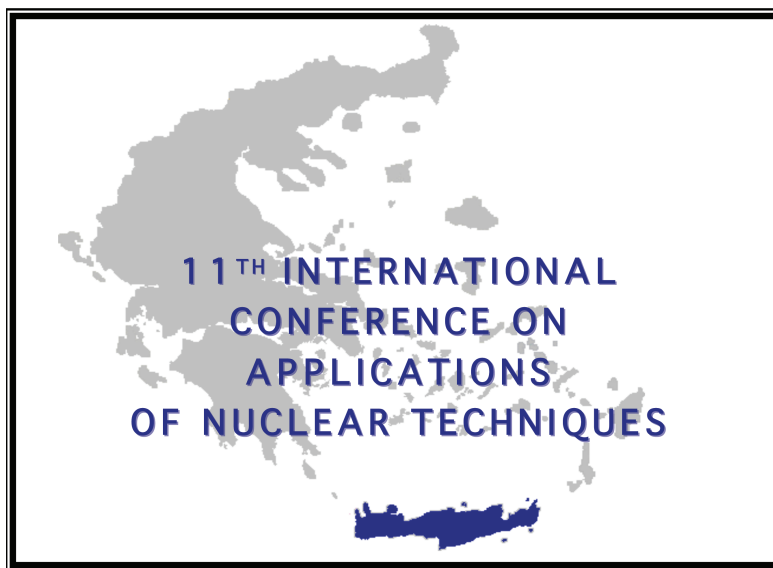


APPLICATIONS OF NUCLEAR TECHNIQUES

Eleventh International Conference

Crete, Greece 12 – 18 June 2011



EDITORS

Marianne E. Hamm
Robert W. Hamm
*R&M Technical Enterprises, Inc.,
Pleasanton, California, USA*

All papers have been peer reviewed.

SPONSORING ORGANIZATION

SAIC, Inc.

AIP
American Institute
of Physics

Melville, New York, 2011
AIP | CONFERENCE PROCEEDINGS ■ 1412

Editors

Marianne E. Hamm

Robert W. Hamm

R&M Technical Enterprises, Inc.

4725 Arlene Pl.

Pleasanton, CA 94566, USA

E-mail: mehamm@comcast.net

rmtech@comcast.net

Authorization to photocopy items for internal or personal use, beyond the free copying permitted under the 1978 U.S. Copyright Law (see statement below), is granted by the American Institute of Physics for users registered with the Copyright Clearance Center (CCC) Transactional Reporting Service, provided that the base fee of \$30.00 per copy is paid directly to CCC, 222 Rosewood Drive, Danvers, MA 01923, USA: <http://www.copyright.com>. For those organizations that have been granted a photocopy license by CCC, a separate system of payment has been arranged. The fee code for users of the Transactional Reporting Services is: 978-0-7354-0986-6/11/\$30.00

© 2011 American Institute of Physics

No claim is made to original U.S. Government works.

Permission is granted to quote from the AIP Conference Proceedings with the customary acknowledgment of the source. Republication of an article or portions thereof (e.g., extensive excerpts, figures, tables, etc.) in original form or in translation, as well as other types of reuse (e.g., in course packs) require formal permission from AIP and may be subject to fees. As a courtesy, the author of the original proceedings article should be informed of any request for republication/reuse. Permission may be obtained online using RightsLink. Locate the article online at <http://proceedings.aip.org>, then simply click on the RightsLink icon/“Permissions/Reprints” link found in the article abstract. You may also address requests to: AIP Office of Rights and Permissions, Suite 1N01, 2 Huntington Quadrangle, Melville, NY 11747-4502, USA; Fax: 516-576-2450; Tel.: 516-576-2268; E-mail: rights@aip.org.

