X-Ray Microtomograph

Sub-Micron resolution

Specifications

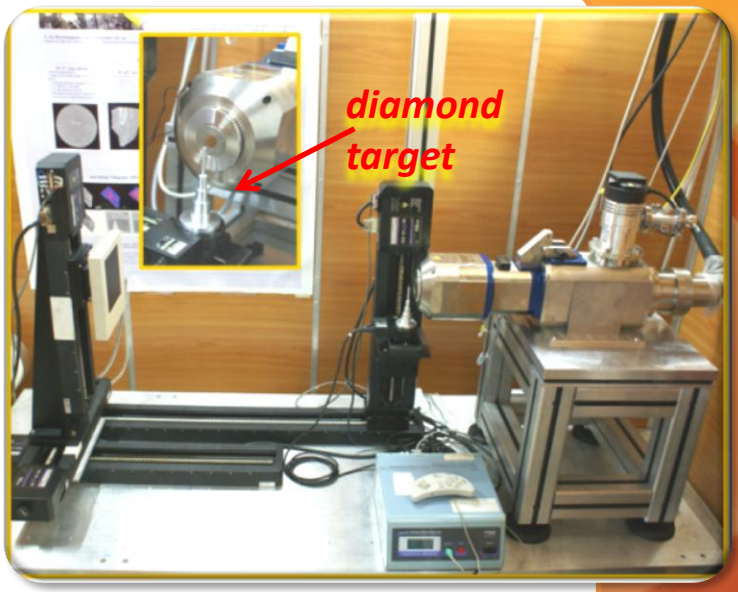
Microfocus X-ray source	Maximum high voltage: 225 kVp Feature recognition: <1 µm Min. object-focus distance: 0.25 mm X-Ray cone: 170°

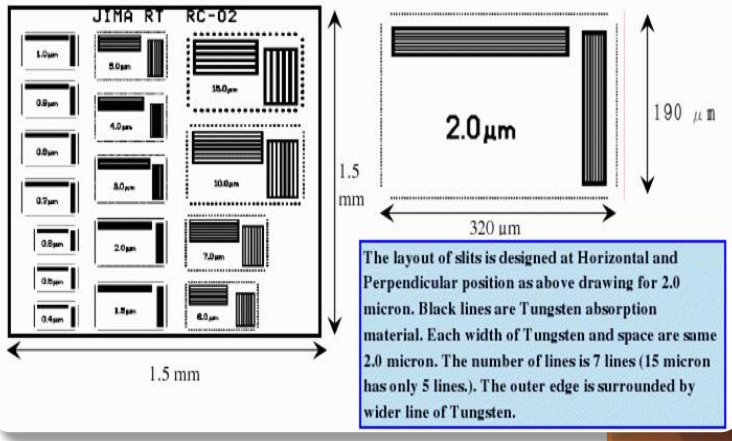
X-Ray detection	
Detector elements	1248 x 1248 a-Si flat panel 1024x1024 flat panel sensor 768 x 576 7" image intensifier (XII)
Detector Effective Area	120x120 mm^2 a-Si 50x50 mm^2 169x169 mm^2 XII
Digital Output	12 bits a-Si, 10 bits XII
Detector movement	300 mm horizontal & vertical

Sample micrometric manipulator	
X stage	travel 800 mm, loading capacity 30 kg
Y stage	travel 50 mm, load 6 kg
Z stage	travel 300 mm, loading capacity 6 kg
θ stage	accuracy 0.03°, loading capacity 20 kg

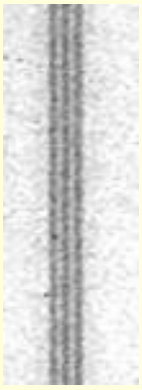
Probe dimensions	Diameter < 100 mm Height < 500 mm Weight < 4 kg
Magnification Factor	< 2000
Source-Detector Distance	< 1000 mm
Source-Object Distance	> 0.5 mm typical

Spatial Resolution	≥ 1µm
Density Resolution	≈. 1%
Scan Method	Cone beam CT Full scan (360º.) Short Scan (180º + fan angle) Oblique View Cone Beam CT
Geometry Calibration Program	Center of Rotation Vertical & Horizontal Alignment Detector tilt angle
Scanning Time	approx. 20min. (720 views)
3D Reconstruction Time Feldkamp Algorithm	≈ 1 min. (512x512, 512 slices) ≈ 10 min. (1024x1024, 1024 slices)
Output data format	32 float, 16 unsigned 16 bits integer
Artefact correction	Ring artefact removal Beam hardening reduction





