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# HYBRID ION TRAP: FIRST APPROACH

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Penning trap is a powerful device for measuring properties of ions and subatomic particles. Presently it can reach the highest accuracy in a determination of the mass of a nuclide.
The typical Penning-trap system for on-line mass measurements requires two dedicated traps. The first trap –preparation trap (PT) –serves for the purification and cooling of the captured ions via the conventional mass selective buffer-gas cooling technique. The second trap –measurement trap (MT) –which is in combination with the downstream MCP detector serves for the determination of the ion's cyclotron frequency and, therefore, its mass. Such a typical system gives rise to mass measurements with uncertainties of a few keV on medium-heavy nuclides with half-lives down to about a few hundred milliseconds. However, when captured, the ions are no longer well centered acquiring coherent axial and magnetron motions, what in turn introduces additional systematic shifts in the measurement of eigenfrequencies and, thus, the systematic error of the measured mass. This effect is one of the limitations in the final precision for the PI-ICR detection technique [1]. For the sake of mass measurements of short-lived nuclides the issue can be circumvented by
combining the features of both the PT and MT in a single 'hybrid'trap. In the hybrid trap the buffer gas can be injected in the trap region in a pulsed manner using a fast piezo valve. In this way the pressure in the trap volume is built up only for the cooling phase, then the valve is closed letting the buffer gas to be pumped out, and when the pressure drop is sufficient, finally the frequency measurement takes place. Besides the reduction of the systematic effects, such the hybrid system would lower the overall cost of the apparatus because it would require only one standard superconducting magnet instead of two, or instead of a special single magnet with two regions of highly homogeneous magnetic fields.
This work presents the design of the proposed 'hybrid'Penning trap system, estimation of its capabilities, and its relevance to the future PITRAP project – the Penning-trap mass spectrometer at the PIK reactor in Gatchina [2].

1. S.Eliseev et al. // Appl. Phys. B. 2014. V.114. P.107.
2. Yu.Gusev et al.// this conference.

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