The Kaon identification system of the NA62 CERN experiment

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NA62 CERN EXPERIMENT

Unseparated hadron beam: K^+ / π^- (63/34/06%)
Beam energy: 75 (±11%) GeV/c

KAON IDENTIFICATION SYSTEM: KTAG

Suppression of the accidental non-kaon background
Definition of offline timestamp for all subdetectors

NA62 challenges
- Identification of K^+ with ≥ 95% efficiency
- Time resolution < 100 ps
- Particle misidentification < 10^{-4}
- Huge illumination: 45 MHz K^+, with ~ 200 γ/K

Existing Beam CEDAR W counter
- Ring imaging optics
- Set up to detect Cherenkov light from K^+

KTAG: CEDAR + new photon detectors and read-out system
Cherenkov light detected in 8 Light boxes

1 Light box contains:
32 R9880 Hamamatsu PMTs
16 R7400 Hamamatsu PMTs
Fast readout electronics
Light box is in an insulated cooled Faraday enclosure flushed with N_2

N_2 pressure: 1.74 bar for K^+

KAON PHYSICS: K^+ → π^+ ν̅ν

NA62 main goal: K^+ → π^+ ν̅ν
- FCNC process forbidden at tree-level
- Constraint on CKM matrix element V_{td}
- Theoretically clean prediction
  BR_{K^+ → π^+ ν̅ν} = (9.11 ± 0.72) × 10^{-11}

Previous measurement from 7 events
E787/949: BR = (17.3^{+11.5}_{-10.3}) × 10^{-11}

→ Sensitive to New Physics
→ Still complementary to LHC searches

NA62 aims to measure BR(K^+ → π^+ ν̅ν) with 10% accuracy
- 100 K^+ → π^+ ν̅ν with S/B = 10 to be achieved in 2–3 years

KTAG PERFORMANCE AND PHYSICS

KTAG is essential to NA62 physics

Single track study with KTAG

Towards the measurement of BR(K^+ → π^+ ν̅ν)

Preliminary analysis:
  M^2_{miss} = (P_{K^+} - P_π)^2

- K^+ timing (KTAG), nominal momentum and direction (no GTK)
- π^+ momentum in [15; 35] GeV/c (STRAW tracker using only Pt kick)
- Decay vertex in fiducial region

MC expectations

Resolution improvement expected from:
- GTK kaon spectrometer information
- Fine STRAW spectrometer alignment with detailed B field map

Background rejection improvements from:
- RICH particle identification (π/μ/e)
- Photon rejection (LKr, LAV, IRC, SAC)
- Muon rejection (MUV)

CONCLUSIONS AND PERSPECTIVES

KTAG: Fully commissioned
KTAG preliminary performance evaluation within expectations:
- Time resolution σ(t(K^+)) ~ 70 ps
- Identification efficiency ≥ 95%

NA62 detector commissioned and ready for physics!
Nominal intensity in 2015–2018 → NA62 promising physics program

2012 - 2014
Oct - Dec 2014
2015 - 2018

Detector installation – Technical run in 2012
Pilot run
Physics Run

EPS-HEP 2015, Vienna, Austria, 22 – 29 July 2015