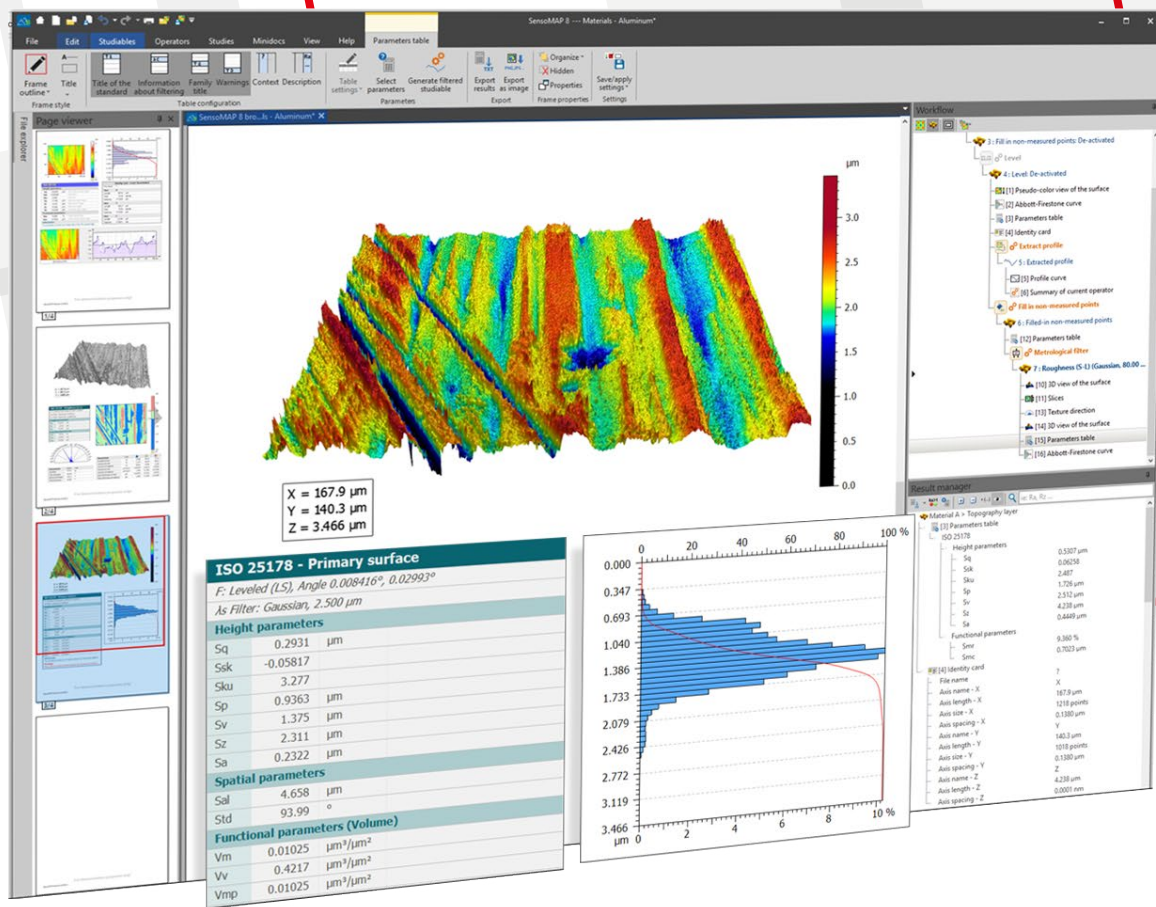


SENSOFAR

METROLOGY



SensoMAP
Advanced Analysis Software

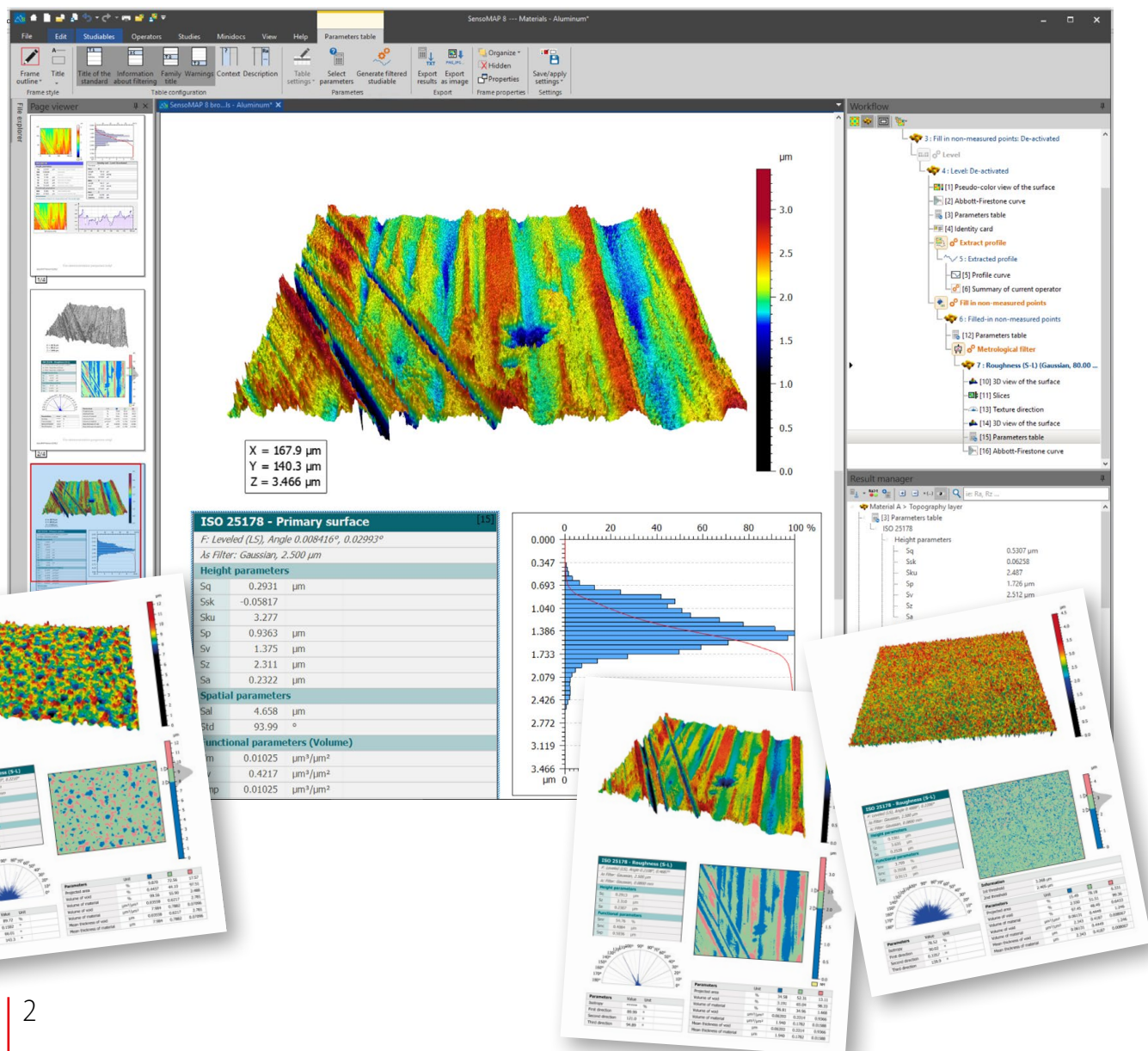




SensoMAP

Advanced Analysis Software

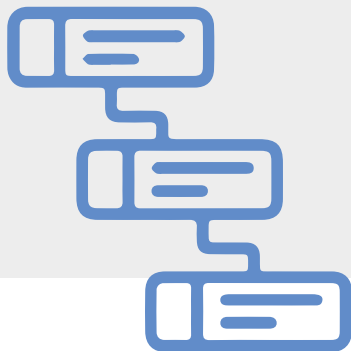
SensoMAP, based on Mountains technology from Digital Surf, is an extremely powerful tool for analysis and reporting. SensoMAP software is modularly adaptable to customer requirements. Two levels (standard and premium) and several modules are available.





