JAEA-IAEA Workshop on Advanced Safeguards Technology for the Future Nuclear Fuel Cycle

13-16 November 2007

Techno Community Square Ricotti Tokai-mura, Ibaraki, Japan

The Canadian Safeguards Support Program Sponsored Projects: Update

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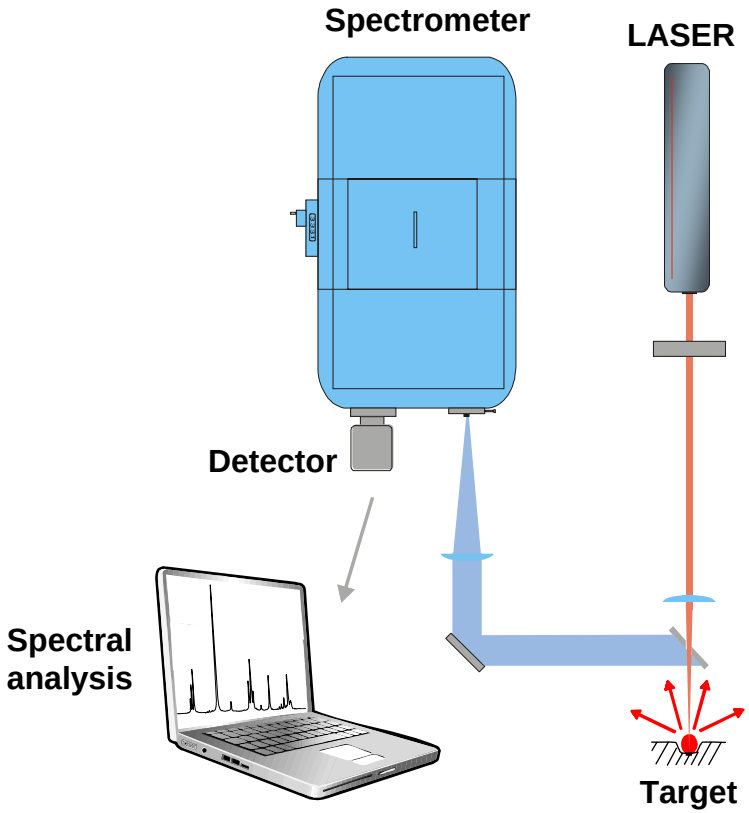
Canada

