Karlsruher Institut für Technologie

Tritiumlabor Karlsruhe

Plasma source characterization using a mass spectrometer and optical emission spectroscopy

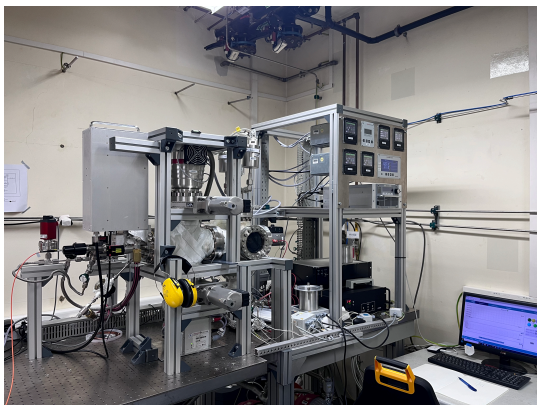
Topic for a thesis at the Tritium Laboratory Karlsruhe

Motivation

The Karlsruhe Tritium Neutrino (KATRIN) experiment measures the neutrino mass by precision spectroscopy of the tritium beta-decay spectrum at its endpoint.

One of the limitations of next-generation neutrino mass experiments (following KATRIN) will be the broadening of the spectrum due to molecular final states. To avoid this, we are currently developing an atomic tritium source.

An important step is the development of atomic beam diagnostic tools such as a mass spectrometer. As a source for atomic hydrogen, an RF-discharge plasma is used, where the atomic density can be monitored with optical emission spectroscopy.



Vacuum system plasma source

Goal

Compare the atomic density inside the plasma source determined by optical emission spectroscopy with the atomic density of the beam from the plasma source determined by a mass spectrometer.

Tasks

1. Improving the hydrogen gas inlet system.
2. Integrating the mass spectrometer and its associated manipulator into the existing vacuum setup.
3. Establishing the mass spectrometer as diagnostic tool by running commissioning measurements.
4. Operating the plasma source at previously determined operation modes and monitoring the atomic density with optical emission spectroscopy and with the mass spectrometer.

The tasks vary from installation work, commissioning of new devices, to analysis of measurement data.

Plasma source

Mass spectrometer

Scope of the thesis

Depending on the start of the thesis and whether it is a master's or bachelor's thesis, different sub-tasks from the list above will be a part of the thesis.

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