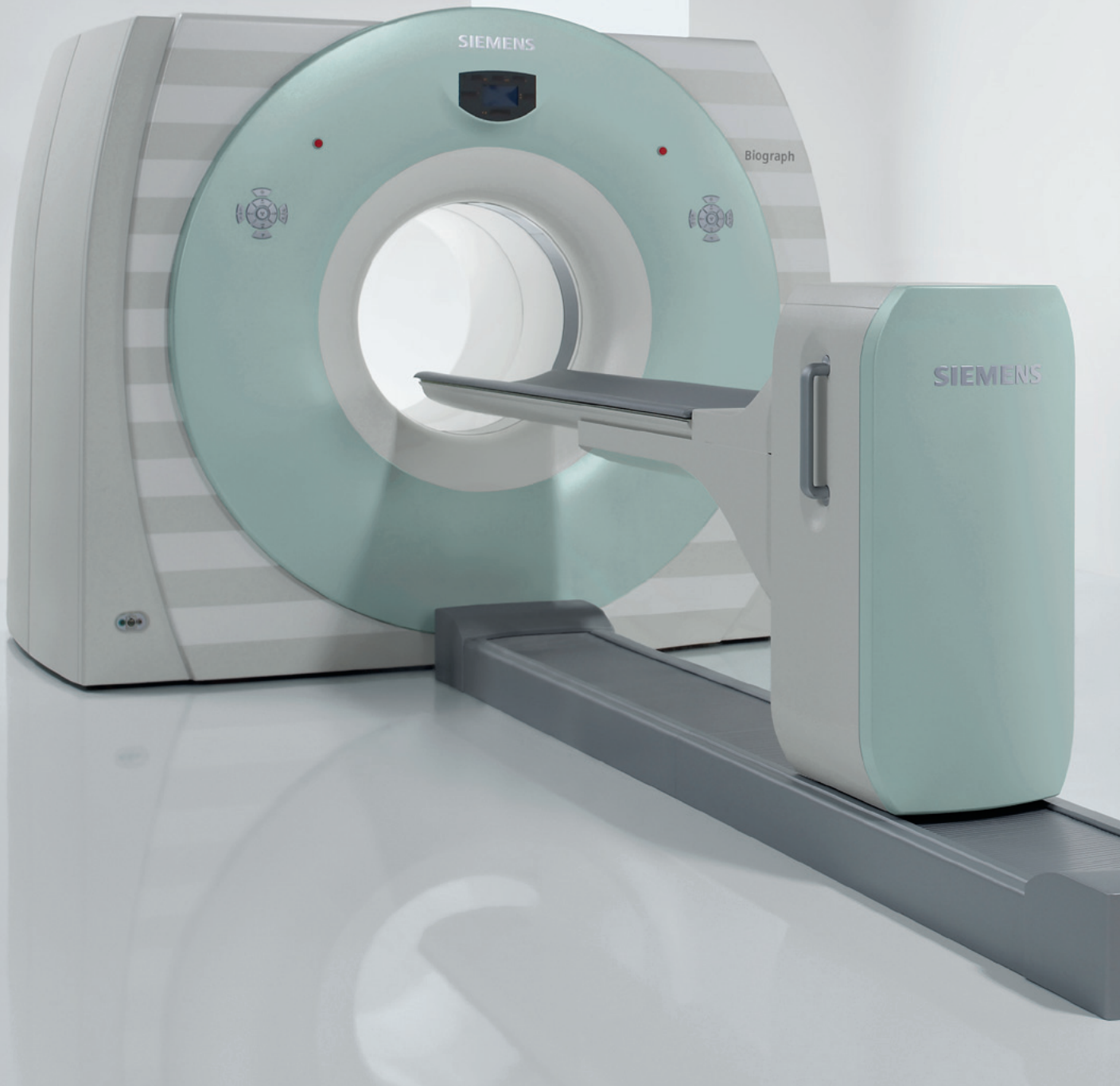


Inside Biograph TruePoint PET•CT

www.siemens.com/mi

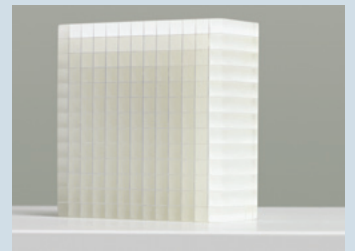
SIEMENS



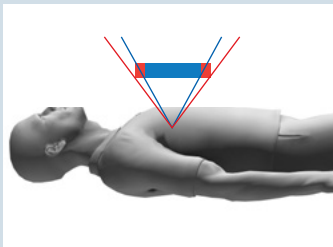
227 kg (500 lb) bed limit with wide pallet helps accommodate bariatric patients.



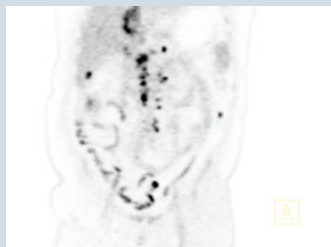
STRATON X-ray tube provides fast 0.33 s CT rotation speed and high resolution.



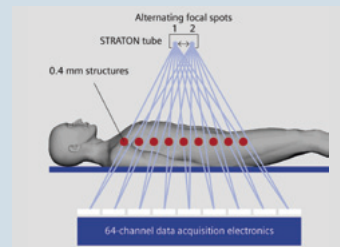
LSO crystals and HI-REZ detectors offer industry-leading PET performance.