Extremely powerful report creation

Designed for use with the broadest range of research and industrial applications, SensoMAP software is the perfect surface imaging, analysis and metrology solution that is fully integrated with Sensofar 3D optical profilers. It includes:



IMAGING

Visualization of surface data using cutting-edge imaging technology and intelligent filters.

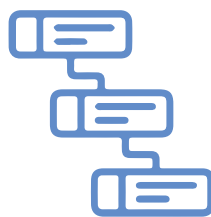
METROLOGY

Analytical studies in accordance with the very latest standards and methods.



REPORTING

Creation of detailed, accurate multi-page surface analysis reports in a smart desktop publishing environment with powerful automation features to speed up analysis.

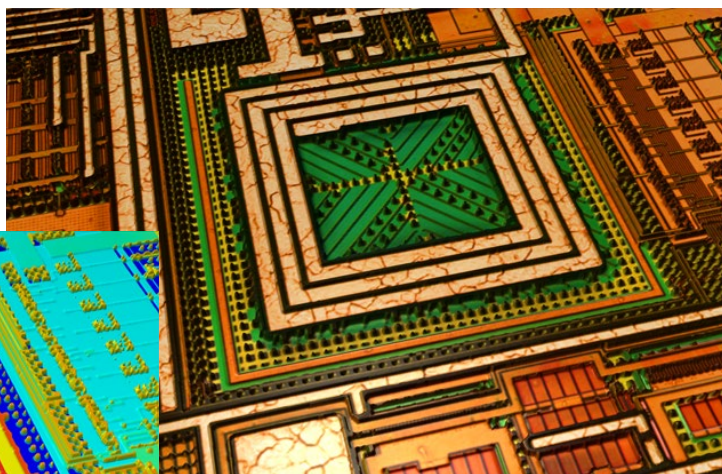
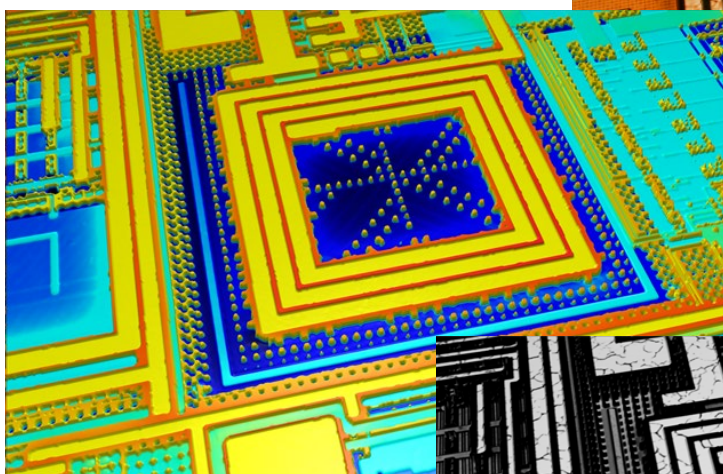


IMAGING

View your surface data in high quality 3D

Real-time 3D imaging

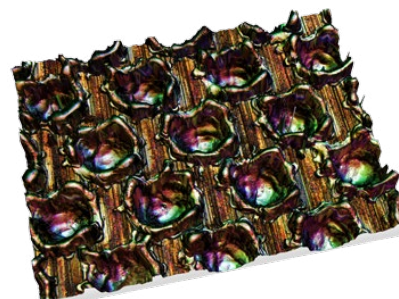
In SensoMAP, you can zoom in on a 3D surface and rotate it in real time. To achieve the best image quality, you can apply image enhancement tools, choose the best lighting conditions, select renderings, set surface height amplification, and use an optimized color palette for the vertical scale. In addition, you can display contour diagrams and photo simulations and you can extract 2D profiles from a 3D surface for visualization and analysis.



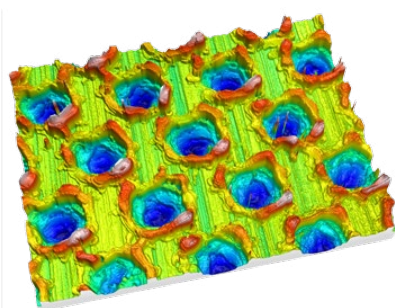


Overlay color and intensity images on 3D surface topography

Multi-channel topography, color and intensity image layers can be manipulated simultaneously. With a single click, you can overlay the color or intensity image on the 3D surface topography to speed up the detection of surface features. You can adjust the transparency of the overlay to achieve optimal rendering.



Color image
0% transparency



Pseudo-color 3D surface
topography
100% transparency

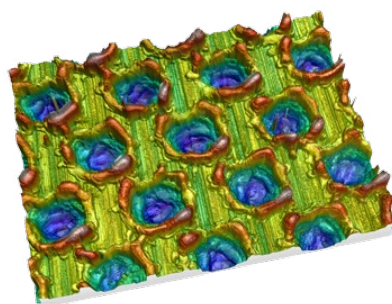


Image overlay on
topography
60% transparency

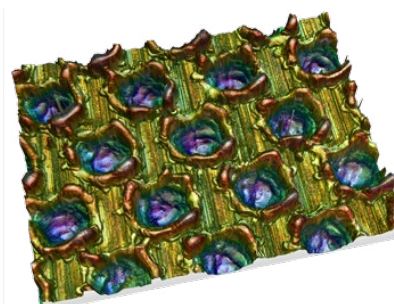


Image overlay on
topography
30% transparency

Extract a sub-surface and analyze it just like a full surface

Once a sub-surface or region of interest has been extracted it can be analyzed in exactly the same way as a full surface; the parameters are calculated for the sub-surface only. For example, you can study the roughness, flatness and coplanarity of planes on MEMS and mechanical and electronic components.

There are several methods for extracting sub-surfaces:

- Extract a rectangular or non-rectangular zone.
- Remove the upper or lower slice of a surface by thresholding.
- Apply a binary mask.
- Automatically partition a surface into motifs (texture cells), then use the Partition and Level operator to extract a sub-surface and level it so that it is ready for independent study.



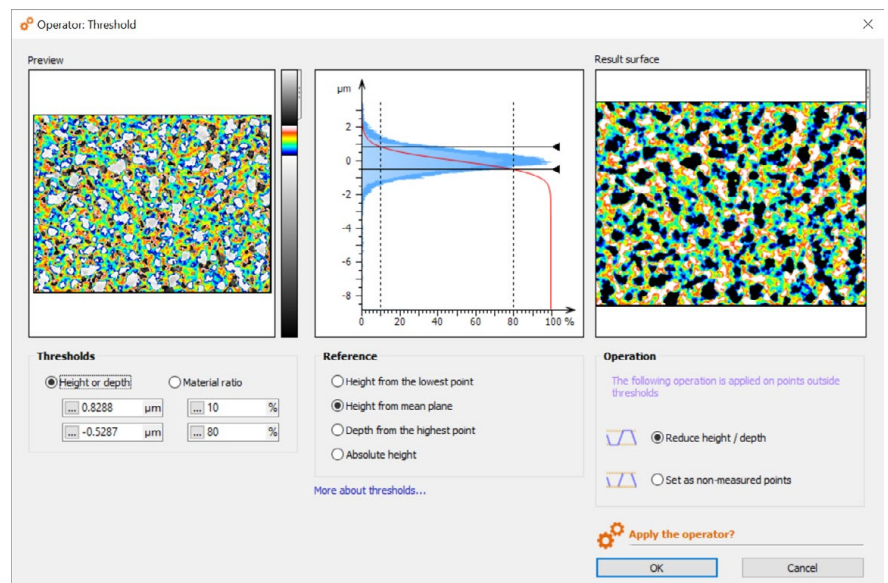
METROLOGY

Use powerful tools to prepare surface data for analysis

Intelligent operators and filters

SensoMAP includes a full set of intelligent operators and filters for normalizing 3D surface data and removing measurement artifacts prior to analysis. They include:

