specification sheet

fast-em
Fast Imaging by Delmic

FAST-EM specifications sheet

Ultra-fast automated multibeam electron microscope

delmic

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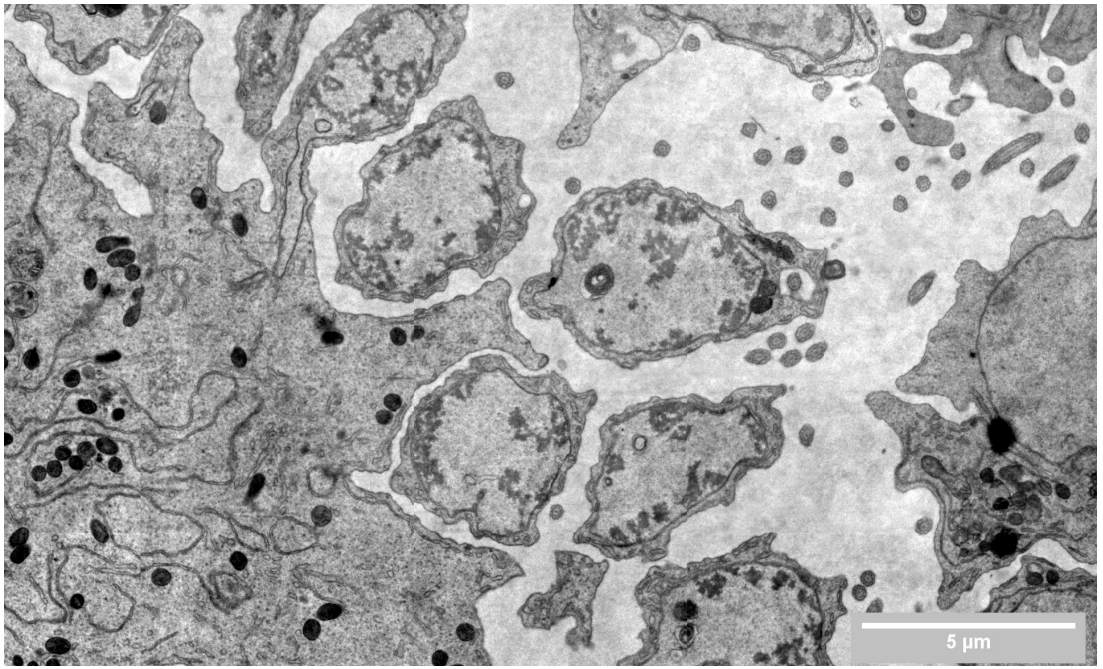
Introduction

FAST-EM is an ultra-fast automated multibeam electron microscope (EM) designed to make complex and large EM projects simple and efficient. Thanks to its automated acquisition, this high-throughput system is ideal for imaging large or multiple samples for quantitative analysis. Delivering powerful insights while keeping the workflows simple, this system allows users to shift their focus from microscope operation to data analysis.

FAST-EM can be used to explore cell architecture, the interaction of neuronal circuits, and the analysis of any biological material. It is extremely beneficial for large volume 3D imaging, large scale 2D imaging and, in general, as a tool that can significantly speed up daily microscopy work.



Key benefits

Image faster

High acquisition speed by using 64 electron beams and short dwell times

Focus on data analysis

Leave the system to automatically acquire complex datasets without constant supervision

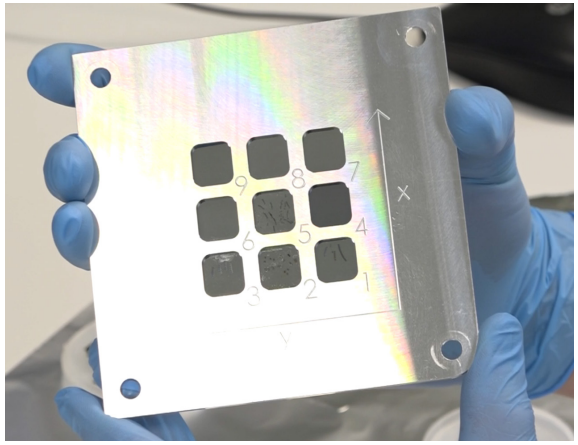
Achieve high sustained throughput

Minimize the overhead during imaging with robust automation

Get the details and the big picture

Collect nanoscale detail while retaining larger context of the sample

Workflow at glance



Prepare and load the samples

FAST-EM uses scintillators as rigid sample support. They are compatible with a wide range of sample collection techniques, including very automated ones. For example, by collecting entire ribbons directly from the microtome by drying the water in the boat and allowing them to deposit onto the scintillators. Alternatively, magnetic techniques have been tested to collect many individual sections on scintillators with extremely high fill factors. Once samples are deposited you can then place the scintillators in FAST-EM, easily. The standard carrier plate holds nine substrates sized at 14*14 mm. Carrier plates can be customized to meet specific requirements for different substrate sizes and applications.

