

Domestic Nuclear Detection Office

Advanced Algorithms for
Security Applications¹⁰

DNDO's Integrated Threat
Detection Platform

Kevin Cronk

Program Manager

Transformational and Applied Research

Domestic Nuclear Detection Office



Homeland
Security

Why is DNDO Here?

- Looking to further collaborate with DHS S&T and the non-rad/nuc detection community
- Improve rad/nuc detection capability through development of integrated multi-threat technologies
- DNDO is funding a study with a national lab to further explore the possibility/ benefit of multi-threat scanning
- Potential for future research solicitation (in conjunction with S&T or UK) for integrated approaches
- Leveraging the established and capable explosives and contraband detection scientific community to further our capability

DNDO's Mission and Objectives

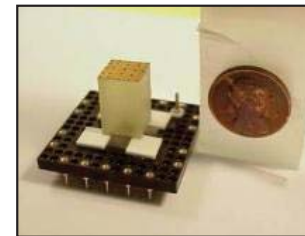
DNDO was established on April 15, 2005 with the signing of NSPD 43 / HSPD 14 for the purpose of improving the Nation's capability to detect and report unauthorized attempts to import, possess, store, develop, or transport nuclear or radiological material for use against the Nation, and to further enhance this capability over time.

- Develop the global nuclear detection and reporting architecture (GNDA)
- Develop, acquire, and support the domestic nuclear detection and reporting system
- Characterize detector system performance before deployment
- Facilitate situational awareness through information sharing and analysis
- Establish operational protocols to ensure detection leads to effective response
- Conduct a transformational research and development program
- Provide centralized planning, integration, and advancement of USG nuclear forensics programs

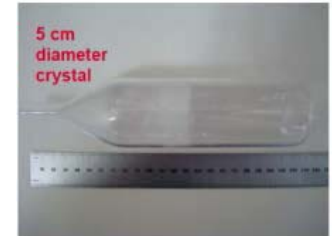
DNDO Transformational R&D Program

Aggressive and expedited R&D programs that seek to develop break-through technologies that will have a dramatic positive impact on capabilities to detect nuclear threats.

- Exploratory Research Program
 - Investigate promising concepts to show feasibility through laboratory Proof-of-Concept demonstrations
- Advanced Technology Demonstration
 - Characterize Performance Test Units in a simulated operational environment to assess technology transition potential
- Academic Research Initiative
 - Create next generation of scientists and engineers
- Small Business Innovative Research
 - Strengthen the role of innovative small business concerns with federally-funded research and development



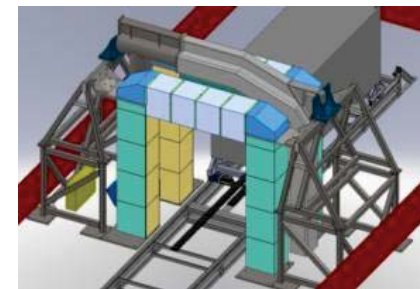
**TlBr
Semiconductor**



**Cs₂LiYCl₆ (CLYC)
Scintillator**



**SORDS Detector
and Truck**



SNAR Test Unit



**Homeland
Security**

DNDO/ S&T/ UK Home Office Collaboration

- Radiation and nuclear detection development and evaluation funded and managed by DNDO
- Contraband detection requirements developed by DHS S&T BMD and the United Kingdom Home Office
- Contraband detection capability development and evaluation funded by the United Kingdom

Nuclear and Radiological Imaging Platform

- Overall Goal: Optimize and characterize the ability of emerging technology to detect nuclear and radiological threats while clearing benign vehicles and containerized cargo regardless of the shielding level.
- Application Space
 - Ports of entry, ports of departure, and other choke point applications for vehicles
 - Lessons learned can be applied to more challenging applications
- Technical Objectives
 - Rapid clearing of cargo (short scan time and short inspection time)
 - High probability of detection of threats in cargo regardless of clutter and degree of shielding (very low false negatives)
 - Very low false alarm rates regardless of clutter (very low false positives)
 - Utility to detect other contraband is desired but not required
 - Maximize operational viability (size, footprint, radiation exposure, cost)

Commercially Available Scanners

- Joint DNDO/ US Customs and Border Protection evaluation of two integrated radiographic/ passive detection systems installed at Pacific Northwest National Lab (PNNL)
- Systems will be utilized to set the baseline performance to benchmark developmental systems
- Data will also be collected to inform algorithms development for data fusion (passive/ radiography)
- Data analysis in progress at Lawrence Livermore National Lab currently (Martz)



SAIC IP 6500 (In Front)



