

Two post-doctoral positions for the GPIB and PIPERADE setups at LP2i-Bordeaux

Contact persons:

Pauline Ascher (ascher@lp2ib.in2p3.fr) and Mathias Gerbaux (gerbaux@lp2ib.in2p3.fr)

LP2iB is involved in several technical developments for the DESIR facility at GANIL [1] at different levels. Among these developments presently being pursued is the commissioning of two ion traps:

- the General Purpose Ion Buncher (GPIB) [2], a radiofrequency-quadrupole cooler and buncher (linear Paul trap) that will be installed in the central beam line of DESIR and will therefore receive beams from the S³-LEB and upgraded SPIRAL1 facilities. It will deliver cooled ion bunches to the different experimental setups of DESIR.
- PIPERADE (Pièges de Penning pour les RADionucléides à DESIR) [3], a double Penning-trap system that will act either as a mass separator to deliver large highly-pure ion samples to the setups of DESIR (such as tape stations for trap-assisted decay spectroscopy), or as a mass spectrometer in its own right. Mass measurements will allow investigating the nuclear structure far from stability, to constrain the stellar nucleosynthesis models as well as to study the weak interaction.

For this purpose, a test beam line has been built at LP2iB including a stable-ion source, some triplets of quadrupole and pairs of steerers, the GPIB, a transfer line, the double-Penning-trap device and a delay-line MCP detector. While the whole line is already functional, a lot of work remains to be done to study in detail the GPIB and PIPERADE setups, as well as the part of the beam line in between.

LP2iB is thus looking for two 2-year post-doctoral fellows, one for the GPIB and the transfer beam line studies and another one for the PIPERADE tests.

The first fellow will participate in fully characterizing the GPIB, in terms of transverse and longitudinal emittances in the bunched-beam mode. First tests have already been achieved, with very promising performances, but this has to be more systematically investigated to fit the needs of the different experiments that will use the beams in the DESIR hall (favouring either time or energy dispersion at the expense of the other). It is also planned to increase the RF voltage (and hence the confining power) of the GPIB to improve the transmission in bunched mode for very high charge (>10⁵ ions/bunch). Studies of the transfer line will also be performed, where the beam has a maximum energy of 3 keV that makes possible to use an electrostatic deflector (allowing beam to go either straight through or turning at 90°). The latter will be necessary -in duplicate- at DESIR where PIPERADE will be on a beam line parallel to the axis of the GPIB. The deflector is at the moment on a dedicated test bench with its own ion source to develop the necessary diagnostics (Faraday cup, MCP with retarding grid, emittancemeter) but it will be reinstalled in the coming months on the main beam line

where it could also send the GPIB beam to the High Resolution Separator [4] also designed and commissioned at LP2iB so as to have a finer measurement of the energy dispersion.

The second fellow will be involved in the tests of the PIPERADE traps. The first trap of PIPERADE aims at separating large ion bunches while maintaining a high resolving power ($\sim 100\,000$) with the sideband buffer gas cooling technique. This separation method has been developed at PIPERADE and is routinely used to deliver pure ion bunches to the second trap. However, while a high resolving power of the order of $100\,000$ was demonstrated, space charge effect studies were not performed yet. The fellow will test the separation technique with a large number of ions and investigate the impact of the ion density on the separation efficiency and selectivity.

In addition, the fellow will actively participate in the mass measurement tests in the second trap, i.e. systematic studies of the ToF-ICR technique (effects of magnetic field inhomogeneities, electric field anharmonicities, mass-dependent effects, ...), as well as first mass measurements with the PI-ICR technique.

The two fellows will integrate the Exotic Nuclei group of LP2iB and will work in close collaboration with the members of the group involved in the PIPERADE project as well as the technical services. He or she will also be given the opportunity to participate in the experiments the group carries out on various facilities (JYFL, ISOLDE, GANIL, ...) about on-line mass measurements, exotic decays ($2p$ radioactivity, β delayed proton emission, ...), nuclear structure or weak interaction studies with nuclear β decay.

Candidates should have completed a PhD in nuclear physics, trap physics or a related subject since **less than 2 years for the PIPERADE position, and less than 6 years for the GPIB position**. They are expected to have a good knowledge in experimental techniques, ion trapping and detection techniques, ion optics and ion optics simulation tools (e.g. SIMION), EPICS control systems as well as scientific programming (Python). They will work in a highly competitive international environment.

The starting date of the post-doctoral contract on PIPERADE is the **1st of September 2023**, whereas it is more flexible for the contract on **GPIB (from 1st of June 2023)**.

Researchers or research engineers interested in the positions are requested to apply on the official CNRS recruitment website (links below) before the **3 May 2023**.

Link for the application to the GPIB position [here](#).

Link for the application to the PIPERADE position [here](#).

[1] <https://www.ganil-spiral2.eu/scientists/ganil-spiral-2-facilities/experimental-areas/desir/>

[2] M. Gerbaux *et al*, *The General Purpose Ion Buncher: A radiofrequency quadrupole cooler-buncher for DESIR at SPIRAL2*, Nucl. Instrum. Methods Phys. Res. A 1046 (2023) 167631

<https://doi.org/10.1016/j.nima.2022.167631>

[3] P. Ascher *et al.*, *PIPERADE: A double Penning trap for mass separation and mass spectrometry at DESIR/SPIRAL2*, Nucl. Instrum. Methods Phys. Res. A 1019 (2021) 16585

<https://doi.org/10.1016/j.nima.2021.165857>

[4] J. Michaud *et al.*, *Status on the DESIR High Resolution Separator Commissioning*, under submission <https://arxiv.org/abs/2203.11214>