

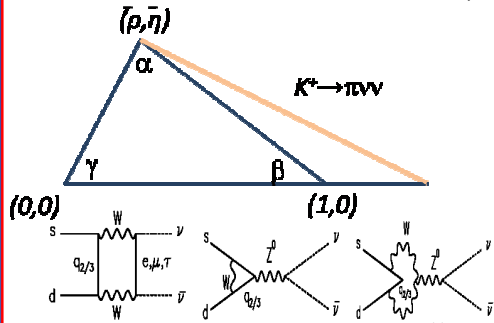
# The Photon Veto System for the NA62 Rare Kaon Decay Experiment

## The NA62 Collaboration

(Bern ITP, Birmingham, CERN, Dubna, Fairfax, Ferrara, Florence, Frascati, Louvain, Mainz, Menlo P., Merced, Moscow, Naples, Perugia, Pisa, Protvino, Rome I&II, S.Luis Potosi, Sofia, Turin, Vancouver)

### THEORY

- $K^+ \rightarrow \pi^+ \nu \bar{\nu}$  BR measures one side of CKM triangle
- Theoretical prediction depending on top (dominant) and charm contributions in loops



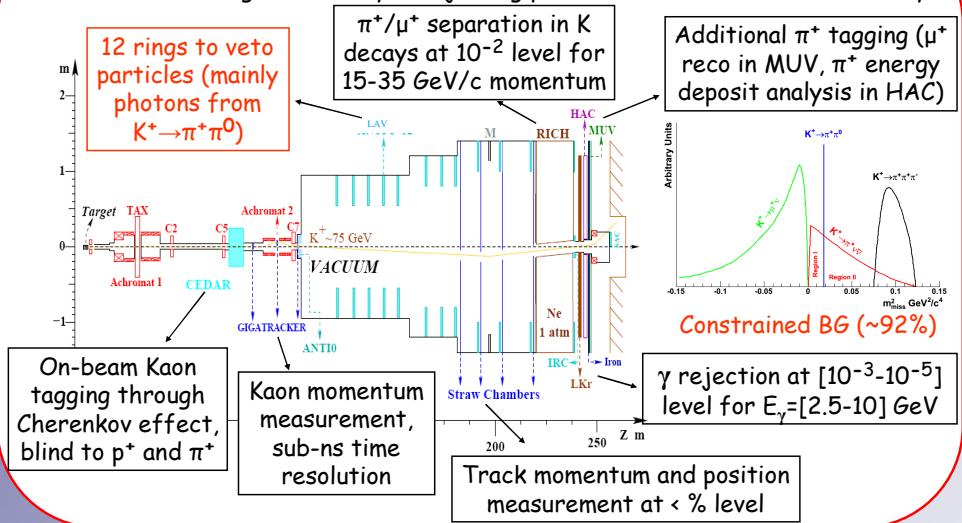
$$BR(K^+ \rightarrow \pi^+ \nu \bar{\nu})_{THEORY} = (8.22 \pm 0.84) \cdot 10^{-11}$$

$$BR(K^+ \rightarrow \pi^+ \nu \bar{\nu})_{EXP} = (1.73^{+1.15}_{-1.05}) \cdot 10^{-10} \text{ (7 candidates)}$$

E787/E949, Phys.Rev.Lett.101, 191082(2008)

### NA62

- Collect  $\sim 100 K^+ \rightarrow \pi^+ \nu \bar{\nu}$  events with  $\sim 10\%$  BG in 2 years
- High efficiency in rejecting photons and muons from Kaon decays

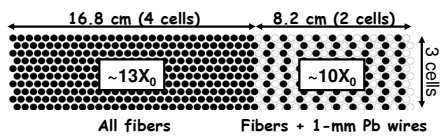
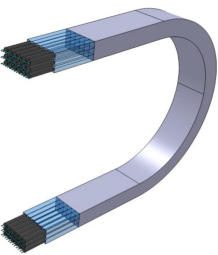


### Large Angle Vetoes (LAV)

3 solutions were tested in order to comply with the experiment's requirements

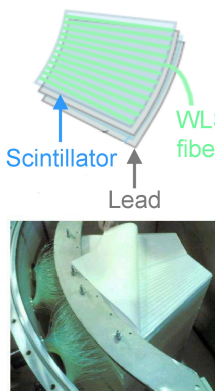
#### Lead + Scintillating fibers (KLOE-like)

