Docket #: S22-317

Novel Electronic Readout for a 100 ps CTR PET Detector with 24:1 Multiplexing Ratio of Timing Channels

Stanford researchers have developed a compact, scalable electronic readout that can multiplex 24 or more fast outputs of each 6x4 SiPM array to only 1 timing channel per detector layer unit. It can do this while maintaining ~100 ps CTR, which can potentially support the world's best CTR TOF-PET system.

Current PET medical imaging systems use large numbers of silicon photomultipliers (SiPMs) to obtain high resolution results and a good time of flight (TOF) performance. This creates a need for effective and scalable multiplexing readout approaches to reduce the number of electronic channels. Most multiplexing methodologies degrade the fast-timing capabilities necessary for TOF-PET.

This novel technology saves resources and reduces complexity without degrading the CTR performance. If successful, a TOF-PET system with 100 ps CTR enables substantial boost in reconstructed image signal-tonoise ratio compared to state-of-the-art TOF-PET systems.

Stage of Development
Proof-of-Concept

Figure

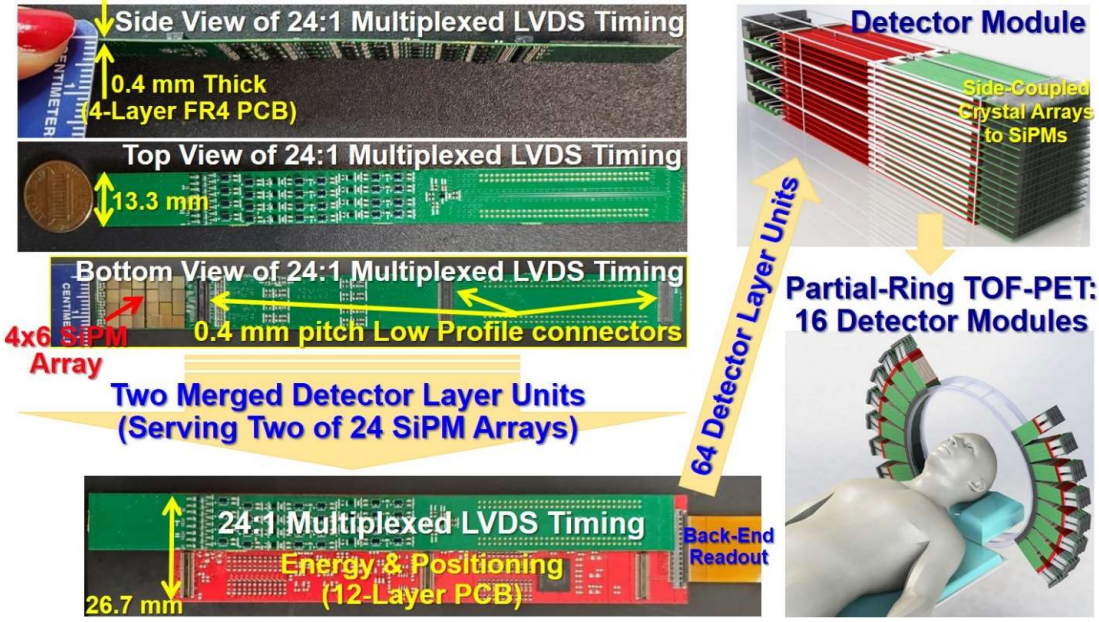


Figure description- Scalable mixed-signal electronic readout scheme for our proposed TOF-PET detectors.
Image credit: https://iopscience.iop.org/article/10.1088/1361-6560/abf1bc

Applications

- **TOF-PET scanners**
- Other applications include:
  - Autonomous vehicle
  - Object detection
  - Active pedestrian safety
  - Robot navigation
  - People counting
  - Other products that employ timing measurements using multiple sensors

Advantages

- Higher multiplexing ratio than current best available systems
- Higher CTR than current best available systems
- Over 40% signal-to-noise ratio improvement relative to Siemens Biograph Vision TOF-PET scanner

Publications

- Pourashraf, Shirin, Andrea Gonzalez-Montoro, Jun Yeon Won, Min Sun Lee, Joshua W. Cates, Zhixiang Zhao, Jae Sung Lee, and Craig S. Levin. "Scalable electronic readout design for a 100 ps coincidence time resolution TOF-PET system." Physics in Medicine & Biology 66, no. 8 (2021): 085005.

Patents

- Published Application: WO2024102854
- Published Application: 20260205329

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