Three-Dimensional (3D) Position-Sensitive Room-Temperature Semiconductor γ-Ray Spectrometers & Imagers

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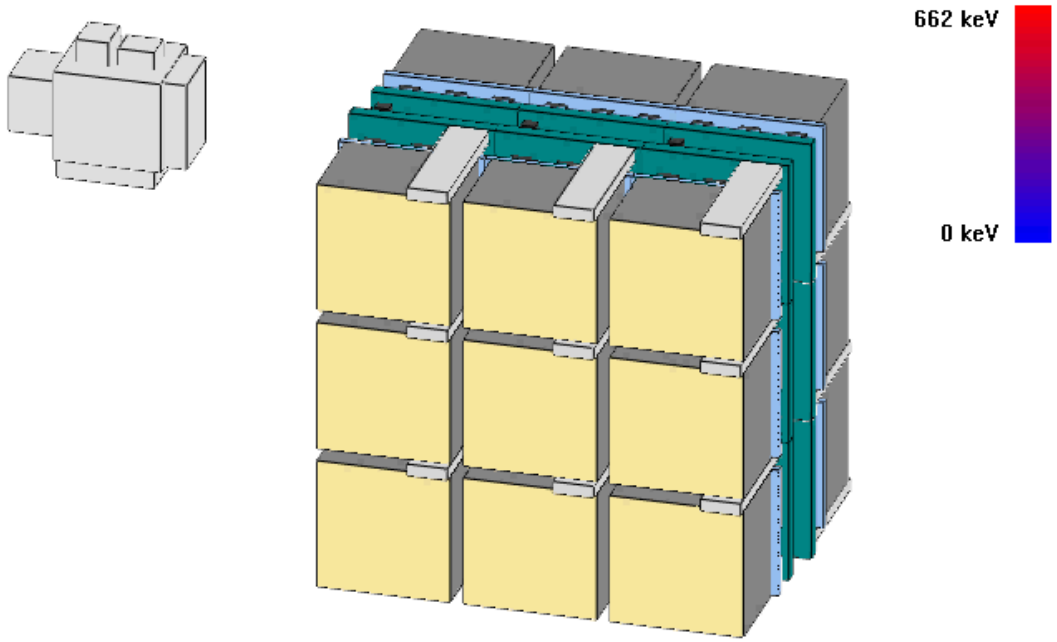
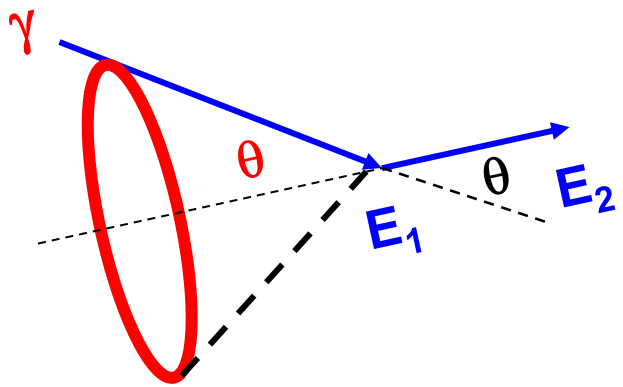
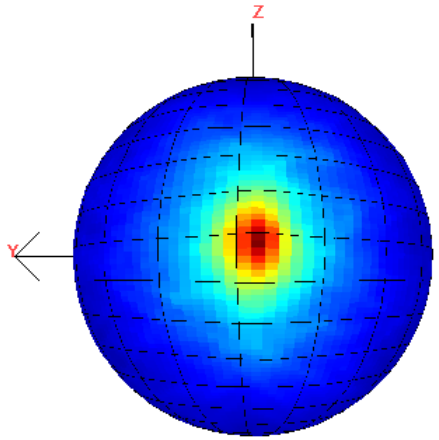
Unique Technology & Impacts

An array of 2×2×1.5 cm³ or 4×4×1.5 cm³ CdZnTe detectors (~100 - 200 cm³)





