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Investigations with mirco-structured units at the KATRIN experiment

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Micro-structured units have been utilised in the KATRIN experiment to study the main spectrometer background, reflecting the significance of background mitigation possibilities in an experiment focused on measuring the absolute mass scale of neutrinos with exceptional sensitivity.
The prevalent background model is characterised by the ionisation of highly excited states originating from radioactive decays within the inner surface, with some of these states undergoing ionisation within the sensitive fluxtube volume, producing background electrons.

Furthermore, the incorporation of micro-structures holds promise for enhancing the sensitivity of the forthcoming detector upgrade of the KATRIN experiment, known as TRISTAN.
The TRISTAN detector upgrade marks the next stage in the KATRIN experiment's evolution, aiming to probe for a sterile neutrino at the keV scale by analysing its effect on the tritium beta spectrum.
Of particular concern are beta electrons that experience scattering upon encountering the golden rear wall of the experiment before reaching the detector. This phenomenon introduces distortions in the observed spectrum, demanding strategies to mitigate such effects to achieve the desired sensitivity levels.
To tackle this issue, various configurations of micro-structured rear walls are under scrutiny via Geant4 simulations. These simulations seek to pinpoint an optimal solution capable of minimizing the influence of scattered beta electrons on the measured spectrum.

The findings of these investigations are showcased in this poster, resulting in an enhanced background model and the identification of the optimal micro-structure unit, delineating shape parameters and material selection tailored for TRISTAN.

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Poster prize

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