NPSS NEWS

ISSUE 3: SEPT. 2017

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2017 IEEE Nuclear Science Symposium and Medical Imaging Conference

24th Room-Temperature Semiconductor Detector Workshop

21 through 28 October 2017, Hyatt Regency Atlanta, Atlanta, Georgia

The 2017 IEEE Nuclear Science Symposium-Medical Imaging Conference (NSS-MIC) and the 24th International Symposium on Room-Temperature Semiconductor Detectors (RSTD) will be an excellent meeting for all interested in the technologies of nuclear detection and imaging. Over 1300 abstracts and summaries from nearly 50 countries were submitted to the core scientific program of the conference. Those submissions have been assessed by over 60 session conveners and 500 abstract/summary reviewers. Acceptance emails have been sent with session times and days to authors now invited to present in oral or poster form at the conference.

ATLANTA AND THE HYATT REGENCY

The 2017 IEEE NSS-MIC & 24th RSTD http://www.nss-mic.org/2017/ will be held in downtown Atlanta, Georgia, USA. The Hyatt Regency Atlanta https://atlanta.regency.hyatt.com/en/hotel/home.html will serve as the conference hotel and the conference's primary meeting facility. Scientific and social activities are scheduled from Saturday, October 21st through Saturday, October 28th. Most activities will be at the hotel.

The Engineering and Science (plenary, oral and poster sessions)

The core of the meeting is the engineering and science presented and discussed. The NSS and RTSD oral, poster, and plenary scientific sessions will run from 8 AM Monday, Oct. 23rd through noon Friday, Oct. 27th. The MIC plenary, oral, and poster scientific sessions will run from 8 AM Wednesday, Oct. 25th through noon Saturday, Oct. 28th.

Individuals planning to attend the conference should review the full schedule of events prior to making airline and hotel reservations as many will be interested in activities beyond the core scientific sessions, including Joint Sessions, Short Courses, Workshops, Special Events, and Social Events some of which occur on days before or after the days of the core NSS, MIC, and RTSD scientific sessions.

TO THE CONFERENCE

The Hartsfield-Jackson Atlanta International Airport (ATL) http://www.atl.com/ is the world's busiest airport as measured by passenger traffic. Most attendees will fly into ATL, as there are direct flights between ATL and most major cities in the world.

John N. Aarsvold
General Chair

The Metropolitan Atlanta Rapid Transit Authority (MARTA) http://www.itsmarta.com/ operates the trains and buses of the Atlanta public transportation system. A MARTA train travels between the airport (ATL) and the Hyatt Regency. The train is boarded in the airport and the appropriate stop is within a block of the hotel. This MARTA train is the most direct way to travel between the Atlanta airport and the Hyatt Regency, the conference hotel.

AT THE CONFERENCE

The Peachtree Center Food Court http://peachtreecenter.com/dine-shop/ is within a block's distance of the Hyatt and is connected to the Hyatt via a covered walkway. The Food Court has over

CONFERENCES Continued on **PAGE 2**

Conferences

Continued from **PAGE 1**

Ralf Engels
Deputy General Chair

50 options for food and provides reasonably priced options for breakfast and lunch during daytime conference hours. Most of the food court options are closed in the evenings.

NUCLEAR SCIENCE SYMPOSIUM (NSS)

Lorenzo Fabris
NSS Program Chair

Sara Pozzi
NSS Deputy Program Chair

The NSS is the leading opportunity for scientists and engineers interested in the fields of nuclear science, radiation instrumentation, software, and their applications, to learn about the latest developments in their field and to meet and discuss the field with colleagues from around the world.

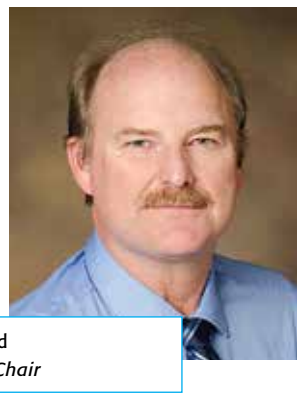
In assembling the program, we have paid close attention to the feedback received form our attendees over the years. With a minor exception on Monday, the NSS program will feature no more than three parallel sessions at any given time, allowing NSS attendees the opportunity to effectively miss fewer talks due to conflicts. We are continuing the tradition started last year that was well received by our community to have a dinner rather than a luncheon. This time, the dinner will be held at the Georgia Aquarium. The Aquarium offers an incredible setting that is hard to find anywhere else, all within walking distance of the conference hotel. We hope everyone will take advantage of this unique opportunity.

The scientific and educational program emphasizes the latest developments in technology, radiation detection materials, new instrumentation techniques, and their implementation in nuclear and high energy physics, astrophysics, accelerators, national nuclear security, and many other radiation environments. Joint sessions with MIC and RTSD, as well as topical workshops cover areas of specific interest. Within the framework of an educational scientific program, short courses are organized focusing on topics of interest for the scientific community.

NSS Program Topics

- Analog and digital circuits
- Astrophysics and space instrumentation
- Computing and software for experiments
- Data analytics
- Data acquisition and analysis systems
- Gaseous detectors
- High energy physics instrumentation
- Instrumentation for homeland and nuclear security
- Neutron detectors and instrumentation
- Neutron and gamma imaging applications
- Nuclear instrumentation and measurement for reactors and related applications
- Nuclear physics instrumentation
- Photodetectors
- Radiation damage effects and radiation hardened devices
- Scintillators
- Semiconductor detectors (tracking and spectroscopy)
- Synchrotron, FEL and beamline instrumentation

MEDICAL IMAGING CONFERENCE (MIC)



Lars R. Furenlid
MIC Program Chair

Matthew A. Kupinski
MIC Deputy Program Chair

The MIC is the principal international meeting focused on the technologies of medical imaging using ionizing radiation. Attendees of the MIC disseminate new research in physics, engineering, and mathematics relevant to the detection of ionizing radiation, quantitative image generation, and multimodality system integration. The topics covered in the conference range from modality-specific advances primarily in nuclear medicine (SPECT and PET), X-ray, and CT, to multimodality advances of SPECT or PET in combination with other imaging technologies (eg, MRI, optical, or US). The MIC scientific core, the joint oral sessions with NSS and RTSD, and the MIC-focused workshops and short courses, provide an excellent forum for sharing fundamental advances in medical imaging detector technologies, algorithms, and practical implementations of such.

MIC Program Topics

- New detector materials/technologies for medical imaging
- High-resolution and preclinical systems (e.g. , small-animal, application-specific, intraoperative, portable systems)
- Clinical emission and hybrid tomography instrumentation (e.g., PET, SPECT, PET/MRI, SPECT/MRI, PET/CT, SPECT/CT)
- Nonemission imaging (e.g., CT, dual-energy CT, phase-contrast CT, optical)
- Spectral, photon-counting, and low-dose CT
- Data corrections and quantitative imaging techniques
- Assessment and comparison of image quality and methods
- Tomographic image reconstruction methods
- Signal and image processing
- Parametric imaging and tracer kinetic modeling methods
- Imaging in radiotherapy and hadron therapy
- Simulation and modeling of medical imaging systems

24TH INTERNATIONAL SYMPOSIUM ON ROOM-TEMPERATURE SEMICONDUCTOR DETECTORS (RTSD)

Michael Fiederle
RTSD Program Cochair

The RTSD represents the largest forum of scientists and engineers developing improved semiconductor radiation detectors and imaging arrays. Room-temperature solid-state radiation detectors for X-ray, gamma-ray, and neutron radiation are increasingly being used in applications in several diverse fields, such as medicine, homeland security, astrophysics, and environmental remediation. The objective of this symposium is to provide a forum for discussion of the state-of-the-art in the development of photoconductive materials for radiation detection, material and detector characterization, device fabrication processes, electronics, and applications. Oral and poster presentations have been organized to represent a broad spectrum of research activities emphasizing either device or material understanding. The RTSD received 132 high-quality abstract submissions, from which 80 oral and 45 poster presentations were selected.

Ralph James
RTSD Program Cochair

RTSD Program Topics

- 3-D photon tracking detectors and image reconstruction technology
- Pixel, strip, Frisch-grid, coplanar grid, and discrete semiconductor detectors
- Detector/ASIC hybridization, interconnects, and electronics
- Semiconductor materials for radiation detection

OUT OF SIGHT

Fanaticism consists of redoubling your efforts when you have forgotten your aim.

George Santayana

NUCLEAR & PLASMA SCIENCES SOCIETY NEWS

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- Organic and other photoconductive materials for radiation detection
- Properties of electrical contacts and device fabrication technology
- Polarization, long-term stability, and radiation damage
- Scintillator/semiconductor hybrid detectors with focus on semiconductor technology
- Solid-state neutron detectors
- Spectrometer systems for homeland security, nuclear inspections, safeguards, and portal monitoring
- Imaging systems for medical, space, nondestructive testing, and cargo monitoring

NSS AND RTSD, NSS-MIC-RTSD, AND NSS-MIC JOINT SESSIONS

Joint Sessions addressing areas of common interest to the NSS, MIC, and RTSD communities have been organized for Tuesday, Oct. 24th (NSS & RTSD) and Wednesday, Oct. 25th (NSS and MIC and NSS/MIC/RTSD). These sessions are an opportunity to highlight interconnected research and development work pursued across the respective fields.

Joint Topics

- Multimodality approaches
- VFront-end electronics, signal digitization and processing
- Beam instrumentation
- New detector developments
- Scintillators and photodetectors
- Semiconductor-based imaging systems
- Simulation and modeling

Industrial Program

Charles Watson
Industrial Program Chair

The Industrial Program is a sell-out this year. Sixty-five companies will be represented, six of them with double booths. The Exhibits will be collocated in the Grand Hall with the technical poster sessions and the coffee breaks. Exhibits will be open from Tuesday noon through Thursday afternoon. A series of technical presentations by various exhibitors will be offered in Hanover Hall during the Exhibition. These will highlight available new technologies and their capabilities. Check the conference program app for the schedule. Also associated with the Industrial Program this year will be a Technology Transfer Program (TPP) workshop, with over a dozen posters from academic and research laboratories sharing their cutting-edge technologies that have potential commercial and industrial applications. Look for this in the poster area near the exhibits. Finally, please join us for the "Happy Hour" Exhibitors' Reception on Tuesday evening following the technical sessions, in the Exhibition area of the Grand Hall. It will be a great opportunity to relax, check out the Exhibits and connect with friends and colleagues.

Short Courses

Youngho Seo
Short Course Cochair

Jennifer Huber
Short Course Cochair

Short Courses Schedule

SC1 (NSS)—Sat-Sun Oct 21-22:
Radiation Detection & Measurement Part I
Radiation Detection & Measurement Part II

SC2 (NSS)—Sat Oct 21:
Integrated Circuits for Detector Signal Processing

SC3 (JOINT)—Sun Oct 22:
Advanced Photodetectors

SC4 (JOINT)—Mon Oct 23:
GATE, a GEANT4-based Simulation Toolkit

SC5 (MIC)—Mon Oct 23:
Image Quality & Statistical Analysis

SC6 (MIC)—Tues Oct 24:
Biomedical Imaging Fundamentals

SC7 (MIC)—Tues Oct 24:
Image Reconstruction: Theory & Practice

Workshops Schedule

Sun Oct 22
- Organic Detectors and Materials
- Software Reliability
- Instrumentation and Measurement in Nuclear Environments
- Advanced Digital Pulse Processing Techniques for Nuclear Science and Engineering Applications

Tues Oct 24
- Non-Conventional Emission Tomography Techniques and Their Applications in Image-Guided Therapeutics

Tues Oct 24-Thurs Oct 26
- Technology Transfer Program

Fri Oct 27-Sat Oct 28
- Big Data by & for High-Speed Imaging & Particle Tracking

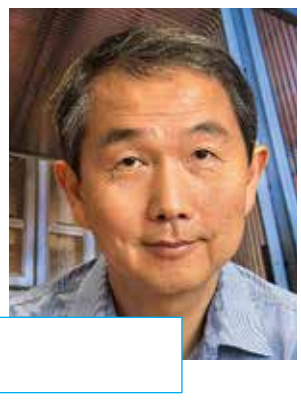
Sat Oct 28
- Dedicated Brain Imaging Systems

Publication

Janet Reddin
Conference Editor

All presentations at the conference, both oral and poster, of peer-reviewed abstracts are eligible to have manuscripts included in the Conference Record. Such manuscripts will be available to all conference attendees through the IEEE Xplore® Digital Library. Authors will have two options: (1) submit only an extended abstract (minimum 2 pages) to the Conference Record and then subsequently, submit a full-length manuscript to a peer-reviewed journal—IEEE Transactions on Nuclear Science (TNS), IEEE Transactions on Radiation and Plasma Medical Sciences (TRPMS) or IEEE Transactions on Medical Imaging (TMI) or (2) submit a regular, full-length manuscript to either the Conference Record or to a journal, but not both. For more information please consult the IEEE Author Digital Tools site then visit the conference website www.nss-mic.org/2017 for the latest details about publishing your manuscript.

Web Page



Bo Yu
Webmaster

Although there are changes in some of the components and interfaces linking to the conference web page, the web-page layout and web-page user interface should be familiar to previous attendees of the NSS-MIC and RTSD. The page and interface have worked very well for many years. Potential attendees and attendees should find it possible to navigate with ease all conference information on the page.

Companion Program

Peggy Woody
Companion Program Cochair

Nancy Watson
Companion Program Cochair

All About Atlanta
Sun Oct 22; 1:00 p.m.–5:00 p.m.

Atlanta's Heroes
Mon Oct 23; 9:30 a.m.–1:30 p.m.

Beautiful Buckhead
Tues Oct 24; 9:30 a.m.–2:30 p.m.

Historic Roswell
Wed Oct 25; 9:30 a.m.–2:30 p.m.

CDC Museum
Thurs Oct 26; 10:15 a.m.–1:15 p.m.
(Requires pre-meeting checks.
See conference website.)

Magnificent Midtown
Fri Oct 27; 9:30 a.m.–12:30 p.m.

ATLANTA AND GEORGIA INFORMATION

Atlanta is the capital of the state of Georgia. The state is known for peanuts, pecans, and peaches—and blueberries, cotton, and tobacco. Georgia's economy is also driven by industry and mining, energy and its uses, and tourism and film, among other things.

Atlanta was the home of Martin Luther King, Jr., and Georgia continues to be the home of Former President James Earl (Jimmy) Carter, Jr. Atlanta is known by neighborhoods—some more than others, as there are 242 that are divisions of 25 neighborhood planning units. Atlanta is the home of Coca Cola, Delta Airlines, and CNN, among several other well-known companies.

