100 Percent Screening of Cargo Containers

(Session 3A: Security II)

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Outline

- Need for Integrated Container Inspection System (ICIS)
- Description of ICIS
  - VACIS
  - Radiation Portal Monitor
  - OCR-Automated Container Identification
  - Radioisotope Identification System (RIIDs)
  - PELAN (material specific inspection)
  - Integrated Data Display
- ICIS Demonstrations
- Automated image analysis (EmptyView)
- Conclusions

Need for Integrated System Approach

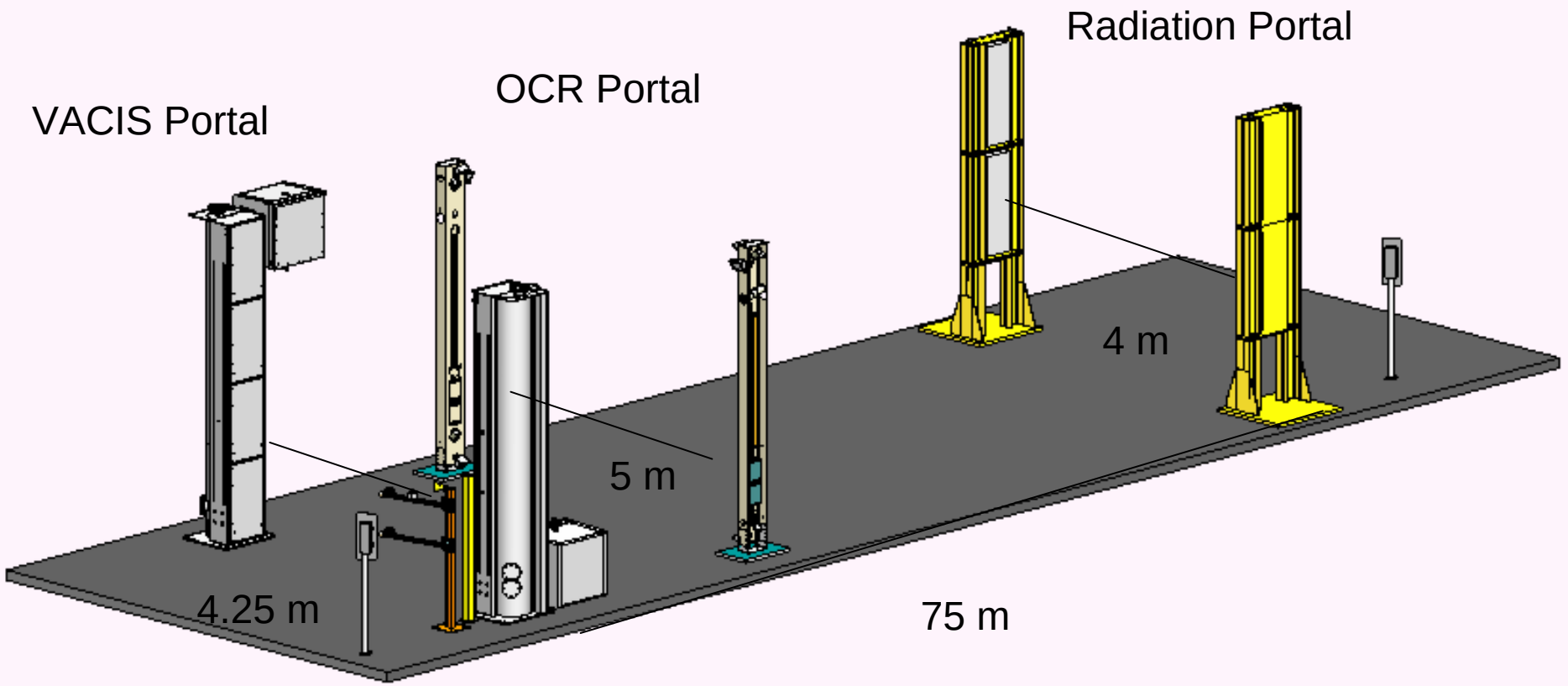
- **Radiation Portal Monitors (RPMs) used to detect nuclear weapons and radioactive materials by detecting gamma-rays and neutrons (Passive Detection)**
- **High density shielding can prevent passive detection of nuclear weapon or radioactive material**
- **Gamma or X-ray radiographic imaging will detect anomalous high density shielding – complements RPMs**

