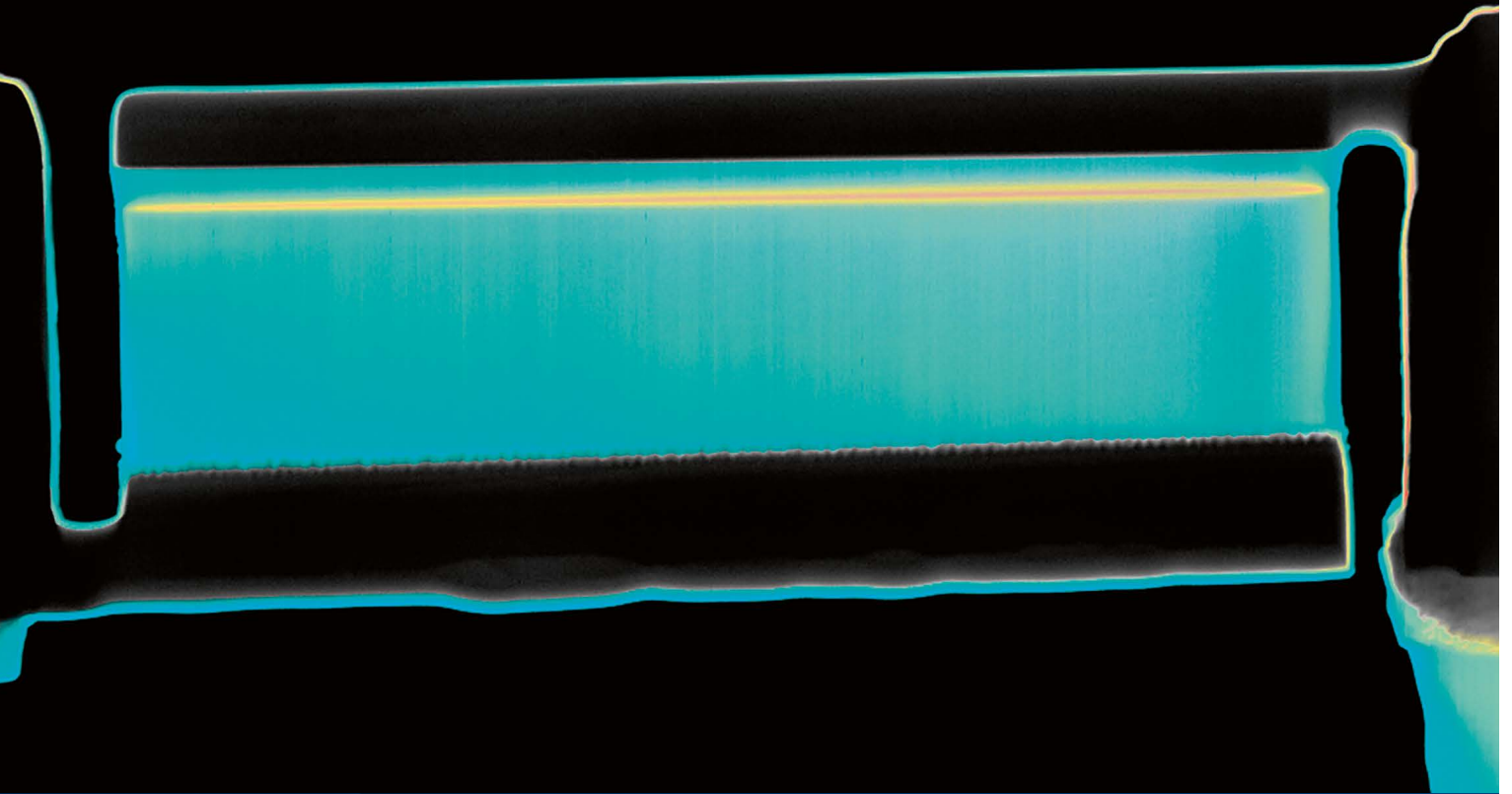


make · explore · discover



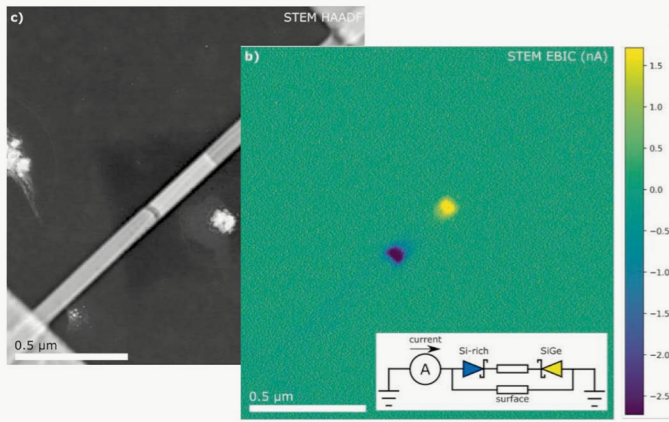
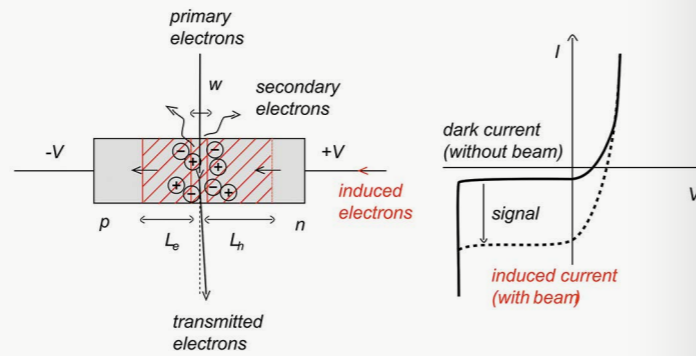
Electrical Analysis for TEM

In-situ imaging of electrical activity at the nanoscale

 point
electronic

Add the Electron Beam Induced Current (EBIC) technique to TEM

- Inelastic loss induces electron-hole pairs in the lamella
- Internal electric fields separate electrons and holes
- Current is measured to acquire EBIC STEM images

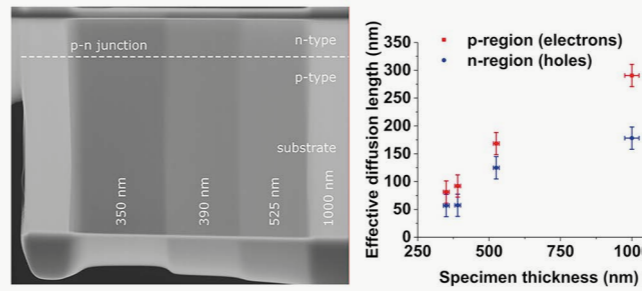
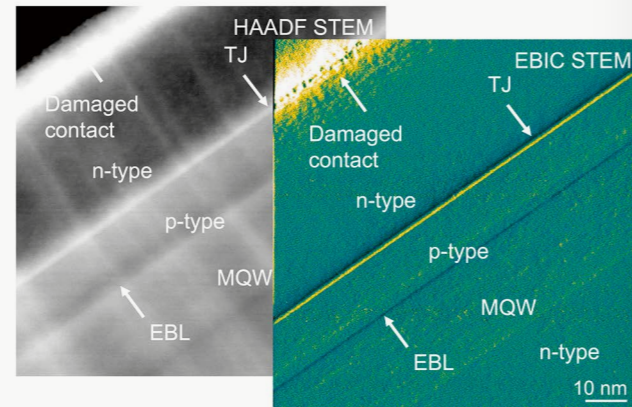


