TEST OF A CONFOCAL MULTILAYER

X-RAY OPTIC

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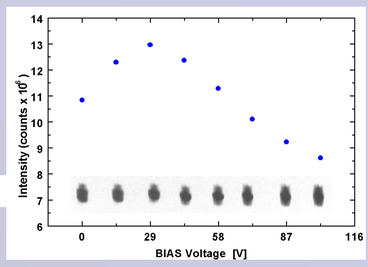
X-Ray Source

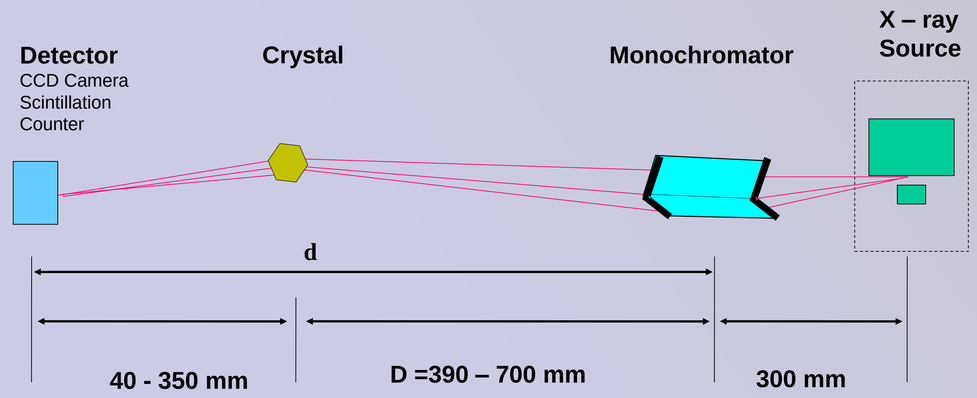
SCHNEIDER® Rotating Anode Generator:
Mo – and Cu –Radiation, 5.5 kW
Spot Focus: 0.3 x 3 mm²

Pin-hole image



Intensity for different values of the bias voltage [V]

Experimental Set-up



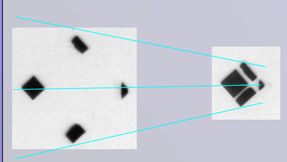
Comparison of two Foci

Focus test with an ENRAF-NONIUS rotating anode CuKα, 35 kV

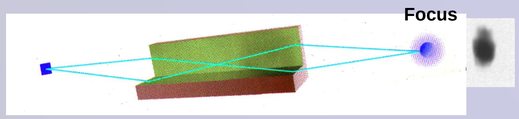
Size mm²	Power kW/mA	Powerdensity kW/mm²	Intensity counts
0.1x1	1.2/34	12	2900
0.3x3	3/85	3.3	4100
Ratio	2.5	0.23	1.44

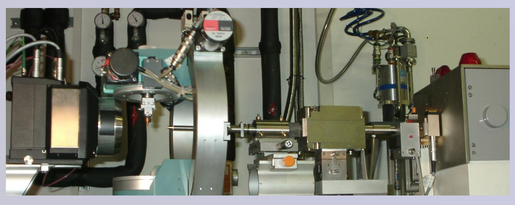
Monochromator

Confocal graded multilayer optic of OSMIC ®Inc.



at 180 mm at 90 mm

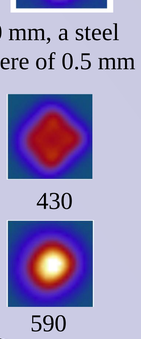




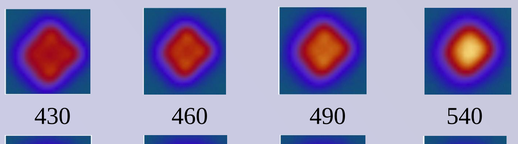
Technical Data from the data sheet of **OSMIC ®Inc** :

Major radius a: 502.5 mm
Minor radius b: 11.8 mm
Position of the mirror : -202.5 mm
Length of the optic : 100 mm
Focal to focal distance: 1005 mm
Distance between Source and optic : 300 mm
side – by – side geometry
horizontal beam geometry (45 ° inclination)

Variation of the Distance **d** from the Optic



430 mm, a steel sphere of 0.5 mm



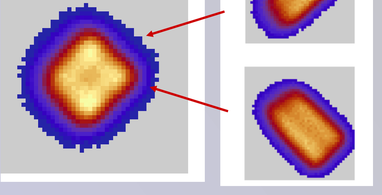
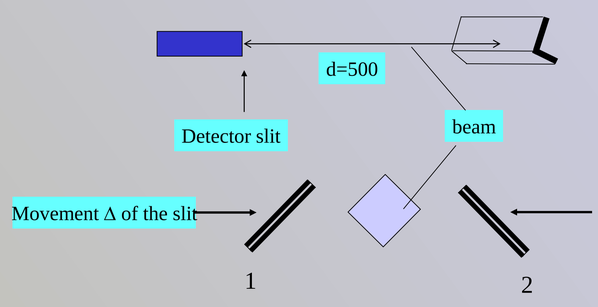


