CT Lab HV

Clear Image, Clear Instructions, Clear Results

High-resolution Industrial X-ray CT Scanner

Rigaku CT Lab HV is a high-resolution and high-voltage industrial X-ray CT scanner with unrivaled application support

Rigaku
POWERING NEW PERSPECTIVES

CT Lab HV

Rigaku CT Lab HV is a high-resolution and high-voltage industrial X-ray computed tomography (CT) scanner.

The CT Lab HV and our unrivaled application support will help you:

Clearly see if you made your products exactly as designed by scanning them non-destructively, allowing you to compare them with the design and identify discrepancies quantitatively.

Clearly see where the problem is when your products are failing by creating a digital twin (CT scan of your product) that allows you to visually inspect the internal structures or run virtual tests such as flow and stress simulations.

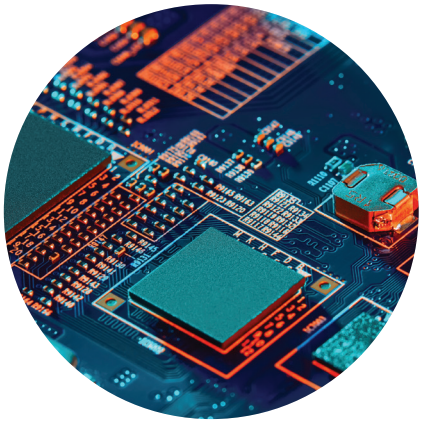
Clearly see inside precious parts and objects non-destructively by scanning objects such as historical artifacts or expensive prototypes.

Spatial resolution	Maximum voltage	Fastest scan
3 µm	**225 kV**	**40 sec**

Non-destructive 3D imaging by X-ray CT can save time and money in various industries.

Batteries

X-ray CT enables the analysis of electrode overhangs and other deformations and defects without taking battery packages apart, providing crucial insights into design optimization.

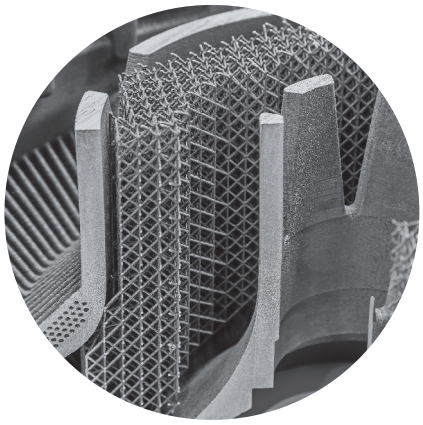


Electronics

You can identify defects such as failed connections and voids in soldering on printed circuit boards (PCBs) and small electronic devices non-destructively, allowing in-depth investigation while keeping the devices' function intact.

Academic Research

Some samples are too unique or precious to section to study their internal structures. X-ray CT is often used to image indispensable samples in archeology, geology, and food and plant science.



Additive Manufacturing

Additively manufactured parts often have complex internal structures that are inaccessible from the outside. X-ray CT can create a digital twin you can use to investigate its dimensions and defects, providing intelligence into process optimization.

Medical Devices

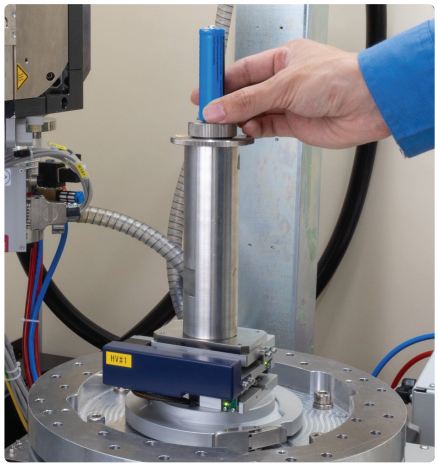
Medical devices, such as stents and implants, are often expensive to analyze destructively or need to be observed in operation. X-ray CT is an ideal technique to visually study their functions and operations to optimize their design or analyze their failure mechanisms.

Reasons to choose the CT Lab HV

Versatile

You can **scan small-to-large samples* non-destructively** because of the large radiation enclosure, wide door opening, variable source-to-object distance (SOD), and source-to-detector distance (SDD).

