



**2001 IEEE Workshop on
Charge-Coupled Devices and
Advanced Image Sensors**

**June 7-9, 2001
Cal-Neva Resort
Lake Tahoe, Nevada USA**



Sponsored by IEEE Electron Devices Society

Welcome to Cal-Neva Resort

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Nobukazu Teranishi	Matushita Electric Corporation
Albert Theuwissen	Philips Semiconductors

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PROGRAM

2001 IEEE Workshop on Charge-Coupled Devices and Advanced Image Sensors

Thursday, June 7

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|-------------------|---|--|------|
| 8:30 | Opening Remarks: | Eric Fossum
Sayed Eid
Jerry Hyncek | |
| Session 1. | CMOS Sensors I | Chairman: Gary Hughes | |
| 9:00
L1 (30) | A Micropower Self-Clocked Camera-on-a-Chip | K.B. Cho ¹ , A. Krymski ² , E.R. Fossum ² | (1) |
| | | <i>¹Photobit Corporation, ²Photobit Technology Corporation</i> | |
| 9:20
L2 (44) | A 3.25M-pixel APS-C Size CMOS Image Sensor | S. Inoue ¹ , K. Sakurai ¹ , I. Ueno ¹ , T. Koizumi ¹ , H. Hiyama ¹ , T. Asaba ¹ ,
S. Sugawa ² , A. Maeda ³ , K. Higashitani ³ , H. Kato ³ , K. Iizuka ⁴ , M. Yamawaki ⁴ | (5) |
| | | <i>¹Canon Inc. Device Development Center, ²Department of Electronic Engineering, Graduate School of Engineering, Tohoku University, ³Mitsubishi Electric Corporation ULSI Development center, ⁴Mitsubishi Electric Corporation LSI Division</i> | |
| 9:40
L3 (38) | Dynamically Reconfigurable Vision CMOS Image Sensor
for Real-Time Staring Active Vision Systems | G. Yang, C. Sun, C. Wrigley, and B. Pain
<i>Center for Space Microelectronic Technology,
JPL, California Institute of Technology</i> | (9) |
| 10:00 | Morning Break | | |
| 10:30
S1 (48) | A High-Sensitivity Oversampling Digital Signal Detection Technique
for CMOS Image Sensors Using Non-Destructive Intermediate
High-Speed Readout Mode | S. Kawahito ¹ , N. Kawai ² , and Y. Tadokoro ² | (13) |
| | | <i>¹Research Institute of Electronics, Shizuoka University,
²Toyohashi University of Technology</i> | |
| 10:45
S2 (51) | A High Speed, 240 Frames/s 4 Megapixel CMOS Sensor | A. Krymski, N. Bock, D. VanBlerkom, N. Tu, E.R. Fossum | (17) |
| | | <i>Photobit Technology Corporation</i> | |
| 11:00
S3 (31) | A 640 x 480 CMOS Image Sensor for High Speed Image Capture | E.C. Fox, G.R. Allan, B. Li, D. Dattani, S. Kamasz, M.J. Kiik, Q. Tang,
A. Pavlov, D. Dykaar, S.G. Ingram | (21) |
| | | <i>DALSA Corp.</i> | |

