Annual report

Search for Θ^+ via $\pi^- p \to K^- X$ reaction at E522 experiment

K. Miwa (*Kyoto Univ.*) for KEK-PS E522 collaboration

We have performed the E522 experiment at the K2 beamline of KEK 12GeV Proton Synchrotron in November 2002 and February 2004. The main objective of this experiment was to search for H-dibaryon resonance with (K^-, K^+) reaction. At KEK-PS E224 experiment, the enhancement was observed at threshold region of the double-Λ system which are decay products from S=-2 system[1]. In this present experiment we aimed to search this enhancement with ten times larger statistics[2].

Besides this reaction, we optionally took (π^-, K^-) data, because the Θ^+ search via mesonic reaction was important and the K2 beamline was unique beamline which could provide a high-momentum π beam. In this report, we mainly mention about this topics.

We used π^- beam extracted at 1.87 and 1.92 GeV/c. As a target, we used a scintillation fiber (SCIFI) target which consisted of $((CH)_n)$and a bulk target of polyethylene which consisted of $((CH_2)_n)$. We irradiated 2.9×10^9 and 3.0×10^9 π^- beam to the SCIFI and the polyethylene targets respectively at beam momentum 1.87GeV/c. At at 1.92GeV/c, 7.4×10^9 π^- beam were irradiated to only polyethylene target.

The experimental set up consists of two parts; one part is a beamline spectrometer to analyze momentum of each incident beam particle with the resolution of $\Delta P/P$=0.5%, and the other part is forward spectrometer to detect scattered particles.

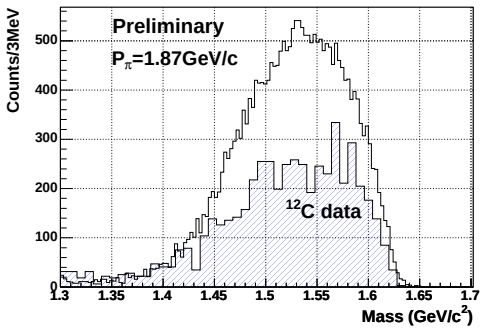

Figure 1: Missing mass spectrum of (π^-, K^-) reaction 1.92GeV/c. The hatched histograms are the carbon target data which is normalized by the target and beam count, and these histograms represent the contribution of carbon nuclei in SCIFI and polyethylene target.

Figure 1 shows the missing mass spectrum of (π^-, K^-) reaction at 1.92GeV/c. It seems that there is a bump around 1.53GeV/c^2. However there is a possibility that the structure is only a statistical fluctuation. We fitted this histogram with the background of cubic function and gaussian peak. The peak position was $1530.6\ ^{+2.2}_{-1.9}(\mathrm{stat.})^{+1.9}_{-1.3}(\mathrm{syst.})$ MeV/c^2 (preliminary), the width was σ=$4.1^{+3.0}_{-1.5}$ MeV/c^2 (preliminary) which was consistent with the expected resolution of 5.6MeV/c^2 within error. The statistical significance is not so large. Therefore we derive the upper limit of the production cross section and obtained the upper limit of the differential cross section via (π^-, K^-) reaction to be $\frac{d\sigma}{d\Omega} = 3.2\mu$b/sr (preliminary) at 90% confidence level. Assuming that K^- is produced isotropically at center of mass system, 10.8% of K^- is accepted by the spectrometer. Then, if the K^- is produced with s-wave, the upper limit of the total cross section is obtained to be $\sigma = 4.1\mu$b (preliminary) at 90% confidence level. These values are much smaller cross section than other hadron resonance and is also smaller than some theoretical calculations.

References

[1] J.K. Ahn *et al.*, Phys. Lett. B **444**, (1998) 267.

[2] C.J. Yoon *et al.*, in: Proc. of the YITP workshop "Multi-quark Hadrons; for, five and more ?", http://www.slac.stanford.edu/econf/C0402171/files/manuscripts/Yoon.pdf