National Institute for Nanotechnology

Institut national de nanotechnologie

Canada NRC·CNRC

Alberta Government

UNIVERSITY OF ALBERTA

Marie D'iorio
NanoIsrael, February 23, 2016

NINT- HISTORY

- Created in 2001 as a partnership between the National Research Council of Canada and the University of Alberta, supported by the government of Alberta and the government of Canada

- Located on the University of Alberta's campus- building opened in 2006; 300+ researchers and graduate students from 5 Faculties; 215,000 ft^2

- Also houses an Innovation Center and Hitachi Product Development Center

NINT APPROACH

Understanding current and emerging needs of Canadian industry, **TRANSLATING** deep interdisciplinary expertise into nano-enabled solutions that meet:

- **SCALABILITY** - from bench to pilot-scale
- **INTEGRATION** - manufacturable integration of physical, chemical and biological sensing and conditioning platforms within a single device
- **ABILITY TO MANUFACTURE** - processes are simple and cost effective
- **E3LS** - Understanding and mitigating environmental and health safety concerns around nano-materials and nano-intermediates' lifecycle

COMPETENCIES

Our competencies are reflected in our current groups:

- Nanomaterials
- Nanodevices
- Nano-biology
- Surfaces and Interfaces
- Tech integration
- Nanofabrication, Characterisation, EM facilities

+Nano Safety- E3LS

SCIENTIFIC PROGRAMS AT NINT

1. Hybrid Nano-electronics
• Nanoscale solutions for next generation electronics

2. Energy Generation & Storage
• Energy solutions for remote and extreme environments

3. Nano-enabled Biomaterials
• Antimicrobial coatings and Nano-enhanced packaging for safer food

4. Metabolomics and Nano-Enabled Sensing & Detection
• Novel detection technologies & prototypes for environmental and health Monitoring

5. Industrial Innovation Support
• Comprehensive R&D support for Canadian Industry

About the NRC

- *2012-13 budget: $774M*
- *Over 4,000 employees and 650 volunteer and independent visitors*
- *Wide variety of disciplines and broad array of services and support to industry*

DRDC

Science and Technology

Defence Research and Development Canada (DRDC) provides integrated science and technology (S&T) advice and technical solutions, performs strategic S&T capability planning, and partners with industry, academia, other government departments (OGDs) and the public safety and national security communities. It delivers solutions for the Department of National Defence and the Canadian Armed Forces (DND/CAF), as well as the public safety and national security communities.

