VA 3: Vacuum Physics

Time: Monday 13:30–14:45 Location: HSZ 301

Invited Talk VA 3.1 Mon 13:30 HSZ 301

High speed massive matter injection in ultrahigh vacuum environment for magnetic fusion devices — •Mathias Dibon[1,2], Peter Lang[1], Gabriella Pautasso[1], Albrecht Herrmann[1], Vitus Mertens[1], Rudolf Neu[1,2], Bernhard Ploeckl[1], and Volker Rohde[1] — [1]Max-Planck-Institute for Plasmaphysics, Boltzmannstr. 2, 85748 Garching, Germany — [2]Technical University Munich, Boltzmannstr. 15, 85748 Garching, Germany

Thermonuclear fusion devices operate with hydrogen plasma at temperatures in the range of 100 - 200 million K. Conversely, the plasma density is very low (10^{20} particles/m^3). In order to achieve this low density and a high purity of the plasma, the pressure in the plasma vessel must be below 10^{-4} Pa. Efficient plasma fuelling without impairing the quality of the vacuum is therefore often done by injecting pellets composed of cryogenic hydrogen. These pellets are injected into the plasma at speeds of about 1000 m/s, allowing particle deposition in the plasma core without degrading the surrounding vacuum. Furthermore, fusion devices of the Tokamak type rely on a very high electrical current (several MA) within the plasma. This bares the risk that the plasma disrupts within milliseconds which can cause severe damage to the fusion device. Hence, these disruptions have to be mitigated which is done by injecting massive amounts of noble gas. High speed gas valves, that operate inside or outside of the vacuum vessel, hold large amounts of noble gas which is released completely into the vacuum vessel within milliseconds (typical flow rate 10^5 Pam^3/s), putting a serious load on the vacuum system.

VA 3.2 Mon 14:15 HSZ 301

A Novel Ion Source: Theory, Experiments and Applications — •Mihail Granovskij, Sergej Uchatsch, Anton Zimare, Christian Reinhardt, Jaroslaw Iwicki, Michael Flämmich, and Ute Bergner — VACOM Vakuum Komponenten & Messtechnik GmbH, Gabelsbergerstraße 9, 07749 Jena

Pressure determination in HV/UHV-processes is generally carried out with well-known hot or cold cathode gauges. While these gauges are reliable in practice, users often face problems achieving the desired operating pressure. Most likely this is caused by leaks which can be identified with a separate leak detector or mass spectrometer. While leak detectors are highly cost-intensive, the application of mass spectrometers seems to be oversized since only the Helium signal is relevant.

Merging the capabilities of total pressure gauges with the basic performance of a mass spectrometer is an approach we present in the present talk. Our novel, simple and compact ion source is simultaneously capable of both: a precise total pressure measurement over a wide range and the determination of Helium partial pressure with a high dynamic range in the UHV without the usage of a cost-intensive electron multiplier.

In the talk we explain the physical principles of the novel ion source. We show experimental results, and provide insights into the overall performance of the gauge. Moreover, we evaluate the capability of detecting the gas composition in the range of 1-50 m/z.