C251-E046

SHIMADZU
Excellence in Science

Microfocus X-Ray CT System

inspeXio 7000

Advanced Operability and Excellent Image Quality That Overturns Conventional Assumptions

inspeXio™ 7000

Microfocus X-Ray CT System

The inspeXio 7000 is a high-performance microfocus X-ray CT system equipped with a Shimadzu microfocus X-ray generator and a large high-resolution flat panel detector.
The large detection area, input resolution equivalent to 14 megapixels, and an enhanced high-output microfocus X-ray generator enable CT images with a large field-of-view, high resolution, and high contrast. In addition, the improved HPCinspeXio high-performance computing system processes images faster.

These developments make the inspeXio 7000 system applicable for researching, developing, or inspecting a wide variety of samples, from composite materials, such as glass fiber reinforced plastic (GFRP) and continuous fiber reinforced thermoplastic laminate (CFRTP) materials to large aluminum die cast parts.

High-Resolution CT Imaging

The large high-resolution flat panel detector has an input resolution equivalent to 14 megapixels, which provides a large field-of-view and high resolution.

High-Contrast CT Imaging

Improvements to the Shimadzu-made microfocus X-ray generator and the sensitivity characteristics of the state-of-the-art flat panel detector enable unprecedented high output and image contrast.

Easy and Fast CT Scanning

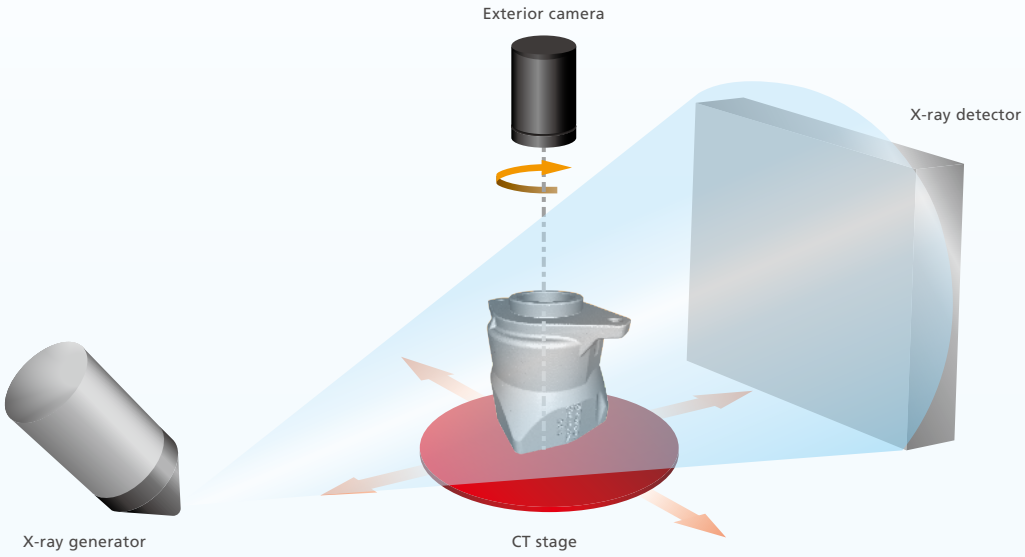
In addition to the automated CT scanning function, which relieves the operator from having to specify parameter settings, the system also includes an improved version of the HPCinspeXio ver. 3.0 high-performance computing system, providing 50 times faster processing speeds.

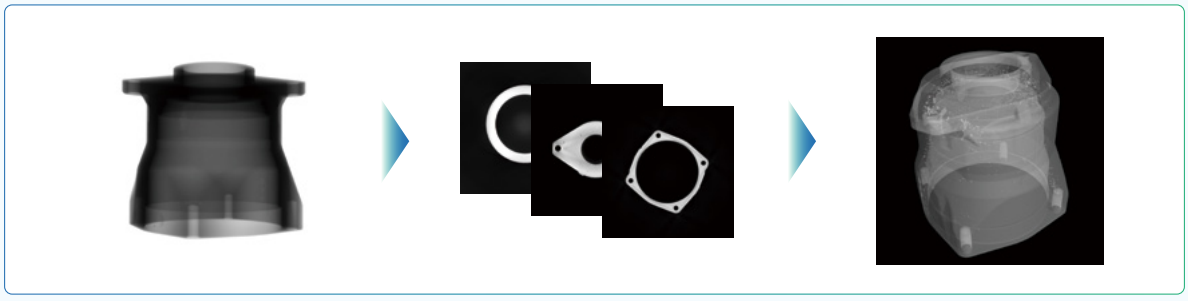

SHIMADZU
inspeXio 7000
READY

System and Principle

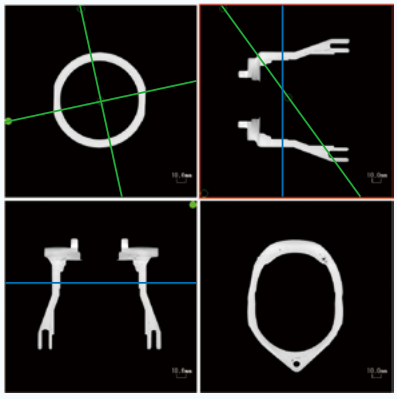
System Configuration and Operating Principle

The inspection target (sample) is placed between the X-ray generator and detector, as shown below.
Then, the sample is rotated 360 degrees to collect X-ray fluoroscopic data from various angles in order to calculate cross-sectional images.

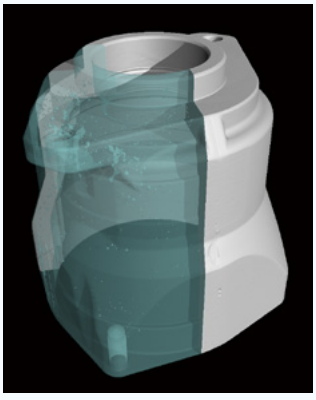




MPR



VR



MPR Display

Displays any cross section desired

Multi Planar Reconstruction (MPR) stacks multiple CT images in a virtual space to display four images—a CT image, mutually longitudinal section images, and a user-selected section image orthogonal to one of the longitudinal section images.

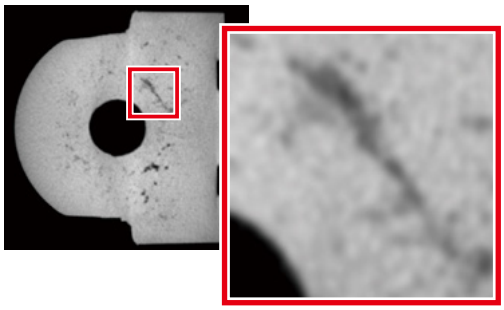
VR Display

Volume rendering (VR) stacks multiple CT images in a virtual space to display a 3D image. Separate 3D image processing software is required for VR display.

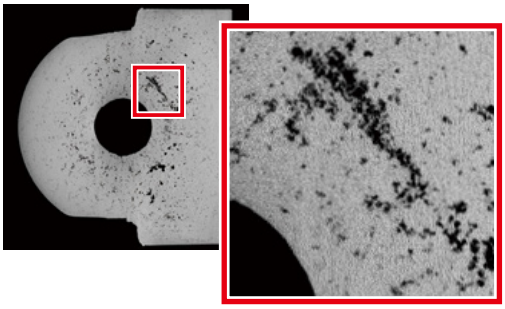
High-Resolution CT Imaging

Maximum 14 Megapixel Input Resolution

The large high-resolution flat panel detector achieves an offset scan input resolution of up to 14 megapixels.



Low-Resolution Cross-Sectional Image

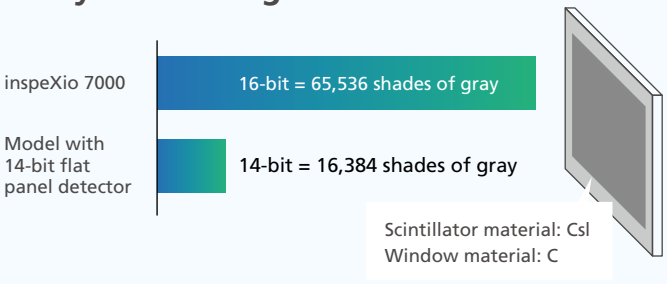


High-Resolution Cross-Sectional Image
(14 Megapixels Input Resolution)

High-Contrast CT Imaging

High-Contrast Detector with Wide Dynamic Range

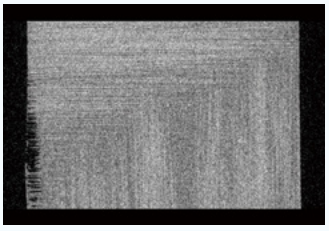
Cesium iodide (CsI), which has excellent sensitivity characteristics in the long wavelength region, is employed as the scintillator material.
The use of carbon (C) for the detector window material enables imaging on low-density materials. Furthermore, the wide dynamic range (16-bits) enables small contrast differences to be displayed.



