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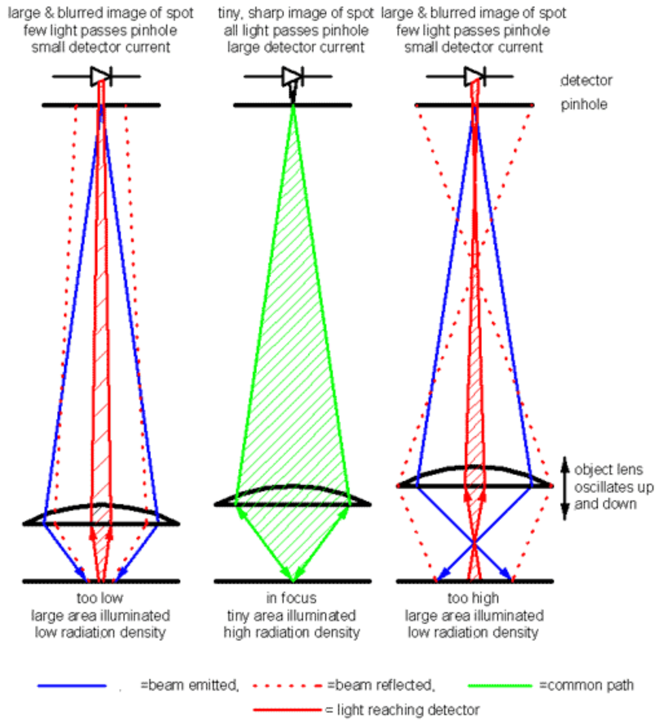
Principle of Operation

Confocal sensor

The light source is projected by the object lens on the sample's surface. The reflected light is collected by the very same lens, focused by the collimator lens and deflected by a beam splitter towards a tiny detector. The object lens continuously scans the measurement range of the sensor. The illumination density is extraordinary high if the sample's surface is exactly in-focus. Due to the conical shape of the light leaving the object lens, the illuminated surface increases with the square of the displacement and the illumination density decreases by the same order. The image of the illuminated surface is projected onto the detector. In the surface is exactly in-focus, all of the light of the image reaches the detector. In case of de-focus, the energy is distributed in a large area around the detector, leading to a small detector signal. The imaging back on the detector also exhibits quadratic decay beyond the focus. Altogether, the optical properties result in a pronounced intensity signal at the true focal position.

In the confocal sensors, the object lens oscillates over the whole measurement range. The sensor's electronics determines the instant of the detector's signal maximum and calculates the profile value.



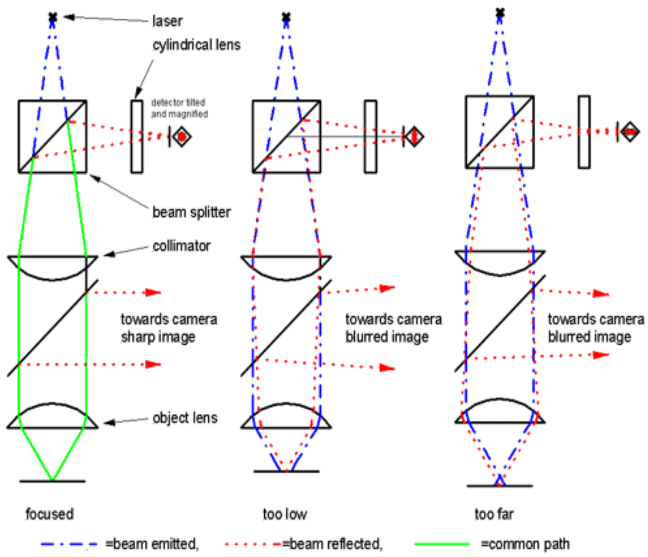
Autofocus sensor

The light source is projected by the object lens on the sample's surface. The reflected light is collected by the very same lens, focused by the collimator lens and deflected towards the detector by a beam splitter. In the absence of the cylindrical lens, the light would converge to a tiny spot on the detector.

The cylindrical lens deviates only one axis of the light, so a horizontal and a vertical focal line originate from the single spot. The detector is placed mid-way between the two focal lines.

A circular spot appears on the sensor if the surface is exactly in-focus. Deviation from the focal position results in an elliptic spot on the detector. The orientation and eccentrity of the spot depends on the magnitude and direction of the defocus. The spot's shape is detectable by the current distribution in a photodiode array.

The sensor's electronics generate a signal resulting in a movement of the object lens to track the surface at exactly the focal distance. The motion of the lens is monitored by an incremental encoder (glass scale), comprising the profile signal.



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White light sensor

This sensor type exploits the dependency of the focal length of the object lens to the wavelength of the light (chromatical aberration, or axial colour). The light of a broadband source (tungsten halogen lamp) is directed by a multimode fibre to the sensor head. The head is purely passive, and usually consists of two or more lenses. The object lens focuses the light towards the sample. Since the system is intentionally not corrected for axial colour, the focal length of blue light is shorter than the focal length of red light, so the white light is separated along the optical axis in order of increasing wavelength (ie colour, from blue to red). Radiation reflected from the surface is collected by the very same object lens, and the light is fed back into the multimode fibre again. This is the reverse process of the imaging described above, and also works best for the wavelength which is in-focus.

On the way back, the radiation directed into a spectrometer. The sensor‘s elec-tronics determine the wavelength of the signal‘s maximum. The profile value is a function of the dominant wavelength.