

Polaris CdZnTe Gamma-Ray Imaging Spectrometer Systems

Zhong He

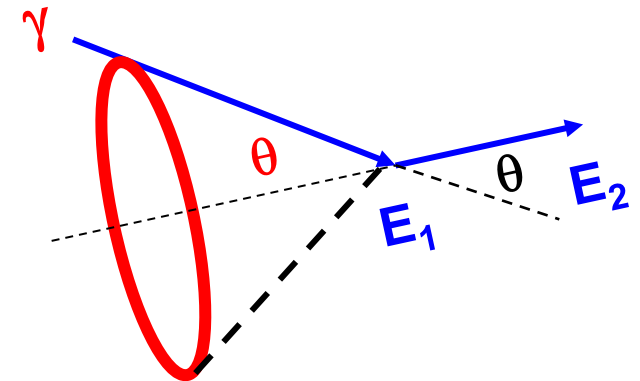
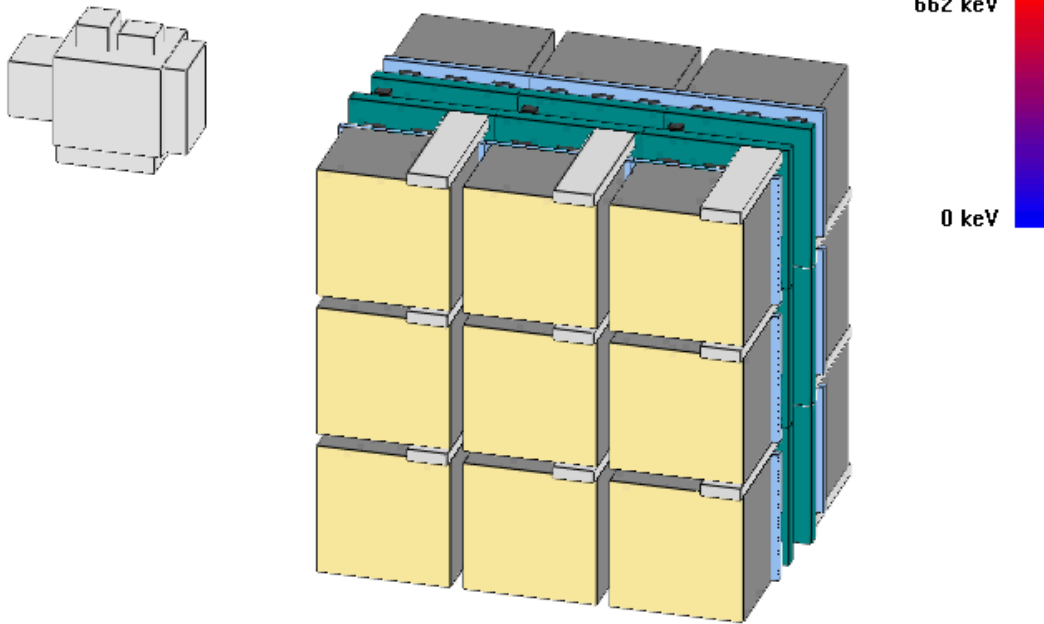
On behalf of the Orion group



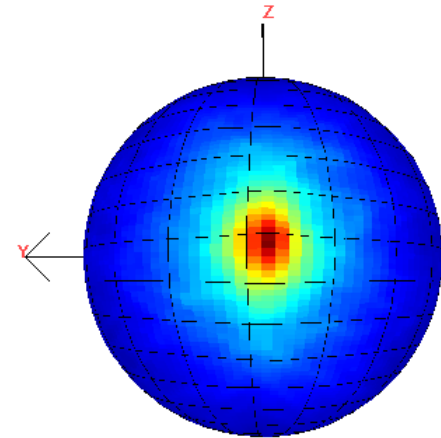
**ISOE International ALARA Symposium
Tokyo, Japan, 27-29 August, 2013**

Polaris Systems

Eighteen $2 \times 2 \times 1.5 \text{ cm}^3$ CdZnTe detectors
(**108** cm^3 , 648 grams = **1.43** lb)



