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## Exploring $\alpha$ -Particle Emission Induced by Relativistic Muons in Nuclear Emulsion

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Nuclear fragmentation first observed in photographic emulsions exposed to cosmic rays and is now studied with greater precision using nuclear track emulsion (NTE) irradiated by relativistic muons. This approach offers a unique way to investigate multi-fragmentation processes induced purely by electromagnetic interactions [1]. Within the BECQUEREL experiment [2], we examined  $\mu$ -nucleus interactions in NTE, focusing on short-range  $\alpha$ -particle tracks arising from the  $3\alpha$  breakup of carbon nuclei in  $\mu + {}^{12}\text{C} \rightarrow 3\alpha$  reactions. Alpha particle kinetic energies were reconstructed for each event by simulating their ionization energy losses in NTE with SRIM software, while full  $4\pi$ -geometry track reconstruction allowed precise determination of emission angles. These measurements facilitated the extraction of combinatorial invariant mass spectra for 2 and 3  $\alpha$  systems, offering new insights into the dynamics of  $\mu$ -induced nuclear fragmentation and the mechanisms of  $\alpha$ -particle emission.

### References

1. D. A. Artemenkov, V. Bradnova, et al., Phys. At. Nucl. 78, 579-585 (2015), doi:10.1134/S106377881504002X [arXiv:1407.4572].
2. P. I. Zarubin, Lect. Notes Phys. 875, 51-93 (2014), doi: 10.1007/978-3-319-01077-9\_3 [arXiv:1309.4881].

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