NSREC 2026 *July 20-24, 2026*

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NORTHROP GRUMMAN AEROSPACE

IEEE NPSS NUCLEAR & PLASMA SCIENCES SOCIETY

July 20-24, 2026

SCHEDULE

Time	Monday, July 20	Tuesday, July 21	Wednesday, July 22	Thursday, July 23	Friday, July 24
7:00	**(7:00) Breakfast** ***Sheraton Hotel*** *Miramar Ballroom*	**(7:00) Breakfast** ***Sheraton Hotel*** *Miramar Ballroom*			
7:30			**(7:30) Breakfast** ***Sheraton Hotel*** *Miramar Ballroom*	**(7:30) Breakfast** ***Sheraton Hotel*** *Miramar Ballroom*	**(7:30) Breakfast** ***Sheraton Hotel*** *Miramar Ballroom*
8:00	**(8:00) Student Awards** **(8:10) Short Course Introduction** *Dr. Pascale Gouker*	**(8:00)** Conference Opening **(8:05)** RESG Awards			
9:00	**[8:20] Part I –Applications of the Natural Space Environment to Heavy Ion Single Event Effects Testing** *Justin Likar*	**(9:00)** Technical Program Opening **(9:05)** Session A - Single-Event Effects: Mechanisms and Modeling	**(8:30)** Invited Paper **(9:30)** Session D - Radiation Effects in Devices and Integrated Circuits	**(8:45)** Session F - Basic Mechanisms of Radiation Effects	**(8:30)** Invited Paper **(9:30)** Session G - suite
10:00	**[9:50] Break** *Level 3 Foyer & Terrace*			**[10:05] Break** *Level 1 - Exhibit Hall A*	
11:00	**[10:20] Part II – Radiation Hardness Assurance Implementations in the European Space Agency (ESA) Projects** *Dr. Cristina Plettner*	**[10:10] Break** *Level 1 - Exhibit Hall A* **(10:40)** Session B - Single-Event Effects: Devices and Integrated Circuits	**[10:20] Break** *Level 1 - Exhibit Hall A* **(10:50)** Session D - suite	**(10:35)** Session G - Hardness Assurance: Piece Parts to Systems and Testing Approaches **(11:25)** Introduction REDW Session	**[10:15] Break** *Level 3 Foyer and Terrace* **(10:45)** Session H - Hardening by Design
12:00	**[11:50] Lunch** **Ballroom B**		**(11:35)** Session E - Environments, Facilities, and Dosimetry	**[11:35] Lunch** ***Level 1 - Exhibit Hall A*** **[12:50] Exhibitor Drawings**	**(11:50)** Conference Closing Remarks
1:00 PM	**[1:10] Part III – Single Event Effects: Upset Rate Analysis for Devices and Systems** *Dr. David Hansen*	**[12:15] Lunch** *Level 1 - Exhibit Hall A* **YP Luncheon (Ticket required)** *Sheraton Hotel*	**[12:05] Lunch** *Level 1 - Exhibit Hall A* **WIE Luncheon (Ticket required)** *Sheraton Hotel*	**(1:20 - 3:20)** REDW Session *Level 3 - Ballroom B*	
2:00 PM	**[2:40] Break** *Level 3 Foyer and Terrace*	**(2:15)** Session C - Photonics Devices and Integrated Circuits	(2:00) Session E - suite		
3:00 PM	**[3:10] Part IV – Radiation Hardness Assurance through System-Level Testing for Commercial space** *Dr. Andrea Coronetti*	**[3:05] Break - *Exhibit Hall A*** **(3:35)** Session C - suite	**(2:45)** Introduction Poster Session Level 3 - Ballroom A **(2:50 - 4:50)** Poster Session Level 3 - Ballroom B		
4:00 PM	**[4:40] Wrap-up** Exam [4:45-5:30]	**(4:20)** End of Sessions **[4:45 - 5:30] Fitness Class** ***Sheraton Hotel*** *Room San Felipe*	**[4:00 - 4:45] Fitness Class** ***Sheraton Hotel*** *Room San Felipe*	**(4:00 - 5:30) RESG OPEN MEETING** *Level 3 - Ballroom A*	
5:00 PM	**[5:00 - 6:00] Fitness Class** ***Sheraton Hotel*** *Room San Felipe*				
5:30 PM					
6:00 PM		**(5:45) Exhibitor Reception** **Puerto Rico Convention Center** *Level 1 - Exhibit Hall A*	**(5:45)** Bus to Social **(6:00) Conference Social** Hilton Caribe		
7:00 PM					
8:00 PM					
9:00 PM					
10:00 PM					

CONFERENCE CHAIR'S INVITATION

Philippe Paillet
NSREC 2026 General Chair
CEA, France

On behalf of the Institute of Electrical and Electronics Engineers (IEEE) and its Nuclear and Plasma Sciences Society (NPSS), Radiation Effects Steering Committee (RESG) and the 2026 Nuclear and Space Radiation Effects Conference (NSREC) committee, I am pleased to invite you to attend NSREC to be held July 20-24, 2026. The conference will be held at the Puerto Rico Convention Center, in the beautiful city of San Juan, Puerto Rico. Once the crown jewel of the Spanish Empire, San Juan was founded in 1521 and is now the Island's historic and cultural center. It is the oldest European-founded city in the Americas, but is home to much more than just history. San Juan blends elements of the Old World (cobblestone streets and colonial architecture) with modern urban life (craft cocktails, contemporary dining, amazing shopping, and vibrant nightlife).

The conference begins Monday, July 20, with a one-day short course titled, "Radiation Hardness Assurance for New Space Missions and Advanced Electronics: Challenges, Risks and Approaches for Success." The short course is organized by Pascale Gouker (MIT Lincoln Lab) and features four parts taught by experts from our community. This Short Course will focus on the challenges, risks, and practical methods for ensuring the reliability of advanced electronic used in modern space missions.

The main technical program is from Tuesday, July 21 to Friday, July 24. Sylvain Girard, University of St Etienne, is the conference Technical Program Chair. He, along with his technical committee, have chosen an outstanding set of contributed papers organized into 8 sessions of oral presentation and a poster session encompassing papers from all sessions. In addition to the main technical sessions, the technical committee has also selected outstanding papers for the Radiation Effects Data Workshop. This is an additional poster session describing radiation effects data on electronics and photonic devices and systems and test facilities. Finally, Sylvain has invited two speakers to give talks of more general interest to start the morning on Wednesday and Friday.

The Industrial Exhibit, organized by Larisa Milic, EMPC, opens Tuesday morning and concludes Thursday after lunch. Attendees will be able to visit the booths during scheduled breaks and lunches from Tuesday to Thursday. Attendees and guests are invited to attend a cocktail reception in the exhibit hall on Tuesday evening. The exhibit showcases the products and capabilities of the exhibitors in areas such as semiconductors, systems, modeling, and test resources.

I hope that you will enjoy our social program in San Juan organized by Melanie Berg, SpaceR3. Two companion tours are scheduled; Tuesday will have a guided Old San Juan walking tour, and Wednesday conference guests can enjoy a trip to the Bacardi factory. On Wednesday evening, we have planned a dinner with live music and performance to cap off the night, for all attendees, at the beautiful historic Caribe Hilton.

Your 2026 Conference Committee looks forward to seeing you in San Juan this July.

SHORT COURSE PROGRAM

RADIATION HARDNESS ASSURANCE FOR NEW SPACE MISSIONS AND ADVANCED ELECTRONICS: CHALLENGES, RISKS AND APPROACHES FOR SUCCESS

PUERTO RICO CONVENTION CENTER, SAN JUAN, PR

BALLROOM A

JULY 20, 2026

8:00 AM	**STUDENT AWARDS** Radiation Effects Steering Group
8:10 AM	**SHORT COURSE INTRODUCTION** Dr. Pascale Gouker, *MIT Lincoln Laboratory*
8:20 AM	**PART I – APPLICATIONS OF THE NATURAL SPACE ENVIRONMENT TO HEAVY ION SINGLE EVENT EFFECTS TESTING** Justin Likar, *Johns Hopkins University Applied Physics Laboratory*
9:50 AM	**BREAK** (Foyer & Terrace)
10:20 AM	**PART II – RADIATION HARDNESS ASSURANCE IMPLEMENTATIONS IN THE EUROPEAN SPACE AGENCY (ESA) PROJECTS** Dr. Cristina Plettner, *European Space Research and Technology Center, Avionics*
11:50 AM	**SHORT COURSE LUNCHEON** (Ballroom B)
1:10 PM	**PART III – SINGLE EVENT EFFECTS: UPSET RATE ANALYSIS FOR DEVICES AND SYSTEMS** Dr. David Hansen, *L3Harris*
2:40 PM	**BREAK** (Foyer & Terrace)
3:10 PM	**PART IV – RADIATION HARDNESS ASSURANCE THROUGH SYSTEM-LEVEL TESTING FOR COMMERCIAL SPACE** Dr. Andrea Coronetti, *The Exploration Company*
4:40 PM	**WRAP-UP**
4:45 PM	**EXAM (only for students requesting CEU credit)**
5:30 PM	**END OF SHORT COURSE**

*The NSREC 2026 Short Course Notebook will be included **in the 1980-2026 Compendium of Short Course Notebooks**, available for download at www.nsrec.com for all registered Short Course Attendees.*

SHORT COURSE PROGRAM

COURSE DESCRIPTION

A short course entitled "*Radiation Hardness Assurance for New Space Missions and Advanced Electronics: Challenges, Risks and Approaches for Success*" will be presented at the 2026 IEEE Nuclear and Space Radiation Effects Conference. New space missions span an unprecedented range of objectives (i.e., exploration and surveillance, planetary science, meteorology and space weather, communications, Earth observation, and commercial services), architectures (i.e., single spacecraft, constellations, hosted payloads, CubeSats, and surface systems), and radiation environments from LEO/GEO/cislunar to deep space, with both ionizing and non-ionizing particle effects. This short course will review the challenges, risks, and practical approaches to radiation hardness assurance (RHA) for devices, circuits, and subsystems including commercial off-the-shelf (COTS), emerging system-on-chip (SoC), and 2.5D/3D integrated technologies in those missions

The short course is organized into four parts. The first part will review the natural space environment and the radiation interaction with matter to provide practical guidance for heavy-ion single-event-effects (SEE) testing. Differences between radiation testing facilities, device design and circuit complexity will be discussed. The second part will review the lessons learned from past European Space missions and what RHA mitigation approaches implemented at the system level flow down to the subsystem and part level. The third part will cover more specifically the various methods used for the SEE rate calculation and will include a comparison with on-orbit data and different device technologies. The fourth part will review how the current commercial space market competition and limited testing resources are changing the mission assurance practices and moving toward exploring new approaches.

The short course is intended for radiation effects engineers, component specialists, system designers, and other technical and management personnel involved in developing reliable systems designed to operate in radiation environments. It provides a unique opportunity for IEEE NSREC attendees to benefit from the expertise of excellent instructors, along with a critical review of state-of-the-art knowledge in the field. Digital short course notes will be provided to each participant.

CONTINUING EDUCATION UNITS (CEUs)

Continuing Education Units (CEUs) will be available. For the interested attendees, an exam will be given at the end of the short course. The course is valued at 0.6 CEUs, and is endorsed by the IEEE and by the International Association for Continuing Education and Training (IACET).

SHORT COURSE CHAIR

Dr. Pascale Gouker

MIT Lincoln Laboratory
Short Course Chair

Dr. Pascale Gouker is a Senior Technical Staff member in the Advanced Technology Division at MIT Lincoln Laboratory. She leads programs and conducts research in novel device design, advanced materials, fabrication techniques, circuit design, and 3D printing innovations for space-based applications.

Her work has included pioneering the first modeling of single-event transient effects in 2D and densely integrated 3D silicon-on-insulator (SOI) circuits. She has also led the development of a novel radiation-hardened fully depleted SOI CMOS technology designed for extreme ionizing and non-ionizing radiation environments. In addition, she has characterized radiation effects in emerging device technologies and developed advanced novel fabrication techniques for both ground-based and space-based imaging systems.

She has authored or co-authored more than 100 papers in peer-reviewed journals and major conference proceedings and contributed to multiple award-winning research efforts. She has been an active volunteer with the IEEE Nuclear and Plasma Sciences Society, serving in numerous supporting and leadership roles within the Radiation Effects Steering Group, the IEEE Nuclear and Space Radiation Effects Conference (NSREC), and on the editorial board of the IEEE Journal on Transactions on Nuclear Science. She will be the 2028 NSREC Conference Chair.

Justin Likar

Justin Likar has 25 years of experience working in the areas of radiation survivability, spacecraft charging effects, radiation hardness assurance and space weather. Justin spent over 15 years working for the commercial and defense industry prior to joining JHU / APL in 2018, where he is presently a Principal Professional Staff Engineer, Chief Technologist and Assistant Group Supervisor with the Space Exploration Sector Space Environmental Effects Engineering group. He is also an instructor with the JHU Whiting School of Engineering, an Associate Fellow of the American Institute of Aeronautics and Astronautics (AIAA) and Member at Large with the IEEE Nuclear and Plasma Sciences Society Radiation Effects Steering Group (RESG). Current projects include optimizing Single Event Effects (SEE) test methods at US heavy ion accelerators, technology development for sustained lunar surface operations and quantifying radiation survivability related risk to non-radiation hardened systems.

PART I – APPLICATIONS OF THE NATURAL SPACE ENVIRONMENT TO HEAVY ION SINGLE EVENT EFFECTS TESTING

Justin Likar, *Johns Hopkins University Applied Physics Laboratory*

Justin Likar will describe the natural space environment with specific practical applications for Heavy Ion Single Event Effects (SEE) testing. The discussion will begin with an overview of the charged particle environments in which all modern space systems operate and include methods for modelling and developing project test requirements. Applications to Heavy Ion SEE testing will be explored, and will consider particle accelerator environments, principles of operation and benefits, limitations and considerations of specific laboratories. Pertinent elements of radiation transport through matter will be discussed with the focus being on practical implementation and methods for determining the sensitive volume (SV). Several illustrative examples of the linear energy transfer (LET) determination will be reviewed, comparing the LET at one (or more) SV in in-flight applications with those achievable using mono-energetic or fragmented Heavy Ion beams; exemplar test articles represent modern, complex systems offering multiple, deep SV and a variety of composition materials requiring high energy Heavy Ion or protons to test. Practical applications for SEE test design and execution will be highlighted throughout.

A top-level outline of the presentation is as follows:

- Short Course Objectives
- Natural Space Environment (NSE) Overview
    - Phenomenology
    - Design Considerations (e.g. Why We Care)
    - Modeling and Simulations (e.g. Practically, How to Define Requirements)
- Heavy Ion test Environment(s) Overview
    - Accelerators - Principles of Operation
- State-Of-The-Art (SOTA) Considerations
    - High Energy Heavy Ion Beams
    - Fragmented Beams
    - Microbeams
- Radiation Transport Basics
    - Just Enough for this Discussion
- Illustrative Examples
    - How Does Facility Environment Tie Back to In-flight Environment and Vice Versa?
    - Impacts on SEE Test Planning and Design
- Conclusions

Dr. Cristina Plettner

Dr. Cristina Plettner is a Radiation Hardness Assurance Engineer at European Space Research and Technology Center (ESA, Netherlands). She received her Ph. D. in Experimental Nuclear Physics in 2001 from Technological University of Dresden, Germany. After two Postdoctoral positions, at GSI, the large accelerator in Germany and in Yale University in the US, Dr. Plettner was Research Staff Member at IBM Yorktown Heights, NY, focusing on Single Event Effects in the 65 nm technology node. Her passion for space applications began more than a decade ago, when she joined Airbus Defence and Space as System Engineer Radiation working for Artemis mission with ESA and NASA. She has authored and co-authored more than 100 technical research papers, in fundamental and applied nuclear physics and holds five patents. Dr. Plettner has served the space radiation effects community as session Chair at RADECS in various years. Currently, she is supporting many ESA scientific and Earth Observation missions in her role as RHA engineer and gives RHA presentations and training in ESA and beyond.

PART II – RADIATION HARDNESS ASSURANCE IMPLEMENTATIONS IN THE EUROPEAN SPACE AGENCY (ESA) PROJECTS

Dr. Cristina Plettner, *the European Space Research and Technology Center, Avionics and EEE Division*

Dr. Cristina Plettner will describe the principles of the radiation hardness assurance (RHA) methodology at ESA, encompassing Total Ionizing Dose (TID), Displacement Damage and Single Event Effects aspects. The presentation will kick off with some lessons learned from the distant past spacecraft anomalies or failures as motivation. Then, a short overview of the specific space environment will be given, with the emphasis of few models of the solar flares. Each mission, depending on its criticality, needs to include and design for a certain class of solar flare. A short overview of ESA missions, cosmic and solar system explorers, will be highlighted. The TID and total non-ionizing dose (TNID) effects will be discussed, with an emphasis on the lot-to-lot variability and how the RHA can mitigate that effectively. The system requirements flow down to subsystem and part level, respectively, will be explained, along with the necessary RHA activities, which need to take place as a function of the specific project phase. Two examples of ESA projects will be focused on illustrating the flexibility of the RHA approaches as a function of mission class (and implicit their different criticality): one Alpha mission class, envisaged for the Lagrange L5 point, with the spacecraft able to map continuously key parameters during a major solar flare and issuing warnings towards Earth; one Gamma mission class, a cube sat mission in the Low Earth Environment (LEO).

A top-level outline of the presentation is as follows:

- Short Course Objectives
- Radiation Hardness Assurance (RHA)
    - Motivation - Spacecraft Failures
    - European Space Standardization System
    - Radiation Hardness Assurance Concept
    - ESA Mission Classification: Classic Space Meets New Space
- Radiation Environment
    - Trapped Particles
    - Solar Flare Particles
    - Galactic Cosmic Rays (GCR)
    - Solar Energetic Particle Models
    - Solar Storms Classification
- Radiation Effects on Components and their Associated RHA
    - Total Ionizing Dose (TID) and Displacement damage (TNID)
    - Single Event Effects (SEE) and Risk Mitigation via ESA Mission Tailoring
- Conclusions

Dr. David Hansen

Dr. David Hansen is a Scientist in the Radiation, Reliability and Components Group at L3Harris in San Diego. He received a Ph.D. in Physics from University of Nevada, Las Vegas in 1998, and completed a National Research Council Postdoc at the Jet Propulsion Laboratory. Dave has been a part of the space radiation community for over 25 years. Prior to joining L3Harris, Dave worked at Space Micro, Maxwell Technologies, and at Boeing as an Associate Technical Fellow. His professional background includes a variety of radiation effects and technologies. His current research focusses on building and validating models that use test data to predict single event effects. He has authored and co-authored over 70 papers in peer reviewed journals. Dave has served the IEEE as well as the NSREC and RADECS conferences as a reviewer, and session chair and he is currently a member of the executive board for the SEE/SoCS conference.