L.C. Catalog Card No. 2011941844

ISBN 978-0-7354-0986-6

ISSN 0094-243X

Printed in the United States of America

AIP Conference Proceedings, Volume 1412
Applications of Nuclear Techniques
Eleventh International Conference

Table of Contents

Preface: 11th International Conference on Applications of Nuclear Techniques George Vourvopoulos, Robert W. Hamm, and Marianne E. Hamm	1
Committees and Sponsors	3
PRESENTATIONS	
Analysis of cultural heritage by accelerator techniques and analytical imaging Ari Ide-Ektessabi, Jay Arre Toque, and Yusuke Murayama	5
Electrostatic matching of a high current proton beam to a RFQ R. Becker, R. W. Hamm, and H. Pearce-Percy	17
Observation of neutron skyshine from an accelerator based neutron source C. B. Franklyn	25
Development of an accelerator mass spectrometer based on a cyclotron Dogyun Kim, Hyeongchan Bhang, and Jongwon Kim	31
Review of activities using the pulsed neutron facility and 2.5-GeV electron linac at Pohang Accelerator Laboratory Guinyun Kim, Manwoo Lee, Kyung Sook Kim, Sungchul Yang, Eunae Kim, Valery Shvetshov, Moo-Hyun Cho, and Haladhara Naik	39
A fast pulsed neutron source for Time-of-Flight detection of nuclear materials and explosives Mahadevan Krishnan, Brian Bures, Colt James, Robert Madden, Wolfgang Hennig, Dimitry Breus, Stephen Asztalos, Konstantin Sabourov, and Stephen Lane	47

The neutrons for science facility at SPIRAL-2	
X. Ledoux, M. Aïche, M. Avrigeanu, V. Avrigeanu, L. Audouin, E. Balanzat, B. Ban-d'Etat, G. Ban, G. Barreau, E. Bauge, G. Bélier, P. Bem, V. Blideanu, J. Blomgren, C. Borcea, S. Bouffard, T. Caillaud, A. Chatillon, S. Czajkowski, P. Dessagne, D. Doré, M. Fallot, F. Farget, U. Fischer, L. Giot, T. Granier, S. Guillous, F. Gunsing, C. Gustavsson, S. Herber, B. Jacquot, B. Jurado, M. Kerveno, A. Klix, O. Landoas, F. R. Lecolley, J. F. Lecolley, J. L. Lecouey, M. Majerle, N. Marie, T. Materna, J. Mrazek, F. Negoita, J. Novak, S. Oberstedt, A. Oberstedt, S. Panebianco, L. Perrot, M. Petrascu, A. J. M. Plompen, S. Pomp, J. M. Ramillon, D. Ridikas, B. Rossé, G. Rudolf, O. Serot, O. Shcherbakov, S. P. Simakov, E. Simeckova, A. G. Smith, J. C. Steckmeyer, J. C. Sublet, J. Taïeb, L. Tassan-Got, A. Takibayev, E. Tungborn, I. Thfoin, I. Tsekhanovich, C. Varignon, and J. P. Wieleczko	55
Tailoring the neutron spectrum from a 14- MeV neutron generator to approximate a spontaneous-fission spectrum	
J. D. Simpson and D. L. Chichester	63
Engineering prototype for a compact medical dielectric wall accelerator	
Anthony Zografos, Andy Hening, Vladimir Joshkin, Kevin Leung, Dave Pearson, Henry Pearce-Percy, Mario Rougieri, Yoko Parker, John Weir, Donald Blackfield, Yu-Juan Chen, Steven Falabella, Gary Guethlein, Brian Poole, Robert W. Hamm, and Reinard Becker	71
Monte Carlo simulation of the conversion x-rays from the electron beam of PFMA-3	
E. Ceccolini, F. Rocchi, D. Mostacci, M. Sumini, and A. Tartari	79
Complete Monte Carlo simulation of neutron scattering experiments	
M. Drosog	86
Use of small angle neutron scattering to study various properties of wool and mohair fibres	
C. B. Franklyn and Gy. Török	93
Use of Be(p,α) and Be(p,d) reactions to determine Be content in sapphire	
C. B. Franklyn	98
High energy PIXE at the ARRONAX facility for multi elemental analysis of thick samples	
C. Koumeir, F. Haddad, V. Metivier, N. Servagent, X. de la Bernardie, E. Garrido, and D. Ragheb	105

