

New perspectives. Full control.

Cios Spin

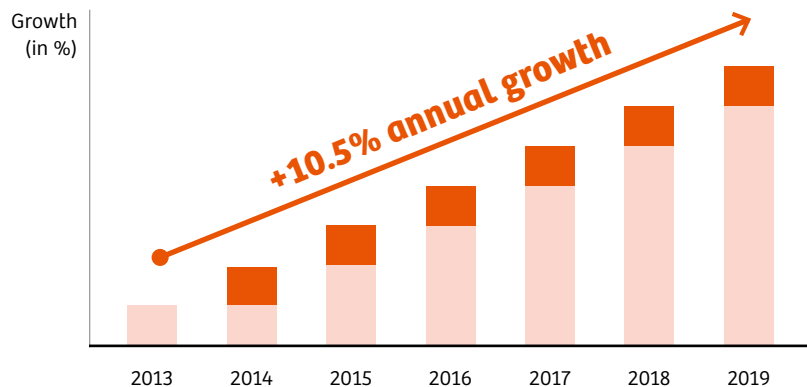
Cutting-edge
mobile 3D imaging
for intraoperative
quality assurance.



Staying competitive in a challenging market

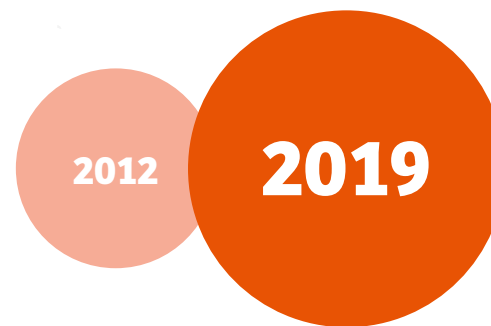
With rising patient numbers and fewer staff, rapid scientific progress, and increasingly outcome-oriented compensation, the environment for healthcare providers around the world is changing.

Medical and technological advancements make it crucial for healthcare providers to keep up. But these developments also offer great opportunities. Minimally invasive procedures are a case in point: Projections show that they are continually growing and increasing in value.



Expected growth of minimally invasive procedures

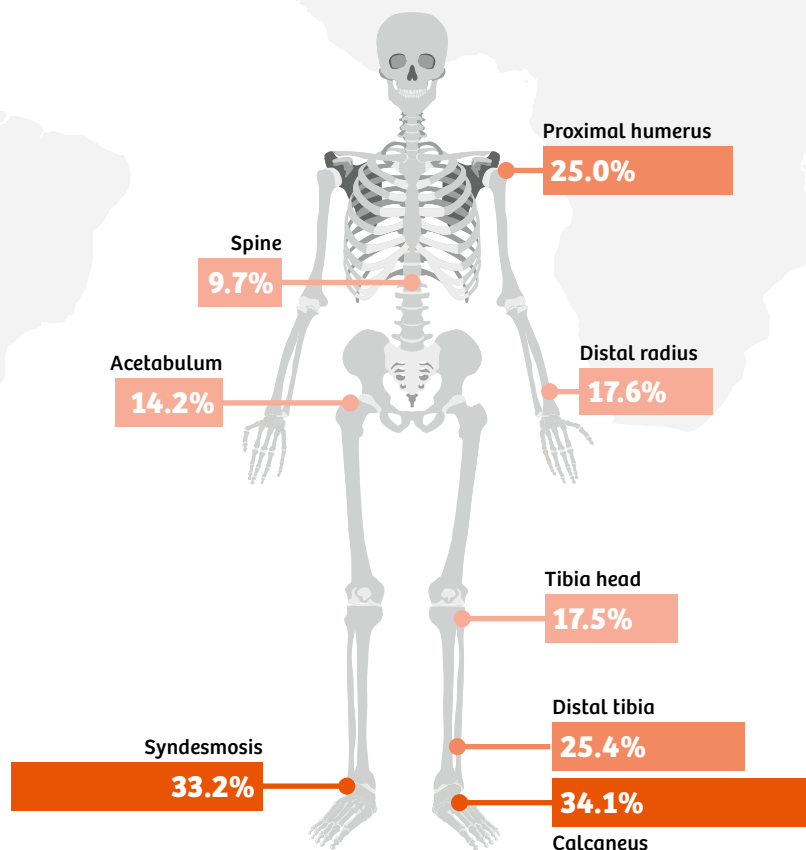
A 2014 study by Transparency Market Research (TMR) projects an annual growth rate of 10.5% for the global market of minimally invasive procedures.¹ Due to further technical and socio-economical development, it is safe to assume this trend will continue.



... and their projected value

The same study estimates the global market for minimally invasive procedures to double in value between 2012 and 2019.²

As minimally invasive procedures gain more prominence in ORs, there is a concurrent trend toward 3D imaging. This development is supported by studies examining intra-operative revision rates.



Corrections after an intraoperative 3D scan

These percentages refer to cases where the 2D dataset suggested everything fit. Only an additional 3D scan revealed the need for further correction.³ Without 3D information, all of these cases may have required postoperative adjustment.

Expand precision medicine

In this environment, we want to help you safeguard optimal surgical outcomes. With Cios Spin®, we make excellent intraoperative 3D imaging accessible – to help you tap into the opportunities offered by new insights and technological advancements.

Progress with us and experience the possibilities of intraoperative 3D imaging. Let Cios Spin support you in expanding precision medicine and advancing therapy outcomes.



New perspectives. Full control.

Conventional 2D imaging may not always provide enough information to safeguard correct placement of screws and implants in demanding procedures. Intraoperative 3D imaging can therefore be an important factor in avoiding postoperative complications and improving surgical outcomes. It is, however, often not considered for clinical routine if it is too cumbersome or causes delays in the workflow.

To provide outstanding 3D capabilities that can be seamlessly integrated into clinical routine, we have developed Cios Spin®: a mobile 2D and 3D C-arm that delivers precise 3D images for intraoperative quality assurance. It features dedicated 3D technologies, allowing you to confirm your planned results – and it's easy to learn, easy to use, and easy to integrate in your surgical routine.

Cios Spin provides new insights and perspectives that give you more certainty in surgical routine, and full control over your procedures. As a smart solution for modern healthcare businesses, it can help you improve outcomes, reduce operational costs and risks, work efficiently, and boost your institution's reputation.

Cios Spin
Cutting-edge mobile 3D imaging for intraoperative quality assurance.

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Cios Spin – At a glance

More certainty in demanding cases

Retina 3D

More confidence with intraoperative 3D

Precise 3D visualization of very fine structures lets you confidently pinpoint anatomical structures, implants, screws, and devices.

High Power 3D

Outstanding 3D images in obese patients

Obese patients and dense tissue require high penetration capability. Cios Spin® comes with 25 kW power* and a unique Energy Storage Unit (ESU)¹ that triples the power when needed.

NaviLink 3D

Seamless integration with navigation

NaviLink 3D*, a digital interface, automatically transfers 3D datasets to certified navigation systems – for combined use of image guidance and navigation in surgery.



More cost-effectiveness in surgery

Profit from intraoperative 3D

Our 3D technology may help you reduce costs caused by revision surgeries, limit postoperative diagnostics, shorten hospital stays, and reduce liability risks.

Versatility that pays off

Cios Spin is designed for multidisciplinary use. Excellent image quality in 3D or 2D allows you to better utilize this C-arm – for potential additional revenue.

More efficiency in intraoperative 3D

Screw Scout

Simplify intraoperative screw assessment

Screw Scout* automatically localizes screws, offering the optimum view of screws in the right 3D planes. You can instantly start screw assessment and save time in your 3D workflow.

Easy 3D

3D made quick and easy

With step-by-step guidance, quick scan times, and self-explanatory 3D visualization functions, Cios Spin improves 3D workflow efficiency.

Wide-space C-arm

Lots of room for demanding setups

Large anatomy requires space, and safe maneuvering is key to efficient 3D. Featuring 93 cm (36.6") between tube and detector, Cios Spin offers plenty of room for any setup.

