Development of High-Field μSR Spectrometer at J-PARC

S. Nishimura[1,2,3#], S. Ito[4], H. Okabe[5], R. Kadono[1,2], A. Koda[1,2,3], K. M. Kojima[6], J. G. Nakamura[1,2], M. Hiraishi[7], and M. Miyazaki[8]

[1] *J-PARC Center, Tokai, Ibaraki 319-1195, Japan*

[2] *Institute of Materials Structure Science, KEK, Tsukuba, Ibaraki 305-0801, Japan*

[3] *The Graduate University for Advanced Studies (SOKENDAI), Tsukuba, Ibaraki 305-0801, Japan*

[4] *School of Materials and Chemical Technology, Tokyo Institute of Technology, Meguro, Tokyo 152-8552, Japan*

[5] *Institute for Materials Research, Tohoku University, Sendai, Miyagi 980-8577, Japan*

[6] *Research Scientist at Centre for Molecular and Materials Science (CMMS), TRIUMF, Vancouver, V6T 2A3, B.C. Canada*

[7] *Graduate School of Science and Engineering, Ibaraki University, Mito, Ibaraki 310-8512, Japan*

[8] *Murotran Institute of Technology, Muroran, Hokkaido, 050-8585, Japan*

 # a corresponding author: E-mail nishimu@post.kek.jp

Muon spin rotation, resonance, and relaxation (μSR) in the high magnetic field is important because it enables measurements such as muon Knight shift and level-crossing resonance (LCR) to provide a detailed understanding of the structure of materials. We are developing a μSR spectrometer "CYCLOPS" for high field measurements up to 5 T in the Materials and Life Science Experimental Facility (MLF) at J-PARC.

A superconducting magnet and a detector with 3,008 channels of fiber scintillator have already been fabricated, and a beam test was conducted in February 2024 with the magnet excited up to 5 T at the J-PARC MLF S1 area. Figure 1 shows the beam test using the CYCLOPS. In the beam test, the fundamental data were measured to evaluate the performance of the spectrometer compared to the simulation. The Transient μSR method [1] was also applied to LCR measurements of two organic compound samples. In this presentation, we will report the evaluation of CYCLOPS and the results of LCR measurements.

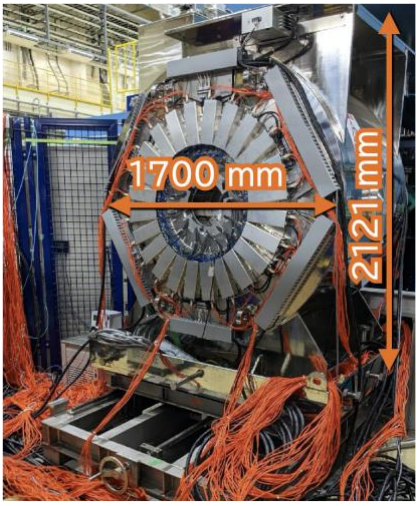

Figure 1. Beam test at the S1 area.

References

[1] S. Nishimura et al., Nucl. Instrum. & Meth. Phys. Res. A **1056**, 168669 (2023).