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Anticoincidence Detector Performance Analysis

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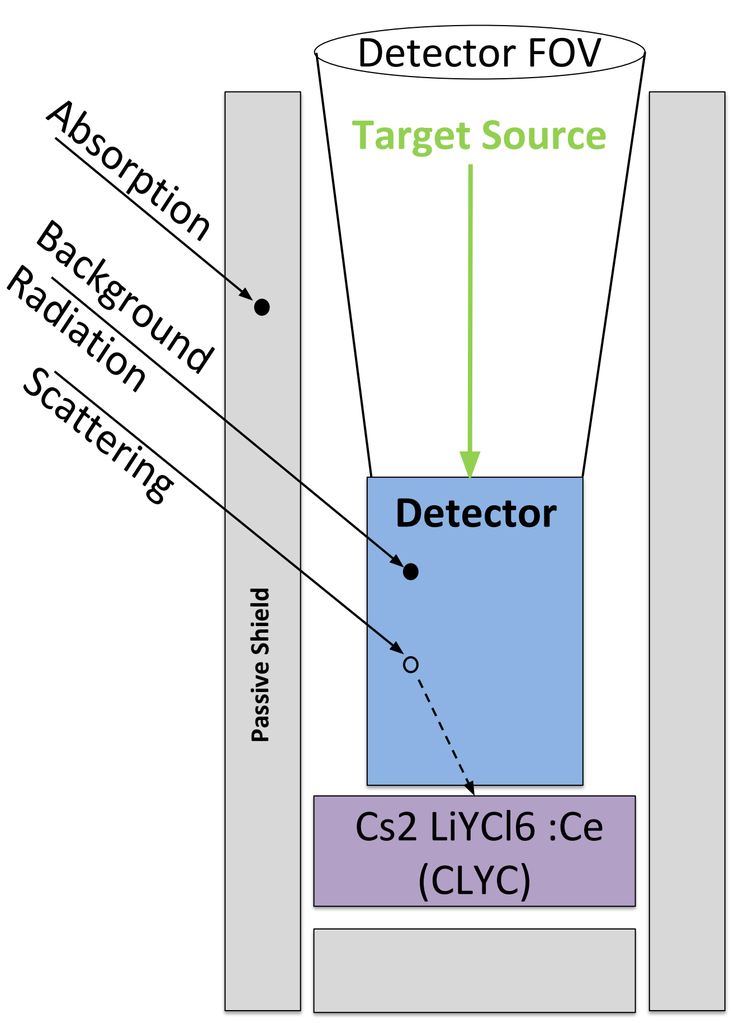
Introduction

The ALFRED project is a balloon-borne anticoincidence x-ray shield developed by students at UAH and funded by NASA's USIP. The active shield was designed, constructed, and calibrated to be flown at an altitude of 48 km on a NASA high-altitude balloon. The shield performance from the flight is analyzed and compared with other active shield configurations.

