UNIVERSAL TEM IMAGING PLATFORM

**IMAGING SOLUTIONS FOR ELECTRON MICROSCOPY.
BASED ON OPTO-DIGITAL KNOW-HOW. DESIGNED BY CUSTOMER REQUIREMENTS.**

Transmission electron microscopy today involves digital technology as standard. High-resolution digital cameras are used for TEM image acquisition, incorporating dedicated software with built-in real-time functionality that calculates the best possible image quality. Completely computer-controlled, the external opportunities for automation are practically revolutionizing the way people work here. Especially in conjunction with dedicated imaging software, scenarios once thought impossible are now becoming reality. It is our aim here at Olympus to find solutions that are individually tailored to our customers' needs.

Our TEM imaging platform iTEM is systematically oriented towards the requirements and workflows of the transmission microscopy field. It is setting a standard with enticingly simple, yet intuitive user operation, as well as a whole host of real-time imaging possibilities. All of our TEM cameras, as well as most modern remote-controlled TEMs, can be operated via iTEM. Numerous real-time functions ensure the best possible image quality during acquisition. iTEM facilitates the processing, analyzing, archiving and documentation of the acquired images within an all-inclusive software package. And solution-oriented extension packages offer an efficient means of expanding the capabilities of even the basic version of iTEM.

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iTEM TEM Imaging Platform
We Focus on Your Image
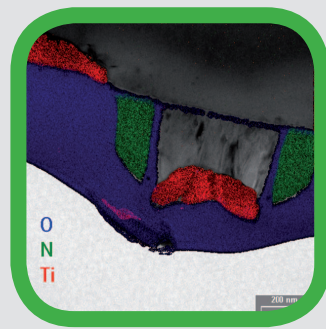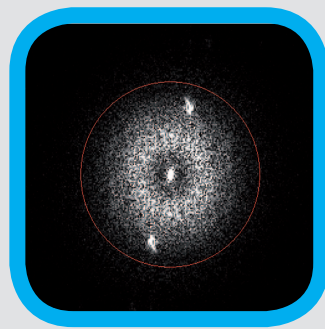
We Focus on Your Image

Image Acquisition

iTEM is systematically oriented towards the requirements and workflows of the transmission microscopy field. The software sets a standard of excellence with enticingly simple, yet intuitive user operation, a range of functions that interact perfectly and a structure that is flexible and modular. Most TEMs can be controlled and automated via iTEM, which includes TEM cameras and their entire range of functions. With a mere click of a button, images are transmitted from microscope camera to iTEM. Various real-time routines ensure that images are of exceptional quality, correctly calibrated and include all microscope parameters. With the right configuration, iTEM controls connected devices, allowing complex recording processes to be performed and automated. The entire image acquisition workflow can be conducted within iTEM.
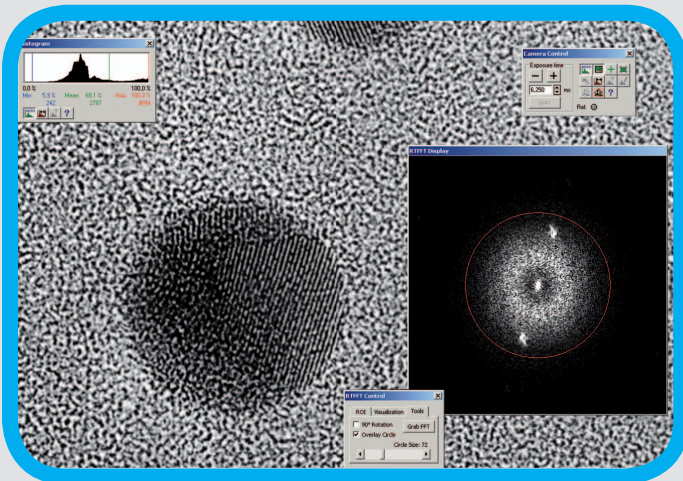
## Remote and Automation