For those looking for background on Atlanta and Georgia, the links below provide potential starting points.

Atlanta Tourism
www.atlanta.net
www.atlanta.com
www.exploregeorgia.org/city/atlanta

Georgia Tourism
www.exploregeorgia.org
www.dot.ga.gov/DS/Travel/Scenic
www.nps.gov/grsm/index.htm

Fall Colors in the North Georgia Mountains
www.exploregeorgia.org/article/georgias-beautiful-fall-colors
www.gastateparks.org/info/243480

SPECIAL AND SOCIAL EVENTS SCHEDULE

Women in Engineering Luncheon
Thurs Oct 26; noon–1:30 p.m.

GATE Users Meeting
Thurs Oct 26; noon–1:30 p.m.

STIR Users & Developers Meeting
Thurs Oct 26; 6:00 p.m.–8 p.m.

SOCIAL EVENTS SCHEDULE

NSS Dinner
(Note: a dinner not a luncheon)
Mon Oct 23; 6:30 p.m.
GA Aquarium

RTSD Luncheon
Tues Oct 24; 11:30 a.m.–2:00 p.m.
GA Aquarium

Exhibitor's Reception
Tues Oct 24: 6:00 p.m.–7:30 p.m.
Grand Hall, Hyatt Regency Hotel

Conference Reception
Wed Oct 25; 6:30 p.m.
Hyatt Regency Hotel

MIC Dinner
Fri Oct 27; 6:30 p.m.
200 Peachtree

MOBILE APPLICATIONS

Tom Lewellen
Mobile Apps Cocoordinator

CONFERENCES Continued on **PAGE 4**

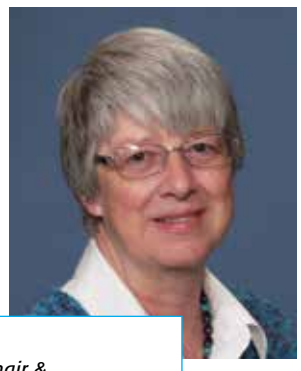
SELF ASSESSMENT?
Next time I send a dumb son of a bitch to get a Coke, I go myself.

Michael Curitz

NSS/MIC/RTSD

Continued from **PAGE 3**

The structure and schedule, as well as almost all other information concerning the conference, will be available on mobile applications when the oral and poster scientific sessions are complete. The app is an extension of that which has been under development over the past several years. Thus, previous attendees will likely have some familiarity with this year's version.



Merry Keyser
Scholarship Chair &
Mobile Apps Cocoordinator

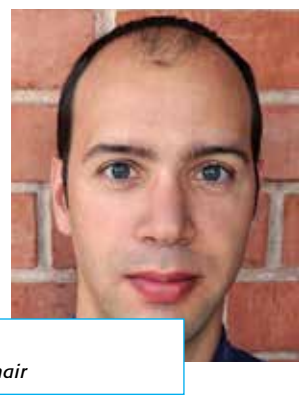
Christina Sanders
Registration Chair

Dean Cutajar
Technology Deputy Chair

SCHOLARSHIP AND GRANTS

Close to 200 individuals applied for training grants for the conference this year, a record number. Thus far, 160 grants have been awarded. The names of over 30 individuals have been placed on a waiting list. The organizing committee continues to seek additional funding in hopes of offering additional trainee grants.

Ron Keyser
Treasurer



Lucca Caucci
Technology Chair

Christoph Ilger
Technology Deputy Chair

FINANCE

The registration fees have been set as below. Distinctions are made between members and non-members, between full professionals and students, and between early and late (before or after Oct 5) registrations.

IEEE Member
$610/$710 before/after Oct 5

Non-IEEE Member
$760/$860 before/after Oct 5

IEEE Student
$225/$325 before/after Oct 5
(proof of student status required)

Non-IEEE Student
$325/$425 before/after Oct 5
(proof of student status required)

REGISTRATION

The registration environment in use this year is an enhancement of that which the conference has used for a few years now. As this is the case, most previous attendees will find this year's registration environment straightforward to navigate.

TECHNOLOGY

Authors of oral presentations are encouraged to submit their presentations via the internet. There will be a speaker-ready room so that authors can upload on-site and so that all authors can review their presentations in the environment that will be active in each presentation room. As in past years, there will be a computer lab with power strips and some CPUs and keyboards. There will be free wireless access throughout the meeting space for conference attendees.

CONFERENCE PROMOTION

Those planning to attend the conference are encouraged to become familiar with the conference website and to stay current by periodically reading the information under the "What's New" button on the website.

For additional information contact Conference General Chair John Aarsvold by E-mail at jaarsvo@emory.edu.

2018 IEEE NSREC

The IEEE Nuclear and Space Radiation Effects Conference will be held July 16th - 20th, 2018 in Kona, Hawaii, Hilton Waikoloa Village. The conference will feature a Technical Program consisting of nine sessions of contributed papers (both oral and poster) that describe the latest observations and research results in radiation effects, an up-to-date Short Course offered on July 16th, a Radiation Effects Data Workshop, and an Industrial Exhibit.

Teresa Farris
Publicity Chair

KONA, HAWAII

It's easy to feel awed on Big Island of Hawaii. From the molten magma flowing from Hawaii Volcanoes National Park to the snow-capped heights of Mauna Kea; from the green rainforests of the Hamakua Coast to the jet-black sands of Punalu'u Beach; Hawaii Island is an unrivaled expression of the power of nature. Hawaii Island is the youngest and largest island in the Hawaiian chain, but it's remarkable for more than just its size. Picture yourself visiting Kilauea, one of the most active volcanoes in the world, or talk history with a cultural demonstrator at Pu'uhonua O Honaunau, an historic park that was once a place of refuge. Whether you're walking on a black sand beach, snorkeling with manta rays, horseback riding in Waimea or sailing along the Kona Coast, Hawaii, the Big Island is your island for adventure.

You may never want or need to leave the Waikoloa Village. Feel the Aloha spirit at the 62 acre resort along the Kohala Coast. The resort features an ocean-fed lagoon with a white sand beach for snorkeling or other water activities, Dolphin Quest where you can swim, feed and play with dolphins, three pools featuring waterfalls, a 175-foot waterslide and an adults-only pool. Dine in one of the many restaurants on site, enjoy a day at the Kohala Spa or visit an eclectic array of shops, boutiques, and galleries throughout the Hilton Waikoloa Village. Cruise the resort on the mahogany canal boats along tranquil waterways or take one of the Swiss-made air-conditioned trams, which operate all day for your convenience. Just outside the resort, but part of the Waikoloa area are two championship golf courses and additional shopping/dining options at the King's Shops or the Queens' Marketplace available via the trolley for a small fee or a moderate walk. For a more adventurous walk you can take the Kings Highway Foot Trail and see the petroglyphs. Please join us for NSREC 2018 on the beautiful Big Island of Hawaii.

TECHNICAL PROGRAM

Chaired by Hugh Barnaby, Arizona State University, papers to be presented at this meeting will describe the effects of space, terrestrial, or nuclear radiation on electronic or photonic devices, circuits, sensors, materials and systems, as well as semiconductor processing technology and techniques for producing radiation-tolerant devices and integrated circuits. The conference will be attended by engineers, scientists, and managers who are concerned with radiation effects.

The conference committee is soliciting papers describing significant new findings in the following or related areas:

Basic Mechanisms of Radiation Effects in Electronic Materials and Devices
- Single Event Charge Collection Phenomena and Mechanisms
- Radiation Transport, Energy Deposition and Dosimetry
- Ionizing Radiation Effects
- Materials and Device Effects
- Displacement Damage
- Processing-Induced Radiation Effects

Radiation Effects on Electronic and Photonic Devices and Circuits
- Single Event Effects
- MOS, Bipolar and Advanced Technologies
- Isolation Technologies, such as SOI and SOS
- Optoelectronic and Optical Devices and Systems
- Methods for Hardened Design and Manufacturing
- Modeling of Devices, Circuits and Systems
- Cryogenic or High Temperature Effects
- Novel Device Structures, such as MEMS and Nanotechnologies
- Techniques for Hardening Circuits and Systems

Space, Atmospheric, and Terrestrial Radiation Effects
- Characterization and Modeling of Radiation Environments
- Space Weather Events and Effects
- Spacecraft Charging
- Predicting and Verifying Soft Error Rates (SER)

Hardness Assurance Technology and Testing
- New Testing Techniques, Guidelines and Hardness Assurance Methodology
- Unique Radiation Exposure Facilities or Novel Instrumentation Methods
- Dosimetry
- New Developments of Interest to the Radiation Effects Community

RADIATION EFFECTS DATA WORKSHOP

The Radiation Effects Data Workshop is a forum for papers on radiation effects data on electronic devices and systems. Workshop papers are intended to provide radiation response data to scientists and engineers who use electronic devices in a radiation environment, and for designers of radiation-hardened or radiation-tolerant systems. Papers describing new simulation facilities are also welcomed.

PAPER SUBMITTAL

Information on the submission of summaries to the 2018 NSREC for either the Technical Sessions or the Data Workshop can be found at www.nsrec.com. The deadline for submitting summaries is February 2nd, 2018.

SHORT COURSE

Attendees will have the opportunity to participate in a one-day Short Course on Monday, July 16th. The short course is being organized by Simone Gerardin, University of Padova. The course will be of interest both to radiation effects specialists and newcomers to the field. Attendees will receive a compendium of the 1980–2018 Short Courses also.

INDUSTRIAL EXHIBIT

An Industrial Exhibit will be included as an integral part of the conference and will be chaired by Tony Amort, The Boeing Company. Exhibitors will include companies or agencies involved in manufacturing electronic devices or systems for applications in space or nuclear environments, modeling and analysis of radiation effects at the device and system level, and radiation testing.

COMMITTEE

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For additional information, contact Teresa Farris, Publicity Chair, at teresa.farris@cobham.com

FAIR ENOUGH

I do not see why we should have the disadvantages of being gentlemen while they have all the advantages of being cads.

Winston Churchill

ICALEPCS-2017

The 16th International Conference on Accelerator and Large Experimental Control Systems (ICALEPCS 2017) will be held at the Palau de Congressos de Catalunya in Barcelona, from the 8th to the 13th of October 2017 and will be hosted by the ALBA Synchrotron.

Barcelona, the capital of Catalonia, is one of the major Mediterranean cities and the second largest city in Spain. Barcelona attracts visitors from all over the world fascinated by the architecture, the heart of modernism, restaurants, museums and the animated bars and live music. Barcelona is the city of contrasts. It is not particularly big, but very dynamic and international, calm but also very active. It has everything: beautiful architecture, cultural events, sea and mountains.

ICALEPCS facilitates fruitful collaborations among the world's control system specialists from large scientific installations, such as particle accelerators, light sources, laser facilities, telescopes, tokamaks, etc. The series of ICALEPCS conferences started in 1985 as a workshop, the first public expert gathering devoted entirely to accelerator control systems in Los Alamos, hosted by LANL. The conferences subsequently rotated between three major areas of the world: America (including North, Central and South America), Asia (including Oceania) and Europe (including Russia, the Near East and Africa). Over the years the conferences saw a growing number of participants, Institutes and countries. ICALEPCS is a biennial series of conferences that is intended to:

» Provide a forum for the interchange of ideas and information between control system specialists working on large experimental physics facilities around the world (accelerators, particle detectors, fusion reactors, telescopes, etc.);

» Create an archival literature of developments and progress in this rapidly changing discipline;

» Promote, where practical, standardization in both hardware and software;

» Promote collaboration between laboratories, institutes and industry.The International Advisory committee (ISAC) for the present edition is chaired by Andy Götz (ESRF, The European Synchrotron, France) and counts 40 members distributed as follows: 17 from Europe/Africa, 12 from Americas and 11 Asia/Oceania.

The abstract submission is now closed. The Program Committee has worked very hard to bring together an excellent technical program encompassing the technical and geographical coverage of the community.

The program covers the following tracks:

» Experiment Control
» Functional Safety and Machine Protection
» Software Technology Evolution
» User Interfaces and User eXperience (UX)
» Project Status Reports
» Control Systems Upgrades
» Data Management and Processing
» Integrating Diverse Systems
» IT Infrastructure for Control Systems
» Feedback Control and Process Tuning
» Hardware Technology
» Timing and Synchronization
» Systems Engineering, Collaborations and Project Management
» Data Analytics

The program is complemented with a number of satellite workshops prior to the conference on October 7th and 8th:

» EPICS Satellite Meeting
» White Rabbit Tutorial Workshop
» TANGO Workshop
» PLC Based Control Systems
» HDF5 and Data Format
» Control System Cybersecurity Workshop
» Motion Control Workshop
» Sardana—Scientific SCADA Suite
» User Experience in MicroTCA

ICALEPCS will have a large exhibition space, offering a broad range of exhibitors to discuss the latest technologies and developments on controls, data acquisition and data management hardware and software.

Please check the website http://icalepcs2017.org/ for details on our program, speakers, exhibitors or the latest news about the conference.

ICALEPCS 2017 Program Chair
Oscar Matilla
Alba Synchrotron

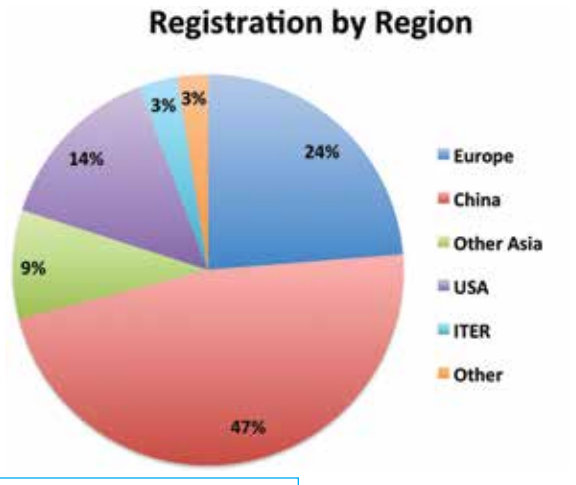
ICALEPCS 2017 Chair
David Fernández
Alba Synchrotron

Conference Reports

SOFE-2017 MAKES HISTORY IN SHANGHAI

Hutch Neilson
General Chair

For engineers and scientists working in magnetic fusion energy R&D, the IEEE Symposium on Fusion Engineering (SOFE) is a highlight of their two-year conference cycle, and the only international conference dedicated to the advancement of fusion engineering. In 2017, the fusion engineering community gathered in Shanghai, China from June 4th through 8th for the 27th SOFE, the first in the Symposium's 52-year history to be held outside the United States. The main program opened on 5 June with an address by Dr. Delong Luo, Director-General of ITER-China, who also represented China's Ministry of Science and Technology. Dr. Luo welcomed the world's fusion community to China and described for them the vibrant and rapidly growing Chinese fusion program, a key factor in the decision to bring the conference to Shanghai. Luo was immediately followed by Dr. Bernard Bigot, Director General of the international ITER Organization, who reported on the progress in ITER construction, the world's most advanced fusion project. From there, the technical program assembled by an international committee led by Dr. Paul Humrickhouse, Idaho National Laboratory, unfolded over the next four days. The program included plenary presentations on leading fusion research and engineering projects. In total, there were almost 500 oral and poster presentations, a modern SOFE record, on fusion engineering topics ranging from materials to components, systems, and project management.



