Contribution ID : **338** Type : **Poster**

Experimental Characterization of a $^{124}Xe^{54+}$ Ion Beam Using Nuclear Track Emulsion

Tuesday, 27 October 2026 19:25 (5)

This study presents an analysis of Nuclear Track Emulsion (NTE) exposed to an extracted $^{124}Xe^{54+}$ beam at around 300 MeV per nucleon at the JINR Nuclotron, conducted within the framework of the BECQUEREL project[1]. The primary aim was to characterize the beam profile and its uniformity, and to determine the Bragg peak position, in support of applied research in electronic components and radiation biology. Three stacks, each consisting of 8-10 nuclear emulsion layers with a thickness of 60 μm deposited on a 2 mm thick glass substrate were exposed transversely to the beam. This configuration enabled the recording of the ion trajectories and their energy deposition along the penetration depth, including the stopping region and the production of long range fragments. The area of each emulsion layer was digitally imaged using an Olympus BX63 intelligent microscope[2]. Owing to the high ionization density of the incident $^{124}Xe^{54+}$ ions, a 4X objective was sufficient for reliable track detection. A Gaussian Mixture Model (GMM) applied to the measured grain area distributions enabled the classification of tracks into three principal groups corresponding to light fragments, intermediate mass fragments, and heavy residues, including the primary beam ions.

References

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Session Classification : Poster session

Track Classification : Nuclear physics