*Sample sizes up to 600 mm diameter, 1200 mm tall can be accommodated with FOV range up to 350 mm.



18650 lithium-ion battery

Luggage

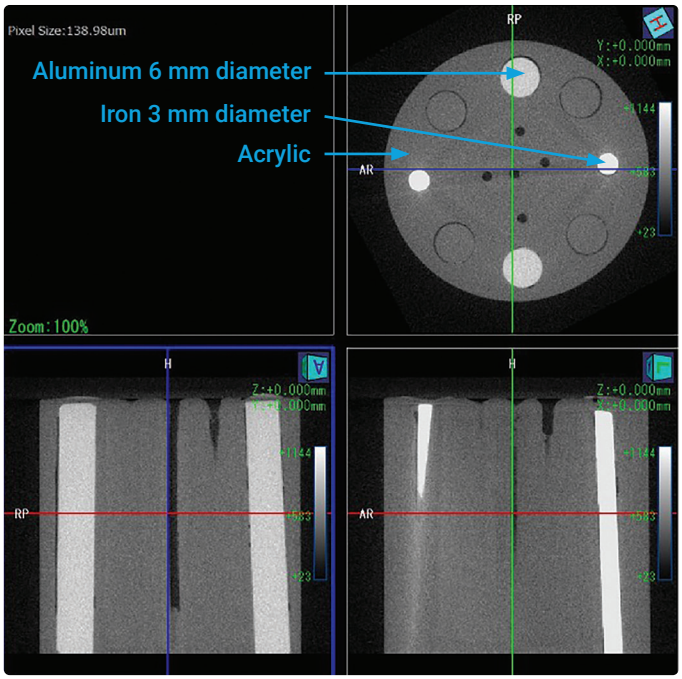
225 kV high-voltage microfocus X-ray tube

Powerful

You can obtain clear images of both low and high-density materials, including those containing titanium and steel, with the **225 kV high-voltage X-ray source**.

Fast

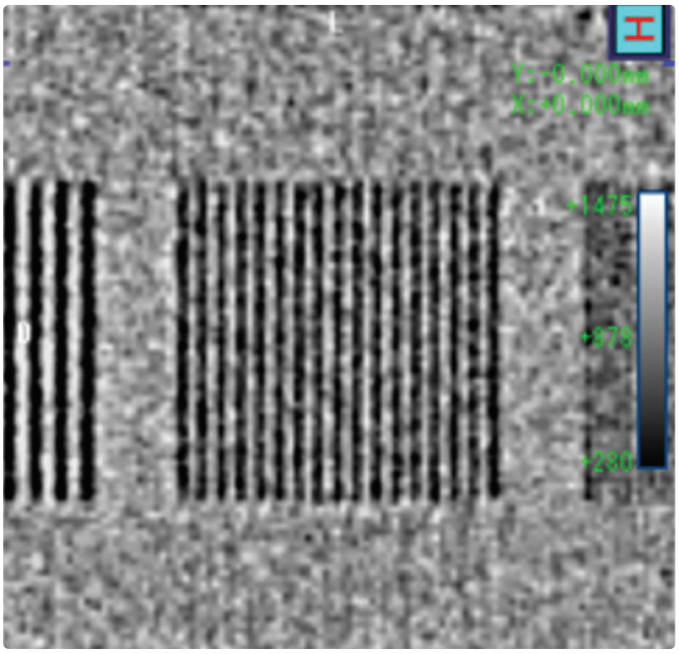
You can save time by obtaining a clear image **within 40 seconds.**



40 second scan of an acrylic phantom containing aluminum and iron rods

High Resolution

You can clearly see details in **high resolution up to true 3 µm spatial resolution** achieved by the variable SOD and SDD for resolution flexibility and the high-voltage X-ray source for reduced beam hardening artifacts.



2D cross-section image of a QRM MicroCT Bar Pattern NANO Phantom, showing resolved 3 µm line pairs

Assuring

You can get inspection results easily and confidently because **Rigaku's application support goes beyond instrument training**. Our CT experts will help you optimize scans and inspections or provide guidance on analysis procedures.

Adaptable

The **third-party-friendly software empowers you** to select the analysis software that perfectly fits your needs. Reconstructed images can be easily saved in universal file formats, such as TIFF.