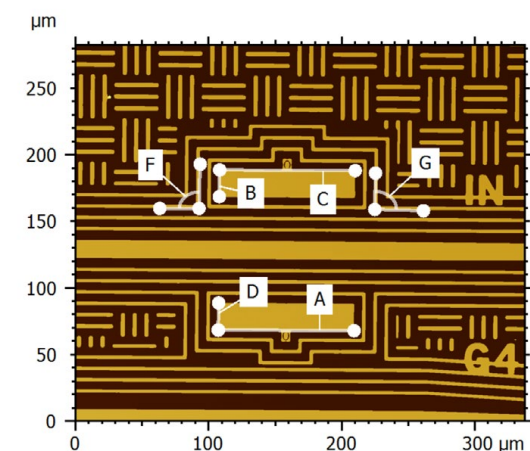
- Leveling
- Flipping (horizontal or vertical)
- Rotation
- Thresholding
- Outlier removal
- Filling in missing data points
- Spatial filtering and surface smoothing
- Retouching of isolated artifacts
- Resampling to improve image resolution





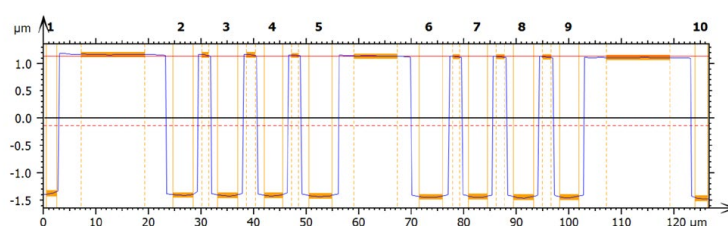
Analyze surface geometry

SensoMAP assures fast and accurate analysis of surface geometry with tools for measuring distances, angles, areas of peaks and valleys, volumes of bumps and holes, step heights on surfaces and profiles, and coplanarity.



Distances		Unit	A	B	C	D
HDist		μm	101.8	20.09	101.7	20.27

Angles		Unit	F	G
Angle		°	91.52	90.36



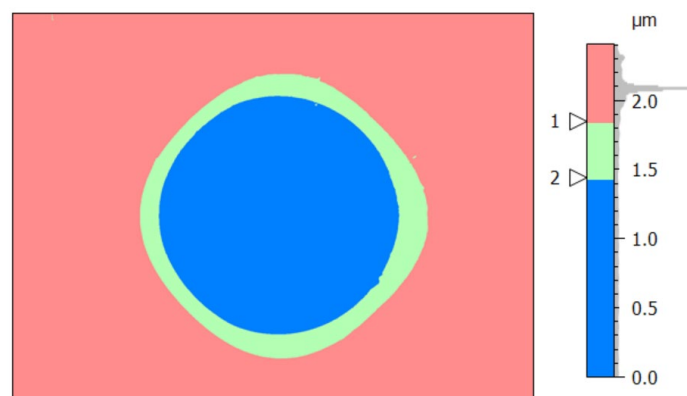
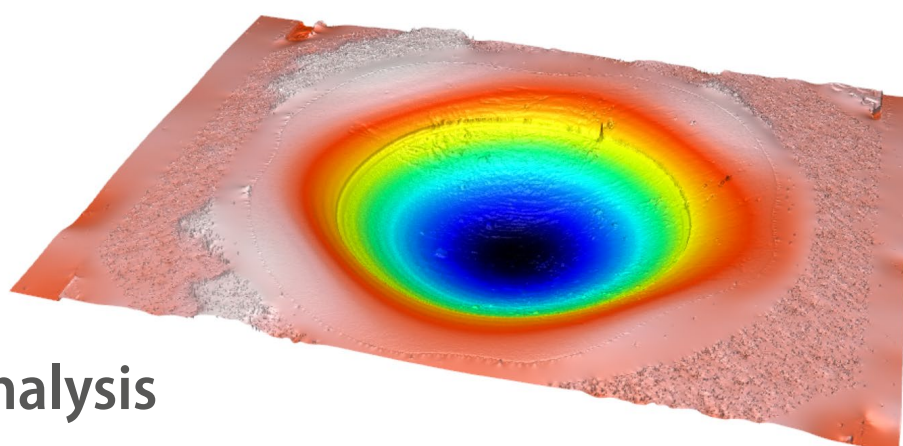
Parameters	Unit	Step 1	Step 2	Step 3	Step 4	Step 5	Step 6	Step 7	Step 8	Step 9	Step 10
Width	μm	1.932	3.864	3.864	3.588	4.416	4.416	3.588	3.864	3.588	2.484
Maximum depth	μm	2.529	2.547	2.557	2.558	2.567	2.582	2.584	2.596	2.591	2.613
Mean depth	μm	2.514	2.541	2.549	2.550	2.561	2.576	2.576	2.584	2.581	2.602

Standard functional analysis

SensoMAP provides standard functional analysis, including the Abbott-Firestone bearing ratio curve and depth distribution histogram, the material/void volume and thickness of up to three vertical surface slices, and surface subtraction for wear analysis.

Information				
1st threshold		1.837 μm		
2nd threshold		1.424 μm		

Parameters	Unit			
Projected area	%	21.59	7.850	70.56
Volume of void	%	10.91	24.76	67.81
Volume of material	%	89.09	75.24	32.19
Volume of void	μm³/mm²	155407	102219	386300
Volume of material	μm³/mm²	1268783	310590	183376
Mean thickness of void	μm	0.1554	0.1022	0.3863
Mean thickness of material	μm	1.269	0.3106	0.1834



Analyze surface texture according to the very latest ISO and national standards

Advanced filtering techniques

Separate roughness and waviness components of surfaces using the latest ISO 16610 advanced filtering techniques, including robust Gaussian and spline filters. Previous filtering techniques are also supported.

Areal parameters

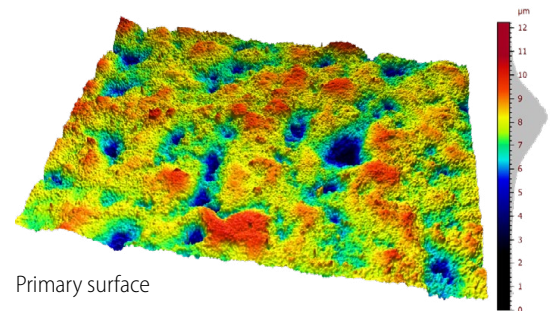
Access ISO 25178 height (S_a , S_q , S_{sk} , S_{ku} , S_z etc.) and bearing ratio (S_{mr} , S_{dc} , S_{xp} etc.) parameters.

Profile parameters

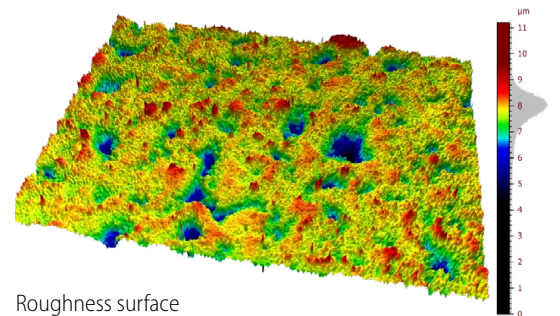
Use ISO 4287 amplitude, spacing, material ratio and peak parameters for primary, waviness and roughness profiles (R_a , R_q , R_{sk} , R_{mr} , R_{dc} , R_{dq} , RP_c etc.) and prepare for the publication of the upcoming ISO 21920 standard.

