Final Report
(Part I)

STATISTICAL PROCESSING OF PIONEER FRONT FILM DATA

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SUMMARY

This report consists of two parts.

Part I is entitled: "Statistical Processing of Pioneer Front Film Data." This report describes the program delivered to the Technical Officer to read and analyze Pioneer Front Film Data in compliance with Items 4 and 5 of the Work Statement of the referenced contract. The work has been completed and will be invoiced.

Part II is a short analytical report entitled: "An Estimate of Particle Flux from Pioneer 8 and 9." This report derives a multiplier permitting conclusions on overall particle flux from the observed flux at Pioneer 8 and 9.

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STATISTICAL PROCESSING OF PIONEER FRONT FILM DATA

1. Introduction

A card file describing all Pioneer events is in existence. This file contains all impacts, as well as positional information on Pioneer. While all relevant information is contained in this file, extraction of this information by means other than computer is so laborious and time consuming, as to make all but the simplest analyses forbidding. A program was constructed to read these data and classify the events according to a number of different criteria. The program is flexible enough, to permit the introduction of further criteria and additional classifications, should this appear desirable.

Not all cards correspond to particle impacts on the pioneer sensors, many are inserted only to supply pioneer position information. On other cards only the grid or film number (but not both) are given. These are also interpreted as blanks.

2. Functional Description of Program

Each pioneer card contains the following information:

a). Timing information: Day, month, year, consecutive day number (from 1/1/1968).

b). Position information: Solar aspect number, earth-sun-probe angle, distance from sun, pioneer position angle (0^{o} corresponds to position on 1/1/68), solar aspect in degrees, celestial aspect (from vernal equinox).

c). Impact information: Telemetering coverage, films or grids impacted, pulse height and satellite identification.

The program reads these cards and tests whether each card corresponds to an event or not. At present, an event is said to have occurred when both a

film and a grid have been excited. (If an alternate definition is desired, a simple change in one statement has to be made). The program separates all cards into 2 sets, events and blanks for each of pioneers 8 and 9. A count is kept for each set and as a control the total number of cards is also counted.

As a further refinement an additional 2 classes of qualifying and non-qualifying events is set up for each satellite. At present, all events are put into the qualifying class, but a future division into e.g., high and low pulse heights is expected.

The information from each card is accumulated in a table. At present this table reflects the organization of events into 10 classes per pioneer revolution, from 0^{o} to 36^{o}, 36^{o} to 72^{o}, etc.

Position information is contained on each card, whether corresponding to an event or not. The first and the last day which the satellite spent in the particular region is thus read from the cards and the total number of days spent in this region becomes available. When each day first appears, its telemetering coverage is accumulated into each particular class, so as to prevent possible misinterpretation of lower impact rates for a particular class. If an event occurs, the frequency counter of its class is advanced.

After all "cards" (or a preset number) have been read the information stored in the frequency table is processed.

The following computations are performed:

All events are subdivided into 3 sets for each of the two pioneers.

Set 1: Lowest angle occurring to 360^{o}

Set 2: 360^{o} - 720^{o}

Set 3: 720^{o} - highest angle

For each of these sets the mean frequency and its standard deviation

are computed. The normalized deviation of the frequency in each class from the mean is also computed.

Further, the overall mean frequency for each satellite and its standard deviation as well as the normalized overall deviation are computed.

3. Mode of Operation

The cards referred to in sections (1) and (2) have been loaded onto a tape. It is most convenient to load this tape onto a disk pack for the operation of this program. This is accomplished by submitting a CRBE-job:

```
SUBMIT ZO2HWXXX
=ZO2HW.FLODP
ENDINPUT
```

This sequence need only be executed once per day. It is a top priority job and will be completed quickly.

After this job has been completed another job is to be submitted which reads and processes the data set generated. This is done by the following instructions:

```
SUBMIT ZO2HWYYY
=ZO2HW.FPRALL
ENDINPUT
```

4. Modification of Program

The program is stored in a CRBE file called

AI2JB.FFPRO

The following changes may be made:

a). Limitation on the number of cards to be read.

Edit the data statement in line 400 MAXC/FFF/

At present, this number is set to 10,000, to allow reading all available cards.

b). Change the classification of events.

Edit the data statement line 400 DELC/XXX./

At present, DELC is set to 36. The number of classes per orbit is changed automatically. In order to permit ready separation of classes into orbits DELC should be chosen so that 360 is an integral multiple of DELC.

c). Change definition of events.

At present, an event is defined as exciting both film and grid. If events only exciting one or the other are to be analyzed, edit line 4200.

At present, the line reads:

```
IF (JF .EQ. 0 . OR. JG. EQ. 0) GO TO 13
```

Change to

```
IF (JF .EQ. 0 .AND. JG .EQ .0) GO TO 13
```

5. Description of Output

For each card read one line is printed containing card number, event or blank number, satellite ID. The remainder of the line reproduces the information on the card as described in section (2).

After all cards have been read the program prints the number of events and blanks for each pioneer as well as the total number of cards read. It further prints the lowest and the highest class for each satellite.

The program also prints the delimiters for each class and the means and standard deviations for each class.

The main output is contained in 2 tables, one for each pioneer. Column 1 in each table contains the lower interval boundary, columns 2 and 3 contain the

first and last day spent in the particular interval. Column 4 contains the number of events occurring during this time and column 5 the accumulated telemetering coverage during this period. Columns 6 and 7 contain the normalized class and overall deviations, respectively.

The program, together with output, have been deliverd to the Technical Officer.