Target Pointer

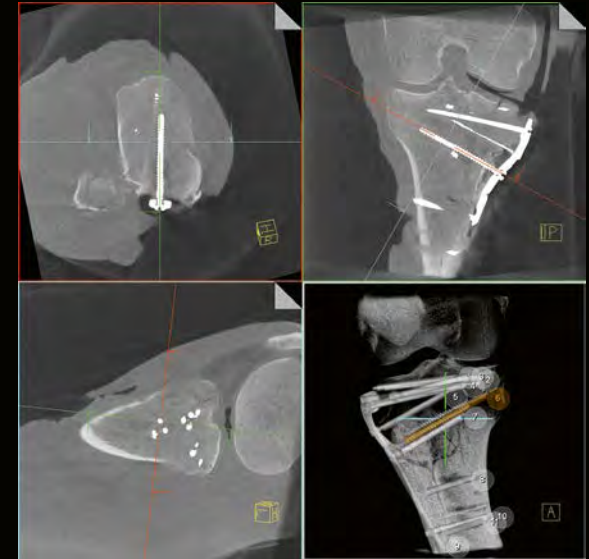
Get it right at first attempt

Our Target Pointer* displays a trajectory that helps you optimally place K-wires or other devices, ultimately saving time.

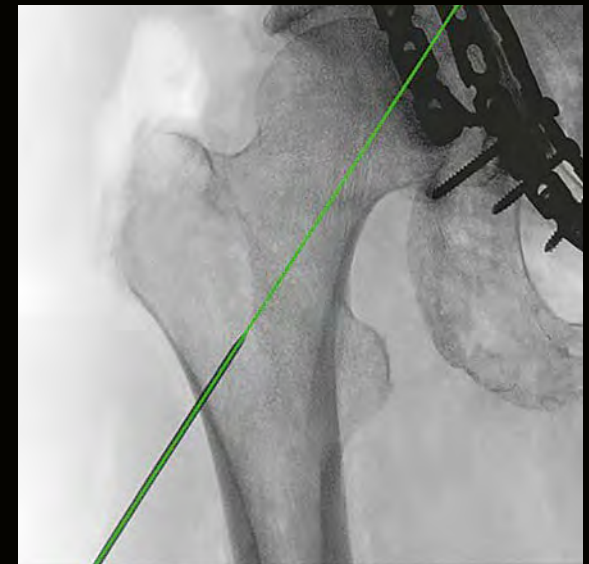
Infection control

Maintain the highest standards

Anti-microbial surfaces, specially developed hardware, and a comprehensive cleaning concept help you stay on top of this important requirement.



Screw Scout – Simply toggle through detected screws
Courtesy of BG Klinik Ludwigshafen, Germany



Target Pointer – Correct position based on the target line
Images from anatomical specimen

You can't treat what you can't see

When it comes to placing screws and implants, or reducing fractures in demanding procedures, conventional 2D imaging may not always provide enough information. In order to safeguard optimal surgical outcome and avoid postoperative complications, surgeons greatly benefit from intraoperative tools that let them confirm their planned results.

"I can't say it clearly enough: Experience is no substitute for a 3D scan. Experienced surgeons, in particular, do not want to do without this intraoperative process control. They know very well that by using this method, they achieve better clinical outcomes and prevent postoperative revisions."

Prof. Dr. med. Paul A. Grützner
Head of the Department of Trauma and Orthopedic Surgery, BG Klinik,
Ludwigshafen, Germany





More certainty in demanding cases

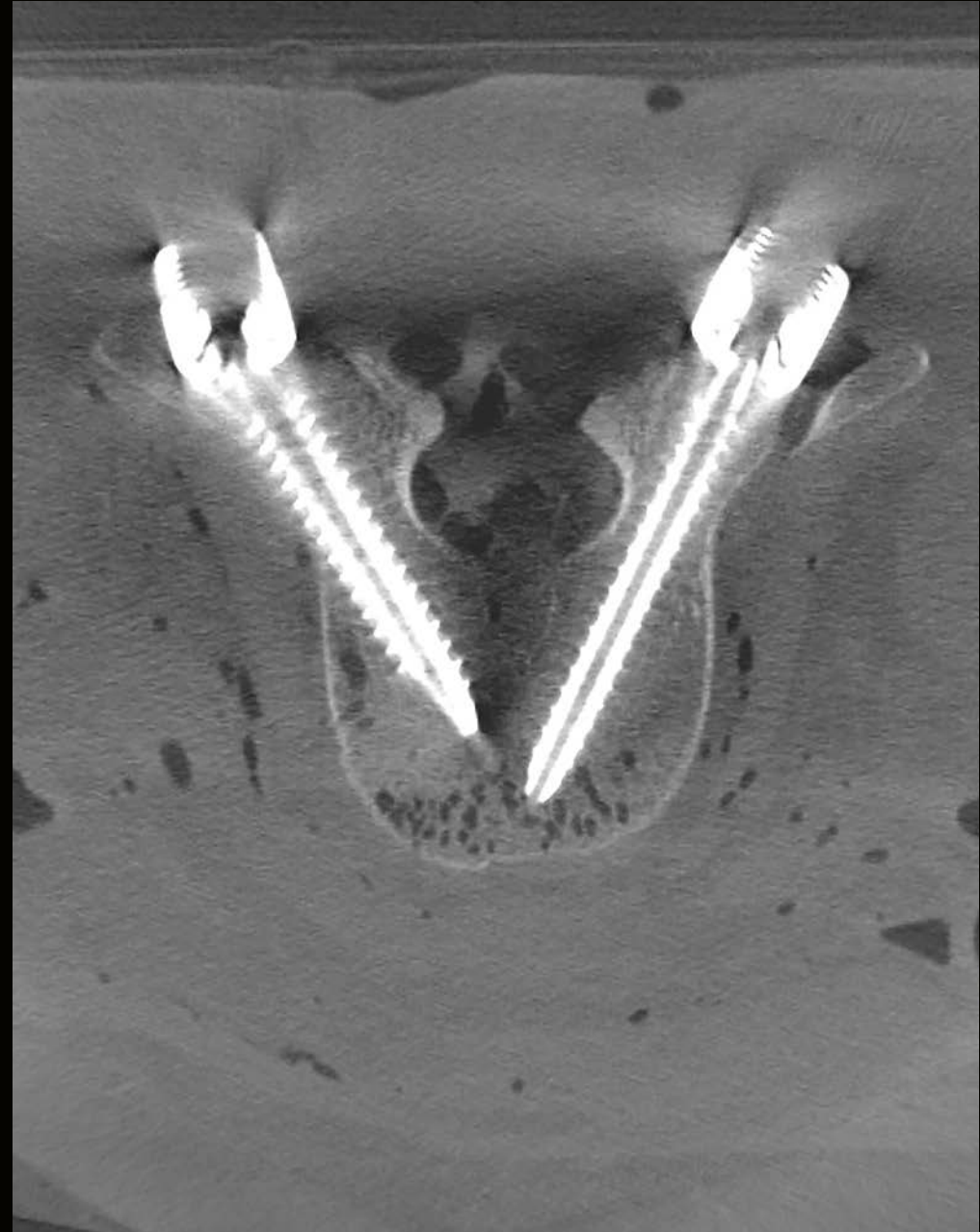
To give you the tools to confirm your results intraoperatively, we've equipped Cios Spin® with dedicated 3D technology. This extra dimension opens up new perspectives: choose coronal, sagittal, or axial views – and confirm that screws and implants are placed correctly.

