T 74: DetSys MAGIX, DetSys KATRIN

Time: Wednesday 15:50–16:50 Location: WIL/A124

T 74.1 Wed 15:50 WIL/A124

A sophisticated trigger veto system for the MAGIX experiment — •Sebastian Stengel for the MAGIX-Collaboration — Institute for Nuclear Physics, Johannes Gutenberg University Mainz

At the new electron accelerator MESA, the MAGIX setup will be used for high- precision scattering experiments including dark sector searches, the study of hadron structure and few-body systems, and investigations of reactions relevant to nuclear astrophysics.

Together with the MAGIX time projection chamber (MX-TPC), the MAGIX trigger veto system builds the sophisticated detector system inside the two high-resolution magnetic spectrometers. It will provide the fast and reliable signals essential for DAQ, coincidence time measurements, and PID, as well as the basic hit and position information for the triggered readout of the MX-TPC.

The MAGIX trigger veto system consists of one segmented trigger layer made of plastic scintillation detectors and a flexible veto system of additional scintillation detectors and lead absorbers mounted below the trigger layer.

The data readout uses the ultrafast preamplifier-discriminator NINO chip which encodes the signal amplitudes using the time-over-threshold method, followed by FPGAs programmed as TDCs.

T 74.2 Wed 16:05 WIL/A124

Scintillating active Transverse Energy Filter: a novel detector concept for low-energy electron background discrimination — •Joscha Lauer for the KATRIN-Collaboration — Karlsruhe Institute of Technology (KIT)

One of the leading sensitivity limiting factors in the Karlsruhe Tritium Neutrino (KATRIN) experiment are background electrons from the main spectrometer. These electrons, presumably low in energy at their creation point, are currently indistinguishable from the tritium beta electrons. Since they arrive at the detector with predominantly small angles relative to the guiding magnetic field lines in contrast to the signal electrons, an angular selective detector has great potential in increasing the sensitivity of the KATRIN experiment by enhancing the signal-to-background ratio.

Micro-structured detector configurations which exhibit angular selectivity due to their 3D structure, so-called active Transverse Energy Filters (aTEF), have been proposed by Eur. Phys. J. C 82 (2022) 922. One approach is a scintillator-based aTEF (scint-aTEF). This presentation gives an overview of the aTEF principle and in particular the scint-aTEF detector, including *GEANT4* simulation-based studies and prototype micro-structures 3D printed via two-photon lithography.

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T 74.3 Wed 16:20 WIL/A124

Design of a scintillating active Transverse Energy Filter for Background Suppression at the KATRIN Experiment — •Nathanael Gutknecht for the KATRIN-Collaboration — Karlsruhe Institute of Technology (KIT)

The **Ka**rlsruhe **Tr**itium **N**eutrino (KATRIN) experiment aims to determine the mass of the electron antineutrino with an unprecedented sensitivity of $0.2\,\mathrm{eV/c^2}$ (90 % C. L.) by precise measurement of the energy spectrum of tritium β-electrons. The energy of the signal electrons are spectrometrically determined in a MAC-E-Filter setup. At the moment, one sensitivity limiting factor is the spectrometer background which consists of electrons that are generated in the mainspectrometer volume. Due to their small initial energy the background electrons have a different angular distribution than the signal electrons at the point of detection.

A scintillating structure acting as an angular selective detector (scint-aTEF) has potential to discriminate between β- and background electrons. This talk will discuss the geometrical concept of the scint-aTEF and its expected impact on the background reduction, based on simulations with *Geant4*.

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T 74.4 Wed 16:35 WIL/A124

PMT test stand simulations of first scintillator prototypes towards active Transverse Energy Filter — •Tom Geigle for the KATRIN-Collaboration — Karlsruhe Institute of Technology (KIT)

The **Ka**rlsruhe **Tri**tium **N**eutrino (KATRIN) experiment has the goal of determining the neutrino mass scale with a sensitivity of $0.2\,\mathrm{eV/c^2}$ (90%C.L.). One of the most important factors limiting the measurement is the background, originating from the main spectrometer which consists of mostly low energy electrons. These electrons are accelerated by the retarding potential and thus possess low transverse energy, resulting primarily in small angles relative to the guiding magnetic field. Therefore, a detector that allows angular sensitivity could greatly improve the sensitivity of the KATRIN experiment.

The concept of an **a**ctive **T**ransverse **E**nergy **F**ilter (aTEF) has been proposed (Eur. Phys. J. C 82 (2022) 922) which could use microstructures to develop such an angular sensitive detector. For this purpose, one of two designs being considered consists of a plastic scintillator that is read out via CMOS **s**ingle-**p**hoton **a**valanche **d**iodes (SPADs). In this presentation, we discuss our first investigation of scintillator prototypes for 2-photon lithography using *Geant4* based simulations and measurements with a photomultiplier setup.

This work is supported by the Helmholtz Association, the Ministry for Education and Research BMBF (05A17PM3, 05A17PX3, 05A17VK2, and 05A17WO3), the Helmholtz Alliance for Astroparticle Physics (HAP), and the Helmholtz Initiative and Networking Fund (W2/W3-118).