Image of the double reflection

Image of the single reflection

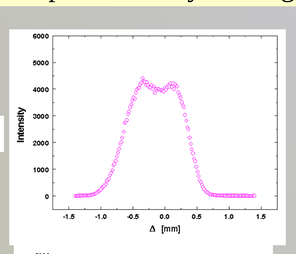
Distance = 430 mm, pixel size 62.5 µm

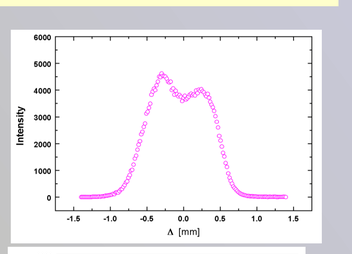
Scan of the Beam: Profile



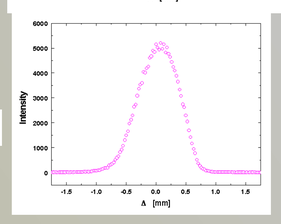
Slit of the detector was put into two positions;
scan was performed by moving the slit in the indicated direction

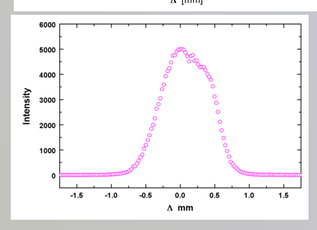
d = 500 mm



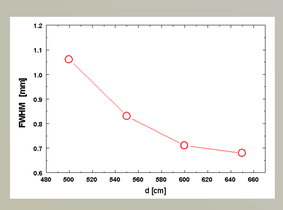


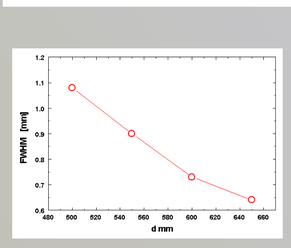
d = 550 mm





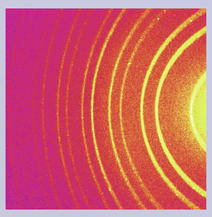
FWHM



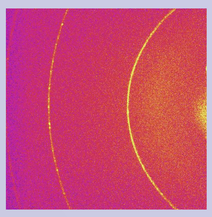


Powder sample

A powder sample (Si-powder) in a capillary (Ø = 0.3 mm) is placed at the position of the single crystal.

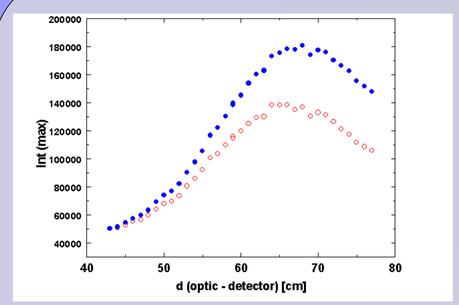


MoKα
Graphite monochromator

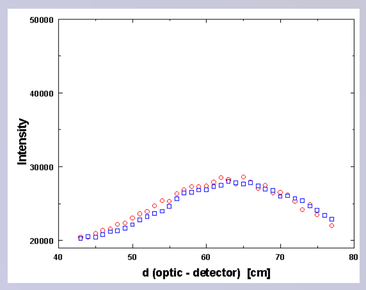


CuKα
OSMIC Optic

Intensity versus Distance



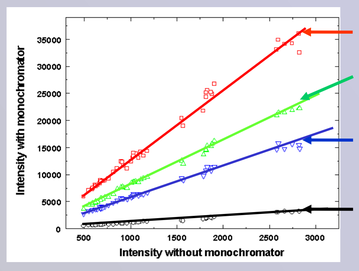
The variation of the maximum intensity:
- measured intensity ,
- intensity corrected for absorption in air.



The variation of the maximum intensity corrected for absorption in air for the two line foci

Comparison

D / **amplification**



D = 600 / **12.8**
D = 500 / **8.0**
D = 400 / **5.6**
G D = 400 / **1.1**

Intensity of reflections from a crystal sphere (Ø = 0.25 mm) for different positions **D** of the optic and for a graphite monochromator **G** versus the intensity without a monochromator

Conclusion

The performance of the multilayer optic :

- Optimum performance for a spot focus 0.3 x 3 mm
- Homogeneous profile for D > 500 mm
- Optimum crystal position with maximum gain depends on the size of the crystal (flexible positioning of the diffractometer).
- Sharp lines with high resolution for powder samples (very useful with a CCD detector for materials with big lattice parameters)
- Precise determination of lattice parameters for single crystals.
- Useful application for metric changes at phase transitions
- Measurements of diffuse intensities.
- Measurements of sputtered thin films

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References

"Confocal Max-Flux™ Optic", OSMIC Inc., Troy, Michigan, USA
J. Schneider Elektrotechnik GmbH, D-77652 Offenburg, Germany