Beam Commissioning Results of the J-PARC 3-GeV RCS injection for the upgraded 400 MeV beam

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The 3-GeV RCS (Rapid Cycling Synchrotron) of J-PARC (Japan Proton Accelerator Research Complex) is designed for a high intensity beam power of 1 MW by injecting and extraction beam at 400 MeV 3 GeV, respectively at a repetition rate of 25 Hz [1]. The beam is simultaneously delivered to the Material and Life Science Experimental Facility as well as to the Main Ring. The RCS beam power at present for operation is 300 kW, while more than a beam power of 500 KW with sufficiently low beam loss has already been demonstrated in the beam studies.

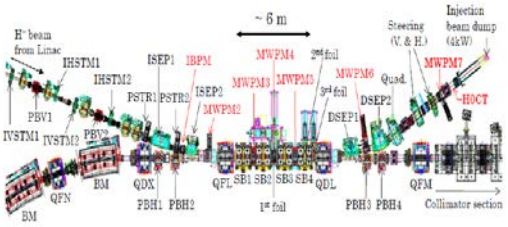

Fig. 1: Layout of the RCS injection area. The H^- beam is stripped to a proton beam by using a stripper foil named 1st foil placed in the middle of 4 chicane magnets (SB1~4). A detail of about latest RCS injection scheme can be found in Ref. [2].

In parallel to the LINAC output energy upgrade to the design 400 MeV, RCS injection system was also finished upgrading in the summer shutdown of 2013. In order to achieve such a high intensity beam, RCS utilizes multi-turn H^- charge-exchange injection for several hundred turns. The higher injected beam energy of 400 MeV plays a significant role in order to mitigate the space charge effect in the lower energy. In spite of an unexpected problem with new power supply for the injection chicane magnets, first stage of the RCS injection beam commissioning with 400 MeV was successfully finished in the assigned study time in 2013 autumn. The commissioning for other parts of the RCS was thus proceeded smoothly, resulting successful demonstrations of high intensity trials with sufficiently low beam loss as well as resuming RCS operation with 300 KW as scheduled. In this paper beam commissioning results of the J-PARC 3-GeV RCS injection are presented.

References

[1] High-intensity Proton Accelerator Project Team, “Accelerator Technical Design Report for J-PARC”, JAERI-Tech 2003-044 and KEK Report 2002-13.

[2] P.K. Saha et al., Physical Review Special Topics - Accel. and Beams, 16, 120102 (2013).