

ELECTRICAL, ELECTRONICS AND COMMUNICATIONS ENGINEERING

INFN - Development and characterisation of ultra-low power monolithic CMOS imagers of X-ray, Gamma and Charge particles

Funded By	ISTITUTO NAZIONALE DI FISICA NUCLEARE [Piva/CF:04430461006]
Supervisor	DA ROCHA ROLO MANUEL DIONISIO - manuel.rollo@polito.it
Contact	
Context of the research activity	A new generation of monolithic CMOS sensors, capable of fully depletion over several hundreds of microns using high-resistivity silicon substrates, will allow for the development of novel ultra-low power CMOS sensors to be used for charged particles, gamma and X-ray detection in science and in medical and industrial applications.
Objectives	Fully-depleted CMOS sensors integrate sensor, readout and processing electronics in the same fully-depleted silicon substrate, and represent a significant step forward in radiation detection, combining the advantages of monolithic active pixel sensors with the enhanced signal collection efficiency of depleted bulk materials. The technology represent a very competitive solution when compared to the traditional hybrid pixel or micro-strip detectors, allowing for significant potential gains in terms of performance, increased robustness and lower production costs. The research will focus on the development of thick high-resistive silicon fully-depleted CMOS sensors, targeting novel CMOS imagers with very high dynamic range and ultra-low power consumption. The fields of applications range from basic science to medical instruments for proton, X-ray, molecular and nuclear imaging. The key challenges are extending the depletion beyond what achieved in previous developments (400 um) and design ultra-low power and high dynamic range read-out electronics that allows to fully exploit the sensor properties. The candidate will participate to the design activities and characterisation of system-grade monolithic CMOS sensors using radioactive sources, particle beams and state-of-the art X-ray irradiation setups allowing for micrometrical spatial resolution.
Skills and competencies for the development of the activity	The skills necessary to tackle the research activity can be acquired during the PhD, provided that the candidate has a solid background in electrical engineering and/or physics. Knowledge of standard programming languages (C++, Python) is highly appreciated. Previous expertise in analog and/or digital circuit design and sensor simulations with TCAD will be a plus.