Areas of Expertise

Army

Air Force

Navy

Personnel

Joint Force Development

Public Safety and Security

Strategic Decision Support

Support to operations

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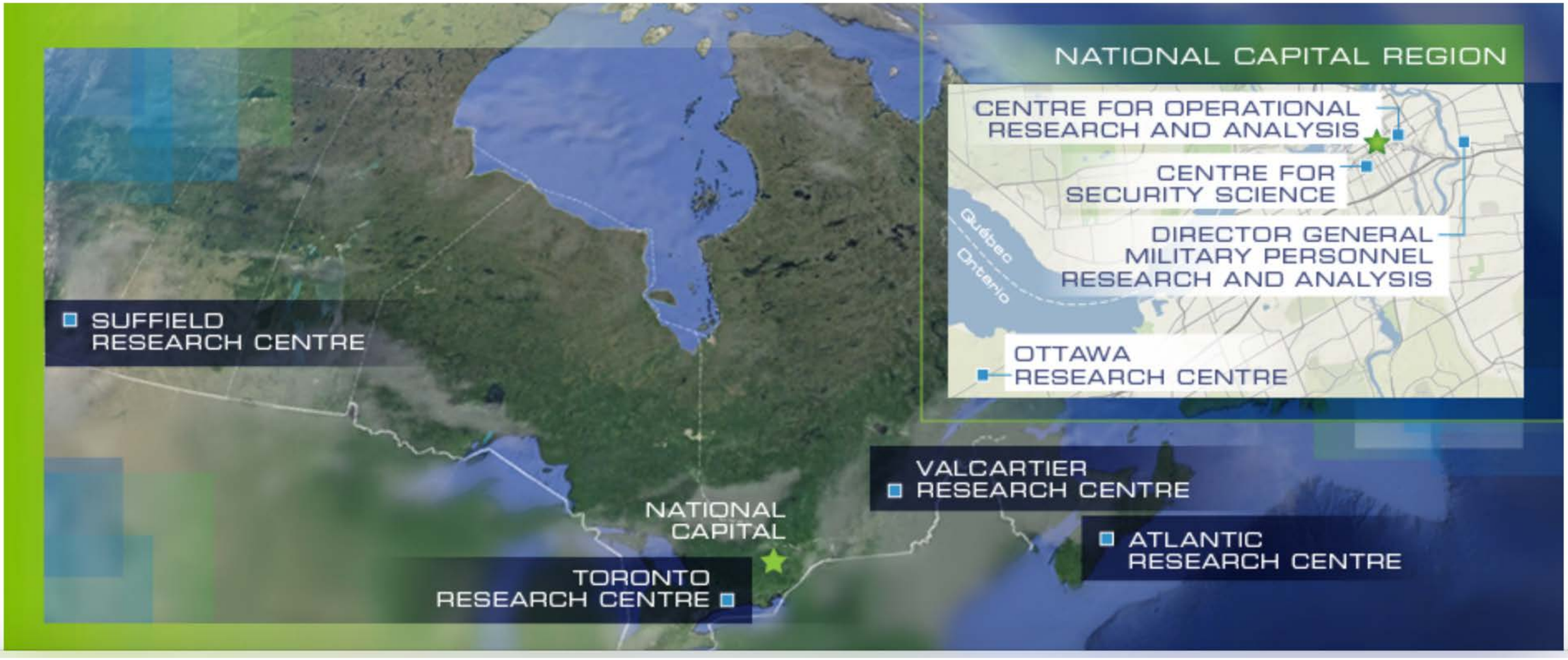
DRDC RESEARCH CENTERS

Research Centres



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S&T PRIORITIES

1. **Build agile and adaptable forces to carry out missions across a wide spectrum of operations;**

2. **Assist and support CAF and civilian personnel before, during and after operations;**

3. **Enable the acquisition, sharing and use of critical information in support of situational awareness and decision-making;**

4. **Develop and implement solutions to maximize the affordability and sustainability of DND and the CAF;**

5. **Support public safety and security practitioners in their mission to protect Canadians; and**

6. **Anticipate, prepare for and counter the emergence of future threats.**

DRDC LOOKS FOR

- **effective project management and delivery capacity;**
- **personnel with expert knowledge of client needs and the ability to tap rich innovation networks;**
- **productive relationships with both existing and new sources of S&T expertise; and**
- **tools and infrastructure which encourage innovation partners to collaboratively deliver S&T solutions.**

In collaboration with departments and agencies, international partners, industry and academia.