The energy loss of Li and C ions with MeV energies in the polycarbonate and polypropylene	113
R. Mikšová, A. Macková, and V. Hnatowicz	
Measurement of neutron reaction cross sections in carbon using a single crystal diamond detector	121
M. Pillon, M. Angelone, A. Krása, A. J. M. Plompen, P. Schillebeeckx, and M. L. Sergi	
Performance of a drift chamber candidate for a cosmic muon tomography system	129
V. Anghel, J. Armitage, J. Botte, K. Boudjemline, J. Bueno, D. Bryman, E. Charles, T. Cousins, P.-L. Drouin, A. Erlandson, G. Gallant, C. Jewett, G. Jonkmans, Z. Liu, S. Noel, G. Oakham, T. J. Stocki, M. Thompson, and D. Waller	
Design and fabrication of Cherenkov counters for the detection of SNM	137
Anna S. Erickson, Anthony Galaitsis, Richard Lanza, Michael Hynes, Adam Bernstein, and Brandon Blackburn	
Optimizing inspection parameters for long stand-off detection of SNM	145
Erik Johnson, Brandon Blackburn, Paul Hausladen, and Michael Hynes	
High energy protons for remote standoff detection of special nuclear materials	153
Richard C. Lanza and Timothy Antaya	
The NA62 RICH Detector	161
Giuseppina Anzivino	
Novel 4π detection system for the measurement of the ${}^6\text{Li}(n,\alpha){}^3\text{H}$ reaction cross section	169
Georgios Giorginis and Raffaele Bencardino	
A direction-sensitive detector for electron antineutrinos	177
F. D. Brooks, M. Drosig, and F. D. Smit	
Characterization of Silicon PhotoMultipliers at LNS-INFN	185
L. Cosentino, P. Finocchiaro, and A. Pappalardo	

Characterization of monoenergetic low energy neutron fields with the μTPC detector C. Golabek, J. Billard, C. Grignon, G. Bosson, O. Bourrion, O. Guillaudin, L. Lebreton, F. Mayet, M. Petit, J.-P. Richer, and D. Santos	192
Overview of silicon detectors in STAR: Present and future Sonia Kabana, SVT, SSD and HFT Detector Groups of the STAR experiment at RHIC	200
CASCADES: An ultra-low-background germanium crystal array at Pacific Northwest National Laboratory M. E. Keillor, C. E. Aalseth, A. R. Day, L. E. Erikson, J. E. Fast, B. D. Glasgow, E. W. Hoppe, T. W. Hossbach, B. J. Hyronimus, H. S. Miley, A. W. Myers, A. Seifert, and T. J. Stavenger	208
Development of ^{10}B-based ^3He replacement neutron detectors Michael J. King, Tsahi Gozani, and Donald B. Hilliard	216
Simulation of charge collection in diamond detectors irradiated with deuteron-triton neutron sources Alberto Milocco, Andrej Trkov, and Mario Pillon	224
Search for $2\nu\beta\beta$-decay of ^{130}Te to the First Excited State of ^{130}Xe with an ultra-low-background germanium crystal array L. K. Mizouni, C. E. Aalseth, F. T. Avignone III, L. E. Erikson, T. W. Hossbach, M. E. Keillor, and J. L. Orrell	232
Recent developments in fast neutron detection and multiplicity counting with liquid scintillator L. F. Nakae, G. F. Chapline, A. M. Glenn, P. L. Kerr, K. S. Kim, S. A. Ouedraogo, M. K. Prasad, S. A. Sheets, N. J. Snyderman, J. M. Verbeke, and R. E. Wurtz	240
Deuterated liquid scintillators: A new tool for neutron measurements M. Ojaruega, F. D. Becchetti, A. N. Villano, R. Torres-Isea, A. Roberts, J. J. Kolata, C. C. Lawrence, S. A. Pozzi, M. Flaska, and S. D. Clarke	249
Modeling of a low-background spectroscopic position-sensitive neutron detector Daria Postovarova, Alexey Evsenin, Igor Gorshkov, Andrey Kuznetsov, Oleg Osetrov, Dmitry Vakhtin, and Pavel Yurmanov	254

