

ARTIS pheno

Optimize clinical operations

Resection of small
pulmonary nodules

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Lung
Cancer
Treatment

SIEMENS
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Reduce the time-at-risk in minimally invasive surgical treatment

“Our data demonstrate a significant learning curve for image-guided video-assisted thoracoscopic surgery in the treatment of solitary pulmonary nodules, as evidenced by decreased localization time and radiation exposure occurring with increased surgical experience.”

Yin-Kai Chao,
Chang Gung Memorial Hospital,
Taoyuan, Taiwan⁴

Therapy challenges in the resection of small pulmonary nodules

Lung cancer is the second most common cancer, with more than 200,000 new diagnosed cases per year in the U.S. alone. As an asymptomatic disease, lung cancer is often detected far too late, and the patients' chances of survival are relatively low.¹ Lung cancer screenings enable physicians to find a tumor at an early stage. If the lesion is small and deep, minimally invasive surgery could be challenging.² CT-based needle localization in the interventional suite and transfer to the OR potentially carries the risk of needle dislocation, hemorrhage, and pneumothorax in an environment that's less safe than the OR.³

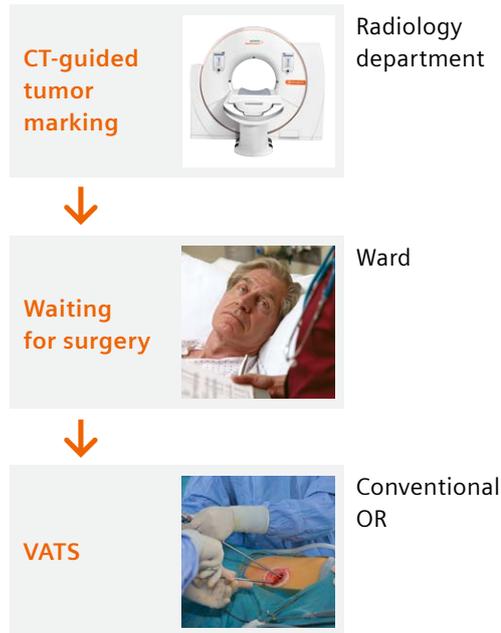
Ready for image-guided thoracoscopic video-assisted surgery

ARTIS pheno installed in a Hybrid OR offers a one-stop workflow and a set of dedicated features for the resection of small pulmonary nodules to master these challenges.⁵ The image-guided video-assisted thoracoscopic surgery (iVATS)⁶ workflow combines intra-operative large-volume 3D imaging and laser-guided needle localization followed by minimally invasive surgery.⁷ With ARTIS pheno, thoracic surgeons can optimize clinical operations by reducing the overall procedure time⁴ and the time-at-risk for the patient.⁸

