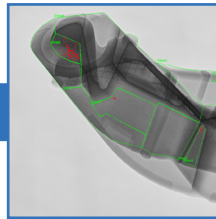
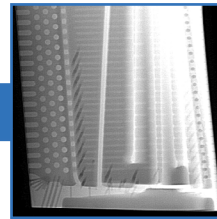


Seifert x|cube series

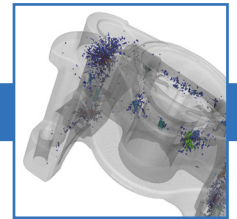
Versatile X-ray system for real-time 2D inspection with 3D computed tomography option



Assisted automatic 2D defect recognition (ADR) in an aluminum casting



Radiographic turbine blade inspection



Precise defect localization and quantitative porosity analysis with 3D CT

Key features & benefits

- Wide application range from automotive's high throughput requirements up to high resolution requirements for aviation casting
- The new 320 kV version comes with maintenance free high voltage plugs and can handle samples up to 300 kg
- Simple loading with extractable parts manipulator
- Max. sample size 600x900 mm (800x1,500 x|cube XL)
- Patented extremely low vibration C arm manipulator, flexible swivel angle of +45° to -45°
- Robust design and intuitive operator guidance with x|touch® control panel and teach and learn functions
- DICOM standard compliant image management
- Optional CT functionality for virtual 3D sections and quantitative porosity analysis



2D X-ray real-time inspection

Flexible automotive and aerospace components assessment

Besides the inspection of safety-relevant castings in the automotive and aerospace industry, the Seifert x|cube is also applied in all areas of industry where there is a need for the fast and effective X-ray inspection of castings, welded structures, plastics, ceramics and special alloys. Its versatility means that it can be used equally well in production, incoming materials inspection and failure analysis environments. Its robust design and the software safety cage ensure it is also ideal for busy industrial areas. The proven Seifert inspection system is now even faster, more flexible and easier to use, while offering a full computed tomography option for when traditional 2D radiography is unable to provide clear results.



Designed for a wide application range

Depending on the inspection task, two x|cube models are available:

- The x|cube Compact is offered with 160 kV, 225 kV or 320 kV, and can handle workpiece dimensions of up to 600 mm diameter and 900 mm height, and an overall weight of up to 100 kg (max. 300 kg at 320 kV).
- The XL model, available with 160 kV or 225 kV, has a larger X-ray protection cabinet and is, thus, suitable for the X-ray inspection of parts with dimensions of up to 800 mm diameter and 1,500 mm height.

Fast, flexible and easy to use

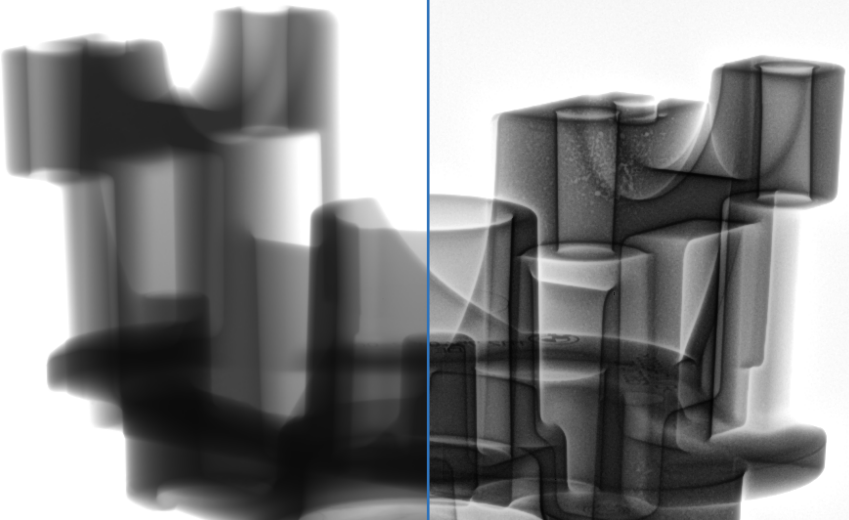
A number of innovative elements ensure that the Seifert x|cube is extremely easy to use. Faster set-up, cycle and image management times result in improved productivity:

- Immediate operational availability without homing
- Fast PLC-type Fanuc servo drives
- Intuitive user guidance with teach and learn capabilities
- x|touch® panel for easy teach-in inspection program creation in less than 30 seconds
- Software safety cage to prevent collisions
- VISTAPLUS software for live, top quality images
- Optional automatic 2D defect recognition (ADR)



Conventional radiography

Flash!Filters™ optimized



Flash!Filters™:

See more – know more

GE's proprietary image optimization technology provides brilliant inspection results optimized for the human eye. This helps significantly to ensure short failure detection times and rich contrast increasing failure detection rate and therefore productivity.

Two options are available:

- Flash!Filters™ for casting inspection
- Flash!Filters™ for weld inspection

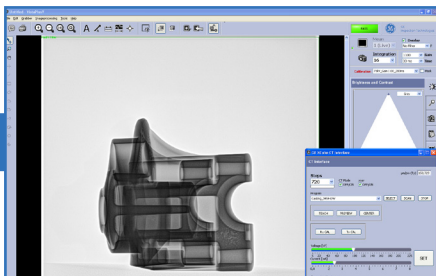
Quantitative 3D failure analysis with CT

Determine the shape, position and size of defects

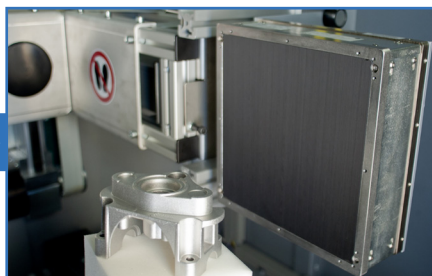
The new computed tomography option converts the Seifert x|cube into an extremely versatile inspection system that also enables detailed 3D inspections. Thanks to the highly dynamic GE DXR digital detectors, it is possible to display the finest contrast differences such as caused by hidden porosity. The program for CT set-up, image acquisition, volume reconstruction and visualization is easy to use. In contrast to 2D X-ray inspection, 3D analysis and process control using volume data offer considerable advantages:

- Reduction of the reject rate due to the 3D analysis of the position, shape and size of defects
- Depending on their size and their absorption behaviour, impurities, such as inclusions or sand core residue in castings or composite delamination, can be detected, located and classified according to their actual density and position

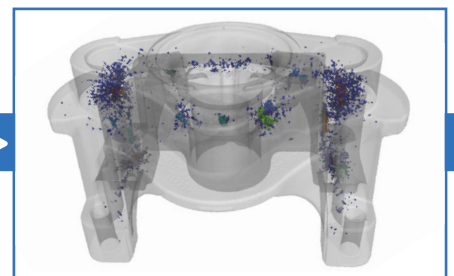
Computed tomography workflow:



With the GE intuitive software it takes just a few clicks to set up the CT scan...



... while the workpiece rotates in the X-ray beam, the extremely fast GE DXR flat panel detector captures a series of 2D radiographic images...



... the reconstructed volume is automatically opened for the 3D analysis and enables, e.g., any virtual sections and quantitative pore analyses.

