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جامعة عين شمس

التوثيق الالكتروني والميكروفيلم

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Characteristics of the Interactions of Helium Fragment from 200A GeV ^{32}S – Emulsion Collisions

By

Maha Fayed Abd-Elmoniem Abd-Elhafiez

Submitted to Physics Department,
Faculty of Science,
Cairo University

Supervisors

Prof. Dr. Abdallah Abd-Elsalam
Professor of Nuclear Physics
Physics Department

A. Abdelsalam
28/3/2005

Prof. Dr. Elham Ahmed Shaat
Professor of Nuclear Physics
Physics Department

E.A. Shaat

Prof. Dr. Zenat Ahmed Abou-Moussa
Professor of Nuclear Physics
Physics Department

Z. Abo-Moussa

Prof. Dr. A. Refaat Ali
Head of Physics Department
Faculty of Science
Cairo University

A. Refaat

1420

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FORWARD

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ABSTRACT

The aim of the present thesis is to study the interaction of the helium fragment emitted from the collisions of ^{32}S nuclei at 200A GeV with nuclear emulsion in order to check whether the interaction cross-section of the helium fragment differs from that of the primary accelerated helium beam.Since uptill now no primary helium beam at energy greater than Dubna energy is available, the present work could provide a good chance for obtaining valuable information about the characteristics of helium beam at higher energy .

A stack of Fuji emulsion film, was tangentially irradiated with 200A GeV ^{32}S ion beam. The exposure of this stack was carried out at the CERN SPS. The beam flux was 1×10^3 ions/cm^3, the scanning was carried out along the track (fast in the forward direction and slow in the backward one).

The experimental value of the interaction mean free path and that of the interaction cross section of ^{32}S nuclei in the emulsion are consistant with the corresponding calculated values which are based on geometrical calculations.

The charge Z of each of all the projectile fragments PF's (having $Z \geq 2$) emitted within the fragmentation cone of an angle 0.072 degree, were measured using the δ-ray counting method.

This work is concerned with studying the doubly charged helium fragments and the characteristic of their interactions with emulsion. It was found that the fragmentation cross-section of different projectiles into helium fragments, does not depend on either projectile mass or incident energy.

All PF's with Z = 2 (helium daughters of 200A GeV ^{32}S), were followed until either interact or leave the pellicles. The value of the interaction mean free path ($\lambda = 20.0 \pm 1.2$ cm) is in good agreement, with the corresponding value of the primary ^{4}He at 3.7A GeV ($\lambda_{primary} = 19.93 \pm 0.60$ cm).

The multiplicity characteristics of the shower, grey and black particles produced in the interactions of ^{4}He (^{32}S daughter) with emulsion nuclei were analyzed and compared with the corresponding values for ^{4}He (200A GeV ^{32}S daughter) of P.L. Jain and with primary ^{4}He at 3.7A GeV. An investigation was carried out to determine the energy of helium emitted from 200A GeV ^{32}S – Em and it was found to be ~ 124A GeV.

The multiplicity distribution of the shower particles produced in the interaction of helium with emulsion is well described by the universal KNO Scaling representation.

Each of the pseudorapidity distributions of the shower particles obtained at different impact parameters was fitted by a Gaussian distribution. The temperature of the pion emitting system was determined in each case, and compared with the critical temperature (~ 200 MeV) for phase transition between a gas of pions and quark-gluon plasma.

The angular distribution of the emitted grey and black particles are studied, where the forward ($\theta_{lab} < 90^{\circ}$) to backward ($\theta_{lab} \geq 90^{\circ}$) ratio, i.e, (F/B) were determined at different impact parameters. The values of $(F/B)_g$ and $(F/B)_b$ were found to be nearly independent of both the projectile mass number and incident energy. It was also found that the emission of the black particles is more isotropic than that of the grey ones.

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Arabic Abstract

Chapter 1

History of High Energy Nucleus – Nucleus Collisions