

KSETA report 2021

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During 2021 two measurement campaigns at the KATRIN experiment were performed, namely KNM5 and KNM6. In addition, the focus on my work was simulations for future improvements of the KATRIN background situation.

For this purpose, I focused on active and passive ways to select certain electrons which would arrive on our focal plane detector. From the first simulation of how electrons from our main spectrometer can be selected by their polar angle until the operation of a filtering device in the KATRIN beamline, was everything included. The idea of this filter is to either detect only or absorb those electrons with characteristics such as the beta electrons from tritium. The major difference between beta and background electrons at KATRIN are there different polar angular distribution to the magnetic field lines at the detector position. Background electrons are assumed to have very low angles, smaller than 10° , whereas beta electrons are present with angles from 0° up to 51° , which is the transmission maximum at our electromagnetic field configuration. From simulation side, we focused on hexagonal channel structures as geometric barrier for these electrons, so that beta electrons would lead to signal in the structure while background electrons can pass the structure so that background is not detected at all.

Proof of principle measurements were taken with a microstructured gold plate with hexagonal channels lithographed. From 20th December, over Christmas and new year's eve until 17th January was a large background investigation campaign. The filter was mounted directly in front of the FPD and only affects half of our circular detector so that for every measurement configuration a direct relation behind the filter to the nominal value can be deduced. This campaign became a major part for my doctoral thesis which is planned to be finished in Summer 2022.

As in the last year, working at the monitor spectrometer was also a part over the whole year. I got into the operation of the monitor spectrometer as an expert in a project management role, greatly enriching my work as I hold responsibility over scientific work and manpower. We took data with a novel detector – TRISTAN detector, which will be installed at the KATRIN beamline after finishing neutrino mass scans.

