

X-ray Microscopy/ Nanotomography

- Imaging by diffractive optics: Fresnel Zone Plate (FZP) + beamshaping optics. Outermost zone width 50 nm.
- Available imaging modes: Absorption-contrast and Zernike phase-contrast.
- Sample preparation by FIB/SEM allows imaging samples with a diameter 8-80 m.
- Available region of interest tomography (ROI).

Key parameters

Designed energy: 9-14 keV

Field of view (µm)	Spatial resolution (nm)	Eff. pix size (nm)	Scan time (min)	Fast scan (min)
50 x 50	50	15nm - 25nm	15 - 30	< 3
85 x 85	100	35nm	15 - 30	< 3

Cameras specifications

Hamamatsu-CMOS camera

Specifications	
Type number	C12849-102U
Imaging device	Scientific CMOS sensor FL-400
Effective no. of pixels	2048 (H)×2048 (V)
Cell size	6.5 µm (H)×6.5 µm (V)
Effective area	13.312 mm (H)×13.312 mm (V)
Scintillator	Gadox 20 µm
FOP ratio	1:1
Full well capacity	30 000 electrons (typ.)
Readout speed	30 frames/s to 25 655 frames/s
Readout noise	2.3 electrons (rms) typ., 1.6 electrons (median) ^{*1}
Exposure time	1 ms to 30 s (100 ms recommended) ^{*2}
Dynamic range	18 000:1 typ. ^{*3}
Sub-array	Yes (at center position)
Binning	2×2, 4×4 ^{*4}
External trigger mode	Edge trigger, Level trigger, Synchronous readout trigger, Start trigger
Trigger output	Programmable timing outputs, Global exposure timing output, Trigger ready output, Fixed level output
Interface	USB 3.0
Maximum tube voltage	90 kV
A/D converter	16 bit
Power supply	AC 100 V to 240 V, 50 Hz/60 Hz
Power consumption	9 VA
Ambient operating temperature	0 °C to +40 °C (+35 °C ^{*5} recommended)
Ambient storage temperature	-10 °C to +50 °C
Ambient operating humidity	70 % max. (with no condensation)

*1 This value is sum of readout noise and dark current at 33 ms exposure.

*2 When exposure time is longer than 100 ms, white spots would be visible and image quality would be degraded.

*3 Calculated from the ratio of the full well capacity and the average readout noise.

*4 Digital processing in the camera

*5 When ambient operating temperature is higher than +35 °C, white spots would be visible and image quality would be degraded.

List of experienced samples

- Nanoporous gold.
- Ceramic nanomaterials.
- Nanostructures linked to the structural coloration typical of birds, butterflies and insects.
- Animal and human bones.
- Tissues.
- Micro-organisms.

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