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



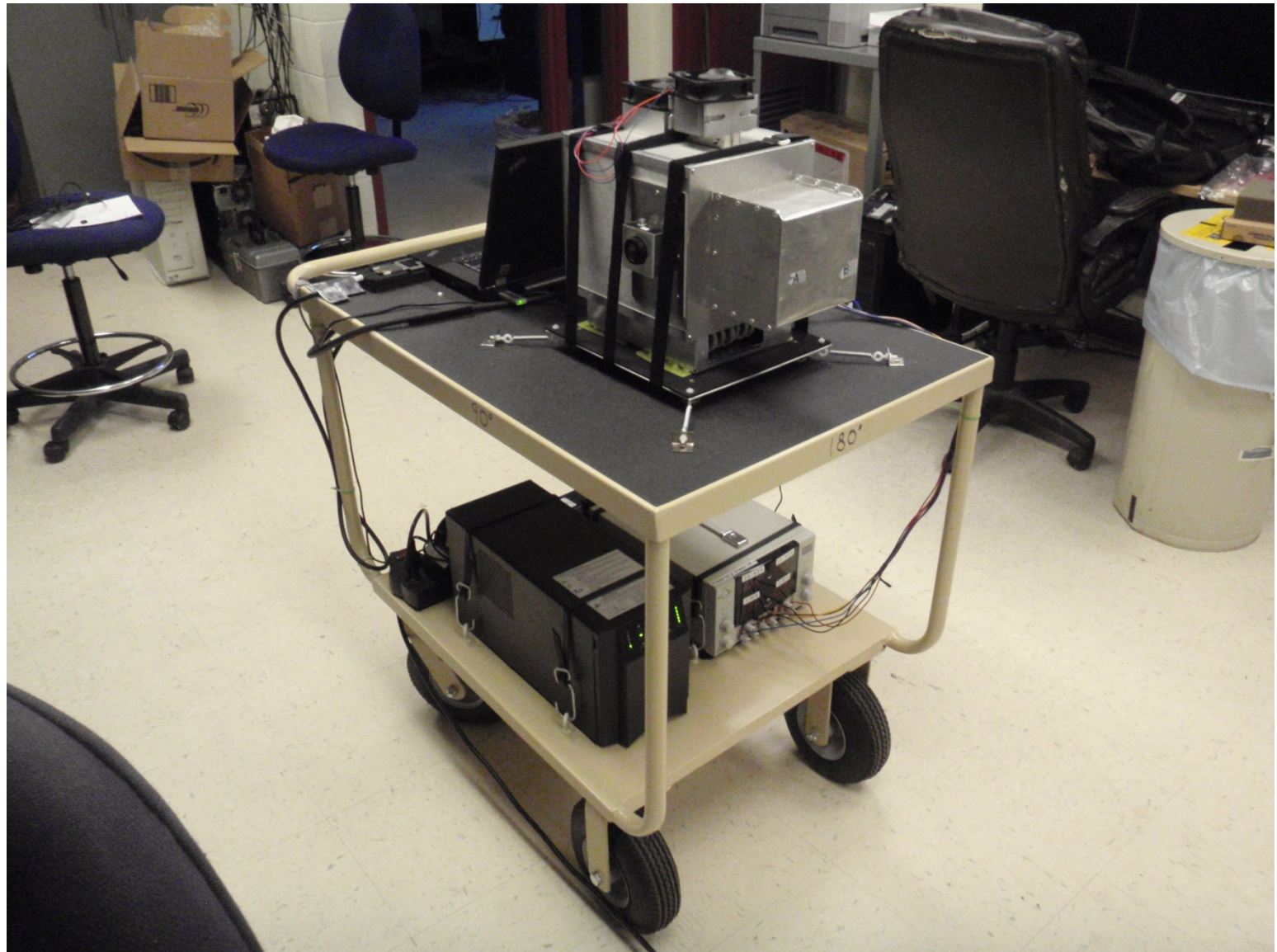
Performance Goals

$\Delta E/E \leq 1\%$ FWHM (at 662 keV)

Real-time γ Imaging + isotope I.D.