Smart parameters tables

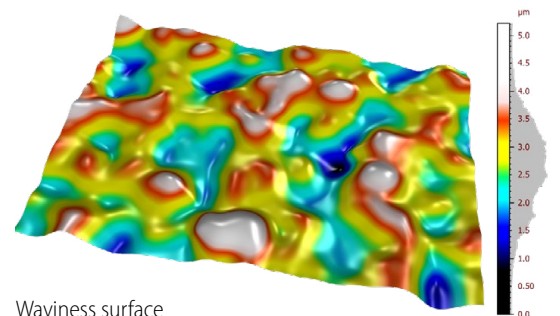
Choosing the right filtering options and parameters is simple. Parameters are grouped by standard, making them easier to find. Warnings (with explanations) are displayed when an error is detected.



Primary surface

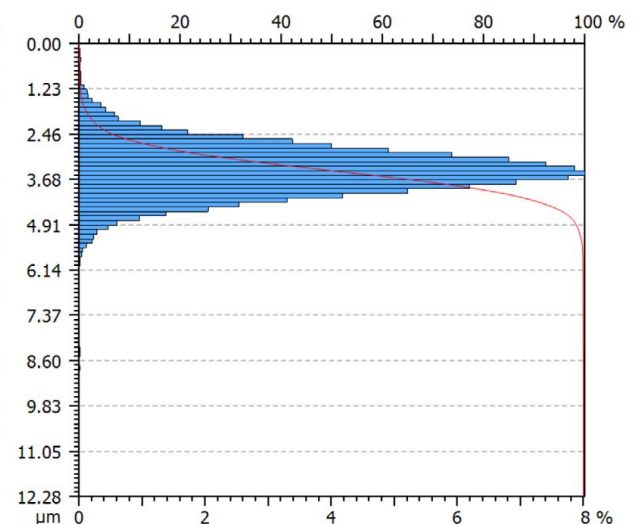


Roughness surface



Waviness surface

ISO 25178 - Roughness (S-L) [15]			
F: Leveled (LS), Angle 0.1713°, 0.2210°			
As Filter: Gaussian, 0.8000 µm			
Ac Filter: Gaussian, 0.2500 mm			
Height parameters			
Sq	0.8666	µm	
Ssk	-0.2223		
Sku	4.055		
Sp	3.552	µm	
Sv	7.782	µm	
Sz	11.33	µm	
Sa	0.6736	µm	
Functional parameters			
Smr	0.2070	%	
Smc	1.072	µm	
Sxp	1.766	µm	





Use powerful tools to prepare surface data for analysis

In SensoMAP you can build a visual analysis report frame by frame, page by page, working in one of six European languages, Brazilian Portuguese, Japanese, Korean or Mandarin Chinese. Frames contain 3D and other views of surface data, the results of applying filters, analytical studies, ISO and national parameters, measurement identity cards, comments and illustrations. You can navigate to any frame in a report by selecting it in the page viewer.

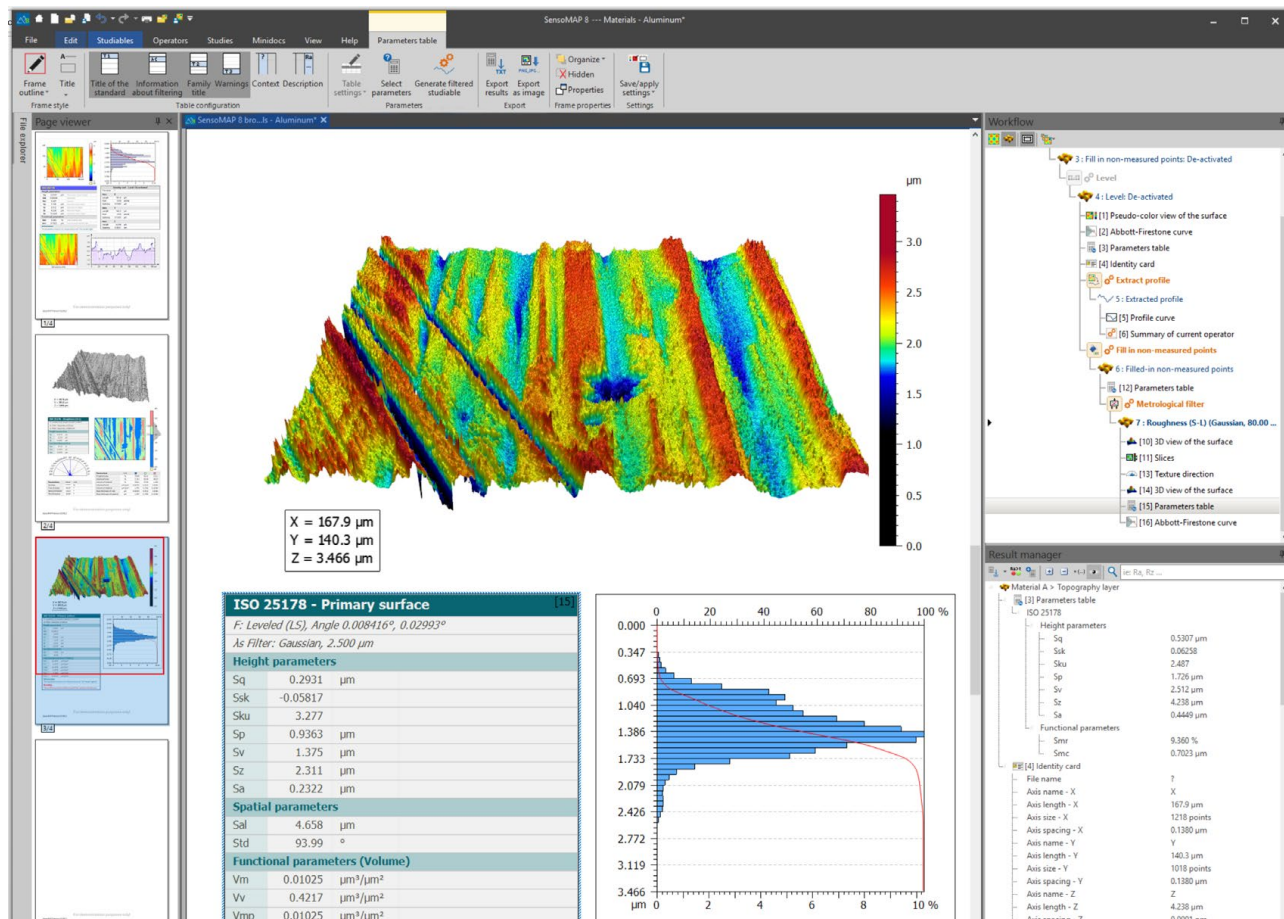
Once an analysis report has been completed it can be applied as a template to automate the analysis of multiple measurement data files. In addition, common sequences of analysis steps can be saved in a library for insertion into future analysis reports to save time.

Pass/fail with tolerance limits

Pass/fail criteria with tolerances can be defined for any parameter. Green (pass) and red (fail) traffic lights are displayed automatically and the parameter value and tolerance limits are shown graphically.

Data export

Frames and pages can be exported as bitmaps up to 1200 dpi for poster sessions. Finished reports can be exported in PDF and RTF formats for easy circulation. All numerical results are accessible in the Results Manager panel and can be exported in Excel-compatible text files for interfacing with 3rd party software, including quality management software.





OPTIONAL MODULES

Different tools and techniques for specific applications

SensoMAP is scalable software available on two product levels:

SensoMAP Standard

SensoMAP Standard provides the features required for standard surface imaging and analysis. It comes with numerous optional modules that can be added at any time for advanced and specialized applications.

SensoMAP Premium

SensoMAP Premium is a much more powerful solution in terms of features and includes all the modules except: Advance contour, Shell extension, Lead (Twist) analysis and Scale-sensitive fractal analysis. Other highly-specialized modules that can be added if required.