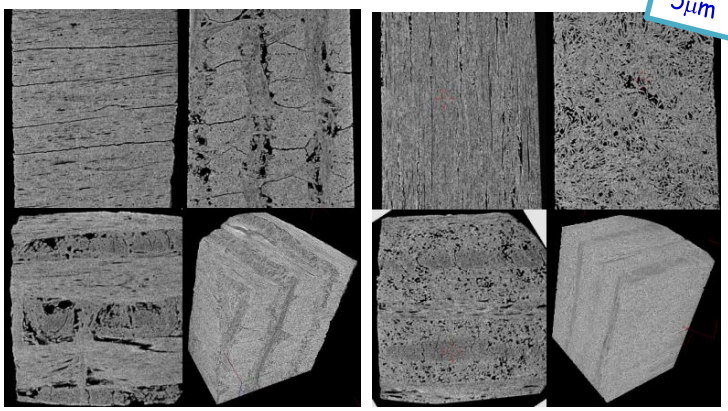
The layout of slits is designed at Horizontal and Perpendicular position as above drawing for 2.0 micron. Black lines are Tungsten absorption material. Each width of Tungsten and space are same 2.0 micron. The number of lines is 7 lines (15 micron has only 5 lines.). The outer edge is surrounded by wider line of Tungsten.



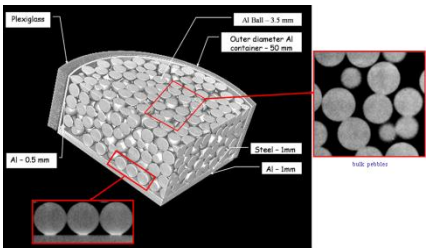
Resolution benchmark: JIMA Mask (0.4 µm)

Applications

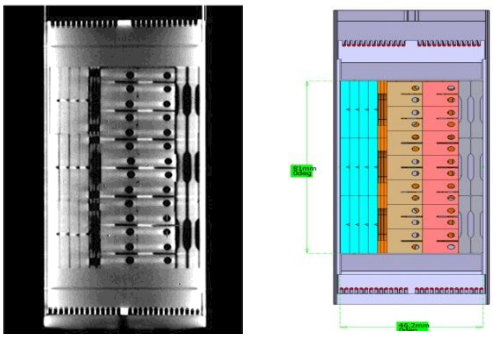
High resolution tomography on fusion technology relevant Carbon Fiber Composites (CFC)



Visualization of contact areas in 3D for compressed pebble bed

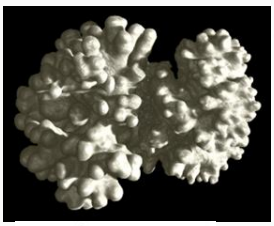


NDT analysis of the IFMIF high flux irradiation capsule loading quality

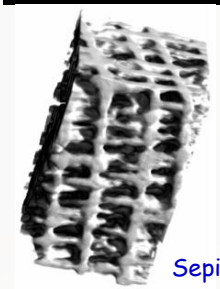


Application to life sciences

Shark tooth

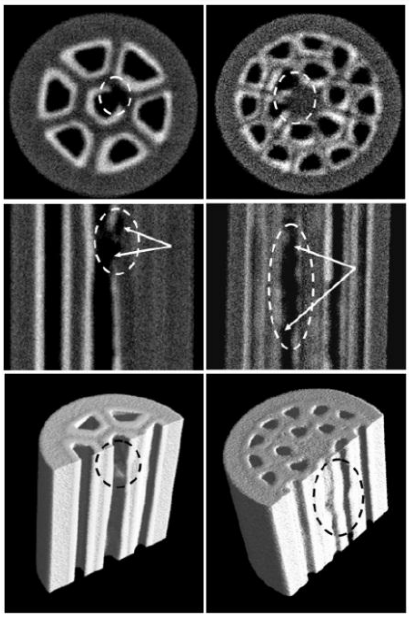


Coral

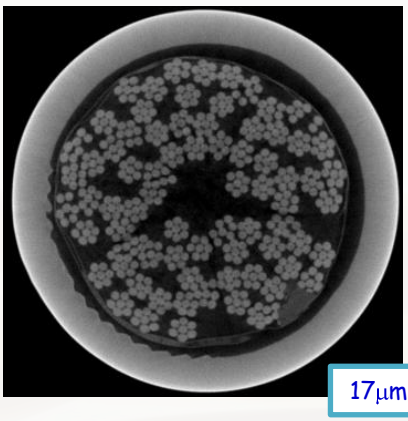


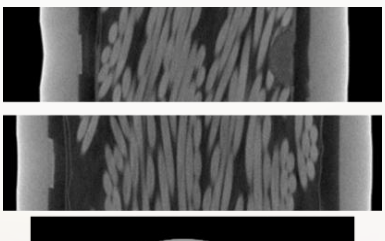
Sepia cuttlebone

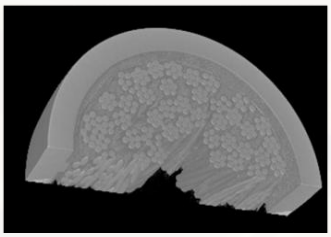
Defects identification in newly developed MgB2 superconductor wires



Superconducting cable in steel pipe







Microtomography measurements with 17 μm voxel resolution on a sample of 20 mm diameter

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