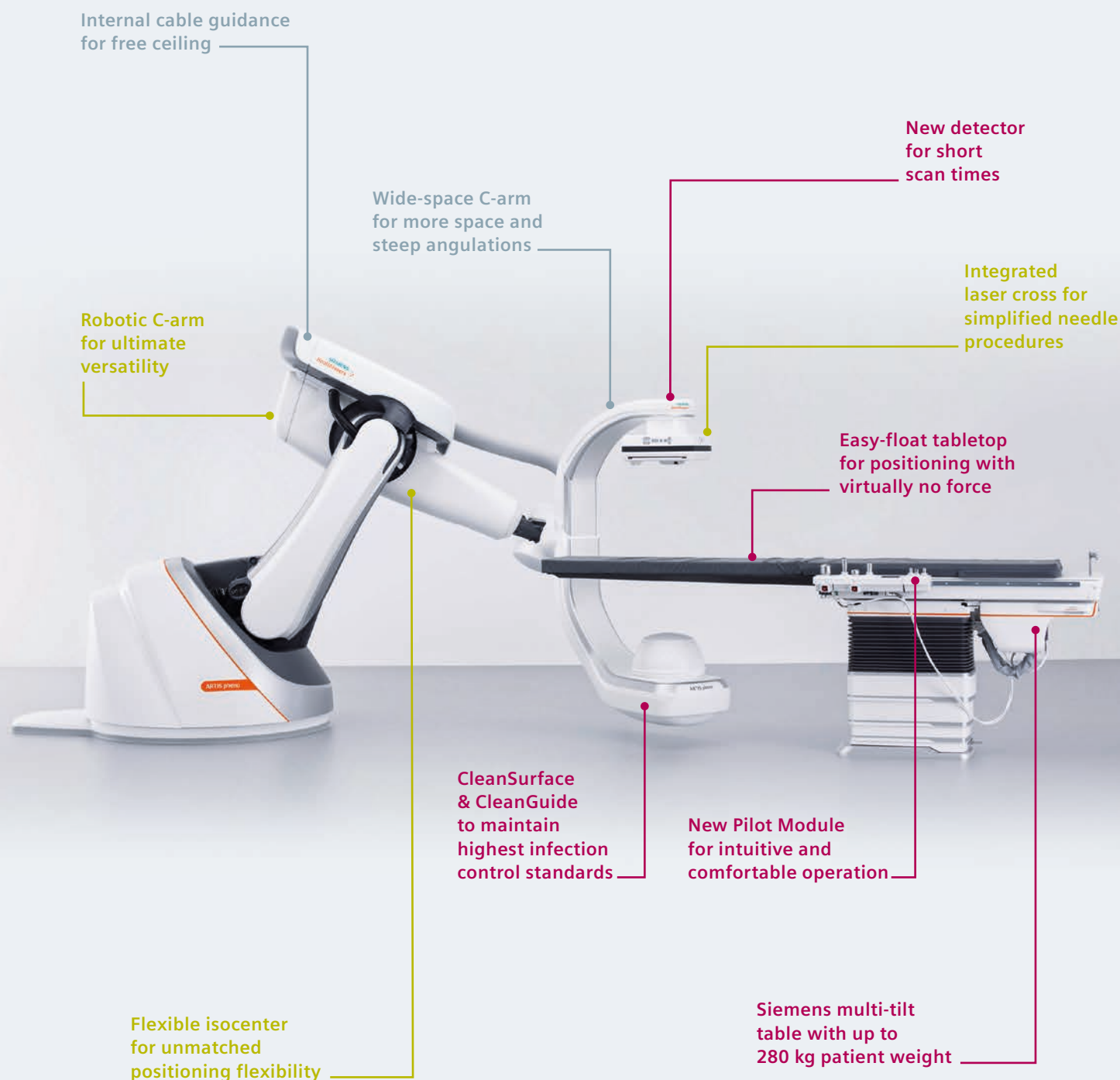
World's population older than 60 years¹⁾

1) Fact sheet no. 404: "Ageing and health", September 2015, World Health Organisation.



Discover
ARTIS
pheno®

* ARTIS pheno is pending 510(k) clearance, and is not yet commercially available in the United States or in other countries. Due to regulatory reasons, its future availability cannot be guaranteed.





Unchained imaging in the OR

Access to high-end imaging in the OR extends boundaries in minimally invasive surgery.

Mobile C-arms are the standard for most image-guided procedures, especially in orthopedic and trauma surgery today. Since their performance has improved significantly over the past years, also more complex endovascular procedures can also be performed with mobile imaging systems. But still today there are limitations, especially in 3D image-guidance and high-end 3D imaging.