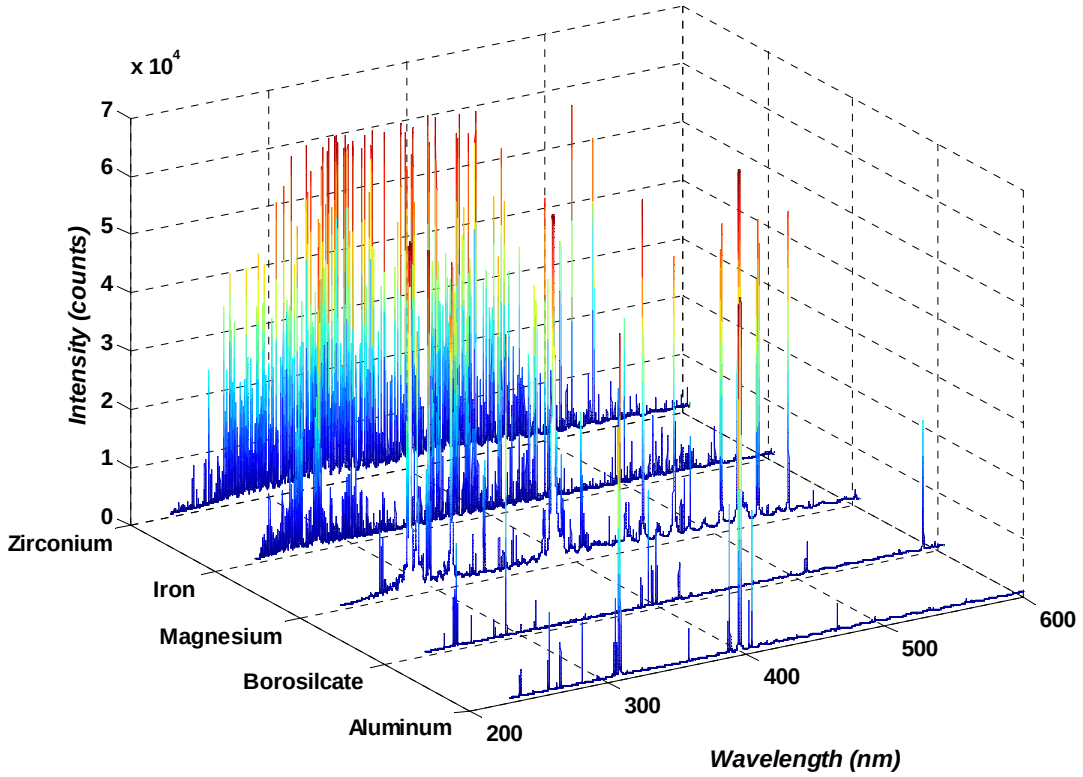
Introduction

- Laser Induced Breakdown Spectroscopy (LIBS)
- Optically Stimulated Luminescence (OSL)
- Fourier Transform Infrared (FTIR) Radiometry
- Digital Cerenkov Viewing Device (DCVD)
  - UV Zoom Lens

Laser Induced Breakdown Spectroscopy (LIBS)

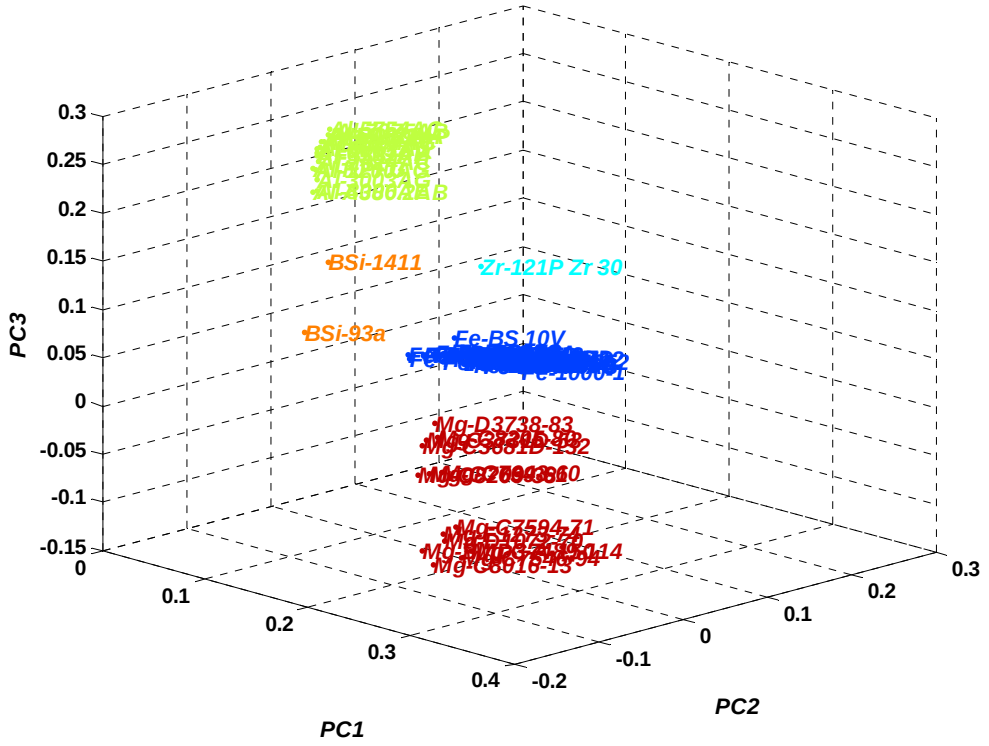


LIBS (contd)



Spectra for 5 materials

LIBS (cont'd)



