BL20XU Medical and Imaging II

The beamline 20XU is designed for application to various imagingtechnologies: X-ray microscopy, micro-tomography, medical imaging, refraction-enhanced imaging, etc. The BL20XU is the second medium-length beamline in the SPring-8.

Area of research

Micro-imaging: Scanning microscopy, Imaging microscopy, Micro-tomography, X-ray holography and other experiments on X-ray optics and developments of optical elements

Medical application: Micro-angiography, Refraction-enhanced imaging, Radiation therapy

Ultra-small angle scattering

Keywords

Scientific field

Micro-imaging, Coherent optics, Medical imaging, Ultra-small-angle scattering

Equipment

High resolution X-ray imaging detectors (CCD camera coupled with optical lens and phosphor screen (beam monitor type II and type III), X-ray zooming tube (Hamamatsu Photonics C5333)

Source and optics

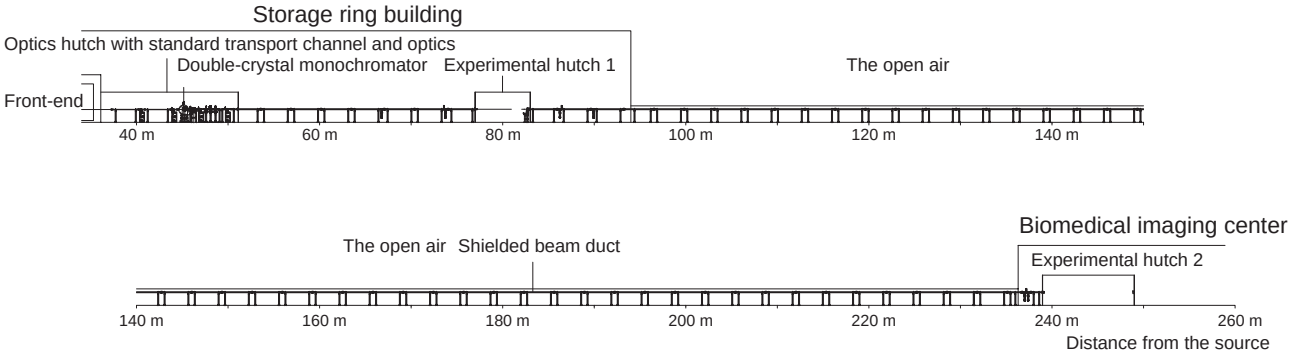
The light source is hybrid-type "in-vacuum" planar undulator whose periodic length is 26 mm. Maximum K-value is designed to be 2.0 in order to cover the full energy regions above 8 keV. Monochromator is "SPring-8 standard" double crystal monochromator placed at 46 m from the source point. The liquid nitrogen cooling system developed at the BL47XU will be employed. The first crystal of monochromator is combination of Si (111) orientation crystal and Si (511) orientation. These two crystals are interchangeable by using linear-translation stage without venting the monochromator vacuum.

The second crystal is Si 111-orientation. Therefore, by switching only the first crystal, both (+ −) configuration of Si 111-111 and Si 511-333 configuration can be used. Therefore, the energy region from 8 to 113 keV is available by the combination of the two reflections.

- Constant exit double crystal monochromator
- SPring-8 standard, cryogenic cooling
- Lattice plane: Si 111 (7.7 ~ 37.7 keV), Si 511 (23 ~ 113 keV)
- Range of Bragg angle: 3 ~ 15 degree

X-rays at sample

- 0.7 mm (vertical) × 1.2 mm (horizontal) at the experimental hutch I
- Flux density at the hutch I is about 10^{13} photons/mm^2 with Si 111 reflection
- ~2 mm × 4 mm at the experimental hutch II

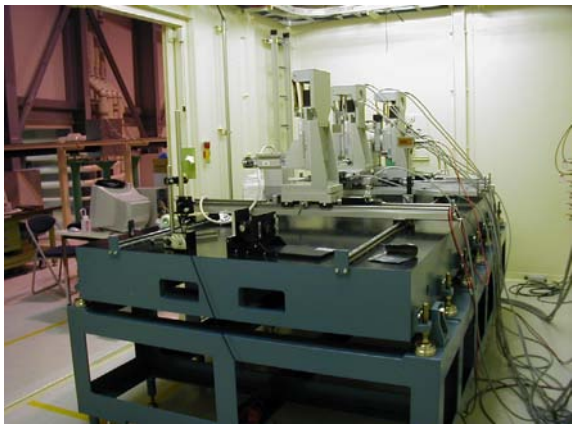


Schematic view of beamline

Experimental stations

Monochromatic beam is extracted into the Biomedical Imaging Center that is located at about 200 m from storage ring. Two experimental hutches are located at 80 m from source and at 245 m from the source, respectively. The first experimental hutch is in the experimental hall of the storage ring building, and the second one is constructed in the Biomedical Imaging Center. The first medium length beamline 20B2 is bending-magnet light source beamline and is now used for medical imaging, microscopy, and X-ray topography. The role of BL20XU is complementary to BL20B2. By using high-flux density X-ray beam from the undulator light source, although the beam cross-section is only a few mm even at the end station that is located at 245 m from the undulator, real time observation of live specimen will become possible. It is also to be noticed that a highly coherent X-ray beam can be provided by utilizing the long source to sample distance of 245 m.

- Detectors : conventional type ionization chambers, NaI scintillation counters, pure Ge detector.
- X-ray imaging detectors : CCD camera coupled with optical lens and phosphor screen (beam monitor type II and type III), direct sensing X-ray pickup-tube camera.



Versatile high-precision diffractometer for X-ray microscopy at the experimental hutch I

Multi-purpose high-precision diffractometer for various imaging experiments at the experimental hutch II

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