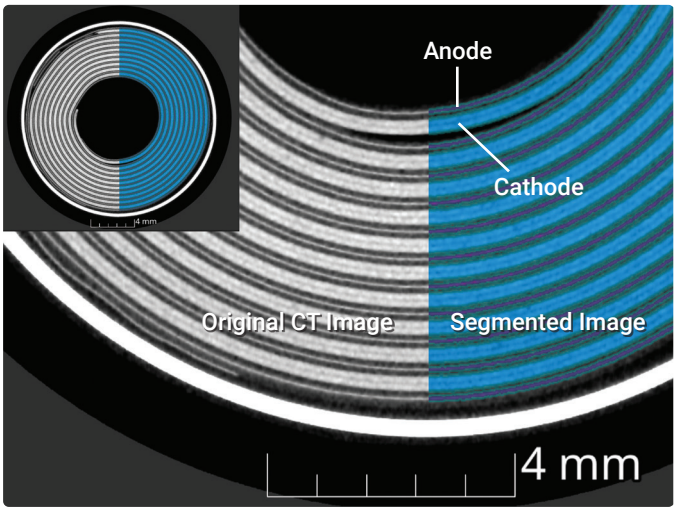
HEXAGON | VOLUME GRAPHICS

dragonfly

Clearly see if you made your products exactly as designed

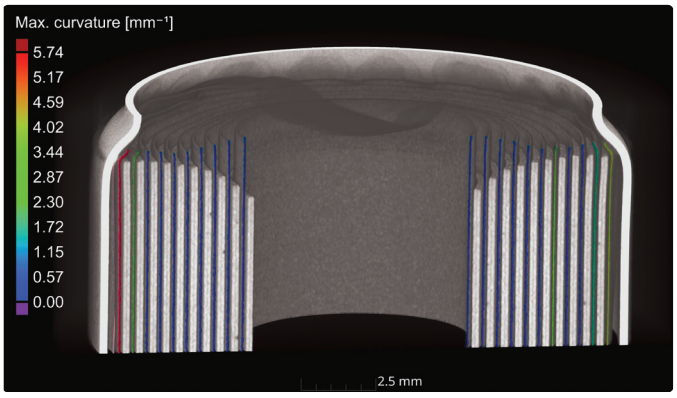
Analyzing internal structures and dimensions of batteries

X-ray CT allows you to visualize the internal structure of batteries in three dimensions. This includes electrodes, separators, electrolyte distribution, and any defects or abnormalities within the battery. By checking the internal structure quantitatively, you can see if your batteries are manufactured according to the specifications. Identifying discrepancies can lead to insights into how to improve their longevities.



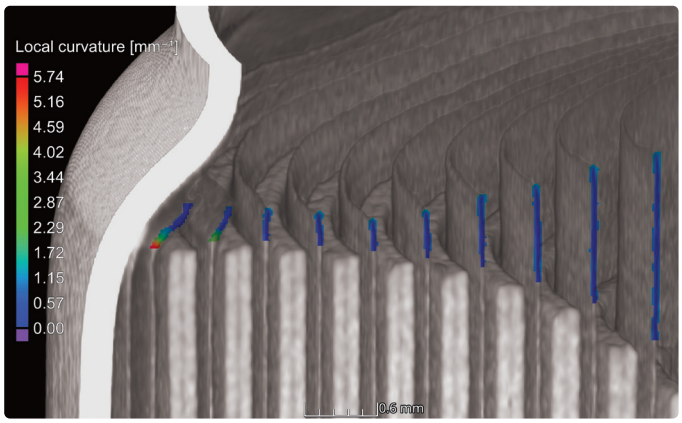
Cross-section of an 18650 battery

Cathode and anode are clearly observed and segmented based on their gray levels. Using the segmented data, you can identify various defects or analyze the anode overhang properties.



Maximum curvature analysis

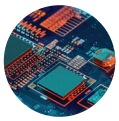
The segmented anode overhang is color-coded for its maximum curvature. You can see that for this battery, the outside anode overhang curvature is over 5 mm^{-1}.



