

18th International Metrology Congress (CIM 2017)

Paris, France
19 - 21 September 2017

ISBN: 978-1-5108-5840-4

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.

This work is licensed under a Creative Commons Attribution license:
<http://creativecommons.org/licenses/by/2.0/>

You are free to:

Share – copy and redistribute the material in any medium or format.

Adapt – remix, transform, and build upon the material for any purpose, even commercial.

The licensor cannot revoke these freedoms as long as you follow the license terms.

Under the following terms:

You must give appropriate credit, provide a link to the license, and indicate if changes were made.

You may do so in any reasonable manner, but not in any way that suggests the licensor endorses you or your use. The copyright is retained by the corresponding authors.

Printed by Curran Associates, Inc. (2018)

For additional information, please contact EDP Sciences – Web of Conferences
at the address below.

EDP Sciences – Web of Conferences
17, Avenue du Hoggar
Parc d'Activité de Courtabœuf
BP 112
F-91944 Les Ulis Cedex A
France

Phone: +33 (0) 1 69 18 75 75

Fax: +33 (0) 1 69 28 84 91

contact-edps@webofconferences.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

TABLE OF CONTENTS

METROLOGY CUSTOM-MADE ISSUES / METROLOGIE: DES ENJEUX SUR-MESURE

INDUSTRY 4.0 AND METROLOGY CENTRES	1
<i>José Luis Prieto</i>	
MÉTROLOGIE ET PÉDAGOGIE	5
<i>Carole Beaulieu, Marie-Aude Engels</i>	
MANAGEMENT OF REFERENCE MEASUREMENT STANDARDS AS PART OF SMART METROLOGY: GAUGE BLOCKS	13
<i>Jean-Michel Pou, Laurent Leblond, Christophe Dubois</i>	
WHEN 1/10TH OF A MILLIMETER WEIGHS 400 T	19
<i>Jean-Marie Carrez, Geoffroy Emain</i>	
DIGITIZING THE CALIBRATION PROCESS	28
<i>Peter Sherwin</i>	
ECONOMIC FEASIBILITY FOR THE CREATION AND MAINTENANCE OF PHYSICAL QUANTITIES PRIMARY MEASUREMENT STANDARDS	31
<i>Pavel Neyezhnikov, Alexander Prokopov</i>	
SMART METROLOGY: FROM THE METROLOGY OF INSTRUMENTATION TO THE METROLOGY OF DECISIONS	36
<i>Jean-Michel Pou, Laurent Leblond</i>	
METROLOGY IN THE NATIONAL AGRICULTURAL TECHNOLOGY INSTITUTE (INTA)	43
<i>Mario Gomez, Raul Kremer, Cristina Slepetic</i>	
TRAINING IN METROLOGY IN THE NATIONAL AGRICULTURAL TECHNOLOGY INSTITUTE (INTA)	52
<i>Mario Gomez, Raul Kremer, Cristina Slepetic</i>	

FLOW METERING / DEBITMETRIE

PERFORMANCE TESTS OF TWO INSERTION TYPE THERMAL MASS FLOW METERS	58
<i>I Care, J Veau, Ph Genoux</i>	
NUMERICAL INVESTIGATION OF FLOW RATE MEASURE USING VORTEX COUNTING AT LOW REYNOLDS NUMBER	68
<i>Abdelkader Zaaraoui</i>	
EDF R&D INDUSTRIAL FLOW METERING TEST FACILITY : MAIN PAST ACHIEVEMENTS AND INNOVATIVE PLANS FOR THE FUTURE	76
<i>Emmanuel Thibert, José Veau</i>	

SI AND INNOVATIVE THERMAL MEASUREMENTS / SI MESURES THERMIQUES INNOVANTES

MEASUREMENT OF TEMPERATURE AND GAS CONCENTRATION IN A FLAME USING A FTIR IMAGER	82
<i>M. A. Rodríguez, G. Guarnizo, J. Meléndez, F. López, J. M. Mantilla, M. J. Martin, D. del Campo</i>	