Intelligent Recording

With IntX (Intelligent eXposure), iTEM provides you with automatic exposure control. Premium quality acquisitions can be made at the click of a button without requiring extensive technical background knowledge. Contrast and brightness may be manually adjusted as required within the live image.
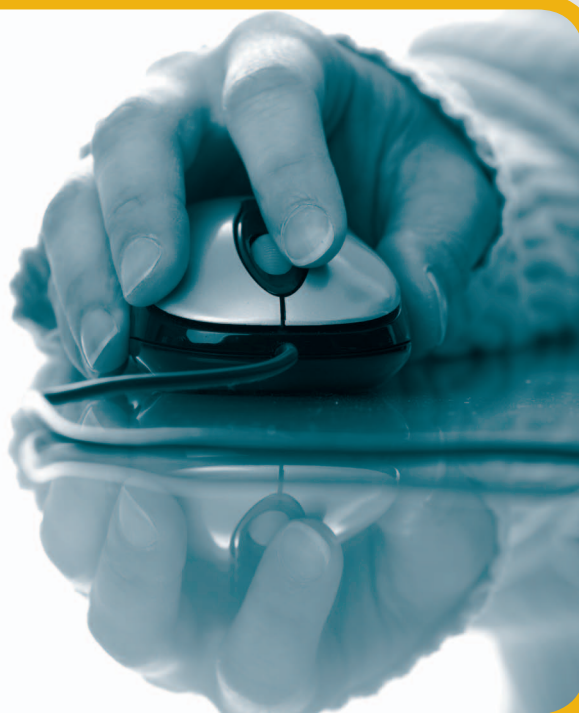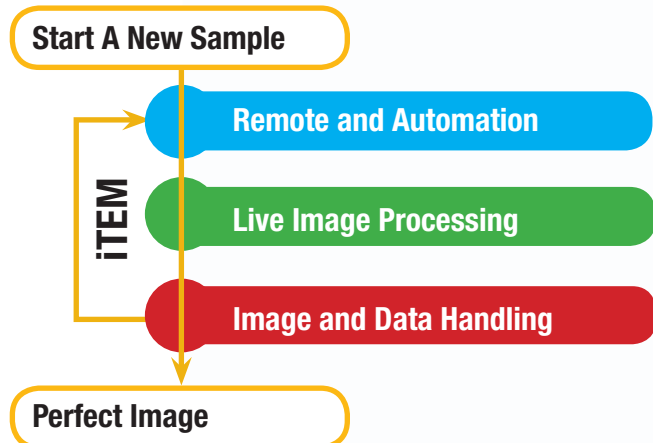
Real-Time Routines

iTEM offers numerous built-in real-time functions during image recording, such as online shading correction, real-time FFT, automatic gain control, etc. A live histogram and over-exposure warning fully utilize the entire dynamic range of the camera without having the images saturated. You can interactively optimize the live image by adjusting contrast and brightness through the live histogram. Other real-time image operations, such as flat field correction, averaging and automatic sharpness, can be used to calculate the best image quality, showing all details inside the image.

Microscope Control

Depending on the type of microscope, iTEM offers software control for a wide range of microscope functions. The auto focus routine integrated into iTEM ensures sharply focused images. All computer-controlled TEMs are compatible for use with the auto focus feature, which is the perfect solution for routine tasks at the microscope, as well as for use with automated applications.
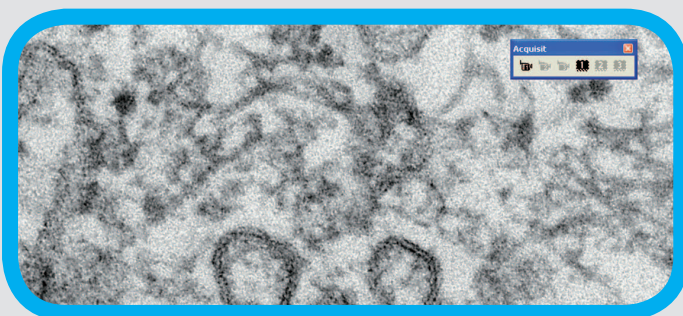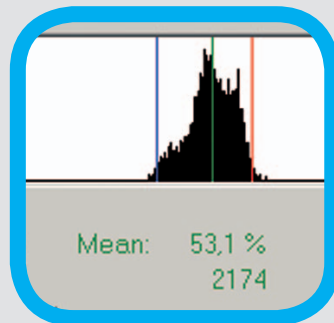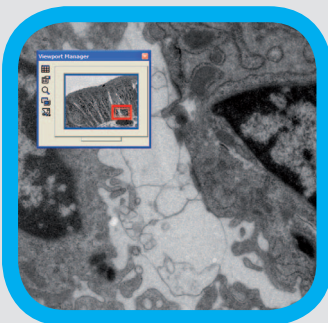
The One-Mouse-Click process for perfect image recording

