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Novel internal target source for future storage ring experiments (APPA)

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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 H2 to Xe) and area densities (~10^10 to ~10^14 cm^-2). For future applications of the SPARC collaboration 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 replace the current one at the ESR or serve as an internal target for CRYRING.

[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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