Polaris 3-D CdZnTe Gamma-Ray Imaging Spectrometers

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On behalf of the Orion group

UNIVERSITY OF MICHIGAN

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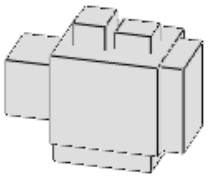
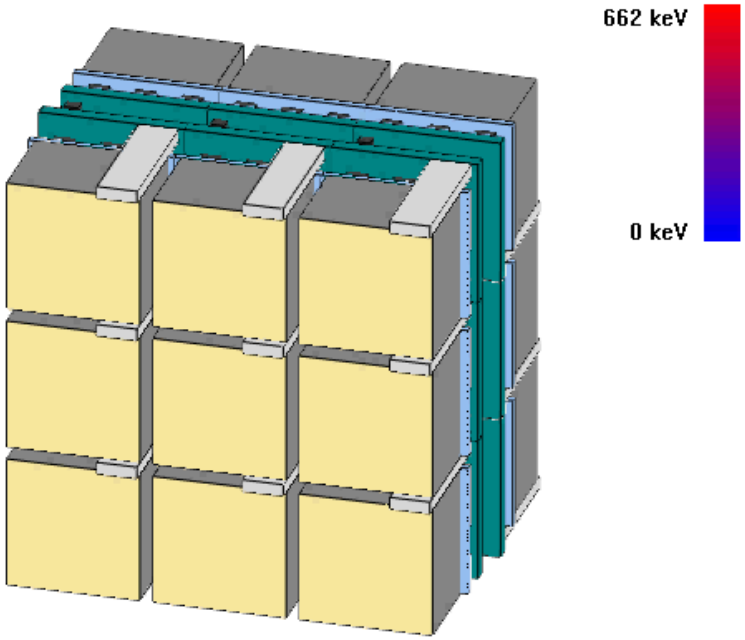
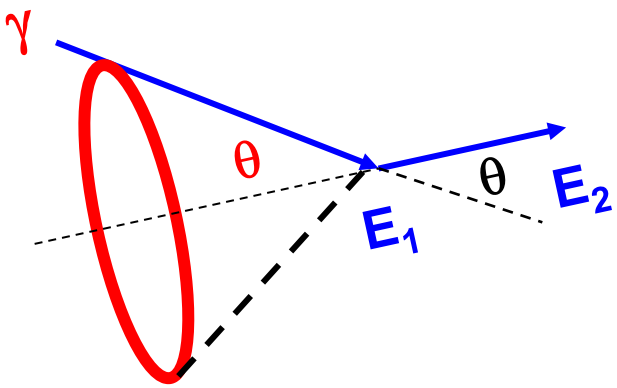
Acknowledgements: DOD DTRA, DOE NA-22 & DHS DNDO

Principle

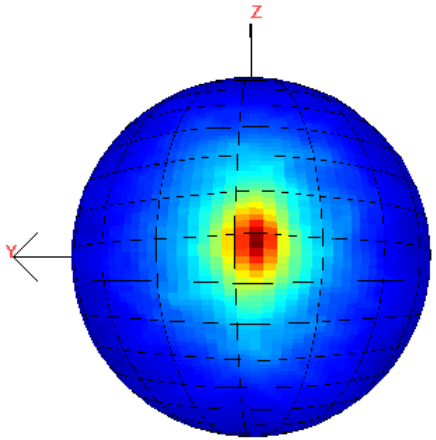
Eighteen 2×2×1.5 cm³ CdZnTe detectors
(108 cm³, 648 grams = 1.43 lb)







