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Longitudinal Mode-by-Mode Feedback System for The J-PARC Main Ring

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The J-PARC Main Ring (MR) is a high intensity proton synchrotron, which accelerates protons from 3 GeV to 30 GeV.

The MR delivers 2.4×10^{14} protons per pulse, which corresponds to the beam power of 470 kW, to the neutrino experiment as of February 2017, and the studies to reach higher beam intensities are in progress.

During studies, we observed the longitudinal dipole coupled-bunch instabilities in the MR for the beam power beyond 470 kW.

To mitigate them for higher beam intensities, we have developed the longitudinal mode-by-mode feedback system.

The feedback system consists of a wall current monitor, a FPGA-based feedback processor, RF power amplifiers, and a RF cavity as a longitudinal kicker.

In the feedback processor, we utilize the single sideband filtering technique to detect the oscillation components of the individual coupled-bunch mode in the beam signal.

We present the design of the feedback system, especially the design detail of the digital filters in the feedback processor.

We also report the preliminary beam measurement results for evaluation of the system performance on detection and excitation of the selected modes.

Description

Algorithm feedback

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Minioral

Yes

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