PART III – SINGLE EVENT EFFECTS: UPSET RATE ANALYSIS FOR DEVICES AND SYSTEMS

Dr. David Hansen, *L3Harris*

The space radiation effects community has developed a few techniques to predict the single event upset rate of semiconductor devices. Despite significant progress in this field, there are often conflicts in the guidelines presented by different authors, and the parameterization of methods can be unclear. Additionally, with the advent of more complex devices, board-level testing, and architectural hardening techniques, many older methods are inadequate for modern technologies.

Dr. David Hansen of L3Harris will present an overview of the current calculation methods for predicting single event effects, and methods for dealing with system level effects. His presentation will be based on insights gained from on-orbit data and will address numerous gaps in the existing rate calculation methodologies.

A top-level outline of the presentation is as follows:

- Introduction - Context of this Talk
- On-Orbit Data – Orbits and Devices with Data.
- Ions, Protons, and the Physics of Interaction with Matter
    - Heavy Ion Track Structure
    - Proton Interactions
- Calculating Cross Sections
    - Calculating Proton Cross Sections from Heavy-Ion Data
    - Calculating from Heavy-Ion Cross Sections from Proton Data
- SEE Rates
    - The Integral Rectangular Parallelepiped (IRPP) Method for Heavy Ion Rates
    - The Direct Integration Method for Proton Rates
    - Petersen's Figure of Merit (PFOM) for Heavy Ions
    - Petersen's Figure of Merit for Protons
- System Level Analysis
    - Triple Mode Redundancy (TMR)
    - Error Correction Codes (ECC)
    - Monte Carlo (MC) Simulations
    - Continuous Time Markov Chain (CTMC) Simulations
    - Bayesian Networks
- Conclusions

Dr. Andrea Coronetti

Dr. Andrea Coronetti is a Radiation Engineer at The Exploration Company GmbH, in Munich, Germany, since 2024. The Exploration Company designs the Nyx spacecraft, a cargo capsule for the International Space Station. The company acts as an integrator by both designing equipment in-house as well as integrating it, mostly, from new space subcontractors. Andrea is tasked with ensuring radiation hardness assurance of the Nyx spacecraft, he oversees the work of EEE engineers and works in close contact with avionics design engineers for safe integration and usage of commercial-off-the-shelf parts. Previously, he has worked for 6 years at the European Organization for Nuclear Research (CERN), in Geneva, Switzerland, during which he has received a PhD in Applied Physics from the University of Jyväskylä, Finland. During his time at CERN, he has co-authored more than 30 papers published in IEEE journals on topics related to accelerator and space radiation hardness assurance, spanning from effects of exotic particles at transistor level up to effects of complex environments on entire systems. During his time at CERN, he has written a guideline for system-level radiation testing, which was published in 2021. He also had major coordination and scientific roles in the RADNEXT and HEARTS EU projects.

PART IV – RADIATION HARDNESS ASSURANCE THROUGH SYSTEM-LEVEL TESTING FOR COMMERCIAL SPACE

Dr. Andrea Coronetti, *The Exploration Company*

The growing competitiveness and time-to-market pressures in the space industry are reshaping mission assurance practices. Schedule and budget constraints increasingly drive design choices, encouraging exploration of alternative approaches regarding radiation hardness assurance (RHA). Yet, the field remains fragmented and lacks standardization, particularly at higher integration levels. This course, led by **Dr. Andrea Coronetti** of The Exploration Company, introduces the methodology of system-level radiation testing as a practical pathway to address this gap. Participants will learn how to design and conduct meaningful tests of commercial off-the-shelf components and systems and manage black-box scenarios. Special focus will be placed on test planning, beam selection, test execution logic, and common pitfalls to avoid, ensuring interpretable and useful outcomes. By the end, attendees new to RHA will be equipped with tools to craft a balanced RHA strategy that aligns with schedule, budget, and acceptable risk—while making informed decisions that connect test results to real-world space environments. The course will also showcase the complementary value of test-as-you-fly approaches and verification of radiation effects mitigations that are paramount when using commercial off-the-shelf electronics in space systems.

A top-level outline of the presentation is as follows:

- Introduction to Course Objectives
- Setting the Scene
  - Differences Between Components and Systems
  - Types of Systems and What is System-Level Radiation Testing
  - System-Level Testing in the RHA Landscape
- Radiation Effects at the System-Level
  - Propagation from Component to System Effects for TID/DD/SEE
  - Generic System-Level Effects
  - Mitigations at the System-Level
- Understanding Limitations and Potentialities of System-Level Radiation Testing
  - Why Does it Not Replace Component Testing?
  - Why May the Outcomes Not Reflect Expectations?
  - Why is the data not Fully Comprehensive and Reusable?
  - What Can System-Level Testing Add in Terms of Radiation Effects Knowledge?
  - System-Level Radiation Testing in a Design Lifecycle
- System-Level Radiation Testing from Design to Outcomes
  - Beams and Sources
  - Requirements
  - Heavy Ion Limitations
  - Protons, Neutrons and Gamma-Rays
- Designing the Experiments
  - Off-the-Shelf Systems
  - Enhanced Observability
  - Take-Aways from Actual Tests
  - Impact of Test Beam Facility on Observability
  - Target Parameters and Beam Parameters Impact
- Using Experimental Data
  - Reliability with SEE and TID
  - Availability of SEE Through Environmental Similitude
- Conclusions

TECHNICAL PROGRAM

TECHNICAL INFORMATION

"On behalf of the Technical Program Committee, I invite you to attend the 2026 NSREC Technical Sessions in San Juan, Puerto Rico. The session chairs, poster chair, and data workshop chair have assembled an outstanding program highlighting the latest results in nuclear and space radiation effects on materials, device, and systems. The broad set of topics presented will benefit individuals in industry, government, and academia from around the globe. I look forward to working with all those who contribute to making this a successful program."

Sylvain Girard
University of St Etienne
Technical Program Chair

The NSREC Technical Program consists of contributed oral and poster papers, a Data Workshop, and invited talks. The oral presentations will be 12 minutes in duration with an additional 3 minutes for questions. The technical sessions and their chairpersons are:

- **Single-Event Effects: Mechanisms and Modeling**
  Chair: Jeffrey WARNER, Northrop Grumman Corporation
- **Single-Event Effects: Devices and Integrated Circuits**
  Chair: Ruben GARCIA ALIA, CERN
- **Photonic Devices and Integrated Circuits**
  Chair: Julien MEKKI, CNES
- **Radiation Effects in Devices and Integrated Circuits**
  Chair: Corinna MARTINELLA, University of Montpellier
- **Environments, Facilities, and Dosimetry**
  Chair: Cornelia HOEHR, TRIUMF
- **Basic Mechanisms of Radiation Effects**
  Chair: Marta BAGATIN, University of Padova
- **Hardness Assurance**
  Chair: Almudena LINDOSO, University Carlos III Madrid
- **Hardening By Design**
  Chair: Nathan NOWLIN, Sandia National Laboratories
- **Poster Session**
  Chair: Vincent GOIFFON, ISAE - SUPAERO
- **Radiation Effects Data Workshop**
  Chair: Jennifer TAGGART, The Aerospace Corporation

Poster Session

Those papers that can be presented more effectively in a visual format with group discussion will be displayed in the Poster Session. Posters can be viewed during the week, and authors will be available during the Poster Session (Wednesday, July 22nd, 2:50 PM – 4:50 PM). The Poster Session is chaired by Vincent Goiffon from *ISAE - SUPAERO*.

Data Workshop

Workshop papers provide piece part radiation response data and radiation test facilities technical information. Workshop papers can be viewed during the week, and authors will be available during the Workshop Session (Thursday, July 23rd, 1:20 PM - 3:20 PM). The Data Workshop is chaired by Jennifer Taggart from *The Aerospace Corporation.*

LATE NEWS

A limited number of late-news papers will be accepted and included in the Poster Session and the Radiation Effects Data Workshop. The submission window for these newsworthy papers is open through May 15, 2026. Detailed instructions for submitting late-news summary are available on the NSREC website at www.nsrec.com.

SESSION CHAIRS

Jeffrey Warner
Northrop Grumman Corporation
SEEs: Mechanisms and Modeling

Ruben García Alía
CERN
SEEs: Devices and Integrated Circuits

Julien Mekki
CNES
Photonic Devices and ICs

Corinna Martinella
University of Montpellier
Radiation Effects in Devices and ICs

Cornelia Hoehr
TRIUMF
Environments, Facilities, and Dosimetry

Marta Bagatin
University of Padova
Basic Mechanisms of Radiation Effects

Almudena Lindoso
University Carlos III Madrid
Hardness Assurance Technologies, Modeling, and Testing

Nathan Nowlin
Sandia National Laboratories
Hardening by Design

Jennifer Taggart
The Aerospace Corporation
Radiation Effects Data Workshop

Vincent Goiffon
ISAE – SUPAERO
Poster Session

TECHNICAL PROGRAM TUESDAY

PUERTO RICO CONVENTION CENTER
Level 3 - BALLROOM A

8:00 AM **OPENING REMARKS**
Philippe Paillet, CEA, General Chair

8:05 AM **AWARDS PRESENTATION**
Kay Chesnut, RTX, Radiation Effects Steering Group, Executive Chair

9:00 AM **TECHNICAL SESSION OPENING REMARKS**
Sylvain Girard, University of St Etienne, Technical Program Chair

SESSION A — Single-Event Effects: Mechanisms and Modeling

9:05 AM **SESSION INTRODUCTION**
Chair: Jeffrey Warner (Northrop Grumman)

A-1 9:10 AM **Low-loss Vertical β-Ga_2O_3 High-Power Diodes with Engineered Contacts: SEB Assessment and Field-Plate Effects**
S. Islam[1], P. Das[2], D. Ball[1], J. Speck[3], E. Farzana[2], D. Fleetwood[1], R. Schrimpf[1]
1. Vanderbilt University, USA
2. Iowa State University, USA
3. University of California, USA

Vertical β-Ga_2O_3 diodes with engineered Pt/PtO_x/thin-Pt Schottky contacts exhibit reduced turn-on voltage. Single-event burnout is experimentally evaluated on structures with and without field plates. TCAD analysis provides insight into the responsible mechanisms.

A-2 9:25 AM **Effect of Multi-Soft-Program Scheme on Single-Event Upset in 3D Charge-Trap NAND Flash Memory**
J. Park[1], V. Shastry[1], M. Breeding[2], S. Yi[1]
1. Texas A&M University, USA
2. Sandia National Laboratories, USA

Effects of multi-soft-program on retention and single-event upset in 176-layer 3D charge-trap (CT) NAND flash are investigated, clarifying the influence of trap occupancy in the CT layer on retention characteristics and heavy-ion-induced threshold voltage loss.

A-3 9:40 AM **Angular Effects on Single-Event Vulnerability at the 3- and 5-nm Bulk FinFET Nodes**
J. Kronenberg[1], S. Tolson[1], X. Zhao[1], Y. Xiong[1], N. Pieper[1], D. Ball[1], B. Bhuva[1]
1. Vanderbilt University, USA

Angular single-event effects at 3- and 5-nm bulk FinFET nodes are presented. The relationship between angular incidence and SE vulnerability is explored as a function of technology scaling, critical charge, and particle LET.

A-4 9:55 AM **Study of Angular and Material Dependence of Single Event Effects in Enhancement-mode GaN HEMTs**

P. Maloney[1], A. Billa[1], B. Bolton[1], S. Hankinson[1], S. Shorina[1], H. Gingold[1], J. Gray[2], L. Massengill[2], D. McMorrow[3], D. Fleetwood[2], E. Zhang[1]

1. University of Central Florida, USA
2. Vanderbilt University, USA
3. US Naval Research Laboratory, USA

Heavy-ion testing of enhancement-mode GaN HEMTs shows SELC and SEB thresholds depend strongly on incident angle and overlying metallization. SEM and SRIM reveal Cu interconnects amplify charge deposition, explaining reduced thresholds at near-normal incidence.

POSTER PAPERS

PA-1 **SoC Processor and Memory Proton Testing Methodology and Results for the AMD Versal ACAP**

G. Smith[1], M. Wirthlin[1], M. Brigham[1]

1. Brigham Young University, USA

A methodology is presented for testing multiple processors and 18 memories simultaneously on the Versal ACAP during a proton irradiation test. Post-run fault analysis is performed to identify the root cause of all processor failures.

PA-2 **Impact of Structural and Numerical Constraints on Single-Event Upsets in ResNet50 Neural Networks**

G. Qiao[1], S. Feng[1], G. Yu[1], M. Tao[2], Y. Chi[1], J. Chen[1], D. Luo[1], J. Yang[2], B. Liang[1]

1. National University of Defense Technology, China
2. Hunan University, China

Using software fault injection and pulsed laser experiments, this work analyzes ResNet50 failure behaviors under radiation, showing that combined structural and numerical constraints significantly enhance model robustness on AI chip.

PA-3 **Heavy-Ion Testing of the AMD Versal Network-on-Chip**

P. Drum[1], A. George[1], M. Cannon[2], A. Kumar[2], N. Myers[2], A. Tabaczynski[2], D. Lee[2], N. Matter[2], P. Thelen[2]

1. University of Pittsburgh, USA
2. Sandia National Laboratories, USA

Heavy-ion tests were performed on the Versal Network-on-Chip to determine cross sections and common errors for two general-use designs. Common errors included correctable parity errors and packet misrouting errors.

PA-4 **Proton Radiation Testing of AI Models on the AMD Versal Deep Learning Processing Unit (DPU)**

J. Brown[1], H. Allan[1], J. Goeders[1], M. Wirthlin[1]

1. Brigham Young University, USA

Fault injection and proton radiation testing of YOLO and ResNet models on the AMD Versal DPU reveal six failure modes, model-dependent error rates, and the predictive capability of fault injection

PA-5 **Evaluation of Single-Event Effects on Swin Transformer Tracking Model for Sub-20nm FinFET-based AI Chips**

Z. Li[1], S. Feng[1], G. Yu[1], M. Tao[2], Y. Chi[1], J. Chen[1], D. Luo[1], J. Yang[2], Y. Liu[1], F. Luo[1], J. Mo[1], B. Liang[1]

1. National University of Defense Technology, China
2. Hunan University, China

Pulsed laser and heavy-ion experiments are conducted on a Swin-Transformer-based edge tracking system. Different structural variants exhibit distinct SEFI/SEU occurrence characteristics, revealing structure-dependent reliability behaviors under radiation-induced single-event effects.

10:10 AM – 10:40 AM
Level 1 - EXHIBIT HALL A

BREAK

SESSION B **SINGLE-EVENT EFFECTS: Devices and Integrated Circuits**

10:40 AM **SESSION INTRODUCTION**

Chair: Ruben García Alía (CERN)

B-1 **LET and Orientation Dependent Angular SEU in 12-nm Bulk FinFET Flip-Flops**

10:45 AM

X. Lu[1], J. Debnath[2], E. Zhang[2], J. Xing[1], C. Elash[1], D. Ramaswami[1], Q. Chen[1], L. Chen[1]

1. University of Saskatchewan, Canada
2. University of Central Florida, USA

Angular heavy-ion SEU cross-sections were measured for 12-nm FinFET flip-flops at 0° and 60° across multiple LETs and fin orientations. Results show increased σSEU under tilt, demonstrating scaling-dependent worst-case conditions and limitations of normal-incidence testing.

B-2 **Angular Dependence of Single Event Upsets in 3D NAND Flash Arrays with Very High Energy Ion Beams**

11:00 AM

M. Bagatin[1], S. Beltrami[2], A. Benvenuti[2], A. Waets[3], N. Emriskova[3], R. Garcia[3], S. Gerardin[1]

1. University of Padova, Italy
2. Micron Technology and Products Group, Italy
3. CERN, Switzerland

The effects of very-high-energy ions on 3D NAND Flash arrays are investigated. Cross sections at grazing angles, the spatial distribution, and clustering of radiation-induced errors are analyzed by exploiting the unique capabilities of high-energy beams.

B-3 **Reliability of Processing-in-Memory Accelerators for Deep Neural Networks Inference**

11:15 AM

M. Wagner[1], F. Santos[1], M. Traiola[1], P. Rech[2], A. Kritikakou[1]

1. INRIA, France
2. University of Trento, Italy

We present the first proton-irradiation campaign for a commercial processing-in-memory (PIM) AI accelerator executing end-to-end DNN inference. We report results from 10 DNN models and a microbenchmark, showing higher error criticality than conventional accelerators.

B-4 11:30 AM **Single-Event Leakage Current and Burnout in High-Voltage GaN and SiC PiN Diodes: A Comparative Analysis**

G. Mayberry[1], X. Zhao[2], H. Gingold[3], P. Maloney[3], S. Islam[1], A. Sengupta[4], X. Shen[5], A. Senarath[1], O. Meilander[1], B. Zhang[2], S. Hankinson[3], B. Bolton[3], W. Hubbard[6], S. Kosier[1], T. Roy[2], E. Zhang[3], D. Fleetwood[1], S. Pantelides[1], M. Ebrish[1], R. Schrimpf[1]

1. Vanderbilt University, USA
2. Duke University, USA
3. University of Central Florida, USA
4. DLR, Germany
5. University of Memphis, USA
6. NanoElectronic Imaging, Inc., USA

High-voltage GaN and SiC vertical PiN diodes were tested for SEEs at similar voltages for a wide LET range. The lower SEE tolerance of GaN is attributed to lower defect-multiplication activation energies.

B-5 11:45 AM **Mechanism of Heavy-Ion Induced Leakage Current in GaN HEMTs Buffer Layers**

J. Gray[1], S. Shorina[2], J. Vielmette[1], D. Ball[1], E. Zhang[2], P. Maloney[2], H. Gingold[2], B. Bolton[2], S. Hankinson[2], A. Billa[2], H. Parra[2], J. Trippe[1], M. Alles[1], S. Kosier[1], D. Fleetwood[1], R. Schrimpf[1], L. Massengill[1]

1. Vanderbilt University, USA
2. University of Central Florida, USA

Heavy ion irradiation enhances leakage currents in GaN-based HEMTs. Experimental analysis confirms a permanent drain-to-source leakage path through the buffer layer under the gate, enabled by defect-assisted hopping.

