Leica Map Start

Surface imaging and Metrology Software.
The Extension for Leica Application Suite

Living up to Life

Leica

M I C R O S Y S T E M S

Industry-Standard Surface Imaging and Analysis

Leica Map Start is the entry level software package of the Leica Map series and is used for viewing and analyzing surface geometry and surface texture. Capabilities include visualization of all the features of measured surfaces, characterization of basic surface features including distances, angles and step heights, and calculation of surface texture parameters. There is a wide range of optional modules for cases in which more advanced surface analysis is required.

Powered by industry-standard Mountains Technology®, **Leica Map Start** builds detailed visual surface metrology reports in a highly intuitive desktop publishing environment*. With its native 64 bit code written to make optimal use of multicore processors and providing accelerated processing and calculations, **Leica Map Start** is the perfect solution for analyzing fast measurements of industrial surfaces made by Leica compound and stereomicroscopes and macroscopes in laboratories, production facilities and onsite.
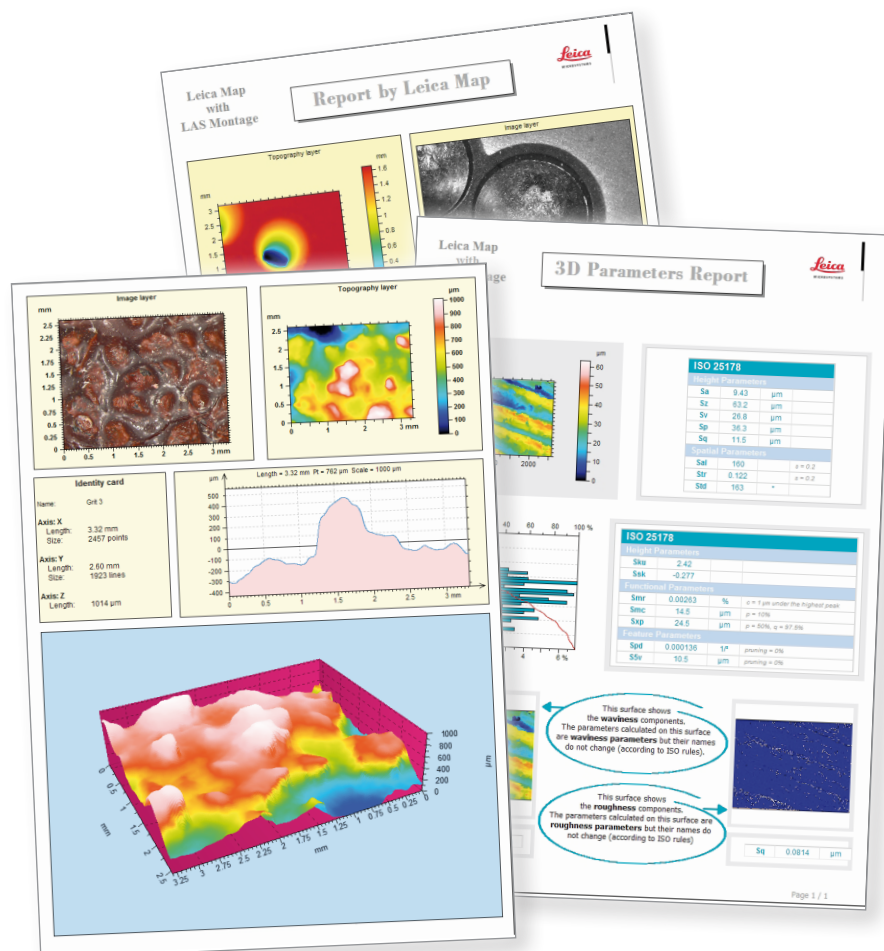
* Mountains Technology® is a registered trademark of Digital Surf SARL.

