



Beitrag ID: 50

Typ: **Contributed talk**

New Muon Campus Simulations for the Muon $g-2$ Experiment at Fermilab

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The Muon $g-2$ Experiment (E989) at Fermilab conducted high-precision measurements of the muon anomalous magnetic moment a_μ using a storage ring from 2018 to 2023, achieving a remarkable precision of 0.20 ppm over Runs 1-3, with analyses for Runs 4-6 ongoing. A comprehensive understanding of the storage ring's beam dynamics and its accurate simulations are crucial for achieving the experiment's ambitious goals. One of the requirements for this effort is a very detailed knowledge of the phase space distribution of the beam. To address this requirement, we performed high-statistics simulations of the Muon $g-2$ Target Station (AP0) and the Muon Campus beamlines: M2 and M3, followed by the Delivery Ring, and then M4 and M5. The resulting muon distribution at the end of the M5 beamline from our previous 3×10^{12} protons-on-target (PoT) simulation serves as an essential input for the storage ring simulations. In 2024, to facilitate the analyses of Runs 4-6, we have updated our Muon Campus models and re-optimised certain parameters to reflect the operational currents and wire chamber measurements of the beam. For these optimisations, we employed the heterogeneous island method, implemented in our evolutionary optimisation tool, *glyphada*. This key update addresses the need to use the best possible beam for the storage ring simulations and thus supports the experiment's overall precision. The Muon $g-2$ Experiment at Fermilab has successfully achieved its 70 ppb systematic uncertainty goal and collected 21 times more data than its predecessor at BNL. The updated and improved Muon Campus models and simulations not only facilitate the experiment's efforts to potentially resolve the current tension between experimental measurements and theoretical predictions of a_μ , but also provide a basis for future simulations for the Mu2e Experiment (E-973), which utilises shared Muon Campus beamlines.

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Sitzung Einordnung: Sessions in Living Room 1+2

Track Klassifizierung: D-1 Beam Dynamics Simulations