TrueV extends the PET field of view (FOV) by 33% and increases NEMA count rate by >70%.



HD-PET offers uniformity, high-resolution, and 2x better contrast over conventional PET.

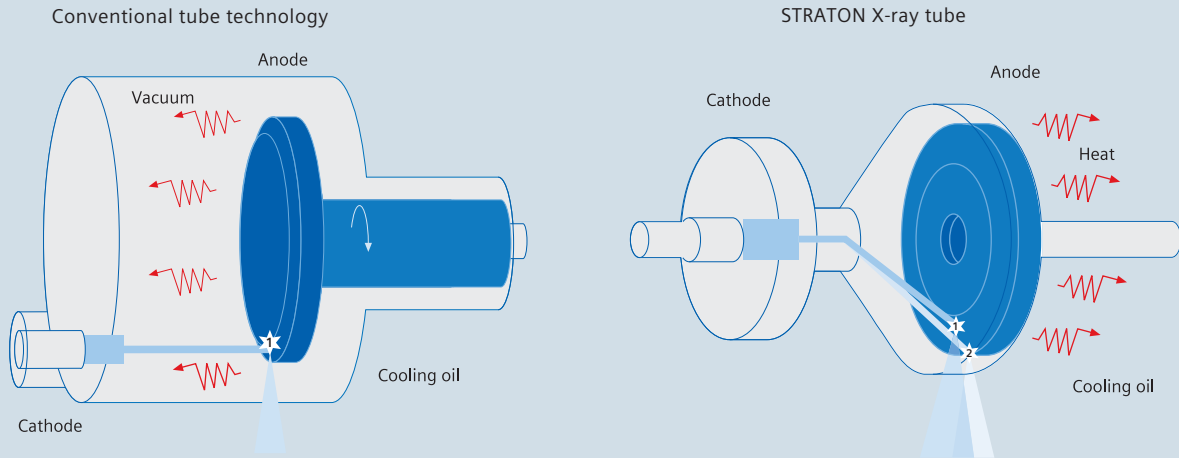


z-Sharp provides .33 mm resolution at any scan and rotation speed and at any position.

STRATON X-ray tube

Our unparalleled 0 MHU STRATON X-ray tube has caused a paradigm shift in CT imaging. The tube's direct anode cooling eliminates the need for heat storage, permitting a compact design and the fastest CT gantry rotation for all applications.

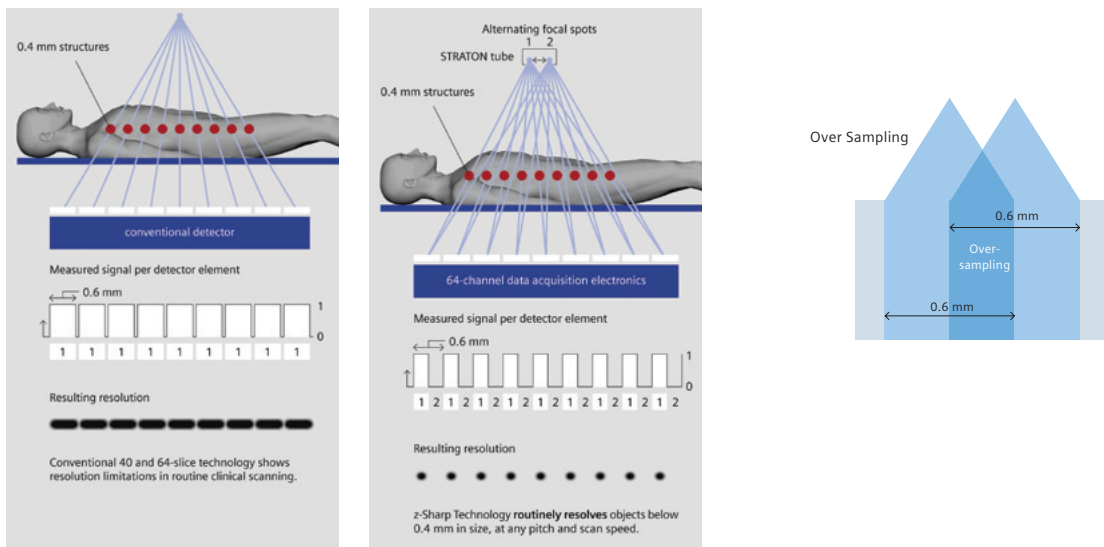
In cardiac imaging, where the ability to freeze motion is critical, Biograph™ 40 and 64 provide you with super-fast rotation time, making non-invasive cardiac diagnosis routinely available. To increase temporal resolution, the proprietary STRATON X-ray tube enables a fast gantry rotation time of 0.33 s, resulting in motion- and artifact-free imaging of the heart.

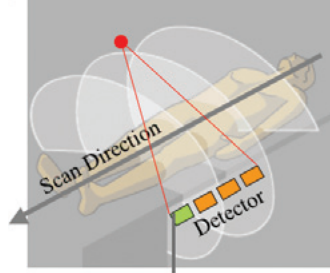


z-Sharp technology

Instead of decreasing the size of detector elements to improve spatial resolution, z-Sharp technology on the Biograph 40 and 64 utilizes two overlapping X-ray beams, resulting in significantly increased resolution without a corresponding increase in dose. This provides you with the industry-leading isotropic resolution of 0.33 mm at any scan and rotation speed, and at any position

within the scan field. In addition, with our proprietary z-UHR technology, the system adapts for ultra-high resolution bone imaging for wrist, joint, or inner ear studies. We push the boundaries of spatial resolution even further providing unparalleled 0.24 mm isotropic resolution — until now seen only with research flat panel and Micro CT technology.