ELECTRICAL METROLOGY FOR INDUSTRY / METROLOGIE ELETRIQUE POUR L'INDUSTRIE

EMPIR PROJECT TRACEPQM: TRACEABILITY ROUTES FOR ELECTRICAL POWER QUALITY MEASUREMENTS	85
<i>Vera Nováková Zchovalová, Antoaneta Yovcheva, Javier Diaz de Aguilar, Raul Caballero Santos, Damir Ilic, Jasmina Loncarevic, Bruno Trinchera, Kristian Ellingsberg, Hervé Ndilimabaka, Aristo Philominraj, Andrei Pokatilov, Oliver Power, Bolstjan Voljc, Valter Tarasso, Huseyin Cayci</i>	

MÉTROLOGIE ÉLECTRIQUE BASSE FRÉQUENCE ET RADIOFRÉQUENCE APPLIQUÉE AUX CIRCUITS 3D EMPILÉS	93
<i>Djamel Allal, Alexandra Delvallée, Mohammad Saif Khan</i>	

METROLOGY IN MEDICAL LABORATORIES / METROLOGIE DANS LES LABORATOIRES MEDICAUX

COMPARAISON INTER-LABORATOIRES : ÉTALONNAGE DES INSTRUMENTS VOLUMÉTRIQUES À PISTON.....	96
<i>Boris Geynet</i>	
SURVEILLANCE DES ENCEINTES THERMOSTATIQUES À L'ÉFES : MÉTROLOGIE ET ANALYSE DE RISQUES	100
<i>Jean Marc Reifenberg</i>	
MEASUREMENT UNCERTAINTY IN CALIBRATION AND COMPLIANCY TESTING OF PCR AND QPCR THERMAL CYCLERS	108
<i>Mary Span, Marc Verblakt, Tom Hendriks</i>	

APPLIED THERMAL MEASUREMENTS / MESURES THERMIQUES APPLIQUÉES

MÉTHODE INNOVANTE POUR LA MESURE EN HYGROMÉTRIE DANS L'INDUSTRIE NUCLÉAIRE	116
<i>David Vasty, Guillaume Chevalier</i>	
TOWARDS IMPROVED HUMIDITY MEASUREMENTS AT HIGH TEMPERATURES AND TRANSIENT CONDITIONS	121
<i>Martti Heinonen, Fausto Arpino, Rien Bosma, Laura Cavallarin, Gino Cortellessa, Marco Dell'Isola, Volker Ebert, Vito C. Fernicola, Eric Georgin, Antonio Giannattasio, Richard Hogstrom, Domen Hudoklin, Anders Kentved, Jan Nielsen, Peter Friis Ostergaard, Andrea Peruzzi, Tomi Pietari, Robert-Jan Pouw, Shahin Tabandeh, Wilhelm van Schaik, Steven Wagner</i>	
MEASUREMENT OF THE THERMAL CONDUCTIVITY OF LIQUIDS BY HOT WIRE METHOD: COMPARISON BETWEEN TRANSIENT AND STATIONARY APPROACHES	129
<i>Jean-Pierre Monchau, Nicolas Lalanne, Laurent Ibos</i>	
BEST PRACTICE FOR CHARACTERISATION OF CALIBRATION FURNACES	140
<i>Jacques-Olivier Favreau, Eric Georgin, Benoît Savanier</i>	
HOME-MADE SOFTWARE DEVELOPMENT FOR OPTIMIZING THE UNCERTAINTY EVALUATION OF SILVER FIXED POINT CELL USED FOR PRACTICAL REALIZATION OF ITS-90	146
<i>N. Arifovic, D. Sestan, D. Zvizdic, J-R. Filtz, G. Failliau, S. Cohodarevic, N. Hodzic, A. Ç. Teymur, N. Jandric, S. Simic, D. MacLochlainn, J. Bojkovski, J. Dmovsek</i>	
EXPANSION OF EUROPEAN RESEARCH CAPABILITIES IN HUMIDITY MEASUREMENT	153
<i>Nedžadeta Hodžic, Semir Cohodarevic, Nebojša Jandric, Radek Strnad, Danijel Sestan, Davor Zvizdic, Vito Fernicola, Denis Smorgon, Luigi Iacomini, Slavica Simic, Dubaltach MacLochlainn, Nuray Karaboce, Seda Oguz AYTEKIN, Jovan Bojkovski, Domen Hudoklin, Olgica Petrusova, Tanja Vukicevic</i>	
IMPLEMENTATION OF ETHANOL HEAT PIPE AT CETIAT	157
<i>JO Favreau, E Georgin, B Savanier, A. Merlone</i>	