Need for Integrated System Approach
continued

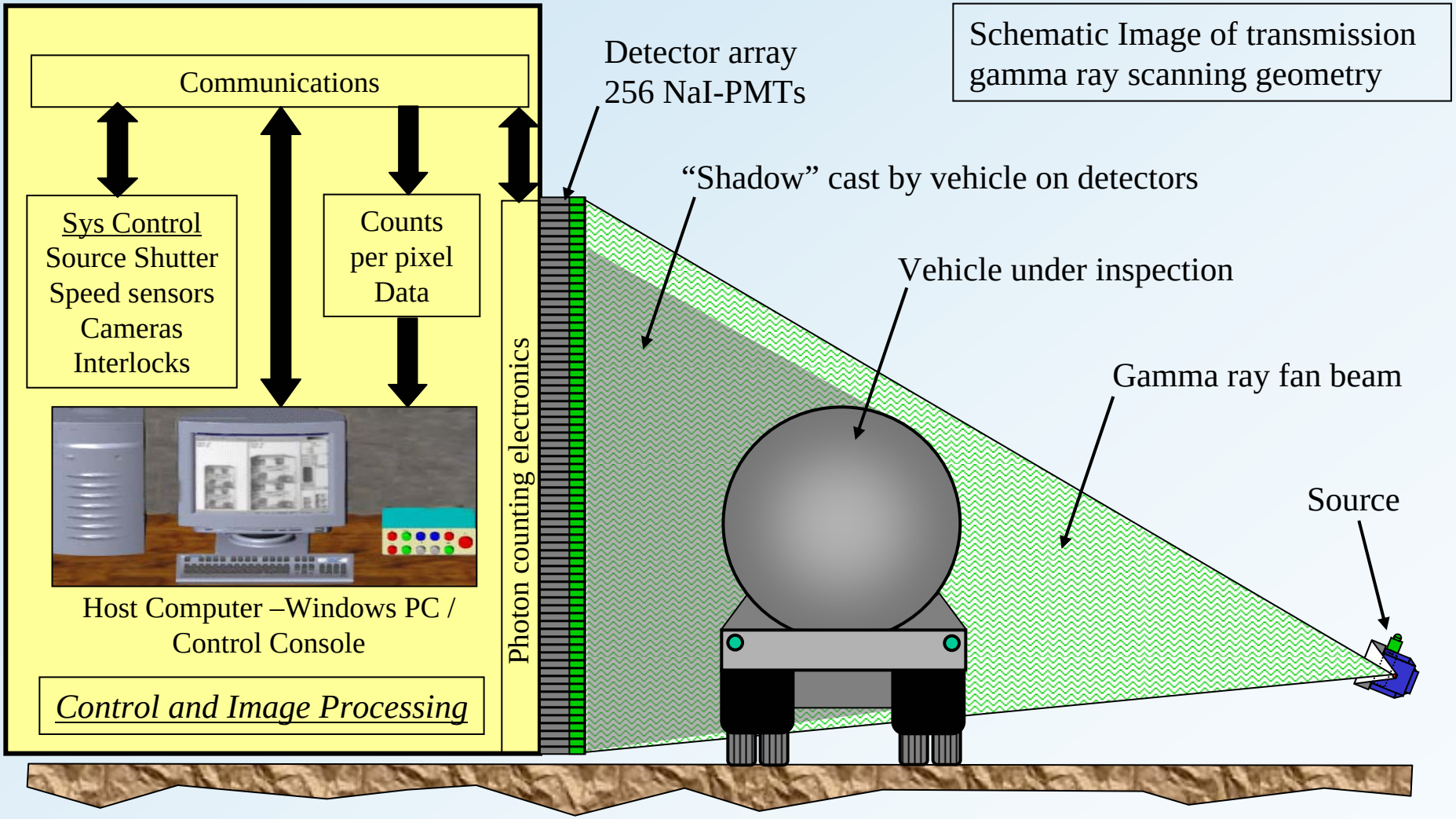
- "Nuisance" alarms in RPMs from naturally radioactive materials in cargo must be resolved promptly
  - Isotope identification using gamma spectroscopy
  - Manifest consistency from gamma/x-ray image
- Material specific neutron interrogation techniques (Active Detection) to verify explosives, chemical agents, and nuclear materials (like U-235 which is difficult to detect passively when shielded)
- Automatic identification of container/truck to minimize impact of inspection on cargo throughput
- "Smart Containers" with intrusion sensors, tracking capability and electronic seals

