EUROPEAN SYNCHROTRON RADIATION FACILITY
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Experiment Report Form

	Experiment title: Study of the charge condensation mechanism in a field-driven charge-density-wave of a quasi-2D material	**Experiment number**: HC-2905
Beamline: ID01	**Date of experiment**: from: 19 Oct 2016 to: 25 Oct 2016	**Date of report**: 11/09/2017
Shifts: 18	**Local contact(s)**: Tao Zhou	*Received at ESRF:*

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Report:

The aim of the proposal is to probe CDW compounds when the sample is submitted to an external current, by using a nanometer and coherent x-ray beam, After a threshold current, an additional current appears at the electrodes of those materials. ID01 is the best beam line to observe this phenomenon by using a 0.3µm coherent beam and by probing a 100µm*100µm area with the quick-mapping procedure.

A cut was made in the middle of the $NbSe_3$ sample, allowing to see how the CDW reacts to this perturbation (see Figure 1). Using the diffractometer, we looked at the (0,2,0) Bragg peak and the CDW satellite (0,1.24,0). Integrating the satellite intensity, we could get the amplitude of the order parameter as a function of position on the sample (Figure 2 a)). One can see lines pattern where the amplitude is stronger. Those lines are along q_{cdw}. Those were seen as well in other experiments (more clearly than in Figure 2 a)), thus we don't think it is just an artefact.

Plus, having the Bragg and satellite, we can calculate the CDW wavevector and make a map of q_{cdw} as a function of the position on the sample. Doing so for different current values, one gets the deformation of the

CDW wavefront under current (Figure 2 b)). Oddly, we were expecting a CDW compression or dilation along the $NbSe_3$ chains. But what we saw is a q_{cdw} variation perpendicular to the chains direction.

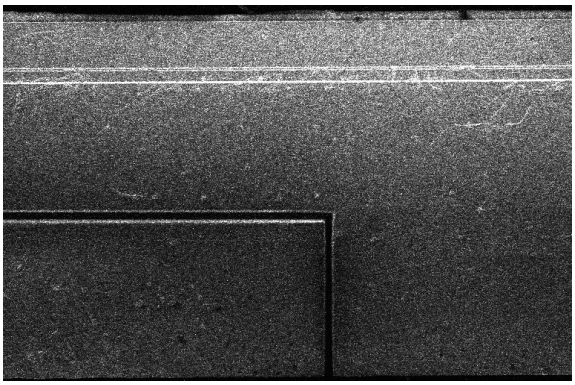

Figure 1 A cut was made on the sample. Adding current, we can see how the CDW reacts to this perturbation

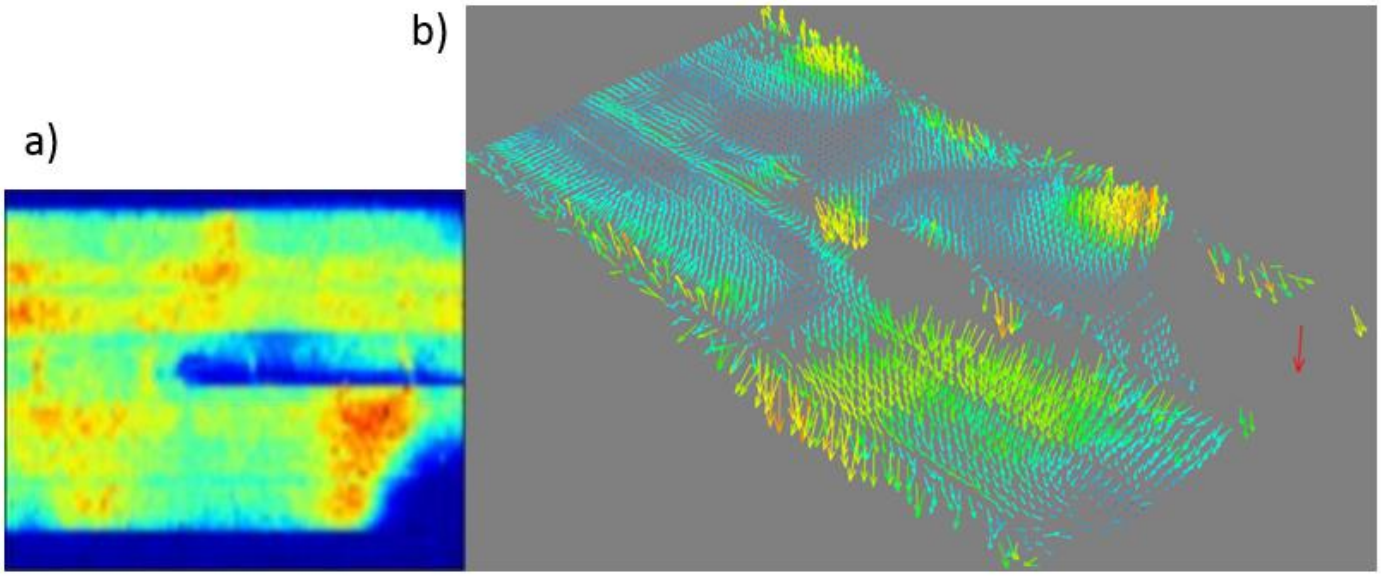

Figure 2 a) Order Parameter of the CDW as a function of position on the sample. One can clearly see the cut made in the middle of the sample. Plus, the CDW amplitude seems to be stronger along some lines in the samples (this was also observed in another sample). b) Variation of the CDW wave-vector q_{cdw} as a function of position on the sample under current. The CDW seems to be quite distorted close to the borders of the sample. Inside the sample, q_{cdw} is distorting perpendicular to the current (to the CDW direction at zero current).