SensoMAP Software Network License allows the software to be used on several computers in a network. The number of computers that can use the software simultaneously depends on the number of "seats" purchased with the network license.

Because there are almost unlimited applications, several optional add-on modules are available to suit your advanced analysis needs.

Optional Modules

Optional



Included

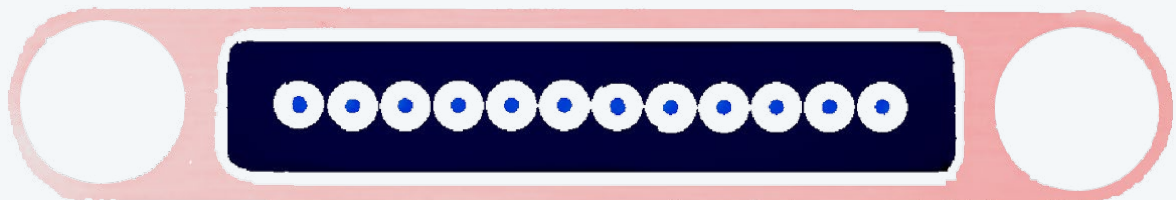
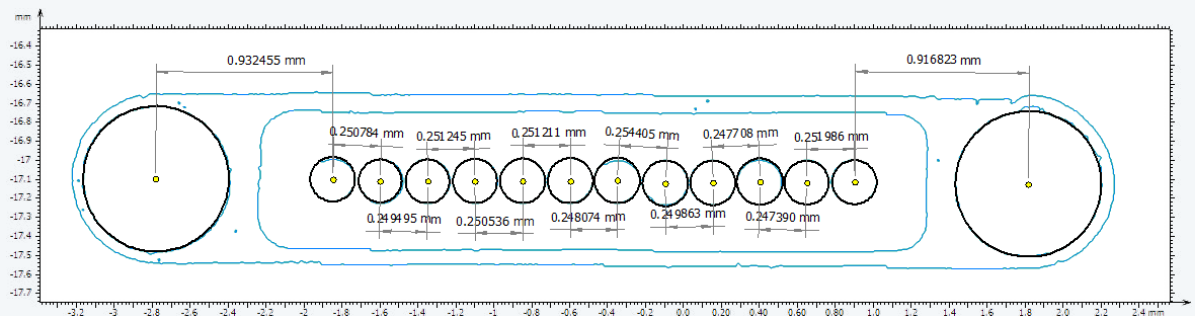


MODULES	Standard	Premium
Advanced Profile		
Contour		
Advanced Contour		
Automotive		
Advanced Topography		
Fourier & Wavelets		
Surface Stitching		
Shell Extension		
Lead Analysis (Twist)		
Particle Analysis		
Scale-Sensitive Analysis		
4D Series		
Statistics		

Contour

Basic geometric dimensioning & tolerancing of contour profiles and horizontal contours extracted from images.

- Smart dimensioning tools to set origin and align data, create geometrical elements (segments, arcs, circles, points etc.) and calculate distances, angles, diameters etc.
- Results tables to keep track of your work
- Basic tolerancing tools applying pass/fail criteria and visualizing them graphically

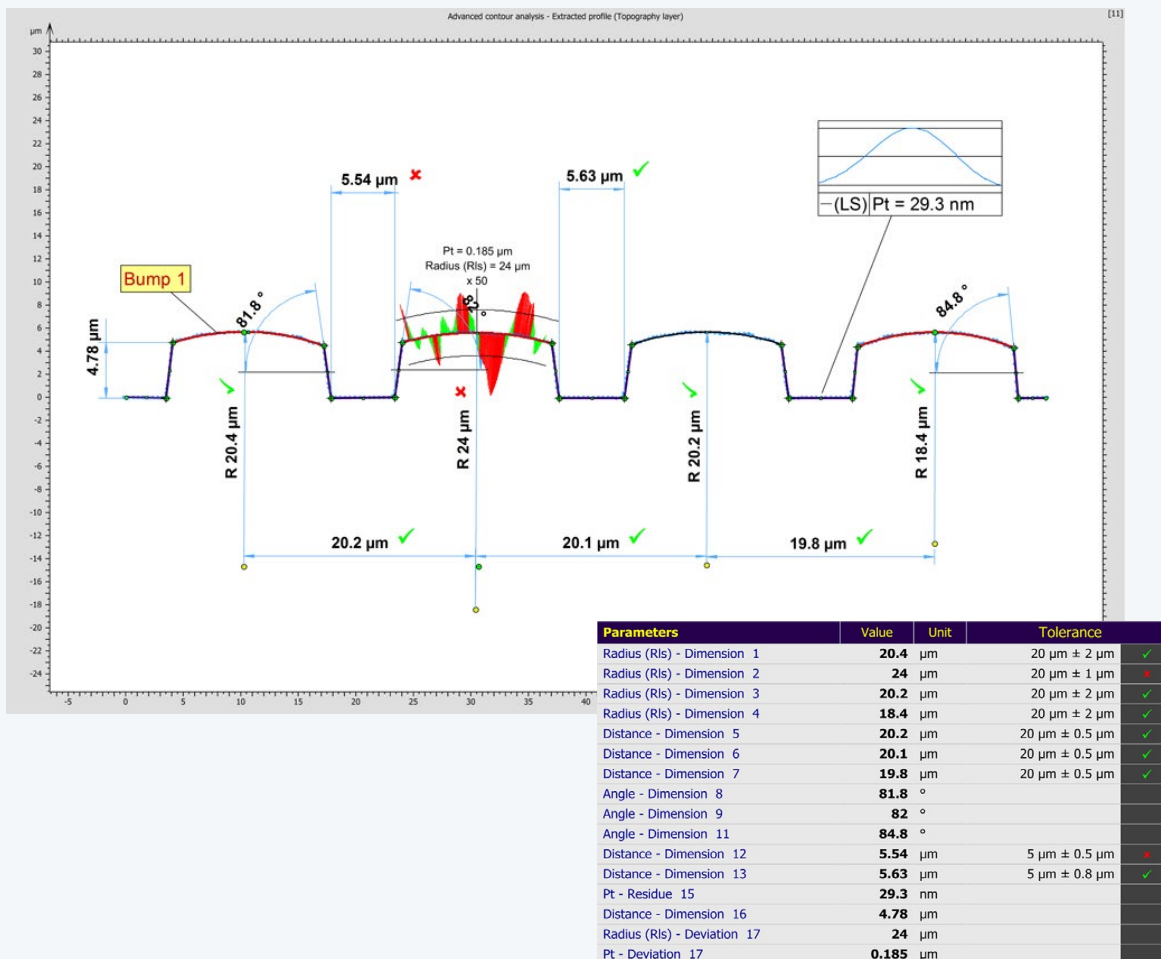




Advance contour

Advanced dimensioning and tolerancing, DXF CAD compare, Gothic arch.

