ESRF	**Experiment title:** Quantitative diffraction on single nano-structures for mechanical, photonic and electronic applications	**Experiment number**: HS-4670
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Report:

Within the framework of the project ANR MecaniX and this long-term proposal (HS-4670) we developed a scanning force microscope for *in situ* nanofocused X-ray diffraction studies (SFINX) [1]. After having demonstrated its capabilities in combination with coherent X-ray diffraction at the old ID01 beamline in June 2013 (see last report), the tool was installed at the upgraded ID01 beamline in December 2014.

SFINX was installed on the diffractometer of the upgraded ID01 beamline and *in situ* bending tests on self-suspended Au nanowires were performed in combination with coherent Bragg diffraction imaging (CBDI). Here, the incident X-ray beam was monochromatized to a photon energy of 9 keV using the new Si 111 double-crystal monochromator and focused down to 350 x 700 nm^2 in vertical and horizontal direction, respectively, using a tungsten Fresnel zone plate. A coherent Bragg diffraction image of a self-suspended Au nanowire which was also presented on the webpage of *Beauty of Science* at ESRF is displayed in Fig. 1 [2]. The inset shows an AFM image of this wire before mechanical testing.

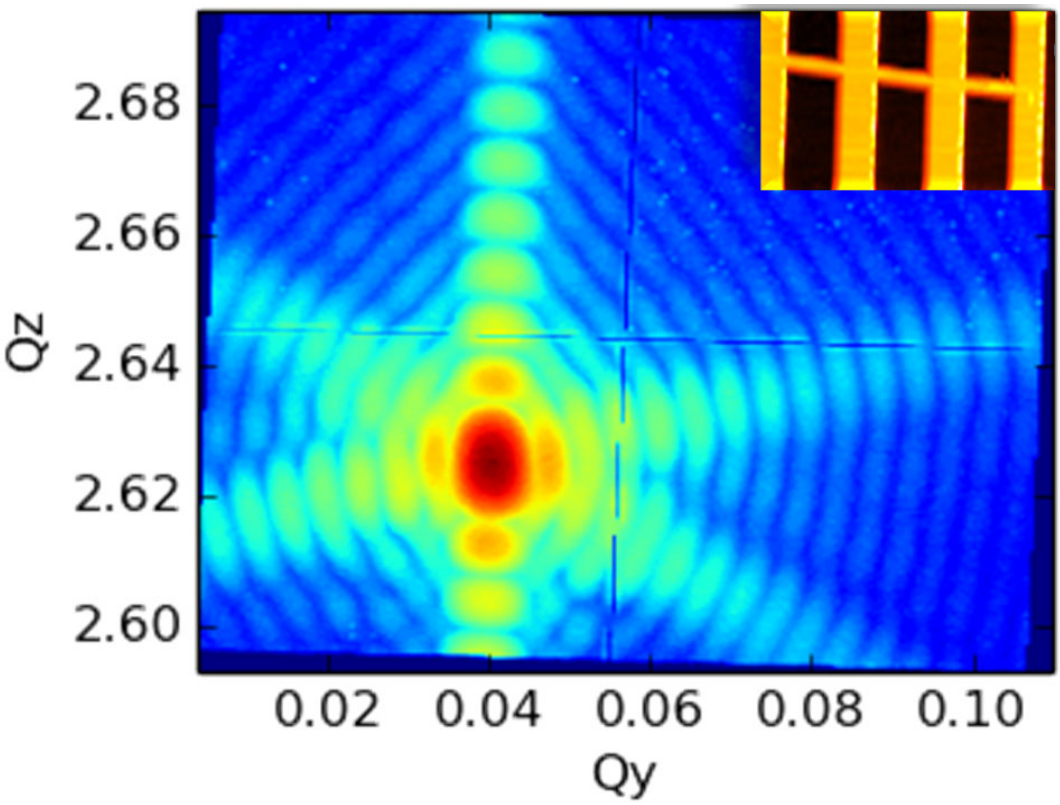

Fig. 1: Coherent Bragg diffraction image of the Au111 Bragg peak for a self-suspended Au nanowire which is shown in the AFM image presented in the inset.

During bending of the nanowire the deformation was monitored by 2D coherent X-ray diffraction. In addition, at several stages of deformation 3D diffraction images were recorded. In order to avoid any vibrations induced by the movement of motors of the diffractometer, these *in situ* coherent Bragg diffraction images were recorded by tuning the energy of the incident X-ray beam by +/- 100 eV instead of rocking the sample. Figures 2(a), (b), and (c) present the energy tuning CBDI of the pristine nanowire, the wire at highest load, and after retracting the AFM-tip, respectively. The range in q is much smaller for the energy tuning CBDI than for ordinary rocking curves, however, it still gives access to the shape and the deformation of the nanostructure.

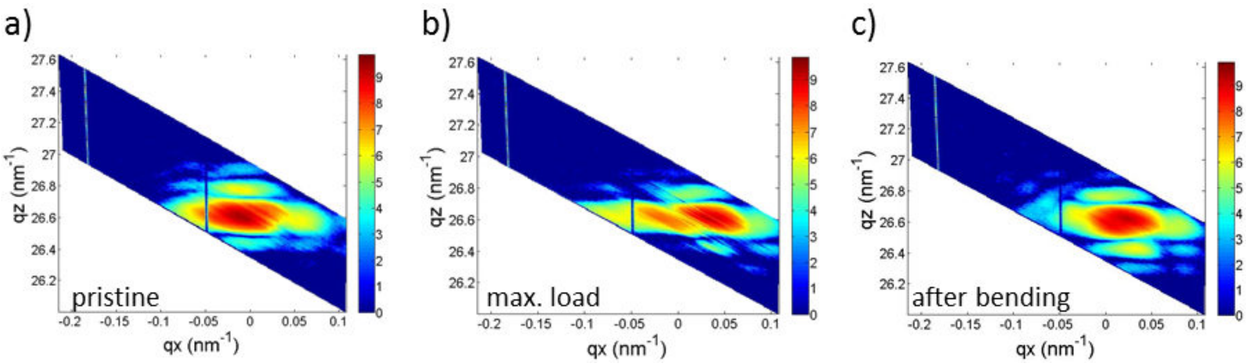

Fig. 2: *In situ* energy tuning CBDI for a) the pristine Au nanowire, b) at highest mechanical load, and c) after unloading and retracting the AFM-tip.

References

[1] Z. Ren, F. Mastropietro, S. Langlais, A. Davydok, M.-I. Richard, O. Thomas, M. Dupraz, M. Verdier, G. Beutier, P. Boesecke, T.W. Cornelius, J. Synchrotron Radiat. 21 (2014) 1128 – 1133

[2] http://www.esrf.eu/home/news/beauty-of-science/content-news/beauty-of-science/beauty-nanobridge.html