



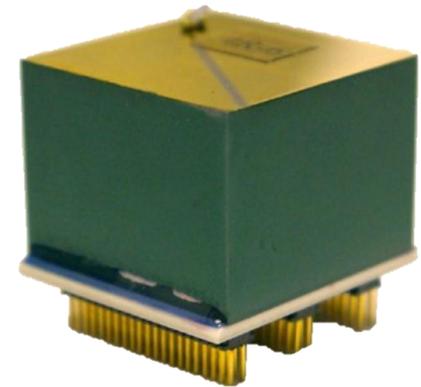
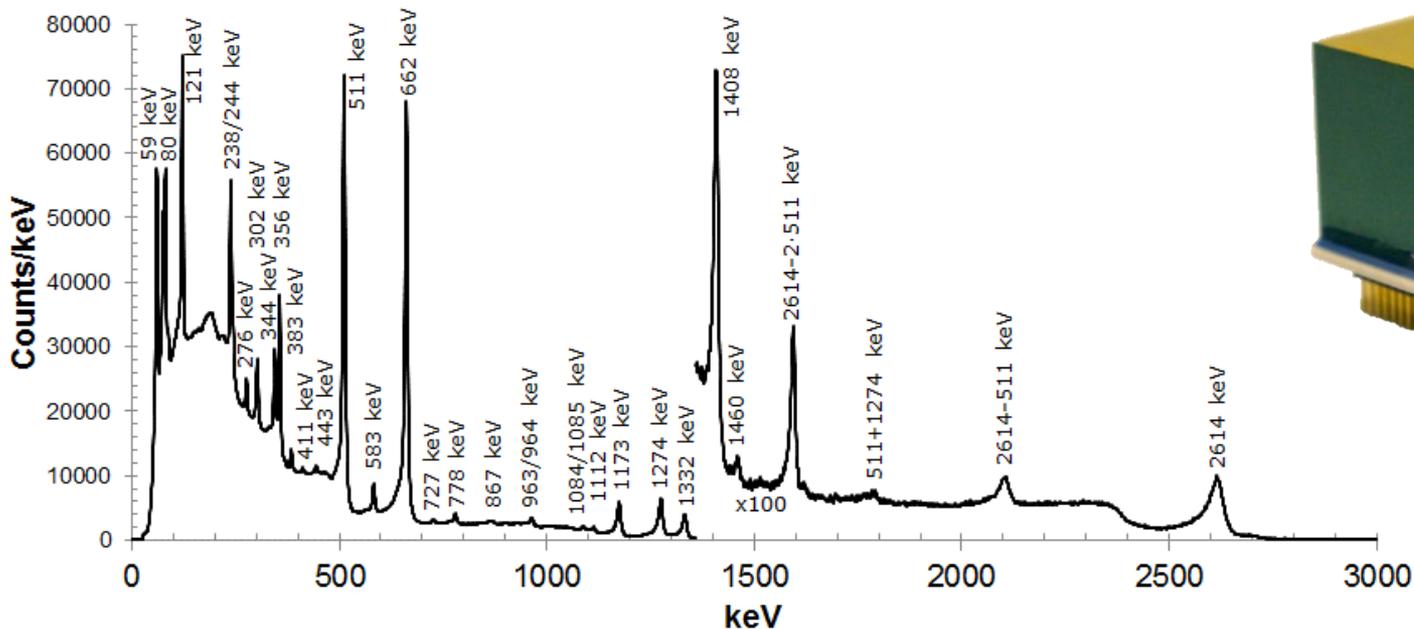
3D Position-Sensitive Pixelated CdZnTe Technology for Applications at NPPs

