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INCLUSIVE DATA IN PROTON-NUCLEUS COLLISIONS AT 67, 200, AND ABOUT 3000 GeV

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DANE INKLUZYWNE DOTYCZĄCE ZDERZEŃ PROTONÓW Z JĄDRAMI PRZY ENERGIACH 67, 200 I OKOŁO 3000 GeV

ЭКСПЕРИМЕНТАЛЬНЫЕ ДАННЫЕ ДЛЯ ИНКЛЮЗИВНЫХ ПРОЦЕССОВ В ПРОТОН - ЯДЕРНЫХ СТОЛКНОВЕНИЯХ ПРИ 67, 200 И ОК. 3000 Гэь

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Summary

Main features of the process of multiple particle production in nuclei in a wide interval of energy between 67 and about 3000 GeV are presented.

Streszczenie

Główne własności procesu wielorodnej produkcji cząstek na jądrach w szerokim zakresie energii pomiędzy 67 a około 3000 GeV zostały przedstawione.

Содержание

Представлено главные свойства процесса множественной генерации частиц на ядрах в широкой области энергии от 67 Гэв до ок. 3000 Гэв.

We would like to give some information on the tendencies which we observed recently in the development of the process of multiple particle production in collisions of protons with nuclei when approching the energy of thousands of GeV.

Some time ago we investigated this process by means of nuclear emulsions exposed to protons from the Serpukhov accelerator /67 GeV/ and from Batavia accelerator /200 GeV/ [1]. We observed that the systematization of the collision events with respect to the increasing number of evaporation tracks /N_h/ of the target nucleus produces data of a similar structure to that which could be expected in an experiment performed with many nuclear targets with increasing mass-numbers A. Of course, the expectation of such a similarity is based on the belief that the multiple production in nuclei is connected with some kind of collisions in the nucleus. A linear increase in the average multiplicity of produced particles with increasing number of evaporation tracks of the target nucleus was widely observed. This suggests that there is a physical relation between the production process and the excitation of the target nucleus. Our experiments showed [1] that these linear relations are valid separately for particles of given rapidity over the

whole rapidity range:

$$\Delta n_s/\eta/ = a/\eta/ + b/\eta/ \cdot N_h \quad , \eta = -\ln \tan \frac{\theta}{2}$$

Consequently, the rapidity /angular/ distributions of particles produced in collisions characterized by different excitations pass smoothly one to another and all together generate a surface covered with these straight lines.

Fig.1 shows the contour map of such a surface fitted to our new super-high energy data of 257 collisions produced by nucleons from cosmic radiation with the average energy of about 3000GeV [2]. The contours correspond to the constant number of particles emitted within a unit interval of η in a single event characterized by the excitation N_h. Analogous maps for 67 and 200 GeV were published previously [1].

The coefficients a and b in function of η for energies 67, 200, and 3000 GeV are presented in Fig.2. They show roughly how the process of multiple production on nuclei develops with the increase in the energy of the projectile.

We would like to stress that with the increasing energy the target excitation dependent part b follows the part a at an energy independent distance of about 2 units of rapidity η.

Our data are based on angular measurements and

are therefore presented in the variable $\eta = -\ln \tan \frac{\theta}{2}$ which is only an approximation of rapidity. Onthe other hand, the component a is for certain slightly contaminated by nuclear effects. Therefore it would be useful to compare our data at 200 GeV with the distribution obtained in HBC at NAL presented also in $-\ln \tan \frac{\theta}{2}$ -variable.