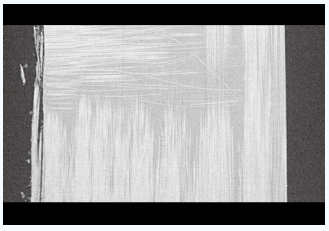
Improved X-Ray Generator

The Shimadzu-made microfocus X-ray generator unit now includes a newly developed irradiation window. Due to the larger proportion of soft X-rays in the X-ray output, it offers significantly improved contrast when scanning low-density materials that easily transmit X-rays.
In addition, the irradiation angle has been optimized for the wide field flat panel detector.

Cross-Sectional Images from Non-Woven Fabric



Previous Cross-Sectional Image



New System Cross-Sectional Image

Easy and Fast CT Scanning

Intuitive User Interface

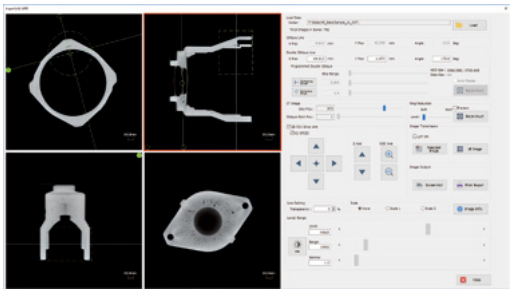
The new user interface features a simpler arrangement for intuitive operation.

Main System Window

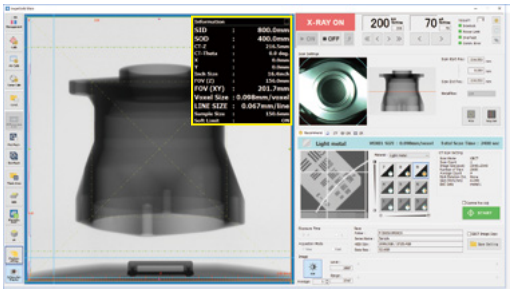
Displays the stage position, scan field of view, equivalent voxel length, and other information in real time (the yellow box), making it easy to scan images with the specified resolution and field-of-view size.

MPR Window

Displays slice, oblique, and double-oblique images, enabling the easy observation of cross-sections.



MPR Window



System Window

Recommend Scanning Function

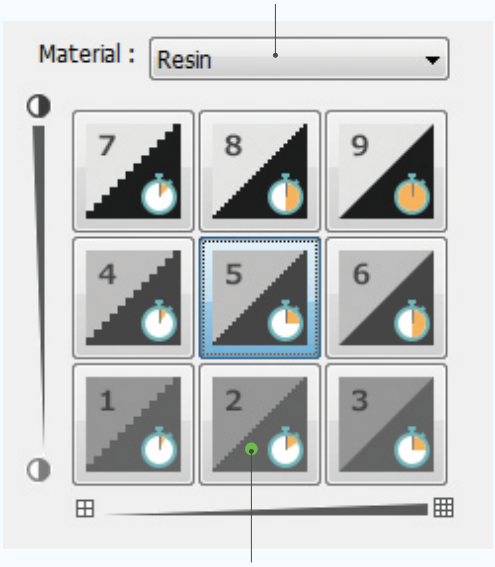
ANALYTICAL INTELLIGENCE

The new recommend scanning function enables scan parameters to be specified easily.
Simply select the material, the desired CT image resolution, and the contrast level, and the system automatically optimizes the CT scanning parameter settings accordingly.

X-ray parameters | Slice thickness | Exposure time

Number of views | Average count | Image size

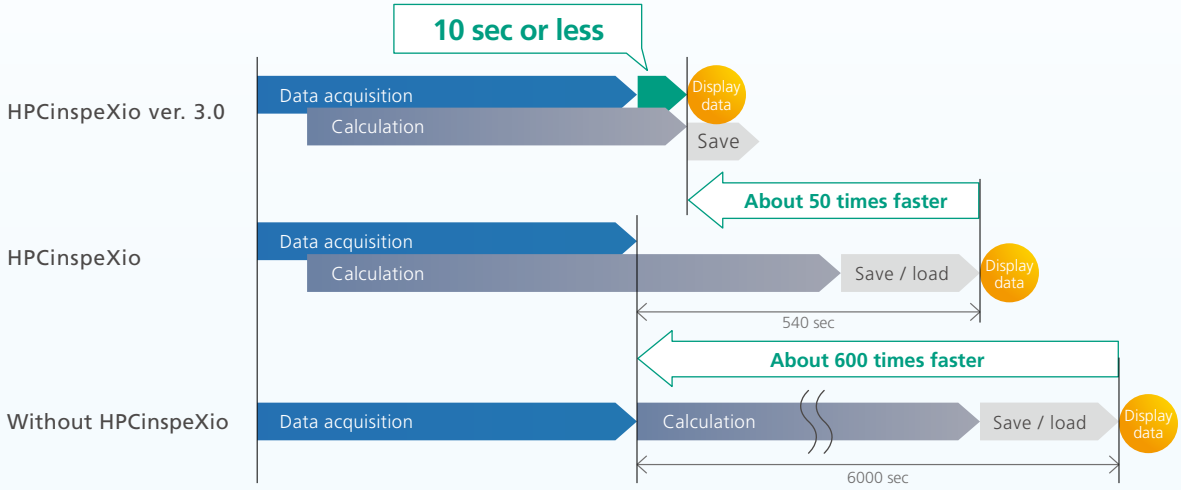
Acquisition mode



HPCinspeXio High-Performance Computing System ver. 3.0

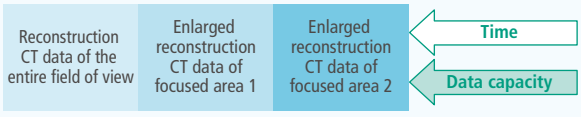
The HPCinspeXio high-performance computing system is around 50 times faster* than the previous version.

* When the fast acquisition mode is configured and the CT slice size is set to 1024 × 1024 pixels

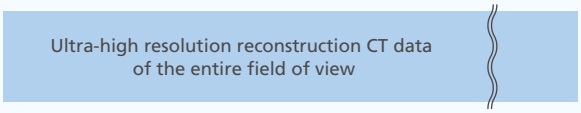


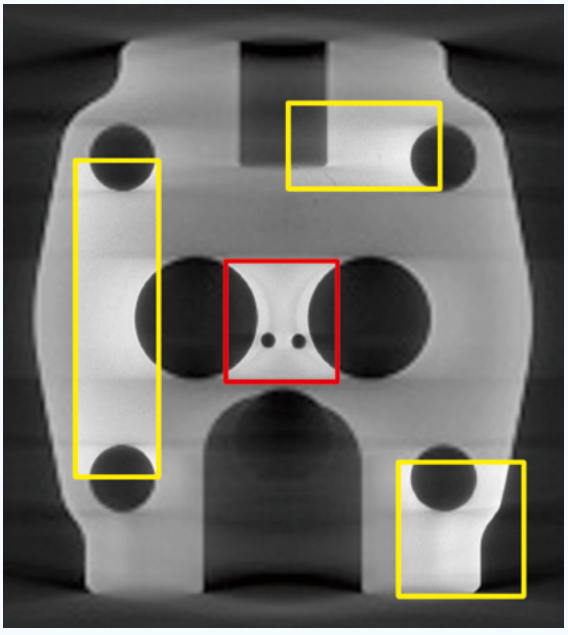
Advanced 3D Image Reconstruction

It is possible to enlarge only the focused areas in images once acquired and perform the reconstruction calculation. High-magnification cross-sectional images can be obtained even in the works that enlargement ratio is difficult to be improved.
Equipped with a high-resolution at panel detector, clear cross-sectional images can be obtained even when performing reconstruction. It is not necessary to perform the CT scanning once again when performing reconstruction only.



Both reconstruction calculation time and data capacity can be reduced.





: Selectable area with traditional software

: Selectable area with new software

Easy and Fast CT Scanning

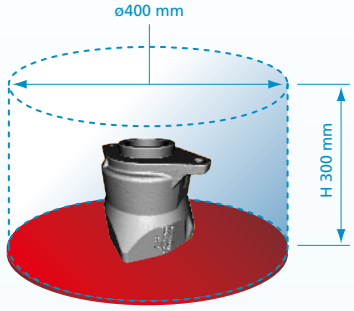
Obtain CT Images in Three Easy Steps

No calibration process is necessary before scanning. Scans can be started immediately after sample placement.

step 1

Place the sample.

