

Ternary Particles of Z from 1 to 6 Emitted in Spontaneous Fission of ^{252}Cf

G. Ahmadov^{1,4,5*}, D. Berikov^{1,6}, M. Holik^{2,3}, Yu. Kopatch¹, F. Ahmadov^{4,5},
K. Ajdarli⁴, S. Nuruyev^{1,5}, A. Sadigov^{4,5}, A. Madadzada^{1,4}

¹*Joint Institute for Nuclear Research, Dubna, Russia*

²*Faculty of Electrical Engineering, UWB in Pilsen, Czech Republic*

³*Institute of Experimental and Applied Physics, CTU, Prague, Czech Republic*

⁴*Innovation and Digital Development Agency Nuclear Research Department, Baku, Azerbaijan*

⁵*Institute of Radiation Problems under Ministry of Science and Education, Baku, Azerbaijan*

⁶*Institute of Nuclear Physics, I Ibragimova, Almaty, Kazakhstan*

In this study, ternary particles of Z from 1 to 6 were measured from spontaneous fission of ^{252}Cf using a position sensitive ΔE -E telescope in which the ΔE -E method was used employed to identify the particles. Specific energy loss (ΔE) was measured using transmission type ΔE detectors of thicknesses 16 μm and 150 μm from Micron Semiconductors, while residual energy (E) was measured using a Timepix detector with thicknesses of 300 and 600 μm . It was possible to measure partial-energy spectra of the various ternary particle types due to the thicknesses of Al foil (30 μm) and ΔE detector (16 μm and 150 μm) placed in front of E detectors. The detector system resolution was sufficient for clear separation of ^1H , ^2H , ^3H , ^6He , and ^8He from ^4He . Gaussian function fitting was used to estimate the yields and energy of various particle types from the measured partial-energy spectra. The energy spectrum of ^1H was different from the spectra of other particles because ^1H from $\text{Al}(\alpha, p)$, $\text{Al}(n, p)$, and $\text{Si}(n, p)$ reactions could contribute to the spectra. Talys calculation was used to estimate the contributions of these reactions for H isotopes. The calculations confirmed the presence of ^1H from $\text{Al}(\alpha, p)$ in the ternary ^1H spectrum within the measured energy range. The background-free energy spectra were obtained by subtracting the calculated spectra from the experimental data. The yields and energies of the various ternary particles, including ^1H , ^2H , ^3H , ^4He , ^6He , ^8He , Li, Be, B, and C, were estimated.