Defense Nuclear Nonproliferation at Brookhaven National Laboratory

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Brookhaven Lab Today

The 17 national labs are unique, helping address DOE's mission by:

- Building, operating big machines a university or company could never build on its own—these facilities require national support
- Forming teams, both within labs and across the DOE complex
- Complementing, competing, and collaborating
- Fundamental, noncommercial research
- Technology transfer
Brookhaven Lab Today

Managed by Brookhaven Science Associates

Numbers
- Employees: 2,500
- Jobs in NY State: approx. 5,400
- Users: 4,000 per year
- Grad/Undergrad students on payroll: 400
- Total funding for FY 2019: $650 million
  - $580 million from the U.S. Department of Energy
  - $70 million from other agencies

Key partnerships
- New York State
- Stony Brook University
- Battelle
Nonproliferation and Nuclear Science

Programs and Capabilities

- National Nuclear Data Center
- Engineering for national security
- Non-destructive particle characterization and forensics using NSLS-II
- Detector design testing
- Data analytics, machine learning, artificial intelligence
- Accelerator Test Facility – training for IAEA

Partners/Joint Appointments

University
- Stony Brook University
- Yale
- The City College of New York

National Lab
- Argonne
- Pacific Northwest National Laboratory
- Oak Ridge National Laboratory

Industry
- GE
- Raytheon
- FLIR

New York State
- NYSERDA
- Westinghouse

BNL/DOE Facilities

- ARM/CRF
- Synchrotron/NSLS-II
- CFN/Nanoscience
- Computation
Defense Nuclear Nonproliferation-Related Activities

- Radiological Response Programs
- International Safeguards Support to the IAEA
- Data Driven Intelligence and Security
- Instrumentation
- Environment and Climate Science
Gamma Spectroscopy - CdZnTe

Crystal growth

Processing

Material Characterization

Detector Fabrication

Improved Radiation Detection Material

Radiation Detection Device
Radiological Response

- Region 1 Radiological Assistance Program (RAP) (Northeast)
- Disaster Assistance Response Team (DART)
- Developing Radiological Dispersion Device (RDD) response tactics
- Testing and evaluating radiation detectors (handheld, backpack, and vehicle portal monitors)
- Training local and regional first responders for nuclear/radiological emergencies
International Safeguards Project Office

- Technical and administrative management of the U.S. Support Program to IAEA Safeguards
  - The USSP transfers technology and services that are available in the United States to improve the effectiveness and efficiency of IAEA Safeguards
- Sponsored by the State Department
- Project management
- Recruitment
- At BNL for 40+ years

www.bnl.gov/ispo
Deep Learning Applied to IAEA Surveillance

- Improve automated review of surveillance images by decreasing the number of false positives
- Applies an open-source algorithm – You Only Look Once (YOLO)
- We have trained the algorithm to “recognize” items that are likely to be found in a nuclear facility
- Next phase is tracking items between cameras as they move through a facility
- Working jointly with Sandia National Laboratories
Transformative capability: Fast Large Area Scanning

10x10 cm swipe sample
Loaded with NIST # 2584, indoor dust sample with added U particles.

Contained in plastic ziplock bag, held in place by frame.
Materials in Radiation Environment Facility

External facility for synchrotron imaging, spectroscopy and diffraction of radioactive materials

- *In situ* characterization capabilities (P, T, stress, ion irradiation, electric field)
- High-throughput and remote access (robotics)
- Radioactive samples: fuel, dispersible transuranics
- Nondestructive, minimal sample preparation, bulk samples for real interfaces
- Ability to create secure area for sensitive research (forensics)
- Building on expertise and methods developed at NSLS and NSLS-II
Questions

- International Safeguards
- Nuclear Security
- Data Driven Intelligence and Security
- Data Analytics