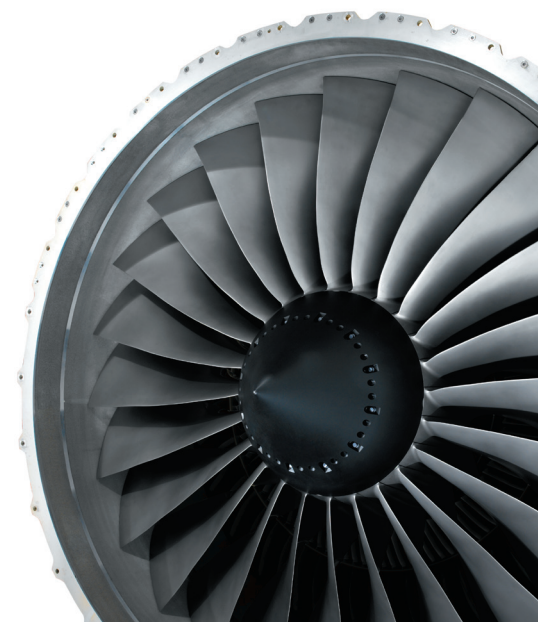
ASTM and DICONDE compliant inspection solution

The x|cube ensures X-ray inspection according to international NDE standards:

- Interface to GE Rhythm software for inspection and automatic image archiving compliant with the international DICONDE standard which incorporates many features that are NDE-focused describing all of the necessary syntax, attributes and data elements

Seifert x|cube – your benefits

- Fast and flexible for a wide range of 160, 225 or 320 kV applications
- Inspection task programming and ADR for high sample throughput
- Intuitive operator guidance
- Visual real-time inspection combined with optional 3D CT capability
- DICONDE compliant digital image analysis and data management
- Modular design configuration for customer oriented solutions
- All relevant hardware and software components are GE technology
- Reduced maintenance – lower operating costs



Technical specifications



Seifert x cube	Compact			XL	
Energy (max.)	160 kV	225 kV	320 kV	160 kV	225 kV
Max. sample size (Ø x height in mm)	600 x 900 **	600 x 900 **	600 x 900 **	800 x 1500**	800 x 1500**
Max. sample weight	100 kg *	100 kg *	300 kg *	100 kg *	100 kg *
Cabinet dimensions, incl. backpack (L x W x H in mm)	2540 x 1700 x 2455	2540 x 1700 x 2455	2540 x 2230 x 2400	2865 x 2106 x 3100	2865 x 2106 x 3100
Cabinet weight approx.	3950 kg	4550 kg	10.500 kg	6550 kg	6550 kg
Control panel weight approx.	350 kg				
Manipulation Travel					
Max. horizontal motion across the X-ray beam	650 mm		660 mm	850 mm	
Max. external loading/unloading position	250 mm		150 mm	250 mm	
Max. horizontal motion magnification axis	650 mm		620 mm	850 mm	
Focus detector distance (FDD)	800-1000 mm		800-1050 mm	1000 - 1200 mm	
Max. vertical motion	900 mm		950 mm	1500 mm	
Max. tilt of the C arm	± 45°				
Max. sample rotation	n x 360°				
2D software	Integrated image optimization system VISTAPLUS, optional with semi-automatic defect recognition (pass/fail assessment by the operator)				
System control	Simple and intuitive system control and programming of recurring inspection tasks thanks to X-Touch® Panel				
Control / Drives	Hardware PLC PC independent / Fanuc servo drives				
Detector options	Selection of various digital flat panel detectors, e.g. temperature stabilized highly-dynamic GE DXR 250RT digital detector for pin sharp live images and very fast CT scans, the GE DXR 500 L detector for particularly high-resolution applications or the DXR 250 providing a large active area				
Flash!Filters™ option	Proprietary live image optimization technology for easier visual defect detection in castings or weldings				
Tube options	Various mini to macro focuses as well as various high-power X-ray tubes up to 320 kV for Compact, 225 kV for XL				
Computed tomography add-on	CT package contains all the required hardware and software components for combined 2D/3D operation with GE detectors				
CT scan range	Max. 170 mm Ø x 170 mm height at DXR 250RT 8"x8" detector				
Min. voxel size	Up to 100 µm, depending on the sample size				
Connection values / capacity	3N PE 400/230V 50/60 Hz, 35 A (160+225 kV), 50 A (320 kV), TN-S or TN-CS network / up to approx. 16 kVA***				
Earthing	Separate earthing for X-ray device and high-voltage generator (< 2 Ω) with at least 6 mm ²				
Means of transport	Complete X-ray protection cabinet with fork lift truck / Control panel (on pallet) with fork lift truck				
Ambient conditions (in accordance with IEC 60 601-1)	Ambient temperature +10° C to +40° C, air pressure 700 hPa to 1060 hPa				
Compliant with national and international standards	ISO 9001; VDE 0100; UW; DIN EN 60204 (VDE 0113); VBG; DIN EN 60529 / IEC 529; German Radiation Control Act (RöV) of 1987 (with amendments in the current version); DIN EN 954-1; CFR 1020.40; DIN 54113				
Radiation protection	The radiation safety cabinet is a full protective installation without type approval according to the German RöV. It complies with French NFC 74 100 and the US Performance Standard 21 CFR Subchapter J. For operation, other official licenses may be necessary.				

* Depends on the loading position.

** Longer workpieces are possible, this involves the workpiece being reloaded and inspected.

*** Depends on the applied X-ray tube

Note: The inspection volume that can be X-rayed varies according to the total wall thickness and the material density.

www.ge-mcs.com/x-ray



GE Sensing & Inspection Technologies GmbH
 Bogenstr. 41
 22926 Ahrensburg
 Germany

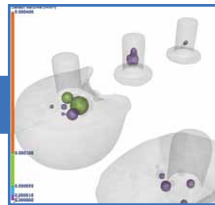
Tel.: +49 4102 807 0
 Fax: +49 4102 807 277
 E-mail: xray.info@ge.com

GE Inspection Technologies, LP
 50 Industrial Park Rd
 Lewistown, PA 17044
 USA

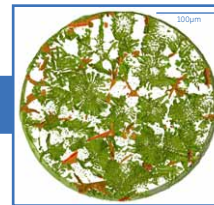
Tel.: 717 242 03 27
 Fax: 717-242-2606
 E-mail: phoenix-usa@ge.com

phoenix nanotom m

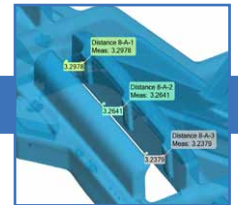
180 kV / 20 W X-ray nanoCT[®] system for high-resolution analysis and 3D metrology



nanoCT[®] of TSVs in an electronic package. The voids in the copper filling are clearly visible.



3D volume slice of an AlMg5Si7 alloy (Ø 350 µm): Fe-aluminides and Mg₂Si-phases.



3D metrology image of an injection molded part showing feature details.

