



See a whole
new world of
precision.

Biograph Vision

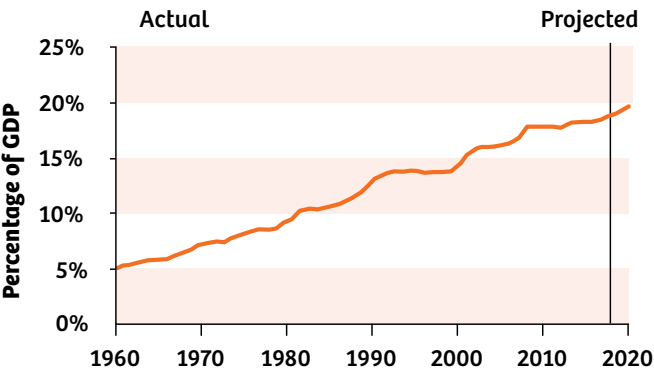
Recognize opportunities in a changing healthcare market.

The healthcare market operates in a constant state of flux. You need to be poised to nimbly address change – from navigating reimbursement cuts and increasing treatment costs to treating an aging population and moving towards value-based care. As the paradigm shifts toward personalized

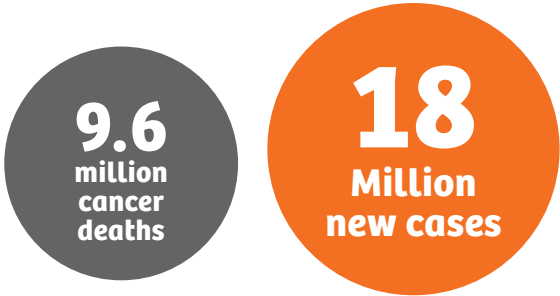
diagnosis and treatment, your response to these changes is more critical than ever and can affect your clinical outcomes and profitability. Change also creates opportunity: with the right tools, you can enhance your competitiveness and reputation as a center of excellence.

Treatment costs are rising.¹

U.S. National Health Expenditures as a Share of GDP, 1960 - 2021



Latest global cancer data by the World Health Organization²



Cancer burden rises to 18.1 million new cases and 9.6 million cancer deaths in 2018.

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PET/CT continues to improve the practice of medicine.

PET/CT has vastly improved the practice of medicine, and its next generation does more than just incrementally continue its momentum. It is designed to address personalized medicine by focusing on clinical insights while driving sustainable outcomes. It proactively simplifies

the implementation of personalized medicine with solutions that help you stage disease more accurately and better define treatment strategies. By advancing the ability to visualize smaller lesions and quantify beyond standardized uptake values (SUV), you will be better equipped to anticipate the course of disease and improve reproducibility.

A lung biopsy procedure with an adverse event can cost up to **28x more than a PET/CT exam.**³

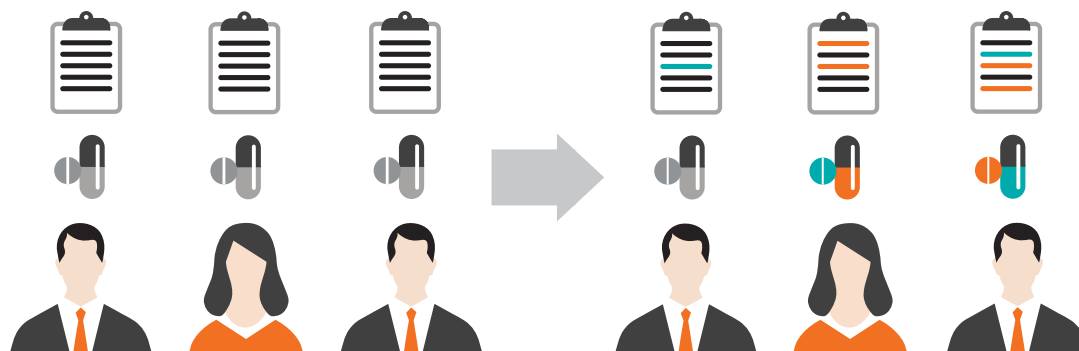
Adding PET/CT to a conventional workup can help **prevent unnecessary surgery in up to 1 of 5 patients** with suspected non-small-cell lung cancer.⁴

In 80% of head and neck cancer cases, the PET/CT GTV contour observed with PET/CT was smaller than in CT alone.⁵

In a 2016 study, adding PET/CT **changed the treatment strategy for 42% of patients** with biochemical recurrence after prostatectomy.⁶

87% of RT sites now incorporate PET imaging into RT planning protocols.⁷

Personalized medicine is about doing things right.



Today:
Volume-oriented healthcare

One-size-fits-all approach
Blanket solution is not beneficial for patients or healthcare systems.

Tomorrow:
Value-oriented healthcare

Getting the right treatment to the right patient at the right time
Custom solution benefits patients and healthcare systems.

Biograph Vision is designed to address personalized medicine by focusing on clinical insights while driving sustainable outcomes. It improves accuracy, performance, and reproducibility to see a whole new world of precision in PET/CT imaging.

A close-up photograph of a young girl with dark hair and eyes, wearing a pink shirt, looking through a magnifying glass at a patch of green grass. The magnifying glass is held in her hands, and the grass is visible through the lens. The background is a soft-focus green field.

**Biograph
Vision**

**See a whole
new world of
precision.**

Strengthen your competitive edge.

Biograph Vision™ is the next generation of PET/CT scanners that empowers you to see a whole new world of precision. Completely new and unique Optiso UDR (Ultra Dynamic Range) detector technology goes beyond digital. With improved accuracy to reveal the bigger picture, Biograph Vision also enhances performance to maximize efficiency and reproducibility, helping you better understand disease progression.

Accuracy to reveal the bigger picture

Biograph Vision introduces the first UDR detector with 3.2-mm LSO crystals^[a], helping you to visualize smaller lesions. 100% coverage^[b] of the silicon photomultiplier (SiPM) sensors leads to the fastest time-of-flight^[a] to improve contrast and signal-to-noise ratio.

Performance to maximize efficiency

With the market's fastest time-of-flight at 214 ps and the highest effective sensitivity at 100 cps/kBq^[a], Biograph Vision helps reduce scan time and injected dose by a factor of 3.9^[b] to improve throughput and reduce patient exposure to radiation and tracer cost.

Reproducibility to understand disease progression

Biograph Vision is designed to provide consistent quantitative accuracy by automatically self-calibrating without the need for an external radioactive source.^[c] The blend of improved resolution and effective sensitivity^[d] enables you to evaluate the impact of the treatment earlier. In addition, its fully automated solution for multiparametric PET imaging provides additional information to enable absolute quantification compared to SUV alone.

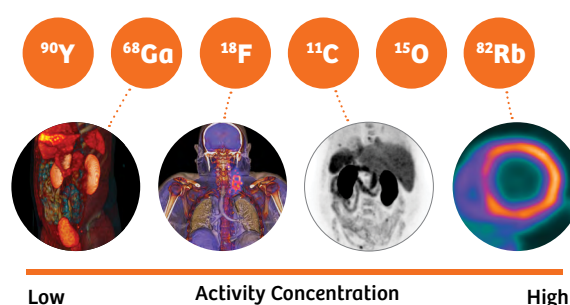
The heart of Biograph Vision — a completely new detector design

The detector is the most important component of a PET/CT system. It defines the quality of the incoming data. The developers at Siemens Healthineers re-envisioned conventional digital detector design – the foundation of Biograph Vision – to improve spatial and temporal resolution, leveraging the full potential of SiPM and going beyond simply replacing a single component.

What is Ultra Dynamic Range (UDR)?

A truly flexible PET/CT system can adapt to the requirements of a wide variety of radioisotopes. As the availability of different tracers grows and PET/CT gets more involved in theranostics, systems should optimally work in a large range of radioactivity, from very low to very high.

The new Optiso UDR detector uses multiple technologies to provide optimal performance in a wide range of count rates. The fastest time-of-flight^[a] and high effective sensitivity provide excellent performance in low- and medium- activity ranges such as ⁹⁰Y, ¹⁸F, and ⁶⁸Ga applications. A small block detector with low dead time makes it suitable to operate in the high-activity concentrations found in studies with very short-lived tracers, such as ⁸²Rb and ¹⁵O.



