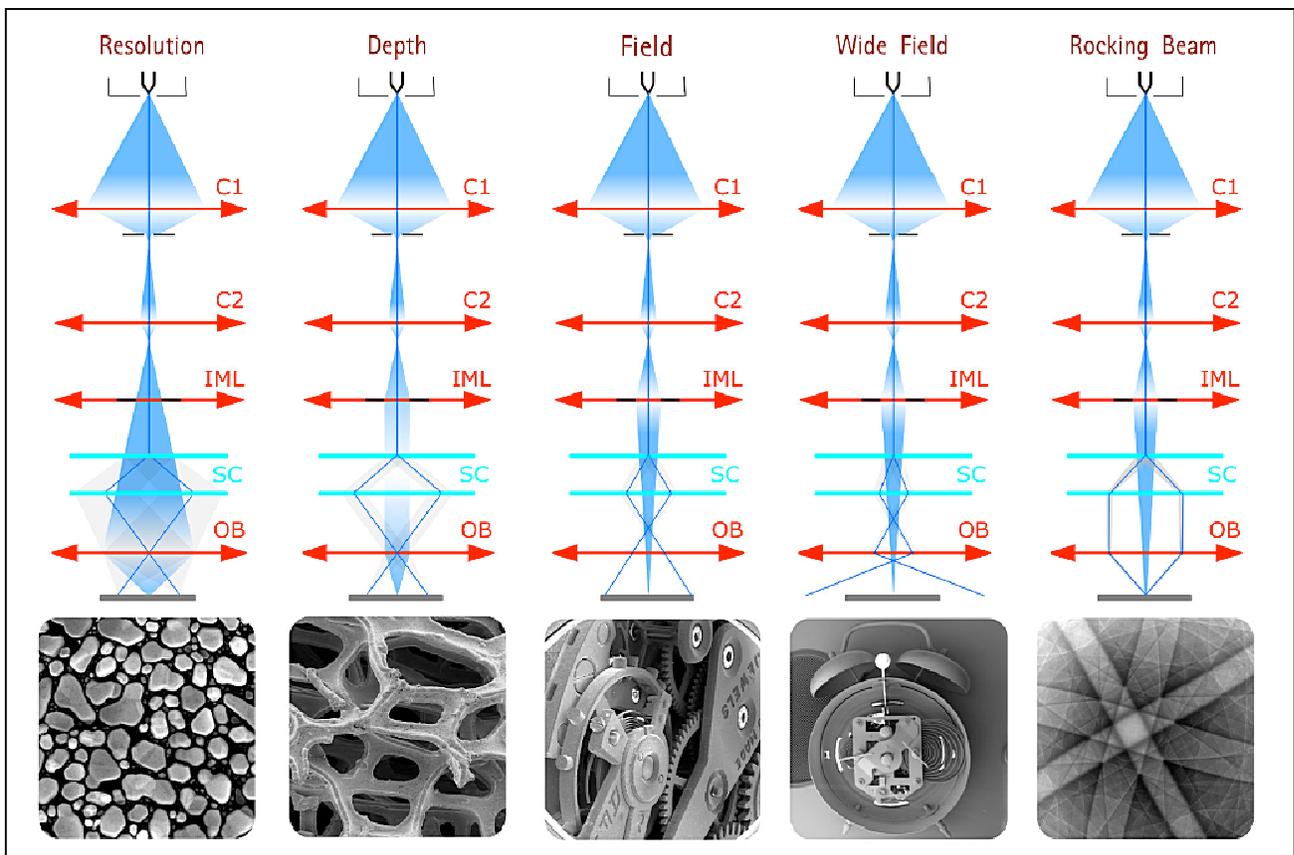


# Tescan Vega-3 LMU

## Unique Features

- 1. Wide Field™ Electron Optics** – The Tescan SEM is the only microscope available with a 4-lens electron optics system. All other SEMs use a conventional 3-lens design. The 4-lens Wide Field™ optics design allows fully electronic control of beam aperture as well as a wide range of special imaging scanning modes (see below).
- 2. Electronic Beam Aperture Control** – Tescan microscopes allow fully electronic and fully automated control of the beam aperture, which is an important parameter controlling the optical/imaging behavior of an SEM, including the ultimate resolution and depth of focus. Conventional SEMs control the beam aperture using physical apertures of fixed size. Users must manually select the physical aperture to use, and then manually align the aperture on the electron optical axis of the SEM. Typically only 3 or 4 apertures are available for selection. The 4-lens design of the Tescan SEM allows full electronic control of the beam aperture and fully automatic alignment. This allows for the possibility of continuous control of beam aperture (rather than only 3 or 4 choices) as well as fully automated operation without requiring user interaction. Dedicated modes can be provided that are optimized according to the goals of the user (e.g. high resolution versus high depth of focus).
- 3. Imaging/Scanning Modes** – Tescan's unique 4-lens electron optical design provides a wide range of imaging and scanning modes, including: High Resolution Imaging (Resolution Mode), high depth of focus imaging (Depth mode), ultra-low magnification imaging (Wide Field mode), Live 3D Stereoscopic imaging, and Selected Area Electron Channeling (beam rocking for acquisition of electron diffraction images). All of the scanning/imaging modes are fully automated and computer software controlled. Switching among modes requires only a mouse click (selection of the desired mode on the GUI) and does not require the operator to select, install, or mechanically align any apertures or other components in the column, or to change the specimen working distance.



4. **Magnification Range** – The Tescan Vega-3 LMU SEM offers the widest magnification range (2.5x to 1,000,000x) available on a commercial SEM, from ultra-low magnification “macro” imaging to high-resolution imaging.
5. **High Resolution Digital Imaging** – The Tescan SEM provides the highest digital imaging resolution available on a commercial SEM: 8,192 x 8,192 pixels (64 million pixels) with 16-bit pixel depth resolution (65,536 gray level resolution).
6. **Remote Operation** – The Tescan SEM is the only commercial SEM available that provides integrated remote access and SEM operation over TCP/IP (LAN or Internet) connections. The Tescan VegaTC operating software includes an integrated SEM server that permits remote operation of all the SEM’s functions over a TCP/IP connection accessible via a modem, LAN, or the Internet. The Tescan SEM server is capable of supporting simultaneous connections from up to 16 clients and each client can have independently controlled read/write privileges.