CANADIAN SAFETY AND SECURITY PROGRAM

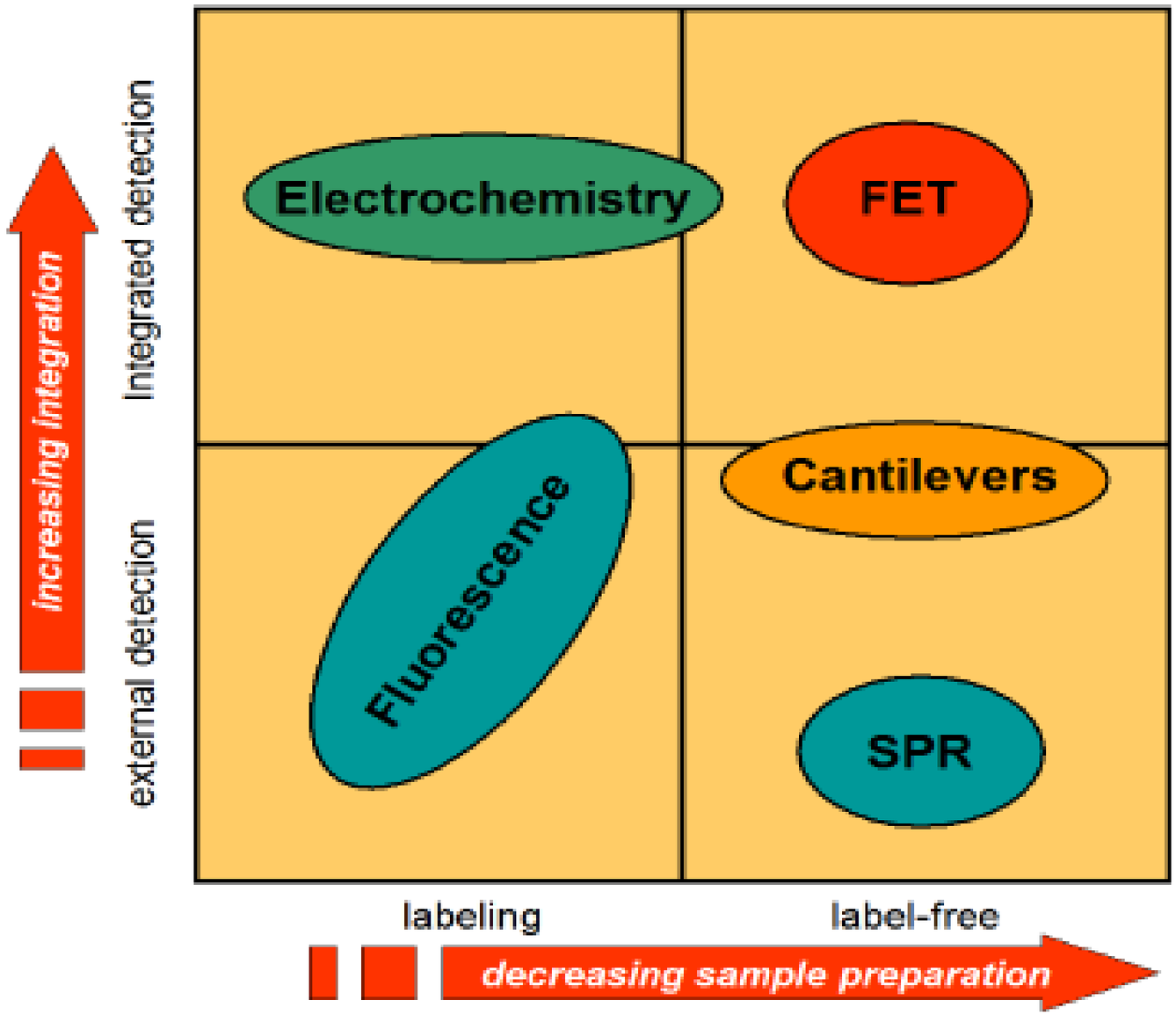
The Canadian Safety and Security Program (CSSP) funds and oversees science and technology (S&T) projects and activities through four funding categories and nine project types.

These projects allow public safety and security professionals to work with S&T experts to identify challenges, develop knowledge and tools, and provide advice that will help protect Canada, its people and institutions.

TYPES OF PROJECTS

1. Studies
2. Research and Development
3. Technology Demonstrations
4. Technology Pilots
5. Workshops
6. Advice and Guidance
7. Technology Acquisition
8. S&T Transition
9. Operational Support through S&T

SAMPLE PREPARATION AND INTEGRATION OF DIFFERENT TRANSDUCERS



Electrochemical Sensors:

- **Uniquely qualified to meet the size, cost, low volume and power requirements of decentralized testing**
- **Great promise for a wide range of biomedical, environmental and national security applications.**

EIS IN BIOSENSORS

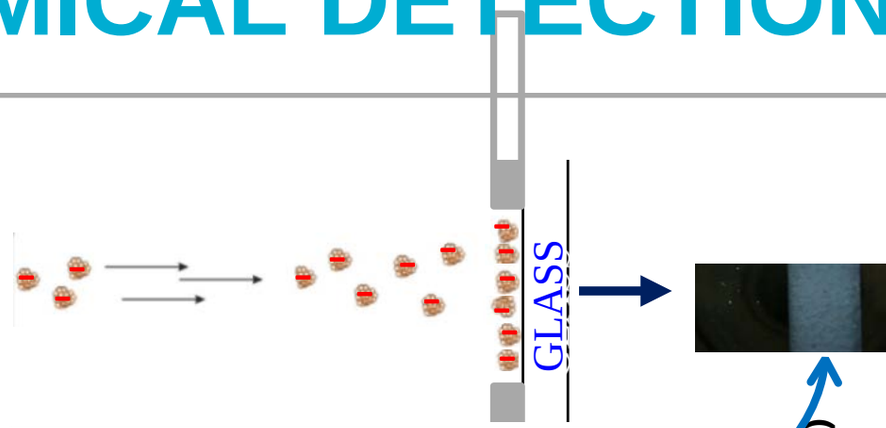
Advantages of EIS in Biosensors:

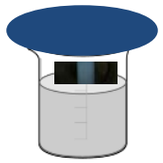
- Inherent potential for label free sensing
- Good sensitivity
- Selectivity via molecular recognition
- Cheap & amenable to handheld devices
- Can be integrated with lab-on-a-chip devices

handheld impedance analyzer
USB-port, 10 Hz-100 kHz

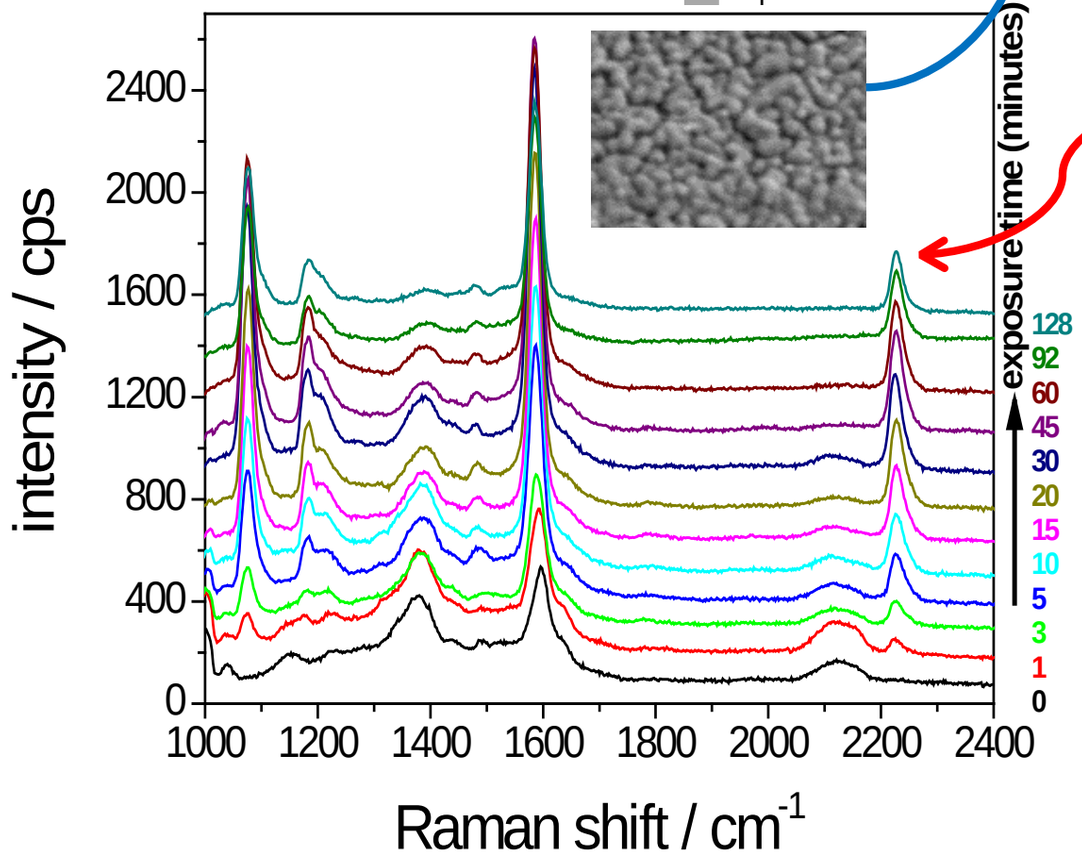
Broeders, J.; et al.; Phys. Status Solidi A, 2011, 208, 1357–1363.

