SENSOFAR

METROLOGY

Engineered for Speed QA/QC and R&D Solution

S neox

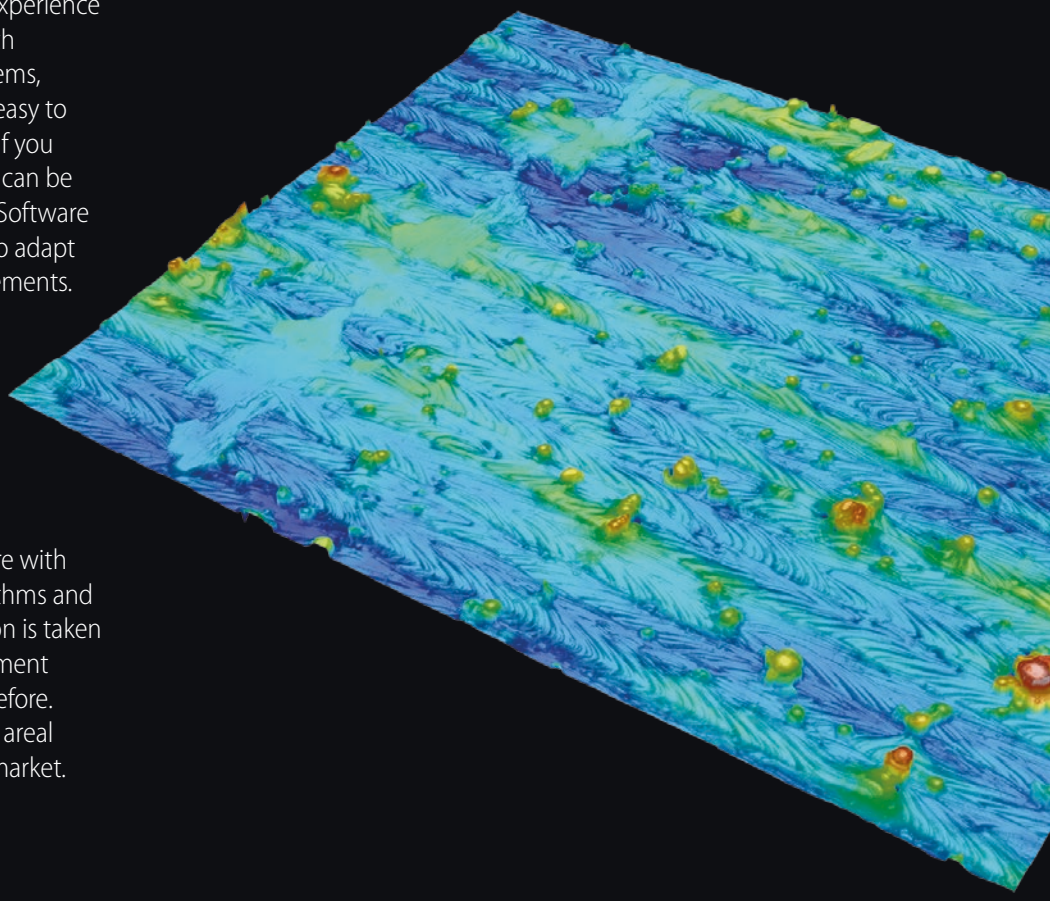
3D Optical Profiler

Simply powerful

The new S neox outperforms existing optical 3D profiling microscopes in terms of performance, functionality, efficiency and design, providing Sensofar with a class-leading areal measurement system.

Easy-to-use

Sensofar is continuously working to provide the most incredible experience to our customers. With the fifth generation of the S neox systems, the goal has been to make it easy to use, intuitive and faster. Even if you are beginner user, the system can be managed with just one click. Software modules have been created to adapt the system to the user requirements.



Faster than ever

Everything is faster than before with new smart and unique algorithms and a new camera. Data acquisition is taken at 180 fps. Standard measurement acquisition is 5X faster than before. Making the S neox the fastest areal measurement system in the market.

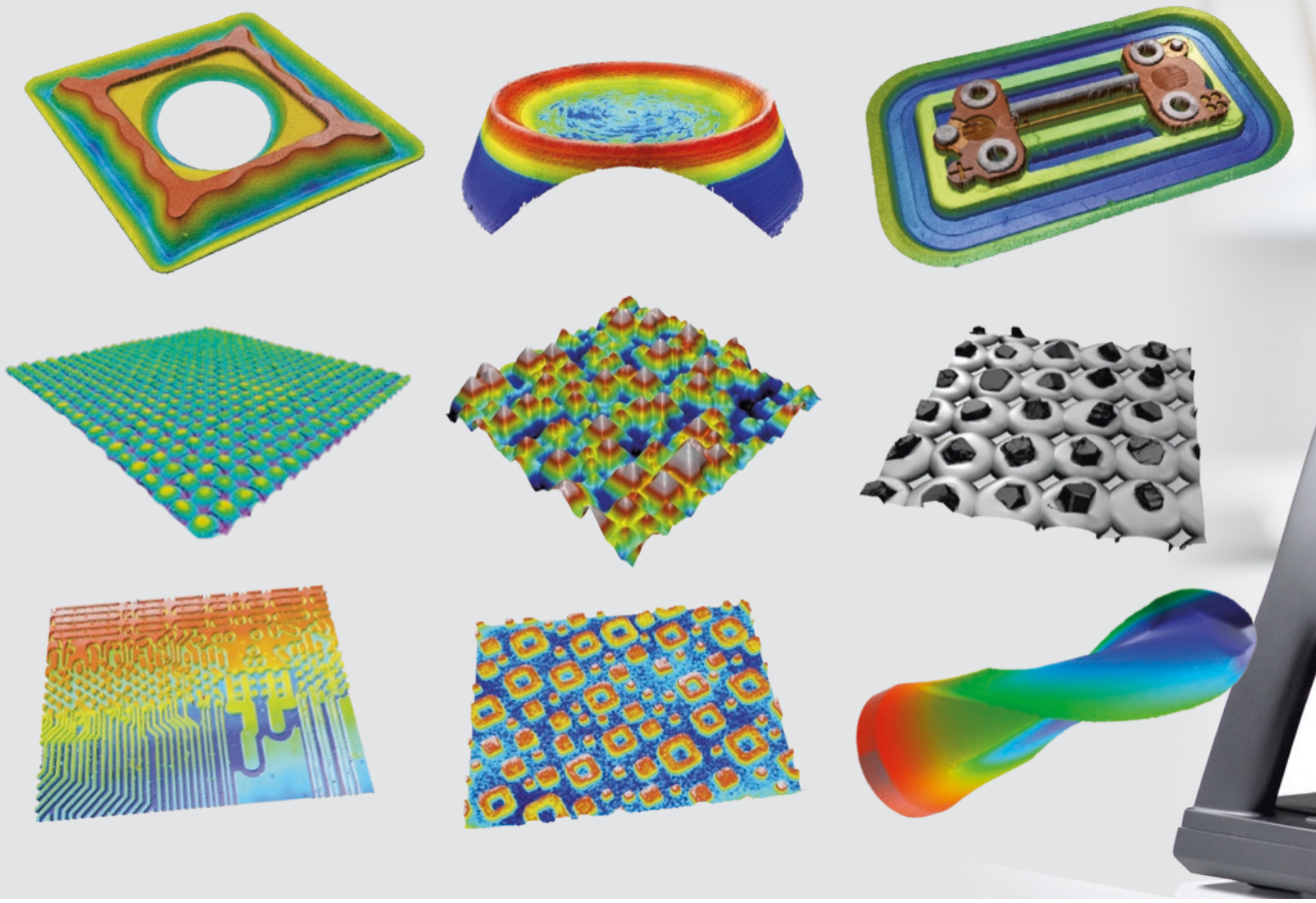
Markets

- Advanced manufacturing
- Aerospace & Automotive
- Archaeology & Paleontology
- Consumer electronics
- Defense & Security
- Medical devices
- Optics
- Tooling

Versatile

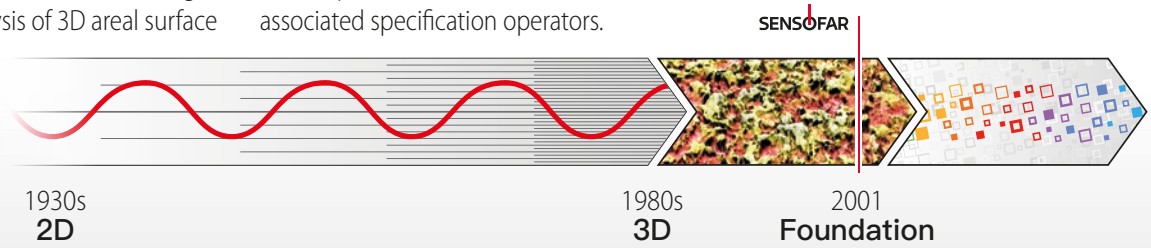
Quality control

Automated modules have been created to facilitate all QC procedures. Ranging from operator access rights control, recipes, compatibility to barcode/QR readers, and customized plugins from our proprietary SensoPRO software to generate pass/fail reports. Our optimized solutions are able to work in QC environments due to their flexibility and easy-to-use interface, which can be programmed to work 24/7.



Surface texture characterization

The ISO 25178: Geometric Product Specifications (GPS) – Surface texture: areal standard is an International Organization for Standardization collection of international standards relating to the analysis of 3D areal surface texture. It is the first international standard taking into account the specification and measurement of 3D surface texture, and in particular defines 3D surface texture parameters and the associated specification operators.

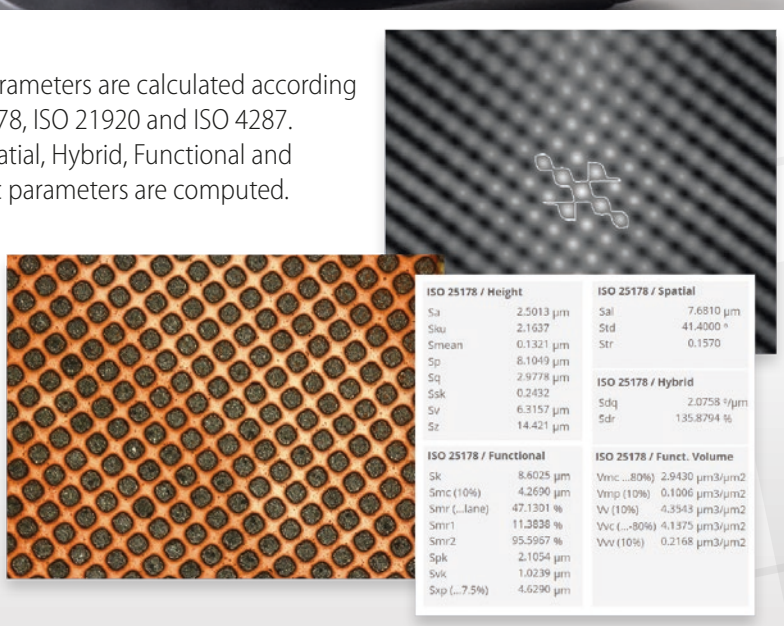


system

Research & Development

With Sensofar's 4-in-1 approach, a single click in SensoSCAN switches the system to the best technique for the task at hand. Each of the four measurement techniques found in the S neox sensor head -Confocal, Interferometry, Ai Focus Variation, Thin Film- contribute critically to the versatility of the system and help to minimize undesirable compromises in the data acquisition. The S neox is ideal for all lab environments, without limitations.

Surface parameters are calculated according to ISO 25178, ISO 21920 and ISO 4287. Height, Spatial, Hybrid, Functional and Volumetric parameters are computed.

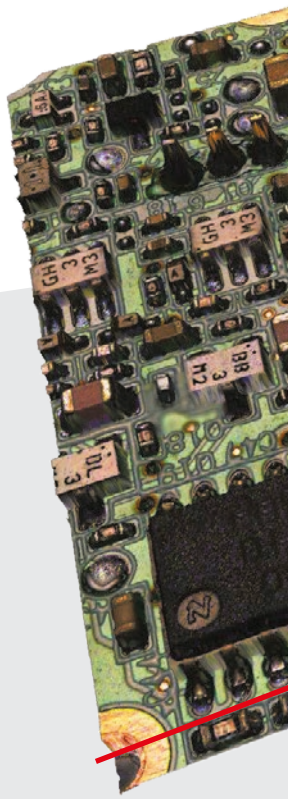


Since 2009, Sensofar has been member of the Technical Committee of the International organization for Standardization (ISO/TC213 WG16)

Guided system

SensoSCAN

Software drives the systems with its clear and intuitive user-friendly interface. The user is guided through the 3D environment, delivering a unique user experience.



Sample Navigation

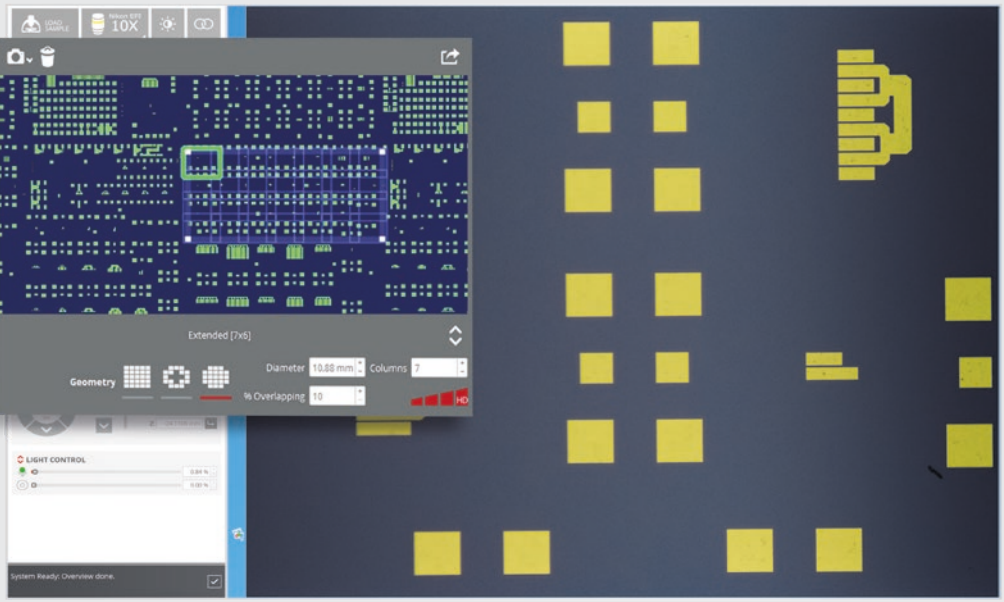
An overview tool helps the user to inspect the sample during measurement preparation, check measurement positions before acquisition as well as assist in the automation procedure. Working with high magnification will be easier, as you will know where you are at every moment.

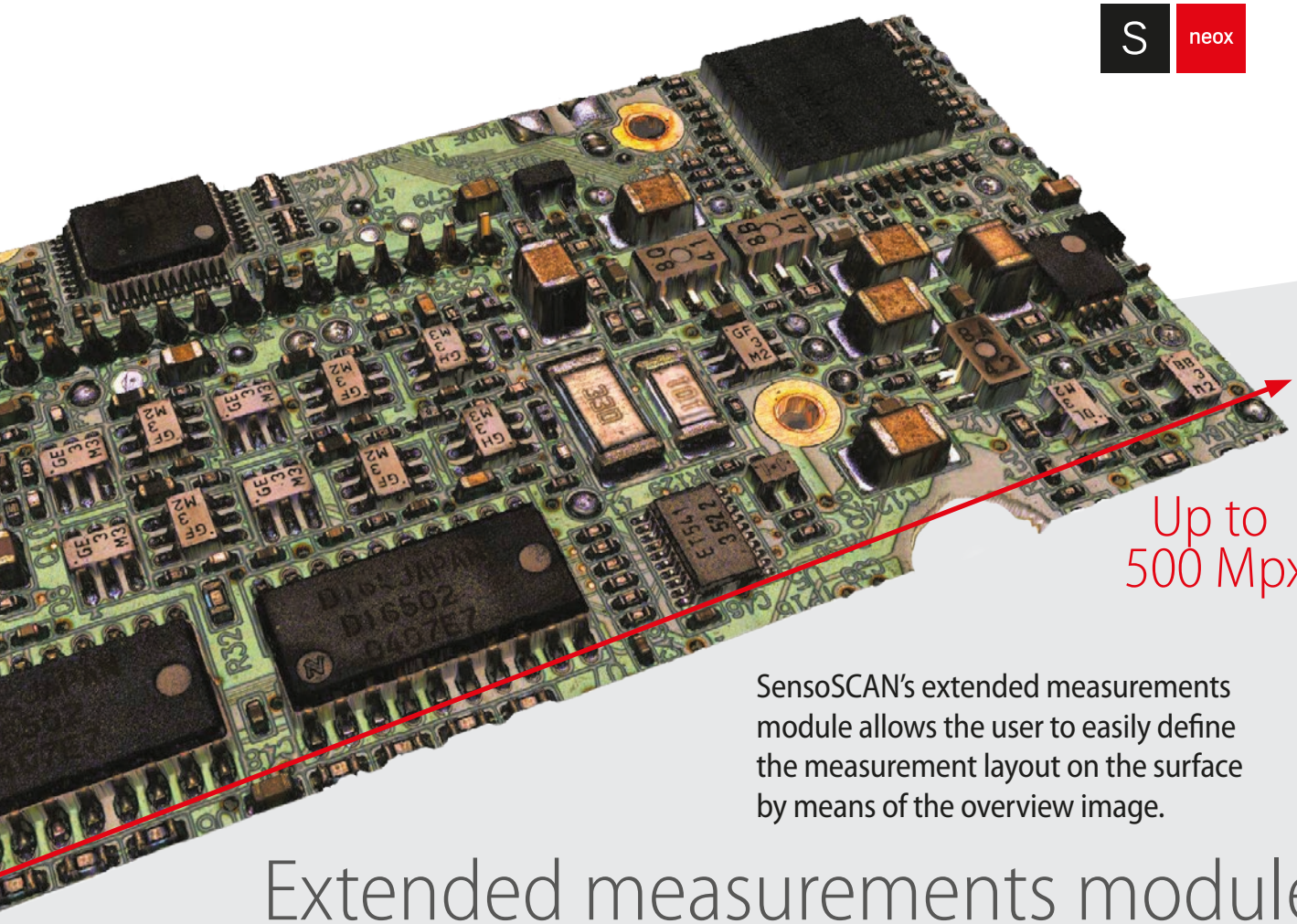
Auto 3D Function

Selecting 3D Auto function, the SensoSCAN software automatically determines the correct illumination and the appropriate measurement range, and then performs the chosen measurement type. A high-quality result can thus be obtained within just a few seconds.

