



2013 INTERNATIONAL IMAGE SENSOR WORKSHOP

Snowbird Resort, Utah, USA

June 12-16, 2013

PROGRAM

Thursday, June 13, 2013

8:30 - 8:45 Welcome and Opening
Eric R. Fossum, Co-Chair and President, IISS
Boyd Fowler, Co-Chair

Session 01 Pixel Technology Overview and Small Pixel Sensors
 Session chair: Nobukazu Teranishi (University of Hyogo / Shizuoka University)

08:45 – 09:00 Innovative Technology Elements for Large and Small Pixel CIS Devices
 01.01 *Ray Fontaine, Technology Analysis Group, Chipworks, Inc. Ottawa, Canada.*

09:00 – 09:15 Blooming and Antiblooming in 1.1um-Pixel CIS
 01.02 *Calvin Chao, Kuo-Yu Chou, Charles Liu, Yi-Che Chen, Hon-Yih Tu, Hsiu-Yu Cheng, Fu-Lung Hsueh, and Shou-Gwo Wuu, Taiwan Semiconductor Manufacturing Company, Hsinchu, Taiwan.*

09:15 – 09:30 Development of Lensed Color Filter Technology for Higher SNR and Lower Crosstalk CMOS Image Sensor
 01.03 *Hong-Ki Kim, Bumsuk Kim, Jung-Saeng Kim, *Jungkuk Park, Yooseung Lee, Taesub Jung, Kyungho Lee, Heegeun Jung, Chang-Rok Moon, JungChak Ahn, Goto Hiroshige, Chi-Young Choi and Duckhyung Lee; LSI Product & Technology, System LSI Division, Samsung Electronics Co., Ltd.; *Color Filter Technology Group, System LSI, Division, Samsung Electronics Co., Ltd, Yongin-City, Gyeonggi-Do, Korea.*

09:30 – 09:45 Architecture and Development of Next Generation Small BSI Pixels
 01.04 *H. Tian, H. Komori, G. Agranov, J. Bai, J. Hyneczek, C. Baron, H-W. Lee, X. Zhao, W. Gazeley, D. Tekleab, S. Nagaraja, W. Gao, P. Adepu, V. Rajasekaran, A. Rayankula, U. Boettiger, M. Mooney, B. Vaartstra, Aptina Imaging, San Jose, CA, USA.*

09:45 – 10:10 Break

Session 02 Imaging Process and Specialty Pixels
 Session co-chairs: Shou-Gwo Wuu (TSMC),
 Jungchak Ahn (Samsung)

10:10 – 10:25 Fundamental Ion Implantation Technologies for Image Sensor Devices
 02.01 *G. Fuse, and M. Sugitani SEN Corporation, Saijo, Japan.*

- 10:25 – 10:40 The Impact of Gate Edge Damage on Pixel Read Noise
02.02 *Jhy-Jyi Sze, R.J. Lin, Seiji Takahashi, J.M. Hung, Y.C. Lu, T.H. Tseng, C.C. Wang, S.F. Ting, and Shou-Gwo Wu, Taiwan Semiconductor Manufacturing Company, Taiwan, R.O.C.*
- 10:40 – 10:55 Photolithographic Solutions for Image Sensors with High Pixel Density
02.03 *Ryo Sasaki, Yuhei Sumiyoshi, Yasuo Hasegawa and Seiya Miura, Canon Inc., Tochigi, Japan.*
- 10:55 – 11:10 Dark Current Reduction in Image Sensors through Metals Gettering:
02.04 A Critical Review of Disruptive Techniques
Venkataramana R. Chavva, Kyu-Ha Shim, and Todd Henry, Applied Materials.—, Varian semiconductor Equipment, Gloucester, MA, USA.
- 11:10 – 11:25 The DUV Stability of Superlattice-doped CMOS Detector Arrays
02.05 *M. E. Hoenk, A. G. Carver, T. Jones, M. Dickie, P. Cheng, F. Greer, S. Nikzad (Jet Propulsion Laboratory, California Institute of Technology, CA, USA), J. Sgro (Alacron, Inc., Nashua, NH, USA), S. Tsur (Applied Materials Inc., Process, Diagnostics & Control, Rehovot, Israel).*
- 11:25 – 11:40 High Quantum Efficiency Back Illuminated Photon Counting, Far UV, UV,
02.06 and Visible Detector Arrays and their High Throughput Fabrication
Shouleh Nikzad, M. E. Hoenk, A. Carver, T.J. Jones, F. Greer, E. Hamden, and T. Goodsall, Jet Propulsion Laboratory, California Institute of Technology, USA.
- 11:40 – 13:10 Lunch

Session 03	Specialty Pixels and Application Specific Imagers Session co-chairs: Daniel Van Blerkom (Forza Silicon), Vyshnavi Suntharalingam (MIT Lincoln Labs)
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- 13:10 – 13:25 A 240x180 120dB 10mW 12us-latency Sparse Output Vision Sensor
03.01 for Mobile Applications
Raphael Berner, Christian Brandli, Minhao Yang, Shih-Chii Liu and Tobi Delbruck, Inst. of Neuroinformatics, University of Zurich and ETH Zurich, Zurich, Switzerland.
- 13:25 – 13:40 Two-color Indirect X-ray Photon Counting Image Sensor
03.02 *Bart Dierickx, Stijn Vandewiele, Benoit Dupont, Arnaud Defernez, Nick Witvrouwen, Dirk Uwaerts, Caeleste, Antwerp, Belgium.*
- 13:40 – 13:55 Fully Organic Integrated Arrays on Flexible Substrates for X-Ray Imaging
03.03 *Pawel E. Malinowski¹, Abhishek Kumar², Date J.D. Moet², David Cheyns¹, Barry P. Rand¹, Jan-Laurens P.J. van der Steen², Kris Myny¹, Soeren Steudel¹, Matthias Simon³, Gerwin Gelinck², and Paul Heremans^{1,2}; ¹IMEC, Leuven, Belgium; ²Holst Centre, Eindhoven, The Netherlands, ³Philips Research, Eindhoven, The Netherlands.*

