ESRF	**Experiment title:** Submicron Diffraction Experiments on Single Polymeric Fibres by X-Ray Waveguide Optics	**Experiment number:** ***SC293***
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Report:

We have successfully tested an X-Ray waveguide for polymer single fibre diffractometry at 13 keV. As indicated in the application, the present waveguide device provides a beam of about 0.13 μm(vertically)x30 μm(horizontally). The monochromatic flux (Si-111) was $>2*10^9$ ph/sec. An ellipsoidal mirror was used for horizontal focusing.

A support structure for the X-ray waveguide with incorporated 3D-piezoscanner and manual translation stages was developed for this experiment. This device was placed on the @-axis of the microfocus beamline kappa-goniometer. In order to align the waveguide and bring the first harmonics in resonance the scanning axis of the goniometer was used. This axis allows to "rock" the whole kappa-goniometer by a few degrees.

Experiments were performed by using a Photonics Science LA CCD detector. A 15 μm diameter Kevlar49 fibre was placed with the fibre axis in the horizontal plane. It was found that the sample support will have to be further improved by incorporating larger range motorized movements and a rotation axis in order to bring the sample into the beam prior to high resolution scanning. Scattering background emanating from the waveguide was reduced by an appropriate aperture. In this way a very low background could be obtained at the sample position.

At the present stage the strongest equatorial and off-equatorial peaks can be observed within a few second measuring time (fig.1). It was actually possible to observe the appearance of the diffraction pattern in real time using a video monitor. For longer accumulation times the weaker layer line reflections were observed. A scanning experiment across the fibre was also performed. Due to an instrumental breakdown (3 shifts lost) we have have not been able to optimize the size of the aperture and in particular perform scanning experiments with the small beam size along the fibre axis in order to verify the "pleated sheets" model.

In conclusion the possibility to perform single fibre experiments on polymeric fibres using an X-ray waveguide has been demonstrated. Further improvement of waveguide optics and a better shielding can be expected. Still the present results appear to be already very promising.

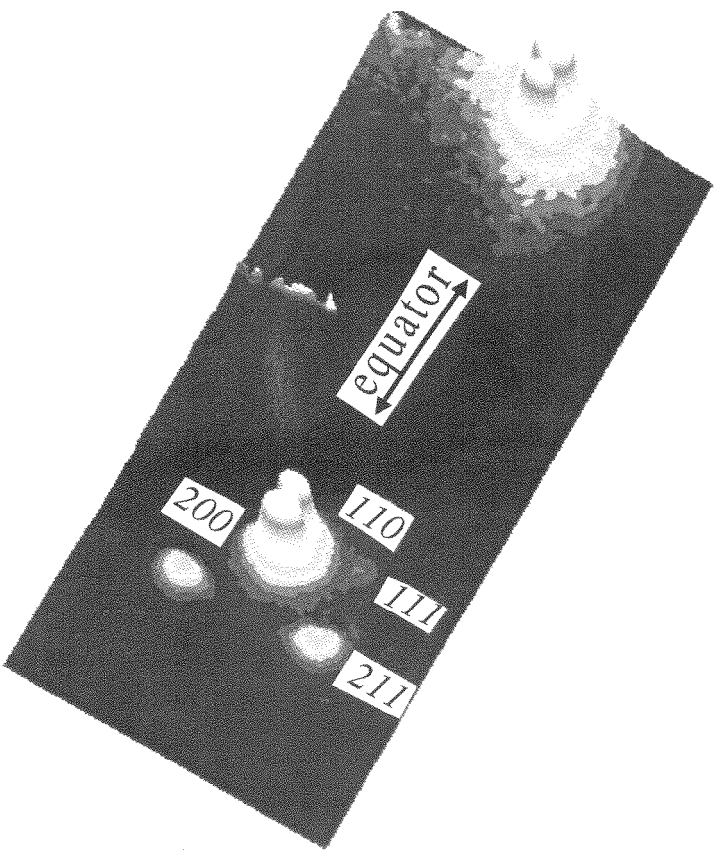

Fig.1 Diffraction pattern (linear scale) from 15 μm Kevlar49 fibre recorded in center of fibre. Pattern truncated to better show weaker peaks.