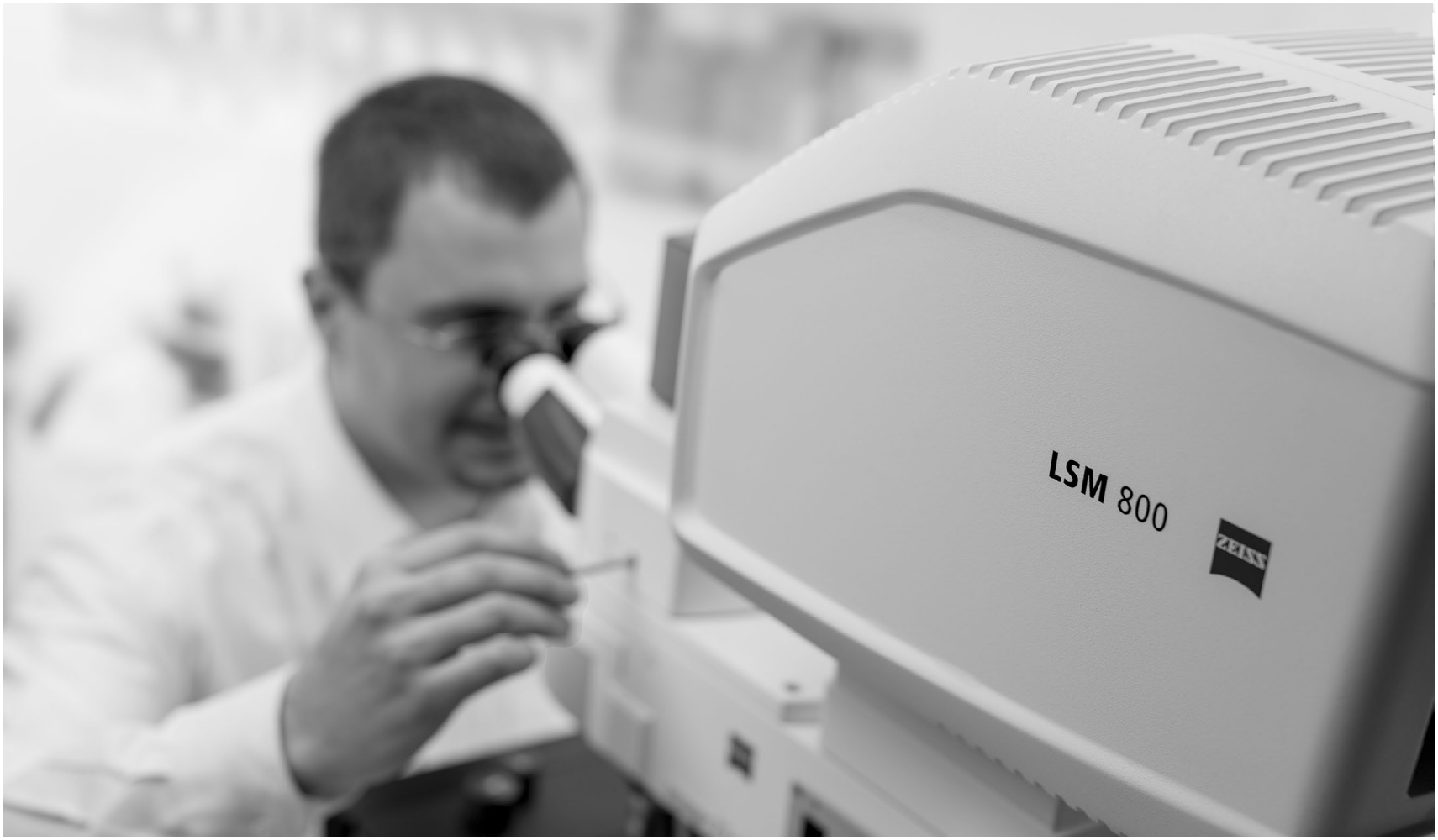

Product Information
Version 1.0

ZEISS LSM 800 for Materials

Your Versatile Confocal Microscope for Research and Failure Analysis

ZEISS

Your Versatile Confocal Microscope for Research and Failure Analysis

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Welcome to the fascinating world of confocal imaging. LSM 800, the confocal laser scanning microscope from ZEISS, is the one instrument you will need for materials research and analysis. Characterize 3D micro structures and surfaces in your lab or multi-user facility. Upgrade your ZEISS light microscope Axio Imager.Z2m with LSM 800 to combine all essential light microscopy contrasting methods for materials with high precision topography – on a single instrument. With no need to change microscopes, you'll save time on set-up. And guided workflows make imaging easy. Discover endless possibilities for analysis: the open software architecture lets you create your own macro solution.

Animation

Simpler. More Intelligent. More Integrated.

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Combine Light Microscopical and Confocal Imaging

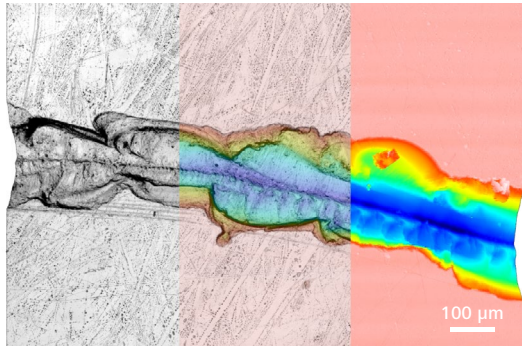
LSM 800, your high-end confocal platform, is made for demanding materials applications in both 2D and 3D. All you need is one sample and one microscope to perform many different analyses, then image your sample using a market-leading range of contrasting techniques. Characterize 3D structures with fluorescence in optical contrast or in confocal mode. As you go along, use Circular Differential Interference Contrast (C-DIC) to identify regions of interest for further investigation of topography in confocal mode.

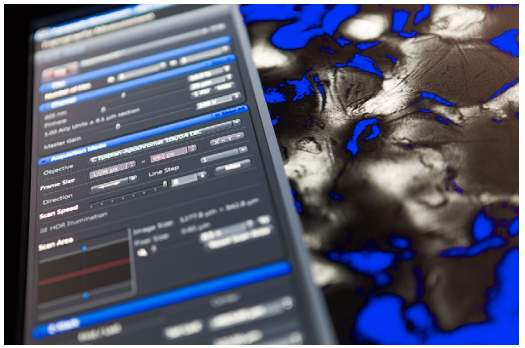
Imaging Made Easy With Guided Workflows

Being able to perform analyses and imaging without having to change microscopes will reduce set-up times and speed up your time-to-result. Simply define the 2D scanning area on your sample, then image and acquire only the region of interest (ROI). You have the advantage of full flexibility in size and orientation of the ROI. That's imaging made easy thanks to a simplified user interface that supports you with guided workflows.

