Session 10: Display and Imaging Systems – Focus Session: Novel Imagers and Specialty Imaging Applications
Tuesday, December 16, 9:00 a.m.
Continental Ballroom 1-3
Co-Chairs: Daping Chu, University of Cambridge
Piet De Moor, IMEC

9:05 a.m.
10.1 Jot Devices and the Quanta Image Sensor (Invited), J. Ma, D. Hondongwa and E. Fossum, Thayer School of Engineering at Dartmouth

The Quanta Image Sensor (QIS) concept and recent work on its associated jot device are discussed. A bipolar jot and a pump gate jot are described. Both have been modelled in TCAD. The pump gate jot features a full well of 200 e- and conversion gain exceeding 300 uV/e-.

9:30 a.m.
10.2 SPAD Based Image Sensors, E. Charbon, Senior Member IEEE

The recent availability of miniaturized photoncounting pixels in standard CMOS processes has paved the way to the introduction of photon counting in low-cost time-of-flight cameras, robotics vision, mobile phones, and consumer electronics. In this paper we describe the technology at the core of this revolution: single-photon avalanche diodes (SPADs) and the architectures enabling SPAD based image sensors. We discuss tradeoffs and design trends, often referring to specific sensor chips and applications.

9:55 a.m.
10.3 Toward 1Gfps: Evolution of Ultra-high-speed Image Sensors: ISIS, BSI, Multi-Collection Gates, and 3D-stacking, T.G. Etoh, V.T.S. Dao, K. Shimonomura, E. Charbon, C. Zhang*, Y. Kamakura and T. Matsuoka**, Ritsumeikan University, *Technical University of Delft, **Osaka University

Evolution of ultra-high-speed image sensors toward 1 Giga fps is presented with innovative technology to achieve the frame rate. The current highest frame rate is 16.7Mfps. A new sensor structure and a new driver circuit are proposed. Simulations prove that they further reduce the frame interval to 1ns.

10:20 a.m.
10.4 Imaging with Organic and Hybrid Photodetectors (Invited), S. Tedde, P. Buechele, R. Fischer, F. Steinbacher, O. Schmidt, Siemens AG

10:45 a.m.
10.5 A CMOS-compatible, Integrated Approach to Hyper- and Multispectral Imaging, A. Lambrechts, P. Gonzalez, B. Geelen, P. Soussan, K. Tack and M. Jayapala, Imec

Imec has developed a process for the monolithic integration of optical filters on top of the CMOS imager sensors, leading to compact, cost-efficient and faster hyperspectral cameras with improved performance. To demonstrate the versatility of imec hyperspectral technology, prototype sensors with different filter arrangements and performance have been successfully fabricated.

11:10 a.m.
10.6 Image Sensors for High-throughput, Massively-parallel DNA Sequencing: Requirements and Roadmap, A. Grot, Pacific Biosciences

The cost of DNA sequencing has dropped significantly over the last decade, due in part to advances in high performance CCD and CMOS image sensors. Key performance specifications – such as resolution, sensitivity, and frame-rate, along with the performance improvements necessary for continued cost reduction – will be discussed.

11:35 a.m.
10.7 High Performance Silicon Imaging Arrays for . . .

12:00 p.m.

10.8 Detecting elementary particles using Hybrid Pixel Detectors at the LHC and beyond, M. Campbell, CERN

On July 4th 2012 CERN announced the discovery of the Higgs Boson at the Large Hadron Collider. Englert and Higgs were awarded the Noble Prize for Physics in 2013 for postulating the existence of the boson along with Brout (now deceased) in 1964. The discovery was made possible by the combination of a machine capable of accelerating protons to unprecedented energies, and two huge detectors, called Atlas and CMS, able of record unambiguously the energy and location of the particle tracks produced by the collisions. Every 50ns bunches of protons are made to collide in the heart of the giant experiments and around 20-30 proton interactions take place generating thousands of debris particles. In searching for the Higgs boson, the particles participating in a given interaction need to be detected and tagged to a given bunch crossover (BCO). The innermost regions of the experiments are equipped with hybrid pixel detectors. This paper will provide a brief overview of the large scale hybrid pixel detector systems used at the LHC experiments. It will also describe how the same hybrid pixel detector approach is used in applications beyond high energy particle physics.