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CASCADE SHOWERS INDUCED BY FNAL 300 GeV π^- IN EMULSION CHAMBERS

S. Dake[1], H. Ito[1], M. Miyanishi[1], H. Oda[1], N. Hotta[2], H. Munakata[2], Y. Nakanishi[2], M. Sakata[2], K. Yamamoto[2], Y. Yamamoto[2], K. Mizutani[3], K. Kasahara[4], T. Yuda[4].

[1]Department of Physics, Kobe University, Kobe
[2]Department of Physics, Konan University, Kobe
[3]Department of Physics, Saitama University, Urawa
[4]Institute for Cosmic Ray Research, University of Tokyo, Tanashi

ABSTRACT

For 300 GeV π^- beam of Fermilab, emulsion chambers were exposed. The present preliminary results are compared with the emulsion data for 400 GeV proton beam. The relative corss-section of the charge exchange for pions is estimated to be about ten percent of the total production one for γ rays.

In order to investigate the cascade behavior originated from the jet showers and to compare the results with previous emulsion data[1] for 400 GeV protons, two emulsion chambers were exposed for 300 GeV negative pion beam at Fermilab.

The energy of the jet origin cascade shower is determined by fitting the theoretical transition curves to the experimental data as mentioned in our previous papers[1,2].

The emulsion chamber design with the face area of 10 cm × 10 cm and with a total thickness of 6 cm lead is illustrated in Fig. 1. One chamber used in the present analysis is composed of 29 sensitive layers (each is 100 μm emulsion coated on both sides of 800 μm acryl base) and 24 lead plates of each 2.5 mm thickness which are gilted by silver.

The pion beam of density 100 ∿150 per cm^2 was irradiated at a right angle to the face of the chamber. The general scanning was carried out in the 5th emulsion layer at the chamber top in front of lead plate and in the 15th emulsion layer at the depth 2.5 cm from the top, in order to find single tracks and jet origin showers respectively. The single tracks of the former are connected to each layer one after another untill the jet origin showers are found. The preliminary 47 events have been obtained in an area 3.8 cm^2 of the chamber.

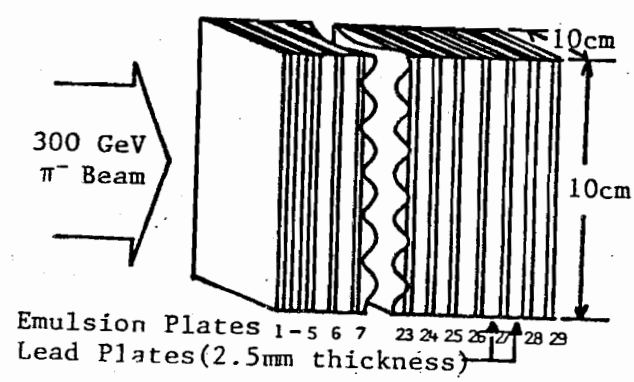

Fig. 1. Emulsion Chamber

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The energy of the cascade shower orginated from a jet shower as mentioned above[2] is equal to the total energy of the initial γ rays (ΣE_γ) mainly from neutral pions at the interaction point. The differential spectrum of the total energy (ΣE_γ) is shown in Fig. 2. In this figure, the detection bias is considered to appear in the lower energy region than 80 GeV.

A partial inelasticity of electromagnetic component (K_γ) i.e. an energy fraction carried by the initial γ rays out of the incident negative pion energy(300 GeV), can be given for each cascade event. The integral spectrum of K_γ obtained in the present experiment is plotted in Fig. 3 (circle marks) together with that of 400 GeV proton data[1] (triangle marks) and with the theoretical curves deduced from the flat type (dashed line) of K distribution and gaussian one (solid line). In this figure, the vertical axis is arbitrary and the data and the curves are normalized in the point K_γ=0.35. The previous data for 400 GeV protons are good consistent with flat one, but the present K_γ spectrum have a bump in the large value of K_γ even within the statistical error. If this will mean the charge exchange effect, the relative cross-section of the exchange for that of total γ rays is estimated as about ten percent.

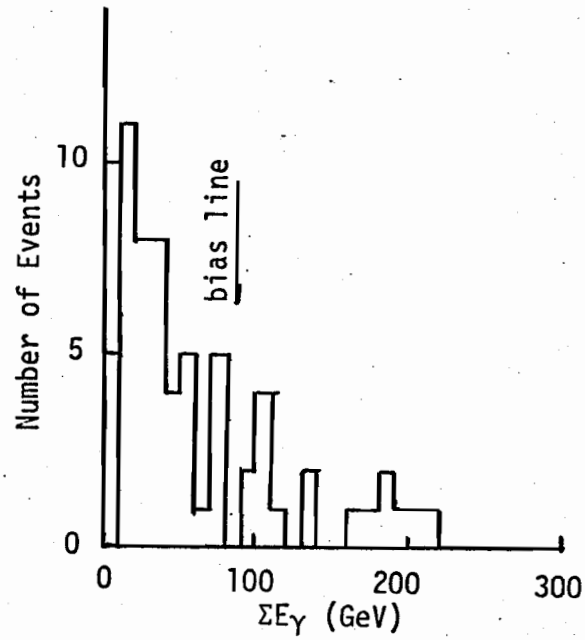

Fig. 2

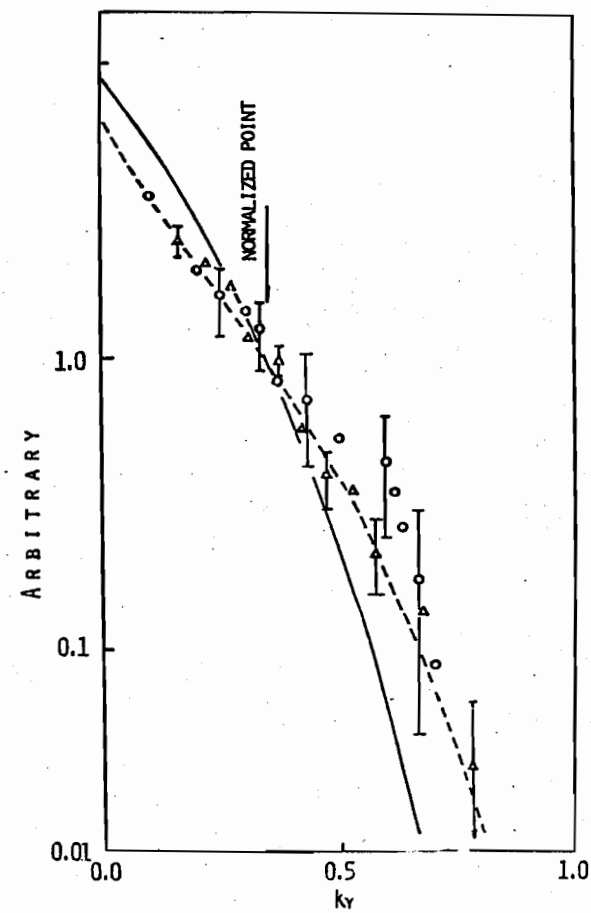

Fig. 3

The authors would like to express their gratitudes to the members of Fermilab for making successful exposure of emulsion to accelerator beams.

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