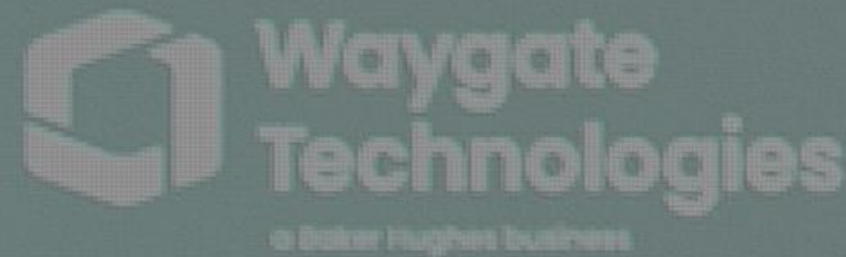


25 years of
Phoenix



What Kind of Modern Equipment does a CT Inspection Service Provider Need

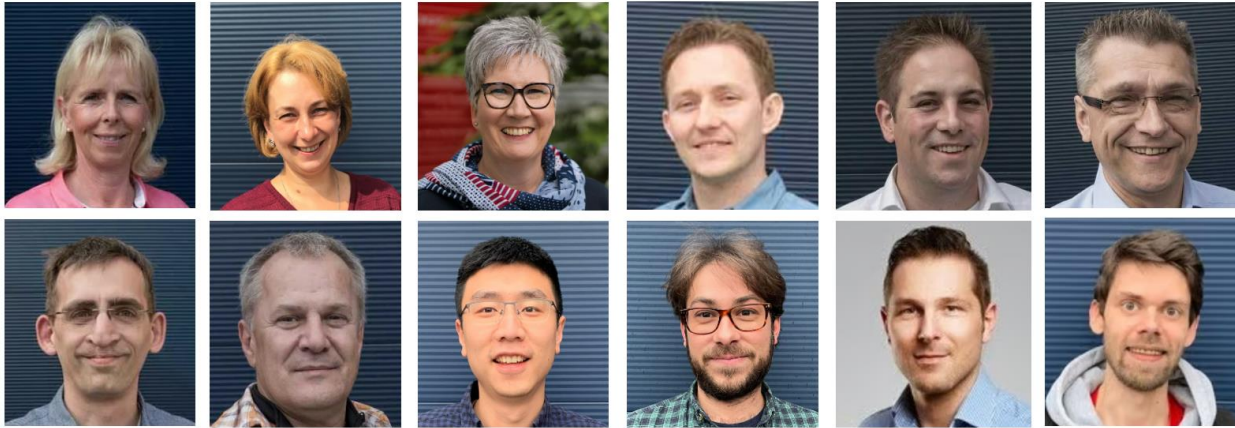
Examples of Current Applications

Global X-Ray and CT Forum

10th - 12th September
Hamburg, Germany

- Introduction
 - Team iWP, company and location
- Review of 18 years of industrial X-ray inspection
 - 2006 - 2014 (3 Systems)
 - 2015 - 2024 (7 Systems)
- Industrial computer tomography - typical examples
 - Nano-CT
 - Micro-CT
 - Metro-CT
 - Macro-CT
 - Meso-CT
- Conclusion & Wish list

Our team, company and location in Neuss



 RT-CT certified according to DIN EN ISO 9712

iWP innovative Werkstoffprüfung GmbH & Co. KG

Heerdterbuschstrasse 10 | D-41460 Neuss

Tel.: +49 2131 40 575 40

Fax: +49 2131 40 575 80

Email: p.mikitisin@i-wp.de

Web: www.i-wp.de

iCT: www.ict.app

DAkS-Nr. D-PL-20481-01

D-U-N-S® Nr: 313566891



The first CT systems and CT examinations

2006



Start with first industrial computer tomograph:
phoenix v|tome|x s225

2008

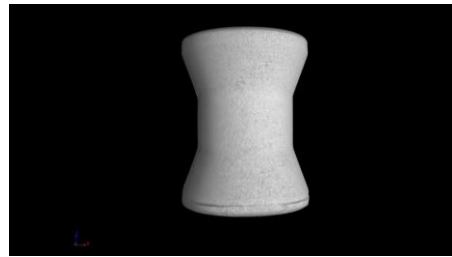
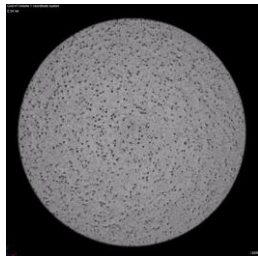
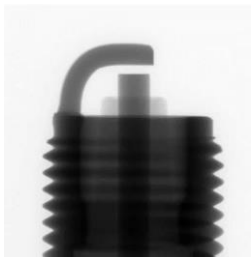


Expansion with a larger dual tube system
(450 kV macro-CT and 240 kV micro-CT)

2013



Fiber analyses and material characterization require a nano-CT system



ghe



in 2015 we founded



iWP innovative Werkstoffprüfung GmbH & Co. KG

Industrial computer tomography

Digital radioscopy

Service, training and sales

Industrial Computer Tomography

Modern Equipment

#iCT | nano-CT | micro-CT | metro-CT | meso-CT | macro-CT

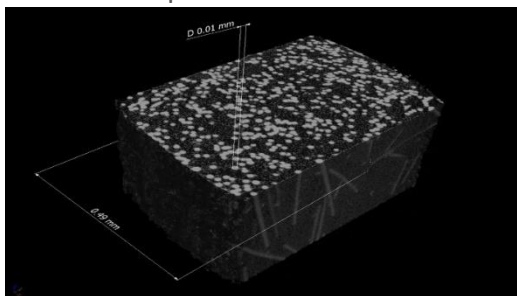
Nano-CT

phoenix nanotom m

- 180kV/15W nanofocus x-ray tube with up to 200nm detail detectability
- Up to 300nm minimum voxel size
- GE DXR detector with 3,072 x 2,400 pixels, dynamic range > 10,000:1
- Granit based manipulator
- Max. Specimen size 240 mm x 250 mm

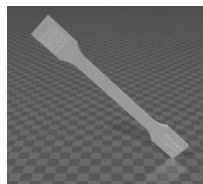
3D metrology package for stable acquisition conditions and reproducible measurement results

Fiber orientation analysis is the reason for the increasing use of fiber composites.



phoenix nanotom s

- 180kV/15W nanofocus X-ray tube with up to 800nm detail detectability
- High image quality due to Hamamatsu CCD detector
- Granite based manipulator
- Max. Specimen size 180 mm x 180 mm



medical syringes



Fibers

(PA271915)
Upgrade in
2021/22



(PA211809)



Rock
s



Coins

Micro-CT

phoenix v|tome|x s225 Pro

- Open microfocus X-ray tube, 225kV/300W with detail detectability down to 6µm.
- High image quality thanks to the new **DXR S100 Pro** detector with 3000 x 2500 pixels (100 µm)
- Max. Sample weight: 10 kg
- Steel up to a wall thickness of 20 mm
- Aluminum up to a wall thickness of 80 mm
- Plastic up to a wall thickness of 120 mm



Soldering



Electric components (MM)



plastic components



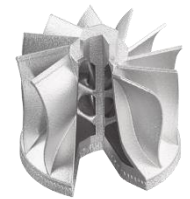
Rubber plastic components



Seals



Weld seams,



Rubber metal components



(PA112506)

**Upgrade in
2021/22**

phoenix pcba analyser 160

- Open microfocus X-ray tube, 160 kV/200W with up to 6µm detail detectability.
- Stable image quality either by PE 0840 detector with 512 x 512 pixels (400 µm) or image intensifier



(PA43303)

Electronic boards



Fracture analysis



Ceramic protection

Metro-CT

phoenix v|tome|x m metrology edition

- Open high power microfocus X-ray tube, closed cooling water circuit;
- 240kV/320W microfocus X-ray tube with detail detectability down to $< 1\mu\text{m}$.
- Up to 300nm minimum voxel size
- Image quality through temperature-stabilized Dynamic41 P200+ detector, 200 μm pixel size, dynamic range $> 10,000 : 1$, up to 30 fps,
- Granite-based 5-axis precision manipulator.
- Max. sample size 360 mm x 600 mm; up to 500 x 600 mm with restricted travel, max. 3D scan size up to 290 mm x 400 mm

Upgrade to Metrology 2.0 in 2022

- The phoenix v|tome|x m is now also available in certain countries as a special Metrology Edition with a measurement accuracy of $3.8+L/100\mu\text{m}$ according to the VDI 2630 guideline; measured as sphere distance deviation in static tomography mode SD (TS). Details of the measurement procedure according to VDI 2630-1.3



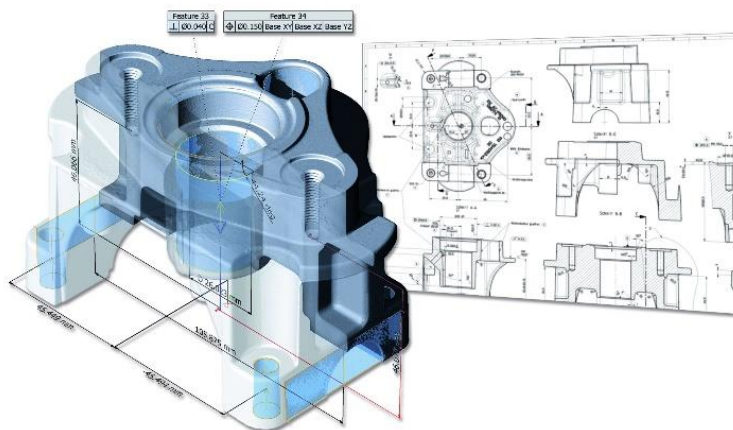
Fireworks



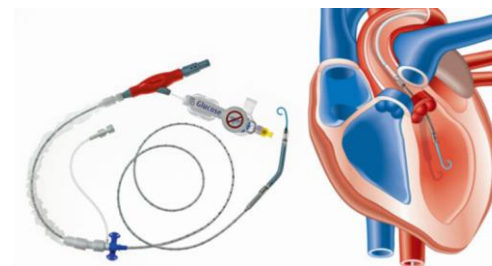
AM components



Flute



Medical Devices



Impella heart pump

(PA262815)
**Upgrade in
2022**

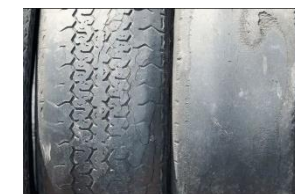
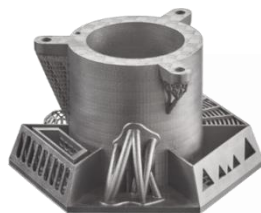