The Solution

ICIS Concept Layout



Operating Principle of VACIS Gamma Ray Imaging



VACIS®

VACIS Configurations

Mobile

Truck-mounted mobile system

Scans containers, trucks and other large objects

Portal

Permanent installation for gates or checkpoints

High throughput – minimal impact on traffic

Railroad

Scans railcars and containers as trains pass by

Relocatable

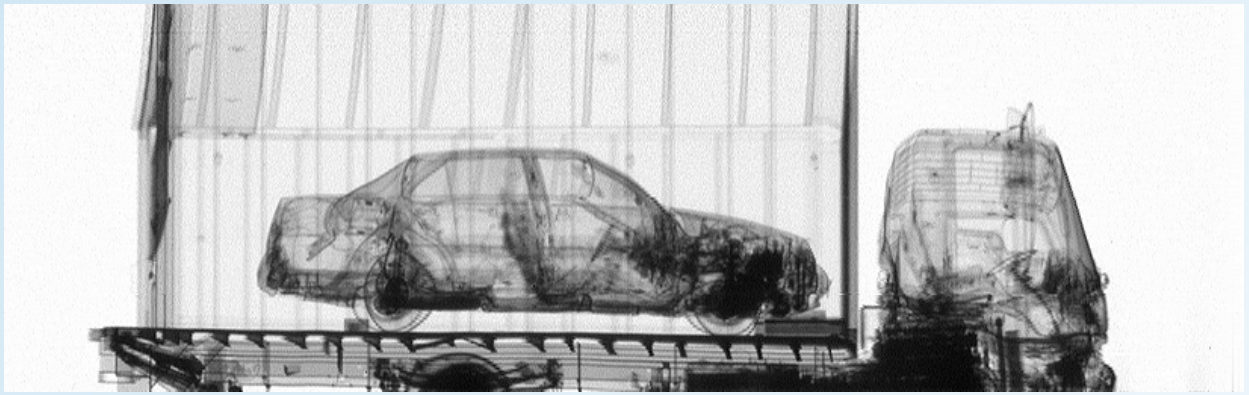
