

# Offline commissioning of the double Penning trap PIPERADE

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FIGURE 1 – Picture of the PIPERADE double Penning trap.

## Abstract

Of the approximately 7,000 nuclei predicted by nuclear models, fewer than a third have had their mass measured experimentally. Many of the remaining nuclei are highly unstable and difficult to produce. Precise *mass measurements* play a crucial role in nuclear structure studies and nucleosynthesis modeling, and require advanced instrumentation to reach the most exotic isotopes.

At the DESIR facility at GANIL, *radioactive nuclei* will be provided both by the S3 low-energy branch, delivering neutron-deficient nuclei via fusion-evaporation reactions, and by SPIRAL1, producing light, neutron-rich isotopes through fragmentation. The Exotic Nuclei group at LP2iB is developing PIPERADE, a double Penning trap dedicated to isobaric purification and precise *mass measurements* of exotic nuclei.

I will present the current setup of PIPERADE at LP2iB and describe the complex ion motion occurring inside a Penning trap. I will then explain the two mass measurement techniques used with PIPERADE. The first method, the Time-of-Flight Ion-Cyclotron Resonance (*ToF-ICR*) technique, is well established and has already yielded promising results. Current efforts focus on the implementation and optimization of the Phase-Imaging Ion-Cyclotron Resonance (*PI-ICR*) method. Finally, I will present the latest results obtained using both methods and conclude by outlining the next steps in the commissioning process.

The setup is scheduled to be relocated to the DESIR facility in 2027, with first on-line experiments planned for 2028. These developments will pave the way for precise *mass measurements* at DESIR, extending the accessible range of exotic nuclei and contributing to the facility's scientific programme.

**Key-words :** *mass measurements ; radioactive nuclei ; ToF-ICR ; PI-ICR*