$$\cos\theta = 1 - \frac{E_1 m_e c^2}{(E_1 + E_2)\cdot E_2}$$



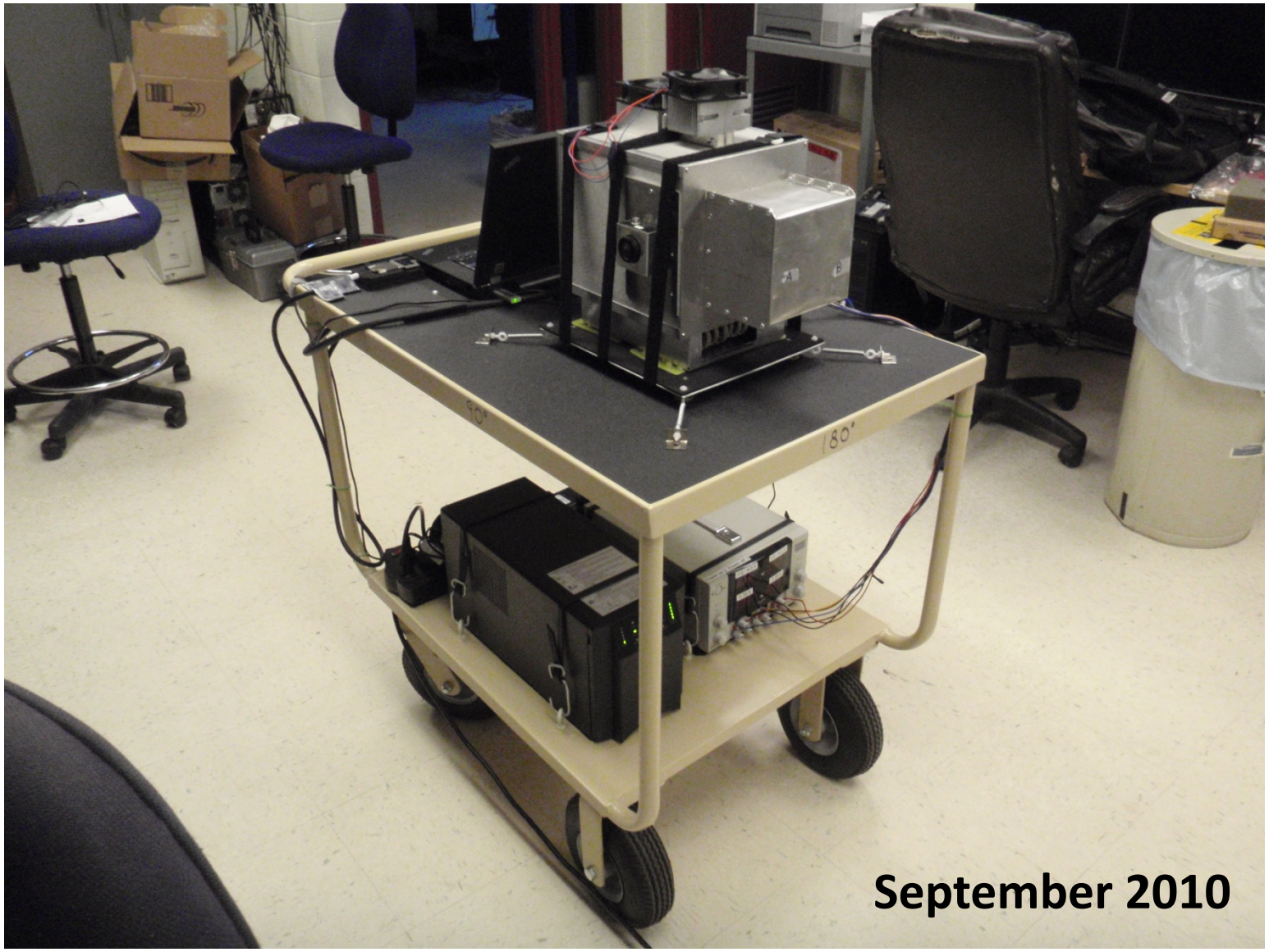
Number of photons: 2033

Performance Goals

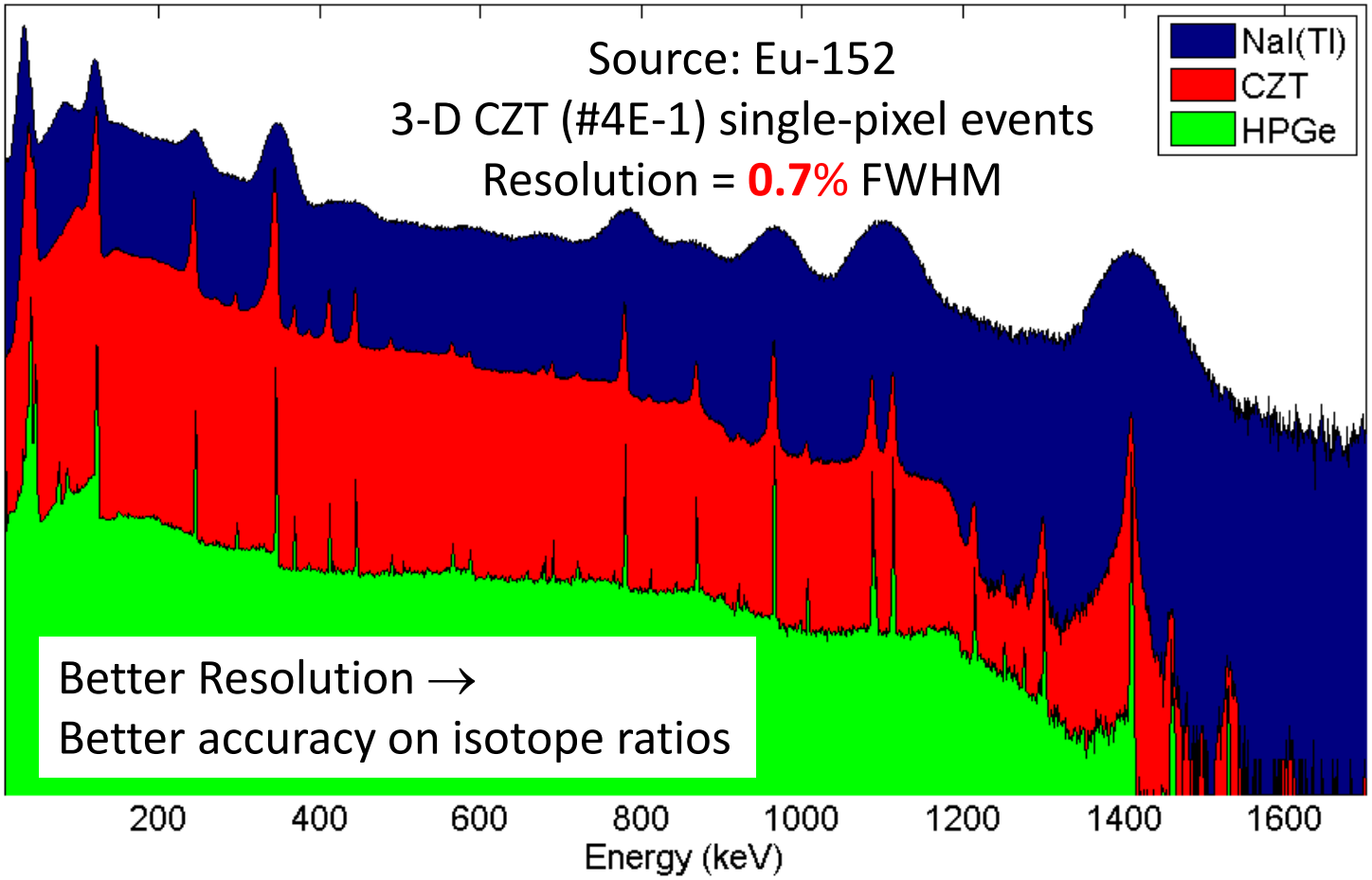
ΔE/E ≤ 1% FWHM (at 662 keV)

Real-time γ Imaging + isotope I.D.