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



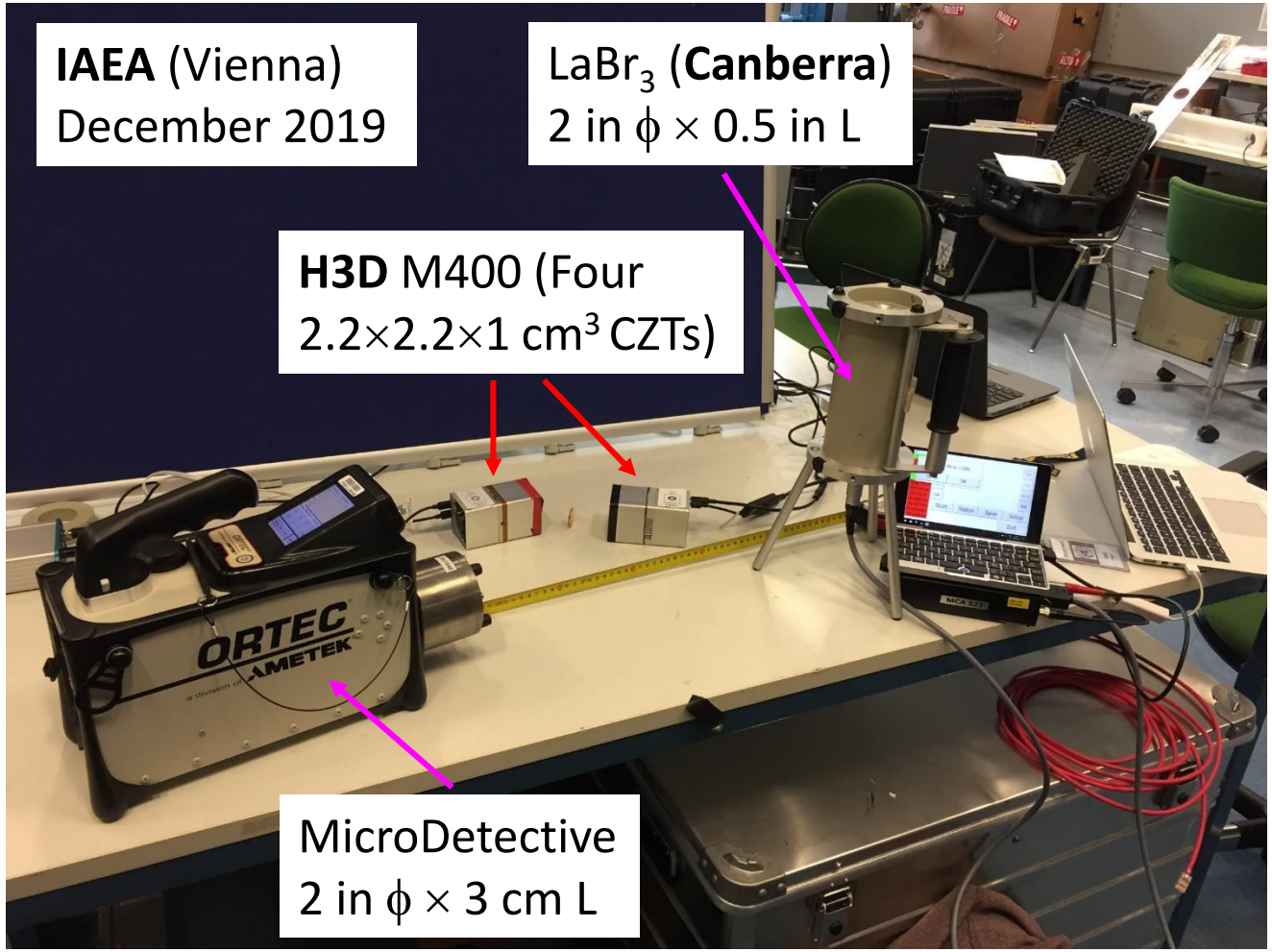
Material Research: Study/Characterize alternative semiconductor materials for gamma-ray detection. Such as **perovskites**.

