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The Calibration System of the muon g-2 experiment at Fermilab

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The muon anomaly, aμ, is a low-energy observable, which can be both measured and computed to high precision, therefore it provides an important test of the Standard Model (SM) and it is a sensitive probe for new physics. The muon anomaly has been measured to 0.54 parts per million by the E821 experiment at the Brookhaven National Laboratory. This result shows a 3 to 4 standard-deviation difference with respect to the SM prediction. A new muon g-2 experiment, E989, is under contruction at Fermilab, aiming to improve the experimental error by a factor of four to clarify the origin of this difference. A central component to reach this fourfold improvement in accuracy is the high-precision laser calibration system, which is designed to monitor the gain fluctuations of the calorimeter photodetectors at 0.04% accuracy during the time muons are kept inside the storage ring (700 μsec). Over longer data collection periods the goal is to keep systematics contributions due to gain fluctuations at the sub-percent level. The laser calibration pulses will be used, prior to data taking, to simulate physics runs and test all calorimeters. We report here the configuration chosen for the laser calibration system, some results from tests with beam performed so far, and the status of the final implementation at Fermilab.

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