

# Radiation Detection at Ultra-High Altitudes

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Scientific ballooning at ultra-high altitudes may provide a new format for x-ray astronomy.

## Scientific Ballooning

High energy radiation emitted by **astrophysical sources** is attenuated by Earth's atmosphere.

At higher altitudes, the atmospheric density decreases and **x-rays** can propagate farther.

Scientists use space or balloon-borne telescopes to get above the densest parts of the atmosphere to detect x-rays.

Typical **scientific balloons** of 40 million cubic feet (mcf) only reach altitudes of 35-40 km. Recently, hard x-ray telescope ALFRED flew on a 60mcf balloon that reached 48km.

How is the **radiation environment** for the 60 mcf balloon different from that of the 40 mcf balloon?

## Atmospheric Analysis and Testing

Hard x-ray transmission for a 40 mcf flight at 38 km (Heft) and 60 mcf flight at 48 km (ALFRED) is compared below in Figure 1.

Atmospheric transmission is found via Beer's Law:  
$$t(x) = \exp\{-\mu x\}$$

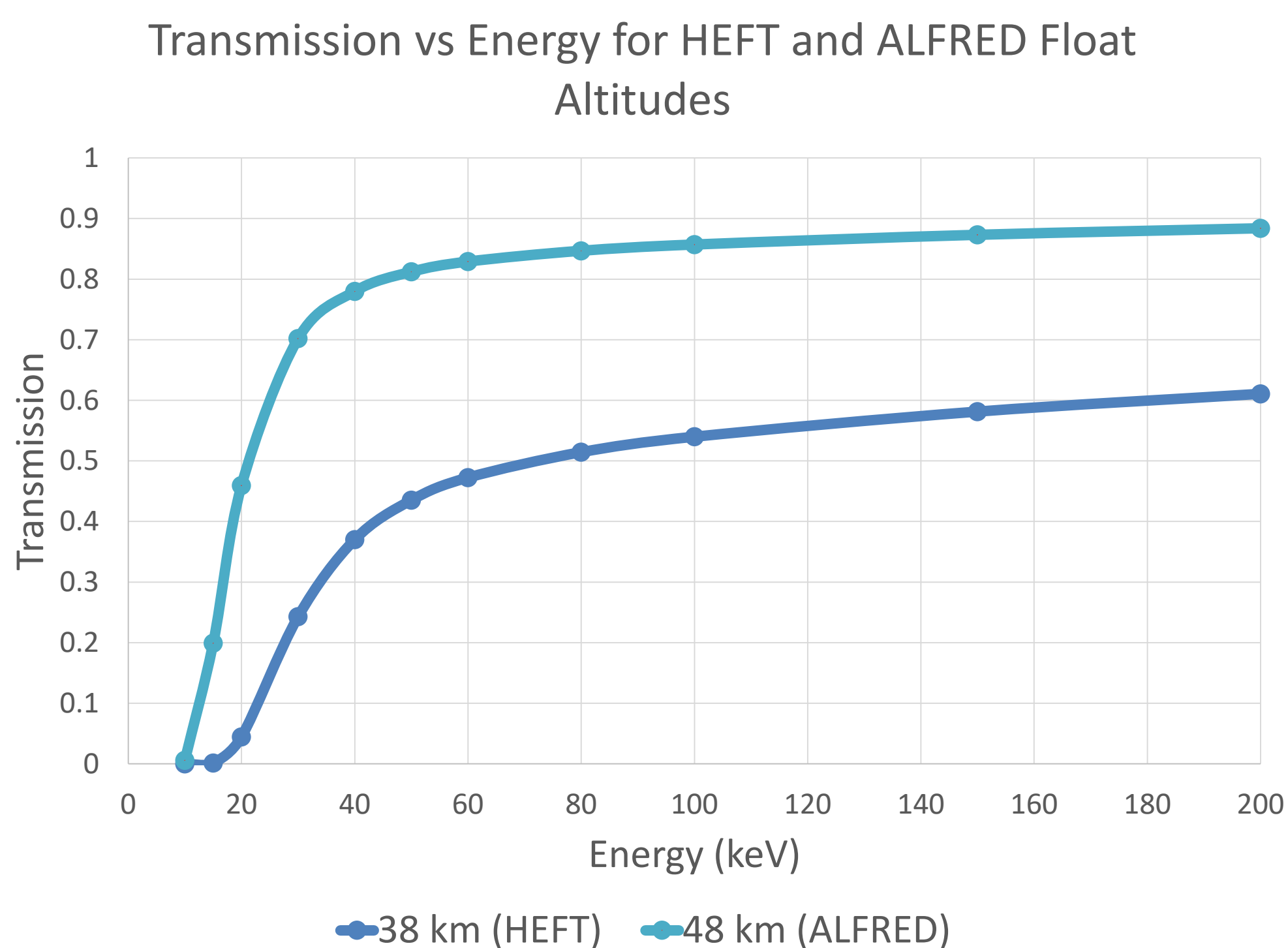


Figure 1. Transmission through atmosphere vs energy

## Key Findings/Results

The ALFRED shield detector measured **higher background rates** at 48 km than at 38 km.

