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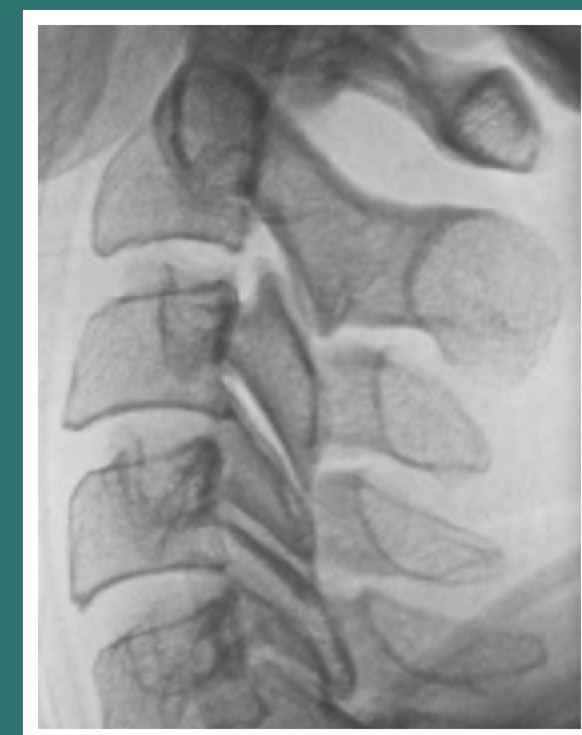
IMAGING



An annual publication presented by
ziehm imaging

Ten years ago,

Ziehm Imaging was the first company to incorporate a flat-panel detector into a mobile C-arm. To celebrate this milestone, we are dedicating the first issue of our magazine to this technology, which has changed not only the quality and format of our images, but also our company itself.

For me personally, this anniversary is very meaningful. Ten years ago, I was the program manager for the introduction of the flat-panel detector in C-arms. Since then, I have accompanied and helped shape the success story of this innovative and fascinating technology.

When I look back on these years, I see an exciting and eventful journey. Since 2006, we have driven the paradigm shift from image intensifiers to flat-panel detectors, and of course we haven't stopped there. With CMOS, we now provide a new detector technology that is widely known for its use in common smartphones. Like the Hubble Space Telescope, it allows us to see the smallest details, and beyond.

Displaying the tiniest vessels has become increasingly important when it comes to succeeding in cardiovascular surgery. For Dr. Seifert, the mobile C-arm is the solution of the future for endovascular hybrid procedures. Seifert loves his Ziehm Vision RFD Hybrid Edition for its efficiency and accuracy. Staying on track is one of the big challenges in a surgical environment, and we have some helpful tips and tricks to help you optimize your 3D workflow. Finally, we address the increasingly frequent challenges involved with when examining obese patients.

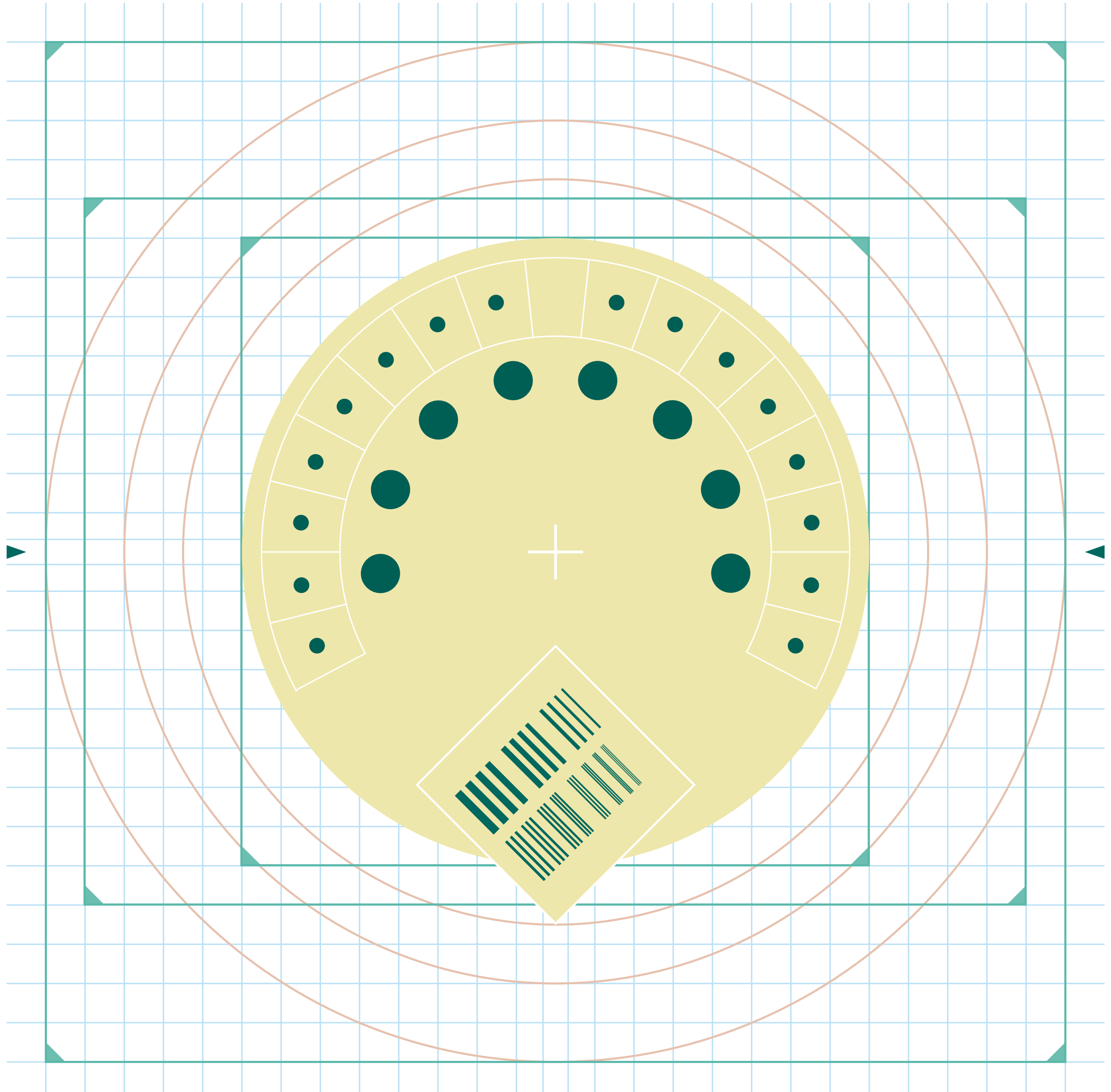
At Ziehm Imaging, we are proud of what we have achieved, and of our unique mobile C-arms. We hope you enjoy reading and celebrating with us.

Vice President Global Sales and Marketing
Martin Törnvik

Klaus Hörndler, CEO of Ziehm Imaging, is a hands-on type of guy. He knows the equipment and technology his company manufactures inside out. In the production department, Hörndler likes to roll up his sleeves and lend a hand, pushing C-arms from one place to another, calibrating monitors or discussing things with his employees. One thing is for certain: Hörndler, who has a degree in electrical engineering, enjoys being where the action is.

Mr. C(EO)MOS

Photo
Juli Sing



What may look like a minimalistic piece of art at first glance is actually a test phantom for measuring dynamics and resolution for C-arm quality assurance.

Previous page
While CEO Klaus Hörndler is often on the road for his company, he spends as much time as possible in the development and production departments to help drive innovative ideas forward.

What moved you to join Ziehm Imaging back in 1994?

That was more or less a coincidence after I got my degree. Ziehm Imaging was looking for engineers and assigned me to the department that developed image converter modules for monitors. I enjoyed the work and it excited me from day one. And I stayed. Back then, it didn't occur to me that I might be leading the company someday.

Twelve years later, you were then appointed CEO. Since then, you are on the road a lot and have all kinds of commitments. How much can you really still get involved in the actual product development these days?

That's something that is still very dear to me. The fact that I'm on the road a lot means that I get to see the different requirements of the international markets and can give feedback to our developers. But especially when things get tough, and we seem to be at a dead end with a product, I obviously try to help and contribute my ideas. In general, I always try to stay as close as possible to what's going on.

In your long career, is there any product that you're especially proud of?

Yes, there is. In fact there are two of them. The first one is obviously the flat-panel detector technology, because we were so far ahead of our competitors back then. Even though it's been ten years, it's still an absolute highlight for me. And the other one, naturally, is the Ziehm Vision RFD 3D, with its fantastic image quality. We developed a product that the entire industry envies us for. We're still the one and only company to offer a mobile 3D device at this level.

Apart from the successful products, why have you stayed loyal to Ziehm Imaging for so long?

I like the medical technology industry and the people who work in this very highly specialized world. At the same time, the technology fascinates me. A C-arm has so many components and parts that all have to work. It feels really great to make applications in the health sector better and safer and help patients in this way.

Working in the health sector and helping people with our products is something I feel really good about.

When you look back at the past 22 years at Ziehm Imaging, how would you describe the company's development?

When I joined Ziehm, the economic situation wasn't very rosy. There were a lot of challenges and the product was obsolete. Mr. Ziehm, the company founder, was hiring new engineers back then, and I was one of them. But the most difficult phase was back in 2003 after our acquisition of Instrumentarium, when we practically became our own direct competitor. That wasn't just uncomfortable for me, it was uncomfortable for a lot of employees. But since we became independent in 2004, we have been able to continue our development under Aton. The past ten years have been especially successful for Ziehm Imaging, with continuous expansion across the board.

