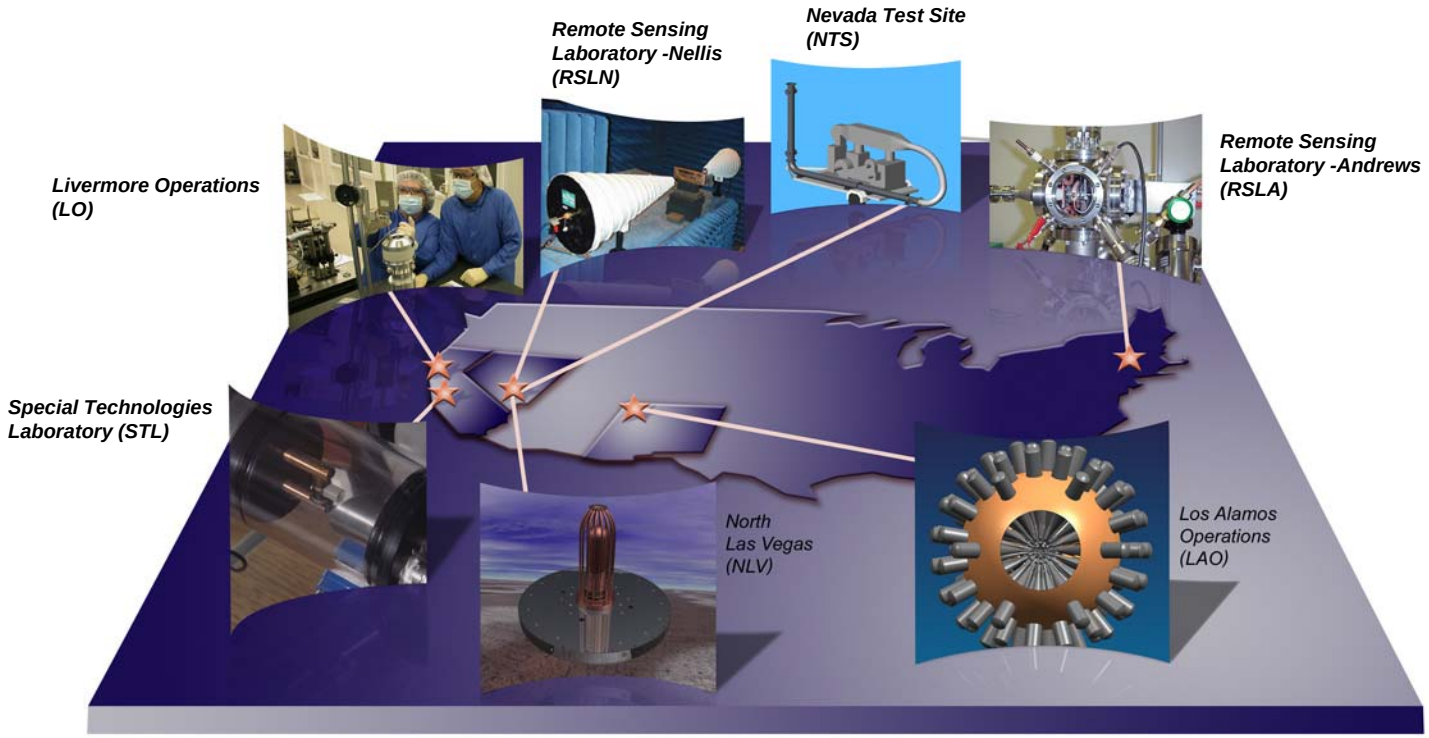
DOE/NV/25946--781

Nevada Test Site — Site Directed Research and Development



NNSA LDRD 2009 Tri-Lab Symposium

Jim Holt
Director, Defense Experimentation & Stockpile Stewardship

August 19, 2009

This work was done by
National Security Technologies, LLC,
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- ***NTS Mission Overview***
- ***SDRD Program Elements***
- ***Selected R&D Highlights***

NSTec operates the Nevada Test Site in support of a diverse mission and customer base

Site Directed R&D SDRD

Stockpile Stewardship

Science, Technology, Engineering, & Construction

Work with Others & New Ventures

Homeland Security & Defense Applications

NSTec mission support carried out from various operations and locations across the US