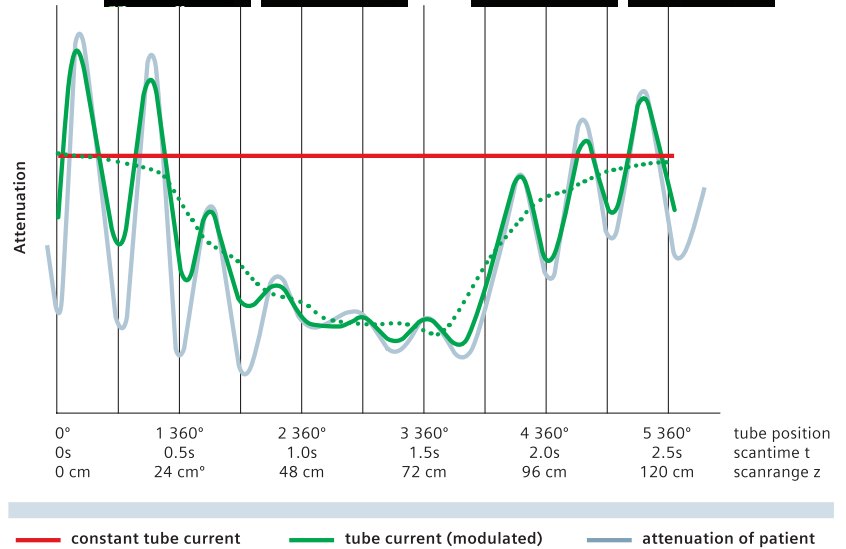
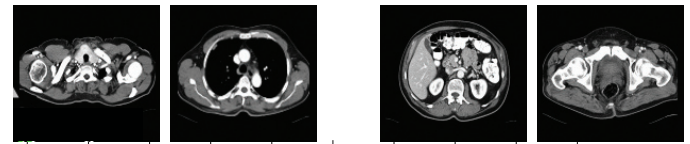


CARE Dose4D: real-time dose modulation

The CARE Dose4D feature utilizes an advanced computing technique that provides real-time dose modulation of the X-ray tube current according to the precise shape of the patient's body during both spiral and sequential scanning. It reduces the patient dose for low attenuation views, while the dose is kept at a nominally higher mA for high attenuation angles. From the initial topogram, a base mA setting is determined. During the scan, a detector element measures the attenuation through the patient and transfers that information to the output generator of the X-ray tube to keep the mA at a level which provides the accepted image quality.

CARE Dose4D provides these economical and clinical benefits:

- Up to 66 percent dose reduction while maintaining the same image quality as compared to clinical protocols not employing CARE Dose4D
- Enhancement of the image quality and reduction of artifacts for scanning of asymmetric body regions, such as the shoulders or scans of the patient with arms alongside the body
- Lower power consumption and reduced heat load
- Longer spiral ranges and more flexibility for multi-phase examinations, especially for obese patients
- Low dose examinations for pediatric patients



SureView: uncompromising image quality

A patented solution for multislice CT scanning, SureView provides exceptional image quality at any pitch setting. To acquire a scan, you simply select the scan volume (range), mAs, scan time, and slice width. All other parameters, such as pitch, are automatically calculated by the scanner, ensuring high quality imaging at any scanning speed. For spiral scanning, SureView yields

a remarkably low image noise level. To produce the same noise level as sequential CT images, our spiral scan protocols are created with lower mAs and therefore, can reduce doses by up to 20 percent. Specify the slice thickness according to your clinical needs, and SureView automatically provides the best image quality with reliable, excellent performance.

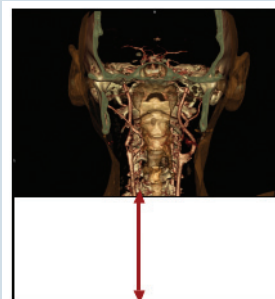
SureView allows more patient coverage without loss of resolution.



49 mm/sec

Siemens 40-slice CT with SureView

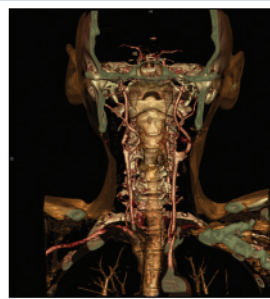
40 x 0.6 mm, 0.37 sec pitch 1.5 for z-resolution of 0.4 mm



