SEARCH FOR AN I=1 RESONANCE IN THE $\bar{p}p \to K_1^0 K^\pm \pi^+ \pi^-$ REACTION, IN THE 1970 MeV MASS REGION

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Introduction

The data come from an experiment undertaken by the Glasgow-Liverpool-Lausanne/Neuchâtel-Paris (IPN) collaboration in the 2-meters HBC at CERN. The beam was set up at 8 different incident momenta between 1.50 - 2.04 GeV/c. The kinematic reconstruction was performed by the THRESH-GRIND programs. The number of events in this channel is the following :

$K_1^0 K^\pm \pi^\mp \pi^+ \pi^-$ 835 events

The four-body mass combination $(K_1^0 K^\pm \pi^+ \pi^-)$ presents a significant bump (about 4 σ's) in the 1970 MeV mass region. A resonant effect at this mass was already observed in the $\rho\pi\pi$ combination, by another experiment.[+]

Structure in $(K_1^0 K^\pm \pi^+ \pi^-)$ combination

The $(K_1^0 K^\pm \pi^+ \pi^-)$ mass spectrum (fig. 1 b) presents a bump at 4 σ in the 1970 MeV region whereas the $(K_1^0 K^\pm \pi^\mp \pi^\mp)$ spectrum (fig. 1 c) does not show any structure (in the spectrum b of figure 1, the two pions have opposite charges, whereas in spectrum c, the charges of the pions are the same ones). This bump cannot be reproduced by a maximum likehood fit. The results of this fit - percentages of produced resonances - are indicated in table I.

This structure cannot be a reflection of an other resonance, otherwise it would be reproduced by the fit. The appearance of an effect in spectrum b but not in spectrum c could be explained by a resonance if the latter decays in the channel : $(K\pi\pi)\bar{K}$, $(\overline{K\pi\pi})K$, or $K\bar{K}\rho$. The modes $\bar{K}^*K\pi$, $K^*\bar{K}\pi$, $K^*\bar{K}^*$ or $(K\bar{K}\pi)\pi$ would show up in spectrum c rather than spectrum b.

[+] C. Caso et al., Lett. al Nuovo Cimento III (1970) 707

Table I

Percentage of resonances produced in the $\bar{p}p \to K_1^o K^{\pm} \pi^{\mp} \pi^+ \pi^-$ reaction.

ln L	321
deg. of freedom	11
$K^{*\pm}$	9.4 ± 2 %
K^{*o}	7 ± 2 %
$K^*-\bar{K}^*$	17 ± 5 %
ρ^o	21 ± 2 %
$(K\bar{K})LD$	2 ± 2 %
D^o	5 ± 1 %
E^o	17 ± 2 %
F_1^o	9 ± 4 %
A_2	8 ± 0,5 %
$K_N^{\pm}$	5 ± 2 %
K_N^o	0. %
PS	0. %

