

## A Geant4-based model for the TRISTAN detector

*Wednesday, 1 September 2021 19:15 (15)*

The TRISTAN project is the upgrade of the KATRIN experiment that aims at searching for sterile neutrino with mass in the keV range through precise measurements of the entire Tritium  $\beta$ -spectrum.

In order to achieve this goal, the current KATRIN detector must be replaced with a multipixel detector based on Silicon Drift Detectors (SDDs). SDDs, with their excellent energy resolution and capability of sustaining high count rates, are commonly used for X-ray spectroscopy. Electron spectroscopy is a relatively novel application, it is therefore necessary to characterize SDDs response to electrons.

To do this we have started illuminating a single SDD with a monochromatic electron beam coming from a SEM (Scanning Electron Microscope), acquiring data at different energies and angles. We have then realized a Geant4 simulation of the electron interaction with Silicon, and we have processed the output with an empirical model that describes SDDs dead-layer and depth-dependent charge collection efficiency. By fitting data with simulations at different energies and angles we have estimated the free parameters of this empirical model.

We have later realized backscattering measurements using two SDDs, one of which operated as a target. We have written a Geant4 simulation of the whole setup and processed its output with the best empirical model found with SEM data. The result of this operation is a satisfactory description of both the spectra of the two single detectors and the spectrum obtained by summing the energies released in the two SDDs for coincident events.

Deriving such a model for electron interactions with an SDD is mandatory in order to accurately reconstruct the continuous  $\beta$ -spectrum that will be measured in TRISTAN. Moreover, we expect that the detector response will be one of the main TRISTAN systematics, therefore the precise estimation of its parameters allows to preserve an high sensitivity in the search for the sterile neutrino.

### Reference to paper (DOI or arXiv)

### Your gender (free text)

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**Session Classification** : Poster session 2

**Track Classification** : Neutrino physics and astrophysics