

# **2009 1st International Conference on Advancements in Nuclear Instrumentation, Measurement Methods and their Applications**

## **(ANIMMA 2009)**

**Marseille, France  
7-10 June 2009**



IEEE Catalog Number: CFP0924I-PRT  
ISBN: 978-1-4244-5207-1

## TABLE OF CONTENTS

### **SESSION 1.1 - MEASUREMENT AND DETECTION METHODS IN FUNDAMENTAL PHYSICS (NUCLEAR PHYSICS AND PHYSICS OF PARTICLES)**

#21 - ATLAS Tile Calorimeter Commissioning and Performance .....	1
<i>J. Abdallah</i>	
#48 - Online Radiation Dose Measurement System for ATLAS Experiment .....	9
<i>I. Mandić, V. Cindro, A. Gorišek, G. Kramberger, M. Mikuž, J. Hartert, J. Bronner, S. Franz</i>	
#214 - Developments on Software Tools for Data Acquisition and Numerical Simulation for Gamma-Ray Scanning .....	16
<i>R. Alami, A. Ouardi, H. Laghyam, S. Lhaiba, B. Bensitel, D. Benchekroun</i>	
#42 - New Developments of Scintillating Crystal-Based Hybrid Single Photon Detectors (X-HPDs) for Charged Particle and Neutrino Detection Applications .....	22
<i>I. Al Samarai, J. Bustos, B. Combettes, A.-G. Dehaine, G. Hallewell</i>	
#33 - Conception and Validation Software Tools for the Level 0 Muon Trigger of LHCb .....	29
<i>E. Aslanides, J. P. Cachemiche, J. Cogan, P.-Y. Duval, F. Hachon, R. LeGac, O. Leroy, P.-L. Liotard, F. Marin, A. Tsaregorodtsev</i>	

### **SESSION 1.2 - INSTRUMENTATION AND MEASUREMENT METHODS FOR EXPERIMENTAL NUCLEAR REACTORS**

#3 - Invited Lecture: Advanced Instrumentation for Experiments in Material Tests Reactors .....	37
<i>D. Iracane, J.-F. Villard</i>	
#112 - New Sensors for the Advanced Test Reactor National Scientific User Facility .....	45
<i>J. L. Rempe, D. L. Knudson, K. G. Condie, J. E. Daw, H. Ban, B. Fox, G. E. Kohse</i>	
#104 - Measurement and Evaluation of the Irradiation Test Parameters for a Specimen in a HANARO Material Irradiation Capsule .....	52
<i>K. N. Choo, B. G. Kim, M. S. Cho, Y. K. Kim, J. J. Ha</i>	
#239 - The Beam of Fission Neutrons at FRM II and its Application in Medicine, Biology, and Materials Characterisation .....	57
<i>F. M. Wagner, H. Breitkreutz, T. Bücherl, B. Loepfer-Kabasakal, W. Petry</i>	
#227 - Recent Developments on Micrometric Fission Chambers for High Neutron Fluxes .....	61
<i>A. Letourneau, S. Bréaud, O. Bringer, S. Chabod, E. Dupont, F. Marie, L. Oriol, S. Panebianco, J. C. Toussaint, C. Veyssiére</i>	
#133 - Invited Lecture: Pressure Measurement Based on Thermocouples .....	69
<i>K. Thomsen</i>	
#137 - Neutron and Gamma Spectrometry in the Research Reactor LR-0 .....	76
<i>S. M. Zaritskiy, B. Ošmera, F. Cvachovec, M. Mařík, S. Pošta, V. Rypar, D. Riazanov, V. Lichadeev, A. Kolros, Z. Matěj</i>	
#125 - Research Activities in Fission Chamber Modeling in Support of the Nuclear Energy Industry .....	83
<i>C. Jamme, P. Filliatre, B. Geslot, L. Oriol, F. Berhouet, J.-F. Villard, L. Vermeeren</i>	
#237 - Neutron Commissioning in the New CABRI Water Loop Facility .....	88
<i>G. Ritter, O. Guéton, F. Mellier, D. Beretz</i>	
# 102 - Calculation of Kinetic Parameters of Caliban Metallic Core Experimental Reactor from Stochastic Neutron Measurements .....	93
<i>P. Casoli, N. Authier, J. Baud</i>	
#221 - Application of the Modified Source Multiplication (MSM) Technique to Subcritical Reactivity Worth Measurements in Thermal and Fast Reactor Systems .....	100
<i>P. Blaise, F. Mellier, P. Fougeras</i>	
#226 - Monitoring Fast Neutron Sources for Accelerator Driven Subcritical Reactor Experiments .....	108
<i>G. Ban, P. Bergonzo, A. Billebaud, R. Brissot, S. Chabod, P. Dessagne, J. M. Fontbonne, M. Kerveno, C. Le Brun, F. R. Lecolley, J. F. Lecolley, J. L. Lecouey, E. Liatard, N. Marie, C. Mer, A. Nuttin, M. Pomorski, J. C. Steckmeyer, H.-E. Thyébault, D. Tromson</i>	
#240 - Invited Lecture: Evaluation of In-Pile Neutron Signals During the Start-up Phase of the FRM II Compact Core Reactor .....	113
<i>A. Röhrlmoser</i>	

## **SESSION 1.3 - NUCLEAR INSTRUMENTATION AND MEASUREMENTS FOR SAFETY, ENVIRONMENT AND HEALTH APPLICATIONS**

#271 - Calibration and Fluctuation of the Secular Frequency Peak Amplitude Versus Initial Condition Distribution of the Ion Cloud Confined into a Three-Dimensional Quadrupole Ion Trap using a Fourier Transform Operating Mode and a Steady Ion Flow Injection Mode .....	120
<i>A. Janulyte, J. Andre, M. Carette, M. Mercury, C. Reynard, Y. Zerega</i>	
#249 - Depth Determination of Entrained Caesium-137 and Cobalt-60 Sources using Scatter Peak Data .....	127
<i>J. C. Adams, M. Mellor, M. J. Joyce</i>	
#54 - Precision Environmental Radiation Monitoring System.....	134
<i>V. Popov, P. Degtiarenko</i>	