55 mm/sec

Competitive 64-slice without SureView

64 x 0.625 mm, 0.4 sec limited to pitch 0.55 for z-resolution of 0.4 mm



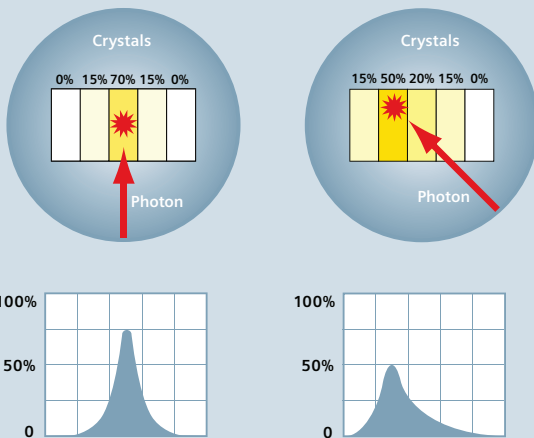
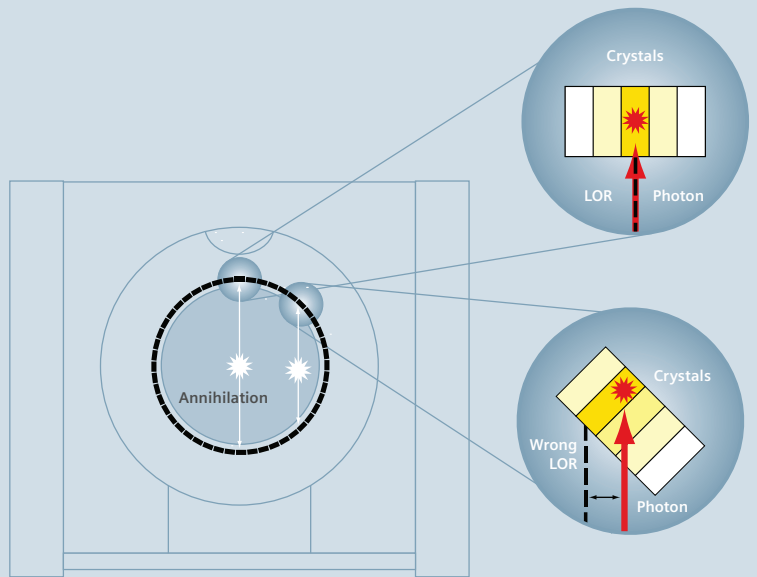
87 mm/sec

Siemens 64-slice CT with SureView

64 x 0.6 mm, 0.33 sec pitch 1.5 for z-resolution of 0.4 mm

Conventional PET or HD•PET: What's the real difference?

When a photon strikes a crystal, it travels a certain distance before its energy is converted into light. If the photon comes from the center of the field of view (FOV), the line of response (LOR) is likely to be correctly localized in the crystal in which the photon entered. The further away from the center of the FOV, the less likely the LOR will be calculated correctly because the photon will hit the crystal on an angle and continue traveling to another crystal before it lights up.



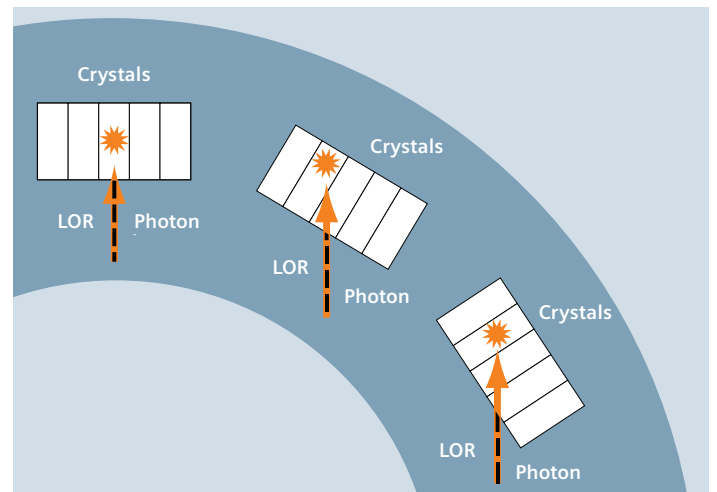
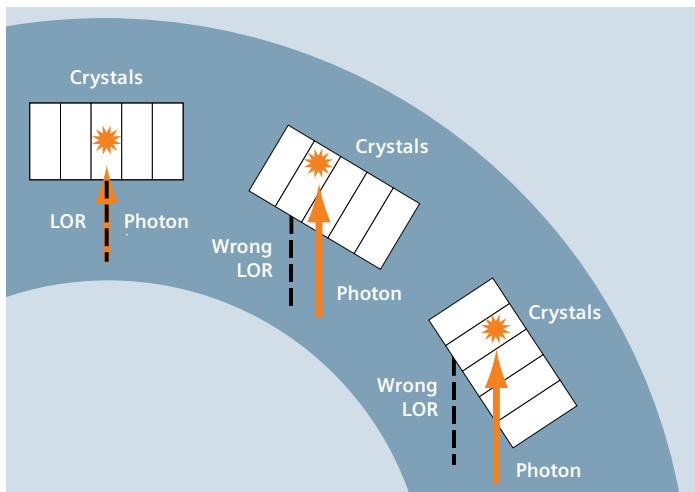
A Point Spread Function (PSF) describes the response of an imaging system to a point source or point object. A system that knows the response of a point source from everywhere in its FOV can use this information to recover the original shape and form of imaged objects. PSFs are used in precision imaging instruments, such as microscopy, ophthalmology, and astronomy (e.g. the Hubble telescope) to make geometric corrections to the final image.

“Our HD•PET studies are a major improvement in study quality; they are clearer, provide better delineation and detection of small foci of disease; they offer improved confidence in diagnosis and diagnostic accuracy, which improves patient care.”