Nevada Test Site
Mercury, Nevada

North Las Vegas Operations
North Las Vegas, Nevada

Remote Sensing Laboratory - Nellis
Nellis AFB, Nevada

Livermore Operations
Livermore, California

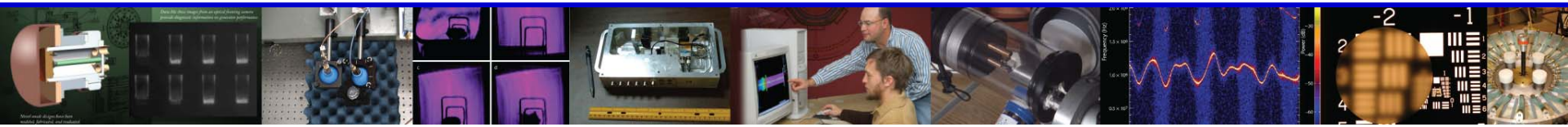
Special Technologies Laboratory
Santa Barbara, California

Remote Sensing Laboratory - Andrews
Andrews AFB, Maryland

Los Alamos Operations including Sandia Operations
Los Alamos, New Mexico
Albuquerque, New Mexico

NSTec
2,600 People
$500M Annually

Site Directed Research and Development is our solution engine for national security needs



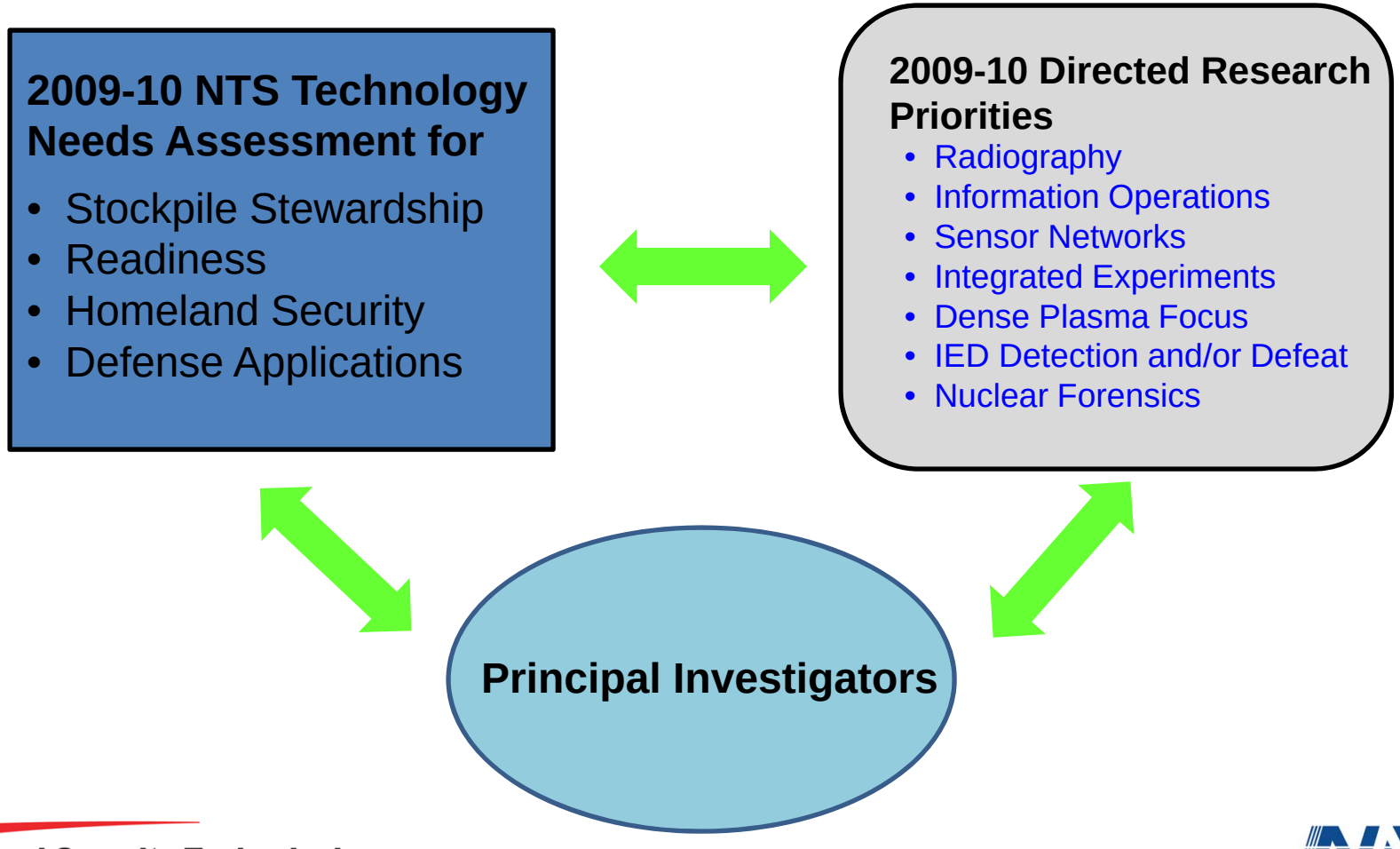
Program started in 2002 with the following tenants:

- *Retention and recruitment of individuals with critical skills*
- *Enhancement of core competencies required for current and future technical missions*
- *Developing and demonstrating innovative ideas and technologies to advance new solutions to national security needs*

Mission relevance directs investment and targets opportunities for technical staff generated ideas

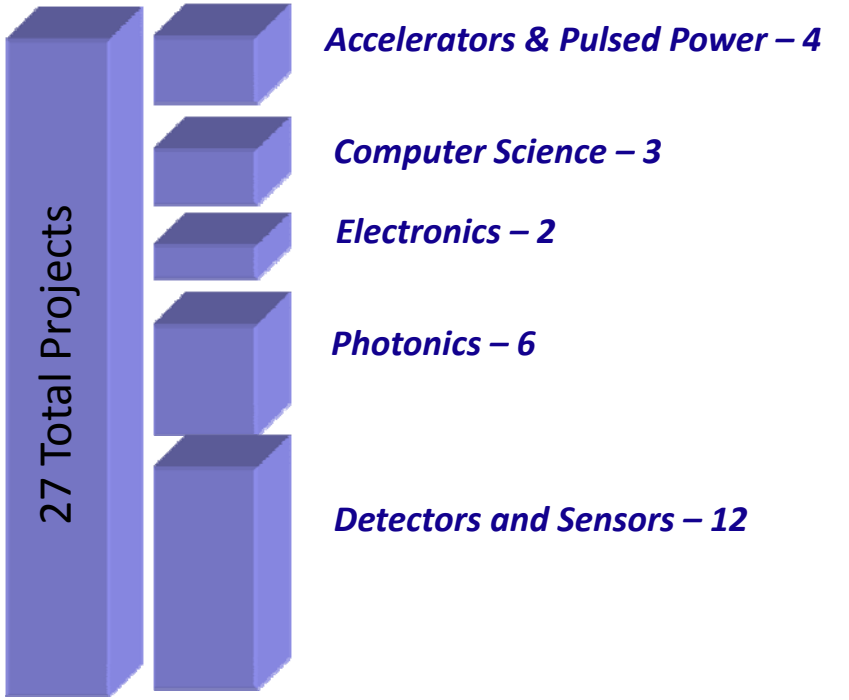
Site Directed R&D SDRD

Our Directed Research Priorities…*PLUS*…our *NTS Technology Needs Assessment Document* guides R&D opportunity

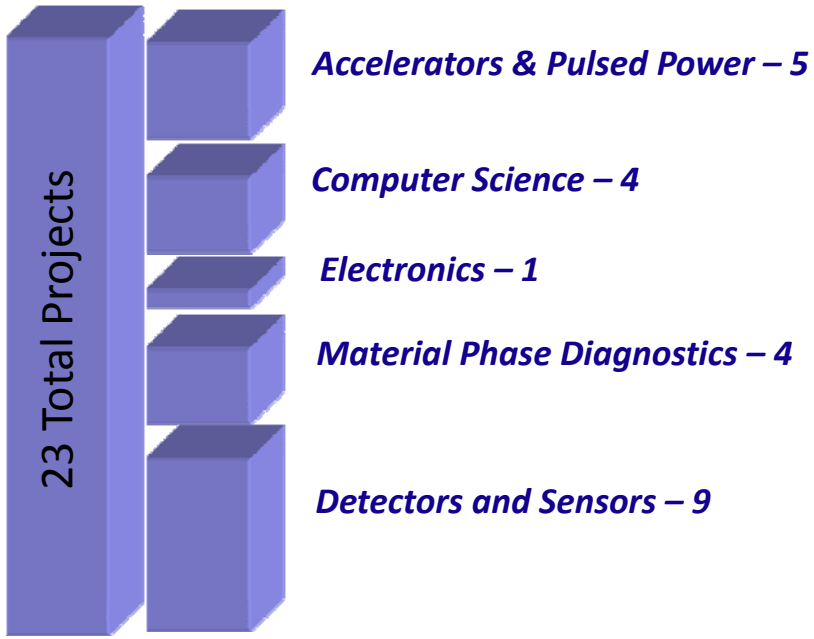


FY 2008 & 2009 project snapshot shows key general technology areas

Projects selected from typically 150 submitted proposals per year
Approximately $5 M total to fund selected projects
One year project duration w/second year follow-on