Capable of:

ΔE/E ≤ 1% FWHM (662 keV) at R.T. + Real-time γ Imaging

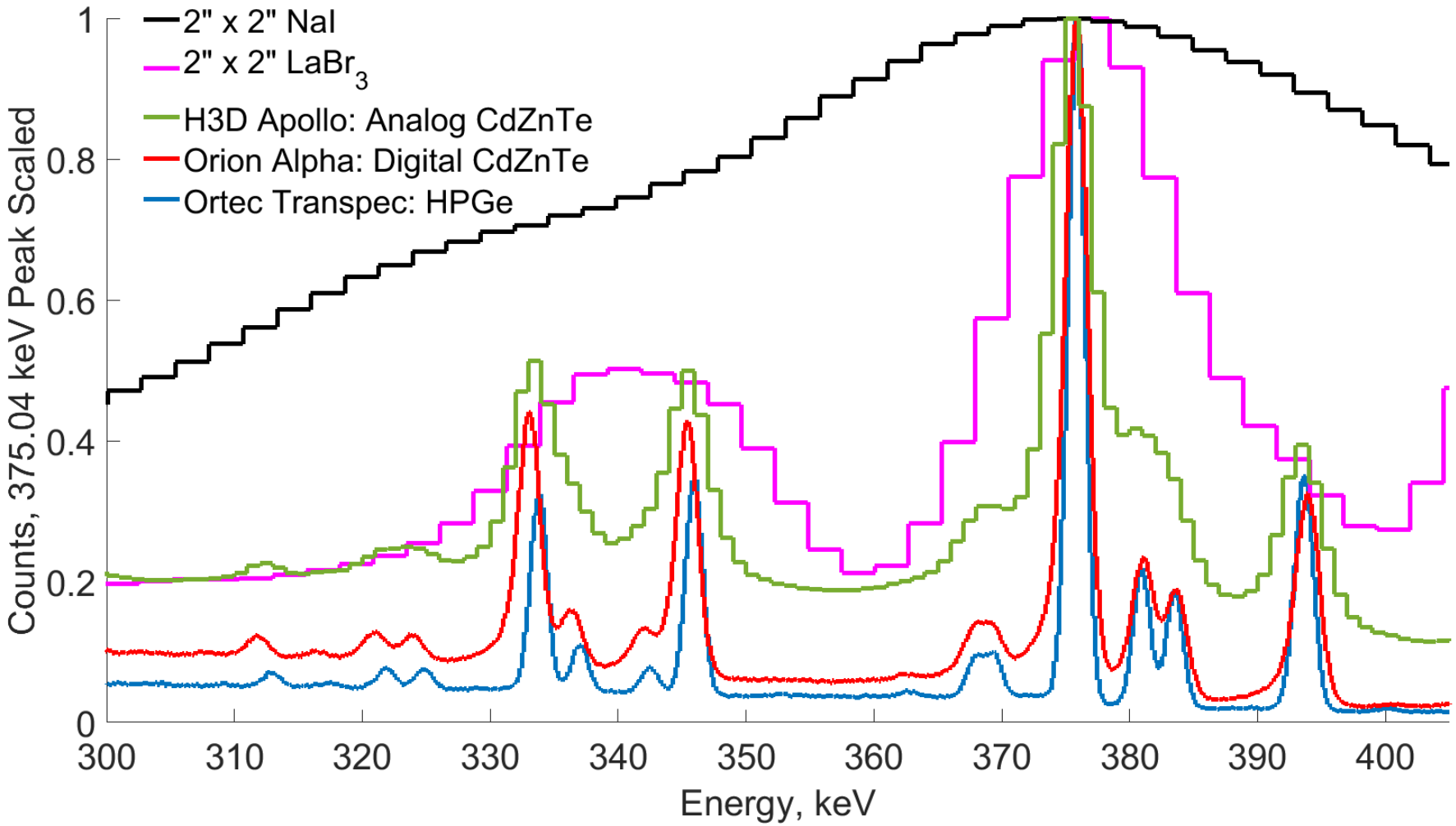
Number of photons: 2033

Compact High Resolution