

## X-ray Diffraction Beamlines in the Brockhouse Sector at the Canadian Light Source

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The Brockhouse sector at the Canadian Light Source (CLS) has three independent hard x-ray beamlines in the final stage of construction. The beamlines will be used for diffraction and scattering experiments for material science. There is one undulator beamline from 5 to 24 keV, and two wiggler beamlines: a low energy (LE) beamline from 7-22 keV and a high energy (HE) beamline from 20-95 keV, sharing a wiggler source. Both insertion devices are in-vacuum and chicaned by 4 mrad in straight section 4 of the 2.9 GeV storage ring at the CLS.

The beamlines have several unique design features. The challenge of having narrowly spaced sources is addressed by using single, side bounce monochromators for the wiggler beamlines. The single wiggler source is split in two by a side bounce mirror, reflecting the low energy beam outboard towards the low energy Bragg monochromator, with Si(111) and Si(311) crystals. A second mirror focuses the beam at the sample, 29m from the source. The focus size is 77  $\mu\text{m}$  vertical and 440  $\mu\text{m}$  horizontal FWHM, with a flux of  $10^{12}$ - $10^{13}$  ph/sec (500mA ring current) and energy resolution of  $10^{-4}$ . The beamline has a Bruker small molecule crystallography station, a Huber goniometer for high resolution powder diffraction and an IBM station for in-situ diffraction experiment.

The HE beamline has a side bounce Laue monochromator, with two fixed sagittal bent silicon crystals. One crystal will cover energies from 20 to 35 keV using the (111) planes, resulting in a flux at the sample of  $10^{14}$  ph/sec, and the other crystal will cover from 40 to 95 keV, using either the (422) or the (533) planes, yielding fluxes of  $10^{11}$ - $10^{12}$  ph/sec. A PerkinElmer amorphous silicon detector with 2048 $\times$ 2048 array of 200 $\mu\text{m}$  pixels will be used. This beamline will be optimized for pair distribution function, high pressure and extreme environment experiments.

The undulator beamline has a double multilayer monochromator (DMM) followed by an optional channel cut monochromator (CCM), both water cooled. With the permanent DMM and the optional CCM, the beamline will provide two operation modes: one with very high flux ( $10^{14}$  –  $10^{13}$  ph/sec) and lower energy resolution ( $\Delta E/E \sim 10^{-2}$ ) for experiments such as time resolved or nanostructures characterization, and another with lower flux ( $10^{12}$  –  $10^{11}$  ph/sec) and higher energy resolution ( $\Delta E/E \sim 10^{-4}$ ) for experiments with highly crystalline samples. The final optical components are two large mirrors in the KB configuration that can focus or collimate the beam horizontally and vertically at the end-stations 50-56 m from the source. The focus size will be 15  $\mu\text{m}$  in the vertical and 170  $\mu\text{m}$  in the horizontal. The beamline will be optimized for single crystal diffraction, thin film characterization, anomalous and inelastic scattering experiments, with a 6-axis Newport Kappa diffractometer as the main end-station.

The wiggler beamlines are under commissioning while the undulator beamline is in the final stage of construction.