Key features & benefits

- Unique temperature stabilized digital GE DXR detector (3,072 x 2,400 pixels) for a high dynamic range > 10,000 : 1 and up to 4 times faster data acquisition at the same high image quality level
- Granite-based manipulator for high stability
- Max. sample size 240 mm Ø x 250 mm in height
- New open 180 kV / 15 W high-power nanofocus X-ray tube with down to 200 nm detail detectability, optimized for long-term stability
- diamond|window for extremely high focal spot stability and up to 2 times faster data acquisition at the same high image quality level
- Down to 300 nm minimum voxel size
- Optimized ease of use due to intelligent system design and advanced phoenix datos|x CT software
- 3D metrology package with temperature stabilized cabinet and high accuracy direct measuring system

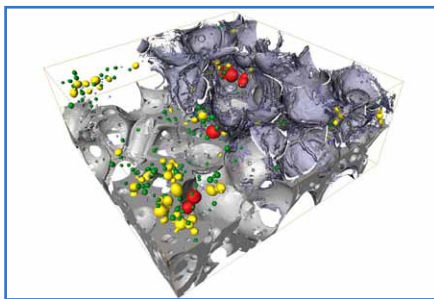


GE imagination at work

phoenix nanotom m

Versatile 3D computed tomography system

High-resolution computed tomography (CT) has become a powerful inspection tool for a wide range of industrial and scientific inspection and metrology applications such as non-destructive structure and failure analysis as well as for quality assurance or production control. With its 180 kV / 20 W ultra high performance nanofocus X-ray tube, precision mechanics and advanced software modules, the phoenix nanotom m is the inspection solution for a wide range of 3D CT applications. Once scanned, the fully three dimensional CT information allows many possibilities for analysis, e.g. non-destructive visualization of slices, arbitrary sectional views, or automatic pore analysis. Since the whole geometry of the object is scanned, precise and reproducible 3D measurements of complex objects and even the automatic generation of first article inspection reports within an hour are possible.



3D nanoCT® evaluation of artificial bone (ceramics matrix with aluminium coating)

nanoCT® – closest to synchrotron CT

With its special design, the nanotom m provides focal spot sizes in the submicron range. Smaller focal spots ensure very little geometric unsharpness and therefore improved image resolution. And due to the new high dynamic range GE DXR detector the system offers long-term stable and optimized image quality.

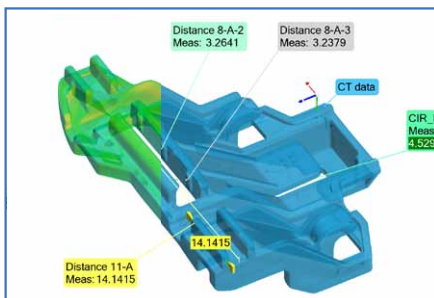
In pursuit of high-resolution images, the potential, convenience and economy of nanoCT can compete in many application fields with limited available synchrotron facilities, e.g.:

- Materials science
- Micro-engineering
- Electronics
- Life sciences
- Geosciences and much more

3D metrology with high-resolution CT

Especially if complex parts with hidden or difficult accessible surfaces have to be measured, CT offers big advantages in comparison with conventional tactile or optical coordinate measuring machines (CMMs). With its optimized 3D metrology package, the phoenix nanotom m includes all essential features for CT with extremely high accuracy and reproducibility:

- Temperature stabilized cabinet
- High accuracy direct measuring system
- Vibration insulation of the manipulator
- Temperature stabilized GE DXR detector for brilliant image quality
- Long-term stability optimized X-ray tube with diamond|window – reduction of artefacts
- 2 calibration objects
- phoenix datos|x software “click & measure|CT” and “metrology”



CAD variance analysis and measurement of 5 features of an injection molded part

First article inspection report in less than 1 hour possible

phoenix datos|x advanced CT software

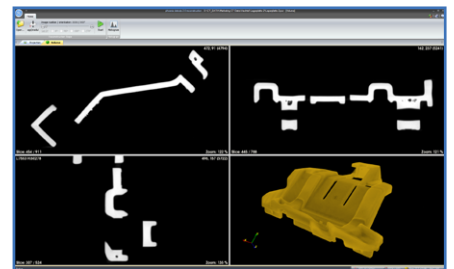
Fully automated data acquisition and volume processing

With datos|x, the entire CT process chain can be fully automated. This minimizes operator time and influence, while highly increasing the repeatability and reproducibility of CT results. Once the appropriate setup is programmed, the whole scan and reconstruction process incl. volume optimization features (e.g. automatic beam hardening correction) or surface extraction can be fully automated. Furthermore, 3D failure analysis or metrology tasks like generation of first article inspection reports can be executed automatically.

Precise, reliable and fast CT results

By using phoenix datos|x CT software, 3D metrology and failure analysis with phoenix|x-ray CT systems becomes as fast and easy as never before

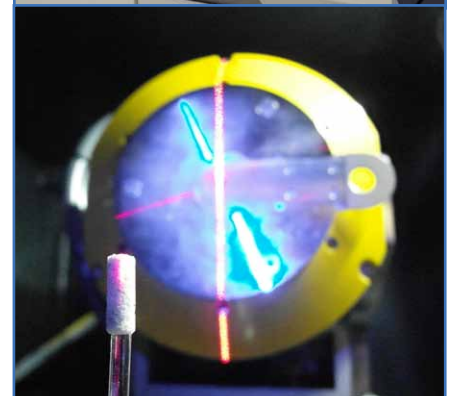
- click & measure|CT: Fully automated data acquisition and volume processing – insert sample, start CT scan, check results
- Reproducible high precision 3D metrology and failure analysis tasks performed with a minimum of operator training
- Significant reduction of required operator time by factor of up to 5
- Wide spectrum of modules for ease of use and accurate CT results
- Accelerated sample throughput due to batch CT scans and up to 9 times faster volume reconstruction



Intuitive graphical user interface for easy usage and a fast learning curve due to clear display of CT results in 2D axis views and 3D render mode.

phoenix nanotom m - Your Advantages

- Unique spatial and contrast resolution on a wide sample range - from small material to medium sized plastic samples covering 3 orders of magnitude (0.25 mm to 250 mm sample size)
- Optimized 3D metrology package for stable acquisition conditions, fast reconstruction within minutes and reproducible measurement results
- Extremely high image quality due to unique temperature stabilized GE DXR detector (3,072 x 2,400 pixels) with a high dynamic range > 10,000 : 1
- Max. sample size 240 mm Ø x 250 mm in height and 3 kg (6.6 lbs.) in weight
- Automatic and continuous adjustment of the magnification
- Optimized ease of use due to system design and advanced phoenix datos|x CT software