Direct deposition of microcolumnar scintillator on CMOS SSPM array: Toward a photon counting detector for x-ray/gamma ray imaging G. Prekas, M. Breen, H. Sabet, H. Bhandari, G. Derderian, F. Robertson Jr., C. J. Stapels, J. Christian, S. Cool, and V. V. Nagarkar	262
Real time pulse pile-up recovery in a high throughput digital pulse processor Paul A. B. Scoullar, Chris C. McLean, and Rob J. Evans	270
Quantitative analysis of particulate matter in Limeira (Brazil) using SR-TXRF Felippe Benavente Canteras and Silvana Moreira	278
Evaluation of heavy metals in solid waste disposal sites in Campinas City, Brazil using synchrotron radiation total reflection x-ray fluorescence Bruna Fernanda de Faria and Silvana Moreira	286
Upgrade of the resonance ionization mass spectrometer for precise identification of failed fuel in a fast reactor Yoshihiro Iwata, Hideki Harano, Chikara Ito, and Takafumi Aoyama	295
Nuclear physics and hadron therapy B. Braunn, J. Colin, C. Courtois, D. Cussol, J. M. Fontbonne, and M. Labalme	303
University of Washington clinical neutron facility: Report on 26 years of operation George E. Laramore, Robert Emery, David Reid, Stefani Banerian, Ira Kalet, Jonathan Jacky, and Ruedi Risler	311
Evaluation of radiation dose effects on rat bones using synchrotron radiation computed microtomography Liebert Parreiras Nogueira, Regina Cély Barroso, Delson Braz, Carlos Eduardo de Almeida, Cherley Borba Andrade, and Giuliana Tromba	319
The characterisation of silicate glasses implanted with Ag⁺ ions P. Malinský, A. Macková, P. Nekvindová, B. Švecová, M. Kormunda, and A. Kolitsch	327

Characterization and Monte Carlo simulations of a 4-liter NaI detection system for use during nuclear and radiological emergencies and for the detection of nuclear materials	
A. Borella, J. Camps, J. Paridaens, and T. Vidmar	335
Active inspection of nuclear materials using ^4He scintillation detectors	
G. Davatz, R. Chandra, U. Gendotti, and A. Howard	343
Noble gas excimer detectors for security and safeguards applications	
Michael V. Hynes, Rico Chandra, Giovanna Davatz, and Richard Lanza	351
Application of triple coincidence for the detection of small amounts of special nuclear materials	
I. Dioszegi, C. Salwen, and L. Forman	354
Delayed neutron and delayed photon characteristics from photofission of actinides	
D. Doré, E. Berthoumieux, X. Ledoux, A. Leprince, D. Ridikas, M. Agelou, F. Carrel, and M. Gmar	362
Neutron time projection chamber for nuclear security and verification applications	
I. Jovanovic, N. S. Bowden, G. P. Carosi, M. Heffner, and C. Roecker	370
Simulated performance of algorithms for the localization of radioactive sources from a position sensitive radiation detecting system (COCAE)	
K. Karafasoulis, K. Zachariadou, S. Seferlis, I. Kaissas, C. Lambropoulos, D. Loukas, and C. Potiriadis	377
Characteristics of the neutron irradiation facilities of the PSI Calibration Laboratory	
H. Hoedlmoser, Ch. Schuler, G. Butterweck, and S. Mayer	385
Development and testing of an air fluorescence imaging system for the detection of radiological contamination	
Elizabeth Inrig, Vern Koslowsky, Bob Andrews, Michael Dick, Patrick Forget, Harry Ing, Roger Hugron, and Larry Wong	393
Nuclear track detector characterization via alpha-spectrometry for radioprotection use	
D. Morelli, G. Immè, M. Aranzulla, A. L. Rosselli Tazzer, R. Catalano, and G. Mangano	401
Radiation safety system for SPIDER neutral beam accelerator	
S. Sandri, A. Coniglio, M. D'Arienzo, and C. Poggi	407

Radiation protection aspects of the SPES project at LNL L. Sarchiapone and D. Zafiroopoulos	415
Industrial application of radioactive ion beams at the RIKEN RI Beam Factory Tadashi Kambara, Atsushi Yoshida, Yoshiyuki Yanagisawa, Daisuke Kameda, Naoki Fukuda, Tetsuya Ohnishi, Toshiyuki Kubo, Ryuji Uemoto, Akira Nagano, and Hiroyuki Uno	423
Nuclear analytical applications within the IAEA Nuclear Data Section Mark A. Kellett	430
Author Index	439