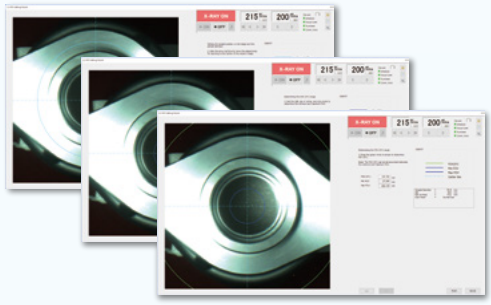
Maximum sample and CT scan size are 400 mm in diameter and 300 mm in height.



step 2

Determine the scan position.

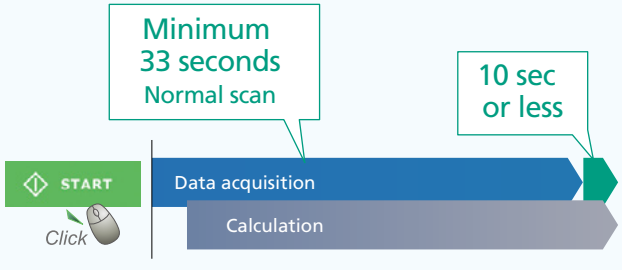
Samples are positioned using the camera mounted on the rotation axis.

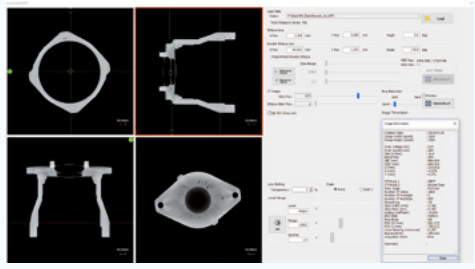


step 3

Start the scan.

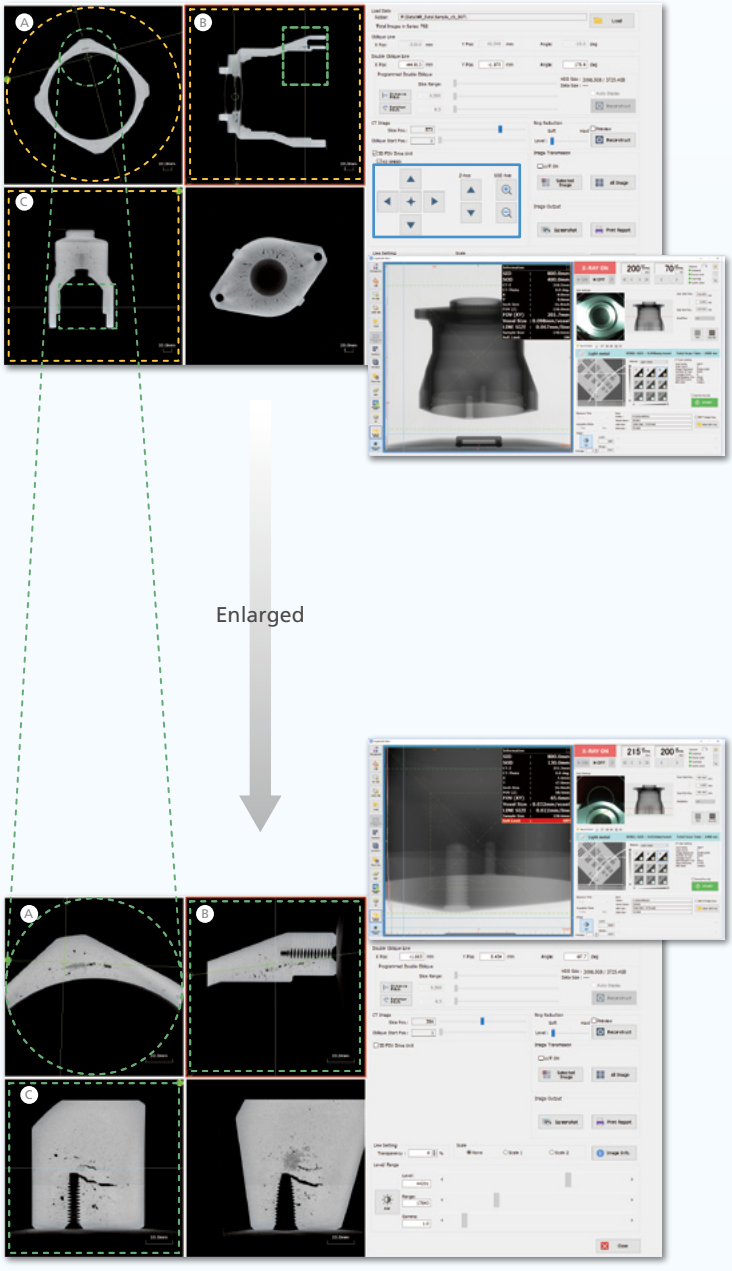
Scans can be started immediately without prior calibration.
In normal scan (600 view), data acquisition can be done in as short as 33 seconds.
Due to the high-performance computing system, MPR images are displayed 10 seconds or less after scanning is finished.

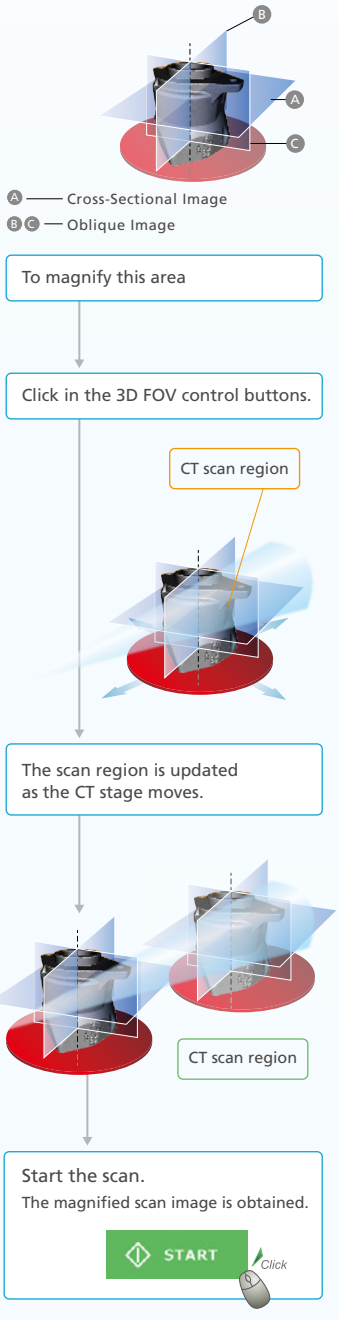




3D CT Scan Region Display Function

As the CT stage moves, the corresponding CT scan region is displayed and overlaid in real-time on the MPR display. Based on the previous CT scan image, additional CT scans for areas of interest can be obtained.





Function

Unique Functions

● Extended Filament Lifetime

The expected lifetime of filament is extended by 2.5 times by automatically adjusting the current value.

● Acquisition Mode Switching Function

Long or short scan times can be specified by combining acquisition mode and exposure time settings.

● Anti-Pinch Prevention Mechanism

A finger-pinch prevention mechanism is provided to prevent accidents when closing the sliding door.

● Door Interlock Mechanisms

The sliding door is equipped with redundant interlock circuits. These ensure X-rays are never emitted when the sliding door is open. In addition, these stop the CT stage from moving when the sliding door is open.

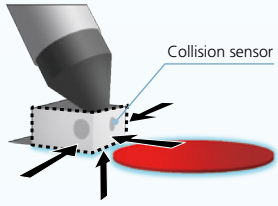
● DICOM Conversion Function

CT Image data can be converted to the DICOM format, which is the world standard for medical imaging. Consequently, this function is essential for analyzing data with medical image analysis software.

- This feature is not guaranteed to function properly with all DICOM compatible software.
- CT image brightness values are indicated in 16-bit grayscale, which do not match Hounsfield values. A function is provided for converting CT image brightness values via manual input.

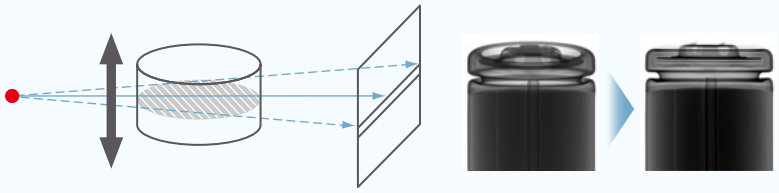
● Collision Sensor

Collision sensors are provided around the X-ray tube to stop the CT stage in the event of an emergency (a collision with the sample). The collision sensor window can be opened or closed depending on the magnification rate.