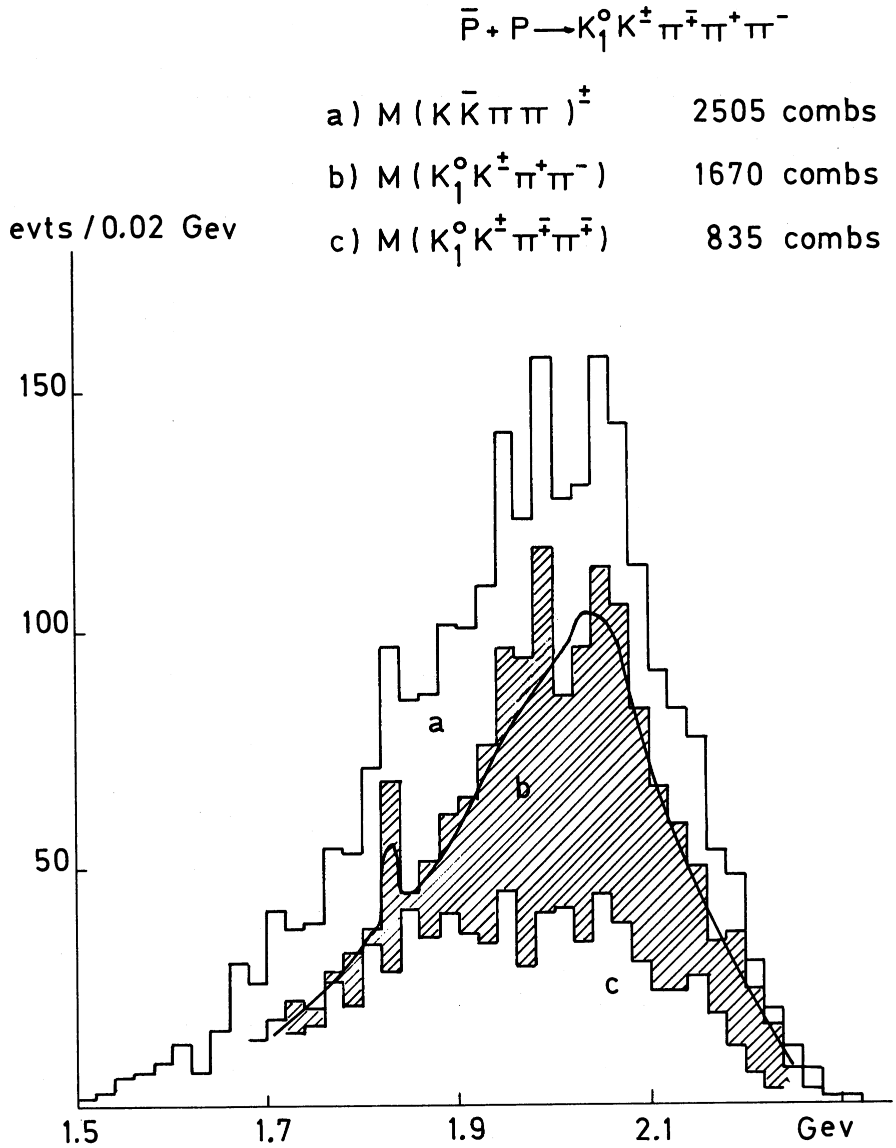
By cuts in the $(K\pi\pi)$ and $(\pi\pi)$ masses (fig. 2 and 3) we can isolate the decay products; indeed the cut $1.39 \leq M_{K\pi\pi} \leq 1.47$ GeV (K_N (1420) region) increases the signal/background ratio for the 1970 MeV peak.

We suggest therefore the following process :

$$\chi^{\pm}(1970) \to K_N (1420)\, \bar{K} + \bar{K}_N (1420)\, K$$

This resonance could be a recurrence of the B meson. The small bump in the ρ^o cut (fig. 3) could be due to the part of the K_N (1420) which decays into $K\rho^o$.

The amount of background under the resonance makes it difficult to determine the width of the resonance; which is of the order of 100 MeV.



The curve represents the fit performed with the percentage of resonances of Table I

