




X-ray and CT technology
for industrial applications



Get the inside picture of complex industrial parts, by looking into the internal structure. Then use CT capability to qualify and quantify any inner or outer dimension in a smooth, non-destructive process.

Industrial X-ray and CT systems bring high accuracy and the ability to measure internal and external dimensions simultaneously without destroying the part. Furthermore, they provide additional insight through the fourth dimension of material density, rapidly making the enabling technology a must-have tool in the quality toolbox.

Exhibiting a broad application reach

Microfocus X-ray and CT technology has evolved over the last ten years to the extent that it is a mainstream metrology technology used for a diversity of applications. The range of applications is growing constantly across the automotive, aerospace, energy, medical and consumer sectors, dealing with plastics, metals and exotic materials.

A legacy in X-ray and CT

Nikon Metrology is dedicated to industrial micro-focus X-ray and CT, as the company built up an install base of several hundreds of inspection systems. CT specialists in Tring, UK, develop complete systems, incorporating proprietary microfocus X-ray sources, high-precision 5-axis fully programmable manipulator and fast reconstruction software that runs on industrial grade PCs.

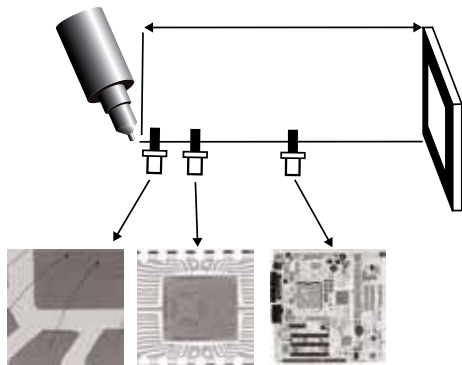
Commercial firms and research organizations purchase X-ray and CT systems that vary in size from the smallest cabinet system up to a customized 50-ton 450kV walk-in inspection room. Installations in the field are used to create digital 3D volumes ranging from the smallest of features within micro components to the contents of large soil samples. If you cannot find a system that suits your specific requirements, Nikon Metrology can probably develop one for you.

WITH CT SCANNING YOU CAN:

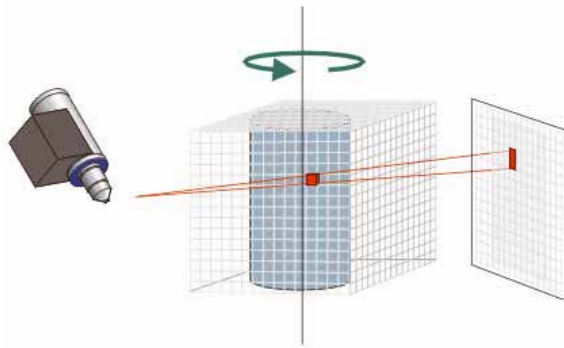
- Verify complex internal structures
- Isolate and inspect included components
- Measure dimensions without sectioning the sample
- Automatically detect and measure internal voids/volumes
- Strip external surfaces from view with ease

Introducing industrial microfocus X-ray and CT

Insight into the inside



Moving the sample closer to the X-ray source increases the magnification of the resulting image



As the component is rotated around its axis while taking X-ray images, a full 3D CT volume is generated.

X-ray technology

X-ray or radiography is fundamentally very straightforward. You place an object on a rotary stage in between an X-ray source and detector. A high-precision microfocus source generates the X-ray radiation and transmits the rays through the sample. A digital flat panel detector captures a 2D image of the X-rays patterns that passed through the specimen, showing different shades of gray depending on material and geometry. Thicker or denser material – such as iron, copper, and lead – translate into darker areas than thin or light materials such as plastics, paper or air.

Computed Tomography (CT)

To generate a 3D CT volume, a series of sequential 2D X-ray images is taken as the object rotates 360 degrees. The images then go through a reconstruction software algorithm that generates a 3D volumetric map of the object. In addition to the outer surface, the volume contains the internal surfaces as well as the complete internal structure that is gained through the fourth dimension density. You can navigate the CT volume as if you are walking through the specimen. This makes it easy to take measurements and trace otherwise invisible assembly errors or structural material imperfections.

Serving multiple purposes

X-ray is typically used for quick manual or automated visual inspection, CT scanning for in-depth analysis supporting research and troubleshooting.

- Defect checks
- Porosity analyses
- Assembly inspection
- Damage analysis
- Inspection of materials
- Dimensional metrology
- Reverse engineering
- Comparison of geometries



CT reconstruction and analysis of a diesel injector component

XT H 160 and XT H 225 Series

All-round X-ray and CT inspection

Detailed capture and measurement of internal component and assembly features is often vital for quality control, failure analysis and material research. The entry-level XT H 160 and the versatile XT H 225 systems offer a microfocus X-ray source, a large inspection volume, high image resolution and is ready for ultrafast CT reconstruction. They covers a wide range of applications, including the inspection of small castings, plastic parts and complex mechanisms as well as researching materials and natural specimens.

