# Investigation of Size and Intensity Distribution of the Focal Spot of Microfocus X-Ray Tubes

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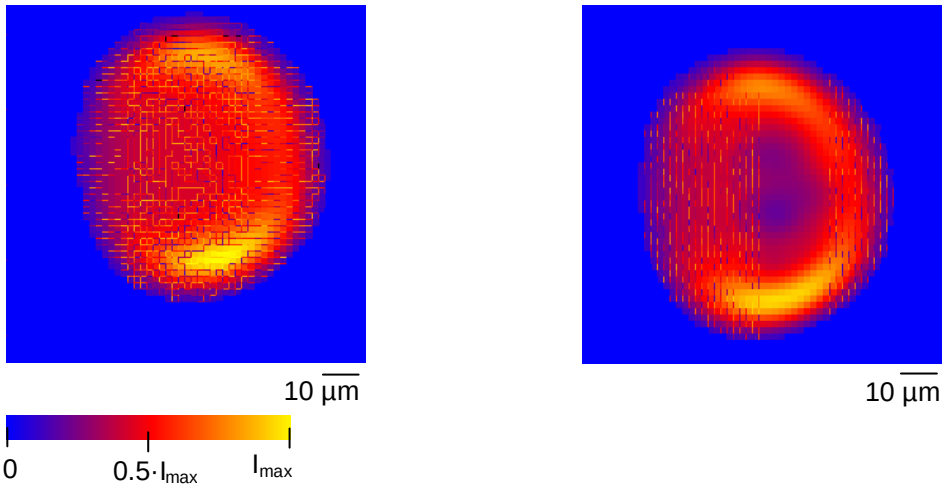
The spatial resolution of x-ray setups with high magnification factors is limited by the size of the focal spot. Therefore, the size and the intensity distribution of the focal spot at a given energy are very important characteristic parameters of x-ray tubes. Difficulties will arise if the small focal spot of a µ-CT setup is to be measured using a pinhole[1]. In order to overcome these limitations, a novel method for measuring the intensity distribution of the focal spot of microfocus x-ray tubes with transmission targets was developed[2]. Hereby, the focus intensity distribution is determined under standard industrial working conditions using a spatially coded mask. With this method, the intensity distribution of focal spots with a size of a few micrometers was measured: The dependence of the focus size and shape on tube voltage and current was investigated. Furthermore, changes of the focus intensity distribution while the target gradually deteriorates were determined, as outlined in the figure below. Finally, a measurement of the focus intensity distribution of an x-ray tube with a structured target[3], of which only certain areas emit x-rays, is presented.

(a) Focus intensity distribution at measurement start

(b) Focus intensity distribution after two hours




Variation over time of the focus intensity distribution of an x-ray tube: Image (a) shows the focus intensity distribution for a tube target "as received", right after power on of the tube, whereas image (b) shows the focus intensity distribution two hours later. The x-ray tube was operated at 100 kV, 16 W. It is clearly visible that the x-ray intensity decreases at the centre of the focal spot. This can be addressed to the deterioration of the tube target, which consists of a Beryllium (Be) substrate onto which a thin Tungsten (W) layer was deposited. Due to the electron impact, the tungsten layer is gradually destroyed. In this case, the x-ray emission decreases, because the x-ray emission of Be irradiated by electrons is very low compared to that of W.

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[2] *M. Engelhardt, J. Baumann, ECNDT proceedings 2006, Th.2.5.4 (2006), www.ndt.net*
[3] *The structured target was made by V. Klüppel, Siemens AG, CT MM 7, Munich*