Weiye Wang
October 2019

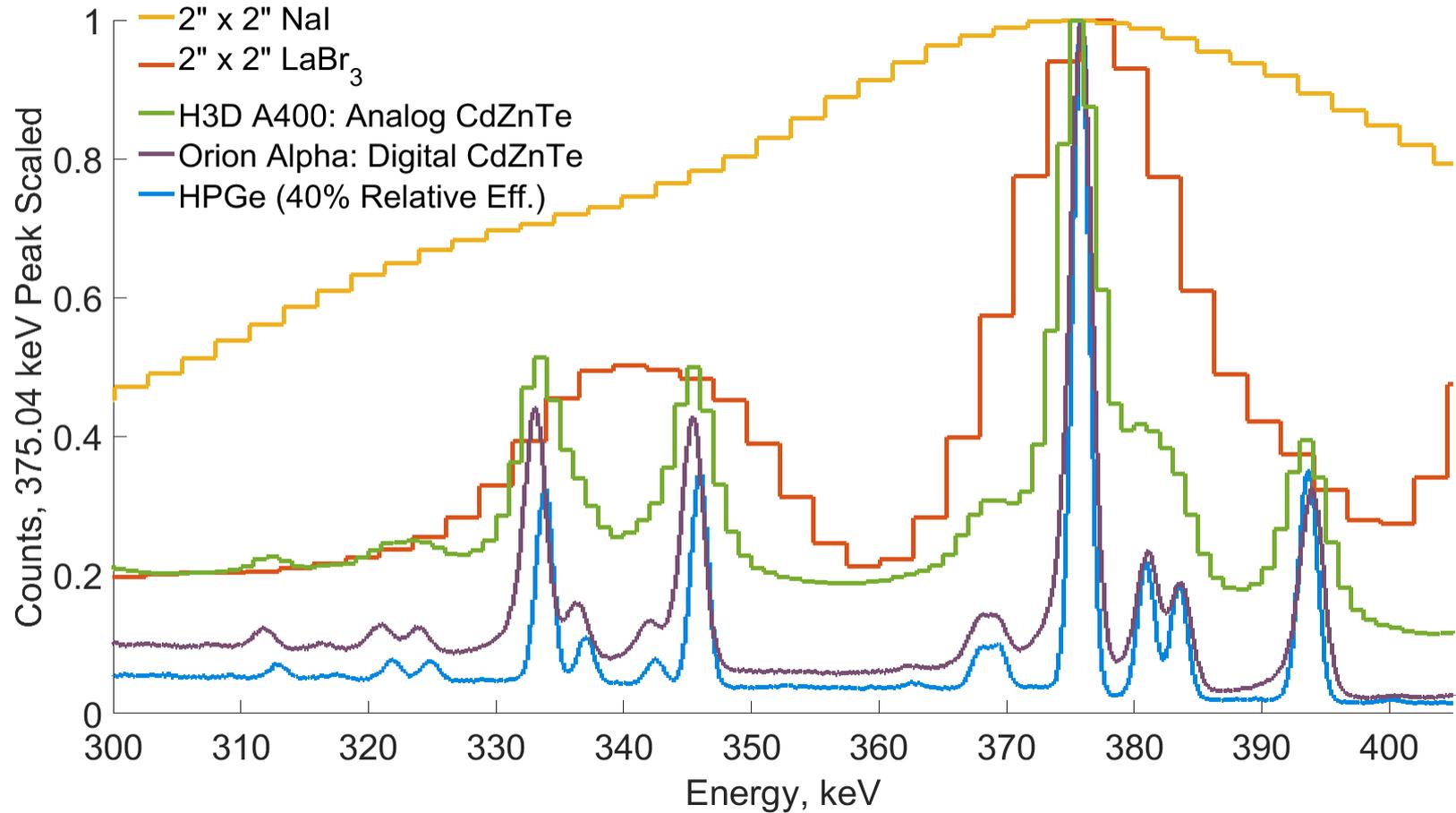


Introduction to CZT

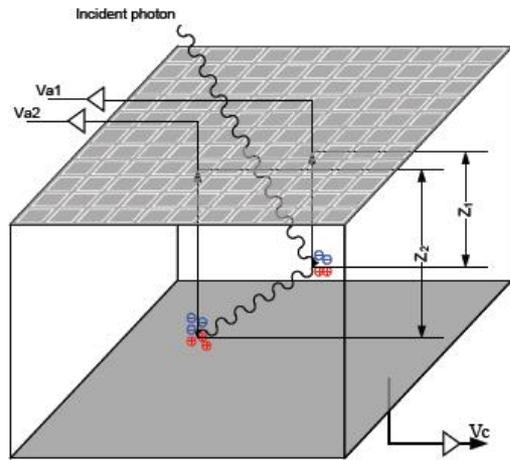
- CZT is a semiconductor radiation detector
- Similar spectroscopic performance to HPGe but operates at room-temperature
- From storage to measurement in < 2 minutes



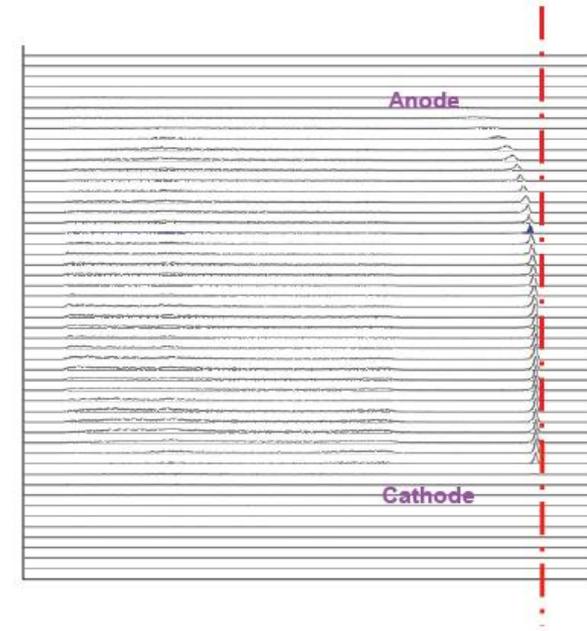
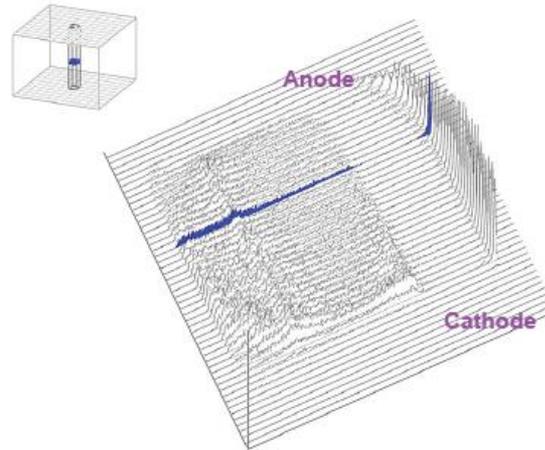
CZT versus HPGe and Scintillators



