MULTIPARTICLE PRODUCTION IN PROTON XENON INTERACTION AT 200 GEV

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In this paper we present part of our results from a study of particle production on different nuclei carried out at the SPS accelerator in Genève (CERN).

In hadron-hadron collision we only observe the asymptotic state produced. In hadron-nucleus interactions the situation is different: a nucleus has the diameter of the order of twelve fermis and proton absorbtion length in nuclear matter is of the order of two fermis. Thus for the high energy particles produced in first collision the nucleus can serve as a micro-detector and we can get information about the early stages of interaction before development of the asymptotic state. It is now well established that hadronic interactions take significant time to develop. This makes it possible to understand the mechanism of hadronisation of partons into observable particles by performing experiments within complex nuclei. For these reasons we have performed an experiment with a two meter streamer chamber with a Xenon gas target inside. The 1.5 Tesla magnet and the down stream wire chambers allowed to measure momenta and charges of all charged particles. The average number of produced mesons was $\langle n \rangle = 15.2 \pm .36$, two times as large as $\langle n \rangle$ produced in proton-proton interactions at the same energy. The naive cascade model, where each of the produced hadron in turn interacts inside the nucleus, predicts $\langle n \rangle \approx 60$. This low $\langle n \rangle$ effect implies that the particle or the constituent "in statu nascendi" cannot interact before traveling some "formation length".

In Fig. 1 we plot the ratio R between the rapidity (relativistic particle velocity) density of pX_e and pp interactions. We used only negative particles in order to exclude the evaporation nucleons; these are the result of the deexcitation of the nucleus and are only indirectly correlated with produced particles. The R distribution shows three prominent features: absorbtion of fast particles, plateau in the central region, and steep

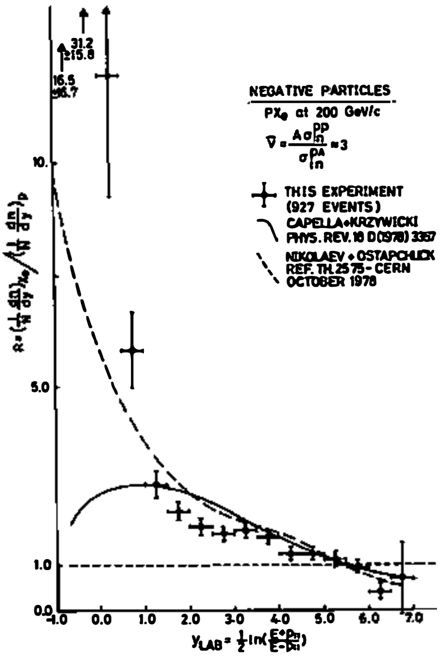

Fig. 1

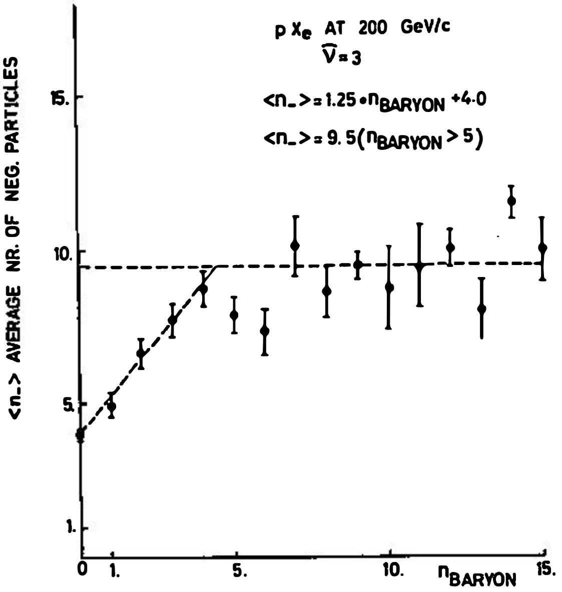

Fig. 2

rise for slow particles indicating the cascading in target fragmentation region. Our R distribution is compared with two models: Relativistic Multiscattering Regge Model and the Constituent Quark Model, supplemented by the formation length concept. Both models badly reproduce our data.

In Fig.2 we plotted the average number of negative particles as a function of slow baryons, which we identified by ionisation ($p_{baryon} < 600$ MeV/c). The striking feature is the saturation effect at $\langle n^- \rangle \approx 9$. This saturation effect, as well as the central plateau for R, one can easily understand if one assumes the interaction of a fast projectile with target to proceed by collision of one, two or three constituent quarks which become "wounded" in the collision and therefore radiate the particles$^{1)}$.

For quantitative understanding of our data we need more elaborate models, which we hope to have in the near future.

1) A. Bialas et al., Acta Phys.Pol., B8 (1977) 585.