Experiment E325 (ϕ)
Measurements of ϕ Meson Decays in Nuclear Matter

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The experiment E325 is to investigate the chiral property of QCD in dense matter through the measurements of vector mesons which decay inside nucleus. The chiral symmetry, broken in our world, is believed to be restored in the system with finite temperature and/or finite density. The order parameter of the symmetry, $< \bar{q}q >$, which is not a measurable quantity determines the vector-meson mass at the same time. It is hence theoretically predicted that possible mass shift of vector mesons can be considered as the partial restoration of the symmetry. The E325 focuses on ϕ mesons ($s\bar{s}$) to study the scenario at the normal nuclear matter density.

The spectrometer as shown in Figure 1 has been built at the EP1B beam line. We use 12GeV $p + A \rightarrow \phi + X$ interactions and measure both $\phi \rightarrow e^+e^-$ and $\phi \rightarrow K^+K^-$ decay modes in the same apparatus. To enhance the decays in the nucleus the spectrometer is designed to detect slowly moving ϕ's ($p_{lab} \sim 1GeV/c$). Electron are triggered by the gas Cherenkov counters and the lead-glass EM calorimeters. Kaons are triggered by the aerogel Cherenkov counters and the Time-of-Flight counters.

The ϕ's are identified in the invariant spectra. Three targets in-line (Cu, CH_2 and C) are employed to deduce the nuclear size dependence of the mass shapes and the branching ratio of the two decay modes. The changes of those observables will be the key signals of the experiment.

The first physics run has been performed in June 1997. Major production runs will start in March 1998 toward the collection of 10K $\phi \rightarrow e^+e^-$ decays. Figure 2 shows the preliminary data of the invariant mass distribution of the K^+K^- decay channel. Although the track fitting is very premature in this stage of analysis (hence the mass resolution is not optimized), $\phi \rightarrow K^+K^-$ decays are clearly identified. Further data accumulation and analyses will give a definite answer to the possible matter modification of the ϕ meson mass.

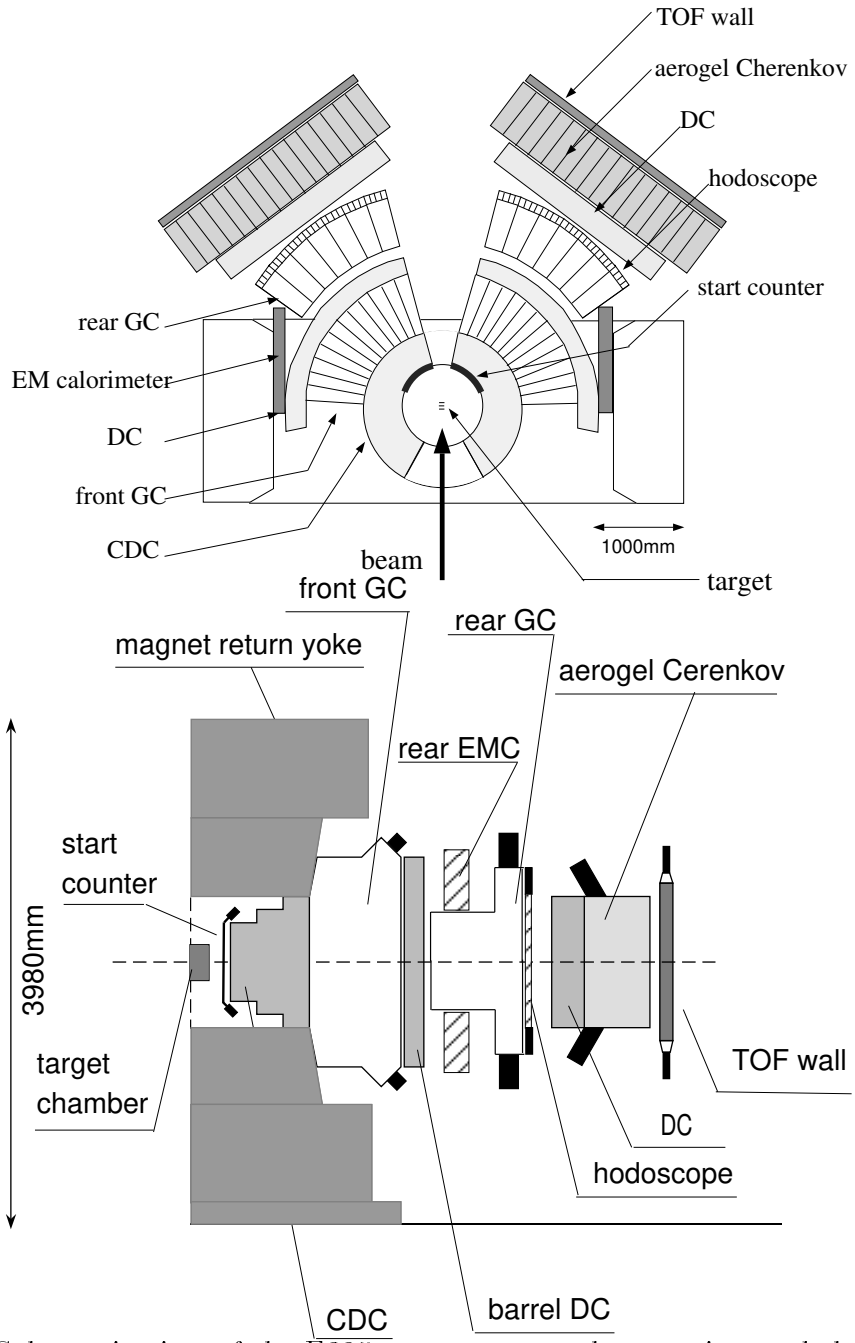

Figure 1. Schematic view of the E325 spectrometer, the top view and the side view

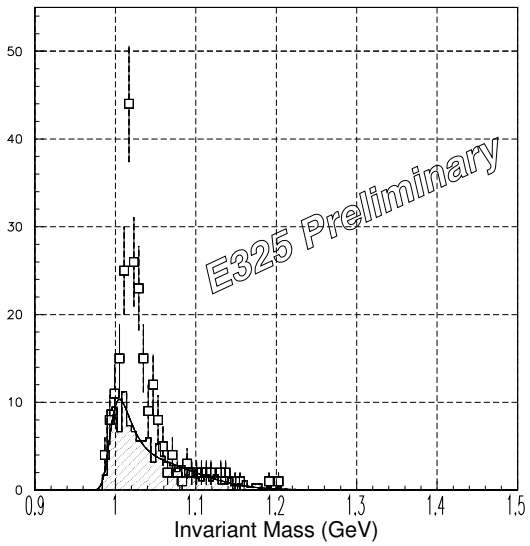

Figure 2. Invariant mass distribution of the K^+K^- channel (unit in GeV)

- Hideto En'yo

  ϕ Decay in Nuclear Matter

  Proceedings fo the U.S.-Japan semnor, 'Properties & Interactions of Hypeons' Oct. 1993, Maui,Hawaii, published from Worlid Scientific.

- S. Yokkaichi et al.

  Measurements of ϕ meson decays in nuclear matter at KEK-PS

  Contribution paper to the Quark Matter 97, Dec. 1997, Tsukuba, to appear in Nuclear Physics.