What does the rapid growth mean for Ziehm Imaging?

On the one hand, growth means more satisfied customers. In Germany, we have always been very strong. But we owe our growth in the recent years particularly to international markets like those in the US, China or the Middle East. Growth also allows us to secure existing jobs and create new ones. We also have to have a certain volume in order to keep expanding our leading edge in technology. In other words, if you want to achieve more, you have to sell more. And we're working to meet this goal at all times.

What's in the future for Ziehm Imaging?

Our increased sales of high-end devices will consolidate our position as a market leader in Central Europe. In this segment, the demand for 3D navigation in mobile imaging is especially great. And of course we plan to expand our international growth by developing and marketing new products, by obtaining approvals in China, Latin America, and other parts of the world, and by operating our local sales system. But the key factor for our continued growth is our broad product portfolio.

Our exclusive focus on the mobile C-arm allows us to respond flexibly to our customer's requirements.

Technical innovations are a prerequisite for growth. What mobile X-ray imaging trends will play important roles in the future?

There's a lot happening in the area of interventional surgery, specifically in vascular surgery and cardiology. In these areas, C-arms are getting closer and closer to achieving the capacities of the fixed installed units. We're meeting this demand by offering our mobile Hybrid Edition, which was developed for hybrid operating rooms. Top image quality is key here, and we are improving our products with new technologies on an ongoing basis. The second big trend involves intraoperative navigation-guided 3D imaging While this topic is well-established in some high-end markets, it hasn't yet arrived everywhere in the world. We have started to make inroads, but there's still a lot to do in this area.

Ziehm Imaging's closest competitors are large companies. What advantages does Ziehm Imaging offer compared to its competitors?

We focus exclusively on the mobile C-arm. That makes us much more flexible. For instance, we are able to implement new ideas and demands much more quickly than our big competitors. And we're also able to respond to our customers' wishes much more precisely. A good example of this is the flat-panel detector. At Ziehm Imaging, we have used flat-panel detectors for ten years and are already launching the next generation on the market. Some of our competitors have yet to do this. We're a great example of Germany's successful SME sector. We're small, but specialized, and when it comes to technology, we're cutting-edge.

Ten years of flat-panel technology marks a milestone for Ziehm Imaging and constitutes a paradigm shift for its customers. In your view, what is the advantage of flat-panel detector technology compared to conventional image intensifiers?

The flat-panel detector enables the C-arm to have a larger opening, which gives the physicians more space near the patient and allows them to work with their instruments unimpeded. The images are absolutely free of distortions, and the contrast and image quality are undoubtedly better than that of the image intensifiers commonly used in the past. On top of that, we are able to design imaging more intelligently, working with lower doses and at the same time, optimizing image quality. All in all, the flat-panel detector is a more modern package that offers more options. Of course, it also costs more than a conventional image intensifier. In the high-end sector, that isn't really a major factor, but in the low-end sector, conventional image intensifiers will continue to be the standard for a number of years due to the lower price tag.

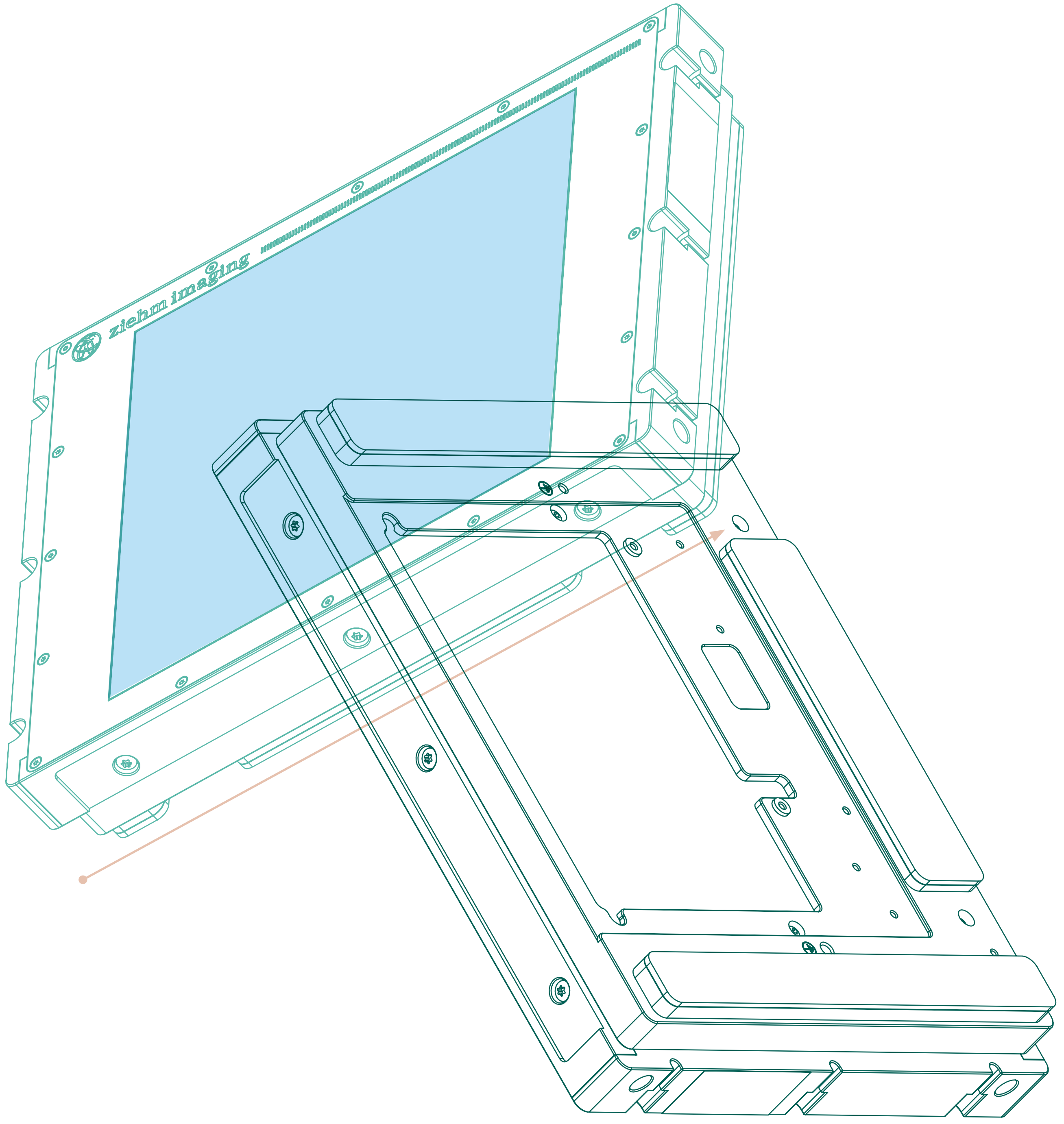
In 2006 you were the Vice President of Global R&D. You were probably closely involved in developing the first flat-panel detector at Ziehm Imaging. Can you recall the first discussions and conversations about this invention?

The development goes back much farther than that. We first started talking about it back in 2000. Back then, we all knew that it was the technology of the future. As a technological leader, our declared goal was to break new ground. So we unanimously decided that we not only wanted to develop the flat-panel detector technology; we had to actually do it.

At the time, Ziehm was ahead of the competitors. The big rivals took a long time to kick into action. Does this make you proud?

In 2006, we were certainly proud of our achievements. Today, it's an expectation that we have set for ourselves and one that we use as a benchmark for achievements. That's why it's important to keep setting new accents. The flat-panel detector alone is no longer enough. It's now especially important to logically integrate it into our system and to explore what we can achieve with the overall system. 3D imaging is a good example of this.

The heart of the new flat-panel detector technology is the CMOS sensor.
CMOS stands for "complementary metal-oxide semiconductor".



The first flat-panel detector with modern CMOS technology produced specifically for Ziehm Imaging is contained in compact housing with an appealing design.

Without the flat-panel detector, we wouldn't be able to move around the operating table and wouldn't be able to provide the image quality we have today. So you see, in the end, the flat-panel detectors will continue to be a very important element, even if it is not the key element.

What makes CMOS stand out is the capability to achieve the same high resolution at a lower dose.

What is your prognosis? What detector technologies will shape the future?

I see different directions for the future. CMOS will definitely play an important role. These detectors are already on the market and various manufacturers, from the big players in the industry, as well as companies in China, Korea and the United States, are addressing this new technology. To date, flat-panel detectors have used amorphous silicon (a-Si), and this technology will also continue to be refined in the future. Today, the image intensifier is still the prevailing product in our business, but in the future, more and more companies will be putting flat-panel detectors on the market.

You just used the term CMOS. For us technology novices, can you describe how the new CMOS technology works – for dummies?

A CMOS detector is like any other detector. Its primary function involves providing an image. But what sets CMOS apart is the higher sensitivity that enables smaller pixels to be displayed with a lower dose while producing the same quality. That permits us to achieve higher resolution with the same dose. Or conversely: you need a lower dose to achieve the same resolution. You can compare it with the first smartphones and the smartphones today. While it was possible to take adequate-quality pictures with the older smartphones, the quality of the pictures provided by the new models is exponentially better.

What do you think are the overall advantages of CMOS?

