DOCUMENT FOR BIT2ON

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PIONEER-F BIT2ON PROGRAM

A. PROBLEM:

There is a problem with a number of bits in a Pioneer-F detecter; these bits (usually 2 and 6) intermittently fail to register. Thus, incorrect values are obtained for the rates. Since these values often differ greatly from the general trend of the data, they can cause significant errors in the fluxes.

B. SOLUTION

To correct this problem, the program BIT2ON was written. This program looks for data deviating significantly from the general trend and then tests the effect of turning on these faulty bits. If the resulting value is closer to the trend, the rate is corrected to this value. The program QUICKBIT is a version of BIT2ON which processes only the event type rates (for the specific rates, see the program description in the Programmer's Guide).

PROGRAMMER'S GUIDE

A. PROGRAM DESCRIPTION

1. BIT2ON

When the Pioneer EDR tapes are processed by PIODRP, the PIoneer rates tapes are generated, containing the values of the sectored and unsectored rates (converted to decimal form). For detailed information on the rates tape format, see Appendix B. Because of the bit failures in the satellite (usually 2 and 6), some of the rates on the EDR tapes are incorrect. Thus, there are incorrect rates written to the rates tapes by PIODRP in some cases. In order to deal with this, the BIT2ON program was developed to reprocess the rates tapes, and generate the "BIT2ON corrected" rates tapes.

The initial rates tapes are read by BIT2ON (in PFRBIT). At this point, there are two options to the approach to the reprocessing: TIMESKIP, and TIMECOPY. In the TIMESKIP option, the user can skip forward to a requested time on the input tape, and begin reprocessing from this point directly to the output tape. With the TIMECOPY option, the user may first copy part of a previously reprocessed tape to the output tape, then skip to the desired time on the input tape and start processing to the output tape following the copied data.

For the reprocessing, the program must first identify the format (A or B), and then whether the rate is sectored or unsectored. This is done in BIT2ON. The subroutine BIT2ON will then call BITUS for unsectored rates, or BITSS for sectored rates. These routines will first compare the incoming rate to the known exceptions and zero values. If a match occurs the rate is reset and the routine returns to BIT2ON for the next rate. If the rate does not match an exception or a zero rate, the routine will then move on to the bit turnon.

Before the bit turnon, the rate must be converted from decimal back to the spacecraft log form. This is accomplished with DECLOG. For a complete description of the spacecraft log - decimal conversion, see the HELDRP manual. Once the rate is in log form, the routine uses GETPUT to turn on bit 2. The rate is then converted back to decimal form by LOGDEC. At this point it must be compared to the table of permitted rates (set up in RATTAB). If it is an allowed rate, the new rate is then compared to the trend. Then, if the new rate is closer to the trend than the old rate, it replaces the previous value of the rate. This same procedure is followed for the bit 6 turnon. After the bit turnons, the trend is reset to the current rate value.

2. QUICKBIT

The QUICKBIT version of BIT2ON follows the same procedures as described above, with two exceptions: the bit 6 turn-on is not done, and only events type rates are processed. This means that the following rates are processed: SR1(ABCD), R1, R2(AB), R3A, R4B, R5B, R9(ABCD), R10(ABCDEFGH), R11(AB), R12(AB), R14(ABCD), and R15(AB).

This makes QUICKBIT about twice as fast as BIT2ON.

B. CALLING ORDER OF ROUTINES

```
PFRBIT
   RATTAB
   BIT2ON
      BITSS
         DECLOG
         GETPUT (BTMNP)
         LOGDEC
      BITUS
         DECLOG
         GETPUT (BTMNP)
         LOGDEC
```

C. DESCRIPTION OF ROUTINES

PFRBIT : found in SBPIO.RATELIST.SOURCE

This is the BIT2ON control routine. It mounts the tapes and skips to the requested day on the input tape, or copies up to a requested day form a previous BIT2ON tape and then skips to the same day on the input tape.

BIT2ON : found in SBPIO.RATELIST.SOURCE

This subroutine handles both formats A and B. It seperates the rates into sectored and unsectored and and calls the appropriate subroutines (BITSS or BITUS).

