ESRF	**Experiment title:** Sliding Charge Density Waves in NbSe3	**Experiment number**: HC 2281
Beamline: ID01	**Date of experiment**: from: 15 avril 2016 to: 19 avril 2016	**Date of report**: 11/09/2017
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Report:

The aim of the proposal was 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. The origin of these additional current is expected to be related to a regular array of CDW dislocations in motion. This phenomenon has never been observed so far. ID01 was 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.

In situ transport measurement and a nanometer coherent x-ray beam were used in order to map the NbSe3 compounds at the sub-micrometer scale. For this purpose, we sucesfully used the fast-scanning *kmap* procedure implemented at ID01.

In the figure below, we show the first map of a CDW NbSe3 system below and above the threshold current above which the collective current appears.

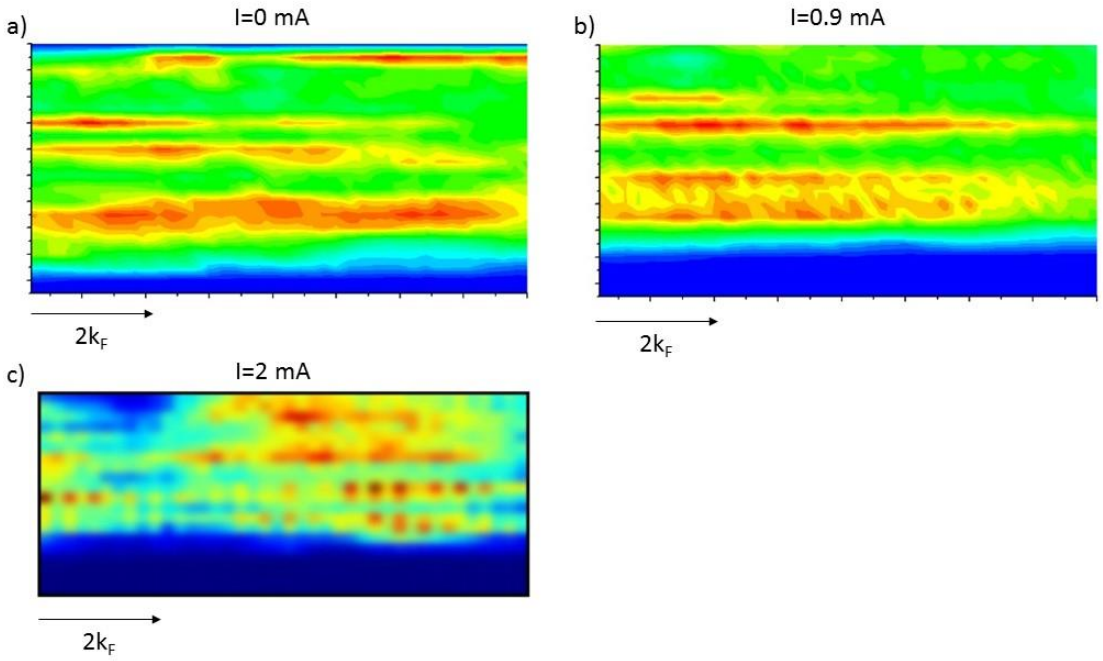

*Figure 1: $2k_F$ satellite reflection (0 1.24 0) associated to the CDW in $NbSe_3$ probed by a 0.3µm*0.3µm coherent x-ray beam and mapping a 100µm*20µm surface at T=120K: a) without external current and b) with a applied dc current greater than the threshold value (Is=0.5mA). Those two maps have been obtained after a sum over all the theta angles around the $2k_F$ satellite reflection and a sum over the region of interest of the medipix camera. The both edges of the sample are visible. This experiment clearly shows the involvement of the periodic modulation of the atomic lattice in the process. C) Presence of regular fringes probably due to the lack of reproducibility of the kmap procedure: at each step in position, the theta angle is slightly oscillating.*

The experiment was very promising although the mechanical stability of the translation of the x-ray beam was not perfect. This is due to the fact that the piezo have to be located below the FZP and not below the sample because of the too heavy weight of the cryostat. Those slight position fluctuations remain small but clearly visible in figure c). This mechanical instability leads to a periodic intensity variation. A long discussion with the ID01 team allowed to improve this instability.

The data analysis is still in progress (after one year of development). This is mainly due to the considerable amount of data to be handled (in the Teraoctet range). Our group has developed a complete data analysis adapted to the physical issue studied here.

We can draw first conclusions: without current, we clearly see the both edges of the sample. After applying currents above the threshold current (we are in the sliding mode for I=0.9mA), the map changes. Widths of rocking curves increase and the CDW looks more homogeneous in the sample. Further analysis is being performed but certainly additional experiments have to be done in the next future.