Smith's Detection HCVP 6030



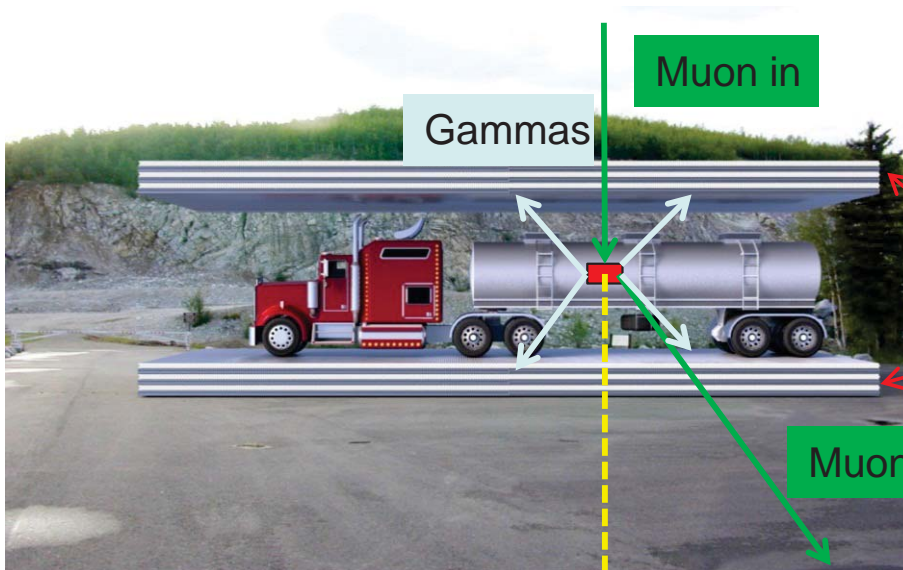
Homeland
Security

DSIC Performance Test Unit



Cosmic-ray muon tomography takes advantage of naturally occurring cosmic ray muons to probe the scene. Muons fully traversing the inspection volume provide information via angle changes from multiple-Coulomb scattering off the nuclei of materials.

Drift tubes used for muon tracking also serve as passive gamma counters.



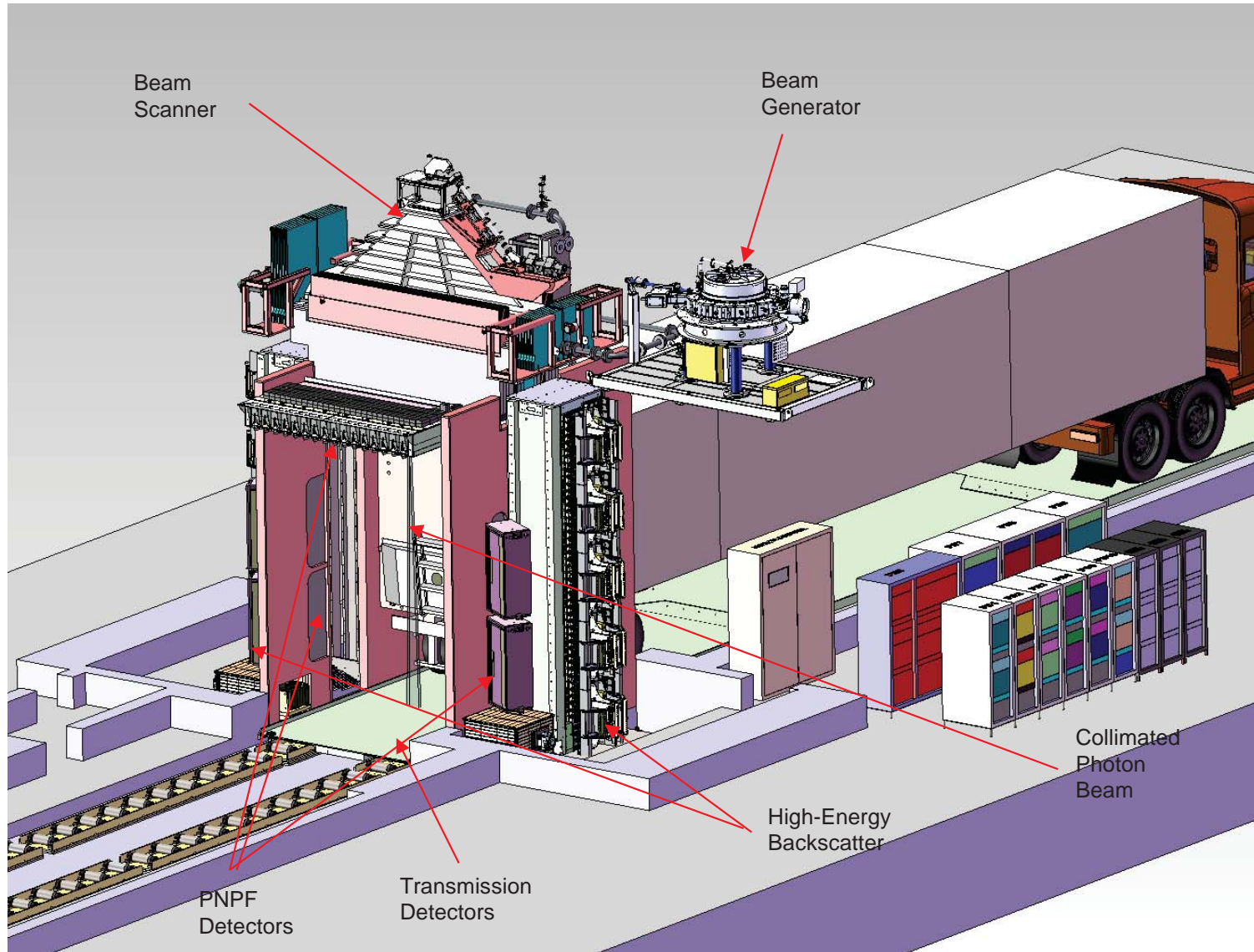
Sealed Drift Tubes for Muon Tracking and Gamma Counting

