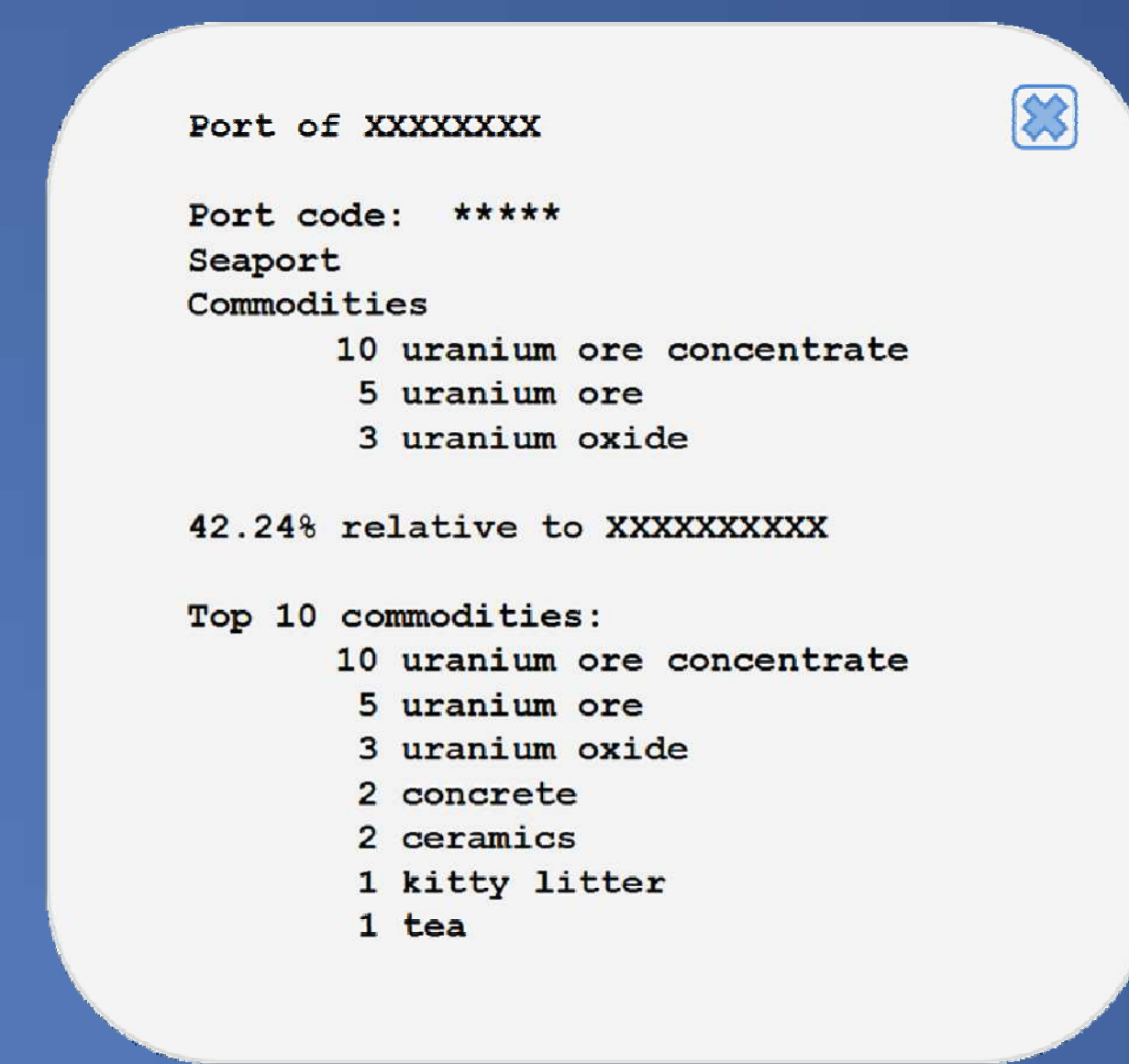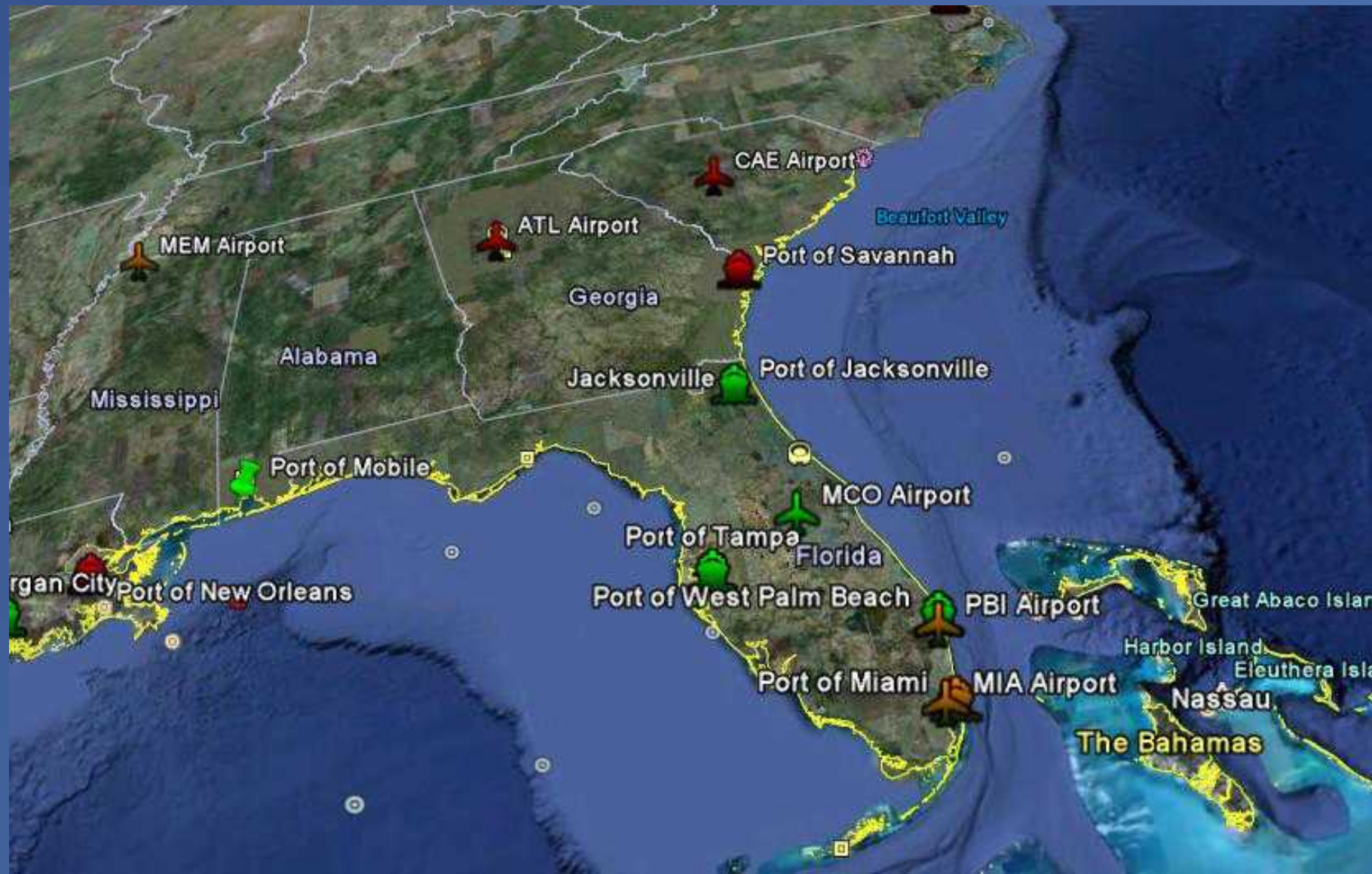# Secondary Reachback

