

Experiment Data and Analysis

Overview of The Balloon Experiments

High altitude balloons have an extensive heritage as platforms for experiments that take place in the upper atmosphere. In this chapter we will examine results from three balloon flight campaigns which carried X-ray spectrometers. The results of the previous two chapters will be applied to determine as much information about the causative precipitating electrons as possible, while avoiding over-fitting the available data. The total precipitating flux and energy distribution of the electrons will be the main targets. The experiments on the balloon flights that we use in this chapter were all equipped with NaI scintillator detectors, and the analysis will be framed around the data that can be obtained from them. There will be questions that can be answered using detectors of a different design, particularly, those sensitive to the angular distribution of the incoming photons. These will be discussed at the end and left for future work.

The balloon flights used in this analysis were from the following campaigns.

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The campaigns each consisted of a number of flights. Each had a somewhat different scientific target, which will be discussed in their analysis sections, however, all of them carried NaI scintillation detectors of a similar design, which we can use with the results from the previous two chapters. We will begin with a discussion of the detector design and operating principles.

Detector Design

The sodium iodide scintillation detector carried by flights on all three balloon campaigns was designed by Dr. Michael McCarthy at the University of Washington, Seattle campus. The instrument design has a heritage extending back to winckler. The instrument specifications follow, reproduced from Millan2014.

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Simulations completed with GEANT3 (the predecessor to GEANT4) indicate that the detector behaves as essentially uncollimated, though the view through the atmosphere results in it having a field of view of approximately 60 degrees Millan2014.

A picture of the detector as flown on the *ABOVE*² campaign is shown in Figure [detector_picture](#). The unit is cylindrical. X-rays deposit their energy in the NaI crystal, and a fraction of the resulting light pulse is converted to a voltage pulse by the photomultiplier tubes. The detector is powered by rechargeable batteries, which are contained in the rectangular foam box behind the detector in Figure [detector_picture](#). ■

figure[p] [width=1.0]figures/chapter5/detector_picture/detector_picture.jpg X — rayspectrometer (white cylinder) enca