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Development of LLRF control system for J-PARC RCS

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The J-PARC Rapid cycling synchrotron (RCS) requires a very stable and precise low level RF (LLRF) control system to handle the ultra-high proton beam currents. The MA-loaded low-Q cavities for the RCS are driven by the superposition of the dual-harmonic RF signal for both the acceleration and the longitudinal bunch shaping. We employ a full-digital system based on direct digital synthesis (DDS). The multi-harmonic RF signals generated by the DDS are easily synchronized without PLLs. We describe the design and the structure of the LLRF blocks. The common feedback loops are used for the stabilizing the beam orbit and phase as well as the RF voltages of the cavity. The heavy beam loading effect is compensated by using the beam feedforward method. We also present the test results of the recently manufactured modules.

Primary author: Dr TAMURA, Fumihiko (JAREI)

Co-authors: Dr TAKAGI, Akira (KEK); Dr SCHNASE, Alexander (JAERI); Dr OHMORI, Chihiro (KEK); Dr EZURA, Eizi (KEK); Dr HARA, Keigo (KEK); Dr NOMURA, Masahiro (JAERI); Dr YOSHII, Masahito (KEK); Dr YAMAMOTO, Masanobu (JAERI); Dr ANAMI, Shozo (KEK)

Presenter: Dr TAMURA, Fumihiko (JAREI)

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