VA 2: Large Vacuum Systems

Time: Monday 11:00–12:15 Location: HSZ 301

Invited Talk VA 2.1 Mon 11:00 HSZ 301

Commissioning of the complete KATRIN Vacuum System —

•Joachim Wolf and KATRIN Collaboration — Karlsruhe Institute of Technology (KIT), IEKP, Postfach 3640, 76021 Karlsruhe

The **Ka**rlsruhe **Tri**tium **N**eutrino (KATRIN) experiment uses the kinematics of electrons from the tritium β-decay to determine the effective neutrino mass with a sensitivity of $m_\nu = 200\,\mathrm{meV/c^2}$ (90% C.L.). The β-electrons are produced in the windowless gaseous tritium source (WGTS) at a pressure of 10^{-3} mbar. Superconducting magnets around the beam lines guide them through the transport and pumping section to the spectrometer, where their energy is analysed. Tritium decaying inside the spectrometer would increase the background rate. Therefore the pumping sections have to reduce the tritium flow from the WGTS by at least 14 orders of magnitude. Two techniques are employed for the tritium retention. The differential pumping section (DPS) uses cascaded turbo-molecular pumps and in the cryogenic pumping section (CPS) the tritium gas is cryosorbed on a 3-K-cold layer of argon frost that covers the beam tubes. The spectrometer section consists of the Pre-Spectrometer ($8.5\,\mathrm{m^3}$, 10^{-11} mbar), the huge Main Spectrometer ($1240\,\mathrm{m^3}$, 10^{-11} mbar), and the detector section, where electrons that pass the electrostatic filter of the Main Spectrometer are counted. The setup of the KATRIN experiment has been completed at KIT in 2016. This talk introduces the various parts of the experiment and their challenging vacuum requirements. Performance data from the ongoing commissioning phase are presented. We acknowledge the support by KSETA, BMBF (05A14VK2), HAP and the Helmholtz association.

VA 2.2 Mon 11:45 HSZ 301

Performance of the KATRIN Cryogenic Pumping Section —

•Carsten Röttele and KATRIN Collaboration — Karlsruhe Institute of Technology (KIT), IEKP, Postfach 3640, 76021 Karlsruhe

The **Ka**rlsruhe **Tri**tium **N**eutrino (KATRIN) experiment uses the kinematics of electrons from the tritium β-decay to determine the effective neutrino mass with a sensitivity of $m_\nu = 200\,\mathrm{meV/c^2}$ (90% C.L.). Produced in the windowless gaseous tritium source (WGTS), the β-electrons are magnetically guided through the beam lines of the transport and pumping section to the spectrometer, where their energy is analysed. The transport and pumping section comprises two parts, the differential pumping section (DPS) and the cryogenic pumping section (CPS). Tritium decaying inside the spectrometer would increase the background rate. Therefore the pumping sections have to reduce the tritium flow from the WGTS by at least 14 orders of magnitude. This talk introduces the CPS, which has been designed to reduce the tritium flow by more than seven orders of magnitude. The tritium is cryosorbed on a 3-K-cold layer of argon frost that covers the gold-coated stainless steel surface of the beam tubes with an area of about $2.5\,\mathrm{m^2}$. The temperature distribution along the cold trap, which is important for the effective reduction factor, has been simulated with COMSOL multiphysics. Results of the simulation will be presented and compared with first experimental data. This work was supported by GRK1694, BMBF (05A14VK2), KSETA and the Helmholtz Association.