H3D's Technology

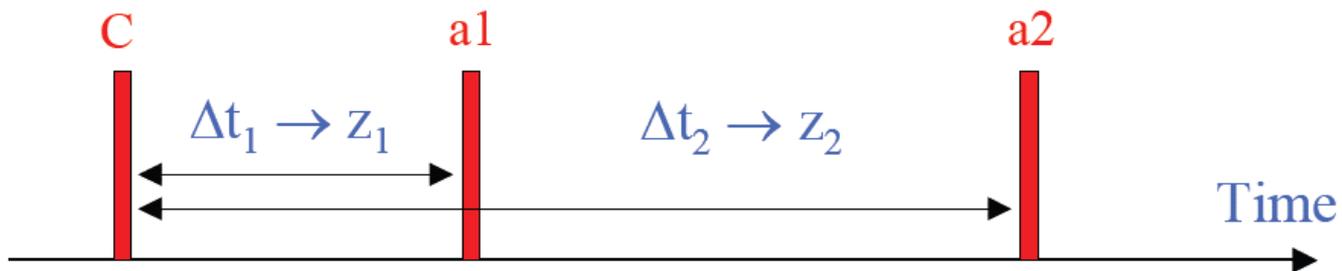


Depth-separated spectra of one pixel



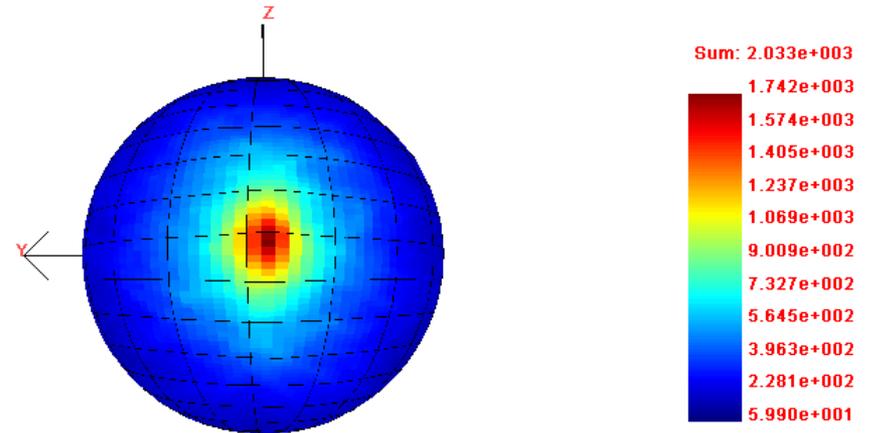
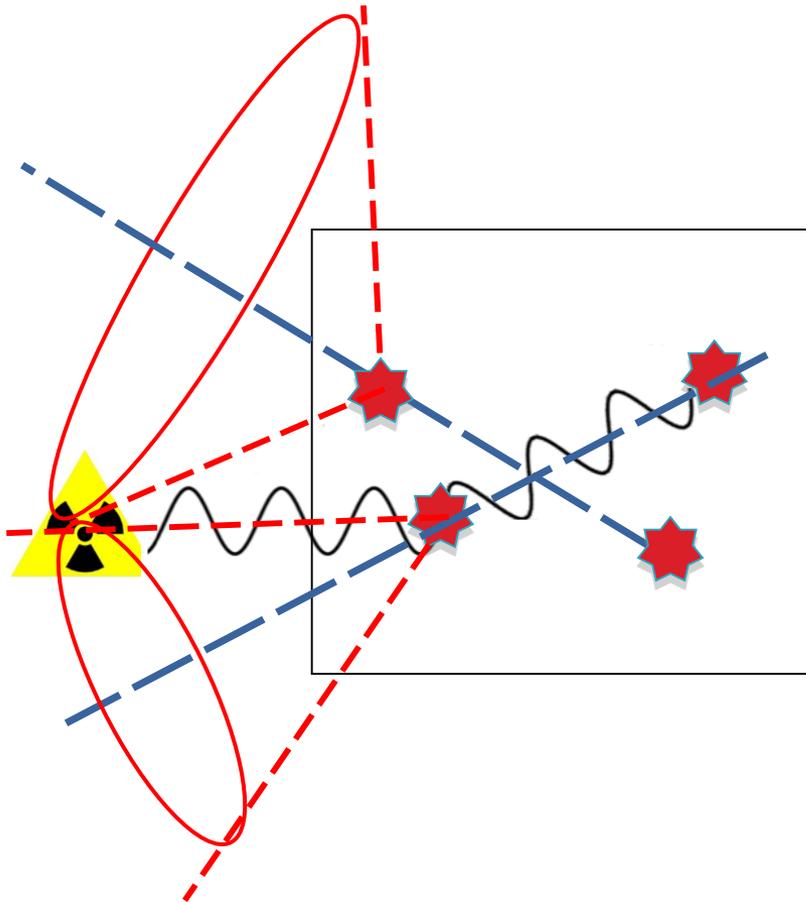
6 cm³ CZT

Triggers



Gamma-Ray Imaging

Compton Imaging: > 250 keV



Number of photons: 2033

Product Summary – H & A

H SERIES
Imaging Spectrometers

Features

- Up to >19 cm³ CZT
- <10 lbs
- Battery operated (6+ hr)
- Control with tablet, phone, or computer
- Washable for easy decon
- ≤1.1% FWHM @662 keV
- Omnidirectional imaging



Applications

- Shielding Evaluation
- Shipping / Receiving
- Hot Spot Characterization
- Waste Characterization

A SERIES
Directional High Res RIID

Features

- Up to >19 cm³ CZT
- 5 lbs
- ≤1.1% FWHM @662 keV
- 9 hr swappable battery
- Rugged (designed to ANSI 42.34)
- Integrated GM and neutron tubes
- Operates from -20 to 50°C
- 1-hand user interface

Applications

- Site Surveys
- Cargo Inspection
- Hot Spot Characterization
- Waste Characterization



Product Summary – P & S

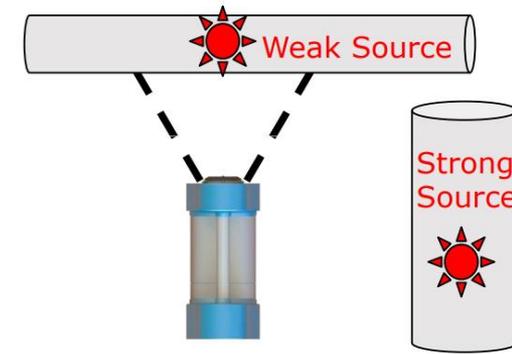
P SERIES
Shielded Imaging Spectrometers

Features

- Collimated with 1" W except for 60°x60° FOV
- >4.5 cm³ of CZT
- Battery operated (10 hr)



- Control with tablet, phone, or computer
- Washable for easy decon
- ≤1.1% FWHM @662 keV
- 35 lbs



Applications

- Pipe crud measurements
- In-situ characterization
- Holdup measurements
- Waste characterization