Analysis & Reporting

It is also possible to create analysis templates to apply pre-determined filter and operator configurations to repeated measurements. And finally, obtain a clear and well-structured report for each measurement, showing the 3D data, a 2D profile and all the ISO parameters.





SensoSCAN's extended measurements module allows the user to easily define the measurement layout on the surface by means of the overview image.

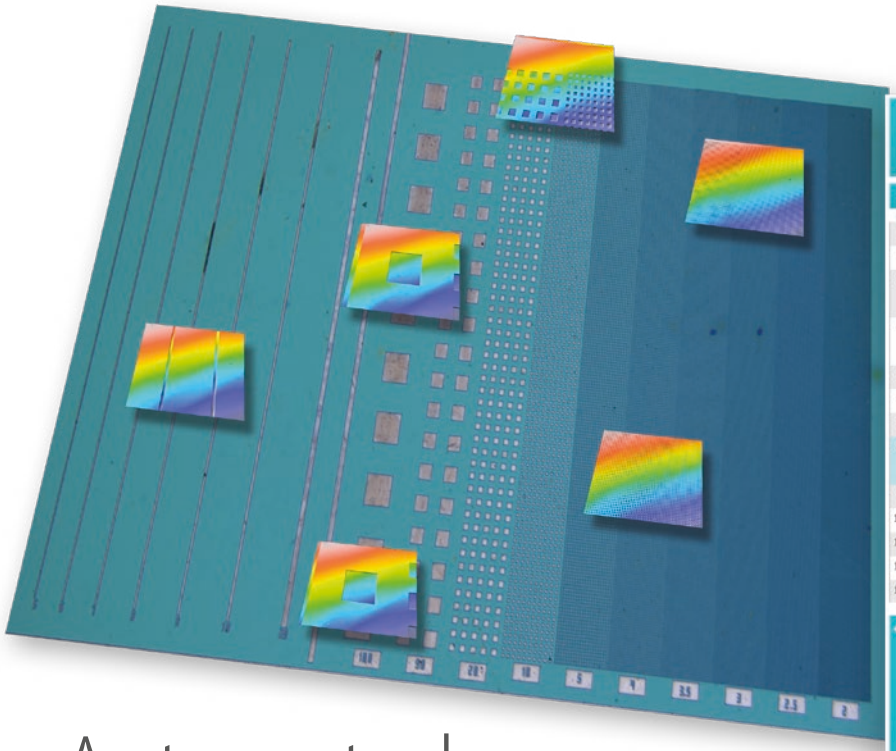
Extended measurements module

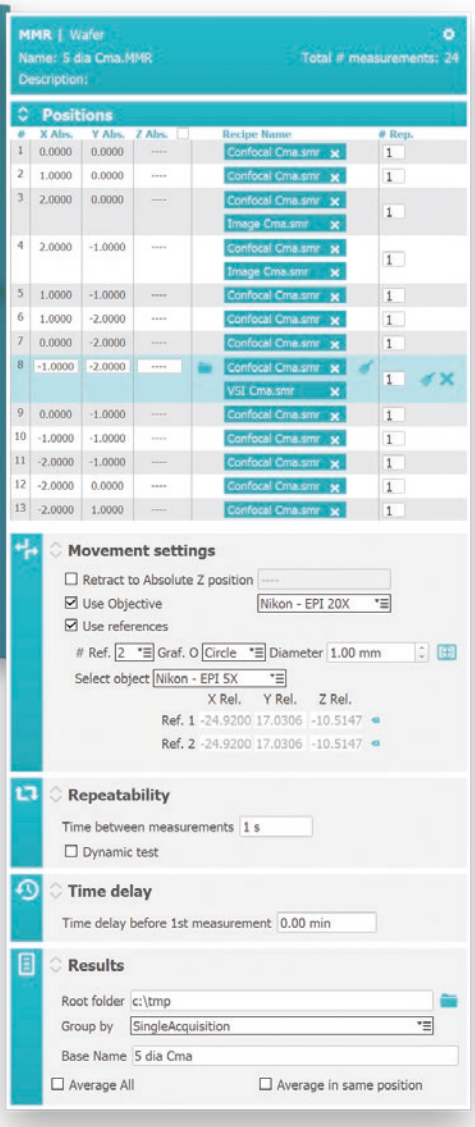
The area can be automatically cropped to rectangular, circular or ring areas of interest. Wide areas up to 500 million pixels are possible. Several scanning strategies such as autofocusing on each field, or focus tracking to minimize vertical scanning range are available.

Sensofar is focused on providing customers with a user-friendly software experience. The redesigned UI and improved algorithms for the extended measurement module now give the user the versatility required for every surface, from ultra-smooth to rough surfaces. These changes greatly improve the results for height map and stack images.

Multiple powerful acquisition settings

Numerous acquisition parameters can be adapted to best suit the intended measurement. For example, various autofocus settings help to reduce the acquisition time, the HDR function helps to improve the illumination of complex 3D structures and selectable Z-scan options also provide an opportunity to optimize the acquisition for varying 3D surfaces.



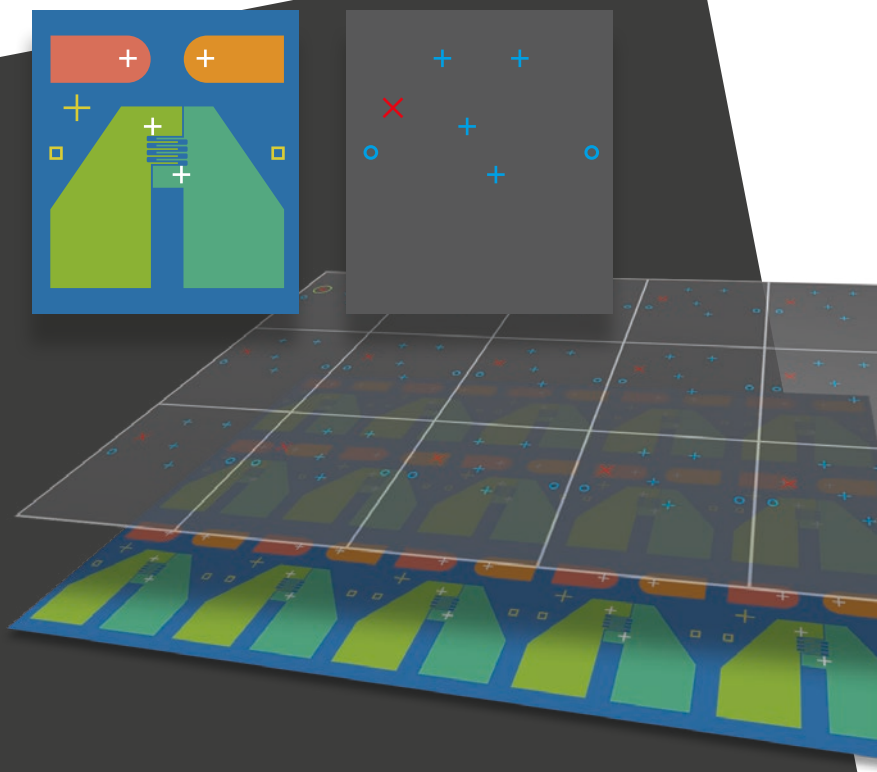


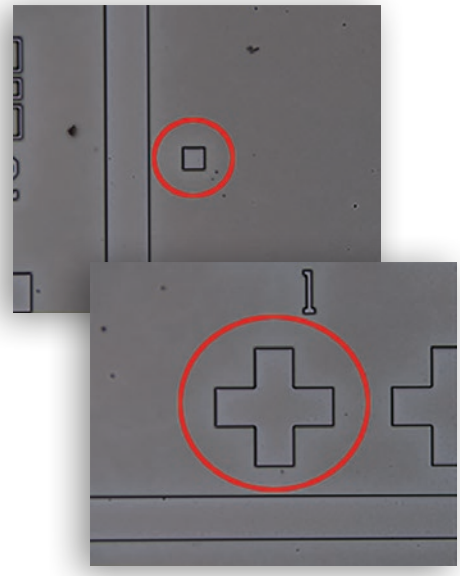
Automated procedures module

The automated procedures module is an easily customizable tool for creating quality control procedures. Creating and running multiple measurement recipes is accomplished using our recipe tool that commands the system to perform several measurements at pre-defined positions. The module combined with tools such as the user manager, sample identification, data exportation, and 'pass or fail' tolerance comparison provides all what is need for QC inspection.

Ready for arrays of samples

The S neox introduces a new functionality that allows to replicate a defined multiple measurement recipe to an array of samples. The multiple measurements will thus be repeated at each sample relative to each sample's reference point. This simplifies the programming of these recipes, as the recipe is defined only once, and improves the reliability. This will solve long-standing requirements from customers working in QC 24/7.





Automatic reference recognition

The S neox now includes automatic detection of fiducials, based on pattern matching algorithms, that enables fully-automated operation without human interaction. What used to be difficult and imprecise, now becomes easy, repetitive, and accurate. The combination of this reference recognition and our automated routines is a step-forward towards industry 4.0.

System validation package

Every S neox is manufactured to deliver accurate and traceable measurements. Systems are calibrated using traceable standards following the ISO 25178 standard part 700 and part 600 for: Z amplification factor, XY amplification factor, flatness deviation, measurement noise as well as parcentricity and parfocality. Any metrology instrument must fulfill it before providing any result.

ISO

CALIBRATION
Estimation of metrologic characteristics

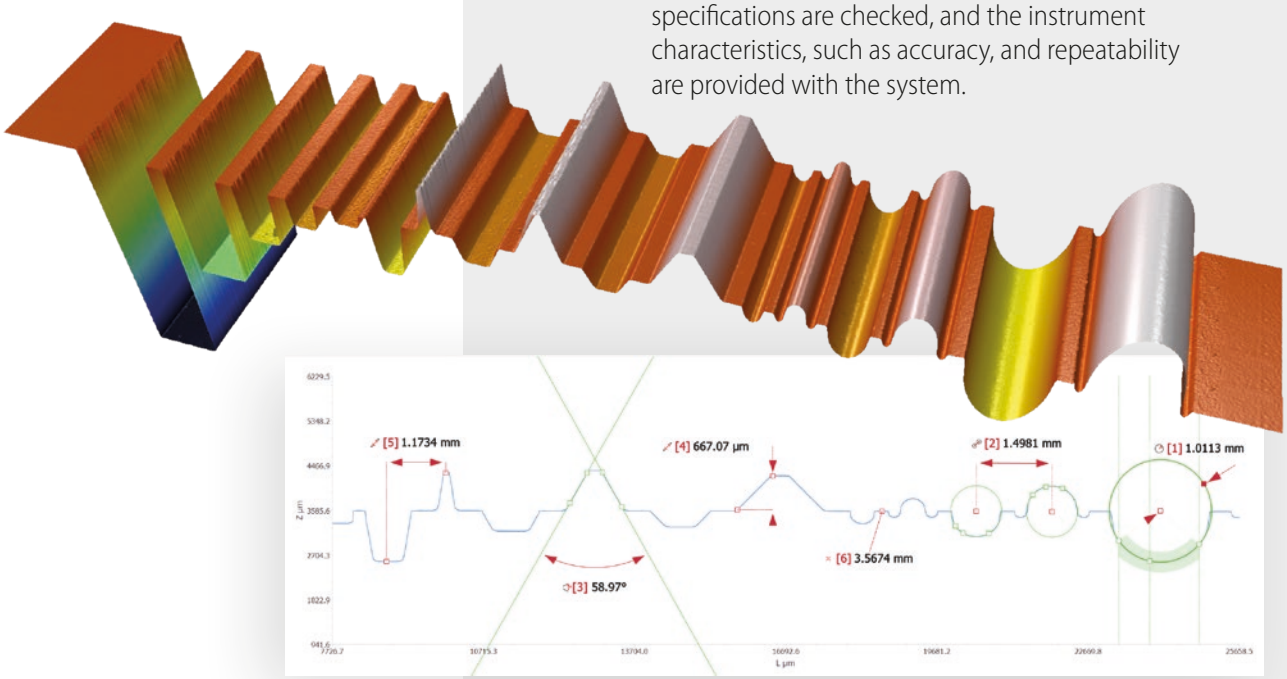
ADJUSTMENT
Correction of systematic errors

VERIFICATION
Test of the validity of calibration and adjustment

PERFORMANCE SPECIFICATION
Specification of instrument characteristics

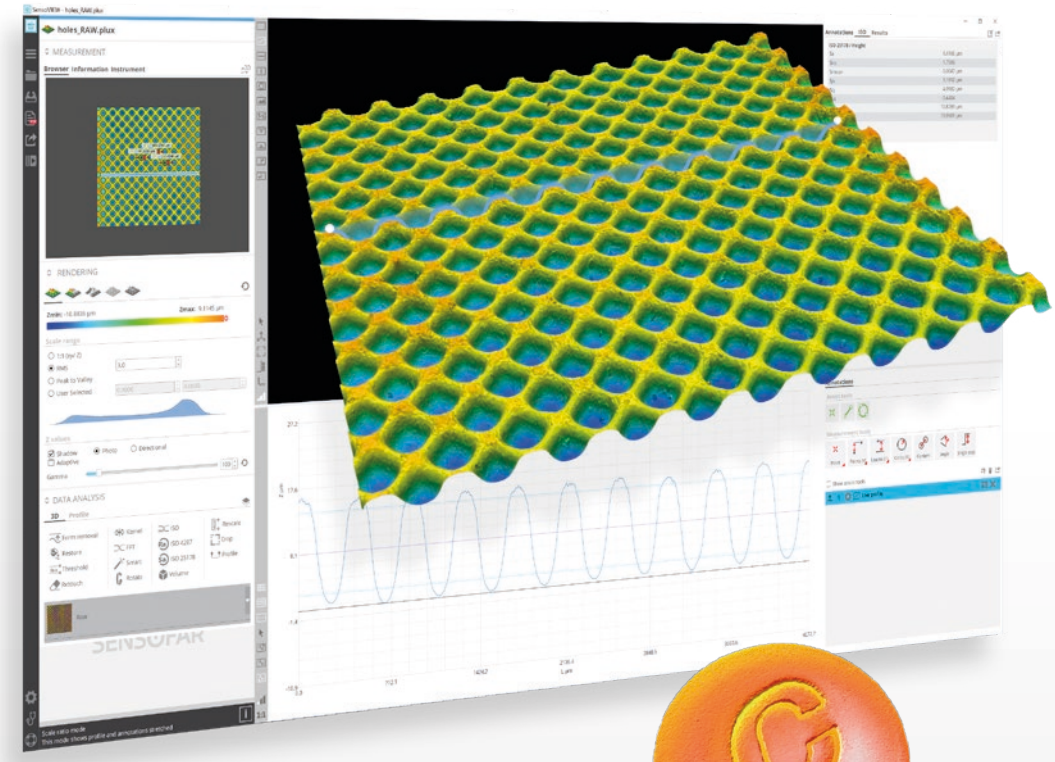
Sensofar systems are in accordance to ISO 25178 standard, providing a truly reliable instrument for surface characterization.

Every S neox is **calibrated** to estimate the metrological characteristics using a traceable calibration standard, **adjusted** to correct systematic errors and **verified** to match the calibrated value. Finally, the **performance** specifications are checked, and the instrument characteristics, such as accuracy, and repeatability are provided with the system.



SensoVIEW

Powerful analysis software



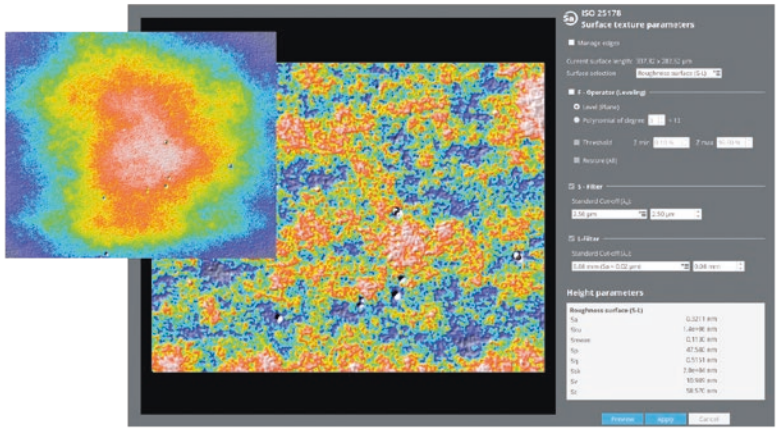
SensoVIEW is the ideal analysis software for a broad range of analysis tasks. It includes a comprehensive suite of tools for preliminary examination and analysis of 3D or 2D measurements, allowing roughness or volume calculations and measuring critical dimensions with a set of analysis tools. The analysis can be saved and applied to several measurements.

