We have studied the structure of the keratin intermediate filament (IF) network in eukaryotic SK8/K18 (IF-free SW13 cells transfected with fluorescent keratin protein [1, 2]) at the P10 beamline using the Göttingen end station [3]. The keratin IF is one component of the cytoskeleton. It provides a pronounced tensile strength to epithelial cells and thus prevents cell rupture as a consequence of external stress. In cells, keratin IFs form bundles and dense networks (see fluorescence micrograph in Figure a) with bundle diameters between a few tens and a few hundreds of nm (measured by electron microscopy). Our goal was to probe the structure of individual bundles in the cell with a nano-focussed beam to obtain knowledge about characteristic length scales in the arrangement of keratin filaments to a bundle.
was visualized using fluorescence microscopy (Figure 1a) and suitable cells for x-ray measurements were selected.

X-ray measurements were carried out in transmission geometry at a photon energy of 13.8 keV. The beam was focussed to about $350 \times 200$ nm$^2$ (horizontal $\times$ vertical) using the KB mirror system. Taking advantage of the beamline microscope (Figure 1c) and the precise sample stage, the samples were positioned in the focus of the beam. To reduce radiation damage, the samples were cooled to 100 K using a Cryostream (Oxford Cryostreams, 700 Series Cryostream Cooler). Diffraction patterns were collected with the Pilatus 300k detector positioned at 5.29 m downstream of the sample. After a coarse mesh scan over a large sample area (Figure 1d, reconstructed dark field image), high resolution region-of-interest scans with a small step size on the order of 200 nm were performed. Figure 1e shows a dark field image reconstructed from a mesh scan on an interesting keratin morphology seen in the fluorescence image (Figure 1a). The total diffraction signal on the keratin network is significantly higher than the background scattering [4]. The azimuthally integrated intensity obtained from averaged diffraction patterns corresponding to different regions-of-interest on the sample (see Figure 2a, ROI 1: background, ROI 2: nucleus, ROI 3: cell without nucleus) are shown in Figure 2b. Especially from the nuclear region, high diffraction signal up to about $1 \text{ nm}^{-1}$ can be detected.

![Figure 2: (a) The diffraction patterns in different regions-of-interest (ROI 1-3) were averaged and the intensity was integrated in azimuthal direction (b).](image)

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**References**