B-6 12:00 AM **Single-Event Burnout of AlN Diodes under Heavy-ion Irradiation**

C. Quiñones[1], J. Osheroff[2], P. Reddy[3], S. Mita[3], R. Kirste[3], R. Collazo[1], Z. Sitar[1]

1. North Carolina State University, USA
2. NASA Goddard Space Flight Center, USA
3. Adroit Materials, USA

Single-event burnout was observed in AlN Schottky barrier and p-n junction diodes under heavy-ion irradiation. Burnout thresholds decreased with increasing ion LET, similar to trends in other wide-bandgap semiconductors.

POSTER PAPERS

PB-1 **Microdose-Induced Stuck Bits in 7-nm FinFET SRAMs**

M. Gorbunov[1], E. Timokhin[1], J. Weijers[1], M. Van de Burgwal[1], L. Berti[1], G. Thys[1], T. Vervecken[2], D. Van Nuffel[2], T. Schulte[2], J. Vanden Berk[2], D. Geys[2], S. Bounasser[3], B. Glass[3]

1. IMEC, Belgium
2. Magics Technologies NV, Belgium
3. ESA, Netherlands

During the heavy-ion test campaign, we observed stuck bits in 7-nm FinFET SRAM blocks with certain bitcell types. The analysis and simulation results indicated that the microdose is the primary mechanism at typical fluence levels.

PB-2 Characterization of Spatial Variability of Single-Event Latch-up in a 14-nm FinFET Technology

S. Zhao[1], X. Li[1], D. Zhang[1], B. Li[1], R. Tang[1], Y. Gao[1], C. Yang[1], P. Lu[2], L. Shu[1], J. Bu[1], J. Gao[1]

1. Institute of Microelectronics of the Chinese Academy of Sciences, China
2. Ocean University of China, China

The significant spatial heterogeneity of SEL characteristics is revealed in a 14-nm FinFET multi-core SoC through heavy-ion and pulsed-laser experiments. A differentiated hardening strategy linking sensitivity to body-tie distance is proposed to provide design guidance.

PB-3 Effects of Electrical Program/Erase Cycling on the Single-Event Response of 65-nm SONOS Charge-Trap NOR Flash Memory

A. Hubbard[1], A. Murali[2], H. Hunnicutt[1], T. Peyton[1], B. Ray[2], A. Ildefonso[1], D. Loveless[1]

1. Indiana University Bloomington, USA
2. Colorado State University, USA

Heavy-ion testing on 65-nm MirrorBit SONOS Charge-Trap NOR flash memory showed that program/erase-cycled sectors exhibit significantly lower bit-normalized SEU cross-sections compared to single-programmed sectors.

PB-4 Mechanism Study of Heavy-Ion SEEs in a 12-bit SAR ADC in 22-nm FD-SOI

J. Zhao[1], Z. Li[1,2], Q. Ma[1], Y. Qing[1], M. Gorbunov[2], M. Zhang[1], E. Tackx[1], J. Prinzie[1], P. Leroux[1]

1. KU Leuven, Belgium
2. IMEC, Belgium

22-nm FD-SOI SAR ADC heavy-ion tests reveal outliers at LET 27.5–60.2. Errors map to sampling, control, comparator, and flip-flop SEEs. As cross-section rises, signatures migrate from single-mechanism to arbitrary multi-bit and mixed-mechanism errors

PB-5 Reliability of Image Classification and Object Detection on Embedded Systolic Arrays

P. Foletto Pimenta[1], S. Savazzi[2], E. Verroi[3], M. Pullia[2], F. Santos[4], P. Rech[1]

1. University of Trento, Italy
2. Centro Nazionale di Adroterapia Oncologica, Italy
3. Trento Institute for Fundamental Physics and Applications, Italy
4. INRIA, France

We investigate the impact of 200 MeV protons on convolutions and prediction tasks executed on Tensor Processing Units. Kernel size does not impact output correctness while detection shows significantly more critical errors than classification.

PB-6 Characterization of Latent Gate Damage and Single-Event Leakage Current by Gate Charge Measurements of Irradiated Silicon Carbide Power MOSFETs

A. Sengupta[1,2], R. Cadena[2], J. Vielmette[2], S. Islam[2], X. Zhao[3], D. Bal[2], A. Sternberg[2], J. Osheroff[4], J. Hutson[5], M. Alles[2], K. Galloway[2], A. Witulski[2], R. Schrimpf[2], S. Kosier[2]

1. DLR, Germany
2. Vanderbilt University, USA
3. Duke University, USA
4. NASA Goddard Space Flight Center, USA
5. Lipscomb University, USA

Gate charge measurements reveal that latent gate damage and drain-gate single-event leakage current in SiC MOSFETs are strongly dependent on the particle energy and drain bias during irradiation and are precursors to single-event gate rupture.

12:15 PM – 2:15 PM **LUNCH in PRCC Level 1 – Exhibit Hall A**
and Young Professionals (YP) LUNCHEON at the Sheraton Hotel

SESSION C **Photonics Devices and Integrated Circuits**

2:15 PM **SESSION INTRODUCTION**
Chair: Julien Mekki (CNES)

C-1
2:20 PM **Dose Rate and Temperature Effects on the Radiation-Induced Attenuation of H_2-loaded Ge-doped Optical Fibers**

A. Morana[1], S. Acid[1], E. Marin[1], A. Boukenter[1], Y. Ouerdane[1], S. Girard[1]
1. Université de Saint-Etienne, France

We study the dose-rate effect on the RIA of H^2-loaded Ge-doped fibers up to a dose of 100 kGy, to better understand the influence of the molecular hydrogen, that seems to stabilize the defects.

C-2
2:35 PM **Real time Responses of COTS Optical Fibers exposed to X-Ray Pulses**

M. Roche[1], O. Duhamel[1], D. Lambert[1], M. Gaillardin[2], S. Girard[3], P. Paillet[1]
1. CEA/CESTA, France
2. CEA/Gramat, France
3. Université de Saint-Etienne, France

We investigate the transient responses of commercial off-the-shelf (COTS) optical fibers under pulsed X-rays with high dose rate. We highlight a large diversity of the fiber response due to different doping strategies.

C-3
2:50 PM **Gamma Irradiation Total-Ionizing and Displacement Damage Effects in a Quanta Image Sensor**

J. Krynski[1,2], A. Salih-Alj[1], A. Le Roch[2], V. Bernard[2], V. Lalucaa[2], C. Virmontois[2], V. Goiffon[1]
1. ISAE-SUPAERO, France
2. CNES, France

A gamma irradiation campaign on a photon-counting image sensor reveals a degradation in noise characteristics and appearance of point defects. Many pixels' dark currents are reduced after gamma exposure, showing a unexpected susceptibility to TID.

3:05 AM – 3:35 PM
Level 1 - EXHIBIT HALL A **BREAK**

C-4
3:35 PM **Radiation Effects on Nanocrystal-Based Logarithmic Short Wavelength Infrared Image Sensor**

A. Neyret[1-4], P. Giudicelli-Vernet[1,3], S. Demiguel[2], S. Masseno1, J. Belloir[3], E. Lhuillier[4], V. Goiffon[1]
1. ISAE-SUPAERO, France
2. Thales Alenia Space, France
3. CNES, France
4. INSP CNRS - Sorbonne Université, France

Radiation effects on Lead Sulfide nanocrystal-based short-wavelength infrared open pixel logarithmic cameras are tested. Imaging performance and device characteristics are tracked upon proton irradiation, demonstrating ionizing and non-ionizing tolerance and suitability for space environments.

C-5 **Radiation-Induced Attenuation in Silicon Photonics Waveguides**
3:50 PM
D. Alfiero[1], L. Olantera[1], C. Scarcella[1], S. Detraz[1], J. Troska[1]
1. CERN, Switzerland

Attenuation changes in Si-photonics waveguides were characterized under displacement damage and ionizing doses relevant to high-energy physics experiments. All waveguide types showed increased attenuation; O-band waveguides were most sensitive, with 0.65dB/mm after 7×10^{15}n/cm^2 neutron fluence.

C-6 **Electrical vs. Optical Degradation due to Cumulative Dose in Vertical Phototransistors**
4:05 PM
B. Ringel[1], J. Heimerl[1], D. Sam[1], M. Hosseinzadeh[1], Q. Parker[1], J. Teng[2], J. Cressler[1]
1. Georgia Institute of Technology, USA
2. The Aerospace Corporation, USA

TID responses of vertical phototransistors based on SiGe-HBTs are evaluated following exposure using a 60Co source. Differences in electrical and optical degradation are observed, highlighting electrical-only analysis is not sufficient for hardness assurance of photodetectors.

POSTER PAPERS

PC-1 **Total Ionizing Dose Effects on the Dark Count Rate in 110 nm CMOS SPADs**
L. Ratti[1], A. Burdyko[2], M. Campajola[3], G. Collazuol[4], M. Da rocha rolo[5], D. Falchieri[6], G. Fiorillo[3], T. Floris[1], F. Licciulli[7], M. Mazziotta[7], L. Pancheri[8], L. Rignanese[6], R. Santoro[2], F. Shojaei[1], C. Vacchi[1]
1. Università degli Studi di Pavia and INFN Pavia, Italy
2. Università degli Studi dell'Insubria and INFN Milano, Italy
3. Università degli Studi di Napoli Federico II and INFN Napoli, Italy
4. Università degli Studi di Padova and INFN Padova, Italy
5. INFN Torino, Italy
6. INFN Bologna, Italy
7. INFN Bari, Italy
8. Università degli Studi di Trento and INFN TIFPA, Italy

SPADs fabricated in a 110 nm CMOS technology, with different active areas and quenching features, are irradiated with 10 keV X-rays up to a total ionizing dose of 10 Mrad(SiO2). Effects on DCR are investigated.

PC-2 **Effects of annealing on Ga-Free T2SL Infrared Detector**
H. Mezouar[1], A. Michez[2], M. Tornay[3], C. Cervera[4], P. Christol[3]
1. University of Montpellier, France
2. DELPHEA, France
3. University Of Montpellier, France
4. University of Grenobles-Alpes and CEA-LETI, France

In this paper, we investigate the effect of thermal annealing on Ga-free InAs/InAsSb type-II superlattice (T2SL) midwave infrared barrier photodetectors irradiated with 60 MeV protons at fluences up to 8x1011 H+/cm².

PC-3 **Radiation-Induced Charge Collection Dynamics in Short-Wavelength P+-N Silicon Avalanche Photodiodes**

N. Karom[1], S. Ball[1], E. Teo[1], A. Veluri[1], P. Harris[1], M. Mccurdy[1], R. Schrimpf[1], D. Fleetwood[1], J. Trippe[1], R. Nederlander[2], R. Reed[1], S. Weiss[1]

1. Vanderbilt University, USA

2. Aegis Aerospace, USA

P+-N Si-APDs show significant gain decrease under alpha irradiation compared to optical excitation. Data analysis and TCAD simulations show this results from significant increases in carrier recombination relative to avalanche generation with increasing EHP density.

PC-4 **Total Ionizing Dose Effects on High-Speed Silicon Integrated Photonic Mach-Zehnder Modulators**

K. Arnold[1], N. Karom[1], J. Slaby[2], A. Veluri[1], A. Kaylor[2], A. Sternberg[1], D. Ball[1], R. Schrimpf[1], D. Fleetwood[1], S. Ralph[2], R. Reed[1], S. Weiss[1]

1. Vanderbilt University, USA

2. Georgia Institute of Technology, USA

Impacts of 10-keV X-ray irradiation on high-speed electro-optic response are observed in silicon Mach-Zehnder modulators. More than 50% electro-optic performance degradation is observed when devices are irradiated under active bias. Underlying ionization mechanisms are examined.

PUERTO RICO CONVENTION CENTER BALLROOM A

8:30 AM **The History of Puerto Rico and San Juan –**
INVITED SPEAKER

SESSION D **Radiation Effects in Devices and Integrated Circuits**

9:30 AM **SESSION INTRODUCTION**
Chair: Corinna Martinella (University of Montpellier)

D-1 **Optimizing Electrical Rapid Annealing for TID Recovery in Bulk FinFETs**
9:35 AM
A. Vidana[1], C. McKay[1], D. Hughart[1], T. Kirby[1,2], N. Nowlin[1], N. Dodds[1], E. Zhang[3], H. Barnaby[2], D. Fleetwood[4]
1. Sandia National Laboratories, USA
2. Arizona State University, USA
3. University of Central Florida, USA
4. Vanderbilt University, USA

Electrical rapid annealing parameters are optimized to reverse TID-induced degradation in bulk FinFETs. Bulk-bias magnitude controls recovery rate dominated by tunneling-assisted charge neutralization, validated by low temperature experiments and TCAD simulations.

D-2 **Total Ionizing Dose Effects in QLC 3-D NAND: Characterization, Analysis and Mitigation**
9:50 AM
M. Kumar[1], H. Ur Rahman[1], I. Chatterjee[2], B. Ray[1]
1. Colorado State University, USA
2. Airbus, Germany

This work performs total-ionizing-dose effects characterization of Quad-level-cell 3-D NAND flash, revealing data corruption at 5 krad(Si). We propose logical downscaling and optimized read to extend TID tolerance beyond 25 krad(Si).

D-3 **Investigation of the Physical Mechanisms Responsible for TID and Electrical Stress Susceptibility in p-GaN Power HEMTs**
10:05 AM
H. Couillaud[1], M. Gaillardin[1], L. Artola[2], G. Hubert[2]
1. CEA, France
2. ONERA, France

Physical mechanisms contribution underlying static electrical parameter instabilities in a COTS p-GaN HEMT with Schottky gate contact are analyzed, focusing on the combined impact of total ionizing dose and several bias conditions.

10:20 – 10:50 AM **BREAK**
Level 1 - EXHIBIT HALL A

D-4 **Total-Ionizing-Dose Effects in AlGaN/GaN FinFETs**
10:50 AM
T. Liu[1], H. Lee[2], S. Islam[1], E. Zhang[3], R. Reed[1], R. Schrimpf[1], S. Rajan[4], D. Fleetwood[1]
1. Vanderbilt University, USA
2. Texas Instruments, USA
3. University of Central Florida, USA
4. Ohio State University, USA

AlGaN/GaN FinFETs and otherwise similar planar devices were subjected to 1.8-MeV proton irradiation and 10-keV X-ray irradiation. FinFETs exhibit less degradation in

threshold voltage and transconductance than planar devices as a result of enhanced gate control.

D-5
11:05 AM

Heavy-Ion-Induced Degradation Dependence on Irradiation Temperature in GaN HEMTs

K. Niskanen[1], A. Tallarico[2], A. Javanainen[1], A. Michez[3], J. Boch[4], F. Wrobel[4], R. Germanicus[5], H. Kettunen[1]

1. University of Jyväskylä, Finland
2. Università di Bologna, Italy
3. Delphea, France
4. Université de Montpellier, France
5. Université de Normandie, France

The effect of temperature on the heavy ion response of gallium nitride high electron mobility transistors is presented. An order of magnitude higher degradation rate is observed at 363 K compared to room temperature irradiation.

D-6
11:20 AM

The Effect of TID on SRAM Stability and PUF in GlobalFoundries 14-nm FinFET Technology

Y. Xiong[1], A. Vidana[1], N. Dodds[1], B. Bhuva[2], N. Nowlin[1]

1. Sandia National Laboratories, USA
2. Vanderbilt University, USA

SRAM stability is evaluated for PUF hardware authentication at a 14-nm bulk FinFET node. Results show TID significantly changes data retention voltages and power-on states of bitcells in high-performance designs but not in high-density designs.

POSTER PAPERS

PD-1

Understanding Radiation-Induced Accuracy Loss in Floating-Gate Based Analog Artificial Neural Networks

N. Afroz[1], A. Sayem[1], A. Dwadasi[1], R. Baumann[1], Y. Makris[2]

1. University of Texas at Dallas, USA
2. University of California, USA

We investigate how total ionizing dose-induced charge loss in analog floating-gates affects the inference accuracy of Analog Artificial Neural Networks (AANNs) and demonstrate how periodic hot-electron reprogramming can restore performance, effectively mitigating radiation-induced degradation.

PD-2

Radiation Threshold of Scaled Isotopically Pure MoS_2 Nanoribbon Field-Effect Transistors

J. Yang[1], T. Pena[2], A. Wright[1], J. Chaney[1], A. Hoang[2], A. Mannix[2], E. Pop[2], D. Daniel[1], J. Taggart[1], S. Stuart[1], A. Bushmaker[1]

1. The Aerospace Corporation, USA
2. Stanford University, USA

We investigate the effects of gamma radiation on scaled monolayer molybdenum disulfide (MoS2) nanoribbon field-effect transistors. At 1 Mrad TID, threshold voltage degradation occurred while field-effect mobility remained constant, indicating gate dielectric limits radiation hardness.

PD-3 **Capacitance Shifts in Multilayer Ceramic Capacitors Induced by Gamma Irradiation**

P. Muscat[1], H. Barnaby[1], G. Rodarte[1], C. Nies[2], M. Conway[3], D. West[2], H. Hairston[2], J. Neuendank[1], Z. Adamany[1]

1. Arizona State University, USA
2. KYOCERA AVX, USA
3. KYOCERA AVX, United Kingdom

Total ionizing dose effects on capacitance were evaluated for X7R and C0G/NP0 multilayer ceramic capacitors using Co-60 gamma irradiation. X7R devices showed monotonic dose-dependent capacitance reduction, while C0G/NP0 capacitors remained stable.

PD-4 **Effects of X-Ray Radiation on the Performance of Lithium Niobate MEMS Resonators**

J. Vivas Gomez[1], H. Parra[1], E. Zhang[1], J. Lee[1], R. Abdolvand[1]

1. University of Central Florida, USA

X-ray total ionizing dose effects were investigated in resonant $LiNbO_3$ TPoS MEMS. After radiation, resonant frequency shifts remained below 0.06%, while bounded, partially recoverable degradation in Q, $keff^2$, motional resistance, and insertion loss are observed.

PD-5 **Radio Frequency Injection Effects on Electronic Devices Subject to Neutron Displacement Damage**

N. Crenshaw[1,2], J. Young[1], J. Wallace[1], I. Timmins[1], L. Musson[1], W. Charlton[2]

1. Sandia National Laboratories, USA
2. University of Texas at Austin, USA

Linear bipolar transistors, differential amplifiers, and operational amplifiers were exposed to individual and combined neutron and electromagnetic environments. Neutron displacement damage was observed to modify device and circuit response to injected RF noise.

