Search for Electric Dipole Moments at COSY in Jülich - Spin Tracking Simulations using Bmad

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The observed matter-antimatter asymmetry in the universe cannot be explained by the Standard Model (SM) of particle physics. In order to resolve the matter dominance an additional $\mathcal{CP}$ violating phenomenon is needed. A candidate for physics beyond the SM is a non-vanishing Electric Dipole Moment (EDM) of subatomic particles. Since permanent EDMs violate parity and time reversal symmetries, they are also $\mathcal{CP}$ violating if the $\mathcal{CPT}$-theorem is assumed.
The JEDI (Jülich Electric Dipole moment Investigations) collaboration in Jülich is preparing a direct EDM measurement of protons and deuterons first at the storage ring COSY (COoler SYnchrotron) and later at a dedicated storage ring.
In order to analyse the data and to disentangle the EDM signal from systematic effects spin tracking simulations are needed. Therefore a model of COSY was implemented using the software library Bmad. It includes the measured magnet misalignments of the latest survey and a simplified description of the RF-Wien Filter device that is used for the EDM measurement. The model was successfully benchmarked using analytical predictions of the spin behavior. A crucial point regarding the data analysis is the knowledge of the orientation of the invariant spin axis with vanishing EDM at the position of the RF-Wien Filter. Especially its radial component is unknown and spin tracking simulations can be used to determine this missing number. Tracking results as well as the algorithm to find the invariant spin axis will be presented.

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