Beam based alignment at the Cooler Synchrotron (COSY) and beyond

T. Wagner[1,2]

[1]Institut für Kernphysik, Forschungszentrum Jülich, Germany
[2]III. Physikalisches Institut B, RWTH Aachen University, Germany

t.wagner@fz-juelich.de

In order to measure the electric dipole moment (EDM) of charged hadrons in storage rings with a high precision one needs to have a small systematic error on the measurement. A large contribution to the systematic error is due to unknown magnetic fields, which are picked up when one is off of the optimal orbit. This can be reduced by controlling the orbit to a high precision and thus obtaining a small orbit root mean square (RMS).

In order to achieve a good orbit RMS in an accelerator one needs to know the size of the offsets between the beam position monitors (BPMs) and the quadrupoles. In order to determine these offsets one can use the beam-based alignment method, which finds the magnetic center of a quadrupole with respect to the electric center of a BPM. When the offsets between the BPMs and quadrupoles are then known, one can re-calibrate the BPMs to have the zero orbit going through the magnetic centers of the quadrupoles.

The working principle of this method will be explained and the results of the beam-based alignment measurement done at the storage ring COSY will be shown. Additionally, ideas on how to make the beam-based alignment easier in future accelerators will also be discussed.