

14th International Conference on Radiation Shielding and the 21st Topical Meeting of the Radiation Protection and Shielding Division (ICRS 14/RPSD 2022)

Seattle, Washington, USA
25 – 29 September 2022

ISBN: 978-1-7138-8630-3

Printed from e-media with permission by:

Curran Associates, Inc.
57 Morehouse Lane
Red Hook, NY 12571



Some format issues inherent in the e-media version may also appear in this print version.

Copyright© (2022) by American Nuclear Society
All rights reserved.

Printed with permission by Curran Associates, Inc. (2024)

For permission requests, please contact American Nuclear Society
at the address below.

American Nuclear Society
555 North Kensington Avenue
La Grange Park, Illinois 60526
USA

Phone: (800) 323-3044
(708) 352-6611
Fax: (708) 352-0499

www.ans.org

Additional copies of this publication are available from:

Curran Associates, Inc.
57 Morehouse Lane
Red Hook, NY 12571 USA
Phone: 845-758-0400
Fax: 845-758-2633
Email: curran@proceedings.com
Web: www.proceedings.com

Proceedings of the 14th International Conference on Radiation Shielding and 21st Topical Meeting of the Radiation Protection and Shielding Division (ICRS 14/RPSD 2022)

Seattle, WA, September 25–29, 2022

1 Monday, September 26

3 Opening Plenary

5 Fission Facilities and Fuel Cycle and Waste Management Facilities

- 6 Neutronic Coupling of Core and Out-of-Vessel Structures for Molten Salt Reactors and Evaluation of its Effects on Dose Rates Using the SCALE/CAAS Methodology—*Kyle Carberry (Georgia Tech), Bojan Petrovic (Georgia Tech)*
- 10 Design of Neutron Collimators for Ex-Vessel Neutron Instrumentation of the NUWARD(TM) Small Modular Reactor—*Rachel Martin (TechnicAtome), Alexis Maitre (TechnicAtome), Michel Boyard (TechnicAtome)*
- 13 Evaluation of Ex-Vessel Neutron Dose Fields and Neutron Dosimetry Gradient Chains at Krško NPP—*Tanja Goričanec (Jožef Stefan Institute), Luka Snoj (Jožef Stefan Institute), Marjan Kromar (Jožef Stefan Institute)*
- 17 Estimating the Amount of ⁹³Mo in Low and Intermediate Level Nuclear Waste—*K. Andgren (Swedish Nuclear Fuel and Waste Management Co.)*

19 Detection and Measurement: I

- 20 Preliminary Helium-3 Detector Response Capabilities in DRIFT—*M.T. Andrews (LANL), A.C. Madden (LANL), D.R. Mayo (LANL), S. Woldegiorgis (LANL)*
- 24 Avalanche-Confinement TEPCs Between Micro and Nanodosimetry—*Davide Bortot (Politecnico di Milano), Davide Mazzucconi (Politecnico di Milano), Andrea Pola (Politecnico di Milano), Stefano Agosteo (Politecnico di Milano), Valeria Conte (INFN - Legnaro National Laboratories)*
- 28 A New Operational Methodology for the Prediction of Total Beta-Gamma Activity Values for LL/IL Waste Produced at CERN—*Luca Bruno (CERN), Gerald Dumont (CERN), Patrycja Dyrz (CERN), Matteo Magistris (CERN), Nabil Mena (CERN), Maeva Rimlinger (CERN), Chris Theis (CERN)*
- 32 Compilation of Nuclear Data Experiments for Radiation Characterisation—*J.-Ch. Sublet (IAEA), Ian Gauld (ORNL), Mark R. Gilbert (UKAEA), Albert C. Kahler (Kahler Nuclear Data Services)*

37 Fusion Facilities

- 38 Radiation Shielding Estimations for the IFMIF-DONES Building Rooms During Activated High Flux Test Module Maintenance Operations—*Gediminas Stankunas (Lithuanian Energy Institute)*
- 41 Shielding Design of the Helium Cooled Pebble Bed Breeding Blanket for DEMO Fusion Reactor—*Iole Palermo (CIEMAT), Francisco A. Hernández (Karlsruhe Institute for Technology), Pavel Pereslavytsev (Karlsruhe Institute for Technology), David Rapisarda (CIEMAT), David Sosa (CIEMAT), Guangming Zhou (Karlsruhe Institute for Technology)*
- 45 Update of Nuclear Responses in the ITER Superconducting Magnets Using the E-lite 360° Analysis Model—*M. Fabbri (Fusion For Energy), R. Pampin (Fusion for Energy), F. Gauthier (ITER Organization), N. Mitchell (ITER Organization), G. Pedroche (TECF3IR), A. Cubi (Latesys)*
- 49 Advanced Shielding and Reflector Materials to Enhance the HT DCLL BB for the EU-DEMO Fusion Reactor—*Iole Palermo (CIEMAT), David Rapisarda (CIEMAT), David Sosa (CIEMAT)*