Track-mounted movable system

Entire system can be moved in 1–2 days

Pallet

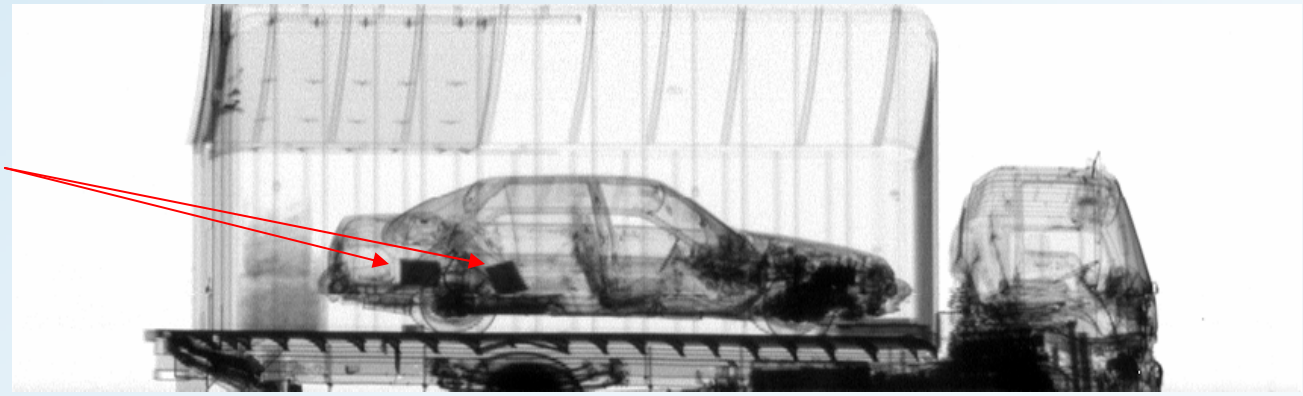
Scans cargo on pallets

Mobile VACIS Images of Auto in Container



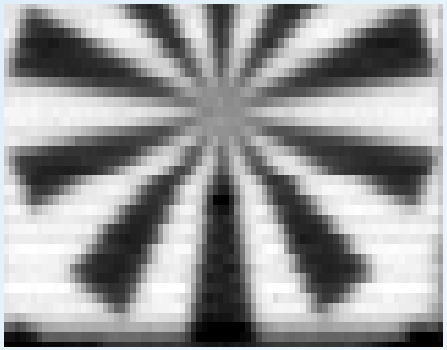
Contraband-free Automobile

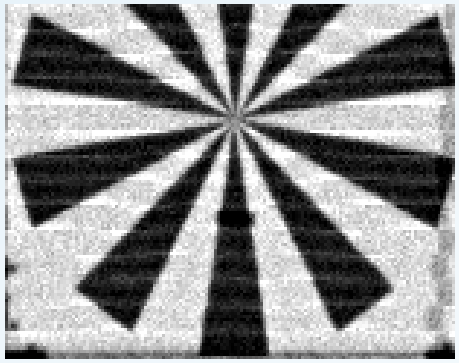
C-4 simulants



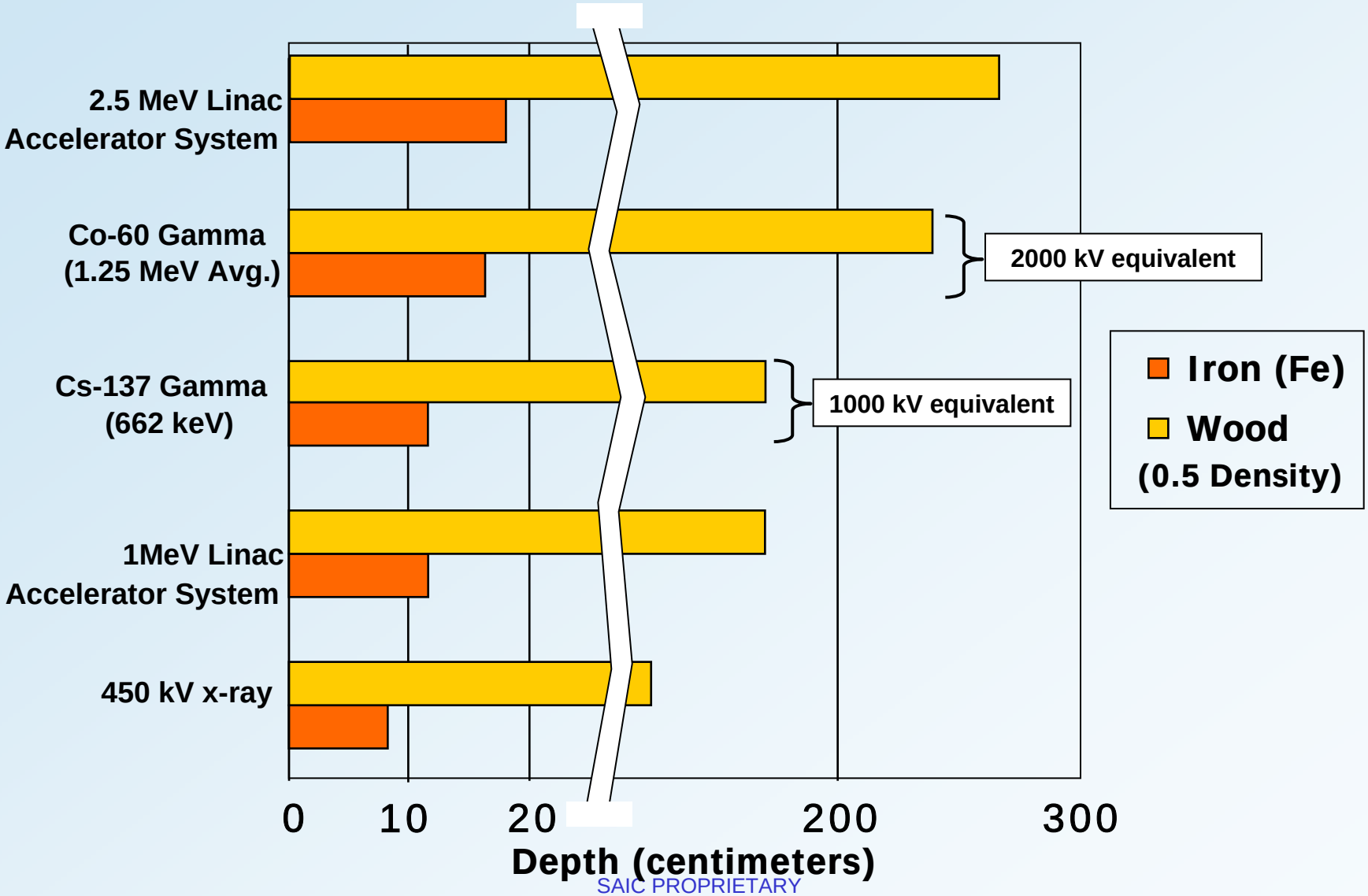
Automobile containing simulated explosives