11:15 S4 (7)	CMOS Image Sensor with CIF/QCIF Switching Function K. Hara, K. Simomura, Y. Endo, K. Okui, S. Komori, and K. Kyuma <i>Mitsubishi Electric Corporation</i>	(25)
11:30 S5 (40)	A New Image Sensor with Programmable Spatially Variant Multiresolution Readout Capability Y. Ohtsuka, I. Ohta, and K. Aizawa <i>Department of Electrical Engineering, University of Tokyo</i>	(29)
11:45 S6 (29)	A Low-Power CMOS Image Sensor with Single-Amplifier Readout Architecture H.N. Tay ¹ , A. Joshi ¹ , W. Chang ² , P. Kim ¹ , Z. Zhang ¹ <i>¹Conexant Systems, Inc., ²Broadcom Corp.</i>	(withdrawn)
11:45	Lunch	
Session 2.	CMOS Sensors II & CMOS Sensor Technology I Chairman: Dan McGrath	
1:30 L4 (57)	2/3" CMOS Imaging Sensor for High Definition Television M. Loose, L.J. Kozlowski, A.M. Joshi, A. Kononenko, S. Xue, J. Lin, J. Luo, I. Ovsiannikov, J. Clarke, and T. Paredes <i>Rockwell Science Center</i>	(33)
1:50 L5 (50)	A Mega-Pixel High Speed CMOS Imager with Sustainable Gigapixel/sec Readout Rate S. Lauxtermann ¹ , G. Izrael ¹ , P. Seitz ¹ , H. Bloss ² , J. Ernst ² , H. Firla ² , S. Gick ² <i>¹Philips Semiconductors, ²CSEM</i>	(37)
2:10 L6 (49)	A CMOS Image Sensor with Non-Destructive Intermediate Readout Mode for Adaptive Iterative Search Motion Vector Estimation D. Handoko ¹ , S.Kawahito ¹ , Y. Tadokoro ² , and A. Matsuzawa ³ <i>¹Shizuoka University, ²Toyohasi University of Technology, ³Matsushita Electric Industrial Co. Ltd.</i>	(41)
2:30 S7 (2)	Fixed Pattern Noise Suppression by a Differential Readout Chain for a Radiation-Tolerant Image Sensor G. Meynants, J. Bogaerts, B. Dierickx, and D. Uwaerts <i>FillFactory</i>	(45)
2:45 S8 (53)	A CMOS Image Sensor Employing a Double Junction Photodiode K.M. Findlater ¹ , D. Renshaw ¹ , J.E.D. Hurwitz ² , R.K. Henderson ² , T.E.R. Bailey ² , J.M. Raynor ² <i>¹Department of Electronics and Electrical Engineering, The University of Edinburgh, ²ST Microelectronics Imaging Division</i>	(49)
3:00	Afternoon Break	
3:30 S9 (8)	Small CMOS Pixel Design with Single Row Line V. Berezin <i>Photobit Corporation</i>	(53)

3:45 S10 (28)	A Crosstalk Study on CMOS Active Pixel Sensor Arrays for Color Imager Applications C.C. Wang, C.G. Sodini <i>Department of Electrical Engineering and Computer Science, MIT</i>	(57)
4:00	Poster Session Rules Explanation	
Session 3.	CMOS & CCD Sensors, Poster Session Chairman: Selim Bencuya	
4:15 P1 (43)	A VGA ISIS for a Video Camera of 1,000,000 fps: A Proposal T. G. Etoh ¹ , H. Mutoh ² , C. Lohmann ¹ , and T. Reisinger ¹ <i>¹Kinki University, ²Link Research Corporation</i>	(61)
4:20 P2 (13)	Resolution Progress of Image Sensor Over Nyquist Rate Using Digital Signal Processing and Optical Low-Pass Filter T. Kimura, H. Gotoh, M. Anodou, and H. Shiraki <i>Department of Systems Engineering, Ibaraki University</i>	(65)
4:25 P3 (25)	Radiation Hardness Study of an APS CMOS Particle Tracker W. Dulinski <i>LEPSI IN2P3/ULP</i>	(69)
4:30 P4 (54)	Hexagonal Array Processing M.D. Purcell ¹ , D. Renshaw ¹ , K.M. Findlater ¹ , J.E.D. Hurwitz ² , S.G. Smith ² , T.E.R. Bailey ² <i>¹Department of Electronics and Electrical Engineering, The University of Edinburgh, ²ST Microelectronics Imaging Division</i>	(72)
4:35 P5 (37)	Dual Mode Active Pixel Sensor with Focal Plane Edge Detection M. Tabet and R.I. Hornsey <i>Department of Electrical & Computer Engineering, University of Waterloo</i>	(76)
4:40 P6 (6)	Design and Development of a Compact Gamma Camera for the Detection of Malignant Sentinel Lymph Nodes D. Lowe, A. Truman, A. Bergman, and H.L. Kwok <i>Department of ECE, University of Victoria</i>	(80)
4:45 P7 (26)	Charge Sharing Modeling in Pixel Detectors with Capacitive Charge Division J. Marczewski ¹ , D. Tomaszewski ¹ , K. Domanski ¹ , P. Grabiec ¹ , M. Caccia ² , S. Borghi ³ , and R Campagnolo ³ , W. Kucwicz ⁴ <i>¹Institute of Electron Technology, Warsaw, ²Universita 'dell'Insubria and INFN, ³Universita' degli Studi di Milano and INFN, ⁴University of Mining and Metallurgy, Krakow</i>	(84)
4:50 P8 (56)	Characterization Methodology for Micro-Lens Performance in CMOS Image Sensors V. Korobov, C. Cork, H. Wolf, S. Fainleib <i>TOWER Semiconductor LTD.</i>	(88)

