

Optical 3D metrology for surface analysis



Your surfaces in focus

To ensure each component exhibits the maximum performance, the surfaces must often have special characteristics. That applies to form deviations and roughness as well as waviness or geometric features.

Only then do components qualify for further processing – otherwise they are discarded immediately. Powerful Mahr metrology provides you with the entire portfolio of characterization options based on precise measuring data. The topographical analyses range from particle analysis to angles and even to the determination of layer thicknesses. This allows you to detect potential errors and to counteract any waste during continuous production.

3D roughness (Sa, ...)

Extensive roughness evaluations as per ISO 25178

2D roughness (Ra, ...)

Profile roughness in accordance with ISO 4287, ISO 13565, ISO 21920, ASME B46.1, ISO 12085, SEP, VDA guidelines, and other standards

Profile trace errors (↷)

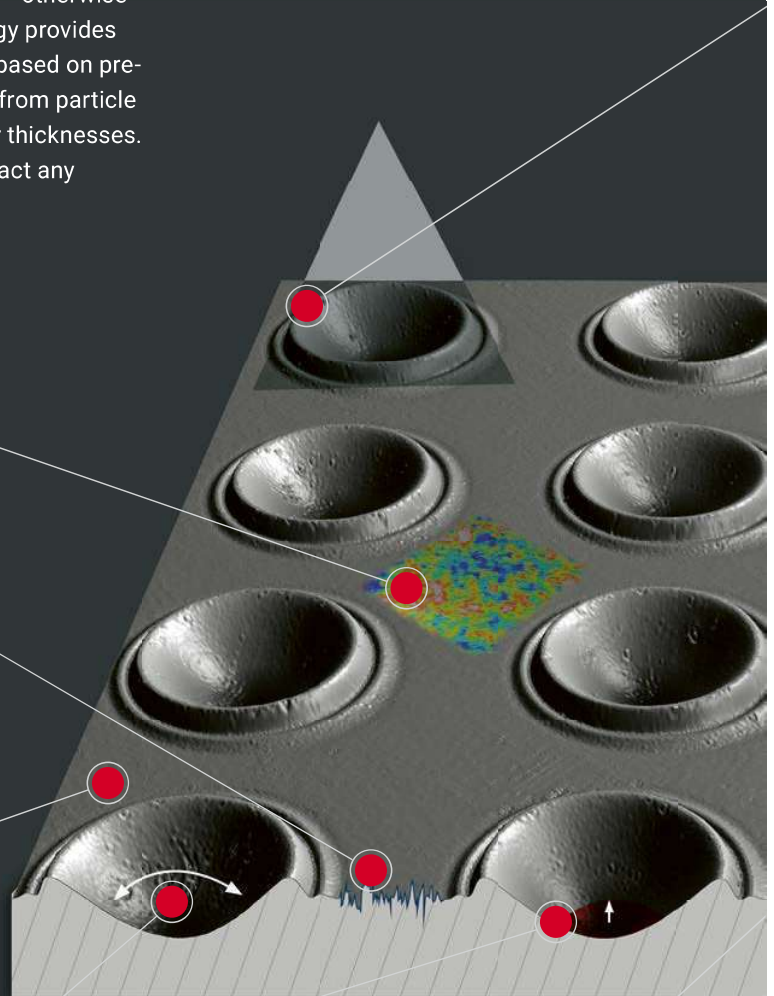
Linear errors compared to a target contour as well as straightness parameters as per ISO 12780

