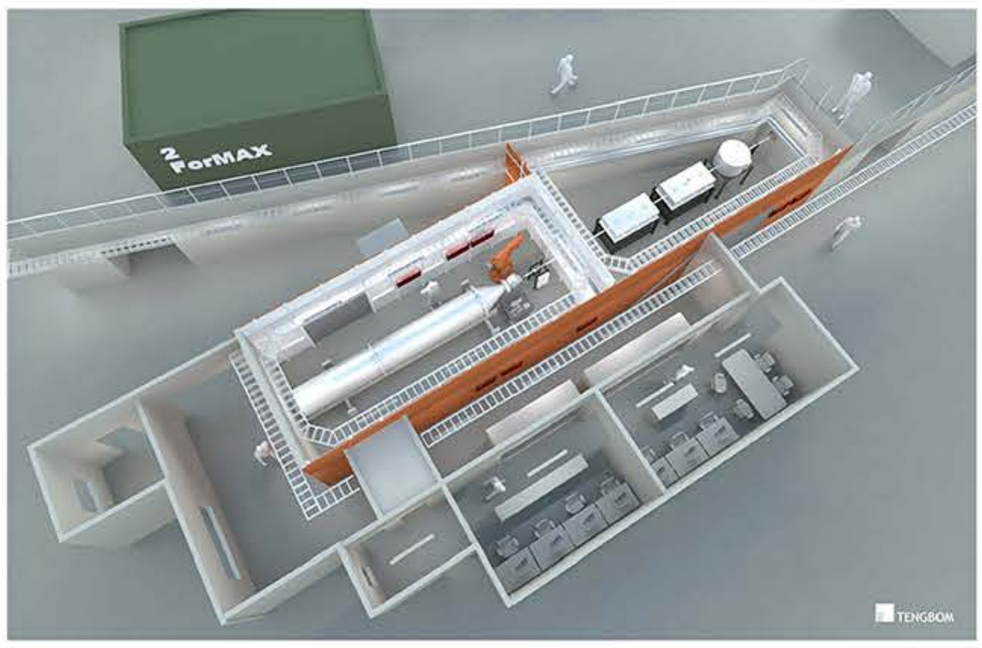
Facility Update

ForMAX – wood research for a better future

MAX IV Laboratory has received 100 million SEK from Knut and Alice Wallenberg Foundation for the investment in a new beamline, ForMAX. The new beamline is tailor-made for solving research questions related to materials from wood and will be a part of the transition to a bioeconomy.

ForMAX is part of Treesearch, a national research platform for research and competence building in the field of new materials and specialty chemicals from forest raw materials.



Concept design of the ForMAX beamline

ForMAX will provide a unique possibility for simultaneous small- and wide-angle x-ray scattering as well x-ray imaging, providing simultaneous structural characterisation from atomic to macroscopic length scales. This is essential when studying hierarchical materials such as wood, which show important structure at many different length scales.

Soft X-ray Laser at MAX IV

A Soft X-ray Laser (SXL) beamline is being designed at the MAX IV Laboratory. The project was proposed by the user community in a workshop held in early 2016 at Stockholm University, which attracted over 100 participants from all over Sweden and abroad. The Conceptual Design Study, planned to take 2 years, is a joint effort of Stockholm University, Uppsala University, KTH Royal Institute of Technology, Lund University and MAX IV Laboratory and has recently received financial support from the Knut and Alice Wallenberg foundation.

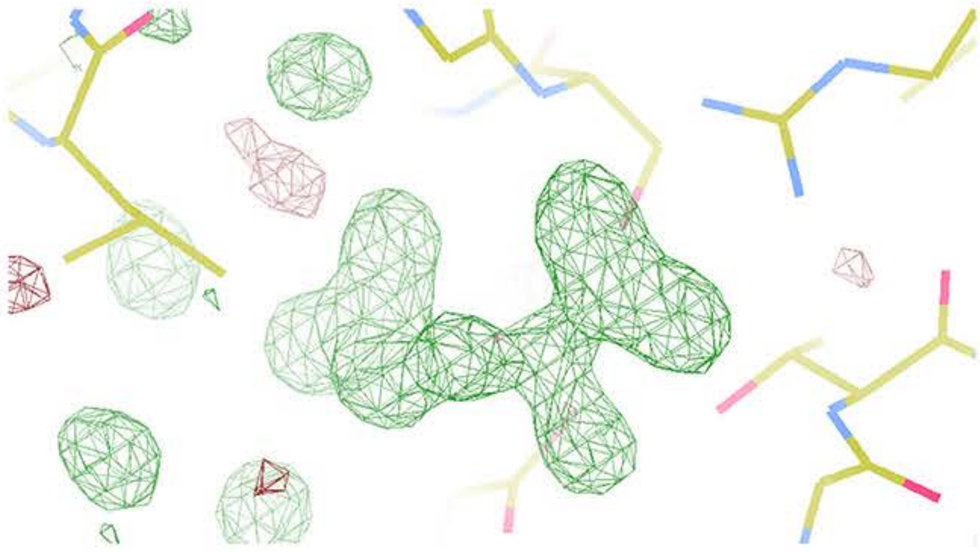
The baseline design of the SXL will deliver coherent, ultrashort, soft X-ray pulses with full polarization control in the range 1-5 nm (0.2-1 keV). The system is building on the MAX IV linac, already today providing 100 fs 3 GeV electron pulses. Scientifically and technically the SXL will complement the existing FemtoMAX beamline which covers higher photon energies in intense, short, partially coherent pulses.

The SXL will generate new opportunities in Atomic and Molecular Science, Condensed Matter Physics and Life Science. A broad range of pump sources for pump-probe experiments will be available together with pulse lengths down to 10 fs foreseen in the first phase and as short as 1 fs being envisaged in a second phase.

First structure phased at BioMAX beamline

The ionotropic glutamate receptors (iGluRs) are highly abundant in the central nervous system (CNS) and mediate fast synaptic neurotransmission. Dysfunction of the glutamatergic system has been associated with various diseases in the CNS, e.g. depression, Parkinson's and Alzheimer's diseases and epilepsy. The iGluRs are for example considered an attractive and appropriate target for the discovery of cognitive enhancers.

Through a protein crystallography experiment at the BioMAX beamline, several data sets were collected, which led to three new structures (wildtype and two mutants of the receptor) in complex with glutamate and a novel positive allosteric modulator. Full data sets could be collected in less than 15 sec and the best data set was collected at 1.3 Å resolution. The initial electron density maps were of excellent quality, allowing unambiguous positioning of glutamate and the novel positive allosteric modulator.



Fo-Fc electron density map contoured at 3 sigma, clearly showing the location of glutamate in the structure.

MAX IV