High-Resolution VACIS



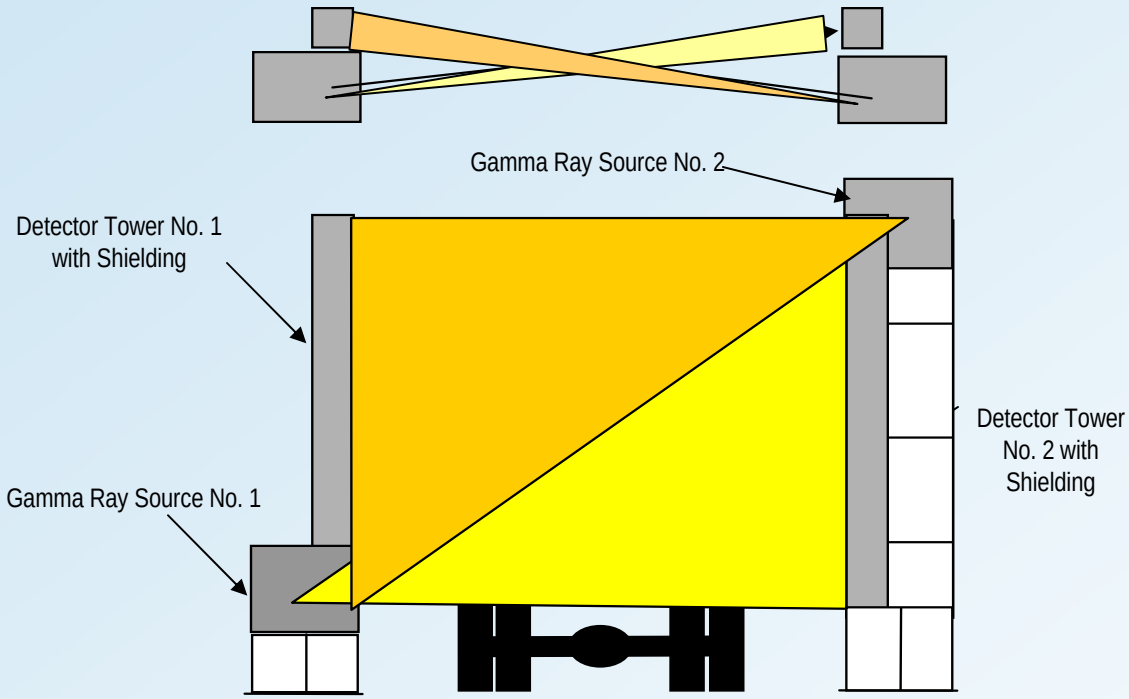


Operational Penetration Comparisons



Portal VACIS

Source-Detector Configuration



Portal VACIS Prototype

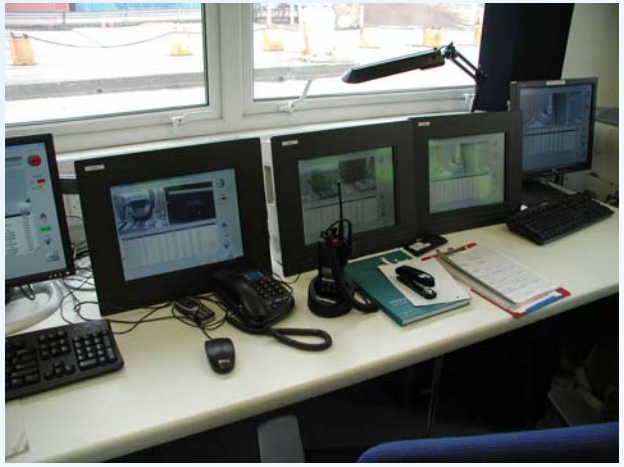
Two Portal VACIS on adjacent traffic lanes

Radiation Portal Monitors

Exploranium AT-9xx Radiation Portal Monitor (RPM)

- Senses and locates gamma ray and neutron sources
- Uses Plastic Scintillators for gamma detection and moderated He-3 detectors for neutrons
- Scans containers, trucks, cars and railcars in traffic
- State-of-the-art sensitivity, very low false-alarm rate
- Configurable for specific materials and alarm thresholds
- Graphic console displays live and stored radiation profiles

RPMs at Felixstowe in UK



Radioisotope Identification

Handheld Analyzers

Exploranium GR-135 Gamma/Neutron Isotope Identifier

- Measures gamma and neutron levels
- Displays real-time dose rates
- Identifies many common nuclides
- Easy one-hand operation
- Upload scanning data for analysis and archiving

Vehicular-Mounted Analyzers

Exploranium GR-460 and GR-660

- Identify, locate and map gamma and neutron radiation
- Quickly survey urban, rural and wilderness terrain
- Airborne, car-mounted and hand-carried configurations

Explosives, Chemical, Other Hazmat

Pulsed-Neutron Elemental Analysis (PELAN)

