PROCEEDINGS OF SPIE

[SPIDigitalLibrary.org/conference-proceedings-of-spie](https://spiedigitallibrary.org/conference-proceedings-of-spie)

Front Matter: Volume 9022

, "Front Matter: Volume 9022," Proc. SPIE 9022, Image Sensors and Imaging Systems 2014, 902201 (7 March 2014); doi: 10.1117/12.2063409

SPIE.

Event: IS&T/SPIE Electronic Imaging, 2014, San Francisco, California, United States

PROCEEDINGS

Image Sensors and Imaging Systems 2014

**Ralf Widenhorn
Antoine Dupret**
Editors

**5–6 February 2014
San Francisco, California, United States**

Sponsored by
IS&T—The Society for Imaging Science and Technology
SPIE

CoSponsored by
Google
CEA-LETI

Published by
SPIE

Volume 9022

Proceedings of SPIE 0277-786X, v. 9022

Image Sensors and Imaging Systems 2014, edited by Ralf Widenhorn, Antoine Dupret,
Proc. of SPIE-IS&T Electronic Imaging, SPIE Vol. 9022, 902201 · © 2014 SPIE-IS&T
CCC code: 0277-786X/14/\$18 · doi: 10.1117/12.2063409

Proc. of SPIE-IS&T/ Vol. 9022 902201-1

The papers included in this volume were part of the technical conference cited on the cover and title page. Papers were selected and subject to review by the editors and conference program committee. Some conference presentations may not be available for publication. The papers published in these proceedings reflect the work and thoughts of the authors and are published herein as submitted. The publishers are not responsible for the validity of the information or for any outcomes resulting from reliance thereon.

Please use the following format to cite material from this book:

Author(s), "Title of Paper," in *Image Sensors and Imaging Systems 2014*, edited by Ralf Widenhorn, Antoine Dupret, Proceedings of SPIE-IS&T Electronic Imaging, SPIE Vol. 9022, Article CID Number (2014)

ISSN: 0277-786X

ISBN: 9780819499394

Copublished by

SPIE

P.O. Box 10, Bellingham, Washington 98227-0010 USA

Telephone +1 360 676 3290 (Pacific Time) · Fax +1 360 647 1445

SPIE.org

and

IS&T—The Society for Imaging Science and Technology

7003 Kilworth Lane, Springfield, Virginia, 22151 USA

Telephone +1 703 642 9090 (Eastern Time) · Fax +1 703 642 9094

imaging.org

Copyright © 2014, Society of Photo-Optical Instrumentation Engineers and The Society for Imaging Science and Technology.

Copying of material in this book for internal or personal use, or for the internal or personal use of specific clients, beyond the fair use provisions granted by the U.S. Copyright Law is authorized by the publishers subject to payment of copying fees. The Transactional Reporting Service base fee for this volume is \$18.00 per article (or portion thereof), which should be paid directly to the Copyright Clearance Center (CCC), 222 Rosewood Drive, Danvers, MA 01923. Payment may also be made electronically through CCC Online at copyright.com. Other copying for republication, resale, advertising or promotion, or any form of systematic or multiple reproduction of any material in this book is prohibited except with permission in writing from the publisher. The CCC fee code is 0277-786X/14/\$18.00.

Printed in the United States of America.

Paper Numbering: Proceedings of SPIE follow an e-First publication model, with papers published first online and then in print and on CD-ROM. Papers are published as they are submitted and meet publication criteria. A unique, consistent, permanent citation identifier (CID) number is assigned to each article at the time of the first publication. Utilization of CIDs allows articles to be fully citable as soon as they are published online, and connects the same identifier to all online, print, and electronic versions of the publication. SPIE uses a six-digit CID article numbering system in which:

- The first four digits correspond to the SPIE volume number.
- The last two digits indicate publication order within the volume using a Base 36 numbering system employing both numerals and letters. These two-number sets start with 00, 01, 02, 03, 04, 05, 06, 07, 08, 09, 0A, 0B ... 0Z, followed by 10-1Z, 20-2Z, etc.

The CID Number appears on each page of the manuscript. The complete citation is used on the first page, and an abbreviated version on subsequent pages. Numbers in the index correspond to the last two digits of the six-digit CID Number.

Contents

vii *Conference Committee*

SESSION 1 HIGH-SPEED SENSORS

- 9022 02 **A time-resolved image sensor for tubeless streak cameras** [9022-1]
K. Yasutomi, S. M. Han, M.-W. Seo, T. Takasawa, K. Kagawa, S. Kawahito, Shizuoka Univ. (Japan)
- 9022 03 **Pixel structure with 10 nsec fully charge transfer time for the 20m frame per second burst CMOS image sensor (Best Student Paper Award)** [9022-2]
K. Miyauchi, T. Takeda, K. Hanzawa, Y. Tochigi, S. Sakai, R. Kuroda, Tohoku Univ. (Japan); H. Tominaga, R. Hirose, K. Takubo, Y. Kondo, Shimadzu Corp. (Japan); S. Sugawa, Tohoku Univ. (Japan)
- 9022 04 **Novel CMOS time-delay integration using single-photon counting for high-speed industrial and aerospace applications** [9022-3]
M. M. El-Desouki, B. Al-Azem, King Abdulaziz City for Science and Technology (Saudi Arabia)
- 9022 05 **Ultra-high speed video capturing of time dependent dielectric breakdown of metal-oxide-silicon capacitor up to 10M frame per second** [9022-4]
F. Shao, D. Kimoto, K. Furukawa, H. Sugo, T. Takeda, K. Miyauchi, Y. Tochigi, R. Kuroda, S. Sugawa, Tohoku Univ. (Japan)