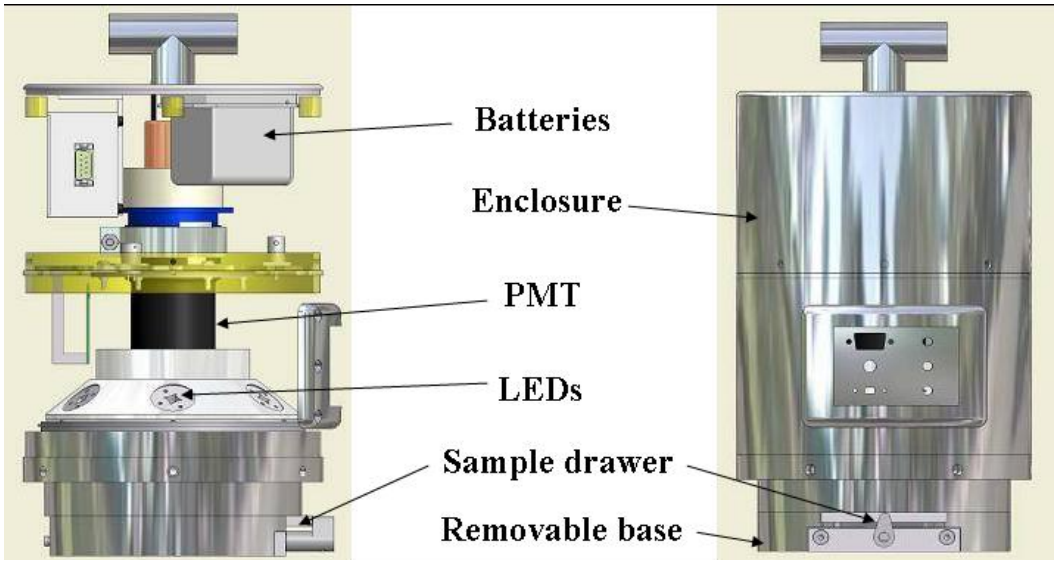
Clustering of the LIBS Spectra using Chemometrics

Class 1: Iron & Steel, Class 2: Zirconium, Class 3: Aluminium, Class 4 Borosilicate, Class 5: Magnesium

LIBS (contd)

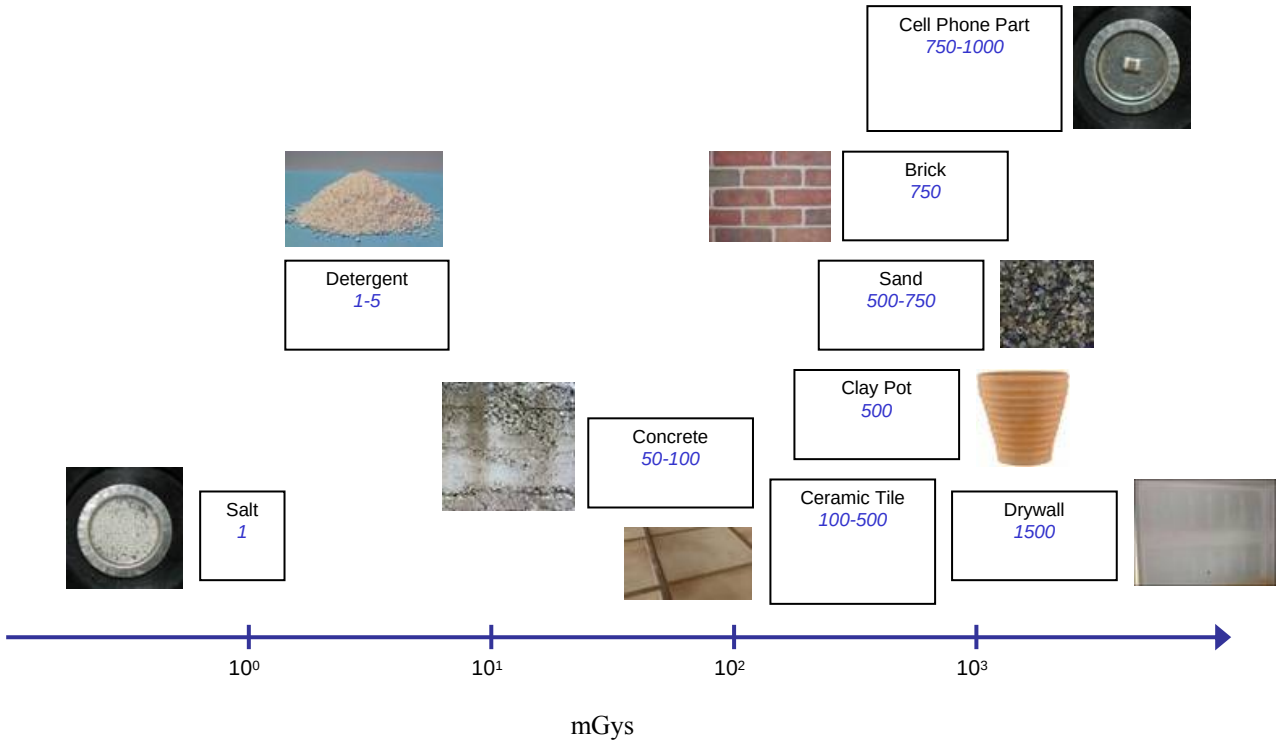
- IAEA Benefits
  - no sample preparation
  - analyze any form (gas, liquid, solid)
  - no physical contact with sample (hostile environments)
  - results in seconds/minutes
  - can identify molecular structures
  - little training
- Next Phase
  - miniaturization
  - reference library/database