Fig. 1

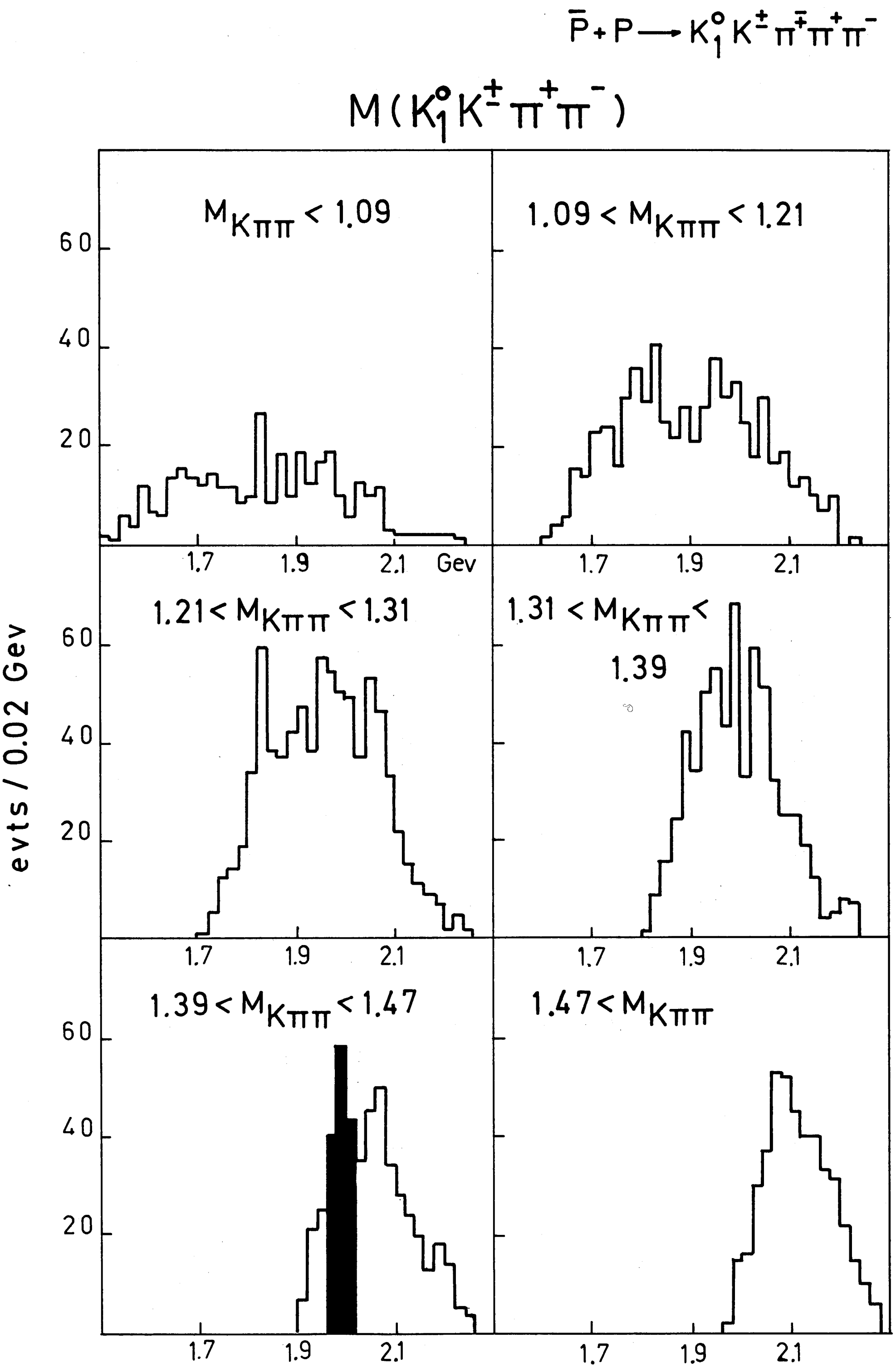
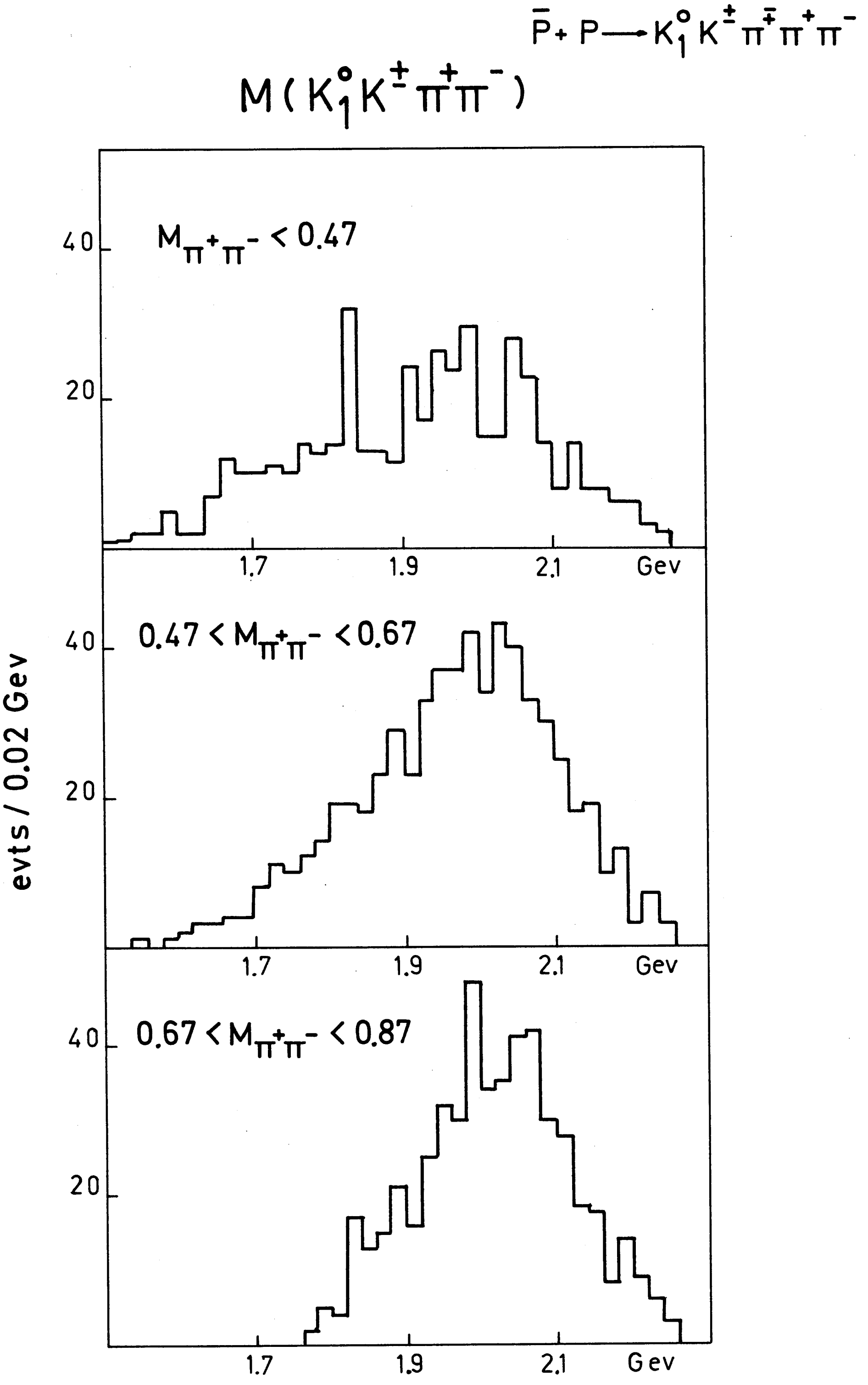

P̄ + P → K°₁ K± π∓ π+ π−
M (K°₁ K± π+ π−)
M Kππ < 1.09
1.09 < M Kππ < 1.21
1.21 < M Kππ < 1.31
1.31 < M Kππ < 1.39
1.39 < M Kππ < 1.47
1.47 < M Kππ
evts / 0.02 Gev
60
40
20
1.7
1.9
2.1
Gev

Fig. 2



$\bar{P} + P \longrightarrow K_1^0 K^{\pm} \pi^{\mp} \pi^+ \pi^-$
$M(K_1^0 K^{\pm} \pi^{\mp} \pi^-)$
evts / 0.02 Gev
$M_{\pi^+\pi^-} < 0.47$
$0.47 < M_{\pi^+\pi^-} < 0.67$
$0.67 < M_{\pi^+\pi^-} < 0.87$
40
20
1.7
1.9
2.1
Gev

Fig. 3