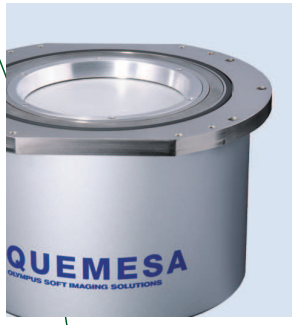
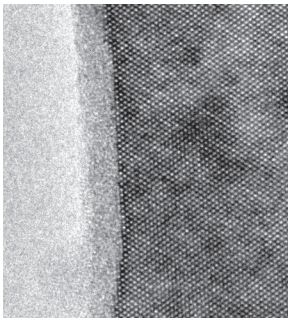
Digital Imaging Solutions

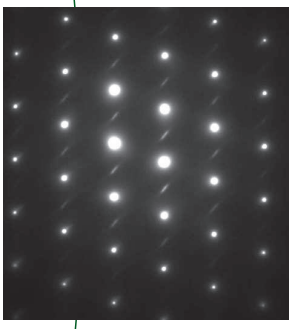
TEM Cameras

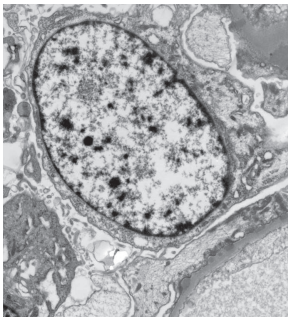
Side- and bottom-mounted TEM cameras

Digital Cameras for Electron Microscopy





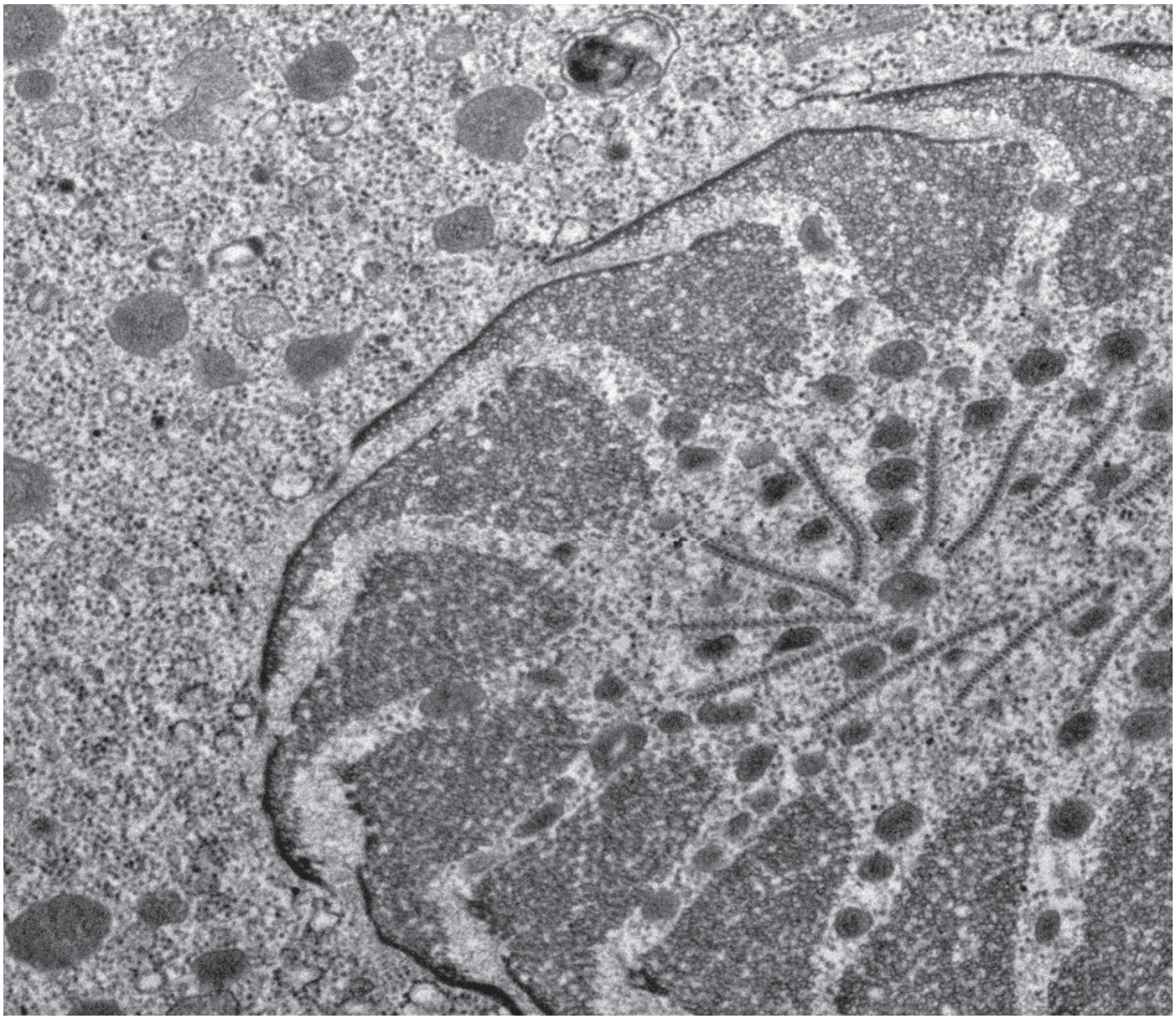




IMAGING SOLUTIONS FOR ELECTRON MICROSCOPY.