S SERIES
Gamma Spectrometers

Features

- Up to >19 cm³ CZT
- 5.2 lbs
- ≤1.1% FWHM @662 keV
- 2 hr battery backup

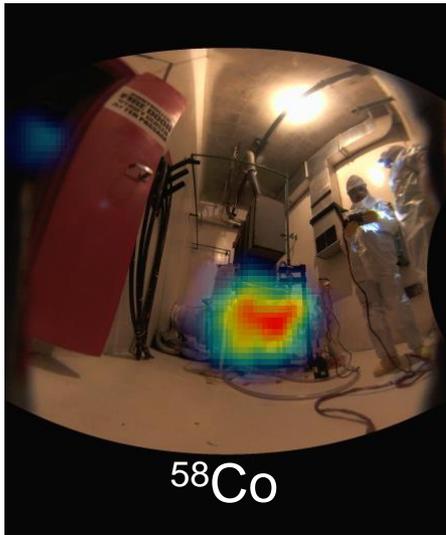
Applications

- Isotopic trend analysis
- Continuous process monitor
- Isotopic characterization of pipe of waste

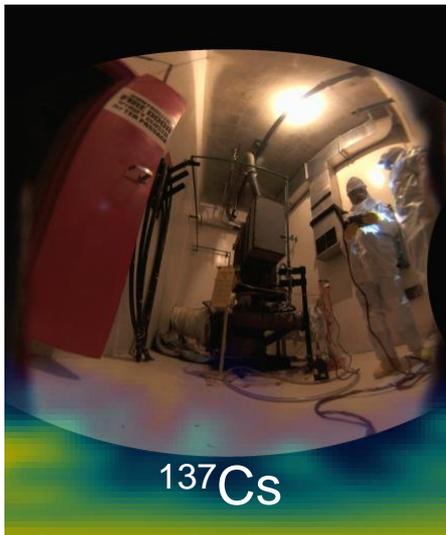
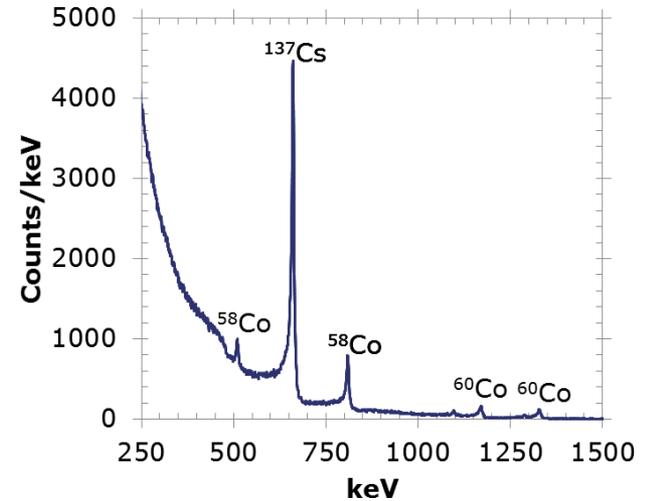
- Connects to computer via Ethernet or radio system
- Connect to tablet through USB, WiFi, or Bluetooth
- Rugged
- Operates from -20 to 50°C



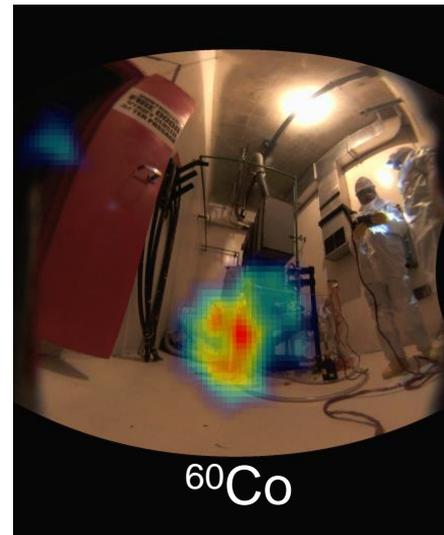
Isotopic Imaging Analysis



Center region of pump hottest from direct ^{58}Co emissions.