- Horseshoe shaped prototype built in Frascati
- 18 readout cells,  $4.2 \times 4.2 \text{ cm}^2$
- Final size, 1/3 of final radial thickness
- Fibers/lead+fibers longitudinally (4/2 cells)



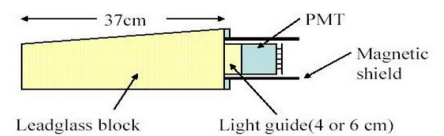
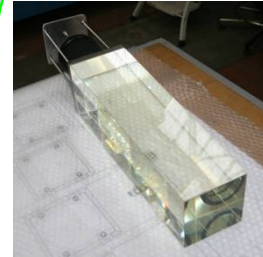
#### Lead + Scintillating tiles (CKM-like)

- Prototype (1/16 of a ring) from FNAL
- 16  $X_0$ , scintillating tiles (5mm) + lead foils (1mm)
- Fibers in the tiles leading signals to PMs

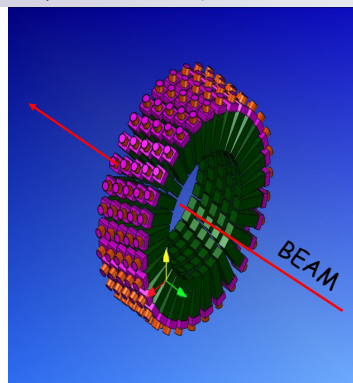
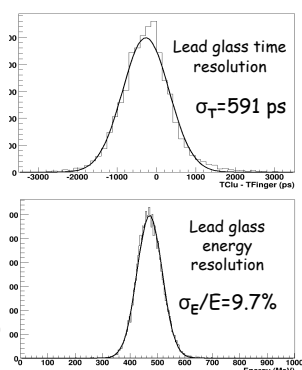
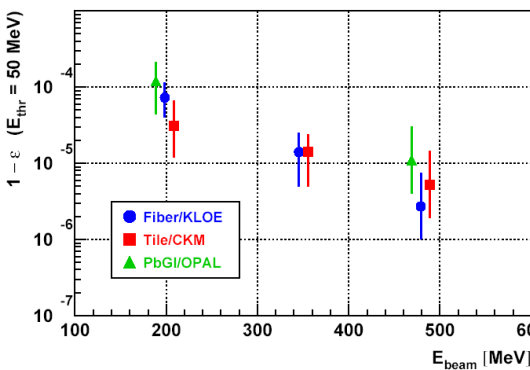


#### Lead glass crystals (from OPAL)

- $\sim 10^4$  crystals used in OPAL, 8 different crystal shapes
- $\rho = 5.6 \text{ g/cm}^3$ ,  $X_0 = 1.5 \text{ cm}$ ,  $R_M = 2.6 \text{ cm}$
- Crystal arrays tested in Frascati and Naples



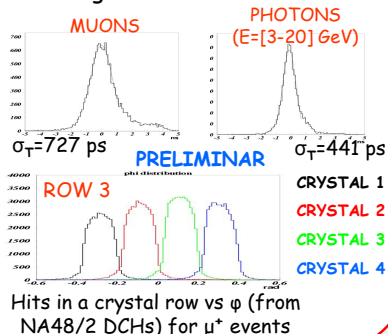
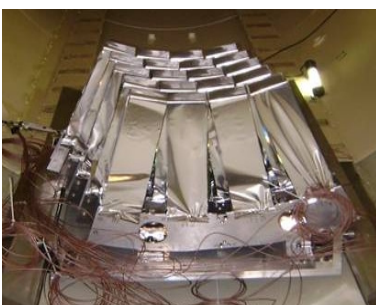
Tests at BTF in Frascati in 2006/7 showed that all the 3 solutions met the experimental requirements; the lead glass option was chosen



### GEOMETRY AND SIGNAL

- Each of 12 stations made of 5 staggered crystal rings
- Each particle crosses at least 3 crystals ( $\sim 20 X_0$ )
- Signals by Cherenkov effect, 1 PM for each crystal
- PMs due to operate in vacuum, mechanical stability and aging tests performed

2008 TEST: in Sept/Oct 2008 a prototype (1/8 of a single station) was built and tested on beam at CERN using NA48/2 detectors



2009: Construction of module 0 (whole station) under way in Frascati