## **SESSION 2.1 - MEASUREMENT AND DETECTION METHODS IN FUNDAMENTAL PHYSICS (FUSION AND PLASMA PHYSICS)**

#5 - Invited Lecture: Towards Diagnostics for a Fusion Reactor .....	141
<i>A. E. Costley</i>	
#236 - On the Operational Specifications and Associated R&D for the VIS/IR Diagnostic for ITER .....	151
<i>R. Reichle, E. de la Cal, Y. Corre, M. Joanny, A. Manzanares, J. L. de Pablos, S. Salasca, J.-M. Travere</i>	
#116 - Development of a Magnetic Diagnostic Suitable for the ITER Radiation Environment.....	158
<i>P. Moreau, I. Bolshakova, B. Brichard, G. Chitarin, R. Delogu, I. Duran, A. Encheva, Y. Fournier, A. Galo, A. Le-Luyer, J. B. Lister, P. Malard, J. M. Moret, P. Pastor, S. Peruzzo, J. Romero, D. Testa, M. Toussaint, G. Vayakis, R. Vila</i>	
#59 - Microwave Reflectrometry: A Sensitive Diagnostic for Electron Density Property Measurement in Tore-Supra Fusion Plasmas.....	166
<i>R. Sabot, C. Bottreau, A. Casati, F. Clairet, T. Gerbaud, J. C. Giacalone, O. Gurcan, P. Hennequin, S. Heuraux, C. Honoré, D. Molina, M. Schubert, L. Vermare, A. Macor, C. Nguyen, E. Trier</i>	
#26 - Neutron Spectroscopy by Means of Artificial Diamond Detectors using a Remote Read Out Scheme .....	174
<i>M. Angelone, G. Aielli, S. Almaviva, R. Cardarelli, D. Lattanzi, M. Marinelli, E. Milani, M. Pillon, G. Prestopino, R. Santonico, C. Verona, G. Verona-Rinati</i>	
#39 - Challenges for Embedded Electronics in Systems Used in Future Facilities Dedicated to International Physics Programs .....	181
<i>O. Flament, J. Baggio, S. Bazzoli, S. Girard, J. Raimbourg, J. L. Leray</i>	
#68 - Invited Lecture: High Resolution Neutron Imaging for Inertial Confinement Fusion Experiments .....	186
<i>I. Thfoin, O. Landoas, T. Caillaud, L. Disdier, J. L. Bourgade, B. Rossé, T. C. Sangster, V. Y. Glebov</i>	

## **SESSION 2.2 - INSTRUMENTATION AND MEASUREMENT METHODS FOR NUCLEAR FUEL CYCLE**

#146 - sIGALE, a New Code for Automatically Determining Radionuclide Activities using CdZnTe Spectrometry .....	192
<i>I. Espagnon, A.-C. Simon, F. Lamadie, C. Mahé</i>	
#264 - Application of Collision Reaction-Cell Based MC-ICPMS to In-Situ Interferences Resolution for Elemental and Isotopic Ratios Measurements of Nuclear Fuel Samples .....	199
<i>A. Nonell, H. Isnard, M. Granet, J. Moureau, G. Favre, F. Chartier</i>	
#155 - Determination of Actinides Isotopic Composition: Performances of the IGA Code on Plutonium Spectra According to the Experimental Setup .....	204
<i>A.-C. Simon, F. Carrel, I. Espagnon, M. Lemercier, A. Pluquet</i>	
#107 - Use of Gamma Spectrometry for Measuring the Fission Product Releases during a Simulated PWR Severe Accident: Application to the VERDON Experimental Program.....	212
<i>G. Ducros, S. Bernard, M. P. Ferroud-Plattet, O. Ichim</i>	
#149 - Invited Lecture: Application of X-Ray Computer Tomography for Observing the Central Void Formations and the Fuel Pin Deformations of Irradiated FBR Fuel Assemblies.....	219
<i>K. Katsuyama, T. Nagamine, H. Furuya</i>	
#242 - The Design, Build and Test of a Digital Analyser for Mixed Radiation Fields.....	226
<i>M. J. Joyce, M. D. Aspinall, F. D. Cave, K. Georgopoulos, Z. Jarrah</i>	

#138 - Diamond Detectors for Alpha Monitoring In Corrosive Media for Nuclear Waste Activity Monitoring.....	232
<i>C. Mer, D. Tromson, J. de Sanoit, M. Pomorski, P. Bergonzo</i>	
#145 - Feedback from the Operation of the ISOCS in Support to the Plutonium Facility Decommissioning Project at the MARCOULE UP1 Reprocessing Plant (France) and Possible Gain for New Projects with New CANBERRA Systems.....	236
<i>S. Dogny, H. Toubon</i>	
#241 - Measurement of Plutonium in Large Concrete Radioactive Waste Packages by Photon Activation Analysis.....	241
<i>F. Carrel, M. Agelou, M. Gmar, F. Lainé, B. Poumarède, B. Rattoni</i>	
#148 - A Methodology for Evaluating the Performance of Software, using Gamma Spectrometry, for Determining the Isotopic Composition of Plutonium .....	248
<i>G. Granier, B. Benezech, J. B. Porcher, A.-C. Simon, N. Pepin, E. Payan, C. Veyer</i>	
#153 - Invited Lecture: Improvement of the Matrix Effect Compensation in Active Neutron Measurement by Simulated Annealing Algorithm (June 2009).....	258
<i>A.-C. Raoux, J. Lordinon, A. Mariani, C. Passard</i>	