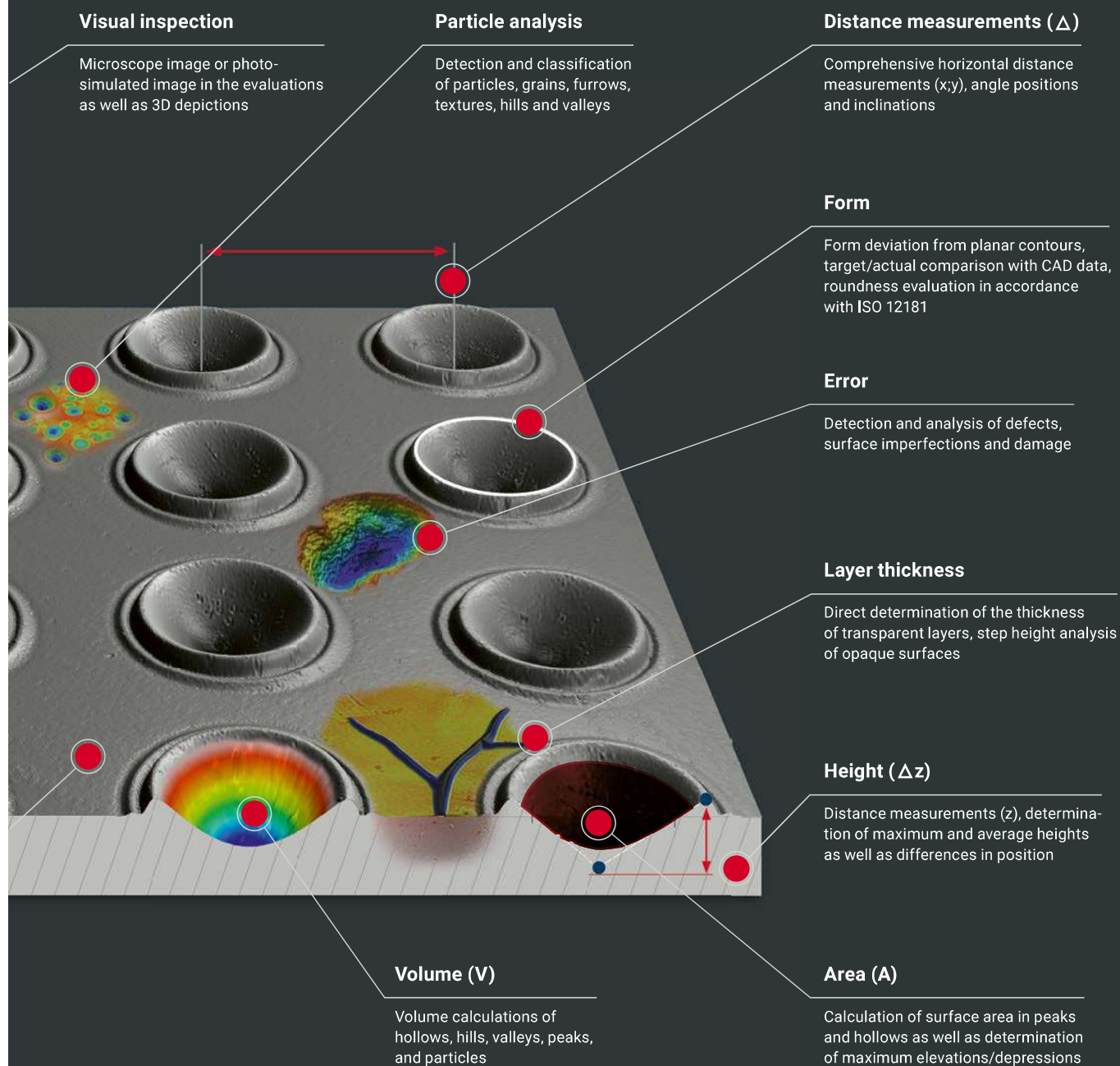
Contour analysis (⌒, R)

Determining radii, circles, segments of a circle and angle determination including evaluation of half or full angles

Flatness (▯)

Determining the flatness of a full or partial surface, e.g. in accordance with ISO 12781





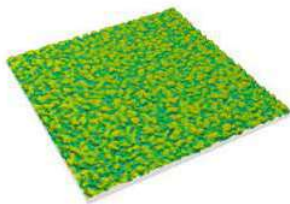
An eye catcher that is functional

Surfaces can be fascinating. They captivate you with flawless optics or well-developed haptics, for example, when things are pleasant to touch or lie comfortably in the hand. Operating elements and design surfaces, for example, thus have special textures that are achieved by blasting, polishing, etching, and using a laser. The spectrum ranges from finely structured housing surfaces made of metal with a homogenous appearance, through to rough plastic, or leather patterns made of distinct embossed structures.

