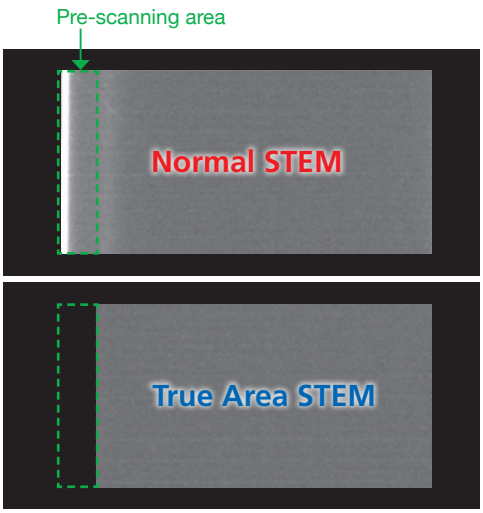
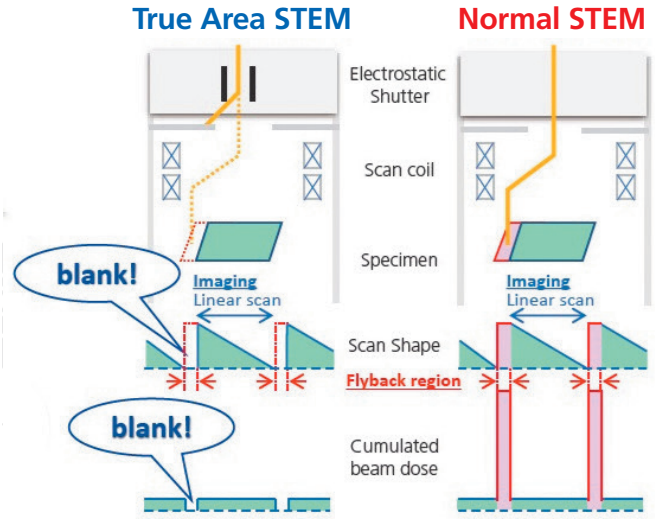
Application note

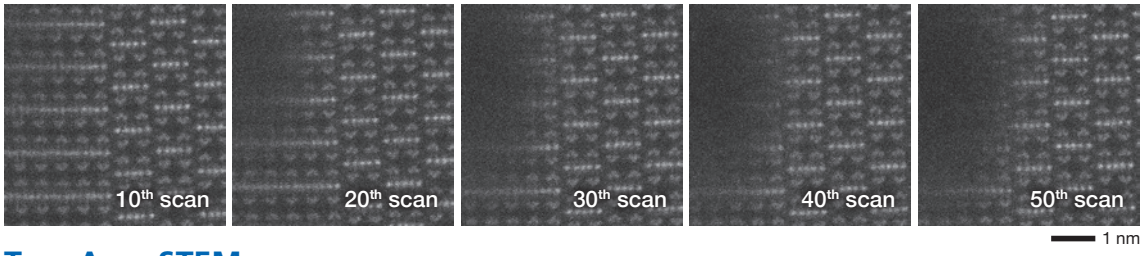
True Area STEM Imaging with reduced beam damage

True Area STEM (TAS) imaging technology with Electrostatic Dose Modulator (EDM) Synchrony[*1] can reduce specimen damage during STEM imaging. EDM Synchrony is integrated with the JEOL STEM system to make a complete flyback blanking solution. The scanning system has an unusable pre-scanning area where the magnetic coil's response is nonlinear in time and data is not acquired. Unnecessary electron radiation damage can occur in this pre-scanning area.

