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Raman spectroscopy for the windowless gaseous tritium source of the KATRIN experiment

Using high-precision spectroscopy of tritium beta decay electrons close to their kinematic endpoint, the KArlsruhe TRItium Neutrino experiment (KATRIN) is targeted to measure the neutrino mass in a model-independent way with a sensitivity of 200 meV/cˆ2 (90% C.L.).
For this purpose, ˜ 10ˆ11 electrons per second are generated in a windowless gaseous tritium source (WGTS) and adiabatically guided to the high-resolution electrostatic spectrometer and the detector for energy analysis. The key parameters of the WGTS have to be stabilized to the 0.1% level and accordingly monitored in order to reach the design sensitivity on the neutrino mass. An example for one of the various high-precision monitoring systems used in the WGTS is a laser Raman system which continuously determines the source gas composition in-line before the gas is injected into the source tube. Using a tritium test circulation loop, the capability of this system to meet the stringent KATRIN requirements were shown, and important information about fluctuations of the tritium gas composition in the WGTS were obtained in a long-term run.
This poster presents an overview of the WGTS and the Raman system in use.

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