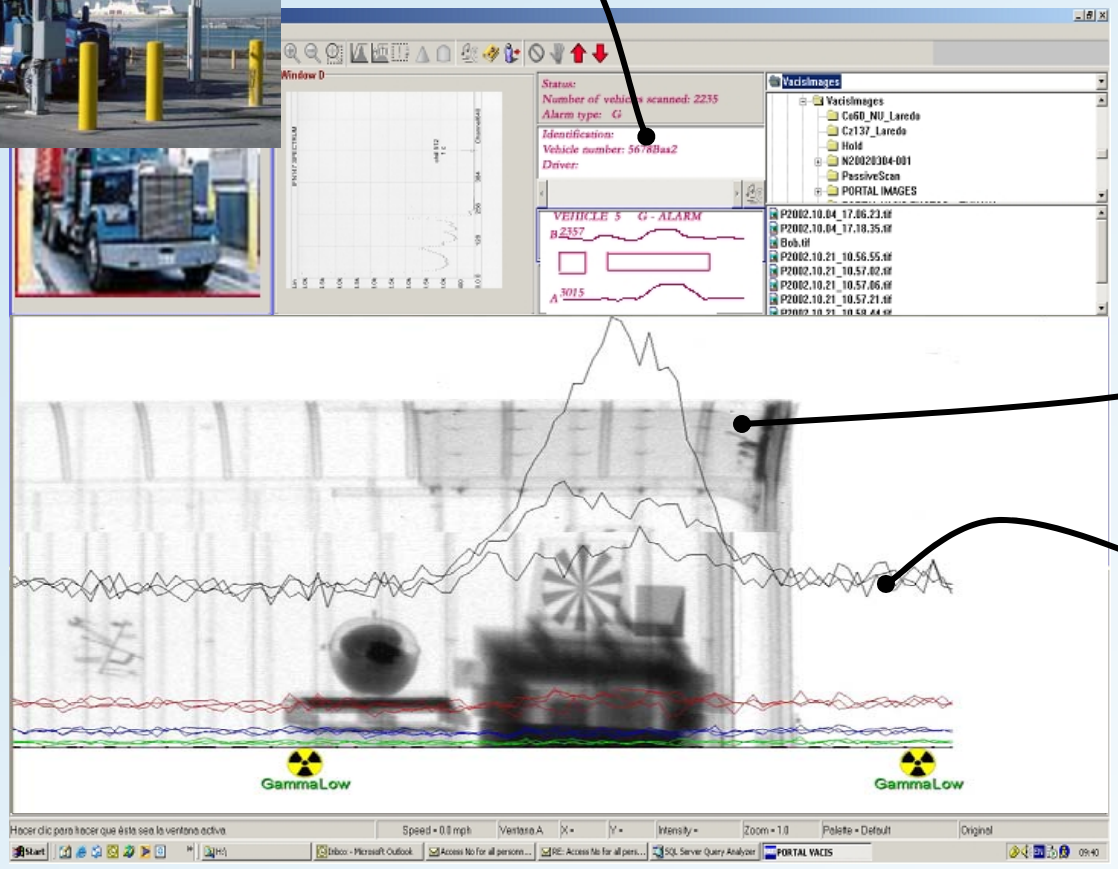
- Fast analysis of explosives and other materials in the field
- State-of-the-art thermal and pulsed neutron technology
- Scans contents of vehicles, cargo containers, luggage, packages, and other places of concealment
- Analyzes bombs, explosive materials, even buried land mines
- Portable system can be carried, set up and operated by a single person
- Wireless notebook controller for safe remote operation