First UM Polaris 3-D CZT detector system



Comparing to Other γ Spectrometers

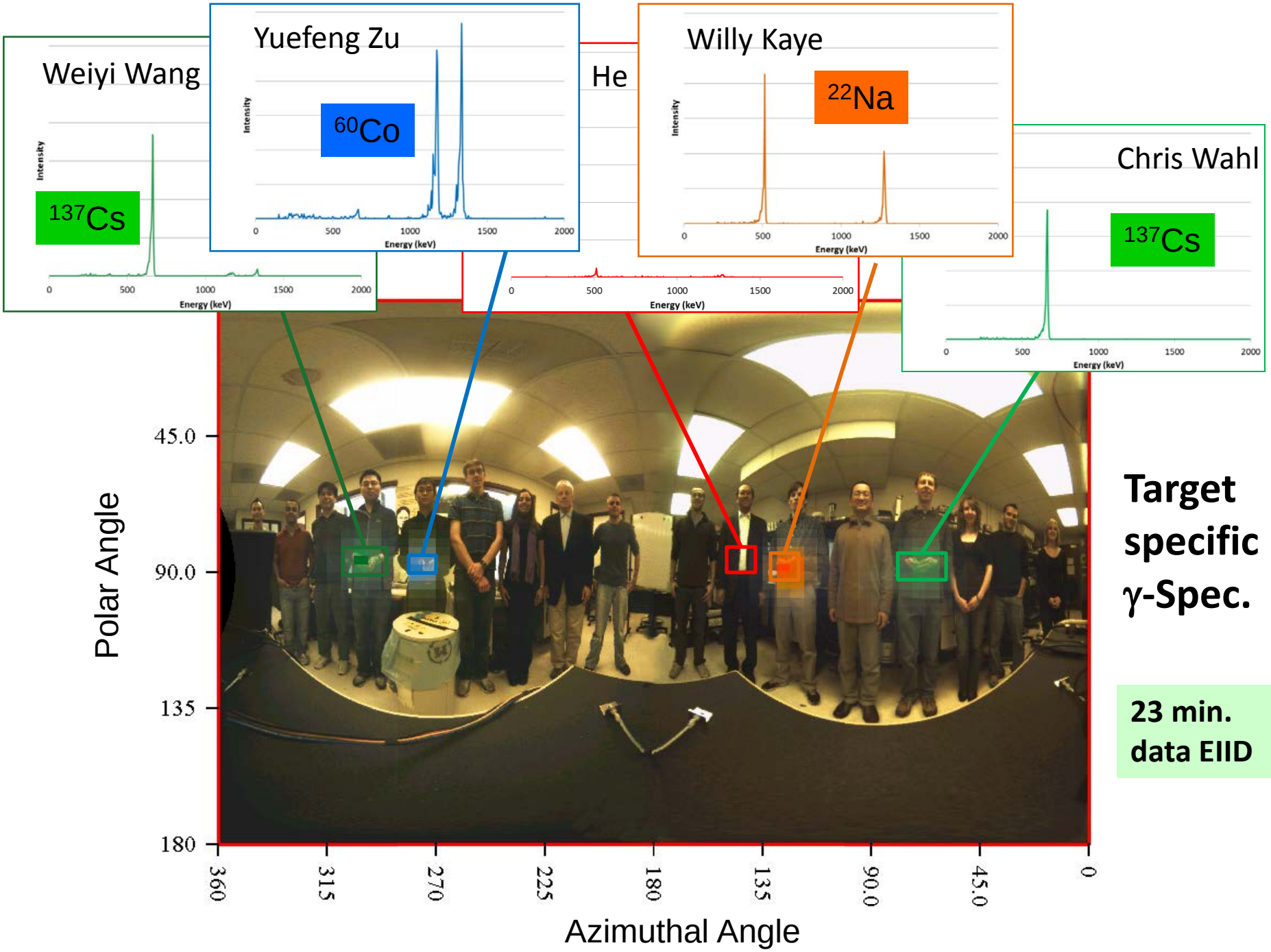


Gamma Imaging Capability

Intensity of:

^{22}Na ^{60}Co ^{137}Cs

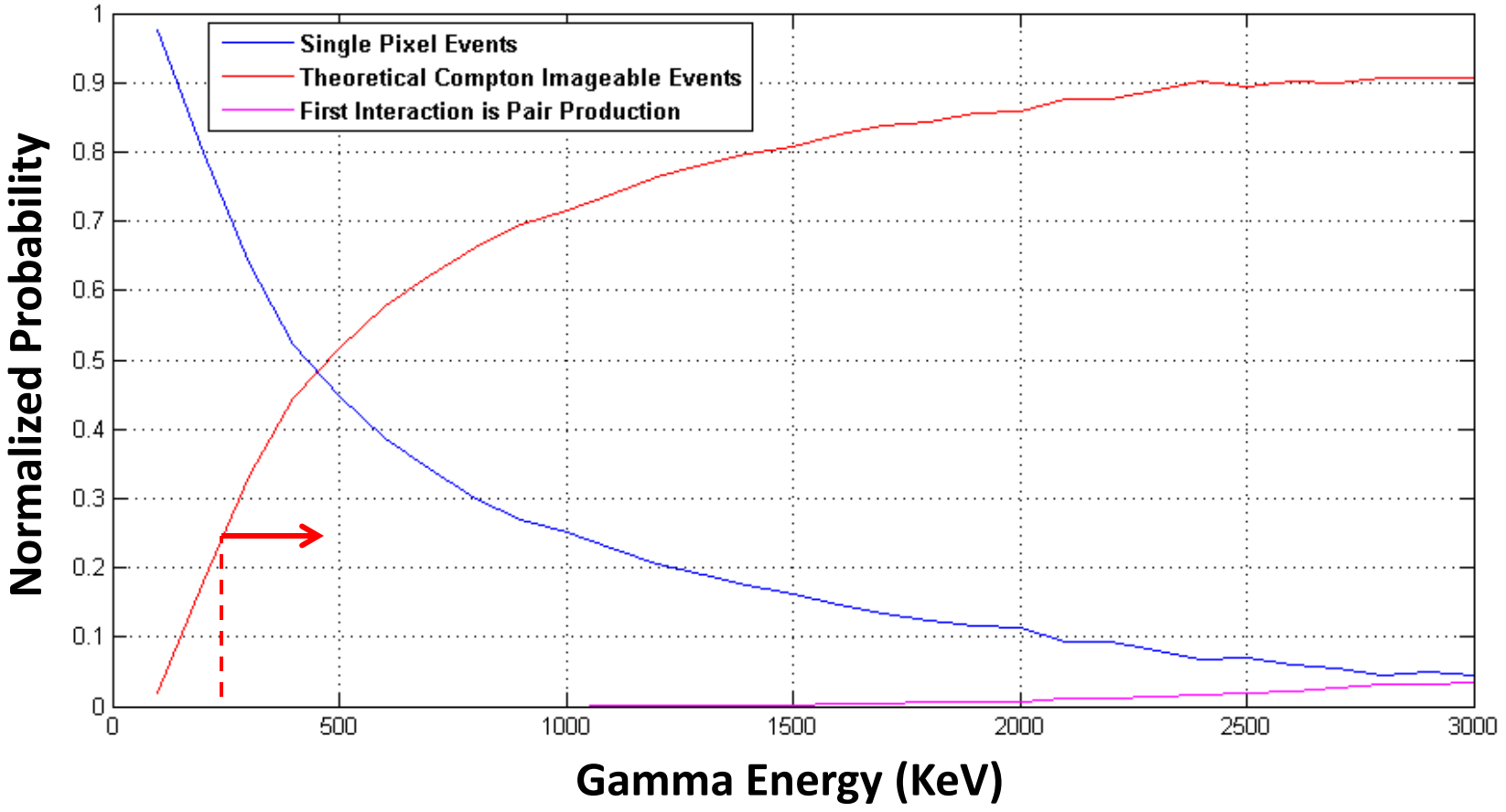
1 minute data EIID



Target specific γ-Spec.

