1-MW Beam Operation Scenarios in J-PARC 3-GeV RCS

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The 3-GeV Rapid Cycling Synchrotron (RCS) of the Japan Proton Accelerator Research Complex (J-PARC) is the world highest class of high-power pulsed proton driver aiming at 1-MW output beam power, providing the proton beam to the Material and Life Science Experimental Facility (MLF) and also to the following 50-GeV Main Ring Synchrotron (MR).

RCS was beam commissioned in October 2007 [1] and made available for user operation in December 2008 with an output beam power of 4 kW. Since then, the output beam power of RCS has been steadily increasing following progressions in beam tuning and hardware improvements [2-3]. So far, RCS has successfully achieved high-intensity beam trials of up to 540 kW at a low-level intensity loss of 1-2% [4], and the output beam power for the routine user program has been increased to 300 kW.

In the summer shutdown period of 2013, the injection beam energy from the linac was upgraded from 181 MeV to the design value of 400 MeV. In addition, in the next summer shutdown of 2014, the maximum peak current of the injection beam will be increased from 30 mA to the design value of 50 mA. In October 2014 after completing these series of linac upgrades, we are to start the final stage of beam tuning toward the design output beam power of 1 MW.

The most important issues in realizing the 1-MW beam operation are control and minimization of beam loss to maintain machine activation within the permissible level. Another main issue is to improve beam quality, namely to realize low-halo/tail beam, which is a key issue especially for the beam injection to the following MR. In this paper we will discuss parameter optimizations from these view-points for the coming 1-MW beam operation, including further machine upgrade scenarios, based on the numerical beam simulation.

References

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