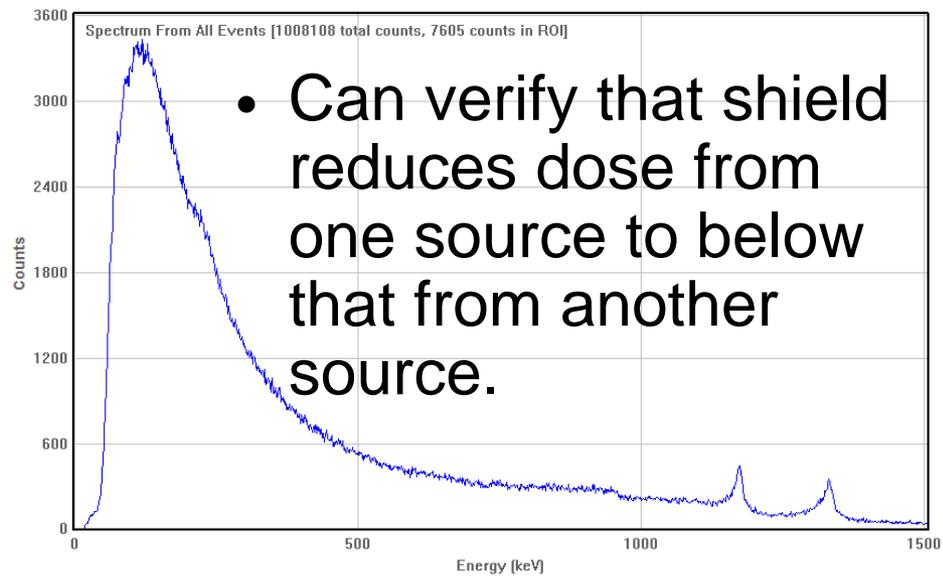
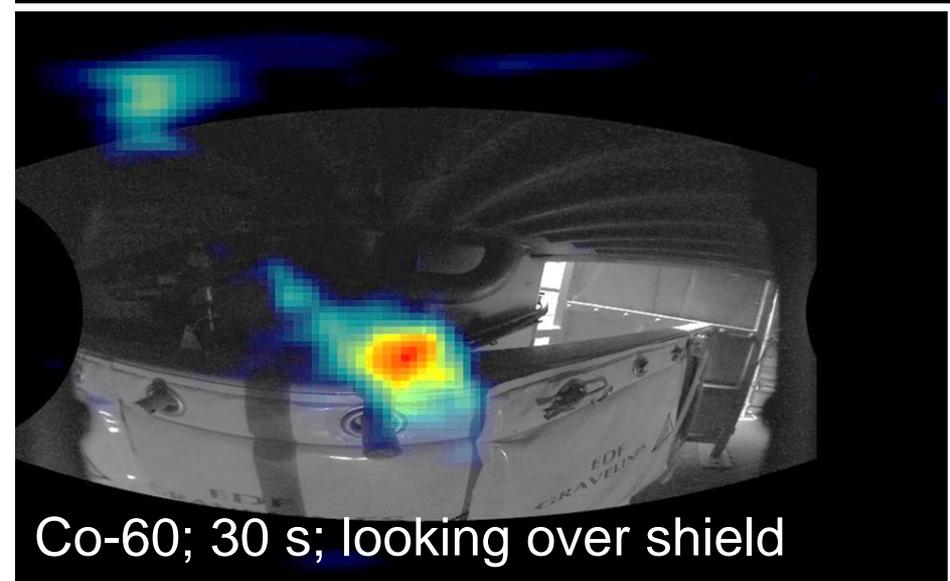
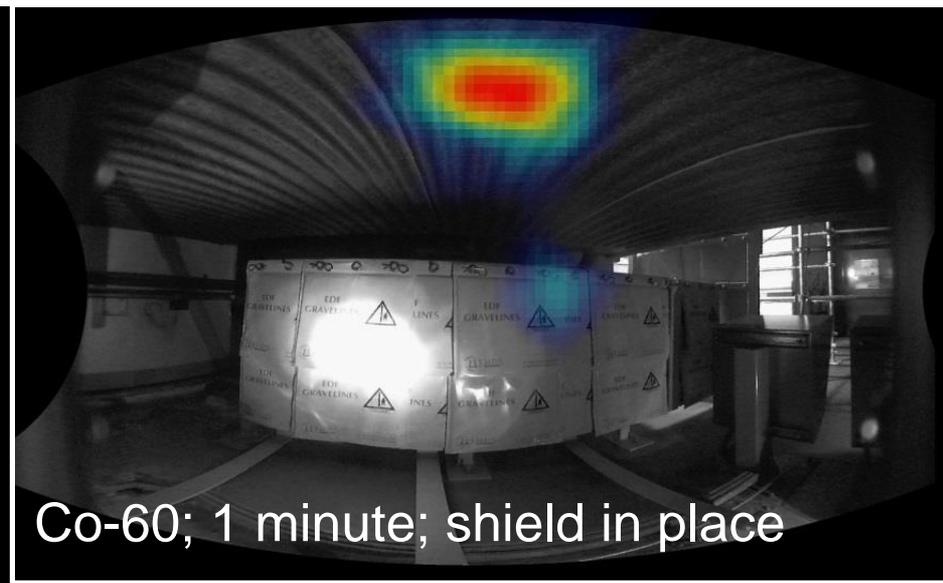
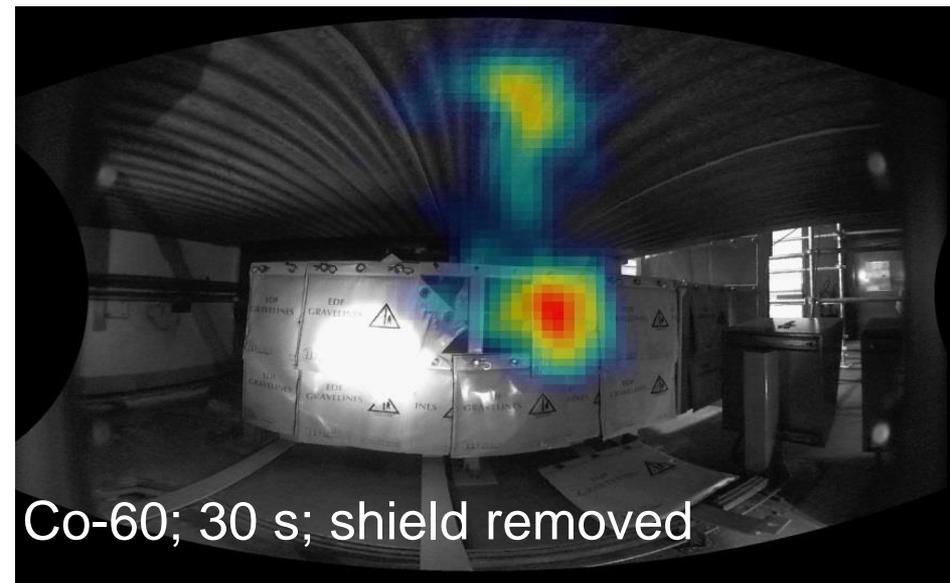


Contamination on floor and wall just behind H100.