East and West came together for SOFE2017.

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Conference Reports

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SOFE-2017 was planned with an eye to the needs of a fusion engineering community in transition. The ITER project is focusing fusion's human and industrial resources in a massive international collaboration to construct a facility that will host the world's first burning plasma. Keeping pace with the ever-growing linkages among the world's fusion programs, the SOFE has evolved from its origins as a U.S.-centered conference to become a major international forum, one that has been strongly supported by the European and Asian communities for many years, notably China in the past decade. Over 200 Chinese researchers came to SOFE2017, accounting for almost half the total attendance, while participation from Europe and North America remained strong (see pie chart). Overall registrations, at 435, exceeded that of recent SOFEs by more than 40%.

Recognizing the changing demographics in fusion, SOFE2017 offered support for young researchers and women. Student travel grants, funded by both U.S. and Chinese government agencies, supported over 20 students to attend the conference. Over 100 papers were entered in the Best Student Paper competition. Two one-day mini-courses provided an opportunity for both students and experienced researchers to obtain a concentrated education in topics that offer important challenges and opportunities. A Women in Engineering reception, featuring Prof. Jing Dong from the Institute of Automation of the Chinese Academy of Sciences as a guest speaker, was one of the week's highlights. The lively discussion that took place showed that women in the STEM professions, whether East or West, face a common set of challenges and have shared ideas about needed solutions.

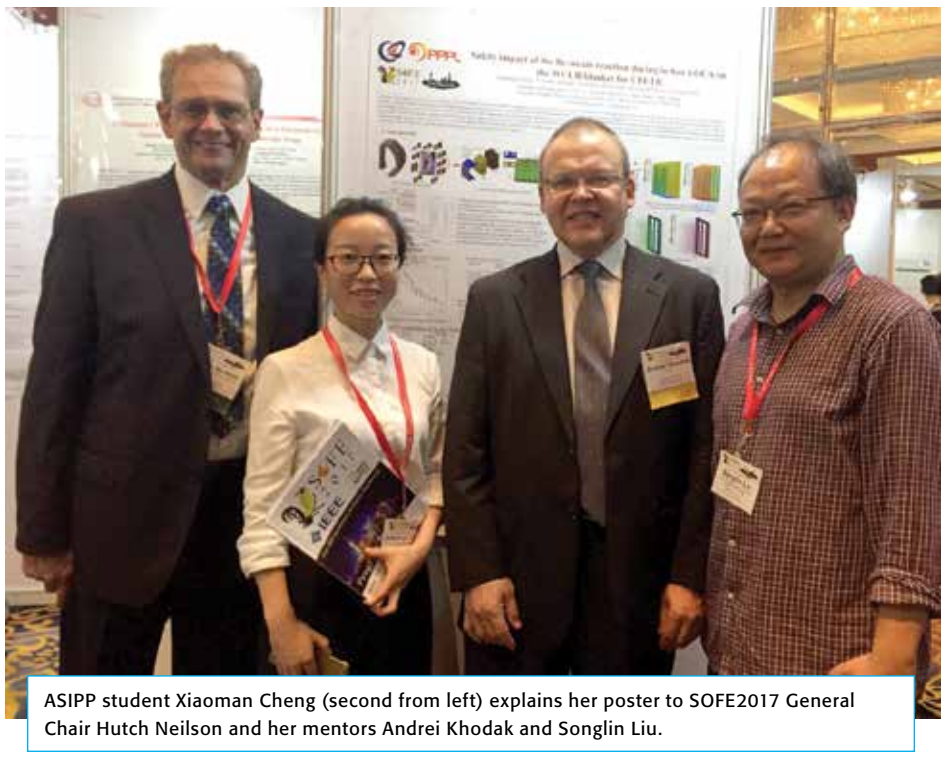
Financially, SOFE2017 received a huge boost in the form of contributions from government agencies, industry, and research institutions, support that enabled the conference to offer a diverse program in a first-rate setting while holding the line on registration fees. Grants were received from the U.S. Department of Energy, the Chinese Academy of Sciences, the China National Natural Science Foundation, Princeton University, and ITER-China Seventeen exhibitors, including several industrial manufacturers, purchased exhibit space in the conference center and advertising pages in the program book. Participants were indebted to Western Superconducting Technologies Co., Ltd. of Xi'an, China for sponsoring the Welcome Reception. Staff from the Institute of Plasma Physics of the Chinese Academy of Sciences (ASIPP) and the Princeton Plasma Physics Laboratory (PPPL), with the support of those institutions, partnered in planning the conference, along with IEEE's Meetings, Conferences, and Events team. The contributions of all these stakeholders to the success of SOFE signifies a strong commitment to the health and vitality of the fusion engineering community.

As always, the SOFE2017 banquet was an occasion to recognize outstanding contributors to the field and to IEEE. Charles Neumeyer, Chair of the NPSS Fusion Technology Standing Committee (FTC), presented the 2016 and 2017 Fusion Technology Awards to Dr. Wayne Meier of Lawrence Livermore National Laboratory and Dr. David Humphreys of General Atomics, respectively. The conference was honored that Prof. Chao Chang of Xi'an Jiaotong University, winner of the 2017 NPSS Early Achievement Award for his work in free electron lasers and high-power microwave devices, elected to accept his award at SOFE. Dr. Carlos Otarola of the Costa Rica Institute of Technology formally accepted the charter for a new NPSS Student Branch Chapter, the first in that country. Finally the FTC's Best Student Paper award was presented to Mr. German Vogel of the University of Science and Technology of China.

The "face of NPSS" at SOFE2017 was Dr. Zhen-An Liu, of the Institute of High Energy Physics of the Chinese Academy of Sciences, who staffed the NPSS booth. Throughout the conference, Zhen-An had many visitors seeking information about NPSS, membership benefits, and costs, conversations that led to about 20 new memberships.

In all, the 27th SOFE was memorable as well as historic. Participants and their guests will remember SOFE2017 for the superb accommodations at the Marriott Shanghai City Centre Hotel, the tours of Shanghai and neighboring towns, the social events, networking with colleagues, and perhaps even the technical presentations! Many young Chinese participants will remember SOFE as their first major international conference and many from the West will look back on their first visit to China and an up-close experience with Chinese cuisine, culture, and technical accomplishments.

Shanghai's spectacular light show attracted many SOFE participants to evening cruises on the Huangpu River.



ASIPP student Xiaoman Cheng (second from left) explains her poster to SOFE2017 General Chair Hutch Neilson and her mentors Andrei Khodak and Songlin Liu.

Zhen-An Liu welcomes visitors to the NPSS booth.

Keeman Kim (S. Korea) and Elizabeth Surrey (United Kingdom) discuss next steps in fusion

The "Russian Table" (and friends) at the SOFE2017 banquet.

DUE RECOGNITION

There are two types of people: Those who come into a room and say, "Well, here I am." And those who come and say "Ah, there you are."

Fredrick Collins

TO EACH HIS OWN

I think men talk with women so they can sleep with them and women sleep with men so they can talk to them.

Jay McInerney

PULSED POWER CONFERENCE

Andreas Neuber
PPS&T Chair

Pulsed Power Scientists and Engineers came together in Brighton, UK, on June 18th, 2017. For five days, the attendees enjoyed the technical presentations, discussions, and social program offered by the twenty-first international IEEE Pulsed Power Conference, sponsored by the IEEE NPSS. For the first time in its 50 year history, since its inception in 1976 in Lubbock, TX, the PPC was held outside the United States. Conference organizers as well as the members of the Pulsed Power Science & Technology (PPS&T) committee are pleased by the PPC's success, and plans are under way to hold the 2025 conference outside the U.S. again. In the meantime, we are of course happy to announce that planning for the 2019 PPC is in full swing. The general chair will be Dr. Raymond Allen from the Naval Research Laboratory.

One of the highlights of the 21st PPC was the recognition of distinguished members through professional awards. Dr. Sergei Rukin from the Institute of Electrophysics, Russian Academy of Science, Ural Division received the Erwin Marx Award, and Dr. Ron Gilgenbach, Distinguished Professor and Chair of Nuclear Engineering and Radiological Sciences at the University of Michigan, received the Peter Haas Award. Art Guenther Outstanding student awards went to Dimitry Mikitchuk, Shelby Lacouture (both 2016), and David Yanuka (2017). The student paper award went to Xukun Liu, Ph.D. Candidate at the State Key Laboratory of Power System and Anton Gusev, Ph.D. Candidate at the Institute of Electrophysics, UB RAS.

Attendees remembered Dr. Boris Kovalchuk, a previous Marx Award winner (1997), who passed away in April of 2017. Dr. Kovalchuk, from the Institute of High Current Electronics (IHCE), Siberian Branch, Russian Academy of Sciences, has produced many outstanding achievements to pulsed power technology over an extended period, most notably the Linear Transformer Driver, LTD.

Attendees also celebrated the accomplishments of Dr. Magne "Kris" Kristiansen, from Texas Tech University, Lubbock TX, the founder of the PPC and chairman of the first two PPC conferences, who passed away just before the conference in May of 2017. Dr. Kristiansen's wife, Aud Kristiansen, and son, Eric Kristiansen, were able to join the memorial session on Thursday morning. Dr. Steve Calico, Raytheon USA, Dr. Gennady Shvetsov, Russian Lavrentyev Institute. of Hydrodynamics, Dr. Edl Schamiloglu, University of New Mexico USA, Mr. Richard Ness, Ness Engineering USA, Dr, Jiande Zhang, NUDT China, Dr. David Wetz, UT Arlington USA, Dr. Bucur Novac, Loughborough University UK, Dr. Andrew Young, LLNL USA and Dr. Frank Hegeler, NRL, USA, contributed to the memorial session chaired by Dr. Andreas Neuber, Texas Tech University USA.

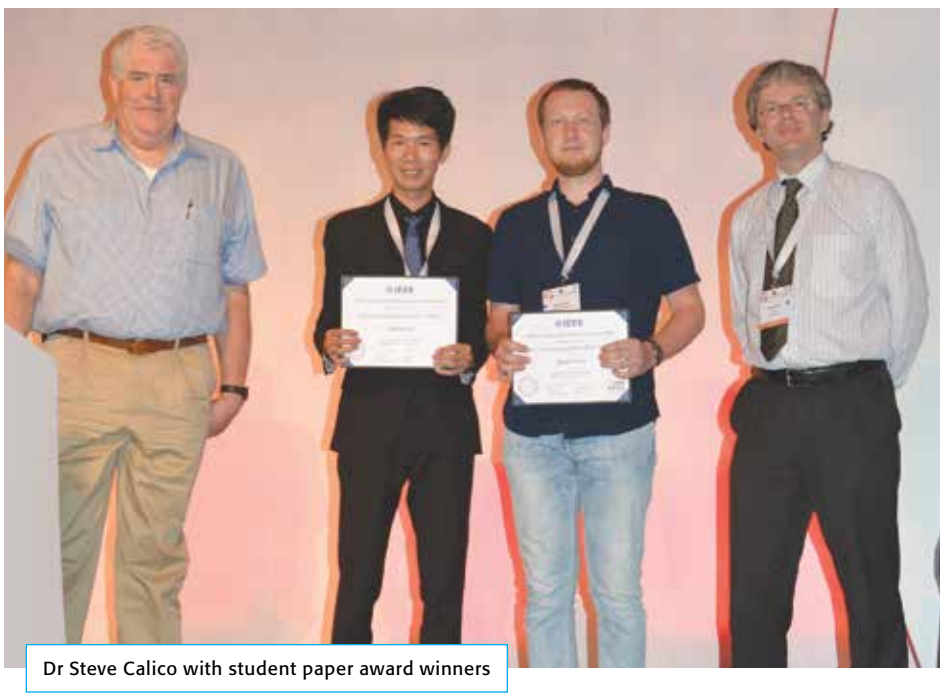
Overall, a total of 456 attendees, also counting the exhibitors and staff, enjoyed the beautiful weather in Brighton, including the night out with the i360 'flight' tower providing ample opportunity for networking as well as some relaxing time between technical sessions. Thank you to all participants, exhibitors, and all involved in making the 21st PPC a success. We are looking forward to 2019, which will be a joint conference with ICOPS, the IEEE Pulsed Power & Plasma Science (PPPS) conference.

Andreas Neuber, chair of the Pulsed Power Technical Committee, can be reached by E-mail at andreas.neuber@ttu.edu

Dr. Ron Gilgenbach Receives Peter Haas Award

Dr Bucur Novac presenting the 2017 student award to David Yanuka, Conference Chair Mark Sinclair to the right

Dr. Sergei Rukin receives Erwin Marx Award



Dr Steve Calico with student paper award winners

BA i360 'flight' tower

I HEAR YOU!

'You have a great gift of silence, Watson," said he, "it makes you quite invaluable as a companion."

Arthur Conan Doyle

President's Report

Stefan Ritt
IEEE NPSS President

In the past months, lots of activity went on behind the scenes to improve our conferences even further. Our new conference chair Susanne Kühn is preparing an improved web site, which consolidates all information to help conference organizers to plan and run an IEEE NPSS conference. Two conference software packets are currently available or are being improved which are available for all our conferences. The conference web site will contain a detailed feature list for each package and documentation for both organizers and conference attendees. The packages cover the whole registration process, abstract submission and evaluation, session building, conference agenda, upload of transparencies and conference evaluation. They include mobile apps that allow attendees to build personalized agendas and receive real-time updates from the conference organizers. Using the same software package across several of our conferences not only minimizes the overall work, but will also give attendees who visit several of our conferences a familiar experience and therefore increase their satisfaction.