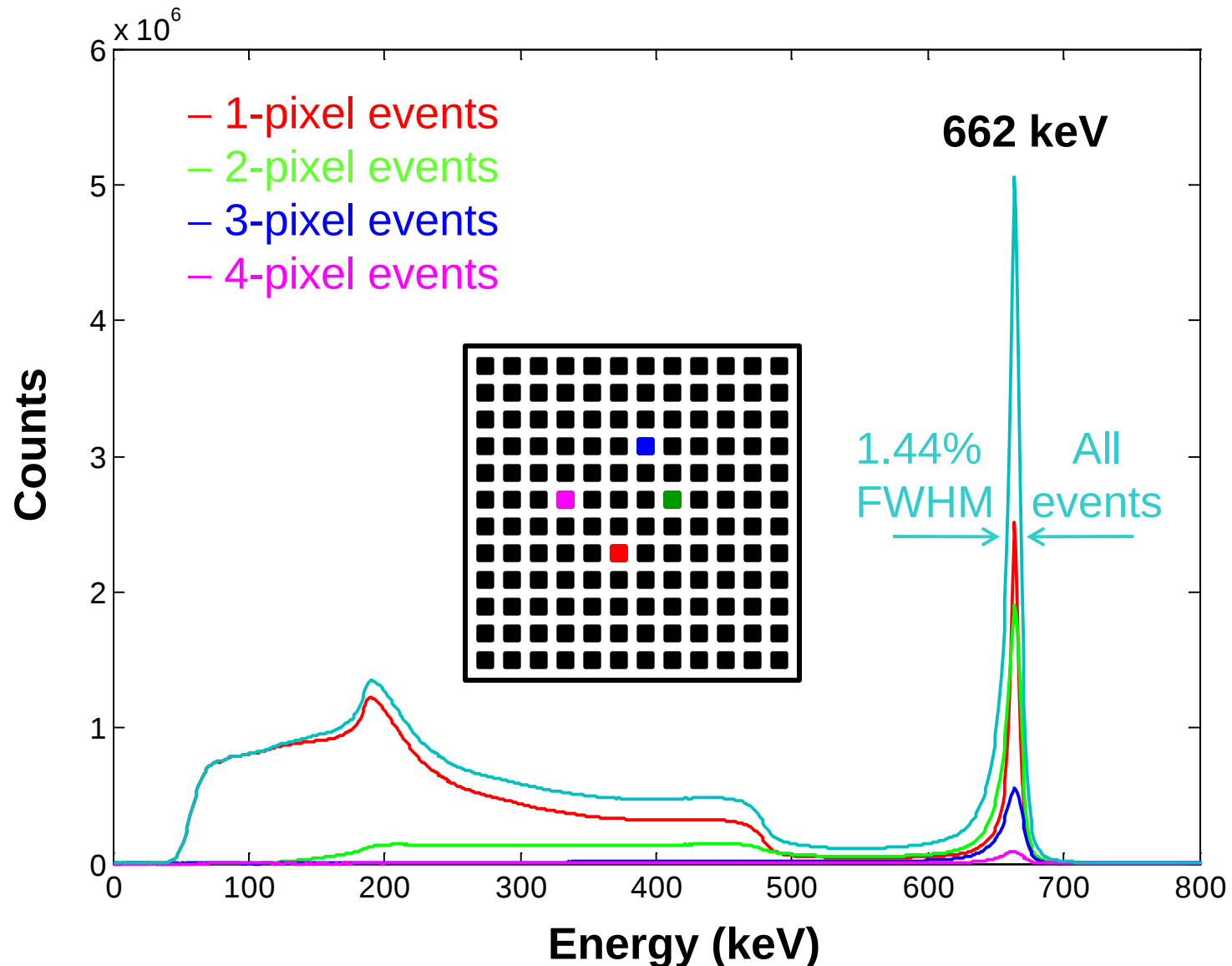
Number of photons: 2033

Polaris 1.1 (GMI ASIC) – August 2010



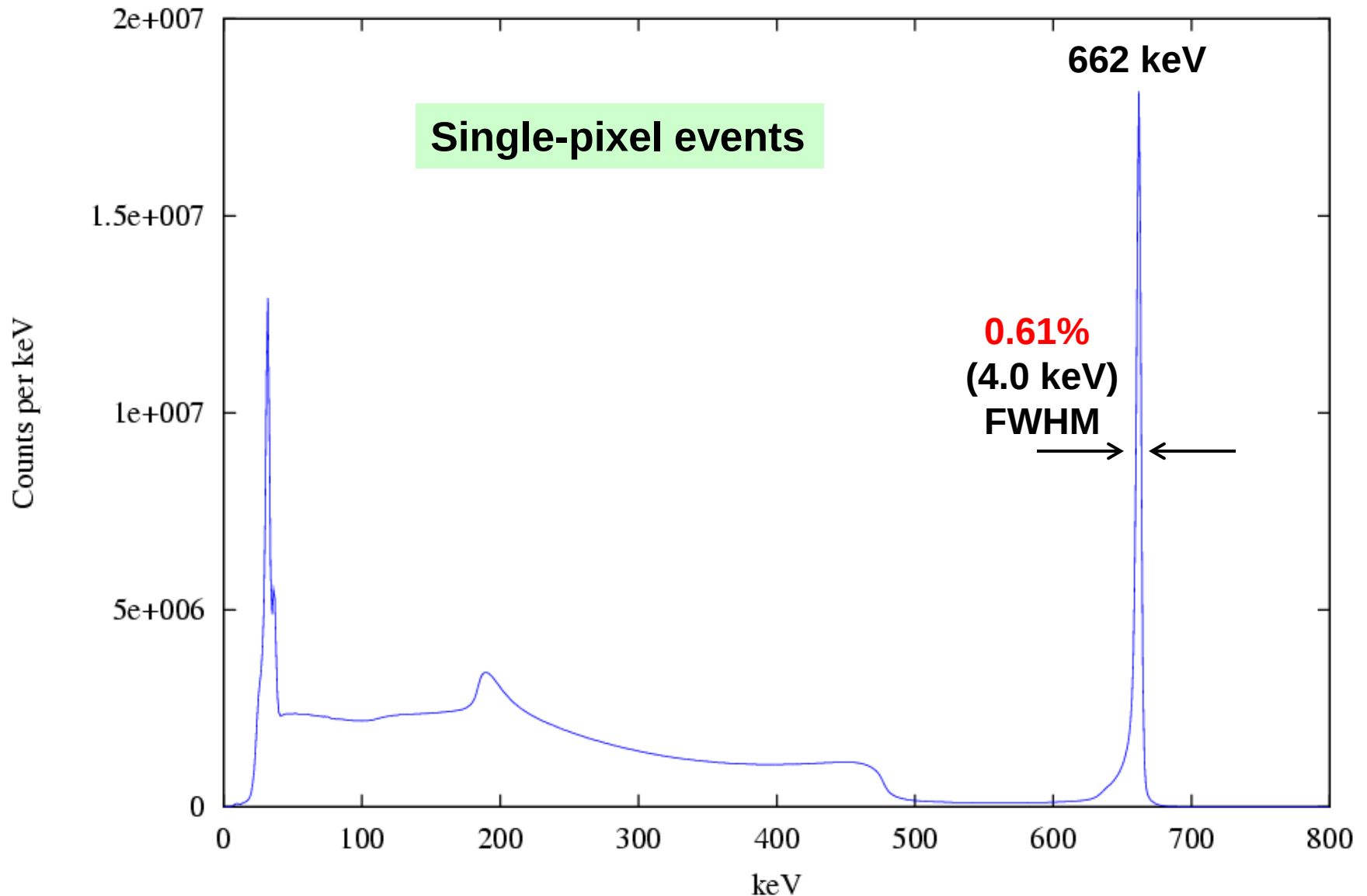
^{137}Cs Energy Spectra of the 1st Polaris system #1.1

(From **all 18 detectors** of Polaris, 24°C, uncollimated ^{137}Cs)