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Abstract: Secondary Reachback is a Department of Homeland Security program designed to provide assistance to Customs and Border Protection officials in assessing threats reported by radiation monitors at the United States' border. U.S. ports of entry have radiation portal monitors that detect radiation emissions from vehicles entering the country. The purpose of these monitors, and of Secondary Reachback, is to detect nuclear material and prevent it from being smuggled into the country. To accomplish this goal, Secondary Reachback draws on the expertise of radiation physicists at Los Alamos, Lawrence Livermore, and Sandia National Laboratories. As part of Secondary Reachback, Sandia has developed software to assist in analyzing existing data from radiation monitors in order to develop "signatures" that model threat and non-threat situations. These signatures provide Customs and Border Protection officials with an additional method for determining whether a vehicle with an anomalous radiation profile is in fact a threat.

```
Port of XXXXXXXX

Port code:  *****
Seaport
Commodities
        10 uranium ore concentrate
         5 uranium ore
         3 uranium oxide

42.24% relative to XXXXXXXXXX

Top 10 commodities:
        10 uranium ore concentrate
         5 uranium ore
         3 uranium oxide
         2 concrete
         2 ceramics
         1 kitty litter
         1 tea
```

Detection Process

Radiation portal monitors are passive detectors that measure the amount of radiation emitted from a vehicle. These monitors use two different methods to detect gamma particles and neutrons. Each monitor has multiple panels to detect radiation throughout the vehicle.

Many safe household products emit radiation and give rise to a number of false detection alarms. One of the goals of this project is to minimize the report of these false alarms. By gathering information on these false alarms, we have been able to better distinguish threats from non-threats, such as kitty litter.

