Contribution ID: **39** Type: **Poster Presentation**

Estimation of Flux and Residual Radioactivity for the COMET Phase-I Experiment

Thursday, 26 November 2020 17:11 (1h 39m)

COherent Muon to Electron Transition (COMET) is an experiment at J-PARC, which will search for coherent neutrino-less conversion of a muon to an electron in muonic atoms. The experiment will be carried out in two steps: Phase-I and Phase-II. In the Phase-I experiment, 3.2 kW 8 GeV proton beam irradiates a 70-cm long graphite target to produce negative pions. The negative pions are captured in the magnetic field and delivered to pion-decay and muon-transport sections. The Phase-I experiment aims to detect the $\mu^- e$ conversion events and measure the beam-related background events for the Phase-II experiment. Now, it has been planned that the maintenance by radiation workers would be conducted after the 150-day operation and the following 180-day cooling. It is necessary to evaluate the residual radiation dose for the safety of the workers during the maintenance. On this study, we calculated fluxes of neutron, photon, proton and other charged particles in the beam room during the beam operation and the residual activity after the cooling time by using Monte Carlo simulation code PHITS version 3.22 and DCHAIN-PHITS version 3.21. The calculation results show that the design of components around the target and beam dump needs to be improved to reduce the radioactivities after the cooling time.

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Session Classification: Poster