

Group Report BL18 SENJU - July 2012

Beamline Update

March 2012 - Online commissioning underway

SENJU is a new TOF single-crystal neutron diffractometer designed for use in materials physics and chemistry research. Commissioning of SENJU had been scheduled to begin in April 2011 but was delayed due to severe damage to the instrument caused by the earthquake of 11 March 2011. The SENJU instrument team (Fig. 1) spent one year deconstructing the beamline, repairing damaged components, and rebuilding the instrument. On 5 March 2012, the reconstruction of SENJU was completed and the first neutron beam was delivered to the sample position (Fig. 2). In the first month, the 2-dimensional detectors, goniometers, sample environment equipment and the device control software were tested and conditioned.



Fig. 1 The SENJU instrument team.



Fig. 2 The first neutron beam at SENJU observed with a neutron camera.

April & May, 2012 - Diffraction measurements of standard samples at room temperature

During April and May, room-temperature single-crystal diffraction images of some standard crystals were collected (e.g. sodium chloride, amino acid (glycine) and sugar (sucrose)). Figure 3 shows the neutron diffraction image from a crystal of sodium chloride. The crystal size was 1.0 mm^3 and the exposure time was 7.5 hours. The (8 8 0) Bragg reflection which corresponds to a d-spacing is 0.5\AA was successfully observed. In the case of the sucrose crystal ($1.0 \times 2.0 \times 3.0 \text{ mm}$) with a 2.5 hour exposure, the (7 0 7) Bragg reflection which is at a d-spacing of 0.5\AA was observed.

Bragg reflections were also successfully observed from two small, laboratory X-ray size single crystals of sodium chloride ($0.3 \times 0.3 \times 0.1 \text{ mm}$) and glycine ($1.3 \times 1.0 \times 0.5 \text{ mm}$) (Fig. 4: NaCl). These results suggest that the structural analyses of laboratory X-ray size crystals using neutron diffraction at SENJU should become feasible when the J-PARC proton accelerators achieve 1 MW power.

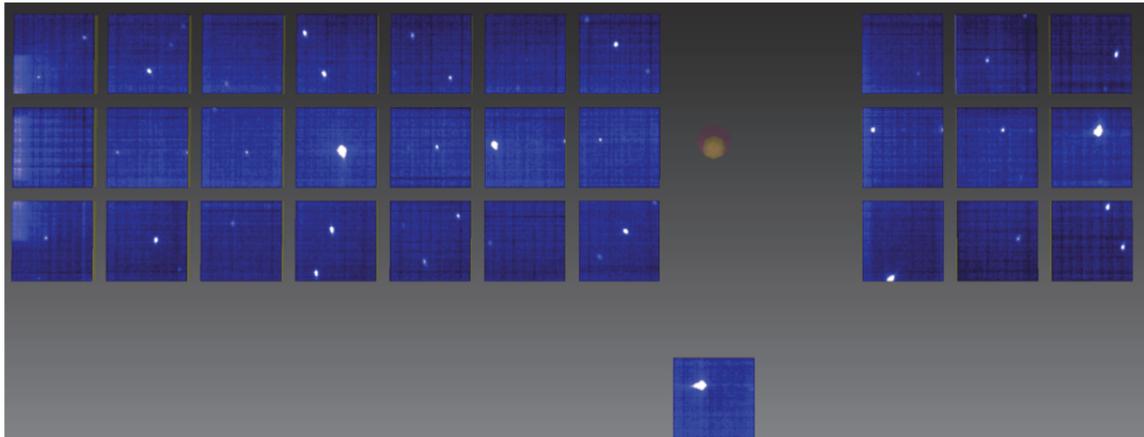


Fig. 3 Neutron diffraction image of a NaCl single crystal (1.0x1.0x1.0mm).

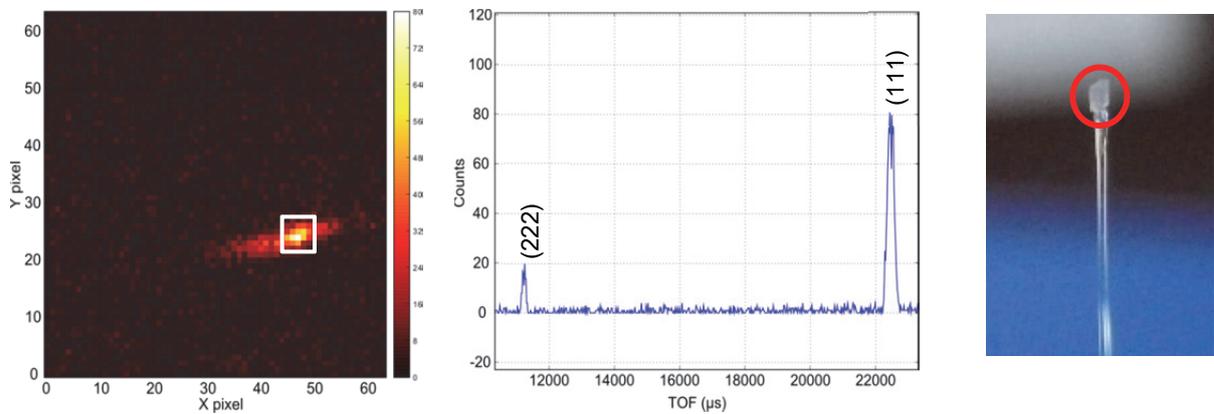


Fig. 4 Bragg spots from a small NaCl single crystal (0.3x0.3x0.1mm). Left) XY image of a Bragg spot observed by a 3-dimensional (X, Y, TOF) detector. Center) TOF image of the Bragg spots. Right) Photo of the NaCl single crystal.

June, 2012 - Commissioning of 4K cryostat

In June, commissioning of the 4 K cryostat for SENJU began. The cryostat has a fixed- κ type two-axis goniometer that uses small piezoelectric motors. After spending some time optimizing the complicated wiring of the motors, a base temperature of 3 K at the top of the goniometer was achieved with a 3 hour cool down from room temperature.