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Event reconstruction in ACTAR TPC: Adaptation for transfer experiments

Traditionally, transfer reaction experiments were performed with solid targets combined with complex devices that suffer from limited luminosity for radioactive beams. Active targets, where the gas works both as target and detection medium, are exceptional devices that allow us to overcome the experimental limitations without losing resolution [1, 2].

However, there is a drawback: the need for the development of reliable pattern recognition algorithms in order to find and fit the tracks of interest. In this work, different alternatives, such as Clustering methods and RANSAC, were implemented and its different strengths and weaknesses were pointed out.

These algorithms were tested using real data from a transfer reaction experiment performed at GANIL in March 2022 with a pure ^{20}O beam provided by the LISE3 spectrometer. In this experiment, the gas consisted of a mixture of D_2 and C_4H_{10}, which was equivalent, in terms of target number, to the use of 5 mg/cm^2 of CH_2 and 10 mg/cm^2 of CD_2 at the same time. The particles of interest escaped the active volume, and an array of silicon detectors was used to measure the residual energy. The reconstruction of the tracks inside the target enables us to measure in an event-by-event basis the interaction point and thus improving significantly the final resolution [3, 4].

References

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