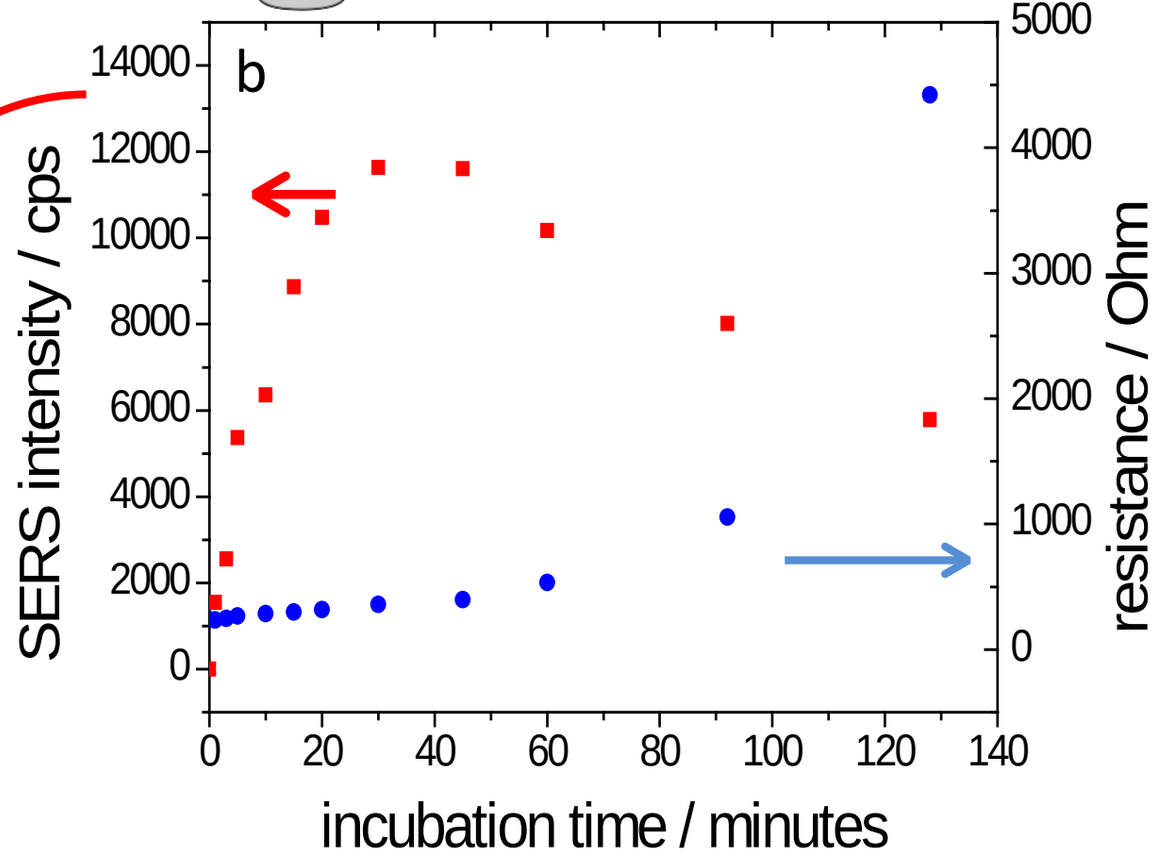
SERS NANOSENSOR FOR HAZARDOUS CHEMICAL DETECTION





