

## Feedback on the report on the NA62 project and the proposal for its extension

Probability of the rare decay  $K^+ \rightarrow \pi^+ \nu \nu$  (of the order of  $10^{-10}$ ) is directly related to the CKM matrix parameters defining the size of CP violation. Theoretically clean, this decay gives a possibility to discover a statistically significant deviation from the Standard Model and to open a new physics domain. NA62 experiment at CERN SPS aims to measure the branching ratio of the  $K^+ \rightarrow \pi^+ \nu \nu$  decay with a precision of the order of 10%, that requires extraordinary experimental efforts. In particular, the charged pion track must be measured with a high precision in conditions of minimum Coulomb scattering. So the key element of the NA62 detector is the magnetic spectrometer, that is made of light drift tubes. JINR group together with the dedicated CERN team were responsible for this spectrometer development, design and production.

After the spectrometer installation in 2014 and commissioning in 2015, the physical data taking was done in 2016-2018. During the LHC Long Shutdown period in 2019-2020 the NA62 experiment entered the stage of the physical data analysis. Starting from 2021, the second data taking period is in progress. And JINR group is currently participating both in the data taking and in the extraction of the physical results, including the additional studies of the rare four-lepton decays of charged kaons.

During the reporting period of 2021-2024, a series of works have been done by JINR group, and some important results have been obtained. A precision measurement of the rare  $K^+ \rightarrow \pi^+ \mu^+ \mu^-$  decay has been performed, and new limits are set for a series of kaon decays, that are forbidden within the Standard Model. Final results are published for the first observation and measurement of the  $K^\pm \rightarrow \pi^0 \pi^0 \mu^\pm \nu$  decay and for the precision measurement of the radiative  $K_{e3\gamma}$  decay.

But the most important achievement is the NA62 published final result of the  $K^+ \rightarrow \pi^+ \nu \nu$  decay study based on the data collected in 2016-2018. 17 signal candidates are observed in data collected in 2018. Together with the 3 candidates registered by NA62 in the 2016 and 2017, this leads to the most precise  $K^+ \rightarrow \pi^+ \nu \nu$  branching ratio measurement  $BR(K^+ \rightarrow \pi^+ \nu \nu) = (10.6^{+4.0}_{-3.4} \pm 0.9_{\text{sys}}) \times 10^{-11}$ , that is in agreement with the Standard Model expectation. JINR group participates in the analysis of background decay modes, software development, detector calibration and maintaining.

During the ongoing data taking period, NA62 collaboration plans to reach its projected statistics of the order of 100 events and precision of the order of 10% for the main goal branching fraction measurement. There is currently no global competition in measuring this decay mode. Dubna group includes young participants working on the data analysis, that will be an excellent school for them.

Accomplished results are adequate to the financial expenses for the project. I support an approval of the report related to the period of 2021-2024. Current and planned work is adequate to the funding requested for the period 2025-2027, and I would recommend extending the NA62 project at JINR for the next 3 years.

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