— Prof. Michael Fulham, Royal Prince Alfred Hospital, Camperdown, Australia

Conventional PET uses the same reconstruction principles across the entire FOV and does not take into account the detector geometry and mispositioning of the LORs. This results in fuzzy edges and increased distortion further from the center of the FOV.

HD•PET incorporates millions of accurately measured point spread functions in the reconstruction algorithms. Using measured PSFs, HD•PET effectively positions the LORs in their actual geometric location, which dramatically reduces blurring and distortion in the final image.

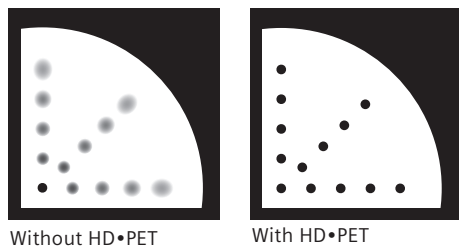


“My HD•PET images are sharper and have less noise. This technology seems to make lesions stand-out noticeably better.” — Hejung Press, M.B.A., M.D, VISTA Radiology, Knoxville, TN, USA

HD Uniformity + HD Resolution + HD Contrast = HD Clarity

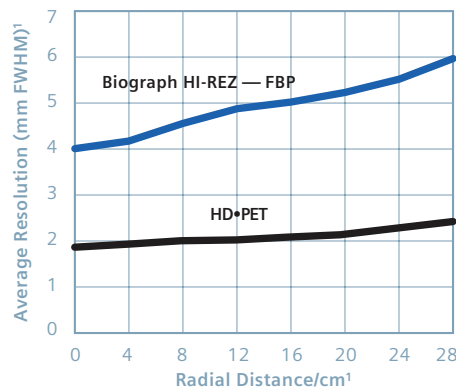
HD Uniformity:

Images are distortion-free throughout the entire field of view, from center to edges, enabling more accurate visualization of fine detail no matter where you look.



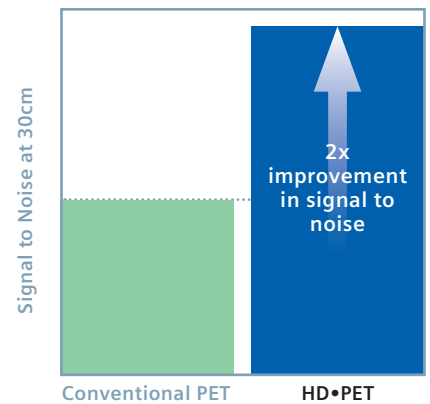
HD Resolution:

HD•PET offers 2 mm uniform resolution across the entire field of view for enhanced detectability and the highest level of detail.



HD Contrast:

With an unprecedented 2x improvement in signal to noise ratio, HD•PET reveals sharper images, as well as greater distinctness within the image.

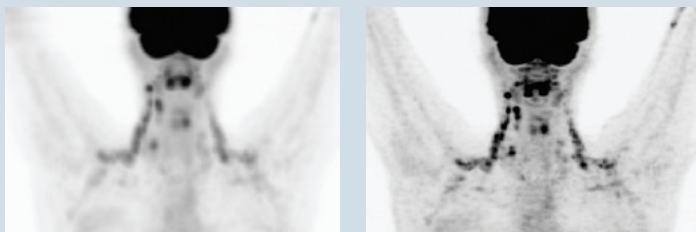


“HD•PET is a real technological advancement for challenging imaging situations, in particular for small lesions and breath-dependent lesions. The Biograph with HD•PET is without any competition at the moment.”

— Prof. Dr. W. Mohnike, Diagnostic Therapy Center Berlin (DTZ), Berlin, Germany

Conventional PET

HD•PET



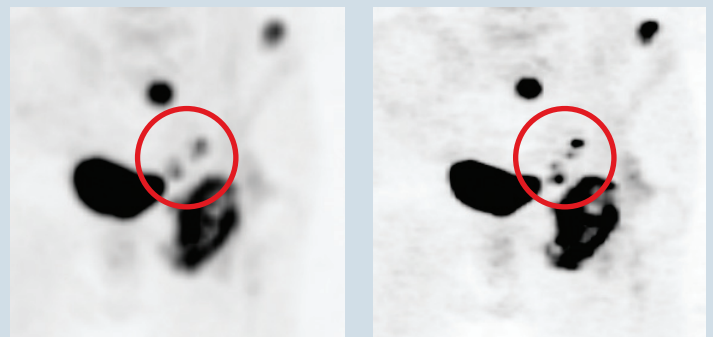
Data courtesy of the University of Erlangen, Erlangen, Germany

HD Clarity:

Greater specificity and accuracy deliver crystal-clear results for more confident diagnoses, and earlier, more targeted treatment.