13:55 – 14:10 MEM-FLIM, a CCD Imager for Fluorescence Lifetime Imaging Microscopy
03.04 *Jan Bosiers, Harry van Kuijk, Wilco Klaassens, René Leenen, Willem Hoekstra, Walter de Laat, Agnes Kleimann, Inge Peters, Jan Nooijen, Qiaole Zhao¹, Ian Ted, Young¹, Sander de Jong², Kees Jalink³, Teledyne DALSA Professional Imaging, The Netherlands, ¹Delft University of Technology, Delft, NL; ²Lambert Instruments, Roden, NL; ³Netherlands Cancer institute, Amsterdam, NL.*

14:10 – 14:25 A Direct-Detection X-Ray Cmos Image Sensor with 500 μm Thick High
03.05 Resistivity Silicon
T. Hatsui^{1,2}, M. Omodani², T. Kudo¹, K. Kobayashi^{1,2}, T. Imamura³, T. Ohmoto³, A. Iwata³, S. Ono¹, Y. Kirihara¹, T. Kameshima², H. Kasai⁴, N. Miura⁴, N. Kuriyama⁴, M. Okihara⁵, Y. Nagatomo⁵, M. Nagasaki⁶, T. Watanabe⁷, Makina Yabashi^{1,2}, ¹RIKEN Spring-8 Center, ²JASRI, ³A-R-Tec Corp., ⁴LAPIS Semiconductor Miyagi Co., Ltd., ⁵LAPIS Semiconductor Co., Ltd., ⁶ARKUS Inc, ⁷University of Hyogo, Japan.

14:25 – 14:40 A FSI CMOS Image Sensor with 200-1000 nm Spectral Response and
03.06 High Robustness to Ultraviolet Light Exposure
Rihito Kuroda, Shun Kawada, Satoshi Nasuno, Taiki Nakazawa, Yasumasa Koda, Katsuhiko Hanzawa and Shigetoshi Sugawa, Graduate School of Engineering, Tohoku University, Miyagi, Japan.

14:40 – 15:05 Break

Session 04	Noise. Session chair: Tetsuo Nomoto (SONY)
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15:05 – 15:20 Read Noise Distribution Modeling for CMOS Image Sensors
04.01 *Boyd Fowler, Dan McGrath, and Peter Bartkovjak, BAE Systems Imaging Solutions, Milpitas, CA 95035 USA.*

15:20 – 15:35 Novel Device with Ultra Low Noise for Smaller CMOS Image Sensor Pixel
04.02 *T.H. Hsu, Shou-Gwo Wu, D.N. Yang, J.C. Liu, H.H. Tseng, W.D. Wang, W.C. Hsu, W.I. Hsu, T.J. Wang, Y.L. Tu, C.S. Tsai, W.P. Mo, C.E. Chen Taiwan Semiconductor Manufacturing Company, Tainan, Taiwan, R.O.C.*

15:35 – 15:50 New Model of Dark Fixed Pattern Noise Generation in CMOS Imager
04.03 Pixel with Negative Transfer-Gate Bias Operation
H. Sasaki, Y. Higashi, H. Yamashita, T. Yoshida, N. Momo, T. Ohguro, H. S. Momose, and Y. Toyoshima, Toshiba Corporation, Yokohama, Japan.

15:50 – 16:05 Emission Microscopy analysis of hot cluster defects of imagers processed on SOI
04.04 *G. Meynants, W. Diels, J. Bogaerts, W. Ogiers, CMOSIS, Antwerp, Belgium.*

16:05 – 16:30 Break

Session 05	Poster Flash Presentations
16:30 – 17:30	Session chair: Bart Dierickx (Caeleste)

- 05.01 Feed-Forward Voltage in CMOS Pinned Photodiodes
Mukul Sarkar (Indian Institute of Technology Delhi), Bernhard Büttgeny (Mesa Imaging), and Albert J.P. Theuwissen (University of Technology Delft/Harvest Imaging).
- 05.02 1280x1024 Logarithmic Snapshot Image Sensor with Photodiode in Solar Cell mode
Yang Ni, New Imaging Technologies SA, France.
- 05.03 New Monolithic CMOS Sensors on a Fully Isolated Substrate
Abderrezak Mekkaoui, Dario Gnani, Maurice Garcia-Sciveres, Lawrence Berkeley National Laboratory, Berkeley, CA, USA.
- 05.04 Logarithmic Image Sensor for Wide Dynamic Range Stereo Vision System
*Christian Bouvier,
Yang Ni, New Imaging Technologies SA, France.*
- 05.05 Segmented-base CMOS Image Sensor for Machine Vision Application
*Tomohiro Yamazaki, Toshinori Otaka and Takayuki Hamamoto
Tokyo University of Science, Tokyo, Japan.*
- 05.06 1.1um Back-Side Illuminated Image Sensor Performance Improvement
*Chi Han_Lin^{1(a)}, Chih-Kung Chang¹, Yu-Kun Hsiao¹, Yueh-Ching Cheng¹
Chih-Cherng Jeng², Kuo-Cheng Lee², Chun-Hao Chou², Yi-Yi Cheng²,
Yen-Hsung Ho², Yin-Chieh Huang², Chin-Chuan Hsieh¹;
¹VisEra Technologies Company, Hsinchu Science Park, Taiwan; ²: Taiwan
Semiconductor Manufacturing Company, Hsinchu Science Park, Taiwan.*
- 05.07 CF/ML Shift Optimization for Small Pixel CMOS Image Sensor through FDTD Simulation
*Wu-Cheng Kuo¹, Wei-Chieh Chiang², Ren-Jie Lin², Yu-Kun Hsiao¹, Jen-Cheng Liu²,
Tsung-Hao Lin¹, Hui-Min Yang¹, D.N. Yaung², and Shou-Gwo Wu², Chin-Chuan Hsieh¹
¹VisEra Technologies Company, Hsinchu Science Park, Taiwan
²Taiwan Semiconductor Manufacturing Company, Hsinchu Science Park, Taiwan.*
- 05.08 The Image Quality Standard based on Human Visual System for the Spectral Sensitivity Crosstalk Depending on Lens F-number
*Kazuyuki Matsushima, Masaaki Sato, Shinichiro Saito, Sony Corporation,
Tokyo, Japan.*
- 05.09 Application Demonstration Of Polarization-Analyzing CMOS Image Sensor and Performance Improvement Using 65 nm Standard CMOS Process
*Takashi TOKUDA, Norimitsu WAKAMA, Toshihiko NODA, Kiyotaka SASAGAWA,
Kiyomi KAKIUCHI, and Jun OHTA, Graduate School of Materials Science, Nara
Institute of Science and Technology, Nara, Japan.*