Start A New Sample

iTEM
- Remote and Automation
- Live Image Processing
- Image and Data Handling

Perfect Image

Live Image Processing

Live Measurements
The images acquired using iTEM are always calibrated correctly, a basic requirement for more advanced work. Interactive measurements, phase analysis or advanced object analysis can be performed inside the live image. The measurement line and the measurements results are displayed in a separate layer.

Digital (Live) Streaming
Images can be easily transferred as a digital video stream using the start and stop button during live acquisition. The AVI-file can later be animated directly in iTEM or in any other movie application. Live images can be transferred directly to the Web via iTEM's NetCam functionality.

Live Annotation
iTEM contains a comprehensive library of text, graphical and editing functions for labeling and highlighting images. It is possible to insert a company logo into an image, emphasize certain details with arrows or color, or insert text within an image – and all without altering the actual image content.

Image and Data Handling

Data bar & Scale bar
iTEM has ample options for showing microscope information and scale bar. All image and microscope data are displayed in a data bar. You define what data is to be shown, a very convenient way of keeping an eye on currently selected settings. The scale bars automatically adapt to the respective zoom factor of an image, while comments can be added which are viewed in the corresponding data bar field.

Image Information
When the image is acquired, iTEM saves all available microscope information and displays it along with other image information in various ways. When inserting images into the integrated database, all data is automatically transferred to the corresponding database fields. When it comes time to generate the report, the fields will be filled out automatically.

Image Format
iTEM supports a multi-dimensional image format for storing, processing and visualizing multiple images acquired at various Z positions, at various times or different angles, or at various energy losses in just one single image file.
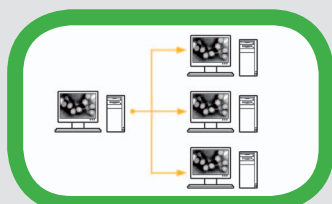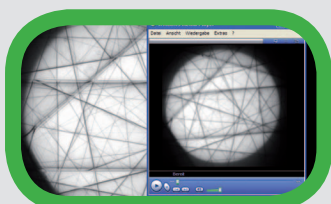
Magnification	2200 x
Accelerating Voltage	80 kV
Stage Position X	211 µm
Stage Position Y	133,6 µm
Stage Position Z	0 µm
Stage Rotation	0 °
Stage Tilt	0 °
Spot Size	2
Emission Current	8,16063 µA
Defocus	-49,99391 µm

Microscope	Accelerating Voltage	Magnification	Label
TEM	120 kV	11000 x	Liver
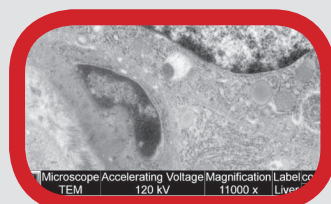
We Focus on Your Image

Image Processing and Analysis

Image acquisition is usually just a means to an end. iTEM offers a complete collection of processing functions for post-acquisition image optimization, often newly developed and unique to iTEM. These include a comprehensive list of filters and visualization tools - opening up unprecedented, image-processing horizons. And as, more often than not, the quantitative results are what really count, iTEM provides the tools for interactive measurements, data analysis and process documentation – such as a basic two-dimensional length measurement, as well as more complex multi-phase particle and object analysis. iTEM ensures that results are available faster, reproducible and saved securely.