More and more leading surgical institutions worldwide want to extend those boundaries for image-guided procedures by integrating high-end imaging like fixed angiography systems together with Cone Beam CT,

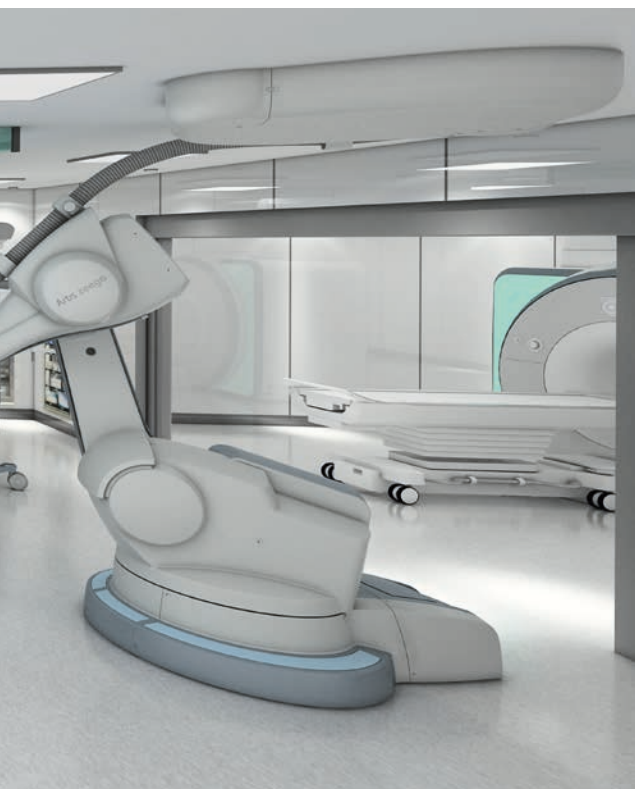
Multislice CT, and MRI systems into their surgical department.

Hybrid rooms with fixed angio systems offer new options like fusion imaging. This 3D Roadmap functionality supports more precise device deployment for TAVI and EVAR procedures and helps reduce time, dose, and contrast medium especially for complex procedures. Intraprocedural 3D imaging with syngo DynaCT can be used for precise guidance or for high-quality 3D assessment after deployment to visualize complications immediately while the patient is in the OR.

Fixed angio systems also have some limitations in 3D imaging compared to Multislice CT and MRI. The acquisition time of a modern Multislice CT

is shorter and the length of the acquired volume is not limited. Functional imaging can also be better performed with CT. Especially in tumor surgery the visualization of residual tumor tissue is much advanced in the MRI scanners compared to CBCT and MSCT. That's the reason why more and more neurosurgical institutes integrate an intraoperational MRI for assessment.

Scientific institutes like the IHU in Strasbourg or MITEC in Nijmegen are building an infrastructure that allows the combination of all kinds of imaging during one procedure to evaluate the best workflow to support image-guided procedures in the future.



Prof. Oliver Meissner, MD, MBA, is a specialist in diagnostic radiology. Following his 13 years at Ludwig-Maximilians-University in Munich, he joined Siemens Healthcare in 2005, where he worked as the Director of Global Marketing for Interventional Radiology, and Director of Innovations. In 2012 he was appointed chairman of Healthcare Management at Steinbeis-University Berlin, where he heads the Medical Innovations and Management (MIM) Institute.

Since 2015 he has also served as the Chief Medical Officer for the JR OP-TIMIERT corporate group, offering an innovative education program to prepare surgical staff for the Hybrid OR.

Prof. Oliver Meissner, MD, MBA, Professor of Healthcare Management, Steinbeis-University Berlin



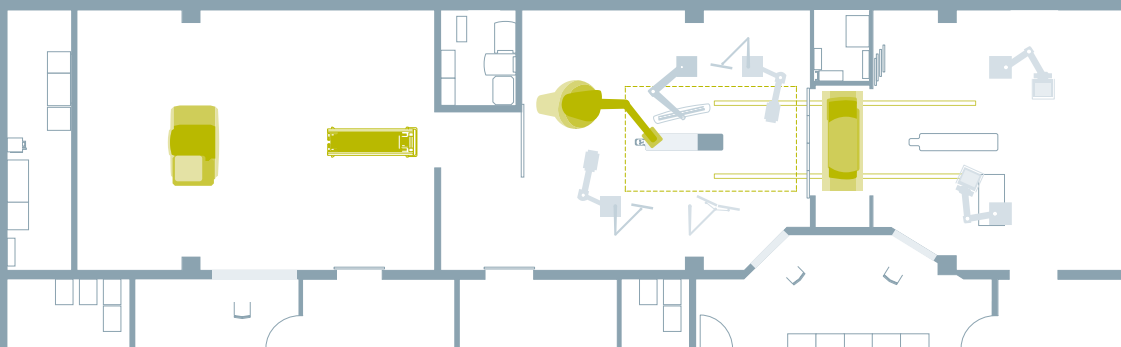
Site planning and CAD support by Enterprise Services & Solutions

