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Achievements on Targets and Target Station for the study of heavy and super heavy nuclei with the Super-Separator-Spectrometer, S3 at GANIL

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GANIL facility was upgraded with a superconducting linear accelerator, which delivers highly intense stable beams. Light ions are used at the Neutron for Science (NFS) experimental hall [1] and heavier ions are essential to produce exotic nuclei, like heavy neutron-deficient isotopes and super heavy nuclei, in the Super Separator Spectrometer (S3) [2, 3].

By combining the intense heavy ion beams with the fully instrumented target station, the various electromagnetic components, the fixed and movable beam dumps, S3 is a powerful tool to purify the elements of interest produced in the target from the primary intense ion beam, and retrieving them at the focal plane with a high transmission. The detection setups, SIRIUS implantation-decay spectroscopy station [4] and S3-LEB (Low Energy Branch) [5] are unique tools designed to study in detail the rare nuclei produced by fusion-evaporation

To achieve the planned extensive experimental program, for instance the study of heavy and super-heavy elements (SHE with $Z > 103$), specific research and developments on targets and their environment are conducted. High-quality targets are an essential element in the experimental setup as they play a key role in the accuracy of obtained observables. To sustain intense beams for a long period, targets are mounted on a rotating wheel and their integrity has to be controlled regularly. S3 will be equipped with two specific target stations, either for stable or actinide targets. They are designed to include fast rotating wheels on which several targets are mounted, and a versatile set of diagnostics and survey tools. The first S3 target station specific for stable targets was commissioned in 2023 with various targets irradiated with a heavy-ion beam and used during the first step of the S3 commissioning conducted in 2024. The instrumentation proved to be efficient in synchronizing the beam with the rotation and in checking the target areal thickness.

After introducing the S3 spectrometer with its scientific programs and technical achievements, we will detail achieved technical developments on S3 the target stations mentioned above. In addition, we propose to report on current targets development at GANIL.

References

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