

Fast-Timing Detector through Redshifted Cherenkov Radiation

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This study explores advancements in Time-of-Flight PET (TOF-PET) technology, specifically focusing on Red-shifted Cherenkov Radiators (RCR) to enhance time resolution in radiation detectors. TOF-PET utilizes radiotracers labeled with positron-emitting radionuclides to track biological targets, aiding in diagnosis, treatment planning, and therapeutic monitoring. Recent hardware, radiotracer, and image analysis advancements have expanded TOF-PET's clinical applications. This study concentrates on the development of RCRs to further improve TOF-PET capabilities. Evaluation of solvents—ODE, CHCl₃, DMSO—reveals ODE's superior UV transparency. The addition of POPOP dopant in ODE significantly enhances the detection of Cherenkov photons, demonstrating the potential of RCR. Time-correlated single photon counting (TCSPC) analysis indicates that RCR detectors offer competitive time responses compared to pure Cherenkov detectors. Coincidence measurements with LYSO detectors demonstrate favorable Coincidence Time Resolutions (CTR) for RCR detectors. These findings offer insights into the optimization of RCRs, suggesting their role in advancing TOF-PET imaging for enhanced diagnostic accuracy and therapeutic monitoring.

Field

Detectors and electronics

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