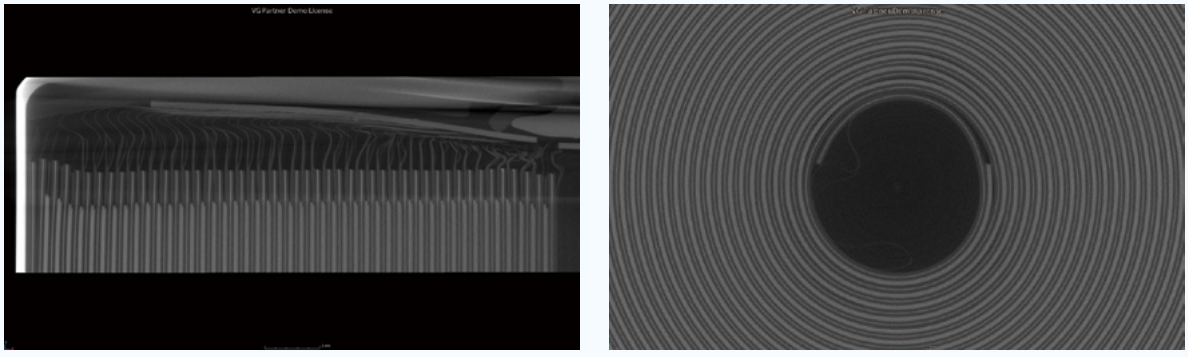


● CR Scan

Computed radiography (CR) can be used to obtain transmission images without distortion in the CT-Z direction by acquiring data only along the vertical center line of the X-ray detector while moving the CT-Z axis vertically.



Improvement of S/N Ratio by SID Switching Function



4680-type lithium-ion rechargeable battery

Source to Image Distance (SID) can be switched among three settings. Depending on the size and area of the object to be imaged, the flat panel detector can be positioned closer to the X-ray generator to obtain a stronger signal and thereby reduce data noise.

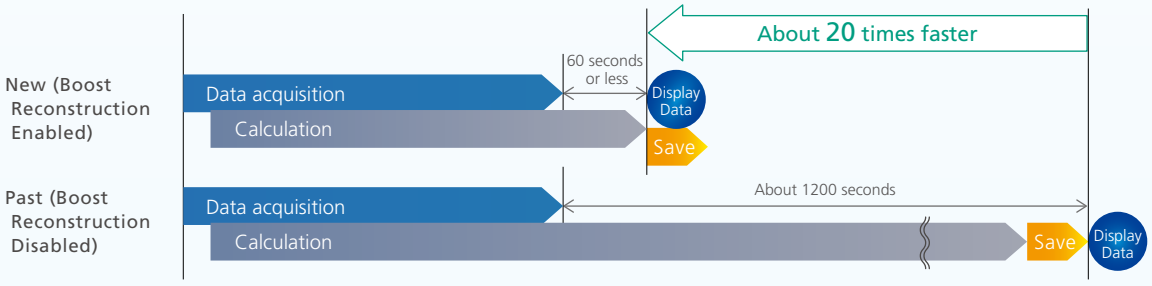
Optional Module

Optional Module “CORE Boost™”

“CORE Boost” is an optional module that extends the 2 functions, “Boost Reconstruction” and “ROI Reconstruction”, to the control software for the inspeXio 7000, inspeXio64.

Boost Reconstruction

Boost Reconstruction Function is an image reconstruction calculation process that uses our proprietary high-speed calculation technology for image reconstruction calculation processing of high-pixel CT images to achieve even higher speed.
Faster image reconstruction at 2048 × 2048 pixels or 4096 × 4096 pixels.



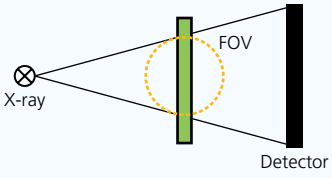
* The above shooting conditions are as follows: clear mode, full scan, 2400 View, 1500 slices, image reconstruction size 2048 × 2048.
* Since Boost Reconstruction Function is a speed-specific image computation technology, it may affect the quality of cross-section images.

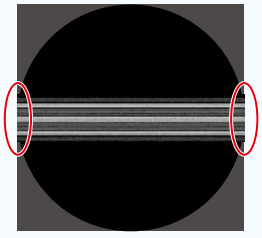
ROI Reconstruction

ROI Reconstruction Function is an image reconstruction calculation process that uses our unique ROI reconstruction technology to improve the image quality of data taken when a part of a workpiece protrudes (truncates) from the left and right sides of an X-ray fluoroscopic image during CT imaging.
This reduces shading artifacts that traditionally occur from the truncation to the entire image, making it easier to analyze with image processing software.

● What’s “Truncation”...?

A part of a workpiece protrudes from the left and right sides of a fluoroscopic image during a CT scan.

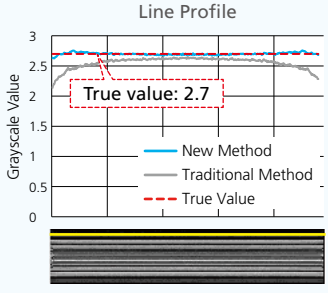




Transected CT Image

● Image Comparison

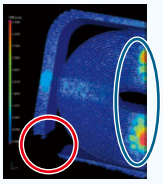
ROI image reconstruction reduces shading artifacts more than traditional methods, so grayscale values are close to true value and uniform.



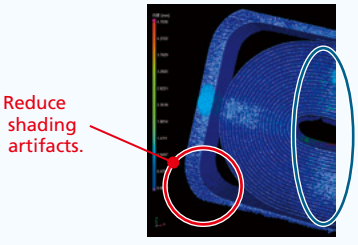
* Comparison of conventional and new line profiles.

● Advantage

The reduced shading artifacts make thresholding easier.



Traditional Method

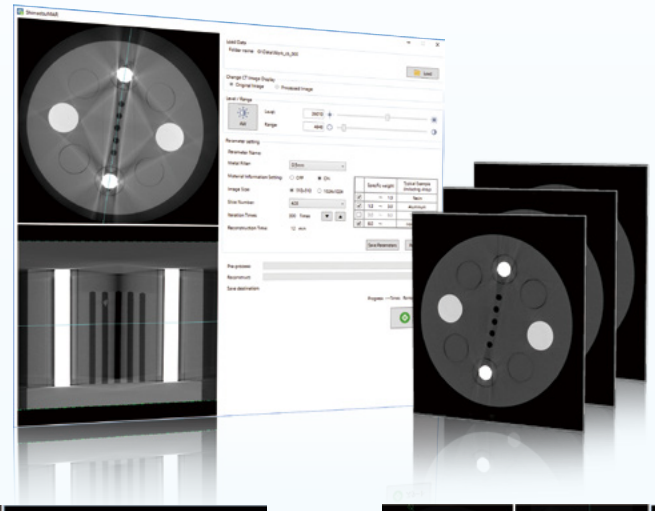


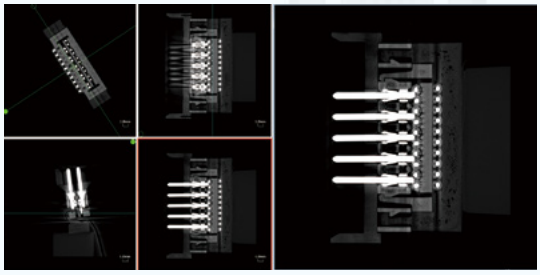
ROI Reconstruction

Optional Software

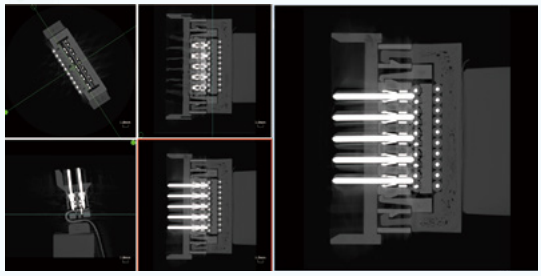
Metal Artifact Reduction Software

This is a reconstruction software program used to reduce metal artifacts in cross-sectional images.
This software allows for easier and more accurate analyses of the cross-sectional images.

