The aim of the project is to develop a new, ultra-low power, low-noise, and highly uniform solutions for analog and analog-to-digital blocks in the latest nanotechnologies for the next generation of biomedical experiments (both neurobiology and X-ray imaging based). The additional requirement is a small area of analog and analog-to-digital blocks, as well as their resistance to PVT (Process-Voltage-Temperature) changes. Additionally, because the existing nanotechnologies have been optimized to increase digital circuits performance, reduce its size, cost and power consumption at the same time there is a need to find solutions allowing for using these technologies to implement high performance analog circuits. These solutions are essential as analog signal conditioning is fundamental for interfacing with world around us while using different kind of sensors. Furthermore, as the modern experiments demand systems combining hundreds/thousands of recording sites, the amount of data transmitted from it may reach easily a tens of Gb/s. Thus, there is a need to develop a system equipped with the blocks responsible for data compression to both meet power requirements and to transmit valuable data. Therefore, the project aims to work on solutions fully exploiting nanotechnologies potential that are essential for the future generation of microsensor matrices parallely processing analog signals received from large amount of detectors. The designed integrated circuit will be tested in a complete multichannel system.

The solutions developed as part of the project will not only be used for microsensor matrices, but also in mobile battery-powered devices or those receiving energy from the outside world in a variety of bio-implants (especially those powered wirelessly, which in turn will allow further miniaturization), as well as in complex SoC systems, whose further development and scaling is limited by the parameters of the analog blocks. The world of living organism processes the information in the analog way and using nanotechnology with transistors in subthreshold range allows to derive patterns regarding ways of processing information from the world of biology. The results of the project will provide answers to many unsolved problems connected with the design of analog and mixed-mode circuits in nanotechnologies and they will show new solutions that effectively harness the capabilities of modern nanotechnologies. The results of the project will be presented at important international conferences and regular journals from ISI Master Journal List.

The project author reflects the view that in terms of power consumption, in many cases analog solutions for today's nanotechnologies may be more effective than digital ones. Also, they can fulfill the requirements for speed associated with parallel signal processing in large microsensor matrices. Systems that receive and process information in parallel with the outside world must be based on analog low-power solutions at input stages. Needless to say, such solutions with reasonably low noise and resistant to fluctuations in the PVT presently do not exist.