



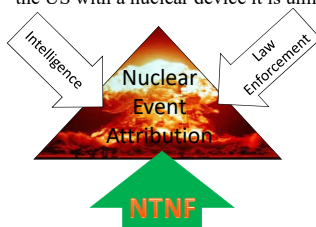
Spectroscopy (LIBS) for Post-Detonation Nuclear Forensics Debris Analysis

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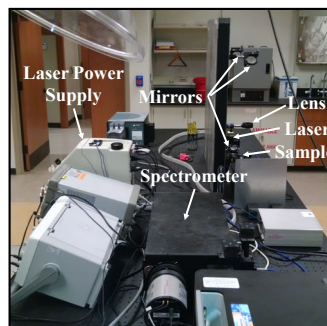
National Technical Nuclear Forensics

Deploying a LIBS system with the 20th CBRNE debris collection teams has the potential to significantly reduce the time required to determine critical facts about the nuclear materials and device design following a nuclear attack. If a terrorist organization attacks the US with a nuclear device it is unlikely we will immediately know the origin of the device or its nuclear materials. Nuclear event attribution uses information from Intelligence, Law Enforcement, and National Technical Nuclear Forensics (NTNF) to identify the original source. NTNF can provide many important facts about the nuclear materials and device design but potentially too late to be useful to decision makers faced with extreme pressure to respond to the attack.



Optimizing system for Glass-Like Samples

LIBS Background



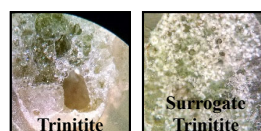
Equipment

- Pulsed laser and associated optics
- Spectrometer, camera, and FOC
- Data acquisition system

Simplified Sample Analysis Sequence

- Laser pulse focused at surface of sample
- Local plasma - bound and unbound excitations
- Plasma cools emitting characteristic light
- Light incident on FOC directed to spectrometer
- Gratings in spectrometer diffract light
- ICCD camera measures the incident light
- Data collected and saved for post processing

Comparing Trinitite and Surrogate Samples



Collecting Data

Collecting Data

The Effects of Sample Non-homogeneity

Collecting Data

Future Work

- An automated x-y stage will be incorporated into the data collection
- External timing controls will be incorporated for more control of camera
- A spotting laser and camera will be incorporated for precise control of sample location
- Additional elements in the Trinitite and surrogate will be measured
- Requirements for isotopic analysis will be determined and purchased if funds available



The Nuclear Science and Engineering Research Center (NSERC) partners the Defense Threat Reduction Agency with the DoD degree-granting institutions to conduct combating weapons of mass destruction (CWMD) research which enhances DoD capabilities and provides the next generation of military officers with CWMD experience to better prepare them to lead in a world with evolving global WMD threats.



The Photonics Research Center educates future Army officers so that each graduate is generally familiar with laser technologies, is both competent and confident in the relationship of photonics technology for defense applications, and has developed a strong base of research and development through hands-on laboratory experiences on topics such as spectroscopy, opto-electronics, and laser physics.

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