To put it in a nutshell, the clinical advantages are definitely offered by the improved image quality, the high resolution and the lower dose.

How long have you already been toying with the idea of this technology?

For about six or seven years. It took a long time to translate this technology into an industrial product. On top of that, we had decided to develop our own Ziehm detector. Now we have finally gotten to where we wanted to go: We have our own CMOS detector that is exactly tailored to our needs.

Were there any critics of CMOS out there, and if so, how do you respond to them?

Of course there were, and there are still some around. I heard criticism or skepticism from various camps. In the end, though, the outstanding performance of the panel speaks for itself. The industry agrees the CMOS panels let you achieve the same image quality with smaller pixels and still get a higher resolution. The criticism usually has to do with cost effectiveness. That's why CMOS panels are mostly used in expensive high-end applications. We'll have to see how this development unfolds in the future. Right now, the spotlight is on us.

In addition to the new CMOS detectors, Ziehm Imaging will also continue to use the tried and true detector technology. What is the advantage of the conventional a-Si detectors?

CMOS is especially cost effective when it is used for smaller formats. While you can also produce larger-scale formats, the larger the format, the more advantages offered by an a-Si detector. That's why the two technologies are both in place and both of them will continue to be refined.

So how does the story end? Will the more modern CMOS technology become the new leader in mobile X-ray imaging?

Yes, it will, but certainly not in all areas or for all devices. It's similar to the automotive world. There you also have whole range of models, including compact, mid-sized and luxury models. While not everyone will choose to buy a top-class model, those who opt for high-end operating room equipment will be "driving" with CMOS technology.

Page 12: NASA, ESA, M. Robberto (STScI / ESA) and the Hubble Space Telescope Orion Treasury Project Team.
Page 15: NASA, ESA and the Hubble Heritage Team (STScI / AURA)-ESA / Hubble Collaboration, in particular B. Whitmore (STScI) and James Long (ESA / Hubble).
Page 16: NASA, ESA, the Hubble Heritage Team (STScI / AURA) and NAOJ.
Page 19: NASA, ESA and the HST Frontier Fields Team (STScI).

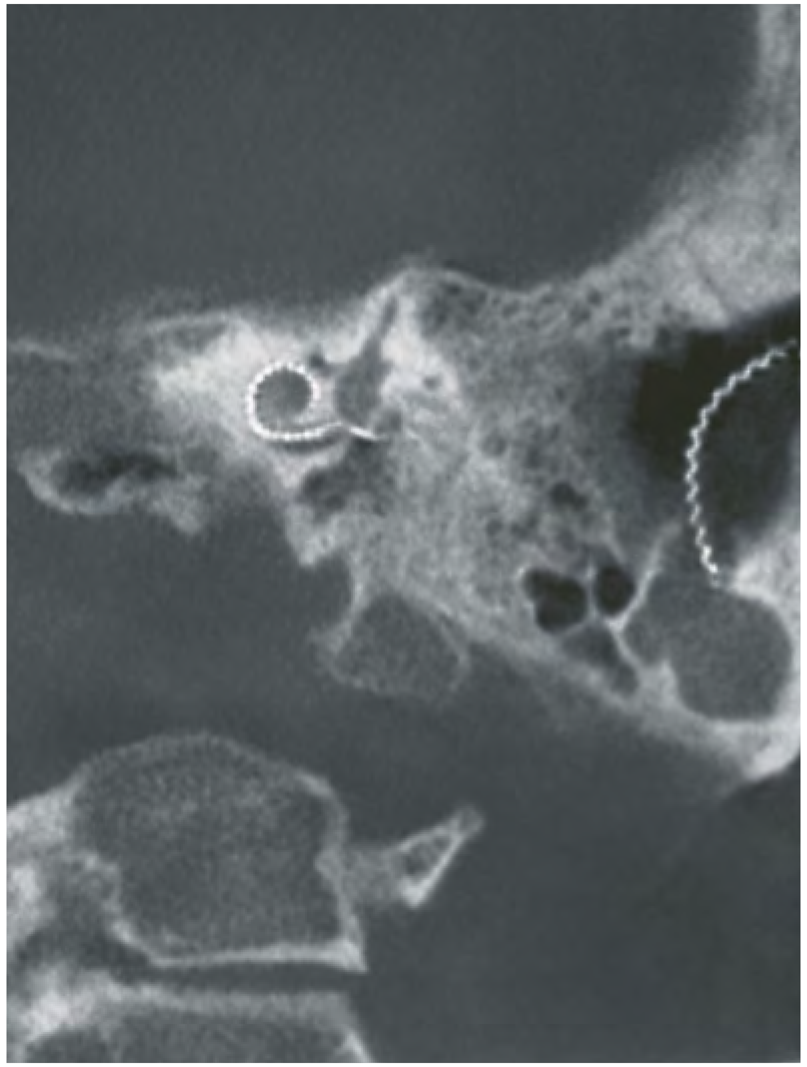
Space images
NASA, ESA, STScI

Clinical images
Ziehm Imaging

Beyond

Ziehm Imaging C-arms feature cutting-edge sensors. They provide fascinating insights into the human body. Innovative sensor technology also helps us understand processes far beyond the scope of our space and time. The Hubble Space Telescope provides us with pictures from the expanse of the universe, revealing structures that appear to be as unique and complex as those deep inside the human body. These insights show more than the naked eye can perceive.

Messier 42, Orion Nebula
Endoscopic retrograde cholangiography (ERCP), native



Cochlear implant, diameter of 6 mm
Antennae Galaxies, merging, Corvus

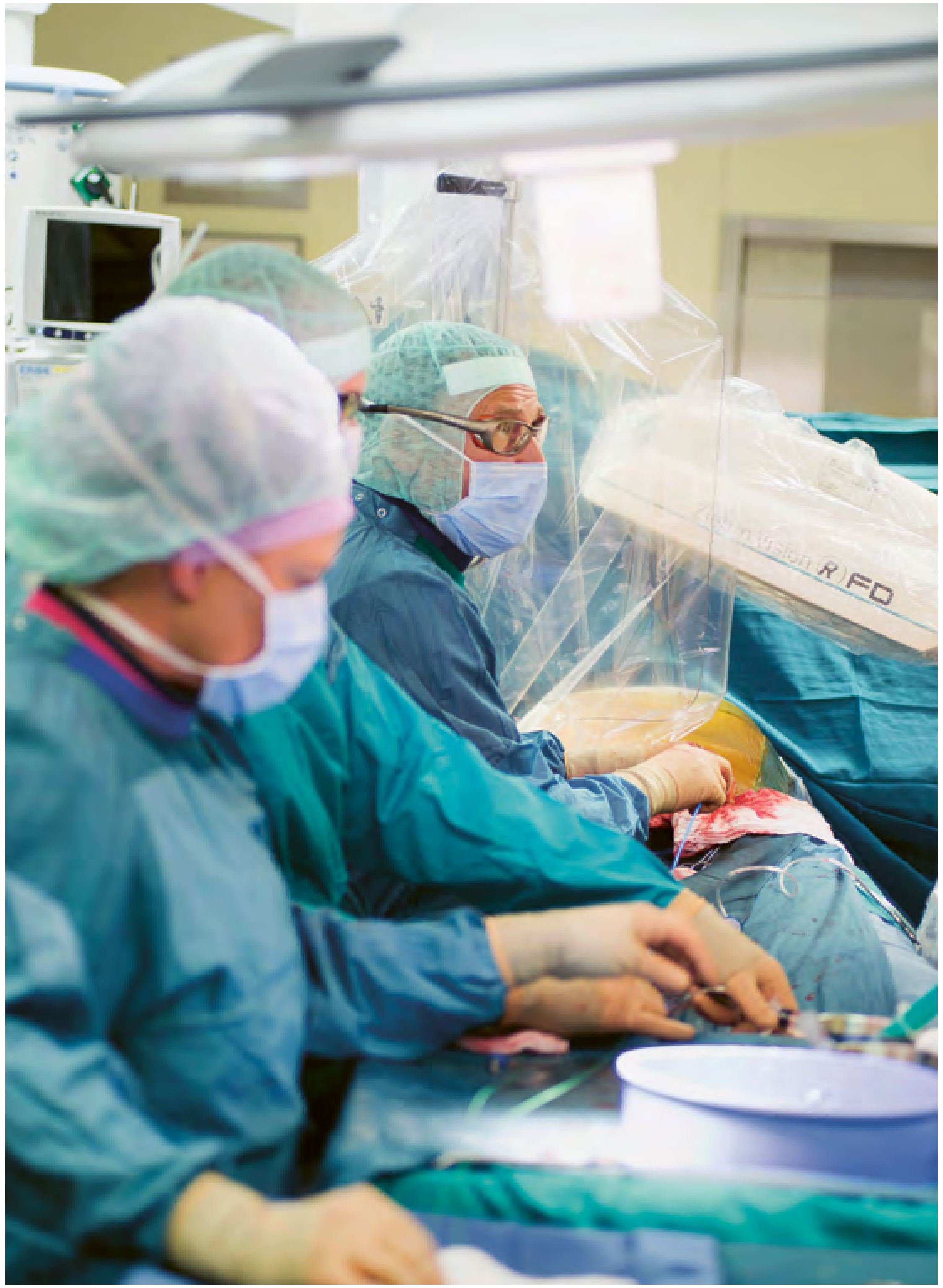
Sh 2-106, birth of a star, Cygnus
Aortic stent graft

Cervical spine
Abell 2744, galactic cluster, Sculptor Galaxy

When surgeon Dr. Sven Seifert enters the OR, he exudes confidence and poise. That's not surprising, considering the number of operations Seifert has successfully performed in the past decades. Seifert has headed the Clinic of Thoracic, Vascular and Endovascular Surgery at the municipal hospital in Chemnitz, Germany, for seven years and has over twenty years of surgical experience under his belt.