4:55 P9 (22)	Low Dark-Current CCD Register Driven from Back Electrodes Through Barrier H. Shiraki and T. Kimura <i>Ibaraki University</i>	(92)
5:00 P10 (35)	Improved One-Dimensional Analysis of CMOS Photodiode Including Epitaxial-Substrate Junction J.S. Lee, R.I. Hornsey <i>Department of Electrical and Computer Engineering, University of Waterloo</i>	(95)
5:05 P11 (55)	Characterization of Pixel Response Time and Image Lag in CMOS Sensors S. Ramaswami, S. Agwani, L. Loh, N. Bossemeyer <i>Image Capture Operation, Motorola Inc.</i>	(99)
5:10 P12 (20)	Linear CCD Sensor with Multiple Resolution Architecture K. Spears <i>Hewlett Packard Comapny</i>	(withdrawn)
5:10 P13 (58)	Custom Imager as Wavefront Sensor D.W. deLimaMonteiro, G. Vdovin <i>ITS/DIMES, Delft University of Technology</i>	(103)
5:15	Short Evening Break	
5:30	Discussion Session Coordinator: Orly Yadid-Pecht	
6:30-8:00	Dinner	
Session 4.	Poster Viewing Coordinator: Orly Yadid-Pecht	
8:00-9:00	All poster paper authors attend their displays	

Friday, June 8

Session 5.	CMOS Sensor Technology II Chairman: J.E.D. Hurwitz	
8:30 L7 (45)	A Four-Transistor Capacitive Feedback Reset Active Pixel and its Reset Noise Reduction Capability I. Takayanagi, Y. Fukunaga, T. Yoshida, and J. Nakamura <i>Advanced Technology Research Center, Olympus Optical Co., Ltd.</i>	(107)
8:50 L8 (21)	Effects of Hydrogen Annealing on 0.25-um CMOS Image Sensor D.N. Yaung, S.G. Wu, H.C. Chien, C.H. Tseng, and C.S. Wang <i>Taiwan Semiconductor Manufacturing Company</i>	(111)

9:10 L9 (33)	CMOS Difference Imager with Charge-Leakage Compensation & Sum Output S. Seshadri, G. Yang, M. Ortiz, C. Wrigley, and B. Pain <i>Center for Space Microelectronics Technology, JPL, California Institute of Technology</i>	(114)
9:30 S11 (12)	Analysis of APS Readout Circuit Delay K. Salama and A. ElGamal <i>Department of Electrical Engineering Stanford University</i>	(118)
9:45 S12 (11)	Crosstalk and Sub-Pixel Distribution of Sensitivity in Color CMOS Image Sensor G. Agranov, V. Berezin, R.H. Tsai <i>Photobit Corporation</i>	(122)
10:00	Morning Break	
10:30 L10 (34)	A High Dynamic Range CMOS APS Image Sensor Y. Wang, S.L. Barna, S. Campbell, and E.R. Fossum <i>Photobit Technology Corporation</i>	(126)
10:50 L11 (18)	A 192 x 124 CMOS Image Sensor with Pixel Parallel Temporal Computing Architecture S. Yoshimura, T. Sugiyama, K. Yonemoto, K. Ueda <i>Sony-Kihara Research Center, Inc.</i>	(130)
11:10 L12 (3)	A 6.6M Pixel CMOS Image Sensor for Electrostatic PCB Inspection D. Scheffer ¹ , G. Meynants ¹ , B. Dierickx ¹ , T. Fujii ² <i>¹FillFactory, ²OHT Inc.</i>	(134)
11:30 S13 (9)	Inverted Logarithmic Active Pixel Sensor with Current Readout C.S. Hong, R.I. Hornsey <i>Department of Electrical and Computing Engineering, University of Waterloo</i>	(138)
11:45 S14 (52)	kTC Noise Cancellation Pixel R.B. Merrill <i>Foveon, Inc.</i>	(142)
12:00	Lunch	
Session 6.	CMOS Sensor Technology III Chairman: Paul K. Lee	
1:30 S15 (10)	CMOS Active Pixel Sensor with In-Pixel Contrast Stretching C.S. Hong, R.I. Hornsey <i>Department of Electrical and Computer Engineering, University of Waterloo</i>	(146)