2008



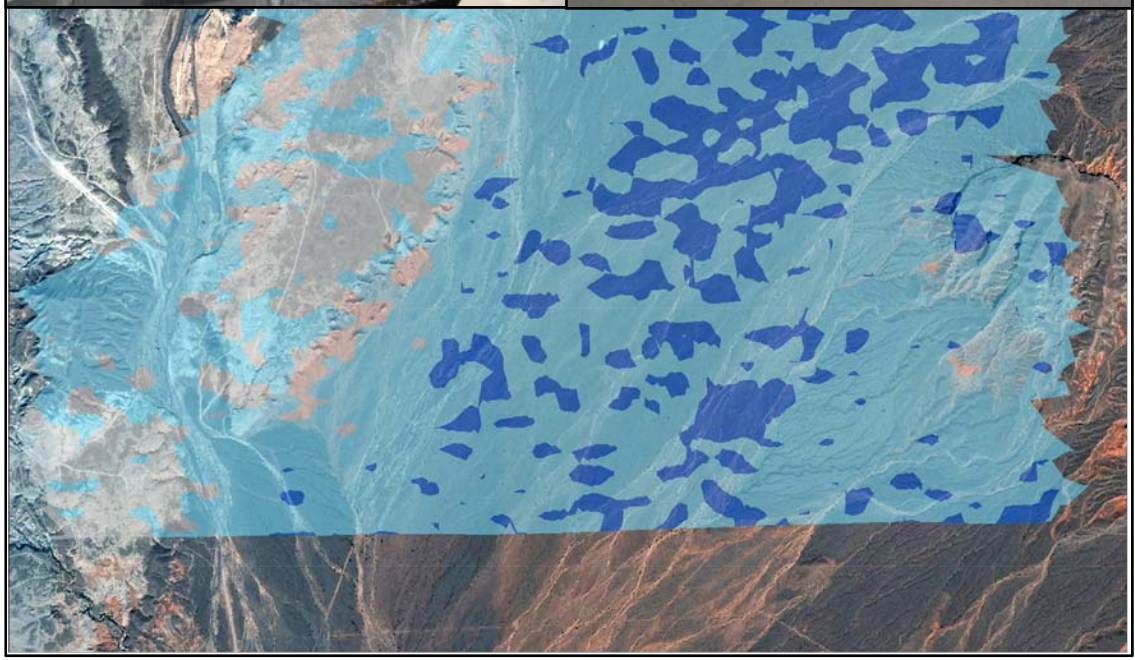
2009

Many prior SDRD projects culminated into mission support for multiple agencies

PDA program running in “field mode” simulating data from a high purity Ge spectrometer complete with a GPS “location”

Radiological Assessment Training Simulator

Multi-path Communication Device



Aerial Neutron Detection

R&D efforts return future value with new projects for our Special Technologies Laboratory

SDRD Project Driver	NEW DOE NA-22 Project
SDRD FY03/04 "Covariance mapping"	**FY09** "Covariance spectroscopy for fissile material detection"
SDRD FY04 "Cathodoluminescence and SEM/EDS analysis"	**FY09** "Automation of micro-particle detection"
SDRD FY07/08 "Frequency-modulated detection of phosphorescence on surfaces"	**FY09** "Frequency-modulated detection of phosphorescence on surfaces"

Current projects are targeting critical mission areas with enhanced emphasis

Materials and Phase Diagnostics

- Phase transitions/shock dynamics with THz spectroscopy
- Picosecond time-resolved electron diffraction of phase transitions
- Debye-Waller dynamic temperature measurements
- Fourier transform spectrometer
- Nano-particle engineering for improved scintillators

Nonproliferation

- DFT computations for uranium chemistry
- SNM end of enrichment time and constituency reconstruction
- Portable tagged neutron triple coincidence counter system