New tube design optimized for long-term stability

Technical Specifications & Configurations



	phoenix nanotom s	phoenix nanotom m
X-ray tube type	Proprietary open high-power nanofocus X-ray tube, optimized for long-term stability	
	Optional X-ray tube cooling	Internal X-ray tube cooling
Max. voltage / power	180kV / 20W	
Target	Tungsten on beryllium (optional tungsten on CVD diamond)	Tungsten on CVD diamond for up to 2 times faster data acquisition at the same high image quality level
	Transmission target type, rotatable for multiple use (other target materials, e.g. molybdenum on request)	
Filament	Tungsten hairpin, pre-adjusted plug-in cartridges for fast and easy exchange	
Geom. magnification (3D)	1.7 x - 250x	1.5 x - 300x
Detail detectability	Down to 200 nm (0.2 microns)	Down to 200 nm (0.2 microns)
Min. voxel size	Down to 500 nm (0.5 microns)	Down to 300 nm (0.3 microns)
Detector type	High-Contrast Detector HCD 120-50, 12 bit, 3 x virtual detector enlargement (max. 6,900 pixel detector width)	Temperature-stabilized high dynamic GE DXR, 14 bit, 1.5 x detector enlargement (max. 4,600 pixel detector width)
Pixels	2,300x2,300	3,072 x 2,400
Pixel size	50 µm	100 µm
Manipulation	Granite based 5-axes manipulator with vibration insulation, precision rotation table on air bearings	
Variable focus detector distance	from 200 mm to 500 mm	from 220 mm to 600 mm
Max. sample diameter	< 1 mm to 120 mm	< 1 mm to 240 mm
Max. sample height / weight	150 mm / 2 kg (4.4 lbs.)	250 mm / 3 kg (6.6 lbs.)
Sample travel length Y / Z	150 mm / 300 mm	250 mm / 400 mm
Rotation	0° - 360° x n	
System dimensions	1,630 mm x 1,432 mm x 740 mm (64.2" x 56.3" x 29.1")	1,980 mm x 1,600 mm x 925 mm (78" x 63" x 36.4")
System weight	Appr. 1,300 kg / 2,870 lbs.	Appr. 1,900 kg / 4,190 lbs.
Optional 3D metrology bundle		Temperature stabilized cabinet, high accuracy direct measuring system, calibration object, datos x module packages "metrology" and "click & measure CT"
Software	phoenix datos x 3D computed tomography acquisition and reconstruction software. Different 3D evaluation software packages for 3D metrology, failure or structure analysis on request.	
CT reconstruction	phoenix datos velo CT speed (2 GPUs)	phoenix datos velo CT high-speed (5 GPUs)
Basic datos x modules	auto ROI, sector scan, fast scan, multi scan, multi volume reconstruction, agc module - automatic geometry calibration, bhc+ module - automatic beam hardening correction, rar module - ring artefact reduction,	
Optional modules	datos x module package 3D "metrology", datos x module package "click & measure CT"	
Optional advanced sample manipulation	Manual XY highly accurate positioning table, tensile & compression testing stage system, coolstage specimen cooling unit	
		Motorized XY-table with two linear axes
Radiation protection	The radiation safety cabinet is a full protective installation without type approval according to the German RöV, complies with French NFC 74 100 and the US Performance Standard 21 CFR Subchapter J. For system operation, other official licenses may be necessary	

www.ge-mcs.com/phoenix



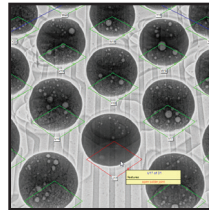
GE Sensing & Inspection Technologies GmbH
 Niels-Bohr-Str. 7
 D-31515 Wunstorf, Germany
 Tel.: +49 5031 172 0
 Fax: +49 5031 172 299
 E-mail: phoenix-info@ge.com

GE Inspection Technologies, LP
 50 Industrial Park Rd
 Lewistown, PA 17044, USA
 Tel.: 717 242 03 27
 Fax: 717-242-2606
 E-mail: phoenix-usa@ge.com

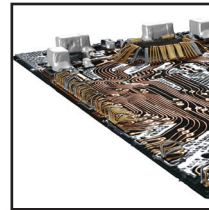
GEIT-31344EN (09/14)

phoenix microme|x / nanome|x

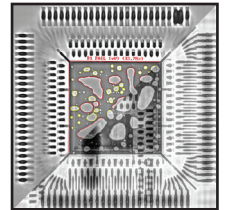
High resolution 180 kV micro- / nanofocus X-ray inspection systems with 3D CT option



Open BGA ball with live CAD data overlay and Flash! Filters™ image optimization



3D Computed Tomography of an USB flash drive



Advanced planarCT evaluation (left) without overlaying features in the X-ray image

Unique features

- Temperature stabilized digital DXR detector with active cooling for high dynamic live imaging
- 180 kV / 20 W high-power micro- /nanofocus tube with up to 0.5 μm or 0.2 μm detail detectability
- x|act package for CAD based μAXI programming and automatic inspection
- diamond|window for up to 2 times faster data acquisition at the same high image quality level
- Optionally 3D computed tomography scans within 10seconds

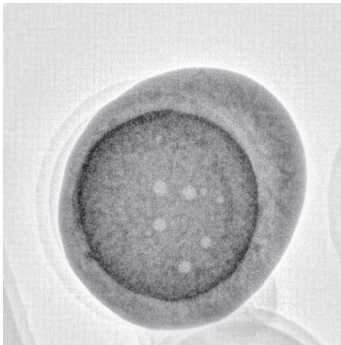


phoenix microme|x / nanome|x

The high performance X-ray inspection solution

The phoenix microme|x and nanome|x series combines high-resolution 2D X-ray technology and 3D CT in one system. Innovative and unique features and an extreme high positioning accuracy make both systems the effective and reliable solution for a wide spectrum of 2D and 3D offline inspection tasks: R&D, failure analysis, process and quality control.

The phoenix|x-ray x|act technology offers easy to program CAD based μ AXI ensuring automated inspection in the micrometer range. Another unique benefit is GE's highly dynamic DXR flat panel detector with active cooling. Offering up to 30 frames per second, it provides outstanding brilliant live imaging and fast data acquisition for 3D CT.



Flash! filtered voids in an open μ BGA ball: 1,970x geometric zoom for extreme high magnification

Brilliant DXR-*HD* live imaging

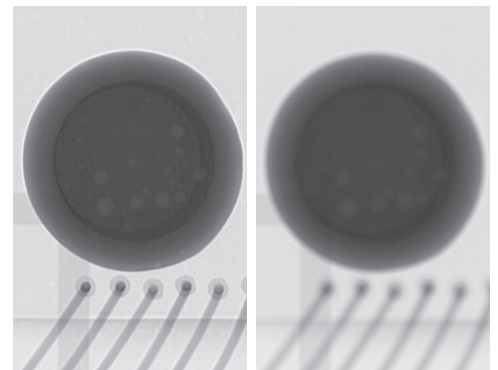
With GE's proprietary high dynamic DXR detector with enhanced scintillator technology phoenix|x-ray introduces a new industry standard for efficient live inspection:

- Full frame rate of 30 frames per second at 1000x1000 pixels offers low noise coupled with brilliant image quality ensuring fast and detailed live inspection
- Active temperature stabilization for precise and reliable inspection results
- Extremely fast data acquisition in 3D CT mode
- Detail detectability down to $0.5 \mu\text{m}$ / $0.2 \mu\text{m}$ for high performance failure analysis

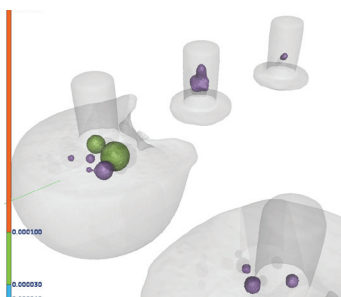
High output with high-resolution: diamond|window

Compared to conventional beryllium targets, the diamond|window allows higher power at a smaller focal spot. This ensures high-resolution even at a high output.

- Up to 2 times faster CT data acquisition at the same high image quality level
- High output with high-resolution
- Non-toxic target
- Improved focal spot position stability within long term measurements
- Increased target lifetime due to less degradation with higher power density



diamond|window beryllium window
(same X-ray tube parameter: 130 kV, 11.4 W)



nanoCT® of TSVs in an electronic package. The voids in the copper filling are clearly visible.

