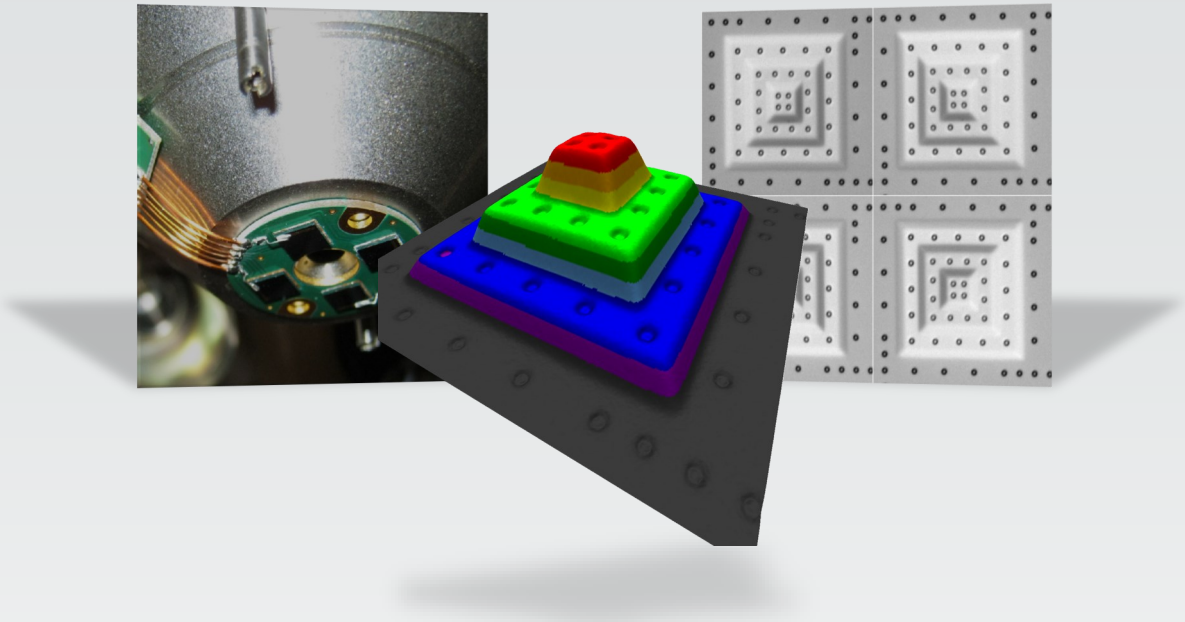
SEM topography

Live 3D shape-from-shading reconstruction with multiple BSE sensors.

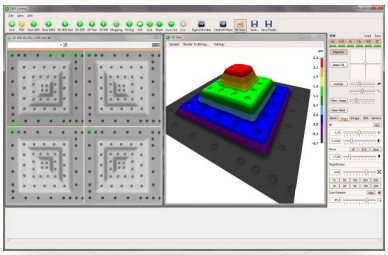


SEM topography delivers high-resolution 3D information about the specimen by recording signals from four backscatter electron sensors mounted underneath the pole piece. An efficient shape-from-shading reconstruction algorithm is applied to these signals to extract quantitative height and texture information. Detailed calibration information about the electron beam and the detectors is automatically managed for quantitative analysis.

Hardware

- scan generator for active electron beam control
- 4 integrated BSE topography sensors
- 4 additional analogue inputs (SE, CL)
- 12 counter inputs (X-Ray mapping)
- USB 2.0 interface

Software



- full and configurable control of SEM data acquisition
- live 3D reconstruction with height colouring
- simultaneous view of all acquired signals
- automatic management of all calibrations
- complete SEM operation, with optional SEM controls

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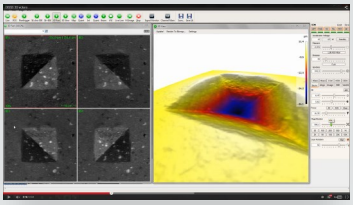
BSE and 3D inserts show FIB microstructure

Live topography

Automatic 3D reconstruction in SEM with Backscattered Electron (BSE) signals

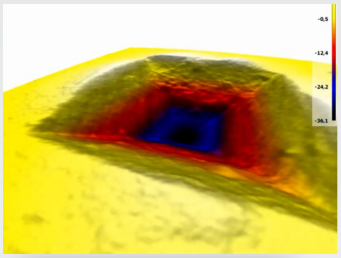


https://youtu.be/SW7X7cjc27o

- fully automated 3D acquisition and reconstruction
- live topographic information with every SEM scan
- fast shape-from-shading reconstruction algorithm
- automatic management of microscope information
- configurable scan size, dwell time and cycling options

3D visualisation

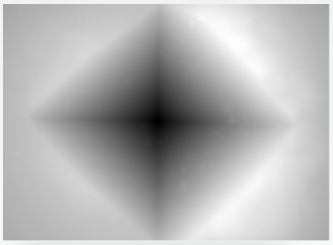
Imaging of complex 3D surfaces with the live 3D rendering



