CB NOTE 325

Fogginess in Kinematic Fit.

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The problem is to extract the channel

$$\bar{p}p \;\rightarrow\; R1R2n\pi^0, \tag{1}$$

with R1 and R2 decaying into $\pi^+\pi^-\pi^0$ from seven π annihilations

$$\bar{p}p \;\rightarrow\; 2\pi^+2\pi^-n\pi^0 \tag{2}$$

If $m(R1) = m(R2)$, we have to consider *apriori* 24 combinations for n=3 . For example,

$$\bar{p}p \;\rightarrow\; \omega\omega\pi^0 \tag{3}$$

$$\bar{p}p \;\rightarrow\; \eta\eta\pi^0 \tag{4}$$

If not , for example

$$\bar{p}p \;\rightarrow\; \omega\eta\pi^0 \tag{5}$$

the number of combinations is twice as much. For n=2 the current version of CB Kinematic Fit is not efficient when the number of combinations is too large .
Indeed the CB-K fit is first looking for the best $\pi^+\pi^-\pi^0$,i.e. the combination which has a mass closest to the PDG value for $R1$, then it takes for $R2$ the best of the remaining $\pi^+\pi^-\pi^0$ with π^0 going into $\gamma\gamma$. In these conditions, $R1$ is always narrower than $R2$ and the number of combinations giving a good fit probability is about two. We have introduced a new algorithm, which treats two resonances $R1$ and $R2$ on equal footing. We defined a parameter F (Fogginess) and

$$F_i = \frac{(m({\pi^+}_i{\pi^-}_j{\pi^0}_k) - m_{R1})^2}{\sigma_{R1}^2} + \frac{(m({\pi^+}_l{\pi^-}_m{\pi^0}_n) - m_{R2})^2}{\sigma_{R2}^2} \tag{6}$$

where $i = 1, 2, ..., n$; n is the number of combination; σ_{R1} and σ_{R2} are the observed width for the corresponding resonances ; m_{R1} and m_{R2} are PDG values of masses of these resonances.

Reaction	Number of events with only one good combination by normal Kin.fit	Number of events with only one good combination by new algorithm
$\bar{p}p \to \omega\omega\pi^0$	750	1450
$\bar{p}p \to \omega\eta\pi^0$	597	930
$\bar{p}p \to \eta\eta\pi^0$	46	85
$\bar{p}p \to \omega\omega$	237	245

We define as the best combination , the combination with the minimum value of F_i.

The results , obtained by using two different algorithms of Kinematic Fits are shown in the Table. The advantage of new algorithm is obvious, the number of events with only one good combination increases by a factor two.

References

[1] N.Djaoshvili et al., CB-Note-321