Expand Your Imaging Range

A confocal unit extends your widefield investigations capacity. Upgrade your Axio Imager.Z2m with LSM 800 and take advantage of its versatility in hardware, e.g. objectives, stages and illumination, as well as software and interfaces. Define your own application world using the powerful Open Application Development (OAD). It's easy to exchange data with external programs such as MATLAB.





Your Insight into the Technology Behind It

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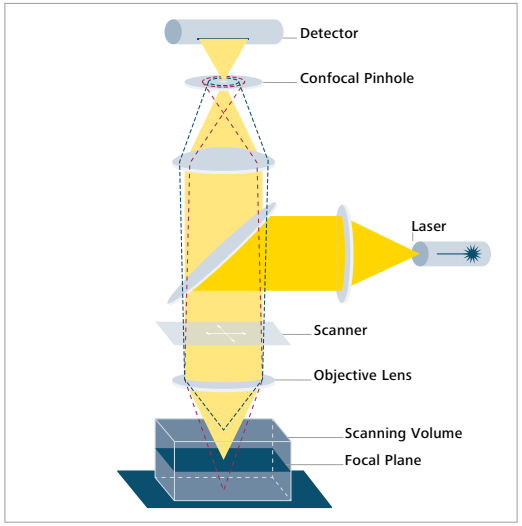
The Confocal Priniciple – Image Your Entire Sample in 3D

LSM 800 is a microscope system that uses laser light in a confocal beam path to capture defined optical sections of your sample and combine them in a three-dimensional image stack. The main feature of a confocal microscope is its aperture (usually called a pinhole) which is arranged in such a way that out-of-focus information will be blocked and only in-focus information can be detected. An image is generated by scanning in x,y-direction. In-focus information appears bright while out-of-focus information is dark. By changing the distance between sample and objective lens, the sample is optically sectioned and an image stack is generated. By analyzing the intensity distribution of a single pixel through the image stack, you can calculate the corresponding height. The height information over the whole field of view can then be combined to form a height map.



Schematic of confocal principle. In-focus information (yellow). Out-of-focus information (red and blue dotted lines).

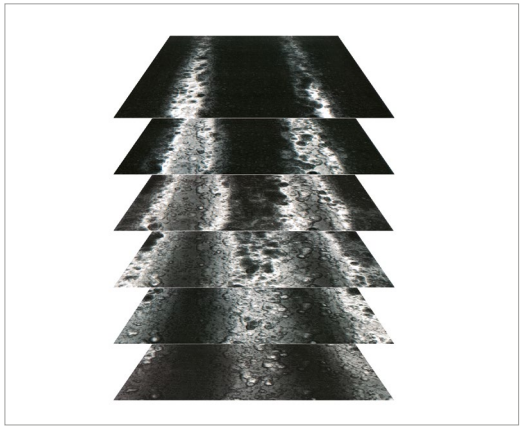
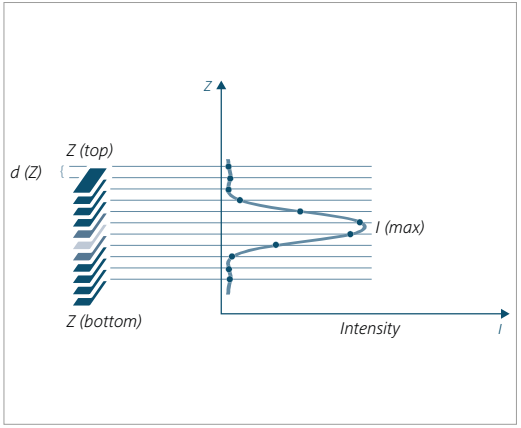
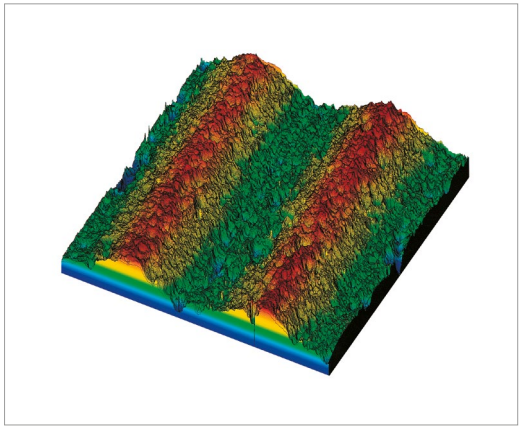


Image stack.



Intensity distribution of one pixel through the image stack.



Sample surface, 2.5D representation.

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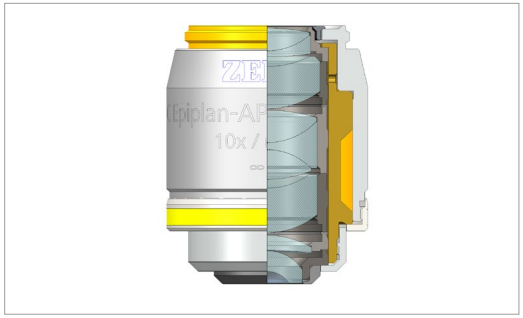
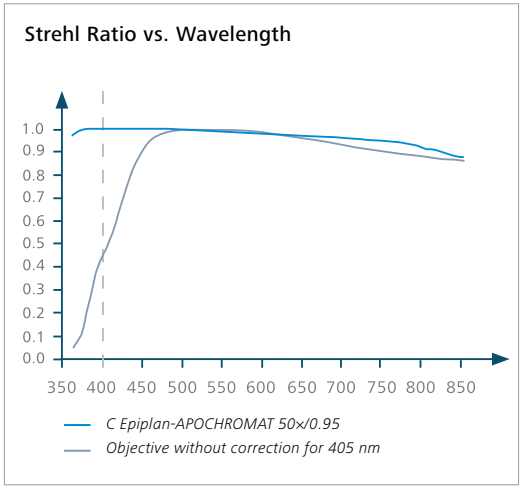
Rely on C Epiplan-APOCHROMAT Objectives

Use the high-power, apochromatically- and flat-field-corrected C Epiplan-APOCHROMAT objective series to satisfy exacting demands for reflected light applications. This will give you the benefit of imaging with enhanced contrast and high transmission in the visible spectral range. Get optimum results in conventional widefield microscopy, differential interference contrast (DIC) and fluorescence. C Epiplan-APOCHROMAT objectives are specially designed for confocal microscopy, achieving minimum aberrations at 405 nm over the full field of view. That produces accurate topography data with less distraction noise and artifacts, thus revealing more details of your surface.