### **SESSION 2.3 - SAFEGUARDS MEASUREMENTS AND HOMELAND SECURITY**

#1 - Invited Lecture: Challenges for Interdiction of Nuclear Threats at Borders.....	267
<i>R. T. Kouzes</i>	
#157 - A Background-Free Direction-Sensitive Neutron Detector.....	270
<i>S. Ahlen, D. Dujmic, P. Fisher, A. Inglis, H. Tomita, H. Wellesstein</i>	
#161 - Is the Holy Grail Plastic? Radiation Identification from Plastic Scintillators.....	276
<i>L. J. C. Butchins, J. M. Gosling, M. R. W. Hogbin, D. C. Jones, R. J. Lacey, J. G. Stearn</i>	
#176 - Reactor Neutrino Detection for Non Proliferation with the NUCIFER Experiment .....	280
<i>A. Porta, V. M. Bui, M. Cribier, M. Fallot, M. Fechner, L. Giot, T. Lasserre, A. Letourneau, D. Lhuillier, J. Martino, G. Mention, D. Motta, T. A. Mueller, R. Queval, J. L. Sida, C. Varignon, F. Yermia</i>	
#277 - Environmental Security of the Adriatic Coastal Sea Floor .....	288
<i>V. Valkovic, D. Matika, R. Kollar, J. Obhodas, D. Sudac</i>	
#162 - Neutron Detection with Water Cerenkov Based Detectors .....	296
<i>S. Dazeley, A. Bernstein, N. Bowden, D. Carr, S. Ouedraogo, R. Svoboda, M. Sweany, M. Tripathi</i>	
#165 - Measurement of Reactor Neutrinos and Backgrounds at the Experimental Fast Reactor JOYO .....	300
<i>H. Furuta, M. Kuze, M. Ishitsuka, T. Konno, F. Suekane, H. Tabata, Y. Sakamoto, C. Ito, M. Takamatsu</i>	
#177 - Invited Lecture: Nuclear Resonance Fluorescence for Materials Assay.....	308
<i>B. Quiter, B. Ludewigt, V. Mozin, S. G. Prussin</i>	
#175 - Cosmic Ray Radiography with RPC for High-Z Material Identification .....	313
<i>A. Piccotti, R. Arnaldi, L. Bianchi, F. Bossu', E. Chiavassa, P. Cortese, G. Dellacasa, N. De Marco, A. Ferretti, M. Gagliardi, M. Gallio, R. Gemme, G. Luparello, P. Mereu, A. Musso, C. Oppedisano, E. Scomparin, E. Vercellin</i>	
#259 - An Integrated Approach for Determining Plutonium Mass in Spent Fuel Assemblies with Nondestructive Assay .....	317
<i>M. T. Swinhoe, S. J. Tobin, M. L. Fensin, H. O. Menlove</i>	
#245 - Environmental Monitoring for Safeguards using $k_0$ -standardised Neutron Activation Analysis .....	322
<i>P. Vermaercke, F. F. Arboccò, L. Sneyers, A. Leal, M. Bruggeman</i>	
#248 - Advances Towards Readily Deployable Antineutrino Detectors for Reactor Monitoring and Safeguards .....	327
<i>B. Cabrera-Palmer, D. Reyna, L. Sadler, J. Lund, S. Kiff, N. Bowden, A. Bernstein, S. Dazeley</i>	
#181 - Invited Lecture: The IAEA Universal Nondestructive Assay Data Acquisition Platform (UNAP) .....	334
<i>M. R. Sweet, M. M. Pickrell, M. R. Newell, R. B. Williams, R. B. Merl, C. J. Carroll, D. G. Pelowitz</i>	

### **SESSION 2.4 - INSTRUMENTATION AND MEASUREMENT METHODS FOR POWER NUCLEAR REACTORS**

#77 - Invited Lecture: Generation IV Nuclear Reactors: R&D Program to Improve Sodium-Cooled Systems Inspection.....	340
<i>F. Baqué, G. Rodriguez, N. Jardin, J. M. Carpreau, J.-M. Augem, J. Sibilo</i>	

<b>#76 - Raman Distributed Sensor System for Temperature Monitoring and Leak Detection in Sodium Circuits of FBR</b>	350
<i>C. Pandian, M. Kasinathan, S. Sosamma, C. B. Rao, T. Jayakumar, N. Murali, V. Paunikar, S. Kumar, K. K. Rajan, B. Raj</i>	
<b>#286 - Aerosol Characterization and Measurement Techniques Towards SFR Safety Studies</b>	354
<i>R. Baskaran, V. Subramanian, J. Misra, R. Indira, P. Chellapandi, B. Raj</i>	
<b>#284 - Intelligent Fiber Optic Pressure Sensor for Measurements in Extreme Conditions</b>	363
<i>G. Y. Buimistriuc, A. M. Rogov</i>	
<b>#90 - Ultrasonic Method for Nuclear Fuel Rods Pressure and Gas Composition Released Measurement</b>	368
<i>E. Rosenkrantz, J.-Y. Ferrandis, G. Leveque, P. Thevenin, D. Baron</i>	
<b>#83 - Sodium Fast Reactor Power Monitoring using <math>^{20}\text{F}</math> Tagging Agent</b>	373
<i>R. Coulon, S. Normand, G. Ban, V. Dumarcher, H. P. Brau, L. Barbot, T. Domenech, V. Kondrasovs, G. Corre, A. M. Frelin, T. Montagu, T. Dautremer, E. Barat</i>	
<b>#81 - Application of Integral Ex-Core and Differential In-Core Neutron Measurements for Adjustment of Fuel Burn-Up Distributions in VVER-1000</b>	381
<i>P. G. Borodkin, G. I. Borodkin, N. N. Khrennikov</i>	
<b>#82 - The Application of Mathematical Modeling for Commercial Nuclear Instrument Design, Development, and Calibration</b>	387
<i>F. L. Bronson, R. McElroy, S. Philips, W. Russ, S. Croft</i>	
<b>#262 - Full Autonomous Monitoring Tools inside Nuclear Reactor Building</b>	395
<i>A. Giraud, J. Veau</i>	