CZT Detectors Delivered to IAEA

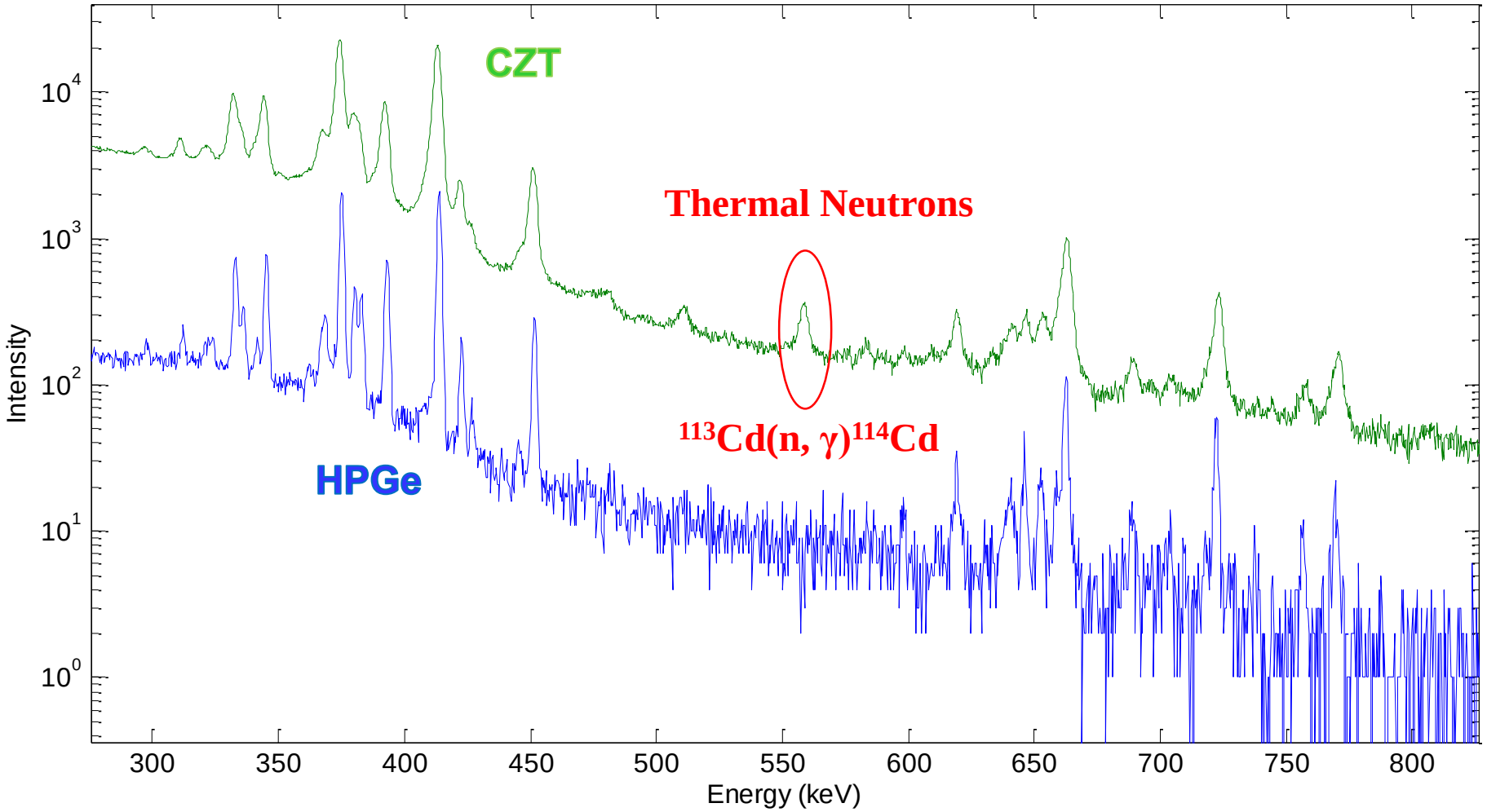


1) No **cryogenic** Cooling (**HPGe**)
2) Resolution superior than **Scintillators**