C Epiplan-APOCHROMAT 10×/0,4 cross section.



Assess the optical quality of C Epiplan–APOCHROMAT objectives by the Strehl ratio. It gives the performance of a real system relative to a theoretically perfect system with a value of 1. Dotted line: 405 nm, optimized confocal laser wavelength.

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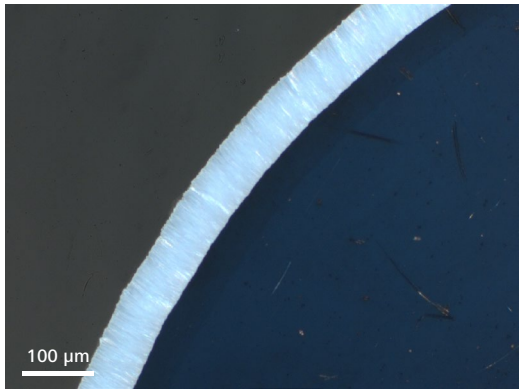
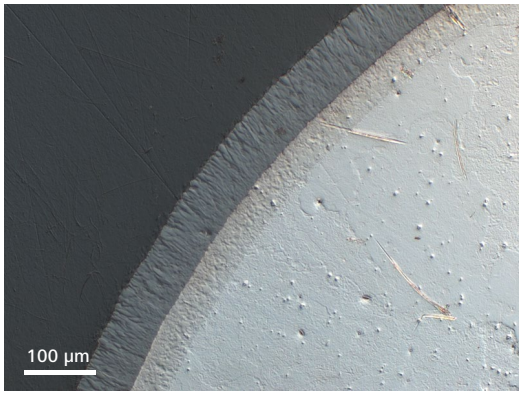
C-DIC – Enhance Contrast without Sacrificing Resolution

Transparent or low reflection samples often have barely detectable structures with weak contrast. Circular Differential Interference Contrast (C-DIC) makes it easy to detect them. C-DIC is a polarization technique which, as opposed to Differential Interference Contrast (DIC), uses circularly polarized light. These advantages are crucial when contrasting diverse directed object structures. The specimen no longer has to be rotated in the field for the best image contrast and quality. With C-DIC, a simple adjustment of the prism is enough. Use this information to locate the area for topographic investigation – another advantage of LSM 800.



Thermal barrier coating on super alloy. Reflected light, polarization contrast, objective: EC Epiplan-Neofluar 20×/0.25.



Thermal barrier coating on super alloy. Reflected light, C-DIC, objective: EC Epiplan-Neofluar 20×/0.25.

Expand Your Possibilities

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Choose the Right Camera

You know how important detailed documentation of results is in your daily work. High contrast images provide information on the quality of your components while quick acquisition times keep processes efficient. ZEISS Axiocam microscope cameras bring you solutions tailored to your applications. Enjoy brilliant images with finest color differentiation of even minute details with the Axiocam 503 color.

OAD: Your Interface to ZEN Imaging Software

Do you have a special application that demands functionality beyond the basic ZEN software? Then opt for ZEN's integrated OAD (Open Application Development) environment. With OAD you create your own macro solution. Enjoy the benefits of easy access to a vital set of ZEN functions and the ability to include libraries such as the.Net Framework.

- Customize and automate your workflows
- Exchange data with external programs such as MATLAB

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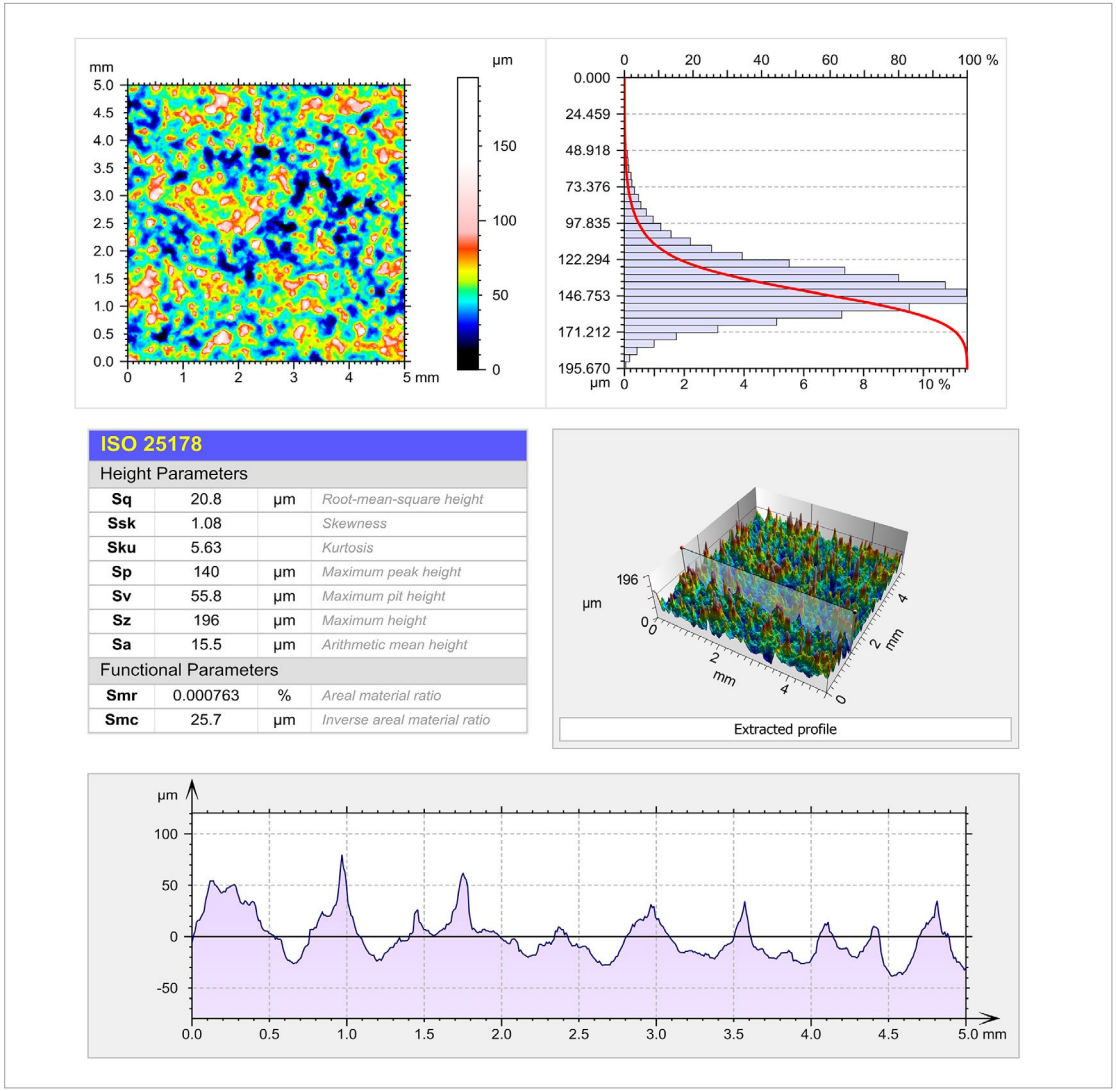
Inspect Surfaces in 3D with ConfoMap