Clearly Structured

Graphical User Interface

iTEM provides you with a well-structured and ergonomic alignment of functionally independent windows. The ViewPort is the main window for working, displaying either one or a group of several images. Being able to view the same image document simultaneously in multiple ViewPorts simplifies interpretation of image content. ViewPort synchronization makes it possible to compare images or image details directly on the PC screen. The ViewPort Navigator enables you to easily navigate throughout the entire image when the image is zoomed.

Workspaces

The entire user interface, including menu structure and button bars, can be set up as you please. iTEM features user-defined workspaces which contain information on the desired appearance of loaded documents, button bars, Image Manager and ViewPort Manager - as defined by you. Such specific appearance settings and function ranges can be selected when installing the software. Just one click of the mouse is all it takes to toggle between various user-defined configurations, workspaces or views, choosing between those for acquisition or analysis purposes.

Spectra

The iTEM Graph window is for displaying, processing, and evaluating one-dimensional data like EDS spectra or line profiles. There are numerous filters used to prepare this data, while the actual graphs can be labeled and displayed with a variety of views. Evaluation functions offer you a more advanced data processing. The Graph feature supports a variety of spectrum file formats and can display multiple spectra in a single window.

Image and Data Processing
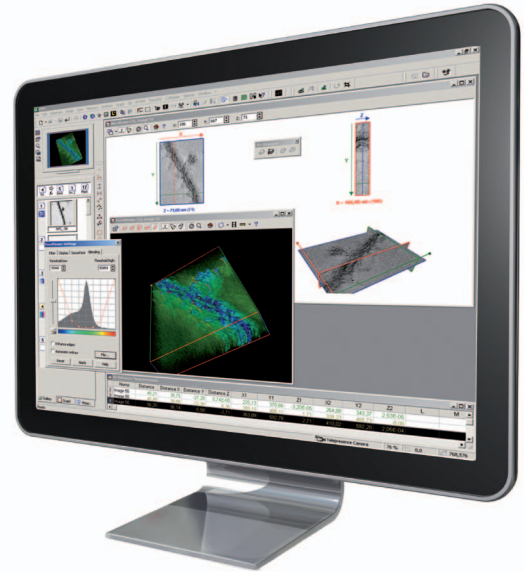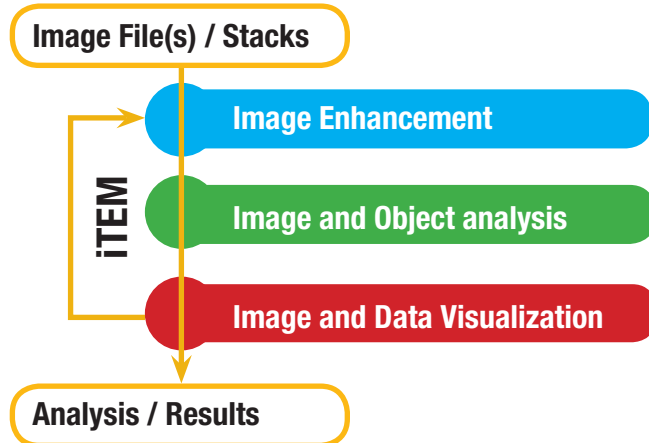
Standard and Extended Filtering

Raw images often need a little touching up for optimum display, which is why iTEM provides all standard filters, morphological filters and qualitative processing tools (brightness, contrast, gamma, etc.). Special filters such as the DCE (Differential Contrast Enhancement) filter for superb local contrast optimization, Sigma for reduction of statistical noise, and many more go above and beyond the current standard. The preview function for each filter facilitates a convenient filter adjustment for each image. Using the arithmetical function, numerous image processing operations can be performed. This makes it very easy to connect images with other images, masks or constants - arithmetically or logically. Also included in iTEM is Fast Fourier Transformation (FFT) with convolution and correlation functionality.

Intensity Operations

iTEM offers many options for post-acquisition image enhancement. These include adjusting contrast and brightness, gamma corrections, as well as various options for equalizing intensity differences. Also included are functions like resolution modification, rotation, bit depth alteration and the simultaneous alignment of two images. Furthermore, images can be binarized after thresholds have been set.