The future is mobile

Photos
Stephan Minx



Operation performed in one of the two hybrid operating rooms at Chemnitz Hospital: The Ziehm Vision RFD Hybrid Edition imaging system permits rapid inversion of the negative contrast during CO_2 angiography. The CO_2 in the arteries is visualized in black and offers the surgeon the usual image with optimum resolution and at high quality.

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Final instructions before surgery:
After donning his protective gear, Dr. Seifert briefs his team on the procedure.

While Seifert's demeanor communicates "commander-in-chief", he's still approachable. The surgeon started working with Ziehm Imaging mobile C-arms in 1996 and has stayed loyal to the manufacturer ever since. Today, three procedures are slated here in Chemnitz, all of which will take place in hybrid operating rooms. Seifert and his team's first procedure of the day will be an endovascular abdominal aortic aneurysm repair (EVAR). The operation is one of the standard procedures performed in the two vascular surgery hybrid operating rooms in Chemnitz.

Seifert performed his first surgical procedure in a hybrid OR in 2007 and is considered to be one of the pioneers of the "hybrid movement". Hybrid surgery was designed to combine the conventional surgical setting with medical imaging in the same room. This combination reduces risks and stress for the patient and also streamlines the surgical workflow. Hybrid operations are now the standard procedure for complex procedures with high intraoperative imaging requirements. They are most commonly used for cardiac and vascular surgery, as well as for neurosurgery. Procedures involving the aorta are risky, time-consuming and radiation-intensive. The hybrid OR offers enormous advantages for this type of surgery, Seifert explains. The hybrid OR is the only setting that ensures the combination of hygiene class 1A and imaging, which is otherwise found only in radiological units. The biggest advantage of the special OR is that the patient needs to undergo only one surgical procedure, Seifert says.

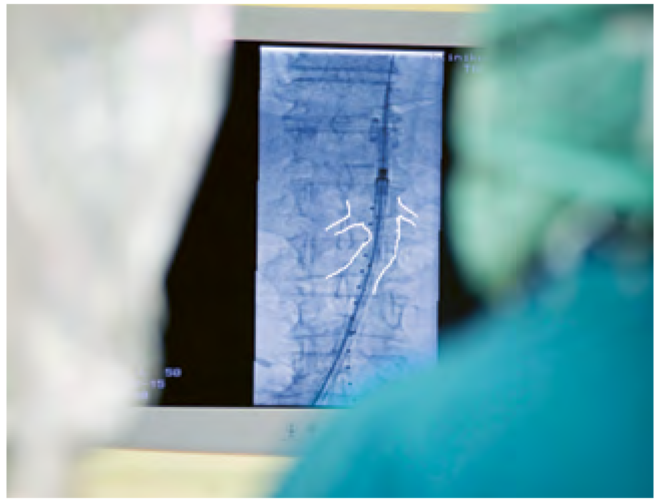
"Since 2014, we have had a hybrid OR with a fixed angiography unit here in Chemnitz. The hybrid OR with a mobile C-arm is directly adjacent," Seifert adds. For a long time, the intraoperative image quality of the mobile C-arm was considered to be inadequate for hybrid applications in vascular surgery, where it is crucial to precisely visualize even the tiniest anatomical structures. This has changed in recent years, Seifert says. "The image quality of mobile C-arms is now outstanding."

Seifert especially appreciates the fact "that with a mobile C-arm, we are able to completely change the surgical set-up during the procedure and also change sides if need be." In addition, the mobile C-arm can also be used in another room as needed. Seifert explains that this has made imaging more efficient and in turn, more cost-effective.

In addition to flexible room scheduling, the surgeon sees the substantially lower investment costs as a particular advantage. Setting up and equipping a standard hybrid operating room takes time and requires considerable construction efforts. In contrast, the mobile C-arm's lower installation and operating costs open up possibilities for smaller hospitals or those on tight budgets to perform hybrid procedures as well, Seifert says. In terms of technology, the mobile C-arm also offers a number of advantages for vascular surgery, Seifert explains. "For me, the effortless way the collimators work and the rotation of the clinical image in the operation setting are both real advantages."

Two joysticks are used to conveniently control the four axes of the mobile C-arm directly from the sterile field.

Dr. Seifert uses the Anatomical Marking Tool to mark the course of the internal iliac artery.



Seifert's mobile hybrid OR features a Ziehm Vision RFD Hybrid Edition, a mobile C-arm that has been specifically tailored for use in a hybrid OR. "The C-arm has a very special shape and our pet name for it is 'The Turtle.'" Seifert is referring to the modern design of the flat-panel detector, whose semi-circular shape in fact does resemble a turtle, to some extent. The Ziehm Vision RFD Hybrid Edition combines a number of highlights that Seifert considers to be particularly important for a mobile C-arm, especially its full motorization in four axes that can be controlled directly from the sterile field via two joysticks. "This feature makes using it effortless for surgeons and their teams."

During the procedure, Seifert uses the wireless footswitch to pinpoint the position at the patient that is best suited for his work. When he changes his operating position, he simply takes the footswitch with him. Safety and efficiency are particularly important in an operating room, Seifert says. That's why he likes to use the Anatomical Marking Tool when he performs EVAR. The "ingenious drawing tool", as Seifert describes it, allows him to precisely trace the course of the internal iliac artery in the live display of the digital subtraction angiography (DSA). Seifert simply uses his forceps as a stylus to input the necessary information onto the clinical image of the C-arm on the sterilely wrapped touchpad. In so doing, Seifert marks a sort of "canal" that can be viewed live on all his monitors and which shows him precisely where the aortic stent must be released in the superimposed fluoroscopy. "This makes us more certain that we have positioned the prosthesis properly and it offers the advantage of considerably less radiation," Seifert adds.

During EVAR, Seifert applies CO_2 to visualize the contrast. Pressure is used to guide the CO_2 into the artery, where it forms a gas bubble and pushes the blood flow of the vessels ahead of it. Contrary to conventional contrast media containing iodine, CO_2 does not pose the risk of an allergic reaction. Seifert was one of the first surgeons to incorporate CO_2 in

The surgeon can optimally position the C-arm, effortlessly and precisely.

clinical routine due to its better tolerability: “CO_2 can be used as a contrast agent in any patient. It does not burden the thyroid and is not expelled through the kidneys.” Seifert plans to eliminate the use of conventional contrast media in as many surgical procedures as possible to reduce the risk to the patients. The increase in common conditions such as obesity and diabetes has boosted the demand for CO_2 angiography. For many patients with these conditions, iodinated contrast media are not an option.

In Seifert’s view, the Ziehm Vision RFD Hybrid Edition offers the ideal imaging system for CO_2 angiography. “We are working with one of the few systems that performs immediate inversion of the subtraction image, which allows us to ideally visualize the contrast.” The rapid inversion of the negative contrast – in other words, the possibility to make the CO_2 within the vessels appear black – enables the angiography images to be displayed in the manner in which the surgeon is accustomed. As he looks at the final image of the surgery, Seifert is pleased with the high quality of CO_2 angiography with the Ziehm Vision RFD Hybrid Edition. “We have succeeded in placing the stent graft in an ideal position, without using conventional contrast media.”