ConfoMap is the ideal option to visualize and inspect measured surfaces in 3D. It lets you evaluate the quality and functional performance of surfaces in accordance with the latest metrology standards, e.g. ISO 25178. You can include comprehensive geometric, functional and roughness studies – and create detailed surface analysis reports. Add optional modules for advanced surface texture analysis, contour analysis, grains and particle analysis, 3D Fourier analysis, analysis of surface evolution, and statistics.

Visualize topography with height maps.



Profit from the functionality of ConfoMap. Perform analyses and find out more about your sample: color-coded height map (top left), Abbott-Firestone curve (top right), table of roughness parameters (mid left), location of extracted profile in 3D height map (mid right), profile from 3D height map (bottom).

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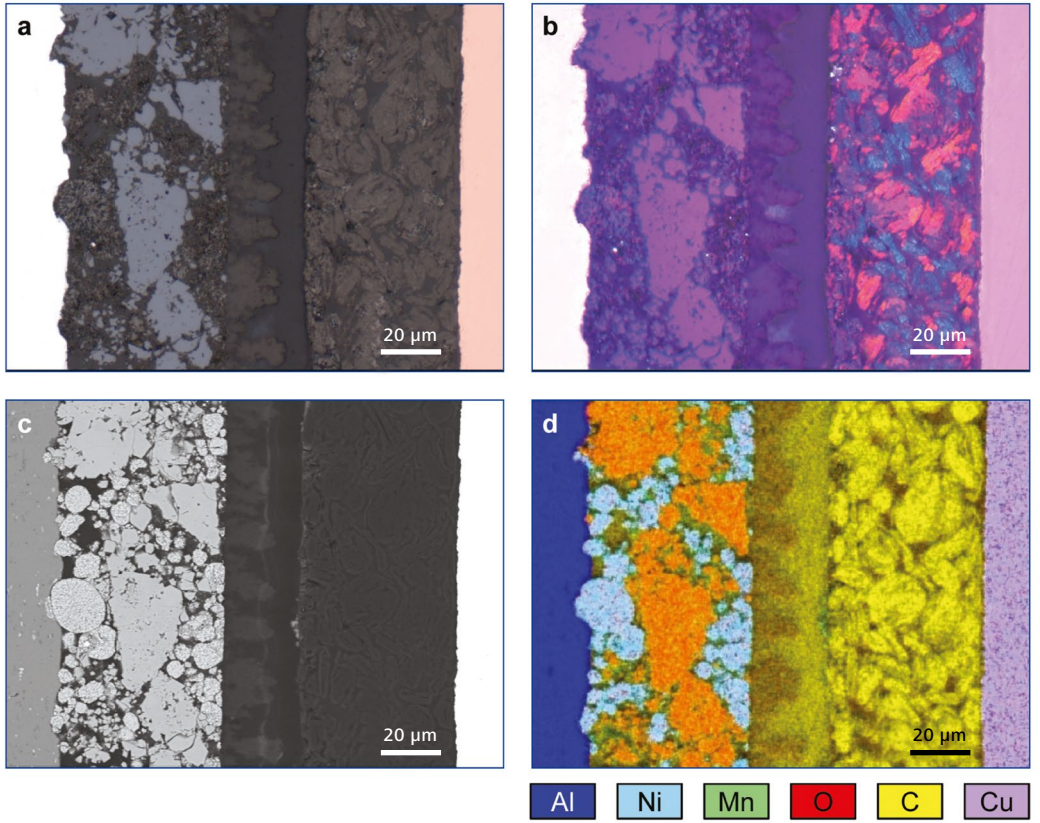
Correlative Microscopy with ZEISS Axio Imager 2: Bridging the Micro and Nano World

Are you looking for a way to effectively combine imaging and analytical methods? Shuttle & Find offers precisely this: An easy-to-use, highly productive workflow from a light to an electron microscope – and vice versa. The workflow between the two systems has never been so easy. The split-second, precise recall of regions of interest enhances productivity. Instead of wasting valuable time searching, you can now gain totally new insights into your samples with a few mouse clicks. Regions of interest, marked in one system, you relocate within seconds in the other system. Open up new dimensions of information in numerous material analysis applications. Absolutely reproducible.



CLEM (Correlative Light and Electron Microscopy) image of a region of interest from an aged Li-ion battery with different contrasts of brightfield (a) and polarized light (b) in LM as well as BSE signal (c) and EDS mapping (d) in SEM.

