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Internal targets for the FAIR storage rings

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Recent modification of the internal target source setup at the experimental storage ring (ESR) led to a significant improvement of its performance. In particular, a reliable operation of the light target gases helium and hydrogen at unprecedented area densities up to values of 10E14 1/cm² was demonstrated [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 (~10E10 to ~10E14 1/cm²).

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].

The new inlet chamber design is currently being assembled and commissioned at GSI. A thorough investigation of the exact target properties is mandatory prior to deployment at a storage ring. Experimental results obtained during the commissioning process of the new internal target chamber design will be presented. Further experimental prospects enabled for the first time by the novel multiphase target source will be discussed.

[1] M. Kühnel et al., Nucl. Instr. Meth. A 602, 311 (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., Nucl. Instr. Meth. B 205, 210 (2003)

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