Characterization of Readout Integrated Circuits (ROIC) for InGaAs-based SPAD arrays

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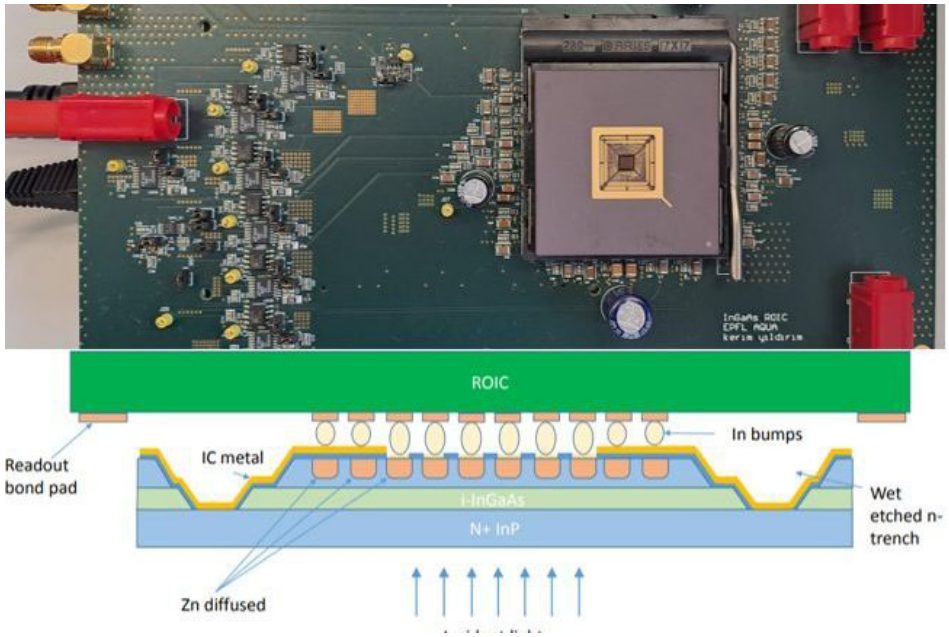
Project Type: *Master/Semester Project*
Location: *Microcity, Neuchatel*
Start Date: *Flexible*

Description:

Single-photon sensitivity, picosecond temporal resolution and CMOS integration makes single-photon avalanche diode (SPAD) arrays desirable for 3D imaging applications including light detection and ranging (LiDAR), fluorescent lifetime imaging (FLIM), quantum key distribution (QKD) and positron emission tomography (PET). InGaAs/InP based SPADs are promising to be used in longer wavelengths for which silicon based SPADs are inefficient due to their higher bandgap. On the other hand, using InGaAs/InP detectors instead of CMOS integrated SPADs brings challenges including 3D integration and higher noise.

At AQUA lab we are developing a hybrid sensor which consists of a CMOS readout integrated circuit (ROIC) bonded to InGaAs/InP SPADs to be used for various 3D imaging applications. The project focuses on the setup of the testing environment of the ROIC which includes the printed circuit board (PCB) and FPGA coding. This will be followed by measurements with the 3D bonded sensor to characterize the SPAD array and imaging experiments. The project can be adapted as a semester project or a master's thesis.



Tasks:

- Literature review to understand the principles of SPADs and readout circuits.
- Design of a new PCB for the ROIC taking the previous one as a reference.
- FPGA firmware design using Verilog/VHDL to control the ROIC and test its functionality.
- SPAD array characterization, LiDAR/3D imaging measurements.