Optical Stimulated Luminescence (OSL)



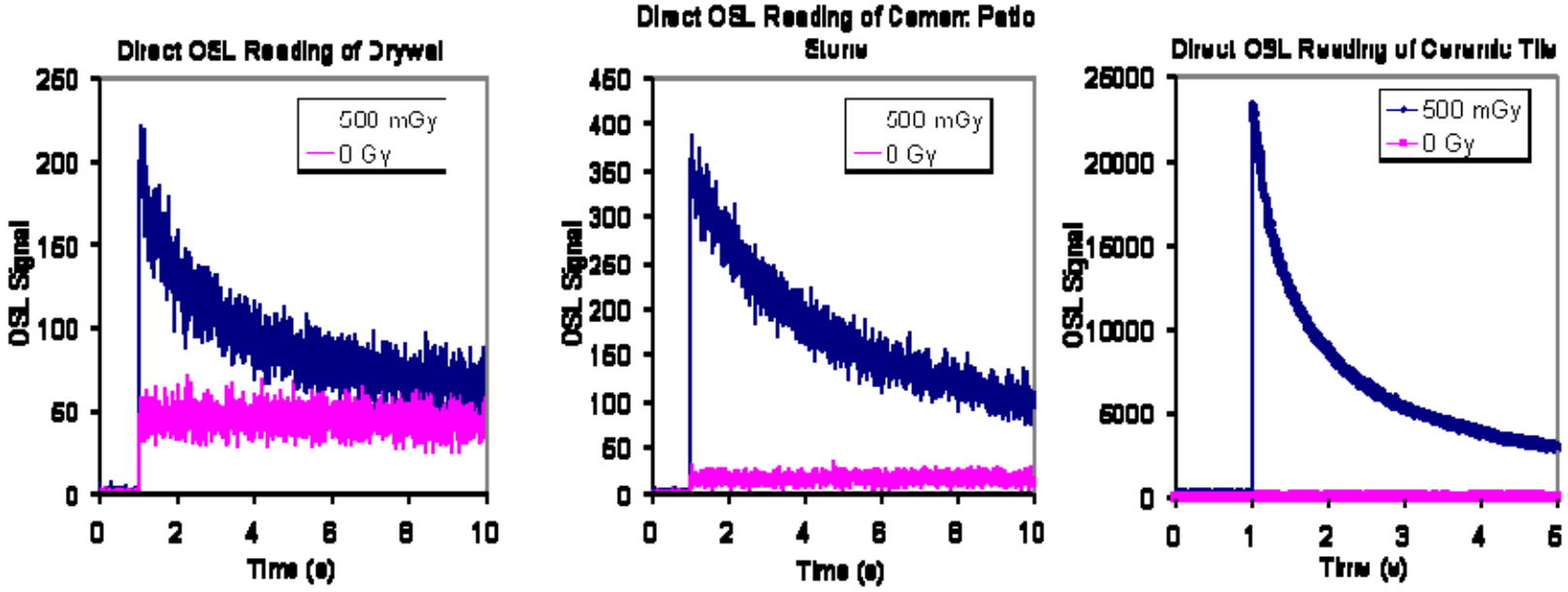
OSL (cont'd)

Sensitivity of OSL Emitters



OSL (cont'd)

*OSL signals measured before and after **30** and **60 second** contact exposures to a **10 mCi Strontium-90** source.*



