

Simulating CZT detector response in GEANT4

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Basics of X-ray attenuation

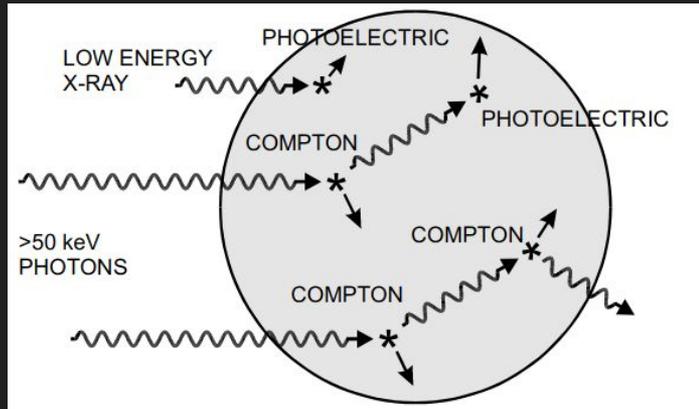
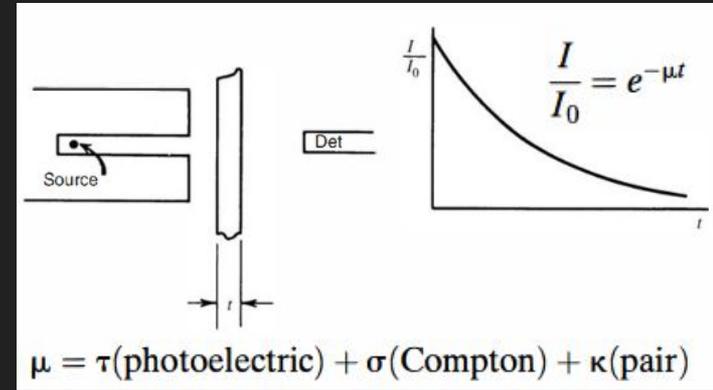


Figure: Helmut Spieler (Lawrence Berkeley Laboratory)

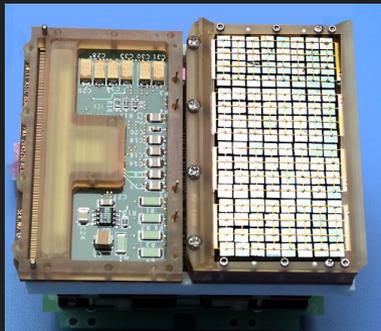


$$\text{mass attenuation coefficient} = \frac{\mu}{\rho} \quad \text{cm}^2/\text{g}$$

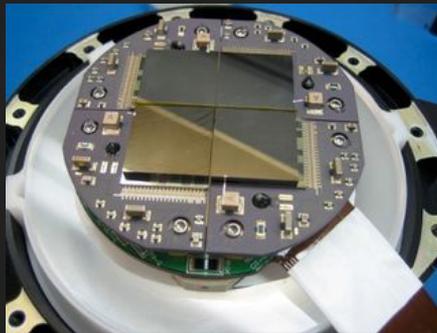
Figures: Radiation Detection and Measurement, Glen F. Knoll

Cadmium Zinc Telluride ($\text{Cd}_{0.9}\text{Zn}_{0.1}\text{Te}$) detectors

- Most common hard x-ray / soft gamma-ray detectors.
- Good efficiency in $\sim 15 - 300$ keV.
- Possible to achieve position sensitivity.
- Compact in size + operating temperature \sim few $^{\circ}\text{C}$.