See More Detail with Simultaneous Image Views

Leica microscopes with motorized focus drives are capable of generating height maps of surface topography, true color images and intensity images. Using the **Leica Map Start** software you can manipulate topography, color and intensity images simultaneously, for example when zooming in on a surface feature, or independently, for example when characterizing the surface texture of the surface topography. In addition you can fly over a surface following a predefined flight plan and even, with the 4D Analysis option, fly over a series of surfaces as they change with respect to time or another physical dimension.

The ability to overlay the color image or the intensity image on the topography makes it possible to see the surface topography in true color and to locate defects, for example fractures, that are most visible in the intensity image.

Furthermore, images can be normalized, corrected and enhanced by applying a wide range of tools, for example inversion and rotation, thresholding to remove anomalous spikes, retouching and smoothing.
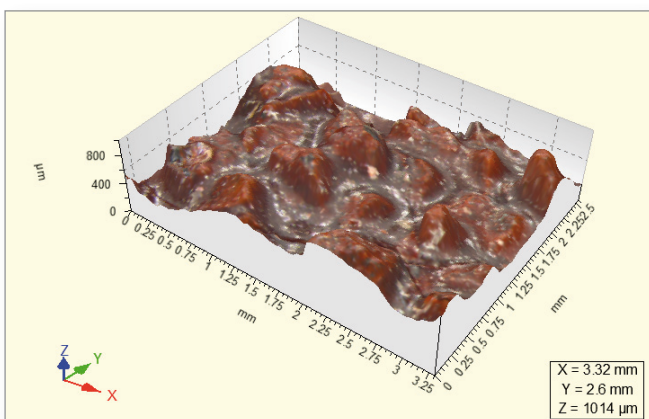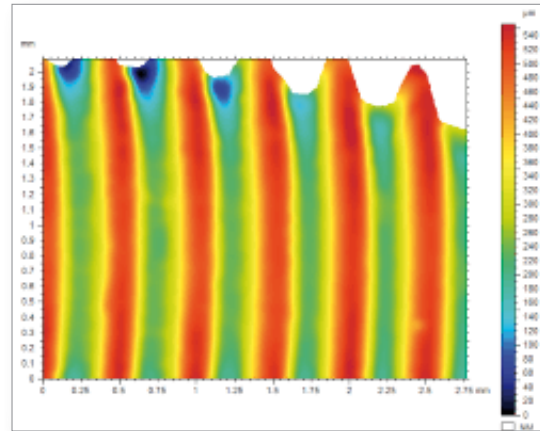
3D view of extended focus colour image
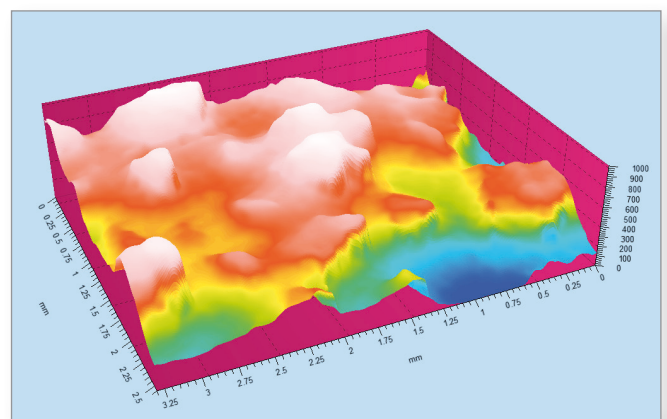
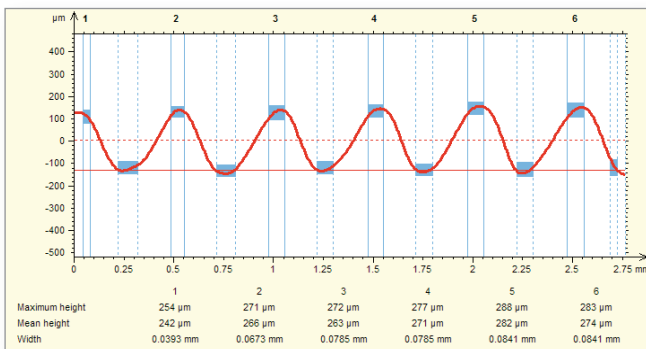3D view of pseudo-colour depthmap image