BITSS : found in SBPIO.RATELIST.SOURCE

This routine checks for sectored rates exceptions,and zeros, trend checks the data, and calls the bit minipulating routines. It will replace the sectored rate with the calculated (bit turned-on) rate if this new rate is closer to the trend, and reset the trend to the most recent rate.

BITUS : found in SBPIO.RATELIST.SOURCE

This is similar to BITSS, except that it is used to process the unsectored rates.

DECLOG : found in SBPIO.PFRDISP.SOURCE

This routine converts the rates decimal values back into the satellite log value.

GETPUT (BTMNP) : found in SDHEL.HELDRP1.SOURCE

This routine turns on the requested bit.

LOGDEC : found in SBPIO.PFRDISP.SOURCE

This routine converts the log back to decimal form.

USER'S GUIDE

A. DESCRIPTION.

The BIT2ON and QUICKBIT programs are designed to do a bit correction and trend check of Pioneer-F rates data. It can process all or part of an input tape; this processing may take place after copying a portion of a previously processed tape.

Only one input tape may be processed per run. The program has two options: TIMESKIP and TIMECOPY. The TIMESKIP option processes an input tape directly to the beginning of an output tape. The input tape may be skipped forward to a requested start time, and will continue to a requested end time. The TIMECOPY option allows a portion of a previously processed tape to be copied to the output tape before new processing begins. In both options an input start and end time determine the records to be processed. If zeros are entered for the start time, processing will begin at the first record of the tape. If zeros are entered for the end time, processing will run to the end of the tape.

If either the input or the output tape is not specified, the request will be ignored. If neither TIMESKIP nor TIMECOPY is entered in the input card, the request will be ignored. An error message is also written if the requested time interval is not found on the specified tapes.

The BIT2ON program processes all of the sectored and unsectored rates, turning on bit 2 and bit 6 in a 12 bit word. Certain rates values which are known to be exceptions (734, 778, 2296, 10208, 12256, 8421376, 16482304, 14254080, 14385152) are changed to pad (-20000000), and values which would be set to zero by turning on bits 2, 6, and 10 (14516224, 14647296) are automatically set to zero. These exceptions and zero values are read into BIT2ON as data, in a namelist (see sample JCL... &EXCEPS...). The sectored and unsectored exceptions are read in seperately (IEXCS and IEXCU). All rates coming in are re-trend checked and failed ony if they are greater than 16 times the last value.

The QUICKBIT program is a version of BIT2ON which has been modified to make it two times as fast. QUICKBIT processes only the event type rates: SR1(ABCD), R1, R2(AB), R3A, R4B, R5B, R9(ABCD), R10(ABCDEFGH), R11(AB), R12(AB), R14(ABCD), and R15(AB). The bit 6 turn-on has also been removed.

