Spectrograph facility: towards 50-100 μeV energy resolution

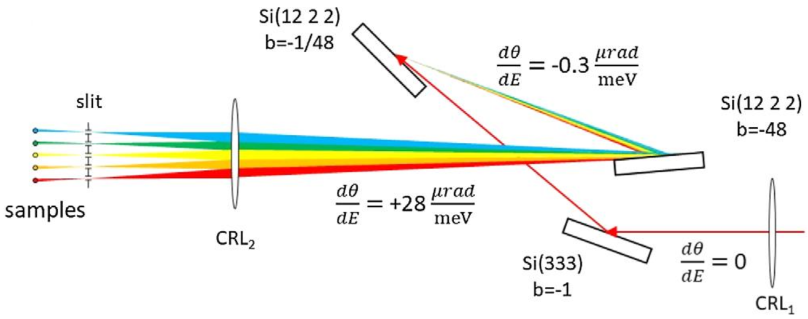
Dimitrios Bessas

ESRF-The European Synchrotron, Grenoble, France

bessas@esrf.fr

A high degree of monochromatization combined with a high incident to the sample flux are the basic requirements in scattering techniques for resolving collective excitations, such as phonons or magnons, in condensed matter. In the traditional approach a high degree of monochromatization is achieved by filtering the vast majority of wavelengths but one and as a result it works at the expense of high incident to the sample flux.

Recently, at the nuclear resonance beamline ID18 at ESRF we have developed a spectrographic approach [1] that is based on the Newton's prism principle, *i.e.*, the X-ray beam is dispersed in space in several monochromatic sub-beams, and we obtained an enhanced energy resolution of approx. 0.1 meV without sacrificing intensity, *i.e.*, all sub-beams (wavelengths) may be recorded simultaneously utilizing a position-sensitive detector. A proof of principle schematic of the spectrograph facility is shown in Fig. 1.



There are two key factors in order to achieve the optimum performance of such a spectrograph facility: (1) the quality of the crystals used for dispersing the X-ray beam that may deteriorate the obtained energy resolution, (2) the existence of a position sensitive detector with timing possibilities. In this talk, the principles of the spectrograph facility at the nuclear resonance beamline ID18 at ESRF will be discussed and hints on the quality of the crystals and a position sensitive detector with moderate timing capabilities will be given.

References:

1. A. I. Chumakov, Y. Shvyd'ko, I. Sergueev, D. Bessas, R. Rüffer, Phys. Rev. Lett. 123, 097402 (2019)