Surface Characterization

ISO 25178			
Height Parameters			
Sa	105	µm	*Arithmetic mean height*
Sq	119	µm	*Root mean square height*
Sp	193	µm	*Maximum peak height*
Sv	363	µm	*Maximum pit height*
Sz	556	µm	*Maximum height*
Ssk	-0.101		*Skewness*
Sku	1.83		*Kurtosis*
Functional Parameters			
Smr	0.0169	%	*Areal material ratio*
Smc	154	µm	*Inverse areal material ratio*
Sxp	194	µm	*Extreme peak height*

Height and bearing ratio parameters

Surface after form removal

	1	2	3	4	5	6
Maximum height	254 µm	271 µm	272 µm	277 µm	288 µm	283 µm
Mean height	242 µm	266 µm	263 µm	271 µm	282 µm	274 µm
Width	0.0393 mm	0.0673 mm	0.0785 mm	0.0785 mm	0.0841 mm	0.0841 mm

Step height measurements

Leica Map Start contains a basic set of tools for characterizing surface geometry. It calculates distances and angles on surfaces and profiles (multi-point vertical cross-sections) and calculates step heights on profiles.

Height and functional bearing ratio parameters are calculated in accordance with the new ISO 25178 standard on area surface texture. The cut-off between the roughness and waviness components of the surface is calculated automatically.

Optional modules, in particular **Basic Surface Texture, Contour Analysis** and **Advanced Contour Analysis,** provide additional tools for the analysis of surface geometry and texture if required.

Traceability Combined with Interactivity

In **Leica Map Start** a surface analysis document is built visually, frame by frame. Every step in the analysis – for example the generation of a 3D image, an analytical study of surface geometry or texture, the insertion of a measurement identity card – is recorded in a hierarchical analysis workflow that shows the dependencies between steps and provides full metrological traceability.