Stents

Macro-CT

phoenix v|tome|x L450

- 450 kV X-ray tube (Mini / Macro Focus)
- Large high-resolution 2K detector DXR250 RT++ with 409 mm x 409 mm active area and 200 µm pixel size
- Horizontal 3x and vertical 4x usable
- 8-axis precision manipulator system based on granite (16 t)
- Detail detectability mini focus ~ 80 µm
- Max. sample size:
 - 1600 x 800 mm
 - 3200 x 800 mm
- Max. test weight:
 - 20 kg (2D)
 - 100 kg (3D)
- Steel up to 80 mm
- Aluminum up to 400 mm
- Plastic up to = 600 mm



Baker Hughes (



(PA252916)
Upgrade in
2021/22



Meso-CT

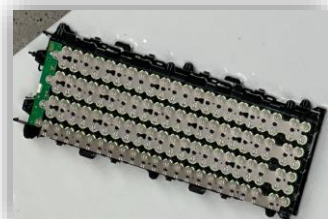
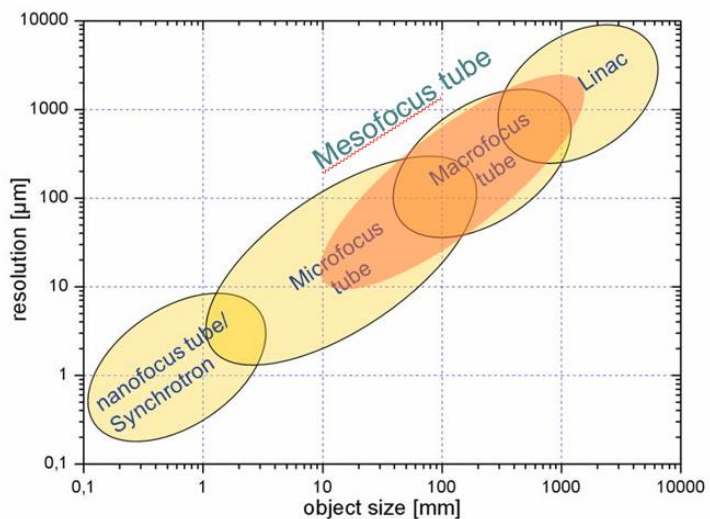
New

Phoenix V|tome|x C450 MF

- 450 kV Mesofocus X-ray (63, 100, 250, 350 and 450 μm) and max. power of 50 to 450 W
- High-resolution 2K detector Dynamic41 with 409 mm x 409 mm active area and 200 μm pixel size
- 4-axis precision manipulator system based on granite
- minimum detail detectability $\sim 50 \mu\text{m}$
- maximum specimen size: 700 x 1000 mm
- maximum test weight: 50 kg
- Steel up to 80 mm
- Aluminum up to 400 mm
- Plastic up to = 600 mm



(PA399523)

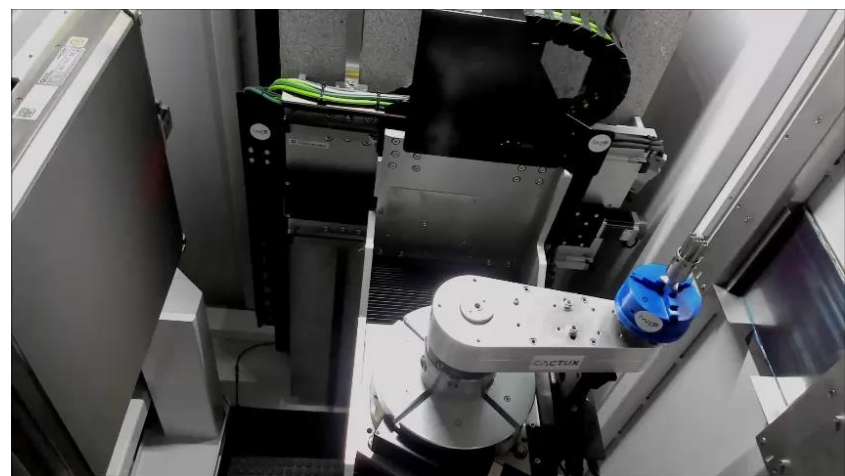
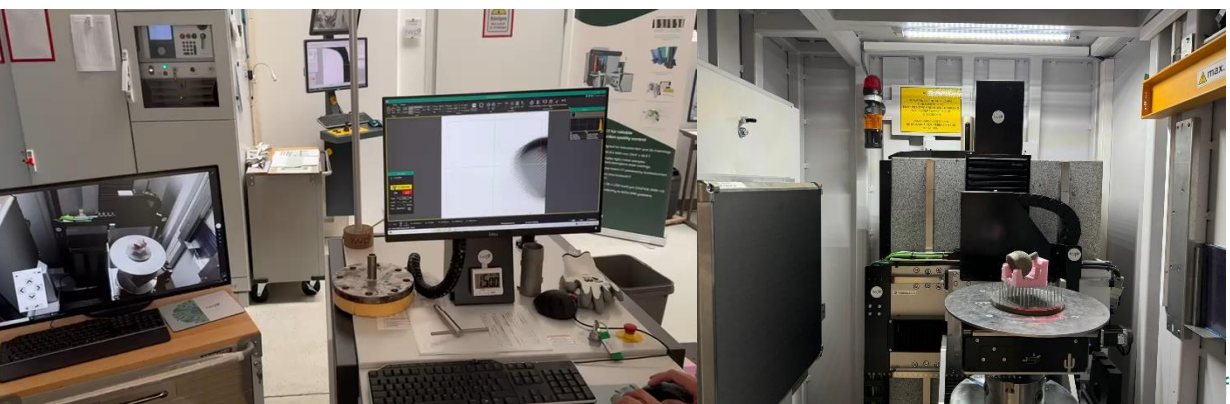
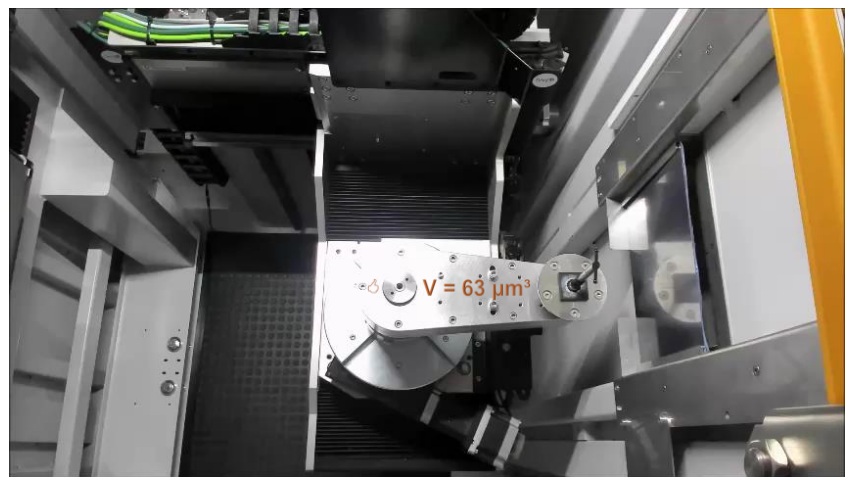
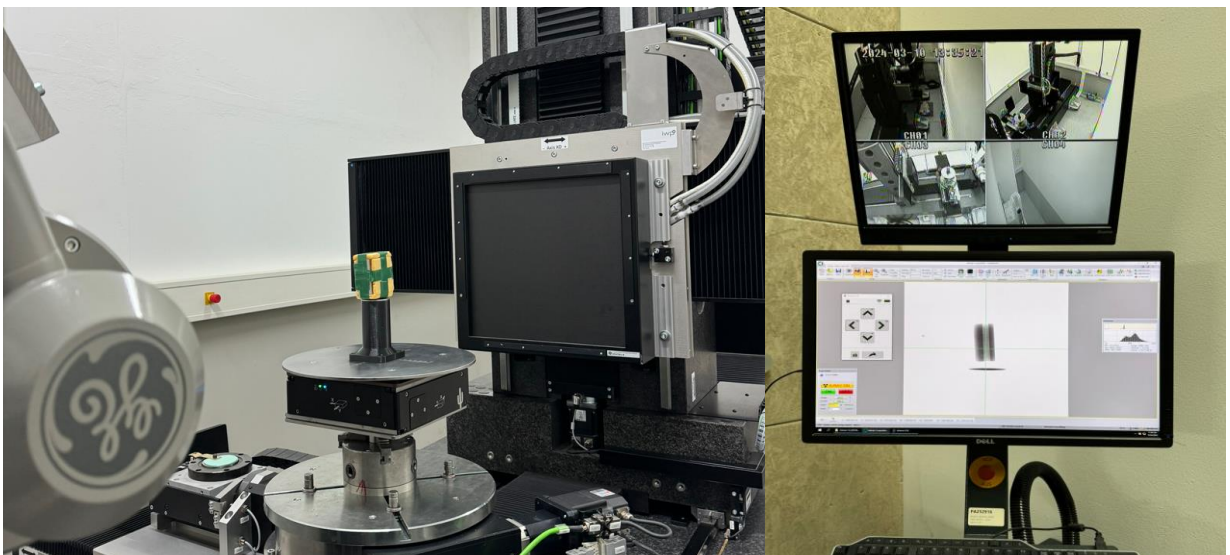


Baker Hughes Confidential

SaguaroX: Motorized xy translation stage for CT stations for quick sample mounting and easy sample centering respect to the X-ray tube. SaguaroX is controlled wirelessly from outside of the CT cabinet.

New

EXAX: With this tool, the standard magnification can be improved from $M = 2$ to $M = 3.2$. This means that the two small focal spots ($63 \mu\text{m} / 100 \mu\text{m}$) of the Comet 450 kV Mesofocus can be used optimally.

