

Determining the atomic density inside a hydrogen beam using a mass spectrometer

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 first step in the development is the characterization of a commercial thermal dissociator with tritium. Before tritium can be used, extensive tests with hydrogen need to be performed.

Goal

Determine the fraction of atoms versus molecules in the beam emitted from the thermal dissociator with a quadrupole mass spectrometer.

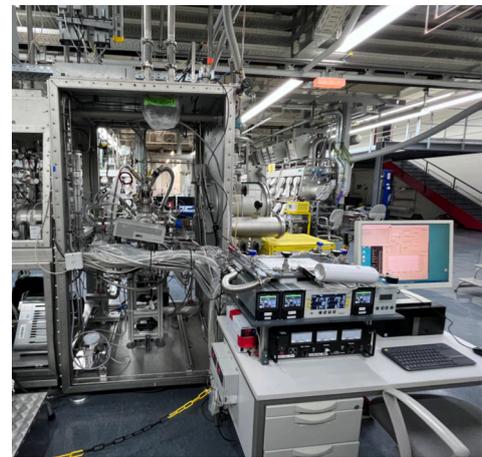
Tasks

1. Extend the existing measurement procedures to establish the mass spectrometer as a diagnostic tool for the hydrogen beam.
2. Perform measurements under different conditions (different temperatures, different gas inlet flows, ...) to get a quantifiable estimation of hydrogen atoms inside the beam.
3. Perform commissioning measurements of the tritium gas loop to prepare measurements with tritium.
4. Repeat hydrogen measurements with tritium.

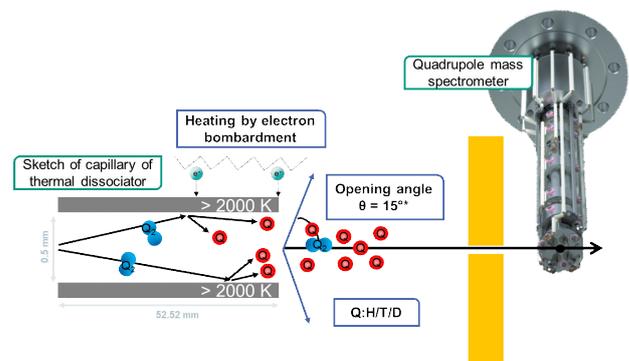
The focus of all tasks is conducting and analyzing measurements using an existing setup.

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.



Experimental setup



Simplified schematic of the setup

Examiner: Prof. Dr. Kathrin Valerius

Advisor: Dr. Caroline Rodenbeck



Contact: caroline.rodenbeck@kit.edu