Leica Map Start is fully interactive. Any step in the workflow can be fine-tuned – for example the location of a profile that has been extracted from a surface can be changed interactively – and dependent steps are recalculated automatically. New steps can be inserted at any time. To gain time, sequences of commonly used steps can be saved and inserted in any document.
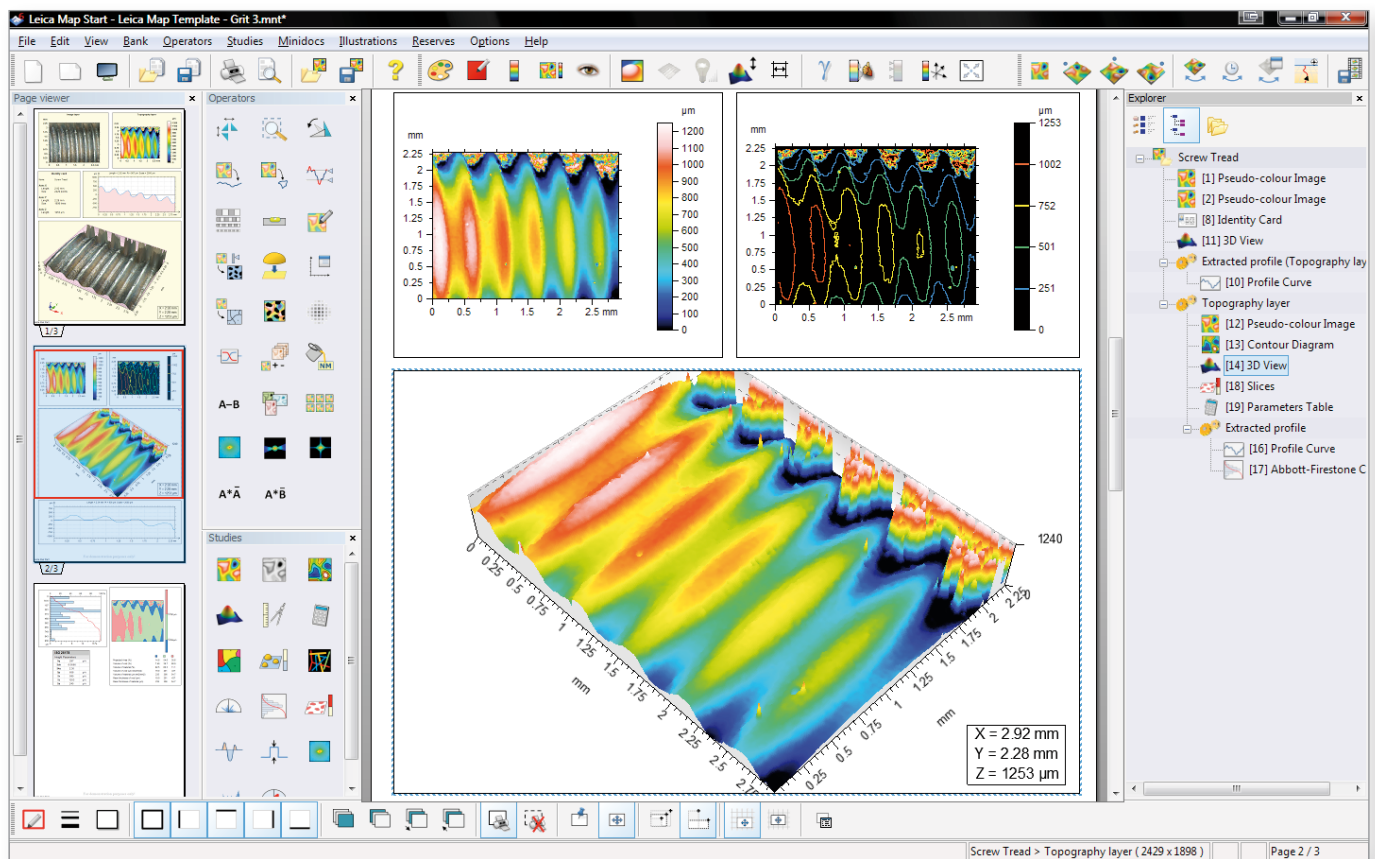
Multiple page analysis document with page viewer (left) and analysis workflow (right)

Ideal Partners –
LAS Montage and Leica Map

A series of image planes at known spacing covering the in focus region of a specimen are acquired by LAS Montage in conjunction with a Leica microscope. From this stack a depthmap and an extended focus image are derived. These images are analyzed automatically by applying an existing **Leica Map Start** analysis document as a template. In routine environments, the template can be prepared by a metrologist and protected against modification by non-authorized staff. The analysis workflow in the template document is applied automatically to each measurement in the series and a report on each measurement is generated automatically. Reports can include pass/fail messages with green/red traffic lights.

