FERMILAB PROPOSAL No. 328

Scientific Spokesman:

M. I. Tretjakova
Laboratory of Cosmic Rays
P. N. Lebedev Physical Institute
Leninsky prospect, 53
Moscow, USSR

The Interactions of π^--Mesons in Nuclear Emulsion at 200 GeV/c (or 300 GeV/c)

M.I. Adamovich, N.A. Dobrotin, M.I. Tretjakova
P.N. Lebedev Physical Institute
of the
Academy of Science of the USSR

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M.I.Adamovich, N.A.Dobrotin, M.I.Tretjakova
P.N.Lebedev Physical Institute of the
Academy of Science of the USSR.

A PROPOSAL OF THE EXPERIMENT AT THE NAL ACCELERATOR (BATAVIA, USA).

THE INTERACTIONS OF π^--MESONS IN NUCLEAR EMULSION AT 200 Gev/c (OR 300 GEV/c).

The investigation of the interactions of π^--mesons on nucleons and nuclei of photoemulsion at 17 and 60 Gev/c give some peculiarities of these interactions. These results are as follows:

1) The asymmetry in a forward direction in an angular distribution of the secondary particles up to multiplicities n=8-10 at 60 Gev/c [1] .

2) The multiplicity distribution in π^-p-and π^-n --interactions [1] .

3) The mean value of the energy carried out by neutral mesons in π^--N-interaction is about 0.4 which is twice as much than in pN-interaction [2] .

4) We develop a method of detecting the e^+e^--pairs for individual events that enables to obtain the characteristics of the π^0 mesons. In particular, the π^--N-interactions at 60 Gev/c with $K_{\pi^0} > 0,6$(a share of such events is 30%) have a leading π^0-mesons ($p > 0,3\ p_0$, $< p_1 > = 0,5$ Gev/c) and its characteristics are similar to those of the charged leading particles [3,4] .

5) It is observed that the cross section for the coherent production of one,three and five charged particles increases in energy interval from 17 to 60 Gev, moreover it increa-

ses more rapidly than for pA-reactions.

6) The cross section for the reaction $\pi^-\pi^0\pi^0$ is equal to ~ 0.7 of that for $\pi^-\to\pi^-\pi^+\pi^-$ reaction. We investigated also the characteristics of the charged particles from the reaction $\pi^-\to\pi^-\pi^+\pi^-$ and that of π^0-mesons from the reaction $\pi^-\to\pi^-\pi^0\pi^0$ [6].

7) In π^--nucleus interactions the mean value of multiplicity has a weak growth with an atom number, and the angular characteristics of secondary particles from a narrow cone are similar to those from π^-p-interactions. It has been obtained that the mean share of the energy carried out by π^0 mesons at 17 Gev is ~ 0.35 for π^-N, π^--light(C,N,O) and π^--heavy(Ag,Br)nuclei and do not depend on the atom number of the target.

THE PROPOSED EXPERIMENTS AT 200 Gev(OR 300 Gev)

1. It is of great interest to investigate the characteristics of π^--M-, π^--nuclei and coherent interactions at 200 Gev(or,if possible, 300 Gev) and to compare both of them with those at low energies and with the data about reactions induced by protons at 200,Gev which the Sovjet collaboration has obtained in emulsions irradiated at NAL [7-15].

2. The requirements for the photoemulsion stacks exposure.

We need three emulsion stacks each has a volume of 1 liter irradiated by π^--mesons at 200 (or 300)Gev. The π^--meson beam must be parallel to the emulsion plane(the dip angle has to be of no more than 5.10^{-3}). The density of the beam within$(2-4).10^4$ pions/cm^2. On the condition that the

beam angle dispersion will be no more than $0.5.10^{-3}$ it is desirable to take some control irradiation of the same stacks perpendicular to the emulsion plane to estimate the distortion level. The particles density must be about 10^5 particles/cm^2.

3. The development of emulsions

For the control of development quality it is necessary to have some possibility to develop a small number of the photoemulsion layers during the preparation and exposures at Batavia. All the stacks will be processed in the USSR.

4. We ask to consider Dr.V.A.Zarev attached at NAL during 1974(or Dr.M.I.Adamovich) from P.N.Lebedev Physical Institute as persons responsible for the emulsion exposure at NAL.

5. Please send all the information about the performing of this experiment to Dr.M.I.Tretjakova,Laboratory of Cosmic rays,P.N.Lebedev Physical Institute,Leninsky prospect,53. Moscow, USSR.

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