### **SESSION 3.1 - NUCLEAR INSTRUMENTATION AND MEASUREMENTS FOR SAFETY, ENVIRONMENT AND HEALTH APPLICATIONS**

<b>#190 - A Low-Noise Front-End Readout Chip Integrated with a High-Resolution TDC for APD-Based Small-Animal PET</b>	404
<i>W. Gao, X. Fang, C. Hu-Guo, D. Brasse, B. Humbert, Y. Hu</i>	
<b>#251 - Imaging for Carbon Translocation to a Fruit of Tomato with Carbon-11 Labeled Carbon Dioxide and Positron Emission Tomography</b>	410
<i>N. Kawachi, K. Kikuchi, N. Suzui, S. Ishii, S. Fujimaki, N. S. Ishioka, H. Watanabe</i>	
<b>#194 - Monte Carlo Simulations of Prompt-gamma Emission during Carbon Ion Irradiation</b>	415
<i>F. Le Fouher, M. Bajard, M. Chevallier, D. Dauvergne, N. Freud, P. Henriet, S. Karkar, J. M. Létang, R. Plescak, C. Ray, D. Schardt, E. Testa, M. Testa</i>	
<b>#196 - Invited Lecture: Multichannel Dosimeter and <math>\alpha\text{-Al}_2\text{O}_3:\text{C}</math> Optically Stimulated Luminescence (OSL) Fiber Sensors for Use in Radiation Therapy – Evaluation with Photon Beams</b>	420
<i>S. Magne, L. de Carlan, J. M. Bordy, A. Isambert, A. Bridier, P. Ferdinand</i>	

### **SESSION 3.2 - ASSOCIATED TRAINING AND EDUCATION ACTIVITIES**

<b>#209 - Education and Training on Nuclear Security in Greece</b>	430
<i>C. N. Pafilis, V. Kamenopoulou, A. Maltezos, T. E. Matikas, S. Seferlis, P. Dimitriou</i>	

### **SESSION 3.3 - NUCLEAR INSTRUMENTATION FOR SAFEGUARDS AND NUCLEAR FUEL CYCLE**

<b>#58 - Measurement of Activity in Large Packages of Radioactive Waste, Taking into Account Heterogeneities in Mass and Activity</b>	434
<i>B. Rottner</i>	
<b>#169 - Improved Verification Methods for Safeguards Verifications at Enrichment Plants</b>	440
<i>A. Lebrun, S. C. Kane, L. Bourva, S. Poirier, N. E. Loghin, D. Langlands</i>	
<b>#166 - Advanced Enrichment Monitoring Technology Based on Transmission Measurements with X-Ray Source and NaI(Tl) Spectrometer</b>	448
<i>K. D. Janakiev, B. D. Boyer, J. M. Goda, T. R. Hill, C. E. Moss, H. Nguyen, R. F. Parker, M. T. Paffett, B. P. Nolen, M. T. Swinhoe</i>	

## **POSTER SESSION 1.1 - MEASUREMENT AND DETECTION METHODS IN FUNDAMENTAL PHYSICS (NUCLEAR PHYSICS AND PARTICLE PHYSICS)**

#22 - TAToO, an Implementation of an Optical Follow Up for ANTARES Events.....	453
<i>M. Ageron</i>	
#32 - Reference Decay Data, Tools and Applications.....	455
<i>C. Dulieu, M. M. Bé, V. Chisté, X. Mougeot</i>	
#44 - A Novel Digital Pulse-Shape Analysis for High-Resolution Position-Sensitive Gamma-Ray Spectroscopy .....	459
<i>J. H. Lee, H. S. Jung, H. Y. Cho, Y. K. Kwon, C. S. Lee</i>	
#45 - Development of a High-Efficiency $4\pi\beta(\text{LS})-\gamma$ Coincidence System for Direct Measurements of Activity in Radioactive Decay .....	464
<i>K. B. Lee, J. M. Lee, T. S. Park, S. H. Lee</i>	
#49 - Optimal Digital Filtering in Gamma-Ray Spectroscopy .....	468
<i>A. Messai, A. Nour, I. Abdellani</i>	
#212 - The First ATLAS Pixel Detector Full-System Test Setup.....	474
<i>G. Hallewell, D. Hoffmann, O. Pisano, A. Rozanov, V. Vacek</i>	
#213 - The ATLAS Calorimeter Trigger Commissioning using Cosmic Ray Data .....	479
<i>N. Kanaya</i>	

## **POSTER SESSION 1.2 - INSTRUMENTATION AND MEASUREMENT METHODS FOR EXPERIMENTAL NUCLEAR REACTORS**

#63 - Measurement of the Thermal Absorption Cross Section in Lucite Using Fermi Age Theory .....	484
<i>R. G. Sanchez, D. K. Hayes, T. J. Grove, J. D. Hutchinson, J. J. Ong, F. K. Tovesson</i>	
#94 - Experimental Measurements at the MASURCA Facility .....	491
<i>W. Assal, J. C. Bosq, F. Mellier</i>	
#97 - Final Qualification of an Industrial Wide Range Neutron Instrumentation in the OSIRIS MTR Reactor .....	500
<i>L. Barbot, S. Normand, P. Pasdeloup, B. Lescop</i>	
#98 - Neutronic Design of Instrumentation for Thermal Effects Measurement on VR-1 Reactor .....	504
<i>T. Bily, L. Sklenka</i>	
#99 - Temperature Monitoring of the FUTURIX MI Irradiation Experiment in PHENIX .....	512
<i>J. M. Bonnerot, J. M. Esclene, A. Ravenet, R. Garrigue, S. Pillon</i>	
#100 - Study of a New Automatic Reactor Power Control for the TRIGA Mark II Reactor at University of Pavia.....	517
<i>A. B. di Tiglione, A. Cammi, M. A. Gadan, G. Magratti, V. Memoli</i>	
#103 - Fibre Optics for Metrology in Nuclear Research Reactors: Application to Dimensional Measurements .....	522
<i>G. Cheymol, B. Brichard, J.-F. Villard</i>	
#105 - Activity Measurement $^{103}\text{Rh}^m$ X-Ray Emitting Radio-Isotope: Application to Experimental Programs Carried Out in the CEA Critical Facilities .....	530
<i>C. Domergue, D. Beretz, C. Destouches, J.-M. Girard, H. Philibert, J. Plagnard</i>	
#109 - Manufacturing and Supply of a Mercury Cooled Rotary Uranium Target for the GELINA Accelerator Facility of IRMM .....	536
<i>M. Febvre</i>	
#110 - Monitoring the Fast Neutrons in a High Flux: The Case for $^{242}\text{Pu}$ Fission Chambers .....	541
<i>P. Filliatre, C. Jammes, L. Oriol, B. Geslot, L. Vermeeren</i>	
#111 - Development and Manufacturing of Special Fission Chambers for In-Core Measurement Requirements in Nuclear Reactors.....	545
<i>B. Geslot, F. Berhouet, L. Oriol, S. Bréaud, C. Jammes, P. Filliatre, J.-F. Villard</i>	
#115 - Braze Refractory Metals Used in High-Temperature Nuclear Instrumentation .....	549
<i>A. J. Palmer, C. J. Woolstenhulme</i>	
#120 - Noise Thermometry for Nuclear Applications .....	554
<i>A. L. Legrand, J.-F. Villard</i>	
#121 - New Temperature Monitoring Devices for High Temperature Irradiation Experiments in the High Flux Reactor Petten.....	559
<i>M. Laurie, M. A. Füetterer, J. M. Lapetite, S. Fourrez, R. Morice</i>	
#123 - Design and Realization of a Measurement System of Cold Neutron Speeds by TOF method .....	566
<i>N. Khentout, B. Meftah</i>	

