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Development of an EtherCAT-based control system for an In-Vacuum Undulator for SPring-8-II

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SPring-8, a third-generation light source, has operated for nearly three decades. Recently, light source accelerators have transitioned towards fourth-generation light sources, which implement low-emittance storage rings. Therefore, SPring-8 will upgrade its storage ring to a new one named SPring-8-II between 2027 and 2028. The upgrade involves implementing new Insertion Devices (IDs), specifically In-Vacuum Undulators for SPring-8-II (IVU-II), and optimizing accelerator control systems. As part of the control system upgrade for slow control, we are replacing VME-based systems with EtherCAT-based systems*. Between 2023 and 2027, the schedule dictates the annual installation of three to a maximum of six IVU-IIs, and we will install EtherCAT control systems accordingly. Crucially, IVU-II control systems installed during the SPring-8 phase must be compatible with the varying operational parameters of SPring-8 and SPring-8-II. In 2024, we implemented the first EtherCAT-based control system, which satisfies the requirements. This system manages the gap between magnets and two power supplies for two steering magnets, monitors magnet temperatures and the vacuum system, and handles interlock signals. In the SPring-8-II era, dedicated systems such as the vacuum controls and the interlock system will handle vacuum and interlock functions, reallocating them from ID controls. Future ID controls will employ the EtherCAT model.

Footnotes

- * <https://www.ethercat.org/default.htm> ** T. Fukui et. al., "Next Generation Control System Using the EtherCAT Technology", ICALEPCS2017, Barcelona, Spain

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Author: YAMAKAWA, Kosei (Japan Synchrotron Radiation Research Institute)

Co-authors: ISHII, Miho (Japan Synchrotron Radiation Research Institute; SPring-8); YAMAGA, Mitsuhiro (Japan Synchrotron Radiation Research Institute; SPring-8); FUKUI, Toru (SPring-8)

Presenter: YAMAKAWA, Kosei (Japan Synchrotron Radiation Research Institute)

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