Tailored Precisely to Your Applications

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Typical Applications, Typical Samples	Task	ZEISS LSM 800 Offers
Coatings, Multi-layered Structures, Lacquer	■ Layer thickness measurement ■ Determination of refraction coefficient	Detect transparent coating layers with ZEISS LSM 800 without destructive sample preparation. Either calculate the material's thickness with a known refraction coefficient or the refraction coefficient with known thickness. A wizard guides you through the steps.
Surface Texture on Structured Material, Tribology Analysis	■ Roughness measurement ISO 25178 3D parameter ■ Individual surface studies	Characterize surface's texture in accordance with international standards. Use the latest filter and analyze techniques to describe your investigated surfaces. A broad range of additional studies like 3D Fourier Analysis, volume studies or segmentation by watershed algorithms supports you to understand your material properties.
Wear Testing	Volume measurement and area of surface structure wear after tribological testing methods	Locate even hard-to-detect wear regions with different contrast methods like BF, DF, and C-DIC. Measure the expansion of the wear zone and its depth to find conclusions about the abrasive behavior and / or ductility of your surface.
Porosity, Hybrid, Bio-Medical	Fluorescent, bio-medical application	Detect even very small and low fluorescent structures on your sample by upgrading a most sensitive GaAsP-Detector or Airyscan to your LSM 800.
Oil and Gas Exploration, Shale Rock Analysis	■ Measure fluid inclusions ■ Measure porosity ■ Study of fluid inclusions and source rock porosity	Investigate potential reservoirs and rock porosity. Find out where oil is migrating with fluorescent 2D and 3D images of petroleum fluid inclusions. Acquire large areas by tiling images together and get sufficient data for evaluation.
3D Topography Imaging and Measurement	■ Dimensional measurement of surface structures ■ Functional surface textures	Measure and analyze tribological optimized surface textures in 3D. Profit from additional packages in ConfoMap: 3D Fourier and Wavelets Analysis, 2D Automotive, 3D Advanced Surface Texture, Contour Analysis, Statistics
Failure Analysis	■ Measurement and characterization of cracks, pitting and corrosion	Find the exact cause of the failure with the broad variety of comprehensive optical techniques. Choose the most suitable method for your analysis, e.g. Brightfield to visualize the area of corrosion and confocal metrology to measure the topography of the corrosion product.

ZEISS LSM 800 at Work

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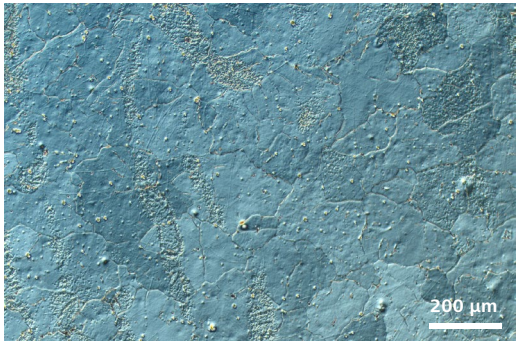
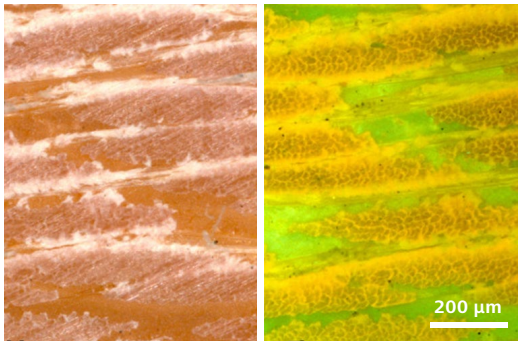
Imaging

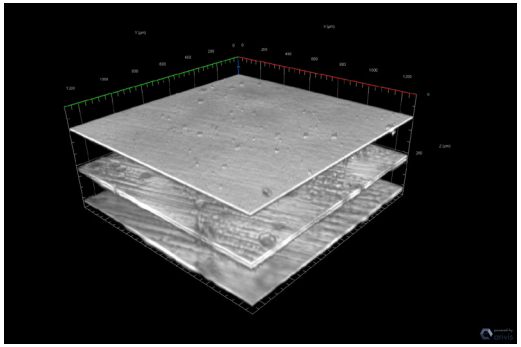


Aluminum structure in Circular Differential Interference Contrast (C-DIC). Objective: EC Epiplan-NEOFLUAR 10×/0.25.



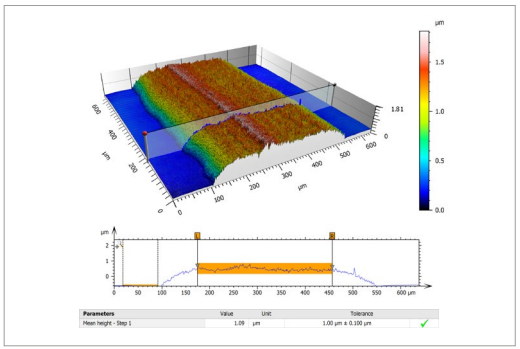
Fiber composite. Comparison of different contrast methods. Left: brightfield, right: fluorescence.

Multi-layered System

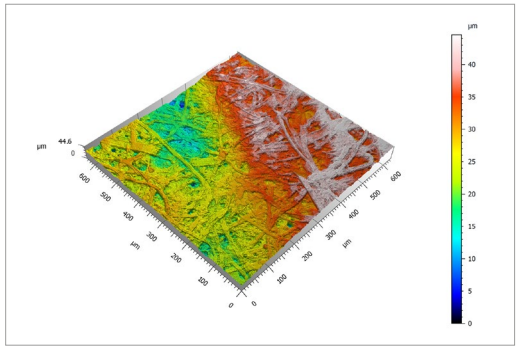


Two-layer system of a compound polymer, layer thickness measurement.

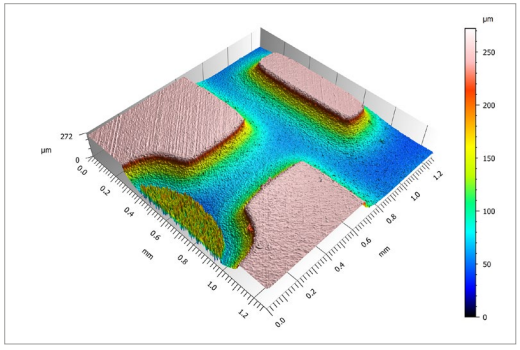
3D Topography



Printed graphite circuit on substrate. 3D-view of color coded height map with step height measurement in profile. Objective: C Epiplan-APOCHROMAT 20×/0.7.



Paper surface with indent from pen, 3D-view of color coded height map. Objective: C Epiplan-APOCHROMAT 20×/0.7.



Fluidic channel, 3D-view of color coded height map. Objective: C Epiplan-APOCHROMAT 10×/0.4.

