ESRF	**Experiment title:** X-Ray Diffraction studies of spatially inhomogeneous YBCO	**Experiment number**:
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Shifts:	**Local contact(s)**: Manfred Burghammer, Martin Rosenthal	*Received at ESRF:*
Names and affiliations of applicants (* indicates experimentalists): Riccardo Comin, Manfred Burghammer, Martin Rosenthal		

Report:

In proposal HC-3427 we performed micro-diffraction measurements on YBCO ($YBa_2Cu_3O_{6.75}$ (hole doping ca 0.13 and T_c=70) single crystals, in order to investigate the spatial texture of the charge ordered phase. We used 14 keV x-rays with a Be lens achieving a beam size of 4x1.5 um (HxV). The detector used is a Pilatus CCD camera placed at about 8 cm from the sample. We used a N2 cryostream to cool down to 90 K.

We detected two charge order reflections at Q=(0,0.31,6.5) and (0,0.69,9.5), the latter shown in Fig.1. Because of this we decided to perform the real space scanning experiment around this position in reciprocal space.

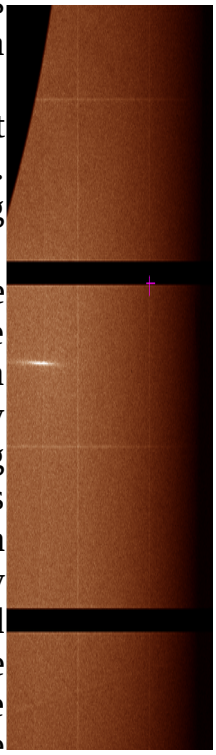

Fig.1. CCD image of the charge order peak detected around [0,0.69,9.5]

The beam was scanned in real space to study the spatial structure of the charge order. We observed a strong modulation of the intensity (quantified in a factor 50) of this signal depending on the position onto the sample. This spatial variation of intensity creates regions of strong signal interleaved with regions having little to no signal (close to the detection limit). This demonstrates the strong inhomogeneity of the charge order in real space and the importance of real space mapping by a tightly focused beam to fully appreciate the spatial extent of the ordered phase and its separation into micro- and nano-regions. The sample fraction having a strong signal is low compared to the total volume probed by the beam, and approximately lies in the range 1-5 %.

We mapped the real space structure of this charge order peak in a grid of 200x100 microns by moving the sample stage.

We observe a microstructure consisting of stripes oriented at 45 degrees with respect to the in plane crystallographic axes a and b. To the best of our knowledge, this structure is unreported and unprecedented for any cuprates. The size of this stripe-like modulation is around 20 micron which is remarkable and goes beyond the mesoscopic length structure we expected. Differently from what observed in other cuprates (Hg-based), the structure of charge order

does not correlate with neither the lattice nor the off-plane CuO chains (probed using a different diffraction peak).
Further analysis is currently underway in order to extract intrinsic parameters in a quantitative way, using the spatial modulation of strength and correlation length, inferred from the measured charge order peak. This quantitative analysis will provide statistical information which will enable us to characterize the texture of charge order with robust statistical methodologies, possibly finding correlations or anti-correlations with other parameters such as hole doping, lattice structure, and oxygen ordering in the CuO chain layers.