# Table of Contents

## Plenary Talks

<table>
<thead>
<tr>
<th>PL-1:</th>
<th>Laser-Switched Photocathodes for Electron Accelerator Applications</th>
<th>1</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Patrick O' Shea (University of Maryland)</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>PL-2:</th>
<th>Vacuum Electronics Research Perspective at the U.S. Naval Research Laboratory</th>
<th>3</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Gerald M. Borsuk, Baruch Levush (U.S. Naval Research Laboratory)</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>PL-3:</th>
<th>Microwave Heating: the Search for the Killer-App Continues</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Robert F. Shiffmann (R. F. Shiffmann Associates, Inc.)</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>PL-4:</th>
<th>THz Applications</th>
<th>7</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Don Arnone (Teraview, UK)</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>PL-5:</th>
<th>The Evolution of Vacuum Electronics for UHF TV Broadcast</th>
<th>9</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Michael A. Boyle (L-3 Communications, Electron Devices Division)</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>PL-6:</th>
<th>Spectroscopic Systems and Vacuum Electronics in the Submillimeter</th>
<th>13</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Frank C. De Lucia (Ohio State University)</td>
<td></td>
</tr>
</tbody>
</table>

## Session 1: THz I, 220 GHz and Beyond

### Session Chair: Dr. William D. Palmer (US Army Research Office)

1.1: The Truth about Terahertz

- Carter Michael Armstrong (L-3 Communications Electron Devices)

1.2: Sub-Millimeter and THz Power Amplifier Development at Northrop Grumman

- Jack C. Tucek, Mark A. Basten, David A. Gallagher, Kenneth E. Kreischer (Northrop Grumman)

1.3: 220 GHz 50 W Sheet Beam Travelling Wave Tube Amplifier

- Mark Field, Robert Borwick, Vivek Mehrroti, Berinder Brar (Teledyne Scientific), Jinfeng Zhao, Young-Min Shin, Diana Gamzina, Alexander Spear, Anisullah Baig, Larry Barnett, Neville Luhmann (University of California, Davis), Takuji Kimura, John Atkinson, Thomas Grant (Communications and Power Industries), Yehuda Goren (Teledyne MEC Vacuum Electronics), Dean Pershing (Beam-Wave Research, Inc.)

1.4: Design of a High-Gain Wideband High-Power 220-GHz Multiple-beam Serpentine TWT

- Khanh Nguyen, Lars Ludeking, John Pasour, Dean Pershing, Edward Wright, David K. Abe, Baruch Levush (U.S. Naval Research Laboratory)

1.5: Development of Field Emission Cathodes, Electron Gun and a Slow Wave Structure for a Terahertz Traveling Wave Tube

- Nathaniel Paul Lockwood, Keith L. Cartwright, Donald A. Shifflet, Paul D. Ginselher (Air Force Research Laboratory), Christian Y. d'Aubiigny, Christopher K. Walker, Abraham Young (University of Arizona), Steven B. Fairchild, Benji Maruyama (Air Force Research Laboratory)

## Session 2: Gyrotrons I, Gyrotrons for Fusion

### Session Chair: Dr. Monica Blank (CPI)

2.1: Experiments with the European 2 MW Coaxial-Cavity Pre-Prototype Gyrotron for ITER

- Tomasz Rzesnicki, Bernhard Piosczyk, Stefan Kern, Stefan Illy, Jianbo Jin, Andrey Samarskov, Andreas Schlaich, Manfred Thumm (Karlsruhe Institute of Technology)

2.2: Design of Phase Correcting Mirror System for Coaxial-Cavity ITER Gyrotron

- Jianbo Jin, Jens Flamm, Stefan Kern, Tomasz Rzesnicki, Manfred Thumm (Karlsruhe Institute of Technology)
2.3: Reliability Test of the ITER 170GHz Gyrotron and Development of the Two-Frequency Gyrotron
Ken Kajiwara, Yasuhisa Oda, Atsushi Kasugai, Koji Takahashi, Keishi Sakamoto
(Japan Atomic Energy Agency)

2.4: Investigations on Parasitic Oscillations in Megawatt Gyrotrons
Andreas Martin Schlachter, Jens Flamm, Gerd Gantenbein, Stefan Kern (Karlsruhe Institute of Technology),
Georg Latsas (University of Athens),
Tomasz Rzesnicki, Andrey Samartsev, Manfred Thumm (Karlsruhe Institute of Technology),
Ioannis Tigelis (National and Kapodistrian University of Athens)

2.5: Design of Major Components for a 4 MW 170 GHz Coaxial-Cavity Gyrotron
Matthias Hermann Beringer, Stefan Illy, Jianbo Jin, Stefan Kern (Karlsruhe Institute of Technology),
Christophe Lievin (Thales Electron Devices), Manfred Thumm (Karlsruhe Institute of Technology)

Session 3: Klystrons I, MBKs and Sheet Beam
Session Chair: Dr. Khanh T. Nguyen (Beam-Wave Research Inc.)

3.1: Experimental Results from a High-Power Broadband 18-Beam Klystron
David K. Abe (U.S. Naval Research Laboratory),
Dean E. Pershing, Edward L. Wright, Khanh T. Nguyen (Beam-Wave Research, Inc.),
Franklin N. Wood (U.S. Naval Research Laboratory), Robert E. Myers (Beam-Wave Research, Inc.),
Edward L. Eisen (Communications and Power Industries, Inc.),
Baruch Levush (U.S. Naval Research Laboratory)

3.2: Development of Sheet Beam Electron Optics System for W-band Klystron
Cunjun Ruan, Shuzhong Wang, Jingxin Xie, Yong Wang (Chinese Academy of Sciences)

3.3: C-band Broadband Multi-Beam Klystron with Bandwidth of 8%
Yaogen Ding, Zhaohuan Zhang, Haibin Ding, Xiaolin Sun, Bin Shen (Chinese Academy of Sciences)

3.4: Sheet Beam Stick for Low-Voltage W-Band Extended Interaction Klystron (EIK)
John Pasour, Edward Wright, Khanh Nguyen, Adam Balkcum, Franklin Wood, John Atkinson,
Michael Cusick, Baruch Levush (U.S. Naval Research Laboratory)

3.5: Sheet Beam EIK Sensitivity to Multimoding and Circuit Imperfections
John Pasour (U.S. Naval Research Laboratory), Khanh Nguyen, Edward Wright (Beam Wave Research, Inc.)

Session 4: Space TWTs
Session Chair: Dr. James A. Dayton, Jr. (Teraphysics)

4.1: Navigation Traveling Wave Tube Amplifiers — Trade-off Aspects
Manuela Rapisarda, Enrico Colzi, Piero Angeletti, Marinella Aloisio (European Space Agency)

4.2: Performance and Reliability of Recent Production Space Linearized Traveling-Wave Tube Amplifiers
William L. Memminger, T. Keith Phelps, Jim Lingenfelter
(L-3 Communications Narda Microwave - West, Inc.)

4.3: Qualification of the 500W Ka Band TWT
Marc Lefèvre, Frédéric André, Jean-François Jarno, Pierre Lecuyer, Jean-Claude Racamier, Ernst Bosch,
Rudolf Christ, Thomas Monses, Helmut Rupp (Thales Microwave & Imaging Systems)

4.4: Ka-Band Satellite Uplink High-Power Helix TWTs:
Output Power Evolution at L-3 ETI
Chae Ki Chong, Jeff W. Forster, Dennis A. Layman, Richard J. Stolz, Xiaoling Zhai
(L-3 Communications, ETI, Inc.)

