DETECTOR ARRAY FOR THE LOW-ENERGY FISSION STUDY

Bezbakh A.A.[1], Zachary C.J.[2], Krupko S.A.[1], Popeko G.S.[1], Fomichev A.S.[1], Golovkov M.S.[1], Hamilton J.H.[2], Ter-Akopian G.M.[1]

[1] *Flerov Laboratory of Nuclear Reactions, JINR, Dubna, 141980 Russia;* [2] *Department of Physics, Vanderbilt University, Nashville, TN 37235, USA*

E-mail: bezbakh@jinr.ru

Significant progress in the study on the low-energy fission process can be achieved by combining prompt γ ray spectroscopy with the measurements of the masses and energy distributions of fission fragments. This enables one to obtain direct data on the fragment excitation energy spectra and the distribution between collective and internal degrees of freedom as well as the actual deformation at the instant of scission.

Design was made for a new setup suitable for the study of ^{252}Cf spontaneous fission using the Gammasphere facility [1] and a new fission fragment TKE chamber. It houses a ^{252}Cf source deposited on a 10 μm platinum backing and placed at a distance of 19 mm from a $LaBr_3$ scintillator (25.4 mm diameter, 76.2 mm length). Placed on the open source side, 450 mm away, is an array of 24 plastics EJ-212 (each being 0.025 mm thick and 20 mm on a side mounted on its PMT R7600U). Gamma-ray signals coming from the Gammasphere for the moving fragments will be Doppler corrected. Fig. 1 gives the event distribution on the plot showing the fragment time of flight (TOF) versus the γ-ray amplitudes measured by the $LaBr_3$ detector for the ^{252}Cf fission fragments. The two event groups, seen in Fig. 1 on the right side, pertain to the heavy and light fragments. On the left of them is the pattern created by the α decay of ^{249}Cf which is present in the source. The two photo-peaks detected for the 388- and 333-keV γ rays emitted at the α decay of ^{249}Cf, as well as their Compton spectrum, were used for precise estimation of the 200-ps RMS resolution obtained for the fission-fragment TOF. The velocity spectrum obtained for the fission fragments of ^{252}Cf is presented in Fig. 2.

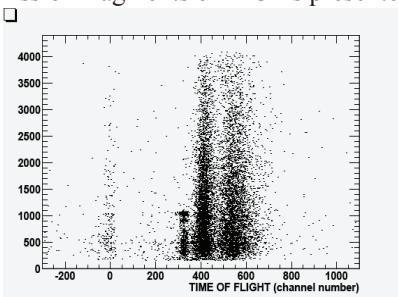

Fig. 1. Plot showing fragment TOF vs amplitude of detected gamma rays.

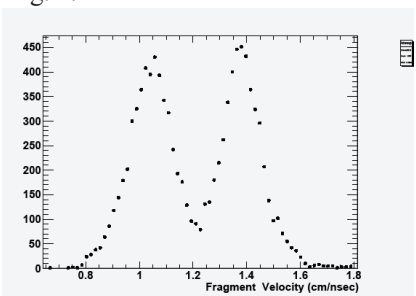

Fig. 2. The measured velocity spectrum of ^{252}Cf fission fragments.

1. https://www.anl.gov/phy/gammasphere