7. **Single-crystal YAG Detectors** – Both the secondary electron detector and the fully retractable backscattered electron (BSE) detector utilize single-crystal YAG scintillators. Compared to other scintillator types, YAG scintillators are non-consumable components that never require replacement. Single-crystal YAG scintillators possess high strength (difficult to break even if struck by a sample), can be cleaned, and do not suffer from radiation damage – they will last the life of the SEM. In addition, YAG scintillator detectors have extremely fast response time (<100ns) allowing them to operate at very high scanning rates (even TV scanning rates). The fast response time of the YAG BSE detector is particularly important for increasing the speed of automated GSR analysis, where the BSE signal is monitored during fast scanning to find potential GSR particles.
8. **Fully and Continuously Retractable Backscattered Electron Detector** – The Tescan SEM includes a fully, continuously retractable backscattered electron (BSE) detector compared to fixed position detectors provided with other instruments. This detector utilizes a UHV (ultra-high vacuum) compatible stainless steel bellows retractor as opposed to sliding O-ring seals to prevent any vacuum leaks during operation. A retractable BSE detector is required to allow very high magnification / high resolution imaging at very short sample working distances, e.g. 1-3mm (fixed detectors require the user to vent the SEM chamber and physically remove the detector). In addition, a continuously retractable BSE detector allows fine positioning of the detector during imaging in order to control the “illumination” conditions of the detector. Retracting the detector provides lower angle, oblique illumination of the sample for improved contrast from fine topographic structures; fully inserted (non-retracted) detector position provides symmetrical illumination of the sample (like a ring illuminator) to enhance compositional contrast and suppress topographic contrast.
9. **Continuous Pixel Dwell/Scan Speed Control** – The Tescan SEM is the only commercial SEM available that provides continuous control of pixel dwell/scanning speed control, from TV-rate scanning to slow scanning. The pixel dwell time on all Tescan microscopes is adjustable from 20 nanoseconds per pixel up to 10,000 microseconds per pixel, adjustable in 0.1 microsecond (100nanosecond) increments. Fine control of both the beam current and pixel dwell/scanning speed allows the user to completely control the electron dose (and rate) to the sample, which can be very important when optimizing imaging conditions, especially for beam-sensitive or charge-sensitive samples.
10. **Integrated Live 3D Imaging and Quantitative 3D Reconstruction** – The Tescan SEM is the only SEM capable of live 3D stereoscopic imaging (live 3D images viewable on the display monitor while navigating around the sample, changing magnifications, etc.). Stereo images can also be saved to disk. The Tescan SEM is also the only SEM capable of offering integrated quantitative 3D reconstruction and analysis. The optional integrated MeX package provides a fully integrated software functionality to create quantitative digital elevation maps from stereo image pairs (stereo image acquisition is automatic using beam tilting technology). The system allows the user to create detailed 3D renderings of the sample surface, shaded with the actual SEM image, zoom, pan, tilt, and rotate the 3D model, as well as extract quantitative profile, area and volume measurements from the digital elevation maps.