Conventional PET

HD•PET



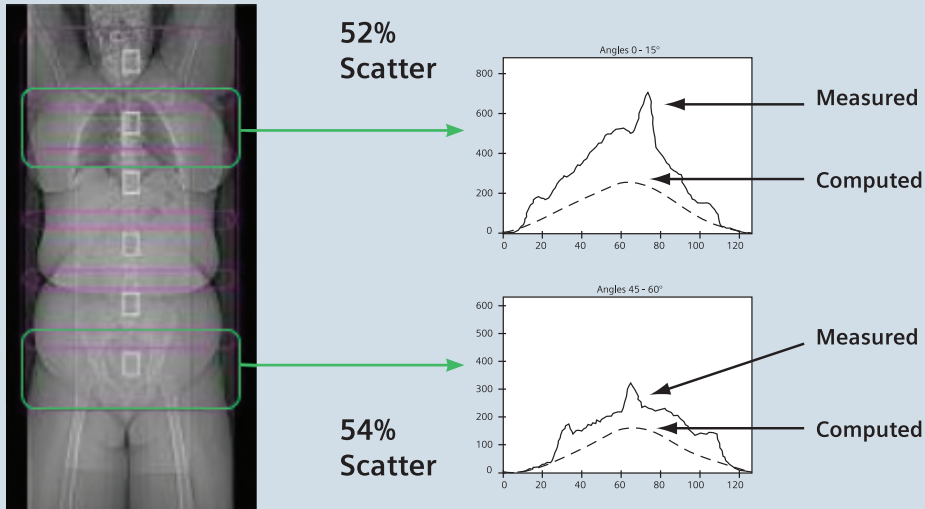
Data courtesy of the University of Erlangen, Erlangen, Germany

¹ Measurements were taken with a line source suspended in air at radial positions from the center to 28 centimeters in 4 centimeter steps. The Biograph HI-REZ-FBP data were reconstructed with a standard filtered backprojection algorithm after FORE rebinning and the HD•PET data were reconstructed with the TrueX algorithm using six iterations and 14 subsets.

TrueC: highly efficient scatter correction

Scatter correction is a vital component of PET image quality, particularly in cardiology where scattered photons are often the result of the activity of structures near the heart, such as the liver and intestines. Without scatter correction, image degradation can result, making analysis difficult, if not impossible. To improve image analysis and thus, the assessment of patients, Biograph TruePoint™ PET•CT includes TrueC, a highly efficient, model-based Compton scatter correction system using Monte Carlo-based computational techniques. This

single scatter simulation algorithm employs a unique, intuitive sampling technique organized as a summation over sample scattering points. TrueC is particularly efficient because it reuses the computed ray sums through the object to compute scatter contributions to multiple lines of response. Our single scatter based computational approach has been proven to offer the best balance of speed and accuracy for individual, patient-tailored scatter correction.

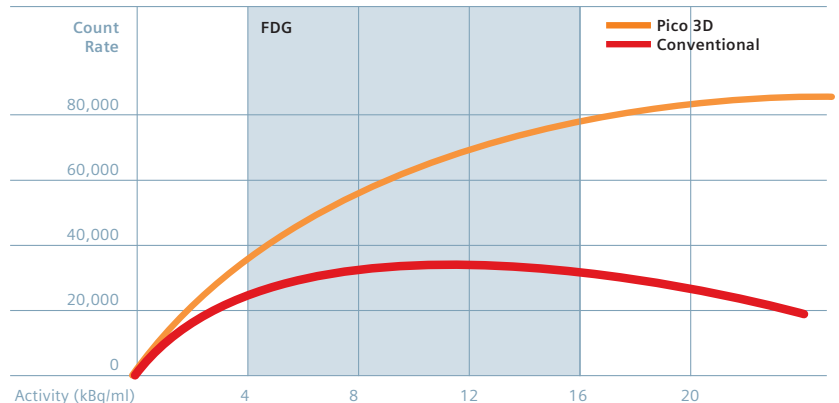


Pico-3D Electronics: optimum performance

Feature	Benefit	Advantage
500 picosecond (vs. 2 nanosecond)* digital time resolution	Superior energy and timing resolution with better scatter and randoms rejection	Unequaled Performance resulting in superior image quality and throughput
10-bit (vs. 6-bit)* energy sampling	Significantly improved energy resolution	Enhanced Image quality from better scatter rejection capabilities
15.6 million (vs. 7.8 million)* samples/second/channel	Faster processing of incoming signals	Increased Count rate with improved system dead time
4.5 nanosecond (vs. 12 nanosecond)* coincidence window	Improved randoms rejection	Higher quality 3D imaging leads to Optimum flexibility across all doses and patient sizes.

* As compared to without Pico-3D

Pico-3D means Performance, Image Quality, Count rate, and Optimum Flexibility in 3D. Ultra-fast detector electronics significantly improve count rate performance, image quality, signal to noise ratio, lesion detectability, and patient scanning flexibility. The combination of these unique detector electronics with the Biograph TruePoint PET•CT's LSO detector crystals virtually eliminates dead time and raises the bar on PET scanning with FDG and beyond.



LSO: state-of-the-art crystal technology

With more than 10 years of experience in Lutetium Oxyorthosilicate (LSO) scintillator crystal technology, Siemens is a pioneer in innovative PET imaging techniques. The Biograph TruePoint PET-CT employs patented LSO PET detectors that provide clear and fast images. A PET scanner's performance greatly depends on the scintillation properties of the detector crystal material. With a fast scintillation decay time of 40 ns and the highest density available, LSO crystals offer the best combination of properties of any PET scintillator known today. LSO offers a fast coincidence timing window of 4.5 ns for efficient rejection of

random events and enough light output for high energy resolution discrimination to facilitate the efficient rejection of randoms — all to provide high count rate statistics, which are essential to high speed PET scanning.