Two procedures become one

Higher efficiency and less risk for the patient

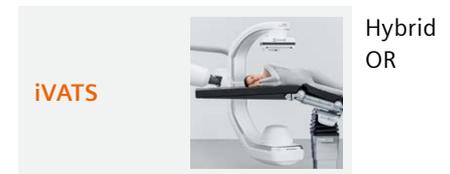
Conventional 2-stage workflow



Time-at-risk⁸



Hybrid OR one-stop workflow

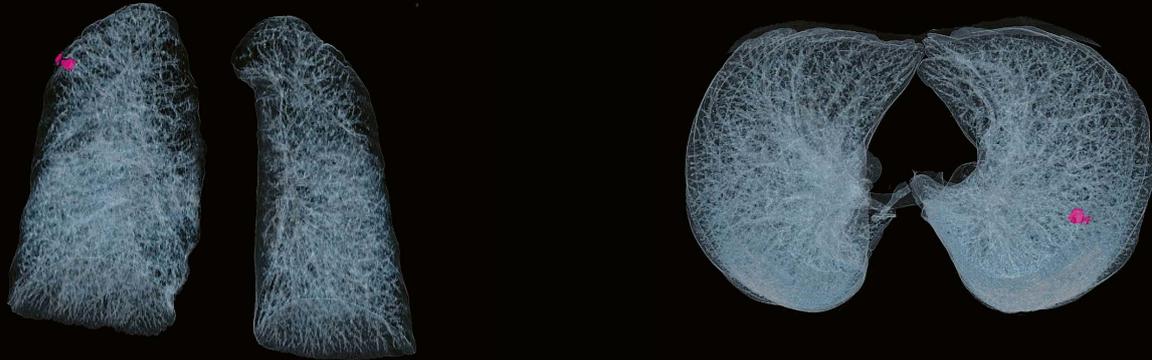


Optimize clinical operations with ARTIS pheno

Dedicated features for image-guided thoracic surgery

- *syngo* DynaCT Large Volume to **visualize the whole thorax including skin in 3D for planning long transthoracic or endobronchial pathways**
- Wide-space C-arm for **collision-free rotation even with large patients in lateral decubitus position** and comfortable ergonomics for the surgeon
- *syngo* Needle Guidance for **planning transthoracic trajectories to multiple lesions**
- Automatic path alignment to align the C-arm automatically with preplanned paths without manual interaction
- Laser cross to **indicate needle entry point and angle**
- Excellent soft-tissue resolution for **visualizing even small lesions at the lowest reasonable dose**
- Integration of segmented OR tables from Trumpf and Getinge for **optimal patient positioning and staff ergonomics**
- Flexible isocenter to **adapt imaging system to special positioning requirements**
- Antimicrobial covers and ceiling-free design contribute to **better infection control management in the Hybrid OR**





Visualization of the lung and the lesion with SOMATOM Sensation 64 and syngo.via Oncology package

Optimize clinical operations in the resection of small pulmonary nodules

A 58-year-old male smoker presented with a small (diameter ~1 cm) pulmonary nodule of unknown dignity. Surgery planning was done preoperatively based on computed tomography. The patient was scheduled for image-guided video-assisted thoracoscopic surgery with wedge resection of the lesion. The surgery was performed as a one-stop procedure in the Hybrid OR with ARTIS pheno.



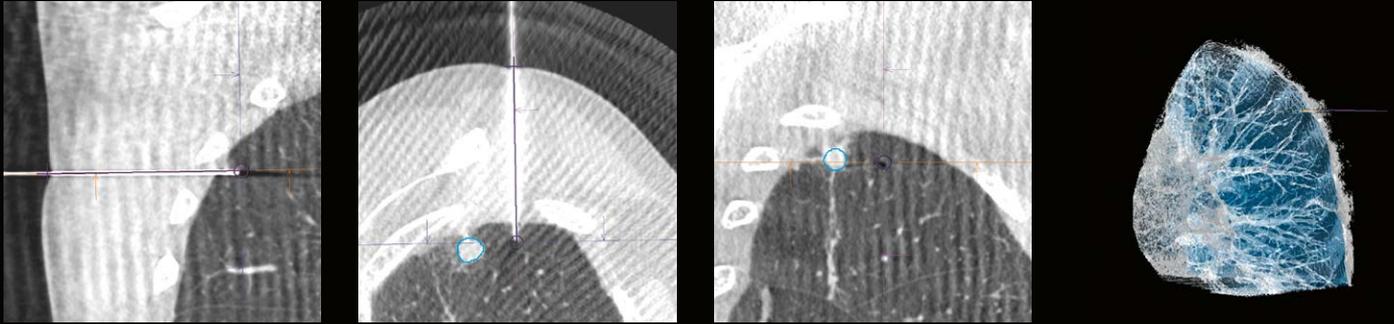
Rotation of the C-arm during a syngo DynaCT run

Intraoperative 3D image acquisition

syngo DynaCT is able to create intraoperatively large-volume 3D images⁹ with high soft-tissue resolution to detect lesions even with low density. Because of the wide-space C-arm,¹⁰ rotations around large patients in lateral decubitus position are easy. The robotic C-arm with the flexible isocenter can adapt to almost any table and work position.