High-resolution 3D computed tomography

For advanced inspection and 3D analysis of smaller samples, phoenix|x-ray's proprietary 3D CT technology is optionally available.

- 180 kV high power X-ray technology, fast image acquisition with DXR detector and diamond window combined with phoenix|x-ray's fast reconstruction software deliver high quality inspection results
- Maximum voxel resolution down to 2 microns; the nanoCT® capability of the nanome|x allows even a higher image sharpness

x|act - CAD based inspection:

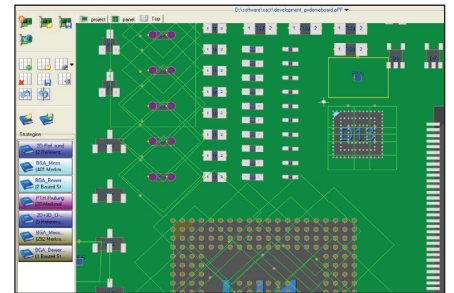
high resolution μ AXI for extremely high defect coverage

As a solution for μ AXI with extremely high defect coverage, phoenix|x-ray provides its high precision systems micromex and nanomex including the unique x|act software package for fast and easy offline CAD programming. Outstanding precision and repeatability, small views with resolutions of only a few micrometers, 360° rotation and oblique viewing up to 70° ensures meeting highest quality standards - even for inspection of components with a pitch of just 100 microns. Besides automated inspection, x|act ensures an easy pad identification by its live CAD data overlay function even in manual inspection while Flash! Filters™ image optimization ensures high defect coverage.

Efficient CAD programming

x|act provides not only a minimal setup time compared with conventional view based AXI - once programmed, the inspection program is portable to all x|act compatible systems.

- Easy pad-based offline programming
- Specific inspection strategies for different pad types
- Fully automated inspection program generation
- Extremely high positioning accuracy even at oblique viewing and rotation
- Easy pad identification in manual X-ray inspection
- High reproducibility on large PCBs



Fast and easy programming: just assign the inspection strategies and let x|act generate the automated inspection program

Virtual board slicing with planarCT

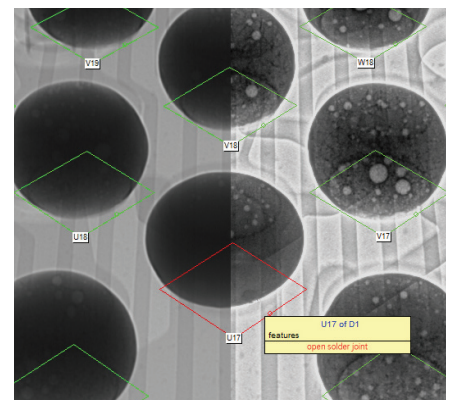
- Easy 2D slice or 3D volume evaluation of large complex boards
- No board cutting, no overlaying structures as in X-ray images



planarCT slice or multislice views allow exact inspection results of a single plane or a whole package

micro- / nanomex – Your Advantages

- Brilliant live inspection images due to high dynamic GE DXR digital detector array
- Unique high power 180 kV / 20 W submicron or nanofocus* tube for even high absorbing electronic samples
- Minimized setup time due to highly efficient automated CAD programming
- Live overlay of CAD and inspection results even in rotated oblique inspection views
- Extremely high defect coverage and repeatability
- Detail detectability down to 0.5 μ m or even 0.2 μ m
- Optional Flash! Filters™ image optimization technology
- Optional advanced failure analysis with high resolution 3D micro- or nanoCT® or large board planarCT
- Optional 3D CT scans up to 10 seconds



x|act provides live CAD overlay and inspection results in the X-ray live image - at any time, at any viewing angle. GE's exclusive Flash! Filters technology option enables faster, more reliable failure detection (right)

* Nanofocus 20 W only with diamond window, otherwise 15 W

Technical Specifications & Configurations



System magnification and resolution

Geometric magnification: DXR max. 1,970 x; max. 2,130 x with image intensifier
Total magnification: DXR max. 2,660 x; max. 22,150 x with image intensifier
Detail detectability: up to 0.5 µm; nanome|x up to 0.2 µm

180 kV microfocus or nanofocus X-ray tube

Type: Low maintenance open microfocus tube with unlimited lifetime, transmission type, 170° cone angle, collimated
Maximal tube voltage: 180 kV
Maximal tube output: 20W (15 W nanofocus tube without diamond window)
Target: Optional non-toxic diamond|window (tungsten on CVD support) for up to 2 times faster data acquisition at the same high image quality level
Filament: Tungsten hairpin, pre-adjusted in plug-in cartridges for fast and easy exchange

X-ray detector

Type: High dynamic GE DXR250RT, temperature stabilized with active cooling for brilliant live imaging and extremely fast CT data acquisition. (Image intensifier and for nanome|x dual|detector configuration also available.)
Pixels: 1000 x 1000 pixels
Resolution (pixel size): 200 x 200 micrometer
Frame grabbing rate: Up to 30 fps at full frame

Precise manipulation

General construction: high-precision vibration-free synchronised 5-axes manipulation
Max. inspection area: 460 mm x 360 mm (18" x 14")
610 mm x 510 mm (24" x 20") without rotation table
Max. sample size/weight: 680 mm x 635 mm (27" x 25")/ 10 kg (22 lbs.)
ovhm – oblique view at highest magnification : continuously adjustable view angle up to 70°, rotation 0° - 360°
Control: Joystick or mouse control (manual mode) and CNC (automatic mode)
Manipulation aids: sample X-ray mapping, click'n-move-to function, click'n-zoom-to function, automatic isocentric manipulator movement, laser crosshair
Anti-Collision System: may be deactivated for maximum magnification (tube touching the sample)

System dimensions

Dimensions (W x H x D): 2,020 mm x 1,920 mm x 1,860 mm (79.5" x 75.6" x 73.2"); (D with console: 2,160 mm (85")
Min. transportation width: 1,560 mm (61.4")
Weight: appr. 2,600 kg / 5,732 lbs.

Radiation Protection

The radiation safety cabinet is a full protective installation without type approval according to the German RöV and the US Performance Standard 21 CFR Subchapter J. For operation, other official licenses may be necessary

Advanced image processing

phoenix x|act: comprehensive CAD based X-ray inspection software comprising image enhancement functions, measuring functions and fast and easy automated CAD based programming for automatic inspection
bga|module (standard): Intuitive automatic view based BGA solder-joint evaluation incl. automatic wetting analysis
vc|module (standard): Intuitive automatic view based voiding calculation software package incl. capability of multiple die attach voiding evaluation

Software Configuration (Option)

x|act BGA check strategy: automated CAD based analysis of BGA solder joints
x|act PTH check strategy: automated CAD based analysis of PTH solder joints
qfp|module: automated QFP solder joint evaluation
qfn|module: automated inspection of QFN / MLF solder joints
pth|module: automated pin-through-hole solder joint evaluation
c4|module: view based evaluation of round solder joints with background structure, such as C4 bumps
m|module: view based registration of multilayer printed circuit boards
quality|review: visual interface for rework and failure indication
Flash! Filters™: GE's exclusive image optimization technology
planarCT module: Non destructive 2D slice and 3D volume board evaluation incl. 3D|viewer software

