

NA62 Status and Outlook

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Kaon physics has been a source of many discoveries and was essential for the establishment of the Standard Model of particle physics as a viable theory of nature. In recent years the kaon physics community is concentrated on measuring the very rare $K^+ \rightarrow \pi^+ \nu \bar{\nu}$ decays, which are considered golden modes in flavour physics. The charged $K^+ \rightarrow \pi^+ \nu \bar{\nu}$ decay mode is under investigation by the NA62 experiment at CERN. The NA62 experiment at CERN collected the world's largest dataset of charged kaon decays in 2016-2018 and restarted operation in 2021. NA62 will continue taking data until CERN Long Shutdown 3. The main goal is to measure the $K^+ \rightarrow \pi^+ \nu \bar{\nu}$ branching ratio with a precision of the order of 10%, but the large data set also allows for a wide variety of precision measurements of rare kaon decays as well as exotic searches for new particles.

The future availability of high-intensity kaon beams at the CERN SPS North Area gives rise to unique possibilities for sensitive tests of the Standard Model in the kaon sector. Rare kaon decay measurements at CERN are listed as an essential scientific activity in the 2020 Update of the European strategy for particle physics and strongly supported in the national roadmaps across Europe. The High Intensity Kaon Experiment (HIKE) is a rich high-intensity kaon physics programme and CERN SPS fixed-target experiment, exploring the precision frontier of the Standard Model in a complementary and synergic way to the LHC experiments. HIKE represents a broad, long-term physics programme at the CERN SPS after Long Shutdown 3 (>2028), covering all the main aspects of rare kaon decays and searches accessible via kaon physics, from ultra-rare kaon decays to precision measurements and searches for new phenomena, with unprecedented world-leading sensitivity.

This seminar will cover the most recent results from the NA62 experiment and will present an overview of the physics goals, detector requirements, and project status for HIKE, the next generation of kaon physics experiments at CERN.