Development of Positron Tracking Detector for Muon $g-2$/EDM Experiment at J-PARC

T. Yamanaka[J, K], T. Aoyagi[A], H. Ikeda[G, K], M. Ikeno[B, K], K. Ueno[B, K], T. Ushizawa[E], T. Uchida[B, K], K. Kawagoe[I], T. Kishishita[B, K], T. Kume[D], S. Kurumida[I], T. Kohriki[B, K], N. Saito[B], O. Sasaki[B, K], T. Sata[I], N. Sato[D], Y. Sato[B, K], M. Shoji[B, K], S. Shirabe[I, K], T. Suehara[I, K], Y. Sue[H], T. Suda[A], H. Sendai[B, K], T. Takatomi[D], M. Tanaka[B, K], K. Tsukada[A], Y. Tsutsumi[I, K], J. Tojo[I, K], K. Namba[A], S. Nishimura[C, K], Y. Honda[A], M. Matama[I, K], T. Mibe[B, K], T. Murakami[B, K], H. Yasuda[F, K], T. Yoshioka[J, K], and J-PARC muon $g-2$/EDM Collaboration[1]

[A]*Research Center for Electron Photon Science, Tohoku University*
[B]*Institute of Particle and Nuclear Studies, High Energy Accelerator Research Organization*
[C]*Institute of Materials Structure Science, High Energy Accelerator Research Organization*
[D]*Mechnical Engineering Center, High Energy Accelerator Research Organization*
[E]*The Graduate University for Advanced Studies*
[F]*Physics Department, Graduate School of Science, The University of Tokyo*
[G]*Japan Aerospace Exploration Agency*
[H]*Department of Physics, Graduate School of Science, Nagoya University*
[K]*Department of Physics, Graduate School of Science, Kyushu University*
[J]*Research Center for Advanced Particle Physics, Kyushu University*
[K]*Open Source Consortium of Instrumentation*

The muon anomalous magnetic moment $(g-2)_\mu$ was measured by BNL in the precision of 0.54 ppm but there was a discrepancy greater than 3 σ between the Standard Model (SM) prediction. There is a possibility that this discrepancy is the result of new physics. The muon electric dipole moment (EDM) is also sensitive to new physics beyond the SM. J-PARC muon $g-2$/EDM (E34) experiment aims to measure $(g-2)_\mu$ with a precision of 0.1 ppm and search for EDM with a sensitivity of 10^{-21} e·cm with a different method from the muon $g-2$/EDM experiments at BNL and FNAL. We utilize high intensity proton beam at J-PARC and newly developed technique of reaccelerated thermal muon beam, which is produced by thermal muonium productions followed by laser ionization and linear acceleration. This muon beam is accelerated to 300 MeV/c and is injected to the storage magnet with a 3 T magnetic field using a newly developed 3-D spiral injection scheme. Positrons from muon decays are detected by the silicon strip tracking detector.

The positron tracking detector consists of 40 modules called vanes. Layout of the detector is shown in Figure 1. Each vane consists of 16 silicon strip sensors. The data from the silicon strip sensors are transferred to the front-end readout system via flexible printed circuits (FPCs) glued on the sensors. Front-end readout consists of ASICs and the FPGA-based readout board. Heat of ASICs is transferred to cooling plates via the FPCs.

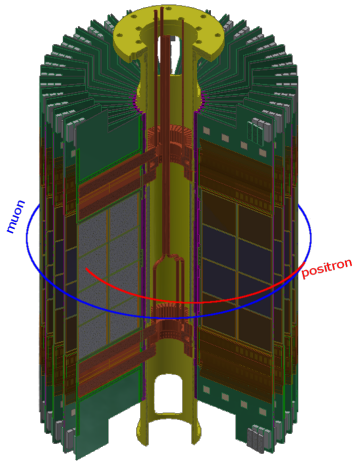

Figure 1: Perspective view of the positron tracking detector

Mass production of silicon strip sensors was started and mass production of FPCs on sensors was finished. Design of readout ASICs is fixed and they will be fabricated for performance evaluation. Developments of other detector components are ongoing. We plan to fabricate the smallest unit of the detector module, a quarter vane, using the production version of detector parts to test the overall performance of the detector. We also plan to fabricate the mechanical mock up of the whole detector structure prior to the actual detector. The status of these fabrications and developments will be presented.