Proprietary 160kV and 225kV microfocus X-ray sources

At the core of the industrial XT H 225 inspection system is a 225kV microfocus X-ray source. It is worthwhile taking a closer look at the X-ray tube and target combination because it has a huge impact on system accuracy and performance. The default microfocus source is equipped with a reflection target, offering a 3 micron spot size. With the optional transmission target, you give in a little bit on power in favor of an even smaller spot size and higher magnification capability. Regardless of the target of choice, the XT H 225 system uses an open-tube X-ray source that has a much lower cost-of-ownership than competitive closed-tube sources.



The XT H 225 ST system variant offers a larger inspection cabinet. The XT 225 LC offers a larger walk-in cabinet. Nikon Metrology can also provide a wide range of customer-specific x-ray and CT configurations. To receive more info, please contact Nikon Metrology.

Measure parts other 225kV sources cannot

Nikon Metrology is the only company to produce a 225kV rotating target X-ray source. Using a rotating target, the electron beam falls on a moving instead of a fixed surface, which yields much more effective cooling. In this way the power in the electron beam can be doubled without significantly degrading the spot size while the X-ray intensity can increase 3-5 times. This offers the opportunity to measure objects faster, or measure either denser or larger objects than those that can be measured using the default 225kV source.

- **Easy operation**

Users are operational with the system within 3 days. An extra tilt axis helps them recognize internal features faster. A CT wizard guides them through the data acquisition.

- **Stunning images**

A small spot size and a high-resolution flat panel create sharp images. Adapt resolution to your needs: full part in coarse resolution and high resolution in a desired region of interest.

- **High performance**

The complete system is optimized for real-time visualization and processing. Market-leading CT reconstruction software runs on a PC built from off-the-shelf components.



XT H 225

XT H 320 and XT H 450 systems

Inspecting larger and denser specimens

Nikon Metrology breaks new ground in micro-CT by adding more powerful microfocus X-ray sources to its solutions portfolio. Microfocus sources at this energy are needed to run highly accurate inspection on dense industrial objects, such as large castings and single-crystal metal alloy turbine blades.



XT H 450

- **Easy automation**

Customizable macros automate the measurement workflow, and tight integration with industry-standard post-processing applications streamline the decision making process.

- **Safety first**

Full protective enclosure – compliant to CE and DIN 54113 radiation safety standards – requires no special badges or protective clothing. Continuous fail-to-safe monitoring during system operation.

- **Low cost-of-ownership**

The open X-ray tube allows for local maintenance of internal tube components. No special floor treatment needed. 3-wheel transportation incorporated to easily maneuver through double-door entries.

First to introduce 320-450kV microfocus sources

Most system suppliers only offer microfocus sources up to 225kV, while more powerful sources in their offerings are minifocus. Nikon Metrology is the only company to produce both 320kV and 450kV microfocus X-ray sources. As the X-ray spot size of these sources is orders of magnitude smaller compared to minifocus sources, end users benefit from superior resolution, accuracy and a wider array of measurable parts.

Unique system configuration for turbine blade inspection

When X-rays penetrate material, they are absorbed but also scattered, an undesired phenomenon that increases with the density of the part. Nikon Metrology developed a proprietary Curved Linear Array (CLA) detector that optimizes the collection of the X-rays travelling through the part, without capturing the undesired scattered X-rays. Such a linear detector realizes stunning image sharpness and contrast by avoiding image pollution and associated contrast reduction. A 450kV source in combination with a CLA is ideal for the inspection of small to medium metal alloy turbine blades. Such an X-ray system offers sufficient source power to penetrate through the part and generate a scatter-free CT volume.

CT scanning of larger specimens

Nikon Metrology offers a range of cabinet sizes and detectors that can handle different sample sizes and materials. Some CT systems can be configured with the Panel Shifting option, which allows for scanning objects that are wider than the detector width.

