

SoftiMAX – A new Soft X-ray Microscopy and Coherent Imaging Beamline at the MAX IV Facility.

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SoftiMAX is a new beamline for soft X-ray spectro-microscopy currently under construction at the new MAX IV synchrotron facility in Lund, Sweden [1]. It is situated at the 3 GeV ring at MAX IV, and will provide a very high average coherent flux owing to the low emittance properties of the ring [2]. The SoftiMAX project consists of two branch lines, utilizing different focusing solutions and catering to a variety of imaging methods. As the construction of the beamline is nearing completion, we present the design and an outlook on the capabilities of the experimental stations.

In overview, the available photon energy range of SoftiMAX is 275 to 2500 eV, with full polarization control up to approx. 1650 eV. The energy resolution will lie between 1000 and 15000 E/dE, depending on the grating and energy used, and the flux on sample in the main branch end-station is ca. 2×10^{10} ph/sec at 275 eV and ca. 2×10^9 ph/sec at 2500 eV with a 1200 l/mm grating and a 20 nm-FZP.

The main branch of SoftiMAX will host an end-station optimized for scanning techniques such as Scanning Transmission X-ray Microscopy (STXM) and diffraction imaging (ptychography [3]). Accordingly, the x-ray beam will be focused using Fresnel Zone Plates (FZP) to a beam size on the sample below 100 nm to allow for small illumination footprint (STXM) or a larger beam size to ease methods that require overlapping illumination (ptychography). STXM will be the first method offered at SoftiMAX in early 2019, and the STXM branch is envisioned to support a wide range of sample types, including material science, environmental science, life science and biology.

The second branch of SoftiMAX will provide a larger spot size than the main branch, and higher flux, by using Kirkpatrick-Baez focusing optics. The envisioned spot size on the sample is here 20 μm , to support methods that require a fully coherent extended beam, such as Fourier Transform Holography, which is the principal mode of operation for this branch. The corresponding end-station will be optimized for the studies of magnetic thin films using magnetic dichroism, but is still in the planning stage.

SoftiMAX is part of the Imaging group at MAX IV, and embedded in a wider infrastructure for sample preparation and data analysis, including a dedicated com-puter cluster and in-house support for spectral analysis and phase retrieval of diffraction data.

First user operation on the main branch is expected to start in early 2020.

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References

- [1] - <https://www.maxiv.lu.se/accelerators-beamlines/beamlines/softimax/>
- [2] - <https://www.maxiv.lu.se/accelerators-beamlines/accelerators/accelerator-documentation/3-gev-storage-ring/>
- [3] - P. Thibault *et al*, *PNAS* **113** (2016) E8219.