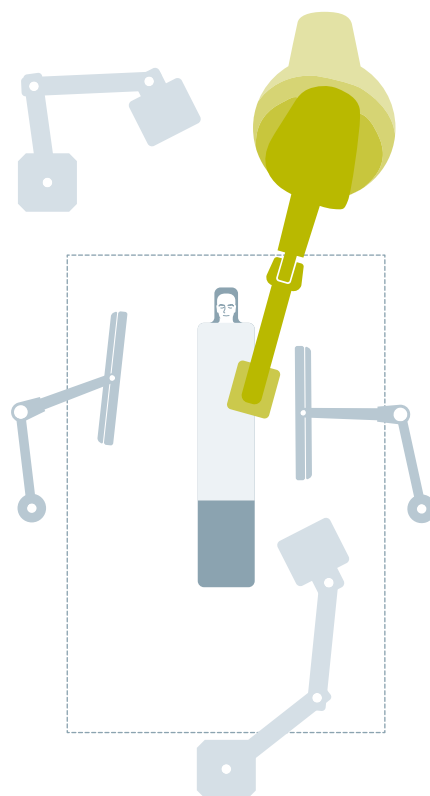
We provide flexible, holistic solutions for healthcare institutions that help reduce costs, improve clinical outcomes, and enhance patient experience. Our services:

- Complete Hybrid OR design planning solutions including third-party equipment
- Optimized layout for multimodality rooms under technical and workflow aspects
- Implementation of environmental, health, and safety requirements to

the planning (such as radiation protection, magnetic field reduction, safety distances, and external field interferences, etc.)

- Realistic 3D room visualization as movies and pictures





“The robotic technology and the flexibility of ARTIS pheno makes it the optimal solution in the surgical theater.”

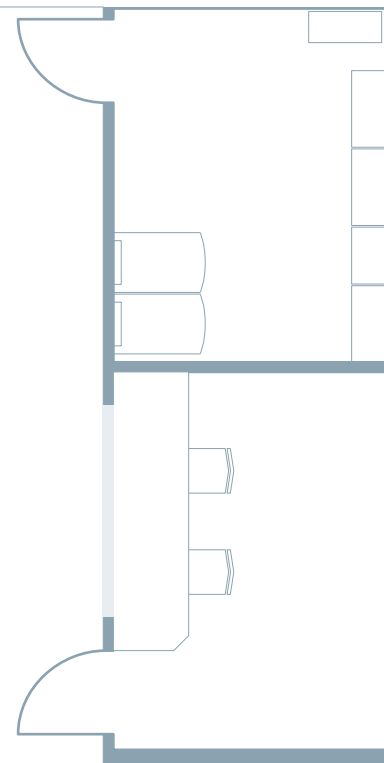
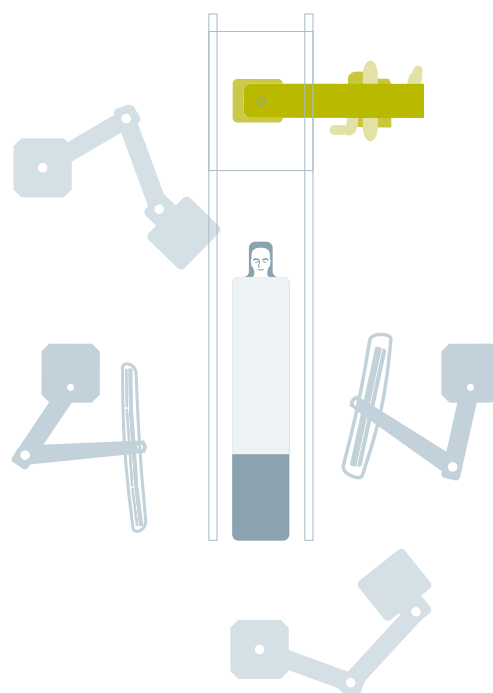
Artis robotic imaging

ARTIS pheno and Artis zeego are especially designed for image-guided procedures in hybrid operating rooms. Especially ARTIS pheno, whose seamless covers, antimicrobial surfaces, sealed tableside modules, and comprehensive cleaning concept help maintain highest standards for infection control. The unique positioning flexibility of the C-arm allows intraprocedural 2D and 3D imaging even during open surgical procedures. ARTIS pheno and Artis zeego can be combined with segmented tabletops when special patient positioning is required. The C-arm can be moved to various park positions in a few seconds to allow free access to the patient in emergency situations.