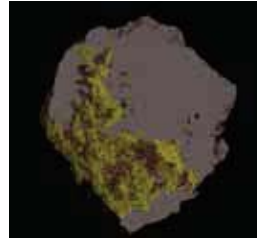


XT H 320 walk-in inspection system

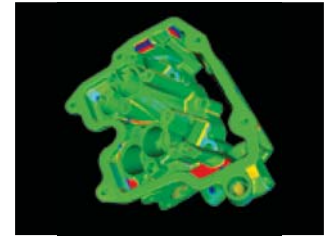
High-performance processing

Intuitive visualization and analysis

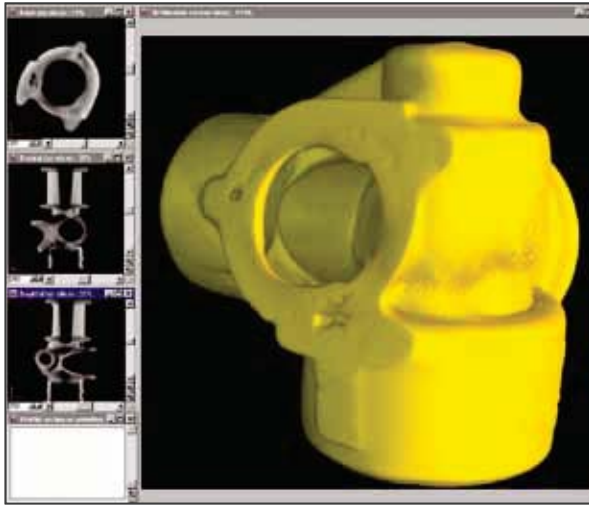
Interactive and user-friendly software is essential in evaluating the complex internal structure of samples and performing accurate inspection. The software tools provide all the means to guide you in retrieving the required information, using the most advanced visualization and analysis capabilities. Developed to streamline the process of inspection and measurement, Nikon Metrology X-ray and CT inspection software runs first-article inspection in minutes, instead of hours or days.



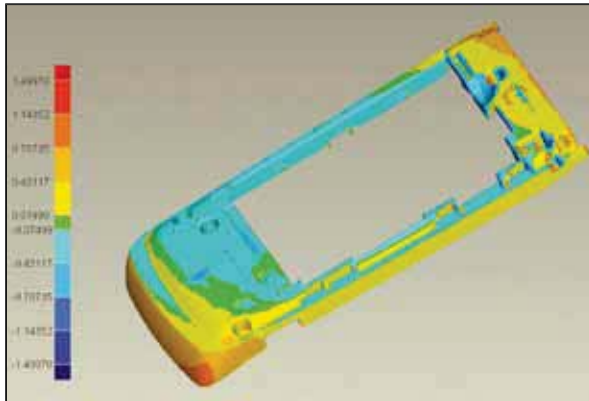
Gold fronds in a rock



Casting post-processing



A 3D volume rendering of a casting



Graphic part-to-CAD analysis results of a mobile phone cover

Real-time X-Ray inspection

- Interactive joystick control for intuitive part positioning
- Ultra-fast acquisition of X-ray scans
- Integrated display and analysis tools
- Capability to measure on screen
- Support of annotation and dimensional data
- Programmable macros for automated repetition

CT reconstruction

- Precise reconstruction into 3D volume dataset using off-the-shelf PC hardware
- Quick full part reconstruction for general analysis
- Detailed reconstruction for drilling into specific regions of interest
- On-the spot creation of CT slices

Offline CT analysis

- CT data is ready for export to Focus Inspection or 3rd party software packages
- CAD-comparison of external and internal surfaces
- Geometric shape fitting in internal 3D features
- Off-line analysis on dedicated visualization station
- Movie capture of complex internal structure



Unparalleled flexibility for your inspection lab

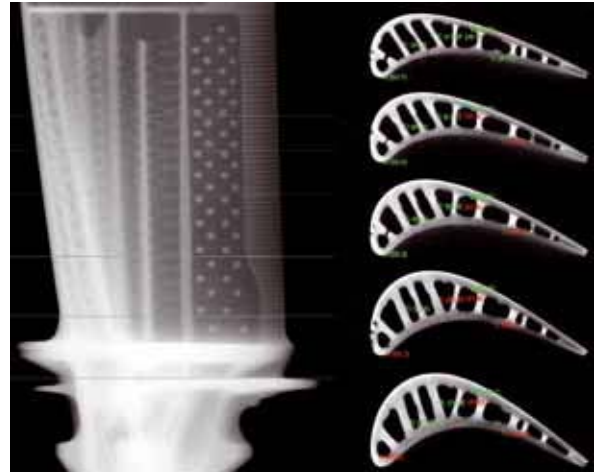
Quality control, failure analysis and material research

Anywhere the internal structure matters, X-ray and CT technology serves as an efficient tool to provide valuable information. Detailed capture and measurement of internal features is often vital for quality control, failure analysis and material research across various industries.

