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Beam alignment strategy at the beam transport line for J-PARC muon g-2/EDM experiment

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To realize very precise measurement of the muon spin precession frequency in the level of sub-ppm, a muon beam is injected into a precisely adjusted storage magnet of sub-ppm uniformity via “Three-dimensional spiral beam injection scheme [1]” at J-PARC muon g-2/EDM experiment. This injection scheme requires a strongly X-Y coupled beam which is applied by eight rotating quadrupoles on the 10m of beam transport line [2]. Currently we have two scenarios of set of rotation angles (1) 45 or 60 degrees fixed, (2) any angles. In this presentation, strategy to precise control of the X-Y coupling at the beam transport line is discussed: how to control/monitor X-Y coupled phase space with eight rotatable quadrupole magnets including its alignment requirements for the case of (1) and (2). Results of alignment of the newly developed mount system for the rotating quad is also introduced. A pair of dedicated magnets called active shield multipole magnet (ASXM) will be set at the entrance and the exit of the beam channel of the storage magnet yoke. These devices will guarantee how well the beam phase space is matched with requirements at the reference point inside the storage magnet [3].

Footnotes

- [1] H. Iinuma et al., Nucl. Instrum. Meth. Phys. Res. Sect. A, vol. 832, pp. 51–62, 2016. doi:10.1016/j.nima.2016.05.126
- [2] H. Iinuma, H. Nakayama, M. Abe, K. Sasaki, and T. Mibe, IEEE Trans. Appl. Supercond., vol. 32, no. 6, pp. 1–5, Sep. 2022. doi:10.1109/TASC.2022.3161889
- [3] H. Iinuma et al., in Proc. IPAC'23, Venice, Italy, May 2023, pp. 304-307. doi:10.18429/JACoW-IPAC2023-MOPA110

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