Development of Cylindrical Drift Chamber for the J-PARC Coherent Muon to Electron Transition Experiment

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On behalf of the COMET Collaboration

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COherent Muon to Electron Transition (COMET) experiment searches for $\mu^- - e^-$ conversion with a single-event sensitivity of 3×10^{-17}. The staged plan, COMET Phase-I, which aims at a direct measurement of background and a search for $\mu^- - e^-$ conversion was approved in 2009 [1]. To cope with the two physics goals for COMET Phase-I, especially the second one, a dedicated detector, Cylindrical Drift Chamber (CDC), has been developed.

COMET Phase-I requires that the detector should avoid the intensive beam coming through stopping targets and accept signal tracks (105 MeV/c electrons) with a large solid angle. The size of CDC is therefore carefully chosen. Under 1 Tesla magnetic field, about half of 105 MeV/c electrons will curve inside the CDC region and hit the trigger counter at either end of CDC after a couple of turns, while most of background tracks will flow away long the beamline. To better measure these curved tracks with a limited number of hit layers, the CDC layers are designed as all stereo without super layer structure. The working gas for CDC is chosen as He:C4H10 (90:10), because for 105 MeV/c electrons, multiple scattering effect dominants over spatial resolution in the final contribution to momentum resolution. A prototype of CDC has been constructed on Nov 2013. A series of tests with cosmic ray have been conducted and spatial resolution is found to be 150 um. According to Monte Carlo simulation based on GEANT and fitting algorithm based on GENFIT, momentum resolution can be about 100 keV/c. Details of the CDC development will be described in the symposium.

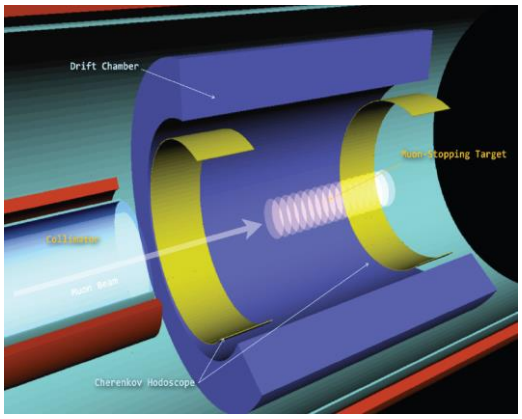

Fig. 1 Schematic View of CDC for COMET Phase-I.

References

[1] COMET Collaboration, Y.Kuno et al., LOI for COMET Phase-I, (2012)