4.5: Recent Results on a X-band 70W Space Traveling Wave Tube
Xinaobao Su, Huiming Fan, Shijie Yu, Li Li, Liuping Liu, Shujun Zhang, Shike Zhao
(Chinese Academy of Sciences)

4.6: Supply Chain Sustainability - Rare Earth Materials
Peter C. Dent, Michael H. Walmer (Electron Energy Corporation)
Session 5: Modeling I

Session Chair: Dr. Alexander N. Vlasov (U.S. Naval Research Laboratory)

5.1: Validation of TESLA for Widely Varying Klystron Designs .......................... 59
Rasheda Begum, Adam J. Balkcum, Edward L. Eisen, Andy Shabazian, Bradford C. Stockwell (Communications & Power Industries, Inc.),
Igor A. Chernyavskiy (Science Applications International Corporation)

5.2: TESLA Modeling of After-Cavity Interaction in High-Efficiency Klystrons ............... 61
Igor A. Chernyavskiy (Science Applications International Corporation),
Alexander N. Vlasov, Baruch Levush (U.S. Naval Research Laboratory),
Edward Eisen, Rasheda Begum (Communications and Power Industries, Inc.),
Richard D. Kowalczyk, Mark F. Kirshner, Craig B. Wilsen (L-3 Communications Electron Devices)

5.3: A Large Signal Model of Extended Interactions Klystrons .................................. 63
David P. Chemin, Thomas M. Antonsen, Jr., Khauht T. Nguyen, Baruch Levush (U.S. Naval Research Laboratory)

5.4: Inductive Output Tube Code Development ...................................................... 65
Edward L. Wright, Khanh T. Nguyen (Beam Wave Research Inc.),
John J. Petillo, Igor A. Chernyavskiy, Christopher Kostas, John F. DeFord, Ben L. Held (Simulation Technology & Applied Research/AWR Corp.),
Lars Ludeking (ATK Mission Systems Group),
Alexander N. Vlasov, John A. Pasour (U.S. Naval Research Laboratory)

5.5: A New Complex Envelope ADI-FDTD Algorithm for 3D Simulation of Slow Wave Structures ................................................................. 67
Simon J. Cooke, Baruch Levush (U.S. Naval Research Laboratory),
Igor A. Chernyavskiy (Science Applications International Corporation),
Moti Botton (Racah Institute of Physics, Hebrew University),
Thomas M. Antonsen, Jr. (University of Maryland)

5.6: GPU Enhancement of FDTD-PIC Plasma-Wave Simulations ................................. 69
Andrew J. Woods, Lars D. Ludeking (Alliant Techsystems)

Session 6: Cathodes I, Cathodes and Guns

Session Chair: Dr. Dan M. Goebel (Jet Propulsion Laboratory)

6.1: High Current Density — Long Life Cathodes for High Frequency Applications ........ 71
Lawrence R. Ives (Calabazas Creek Research, Inc.), Louis R. Falce (Consultant),
George Collins, David Marsden, George Miram (Calabazas Creek Research, Inc.),
Steve Schwartzkopf, Bryan Smith (Ron Witherspoon, Inc.)

6.2: Optimizing Osmium-Ruthenium Films to Inhibit Tungsten Interdiffusion .............. 73
Phillip Daniel Swartzentruber, Wen-Chung Li, Thomas John Balk (University of Kentucky),
Scott Roberts (Semicom Associates)

6.3: Low and Zero Compression Electron Guns ..................................................... 75
Michael Read, Lawrence Ives, Thuc Bui (Calabazas Creek Research, Inc.),
Hien Tran (North Carolina State University)

6.4: Photoemission Images of Cesium Coated p- and n-Type GaN ............................... 77
Jonathan L. Shaw, Kevin L. Jensen, Joan E. Yater (U.S. Naval Research Laboratory)

6.5: Electron Emission from Alkali-Coated Metal Photocathodes ............................. 79
Eric J. Montgomery, Donald W. Feldman, Patrick G. O'Shea, Peter Z. Pan, Noah Sennett (University of Maryland),
Kevin L. Jensen (U.S. Naval Research Laboratory)

6.6: Emission Imaging of a Single Crystal LaB6 Cathode Surface ................................ 81
Gerald G. Magera, Victor Katsap (Applied Physics Technologies, Inc.)
Session 7: TWTs I
Session Chair: Dr. David R. Whaley (L-3 Communications Electron Devices Division)

7.1: TWT and X-Ray Devices Based on Carbon Nano-Tubes ........................................... 83
Frédéric André, Pascal Ponard, Yoann Rozier, Christophe Bourat, Laurent Gangloff, Stéphane Xavier
(Thales Research and Technology)

7.2: Magnetic Interaction between Traveling Wave Tubes and Its Effect on Performance and Reliability ................................................................. 85
Chris L. Wheeland, Michael Boyle, Marc Barsanti, Richard True
(L-3 Communications Electron Devices Division)

7.3: 250W to 275W S-band Traveling Wave Tubes with Waveguide Output .......................... 87
Wolfgang Dür, Gerd Fischer, Ernst Bosch (Thales Electron Devices)

7.4: Development of a Compact and Lightweight S-Band Traveling-Wave Tube for Microwave Power Module ................................................................. 89
Hoyoung Song, Leslie Tekamp (University of Colorado at Colorado Springs),
Frank Francisco (Triton Services, Inc.),
Gil Won Choi, Jin Jo Choi (Kwangwoon University),
Seon Joo Kim, Sung Hoon Jang (Agency for Defense Development, South Korea)

7.5: Direct IF Sampling of TWT AM and PM Noise ............................................................ 91
K. Bryan Mitsdarffer, William F. Crespo (U.S. Naval Surface Warfare Center),
Lowell R. Hoover (Polyphase Microwave Inc.)

Session 8: Sheet Beams
Session Chair: Lawrence R. Ives (Calabazas Creek Research, Inc.)

8.1: Nonlinear Characteristics of Transverse Interaction in Sheet Beam Amplifiers ............. 93
Simon J. Cooke, Baruch Levush (U.S. Naval Research Laboratory),
Thomas M. Antonsen (University of Maryland)

8.2: On the Opportunity of Self-Oscillation in Sheet Beam Devices ................................ 95
Anatoly V. Galdetskii (FSUE Istok)

8.3: A High Aspect Ratio, High Current Density Sheet Beam Electron Gun .................... 97
John E. Atkinson, Deepika D. Gajaria, Thomas J. Grant, Takuji Kimura, Bradford C. Stockwell
(Communications and Power Industries, Inc.),
Mark Field (Teledyne Scientific),
Robert J. Borwick III, Berinder Brar (Teledyne Scientific),
John A. Pasour (U.S. Naval Research Laboratory)

8.4: Terahertz Sheet Beam Gun Analyzer ........................................................................ 99
(University of California, Davis)

8.5: Numerical Simulation and Experimental Test of a Sheet Beam Electron Gun .......... 101
Ding Zhao, Cunjian Ruan, Yong Wang, Wang Ruan (Chinese Academy of Sciences)

Poster Session I

P1-1: Study of a 200GHz Microklystron using a Small-scaled Pseudospark Electron Beam ................................................................. 103
Thomas G. Schuhmann (Duke University), Huabi Yin (University of Strathclyde),
Daohui Li (University of London), David Bowes, Adrian W. Cross (University of Strathclyde),
Jonathan Protz (Duke University), Xiaodong Chen (University of London),
Wenlong He, Alan D. R. Phelps, Kevin Ronald (University of Strathclyde),
Jun Zhou (University of London), Marc Verdiel, Matt Reynolds (Duke University)

P1-2: WITHDRAWN

P1-3: Cavity Design for an X-band Sheet Beam Klystron .................................................. 105
Wang Ruan, Yong Wang, Yaogeng Ding, Cunjian Ruan, Ding Zhao, Rui Zhang, Shuguang Wang,
Xinlei Wang (Chinese Academy of Sciences)
P1-22: Development of the Hollow Cathode Assembly for Ion and Hall Thruster at BVERI 
Zhiqiang Yu, Ji Li, Wensheng Shao (Beijing Vacuum Electronics Research Institute)