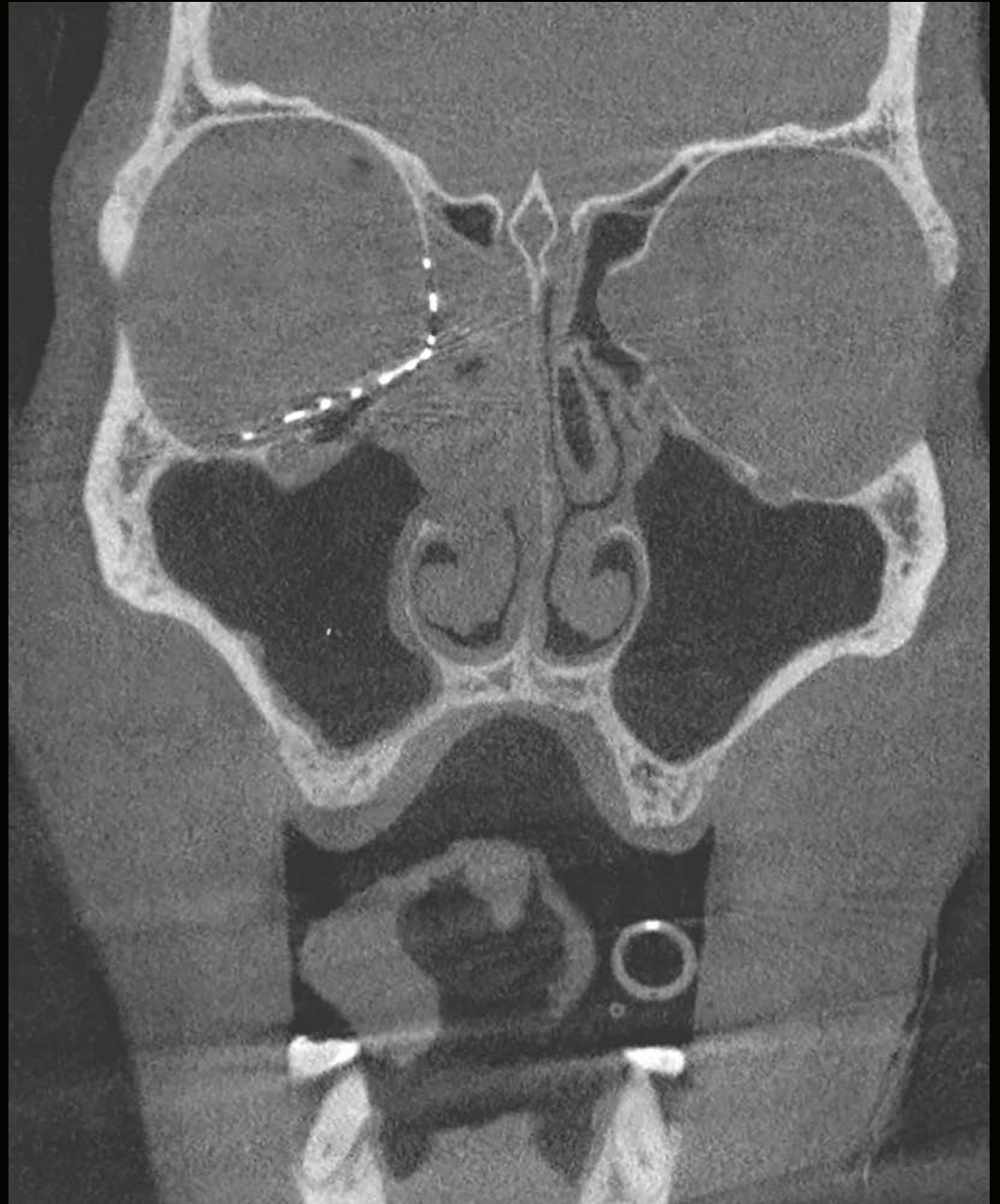
We know that your cases can be quite demanding. To help you expand precision medicine and advance therapy outcomes, Cios Spin lets you visualize very fine structures, even in obese patients and dense tissue.

Read on to find out how Cios Spin gives you full control over your procedures with intraoperative 3D.

Confirm your results with intraoperative 3D

Are the screws placed correctly? Freely choose whichever plane or angle, and see the anatomy or screws you want to check. Be sure of your results by moving through every dimension. Get a coronal, sagittal, and axial view – or any other plane you need. For more certainty in the OR – even in demanding cases.





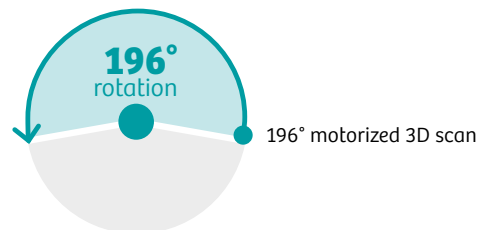
Confidently evaluate your case with Retina 3D

When you see more, you enjoy more certainty: With Retina 3D, Cios Spin® lets you visualize anatomical structures, implants, screws, and devices – directly in the OR. If necessary, perform corrections during the same surgery. This may help you reduce the risk of needing revision surgery afterwards.



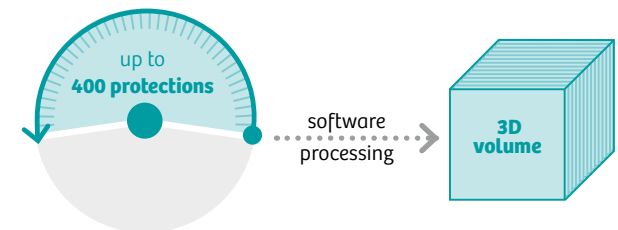
High 3D scan accuracy

With iso-centric scan technology, we safeguard smooth orbital movement around the patient. Cios Spin covers patient anatomy with 196° from any direction in a motorized 3D scan – giving you complete, highly accurate 3D information in outstanding quality.

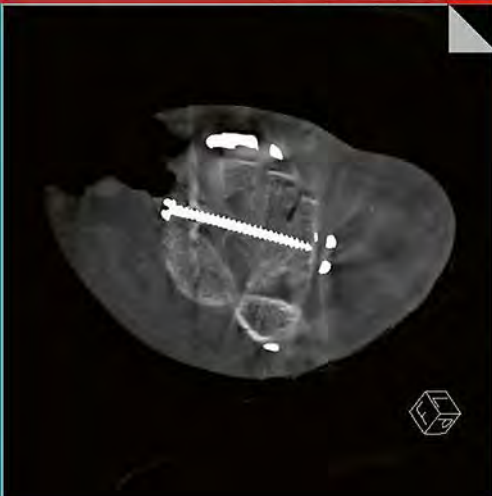
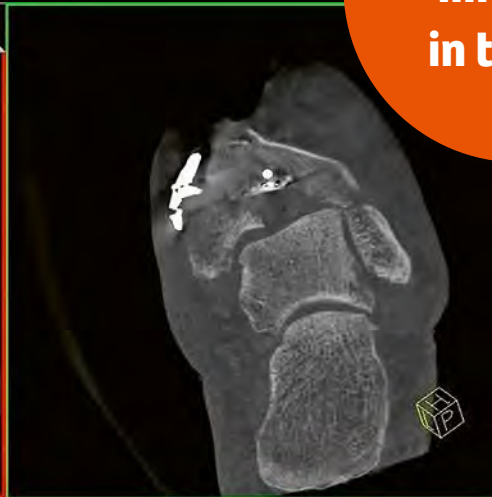


Fine structures in 3D

Retina 3D scan technology uses up to 400 projections – provided by the large (30 x 30 cm) complementary metal-oxide-semiconductor CMOS flat detector – for high-quality 3D reconstruction and high resolution. Even very tiny anatomical structures and implants become visible.



**CT-like
imaging
in the OR**



Coronal, sagittal, and axial projections let you evaluate the placement of screws and wires during surgery. Confidently check the reduction of small fractures with Retina 3D.