Reveal internal electric fields

- Map junctions and contacts in devices
- Validate doping profiles against design
- Correlate with device model and parameters

Discover electrical activity of each layer

- Localize sites with increased recombination activity
- Distinguish defects with/without electrical activity
- Continue with high-resolution techniques

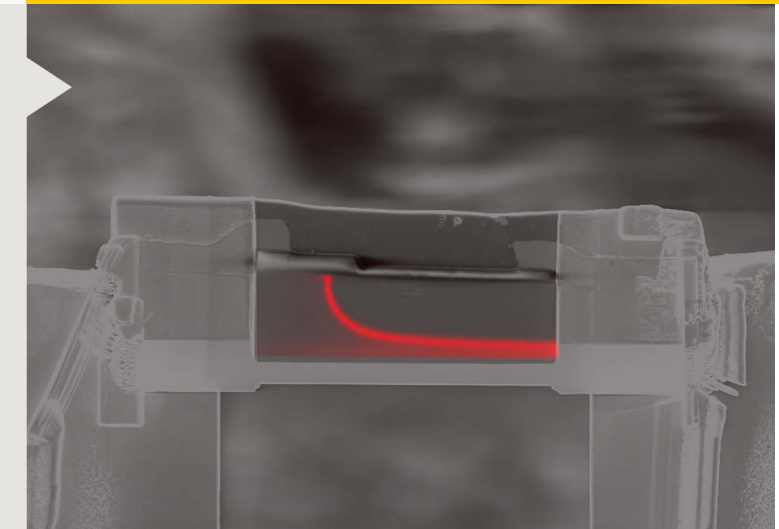


Determine fundamental parameters

- Depletion width at junctions
- Diffusion length of minority carriers
- Recombination strength of dislocations