Local curvature analysis

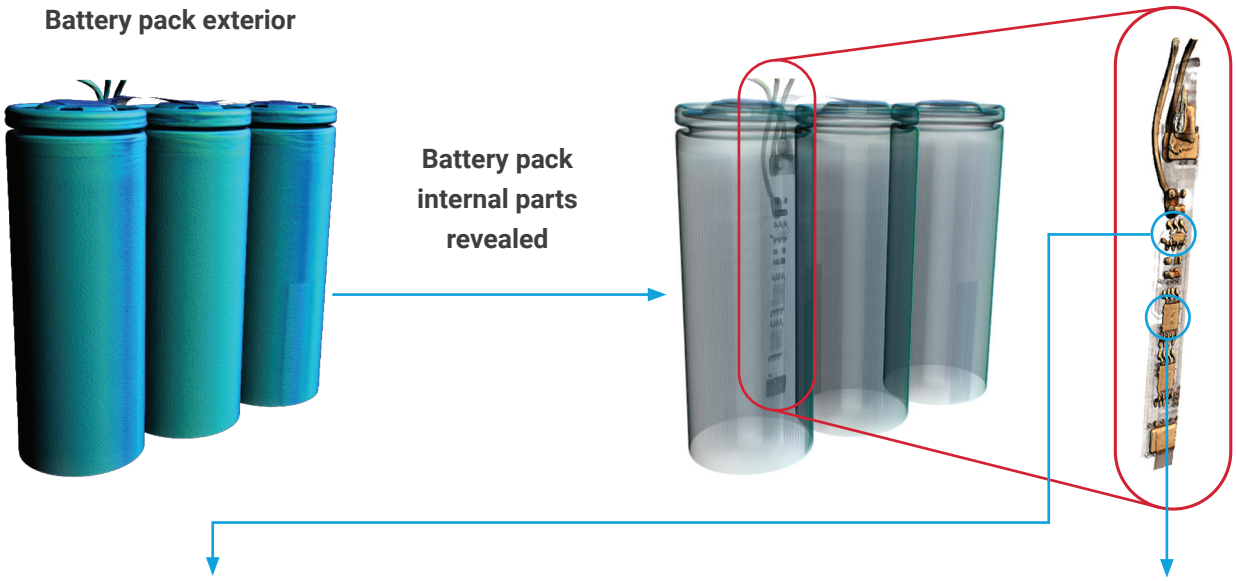
The segmented anode overhang is color-coded for it's local curvature. Close to the outer battery case, the local curvature exceeds 5 mm^{-1}.

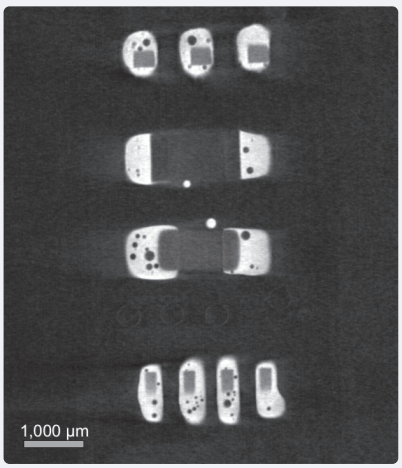
Clearly see where the problem is when your products are failing



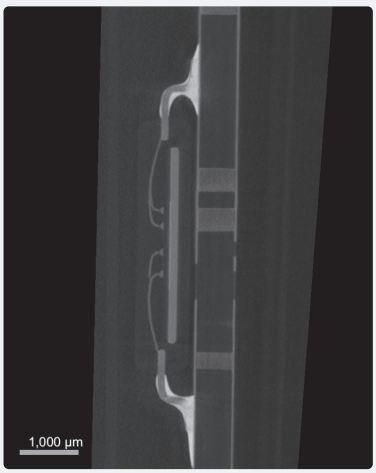
Inspecting the integrity and defects of electronic components

X-ray CT allows for non-destructive inspection of the internal structure of printed circuit boards (PCBs) and electronic components. This includes detecting defects such as voids, cracks, and delamination within PCB layers. CT data provides valuable information about the quality of manufacturing processes and helps identify potential failure points and overall performance improvement.