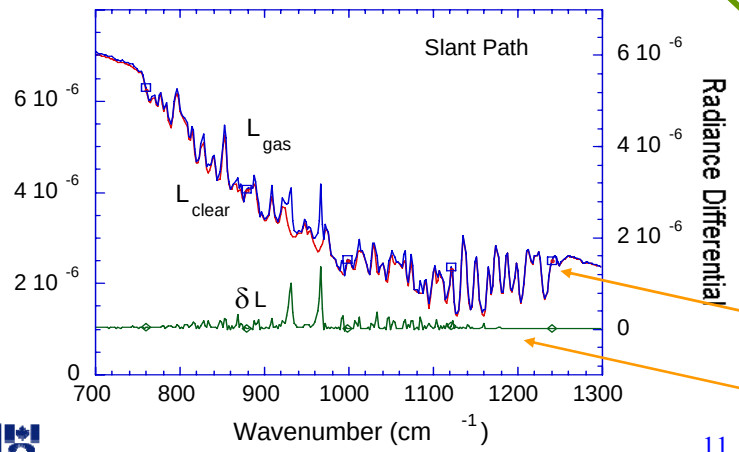
OSL (cont'd)

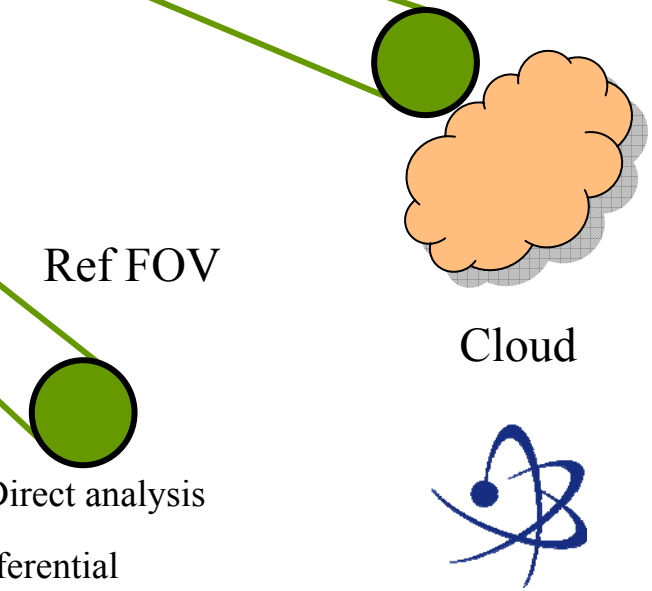
- IAEA Benefits
  - little sample preparation
  - results in seconds/minutes
  - little training
  - foresenic capability
- Next Phase
  - miniaturization
  - reference library/database

Fourier-Transform Infrared (FTIR) Radiometry

- Double input-beam FTIR
- Spectral Band: 7 - 14 μm
- MCT Detector
- Spectral resol'n: 1 - 64 cm^{-1}
- 4-in telescopes
- FOV (8 mrad)

