

# Development of X-ray Spectroscopy Detectors for Synchrotron Radiation Sources

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Synchrotron radiation facilities serve as crucial interdisciplinary research platforms, with the performance and operational efficiency closely tied to the quality of the employed detector technology. The Silicon Drift Detector (SDD) is characterized by high count rates, and superior energy resolution, which has led to its widespread application in synchrotron radiation spectroscopy experiments in recent years. China is currently constructing a fourth-generation High Energy Photon Source (HEPS), which is expected to be open to users by 2025. With the increasing brightness of the light source and the need to improve experimental efficiency, there is a gradual progression towards the development of array SDD detectors. The HEPS/PAPS Detector System Project Team at the Institute of High Energy Physics has conducted the key technological research and development for the unit and array SDD detectors in response to future synchrotron radiation requirements, and has obtained some preliminary test results. The project team has established a dedicated research and testing platform at the Platform of Advanced Photon Source Technology (PAPS). The unit SDD has an effective area of  $12 \text{ mm}^2$ , and the array SDD consists of a  $2 \times 10$  array, with  $10 \text{ mm}^2/\text{pixel}$ . The Low-noise ASIC chips employ the reset preamplifier technology to amplify the signals from the SDD. The readout electronics utilize high-speed ADC and FPGA for signal acquisition and processing. The development and performance testing of both unit and array SDD sensors have already been achieved, with the unit sensor exhibited a leakage current of  $10 \text{ pA}@ -20^\circ\text{C}$ . After system integration and testing, the single-unit SDD detector achieved an energy resolution of  $160 \text{ eV}@5.9 \text{ keV} (-20^\circ\text{C})$ , and the 20-unit array-SDD detector reached an energy resolution of  $300 \text{ eV}@ 13.6 \text{ keV}$ . The maximum counting rate for a single channel can reach about 1 Mcps.

## Collaboration

## Role of Submitter

I am the presenter

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