

XL30 ESEM[®]

Scanning Electron Microscope

Technical Data Sheet



The XL30 ESEM sets a new standard for scanning electron microscopy. Only the ESEM provides high resolution secondary electron imaging and X-ray analysis in a high pressure gaseous atmosphere such as water vapour as well as in high vacuum. The XL30 ESEM combines the ease of use and full computer control of the XL series with the unique capabilities of ESEM technology to provide an affordable solution to current and near future needs of the modern SEM laboratory.

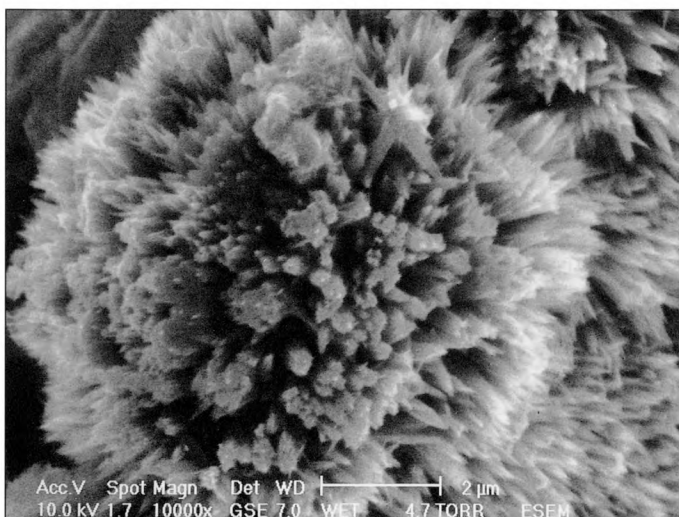
The Philips XL Series SEMs provide advanced technology with unprecedented user-friendliness. The XL30 ESEM extends this concept with patented ESEM technology, opening up a new range of applications. These include stable imaging of hydrated and wet samples and pure SE imaging of nonconducting, uncoated materials at any kV, thus eliminating any need for specimen preparation. The extensive range of accessories allows the system to be configured for dedicated tasks. The integration of advanced electron optics and extensive system automation results in exceptional capabilities, flexibility and ease of use. Numerous built-in interlocks and status checks guarantee safe operation under all conditions. The system can also be equipped with embedded EDX capability with the same system philosophy as the basic microscope and with a similar user interface. In this way the operator has a single system with full ESEM and analytical capabilities.

Only ESEM provides:

- secondary electron imaging in both gaseous and high vacuum condition. Other SEMs capable of operating at low vacuum are limited to lower resolution backscattered electron images. Gas ionisation in the ESEM eliminates charging artefacts in both images and X-ray analysis.
- chamber pressures well above 4.6 Torr. A water vapour pressure above 4.6 Torr is an essential requirement to keep wet and hydrated samples in their original state.
- a built-in source of water vapour and an auxiliary gas manifold permitting the use of a wide variety of gases in the chamber.
- controlled gas ionisation to suppress charging artefacts.
- high resolution SE imaging of outgassing, heated or light emitting-specimens.

ELECTRON OPTICAL SYSTEM

Gun	Gun configuration control is fully automatic with optional auto saturation and auto alignment. Standard auto bias control optimises emission for total voltage range including low voltage performance. High and low voltage anodes are standard.
Alignment	Computer assisted alignment allows free change of spotsize and high voltage without the necessity of realigning the system.
Resolution LaB₆	2.5 nm at 30 kV at 10mbar (7.5 Torr) or in high vacuum 15 nm at 1 kV in high vacuum (with high vacuum SE detector).
Resolution W	3.5 nm at 30 kV at 10mbar (7.5 Torr) or in high vacuum 30 nm at 1 kV in high vacuum (with high vacuum SE detector).
Continuously Variable Accelerating Voltage	Over the range 0.2 - 30 kV. Image rotation and focus automatically compensated over the full range.
Continuously Variable Beam Current Control	Over the full range of voltage. Maximum beam current: 1 μ A at 30 kV (W), 200 μ m final aperture. 8 pre-calibrated values (spotsizes) for each selected kV and choice of automatic coupling of spotsize to magnification.
Mechanically Pre-Centered Conical Objective Lens	Simplified alignment procedure, data file saved. Focus range 3.0mm to 45mm FWD. Autofocus standard. Precise mouse focus with magnification adjusted sensitivity. Dynamic focus \pm 80 degrees. Rotation free focusing.
Exchangeable Final Lens Aperture	Pre-centered in the principle plane of the final lens. Standard size aperture optimised for both spotsize and beam current over the full range of accelerating voltages.
Stigmators	Autostigmator standard. Manual control of X and Y simultaneously. Visual indication of actual setting. Sensitivity automatically adjusted to the magnification.
Continuous Electronic Image Shift	Total range for both X and Y 40 μ m. Sensitivity adjusted to magnification. Direction always consistent and independent of scan rotation.
Scan rotation	Scan rotation at all available scan rates including TV. Range -180 to +180 degrees.