<b>#126 - Characterization of a Fast to Thermal Neutron Spectrum Converter on PROSPERO Reactor</b>	574
<i>X. Jacquet, N. Authier, P. Casoli, S. Combacon, Y. Calzavarra</i>	
<b>#127 - An Innovating Active Neutronics Interrogation and Time-Dependent Method for Calibrating Fission Chambers in the Dedicated CELINA Facility using a Pulsed Neutron Generator</b>	580
<i>J.-P. Hudelot, J.-M. Girard</i>	
<b>#130 - Interpretation of In-Pile Oscillation Experiments in the MINERVE Facility for the Improvement of Fission Product Cross Sections</b>	587
<i>A. Gruel, P. Leconte, D. Bernard</i>	
<b>#134 - In Core Fuel Performance and Material Characterisation in the Halden Reactor</b>	591
<i>R. Van Nieuwenhove, S. Solstad</i>	
<b>#135 - Experimental Verification of the Fission Chamber Gamma Signal Suppression by the Campbelling Mode</b>	598
<i>L. Vermeeren, M. Wéber, L. Oriol, S. Bréaud, P. Filliatre, B. Geslot, C. Jammes, S. Normand, B. Lescop</i>	
<b>#136 - Innovations for In-Pile Measurements in the Framework of the CEA-SCK CEN Joint Instrumentation Laboratory</b>	606
<i>J.-F. Villard, M. Schyns</i>	
<b>#218 - Improvements in the Modelling of Micro Fission Chambers Operated in Current Mode</b>	614
<i>S. Chabod, A. Letourneau</i>	
<b>#222 - 3-Dimensional Coupled Neutronic and Thermohydraulic Calculations for a Compact Core Combining MCNPX and CFX</b>	620
<i>H. Breitkreutz, A. Röhrmoser, W. Petry</i>	
<b>#223 - Acoustic Sensor for In-Pile Fuel Rod Fission Gas Release Measurements</b>	625
<i>D. Fourmentel, J.-F. Villard, J.-Y. Ferrandis, F. Augereau, E. Rosenkrantz, M. Dierckx</i>	
<b>#228 - Oscillation Experiments Techniques in CEA MINERVE Pool Experimental Reactor</b>	630
<i>M. Antony, J. Di Salvo, A. Pepino, J. C. Bosq, D. Bernard, P. Leconte, J.-P. Hudelot, A. Lyoussi</i>	
<b>#231 - Improved SAFARI-1 Research Reactor Irradiation Position Modeling in OSCAR-3 Code System</b>	636
<i>L. E. Moloko, M. G. A. H. Belal</i>	
<b>#233 - A Neutronic Evaluation of VHTR and LS-VHTR</b>	643
<i>F. C. Silva, C. Pereira, A. L. Costa, C. A. M. Silva, M. A. F. Veloso</i>	
<b>#235 - Valuation of Power Oscillations in a BWR after Control Rod Banks Withdrawal Events</b>	650
<i>A. L. Costa, C. Pereira, F. D'Auria, C. A. M. Silva, M. A. F. Veloso</i>	
<b>#238 - The BR1 Reactor: A Versatile Irradiation Facility for Fundamental Research and Industrial Applications</b>	656
<i>J. Wagemans, G. Vittiglio, E. Malambu, H. A. Abderrahim</i>	
<b>#268 - The MADERE Radio-Activity Measurement Plateform: Developments for a Better Addressing to the Experimental Needs</b>	660
<i>J.-M. Girard, H. Philibert, S. Testanière, C. Domergue, D. Beret</i>	
<b>#269 - Accident Simulation Testing in the HFR</b>	668
<i>K. Bakker, S. de Groot, R. K. Mutnuru</i>	
<b>#283 - Methods and Instrumentation for Investigating Hall Sensors during their Irradiation in Nuclear Research Reactors</b>	673
<i>I. Bolshakova, V. Chekanov, I. Duran, R. Holyaka, R. Konopleva, S. Kulikov, C. Leroy, E. Makido, A. Marusenkov, P. Moreau, I. Nazarkin, F. Shurygin, J. Stockel, G. Vayakis, V. Yerashok</i>	
<b>#285 - Changing of the RPS Annunciators to Improve the Human Machine Interface (May 2009)</b>	678
<i>A. E. Velasco</i>	
<b>#287 - Neutron Dosimetry and 3D Neutron Transport Calculations in the HFR Petten: A Powerful Tool in Detailed Neutron Monitoring and Damage Analysis</b>	683
<i>R. K. Mutnuru, D. J. Ketema, S. C. van der Marck</i>	

