

# 5<sup>th</sup> ITG International Vacuum Electronics Workshop 2016

September 8 – 9, 2016, Physikzentrum Bad Honnef ([www.pbh.de](http://www.pbh.de)), Germany

## Workshop, Previous Day

### Wednesday, September 7, 2016

<b>15:30</b>	<b>ITG (VDE)-Fachausschuss 8.6 “Vakuumelektronik und Displays”, 128<sup>th</sup> Meeting</b> Physikzentrum Bad Honnef (PBH), Conference room: <b>Wintergarten</b>
<b>18:30</b>	Start of the ITG Workshop for all participants: <b>Come Together Dinner &amp; Evening Discussion,</b> Physikzentrum Bad Honnef: <b>Lichtenberg-Keller</b> (at basement level)

## Workshop Program, 1<sup>st</sup> Day

### Thursday, September 8, 2016

Location: **Wilhelm und Else Heraeus Hörsaal**

<b>08:30</b>	<b>Welcome Address: Wolfram Knapp, Workshop Chairman</b>
	<b>Session 1.1: Vacuum Technologies and Electron Sources</b> <b>Plasma Applications</b> Chairman: <b>Wolfram Knapp</b>
<b>08:40</b> <i>L1.1-1</i>	<b>ENABLING TECHNOLOGIES, TECHNOLOGICAL WAVES AND FUTURE PERSPECTIVES OF VACUUM ELECTRONICS</b> <b>Georg Gärtner</b> Consultant*, Aachen, Germany; * till 2014 Philips Research Aachen
<b>09:05</b> <i>L1.1-2</i>	<b>SI TIP FIELD EMISSION ELECTRON SOURCE FOR APPLICATION IN IONISATION VACUUM GAUGES</b> <b>Christian Prommesberger, Christoph Langer, Robert Ławrowski, Rupert Schreiner</b> Faculty of General Sciences and Microsystems Technology, OTH Regensburg, D-93053 Regensburg, Germany
<b>09:30</b> <i>L1.1-3</i>	<b>DEVELOPMENT OF A TOROIDAL EB SOURCE FOR NON-THERMAL ELECTRON TREATMENT OF BULK GOODS</b> <b>Ignacio Gabriel Vicente-Gabas, Ralf Bluethner, Sebastian Schmidt, Goesta Mattausch, Frank-Holm Roegner</b> FEP - Fraunhofer Institute for Organic Electronics, Electron Beam and Plasma Technology, Winterbergstr. 28, 01277 Dresden, Germany

<p><b>09:55</b> <i>L1.1-4</i></p>	<p><b>APPLICATIONS OF NANO-COMPOSITE MATERIALS CARRYING GA/cm<sup>2</sup> CURRENT DENSITY DUE TO A BOSE-EINSTEIN CONDENSATE AT ROOM TEMPERATURE PRODUCED BY FOCUSED ELECTRON BEAM INDUCED PROCESSING FOR MANY EXTRAORDINARY NOVEL TECHNICAL APPLICATIONS</b></p> <p>Hans W.P. Koops HaWilKo GmbH, Ernst Ludwig Str. 16, 64372 Ober-Ramstadt, Germany</p>
<p><b>10:20</b></p>	<p><b>Coffee Break</b></p>
<p><b>10:50</b> <i>L1.2-1</i></p> <p><b>11:15</b> <i>L1.2-2</i></p> <p><b>11:40</b> <i>L1.2-3</i></p> <p><b>12:05</b> <i>L1.2-4</i></p>	<p><b>Session 1.2: Space Cs Clock and Vacuum Measurements</b> Chairman: Ernst Bosch</p> <p><b>COMBINED VACUUM GAUGE BASED ON MEMS PRESSURE SENSORS</b> <u>Robert Degraf</u>, Christoph Langer, Florian Dams, Rupert Schreiner Faculty of General Sciences and Microsystems Technology, OTH Regensburg, D-93053 Regensburg, Germany</p> <p><b>RECENT ACHIEVEMENTS IN SERIAL CO-SPUTTERING</b> Stefan Körner<sup>1</sup>, Andreas Pflug<sup>2</sup>, Michael Siemers<sup>2</sup>, Volker Sittinger<sup>2</sup>, Lucie Behnke<sup>3</sup>, Ruslan Muydinov<sup>1</sup>, <u>Bernd Szyszka</u><sup>1</sup> <sup>1</sup>TU Berlin, Chair TFD, Office HFT 5-2, Einsteinufer 25, 10587 Berlin, Germany <sup>2</sup>Fraunhofer IST, Bienroder Weg 54e, 38108 Braunschweig, Germany <sup>3</sup>Solayer GmbH, Sachsenallee 28, 01723 Kesselsdorf, Germany</p> <p><b>DEVELOPMENT OF THE OPTICAL SPACE CS CLOCK</b> A. Douahi<sup>1</sup>, <u>R. Schmeissner</u><sup>1</sup>, P. Dufreche<sup>1</sup>, A. Brechenmacher<sup>1</sup>, F. Chastellain<sup>2</sup>, A. Romer<sup>2</sup>, C. Roth<sup>2</sup>, W.W. Coppoolse<sup>2</sup>, N. Mestre<sup>1</sup>, Michel Baldy<sup>1</sup> <sup>1</sup>Thales Electron Devices S.A.S, 2 rue Marcel Dassault, 78141 Vélizy-Villacoublay cedex, France <sup>2</sup>RUAG AG, Schaffhauserstr. 580, 8052 Zurich, Switzerland</p> <p><b>THERMAL CONDUCTIVITY MEASUREMENT WITH “FREE FLOATING” MOLECULE DETECTOR</b> Heinz Plöchinger Thyracont Vacuum Instruments GmbH, Max-Emanuel-Str. 10, 94036 Passau, Germany</p>
<p><b>12:30</b></p>	<p><b>Lunch</b></p>