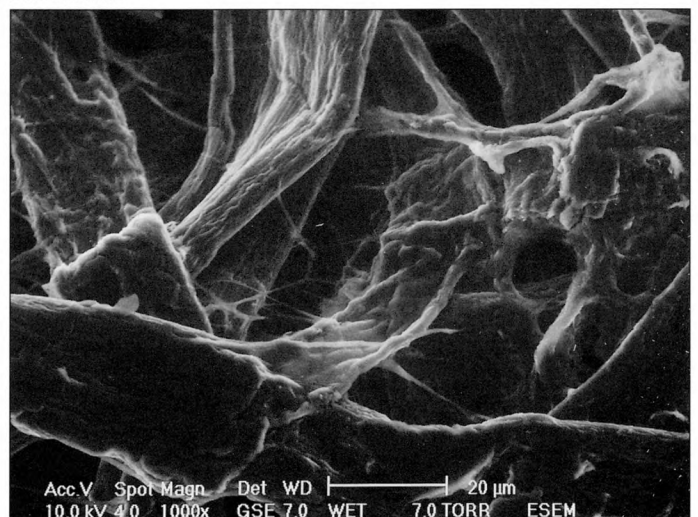
Rust, uncoated in H₂O vapour.**SCANNING SYSTEM**

Magnification	User defined presets, stepped and continuous. Selected magnification value independent of working distance. Powerzoom and automatic scaled μ -marker. Range (related to image width of 12 cm) 10x to 400.000x in high vacuum. 250x to 400.000x in ESEM mode. (125x option) Standard on-screen X and Y measurement.
Survey Mode	User selected region of interest automatically centred, followed by power zoom to required magnification. Image conditions and position can be stored and labelled, then survey resumed.
Scan Modes	Full frame, selected area, horizontal line, spot. Built-in low pass filter automatically adapted to selected line time. Size and position of selected area user defined. Optional external scan mode. Split screen, dual magnification and dual detector modes.
Scan Generator	TV plus 4 user preset slowscans including photoscan available. Preset conditions of linetime and lines per frame can be chosen from > 80 combinations depending on user and or application orientation. Capable of digital line scans for EDX. Chosen conditions are stored until changed. Default values can always be reset.

SPECIMEN HANDLING

Eucentric Goniometer Stage	4 axis motorised stage (X,Y,R,Z) with total manual override including Tilt. Integrated readout on-screen of all movements. Tilt setting monitored throughout entire microscope control software. Motorised stage supported by extensive software capability including stage mapping, up to 3 point alignment and compucentric rotation. Tilt eucentric working distance at 10 mm with optimum detector geometries.
CompEucentric Stage Movement	Computerised stage control calculates the off centre rotation for any point of interest. This allows viewing at any angle of rotation of the same point of interest.
Specimen Movement	X = 50 mm, Y = 50 mm, Rotation = 360° continuous. Tilt range: -15 to +75 degrees, (for large specimen 0 to +45°). Z movement: 50mm total. Max. free space (FWD = 4 mm) = 37 mm (rotation sub-stage included). Max weight = 1kg
Specimen Exchange	Drawertype entry Exchange time: <4minutes to high vacuum <2 minutes to ESEM mode

Sample Chamber Dimensions Inside chamber diameter 284mm.

Paper, uncoated in H₂O vapour.

CHAMBER ENVIRONMENT CONTROL

Selection of Software control of pressure mode of operation. Operating environment of water vapour (using built in water vapour reservoir) or user supplied gas through a separate inlet.

Pressure range 0.1 to 25 mbar (17 Torr) (LaB₆ model), 50 Torr attainable 0.1 to 25 mbar (17 Torr) (W model)

ELECTRON DETECTORS

ESEM Mode Patented Gaseous Secondary Electron Detector gives high efficiency detection in a wide range of chamber gases including water vapour.

High Vacuum Mode Optional Everhart-Thornley Secondary Electron Detector with high efficiency longlife scintillator Automatic control of contrast and brightness. Grid control continuous from -150 V to + 300 V to give backscattered electron imaging

IMAGE PROCESSING

Video Outputs User selectable display from 4 available images (8 optional). Convenient TV output at any scan rate. Optional output for second monitor, colour images, Red/Green stereo and detector coding.

SCSI-bus Digital Interface For internal communication between PC and built-in control processors.

Storage Standard definition (SD) image: 702 x 484 pixels (8 bit). High definition (HD) image: 1404 x 968 pixels (8 bit).