53 Fuel Cycle and Waste Management Facilities and Decommissioning

- 54 Overview of ORNL SCALE Shielding Analyses for Spent Nuclear Fuel Transportation and Storage Applications—*Georgeta Radulescu (ORNL), Cihangir Celik (ORNL), Peter Stefanovic (ORNL)*
- 58 Decommissioning-Oriented Design of Concrete Bunker in a Medical Cyclotron Facility: A Case Study—*Andrea Pola (Politecnico di Milano), Davide Mazzucconi (Politecnico di Milano), Davide Bortot (Politecnico di Milano), Alessandro Porta (Politecnico di Milano), Stefano Agosteo (Politecnico di Milano)*
- 62 Radiological Characterization Studies for the CNGS Dismantling—*Claudia Ahdida (CERN), Elzbieta Nowak (CERN), Christelle Saury (CERN), Heinz Vincke (CERN), Helmut Vincke (CERN)*
- 66 Activation Calculation Using Three-Dimensional Monte Carlo Code in a Pressurized Water Reactor—*Takuma Sugihara (Mitsubishi Heavy Industries), Tomohiro Ogata (Mitsubishi Heavy Industries), Kuniaki Konishi (Mitsubishi Heavy Industries), Shozo Komori (Kyushu Electric Power Co.), Yasuaki Inokuchi (Kyushu Electric Power Co.)*

71 Detection and Measurement: II

- 72 Boron-Lined Proportional Counter Sensitivity Determined by Simulation—*Stephane Bourganel (CEA), Laurence Pangault-Granier (CEA), Aly Elayeb (PHOTONIS Nuclear Instrumentation)*

- 76 Pulsed Radiation Monitoring Using Ionisation Chamber with Dedicated Integrated Circuit at CERN Antimatter-Facility—*Sarath Kundumattathil Mohanan (CERN), Hamza Boukabache (CERN), Vassili Cruchet (CERN), Daniel Perrin (CERN)*
- 80 Radon Detection on a Spanish Natural Gas Well Using Electrets and Lucas Cell—*A. Noverques (Politechnic Univ. Valencia), B. Juste (Politechnic Univ. Valencia), B. Mora (GD Energy Systems), A. Arribas (GD Energy Systems), G. Verdu (Politechnic Univ. Valencia)*
- 83 Optimization of a GaN Microstructured Thermal Neutron Detector Geometry Using MCNP—*Eric Giunta (Kansas State), Micheal Pfeifer (Kansas State), Bryce Davidson (Kansas State), Sanchit Sharma (Kansas State), Keith Huddleston (Kansas State), Nathanael Simerl (Kansas State), Douglas S. McGregor (Kansas State), Walter McNeil (Kansas State), Amir A. Bahadori (Kansas State)*
- 87 Measurement of Response Functions of Enriched Lithium-6 CLYC Scintillator for 1.2 MeV, 5.0 MeV and 14.8 MeV Neutrons—*So Kamada (National Maritime Research Institute), Masayuki Hagiwara (National Institutes for Quantum Science and Technology)*

91 Fusion Facilities, CAD, and Visualization

- 92 Effect of Shielding Homogenization on Neutronics of ITER EP Plugs—*Bor Kos (ORNL), Michael Messineo (PPPL), Tara Pandya (ORNL), Brian Linn (PPPL), Allan Basile (PPPL)*
- 96 Biological Shielding and Neutronics for the ST40 Tokamak—*J.O. Astbury (Tokamak Energy), C. L. Wilson (Tokamak Energy)*
- 99 Re-Evaluation of Shielding Ability and Induced Radioactivity of KSTAR Facility with Increasing Neutron Yields—*Uk-Jae Lee (Pohang Accelerator Laboratory), Nam-Suk Jung (Pohang Accelerator Laboratory), Hee-Seock Lee (Pohang Accelerator Laboratory), Hee-Soo Kim (National Fusion Research Institute)*
- 103 An IGES and OFF to MCNP Geometry Processor—*Kyle B. Grammer (ORNL)*
- 107 Virtual Reality Visualization of Dose Rate Fields for Dose Rate Planning and Optimization Using ADEPT-PSIM—*M. Smith (Kinectrics), D. Parvin (Cavendish Nuclear), M. Nguyen (Kinectrics), E. Heritage (Kinectrics), G. Failla (Silver Fir Software), A. Cooper (Silver Fir Software)*

111 Decommissioning

- 112 Study on Effects of Pressurizer Cutting Scenario of Pressurizer in Pressurized Water Reactor—*Hak Yun Lee (Chosun Univ.), Min Ho Lee (Chosun Univ.), Sun il Kim (Chosun Univ.), Jong Soon Song (Chosun Univ.)*
- 115 Dosimetry for Decommissioning of Nuclear Power Plants—*Reuven Rachamin (Helmholtz-Zentrum Dresden-Rossendorf), Joerg Konheiser (Helmholtz-Zentrum Dresden-Rossendorf), Astrid Barkleit (Helmholtz-Zentrum Dresden-Rossendorf), Marcus Seidl (PreussenElektra)*
- 119 Assessment of Waste Form Acceptance Criteria for Phosphate-Based Geopolymer Waste Form to Immobilize Radioactive Borate Waste—*Byoungkwan Kim (Pohang Univ. Science and Technology), Jaehyuk Kang (Pohang Univ. Science and Technology), Younglim Shin (Pohang Univ. Science and Technology), Wooyong Um (Pohang Univ. Science and Technology)*
- 121 Study of Activation in Fuel Assemblies for Decommissioning Tasks Optimization—*E. Jabaloyas (Univ. Politècnica de València), J. Ródenas (Univ. Politècnica de València), A. Querol (Florida Univ.), G. Verdu (Univ. Politècnica de València)*
- 125 Decommissioning of Steam Reformers -- From Radiological Characterization to a Decommissioning Concept—*Luc Schlömer (WTI), Henning Keller (WTI), Sven Tittelbach (WTI)*