Hardware Configuration (Option)

Tilt/rotate unit: tilt ± 45° and rotation n x 360° for samples up to 2 kg
Manual bar code reader: for product identification

Computed Tomography (Option)

Upgrade package for combined 2D/3D (computed tomography) operation
CT-unit: precision rotation axis
Volume acquisition / reconstruction software: phoenix datos|x
Max. geom. magnification: 100 x (CT)
Max. voxel resolution: down to 2 µm, resolution depending on the sample size. The nanoCT® function of the nanome|x allows a higher image sharpness.



www.gemeasurement.com/x-ray

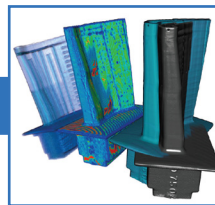


GE Sensing & Inspection Technologies GmbH
phoenix|x-ray
Niels-Bohr-Str. 7
D-31515 Wunstorf
Germany
Tel.: +49 5031 172 0
Fax: +49 5031 172 299
E-mail: phoenix-info@ge.com

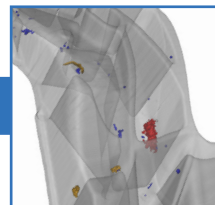
GE Inspection Technologies, LP
50 Industrial Park Rd
Lewistown, PA 17044
USA
Tel.: 717 242 03 27
Fax: 717-242-2606
E-mail: phoenix-usa@ge.com

phoenix v|tome|x m

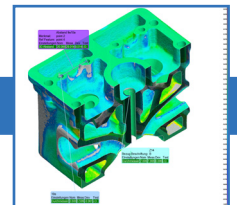
Powerful versatile X-ray microfocus CT system for 3D metrology and analysis with up to 300 kV / 500 W



3D analyses of a scanned turbine blade.



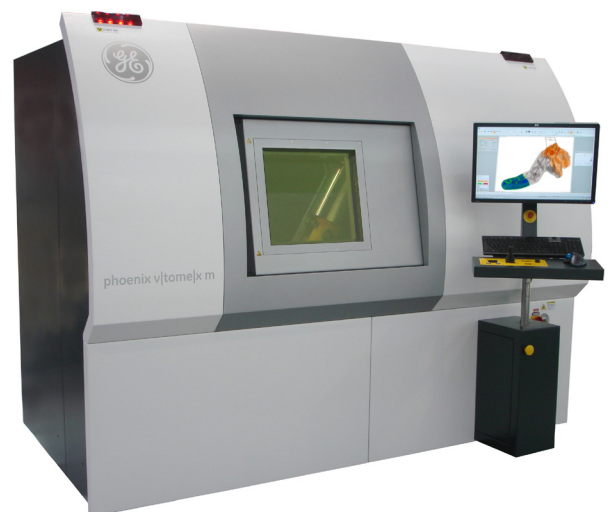
Automatic pore volume analysis in an aluminum casting.



3D measurements and nominal-actual CAD comparison on an aluminum cylinder head.

Key features & benefits

- scatter|correct: highly improved CT quality level compared to conventional mikrofocus cone beam CT
- Industry leading magnification and power at 300 kV for high absorbing samples on a wide application range
- Unique dual|tube configuration for high power μ CT as well as high resolution nanoCT[®]
- First compact 300 kV microfocus CT system with $1 \mu\text{m}$ detail detectability
- metrology|edition for precision measurements with up to $4+L/100 \mu\text{m}$ referring to VDI 2630 guideline*
- Max. sample size up to 500 mm \varnothing x 600 mm in height; 3D scanning area max. 290 mm \varnothing x 400 mm; up to 50 kg (110 lbs.)

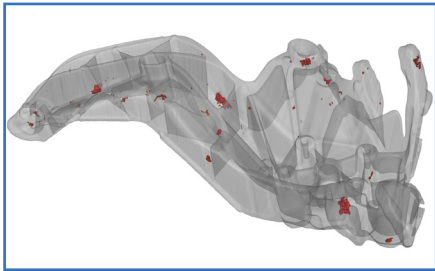


phoenix v|tome|x m

High-end tool for 3D industrial and scientific analysis tasks

Within the phoenix v|tome|x m, GE's unique 300 kV microfocus X-ray tube is for the first time available in a compact CT system for industrial process control as well as for scientific research applications. Beyond down to $< 1 \mu\text{m}$ detail detectability, the system offers industry leading magnification and power at 300 kV. GE's high dynamic DXR digital detector array and the click & measure|CT automatization functionality make it an efficient 3D tool for industrial inspection and scientific research. Due to its dual|tube configuration, detailed 3D information for an extremely wide sample range is provided: from high resolution nanoCT® of low absorbing samples up to high power μCT applications such as turbine blade inspection.

Industrial non-destructive 3D testing

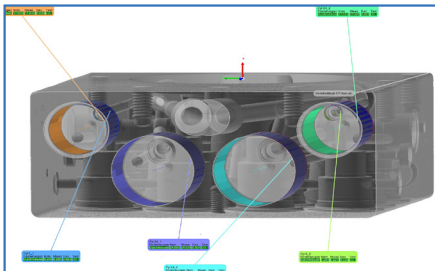


Automated 3D porosity analysis in an automotive control arm

Beyond high-resolution 3D analysis in R&D and failure analysis labs, the phoenix v|tome|x m allows even 3D production control due to its powerful 300kV tube and high dynamic detector technology for fast CT acquisition, fast velo|CT volume reconstruction and its high automation grade. Applications are, e.g., in light metal casting, electronics assembly, plastics molding as well as in turbine blade inspection:

- Internal defect analysis / 3D quantitative porosity analysis
- Assembly control
- Materials structure analysis

Reproducible precision 3D metrology with CT

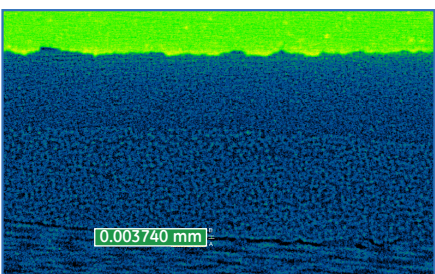


3D metrology of internal features of a valve block made of high grade aircraft aluminum

Especially if complex parts with hidden or difficult accessible surfaces have to be measured, 3D CT offers big advantages in comparison with conventional tactile or optical coordinate measuring machines (CMMs) e.g. for work piece qualification and fast first article inspection. Optimized for long term stability and equipped with its specific 3D metrology package and advanced scatter|correct technology, the phoenix v|tome|x m includes all essential features for CT with extremely high accuracy and reproducibility:

- Accuracy specification of $4+L/100 \mu\text{m}$ referring to VDI 2630 guideline*
- Nominal-actual CAD comparison
- Dimensional measurements / wall thickness analysis
- Reverse engineering / tool compensation

Explore the 3rd dimension of science



nanoCT® of an aluminium plate (green) welded with carbon fibers in polyamide matrix

With its high resolution 180 kV nanoCT® option, the new phoenix v|tome|x m opens a non destructive third dimension for scientific research down to the submicron scale - with no required preparation, slicing, coating or vacuum treatment. Analyze biomedical, materials science, composite, electronics or geological samples with down to < 1 micron voxel size.