TEM CAMERA SYSTEMS

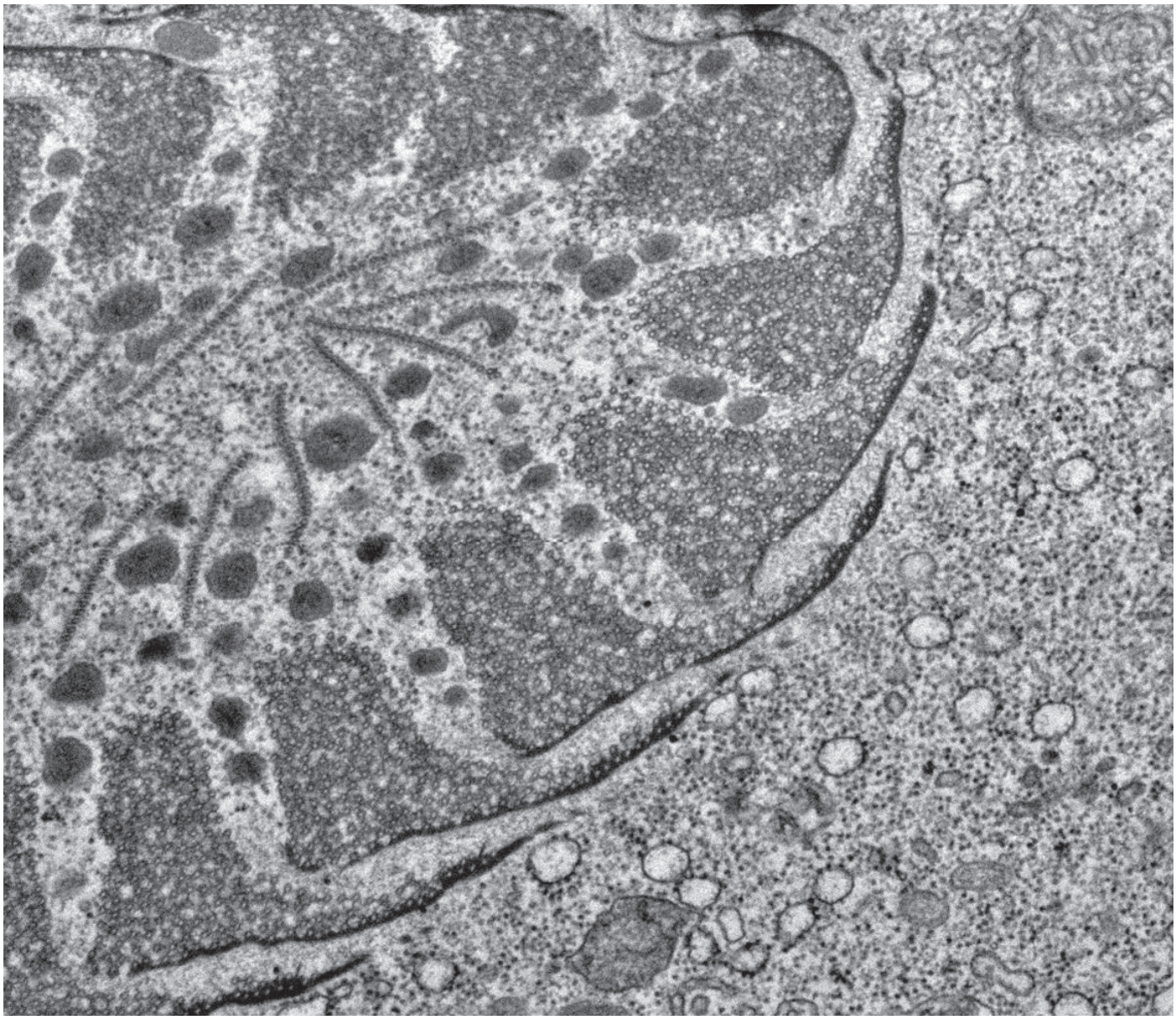
Transmission electron microscopy today involves digital technology as standard. High-resolution digital cameras are used for TEM image acquisition, incorporating dedicated software with built-in real-time functionality that provides the best possible image quality. Our EM hardware and software solutions are the results of more than 25 years of experience and expertise with market and customer demands. Our unique optical and technical knowledge in microscopy not only guarantees the uncompromising quality of our system components such as optics, precision engineered parts, and programming – it is above all the basis for the perfect balance between the components that gives our solutions their outstanding performance. Based on this we integrate hardware and software with the electron microscopes to meet all of the various criteria in the diverse application areas of EM. Our slogan "Electron Microscopy made simple" embodies our general philosophy and corporate identity in the field of electron microscopy: a comprehensive approach to products, applications, consulting, service, support and training to make life easier for everyone in the EM lab.