129 Detection and Measurement: III

- 130 A New Active Fluorescence Dosimeter for Pulsed Photon Radiation—*Albrecht Leuschner (Deutsches Elektronen-Synchrotron), Sven Zander (Deutsches Elektronen-Synchrotron), Taiee Ted Liang (Deutsches Elektronen-Synchrotron)*
- 132 Comparison of Measurements and MCNP Calculations for Response of an Optical Fiber-Based Gamma Thermometer in the Ohio State University Research Reactor—*Anthony Birri (Ohio State), Joshua Jones (Ohio State), Thomas E. Blue (Ohio State)*
- 136 Threat Sources for Detection Algorithm Testing Developed with SCALE—*Douglas E. Peplow (ORNL), Daniel E. Archer (ORNL), James M. Ghawaly, Jr. (ORNL), Tenzing H.Y. Joshi (Berkeley Lab), Mark S. Bandstra (Berkeley Lab), Brian J. Quiter (Berkeley Lab)*
- 140 Detection Algorithm Virtual Testbed for Urban Search with SCALE—*Douglas E. Peplow (ORNL), Daniel E. Archer (ORNL), James M. Ghawaly, Jr. (ORNL), Tenzing H.Y. Joshi (Berkeley Lab), Mark S. Bandstra (Berkeley Lab), Brian J. Quiter (Berkeley Lab), Abigael C. Nachtsheim (LANL)*

145 CAD, Visualization, and General Shielding

- 146 VR System for Monte Carlo Simulation Codes Using Web Application Software with Commodity Devices—*Seiki Ohnishi (National Maritime Research Institute)*
- 149 SDR Calculations Involving Geometry Movement After Shutdown—*Chelsea A. D'Angelo (Univ. Wisconsin, Madison), Paul P.H. Wilson (Univ. Wisconsin, Madison)*
- 153 Current Status of Discussion for Japanese Shielding Material Standard for Facility Design—*Koichi Okuno (Hazama-Ando Technical Research Institute), Ken-ichi Kimura (Fujita Corp.), Mikihiro Nakata (MHI Nuclear Development Co.), Tomohiro Ogata (Mitsubishi Heavy Industries), Yukio Sakamoto (Atox Co.), Erina Matsuyama (Toshiba Energy Systems and Solutions), Masahiro Taniguchi (Taisei Corp.), Ken-ichi Tanaka (Institute of Applied Energy), Koji Oishi (Japan Environment Research Co.), Satoshi Takeo (Hitachi-GE Nuclear Energy), Satoshi Ishikawa (ITOCHU Techono-Solutions Corp.), Hidenori Kawano (Atox Co.), Masahiro Yoshida (Nuclear Safety Technology Center), Toshio Amano (ITOCHU Techono-Solutions Corp.), Kazuaki Kosako (Shimizu Corp.), Yoshihiro Hirao (National Maritime Research Institute), Toshinobu Maenaka (Takenaka Corp.)*
- 156 Effect of Photonuclear Reaction on Deep Penetration Problem for Build-Up Coefficient Calculation—*Seiki Ohnishi (National Maritime Research Institute), Fumiyo Nobuhara (Tokyo Nuclear Services Co.), Yoshihiro Hirao (National Maritime Research Institute)*
- 160 Impact of Photoneutron Spectrum Shape for Pb(y,xn) on Shielding Design—*Tran Kim Tuyet (SOKENDAI/KEK), Toshiya Sanami (SOKENDAI/KEK), Hirohito Yamazaki (SOKENDAI/KEK)*

165 Tuesday, September 27

167 Plenary 2

169 Fukushima and Machine Learning

- 170 Investigation and Analysis of the TEPCO's Fukushima Daiichi NPS Accident (March 2021)—*Masaya Yasui (Nuclear Regulatory Agency)*
- 174 Estimation of ¹³⁷Cs Activity Using Pinhole Gamma Camera at Unit 2 Operation Floor in Fukushima Daiichi Nuclear Power Station—*Katsumi Hayashi (Nuclear Regulation Authority), Hideo Hirayama (High Energy Accelerator Research Organization), Kohei Iwanaga (Nuclear Regulation Authority), Kenjiro Kondo (High Energy Accelerator Research Organization), Seishiro Suzuki (Nuclear Regulation Authority)*