PD-6 **Ring-Oscillator-Based Methodology for Degradation Parameter Extraction After TID Irradiations**

X. Zhao[1], J. Kronenberg[1], S. Tolson[1], N. Pieper[1], Y. Xiong[1], B. Bhuva[1]

1. Vanderbilt University, USA

Different RO designs are used to determine effective degradations in NMOS and PMOS currents after TID exposures in a 3-nm bulk FinFET technology, revealing effects of irradiation bias and circuit activity that influence degradation levels.

SESSION E **Environments, Facilities, and Dosimetry**

11:35 AM **SESSION INTRODUCTION**
Chair: Cornelia Hoehr (TRIUMF)

E-1
11:40 AM **TimePix2 and SOI Microdosimeter: Comparison of Response in Heavy Ion Beam**

L. Tran[1], D. Miller[1], S. George[2], V. Pan[1], J. Vohradsky[1], D. Bennett[1], S. Rozhdestvenskyy[3], M. Povoli[4], A. Kok[4], S. Kodaira[5], H. Kitamura[5], T. Inaniwa[5], L. Pinsky[3], A. Rosenfeld[1]

1. University of Wollongong, Australia
2. NASA, USA
3. University of Houston, USA
4. SINTEF, Norway
5. National Institutes for Quantum and Radiological Science and Technology, Japan

SOI microdosimeter and TimePix responses were compared behind aluminium shielding of varying thicknesses to simulate astronaut exposure using 290MeV/u ^{12}C, 400MeV/u ^{20}Ne, 800MeV/u ^{28}Si, and 650MeV/u ^{40}Ar ions. Good agreement was observed.

E-2
11:55 AM **Temperature Calibration of Radioluminescent Pure Silica Core Fiber Based Dosimeters for Space Applications**

S. Acid[1,2], A. Morana[2], I. Zghari[3], M. Aubry[4], N. Kerboub[1], J. Guillermin[4], J. Mekki[1], Y. Ouerdane[2], M. Darnon[2], H. El Hamzaoui[3], B. Capoen[3], M. Bouazaoui[3], A. Boukenter[2], S. Girard[2]

1. CNES, France
2. Université de Saint Etienne, France
3. Université de Lille, France
4. TRAD, France

We demonstrate temperature calibrated radioluminescent dosimetry using pre-irradiated pure silica core optical fibers, achieving stable real-time dose-rate measurements under coupled temperature and dose-rate variations, with mean errors below 1.5%, validating feasibility for space radiation monitoring.

12:10 AM – 2:00 PM **LUNCH at Level 1 - EXHIBIT HALL A**
Level 1 - EXHIBIT HALL A **WOMEN IN ENGINEERING (WIE) LUNCHEON at Sheraton Hotel**

E-3
2:00 PM **Commercial Solid-State Detectors for Identifying Pulsed-Laser Operating Parameters for Surrogate SEE Testing**

J. Hales[1], A. Ildefonso[2], T. Crane[1], A. Khachatrian[1], D. McMorrow[1]

1. US Naval Research Laboratory, USA
2. Indiana University Bloomington, USA

This work identifies solid-state detectors that exhibit transient responses which are strongly dependent on pulsed-laser operating parameters. Such standardized reference detectors are important for providing repeatability and traceability in surrogate single-event effects testing.

E-4
2:15 PM **Influence of Pure-Silica Core Optical Fibers as Transport Fibers in a Radioluminescence-based Dosimetry System**

F. Fricano[1], A. Morana[2], Y. Ouerdane[2], D. Lambert[1], P. Paillet[1], S. Girard[2]

1. CEA/CESTA, France
2. Université de Saint Etienne, France

The influence of fibers with different hydroxyl (OH) group contents, commonly used as transport fibers in dosimetry systems based on the radioluminescence of scintillating optical fibers, such as Ce^{3+}-doped fibers, is evaluated.

E-5
2:30 PM

Dual-Reference-Level Inversion for High-Linearity In-Situ Radiation Dosimetry in 3D NAND Flash

M. Dong[1], W. Chen[1], Z. Zhang[1], Y. Ouyang[1], L. Cai[1]
1. Sun Yat-sen University, China

This work demonstrates a high-linearity radiation dosimeter using commercial 3D NAND. The dual-reference-level sampling technique achieves linearity above 0.9867 up to 35 krad(Si) with 3.0% maximum relative error, enabling accurate in-situ monitoring for aerospace applications.

POSTER PAPERS

PE-1

Real-time Monitoring of the CHARM Mixed Field Irradiation with Optical Fiber Dosimeters

L. Weninger[1], S. Acid[1,2], Y. Aguiar[3], R. Garcia[3], N. Kerboub[2], S. Fiore[3], D. Prelipcean[3], A. Morana[1], S. Girard[1]
1. Université de Saint Etienne, France
2. CNES, France
3. CERN, Switzerland

We propose a novel approach to adapt optical-fiber based dosimeters based on the radiation-induced luminescence (RIL) phenomenon to the pulsed (spill-based time structure) mixed-field environment of the CHARM facility at CERN.

PE-2

Very High-Energy Heavy-Ion SEE Testing Results at the HEARTS@CERN Facility During the 2025 Run

B. Tissot Ferraz[1], T. Beene[1], D. Söderström[1], I. Slipukhin[1], R. Garcia[1], N. Emriskova[1], A. Waets[1], Y. Aguiar[1], D. Prelipcean[1], C. Matteo[1], M. Garcia[1], D. Lucsanyi[1], R. Federico[1], G. Pezzullo[1], G. Kucharska[1], E. Garcia[1], J. McCarthy[1], M. Delrieux[1]
1. CERN, Switzerland

The paper presents the results of Single-Event-Effect testing of commercial electronic devices with very high-energy heavy ions at the HEARTS@CERN facility during the 2025 run, along with the beam characterization and the adopted dosimetry practices.

PE-3

Evaluating 3-D NAND as a Passive Radiation Dosimeter: A Comparison of FG and CT Technology

M. Kumar[1], J. Bell[1], A. Brandl[1], B. Ray[1]
1. Colorado State University, USA

This work experimentally investigates 3-D floating-gate and charge-trap NAND flash as passive radiation dosimeters, showing linear FG sensitivity of ~12.5 mV/krad(Si), while CT exhibits multi-mechanism, non-linear response with ~35 mV/krad(Si) initially, reducing to ~18 mV/krad(Si).

PE-4 **Operational Time-Resolved Single-Event Upset Rate Estimation from On-Board Particle Flux Measurements**

A. Koziukov[1], G. Protopopov[1], M. Kozhukhov[1], I. Gvozdev[1]
1. RH-Forecast LLC, Russian Federation

This paper presents a time-resolved, measurement-driven approach to estimate SEU rates in spacecraft memories during SPEs by reconstructing particle spectra from GOES-16 and ACE flux measurements. The method is validated against in-flight upset-count data from RHEME-3.

PE-5 **Investigation of the Energy-Dependent Response of Si IGBT and SiC Power MOSFETs to Fast Neutrons**

C. Cazzaniga[1], F. Principato[2], F. Pintacuda[3], X. Ledoux[4], M. Kastriotou[1], C. Frost[1]
1. STFC, United Kingdom
2. Palermo University, Italy
3. STMicroelectronics, Italy
4. GANIL, France

Silicon IGBT and silicon carbide power MOSFETs have been studied with fast neutrons in the 2-40 MeV range at GANIL SPIRAL-2 where energy selection is possible. The results can be compared with atmospheric neutron tests.

POSTER SESSION

2:45 PM **SESSION INTRODUCTION**

Chair: Vincent Goiffon (ISAE-SUPAERO)

2:50 PM – 4:50 PM **POSTER SESSION**

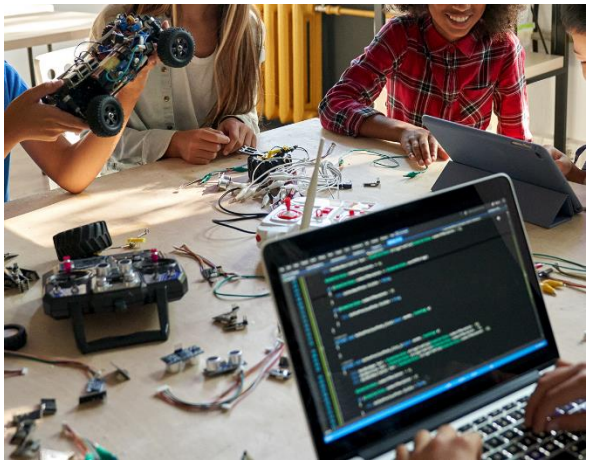
Level 3 - BALLROOM B

Project with local young students from Puerto Rico

The Puerto Rico STEM education program has been working with Space R3 LLC to develop a series of microelectronics-based projects for high school students (ages 15–18). Participating students are from University Gardens High School and Papa Juan XXIII High School, both located in San Juan, Puerto Rico. These projects span multiple disciplines, including mathematics, science, and engineering, with a strong emphasis on radiation effects in microelectronics.

The program has run for approximately one academic year, beginning in September 2025 and concluding at the NSREC 2026 Conference. During this time, students and their teachers designed, built, and tested a variety of microelectronic systems. Guest speakers included Nicole Pothier McGillivray (Carrington Shield Strategies, LLC), Ricardo De Jesus (Raytheon), Lea Ann Smith (Radiation Test Solutions, Inc.), Nicholas Christian (Radiation Test Solutions, Inc.), and Melanie Berg (Space R3 LLC).

Industry partners generously donated access to radiation testing facilities and shared their expertise. ProNova Solutions, LLC provided proton testing, VPT Rad, Inc. provided total ionizing dose (TID) testing, and Radiation Test Solutions, Inc. (RTS) provided neutron testing. The IEEE Nuclear and Plasma Sciences Society (NPSS) also provided generous financial support.



Data acquisition was performed by Space R3 LLC in collaboration with Natch León of Papa Juan XXIII High School. Three engineering students were selected to travel to the TID facility and participate in testing, while mathematics students received the resulting data and performed the analysis. The results will be presented by the students during a poster session at the NSREC 2026 Conference.

NSREC 2026 has decided to reserve a dedicated spot in its POSTER SESSION for the STEM-PR students to present their work to the community.

***Please visit these Posters* and discuss the results with our youngest colleagues!**

PUERTO RICO CONVENTION CENTER
Level 3 - BALLROOM A

SESSION F **Basic Mechanisms of Radiation Effects**

8:45 AM **SESSION INTRODUCTION**
Chair: Marta Bagatin (University of Padova)

F-1
8:50 AM **Investigation of Total Ionizing Dose-Induced Trap Density in 12-nm FinFET Technology Using *1/f* Noise**
K. Sapkota[1], B. Tierney[1], A. Vidana[1], B. Dodd[1], J. Neuendank[1,2], R. Ghimire[3], M. Spear[3], H. Barnaby[2], N. Nowlin[1]
1. Sandia National Laboratories, USA
2. Arizona State University, USA
3. Air Force Research Laboratory, USA

The *1/f* noise level measured in GlobalFoundries 12-nm FinFETs increases with ionizing dose. The TID-induced traps near the silicon-oxide interface are estimated, and their behaviors for different threshold voltages are discussed.

F-2
9:05 AM **TID Response Comparison of Two 28-nm CMOS Technology Flavors: HPL vs. HPC+**
G. Andreetta[1], L. Gelmi[2], E. Vallicelli[3], M. De Matteis[3], A. Lai[4], A. Paccagnella[1], S. Mattiazzo[1], S. Bonaldo[1]
1. University of Padova, Italy
2. University of Pavia, Italy
3. University of Milano Bicocca, Italy
4. INFN Cagliari, Italy

Total ionizing dose (TID) is investigated by X-rays in two 28-nm CMOS technology flavors, HPL and HPC+. Differences in the TID sensitivity are found in short-channel devices.

F-3
9:20 AM **Displacement Damage Mitigation in Fully Isolated N and P-Type Pixel Microvolumes**
A. Salih Alj[1], V. Goiffon[1], M. Bolin[1], J. Carrere[2], V. Malherbe[2], C. Virmontois[3]
1. ISAE-SUPAERO, France
2. STMicroelectronics, France
3. CNES, France

We show that isolation trenches reduce displacement damage in silicon microvolumes by strongly reducing divacancy formation, based on dark current spectroscopy comparing gamma- and proton-irradiated trench photogates with trench-less vertical photodiodes.

F-4
9:35 AM **High-Field-Induced Recovery of TID-Induced Threshold Voltage Shifts in SiC MOSFETs**
Z. Stone[1], M. Hu[1], D. Fleetwood[1], J. Trippe[1], S. Kosier[1], R. Schrimpf[1], D. Ball[1], R. Cadena[1], M. Alles[1], L. Massengill[1]
1. Vanderbilt University, USA

Threshold-voltage recovery in TID-irradiated SiC MOSFETs by high-field stress is highly repeatable to 1 Mrad(SiO_2) cumulative dose. We find that Fowler–Nordheim electron injection reversibly cycles oxide defects between charged and neutral states without progressive degradation.

F-5 9:50 AM **Low-Frequency Noise and Heavy-ion Radiation Effects in Enhancement-Mode GaN Power HEMTs**

S. Shorina[1], E. Zhang[1], H. Parra[1], A. Billa[1], P. Maloney[1], B. Bolton[1], S. Hankinson[1], H. Gingold[1], J. Debnath[1], S. Islam[2], T. Liu[2], J. Gray[2], D. Fleetwood[2], L. Massengill[2]

1. University of Central Florida, USA

2. Vanderbilt University, USA

Low-frequency noise in enhancement-mode power HEMTs increases after krypton irradiation, indicating radiation-activated trap generation near the channel and buffer layer. Nitrogen vacancy related defects are likely responsible for the increased noise.

POSTER PAPERS

PF-1 **Dose Enhancement Effects in Nanometer-Scale Technologies**

E. Wong[1], B. Dodd[1], C. Champagne[1], D. Ball[1], S. Kosier[1], M. Hu[1], R. Reed[1], B. Sierawski[1], D. Fleetwood[1], R. Schrimpf[1], J. Trippe[1]

1. Vanderbilt University, USA

Dose enhancement in nanometer-scale devices is quantified via Monte Carlo radiation-transport simulations of 22-nm FDSOI devices. Results are calibrated and compared via comparison with experimental data on structures having high-Z gate stacks.

PF-2 **Electric-Field-Dependence of X-Ray TID-Induced Instabilities in Enhancement-Mode GaN HEMTs**

A. Billa[1], S. Shorina[1], P. Maloney[1], J. Debnath[1], H. Parra[1], B. Bolton[1], E. Zhang[1]

1. University of Central Florida, USA

X-ray total ionizing dose effects in enhancement-mode GaN HEMTs are examined under different post-irradiation electric fields. Threshold-voltage shifts and recovery depend strongly on bias history, with TCAD simulations linking field distribution to charge trapping stability.

PF-3 **Electrically detected magnetic resonance and near zero field magnetoresistance study of heavy ion irradiation in GaN pn junction diodes**

D. Hassenmayer[1], M. Elko[1], P. Lenahan[1]

1. Penn State University, USA

Electrically detected magnetic resonance (EDMR) and near zero field magnetoresistance (NZFMR) measurements were utilized to detect atomic scale defects generated by heavy ion irradiation of GaN pn junction diodes at room temperature.

PF-4 **Degradation mechanisms and radiation-induced material modifications in SiC power diodes**

H. Goncalves de Medeiros[1], N. Für[1], A. Erlebach[1], M. Belanche[1], J. Reuteler[1], K. Voss[2], U. Grossner[1]

1. ETH Zurich, Switzerland

2. GSI, Switzerland

SELC and SEB degradation and their mechanisms in SiC power diodes are investigated through post-irradiation characterization with EDX, Ultraviolet-Visible Photoluminescence (UVPL), and Raman Spectroscopy. 3D-TCAD is employed to put the findings into perspective.

PF-5 **Onset of Degradation in COTS SiC Power Diodes Exposed to High-Energy Proton Irradiation**

N. Für[1], H. Goncalves de Medeiros[1], M. Nagel[1], M. Kirchbaumer[1], M. Belanche Guadas[1], R. Kupper[1], U. Grossner[1]

1. ETH Zürich, Switzerland

Based on high-energy (200 MeV) proton irradiation on COTS SiC power diodes, the impact of displacement-induced defect activation in radiation-induced damage and, in consequence, the limitations of standard derating practices are discussed.

PF-6 **Investigation on Mechanism of Total Ionizing Dose Effects in Tin Oxide Field-Effect Transistors by Gamma-ray Irradiation**

S. Kim[1], H. Kim[2], G. Jeon[1], Y. Hwang[1], R. Chung[2], D. Kim[1]

1. Korea Atomic Energy Research Institute, Korea

2. Kyungpook National University, Korea

Total ionizing dose effects in SnO_2 FETs were investigated using Co-60 gamma irradiation. The results revealed the dose-dependent correlation between pre-existing oxygen vacancies and radiation-induced electron-hole pairs, relating to the degradation of device performance.

PF-7 **Field-Assisted Charge Detrapping and Gain Recovering in a Standard NPN Bipolar Transistor**

I. Lopez Calle[1]

1. European Space Agency (ESA), Netherlands

An intense electric field applied between collector and emitter accelerates charge detrapping and enables instantaneous gain recovery in irradiated bipolar COTS transistors. This approach supports hardness-assurance methodologies and rapid in-situ mitigation of bipolar COTS components.

10:05 – 10:35 AM **BREAK**
Level 1 - EXHIBIT HALL A

SESSION G **Hardness Assurance: Piece Parts to Systems and Testing Approaches**
10:35 AM **SESSION INTRODUCTION**
Chair: Almudena Lindoso (University Carlos III Madrid)

G-1 **Pulsed Electrons: A Method for Inducing Ion-like Single-Event Transients and Latchup**
10:40 AM

G. Tzintzarov[1], J. Teng[1], A. Kulkarni[2], S. Brian[2], P. Musumeci[2], A. Bushmaker[1], S. Milton[3], R. Berry[4], G. Allen[5]

1. The Aerospace Corporation, USA

2. University of California, USA

3. TAU Systems, USA

4. RadiaBeam Technologies, USA

5. NASA Jet Propulsion Laboratory, USA

Development of SEE testing using pulsed electrons is discussed. SET correlation in a photodiode is achieved and SEL testing in a COTS part is discussed. Results support the use of such beams for RHA testing.

