# BL40B2
# Structural Biology II

## 1. Introduction

A common application of BL40B2 is small-angle X-ray scattering measurement for soft materials such as proteins, synthetic polymers, and micelles. The beamline utilizes a 1-m long bent-cylinder mirror to provide a 200 μm × 200 μm focal spot at a detector. These devices are located at distances of 40.7 m and 58.6 m from a bending magnet light source, corresponding to a magnification ratio of about 1/2 in the collection optics. The X-ray energy can be selected from the range of 6.5 keV to 17.5 keV by an Si (111) double-crystal monochromator system. A structural scale for scattering measurement can be probed from 0.15 nm to 600 nm. In FY2019, we focused on improving a solution scattering system and scattering measurement systems using 50-μm beam.

## 2. The updated solution scattering system with an automatic-cell-cleaning

Solution scattering experiments require the exchange of solutions in the same cell, so that it must be washed and dried. In order to improve the efficiency of these procedures, an automatic-cell-cleaning system (BioCUBE, Xenocs Inc., France) was introduced. Figure 1 shows a schematic diagram of the system. The chamber of 90 mm × 125 mm × 89 mm in size (see Fig. 2) can be evacuated to vacuum in order to keep lower background level. The cell consists of a quartz capillary with 1.1 mm or 2 mm in diameter (see Fig. 3), and it is possible to automatically transfer a small amount of liquid injected into the funnel to the capillary onto the optical path (see Fig. 1). We are planning to conduct a connection test with beamline devices in FY2020.

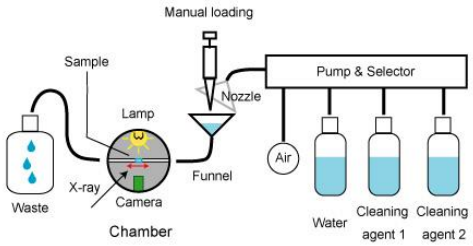


Fig. 1. A schematic diagram of sample transfer, cleaning and drying system.

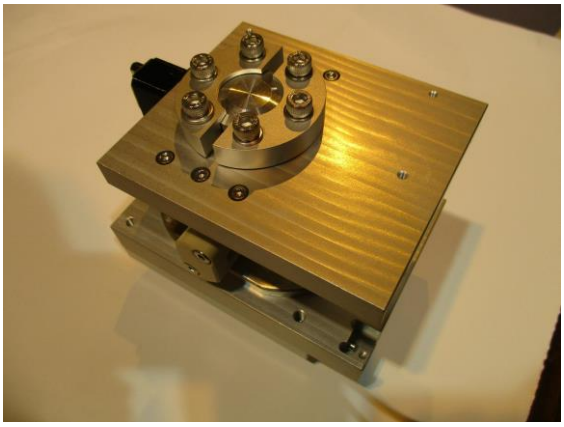

Fig. 2. Chamber of a transfer-and-cleaning system.

## 3. Improvement of scattering measurement system using 50-μm beam

When the user wants to use the reduced irradiation area to 50 μm in diameter, a pinhole is placed just upstream of the sample on an optical path. To improve the measurement efficiency, we installed a bent cylinder mirror in an experimental hutch and confirmed a 51 μm × 55 μm focal spot. The

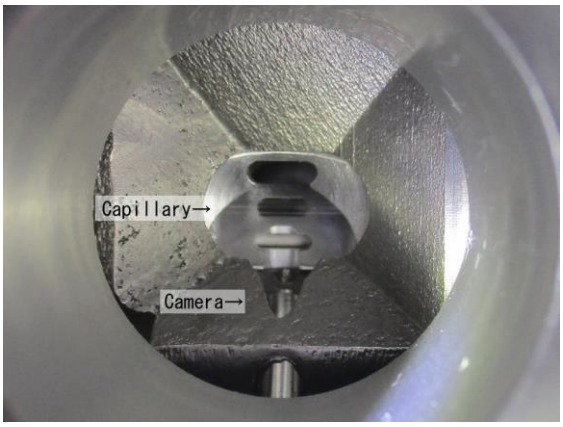


Fig. 3. Quartz capillary and camera to control the transfer inside the chamber.

Fig. 4. Ir-coated cylinder mirror of BL40B2 experimental hutch.

focused beam on the sample has been provided since FY2018. However, the upper range of X-ray energy is limited to 9 keV, because the angle of incidence of the mirror with the fixed sagittal curvature must be set to 6.5 mrad due to focus on the sample position.

To enlarge the energy range of the total reflection, an iridium-coated cylindrical mirror was installed (see Fig. 4). It has extended the range up to 11 keV with a flux of more than 8 times that of the previous rhodium-coated mirror. As a consequence, we have a 20 % wider Q-range available by changing X-ray energy. It will greatly contribute to improve usability and the efficiency of the molecular arrangement measurement confined in the nanometer space [1,2].

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**References:**

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[2] K. Tomita *et al.*, *P. C. C. P.*, **20** (2018) 13714-13721.