Images for illustrative purposes only.

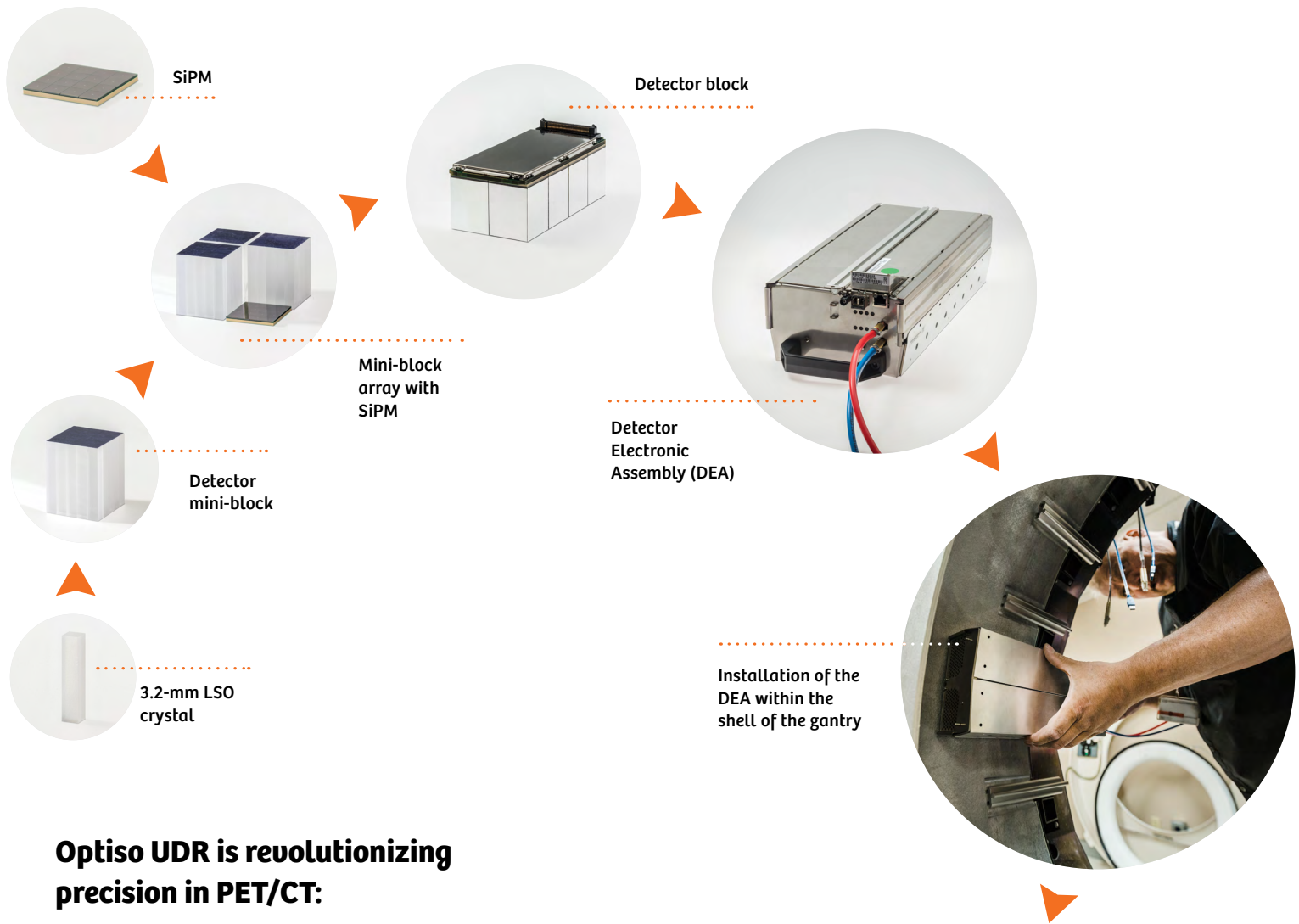
Data acquired on Biograph mCT systems.

⁶⁸Ga: Data courtesy of University of Erlangen, Erlangen, Germany

¹⁸F: Data courtesy of Kantonsspital Baselland, Liestal, Switzerland

¹¹C: Data courtesy of West Virginia University, Morgantown, West Virginia

⁸²Rb: Data courtesy of Central Manchester University Hospitals, Manchester, UK

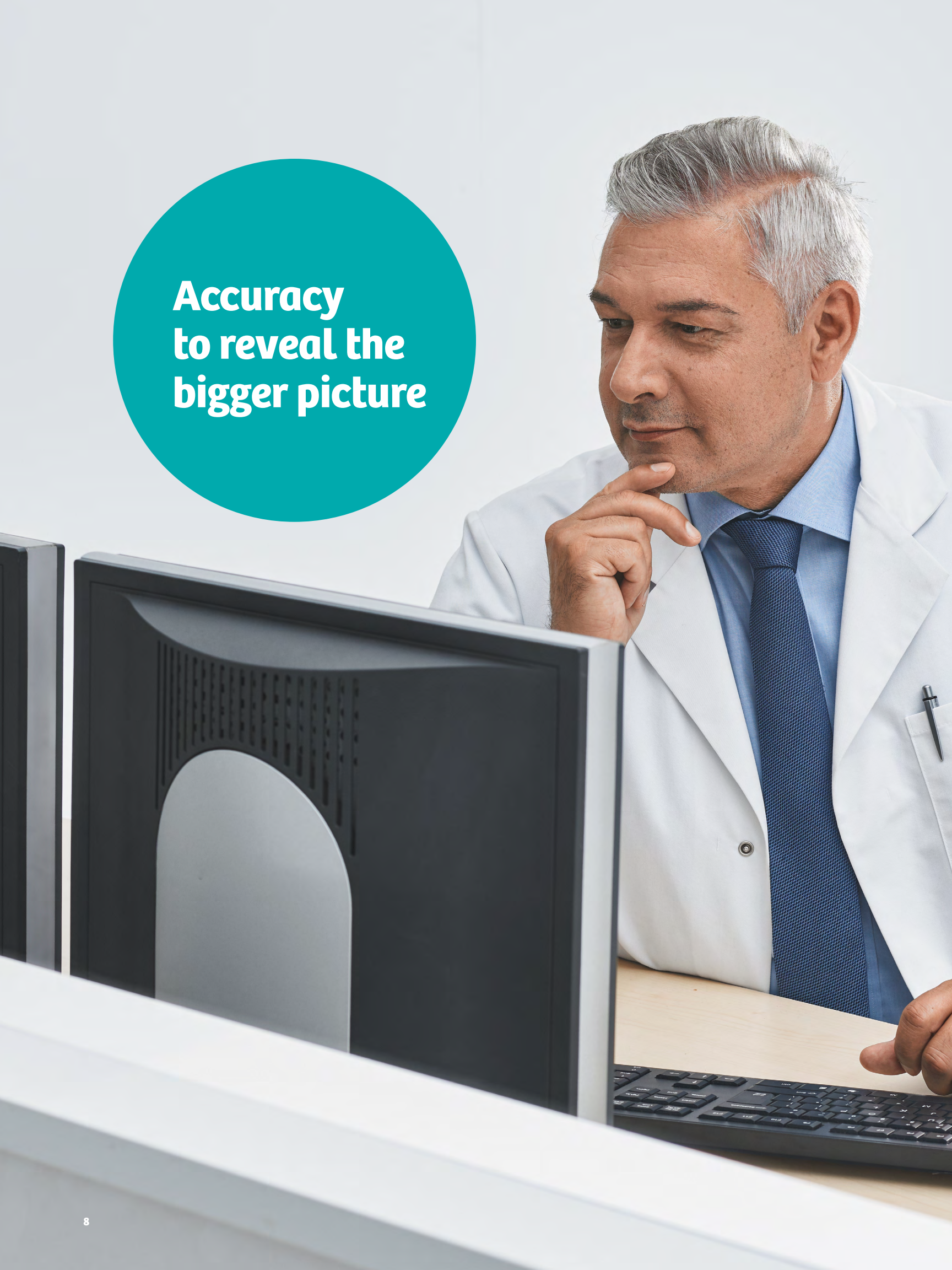


Optiso UDR is revolutionizing precision in PET/CT:

- A fast, efficient scintillator, LSO is grown and cut in-house through a vertically integrated manufacturing process to ensure the highest quality.
- 3.2-mm crystal elements are individually selected and deliver high isotropic spatial resolution; higher spatial resolution may result in improved lesion detectability.
- 100% coverage^[b] of the crystal area with SiPM sensors results in a timing resolution of 214 picoseconds^[b], providing 3.9 times higher effective sensitivity^[d] for faster scans and lower dose.
- A small block size delivers >1870-kilo counts per second^[b] effective peak NECR for improved clinical performance.
- High-flow direct-cooling of the DEA allows the detector temperature to remain stable at room temperature for outstanding performance and serviceability, and improved patient comfort.

