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Developments of the HRS, GPIB and PIPERADE devices for the DESIR facility

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The DESIR facility at GANIL will receive neutron-deficient ion beams produced by fusion evaporation at S3 (Super Separator Spectrometer) and exotic light nuclei produced by fragmentation at SPIRAL1. DESIR is an experimental hall dedicated to the study of nuclear structure, astrophysics and weak interaction using beta decay spectroscopy, laser spectroscopy and trap-based experiments at low energy (30-60 keV). Those experiments require highly pure samples of nuclei at odds with the non-selectivity of all the production methods. Therefore, in order to deliver large and very pure samples of exotic nuclei to the different experiments, the LP2iB is currently developing three new devices; a High resolution mass separator (HRS), a radiofrequency quadrupole cooler buncher [1] and a double Penning trap mass spectrometer PIPERADE** [2] that will be placed at the entrance of the DESIR facility. We aim at extracting ion bunches from the GPIB with the best compromise between energy and time dispersion to fit the needs of the downstream experiment using the beam. For now, these bunches are directly sent to PIPERADE. With this device we will be able to perform mass measurements and/or purification at the isomeric level. Indeed Penning traps are designed to reach resolving power of the order of 10^5 to 10^7 depending on the separation techniques. Whether PIPERADE is used to purify or to measure masses, we will have to deal with short-lived nuclei. And since these techniques are time consuming, one of the challenges is to develop short operating cycles while keeping a high mass resolving power to extract the nuclides of interest from the large amount of isobaric and/or isomeric contaminants. The HRS, the GPIB and PIPERADE are now fully assembled at LP2iB and currently under commissioning before being moved to GANIL when the DESIR hall will be accessible. The latest achievements and the first mass measurements will be presented.

[1] M. Gerbaux, P. Ascher, A. Husson, A. de Roubin, P. Alfaut, M. Aouadi, B. Blank, L. Daudin, S. E. Abbeir and M. Flayol, et al.

“The General Purpose Ion Buncher: A radiofrequency quadrupole cooler-buncher for DESIR at SPIRAL2”, Nucl. Instrum. Meth. A 1046 (2023), 167631
doi:10.1016/j.nima.2022.167631

[2] P. Ascher, L. Daudin, M. Flayol, M. Gerbaux, S. Grévy, et al.. PIPERADE: A double Penning trap for mass separation and mass spectrometry at DESIR/SPIRAL2. Nucl.Instrum.Meth.A, 2021, 1019, pp.165857. <10.1016/j.nima.2021.165857>.

*Désintégration, Excitation et Stockage d'Ions Radioactifs i.e. Decay, Excitation and Storage of Radioactive Ions GPIB –General Purpose Ion Buncher*** Pléges de PENning pour les RADionucléides à DESir i.e. Penning traps for radionuclides at DESIR

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