PELAN Neutron Interrogation System Detecting Explosives

PELAN

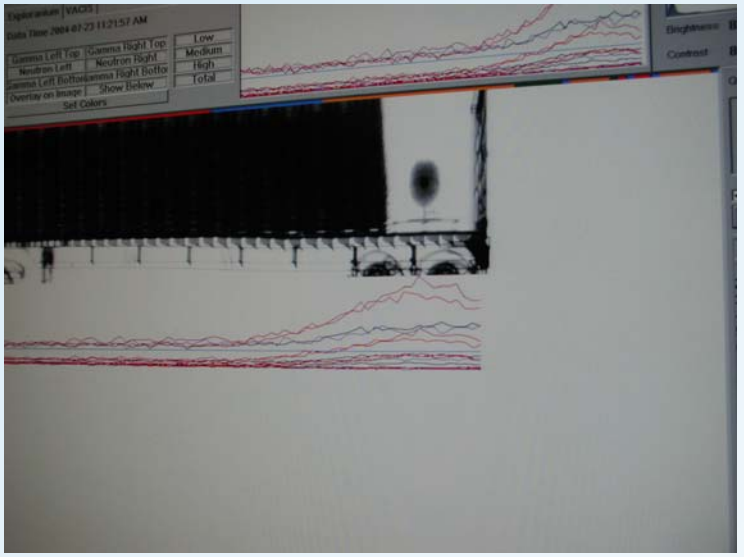
200 lbs ANFO Inside of Rental van

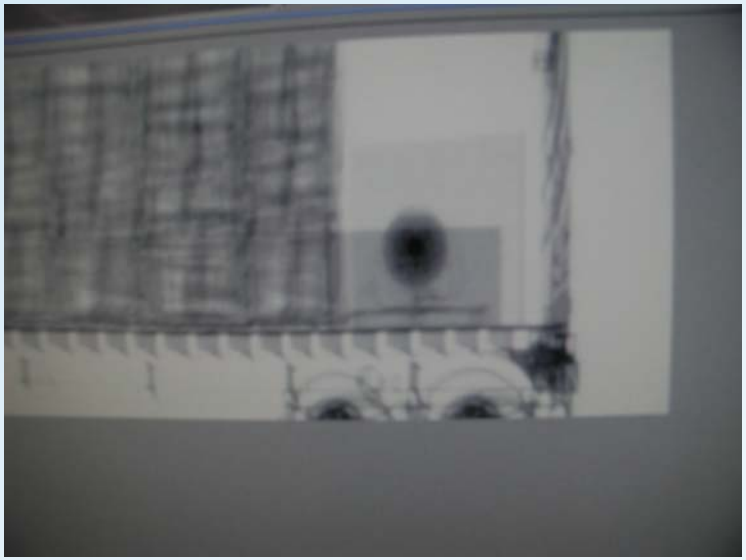
ICIS Viewer - integrated data display

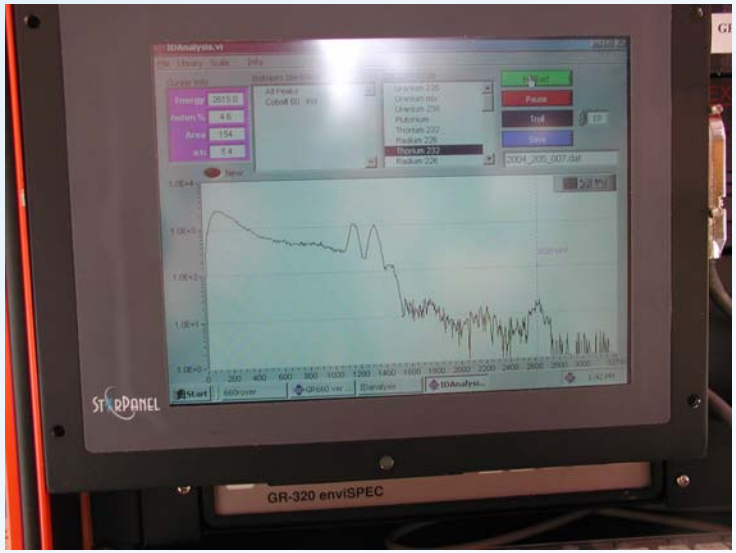


ICIS at Tacoma

Typical Initial Image Data







ICIS Prototype Testing at San Diego

- ICIS uses advanced Portal VACIS with “drive-through” capability (up to 10 mph)
- ICIS uses relocatable Exploranium Radiation Portal Monitor (can be repositioned using fork lift and is “free-standing”)
- OCR video cameras for automatically reading container ID and line scan video for automatic OCR reading of chassis number

ICIS Overview

Portal VACIS

Video OCR System

Relocatable RPM

ICIS Demonstration and the Hong Kong CTOA

- Hong Kong Container Terminal Operators Association (CTOA)
  - Promotes the Port of Hong Kong as the key container hub in the region
  - Composed of HIT, Modern Terminals, CSX WT, COSCO-HIT and ACT

- CTOA is currently evaluating new terminal security measures
  - Respond to current and future CSI requirements
  - Reduce vulnerability, mitigate impact, recover faster
  - Enhance security without impeding traffic
- SAIC is working with CTOA to evaluate the ICIS system
  - High throughput – capable of screening containers in normal traffic
  - Fixed and mobile configurations to support gate and quay operations
  - Combines gamma ray imaging, radiation screening and OCR identification
  - Provides screening data to Customs authorities in near real time
  - Provides a database for reference in the event of an incident

The ICIS System

VACIS® gamma imaging

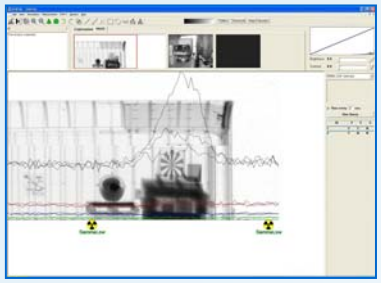
Cargo images

OCR identification

Container IDs

ICIS Database

ICIS Viewer



Integrated ICIS data

Integrated ICIS data

Customs Agencies

Radiation profiles

Container data

Radiation Portal Monitor

Terminal Operators

Manifest data

Carriers

ICIS Demonstration

- Concept of operation
  - Install in terminal's normal traffic patterns
  - Collect and integrate imaging, radiation and OCR data
  - Provide data to Customs and other approved parties

- Hong Kong ICIS demonstration
  - Install VACIS Portal, RPM and OCR at Modern Terminals and/or Hong Kong International Terminals
  - Collect and integrate data in central repository
  - Provide integrated data to Customs and CTOA for evaluation
  - Began operation September 27, 2004; 6-months demonstration
- Goal: Demonstrate the benefits of ICIS for Customs, terminal operators and shippers
  - Increase supply chain security by screening cargo at port of origin
  - Reduce security costs for terminals by minimizing impact on traffic
  - Reduce costs for shippers by qualifying for expedited processing
  - Enhance cargo security and management through data analysis
  - Expedite recovery following an incident