<p><b>13:30</b> <i>L1.3-1</i></p> <p><b>13:55</b> <i>L1.3-2</i></p> <p><b>14:20</b> <i>L1.3-3</i></p> <p><b>14:45</b> <i>L1.3-4</i></p>	<p><b>Session 1.3: Gyrotrons (I)</b> Chairman: <b>Manfred Thumm</b></p> <p><b>RECENT STATUS OF GYROTRON RESEARCH AND DEVELOPMENT AT KIT AS PART OF THE EUROPAEN FUSION GYROTRON PROGRAM</b> <b>S. Illy<sup>1</sup>, F. Albajar<sup>5</sup>, K. A. Avramidis<sup>1</sup>, A. Bruschi<sup>7</sup>, J. Franck<sup>1</sup>, F. Wilde<sup>1,3</sup>, G. Gantenbein<sup>1</sup>, J. P. Hogge<sup>4</sup>, J. Jin<sup>1</sup>, P. Kalaria<sup>1</sup>, I. Gr. Pagonakis<sup>1</sup>, T. Rzesnicki<sup>1</sup>, S. Ruess<sup>1,2</sup>, M. Thumm<sup>1,2</sup>, I. G. Tigelis<sup>6</sup>, C. Wu<sup>1</sup>, J. Zhang<sup>1</sup>, and J. Jelonnek<sup>1,2</sup></b> <sup>1</sup>IHM, <sup>2</sup>IHE, Karlsruhe Institute of Technology (KIT), D-76131 Karlsruhe, Germany, <sup>3</sup>Max-Planck-Institut für Plasmaphysik, Teilinst. Greifswald, D-17491 Greifswald, Germany <sup>4</sup>Swiss Plasma Center (SPC), Ecole Polytechnique Fédérale de Lausanne, CH-1015 Lausanne, Switzerland <sup>5</sup>European Joint Undertaking for ITER and the Development of Fusion Energy (F4E), Barcelona, E 08019, Spain <sup>6</sup>Faculty of Physics, National and Kapodistrian University of Athens, Zografou, GR-157 84, Athens, Greece <sup>7</sup>Istituto di Fisica del Plasma, Consiglio Nazionale delle Ricerche, 20125 Milano, Italy</p> <p><b>OPERATION LIMITS OF A 236 GHZ HOLLOW-CAVITY GYROTRON FOR DEMO</b> <b>Parth C. Kalaria<sup>1</sup>, Konstantinos A. Avramidis<sup>1</sup>, Joachim Franck<sup>1</sup>, Gerd Gantenbein<sup>1</sup>, Stefan Illy<sup>1</sup>, Ioannis Gr. Pagonakis<sup>1</sup>, Manfred Thumm<sup>1</sup>, John Jelonnek<sup>1,2</sup></b> <sup>1</sup>IHM, <sup>2</sup>IHE, Karlsruhe Institute of Technology (KIT), Kaiserstr. 12, 76131 Karlsruhe, Germany</p> <p><b>GYROTRON SIMULATIONS WITH CST STUDIO SUITE®</b> <b>Monika C. Balk</b> CST AG, Bad Nauheimer Str. 19, 64289 Darmstadt, Germany</p> <p><b>ONGOING DEVELOPMENTS FOR THE KIT 2-MW 170 GHz COAXIAL CAVITY GYROTRON PROTOTYPE</b> <b>Sebastian Ruess<sup>1,2</sup>, Gerd Gantenbein<sup>1</sup>, Stefan Illy<sup>1</sup>, Ioannis Gr. Pagonakis<sup>1</sup>, T. Rzesnicki<sup>1</sup>, Manfred Thumm<sup>1,2</sup>, and John Jelonnek<sup>1,2</sup></b> <sup>1</sup>IHM, <sup>2</sup>IHE, Karlsruhe Institute of Technology (KIT), Kaiserstr. 12, D-76131 Karlsruhe, Germany</p>
<p><b>15:10</b></p>	<p><b>Coffee Break</b></p>
<p><b>15:40</b> <i>L1.4-1</i></p>	<p><b>Session 1.4: Gyrotrons (II) and KATHRIN Experiment</b> Chairman: <b>Ernst Bosch</b></p> <p><b>INSERT MISALIGNMENT IN COAXIAL GYROTRONS: PHYSICAL EFFECTS AND NUMERICAL TREATMENT</b> <b>Joachim Franck<sup>1</sup>, Konstantinos A. Avramidis<sup>1</sup>, Gerd Gantenbein<sup>1</sup>, Stefan Illy<sup>1</sup>, Ioannis Gr. Pagonakis<sup>1</sup>, Manfred Thumm<sup>1,2</sup>, John Jelonnek<sup>1,2</sup></b> <sup>1</sup>Institute for Pulsed Power and Microwave Technology (IHM), <sup>2</sup>Institute of High Frequency Techniques and Electronics (IHE), Karlsruhe Institute of Technology (KIT), Kaiserstr. 12, 76131 Karlsruhe, Germany</p>