- 11. Integrated Hardware Diagnostics** – The Tescan SEM is the only SEM incorporating a fully automatic and integrated hardware diagnostics system. This system utilizes an integrated I2C “back channel” bus allowing direct access and testing of all SEM subsystems. A complete hardware/software selftest is executed at each user logon; all faults, errors, and unusual conditions or user settings are reported, and corrective actions suggested. All selftest results are appended to and permanently saved in monthly log files. Diagnostic selftests can also be initiated manually at anytime following logon.
- 12. User Upgradeable PCs** – The unique architecture of the Tescan SEMs allows users to easily upgrade their own PCs without requiring a service visit. The PC contains no special or proprietary hardware whatsoever, and interfaces to the microscope solely via a standard Ethernet network connection.
- 13. Capabilities for System Expansion** – The Tescan Vega-3 LMU image acquisition system provides inputs for up to eight detectors, allowing for future retrofitting of additional imaging detector systems (e.g. Cathodoluminescence (CL), Transmitted Electron detector (STEM), EBIC, etc.)
- 14. In-Flight Beam Tracing™** - Tescan’s In-Flight Beam Tracing™ technology, introduced in the third generation Vega-3 models, integrates real-time complete electron optical characterization. These calculations are done on the fly every time a change in operating conditions is made. One of the unique capabilities that In-Flight Beam Tracing™ provides is the ability to directly specify the desired probe diameter or probe current and the system adjusts the optics automatically to achieve this. This is very different from typical SEM technology, where users can only select a dimensionless "spot size" number or percentage.
- 15. Scripting** – Tescan’s third generation Vega-3 models now include the built-in Scriptor™ extension, allowing users to create powerful scripts to automate repetitive or commonly executed tasks.
- 16. Crystallographic Imaging** – Tescan’s third generation Vega-3 SEM models are the only instruments available with built-in capabilities for dynamically corrected selected area electron channeling. This scanning mode allows users to acquire electron diffraction images from crystallographic samples, which is helpful for determining lattice orientations as well as phase identification. Dynamic electron optical corrections allow acquisition of electron diffraction patterns from grains or particles as small as 20 microns. Acquisition of selected area channeling patterns is fully automated and computer controlled.
- 17. Integrated Active Vibration Isolation** – Tescan is the only SEM manufacturer to offer an active vibration isolation system fully integrated into the microscope frame. This system, which operates on principles similar to noise cancellation headphones, offers significant improvements over conventional springs or pneumatic systems, including
  - a. Active dampening and isolation in all six degrees of freedom
  - b. Almost no natural low-frequency resonance and therefore excellent vibration isolation characteristics in frequency ranges common to building vibrations (e.g. below 10Hz)
  - c. Better vibration attenuation than normally possible with passive systems (>98.75% isolation above 10Hz).