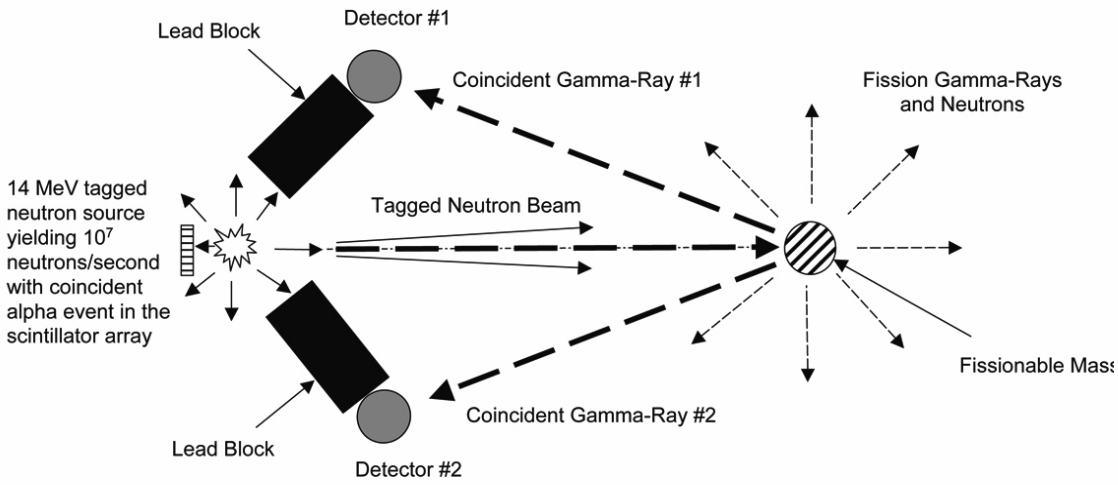
Advanced Detectors and Sensors

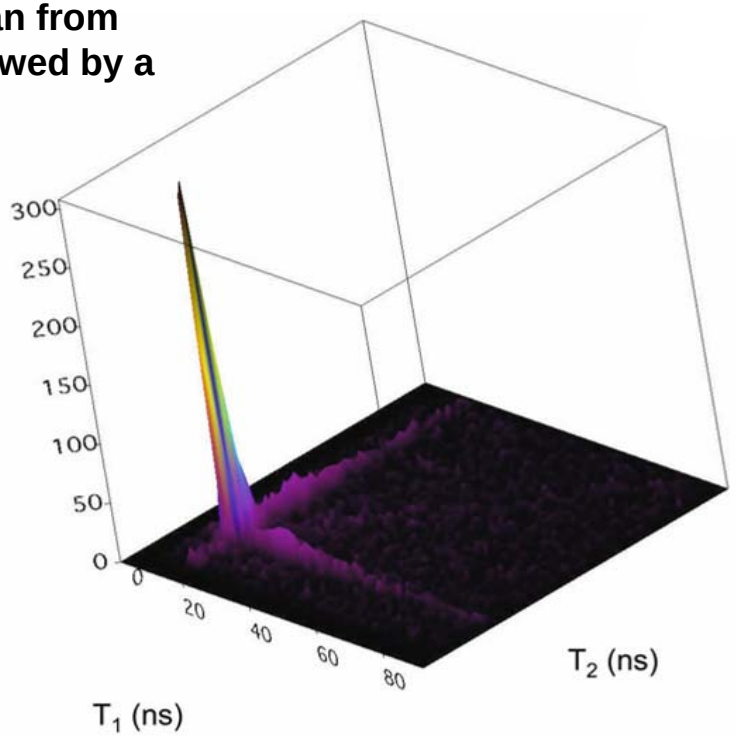
- Multi-band RF receiver and antenna array
- Differential mobility spectrometry/mass spectrometry

Active interrogation for border/container security and detection of nuclear material

Detecting fissile material using a low-dose portable neutron generator system is ongoing focus *(Poster presentation)*

The triple coincidence response profile from DU is different than from non-fissile materials. Can observe the gamma-ray "spike" followed by a second peak separated in time by the neutron time of flight.



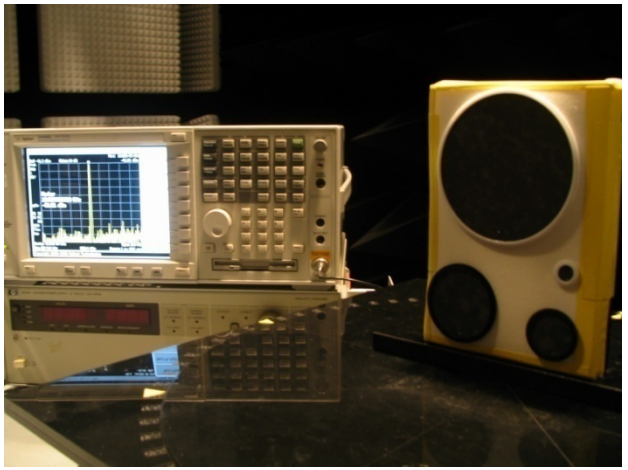


Using the Triple Coincidence Technique to Detect DU
This is equivalent to being able to see 1.56 kg of ^{239}Pu or 1.8 kg of ^{235}U at this distance.