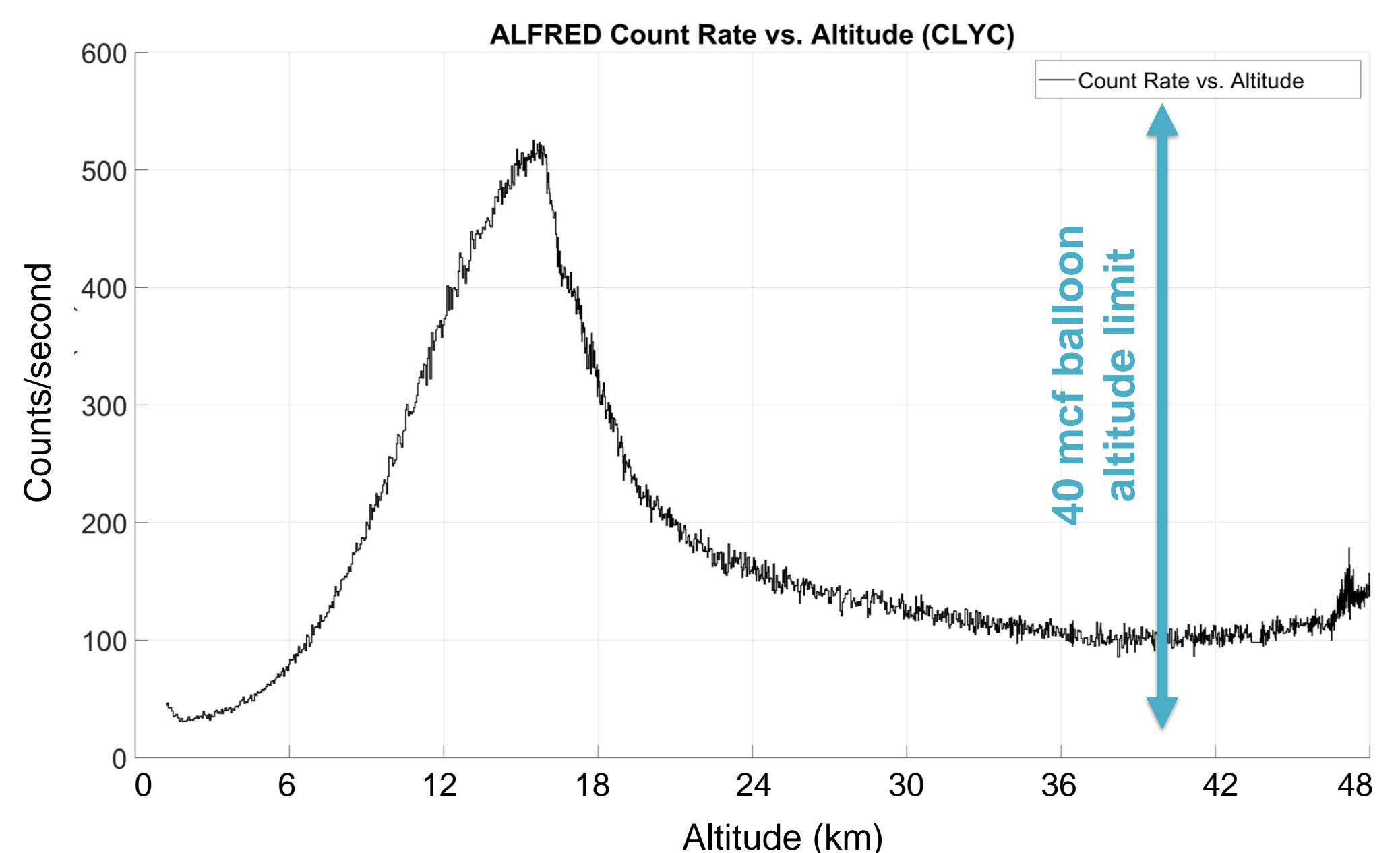


Figure 2. Altitude vs count rate on the ALFRED shield

ALFRED detector spectral results are about an order of magnitude higher than HEFT background.

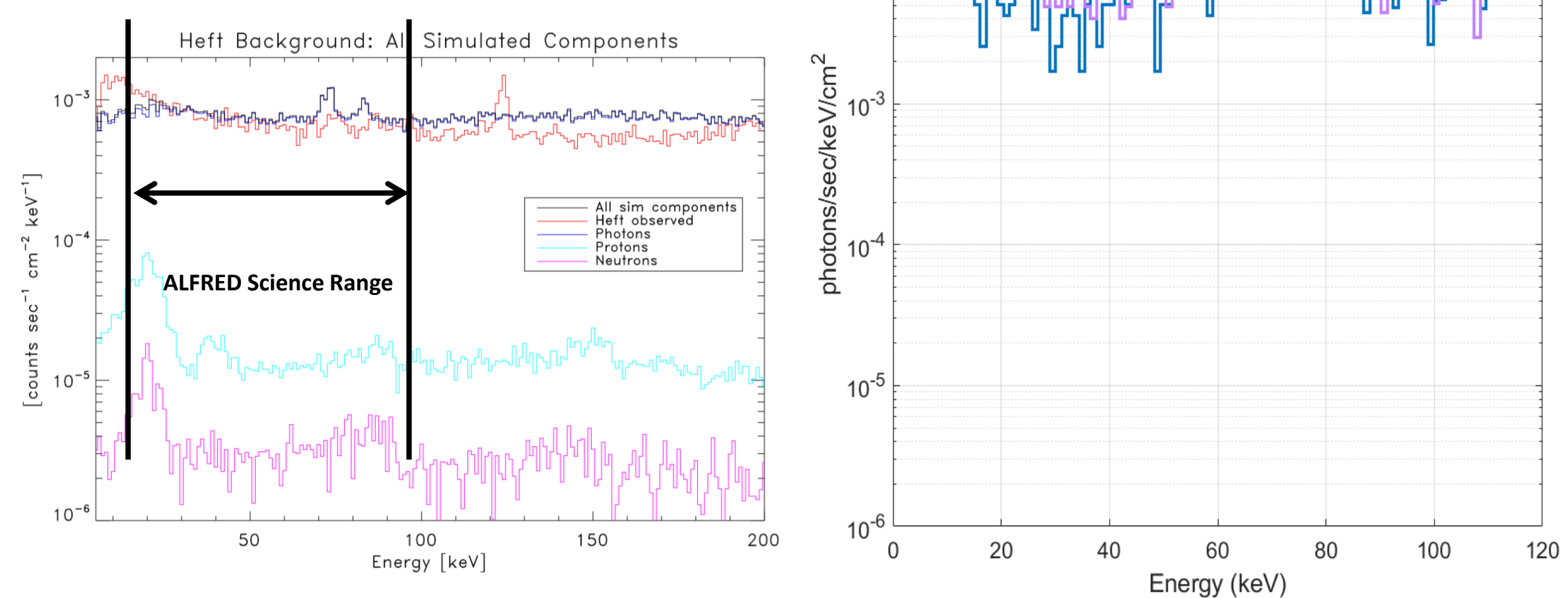


Figure 3. Background spectrum comparison between ALFRED flight on 60mcf and Heft flight (Baumgartner 2007) on 40mcf.

## Conclusions

Data from **long duration flights** is still needed to verify if the 60mcf is a durable platform for longer data collection.

The difference in altitude between the 40mcf and 60mcf allows for significantly **increased radiation transmission**, but **higher background rates** must be considered.

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