The most perceptive visualization of your topographies

Five smart visualization modes (false color, stack, stack & false color, true color or directional luminance) are always within reach in the main screen.

Image control options are always in continuous development for an excellent fit to all sample types and customer needs. A full range of image processing settings are included in each of the rendering visualizations choices and presented together with scale options for a better adjustment.

ISO 21920, 25178 and 12781 calculations



Dedicated operators are available to simplify the calculation of surface texture parameters following ISO standards: ISO 21920 for roughness on profiles, ISO 25178 for roughness on areas, and ISO 12781 for flatness.

Simple yet powerful, designed for you

This dynamic software provided with the Sensofar systems offers a complete set of user friendly tools for displaying and analyzing measurements. The user is trained and guided through the 3D environment, delivering a unique user experience: Access to operators in just one-click; icons with eye-catching design; a better function understanding; and simultaneous 3D, 2D and profile views are just some of the key features of the SensoVIEW analysis software.

Choose your own view

3D and 2D interactive views provide multiple scaling, display and render options.

Process your data

Full set of operators to process the data information or generate alternative layers.

Interact with analysis tools

Broad range of analysis tools for preliminary examination and analysis of 3D or 2D measurements.

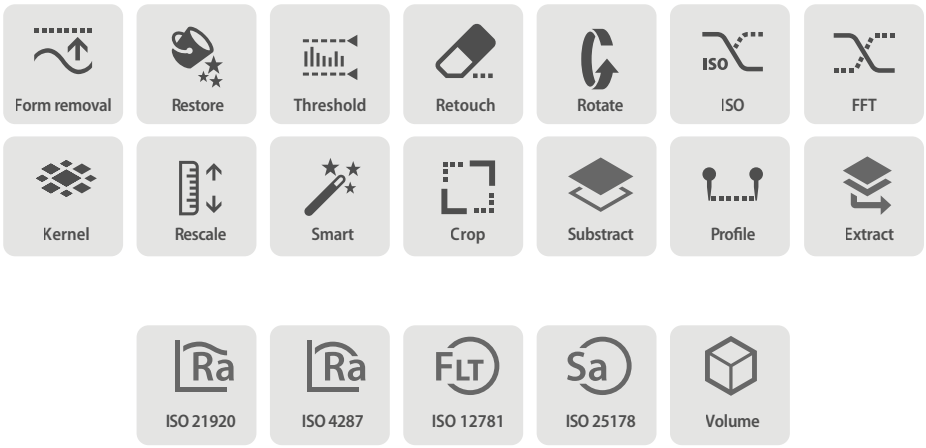
Apply your analysis

Create analysis templates to apply several presets to a series of topographies.

Get your results

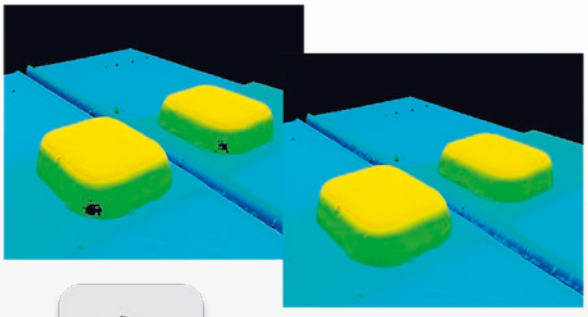
Get a customizable report or export the 3D measurement data in multiple formats.

Guided measurement

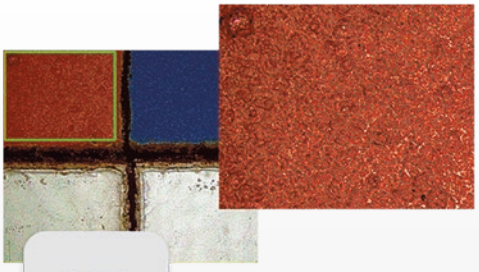


Sequential operators

A smart suite of operators, which can be applied to 3D/2D measurements and profiles, provides the opportunity to remove form, apply a threshold, retouch data points, restore non-measurable data and apply a range of filters and/or generate alternative layers by cropping, subtracting or extracting a profile.

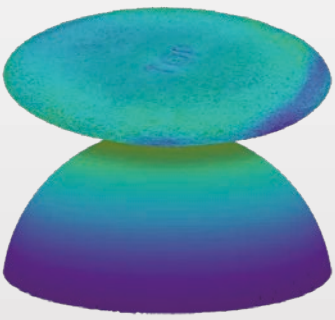


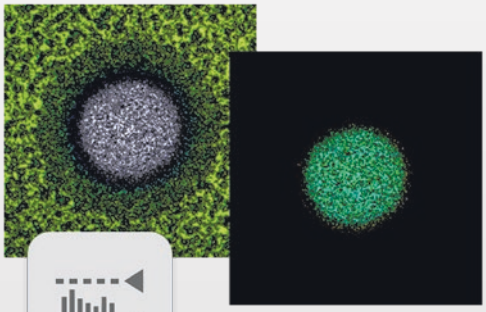
Restore



Crop

Form removal



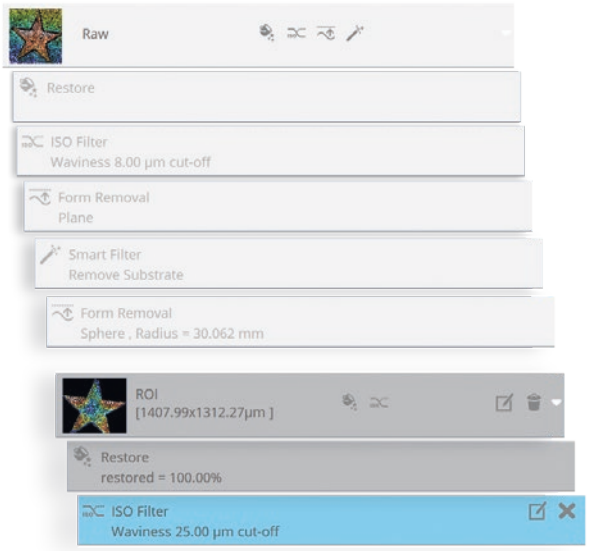


Threshold

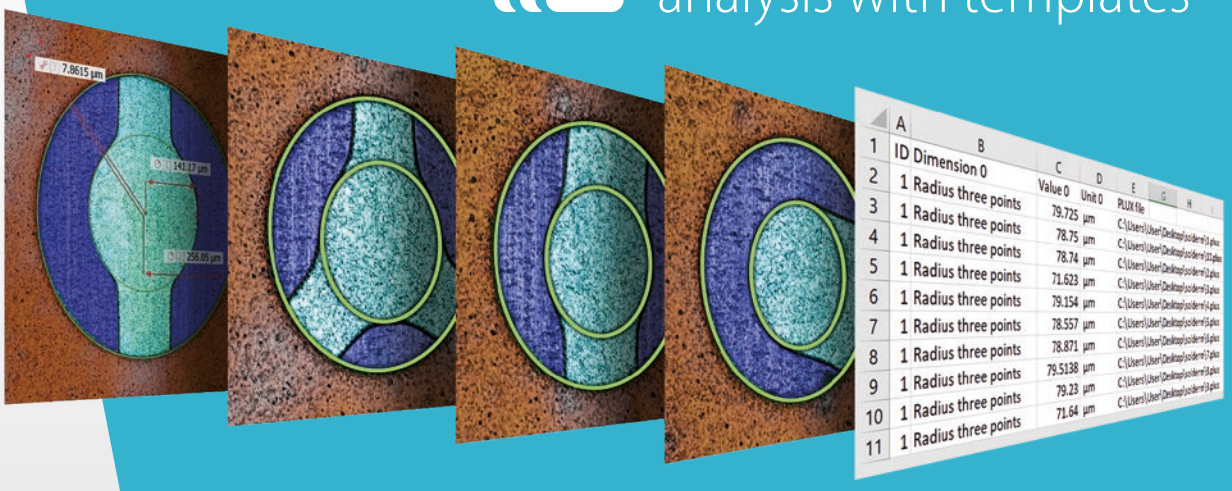
examination

Doing repetitive tasks, efficiently

When a process data analysis is defined, it is possible to create analysis templates to apply these pre-determined filters and operator configurations to repetitive measurements.



Automate your data analysis with templates

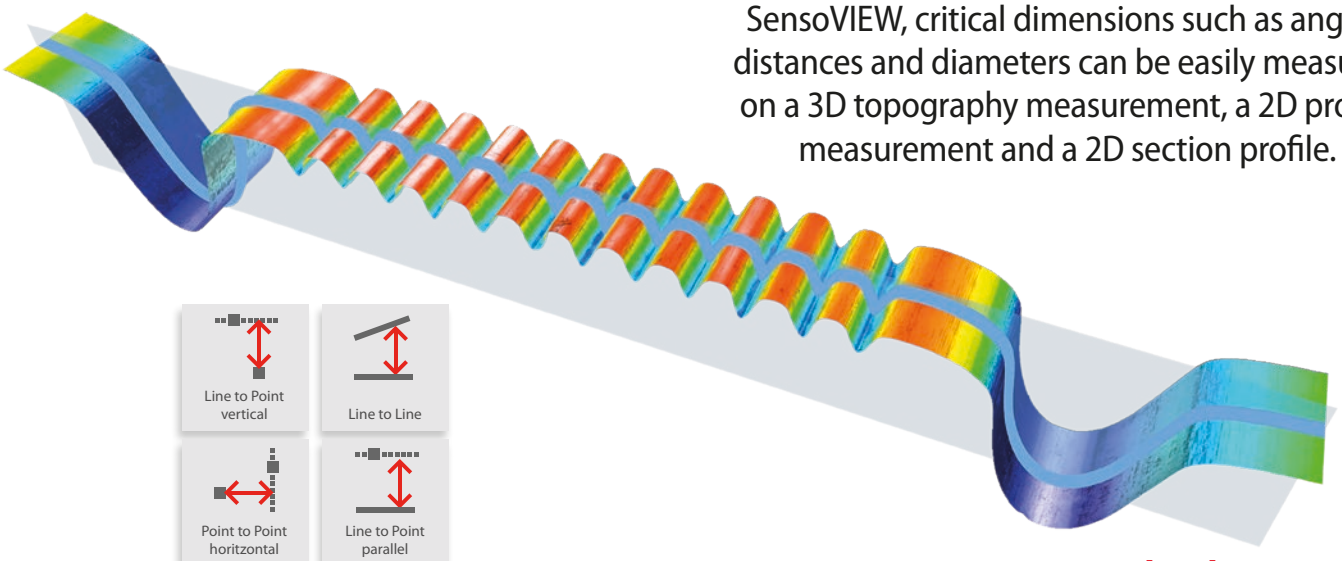


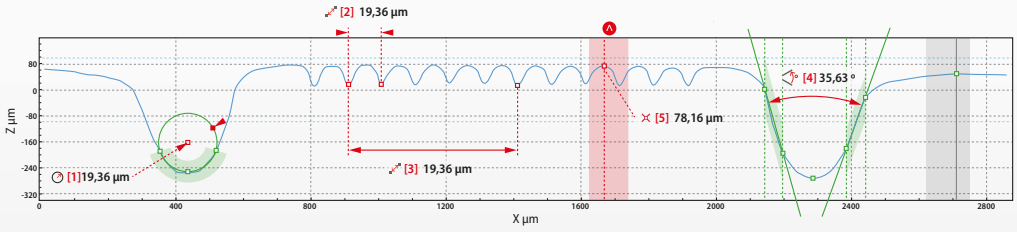
	A	B	C	D	E
1	ID Dimension 0		Value 0	Unit 0	PLUX file
2	1	Radius three points	79.725	µm	C:\Users\User\Desktop\solder\1.plux
3	1	Radius three points	78.75	µm	C:\Users\User\Desktop\solder\10.plux
4	1	Radius three points	78.74	µm	C:\Users\User\Desktop\solder\2.plux
5	1	Radius three points	71.623	µm	C:\Users\User\Desktop\solder\3.plux
6	1	Radius three points	79.154	µm	C:\Users\User\Desktop\solder\4.plux
7	1	Radius three points	78.557	µm	C:\Users\User\Desktop\solder\5.plux
8	1	Radius three points	78.871	µm	C:\Users\User\Desktop\solder\6.plux
9	1	Radius three points	79.5138	µm	C:\Users\User\Desktop\solder\7.plux
10	1	Radius three points	79.23	µm	C:\Users\User\Desktop\solder\8.plux
11	1	Radius three points	71.64	µm	C:\Users\User\Desktop\solder\9.plux

When the analysis process is defined, the user can create a template to apply it to multiple measurements. The template will contain all the information from the filters, operators, and critical dimensions used, as well as the export settings. Besides that, any possible shift or rotation between the template and the topography can be corrected using SensoVIEW's pattern recognition algorithms.

Measuring critical

Always with the priority of facilitating operations and procedures for the user, assist tools have been developed for critical dimensions options. Using SensoVIEW, critical dimensions such as angles, distances and diameters can be easily measured on a 3D topography measurement, a 2D profile measurement and a 2D section profile.



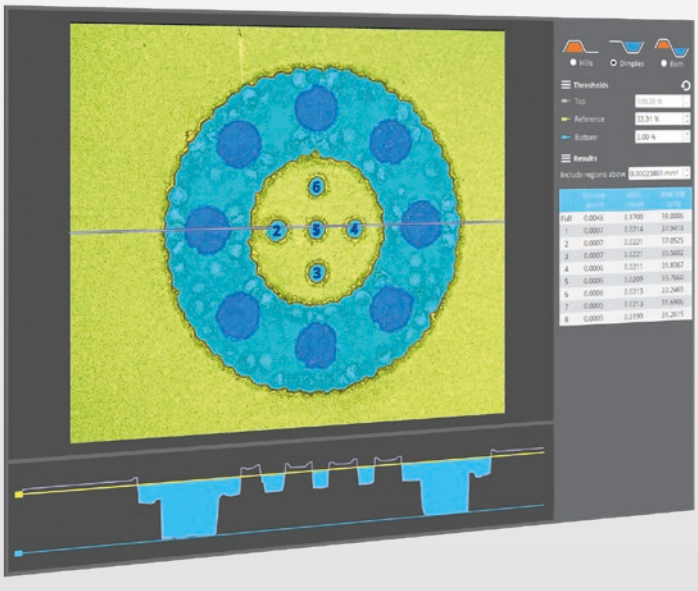


Multiple measurement tools

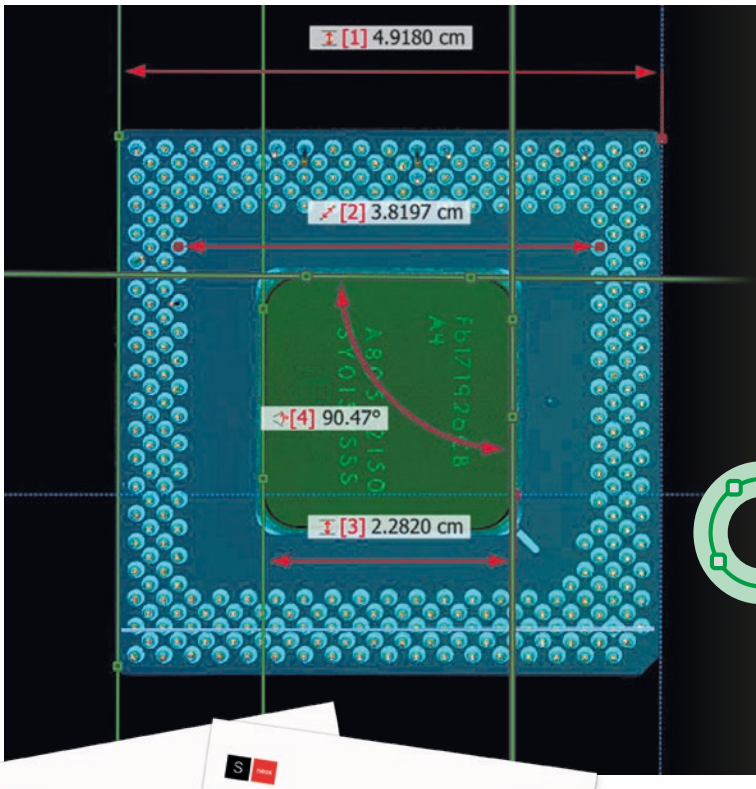
A complete assortment of tools ready to add the most essential dimensions when measuring (radiuses, angles, diameters, step heights and perpendicular & parallel distances). These tools will return a numerical value for a particular dimension.

Volume geometries

Volume calculation allows the user to get the volume of a 3D topography region. Two modes are possible: thresholding (defining the minimum and maximum Z limits) or leveling (defining a ROI by circle, polygonal or rectangular geometries).



dimensions in all axes



Useful assist measurement tools

Assist tools are a quick and handy way to draw the most basic and primary forms (points, lines and circles) in selected rendering views to, later on, add the corresponding dimensions. It is an optional aid when drawing the measurement tools.

