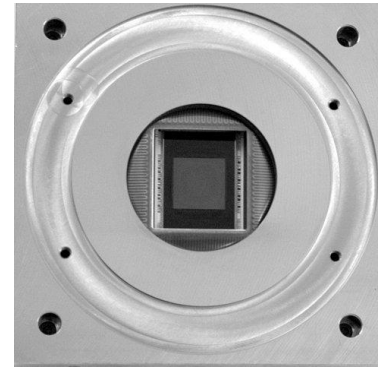


XR401: High Sensitivity sCMOS Camera for TEM

4.0 Megapixel Scientific CMOS
30 Frames/Second Readout
70% Efficiency, Non-Blooming Sensor
AMT's Proven, High Performance B-Lens
Peltier cooled



The XR401 features a cooled sCMOS sensor that simultaneously achieves high resolution and fast readout speeds. The sCMOS breakthrough in signal-to-noise means low dose imaging – once only available with expensive, slow scan cameras - is now possible with this fast and affordable camera. Non-blooming sCMOS sensors are more suitable for diffraction than anti-blooming CCD sensors that have ~100:1 blooming suppression. This sensor is combined with AMT's high throughput optics to achieve high levels of speed, sensitivity, and dynamic range for normal imaging, low dose imaging, cryo-TEM, and diffraction. Lens coupling eliminates lifetime limitations from defect generation and displacement damage that occur in direct electron exposure systems using more conventional CMOS architectures.



AMT's lens combines extraordinary speed with high resolution. This lens maintains both high MTF and high numerical aperture (NA) to provide unmatched sharpness and extremely high sensitivity. This lens also has negligible distortion across the entire field and maintains focus at all corners.

AMT's advanced phosphor and substrate technologies produce brighter images with less structured noise than competing phosphors, while resisting beam damage. Note that reducing structured noise improves both aesthetics and quantitative data quality.

AMT's software is also well regarded for its efficiency and ease-of-use, which help make AMT's systems productivity enhancers.

Standard XR401 Camera Configurations

XR401S-B Classic Wide Angle Side Mount	XR401M-B Multi-Discipline Mid-Mount
XR401L-B High Magnification Low Mount	XR401CH-B Spectrometer compatible

- 1) All configurations use AMT's high performance B-lens with large 0.013 mm pixels with a 26 mm square phosphor.
- 2) Max guaranteed display rate 30 fps @ 2x2 binning with USB3 interface.

- 3) Single electron detection SNR of 15:1 at 120kV. Phosphors are customized for TEM accelerating voltages.

Sensor and Camera Head

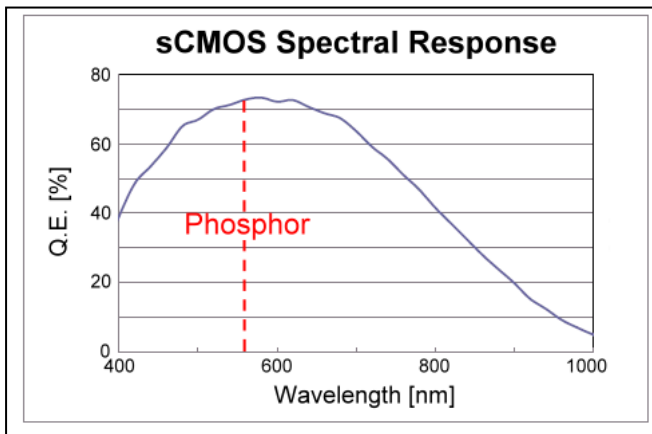
- 1) Scientific grade, FL-400 sCMOS sensor with on-chip A/D converters at each column with 16 bit readout and 23000:1 inherent dynamic range.

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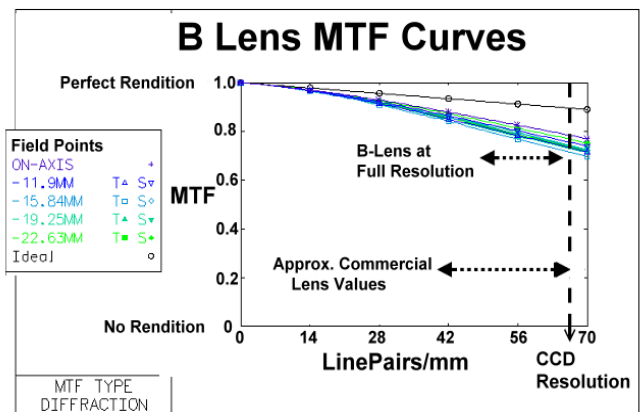


- 2) 2048 x 2048 x 13 μm pixels with 26x26 mm pickup area.
- 3) An absolute quantum efficiency is >70% at the output wavelength of the scintillator.
- 4) 1.3 electrons per pixel readout noise at full speed with negligible pattern noise.
- 5) Dark current of 0.15 electron/pixel/s with water cooling.
- 6) 23000:1 inherent dynamic range with full well capacity 30,000 electrons (typical).
- 7) Electronic Shutter with no beam blanking or mechanical shutter required with single exposures adjustable from 1 ms to 10 s.

8) High speed USB 3.0 interface standard with CameraLink optional.

Lens

- 1) Finite-conjugate B-lens, color corrected with 0.50x magnification with <1% distortion across the field.
- 2) Lens maintains >50% MTF @ 100 line-pairs/mm with numerical aperture of 0.23 @image.
- 3) Telecentric lens design that is compatible with micro-lenses on sCMOS sensor.
- 4) All lens components and glass-shielding are melt characterized, AR coated, and made with demanding 1/10 to 1/4 wave optical surface tolerances.



Vacuum and Mechanical

- 1) All seals are either static or rotating to avoid possibility of catastrophic vacuum failure.
- 2) All electronics are outside the TEM vacuum.
- 3) Proprietary P43 phosphor and substrate for minimum structured background.
- 4) Phosphor characteristic optimized for kV and application.
- 5) Radiation shielding for 200kV standard. Shielding for higher energy systems is available.

Cooling

- 1) The sensor is Peltier cooled to -20 $^{\circ}$ C with a water connection, or to -10 $^{\circ}$ C waterless with fan.
- 2) Sensor is hermetically sealed and outside the TEM vacuum for added reliability.
- 3) Sensor never requires baking or de-icing.
- 4) Camera has fail-safe circuitry for protection against power or water failures.

Software and Computer

- 1) Win7 x 32-bit OS standard (see separate computer specification for more details).
- 2) The software package includes a comprehensive graphical interface for camera operation, image display, and image storage.
- 3) AMT systems communicate with SerialEM, TIA, TEMography, and all modern TEM remote control interfaces, when such interfaces are available.
- 4) Camera and software can operate in low dose mode for SerialEM, TEMography and TIA.
- 5) A more extensive list of operating and analysis functions is available in a separate document.

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