- live surface 3D rendering with full scan control
- automatic height colour coding and colour bar
- free rotation, scaling and panning of 3D view
- width and length are given by scan size
- image export for presentation and publication

Height data*

Off-line quantitative height information with built-in calibration



- height data is output by the reconstruction algorithm
- results are given in distance units, e.g. nm
- height is calculated for each SEM scan point
- resolution is linked to step size, dwell time and calibration
- out-of-sight features or internal cavities are not measured

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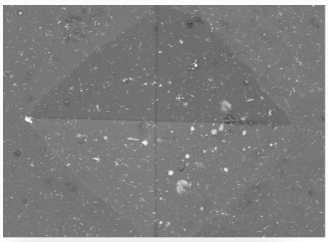
Texture data*

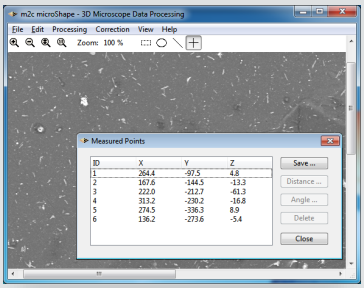
Off-line BSE intensity without shadowing



- texture data is output by the reconstruction algorithm
- intensity is calculated for each SEM scan point
- topographic shadowing is automatically removed
- flat illumination is obtain across uneven samples

3D analysis*

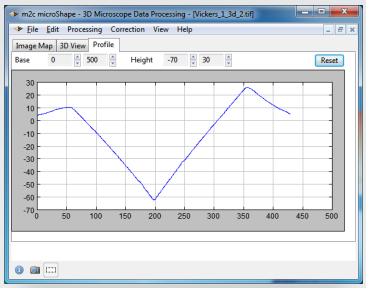
Points, distances and angle measurements



- selection of points from height or texture images
- report of XYZ coordinates of selected points
- measurement of spatial distances and angles
- adjustment of scale, resolution and shear

3D profiles*

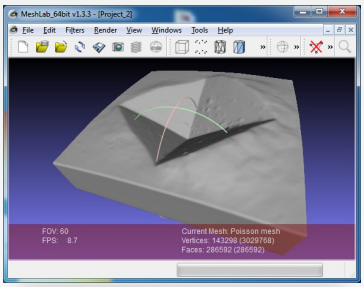
Free selection and extraction of 3D line profiles



- built-in height profile viewer
- configurable plot parameters
- export profile plot to data or image files

3D export*

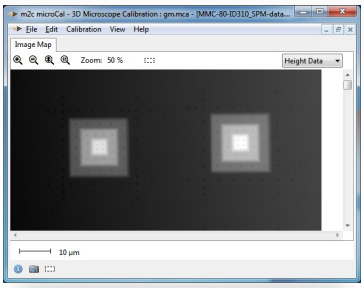
Flexible and easy 3D data export to standard file formats



- 3D measurements export to standard file formats
- height and texture data export to standard image formats
- export of original SEM image data
- mesh generation by third party software only

Automatic calibration*

Robust and sophisticated calibration with minimum user intervention



- one step calibration for lateral and vertical calibration
- one calibration model for all axes
- one click application
- one reference structure for full calibration

BSE and 3D inserts show Vickers microstructure
* m_2c optional analysis software

Specifications

Data acquisition

- USB 2.0 interface for control and data transfer
- 16,384 × 16,384 pixels max. scan size
- 4 × 12 bit D/A converter for analogue video signals
- 12 × 16 bit counter for mapping
- 15 fps at 512 × 512 pixels live imaging
- 32,000× maximum oversampling
- trigger inputs and clock outputs for synchronisation
- mains synchronization for slow scan
- line and frame signal averaging
- signal monitor with gamma and gradation curves
- area mapping, line scanning, point measurements
- ROI scan with zoom for focus and astigmatism corrections
- AVI video acquisition with time lapse
- simultaneous acquisition of all detectors signals
- live signal mixer with configurable colour classification
- automated calibration management with Mag, HV, WD
- configurable data acquisition for custom workflows
    - configurable pre-set acquisition buttons
    - scan size up to 16,384 × 16,384 pixels
    - oversampling up to 32,000×
    - line averaging up to 50×
    - frame averaging up to 256×
    - gate time and signal accumulation for mapping
    - automatic brightness and contrast
- standard file format output
- context sensitive online help
- TWAIN interface for integration with third party software
- API for development of custom acquisition software
- compatible with Windows 2k up to 10 (x86, x64)

Surface reconstruction

- 3D visualisation of sample surface (topography)
- live topographic imaging (1s for 500x500 pixels)
- automatic height colouring and mountain view
- shape-from-shadow reconstruction algorithm
- 3D rotation, pan and zoom
- 3D view capture and export
- automated calibration management
- off-line measurements with m2c microShape software
    - height and texture data
    - line profiles and point measurement
    - spatial distances and angles
    - geometric operations: cropping, orientation, resolution
    - 3D corrections: scale and shear operations
    - height and texture data export

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