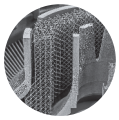
Detailed investigation of voids in solder joints (cross-section, top view)



Detailed investigation of the wires (cross-section, side view)

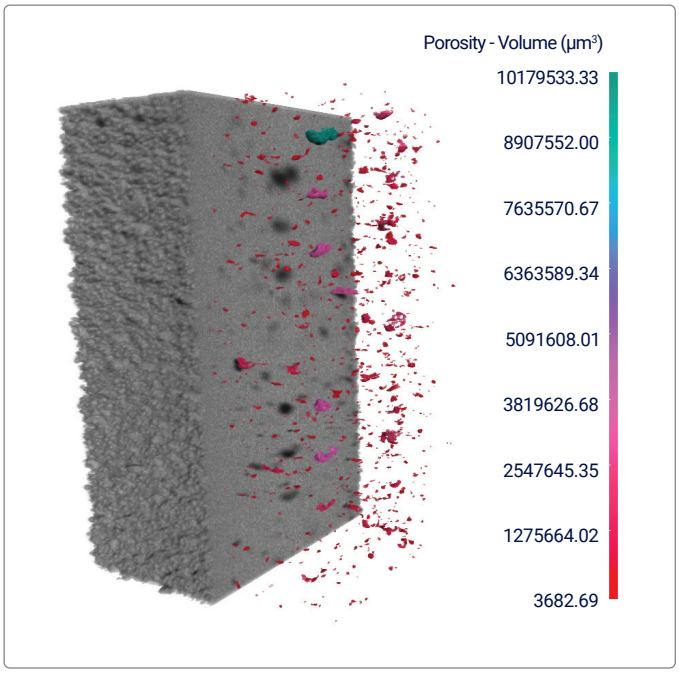
3D rendered view of the wires

Clearly see inside precious parts and objects



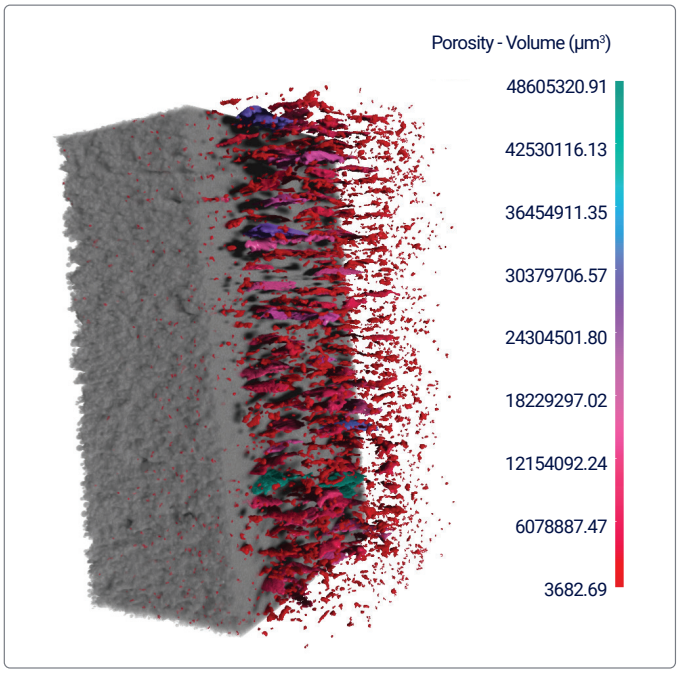
Studying cracks, pores, and surface roughness of additively manufactured objects

X-ray CT plays a vital role in the quality assurance, process optimization, and failure analysis of additively manufactured parts. You can visualize cracks and pores non-destructively and analyze their sizes, shapes, and spatial distribution quantitatively. It is also ideal for investigating surface roughness and morphology, which are complex and often require three-dimensional measurement when parts are manufactured from a powder source.



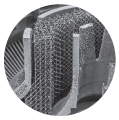
AM Ti-6Al-4V - Sufficient energy density

Void volume was analyzed by segmenting a CT scan of a 5 × 5 mm Ti-6Al-4V bar manufactured by electron beam melting (EBM) at a sufficient energy density to melt all particles completely.



AM Ti-6Al-4V - Insufficient energy density

Void volume was analyzed by segmenting a CT scan of a 5 × 5 mm Ti-6Al-4V bar manufactured by EBM at an insufficient energy density. A large number of voids resulting from the incomplete melting are observed. The results show that void sizes for this sample exceed 4×10^7 µm³.