SESSION 2 SMART SENSORS

- 9022 06 **Low data rate architecture for smart image sensor** [9022-5]
A. Darwish, G. Sicard, L. Fesquet, TIMA Lab., CNRS, Univ. Grenoble Alpes (France)
- 9022 07 **Frameless, time domain continuous image capture** [9022-6]
H. G. Dietz, Univ. of Kentucky (United States)
- 9022 09 **Smart imaging for power-efficient extraction of Viola-Jones local descriptors (Best Paper Award)** [9022-8]
J. Fernández-Berni, R. Carmona-Galán, R. del Río, J. A. Leñero-Bardallo, IMSE-CNM (Spain) and Univ. de Sevilla (Spain); M. Suárez-Cambre, Univ. de Santiago de Compostela (Spain); Á. Rodríguez-Vázquez, IMSE-CNM (Spain) and Univ. de Sevilla (Spain)

SESSION 3 HIGH-PERFORMANCE SENSORS

- 9022 0A **Time-to-digital converter based on analog time expansion for 3D time of flight cameras** [9022-9]
M. Tanveer, Luleå Univ. of Technology (Sweden); I. Nissinen, J. Nissinen, J. Kostamovaara, Univ. of Oulu (Finland); J. Borg, J. Johanson, Luleå Univ. of Technology (Sweden)
- 9022 0B **Experiment on digital CDS with 33-M pixel 120-fps super hi-vision image sensor** [9022-10]
J. Yonai, T. Yasue, K. Kitamura, T. Hayashida, NHK Science and Technology Research Labs. (Japan); T. Watabe, NHK Engineering Services, Inc. (Japan); H. Shimamoto, NHK Science and Technology Research Labs. (Japan); S. Kawahito, Shizuoka Univ. (Japan)
- 9022 0C **Pixel structure for asymmetry removal in ToF 3D camera** [9022-11]
B. Kang, J. Shin, J. Choi, J. D. K. Kim, Samsung Advanced Institute of Technology (Korea, Republic of)
- 9022 0D **A stimulated Raman scattering imager using high-speed lateral electric field modulator and lock-in pixels amplifiers** [9022-12]
K. Mars, B. Guseul, H. S. Man, T. Takasawa, K. Yasutomi, K. Kagawa, Shizuoka Univ. (Japan); M. Hashimoto, Osaka Univ. (Japan); S. Kawahito, Shizuoka Univ. (Japan)

SESSION 4 NOISE AND CHARACTERIZATION

- 9022 0E **Estimating an image sensor's temperature for darksignal-correction** [9022-13]
J. Achatzi, G. Fischer, Fachhochschule Köln (Germany); V. Zimmer, Leica Camera AG (Germany); D. Paulus, Univ. Koblenz-Landau (Germany)
- 9022 0F **A statistical evaluation of effective time constants of random telegraph noise with various operation timings of in-pixel source follower transistors** [9022-14]
A. Yonezawa, R. Kuroda, A. Teramoto, T. Obara, S. Sugawa, Tohoku Univ. (Japan)
- 9022 0G **Correcting high density hot pixel defects in digital imagers** [9022-15]
G. H. Chapman, R. Thomas, Simon Fraser Univ. (Canada); Z. Koren, I. Koren, Univ. of Massachusetts Amherst (United States)
- 9022 0H **Comparison of two optimized readout chains for low light CIS** [9022-16]
A. Boukhayma, CEA-LETI (France) and Ecole Polytechnique Fédérale de Lausanne (Switzerland); A. Peizerat, A. Dupret, CEA-LETI (France); C. Enz, Ecole Polytechnique Fédérale de Lausanne (Switzerland)
- 9022 0I **Review of ADCs for imaging** [9022-17]
J. A. Leñero-Bardallo, J. Fernández-Berni, Á. Rodríguez-Vázquez, IMSE-CNM (Spain) and Univ. de Sevilla (Spain)