SI AND NEW ELECTRICAL STANDARDS / SI ET NOUVELLES REFERENCES EN ELECTRICITE

TOWARDS THE PROPAGATION OF AC QUANTUM VOLTAGE STANDARDS, THE EMPIR ACQ-PRO PROJECT	162
<i>Raúl Caballero, Javier Díaz de Aguilar, Ralf Behr, Jonathan Williams, Andrea Sosso, Martin Šíra, Yolanda A. Sanmamed</i>	
ON-SITE BIPM COMPARISON OF QUANTUM HALL EFFECT RESISTANCE STANDARDS AND THEIR SCALING TO OTHER VALUES.....	166
<i>Benjamin Rolland, Pierre Gourmay, Nick Fletcher</i>	
MISE EN PLACE DE LA TRAÇABILITÉ DES MESURES DE PARAMÈTRES S SUR GUIDE D'ONDES AU LNE	171
<i>Djamel Allal, Alexis Litwin</i>	
CALIBRATION FACTOR COMPARISON BETWEEN TÜBITAK UME AND SASO NMCC	174
<i>Erkan Danaci, Murat Celep, Handan Sakarya, Ozlen Tuncel, Khalid Saleh AlDawood, Ibrahim Mohammed AlBoraih, Ahmed Hamad AlJawan</i>	

INTER-LABORATORY MEASUREMENT COMPARISON BETWEEN INRIM AND ESA ON ELECTRICAL QUANTITIES	181
<i>Flavio Galliana, Pier Paolo Capra, Roberto Cerri, Vincenzo D'Elia, Enrico Gasparotto, Luca Roncaglione Tet, Marco Del Moro, Alessandro Cozzani</i>	
10 V, 1 Ω, 10 KΩ HIGH ACCURACY STANDARD SETUP FOR CALIBRATION OF MULTIFUNCTION ELECTRICAL INSTRUMENTS AND FOR INTER-LABORATORY COMPARISONS	185
<i>Pier Paolo Capra, Roberto Cerri, Flavio Galliana, Marco Lanzillotti</i>	
CHARACTERIZATION OF BNC TYPE CALIBRATION STANDARDS.....	189
<i>Murat Celep, Erkan Danaci, Handan Sakarya</i>	
BILATERAL COMPARISON ON TRANSMISSION COEFFICIENT MEASUREMENTS BETWEEN TÛBITAK UME AND SASO NMCC	193
<i>Handan Sakarya, Murat Celep, Ahmed Hamad AlJawan, Ibrahim Mohammed AlBoraih, Khalid AlDawood</i>	
DESIGNING COUPLED COPLANAR WAVEGUIDE STANDARDS FOR ON-WAFER MIXED-MODE S-PARAMETER MEASUREMENT	198
<i>Thi Dao Pham, Djamel Allal, François Ziadé, Eric Bergeault</i>	
PROPRIÉTÉS ÉLECTROMAGNÉTIQUES MATÉRIAUX PAR LA MESURE DES PARAMÈTRES S SUR LIGNE DE TRANSMISSION	202
<i>Michaël Charles, Nesar Ahmad Hewad</i>	