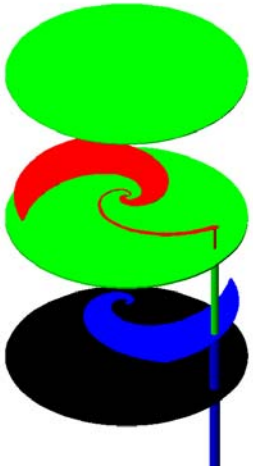
RF surveillance & EM countermeasure techniques are vital to many facets of national security

Site Directed R&D SDRD

A new advanced and highly integrated approach is being developed for multi-frequency wide spectrum detection
(Poster Presentation)



- Covers the frequency bands from 9.3 GHz to 24 GHz
- Collaboration with University of Colorado for complementary antenna design
- New receiver will significantly enhance the capabilities of specialized tools for microwave detection in security system access



Spiral design antenna topology used with miniaturization

New wireless security assessment tool for use by network engineers and security analysts

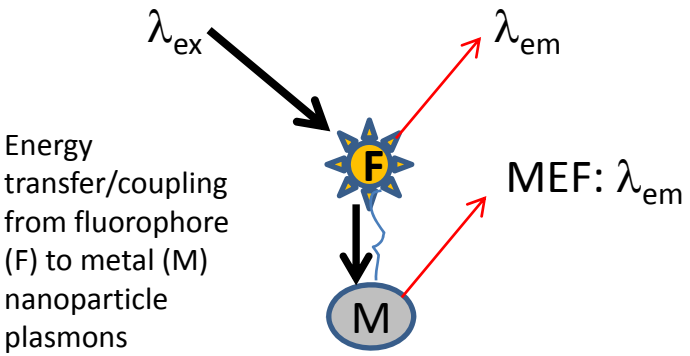
- Scans for unauthorized wireless from 2.4 GHz to 5 GHz
- Portable, easy to use
- GPS capable for mapping wireless access points
- Use to assess security protocols & vulnerabilities for wireless network setup

OQO ultra mobile personal computer

Screenshot of fake access points caught

Metal Enhanced Fluorescence (MEF) using metal nanoparticles may improve energy transfer in scintillators

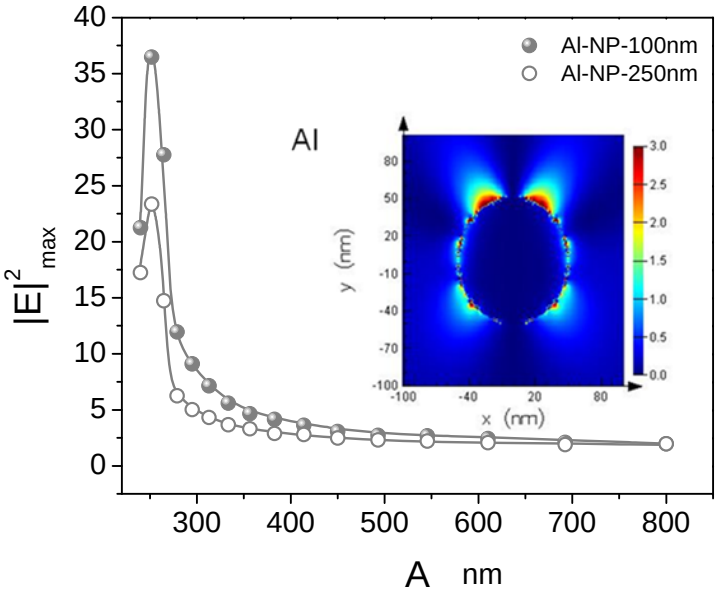
Metal nanoparticles can increase sensitivity by several orders of magnitude. Light scattered from one nanoparticle is equivalent to the light emitted from $5x10^5$ fluorophores. *(collaboration with UMBI)*



Can MNPs be used to enhance scintillator output and/or decrease decay time?

Approach:

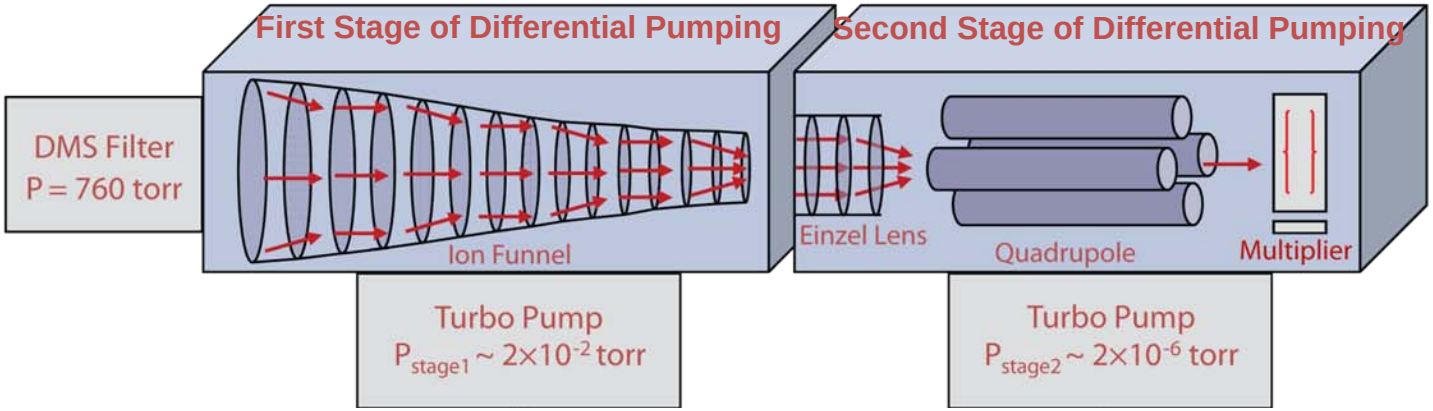
1. Simulations performed to determine most appropriate metal and nanoparticle size for optimal enhancement of toluene excitation/emission
2. Enhancement measured using 265 nm excitation (toluene absorption maximum)
3. Determine whether enhancement is also observed when ionizing radiation is the excitation source



