Innovative Concepts for Collision Studies at GSI's and FAIR's Storage Rings*

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Installation of two new detector manipulators in the dipoles of the ESR

Two prototype systems of a new particle detector manipulator ([1], and Fig. 1) are currently being installed in the ESR's first dipole magnets in the south and the north arc, i.e., behind the electron cooler and the gas-target, respectively. The manipulators are equipped with vacuum gate valves and vacuum pumps and can thus be separated completely from the main vacuum system of the storage ring. The present design is especially adapted for the installation of detectors at the last ports of the C-type dipole magnets. The set-up in the south arc behind the electron cooler features a detector pocket with an entrance window of 25 μm thickness and is primarily targeted at recombination studies with a stochastically cooled ion beam using the electron cooler solely as a target for free electrons (cf. e.g. [2]).
In the north arc a special detector mount is installed that allows for the placement of a detector in-vacuum on the inside of the ring. As a consequence of the C-type magnet design, the detector has to be inserted from the outside of the ring prior to beam injection leaving sufficient space for the circulating initially uncooled primary beam.
The main purpose of this set-up is to enable nuclear reaction studies at the internal gas-target at ion energies around the Coulomb barrier or around the Gamov window such as nuclear astrophysics (p,γ) experiments [3]. A new UHV compatible position sensitive ceramic-mounted Si-detector (Micron semiconductors) is delivered, was vacuum tested at GSI and will be mounted in the near future. Commissioning of the manipulators with beam and first (p,γ) data taking runs at the ESR are scheduled for the upcoming beamtimes spring/summer 2014.

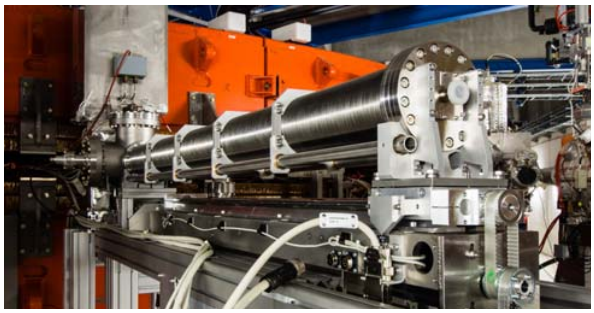

Figure 1: New detector manipulator in the first dipole magnet of the south arc (behind the electron cooler) of the ESR.

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A new data acquisition for the integration of Schottky signals in AP experiments

In a collaboration of Giessen University, EMMI and GSI a new data acquisition is presently being set-up that aims at the continuous and broadband recording of RF Schottky signals at the present ESR, and in perspective at FAIR's future storage rings. In addition to the well-established Schottky mass and decay studies (cf. e.g. [4]) it is envisaged to provide a transparent, seamless and non-destructive recording of ion beam parameters ('beam logbook') and supply the data for storage ring experiments. The DAQ system comprises a modular PXIe crate and corresponding modules (National Instrument VSA type NI-5663E and Counter NI-6602, additional digitizer SPDevices ADQ-214) and is capable of uninterrupted high-resolution recording of the full ring momentum acceptance. The DAQ records the Schottky signals of both, the old parallel plate pick-up and the new high-resolution cavity-based pick-up [5] simultaneously. In particular, the single particle sensitivity of the new resonant pick-up features a much improved time-resolution. The combination of both pick-ups with the new highly performant DAQ will also facilitate new experimental schemes for atomic and nuclear collsion studies at storage rings [6].
The system is presently being commisioned offline with test signals: an initial data taking software (using NI Labview) and first data analysis routines have already been implemented. Tests and optimizations with beams are planned for the course of 2014.

References

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