ENERGY NEW AGE / ENERGIE NEW AGE

METROLOGY FOR LNG CUSTODY TRANSFER AND TRANSPORT FUEL APPLICATIONS.....	206
<i>Gerard Nieuwenkamp, Nikola Pelevic, Jianrong Li, Oliver Bùker, Karine Arrhenius, Krister Stolt, Kurt Rasmussen, Johan Kondrup, Rémy Maury, Markus Richter, Rafael Lentner, P. Alberto Albo, Simona Lago, Andrew Brown, Arul Murugan, Bjorn Giesecking, Jordan Tompkins, Peter Eilts, Lennart Klare, Kai Moshammer, Arnas Lucassen, Kianoosh Hadidi</i>	
PARTICULATE CONTENT OF BIOGAS.....	213
<i>Richard Högström, Hannu Vesala, Martti Heinonen</i>	
METROLOGY FOR SUSTAINABLE HYDROGEN ENERGY APPLICATIONS. HYDROGEN QUALITY SPECIFICATION FOR FUEL CELL VEHICLES	216
<i>Andrés Rojo, Dolores Del Campo, Teresa E. Fernández</i>	
A FULL-SCALE THERMO-HYDRAULIC SIMULATOR FOR THE CHARACTERIZATION OF BUILDING HEAT COST ALLOCATION METHODS.....	220
<i>Fabio Saba, Marco Carlo Masoero, Vito Fernicola</i>	
CALIBRATION OF PRIMARY MEASURING CONVERTER BY USING OF MODELING AND EXPERIMENTAL EVALUATION OF THE INITIAL DATA	240
<i>Vladimir Skliarov, Konstantin Muentean, Eugen Timofeev</i>	
MODELING AND EVALUATION OF THE ENERGY SAVING UNDER THE IMPROVEMENTS OF THE CALIBRATORS OF TEMPERATURE USING BY FINITE ELEMENT METHOD.....	243
<i>Vladimir Skliarov, Maxim Zalohin, Svetlana Fil</i>	

METROLOGY 4.0 / METROLOGIE 4.0

THE EUROPEAN METROLOGY CLOUD.....	248
<i>Florian Thiel, Marko Esche, Federico Grasso Toro, Alexander Oppermann, Jan Wetzlich, Daniel Peters</i>	
PRAGMATIC BIG DATA AND SMART MANUFACTURING.....	252
<i>Amine Lies Benhenni</i>	
THE 4.0 METROLOGY AT PSA GROUP. FOR A MORE EFFICIENT INDUSTRIAL METROLOGY	257
<i>Soupala Gries, Laurent Selski</i>	
DO OUR MEASUREMENT DEVICES SPEAK THE SAME LANGUAGE?	261
<i>Michael Radeck</i>	
AVOIDING AI ARMAGEDDON WITH METROLOGICALLY-ORIENTED PSYCHOMETRICS.....	263
<i>Matt Barney, William Fisher</i>	
TOPICAL METROLOGY PROBLEMS IN THE ERA OF CYBER-PHYSICAL SYSTEMS AND INTERNET OF THINGS	269
<i>Ronald Taymanov, Kseniia Sapozhnikova, Anton Ionov</i>	
METROLOGY, PSYCHOMETRICS, AND NEW HORIZONS FOR INNOVATION.....	276
<i>William P. Fisher Jr.</i>	

