

Nuclear Nonproliferation Program Activities at the University of Michigan

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Detection for Nuclear Nonproliferation Group

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Sciences*

University of Michigan, Ann Arbor, MI

Oak Ridge National Laboratory

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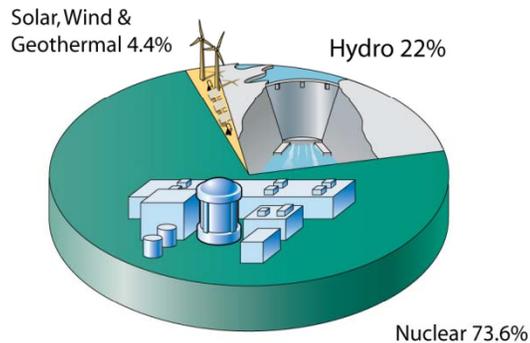


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Global Nuclear Expansion Poses New Challenges for Nuclear Nonproliferation

- Driving factors:

1. Increasing energy demand
2. Climate change
3. Economics
4. Fuel price stability
5. Security of supply



- Challenges:

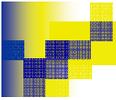
1. Continued safe operation
2. Used nuclear fuel management
3. Increased fuel cycle security
4. Aging labor force



Images from: <http://www.nei.org>

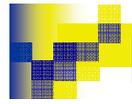


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Nuclear Nonproliferation and the Nuclear Renaissance

- The rapid growth of nuclear energy in today's global marketplace necessitates additional safety protocols to maintain peaceful application
- *An urgent need:* accurate and timely detection and characterization of nuclear materials in transit
- Presently, this need is not fully addressed for the following reasons:
 - Insufficient tools and techniques in the field
 - Insufficient modeling and simulation tools
 - Lack of communication between industrial needs and educational programs

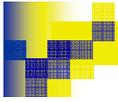


University of Michigan

Nuclear Engineering & Radiological Sciences

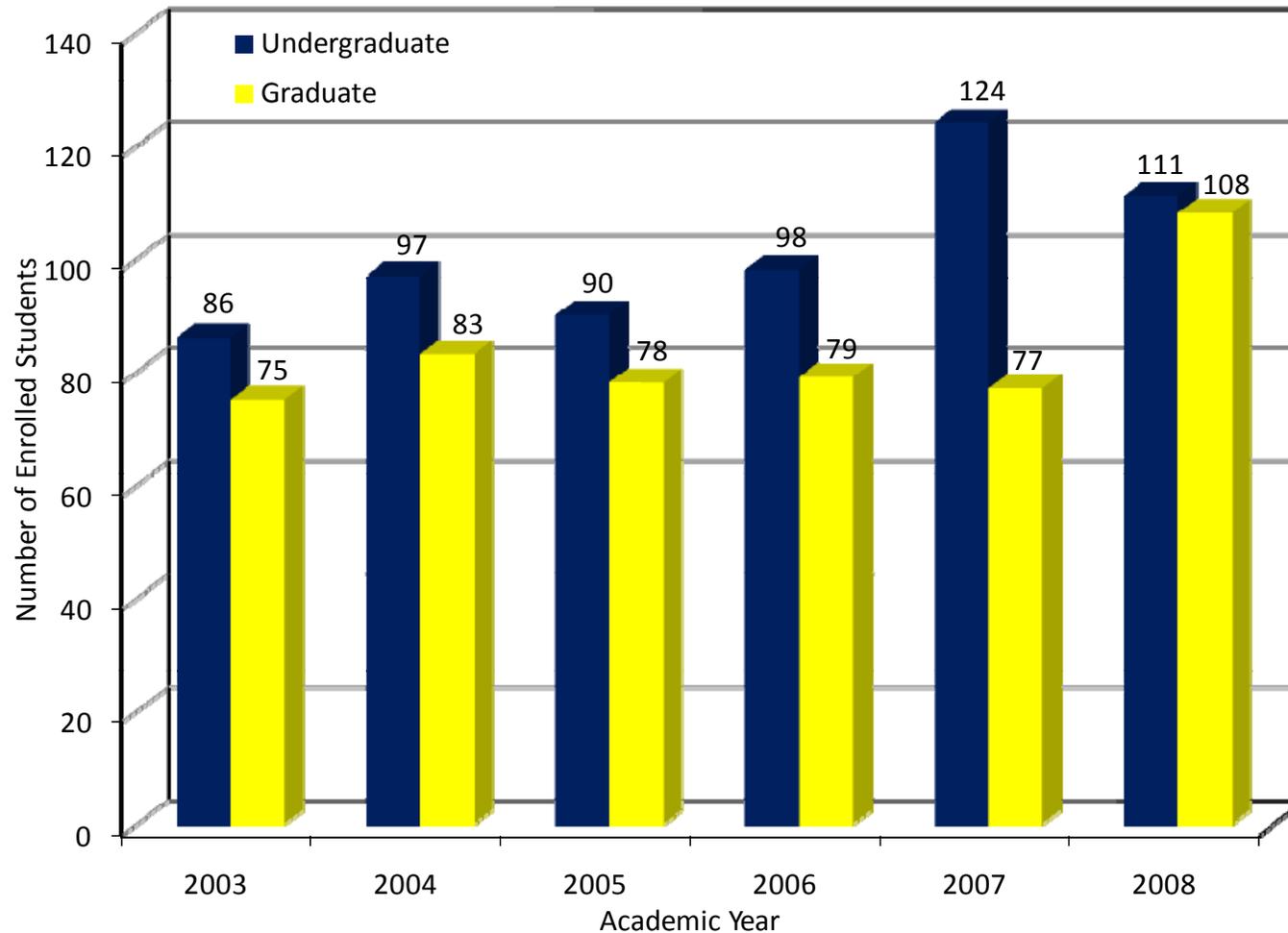
- NERS has one of the longest and well-regarded records of nuclear engineering (NE) education in the world
 - Currently the number-one ranked NE graduate school by *US News and World Report* (USN&WR)
- Internationally-renowned curricula spanning the breadth of the nuclear sciences:
 - Fission systems and radiation transport, nuclear materials, plasmas and fusion, radiation measurement and detection, radiation safety and medical physics
- The NERS department has a well-established tradition of expertise relevant to many of the challenges facing the nuclear renaissance





