

SDDs for the measurement of forbidden β spectra of interest to astroparticle physics

Wednesday 27 August 2025 18:00 (2 hours)

The ASPECT-BET project, or An sdd-SPECTrometer for BETa decay studies, aims to develop a novel technique for the precise measurement of forbidden β spectra in the 10 keV–1 MeV range. Accurately measuring a set of β spectra from different isotopes using the same setup can help in ruling out those nuclear models unable to predict the spectral shapes. Experiments in the field of $0\nu\beta\beta$, WIMP, and Reactor neutrino oscillation searches would greatly benefit from such measurements, usable to help find a reliable nuclear model.

The ASPECT-BET technique employs a Silicon Drift Detector (SDD) as the main spectrometer with the option of a veto system to reject events exhibiting only partial energy deposition in the SDD. The SDD is optimized for higher efficiency, having an active area of 64 mm² and a thickness of 1 mm, specifically designed to contain electrons with energy up to 1 MeV. These detectors can be operated at room temperature, exhibiting an excellent energy resolution (~200 eV at 5.9 keV), thus allowing measurements of fast-decaying isotopes, non accessible with other state-of-the-art techniques based on cryogenic detectors.

A precise understanding of the spectrometer's response to electrons is crucial for accurately reconstructing the theoretical shape of the beta spectrum. To compute this response, GEANT4 simulations optimized for low-energy electron interactions are used. These simulations have been extensively validated with measurements taken with both artificial and radioactive electron sources. In this poster, we present the performance of these simulations in reconstructing the electron spectra measured with the ASPECT-BET SDDs. In particular, the allowed beta spectrum of a ¹⁴C source was measured and analyzed, proving that this system is suitable for the application in ASPECT-BET. The non-unique 2nd forbidden ⁹⁹Tc β spectrum was also measured, and the status of its interpretation based on different nuclear theories will be shown as well.

Collaboration you are representing

ASPECT-BET

Author: NAVA, Andrea (University of Milano-Bicocca)

Presenter: NAVA, Andrea (University of Milano-Bicocca)

Session Classification: Poster session

Track Classification: Neutrino Physics and Astrophysics