Unique integration of a completely new detector design



A middle-aged man with grey hair, wearing a white lab coat over a blue shirt and a dark blue tie, is seated at a desk. He is looking at a computer monitor with a thoughtful expression, his hand resting on his chin. The monitor is a large, dark, curved model. A black keyboard is visible on the desk in front of him. A teal circle is overlaid on the left side of the image, containing white text.

**Accuracy
to reveal the
bigger picture**

Improving resolution can positively impact health outcomes.

Low resolution limits PET/CT's ability to identify and accurately measure small lesions. Missing lymph node involvement or distant metastasis can impact disease classification, which, in turn, may affect surgery, therapy, and outcomes.

Improving spatial and temporal resolution can significantly improve lesion-detection performance for oncologic PET/CT imaging. It can also help define the appropriate stage and possible

treatment strategy. As a study by Li et al demonstrated, "... [Higher resolution] had a significant effect on detected lesion numbers, sensitivity, and image quality.⁸ Thanks to its innovative digital detector design, Biograph Vision is specifically designed to break through the limits of spatial and temporal resolution.

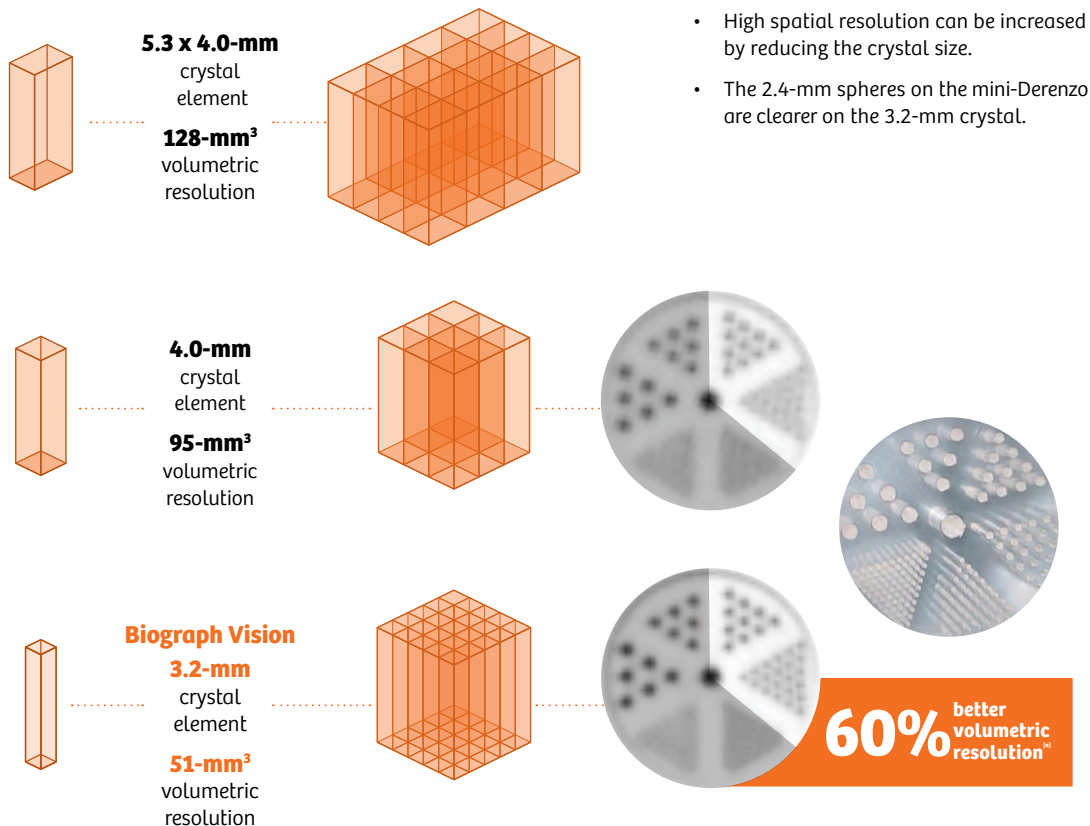
Spatial resolution: Small crystals, big impact

Partial volume effect (PVE) makes small lesions appear larger and more diffused than they actually are. If a lesion is small compared to the crystal size, image quality degrades and PVE causes measuring inaccuracies.

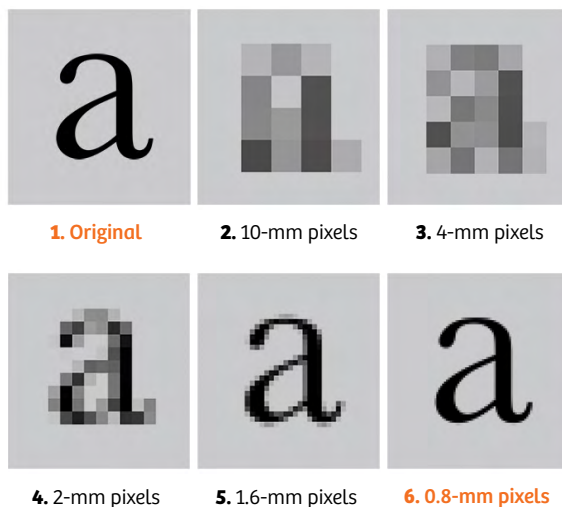
Improving spatial resolution with smaller crystal sizes is one of the most effective ways to deal with partial volume effect. With 3.2-mm

crystals, Biograph Vision delivers high spatial resolution to reduce the impact of PVE. This helps you quantify more accurately and more confidently understand disease progression.

See the difference.



Crystal size matters.



When a lesion is small relative to crystal size, PVE diffuses the image, similar to the jagged pixelation shown in images 2 to 5. Smaller crystal sizes mitigate PVE and improve the spatial resolution, resulting in sharper images that look closer to the original, such as the example of number 6. With small 3.2-mm crystals and pixels as small as 0.8 mm, Biograph Vision helps to minimize PVE.

“... by improving the spatial resolution ... you also have less partial volume effect, so you get sharper images and more accurate quantification.”



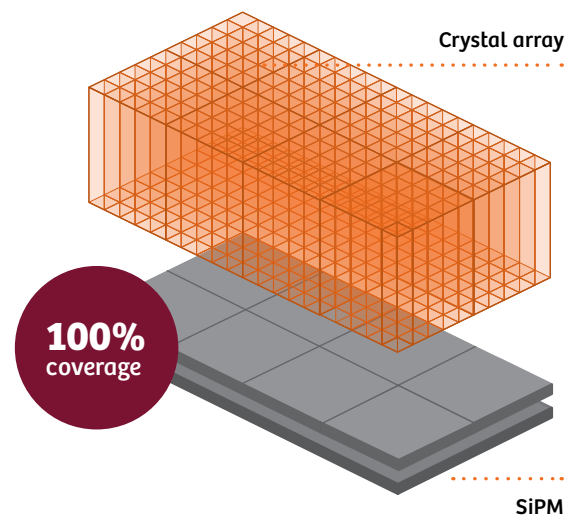
Prof. Ronald Boellard, Ph.D | University Medical Center | Groningen

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

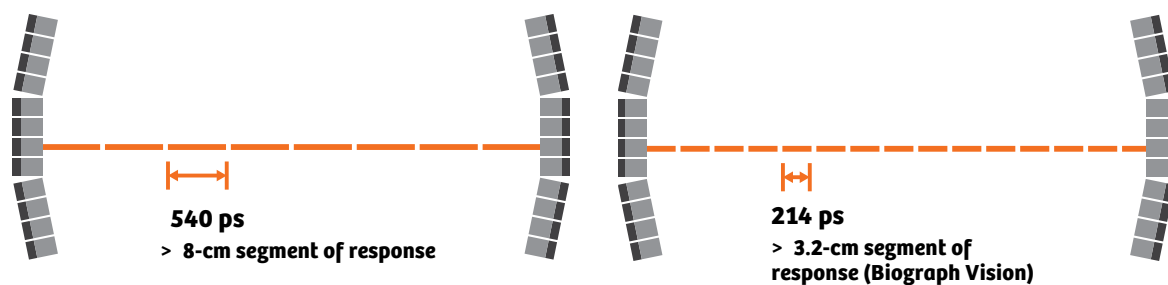
Temporal resolution: Exceptional time-of-flight

Along with higher spatial resolution, a faster time-of-flight also makes it easier to see small lesions. Time-of-flight systems measure the time difference between the detection of each coincidence photon to better determine the event location along the line of response. Faster temporal resolution allows for smaller segments of response, which increase the accuracy of locating the annihilation event.