Swift/BAT

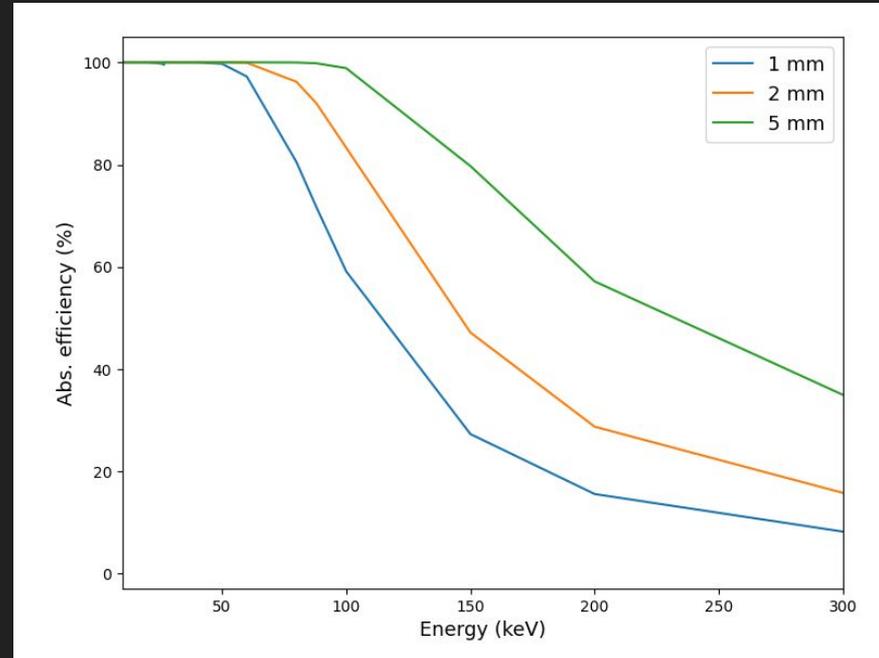
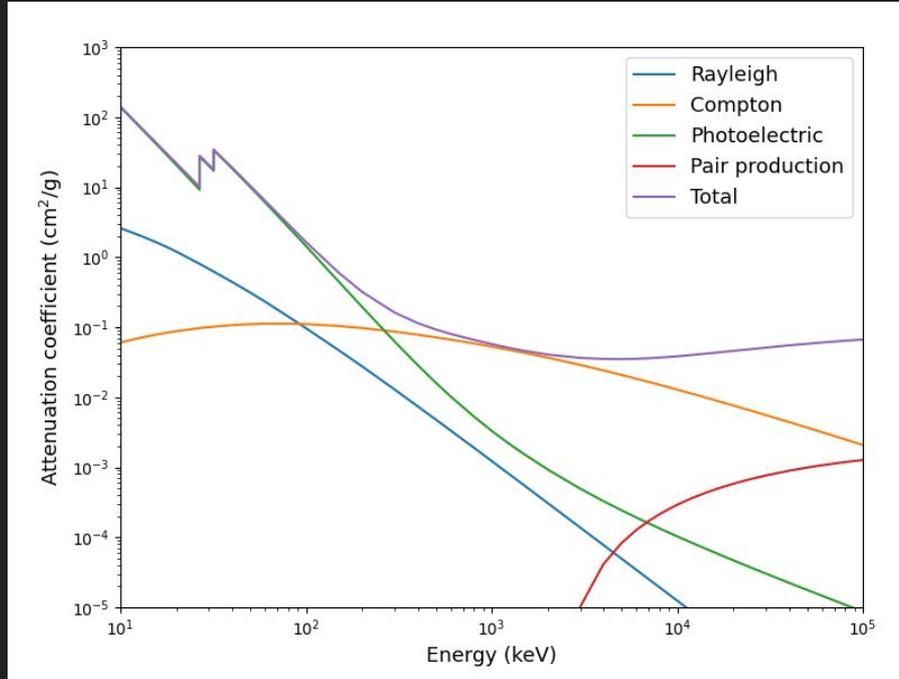