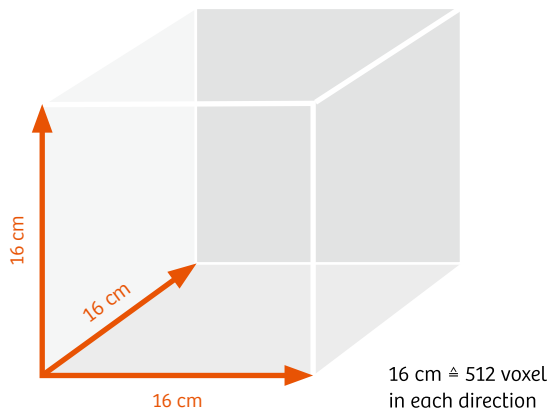
Without metal artifact reduction



With metal artifact reduction

**Fewer metal artifacts,
more confidence**

Metal artifacts caused by screws, plates, and other metal implants are reduced with a dedicated algorithm. Select this function and see details that were obscured.



Large volume with excellent resolution

Retina 3D delivers a 3D image that covers a volume of 16 cm in each direction at a high resolution of 512^3 voxel, with a voxel side length of 0.3 mm.

With Cios Spin®, you can therefore see the following in one volume:

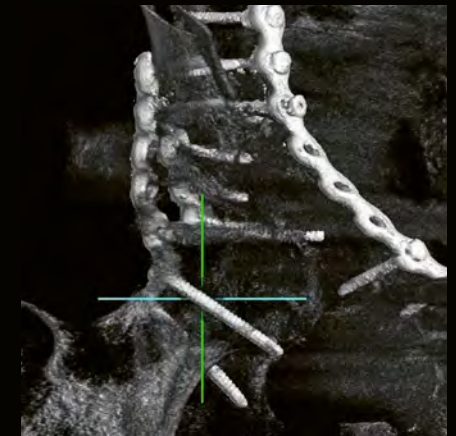
- Seven cervical vertebrae
- Six thoracic vertebrae
- Bilateral middle face, orbitae, mandibles, and skull base
- Bilateral iliosacral joints
- Femur head and unilateral pelvis



Orbital floor fracture with mesh



Thoracic spine: Spinal fusion with cage
Courtesy of BG Klinik Ludwigshafen, Germany



Pelvic ring fracture fixation
Courtesy of BG Klinik Ludwigshafen, Germany

2D excellence? Yes, of course.

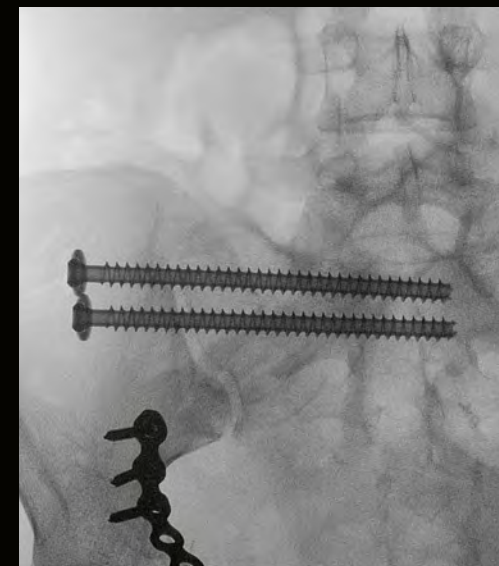
Rest assured that Cios Spin delivers high quality in 2D as well – in fact, we have improved it further. Cios Spin offers 2D technology with an array of helpful, innovative features designed to deliver outstanding images. 2D or 3D, the choice is yours.

Control dose, boost quality

A newly developed 2D imaging chain with the CMOS flat detector, CARE technologies for the right dose in each individual case, and intelligent power management put you in control: Profit from the ideal balance of image quality and dose – and get high 2D image quality for the level of detail to see what you need.



Courtesy of BG Klinik Ludwigshafen, Germany



Courtesy of BG Klinik Ludwigshafen, Germany

Boost your insights with High Power 3D

Obese patients and regions of dense tissue – such as the pelvis or the lumbar spine – are a challenge for conventional C-arms.

Rising to the occasion, Cios Spin® comes with high power output, plus a unique energy buffer that boosts power even further. So you can visualize all of the crucial details.

Use the power you need

Cios Spin features 25 kW power output* with up to 250 mA tube current, compared to 2.5 kW in conventional C-arms. What's more, our Energy Storage Unit (ESU)* buffers energy to automatically triple the applicable power if necessary.

Precise 3D in obese patients



Courtesy of BG Klinik Ludwigshafen, Germany



Images from anatomical specimen

Get connected with NaviLink 3D

Navigated surgeries demand a fast, reliable connection between C-arm and navigation system. After you have performed a 3D scan, our NaviLink 3D* automatically transmits image data, together with the spatial coordinates, to the connected navigation system. Now you're ready to navigate based on precise 3D images.

Seamless connection to navigation

NaviLink 3D is a digital interface for connecting to certified navigation systems. It automatically transfers 3D datasets to the navigation system, allowing combined use of imaging and navigation in surgery.



A perfect tool to check results

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"In our opinion, if you are treating complex intra-articular fractures, 3D imaging is very helpful – maybe even a must – if you want to achieve good results in terms of reduction and implant placement. Cios Spin offers you a perfect tool to check your surgery result intraoperatively to revise things immediately if needed. In comparison to conventional systems, the image is so good that you don't need a post-operative CT scan anymore – even in complex anatomical regions such as the spine or pelvis."

Dr. med. Jochen Franke
Managing Senior Consultant
Head – Division of Trauma
BG Klinik Ludwigshafen, Germany

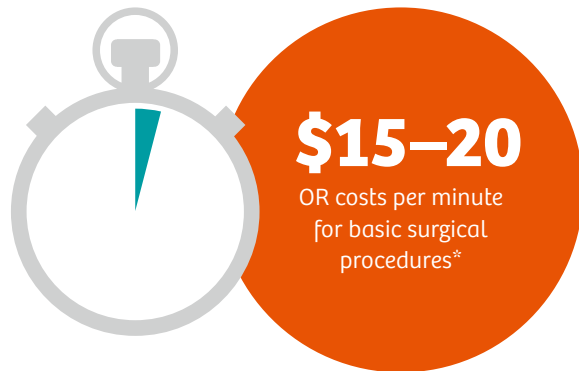
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**How much money could you
save with intraoperative 3D?
Take a look at pages 30 – 31.**

Is intraoperative 3D fit for clinical routine?

In daily routine, it's all about increasing efficiency. If 3D intraoperative imaging is too cumbersome, causes delays in the workflow, or requires extensive training, it is often not considered for clinical routine.

A study has shown that every additional minute significantly adds to OR costs.⁴



Would you consider 3D if it could easily be integrated into your workflow?





More efficiency in intraoperative 3D

Cios Spin® is built on a concept as smart as plug-and-play. For efficient and uninterrupted surgical workflows, Cios Spin comes with feature packages such as Easy 3D: easy to learn, easy to use, and easy to integrate into your surgical routine.

With intuitive software that guides you step-by-step, and enough space for demanding setups, Cios Spin optimizes clinical operations. Experience quick scan times, guidance, and efficiency both in 2D and 3D.