“A successful and safe step-wise process has been established for iVATS, combining intraoperative C-arm CT scanning and thoracoscopic surgery in a hybrid operating room.”

Raphael Bueno,
Brigham and Woman’s Hospital, Boston, USA⁷



Defining a needle path to the lesion in different cross-sections with syngo Needle Guidance

Accurate marking of the lesion

A needle trajectory is planned by defining the entry and the end point of the needle in different cross-sections. The planning result can be checked in the 3D image by inspecting the image from different directions. Tumors can be segmented and represented in different color schemes. syngo Needle Guidance allows the penetration depth and the size of the lesion to be measured.

“The [potential] benefits of computed tomography-assisted thoracoscopic surgery (CATS) are (a) A one-stop procedure, (b) Lower risk for the patient (no patient relocation, no marking wire loss), and (c) No coordination required between the CT room and OR.”

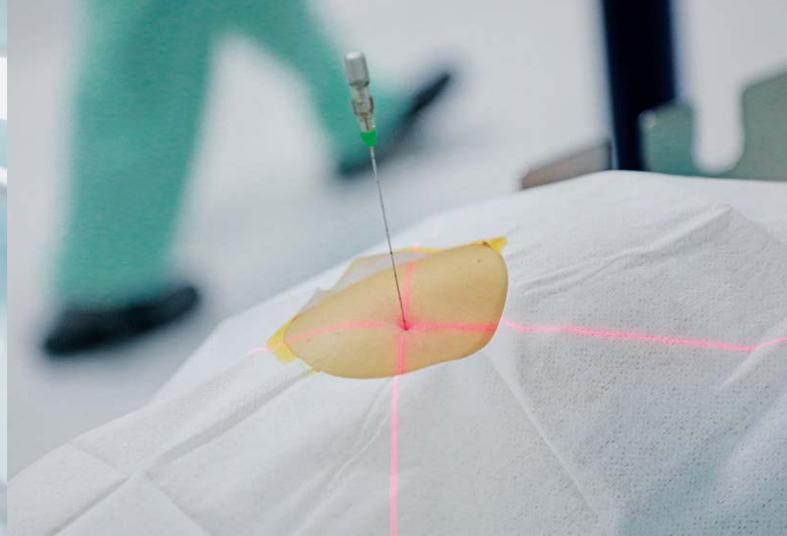
Michael Kostrzewa, Eric Roessner,
University Medical Center Mannheim, Germany²



Yao Fong, Chi Mei Medical Center, Tainan, Taiwan

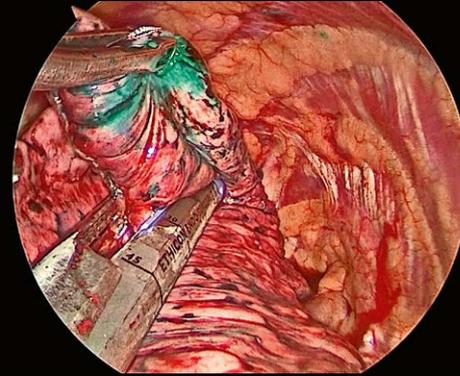
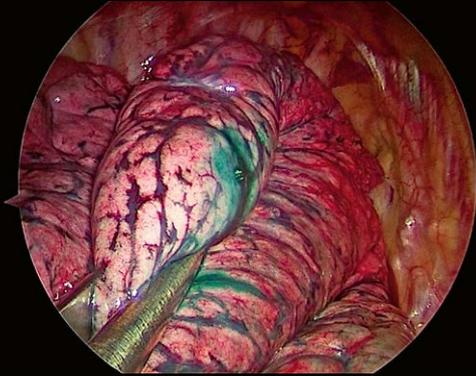
Optimal support for fast needle insertion

To hit the target as planned, it is crucial to achieve the correct skin entry point at the right angle. With the push of a button, ARTIS pheno's C-arm automatically aligns with the envisioned path. Thanks to its flexible isocenter, with ARTIS pheno almost any body position and angulation is possible.



