

### E391a

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$K_L \rightarrow \pi^0 \nu \nu$  decay is one of the best processes to check critically the Standard Model (SM) and to look for Beyond-Standard-Model (BSM) effects. Through the measurement of this decay rate a fundamental parameter of the flavor physics can be obtained with an ideally small theoretical ambiguity. Once an experiment finds a deviation from the SM prediction, it clearly indicates a discovery of a BSM effect.

Nevertheless, no dedicated experiment has been performed. This is because  $K_L \rightarrow \pi^0 \nu \nu$  decay is highly suppressed as a small branching ratio ( $O(10^{-11})$ ), and moreover, because measurement has been thought to be difficult due to few kinematical constraints in the  $K_L \rightarrow \pi^0 \nu \nu$  decay.

E391a is the first experiment dedicated to the decay  $K_L \rightarrow \pi^0 \nu \nu$ . It was approved in 2001, and the detector system was vigorously constructed in this fiscal year (Fy 2003). And then, the data taking started in February 2004.

Fig.1 shows an experimental setup. Almost all detectors are installed in vacuum. The detector system consists of 575 CsI calorimeters to measure the two gammas from a  $K_L \rightarrow \pi^0 \nu \nu$  and sampling calorimeters surrounding the decay fiducial region to veto the other decays and beam backgrounds.

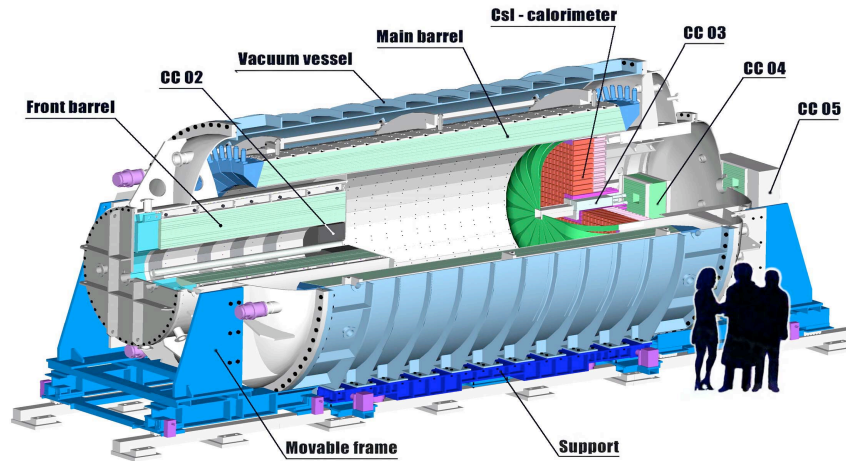


Fig. 1 E391a Detector System

The vacuum vessel was designed as it can be separated into three sections: the

downstream section which contains the CsI calorimeters and the upstream and middle sections, in which large sampling calorimeters of front and main barrels are installed respectively. The fabrication, assembling and installation of the front and main calorimeters are one of highlights of detector construction in Fy-2003. After connecting the three section we started evacuation from 1st February 2004..

All CsI and other detectors were calibrated by using cosmic ray  $\mu$ , punch-through  $\mu$ . The gain constants obtained from those two method agree with each other within 3 %.

On 17 February 2004 data taking was started on schedule. The vacuum level reaches less than  $1 \times 10^{-1}$  Pa in the detector region and less than  $2 \times 10^{-5}$  Pa around the beam region. During the data taking line shape peaks of  $K_L \rightarrow \pi^0 \pi^0$  and  $K_L \rightarrow \pi^0 \pi^0 \pi^0$  decays were monitored as shown in Fig 2. The data taking will be continued up to June 2004, and extrapolating the yields of these peaks, the experiment will reach the goal sensitivity of  $O(-10)$  for the  $K_L \rightarrow \pi^0 \nu \nu$  decay.

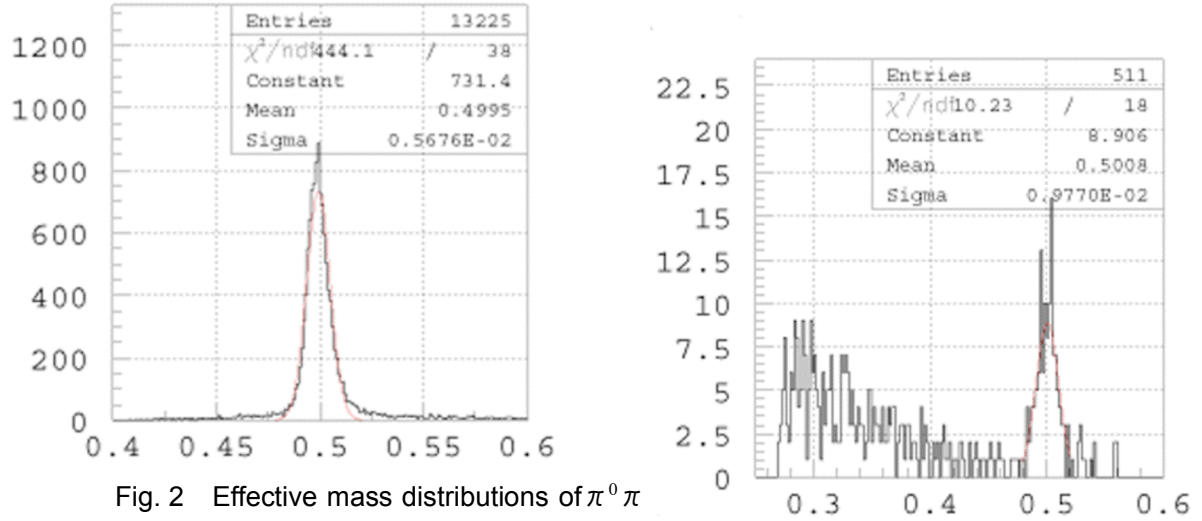


Fig. 2 Effective mass distributions of  $\pi^0 \pi^0$