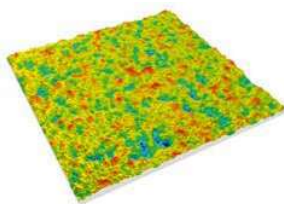
Optical measuring systems are particularly used for development and quality control processes: They check the surfaces of tool inserts during production and the final products for consumers.

The most common measuring tasks

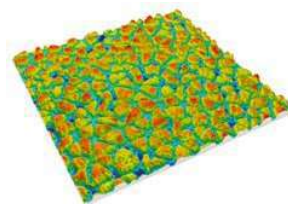
- Isotropy
- Structural evaluation
- Waviness
- Roughness



Topography of a lock handle



Surface of a switch



Embossed structure of artificial leather

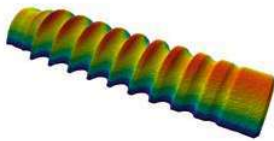
The prototype for perfection

When it comes to implants for the human body, no amount of work is too much and no quality checks are too accurate. All of the manufacturing processes are monitored and the production systems are set accurately. This is why manufacturers of medical implants depend on reliable key figures.

The optical 3D measuring systems from Mahr supply fast and highly accurate results – regardless of whether this relates to the measurement of complex geometries on dental implants, the roughness measurement on hip prostheses polished to the nanometer, or on roughened products used for trauma surgery. The high level of reproducibility and accuracy of measurements, that can be traced back to international guidelines and standards, ensures that it is not just polishing and blasting processes that you can monitor safely.

