

# The MID station at the European X-ray Free-Electron Laser facility

The Materials Imaging and Dynamics (MID) station at the forthcoming European X-ray Free-Electron Laser facility (XFEL.EU) will allow investigations of materials using wide- and small-angle X-ray scattering techniques. The special features of the radiation from XFEL.EU allow novel experiments to be conducted, for instance exploiting the temporal structure and coherence properties of the X-rays. Of particular interest are the investigations of fast and ultra-fast dynamics using X-ray speckle correlation techniques (XPCS) and coherent X-ray diffractive imaging (CXDI).

The MID station will also provide new possibilities for time-resolved scattering in general and the use of very high energies (up to the 100 keV range) is also foreseen for certain materials science experiments. The instrument will also provide an optical laser system allowing optical pump / X-ray probe measurements at highest repetition rates (up to 4.5 MHz). The MID station features appropriate X-ray optics to tailor the beam for the aforementioned experiments with variable spot sizes between 100 & 1  $\mu\text{m}$  and smaller.

The instrumentation foreseen comprises a multi-circle diffractometer as well as an in-vacuum sample handling system. Highly specialized and optimized 2D pixel detectors are currently being developed to be able to fulfill the scientific goals of the MID station.

Additionally, an X-ray split & delay will be implemented allowing X-ray pump / X-ray probe, two-color and stereo imaging experiments, ultrafast X-ray tomography, and speckle visibility spectroscopy on summed images.

At the end of the instrument, a diagnostic endstation will provide essential information for data analysis, e.g. the intensity and spectrum of the individual X-ray pulses.

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