Vapour exposure

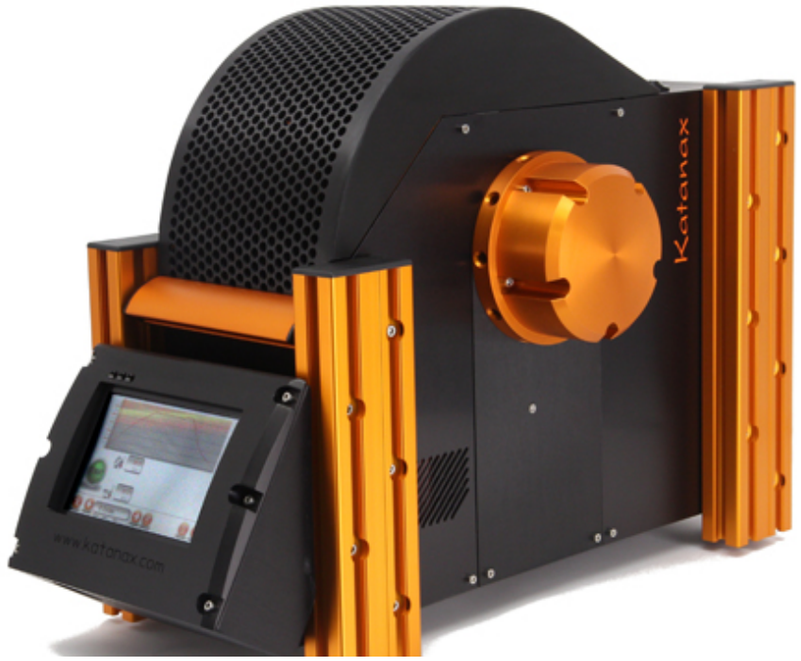




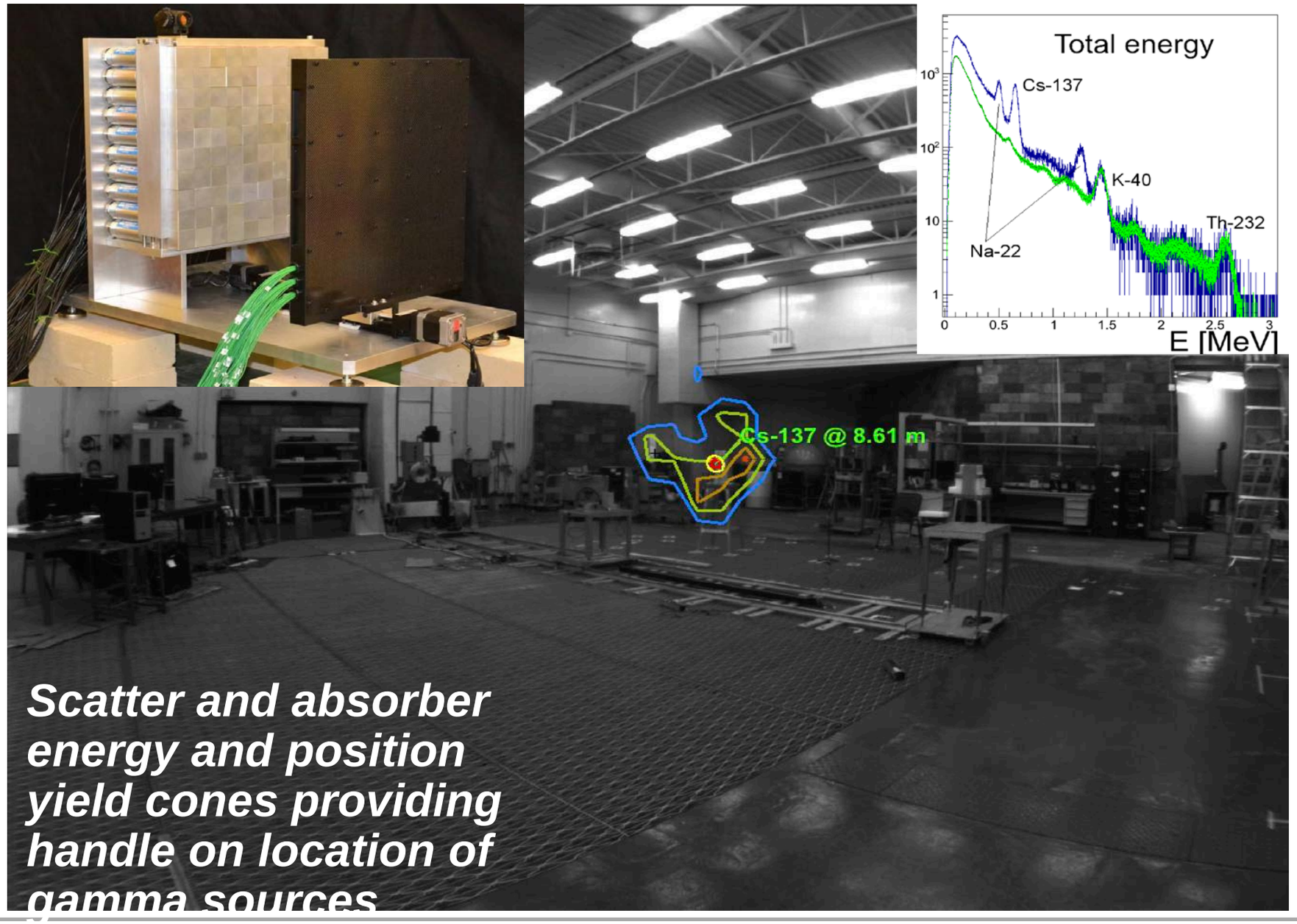
- development of SERS (surface-enhanced Raman spectroscopy) nanosensors for the detection of hazard chemicals (NRC and DRDC)
- portable sensors are flexible and easily deployable with equipment that can are integrated into first-responder's gear