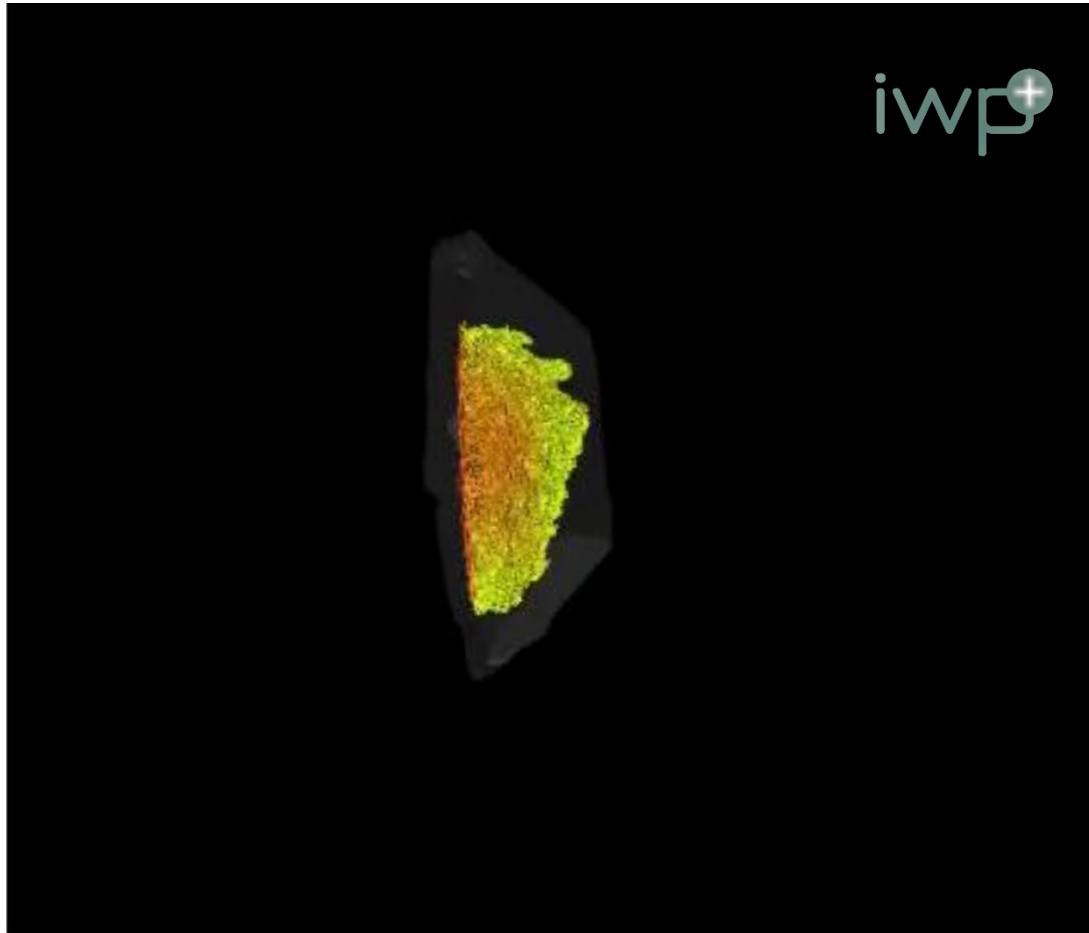
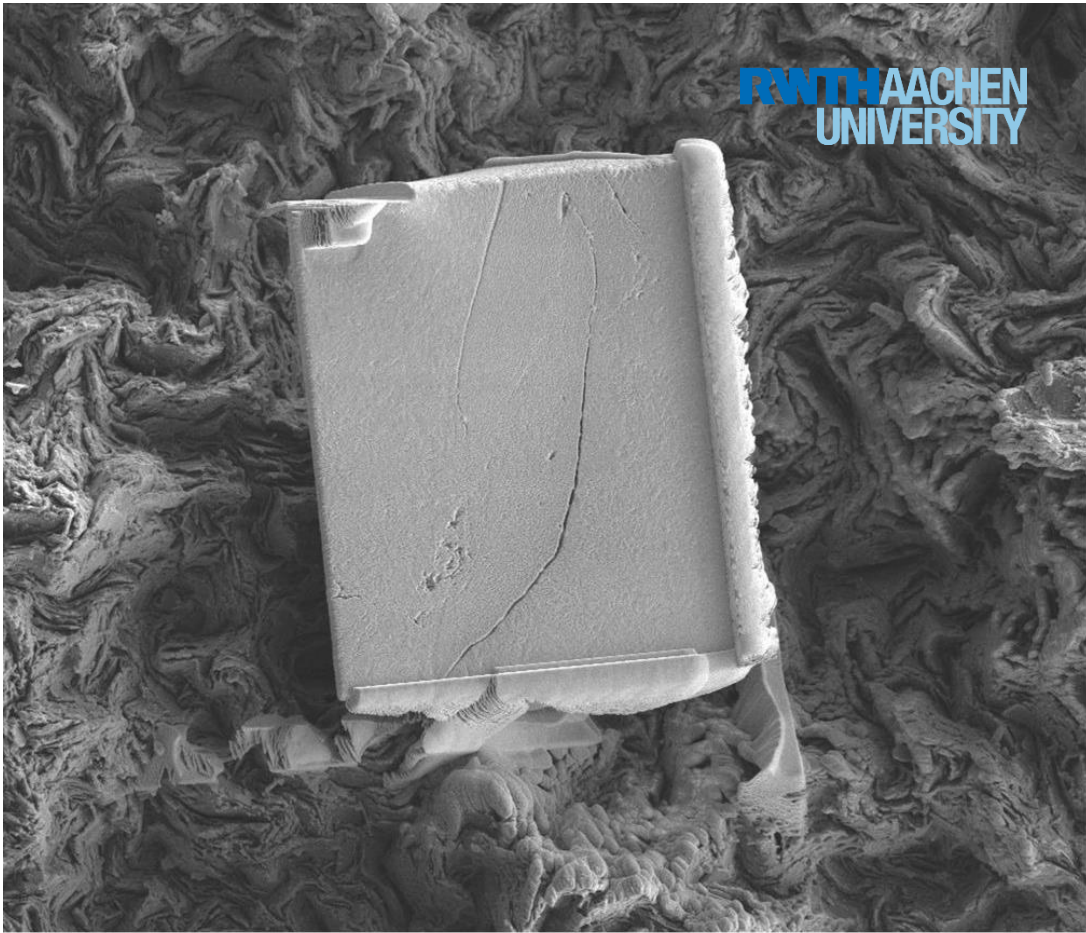


Confidential

Industrial Computer Tomography

Examples

#iCT | **nano-CT** | micro-CT | metro-CT | meso-CT | macro-CT



(2024) PhD Thesis, Adrian Mikitisin: Mikrostrukturelle Untersuchungen von Verschleiß- und Schädigungsmechanismen in Wälzlagern

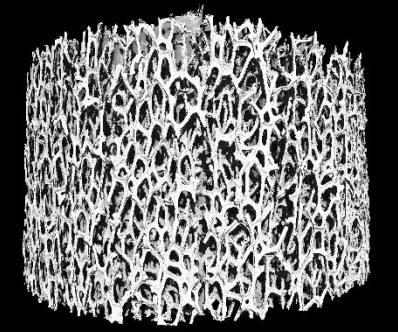
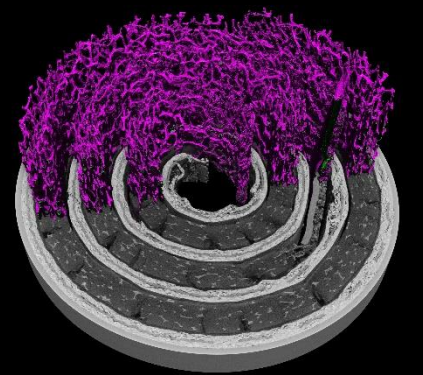
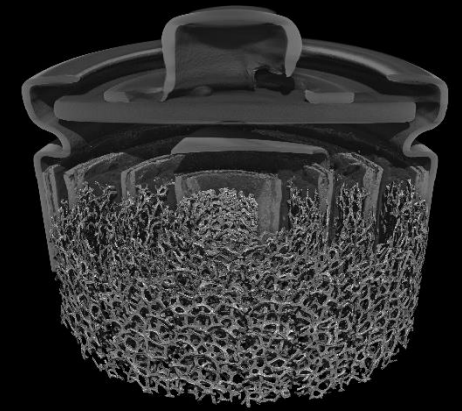
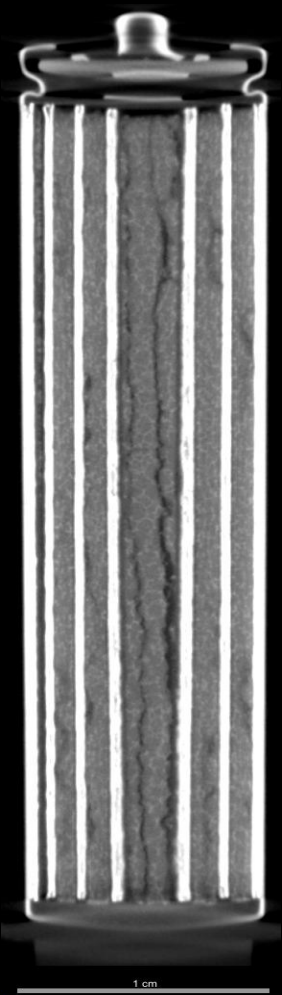
40 µm

1.3505/100Cr6 (bearing steel)