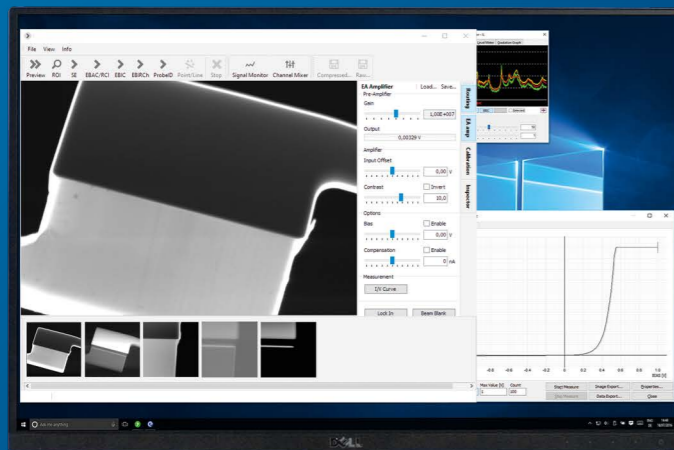
Screen FIB-SEM samples

- Apply standard FIB workflows for in-situ biasing
- Use wide field-of-view of EA in SEM to select target
- Verify lamellas in SEM for preparation damage



Enable direct correlation of electrical activity with high resolution data

Turn-key solution for in-situ TEM



Electronics are fully integrated and software controlled

- Fast amplification optimized for imaging
- Wide gain range to fit all techniques
- Miniaturized on-holder electronics
- Automated signal routing
- Reference sample for training*



* optional

EA for TEM



EA electronics for in-situ biasing holders

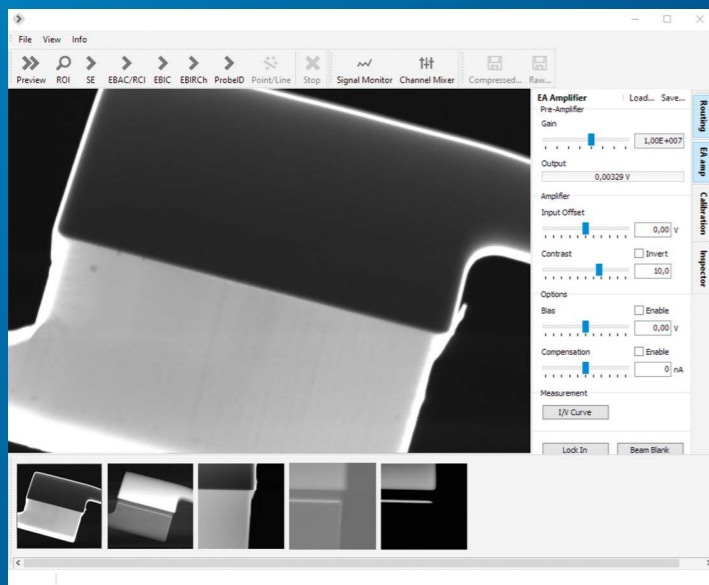
- First stage analog amplification for minimum noise
- Wide gain range for all EA techniques and samples
- Built-in voltage bias and current compensation
- Automated signal routing to avoid electric discharge
- Switchable low passes for signal filtering
- Automated zero adjustment

REVOLON TEM Scan Controller

- Integrated scan generator and image acquisition
- Large pixel resolution and high scanning speed
- Second stage digital amplification for EA
- Simultaneous BF, HAADF and EA inputs