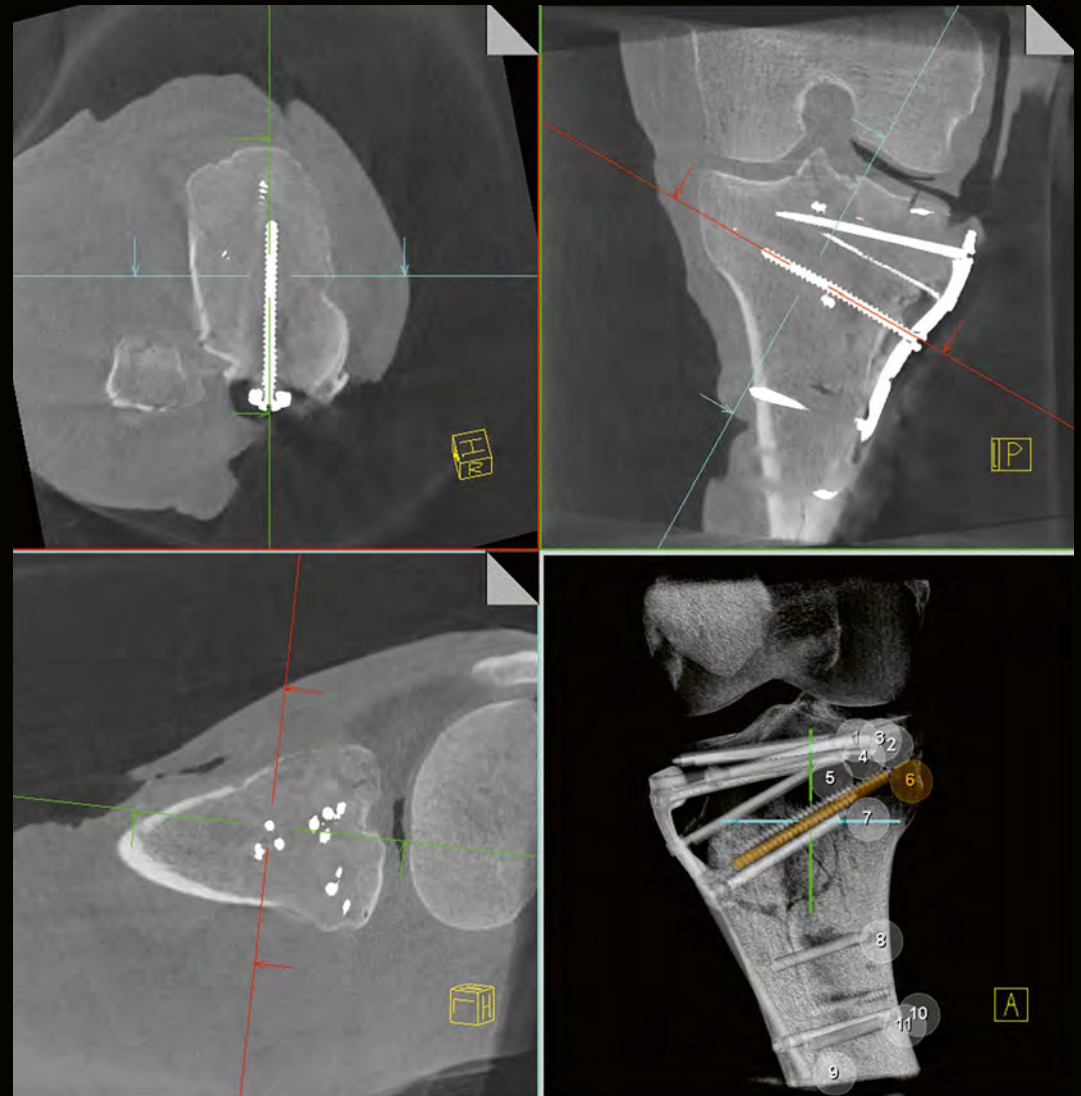
Read on and transform care delivery with us.

Easy screw assessment – with Screw Scout

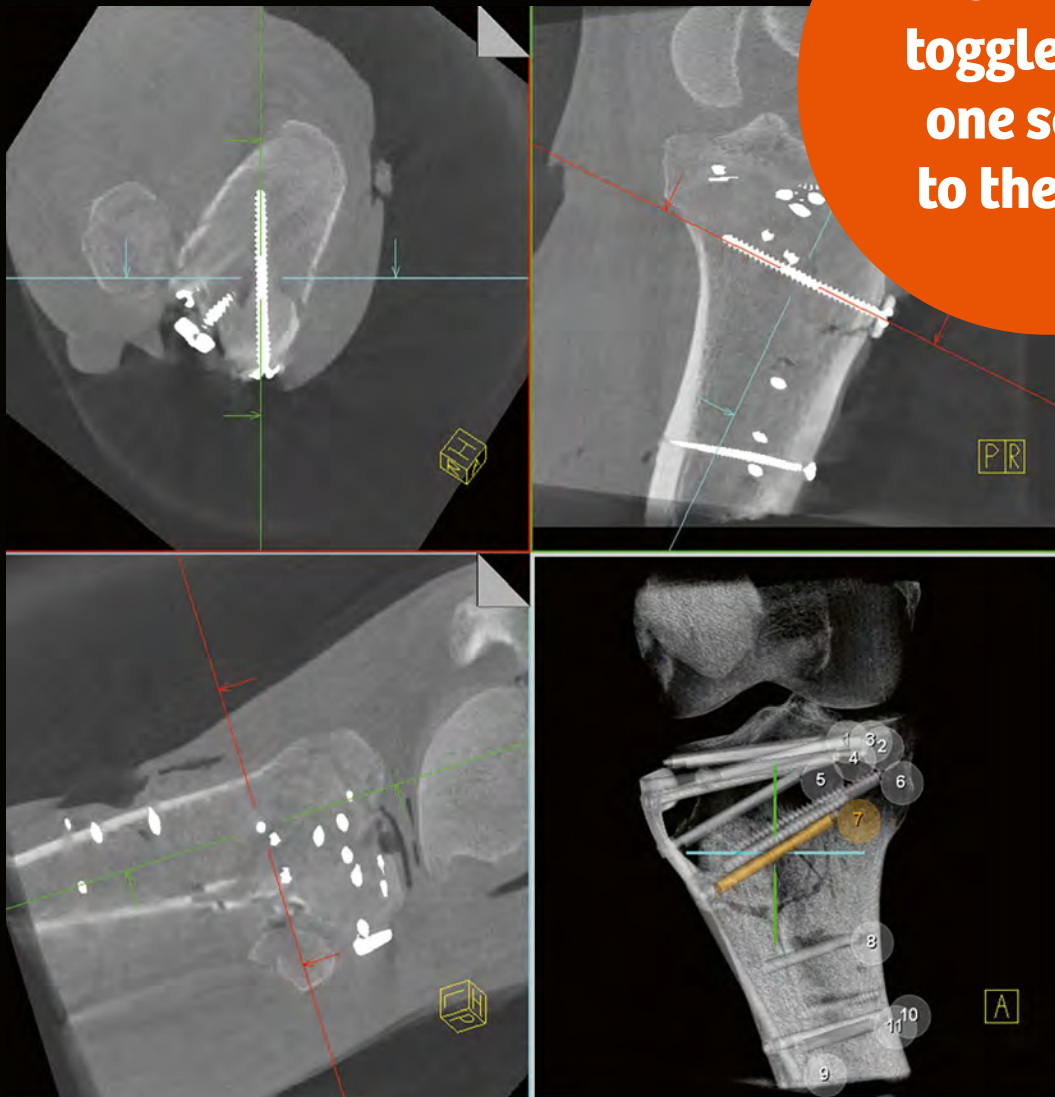
With a conventional C-arm, locating and marking screws in a 3D image can be a difficult, time-consuming task. Thanks to Screw Scout¹ on Cios Spin[®], screw assessment becomes particularly easy and convenient. Just toggle through the detected screws and save precious OR time.

Screws are detected automatically

Screw Scout assists you in localizing screws, K-wires, or implants, and prepares an optimum view in three planes. You can instantly start screw assessment on the image thanks to the precisely adjusted view – keeping your 3D workflow highly efficient. Screw Scout shows a high finding rate in the following regions: cervical spine, thoracic spine, lumbar spine, acetabulum, tibial head.⁵



Simply toggle from one screw to the next



.....

"If you want to check the position of implants, especially screws or linear objects like K-wires, you normally have to adjust each in three orthogonal planes manually. For this, you need a lot of experience, time, and very good 3D orientation. Screw Scout detects these objects for you and adjusts the planes automatically. Depending on the number of screws and other linear objects, you save up to several minutes intraoperatively with Screw Scout."