Zeiss GeminiSEM 300

Phoenix nanotom m180

NanoCT

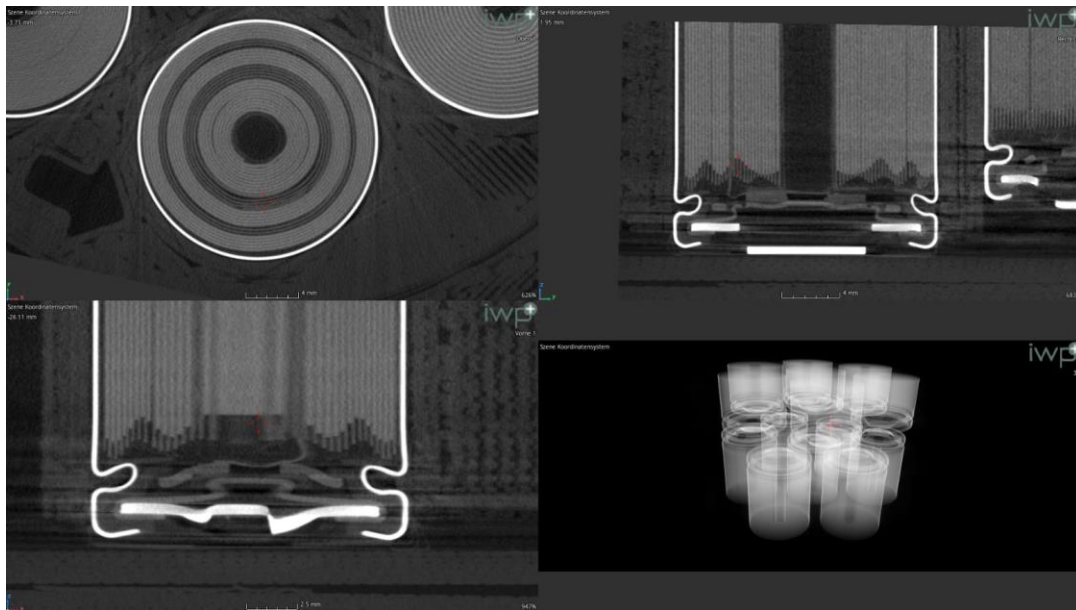


Nanotom m180, datos 2.8.2, VGStudio Max 2022.2

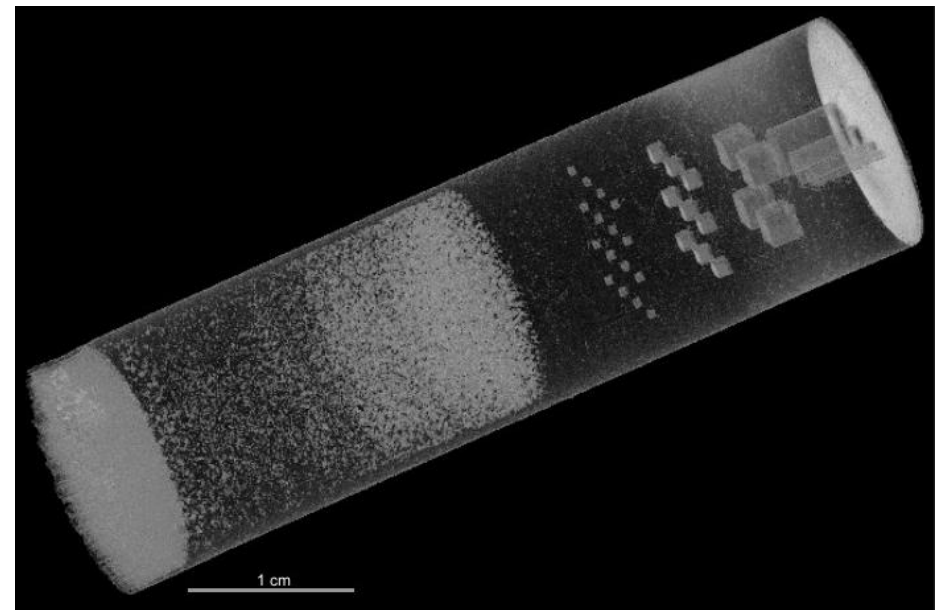
Industrial Computer Tomography

Examples

#iCT | nano-CT | **micro-CT & metro-CT** | meso-CT | macro-CT



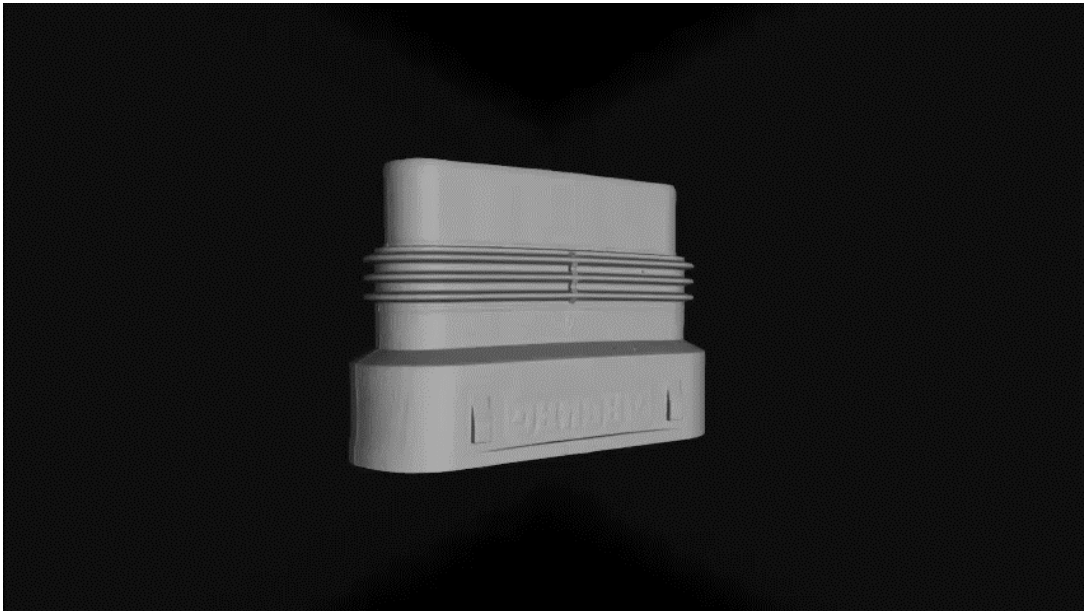
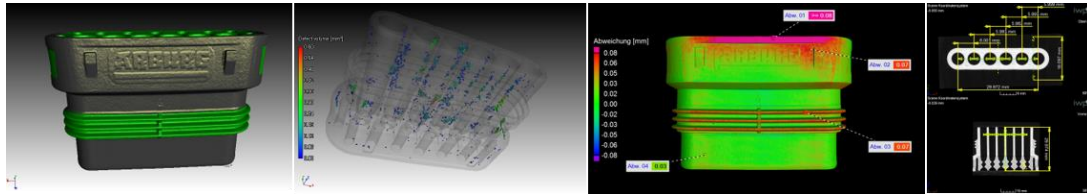
Phoenix V|tome|x s225 scan of 14 Batteries in 56s.



Phoenix V|tome|x s225 scan of the reference RT-CT-Ti01

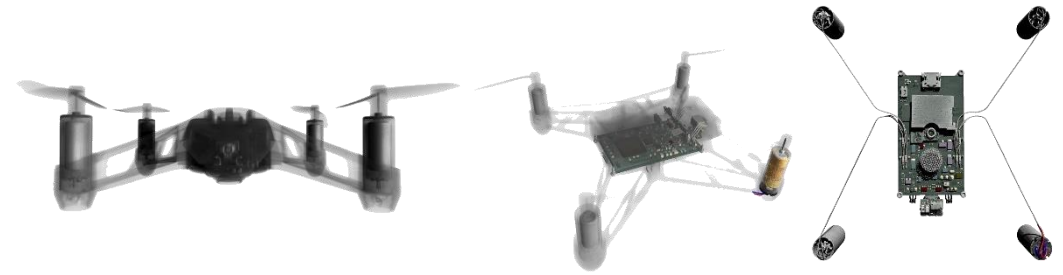
Metro-CT

- Metrology-CT
- Plastic connector (ARBUS)
- Measurement accuracy: $3.8+L/100 \mu\text{m}$ referring to VDI 2630



MM-CT

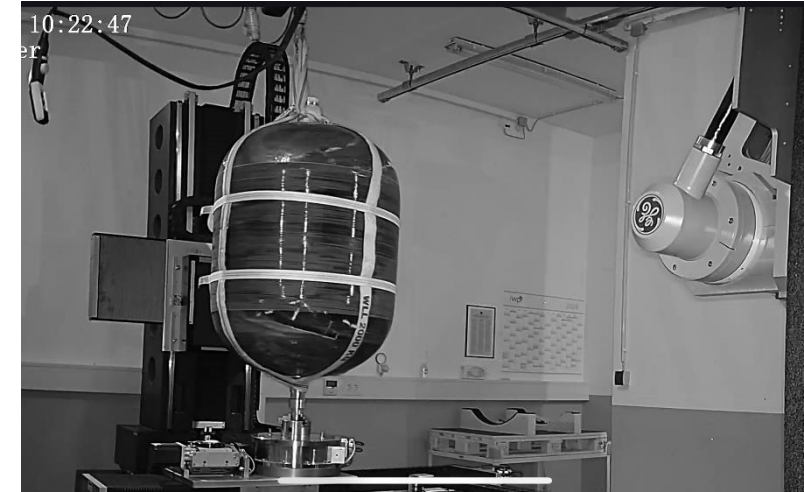
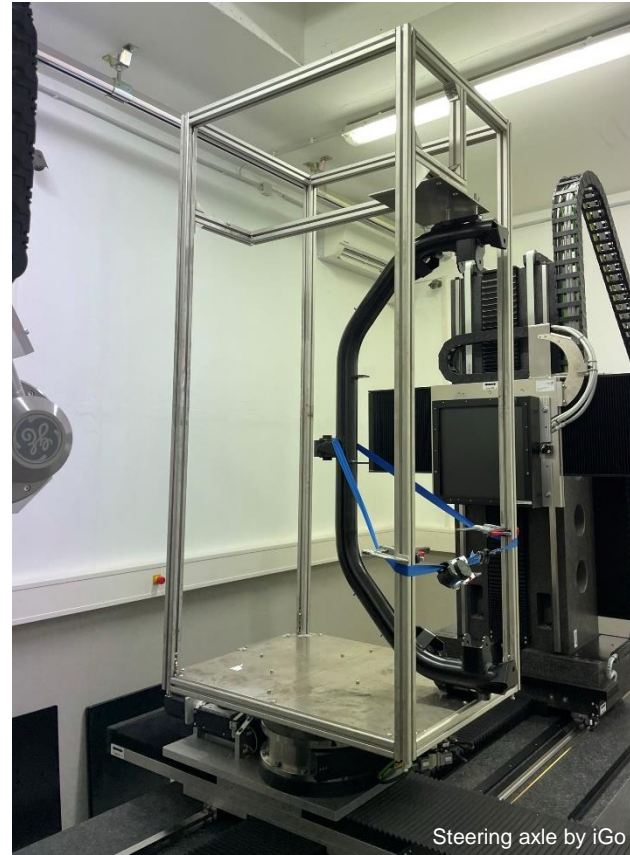
- Multi material-CT - Drone
- Plastic, metal, copper