Optional Statistics

The **Statistics** optional module provides dynamically updated parameters on a series of measurements, including capability (Cpk) parameters for monitoring the repeatability of the production process. It can analyze multiple measurement populations and all results can be exported in Excel format for use by an external quality management system.
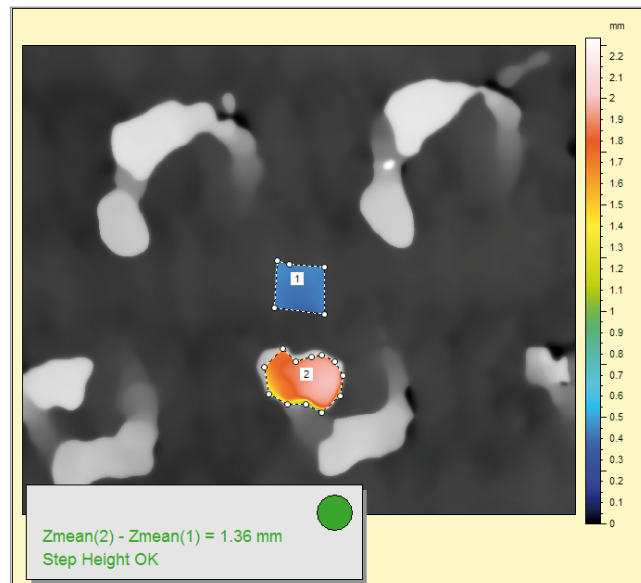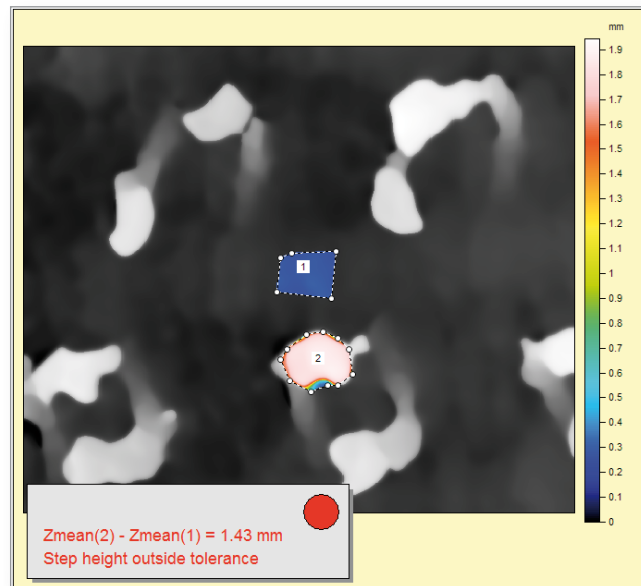

Image of two similar surfaces showing traffic light acceptance symbols. The step height measured on the upper surface fails and the lower passes.

Further Analysis of Surface Texture

The **Basic Surface Texture** optional module provides additional features for the analysis of surface texture.

Geometrical studies include the calculation of areas of peaks and valleys on vertical cross-sectional profiles, volumes of bumps and holes, and step heights between zones on surfaces (for example in the assessment of layered electronic and mechanical components, MEMS and electronic circuit boards).

Functional studies include the Abbott-Firestone or bearing ratio curve, the depth distribution histogram and surface subtraction (applied in tribological studies including studies of bearing and sealing surfaces and wear).

In addition, the roughness and waviness components of a surface can be separated using ISO 16610 advanced filtering techniques and ISO 4287 primary and roughness parameters are calculated.
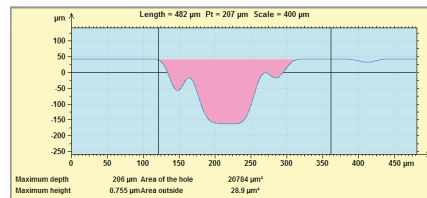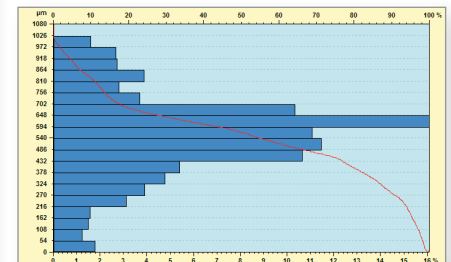

Cross-section profile measure area under mean surface
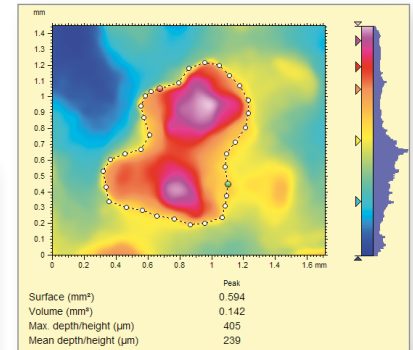
Calculation of volume of a manually defined hole

Coplanarity of contact zones on an electronic component using the step height (surfaces) study

Abbott-Firestone curve and depth distribution histogram

Grains and Particles Analysis

The **Grains & Particles** optional module detects and analyzes grains, particles and islands (collectively referred to as "grains") and motifs. Grains are separated from the background on the horizontal plane using binarization techniques. Statistics are generated for all grains, a sub-set of grains or individual grains (area, perimeter, diameter, form factor, aspect ratio, roundness, orientation, etc.).