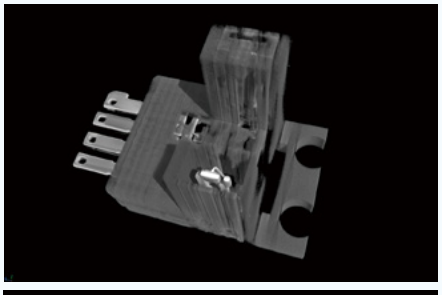


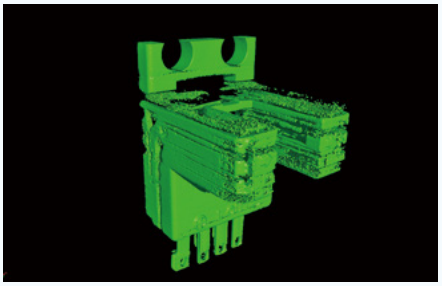


10-pin connector before processing

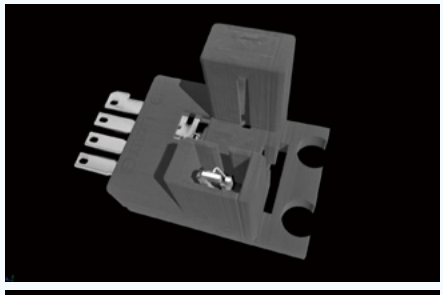


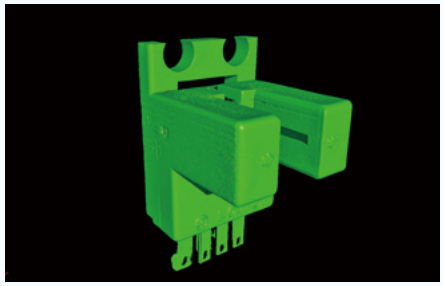
10-pin connector after processing





Photosensor before processing
(Top: VR image, bottom: STL)



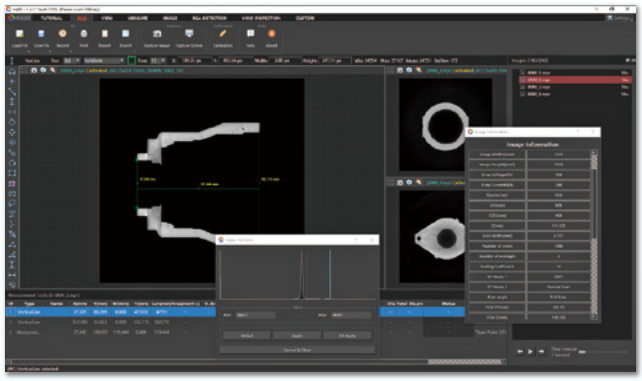


Photosensor after processing
(Top: VR image, bottom: STL)

HADI-S

2D Image Processing Software

This two dimensional image processing software enables sophisticated image processing. Various image processing such as dimension measurement and filtering is possible for transmission images and cross-sectional images.

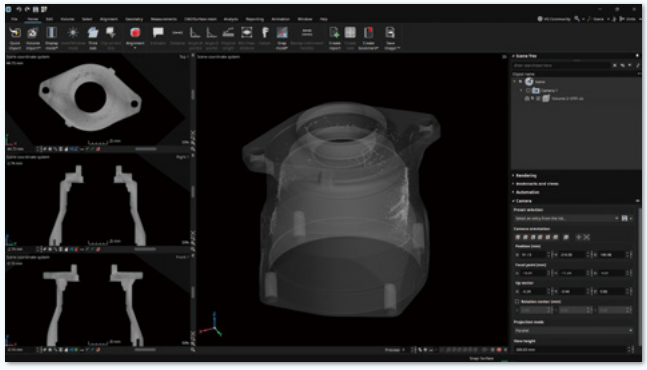


(Smart Vision Corporation)

VGStudio MAX

3D Image Processing Software

This is an extended version of VGStudio. Extended functionality includes animation creation (rotation, truncating, and viewpoint movement), measurement of length, angle, minimum distance, histogram, volume, surface area, void ratio, ROI extraction, image filtering, and multiple 3D image alignment.

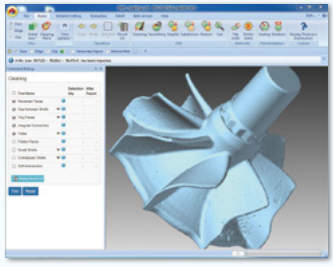


(Hexagon AB)

POLYGONALmeister

Polygon editing software

POLYGONALmeister is a polygon editing software for editing surface measurement data. It solves issues such as noise and artifacts as well as reducing data size. It is especially suitable when using measurement data in design, analysis, 3D printing, etc.



(UEL Corporation)

Image processing software
- Observation / measurement
- Output polygon data (stl)

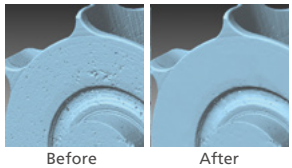
POLYGONALmeister
- Modification of polygon data
- Data reduction
- Correction of artifacts

3D Printer

3D Printing

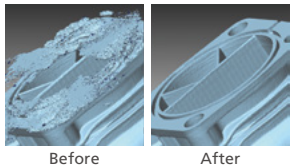
Design / Analysis

● Fix dents etc.



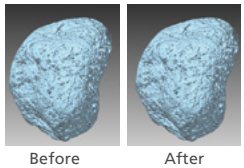
Before After

● Extract necessary parts



Before After

● Simplify porous material within tolerance



Before 1.4 GB

After 51 MB (3.67%)

RIKEN

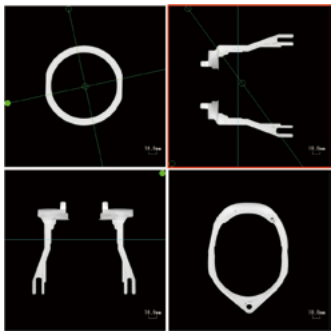
This software makes use of the results of an integrated research program with RIKEN

Applications

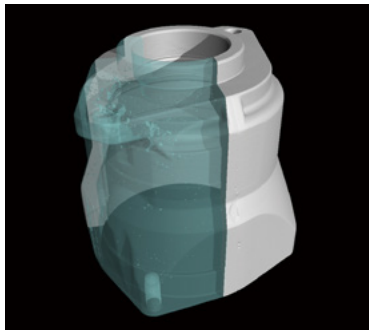
Visit our website to see enlarged application data.

Application

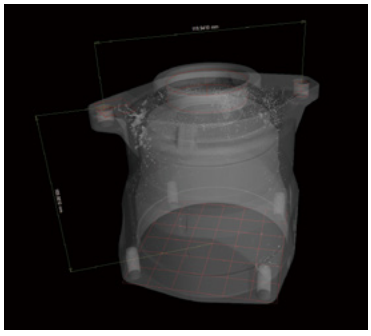
Aluminum Die Castings



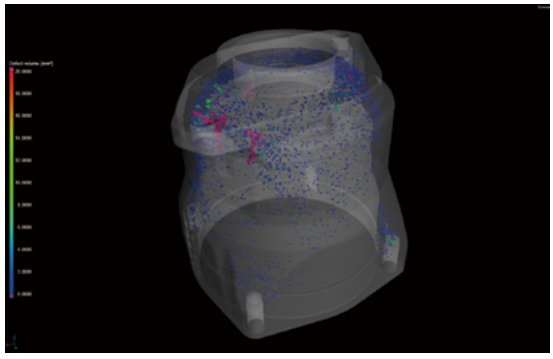
MPR Image FOV = ø207.6 mm



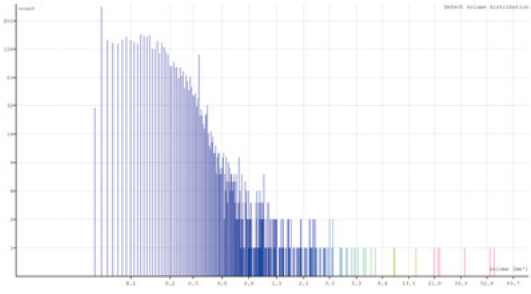
VR Image



3D Measurement

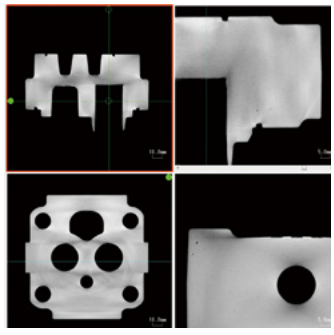


Defect Analysis

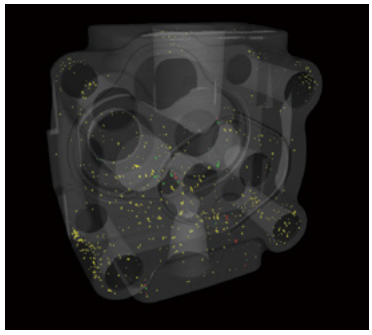


Defect Analysis Histogram

Defect analysis identifies voids and displays a color-coded map of the voids based on their volume. It can also display a frequency histogram of scale the void volume and count.