Dr. med. Jochen Franke
 Managing Senior Physician
 BG Klinik Ludwigshafen, Germany

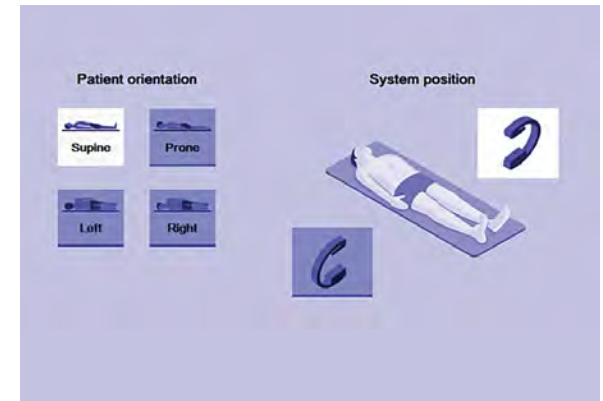
.....

..... just one click and the planes adjust automatically

.....> **Screw 7**

Easy 3D – and we mean easy

Adding intraoperative 3D to your surgical routine must not come at the cost of workflow efficiency. We've taken that to heart. Step-by-step guidance, quick scan times, and self-explanatory 3D visualization functions make Cios Spin® a quick and intuitive solution in your surgical routine.



Get ready in a flash

3D Scandialog guides you through the 3D setup, supporting you step-by-step. Setup is easy and fail-safe – you'll notice improved efficiency right away.

Configure scan>

First, select the scan quality and dose depending on the patient. The most common setting is selected by default.

Patient and system position>

Using the intuitive symbols, select the patient orientation and then the system position in relation to the patient.



Collision check>

Next, perform a manual or motorized collision check, supported by the intelligent system – to avoid collisions with the patient or table during the automated 3D scan.



Scan with wireless footswitch>

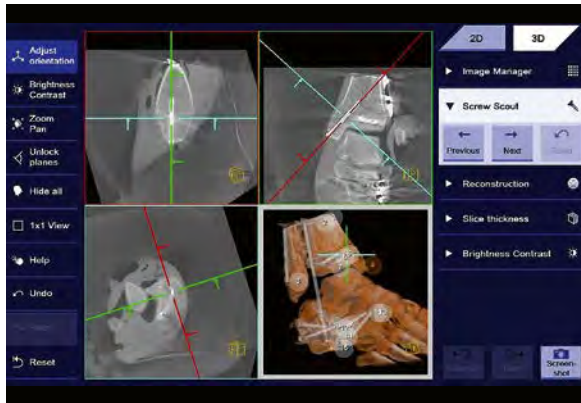
To perform the 3D scan, simply use the wireless footswitch*. This option means greater freedom in the OR – and it's easier to move the footswitch to a radiation-safe distance.



**Only
30 sec.**

3D scan in only 30 seconds

Benefit from a fast 3D scan, thanks to the proven iso-centric design. If needed, Cios Spin lets you interrupt and resume the scan process without restarting the setup. And with the quick scan, apnea time can be reduced, for example in spine surgery.



Intuitive 3D image evaluation

Easy 3D allows you to view your scan in three perspectives (coronal, sagittal, axial) and as a 3D rendering. Rotate, zoom, adjust orientation, and more: All 3D visualization functions are available on the intuitive touch interface. And if you ever need help, a smart digital assistant provides instant how-to support.

Speaking of smart, the touch user interface can be draped and used with gloves, giving you full 3D control from within the sterile field. Choose between a small mobile cart* and direct table-side* attachment. It will save time either way.

Courtesy of BG Klinik Ludwigshafen, Germany



Full control
from the
sterile field

Ease of use in 2D, too – with Target Pointer

Cios Spin® also features innovative 2D technology. One example is the integrated Target Pointer*, which displays an overlay trajectory on 2D images, helping you stay on track.

Get it right at first attempt

When you hold a K-wire at your planned entry point, the algorithm projects a virtual line based on the direction of the tip of the wire. Younger surgeons can profit from Target Pointer. Because the target line helps them predict and, if necessary, correct the position of the K-wire or similar devices before insertion, they can save both time and dose.⁶



Images from anatomical specimen

Maintain the highest infection control standards

In the OR, one of the worst complications is an infection following surgery: potentially life-threatening for patients, and cost-intensive for you.

Helping you fight germs

Cios Spin® helps you with efficient infection control measures. Several surfaces of the C-arm feature an anti-microbial paint, that support regular cleaning and disinfection efforts. The system can be easily covered with sterile drapes and the washable mouse* can be quickly disinfected, making it easy to maintain a high level of sterility. You also benefit from fewer wires – the cable between C-arm and chassis is fully enclosed, and a wireless footswitch* is optionally available. Less cleaning time, less hassle. In addition, you'll profit from our comprehensive cleaning concept including recommendations and guidance for optimum cleaning procedures.



More room for demanding setups: wide-space C-arm

In setups with OR table accessories, devices in place, or obese patients, conventional C-arms may not provide enough space – resulting in cumbersome placement, collisions, and a slower workflow. The wide C-arm design of Cios Spin makes surgery with 2D imaging and 3D scanning much easier.

Room to maneuver freely

With a tube-detector distance of 93 cm (36.6”), Cios Spin offers plenty of room, even for challenging setups – in both 2D and 3D.



A big step forward in usability

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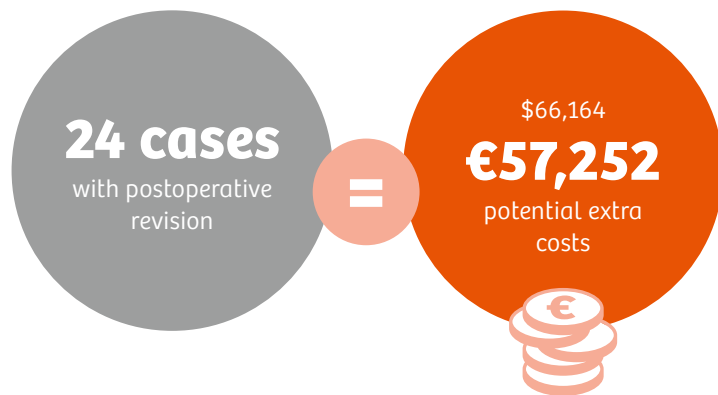
“Intraoperative 3D won’t be used if it’s cumbersome. The new usability concept of Cios Spin is a big step forward. Its step-by-step support guides even inexperienced users easily and efficiently through the workflow. It makes intraoperative 3D imaging faster and easier – and hopefully helps more physicians worldwide achieve better patient outcomes. The Target Pointer helps even experienced surgeons when it comes to targeting longer distances, e.g. placing a K-wire in the proximal femur in less time, with less dose, and with more accuracy.”

Dr. med. Jochen Franke
Managing Senior Consultant
Head – Division of Trauma
BG Klinik Ludwigshafen, Germany

What you don't see can cost you money

If misplaced screws and implants are not detected intraoperatively, additional costs can arise. These include revision surgeries, longer hospital stays, additional postoperative diagnostics, and liability issues.

A study has shown that postoperative revisions are correlated with high potential extra costs.⁷



What if you could reduce these costs?



More cost-effectiveness in surgery

Detect issues that would have gone unnoticed with 2D – and solve them intraoperatively. Intraoperative corrections based on 3D images from Cios Spin® can help you avoid subsequent costs – and can positively impact your department's financial performance.

We're proud to make excellent intraoperative 3D imaging accessible with Cios Spin – to help you reduce complication rates, postoperative CT scans, and patients' duration of stay.

