Contribution ID: **198** Type: **Poster**

Properties of charged mesons (π±) and protons in central pC-, -dC-, αC-, and CC- collisions at a 4.2 A GeV/c FIRST IMPULSE

The peculiarities of nucleus-nucleus interactions can be seen in the study of the mechanism of these interactions depending on the degree of centrality of the events under consideration. The interaction of high-energy nuclei with the target nucleus allows for multinucleon collisions [1]. In this paper, to determine the degree of centrality of the collisions, we take the "net" charge Q: for pC interactions Q = n+- n– prp, where n+ and n- are the number of single-charged positive and negative particles in the case of npevp, the number of evaporating protons; for other collisions Q = n+- n– nps- nts, where nps and nts are the number of stripping protons from the projectile nucleus and the target nucleus, respectively. As nps- we take as nps- particles with P>3 GeV/c and departure angle Θ<4°. Protons with momentum P<0.3 GeV/c were considered to be proton spectators of the target nucleus [2].

Experimental material obtained with a two-metre-long propane bubble chamber of the JINR LWE placed in a magnetic field of 1.5 Tesla and irradiated at JINR with a beam of protons, deuteron nuclei, helium and carbon with a momentum of 4.2 A GeV/sec. The experimental data are compared with the predictions of the FRITIOF model [3,4], adapted to energies below 10 GeV. As the aiming parameter decreases, the number of secondary particles and the number of cascade interactions in the remaining nuclei increase. Therefore, one can expect preferential birth of nucleons in the fragmentation regions of the nuclei. In central collisions, because of the large number of primary interactions, the nucleon yield in the fragmentation regions should be minimal.

The correlation between the mean momenta of π-mesons and their mean departure angle leads to a weak dependence on Q of the mean transverse momenta of π-mesons for all AC interactions studied by us. For <pt> π+ -mesons, a weak (~10%) increase with increasing Q is observed. The vast majority of π-mesons have transverse momentum up to 0.5 GeV/s, nevertheless, in the interactions under consideration there are hard collisions leading to the formation of π-mesons with large pt (0.5-1 GeV/s). Dependence of the mean velocities of π-mesons on the collision parameter of the studied AC collisions. It can be seen that in peripheral pC-, dC-, and αC-collisions (Q<2) π-mesons are formed predominantly in the central stability region (y=1-1,1). As the collision parameter increases, there is a shift of <y> to lower values, apparently due to π-mesons produced in secondary nucleon-nucleon collisions (this is clearly seen in pC collisions). In CC collisions, both <yπ-> and <yπ+> are practically independent of Q.

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Section

Heavy ion collisions at Intermediate and high energies

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Session Classification: Poster session