PhD in: Electrical, Electronics and Communication Engineering

Research Title: High-voltage, fully depleted CMOS sensors for radiation detection

Funded by	Istituto Nazionale di Fisica Nucleare (INFN)

Supervisor	Angelo Rivetti, Giovanni Mazza

Contact	https://wiki.to.infn.it/doku.php?id=vlsi:home

Context of the research activity	The National Institute for Nuclear Physics (INFN), operating under the ministry of education and research (MIUR), is the Italian research agency in charge of studying the fundamental constituents of matter and the physical laws that govern them. To fulfill its mission, INFN needs to develop novel radiation detectors, based on customized sensors and dedicated front-end electronics. CMOS sensors, such those used in cell-phone cameras, are in principle an attractive options to realize also charged particle and X-ray detectors. However, in many applications, the needs to achieve fast timing and/or radiation tolerance make a prompt collection of the charged deposited by the impinging radiation mandatory. The use of a sufficiently high electric becomes thus necessary. The design of such High-voltage CMOS sensors is currently a very intensive line of research. In this context, INFN has developed prototype CMOS sensors targeting a bias voltage greater than 100 V and full depletion of the wafer substrate. A second run of prototypes is planned soon. The following steps will involve the detailed characterization of the sensors and the study of improved sensor geometries through the use of device level simulators. Optimized front-end electronics capable of taking full advantage of the sensor properties must also be developed. This position is funded thanks to an agreement between INFN and the Chinese Institute of High-Energy Physics and reserved to Chinese Nationals.

Objectives	The primary objective of the research activity is the development of novel high-voltage CMOS sensors capable of working in full-depletion.

The project involves two key aspects. The first one is the optimization of the sensor performance, through device-level simulator like TCAD.

The second aspect is the design of optimized analog front-end electronics, capable of taking full advantage of the sensor performance, such as the very low capacitance of the collection electrode and the fast signal collection time. |

Skills and competencies for the development of the activity	The candidate should have at least a basic knowledge of CMOS processes and good computing skills. Previous expertise with device-level simulators and analog design tools is an advantage.