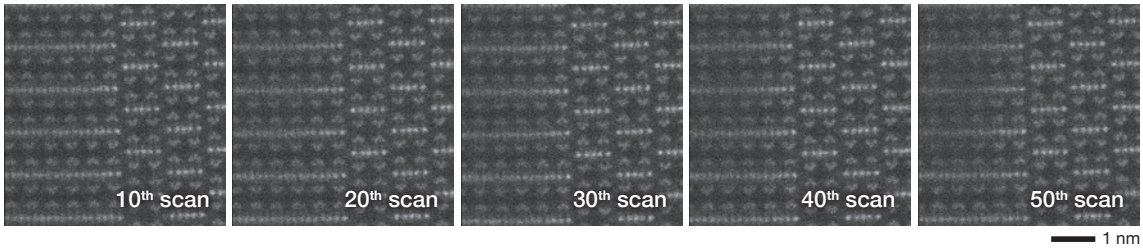




Normal STEM



True Area STEM

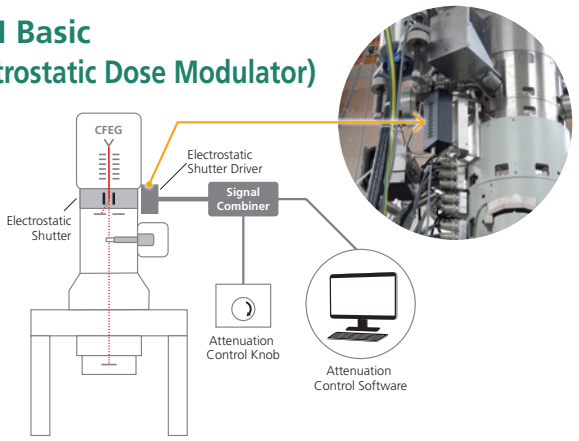


Flip-book animations

The data[*2] above are arrays of STEM images obtained using a sample, talc in riebeckite (mineral)[*3], scanned 50 times. The top row shows images acquired without TAS, while the bottom row shows images acquired in TAS mode. In the top row, significant electron beam damage is observed at the left edge of the field of view due to damage originating from the electron beam in the pre-scanning area (just outside the field of view). In contrast, in the bottom row with TAS mode, no damage caused by the fly-back irradiation is observed.

[*1] True Area Scan mode is available with EDM Synchrony. In case that the TEM control system is FEMTUS™-MDP, both EDM Basic and EDM Synchrony can provide TAS mode.
[*2] Measurement conditions: Instrument JEM-ARM300F2, accelerating voltage 300 kV, electron beam current 5 pico-amperes, dwell time 16 microseconds, number of pixels 512 × 512.
[*3] The boundary between phyllosilicate (talc) and amphibole (riebeckite) in crocidolite asbestos.

EDM Basic (Electrostatic Dose Modulator)



The Electrostatic Dose Modulator (EDM) is a fast beam blanking system with a pre-sample electrostatic deflector, including electronics and software control. With EDM, the 100,000x improvement in blanking speed immediately improves the clarity of data taken at fast exposure times. EDM can also attenuate electron illumination without affecting imaging conditions, giving TEM and STEM users exceptional control over the dose on their samples.

Programmable STEM with EDM Synchrony

The optional Synchrony upgrade takes EDM's timing and synchronization capabilities to the next level. Synchrony can coordinate with a STEM controller, tracking the probe beam location as it scans across the sample. EDM's lightning-fast electrostatic blanking turns the beam on for a specified time at each pixel, or keeps the beam blanked to completely exclude sensitive regions from dose.

Pulse System

PULSE turboTEM

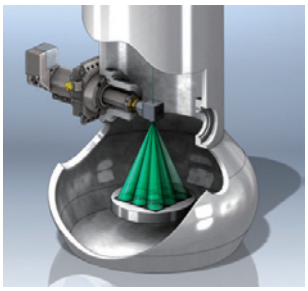
JEOL is pleased to offer Pulse for STEM. Pulse is a real time signal processor that enables digital imaging using standard analog STEM detectors. The device simply plugs in between your STEM detector and data acquisition system to deliver improved signal to noise ratios in your STEM images, particularly in low-dose or high-speed imaging modes.

TEMPO

TEMPO turboTEM

This is a completely new approach to STEM which inverts the typical approach to image formation by using the time required to reach a fixed number of electrons as the basis for pixel intensity rather than the number of electrons detected in a fixed amount of pixel dwell time. Once the desired number of electrons have been counted in a given pixel, the electron beam can then be rapidly blanked resulting in a significant reduction in overall dose applied to a specimen.

Relativity™ Electrostatic Subframing System



The IDES Relativity™ Electrostatic Subframing System multiplies the frame rate of cameras on JEOL TEMs. Microscopes equipped with Relativity™ achieve exceptional time resolution, data throughput, and advanced automation capabilities.

Luminary™ Micro Compact Specimen Photoexcitation System

Luminary™ Micro is a Compact Specimen Photoexcitation System (CPXS) for JEOL TEMs. With Luminary™ Micro, users can study laser-induced phenomena in situ using fast cameras. Combined with IDES/JEOL EDM fast shutter and/or Relativity™ subframing systems, Luminary™ Micro allows users to perform time-resolved studies using pump-probe methods on the microsecond time scale.

EM-IDES-002

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