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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 a nucleus. The conversion process results in a monochromatic electron with an energy slightly below the muon rest mass (104.97 MeV). Goal of the experiment is to improve of four orders of magnitude the previous measurement and reach a single event sensitivity of 2.5×10^{-17} on the conversion rate with respect to the muon capture rate.

In many of Beyond the Standard Model (BSM) scenarios, rates for CLFV processes are within the reach of the next generation of 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 will be crucial evidence of new physics.

The experiment goal is obtained with a very intense pulsed negative muon beam sent to an Aluminium target for a total number of 10^{18} stopped muons. Production and transport of the muons is done with a complicated and sophisticated magnetic systems composed by a production, a transport and a detector solenoid.

The improvement with respect to previous conversion experiments is based on four elements: the muon 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 by the Decay in Orbit (DIO) background by a 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 surrounds the detector solenoid and contributes to make the cosmic based background negligible.

Experimental Collaboration

mu2e

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