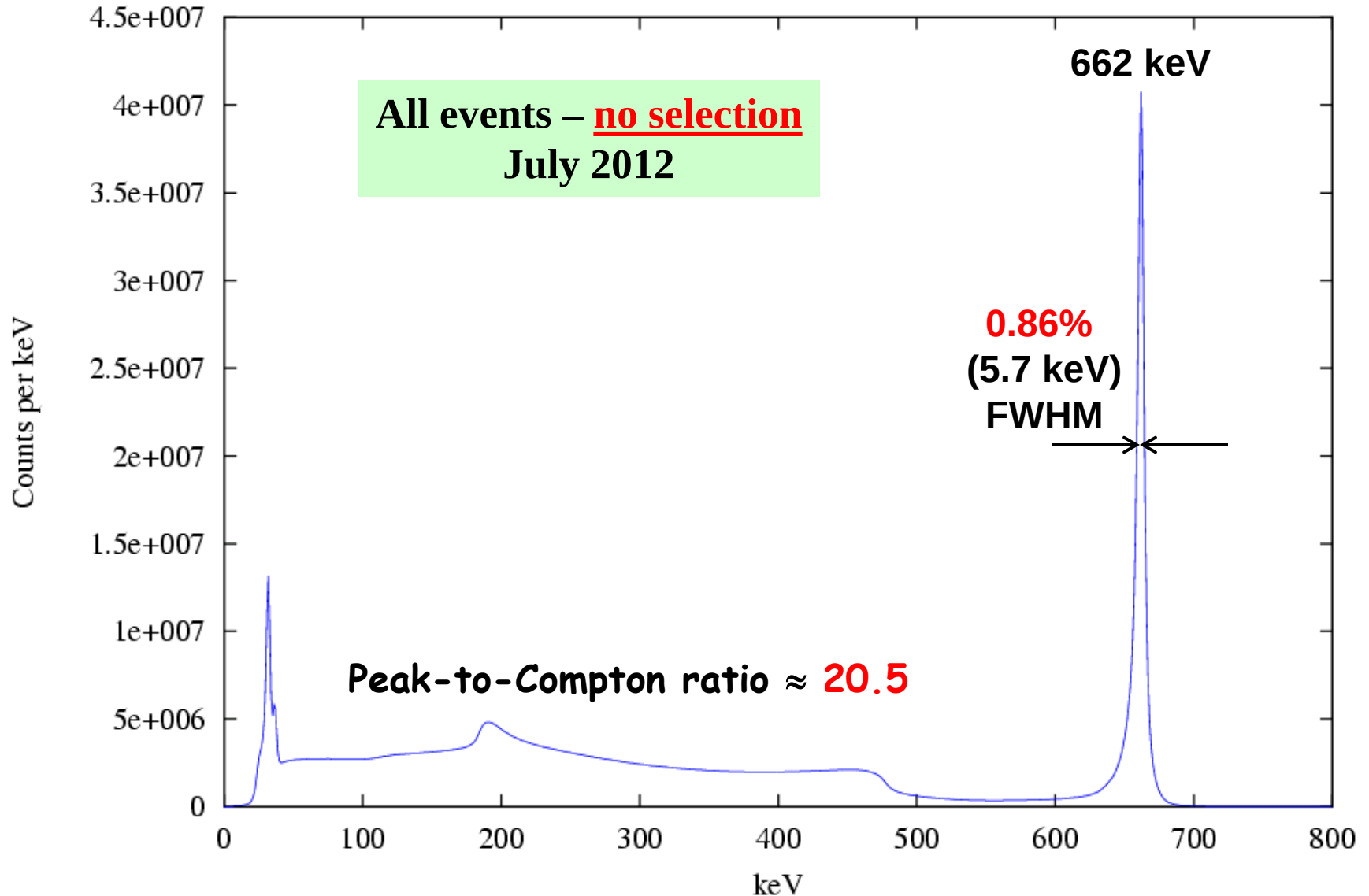
2nd-Generation Polaris System #2.1 ([BNL](#) ASIC)

(From **all 18 detectors**, room-temperature, uncollimated ^{137}Cs)



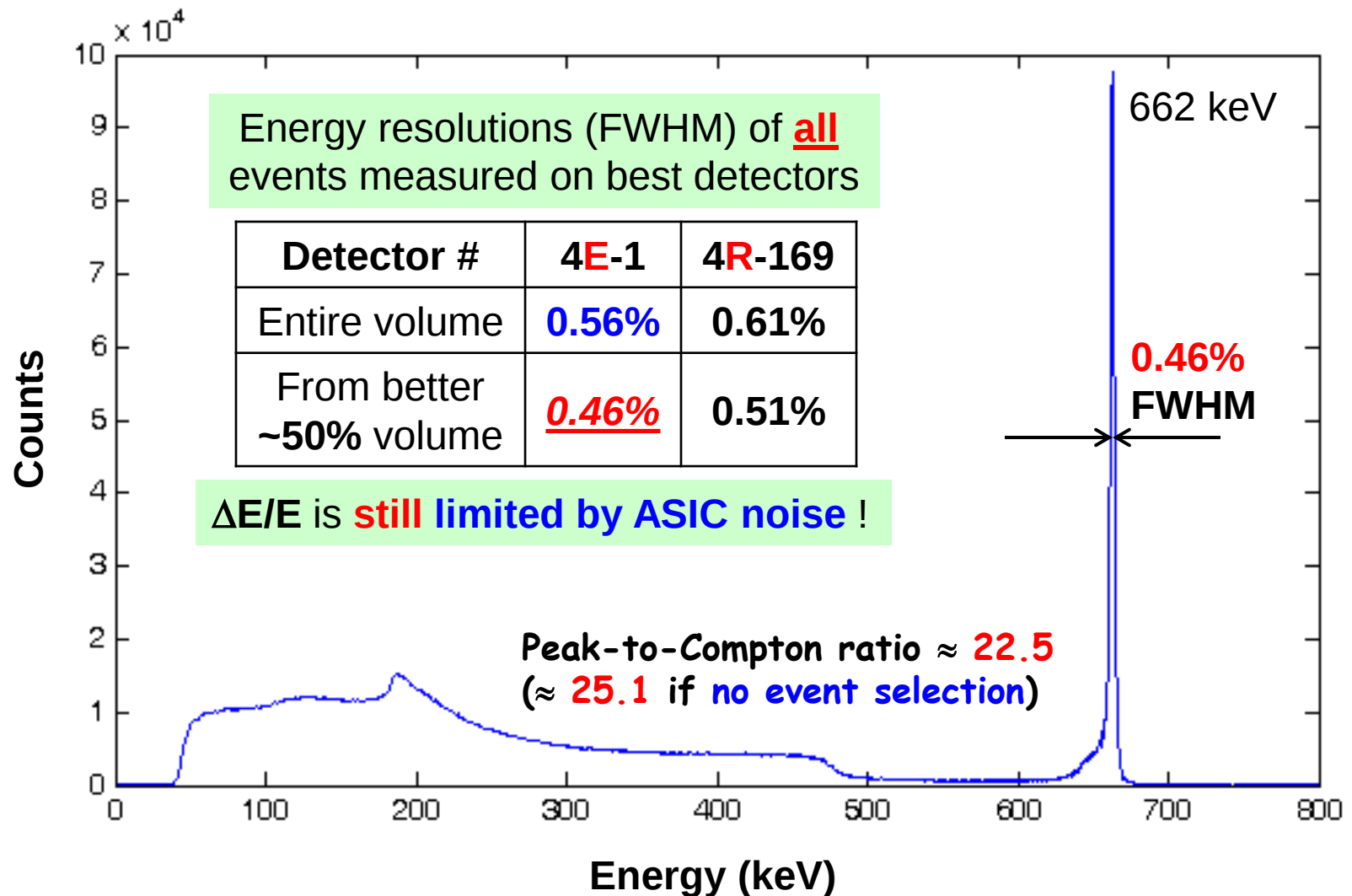
2nd-Generation Polaris System #2.1 ([BNL](#) ASIC)

