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Measurement of residual μˆ+ polarization in a CeF3 material and timing resolution of a CeF3 detector to search for T-violating μˆ+ polarization in Kˆ+⟶πˆ0 μˆ+ ν decay

Time reversal symmetry has long been a subject of interest from pre-modern physics time, since it implies the reversibility of motion. In the Kˆ+⟶πˆ0 μˆ+ ν (K_μ3) decay, the transverse muon polarization (P_T) is defined as the polarization component perpendicular to the decay plane. A non-vanishing value of P_T provide clear evidence for T-violation under the condition that spurious effects from final state interactions are negligibly small. We are now proposing a new T-violation experiment to achieve ΔP_T˜10ˆ(-5) at the J-PARC Hadron Hall without using a magnetic spectrometer. The most important characteristics of the new experiment is the measurements of the muon momentum vector, the πˆ0 momentum vector, and the muon polarization by the same highly segmented sequential electro-magnetic calorimeter surrounding the Kˆ+ stopping target. Here it should be noted that one of key issues in the experiment is the choice of a scintillation material which can preserve the muon spin polarization for a reasonably long time [1].
A test experiment to measure residual muon polarization in CeF3, LaF3, PrF3, and NdF3 scintillating crystals was performed using a 100% polarized muon beam at J-PARC MLF. In the longitudinal field of 140 Gauss, the muon polarization in these materials was obtained to be 90% at room temperature, which is high enough to perform the new T-violation experiment [1-3]. Since the calorimeter should be placed very close to the Kˆ+ beam line, a single rate for each module will be very high and the timing resolution must be better than 1 ns to reduce accidental background effects. The timing resolution using a CeF3 crystal with the size of 20×20×20 mmˆ3 was obtained to be ˜100 ps using solar-blind phototubes. The time interval of the two CeF3 detector signals generated by the cosmic ray passage was measured. The timing resolution is sufficiently good, and the accidental background must be harmless in the proposed T-violation experiment.
In this talk, some details of the future T-violation experiment, the results of the test experiment to determine the residual polarization in CeF3, LaF3, PrF3, and NdF3 materials and the measurement of the CeF3 timing resolution will be reported.

References

[1] S. Shimizu et al., Nucl. Instrum. Methods A 945 (2019) 162587.
[2] K. Horie et al., Nucl. Instrum. Methods A 1037 (2022) 166932.
[3] Horie et al., Nucl. Instrum. Methods A 1066 (2024) 169606.

Primary author: Mr IDE, SHUNGO (The Univesity of Osaka)

Co-authors: Dr HORIE, KEITO; Prof. MIHARA, MOTOTSUGU (The University of Osaka); Mr IMAI, RYUNOSUKE; Prof. SHIMIZU, SUGURU (The Univesity of Osaka)

Presenter: Mr IDE, SHUNGO (The Univesity of Osaka)