STUDY OF A $(KK\pi)$ ENHANCEMENT IN $KK3\pi$ ANNIHILATIONS OF ANTIPROTONS AT REST

R. Armenteros, D. N. Edwards, T. Jacobsen, A. Shapira J. Vandermeulen, Ch. d'Andlau, A. Astier, P. Baillon, H. Briand, J. Cohen-Ganouna, C. Defoix, J. Siaud, C. Chesquiere and *P. Rivet*

CERN

(Presented by A. ASTIER)

1) I want to bring up to data the results concerning the $(K\bar{K}\pi)$ enhancement observed at 1410 MeV in the channel

$$pp \rightarrow K_1^0 K^\pm \pi^\mp \pi^+ \pi^-,$$

of $\bar{p}$ annihilations at rest.

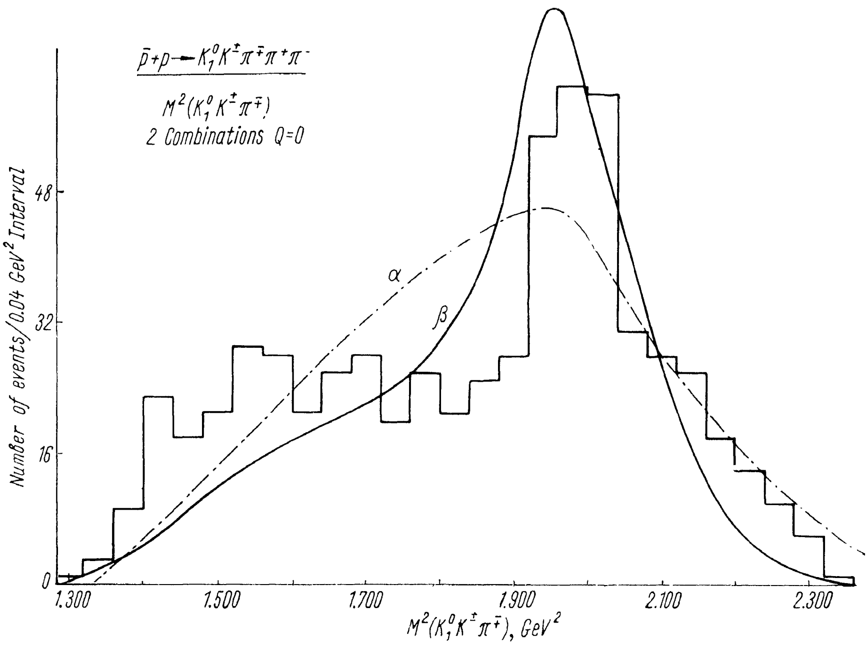

Fig. 1.

Since the Sienna Conference, the statistics has been doubled, with the result that the final sample of 316 events reproduces closely the initial features, that is to say:

— the strong enhancement at 1410 MeV in the $(K_1^0 K^\pm \pi^\mp)$ mass spectrum.

— the large production of K^*_{888} almost entirely within the $(KK\pi)$ enhancement.

— the concentration of KK masses at low values.

2) We have tried to see if these different observations could be accounted for by considering that the only true resonant effect is the well-established K^*_{888}.

To do that, which is not a simple problem, we have computed the $(K_1^0 K^\pm \pi^\mp)$ mass spectrum when we choose for the production reaction a matrix element of the form $M \propto \frac{1}{\Delta_{13} - \Delta^* + im^*\Gamma^*} +$ + similar terms in Δ_{14}, Δ_{23} and Δ_{14} where Δ_{ij} denotes the effective mass squared of particles i and j, with the labelling $\underset{1}{K_1^0}\underset{2}{K^\pm}\underset{3}{\pi^\mp}\underset{4}{\pi^\mp}\underset{5}{\pi^\pm}$; $m^* = 888\ \mathrm{MeV}/c^2$, $\Gamma^* = 50$ MeV; $s^* = m^{*2}$

That is to say, when we put in interference the four $K\pi$ interactions available with $I_z = \pm 1/2$ in the final state.

The result is shown in the Fig. 1 (curve α).

