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Cryogenic Surfaces in the Room Temperature SIS18 Ion Catcher

The heavy ion synchrotron SIS100 at the FAIR facility, which is currently built at the GSI Helmholtzzentrum in Darmstadt, will provide heavy ion beams of highest intensities, 5e11 Uranium particles per pulse. For FAIR operation, the existing heavy ion synchrotron SIS18 at GSI will be used as a booster synchrotron for SIS100. Four injections of 1.25e11 will be accumulated in SIS100 for further acceleration. In order to reach the intensity goals, medium charge state heavy ions have to be used. Unfortunately, such ions have very high ionization cross sections in collisions with residual gas particles. This yields in beam loss and subsequent pressure rise via ion impact stimulated gas desorption. Such, self-amplification up to complete beam loss can evolve. To reduce the desorption yield and thereby the dynamic vacuum, room temperature ion catchers which provide low desorption surfaces have been installed in SIS18. This measure shifts the intensity limit for heavy ion operation in SIS18 to higher number of particles.
Heavy ion operation with medium charge states can be simulated using the StrahlSim code. Dynamic vacuum simulations with cryogenic surfaces show, that their high sticking probability prevents the vacuum system from pressure built-ups during operation with heavy ions. This can stabilize the operation with heavy ion beams at higher intensities, than solely with NEG-coated room temperature surfaces.
A prototype ion catcher containing cryogenic surfaces has been developed and built. The surfaces are cooled by a commercial cold head, which easily allows this system being integrated into the room temperature synchrotron. The cold head can be removed without breaking the UHV system, such that a vacuum-bakeout and activation of NEG-surfaces is possible. The development and first laboratory tests of this system are presented.

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