Space and comfort: needle guidance with integrated laser cross and wide-space C-arm

The laser cross directs the surgeon accurately. The planned path is superimposed on the large display with live fluoroscopy. The needle position can be controlled in lateral and bull's-eye view. Structure Scout keeps the image quality constant at the lowest reasonable dose – no matter what patient is on the table. ARTIS pheno delivers consistent images in 2K quality.



Single-port VATS and resected wedge. The green dye indicates the lesion.

“With ARTIS pheno and syngo Needle Guidance, the accuracy of locating lesions has improved significantly.”

Yao Fong,
Chi Mei Medical Center, Tainan, Taiwan

Marker allows quick and effective localization of the lesion

Depending on the location of the lesion, different markers can be used to localize the tumor. In this case a single-port and a fluorescent dye are used. The marker permits the use of a tissue-sparing VATS.



Yao Fong, Chi Mei Medical Center, Tainan, Taiwan

“Compared with the preoperative computed tomography-guided approach, its intraoperative counterpart is associated with a decreased time-at-risk between the completion of localization and skin incision.”

Yin-Kai Chao
Chang Gung Memorial Hospital, Taoyuan, Taiwan⁸

A hybrid operating room for thoracic surgery and multidisciplinary use

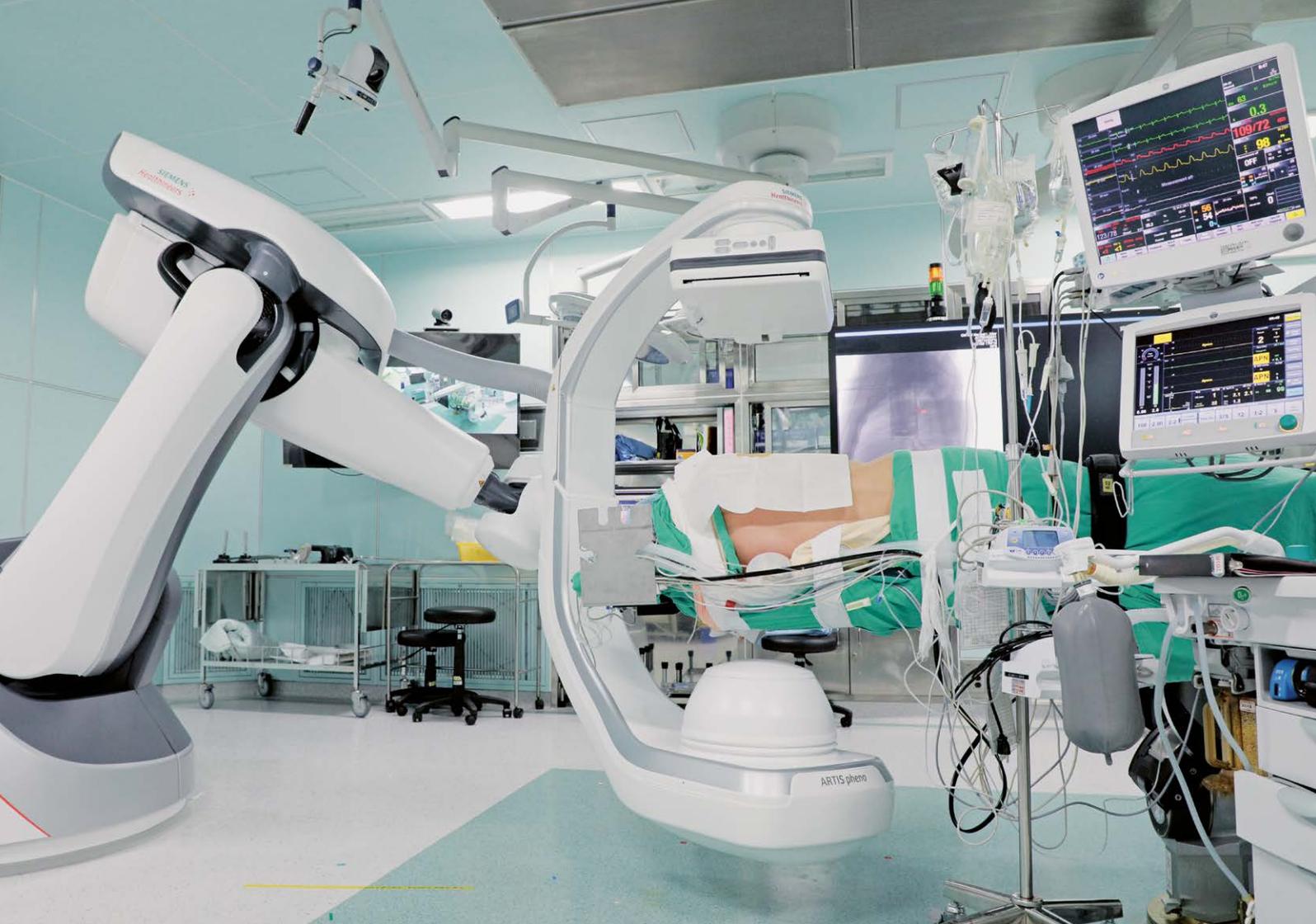
Room set-up

- ARTIS pheno robotic imaging system
- Maquet Magnus OR table
- 55" large display
- syngo DynaCT Large Volume
- syngo Needle Guidance

"By performing the localization procedure and the lung surgery in the same hybrid operating room environment, [...] potential risks can be minimized. The marriage of radiology and thoracic surgery techniques in the hybrid operating theater may open doors to new techniques that can be potentially safer, more effective, and more economical for patients."

Calvin Ng,
Prince of Wales Hospital, Hong Kong, China¹¹





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Benefits of iVATS with ARTIS robotic imaging systems