### **POSTER SESSION 1.3 - NUCLEAR INSTRUMENTATION AND MEASUREMENTS FOR SAFETY, ENVIRONMENT AND HEALTH APPLICATIONS**

<b>#188 - New Techniques of Low Level Environmental Radiation Monitoring at JLab</b>	687
<i>P. Degtiarenko, V. Popov</i>	
<b>#189 - Germanium Detector Calibration According to the Standard NF M 60-810 without using Radioactive Sources</b>	692
<i>J. M. Duda, J. Chazalet, Y. Tauvel, F. Poulet, I. Garell, Y. Losset, L. Vichot</i>	
<b>#191 - LORINE: Neutron Emission LOcatoR by SOI Detectors</b>	698
<i>H. Hamrita, V. Kondrasovs, J. M. Borbotte, N. Saurel, S. Normand</i>	

<b>#254 - A Monitoring System of Radioactive Tracers in Hydroponic Solution for Research on Plant Physiology.....</b>	701
<i>N. Suzui, N. Kawachi, M. Yamaguchi, N. S. Ishioka, S. Fujimaki</i>	
<b>#255 - Experimental Study of the Zeolite Affinity for the Dioxin Adsorption for a New Direct and On-Line Measurement Method.....</b>	704
<i>M. Mercury, M. Carette, A. Janulyte, R. Denoyel, C. Reynard, Y. Zerega, A. Simon-Masseron</i>	

**POSTER SESSION 2.1 - MEASUREMENT AND DETECTION METHODS IN FUNDAMENTAL PHYSICS (FUSION AND PLASMA PHYSICS)**

<b>#25 - Recent Advances in the Development of X-Ray Cameras Inserted Inside a Pressurized Box for LMJ Plasma Diagnostics.....</b>	709
<i>T. Beck, C. Zuber, D. Aubert, C. Chollet, P. Brunel, S. Huelvan, C. Brisset, H.-P. Jacquet</i>	
<b>#31 - Acquisition of Neutron-Induced Gamma Signatures for PFTNA Techniques.....</b>	715
<i>E. Cusset, R. Vogler</i>	
<b>#55 - Measurement Methods Associated to Laser Ablation Technique in Layer Removal Process on Plasma Facing Components.....</b>	719
<i>H. Roche, C. Grisolia, C. Hernandez, X. Courtois, N. Vignal, T. Loarer, C. Pocheau, E. Gauthier, P. Delaporte, L. Mercadier, A. Semerok, D. Farage</i>	
<b>#57 - Neutron Spectroscopy in Inertial Confinement Fusion Experiments using the DEMIN Spectrometer .....</b>	724
<i>B. Rossé, M. Houry, E. Delagnes, P. Legou, O. Landoas, V. Y. Glebov, T. C. Sangster</i>	
<b>#61 - Radial Dependence of Induced Current Density and Small Pixel Effect in Parallel-Plate Detectors.....</b>	729
<i>V. V. Samedov</i>	
<b>#62 - Position Resolution Estimation for Centroid Formula in Strip Detectors .....</b>	735
<i>V. V. Samedov</i>	
<b>#65 - New Method to Define and Optimize the Diagnostic Electrical Acquisition Channels Application to the LMJ DMX Plasma Diagnostic.....</b>	738
<i>P. Semécuble, V. Allouche, M. Prat, B. Villette</i>	
<b>#101 - Analysis of the Polarisation Rotation of Far Infrared Beams in the TORE SUPRA Plasmas .....</b>	744
<i>C. Brault, C. Gil, P. Spuig</i>	
<b>#113 - Development of On-Line Tritium Monitor Based Upon Artificial Diamond for Fusion Applications.....</b>	748
<i>M. Pillon, M. Angelone, P. Batistoni, R. Villari, S. Almaviva, M. Marinelli, E. Milani, G. Prestopino, C. Verona, G. Verona-Rinati</i>	
<b>#117 - On the Possibility of Tritium Measurement in a Tokamak by a Laser Technique .....</b>	752
<i>L. Mercadier, J. Hermann, C. Grisolia, A. Semerok</i>	
<b>#276 - Laser-Induced Fluorescence Diagnostic for Ions or Atoms .....</b>	757
<i>N. Claire, F. Doveil</i>	

**POSTER SESSION 2.2 - INSTRUMENTATION AND MEASUREMENT METHODS FOR NUCLEAR FUEL CYCLE**

<b>#69 - Metrological References for Nuclear Measurements Provided by the LNE-LNHB to Users Through a Strict Traceability Chain.....</b>	761
<i>E. Verdeau</i>	
<b>#119 - The Use of Gamma Spectrometry for the Characterization of the Irradiated Fuel by Non-Destructive Measurement .....</b>	767
<i>L. Loubet</i>	
<b>#122 - Utilization of Freshly Induced High-Energy Gamma-Ray Activity as a Measure of Fission Rates in Re-Irradiated Burnt UO<sub>2</sub> Fuel.....</b>	769
<i>H. Kröhner, M. F. Murphy, G. Perret, R. Chawla</i>	
<b>#142 - Chemical Speciation at the Liquid-Liquid Interface: Development of a Time-Resolved-Spectroscopy Induced by the Evanescence Wave of a Laser Beam .....</b>	775
<i>F. Canto, L. Couston, T. H. Vu, M.-C. Charbonnel</i>	
<b>#143 - The I-SCC Behavior of N18 Alloy at Constant Strain Rate.....</b>	781
<i>X. Dai, W. Zhao, Y. Wang</i>	

