# PROCEEDINGS OF SPIE

# Medical Applications of Radiation Detectors V

H. Bradford Barber Lars R. Furenlid Hans N. Roehrig Editors

12–13 August 2015 San Diego, California, United States

Sponsored and Published by SPIE

Volume 9594

Proceedings of SPIE 0277-786X, V. 9594

SPIE is an international society advancing an interdisciplinary approach to the science and application of light.

Medical Applications of Radiation Detectors V, edited by H. Bradford Barber, Lars R. Furenlid, Hans N. Roehrig, Proc. of SPIE Vol. 9594, 959401 ⋅ © 2015 SPIE ⋅ CCC code: 0277-786X/15/\$18 ⋅ doi: 10.1117/12.2218025

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 publisher is 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 *Medical Applications of Radiation Detectors V*, edited by H. Bradford Barber, Lars R. Furenlid, Hans N. Roehrig, Proceedings of SPIE Vol. 9594 (SPIE, Bellingham, WA, 2015) Article CID Number.

ISSN: 0277-786X ISBN: 9781628417609

Published 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

Copyright © 2015, Society of Photo-Optical Instrumentation Engineers.

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 SPIE 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/15/\$18.00.

Printed in the United States of America.

Publication of record for individual papers is online in the SPIE Digital Library.



**Paper Numbering:** Proceedings of SPIE follow an e-First publication model, with papers published first online and then in print. Papers are published as they are submitted and meet publication criteria. A unique 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.

# **Contents**

V	Authors
---	---------

vii Conference Committee

SESSION 1	DIGITAL RADIOGRAPHY AND CT
9594 02	Dual-energy X-ray computed tomography system using a cadmium telluride detector and its application to gadolinium imaging [9594-1]
9594 03	Exploring the feasibility of traditional image querying tasks for industrial radiographs [9594-2]
9594 05	Monochromatic X-ray photon counting using an energy-selecting device and its application to iodine imaging [9594-4]
9594 06	Si-strip photon counting detectors for contrast enhanced spectral mammography (Invited Paper) [9594-5]
SESSION 2	SPECT, PET, AND PRECLINICAL IMAGING
9594 0A	Optimization of an adaptive SPECT system with the scanning linear estimator [9594-9]
9594 OB	Fisher information analysis of digital pulse timing [9594-10]
SESSION 3	NEW DETECTORS FOR MEDICAL IMAGING
9594 OC	Properties of transparent (Gd,Lu)3(Al,Ga)5O12:Ce ceramic with Mg, Ca and Ce co-dopants (Invited Paper) [9594-11]
9594 OD	Improvement of medical imaging with enhanced light extraction of scintillators by integrated nanophotonics [9594-12]
9594 OE	Efficient high-resolution hard x-ray imaging with transparent Lu <sub>2</sub> O <sub>3</sub> :Eu scintillator thin films (Invited Paper) $[9594-13]$
9594 OE 9594 OF	, , , ,
	(Invited Paper) [9594-13]  Dual-energy X-ray photon counting using an LSO-MPPC spectrometer and an energy-

- 9594 01 Big-data x-ray phase contrast imaging simulation challenges [9594-17]
- Portable LED-induced autofluorescence imager with a probe of L shape for oral cancer diagnosis [9594-18]

## **Authors**

Numbers in the index correspond to the last two digits of the six-digit citation identifier (CID) article numbering system used in Proceedings of SPIE. The first four digits reflect the volume number. Base 36 numbering is employed for the last two digits and indicates the order of articles within the volume. Numbers start with 00, 01, 02, 03, 04, 05, 06, 07, 08, 09, 0A, 0B...0Z, followed by 10-1Z, 20-2Z, etc.

Almer, Jonathan D., 0E Baldoni, Gary, 0C Barber, William C., 06 Bray, Iliana E., 03 Brecher, Charles, OC, OE Caucci, Luca, 0G Chen, Buxin, 06 Chen, Chin-Tu, 06 Cheng, Nai-Lun, 0J Chiana, Hou-Chi, 0J Chiou, Jin-Chern, 0J Clarkson, Eric, 0A Dagel, Amber L., 01 Furenlid, Lars R., OB, OG Gandhi, Thulasi, 06 Ghanbari, Nasrin, 0A Glodo, Jarek, 0C Hagiwara, Osahiko, 02, 05, 0F

Hartsough, Neal E., 06 Huang, Ting-Wei, 0J

Iwanczyk, Jan S., 06

Ji, Chuncheng, 0C

Jimenez, Edward S., 03, 01

Kenesei, Peter, 0E

Kupinski, Matthew A., 0A

Kusachi, Shinya, 02, 05, 0F

Lee, Yu-Cheng, 0J

Li, Xin, 0A

Malakhov, Nail, 06

Mang, Ou-Yang, 0J

Marton, Zsolt, 0E

Matsukiyo, Hiroshi, 02, 05, 0F

Miceli, Antonino, 0E

Miller, Stuart R., 0E

Miura, Yasuhiro, 02

Moore, Matthew D., 0E

Nagarkar, Vivek V., 0E

Oda, Yasuyuki, 02, 05, 0F

Reiser, Ingrid, 06

Rhodes, William H., 0C

Ruiz-Gonzalez, Maria, 0B

Sato, Eiichi, 02, 05, 0F

Shah, Ishaan, OC

Shirwadkar, Urmila, OC

Tsai, Stephany J., 03

Wang, Yimin, 0C

Watanabe, Manabu, 02, 05, 0F

Wawrzyniak, Gregor, 06

Wessel, Jan C., 06

Woods, Russell, 0E Yamaguchi, Satoshi, 02, 05, 0F Yan, Yung-Jhe, 0J Ye, Mao, 0D Yi, Ya Sha, 0D

Proc. of SPIE Vol. 9594 959401-6

# **Conference Committee**

#### **Program Track Chairs**

**Ali M. Khounsary**, X-ray Optics, Inc. (United States) and Illinois Institute of Technology (United States)

Ralph B. James, Brookhaven National Laboratory (United States)

#### Conference Chairs

H. Bradford Barber, The University of Arizona (United States)
 Lars R. Furenlid, The University of Arizona (United States)
 Hans N. Roehrig, The University of Arizona (United States)

## Conference Program Committee

**Yonggang Cui**, Brookhaven National Laboratory (United States) **F. Patrick Doty**, Sandia National Laboratories, California

(United States)

**Geoffrey Harding**, Morpho Detection (Germany)

Ralph B. James, Brookhaven National Laboratory (United States)

Edward S. Jimenez Jr., Sandia National Laboratories (United States)

**Denny L. Lee**, Direct X Ray Digital Imaging Technology LLC (United States)

**Rex A. Moats**, Children's Hospital Los Angeles (United States) and The University of Southern California (United States)

**Vivek V. Nagarkar**, Radiation Monitoring Devices, Inc. (United States)

Eiichi Sato, Iwate Medical University (Japan)

**Michael R. Squillante**, Radiation Monitoring Devices, Inc. (United States)

### Session Chairs

Digital Radiography and CTH. Bradford Barber, The University of Arizona (United States)

2 SPECT, PET, and Preclinical Imaging Edward S. Jimenez Jr., Sandia National Laboratories (United States)

3 New Detectors for Medical Imaging Lars R. Furenlid, The University of Arizona (United States)

4 Phase Contrast Imaging and Other Esen Salcin, College of Optical Sciences, The University of Arizona (United States)

Proc. of SPIE Vol. 9594 959401-8