Automatic edge detection

The critical dimensions tools have an auto-adjustment feature. To activate it, the user just needs to right-click and drag over the point, line, or circle drawn in the scene to have it adjusted to the features of the sample.

Customizable reports

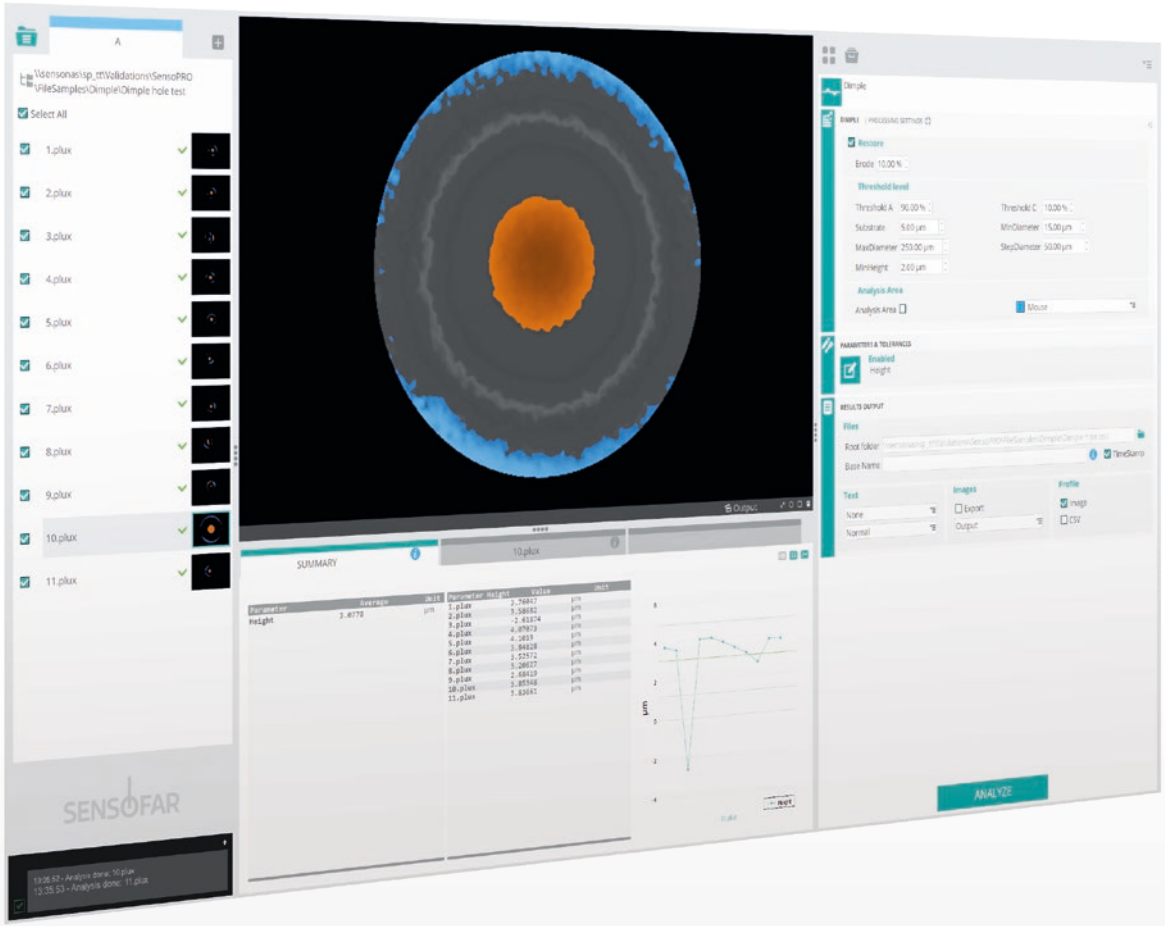
With the possibility to choose from different report templates, the user can configure every section to fit as much as possible to their requirements. A flexible way to obtain clear and well-structured reports for each measurement, showing the acquisition information, 3D data, a 2D profile and all the ISO parameters, among others.

SensoMAP

SensoMAP, based on Mountains technology from Digital Surf, is an extremely powerful tool for analysis and reporting. SensoMAP software is completely modularly adaptable to customer requirements. Two levels (standard and premium) and several modules (2D, 3D or 4D modules, Advanced Contour, Particles Analysis, Statistics and Shell CAD Compare) are available.

SensoPRO

Rapid Quality Control



It has never been so easy to perform fast quality control in a production line. Thanks to SensoPRO, the operator in the production line only needs to load the sample and follow guided instructions. Plug-in-based data analysis algorithms provide a high degree of flexibility.

Automatic recognition of the features of interest

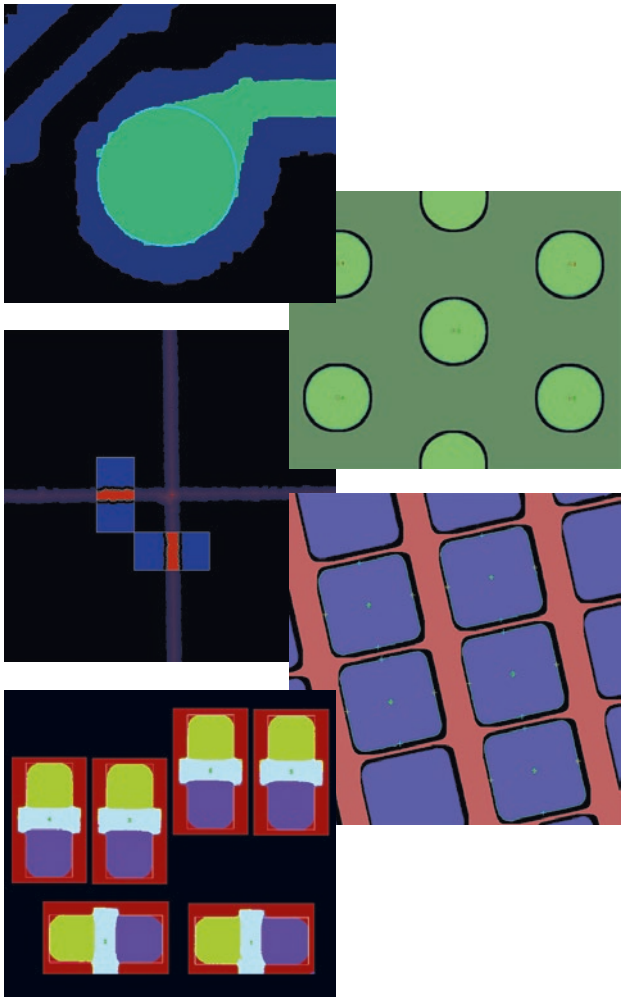
Analysis of a massive datasets (>100 files)

One second processing time per file

Configurable processing settings and parameters

Command line available for external SensoPRO integration

Pass/Fail reports based on predefined tolerances



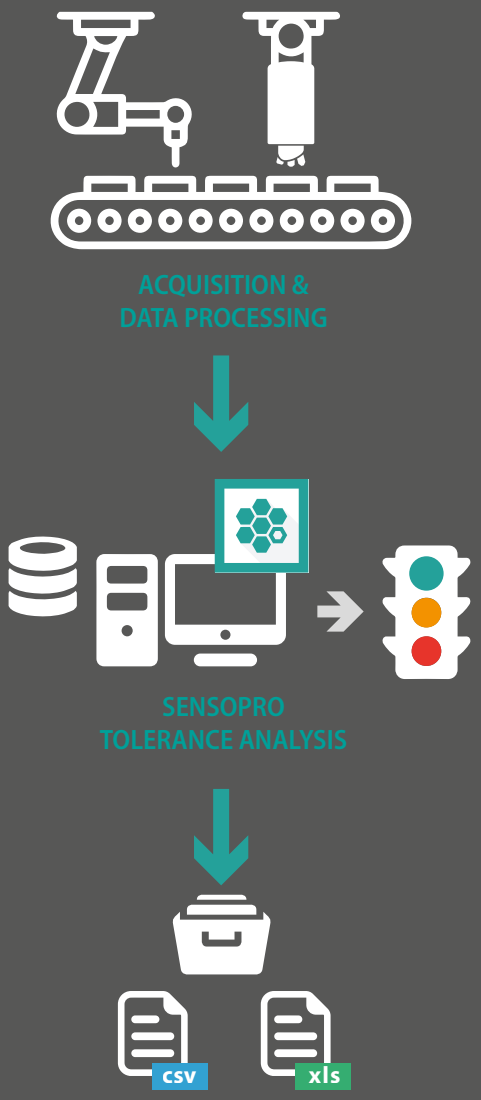
Results

Once the analysis is done, the results and the standard deviations for each parameter are shown on a table. If any tolerances are applied, these will be highlighted in the summary section. A part from that, the data visualization is also discretized, it is reduced to the physical aspects for that feature fitted by the analysis. When multiple features are detected, they are numbered and can be selected to reveal the individual fit parameters.

Parameter	Tolerance	Average	St. Dev.	Median	Max.	Min.	Unit
Sa	-	1.2871	0.0643	1.3114	1.3568	1.1622	µm
Sq	-	1.5062	0.0679	1.5395	1.5812	1.3777	µm
Sz	-	8.2571	0.6008	8.2604	9.1263	7.2603	µm
Sp	-	4.2785	0.3618	4.3899	4.7168	3.6738	µm
Sv	-	3.9786	0.3514	3.9220	4.6820	3.5865	µm
Ssk	-	-0.1990	0.0694	-0.1639	-0.1483	-0.3423	
Sku	-	2.1292	0.1249	2.1601	2.3355	1.9571	
Sal	-	19.4324	0.6795	20.0054	20.0054	18.7161	µm
Str	-	0.0597	0.0021	0.0615	0.0615	0.0575	
Std	-	90.8778	0.0833	90.9000	91.0000	90.7000	°
Sdq	-	0.1956	0.0109	0.1913	0.2133	0.1863	°/µm
Sdr	-	1.7801	0.1733	1.7269	2.0577	1.6286	%
S_ratio	-	1.0178	0.0017	1.0173	1.0206	1.0163	
Smr	-	55.1604	0.3693	55.2070	55.6773	54.5405	%
Smc	-	1.8544	0.1166	1.8390	2.0382	1.6557	µm

How does it work?

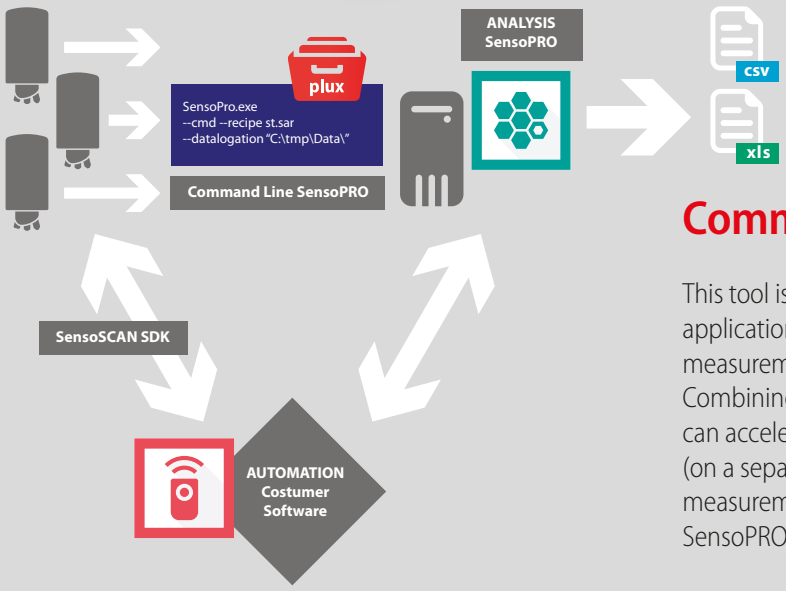
This 64-bit data analysis solution provides an environment for QA engineers and technicians to quickly and easily analyze production parameters. SensoPRO can be linked to the acquisition software (SensoSCAN) so that measured data can be automatically transferred to SensoPRO and analyzed. Once configured, a single-click both acquires and analyzes the measurement data.



Several options for managing the output files from a successful analysis are provided to get a complete report showing pass or fail results.

Guide tool for the QC manager

A revolutionary innovation for optical profilometers which substantially improves its usability and simplifies the task of setting tolerances when creating a recipe, as well as deciding which are the key parameters to control the production line by comparing multiple sets of data. Specially conceived for non-expert users who need traceable production control.

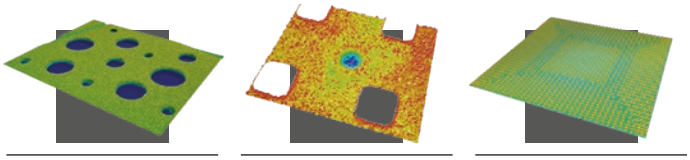


Command line available

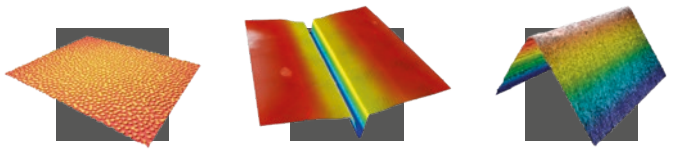
This tool is a solution to create proprietary applications able to manage SensoPRO to analyze measurement acquired with Sensofar systems. Combining this solution with SensoSCAN SDK, we can accelerate QC processes by analyzing in parallel (on a separate computer) while acquiring new measurements. Command line is an easy way to call SensoPRO analysis software from other software.

SensoPRO Plugins

This Plugin-based data analysis approach also provides a high degree of flexibility and specificity, making use of targeted algorithms that are optimized to the exact application needs.



Holes | Dimples | Bumps



Surface charact. | Trenches & Grooves | Edges

Traces | Step height

Generic plugins

An extensive collection of general plugins addresses common structures and shapes encountered in surface characterization, offering efficient solutions for surface analysis.

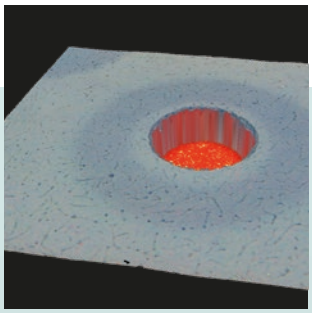
Processing settings

Comprising threshold settings, filters, operators, crop settings, etc., that can be applied to the measured data before the analysis. Each Plugin has its own suite of processing settings.

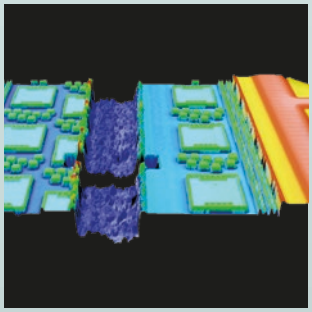
Parameters & Tolerances

Set of fitting parameters and selection of tolerances for further analyses. Optimizes the results, e.g. according to known results, scaling, (manufacturing) conditions and tolerances.

Parameter	Average	St. Dev.	Unit
L1	182.965	1.26832	µm
W1	186.62	0.666153	µm
Z1	16.3865	0.195507	µm
Z2	15.8412	0.2756	µm
ZO1	9.23902	0.539519	µm
ZO2	9.78429	0.621179	µm
L2	192.425	2.06669	µm
W2	186.62	1.05328	µm
SL	455.8	1.94215	µm
SW	189.2	1.05328	µm
D	89.655	1.57992	µm
D1	1.29	1.15381	µm
D2	1.29	2.15858	µm
D3	0.86	1.33231	µm
D4	1.72	1.33231	µm



The Color Concentricity plugin assesses concentricity utilizing both color and height information.



The Wave Groove Line plugin set was designed to acurately define distances between specific lines, disregarding features on the top of the chip.

Custom plugins

What sets SensoPRO apart is its ability to fulfill custom requirements. With over 60 plugins developed, SensoPRO has covered the distinctive needs of applications that demand complete automated analysis. Have a look at the following examples:

Do you need a custom solution?

We can adapt and develop any analysis solutions for your application.

Why 4-in-1 tech

Ai Focus Variation

Active illumination Focus Variation is an optical technology that has been developed for measuring the shape of large rough surfaces. This technology is based on Sensofar's extensive expertise in the field of combined confocal and interferometric 3D measurements, and is specifically designed to complement confocal measurements at low magnification. It has been improved with the use of active illumination to get more reliable focus location even on optically smooth surfaces. Highlights of the technology include high slope surfaces (up to 86°), highest speed (up to 3mm/s) and large vertical range measurements.

Confocal

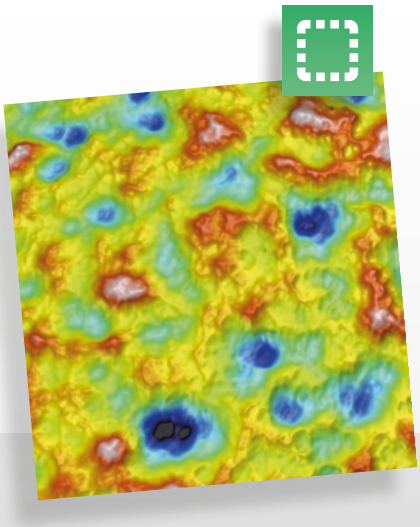
Confocal profilers have been developed to measure the surface height of smooth to very rough surfaces. Confocal profiling provides the highest lateral resolution, up to 0.15 µm line & space, with spatial sampling can be reduced to 0.01 µm, which is ideal for critical dimension measurements. High NA (0.95) and high magnification (150X) objectives are available to measure smooth surfaces with steep local slopes over 70° (for rough surfaces up to 86°). The proprietary confocal algorithms provide vertical repeatability on the nanometer scale.

