Extraction Aperture and Beam Size for 8 GeV Beam for μ-e Conversion Experiment in J-PARC

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An experiment searching coherent neutrino-less conversion of a muon to an electron (COMET) has been proposed. A 8 GeV-bunched proton beam is extracted from the J-PARC main ring (MR) by the slow extraction with a third integer resonance and delivered to the Nuclear and Particle Experimental Hall. Phase-I in this experiment requires a beam power of 3.2 kW at 8 GeV, which can be obtained by storing 6.4×10^{12} protons in the MR at 2.48 s cycle. The number of particles is not so large and the space charge detuning is moderate in the RCS and MR injection and acceleration. The magnetic septa and quadrupole magnets in the slow extraction region in the MR have apertures accepting 30 GeV beam with the emittance dumped adiabatically for 54 π mm·mrad at 3 GeV. However, the 8 GeV beam emittance is 4 times larger by less adiabatic dumping effect, when the beam emittance at 3 GeV is same. This case, the extraction apertures can not accept all of the 8 GeV beam. To solve this problem, the following scheme has been proposed; a phase space area painted for the beam injected in the RCS can be rather reduced than that of a high intensity operation. The emittance growth in the RCS or the MR is suppressed by various beam tuning. A 8 GeV acceleration test based on this scheme has been performed without slow extraction. The beam emittance derived from the beam profiles measured in the MR is acceptable for the extraction aperture.