<b>16:05</b> <i>L1.4-2</i>	<b>SIMULATION OF GYROTRON MULTISTAGE DEPRESSED COLLECTORS USING BEAM-SHAPE TRANSFORM AND E×B DRIFT</b> <b>Chuanren Wu<sup>1</sup>, Ioannis Gr. Pagonakis<sup>1</sup>, Stefan Illy<sup>1</sup>, Gerd Gantenbein<sup>1</sup>, Manfred Thumm<sup>1,2</sup>, John Jelonnek<sup>1,2</sup></b> <sup>1</sup> IHM, <sup>2</sup> IHE, Karlsruhe Institute of Technology (KIT), Kaiserstr. 12, D-76131 Karlsruhe, Germany
<b>16:30</b> <i>L1.4-3</i>	<b>VACUUM PERFORMANCE OF THE KATRIN EXPERIMENT</b> <b>Florian M. Fraenkle</b> Karlsruher Institut für Technologie (KIT), Institut für Kernphysik (IKP), Hermann-von-Helmholtz-Platz 1, 76344 Eggenstein-Leopoldshafen, Germany
<b>16:55</b> <i>L1.4-4</i>	<b>PENNING DISCHARGE IN THE KATRIN PRESPECTROMETER</b> <b>Ferenc Glück</b> Karlsruher Institut für Technologie (KIT), Institut für Kernphysik (IKP), Hermann-von-Helmholtz-Platz 1, 76344 Eggenstein-Leopoldshafen, Germany

<b>18:30</b>	<b>Workshop Dinner &amp; Evening Discussion</b> Physikzentrum Bad Honnef: <b>Lichtenberg-Keller</b> (at basement level)
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## Workshop Program, 2<sup>nd</sup> Day