(From **all 18 detectors**, room-temperature, uncollimated ^{137}Cs)

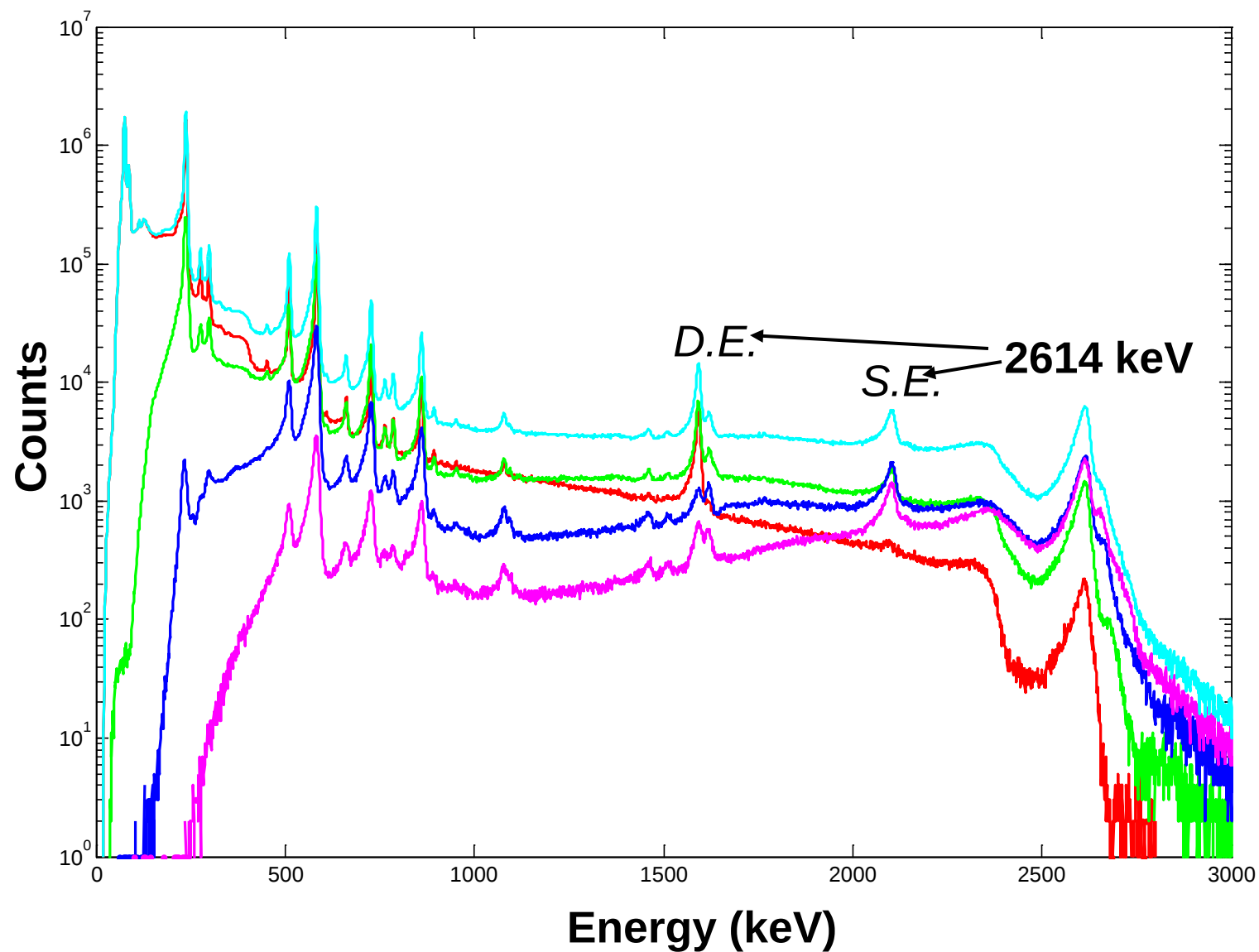