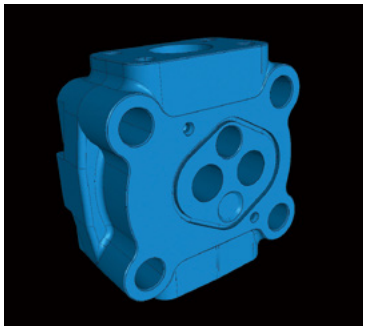
MPR Image FOV = ø161.5 mm



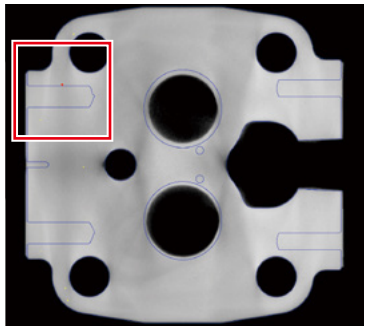
Defect Analysis

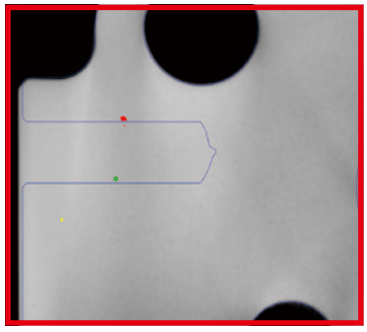
By scanning the die cast part before machining and then specifying the surface after machining (CAD data), the software can determine which voids are removed by machining, which remain internally, and which are exposed on the surface after machining.

- Voids that are removed
- Internal voids
- Voids exposed on the surface



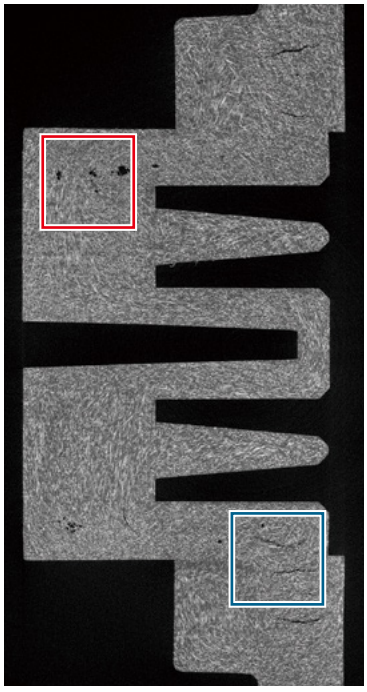
3D CAD



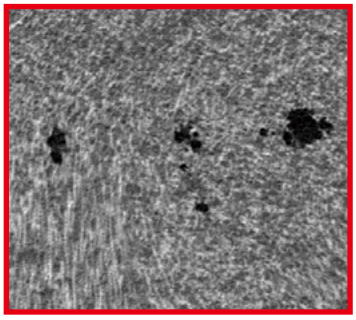


Void Determination Based on Specifying Defect Cross Section and Surface
Blue line: CAD data analysis after machining

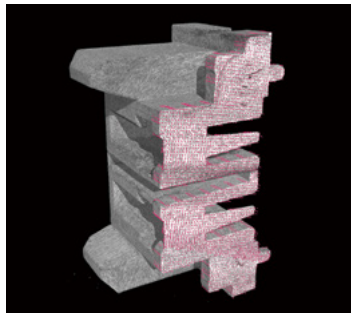
GFRP (Glass Fiber Reinforced Plastic)



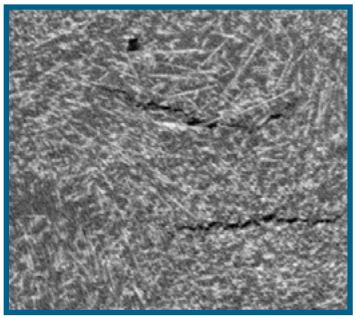
Cross-Sectional Image FOV = ø20 mm



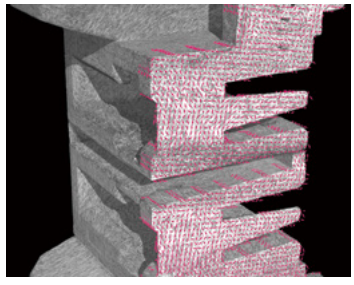
Cross-Sectional Image (enlarged view)



Fiber Orientation Analysis

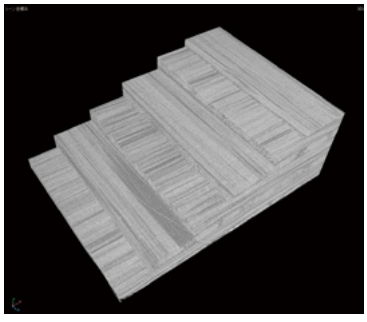


Cross-Sectional Image (enlarged view)

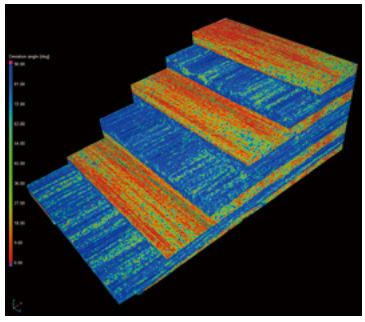


Fiber orientation analysis can display a color-coded map of filler orientation. Needles can also be displayed based on the orientation.

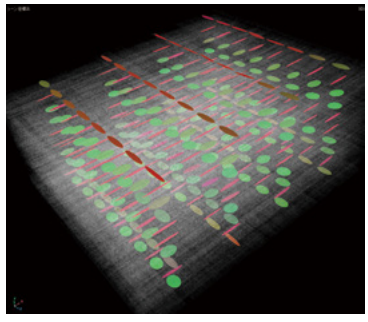
CFRTP



VR Image



Fiber Orientation Analysis



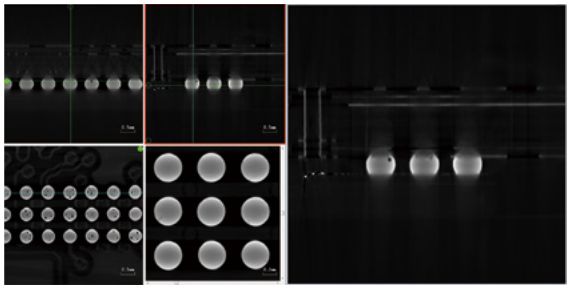
Evaluation of Orientation Tensor

Applications

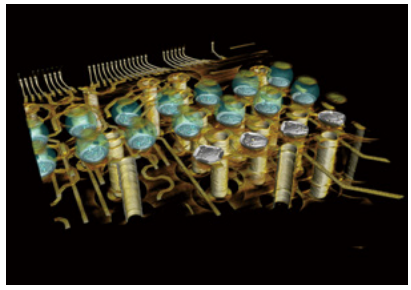
Visit our website to see enlarged application data.

Application

BGA (Ball Grid Array)