P1-23: Simulation of the Microwave Drying Material Process in the Pyramidal Chamber 
Igor Nikolaevich Kizhlay, Anatoly Konstantinovich Sintsyn
(The Belarusian State University of Computer Science and Radioelectronics)

P1-24: Diocotron Instability of a Relativistic Sheet Electron Beam 
Ying Han, Cunjun Ruan, Yong Wang, Xiaofeng Zhang (Chinese Academy of Sciences)

P1-25: CW Microwave Radiation Source from Micro-Hollow Cathode Plasma Discharge 
Michael C. Wong, Charles E. Hunt, Ivor Brodie, Brian H. Kolner (University of California, Davis)

P1-26: High Temperature Brazing Using nano-Particles 
Daniel Busbaher (Semicon Associates), Wen Liu, Dusan P. Sekulic (University of Kentucky)

P1-27: Theoretical Study of DC-biased Single-surface Multipactor 
for Pulsed Electron Beam Generation 
Seok-Gy Jeon, Jung-II Kim, Seong-Ta Han, Geun-Ju Kim (Korea Electrotechnology Research Institute)

P1-28: Metal Alloy Cathodes for Very High Emission-Density Applications 
Boris Cheslavovich Djuba, Anatoly Pavlovich Makarov, Alexander Andreovich Negirev, 
Stanislav Efimovich Rozhkov, Eugeny Mikhailovich Zemchikhin (FSUE Istok)

P1-29: Investigation of Large Field-Emission from a Composited Cold Cathode 
Yu Shen, Wei Lei, Xiaobing Zhang, Baoping Wang (Southeast University, Nanjing), 
Yuchun Wang, Xiaofeng Li, Zengqiang Bao (Sanle Co. Ltd.)

Wei Liu, Jinshu Wang, Zhiyuan Ren, Fan Yang, Meiling Zhou, Tieyong Zuo 
(University of Kentucky)

P1-31: Manufacturing for a Sheet Beam M-Type Cathode 
Yin Shengyi, Wang Yu, Wang Xinxin, Meng Mingfeng, Ruan Cunjun (Chinese Academy of Sciences)

P1-32: Thermal Analysis of the Gridded Electron-gun 
Liucong Yao, Xiaobao Su, Wei Lv (Chinese Academy of Sciences)

P1-33: Thermal Properties of Alumina Cathode Heater Potting Materials 
Lindsey Wolverton, James O. Tarter (Semicon Associates), 
Richard E. Eitel, Matthew Weisenberger, Carissa Dowden (University of Kentucky)

P1-34: Stability Improvements on Vogel Mounted Thermal Sources 

P1-35: Improvements in Miniature Wire-Strung Cathodes for High Frequency VEDs 
Bernard Kenneth Vancil (e beam, inc.), James E. Dayton, Carol Kory (Teraphysics Corporation), 
Victor Schmidt, John Lorr (e beam, inc.)

P1-36: Evaluation of Ba/BaO of Oxide Cathode Evaporation with Quadrupole Mass Spectrometer 
Mei Xiao, Xiaobing Zhang, Wei Lei, Peng xiang Wang (Southeast University, China)

P1-37: Calibrated Cathode Temperature Measurements Using an IR Pyrometer 
Wronald Scott Best, William G. Welsh, James E. Hall, Joseph M. Moseley (MPD, Inc.)

P1-38: Study on Real-time Measurement of Pressure inside Field Emission Displays 
Yunkang Cui (Southeast University, Nanjing Institute of Technology & Jiangsu Information Display Engineering Research Center), 
Xiaobing Zhang (Southeast University & Jiangsu Information Display Engineering Research Center), 
Wei Lei, Yunsong Di, Mei Xiao (Southeast University, China)

P1-39: Large Current Emission from CNTs Synthesized by a Local Heating CVD Method 
Yunsong Di (Nanjing Normal University & Southeast University, China), 
Yunkang Cui, Feng Gao, Xiaobing Zhang, Wei Lei (Southeast University, China)
Session 9: THz II, SWS Fabrication
Session Chair: Dr. John H. Booske (University of Wisconsin)

9.1: Terahertz Backward-Wave Oscillator Slow-Wave Circuits ............................................. 179
Guillermo A. Oviedo Vela (University of Utah), Mark S. Miller (University of Utah and Terahertz Device Corporation), Richard W. Grow (University of Utah)

9.2: Fabrication Techniques for a THz ELK .................................................................................. 181
Richard John Dobbs, Albert Roitman, Mark Hyttinen, Dan Sweeney (Communications & Power Industries Canada, Inc.), David Chemin (Science Applications International Corp.), Monica Blank (Communications & Power Industries, Inc.), N. Scott Barker, John Booske (University of Wisconsin), Edward Wright (Beam-Wave Research, Inc.), Jeffrey Calame (U.S. Naval Research Laboratory), Olga V. Makarova (Creatv Micro Tech, Inc.)

9.3: Fabrication of Solid Copper 220 GHz Folded Waveguide Circuits by UV Lithography .......................................................................................................................... 183

9.4: MEMS Fabrication of 0.22 THz Sheet Beam TWT Circuit ....................................................... 185
Young-Min Shin, Anisullah Baig, Diana Gamzina, Neville C. Luhmann Jr. (University of California, Davis)

9.5: Microfabrication of a 220 GHz Grating for Sheet Beam Amplifiers ...................................... 187
Colin D. Joyce, Jeffrey P. Calame, Morag Garven, Doewon Park, Robert Bass, Baruch Levush (U.S. Naval Research Laboratory)

Session 10: Gyrotrons II, Oscillators and Amplifiers
Session Chair: Kwo Ray Chu (National Tsing Hua University)

10.1: Development and Demonstration of a Multi-Megawatt 95 GHz Gyrotron .................................... 189
Monica Blank, Philipp Borchard, Patrick Cahalan, Stephen Cauflman, Kevin Felch (Communications and Power Industries)

10.2: A Research to a High-Order-Mode Gyrokystron .................................................................... 191
Michael Petelin, Yury Danilov, Vladimir Pavelyev, Eugene Zasypkin, Nikolay Zaitsev (Russian Academy of Sciences)

10.3: Experimental Measurement of Picosecond Pulse Amplification in a 140 GHz Gyro-TWT .............................................................................................................................. 193
Haejin Kim, Emilio A. Nanni, Michael A. Shapiro, Jagadishwar R. Sirigiri, Richard J. Temkin, Paul P. Woskov (Massachusetts Institute of Technology)

10.4: Experimental Demonstration of a W-band gyro-BWO using a Helically Corrugated Waveguide ............................................................................................................................ 195
Craig R. Donaldson, Wenlong He, Adrian W. Cross, Fengting Li, Alan D. R. Phelps, Liang Zhang, Kevin Ronald, Craig W. Robertson, Colin G. Whyte, Paul McElhinney (University of Strathclyde)

10.5: Development of THz Gyrotrons with Pulsed Solenoids for Detecting Concealed Radioactive Materials .................................................................................................................. 197
Gregory S. Nusinovich, Victor L. Grushin, Thomas M. Antonsen, Jr., Ruifeng Pu, Oleksandr V. Siniatyn, John Rodgers, Ali B. Mohamed, Joseph Silverman, Mohammad Al-Sheikhly (University of Maryland), Yakov S. Dimant (Boston University)

10.6: Operation of a Tunable Second-Harmonic 330 GHz CW Gyrotron ............................................. 199
Antonio C. Torrezan, Michael A. Shapiro, Jagadishwar R. Sirigiri, Richard J. Temkin (Massachusetts Institute of Technology)

Session 11: Cathodes II, Field Emission
Session Chair: Frederic Andre (Thales Electron Devices)

11.1: A Reliable Improved Spindt Cathode Design for High Currents ............................................. 201
Capp A. Spindt, Christopher E. Holland, Paul R. Schwobiel (SRI International)
11.2: “Digital” Vacuum Microelectronics: Carbon Nanotube-Based Inverse Majority Gates for High Temperature Applications ........................................................................ 203
Harish M. Manohara, Mohammad M. Mojarradi, Risaku Toda, Robert H. Lin, Anna Liao (California Institute of Technology)