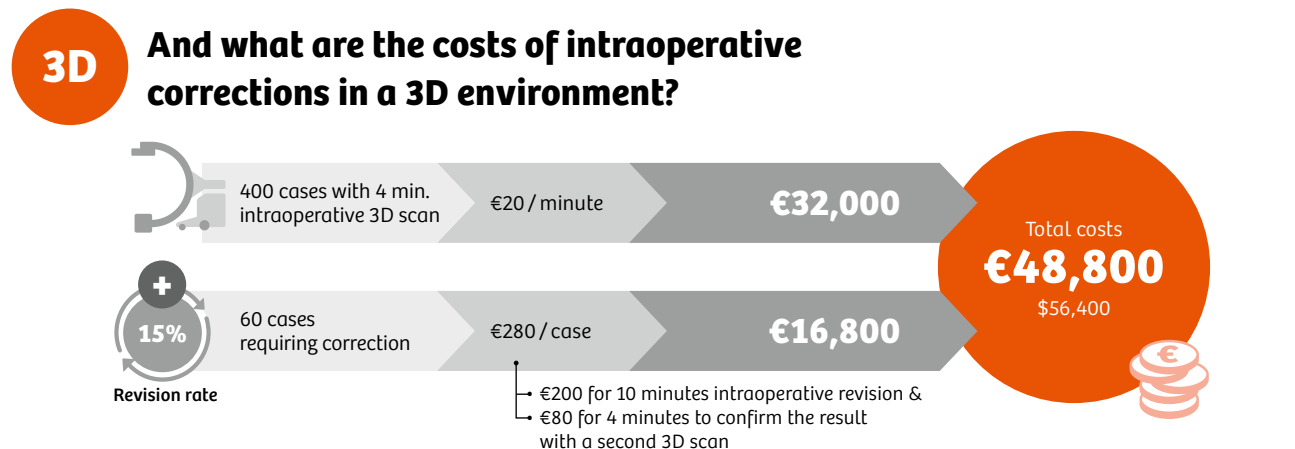
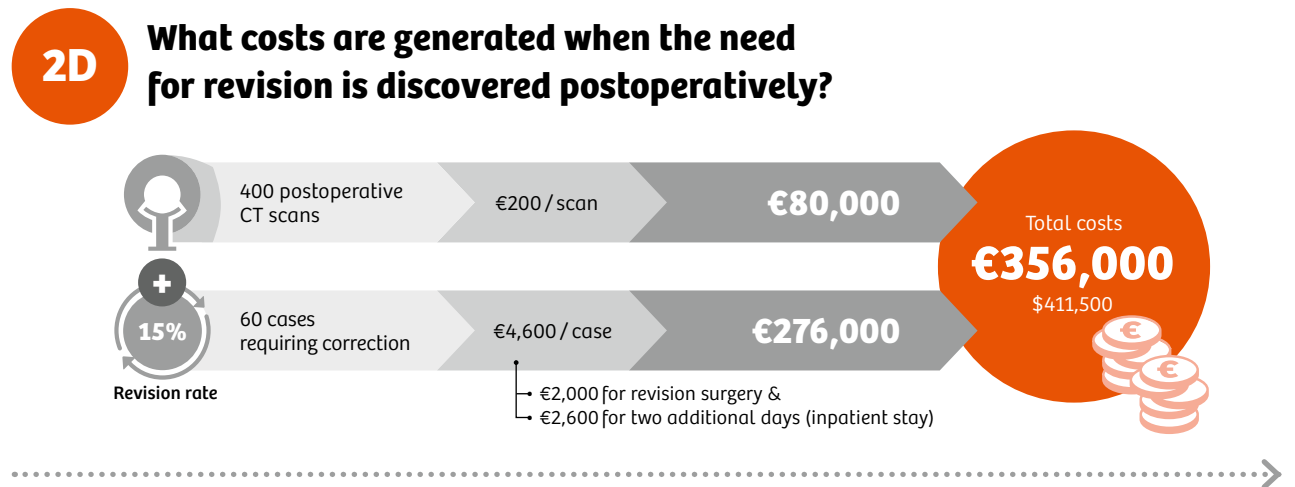
Cios Spin is an investment that pays off.
Find out how on the following pages.

Profit from intraoperative 3D imaging

What you don't see can cost you money. For example, if misplaced screws and implants are not detected intraoperatively, additional costs may arise. With Cios Spin®, you can enhance cost effectiveness – thanks to 3D technology that may help you reduce revision surgery, limit postoperative diagnostics, shorten hospital stays, and reduce liability risks.

Crunching the numbers: two sample calculations⁸

Let's assume that a hospital performs 400 osteosynthesis procedures per year. For their case mix, we use a revision rate of 15% in our sample calculation. This means that 60 cases would require intraoperative correction.



Profit from multipurpose use

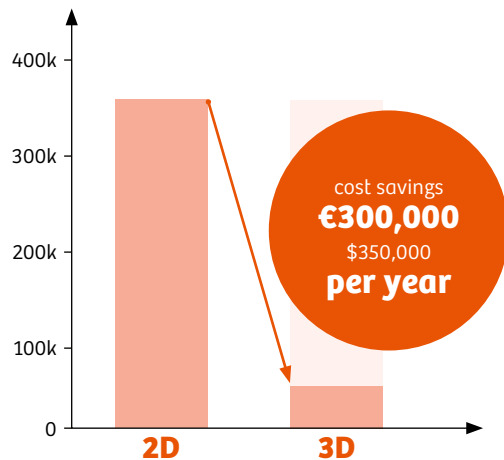


Cios Spin is ready for a large case spectrum – and smart utilization can help you pay off your investment.

Cios Spin is suitable for multidisciplinary use, including 2D and 3D imaging in orthopedic trauma, spine surgery, and CMF – from simple to complex cases. It's also an ideal choice for 2D imaging in gastroenterology, urology and vascular surgery. In addition, Cios Spin can be used for routine 2D intraoperative fluoroscopy in all disciplines.

In our hypothetical case, Cios Spin would generate significant cost savings.

Additional costs (€)/year



Looking at our hypothetical numbers of €356,000 (\$410,000) with 2D and €48,800 (\$56,400) with 3D, we have a difference of €307,200 (\$356,880) after one year.

These are the potential cost savings thanks to Cios Spin with 3D.

A way to save money and time

“In complex intraarticular fracture treatment, if you detect a problem postoperatively, it can be an indication for a revision surgery. In many countries there is no refund for the second surgery, and there is a higher risk of complications for the patients. In my opinion, using intraoperative 3D imaging allows for immediate improvement of your surgery result. This way, you won’t need a post-operative CT scan and a second surgery – saving you money and time. In addition, Cios Spin can be used interdisciplinarily, e.g. between orthopedic trauma, Spine, and CMF, so that the investment is shared.”

Dr. med. Jochen Franke
Managing Senior Consultant
Head – Division of Trauma
BG Klinik Ludwigshafen, Germany

Additional products & services

Good to know: Cios Spin® seamlessly integrates with all the other products of our large Cios portfolio, making fleet management a breeze. One family, one big idea – setting new standards in imaging precision. To give you full control, we've also put together a smart collection of Siemens services and third-party accessories: from remote monitoring, to helpful apps, to radiation protection. Get an overview here!



Cios Select with FD

Select smart surgical imaging.

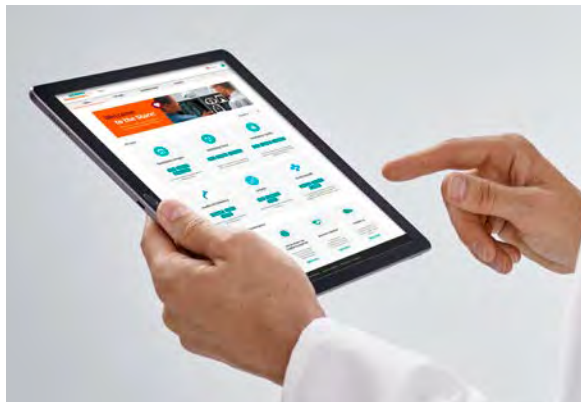
Cios Select with modern flat-detector technology combines premium capabilities with an economic system design. The result is a system that delivers excellent images, easy handling, and high system availability. For you, this means access to optimal support in surgical procedures, efficient workflows, and high reliability in multidisciplinary use. Clearly a smart choice for your surgical routine.



Cios Fusion

Fuse surgical versatility with Full View FD.

Looking to equip your OR with innovative solutions for advanced procedures? Then Cios Fusion® is for you. Combining Full View FD technology with easy and flexible maneuverability, it offers large, crystal-clear images – and helps you increase your surgical versatility.