Clearly, the model does not account for the experimental results. That is the reason we propose the existence of a strong $(K\bar{K}\pi)$ interaction, or resonance, which has been called E.

3) The question which might be asked is: are we not in presence of a Peierls mechanism? all what we can say is that we do not observe the strong mass spectrum asymmetry predicted in this case by Nuenberg, Pais and Oakes. However, in our case, phase space limitations could reduce the asymmetry. As we did not compute this last effect, we cannot exclude this interpretation.

4) The Fig. 2 shows the spectrum obtained by subtracting the $(Q) = 2$ $(K\bar{K}\pi)$ mass spectrum from the $Q = 0$ one. The result is compatible with an almost pure Breit-Wigner distribution (multiplied of course by the invariant phase space).

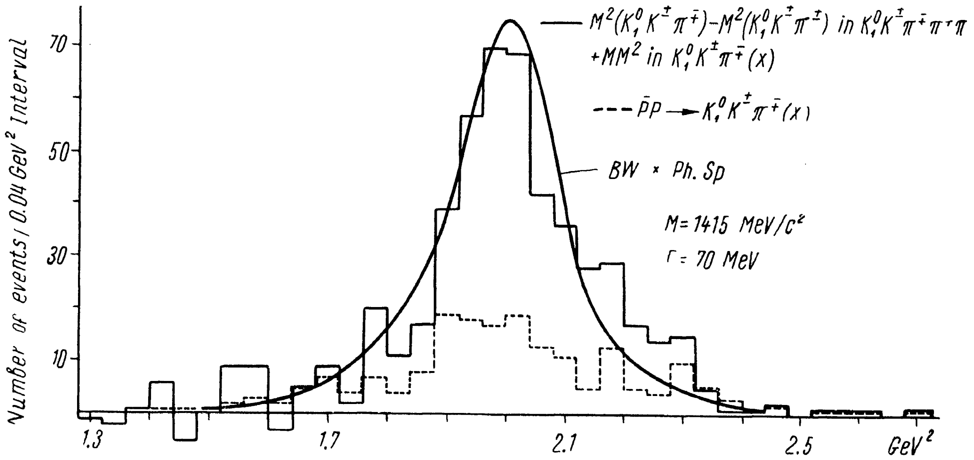

Fig. 2.

The simple following interpretation is straightforward: in each $K_1^0K^{\pm}\pi^{\mp}\pi^+\pi^-$ annihilation, one of the two neutral $K\bar{K}\pi$ combinations is resonant. On the spectrum shown, the non-resonant $Q = 0$ combination has been statistically eliminated when subtracting the $(Q) = 2$ combination, which is known to be non-resonant.

The Breit-Wigner curve shown corresponds to $M = 1415$ MeV/c² $\Gamma = 70$ MeV. The errors on this values are not expected to exceed ± 15 MeV.

5) We have also searched for the E in the other $K\bar{K}$ 3π channels. We have found it only in the $K_1^0K^{\pm}\pi^{\mp}\pi^0\pi^0$ channel. The $K_1^0K^{\pm}\pi^{\mp}$ mass distribution is shown by the dotted line on the slide. This distribution is compatible with a pure resonant one. Actually, it has been added to the subtracted spectrum I just described. That means that it is most likely that there is no charged $K\bar{K}\pi$ resonant combination. This fact, joined to the fact, that no charged $K\bar{K}\pi$ enhancement has been seen in any final state, strongly suggests that the I-spin of the E is zero.

6) Finally we have tried to determine the spin and parity of the E, essentially by looking at its decay Dalitz plot and at the angular distribution of the K^* coming from its decay ($E \rightarrow K\bar{K}^*$ or $K\bar{K}\pi^*$) as seen in the E center of mass with respect to ist line of flight.

Only the values 0 and 1 have been tried for its spin. Among these, the only compatible with the experimental results is the value 1, associated with parity,—, and G parity —, i. e. charge cojugation C = —1. However, as we did not see the decay $E \rightarrow K_1^0K_2^0\pi^0$, and as our statistics are poor, we cannot firmly conclude.