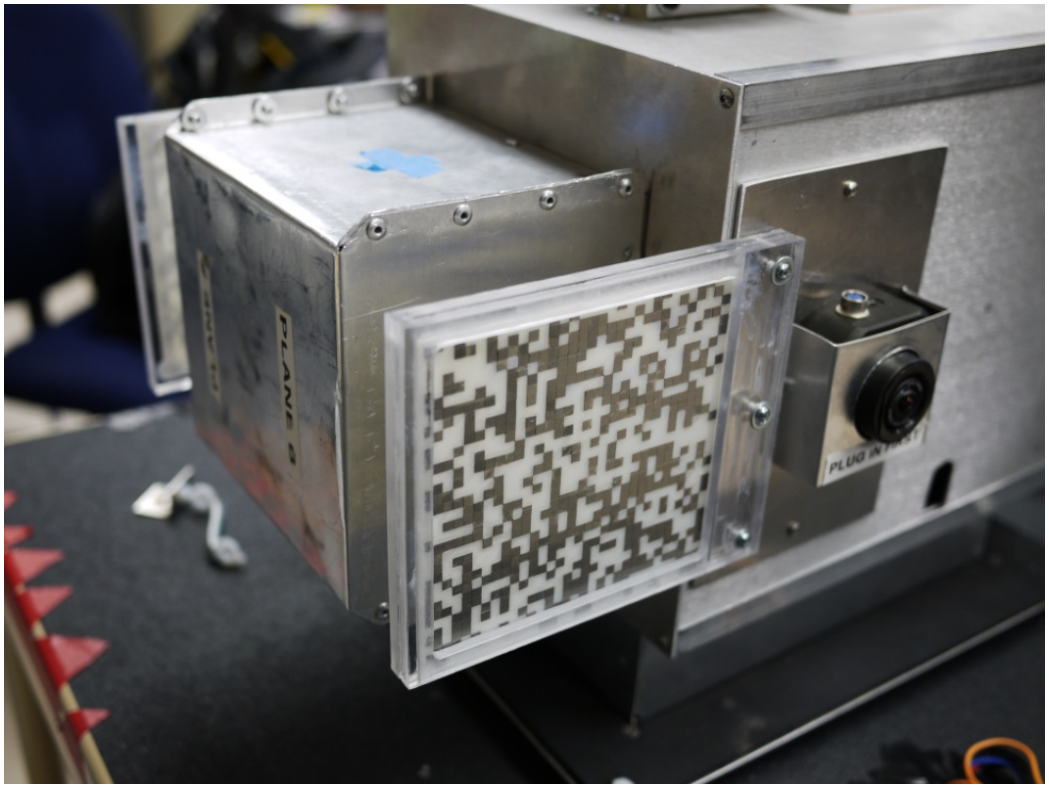
23 min. data EIID

Energy Range of Compton Imaging



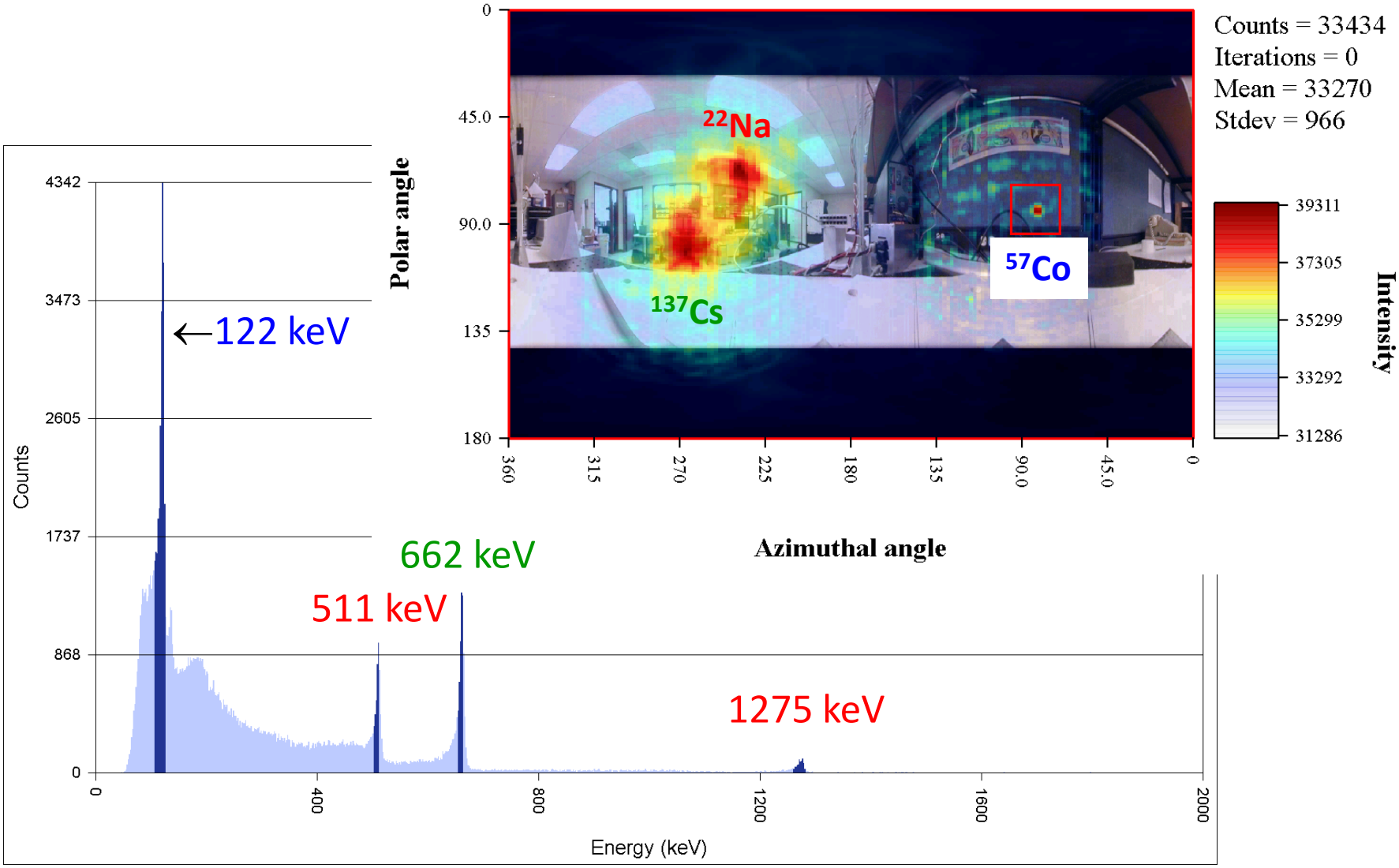
Polaris-H performs Compton imaging for γ-rays with E ≥ 250 keV

Coded Aperture Imaging at E ≤ 250 keV



Principle: Recognize unique mask shadows from different incident gamma-ray angles

Real-Time Combined Coded Aperture and Compton Imaging



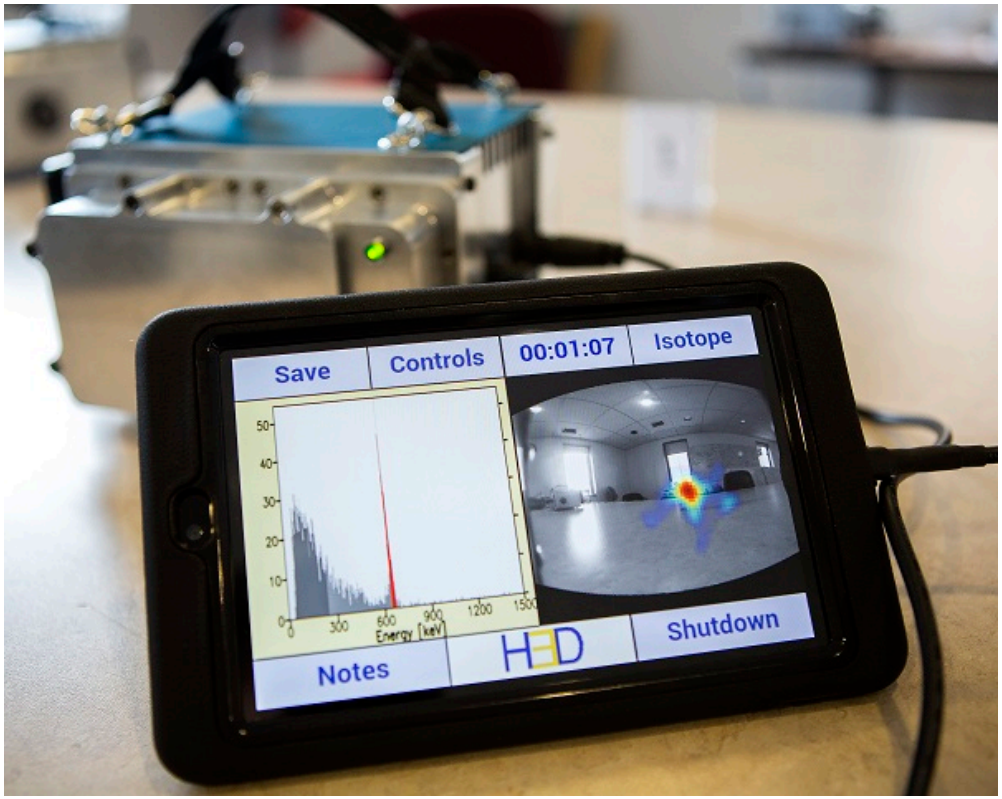
Univ. of Michigan Polaris Technology

↓ Licensed to

H3D, Inc.

