

# Real-Time Active Collimation of Charge-Sharing Events in Monolithic SDD Arrays

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## Abstract

Monolithic arrays of Silicon Drift Detector (SDD) are widely adopted in X-ray spectroscopy for their excellent energy resolution and high count rate capability in compact size. However, they suffer from charge sharing (CS) between adjacent pixels. Traditional solutions, such as mechanical collimation, reduce active area and detection efficiency, more significantly in case of small pixels.

We will present at the conference the first implementation of real-time active collimation on a custom-designed Digital Pulse Processor (DPP) developed using the CAEN DT5560 digitizer platform. The DPP incorporates our previously developed and characterized CASPER (Charge-sharing Analysis and Spectroscopic Performance Enhancement via Reconstruction) algorithm to identify and process CS events during acquisition, enhancing spectral quality without sacrificing active area. Additionally, we will present the real-time implementation of the Decision Tree-based CASPER-AI algorithm on the same platform, leveraging machine learning for real-time CS identification and recovery.

## References

- [1] Urban, K., Carminati, M., Descher, M., Edzards, F., Fink, D., Fiorini, C., ... & Wolf, J. (2022). Characterization measurements of the TRISTAN multi-pixel silicon drift detector. *Journal of Instrumentation*, 17(09), C09020.
- [2] Pedretti, B., Borghi, G., Ticchi, G., Di Vita, D., Carminati, M., & Fiorini, C. (2024). Charge Sharing Assessment and Active Collimation in Monolithic Arrays of Silicon Drift Detectors. *IEEE Transactions on Nuclear Science*.