The systems do not require ceiling-mounted components that might restrict the laminar air flow above the operating field. The required minimum room size is only 5×7.6 m. Standard room size is 7×8 m. Regardless, we recommend a room

size of 9×8 m to allow ideal workflow for complex procedures.

O. MEISSNER: “The robotic technology and the flexibility of ARTIS pheno makes it the optimal solution in the surgical theater. The system is optimally constructed to respect laminar air flow. ARTIS pheno can be moved into virtually any position to get best access to the patient. It not only allows for advanced 2D and 3D imaging, but also enables fusion techniques with preoperative CT or MR datasets. Therefore, procedures like TAVIs or EVARs can be planned and performed with high accuracy. 3D images from the thorax can be acquired in only 3 seconds, with almost no breathing or motion artifacts. The field of view can be increased to 45 cm diameter, allowing for the visualization of the whole abdominal area. This can be extremely helpful for laser-guided procedures, for example.”



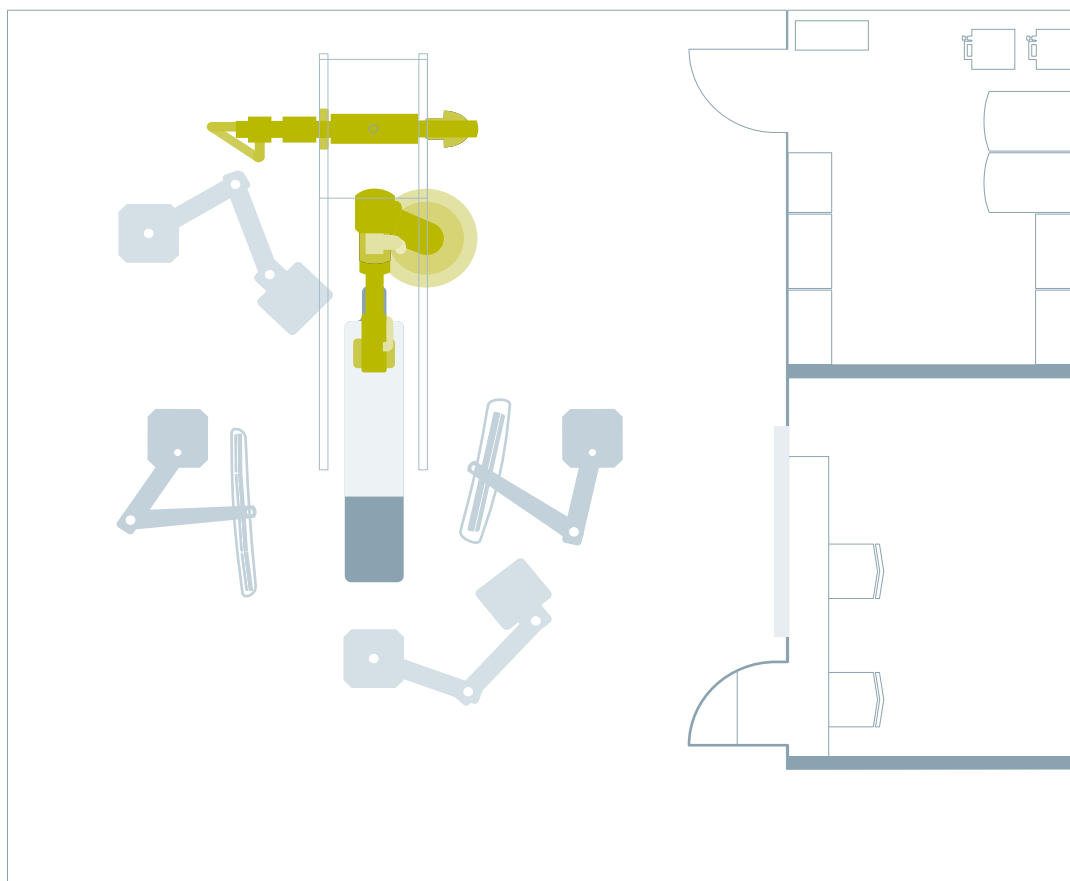
Artis ceiling

“A ceiling-mounted system can be the optimal choice in thoracic or abdominal treatment.”