Comparison on measured plutonium spectra



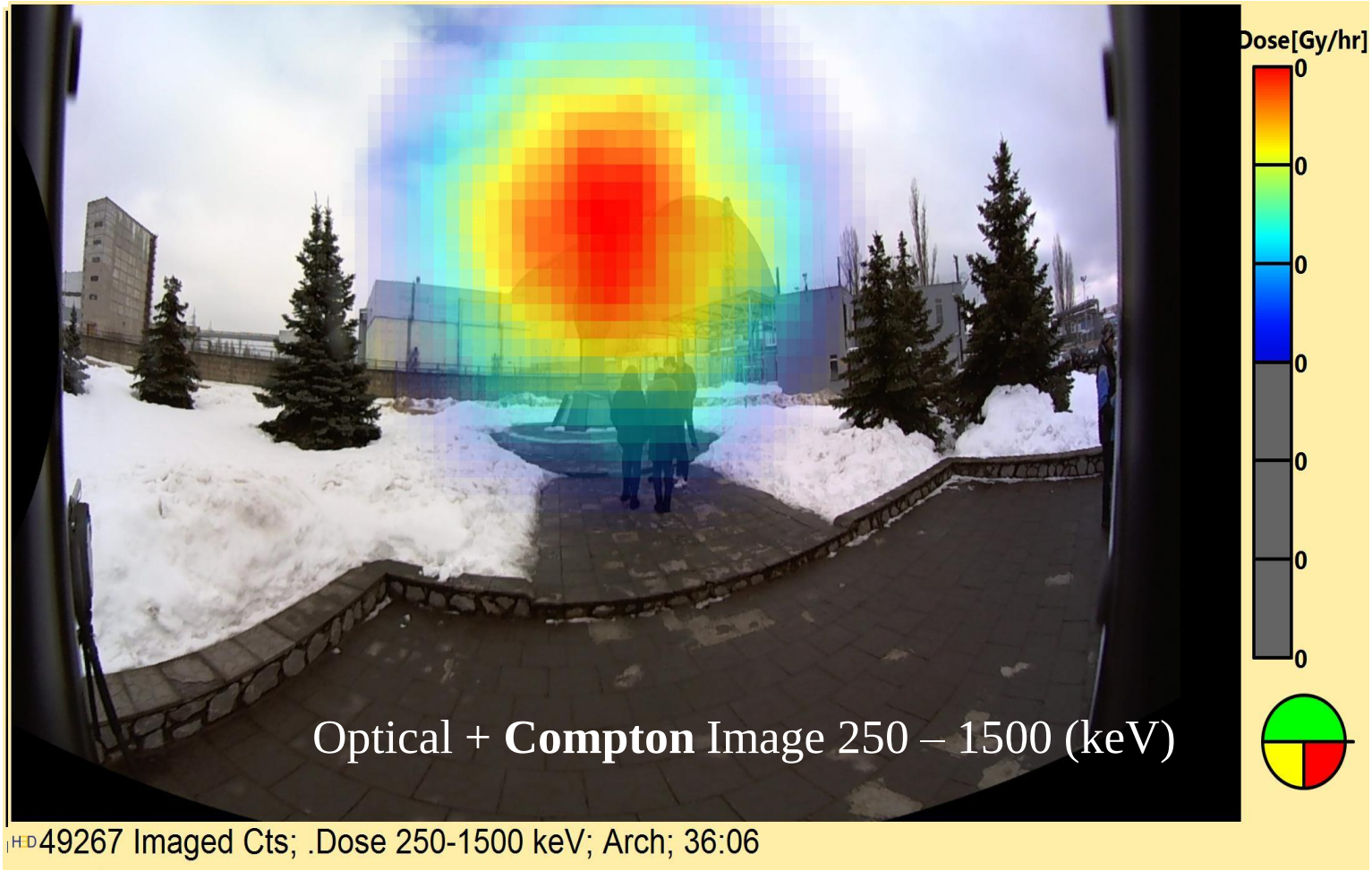
Gamma & Neutron Detection on the Same Detector



Real-Time Imaging on Gamma-Emitting Isotopes

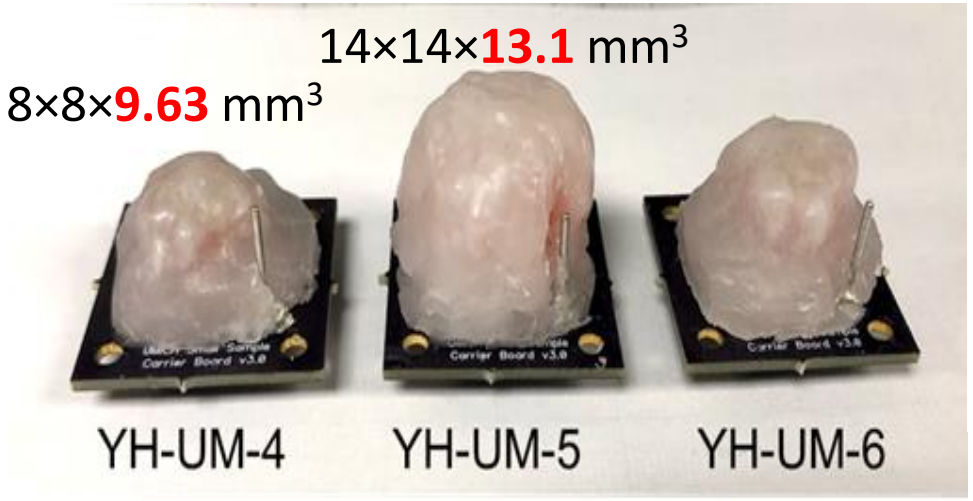
Optical & (^{60}Co) Gamma Images at Fermi Nuclear Plant

