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The muon to electron conversion process and the Mu2e experiment at Fermilab

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The Mu2e experiment aims to measure the charged-lepton flavour violating (CLFV) neutrino-less conversion of a negative muon into an electron in the field of an aluminum nucleus. The conversion process results in a monochromatic electron with an energy slightly below the muon rest mass (104.97 MeV). The Mu2e goal is to improve the world's best limit by SINDRUM II of four orders of magnitude and reach a single event sensitivity of 3.0 x 10^{-17} on the conversion rate with respect to the muon capture rate.
In many Beyond the Standard Model (BSM) scenarios, rates for CLFV processes are within the reach of the next generation experiments and their searches have a sensitivity to new physics that exceeds the LHC reach bringing the reach of new mass scale up to 10^4 TeV. In this context, indirect measurements of CLFV could provide crucial evidence for new physics.
Mu2e exploits a very intense pulsed negative muon beam on an aluminum target for a total number of 10^{18} stopped muons. Production and transport of the muons is performed with a complex and sophisticated magnetic system composed by a production, a transport and a detector solenoid.
The improvement with respect to previous conversion experiments is based on four main elements: the muon beam intensity, the beam structure layout, the extinction of out of time particles and the precise electron identification in the detector solenoid. The conversion electron will be reconstructed and separated from the Decay in Orbit (DIO) background by exploiting the very high resolution (120 keV) tracking system based on straw technology. The crystal calorimeter system will confirm that the candidates are indeed electrons by performing a powerful mu/e rejection while granting a tracking independent HLT filter. A Cosmic Ray Veto system will surround the entire detector solenoid and contribute to minimize the backgrounds due to cosmic muons.

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