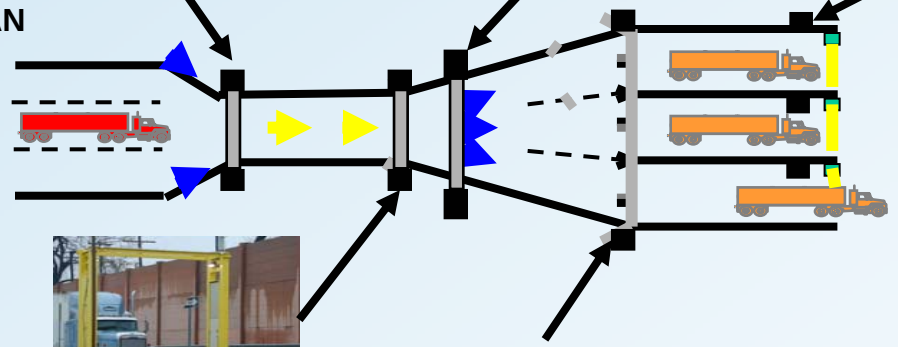
Hong Kong Demo – 100% Screening

- In-line screening does not require trucks to stop at gate
- 100% Passive radiation + VACIS + OCR
- Modern Terminals Ltd. #1, 2, 5, >2 million containers/yr
- Current (10/13-14th) throughput averaging 1960 containers per day
- Quay-side VACIS for trans-shipment containers

Non STOP PORTAL VACIS SCAN

OCR PORTAL

SECURITY AND INFORMATION KIOSK AND PRINTER



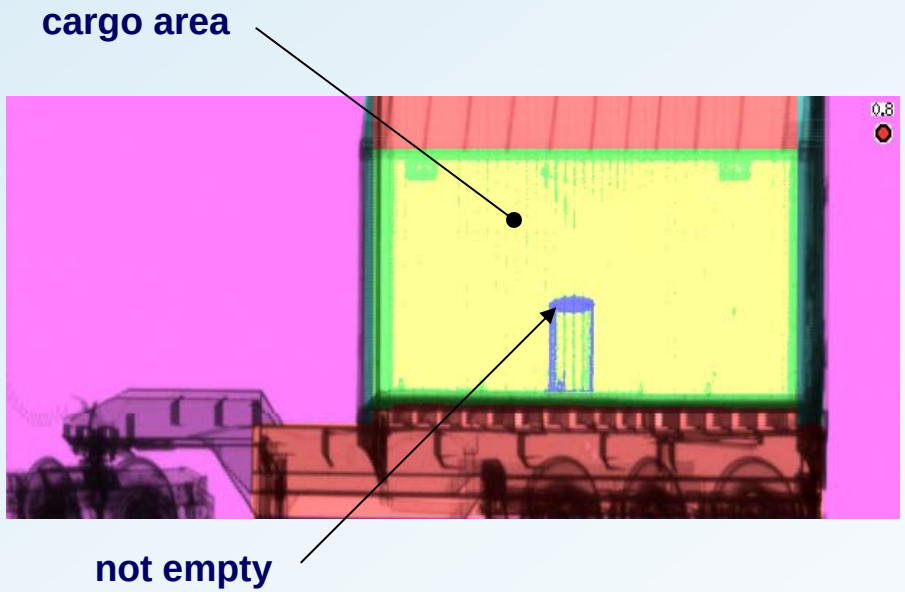
EXPLORANIUM RADIATION PORTAL

COMPLETE DATA SET AVAILABLE FOR REVIEW

Video of Hong Kong ICIS Demo

Automatic Detection of Empty Containers

- Portal VACIS designed to automatically detect empty containers (EmptyView)
- fast algorithm defines segments
- cargo area searched for contents
- Performance
  - Accuracy 97.2%
  - False Negative probability 0.4%



Summary and Conclusions

- **Combining a RPM with a Portal VACIS enhances the effectiveness for detecting a nuclear weapon or RDD**
  - **Two systems complement**
  - **RPM provides passive detection (unless dense shielding used)**
  - **VACIS gamma imaging detects dense shielding**
- **Other technologies further enhance detection and minimize disruption of commerce**
  - **Isotope Identifier helps resolve “nuisance” RPM alarms**
  - **PELAN provides material specific information-verification**
  - **Automatic container/truck ID speeds flow**
- **Integrated display facilitates operator decision process**
- **New technologies under development will enhance performance of Integrated Container Inspection System (ICIS)**