NuSTAR



AstroSat/CZTI

CZT detection efficiency



Typical spectral response of CZT detector

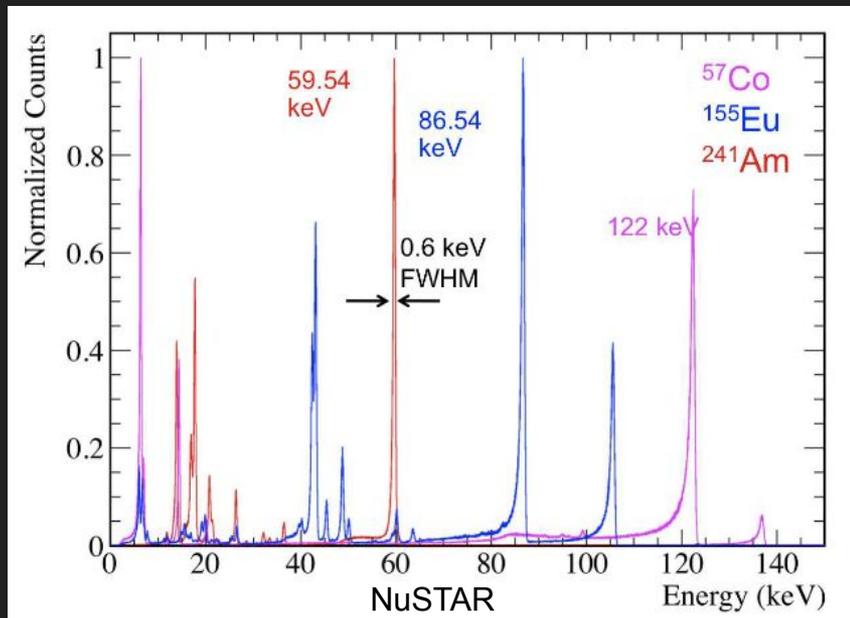


Figure: Varun Bhlerao

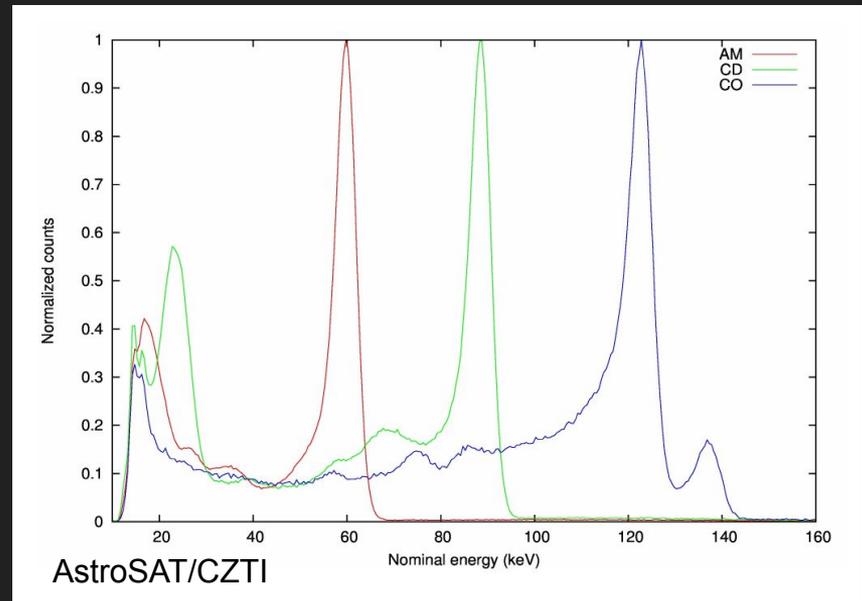
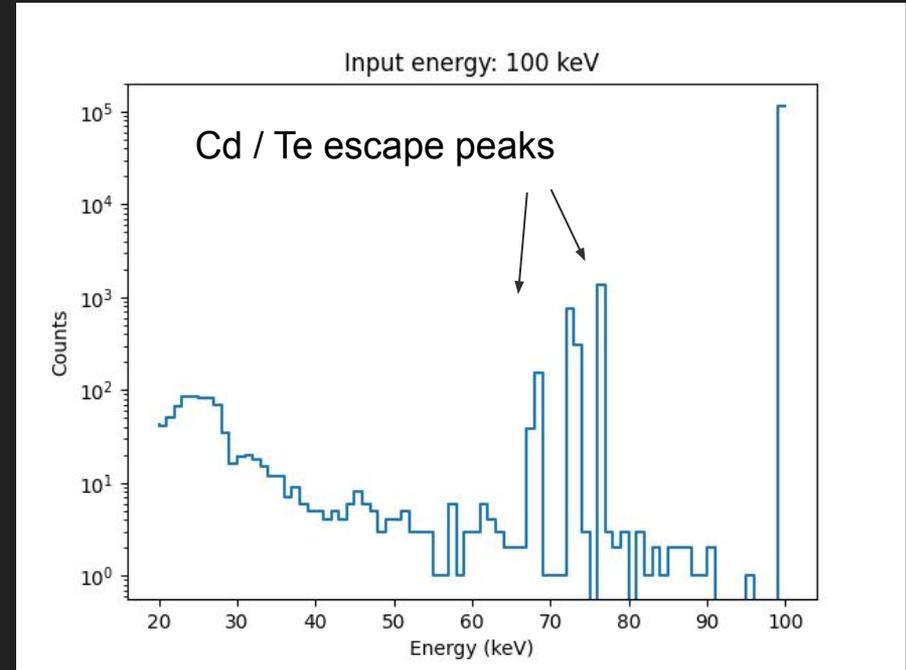
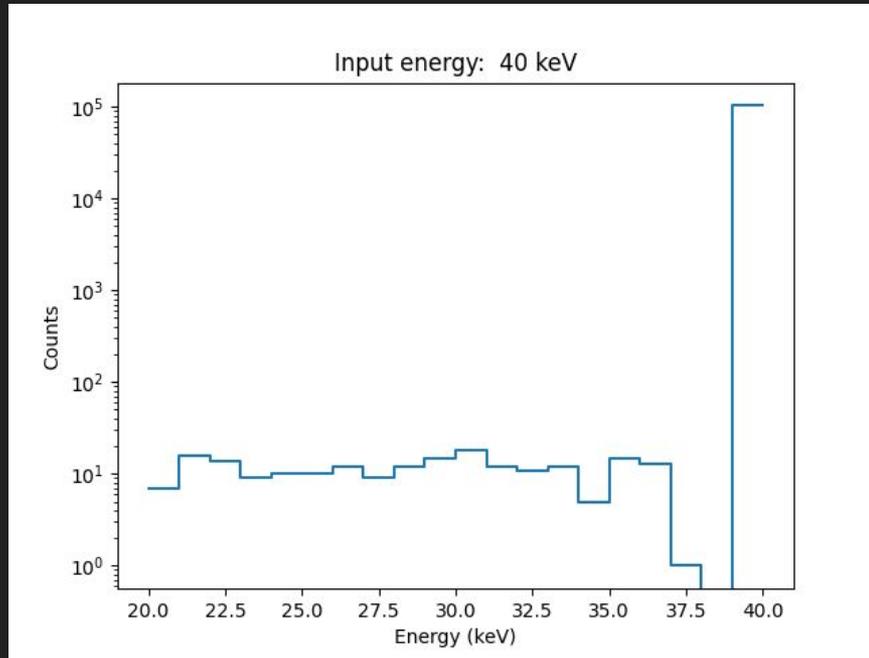