- 05.10 Image Sensor Performance from a Security Camera Perspective
Anders Johannesson and Henrik Eliasson, Axis Communications AB, Lund, Sweden.
- 05.11 A Passive Integrator to Achieve Low Power, Low Noise Signal Amplification
Yannick De Wit, ON-Semiconductor, Mechelen, Belgium.
- 05.12 BSI Low Light Level CMOS Image Sensor Employing P-type Pixel
*John Tower, James Janesick, Thomas Senko, Peter Levine, Mark Grygon, James Andrews, Judy Zhu, Thomas Vogelsong, SRI International, Princeton, NJ, USA
Guang Yang, Steven Huang, Chao Sun, Barmak Mansoorian, Forza Silicon Corporation, Pasadena, CA, USA.*
- 05.13 A Low Power Counting Method in Ramp ADCs used in CMOS Image Sensors
Cheng Ma, Xinyang Wang, ChangChun Institute of Optics, Fine Mechanics and Physics, Chinese Academy of Science, Changchun, China.
- 05.14 Single Slope ADC with On-chip Accelerated Continuous-time Differential Ramp Generator for Low Noise Column-Parallel CMOS Image Sensor
Dexue Zhang, Rami Yassine, Loc Truong, Jeff Rysinski, Daniel Van Blerkom and Barmak Mansoorian, Forza Silicon Corporation, Pasadena, CA, USA.
- 05.15 Division-of-Focal-Plane Spectral-Polarization Imaging Sensor
Viktor Gruev, Meenal Kulkarni, Department of Computer Science and Engineering, Washington University in Saint Louis, Saint Louis, MO, USA.
- 05.16 Simple Technique to Reduce FPN in a Linear-Logarithm APS
Carlos A. de Moraes Cruz^()(**), Davies W. de Lima Monteiro^(***), Gilles Sicard^(****) and Alexandre K. P. Souza^(*), ^(*)Department of Electronics and Computation, Universidade Federal do Amazonas, Manaus, AM, Brazil; ^(**)Graduate Program in Electrical Engineering - Federal University of Minas Gerais, Belo Horizonte, MG, Brazil; ^(***)Department of Electrical Engineering, DEE/PPGEE, Universidade Federal de Minas Gerais, Belo Horizonte, MG, Brazil; ^(****)TIMA Laboratory, CNRS, Grenoble INP, Grenoble, France.*
- 05.17 Reduction of Motion Blur in CMOS Linear Arrays and TDI Imagers
Benoit Dupont, Bart Dierickx, Caeleste, Antwerp, Belgium.
- 05.18 Column-Parallel Architecture for Line-of-Sight Detection Image Sensor based on Centroid Calculation
Hayato Kawakami, Satori Igarashi, Yuta Sasada, Junichi Akita, School of Electrical and Comp. Eng., Kanazawa University, Kanazawa, Ishikawa, Japan.
- 05.19 Image Lag Analysis and Photodiode Shape Optimization of 4T CMOS Pixels
Yang Xu¹, Albert J.P. Theuwissen^{1,2}; ¹: Delft University of Technology, Delft, the Netherlands; ²: Harvest Imaging, Bree, Belgium.
- 05.20 A Radiation Tolerant 4T pixel for Space Applications: Layout and Process Optimization
Manuel Innocent, ON Semiconductor, Mechelen, Belgium.

