Journal of Physics: Conference Series **635** (2015) 112061 doi:10.1088/1742-6596/635/11/112061

An ion source platform of the cryogenic storage ring (CSR)

P M Mishra* [1], **K Blaum***, **C Breitenfeldt***,†, **S George***, **J Göck***, **M Grieser***, **R von Hahn***, **J Karthein***, **T Kolling**§, **C Krantz***, **H Kreckel***, **S Kumar***, **J Mohrbach**§, **G Niedner-Schatteburg**§, **C Meyer***, **R Repnow***, **L Schweikard**†, **and A Wolf***

* Max-Planck-Institut für Kernphysik, D-69117 Heidelberg, Germany

† Institut für Physik, Ernst-Moritz-Arndt Universität Greifswald, D-17487 Greifswald, Germany

§ Fachbereich Chemie, Technische Universität Kaiserslautern, Erwin-Schrödinger-Straβe 52, 67663 Kaiserslautern, Germany

Synopsis A network of ion sources is being developed on the 300-kV acceleration platform of the cryogenic storage ring (CSR) at the Max-Planck-Institut für Kernphysik. It consists of several types of sources like a metal ion sputtering source (MISS), a Penning source, a laser vaporization (LVAP) source, and an electrospray ionization (ESI) source to produce a large variety of ions which can be studied for photon and electron interaction in a ro-vibrationally cold environment. Furthermore a storage device such as a radiofrequency quadrupole (RFQ) is foreseen for internal state cooling and accumulation of rarely produced species.

In order to determine ground state properties of small molecules and clusters and to understand their structure as well as various quantum dynamical interactions, it is crucial to produce and accumulate sufficient amount of state-selected ions of interest. The ions will be studied in the cryogenic storage ring (CSR) [1], currently under commissioning at the Max-Planck-Institut für Kernphysik in Heidelberg, by miscellaneous experimental probes such as laser, cold electron, and neutral atom collisions. Photodissociation, electron-ion recombination, and ion-atom interaction taking place in the extremely background free environment of the CSR will provide a unique insight into the ground state properties and interaction of various ion species ranging from small diatomic molecules to larger molecules like clusters, biomolecules or PAHs.

In this contribution we describe the various ion sources and traps in the first phase of the CSR. Figure 1 shows the layout of the sources to be installed on the high-voltage platform of the CSR enabling various ion beams of energies up to 300 keV. Standard sources installed for the commissioning of the CSR are a Penning ion source (positive Heinecke type) and a Middleton type sputter source (MISS) for anionic species. In addition to this the development of a laser vaporization source (LVAP) as well as an electrospray ion (ESI) source for complex biomolecules has been triggered. A radiofrequency quadrupole (RFQ) trap will be added for ion accumulation and internal state cooling using buffer gas. To transport the ions between the different sources and the RFQ trap as well as further towards injection into the CSR (via an optional mass analyzing magnet) a purely electrostatic ion optical beam line has been designed. Ion optical simulations performed using SIMION 8.1 and the entire layout of the source facility will be presented.

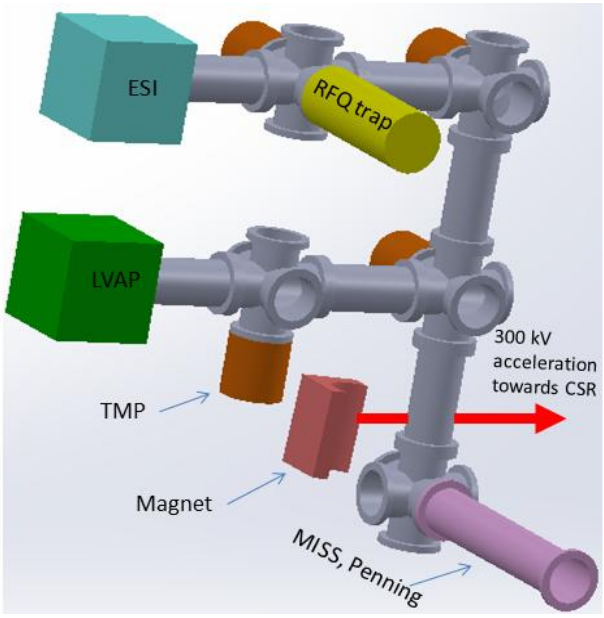

Figure 1. Phase-I layout of the ion source network for the CSR

References

[1] R. von Hahn *et al* 2011 *Nucl. Instrum. Meth. B* **269** 2871

[1] E-mail: pmishra@mpi-hd.mpg.de