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Fission investigations in the MAYA active target

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This work addresses the first inverse-kinematics fission measurements in a gaseous active target [1]. A 238U beam was sent into the MAYA active target, where fusion and transfer-induced fission reactions occured with 12C nuclei of the gas filling the detection volume. A telescope of Si detectors was included in the setup to measure the target-like transfer partner and identify the fissioning system and its excitation energy.
The main results of this experiment and the performance of MAYA will be discussed in this contribution, with a view to next-generation active target systems.
Specific modifications to the setup were required due to the high ionization created by the 238U beam. In particular, an electrostatic mask along the beam axis was used to contain the electrons and positive ions produced by the beam, and preserve the uniformity of the electric field [2].
A remarkable response of the setup was achieved at beam intensities of several millions of pps, which allowed the accurate reconstruction of the fission-fragment trajectories. Moreover, a complete charac- terization of the different 238U +12C transfer channels was obtained, and the slowing down of 238U projectiles in the gas was used to explore the dissipation of energy as a function of the energy in the entrance channel [3]. The competition between fusion-and transfer-induced fission cross-sections could also be investigated.
Beyond the interest of the measured physical observables, technical aspects to be considered for the preparation of future experiments were studied, and the the limits of the performance of the electrostatic mask were established.
The detection of target-like products in MAYA was especially challenging. The higher amplification re- quired to detect these lighter nuclei could only be achieved at the cost of scaling down the beam intensity. However, the main difficulties were identified and possible solutions will be discussed.
In summary, this work showed the capabilities of active targets for investigations that require heavy-ion beams, and some of the challenges to be faced by future projects.
[1] C. Rodríguez-Tajes et al., Nucl. Phys. A 958 (2017) 246.
[2] C. Rodríguez-Tajes et al., Nucl. Instr. Meth. A 768 (2014) 179.
[3] G. Scamps et al., Phys. Rev. C 95 (2017) 024613.

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