Artis ceiling-mounted systems provide high positioning flexibility and large patient coverage. The C-arm can be conveniently positioned around the patient's left, right, or head side – and any angle in between. This enables optimum patient access. Fast intraprocedural 3D imaging with syngo DynaCT from the lateral position also covers the patient's lower abdomen.

Especially for installation in operating rooms, the ceiling rails can be extended to allow a convenient park position with free access to the operating table. The required minimum room size is only 5 × 6.5 m. Recommended room size is 7 × 8 m for adequate work space.

O. MEISSNER: “A ceiling-mounted system can be the optimal choice in thoracic or abdominal treatment. Here, surgeons and interventional radiologists often work closely together. And the IR staff is used to handling the system. Artis ceiling provides fast and accurate imaging in the lateral position with scan times of about 5 seconds. Fast 3D imaging with good soft tissue resolution is often required to check for endoleaks after aortic aneurysm treatment, for example, or tumor vascularization at the end of the procedure.”



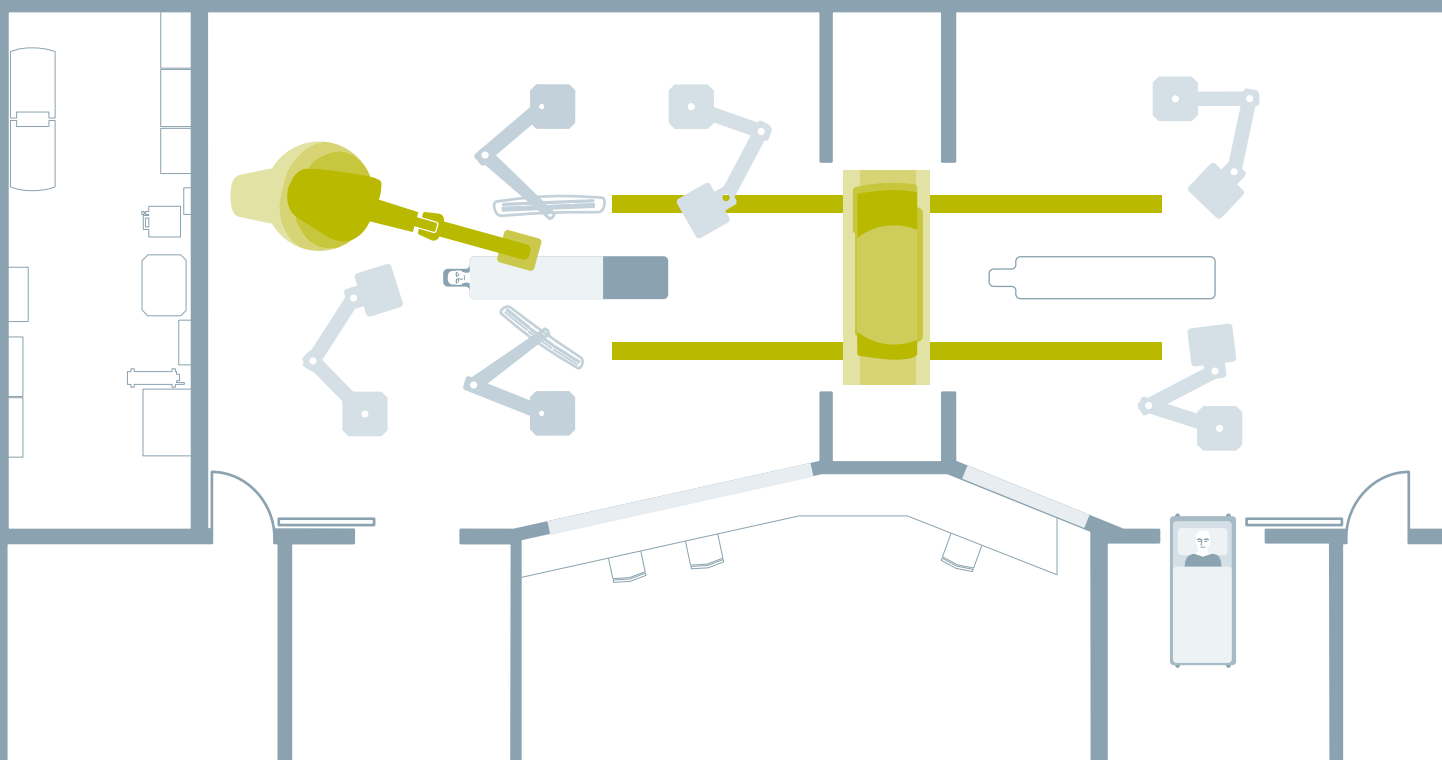
Artis biplane

“Especially in neurosurgery, biplane imaging can be considered the gold standard.”