On the publications side we are happy to have seen the first three issues of our new journal IEEE Transactions on Radiation and Plasma Medical Sciences (TRPMS). This journal is cosponsored by the Engineering in Medicine and Biology Society (EMBS) and covers areas related to radiation- and plasma-based medical sciences. It is a unique publication related to the application of radiation and plasma sciences within the medical field. If you work in this area, please consider submitting an article to this journal. Please note that since last year all IEEE journals require an Open Researcher and Contributor ID (ORCID) for all authors. ORCID is a persistent unique identifier for authors similar to an article's Digital Object Identifier (DOI). ORCIDs allow accurate attribution of an author's published work. Researchers can sign up for a free ORCID via an easy registration process at the orcid.org web site.

Another new exciting project is IEEE DataPort, which is a cloud repository to store big data sets up to 2 TB. It is currently in its beta version and free of charge. With IEEE DataPort, you can store a dataset long-term and make it accessible to a broad set of researches, engineers and industry. People can try different analysis methods for a public dataset and submit the methods together with the dataset. Supporting a Digital Object Identifier (DOI) for each dataset and analysis method, IEEE DataPort supports the request of many funding agencies to retain referencable data for reproducible research. Give it a try at http://bigdata.ieee.org/ieee-dataport.

I would like to dedicate the remainder of this article to our Young Professionals (YP). These are students, post-docs and members in their early years of their profession. They are the future of our society, and I strongly believe that we have to give all possible support and guidance to incorporate them into our society and motivate them to become volunteers.

I have attended several YP events, and sometimes young people ask me what they might do to improve their career. I have a simple answer to that: Always do a bit more than what you have been asked to do This will distinguish you from others, make you stand out from the crowd. At the university or college level there might be offers for special projects or courses that are not mandatory, but that will give you the chance to learn additional skills. This will make you special. During your Ph.D. program or during your professional career you can learn new technologies and methods, and IEEE will help you in that through conferences, online courses and publications. Let me give you one example: I personally learned in my career about ten computing languages, and only the first one I was taught in high school, the others I learned on my own initiative from books and courses, and nobody asked me to do that. The last one I mastered just two years ago: JavaScript together with HTML5, a language I can highly recommend for any web programming and visualization in all fields of engineering. The effect of this was that people noticed this about me. They realized that I'm active, willing to learn new things. I have gotten job offers I didn't ask for throughout my whole career, including my present position as NPSS president. Having always done a bit more than I was asked for was a door opener for me. This is also true for your private life: Do something for your family or your partner you haven't been asked for. Maybe a gift outside the usual birthday-Christmas-Valentine's Day cycle. Some unexpected dinner or some concert tickets. This has helped me to stay in a healthy partnership for more than 35 years now.

A good opportunity to do a bit more is to become active in a professional organization like IEEE. Conference organizers are always looking for young professionals to help in planning and running a conference. Editors need help in reviewing papers and conference proceedings. You can get actively involved in YP events, and I'm more than happy to bring you into contact with the YP group inside IEEE. We recently established a student competition to produce a video about IEEE, where you can even win a prize (see below). So become active, distinguish yourself from your peers, and you will see that you meet new interesting people; one of them may be your next boss.

Sincerely,

Stefan Ritt, IEEE NPSS President, can be reached at the Paul Scherrer Institute, CH-5232 Villigen PSI, WBWA/140, Switzerland; Phone: +41 56 310 3728; E-mail: stefan.ritt@psi.ch.

Secretary's Report

Albe Larsen
IEEE NPSS Secretary and Newsletter Editor

The NPSS AdCom met in New Orleans, Louisiana on July 22nd , following the NSREC Conference.

The Society remains financially healthy despite threats of increased charges from IEEE and decreased revenues from publications and conferences. A new publications revenue algorithm may cost us quite a lot of money. Conferences continue with problems of visa uncertainties and tough federal control of laboratory travel—a huge disservice to U.S. scientists and engineers.

There remains concern about the IEEE Board of Directors and the excessive use of executive sessions. What was once a transparent organization is becoming worrisomely secretive.

ADCOM ACTIONS:

» It was moved that the NPSS-PPST Committee Technically Cosponsor the EAPPC/BEAMS Conference (7th Euro-Asian Pulsed Power Conference with the 22nd Intl. Conference on High-Power Particle Beams) to be held on September 16-20, 2018 in Changsha, China. Passed unanimously

» It was moved that the NPSS-PPST Committee Technically Cosponsor the 2018 EML Symposium to be held in St. Louis, France in 2018. Passed unanimously.

» It was moved that t he NPSS PPS&T Committee Technically Cosponsor the IPMHVC 2018 (International Power Modulator and High Voltage Conference) to be held in Jackson, Wyoming, USA, June 3rd–7th, 2018. Carried unanimously.

» It was moved by the Radiation Instrumentation Steering Committee that the IEEE Emilio Gatti Radiation Instrumentation Technical Achievement Award be established as an annual award with a prize of $2000, with funds budgeted in the NSS conference budget. The award would be eligible to individuals with at least ten years of professional experience and contributions in the areas: radiation detectors, radiation instrumentation, nuclear electronics, measurement techniques for ionizing radiation.

Description: *To recognize a mid-career individual who has made significant and innovative technical contributions in the field of radiation detectors, radiation instrumentation and/or nuclear electronics, and/or measurement techniques for ionizing radiation.*

The motion carried unanimously.

FINANCE COMMITTEE MOTIONS:

» It was moved that the IEEE NPSS establish the NPSS Magne 'Kris' Kristiansen Award for Contributions to Experimental Nuclear and Plasma Science.

The funding for the award comes from the IEEE Foundation, from matching donations from the Kristiansen family and from IEEE NPSS. The $2000 award, eligible only to IEEE NPSS members, will be granted annually unless there is no suitable candidate deemed to be eligible. Judging will be based on outstanding contributions to experimental nuclear and plasma science, with preference given to areas within the broadest scope of plasma sciences encompassing the generation of strong pulsed electromagnetic fields including their interaction with plasmas and other pulsed power applications. The motion carried unanimously.

» FinCom presented a policy for travel reimbursement for AdCom travel. It carried unanimously. Contact Albe Larsen a.m.larsen@ieee.org if you need details.

» FinCom moved the approval of reallocating $55k of 2017 initiative funding for the Rugged SunBlazer project. The motion carried unanimously.

» FinCom moved that the following initiatives be approved for 2018:

- NPSS Instrumentation Schools $25k
- Conference S/W Development $65k
- Internet Connectivity for Education and Business $145k
- In-Process Conference Management Tool $125k

The motion carried unanimously

» FinCom moved that $12k of 2017 initiative funding be reallocated for further development of the Indico conference software. The motion carried unanimously.

AdCom will hold its final meeting of 2017, the Annual Meeting, at the Hyatt Regency Atlanta, on Saturday, 28th October 2017, in Atlanta, Georgia, U.S.A.

Albe Larsen, IEEE NPSS Secretary and Newsletter Editor, can be reached by E-mail at a.m.larsen@ieee.org.

The video shall be no more than two minutes long and shall be based on the importance and relevance of NPSS to the student. For example, the video might show the relevance of a specific technology in the NPSS field of interest or NPSS activities to his/her work. The video copyright must be assigned to IEEE. Contributions are due by 15 December 2017. Please contact p.clout@ieee.org about submitting the entry.

The videos will be used on our web site, at conferences between sessions, at the Membership table, and elsewhere as IEEE or NPSS deems appropriate.

A Committee comprised of the chairs of the Communications, Awards, and Membership committees plus three additional members chosen by the designated members in consultation with the NPSS President will judge the submissions.

Prizes:

First Prize: Up to $2500 to attend the NPSS conference of his of her choice, plus certificate
Second Prize: 128 GB IPad Pro ($700) or gift certificate of equivalent value plus certificate
Third Prize: $250 gift certificate plus certificate

All IEEE NPSS students are welcome to participate!

Technical Committees

COMPUTER APPLICATIONS IN NUCLEAR AND PLASMA SCIENCES

Martin Purschke
Chair, CANPS Technical Committee

It is now less than a year until we will hold the next Real-Time in the wonderful Colonial Williamsburg conference facilities in Virginia. We will have the place entirely to ourselves, and will have a stimulating environment with a close proximity of posters, industrial exhibitions, and the coffee area. My committee, chairman David Abott, and Jefferson Lab conference support have been busy preparing the infrastructure for the meeting, web sites, registration, room blocks, and the traditional short courses held the weekend before the meeting. Today we are showing the picture from the main conference website https://indico.cern.ch/event/543031, and photos from the hotel reception area and a part of the main meeting room, where we will get together next year in June.

This time, we have the 4th installment of the articles by the student award winners from the 2016 Real-Time conference. In this issue you can read about the award-winning work from Davide Pedretti from the University of Padova. Davide received a master's degree from the University of Parma, Italy, in 2012. He has since been working on his PhD in Information Engineering. Davide has designed and built a data acquisition system for beam diagnostics for the accelerator complex at the National Laboratories of Legnaro (LNL). LNL is one of the four national labs of the Italian Institute of Nuclear Physics (INFN) that covers the main research fields of nuclear physics and nuclear-astrophysics, as well as interdisciplinary applications, ranging from the production of radionuclides of medical interest to applications of nuclear technologies. Davide has joined the LNL control group, where his main contribution has been the design of a Universal I/O controller. His contribution will soon be at work in the distributed control system of the accelerator.

Martin Purschke, CANPS chair, can be reached by E-mail at Purschke@bnl.gov.

NUCLEAR MEDICAL AND IMAGING SCIENCES

As I write this the program committee is finalizing the selection of abstracts for presentation in the 2017 IEEE NPSS Nuclear Science Symposium and Medical Imaging Conference (NSS/MIC) which will take place at the Hyatt Regency, Atlanta from the 21st to 28th of October. John Aarsvold is the General Chair for the meeting, while Lars Furenlid and Matthew Kupinski serve as the MIC Program Chair and Deputy Program Chair respectively. The program is available at http://www.nss-mic.org/2017/.

Looking further ahead, the 2018 IEEE NSS/MIC will be in the spectacular new conference centre in Sydney from the 29th of October to the 6th of November. Anatoly Rosenfeld will be the General Chair with Steve Meikle and Taiga Yamaya serving as MIC Program Chair and Deputy respectively. For 2019 the meeting will be in the UK for the first time, in Manchester with General ChairPaul Marsden and Dimitra Darambara and Suleman Surti as MIC Chair and Deputy Chair respectively. Finally, the decision has now been taken for 2020 meeting to be held in Boston, with Lorenzo Fabris as General Chair

This year we have 9 excellent candidates standing for the five seats on NMISC. They are all regular conference contributors and keen to contribute more. Our aim is to try and involve the elected members much more during their term of office. Thanks to everyone who has either volunteered or proposed candidates and to Emilie Roncali, NMISC Secretary, for putting together the list of candidates.

Paul Marsden
NMISC Chair

Paul Marsden can be reached at the Division of Imaging Sciences and Biomedical Engineering, King's College London, St Thomas' Hospital, London, SE1 7EH, UK; Phone: +44 (0)20 718 53208; Email: paul.marsden@kcl.ac.uk

TECHNICAL COMITTEES Continued on **PAGE 16**

Functional Committees

AWARDS

Janet Barth
IEEE NPSS Awards Committee Chair

We are now soliciting nominations for our NPSS Awards for the coming year, 2018. Members of our community are eligible for a number of awards for exceptional contributions to our field or our Society. These include the highest IEEE level awards, such as the IEEE Medal for Healthcare Innovations and Technology and the IEEE Marie Sklowdowska-Curie Technical Field Award, our Society awards, and numerous Technical Committee and Conference awards. Information about all of these awards can be found on the NPSS website http://ieee-npss.org/awards/. The due dates for nominations vary according to the award, but the NPSS Society-level awards are generally due 31 January 2018. It takes time to put together an effective nomination and many awards require endorsement letters, so it's not too early to start thinking about possible candidates and working on nomination packages before the end of this year. There are tips on our NPSS Awards website on how to write a successful nomination.

There are also a number of grants sponsored by NPSS that are designed to help students and young researchers attend various NPSS conferences and Short Courses. The Paul Phelps Continuing Education Grants provide funds for students, postdocs, and unemployed NPSS members to cover the cost of tuition and other expenses for Short Courses offered at NPSS conferences. Many of the NPSS Technical Committees sponsor student awards and travel grants, and many of our conferences also offer NPSS Student Paper Awards for outstanding student contributions at our conferences. Details on how to apply for these awards and grants are given on the NPSS Awards website.

Please nominate one of your colleagues, or yourself, for one of the many NPSS awards or grants (self nominations are allowed for some of the awards – just check the details to be sure). It's a great opportunity to recognize some of the many outstanding colleagues in our field and to raise the level of prestige of our Society. Visit the NPSS Awards website for details of each award, nomination forms, and submission instructions.

Before preparing a nomination please note the IEEE policy on Hierarchy of Awards. More information about the hierarchy of awards is provided on the NPSS Awards website. IEEE Policy on Award Limitations states "Normally, an individual shall receive only one honor in recognition of a given achievement, unless the significance of the achievement is such as to merit subsequently a higher award. A higher award may be given in the following year or thereafter."

Janet Barth, Chair of the NPSS Awards Committee, can be reached by E-mail at jbarth@ieee.org.

NOMINATE A WORTHY COLLEAGUE FOR THE MARIE SKLODOWSKA-CURIE AWARD

You are eligible to be a nominator/endorser for a Technical Field Award if you are not serving on the following committees:

- IEEE Board of Directors
- IEEE Awards Board
- IEEE Technical Field Award Council
- IEEE Curie Award Committee

More information on the award, guidelines, scope, nomination deadline can be found at http://www.ieee.org/about/awards/tfas/curie.html

The nomination form is electronic. The deadline is 15th January 2018.

If you have any questions or concerns, please feel free to contact mahjeda.ali@ieee.org or awards@ieee.org.

NSREC ANNOUNCES 2017 PHELPS AWARD RECIPIENTS

The 2017 Paul Phelps Continuing Education Grant was awarded to three student members from the radiation effects community. At the opening of the NSREC technical sessions (July 17, 2017), Allan Johnston, Chairman of the Radiation Effects Steering Group, announced the grant awards. The grants included tuition for the 2017 NSREC Short Course and a check for $750.

The purpose of the Phelps Grant is to promote continuing education and encourage membership in the Nuclear and Plasma Sciences Society (NPSS). The criteria for judging are exceptional promise as a student, postdoc or research associate in any of the fields of NPSS, or exceptional work in those fields by currently unemployed NPSS members with an expectation that attendance at the Short Course will improve the possibility of obtaining a job in an NPSS field.

The three recipients of the 2017 Paul Phelps Continuing Education Grant were Yanran (Paula) Chen, Adriana Morana, Hangfang Zhang.