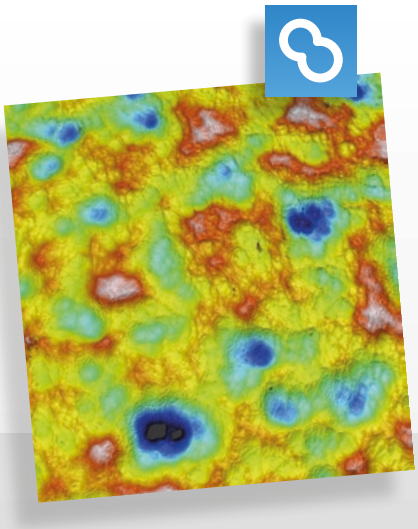
Interferometry

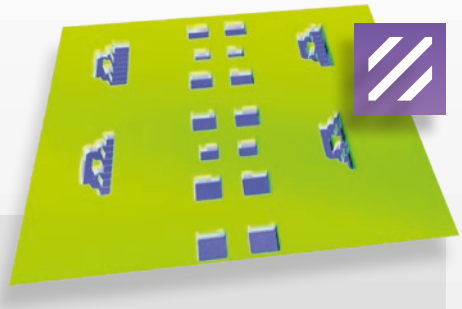
PSI Phase Shift Interferometry has been developed to measure the surface height of very smooth and continuous surfaces with sub-Angstrom resolution, for all numerical apertures (NA). Very low magnifications (2.5X) can be employed to measure large fields of view with the same height resolution.

CSI Coherence Scanning Interferometry uses white light to scan the surface height of smooth to moderately rough surfaces, achieving 1 nm height resolution at any magnification.

EPSI Extended Phase Shifting Interferometry combines two interferometric technologies, CSI and PSI, overcoming the limitations of the two by achieving 0.1 nm of measurement noise in a larger range of some hundreds of microns.

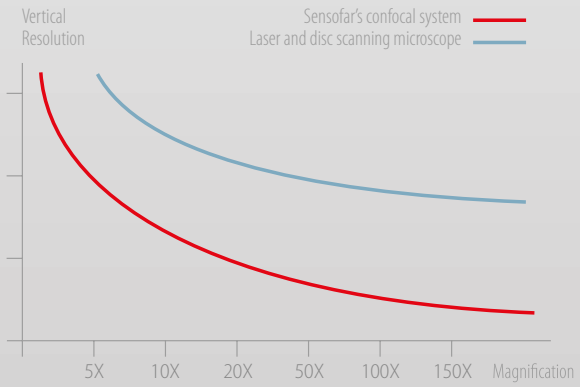






No moving parts

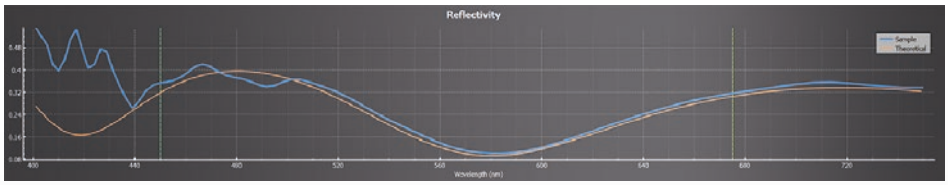
The confocal scanning technique implemented in Sensofar's systems is a Microdisplay Scan Confocal Microscope (ISO 25178-607). The microdisplay creates a rapidly switching device with no moving parts, making data acquisition fast, reliable and accurate. Due to this and the associated algorithms, Sensofar's confocal technique yields a class-leading vertical resolution, better than other confocal approaches and even better than laser scanning confocal systems.



nologies?

Thin film

Thin film measurement technique measures the thickness of optically transparent layers quickly, accurately, non-destructively and requires no sample preparation. The system acquires the reflectance spectrum of the sample in the visible range, and is compared with a simulated spectra calculated by the software, with layer thickness modification until the best fit is found. Transparent films from 50 nm to 1.5 µm can be measured in less than one second. Sample evaluation spot diameter is dependent on the objective magnification which can be as low as 0.5 µm and up to 40 µm.

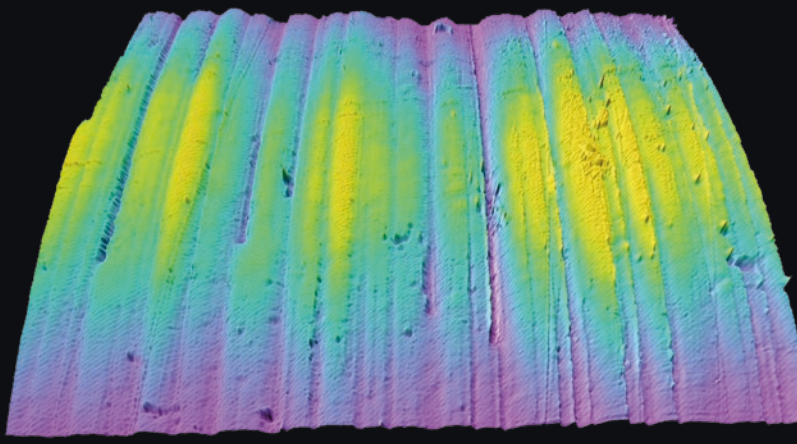


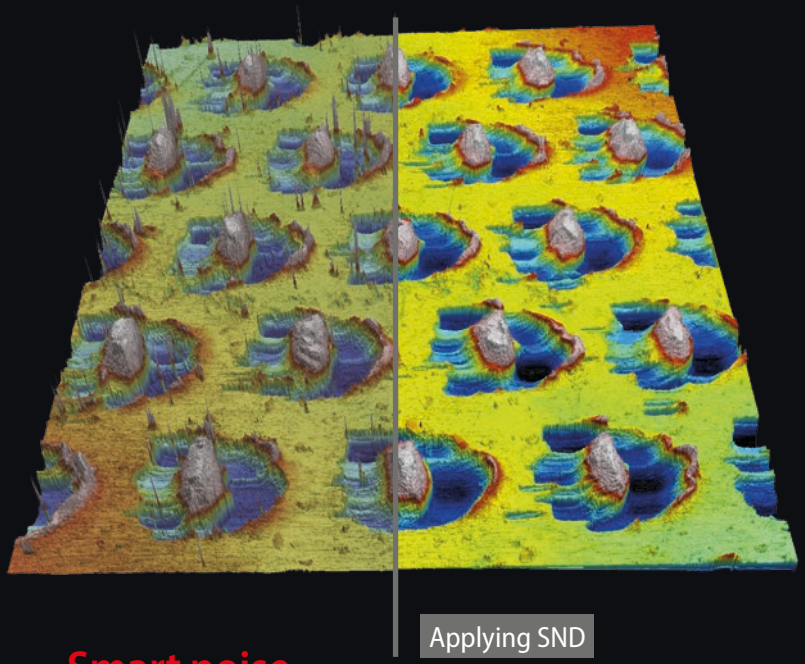
	Ai FOCUS VARIATION	CONFOCAL	INTERFEROMETRY
Rough samples	★★★	★★★	★
Smooth samples	★	★★	★★★
Micro-scale features	★★	★★★	★★★
Nano-scale features		★★	★★★
High local slopes	★★★	★★	★
Thickness		★★★	★★★

Features that make the

Continuous Confocal

Revolutionary step in Confocal measurement technology, steadily reducing the acquisition time by a factor of 3. Continuous Confocal mode avoids the discrete (and time-consuming) plane-by-plane acquisition of classical Confocal by simultaneously scanning the in-plane and Z axis. Essential for reducing acquisition times for large area scans and large Z scans.





Applying SND

Smart noise detection

S neox uses a detection algorithm (SND) to detect those pixels in which the data is not reliable. In comparison to other techniques that use spatial averaging, S neox does this process pixel by pixel without compromising lateral resolution.

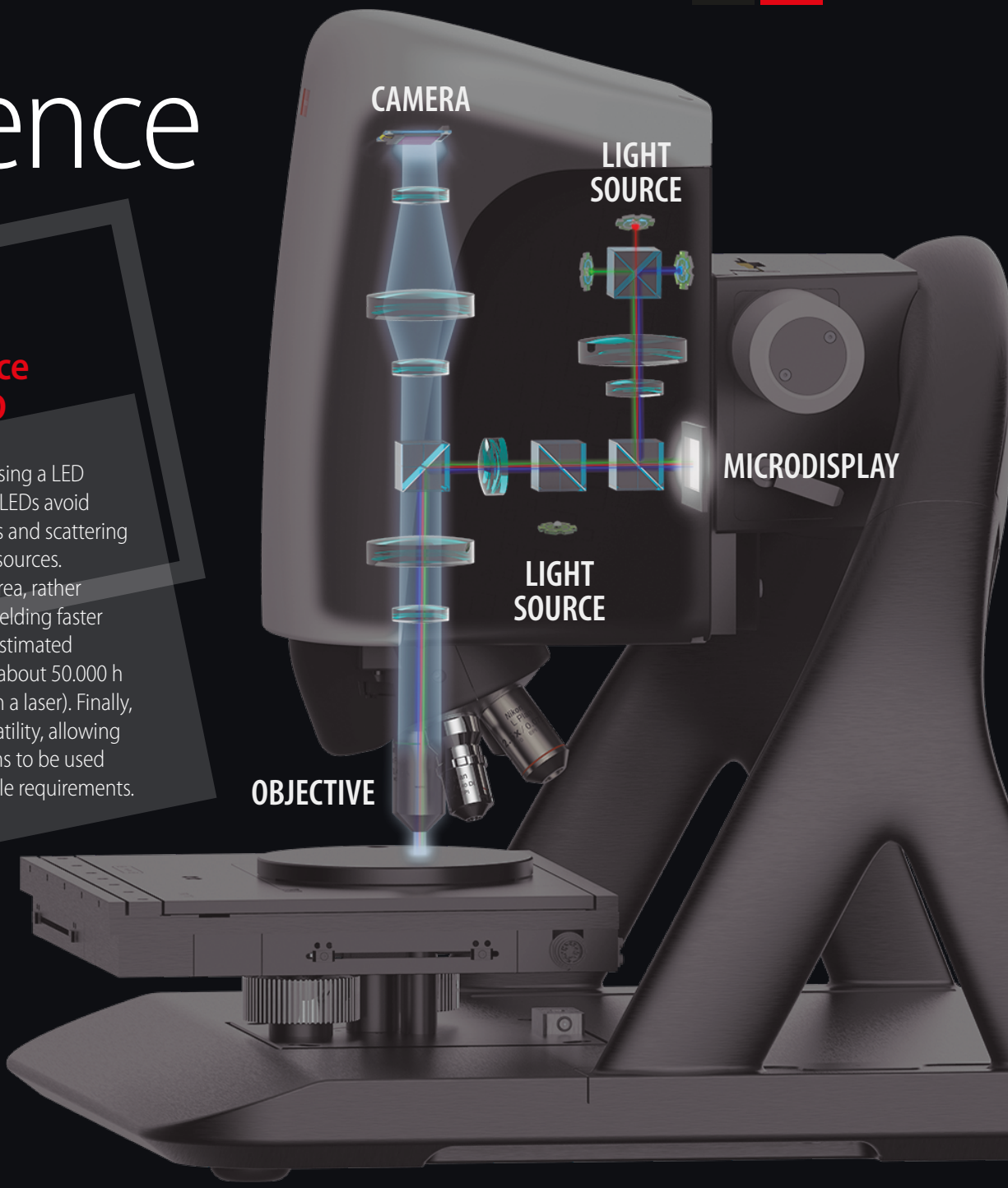
HDR

High Dynamic Range mitigates reflection and drop-out points on highly reflective surfaces.

difference

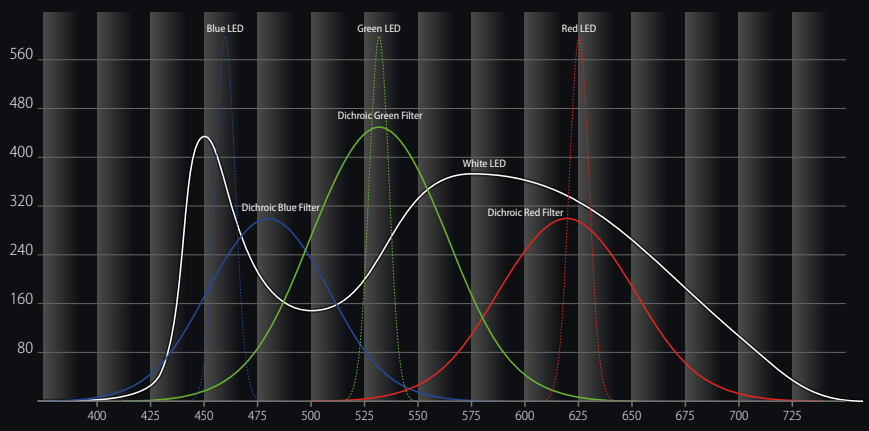
Improving performance using a LED

The advantages of using a LED over a laser are vast. LEDs avoid interference patterns and scattering typical of laser light sources. LEDs illuminate an area, rather than a single spot, yielding faster measurement. The estimated lifetime of an LED is about 50.000 h (25 times better than a laser). Finally, they offer great versatility, allowing different wavelengths to be used depending on sample requirements.

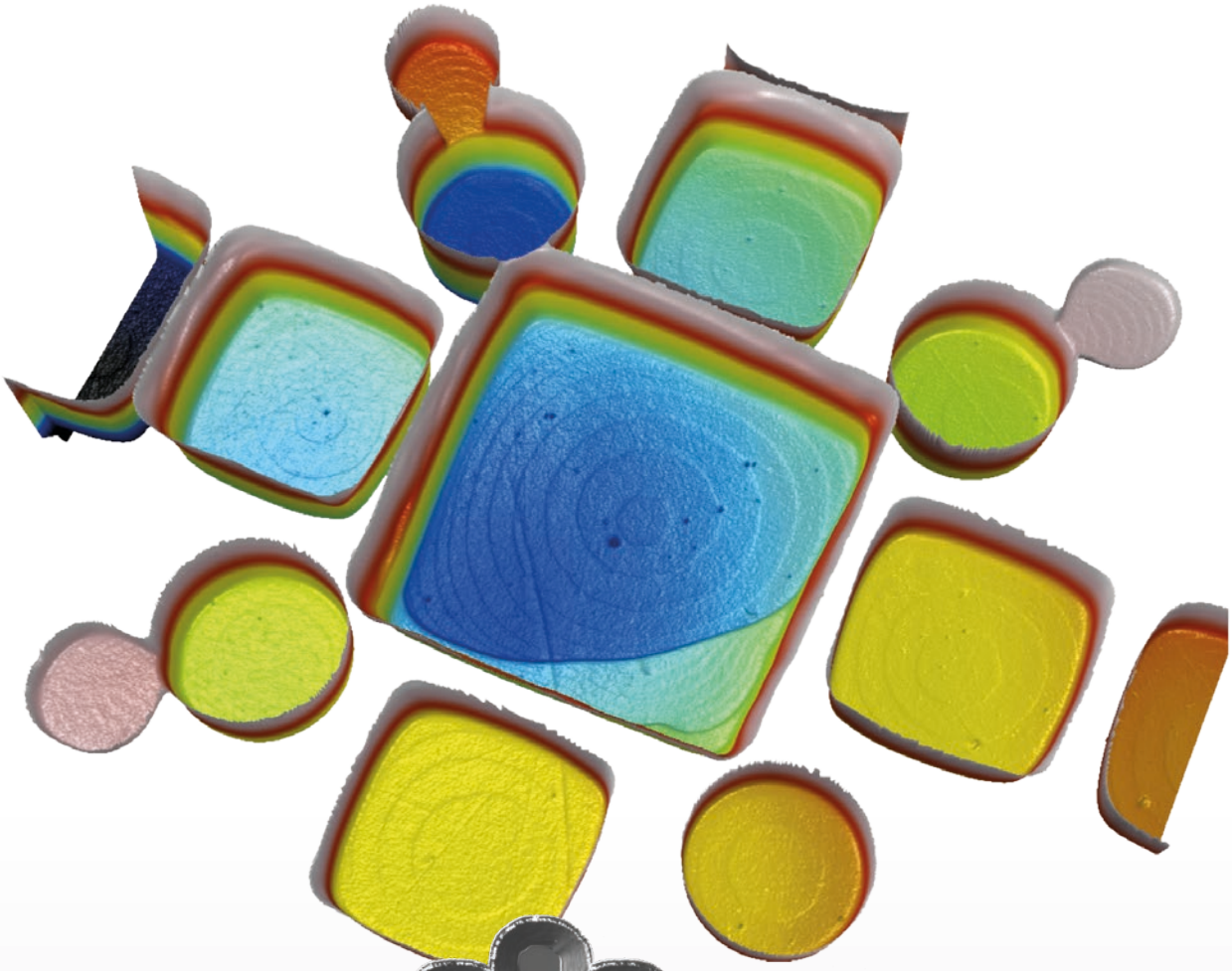


Multispectral wavelength LEDs

Focused on optimizing the light source for each application, S neox has four LED light sources inside its optical core: red (630 nm), green (530 nm), blue (460 nm) and white. Shorter wavelength is used on those applications where the highest lateral resolution is required. Longer wavelengths provide greater optical coherence, up to 20 µm, making Phase Shifting Interferometry possible on large area smooth surfaces. Additionally, the red, green and blue LEDs are pulsed to acquire real color images and high contrast color-coded depth information in real time.