CANADIAN NUCLEAR FORENSICS LAB NETWORK

- Nuclear forensics is the scientific analysis of:
  - nuclear materials and other radioactive materials
  - evidence contaminated with radioactive materials
- NRC is engaged in the development of:
  - the Nuclear Forensics (NF) lab network concept of operations
  - development of standard operating procedures
- NRC is active in a multi-agency exercise by:
  - providing the NF network with certified reference radiochronometer material (Co60/Ni60)
- NRC is supporting the added value of a Uranium isotope ratio measurement to an existing NRC CRM PACS-3



COMPTON GAMMA IMAGING AT NRC



Scatter and absorber energy and position yield cones providing handle on location of gamma sources

2007-2012

development of prototype Compton gamma imagers for photographing gamma-ray fields at distance for safety and security applications

2015-2018

develop mission-ready TRL-8 modularized Compton gamma imager (multiple agencies + Radiation Solutions Inc)

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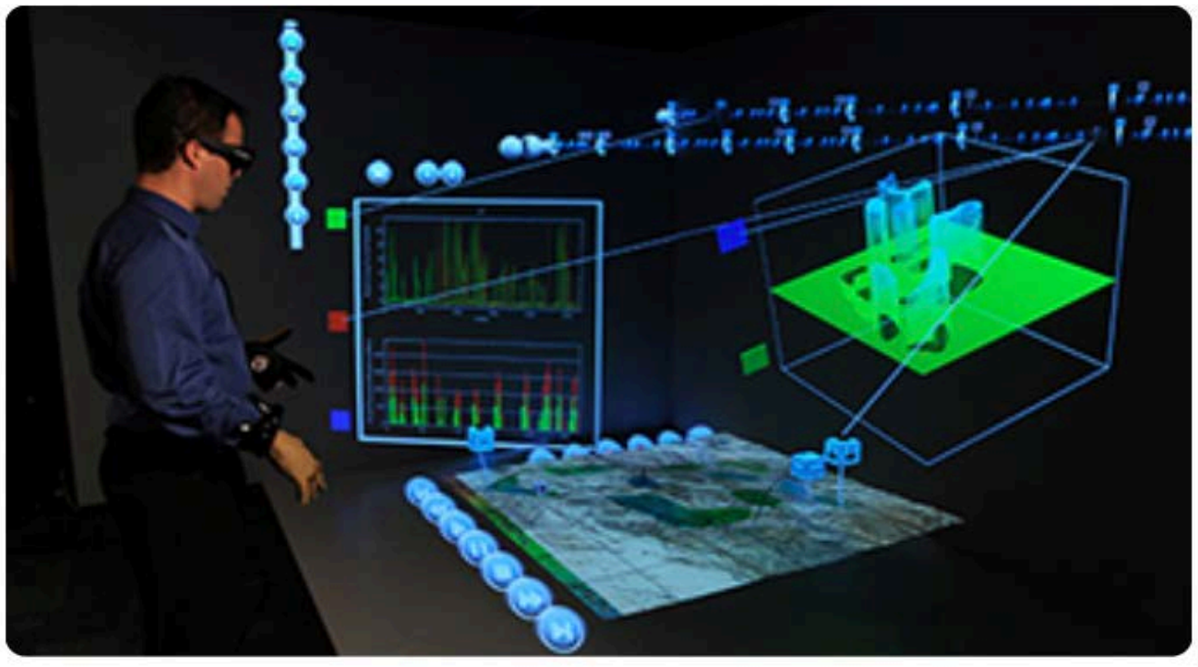

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