METROLOGY FOR HEALTH AND BETTER LIFE / METROLOGIE, SANTE ET CONFORT DE VIE

METROLOGY FOR THE PROTECTION OF INDIVIDUALS AND WORKERS IN THE FIELD OF RADIATION	284
<i>François Suder, Sophie Verhaeghe</i>	
METROLOGY IN THERMAL CYCLERS: A NEW APPROACH	288
<i>Robert Cherpin, Didier Bozonnet</i>	
METROLOGY OF THE VITAMIN-D-SYNTHETIC ACTIVITY OF UV LAMPS	291
<i>Irina Terenetskaya, Tetiana Orlova</i>	
FORENSIC METROLOGY: ITS IMPORTANCE AND EVOLUTION	298
<i>Alessandro Ferrero, Veronica Scotti</i>	
DEVELOPMENT OF AN ALTERNATIVE METHOD FOR THE CALIBRATION OF ECG SIMULATORS	303
<i>Roberto Benítez, Romi Uresti, Carolina Solorzano</i>	
METROLOGICAL APPROACH TO MEASUREMENTS OF EMOTIONS BEING EXPECTED IN RESPONSE TO ACOUSTIC IMPACTS	309
<i>Kseniia Sapozhnikova, Roald Taymanov, Iuliia Baksheeva, Svetlana Kostromina, Daria Gnedykh, Irina Danilova</i>	
ANALYSE DE DONNÉES D'ÉTALONNAGE SUR UN PARC D'ANÉMOMÈTRES	316
<i>Sullivan Lechêne, Bertrand Blanquart, Jean-Raymond Fontaine</i>	

METROLOGY FOR A CLEANER ENVIRONMENT / METROLOGIE POUR UN ENVIRONNEMENT PLUS PROPRE

STUDY OF TRAFFIC REAL DRIVING EMISSIONS IN MADRID IN 2015 AND CONCLUSIONS	324
<i>Josefina de la Fuente, Aida Domínguez-Sáez, Manuel Pujadas</i>	
NEW OUTLOOK IN BOD MEASUREMENT AND BIOPROCESS MANAGEMENT: THE ENVERDI® KIT	334
<i>Mathieu Muller, Solenn Bellaton, Alison Yoris, Sabrina Guérin-Rechdaoui, Laurent Clousier, Vincent Rocher</i>	
PRODUCTION AND VALIDATION OF PRIMARY CARBON DIOXIDE REFERENCE STANDARDS AT INRIM	344
<i>Francesca Rolle, Francesca Pennecchi, Enrica Pessana, Michela Sega</i>	
VERIFICATION OF ¹³⁷CS DETERMINATION IN SEAWATER USING CU-HEXACYANOFERRATES FILTERS	348
<i>Suputra Visetpotjanakit, Chitsanupong Khrautongkieo</i>	

METROLOGY CONCEPTS AND UNCERTAINTY / INCERTITUDES ET CONCEPTS METROLOGIQUES

LES COMPARAISONS INTERLABORATOIRES SONT INCONTOURNABLES !	351
<i>David Lelong</i>	
METHOD OF THE DRIFT: MORE THAN JUST AN OPTIMIZATION METHOD	353
<i>Olivier Demars, Christophe Dubois</i>	
ANALYSIS OF INTERLABORATORY COMPARISON WHEN THE MEASUREMENTS ARE NOT NORMALLY DISTRIBUTED	359
<i>Alexandre Allard, Soraya Amarouche</i>	
TOWARDS AN ALIGNMENT OF ENGINEERING AND PSYCHOMETRIC APPROACHES TO UNCERTAINTY IN MEASUREMENT: CONSEQUENCES FOR THE FUTURE	373
<i>William P. Fisher Jr., A. Jackson Stenner</i>	
THE USE OF AUTOREGRESSION MODEL FOR MAINTAINING THE NATIONAL TIME SCALE OF UKRAINE	382
<i>Pavel Neyezhnikov, Eduard Koretskyi</i>	
LA C2I OU RENDRE L'ÉTALONNAGE CONDITIONNEL	386
<i>Pascal Coquet</i>	
RECONSTRUCTION OF A SIGNAL FROM TIME-AVERAGED DATA	390
<i>Alistair B Forbes</i>	

NANO: SMALL IS BEAUTIFUL

COMPUTATIONAL NANOMETROLOGY OF NANOSTRUCTURES: THE CHALLENGE OF SPATIAL COMPLEXITY	394
<i>Vassilios Constantoudis, Kostas Poullos, Manolis Chatzigeorgiou, George Papavieros</i>	