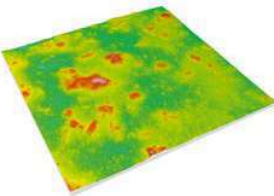
The most common measuring tasks

- Roughness 2D/3D
- Complex geometries
- Pore and particle analyses



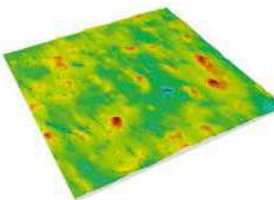
Dental prosthesis

Geometry of the roughened surface of a dental screw



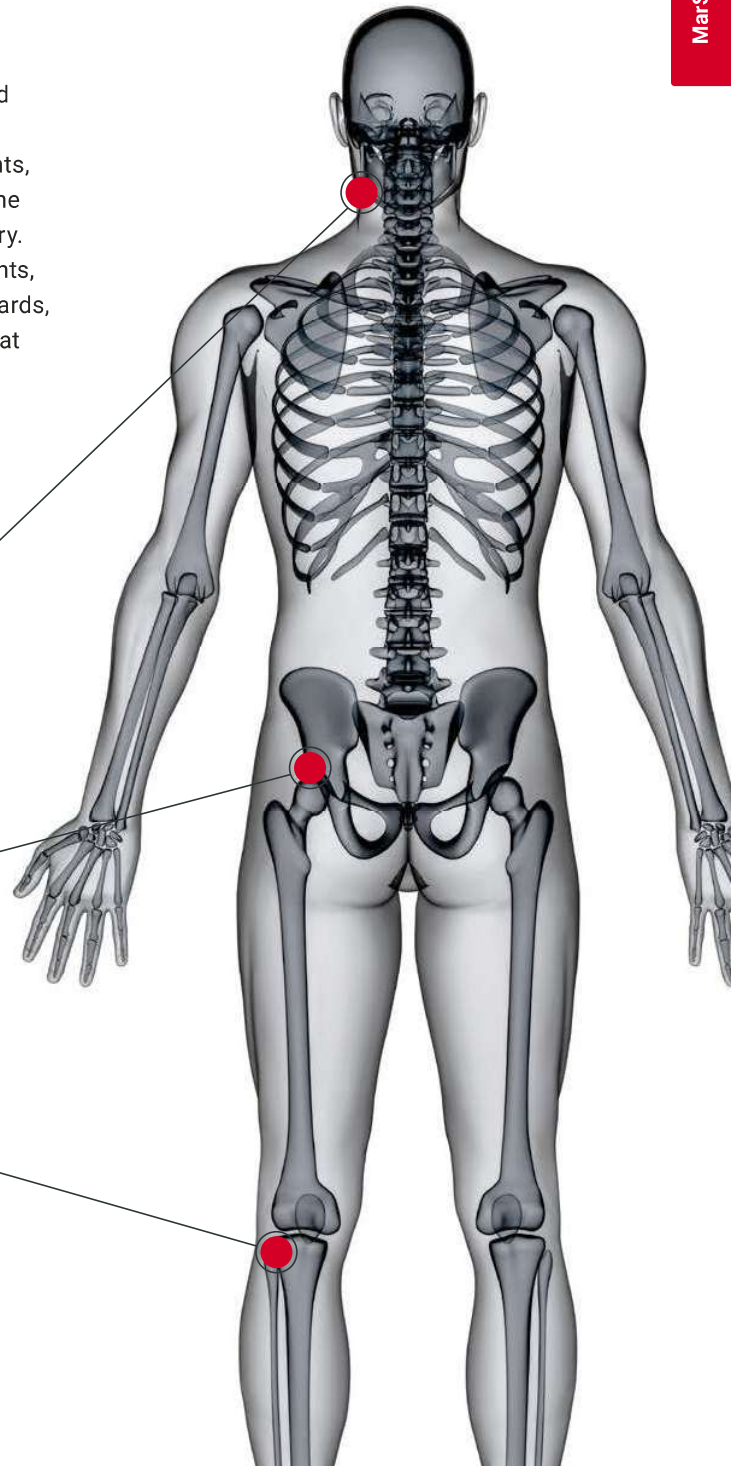
Hip joint

Carbides on an artificial hip joint



Knee joint

Polished articulating surface of a knee implant



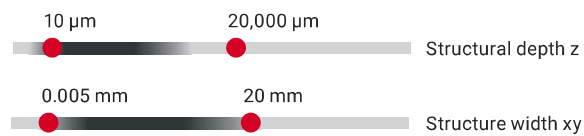
Perfect analysis **for steep surfaces and complex contours**

Focus variation (FV)

The principle of focus variation deliberately uses the depth of field of an optical system to capture three-dimensional surface structures. The sample is moved vertically through a defined measuring range while images are continuously recorded. For each pixel, the software analyzes at which focus position the image sharpness is highest – in other words, when that point is best in focus. This process creates a complete 3D height profile of the surface.



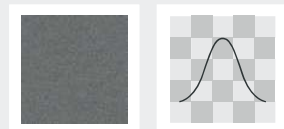
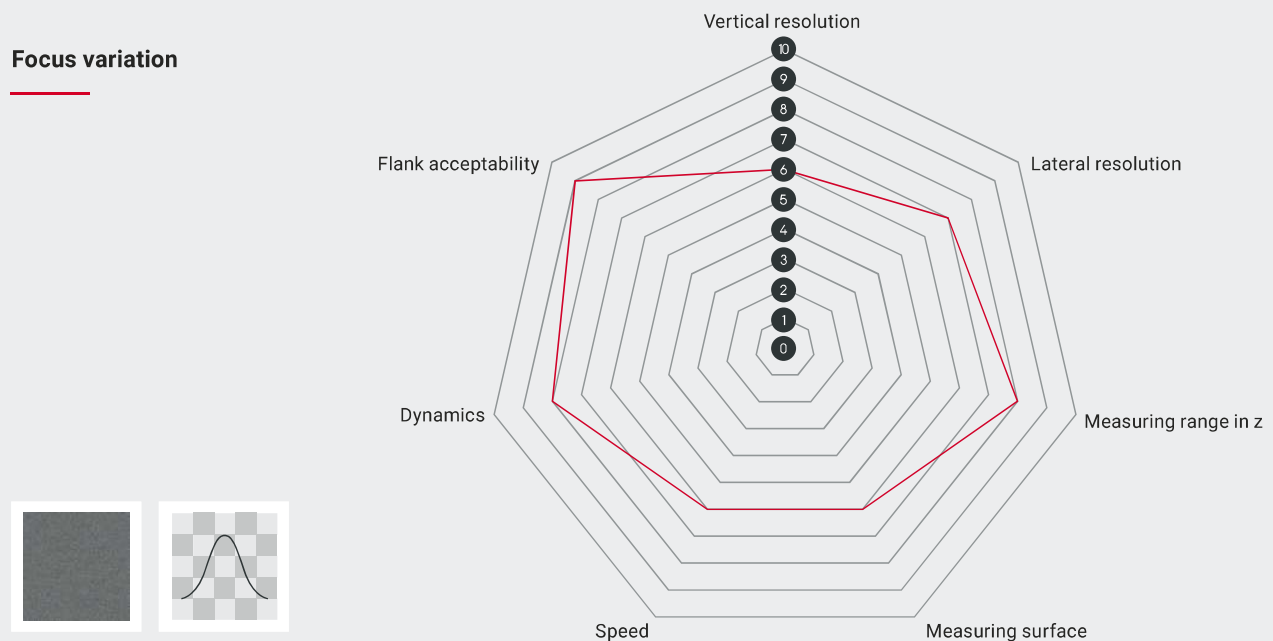
Typical structural sizes