Straight to Results and Views


```
Image File(s) / Stacks
    │
    ├──► Image Enhancement
    │
iTEM  Image and Object analysis
    │
    └── Image and Data Visualization
    │
Analysis / Results
```

Visualization

False-Color Images

A false-color LUT (Look Up Table) can be assigned to images. These are for taking monochrome images and turning them into false-color images. This can be very useful for making detail more readily visible in certain applications. With 16-bit images, you can interactively define how they are displayed.

3-D Surfaces

Using height and texture information, the 3-D surface functions available within iTEM calculate, visualize and animate realistic-looking three-dimensional views. Animated sequences may also be saved as AVI files.

Slice Viewer

The SliceViewer is a tool for visualizing and animating image stacks. You can move about interactively within the 3-D visualization and then have the entire process animated from the desired perspective. The single view displays both the XYZ slice and individual component slices. Any view generated can also be directly copied into an image buffer. The Slice Viewer's multiple view shows all four views within a single document. The respective projections are updated in accordance with the data selected in the XYZ slice.
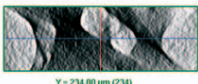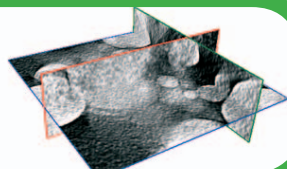
Image and Object Analysis

Image Measurement

iTEM features a unique environment for interactive measurement tasks and dimensioning. Measurement lines, objects and values appear in color in the image. All measurements conducted are shown in a clearly structured tree control. There is a direct connection between measurement results and the image – and the measurements on multiple images can be combined in one result. Measurement results and statistics are shown in sheets, displayed as a diagram or via a graph for more extended processing routines and can be automatically saved in the database or inserted into reports.

Phase Analysis / Object Counting

iTEM features advanced multi-phase analysis capabilities, i.e. threshold-based phase analysis and object counting. The automatic threshold algorithm ensures quick results. Thresholds can also be defined by picking grey values with the pipette tool directly from the image. It automatically calculates area, area fraction and number of objects in absolute and percentage values. The results can then be exported to MS Excel with one mouse click for further analysis.
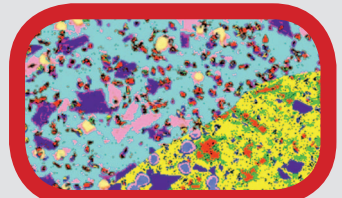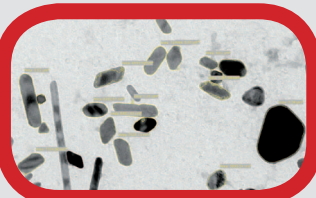
We Focus on Your Image

Image and Data Management

With digital imaging, a single experimental session can easily generate dozens or even hundreds of images. Automated analysis processes also result in a myriad of analytical data, with overall storage requirements that could easily reach the terabyte range. Image storing and well-structured archiving has certainly become an important task in daily lab routines. The archiving and reporting features integrated into iTEM meet current, and increasingly demanding, expectations. You, the user, clearly benefit from workflows that are easier to manage, more efficient and faster.

Automation

Macro Recording

Routine procedures can be automated via macros without the need for any programming knowledge. The macro recorder collects all manually performed processing steps in a text document and allows for later repetition of all steps at a click of a button. With the embedded text editor, these macros can be changed and extended at any time.

Programming

The programming language Imaging C offers advanced users a complete, integrated development environment. This includes a programming library with unrestricted access to the wide range of image acquisition and processing functions. Imaging C consists of a compiler, an interpreter, a macro recorder, a multiple-document (MDI) text editor, a symbol and function browser, and an interactive debugger with single-step processing, conditional breakpoints and a browser for variables and constants.

Structured Archiving

Flexible and Easy Configuration

iTEM makes it possible to completely archive all components relevant to a particular task or order. This structured archiving is done by a powerful, fully networkable database which is tightly integrated within iTEM; it allows users without programming experience to archive images and related data. All the data relevant to a particular task or order is administered along with accompanying images, spectrums, evaluations, reports and any other documents – in a way that is clearly structured, easy to access and tremendously flexible.