Dr. Willy Kaye, President

See live demo at H3D booth



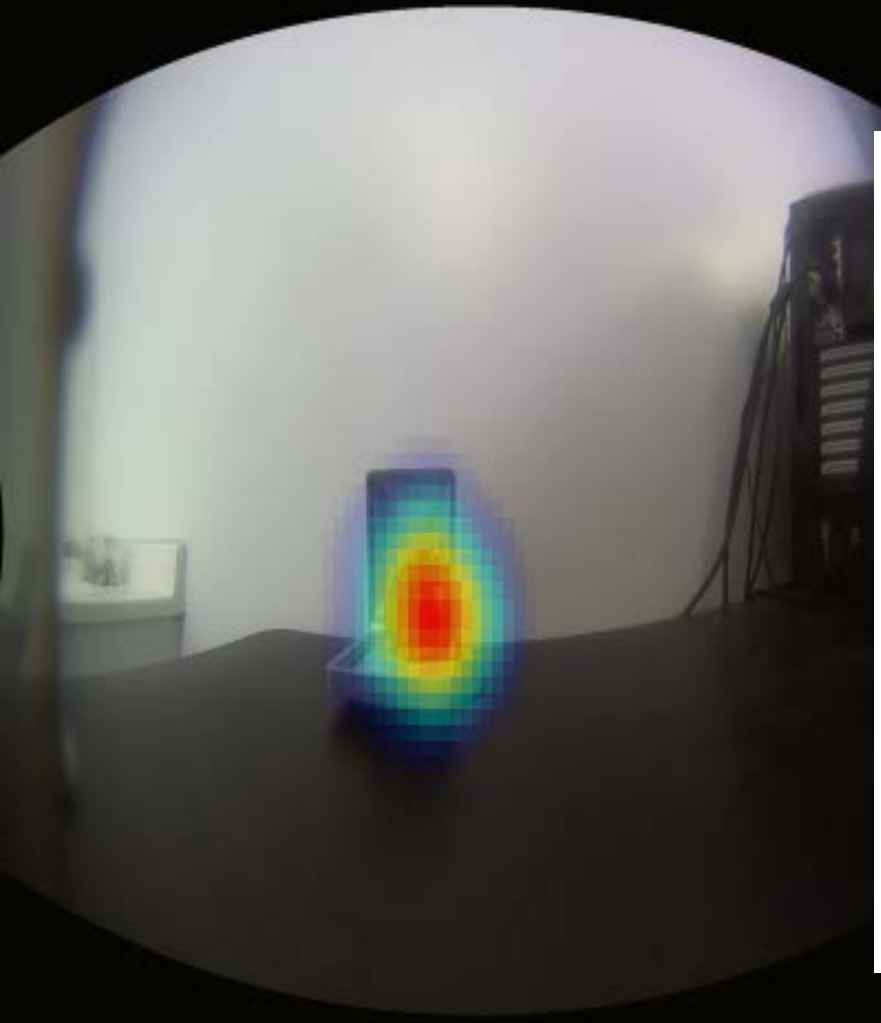
First Demonstration at Fermi in March 2012

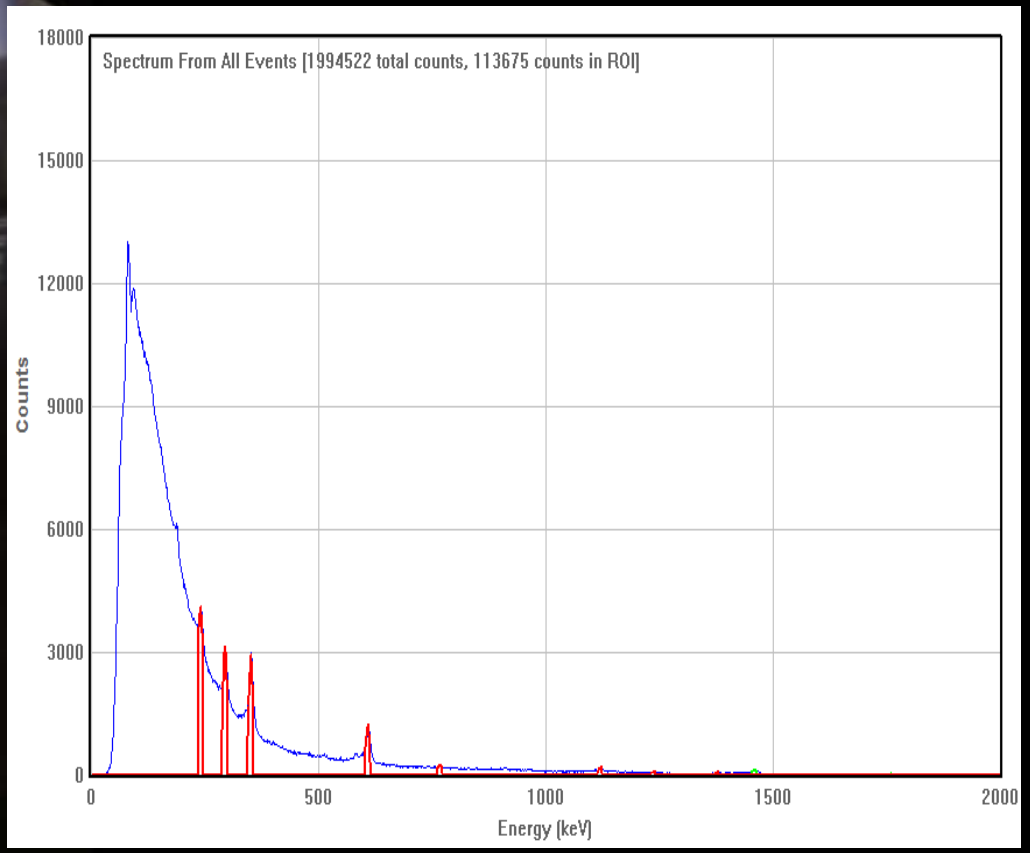
Optical & (^{60}Co) Gamma Images

Radium watch at 7 inches from face

Following measurements were performed by H3D Inc., edited by Dr. Chris Wahl

Simple Back-Projection – **27 hr** (11.7k counts)