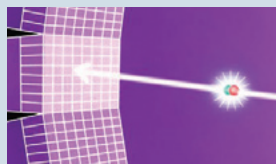
PET Detector Material Properties

Property	Characteristic	Desired Value	LSO	BGO	GSO	NaI
Density (g/cc)	Defines detection efficiency of detector	High	7.4	7.1	6.7	3.7
Effective Atomic Number	Scanner sensitivity	High	65	75	59	51
Decay Time (nsec)	Defines detector dead time and randoms rejection	Low	40	300	60	230
Relative Light Output (%)	Impacts spatial and energy resolution	High	75	15	35	100
Energy Resolution (%)	Influences scatter rejection	Low	10.0	10.1	9.5	7.8
Nonhygroscopic	Simplifies manufacturing, improves reliability and reduces service costs	Yes	Yes	Yes	Yes	No
Ruggedness		Yes	Yes	Yes	No	No

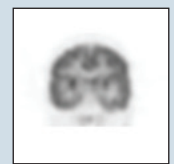
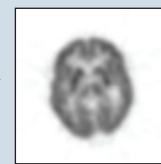
HI-REZ: more than 250% improved volumetric resolution

LSO is capable of tremendous light output, which enables very small individual detector crystals to be produced. The extremely small HI-REZ crystals result in exceptional isometric spatial resolution — an improvement of 250% — without any loss of sensitivity.

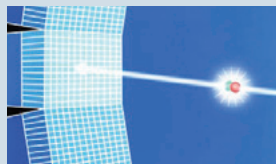
Conventional PET



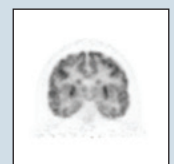
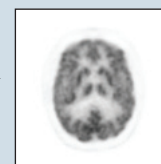
Conventional PET detector block and annihilation



HI-REZ PET



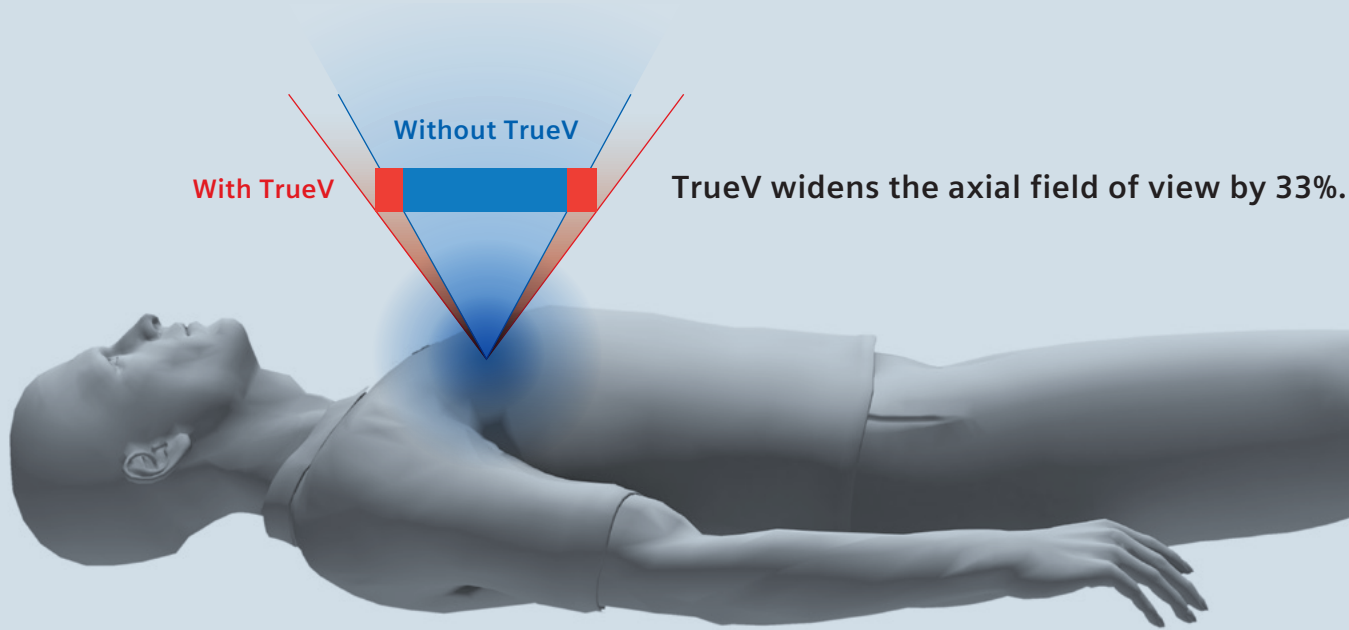
LSO HI-REZ detector block and annihilation



	Conventional PET	LSO HI-REZ PET	Benefit
Crystal Material	BGO	LSO	LSO provides higher throughput
Relative Light Output	<20%	>70%	Greater light output enables smaller crystals and finer spatial resolution
Crystal Size	6.45 mm x 6.45 mm	4.0 mm x 4.0 mm	Smaller crystal size enables finer spatial resolution
Total Number of Crystals	<11,000	24,336 (32,448)*	Greater number of crystals allows finer spatial resolution across scanner field of view
Number of Detector Rings	24	39 (52)*	More detector rings allow greater count rate statistics
Number of Contiguous Image Planes	47	81 (109)*	More image planes facilitate finer sampling
Slice Spacing	3.375 mm	2.0 mm	Thinner slices facilitate reduced partial volume effects
Volumetric Resolution	>200 mm ³	<75 mm ³	Better than 250% finer volumetric resolution for excellent diagnostic confidence

