

Energy and Efficiency Calibration of Silicon Drift Detector

Abstract

The study of the spectrum from a X-ray radiation source is crucial for obtaining precise information about X-ray characteristics. The continuum segment of the spectrum provides direct insights into the applied tube voltage, while the superimposed lines reveal details about the emission from the elements in the target. Various types of detectors are employed in the of research of X-ray radiation, with the Silicon Drift Detector (SDD) being the most widely utilized due to its excellent energy resolution, compact size, options of detection area, compatibility with direct measurement in air/vacuum, and remarkably high-count rate, distinguishing it from the conventional silicon lithium Si(Li) detector.

Since commercially available X-ray sources lack calibration, ensuring the calibration of detectors used for X-ray source spectra measurement becomes essential for X-ray spectroscopists. The objective of this project is to empirically investigate the calibration of the SDD in energy and efficiency, by utilizing multiple radioactive sources of low-activity. The project mainly aims to assess how different operational parameters of the detector affect the calibration and its stability. This project requires fundamental Python programming and data processing . During the project tenure the project student will not be exposed to ionizing radiation.

Work Scope:

1. Gain an understanding of the operational principles of a solid-state drift detector.
2. Familiarize oneself with the X-ray energy emission from radioactive sources and calculate their photon flux.
3. Understand the experimental setup and measurement conditions.
4. Energy Calibration: Use available experimental data from radioactive sources at varying detector settings, and perform calculations.
5. Efficiency Calibration: Use available experimental data from radioactive sources at varying detector distances, and perform calculations.
6. Develop Python scripts/code to analyze the experimental results & report writing.

Academic Project Requirements:

1) Required No. of student(s) for academic project: 1

2) Name of course with branch/discipline: M.Sc. Physics

3) Academic Project duration:

(a) Total academic project duration: 26 Weeks

(b) Student's presence at IPR for academic project work: 2 Full working Days per week

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