WE FOCUS ON YOUR IMAGE.
RELIABLE, REPRODUCIBLE AND OBJECTIVE.

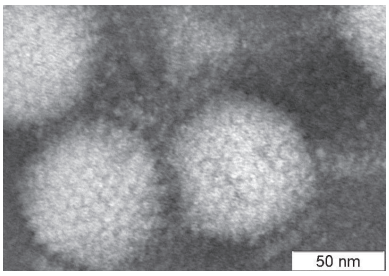
Our camera models for the side-entry ("35 mm") port of almost all standard TEMs are the 2.8 megapixel MegaView G3, the 4 megapixel Veleta, and the 16 megapixel Morada G3. These are all lens-optically coupled and offer a well-coordinated, comprehensive concept composed of the latest in electronics, dedicated lens optics, design and functionality. All our camera models for the bottom-mounted on-axis port – the 5.3 megapixel Tengra, the 11 megapixel Quemesa are all fibre-optically coupled and offer properties such as highest resolution, high frame rates, excellent signal-to-noise ratio and a wide dynamic range.

As the best camera needs also perfectly fitting software which provides all necessary tools to acquire, analyse and share razor sharp and high quality images, we offer the most versatile EM software on the market: the well-established iTEM platform and the all new most modern RADIUS software. These EM imaging solutions are systematically oriented towards the requirements and workflows of today's electron microscopy applications and set a standard of excellence with enticingly simple, yet intuitive user operation and a structure that is flexible and modular.

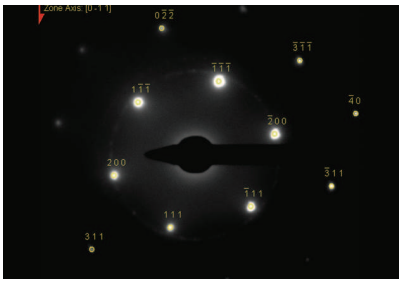


Panorama image, acquired with the automatic multiple image acquisition ("MIA") function of the EMSIS imaging software.

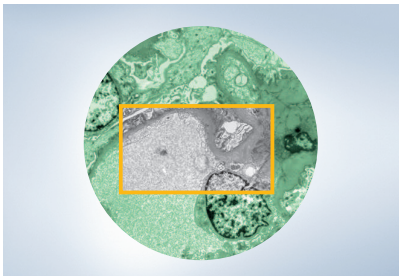
BUDGET FRIENDLY 2.8 MEGAPIXEL SIDE-MOUNTED TEM CAMERA WITH VERY HIGH SPEED



Adenovirus



SAD image of small Al crystallite, indexing by use of iTEM Solution Diffraction.



MegaView G2: Field of view (exemplary)

MegaView G3

The MegaView G3 is our new high-speed CCD camera with up to 160 frames per second. With its 2.8 Megapixel it doubles its predecessor's resolution and yielding 6x higher frame rates. Its CCD technology provides perfect signal to noise ratio but still good pricing.
The budget friendly MegaView G3 is equally attractive for users in the bio-medical, life sciences, and materials science fields.

The MegaView G3 consists of a high yield phosphor screen, a prism to reflect the image onto the CCD sensor, as well as housing and flange specific to fit almost every TEM. The patented rigid coupled phosphor screen-lens-scintillator-CCD combination provides optimum conditions for artifact-free shading correction. The single port design gives leaves the second port free for other devices.

The MegaView G3 camera system is equipped with a customized high quality lens. In conjunction with the CCD chip and the efficient scintillator, the MegaView G3 system ensures great sensitivity and light efficiency, as well as a high signal-to-noise ratio.
The hyper fast interline CCD image sensor used in the MegaView G3 provides a maximum resolution of 2.8 Megapixel with 14 bit dynamic range. Its extremly high speed proofs the CCD still a perfect technique with a high quantum efficiency.

Several binning modes are supported by the MegaView G3. The users can select between modes of 2x, 4x and 8x binning. This offers sensitivity that can be increased even more. The interline chip uses an electronic shutter. The MegaView G3 offers exposure times ranging from 100 µs to 10 s and frame rates of more than 55 images per second at full resolution and more than 155 images per second at binning 5x. This very high frame rates are ideal for locating suitable specimen segments directly on-screen or adjusting the microscope parameters. At any resolution the camera provides excellent dynamic range and sensitivity.

What makes the MegaView G3 even more attractive is that almost all existing MegaView systems can be upgraded in the field for a fraction of the cost of a new system, hence making even these legacy systems can be made future safe with USB 3.0 and 64 bit operating systems.

