

Progress and Prospects for Muon Cooling and Acceleration at J-PARC

Tuesday 2 September 2025 16:15 (25 minutes)

Acceleration of cooled muons is a promising technology for realizing a low-emittance muon beam, which is essential for noble muon sciences such as precise measurements of the muon dipole moments and muon microscopy. This technology is being developed at the Material and Life science experimental Facility at J-PARC. There, muons are cooled down to thermal energy through Muonium formation followed by laser ionization. The resulting cooled muon beam, known as ultraslow muon, is then reaccelerated using a radio-frequency cavity.

In 2024, we achieved the world's first successful radio-frequency acceleration of positive muons to 100 keV. The normalized emittance of the reaccelerated beam was measured to be $< 1 \pi$ mm mrad, representing a > 100 reduction compared to conventional surface muon beams. Construction of both the ultraslow muon source and cavities is ongoing to achieve the acceleration up to 200 MeV with an intensity of $10^5 \mu/s$ by 2030. In this contribution, we present the recent result and prospects of these activities.

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Session Classification: WG3+WG4

Track Classification: NuFACT 2025: WG4 - Muon Physics