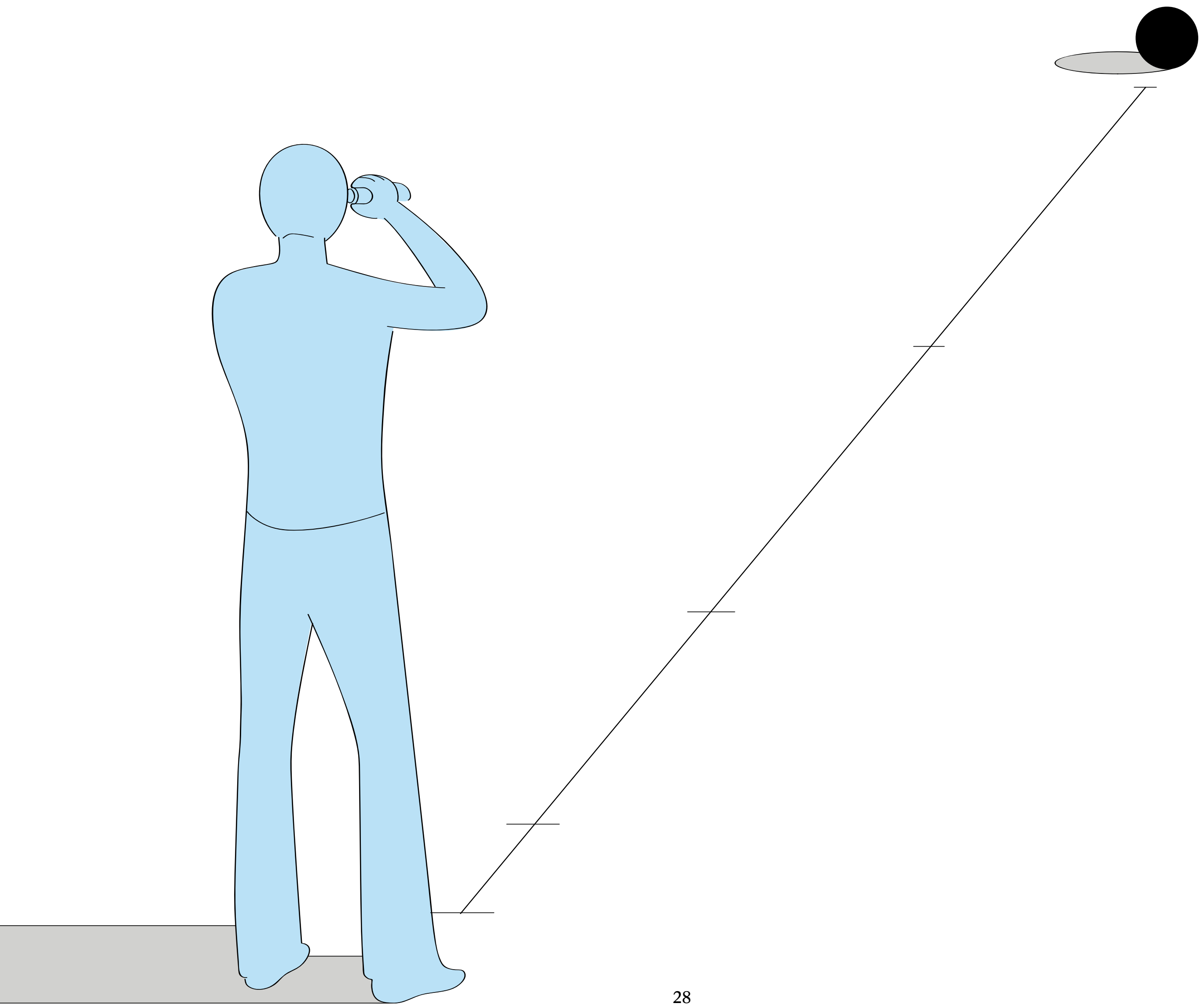
Seifert is satisfied as he wraps up the procedure. Despite the heavily calcified arteries and the difficult morphology of the surgical site, the procedure has been successful. The patient has been spared a postoperative follow-up scan and a possible additional operation. As Seifert puts it, his “Turtle” has done an outstanding job. “The future belongs to the mobile hybrid OR. The mobile C-arm with the image quality we have experienced today offers a space-saving and cost-efficient alternative to a fixed installed unit.”

Watch video of the operation on YouTube.

Chemnitz Hospital

With over 1,700 beds, Chemnitz Hospital is one of Germany’s largest municipal hospitals. Every year, some 75,000 individuals are treated as in-patients and around 181,000 receive out-patient treatment. The hospital has a staff of nearly 6,000 and has had “maximum-care” status since 2013.— klinikumchemnitz.de

1 “Keep your distance”
The longer the distance, the lower the dose. If the distance is doubled, the patient is exposed to only one-quarter of the original dose; if it is tripled, it drops to one-ninth of the original amount.



As the “grande dame” of medical imaging, the X-ray, which revolutionized medicine, is still as relevant as ever. So it’s important to ensure that it is used wisely and that radiation exposure is kept to a minimum.

The right dose

In an internet forum, a young doctor asks about the proper term for the apron you have to wear during trauma surgery and whether it protects you from radiation. A fellow physician responds that it doesn’t really matter, since the little bit of radiation emitted during trauma examinations is harmless anyway. The response gives credence to the findings of an investigation conducted by the FDA advisory committee revealing large gaps in the level of knowledge and training on the part of physicians regularly working with fluoroscopy. Especially in recent years, the lack of awareness about handing X-ray radiation in clinical areas outside radiology units has been criticized. Medical journals have lamented the paucity of requisite basic knowledge on the part of physicians working in trauma, orthopedics and cardiology departments. Organizations such as the International Commission on Radiological Protection (ICRP) and the European ALARA Network have therefore called for more stringent guidelines for the medical use of radiation, along with standardized training on safety and use. The aim is to bring about a new way of handling radiation and to raise awareness on the part of individuals exposed to radiation.

Illustrations
Markus Stumpf

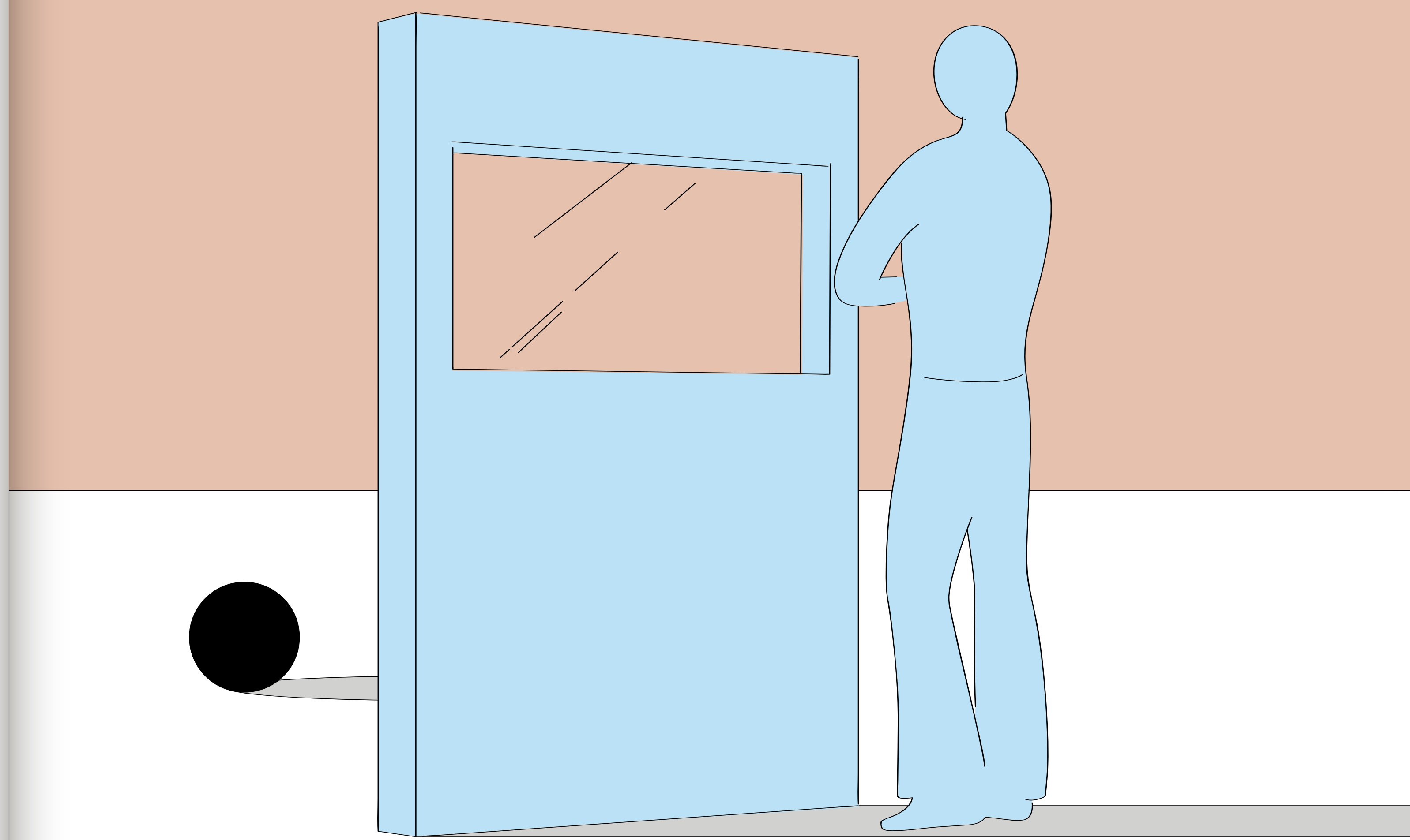
No matter what the issue, the first step involves educating users about the meaning of “dose”. At the most basic level, “dose” refers to radiation energy. The ionizing radiation consists of highly energetic photons characterized by waves. When these X-ray photons encounter tissue, an interaction occurs. The photons release energy to the penetrated medium, for instance, human tissue. There are two ways to influence the dose. The first is the tube current, in other words, the number of electrons provided to generate photons. The other way involves the tube voltage, which determines the velocity of the electrons involved in forming photons. “Dose” is therefore always a value resulting from the energy of the photons and their number. The higher the dose, the higher the risk.

While the best form of radiation protection obviously involves reducing the dose to a minimum, another way to do this is to keep the greatest possible distance from the radiation source. The principle that the dose decreases inversely to the square of the distance applies. This means that if the distance to the radiation source is doubled, the dose is only one quarter. It also means that you should only stay in the exposure area if it is absolutely necessary and otherwise should move to radiation-protected areas.

Physicians and medical personnel protect their bodies with radiation protection equipment such as radiation protection aprons, protective lead glass screens attached to the table or hanging lead strips. These methods are so effective because X-rays are attenuated to different degrees by different materials. The high density of lead enables it to shield off X-rays very effectively, thus making it the ideal basis for radiation protection equipment. Exposed body parts such as eyes or the thyroid in particular should be shielded off with special glasses or a thyroid guard, since the legally prescribed dose limit can be exceeded quickly in these areas of the body.