Chernobyl Arch by Dr. Willy Kaye of H3D Inc. in 2019



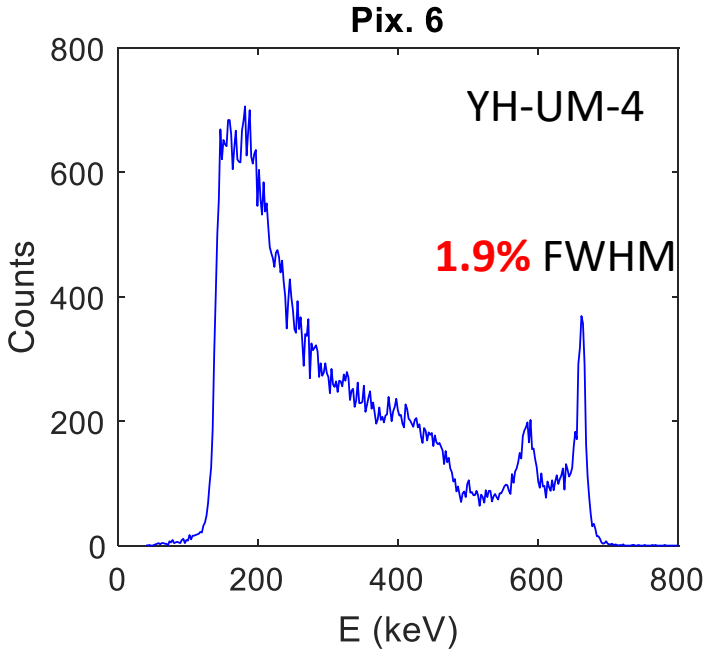
Explore Alternative **Semiconductor** Materials

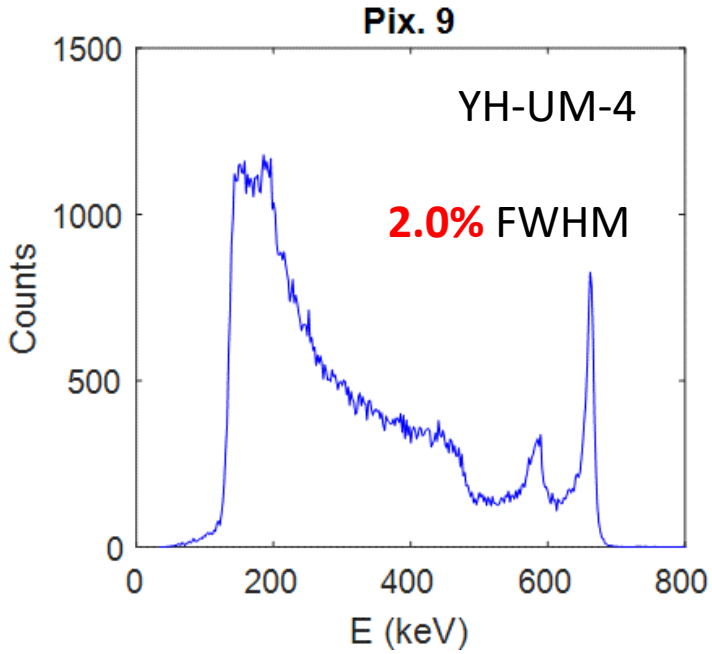
$CsPbBr_3$ perovskite semiconductor detectors



8.5×8.5×**13.2** mm^3

Only YH-UM-**4** operated at **350** V





Hole life time τ >> 120 μs **&** mobility ≈ **22** $cm^2/(V\cdot s)$

Observed $\mu_h \cdot \tau_h$ >> 2.6×10^{-3} cm^2/V

From Northwestern University

Looking for collaborations:

- **Applications** using **high-resolution imaging** gamma-ray spectrometers

- **Integrated 3-dimensional gamma-ray imaging** and isotope I.D. with **spatial awareness** (Inertial **m**easurements **u**nit (**IMU**), Simultaneous Localization and Mapping (**SLAM**), etc.)