# VA 3: Large Vacuum Systems

Time: Monday 14:00–15:45 Location: A 060

**Invited Talk** VA 3.1 Mon 14:00 A 060

**Measurement and simulation of deuterium and tritium retention in the KATRIN beam line** — •Carsten Röttele and KATRIN Collaboration — Karlsruhe Institute of Technology (KIT), ETP, Postfach 3640, 76021 Karlsruhe

The **Ka**rlsruhe **Tri**tium **N**eutrino (KATRIN) experiment aims to determine the effective neutrino mass with a sensitivity of $m_\nu = 0.2\,\mathrm{eV/c^2}$ (90% C.L.) using electrons from the tritium $\beta$-decay. The $\beta$-electrons produced in the windowless gaseous tritium source (WGTS) are magnetically guided through the beamlines of the transport and pumping section to the huge main spectrometer for energy measurement. In order to minimize the background rate from tritium ($T_2$) decaying in the spectrometer to less than 0.01 counts per second, the pumping sections have to reduce the tritium flow from the WGTS by at least 14 orders of magnitude. Therefore KATRIN combines a differential pumping section (DPS), using turbo-molecular pumps and a cryogenic pumping section (CPS) with a combined reduction factor of more than $10^{14}$. This talk introduces the results of first deuterium ($D_2$) measurements probing the performance of the transport and pumping section, including first commissioning data for the 3-K-cold argon frost layer used to increase the cryo-sorption in the CPS. These results are compared with Test Particle Monte Carlo (TPMC) vacuum simulations with MOLFLOW+. The post-processing of the CPS TPMC results introduces a time dependent model of the reduction factor and of $D_2$ and $T_2$ migration along the beamline. This work was supported by GRK1694, BMBF (05A17VK2), KSETA and the HGF.

VA 3.2 Mon 14:45 A 060

**Loops - The tritium processing system of the KATRIN experiment** — •Alexander Marsteller — Karlsruher Institut für Technologie, Karlsruhe, Deutschland

The **Ka**rlsruhe **Tri**tium **N**eutrino (KATRIN) experiment aims to determine the effective neutrino mass with a sensitivity of $m_\nu = 0.2\,\mathrm{eV/c^2}$ (90% C.L.) using electrons from the tritium $\beta$-decay. The $\beta$-electrons produced in the windowless gaseous tritium source (WGTS) are guided by magnetic fields ranging from 3.0 T to 5.6 T through the beamlines of the transport and pumping section to the huge main spectrometer for energy measurement. To reduce systematic uncertainty on the neutrino mass, the tritium density inside the WGTS needs to be stable to the promille level. In order to minimize the background rate from tritium ($T_2$) decaying in the spectrometer to less than 0.01 counts per second, the pumping sections have to reduce the tritium flow from the WGTS by at least 14 orders of magnitude. Therefore KATRIN combines a differential pumping section (DPS), using turbo-molecular pumps and a cryogenic pumping section (CPS) with a combined reduction factor of more than $10^{14}$.

This talk introduces the Loops system responsible for cycling tritium throughout the source section (WGTS and DPS) of the KATRIN experiment. Furthermore the magnetic shielding of the TMPs used in the Loops system of WGTS and DPS is introduced. This work was supported by BMBF (05A17VK2), KSETA and the HGF.

VA 3.3 Mon 15:15 A 060

**The first gaseous $^{83\mathrm{m}}$Kr in the KATRIN experiment: hardware and simulation** — •Fabian Friedel and KATRIN collaboration — Karlsruhe Institute of Technology (KIT), ETP, Postfach 3640, 76021 Karlsruhe

The aim of the **Ka**rlsruhe **Tri**tium **N**eutrino (KATRIN) experiment is to determine the effective mass of the electron antineutrino with a sensitivity of 200 $\mathrm{meV/c^2}$ (90% C.L.). This will be achieved by measuring the $\beta$-spectrum of tritium close to the kinematic endpoint at 18.6 keV. In the neutrino mass measurement the tritium will be injected into the **W**indowless **G**aseous **T**ritium **S**ource (WGTS). The $\beta$-electrons are guided magnetically through the 70 m long set-up and analyzed by an electrostatic filter and a silicium pixel detector. In July 2017 a commissioning milestone of the experiment has been achieved by measuring electrons from a gaseous $^{83\mathrm{m}}$Kr source transmitted through the whole KATRIN set-up. The radioactive $^{83\mathrm{m}}$Kr emitts monoenergetic conversion electrons at several energies between 17.8 keV and 32.1 keV. The Kr source was installed at the WGTS. It consisted of a zeolithe substrate where the parent radionuclide $^{83\mathrm{m}}$Rb had been implanted. The main results of the operation of this krypton source will be presented. Furthermore TPMC simulations of the gas distribution inside the vacuum tube have been performed. This work has been supported by BMBF (05A17VK2), KSETA and the Helmholtz Association.