Figure: AstroSAT/CZTI team

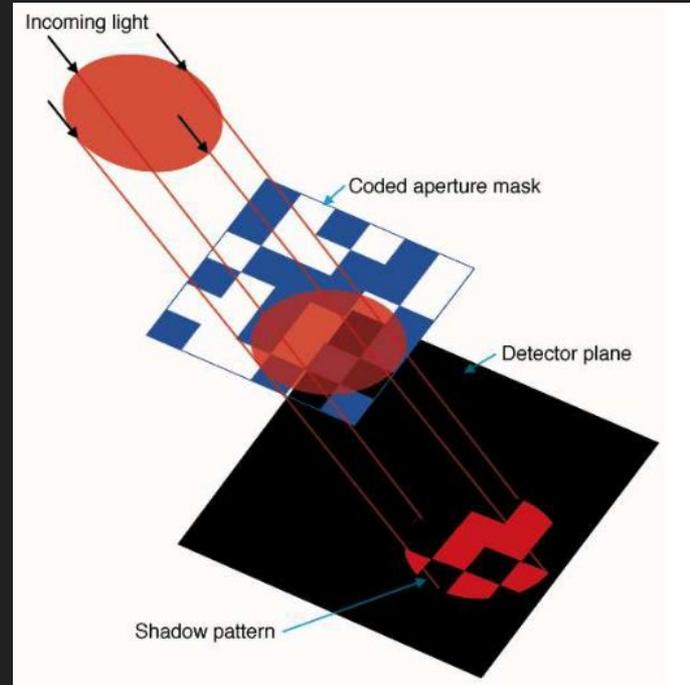
What can GEANT model?