Outstanding lateral &



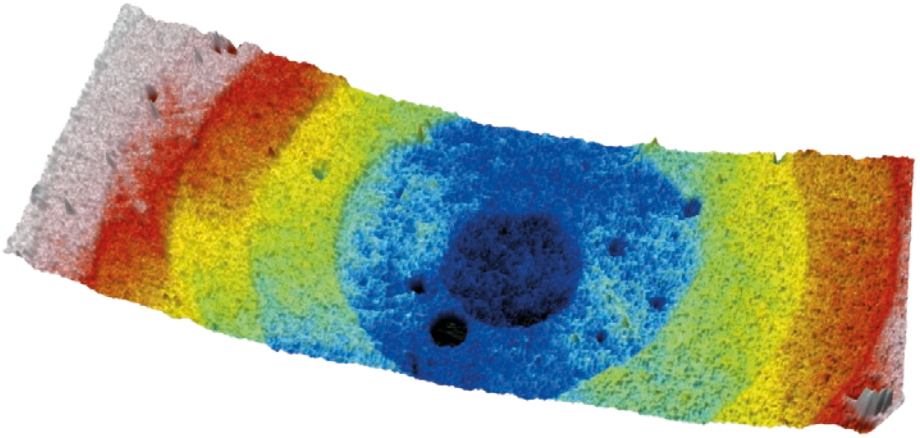
DIC observation

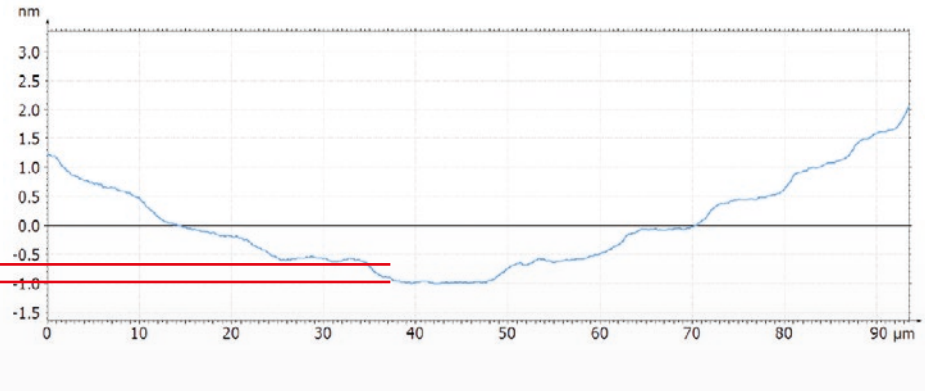
Differential Interference Contrast (DIC) is used to emphasize very small height features that have no contrast in normal observation. With the use of a Nomarski prism, an interferential image is created resolving sub-nanometer scale structures not visible in brightfield or confocal images.

vertical resolution

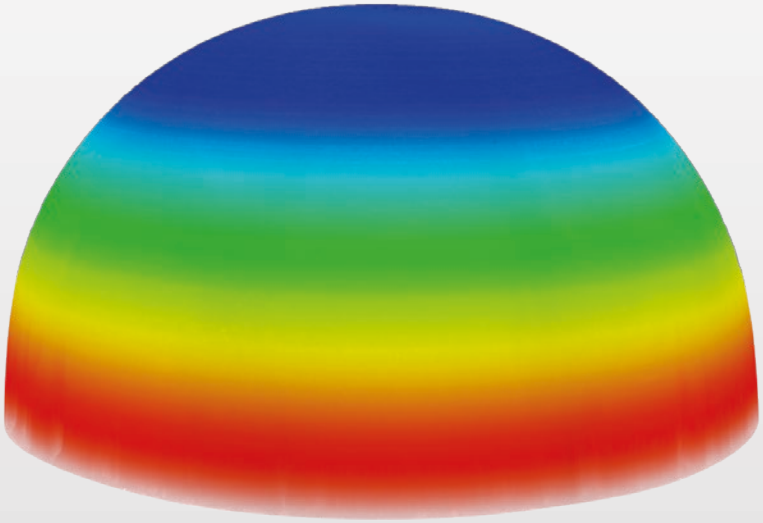
High resolution

Vertical resolution is limited by the instrument noise, which is fixed for Interferometry, but dependent of the numerical aperture for Confocal. Sensofar proprietary algorithms deliver nanometer level system noise for any measurements technique at the highest possible lateral resolution for an optical instrument. The topography shown is a sub-nanometer (0.3 nm) atomic layer. Courtesy of PTB.





0.3 nm
Step height



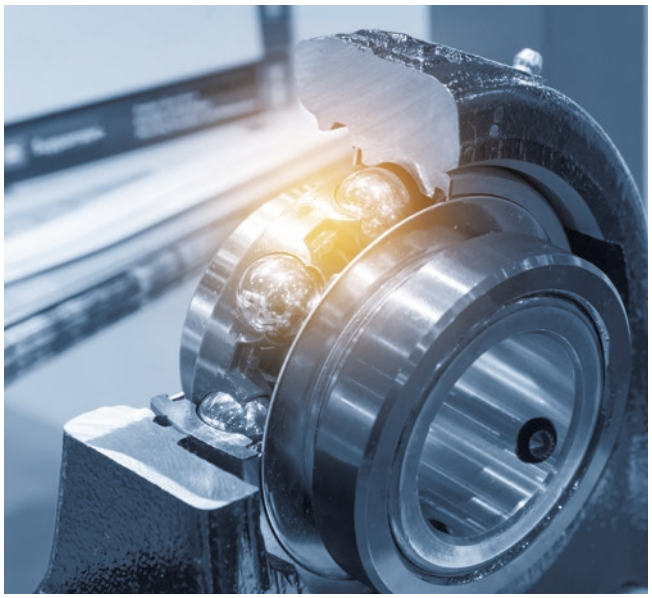
High slopes

Numerical Aperture (NA) of the microscope objective limits the maximum measurable slope on optically smooth surfaces, while optically rough, or scattering surfaces, provide signal beyond that limit. Sensofar algorithms are designed to measure up to 71º on smooth surfaces (0.95 NA), and up to 86º on rough samples.

USER'S EXPERIENCE

> The new S neox is beautifully engineered to make it an outstanding instrument for measuring surface textures
>
> It is amazingly fast and has excellent resolution. The flexibility and combination of Confocal, Interferometry, and Ai Focus Variation, along with excellent analysis options, make it a fantastic tool for a wide range of research and studies, covering many applications, topographies, and materials.

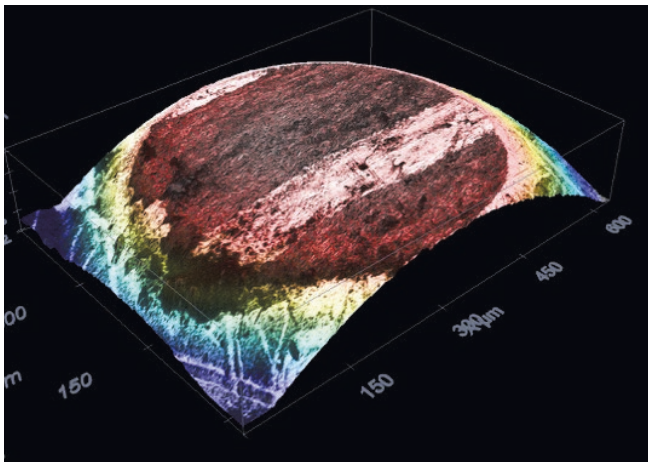
Prof. Christopher A. Brown
Ph.D., PE, FASME
Director, Surface Metrology Lab
Department of Mech I Engineering
Worcester Polytechnic Institute, USA



TRIBOLOGY

Transfer layer evolution during friction in W-C:H coatings

The study focuses on the development of nanocomposite W-C:H coatings with high hardness and simultaneously, with a lower coefficient of friction. Up to now, conventional optical microscopy, SEM/EDS, SEM/FIB and Raman spectroscopy were used to evaluate different aspects of the transfer layer formation. However, the information obtained with the Sensofar 3D optical profilometer, was newly introduced which provided further qualitative and quantitative information about the transfer layer within the whole contact area.



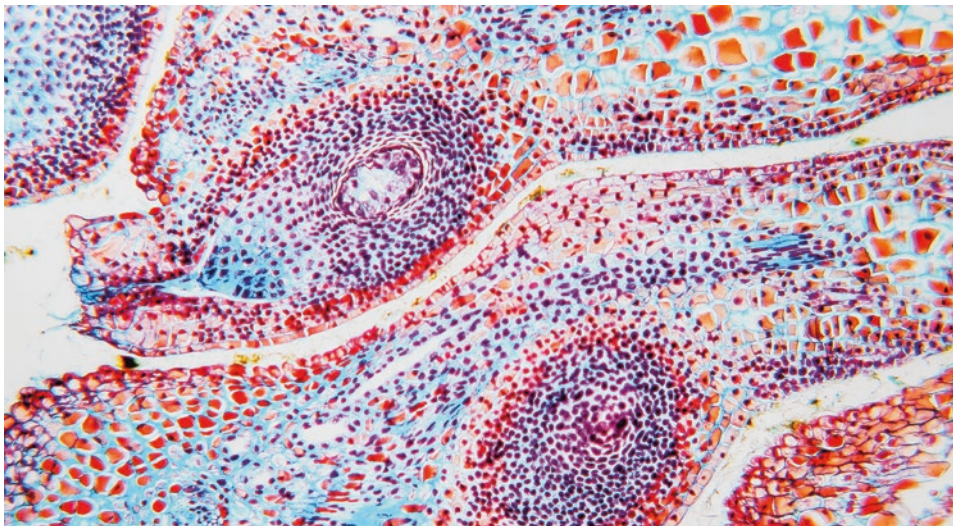
Institute of Materials Research SAV Košice

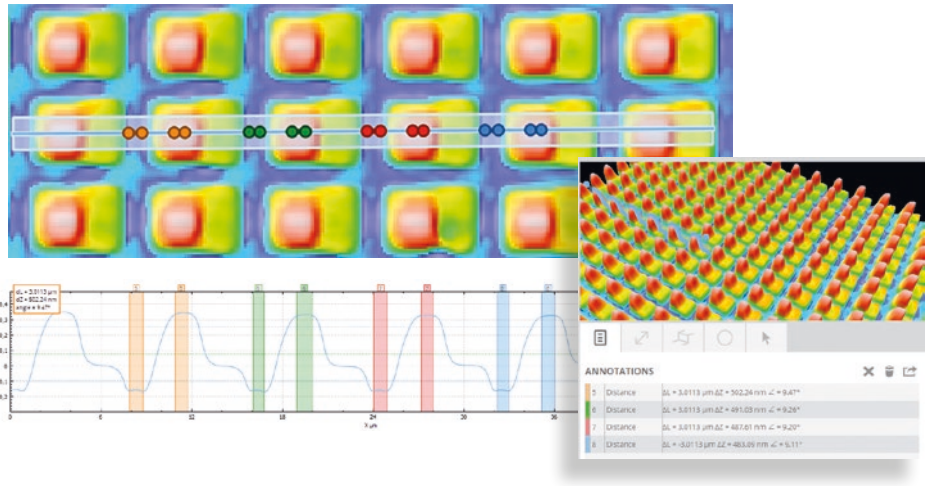
MICROELECTRONICS

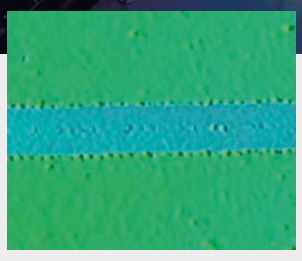
Measurements of the initial deflection of a nano pressure sensor for biological applications

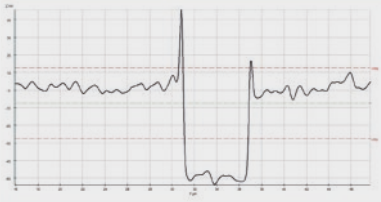
In the fabrication of nano pressure sensors for biological applications, the sacrificial layer etching and the sealing of the two membranes separated by a vacuum gap is critical. Knowing the exact timing of the initial deflection of the membrane after the fabrication process is also key. As samples must be under vacuum pressure, measurements with a SEM may alter their initial state. That's why we chose Sensofar's S neox, since we were able to image and measure, in a quick non-destructive way, the deflection of the membranes after manufacturing.

CENTRO NACIONAL DE MICROELECTRONICA IMSE









CONSUMER ELECTRONICS

Laser structuring of organic optoelectronic devices

To build large-scale organic light emitting diodes (OLEDs) for luminaires requires an invisible series of connections to reduce the device's current and then to mitigate ohmic losses. Laser-etched lines some with a width of a few micrometers and a depth of about 100 nm were monitored. The S neox allows us to detect if the removal process worked by measuring the thin film layers.

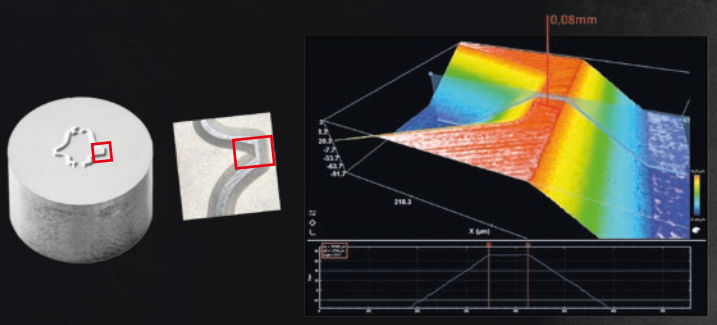
KIT Karlsruher Institut für Technologie

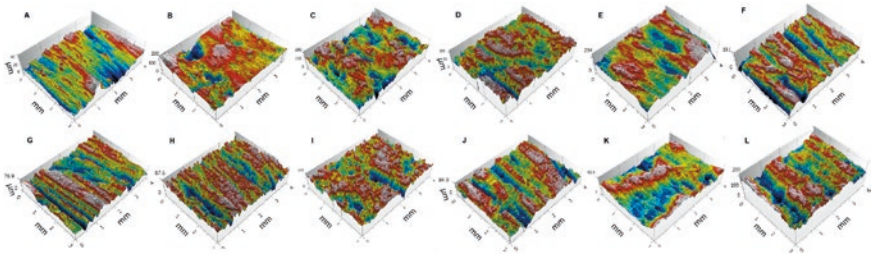
MICROMANUFACTURING

Measurements for femtosecond laser micro-milling and functional texturing

Sensofar's profiler has outstanding lateral resolution, which is a critical requirement to analyze nano structures over micro structures. This is necessary to be sure that the functional texturing will work properly based on the created texture. With the S neox, we are able to obtain fast and non-destructive measurements to assure the micro-millings are delivered within the correct tolerance.

microrelleus



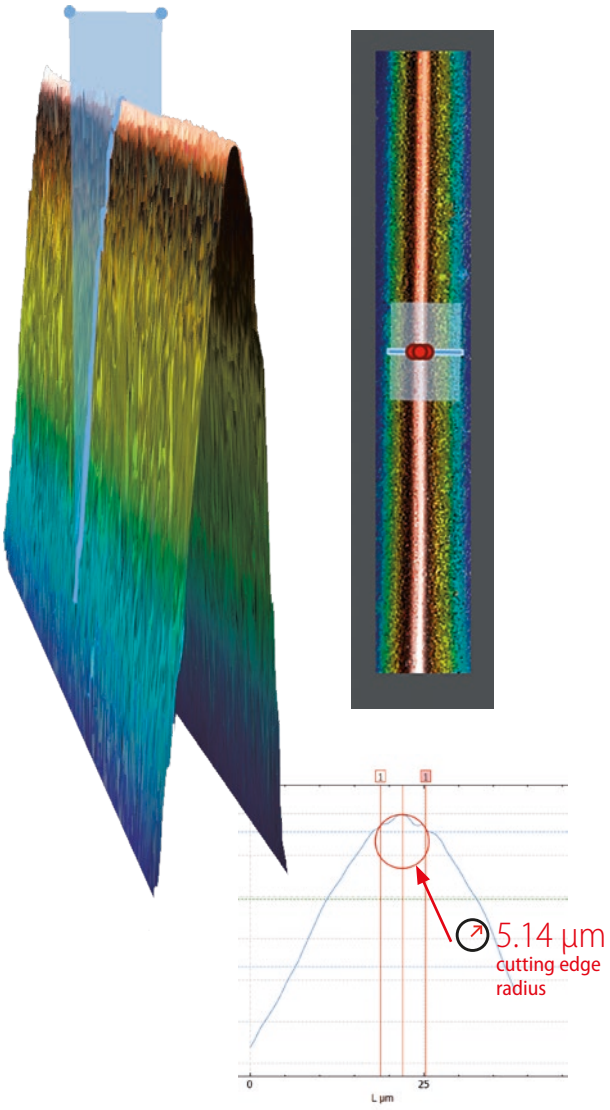


ARCHAEOLOGY

The use of ochre 40,000 years ago in Africa

To analyze pieces of iron-rich mineral fragments and identify facets of ochre pieces ground on different rocks, the Confocal technology was an ideal technique. With the ability of the S neox to measure large areas and large objects, and the set of filters to treat the 3D images, we are able to focus on the roughness of the usewear. It provides key information on the use of these pigments in those societies, and help establish their function through time and when they were first used symbolically in the history of mankind.

université de BORDEAUX



MICROMANUFACTURING

Cutting edge measurement of an insert

Whirling inserts are used to produce threads. The whirling process is complex, that's why there are many different angles (lead angle, angle of rake, clearance angle) on an insert. The 3D optical profilometer S neox Five Axis makes it possible to quickly and flexibly obtain the key parameters necessary for the continuous improvement of our tools, such as the cutting edge radius, clearance and rake angles, or even the roughness at the edge.