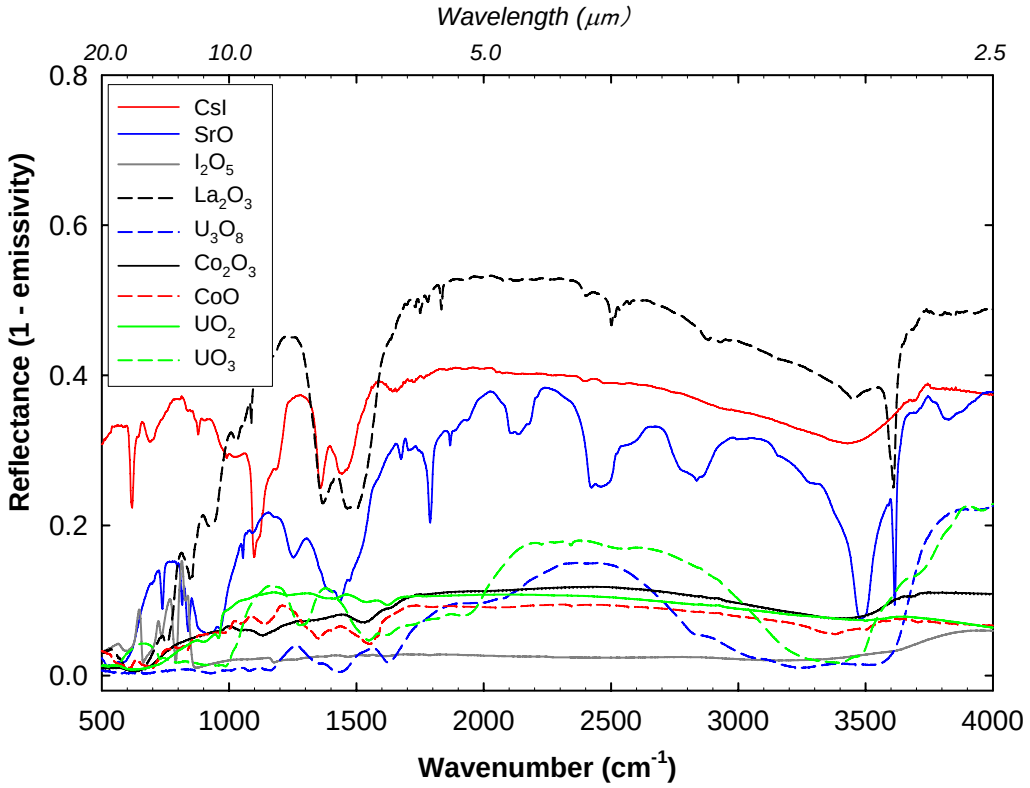
Compact ATmospheric Sounding Interferometer



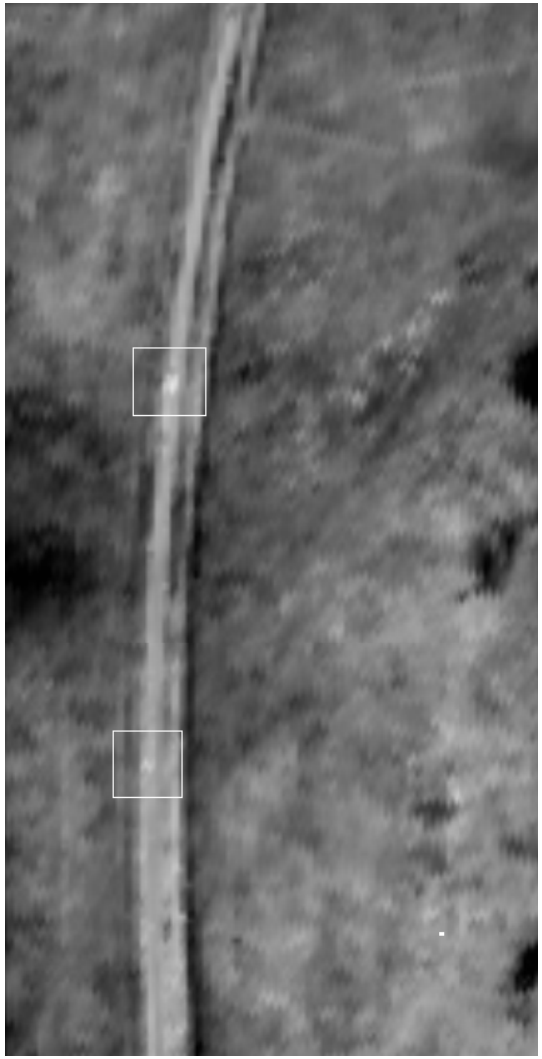


FTIR (cont'd)