<b>#147 - An Online Monitoring System for Nuclear Waste Storage</b>	787
<i>A. Pappalardo, M. Barbagallo, V. Bellini, M. Capogni, L. Cosentino, V. Febraro, P. Finocchiaro, G. Greco, C. Scirè, S. Scirè</i>	
<b>#151 - PING: A New Approach for Nuclear Fuel Cycle Instrumentation</b>	791
<i>S. Normand, V. Kondrasov, G. Corre, C. Passard</i>	
<b>#154 - Characterization System for Germanium Detectors Dedicated to Gamma Spectroscopy Applied to Nuclear Waste</b>	795
<i>J. Rocca, C. Portella, N. Saurel</i>	
<b>#184 - Experimental Validation of the LILW Storage Strategy Applied in the National Dutch Interim Storage Facility</b>	799
<i>L. P. M. van Velzen, J. Welbergen</i>	
<b>#230 - Monte Carlo Shielding Comparative Analysis Applied to TRIGA HEU and LEU Spent Fuel Transport</b>	807
<i>C. A. Margeanu, S. Margeanu, D. Barbos, C. Iorgulis</i>	
<b>#244 - Thermal Desorption Gas Chromatography and Positron Annihilation Spectroscopy Contribution to Alpha Decay Studies in Actinide-Doped Matrices</b>	813
<i>D. Roudil, C. Jegou, R. Pik, M. F. Barthe, M. Cuney, F. Vella, Y. Pipon, B. Folch, V. Broudic</i>	
<b>#263 - Attractive Approach to Analyse Trace and Ultra-Trace Elements on Transmutation Targets by Direct Separation of Isobaric Interferences using Collision Reaction Cell Implanted on MC-ICPMS</b>	819
<i>H. Isnard, J. Moureau, S. Quidelleur, F. Gueguen, M. Granet, G. Favre, A. Nonell, F. Chartier</i>	

### **POSTER SESSION 2.3 - SAFEGUARDS MEASUREMENTS AND HOMELAND SECURITY**

<b>#160 - The Use of Monte Carlo Techniques for the Calibration of IAEA Safeguards Instrumentation</b>	825
<i>A. P. Belian, L. Bourva, S. C. Kane, A. Lebrun</i>	
<b>#163 - Improvement of the Calibration Database of the EURITRACK Tagged Neutron Inspection System</b>	831
<i>W. El Kanawati, C. Carasco, B. Pérot, A. Mariani, A.-C. Raoux, V. Valkovic, D. Sudac, J. Obhodas, M. Baricevic</i>	
<b>#168 - Active Neutron Interrogation for the Verification of Irradiated HEU Residues</b>	838
<i>A. Lebrun, I. El-Osery, M. Guzman, G. Tributsch, A. Nirschl, F. Wijtsma</i>	
<b>#172 - Measurement of the Plutonium Hold-Up in a Melting Furnace at CEA Bruyères-Le-Châtel</b>	842
<i>R. Oddou, J. Chevillon, H. Schoech, M. Vincent</i>	
<b>#173 - Applications of the Associated Particle Technique</b>	846
<i>B. Pérot, C. Carasco, A. Mariani, J.-L. Ma, S. Dejouies, W. El Kanawati, C. Eleon</i>	
<b>#174 - The Role of the Nuclear Industry in Advancing Safeguards Instrumentation</b>	853
<i>N. Peter, M. Koskelo, M. Stein</i>	
<b>#179 - The Use of Fast and Thermal Neutron Detectors Based on Oxide Scintillators in Inspection Systems for Prevention of Illegal Transportation of Radioactive Substances</b>	860
<i>V. D. Ryzhikov, B. V. Grinyov, G. M. Onishchenko, L. A. Piven, O. K. Lysetska, L. L. Nagornaya, T. Poche</i>	
<b>#183 - Material Recognition using Neutron/Gamma Interrogation with Time Tagged Fission Sources</b>	866
<i>D. Fabris, H. Xin, M. Lunardon, S. Moretto, G. Nebbia, S. Pesente, L. Stevanato, G. Viesti, L. Sajo-Bohus</i>	
<b>#258 - Design of a New Unattended Detection System to Distinguish Different Types of Assemblies at Fast Breeder Reactors</b>	871
<i>M. Frankl, T. Poche, C. Liguori, M. Lang</i>	
<b>#279 - Underwater Detection of a TNT Explosive</b>	875
<i>D. Sudac, V. Valkovic, K. Nad, J. Obhodas</i>	

### **POSTER SESSION 2.4 - INSTRUMENTATION AND MEASUREMENT METHODS FOR POWER NUCLEAR REACTORS**

<b>#75 - Eddy Current Position Sensing System for Diverse Safety ROD of PFBR</b>	879
<i>C. B. Rao, S. Sosamma, R. Vijayashree, P. Kalyanasundaram, B. Raj</i>	
<b>#78 - Acoustic Coupling of Ultrasonic Transducers for In-Service Inspection of Sodium Fast Reactors</b>	884
<i>K. Paumel, O. Descombin, J. Moysan, G. Corneloup, J.-M. Augem</i>	
<b>#79 - Towards In-Service Acoustic Characterization of the Gaseous Microbubbles Applied to Liquid Sodium</b>	890
<i>M. Cavaro, J. Moysan, G. Corneloup, C. Gueudré, C. Payan, F. Baqué, G. Prele, J. Sibilo</i>	
<b>#80 - Ultrasonic Techniques for Improving Inspection of Sodium-Cooled Systems</b>	896
<i>G. Gobillot, F. Baqué, C. Lhuillier, P. H. Brau, M. A. Ploix, J.-M. Augem, J. F. Saillant</i>	