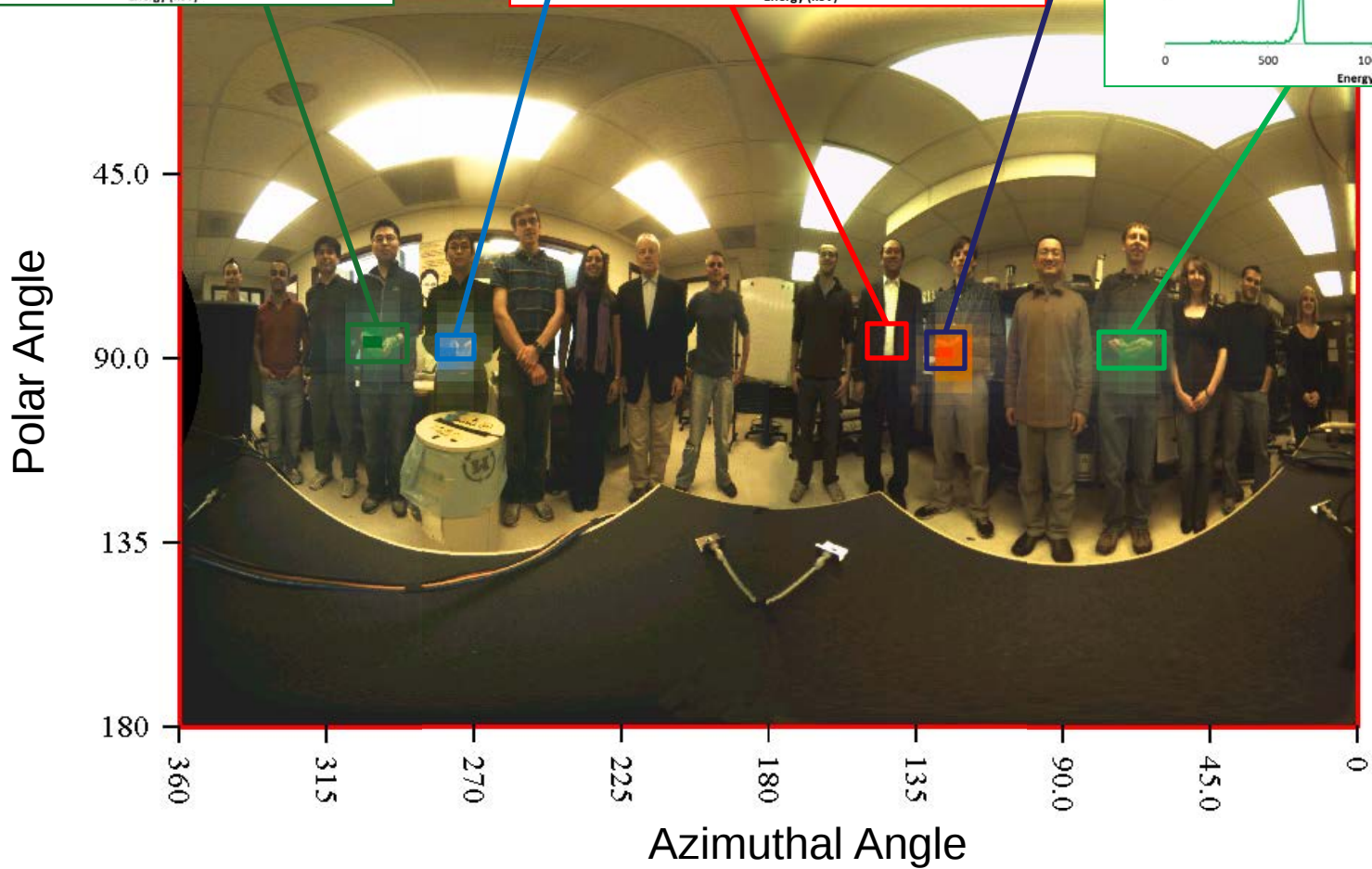
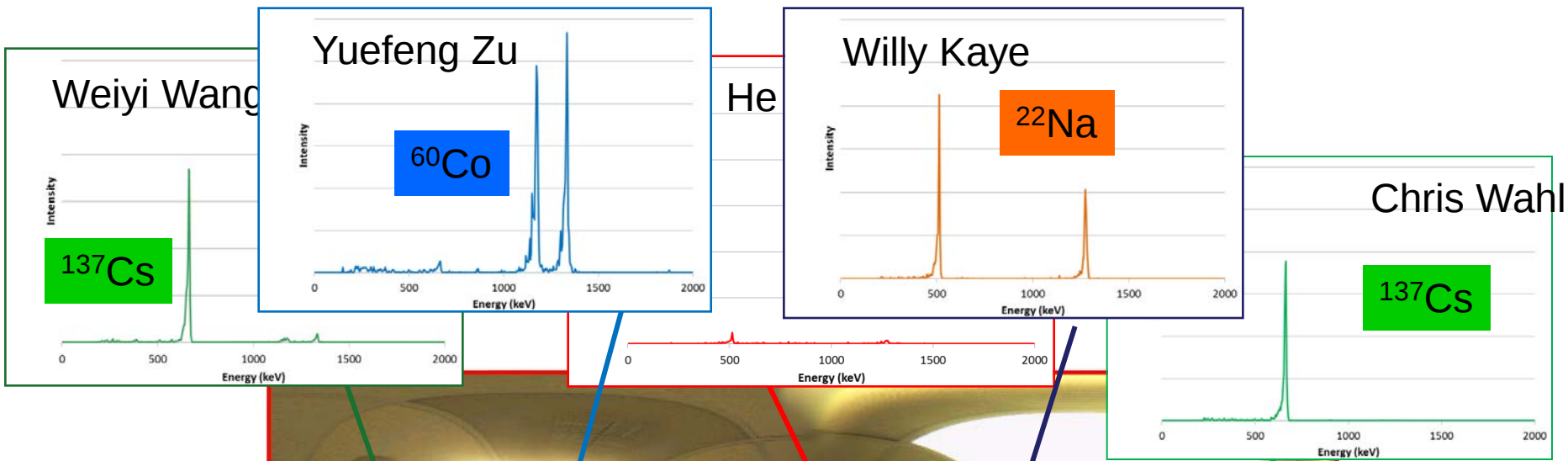
Next-Generation digital 3-D CdZnTe detectors