Friday, June 14, 2013

Session 06	Avalanche Photo Diode and Photon Counting Session chair: Lindsay Grant (ST Microelectronics)
8:30 – 8:45 06.01	CMOS Image Sensors Based on Linear Mode APDs: Analysis and Future Perspectives <i>Lucio Pancheri^a, Olga Shcherbakova^{a,b}, Nicola Massari^b, Gian-Franco Dalla Betta^a and David Stoppa^b,^a: University of Trento, Trento, Italy; ^b: Fondazione Bruno Kessler, Trento, Italy.</i>
8:45 – 9:00 06.02	Two-Dimensional Mapping of Photon Counts in Low-Noise Single-Photon Avalanche Diodes <i>Jau-Yang Wu, Shu-Cheng Li, Fang-Ze Hsu, and Sheng-Di Lin, Department of Electronics Engineering, National Chiao Tung University, Hsinchu, Taiwan.</i>
9:00 – 9:15 06.03	9.8 μ m SPAD-based Analogue Single Photon Counting Pixel with Bias Controlled Sensitivity <i>Neale A.W. Dutton^{1,2}, Lindsay A. Grant¹, Robert K. Henderson² ¹ST Microelectronics Imaging Division, Pinkhill, Edinburgh, UK, ²The University of Edinburgh, Edinburgh, UK.</i>
9:15 – 9:30 06.04	Stabilizing Sensitivity in Large Single-Photon Image Sensors with an Integrated 3.3-to-25V All-Digital Charge Pump <i>Shingo Mandai and Edoardo Charbon, Delft University of Technology, Delft, The Netherlands.</i>
9:30 – 9:45 06.05	A 92k SPAD Time-Resolved Sensor in 0.13 μ m CIS Technology for PET/MRI Applications <i>Richard J. Walker¹, Leo H. C. Braga², Ahmet T. Erdogan¹, Leonardo Gasparini², Lindsay A. Grant³, Robert K. Henderson¹, Nicola Massari², Matteo Perenzoni², David Stoppa²; ¹CMOS Sensors and Systems (CSS) Group, School of Engineering, The University of Edinburgh, Edinburgh, UK; ²Smart Optical Sensors and Interfaces (SOI) Group, Fondazione Bruno Kessler (FBK), Trento, Italy; ³Imaging Division, STMicroelectronics, Edinburgh, UK.</i>
9:45 – 10:00 06.06	Monolithic Integration of LEDs and Silicon Photomultipliers in Standard CMOS Technology for Consumer Applications <i>Nupur Lodha, Shingo Mandai, and Edoardo Charbon; Circuits and Systems, Delft University of Technology, Delft, The Netherlands.</i>
10:00 – 10:15 06.07	Silicon Integrated Electrical Micro-Lens for CMOS SPADs based on Avalanche Propagation Phenomenon <i>Chockalingam Veerappan, Student Member IEEE, Yuki Maruyama, Member IEEE, Edoardo Charbon, Senior Member IEEE.</i>
10:15 – 10:40	Break

- 07.01 Device Simulation with Electromagnetic Field Propagation Models for High-Speed Image Sensors and FDA Noise Analysis
Hideki Mutoh, Link Research Corporation, Odawara, Kanagawa, Japan.
- 07.02 Monolithic Integration of Flexible Spectral Filters with CMOS Image Sensors at Wafer Level for Low Cost Hyperspectral Imaging
Murali Jayapala, Andy Lambrechts, Nicolaas Tack, Bert Geelen, Bart Masschelein, Philippe Soussan, IMEC, Leuven, Belgium.
- 07.03 Prototype TDI Sensors in Embedded CCD in CMOS technology
Alper Ercan^{1,2}, Luc Haspeslagh¹, Koen De Munck¹, Kyriaki Minoglou¹, Anne Lauwers¹, Piet De Moor¹; ¹Imec, Heverlee, Belgium; ²ESAT KU Leuven, Heverlee, Belgium.
- 7.04 A Dual Exposure Method for Wide Dynamic Range Operation of CMOS Image Sensors
Woon-Il Choi, Hashimoto Masashi¹, Masayuki Uno² and Hi-Deok, Dept. of Electronics Engi., Chungnam National Univ., Daejeon, Korea; ¹: LG Innotek, Ansan, Kyeonggi, Korea; ²: Linear Cell Design Corp. Ina-shi, Nagano, Japan.
- 7.05 A Low-Invasive Micro Imaging Device for Measuring Neural Activities Implanted in the Mouse Deep Brain
Jun Ohta, Chiakra Kitsumoto, Makito Haruta, Yoshinori Sunaga, Toshihiko Noda, Kiyotaka Sasagawa, Takashi Tokuda, Mayumi Motoyama, and Yasumi Ohta Graduate School of Materials Science, Nara Institute of Science and Technology, Nara, Japan.
- 07.06 Designing Incremental Sigma-Delta ADCs for Low Thermal Noise in Image Sensors
Adi Khakoni, Georges Gielen, KU Leuven, Dept. Elektrotechniek ESAT-MICAS, Leuven, Belgium.
- 07.07 Digital Integration Sensor
Song Chen, Andrew Ceballos, and Eric R. Fossum, Thayer School of Engineering at Dartmouth, Hanover, NH, USA.
- 07.08 Design of Analog Readout Circuitry with Front-end Multiplexing for Column Parallel Image Sensors
Steven Huang, David Estrada, Daniel Van Blerkom and Barmak Mansoorian, Forza Silicon Corporation, Pasadena, CA, USA.
- 07.09 RF Design Issues and Challenges in a CMOS Image Sensor Process
Loc Truong, Dexue Zhang, Tomer Leitner¹ and Barmak Mansoorian, Forza Silicon Corporation, Pasadena, CA, USA, ¹: Tower Semiconductor LTD.

