5 IMSS Instrument R&D Team

The IMSS Instrument R&D Team was formed in May 2010, and is developing a new detector system for material physics and biology. As the background of starting up the team, there was great progress in the Data Acquisition System for some large-scale detectors installed in J-PARC MLF, with the co-operation of the IPNS Electronics System (E-sys) Group. The Photon Factory then started developing detectors using fast signal processing, in collaboration with the E-sys Group, in FY2009. The Instrument R&D Team has been continuing and encouraging R&D projects by applying advanced electronic techniques since the team was founded. In KEK, the Instrument R&D Team conducts research using the IMSS's four quantum-beam probes of Synchrotron Radiation, Neutrons, Muons and Positrons, and also serves as an interface between IMSS and other groups in KEK, such as the KEK-Detector Technology Project, which is an inter-divisional KEK-wide group for detector development.

The following two main projects at the initial stage in the Photon Factory are briefly reported here.

A. Ultra-fast signal processing system for Si-APD array X-ray detectors

This project is for a new Si-APD array X-ray detector which has a fast response and high spatial resolution. At the present stage, we have succeeded in taking very fast pulses, less than 1 ns FWHM, from an 8 × 2 array of 200 μm × 200 μm pixels with hybrid IC amplifiers. Now, we are preparing a 64-ch Si-APD linear array and ultra-fast ASIC circuits. The linear array has 64 pixels of 100 μm × 200 μm. A prototype of the front-end ASIC operates as fast amplifiers and discriminators. Testing of the ASIC chip is now in progress.

B. Auger-electron detector system for depth-resolved X-ray Magnetic Circular Dichroism (XMCD)

The old system consisted of a CCD and a fluorescence screen for depth-selective measurement of Auger electrons. We are now preparing a multi-anode MCP detector system, which has an angle resolution of one degree and a fast digital data read-out of 30 channels. The new system will greatly improve the S/N ratio and the dynamic range of output counts. For fast switching of polarized radiation, of which the repetition rate is 10 Hz, the multi-channel read-out will play an important role. This system was prepared for the second ID installation at BL-16 in the autumn of 2010. Continuous 1-kHz data acquisition during 10-Hz polarization switching was achieved. XMCD measurements combined with polarization switching are now under commissioning.

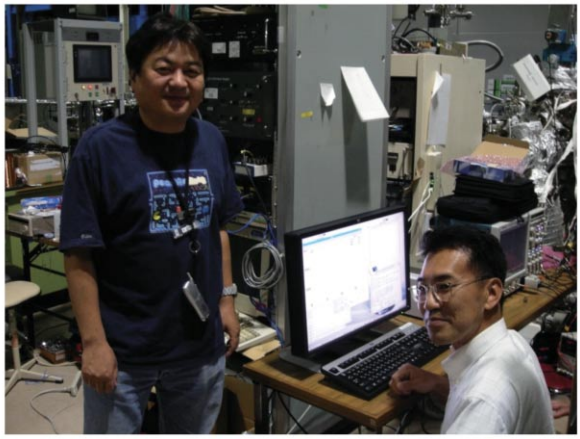

Figure 1
Software development for the multi-anode MCP system at BL-16A, through collaboration between Instrument R&D Team and E-sys Group.