- 178 Estimated Cs-137 Radioactivity Deposited in the Gap Between the Top and Middle Cover of the Shield Plug in Fukushima Daiichi Nuclear Power Station Unit 2—*Kohei Iwanaga (Nuclear Regulatory Agency), Hideo Hirayama (High Energy Accelerator Research Organization), Katsumi Hayashi (Nuclear Regulatory Agency), Kenjiro Kondo (Nuclear Regulatory Agency), Seishiro Suzuki (Nuclear Regulatory Agency), Zenko Yoshida (Nuclear Regulatory Agency)*
- 182 Radiation Environment Around the Contaminated Water Storage Tank Including Highly Concentrated $^{90}\text{Sr}/^{90}\text{Y}$ at Fukushima Daiichi Nuclear Power Station—*Hideo Hirayama (Nuclear Regulatory Agency), Kenjiro Kondo (Nuclear Regulatory Agency), Seishiro Suzuki (Nuclear Regulatory Agency), Shimpei Hamamoto (Nuclear Regulatory Agency), Kohei Iwanaga (Nuclear Regulatory Agency)*
- 186 Neutron Spectra Reconstruction with an Artificial Neural Network Trained with a Large Built Dataset—*M. Bouhadida (IRSN), M. Brovchenko (IRSN), T. Vinchon (IRSN), W. Monange (IRSN), F. Trompier (IRSN)*
- 191 Medical Facilities, FLASH Radiotherapy, Medical Physics, Health Physics, and Dosimetry: I**
- 192 Study on Optimum Thickness of Iron Shield for Medical Electron Linac of Energy is up to 25 MeV—*Koji Oishi (Japan Environment Research Co.), Kazuaki Kosako (Shimizu Corp.), Takashi Nakamura (Tohoku Univ., Emeritus)*
- 195 Influence of Differences in Model Parameters Observed in Europe and Japan, on the Effective Dose Predicted by the European Model for Inhabited Areas (ERMIN)—*Jun Hirouchi (Japan Atomic Energy Agency), Thomas Charnock (UK Health Security Agency)*
- 199 Assessment of Radiation Dose of Mobile Computed Tomography in Intensive Care Units—*Eunhye Kim (Korea Univ.), Hyemin Park (Korea Univ.), Jungmin Kim (Korea Univ.)*
- 203 Few-View CT Image Reconstruction via Least-Squares Problem: Minimizing the Backward Error With LSMB—*M. Chillarón (Univ. Politècnica de València), V. Vidal (Univ. Politècnica de València), G. Verdu (Univ. Politècnica de València)*
- 207 Operational Radiation Protection Challenges at MEDICIS, a CERN Facility for the Production of Non-Conventional Isotopes for Medical Research—*Fabio Pozzi (CERN), Elodie Aubert (CERN), Pierre Carbonez (CERN), Alexandre Dorsival (CERN), Charlotte Duchemin (CERN), Siria Medici (CERN), Thierry Stora (CERN), Heinz Vincke (CERN)*
- 211 High-Intensity Laser Facilities**
- 212 Radiation Protection at Laser-Driven Accelerator Facilities: The ELI Beamlines Case—*A. Cimmino (ELI Beamlines), R. Versaci (ELI Beamlines), V. Olšovcová (ELI Beamlines), D. Horváth (ELI Beamlines), B. Lefebvre (ELI Beamlines), V. Stránský (ELI Beamlines), R. Truneček (ELI Beamlines)*
- 216 Radiation Field Characterization and Shielding Assessment at Ultra-Intense Laser Facilities—*Anna Ferrari (Helmholtz-Zentrum Dresden-Rossendorf), Josefina Metzkes-Ng (Helmholtz-Zentrum Dresden-Rossendorf), Maria Molodtsova (Technische Univ. Dresden), Stephan Kraft (Helmholtz-Zentrum Dresden-Rossendorf), Thomas E. Cowan (Helmholtz-Zentrum Dresden-Rossendorf)*
- 220 Review of Radiation Protection Studies on the X-Ray Generated from Laser-Solid Interactions—*Rui Qiu (Tsinghua Univ.), Shuoyang Wei (Tsinghua Univ.), Honghu Song (Tsinghua Univ.), Hui Zhang (Tsinghua Univ.), Junli Li (Tsinghua Univ.)*
- 223 An Active Bremsstrahlung Spectrometer for Bremsstrahlung Photons Generated from Ultra-Short and Ultra-High Laser Facilities—*Honghu Song (Tsinghua Univ.), Rui Qiu (Tsinghua Univ.), Hui Zhang (Tsinghua Univ.), Zhen Wu (Tsinghua Univ.), Junli Li (Tsinghua Univ.)*
- 225 Medical Facilities, FLASH Radiotherapy, Medical Physics, Health Physics, and Dosimetry: II**
- 226 Novel Bremsstrahlung Converter Designs for Ultra High Dose Rate Radiotherapy Systems—*Andrew Rosenstrom (Georgia Tech), Mario Santana Leitner (SLAC), Sayed Rokni (SLAC), Shaheen Dewji (Georgia Tech), Billy W. Loo Jr. (Stanford Univ.)*
- 230 MLEM Neutron Spectra Unfolding for Radiotherapy Photon Beams Using Bonner Sphere Spectrometer: A Simulation Study.—*S. Oliver (Univ. Politècnica de València), S. Morató (Univ. Politècnica de València), B. Juste (Univ. Politècnica de València), R. Miró (Univ. Politècnica de València), G. Verdu (Univ. Politècnica de València), N. Tejedor (Hospital Universitari i Politècnic La Fe de València), J. Pérez-Calatayud (Unidad Mixta de Investigación en Radiofísica e Instrumentación Nuclear en Medicina)*
- 234 Monte Carlo Calculations in Different Tumor Phenotypes for Radiopharmaceutical Therapy Using Auger Electron Emitting Radionuclides—*Jorge Borbinha (Instituto Superior Técnico), Durval Costa (Fundação Champalimaud), Paulo Ferreira (Fundação Champalimaud), Pedro Vaz (Instituto Superior Técnico), Salvatore D. Maria (Instituto Superior Técnico)*