Yanran (Paula) Chen
Paul Phelps Continuing Education Grant recipient

Yanran (Paula) Chen is pursuing her Ph.D. in the Department of Electrical Engineering and Computer Science at Vanderbilt University in Nashville, Tennessee. The focus of her Ph.D. dissertation work is on developing radiation-hardened-by-design (RHBD) all-digital phase-lock loops (ADPLLs). Specifically, she has identified the sensitive sub circuits in common ADPLL designs and studied single-event transient (SETs) and single-event upsets (SEUs) induced failure modes using laser experiments and FPGA fault-injection experiments. She also developed time-domain analytical model for SEU-induced errors in ADPLLs. RHBD guidelines for common types of ADPLLs are extracted based on the analytical model and experimental results. She has authored or coauthored 12 publications. Her Ph.D. advisor is Dr. Lloyd W. Massengill. Her research is supported by the Defense Threat Reduction Agency (DTRA).

Adriana Morana
Paul Phelps Continuing Education Grant recipient

Adriana Morana obtained her Ph.D. in Optics and Photonics in the French University of Saint Etienne and the Italian University of Palermo, in December 2013. All her studies focused on radiation-induced effects in silica-based optical fiber sensors, mainly based on Fiber Bragg gratings, for point measurements, and scattering phenomena, for distributed sensing. The main topic of her Ph.D. work was the development of a new manufacturing method of radiation-resistant temperature and strain sensors based on fiber Bragg gratings. The obtained results led to a patent and a European project HOBAN for marketing such sensors. Adriana has authored or coauthored 14 publications in international journals and she has attended NSREC, RADECS and ANIMMA conferences since the beginning of her research work on radiation-effects. Next year she will continue her collaboration with the University of Saint Etienne and the MOPERE research group. Pr. Sylvain Girard nominated her.

NO PAIN, NO GAIN

In the long run, a harmful truth is better than a useful lie.

Thomas Mann

ESPECIALLY A VIRTUAL ONE!

It is very hard to live up to an image.

Elvis Presley

Functional Committees

Continued from **PAGE 9**

Hangfang Zhang
Paul Phelps Continuing Education Grant recipient

Hangfang Zhang is pursuing her Ph.D. in the Department of Electrical Engineering and Computer Science at Vanderbilt University in Nashville, Tennessee. Her studies involve investigating radiation effects in sequential circuits and integrated circuit design in advanced technologies. The focus of her Ph.D. dissertation work is on comparative studies of single event responses of sequential circuits for planar and FinFET technologies. Her research utilizes theoretical analysis, TCAD and circuit level simulations, and experiments to identify fundamental mechanisms and illustrate the differences in single event responses under different circumstances for those technologies. The aim of her work is to identify the underlying mechanisms and provide designing guidelines in FinFET technologies. She has authored or coauthored 9 publications. She is advised by Dr. Bharat L. Bhuva. Her research is supported by the Soft Error Consortium.

NSREC CALLS FOR NOMINATIONS FOR 2018 AWARDS

Teresa Farris
NSREC Publicity Chair

Nominations are due January 26, 2018 for awards that will be presented at the IEEE NSREC 2018 Conference July 16th -20th, 2018 in Kona, Hawaii.

RADIATION EFFECTS AWARD NOMINATIONS

Nominations are currently being accepted for the 2018 IEEE Nuclear and Plasma Sciences Society (NPSS) Radiation Effects Award. The purpose of the award is to recognize individuals who have had a sustained history of outstanding and innovative technical and/or leadership contributions to the radiation effects community. The $3000 cash award and plaque will be presented at NSREC Kona. Nomination forms are available electronically at http://ieee-npss.org/technical-committees/radiation-effects/ and must be submitted by January 26th, 2018.

Additional information can be obtained from Tom Turflinger, Senior Member-at- Large, Aerospace Corporation, for the Radiation Effects Steering Group. Tom can be reached at 571-307-3715, thomas.l.turflinger@aero.org.

PAUL PHELPS CONTINUING EDUCATION GRANT NOMINATIONS

Nominations are currently being accepted for the 2018 Paul Phelps Continuing Education Grant. The purpose of the grant is to promote continuing education (attendance at the 2018 NSREC Short Course) and encourage membership in NPSS. Outstanding members of NPSS who are either Student Members, Post-Doctoral Fellows or Research Associates, or unemployed members needing assistance in changing career direction can be nominated for the award. Funds are to be used towards covering travel costs to attend the NSREC Short Course. The grant also provides complimentary short course registration.

Nomination forms are available electronically at http://ieee-npss.org/technical-committees/radiation-effects/ and must be submitted by January 26, 2018.

Additional information can be obtained from Ethan Cannon, Member-at-Large, The Boeing Company, for the Radiation Effects Steering Group. Ethan can be reached at 253-65-5104, ethan.cannon@boeing.com.

AND PRACTICE IT THEY DO

"Oh, no, Minister," Sir Humphrey assured him. "That [winking at corruption] would be unthinkable. It could never be government policy—only government practice."

BBC's Yes Minister

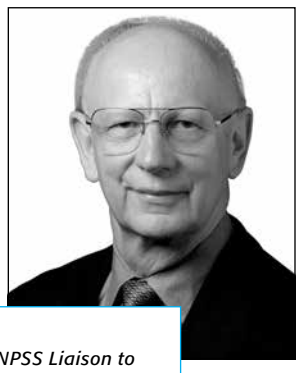
AND THE LAWYER'S FRIEND

A patent is really a license to be sued.

Arthur C. Clarke

Liaison Report

IEEE SMART VILLAGE WORKSHOP



Ray Larsen
ISV Chairma], NPSS Liaison to Humanitarian Activities

Accra, Ghana, June 26—July 2, 2017

Excitement, anticipation, eagerness was palpable as the delegates to the IEEE Smart Village (ISV) Workshop opened their meeting in Accra, Ghana, in late June, in conjunction with the IEEE PES Power Africa conference. Attendees were ISV volunteers, including the leadership team of Ray Larsen, chair, and Robin Podmore, vice chair, and ISV's staff support, Mike Wilson, successful ISV entrepreneurs such as Ifeanyi Orajaka of Nigeria and Paras Loomba of India, and a sea of potential volunteers from Egypt south through sub-Saharan Africa.

The meeting, held at the Ghana Institute of Management and Public Administration (GIMPA) intersected with Power Africa on a number of occasions with Ray Larsen giving a plenary paper on ISV, with panel discussion participation and with free movement from one meeting to the other of delegates with more Power Africa people joining ISV than expected.

The ISV program featured reports from successful ISV-start-up enterprises such as Green Village Enterprise of Nigeria headed by Ifeanyi and Global Himalayan Expeditions of Ladakh India, headed by Paras Loomba, and an extensive introduction of the Master's in Development Practice at Regis University in Denver, CO by Director Nina Miller which uses the ISV-funded IEEE Global Classroom at the Posner Center in Denver to allow students across the world to connect in live classroom lectures, discussion and animated exchange, A live demonstration with ISV volunteer Dan Wessner (the original creator of the Regis program) in Vietnam, our group in Accra, and Denver volunteers showed just how this innovative program works. It is now starting its third cohort and a number of students have completed the certificate possibility, an option instead of the full Master's degree.

After hearing from entrepreneurs, we heard from the large class of potential entrepreneurs who are bringing proposals to ISV for new enterprises. These included attendees from Egypt, Cameroon, Democratic Republic of Congo, Ethiopia, Kenya, Liberia, Mali, Malawi, Nigeria and Rwanda. In some cases these potential entrepreneurs are working with and getting guidance from successful ISV entrepreneurs. Others are learning what the next steps are that they have to take to start their own enterprises.

All benefited from discussion of available products, and all worked with Paras Loomba as he taught the group to assemble LED light bulbs, a possible local enterprise to support the installation of Microgrids or home lighting kits.

In addition, there was further discussion of educational opportunities, with a presentation of the plans for linking schools in Papua New Guinea, and Cameroon's training of technicians needed to service the solar Microgrids. As part of its 'three-legged stool' or 3-Pillar approach, ISV includes Electricity, Education and Enterprise." Starting with the transformative power of electricity opens new dimensions for all in developing lands to experience the power of high-level education, independence from handouts, and the opportunity to develop additional local sustainable enterprise to support communities, create jobs and foster world-class education at ~1% of the US cost.

Successful light bulb test!

Teams work to assemble LED light bulbs, a GHE village industry.

Another team has success at LED light bulb assembly!

Smart Village attendees on field trip to Microgrid solar facility on Pediatorkope Island. The island is used as a testing ground for various projects from solar panels to electricity generating swing sets.

Long boats out to Pediatorkope Island

Articles

Metamaterials for High Power Microwave Applications

ABSTRACT

There is increasing interest in using metamaterials for designing HPM sources because of their so-called unique electromagnetic properties that are not found in nature, such as below cutoff propagation, which is the main property that allows for a compact design, and negative refractive index that allows backward wave propagation and reversed Cerenkov radiation. As such, new beam/wave interactions can be engineered using metamaterials. In this article, a novel metamaterial slow-wave structure (MSWS) is designed for high power microwave (HPM) generation which is an efficient and compact new O-type device whose output parameters are comparable to, and even better than conventional devices. We also show that the main properties of MSWSs, such as the existence of the lowest order wave with negative dispersion, also appear in ordinary metallic periodic systems with deep corrugation.

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Index Terms—metamaterials, slow wave structure, HPM, dispersion diagram.

I. INTRODUCTION

Metamaterials are promising artificial materials that have found many applications in modern passive electromagnetic devices such as antennas, phase shifters, power dividers, filters, among others. They consist of a subwavelength resonant structure that can produce electromagnetic (EM) behavior not typically available in nature and they exhibit unusual physical properties such as negative index of refraction, backward Cherenkov radiation [1-6], etc. Unusual electrodynamic properties of metamaterials naturally call for investigations of their applicability as slow wave structure (SWS) elements in modern microwave vacuum electron devices [7-11] for high power microwave (HPM) generation. It is anticipated that metamaterial SWS- (MSWS-) based HPM sources driven by intense electron beams will have unusual properties as well, so one might be able to achieve more compact microwave sources with conceivably better performance than sources based on conventional structures.

Although the unique properties of metamaterials for HPM generation have been demonstrated in this work, many conventional vacuum electron microwave devices have been known to have similar properties long before the appearance of MSWSs. Here we are showing for the first time that the unique properties of MSWSs are also inherent to conventional periodic structures with increasing depth of corrugation [12].

In this work, we simulate the interaction of such a MSWS with a high-current electron beam using the particle-in-cell (PIC) codes MAGIC [13] and CST particle studio [14], and we performed numerical cold-tests using the electromagnetic code HFSS [15].

II. A NOVEL MSWS DESIGN

A Multidisciplinary University Research Initiative (MURI) grant was awarded in FY12 to research the topic of "innovative use of metamaterials in confining, controlling, and radiating intense microwave pulses" with contributions from five universities, led by the University of New Mexico (UNM), and including MIT, Ohio State, UC Irvine, and Louisiana State. The research described in this article was supported by this grant.

Cerenkov radiation in a MSWS has been a topic of recent interest due to the backward wave generation and interest in comparing its operation with a backward wave oscillator (BWO) [16]. In light of this motivation, we describe a novel design of a MSWS for HPM generation that produces HPM radiation due to the coupling of an electron beam with a MSWS. This interaction is similar to that in a BWO because the electron beam interacts with a negative dispersion mode, resulting in backward wave propagation. The difference is that in a BWO negative dispersion occurs in the second passband, whereas for the MSWS negative dispersion occurs in the first passband.

The MSWS comprises periodically alternating, oppositely oriented split ring resonators (SRRs) connected to a metal tube where the distance between the rings is much less than a wavelength of the radiation generated. The SRRs provide negative permeability. The diameter of the metal tube that the SRRS are coaxially contained in is such that the generated oscillations are below cutoff, thus providing negative permittivity. A tubular electron beam propagates through this structure coaxially. The interaction space is coupled with the outer coaxial channel through gaps between the SRRs. Radiation is extracted at the output end of the outer channel via a conical horn section.

Unlike [8], where generation of around 5 MW in S-band was demonstrated in a MSWS comprising a parallel plate complementary SRR array, here we are aiming to achieve optimum coupling of the electron beam to the MSWS to demonstrate >100 MW generation with rapid growth. (The growth time of oscillations in [8] was a few 100 ns. We require growth times to be no longer than several ns due to short pulse SINUS-6 electron beam accelerator available at UNM.) Since the synchronous operating wave has negative dispersion, its interaction with the electron beam inside the MSWS is as in a conventional BWO with reflections from the ends where cylindrical waveguides with the same radius as the minimal radius of the MSWS are placed. It is pertinent to reiterate that the frequency of the generated wave in the MSWS is below the cutoff frequency for a regular waveguide of the same radius. We next describe some design considerations.

First, conventional metamaterial structures cannot survive in the high-power environment because of their geometry and material that comprise a dielectric substrate with etched metallic structures. Since metamaterials are highly resonant structures, the dielectric substrate would heat and likely melt. In addition, as a MSWS, the presence of electrons usually leads to charging of a dielectric, which in turn may result in dielectric breakdown [17]. In order to eliminate these problems, we chose to use an all-metallic structure. Secondly, we designed a structure that can produce a backward wave with a negative dispersion mode and has negative refraction index, which is one of the fundamental metamaterial properties due to the configuration of its geometry.

Unlike the planar metamaterials that have been used for studying the passive interaction with electromagnetic fields [1-3] here we study a cylindrical MSWS consisting of separate rings with oppositely oriented cuts as shown in Fig. 1.

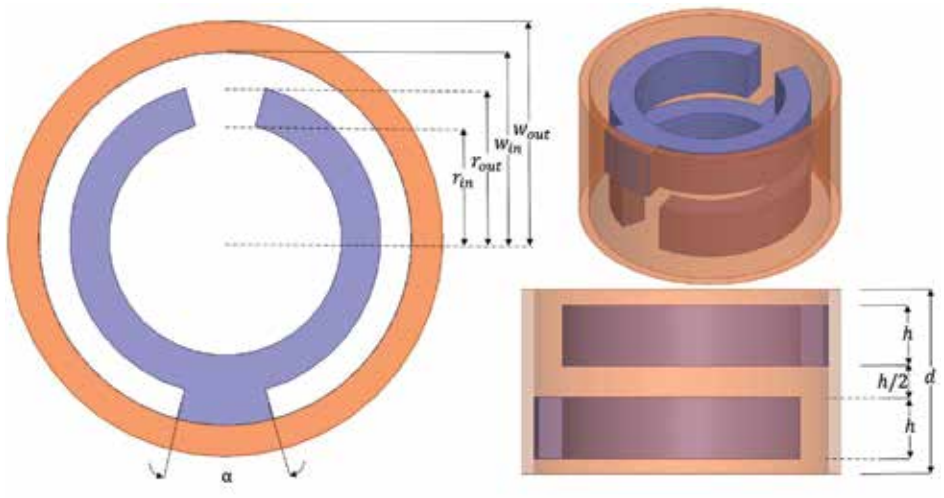


Figure 1. Geometry of the O-Type MSWS in different angles of view for a single unit cell.