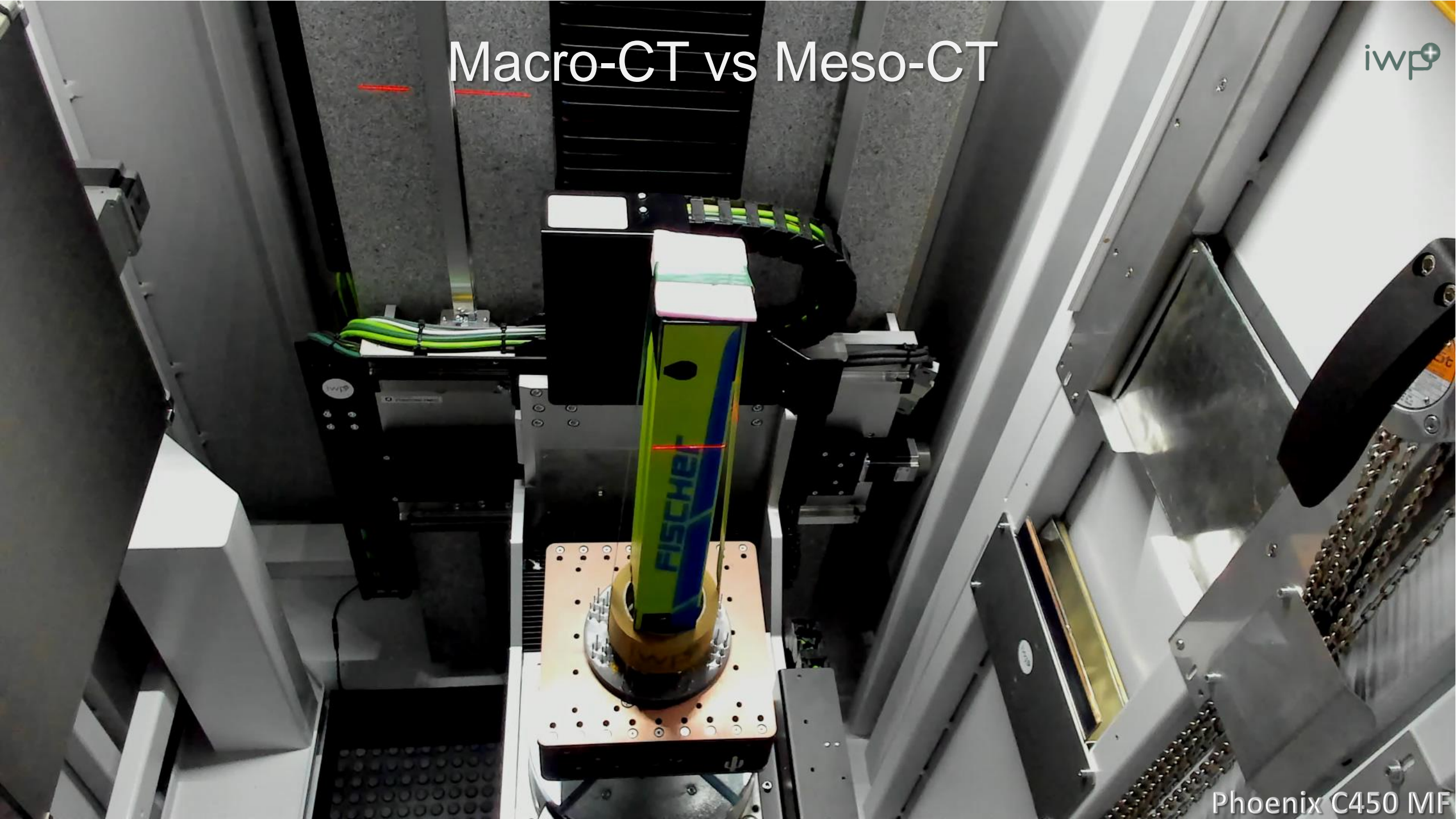
Industrial Computer Tomography

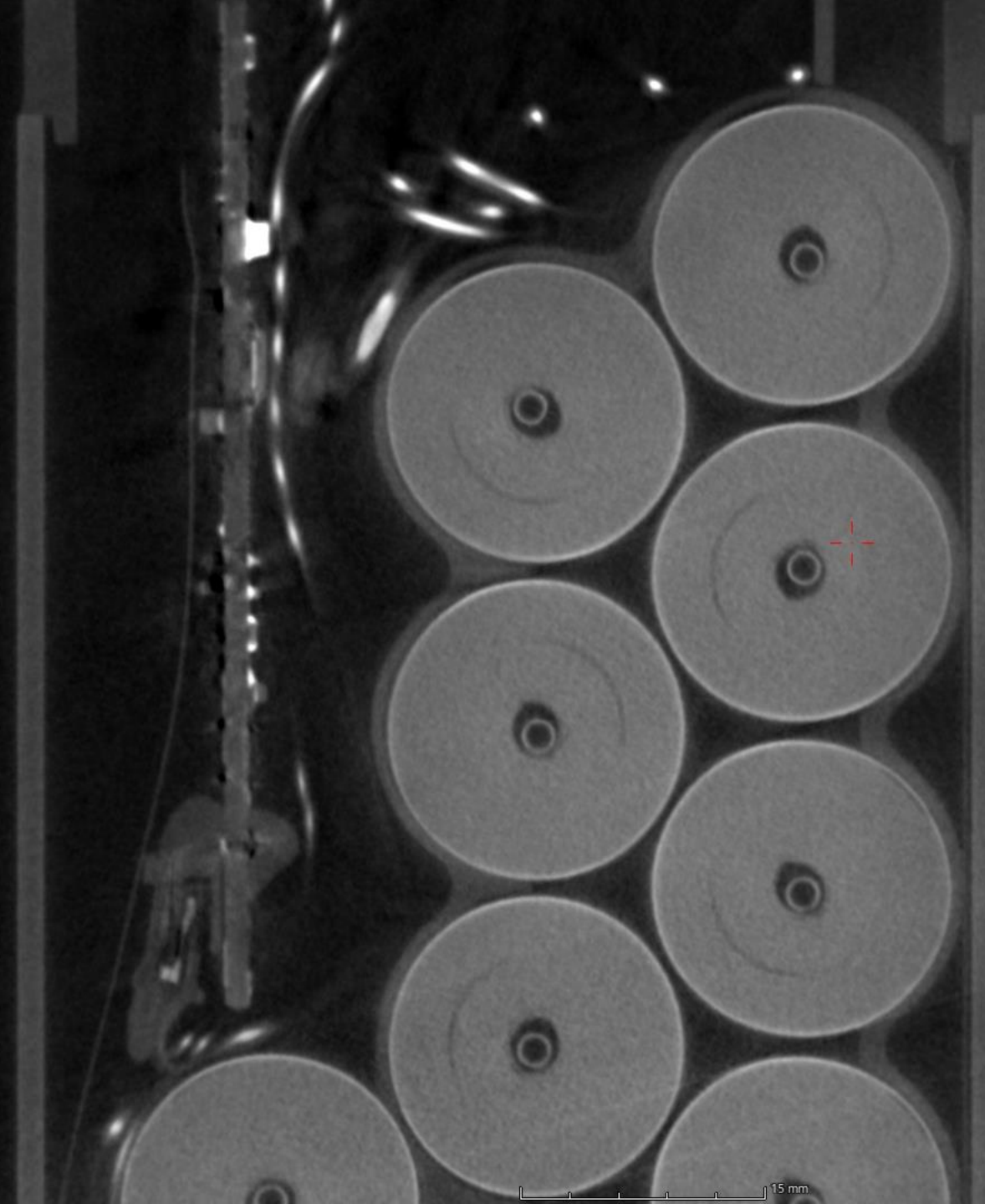
Examples

#iCT | nano-CT | micro-CT | metro-CT | **macro-CT** & **meso-CT**



Macro-CT vs Meso-CT