G-2
10:55 AM

Data Sanitization of Aged SRAM Array using Ionizing Radiation

A. Stephen Vellankanni[1], I. Chatterjee[2], U. Guin[3], B. Ray[1]
1. Colorado State University, USA
2. Airbus Defence and Space, Germany
3. Auburn University, USA

We demonstrate a TID-based data sanitization technique for aged SRAM, achieving near-complete removal of aging-induced data imprints after 100 krad(Si), and provide a root-cause analysis of the underlying physical mechanisms.

G-3
11:10 AM

Improved Methods for Thermal Neutron SEE Testing and Evaluation

R. Zedric[1], N. Dodds[1], J. Joffrion[1], Y. Xiong[1], A. Tonigan[1]
1. Sandia National Laboratories, USA

Evidence is presented that suggests the international standard for thermal neutron SEE testing contains an error that causes the calculated cross sections to be artificially low. The impacts are quantified, and the formula is corrected.

11:25 AM

RADIATION EFFECTS DATA WORKSHOP INTRODUCTION

Chair: Jennifer Taggart (The Aerospace Corporation)

11:35 PM – 1:20 PM
Level 1 - EXHIBIT HALL A
12:50 PM

LUNCH with the Exhibitors
Exhibitor Drawings

1:20 PM – 3:20 PM

PUERTO RICO CONVENTION CENTER
Level 3 - BALLROOM B

RADIATION EFFECTS DATA WORKSHOP

DW-1

An Integrated National Network of Space Irradiation Facilities for Radiation Effects Testing and Component Qualification

M. Vadrucci[1], R. Carpentiero[1], M. Di Clemente[1]
1. Italian Space Agency, Italy

The paper describes ASIF, Italy's national space irradiation network, highlighting the REX electron accelerator used within ACDC_Q to optimize diamond quantum sensors, offering controlled irradiation for space qualification and advancing technological autonomy and international research.

DW-2

ANSTO Microbeam Facility: Versatile Scanning Modalities For Radiation Testing

R. Drury[1], P. Zeljko[1], S. Peracchi[1]
1. Australian Nuclear Science and Technology Organisation, Australia

The ANSTO microbeam facilities and the latest developments in scanning modalities are presented, highlighting advanced, spatially resolved radiation testing capabilities for devices, materials, and biological samples, delivering insights into localised damage beyond conventional broad-beam irradiation.

DW-3 **A New SRIM-Based Stackup Tool for Calculating Energy Loss, LET, and Ion Range in Common SEE Testing Materials**

A. Yeck[1], C. Farah[1], D. McNanney[1], S. Lidia[1]
1. Facility for Rare Isotope Beams, Michigan State University, USA

The Facility for Rare Isotope Beams at Michigan State University has introduced a new SRIM-based stackup tool for calculating energy loss, LET, and range in common SEE testing materials.

DW-4 **Proton and Heavy-Ion Characterizations on Microchip Radiation-Tolerant PolarFire® SoC FPGA RTPFS460ZT Microprocessor Subsystem**

S. Toguchi[1], N. Rezzak[1], D. McNamara[2], C. Jean[2], B. Burke[2], R. Mohan[1], I. Bryant[3], M. Madugoda[1], M. Urias[1]
1. Microchip Technology, USA
2. Microchip Technology, Ireland
3. Microchip Technology, United Kingdom

This paper presents results on the impact of protons and heavy ions on the Radiation-Tolerant PolarFire® SoC FPGA RTPFS460ZT Microprocessor Subsystem (MSS), demonstrating its potential suitability for space applications.

DW-5 **TID Characterization of Microchip Radiation-Tolerant PolarFire® SoC RTPFS460ZT FPGA**

M. Urias[1], A. Cai[1], N. Rezzak[1], S. Toguchi[1]
1. Microchip Technology, USA

This paper provides the Total Ionizing Dose (TID) response of the Radiation-Tolerant PolarFire® SoC FPGA RTPFS460ZT using gamma ray, demonstrating its resistance to TID up to 100 krad (SiO_2).

DW-6 **Characterization of Heavy Ion and Proton-Induced Single-Event Effects in Microchip PolarFire® SoC FPGA RTPFS460ZT Fabric**

N. Rezzak[1], S. Toguchi[1], M. Madugoda[1], M. Reaz[1], M. Urias[1]
1. Microchip Technology, USA

This paper presents heavy ion and proton SEE results on the RTPFS460ZT PolarFire® SoC FPGA fabric. Results cover SEL, SEU, and SEFI across Flip-Flops, SRAM, Mathblock, PLL and pNVM, confirming its suitability for space environments.

DW-7 **SEE and Total Dose Results of the ISL73849SLH Radiation Hardened Single/Dual Phase Current Mode PWM Controller with PMBus &Telemetry**

W. Newman[1], M. Campanella[1], E. Thomson[1], W. Choroco[1], C. Thomson[1]
1. Renesas Electronics America, USA

We report the single event performance and low dose rate TID results of the radiation-hardened ISL73849SLH Single/Dual Phase Current Mode PWM Controller with PMBus & Telemetry.

DW-8 **Total Dose and Single-Event Effects Testing of the ISL73846 2MHz Double Ended PWM Controller with Synchronous Rectification**

M. Campanella[1], W. Newman[1], E. Thomson[1], C. Thomson[1], T. Linder[1]
1. Renesas Electronics America, USA

We report the single event effects and total ionizing dose test results for the ISL73846 2MHz double ended PWM controller with synchronous rectification.

DW-9 **Total Dose and Single-Event Effects Testing of the ISL75055 3A Source and Sink DDR Terminator/LDO with Buffered Reference**

M. Campanella[1], W. Newman[1], E. Thomson[1], C. Thomson[1], D. Wackley[1]
1. Renesas Electronics America, USA

We report the single event effects and total ionizing dose test results for the ISL75055 3A Source and Sink DDR Terminator/LDO with Buffered Reference.

DW-10 **Compendium of NASA Goddard Space Flight Center's Current Radiation Effects Test Results**

L. Ryder[1], K. Ryder[1], E. Wilcox[1], T. Carstens[1], S. Roffe[1], A. Wood[1], M. Campola[1], J. Osheroff[1], M. Joplin[1]
1. NASA Goddard Space Flight Center, USA

We present results and analysis investigating the effects of radiation on a variety of candidate spacecraft electronics to heavy ion- and proton-induced single-event effects (SEE), proton-induced displacement damage dose (DDD), and total ionizing dose (TID).

DW-11 **A Novel Multifunctional Radiation Shielding to Enable the use of COTS based Electronics in Space**

L. Sihver[1], Y. Barghouty[1]
1. Cosmic Shielding Corporation, USA

A lightweight hydrogen rich nano doped Multifunctional Shielding Polymer (MSP), commercially branded as Plasteel™, with exceptional shielding properties, and good mechanical and thermal characteristics will be presented.

DW-12 **Heavy Ion Characterization of F28377D-SEP Microcontroller**

A. Dwadasi[1], M. Pate[2], R. Rodriguez-Davila[1], T. Nikoubin[1], R. Baumann[1]
1. University of Texas at Dallas, USA
2. Texas Instruments, USA

This work reports the SEL, SEU and SEFI test results obtained from Heavy-Ion testing of TI F28377D-SEP Microcontroller. This dual-core microcontroller is designed for real-time closed-loop control in power and motor-drive applications with dedicated peripherals.

DW-13 **Radiation Evaluation of the TPS7H1301-SP 3V to 6.3V Input, 400mA, -6V to -0.6V Radiation-Hardened Switched Capacitor Voltage Inverter with Integrated Low Dropout Regulator**

A. Marinelarena[1], T. Lew[1], M. Trevino[1]
1. Texas Instruments, USA

Single Events Effects and Total Ionizing Dose results for the TPS7H1301-SP 3V to 6.3V Input, Switched Capacitor Voltage Inverter is summarized, showing robust SEE performance up to LET_{EFF}=75MeV-cm^2/mg and excellent TID performance up to 100krad(Si).

DW-14 **Neutron Irradiation of BJT-Based Level Translators and TVS Diodes for Fusion Reactor Systems**

K. Reed[1], N. Ericson[1], S. Frank[1], L. Clonts[1], P. Mulligan[1], F. Ivester[1], C. Harvey[1], H. Patel[1]
1. Oak Ridge National Laboratory, USA

Emerging fusion reactors require advanced instrumentation and control systems in locations subject to high neutron and gamma doses. This summary details the irradiation testing and results of level translator and protection circuitry for ITER subsystems.

DW-15 **Irradiation of Operational Amplifiers for Fusion Reactor Instrumentation and Control**

N. Ericson[1], K. Reed[1], S. Frank[1], L. Clonts[1], P. Mulligan[1], F. Ivester[1], C. Harvey[1], H. Patel[1]
1. Oak Ridge National Laboratory, USA

An electronics system for monitoring ITER vacuum/gas systems was prototyped without radiation-hardened components. In response to ITER's demanding radiation levels, this paper reports detailed testing of a precision amplifier, summarizing test design and performance trends.

DW-16 **Single Event Effects Susceptibilities of Select Commercial-Off-The Shelf Components for Space**

D. Lo[1], T. Tran[1]
1. Northrop Grumman Systems Corporation, USA

We report the results of single event effects (SEE) testing with heavy ions of COTS (commercial-off-the-shelf) electronic components considered for space missions.

DW-17 **Characterization of the sensitivity of three MMIC LNAs to Total Ionizing Dose**

J. Diot[1], M. Gaillardin[1], G. Assaillit[1], C. Delbos[1], D. Poujols[1]
1. CEA, France

High-performance RF components are being increasingly used in different applications. It is essential to characterize their sensitivity to ionizing radiation. This study aims to determine the susceptibility of three LNAs: CMD319C3, CMD264P3, and HMC8411LP2FE.

DW-18 **SEE Test Results of Microchip's Radiation Hardened Resettable Latch-up Current Limiter LX7714**

J. Heun[1], E. Colmet-Daage[1], R. Stevens[1], D. Johnson[1], O. Mansilla[1]
1. Microchip Technology, USA

Microchip has developed the radiation hardened LX7714 power switch to protect satellite power buses from destructive overcurrent events. This paper focuses on destructive Single Event Latch-up (SEL) and Single Event Transient (SET) test results.

DW-19 **Single Event Effects and Total Ionizing Dose Characterization of the Frontgrade Technologies UT88ETHPHY4P10G Four Port 10GBase-T Ethernet PHY**

M. Vonthun[1], A. Turnbull[1], V. Olariu[1], R. Dumitru[1], B. Baranski[1], G. Hoglund[1]
1. Frontgrade Technologies, USA

The UT88ETHPHY4P10G 10G Ethernet Phy was characterized for SEL and SEFI up to a LET of 67 MeV·cm^2/mg with heavy ions and characterized for total ionizing dose to 300 krad(Si).

DW-20 **Single Event Effects and Total Ionizing Dose Characterization of the Frontgrade Technologies UT8MRQRHXG QSPI MRAM Memory**

M. Vonthun[1], E. Fehrman[1], R. Dumitru[1], G. Hoglund[1], A. Turnbull[1], J. Benthem[1], S. Sapp[1]
1. Frontgrade Technologies, USA

The UT8MRQRHXG QSPI MRAM was characterized for SEL and SEFI up to a LET of 77.5 MeV·cm^2/mg with heavy ions and characterized for total ionizing dose to 300 krad(Si).

DW-21 **Radiation Testing of the FeRAM-version of the MSP430FR5994**

H. Quinn[1], M. Felix[2], W. Slater[1]
1. Air Force Research Laboratory, USA
2. Cosmiac, USA

The Texas Instruments MSP430FR5994 is a potential option for direct-to-digital computation for low-bandwidth sensors. The results are compared to a previous version of the component.

DW-22 **Heavy Ion and Proton Radiation Test Results for Micron DDR4 DRAM**

I. Troxel[1], M. Gruber[1], D. Christenson[1], P. Tokeshi[2], B. Mark[2]
1. Troxel Aerospace Industries, USA
2. Moog Broad Reach, USA

Heavy ion and proton DSEE and NDSEE characterization results are presented for testing of Micron DDR4 DRAM devices.

DW-23 **A Combined, Radiation-Electrical Stress Characterization of Power GaN HEMTs**

J. Van Burger[1], J. Oarethu[1], C. Pham[1], N. French[1], N. Leak[2], S. Defaz[2], J. Saldivar[2], F. Luo[2], M. Salato[3], R. Strittmatter[4], J. Likar[1], J. Kozak[1]
1. Johns Hopkins Applied Physics Lab, USA
2. Stony Brook University, USA
3. EPC Space, USA
4. EPC Corporation, USA

GaN HEMTs offer advantages for space power electronics because of increasing power density and TID resilience. Electrical and SEE stresses are now being combined to evaluate the impact on electrical parameter derating, and useful lifetime.

DW-24 **Angular and Energy Dependence of Heavy Ion Induced SEE in Commercial EPC eGaN Power Transistors**

P. Maloney[1], A. Billa[1], B. Bolton[1], S. Hankinson[1], H. Gingold[1], S. Shorina[1], D. Fleetwood[2], E. Zhang[1]
1. University of Central Florida, USA
2. Vanderbilt University, USA

This paper reports angular heavy-ion single-event effects in commercial EPC enhancement-mode GaN power HEMTs, including SELC and SEB thresholds, based primarily on Xe irradiation at 16 and 20 MeV, with supporting Ag and Cu data.

DW-25 **Analysis of Heavy-Ion-Induced Current Waveforms in Si and SiC 1200 V Power Devices**

S. Taniguchi[1], H. Nakamoto[1], J. Furuta[2], R. Nakajima[1], A. Matsumoto[1], S. Onoda[3], K. Kobayashi[1]

1. Kyoto Institute of Technology, Japan
2. Okayama Prefectural University, Japan
3. National Institutes for Quantum Science and Technology, Japan

We measured heavy-ion-induced current waveforms of 1200 V Si and SiC devices to investigate Single Event Burnout mechanisms. The study evaluates the impact of material properties and structural differences on the failure process.

DW-26 **Total Ionizing Dose and Single Event Effects Results of the VPT Components 2N7561, 2N7555 and 2N7556 Power MOSFETs**

P. Benedetto[1]

1. Arizona State University, USA

This paper shows the radiation results of the VPT Components RAD7234 die family of n-channel MOSFETs fabricated at LA Semiconductor, designed to be radiation-hardened to 100krad(Si) and SEE immune to Xe (15 MeV/n beam).

DW-27 **Total Ionizing Dose and Class P-Equivalent Reliability Testing of a Commercial-Quality, Plastic-Encapsulated Analog Digital Converter**

E. Auden[1], A. Wright[2], J. Bonsall[2], J. Teng[2], T. Rodriguez[2], N. Sepulveda-Ramos[2]

1. Los Alamos National Laboratory, USA
2. The Aerospace Corporation, USA

We present results for a commercial-quality, plastic-encapsulated microcircuit (PEM) analog digital converter (ADC) subjected to total ionizing dose (TID) testing and reliability screening commensurate with MIL-STD-38535 class P.

DW-28 **TID and Proton SEE Characterization of a COTS Current Sense Amplifier, ADC, and DC-DC Converter**

B. Torres-Kulik[1], M. Mahmud[1], D. Hiemstra[1]

1. MDA Space, Canada

The total ionizing dose and proton single event effects characterization of a commercial-off-the-shelf current sense amplifier, analog to digital converter, and DC-DC converter is summarized.

DW-29 **TID and SEE Evaluation of the MAX22507E Transceiver**

J. Cardenas Chavez[1], D. Hiemstra[2], A. Noguera Cundar[1], L. Chen[1]

1. University of Saskatchewan, Canada
2. MDA Space, Canada

This study evaluated the MAX22507E transceiver for TID and SEE using low-dose rate ^{60}Co radiation and high-energy protons. The transceiver showed TID tolerance up to 80 krad(Si), with functional failure observed due to SEE observed.

DW-30 **Guide to the 2025 IEEE Radiation Effects Data Workshop Record**

D. Hiemstra[1]

1. MDA Space, Canada

The 2025 Workshop Record has been reviewed and a table prepared to facilitate the search for radiation response data by part number, type or effect.

DW-31 **Single Event Upset Characterization of the Versal® AI Engines Using Proton Irradiation**

D. Hiemstra[1], N. Hu[1]
1. MDA Space, Canada

Proton induced SEU cross-section of the Versal XCVC1902 AI Engines is presented. Upset rates in the space radiation environment are estimated.

DW-32 **Neutrons and > 60 MeV Protons Evaluation of AMD 6nm VersalTM Series Gen 2 Multicore Scalar Processing System (PS)**

P. Maillard[1]
1. AMD, USA

This paper presents the neutrons and proton single-event responses of AMD's 6nm Versal™ AIE Edge Gen2 multicore scalar processing system (PS) using AMD's System Validation Tool (SVT) suite. SEU, SEFI, and SEL results are presented.

4:00 PM – 5:30 PM **RESG OPEN MEETING**

Level 3 - BALLROOM A

PUERTO RICO CONVENTION CENTER
Level 3 - BALLROOM A

8:30 AM **The Future of CERN - Markus BRUEGGER**
INVITED SPEAKER

SESSION G **HARDNESS ASSURANCE: PIECE PARTS TO SYSTEMS AND TESTING APPROACHES**

G-4 **Predicting the Location of Heavy-Ion Interactions within Analog Components**
9:30 AM
J. Carpenter[1], T. Peyton[1], J. Hales[2], T. Crane[2], D. McMorrow[2], M. McKinney[1], J. Lazenby[1], D. Loveless[1], A. Ildefonso[1]
1. Indiana University, USA
2. U.S. Naval Research Laboratory, USA

Distance-based hierarchical clustering links heavy-ion SETs to spatially encoded pulsed-laser libraries, enabling the prediction of interaction locations in a COTS operational amplifier. Topside SPA validates clustering confidence, enabling accurate spatial mapping of heavy-ion-sensitive nodes.

G-5 **Estimating SEU Cross-Sections in Single-Port and Two-Port SRAMs Using Data Retention Voltage Measurements**
9:45 AM
S. Tolson[1], X. Zhao[1], J. Kronenberg[1], N. Pieper[1], Y. Xiong[1], B. Bhuva[1]
1. Vanderbilt University, USA

SEU cross-sections of single-port and two-port SRAMs fabricated in a commercial 3-nm bulk FinFET technology node process are estimated using data retention voltage measurements, a simple measure of an SRAM cell's stability.