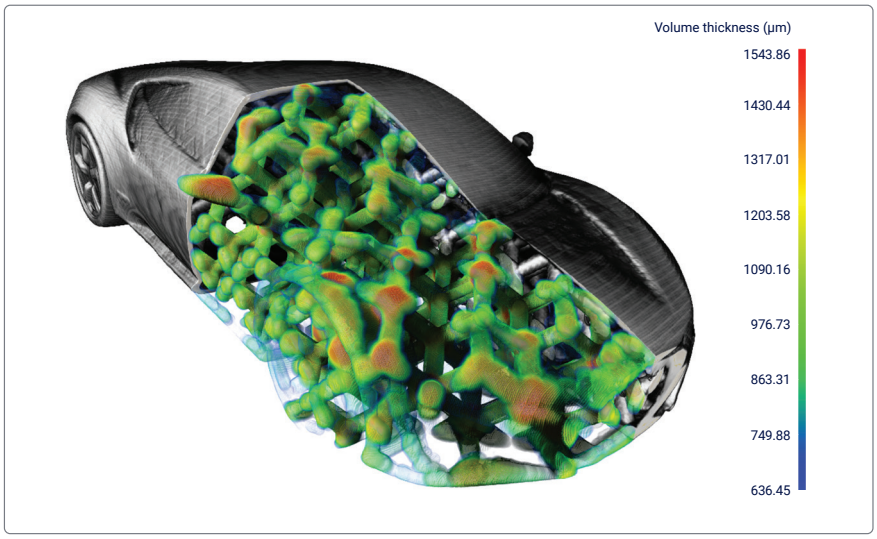
Studying dimensions, volume thickness, and stress distribution of additively manufactured objects

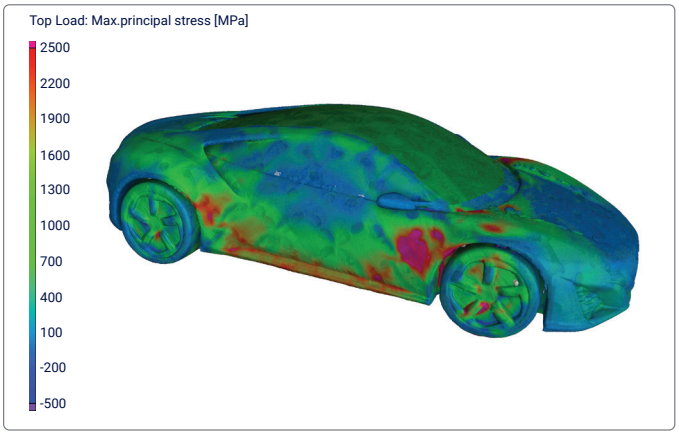
X-ray CT allows you to analyze dimensions or compare actual (CT data) and nominal (CAD drawing) shapes of additively manufactured parts. You can also use the CT data as a digital-twin and apply damaging conditions such as mechanical stress to simulate how the parts behave.

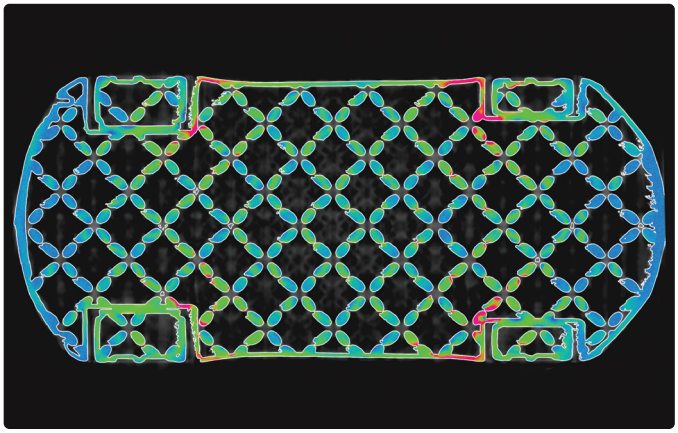
Additively manufactured Inconel part

The 3D printed Inconel sample (top) and 3D rendering with volume thickness analysis results (right).