Integrated and easy-to-use quantitative software

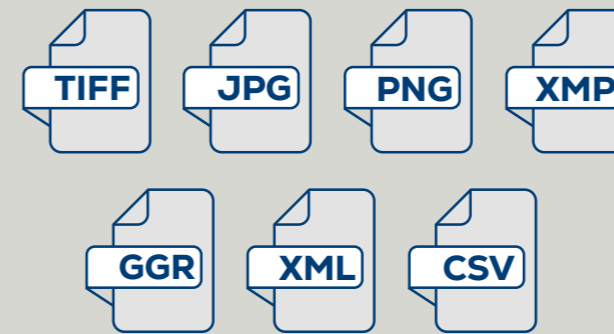
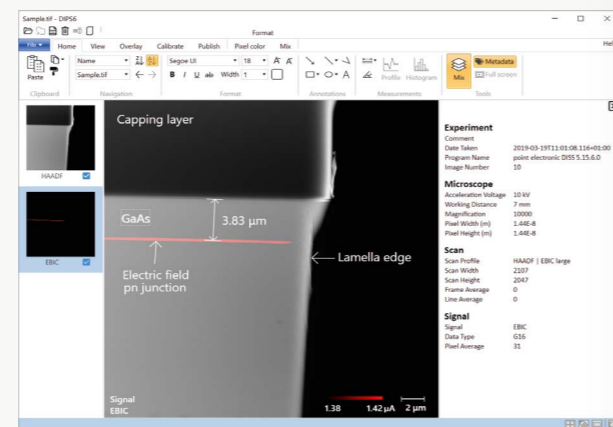


Control and Acquisition app

- EA amplifier control
- EA, HAADF and BF image acquisition
- Automatic quantification to $\mu\text{A}\dots\text{fA}$
- Current-voltage sweep tool
- Live image colour mix tool
- Standard file formats

Microscope Data app (DIPS6)

- Full image and metadata viewer
- Automatic quantification to $\mu\text{A}\dots\text{fA}$
- Gradient-based pseudocolours
- Colour mix of signals for visualization
- Export of quantitative pixel values



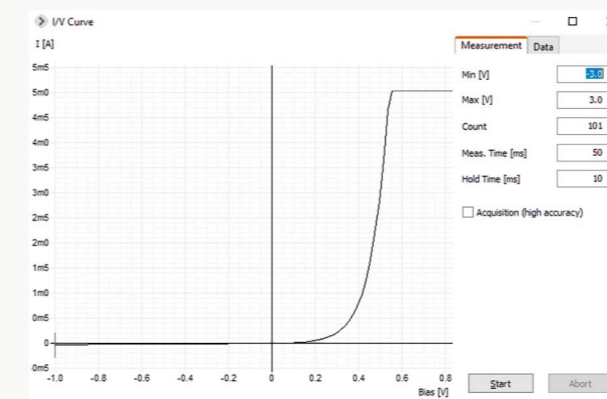
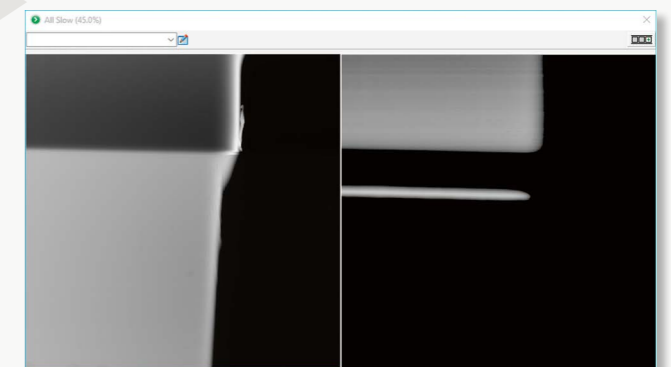
Standard file formats

- TIF un-compressed grayscale data
- JPEG compressed grayscale data
- PNG colour images
- XMP metadata
- GGR colour gradients
- XML formulas
- CSV pixel values

EA for TEM

Automatic quantification of pixel values

- Analog EA signals are factory calibrated
- Softwares shows quantified values
- Metadata includes calibration parameters



Integrated current-voltage sweep tool

- Configurable range, points and measure time
- Verify electrical connections to device
- Inspect for electron beam damage

EA electronics for in-situ biasing holders

Input channels	4x to in-situ biasing holder, or 6x to in-situ biasing holder
Routing	EA high (pre-amplifier) EA low (ground or bias voltage) External
Pre-amplifier	10 ⁴ ... 10 ⁹ V/A variable gain approx. 100 kHz bandwidth at 10 ⁷ V/A
Internal sources	-5 ... 5 V, 16-bit bias voltage -1 ... 1 μ A, 16-bit compensation current 10 μ A, 30 μ A and 100 μ A bias current limits

REVOLON TEM Scan Controller

Signal inputs	1x calibrated EA 4x STEM
Digitization	20-bit EA, saved to 16-bit, 1 Msps 12-bit STEM, saved to 16-bit, 100 Msps
Scan generator	X and Y scan outputs (calibrated) Beam blank output (optional) 64k \times 64k pixels maximum resolution 0.5 GPixels maximum frame size (software limit) 1 μ s minimum pixel dwell time (EA input limit)
Synchronization	Pixel, Line and Frame trigger outputs 10ns.... 100ms trigger lengths Pixel, Line and Frame trigger inputs