G-6 **FlipFlop architecture effect on GEO error rate for FinFET 3-nm node**
10:00 AM
G. Gasiot[1], S. El Hajji[1], T. Thery[1], V. Correas[1], V. Malherbe[1], Y. Xiong[2], N. Pieper[2], J. Kronenberg[2], J-L. Autran[3], B. Bhuva[2], D. Pandini[4], P. Roche[1]
1. STMicroelectronics, France
2. Vanderbilt University, USA
3. Institut de Physique de Rennes, France
4. STMicroelectronics, Italy

Once validated an industrial Monte Carlo modeling tool is used to explore the error rate response of several Flip Flop designs in 3-nm FinFETs to help designers in selecting the best ones for their needs.

POSTER PAPERS

PG-1 **Variability Analysis of TID-Induced Failure in a Complex Microcontroller**
I. Hudson[1], H. Hunnicutt[1], D. Loveless[1]
1. Indiana University, USA

Inter-device variability in TID-induced functional failure was observed across forty-six MSP430FR6989 microcontroller units. A combination of programmable bias and the internal VLO oscillator's baseline behavior is shown to be predictive of the failure dose.

PG-2 **Benchtop Emulation of System-Level Analog Single-Event Transients from Piece-Part Data**

M. McKinney[1], C. James[1], T. Peyton[1], H. Hunnicutt[1], D. Loveless[1]
1. Indiana University, USA

A board-level ASET emulation methodology is demonstrated by comparing heavy-ion–induced transients in a linear voltage regulator with emulated responses derived from measured piece-part SETs, enabling system verification with reduced radiation testing.

PG-3 **Electron Pulses Generated by Compact Laser-Plasma Accelerators as Surrogates for Heavy Ions in Single Event Effect Testing**

M. Hu[1], J. Trippe[1], D. Ball[1], A. Sternberg[1], B. Sierawski[1], M. Solt[2], J. Thieman[2], S. Schroeder[3], J. Van Tilborg[3], J. Matson[2], J. Warner[2], B. Dorney[2], R. Jacob[3], C. Berger[3], B. Greenwood[3], S. Barber[3], R. Reed[1], D. Fleetwood[1], S. Wolin[2], K. Nagamatsu[2], M. McLain[2]
1. Vanderbilt University, USA
2. Northrop Grumman, USA
3. Lawrence Berkeley National Laboratory, USA

Laser-plasma accelerated electron bunches are investigated as surrogates for heavy ion testing of single event effects in microelectronics. Experimental data and high-fidelity simulations show that microelectronic responses to electron bunches can mimic heavy ions.

PG-4 **Augmenting Pulsed-Laser Latchup Screening Process with SEL Historical Data Model**

J. Warner[1], S. Messenger[1], B. Song[1], J. Rodriguez[1]
1. Northrop Grumman, USA

Pulsed-laser screening was performed on commercial CMOS devices to estimate the latchup cross-section vs LET curve and historical heavy ion data is used to bound SEL risk.

10:15 AM – 10:45 AM
Level 3 FOYER and TERRACE

BREAK

SESSION H **Hardening by Design**

10:45 AM **SESSION INTRODUCTION**
Chair: Nathan Nowlin (Sandia National Laboratories)

H-1
10:50 AM **A Novel Radiation-Hardened-by-Design FPGA 10T FinFET Configuration Cell Using High-Resistance Feedback**

M. Reaz[1], N. Rezzak[1], V. Nguyen[1], J. McCollum[1], F. Hawley[1], E. Hamdy[1]
1. Microchip Technology, USA

A novel RHBD 10T FPGA configuration cell in 12-nm FinFETs using 1.8V devices and a high-resistance RC feedback demonstrates SEU immunity from terrestrial-to-GEO environments, with TCAD identifying gate-oxide charge collection causing exceptionally rare high-LET SEUs.

H-2
11:05 AM

Impact of Topology on TID Response of 4th-Generation SiGe HBT Current Mirrors

Z. Brumbach[1], M. Hosseinzadeh[1], Q. Parker[1], D. Sam[1], B. Ringel[1], C. Ellis[1], Y. Mensah[1], P. Harris[2], M. McCurdy[2], R. Reed[2], J. Cressler[1]

1. Georgia Institute of Technology, USA
2. Vanderbilt University, USA

TID effects on four distinct SiGe HBT current mirror topologies are analyzed. Simple and cascode current mirrors showed mild degradation, while Wilson and balanced-Wilson topologies did not. Circuit simulations were conducted to understand system-level impact.

H-3
11:20 AM

Comparing the SEE Response of Different RF Topological Design Choices Using Active RF Isolators

D. Sam[1], J. Caezza[1], J. Teng[2], B. Ringel[1], G. Tzintzarov[2], J. Cressler[1]

1. Georgia Institute of Technology, USA
2. The Aerospace Corporation, USA

A pulsed-laser study compares the SEE response of two RF isolator topologies. Results demonstrate a reduced transient magnitude and duration in one of the topologies, and circuit simulations are leveraged to pinpoint SEE-resilient design choices.

H-4
11:35 AM

Radiation-Tolerant Analog In-Memory FFT Using Commercial Off-The-Shelf 176-Layer 3D NAND Flash

V. Shastry[1], J. Park[1], S. Seo[2], S. Kim[2], S. Yi[1]

1. Texas A&M University, USA
2. University of Rhode Island, USA

Heavy-ion tolerant analog in-memory FFT computation is evaluated using commercial 176-layer TLC 3D NAND flash operated in SLC mode, where widened threshold voltage separation preserves FFT accuracy under heavy-ion exposure despite radiation-induced threshold voltage variability.

POSTER PAPERS

PH-1

Investigating Flux Dependent Fault Masking and Recoverability in a Mixed-Signal SoC via Spatial and Temporal Gating

A. Dwadasi[1], R. Rodriguez-Davila[1], M. Pate[2], T. Nikoubin[1], R. Baumann[1]

1. University of Texas at Dallas, USA
2. Texas Instruments, USA

Flux dependent fault masking in a TI F28377D-SEP microcontroller is investigated using a high-speed shutter and 3-D printed physical masks, showing how temporal and spatial gating can expose hidden unrecoverable faults during accelerated SEE testing.

PH-2

Evaluation of single-event upset effects on VGG neural networks under model lightweighting and algorithm-level hardening

N. Yingqiang[1], T. Ming[2], Y. Guofang[1], C. Yaqing[1], C. Jianjun[1], L. Deng[1], Y. Jiaofen[2], L. Bin[1]

1. National University of Defense Technology, China
2. Hunan University, China

This paper investigates SEU robustness of lightweight VGG networks using ReLU_max and L1-based algorithm-level hardening, evaluated via fault injection, heavy-ion, and laser experiments on sub-20 nm FinFET AI chips, revealing compression-dependent hardening effectiveness.

11:50 AM **CLOSING REMARKS**

RESG NEWS

The purposes of the Radiation Effects Committee (REC) of the IEEE Nuclear and Plasma Sciences Society are to advance the theory and application of radiation effects and its allied sciences, to disseminate information pertaining to those fields, and to maintain high scientific and technical standards among its members.

Kay Chesnut, RTX
Executive Chair

The Committee aids in promoting close cooperation and the exchange of technical information among its members. This goal is met by running conferences for the presentation and discussion of original contributions, assisting in the publication of technical papers on radiation effects in the *IEEE Transactions on Nuclear Science (TNS)*, coordinating development of radiation effects measurement definitions and standards within IEEE and other standards organizations, providing a sounding board for radiation effects specialists, providing for the continued professional development and needs of its members, and providing liaisons between IEEE and other technical organizations in the areas of radiation effects.

Each year, the REC provides a forum for the technical exchange of information by holding the Nuclear and Space Radiation Effects Conference (NSREC). NSREC is an international forum for presentation of research papers on radiation effects, including effects on electronic and photonic materials, devices, circuits, sensors, systems, semiconductor processing technology, and design techniques for producing radiation-tolerant (hardened) devices and integrated circuits. Papers presented at the NSREC are submitted for possible publication in the Spring issue of the *IEEE TNS*.

Heather Quinn,
Air Force Research Laboratory
Executive Vice-Chair

NSREC 2026 will be held in San Juan, PR, July 20-24, at the Puerto Rico Convention Center in San Juan Puerto Rico, with the adjoining Sheraton Puerto Rico Resort. Dr. Philippe Paillet, CEA, is the Conference Chair. The 2026 NSREC supporters are Southwest Research Institute, AMD, Renesas, TAU Systems, Northrop Grumman, and Aerospace Corporation. We appreciate our supporters for their significant commitment to the conference. The supporters' ongoing commitment to NSREC allows us to keep conference registration rates affordable. We welcome other organizations to consider supporting NSREC 2027 in Atlanta, GA.

Our upcoming NSREC chairs include Jonathan Pellish, IEEE, for 2027, Pascale Gouker, MIT Lincoln Laboratories, for 2028, and Brian Sierawski, Vanderbilt University, for 2029. Papers presented at the 2026 NSREC are eligible for publication in a Spring 2027 issue of the IEEE TNS. Authors must upload their papers prior to the conference for consideration for publication in the TNS Special Issue. Detailed instructions can be found at www.nsrec.com.

Keep visiting our web site for author information, paper submission details, exhibitor links, on-line registration, and the latest NSREC information.

Dan Fleetwood
Vice-Chair of Publications

All papers accepted for oral or poster presentation in the 2026 technical program will be eligible for publication in a special Spring 2027 issue of the *IEEE Transactions on Nuclear Science (TNS)*, based on separate submission of a complete paper. Each *IEEE TNS* submitted paper will be subject to the standard full peer review. All papers must be submitted through the IEEE Author Portal. While this is a different site than used for submissions in previous years, the process is similar. Instructions for submitting and reviewing papers can be found under the Publications tab at the Conference website ***www.nsrec.com.*** The deadline for submission of *TNS* papers is July 17, 2026. Data Workshop papers are published in a Workshop Record and are not candidates for publication in the *IEEE TNS.* The process for the Workshop Record is managed by the Workshop Chair.

The review process for papers submitted to the *TNS* is managed by a team of editors. To provide consistent review of papers, this editorial team manages the review process for all radiation effects papers submitted to the *TNS* throughout the year. The editorial team consists of a senior editor and associate editors who are technically knowledgeable in one or more specializations and are experienced in the publication process. If you would like to serve as a reviewer for the NSREC or RADECS special issues of the *TNS*, and/or for radiation effects papers submitted throughout the year, please contact one of the editors. The editors for the 2026 NSREC are:

Dan Fleetwood, Senior Editor, Vanderbilt University
Email: dan.fleetwood@vanderbilt.edu

Heather Quinn, Associate Editor, Air Force Research Laboratory
Email: heather.quinn.2@spaceforce.mil

Steven Moss, Associate Editor, The Aerospace Corporation, retired
Email: scmosshb@aol.com

Vincent Goiffon, Associate Editor, ISAE-SUPAERO
Email: vincent.goiffon@isae.fr

Philippe Paillet, Associate Editor, CEA
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Enxia Zhang, Associate Editor, University of Central Florida
Email: enxia.zhang@ucf.edu

RESG NEWS

ARE YOU A MEMBER OF IEEE?

Now is the time to join the Institute of Electrical and Electronics Engineers (IEEE) and the Nuclear Plasma Sciences Society (NPSS). Why? First of all, you'll become a member of the largest professional engineering society in the world. About 60% of NSREC attendees are IEEE members. The cost of membership in the IEEE depends on your country and your career phase. IEEE members receive access to a broad range of benefits, including a terrific insurance program, on-line access to IEEE publications and reduced rates at all IEEE-sponsored conferences, including, of course, NSREC and the Short Course!

NPSS membership is $35 annually. NPSS members receive a free subscription to NPSS News, and a free on-line electronic access via IEEE Xplore to the *IEEE Transactions on Nuclear Science* (*TNS*) and the NSREC Data Workshop Records. Members can search and view digital copies of the entire IEEE TNS paper archive from current issues to the first IEEE NSREC in 1964. NPSS members get to vote in our elections, including the election for Junior Member At-Large that is held at the annual open meeting during the conference.

Apply for membership at ***http://ieee-npss.org/why-join-npss-and-ieee/*** or visit the IEEE registration desk at the conference.

NSREC PUBLICATIONS

NSREC has two publications each year:

- ***IEEE Transactions on Nuclear Science.*** This IEEE journal is the official archive of research papers presented at NSREC. Papers presented at the conference undergo an additional submission and peer review before they are accepted for the 2026 special issue.
- ***IEEE Radiation Effects Data Workshop Record.*** Published each year in October, this IEEE proceedings has become the source for radiation test data on semiconductor components.

A complimentary copy of the 2026 *IEEE Radiation Effects Data Workshop Record* and the 2026 special NSREC issue of the *IEEE TNS* will be available for download to each NSREC technical session attendee if one has opted into inclusion on the attendee list.

RADIATION EFFECTS COMMITTEE ANNUAL OPEN MEETING

You are invited to attend the IEEE Radiation Effects Committee's Annual Open Meeting on Thursday, July 23, 4:00 pm – 5:30 pm. All conference attendees are encouraged to attend, including attendees that are not IEEE NPSS members. A welcome reception for new NPSS members will follow the open meeting.

THURSDAY, JULY 2 3 4:00 PM – 5:30 PM

During the open REC meeting we will discuss the current and future conferences. Nominations for the 2026 Junior Member-at-Large to the Radiation Effects Steering Group are accepted at the meeting. Voting instructions for IEEE NPSS members will be provided. Join IEEE NPSS and you can vote!

AWARDS

2025 OUTSTANDING PAPER AWARD

Gamma-Ray Induced Displacement Damage in Silicon Microvolumes: Single Defect Generation Rate and Random Telegraph Signal

V. Goiffon, C. Durnez, A. Jay, A. Jouni, V. Karchenkova, A. Antonsanti, V. Lalucaa, D. Lambert, T. Jarrin, A. Salih Alj, R. Monflier, N. Richard, P. Paillet, A. Hemeryck, D. McGrath, and C. Virmontois

2025 MERITORIOUS PAPER AWARDS (2)

Pulsed, Focused Electrons as a Surrogate Single-Event Effects Testing Technique

G. Tzintzarov, J. W. Teng, A. Kulkarni, A. W. Bushmaker, P. Musumeci, M. D. Looper, D. Daniel, R. Berry, S. Milton, L. D. Edmonds, and G. Allen

Ultra-Fast Recovery from TID-Induced Degradation in MOS Transistors via Electrical Rapid Annealing

A. I. Vidana, C. G. McKay, N. A. Dodds, D. R. Hughart, P. Oldiges, T. Wallace, J. V. D'Amico, J. Joffrion, K. R. Sapkota, R. N. Nowlin, and H. J. Barnaby

2025 OUTSTANDING STUDENT PAPER AWARD

Analysis of Optical and Electrical Single-Event Transients in Integrated Silicon Photonic Micro-Ring Modulators

B. L. Ringel, J. W. Teng, P. J. Francis, M. Hosseinzadeh, D. G. Sam, J. H. Shin, Z. R. Brumbach, C. R. Snyder, A. Ildefonso, A. Khachatrian, D. McMorrow, J. M. Hales, T. Crane, G. N. Tzintzarov, and J. D. Cressler

2025 OUTSTANDING DATA WORKSHOP PRESENTATION AWARDS

CHALICE: Calculator for Highly Accurate Laser-Induced Carrier Excitation

A. Ildefonso, J. M. Hales, T. Crane, and D. McMorrow

2026 RADIATION EFFECTS AWARDS

The winners of the 2026 Radiation Effects and 2026 Radiation Effects Early Achievement Awards will be announced Tuesday, July 21, at the conference opening. The purpose of the Radiation Effects 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 purpose of the Radiation Effects Early Achievement Award is to recognize an individual within the first ten years of beginning his or her career whose technical contributions and leadership have had a significant impact on the field of radiation effects.

2027 RADIATION EFFECTS AWARD

Nominations are currently being accepted for the 2027 IEEE Nuclear and Plasma Sciences Society (NPSS) Radiation Effects Award. The basis of the award is for individuals who have: (1) a substantial, long-term history of technical contributions that have had major impact on the radiation effects community. Examples include benchmark work that initiated major research and development activities or a major body of work that provided a solution to a widely recognized problem in radiation effects; and/or (2) a demonstrated long-term history of outstanding and innovative leadership contributions in support of the radiation effects community. Examples include initiation or development of innovative approaches for promoting cooperation and exchange of technical information or outstanding leadership in support of the professional development of the members of the radiation effects community.

Nominations are currently being accepted for the 2027 Radiation Effects Early Achievement Award. The basis of the award is for individuals whose technical contributions and leadership during the first ten years of the recipient's career that have had a major impact on the Radiation Effects Community. Examples include work that provides a solution to important technical problems in radiation effects or work that identifies significant new issues in the field. Other factors are cumulative research contributions over the first part of the career, internationally recognized leadership, and mentorship. It is the intent of the RESG to give special consideration for this award to members of the community who are IEEE/NPSS members.

Monetary awards and plaques will be presented at the NSREC in Atlanta, GA, in July 2027. Nomination forms are available electronically in PDF Format or in Microsoft Word format at ***http://ieee-npss.org/technical-committees/radiationeffects/***.
Forms should be sent to Justin Likar, Member-at-Large, JHUAPL at ***Justin.Likar@jhuapl.edu***

CONFERENCE INFORMATION

CONFERENCE LOCATION

The **Puerto Rico Convention Center** is the location for NSREC 2026. Located in San Juan, Puerto Rico's capital city, it is just steps from a rich array of cultural attractions, historic treasures and architectural masterpieces, some of which date back centuries to when the city was a Spanish military stronghold.

Puerto Rico is the smallest island in the Greater Antilles, nestled in the Caribbean, just east of the Dominican Republic and west of the Virgin Islands. Known for its stunning beaches, vibrant culture, and rich history, Puerto Rico's location makes it a perfect destination with easy access from the mainland U.S. As a U.S. territory, American citizens do not need a passport and the official currency is the U.S. dollar.

Photo Courtesy of Puerto Rico Convention Center

LUNCHES, AND BREAKS Puerto Rico Convention Center

The 2026 IEEE NSREC will provide refreshments at breaks and lunches during the NSREC Short Course and Technical Sessions. Additionally, lunch will be included on Monday for the Short Course attendees. These meals and refreshments are for ***registered conference attendees only***. Please see the schedule for times and locations.

