DanMAX – materials science at MAX IV

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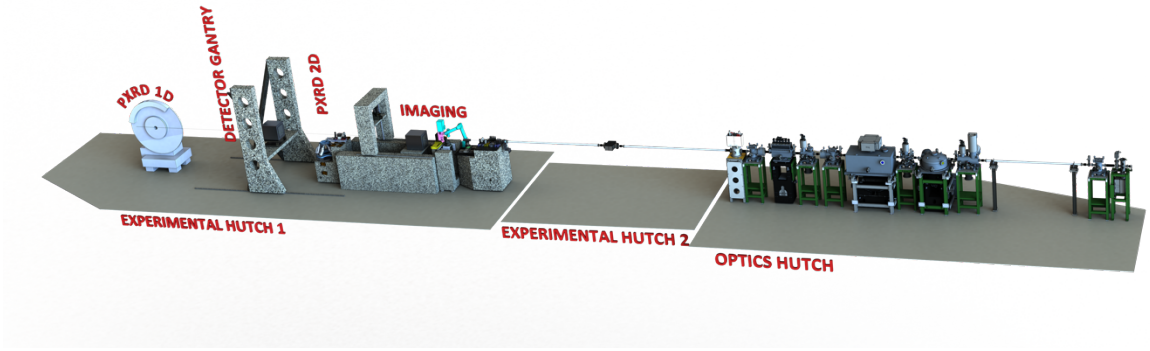
The DanMAX beamline[1] currently under construction at the 3 GeV MAX IV synchrotron facility[2] will be highly versatile and perform both PXRD and full-field imaging experiments in the energy range 15-35 keV. The very brilliant X-ray source and a flexible optics system allows for both three different band pass modes, and focusing of the beam from ~5 µm up to ~ 1 mm. Here we present the instrument and the current status.

DanMAX will have two instruments for PXRD; a high resolution instrument and an instrument with an area detector and large sample environments. The high resolution instrument will use a strip detector with large angular coverage. This will enable fast experiment with high resolution. The instrument will have a robotic sample changer and use computer vision to align the samples, thus ensuring the optimal data quality. The area detector instrument will be built around a hexapod that can accommodate bulky and heavy sample environments. For this setup one or more large area detectors will be used to record the diffraction data. The detector positioning stage will offer large flexibility in both sample to detector distance and in detector tilt to increase the attainable Q range.

The imaging instrument will be a versatile setup allowing a wide range of full field and diffraction based imaging studies. With the extremely high photon flux from the DanMAX insertion device and a high-speed air bearing tomography stage, a fast (>1 Hz) tomography of a millimeter-sized samples with a micron resolution is expected. With the use of compound refractive and multilayer Laue lenses in an X-ray microscopic setup, a high-resolution nanotomography (with the spatial resolution down to 50 nm) could be performed. High coherence fraction of the beam would enhance phase contrast imaging significantly.

Diffraction-based imaging methods would be used in order to study a three-dimensional grain structure in crystalline materials using the 3D-XRD scans, and further look into microstrains, domains structure and dislocations of an individual crystallite can be made using dark field X-ray microscopy. Imaging stage would be capable of holding versatile sample environments for in-situ and in-operando studies and a sample-changing robot for the increased throughput.

A wide range of advanced sample environments will be available at the beamline. Open standards will be available, both mechanical and software, for fast and easy integration of custom-built sample environments at the beamline. DanMAX is expected to be available for users in 2021.



References:

[1] www.maxiv.lu.se/danmax

[2] Tavares, P. F., Leemann, S. C., Sjöström, M. and Anderson, Å. *J. Synchrotron Rad.*, 2014, 21, 862-877.