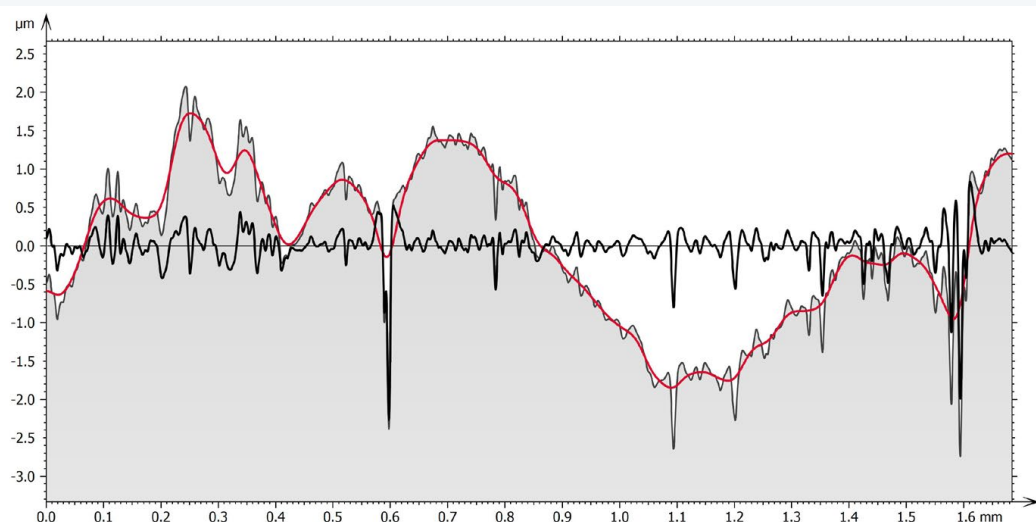
- Advanced form deviation analysis tools
 - Display form deviation from nominal or CAD DXF-based data and calculate parameters
 - Identify areas with the most significant deviation & export form deviation for further analysis
- Study profiles with variable dimensions
- Perform Gothic Arch analysis on V-shaped profiles



Advanced profile

Advanced profile filtering, fractal and Fourier analysis, statistical analysis of series of profiles.

- Apply advanced 2D filtering techniques – remove form and apply roughness/waviness filters from Gaussian to ISO 16610 – apply morphological filters – denoise profiles using the FFT plot editor
- Correct measurement anomalies – use data correction tools (thresholding, retouching and resampling) to eliminate anomalies and improve resolution prior to analysis
- Assess surface functionality
- Extract sliding profiles
- Use FFT-based tools to analyze process-surface interactions and other surface characteristics
- Analyze fractal dimensions of surfaces using the enclosing boxes and morphological envelopes methods
- Overcome measurement limits virtually
- Statistical analysis of series of profiles or multiple profiles extracted from the same surface
- MATLAB™ compatibility



Information

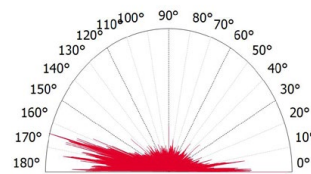
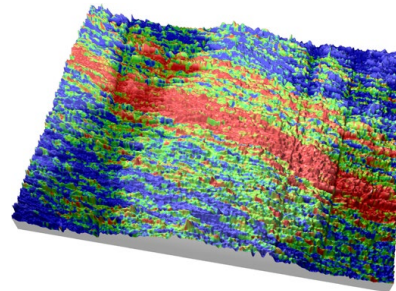
Profile	Roughness profile (S-L) & Waviness profile (S-F)
Filter settings	Gaussian filter, cut-off 0.080 mm, Manage end effects



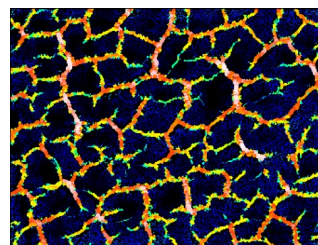
Advanced topography

Advanced studies, parameters & filters for 3D ("areal") surface texture analysis.

- Analyze sub-surfaces: extract and level planes in the same way as full surface measurements
- Calculate 3D surface texture and form parameters: ISO 25178 functional, spatial and hybrid parameters and ISO 12178 flatness parameters
- Graphically study functional volume parameters associated with wear and lubrication – visualize friction, core and lubrication zones on tribological surfaces.
- Analyze fractal dimensions of surfaces using the enclosing boxes and morphological envelopes methods
- Study surface isotropy, directionality and periodicity – view dominant surface directions on a compass rose and calculate parameters
- Apply morphological filters to surfaces – erosion, dilation, opening, closing, and sequential filters
- Study circular profiles with the abscissa in degree units
- Analyze furrows
- Map local properties
- MATLAB™ compatibility

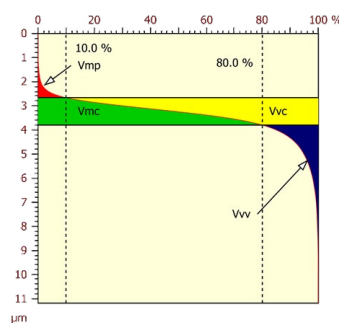


Parameters	Value	Unit
Isotropy	24.9	%
First direction	165	°
Second direction	180	°
Third direction	173	°



All furrows are displayed.

Parameters	Value	Unit
Maximum depth of furrows	110	μm
Mean depth of furrows	17.7	μm
Mean density of furrows	1206	cm/cm2

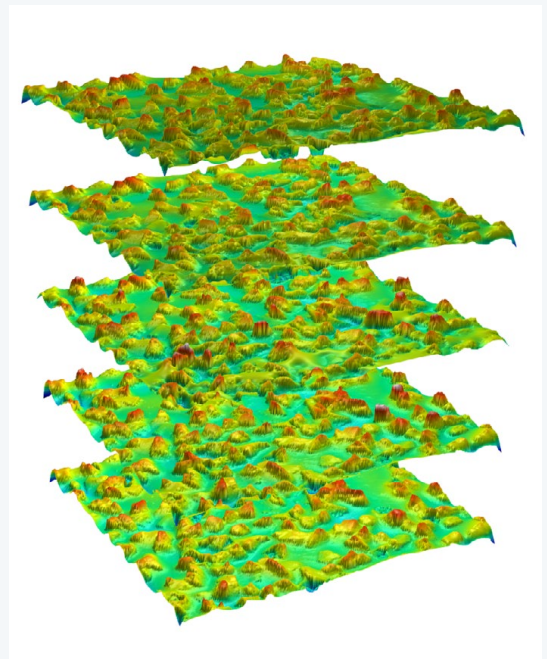


Parameters	Value	Unit
Vmp	0.0279	ml/m2
Vmc	0.533	ml/m2
Vvc	0.608	ml/m2
Vvv	0.182	ml/m2

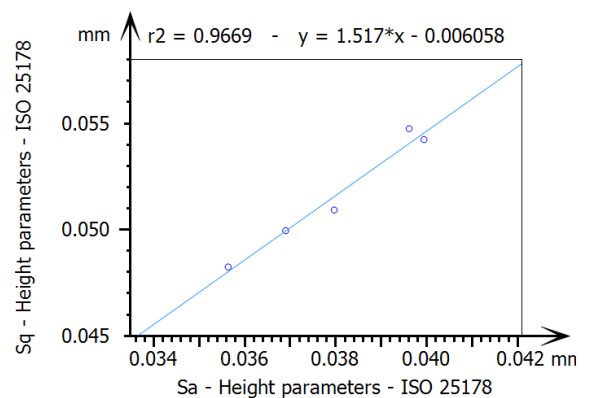
4D series

Analyze surface evolution with respect to time, temperature, magnetic field or another dimension.

- Combine a series of surface measurements for 4D analysis with respect to time, temperature, magnetic field or another dimension
- Visualize surface, profile and point evolution, even fly over a surface as it changes and record a movie for presentations
- Generate statistics on surface change
- Highlight areas of preponderant change using the Karhunen-Loève transform (principal component analysis)



		Mean	Std dev
ISO 25178 - Roughness (S-L)			
<i>F: Leveled (LS)</i>			
<i>As Filter: Gaussian, 2.500 μm</i>			
<i>λc Filter: Gaussian, 0.8000 mm</i>			
Height parameters			
Sq	mm	0.05162	0.002504
Sz	mm	0.6849	0.08639
Sa	mm	0.03801	0.001623
Functional parameters			
Smr	%	0.001526	0.000
Smc	mm	0.07162	0.002904
Sxp	mm	0.05991	0.003793
Spatial parameters			
Sal	mm	0.1595	0.003272
Str		0.7899	0.01238
Std	°	75.35	9.345





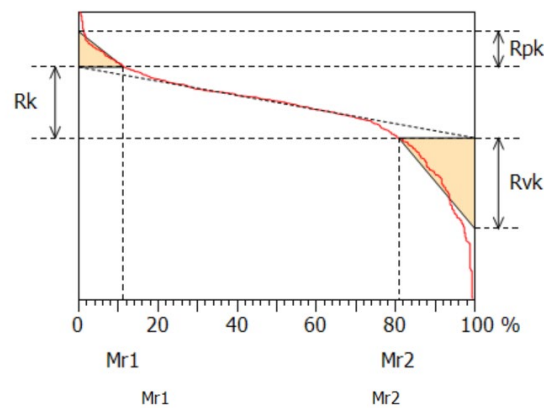
Automotive

Assess functional performance with a full set of 2D parameters developed by the automotive industry.