SESSION 5 TECHNOLOGICAL IMPROVEMENTS

- 9022 0J **Color image sensor using stacked organic photoconductive films with transparent readout circuits separated by thin interlayer insulator** [9022-18]
T. Sakai, H. Seo, S. Aihara, H. Ohtake, M. Kubota, NHK Science and Technology Research Labs. (Japan); M. Furuta, Kochi Univ. of Technology (Japan)
- 9022 0K **Real-time compact multispectral imaging solutions using dichroic filter arrays** [9022-19]
E. V. Chandler, D. E. Fish, Pixelteq, Inc. (United States)
- 9022 0L **A 1024×1 linear photodiode array sensor with fast readout speed flexible pixel-level integration time and high stability to UV light exposure** [9022-20]
T. Akutsu, S. Kawada, Y. Koda, T. Nakazawa, R. Kuroda, S. Sugawa, Tohoku Univ. (Japan)
- 9022 0M **A high fill-factor low dark leakage CMOS image sensor with shared-pixel design** [9022-21]
M.-W. Seo, K. Yasutomi, K. Kagawa, S. Kawahito, Shizuoka Univ. (Japan)
- 9022 0N **Co-integration of a smart CMOS image sensor and a spatial light modulator for real-time optical phase modulation** [9022-22]
T. Laforest, A. Verdant, A. Dupret, CEA-LETI-MINATEC (France); S. Gigan, F. Ramaz, ESPCI ParisTech, Institut Langevin, CNRS (France); G. Tessier, Neurophysiology and New Microscopies Lab., CNRS, Univ. Paris Descartes (France)

SESSION 6 APPLICATIONS

- 9022 0P **A CMOS time-of-flight range image sensor using draining only modulation structure** [9022-24]
S. Han, K. Yasutomi, K. Kagawa, S. Kawahito, Shizuoka Univ. (Japan)
- 9022 0Q **A high speed 2D time-to-impact algorithm targeted for smart image sensors** [9022-25]
A. Åström, Combitech AB (Sweden); R. Forchheimer, Linköping Univ. (Sweden)
- 9022 0R **Real-time 3D millimeter wave imaging based FMCW using GGD focal plane array as detectors** [9022-26]
A. Levanon, D. Rozban, N. S. Kopeika, Y. Yitzhaky, Ben-Gurion Univ. of the Negev (Israel); A. Abramovich, Ariel Univ. (Israel)

INTERACTIVE PAPER SESSION

- 9022 0T **Iterative compressive sampling for hyperspectral images via source separation** [9022-28]
S. Kamdem Kuiteing, M. Barni, Univ. degli Studi di Siena (Italy)
- 9022 0V **Hyperspectral imaging applied to end-of-life concrete recycling** [9022-30]
S. Serranti, G. Bonifazi, Univ. degli Studi di Roma La Sapienza (Italy)

- 9022 OW **An indirect time-of-flight measurement technique for sub-mm range resolution using impulse photocurrent response** [9022-31]
T. Usui, K. Yasutomi, H. S. Man, T. Takasawa, K. Kagawa, S. Kawahito, Shizuoka Univ. (Japan)
- 9022 OX **Theoretical study of an efficient bracketing camera system architecture** [9022-32]
A. Besrour, Univ. of Carthage (Tunisia); H. Snoussi, Univ. de Technologie Troyes (France);
M. Siala, F. Abdelkefi, Univ. of Carthage (Tunisia)

Author Index

Conference Committee

Symposium Chair

Sergio R. Goma, Qualcomm Inc. (United States)

Symposium Cochair

Sheila S. Hemami, Northeastern University (United States)

Conference Chairs

Ralf Widenhorn, Portland State University (United States)

Antoine Dupret, Commissariat à l'Énergie Atomique (France)

Conference Program Committee

Morley M. Blouke, Portland State University (United States)

Erik Bodegom, Portland State University (United States)

Glenn H. Chapman, Simon Fraser University (Canada)

Arnaud Darmont, Aphesa SPRL (Belgium)

James A. DiBella Sr., Truesense Imaging, Inc. (United States)

Boyd A. Fowler, Google (United States)

Kevin J. Matherson, Microsoft Corporation (United States)

Alice L. Reinheimer, e2v (United States)

Franz Riedlberger, Jazz Semiconductor, Inc. (United States)

Nobukazu Teranishi, University of Hyogo (Japan) and Shizuoka University (Japan)

Jean-Michel Tualle, Université Paris 13 (France)

Xinyang Wang, Chinese Academy of Sciences (China)

Session Chairs

1 High-Speed Sensors

Xinyang Wang, Chinese Academy of Sciences (China)

Jean-Michel Tualle, Université Paris 13 (France)

2 Smart Sensors

Morley M. Blouke, Portland State University (United States)

Alice L. Reinheimer, e2v (United States)

3 High-Performance Sensors

Kevin J. Matherson, Microsoft Corporation (United States)

- 4 Noise and Characterization
Boyd A. Fowler, Google (United States)
Antoine Dupret, Commissariat à l'Énergie Atomique (France)
- 5 Technological Improvements
James A. DiBella Sr., Truesense Imaging, Inc. (United States)
Nobukazu Teranishi, University of Hogo (Japan) and Shizuoka University (Japan)
- 6 Applications
Arnaud Darmont, Aphesa SPRL (Belgium)