Top 92% of Alarms	Percent of Loads
Kitty Litter	34%
Medical (In, I, Tc, Tl)	16%
Abrasives	8%
Refractory material	8%
Scouring Pads	6%
Mica	5%
Potassium/Potash	5%
Granite slabs	4%
Toilet bowls & tile	4%
Trucks/cars	2%

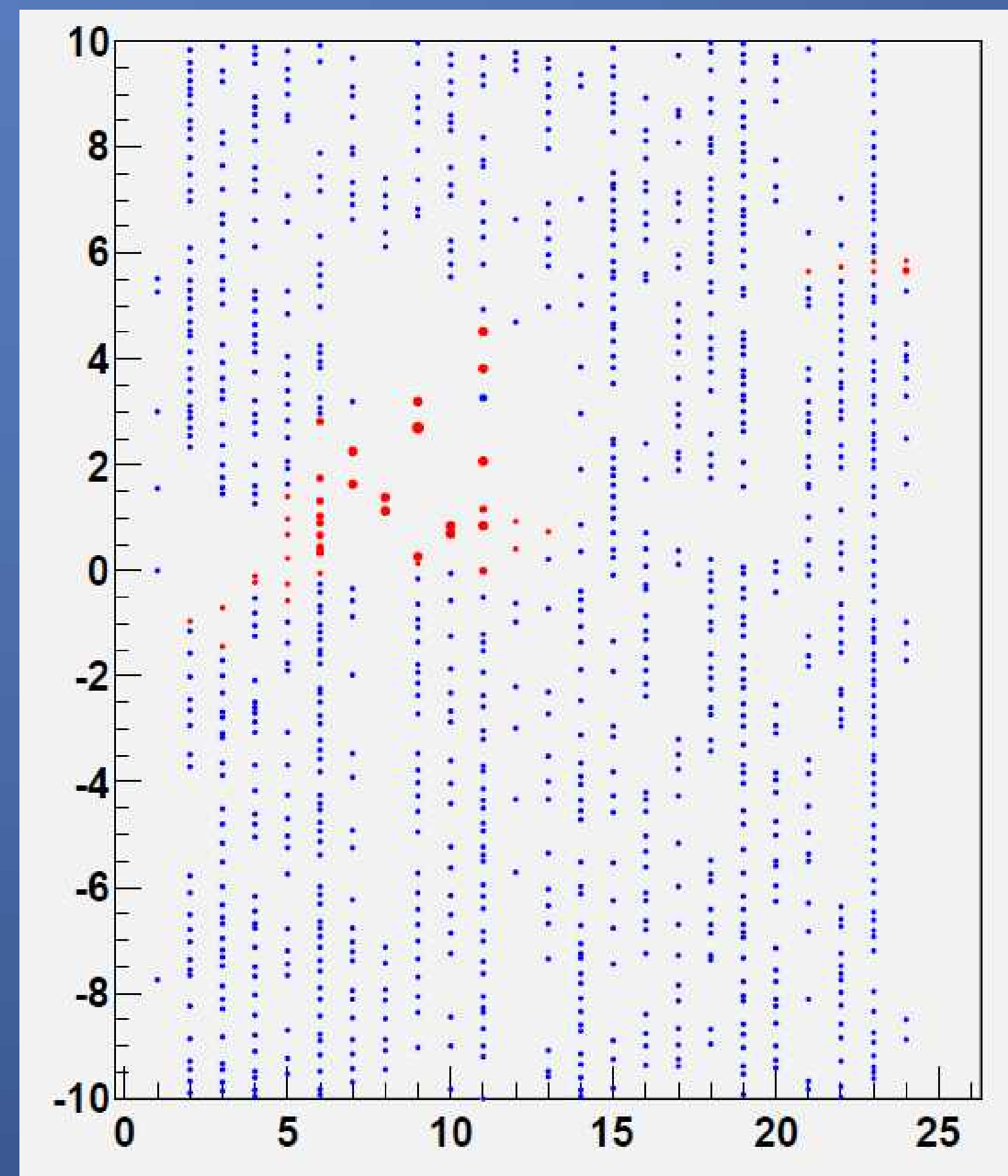Dennis Weir, Pacific Northwest National Laboratory, PNNL-SA-63388

One of the major ways in which we model non-threats is through spectroscopy. Spectroscopy compares energy levels of different sensors in the portals. From this comparative analysis, we can distinguish the spectrum of Potassium-40, which is commonly found in kitty litter, from that of Uranium-235, which is found in nuclear weapons.

Our Role in the Project

One of the major challenges of the Secondary Reachback project is verifying the fidelity of the data retrieved and the tools used by analysts to develop signatures. We wrote and ran many tests to ensure that the codebase was functioning as desired. In our efforts to create an efficient test suite, we rewrote many previously written tests, making them more scalable.

We developed and tested an automated tool to analyze data from multiple vehicles using the CERN ROOT libraries. One of the uses of this tool was to analyze cross-talk, which is the phenomenon that occurs when a vehicle has high enough radiation levels that it causes false alarms for other vehicles passing through neighboring lanes.

We began writing a web interface for the project's data analysts to use for retrieving data from the project database. The web interface is designed to be very flexible, allowing data retrieval without the need to write SQL queries.

Future Work:

- Enhance the web interface to provide more comprehensive and user-friendly access to the project database
- Expand the test suite to ensure the reliability of the entire codebase