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Development of a drift tube for study of a quantum mechanical scattering of muons in helum gas

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The first principle calculation involving muon needs to consider the effect of quantum fluctuations as well and it is still in a state of development. In order to verify the first principle calculation, the basic data for the collision cross section at low energy region corresponding to the binding energy of the muon and the target molecule is necessary. Especially the elastic scattering cross sections and the potential energy surfaces in the thermal energy region are extremely important for studying the muon behavior in the envi-ronment. However, since the collision experiment in this energy region is technically difficult, the report of experimental results for the interaction between two bodies in an isolated system, especially for the elastic scattering, is sparse. By applying the drift tube technique to the muon collision experiment, we consider that information of interactions between a muon and a molecule in gas can be obtained for less than 1 eV region.
The positive muons (~2.7 MeV) generated are passed through an thin aluminum plate and to decelerate it to 100 keV. The decelerated muons enter the drift tube and travel a few centimeters by repeatedly colliding with buffer gas (~100 kPa) and then thermalizes. The thermalized muon travels with certain mobility toward the back due to the uniform electric field (~100 V/cm) applied to the inside of the drift tube. After the muons travel a few centimeters from the point where it thermalized, they decay to positrons. The positrons pass through the double scintillation fiber installed on the outside of the drift tube.By installing the fibers in double, the flight direction of the positron can be determined and the projection diagram to the central axis of the drift tube at the decay point can be obtained.
We have successfully measured the muon stop position at the S-line.

Primary author: MATOBA, Shiro (High Energy Accelerator Research Organization)

Co-authors: KOJIMA, Kenji (TRIUMF and SBQMI, UBC); KANDA, Sohtaro (KEK)

Presenter: MATOBA, Shiro (High Energy Accelerator Research Organization)

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