Focus variation

Roughness		Geometry			Flatness
Rough	Fine	Macro	Micro	Nano	
●	○	●	●	○	●
●	○	●	●	○	○
○	○	●	○	○	○
○	○	●	○	○	○

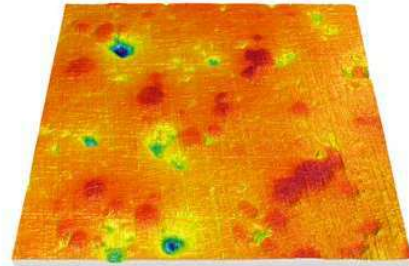
Focus variation



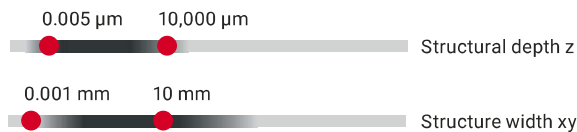
The right technology for every measuring task

Patented confocal technology (CMP)

The robust MarSurf CM sensor technology is based on the patented Confocal Multi-Pinhole (CMP) technology. The light of an LED light source shines through the pinholes of a multi-pinhole disc (MPD) and is focused through the objective lens on to the surface of the specimen. The specimen reflects the light beams back to the measuring device. At every pinhole of the MPD, the reflected light is then reduced to the focused part. The rotation of the multi-pinhole disc ensures that the surface can be scanned fully. This principle prevents the scattered light from adjacent measuring points interfering with the camera pixels. When combined, these individual values provide the confocal curve from which the precise height value of a pixel is determined.

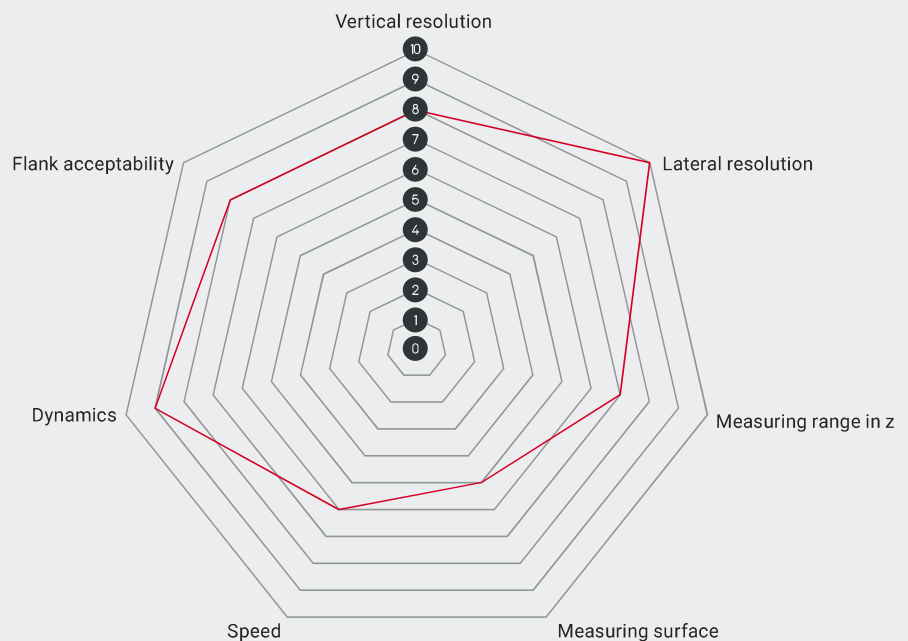


Typical structural sizes



Roughness		Geometry			Flatness
Rough	Fine	Macro	Micro	Nano	
●	●	●	●	●	●
●	●	●	●	●	●
●	●	○	●	●	○
●	○	○	●	○	○