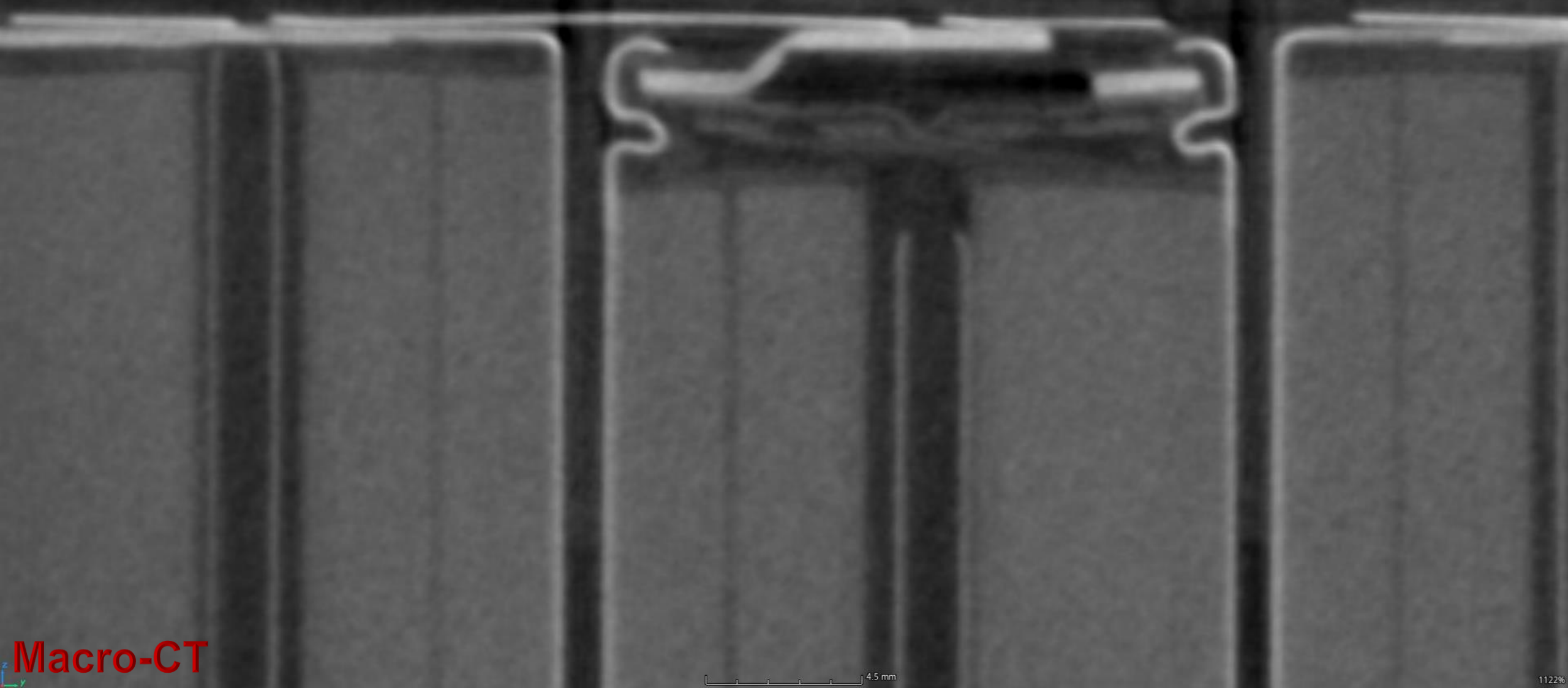






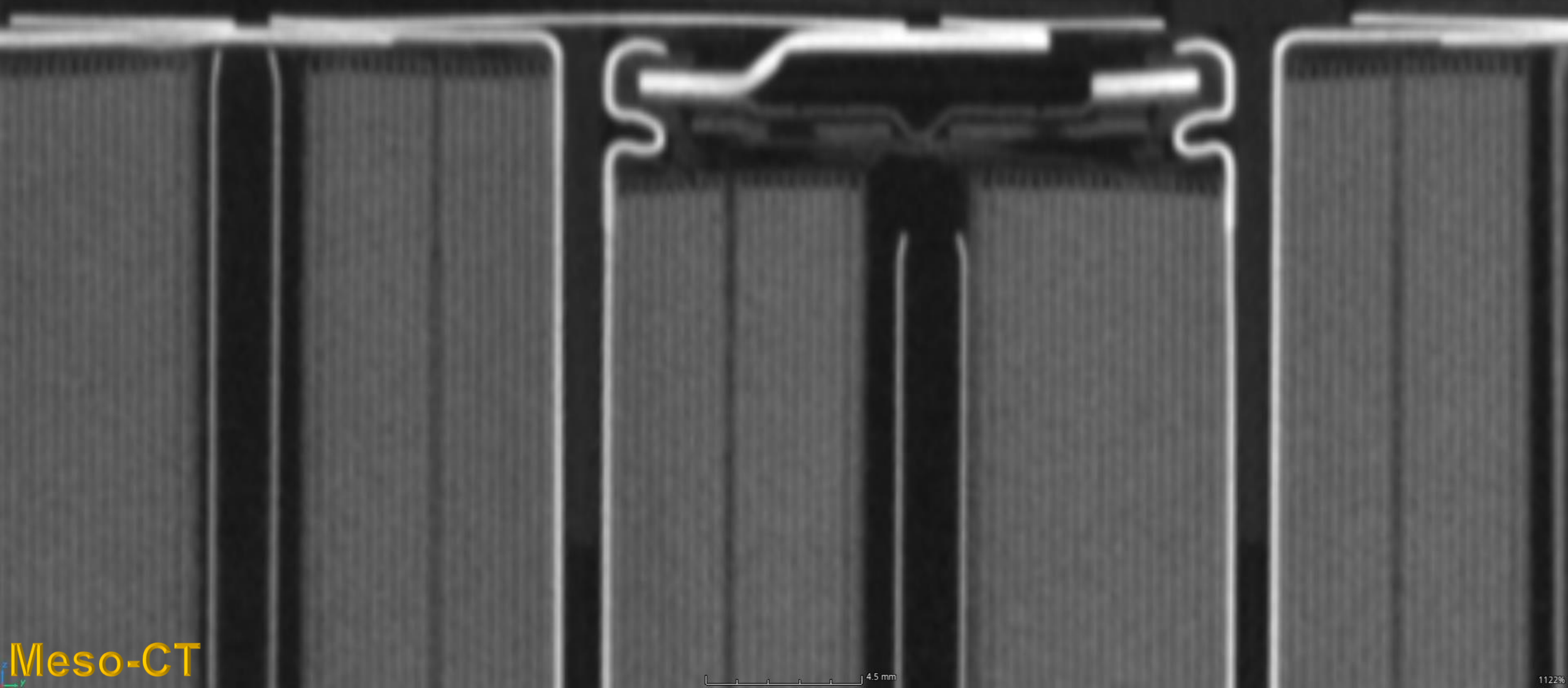
Meso-CT

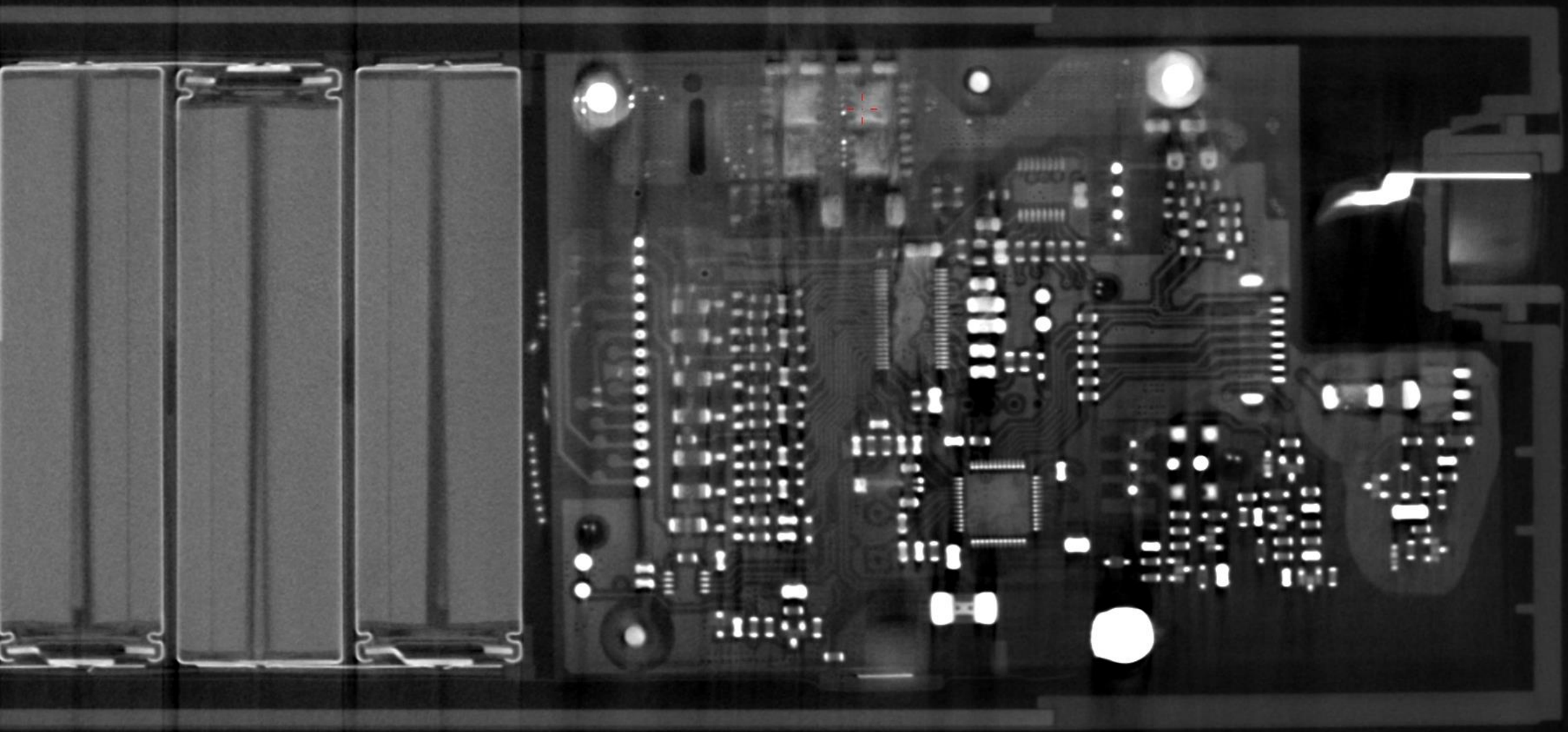
15 mm

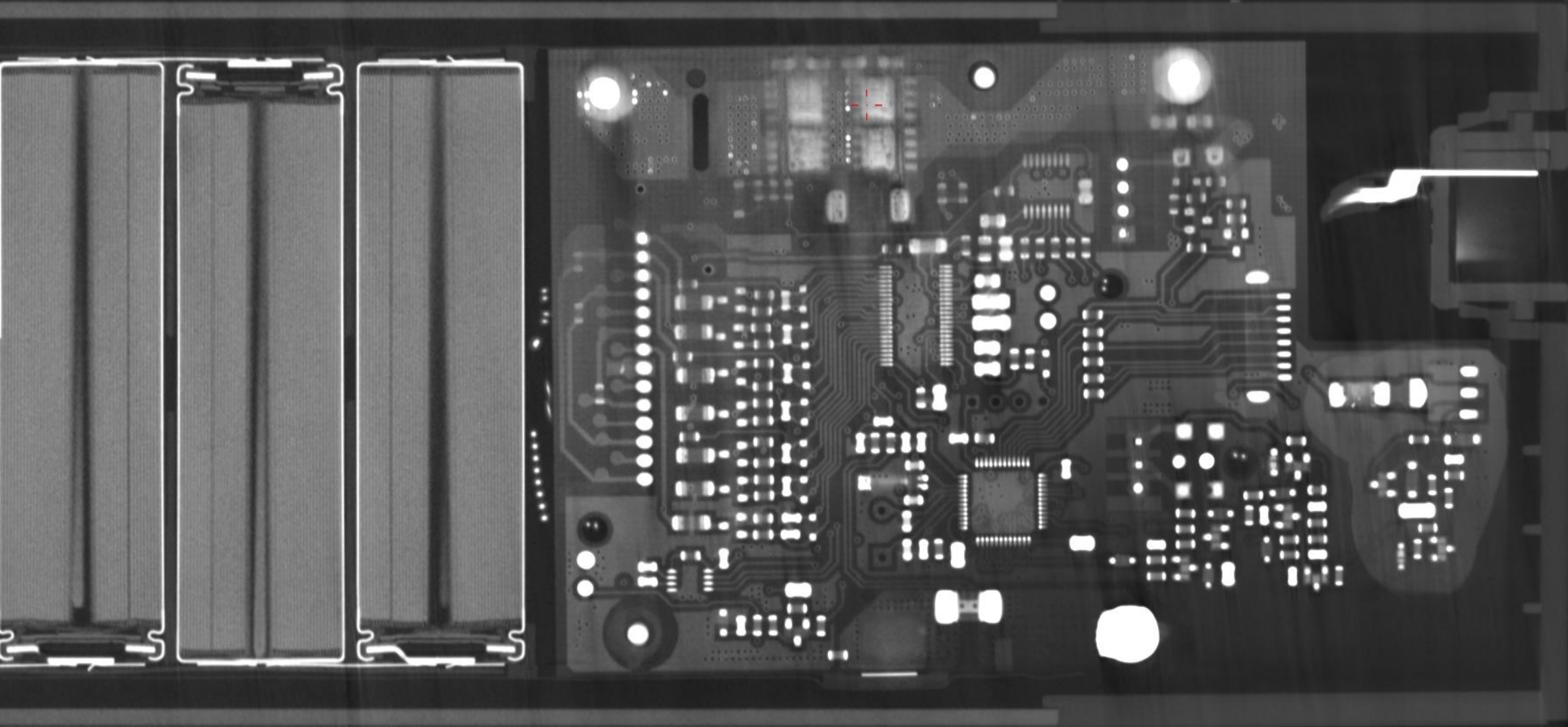


