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Precision measurements with kaon and pion decays at CERN

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The NA62 experiment at CERN collected the world's largest dataset of charged kaon decays in 2016-2018, leading to the first measurement of the branching ratio of the ultra-rare $K^+ \rightarrow \pi^+ \nu \bar{\nu}$ decay, based on 20 candidates.

In this talk NA62 reports new results from the analyses of rare kaon and pion decays, using data samples collected in 2017-2018. A sample of $K^+ \rightarrow \pi^+ \gamma \gamma$ decays was collected using a minimum-bias trigger, and the results include measurement of the branching ratio, study of the di-photon mass spectrum, and the first search for production and prompt decay of an axion-like particle with gluon coupling in the process $K^+ \rightarrow \pi^+ A$, $A \rightarrow \gamma \gamma$. A sample of $\pi^0 \rightarrow e^+ e^-$ decay candidates was collected using a dedicated scaled down di-electron trigger, and a preliminary result of the branching fraction measurement is presented. Recent results from analyses of $K^+ \rightarrow \pi^0 e^+ \nu \gamma$ and $K^+ \rightarrow \pi^+ \mu^+ \mu^-$ decays using 2017-2018 datasets are also presented. The radiative kaon decay $K^+ \rightarrow \pi^0 e^+ \nu \gamma$ (Ke3g) is studied with a data sample of O(100k) Ke3g candidates with sub-percent background contaminations. Results with the most precise measurements of the Ke3g branching ratios and T-asymmetry are presented. The $K^+ \rightarrow \pi^+ \mu^+ \mu^-$ sample comprises about 27k signal events with negligible background contamination, and the presented analysis results include the most precise determination of the branching ratio and the form factor.

The first observation of the decay $K^\pm \rightarrow \pi^0 \pi^0 \mu^\pm \nu$ ($K00\mu4$) by the NA48/2 experiment at the CERN and the final measurement of the branching ratio are also presented. The result is converted into a first measurement of the R form factor in $Kl4$ decays and compared with the prediction from 1-loop Chiral Perturbation Theory.

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