FEATURES
Up to 1936 x 1456 pixels
More than 55 fps @ full resolution
Peltier cooled
Lens coupled
14 bit
Large field of view

APPLICATIONS
Life Sciences
Pathology
Diffraction
Materials Science
Digital documentation

VERSATILE 4 MEGAPIXEL SIDE-MOUNTED TEM CAMERA

Veleta

Veleta is a side-mounted TEM CCD camera offering 2048 x 2048 pixels and a dynamic range of 14 bit. The camera fits perfectly into our product line of sophisticated, side-mounted TEM cameras. Veleta reflects current requirements in Life and Medical Sciences, as well as in Materials Sciences, hence being our most versatile side-mounted camera.

The highly sensitive CCD chip used in the Veleta provides 4 megapixel and in combination with further dark current reduction measures, this increases the detection efficiency of the entire camera system. The CCD sensor possesses uniquely high quantum efficiency, which in combination with reduced dark current results in a tremendous increase of the total detection quantum efficiency of the whole system.

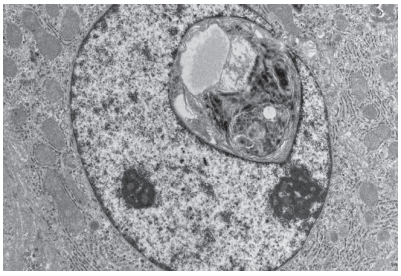
Having an fast interline CCD sensor it provides an internal electronic shutter. The Veleta offers exposure times ranging from 1 ms to 100 s. The CCD sensor's smart architecture guarantees high anti-blooming, making it perfectly suitable for acquiring clearly distinguishable diffraction patterns.

Due to a partnership with the best lens makers, the Veleta camera system has been equipped with a high quality dedicated lens. This customized optics of the Veleta and more efficient scintillators ensure great sensitivity and light efficiency, as well as a perfect signal-to-noise ratio. The Veleta provides frame rates of more than 19 images per second at binning 4x. This high frame rate is ideal for locating suitable sample segments directly on-screen. In conjunction with the online Fourier transformation of our software, the focusing mode offers ideal assistance for setting various microscope parameters. This enables you to conveniently focus your sample on your PC screen as opposed to having to use the viewing screen of the microscope. No matter what mode you select, the Veleta with its high versatility offers excellent dynamic range and high sensitivity and always great images.

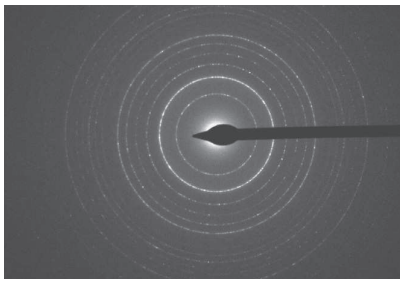
FEATURES
Up to 2048 x 2048 pixels
More than 19 fps @ binning 4x
Peltier cooled
Lens coupled
14 bit
Large field of view

APPLICATIONS
Tomography
Diffraction
Materials Science
Virology
Pathology

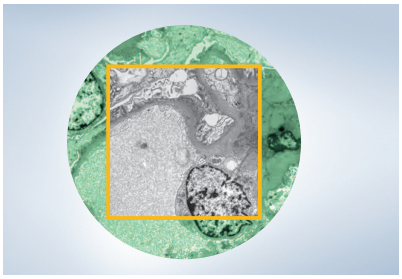
Veleta: Lens-optically coupled 4 megapixel side-mounted TEM Camera.



Liver cell - nucelus



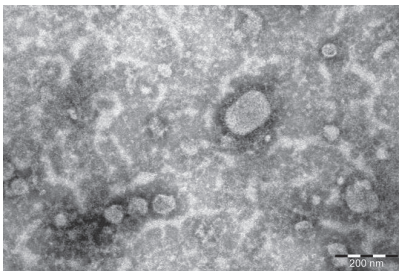
Diffraction image of aluminium



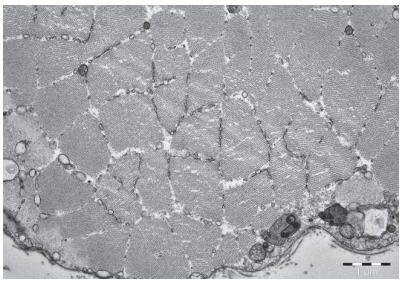
Veleta: Field of view (exemplary)

16 MEGAPIXEL SIDE-MOUNTED TEM CAMERA

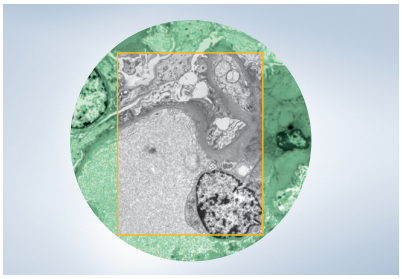
Morada G3: 16 megapixel side-mounted TEM CCD camera.



Coronavirus



Muscle cells



Morada G3: Field of view (exemplary)

Morada G3

The 16 megapixel TEM CCD camera Morada G3 is the reinvention of the first commercially available 11 megapixel TEM CCD camera of modern electron microscopy. It offers the best value solution for all TEM image acquisition applications which require an extremely large field of view combined with highest resolution, high frame rates and excellent contrast.