Personalized Structure

The structure of the database can be easily adapted to suit the respective workflow. You decide which criteria are the most important for classifying data. User input such as pick lists or text prompts for selected database fields helps to significantly minimize effort, as well as the possibility of mistakes being made. Input, display and query masks may be defined independently. Multi-tabbed dialogs provide maximum information with minimal GUI cluttering. Preferred queries can be stored and loaded.

Automatic Data Storing

All data collected during your session is automatically saved with the image and can be expanded at any time. Images can be stored with associated images, spectra, analytical data, reports and documents as database records, facilitating the well-structured, easy-to-navigate and easy-to-access documentation of tasks and processing steps.

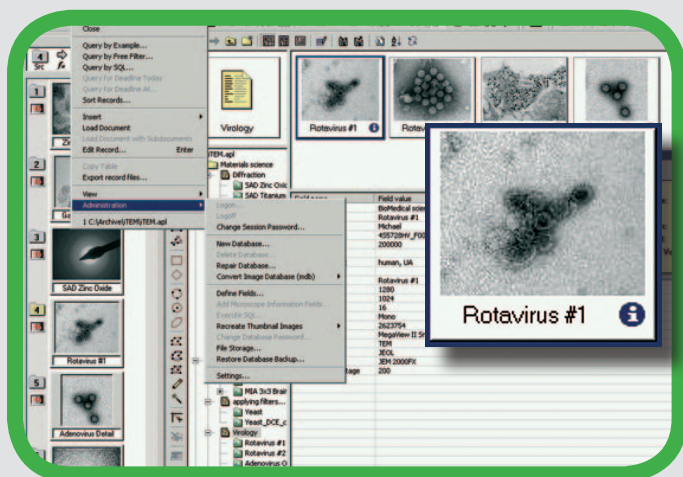## The Right Infrastructure for Managing Your Results

Image, Data, Results

iTEM
- Automation
- Archiving
- Reporting

Perfect Presentation

Rotavirus #1

Result Presentation

Fast Procedure

The iTEM Report Generator has access to all the information you have archived. All data fields, images, spectrums and diagrams relevant to a particular task can thus be easily inserted into the report. Text fields are automatically filled out with analytical results and/or the contents of database field contents. The drag and drop of images, sheets and database content is all that is required for generating a report within seconds.

Optimized Images

The Report Generator is a real expert when it comes to documents that have lots of images. Standard magnification, subsequent digital magnification, digital image clipping, mouse-controlled selection of image segments, digital detail-zooming function, image rotation, scale-bar display, magnification display – all of these are supported.

Definable Multi-Page Templates

The use of different layouts for cover pages, sheet pages, image layouts and conclusion pages is no trouble at all as a report document can be based on multiple templates. An export function for exporting completed reports into formats suitable for word-processing programs has also been integrated.

We Focus on Your Image

The iTEM Solutions

One of ITEM's distinguishing features is how easily it can be expanded by highly sophisticated software extensions. These extensions – called Solutions – extend iTEM's range of functions for solving specific transmission microscopy tasks and enhance the application possibilities of your system. You can thus put together your own personal software solution for dealing with your particular application. All solutions work together seamlessly, both within iTEM and with all the other solutions. Involved here are the acquisition, processing and evaluation routines for all prevailing methods of in-column energy-filtered electron microscopy, acquisition, reconstruction and visualization of electron tomography stacks, electron diffraction pattern analysis, as well as high performance particle and object analysis.
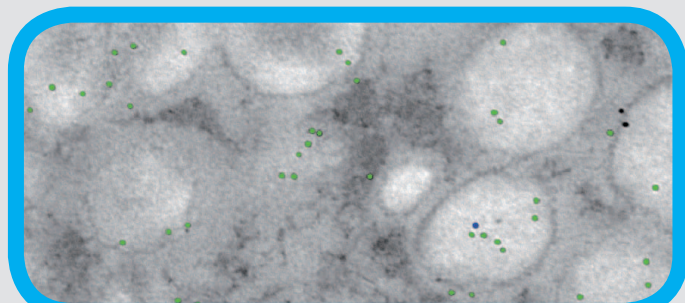
iTEM Solution EFTEM

