VA 1: Vacuum Generation and Measurement

Time: Monday 9:00–10:45 Location: HSZ 301

Invited Talk VA 1.1 Mon 9:00 HSZ 301

Assessment of a Pressure Gauge Filament for Neutral Gas Density Measurement using Alternating Current as Source Power — •Nikola Jaksic, Hans Meister, and Andrea Scarabosio — Max Planck Institute for Plasma Physics, EURATOM Association, Boltzmannstr. 2, 85748 Garching, Germany

Vacuum in plasma fusion research is primarily required to guarantee interference-free fusion processes of the hydrogen isotopes deuterium and tritium and additionally as an insulator between very hot particles and solid objects. Moreover, vacuum is required in cryogenic areas of the fusion device e.g. for insulation of super conducting coils which operate at 4 K. An overview of the existing vacuum measurement systems and the measurement system which fulfill the essential demands for the ITER experiment, currently under construction is presented. In plasma fusion research the neutral gas density is usually measured using hot cathode ionization gauges which are modified for the application in high magnetic fields and for a measurement range between 10^-4 Pa and 20 Pa. For obtaining sufficient electron emission, high filament temperatures in the order of 1800 K are required and thus high usually direct heating currents. The heating current to achieve the right operational temperature could be reduced by using a thinner filament in combination with alternating current with suitably chosen frequency. To estimate the suitability of such a solution a feasibility study by means of numerical methods has been carried out. The results of the filament preliminary numerical analyses are presented.

VA 1.2 Mon 9:45 HSZ 301

Measurement of the Rotor Temperature of shielded TMPs in Magnetic Fields for the KATRIN Experiment — •Fabio Bertucco and KATRIN Collaboration — Karlsruhe Institute of Technology (KIT), IEKP, Postfach 3640, 76021 Karlsruhe

When turbo-molecular pumps (TMP) are operated in an external magnetic field, one needs to know the influence of eddy currents on the rotor temperature to ensure safe operating conditions. For long-term operation a rotor temperature below 90 °C is recommended. At temperatures above 120 °C the thermal expansion of the rotor can exceed the gap between stator and rotor, causing a collision. The **Ka**rlsruhe **Tri**tium **N**eutrino (KATRIN) experiment operates more than 20 magnetically levitated TMPs close to superconducting solenoids in magnetic fields up to 18 mT. Since the temperature of the fast moving rotor can not be measured directly, a test setup with Helmholtz coils and an infrared pyrometer for the temperature measurement was used at KIT to investigate the rotor temperature for different magnetic field. In order to operate the TMPs as close to the KATRIN components as possible they have been encased in a magnetic shielding. This talk will present measurements with different TMPs in magnetic fields up to 20 mT with and without shielding. We acknowledge the support by KSETA, BMBF (05A14VK2), HAP and the Helmholtz association.

VA 1.3 Mon 10:15 HSZ 301

New technologies for dry and clean vacuum — •Alexander Kaiser — Leybold GmbH, Bonner Str. 498, 50968 Köln

The history of vacuum goes back several centuries and is characterized by large and noisy machines that have the potential to pollute the environment and the vacuum chamber with oil and particles. While several high and ultra-high vacuum pumping principles offer suitable hydrocarbon-free clean pumping, there are still compromises with today's fore-vacuum pumps, which are becoming increasingly unacceptable in many research applications.

The ideal vacuum pump is a reliable tool providing clean vacuum with low operational noise, low power consumption and runs maintenance-free. Today, this can be achieved by pumps based on screw or multi-stage roots technology where optimized rotors rotate in an oil-free compression suction chamber without generating friction. Because of the non-contacting oil-free operation, no wear is produced and neither oil nor particles can contaminate the vacuum chamber and the environment. By optimizing the rotor design and vacuum channels, the pumps can be designed to run almost noise free with no disturbance for the user and with highest energy-efficiency.

This talk gives an overview of dry and clean vacuum pump technologies and the current challenges and solutions in developing a pump almost not audible for the operator.