The exhibitors will host lunches Tuesday to Thursday, at Level 1 of the Puerto Rico Convention Center in Exhibition Hall A. These lunches are for ***registered conference attendees and Exhibit Booth Staffers only.***

ROOMS FOR SIDE MEETINGS Puerto Rico Convention Center

A few "side meeting rooms" are available for use by any registered conference attendee at the Puerto Rico Conference Center on a first-come, first-served basis. *NSREC encourages side meetings to be scheduled at times other than during technical sessions.* Send an e-mail to **j.teehan@ieee.org** to make side meeting reservations before the conference. To make a side meeting room reservation during the conference, see the NSREC Registration staff.

Notes: You must register for the conference before a side meeting room can be reserved! All audio/visual equipment and refreshments must be coordinated directly with the Hotel and are the responsibility of the attendee hosting the meeting.

For more details on how to request additional accommodations for the side meeting rooms, please contact **j.teehan@ieee.org**.

CONFERENCE INFORMATION

CONFERENCE HOTEL

The Sheraton Puerto Rico Resort & Casino is the NSREC 2026 Conference Hotel.

Please note that **the hotel is NOT a beach resort**, it is located right next to the PRCC.

The nearest public beach is Escambrón, reachable via the bus shuttle from the hotel (see "Getting around" section).

Sheraton Puerto Rico Resort & Casino,
200 Convention Blvd,
San Juan, PR, USA, 00907

Website: ***https://www.marriott.com/en-us/hotels/sjusi-sheraton-puerto-rico-resort-and-casino/overview/?scid=f2ae0541-1279-4f24-b197-a979c79310b0***

Photos Courtesy of Sheraton Puerto Rico Resort& Casino

HOTEL RESERVATIONS

We have a **NEGOTIATED GROUP RATE** at the **Sheraton Puerto Rico Resort & Casino.**
Room rates for a standard king or two queen are: **$245.00 USD single/double per night**

The preferred method to make reservations is by using the following weblinks:
https://book.passkey.com/event/51004057/owner/5772432/home?utm_campaign=299386963c

Room taxes currently at 11% + $2.50 will be added to all rates listed above.
In any case, enter your arrival and departure dates and follow the prompts.
Room reservations require a credit card as a guarantee. The cut-off for IEEE NSREC reservations is at 5:00 PM Eastern Daylight Time (EDT) ***on June 15, 2026***. Once the room block has been filled OR after the cut-off date (whichever comes first!), it is at the hotel's discretion as to whether they can book more rooms and at what room rate will be offered. **Early reservations are strongly suggested!**

Please be certain to notify the hotel of any change to your arrival or departure dates. When you check into the hotel, be sure to verify your departure date.

BREAKFASTS Sheraton Hotel

The 2026 IEEE NSREC will provide breakfast during the NSREC Short Course and Technical Sessions. These breakfasts are for ***registered conference attendees only***. Please see the schedule for times and locations.

GETTING AROUND

For nearby destinations, ***the Sheraton Puerto Rico Resort offers shuttle service*** to select locations, such as Old San Juan and Escambrón Beach, providing an easy and convenient option (ask hotel lobby for details).

Getting around San Juan is convenient and accessible, with several transportation options available throughout the city. ***Ride-sharing services such as Uber are widely used*** and provide a quick and reliable way to travel between key areas.

Taxis are readily available at hotels and popular destinations, while many of San Juan's top attractions are located within short driving distances of one another.

BUSINESS CENTER The Sheraton Puerto Rico Resort & Casino can accommodate those traveling on business, the self-service facility allows guests to fax, copy, and print documents and surf the web. Take advantage of black and white printers as well as reliable parcel service.

REGISTRATION AND TRAVEL

CONFERENCE REGISTRATION

John Teehan IEEE Registration Services

NSREC encourages Pre-Registration and offers a lower registration rate, "Early Registration," if the payment is received no later than Friday, June 26. After that date, the "Late Registration" rates apply.

Registrations can be submitted using the NSREC website link: www.nsrec.com. All Registrations must be completed online using the Registration Portal. Telephone registrations will not be accepted.

A Hospitality desk will be available for "On-site" Registration (Late Fees) next to the Registration Desk for those that may not have access to the online registration.

There are three acceptable forms of payment for registration and activity fees: 1) check made payable to "IEEE NSREC" in U.S. dollars and drawn on a U.S. bank, 2) Wire Transfer, or 3) MasterCard, VISA, Discover, and American Express credit card.

REGISTRATION LOCATION & TIMES IN San Juan

On Sunday July 19, the registration desk will be located at the Sheraton Hotel

Registration hours are:

Sunday, July 19	**5:00 PM – 7:00 PM**

For the rest of the week, the registration desk will be on Level 2 of the Puerto Rico Convention Center

Registration hours are:

Monday, July 20	**7:30 AM – 5:00 PM**
Tuesday, July 21	**7:30 AM – 5:00 PM**
Wednesday, July 22	**7:30 AM – 3:00 PM**
Thursday, July 23	**7:30 AM – 3:00 PM**
Friday, July 24	**7:30 AM – 10:00 AM**

CONFERENCE CANCELLATION POLICY

A $50 processing fee will be withheld from all refunds. Due to advance financial commitments, refunds of registration fees requested after June 30, 2026, cannot be guaranteed. Consideration of requests for refunds will be processed after the conference. To request a refund, you must notify NSREC at NSRECreg@ieee.org.

ON-SITE HOSPITALITY LOCATION & TIMES

An Event Hub will also provide ***ON-SITE*** assistance for ***REGISTRATION***, directions to the different events, and answer any questions. It will be located at the same places than the registration desk and follow the same schedule as above.

HOTEL RESERVATIONS

The preferred method to make reservations is by using the following weblinks:
Sheraton Puerto Rico Resort & Casino room rates for a standard king or two queen are:
NEGOTIATED GROUP RATE: $245.00 USD single/double per night

https://book.passkey.com/event/51004057/owner/5772432/home?utm_campaign=299386963c

Room taxes currently at 11% + $2.50 will be added to all rates listed above.
In any case, enter your arrival and departure dates and follow the prompts.
Room reservations require a credit card as a guarantee. The cut-off for IEEE NSREC reservations is at 5:00 PM Eastern Daylight Time (EDT) ***on June 15, 2026***. Once the room block has been filled OR after the cut-off date (whichever comes first!), it is at the hotel's discretion as to whether they can book more rooms and at what room rate will be offered. Early reservations are strongly suggested!

Please be certain to notify the hotel of any change to your arrival or departure dates. When you check into the hotel, be sure to verify your departure date.

REGISTRATION AND TRAVEL

AIRPORT AND TRANSPORTATION INFORMATION

The Luis Muñoz Marín International Airport (code: **SJU**) is located approximately 7 miles from the Sheraton Puerto Rico Resort & Casino. Traveling outside of normal commuting hours, the drive typically takes between 15-20 minutes.

TAXI SERVICE & RIDESHARE

Airport to Hotel Transportation:
There is no scheduled shuttle service between the Hotel and the Airport, but all commercial operators pick up on Level 1 of Terminal A or B. Major rental car companies are also present.

1. The only companies that offer ride-sharing service in Puerto Rico are UBER and Lyft. There are several designated areas for passenger pick-ups:
   - Terminal A: far end of luggage area
   - Terminals B and C: columns 16-19

2. Taxis pick up right outside the baggage area of either Terminal A or B, with regulated rates approved by the Puerto Rico Tourism Company.

From the airport, the fixed taxi rate to the *Convention Center area (**Zone 5**)* is **$17**. This includes the Sheraton Puerto Rico Resort & Casino.
There is also a flat airport fee of $3, and a $1 fee per luggage. A late night charge (10PM-6AM) may apply. The total fare is per trip, not per person.

*Accessible services are offered by most taxi companies during airport hours; however, to ensure an accessible taxi will be available for your use, please call the service of your choice for schedules, reservations, fees and information.

TIPS WHEN VISITING San Juan

Weather: The average daily temperature in Puerto Rico in July ranges from 81°F (27°C) to 88°F (31°C). The days are usually hot and humid, but with a slight breeze providing perfect conditions. Rain showers are common in the afternoons, they are often brief, with clear skies returning shortly after.

Driving: Be patient in traffic and mindful of pedestrians. Obey all traffic rules and be alert, whether driving or walking.

Restaurants & Tipping: Be aware that upscale restaurants might require reservations, especially during the busy dining hours of 6:00pm – 8:00pm. Most restaurants accept “casual” dress, although some are less “casual” than others. Standard tipping is 20 percent of the bill. Some restaurants add a “service charge” (gratuity) for groups of 6 or more, so check your bill to see if this has already been added

INDUSTRIAL EXHIBITS

Larisa Milic
Industrial Exhibits Chair
EMPC

The 2026 NSREC Industrial Exhibit Event will showcase leading global suppliers of radiation-hardened products, advanced materials, specialized services, and cutting-edge research and development. This premier event offers suppliers, engineers, and technical managers a unique opportunity to connect and collaborate on the challenges and solutions for radiation-tolerant electronics in space and terrestrial systems, military applications, and other demanding environments.

The 2026 NSREC Industrial Exhibit Event is being held at the **Puerto Rico Convention Center** in **Exhibition Hall A (Level 1)** on Tuesday, Wednesday, and Thursday. Conference breaks and lunches will be in the Exhibit Area on Tuesday, Wednesday, and Thursday for registered attendees, with an Exhibitor Raffle Drawing held on Thursday. NSREC badges must be worn at all times.

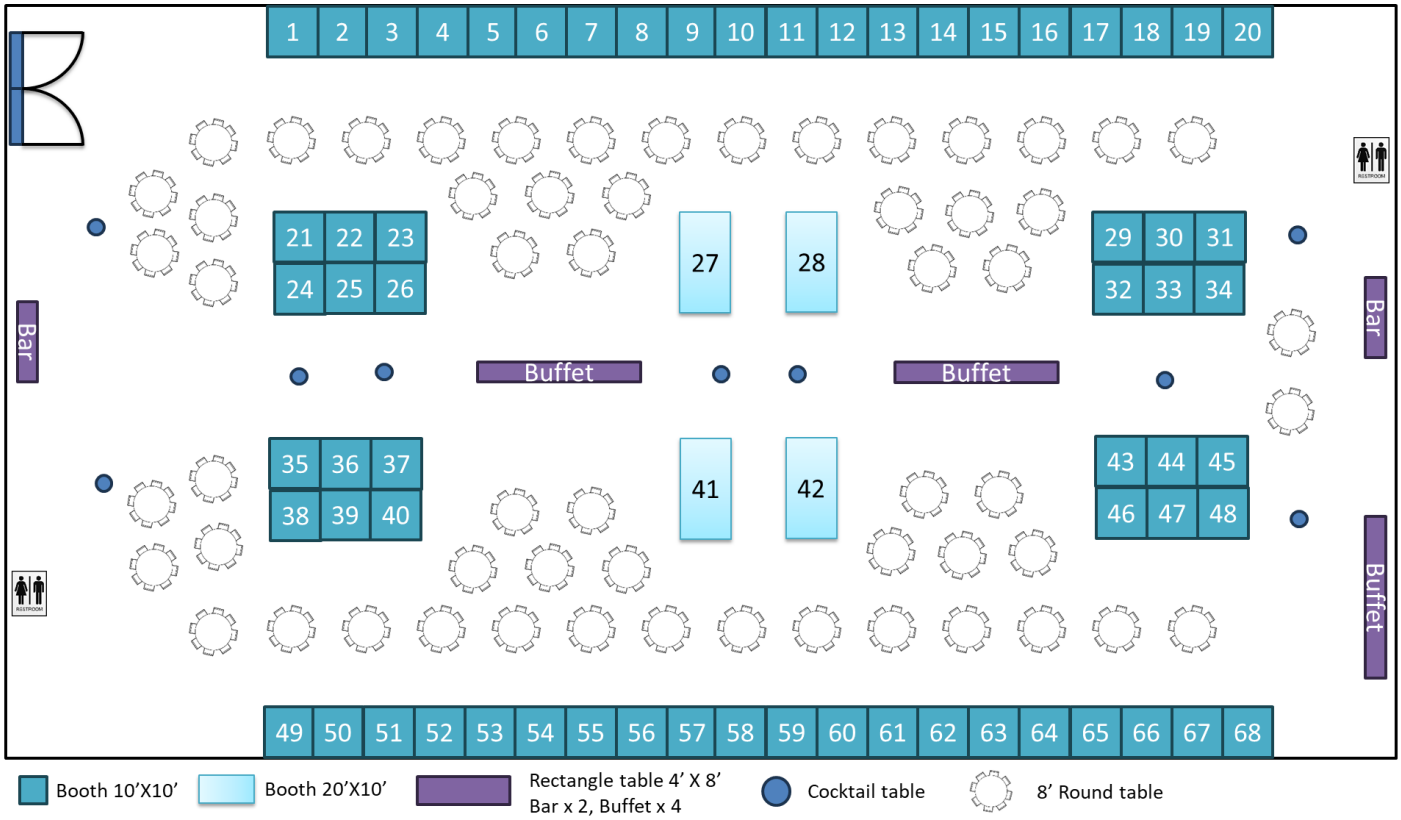
Tuesday evening, the exhibitors will host the Industrial Exhibits Reception featuring hors d'oeuvres in the Exhibit Area. The reception is open to all NSREC attendees and their guests.

NOTE: Children under 16 must be accompanied by an adult in the Exhibit Area.

For more information, contact:

- Larisa Milic
- Email: lmilic@empc.com

Interactive list of exhibitors: https://nsrec-26.expofp.com/



INDUSTRIAL EXHIBITS

Please check our website for a current listing of companies exhibiting at the 2026 NSREC event:
https://www.nsrec.com/industrial-exhibits-2026/

INDUSTRIAL EXHIBIT AGENDA
PUERTO RICO CONVENTION CENTER
LEVEL 1 - EXHIBIT HALL A

TUESDAY, JULY 21
BOOTHS OPEN
9:00AM – 4:30PM

MORNING BREAK
10:10AM – 10:40AM

AFTERNOON BREAK
3:05PM – 3:35PM

RECEPTION
5:45PM – 8:00PM

WEDNESDAY, JULY 22
BOOTHS OPEN
10:00AM – 2:00PM

MORNING BREAK
10:20AM – 10:50AM

LUNCH
12:05AM – 2:00PM

THURSDAY, JULY 23
BOOTHS OPEN
9:00AM – 2:00PM

MORNING BREAK
10:05AM – 10:35AM

LUNCH
11:35AM – 1:20PM

RAFFLE DRAWING
12:50 – 1:20PM

All of the exhibit events are for Registered Attendees

The Exhibit Reception is for Registered Attendees and Guests

INDUSTRIAL EXHIBITS

SOCIAL PROGRAM

Welcome to the Puerto Rico Convention Center and the Sheraton Puerto Rico Resort & Casino in San Juan, Puerto Rico.
It is my pleasure to welcome you to this vibrant and historic destination, where rich cultural heritage and modern innovation come together to create an exceptional setting for our conference. Located in the heart of the Convention District, our venue offers convenient access to Old San Juan, known for its centuries-old architecture, iconic forts, and lively atmosphere – and as the birthplace of the piña colada.
I encourage you to join us for the conference social events and take time to experience the culture, cuisine, and hospitality that make Puerto Rico so memorable – from historic streets to waterfront evenings and iconic venues.
It has been a privilege to serve as Local Arrangements Chair, and I hope you find your time here as enjoyable and rewarding as I have over the years.
¡Bienvenidos! and welcome to NSREC 2026.
– Melanie Berg
Space R3
Local Arrangements Chair

NSREC 2026 will take place in San Juan, Puerto Rico—a destination where vibrant culture, rich history, and natural beauty come together. From the rhythm of salsa and reggaetón to the gentle sound of ocean waves along sunlit shores, every moment here feels alive with energy and possibility. Whether you're drawn to music, cuisine, history, or breathtaking landscapes, Puerto Rico welcomes it all. Here, traditions as diverse as the people create an atmosphere where every voice and every experience have their place. It's a destination that celebrates individuality while bringing people together through culture, creativity, and connection. With its perfect blend of Caribbean warmth, color, and hospitality, Puerto Rico draws you in—and keeps you wanting more.

The Puerto Rico Convention Center, the site of NSREC 2026, is ideally located in the Convention District and directly across from the Sheraton Puerto Rico Resort & Casino. This central location offers convenient access to Old San Juan, beautiful beaches, and the island's top cultural attractions. Just a short drive from Luis Muñoz Marín International Airport, the area provides an accessible and comfortable base for your stay.

The conference committee has designed a social program that will highlight some of Puerto Rico's most memorable and historic sites. During the companion events, attendees are invited to attend an **Old San Juan Walking Tour**, a guided exploration of its cobblestone streets, forts, and vibrant local culture. This is a great way to experience the charm of Old San Juan and learn some of the history of the island. On Wednesday, we will visit **Casa BACARDÍ**, the world's largest premium rum distillery, where guests will learn about its history and enjoy their Legacy tour for a unique experience.

The midweek conference social will be held at the iconic **Caribe Hilton**, a beachfront landmark known for its historic significance and stunning ocean views. This evening will showcase the island's natural beauty and cuisine, offering a taste of authentic Puerto Rican flavors and traditions in a uniquely Caribbean setting. Guests will enjoy an evening that blends Puerto Rico's rich heritage with its modern energy, creating a memorable and uniquely Caribbean experience.

This is Puerto Rico—an island of rhythm, history, and unforgettable experiences. Please join us for NSREC 2026 and discover it for yourself.

When allowed, children must be accompanied by an adult during all tours and social events.

SOCIAL PROGRAM

SUNDAY, JULY 19
6:00 PM TO 9:00 PM
REGISTRATION
PUERTO RICO CONVENTION CENTER

For this Sunday event only, the conference registration desk will be located on **Level 2 of the Sheraton Hotel.** It will open **from 5:00 to 7:00 PM** to secure badges.

WELCOME RECEPTION
SHERATON HOTEL
BELLAVISTA TERRACE

After registration, **join us at the 4th floor of the Sheraton Hotel** for **complimentary refreshments** in the **Bellavista Terrace**. The reception is **open to Short Course attendees and registered guests** and is a great time to meet new friends and renew old acquaintances. NSREC attendees and guests must wear **NSREC badges for entrance to the Welcome Reception**.