- 07.10 A 120 μ W Vision Chip with ROI Detection
Arnaud Verdant, Antoine Dupret, Patrick Villard, Laurent Alacoque (CEA - LETI – MINATEC Campus, Grenoble, France), Hervé Mathias, Flavien Delgehier (IEF, Orsay, France).
- 07.11 Design of Pixel for High Speed CMOS Image Sensors
Zhongxiang Cao, Yangfan Zhou, Quanliang Li, Qi Qin, Liyuan Liu, and Nanjian Wu State Key Laboratory of Superlattices and Microstructures, Institute of Semiconductors, Chinese Academy of Sciences, Beijing, P. R. China.
- 07.12 A Multi-Channel Digital Silicon Photomultiplier Array for Nuclear Medical Imaging Systems based on PET-MRI
Shingo Mandai and Edoardo Charbon, Delft University of Technology, Delft, The Netherlands.
- 07.13 Real-time Calibration of a 14-Bit Single Slope ADC with 290MHz On-chip Accelerated Ramp Generator for Column-Parallel Image Sensors
Jonathan Bergey, Sam Bagwell, Jackson Law, Wilson Law, Forza Silicon Corporation, Pasadena, CA, USA
- 07.14 A Novel Architecture for the Implementation of a Family of High Speed, Multi-line CMOS Image Sensors
M. Moser, E. Fox, D. Deering, P. Donegan, M. Sonder, D. Marchesan, D. Verbugt, Binqiao Li, Feng-Hua Feng, Shujuan Xie, N. Safavian, R. Ghannoum, H. Mei, TELEDYNE DALSA Corporation, Waterloo, ON, Canada.
- 07.15 On The Pixel Level Estimation of Pinning Voltage, Pinned Photodiode Capacitance and Transfer Gate Channel Potential
Vincent Goiffon¹, Julien Michelot², Pierre Magnan¹, Magali Estriebeau¹, Olivier Marcelot¹, Paola Cervantes¹, Alice Pelamatti¹, and Philippe Martin-Gonthier¹, ¹ISAE, Université de Toulouse, Toulouse, France; ²Pyxalis, Grenoble, France.
- 07.16 Novel Auto-Adaptative Integration-Time Technique for CMOS Image Sensor
Hassan Abbass¹, Hawraa Amhaz¹, David Alleyson², Gilles Sicard¹, ¹TIMA Laboratory (CNRS, Grenoble INP, UJF, ²LPNC Laboratory, Pierre Mendes France University, Grenoble, France.
- 07.17 A Broadcast Quality 2.3MP CMOS Image Sensor with Dynamic Range Extension Mode.
Emanuele Mandelli, Lester Kozlowski, AltaSens Inc, Westlake Village, CA, USA.
- 07.18 A Fully Depleted Backside Illuminated CMOS Imager with VGA Resolution and 15 micron Pixel Pitch
Stefan Lauxtermann, Vikram Vangapally, Sensor Creations Inc. (SCI), Camarillo, CA, USA.

- 07.19 Linear High-Dynamic-Range Bouncing Pixel with Single Sample
*Pablo N. A. Belmonte^{1,2}, P.J. French², Davies W. De Lima Monteiro¹, Frank Sill Torres¹,
¹Department of Electrical Engineering, DEE/PPGEE, Universidade Federal de Minas Gerais, Belo Horizonte, MG, Brazil; ²Delft University of Technology, Electronic Instrumentation Laboratory, Delft, The Netherlands.*
- 07.20 Jailbreak Imagers: Transforming a Single-Photon Image Sensor into a True Random Number Generator.
*Samuel Burri¹, Damien Stucki², Yuki Maruyama³, Claudio Bruschini¹, Edoardo Charbon³,
Francesco Regazzoni³, ¹EPFL, School of Engineering, Lausanne, Switzerland; ²ID Quantique, Switzerland; ³Delft University of Technology, Delft, Netherlands.*
- 7.21 Comparison of Two Cameras based on Single Photon Avalanche Diodes (SPADS) for Fluorescence Lifetime Imaging Application with Picosecond Resolution
*F. Powolny¹, S. Burri¹, C. Bruschini^{1,2}, X. Michalet³, F. Regazzoni⁴, E. Charbon^{1,4},
¹Ecole Polytechnique Fédérale de Lausanne (EPFL), Lausanne, Switzerland; ²Centre Hospitalier Universitaire Vaudois (CHUV), Lausanne, Switzerland; ³University of California, Los Angeles (UCLA), Los Angeles, USA; ⁴Delft University of Technology, Delft, The Netherlands.*
- 07.22 Radiation-hard Active Pixel Detectors for Tracking of Charged Particles Based on HV-CMOS Technology
F. Bompard,¹ S. Feigl,² M. Garcia-Sciveres,³ L. Meng,² D. Muenstermann,⁴ P. Pangaud,¹ I. Peric,⁵ and A. Rozanov¹.¹CPPM, Aix-Marseille Université, Marseille, France; ²CERN, Geneva, Switzerland; ³Lawrence Berkeley National Laboratory, Berkeley, CA, USA; ⁴DPNC, Université de Genève, Genève, Switzerland; ⁵Institute for Computer Science, University of Heidelberg, Mannheim, Germany.
- 07.23 Digital Calibration Algorithm for 2-Stage Cyclic ADC used in 33-Mpixel 120-fps CMOS Image Sensor
T. Watabe^{1,4}, K. Kitamura^{2,4}, T. Hayashida², T. Kosugi³, H. Ohtake², H. Shimamoto², S. Kawahito^{3,4}, and N. Egami²; ¹NHK Engineering System, Inc., Setagaya-ku, Tokyo, JAPAN ; ²NHK Science and Technology Research Laboratories; ³Brookman Technology, Inc.; ⁴Shizuoka University, Japan.
- 07.24 An Optical Punch-Through Diode and Gate Biasing 1-T Pixel for Binary Pixels in Fully Digital CMOS Image Sensors
Hyung-june Yoon¹ and Edoardo Charbon^{1,2}; ¹EPFL, Lausanne, Switzerland; ²Delft University of Technology, Delft, Netherlands.
- 07.25 A 5.2Mpixel@250Fps 16Gbps CMOS Image Sensor with Embedded Digital \ Processor for Reconfigurability and on-chip Image Correction
Francisco Jiménez-Garrido¹, José Fernández-Pérez¹, Cayetana Utrera¹, José Ma Muñoz¹, Ma. Dolores Pardo¹, Rafael Domínguez-Castro¹, Fernando Medeiro¹ and Angel Rodríguez-Vázquez^{2,1}; ¹Universidad de Sevilla, Instituto de Microelectrónica de Sevilla (IMSE-CNM), Sevilla, Spain; ²Consejo Superior de Investigaciones Científicas (CSIC), Instituto de Microelectrónica de Sevilla (IMSE-CNM); ³Innovaciones Microelectrónicas S.L. (ANAFOCUS); Sevilla (Spain).