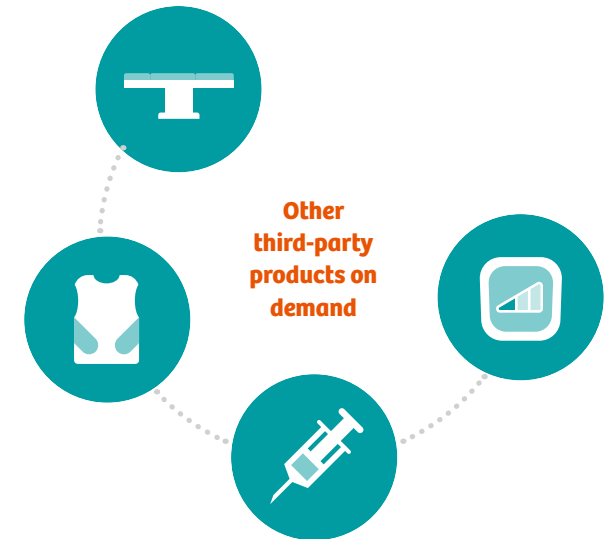
Expand your capabilities with Cios OpenApps

In the past, growing into more profitable procedures often meant expensive investments in new equipment. Digitalization opens up new opportunities. Cios Spin with Cios OpenApps¹ connects you to the Siemens Healthineers Digital Ecosystem Store, where you'll find compatible, certified apps to best support you during your procedures. Once you've found the apps to streamline your work, run them directly from your C-arm in the OR – no new hardware is required. All apps are easy to download and install, and come with a 90-day free trial.



Advanced system support

Smart Remote Services (SRS) is a secure data link that connects your medical equipment to our experts who provide you with proactive and interactive services caring for your running operations – including fast error identification, remote repair, software updates, and collaboration services. Via SRS, the performance and condition of your equipment can be monitored in real time.



Accessory solutions

Choosing a new imaging system may inspire other equipment renewals or additions at your workplace. Our accessory solutions portfolio offers a broad range of complementary products, such as mobile surgical tables, radiation protection clothing, contrast injectors, and personal dosimetry systems. Need something else? Talk to us about third-party products not available in the catalog.

We will gladly tailor a package to your individual needs.

Technical specifications

C-arm specifications

Detector technology	CMOS flat detector
Field of view	30 x 30 cm (12" x 12")
Image resolution	1952 x 1952 pixels
Power management	<ul style="list-style-type: none"> • 25 kW / 12 kW • Energy Storage Unit (ESU)* • Active cooling†
Orbital movement	200°
Immersion depth	74 cm (29.1")
Free space	93 cm (36.6")

Retina 3D imaging†

Scan technology	Iso-centric scan technology
Projections for 3D reconstruction	Up to 400
3D volume size	16 x 16 x 16 cm (6.3" x 6.3" x 6.3")
3D volume resolution	512 x 512 x 512 voxels
Scan speed	30 seconds
3D viewing	Simultaneous display of 3 projections (transversal, coronal, and sagittal)
3D power scan option for obese patients	Yes
3D volume rendering	Volume rendering technique (VRT)
Metal artifact reduction	Yes*
Navigation interface	NaviLink 3D*

Clinical workflow support

Operating modes	<ul style="list-style-type: none"> • Single Image • Fluoroscopy • Fluoroscopy High Level • Subtraction / Roadmap* • Digital Cine Mode*
DICOM services	<ul style="list-style-type: none"> • DICOM Send / Storage Commitment* • DICOM Print* • DICOM Query / Retrieve* • DICOM Worklist / MPPS*
Data transfer	LAN / WLAN*
Image storage	300,000 images
Interface for hosting certified partner applications	Cios OpenApps
Screw Scout	Yes*
Target Pointer	Yes*
Software packages*	<ul style="list-style-type: none"> • Vascular software • Live graphical overlay • Stenosis quantification • 2D and 3D measurement
CARE program (Combined applications to reduce Exposure)	Yes
Anti-microbial coating on C-arm and housing	Yes

System control

Control program	Touch user interface
Brakes control	Electromagnetic brakes
Table-side control	Yes*
Motorization	Yes*
Position storage	Yes*
Laser light localizer	Yes*
Wireless footswitch	Yes*

Why Siemens Healthineers?

At Siemens Healthineers, our purpose is to enable healthcare providers to increase value by empowering them on their journey towards expanding precision medicine, transforming care delivery, and improving patient experience, all enabled by digitalizing healthcare.

An estimated 5 million patients globally everyday benefit from our innovative technologies and services in the areas of diagnostic and therapeutic imaging, laboratory diagnostics and molecular medicine, as well as digital health and enterprise services.

We are a leading medical technology company with over 170 years of experience and 18,000 patents globally. With more than 48,000 dedicated colleagues in 75 countries, we will continue to innovate and shape the future of healthcare.



On account of certain regional limitations of sales rights and service availability, we cannot guarantee that all products included in this brochure are available through the Siemens sales organization worldwide.

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The speaker is separately engaged and paid by Siemens to provide product reference services.

The statements by Siemens' customers described herein are based on results that were achieved in the customer's unique setting. Since there is no "typical" hospital and many variables exist (e.g., hospital size, case mix, level of IT adoption) there can be no guarantee that other customers will achieve the same results.

- 1 Transparency Market Research (2014): Minimally Invasive Surgery Market (Surgical Devices, Monitoring & Visualization Devices, and Endoscopy Devices) – Global Industry Analysis, Size, Share, Growth, Trends and Forecast, 2013–2019.
- 2 Transparency Market Research (2014): Minimally Invasive Surgery Market.
- 3 Calculations based on:
Atesok K, et al., Injury 2007; Beck M, et al., Eur Spine J 2009; Franke J, et al., J Bone Joint Surg Am 2012; Geerling J, et al., J Trauma 2009; Hepp, et al., Unfallchirurg, 2013; Kendoff D, et al., J Trauma 2009; Von Recum J, et al., Unfallchirurg. 2012; Richter M, et al., J Orthop Trauma 2005; Rübberdt, et al., UCH 2006; Schnetzke M, et al., Arch Orthop Trauma Surg 2018.; Wendl K, et al., Trauma&Berufskr 2009.
- 4 Macario A. What does one minute of operating room time cost? J Clin Anesth. 2010 Jun; 22(4): 233–6.
- 5 Beisemann N, Vetter S, Meinzer HP, Brehler M, Grützner PA, Franke J. Validierung einer Applikation für mobile C-Bögen zur automatischen intraoperativen Schraubendarstellung in 3D Datensätzen in sechs anatomischen Regionen. Deutscher Kongress für Orthopädie und Unfallchirurgie (DKOU 2017). Available from: doi:10.3205/17dkou336.
- 6 See, e.g.: Swartman B, Frere D, Wei W, Schnetzke M, Grechenig S, Matiyahu A, et al. Wire Placement in the Lisfranc Joint Using a 2D Projection-Based Software Application for Mobile C-Arms: an Experimental Study in 20 Cadaver Specimens. In: Klaus Radermacher and Ferdinando Rodriguez Y Baena (editors). CAOS 2017. 17th Annual Meeting of the International Society for Computer Assisted Orthopaedic Surgery, vol 1, pages 385–390.
Swartman B, Frere D, Wei W, Schnetzke M, Grechenig S, Matiyahu A, et al. Wire Placement in the Sustentaculum Tali Using a 2D Projection-Based Software Application for Mobile C-Arms: Cadaveric Study. Foot Ankle Int. 2018 Apr; 39(4): 485–492.
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- 7 Hüfner T, Stübiger T, Gössling T, Kendoff D, Geerling J, Krettek C. Kosten- und Nutzenanalyse der intraoperativen 3D-Bildgebung. Der Unfallchirurg. 2007 Jan; 110(1): 14–21.
- 8 Investment costs, revision rates, case mix and amount of procedures are exemplary and for illustration of the cost scheme. Data may vary for specific clinical settings and due to regional reimbursements schemes.

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