Compact CT system with unique dual|tube combination

phoenix datos|x CT software

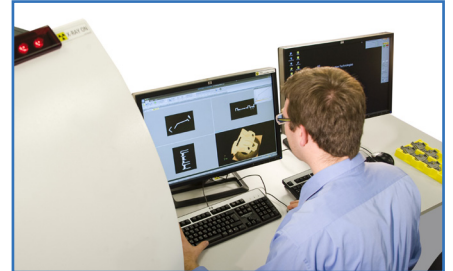
Fully automated data acquisition and volume processing

With datos|x, the entire CT process chain can be fully automated. Once the appropriate setup is programmed, the whole scan and reconstruction process as well as 3D failure analysis or metrology evaluations like generation of first article inspection reports can be executed automatically.

Precise, reliable and fast CT results

By using phoenix datos|x CT software, 3D metrology and failure analysis with phoenix|x-ray CT systems becomes as fast and easy as never before.

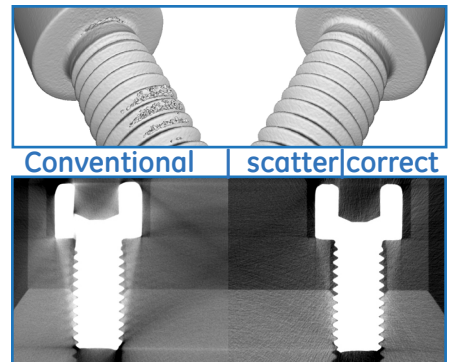
- click & measure|CT: Fully automated data acquisition and volume processing – insert sample, start CT scan, check results
- Reproducible high precision 3D metrology and failure analysis tasks performed with a minimum of operator training
- Significant reduction of required operator time by factor of up to 5
- Wide spectrum of modules for ease of use and accurate CT results



Easy and user friendly CT operation and evaluation.

Unique scatter|correct technology

GE's breakthrough scatter|correct technology innovation is exclusively available in industrial microCT for the v|tome|x m system. This technological advancement automatically removes scatter artifacts from the CT volume, allowing users to gain significant improved CT results compared to conventional cone beam microCT.



Compared with conventional cone beam CT, scatter|correct significantly improves the result quality of CT

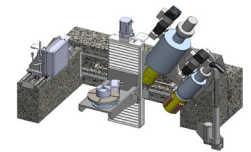
phoenix v|tome|x m - Your Advantages

- Reduced CT artifacts by up to 300 kV X-ray radiation and advanced, high quality scatter|correct option
- High precision 3D metrology referring to VDI standard 2630 and non destructive testing tasks performed with minimal operator training
- Increased 3D inspection throughput due to high power X-ray tube, efficient, fast detector technology and a high grade of automation
- Very high image quality due to unique GE DXR detector array with an extremely high dynamic range
- All major hardware and CT software components of the system are proprietary GE technology optimally compatible with one another
- Significant reduction of required operator time by using the click & measure|CT functionality
- Stability optimized CT acquisition conditions due to temperature stabilized X-ray tube, digital detector array and cabinet



The unique 300 kV microfocus X-ray tube allows 3D scans even of large or high absorbing work pieces.

Technical Specifications & Configurations



	phoenix v tome x s	phoenix v tome x m**
X-ray tube type	Open directional high-power microfocus X-ray tube, closed cooling water circuit. Optional additional (open) transmission high power nanofocus X-ray tube	
Max. voltage / power	240 kV / 320 W	300 kV / 500 W. Alternatively available with 240 kV / 320 W microfocus X-ray tube
	Optional additional 180 kV / 15 W in dual tube configuration. Easy tube exchange just by a push of a button	
Geometrical magnification (3D)	1.46 x to 100 x; up to 200 x with nanofocus tube	1.3 x to 100 x at 800 mm FDD (min. sample Ø 2 mm), up to 200 x with nanofocus tube
Detail detectability	Down to < 1 micron (microfocus tube); optional down to < 0.5 micron (nanofocus tube)	
Min. voxel size	Down to 2 microns (microfocus tube)	Down to 1 micron (microfocus tube)
	Optional down to < 1 micron (nanofocus tube)	
Measurement accuracy		4+L/100 µm referring to VDI 2630-1.3 guideline* /**
Detector type (all according US ASTM E2597-07 standard)	Temperature stabilized digital GE DXR detector array, 200 µm pixel size, 1,000 x 1,000 pixels, 200 x 200 mm, extremely high dynamic range > 10000:1, 2x detector enlargement	Temperature stabilized digital GE DXR detector array, 200 µm pixel size, 2000 x 2000 pixels, 400 x 400 mm, extremely high dynamic range > 10000:1
	Optional 400 x 400 mm large 4 MPixel DXR detector (without detector enlargement)	
Manipulation	6-axes metal precision manipulator	Granite based precision 5-axes manipulator (6-axes with detector shift)
Focus-detector-distance	800 mm	800 mm fixed
Max. sample diameter x height	max. 3D scanning size up to 260 mm x 420 mm	360 mm x 600 mm; up to 500 x 600 mm with limited travel range, max. 3D scanning size up to 290 mm x 400 mm
Max. sample weight	max. up to 10 kg (220 lbs.)	High accuracy CT up to 20 kg (44 lbs.); max. up to 50 kg (110 lbs.)
Focus object distance (micro-focus tube)	7 mm to 545 mm	8 mm to 600 mm at FDD 800 (min. sample Ø 2 mm)
System dimensions W x H x D	2,170 mm x 1,690 mm x 1,500 mm (85.4" x 66.5" 59")	2,620 mm x 2,060 mm x 2,980 mm (103" x 81" x 117.3) D 1,570 mm (62") without user panel and generators
System weight (without ext. components)	Appr. 2,900 kg / 6,400 lbs.	Appr. 7,960 kg / 17,550 lbs. (300 kV configuration) Appr. 6,410 kg / 14,150 lbs. (240 kV configuration)
Temperature stabilization	Active X-ray tube cooling temperature stabilized detector	Active X-ray tube cooling temperature controlled cabinet temperature stabilized detector
Optional scatter correct hard-/software bundle (also upgrade option)		CT quality like 2D fan beam CT with minimized scatter radiation artifacts. Max. scan diameter: 260 mm, geom. magnification 1,51x - 100x
Opt. 2D inspection bundle	Tilt and rotation axes for tilted 2D inspection of samples up to 10 kg (22 lbs.) 2D inspection software	
Opt. 3D metrology bundle** (also upgrade option)	High accuracy direct measuring system 2 calibration objects phoenix datos x CT software package "metrology"	
Opt. nanoCT® bundle	180 kV / 15 W high power nanofocus tube Precision rotation unit with air bearings diamond window	
Opt. click&measure CT	Optional fully automated CT process chain	included
Software	phoenix datos x 3D computed tomography acquisition and reconstruction software. Different 3D evaluation software packages for 3D metrology, failure or structure analysis on request	
Radiation protection	The radiation safety cabinet is a full protective installation without type approval according to the German RöV. It complies with French NFC 74 100 and the US Performance Standard 21 CFR Subchapter J. For operation, other official licenses may be necessary.	