Confocal



Maximum flexibility even for larger structures

Profilometry point sensors

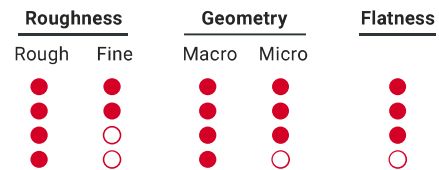
The diffraction of white light in different wavelengths is used when recording measuring values to determine the height. Each of these wavelengths is assigned to a height value via a spectrometer.



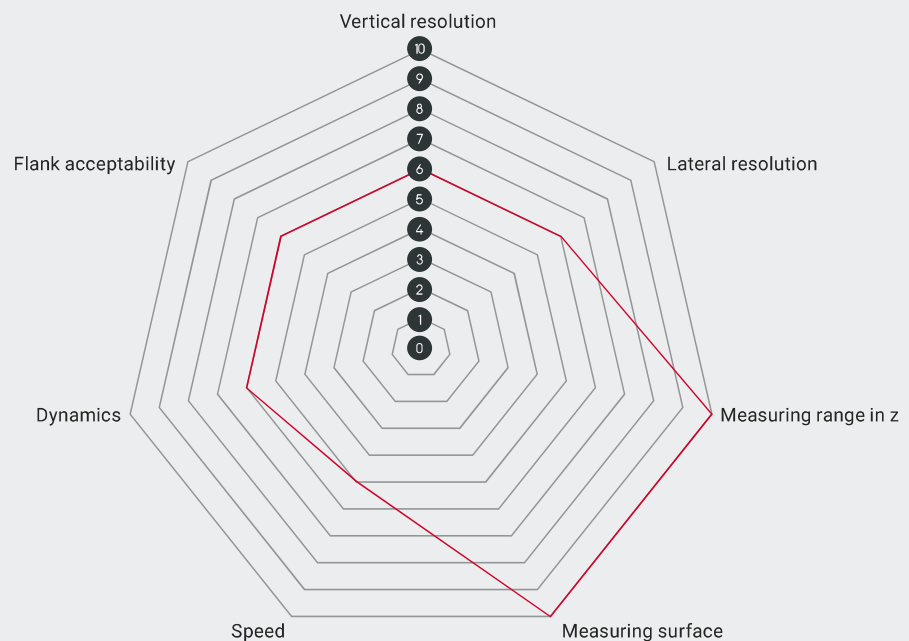
Typical structural sizes



Chromatic-confocal point sensor



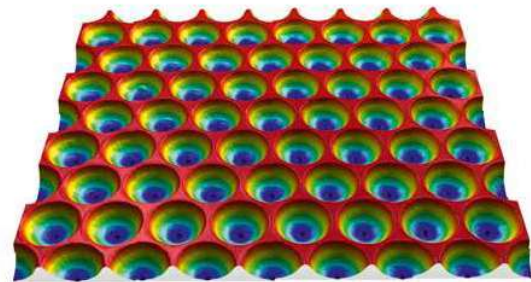
chromatic-confocal (point sensor)



Large-area high-speed measurement

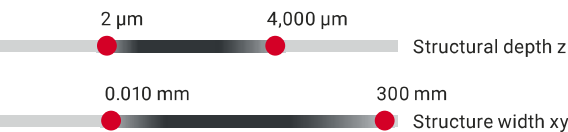
Profilometry line sensors

With the chromatic linear sensor CL, 1200 points are focused along a linear line of the surface of the measuring object. The reflected light for each of these 1200 channels can be analyzed.



MarSurf3D | Optical solutions

Typical structural sizes



Chromatic confocal line sensors

Geometry		Flatness
Macro	Micro	
●	●	●
●	●	●
●	●	○
●	○	○

chromatic-confocal (line sensor)

