

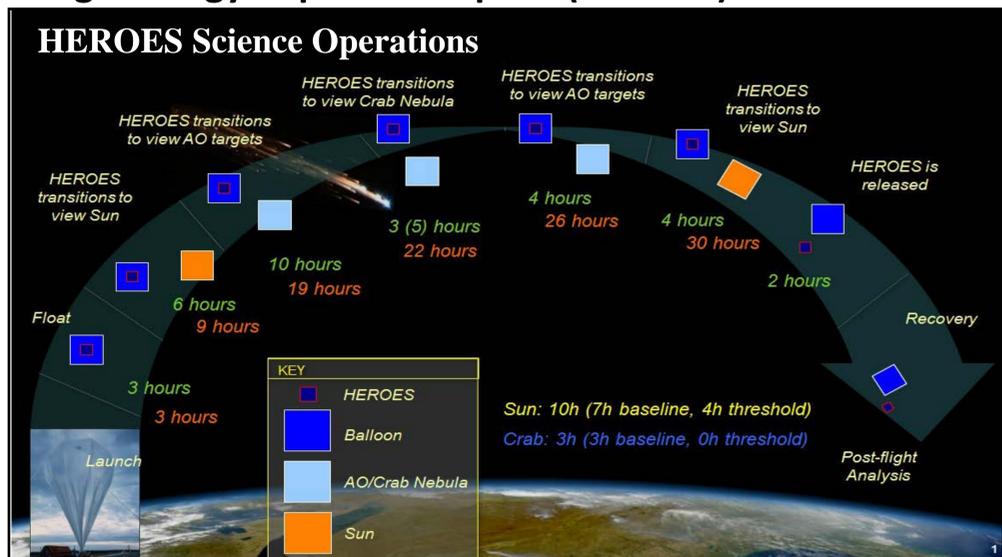
# An Overview of the Active Luminescence for X-Ray Emission Detection Instrument

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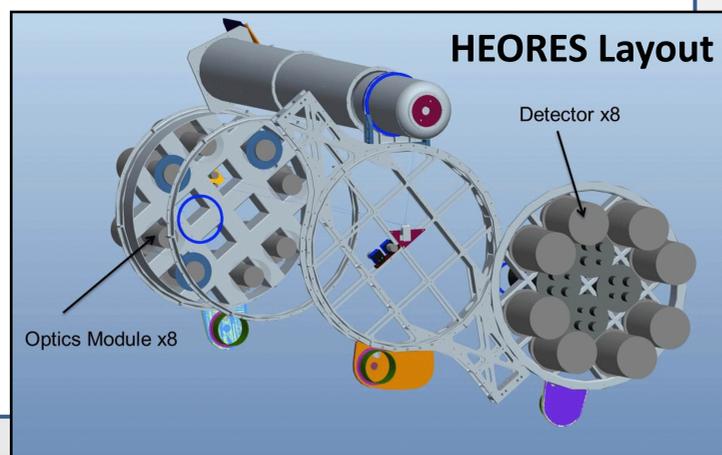


**Abstract:** The Active Luminescence For x-Ray Emission Detection (ALFRED) project is a cooperative research agreement between the UAH Space Hardware Club and NASA's Undergraduate Student Instrument Project (USIP). The project instrument is an anti-coincidence shield for use on the NASA HEROES balloon-borne X-ray telescope. The active shield will detect the X-ray background in a range of 20-100 keV using scintillation material coupled to a photomultiplier. The project will culminate in a proof of concept flight of a scaled system on a high altitude balloon to evaluate performance models and design architecture. Presented is an overview on anti-coincidence detection systems, and of the ALFRED instrument.

