DIFFRACTIVE PROCESSES IN $\bar{p}p$ INTERACTIONS AT 5.1 GeV/c

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(Presented by R.I. Hulsizer)

We have investigated the interaction $\bar{p}p \to \bar{p}p\pi^+\pi^-$ at 5.1 GeV/c. By a selection in the variables of the kinetic energy of each particle, and the Van Hove angles of each event, we have separated the final state $\bar{p}p \to \bar{\Delta}\Delta$ as well as the final states $\bar{p}p \to (p\pi^+\pi^-)\bar{p}$ and $\bar{p}p \to (\bar{p}\pi^+\pi^-)p$ where the particles in parentheses represent the dissociation of the proton and antiproton, respectively. The results will appear in detail in Physics Letters B.

Figure 1 shows the distribution of all events in the energy simplex and in the Van Hove angles. By making a selection of these events for which $M(p\pi^+)$ and $M(\bar{p}\pi^-)$ lie in the Δ and $\bar{\Delta}$ band, respectively, and the Van Hove angles lie in the region that corresponds to $q_{\bar{p}} > q_{\pi^-} > q_{\pi^+} > q_p$, the shaded portions of Fig. 2 are obtained. The unshaded portions represent the total sample. The q's are the longitudinal momenta of the particles.

By treating the combination $(p\pi^+)$ as a single particle, the quasi-three-body prism plot of Fig. 3a is obtained. The above cuts give the distributions shown in Figs. 3b and 3d. By selecting events in the portion of Fig. 3a that lies in the cylinder going down to the right from the left end of the dense cylinder in Fig. 3a, we obtain the events shown in Figs. 3c and 3e. Events where $M(p\pi^+)$ and $M(\bar{p}\pi^-)$ lie in the Δ and $\bar{\Delta}$ band respectively, have been eliminated from this sample. The invariant mass distributions of this sample are shown in Fig. 4. We believe these represent the diffractive dissociation of the proton, with subsequent decay into $\Delta\pi^-$. The solid curve in Fig. 4c shows the mass distribution of $p\pi^+\pi^-$ diffractively produced in $\pi^- p \to \pi^- p\pi^+\pi^-$ at 15 GeV/c. This component represents 15% of the $\bar{p}p\pi^+\pi^-$ events. A similar treatment of $\bar{p}p \to (\bar{p}\pi^+\pi^-)p$ indicates another 15%. Therefore we believe that 30% of the $\bar{p}p \to \bar{p}p\pi^+\pi^-$ results from diffractive dissociation of the proton and antiproton.