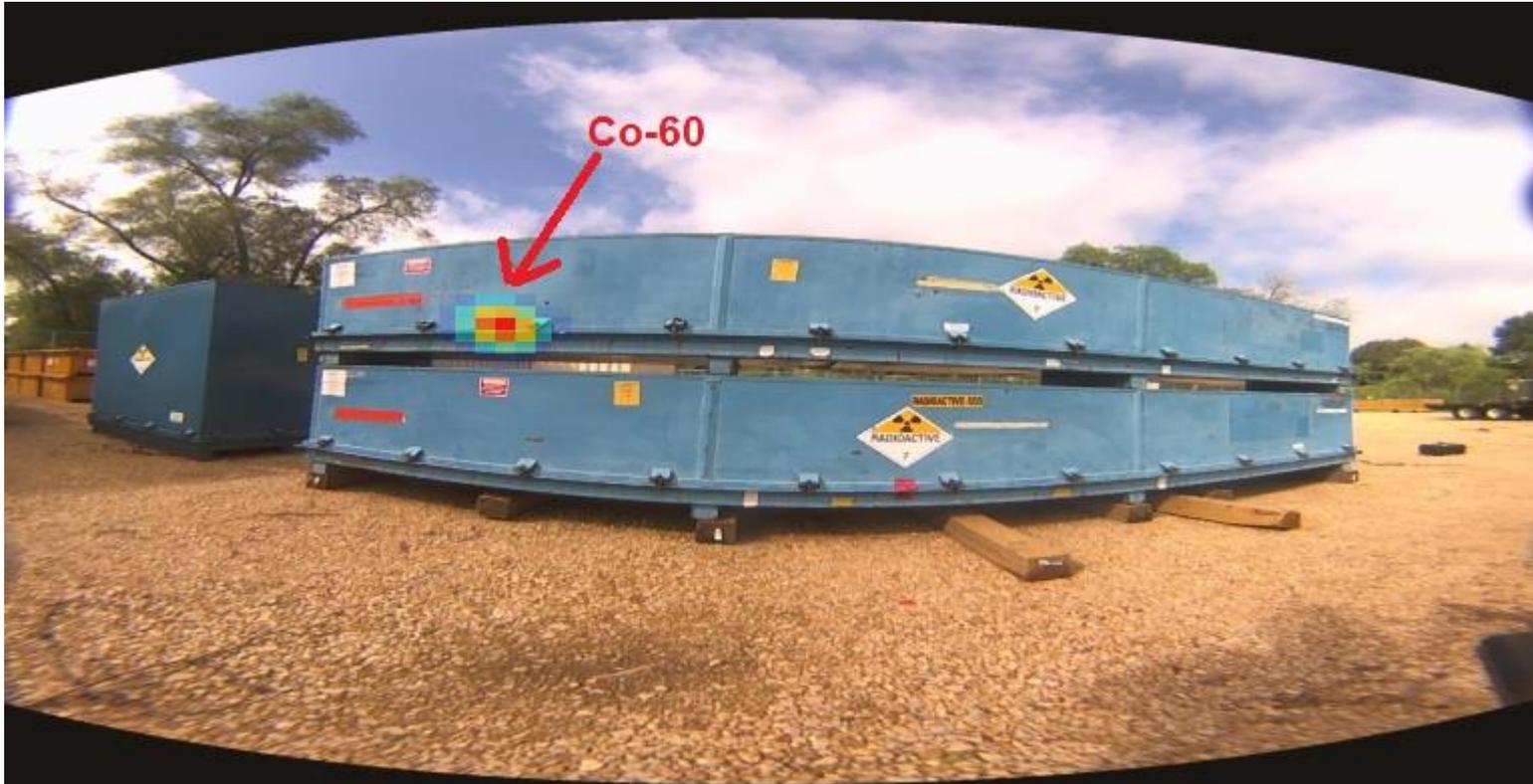


Left region of pump hottest from direct ^{60}Co emissions.

Shielding Design and Optimization



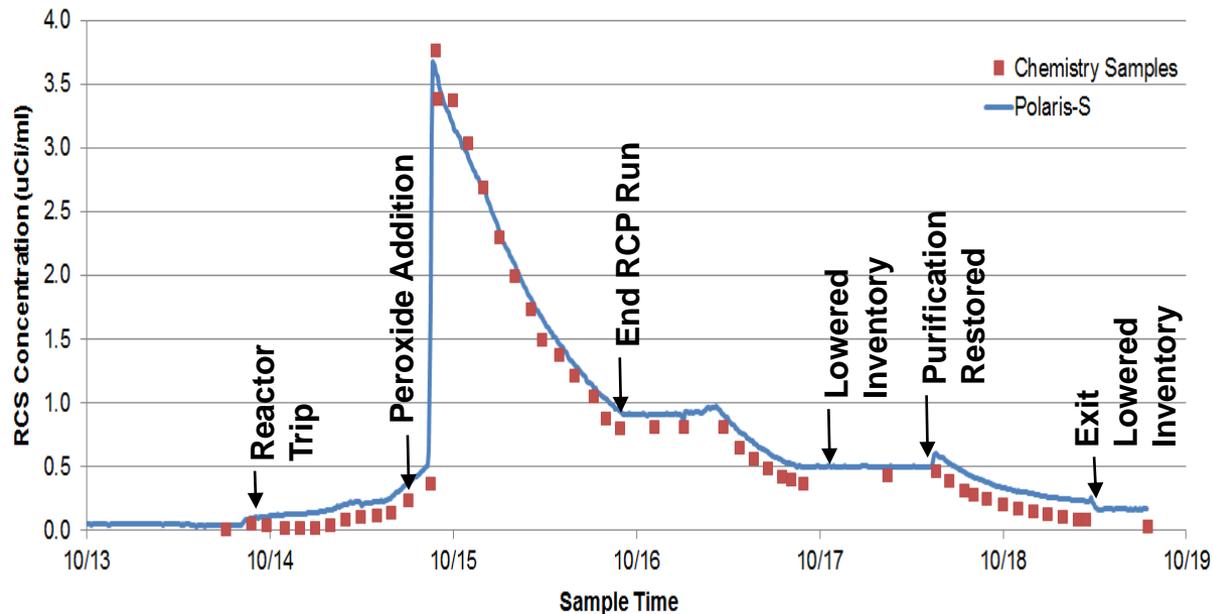
Shipping



Co-60; 17 min. with H100 → 5 min. with H400

Real-time Isotopic Trending

- Permanent mounted systems in critical areas
- Provide real-time ratios and isotopics