The Morada G3 provides up to 4872 x 3248 pixels, resulting in the largest field of view currently available for the side-mount (35mm) port of 36 mm x 24 mm. The 7.4 µm x 7.4 µm pixel size ensures best resolution and hence perfectly resolved images in low and mid-range magnifications. The Morada G3 camera system with its high-precision, rigid, patented mechanics uses a custom-made lens, ensuring minimum distortion and extremely high light transmission efficiency. The scintillators, optimized for the respective high tension of the specific TEM, deliver a perfect signal-to-noise ratio, resulting in an outstanding image with optimal resolution and high sensitivity.

The smart and newly designed electronics of the Morada G3 provide exposure times from 1 ms to up to 60 sec. Its low power consumption renders additional water cooling redundant. Morada G3's large full well capacity results in an efficient 14 bit dynamic range, ensuring data precision for any imaging task. The real-time functionalities of the associated imaging software, such as automatic online shading correction, also support the high-quality image results of the entire camera system.

The combination of advanced CCD technology and sophisticated electronics enables high-speed performance. This fast viewing (high-speed) mode allows the user to find specimen areas of interest quickly and efficiently, and to simultaneously zoom into interesting details without any delay. Thanks to high frame rates, operations such as microscopy alignments and focusing are performed with high precision using the camera display instead of the TEM viewing screen. The Morada G3 is a high-speed digital imaging solution supporting several binning modes as well as partial read-out. Using the binning mode increases frame rates and sensitivity. At binning 4x, the Morada G3 offers more than 10 fps.

FEATURES
Up to 4872 x 3248 pixels
More than 10 fps @ binning 4x
Peltier cooled
Lens coupled
14 bit
Large field of view

APPLICATIONS
Life and Materials Sciences
Pathology
Virology
Immunogold labeling
Digital documentation

5.3 MEGAPIXEL BOTTOM-MOUNTED TEM CAMERA

Tengra

Tengra is EMSIS' 5.3 megaPixel TEM CCD bottom-mounted on-axis camera. This state-of-the-art camera offers a great-value solution for all standard TEM image acquisition applications with a strong focus on materials sciences. Tengra combines a large, sensitive CCD chip with attractively high readout speed, tapered fiber optics and a perfectly matched phosphor scintillator, to meet the highest quality demands.

The Tengra camera system provides extraordinary resolution with its 2:1 fiber-optic taper, which increases the effective pixel size to 18 µm x 18 µm; hence ideally matching scintillator thickness and pixel size and ensuring that the maximum number of photons are detected. This highly efficient conversion of primary electrons in the scintillator combined with optimized electronic design delivers a near perfect signal-to-noise ratio, resulting in an outstanding image with optimal resolution and high sensitivity.

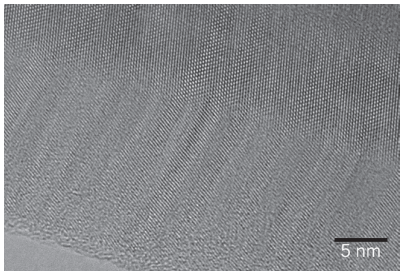
A Peltier cooling, supported by an self-contained water cooling system, minimizes the CCD dark current of the Tengra camera system and stabilizes the system temperature. A well capacity of over 60,000 electrons results in an efficient 14-bit dynamic range and a perfect signal-to-noise ratio, ensuring data precision for any imaging task. The interline CCD chip provides up to 2304 x 2304 pixel resolution resulting in a large field of view of 41 mm x 41 mm, which enables the camera to offer a field of view corresponding approximately to half the size of a conventional photo plate.

The Tengra is a high-speed digital imaging solution supporting several binning modes as well as partial read-out. Using the binning mode increases frame rates and sensitivity. Capturing and streaming digital video directly from live images to observe dynamic events has been a basic element of our imaging platform already for years. The Tengra is an ideal solution for recording high resolution electron diffraction patterns. The high anti-blooming performance of the CCD sensor and advanced CCD electronic design make the recording of electron diffraction patterns without artifacts an easy and routine task. It guarantees optimum sensitivity and resolution for diffraction imaging.

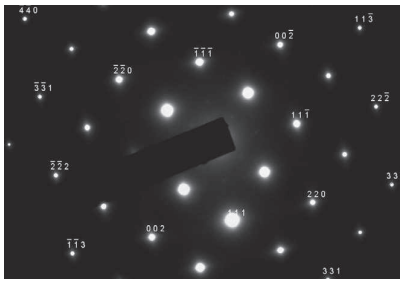
FEATURES
Up to 2304 x 2304 Pixels
More than 12 fps @ binning 4x
FireWire™ (IEEE 1394a)
Fiber optically coupled (2:1 taper)
14 bit
Large field of view

APPLICATIONS
Materials Sciences
Diffraction
Particle and object analysis
Life Science
Digital documentation