Grains can be sorted into subsets with respect to a threshold value on any parameter. This grain topography can be viewed independently from the background. Grains can also be analyzed on the vertical axis with respect to a specified threshold height. In this case height and volume parameters are generated in addition to area, etc.

A surface is partitioned into motifs by applying segmentation by watersheds. Small or insignificant motifs can be merged into larger ones in accordance with user-configurable criteria. Motif shape detection means that spheres can be fitted to motifs for example in the cha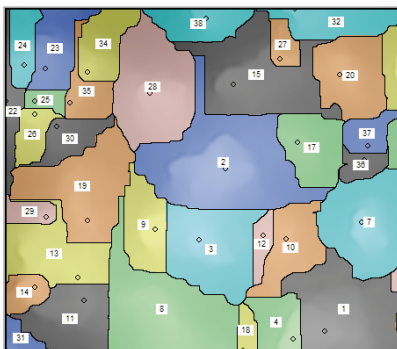racterization of lens. Height, area, volume and other parameters are generated. Motifs analysis can be applied to find relationships between peak and valley locations and functional performance.
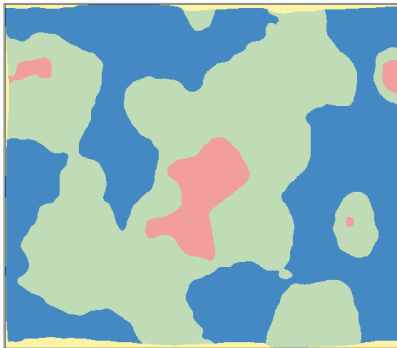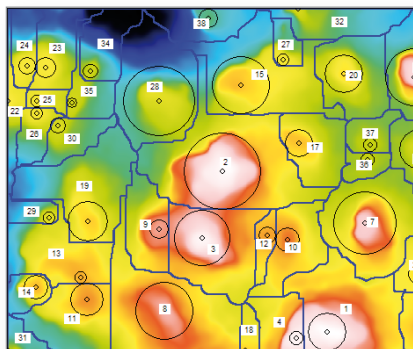

Threshold separation of peaks does not select the details in this case
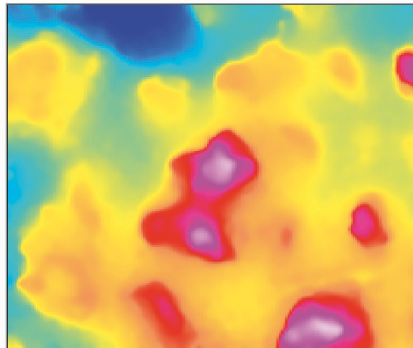
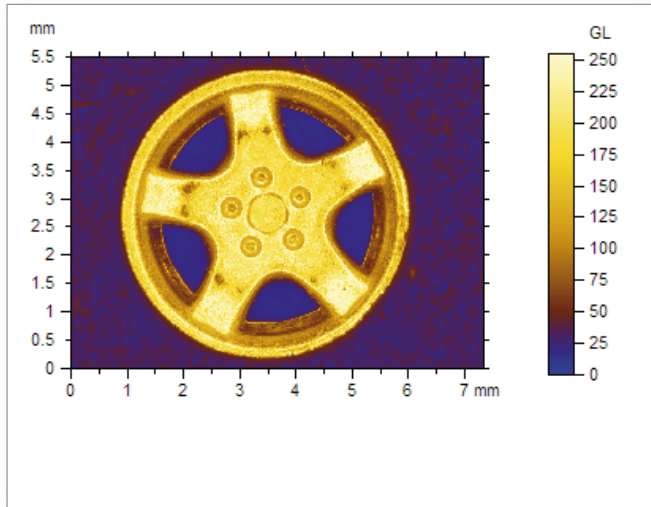
Pseudo-colour image shows peaks in depthmap
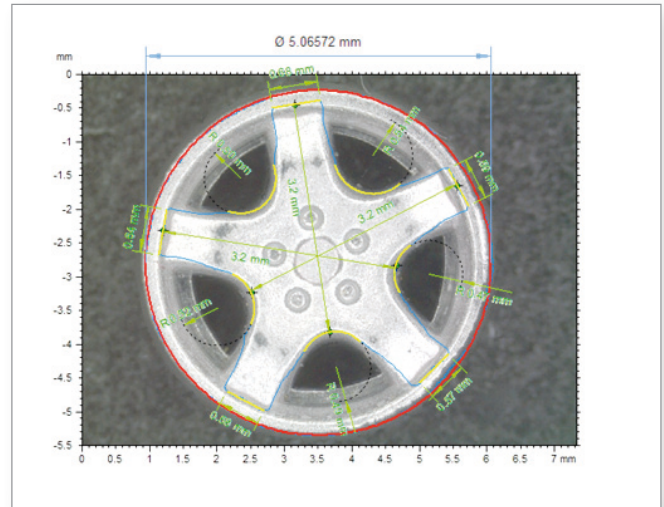