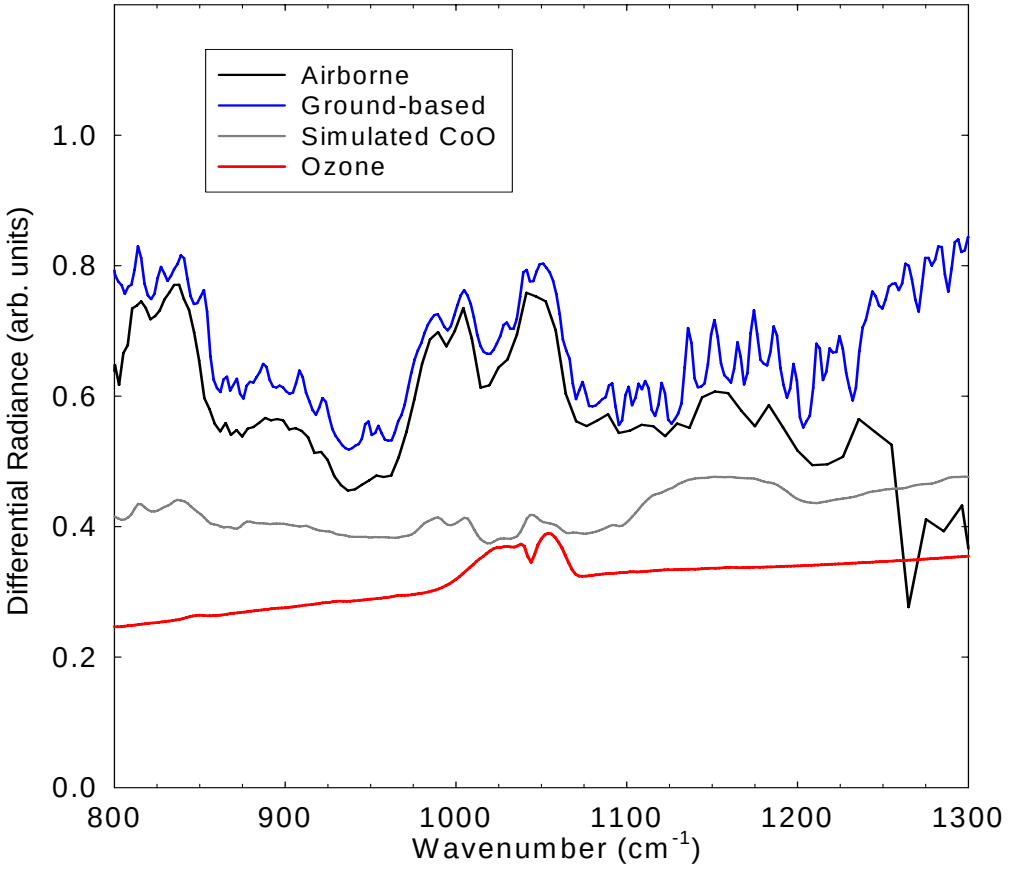
IR Absorption Signatures of Radiological Products



FTIR (cont'd)



Airborne Detection of CoO @ 1km



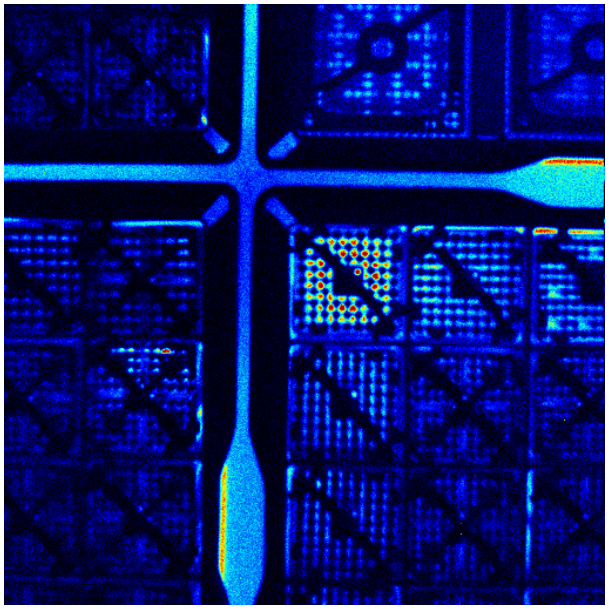
FTIR (cont'd)

- IAEA Benefits
  - standoff detection
  - results in seconds/minutes
  - little training

