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BL06-XAIRA, the new microfocus beamline for MX at ALBA: status and scientific opportunities

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BL06-XAIRA beamline at ALBA synchrotron light facility, foreseen to perform the first experiments by the end of 2023, will be dedicated to microfocus macromolecular crystallography, complying with a long-standing request from the scientific community and complementing the available MX capabilities of BL13-XALOC beamline.
The beamline is designed to support a broad range of biomedical structure determination methods and, more specifically, to cater for three main scientific cases: i) microfocus MX experiments, such as projects producing crystals with micrometric sizes, reduced diffracting power or requiring complex data collection strategies; ii) fixed-target serial crystallography (SSX) experiments; and iii) anomalous phasing and elemental characterization.
XAIRA will provide a highly stable X-ray beam with a micrometric size (3 × 1 μm2 FWHM at 1 Å wavelength), adjustable to the users'needs, down to 1×1 μm2 and up to at least 10 × 10 μm2.
A novel dual monochromator design developed inhouse allows the photon wavelength to be selected within the 4.0 –14 keV energy range, using either a double multilayer monochromator, for high photon fluxes over 3·1013 ph/s, or a channel-cut monochromator, for extra beam stability at >3·1012 ph/s. The photon source, a 2.3m-long, 191.9 mm magnetic period in-vacuum undulator is the longest installed at ALBA.
Another distinctive element of the beamline is the chamber enclosing the whole end station, which allows experiments to be performed either in air or in helium atmosphere, both at room temperature or cryogenic conditions. The helium environment not only can drastically reduce the background noise, thus increasing data quality for the whole energy range, but also prevents flux loss at low energies, providing the optimal conditions for anomalous phasing experiments achievable in general-purpose beamlines.
A vertical single-axis diffractometer will allow for "traditional"oscillation data collection from samples on pins, meshes and small chips, while a dedicated sample rastering stage will also be available for non-oscillation data collection from large SSX chips.
XAIRA will be equipped with a pixel-array photon-counting detector capable of data acquisition at a maximum frame rate of 1 kHz. In combination with the high flux provided by the multilayer, this will enable time-resolved SSX experiments in the millisecond regime.
The state-of-the-art detector, in combination with an automated sample mounting system with a dewar capacity for over 450 samples and automated data analysis capabilities, grant XAIRA the necessary high throughput to allow rapid sample screening and data collection of crystals.
XAIRA is currently under construction; the optical system is currently being commissioned and the beamline will see first light in the forecoming months.

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