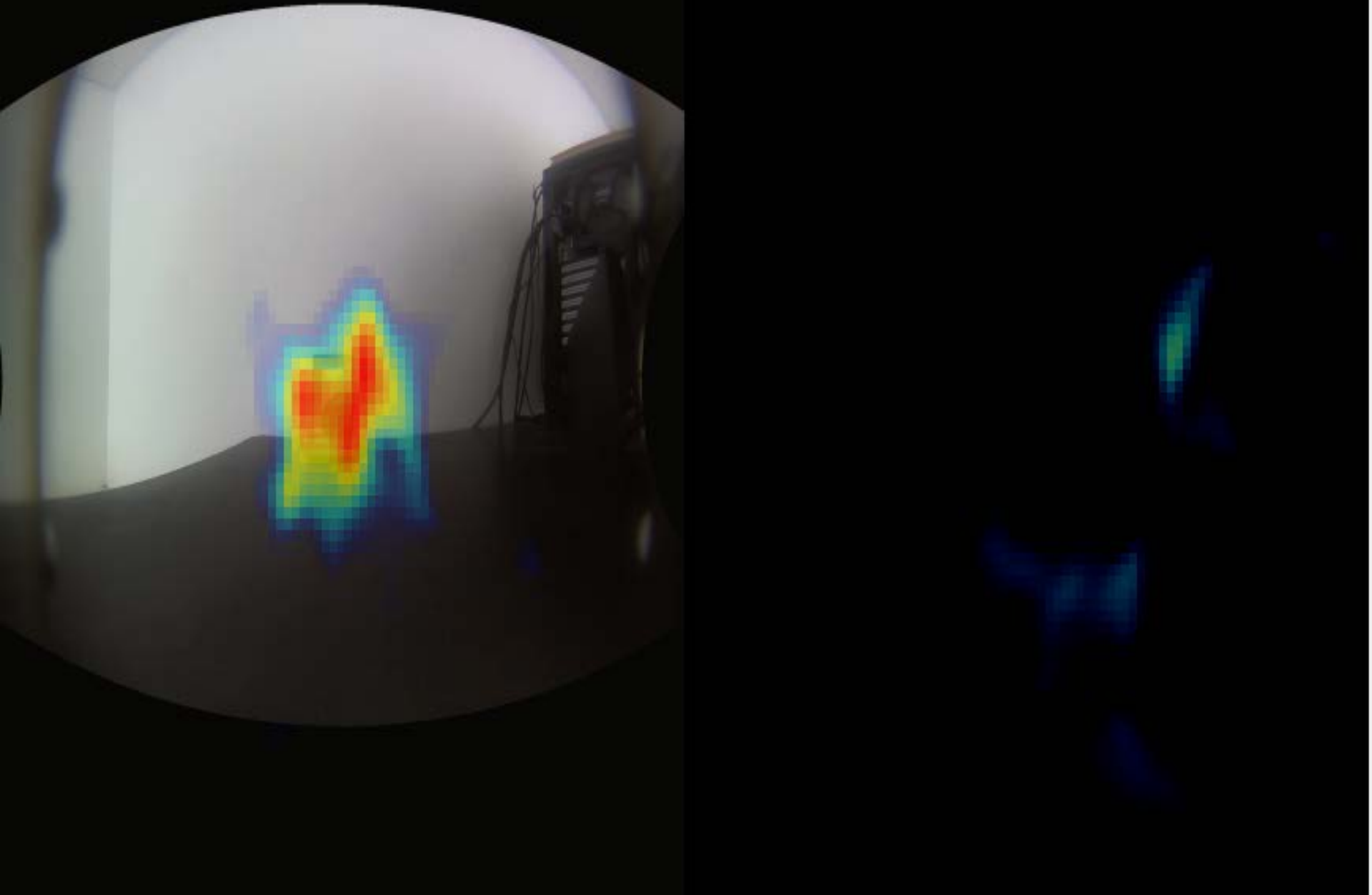




High resolution mode (MLEM) – **27 hr**

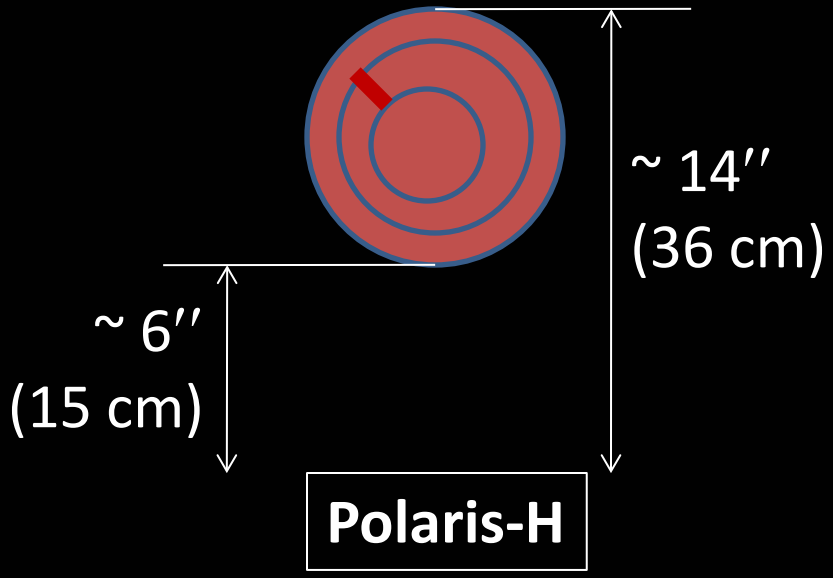
Radium watch at 1 foot

Simple Back-Projection – **2 hours** (603 counts from 7 lines)