DYNAMICS OF PRESSURE / LES DYNAMIQUES DE LA PRESSION

TRACEABLE CALIBRATION OF AUTOMATIC WEIGHING INSTRUMENTS IN DYNAMIC OPERATION	402
<i>Matej Grum</i>	
DEVELOPMENT OF A DYNAMIC STANDARD OF PRESSURE	407
<i>Alberto J. Díaz Tey, Georges Govaere Vicarioli, José E. Marín Rodríguez</i>	
DYNAMIC PRESSURE TRANSDUCER CALIBRATION – TRACEABLE?	415
<i>Thomas Platte, Martin Iwanczyk, Michael Mende</i>	
THE OBTAINING OF THE LABEL RELIABILITY MEASURE FOR GRAVITY MEASUREMENT BY THE LSBB UNDERGROUND LAB	419
<i>Camille Gonnet, Claire Barra, Jean-Baptiste Decitre, Séverine Rosat, Daniel Boyer</i>	
ETALONNAGE DE MASSES "SPÉCIALES", COMMENT RÉPONDRE AUX BESOINS DES CLIENTS ?	422
<i>Laure Domenech, David Benhamou</i>	
ULTRASONS ET VIS INSTRUMENTÉES POUR SÉCURISER VOS ASSEMBLAGES BOULONNÉS	426
<i>Jean-Philippe Godin</i>	
GPU-BASED RAYTRACING FOR ACCELERATING DEFLECTOMETRIC ASPHERE MEASUREMENTS	434
<i>Alexander Puschke, Marc Fischer, Marcus Petz, Rainer Tutsch</i>	
A NEW TYPE OF COMPACT PRECISION AMPLIFIER FOR STRAIN GAUGE BASED TRANSDUCERS	438
<i>André Schäfer</i>	
FORCE CALIBRATION WITH BUILD UP SYSTEMS	442
<i>Thomas Kleckers, Andre Schaefer</i>	

OPTICAL AGILE MEASUREMENT / FLEXIBILITE DES MESURES OPTIQUES

DEVELOPMENT OF OPTICAL METHODS FOR SURFACE AND VOLUMETRIC MEASUREMENTS	447
<i>Guillaume Gomit, Lionel Thomas, Ludovic Chatellier, Damien Calluud, Laurent David, Benoit Tremblais, Majdi Khoudeir, Benjamin Bringier, Jean Christophe Dupré, Pierre Morandi, Pascal Dounalin, Fabrice Bremand</i>	
ROBOT SOLUTIONS FOR AUTOMATED 3D SURFACE MEASUREMENT IN PRODUCTION	459
<i>Reinhard Danzl, Thomas Lankmair, Anne Calvez, Franz Helmi</i>	
FREE FORM DEFECTS MEASUREMENT BY INTERFEROMETRY	466
<i>Said Meguellati</i>	
PERFORMANCE OF A LOW COST LASER SCANNER USING A GRANITE SQUARE GAUGE	469
<i>Antonio Piratelli-Filho, Nabil Anwer, Charyar Mehdi Souzani, Rosenda Valdes Arencibia, Lucas Peres dos Reis</i>	

CHEMISTRY / CHIMIE

THE CONTACT SURFACE OF OAK CHIPS / WINE DETERMINED BY IMAGE ANALYSIS	473
<i>Igor Chiciuc, Andrei Chiciuc</i>	
FEATURES AND PROBLEMS OF METROLOGICAL TRACEABILITY OF GAS MIXTURES USING UV ABSORPTION, FTIR, AND CRD SPECTROSCOPY	478
<i>Leonid Konopelko, Vitaly Beloborodov, Ian Chubchenko, Dmitry Rumiantsev</i>	

OPTICAL MEASUREMENTS / MESURES OPTIQUES

NEW OPTICAL POWER SENSORS USING PYROLYTIC GRAPHITE481
Patrick Pinot, Zaccaria Silvestri

Author Index