11.3: Emittance, Space Charge, and Sharp Electron Sources .............................................................................................................. 205
Kevin L. Jensen (U.S. Naval Research Laboratory), Patrick G. O’Shea, Donald W. Feldman (University of Maryland)

11.4: Examination of Field Emission from Copper Knife Edge Cathodes with Low-Work Function Coatings ............................................................................................. 207
Nishant Sule, Matt Kirley, Bozidar Novakovic, John Scharer, Irena Knezevic, John Booske (University of Wisconsin-Madison)

11.5: Electron Transport and Emission from Thin Film Semiconductors ............................................................................................ 209
Kevin L. Jensen, Joan E. Yater, Bradford B. Pate, Jon L. Shaw (U.S. Naval Research Laboratory), Eric J. Montgomery, Donald W. Feldman, Patrick G. O’Shea (University of Maryland)

11.6: Emission Characterization of Diamond Current Amplifier ........................................................................................................... 211
Joan E. Yater, Jonathan L. Shaw, Kevin L. Jensen, James E. Butler, Bradford B. Pate (U.S. Naval Research Laboratory), Robert E. Myers (Beam-Wave Research, Inc.), Tatyana Feygelson (Science Applications International Corp.)

Session 12: Klystrons II, IOTs and Broadband
Session Chair: Dr. Richard B. True (L-3 Communications Electron Device Division)

12.1: A High Power Wideband Inductive Output Tube ......................................................................................................................... 213
Richard D. Kowalczyk, Mark F. Kirshner, Richard B. True, Craig B. Wilsen, Michael A. Boyle, Holger Schult, John C. Cipolla (L-3 Communications Electron Devices)

12.2: A 350 MHz, 200 kW CW, Multiple Beam IOT .......................................................................................................................... 215
Lawrence Ives, Michael Read, David Marsden, Robert H. Jackson, Thuc Bui (Calabazas Creek Research, Inc.), Takuji Kimura, Edward Eisen (Communications & Power Industries, Inc.)

12.3: Extended Interaction Klystrons for Terahertz Power Amplifiers ................................................................................................. 217
David P. Chemin, Alex Burke, Igor Chernyavskyi, John Petillo (Science Applications International Corporation), Richard Dobbs, Albert Roitman, Peter Horoyski, Mark Hyttinen, Dave Berry (Communications & Power Industries), Khanh Nguyen, Vadim Jabotinsky, Dean Pershing, Edward Wright (Beam-Wave Research, Inc.), Todd Gaier, Anders Skalare (Jet Propulsion Laboratory), Monica Blank (Communications & Power Industries), Jeffrey Calame, Baruch Levush (U.S. Naval Research Laboratory), N. Scott Barker, Robert Weikle (University of Virginia), Jeffrey Neilson (Lexam Research), John Booske (University of Wisconsin)

12.4: Research Progress of S-band Broadband Klystron in IECAS .............................................................................................................. 219
Yong Wang, Yaogen Ding, Pukun Liu, Zhiquiang Zhang, Jian Zhang (Chinese Academy of Sciences)

12.5: Research Progress on X-band Broadband CW Klystron .................................................................................................................. 221
Yaogen Ding, Bo Yu, Bin Shen, Haibin Ding, Ming Cao, Chunyu Wang (Chinese Academy of Sciences)

Poster Session II

P2-1: Non-resonant Perturbation Formula for Interaction Impedance Measurement for a Folded-Waveguide SWS ......................................................................................... 223
M. Sumathy (Microwave Tube Research and Development Centre, India), K. J. Vinoy (Indian Institute of Science), Subrata Kumar Datta (Microwave Tube Research and Development Centre, India)

P2-2: Tape-Helix Analysis of Conductivity Losses in a Metal Segment Loaded Helical SWS ................................................................................................. 225
Raja Ramana Rao Parmisetty, Subrata Kumar Datta (Microwave Tube Research & Development Centre, India), Vijay A. Deshmukh (Defense Institute of Advanced Technology), Lalit Kumar (Microwave Tube Research and Development Centre, India)
P2-3: Exploration of a Broadband ‘Semi-Vane’ Helical SWS .................................................. 227
Rangaswamy Seshadri, Vemula Bhanu Naidu, Raja Ramana Rao, Subrata Kumar Datta, Sudhir Karnath
(Microwave Tube Research and Development Centre, India), Pradip Kumar Jain (Banaras Hindu University),
Lalit Kumar (Microwave Tube Research and Development Centre, India)

P2-4: Improved Rod Shapes for Helix Slow Wave Structures .............................................. 229
Mauro Mineo, Claudio Paoloni (University of Roma Tor Vergata)

P2-5: Computational Investigation of the Phase Velocity and Loss of a Helix TWT ................. 231
Brian C. D. Williams, Russell Hamilton Martin (L-3 Communications Electron Technologies Inc.)

P2-6: Analysis of a Ridge-Loaded Rectangular Folded-Waveguide SWS .............................. 233
M. Sumathy (Microwave Tube Research and Development Centre, India), K. J. Vinoy (Indian Institute of Science),
Subrata Kumar Datta (Microwave Tube Research and Development Centre, India)

P2-7: Slow-Wave Structure Formed by Rectangular Rings .................................................. 235
Yuriy Nikitich Pchelnikov (Consultant)

P2-8: The Influence of the High-frequency Parameter on Harmonic of Traveling-Wave Tube .................................................. 237
Guoxing Miao, Xiaobao Su, Na Wei (Chinese Academy of Sciences)

P2-9: Parameter Research in the Time-Dependent PIC Simulation of TWTA ......................... 239
Tao Liu, Pu-Kun Liu, Zi-Cheng Wang (Chinese Academy of Sciences)

P2-10: Sunshine’s Effect on Radiator Performance of Radiation Cooled Traveling Wave Tube .................................................. 241
Guangjiang Yuan, Pukun Liu (Chinese Academy of Sciences)

P2-11: Small-Signal Eulerian Hydrodynamic Analysis of a Plasma-Filled Helix TWT ............. 243
Subrata Kumar Datta, Lalit Kumar (Microwave Tube Research and Development Centre),
Baidyanath Nath Basu (College of Engineering and Technology, Moradabad, India)

P2-12: Thermal Analysis of Slow Wave Structure for a Space Helix TWT ............................ 245
Mukesh Kumar Alaria (CEERI/CSIR, India), Sunny (MIMIT, India),
Ashok Kumar Sinha, Vishnu Srivastava (CEERI/CSIR, India)

P2-13: Determination of the Maximum Incremental Rate and Boundaries of the TWT Interaction Area ........................................................................................................... 247
Yuriy Nikitich Pchelnikov (Consultant)

P2-14: Suppressing of Self-Modulation in Vacuum Tube Delayed Feedback Oscillators Using an Additional Delayed Feedback .................................................. 249
Oleg S. Khavroshin, Nikita M. Ryskin (Saratov State University)

P2-15: A Large Signal Disk-Beam Model for TWTs .............................................................. 251
Daniel T. Lopes (Nuclear and Energetic Research Institute/University of São Paulo),
Cláudio C. Motta (University of São Paulo)

P2-16: Improved Method of Determining the Dielectric Properties of Basic Rods Used in Traveling Wave Tubes .................................................. 253
Andrey B. Danilov, Elena M. Il’ina, Boris V. Shalaev (The Federal State Unitary Enterprise “NPP Almaz”)

P2-17: Numerical Simulation of a Traveling Wave Tube Oscillator with Delayed Feedback Using Nonstationary Discrete Theory .................................................. 255
Vladimir Nikolaevich Titov, Anton Valerievich Yakovlev, Nikita Mikhailovich Ryskin
(Saratov State University)