Standard framestore: 4 SD images
With expansion: 8 SD images or 1 HD image.

Processing Capabilities Fast processing: copy image, recursive filtering, integration, image-in-image selected area display, look-up tables for enhancement, user selected gamma, background subtraction, post mixing. Graphics: μ -marker and databar with user selected microscope parameters.

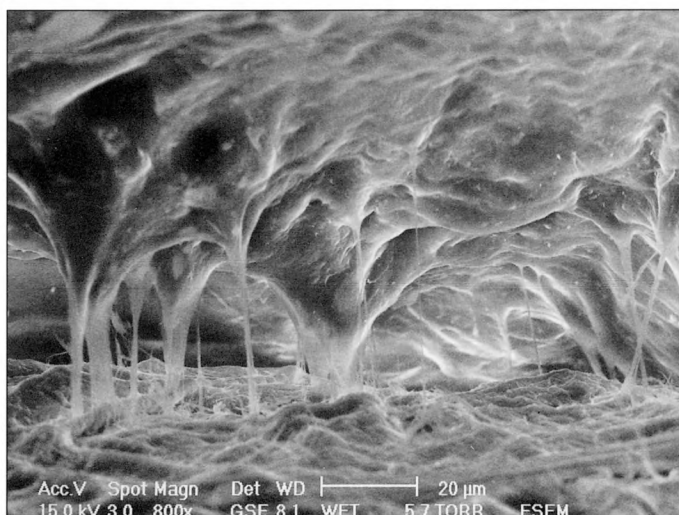
Text in Image Standard. Enhanced graphics editor optional.

DISPLAY AND RECORDING

Viewing Monitors One (optional two) 17" high brilliance colour monitor.

High Resolution Photomonitor Vertically positioned 7", 2000 line monitor.

Recording Option Video hardcopy unit, range of cameras. Storage of digital images on hard disk or on floppy disk. Optional storage on laser optical disk. Digital image store in TIFF format for transfer to and from other software packages.



Adhesive on paper, uncoated in H₂O vapour.

VACUUM SYSTEM

High Vacuum pump Edwards DIFFSTAK135 l/sec. End pressure 10⁻⁴ Pa (10⁻⁴ mbar)

Pre-vacuum Pumps 2 Edwards RV8, designed for continuous pumping of water vapour.

Ion Getter Pump System Standard in LaB₆ versions. End pressure 5 x 10⁻⁶ Pa (5 x 10⁻⁸ mbar).

HARDWARE OPTIONS

Viewing Options Viewport or infra-red chamber camera. For observation of the sample in high vacuum or ESEM modes

Micromanipulator/Microinjector For sample manipulation and injection of gases or liquids.

Sub-stages:

Cooling Stage Temperature controlled cooling/heating stage (+/- 20° C from ambient).

Heating Stage Up to 1000° C.

Detectors High vacuum secondary electron detector, Solid state backscatter detector, specimen current detector suitable for both imaging and measuring, Robinson backscatter electron detector, CL detector, EDX detector types, electron Backscatter Pattern (EBSP).

SOFTWARE OPTIONS

Column Functions True auto saturation and auto alignment. Integrated beam blanking.

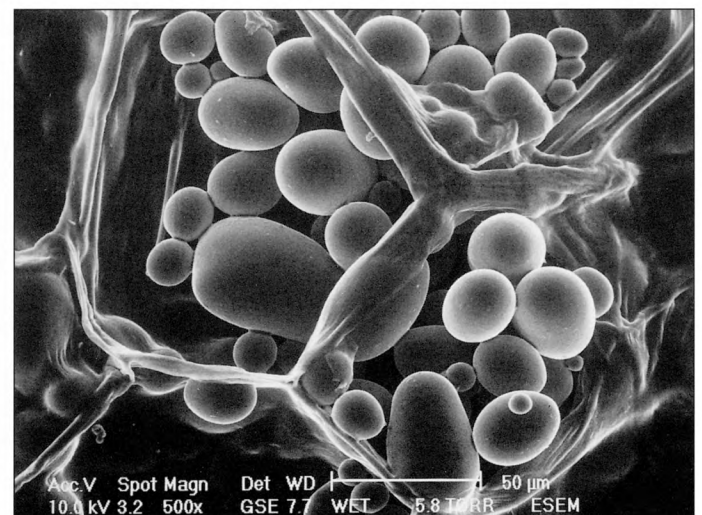
Image Handling

- Measurement of random image points and height (stereo method)
- Two dimensional convolution using up to 5 x 5 matrices (edge enhancement, differentiation)
- Storing and retrieving of images to and from the PC disk.
- Colouring of images and image manipulation
- Histogram analysis
- Image analysis, basic and extended
- Image database management