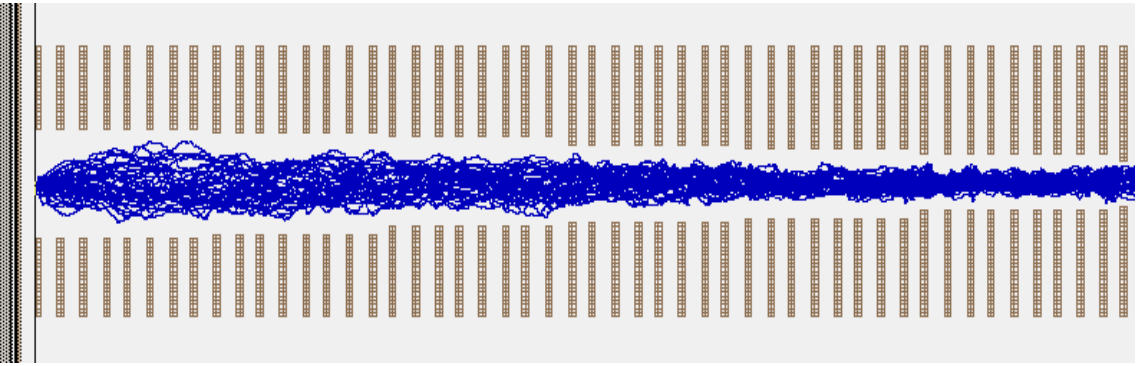
Simulations show an Al-NP (100 nm diameter) increases the electric field by 35 fold at ca. 285 nm (toluene emission frequency).

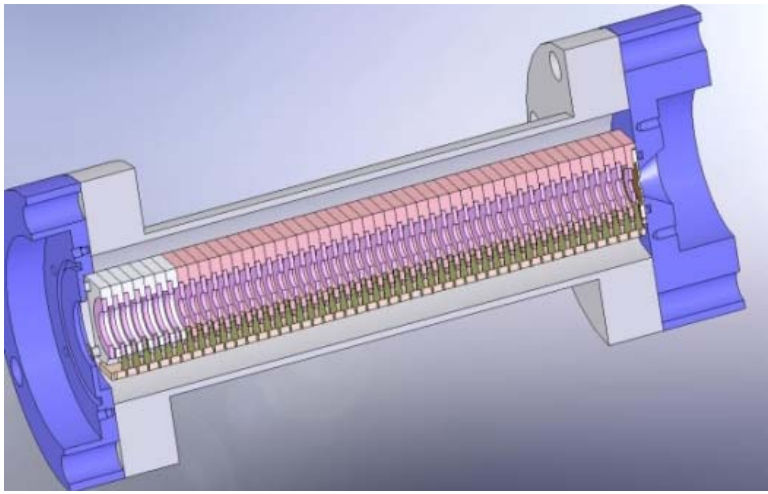
High sensitivity chemical detection for counterterrorism seeks ease of use and portability

Compact integrated differential mobility spectrometer with quadrupole mass spectrometer (Poster Presentation)

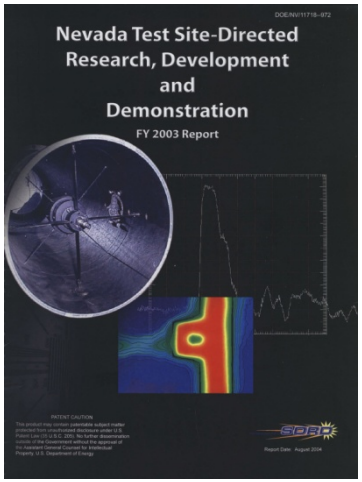


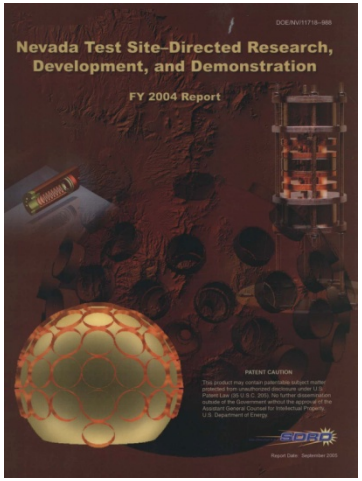
Ion transport modeling used to design 50 lens element RF “ion funnel” for radial confinement

