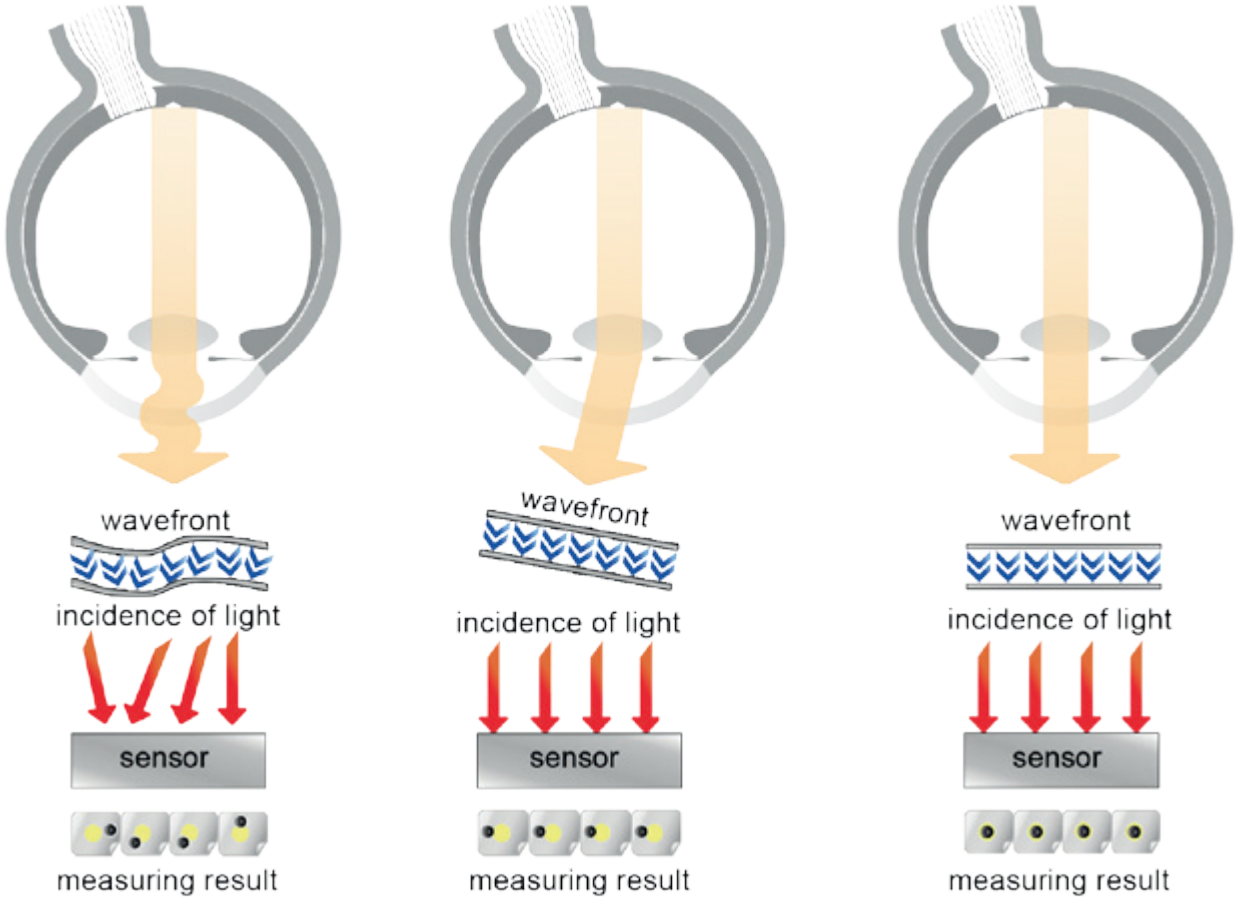
With an eye on the essentials

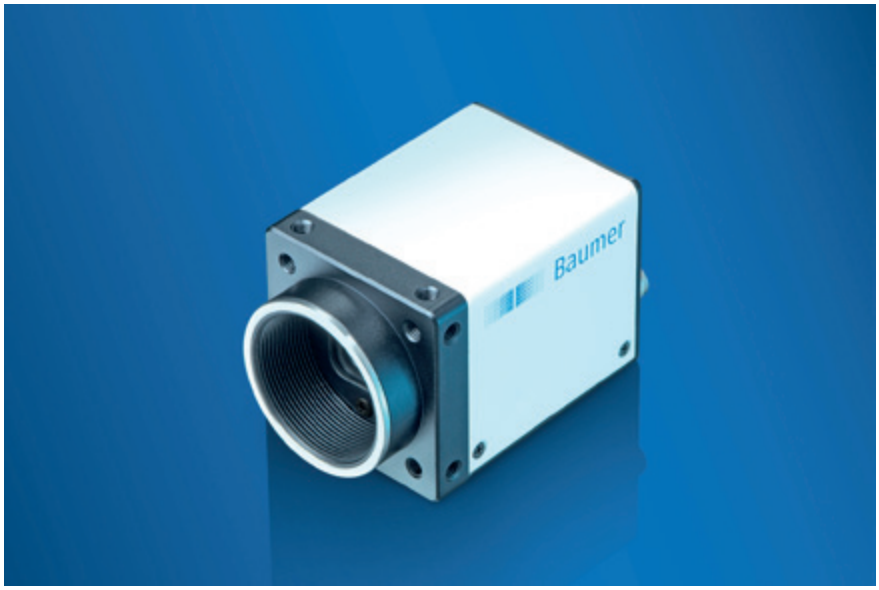
Baumer cameras as a key component in ophthalmology

Today, medical diagnostic equipment benefits from the diverse possibilities of digital image processing and its components. Especially in ophthalmology, when they say, „Look into my eyes" – camera-based diagnostic instruments increasingly assert themselves. In wavefront analysis of the human eye, vision defects are reliably diagnosed through the use of Baumer TXG cameras and optimum laser treatment is prepared.

Vision impairments can afflict anybody, usually with far-reaching consequences. Spherical and cylindrical aberrations, common general imaging defects of the human eye, can be corrected by means of glasses and contact lenses. By contrast, higher order imaging defects, so-called wavefront aberrations, usually require surgical intervention. However, an appropriate diagnosis is the basis of treatment.Irregular refractive conditions within the pupil and spherical aberrations can be diagnosed by means of wavefront analysis. Here, the wavefront defects caused by the patient's eye are measured and displayed on a color-coded wavefront chart. Camera-based systems operating on the Hartman-Shack or the Tscherning principle more and more become the dominant diagnostic instruments. In Hartmann-Shack wavefront analysis, the ocular fundus is „lit up" by a laser. After passing through the lens, the reflected light is focused on an imaging system (a camera sensor) outside the eye by a lens array. The generated pixels are compared to the reference points of an ideal imaging lens. This comparison enables quantifying the wavefront defects for visualization in a wavefront chart. In the Tscherning principle, on the other hand, a grid of beams or a network of light spots is projected in parallel onto the retina.



In wavefront analysis the generated pixels (black dots) are compared with the reference points of an ideal imaging lens (yellow points).



The image of this projected pattern is recorded by a high-definition camera and compared with an ideal image. Here too, conclusions about the eye's aberration can be drawn by comparing the actual image with reference values (see illustration). Both methods create the wavefront chart for both the eye as a whole and for the retina defect in particular (corneal wavefront analysis). In a later operation, the laser ablation profile for each area of the retina can be selectively calculated on the basis of this chart. It goes without saying that components deployed in such medical applications have to meet the highest demands in terms of measuring accuracy and system reliability. Baumer TX series cameras are ideally suited for use in state-of-the-art diagnostic instruments thanks to their highly-sensitive CCD sensors, perfect image quality and excellent color accuracy combined with long-term reliability and system stability. Camera models with resolution up to 5 megapixels and a GigE Vision® interface enable easy, cost-effective integration into a diagnostic instrument.

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