- 238 Development of Improved Dosimetry Standards for FLASH Radiotherapy: The UHPulse Project—*A. Cimmino (ELI Beamlines), A. Schüller (Physikalisch-Technische Bundesanstalt), S. Heinrich (Institut Curie), C. Fouillade (Institut Curie), A. Subiel (National Physical Laboratory), L. De Marzi (Institut Curie), F. Romano (Istituto Nazionale di Fisica Nucleare), P. Peier (Eidgenössisches Institut für Metrologie), M. Trachsel (Eidgenössisches Institut für Metrologie), C. Fleta (Centro Nacional de Microelectronica), R. Kranzer (Physikalisch-Technische Werkstaetten-Freiburg), M. Caresana (Politecnico di Milano), S. Salvador (Normandie Univ.), S. Busold (Varian Medical Systems), A. Schönfeld (Sun Nuclear Corp.), M. McEwen (National Research Council of Canada), F. Gomez (Univ. Santiago de Compostela), J. Šolc (Czech Metrology Institute), C. Bailat (Centre Hospitalier Univ. Vaudois), J. Jakubek (ADVACAM), J. Pawelke (Technische Univ. Dresden), M. Borghesi (Queen's Univ. Belfast), R-P. Kapsch (Physikalisch-Technische Bundesanstalt), A. Knyziak (Central Office of Measures), V. Olšovcová (ELI Beamlines), C. Kottler (Eidgenössisches Institut für Metrologie), D. Poppinga (Physikalisch-Technische Werkstaetten-Freiburg), I. Ambrožová (Nuclear Physics Institute of the CAS), C-S. Schmitzer (EBG MedAustron), S. Rossomme (IBA Dosimetry), M-C. Vozenin (Centre Hospitalier Univ. Vaudois)*
- 243 General Shielding**
- 244 Proposal of a New Structure for Duct Shielding in Radiation Therapy Room—*Sangrok Kim (Korea Institute of Radiological and Medical Sciences), Gisub Kim (Korea Institute of Radiological and Medical Sciences)*
- 248 On Publication of "A Handbook of Radiation Shielding" Supervised by the Shielding Research Committee of Atomic Energy Society of Japan—*Yoshihiro Hirao (National Maritime Research Institute), Yoshitomo Uwamino (Institute of Physical and Chemical Research)*
- 253 Radiation Shielding for the Transportation of Radioactive Lutetium-177—*C. Jacobs (South African Nuclear Energy Corp.), E.M. Chinaka (South African Nuclear Energy Corp.), L. Bedhesi (South African Nuclear Energy Corp.)*
- 257 MCNP Analysis for Dose Rate Measurements on Radioactive Waste Transportation Ship—*Kaori Yamagata (Mitsubishi Heavy Industries), Masashi Osaki (MHI NS Engineering Co.), Yu Sugimoto (MHI NS Engineering Co.)*
- 260 Shielding Calculation of the Low- and Intermediate-Level Radioactive Waste Drum from a Nuclear Reactor Using Monte Carlo Codes—*Wenxuan Wang (Harbin Turbine Co.), Luis Fernando Salas-Tapia (Harbin Engineering Univ.), Xiang Wang (Harbin Engineering Univ.), Tian Zhang (Harbin Engineering Univ.)*
- 265 Medical Facilities, FLASH Radiotherapy, Medical Physics, Health Physics, and Dosimetry: III**
- 266 The Characterization of Radiation Field near PET Medical Cyclotron—*Martin Schulc (Research Centre Rez), Marek Zmeskal (Research Centre Rez), Evzen Losa (Research Centre Rez), Zdenek Matej (Masaryk Univ.), Michal Kostal (Research Centre Rez), Simon Vadjak (UJV Rez), Roberto Capote (IAEA)*
- 270 Current Status of TRIPOLI-4® on Adult and Pediatric Computational Phantoms for Radiation Dosimetry Study—*Yi-Kang Lee (CEA), François-Xavier Hugot (CEA)*
- 274 Meta-Heuristic Optimization Methods for Isotope Production Target Design—*Cameron Salyer (Univ. Tennessee, Knoxville), Sandra Bogetic (Univ. Tennessee, Knoxville)*
- 278 Advancement of the Meta-Heuristic Optimization Algorithms for Boron Neutron Capture Therapy—*Christopher Busch (Univ. Tennessee, Knoxville), Sandra Bogetic (Univ. Tennessee, Knoxville), Chester Ramsey (Univ. Tennessee, Knoxville)*
- 282 Modeling Dynamic Voxelized Biological Sample Irradiation with Non-Uniform Neutron Beam—*Eric Giunta (Kansas State), Alan Cebula (Kansas State), Amir A. Bahadori (Kansas State)*
- 287 Wednesday, September 28**
- 289 Plenary 3**
- 291 Space Applications and Activation**
- 292 The Sensitivity of Three Terrestrial Bacteria to a Multi-Mission Radioisotope Thermoelectric Generator—*Noel B. Nelson (ORNL), Michael B.R. Smith (ORNL), Lawrence H. Heilbronn (Univ. Tennessee, Knoxville), Harrison L. Line (Univ. Tennessee, Knoxville), Douglas E. Peplow (ORNL), Mathew W. Swinney (ORNL)*
- 296 The Lunar Neutron Environment Behind Regolith Shielding—*Lawrence Heilbronn (Univ. Tennessee, Knoxville)*
- 301 RayActive : A New CAD Based Neutron Induced Activation Analysis Methodology—*Nicolas Dray (Trad - Tests & Radiations), Eric Suraud (Laboratoire de Physique Théorique de Toulouse), Cédric Dossat (Trad - Tests & Radiations), Nathalie Chatry (Trad - Tests & Radiations)*
- 305 Activation of Cooling Water at the European XFEL Beam Dumps—*Michael Schmitz (DESY), Taiee Ted Liang (DESY)*