* Measured as deviation of sphere distance in tomographic static mode SD(TS), method details referring to VDI 2630-1.3 guideline on request, valid only for phoenix v|tome|x m metrology edition

** phoenix v|tome|x m metrology|edition only available in specific countries at present, more information on request



GE Sensing & Inspection Technologies GmbH
 phoenix|x-ray
 Niels-Bohr-Str. 7
 31515 Wunstorf, Germany
 Tel.: +49 5031 172 0
 Fax: +49 5031 172 299
 E-mail: phoenix-info@ge.com

GE Inspection Technologies, LP
 50 Industrial Park Rd
 Lewistown, PA 17044, USA
 Tel.: 717 242 03 27
 Fax: 717-242-2606
 E-mail: phoenix-usa@ge.com

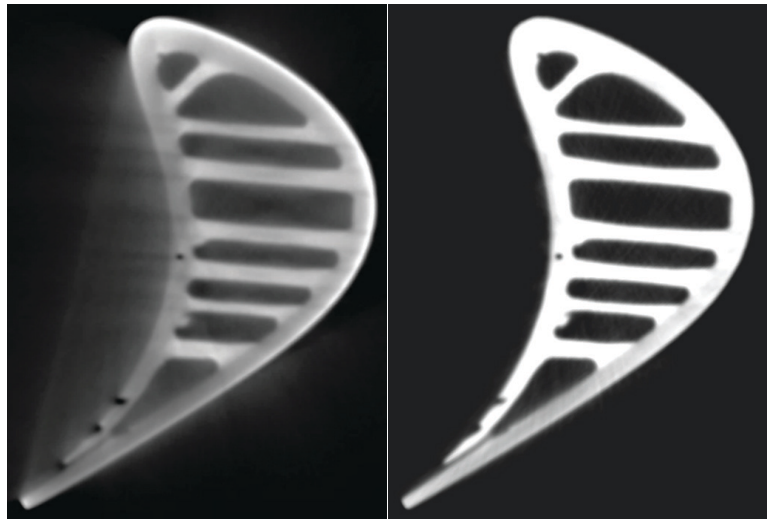
www.gemeasurement.com/x-ray

scatter|correct

Unique tool for high quality scatter reduced industrial CT scans acquired in significantly shorter scan time

Key features & benefits

- Low artifact high precision performance of fan beam CT combined with up to 100 times faster* inspection speed of cone beam CT
- Provides significant quality improvement not only for high scattering materials such as steel and aluminium, but also for composites and multi material samples
- Proprietary GE technology - exclusively available as option for the industrial mini- and microCT scanner phoenix v|tome|x c and m as well as upgrade package for installed m systems



*) While a typical fan beam CT scan of 1000 slices requires 1 minute per slice = 1000 minutes, a cone beam CT scan requires only 10 minutes.

Conventional cone beam CT with scatter radiation artifacts

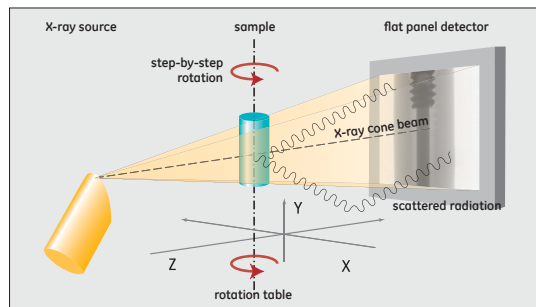
Advanced scatter|correct cone beam CT



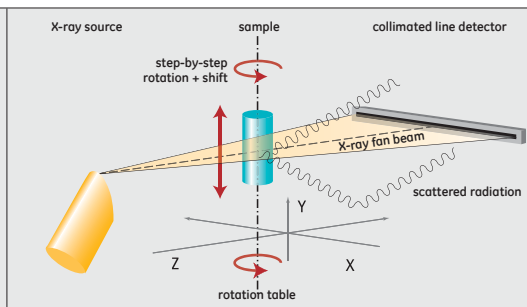
The problem: scattered radiation decreasing CT speed or quality

At industrial **cone beam CT**, a high dynamic flat panel detector capturing thousands of slices parallel is being used for generating volumetric data of the whole scan part comparatively fast in just one 360° rotation. Until now, X-ray scatter resulting in spurious X-rays meeting the detector array from directions not along the source-detector path **negatively impacts the CT quality**.

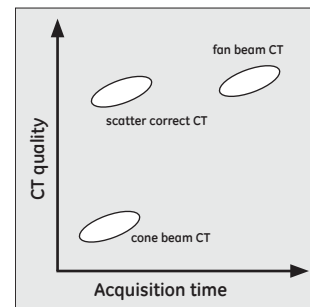
To significantly reduce scattering artifacts at high X-ray energy, **fan beam CT** with collimated line detector arrays has been the ultimate solution for decades. Due to acquiring data for only one CT slice at a time and vertically shifting the sample in the fan beam to repeat the procedure few hundred times, this CT technique **requires hours instead of minutes per CT scan**.



Conventional **cone beam CT** with scattered radiation hitting the detector

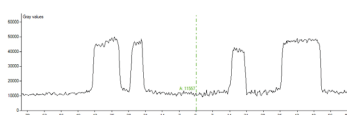
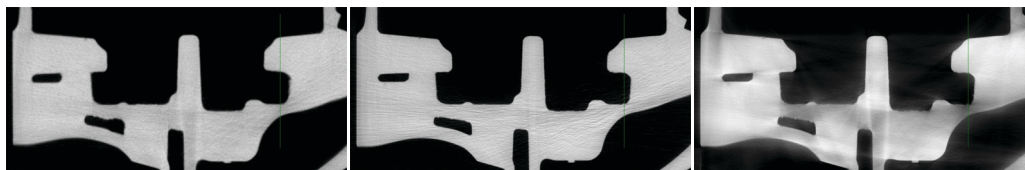


Scatter artifact reduced slice-by-slice **fan beam CT**

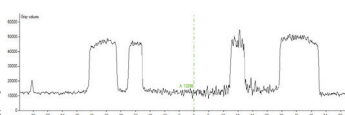


Relation between acquisition time and CT quality

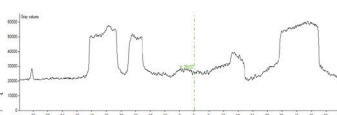
The solution: scatter|correct for high speed, high quality CT scans



Conventional fan beam CT
2 hrs. scan time



scatter|correct optimized
9 min. scan time*



Conventional cone beam CT
9 min. scan time

*) scatter|correct requires one initial correction scan per part type

For industrial process control, excellent CT quality at high sample throughput is evident.

GE's proprietary scatter|correct option is a combination of hard- and software advances allowing users to scan large sample batches in reasonable time as well as significantly reducing scattering artifacts to improve the precision of failure analysis and 3D metrology inspection tasks.

scatter|correct - Your Advantages

- GE's proprietary scatter|correct functionality allows customers to gain CT quality never before reached with industrial flat panel based cone beam CT
- Combining high precision fan beam CT quality with high throughput of fully automated cone beam CT
- Clearly improved quantitative volume evaluation, e.g. automatic defect recognition or precise 3D metrology of difficult to penetrate multimaterial objects
- Significantly increased inspection productivity allowing CT to migrate from R&D applications to serial inspection on the production floor



www.ge-mcs.com/x-ray

GEIT-31352EN (11/15)