To ensure reliable results, you have to make a prudent compromise between the lowest possible radiation dose and adequate image quality.

The principle “as low as reasonably achievable” – ALARA – serves as a rule of thumb for dealing with radiation exposure. How can imaging be performed with the least possible radiation and still produce accurate results? It thus describes the compromise between medically adequate image quality and the lowest possible dose. Closely connected to this is the question of image frequency. The fluoroscopy mode with continuous radiation creates the highest radiation exposure. In contrast, the pulsed mode releases radiation only at defined time intervals. In the time between the radiation intervals, the most recently captured image is displayed. The pulsed mode permits the dose to be decreased by reducing the image frequency. Besides pulsed fluoroscopy, additional imaging algorithms are available today that can be used to achieve adequate image quality despite a reduced dose. These are complex programs that can filter out the typical noise of an X-ray image to some extent, comparable to the noise filters used in stereo systems.



2 “Protect yourself”
Shields and protective clothing help to significantly reduce radiation. The best protection is always that offered by walls, however. If possible, leave the room containing the radiation.

In order to localize the area to be scanned as precisely as possible, an X-ray-free laser cross hair is used. Collimators in the generator can limit the radiation field to the medically relevant area. A positive side effect is the reduced irradiated body mass and in turn, the decrease in scatter radiation. Scatter radiation refers to the photons diverted, or “scattered” in the medium.

The use of an anti-scatter grid is also important. The grid is located directly in front of the image plane and catches the photons scattered in the patient’s body. While using a grid leads to a higher patient entrance dose, it generates better image quality. In low-dose examinations, for example, in children or on extremities, scatter radiation occurs only in very low quantities, meaning that a grid can be dispensed with.

The skin entrance dose is another factor that is increasingly drawing attention. This refers to the photons that strike the patient’s uppermost skin layer. Low-energy photons are often ineffective for imaging, because they are unable to penetrate the patient. When it comes to the radiation dose, however, these photons play a part, as do higher-energy photons. Certain filters in the generator housing that consist of various elements such as copper or aluminum catch the low-energy photons and in so doing, filter the radiation so that only the photons remain that have enough energy to reach the detector through the tissue.

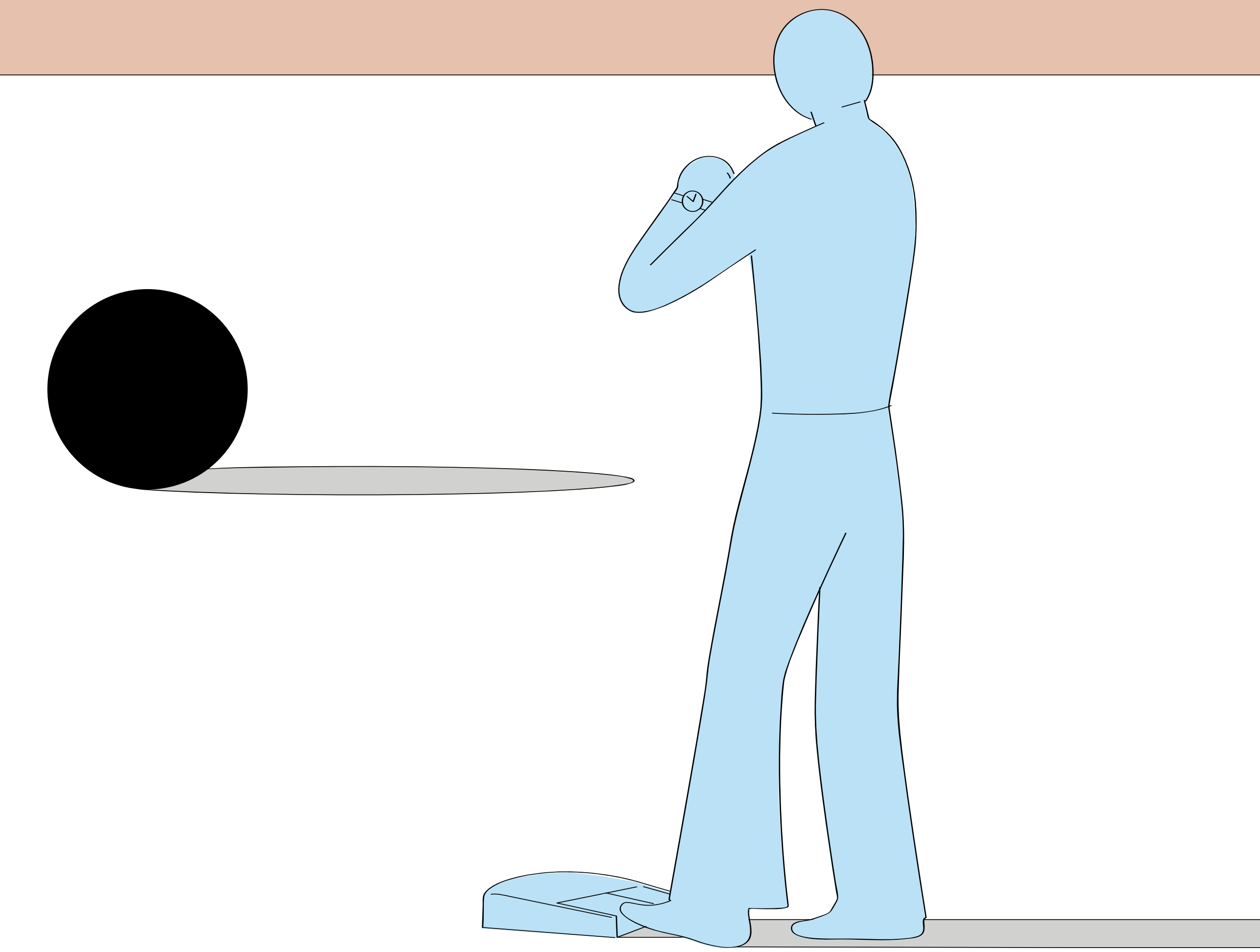
Apart from this prefiltering of the radiation, low-dose programs also play an important role in reducing the skin entrance dose. These programs are most frequently used in children or in women of reproductive age. But low-dose programs can also be a useful alternative for adults, for instance, when scanning extremities. Low-dose programs ultimately reduce the number of photons, which can lead to higher noise in the X-ray image. Here too, it must be decided on a case-by-case basis which image quality is sufficient for accurate results. When locating metal implants, for example, the low-dose mode is often sufficient owing to the high metal contrast.

When endeavoring to deal responsibly with radiation and determining doses, it is always important to consider whether an X-ray is really necessary. There are a number of ways to work in a dose-sparing manner, but you have to be familiar with them and even more important, actually use them.

SmartDose concept

Ziehm Imaging offers its SmartDose concept, which already features the above-mentioned options for ensuring top image quality at low doses. The low-dose mode contains special dose-optimized settings for all anatomical programs. The removable grid permits a significant reduction of the skin entrance dose for examinations in the lower kilovolt range. The reduction of the pulse frequency can be manually selected or is automatically adjusted depending on the patient's movement – more quickly than would be possible with a manual procedure (ODDC function). SmartDose also enables exposure-free enlargement of the X-ray image and exposure-free positioning of the collimators.

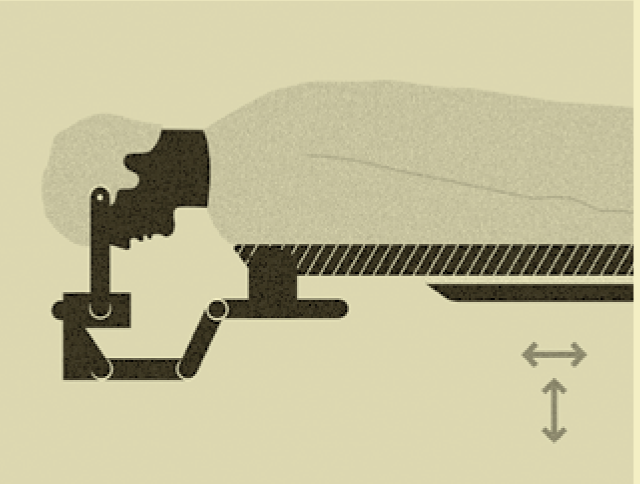
3 "Use sparingly"
Use radiation only if it is absolutely necessary and make sure exposure is always as brief as possible. Technical solutions such as Targeting and the Pulse Mode permit radiation to be used in controlled manner.



Three steps for creating a 3D image

Eva-Maria Ilg, Lena Lochner and Nadja Baitis of Ziehm Imaging's product management department are responsible for the fleet's flagship: the Ziehm Vision RFD 3D. Every day, they work hard to improve and refine this high-end device, whose unbeatable image quality is extremely wellsuited for treating complex fractures. Using the revolutionary 3D imaging with mobile C-arms requires some adjustments to clinical routine for prepping and positioning the patient. The three experts at Ziehm Imaging are in communication with physicians and hospital personnel worldwide, providing all kinds of tips and tricks for clinical routine.