307 Nuclear Data, Uncertainty Quantification, and ICSBEP Benchmarks

- 308 Multifaceted Coded Nuclear Data Libraries Assemblage, Verification and Validation: TENDL-2021—*J-Ch. Sublet (IAEA), Arjan Koning (IAEA), Dimitri Rochman (Paul Scherrer Institut), Mark R. Gilbert (UKAEA), Albert C. Kahler (Kahler Nuclear Data Services), Cedric Jouanne (CEA), Jaakko Leppanen (VTT Technical Research Centre of Finland), Steven C. van der Marck (NRG), Paul Romano (ANL)*
- 312 Using the MCNP6 Perturbation Capability for Source Nuclide Density Sensitivities—*Jeffrey A. Favorite (LANL)*
- 316 Sensitivity Analysis in Coupled Radiation Transport Simulations—*Christopher M. Perfetti (Univ. New Mexico), Brian Franke (Sandia), Ron Kensek (Sandia), Aaron Olson (Sandia)*
- 320 New Capabilities in SENSIMG, a Tool for Multigroup Discrete Ordinates Sensitivity Analysis—*Jeffrey A. Favorite (LANL), Alexander R. Clark (LANL)*
- 324 Availability of Shielding Benchmark Experiment Data in the ICSBEP Handbook—*John D. Bess (JFoster and Assoc.), Tatiana Ivanova (OECD NEA), Shuichi Tsuda (Japan Atomic Energy Agency)*

329 Accelerator Activation

- 330 The AARE Package Building on CINDER2008 for Radionuclide Inventory Assessments of Accelerator Environments—*Franz X. Gallmeier (ORNL), Erik B. Iverson (ORNL), Wei Lu (ORNL), Irina I. Popova (ORNL), Igor Remec (ORNL), Bradley J. Micklich (ANL), Thomas M. Miller (ORNL), Michael J. Mocko (LANL), Charles Kelsey (LANL), Tucker C. McClanahan (ORNL), Michael Wohlmuther (European Spallation Source)*
- 334 Comparison of CINDER90 and CINDER2008 for Second Target Station Target Activation—*Tucker C. McClanahan (ORNL), Igor Remec (ORNL)*
- 338 Design of a Neutron Beamline Shield Plug and Residual Dose Rate Analysis at Second Target Station—*Kumar Mohindroo (ORNL), Thomas Miller (ORNL)*
- 342 Activation Analysis in Preparation for a Tungsten Irradiation Experiment at LANSCE—*Kristel Ghoos (ORNL), Tucker McClanahan (ORNL), Lukas Zavorka (ORNL), Igor Remec (ORNL)*

- 346 Estimation of Gas Bremsstrahlung from 3-GeV Synchrotron Rings Based on the Residual Gas Compositions—*Akihiro Takeuchi (National Institutes for Quantum Science and Technology), Masayuki Hagiwara (National Institutes for Quantum Science and Technology), Hiroki Matsuda (National Institutes for Quantum Science and Technology), Toshiro Itoga (Japan Synchrotron Radiation Research Institute), Hiroyuki Konishi (National Institutes for Quantum Science and Technology)*

349 Experimental Validation and SINBAD and ICSBEP Benchmarks: I

- 350 NEA Technical Review Activity of Integral Experimental Data for Shielding Benchmark Calculations—*Tatiana Ivanova (OECD/NEA), Robert E. Grove (ORNL), John D. Bess (JFoster & Assoc.), Pedro Ortego (SEA), Ivo Kodeli (UKAEA), Shuichi Tsuda (Japan Atomic Energy Agency), Timothy E. Valentine (ORNL)*
- 354 The Task Force to Reinvigorate SINBAD—*Thomas M. Miller (ORNL), Oliver Buss (Nuclear Energy Agency), Michael Fleming (Nuclear Energy Agency)*
- 358 Bulk and Maze Shielding Experiments with 24-GeV/c Protons at CERN/CHARM—*Noriaki Nakao (Shimizu Corp.), Toshiya Sanami (High Energy Accelerator Research Org.), Tsuyoshi Kajimoto (Hiroshima Univ.)*
- 362 Preliminary Comparison of the TRIPOLI-4® and DIANE Monte Carlo Codes on the Barber and George Photonuclear Benchmark—*Tran Kim Tuyet (Univ. Paris-Saclay), Alexis Jinaphanh (Univ. Paris-Saclay), Frederic Gerardin (CEA), Sebastien Lemaire (CEA), Andrea Zoia (Univ. Paris-Saclay)*
- 366 Benchmarks of Neutron and Proton Induced Nuclear Data Against Accelerator-Related Experiments in SINBAD—*Yurdunaz Celik (SCK CEN), Maureen Ciccarelli (SCK CEN), Omar Bouhassoun (SCK CEN), Gert Van den Eynde (SCK CEN)*
- ### 371 Accelerator Facilities: I
- 372 PENELOPE-Based Software for Dose Calculations Involving Photon and Electron Beams—*R.A. Schwarz (PNNL), M.K. Murphy (PNNL), M. Azuma (PNNL), J.V. Livingston (PNNL), R.J. McConn (PNNL), D.J. Sunderland (PNNL)*
- 375 Response of Neutron Rem Counters in the APSU Radiation Environment—*S. Chitra (ANL), B.J. Micklich (ANL)*
- 379 Dismantling and Clearance Approach for the Swiss Light Source (SLS)—*Roman Galeev (Paul Scherrer Institute), Nick Walter (Paul Scherrer Institute), Eike Hohmann (Paul Scherrer Institute), Sabine Mayer (Paul Scherrer Institute)*
- 383 Bulk Shielding Design of 4GSR Light Source in Korea—*Nam-Suk Jung (Pohang Accelerator Laboratory), Hee-Seock Lee (Pohang Accelerator Laboratory)*

