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The kaon identification system in the NA62 experiment at CERN SPS

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The main goal of the NA62 experiment at the CERN SPS accelerator is to measure the branching ratio of the ultra-rare $K^+ \to \pi^+ \nu \bar{\nu}$ decay with 10% accuracy. This will be achieved by detecting ~ 100 $K^+ \to \pi^+ \nu \bar{\nu}$ decays with a ratio signal/background ~ 10 in 2-3 years of data taking starting in October 2014. NA62 will use a high-energy unseparated charged beam, with kaons corresponding to $\sim 6\%$ of the beam, and a kaon decay-in-flight technique. Since pions and protons cannot be separated efficiently from kaons at the beam level, the identification of kaons within a 750MHz particle rate is mandatory. The time information is also essential to reconstruct the $K^+ \to \pi^+ \nu \bar{\nu}$ decay and to guarantee the rejection of background induced by accidental overlap of events in the detector.
A differential Cherenkov detector (CEDAR) filled with Hydrogen or Nitrogen gas, and placed in the incoming beam, will perform the fast identification of kaons, before their decays,
with an efficiency of at least 95%. The CEDAR is insensitive to pions and protons and will provide precise time information with a resolution of at least 100ps. With respect to previous applications, the CEDAR will work within NA62 under unprecedented beam conditions. To stand the particle rate and to meet the performances required, an upgraded version (CEDAR-KTAG) with new photon detectors, readout, mechanics, cooling and safety systems has been proposed and realised for NA62. The CEDAR-KTAG upgrade has been successfully commissioned during a physics run at CERN in 2012. With half-detector equipped, the measured time resolutions are already within the required detector performances and the capability to distinguish between kaons and pions is validated by pressure scan results.

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