P2-18: The Backward-wave Oscillation Research in High Power Broadband Helical Traveling Wave Tube .................................................. 257
Yulu Hu (University of Electronic Science and Technology of China),
YanMei Wang (Beijing Vacuum Electronics Research Institute),
Zhonghai Yang, Jiangjing Li, Bin Li, Tao Huang, Quan Hu, Xiaolin Jin, Xiaofang Zhu, Shanshan Ma
(University of Electronic Science and Technology of China)
P2-19: Design of Dual Anode Electron Gun and Beam Focusing for Ku-band 140W Short Length Space TWT
Rajendra Kumar Sharma, Prashant Sharma, Amitavo Roy Choudhury, Sudhir Mohan Sharma, Suneeta Arya
(Central Electronics Engineering Research Institute, India)

P2-20: Harmonics and Inter-modulation Analyses for 140W Short-Length TWT
Vishnu Srivastava, Dheeraj Kumar, Abhishek Jain, Rajendra Kumar Sharma
(Central Electronics Engineering Research Institute, India)

P2-21: Optimization of Waveguide Coupler for Coupled-cavity TWT Using Artificial Neural Network
V. Latha Christie, M. Sumathy, Lalit Kumar (Microwave Tube Research and Development Centre), Sheila Prasad (Northeastern University)

P2-22: Design of Multistage Depressed Collectors Using 3D Conformal Finite-Difference Time-Domain Particle-In-Cell Simulations
M. C. Lin, P. H. Stoltz, D. N. Smithe (Tech-X Corporation), H. Song (University of Colorado, Colorado Spring), S. J. Kim, S. H. Jang (Agency for Defense Development, South Korea), G. W. Choi, J. J. Choi (Kwangwoon University)

P2-23: High Electron Efficiency Design for K and Ka Band TWT
Bo Qu, Minghui Liu, Jiajun Feng, Shaohui Lun, Li Li, Xiaofeng Liang
(Beijing Vacuum Electronics Research Institute)

P2-24: Numerical Simulation of Resonant Loss in Coupled-Cavity SWS
V. Latha Christie, M. Sumathy, Lalit Kumar (Microwave Tube Research and Development Centre)

P2-25: Monte Carlo Simulation of Multiport Amplifier Isolation Performance
Giovanni De Donato, Marinella Aloisio, Piero Angeletti, Salvatore D’Addio (European Space Agency)

P2-26: 2.5 Dimensional Beam-wave Interaction Program for Sheet Beam Klystrons Based on Rod Model
Xiaofeng Zhang, Cunjun Ruan, Ding Zhao, Jirun Luo, Wang Ruan, Ying Han (Chinese Academy of Sciences)

P2-27: A Vector Finite Element Helmholtz Solver for Nemesis
Thuc Bui, Michael Read, Lawrence R. Ives (Calabazas Creek Research, Inc.), Henry Freund (Science Applications International Corporation)

P2-28: Modeling of Beam Generation in IOT Electron Guns
Robert H. Jackson, Thuc Bui, Michael Read, Lawrence R. Ives (Calabazas Creek Research, Inc.)

P2-29: High Accuracy Electron Beam Model Development: MICHELLE eBEAM
Serguei Ovtchinnikov, Roman Shitokhame, Masis Mkrtchyan, Christopher Kostas, John Petillo (Science Applications International Corporation), Simon Cooke, Alexander Vlasov, Baruch Levush (U.S. Naval Research Laboratory)

P2-30: Design of a Doubly Convergent Multiple Beam Gun
Lawrence R. Ives, Thuc Bui, Michael Read (Calabazas Creek Research, Inc.), Adam Attarian, Billy Tallis, Cynthia Andujar, Virginia Forstall, Hien Tran (North Carolina State University)

P2-31: Use of Optimization for the Design of Electron Guns
Michael Read, Lawrence R. Ives, Thuc Bui (Calabazas Creek Research, Inc.), Adam Attarian, William Tallis, Cynthia Andujar, Virginia Forstall, Hien Tran (North Carolina State University)

P2-32: Advances in Beam Optics Analyzer
Thuc Bui, Lawrence Ives, Michael Read (Calabazas Creek Research, Inc.), Mattie Posth (Consultant)

P2-33: Numerical Issues in High Precision Charged Particle Optics
Robert H. Jackson (Calabazas Creek Research, Inc.)

P2-34: Improved Space Charge Modeling in Cylindrical Coordinates
Robert H. Jackson, Thuc Bui (Calabazas Creek Research, Inc.), Alan C. Wu, John P. Verboncoeur (University of California, Berkeley)
Session 13: TWTs II
Session Chair: Dr. Yehuda Goren (Teledyne MEC)

13.1: High Power Efficient Mini-TWTs from 4 to 40 GHz
Philippe Thouvenin, Fabrice Vasseur, Sylvester Challeml, Pierre Nugas
(THALES Microwave & Imaging Subsystems)

13.2: A 125 Watt Ka-Band Mini Traveling Wave Tube
Jim Taylor, Chad Marchewka, Adrian Donald, Richard True, Tom Hargreaves
(L-3 Communications Electron Devices)

13.3: Development of Ultra Wide Band Helix Mini-TWTs
Tushar K. Ghosh, Anthony J. Challis, Anthony Tokeley, Michael J. Duffield, Kevin Rushbrook, Ian Poston,
Alan Jacob, Darrin Bowler (e2v Technologies Ltd.)

13.4: 200 Watt CW IJ Band Miniature Helix Traveling Wave Tube
Ray F. Watkins, Richard True, Conrad Marotta, Mark Barsanti (L-3 Communications)

13.5: R&D Challenges for Broadband Satcoms in 2020
Marinella Aloisio, Piero Angeletti, Francesco Coromina, Francois Deborgies, Riccardo De Gaudenzi,
Alberto Ginesi (European Space Agency)

13.6: Development of 40W 26.5-40GHz Helix-TWT with 37% Overall Efficiency
Ming-Guang Huang, Bao-Liang Hao, Pu-Kun Liu, Wei Liu (Chinese Academy of Sciences)

Session 14: Gyrotrons III, Gyrotron Technology
Session Chair: Michael I. Petelin (Institute of Applied Physics, RAS)

14.1: Performance Analysis of a High Current Density Magnetron Injection Gun
Larry R. Barnett, Neville C. Luhrman, Jr. (University of California, Davis),
Chen-Chi Chia, Kwo Ray Chu (National Tsing Hua University)

14.2: Operation of a 1.5 MW, 110 GHz Gyrotron with an Advanced Internal Mode Converter
David S. Tax, Eummi M. Choi, Yoshitoku Hidaka, Ivan Mastovsky, Michael A. Shapiro,
Jagadishwar R. Sirigiri, Richard J. Temkin, Antonio C. Torrezan (Massachusetts Institute of Technology),
Jeff Neilsen (Calabaza Creek Research, Inc.)

14.3: Design of an Internal Coupler to Corrugated Waveguide for High Power Gyrotrons
Jeffrey M. Neilson (Calabaza Creek Research, Inc.),
Philipp Borchard (Dymenso LLC)

14.4: Design of a 250 GHz Photonic Band Gap Gyrotron Amplifier
Emilio Alessandro Nanni, Michael A. Shapiro, Jagadishwar R. Sirigiri, Richard J. Temkin
(Massachusetts Institute of Technology)
P3-9: 2 MW CW RF load for Gaussian Mode Gyrotrons
Lawrence R. Ives, Maxwell Mizuhara, Jeff Neilson (Calabasas Creek Research, Inc.)