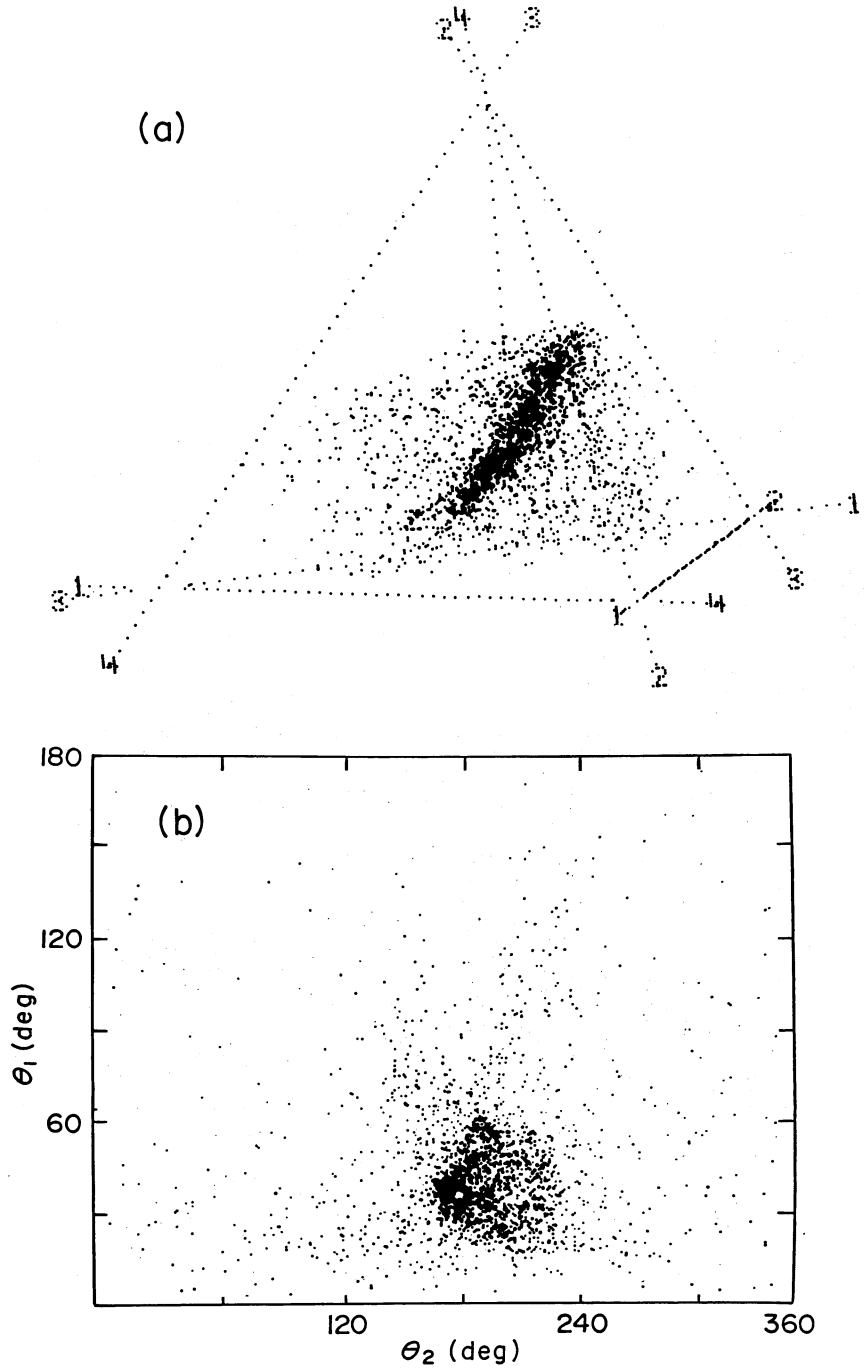

Fig. 1

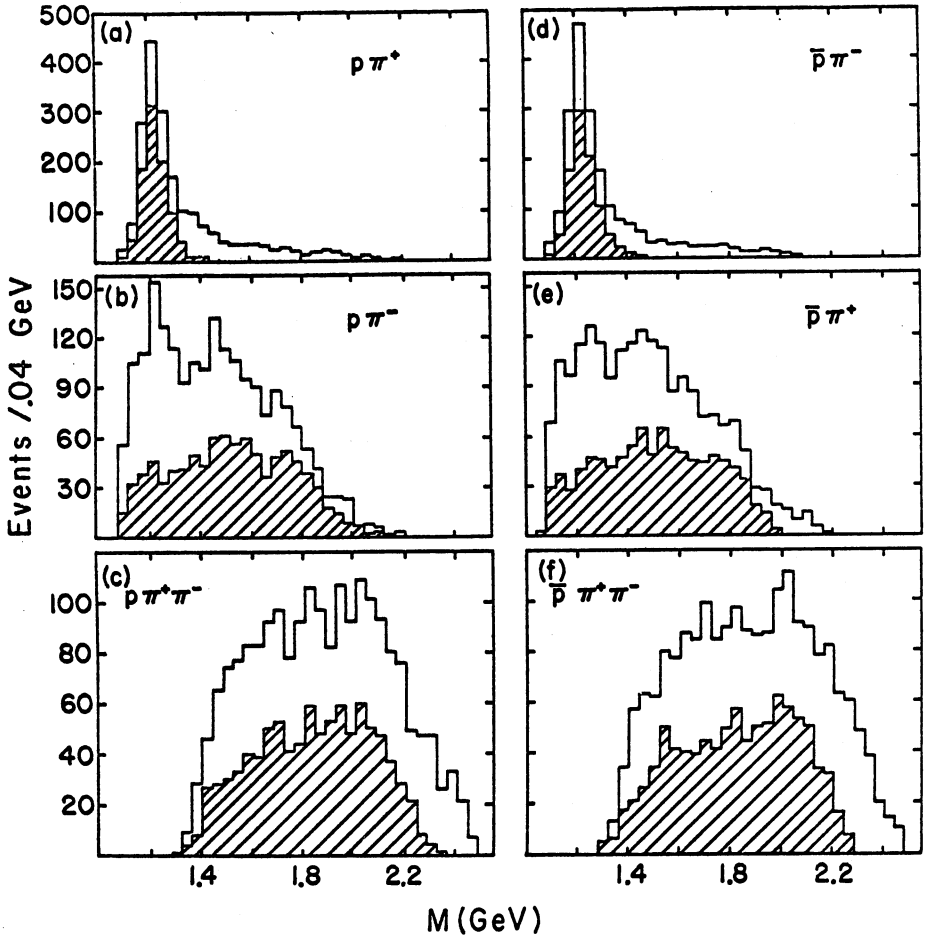
(a)
$p\pi^+$
(d)
$\bar{p}\pi^-$
(b)
$p\pi^-$
(e)
$\bar{p}\pi^+$
(c)
$p\pi^+\pi^-$
(f)
$\bar{p}\pi^+\pi^-$
Events /.04 GeV
M(GeV)
1.4
1.8
2.2