Watershed finds regions of the peaks

Estimate size of peaks shown as circles

Contour Analysis, Spectral Analysis, 4D Analysis and Stitching

Extended focus image of component

Horizontal contour dimensions using Advanced Contour Analysis option

Contour Analysis

There are two optional modules for contour analysis, the dimensional analysis of component geometry on cross-sectional profiles extracted from the surface.

The **Contour Analysis module** provides geometric dimensioning for profiles extracted on the Z axis and the XY plane. Dimensions are calculated using auto-dimensioning and interactive tools.

The **Advanced Contour Analysis** module compares profiles with CAD models (DXF) or user-defined nominal forms, which can include large positional tolerances. It provides comprehensive form deviation analysis and generates a full analysis report.

3D Fourier Analysis, 4D Analysis and Surface Stitching

The **3D Fourier Analysis** optional module is used to filter noisy images and to eliminate specific frequencies by directly editing the FFT and provides tools for spectral analysis.

The **4D Analysis** optional module provides visualization and statistical analysis of surface evolution with respect to time, temperature or another physical dimension.

The **Surface Stitching** optional module assembles multiple measurements that overlap on the horizontal or vertical axes into a single surface ready for analysis.

Leica Map Start Specifications

Instrument compatibility
- ▶ The Leica Map Start software is dedicated to Leica microscopes, macroscopes and stereo-microscopes with motorized focus controls and requires LAS Montage software to be installed.

PC requirements
- ▶ Recommended minimum: Windows 7 or Vista; 4 GB RAM; multi-core processor; 1280x1024 or higher graphics resolution in 32-bit colors. 250 MB disk space; OpenGL accelerated graphics board; USB port for hardware protection key.

Desktop publishing environment
- ▶ Build a detailed visual metrology report frame by frame in an intuitive desktop publishing environment, working in onscreen, portrait or landscape format.
- ▶ Work in one of six European languages, Japanese, Mandarin or Korean.

Productivity features
- ▶ Save common sequences of analysis steps and reuse them in any document.
- ▶ Use any document as a template for the automatic analysis of similar measurement data sets.
- ▶ Navigate to anywhere in a document with a single click using the page viewer.
- ▶ Hierarchical analysis workflow assuring full metrological traceability.
- ▶ Fine-tune any step at any time with automatic recalculation of dependent steps.

Real time 3D imaging
- ▶ View 3D topography images in real time, overlay color (RGB) and intensity images on the topography.
- ▶ Fly over surfaces, record flights as movies.
- ▶ Select any color palette for the vertical scale and fine-tune it automatically or interactively to highlight surface features.

