includes a high accuracy single axis diffractometer complemented with a removable mini-kappa mount and an automated mounting robot that can work with both cryogenic samples and crystallization plates. A photon-counting 6-Mpixel detector, built with parallel pixel electronics, offers outstanding capabilities like a large sensitive area (431×448 mm^2), a very fast framing rate (12 images/second), a large dynamic range (20 bits, $>10^6$), and negligible dark current noise.

The optical design foresees two main operation modes: an unfocused configuration, where one or both mirrors are removed from the photon beam path, resulting in a very small beam divergence of less than 0.03 mrad vertically, a mode that can be especially useful for large macromolecular complexes with large unit cell parameters; and a focused configuration, where both mirrors can focus the beam to 50×7 μm^2 FWHM (H×V) on small or microcrystals, while at the same time keeping a small and useful vertical divergence (0.1 mrad). In addition, the mirrors allow variable focusing if matching the size of the x-ray beam to the dimensions of the crystals or if focusing at the detector (which can be placed at any distance between 80 mm to 1300 mm from sample) are required. In this case, the beam size at sample position can range from 50×7 μm^2 to 300×300 μm^2 (H×V). In order to avoid x-ray beam deformations caused by the optics when defocusing, slope errors of the mounted mirrors have been reduced to 70 nrad rms and the monochromator crystal can work near the zero expansion temperature of Silicon (124 K).

To fulfil the needs of standard multiple wavelength anomalous diffraction experiments, the beamline will deliver over $3\bullet10^{12}$ ph/s in the 5-21 keV energy range, which covers all the common K and L_3 absorption edges, and an energy resolution of $\Delta E/E \sim 2\bullet10^{-4}$. Finally, a major design objective has been to optimize the beam stability at sample position to improve successful data collection. In this respect, the beamline is equipped with an exhaustive diagnostics system that includes 4-diode and diamond X-ray monitors and fluorescent screens, a feedback system on the pitch of the second crystal surface of the monochromator, and seismic accelerometers near the critical optical surfaces to monitor vibrations in real time. Moreover, the cooling system of the monochromator has been designed to work at low liquid N2 flows, close to the laminar regime.

Currently being the only MX beamline at ALBA, XALOC has been designed to deal not only with heavily automated x-ray diffraction experiments but also non-standard and trickier ones as well as a myriad of crystal sizes and unit cell parameters. XALOC is now finalizing the control system and is ready to start x-ray beam commissioning. It is expected to be opened to users at the beginning of 2012.

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Keywords: beam line, synchrotron, macromolecular crystallography

MS07.P07

Acta Cryst. (2011) A**67,** C257

High-brightness liquid-metal-jet x-ray tube

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High-end x-ray diffraction and scattering techniques such as high-resolution XRD, protein crystallography, and SAXS rely heavily on the x-ray source brightness for resolution and exposure time. Thus, synchrotron radiation sources are the obvious choice. However, many users and applications benefit from laboratory systems based on compacts sources. Unfortunately, the brightness of present electron-impact x-ray sources is fundamentally limited by thermal constraints in the anode technology and this limits their applicability.

We have demonstrated a new anode concept, the liquid metal jet [1]. This regenerative anode allows operation of micro focus tubes with an electron beam power density orders of magnitude higher than present solid or rotating anodes. The source has been demonstrated for a wide range of liquid anodes and x-ray emission energies, e.g., [1,2]. Our current liquid-metal-jet prototype x-ray source systems rely on room-temperature liquid-metal alloys as anode and typically operate at approximately one order of magnitude higher brightness than present state-of-the-art x-ray tubes. This unprecedented brightness makes the liquid-metal-jet-x-ray source suitable for a wide range of diffraction, scattering, and imaging applications.

In this contribution we will present a new version of the source which is optimized for diffraction and scattering applications. It runs with an almost pure Ga alloy and a 70 kV magnetically focussed LaB_6-based electron gun to generate intense emission of the 9.25 kV Ga-K_α line. The source typically operates with a 20 μm diameter focus and 200 W of electron-beam power. We will present a detailed characterization of the source including spot size, stability, lifetime, flux and brightness. In addition, we demonstrate the use of the liquid-metal-jet source for important applications, including SAXS and phase imaging [3], clearly showing the benefits of increased brightness.

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Keywords: X-ray, source, tube

MS07.P08

Acta Cryst. (2011) A**67,** C257

On the purirty of micro-source X-ray radiation

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Multilayer optics are currently adopted in many laboratories for single crystal diffraction, using very low power X-ray generated by micro-sources. The high-brilliance and the micro-focusing are the main advantages of these radiation sources, that allow high performance experiments also on a laboratory scale.

However, we recently discovered [1] a fundamental defect of this technology, namely the significant contamination of the characteristic radiation by low energy photons which are reflected by the mirrors because of the small incidence angle. Simple experiments show that the contamination can significantly reduce the accuracy of measured intensities, especially when Mo Kα radiation is used.

We have therefore proposed a simple and economic solution to the problem [1]: an aluminium filter of adequate thickness efficiently removes the low energy contaminant photons. Performances of Al-filtered data collections are reported and alternative solutions are discussed.

[1] P. Macchi, H.-B. Bürgi, A.S. Chimpri. J. Hauser, Z. Gàl *J. Appl. Cryst. in the press*.

Keywords: microsource; optics; X-ray diffraction