

Toward high-precision measurement of muon lifetime with an intense pulsed muon beam at J-PARC

Precise measurements of the muon lifetime can determine the Fermi constant, which is the coupling constant for the weak interaction. The Fermi constant is an essential parameter of the Standard Model that should be determined experimentally, as well as the fine structure constant and the mass of the weak boson. In the 2000s, the FAST [1] and MuLan [2] experiments were performed using continuous muon beams at PSI. The former obtained the muon lifetime with a precision of 16 ppm and the latter with a precision of 1 ppm. An experiment using a pulsed muon beam was also conducted at RIKEN-RAL [3]. We have studied the feasibility of further high-precision measurement using an intense pulsed muon beam at J-PARC MLF MUSE to revisit this topic. A segmented scintillation counter with SiPM readout will be employed in a proposed experiment to obtain a muon lifetime spectrum with pileup correction. We will report on an overview of the experiment, detector prototype development, and pileup correction modeling in this contribution.

[1] A. Barczyk et al. (FAST Collaboration), Phys. Lett. B 663, 172 (2008).

[2] V. Tishchenko et al. (MuLan Collaboration), Phys. Rev. D 87, 052003 (2013).

[3] D. Tomono et al, Nucl. Phys. B, Proc. Suppl. 149, 341 (2005).

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