Time-of-flight performance depends on collecting light from all photons in the scintillation. Biograph Vision is designed so SiPMs cover the entire LSO array area, allowing all light from the scintillation to be detected. This leads to 100% coverage and enables fast temporal resolution.^[b]



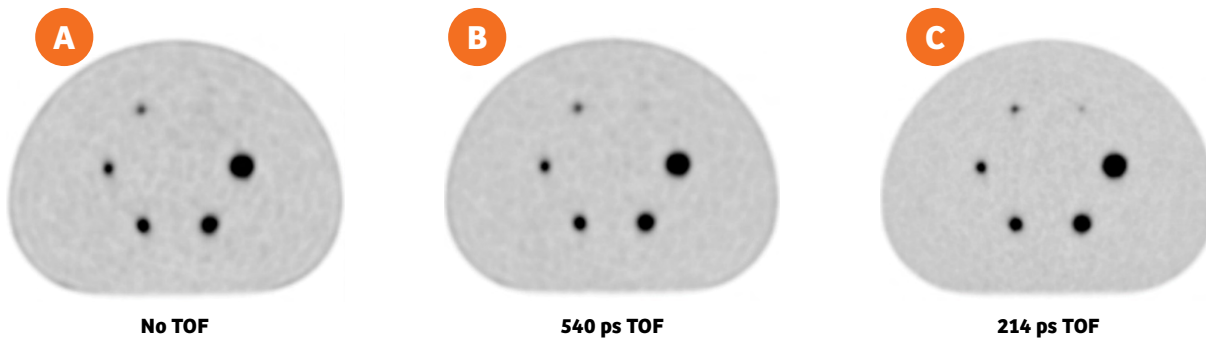
See the difference.



Fast time-of-flight enables smaller segments of response. This improves the signal-to-noise ratio.

Better time-of-flight reduces noise.

Less noise means greater image clarity, making small lesions easier to find.



Images A and B acquired on Biograph mCT.
Image C acquired on Biograph Vision.

"...because of the high sensitivity of the system, we can achieve good image quality and low noise even if injecting low activities."



Silvano Gnesin | Centre hospitalier universitaire Vaudois CHUV

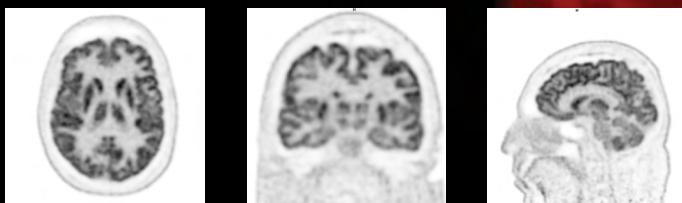
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The bigger picture

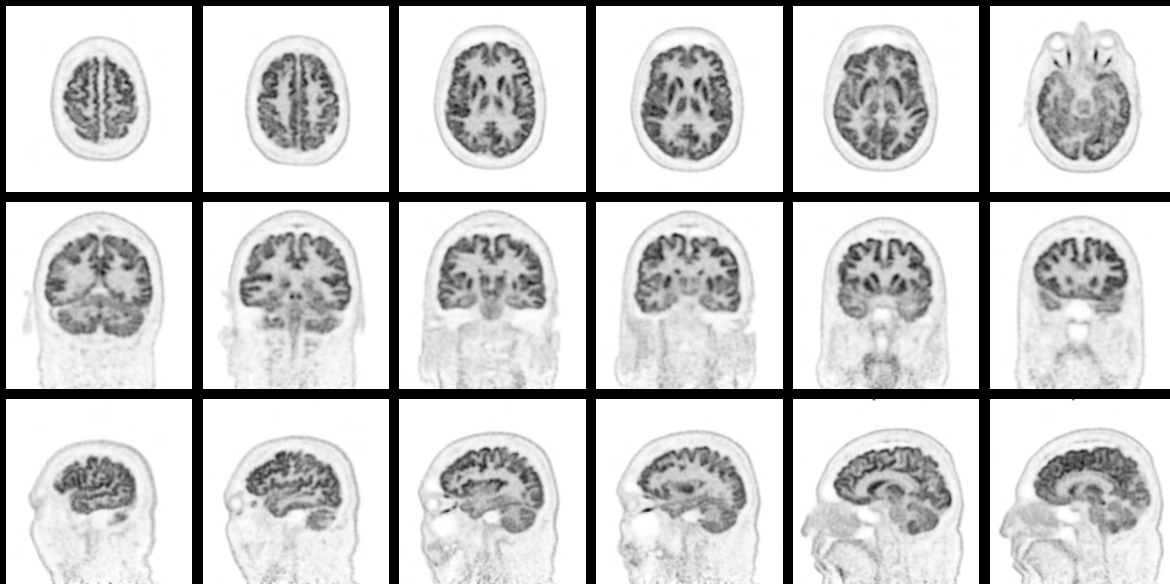
See how Biograph Vision with Optiso UDR creates a whole new world of precision.

Neurology

This example shows sharply delineated cortical uptake, with high contrast between the gray and white matter. There is impressive definition of the gyri, basal ganglia, and cerebellum.



