

【Grant-in-Aid for Scientific Research (S)】

Broad Section B



Title of Project : New Initiative on Search for Charged Lepton Flavor Violation with Highly Intense Muon Source

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Research Project Number : 18H05231 Researcher Number : 30170020

Keyword : Elementary Particle

【Purpose and Background of the Research】

One of the most important subjects in elementary particle physics is to search for new physics phenomena beyond the Standard Model (SM). Charged lepton flavor violation (CLFV) is known not to occur in the framework of the SM, whereas it is expected to occur in the new physics models. Therefore, CLFV is considered to be one of the best to search for new physics. One of the most important CLFV processes is muon to electron conversion (μ -e conversion) in a muonic atom. We are preparing an experiment to search for it with a factor of about 100 improvement over the previous search. This experiment is called the COMET (J-PARC E21) Phase-I experiment. In particular, in this project, we will improve its experimental sensitivity by another 8 times over the original proposal of COMET Phase-I.

【Research Methods】

The present research method is to construct the COMET Phase-I detector to carry out our research for μ -e conversion. The detector is a cylindrical drift chamber (CDC) where a muon stopping target made of aluminium is placed at the center of the

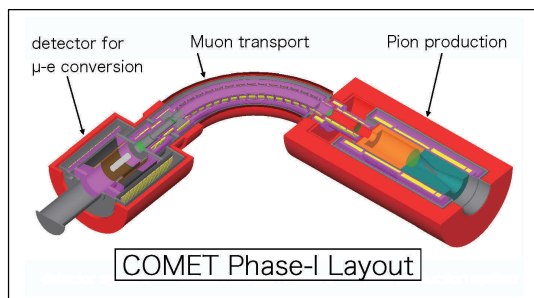


Figure 1

CDC. In particular, in this project, we intend to make three modifications of improvement. They are as follows: (1) We will install another solenoid magnet (named the Bridge Solenoid) between the solenoids of the muon transport section (3T) and the detector solenoid (1T). It would be useful to increase a total number of muons stopped and to reduce background hits. (2) We will replace all the

silicon-based photon sensors for the CDC trigger counters, by fine-mesh photomultipliers, and will place additional radiation shielding for them (3) We will make special selection of the parts and FPGA used in the frontend electronics of the CDC to make them stronger against radiation.

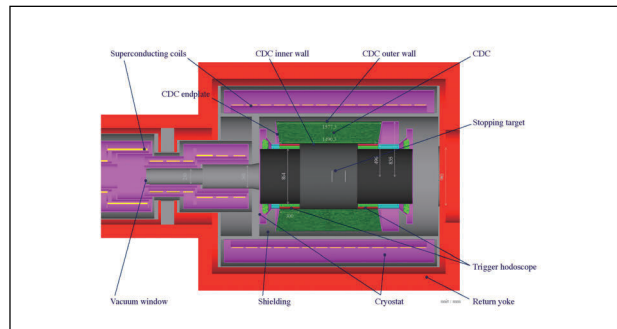


Figure 2 CDC layout

【Expected Research Achievements and Scientific Significance】

The COMET Phase-I with the proposed modifications, will intend at the 800 times improvement to aim at the discovery. If it is found, it would make a big paradigm change in the elementary particle physics.

【Publications Relevant to the Project】

- Y. Kuno, “A Search for Muon-to-electron Conversion at J-PARC: The COMET Experiment”, PTEP 2013 (2013) 022C01, DOI : 10.1093/ptep/pts089
- Y. Kuno and Y. Okada, “Muon Decay and Physics beyond the Standard Model”, Rev. Mod. Phys. 73 (2001) 151-202, DOI : 10.1103/RevModPhys.73.151

【Term of Project】 FY2018-2022

【Budget Allocation】 148,500 Thousand Yen

【Homepage Address and Other Contact Information】

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