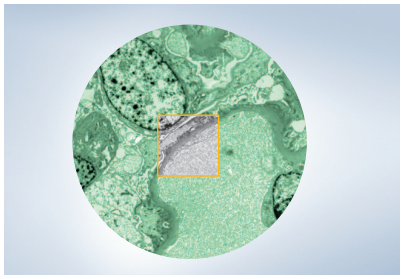
Tengra: Fiber-optically coupled 5.3 megapixel bottom-mounted TEM Camera



Alloy

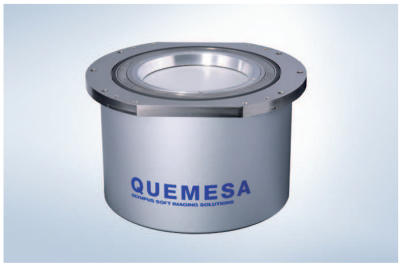


Diffraction image of aluminium

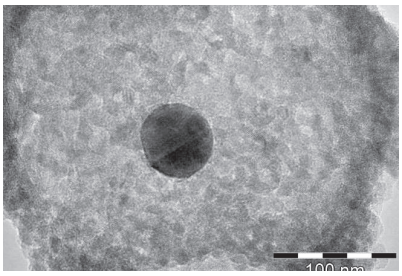


Tengra: Field of view (exemplary)

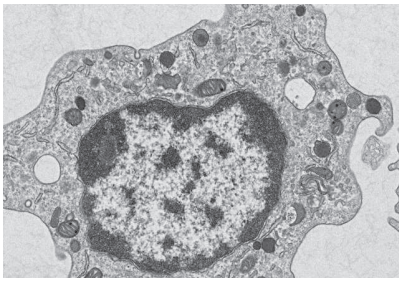
11 MEGAPIXEL BOTTOM-MOUNTED TEM CAMERA



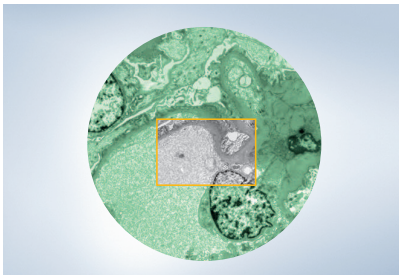
Quemesa: The next generation of TEM camera technology combines superior technical implementation with outstanding user friendliness and flexibility.



Au-ZrO2, 1,500,000x, 200 kV (courtesy of Max-Planck Institute for Coal Research, Muelheim/Ruhr, Germany)



Blood cell, 6,800x, 120 kV



Quemesa: Field of view (exemplary)

Quemesa

The Quemesa provides everything expected of a high-end TEM CCD camera today: the extremely high resolution, very high sensitivity, superior contrast, high frame rates, and a large field of view. These superior properties make the Quemesa the ideal choice both for biomedical and materials science applications. The most satisfying aspect of this CCD TEM camera is that the TEM itself is now the only limiting factor with regard to resolution and sensitivity for most current TEM applications – no longer the camera.

High sensitivity and contrast at optimal resolution are the requisite ultimate goals for any TEM camera system. Every single photon generated in the scintillator per incident electron is of importance. The camera scintillator needs to be optimized to achieve the maximum signal from the pear-shaped interaction volume. This is done by matching the effective pixel size through optimization of scintillator thickness. The Quemesa camera system does this perfectly. Bringing scintillator thickness and pixel size into ideal correlation with one another ensures the maximum number of photons is detected. This guarantees an outstanding image.

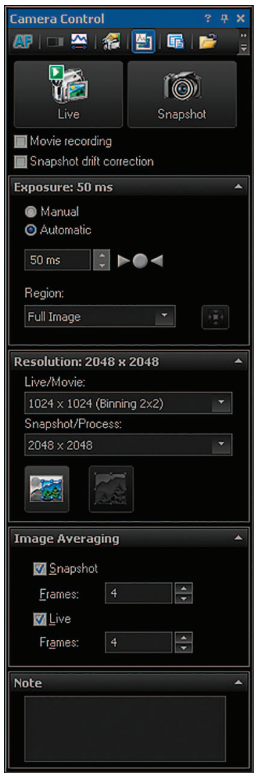
The 2:1 fiber-optical taper provides the highest quality. This increases the effective pixel size to 18 µm x 18 µm. In combination with the optimized scintillator thickness, this ensures optimal resolution and sensitivity. The taper provides a further benefit – an extremely large field of view for a bottom-mounted TEM CCD camera. Its dimensions are almost comparable to the photo plate size of most current TEMs.

The Quemesa's fast single port read-out supports high frame rates of more than 12 fps, making it much more convenient to scan and focus on the PC monitor. The use of single port readout ensures a homogeneous CCD response over the whole readout area. Even when in the highest quality mode (full resolution) the camera provides more than 2 fps. This camera provides superb dynamic range and sensitivity no matter which resolution mode is employed. Due to highly efficient conversion of primary electrons in the scintillator and optimized electronics design, the Quemesa system gains a near perfect signal-to-noise ratio, resulting in very high sensitivity. This enables you to view your samples on your monitor at beam intensities so low it would normally prevent seeing an image on the TEM viewing screen. The finest detail is still shown perfectly in the camera image.