Methodology

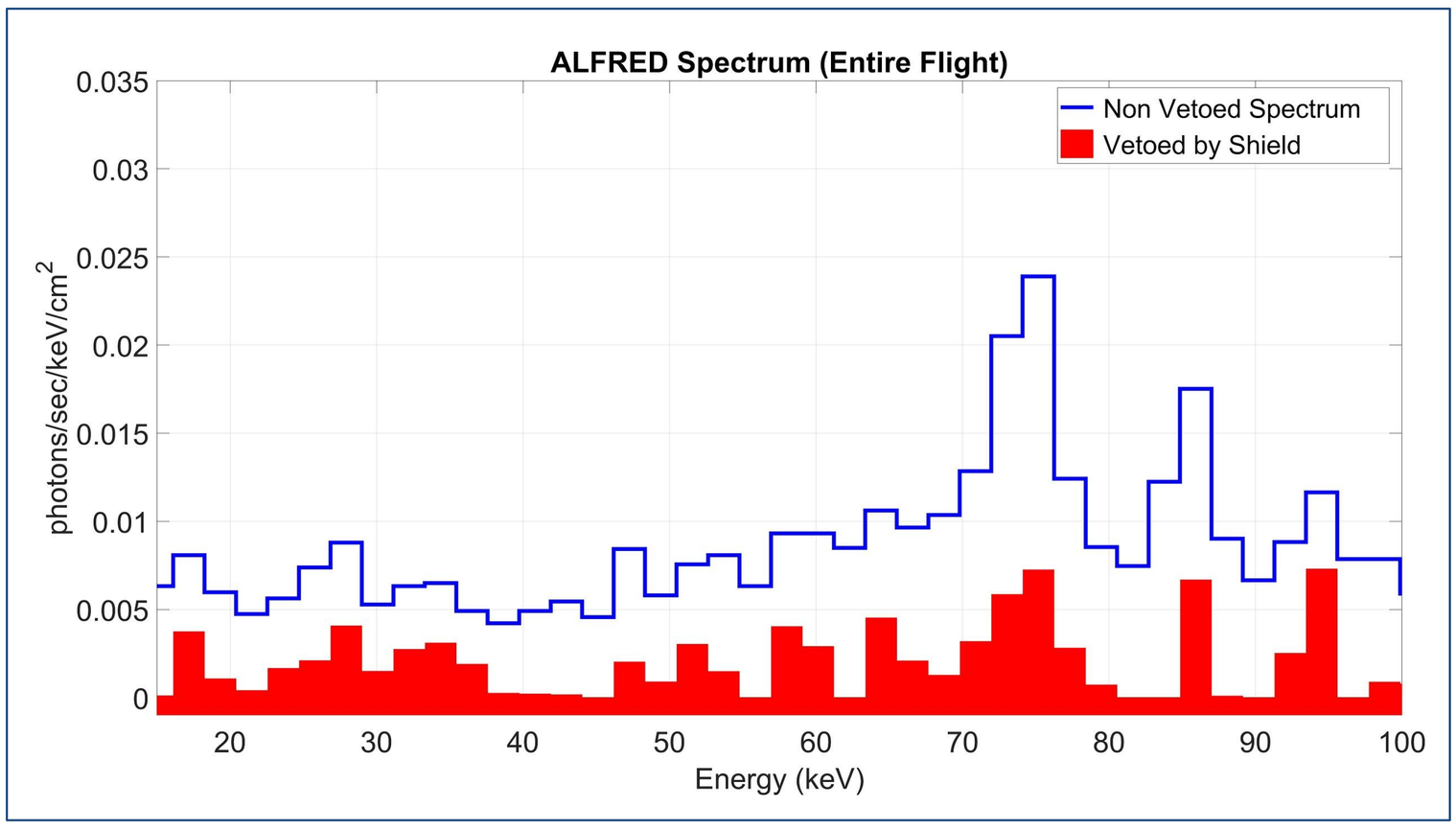
- A thin, passive shield blocks some background events while an active shield is used to detect those that get through.
- If an event is detected in both the active shield and the detector, it is vetoed as a "bad" signal.
- Data was collected with the active shield both on and off.



The ALFRED shield design is shown with both passive and active shielding.

Key Results

- ALFRED vetoed 21%-49% of background events across 20-100 keV.
- A conventional anticoincidence shield at a similar altitude vetoed 19%-53% of the events across its 10-75 keV range[1].
- The performance of the ALFRED shield is comparable to other techniques.



The chart compares count rates and veto rates across ALFRED's science range (20 - 100 keV).

- The peaks at 73, 75, and 85 keV are consistent with lead's K-level emission lines.
- ALFRED vetoed much of the emissions from the lead shielding, indicating a valid design approach.

Impact

X-ray detectors are conventionally shielded with heavy, passive materials such as lead. Mass is at a premium on air and space-based platforms, however, so there has been interest in more sophisticated solutions. Active shield solutions promise higher mass efficiency, but are also expensive and more complex. By using a hybrid of passive and active shielding methods, ALFRED has demonstrated a lightweight, cheap, and effective shield.

Acknowledgements

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[1] Baumgartner, Wayne. *Background in Balloon Borne Cadmium Zinc Telluride Detectors,* 2007