Sample: Courtesy of Nissin Manufacturing Co., Ltd.







Principal stress calculation

The principal stress distribution was simulated and shown in a 3D rendering (left) and in the top-view cross section (right). The simulation indicates that the front parts of the side walls are experiencing the highest tensile stress.

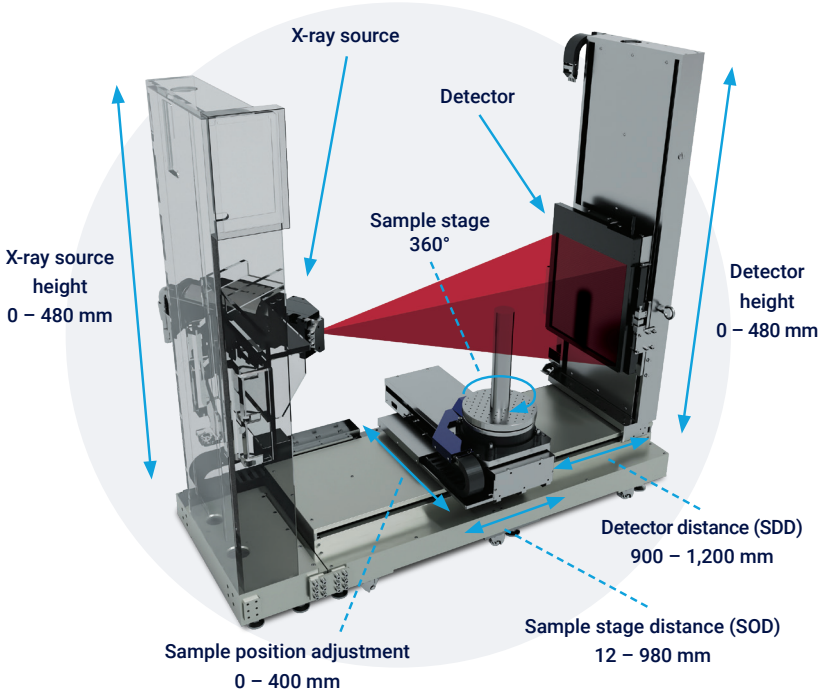
Ultimate flexibility

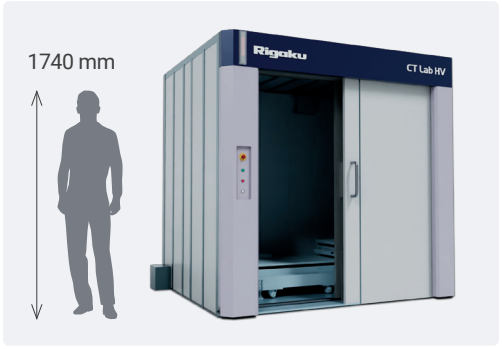
Take advantage of the flexible design

Large enclosure and variable SDD and SOD

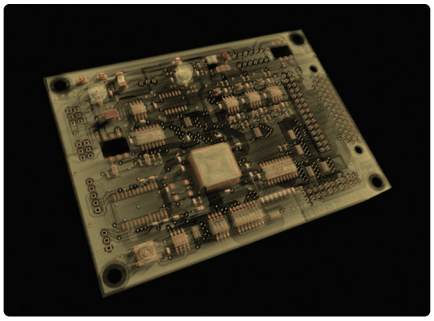
The CT Lab HV's large radiation enclosure, wide door opening, and variable X-ray source height, sample position, detector height and position enable the ultimate flexibility to accommodate small-to-large samples* while optimizing the resolution.

*Sample sizes up to 600 mm diameter, 1200 mm tall can be accommodated with FOV range up to 350 mm.

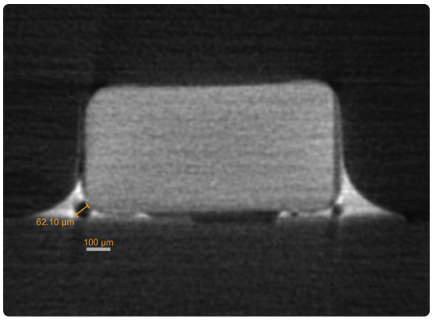




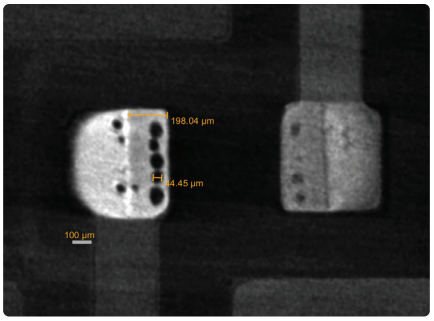
The flexibility also allows you to scan large samples at higher resolution, providing the entire view of the sample and detailed images of the areas that require further investigation.