Artis biplane with two large HDR flat detectors is specially designed for advanced imaging in neurosurgery. The positioning flexibility allows optimum access to the patient’s head as well as extensive coverage from head to toe in biplane imaging. In single plane mode, the table and stand rotation allows access even to the patient’s left side. A special orthogonal position with rotated table enables easy access to the patient’s head for complex procedures under anesthesia in the OR.

To guarantee optimal hygienic conditions, a laminar air flow ceiling is required. The minimum room size is only 5 × 6.6 m. Due to the number of components and staff we would recommend a size of 7 × 8.5 m.

O. MEISSNER: “Especially in neurosurgery, biplane imaging can be considered the gold standard. Since advanced imaging will now be used directly in the operating room, aneurysm repair, AVM treatment, and tumor embolization will be supported by 2D/3D image overlay or 4D real-time flow illustration. Even stereotactic interventions profit from excellent visualization of the vascular anatomy and pathology of the brain.”



MIYABI Angio-CT

ARTIS pheno and SOMATOM Definition Edge in a dual-room configuration with CT garage

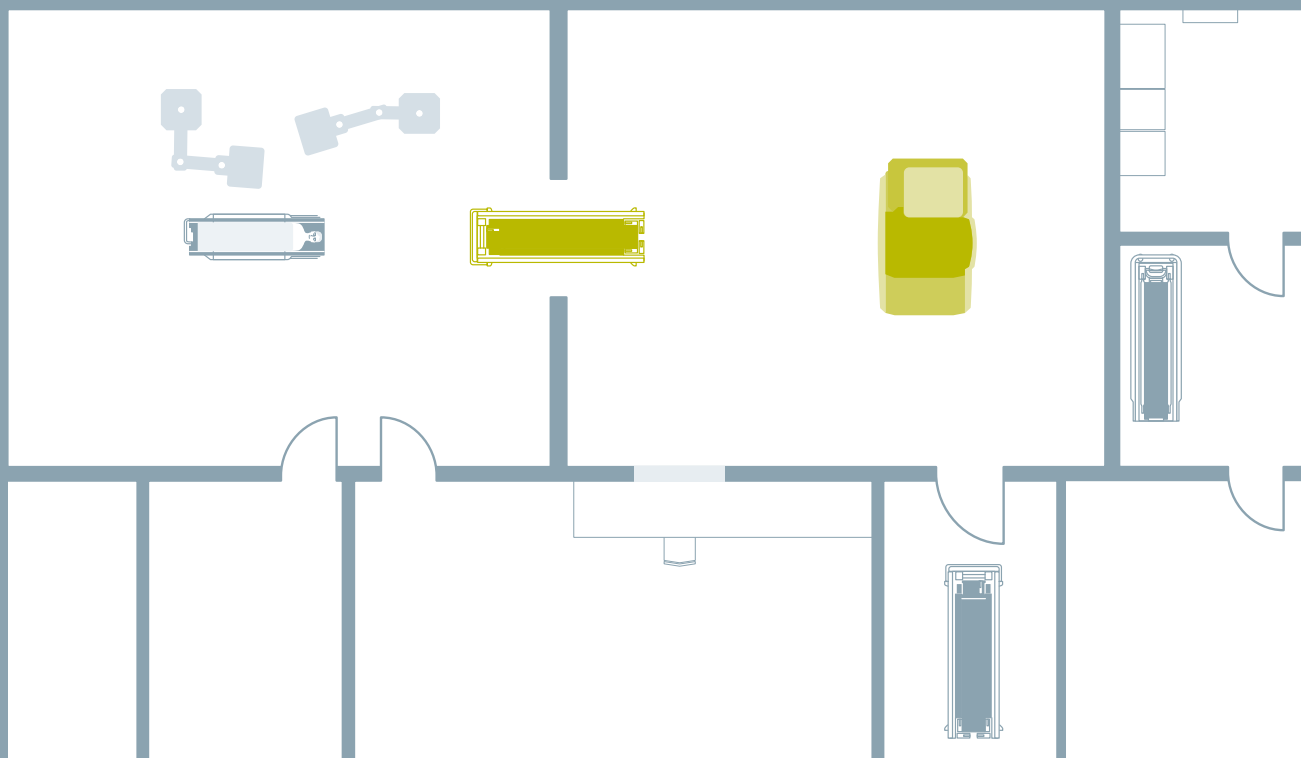
MIYABI Angio-CT* combines angiography and sliding gantry CT for Hybrid imaging by leveraging the strengths of each modality. Both systems slide over the same table to quickly switch between modalities, offering new possibilities in therapy, interventions, and immediate assessment of treatment results. MIYABI Angio-CT brings direct patient response monitoring and personalized treatment within reach. A versatile workhorse with exceptional imaging capabilities – for an extra margin of safety and confidence in all procedures. MIYABI Angio-CT can be configured for single-room or dual-room use. In the dual-room setup,

