Upgrade of the Main Magnetic Focus Ion Trap in Giessen

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Synopsis The Main Magnetic Focus Ion Trap installed in Giessen is being upgraded aiming at the extension of the range of producible ion species. The presently reported effort includes the installation of a system for extra fine-dosed introduction of gaseous parent materials into the trap region and the arrangement for the possibility of periodic dumping of the ion trap.

The Main Magnetic Focus Ion Trap (MaMFIT), a compact tool for spectroscopy of highly-charged ions [1], has been recently installed in Giessen and has already been employed for investigation of dielectronic recombination in highly-charged iridium ions [2]. The present construction, however, enables the experimental access almost exclusively to the ions of the sputtered cathode material, which, presently, is iridium. The main reason for this restriction is the process of evaporative cooling, in which heavier ions are cooled in Coulomb collisions with lighter ions resulting in the former being trapped for much longer time (and, thus, in higher charge states), while the latter mostly leave the trap after gaining additional kinetic energy before their high ionization stages can be achieved.

We report on an effort aimed at the enhancement of the versatility of the MaMFIT in Giessen thus enabling experimental access to ions of a wider spectrum of elements. It includes the arrangement for periodic dumping of the local ion trap by changing the potential on the drift tube thus preventing the trap from being filled with ions of the cathode material. For Electron Beam Ion Traps (EBIT), periodic time spans between the trap dumps are typically in the range from 0.1 to few seconds. In the case of MaMFIT, the electron current density in the small local trap is predicted to be higher than in typical EBITs. The corresponding required dumping time periods are, therefore, expected to be shorter. Another aspect of the presently reported upgrade is the system for supplying gaseous parent elements. When aiming at production of ions of injected elements, a sufficient amount of the parent gas should be introduced into the trap region, however, with smallest possible influence on the overall pressure in the setup. Employing the experience with the available ballistic gas inlet system installed on the EBIT at NIST [3], an analogous system adjusted for the present MaMFIT setup has been designed, built and installed. Fig. 1 shows the CAD model of the drift tube region of the present setup. With the described upgrade, the Giessen MaMFIT setup is currently being prepared for test measurements of spectra of highly-charged noble-gas ions.

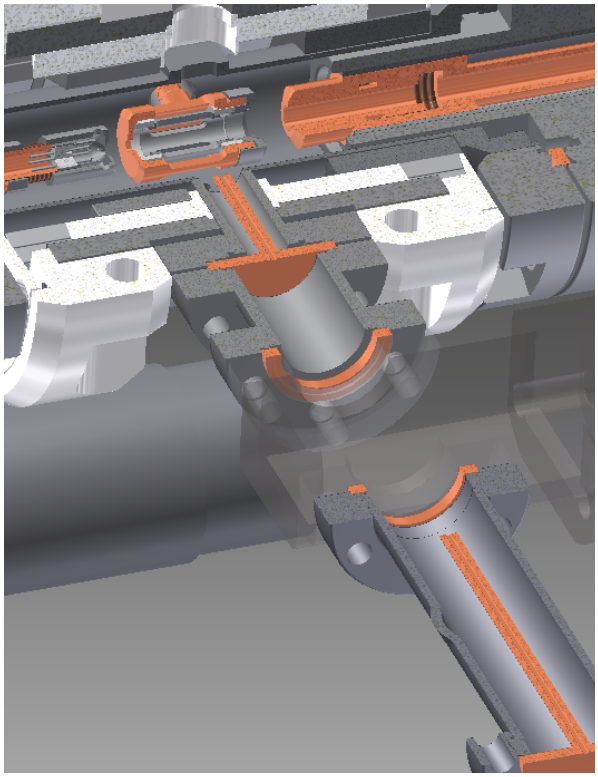

Figure 1. The fragment of the CAD model of the MaMFIT setup in Giessen showing the drift tube arrangement together with the gas inlet system.

References

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