07.26 Reconfigurable Focal-Plane Hardware for Block-Wise Intra-Frame HDR Imaging
*Jorge Fernandez-Berni, Ricardo Carmona-Galan, Angel Rodriguez-Vazquez,
Institute of Microelectronics of Seville (CSIC - Universidad de Sevilla) Seville, Spain.*

12:00 17:30 Social Event

17:30 – 19:00 Poster viewing

Saturday, June 15, 2013

Session 08 Invited Presentation, Array Imagers and Large Area Sensors
Session co-chairs: Junichi Nakamura (Aptina Imaging),
Shouleh Nikzad (JPL, California Institute of Technology)

8:45 – 9:05 Invited Presentation: Zooming in to Multi-Aperture Cameras
08.01 *Gal Shabtay, Noy Cohen, David Mendlovic and Eran Kali, Corephotonics Ltd, Israel.*

9:05-9:20 LASSENA: A 6.7 Megapixel, 3-sides Buttable Wafer-Scale CMOS Sensor
08.02 using a Novel Grid-Addressing architecture
*I Sedgwick, D Das, N Guerrini, B Marsh, R Turchetta, Science and Technology
Facilities Council, Rutherford Appleton Laboratory, UK.*

9.20 – 9.35 Requirements, Developments and Challenges for CCD and CMOS Image
08.03 Sensors for Space Applications
*P.Garé, N.Nelms, Y.Nowicki-Bringuier, D.Martin, R.Meynart, M.Zahir,
European Space Agency, Noordwijk, The Netherlands.*

9:35 – 9:50 Fabrication of Large Format, Fully Depleted CCDs for the Dark Energy
08.04 Survey Camera
*S.E. Holland¹, C.J. Bebek¹, K.S. Dawson⁴, H.T. Diehl³, F. Dion², J.H. Emes¹,
J. Estrada³, R. Frost², R. Groulx², A. Karcher¹, W.F. Kolbe¹, D. Kubik³,
N.P. Palaio¹, C.H. Tran¹, G. Wang¹, and N.A. Roe¹; ¹Lawrence Berkeley National
Laboratory, Berkeley, CA, USA; ²Teledyne DALSA Semiconductor, Bromont,
Québec, Canada; ³Fermi National Accelerator Laboratory, Batavia, IL, USA;
⁴University of Utah, Salt Lake City, UT, USA.*

9:50 – 10:05 A 12MP 16-Focal Plane CMOS Image Sensor with 1.75 μ m Pixel:
08:05 Architecture and Implementation
*Kwang-Bo Cho¹, Nick Tu¹, John Brummer¹, Khandaker Azad¹, Leo Hsu¹, Vivian Wang¹,
Dongsoo Kim¹, Krishna Palle¹, Tien-Min Miao¹, Yandong Chen¹, Canaan Hong¹,
Toan Bao¹, Vitanshu Sharma¹, Yuan Fong¹, Kumudini Irkar¹, Syed Hashmi¹, Vinesh
Sukumar¹, Salman Kabir¹, Gershon Rosenblum¹, Yong Gao¹, Kil-Ho Ahn², Hyuk-Jin Ko²,
Jeff Watson³, Chris Kenoyer³; ¹Aptina, LLC, San Jose, CA, USA; ²Aptina Korea Co,
Seoul, Korea; ³Aptina, LLC, Corvallis, OR, USA.*

10:05 – 10:30 Break

Session 09	Image Sensor Design Session chair: Alex Krymski (Alexima)
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- 10:30 – 10:45 Application of Photon Statistics to the Quanta Image Sensor
09.01 *Eric R. Fossum, Thayer School of Engineering at Dartmouth, Hanover, NH, USA.*
- 10:45 – 11:00 Early Research Progress on Quanta Image Sensors
09.02 *Saleh Masoodian, Yue Song, Donald Hondongwa, Jiayu Ma, Kofi Odame and Eric R. Fossum, Thayer School of Engineering at Dartmouth, Hanover, NH, USA.*
- 11:00 – 11:15 Organic CMOS Image Sensor with Thin Panchromatic Organic Photoelectric
09.03 Conversion Layer: Durability and Performance
Mikio Ihama¹, Hideyuki Koguchi¹, Hiroshi Inomata¹, Hideki Asano¹, Yuuki Imada¹, Yasuyoshi Mishima¹, Yoshihisa Kato², Yutaka Hirose², Mizuki Segawa², Tetsuya Ueda², Shinji Kishimura²; ¹Frontier Core-Technology Laboratories, FUJIFILM Corporation, Kanagawa, Japan; ²Industrial Devices Company, Panasonic Corporation¹, Nagaokakyo City, Kyoto, Japan.
- 11:15 – 11:30 A 1-inch Optical Format, 80fps, 10.8Mpixel CMOS Image Sensor
09.04 Operating in a Pixel-to-ADC Pipelined Sequence Mode
Isao Takayanagi, Norio Yoshimura, Toshiaki Sato, Shinichiro Matsuo, Tetsuji Kawaguchi, Kazuya Mori, Shinji Osawa, [†]Timothy Bales, ^{††}Ernesto S. Gattuso, ^{††}Douglas Fetting, ^{††}Bob Gravelle, ^{††}Dan Pates, ^{††}Scott Johnson, Junichi Nakamura, Aptina Japan, [†]Aptina UK, ^{††}Aptina Imaging.
- 11:30 – 11:45 A 4K2K 60-fps Image Sensor Based on Stagger-laced Dual-exposure Technique
09.05 *Yusuke Okada, Takeo Azuma, Toshinobu Matsuno, Hiroyoshi Komobuchi (Panasonic Corporation, Kyoto, Japan), Jan Craninckx, Bertrand Parvais, Kyriaki Minoglou, Koen De Munck, Luc Haspeslagh, Piet De Moor (IMEC, Heverlee, Belgium), Serge Biesemans (now at TEL Europe).*
- 11:45 – 12:00 24 MPixel 36x24mm² 14 bit Image Sensor in 110/90 nm CMOS Technology
09.06 *G. Meynants, J. Bogaerts, B. Wolfs, B. Ceulemans, T. DeRidder, A. Gvozdenović, E. Gillisjans, X. Salmon, G. VandeVelde, CMOSIS nv, Antwerp, Belgium.*
- 12:00 – 12:15 A 1.1e⁻_{rms} Temporal Noise 87.5dB DR CMOS Image Sensors With Low-Noise
09.07 Transistors and Column-Parallel ADCs
Min-Woong Seo¹, Takehide Sawamoto², Tomoyuki Akahori², Zheng Liu², Keita Yasutomi¹, Keiichiro Kagawa¹, and Shoji Kawahito^{1,2}; ¹Research Institute of Electronics, Shizuoka University, Johoku, Hamamatsu, Japan; ²Brookman Technology, Inc, Hamamatsu, Japan.
- 12:15 – 13:45 Lunch

