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Can machine learning reduce the number of anode readouts for reconstruction coincident single photon in CDIR resistive sea photon detectors?

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This study focuses on exploring the potential of Charge Division Imaging Readout (CDIR) for MCP based resistive sea photon detectors. CDIR spreads the MCP charge footprint capacitively between readout nodes forming anode segments. Charge measurements at each node are then used to reconstruct incident photon's position and time.

A primary objective is to investigate the minimum number of anode segmentations necessary, to allow successful reconstruction of multiple photons within a given time interval where pile up would be an issue for traditional approaches. Allowing for optimisation of the anode structure, segmentation and readout scheme for improved distortion, timing, or rate capability.

Algorithmic and machine learning techniques will be compared and utilised to reconstruct spatial positions of multiple photons, while considering computational efficiency. The comparison will aim to determine whether machine learning reduces the required number of readout nodes for successful reconstruction, in comparison to traditional algorithmic methods, and will investigate if machine learning techniques can be utilised to correct for algorithmic systematic errors to provide a more robust system.

This investigation holds promise for improving the computational efficiency and overall performance of single photon detectors particularly for coincident single photon detection, opening new possibilities for advancements in fields such as quantum physics, particle physics, and biomedical imaging.

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