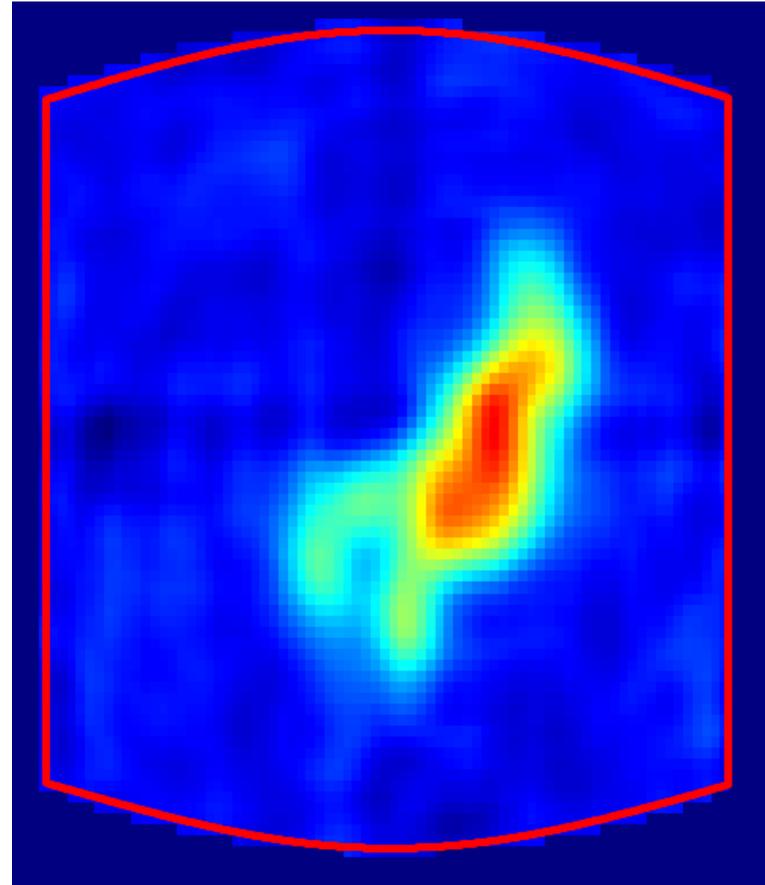


Measurements at Prairie Island Nuclear Generating Station showing ability to replace the need for chemistry samples for certain applications

Summary

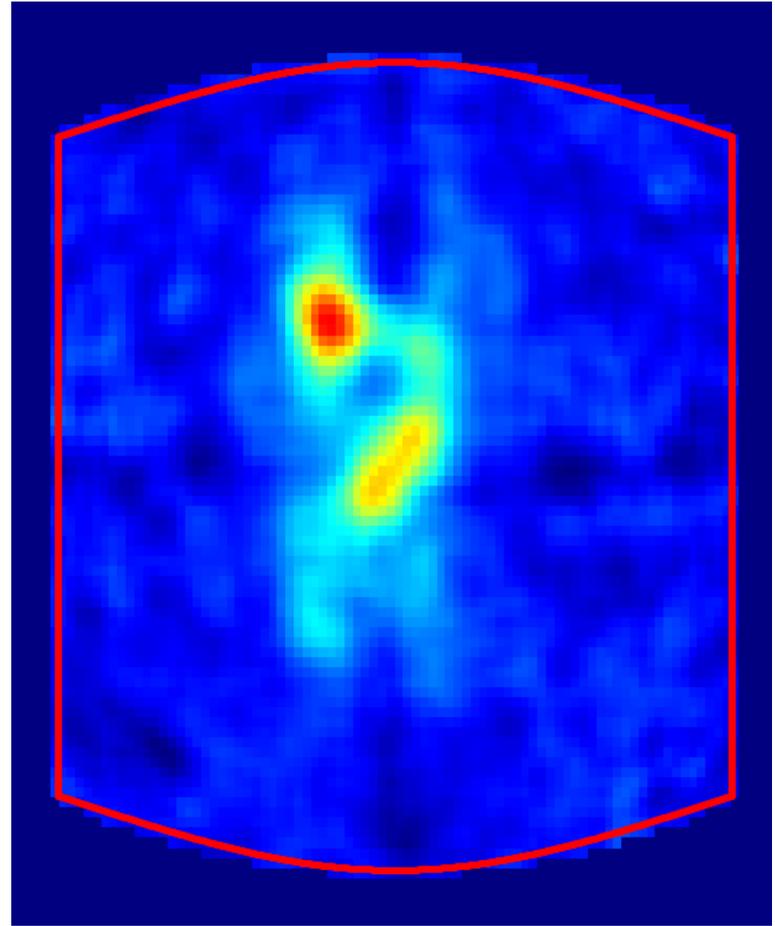
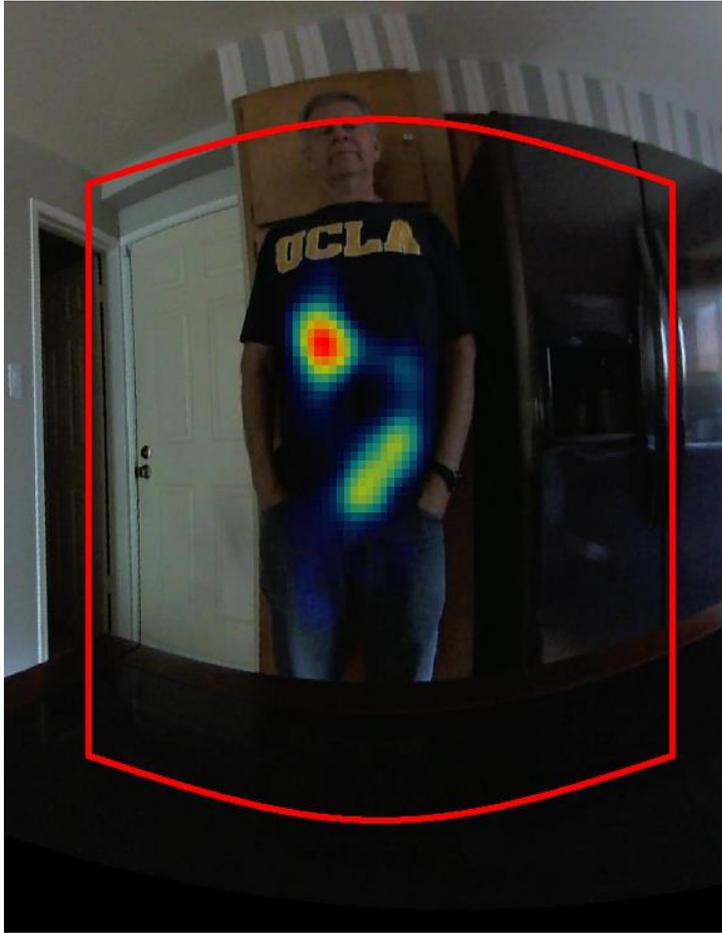
- We have made a flexible pixelated CZT detector platform with
 - Energy range of 50 keV to 3 MeV
 - <1% energy resolution @ 662 keV
 - Omnidirectional imaging capability
 - Fieldable compact formfactor
- Deployed at >70% US NPPs for source detection, identification, localization, and quantification.
- Pixelated CZT energy resolution will continue to improve with next generation readout electronics and reconstruction methods and will further close the gap to the gold standard of HPGGe.

