ОБЪЕДИНЕННЫЙ
ИНСТИТУТ
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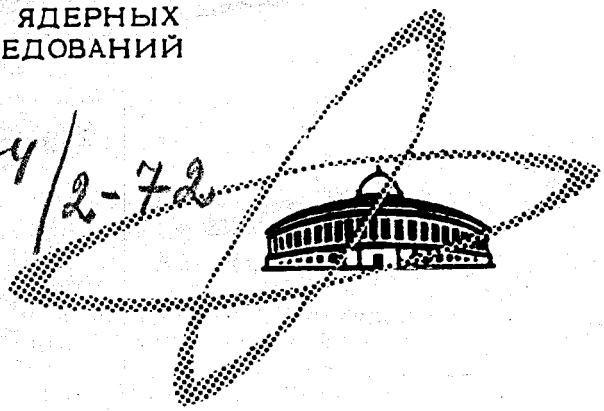
ИССЛЕДОВАНИЙ
Дубна



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This report is a summary of a series of studies [1-2] on multiplicity and angular distribution in inelastic interactions with emulsion nucleons. They were selected by the following criteria:

i) no black track and at most one forward grey track (usually recoil proton with kinetic energy between 30 and 400 MeV) in a star.

ii) a lower limit of the target mass [3] not higher than the nucleon mass.

iii) no accompanying electron in even-prong stars. Roughly half of them corresponds to collisions with emulsion hydrogen.

iv) the coherent interactions described in another report [4] were subtracted from the odd-prong number stars. The remaining are collisions with quasi-free neutrons of emulsion nuclei.

The average multiplicities $\langle n \rangle$ obtained by us after correction for Dalitz pairs (~ 0.06) are shown in Table 1. The statistics in each group is of the order of 500 events.

If we assume that the probability of nucleon charge exchange is ~ 0.3 [5], then the average multiplicity of particles produced (also shown in Table 1) will be the same in collisions with protons and neutrons.

The average multiplicities in $\pi^- - p$ and $p - p$ interactions are compared with those at lower energy in fig. 1. The bubble-chamber results come from the compilation made in ref. [6]. The remaining points are taken from the relatively high statistics emulsion works in which the same selection criteria were applied [7-11]. It is seen that for lower energy (up to 22 GeV/c) the emulsion results do not deviate significantly from the others though they may be slightly higher in $p-p$ interaction. The curves represent the best fits [6] done without emulsion points. The power dependence with exponent of ~ 0.66 fits both $\pi^- - p$ and $p - p$ data, the former being shifted towards the higher values of n at the same total centre-of-mass energy E. For $\pi^- - p$ the logarithmic dependence cannot be ruled out. The χ^2-value is 16 for 9 points against 10 for the power dependence. If we include emulsion data the relevant values are 20 and 13 for 13 points.

The angular distribution of secondary particles in $\pi^- - p$ are shown in fig. 2 in θ_{cms} - variable. The transition to the centre-of-mass system was done assuming that the transverse-momentum distribution and proton charge exchange probability are the same as for lower energy and that the laboratory angular distribution of slow protons is the same as for all particles. This is described in details in refs. [12,13].

An anisotropy of the angular distribution decreases with increasing multiplicity being very strong at low n and still visible at the highest n. For $\pi^- - p$ interactions there is a forward asymmetry (i.e. more points follow the direction of the incident pion) up to $n \cong 8$. These features of the angular distribution were observed previously at lower energy. At our energies they extend to higher multiplicities.

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Table 1

Primary	Average $\langle n \rangle$ of all particles produced		Average $\langle n \rangle$ of particles produced	
	Proton target	Neutron target	Proton target	Neutron t.
45 GeV/c	*5.7±0.2	5.2±0.3	5.0±0.2	4.9±0.3
60 GeV/c	6.4±0.2	6.0±0.2	5.7±0.2	5.7±0.2
50 GeV/c	*5.8±0.2	5.0±0.2	4.4±0.2	4.0±0.2
67 GeV/c	6.4±0.2	6.0±0.2	5.0±0.2	5.0±0.2

*Results of the Tashkent group

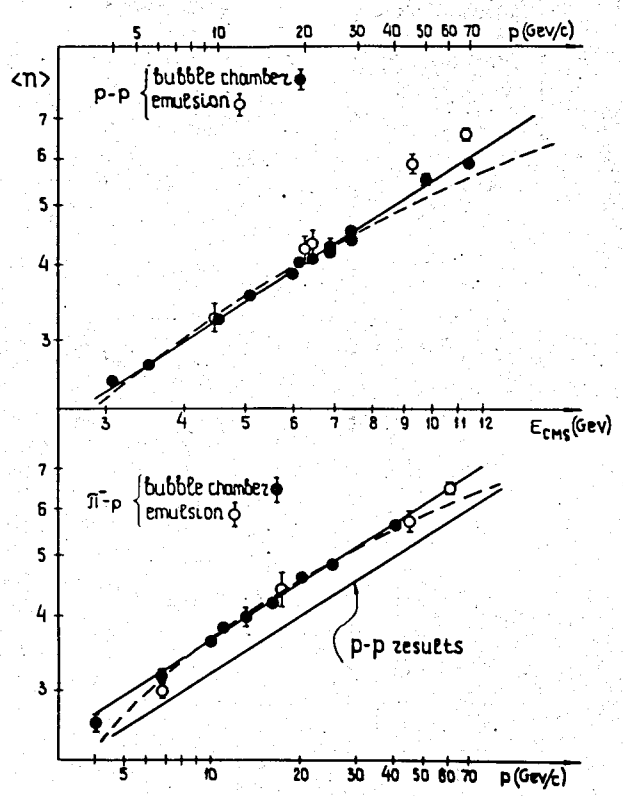
<n>
p-p
bubble chamber
emulsion
p (Gev/c)
E_CMS (Gev)
π⁻p
bubble chamber
emulsion
p-p results
p (Gev/c)

Fig. 1

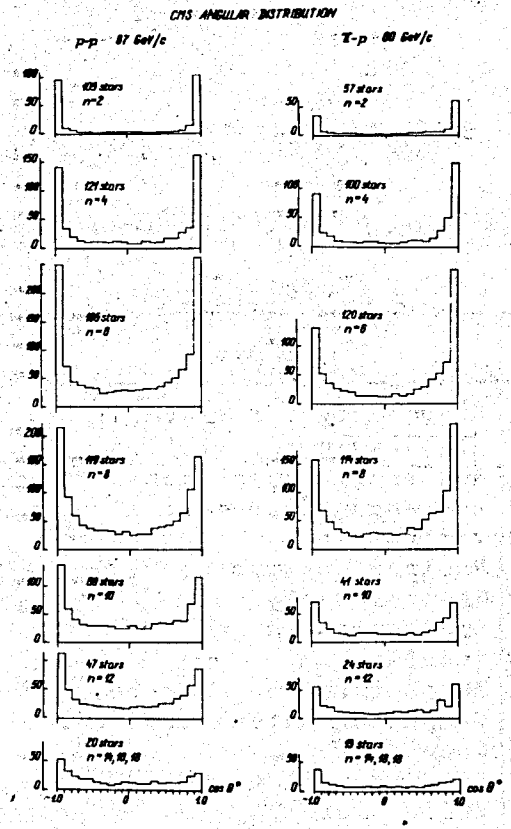
CMS ANGULAR DISTRIBUTION
p-p 67 Gev/c
π-p 60 Gev/c
cos θ*

Fig. 2