## High Energy Replicated Optics (HEORES) Overview

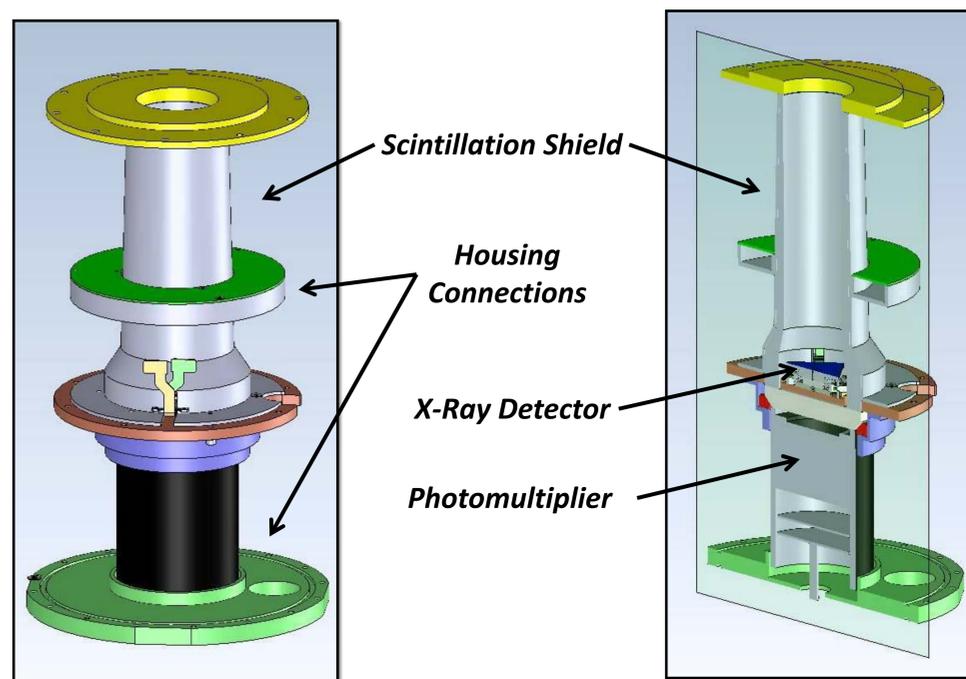


- The ALFRED project will design an anti-coincidence shield to replace the current lead passive shielding surrounding the detectors onboard HEROES
- The HEROES simplified layout (showing detector components) is shown on the right with the high incident grazing optics and detectors highlighted
- The primary detectors on HEROES are Cadmium Telluride



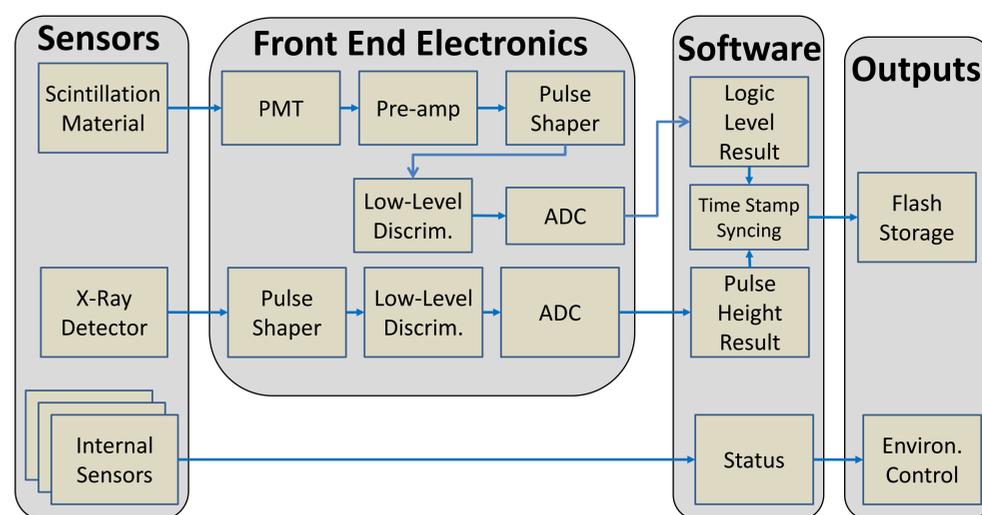
## Instrument Layout

The current conceptual layout of the instrument will operate as follows



## Signal Processing

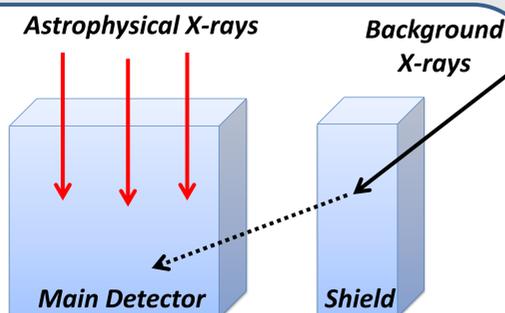
The photomultiplier is used to convert the stimulated photon emission from the scintillator into a current which is processed by a data acquisition setup



## Anti-Coincidence Shielding

### Principles of Operation

- Anti-coincident shielding works by removing events that are detected simultaneously by the shield and the main detector



$$\text{Main Photoevent} + \text{Shield Photoevent} = \text{Veto Signal}$$

### Shielding Material

- To detect X-rays a scintillator is used. Scintillation material will emit photons in response to high energy particle interactions. These emitted photons are collected by a photomultiplier tube which converts them to an electrical signal.
- To design the shield the ALFRED team is using GEANT4 (GEometry ANd Tracking) developed by CERN to simulate the matter particle interactions

## Current Project Status

The ALFRED team is currently in the initial design and development phase. We are working towards a preliminary design review scheduled for early next year. The team is utilizing GEANT 4 to conduct simulations on the scintillation material and shield geometry, which will be used to drive its electrical and mechanical layout.