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First tests from the Fast Radioactive Ion Extraction and Neutralization Device for S^3 project

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The GANIL accelerator complex in Caen, France recently commissioned a new superconducting linear accelerator as part of the SPIRAL2 facility. This facility will enable the production of heavy and super-heavy radionuclides via fusion-evaporation at the entrance of the Super Separator Spectrometer (S^3) experimental area. There, the secondary beam undergoes several stages of mass separation and focusing to be finally delivered to a focal plane experiment [1]. Located at S^3 focal point, the S^3 Low Energy Branch (S^3 -LEB) is a low-energy experiment dedicated to the study of nuclides using the In-Gas Laser Ionization Spectroscopy (IGLIS) technique, as well as decay spectroscopy and mass spectrometry [2]. These techniques allow to probe the structure of exotic nuclei, providing access to properties such as the charge radius, the spin and the magnetic and quadrupole moments.

The reaction products from S^3 enter the S^3 -LEB gas cell by passing through a thin window. They are stopped and neutralized by collisions with the buffer gas before being extracted by the argon gas flow in a supersonic jet. In the gas jet, a two-step ionization of the isotopes is performed using wavelength-tunable titanium:sapphire (Ti:sa) lasers. The supersonic jet ensures a minimization of the pressure and temperature and, consequently, maximizes the spectral resolution.

The current S^3 -LEB gas cell allows only the study of nuclides with a half-life superior to 600 ms. In order to speed up the extraction process for shorter species, the Fast Radioactive Ion Extraction and Neutralization Device for S^3 (FRIENDS³) project aims to design a new gas cell. The latter needs to minimize the extraction time, maximize the extraction and neutralization efficiency while minimizing the neutralization time. In the new design, the beam would enter through the window and be guided and extracted toward a neutralization tube using an electric field [3]. In the second part of the setup, the ions will then undergo neutralization by recombination with free electrons. The FRIENDS³ setup has been designed and constructed, and is currently in the test phase, first at Orsay, then at GANIL. This work will present the status of the FRIENDS³ project, as well as recent results from the commissioning phase.

References

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