P3-10: Design of Interaction Cavity for 120 GHz, 1 MW Gyrotron
Nitin Kumar, Hasina Khatun, Udaybir Singh, Anil Kumar, Mukesh K. Alaria
(Central Electronics Engineering Research Institute),
T. P. Singh (J. V. College, India),
A. K. Sinha (Central Electronics Engineering Research Institute)

P3-11: Some Phenomena in the Experimental Process of a Harmonic Multiplying Gyrotron Traveling Tube
Jirun Luo, Yansheng Zhang, Wei Guo, Min Zhu, Guangjiang Yuan, Jian Cui, Yinghui Zhang, Lihong Ren,
Jingxin Yang (Chinese Academy of Sciences)

P3-12: Study of a Vlasov Mode Converter for 94GHz Whispering Gallery Mode Gyrotron
Bin Wang, Chao-Hai Du, Pu-Kun Liu, Zhi-Hui Geng, Shou-Xi Xu (Chinese Academy of Sciences)

P3-13: Design of a Quasi-Optical Mode Converter for W-Band Gyrotron Oscillator
Shou-Xi Xu, Bin Wang, Pu-Kun Liu, Zhi-hui Geng (Chinese Academy of Sciences)

P3-14: Effect of Beam Tunnel Geometry on Electron Beam Parameters for 42 GHz Gyrotron
Udaybir Singh, Nitin Kumar, Mukesh K. Alaria (Central Electronics Engineering Research Institute, India),
L. P. Purohit (Gurukul Kangri Vishwavidyalaya),
Ashok K. Sinha (Central Electronics Engineering Research Institute, India),
B. Piosczyk, M. Thumm, G. Gantenbein (Karlsruhe Institute of Technology)

P3-15: Eigen Mode Analysis of Cylindrical Cavity for Millimeter & Submillimeter Gyrotrons
Mukesh Kumar Alaria (Central Electronics Engineering Research Institute, India),
Paramita Mukherjee (Burdwan University, India),
Ashok Kumar Alaria (Central Electronics Engineering Research Institute, India)

P3-16: The Thickness of the Lossy Layer on Saturated Power of Gyrotron Traveling Wave Amplifier
Hai-yan Sun (North China University of Technology),
Li Yin (Institute of China Electronic Technology Group Corporation),
Kong Ling-bao (Beijing University of Chemical Technology)

P3-17: Ka-Band Gyrotron-Traveling Wave-Tube
EFeng Wang, Ben Tian Liu, Zhiliang Li, Li Jun Qian, Jinjun Feng, Tiechang Yan, Min Zhu, Shi Lu Zhao
(Beijing Vacuum Electronics Research InstituteBeijing, China)

P3-18: High-Efficient Synthesized Launcher for Coaxial Cavity Gyrotron
Alexey Chirkov, Gregory G. Denisov, Igor V. Yefremov, Serguei Yu. Kornishkin, Alexey Yu. Plyashkevich
(Russian Academy of Sciences)

P3-19: Optimization of Waveguide Couplers for Traveling Wave Tube on Coupled Cavity Chain
Dmitrij Alexandrovich Komarov, Sergey P. Morev, Aleksey V. Gudovich
(Federal State Unitary Enterprise, Russia)

P3-20: Analysis of Dispersion and Interaction Impedance for Vane-loaded Coaxial Waveguide Structure
Simhadri Unna Maheswara Reddy, Subrata Kumar Datta, Pamisetty Raja Ramana Rao
(Microwave Tube Research and Development Centre, India),
Pradip Kumar Jain (Banaras Hindu University),
Lalit Kumar (Microwave Tube Research and Development Centre, Russia)

P3-21: Principles of Synthesis of Multimode Waveguide Units
Dmitry I. Sobolev, Gregory G. Denisov (Institute of Applied Physics. Russian Academy of Sciences)

P3-22: Excitation Equations for the Longitudinally-Irregular Waveguide with Finite Conductions of the Walls
Stanislav V. Kolosov, Alexander Alexandrovich Kurayev, Alexey Olegovich Rak
(Belarusian State University of Informatics and Radioelectronics)
P3-23: Peniotron and Large-orbit Gyrotron at H41-mode: Comparison of Efficiency
Stanislav V. Kolosov, Alexander Alexandrovich Kurayev, Alexey Olegovich Rak
(Belarusian State University of Informatics and Radioelectronics)

P3-24: Coaxial Klinooorotron
Alexander Alexandrovich Kurayev, Anatoly Konstantinovich Sinitsyn, Alexey Olegovich Rak
(Belarusian State University of Informatics and Radioelectronics),
Victor Danilovich Yeryomka
(Uchakov Institute of Radiophysics and Electronics of the National Academy of Sciences of Ukraine)

P3-25: Influence of Implementing Straps on Pulsed Relativistic Magnetron Operation
Sarita Prasad, David Galbreath, Mikhail Fuks, Edl Schamiloglu (University of New Mexico)

P3-26: Three-Dimensional Particle-In-Cell Simulation of 35 GHz Spatial-Harmonic Magnetron
Jung-Il Kim, Seok-Gy Jeon, Jeun-Ju Kim, Seong-Tae Han (Korea Electrotechnology Research Institute),
Anatoly Semenovich Tishchenko (Institute of Radio Physics and Electronics, Ukraine)

P3-27: A Compact High Power Microwave System
Mats Jansson, Fredrik Olsson, Denny Åberg (BAE Systems Bofors, Sweden)

P3-28: Chaotization of Oscillations State in Crossed-Field Systems
Mykola Volodymyrovych Volovenko, Victor Mykolajovych Zinkivski, Olexandr Mykolajovych Nikitenko
(Kharkiv National University of Radiotechnics)

P3-29: Dispersion Relation of Electromagnetic Waves in Magnetized Plasma Dielectric Photonic Crystals
Limei Qi (Qufu Normal University, China),
Cuiping Zhang (The People's Hospital, China)

P3-30: Slow-wave Structure for a Photonic Free-Electron Laser
Thomas Denis, Peter J. M. van der Slot, Klaus J. Böller (University of Twente)

P3-31: Giant Cathode-Heating Units for Relativistic Electron Injectors and Powerful Electron-Beam Vacuum Plasma Devices
Sergy Vasiliia Korolev, Aleksandr Ilyich Shapiro, Vera Isevna Alehina, Artur Nikolaevich Ermilov,
Yurij Alecsevich Kovalenko, Pavlovish Aleksandr Shumilin (Federal State Unitary Enterprise, Russia)

P3-32: Fabrication of the Big-size Thermionic Dispenser Cathode
Hui Wang, Zhiqiang Yu, Ji Li, Wensheng Shao (Beijing Vacuum Electronics Research Institute),
Anmin Yang, Liansheng Xia, Jinshui Shi (Institute of Fluid Physics)

P3-33: Simulation of a Virtual Cathode Oscillator with CST STUDIO SUITE TM
Monica C. Balk (CST AG, Germany)

P3-34: Design of a Gridded Electron Gun Using the Particle Path and the FEM Approach
César C. Xavier, Cláudio C. Motta (University of Sao Paulo)

P3-35: Computer Simulation of a Novel Large-orbit Electron Gun
Xinhui Wu, Jiayin Li (University of Electronic Science and Technology of China)

P3-36: Dispersion Properties of Plasma-Filled Two-Dimensional Metallic Photonic Crystals
Tao Fu, Ziqiang Yang, Xi Gao, Zongjun Shi (University of Electronics Science and Technology of China)

P3-37: Emission Characteristics of Sc-doped Dispenser Cathodes in Electron Gun Open Structures
Wei Liu, Yiman Wang, Lei Zhao, Lili Li, Xizhu Zhang, Jinshu Wang (Beijing University of Technology)

Session 16: TWT Modeling
Session Chair: David P. Chemin (SAIC)

16.1: 2D Modeling of Beam-Wave Interaction in Coupled Cavity TWT with TESLA
Alexander N. Vlasov, Simon J. Cooke, Baruch Levush (U.S. Naval Research Laboratory),
Thomas M. Antonsen, Jr. (University of Maryland),
Igor A. Chernyavskiy, David P. Chemin (Science Applications International Corporation)
Paul B. Larsen, David K. Abe, Simon J. Cooke, Baruch Levush (U.S. Naval Research Laboratory), Thomas M. Antonsen, Jr. (University of Maryland, College Park)

