PERIPHERAL PION-NUCLEON INTERACTIONS AT 7 BeV

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Using special criteria, 101 events which can be described by the one-pion exchange model were selected from 951 π^-N interactions.

BELYAKOV et al,[1] who studied the interactions of π^- mesons with nucleons, obtained values of various average quantities characterizing these interactions which disagree with the statistical theory of Fermi.

We have attempted to select peripheral π^-N interactions which can be described by a one-pion exchange model.[2-4] The π^-N interactions can be then represented by the two diagrams shown in Fig. 1. These diagrams correspond to the following possible processes:

$$\pi^- + p \to p + \pi^- + \pi^0, \quad (1.1)$$
$$\pi^- + n \to p + \pi^- + \pi^-, \quad (1.2)$$
$$\pi^- + p \to p + \pi^0 + \pi^- + \pi^0, \quad (2.1)$$
$$\pi^- + p \to p + \pi^- + \pi^0 + \pi^0, \quad (2.2)$$
$$\pi^- + p \to p + \pi^- + \pi^+ + \pi^-. \quad (2.3)$$
$$\pi^- + p \to p + \pi^+ + \pi^- + \pi^-. \quad (2.4)$$
$$\pi^- + n \to p + \pi^- + \pi^0 + \pi^-. \quad (2.5)$$
$$\pi^- + n \to p + \pi^0 + \pi^- + \pi^-. \quad (2.6)$$

For selection of these events, we used the following criteria:

1. We analyzed only two-, three-, and four-prong stars with an identified recoil proton.

2. A selected event had to have an elasticity factor $K_M < 0.5$ in the so-called mirror coordinate system.[5] This criterion corresponds to the fact that the energy of the protons in the laboratory system is low.[6]

3. Angular criterion. In the c.m.s. of the primary pion and nucleon, the π mesons produced in the upper vertex of the diagram in Fig. 1 should propagate forwards, and the π mesons from the lower vertex backwards.

4. In the c.m.s. of the primary pion and nucleon, the momentum of the recoil proton emitted in the reaction (Fig. 1, diagram 1) should be > 1.72 BeV/c (taking the experimental error into account > 1.55 BeV/c).

Out of 169 two-, three-, and four-prong stars with identified recoil proton we selected 17 events

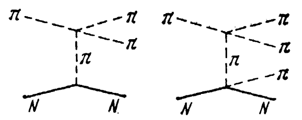

Diagram 1 Diagram 2

FIG. 1

which according to our criteria correspond to diagram 1 in Fig. 1. The maximum number of events which can be described by diagram 2 equals 84.

For all the analyzed stars we determined the rest mass W of the particle emitted from the lower vertex of the diagram in Fig. 1. For the 17 events corresponding to diagram 1 the rest mass W is narrowly distributed about the nucleon rest mass. For the remaining events the distribution of W exhibits a maximum near 1.2—1.3 BeV, which corresponds to the (π, N) isobar with $T = 3/2$.

We calculated the square of the 4-momentum Δ^2 of the exchange pions. The Δ^2 distribution is shown in Fig. 2. Figure 2a shows the Δ^2 distribution of the 17 events corresponding to diagram 1 [see Eq. (3.3) from [3] for W = M]. The Δ^2 distribution of the events with inelasticity factor in the mirror system $K_M < 0.5$, selected according to the angular criterion for diagram 2, is shown in Fig. 2b (84 events).

The Δ^2 distribution for both groups of events (diagrams 1 and 2) are characterized by a maxi-

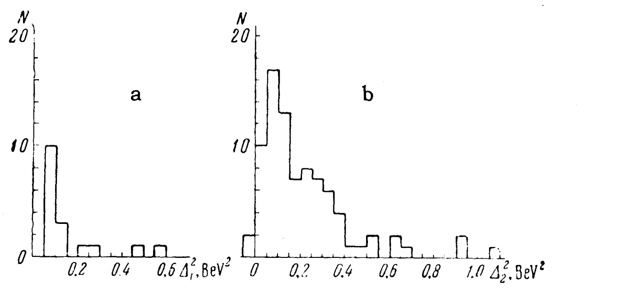

FIG. 2

mum in the range of small Δ^2 ($0 < \Delta_1^2 < 0.15$ BeV^2 for diagram 1 and $0 < \Delta_2^2 < 0.4$ BeV^2 for diagram 2) which is in agreement with the peripheral collision model.

From the fact that the number of (π, N) and (π, π) isobars among the 169 events is relatively small, we can conclude that the number of events going through the isobar channels is only a small fraction, of the order of several percent, of the total number of π^-N interactions at 7 BeV (see [7]).

A detailed analysis of the data will be published in the Czechoslovak Journal of Physics.

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241