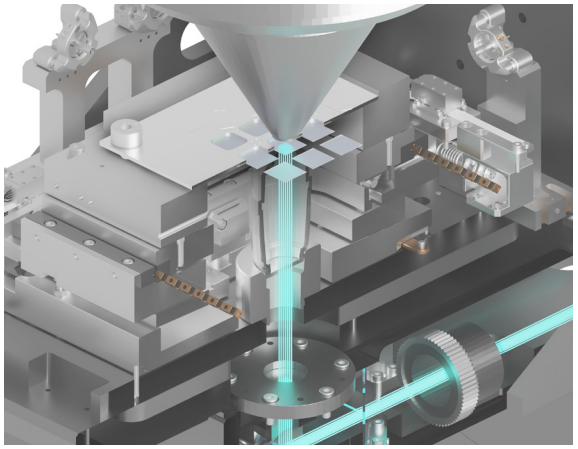


Image with 64 beams and shorter dwell times

FAST-EM uses 64 electron beams that scan over your sample in parallel. The signal from each individual beam is recorded using a fast and highly sensitive Silicon Photo Multiplier (SiPM) array.

FAST-EM uses Scanning Transmission Electron Microscopy (STEM) for image formation. Scintillators, that are carrying the samples, produce localized cathodoluminescence when struck by electrons. Light is then captured using an electro-optical acquisition path by means of a Silicon Photo Multiplier array, and processed to form the final image. Due to this unique detection setup you can obtain excellent signal to noise ratios even at dwell times as short as 400 ns.

Acquire and analyse images with minimal user interaction

The reliability of the microscope and the software allow the operator to leave the system running without constant supervision. Delmic's easy-to use and robust automation software (Odemis) allows you to easily create and manage projects which are handled automatically. Finally, an optimized storage solution enables easy access to your projects after acquisition for visualization, analysis and collaboration purposes.

System specifications

Electron optics

System base		Thermo Fisher Scientific Apreo 2
Emitter		Schottky field emission source
Beam stability		< 3% beamlet intensity variation
Voltage range		2.5 kV -10 kV
Beamlet current		400 pA -1000 pA
Total current		25 nA - 64 nA
Nominal working distance		5 mm
Single beam mode		Yes

Scanning and detection

Multiprobe arrangement		Square, 8 x 8 array
Beamlets		64
Dwell time		400 ns minimum, adjustable
Pixel size	During field acquisition	4 nm
Beamlet pitch		3.2 µm
Field of view (single field)		25.6 µm x 25.6 µm
Detectors	Multibeam	Transmission detector with 64 silicon photomultiplier cells
	Single-beam	Segmented in-lens backscattered electron detector
		Upper in-lens secondary electron detector

Sample and stage

Type		3-axes motorized (XYZ)
Stage positioning readout		Laser interferometry for nanometer-level positioning accuracy
Travel range XY		50 mm × 50 mm
Typical substrate size		14 mm x 14 mm *
Max simultaneous substrates		9 substrates with current substrate size

* *Other sizes can be available*

System specifications

Sample substrates

Usable samples	Directly on scintillators	Sections (maximum thickness < 200 nm), nanoparticles, vesicles, viruses
Unattended run-time		Up to 72 hours
Use cases	Routine data collection	Automated imaging of user-defined Regions of Interest and section arrays
Data format		One 16-bit TIFF per field image, stored per project
Sustained throughput	During megafield acquisition at 400 ns dwell time	100 megapixels/second

Software

Main PC	64-bit GUI with Windows
Microscope control	Linux-based acquisition control
Acquisition support	User guidance for basic operations
System health monitoring	Continuous logging of crucial system features
Automatic calibrations	Detector gain, detector alignment, autostigmation, autofocus, global alignment of components

Vacuum and support hardware

System hardware	≥ 4 core CPU, ≥ 8Gb RAM, ≥ 1 Tb HDD, 1Gbps Ethernet
I/O	2 Monitors, 1920*1200 pixels (24''), keyboard, optical mouse
Vacuum pumps	1x Scroll pump
	1x 240 l/s turbomolecular drag pump
Operational vacuum	≤ 6×10^{4} Pa
Network storage connection	10 Gbit Ethernet (10 GBASE-SR using LC Duplex OM3 MM fiber)

Optional components

High performance storage module	Scalable high-speed storage for data analysis and data sharing
Support Infrastructure	Standalone water chiller
	Acoustic enclosure for backing pump
Consumables	Sample substrates

Interested?

For more information on this topic visit www.delmic.com

About

Delmic is a passionate high-tech company based in Delft, the Netherlands that develops powerful and user-friendly solutions for light and electron microscopy. Our systems are used by researchers and companies all over the world in fields ranging from life sciences, geology, material sciences to nanophotonics.

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