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Technical progress at the double Penning trap PIPERADE

The double Penning trap PIPERADE (Pièges de Penning pour les RADionucléides à DESIR) [1] for the DESIR facility has been advancing in its commissioning phase at the LP2i-Bordeaux laboratory. The traps were designed with the objective of performing high-precision mass measurements and high-resolution mass purification of strongly contaminated ion beams. The latter will be produced by the existing SPIRAL1 facility and the S3 spectrometer. In order to push the limits of existing devices, PIPERADE is equipped with a new type of high-capacity large trap that aims to separate up to 10^4 - 10^5 ions per bunch.

The purified samples will be re-injected in the main DESIR beam line for downstream setups to perform trap-assisted spectroscopy. Alternatively, the purified samples will be utilized to perform high-precision mass measurements. In this context, standard ion-beam manipulation techniques are now being routinely demonstrated, i.e. the sideband buffer gas cooling (BGC) [2] and the time-of-flight ion-cyclotron-resonance (ToF-ICR) [3], while others are being implemented - phase-imaging ion-cyclotron-resonance (PI-ICR) [4]. Last year, as part of the implementation process of PI-ICR, an imaging system consisting of a microchannel-plate detector coupled to an anode constructed of helical wire delay lines was installed. RoentDek Handels GmbH has developed the delay-line anode with a specific three-layer geometry ("Hexanode") [5] to improve the ambiguity of multi-hit position and time encoding on the detector.

In this contribution, we will present the latest achievement from the BGC technique, the first mass measurement by using ToF-ICR and finally, the detector installation to allow the position encoding for future PI-ICR measurements.

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[3] M. Koenig, et al., Int. J. Mass Spectrom. 31 (1995) 95

[4] S. Eliseev et al., Phys. Rev. Lett. 110 082501 (2013)

[5] O. Jagutzki et al., IEEE Trans. Nuc. Sci. 49 (2002) 5

Abstracts

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