Energy-Filtered Transmissions Electron Microscopy (EFTEM) is an analysis method providing materials scientists, medical specialists and biologists with a unique insight into their work. iTEM Solution EFTEM offers acquisition, processing and evaluation routines for all prevailing methods of in-column energy-filtered electron microscopy, applicable for both Image EELS and ESI methods. The software facilitates a fast and effortless generation of high-resolution element diffraction maps accompanied by extensive information on the chemical composition of the structure. EELS spectra can also be acquired using iTEM Solution EFTEM, quantified within the software and allowing for the immediate determination of specimen thickness. iTEM Solution EFTEM also offers an impressive variety of spectra-processing functions. This solution includes an EELS atlas with a wide range of reference spectra, as well as automatic generation of spectral information.

iTEM Solution Detection

iTEM Solution Detection is based on sophisticated multi-phase particle detection which registers and analyzes thousands of image objects within seconds. The resulting data is easy to verify because the data sheet is linked to the image, thus simplifying any further classification. iTEM Solution Detection also has a feature called the "Separator" which automatically separates particles using a smart and tremendously effective algorithm, creating image-analysis possibilities for particle analysis scarcely dreamt of by most users. Quantitative results can be obtained quickly and without the assistance of image-processing experts, while evaluating images has never been easier. Numerous predefined particle parameters can be used during analysis and the list of particle parameters can be extended with user-defined entries. Analysis can be restricted to Regions of Interest (ROI), while any alteration to detection settings is implemented and displayed immediately. Users can also define filter areas for various particle parameters and connect them logically.

Expand Your Possibilities

iTEM TEM Platform

iTEM Solution EFTEM

iTEM Solution Detection

iTEM Solution Tomography

iTEM Solution Diffraction

Customized iTEM Solution

iTEM Solution Tomography

Electron tomography is a more widely known and versatile method for obtaining TEM sample information from the third dimension. This 3-D information is of critical importance for understanding biological systems or material science samples. The iTEM Solution Tomography feature enables you to obtain the desired results with the greatest of accuracy and reliability – and minimal user intervention. The user-friendly workflow, including automatic acquisition, alignment, reconstruction and visualization, makes it very easy to achieve the best results from a standard tomography sample – even for inexperienced users. iTEM Solution Tomography allows you to acquire a tilt series while automatically correcting focus changes, illumination conditions, specimen drift and mechanical instabilities of the goniometer by using live image tracking. The acquired tilt series can be stored as a standard multiple-page TIFF file with all the necessary image information and meta data (tilt axis, angle, shift, goniometer data, etc.). This data is then used for alignment and reconstruction purposes. In addition, stacks can be stored as an AVI file and played on any third party software. A comprehensive alignment routine aligns the images reliably along the tilt axis without requiring fiducial markers. Any necessary filters and morphing algorithms are applied automatically. The final visualization step is carried out using SliceViewer and VoxelViewer, the fully integrated 3-D visualization tools.

iTEM Solution Diffraction

Electron diffraction provides important information on the microstructure of crystalline materials. The iTEM Solution Diffraction feature makes it possible to automatically index, evaluate, measure and analyze diffraction patterns (SAED) of both single crystalline and polycrystalline samples. With remote-capable TEMs, all diffraction patterns subsequently acquired are thus immediately calibrated. After the crystal structure and lattice parameters have been determined, automatic indexing is conducted. G vectors may also be defined manually if desired. Alongside the Miller indices, the zone axis is shown as the indexing result on the image overlay. iTEM Solution Diffraction allows for the easy analysis of diffraction patterns, with simple measurement of both lattice plane distances and the angles between two planes. The results are visualized in a clearly structured tree control, which facilitates quick and easy access for users. Online statistics provide information on the accuracy of measured values.
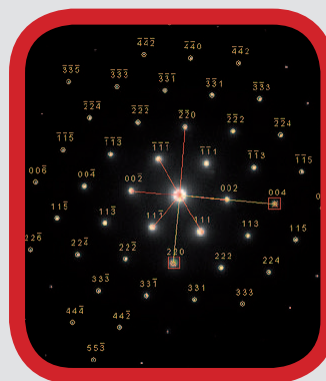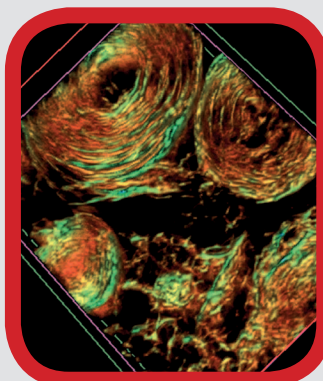
Specifications

