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Novel internal target source for future storage ring experiments

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The introduction of cryogenically cooled, few micrometer-sized nozzle geometries and an essential modification of the experimental storage ring (ESR) target station for the first time allowed for a reliable operation using the light target gases helium and hydrogen at area densities up to values of 10^{14} cm^{-2} [1]. In the course of these optimization efforts, a remarkably versatile target source was established, enabling operation over the whole range of desired target gases (from H_2 to Xe) and area densities (˜10^{10} to ˜10^{14} cm^{-2}).

For more general, future applications at storage rings a completely new inlet chamber was proposed based on the experience gained during previous modification processes [2]. The much more compact chamber design will maintain the demanding storage ring vacuum requirements while enabling the operation of the target beam at an interaction length down to 1 mm. This is of paramount importance with respect to the realization of high precision experiments, e.g. by reducing the inaccuracy of the observation angle causing the relativistic Doppler broadening [3]. While being intended for the deployment at the future high energy storage ring (HESR) within the FAIR project, the new inlet chamber could also be introduced to other storage rings - such as the TSR@ISOLDE - due to its compact size and modularity, which offers numerous experimental possibilities.

[1] M. Kühnel *et al.*, NIM A, 602, 311-314 (2009)

[2] N. Petridis, A. Kalinin, and R. E. Grisenti, "Technical Design Report: SPARC-Target@HESR", Stored Particles Atomic Physics Research Collaboration, 2014

[3] T. Stöhlker *et al.*, NIM B, 205, 210-214 (2003)

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