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J-PARC operation with the high repetition rate upgrade

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The main ring synchrotron (MR) of the Japan Proton Accelerator Research Complex (J-PARC) has provided high-intensity proton beams to the T2K long-baseline neutrino experiment, which requires high statistics to confirm the existence of CP violation. We plan to increase the beam power from 0.5 MW in 2021 operation to 1.3 MW by 2028 in the fast extraction mode of the MR. This upgrade supports higher statistics for T2K and the Hyper-Kamiokande long-baseline project, which will start from 2027.

The scheme of the upgrade is to quicken the repetition period by a factor of two from 2.5 s in 2021 operation, and to increase the number of protons per pulse 30% more. This scheme requires hardware upgrades on the power supplies of the main magnets, high gradient RF system, collimator system, injection and fast extraction systems, and beam monitors. The upgrade of the MR is on schedule. The hardware upgrade for high-repetition operation was completed by 2022. The remaining upgrades will be accomplished in following several years to increase the number of protons per pulse. The improvement of the beam dynamics in the MR is also necessary to manage higher space charge effects due to increase of the beam intensity, and to localize beam losses at the collimator section in the MR more efficiently. This presentation reports the first results of the MR beam operation in the high repetition rate and the strategies to 1.3 MW operation based on beam study results.

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Footnotes

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