

Development of Electrodes for the Muon Penning Trap Experiment

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At the J-PARC MLF/H-Line, an experiment to measure the fundamental properties of the muon by a Penning trap is planned. The final target precisions are 1 parts-per-billion for the magnetic moment and the mass, and 1 parts-per-million for the lifetime. A trapping electromagnetic field of a Penning trap is provided by a homogeneous magnetic field and a quadrupolar electrostatic potential. The experimental setup is shown in Fig.1. In this experiment, surface muon beams obtained at the J-PARC-MLF muon beamline H1 area are injected into the experimental apparatus to produce ultra-slow muonium, which is then laser-ionized to capture the ultra-slow muons at the electrodes center. Electrodes to produce the electric potential are therefore an essential component of this experiment. For the start of the experiment, we are designing and developing a box-shaped electrodes that enables the muon penning trap.

We have already designed the electrodes once and confirmed that the harmonicity of less than 20% can be achieved in the muon storage region inside the electrodes. Currently, for further harmonic improvement, we are creating a tool to optimize electrodes placement and voltage. In this presentation, we will report on the development status of the electrodes optimization tool and the latest design of the electrodes.

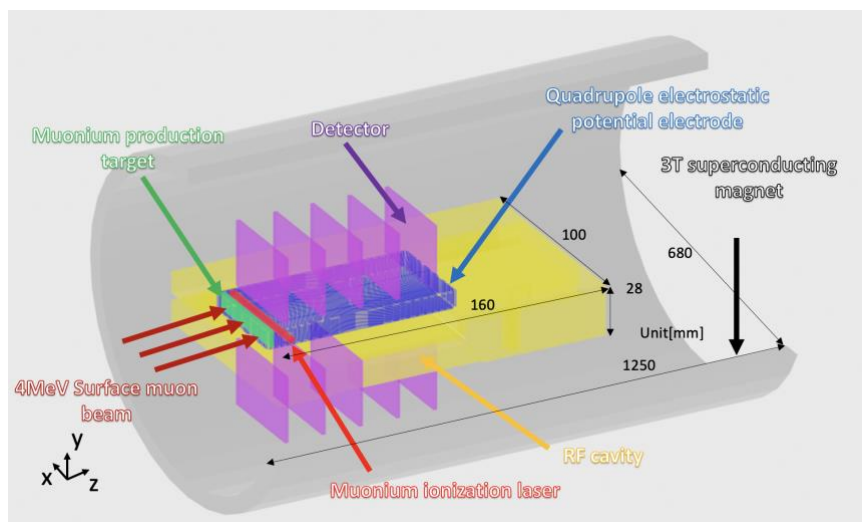


Figure 1: Schematic view of the Penning trap experiment of muons.