

# Monitoring System of Number of Particles in J-PARC Linac and RCS

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(Received January 10, 2020)

It is necessary to perform beam operation in J-PARC Linac and RCS that does not exceed the permissible (limit) number of integrated particles per hour. Thus, to measure and monitor the integrated particles for each beam destination, the monitoring system of number of particles has been developed. In this system, to measure and monitor the number of particles correctly and reliably, it is indispensable to eliminate the error (failure) of beam current measurement. Therefore, we have developed a particle counter that measures the number of particles correctly and reliably at the repetition rate of 25 Hz by monitoring the timing signals for beam measurement. In this paper, the functions of the monitoring system of number of particles are described focusing on the function of the particle counter's timing signal monitoring.

**KEYWORDS:** J-PARC, Linac, RCS, particle counter, number of particles, timing chart, FPGA

## 1. Introduction

In the Linac, the beam is accelerated up to 400 MeV. Then, it is accelerated up to 3 GeV (1 MW) in the Rapid Cycling Synchrotron (RCS). The RCS accelerates the  $8.3 \times 10^{13}$  particles per pulse at the repetition rate of 25 Hz. And, it is subsequently extracted to the Material and Life Science Facility (MLF) and the Main Ring. (MR) [1]. On the other hand, beams for beam study of Linac and RCS are also extracted to the beam dump (BD) [2]. For each BD, MLF and MR, the allowable (limit) integrated number of particles per hour (INP/h) is defined by law permission. Therefore, it is important to measure the beam current for each beam destination (BDs, MLF and MR) and to perform the accelerator operation that never exceeds the permissible INP/h.

Therefore, it is essential to configure a system that reliably measures and manages the number of particles in all 25 Hz beams. Then, we developed the particle counter that has the function of eliminating beam measurement errors (failures), and configured Monitoring System of Number of Particles (MSNP) for Linac and RCS, which measures all 25 Hz beams and monitors INP/h at each destination.

## 2. Monitoring System of Number of Particles