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The KAON identification system at the NA62 experiment at CERN (12' + 3')

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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 about 100 $K^+ \to \pi^+\nu\bar{\nu}$ decays with a ratio signal/background ~ 10 in 2-3 years of data taking starting in 2015. NA62 uses a 750MHz high-energy un-separated charged hadron beam, with kaons corresponding to ~ 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 the high-intensity NA62 beam 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 Nitrogen gas, and placed in the incoming beam, is used to perform the fast identification of kaons, before their decays. The CEDAR is insensitive to pions and protons and must provide an efficiency of at least 95% and precise time information with a resolution of at least 100ps. To stand the kaon rate (50MHz average) and to meet the performances required, an upgraded version (CEDAR-KTAG) with new photon detectors, readout, mechanics, cooling and safety systems has been realised for NA62. The fully equipped CEDAR-KTAG detector, its readout and front-end chain have been successfully commissioned during a pilot run at CERN in 2014. The kaon rate results in a ~ 10MHz rate in the sub-detectors after the 65m long decay region. Hardware lowest-level (L0) triggers are used to reduce the rate from ~ 10MHz to ~ 1MHz, still preserving most of the decays of interest. Following a L0 trigger, most sub-detectors, KTAG included, transfer data to dedicated PCs, where two trigger levels (L1 and L2) are applied via software, to reach a final rate of ~ 10kHz. With the data taking started from June 2015, while the NA62 experiment is finalising the detector and read-out commissioning, the CEDAR-KTAG time resolution and efficiency have been measured to be within the required detector performances. The capability to distinguish between kaons and pions has been validated and the development of L1 trigger algorithms for online kaon identification has been completed.

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Session Classification: Detector: R&D and Performance

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