*Q. VERITAS**

External collaborations	UU, KTH, SU, LiU, HZB, PSI, SOLEIL, UPMC
Original budget and funders	70.7 MSEK, KAW and 12 Swedish universities
Official start	September 2011
Expected date of completion	January 2018

VERITAS aims at becoming a world leading beamline for Resonant Inelastic X-ray Scattering (RIXS) in the 275-1 500 eV range. This goal will be achieved by fully utilising the high current and extraordinary emittance of the MAX IV 3 GeV storage ring. The beamline will deliver a high flux of highly monochromatic photons of well-defined polarisation in a small focal spot at the sample. It will be adapted to a large high-resolution soft X-ray spectrometer, which is rotatable in the horizontal plane.

RIXS gives information about the local electronic structure at selected atomic sites, and about local dynamics on the sub-nanometre length and femtosecond time scale. The inherent sensitivity to the local wavefunction symmetry is enhanced when polarisation of the incident radiation is controlled. Monitoring the momentum transfer (Q) in the scattering process gives additional information on band structure and fundamental excitations. Furthermore, RIXS is a bulk-probing technique and thus ideal for investigating bulk properties and buried structures, and for *in-situ* studies of processes under ambient conditions.

Technical description

The beamline utilises an elliptically polarising undulator optimised for maximum photon flux in the 275 - 1 500 eV range with linear polarised light of any orientation and circular polarised light. The beamline uses a collimated plane-grating monochromator and has two branches; the RIXS branch and an open port with refocussing to be used for user supplied endstations. Selection between branches are made by switching the focusing mirror. The endstation, including a custom experimental chamber, allowing for continuous 120^{o} in-plane rotation, a compact large-bore manipulator system, and a collimated RIXS instrument is developed in close cooperation with Uppsala University.

Present status

The beamline infrastructure is ready, including buildings, cabling, water and gas supply. The beamline vacuum system is in place from the optics hutch to the RIXS endstation. The monochromator and mirror systems have been installed and are awaiting first light. The design of the RIXS instrument is finalised and build-up of the instrument is well underway. The design of the second branch is done and procurement of the optics has started.

Expected status at the end 2018

At the end of 2018 we will have been operational for one year with the RIXS endstation. Also the second branch should have seen users. We will be able to run solid, liquid and gaseous systems. We will offer a number of experimental environments from He cooled solid-state manipulators to liquid micro-jets and reaction cells.

Major partners and additional funding

Uppsala University (UU), KTH Royal Institute of Technology, Stockholm University (SU), Linköping University (LiU), Helmholtz-Zentrum Berlin (HZB), Paul Scherrer Institut (PSI), SOLEIL, Université Pierre et Marie Curie (UPMC).

The beamline project manager Marcus Agåker was granted an SSF infrastructure fellowship of 15 MSEK for continued support and development of VERITAS.

Changes made since the start

Recent developments highlight emphasis on strongly correlated electron systems, and systems with large spin orbit coupling. New collaborations have been initiated with strong theory groups at UU, and with magnetism researchers at the technical faculty of Uppsala University.

Due to increased costs for infrastructure the PVD (physical vapour deposition) system included in the beamline will be put on hold. The RIXS spectrometer has been prepared for polarisation measurements to add full control over energy, momentum, and polarisation measurements.

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

Comparison to beamlines world wide

ERIXS at ESRF (France), SIX at NSLS II (USA), I21 beamline at Diamond Light Source (UK), ADRESS at SLS (Switzerland), and SEXTANTS at SOLEIL (France)

Future development

We envision a continued work to broaden the scope of the RIXS technique. The beamline staff will work to open up new collaborations that will introduce more fields of science to the RIXS technique. Sample environments for *in-situ* experiments in fields like electrochemistry, solar cells, Li-ion batteries, corrosion and catalysis amongst others will be developed. We will strive to have a cross-beamline user base with synergies with amongst other Balder, SPECIES, HIPPIE and the ARPES beamlines at MAX IV. In particular sample environments will be shared between the SPECIES RIXS and the VERITAS beamline opening up a unique range from 27 eV to 1 500 eV of high resolution RIXS between them.

A general purpose cryostat goniometer will allow to reach down to T= 10 K while a dedicated cryostat, developed with Uppsala University, will allow temperatures down to T< 4K. This combined with facilities for providing strong external magnetic fields will make us very attractive to a broad section of the material science community.

The VERITAS open port will be a strong case for a high-throughput RIXS instrument to be built with three uses. 1) as a high throughput RIXS option at the SPECIES endstation 2) for a dedicated moveable RIXSmap endstation and 3) as part of a Resonant Elastic X-ray Scattering (REXS) station with the ability to filter out the elastic part of the spectrum for correlated materials making the VERITAS a very attractive beamline for the correlated materials community, matching REXS with the high resolution Q-dependent capabilities of the other VERITAS branch.