PC/Laptop, Display

PC/Laptop	Intel Core i3 minimum 2x USB 2.0 minimum
Display	1,280 x 1,024 resolution minimum
Operating systems	Windows 11 ... 7 Network recommended for remote support

Control and Acquisition app

EA amplifier	Gain, Contrast, Brightness, Bias, Compensation, Inv. Save/load amplifier profile
REVOLON TEM Scan Controller	Configurable scan profiles Signals, pixel resolution, speed, averaging, sync Manual/automatic image range
Inspector tool	Automatic quantification of pixel values Editable formula files
Current voltage (IV) tool	Voltage range, steps, time Live plot with data and graph export
Image mixing tool	Manual colour assignment Live mix with image export
Save file formats	uncompressed 8-bit or 16-bit multi-page TIF compressed JPEG XMP metadata embedded into TIF and JPEG
Operating systems	Windows 11 ... 7

Microscope Data app (DIPS6)

Input file formats	Uncompressed 8-bit or 16-bit multi-page TIF Compressed JPEG XMP metadata embedded into TIF and JPEG
Export file formats	PNG images CSV data with pixel values
View modes	Single page image and metadata Multiple pages/file Layers/image mix view
Quantification	Automatic, using XMP values and formulas Manual, using XML formulas
Pseudo-colour	GGR gradient based colour mapping Automatic and manual control of range
Annotations	Labels, arrows, lines, rectangles, circles
Measurements	Distances, angles Line profile Histogram
Operating systems	Windows 11 ... 7

Parts and Cables

EA biasing holder electronics	Standard	1x
REVOLON TEM Scan Controller	Standard	1x
EA biasing holder cable	Standard	1x
EA ground strap	Standard	1x
TEM signal cable	Standard	1x
TEM external scan interface cable	Standard	1x
USB cable	Standard	1x
USB memory stick with software	Standard	1x
EA reference sample	Optional	1x
PC, keyboard, mouse	Optional	1x
Display	Optional	1x

Software packages

Drivers	PEUSB
Libraries	REVOLON Control
Software	Control and Acquisition app Microscope Data app (DIPS6) EMGateway server

Weight & Dimensions

EA biasing holder electronics	66 mm length typ. 60 mm diameter
REVOLON TEM Scan Controller	64 x 8.7 x 29.5 cm 3.4 kg
Shipping	typ. 64 x 32 x 56 cm typ. 7.5 kg

Site requirements

Power	1x mains 110/220 VAC single phase 50-60 Hz on the same earth as the microscope
Microscope	1x biasing holder (see compatible models) 1x external scan interface 1x video connection (HAADF preferred) 1x microscope ground
Space	EA electronics must be mounted on the TEM in-situ biasing holder REVOLON TEM Scan Controller may be placed in a TEM electronics rack

EA for TEM



Our design principles

We look back on over 30 years of experience in development and manufacture of high-performance instruments and technologies for microscopy.

We are driven by an ambition to expand abilities and to improve performance of electron microscopes.

Our aspiration is to make the best quality tools and to join our customers on their journeys of scientific exploration and discovery.

Performance

Microscopy must be a reliable and enjoyable experience

- Design for highest speed and resolution at the lowest noise
- Develop smart independent controllers for live optimization
- Support new users with intuitive and automated controls
- Assist advanced users with access to all parameters

Efficiency

Microscopes must provide an uninterrupted focus

- Use standard microscope controls and data formats
- Give instant feedback with live image mixing and processing
- Add bespoke software tools and algorithms for repetitive tasks
- Support developers with open access libraries and documentation

Environment

Products and technologies must be sustainable

- Reduce power consumption through smart design
- Minimize material use, embrace reuse where possible
- Save weight and volume for shipping and maintenance
- Enable everyone to develop sustainable innovations

Quantification

Data and control must be in physical units

- Provide calibrated inputs and outputs for quantitative measurements
- Supply samples, procedures, and software for calibration
- Distribute all control parameters in device independent values
- Empower the user to operate the SEM as a measuring device

point electronic GmbH
Erich-Neuß-Weg 15 | 06120 Halle (Saale) | Germany
Tel.: +49 345 1201190 | info@pointelectronic.de
www.pointelectronic.de

