

Design of the positron tracking detector for the muon g-2/EDM experiment at J-PARC

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The muon anomalous magnetic moment (g-2) and the muon electric dipole moment (EDM) are the fundamental quantities in particle physics. The previous measurement in BNL (E821)^[1] achieved an accuracy of 0.54 ppm for g-2, and there is 3.3σ discrepancy between experimental value and the Standard Model prediction. And the present muon EDM limit is $1.8 \times 10^{-19} \text{ e} \cdot \text{cm}$. So we plan a new muon g-2/EDM measurement at J-PARC^[2] to measure the muon g-2 with the precision a 0.1 ppm and EDM with the sensitivity of $10^{-21} \text{ e} \cdot \text{cm}$. In this experiment, we accelerate muon to 300 MeV/c, storage in the 3 T precision magnetic fields and reconstruct a track of muon decay positron by highly-segmented tracking detector. We use silicon strip sensors for the tracker because the tracker requires high rate capability, high stability against a large rate change, stable operation in a high magnetic field, and high position resolution. We optimized sensor specification and estimated the requirement of accuracy of the alignment by using the simulation. Based on the specifications, we produced two types of new test sensors. We evaluated the performance of test sensor, and estimated signal to noise ratio.

We will present results of specification, estimation of the requirements for the sensor alignment, and test sensors evaluation.

References

- [1] G.W. Bennett et al., Phys. Rev. D 73, 072003 (2006).
- [2] N. Saito et al., AIP Conf. Proc. 73 (2012) 45

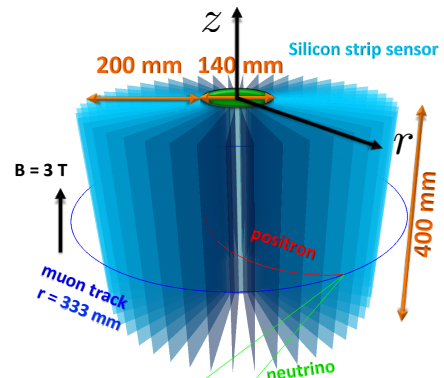


Fig. 1, schematic view of positron tracking detector

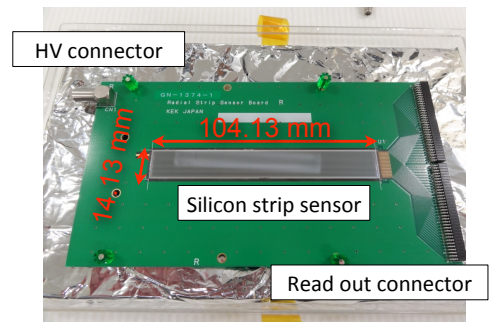


Fig. 2, a test silicon strip sensor