**Friday, September 9, 2016**

Location: **Wilhelm und Else Heraeus Hörsaal**

<b>08:40</b> <i>L2.1-1</i>	<b>Session 2.1: Vacuum Interrupters</b> Chairman: <b>Volker Hinrichsen</b>  <b>SHORT-CIRCUIT CURRENT INTERRUPTION IN LIQUID NITROGEN ENVIRONMENT</b> <b>Karsten Golde<sup>1</sup>, Volker Hinrichsen<sup>1</sup>, Dietmar Gentsch<sup>2</sup>, Andreas Lawall<sup>3</sup>, Erik D. Taylor<sup>3</sup></b> <sup>1</sup> High Voltage Laboratories, Technische Universität Darmstadt, Darmstadt, Germany <sup>2</sup> ABB AG, Ratingen, Germany <sup>3</sup> Siemens AG, Berlin, Germany
<b>09:05</b> <i>L2.1-2</i>	<b>MODEL FOR THE WELDING OF AXIAL MAGNETIC FIELD VACUUM INTERRUPTER CONTACTS</b> <b>Erik D. Taylor<sup>1</sup>, Andreas Lawall<sup>1</sup>, and Paul G. Slade<sup>2</sup></b> <sup>1</sup> Siemens AG, Rohrdamm 88, Berlin, 13629 Germany <sup>2</sup> Consultant, Ithaca, NY 14850, U.S.A.

<b>09:30</b> <i>L2.1-3</i>	<p><b>“METAL VAPOUR IMPACT ON CERAMIC SURFACES OF VACUUM INTERRUPTER” AFTER CURRENT INTERRUPTION OPERATIONS</b></p> <p><b>DIELECTRIC PERFORMANCE AND SURFACE RESISTANCE</b></p> <p><b>MEASUREMENT: FINAL PRINCIPLE IN PRACTICE</b></p> <p><b><u>Dietmar Gentsch</u><sup>1</sup>, <u>Michael Kurrat</u><sup>2</sup>, <u>Ingo Gramberg</u><sup>2</sup></b></p> <p><sup>1</sup>ABB AG, Calor Emag Mittelspannungsprodukte, Oberhausener Str. 33, 40472 Ratingen, Germany</p> <p><sup>2</sup>Institute for High Voltage Technology and Electrical Power Systems, Technische Universität Braunschweig, Schleinitzstr. 23, 38106 Braunschweig, Germany</p>
<b>09:55</b> <i>L2.1-4</i>	<p><b>MEASURING EMISSIVITY OF CONTACT MATERIAL USING THERMOGRAPHY CAMERA</b></p> <p><b><u>Tobias Pieniak</u><sup>1</sup>, <u>Michael Kurrat</u><sup>1</sup>, <u>Dietmar Gentsch</u><sup>2</sup></b></p> <p><sup>1</sup>Institute for High Voltage Technology and Electrical Power Systems, Technische Universität Braunschweig, Schleinitzstr. 23, 38106 Braunschweig, Germany</p> <p><sup>2</sup>ABB AG, Calor Emag Mittelspannungsprodukte, Oberhausener-Str. 33, 40472 Ratingen, Germany</p>
<b>10:20</b>	<p><b>Coffee Break</b></p>
<b>10:50</b> <i>L2.2-1</i>	<p><b><i>Session 2.2: Arc Investigations, Gas Discharge Tube, HEMP Thruster and Klystron</i></b></p> <p>Chairman: <b>Andreas Lawall</b></p> <p><b>INVESTIGATION OF HIGH CURRENT VACUUM ARCS DURING THE FORMATION OF ANODE MODES BY TIME AND SPACE RESOLVED SPECTROSCOPY</b></p> <p><b><u>R. Methling</u><sup>1</sup>, <u>A. Khakpour</u><sup>1</sup>, <u>S. Gortschakow</u><sup>1</sup>, <u>D. Uhrlandt</u><sup>1</sup>, <u>St. Franke</u><sup>1</sup>, <u>S. Popov</u><sup>2</sup>, <u>A. Batrakov</u><sup>2</sup>, and <u>K. D. Weltmann</u><sup>1</sup></b></p> <p><sup>1</sup>Leibniz Institute for Plasma Science and Technology, 17489 Greifswald, Germany</p> <p><sup>2</sup>Institute of High Current Electronics, Russian Academy of Sciences, 634055 Tomsk, Russia</p>
<b>11:15</b> <i>L2.2-2</i>	<p><b>STACKED GAS DISCHARGE TUBE (GDT) AS A NEW OVERVOLTAGE PROTECTION DEVICE FOR RADIO BASE STATIONS (RBS)</b></p> <p><b><u>Wolfgang Däumer</u>, <u>Robert Hoffmann</u>, <u>Frank Werner</u></b></p> <p>EPCOS AG, A TDK GROUP COMPANY, Rohrdamm 88, 13629 Berlin, Germany</p>
<b>11:40</b> <i>L2.2-3</i>	<p><b>THE HEMP-TRUSTER: CURRENT DEVELOPMENT AND PERSPECTIVE</b></p> <p><b><u>Ralf Heidemann</u><sup>1</sup>, <u>S. Weis</u><sup>1</sup>, <u>A. Lazurenko</u><sup>1</sup>, <u>H. Stalzer</u><sup>1</sup>, <u>A. Genovese</u><sup>1</sup>, <u>P. Holtmann</u><sup>1</sup>, <u>N. Püttmann</u><sup>2</sup></b></p> <p><sup>1</sup>Thales Deutschland GmbH Business Unit Electron Devices, Ulm, Germany,</p> <p><sup>2</sup>Deutsches Zentrum für Luft- und Raumfahrt e. V. (DLR) - Raumfahrt-Agentur, Bonn, Germany</p>
<b>12:05</b> <i>L2.2-4</i>	<p><b>TENTATIVE DESIGN OF A W-BAND HOLLOW-BEAM KLYSTRON FOR FREQUENCY TRIPLING</b></p> <p><b><u>Jiwei Nie</u>, <u>Heino Henke</u></b></p> <p>Technische Universität Berlin, Sekr. EN-2, Einsteinufer 17, 10587 Berlin, Germany</p>

