

Report on the request for prolongation of the project
“Measurement of the rare decay $K^+ \rightarrow \pi^+ \nu \nu$ at the CERN SPS (NA62)”

The NA62 project continues a series of experiments to study kaon decays and to provide precise tests of the Standard Model, to gain new knowledge about the CP-violation nature and to search for the occurrence of new physics beyond the SM. The project was started in 2010 aimed to register 100 events of a very rare kaon decay $K^+ \rightarrow \pi^+ \nu \nu$. Assuming 10^{-10} branching ratio, the experimental facility should ensure the fulfilment of two main tasks – suppression of the background and the usage of a high intensity unseparated K^+ beam.

The main element of the proposed experimental facility is the magnetic spectrometer with tracker detectors produced using the straw tube technology. The JINR team made a great contribution to the construction, manufacturing and commissioning of the straw tube detectors. The facility was tested during the autumn 2014 run with CERN SPS beams. In 2016, data taking was started and 20 signal candidates were registered by the NA62 collaboration before the CERN shut down. This result alone leads to the most precise branching ratio measurement $BR(K^+ \rightarrow \pi^+ \nu \nu) = (11.0^{+4.0}_{-3.5} \pm 0.3_{\text{sys}}) \times 10^{-11}$.

Additionally, the NA62 collaboration studies a series of rare kaon decay modes. The JINR group also participates in the analysis of several four-lepton decays with branching ratios of the order of 10^{-8} . Their precision measurement will broaden our knowledge of the ChPT parameters and verify its validity. The search for the forbidden modes will test the limits of the SM.

Large scale statistics of kaon decays together with high accuracy measurements allow to search for other rare kaon decays to check the existence of a supersymmetric particle sgolstino, to search for new light candidates for the dark matter, to study the possible heavy neutral lepton production and to verify the validity of the Chiral perturbation theory.

During the last period of the project, with the significant participation of the JINR group, a new upper limit on the rate of the decay violating the lepton number $K \rightarrow \pi \mu^\pm \mu^\pm$ has been obtained, the first observation and study of the rare decay $K^\pm \rightarrow \pi^\pm \pi^0 e^+ e^-$ has been done, and the most precise measurement of the combined form factors of K_{e3} and $K_{\mu 3}$ decays has been performed. New limits have been

established on the elements of the heavy neutrino mixing matrix $|U_{e4}^2|$ and $|U_{\mu 4}^2|$.

The obtained results were presented at many international conferences by JINR participants. Three papers were prepared by JINR principal co-authors.

I observe that currently the results of the JINR group are clearly visible in methodological and scientific fields. Based on the proposal to prolong the project, I conclude that the JINR team is fully integrated into the preparation of the NA62 experiment, data collection and analysis.

I consider the required financial support, which should ensure the activity of the JINR group and cover the expenses for the implementation of the experiment by the JINR side, to be justified and adequate. I support the approval of the project prolongation.

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