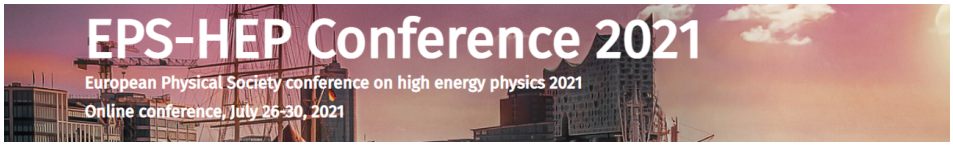

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Beam dynamics corrections to the Run-1 measurement of the experiment Muon g-2 at Fermilab

The Muon g-2 experiment at Fermilab aims to measure the muon anomalous magnetic moment (a_μ) with a final accuracy of 140 part per billions (ppb). The first result on Run-1 dataset were unveiled on April 7, 2021, showing a very good agreement with the previous experimental result at Brookhaven National Laboratory (BNL), improving the uncertainty by achieving a precision of 460 ppb compared to 540 ppb of BNL. Due to the extremely high precision of the experiment four different beam dynamics corrections must be applied to obtain the final value of the anomalous precession frequency. Two corrections are associated with the use of electrostatic quadrupole (ESQ) vertical focusing on the storage ring. A vertically magnetic field is felt by muons passing through the radial electric field components created by the ESQ system. Due to the vertical betatron motions the muons do not orbit the ring in a plane orthogonal to the vertical magnetic field direction. A correction is necessary to account for an average pitch angle associated with their trajectories. A third correction is caused by muons that escape the ring during the storage time experiencing a biased initial spin phase compared to the parent distribution. Finally, because two high-voltage resistors in the ESQ network had longer than designed RC time constants, the vertical and horizontal centroids of the stored muon beam drifted slightly, during each storage ring fill. This led to the phase-acceptance relationship that requires a correction. I will present this high precision measurement focusing on the beam dynamics corrections to ω_a.

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Collaboration / Activity

Muon g-2 Collaboration

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