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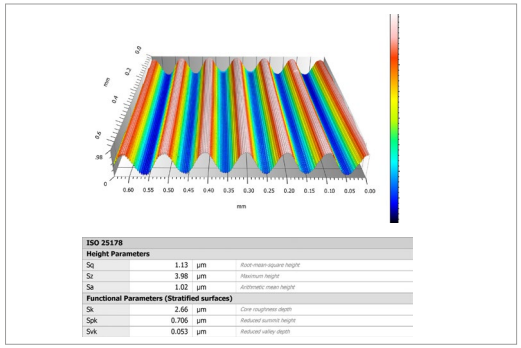
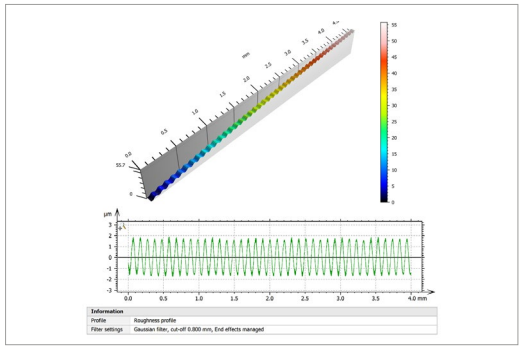
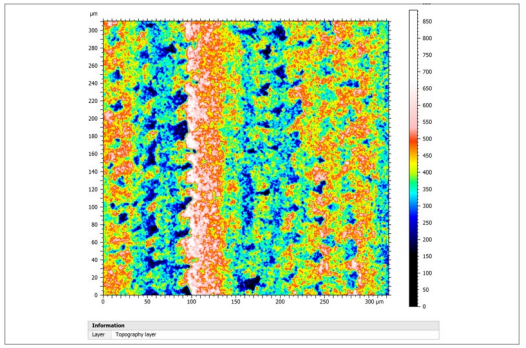
Surface Texture



Surface texture of geometric standard (ISO 5436-1, type C), 3D-view of color coded height map with ISO 25178 roughness parameter. Objective: C Epiplan-APOCHROMAT 20×/0.7.

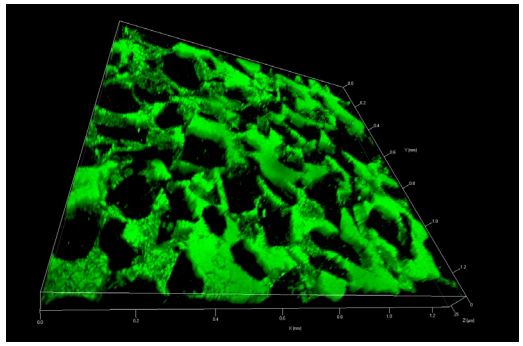


Surface texture of geometric standard (ISO 5436-1, type C), 3D-view of color coded height map with profile view. 7×1 tiles image to get the evaluation length of 4 mm. Objective: C Epiplan-APOCHROMAT 20×/0.7.



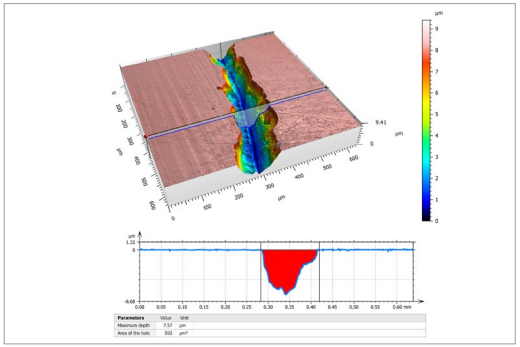
Printed graphite structure, color coded height map. Objective: C Epiplan-APOCHROMAT 20×/0.7.

Porosity



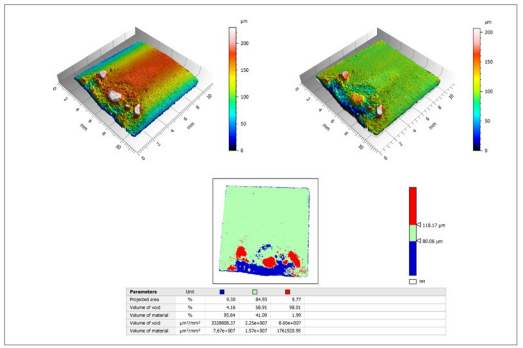
Sandstone. 3D representation of fluorescent dye to visualize porosity, 4×4 tiles image. Objective: EC Epliplan-APOCHROMAT 20×/0.6.

Failure Analysis



Failure analysis on a display of a mobile phone. 3D-view of color coded height map with depth evaluation in profile view. Objective: C Epiplan-APOCHROMAT 20×/0.7.

Wear



Erosion on electrical switch. Evaluation of material erosion and accumulation. 5×5 tiles image. Objective: C Epiplan-APOCHROMAT 10×/0.4.

Your Flexible Choice of Components

1 Microscope
- Axio Imager.Z2m
- Camera port
- Manual or motorized stages

2 Objectives
- C Epiplan-APOCHROMAT
- LD C Epiplan-APOCHROMAT
- EC Epiplan-NEOFLOUAR

3 Illumination
- Laser module URGB (405, 488, 561, 640 nm)
- Laser module U (405 nm)

Reflected Light:
- Halogen
- HXP

Transmitted Light:
- Halogen
- LED

4 Scanning Module
- 1 channel multi-alkali (MA) PMT or 2 channel multi-alkali (MA) PMTs
- 1 additional GaAsP PMT, MA PMT or Airyscan detector for 40× or 63× objectives

5 Software
- ZEN (blue edition), recommended modules: Topography module, Tiles & Positions
- ConfoMap, recommended modules: 2D Automotive, Contour Analysis

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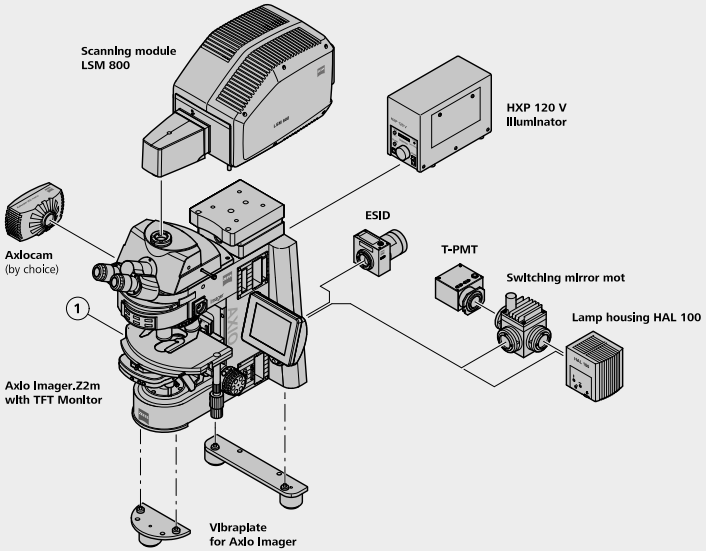