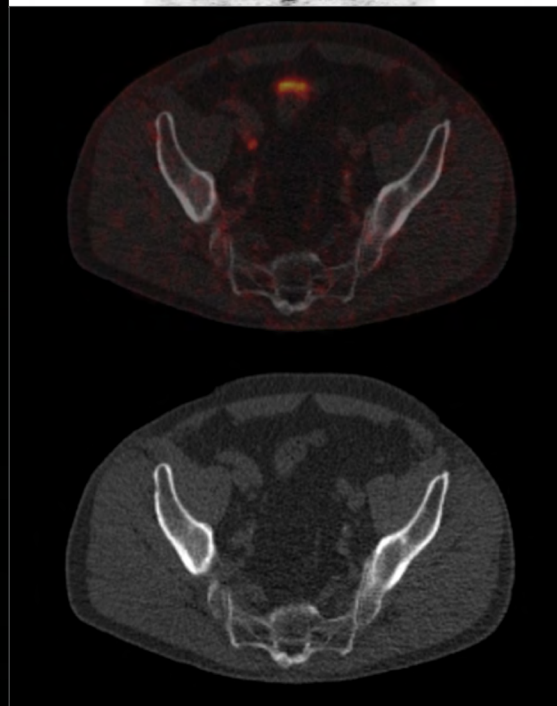
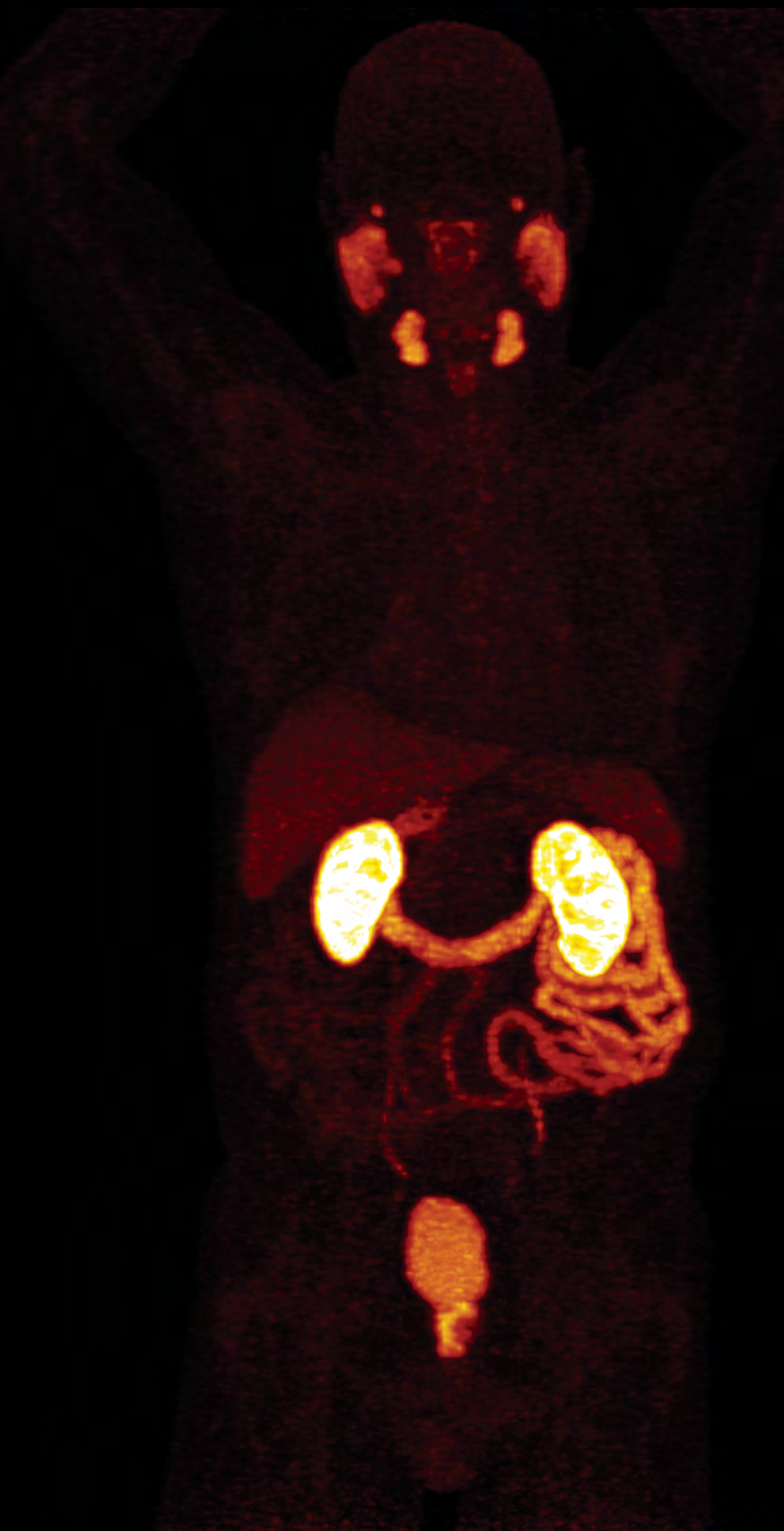
Data courtesy of Centre Hospitalier Universitaire Vaudois, Lausanne, Switzerland



Normal cerebral metabolism over the cortex. Visible changes corresponding to known cerebral vascular accident site on right cerebellum. Excellent delineation of functioning cortex and sharp contrast between cortex and white matter. Additionally, there is sharp basal ganglial edge definition, especially the sharp margins and distinct separation of the head of caudate nucleus and putamen with 135 MBq (3.6 mCi) injected dose.

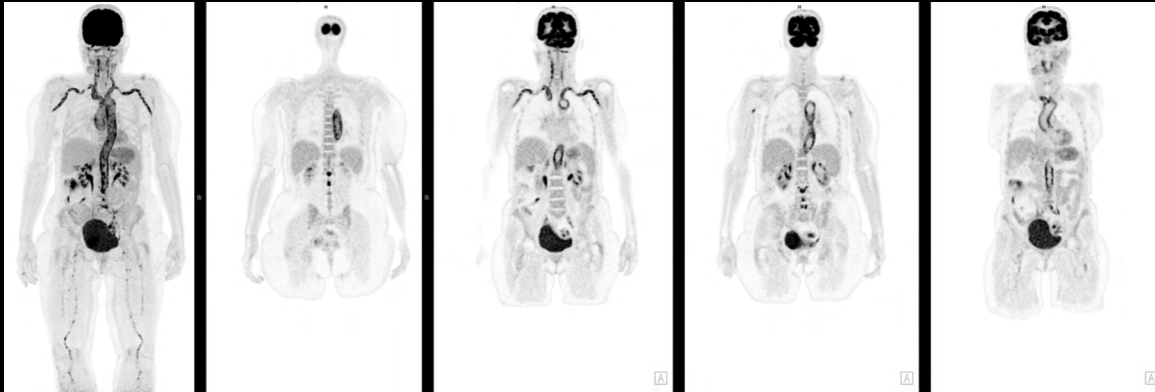
Data courtesy of Centre Hospitalier Universitaire Vaudois, Lausanne, Switzerland

Oncology



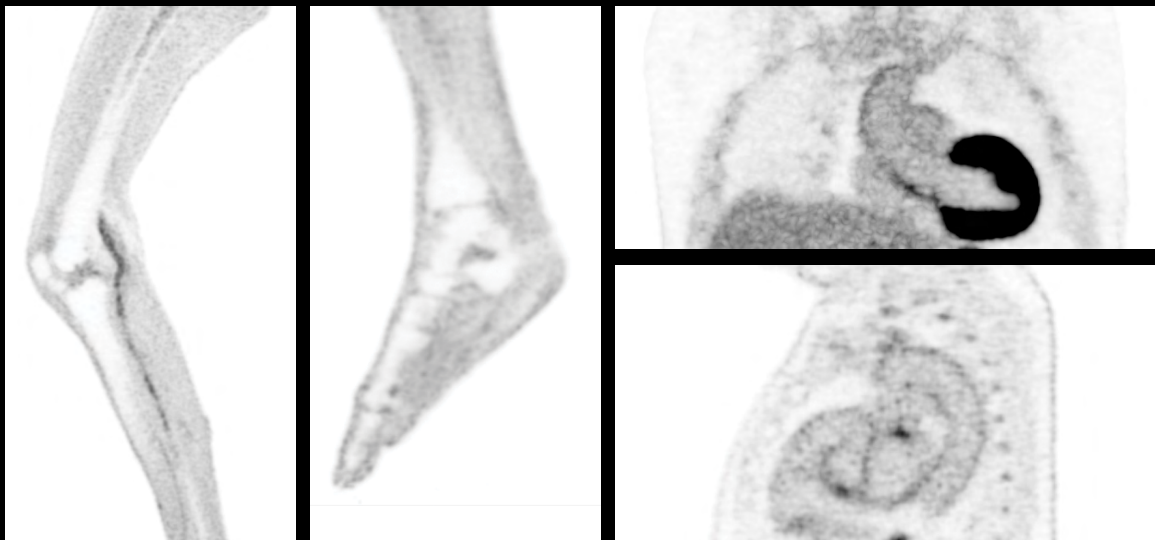
Data courtesy of University Medical Center
Groningen, Groningen, The Netherlands

A small, 7mm solitary pelvic lymph nodal metastasis is visualized in a patient with primary prostate cancer who otherwise had no clinical or radiological suspicion of metastases. Detection of a single metastatic lymph node puts the patient in stage IV; irrespective of the Gleason score or PSA level. Biograph Vision enables high lesion contrast to background with standard acquisition time in spite of a low injected dose of 100 MBq (2.7 mCi) and long post injection delay of 1 hour and 45 minutes.



Abnormal heterogeneously increased activity throughout the extent of the aorta, particularly the abdominal aorta from the level of the renal calyces caudal. The improved contrast from the 214 ps TOF helps improve the visualization of the uptake pattern in the vascular structures in this case.