- Reduction of time-at-risk by ~94 percent compared with CT-based two-room workflow⁸
- Reduction of radiation exposure by ~47 percent compared with CT-based two-room workflow⁸
- ~10 percent faster tumor localization compared with CT-based two-room workflow⁸
- One-stop procedure⁷
- Proven safety and efficacy⁷
- Proven precision in needle localizations²

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.

References

- 1 American Cancer Society, "Key Statistics for Lung Cancer" 2018
- 2 Michael Kostrzewa, Eric Roessner et al., "Computed Tomography-Assisted Thoracoscopic Surgery, A Novel, Innovative Approach in Patients With Deep Intrapulmonary Lesions of Unknown Malignant Status" *Investig Radiol*, 2017
- 3 Calvin Ng et al., "Image-guided localization of small lung nodules in video-assisted thoracic surgery" *J Thorac Dis*, 2016
- 4 Yin-Kai Chao et al., "Learning curve of image-guided video-assisted thoracoscopic surgery for small pulmonary nodules: A prospective analysis of 30 initial patients" *J Thorac Cardiovasc Surg*, 2018
- 5 Jin-Shing Chen et al., "Image-guided thoracoscopic surgery with dye localization in a hybrid operating room" *J Thorac Dis*, 2016
- 6 iVATS, iDeal-VATS, and CATS are terms for image-guided video-assisted thoracoscopic surgery. The methods differ: for example, in terms of what marker is used.
- 7 Raphael Bueno et al., "Image-guided Video Assisted Thoracoscopic Surgery (iVATS) - Phase I-II Clinical Trial" *J Surg Oncol*, 2015
- 8 Yin-Kai Chao et al., "A comparison of efficacy and safety of preoperative versus intraoperative computed tomography-guided thoracoscopic lung resection" *J Thor Cardiovasc Surg*, 2018
- 9 syngo DynaCT Large Volume:
Reconstructed volume portrait: 32 cm diameter x 23.5 cm height;
Reconstructed volume landscape: 43 cm diameter x 17.5 cm height
- 10 Wide-space C-arm: free space of 95.5 cm
- 11 Calvin Ng et al., "Hybrid DynaCT Scan-Guided Localization Single-Port Lobectomy" *Chest*, 2015



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