1:45 S16 (39)	Differential Mode CMOS APS for Optically Programmable Gate Array (OPGA) S.U. Ay ^{1,3} , S. Barna ² , E.R. Fossum ¹ ¹ Photobit Technology Corporation, ² Photobit Corporation ³ Department of Electrical Engineering-Electrophysics, University of Southern California	(150)
2:00 S17 (47)	Column Parallel A/D Conversion on CMOS Image Sensor T. Hamamoto, T. Wakamatsu, N. Inokihara, K. Aizawa Science University of Tokyo	(154)
2:15 S18 (41)	Empirical CMOS APS MTF Modeling I. Shcherback, O. Yadid-Pecht Ben-Gurion University	(158)
2:30 S19 (36)	CMOS Photodiodes with Substrate Openings for Higher Conversion Gain in Active Pixel Sensors J.S. Lee, R.I. Hornsey Department of Electrical and Computer Engineering, University of Waterloo	(162)
2:45 S20 (24)	How to Design CMOS APS for Particle Tracking G. Deptuch IReS IN2P3/ULP	(165)
Session 7.	Workshop Social Activity Coordinator: Sayed Eid	
3:00-7:00	Boat Cruise	
7:00-8:30	Dinner	
Session 8.	CMOS Sensor Applications Chairman: Bart Dierickx	
8:30 S21 (27)	CMOS Sensor for the Detection of Minimum Ionizing Particles R. Turchetta ¹ , C. Didcot ² ¹ Rutherford Appleton Laboratory, ² OX11, 0QX	(169)
8:45 S22 (1)	Development of CMOS Image Sensor Overlaid with a HARP Photoconversion Layer T. Hayashida, M. Yamaguchi, M. Kosugi, T. Watabe, Y. Ishiguro, K. Moroboshi, H. Ohtake, H. Kokubun, T. Watanabe, K. Tanioka NHK Science & Technical Research Laboratories	(173)
9:00 S23 (4)	A Retina/V1 Simple Cell Chip for Physiology Experiment Design or Classroom Demonstration T. Delbruck, S. Bovet, E. Chicca, S.C. Liu, G.M. Ricci Institute for Neuroinformatics (INI)	(177)

Saturday, June 9

- Session 9. Walter Kosonocky Award**
Chairman: Albert Theuwissen
- 8:30 **Walter Kosonocky Award Paper Presentation**
- Session 10. CCD Image Sensors and Other Imaging Devices**
Chairman: Gareth Ingram
- 9:00 **A Color Image Sensor with 9um Pixels** (181)
L13 (15) **for High-End Digital Still Photography**
C. Draijer, G. Kreider, B. Dillen, W. Klaassens, H. Peek, A. Theuwissen
Philips Semiconductors Image Sensors
- 9:20 **Impactron-A New Solid State Image Intensifier** (185)
L14 (14) J. Hyneczek
ISETEX, Inc.
- 9:40 **3.4M Pixel TDI Image Sensor for Confocal Scanning Microscopy** (189)
S 24 (5) I. Itoi, Y. Miura, S. Okamura, S. Kashima, H. Shibuya
Texas Instruments Japan Ltd.
- 9:55 **The Perfect Imager for Digital Still Cameras** (193)
S 25 (16) J. Bosiers, E. Roks
Philips Semiconductors Image Sensors
- 10:10 **Enhanced Full Well for Vertical Antiblooming, High Sensitivity** (197)
S 26 (17) **Time-Delay and Integration (TDI) CCDs with GHz Data Rates**
S.R. Kamasz, S.P. Singh, S.G. Ingram, M.J. Kiik, Q. Tang, B. Benwell
DALSA, Inc.
- 10:25 **Morning Break**
- 10:45 **Dual Linescan Architecture for High Responsivity** (201)
S27 (19) **and Low Photon Shot Noise**
N. O
DALSA, Inc.
- 11:00 **Ultra-High-Sensitivity New Super-HARP Pickup Tube** (204)
S28 (23) K. Tanioka¹, Y. Ohkawa¹, K. Miyakawa¹, S. Suzuki¹, T. Takahata¹,
N. Egami¹, K. Ogusu², A. Kobayashi², T. Hirai², T. Kawai²
¹*NHK Science & Technical Research Laboratories*
²*Hamamatsu Photonics, K.K.*
- 11:15 **Correction of Radiation Damage in the Chandra X-ray CCDs** (208)
S29 (32) G. Prigozhin, M. Bautz, S. Kissel, B. LaMarr, G. Ricker
Center for Space Research, MIT

- 11:30
S30 (42) **An Ultra-High-Speed Camera with an In-situ Storage Image Sensor
for Preliminary Test** (212)
D. Poggemann¹, T.G. Etoh¹, A. Ruckelshausen¹, G. Kreider²,
A. Theuwissen², Y. Kondo³, H. Maruno³, K. Takubo³, and H. Soya³
*¹Department of Electrical Engineering and Computer Sciences,
University of Applied Sciences Osnabrueck,
²Philips Semiconductors,
³Shimadzu Corporation*
- 11:45
S31 (46) **High Burst Rate CCDs** (216)
Capable of Imaging at > 1 Million Frames Per Second
J. Tower
Sarnoff Corporation
- 12:00 **Concluding Remarks:** Eric Fossum
- 12:15 **Adjourn**