FEATURES
Up to 4008 x 2672 pixels
More than 12 fps @ binning 4x
FireWire™ (IEEE 1394a)
Fiber optically coupled (2:1 taper)
14 bit
Dedicated water cooling system

APPLICATIONS
Life and Materials Sciences
Diffraction
Low Dose Imaging
Virology
Digital documentation

RADIUS - EM IMAGING SOFTWARE



Complete control. The clear dialog window provide immediate access to adjustable camera parameters.

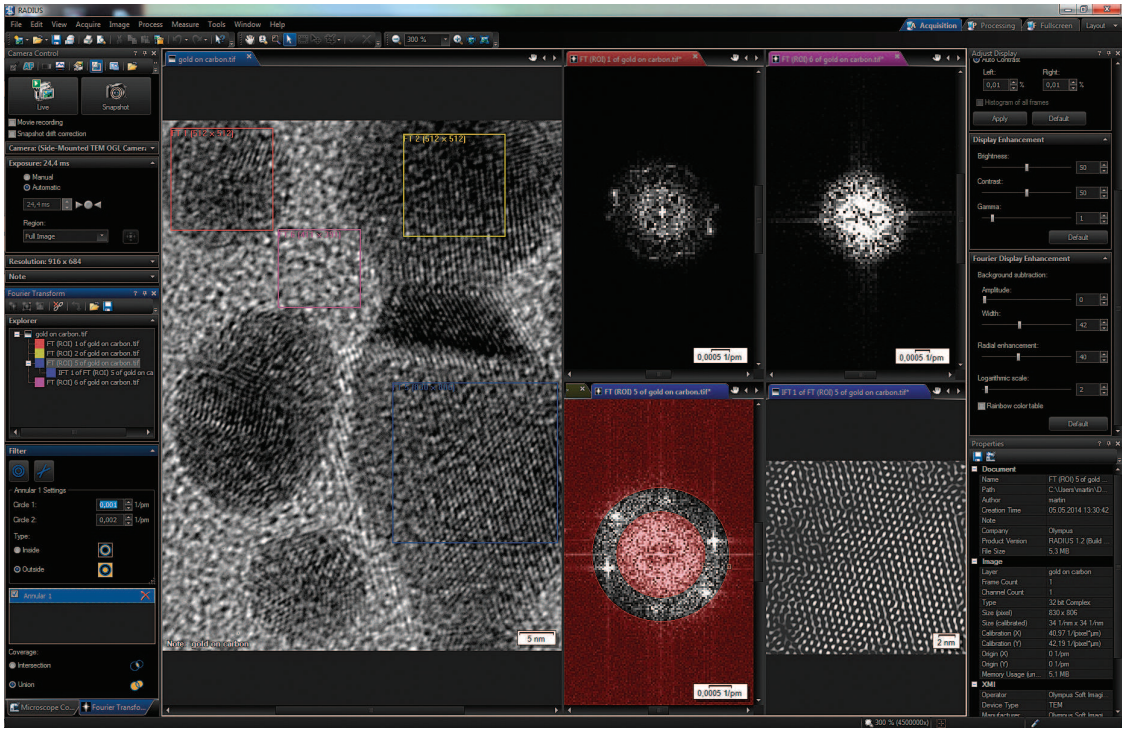
RADIUS

RADIUS is our visionary software for electron microscopy (EM) requirements both today and tomorrow. This most modern EM imaging software is the perfect interface between microscope, camera and specimen. As the central integrator, RADIUS guides you systematically through every working step with clearly-organized layouts and defined workflows - starting with system control, moving on to image capture and further processing, finally covering documentation and distribution of the results.

RADIUS is fascinating in terms of system integration. Microscope, camera, motorized stage, goniometer, image/beam shift - there is hardly a system component which is not integrated in RADIUS and accessible in direct live mode.

RADIUS and the EMSIS TEM cameras are perfectly matched. It is extremely simple to capture perfect, detailed images with RADIUS. In live mode, there is direct access to all the important camera functions, such as exposure times, resolutions, camera change and averaging and moreover, every setting change is executed "on-the-fly". As with the camera control, the user has direct access from RADIUS to the motorized and controllable components of many modern electron microscopes. With unique camera features like online sharpness filter, smart averaging, snapshot drift correction, enhanced Fourier transformation and filtering and unique device controls like "Click-to-center" and automatic eucentricity, RADIUS is the one EM software ensuring best quality images with a mere click of a button.

