Investigation of alpha particle emission in nuclear track emulsion irradiated by relativistic muons

Authors: Marimuthu Natarajan[1]; Ekaterina Khabarova[2]

Co-authors: Andrei Zaitsev [1]; Pavel Zarubin [1]

[1] *JINR*

[2] *SPbPU*

Corresponding Authors: nmkmari@gmail.com, katyakhabarovaa@mail.ru

This study presents the results of exposing a nuclear track emulsion (NTE) to a relativistic muon beam. Exposure of NTE layers by relativistic muons enables the simultaneous study of nuclear multifragmentation under the influence of a purely electromagnetic probe 1. The primary objective is to identify and measure the lengths of short-range alpha particle tracks generated by muon-nucleus interactions within the NTE. The formation of such tracks occurs through the 3α fragmentation of carbon nuclei in $\mu + {}^{12}\mathrm{C} \to \mu' + 3\alpha$ interactions induced by relativistic muons. The ionization losses of alpha particles within the NTE were simulated using the SRIM program, enabling the accurate reconstruction of their kinetic energies for each observed event. The track reconstruction provided an precise determination of the emission angles of the alpha particles. Furthermore, this methodology allowed for the extraction of combinatorial spectra of invariant masses for alpha particle systems. The findings presented here, part of the BECQUEREL experiment 2, were compared with those obtained from organic scintillators, which were also used in studying 3α fragmentation of ${}^{12}\mathrm{C}$ nuclei 3. This comparison aims to deepen our understanding of muon-induced interactions in both nuclear emulsion and organic scintillators.

References

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