Average delta in angle proportional to muon energy and $(\text{density} \cdot Z^2)$ of target



Homeland
Security

Passport Scanner Technology

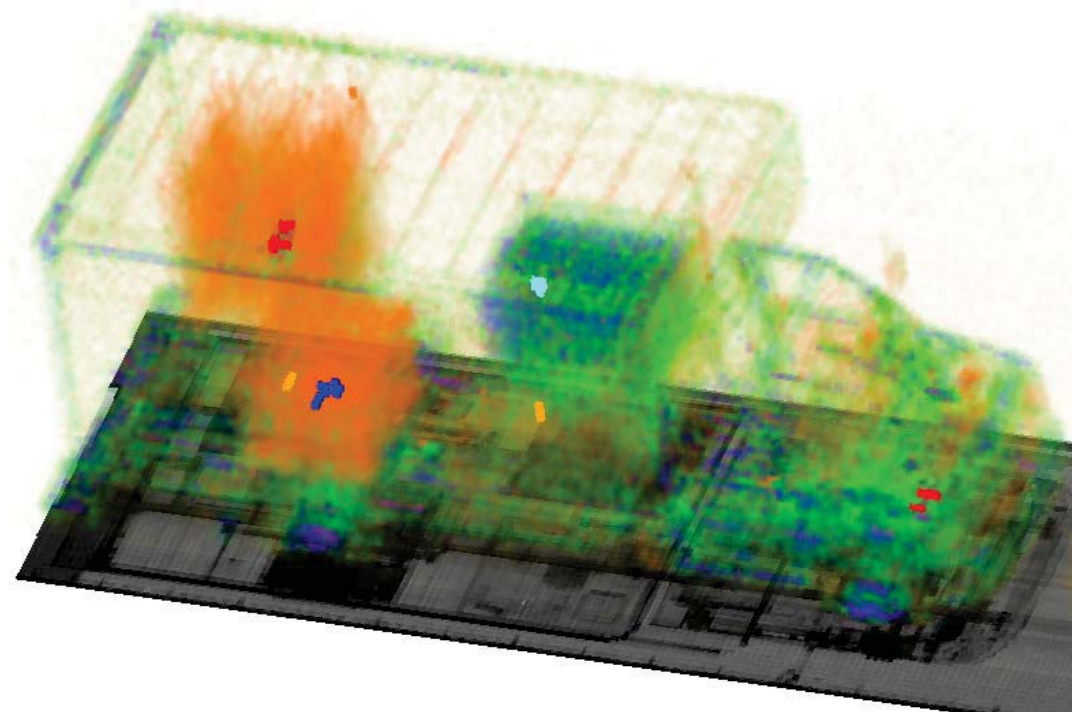


U.S. DEPARTMENT OF
HOMELAND SECURITY

Homeland Security

Beyond Radiation and Nuclear Detection

- System originally designed to meet DNDO rad/ nuc detection requirements
- Technology shows promise for multi-threat detection
 - High-Energy Backscatter
 - Effective Z
 - Density
 - Nuclear resonance fluorescence
 - Elemental analysis



System Build at Massport



**Homeland
Security**

Joint System Evaluation

- Full government integrated system characterization
- Real-time user interaction
- Multi-threat detection evaluation
- Stream-of-commerce data collection
- Broad government evaluation
 - DNDO
 - DHS S&T
 - US CBP
 - UK Home Office
 - Atomic Weapons Establishment

Working with DNDO

- Solicitations posted on Fed Biz Ops
 - www.fbo.gov
- Exploratory research solicitations
 - TRL 1-4
- Advanced Technology Demonstrations
 - TRL 5-7
- SBIR

Thank you

Kevin Cronk
DNDO/ TAR

kevin.cronk@hq.dhs.gov



Homeland Security