Recent NERS Enrollment Statistics

Graduate and Undergraduate



Detection for Nuclear Nonproliferation Group

Newly established group at the University of Michigan
Group Leader: Sara Pozzi

Group Members

- Marek Flaska, Assistant Research Scientist
- Shaun Clarke, Postdoctoral Research Fellow
- Eric Miller, Graduate Student
- Jennifer Dolan, Graduate Student
- Ben Maestas, Graduate Student
- Mark Bourne, Undergraduate Student
- Scott Ambers, Undergraduate Student
- Bill Walsh, Undergraduate Student
- Lu Huang, Undergraduate Student
- Ben Dennis, Undergraduate Student
- Paul Stanfield, Undergraduate Student



Collaborators – National

- Vladimir Protopopescu, Oak Ridge National Laboratory
- Alan Hunt, Idaho Accelerator Center
- Donald Umstadter, University of Nebraska
- Peter Vanier, Brookhaven National Laboratory
- John Mattingly, Sandia National Laboratory
- Andrey Gueorgueiv, Icx Radiation



Collaborators – International

- Imre Pazsit, Andreas Enqvist, Chalmers University of Technology, Sweden
- Enrico Padovani, Polytechnic of Milan, Italy
- Paul Scoullar, Southern Innovation, Australia
- Peter Schillebeeckx, JRC Geel Belgium
- Senada Avdic, University of Tulsa, Bosnia

MichiganEngineering
Department of Nuclear Engineering & Radiological Sciences

Detection for Nuclear Nonproliferation Group

We're looking for talented and motivated students who are interested in research in the areas of:

- Radiation detection and characterization
- Radiation detector response modeling
- Monte Carlo simulations and code development
- Measurements using state-of-the-art radiation detectors
- Source identification algorithm development

Please contact us for additional information!

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"... Today, the gravest danger in the war on terror, the gravest danger facing America and the world is outlaw regimes that seek and possess nuclear, chemical and biological weapons ..."
-President George W. Bush, 2003 State of the Union Address

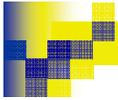
The primary goal of our research is the advancement of technologies to combat the proliferation of nuclear weapons and associated materials. We are also interested in applications such as nuclear medicine, imaging, and reactor fuel analysis.

The performance assessment of existing techniques—and the development of new, more advanced ones—rely on accurate simulation of realistic threat scenarios. We rely on the use of Monte Carlo and analytical methods to investigate the physics of detection.

<http://www-ners.engin.umich.edu/labs/dnng/>

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International Measurement Campaigns

Plutonium oxide measurements:
Ispra, Italy - August 2008



Capture-gated detector measurements :
Geel, Belgium - October 2008



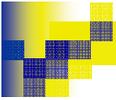
New Course Available in NERS

Detection Techniques for Nuclear Nonproliferation



- Nuclear nonproliferation; homeland security
- Introduction to the physics of nuclear fission
- Monte Carlo simulations for nuclear nonproliferation applications: MCNP5, MCNP-PoliMi
- Passive and active interrogation of nuclear materials
- Detectors and safeguards instruments

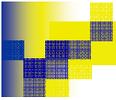




Certified Degree Program in Nuclear Nonproliferation at UM

- Would respond to the urgent need of trained professionals in the area of nuclear nonproliferation and homeland security
- Goal: Attract the best students, from the U.S. and abroad, to study and conduct research at UM → *develop future leaders in the field*
- Graduate program at the MS and PhD level to include:
 - Radiation detection for nuclear materials identification and characterization
 - Fundamentals in nuclear engineering and nuclear science
 - Nonproliferation policy issues
- Student internships in world-class experimental facilities with subject-matter experts
- Build and expand collaborations with international institutions
 - ORNL, INL, SNL, LBNL, LANL, JRC Italy, JRC Belgium, Chalmers University of Technology, Sweden



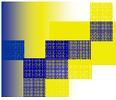


Institute of Nuclear Materials Management

Newly Developed UM Student Chapter

- The UM student chapter was established with officer elections on 20 November 2008
- Chapter Goals:
 - Involvement in NERS department
 - Outreach to School of Policy
 - Collaboration with the National INMM through events and the National Conferences
 - Student mentorship from INMM professionals
 - Host a presentation series by INMM professionals



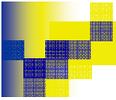


Developing Nonproliferation Professionals

Collaborations with ORNL

- In order to development growth of well-balanced nonproliferation professionals, collaborations with top national-lab researchers are necessary
 - Student internships
 - Postdoctoral research assignments
 - Seminars offered by ORNL staff at UM
 - Seminar series with international experts
 - Participation in ORNL nonproliferation workshops





Concluding Remarks

- The imminent nuclear renaissance poses unique nuclear nonproliferation challenges
- The NERS department has a tradition of expertise relevant to many of these challenges
- Clear definitions of both research and educational needs of the nuclear industry are paramount to meeting these challenges
- Program expansion – funding for future collaborations