1



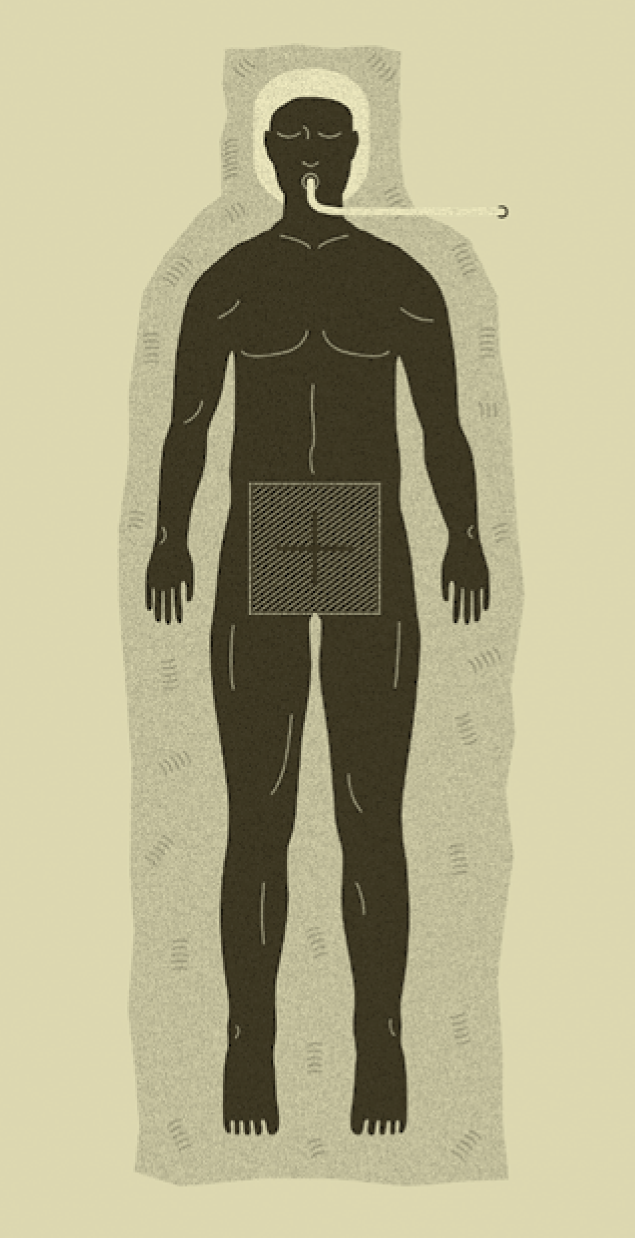
Prepare the OR

- **The right operating table**
On an adjustable carbon table top or carbon table top segment, the patient can be optimally positioned for the C-arm's scan center with respect to height and lateral horizontal shift. The table top can also be imaged without creating any artifacts.
- **Special table accessories**
For operations on the scull or the elbow or wrist, special operating table systems, extensions or carbon head holders should be used.

2

Prepare the patient

- **Proper positioning**
Positioning aids that will remain in the scan field (such as leg or pelvic supports) also need to be able to be scanned without producing any artifacts. It is always better to remove positioning aids from the scan center in order to allow room for the orbital movement. This also permits the dose applied to the patient to be reduced. For operations on the cervical spine, the patient's arms should be positioned next to the body.
- **Use exposure protection**
For many applications, a lead apron can also be used for the patient to guarantee optimum radiation protection.
- **Control the contralateral surgical region**
For surgical procedures involving the lower extremities, as much of the contralateral surgical region as possible should be removed from the radiation field. Before surgery, it should be checked whether an osteosynthetic or prosthetic implant has been implanted in this region.
- **Position the structure to be operated on in the isocenter**
For surgical procedures involving the upper body (e.g. on the spine), the patient should be positioned as centrally as possible on the operating table. For scans of the hip, shoulder or extremities, the side to be operated on should be located opposite the C-arm and should be placed closer to the center of the operating table.
- **Sterile draping of the surgical field**
During the 3D scan, the generator moves below the operating table and across the height of the table. For this reason, maximum sterility below the table must be ensured; this can be achieved through proper sterile draping.



3

Prepare for the successful 3D scan

- **Start up the C-arm in good time**
In order to avoid unnecessary down time in the operating room, the C-arm can already be switched on while the patient is being positioned.
- **Optimal presettings**
Thanks to the C-arm's individual settings to accommodate the patient's size, the area of application and the body region to be operated on in the 3D menu, the radiation, scan and path parameters are automatically selected to ensure optimum image quality.
- **Setting the starting position**
To ensure a smooth surgical procedure, the "Starting position" menu item should be used to place the C-arm in starting or neutral position.
- **Proper positioning**
The region of interest (ROI) is set with the two vertically stacked and one horizontal laser of the C-arm in the isocenter in an efficient and exposure-free manner. A motorized operating table is particularly helpful for positioning.
- **Preventing information loss**
If a screw or an implant is located exactly in the C-arm's 3D rotation angle, information behind the metallic body can be lost (orthogonal effect). Rotating the C-arm by as little as 5–10° can bring about successful 3D results.
- **Collision check**
The reconstructed data volume has an edge length of 16 cm. In order to display the surgical site in the best possible manner in the isocenter, during the collision check, a 2D image should be taken in both anteroposterior and in lateral position. Afterwards, corrections to the patient positioning can be carried out as needed.
- **Correcting the trajectory**
During the collision check of the C-arm for the 3D scan, in the event of a collision with an object, such as the table, it is possible to correct the trajectory in a horizontal direction. This enables optimal adjustment of the orbital rotation for the C-arm to the actual conditions, without losing the presettings or limiting the scan field.
- **Breathing stop for better image quality**
For spinal operations in particular, the patient's breathing must be stopped in expiration for the duration of the 3D scan (approximately 45 seconds). If this is communicated five minutes ahead of time, the patient can be hyperoxygenated.

→ Now, the wireless footswitch is used to start the fully automatic scan from outside the operating room.
The team exits the room and is protected from exposure.

The United States is not just the land of freedom; it's also the land of unhealthy diets. In a place characterized by 80-ounce soft drink cups and fast food chains, as well as by large numbers of obese people, the medical sector is facing new challenges.

Super size: Not always so super

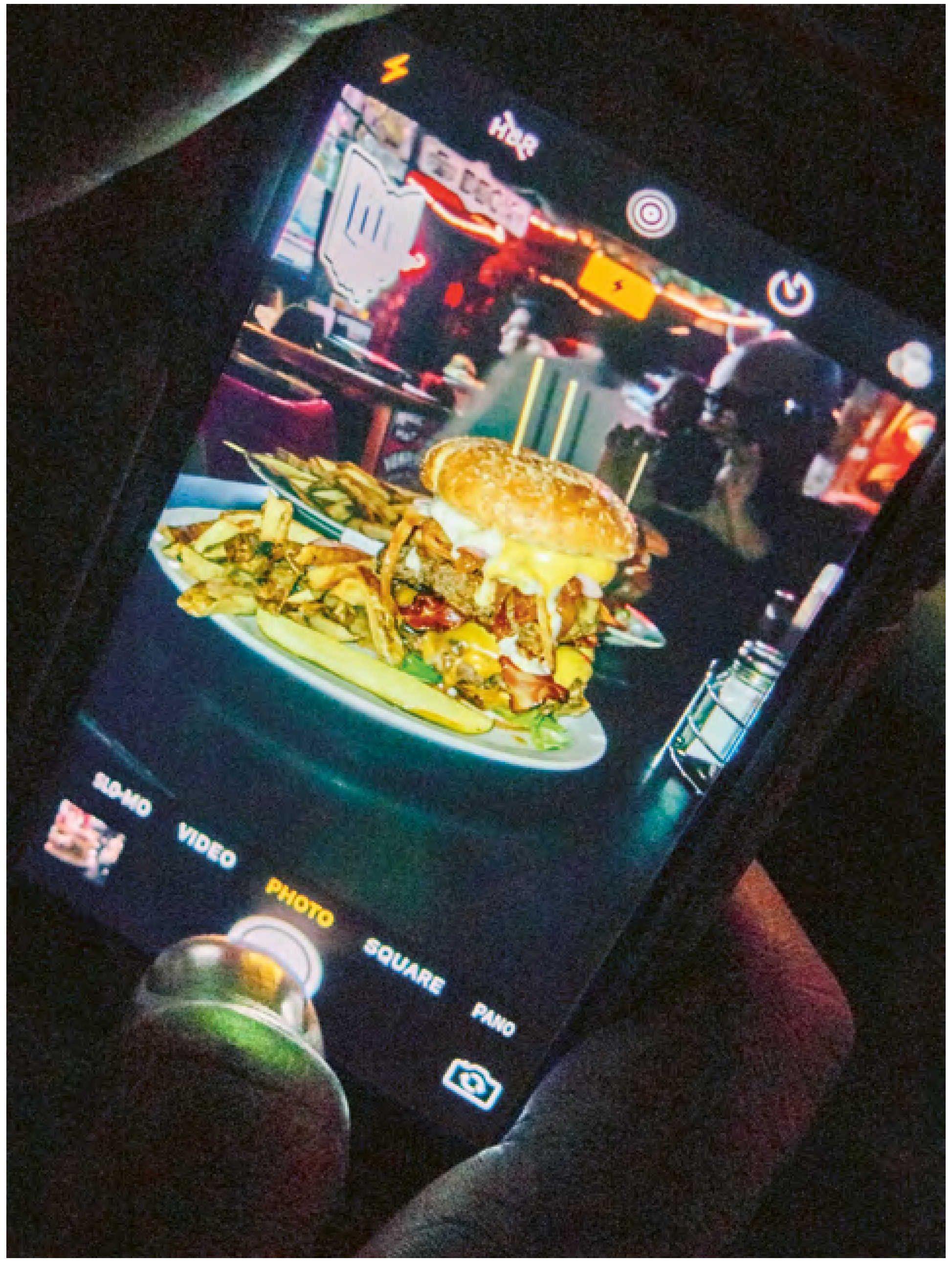
Photos
Christoph Grau

Nearly 11 percent of the world population suffers from hunger, a shocking development. What is even more frightening is the fact that considerably more people die from the complications of overweight or obesity than from hunger. According to the World Health Organization, in 2014, about 39 percent of the world's adult population was overweight and 13 percent was obese. The share of overweight people in the overall global population has therefore more than doubled in the past 30 years. Society has been confronted with a new challenge in the past years. People are less active in their free time, the number of jobs involving heavy labor is decreasing, and improvements in the infrastructures of many countries have eliminated the need to cover long distances by foot. Despite all these changes, the number of calories consumed has remained at a high level. The sheer variety of foods high in sugar and fat is mind-boggling. Products loaded with sugar, frozen foods and mega-sized packages dominate the supermarket shelves. While researchers assume that being slightly overweight is not necessarily harmful, morbid obesity is increasingly posing a problem for health systems.