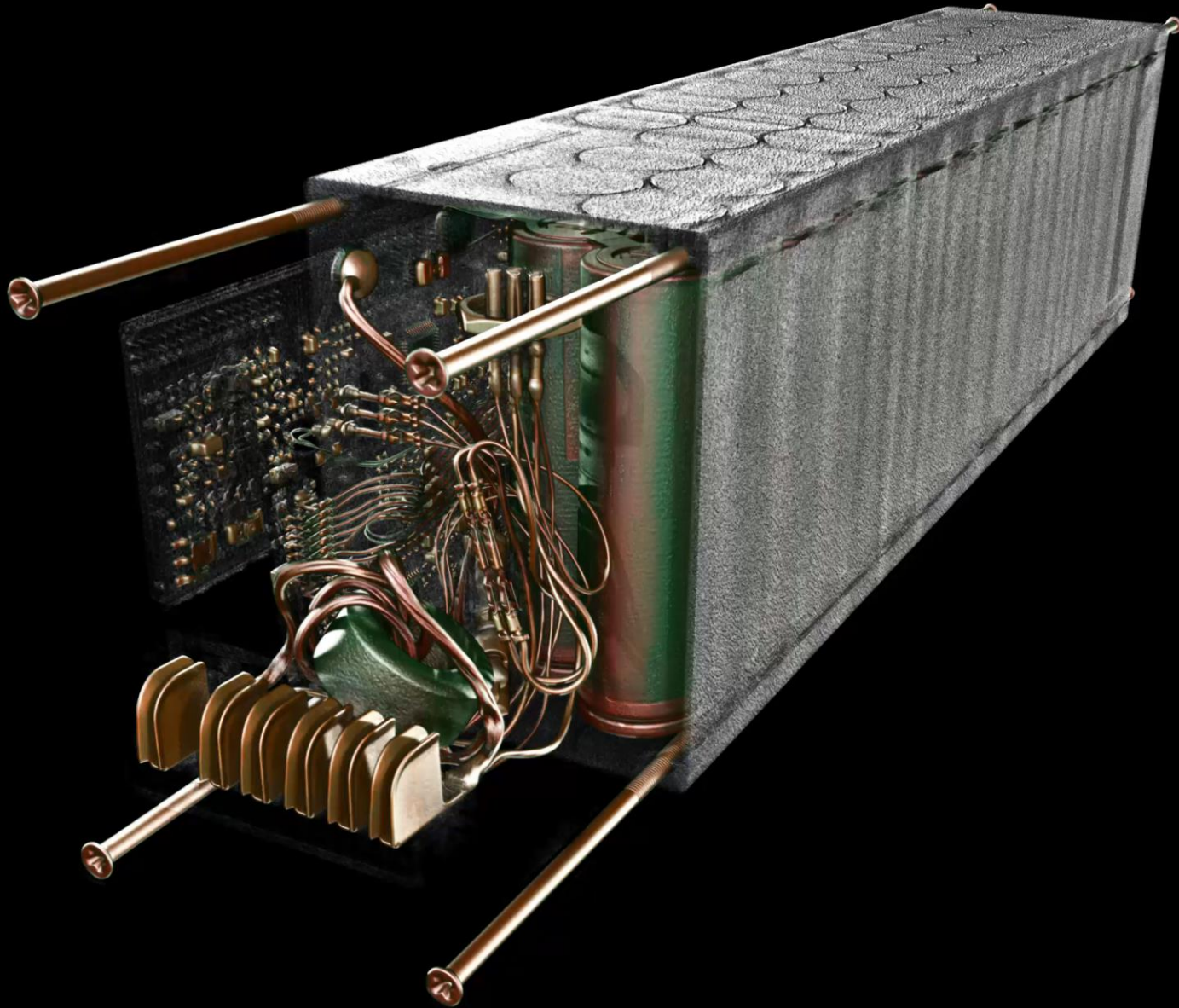
Macro-CT

4.5 mm

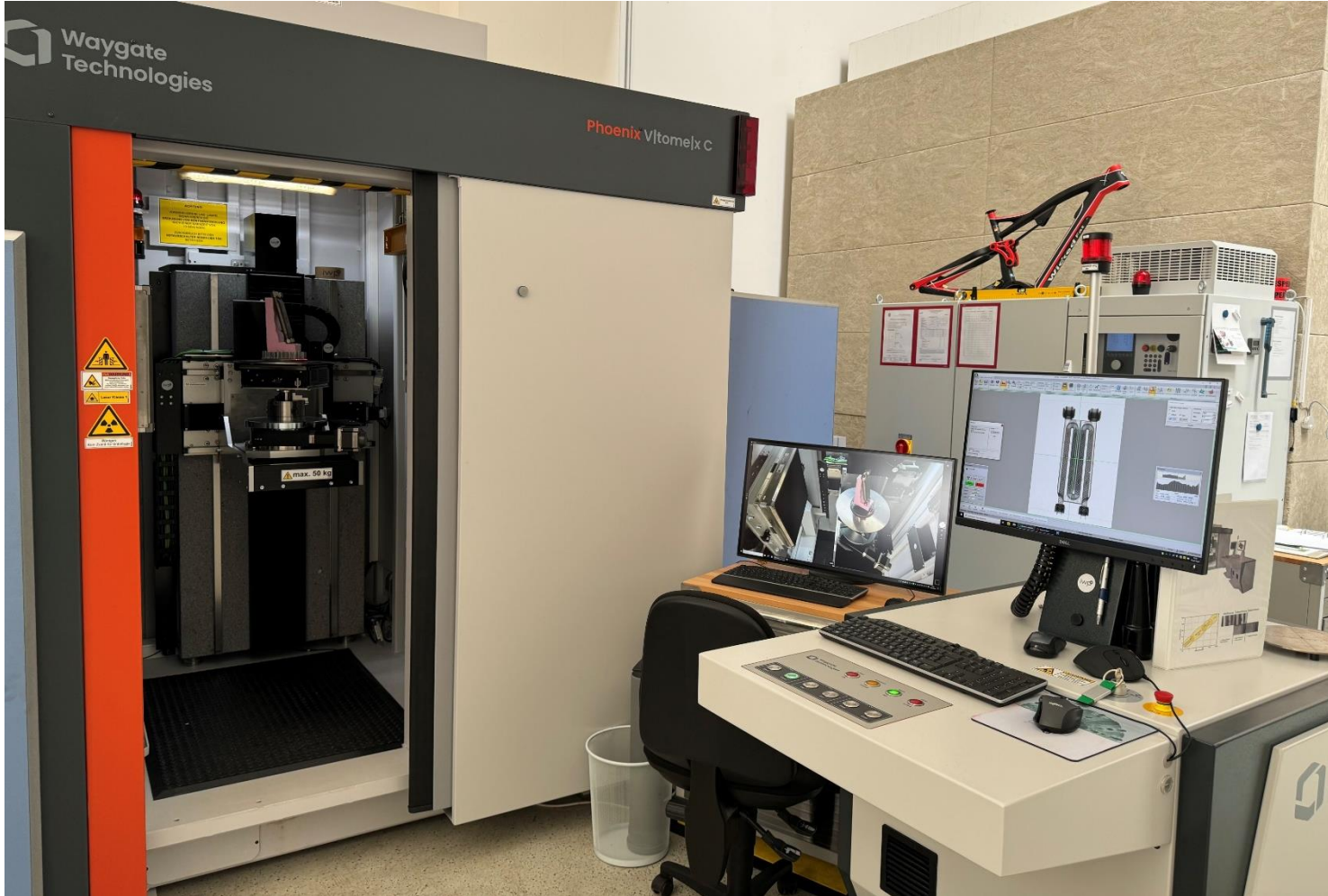




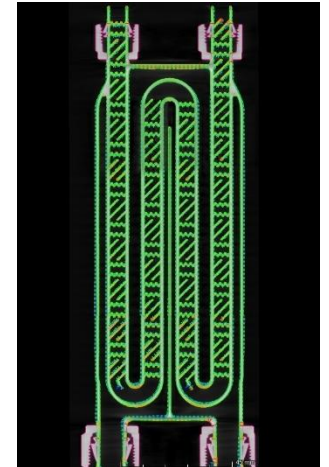
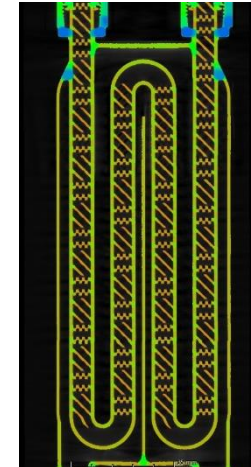
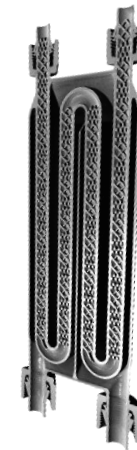




