

## Search of New Physics with Kaon decays at NA62

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The SM prediction for the ratio of purely leptonic decay rates of the charged kaon  $R_K = \Gamma(K_{e2})/\Gamma(K_{\mu2})$  has an excellent sub-permille precision. Due to the helicity suppression of the SM contribution, the ratio is sensitive to non-SM effects; in particular, LFV contributions in the MSSM can modify it by a few percent without contradicting any other presently known experimental constraints. Current experimental precision is limited to 4.5%, and is insufficient for a stringent SM test. The NA62 experiment at the CERN SPS is aiming at improving the precision by almost an order of magnitude, using a dedicated data set collected in 2007/08. The status of the analysis will be discussed in detail.

The NA62 experiment will then evolve to the study of ultra-rare kaon decays. The  $K^+$  to  $\pi^+ \nu \bar{\nu}$  decay is a flavor changing neutral current process which proceed through box and purely electroweak penguin diagrams. It is very clean theoretically: short distance dynamics dominates, c-quarks contributions have been evaluated to NNLO order at 5%, and the hadronic matrix elements can be parameterized in terms of the  $K^+$  to  $\pi^0 e^+ \nu \bar{\nu}$  branching ratio that is well known experimentally.

For these reasons  $K^+$  to  $\pi^+ \nu \bar{\nu}$ , together with  $KL$  to  $\pi^0 \nu \bar{\nu}$ , is extremely sensitive to new physics contributions. Moreover, it allows a precise measurement of the CKM parameter  $V_{td}$ , independent from B oscillation measurements. The computed branching ratio is  $(8.0 \pm 1.1) \cdot 10^{-11}$ . The existing measurement, based on 3 events from E787/949 experiments at BNL, is  $(1.47 \pm 1.30 \pm 0.89) \cdot 10^{-10}$ , compatible with the SM within errors. A 10% accuracy measurement is required to provide a significative test of new physics scenarios. This is the goal of the proposed NA62 experiment at the CERN SPS, that aims to collect about 80 events in two years of data taking, keeping background contamination lower than 10%. The experiment will be based on the NA48 apparatus and will use the same CERN-SPS beam line which produced the kaon beam for the NA48 experiment. The experiment is being designed to reach  $10^{-12}$  sensitivity per event, exploiting a decay in flight technique which allows to reach a 10% signal acceptance. The detector requires a sophisticated technology for which an intense R&D program has started. The flux of  $K^+$  will be about 100 times higher than for NA48, opening many other physics opportunities. The status of the project, the R&D program and the perspectives of the experiment will be discussed.

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