- Calculate a comprehensive set of 2D parameters

- ISO 13565-2 Rk parameters
- ISO 13565-3 parameters
- ISO 12085 motifs parameters
- ISO 12780 straightness parameters
- ISO 12781 roundness parameters
- VDA 2007 dominant waviness

- Graphically study Rk parameters associated with wear and lubrication – visualize friction, core and lubrication zones on tribological profiles.



Information

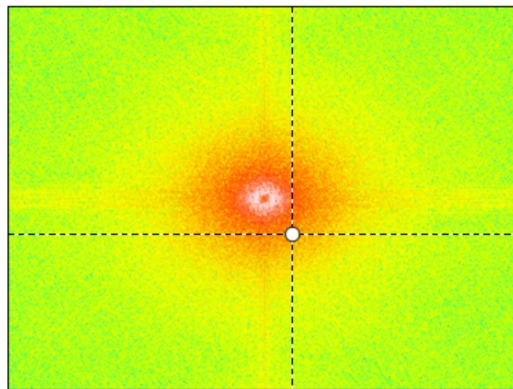
Filter settings Double Gaussian filter, 0.8000 mm, Manage...

Parameters	Value	Unit
Rk	21.57	μm
Rpk	10.76	μm
Rvk	27.61	μm
Mr1	11.30	%
Mr2	80.76	%
A1	607.5	$\mu\text{m}^2/\text{mm}$
A2	2656	$\mu\text{m}^2/\text{mm}$
Rpk*	16.65	μm
Rvk*	49.33	μm

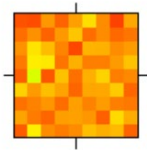
Fourier & Wavelets

FFT-based texture analysis, advanced FFT filtering, multi-scale analysis by wavelets.

- Work with a wide range of FFT-based plots – interactive frequency spectrum, interactive power spectrum density, autocorrelation and intercorrelation
- Calculate isotropy, directionality and periodicity – view dominant surface directions on a compass rose and calculate parameters
- Denoise surfaces using the FFT plot editor



Parameters	Value	Unit
X	18.57	μm
Y	-10.76	μm
Wavelength	9.313	μm
Angle	-59.91	°
Magnitude	-14.36	dBc
Phase	40.95	°

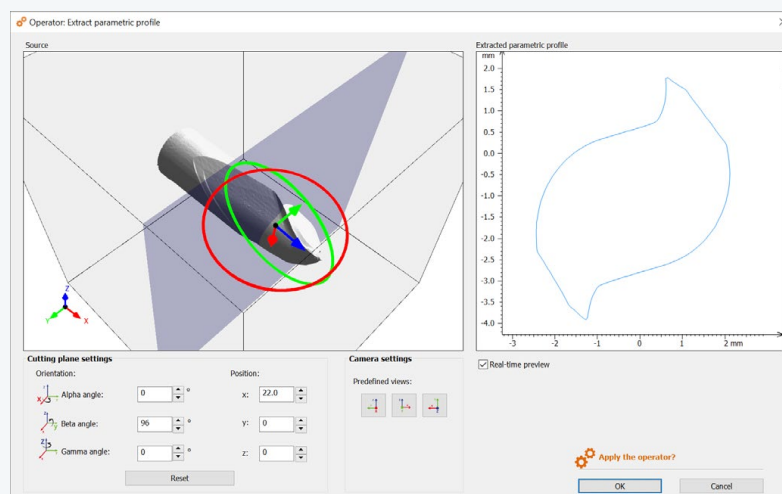
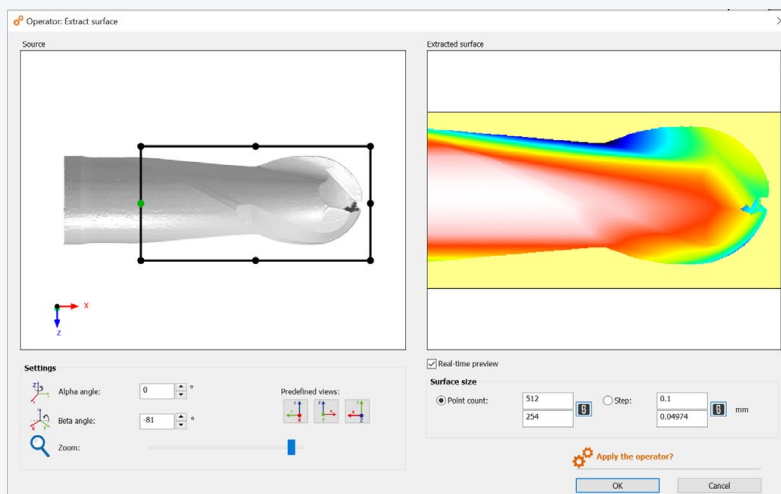




Shell extension

Freeform surface management, complex shape analysis, high quality 3D visualization.

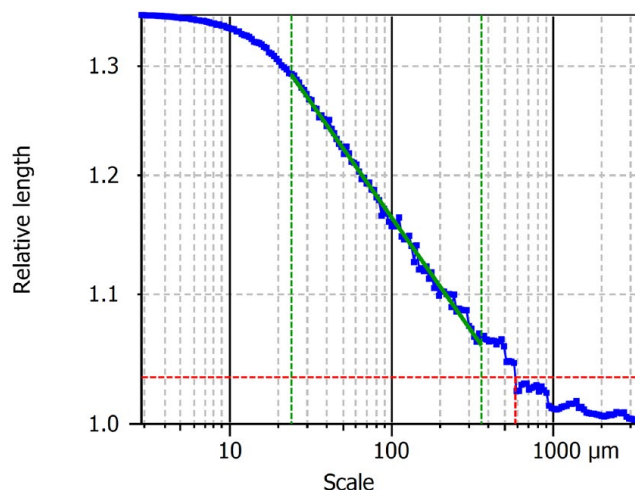
- Shell data (freeform surface) management load most types of file formats for freeform surfaces (.STL, .OBJ, .PLY, .3MF etc.)
- Analyze data generated by profilers with multiple scanning axes including complex shapes (gears etc.)
- Analyze objects produced by additive manufacturing
- Visualize objects from all angles in high quality 3D
- 3D print produces accurate centimetric/inch-scale objects that can be manipulated from data at the sub-millimeter scale (useful for teaching purposes or prototypes)
- Extract any external or internal part of the face of an object and also extract cross-sections at any angle



Scale-sensitive fractal analysis

Implements a multi-scale analysis based on length-scale or area-scale analyses (formerly in Sfrax software).

- Length-scale analysis on a profile or on a surface (lines or columns). Calculates relative-area in function of scale.
- Area-scale analysis on a surface (one corner or four corners). Calculates relative-area as a function of scale.
- Log-log graph of relative length/area or complexity as a function of scale: Possibility to define the analysis domain and the regression domain for the calculation of fractal dimensions.
- Provides regression coefficient R^2 for functional correlation analyses. Calculates Smooth-Rough crossover and other parameters formerly included in Sfrax software.
- Includes Dental microwear texture analysis: with parameters HAsfc (heterogeneity of complexity) and ePLsar (exact proportion of length-scale analysis).