Data courtesy of University Medical Center Groningen, Groningen, The Netherlands

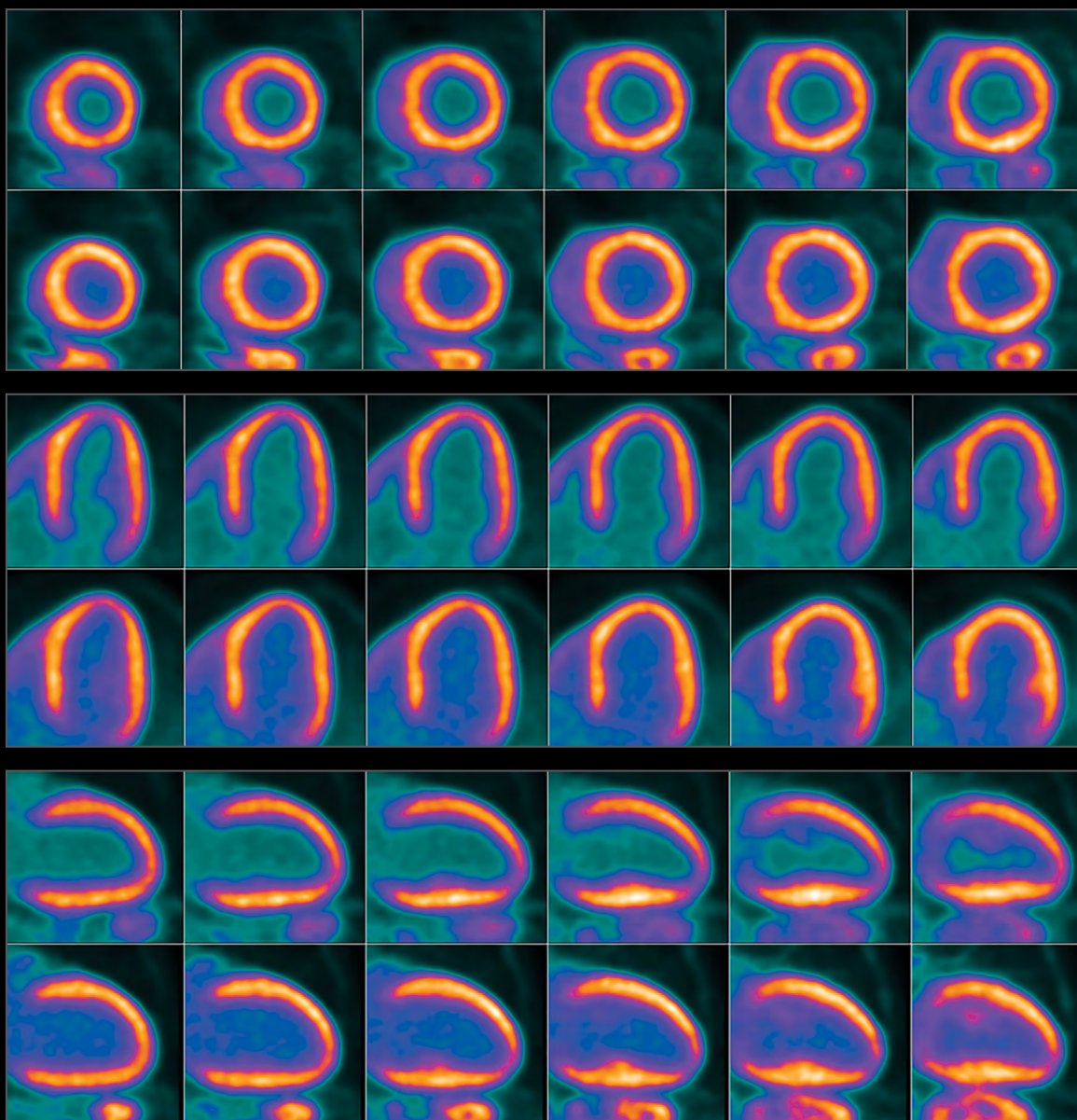


The ankle and knee joints are clearly delineated, and the bones of the mid foot can be visualized as well. Papillary musculature and excellent definition of the aortic wall and cardiac chambers can also be seen.

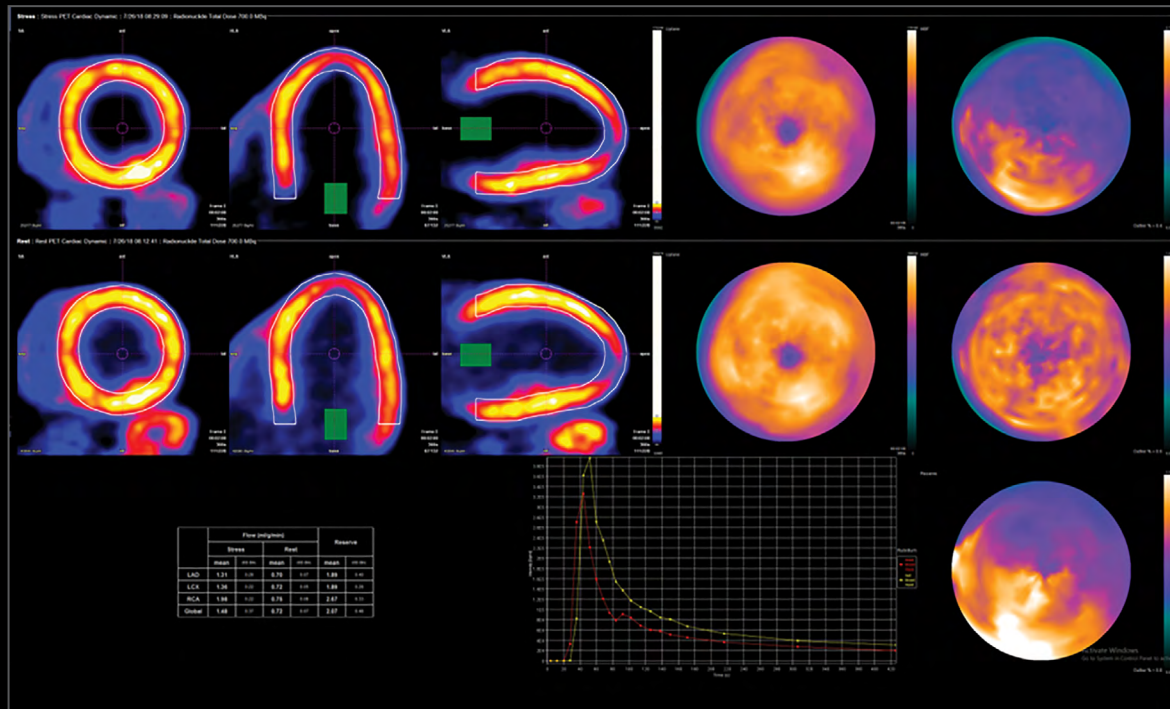
Data courtesy of University Medical Center Groningen, Groningen, The Netherlands

With Biograph Vision precise localization of PET activity can be achieved, which can possibly affect patient management.

