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The Ring Imaging Cherenkov Detector of the NA62 experiment at CERN: basic performance and aging effects

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The NA62 experiment is designed to measure the extremely rare kaon decay $K^+ \to \pi^+ \nu \bar{\nu}$ at the CERN SPS. This decay mode is highly sensitive to indirect effects of new physics at energy scales beyond the reach of current accelerators, and its branching ratio is predicted with high precision by the Standard Model to be below 10^{-10}. One of the main experimental challenges in NA62 is the suppression of background decay channels with branching ratios up to ten orders of magnitude larger than the signal and exhibiting similar experimental signatures. A dominant background arises from the decay $K^+ \to \mu^+ \nu$, making highly efficient pion/muon separation essential. A key component of particle identification (PID) in NA62 is the Ring Imaging Cherenkov (RICH) detector, which distinguishes μ^+ from π^+ in the momentum range between 15 and 35 GeV/c with a muon rejection factor of 10^{-2}. It also measures the arrival time of charged particles with a precision better than 100 ps and plays a central role in the NA62 trigger system. Since the start of data collection in 2016, the RICH detector has been operating successfully, ultimately allowing the first observation of the decay $K^+ \to \pi^+ \nu \bar{\nu}$ with a significance exceeding 5σ, based on data from the period 2016–2022. This contribution presents the evolution of the RICH detector's basic performance parameters as well as recent studies on aging effects.

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