Referee report on the COMET experiment (JINR participation)

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The report given to the Program Advisory Committee of JINR on 21 June 2021 outlines the proposal submitted by JINR researchers to carry on activities on muon physics, in the framework of the COMET experiment, to search for tiny effects possibly pointing to the existence of new physics, through the study of Lepton Flavor Violating reactions, for the years 2022-2024, after many years of participation in the project preparation.

COMET is an experiment at J-PARC in Japan, which aims at a sensitive search for lepton flavor violating neutrinoless conversion of muons into electrons in the nucleus field ($\mu- + N \rightarrow e- + N$). The experimental sensitivity goal for this process is order of 10^{-15} for Phase-I and 10^{-17} for Phase-II, which is a large factor of improvement over existing limits. COMET is scheduled to proceed through Phase-I and Phase-II experimental schedules. Even before the start of Phase 1, the group will conduct in 2022 the so-called Phase-α which is planned to be implemented before Phase-I in 2022 as a crucial demonstration facility. In Phase-α, the collaboration will measure general features of the beams.

The JINR group intends to contribute to the R&D work and the construction of two sub-detectors, namely the ECAL and the straw tracker system. The first contribution deals with tests and characterization of LYSO crystals that will constitute the calorimeter. The work for the straw tube system is more qualifying, since it includes the realization of a construction facility at JINR for both phase I and II, under full JINR responsibility. The JINR COMET group is large, 31 heads, with the good fraction of FTEs of 20.9. Compared to previous reports at this PAC, researchers of the Mue2 experiment at FNAL joined the JINR contingent of COMET. The present overall group includes 1 master student and 9 young researchers.

In the recommendations of the PAC of 3-4 February 2020, it was stated the relevance of this physics studies, but also the necessity of converging into a single JINR international experiment to ensure the necessary resources for a long-term, visible participation of the laboratory, with strong scientific impact. To some extent, this goal is being achieved with the JINR participation in the COMET project, which was already identified at that time as the best candidate. In fact, several researchers from the FNAL Mu2e experiments have now merged with the existing COMET group, although most of them intend to share their FTE quota with the T2K-Hyper-K experiment, also at J-PARC.

The referee is convinced that the JINR COMET group in its present configuration is well structured, and potentially very strong and visible in perspective. However, given the numerical

consistency in terms of head count and FTEs, the group should aim at well identified contributions at the construction, data analysis, educational and management levels, also considering the future contribution of the new JINR collaborators. If this further boost will materialize in the near future, and the proponents will show how to achieve this in a convincing manner, the referee will propose the highest support to be given to the project.

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