

Expression of interest for research cooperation in Horizon 2020

Description of institution

Interested institution:	AGH University of Science and Technology
Department carrying out the proposed research	Department of Measurements and Electronics ASIC Design Group
Adress and webpage	http://www.kmet.agh.edu.pl/katedra-metrologii/zespoly-badawcze/asics/
Contact person (name, e-mail address, phone)	dr hab. inż. Robert Szczygieł, prof. AGH, robert.szczygiel@agh.edu.pl, (+48 12) 617-32-99

Research offer

Brief description of the department (key research facilities, infrastructure, equipment)

A Microelectronics Group is located in the Department of Measurements and Electronics and is involved in many projects which are based on design of integrated electronics ASICs. Our group has experience in different types of ASIC technologies, i.e. CMOS 350nm, 180nm, 130nm, down to 40nm and also in 3D technology (for details please see <http://www.kmet.agh.edu.pl/katedra-metrologii/zespoly-badawcze/asics/?lang=en>).

We do have constant access to both the software for ASIC design (Cadence and Mentor packages) and laboratory for integrated circuit testing including:

- probe station Alessi with sets of micromanipulators and active probe for testing naked integrated
- circuits,
- wire bonding facility (Kulicke & Soffa Digital Wire Bonder 4500),
- X-ray generator with step motors,
- femtosecond laser with pulse picker,
- Network Spectrum Analyzer HP4195, Semiconductor Parameter Analyzer, RLC meter Agilent 20 Hz -2 MHz,
- Keithley for measurements of extremely low currents,
- National Instruments based different types of complete test stations based on PXI, etc.

Scientific area

<input type="checkbox"/> Chemistry	<input type="checkbox"/> Social Sciences and Humanities
<input type="checkbox"/> Economic Sciences	<input type="checkbox"/> X Information Science and Engineering
<input type="checkbox"/> Environment and Geosciences	<input type="checkbox"/> Life Sciences
<input type="checkbox"/> Mathematics	<input type="checkbox"/> Physics

Research field

The research activities of the group focus mainly on the development of multichannel readout ASICs for neurobiology, X-ray imaging and high energy physics applications and in the last two years also in RF designs. The common features of these ASICs are:

- multichannel architecture and good matching,
- low power and low silicon area per single channel,
- mixed-mode architecture with data compression,
- low noise, crosstalk minimization,
- new solutions using deep submicron technology.

The proposed research/project description

The aim of this project is the exploration and realization of a new concept of hybrid pixel detectors for X-ray imaging operating in a single photon counting mode. The detector should both have a high position resolution and allow to obtain spectrometric information about incoming photons. Additionally, detector will be able to operate with high intensity of incoming X-ray photons and register the X-ray photons from wide energy range. Satisfying above requirements, detector will allow fast digital X-ray colour imaging which is especially important in medical imaging.

As it comes to the scientific project site, the Microelectronics Group members perceive that there is a known and still unsolved problem regarding image quality (dynamic range, noise, charge sharing, additional background unwanted X-ray radiation) and high processing speed of single photon counting systems. These types of detectors are necessary to develop new techniques used in X-ray imaging which are currently limited. Namely, these detectors could be used in different synchrotron facilities where new scientific methods in experimental science (like X-ray Photon Correlation Spectroscopy, many flavours of X-Ray Fluorescence Spectroscopy, Ptychography etc.) are going to be used to answer principal questions of matter structure and conversion processes in different materials. However, the power of these X-ray sources can not be fully used as current detectors suffer from a lack of high resolution very fast single photon counting systems. Also, there are many techniques in medical imaging like computer tomography, bone densitometry and mammography, etc., which can profit a lot if a detection system with high position resolution and multiple energy X-ray imaging comes into a daily practice. This however could be realized if new detectors of abovementioned requirements were developed.

Additional information (key Persons and Expertise; additional trainings, research programme, other)

The Microelectronics Group has large experience in project of both nature the scientific and industrial. The brief description of our main activities can be found in the following web link:
<http://www.kmet.agh.edu.pl/katedra-metrologii/zespoly-badawcze/asics/asic-badania-naukowe/?lang=en>