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**Development of software for a new time-of-flight single crystal diffractometer SENJU at J-PARC**

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For a single crystal diffractometer, device control, data processing and data visualization software is one of the most important components. We have developed software for SENJU, a new time-of-flight (TOF) single crystal neutron diffractometer which is being constructed in Materials and Life Science Experimental Facility (MLF) at Japan Proton Accelerator Research Complex (J-PARC).

SENJU aims to measure diffraction under various types of sample environment, e.g. low temperature, magnetic field and high pressure. So, the software for SENJU can control detectors, goniometer and such sample environment devices simultaneously from one GUI. In addition, when new devices are installed in future, the software can easily support those devices.

Data processing component of the software was developed based on the software STARGazer [1], which was developed for a single crystal diffractometer iBIX at MLF. Though the arrangement, pixel number and pixel size of detectors are different between SENJU and iBIX, the "modified STARGazer" can process the data of both diffractometers by changing a detector-setting file.

Visualization of raw data is important because SENJU also aims to observe diffuse scattering and satellite reflections caused by disordering or incommensurate structures. Data visualization component of the software can show the raw data of all detectors simultaneously (Fig.1), and also reconstruct the intensity distribution of detectors in 3D reciprocal space.

Although the schedule has been delayed because of the devastating disaster, SENJU will be in commission in 2012.

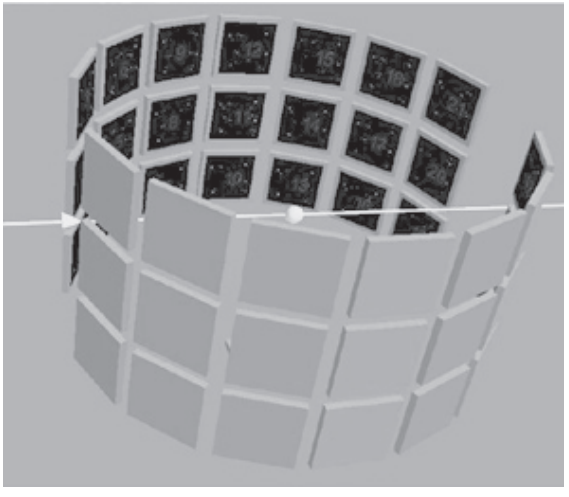

Fig.1 Data visualization of all detectors of SENJU

[1] T. Ohhara, K. Kusaka, T. Hosoya, K. Tomoyori, *et al., Nuclear Inst. Meth. Phys. A,* **2009,** *600*, 195-197.

**Keywords: neutron, single crystal, software**

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**Developments for Upgrades of 2-Dimension Scintillator Detector System, Data Acquisition Electronics and Software for J-PARC**

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Since 2004, we have been developing a high-performance photon-counting 2-dimension scintillator detector system, a high-throughput time-of-flight data acquisition (DAQ) system and operation software for various instruments at J-PARC. Our detectors are composed of ceramic ZnS/$^{10}B_2O_3$ scintillator sheets, wavelength-shifting (WLS) fibers, 64-ch multi-anode photomultipliers (PMT), a high-speed 512-channel amplifier and discriminator, and a 512-channel encoder module with FPGAs for time and position determination. The detectors of iBIX, IBARAKI Biological Crystal Diffractometer, BL03, have 256×256 pixels (0.5mm pitch), and 133×133mm$^2$ detective area[1], and those of SENJU, Single Crystal Neutron Diffractometer under Extreme Condition, BL18 (under construction), have 64×64 pixels (4mm pitch) and 260×260mm$^2$ detective area. The DAQ electronics 'READOUT modules' and software are widely used in common at TAKUMI (BL19), VNR (BL17) in addition to the above two.

Now we're working on the upgrades of those systems and we have developed bright but short-lifetime and low afterglow scintillator, high efficient light-guide system, a new encoder module with a new position-analysis program on FPGAs, and DAQ electronics with a giga-bit Ethernet port. In case of software, we have made our iBIX programs to a new shared library generally used at other instruments. The library includes control of the electronics, data acquisition, data logging, and online analyses, and it can be used from C++ programs or Python scripts on Linux (RHEL clones, Ubuntu), Windows, and Mac OS X. We will install those upgrades to the instruments at J-PARC during 2012.

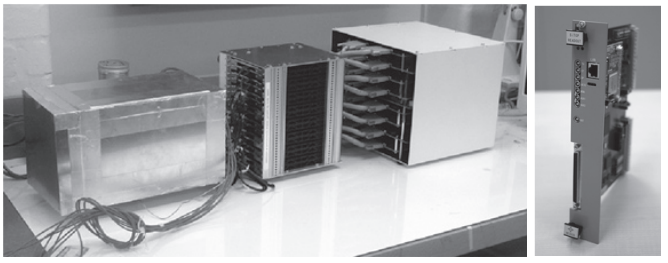

**Fig. 1** Detector unit for BL03 iBIX diffractometer (left) and a new data acquisition electronics with a GbE port (right).

[1] T. Hosoya, T. Nakamura, M. Katagiri, A. Birumachi, M. Ebine, K. Soyama, *Nucl. Instr. and Meth. A*, **2009**, *600*, 217-219.

**Keywords: neutron area detector, data acquisition, J-PARC**