Session 10	Depth Sensing, TOF, and Time Resolving Imaging. Session co-chairs: David Stoppa (Fondazione Bruno Kessler), Edoardo Charbon (Delft University of Technology)
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- 13:45 – 14:00 A CMOS Image Sensor for In-Pixel Background Suppression and Frequency
10.01 and Phase Detection for Structured Light 3-D Acquisition Systems
Hiroki Yabe (Department of Electrical Engineering and Information Systems, The University of Tokyo, Tokyo, Japan) and Makoto Ikeda (VLSI Design and Education Center (VDEC), The University of Tokyo, Tokyo, Japan).
- 14:00 – 14:15 Compact Ambient Light Cancellation Design and Optimization for 3D
10.02 Time-of-Flight Image Sensors
Yibing M. Wang¹, Ilia Ovsianikov¹, Sung-Jae Byun², Tae-Yon Lee², Yongjei Lee³, Grzegorz Waligorski¹, Hongyu Wang¹, Seunghoon Lee², Dong-Ki Min², Yoondong Park², Tae-Chan Kim², Chi-Young Choi², Gabsso Han², and Eric R. Fossum^{1,2};
¹Samsung Semiconductor, Inc., Pasadena, CA, USA; ²Samsung Electronics Co., Ltd. Image Development Team, Giheung, South Korea; ³Kunsan National University, Dept. of Physics, Jeonbuk, South Korea.
- 14:15 – 14:30 3dim: Compact and Low Power Time-of-Flight Sensor for 3D Capture Using
10.03 Parametric Signal Processing
Andrea Colaco^{1,2}, Ahmed Kirmani¹, Nan-Wei Gong^{1,2}, Tim McGarry³, Laurence Watkins³, and Vivek K Goyal¹, ¹Massachusetts Institute of Technology; ²3dim Tech, Inc.; ³Princeton Optronics.
- 14:30 – 14:45 CMOS Image Sensor for 3-D Range Map Acquisition With Pixel-Parallel
10.04 Correlation In Region of Interest
Takahiko Matsushima¹ and Makoto Ikeda²; ¹Department of Electrical Engineering and Information Systems, The University of Tokyo; ²VLSI Design and Education Center (VDEC), The University of Tokyo, Tokyo, Japan.
- 14:45 – 15:00 A Time-of-Flight Image Sensor with Sub-mm Resolution Using Draining Only
10.05 Modulation Pixels
Keita Yasutomi, Takahiro Usui, Sang-Man Han, Masatoshi Kodama, Taishi Takasawa, Keiichiro Kagawa, Shoji Kawahito; Shizuoka University, Hamamatsu, Japan.
- 15:00 – 15:15 CMOS Lock-in Pixel Image Sensors with Lateral Electric Field Control for
10.06 Time-Resolved Imaging
Shoji Kawahito, Guseul Baek, Zhuo Li, Sang-Man Han, Min-Woong Seo, Keita Yasutomi and Keiichiro Kagawa; Research Institute of Electronics, Shizuoka University, Hamamatsu, Japan.
- 15:15 – 15:40 Break

Session 11	Invited Presentation and High Speed. Session chair: Shoji Kawahito (Shizuoka University)
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15:40 – 15:55 CMOS Image Sensor Pixel with 2D CCD Memory Bank for Ultra High Speed
11.01 Imaging with Large Pixel Count

A. Lahav[#], J. Crooks^{}, B. Marsh^{*}, R. Turchetta^{*}, and A. Fenigstein[#],*

[#]TowerJazz Semiconductor Ltd, Migdal Haemek, Israel;

^{}STFC Rutherford Appleton Laboratory, Didcot, Oxfordshire, UK.*

15:55 – 16:10 Ultra-High Speed Imaging At Megaframes per Second with A Megapixel
11.02 CMOS Image Sensor

J. Crooks^a, B. Marsh^a, R. Turchetta^a, K. Taylor^b, W. Chan^b, A. Lahav^c, A. Fenigstein^c,

^aSTFC Rutherford Appleton Laboratory, Didcot, Oxfordshire, UK;

^bSpecialised Imaging, Tring, Hertfordshire, UK;

^cTowerJazz Semiconductor Ltd, Migdal Haemek, Israel.