The MSWS consists of SRRs where the broadside coupled rings are 180° out of phase. Each split ring is electrically connected to the output waveguide with a 30° conducting tab, and each ring has a slit in one side except for the final three rings that are solid. These final rings, which are continued onto a conical antenna, are connected to each other in a different way than the other rings, as shown in Fig. 2. The actual MSWS consists of 12 split ring elements and is mounted inside a cylindrical channel. It also has regular cylindrical waveguides at both ends of the MSWS connected to the channel and all the rings to keep them at the same potential kV with respect to the cathode potential. A conical horn section is also included in order to mitigate undesired breakdown at the output port.

ARTICLES Continued on **PAGE 12**

Metamaterials Continued from **PAGE 11**

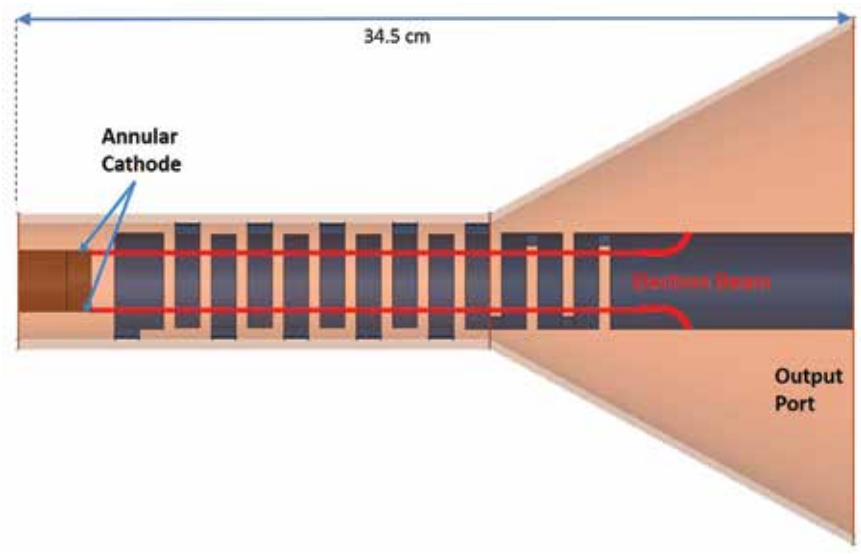


Figure 2. Illustration of the entire SWS tube.

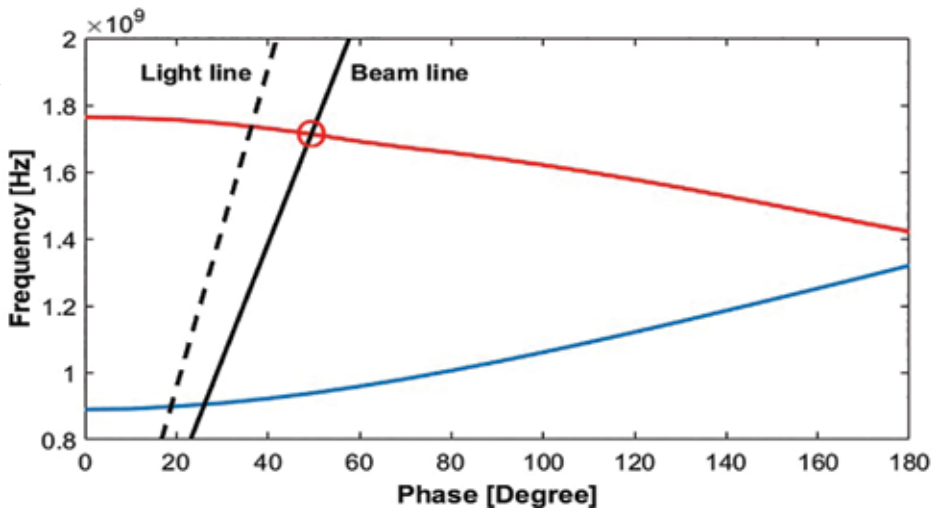
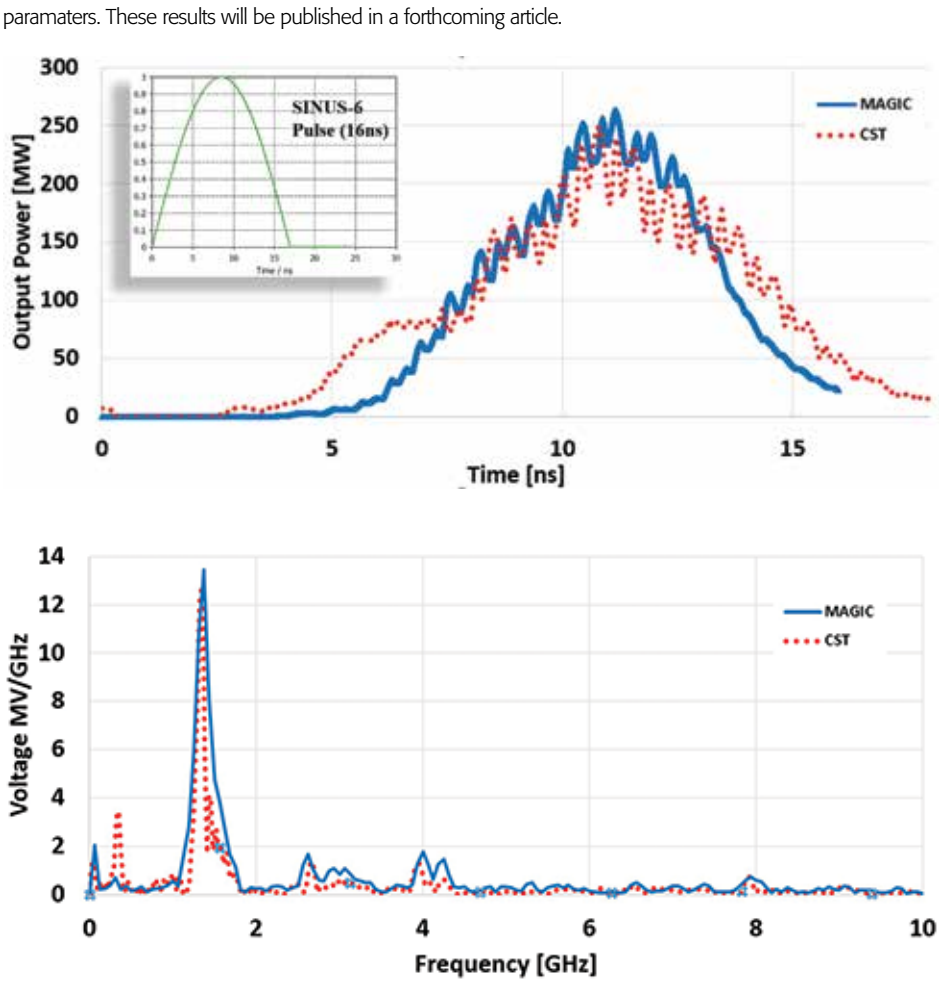


Figure 3. Dispersion diagram for the MSWS. The first two modes are shown, along with the light line (dashed) and the beam line (solid).

Using particle-in-cell (PIC) simulations, it was found that the electron beam in the interaction space forms a sequence of trapped electron bunches due to the synchronous operating wave. The output parameters of this oscillator for an applied voltage kV, electron beam current kA, and guide axial magnetic field T are a radiation power MW which is a record high power reported in the literature for a metamaterial concept. The radiation frequency is GHz and the beam to microwave conversion efficiency % when the total SWS length consisting of 12 split rings is 34.5 cm. The output radiation pattern corresponds to a TE21-like mode.

In order to verify the MAGIC PIC code simulation results, we also modeled the same structure using CST Particle Studio. Figure 4 shows a comparison of the output power and FFT of the RF signal obtained from both codes. Both PIC code simulation results are in very good agreement.

A precision MSWS was fabricated for experimental hot tests, and is shown in Fig. 5. Due to damage on the plastic oil-vacuum interface (evidence of arcing) of the SINUS-6 electron beam accelerator, experiments had to be performed at a reduced voltage in order to avoid electrical breakdown. There is excellent agreement between the MAGIC simulations and the experimental results. On the order of 100 MW was generated at a frequency of 1.43 GHz with no evidence of electrical breakdown in the MSWS at these reduced input paramaters. These results will be published in a forthcoming article.



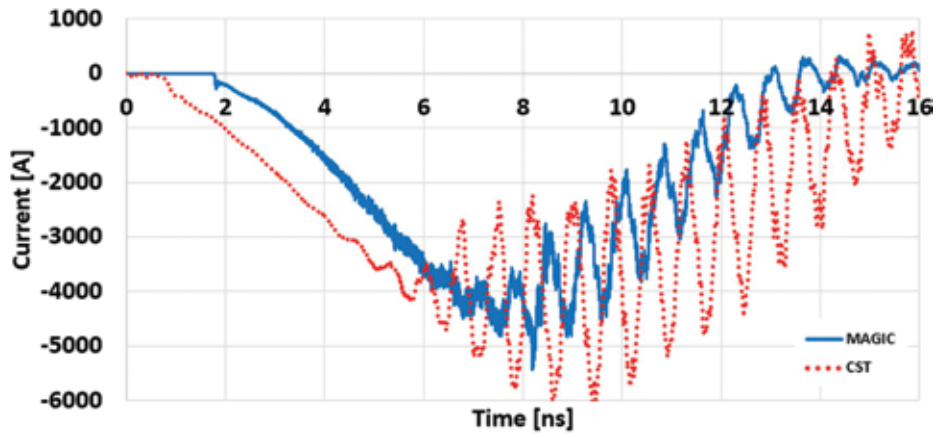


Figure 4. CST (dashed) and MAGIC PIC (solid) simulations output: Top: radiation power P; middle: radiation spectrum; bottom: anode current.

Figure 5. Photograph of the interior of the precision-manufactured MSWS for hot test experiments.

III.SIMILARITY PROPERTIES OF MSWS AND ORDINARY PERIODIC STRUCTURES

A study of the evolution of wave dispersion in systems of all-metallic periodic structures with increasing corrugation depth shows a similarity of the properties of waves in MSWSs and traditional metallic SWSs used in HPM sources. We show that the main properties of MSWSs, such as the existence of a lowest order negative dispersion wave below cutoff, also appears in conventional metallic periodic systems with deep corrugations. Furthermore, we find that the appearance of negative dispersion in the first passband in all-metallic periodic structures with increasing corrugation depth is accompanied by a hybrid mode being identified as the lowest order negative dispersion mode [12].

We consider the evolution of the dispersion characteristics of low-order waves in an axisymmetric cylindrical system with a sinusoidal profile.

$$R(z)=R_0+l_0\sin(\bar{h}z)\#(1)$$

That depends on the amplitude (depth) of corrugation (is the average radius of the cylindrical structure) in order to compare with the dispersion characteristics of MSWSs.

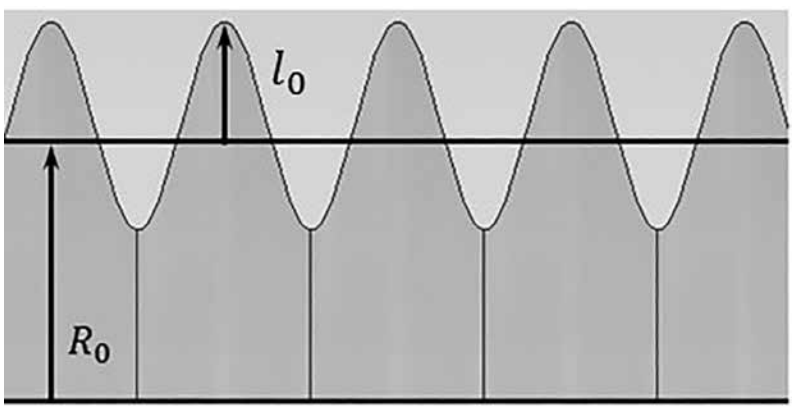


Figure 6. Cylindrical SWS with a sinusoidal profile.

Figure 7 shows the evolution of the dispersion relation as the corrugation depth increases for the lowest modes of a SWS with cm. We considered SWSs with period cm that was used earlier in a relativistic TWT [18] with the operating TM01-mode when mm.

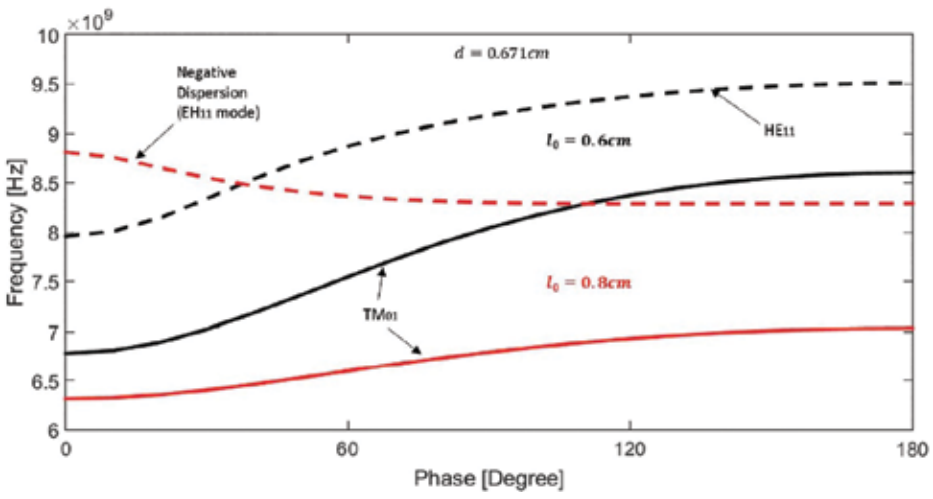


Figure 7. Dispersion diagram for the lowest order modes with different corrugation depths in a cylindrical SWS (solid lines represent the first mode while dashed lines represent the second mode for each corrugation depth indicated) with mean radius R_0=1.6 cm and period d=0.671 cm.