Example of RADIUS user interface, showing the use of the Fourier transformation, including different ROIs and filtering.



iTEM - TEM IMAGING PLATFORM

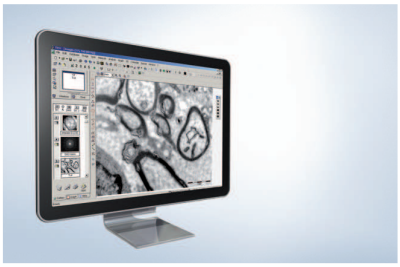
iTEM

iTEM is EMSIS' well known and settled electron microscopy imaging software, matured on hundreds of EM systems world wide. Its still sophisticated features are oriented towards the requirements and workflows of the whole transmission microscopy field. The software set standards for intuitive user operation, with a range of functions that interact perfectly and a structure that is flexible and modular. iTEM provides all important camera and TEM functions readily available.

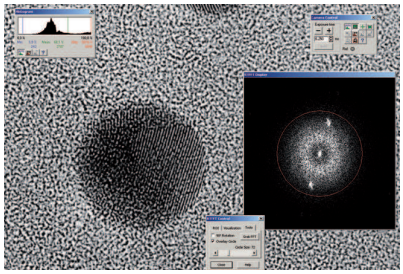
With IntX (Intelligent eXposure), iTEM provides you with automatic exposure control.. iTEM offers numerous built-in real-time functions during image recording, such as online shading correction, real-time FFT, automatic gain control, etc. iTEM offers a complete collection of processing functions for post-acquisition image optimization, including a comprehensive list of filters and visualization tools. iTEM provides the tools for interactive measurements, data analysis and process documentation.

iTEM can be expanded by the following Solutions:

- iTEM EFTEM: Acquisition, processing and evaluation routines for all prevailing methods of energy-filtered electron microscopy.
- iTEM Tomography: Acquisition, reconstruction and visualization of electron tomography stacks.
- iTEM Detection: High performance particle analysis.
- iTEM Diffraction: Electron diffraction pattern analysis.



iTEM is systematically oriented towards the requirements and workflows of the transmission microscopy field.



iTEM offers numerous built-in real-time functions during image recording.

Side-mounted TEM cameras

	MegaView G3	Veleta	Morada G3
Chip type	Interline CCD sensor	Interline CCD sensor	Interline CCD sensor
Resolution (pixels)	1936 x 1456	2048 x 2048	4872 x 3248
Binning 2x (pixels)	968 x 728	1024 x 1024	2436 x 1624
Pixel size (µm²)	4.55 x 4.55	7.4 x 7.4	7.4 x 7.4
Effective pixel size (µm²)	13 x 13	13.1 x 13.1	7.4 x 7.4
Binning	2x, 4x, 8x	2x, 4x	2x, 3x, 4x
Pixel clock rate (MHz)		25	25/50
Frame rate (fps) @ full resolution	> 55	> 5	> 3
Frame rate (fps) @ binning	> 150 (5x)	> 19 (4x)	10 (4x)
Digitization (bit)	14	14	14
Exposure time	100 µs - 10 s	1 ms - 100 s	1 ms - 60 s
Cooling	15° C @ 25° C ambient temperature	10° C @ 25° C ambient temperature	20° C @ 25° C ambient temperature
Camera mount	Wide angle port (35 mm)	Wide angle port (35 mm)	Wide angle port (35 mm)
Anti Blooming	> 300x	> 300x	> 100x
PC Interface	USB 3.0 (USB3 Vision)	FireWire™ (IEEE 1394a)	FireWire™ (IEEE 1394a)
Camera coupling	Lens-optically coupled	Lens-optically coupled	Lens-optically coupled
Partial Readout	Yes	Yes	Yes
Full well capacity (e-)	20.000	40.000	30.000
Scintillator	High quality phosphor	High quality phosphor	High quality phosphor

Bottom-mounted TEM cameras

	Tengra	Quemesa
Chip type	Interline CCD sensor	Interline CCD sensor
Resolution (pixels)	2304 x 2304	4008 x 2664
Binning 2x (pixels)	1152 x 1152	2004 x 1332
Pixel size (µm²)	9 x 9	9 x 9
Effective pixel size (µm²)	18 x 18	18 x 18
Binning	2x, 3x, 4x	2x, 3x, 4x
Pixel clock rate (MHz)	24.6 / 49.2 (live)	24.6 / 49.2 (live)
Frame rate (fps) @ full resolution	> 2 (HQ)	> 2 (HQ)
Frame rate (fps) @ binning	> 12 (4x)	> 12 (4x)
Digitization (bit)	14	14
Exposure time	1 ms - 100 s	1 ms - 100 s
Cooling	20° C @ 25° C ambient temperature	20° C @ 25° C ambient temperature
Camera mount	Bottom port (on-axis)	Bottom port (on-axis)
Anti Blooming	> 100x	> 100x
PC Interface	FireWire™ (IEEE 1394a)	FireWire™ (IEEE 1394a)
Camera coupling	Fiber optics (2:1)	Fiber optics (2:1)
Partial Readout	Yes	Yes
Full well capacity (e-)	> 60.000	> 60.000
Scintillator	High quality phosphor	High quality phosphor

All our cameras are CE certified and RoHS compliant.

EMSIS GmbH
Mendelstrasse 17
48149 Münster
Germany
Phone: +49 (0)251 297962-0

info@emsis.eu
www.emsis.eu