Tuning of Ultra-Slow Muon Transport System

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The ultra-slow muon beam is expected to be a new probe for surface and interface physics [1]. A new beamline for ultra-slow muon is now under construction at the Materials and Life Science facility (MLF) of the J-PARC [2].

The beamline, called U-Line, has three sections. The first section, which mainly consists of solenoid magnets, transports surface muon (~ 4 MeV) beam from a muon production target to a hot tungsten target. The second section consists of the hot tungsten target, ionizing laser, and an ultra-slow muon transport system. Muons stopped in the hot tungsten target form muoniums and evaporate to vacuum. The laser ionizes muoniums to produce ultra-slow muons (< 1 eV). The ultra-slow muon transport system serves muons to a μSR chamber or the third section, a re-accelerator and a muon microscope. The first and the second section were already installed [3] and the muon beam successfully transported through the first section.

Before transporting ultra-slow muons through the second section, we tuned the transport system utilizing ⁷Li⁺, which contained in the tungsten target as impurity. Li ions can be evaporated as ions from the hot tungsten and behave like heavier ultra-slow muons. So, we transported Li ions as an ultra-slow beam and optimized the beam transportation and the beam properties. The latest results of the Li tuning will be reported in the presentation. Furthermore, the status of the tuning utilizing laser ionized H⁺ or D⁺, scheduled after the Li tuning, will be also reported.

References