HOHENHEIDE
BEAM BEYOND FUTURE

Radiometric apertures

The essential part of a filter radiometer is precision aperture which is used to determine the amount of irradition entering the device. The knowledge about the diameter of the aperture contributes directly to the uncertainty estimate of optical radiometric measurements. The quality of an aperture, in turn, depends on the machining process.

The precision apertures for filter radiometers can be manufactured in several ways: by using ordinary milling techiques or diamond turning. The choise of the manufacturing technique depends on variety of factors: material, desired diameter of the aperture, edge thickness of the aperture, surface finish and coating ao.

The calibration of the manufactured aperture gives an estimate for the choice of the aperture desing and the manufacturing. Also, for calibration of an aperture several measurement methods can be applied. Amongst the others, the popular methods are based on laser beam scanning technique and video measuring machines.

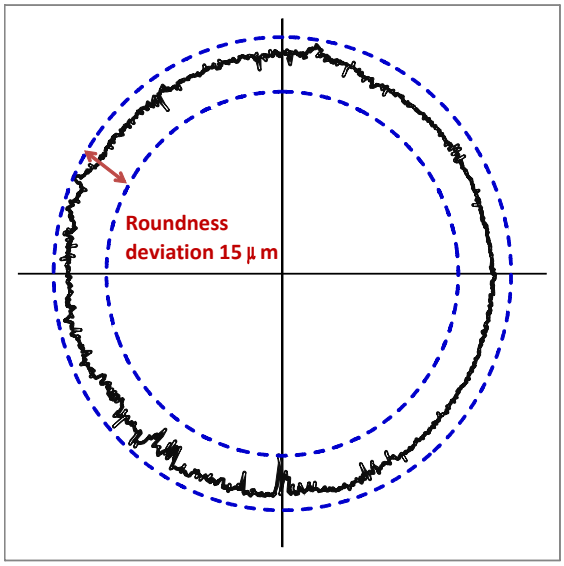

Fig 1. Measured roundness deviation of precision aperture made of brass with nominal diameter of 8 mm.

We have designed and manufactured several precision apertures made of aluminum and brass. The nominal diameters of apertures range from 3 mm to 8 mm. Also, knife-edge thicknesses of the apertures have been set at demanding levels: from 30 µm to 60 µm. The accurate machining of the apertures have an effect on the deviation from nominal diameter and roundness deviation. As an example, the measured roundness deviation of an 8-mm nominal diameter aperture can be seen in Fig. 1. The diameter of the aperture is (7,998±0,002) mm (k=2) measured by a National Metrology Institute by using video measuring machine. The surface of the measured diameter was passivated before calibration.

The calibration yields an average value of the aperture diameter. We have analysed the effect of roundness deviation on the calculation of the aperture area, also. The analysis show that the difference between aperture area calculated by using the shape of measured roundness deviation (Fig. 1) and that of calculated by using calibrated average diameter is less than 0,01 % for 8-mm diameter aperture . Such large apertures can be used, eg with 3-element reflection trap detectors (consisting of photodiodes with active area 18x18 mm^2) which are currently under development in our company.

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