The United States is particularly strongly affected by the rising number of overweight people. Former New York City mayor Michael Bloomberg

declared obesity to be a national problem. While the US government and a number of organizations have invested efforts in education and prevention, little success has been registered to date.

In the United States, the state of Texas is particularly hard hit by the increasing number of overweight and obese people. With its share of obese residents at 34.9 percent, Texas is one of the top ten regions with the highest obesity rate. In Texas, famed for gigantic steaks and sumptuous barbecues, one out of three adults is obese. This situation is a real burden on the health system, as well as on medical technology, since diseases such as diabetes, stroke and heart attack are often associated with obesity. Overweight patients often have risk factors compounding their obesity that make surgical treatment more likely. To make matters worse, surgeons often have to handle complex challenges during orthopedic and trauma surgery, because X-ray imaging is much more difficult than usual. How do you scan a 400-pound person, whose weight can no longer be registered on a normal bathroom scale and whose body circumference is off the charts? When it comes to intraoperative fluoroscopy in particular, the obese patient's thick fat layers and massive body circumference are a real problem. While imaging procedures are expected to



deliver high-performance results, in many cases anatomical structures are difficult to identify, making an increased radiation dose necessary.

Dr. Milton Routt, an orthopedic trauma specialist at the University of Texas Health Science Center, has examined a number of obese patients in Houston. He values the impressive capabilities of the C-arm by Ziehm Imaging. “Examining obese patients is one of the most challenging factors when it comes to achieving sufficient intraoperative image quality. With the Ziehm Vision RFD 3D, we now can serve this growing patient population even better than before.” The Ziehm Vision RFD 3D provides excellent image quality even under extenuating circumstances, thanks to its rotating anode, its high-performance generator and the many advantages offered by the flat-panel detector. For example, when used in obese patients, there are no distortions at the edges of the image. The improved soft tissue and bone contrast and the optimized noise reduction produce meaningful and reliable imaging results. Special anatomical programs permit obese people to be examined without having to increase the radiation dose. While the Ziehm Vision RFD 3D cannot eliminate the causes of obesity and excessive overweight, it does allow the surgeon to successfully treat severe complications of obesity.

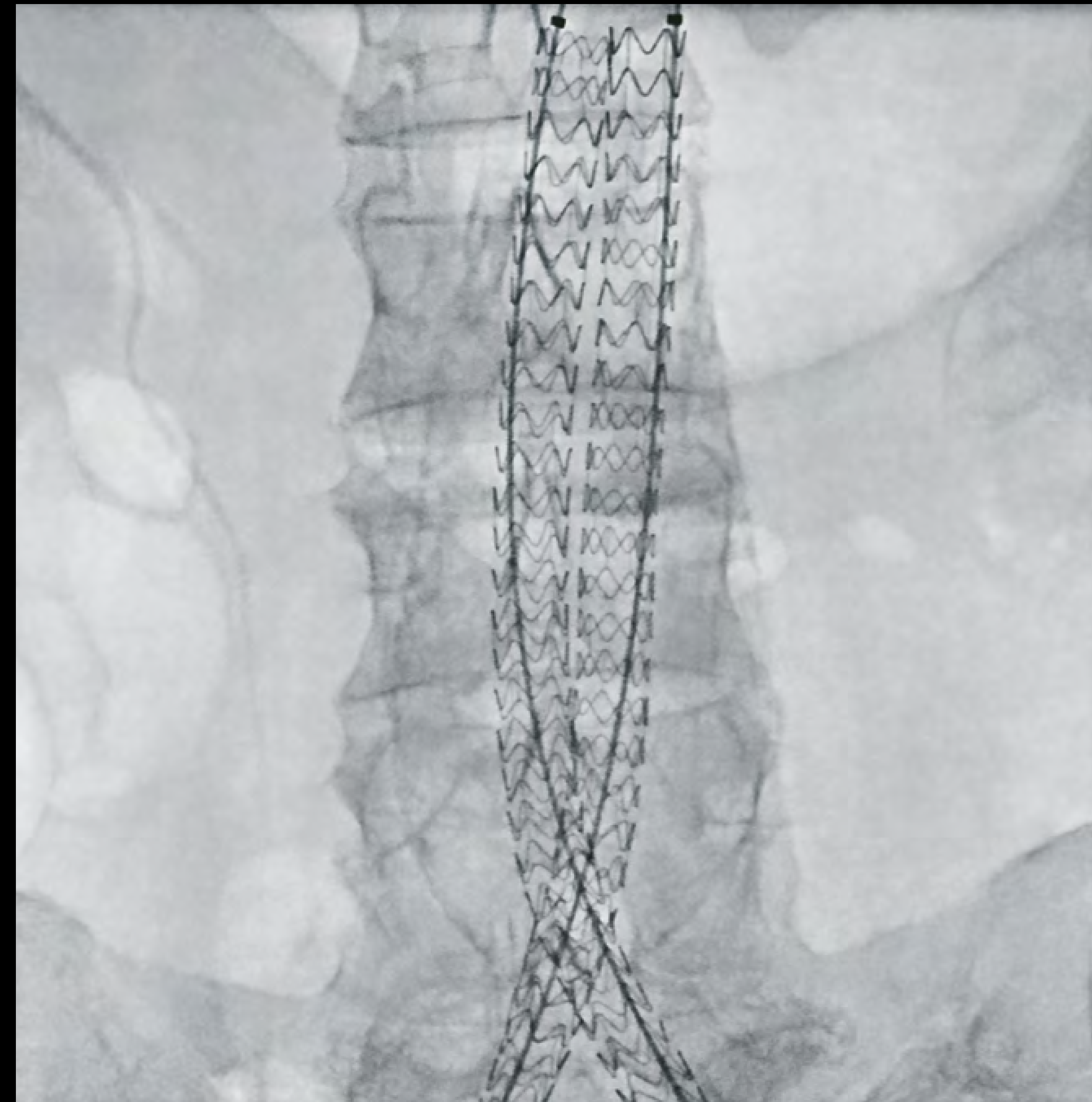


Image of the year

Among the thousands of images captured annually by our mobile C-arms, this image stands out in particular. It shows the sophisticated endoprosthetic surgical repair of an abdominal aortic aneurysm performed using an innovative endovascular sealing technology (EVAS). In such procedures, the C-arm's liquid cooling significantly increases its performance capacity, even during prolonged periods. Image-stabilization algorithms and filters ensure crystal-clear resolution of the stent. The noise suppression in the background also helps create outstanding image quality.

The image was generated with the Ziehm Vision RFD Hybrid Edition at the university hospital in Parma, Italy.

Photos
Juli Sing

We build C-arms

The instruments supplied by Ziehm Imaging throughout the world are meticulously assembled by hand. In so doing, the people who work here develop a special relationship to “their” components. In each and every step, their top priority is quality and optimal interaction. Top-level precision applied with the utmost sensitivity goes into the over 1,000 mobile X-ray systems created each year in Nuremberg.

After in-depth testing, the C-arm's housing components
are ready to be assembled.

One employee is responsible for the assembly of a
future C-arm, carrying out both the mechanical and electronic
assembly of the mobile tripod.

The housing, which is still empty, will be equipped with
the heart and soul of the C-arm: the detector.

Testing and calibrating the monitors of the C-arm
and mobile tripod are essential for reliable imaging
in the operating room.

The necessary safety labels are affixed to the finished C-arm.

Final tests (behind lead glass) for a 3D device before it makes its way to the customer.

In order to ensure top quality for the customer
on site, the system is put through its paces before
it leaves production.

About Ziehm Imaging

Ziehm Imaging was founded in 1972 and today has a staff of over 500 worldwide. At its headquarters in Nuremberg, Ziehm Imaging manufactures over 1,100 C-arms annually. With a market share of almost 40 percent in Europe, Ziehm Imaging is not only one of the market leaders in the area of mobile C-arms; it is also an internationally recognized innovator in the area of medical imaging.

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ziehm imaging

Ziehm Imaging is specialized in the development and manufacture of mobile C-arms. For 45 years, we have produced technologies that enhance imaging and streamline clinical workflows. The mobile X-ray devices' exceptional image quality and flexibility in the operating room serve as an important basis for treatment success.