(VAD_UM digital ASIC, Room-temperature, uncollimated ^{137}Cs)



^{228}Th Energy Spectra Polaris-2





**Target
specific
 γ -Spec.**

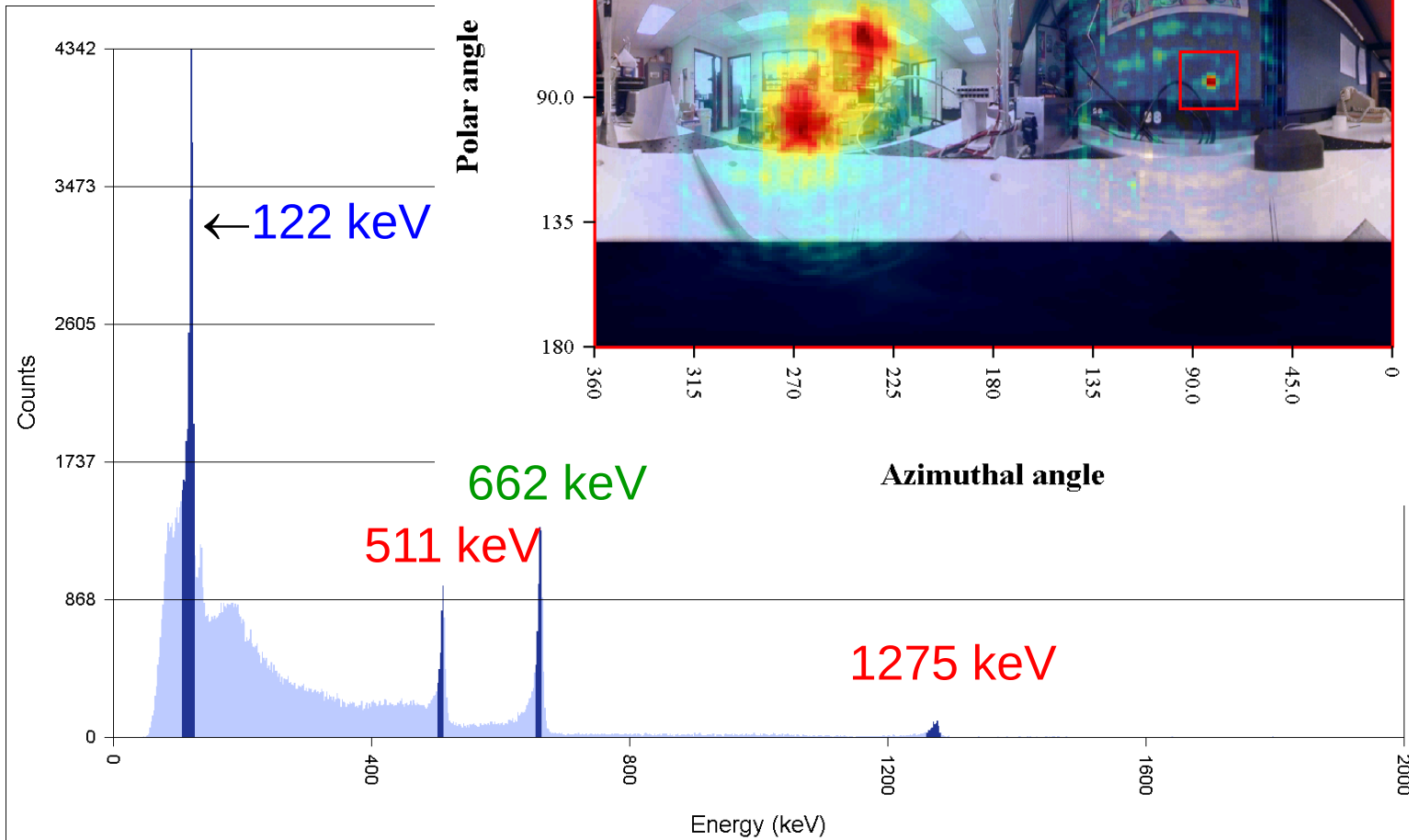
**23 min.
data EIID**

Real-Time Combined Coded Aperture and Compton Imaging for Locating Sources

From all 18 detectors

Isotope selected:

^{57}Co , ^{22}Na , ^{137}Cs



Counts = 33434
Iterations = 0
Mean = 33270
Stdev = 966

Intensity

Detection Sensitivity of Polaris

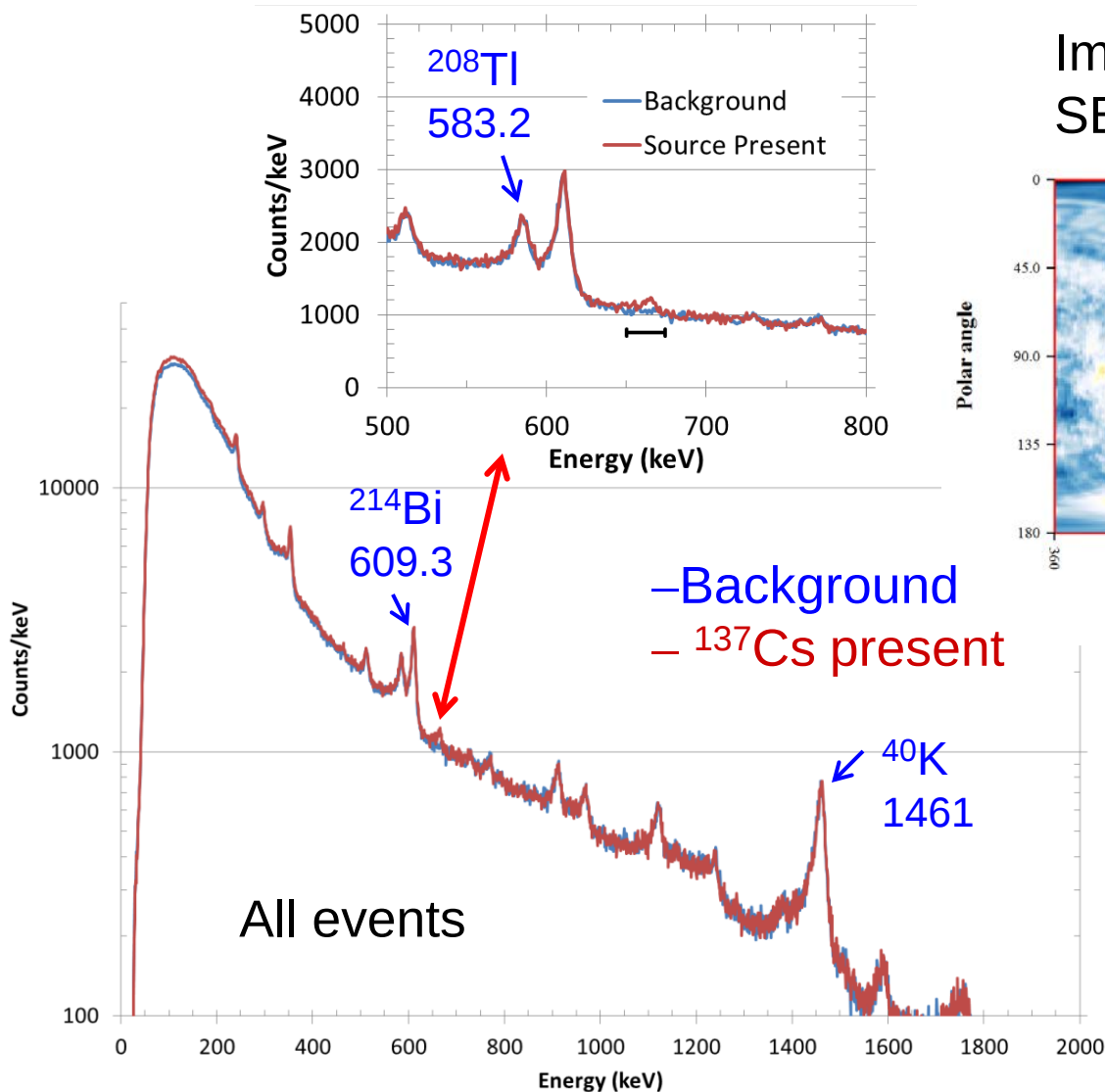
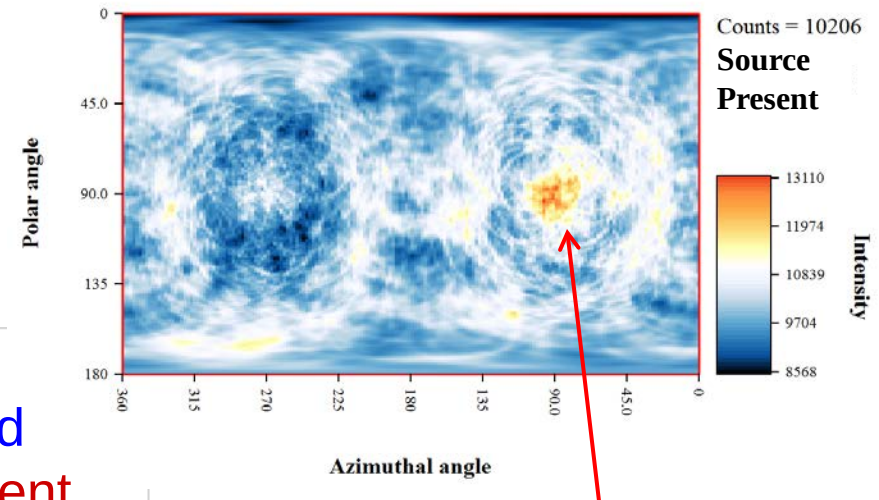


Image of $650 \leq E_\gamma \leq 674$ keV
SBP with 2 – 4 pixel events



A 30 μCi Cs-137 source behind
a wall at $\sim 4\text{m}$

A 12-hour “background”
Measurement

Today and Tomorrow