Cardiology



Data courtesy of Centre Hospitalier Universitaire
Vaudois, Lausanne, Switzerland

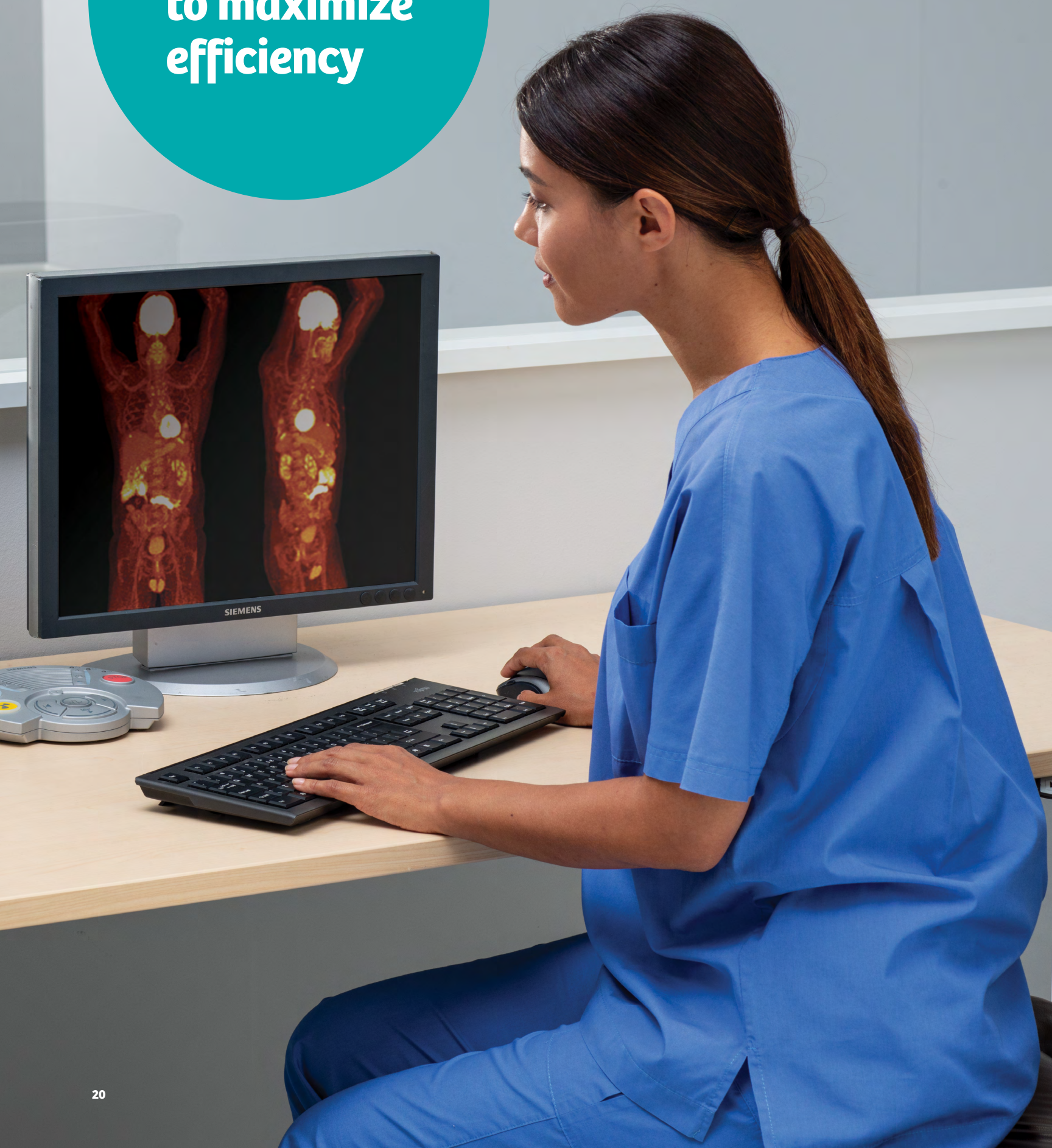


	Flow (ml/g/min)				Reserve	
	Stress		Rest			
	mean	std dev.	mean	std dev.	mean	std dev.
LAD	1.31	0.28	0.70	0.07	1.89	0.40
LCX	1.36	0.22	0.72	0.05	1.89	0.28
RCA	1.98	0.22	0.75	0.08	2.67	0.33
Global	1.48	0.37	0.72	0.07	2.07	0.48

The Optiso UDR detector provides excellent performance in applications that require dealing with high activity concentrations, such as myocardial bloodflow (MBF) with ^{82}Rb . This example demonstrates high image quality with sharp definition of left ventricular margins with low noise on a 700 MBq (18.9 mCi) ^{82}Rb for both stress and rest. A global coronary flow reserve of 2.07 is observed, with stress MBF values of 1.48 ml/g/min.

Data courtesy of Centre Hospitalier Universitaire
Vaudois, Lausanne, Switzerland

**Performance
to maximize
efficiency**



Optimize your clinical operations with quality images and efficient workflow.

Throughput issues can compound, resulting in higher costs, inefficient workflow, and missed opportunities for additional scan slots.

Biograph Vision has the market's highest effective sensitivity at 100 cps/kBq.^[b] The fastest time-of-flight in the industry^[a] delivers 3.9 times higher

effective sensitivity while proportionally reducing scan time and injected dose.^[d] Besides an increase in throughput^[d] to boost productivity, Biograph Vision can also improve image quality, and patients are less likely to move with shorter scan times.



Adding 2 slots per day could result in more than 500 patients examined in one year. In the USA, this could amount to ~\$866,560 per institution.⁹

High-quality, low-dose whole-body exams in less than 5 minutes

Biograph Vision requires significantly less injected tracer dose compared to current state-of-the-art technology^[d] without compromising image quality or scan speed. This not only reduces patient exposure, but also may save on tracer cost. Combined with FlowMotion, Biograph Vision is designed to also reduce unnecessary exposure to CT radiation, provide greater patient comfort, and further decrease examination times compared to current state-of-the-art technology.^[d]



4-minute scan MIP



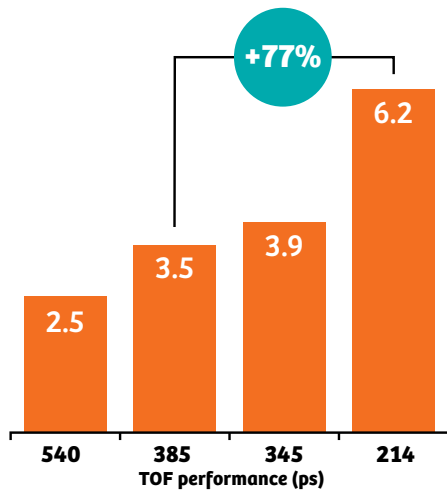
8-minute scan MIP



16-minute scan MIP



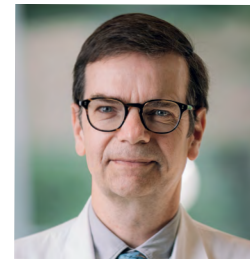
Data courtesy of University Medical Center Groningen, Groningen, The Netherlands



Time-of-flight sensitivity gain

214-ps timing resolution for faster time-of-flight^[a] and better effective sensitivity.^[a] Gain is calculated for a 20-cm cylindrical phantom.

“We can reduce the injected activity by about one-third at least. This was also not at the cost of the acquisition time. The acquisition time could be also reduced, so we were really pleased to be able to work on those two variables and to make better images, faster, with less activity.”



Prof. John Prior | Centre hospitalier universitaire Vaudois CHUV

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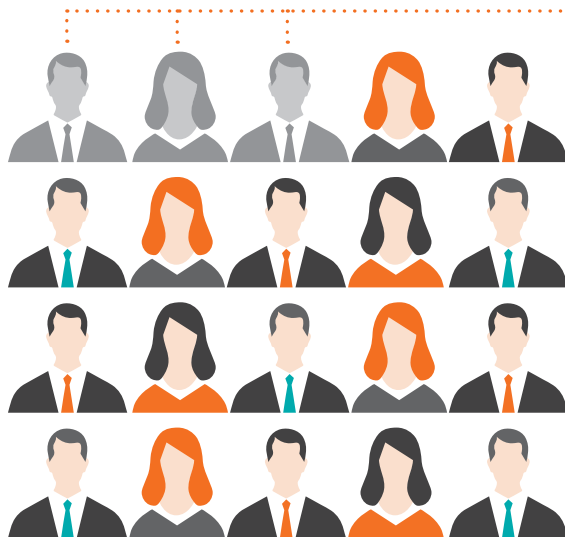
**Reproducibility
to understand
disease
progression**

Reduce unwarranted variations to maximize patient care.

When imaging cancer patients, blurry, noisy images can lead to undetected lesions and inaccurate quantitative values. This can lead to imprecise treatment evaluation while an ineffective, costly therapy remains in use.

Biograph Vision's combination of improved resolution and effective sensitivity helps you better understand disease progression and treatment resistance, so you can more precisely tailor treatment and make earlier adjustments.

The cost of imprecise treatment



15% of patients receiving Imatinib Mesylate (IM) treatment for gastrointestinal stromal tumors showed primary resistance, wasting time and potentially up to \$146,000/year.

Treatment with IM costs \$146,000¹⁰ per year, but more than 15% of gastrointestinal stromal tumor patients displayed primary resistance¹¹ — wasting both time and money. Identifying non-responders as early as possible in cancer treatment can maximize patient care and outcomes.

Due to its high reproducibility, PET/CT effectively detected early response to IM treatment.¹¹ By identifying non-responders early on, such as these IM-resistant patients, you can reduce the use of ineffective therapies, saving costs and sparing the patients from negative side effects.

High reproducibility requires consistent accurate results.

Accurate results start with a reliably calibrated scanner.

Since high reproducibility starts with a reliably calibrated scanner, quality control is a necessary part of every PET/CT lab routine. Manual quality control consumes your staff's time and exposes them to radioactive sources.