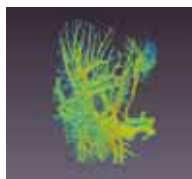
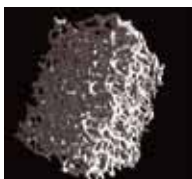
- Fault detection and failure analysis
- Assembly inspection of complex mechanisms
- Dimensional measurement of internal components
- Part to CAD comparison
- Advanced material research
- Analysis of the biological structures
- Digital archiving of models

Wide range of applications

- Automotive
 - Electrical connectors
 - Injection nozzles
 - Sensors (e.g. Lambda sensor)
 - Translucent dashboard LED light pipes
 - Small high-pressure die casting parts e.g. turbo compressor
- Aerospace
 - Positioning of cores in wax for turbine blades
 - Crack analysis in components
 - Blade inspection
- Plastic injection molding
 - Complex plastic components (e.g. fan)
 - Soft, translucent materials where tactile or optical is no option
 - Ultra-sonic welding of plastic parts
- Pharmaceutical/medical
 - Medicine dispensers
 - Small instruments
 - Small plastic or composite parts
 - Bone structures
- Research
 - Material verification and analysis (e.g. structure, porosity, defects)
 - Paleontology (e.g. bones, skulls, fossils) and soils
 - Archeology



X-ray image and CT slices of a single-crystal aerospace turbine blade generated using an XT H 450 system equipped with a Curved Linear Array (CLA) detector.



Specifications

	XT H 160	XT H 225	XT H 225 ST	XT H 225/320 LC	XT H 450 3D	XT H 450 2D
X-Ray Source (Standard)	Open Tube UltraFocus Reflection Target	Open Tube UltraFocus Reflection Target	Open Tube UltraFocus Reflection Target	Open Tube UltraFocus Reflection Target	Open Tube MicroFocus	Open Tube MicroFocus
X-Ray Source (Option)	n.a.	Rotating Target	180kV NanoTech Transmission Target Rotating Target	320kV Module Rotating Target	n.a.	n.a.
Maximum kV	160 kV	225 kV	225 kV	225 kV / 320 kV	450 kV	450 kV
Power Rating	225W	225W	225W	225W / 320W (320kV Module or Rotating Target)	450W	450W
X-Ray Spot Size	3µm	3µm	225kV UltraFocus: 3µm 180kV Transmission: 1µm	225kV UltraFocus: 3µm 320kV Module: 20µm	80µm	80µm
Geometric Magnification	> 150x	> 150x	> 150x	> 150x	> 15x	> 8x
Imaging System (Standard)	Varian 1313 Flat Panel Detector	Varian 2520 Flat Panel Detector	Varian 2520 Flat Panel Detector	Varian 2520 Flat Panel Detector	Perkin Elmer 1620 Flat Panel Detector	Curved Linear Diode Array (CLDA)
Imaging System (Option)	n.a.	Perkin Elmer 0820 Flat Panel Detector Perkin Elmer 0820 Panel Scan	Perkin Elmer 0820 Flat Panel Detector Perkin Elmer 0820 Panel Scan Perkin Elmer 1620 Flat Panel Detector Perkin Elmer 1621 Flat Panel Detector	Perkin Elmer 0820 Flat Panel Detector Perkin Elmer 1620 Flat Panel Detector Perkin Elmer 1621 Flat Panel Detector	Perkin Elmer 1621 Flat Panel Detector Combined 2D/3D with Curved Linear Diode Array (CLDA)	Combined 2D/3D with Perkin Elmer 1621 Flat Panel Detector
Manipulator (Standard)	5 Axes	5 Axes	5 Axes	4 Axes	4 Axes	4 Axes
Axes Travel	(X) 200mm (Y) 300mm (Z) 610mm (Tilt) +/- 30° (Rotate) n*360°	(X) 200mm (Y) 300mm (Z) 610mm (Tilt) +/- 30° (Rotate) n*360°	(X) 460mm (Y) 470mm (Z) 600mm (Tilt) +/- 30° (Rotate) n*360°	(X) 500mm (Y) 500mm (Z) 600mm (Rotate) n*360	(X) 400mm (Y) 600mm (Z) 600mm (Rotate) n*360	(X) 400mm (Y) 600mm (Z) 600mm (Rotate) n*360
Manipulator (Option)	n.a.	n.a.	n.a.	Additional Tilt Axis	Additional Tilt Axis	Additional Tilt Axis
Max. Sample Weight	15 kg	15 kg	50 kg	50 kg	50 kg	50 kg
CT Ready	Yes	Yes	Yes	Yes	Yes (3D)	Yes (2D)
Cabinet Dimensions (LxWxH)	1773mm x 935mm x 1785mm	1773mm x 935mm x 1785mm	2214mm x 1335mm x 2205mm	3288mm x 1595mm x 2600	3500mm x 1820mm x 2443mm	3500mm x 1820mm x 2443mm
Weight	2,500 kg	2,500 kg	3,000 kg	8,000 kg	11,000 kg	11,000 kg
Safety	All Nikon Metrology X-ray systems are manufactured to IRR99					
Control	All Nikon Metrology X-Ray systems are controlled by Nikon Metrology's in-house Inspect-X software					
Common System Options	Advanced High Speed Reconstruction Workstation					
Common System Options	Multi Metal Target (UltraFocus Reflecton Target Only) Advanced Filter Kit (UltraFocus Reflection Target Only)					

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