Study of Isospin Effects in Multifragmentation of Hot Nuclei at Forward Angles Using Inverse Kinematics

M. Veselsky, A. Keksis, G. A. Souliotis, A. Ruangma, D. Shetty, E. Squibb, E. M. Winchester, E. Martin, and S. J. Yennello

Previous works featuring a study of isospin effects on projectile multifragmentation [1, 2, 3] using the forward multidetector array FAUST demonstrated the possibility to fully isotopically resolve the emitted fragments and to perform full calorimetry of the excited quasiprojectile with mass up to 30 (with the exception of neutrons). The mass, charge and excitation energy of the quasiprojectile was determined. Deep inelastic transfer was determined as the dominating production mechanism of hot nuclei in peripheral collisions at projectile energies up to 50 MeV/nucleon. The dependence of several multifragmentation observables on the isospin of the quasiprojectile was obtained. In particular, an inhomogeneous distribution of isospin between light charged particles and intermediate mass fragments was observed [1] and a caloric curve was constructed using the isospin dependence of 3H/3He isobaric ratio [3].

As an extension of previous work, we performed a FAUST run focused on study of multifragmentation of the hot nuclei produced in violent collisions. When using inverse kinematics, a full-angle coverage of FAUST at angles between 3-40 deg can, in principle, mean full coverage even for hot nuclei created in violent collisions at the velocity range of the mid-velocity source. Using the approximate relation for FAUST angular acceptance [1] $\sqrt{E^* E_{lab}} < 0.55$, one can estimate that, for instance, at energy 45 MeV/nucleon a hot nucleus with excitation energy up to 13.5 MeV/nucleon can be fully detected. When assuming a mass of the projectile around 40 and the possibility to isotopically resolve charged particles up to Z = 6-7, it is possible to reconstruct the isospin of the hot nucleus undergoing multifragmentation.

The experiment was carried out using a ^{40}Ca beam of energy 52 MeV/nucleon impinging on ^{27}Al target. The projectile-target combination was selected as relatively proton-rich in order to minimize the impact of the fact that neutrons have not been detected in the experiment (the possibility to supplement the experiment by neutron detection within the FAUST coverage is under investigation for future experiments). The main goal of the analysis is to reconstruct the mass and charge of the hot mid-velocity source using detected and isotopically resolved charged particles and to study its characteristics as a function of isospin asymmetry. At present, the analysis is in the stage of detector calibration. The quality of the data appears to be adequate and preliminary results are expected in the near future.

References

[1] M. Veselsky *et al*., Phys. Rev. C **62**, 64613 (2000).

[2] M. Veselsky *et al*., Phys. Rev. C **62**, 41605 (2000).

[3] M. Veselsky *et al*., Phys. Lett. **B497**, 1 (2001).