*DanMAX**

External collaborations	DTU; AU; KU
Original budget and funders	122 MSEK. Ministry of Higher Education and Science (DK); The Capital Region (DK); Central Denmark Region; DTU; AU; KU; MAX IV
Official start	January 2016
Expected date of completion	DDR review in December 2016. Commissioning in 2019. First user Summer 2019.

DanMAX will do materials science research on a range of materials. The focus is on studying real materials at real conditions at real timescales. By combining two powerful techniques – powder X-ray diffraction (PXRD) and full field imaging - each one giving information on different length scales - it is possible to gain additional insight in the material properties and performance. At the moment, DanMAX is the only beamline at the MAX IV Laboratory dedicated to powder diffraction studies, while its imaging capabilities will be complimentary to NanoMAX and the future MedMAX beamlines, with the samples scale sizes ranging from tens of microns to millimetres. A broad research community in the field of material sciences, energy materials, food science, geoscience and pharmaceuticals will benefit from DanMAX. In addition to the large Danish user community also a large Swedish and international scientific community will benefit from DanMAX.

Technical description

DanMAX is a dual instrument beamline capable of doing full field imaging with attenuation and phase contrast modes and a versatile powder diffraction instrument. Key is to have a large ensemble of sample environments and an active development of sample environments in collaboration with the user community.

Design goals:
Energy range: 15-35 keV, Beam size: 3 µm to 3 mm.
One large experimental hutch will contain both imaging and powder diffraction instruments.
High intensity pink beam mode and highly monochromatic modes can be used. Fixed exit monochromators will allow users to easily change between modes and energies.

Technical implementation:
Three-meter long in-vacuum undulator, 16 mm magnetic period, 4 mm minimum gap.
Si 111 horizontally deflecting double crystal monochromator ($\Delta E/E \sim 2x10^{-4}$, nitrogen cooled).
Broad bandwidth double bounce multilayer monochromator ($\Delta E/E \sim 2\%$, water-cooled).
Optional 2-3 tranfocators with one- and two-dimensional Be compound refractive lenses.

Present status

Contracts for the insertion device and the frontend have been signed and fabrication started.
The first DanMAX users meetings has been held to gather input on the scientific case for the beamline and corresponding specifications for the endstation. The second users meeting is scheduled for January 2017 in order to finalise the specifications and design of endstation instruments.

Expected status end 2018

Installation of insertion device, front end and hutches/infrastructure will be completed in 2018. Installation of optics and experimental stations will be ongoing.

Major partners and additional funding

Major partners for the DanMAX project are the MAX IV Laboratory, Technical University of Denmark (DTU), Aarhus University (AU), University of Copenhagen (KU), Central Denmark Region, Danish Ministry of Higher Education and Science and the Capital Region of Denmark.

Changes made since the start

Since the project is relatively new and the DDR is planned for November 2016, no changes have been made so far.

* https://www.maxiv.lu.se/accelerators-beamlines/beamlines/danmax/

Comparison to beamlines worldwide

PXRD: MS at SLS (Switzerland), BL02B2 at SPring8 (Japan), and I11 at Diamond Light Source (UK).
Imaging: TOMCAT at SLS (Switzerland), ID19 at ESRF (France), ID06 (dark field X-ray microscopy) at ESRF (France), and P05 at PETRAIII (Germany).

Future development

There is a great need for additional powder diffraction capability at MAX IV and in the community at large. Therefore the possibility will be investigated of developing a simple powder diffraction side-branch - that can operate in parallel with the main station at DanMAX - by using a Laue monochromator to split of a small part of the photon beam. This could significantly increase the powder diffraction capacity at MAX IV.

As DanMAX relies of quite advanced and capable sample environments due to the focus on *in-situ* and *in-operando* studies of real materials under real conditions, a strong program is needed of ongoing development of further sample environments. This development must happen in close interaction with the future user community at DanMAX in order to meet the needs of their research.