Tuning of the 3-50BT of J-PARC for operations

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The J-PARC has the three accelerators: the linac for 400 MeV protons, the rapid cycle synchrotron (RCS) for 3 GeV protons, and the main ring (MR) for 30 GeV protons. The beam transport line between the RCS and the MR is called as the 3-50BT. The main issues of the 3-50BT are to transport 3 GeV proton beams without unexpected losses, to cut the beam halos effectively at the collimator section, and to match the beams into the MR 6 dimensionally. The latter two issues are important to achieve higher beam intensity in the MR and to save beam losses within the collimator capacity both in the 3-50BT and the MR.

The tuning process of the 3-50BT has been improved step by step in these years. Till spring 2013, the collimator section of the 3-50BT was not achromatic in our user operation. To make the section achromatic, our simulation model of the 3-50BT had to be reconstructed. The dispersion of the 3-50BT was successfully modeled with a newly developed method to measure the fudge factors of quadrupole magnets [1]. Based on the model, the beam optics was changed not only in the 3-50BT but also in the other beam transport line '3NBT' which connects from RCS to the Material and Life Science Experimental Facility (MLF) and shares its upstream section with the 3-50BT. After this achromatic tuning, the beta function was also measured with the 3 profile methods and the quadrupole scanning methods. Then the collimator jaws in the 3-50BT were correctly set to cut beam halos effectively. These tuning was completed in this year. Monitors and steering magnets were newly installed during the shut-down in 2013 for this purpose. The 6D (transverse twiss, horizontal dispersion) matching from the 3-50BT to the MR was also performed in this year. By the last year, only 4D matching, transverse twiss matching, was adopted. The 4D matching approach had no big problems for low beam intensity, but it is not enough to seek much higher beam intensity. The 6D matching was based on the linear response method, where the 11 quadrupoles of the downstream of the 3-50BT were modified and the response of twiss and dispersion in the MR were measured. The main issues of the 3-50BT can be satisfied through these tunings.

References

[1] H. Harada, S. Meigo, M. Shirakata, Y. Sato, F. Tamura, M. Tejima, S. Igarashi, Y. Hashimoto and T. Koseki, in this proceedings.