For the sinusoidal SWS with period cm the hybrid EH11 mode (its structure is shown in Fig. 8) displays negative dispersion when the corrugation depth mm (Fig. 7).

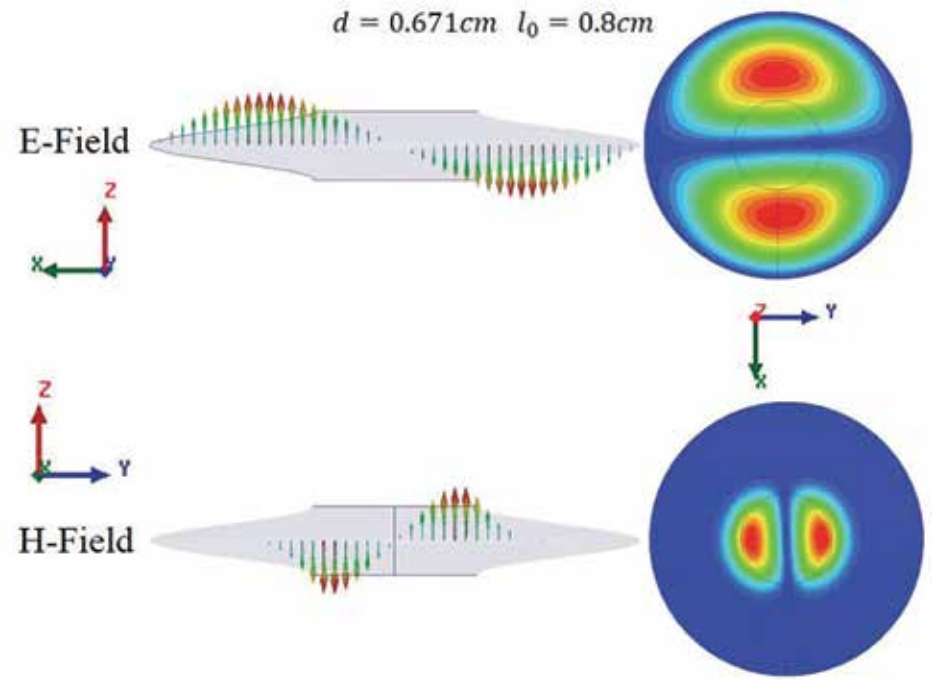


Figure 8. Structure of the hybrid EH11 mode in an all-metallic SWS with sinusoidal corrugation.

Thus, we have shown that the well-known properties of MSWSs are, in fact, common properties of all-metallic periodic systems with deep corrugations.

It is conceivable that additional properties of MSWSs will be identified in the future that will not have similar properties in traditional SWSs.

IV.CONCLUSIONS

Using the metamaterial concept, we designed a novel effective microwave oscillator with a MSWS and have achieved record high output power of about 100 MW in experiment, which agrees with PIC simulation results for the reduced input parameters. Computer simulations show that with applied voltage 400 kV, radiation power is 260 MW with frequency 1.4 GHz. An efficiency of 15% is achieved with very fast rise time 4 ns. The designed MSWS consisting of rings with oppositely oriented cuts with small period that is much less than wavelength shows metamaterial properties such as below cut-off propagation, and negative dispersion.

We also show that long before the appearance of the concept of MSWSs, many researchers in vacuum electronics worked with SWSs having properties similar to the known (at present) "unique" properties of MSWSs without knowing about it.

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Improving PET Quantitation with Denoising, Motion Compensation, and Deblurring

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Positron emission tomography (PET) enables 3D visualization of vital physiological information, e.g., metabolism, blood flow, and neuroreceptor concentration by using targeted radioisotope-labeled tracers. Quantitative interpretation of PET images is crucial both in diagnostic and therapeutic contexts. As a result of its unique functional capabilities, PET imaging plays a pivotal role in diagnostics and in therapeutic assessment in many areas of medicine, including oncology, neurology, and cardiology. Accurate quantitation requires correction of PET raw data and/or images for a number of physical effects. These include attenuation correction, randoms and scatter correction, subject motion correction, and partial volume correction. We have developed a range of techniques that address the PET denoising, motion compensation, deblurring problems. Several of these methods greatly enhance the quantitative capabilities of PET particularly by incorporating information from an anatomical imaging modality such as magnetic resonance imaging (MRI).

IMAGE DENOISING

Faced with a fundamental tradeoff between radiation dose and image noise, PET data is inherently noisy. The high levels of noise in PET images pose a challenge to accurate quantitation. This issue is particularly well-pronounced at the early time frames of dynamic PET images, which are usually short to capture rapid changes in tracer uptake patterns. In order to improve image quality and quantitative accuracy, statistical image reconstruction algorithms model the Poisson characteristics of PET data and employ numerical optimization algorithms to solve the corresponding optimization problem [1, 2]. Common reconstruction procedures, such as ordered subsets expectation maximization, are therefore routinely followed by a post-filtering step for denoising the reconstructed image. A range of strategies have been proposed for post-reconstruction denoising of both static and dynamic PET images [3, 4]. In recent years, image denoising based on non-local means (NLM) has become popular [5]. Unlike conventional neighborhood filters, which use local similarities, in this technique, the search for voxels similar to a given voxel is no longer restricted to its immediate vicinity. This is an attractive feature for dynamic PET images since tissue types exhibiting similar tracer

ARTICLES Continued on **PAGE 14**

PET Quantitation Continued from **PAGE 13**

dynamics are often distributed all over the body. We have developed denoising techniques for dynamic PET images which are inspired by NLM denoising.

NLM denoising computes weighted averages of voxel intensities assigning larger weights to voxels that are similar to a given voxel in terms of their local neighborhoods or patches. In our work [6], we introduced three key modifications to tailor the original NLM framework to dynamic PET. Firstly, we derived similarities from less noisy later time points to denoise the entire time series. Secondly, we used spatiotemporal patches for robust similarity computation. Finally, we used a spatially varying smoothing parameter based on a local variance approximation over each spatiotemporal patch. To assess the performance of our denoising technique, we performed realistic simulations on a dynamic digital phantom based on the Digimouse atlas. For experimental validation, we denoised [18F]FDG PET images from a mouse study and a hepatocellular carcinoma patient study. We compared the performance of NLM denoising with four other denoising approaches – Gaussian filtering, PCA, HYPR, and conventional NLM based on spatial patches. The simulation study revealed noticeable improvement in bias-variance performance achieved
using our NLM technique relative to all the other methods. The experimental data analysis revealed that our technique leads to clear improvement in contrast-to-noise ratio in Patlak parametric images generated from denoised preclinical and clinical dynamic images, indicating its ability to preserve image contrast and high-intensity details while lowering the background noise variance. In a follow-up study, we extended the denoising framework by using non-local Euclidean means [7]. To further improve denoising performance along sharp edges, we used anatomical guidance to limit the spatial window for non-local similarity computation. We tested this anatomically guided denoising technique by performing simulations on the BrainWeb digital phantom and on human datasets (Fig. I A-C) and demonstrated its robustness particularly at high noise levels and its ability to preserve sharp edges (e.g. tissue and organ boundaries).

MOTION COMPENSATED IMAGE RECONSTRUCTION

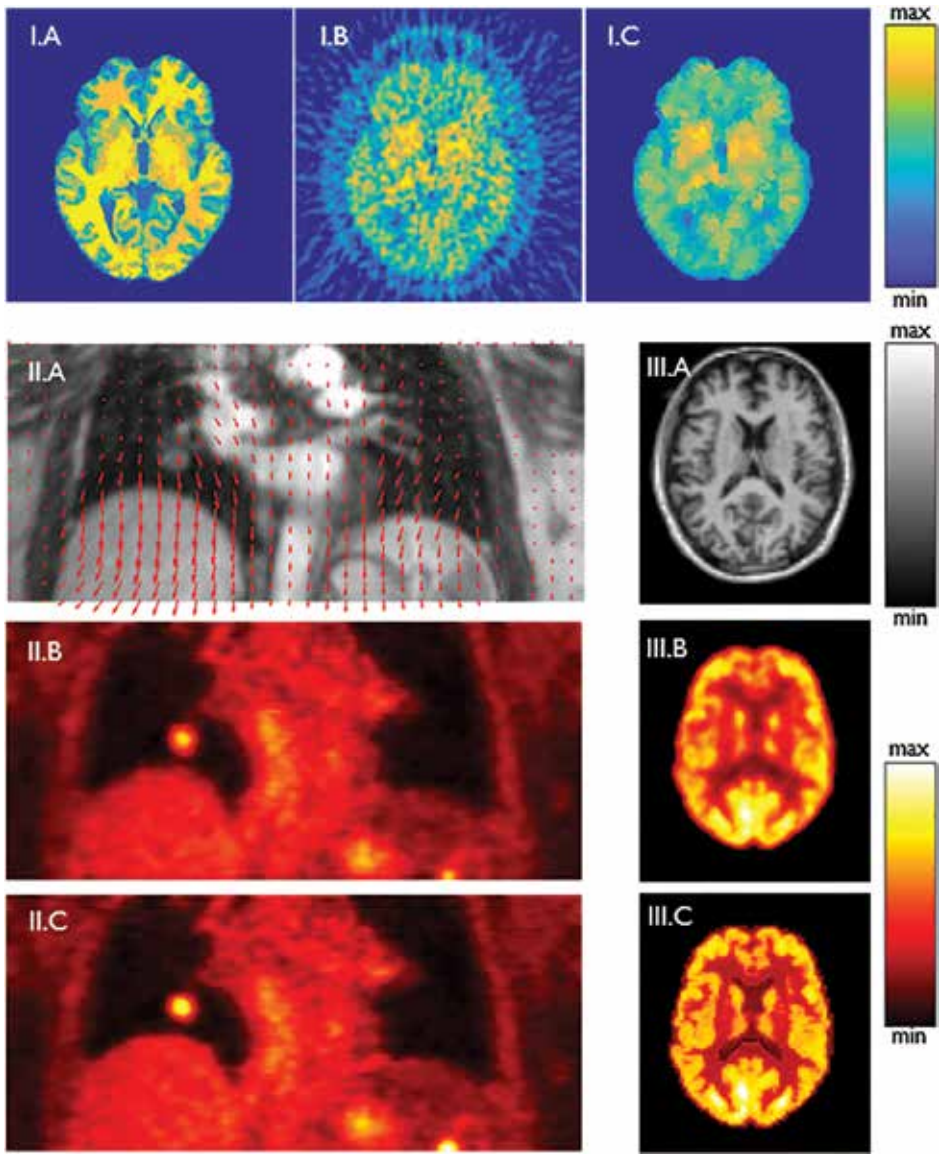
Pulmonary PET imaging is confounded by blurring artifacts caused by respiratory motion, which degrade both image quality and quantitative accuracy. Simultaneous whole body PET/MRI is an emerging technology that combines the strengths of two complementary imaging modalities and is becoming an increasingly potent tool for integrated imaging. While PET reveals only functional or physiological information, MRI is able to generate structural or anatomical information, generally with higher resolution. In the context of lung imaging, where PET scans are severely compromised by respiratory motion, we have developed a maximum a posteriori estimation framework that incorporates deformation fields derived from simultaneously acquired MRI data.

We developed and implemented a complete data acquisition and processing framework for respiratory motion compensated image reconstruction using simultaneous PET/MRI and validated it through simulation and clinical patient studies [8, 9]. For fast acquisition of high-quality 4D MR images, we developed a novel Golden-angle RAdial Navigated Gradient Echo (GRANGE) pulse sequence and used it in conjunction with sparsity-enforcing k-t FOCUSS reconstruction. We used a 1D slice-projection navigator signal encapsulated within this pulse sequence along with a histogram-based gate assignment technique to retrospectively sort the MR and PET data into individual gates. We computed deformation fields for each gate via nonrigid registration. The deformation fields are incorporated into the PET data model as well as utilized for generating dynamic attenuation maps. The framework was validated using simulation studies on the 4D XCAT phantom and three clinical patient studies that were performed on the Biograph mMR, a simultaneous PET/MR scanner. We compared motion corrected results with ungated and single-gate reconstruction results and demonstrated that this method led to robust increases in contrast-to-noise ratio of high-intensity features of interest affected by respiratory motion (Fig. II A-C). This technique enables the generation of PET images free of motion artifacts, which leads to improved image quantitation, thereby facilitating lung cancer staging and treatment optimization.

PARTIAL VOLUME CORRECTION

The quantitative accuracy of PET is degraded by partial volume effects caused by the limited spatial resolution capabilities of PET scanners. We developed an image deblurring technique that uses the spatially varying point spread function of the scanner measured in the image space. To stabilize the deconvolution problem, we introduce the joint entropy between the PET image and a high-resolution MR image as an information theoretic penalty function [10]. We implemented a computationally efficient framework for solving the corresponding numerical optimization problem. By means of simulations on the BrainWeb phantom, we showed that our method leads to faster convergence and a lower mean squared error. The technique was applied to Hoffman brain phantom data as well as human data. Compared to standalone deblurring, which tends to amplify noise, the joint entropy prior leads to a smooth PET image with sharp boundaries consistent with MRI. One challenge with our approach, however, is the spurious interpretation of intermediate intensity values that are generated by the blurring effects as separate peaks in the joint probability density function. We further extended this method to include a spatial encoding scheme that leads to a weighted joint entropy regularizer which suppresses the effect of the spurious peaks [11]. Our studies on the BrainWeb digital phantom and the Hoffman experimental phantom show that the resultant technique reduces mean squared error in the deblurred PET image and leads to a more realistic gray-to-white contrast ratio. We also showed that the spatially encoded joint entropy prior is more robust than ordinary joint entropy in the presence of structural discrepancies between the PET and the anatomical images and suppresses artifacts arising from such discrepancies. The method was applied to range of human studies (Fig. III A-C).

PET Imaging of tau tangles in the brain is very promising for monitoring the progression of Alzheimer's disease and chronic traumatic encephalopathies. However, partial volume effects associated with the limited PET spatial resolution pose a challenge to quantitation. Application of our anatomically guided deblurring method to a pool of clinical subjects revealed a marked improvement in the correlation of PET measures with well-recognized clinical metrics of cognitive performance [12].



I. Anatomically guided nonlocal means denoising: A. Segmented MR B. Noisy frame from dynamic [18]F AV1451 image of neurofibrillary tangles in a human subject with mild cognitive impairment. C Denoised PET image. II. Motion compensation using simultaneous PET/MR: A. MR image with superimposed displacement fields. B. Uncorrected PET image showing a lung lesion with motion induced blurring. C. Motion corrected PET image. III. Anatomically guided image deblurring: A. TI weighted MR image of a human subject. B. [18]F FDG PET image. C. Deblurred PET image based on anatomical prior information.

