Simulation of the Guide Field Flipping Procedure for the Frequency Domain Method

A. Aksentyev, IKP, Forschungszentrum Juelich, Germany,
Y. Senichev, Institute for Nuclear Research of RAS, 117312, Moscow, Russia
on behalf of the JEDI Collaboration

Abstract

The spin vector of a particle injected into a perfectly aligned storage ring precesses about the vertically-orientated guide field. In the presence of an Electric Dipole Moment (EDM), the spin precession axis acquires a proportional radial component.

However, in an imperfect ring, rotational magnet misalignments induce a radial component to the spin precession axis, related to the Magnetic Dipole Moment (MDM). In the Frequency Domain Method, [*] this additional precession is dealt with by consecutively injecting the beam in opposite directions, and constructing the EDM estimator as the sum of the clockwise and counter-clockwise vertical plane precession frequencies. Since the radial MDM component changes sign when the magnetic field direction is reversed, it cancels in the sum, leaving only the EDM effect.

In order to reproduce the guide field magnitude with precision sufficient for the cancellation of the MDM effect, we propose to calibrate the guide field via the horizontal plane precession frequency. In the present work we describe the algorithm of the field flipping procedure, and make a numerical simulation.

References

[*] Senichev Y, Aksentev A, Ivanov A, Valetov E. Frequency domain method of the search for the deuteron electric dipole moment in a storage ring with imperfections. arXiv:171106512. 2017 Nov 17.