The partnership pilot project between iWP and Waygate started late in December 2023, but in the last 8 months we have already been able to do some interesting examinations. You have already seen one example in the previous slides, here is another one, unfortunately the others are not allowed to be shown due to NDA.



iwp



CT Probekörper
Art.Nr.: 01033470
FAFR: 2315522
Art. Reaktor: 01033375
FAFR Reaktor: 2315458
Baujobstart: 15.11.2023
Maschine: EOS M290
Material: Hastelloy C22 | 02005961

CT Probekörper
Art.Nr.: 01033470
FAFR: 2315527
Art. Reaktor: 01033375
FAFR Reaktor: 2315459
Baujobstart: 20.11.2023
Maschine: EOS M290
Material: Hastelloy C22 | 02005961

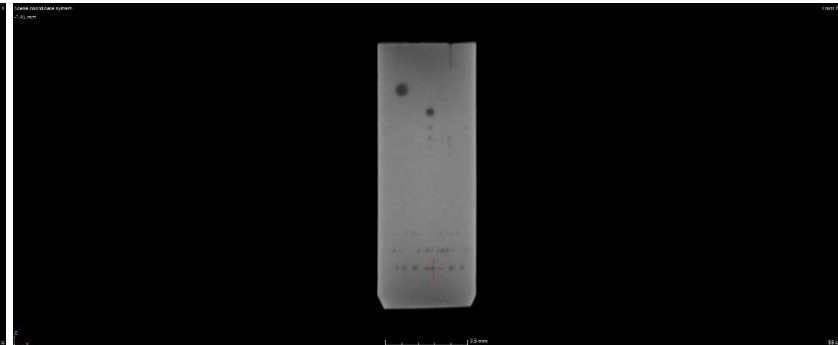
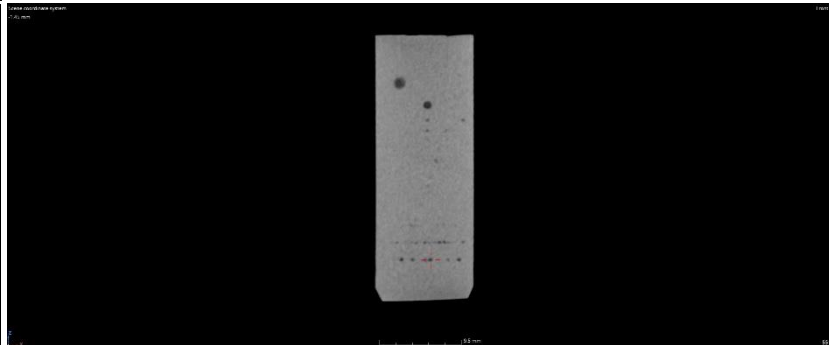
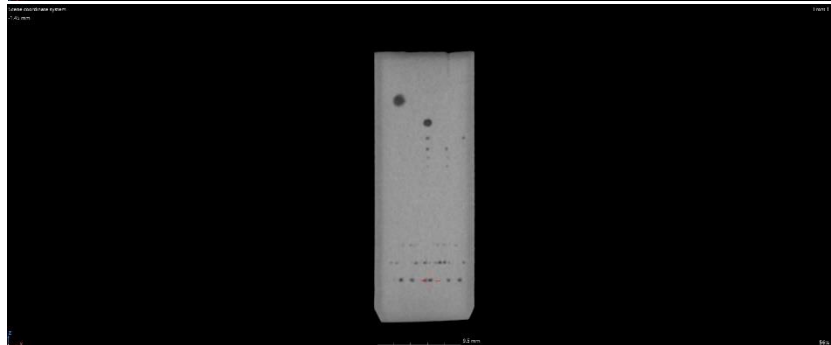
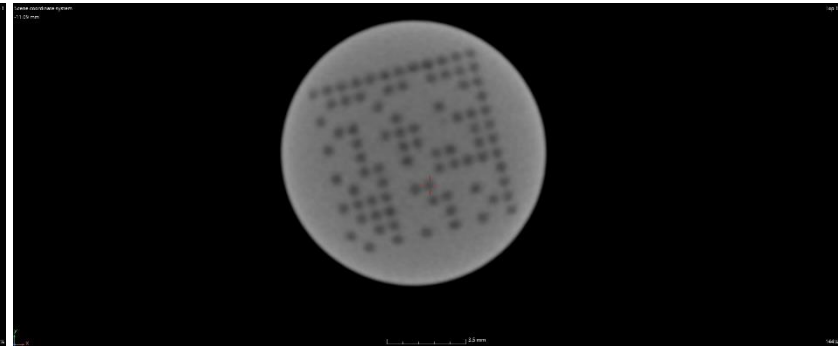
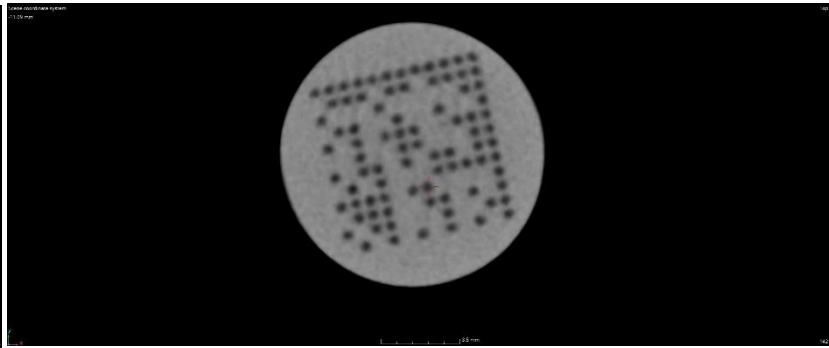
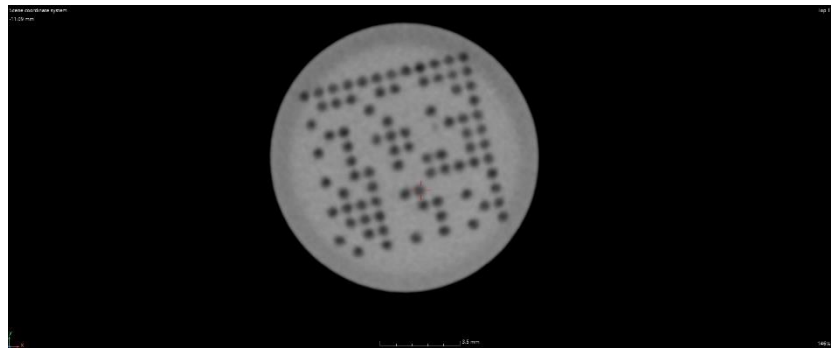
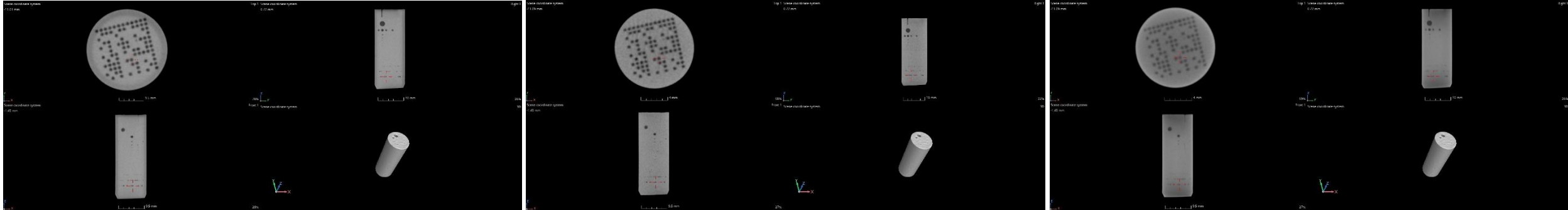


Computertomographie

ative Werkstoffprüfung GmbH & Co. KG
Telefon +49 2131-405 75 40
Fax +49 2131-405 75 80
Email ct@i-wp.de



Reference samples for AM
(Al, Ti, 316L an Hastelloy)



Phoenix V|tome|x m240

Phoenix V|tome|x C450MF

Phoenix V|tome|x L450

Industrial Computer Tomography

Conclusion & Wish list

#iCT | nano-CT | micro-CT | metro-CT | meso-CT | macro-CT

- Conclusion
 - iWP provides X-ray services from nano to macro-CT
 - Phoenix CT systems are robust and have little to “no” downtime
 - Nano CT is used for the smallest samples, but can also be used for high-resolution battery scans
 - Micro- & Metro-CT is our workhorse for daily work
 - Macro- and Meso-CT is needed for big, dense and heavy parts
 - Mesofocus systems enables higher resolution for denser samples
 - Use CACTUX tools for better scans and shorter scan times

Wish list

- Application-optimized software:
 - Interface to ERP system or other database.
 - Automatic test report with settings after measurement.
 - Standardized data structure including database (see healthcare)
- Regular software updates - how about a datos 365 model, like Microsoft 365?
- Performance monitoring with storage of data and statistical evaluation.
- Price-performance optimization, especially for spare parts.
- Better and faster communication with customers and project partners.
- More events like this or smaller events, e.g. at the customer's site.

Thank you for your attention

