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Simulation study on the slow extraction for the improvement of the beam spill structure at J-PARC main ring

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J-PARC Main Ring (MR) delivers slow extracted 30 GeV proton beam to the Hadron Experimental Facility using third-order resonance.

Various particle and nuclear physics experiments are being conducted there, and one of the important properties required for the proton beam is the flatness of the time structure of the extracted beam (spill structure). At J-PARC MR, the large current ripples in the main magnet power supplies caused the fluctuation of the betatron tune, resulting in a large spill structure.

But the main magnet power supplies were upgraded from 2021 to 2022, and the adjustments of the power supply controls are currently underway. Improvement of the current ripples of the power supplies is expected and the first beam test for the slow extraction with new power supplies is planned in early 2023.

Thus we performed a simple beam simulation of the MR slow beam extraction to investigate the effect of the current ripples of the main magnet power supplies on the beam spill structure.

In addition, we investigated in the simulation the effects of the feedback control system using fast Q magnets and the transverse RF system aiming to improve the spill structure by kicking the beam in the horizontal direction by adding white noise to the stripline kickers. We tried to optimize their parameters with the improved current ripples of the new main magnet power supplies. This study reports those results.

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Footnotes

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Yes

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