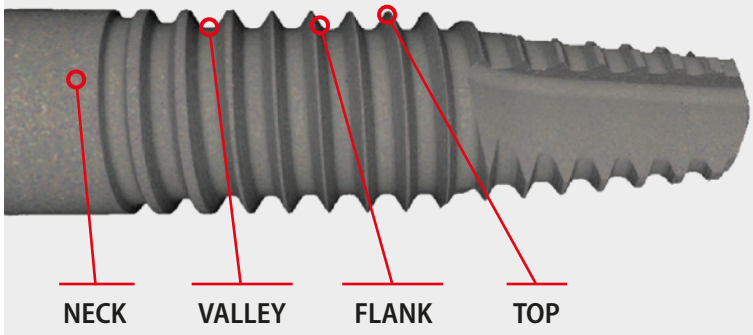
UTILIS
Tooling for High Technology

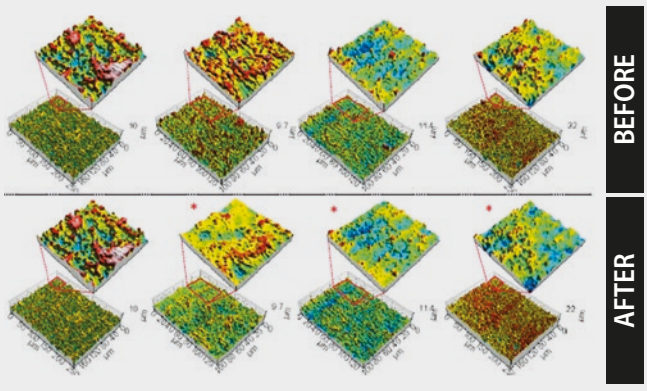
MEDICAL DEVICES

The effect of surgical insertion on dental implant surface topography

Implant research has been focused on the development of new surface treatments to increase surface roughness, aiming to enhance the biological response and ultimately, the osteointegration. The study came to the conclusion that Sensofar's S neox's Confocal technology is an effective technique to characterize different locations on a complex threaded dental implant with high resolution.

MONDRAGON UNIBERTSITATEA





Motorized nosepiece

The motorized nosepiece can hold up to six objectives simultaneously, including brightfield and interferometry objectives. The SensoSCAN software handles the motorized change automatically and corrects automatically any possible parfocality adjustment.

Hardware

Motorized tip-tilt

The motorized tip-tilt has been designed to automatically level the sample in less than 3s. This device reduces sample preparation time, and allows sample leveling in multiple positions for automated applications. The auto-tilt function can be used with all imaging techniques.

Stand structure

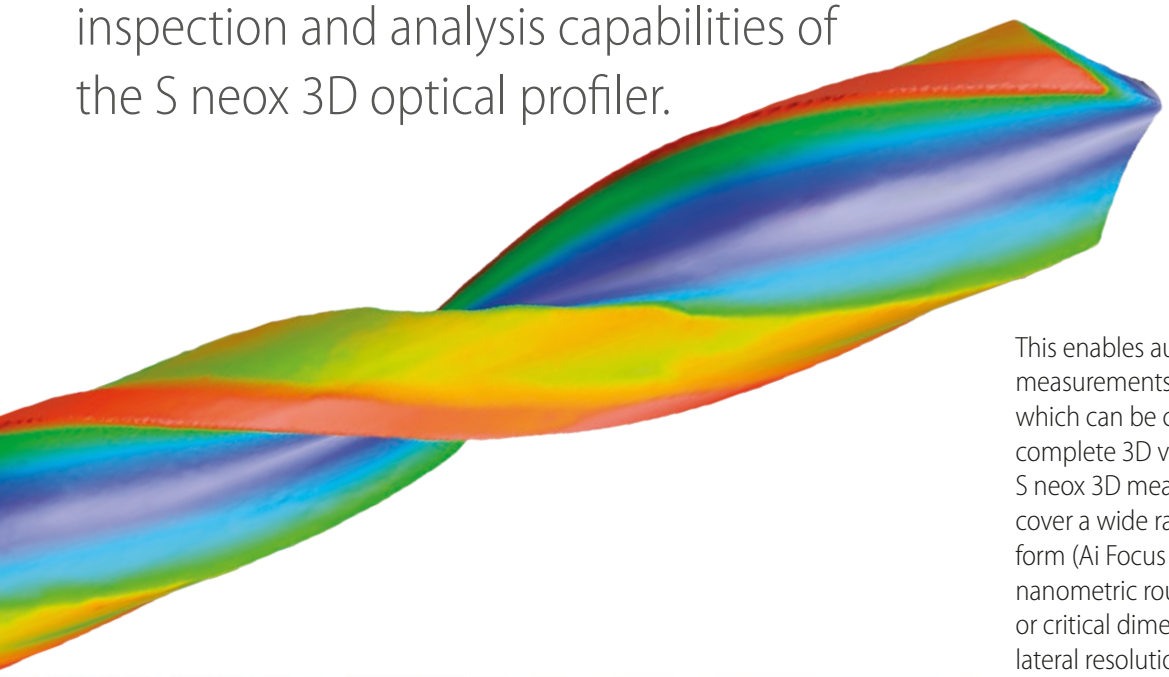
The S neox is a complete tool. Its design is ideal for obtaining a fast, non-invasive assessment of the micro- and nanogeometry of technical surfaces in multiple configurations. S neox provides the flexibility, durability and efficiency required from the standard setup for R&D and quality inspection laboratories to sophisticated, customized solutions for online process controls, measuring samples up to 300x300 mm^2 and maximum height up to 350 mm.

Ring light

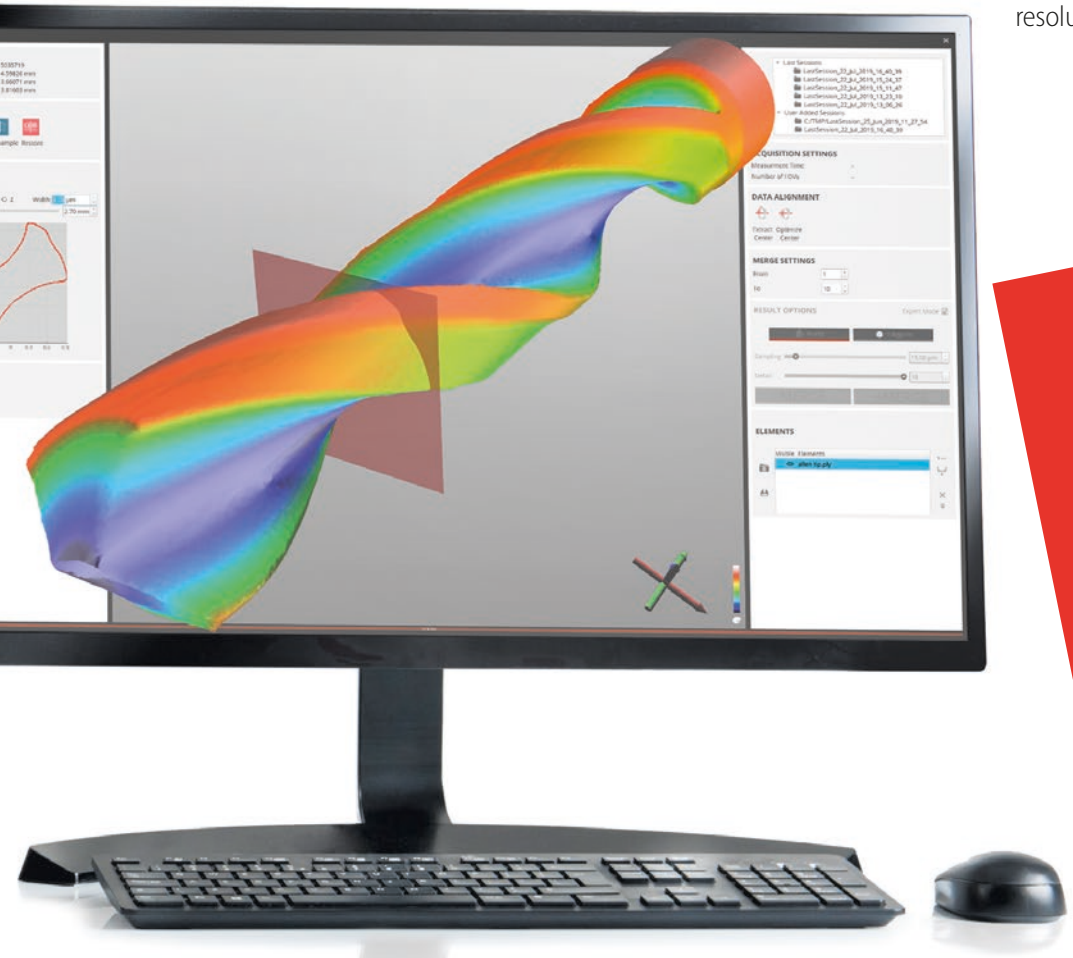
The ring light is based on an LED ring for illuminating samples in a uniform and efficient way. Mounted above and around the objective, the ring light provides increased signal for the Ai Focus Variation technique. This ensures proper illumination at the focal plane.

Complete accessibility

The **S neox Five Axis 3D optical profiler** combines a high-accuracy rotational module with the advanced inspection and analysis capabilities of the S neox 3D optical profiler.



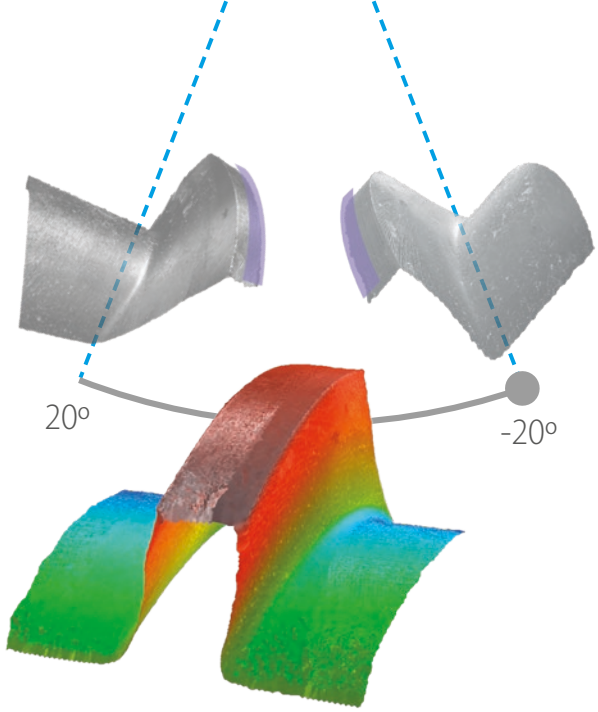
This enables automatic 3D surface measurements at defined positions which can be combined to create a complete 3D volumetric measurement. S neox 3D measurement technologies cover a wide range of scales, including form (Ai Focus Variation), sub nanometric roughness (Interferometry) or critical dimensions that require high lateral resolution as well as vertical resolution (Confocal).



Rotational stage

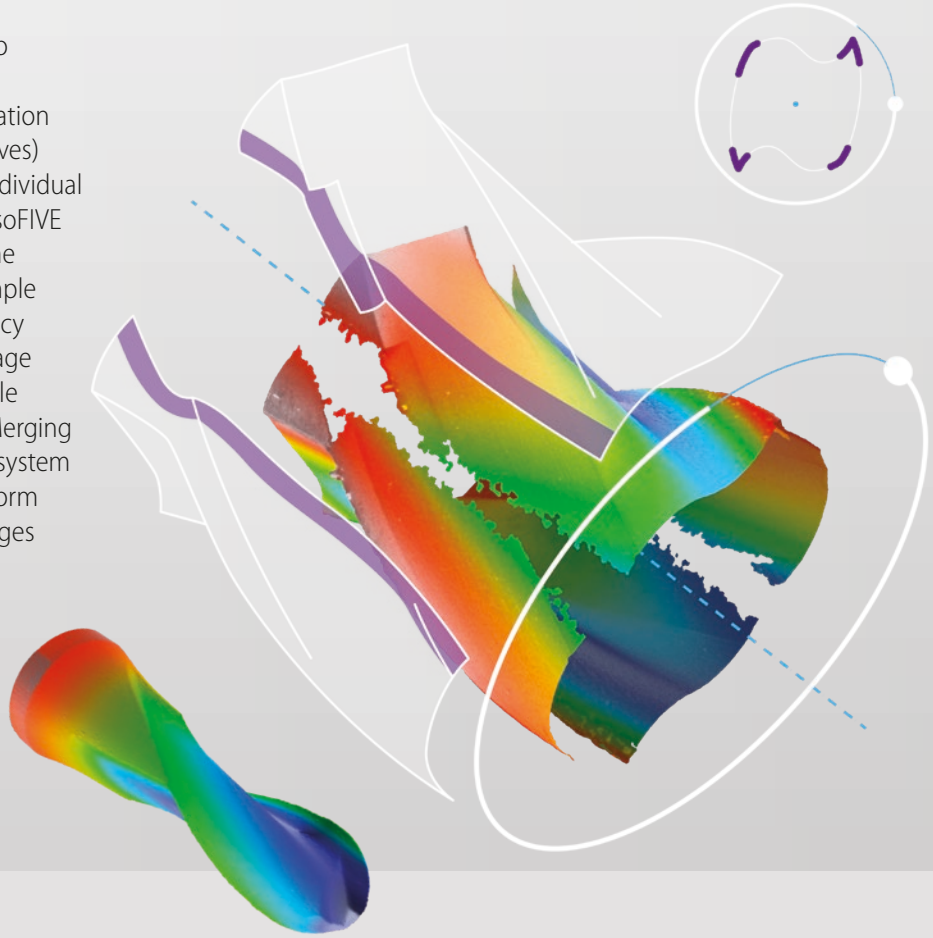
The Five Axis rotational stage consists of a high-precision motorized rotating A axis with 360º of endless rotation, 10 arc sec positioning repeatability, a motorized B axis, -30º to 110º, 0.5 arc sec resolution, with limit switch. It is equipped with a System3R clamping system.

The S neox Five Axis makes it possible to take automatic 3D surface measurements at defined positions, and combine them to create a complete 3D volumetric measurement



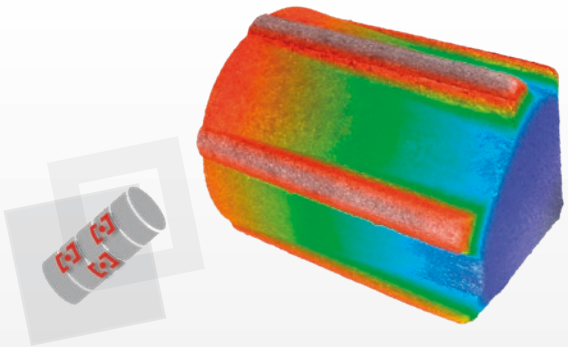
A complete 3D measurement

S neox Five Axis is able to measure the sample at different positions of rotation and elevation (perspectives) generating a group of individual measurements. The SensoFIVE software merges all of the surfaces providing a sample surface with high accuracy by using the stacked image information of each single surface measurement. Merging different elevations, the system can provide shape and form information on sharp edges and/or critical surfaces.