“MIYABI Angio-CT lets you quickly switch between a high-end angiographic system and a sliding gantry CT while the patient remains on the same table, leveraging the strengths of each modality”

one CT system on rails serves two rooms that are separated by a lead-shielded door. Alternatively, the CT can be parked in a “garage,” maintaining sterility in surgical rooms. This type of modality combination connects a standard OR and a Hybrid OR. Both rooms can be standard size but the tables must be aligned on the same axis. A parking space for the CT in between is state of the art to enable independent working.

O. MEISSNER: “MIYABI Angio-CT lets you quickly switch between a high-end angiographic system and a sliding gantry CT while the patient remains on the same table, leveraging the strengths of each modality: angiography in guiding 2D endovascular procedures with higher spatial resolution, and the CT in faster 4D guidance and higher soft-tissue contrast. This enables fast diagnosis in complex emergency situations, for example with polytrauma patients, and helps determine treatment response assessment and reliable endpoint determination in stroke and tumor patients.”

* MIYABI Angio-CT is a customized solution and not commercially available in all countries. Due to regulatory reasons, future availability cannot be guaranteed. Please contact your local Siemens organization for further details.



MAGNETOM Combi Suite Neurosurgery

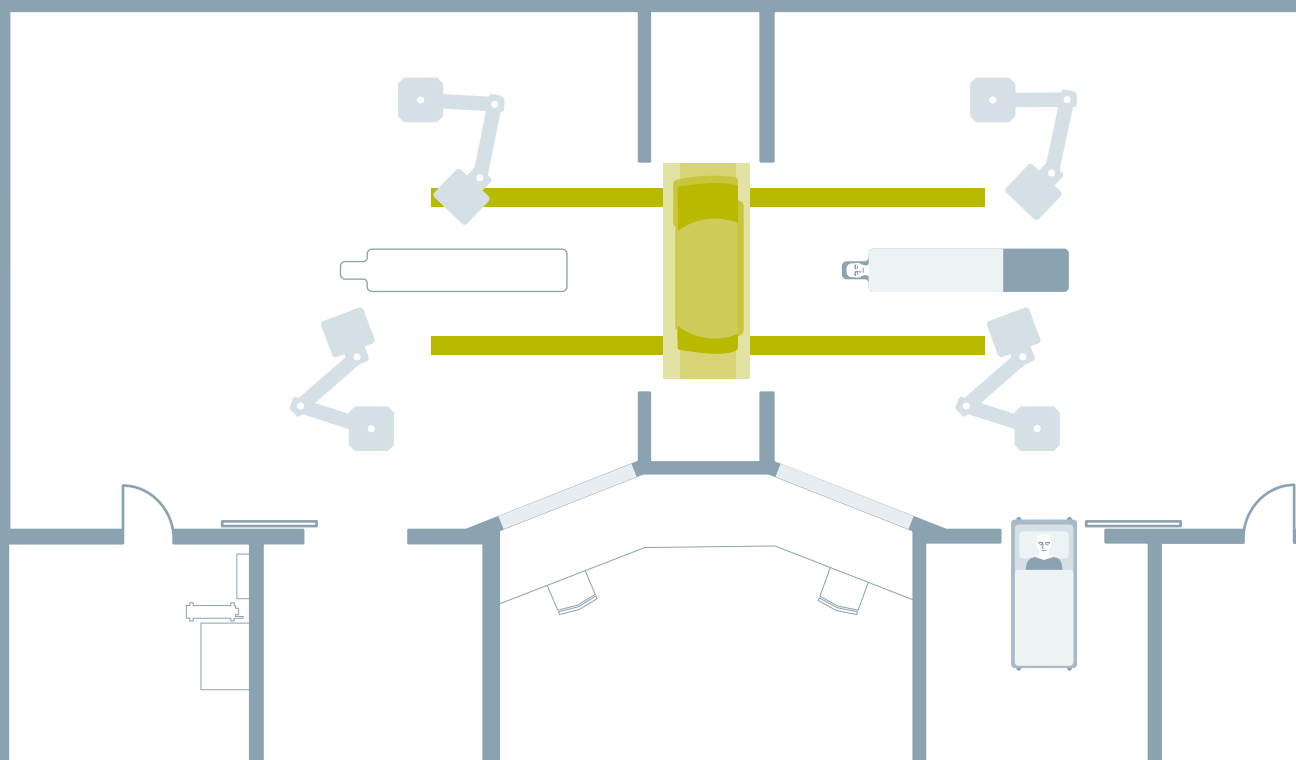
“With ioMRI, neurosurgeons will profit from superior MRI visualization of brain morphology and function. In up to 30 percent of patients, findings at intraoperative MRI will lead to modifications of the surgical procedure.”