GRAPHICAL USER INTERFACE	
Import of all common image formats	*.tif, *.jpg, *.bmp, *.pcd, *.eps, *.png, etc.
Handling of multidimensional images	Animate, combine, extract
Automatic image calibration	Calibration data is automatically saved with the image
(Live) annotations and (Live) overlays	Use text, logos, arrows for labeling (also in live image)
Multiple ViewPort	Image synchronization, Navigator
Image information	Microscope and camera settings are stored within the image during image acquisition
Image types	Binary 8-bit gray, 8-bit color palette, 16-bit gray, true color (24-bit RGB)
Automatically adjusted scale bar	
Send via e-mail	
Workspace management	

TEM, CAMERA AND THIRD-PARTY DEVICE CONTROL	
Complete microscope control via intuitive software interface	TEM - Auto alignment (Auto focus, Auto Astigmatism, Alignment) - Available for most microscope types
Camera support	All OSIS on-axis and bottom-mounted TEM cameras
Motorized stages	Available for most microscope types

ADVANCED LIVE IMAGE ACQUISITION	
Camera Interface	FireWire™ IEEE 1394a (specified), USB2 (specified) Frame grabber (specified), TWAIN
Digital Live Streaming	Making movies of single acquisitions or from the live image directly
Digital live processing and measurements during image acquisition	
Automated exposure optimization	Intelligent exposure
Real-time Fast Fourier Transformation	
Live display	Saturation, false colors, etc.
NetCam	Internet live streaming
Panorama image acquisition	Panorama image function

IMAGE PROCESSING	
Intensity	Maximize and equalize contrast, modify gray values, etc
Changing bit depth	8/16 bit, color 8/24 bit, binarize
Filters with preview function	Sharpen, Edge Enhance, Mean, Median, Sobel, Roberts, NxN, Low pass, Rank, Sigma, Differentiate x/y, connectivity, DCE, shading correction, Separator. etc.
Morphological filters	Erosion, Dilation, Open, Close, Top Hat, Skeleton, etc.
3-D display	3-D perspective, 3-D animation, height lines, texture
SliceViewer	Display and navigation through image stacks
Image 'Pocket Calculator'	Addition, subtraction, multiplication, division, and, or, XOR, absolute amount
3-D processing	3-D measurements

MEASUREMENTS AND OBJECT ANALYSIS	
Interactive measurements	Count, distances (vertical, horizontal, arbitrary), intensity profile, angle, polygon, size, shape, etc.
Object analysis	Magic Wand
Phase analysis	Absolute and percentage
Selection	Basic (frame, mask), ROI (polygon, rectangle, virtual ROI, etc.)
Data output	Graph (visualize, process and analyze diagrams)

IMAGE AND DATE ARCHIVING	
	Clearly structured data management of image files, sheets, diagrams, reports and other files
	Exceptional flexibility, ease of use and rapid access to data
	User-definable structure
	Database assistant for set-up
	Predefined and individual fields and categories
	Fast, high-performance query functions with logical connections
	Data backup and access
	Networkable

REPORT GENERATION	
	Reporting solution with integrated word processing, database connection and image support
	User-definable templates
	Support of record fields, images, sheets and diagrams
	Special functions such as detail zoom, auto text or different magnification types
	Compatible with Microsoft Word

AUTOMATION	
Programming language	Environment for developing modules
Macro recording	Scripts and playing back sequences

EXTENSIONS	
iTEM Solutions	Extensions for dedicated TEM applications (Diffraction, Tomography, Particle Analysis, EFTEM)

www.olympus-sis.com
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OLYMPUS
Your Vision, Our Future

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