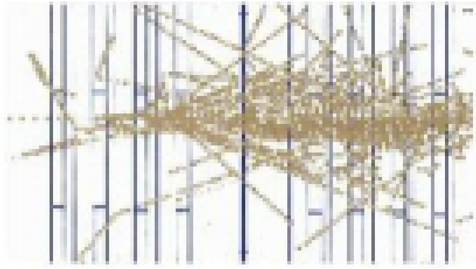

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The NA62 rare kaon decay experiment photon veto system

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Summary

The NA62 rare kaon decay experiment photon veto system

The NA62 experiment at CERN SPS is aimed to measure the very rare decay K^+ -> pi^+ nu anti-nu. This poses very stringent requirements on the particle identification capabalities of the apparatus in order to reject the overwhelming K^+ -> mu^+ nu and K^+ -> pi^+ pi0 background.
In particular, a pi0 detection at the level of (1-10-8) is needed to complement the kinematical rejection of pi^+pi0 events.
In order to have a full acceptance from 0 to 50 mrad, partly covered by the NA48 liquid Kripton calorimeter, a set of veto anti-counters should be placed along the vacuum decay tank, to catch large-angle photons with a detection efficiency better than (1-10-4) in a wide energy range [from few hundreds MeV to 35 GeV].
In order to meet the photon efficiency requirement, those calorimetric detectors should also have a good energy resolution [at the level of 10% at 1 GeV to have a precise definition of the energy threshold], good time resolution [better than ~ 1 ns] in order to be used at the trigger level, sensitivity to minimum ionizing particles, in order to allow in-situ calibration with muons of the beam halo.
Finally a moderate segmentation in the azimutal coordinate is desirable.
Intense R&D programs have been carried out in order to study different technological solutions: "spaghetti" calorimeter, lead/scintillator sandwich calorimeter, and -finally- an original re-use of the existing barrel of the OPAL lead-glass electromagnetic calorimeter.
This last solution is based on the peculiar radial arrangement of the lead-glass crystals in rings; since in this configuration the incoming photons hit the crystal laterally -on the short side- multiple staggered layers of those rings should be arranged to form a single veto detector.
This solution is very cost-effective, since all the detector elements [including photomultipliers and power supplies] are available, but poses all the problems typical of longitudinally segmented calorimeters.
Moreover, the actual capability of reaching the required level of detection efficiency should be studied.
Studies of the performance of all those kind of calorimeters at the Frascati BTF electron and photon beam in the most interesting, low energy range [100-500

MeV]
are here reported.

Primary author: VALENTE, Paolo (RM1)

Presenter: PALLADINO, Vito (INFN e Universita' Napoli)

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