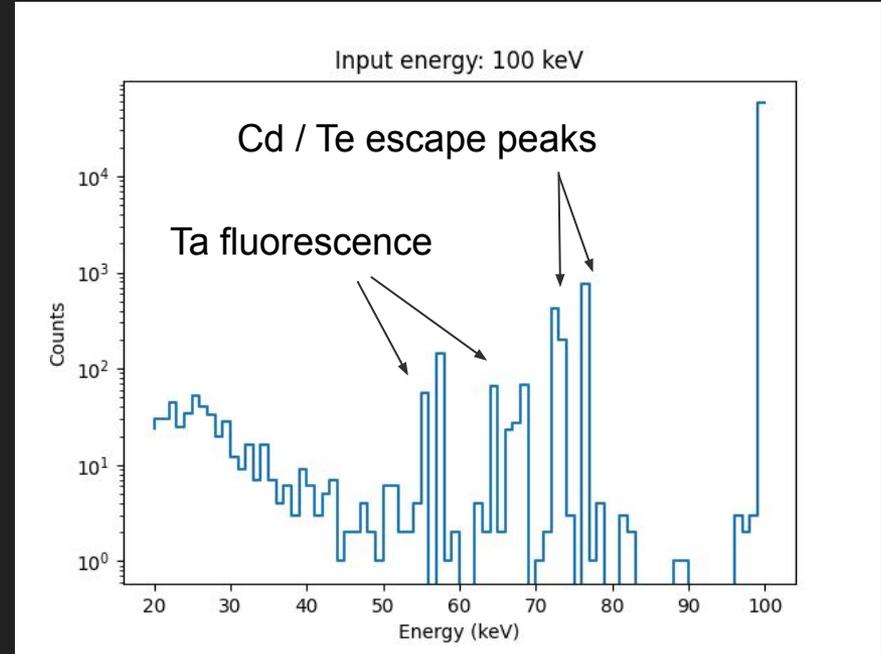
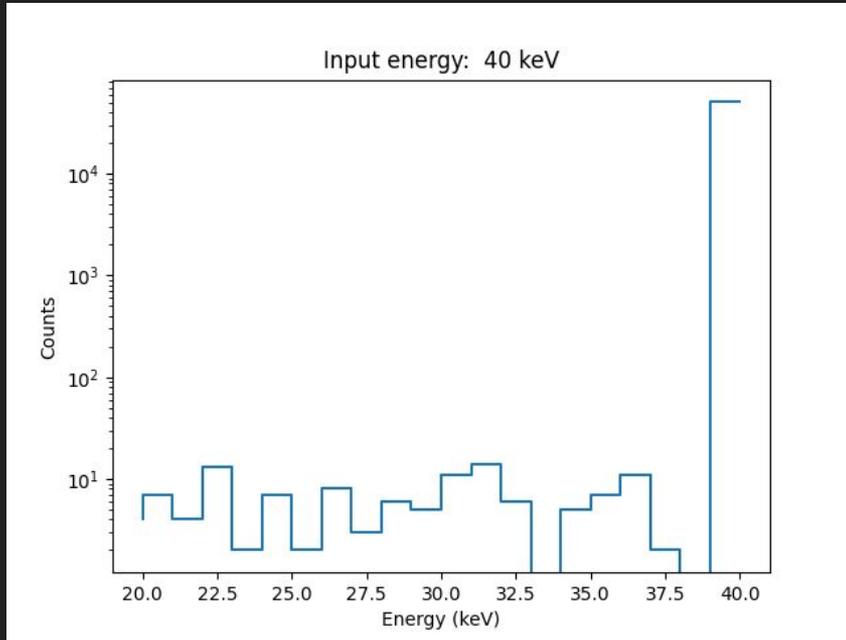
Not modeled by GEANT4

- Energy resolution.
- Charge transport and trapping
- Electronic noise

Coded mask imaging



What happens if you put a mask in front?



Thank you