References

1. J.Babecki, Z.Czachowska, B.Furmańska, J.Gierula, R.Hołyński, A.Jurak, S.Krzywdziński, G.Nowak, B.Ślęzak and W.Wolter:
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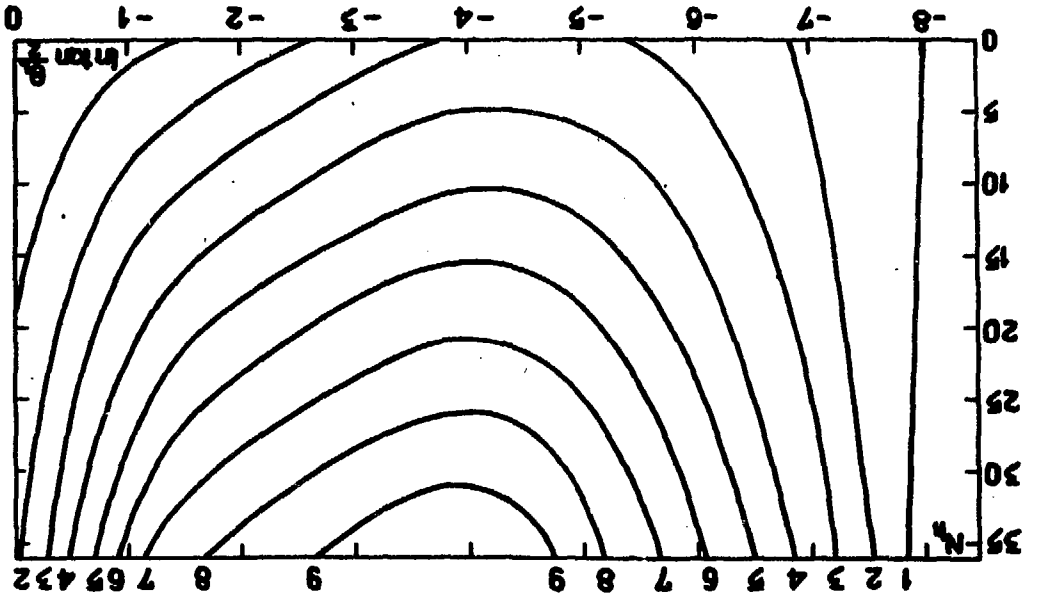

Fig.1 Contour map of the Δn_s distribution fitted to data of 257 evets produced in nuclear emulsion by nucleons from cosmic radiation with energy of about 3000 GeV

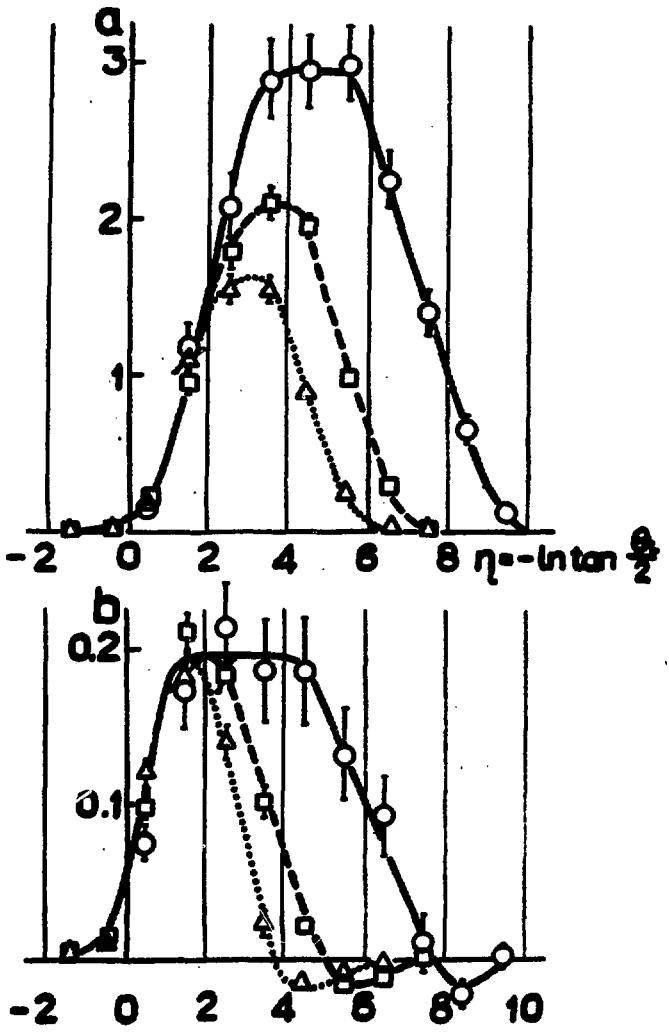

Fig.2 Rapidity dependence of coefficients a and b for 67 Gev data △ ,200 GeV data □ and 3000 Gev data ○ .

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