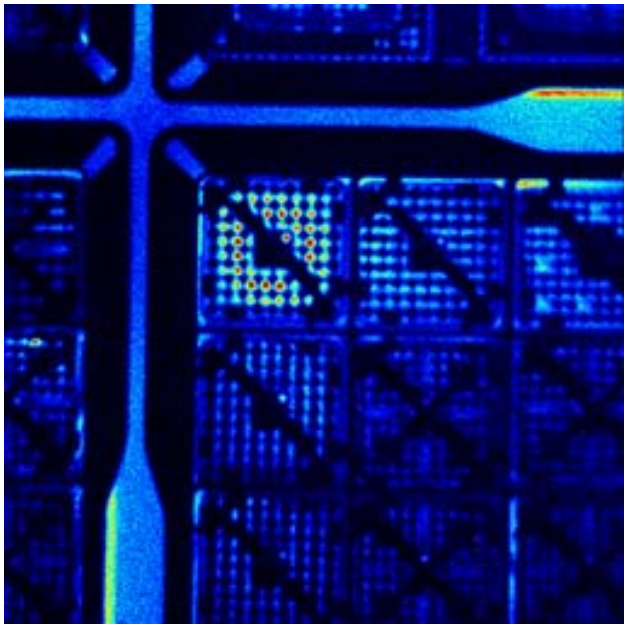
- Next Phase
  - miniaturization
  - reference library/database

DCVD UV Zoom Lens

UV Zoom Lens (cont'd)



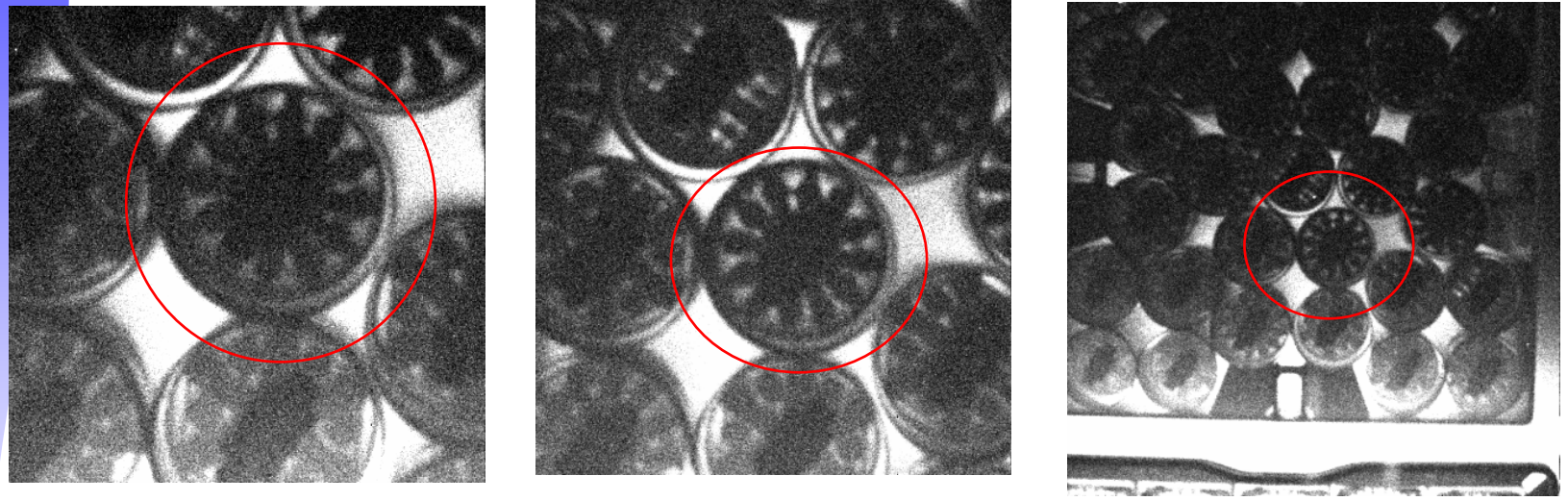
A)



B)

Field of views of a 40910 MWd/t U, 6 year cooled BWR spent fuel assembly using (A) 80 and (B) 105 mm focal lengths

UV Zoom Lens (cont'd)



A) B) C)

Image details of a 1180 MWd/t U , 36 year cooled Ågesta spent fuel assembly using the (A) the 250 mm lens and the UV Zoom lens at (B) 200 mm and (C) 80 mm focal lengths.

UV Zoom Lens (cont'd)

- IAEA Benefits
  - easy of use
  - quick alignment tool
  - reduction of components
  - no activities over the pool
  - a producible lens

- Next Phase
  - identification and quantifying spent fuel partial defects

Acknowledgements

CNSC

IAEA

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NRC·CNRC Industrial Materials Institute

CRTI CBRN Research & Technology Initiative

MINDCELL

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LENS-TECH AB