AMSTERDAM
SCIENTIFIC
INSTRUMENTS

CheeTah

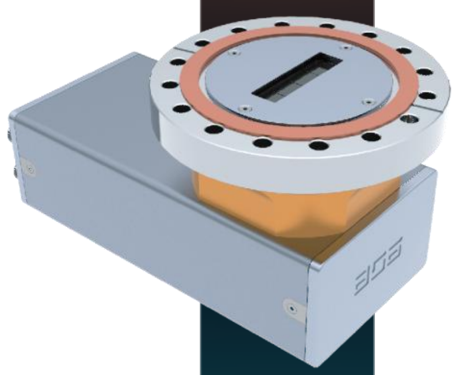
Timepix3

Ultra-fast event-based detector for electron microscopy

CheeTah is the most versatile, event-based electron detector that allows sensitive sample characterization before they damage, with up to 1000× faster scans and dramatically reduced data volumes.

Technology

CheeTah is the most versatile, event-based, zero-suppressed electron detector that lets researchers image sensitive samples before they're destroyed. By increasing scanning speeds and reducing storage needs by up to 1000×, it turns hours into minutes and terabytes into gigabytes—delivering clean, analysis-ready data. Fully compatible with 4D-STEM, ptychography, time-resolved EELS, UTEM, and dynamic or time-correlated experiments, CheeTah maximizes beam efficiency, preserves samples, and accelerates discovery across advanced materials, biological imaging, and high-throughput studies. With complete control over acquisition, sensor configuration, and robust data pipelines, it empowers scientists to push the boundaries of what's observable in electron microscopy.



General Features

* Event-driven (data-based) readout — no frame acquisition

* 320 Mhits/s maximum throughput * 512 × 512 pixels, 55 µm pitch

* Simultaneous ToA (timing) and ToT (energy) per pixel

* ~1.56 ns timing binning

* 40 Gbit/s high-speed interface for sustained data streaming

Specification

Parameter	SINGLE	QUAD	LINEA	ULTRA
Interface	256 × 256	512 × 512	256 × 1024	512 × 1024
Pixel Matrix	55 µm	55 µm	55 µm	55 µm
Active Area	14.08 × 14.08 mm^2	28.16 × 28.16 mm^2	14.08 × 56.32 mm^2	28.16 × 56.32 mm^2
Max Throughput	80 Mhits/s	320 Mhits/s	320 Mhits/s	640 Mhits/s
Time Resolution	~1.56 ns			
Energy Measurement	Time-over-Threshold (ToT)			
Readout Type	Event-driven			
Counter Depth	14-bit ToT / 18-bit ToA			
Cooling	Air / Liquid (configurable)			
Sensor Options	Si (thickness configurable) / GaAs			
Sensor Technology	Timepix3			

Applications in TEM & Ultrafast TEM

*** 4D-STEM**
High-speed diffraction pattern acquisition for strain, orientation, phase, and electric field mapping.

*** Nano-beam diffraction (NBD) & CBED**
Event-based acquisition of sharp diffraction disks at high dynamic range.

*** Low-dose diffraction of beam-sensitive materials**
Sparse electron counting enables studies of 2D materials, soft matter, and hybrid perovskites.

*** In situ TEM dynamics**
Real-time monitoring during heating, biasing, mechanical deformation, or environmental TEM experiments.

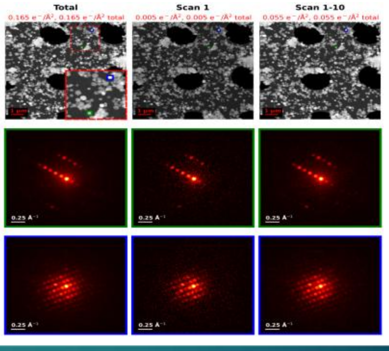
*** Ultrafast TEM (UTEM)**
Time-stamping of individual electron packets for pump–probe experiments with nanosecond temporal precision.

*** Time-Resolved EELS**
Time-resolved fast EELS enables nanosecond-scale dynamics in materials and operando studies.

*** Transient diffraction experiments**
Capture of structural phase transitions and non-equilibrium dynamics.

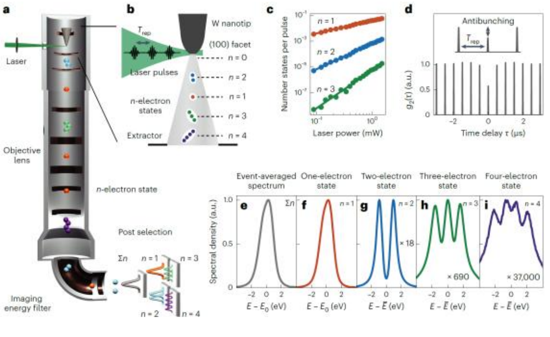
Damage mitigation > precise time-slicing

Annys et al., Ultramicroscopy 277, 114206 (2025)



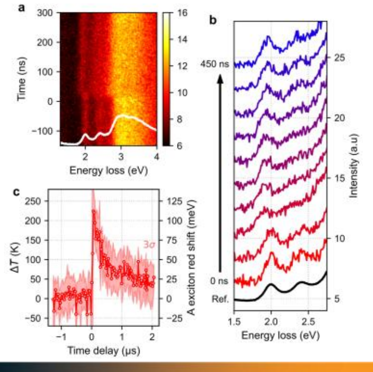
Coulomb-Correlations in a TEM

Haindl et al., Nat. Phys. 19, 1410-1417 (2023)



Real Time spectral evolution

Castioni et al., Nano Lett. 25, 1601-1608 (2025)



electrons@amscins.com

hello@amscins.com