

PIPERADE at DESIR:

A double Penning trap for high resolution mass separation and an RFQ for cooling and bunching the beam

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The future DESIR facility (Decay, Excitation and Storage of the Radioactive Ions) will be part of the new accelerator complex SPIRAL2 at GANIL. Beams from SPIRAL1 and S3 will be delivered to DESIR for decay spectroscopy studies, laser spectroscopy and trap-based experiments. For many of these experiments, highly pure samples of exotic nuclei are needed, in order to reach a high precision and accuracy. Therefore, a system to purify the radioactive ion beam from undesired contaminants is under development at CENBG.

First of all, in order to inject the ions into the mass separator, an RFQ (Radio Frequency Quadrupole, called GPIB for General Purpose Ion Buncher) has been developed at CENBG. The purpose of this linear trap is to reduce the transverse and longitudinal emittance of the beam, not only for the injection into the PIPERADE separator but also for any other experiments at DESIR which need a cooled and/or bunched beam. The status of this development as well as first measurements will be presented.

The second part of the project concerns the separator itself, which consists of two Penning traps, the Penning trap technique allowing to reach a high resolution (10^5 - 10^6). Therefore, all isobaric species not separated in the HRS will be cleaned by PIPERADE. The selection will be performed in the first trap whereas the second trap will accumulate ions of interest, offering the possibility of trap-assisted spectroscopy with maximized statistics.

The large inner diameter of the purification trap will limit the space charge effects and allow to clean large samples ($>10^4$ per bunch). Different excitation schemes recently developed or under study will allow to reach a very high resolution, offering also the possibility of isomeric cleaning. These methods as well as the final design of the setup will be presented.