For the rest of the week, the conference registration desk will be located on **Level 2 of the Puerto Rico Convention Center.** It will open **from 7:30 AM to 5:00 PM**.

TUESDAY JULY 21
12:00 PM TO 2:00 PM

IEEE YOUNG PROFESSIONALS LUNCHEON

SHERATON HOTEL

The annual IEEE Young Professionals reception will be held on Tuesday at the Sheraton Hotel. It will be a luncheon " meet and greet " with an experience panel. IEEE members who are Young Professionals (those who have graduated their first professional degree in the last 15 years; (https://yp.ieee.org) are especially invited to register (at no cost) for this unique event. This represents an excellent opportunity to step away from the main conference floor for a few hours to mingle with other early career attendees and a few veteran attendees as well.

Have a brief question you'd like to ask the group about career options, technical growth, workplace personalities, or something else? Come with your questions!

Note: Tickets are required so check the box for this reception when you register for the conference.

TUESDAY, JULY 21
5:45 PM TO 8:00 PM

INDUSTRIAL EXHIBITS RECEPTION

PUERTO RICO CONVENTION CENTER
Level 1 EXHIBIT HALL A

Join us for the 2026 Industrial Exhibits Reception hosted by your NSREC exhibitors. All NSREC attendees and their registered guests are invited for complimentary drinks and hors d'oeuvres.

Drinks will be served in the Exhibit Hall A at the Puerto Rico Convention Center. All registered attendees should be sure to visit the booths and participate in the raffles. NSREC attendees and guests must wear NSREC badges for entrance to the Exhibits and Reception.
A "special" LEGO promotion will be held, and each booth must be visited to gather all the pieces to build a one-of-a-kind Lego toy.

SOCIAL PROGRAM

WEDNESDAY, JULY 22
12:00 PM TO 2:00 PM

WOMEN IN ENGINEERING LUNCHEON

SHERATON HOTEL

Join us for an interesting Women In Engineering event, hosted by Farah El Mamouni. She has carved out a unique panel of outstanding women engineers to discuss their diverse career paths and share their tips and lesson learned with the rising young women engineers.

Limited Availability - Priority will be given to IEEE *WIE Members*.

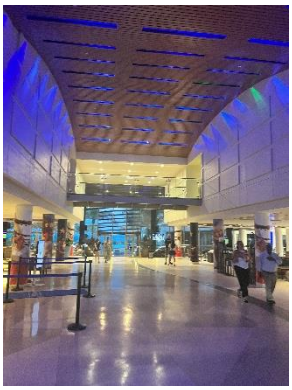
Note: Tickets are required so check the box for this reception when you register for the conference.

WEDNESDAY JULY 22
6:00 PM TO 10:00 PM

CONFERENCE SOCIAL

HILTON CARIBE HOTEL

Join your colleagues and friends for dinner, beverages, and entertainment at the **Caribe Hilton**. Approximately 1 mile from the Sheraton Puerto Rico Resort & Casino. While walking is possible, it is not recommended for safety reasons. Buses will be provided, starting at 5:45 PM.



The conference social evening will be held at the iconic Caribe Hilton, a historic beachfront resort in San Juan known for its beautiful oceanfront setting and relaxed Caribbean atmosphere. The evening will begin with a cocktail hour on the Caribe Hilton grounds, where attendees can enjoy tropical surroundings, ocean views, and gentle island breezes while connecting with colleagues in a relaxed setting.

Following the reception, guests will be seated for a buffet dinner, experiencing the flavors, hospitality, and vibrant ambiance that make Puerto Rico so memorable. As the birthplace of the original piña colada, the Caribe Hilton offers a unique blend of history and Caribbean charm, creating an unforgettable setting for this special evening.

Throughout the evening, guests will enjoy live Puerto Rican music, featuring the rhythms of salsa, Latin jazz, and traditional Boricua styles such as plena and bomba. Bomba, one of the island's oldest musical traditions, is characterized by its expressive drum-driven rhythms and dynamic interaction between dancer and musician, while plena is often referred to as the "people's music," known for its storytelling and lively, melodic style. These performances celebrate Puerto Rico's rich cultural heritage and invite attendees to take part in the experience—whether enjoying the music or joining in the dancing—creating a vibrant and engaging atmosphere for all.

SOCIAL PROGRAM

Dinner will be served outdoors on the Caribe Hilton's tropical grounds, set among palm trees and overlooking the ocean, weather permitting. As the evening progresses, guests may enjoy the warm island air, soft ambient lighting, and the gentle sound of waves nearby. Attendees are also invited to stroll to the beachfront area, where the shoreline provides a scenic and relaxing complement to the evening's program.

For those who are not ready for the evening to end, transportation will be provided by chartered buses to Old San Juan following the event, offering a lively and enjoyable ride as the evening continues. Guests may explore the vibrant streets, enjoy local music, and experience the energy and charm of this historic district after dark. Return transportation to the hotel will be the responsibility of each guest, with taxis and rideshare services readily available.

Tickets are not included in the conference registration so be sure to purchase them with your registration.

Timeline

- **5:45 pm:** **Bus transport to Caribe Hilton (5-10 minutes)**
- **6:00pm:** **Doors Open, Cocktail Hour**
- **7:00pm:** **Seating for buffet dinner**
- **8:30pm:** **Live performances**
- **10:00pm:** **Event End (Bus back to Sheraton/Charter bus to Old San Juan)**

Prices for the event:

Wednesday Social	Early	Late
Adult (18 yrs +)	$75.00	$95.00
Teen (13-17 yrs)	$55.00	$75.00
Child (4-12 yrs)	$45.00	$65.00
Infant (0-3 yrs)	$0.00	$0.00

COMPANION SOCIAL PROGRAM

TUESDAY, JULY 21
9:30 AM TO 12:15 PM

OLD SAN JUAN WALKING TOUR

MEET AT THE SHERATON HOTEL SAN JUAN FOYER (TOP OF THE ESCALATORS)

A guided walking tour of Old San Juan offers a unique opportunity to experience one of the oldest and most historically significant cities in the Americas. Founded in the early 16th century, Old San Juan is renowned for its distinctive blue cobblestone streets, vibrant colonial architecture, and rich cultural heritage.

The tour begins at Plaza Colón, a central gathering place that marks the gateway to the historic district. From there, attendees will make their way through the city to the Capitol of Puerto Rico, an impressive neoclassical building that reflects the island's political history and architectural elegance.

Continuing through Old San Juan, guests will visit Castillo San Felipe del Morro, one of the most iconic fortifications in the Caribbean.

Perched on a promontory overlooking the Atlantic Ocean, El Morro offers sweeping coastal views and a glimpse into the island's strategic importance during the Spanish colonial era.
The tour also includes a walk along Paseo de la Princesa, a scenic promenade that follows the old city walls and leads toward the waterfront. This picturesque walkway, lined with trees, historic structures, and public art, provides a relaxing contrast to the city's bustling streets.

In addition to these featured stops, Old San Juan is home to many other notable landmarks, including Castillo de San Cristóbal, Catedral de San Juan Bautista, and La Fortaleza, the official residence of the Governor. Throughout the experience, attendees will encounter lively plazas, local shops, and colorful buildings that reflect the enduring culture and daily life of Puerto Rico. This walking tour offers both a structured exploration of key sites and a broader introduction to the history, architecture, and atmosphere that make Old San Juan a truly memorable destination.

Timeline

- **9:15am** **Meet at the Sheraton Puerto Rico (Top of escalators)**
- **9:30am** **Bus depart from the Sheraton Puerto Rico Resort to Old San Juan**
- **10:00am** **Guided walking tour of Old San Juan**
- **12:00pm** **Bus depart from Old San Juan to Sheraton Puerto Rico Resort**
- **12:15pm** **Arrive at Sheraton Puerto Rico Resort**

Lunch is on your own. If you decide to stay at Old San Juan for lunch (or shopping, etc…), you can either Uber back, or take the free shuttle bus to the Sheraton Puerto Rico Resort (ask Hotel Lobby for details).

Price for Event: it is the same for every participant, except young children

Walking Tour	Early	Late
Participant (7 yrs +)	$ 25.00	$ 30.00
Infant (0-6 yrs)	$ 0.00	$ 0.00

COMPANION SOCIAL PROGRAM

WED. JULY 22
12:00 PM TO 3:00 PM

CASA BACARDÍ

MEET AT THE SHERATON HOTEL SAN JUAN FOYER (TOP OF THE ESCALATORS)

Discover the spirit of Puerto Rico with a visit to **Casa BACARDÍ**, the world's largest premium rum distillery and a true icon of Caribbean heritage.

Set against the scenic backdrop of San Juan Bay, this immersive experience offers a behind-the-scenes look at the history, craftsmanship, and culture that have defined the Bacardí legacy for over 160 years.

Without booking an experience/tour, you can grab a bite from our delicious food kiosk, do some shopping at the BACARDÍ Store, or just relax and enjoy the breathtaking views while sipping on a delicious and refreshing cocktail at the Pavilion.

Guests may enjoy the guided heritage tour exploring the Bacardí story and rum-making process. from a selection of curated experiences.

- This includes: welcome cocktail, short history tour + film, access to pavilion/bar

The **Legacy Tour** will be a well-rounded introduction to Casa BACARDÍ.

Whether you're drawn by the history, the flavors, or the stunning waterfront setting, Casa BACARDÍ offers a memorable and uniquely Puerto Rican experience.

Transportation included.

Please note that this tour is only for people of age 18 yrs +.

Younger folks ***(0-17 yrs) will NOT be allowed*** on the tour.

Timeline

- **12:15 pm** **Meet at the Sheraton Puerto Rico Resort (top of escalators)**
- **12:30 pm** **Bus depart from the Sheraton Puerto Rico Resort to Casa Bacardí**
- **1:00 pm** **Arrival at Casa Bacardí**
- **2:30 pm** **Bus depart Casa Bacardí**
- **3:00 pm** **Bus arrive Sheraton Puerto Rico Resort**

Prices for Event/Experience:

Legacy Tour	**1:15pm – 2:05pm**	**Early**	**Late**
	Adult (18 yrs +)	**$ 45.00/pers**	**$ 50.00/pers**
	Child (0-17 yrs)	**Not allowed**	**Not allowed**

Note: The available times shown in the table above have been selected to best align with our group schedule and transportation.

COMPANION SOCIAL PROGRAM

ACTIVITIES POLICIES

Participation: All participants in the NSREC activities must be conference attendees, registered guests of a conference attendee, registered exhibitors or registered guests of an exhibitor. Any children under 18 years of age must be accompanied by an adult at all times; no children will be allowed to attend any function without this adult supervision.

Cancellation: To encourage advance registration for conference social activities, NSREC will refund all activity fees for conference attendees and/or their companions who, for any reason, are unable to attend the conference as long as that notice is provided as follows. If your plans change after your Activities Registration form is submitted, simply request a refund by notifying John Teehan via e-mail (j.teehan@ ieee.org) by no later than June 30th.

Wheelchairs and Strollers: Both wheelchairs and strollers can be stored in the luggage compartment of the buses but please note that you must provide your own personnel to push these devices.

FITNESS ACTIVITIES

Olga Paillet received her PhD degree in Sports Physiology from the University of Health and Sports in Saint Petersburg, Russia in 1992. She also graduated from the University of Paris as a sport trainer in 2001, and from the Faculty of Medicine of the Paris University as a nutritionist in 2012. She has been practicing in Paris for the last 20 years. Alongside her professional activities, she is also a high-level professional and trained instructor in fitness and gymnastics, as well as a dance teacher and choreographer. She is a personal trainer and teaches Group Workout fitness.

Classes are 45-60 minutes. The workout consists of fitness cardio/strength circuit training accompanied by top-hits of popular music. The workouts have simple but efficient exercises and movements designed to boost cardiovascular health, strength, muscle tone, and endurance. Participants will receive one-on-one attention from Olga during class and can ask Olga questions before or after class. Suitable for all fitness levels. Join this fun group class workout!

Location: all will be located in **Room San Felipe (Sheraton Hotel - Level 2)**
Workout schedule:
Monday: 5:00 PM – 6:00 PM
Tuesday: 4:45 PM – 5:30 PM
Wednesday: 4:00 PM – 4:45 PM

Wear your workout clothes!

*Special this year! ***Possible morning Aquagym sessions*** at the Sheraton Hotel (Pool on the 4th floor): ***Ask Olga for details***!

LOCAL ACTIVITIES

GENERAL INFORMATION

DISTRITO T-MOBILE

Distrito T-Mobile is Puerto Rico's premier open-air entertainment district, located adjacent to the Puerto Rico Convention Center in San Juan. Spanning over 475,000 square feet, it offers a dynamic mix of dining, nightlife, and live entertainment in a vibrant, pedestrian-friendly setting.

Designed as a central gathering place for both visitors and locals, Distrito T-Mobile features a diverse collection of restaurants and bars, from casual eateries to upscale dining experiences. The district's expansive plaza hosts concerts, cultural events, and large-screen broadcasts, creating an energetic atmosphere day and night.

Guests can enjoy a range of attractions, including a state-of-the-art cinema, live music venues, and interactive experiences, all set against a modern Caribbean backdrop. Distrito T-Mobile serves as a convenient and engaging destination for conference attendees to network, unwind, and experience the vibrant spirit of San Juan.

ESCAMBRÓN BEACH

Escambrón Beach, located just minutes from the Convention District, is one of San Juan's most accessible and scenic coastal destinations. Known for its calm, protected waters and beautiful views, it offers an ideal setting for swimming, relaxing, or enjoying the natural beauty of the Caribbean. Surrounded by historic landmarks and walking paths, Escambrón provides a unique blend of shoreline tran quility and cultural significance.

CONDADO BEACH

Escape to Condado, San Juan's lively beach district just a short ride from the Convention Center. Known for its golden sands, turquoise waters, and vibrant dining scene, Condado is the perfect place to unwind after a day of meetings. From beachfront cafés to rooftop bars, it's where relaxation meets energy in a true Caribbean setting.

PASEO DE LA PRINCESA

Paseo de la Princesa is a scenic waterfront promenade in Old San Juan, located just a 10–15 minute drive from the Sheraton Puerto Rico Convention Center Hotel. Set along the historic city walls, the paseo leads to the iconic Raíces Fountain overlooking San Juan Bay.

Lined with trees, classic lampposts, and local artisan vendors, it's an ideal place for a leisurely stroll—especially in the late afternoon and evening when the ocean breeze and sunset views create a vibrant yet tranquil atmosphere. Visitors can enjoy street performances, local crafts, and sweeping waterfront views, making Paseo de la Princesa a perfect blend of history, culture, and coastal beauty.

LOCAL ACTIVITIES

LA FACTORÍA

La Factoría is one of San Juan's most iconic nightlife destinations, located in the heart of Old San Juan. Set within a historic colonial building, this renowned bar is known for its unique layout of multiple interconnected rooms, each offering a different atmosphere—from intimate cocktail lounges to lively dance spaces.

Celebrated for its expertly crafted drinks and vibrant energy, La Factoría regularly features live music, including salsa and Latin rhythms, alongside DJs and late-night dancing. Consistently ranked among the world's best bars, it offers an unforgettable blend of historic charm and contemporary nightlife in one of San Juan's most atmospheric settings.

BIOLUMINESCENT BAY (NIGHT TOUR)

Experience one of Puerto Rico's most unique natural wonders at a bioluminescent bay, where microscopic organisms illuminate the water with a glowing blue light when disturbed. Just a short trip from San Juan, guided evening kayak tours or electric boat tours allow visitors to glide through calm waters that shimmer with every movement, creating a truly unforgettable, almost magical experience.

One of the most popular locations is Laguna Grande in Fajardo, approximately 45–60 minutes from the Sheraton Puerto Rico Convention Center Hotel. Best viewed on darker nights, the bioluminescent effect is a rare phenomenon found in only a few places worldwide, making it a must-see highlight for those looking to experience the natural beauty of Puerto Rico.

MUSEO DE ARTE DE PUERTO RICO

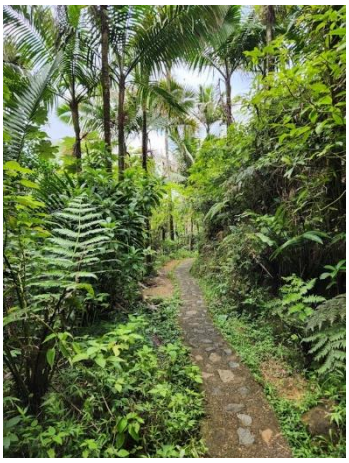
Museo de Arte de Puerto Rico is the island's premier art museum, located in the vibrant Santurce district just 10–15 minutes from the Sheraton Puerto Rico Convention Center Hotel. Housed in a beautifully restored historic building, the museum features an extensive collection of Puerto Rican art spanning from traditional works to contemporary exhibitions.

In addition to its galleries, the museum offers a serene sculpture garden and landscaped grounds, providing a peaceful setting to explore art and culture. Combining history, creativity, and modern design, Museo de Arte de Puerto Rico offers a rich cultural experience in one of San Juan's most dynamic neighborhoods.

LOCAL ACTIVITIES

EL YUNQUE Rainforest

Experience the natural beauty of Puerto Rico with a visit to **El Yunque National Forest**, the only tropical rainforest in the U.S. National Forest System.



This guided excursion offers a relaxed and accessible way to explore the lush landscape of El Yunque, featuring an easy walk through scenic trails surrounded by vibrant greenery, waterfalls, and native wildlife. Along the way, guests will learn about the rainforest's unique ecosystem and cultural significance.

LUQUILLO BEACH

Start a relaxing day at **Luquillo Beach**, one of Puerto Rico's most beloved coastal destinations. Here, you'll have time to unwind on the golden sands, take in the ocean views, and explore the nearby kiosks offering a variety of local food, drinks, and artisan goods.

This excursion is perfect for those looking to enjoy a balance of light activity and leisure in a beautiful tropical setting.

GETTING AROUND

Getting around San Juan is convenient and accessible, with several transportation options available throughout the city. ***Ride-sharing services such as Uber are widely used*** and provide a quick and reliable way to travel between key areas, including Old San Juan, Condado, and Santurce.

Taxis are readily available at hotels and popular destinations, while many of San Juan's top attractions are located within short driving distances of one another. In historic Old San Juan, narrow streets and limited parking make walking the best way to explore.

For nearby destinations, ***the Sheraton Puerto Rico Resort also offers shuttle service*** to select locations, such as Old San Juan and Escambrón Beach, providing an easy and convenient option when available.

2025 CONFERENCE COMMITTEE

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