Magnetic Field Perturbations Due to a MicroTCA Crate

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Abstract

The Muon g-2 experiment at the Fermi National Accelerator Laboratory intends to test the completeness of the Standard Model. The E821 experiment at Brookhaven National Laboratory measured the anomalous magnetic moment of the muon in a constant magnetic field, a measure of how much the magnetic moment of the muon differs from the theoretical predicted value of two. Brookhaven scientists found a 3.6σ standard deviation from the theoretically predicted value. While a 3.6σ deviation from theory is significant, it is not enough to conclude that there is new physics affecting the property of the muon. Fermilab's experiment aims to increase the precision of their experiment to determine if there is a 5σ standard deviation, which would be enough to conclude that new physics were involved. This would then suggest that the Standard Model is incomplete. In order to ensure this precision, the electronics near the experiment were tested to check how high the magnetic field perturbations were when put near a calibration magnet. If the perturbations of the electronics or the parts of the electronics were above a value of 1×10^{-6}, also known as 1 ppm, then the perturbations were too high and the part needed to be replaced. For the experiment, a MicroTCA crate would be used and thus is what was tested here along with its power module and power cable. It was determined that the power cable and some parts inside of the MicroTCA crate itself had perturbations that were too large for the experiment. Hence, these parts are to be replaced before the Muon g-2 experiment starts in 2016.