

Comparative Analysis of Novel Time-Walk Correction Methods for Metascintillators

Tuesday, 21 May 2024 12:20 (20 minutes)

Development of novel scintillator materials and effective Time-Walk Correction (TWC) methods aim to improve coincidence time resolutions (CTRs) in Time-of-Flight Positron Emission Tomography (ToF-PET) systems. This study introduces an innovative approach using metascintillators coupled with advanced photodetector technologies to address the limitations of time-walk effects on CTR. We evaluated Linear (L-), Differential (D-), and Hyperbolic (H-) TWC strategies, focusing on their impact on enhancing CTR in ToF-PET applications. The H-TWC method aims to mitigate long-tailed coincidence time distributions, thus leading to a more standardized Gaussian distribution and improving the CTR.

Our experimental setup employed $3 \times 3 \text{ mm}^2$ NUV-HD-MT photodetectors from Fondazione Bruno Kessler (FBK) coupled with $3 \times 3 \times 5 \text{ mm}^3$ LYSO:Ce,Ca reference crystals and novel $3 \times 3 \times 15 \text{ mm}^3$ BGO-EJ232 metascintillator heterostructures. Results indicate that while all the TWC methods do not improve the CTR values on the reference crystals measurements, the H-TWC demonstrates improvements from 50 ps up to 60 ps when metascintillator pixels are used. Our findings indicate that while L-TWC and D-TWC methods demonstrate similar improvements, the hyperbolic approach significantly enhances CTR values by effectively neutralizing heavy-tailed distributions.

Field

Software and quantification

Primary author: LATELLA, Riccardo (Universidad Politécnic de Valencia)

Co-authors: GONZALEZ, Antonio (Institute for Instrumentation in Molecular Imaging, i3M-CSIC); KONSTANTINOU, Georgios (EPFL); LECOQ, Paul

Presenter: LATELLA, Riccardo (Universidad Politécnic de Valencia)

Session Classification: Scintillators for fast timing

Track Classification: Fast timing