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Development of next generation LLRF control system for J-PARC rapid cycling synchrotron

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The low level rf (LLRF) control system for the rapid cycling synchrotron of the Japan Proton Accelerator Research Complex (J-PARC) started its operation in 2007. The key functions of the LLRF control system are the dual harmonic auto voltage control, which generates superposed voltages of the fundamental accelerating harmonic and the second harmonic in a single wideband magnetic alloy (MA) cavity, and the multiharmonic rf feedforward to compensate the beam loading in the MA cavity caused by high intensity beams. These functions are necessary to accelerate high intensity proton beams. The system has been working well without major problems for more than ten years. However, the old FPGAs (Xilinx Vertex-II pro etc.) are discontinued and not supported by the current development environment. It will be difficult to maintain the system in near future. Thus, we are planning to replace the existing VME-based LLRF control system with a new MicroTCA.4 based system. The system controls twelve cavities independently and calculates vector sum of the cavity voltages in real time for phase feedback.. Signal and data transfer between the modules is a key to realize the functions. In the existing system, the transfer is implemented not only the backplane but also serial link via cables between the VME modules. It is much more simplified in the new system thanks to the high speed communication capability of the MTCA.4 backplane. In this presentation, we present the configuration of the system under development, the implemented functions, and preliminary test results.

Minioral

Yes

Description

system

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