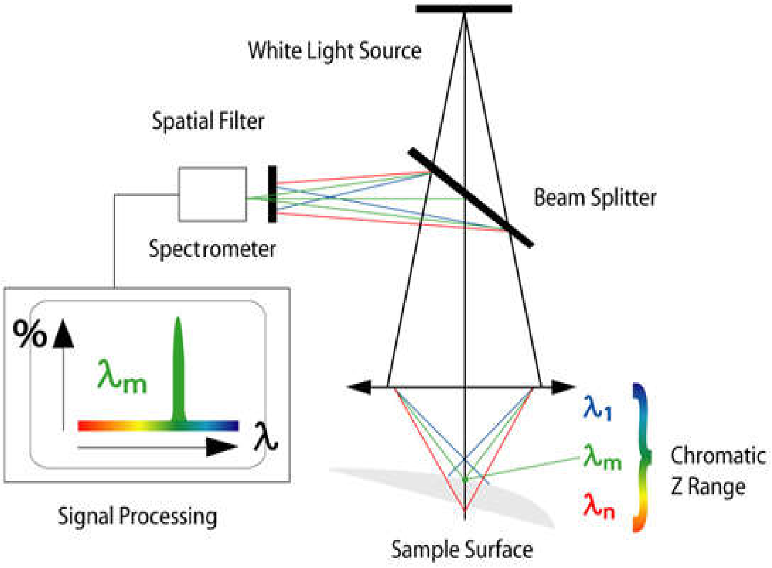
Instrument:

The Nanovea 3D Non-Contact Profilometer is designed with leading-edge optical pens featuring superior Chromatic Confocal optical technology (axial chromatism), A nano through macro range is obtained during a ISO- and ASTM-compliant measurement on a wider range of geometries and materials than any other profilometer. With the use of a large range of optical pens, the profilometer has an endless range of applications. Nanovea's profilometer has zero influence from sample reflectivity, sample color, and does not require any sample preparation. The measurement of transparent, opaque, specular, diffusive, polished, rough, and others are all easily accomplished with very little measurement setup. Nanovea's line of profilometers all use the same, simple software creating a user-friendly platform for end-user ease of use. Unlike other profilometers used today, switching from small measurement areas to larger measurement areas is simple, and can be precisely measured without the need of image stitching. For applications exceeding profilometer capability, atomic force microscope (AFM) integration is available to complete the range from sub-nano through macro. **Serial #: STZ-13-243**

Measurement Principle:

The Chromatic Confocal technique uses a white light source, where light passes through an objective lens with a high degree of chromatic aberration. The refractive index of the objective lens will vary in relation to the wavelength of the light. In effect, each separate wavelength of the incident white light will re-focus at a different distance from the lens (different height). When the measured sample is within the range of possible heights, a single monochromatic point will be focalized to form the image. Due to the confocal configuration of the system, only the focused wavelength will pass through the spatial filter with high efficiency, thus causing all other wavelengths to be out of focus. The spectral analysis is done using a diffraction grating. This technique deviates each wavelength at a different position, intercepting a line of CCD, which in turn indicates the position of the maximum intensity and allows direct correspondence to the Z height position. Unlike the errors caused by probe contact or the manipulative Interferometry technique, Chromatic Confocal technology measures height directly from the detection of the wavelength that hits the surface of the sample in focus. It is a direct measurement with no mathematical software manipulation. This provides unmatched accuracy on the surface measured because a data point is either measured accurately without software interpretation or not at all. The software completes the unmeasured point but the user is fully aware of it and can have confidence that there are no hidden artifacts created by software guessing.



Definitions of Height Parameters

Height Parameter		Definition
Sa	Arithmetical Mean Height	Mean surface roughness. $Sa = \frac{1}{A}\iint_A \lvert z(x,y)\rvert dxdy$
Sq	Root Mean Square Height	Standard deviation of the height distribution, or RMS surface roughness. $Sq = \sqrt{\frac{1}{A}\iint_A z^2(x,y)dxdy}$ Computes the standard deviation for the amplitudes of the surface (RMS).
Sp	Maximum Peak Height	Height between the highest peak and the mean plane.
Sv	Maximum Pit Height	Depth between the mean plane and the deepest valley.
Sz	Maximum Height	Height between the highest peak and the deepest valley.
Ssk	Skewness	Skewness of the height distribution. $Ssk = \frac{1}{Sq^3}\left[\frac{1}{A}\iint_A z^3(x,y)dxdy\right]$ Skewness qualifies the symmetry of the height distribution. A negative Ssk indicates that the surface is composed of mainly one plateau and deep and fine valleys. In this case, the distribution is sloping to the top. A positive Ssk indicates a surface with a lot of peaks on a plane. Therefore, the distribution is sloping to the bottom. Due to the large exponent used, this parameter is very sensitive to the sampling and noise of the measurement.
Sku	Kurtosis	Kurtosis of the height distribution. $Sku = \frac{1}{Sq^4}\left[\frac{1}{A}\iint_A z^4(x,y)dxdy\right]$ Kurtosis qualifies the flatness of the height distribution. Due to the large exponent used, this parameter is very sensitive to the sampling and noise of the measurement.
Spar	Projected Area	Projected surface area.
Sdar	Developed Area	Developed surface area.
FLTt	Total Height	Peak to valley flatness deviation of the waviness surface, Gaussian filter

FLTp	Peak Height	Peak to reference flatness deviation of the waviness surface, Gaussian filter
FLTv	Valley Height	Reference to valley flatness deviation of the waviness surface, Gaussian filter
FLTq	Flatness	Root mean square flatness deviation of the waviness surface, Gaussian filter $FLTq = \sqrt{\frac{1}{\mathrm{A}} \iint_{\mathrm{A}} \mathrm{z}^2(\mathrm{x},\mathrm{y})\mathrm{dxdy}}$ Computes the standard deviation for the amplitudes of the surface (RMS).
Pa	Arithmetic Mean Deviation	Mean deviation of the primary profile $Pa = \frac{1}{l}\sum_{0}^{l}\lvert Z(x)\rvert$
Pz	Maximum height	Maximum height of the primary profile within a sampling length, calculated as the average of the peak to valley height defined on a sampling length
Ra	Arithmetic Mean Deviation	Mean deviation of the roughness profile, Gaussian filter $Ra = \frac{1}{l}\sum_{0}^{l}\lvert Z(x)\rvert$
Rz	Maximum height	Maximum height of the roughness profile within a sampling length, calculated as the average of the peak to valley height defined on a sampling length
Wa	Arithmetic Mean Deviation	Mean deviation of the waviness profile, Gaussian filter $Wa = \frac{1}{l}\sum_{0}^{l}\lvert Z(x)\rvert$
Wz	Maximum height	Maximum height of the waviness profile within a sampling length, calculated as the average of the peak to valley height defined on a sampling length