<b>12:30</b>	<b>Lunch</b>
	<p><b>Session 2.3: Traveling Wave Tubes (TWTs)</b> Chairman: <b>Manfred Thumm</b></p>
<b>13:30</b> <i>L2.3-1</i>	<p><b>170W Ka WIDEBAND SPACE TRAVELING-WAVE TUBE (TWT)</b> <b>Luisa Fernandez Pena, Benoit Michel, <u>Sophie Kohler</u>, Jean Gastaud, Alain Laurent</b> Thales Electron Devices S.A.S, 2 rue Marcel Dassault, 78141 Vélizy-Villacoublay cedex, France</p>
<b>13:55</b> <i>L2.3-2</i>	<p><b>SIMULATION OF TRAVELING-WAVE TUBE MULTI-TONE BEHAVIOR</b> <b><u>Djamschid Safi</u><sup>1</sup>, Philip Birtel<sup>2</sup>, Frédéric André<sup>3</sup>, Arne F. Jacob<sup>1</sup></b> <sup>1</sup>Institut für Hochfrequenztechnik, Technische Universität Hamburg, Hamburg, Germany <sup>2</sup>Thales Electronic Systems, Ulm, Germany <sup>3</sup>Thales Electron Devices, Vélizy-Villacoublay, France</p>
<b>14:20</b> <i>L2.3-3</i>	<p><b>BEAM FOCUSING IN SATCOM TWT INCLUDING THERMAL ELECTRONS</b> <b><u>Philip Birtel</u>, Juergen Wegener, Jean-Francois David</b> Thales Electronic Systems, 89075 Ulm, Germany</p>
<b>14:45</b> <i>L2.3-4</i>	<p><b>ACCURATE FIELD SHAPE MODEL FOR BEAM-WAVE INTERACTION</b> <b>SIMULATION OF FOLDED-WAVEGUIDE TRAVELING-WAVE TUBES</b> <b><u>Sascha Meyne</u><sup>1</sup>, Jean-François David<sup>2</sup>, Arne F. Jacob<sup>1</sup></b> <sup>1</sup>Institut für Hochfrequenztechnik, Technische Universität Hamburg, Hamburg, Germany <sup>2</sup>Thales Electron Devices, Vélizy-Villacoublay, France</p>
<b>15:10</b>	<b>Closing Words: Manfred Thumm, Workshop Co-Chairman</b>
<b>15:20</b>	<b>Coffee Break → End of Workshop: 16:00</b>