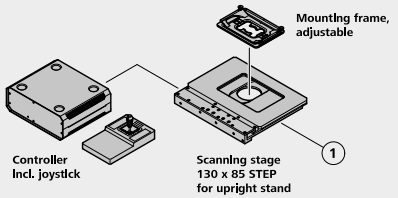

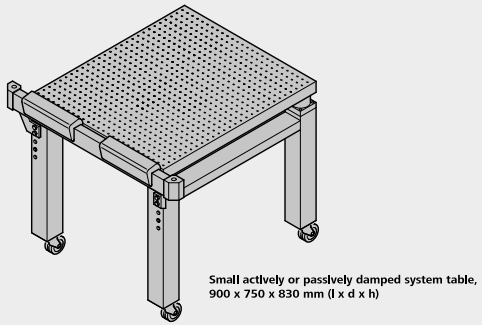

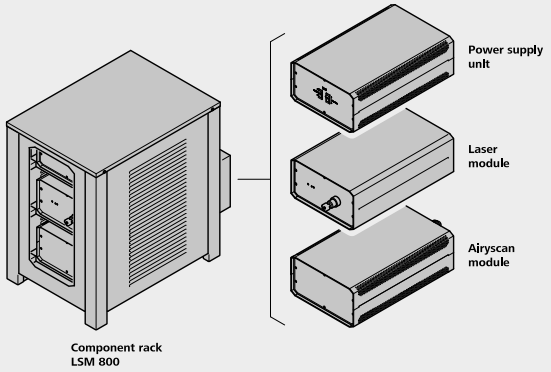

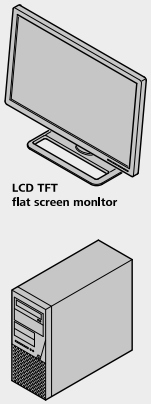

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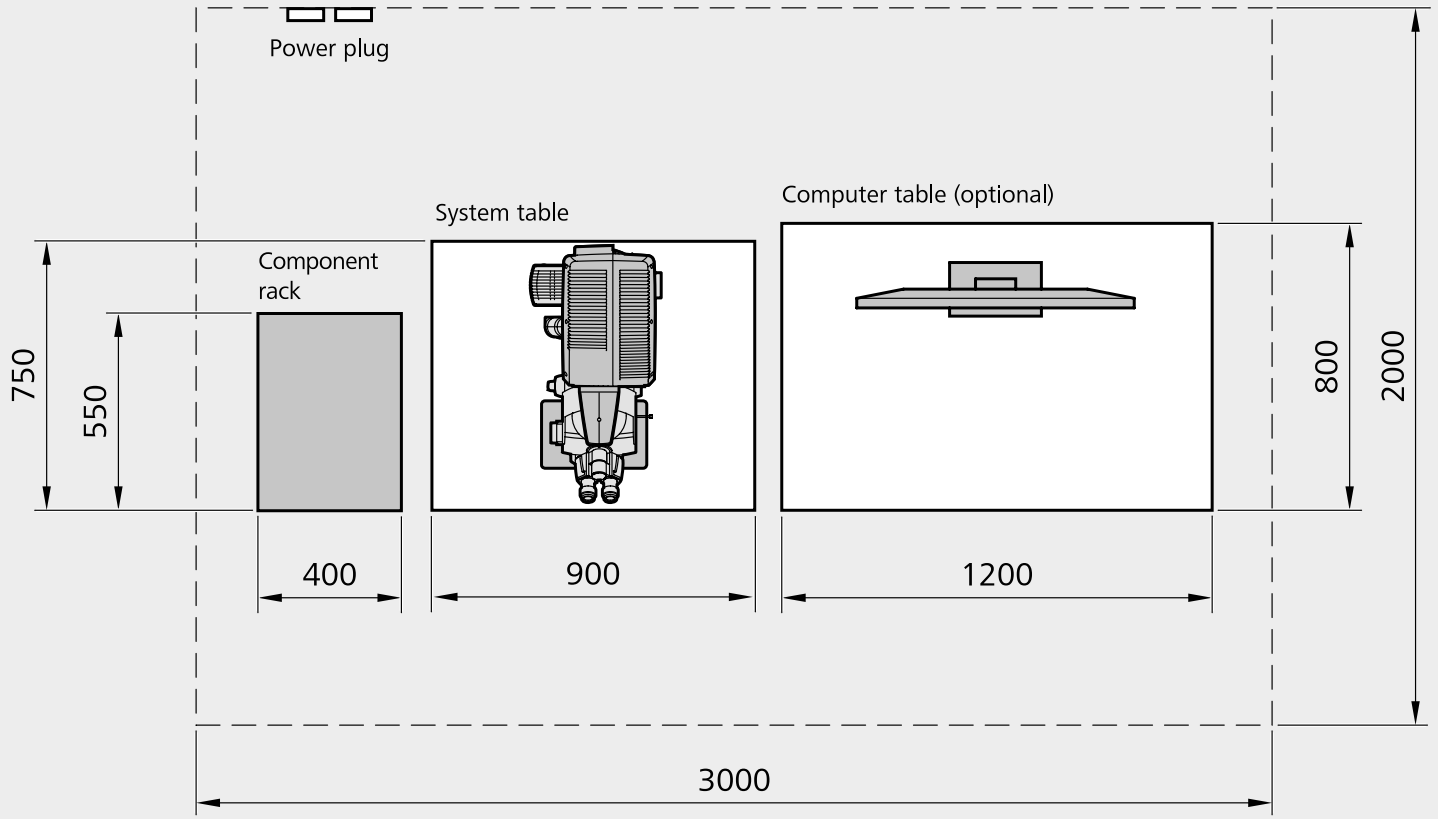

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Microscopes	
Stands	Axio Imager.Z2m
z drive	Smallest increment 10 nm
XY Stage (option)	Motorized XY scanning stage for Mark & Find function (xy) as well as Tile Scan (Mosaic Scan). Tiling not available for layer thickness measurements. Smallest increment 0.2 µm
Objectives	More than 40 reflected-light objectives. Recommended: C Epiplan-APOCHROMAT series (specially designed for 405 nm)

Scanning Module	
Scanner	Two independent, galvanometric scanning mirrors with ultra-short line and frame flyback
Scanning Resolution	4 × 1 to 6,144 × 6,144 pixels , continuously adjustable (for each axis)
Scanning Speed	Up to 8 images/sec with 1024 × 256 pixels; Up to 2 images/sec with 1024 × 1024 pixels
Scanning Zoom	0.5× to 40×; continuously adjustable
Scanning Rotation	Can be rotated freely (360°), adjustable in increments of 0.1°, freely adjustable xy offset
Scanning Field	12.7 mm × 12.7 mm in the intermediate image plane with full pupil illumination
Pinhole	Master pinhole with preset size and position; automatic alignment
Beam Path	One major beam splitter at 10 degree provides 80:20 split ratio at 405 nm and excellent laser line suppression at 488, 561 and 640 nm. In multi-channel-systems, patented Variable Secondary Dichroics (VSDs) can be used to flexibly divert the respective spectral range of light to chosen channels. Emission filters can be used to clean up the signal when imaging autofluorescent or highly scattering samples.