Information

Method	Length-scale (rows)
--------	---------------------

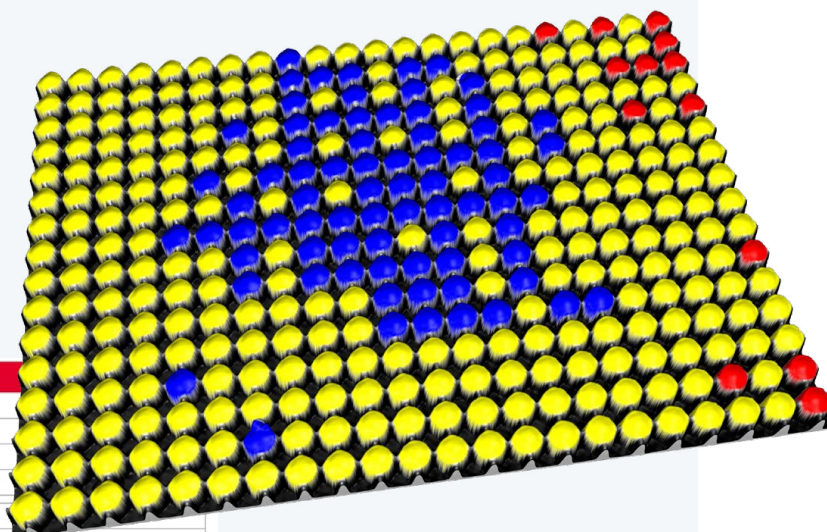
Parameters	Value	Unit	Comment
SRC threshold	1.0350		
SRC	581.2665	μm	
Lsfc	73.4712		
Smfc	67.6474	μm	



Particle analysis

A comprehensive toolset for detecting and analyzing particles, pores, grains, islands etc. on structured surfaces.

- Detect any feature – choose from a range of feature detection methods based on different segmentation principles (threshold, watershed etc.)
- Particle classification – detected particles can be grouped into different classes based on their characteristics, such as their geometrical shape, height or size.
- Display options – access a wide range of graphical representations and customize display of results, including overlay on topography.
- Generate charts and statistical results for all particles, subsets of particles or individual particles.

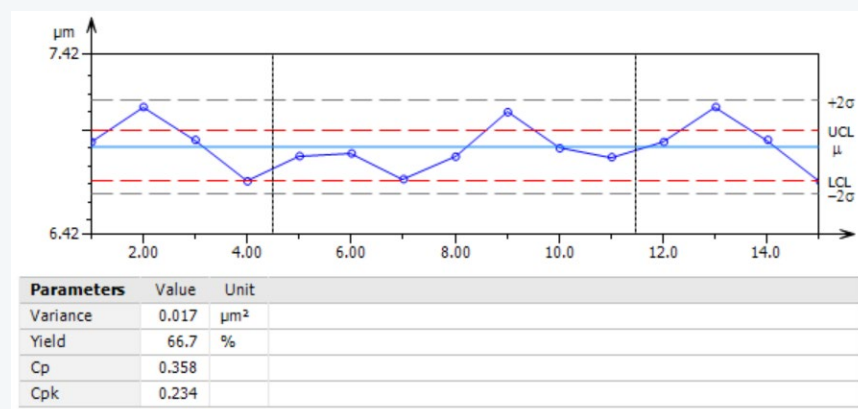


Information					
Method	Circle detection				
Threshold		20.8	%		
Min diameter (for detection)		2.00	µm		
Max diameter (for detection)		20.0	µm		
Number of particles		352			
Coverage		56.9	%		
Density		30874	Particles/mm²		
Parameters	△	Default classification	Projected area	Perimeter	Radius (circle)
Unit			µm²	µm	µm
Particle #94	■	B	18.2	15124	2.41
Particle #95	■	B	18.2	15124	2.41
Particle #96	■	B	18.2	15124	2.41
Particle #97	■	B	18.2	15124	2.41
Particle #98	■	B	18.2	15124	2.41
Particle #99	■	B	18.2	15124	2.41
Particle #100	■	B	18.2	15124	2.41
Particle #101	■	B	18.2	15124	2.41
Particle #102	■	B	18.2	15124	2.41
Particle #103	■	B	18.2	15124	2.41
Particle #104	■	B	18.2	15124	2.41
Particle #105	■	B	18.2	15124	2.41
Particle #106	■	C	19.5	15645	2.49
Particle #107	■	B	18.2	15124	2.41
Particle #108	■	A	17.0	14602	2.32
Particle #109	■	B	18.2	15124	2.41
Mean		*****	18.4	15215	2.42

Statistics

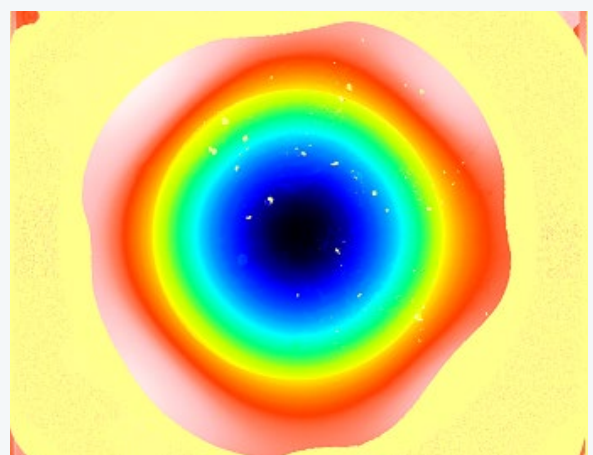
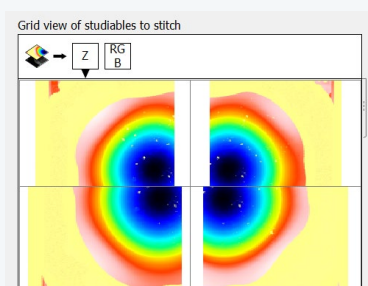
Automated statistics for multiple data populations, process capability.

- Prepare data automatically using templates – include all parameters for statistical analysis in a predefined analysis workflow – use it as a template for automatically generating analysis reports on one or more populations.
- Generate statistical reports – select the static or dynamic population(s) to be analyzed and create a report with parameter tables, control charts, histograms, box plots and scatter plots as required – statistics for dynamic populations are updated automatically.
- Monitor key parameters and process capability – control charts include standard deviation limits (1 to 3 sigma), control limits and vertical bars separating different populations, together with yield capability



Surface stitching

Increase profilometer range. Use stitching to expand range of all axes (including Z) and overcome instrument limitations.





System requirements

MODULES	
Operating systems	Windows 7, Windows 8 or Windows 10, 64 bit Recommended: Windows 10
Recommended processor	– for standard use: quadcore processor – for intensive use: multiple quadcore processors
Disk	– Minimum: 1 GB of HDD free space
RAM	– Minimum: 4GB – Recommended for standard use: 8GB – Recommended for intensive use: 32GB
Graphics	– Minimum: OpenGL 2.0 or Direct X 9.0c support – Recommended: Dedicated GPU 1 GB
Screen resolution	– Minimum: 1280×768 – Recommended: Full HD
Other	– 1 free USB port (software use is protected by USB security key)

Languages:

User interface is available in 11 languages (EN, DE, FR, JP, ES, IT, CN, KR, BR, PL, RU)



SENSOFAR is a leading-edge technology company that has the highest quality standards within the field of surface metrology

Sensofar Metrology provides high-accuracy optical profilers based on confocal, interferometry and focus variation techniques, from standard setups for R&D and quality inspection laboratories to complete non-contact metrology solutions for in-line production processes. The Sensofar Group is headquartered in Barcelona, known as a technology and innovation hub in Europe. The Group is represented in over 30 countries through a global network of partners and has its own offices in Asia, Germany and the United States.

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