MPR Image FOV = ø5 mm

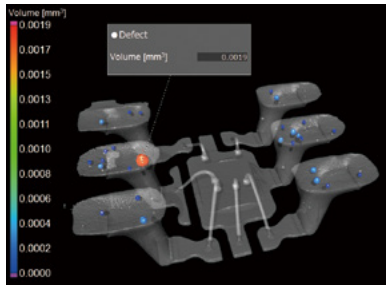


VR Image

Crystal Unit

CR Image FOV = 10 mm × 20 mm

VR Image

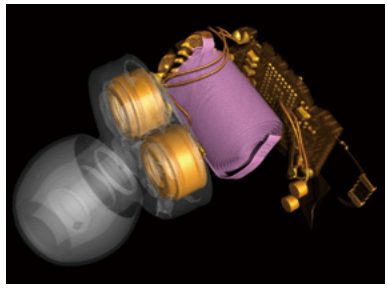


Defect Analysis

Wireless Earphones

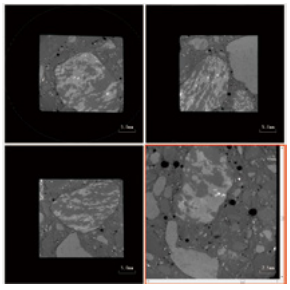
Oblique Image FOV = ø30 mm

Oblique Image FOV = ø30 mm

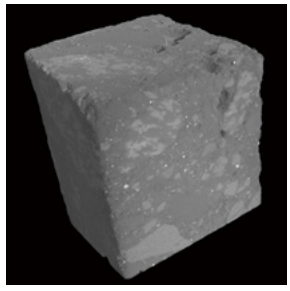


VR Image

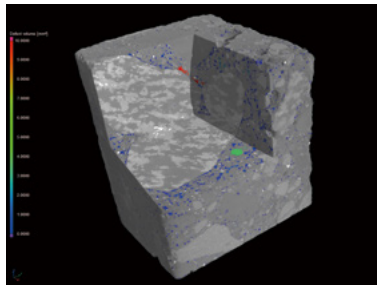
Concrete



MPR Image FOV = ø42 mm



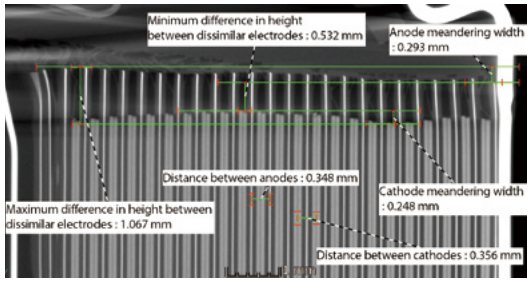
VR Image



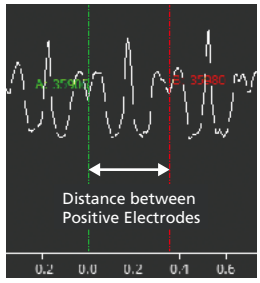
Void Analysis
Provided by Emeritus Professor Moriyoshi at Hokkaido University

Lithium-Ion Rechargeable Battery

Cross-Sectional Image FOV = ø18.4 mm

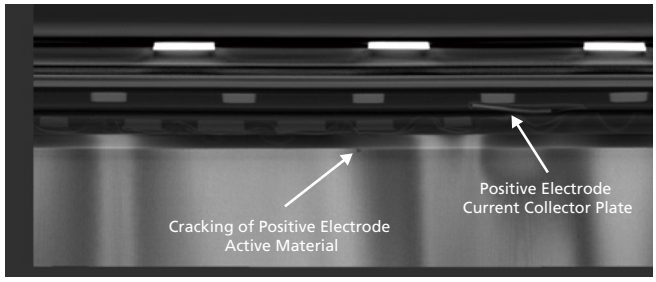


Cross-Sectional Image FOV = ø15 mm
Distance Measurement between Electrodes



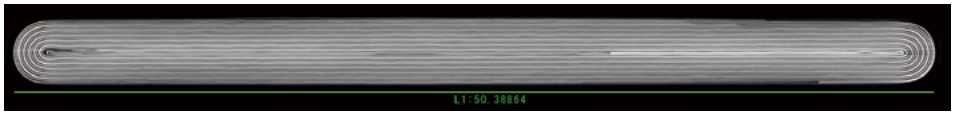
Line Profile of Grayscale Value

VR Image (Unrolled the Purple Cylinder)

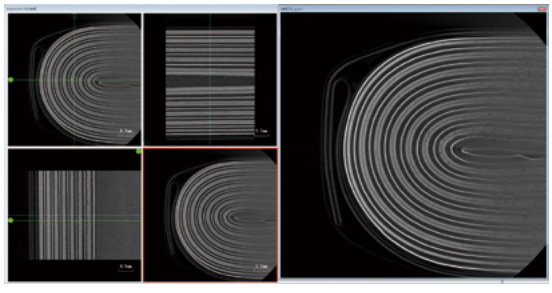


Unrolled Cylinder Cross-Sectional Image of Cathode Active Materials

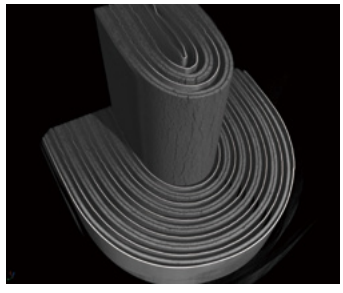
Rectangular Lithium Polymer Battery (for Smartphones)



Cross-Sectional Image

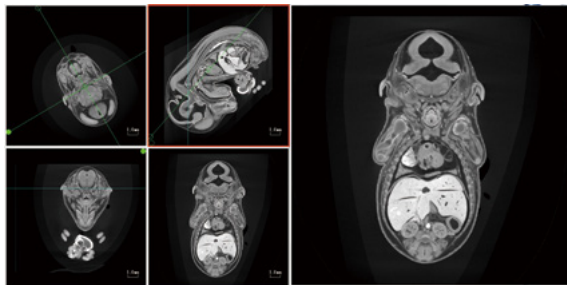


MPR Image FOV = ø4.4 mm

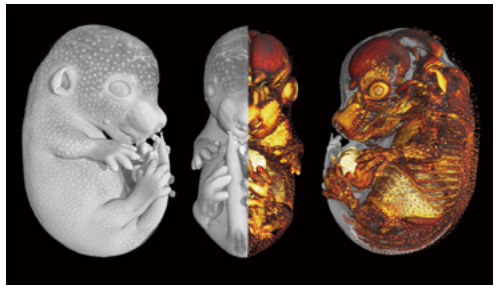


VR Image

Mouse fetus



MPR Image FOV = ø13.7 mm



VR Image

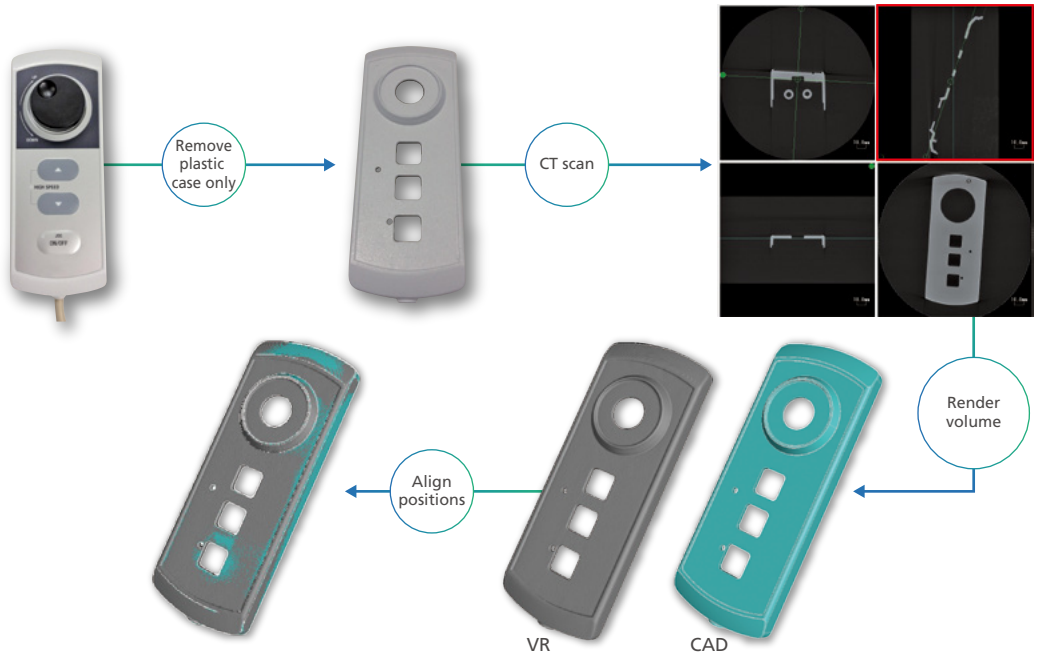
Product Verification Example

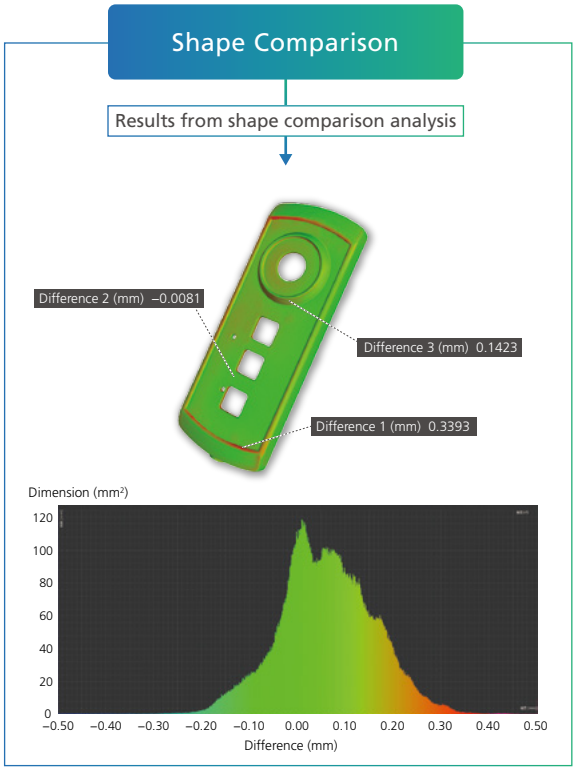
Visit our website to see enlarged application data.