A 3D volume view of a large 110 × 80 mm PCB



A high-resolution cross-section of a condenser



A high-resolution cross-section of a solder joint

Ultimate peace of mind

Don’t worry about maintaining the X-ray source performance

Automatic Intensity Control (AIC) for continuous intensity of radiation

AIC automatically controls the X-ray focus size and power to maintain the X-ray intensity to eliminate artifacts in long scans and avoid drifts of process control criteria used in X-ray CT image analysis.

Automatic tube calibration for optimum performance

The automatic X-ray tube calibration controls the magnetic field where the electron gun hits the target. This maintains the data integrity and stability. It also makes the X-ray geometry alignment easy after a cathode exchange.

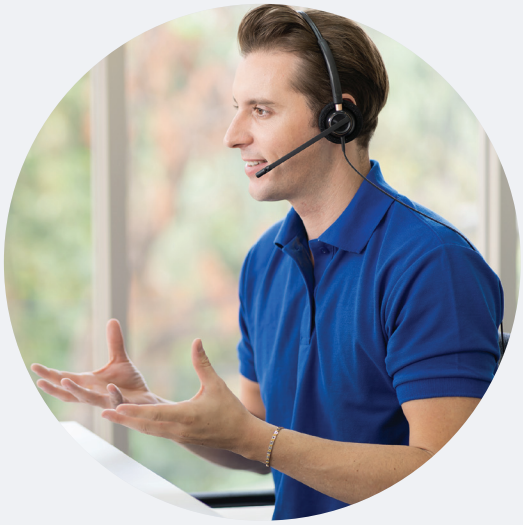
Easy maintenance with adjusted ready-to-use click-in cathodes and automatic tube venting

You can easily change the filament cathode without requiring a service call.

Don’t worry about complex data analysis

Lifetime application support

However clear the CT images you might obtain from your scanner, the interpretation of CT data and qualification of scanned products are not always straightforward. Without proper optimization, data analysis alone can take a long time, while you need the results fast. All CT Lab HVs come with in-person training at your facility to ensure you are comfortable with collecting data and analyzing your own samples. Our experts will continue to provide technical support to help you set up your inspection procedures for the lifetime of your CT Lab HV.



Specifications

Overall performance	
Field of view (FOV)	Min. 4 mm φ × 2.5 mm/scan Max. 350 mm φ × 230 mm/scan
Minimum voxel size	1.5 µm
Best spatial resolution	3 µm
Scan modes	Standard, stitched, half

Detector	
Detector type	8 Mp flat panel
Active area	433.7 mm × 433.7 mm
Pixel count	2816 × 2816 pixels
Pixel size	154 × 154 µm
Dynamic range	16-bit
Detector height	0 –480 mm, variable

X-ray source	
Maximum power	300 W
Applied voltage	20 – 225 kV
Filament current	50 – 3000 µA
Target material	W
Tube type	Reflection, open
Minimum focus size	3 × 5 µm
Filter materials	Al, Cu, Sn (1 mm thick)
Cooling	Water cooled
Source height	0 – 480 mm, variable

Geometry and sample holder	
Source-to-object distance (SOD)	12 – 980 mm
Source-to-detector distance (SDD)	900 – 1200 mm
Maximum sample/object size	600 mm φ × 1200 mm
Maximum sample/object weight	50 kg
Sample rotation	0 – 360°
Sample/object horizontal translation	0 – 400 mm, variable

Total weight: 4400 kg

Required power supply:

115 V (US) / 230 V (Europe), ±10%, 15 A, single phase, 50/60 Hz ±1% 300 VA
230 V (US, Europe) ±10%, 15 A, single phase, 50/60 Hz ±1% 300 VA

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