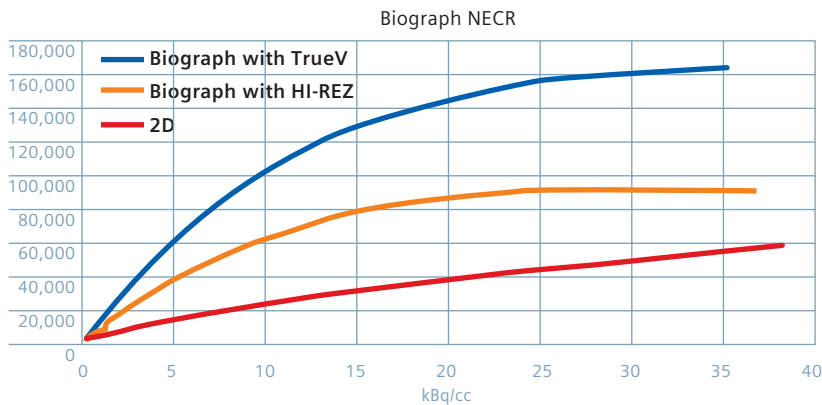
* Optional

TrueV: Extended Field of View



“TrueV extended PET field of view from Siemens has raised all of our expectations as to what PET•CT should be and what it can do to help our patients.”

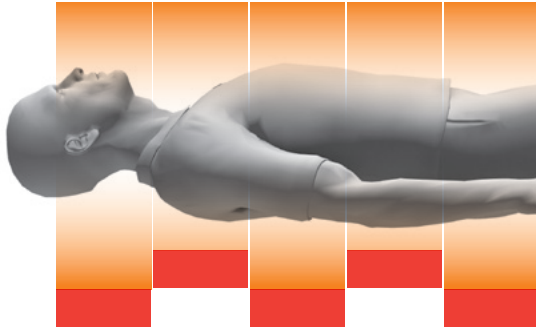
— Dr. David Townsend, University of Tennessee, Knoxville, TN, USA



TrueV widens the axial field of view (FOV) by 33 percent, which increases count rate performance by more than 70 percent, giving you the clinical flexibility to lower dose rates or scan times by 50 percent. To make the most of the additional FOV, the acceptance angle in the 3D PET acquisition is increased. In this way, more lines of response can be measured per a given unit of time. By increasing the lines of response and thereby, the count rate, scanning protocols can be more flexible. With TrueV you can improve image quality while shortening scan time or reducing the injected dose. Shortened scan time results in less patient motion, fewer artifacts and more time for dedicated CT scans.

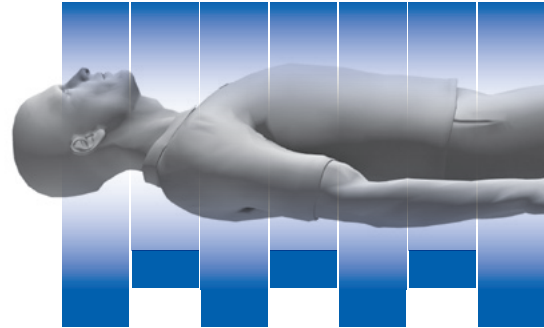
TrueV enables the fastest whole-body scans possible.

Biograph with TrueV



5 bed positions
2 minutes per bed
10 minutes total time

Biograph

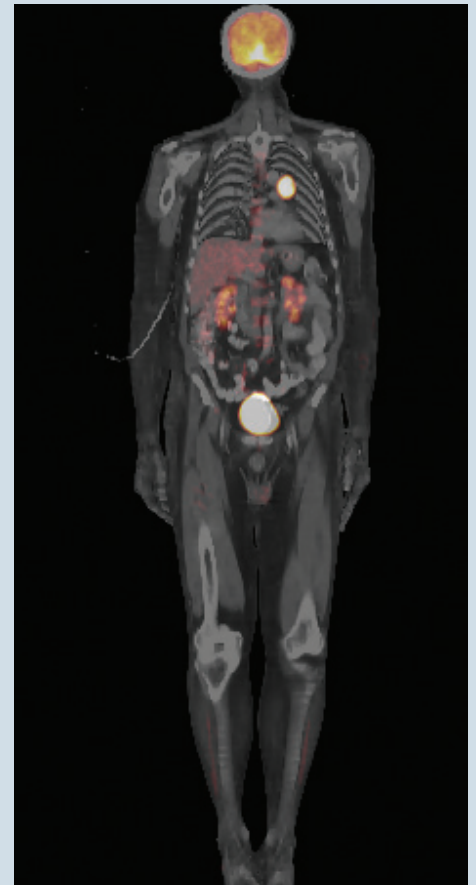


7 bed positions
3 minutes per bed
21 minutes total time

Feature	Biograph	Biograph with TrueV
Axial bed coverage	162 mm	216 mm
Sensitivity	4.2 cps/kBq@435 keV	7.6 cps/kBq@435 keV
NECR	96 kcps	165 kcps
Resolution	4.2 mm	4.2 mm
Total number of detector elements	24,336	32,448
Total number of detector rings	39	52

TrueV enables:

- More than a 70% higher noise effective count rate (NECR) for better image quality
- 2x faster PET•CT for faster imaging
- Half the injected dose



Data courtesy of the University of Tennessee, Knoxville, TN, USA

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