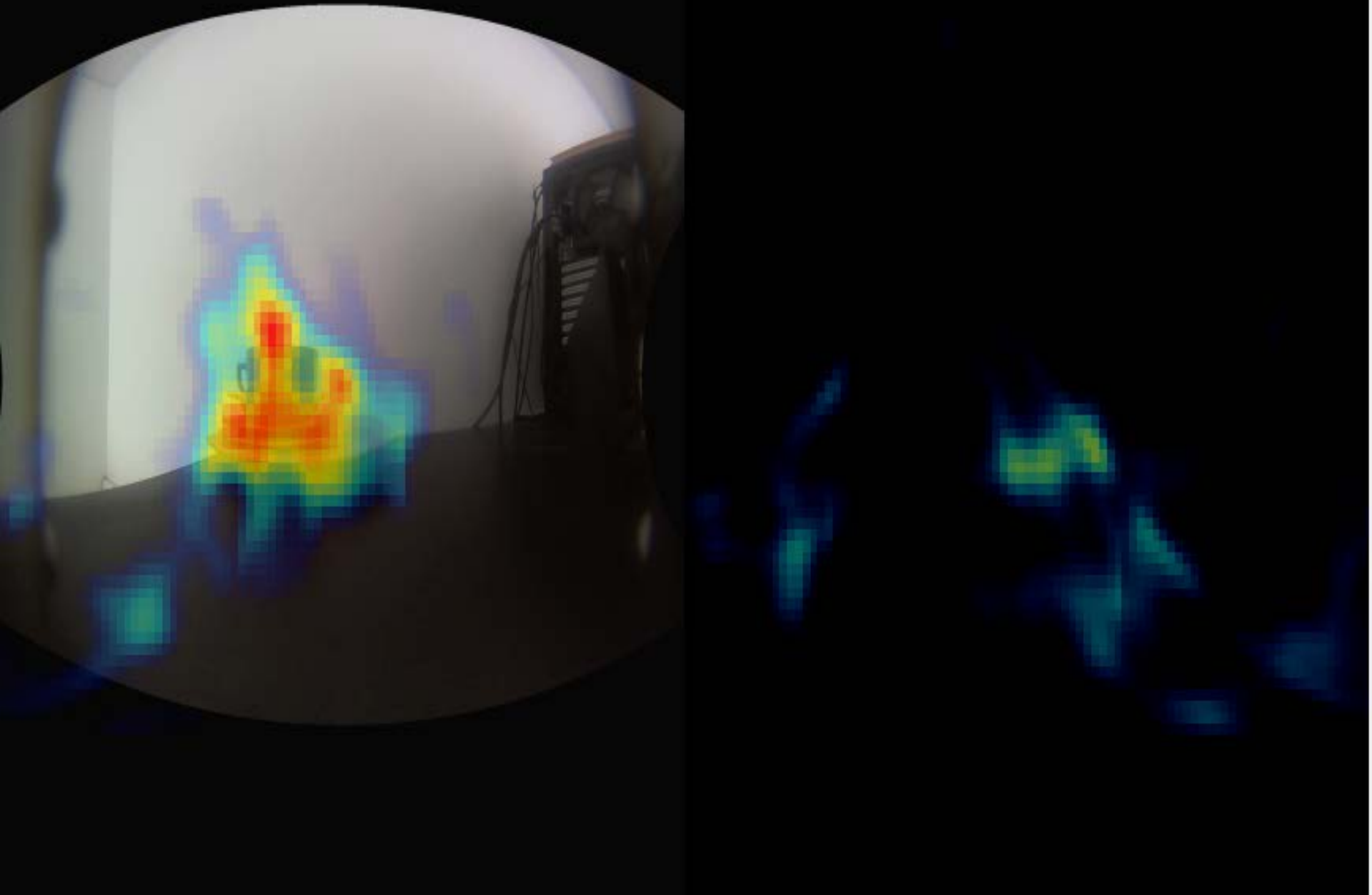


Fiestaware

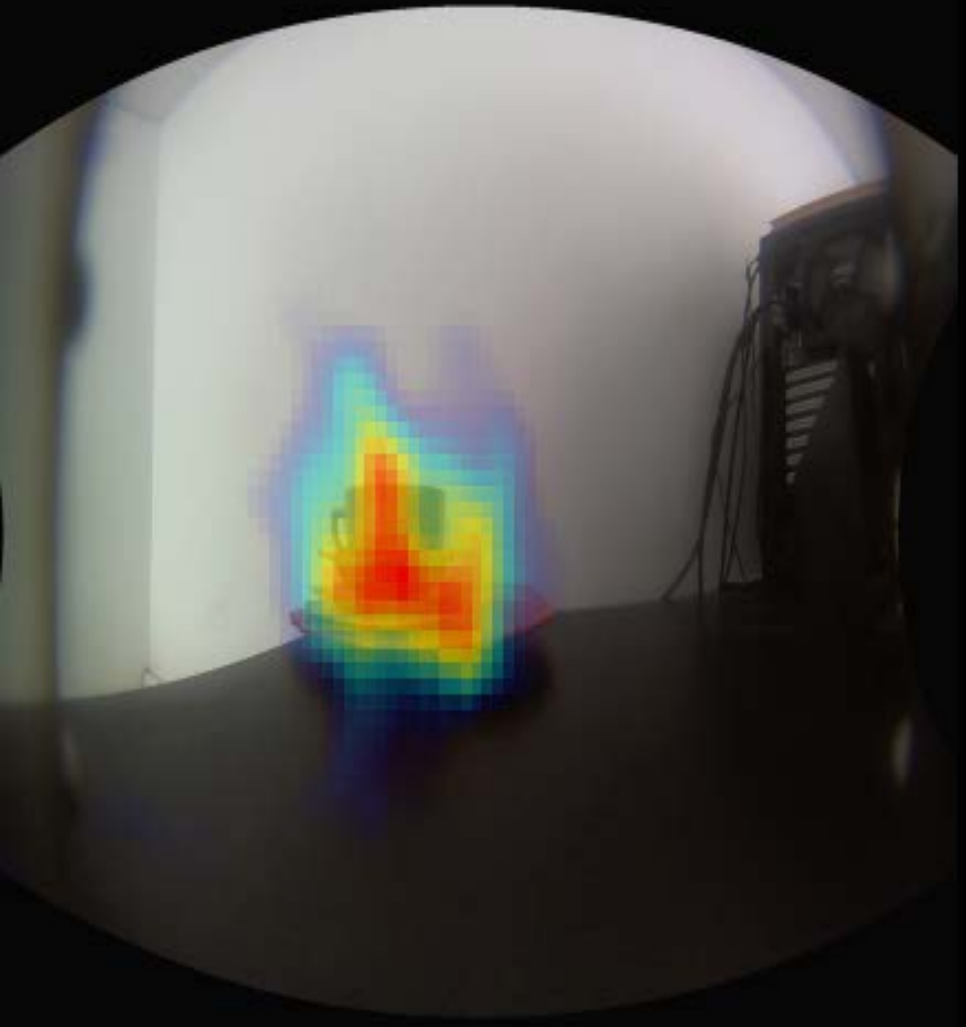
Distance:



6 hours (367 counts, imaging 766 and 1000 keV lines)



12 hours (786 counts, imaging 766 and 1000 keV lines)



Shape of fiestaware start to appear – what you can see from an overnight measurement