<b>#84 - Neutron Flux Incore Instrumentation of AREVA's EPR™</b>	900
<i>C. Düweke, N. Thillosen, J. Ziethe</i>	
<b>#86 - Automation of Radionuclide Analysis in Nuclear Industry</b>	906
<i>V. Gostilo, A. Sokolov, V. Kuzmenko, V. Kondratjev</i>	
<b>#88 - An Artificial Neural Network Approach for the Discordance Sensor Data Validation for SCRAM Parameters</b>	912
<i>M. Kasinathan, B. SaidharRao, N. Murali, P. Swaminathan</i>	
<b>#89 - An Advanced NSSS Integrity Monitoring System for Shin-Kori Nuclear Units 3&amp;4</b>	917
<i>Y. G. Oh, H. B. Kim, S. R. Galin, S. H. Kim, S. J. Lee</i>	
<b>#91 - Computer Based Systems for Prototype Fast Breeder Reactor</b>	923
<i>N. Sridhar, B. Krishnakumar, S. I. Sambasivan</i>	
<b>#92 - Advanced Nuclear Instrumentation Design using Programmable Logic Devices</b>	929
<i>M. K. Misra, L. Srivani, S. I. Sambasivan</i>	
<b>#93 - Implementation of New Reactivity Measurement System and New Reactor Noise Analysis Equipment in a VVER-440 Nuclear Power Plant</b>	937
<i>J. Végh, S. Kiss, S. Lipcsei, C. Horváth, I. Pós, G. Kiss</i>	
<b>#219 - Potentialities of Optical On Line Techniques: Application to the Study of Thermochemical Cycles for Hydrogen Production</b>	944
<i>D. Doizi, B. Larousse, A. Pailloux, V. Dauvois, J. L. Roujou, L. Croize, Y. Zanella, J. M. Hartmann</i>	
<b>#267 - In-Sodium Hydrogen Detection in the PHENIX Fast Reactor Steam Generator: A Comparison Between Two Detection Methods (May 2009)</b>	949
<i>J. P. Jeannot, T. Gnanasekaran, C. Latge, R. Sridharan, L. Martin, R. Ganesan, J.-M. Augem, J. L. Courouau, G. Gobillot</i>	
<b>#274 - Advanced Experimental Tools Designed for the Assessment of the Thermal Load Applied to the Mixing Tee and Nozzle Geometries in the PWR Plant</b>	957
<i>O. Braillard, D. Edelin</i>	
<b>#286 - Aerosol Characterization and Measurement Techniques Towards SFR Safety Studies</b>	964
<i>R. Baskaran, V. Subramanian, J. Misra, R. Indira, P. Chellapandi, B. Raj</i>	

### **POSTER SESSION 3.1 - NUCLEAR INSTRUMENTATION AND MEASUREMENTS FOR SAFETY, ENVIRONMENT AND HEALTH APPLICATIONS**

<b>#170 - Development and Studies of Novel Microfabricated Radiation Hard Scintillation Detectors with High Spatial Resolution</b>	973
<i>A. Mapelli, B. Gorini, M. Haguenauer, S. Jiguet, N. V. Triviño, P. Renaud</i>	
<b>#187 - Development of the XPADE3 X-Ray Photon Counting Imager DAQ Electronics</b>	978
<i>A. Dawiec, B. Dinkespiler, P. Breugnon, K. Arnaud, S. Godiot, S. Hustache, K. Medjoubi, J.-F. Berar, N. Boudet, C. Morel</i>	
<b>#192 - Status of Development on <sup>99</sup>Mo Production Technology in JMTR</b>	981
<i>Y. Inaba, K. Iimura, J. Hosokawa, H. Izumo, N. Hori, E. Ishitsuka</i>	
<b>#200 - The Effectiveness of Thermoluminescent Crystals for Calculation of Required Barrier against Radiation at the Diagnostic X-ray Units</b>	989
<i>S. A. Rahimi</i>	

### **POSTER SESSION 3.2 - ASSOCIATED TRAINING AND EDUCATION ACTIVITIES**

<b>#204 - More Than 20 Years of Experience of the IAEA in Providing Training on Nuclear Instrumentation for Developing Countries</b>	993
<i>P. H. B. Becker, M. Gardos, S. Hollenthoner, T. Tranpraphan, A. Markowicz</i>	
<b>#207 - A Training and Educational Tool for Neutron Coincidence Measurements</b>	1002
<i>J. Huszti, J. Bagi, D. Langner</i>	
<b>#208 - Simulation Software of Radioactive Decay, <math>\beta</math> and <math>\gamma</math> Disintegration of Cesium 137</b>	1006
<i>J. M. Laugier</i>	
<b>#256 - Graduate Studies in Instrumentation at University of Provence</b>	1010
<i>M. Carette, C. Reynard, N. Claire, J. L. Deschaintres, B. Felts, A. Lyoussi, J. Andre, D. Bertin</i>	
<b>#257 - Thermoluminescent Detectors Measurements in Critical Mock-up: Monte-Carlo Calculations of Cavity Phenomena</b>	1012
<i>H. Amharrak, J. Di Salvo, N. Thiollay, A. Roche, A. Lyoussi, G. Bignan, C. Reynard</i>	

<b>#273 - Reduction of Uncertainties Concerning Fission Chambers Measurements through a Better Understanding of the Calibration Process and the Dead Time Phenomenon.....</b>	1017
<i>N. B. de LANAUTE, F. MELLIER, A. LYOUSSE, J. C. BOSQ, P. CHAUSSONNET</i>	

## **ADDITIONAL PAPERS**

<b>#51 - Radiation Hard Silicon Strips Detectors for the SLHC.....</b>	1022
<i>M. Miñano</i>	
<b>#70 - First Results on Material Identification and Imaging with a Large-volume Muon Tomography Prototype .....</b>	1027
<i>S. Pesente, S. Vanini, M. Benettoni, G. Bonomi, P. Calvini, P. Checchia, E. Conti, F. Gonella, G. Nebbia, S. Squarcia, G. Viesti, A. Zenoni, G. Zumerle</i>	
<b>#139 - Latest Methodological Developments for the Measurement of Diffusion and Permeation Coefficients in Concretes and Clays.....</b>	1031
<i>P. Berne, C. Brouard, A. Duhart-Barone, D. Grec, A. Le Cocguen, J. Pocachard</i>	
<b>#232 - Development of a Neutron Imaging Facility at the CENM Al Maâmora TRIGA .....</b>	1038
<i>A. Ouardi, R. Alami, A. Bensitel, A. Hommada, A. Benchekroune</i>	
<b>#290 - New Radiation Sensor Embedded in a Metal Detection Unit .....</b>	1042
<i>A. Osovitzky, I. Cohen-Zada, E. Vulasky, M. Gelman, E. Marcus, D. Ginzburg, A. Manor, N. Ankry, V. Pushkarsky, M. Lefevre, Y. Kadmon, Y. Cohen</i>	

**Author Index**