The MAGNETOM Combi Suite Neurosurgery enables intraoperative MRI in neurosurgery OR theaters in a very smooth way. A dedicated MR table, the Combi Dockable Table, docks to the OR table. The patient will be directly transferred from the OR table onto the Combi Dockable Table and brought to the MR system. Two neurosurgical head clamp solutions can be combined with the system: the Noras Flexibility solution and the pmi DORO® solution. For both solutions freedom of positioning is ensured by the extra space provided by the special design of the Combi Dockable table.

With the MR and the OR theater located next to each other – but in two separate rooms – an efficient utilization of the facilities is ensured. The MR system may be used for diagnostic MRI examinations throughout the day, whereas only a certain time

frame needs to be blocked for the intraoperative imaging. The OR may be used for any kind of procedures and is not only dedicated to procedures with ioMRI. The compact siting of the MAGNETOM Aera and MAGNETOM Skyra, resulting in a small stray field, allows for a minimum of space required.

O. MEISSNER: “With ioMRI, neurosurgeons will profit from superior MRI visualization of brain morphology and function. In up to 30 percent of patients, findings at intraoperative MRI will lead to modifications of the surgical procedure. Thus, the use of ioMRI can contribute to optimal extent-of-resection (EOR) while preserving important areas of the brain, fewer follow-up surgeries, and lower mortality rates for the patients.”



Intraoperative sliding gantry CT, dual-room configuration

“During surgery, the situation in the operating field often changes, as in brain surgery due to brain shift, or after partial tumor resection.”

Without repositioning of the patient, high-end 3D imaging and image-guided interventions can be combined. This saves time for optimal treatment of the patient.

To enable optimal utilization of the imaging equipment in the operating room, the aligned room layout allows the use of the ioCT in two rooms. The CT system can travel up to 12 m and can optionally be parked in a CT garage.

O. MEISSNER: “During surgery, the situation in the operating field often changes, as in brain surgery due to brain shift, or after partial tumor resection. With ioCT, the new situation can be estimated in real time. This is especially helpful with the use of navigation systems, when the dataset can be updated whenever necessary. This innovative workflow can also be used in video-assisted thorax surgery (VATS) when marking of the lesion will be performed with ioCT directly in the OR. That saves overall procedure time and reduces the risk of pneumothorax or deposition of the marker during patient transportation.”

Training for Hybrid OR technicians

Successful debut



PD Dr. med. Johannes Gahlen
Clinical Director, Vascular Surgery Clinic
Ludwigsburg, Germany

"The success and safe utilization of Hybrid ORs is dependent on optimally trained personnel who support the surgeon during interventions," says Johannes Gahlen, Clinical Director, Ludwigsburg, Germany. However, the education of medical staff still remains a challenge, because working in this new environment fundamentally changes their workflow. The JR OP-Academy in collaboration with Siemens Healthineers has now set up a special training program to overcome these obstacles. The surgical staff can learn about the principles of advanced imaging system movements, radiation protection, and the general requirements of the hybrid room concept. The 3D image guidance procedure is practiced in the Siemens Healthineers training facilities in

Erlangen and Forchheim, while the trainings at the University of Magdeburg and the hospitals at Weiden and Ludwigsburg focus on dose management and the clinical workflow. One positive benefit of the training: "While learning about various Hybrid OR room setups, I was able to support the planning team at my hospital," comments Claus Schwarz, a new Hybrid OR technician (HOT) from Vienna.

The state recognition of the qualification has been confirmed by Berlin Steinbeis University.

More courses will follow in 2017

To learn more:
www.jr-optimiert.de/akademie/hot



The first attendees
have completed the
HOT pilot class

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- Meet hybrid operating room experts and pioneers.
- Successful hospital managers look back on the milestones of their hybrid project.
- Useful info graphics and figures support you with your investment decision.

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 Find an order form at:
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