387 Experimental Validation and SINBAD and ICSBEP Benchmarks: II

- 388 Consistency Among the Results of the ASPIS Iron88, PCA Replica and PCA Benchmark Results—Ivan A. Kodeli (UKAEA), Steven van der Marck (NRG)
- 393 Attila Benchmark Calculations Using the SINBAD Database—E. Heritage (Kinectrics), M. Smith (Kinectrics), G. Failla (Silver Fir Software), A. Cooper (Silver Fir Software)
- 398 Evaluation of the HCLL Experiment for SINBAD—Pedro Ortego (SEA)
- 402 Benchmarking of Stainless Steel Cube Neutron Leakage in Research Center Rez—Michal Kostal (Research Center Rez), Zdeněk Matěj (Masaryk Univ.), Martin Schulc (Research Center Rez), Evžen Losa (Research Center Rez), Jan Šimon (Research Center Rez), Evžen Novák (Research Center Rez), František Cvachovec (Masaryk Univ.), Václav Přenosil (Masaryk Univ.), Filip Mravec (Masaryk Univ.), Tomáš Czako (Research Center Rez), Vojtěch Rypar (Research Center Rez), Andrej Trkov (IAEA Nuclear Data Section), Roberto Capote (IAEA Nuclear Data Section)
- 406 Health Physics Research Reactor Criticality Accident Alarm System Benchmark Overview—Mathieu N. Dupont (ORNL)

411 Thursday, September 29

413 Plenary 4

415 Accelerator Facilities: II

- 416 Prompt Radiation Dose Analysis Within the European Spallation Source Connection Cell—Thomas M. Miller (European Spallation Source)
- 419 Design of Temporary Beam Stops at ESS—A. Chambon (Technical Univ. Denmark), L. Zanini (European Spallation Source)
- 423 Radiation Transport Calculations for the European Spallation Source Accelerator Environment—Douglas D. Di Julio (European Spallation Source), Mamad Eshraqi (European Spallation Source), Wolfgang Hees (European Spallation Source), Yvonne Hinrichsen (European Spallation Source), Esben Klinkby (European Spallation Source), Anton Lundmark (European Spallation Source), Gunter Muhrer (European Spallation Source), Daniel Noll (European Spallation Source)
- 427 Neutronics Calculations for the Common Shielding Project at ESS—V. Santoro (European Spallation Source), K.H. Andersen (ORNL), A. Khaplanov (European Spallation Source), R. Kolevator (Institute for Energy Technology), O. Gonzalez (ESS-BILBAO), F. Gruenauer (Physics Consulting), M. Magan (ESS-BILBAO), T. H. Randriamalala (Forschungszentrum Juelich)

- 431 Beamline Simulation for the NNBAR Experiment at the European Spallation Source—M. Holl (European Spallation Source), R. Kolevator (European Spallation Source Consultant), B. Meirose (Stockholm Univ.), D. Milstead (Stockholm Univ.), B. Rataj (European Spallation Source), V. Santoro (European Spallation Source), L. Zanini (European Spallation Source)

435 Deterministic Methods

- 436 Two-Group Flux Analysis of Neutrons Which Penetrate Metallic Walls -- Deterministic Predictions vs. MC Simulations—Eric V. Steinfelds (Western Kentucky Univ.), Keith Andrew (Western Kentucky Univ.)
- 440 MATXS Multigroup File Problem due to NJOY Unresolved Resonance Processing—Chikara Konno (Japan Atomic Energy Agency), Kenichi Tada (Japan Atomic Energy Agency), Saerom Kwon (National Institutes for Quantum Science and Technology)
- 444 Multigroup Boundary Projection Acceleration of Partially-Converged Nested Iterations Applied to Fixed-Source Sub-Critical Transport Problems—D. Sciannandrone (CEA), E. Masiello (CEA), D. Mancusi (CEA), S. Bourganel (CEA)
- 448 Domain Decomposition of the First Collision Source Method in the IDT Solver—Matteo Falabino (CEA), Daniele Sciannandrone (CEA), Emiliano Masiello (CEA), Jean-François Vidal (CEA)