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NOT MIND OVER MATTER

Be who you are and say what you feel because those who mind don't matter and those who matter don't mind.

Theodor Seuss Geisel

IS EVERYBODY...

Happy people don't need to have fun.

Jean Stafford

An I/O Controller for Real Time Distributed Tasks in Particle Accelerators

Davide Pedretti
CANPS Student Paper Award Recipient

Selective Production of Exotic Species (SPES) is a second-generation Isotope Separation On-Line (ISOL) radioactive ion beam (RIB) facility in construction at the National Laboratory of Legnaro, Italy [1]. The core of this ISOL facility is the 70p cyclotron: a particle accelerator in which negative hydrogen ions (H-) accelerate outwards from the centre along a spiral path until they reach the stripper foils, enabling the extraction of currents up to 750 uA of protons in the energy range 35 to 70 MeV. The proton beam collides with a uranium carbide (UCx) target and generates the exotic particles by uranium fission. Those neutron-rich radioactive ions get further ionized, and selected. The so generated RIB is then re-accelerated and transported to the experimental halls. The SPES project is intended for fundamental nuclear physics research. The physics of radioactive nuclear beams is important for investigating the nuclide chart for nuclei far from the stability valley, as well as other experimental applications in different fields of science, such as astrophysics and nuclear medicine (radiopharmaceutical production for therapy and diagnostics). The SPES accelerator complex builds on the existing LINAC accelerator that will be upgraded to fulfill the requirements of the new project.

The ongoing upgrade campaign also involves the distributed control system of the facility. This offers the system engineers an opportunity to embed the controls of several appliances with very different requirements and different tasks, ranging from security and surveillance operations, beam diagnostic, data acquisition and data logging. The real-time applications and fast peripherals controls commonly found in these environments are accompanied by the challenge of developing embedded systems, custom hardware and software designed to perform specific tasks. On the other hand, the complexity of these distributed control networks and the need for maintainability and modularity call for hardware and software standardization. Is it possible to achieve standardization embedding the controls of any appliance or small group of appliances around the complex?

From the software point of view, the standardization and integration is achieved using the EPICS framework. EPICS provides a number of tools for creating a distributed control system minimizing the need for custom coding and helps ensure uniform operator interfaces [2]. Each intelligent node in the control network hosts EPICS IOC software consisting of a database with the process variables necessary to control and monitor the status of the linked devices. An arbitrary number of software IOCs can be supported, which can exchange information with each other via the Local Area Network (LAN) thanks to the Channel Access layer supported by the EPICS IOCs.

From the hardware point of view, achieving standardization and modularity is more demanding. There is no general-purpose solution available to fulfill all the requirements in a control system. That calls for some custom hardware design. So far, the approach in our facility to achieve standardization and modularity was the adoption of a VME/cPCI/uTCA based field bus containing a CPU board with an Ethernet port acting as an EPICS IOC, plus various I/O modules for interfacing with the appliances under control. Today, the trend is to use Computer-on-Modules (COM), making cutting edge technology easily accessible and lowering the entry barriers to anyone prototyping and developing embedded systems [3]. The idea is to move towards a COM based "general-purpose custom" hardware platform. Driven by those considerations, we have designed the Input Output Controller (IOC) board that addresses the needs of most control subsystems in our laboratory to replace the VME crates in several applications.

The result is a custom motherboard. It is a 14-layer PCB made of high performance dielectric, ISOLA FR408HR, which is built around the COM Express standard that defines different module types and form factors. The type specifies the module pinout configuration and features, while the form factor refers to the module size. The COM Express carrier board design complies with the Type 6 standard and can host the mini, compact or basic form factors, each available with different processors fulfilling the computational power requirements of different applications [4] [5]. The software development is mostly independent of the custom hardware implementation, since the selected compact module (cExpress-BT) has an Intel Atom E3845 @ 1.91GHz processor that boots a standard Linux distribution from an external Solid State Drive (SSD) via SATA Gen2 connector. The carrier is also equipped with a tiny Embedded USB2.0 Mass Storage Drive suitable for embedded applications requiring a minimal operating system. The x86_64 architecture, together with all generic PC peripherals, is readily available in off-the-shelf modules along with more system specific features linked to the on-board FPGA. This partially bridges the gap between custom development and commercial personal computers. The end user sees a general-purpose PC with a high level of hardware abstraction without exposure to the FPGA functionality that frees the Operating System from real time tasks. The FPGA chosen is a Spartan 6 XC6SLX75T, a good compromise between power consumption, cost, and performance. This programmable logic is intended for fast peripherals control, data acquisition, data buffering and fast data pre-processing. The Spartan 6 interfaces to the CPU either via an USB 3.0 to parallel bridge, or can appear in the operating system as a PCIe x4 end-point, after the driver compilation and installation. Device-to-device and device-to-cloud connectivity are of crucial importance for an IOC board acting as a local intelligent node in a distributed system. LAN connectivity is guaranteed via 1000 BASE-T ethernet link. WiFi and optical ethernet are available for those applications requiring galvanic isolation. The design has a high degree of modularity thanks to the FPGA that provides support for the peripherals not commonly supported by desktop PCs. In addition, functionality extension is possible via the three PCIe 1.0 slots, the Low Pin Count (LPC) FMC connector, and the general purpose digital and analog inputs and output channels. The carrier can be supplied using both standard ATX or AT power sources, although the ATX supply is converted to AT style operation in the motherboard in order to accommodate the Power Over Ethernet Plus (PoE+) as a power solution for low-power applications. The DC/DC conversion stages and the power distribution have been studied carefully, as the power integrity has been one of the main concerns while designing a mixed digital and analog PCB. The on-board hardware monitor chip continuously scans the voltages, currents and temperatures, modulates the fan speed and, if necessary, starts the CPU standby or shut down procedures as an over-temperature and over-current protection. Thinking about a distributed system, the remote FPGA configuration and debugging is a key feature, here achieved via an USB to JTAG bridge between the processor and the FPGA. The remote COM Express runs the Xilinx "cse_server" that opens a TCP port for the Xilinx's tools (iMPACT and ChipScope) running in the local computer in the accelerator's control room. The block diagram gives an overview of the main features and on-board interfaces.

Crosstalk, impedance mismatches, plane resonances, as well as not optimal thermal distributions can manifest themselves as wrong behaviors rather than long-term failures that are hardly reproducible. Therefore, post-layout signal integrity and thermal analysis simulations have been used prior to prototyping, in order to validate the layout quality. Two prototypes are available in our laboratory and all the main features have been tested alongside firmware development.

The COM Express carrier board design promises to be an excellent solution to achieve a high degree of integration. The SPES project is the ideal test bench to develop the applications of the IOC board in terms of data acquisition, fast parallel digital pre-processing, as well as slow control and remote monitoring. The transport of the SPES neutron-rich ion beams (Cs, Xe, Rb, Ba, Br, Sn) requires a new diagnostic system that outperforms the legacy VME-based current- and beam-position monitors [6]. The new beam diagnostics data readout chain will be based on the IOC concept. The IOCs scan and digitize the vertical and horizontal beam position signals generated by the beam profiler monitor (a mesh of 37 horizontal wires and 37 vertical wires) and the current signals from a Faraday Cup, and interface the diagnostic data to the control network for remote beam profile visualization. The FPGA firmware handles the analog input multiplexing, reads the data stream from the on-board 16-bits @ 1Msps ADCs, manages the data buffering and Direct Memory Access (DMA) data transfers to the processor, while the COM Express implements an EPICS Channel Access Server (CAS). This eliminates the need for a real-time operating system (VxWorks in the previous implementation), and the VME crate is replaced by a single IOC board running a standard Linux distribution. The IOC-based diagnostics readout chain has already been validated in the field with a heavy ion beam, and a first production slot of 20 carriers has been commissioned.

Staying in the field of system monitoring and data visualization, the IOC board architecture fits perfectly into the concept of real time data visualization and control using modern web technologies [7]. Embedded web servers running on the COM Express installed in diagnostic stations around the accelerator can be controlled from any browser using basic HTML technologies. For example, the live ion beam profile could be accessed and displayed on a tablet from anywhere on the campus (or even at home). Of course, for safety reasons the access to the control network of the facility is governed by stringent policies to avoid unauthorized persons to operate the machine. Concerning safety and radioprotection, the IOC board will play a primary role in the SPES high current H- cyclotron hardware interlock system. The IOC, equipped with a commercial 4 channel picoamperemeter FMC card, will be the core of a fast-reacting protection system together with a four-sector collimator mounted on the beam line that measures the beam halo. The current from each sector gets sampled by the FMC, filtered, averaged and compared with high and low thresholds by the FPGA. In case of excessive current or imbalanced distribution, the FPGA generates an interlock signal that will trip the cyclotron. In this case, the FPGA and the processor work as two standalone systems: the software running in the COM Express is acting only as remote process monitor and does not interact with the interlock logic that works autonomously and takes place only inside the FPGA.

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Figure 1: The Input Output Controller for real time distributed tasks in particle accelerators. This COM Express carrier board behaves like a general purpose PC which is able to fullfill several specific and time critical features normally encountered in a physical facility thanks to the on board FPGA.

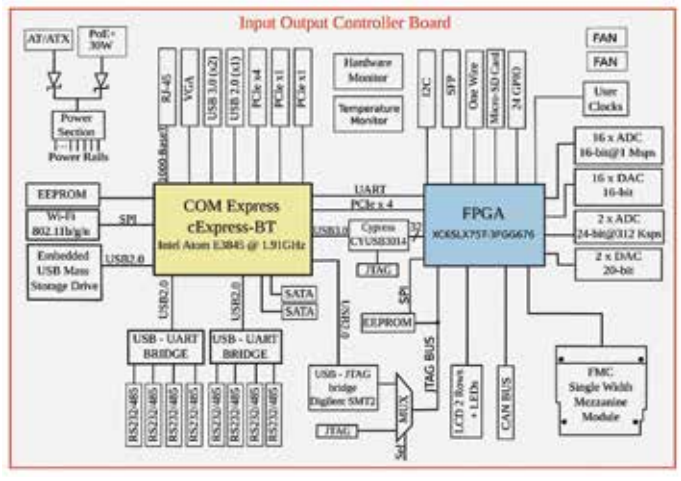

Figure 2: The IOC block diagram.

Obituary

'Kris' Kristiansen

MAGNE "KRIS" KRISTIANSEN

Magne "Kris" Kristiansen, 85 of Lubbock, TX passed away Tuesday, May 9th, 2017. He was born April 14th, 1932 in Elverum, Norway. After serving in the Royal Norwegian Airforce, Kris attended the University of Texas in Austin graduating with a Ph.D. in Electrical Engineering. His Ph.D. dissertation formed the basis for our current understanding of wave propagation in reactor plasmas and is 50 years later still being cited in technical publications. Upon graduation, Kris started his academic career as an Assistant Professor of Electrical Engineering at Texas Tech University. Kris's initial research at Texas Tech was in the field of fusion reactions, eventually moving into the field of Pulsed Power where he became world renowned. Notable areas of pulsed-power research included railguns, pulse-forming networks, spark gaps, vircators, explosive flux compression generators and surface flashover switching.

As an early leader in the field of pulsed power, Kris organized the first and second International Pulsed Power Conferences held in Lubbock in 1976 and 1979, respectively. Kris's laboratory became the internationally renowned "Pulsed Power Laboratory" and then in 1998 the "Center for Pulsed Power and Power Electronics" at Texas Tech University as it is known today. The Center at the time of his retirement was a $5M dollar per year research operation that continues to expand to this day.

As part of Kris's 47 years at Texas Tech, Kris authored/coauthored over 500 journal articles and conference proceeding papers, organized more than 30 national and international conferences and workshops, and served on numerous DOD and DOE committees and panels. Kris received numerous awards during his career including the Peter Haas award for contributions to pulsed power technologies, the NPSS Merit award and several Texas Tech faculty awards. His several appointments included Fellow of both the IEEE and APS, Horn and Thornton professorships, and foreign membership to the Russian Academy of Sciences.

During his career Kris mentored hundreds of students and young researchers serving on over 150 M.S thesis and Ph.D. committees. His students can be found in over 15 countries and at nearly every pulsed-power research group in the U.S. He eventually became known as the "godfather of pulsed power" since a vast majority of the researchers in the field were either students of Kris, students of Kris's students or colleagues that worked with Kris at Texas Tech University.

This article was prepared by Andreas Neuber, Chair of the IEEE NPSS Pulsed Power Technical Committee, and a colleague of Kris's at TTU. Andreas can be reached by E-mail at andreas.neuber@ttu.edu.

Technical Committees Continued from **PAGE 9**

PULSED POWER SCIENCE AND TECHNOLOGY

Fully operating under new by-laws for the second year has been exciting and brought with it a number of positive changes. Foremost, the transition to an elected technical PPS&T committee is in full swing. At the time of writing, the PPS&T nominations have closed, and balloting shall commence in a few weeks. Not too long after the distribution of this newsletter, in September of 2017, the second set of four elected members of the PPS&T committee will be announced. Thank you to the eight very qualified members of the community who have shown their desire to serve on the committee and whose names appeared on the ballot. As we move forward, we would like to remind everyone in our community to assist each other in attaining professional recognition. Such recognition starts with nominating your collaborator or other professional contacts for IEEE senior member. The paperwork required for such a nomination is very limited, and the main requirement is that candidates shall have been in professional practice for at least ten years. Of course, I would like to encourage each distinguished member of our community to consider entering the process of elevation to the grade of IEEE Fellow. More information and contact information for our committee and its subcommittees may be found at ieee-npss.org under PPS&T. Finally, please look for a call for nominations for the 2018 Arthur Guenther Outstanding Student award, which has been awarded annually since 2016.

Andreas Neuber
PPS&T Chair

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Publicity releases for forthcoming meetings, items of interest from local chapters, committee reports, announcements, awards, or other materials requiring society publicity or relevant to NPSS should be submitted to the Newsletter Editor by October 5th, 2017 for publication in the December 2017 Newsletter.

News articles are actively solicited from contributing editors, particularly related to important R&D activities, significant industrial applications, early reports on technical breakthroughs, accomplishments at the big laboratories and similar subjects. The various *Transactions*, of course, deal with formal treatment in depth of technical subjects. News articles should have an element of general interest or contribute to a general understanding of technical problems or fields of technical interest or could be assessments of important ongoing technical endeavors.

Advice on possible authors or offers of such articles are invited by the editor.