16:10 – 16:25 High Speed, Backside Illuminated 1024x1 Line Imager with Charge Domain
11.03 frame store in Espros Photonic CMOSTM Technology

*Martin Popp, Beat De Coi, Dieter Huber, Pascal Ferrat, Markus Ledergerber,
Espros Photonics AG, Sargans, Switzerland.*

16:25 – 16:40 Toward one Giga frames per second: Multi-Collection-Gate BSI Image Sensors
11.04

Takeharu G. Etoh¹, Son V. T. Dao¹, Tetsuo Yamada² and Edoardo Charbon³,

*¹Ritsumeikan University, Kusatsu, Japan; ²Tokyo Polytechnic University, Atsugi,
Japan; ³Technische Universiteit Delft, Delft, the Netherlands.*

16:40 – 16:55 A 5 Megapixel, 1000fps CMOS Image Sensor with High Dynamic Range
11.05 and 14-bit A/D Converters

*Bart Cremers, Manuel Innocent, Carl Luypaert, John Compier, Ishwar Chandra
Mudegowdar, Cedric Esquenet, Genis, Chapinal, Wiet Vroom, Tim Blanchaert,
Thomas Cools, Joost Decupere, Roel Aerts, Peter Deruytere, Tomas Geurts;
ON Semiconductor, Mechelen, Belgium.*

16:55 – 17:15 Invited Presentation: Many Pixels Make Light Work
11.06 **Mike Tompsett**

18:30 – 20:30 Dinner and 2013 IISS Awards

- *Best Poster Award*
- *Walter Kosonocky Award*
- *Exceptional Service Award to*
Albert JP Theuwissen
For exceptional contributions to the education of image sensor specialists
- *Exceptional Lifetime Achievement Award to*
Gene Weckler
For exceptional contributions to the field of solid-state image sensors

Sunday, June 16, 2013

Session 12	Global Shutter Session chair: Albert Theuwissen (Harvest Imaging)
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8:30 – 8:45 Low Noise High Efficiency 3.75 μ m and 2.8 μ m Global Shutter CMOS
12.01 Pixel Arrays
Sergey Velichko¹, Gennadiy Agranov², Jaroslav Hynecek², Scott Johnson¹, Hirofumi Komori², Jenny Bai², Igor Karasev², Rick Mauritzson¹, Xianmin Yi², Victor Lenchenkov², Sarah Zhao², Hyuntae Kim¹; ¹Aptina, Meridian, ID, USA, ²Aptina, San Jose, CA, USA.

8:45 – 9:00 IR Enhanced Global Shutter Pixel for High Speed Applications
12.02 *Assaf Lahav¹, Adi Birman¹, Dima Veinger¹, Amos Fenigstein¹, Dexue Zhang², Daniel Van Blerkom²; ¹TowerJazz Semiconductor Ltd, Migdal Haemek, Israel; ²Forza Silicon Corp., CA, USA.*

9:00 – 9:15 3.5 μ m Global Shutter Pixel With Transistor Sharing And Correlated
12.03 Double Sampling
B. Wolfs, J. Bogaerts, G. Meynants; CMOSIS nv, Antwerpen, Belgium.

9:15 – 9:30 Global Shutter Pixel with Floating Storage Gate
12.04 *Alex Krymski, Luxima Technology LLC/ Alexima, Pasadena, CA, USA.*

9:30 – 9:45 High Frame-Rate Global Shutter Image Sensor with Dual-Reset Branch
12.05 SAR ADC Architecture
Daniel Van Blerkom, Jeff Rysinski, Yingying Wang, Kevin Stevulak, Christophe Basset, Loc Truong, Rami Yassine, Guang Yang, Chao Sun, Kai Ling Ong, Steve Huang, Forza Silicon Corporation, Pasadena, CA, USA.

9:45 – 10:00 A 4e-Noise 2/3-inch Global Shutter 1920x1080p120 CMOS-Imager
12.06 *Peter Centen¹, Steffen Lehr², Sabine Roth², Jeroen Rotte¹, Friedrich Heizmann², Akbar Momin², Ralf Dohmen², Karl-Heinz Schaaß², Klaas Jan Damstra¹, Ruud van Ree¹, Michael Schreiber²; ¹Grass Valley, Breda, The Netherlands. ²Viimagic; Villingen, Germany.*

10:00 – 10:25 Break

Session 13	Invited Presentation, Oversampling, and High Dynamic Range Session co-chairs: Shigetoshi Sugawa (Tohoku University), Vladimir Koifman (Analog Value)
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10:25 – 10:45 Invited Presentation: Image Quality of Oversampling Cameras
13.01 *Juha Alakarhu, Samu Koskinen, Eero Tuulos, Nokia Corporation, Camera Technologies, Tempere, Finland.*

10:45 – 11:00 Overcoming the Full Well Capacity Limit: High Dynamic Range Imaging
13.02 Using Multi-Bit Temporal Oversampling and Conditional Reset
Thomas Vogelsang, Michael Guidash, Song Xue, Rambus Inc, Sunnyvale, CA, USA.

- 11:00 – 11:15 A Comparison of High Dynamic Range CIS Technologies for Automotive
13.03 Applications
Johannes Solhusvik, Jiangtao Kuang, Zhiqiang Lin, Sohei Manabe, Jeong-Ho Lyu, Howard Rhodes, OmniVision Technologies.
- 11:15 – 11:30 An Overflow Photo-Gate Pixel Enables High FWC and Improved Proton
13.04 Radiation Tolerance in CMOS Pixels
Yannick De Wit & Manuel Innocent, ON-Semiconductor, Mechelen, Belgium.
- 11:30 – 11:45 A CMOS HDR Imager with an Analog Local Adaptation
13.05
Gilles SICARD¹, Hassan ABBAS¹, Hawraa AMHAZ^{1,}, Hakim ZIMOUCHE^{1,**}, Robin ROLLAND², David ALLEYSSON³; ¹CNRS, G-INP, UJF, TIMA Laboratory, Grenoble, France; ²CIME-Nanotech, Grenoble, France; ³CNRS, UPMF, LPNC Laboratory, Grenoble, France; *Now with CEA LETI, **Now with LIRMM Laboratory, Montpellier, France.*