

Emergency Response Demonstration: PRISM System for At-Sea Maritime Field Tests

Collaboration project between RSL, LBNL, LLNL, ORNL, SNL
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Project Overview, Goal and Tasks

Overview

A measurement campaign will be performed on board of a cargo ship at sea to test the capability of various existing gamma-ray imaging systems to detect sources inside containers. LBNL will participate to these measurements with the CdZnTe-based Portable Radiation Imaging, Spectroscopy and Mapping (PRISM) System.

Goal

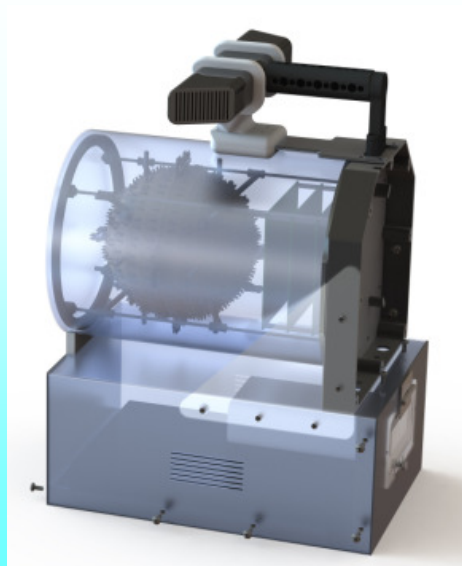
The main goals for this project is to evaluate the PRISM prototype for search missions on board of cargo ships.

Tasks:

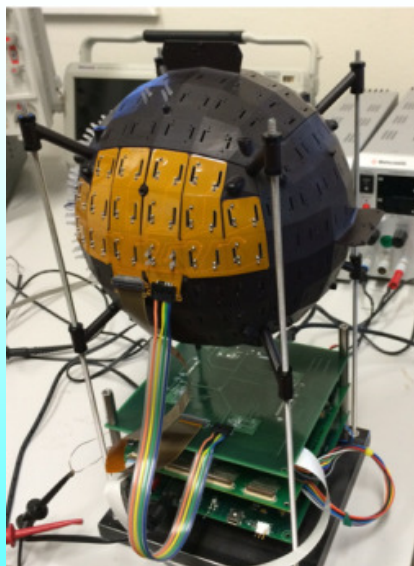
- Prepare the PRISM system for the challenging conditions existing on board of a cargo ship at sea.
- Participate in the measurement campaign
- Analyze data and evaluate system performance



Portable Radiation Imaging, Spectroscopy and Mapping (PRISM) System



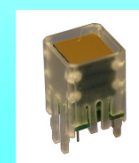
See-through view of the PRISM prototype CAD model.



Picture of the PRISM prototype being assembled

PRISM is a multi-modality imaging system that uses 96 1x1x1cm³ co-planar CdZnTe detectors placed in random pattern inside a spherical shell. This spherical arrangement insures simultaneous Compton imaging and coded aperture imaging with a 4- π field of view, which is unprecedented. A total of 500 g of active CdZnTe is present.

The PRISM prototype also comprises a computer vision subsystem whose purpose is to track in real time the position and orientation of the imaging instrument with respect to the environment, and to create a 3-D model of the environment. This 3-D model is used to constrain the image space for the radiation emitters to physical objects.



1-cm³ co-planar grid (CPG) modular detector element

Preliminary Imaging and Mapping Results

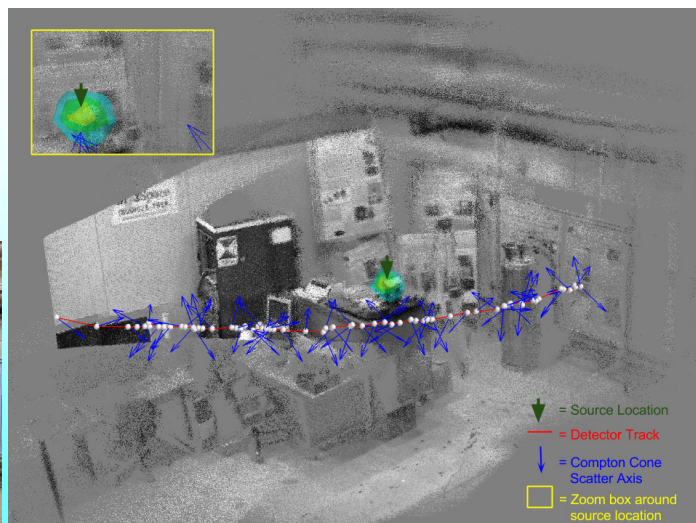
Preliminary imaging and mapping measurements have been performed with two other gamma-ray imagers available in our lab: the Compact Compton Imager, CCI-2 and the High Efficiency Multimode Imager (HEMI) using the computer vision employed by PRISM.

Relevance to Program Objective:

- The PRISM system introduces several unique features, among the most relevant:
- simultaneous coded aperture and Compton imaging with a large 4- π field of view
 - unprecedented image sensitivity for a man-portable system
 - mapping of radiation using "free-moving" man-portable imagers without dependency on external sensors, beacons or GPS signals.
 - real-time mapping in 3-D of radiological threats and physical environment.
 - unprecedented situational awareness



Image of the lab space showing the location of a Cs-137 source



Rendering of the reconstructed radiation distribution overlapped onto the 3-D point cloud of the physical space