16.3: Simulation of a Ku-band Helix TWT Interaction and IM3 Using 3D Particle Codes .......... 409
Li Li, Jinjun Feng (Beijing Vacuum Electronics Research Institute, Beijing China)

16.4: 2D and 3D Analysis of a 2-Stage Depressed Collector Including the Effects of Secondary Electrons ........................................................................... 411
Raja Ramana Rao Pamisetty (Microwave Tube Research and Development Centre, India), Subrata Kumar Datta (Microwave Tube Research and Development Centre, India), Vijay A. Deshmukh (Defence Institute of Advanced Technology, India)

16.5: The Suppression of BWO Power Holes in the TWTs Using the Helix Pitch Taper Method ........................................................................................................ 413
Zhaoyun Duan (University of Electronic Science and Technology of China), Fang Guo (University of Electronic Science and Technology of China), Yanmei Wang (Beijing Vacuum Electronics Research Institute), Yanyu Wei, Yubin Gong, Wuxiang Wang (University of Electronic Science and Technology of China)

16.6: New Features and Recent Developments of Microwave Tube Simulator Suite .......... 415
Bin Li (University of Electronic Science and Technology of China), YiXue Wei (Beijing Vacuum Electronics Research Institute), ZhongHai Yang, JianQing Li, Tao Huang, XiaoLin Jia, Quan Hu, YuLu Hu, Li Xu, XiaoFang Zhu, JunJian Ma, WeiFeng Peng, Li Xiao, GuoXian He (University of Electronic Science and Technology of China)

Session 17: Cathodes III, Scandate and Thin Film
Session Chair: Dr. William G. Tighe (L-3 Communications Electron Technologies, Inc.)

17.1: A New Model for the Mechanism of Operation of Scandate and Refractory Oxide Cathodes ........................................................................................................ 417
Ivor -. Brodie (University of California, Davis)

17.2: Ab initio Models of Dispenser B-type, Scandate, and Alloy Cathode Surfaces .......... 419
Vasilios Vlahos, Dane Morgan, John H. Booske (University of Wisconsin-Madison)

17.3: Work Function Reduction by Multilayer Oxides: Thermionic Electron Emission Microscopy of Scandium Oxide and Barium Oxide on Tungsten ................................................................. 421
Joel M. Vaughn (Ohio University), Keith D. Jamison (Nanohmics, Inc.), Martin E. Kordesch (Ohio University)

17.4: Electron Field Emission from a Tetrapod-like ZnO Film Deposited on Metal Mesh by DC Electrophoresis ................................................................. 423
Li-An Ma, Shu-Quang Cai (Fujian University of Technology), Li-Qin Hu, Tai-Liang Guo (Fuzhou University, Fuzhou)

17.5: High Current Density and Long Life — Nanocomposite Scandate Dispenser Cathode Fabrication ........................................................................................................ 425
Jinfeng Zhao (University of California, Davis), Na Li, Ji Li (Beijing Vacuum Electronics Research Institute), Larry Barnett, Mike Banducci, Diana Ganzina, Neville C. Luhrmann, Jr. (University of California, Davis)

17.6: Evaporation Behavior of Scandia Doped Dispenser Cathode ........................................ 427
Jinshu Wang, Lili Li, Zhao Lei, Yiman Wang, Wei Liu, Xizhu Zhang (Beijing University of Technology)

Session 18: Klystrons III, Single Beam
Session Chair: Yaogen Ding (Chinese Academy of Sciences)

18.1: Development of a Permanent Magnet Focused Ka-Band Klystron ................................ 429
Adam Balkcum, Rasheda Begum, Lydia Cox, Brad Stockwell, Lou Zitelli (Communications and Power Industries, Inc.)

18.2: Design and Operation of a Pulsed 25 KW, MSDC Ku-Band Klystron ........................ 431
Jonathan Page, Adam Balkcum, Rasheda Begum, Lydia Cox, Thomas Habermann, Mark Henderson, Tom Hunter, Armand Staprans, Brad Stockwell, Lou Zitelli (Communications and Power Industries, Inc.)
18.3: Klystron Lifetime and Reliability Analysis: Five Year Update ........................................ 433
Adam Balkcum (Communications and Power Industries, Inc.)

18.4: Development of 17 kW CW S-band Broadband Klystron ........................................ 435
Haibing Ding, Yaogen Ding, Bin Shen, Bo Yu, Ke Tang, Chunyu Wang (Chinese Academy of Sciences)

18.5: Development of an S-band, 200 MHz Instantaneous Bandwidth, 22 kW Average Power Klystron ........................................ 437
Zhao-chuan Zhang, Bao-li Shen, Chun-jiu Fu, Xiao-juan Yu, Feng Zhang, Yun-ping Huang (Chinese Academy of Sciences)

Session 19: Modeling II
Session Chair: John P. Verboncoeur (University of California, Berkeley)

19.1: Status of the MICHELLE Code and Applications ........................................ 439
John Petillo (Science Applications International Corporation), Dimitrios Panagos, Serguei Ovtchinikov, Alex Burke, Chris Kostas, Ben Held, John DeFord (Simulation Technology & Applied Research), Eric Nelson (Los Alamos National Laboratory), Khanh Nguyen, Ed Wright (Beam Wave Research, Inc.), Kevin Jensen, Baruch Levush (U.S. Naval Research Laboratory)

19.2: Modeling Emission Processes in the Finite-Element MICHELLE Gun & Collector Simulation Code ........................................ 441
John Petillo, Dimitrios Panagos, Serguei Ovtchinikov, Alexander Burke, Christopher Kostas (Science Applications Int’l Corporation), Kevin Jensen, Baruch Levush (U.S. Naval Research Laboratory), Ben Held, John DeFord (Simulation Technology & Applied Research, Inc.), Eric Nelson (Los Alamos National Laboratory)

19.3: Demystifying Relaxation in the Gun Code Algorithm ........................................ 443
Eric M. Nelson (Los Alamos National Laboratory), John J. Petillo (Science Applications International Corp), Baruch Levush (U.S. Naval Research Laboratory)

19.4: Multi-Physics Simulations with VORPAL ........................................ 445
David Smithe, Peter Stoltz, Ming-Chieh Lin, Dan Karipides (Tech-X Corporation), Haipeng Wang, Kai Tian, Gary Cheng (Thomas Jefferson National Accelerator Facility)

19.5: Simulation of DC High-Voltage Breakdown for Angled Dielectric Insulators Including Space-Charge Effects ........................................ 447
Manuel P. Aldan, John P. Verboncoeur (University of California, Berkeley), Lawrence R. Ives (Calabazas Creek Research, Inc.)

Poster Session IV

P4-1: Electron Gun with Cold Cathode for THz Devices ........................................ 449
Giacomo Ulisse, Francesca Brunetti, Aldo Di Carlo (University of Roma)

P4-2: Permanent Magnet for HiFIVE Sheet Beam Transport ........................................ 451
Bradford C. Stockwell, John E. Atkinson, Deepika D. Gajaria, Thomas J. Grant, Takuji Kimura (Communications and Power Industries, Inc.), Mark Field (Teledyne Scientific & Imaging), John A. Pasour (U.S. Naval Research Laboratory)

P4-3: Two-Dimensional Millimeter Wave Photonic Crystals Fabricated by Wet Etching of Silicon ........................................ 453
Jung-II Kim, Seok-Gy Jeon, Seong-Tae Han, Geun-Ju Kim (Korea Electrotechnology Research Institute), Huyn-Haeng Lee (Chosun University), Si-Hyun Park (Yeungnam University)

P4-4: Design and Analysis of a Microfabricated Ladder Type Slow-Wave Structure for a Millimeter-Wave Traveling-Wave Tube ........................................ 455
Christopher Douglas, Hoyoung Song (University of Colorado at Colorado Springs), Ming-Chieh Lin, David Smithe, Peter Stoltz (Tech-X Corporation)

P4-5: The Sheet Electron Beam Interaction with the In-Phase Mode in the Opposing Combs ........................................ 457
Yuriy Nikitch Pchelnikov (Consultant)
P4-6: Single-mode Transmission in Planer Photonic Crystal Folded Waveguide
Qian-Zhong Xue, Yan-Lin Li, Chao-Hai Du, Zuo Yuan (Chinese Academy of Sciences)

P4-7: WITHDRAWN

P4-8: Folded Waveguide TWT Frequency Characteristics in the Range 600–3000 GHZ
Anatoli Vladimirovich Aksenchyk, Alexander Alexandrovich Kurayev, Irina Fedorovna Kirinovich
(Byelarussian State University of Informatics and Radioelectronics)

P4-9: High Power RF Transmitter for Test Stands
Michael A. Kempkes, Ian S. Roth, John Kinross-Wright, Robert A. Phillips, Kenneth C. Schrock,
Marcel P. J. Gaudreau (Diversified Technologies, Inc.)

