

Master Theses in Electrical Engineering

Ultrafast TI-LGAD-based array detector for photon science applications

Thesis description:

Description:

Trench-Isolated Low-Gain Avalanche Diodes (TI-LGADs) represent a cutting-edge detector technology enabling ultrafast timing and high spatial resolution measurements. These devices are revolutionizing fields such as high-energy physics, photon science, beam diagnostics, and advanced accelerator instrumentation. In photon science, techniques like nuclear resonant scattering and time-resolved X-ray experiments could achieve an unprecedented level of precision through detectors based on TI-LGAD technology. Ongoing developments at KIT have already led to the design and successful fabrication of the first single-sensor prototype.

Thesis Objective:

The aim of this master's thesis is to develop FPGA firmware capable of managing up to four parallel TI-LGAD detector systems, implementing precise timing synchronization between channels, and integrating the system with a Petalinux-based control and readout algorithm. The work will involve both hardware-software co-design and full integration of the detector array, ensuring reliable data acquisition and real-time processing. The student will design and implement firmware for ZYNQ sUltraScale+ (US+) devices, focusing on low-latency readout, precise timing alignment, and deterministic synchronization across multiple detectors.

The student will acquire expertise in FPGA firmware design, Petalinux development, hardware-software integration, and high-performance detector systems. This thesis offers a unique opportunity to collaborate with experts from KIT, DESY, and ESRF, contributing to state-of-the-art detector instrumentation for cutting-edge research.

If you have a passion for electronics, FPGA programming, and photon science, this project provides a rare chance to combine advanced technology development with real-world experimental applications.

Duration: minimum 6 months, starting date: soon

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