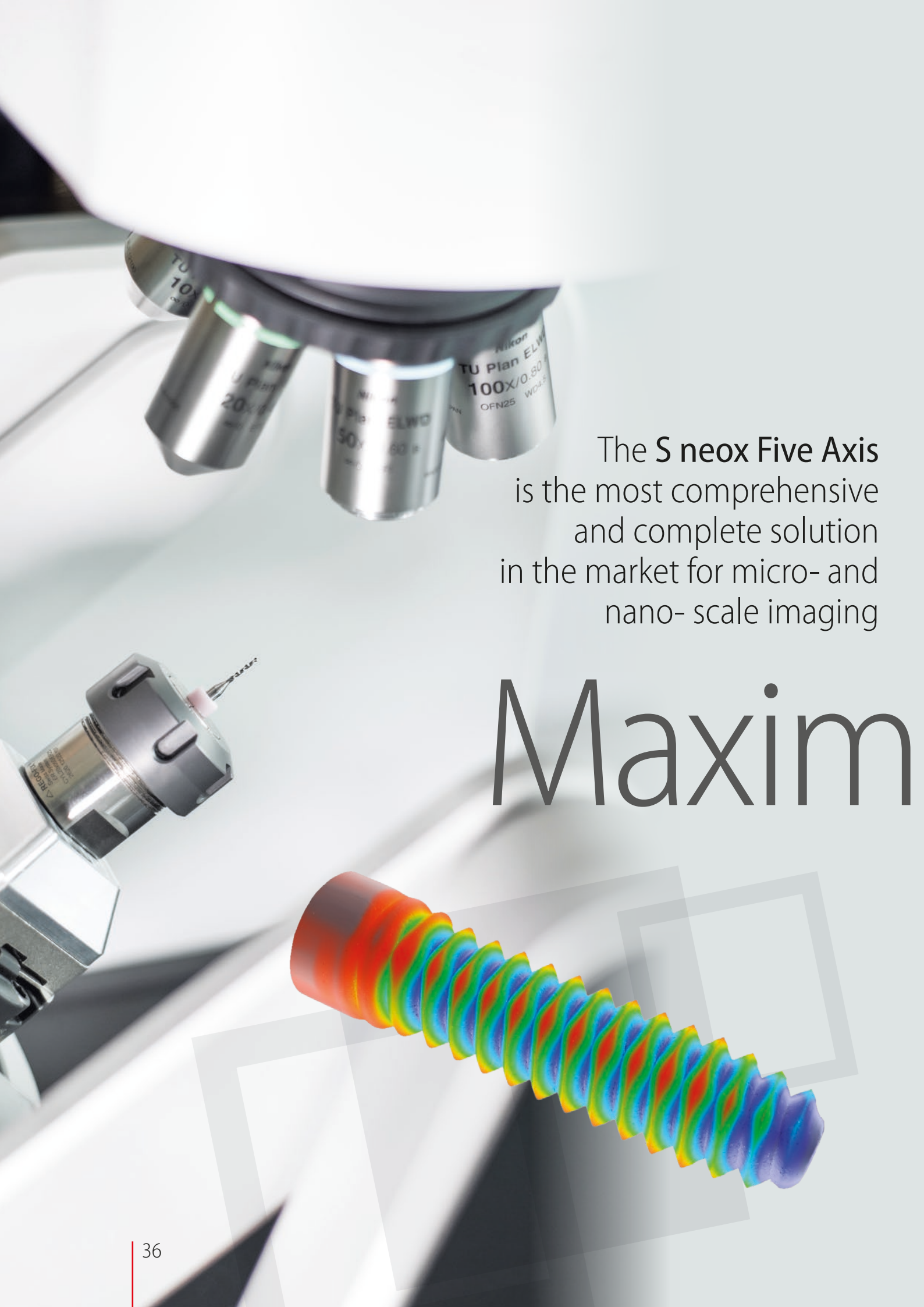
Connecting adjoining surfaces to measure angles greater than 90º

Measuring complex surfaces which contain steep angles is very difficult due to shadowing effects that prevent you from obtaining a complete measurement within a single acquisition. It is necessary to tilt the sample in order to measure it from two different positions and combine the two topography results to obtain the complete measurement. Five Axis rotational stage allows the sample to be positioned in opposite directions to make the entire surface visible. The system will acquire the individual measurements and then, it will merge them automatically to get the complete 3D volumetric measurement.



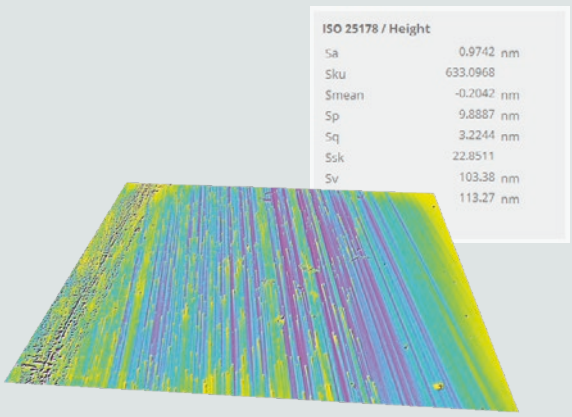
Multiple axis positions, measurements without limitation

Measuring different parts of the sample with one click is possible thanks to automation routines. A user-friendly interface allows you to find the measurement position without any constraints. Then focus on the critical parts of your sample and add them to the automation routine. Finally click Acquire to obtain all parts measured with one single click. This is an incredibly fast and easy way to automate the measurement routines.



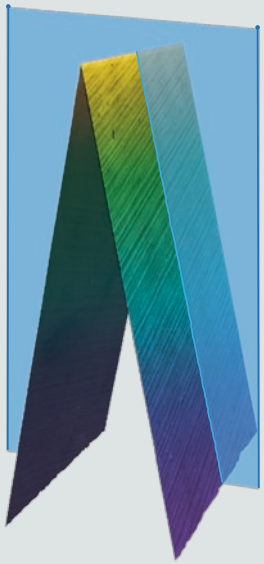
The **S neox Five Axis**
is the most comprehensive
and complete solution
in the market for micro- and
nano- scale imaging

Maxim



Accurate and reliable surface finish measurements

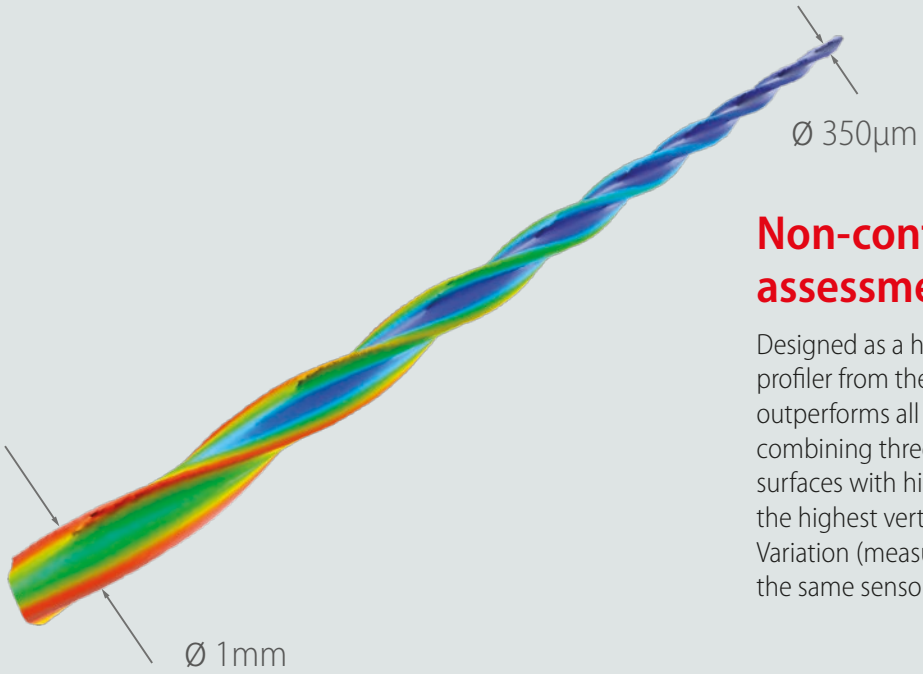
Our Confocal and Interferometry technologies allow you to measure surfaces with any kind of roughness from extremely rough (typical of additive manufacturing applications) to highly reflective surfaces of the order of 1 Å as a diamond mirror-like surface. Converting our system into repetitive and traceable, according to NPL, NIST and PTB roughness standards. Ai Focus Variation technology provides a quick and easy response for measuring outstanding slopes independently of the objective lenses.



Overcoming the limitations of Focus Variation

S neox Five Axis is able to measure the shape and surface finish. Focusing on the shape, the system is able to measure samples with small diameters up to 0.5 mm and cutting edge radius up to 150 nm. Confocal technology and high numerical apertural (0.95) allows you to measure small cutting edge radius.

um versatility



Non-contact surface assessment

Designed as a high-performance 3D optical profiler from the outset, S neox Five Axis outperforms all existing optical profilers by combining three techniques – Confocal (best for surfaces with high slope), Interferometry (yields the highest vertical resolution) and Ai Focus Variation (measure shape in mere seconds) – in the same sensor head without any moving parts.

Specifications

Objective lenses

Brightfield

MAG	2.5X EPI	5X BF	10X BF	10X SLWD	20X BF	20 EPI	20X ELWD	20X SLWD	22X WI	50X BF	50X EPI	50X EPI	50X ELWD
NA	0.075	0.15	0.30	0.20	0.45	0.60	0.40	0.30	0.50	0.80	0.80	0.95	0.60
WD (mm)	6.50	20.00	15.80	37.00	3.00	3.00	19.00	30.00	3.50	1.00	2.00	0.35	11.00
Spatial sampling[1] (µm)	2.76	1.38	0.69	0.69	0.34	0.34	0.34	0.34	0.31	0.13	0.13	0.13	0.13
Optical resolution[2] (µm)	1.87	0.94	0.47	0.70	0.31	0.23	0.35	0.47	0.28	0.18	0.18	0.15	0.23
Measurement noise[3] (nm)	300	115	30	50	8	6	10	20	15	4	4	3	5
Maximum slope[4] (º)	4	9	17	12	27	37	24	17	-	53	53	72	37

System specifications

Measuring principle	Confocal, PSI, ePSI, CSI, Ai Focus Variation and Thin Film
Observation types	Brightfield, DIC, Sequential Color RGB, Confocal, Interferential Phase Contrast
Measurement types	Image, 3D, 3D thickness, profile and coordinates
Camera	5Mpx: 2448x2048 pixels (60 fps)
Total magnification (27" screen)	60X - 21600X
Display resolution	0.001 nm
Field of view	from 0.11 to 6.7 mm (single shot)
Max. Extended measuring area	10x12 (Max. Resolution); 175x175 (Low resolution) (500 Mpx)
Confocal frame rate	60 fps (5Mpx); 180 fps (1.2 Mpx)
Vertical scan range	Linear stage: 40 mm range; Piezoelectric scanner: 200 µm (Optional)
Max. Z measuring range	PSI 20 µm; CSI 10 mm; Confocal & Ai Focus Variation 34 mm
XY stage range	Manual: 40x40 mm; Motorized: 114x75 mm, 154x154 mm, 255x215 mm, 302x302 mm
LED light sources	Red (630 nm); green (530 nm); blue (460 nm) and white (580 nm; center)
Ring light illumination	Green ring light compatible with 6 position nosepiece
Nosepiece	6 position fully motorized
Sample reflectivity	0.05 % to 100%
Sample weight	up to 25 Kg
Sample height	40 mm (standard); 150 mm and 350 mm (optional)
User Management rights	Administrator, supervisor, advanced operator, operator
Advanced Software Analysis	SensoVIEW, SensoMAP, SensoPRO, SensoMATCH, SensoCOMP
Power	Line Voltage 100-240 V AC; frequency 50/60 Hz single phase
Computer	Latest INTEL processor; 3840x2160 pixels resolution (4K) (27")
Operating system	Microsoft Windows 64 bit
Dimensions	System: 600x610x740 mm (23.6x24x29.1 in); Controller: 209x318x343 mm (8.2x12.5x 13.5 in)
Weight[9]	61 Kg (134 lbs)
Environment	Temperature 10 ºC to 35 ºC; Humidity <80 % RH; Altitude <2000 m

Accuracy and repeatability[6]

Standard	Value	U , σ	Technique
Step height	48600 nm	U=300 nm, σ= 10 nm	Confocal & CSI
	7616 nm	U=79 nm, σ= 5 nm	Confocal & CSI
	941.6 nm	U=7 nm, σ= 1 nm	Confocal & CSI
	186 nm	U=4 nm, σ= 0.4 nm	Confocal & CSI
	44.3 nm	U=0.5 nm, σ= 0.1 nm	PSI
	10.8 nm	U=0.5 nm, σ= 0.05 nm	PSI
Areal roughness (Sa)[7]	0.79 µm	U=0.04 µm, σ=0.0005 µm	Confocal, AiFV & CSI
Profile roughness (Ra)[8]	2.40 µm	U=0.03 µm, σ= 0.002 µm	Confocal, AiFV & CSI
	0.88 µm	U=0.015 µm, σ= 0.0005 µm	Confocal, AiFV & CSI
	0.23 µm	U=0.005 µm, σ= 0.0002 µm	Confocal, AiFV & CSI

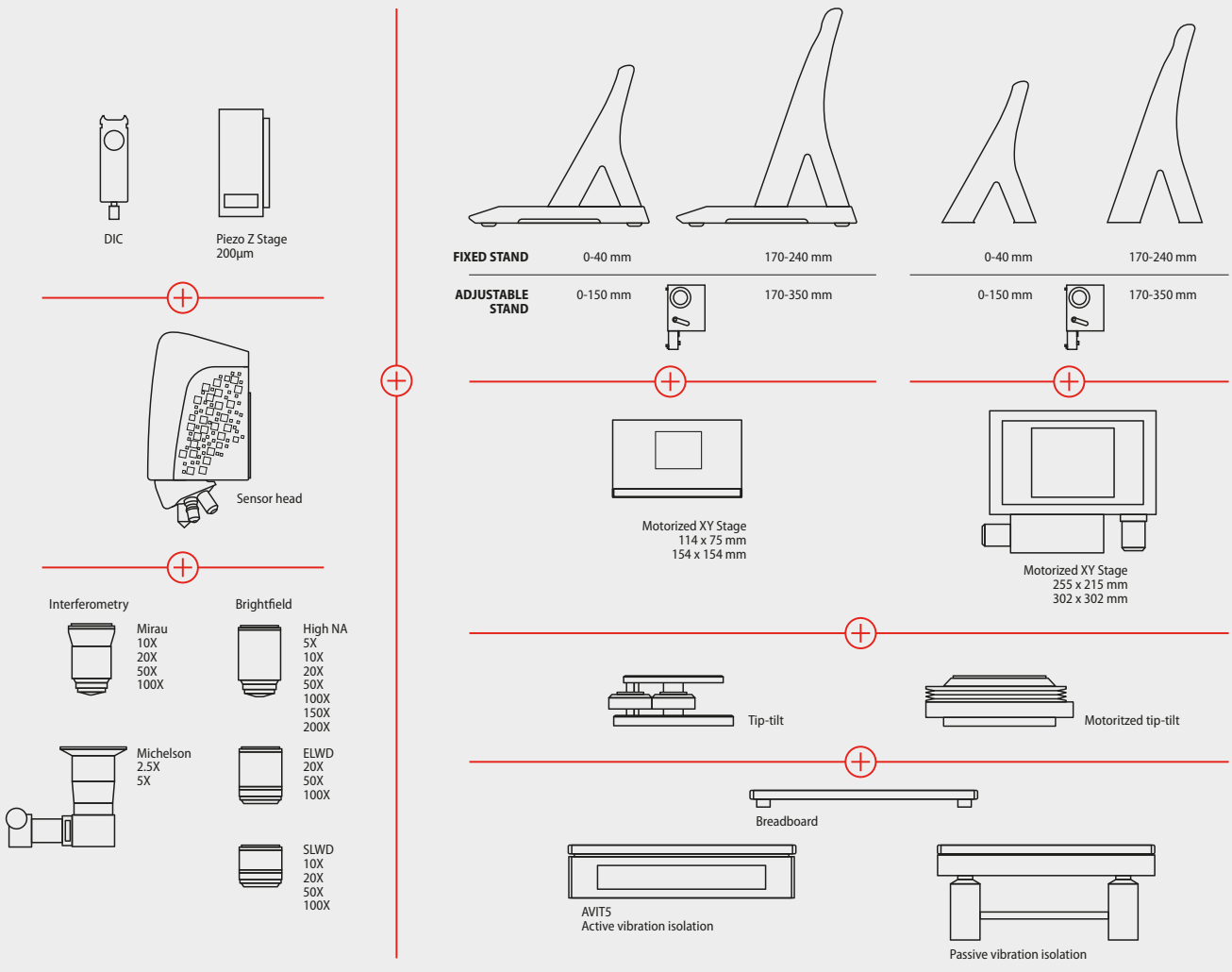
1 Pixel size on the surface. **2** L&S: Line and Space. Values for blue LED. **3** System noise measured as the difference between two consecutive measures on a calibration mirror placed perpendicular to the optical axis. For interferometry objectives, PSI, 10 phase averages, values obtained in a VC-E vibration environment. The 0.01 nm are achieved with Piezo stage scanner and temperature controlled room. Values for green LED (white LED for CSI). Resolution HD. **4** On smooth surfaces, up to 71º. On scattering surfaces, up to 86º. **5** Maximum field of view with 3/2" camera and 0.5X optics. **6** Objective used for Confocal and Ai Focus Variation 50X 0.80 NA and for CSI and PSI 50X 0.50NA. Resolution 1220x1024 pixels. All measurements are done using PZT. Uncertainty (U) according to ISO/IEC guide 98-3:2008 GUM:1995, K=1,96 (level of confidence 95%). **σ** according to 25 measures. **7** Area of 1x1 mm. **8** Profile of 4 mm length. **9** Fixed stand with 114 x 75 mm XY stage.

Interferometry

50X SLWD	100X BF	100X EPI	100X EPI	100X ELWD	100X SLWD	150X EPI	150X EPI	2.5X TI	5X MC	10X MC	10X MR	20X MC	20X MR	50X MR	100X MR
0.40	0.90	0.90	0.95	0.80	0.60	0.90	0.95	0.075	0.14	0.10	0.28	0.10	0.38	0.50	0.70
22.00	1.00	2.00	0.32	4.50	10.00	1.50	0.20	10.30	13.00	25.00	8.00	16.70	6.00	3.60	2.00
0.13	0.07	0.07	0.07	0.07	0.07	0.05	0.05	2.76	1.38	0.69	0.69	0.34	0.34	0.13	0.07
0.35	0.16	0.16	0.15	0.18	0.23	0.16	0.15	1.87	1.00	1.40	0.50	1.40	0.37	0.28	0.20
15	3	3	2	3	12	2	1	PSI/ePSI 0.1 nm (0.01 nm with PZT) CSI 1 nm							
24	64	64	72	53	37	64	72	4	8	6	16	6	22	30	44

MAG	2.5X	5X	10X	20X	22X	50X	100X	150X
FOV [5](µm)	6756x5652	3378x2826	1689x1413	845x707	767x642	338x283	169x141	113x94

System configuration



SENSOFAR

METROLOGY

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

Sensofar 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 has its headquarters in Barcelona, a European technology and innovation hub. 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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