Fig. 2

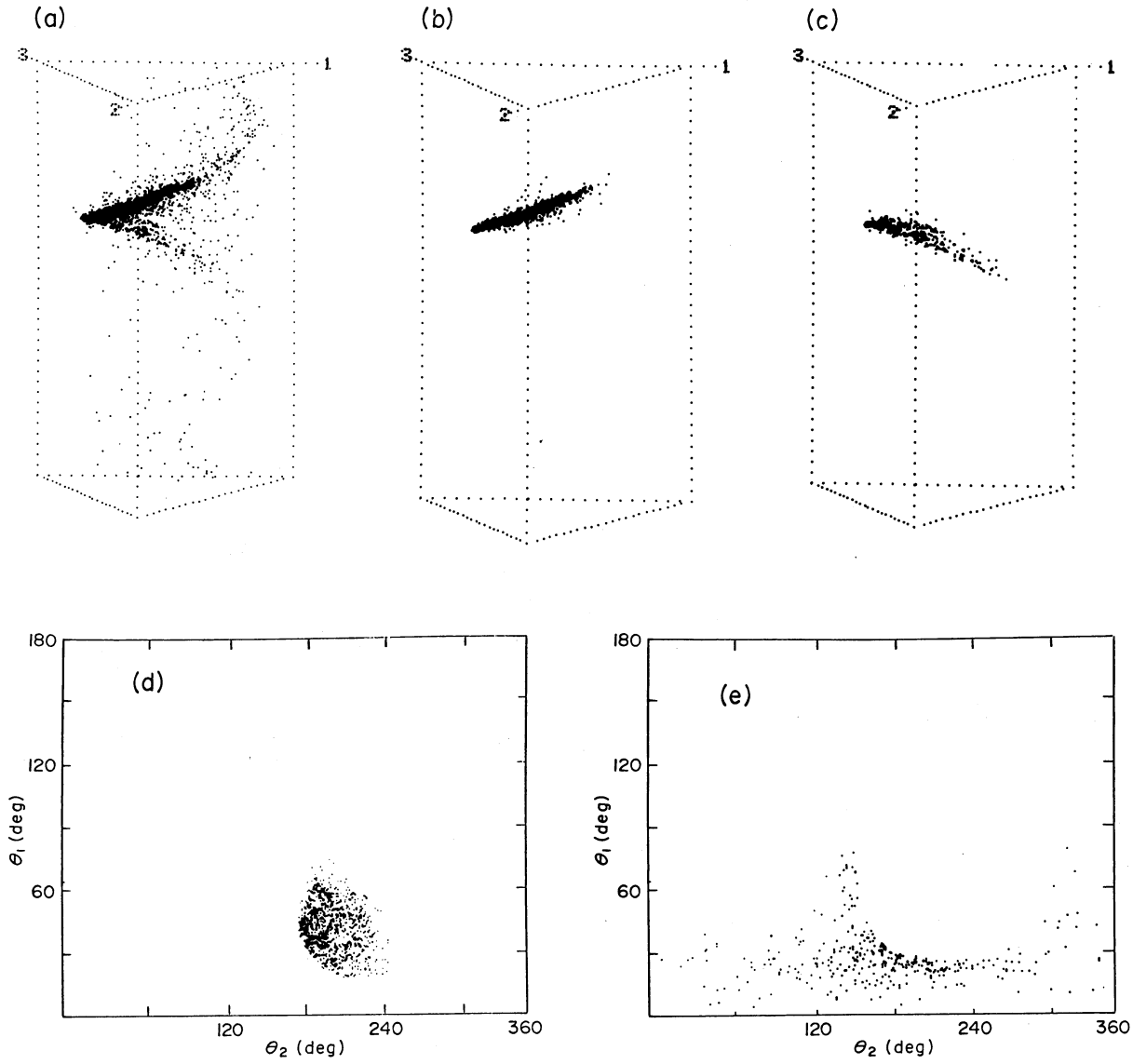

Fig. 3

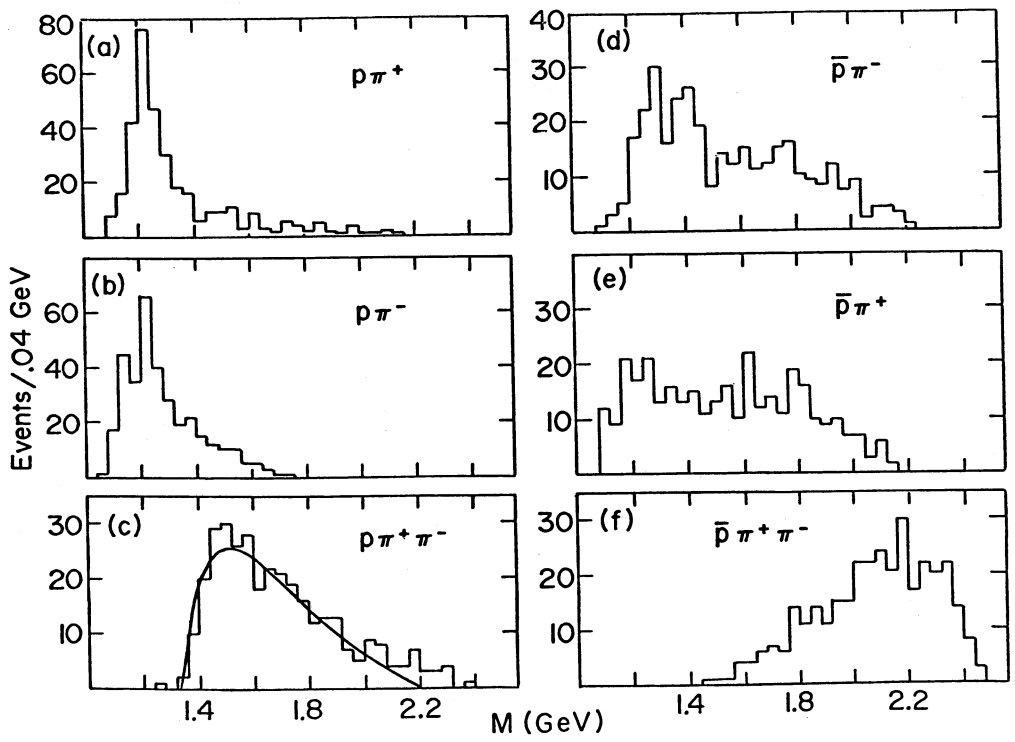
(a)
$p\pi^+$
(b)
$p\pi^-$
(c)
$p\pi^+\pi^-$
(d)
$\bar{p}\pi^-$
(e)
$\bar{p}\pi^+$
(f)
$\bar{p}\pi^+\pi^-$
Events/.04 GeV
M (GeV)
1.4
1.8
2.2

Fig. 4

D I S C U S S I O N

- *Smith:*

What you call diffraction dissociation may be described in terms of the Deck mechanism.

- *Cvach:*

You have shown that in your diffractively selected events there are still many $\bar{\Delta}^{++}\Delta^{++}$ events. They should not be there because diffraction production is governed by Pomeron exchange and the $\Delta^{++}\bar{\Delta}^{++}$ production is dominated by π exchange. It seems to me that your selection of diffraction does not work very well.

- *Hulsizer:*

It is very difficult to analyse the data to know where those $\Delta\bar{\Delta}$ are coming from. We think that this is one reason why the estimates on the $\Delta\bar{\Delta}$ production have been so contradictory.

- *Diaz:*

How do you treat the interference between the Pomeron and the pion exchanges?

- *Hulsizer:*

The only interference is in the overlap region of both processes. We first looked at all events outside the overlap region and then those inside the overlap region. Comparing them we found that there may be some interference but not very much.