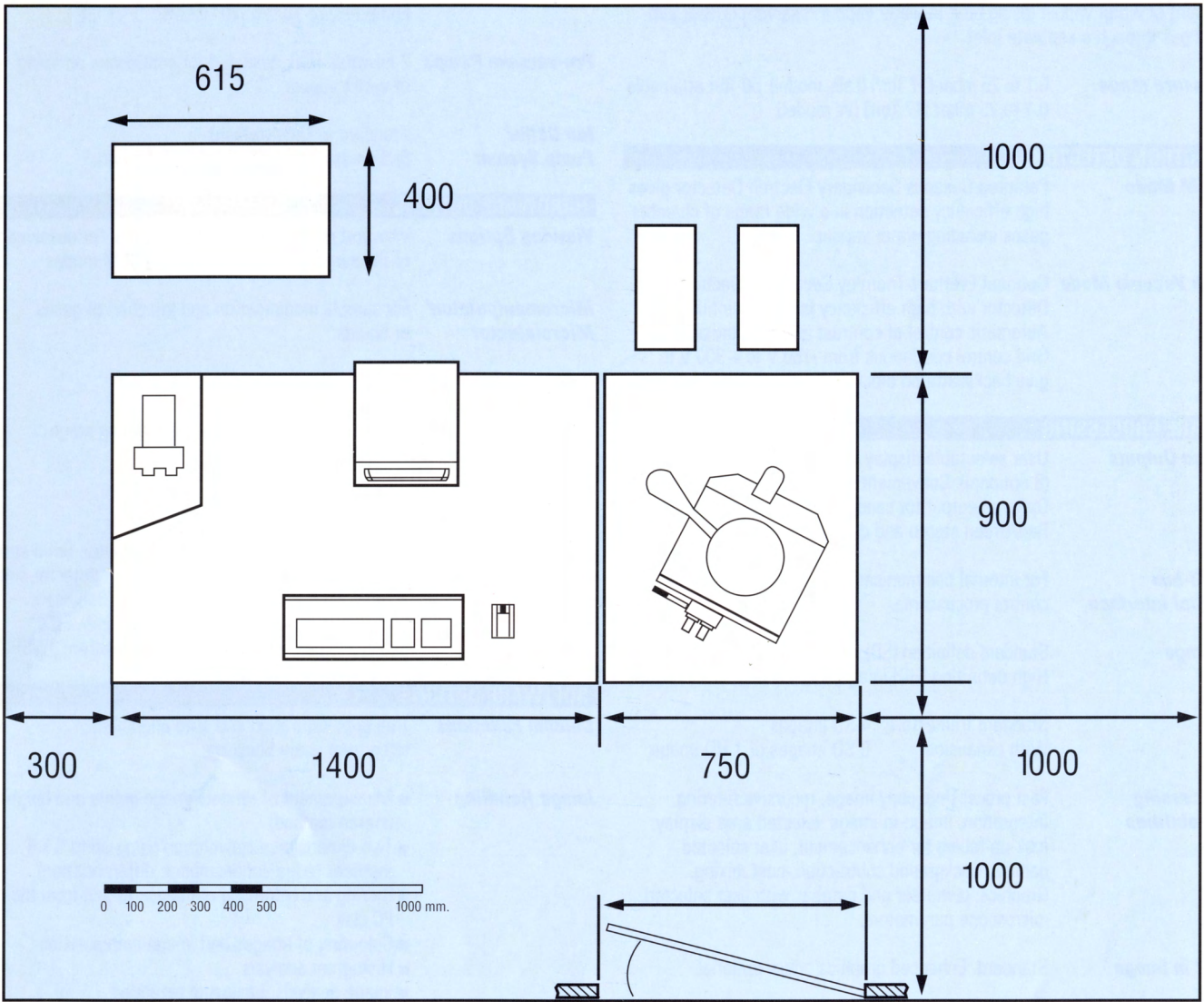
Extension facilities

- Multi-user software shell
- Diagnostic support
- Remote control library
- Metrology package

Fully MS Windows compatible Application programs including MS Word, Excel and Wordperfect can be utilised fully for report writing or by DDE for auto generation of statistics and graphical output.



Cross section fresh potato revealing starch, uncoated in H₂O vapour.



ESEM® is a registered trademark of Philips ElectroScan.

THE ■ XL SERIES SEMs FROM PHILIPS

Philips Electron Optics
Building AAE, P.O.Box 218
5600 MD Eindhoven, The Netherlands
Tel. +31 40 2766768, Fax. +31 40 2766786
E-mail: marcom@eo.ie.philips.nl
Internet: <http://www.peo.philips.com/>



PHILIPS