QualityGuard™^[c] uses the natural background radioactivity of lutetium present on LSO detectors to automatically calibrate itself, eliminating the need for an external source for daily and weekly PET quality control.^[c] Automatically running during off hours, it can reduce your staff's exposure to calibration sources by up to 98%^[b] and increase workflow productivity by helping you save up to 30 minutes of technologist time per day.^[b]



Less exposure and more efficient workflow with QualityGuard.^[b]

Current quality control methods are time consuming, labor intensive and unnecessarily expose technologists to radiation. QualityGuard automates daily and weekly quality control without a radioactive source.

120 hours

Unproductive technologist time per year^[b]

12 kg

lifted twice every day with risk of work-related injury^[b]

500x

Per year techs are exposed to radioactive sources^[b]

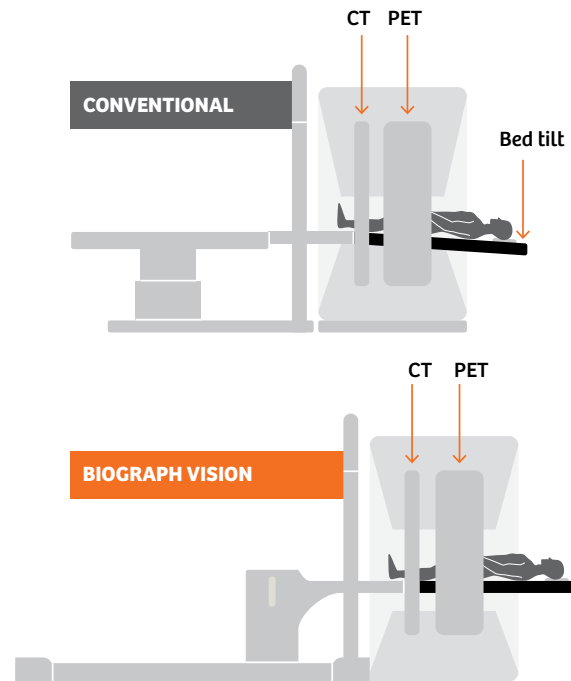
Start improving workflow.
Download the QualityGuard flyer:
[siemens.com/QualityGuard](https://www.siemens.com/QualityGuard)

Reliable quantitative values with Optiso UDR detector

Accurate values also need high-quality data. The Optiso UDR detector delivers an accurate measure of the uptake in isotopes with both low and high count rates, such as ⁹⁰Y and ⁸²Rb respectively. The detector leverages the fastest time-of-flight^[a] in the industry for high signal-to-noise ratio and small crystal elements for reduced partial volume effect, maximizing the contrast and resolution and delivering accurate and reliable quantitative values.

Unique bed design enables a reliable match of PET and CT.

Biograph Vision's zero-differential-deflection patient bed provides perfect registration between the CT and PET fields of view, ensuring accurate attenuation correction for more precise quantification. Its unique cantilever design allows the pedestal and table to move as one unit. It supports 227 kg (500 lb) in accurate alignment without any differential deflection between PET and CT acquisitions.



“Being more quantitative, our reproducibility can be that much better, and it may matter when we’re trying to do a repeat scan early on in a therapy and decide what to do. Because you’d like to know in a very short period of time: No, it’s time to change therapy or it’s looking promising.”



Richard E. Carson, PhD | Yale PET Center | Yale School of Medicine

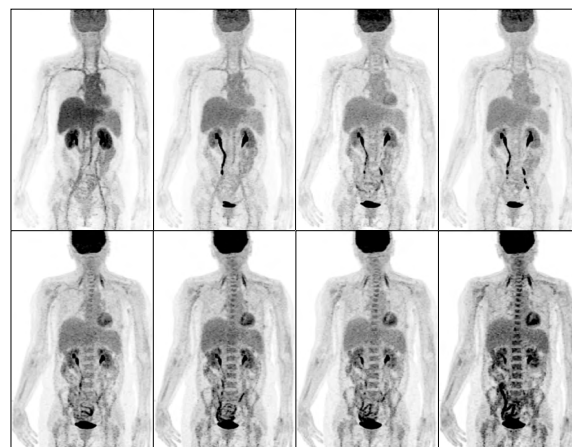
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Advanced standardization for consistent image quality and reproducibility

FlowMotion lets you develop and save protocols based on clinical indication so they're easily incorporated into the clinical routine for your patients — helping to reduce the variability of image quality from different users and enabling reliable visualization of disease from one exam to another.

Instead of being limited to a single-bed position with the organ of interest positioned in the center of the detectors, FlowMotion also allows you to obtain whole-body dynamic images. It continually moves the bed through the gantry in a bi-directional motion along the entire body so you can visualize the tracer distribution over time, and thereby also move whole-body Multiparametric PET into clinical practice.



Whole-body dynamic imaging allows for the acquisition of whole-body frames over time.

Image courtesy of Keio University, Tokyo, Japan

Parametric imaging increases reproducibility.

One of the most important aspects of PET imaging is the ability to quantify the uptake of tracer in a specific tissue. Implementing SUV based on static images was a key milestone to facilitate the use of semi-quantitative metrics in clinical practice. However, PET tracer distribution — a dynamic process altered by a number of factors specific to each organ and region of interest — cannot always be accurately accounted for with SUV.

Parametric imaging can reduce the variability, but conventional methods are extremely complex and time consuming. For this reason, parametric imaging was mostly only used in research environments.

Go beyond SUV with the FlowMotion Multiparametric PET Suite.

FlowMotion Multiparametric PET Suite is the first fully integrated solution for parametric PET imaging. It makes it easier and faster to perform parametric imaging in daily clinical routine. It is completely automated and integrated into the PET/CT workflow, allowing users to obtain images of SUV, metabolic glucose rate (Ki), and distribution volume (DV) all at once for more reproducible images and therefore more efficient information for planning and therapy strategy. The visualization software solution, *syngo.via*, includes a dedicated workflow that simplifies reading.

.....

Integrate parametric imaging into your workflow.
Download the FlowMotion Multiparametric PET Suite flyer:
siemens.com/MultiparametricPET

.....

More unique features that fit your needs

Large bore with 24% more space than industry standard^[a]

A 78-cm bore and 227-kg (500-lb) table capacity support the study of a broad patient population (e.g., obese or claustrophobic). The large bore makes for a more comfortable patient experience and allows for easier positioning of radiation therapy accessories.

Short tunnel

The 136-cm tunnel improves patient comfort and facilitates patient positioning.

Bed-integrated physiological inputs

Integrated physiological inputs and IV support provide a clutter-free work environment. Controls on each side of the gantry simplify patient positioning.

OncoFreeze™

Allows you to acquire images virtually free of respiratory motion without extending scan time. This increases your clinical confidence with improved detection, delineation, and quantification of lesions.

CardioFreeze™

Reduces image blur from both cardiac and respiratory motion using only the ECG trigger for gating. Decreasing the blur may improve visualization of myocardial tracer distribution, wall thickness, and defect definition.



At Siemens Healthineers, we enable healthcare providers to achieve better outcomes at lower costs by expanding precision medicine, transforming care delivery, improving patient experience, and digitalizing healthcare.

Healthcare providers around the world have long relied upon our engineering excellence and leading-edge, high-quality medical technologies across a broad portfolio. Our technologies touch an estimated 5 million patients globally every day*. At the same time, they help hospital departments to continuously improve their clinical, operational, and financial outcomes.

We now consolidate this unprecedented volume of data and insights and turn them into pioneering enterprise and digital health services. With those, we maximize opportunities and share risks of your entire health system.

Partnerships are built on people. With Siemens Healthineers, there is no team more committed and more connected than we are to realize your success together.

*Siemens AG, "Sustainable healthcare strategy — indicators in fiscal 2014," pages 3-4

Disclaimers:

- [a] Based on competitive literature available at time of publication. Data on file.
- [b] Based on internal measurements available at time of publication. Data on file.
- [c] QualityGuard is currently under development on Biograph Vision and is not available for sale in the U.S. or any other country. Future availability cannot be guaranteed.
- [d] Compared to current state-of-the-art technologies. Data on file.
- [e] Data based on comparison of Biograph mCT systems with and without QualityGuard.

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