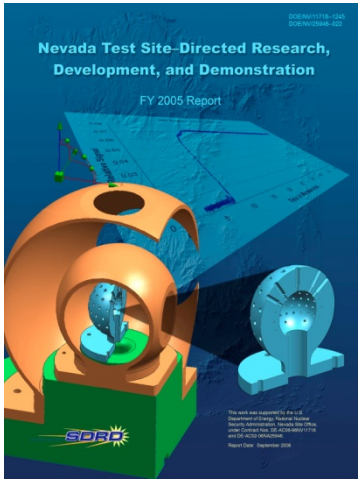


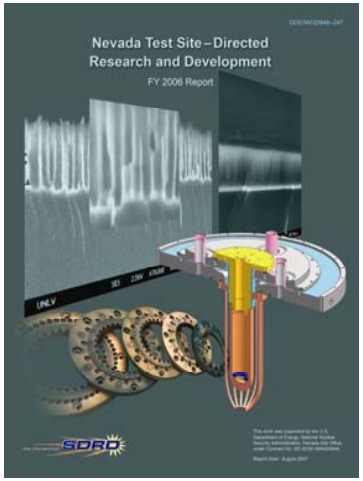


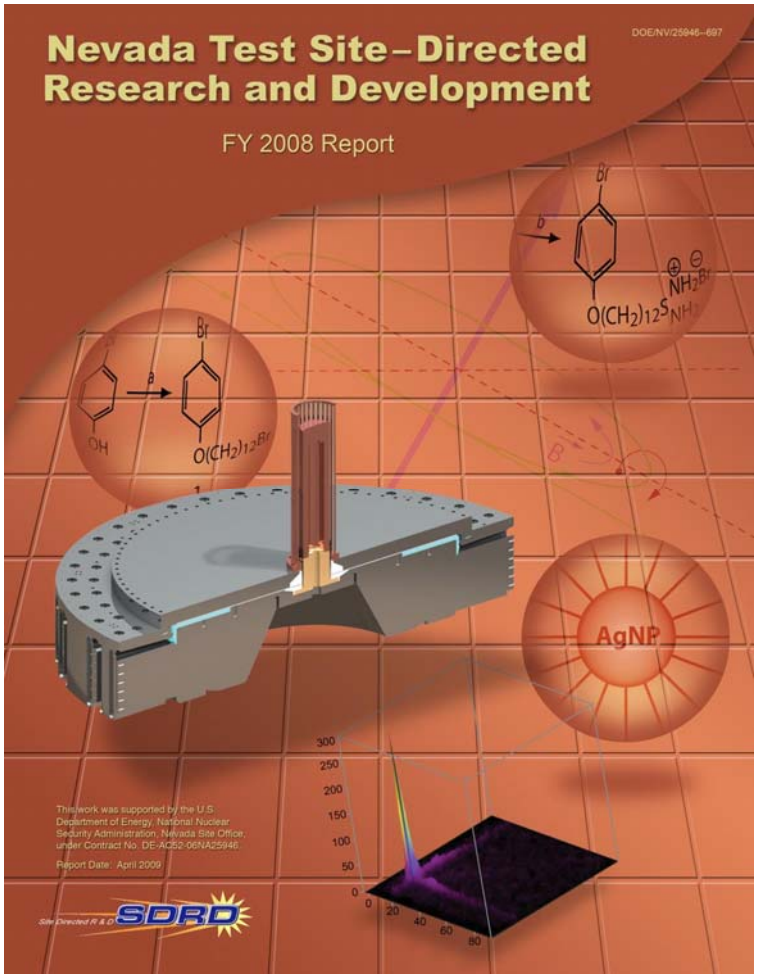
Project articles published at year end in compendium volume and available thru OSTI











Summary

- *SDRD is forward looking and anticipating needs to advance solutions for our customers and national security*
- *Exploring new ways to complement outside laboratory efforts and utilize user facilities*
- *Finding niche areas to grow new opportunities*
- *Leveraging resources for enhanced capabilities*
- *Balancing risk and return on investment for maximum value*

For further information

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