P4-10: Distributed Discharge Limiter Studies for X-band High Power Microwaves
David Holmquist (University of Wisconsin, Madison),
Matt Kirley (),
Carson Cook, John Scharer, John Booske (University of Wisconsin, Madison)

P4-11: Secondary Electron Emission Database
Pedro N. Safier (S&J Solutions LLC), Joan E. Yater (U.S. Naval Research Laboratory),
Robert E. Myers (Beam Wave Research Inc.), Baruch Levush (U.S. Naval Research Laboratory)

P4-12: Asymmetric Coupling Cavity with Electromagnetic Band Gap
Ningfeng Bai (Southeast University, China),
JinJun Feng, Fujiang Liao (National Key Laboratory for Vacuum Electronics Beijing),
Xiaohan Sun (Southeast University, China)

P4-13: 50 keV Electrons Energy Loss Distribution in Multi-Layer Targets
Eric Munro, John Rouse, Xieqing Zhu, Victor Katsap (Munro's Electron Beam Software Ltd.)

P4-14: Compensation of Wave H01 Reflection from a Dielectric Window on to the Horn Aperture
Oksana Ivanovna Natarnovich, Anatoliy Konstantinovich Sinisyn
(Belarussian State University of Informatics and Radioelectronics)

P4-15: High Current X-Ray Source Technology for Medical Imaging
Rolf K. Behling, Stefan Hauttmann, Steffen Holzapfel, Wolfram Maring (Philips Healthcare, Germany)

P4-16: High-effective Switching and Power Amplifier Tubes with Electrons Deceleration and Their Application in Power Electronics
Vladimir Innokentievich Perevodchikov, Nickolay Igrevitch Korunov, Pavel Mikhailovich Stalkov,
Ivan Mikhailovich Trukhachev, Valentina Nikololavena Shapenko, Alexander Vladimirovich Sherbakov,
Alexander Livovich Shapiro (Fedelta State Unitary Enterprise, Russia)

P4-17: Recent Advances on Electrical Contact Resistance: Theory and Experiment
Peng Zhang, Matthew R. Gomez, David M. French (University of Michigan, Ann Arbor),
Wilkin Tang (Air Force Research Laboratory, New Mexico),
Yue Ying Lau, Ronald M. Gilgenbach (University of Michigan, Ann Arbor)

P4-18: Cold Testing Platform for Electromagnetic Band Gap Waveguide
Ningfeng Bai, Hehong Fan, Xingyun Zhao (Southeast University, Nanjing),
Fujiang Liao, Jinjun Feng (National Key Laboratory for Vacuum Electronics, Beijing),
Xiaohan Sun (Southeast University, Nanjing)

P4-19: Tracing Backscattered Electrons in Full Energy Range
Eric Munro, John Rouse, Xieqing Zhu, Victor Katsap (Munro's Electron Beam Software Ltd.)

P4-20: Development of a Miniature Magnetic Sector Mass Spectrometer
Detian Li, Meiru Guo, Wenjin Guo, Yuhua Xiao, Yide Zhao, Liang Wang (Lanzhou Institute of Physics)

P4-21: The Analysis Research of Design the Magnetic Field of the Solenoid
Tian Hang, Ding Sheng, Zhiquang Gao, Daxi Ji, Yiqun Liu, Pengchao Huang, Hui Xu, Xiaofeng Li,
Zhengqiang Bao (Nanjing Science Electronic Information Industrial Group Co., Ltd.)

P4-22: Electrostatic Focusing of Electrons off a Large-Area Reticulated Vitreous Carbon (RVC) Field Emission Source
Brady C. Smith, Charles E. Hunt, Ivor Brodie (University of California, Davis)
P4-23: Determination of the Field Enhancement Factor Distribution of Field Emitter Nanoemission Matrix from Emission Investigation
Yurij Alekseevich Kovalenko, Sergi Vasilia Korolev (Federal State Unitary Enterprise, Russia)

P4-24: Design and Test of a High Efficiency Energy Recovery Pulse Modulator
Wen-Ching Tsai, Calvin W. Domier, Larry R. Barnett, Neville C. Luhmann, Jr.
(University of California, Davis)

Session 20: TWTs III
Session Chair: Philippe Thouvenin (Thales Components and Subsystems)

20.1: A Novel Millimeter-Wave Slow-Wave Structure for Longitudinal Interaction with a Sheet Electron Beam
Yury N. Pchelnikov (Consultant), David K. Abe (U.S. U.S. Naval Research Laboratory)

20.2: Testing of the Omigliuide Traveling-Wave Tube

20.3: High Power Ka-band Folded Waveguide Traveling-Wave Tube
Huarong Gong, Yubin Gong, Tao Tang, Wenxiang Wang
(University of Electronic Science & Technology of China)

20.4: Progress of W-band 10W CW TWT
Jinjun Feng, Yinlu Hu, Jun Cai, Shaoyun Ma, Xianping Wu (Vacuum Electronics Research Institute, Beijing)

20.5: W-band SSVDTM High Power Amplifier and Electronic Power Conditioner, Modulator and Supply
Larry Sadwick, J. Chm, C. Capson, M. Brady, W. Ford, Jennifer Hwu (InnoSys, Inc.)

20.6: Design and Development of 100 GHz Folded Waveguide TWT
Rajendra Kumar Sharma, Arun Kumar Sharma, Banshi Dhar Pant, Sudhir Mohan Sharma, Susanta Arya, Manish Budania, Isha Rathi, Nagahanumaiah, Vishnu Srivastava (Central Electronics Engineering Research Institute, India)

Session 21: Magnetrons
Session Chair: Yue-Ying Lau (University of Michigan)

21.1: Recirculating-Planar-Magnetrons for High Power, High-Frequency Radiation Generation
Ronald M. Gilgenbach, Yue-Ying Lau, David M. French (University of Michigan), Brad W. Hoff (Air Force Research Laboratory), Matthew Franzl (University of Michigan), John W. Luginess (Air Force Office of Scientific Research)

21.2: Electron Dynamics and Fast Startup in Inverted Magnetrons

21.3: Mode Separation in a Magnetron with Diffraction Output Driven by a Transparent Cathode
Mikhail I. Fuks, Edl Schamiologlu (The University of New Mexico)

21.4: WITHDRAWN

21.5: Buneman-Hartree Condition Revisited
David H. Simon, Yue Y. Lau (University of Michigan), Wilkin Tang, Keith Cartwright, Brad Hoff (Air Force Research Laboratory), Ronald M. Gilgenbach (University of Michigan), John W. Luginess (Air Force Office of Scientific Research)

21.6: Progress in ICEPIC Simulation of Commercial Strapped Magnetrons as HPM Sources
John D. Keisling, Maximo S. Lazo (SAIC)

Author Index

Hotel Floor Plan