Imaging Tc-99m



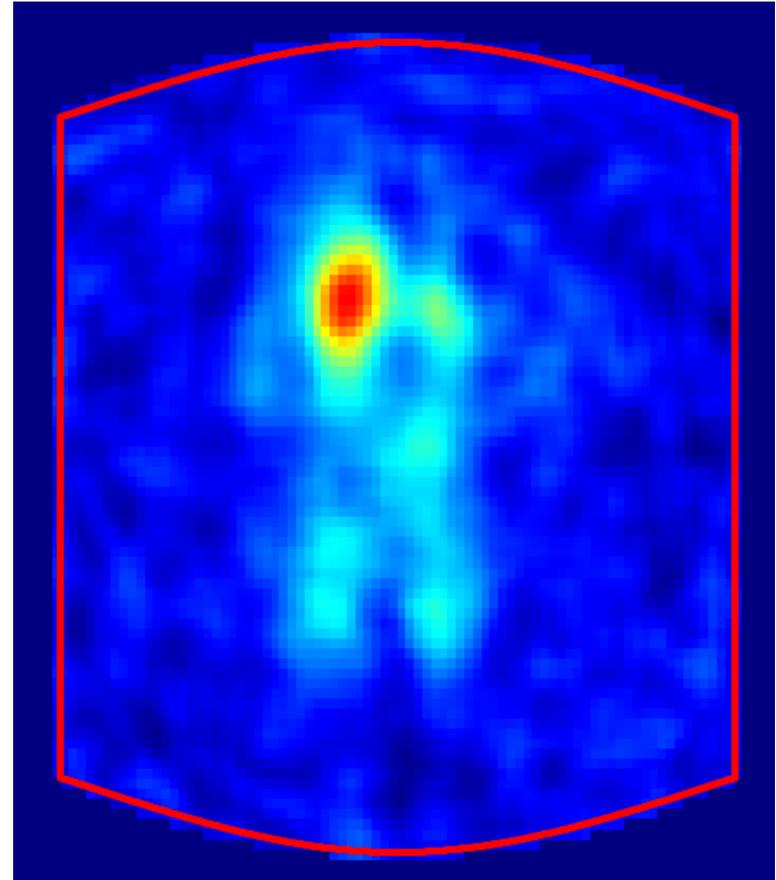
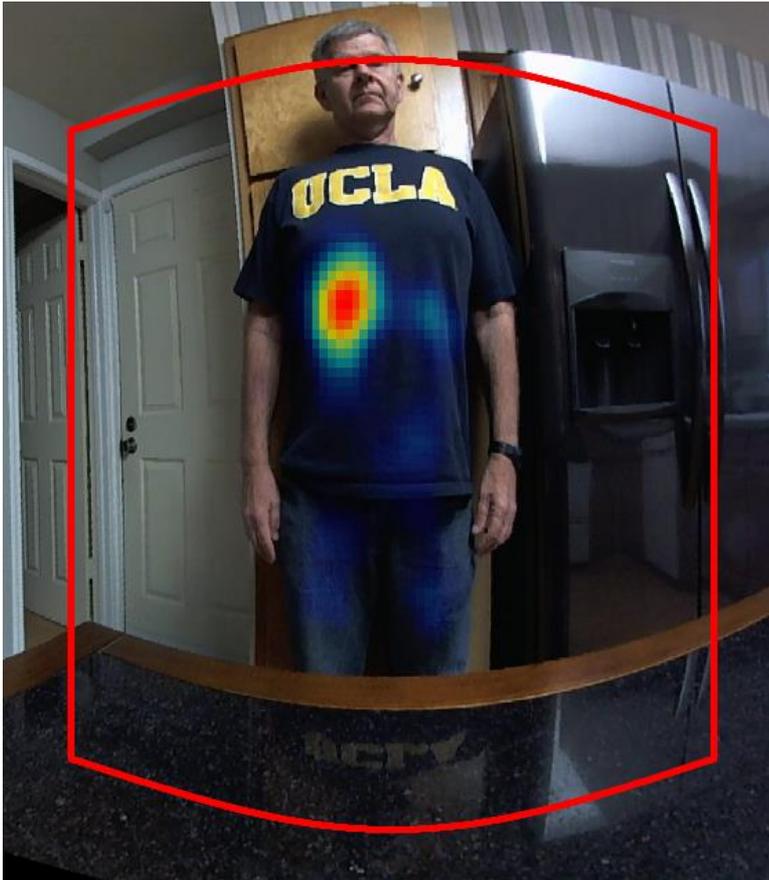
Several hours after treatment

Imaging Tc-99m



The day after, before urination

Imaging Tc-99m



The day after, after urination

Imaging Tc-99m



Please visit H3D's booth at the conference.



H3D Inc.

Questions?