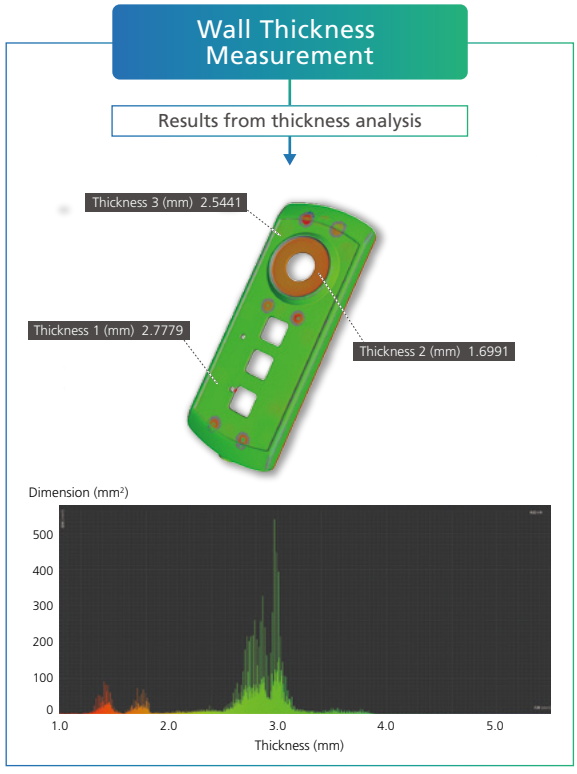
Application

Analysis Using PointMaster Reverse Engineering Software

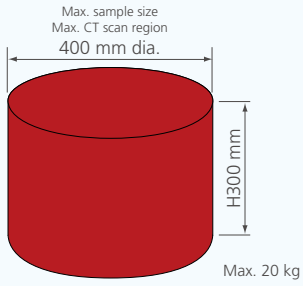
The software can align CT data with 3D-CAD data, calculate the distance between the boundary surface defined in the CT data and the corresponding 3D-CAD data, and display a color-coded map based on such differences.







Specifications

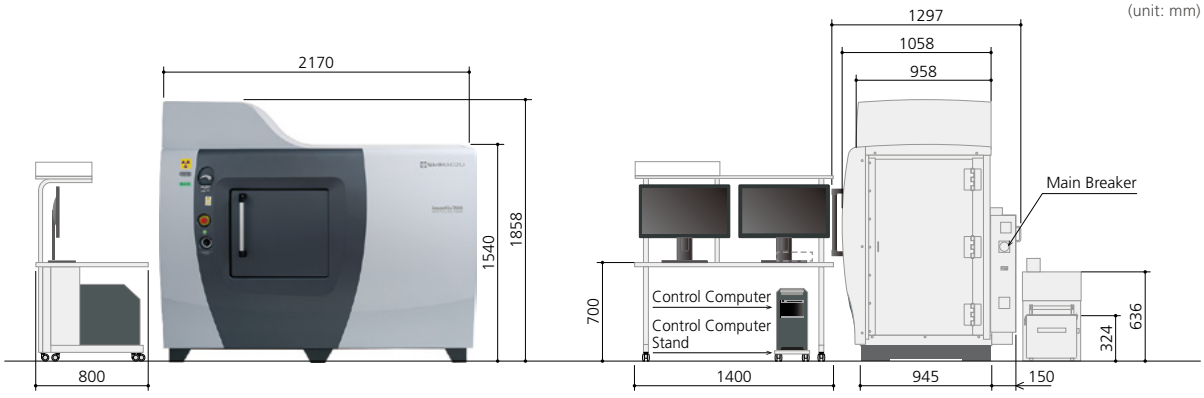
inspeXio 7000 Series		
Model		**inspeXio 7000**
P/N		S363-00001
X-Ray Generator	Rated Power	135 W
	Max. Tube Voltage	225 kV
	Max. Tube Current	1000 µA
X-Ray Detector		Flat panel detector
X-Ray Detector Size		16 inch
X-Ray Detector Shades of Gray		16-bit = 65,536 shades of gray
Max. Input Resolution (for Offset Scan)		Approx. 14,000,000 pixels
Max. Sample Size and Weight, and Max. CT-Scan Region		
Max. CT Image Size	Two-Dimensional CT	4096 × 4096
	Cone-Beam CT	4096 × 4096
High-Performance Computing System	Version	HPCinspeXio ver. 3.0
	For 1024 × 1024 pixel CT images	10 sec or less after completing data acquisition
	Positioning via an Exterior Camera	Yes
Scan Support Functions	3D CT Scan Region Display Function	Yes
	Recommend Scanning	Yes
	SOD Axis*1	890 mm
CT Stage Max. Stroke	SID Axis*2	Switchable between 3 levels (600, 800, 1200)
	CT-Z Axis	300 mm
Scan Modes		Normal scan, half scan, offset scan, FS scan*3, 2DCT*4, CBCT*5
CT Data Acquisition Time		Any value from 10 sec to 60 min
Shield Box Size and Mass		W2170 × D1350 × H1858 mm, approx. 3100 kg
Power Requirements	Main Unit	AC 200/220/230/240 V (tap switching) ±10 %, 50/60 Hz, 2 kVA
	Control Computer (Note 1)(Note 2)	AC100 V – AC 240 V ±10 %, 50/60 Hz, 1.5 kVA
	Ground	Type-D ground (100 ohm max. ground resistance)
CE, KC		Yes
External Leakage Dose		0.5 µSv/h or less
Option		Operation Box. Exterior Camera Retraction Unit

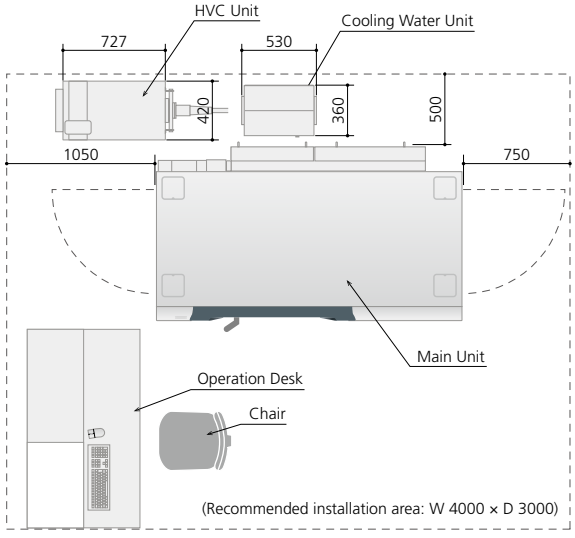
*1 SOD axis: The SOD (= Source to Object Distance) axis is used to change the distance between the focal point and sample.
*2 SID axis: The SID (= Source to Image Distance) axis is used to change the distance between the focal point and detector.
*3 FS scan: The fan-shaped (FS) scan obtains CT images by scanning the sample at 60, 90, and 120 degree rotation angles.
*4 2DCT: Two-dimensional computed tomography (2DCT) obtains one or three CT images from each CT scan.
*5 CBCT: Cone beam computed tomography (CBCT) obtains several hundred CT images from each CT scan.

Note 1: For Japanese specifications, table tap and PC inlet cables (3 pcs) are included.
Note 2: Except for Japanese specifications, table tap and PC inlet cables (3 pcs) are not included. Please prepare products in compliance with each country's standards.

Layout and Dimensional Drawings

(unit: mm)





ANALYTICAL INTELLIGENCE

- Automated support functions utilizing digital technology, such as M2M, IoT, and Artificial Intelligence (AI), that enable higher productivity and maximum reliability.
- Allows a system to monitor and diagnose itself, handle any issues during data acquisition without user input, and automatically behave as if it were operated by an expert.
- Supports the acquisition of high quality, reproducible data regardless of an operator's skill level for both routine and demanding applications.

SHIMADZU

Shimadzu Corporation

www.shimadzu.com/an/

© Shimadzu Corporation, 2025 / First Edition: October 2025, 3655-09503-PDFNS,C251-E046