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ANALYSIS OF Λ AND ASSOCIATIVE
PION PRODUCTION
IN RELATIVISTIC NUCLEUS-NUCLEUS
COLLISIONS

Dubna—Tbilisi—Warsaw Collaboration

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Experimental investigations of the nuclear stopping power^{1/}, density and temperature^{2/} in relativistic nucleus-nucleus collisions are expected to shed light on the widely discussed problem of quark-gluon plasma formation. Data on nucleus-nucleus collisions show that nuclear matter is in general substantially transparent^{3/}, i.e., interaction products "remember" the primary collision direction. The first evidence for isotropic flow of the energy and the number of particles has been obtained from Nb-Nb high multiplicity collisions at 0.4 GeV per incident nucleon^{4/}.

Our data at 4.5 GeV/c per incident nucleon^{5/} obtained using the streamer chamber spectrometer, SKM-200 show that $\cos \theta^*$ (θ^* - emission angle in the nucleon-nucleon, N-N, c.m. system) distributions for Λ 's produced in central C-C, C-Ne and O-Ne collisions are flat (in contrast to those observed for both p-p^{6/} and inelastic He-Li collisions), whereas $\cos \theta^*$ distributions of π^- -mesons^{7/} are similar and forward-backward peaked (Fig.1). Pions from central collisions with Λ 's produced beyond the N-N kinematical limit were analyzed as a separate pion subsample (the cross section for such " Λ out" events is $\sigma \approx 10^{-3} \sigma^{\text{inel}}$). Angular distributions of the flows of the

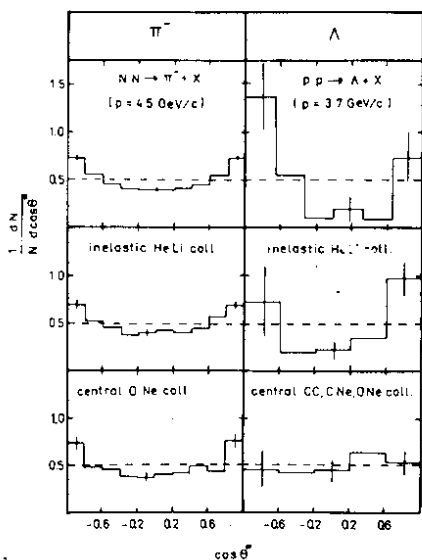


Fig. 1

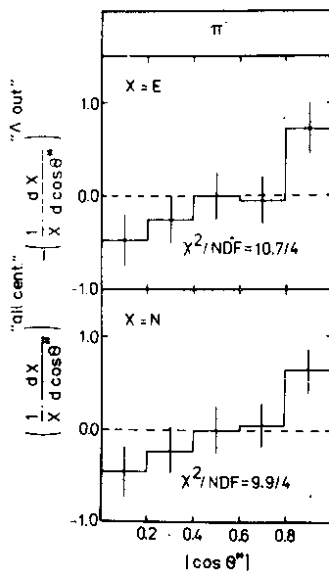


Fig. 2

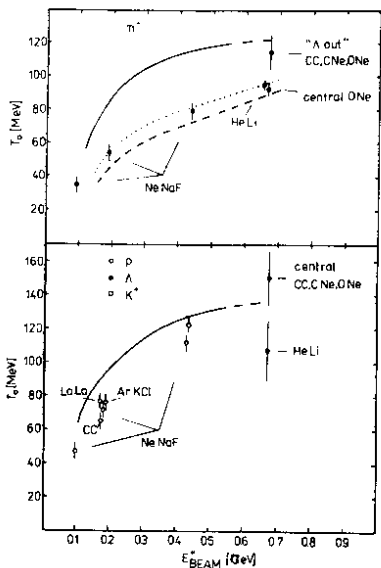


Fig. 3

gies^{/2/}, together with out data. Solid lines correspond to calculations performed assuming the full thermalization of nuclear matter (100% stopping power)^{/8/}. N-N data, shown as dotted and dashed lines, correspond to T_0 calculated using the $\langle p_T \rangle$ and $(\frac{d^3\sigma}{dp^3}(\theta^* = 90^\circ) \sim \exp(-T^*/T_0))$ fits^{/2/}, respectively. The highest values of T_0 close to the full thermalization are obtained for Λ 's from central nuclear collisions ($T_0 = (150 \pm 19)$ MeV) and for π 's from "A out" events ($T_0 = (114 \pm 11)$ MeV). Temperatures derived from the pion data are expected to be underestimated due to a possible significant contribution of pions from decays of Δ and possibly to other effects discussed in ref.^{/8/}.

Our data presented in this paper seem to indicate that in the above discussed "A out" events Λ 's and pions are emitted from a single hot source being at rest in the N-N c.m. system.

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to calculate T_0 values from the data presented in the above paper and references therein, we used the $(\frac{d^3\sigma}{dp^3}(\theta^* = 90^\circ) \sim \exp(-T^*/T_0))$ fit.

energy and the number of pions turned out to be flat for "A out" events. The differences between the distributions for "A out" and "all central" O-Ne events are plotted in Fig.2.

The average transverse momenta and their dispersions for pions from "A out" and "all central" O-Ne events are: $\langle p_T \rangle = 279 \pm 21$, $D_{p_T} = 191 \pm 22$ and $\langle p_T \rangle = 234 \pm 6$, $D_{p_T} = 164 \pm 8$ (in MeV/c), respectively.

Average temperatures, T_0 , of particle sources can be obtained using a $\langle p_T \rangle$ fit^{/8/}. Fig.3 shows T_0 versus the kinetic c.m. energy of the incident beam per nucleon for protons, K^+ , and π^- -mesons at lower ener-

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Аникина М. и др.

E1-84-376

Анализ взаимодействия Λ -гиперонов и ассоциативного рождения пионов во взаимодействиях релятивистских ядер

Дается анализ процессов образования пионов, Λ -гиперонов и ассоциативного рождения пионов в центральных ядро-ядерных взаимодействиях при 4,5 ГэВ/с на нуклон, зарегистрированных в струйном спектрометре СКМ-200. Полученные результаты указывают на то, что в событиях, в которых рождаются кумулятивные Λ -гипероны, частицы испускаются из одного "горячего" источника, покоящегося в системе центра масс для нуклон-нуклонного взаимодействия.

Работа выполнена в Лаборатории высоких энергий ОИЯИ.

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Anikina M. et al.

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Analysis of Λ and Associative Ion Production in Relativistic Nucleus-Nucleus Collisions

Data on pion, Λ and associative pion production in central nucleus-nucleus collisions at a momentum of 4.5 GeV/c per incident nucleon obtained using the streamer spectrometer, SKM-200, are analyzed. The results indicate that a single hot source of particles being at rest in the c.m. system is created in events with Λ 's produced beyond the nucleon-nucleon kinematical limit.

The investigation has been performed at the Laboratory of High Energies, JINR.

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