SORMA WEST 2008

2008 Symposium on Radiation Measurements and Applications

June 2-5, 2008 Berkeley, California, USA

Supplementary Oral-Program Materials

Monday AM I and II: Featured Speakers in Plenary Session

Thursday PM II: SORMA Summaries and Perspectives

We invite you to Berkeley for the first West Coast meeting of the Symposium on Radiation Measurements and Applications.

SORMA West 2008 is hosted jointly by the University of California, Berkeley and the Lawrence Berkeley and Lawrence Livermore National Laboratories. It is made possible by the generosity of our sponsors and supporters.

We gratefully acknowledge the cooperation and advice of the original SORMA, now SORMA East, hosted by the University of Michigan and next scheduled for 2010.

Monday Plenary I
9-10:15 A.M.
Chairs: Stephen Derenzo and Bill Moses, LBNL

Monday Plenary I-1
Research and Development Opportunities at DNDO
William Hagan, Assistant Director, Office of Transformational Research and Development, Department of Homeland Security/Domestic Nuclear Detection Office

A short overview of the Domestic Nuclear Detection Office (DNDO) will precede a summary of near-term system development programs and long-term research and development programs. Opportunities for proposal submission for long-term R&D will also be summarized. As an indication of technical challenges of future interest, linkages between threat pathways on the Global Nuclear Detection Architecture (GNDA), R&D technology areas, and individual projects will be described as well as examples of R&D coordination between various relevant governmental entities.

Monday Plenary I-2
Advanced Nuclear Safeguards for the 21st Century
Michael C. Miller, Los Alamos National Laboratory

The global expansion of nuclear energy provides not only the benefit of carbon-neutral electricity, but also the potential for proliferation concern as well. Nuclear safeguards implemented at the state level (domestic) and at the international level by the International Atomic Energy Agency (IAEA) are essential for ensuring that nuclear materials are not misused. In the same way that the 1950's Atoms for Peace initiative provided the foundation for a robust research and development program in nuclear safeguards, the expansion in nuclear energy that is underway today provides the impetus to enter a new era of technical development in the safeguards community. In this paper I will describe the research and technology development needed to achieve a new generation of safeguards in support of the nuclear renaissance.

Monday Plenary II
10:45 A.M. to noon
Chairs: Stephen Derenzo and Bill Moses, LBNL

Monday Plenary II-1
Maximum-Likelihood Methods for Processing Signals from Gamma-Ray Detectors
Harrison H. Barrett (presenting)
William C. J. Hunter[1], Brian W. Miller, Stephen K. Moore, Yichun Chen[2] and Lars R. Furenlid, Center for Gamma-ray Imaging, University of Arizona, Tucson AZ

In any gamma-ray detector, each event produces electrical signals on one or more circuit elements. From these signals, we may wish to determine the presence of an interaction; its time of occurrence and its spatial coordinates in two or three dimensions; the total energy deposited in the detector and whether multiple interactions occurred; aggregate properties such as the energy spectrum, the spatial fluence or the spatiospectral fluence, and list-mode probabilities for tomographic reconstruction. Maximum-likelihood methods provide a rigorous and in some senses optimal approach to extracting this information. Moreover, the associated Fisher information matrix provides a rigorous way of assessing and optimizing the information conveyed by the detector. This paper will review the principles of likelihood methods as applied to gamma-ray detectors and illustrate their power with recent results from the Center for Gamma-ray Imaging.
This work was supported by NIH grant no. P41 EB002035.

[1]Now with University of Washington, Seattle WA
[2]Now with National Central University, Taiwan

Monday Plenary II-2
On The Detectability of Nuclear Material Signatures
Tsahi Gozani, Chief Scientist and President Emeritus, Rapiscan Laboratories, Sunnyvale, CA

Detection and interdiction of nuclear materials in all forms of transport is one of the most critical security issues facing the United States and the rest of the civilized world. Naturally emitted gamma rays by these materials, while abundant and detectable when unshielded, are low in energy and readily shielded. X-ray radiography is useful in detecting the possible presence of shielding material.

Positive detection of concealed nuclear materials requires methods which unequivocally detect specific attributes of the materials. These methods typically involve active

interrogation by penetrating radiation of neutrons, photons or other particles. Fortunately, nuclear materials, probed by various types of radiation, yield very unique and often strong signatures. Paramount among them are the detectable fission signatures, namely prompt neutrons and gamma rays, and delayed neutrons gamma rays. Other useful signatures are the nuclear states excited by neutrons, via inelastic scattering, or photons, via nuclear resonance fluorescence and absorption.

The signatures are very different in magnitude, level of specificity, ease of excitation and detection, signal to background ratios, etc. For example, delayed neutrons are very unique to the fission process, but they are scarce, have low energy, and hence are easily absorbed. Delayed gamma rays are more abundant but "featureless," and have higher background from natural sources and, more importantly, from activation due to the interrogation sources.

The prompt fission signatures need to be measured in the presence of the much higher levels of probing radiation. This requires taking special measures to look for the prompt fission signatures, sometimes leading to a significant sensitivity loss or a complete inability to detect them.

Characteristic gamma rays induced in nuclear materials reflecting their nuclear structure, while rather unique, require very high intensity of interrogation radiation and very high resolution in energy and/or time.

The trade off of signatures, their means of stimulation, and methods of detection, will be reviewed.

Work supported by Department of Homeland Security, Domestic Nuclear Detection Office, Transformational and Applied Research Directorate

Thursday PM II
3:45-5;15 pm, Stanley 105
Chair: Stephen Derenzo (LBNL)

This is a summary or rapporteur session whose content will be based on presentations made throughout the week.

John Valentine (Lawrence Livermore National Laboratory)
Scintillators (18 minutes)

Kanai Shah (Radiation Monitoring Devices, Inc.)
Photodetectors (18 minutes)

Kai Vetter (UC Berkeley / LBNL)
Semiconductor detectors (18 minutes)

Glenn Knoll (University of Michigan)
Applications and perspectives (30 minutes)