Detection Options	
Detectors	Depending on whether it is configured with 1 or 2 multialkali (MA) PMT (typical QE25%)
	2-CH scanhead can be further upgrated by 1 additional GaAsP PMT (typical QE 45%), MA PMT or Airyscan detector
	Transmitted light detector (ESID or T-PMT)
Data Depth	8-bit and 16-bit available
Real-Time Electronics	Microscope, laser, scanning module and additional accessory control; data acquisition and synchronization management through real-time electronics; oversampling read-out logic for best sensitivity; data transfer between real-time electronics and user PC via LVDS with the ability to evaluate the data online during image acquisition

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Standard Software	
ZEN Imaging Software with topography module	A software package that sets up various experiments (topography, layer thickness measurements, fluorescence, light microscopy). Software can be upgraded with additional modules for special requirements. The user interface and wizard for topography and layer thickness measurements offer a convenient way to configure all motorized functions of the scanning module, laser and microscope. Includes computation and post-processing of height information. Transfer of topography data to the analysis software (ConfoMap).
ConfoMap	ConfoMap is the comprehensive software for analyzing and presenting topography data. The standard ComfoMap package comes with many analytical studies. It can be upgraded further for advanced surface texture analysis, dimensional analysis, grain and particle analysis, 3D Fourier analysis and the analysis of surface evolution and statistics. Based on the well-established Mountains Technology®, ConfoMap is subject to continuous evolution by metrologists and software engineers.

Optional Software	
Tiles & Positions	A powerful tool in your microscopy applications that makes it easier to image large areas on your samples at high resolutions.
Shuttle & Find	A correlative microscopy interface for ZEISS light microscopes, scanning electron microscopes (SEMs) and focused ion bean SEMs (FIB-SEMs). It lets you identify an area of interest in one instrument and find that specific area again for analysis in another instrument.
3Dxl Viewer – powered by arivis®	Visualizes very large data sets, fully integrated in ZEN imaging software. Various rapid 3D and 4D reconstructions and modes are available: shadow projection, transparency projection, maximum intensity projection, mixed mode, surface rendering
Open Application Development (OAD)	Python scripting interface for automation & customization. Experiment Feedback for smart experiments. Open interface to third party software (e.g. MATLAB)
Experiment Designer	Defintion of advanced automated imaging

Lasers	
Laser Module URGB (pigtailed; 405, 488, 561, 640 nm)	Single-mode polarization preserving fiber
	Typical total dynamic range of 10.000:1; direct modulation 500:1
	Diode laser (405 nm, 5 mW); laser class 3B
	Diode laser (488 nm, 10 mW); laser class 3B
	Diode (SHG) laser (561 nm, 10 mW); laser class 3B
	Diode laser (640 nm, 5 mW); laser class 3B
Laser Module U (pigtailed; 405 nm)	Single-mode polarization preserving fiber
	Typical total dynamic range 25:1
	Diode Laser (405 nm, 5 mW); laser class 3B

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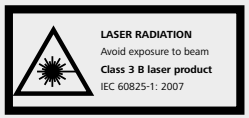
Power Requirements		
LSM 800 has a mains power supply cable and country-specific plug or plug NEMA L 14-30P (2/N/Ground 120/240V/30A). Plus the matching mains socket outlet. The mains socket outlet must be equipped with a fuse that has a minimum tripping characteristic C according to IEC/EN 60898.		
Line Voltage	100 V AC ... 125 V AC (+10%)	220 V AC ... 240 V AC (+10%)
Line Frequency	50 ... 60 Hz	50 ... 60 Hz
Max. Current	1 phase at 5 A	2 phases at 3 A
Power Plug	NEMA 5/15	Country specific connectors
Power Consumption	550 VA (continuous operation; maximum)	575 VA (continuous operation; maximum)
	260 VA (standby operation)	280 VA (standby operation)
	0.011 VA (off mode)	0.025 VA (off mode)
Heat Emission	500 W	500 W

EMC Test
according to DIN EN 61326-1 (07/2013)
1. Noise emission according to CISPR 11 / DIN EN 55011 (04/2011)
2. Noise immunity according to table 2 (industrial sector)

Environmental Requirements	
For operation, the system has to be placed in a closed room.	
1. Operation, specified performance	T = 22° C ±3° C without interruption (24 h per day independently whether the system is operated or switched off). The system must never be placed in the the direct air flow from air conditioning.
2. Operation, reduced performance	T = 15° C to 35° C, any conditions different from item 1. and 4.
3. Storage, less than 16 h	T = -20° C to 55° C
4. Temperature gradient	±0.5° C/h
5. Warm-up time	1 h for standard imaging; ≥2h for high-precision and/or long-term measurements
6. Relative humidity	<65% at 30° C
7. Operation altitude	max. 2,000 m
8. Loss of heat	500 W



LSM 800 meets the requirements according to IEC 60825-1:2007

Count on Service in the True Sense of the Word

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Because the ZEISS microscope system is one of your most important tools, we make sure it is always ready to perform. What's more, we'll see to it that you are employing all the options that get the best from your microscope. You can choose from a range of service products, each delivered by highly qualified ZEISS specialists who will support you long beyond the purchase of your system. Our aim is to enable you to experience those special moments that inspire your work.

Repair. Maintain. Optimize.
Attain maximum uptime with your microscope. A ZEISS Protect Service Agreement lets you budget for operating costs, all the while reducing costly downtime and achieving the best results through the improved performance of your system. Choose from service agreements designed to give you a range of options and control levels. We'll work with you to select the service program that addresses your system needs and usage requirements, in line with your organization's standard practices.

Our service on-demand also brings you distinct advantages. ZEISS service staff will analyze issues at hand and resolve them – whether using remote maintenance software or working on site.

Enhance Your Microscope System.
Your ZEISS microscope system is designed for a variety of updates: open interfaces allow you to maintain a high technological level at all times. As a result you'll work more efficiently now, while extending the productive lifetime of your microscope as new update possibilities come on stream.

Profit from the optimized performance of your microscope system with services from ZEISS – now and for years to come.

>> www.zeiss.com/microservice

Not for therapeutic, treatment or medical diagnostic evidence. Not all products are available in every country. Contact your local ZEISS representative for more information.
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