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Colloquia: COMEX7

FARCOS detector in the CHIFAR experiment

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Summary. — The CHIFAR experiment, carried out at Laboratori Nazionali del Sud-INFN (INFN-LNS), was proposed to investigate the emission probability of Intermediate Mass Fragments (IMFs) in non-central Heavy Ion (HI) collisions, focusing also on the role of the Isospin degree of freedom of the colliding nuclei. The results of the energy calibration, resolution and particle identification phase of FARCOS correlator used in the CHIFAR experiment are reported.

1. – Introduction

The CHIMERA collaboration investigated some reaction systems, such as the "neutron rich" ^{124}Sn+^{64}Ni and the "neutron poor" ^{112}Sn+^{58}Ni at 35 AMeV beam energy, in the REVERSE experiment [1]. One of the main obtained results highlighted that the fast dynamical emission is favoured for neutron rich system, according to the Isospin ratio N/Z. The InKiIsSy experiment [2] compared two nuclear reactions: ^{124}Xe+^{64}Zn and ^{124}Xe+^{64}Ni, which differ by the isospin in the target nucleus ($N - Z = 4$ *vs.*

$N - Z = 8$). Data analysis of REVERSE and InKiIsSy showed that the IMFs emission probability increases with the isospin content of both projectile and target. The CHIFAR experiment [3], carried out at LNS-INFN, was proposed to study the above-mentioned physics cases at a lower energy regime. The "neutron rich" system ^{124}Sn+^{64}Ni, the "neutron poor" system ^{112}Sn+^{58}Ni and the "isobaric" one ^{124}Xe+^{64}Zn were investigated at 20 AMeV incident beam energy. One of the experimental goals was the study of the emission mechanisms (dynamical or statistical), the IMFs production and the investigation of the isospin role in HI collisions.

2. – Experimental setup

For the first time the experimental setup was equipped with ten telescopes of FARCOS (Femtoscope ARray for COrrelation and Spectroscopy) correlator in its final configuration [4], coupled with the 4π CHIMERA multi-detector allowing to study correlations among IMFs and light charged particles produced in a nuclear reaction [1]. Each FARCOS telescope is composed of two stages of Double Sided Silicon Strip Detectors (DSSSD), with 300 μm and 1500 μm of thickness respectively, and 4 CsI(Tl) crystals of 6 cm of thickness. FARCOS is characterized by high energy and angular resolution performances; telescopes covered the angles in the laboratory frame between 13° and 30°.

3. – Data analysis and preliminary results

The analysis started with the data collected by the FARCOS correlator, so the first step was focused on the energy calibration of the first two stages of the correlator, the DSSSDs. The punching through technique was applied in the ΔE-E identification matrices obtained from the Si-detectors. Then, the energy resolution of the DSSSDs was estimated through some elastic scatterings; the electronics and detector errors were calculated. An electronics error of around (0.5-1)MeV±0.2MeV and a total energy resolution between 1.2%-2.2% were obtained. Concerning the particles identification obtained with the FARCOS telescopes, an automatic algorithm (developed by the CHIMERA collaboration) based on the Bethe-Bloch formula was applied to the ΔE-E matrices of the DSSSDs: the charge and mass distributions were obtained for the three reactions analyzed, with similar results. An unambiguous charge identification of fragments up to $Z \approx 16$ and an isotopic identification for IMFs with atomic number up to $Z \approx 9$ and $A \approx 20$ were achieved. Finally, a preliminary analysis about the isospin role in HI collisions has permitted to underline the effect of neutrons enrichment for neutron rich system, so the IMFs isospin distribution follows the initial isospin content. This preliminary analysis included only FARCOS's data, without CHIMERA ones, and so without the possibility to select global variables useful for the event mechanism selection, that are mandatory for the characterization of the reaction mechanisms. Further analysis, with data merged and specific constraints related to multiplicity and impact parameter, will be necessary in order to highlight more quantitative results.

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