BL35XU
High-Resolution Inelastic X-Ray Scattering

1. Introduction & Overview

BL35XU is dedicated to the study of the dynamics of materials using inelastic X-ray scattering. During FY 2013 (April of 2013 - March of 2014) the BL35XU scientific staff included S. Tsutsui, H. Uchiyama, and A. Baron, with additional support on specific issues from D. Ishikawa and H. Fukui. Technical support, from SES, was mostly by T. Oguchi.

Scientific work at the beamline continued along similar directions as previously, including both crystalline and disordered materials. Work on systems under high pressure in diamond anvil cells (DACs) continues to expand, including both solids and liquids. A grazing incidence geometry was also initiated to allow studies of phonons in thin, ~1 micron, quantum well structures.

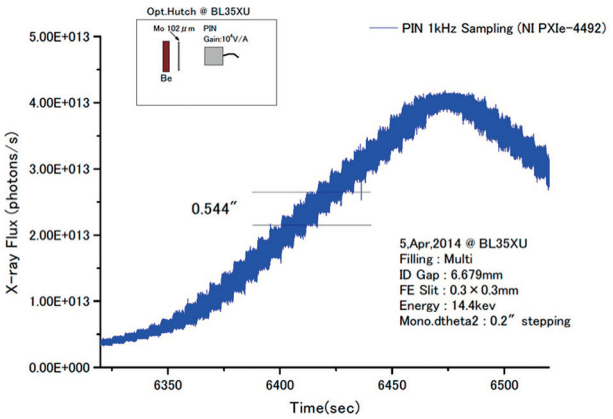

Figure 1. Measurement of the vibration of the BL35XU Monochromator done by the optics group (H. Yamazaki *et al*). The vibration is bad - see text for discussion.

2. Monochromator Issues

There were two problems with the high-heat-load monochromator - failure (again) of the Y1 encoder and the ongoing issue of increased vibrations. The second was fixed by replacing readout electronics while the first was more serious.

In good running conditions, the beam size at the sample using the bent cylindrical mirror at BL35XU is ~60 x 70 μm^2 (and occasionally better). Occasaionally, this has been degraded by monochromator vibrations as caused by specific changes to the mono. However, beginning in 2012, a persistent worsening of the vertical beam size was noted - with ~ 100-120 microns becomming typical, and 150 to 180 microns appearing in some cases (the horizontal size remained ~70 microns). While traced to the monochromator, there were no specific changes introduced in the mono in that period of time. BL staff was not able to find the exact source of the problem with the monochromator mechanics. The increased size is a serious issue, as samples ~0.1 mm in dimension are measured at BL35XU fairly regularly.

The optics group kindly measured the vibrations (figure 1) and the level of the vibrations was nearly 3 μrad, approximately a factor of two to three larger than at other beamlines. Based on this, and the persistent enlargement of the beam size, optics group suggested replacing the monochromator. (Discussions about replacing the luquid nitrogen tubing with a low-vibration version had been ongoing for several years, however, given the seriousneess of the problems, full mono repalcement was now considered). This is scheduled for the summer of 2014.

3. KB Mirror Setup -.

Issues slowing the installation of the KB setup, which is used in combination the cylindrical mirror to achieve a ~16 micron focal spot, appear to be resolved. There had been ongoing problems for 2 years, with the installation too often taking 2 to 3 days, as opposed to the ~12 hours originally needed. Following on work in FY 2012, and after replacement of some motorized stages (see section 4) the installation was reduced to the original ~12 hours. It is expected this will continue.

4. Motorized Motion Stage Maintenance.

There were several instances of translation and rotation stages not moving properly: this included several 5 cm XY stages and KTG-16 XZ stages from Kohzu Precision, and an Eulerian cradle from Huber - most had been in operation for ~10 years. These stages were, mostly, maintenanced by the manufacturer and are now performing well. However, their failure was sometimes a surprise, and not always immediately recognized due to intermittency. In all cases, the problem was essentially an increase in the viscosity (nearly, solidification) of the grease. Cleaning and re-greasing restored good operation, and eventually this became possible in-house (T. Oguchi).

5. Cryo-Furnace Operation

There was increasing demand for the new cryo-furnace - capable of operating between 10 and 500 K or 10 and 800 K, depending on the sensor configuration. The ability to do experiments bridging room temperature was greeted with enthusiasm by the users.

6. Next Generation Beamline

Effort continued to focus on BL43LXU, especially A. Baron, D. Ishikawa and H. Uchiyama spent large amounts of time commissioning BL43LXU.

7. Other

Other improvements, reports, and changes include:

- For the third year, the granite base for the spectrometer remained stable and was not re-aligned. This makes one hopeful that the floor is finally stable.
- A variety of changes were made in the backup system and the networking of the computer systems to comply with current standards of the SPring-8 networks. The network file system NFS was a particular issue.
- Computer screens were upgraded from 24" to 30".
- A glove box was installed at BL35XU in response to increased interest from users to investigate oxygen and moisture sensitive samples. This (refurbished) system required some efforts to get to work - but now seems to operate at the ppm level.
- The avalanche photodiode detector on the two-theta arm of the spectrometer was replaced - it died after >10 years of operation.
- The mounting configuration of the IXS detectors was changed to make it easier to isolate them and avoid noise.

Alfred Q. R. BARON
Satoshi TSUTSUI
Hiroshi UCHIYAMA
Daisuke ISHIKAWA
Hiroshi FUKUI