453 Accelerator Facilities: III

- 454 Radiation Protection and the Design of the Shielding Envelope at the MINERVA Facility—Daniela Ene (SCK CEN), Yurdunaz Celik (SCK CEN), Adrian Fabich (SCK CEN), Alexey Stankovskiy (SCK CEN)
- 458 Radiation Field due to Beam Losses and Back Streaming in the Proton Beam Handling Room of the MINERVA Full Power Facility—Yurdunaz Celik (SCK CEN), Willem Leysen (SCK CEN), Daniela Ene (SCK CEN), Alexey Stankovskiy (SCK CEN), Gert Van den Eynde (SCK CEN)
- 462 Shielding Calculations with the Unstructured Mesh Model of the ORNL's Second Target Station—Lukas Zavorcka (ORNL), Igor Remec (ORNL)
- 466 Analysis of the Preliminary Bunker Shielding Design with a Mix of Populated and Unpopulated Neutron Beamlines at the Spallation Neutron Source Second Target Station—Thomas M. Miller (ORNL), Paul Mueller (ORNL), Kumar Mohindroo (ORNL), Igor Remec (ORNL)
- 470 Shielding Analyses for SNS Accelerator Power Upgrade—I. Popova (ORNL), F. X. Gallmeier (ORNL)

475 Hybrid and Monte Carlo Methods

- 476 Decay Dose Shielding Analysis with Hybrid Unstructured Mesh/Constructive Solid Geometry Monte Carlo Calculation and ADVANTG Acceleration—*Ahmad Ibrahim (ORNL), Tucker McClanahan (ORNL), Igor Remec (ORNL)*
- 480 Efficiency Comparison of Radiation Transport Variance Reduction Methods for Wide-Area Environmental Contamination Assay Applications—*E. Asano (Georgia Tech), S. Dewji (Georgia Tech)*
- 484 An Overview of the Capabilities and Recent Developments of the FLUKA Particle Transport Code—*F. Salvat-Pujol (European Org. for Nuclear Research), V. Vlachoudis (European Org. for Nuclear Research)*
- 488 Monte Carlo Delta Tracking with Next-Event Estimators—*Timothy P. Burke (LANL)*
- 490 Improved Heavy Ion Inelastic Reaction Simulation of PHITS by JQMD2.1—*Tatsuhiko Ogawa (Japan Atomic Energy Agency), Shintaro Hashimoto (Japan Atomic Energy Agency), Tatsuhiko Sato (Japan Atomic Energy Agency), Koji Niita (Research Org. for Information Science and Technology)*

495 Accelerator Facilities: IV

- 496 LHC 2021 Pilot Beam Preparation: FLUKA Monte Carlo Simulations and Operational Radiation Protection Aspects—*Davide Bozzato (Karlsruher Institut für Technologie), Robert Froeschl (CERN)*
- 500 Monte Carlo Study of an Electron-Based Neutron Source for Bragg Edge Imaging—*Mahdi Bakhtiari (Pohang Univ. Science and Technology), Nam-Suk Jung (Pohang Accelerator Laboratory), Wooyong Um (Pohang Univ. Science and Technology), Hee-Seock Lee (Pohang Univ. Science and Technology)*
- 504 Radiation Shielding Analysis for the PIP-II Linac at Fermilab—*Igor Rakhno (Fermi Nat'l Accelerator Laboratory), Nikolai Mokhov (Fermi Nat'l Accelerator Laboratory), Igor Tropin (Fermi Nat'l Accelerator Laboratory), Sergei Striganov (Fermi Nat'l Accelerator Laboratory), Yury Eidelman (RadiaSoft)*
- 508 Optimization Studies for the Long-Baseline Neutrino Facility at Fermilab—*Igor Rakhno (Fermi Nat'l Accelerator Laboratory), Nikolai Mokhov (Fermi Nat'l Accelerator Laboratory), Igor Tropin (Fermi Nat'l Accelerator Laboratory), Sergei Striganov (Fermi Nat'l Accelerator Laboratory)*

513 Monte Carlo Methods

- 514 Coupling Fixed-Sources Criticality and AMS Shielding Modes within TRIPOLI-4® Code—*Odile Petit (CEA), Yannick Penelieu (CEA)*
- 518 Methodology for Phase Space File Computational Generation for Monte Carlo Simulations at the Exit of a Medical Linear Accelerator—*S. Oliver (Univ. Politècnica de València), B. Juste (Univ. Politècnica de València), R. Miró (Univ. Politècnica de València), G. Verdu (Universitat Politècnica de València)*
- 521 Weight Values for MCNP Calculations Based on Recursive Monte-Carlo Method—*Pratibha Yadav (Helmholtz-Zentrum Dresden-Rossendorf), Reuven Rachamin (Helmholtz-Zentrum Dresden-Rossendorf), Jörg Konheiser (Helmholtz-Zentrum Dresden-Rossendorf)*
- 525 Development of Neutron Shielding Evaluation Technique in a Carbon Ion Therapy Facility Based on Parameterized Source Term: A Monte Carlo Study—*Bo-Wi Cheon (Yonsei Univ.), Wook-Geun Shin (Massachusetts General Hospital), Soo Min Lee (Yonsei Univ.), Hyoujun Park (Yonsei Univ.), Hyungjoo Choi (Yonsei Univ.), Saerom Sung (Yonsei Univ.), Seongmoon Jung (Seoul Nat'l Univ. Hospital), Chul Hee Min (Yonsei Univ.)*

529 Appendix: Workshops