Data correction and denoising
- ▶ Invert, rotate, flip the surface, remove nominal surface tilt, delete aberrant points, retouch areas, smooth data points.

Dimensions
- ▶ Measure distances and angles on profiles and surfaces, measure step heights on profiles.

ISO 3D surface texture parameters
- ▶ Calculate 3D height and bearing ratio parameters (ISO 25178, EUR 15178).

Leica Map Premium

In addition to purchasing Leica Map Start plus optional modules, it is also possible to order or upgrade to Leica Map Premium. Leica Map Premium is a top of the line surface imaging and analysis package including all of the functions in Leica Map Start and all of the optional modules with the exception of Advanced Contour Analysis and Statistics.

Leica Map Premium is a universal solution that is compatible with single-point tactile and optical profilers and scanning probe microscopes, as well as optical microscopes. In addition, Leica Map Premium includes numerous additional features that are not included in Leica Map Start or its optional modules, in particular tools for advanced functional analysis, the analysis of surface isotropy, directionality and periodicity, fractal analysis, and sub-subsurface analysis. Functional studies of the surface bearing ratio curve, depth distribution and wear and lubrication zones, together with ISO 25178 functional volume, hybrid and spatial parameters are important in tribological applications. Sub-surfaces are extracted (for example from layered mechanical or electronic surfaces) and analyzed in exactly the same way as full surfaces. ISO 12781 flatness parameters are calculated.

Leica Map Start Optional Modules

Basic Surface Texture
- ▶ Level surfaces and profiles.
- ▶ Calculate the area of peaks and valleys and the volume of bumps and holes.
- ▶ Calculate the material/void composition and thickness of up to three vertical surface slices.
- ▶ Subtract one surface from another (wear).
- ▶ Measure step heights on surfaces.
- ▶ Apply ISO 16610 advanced roughness/waviness filtering techniques (robust Gaussian and spline filters).
- ▶ Calculate ISO 4287 primary and roughness parameters.

Grains & Particles
- ▶ Detect grains and particles and separate them from the background on the horizontal axis; generate statistics on all/selected/individual grains (area, perimeter, diameter, form factor, aspect ratio, roundness, orientation, etc.).
- ▶ Detect islands above a specified threshold height and generate height and volume parameters in addition to area, etc. for all/selected/individual islands.
- ▶ Partition a surface into motifs applying segmentation by watershed Detect motif shapes and fit spheres to motifs where applicable. Generate statistics on all/selected/individual motifs. Calculate features parameters (ISO 25178).

Contour Analysis

- ▶ Measure dimensions, radii, diameters, angles on cross-sectional vertical profiles or horizontal profiles.
- ▶ Define nominal form using auto-dimensioning and interactive tools.
- ▶ Specify tolerances and check for form deviations.

Advanced Contour Analysis
- ▶ Display magnified form deviation graphics.
- ▶ Analyze surfaces with large positional tolerances.
- ▶ Compare measured data with CAD models (DXF).

Statistics
- ▶ Generate statistics on multiple measurement populations.
- ▶ Update statistics dynamically when new measurements are made.
- ▶ Generate capability parameters (Cpk) to monitor the repeatability of the production process.

3D Fourier Analysis
- ▶ Filter noisy images by thresholding the FFT
- ▶ Filter out specific frequencies by direct edition of the FFT
- ▶ Analyze frequency spectrum, power spectrum density, etc.
- ▶ Calculate auto- and inter-correlations.

4D Analysis
- ▶ Visualize and analyze surface evolution with respect to a 4th dimension (time, temperature, etc.)
- ▶ Fly over a surface as it changes, record an animated movie.
- ▶ Generate statistics on surface change.
- ▶ Highlight areas of preponderant change.

Surface Stitching
- ▶ Extend the field of view by automatically stitching together multiple measurements.
- ▶ Extend the vertical range by patching together measurements made at different heights into a single surface.