B. JCL FOR RATES

The program requires 160K of main storage.

```
//SBPIOBT2 JOB (SB0012356F,T,SA0001,001001),BF3,MSGLEVEL=1
```

```
//* BIT2ON THISDATE
//GO  EXEC  PGM=BIT2ON,REGION=200K
//STEPLIB   DD   DSN=SDHEL.LIB.LOAD,DISP=SHR
//GO.FT05F001  DD  DDNAME=DATA5
//GO.FT06F001  DD  SYSOUT=A,DCB=(RECFM=VBA,LRECL=137,BLKSIZE=7265)
//GO.FT20F001  DD  DUMMY
//GO.FT30F001  DD  DUMMY
//GO.FT08F001  DD  SYSOUT=A,DCB=(RECFM=VBA,LRECL=137,BLKSIZE=7265)
//GO.FT09F001  DD  DSN=PIORAT,UNIT=(6250,,DEFER),DISP=SHR,
//  VOL=SER=DUMRAT,DCB=DEN=3
//GO.FT10F001  DD  DSN=PIORAT,UNIT=(6250,,DEFER),DISP=SHR,
//  DCB=(RECFM=VBS,LRECL=1740,BLKSIZE=8704,BUFNO=1,DEN=3),
//  VOL=SER=DUMOUT,LABEL=(,SL,,OUT)
//GO.SYSUDUMP  DD  SYSOUT=A
//*DATACARD   DTYPE(1-8),ID(9-10),DTAPE(13-20),DTPOUT(21-28),
//*           DTPCPY(29-36),HTIME:  START:YR(37-38),MN(39-40),DAY(41-42)
//*                                 END:  YR(49-50),MN(51-52),DAY(53-54)
//*  DTYPE=TIMESKIP     DTAPE IS MOVED FORWARD TO THE REQUESTED
//*                     START DAY AND PROCESSING IS STARTED AT
//*                     THE BEGINNING OF DTPCPY.
//*  DTYPE=TIMECPY      DTPOUT IS COPIED TO DTPCPY UP TO THE
//*                     REQUESTED START TIME, THEN DTAPE IS MOVED
//*                     TO THE REQUESTED TIME AND PROCESSING IS STARTED
//*                     ONTO DTPCPY, UP TO THE REQUESTED END TIME.
//*DATACARD
//*DTAPE ID DTAPE    DTPOUT   DTPCPY   YYMMDD0YYMMDD0
//GO.DATA5   DD *
 &EXCEPS NEXCS=0,IEXCS=100*999999,NEXCU=0,IEXCU=100*999999,NZERO=0,
  IZERO=100*999999,&END
 &EXCEPS NEXCS=09,IEXCS(1)=734,IEXCS(2)=8421376,IEXCS(3)=16482304,
  IEXCS(4)=14254080,IEXCS(5)=14385152,IEXCS(6)=778,IEXCS(7)=2296,
  IEXCS(8)=10208,IEXCS(9)=12256,NEXCU=9,IEXCU(1)=734,
  IEXCU(2)=8421376,IEXCU(3)=16482304,IEXCU(4)=10208,
  IEXCU(5)=12256,IEXCU(6)=14254080,IEXCU(7)=14385152,
  IEXCU(8)=778,IEXCU(9)=2296,
  NZERO=2,IZERO(1)=14516224,IZERO(2)=14647296 &END
 &TRENDS LASTUS=128*0,LASTSS=128*0,  &END
 &TRENDS LASTUS(9,1)=0174,LASTUS(4,2)=0186,LASTUS(5,2)=369,
 LASTUS(9,2)=0281,LASTUS(9,3)=0281,LASTUS(14,3)=514,
 LASTUS(14,4)=0192,LASTUS(14,6)=642,LASTUS(14,7)=102,
 LASTUS(14,8)=634,LASTUS(9,4)=0399,&END
TIMESKIP F   E00344   DSD04    DSD04    80090408009070
// EXEC NOTIFYTS
```

QUICKBIT : 0.35 CPU, 0.30 IO for approximately 1500 records (on the IBM 360/91)

BIT2ON : 0.70 CPU, 0.30 IO for approximately 1500 records (on the IBM 360/91)

JCL to run these may be found in SBPIO.LIB.CNTL under the member names : BIT2ON, and BIT2QK.

C. DATA CARDS

The trends, exceptions and zeros are read in through namelist inputs.

trends:

```
&TRENDS LASTSS(I,J)=N,LASTUS(I,J)=N ,&END
```

LASTSS = the table of sectored rates trends
LASTUS = the table of unsectored rates trends

exceptions and zeros:

```
&EXCEPS NEXCS=N1,IEXCS(1)=?,...IEXCS(N1)=?,
 NEXCU=N2,IEXCU(1)=?,.....IEXCU(N2)=?,
 NZERO=N3,IZERO(1)=?,.....IZERO(N3)=?,&END
```

NEXCS = the number of sectored exceptions
IEXCS = the value of the sectored exception
NEXCU = the number of unsectored exceptions
IEXCU = the value of the unsectored exception
NZERO = the number of zero exceptions
IZERO = the value of the zero exception

For an example of typical values see the JCL FOR RATES section.

Input data for tapes and processing:

card columns	description
1-8	option, must contain word TIMESKIP or TIMECOPY
9-10	HID: should be blank F
11-12	blank
13-20	input tape; data to be processed
21-28	previously processed tape to be copied
29-36	tape to which data will be copied and processed
37-38 ; 49-50	2 digit start year ; 2 digit end year
39-40 ; 51-52	start month ; end month
41-42 ; 53-54	start days ; end days
43-44 ; 55-56	start hour ; end hour
45-46 ; 57-58	start minutes ; end minutes
47-48 ; 59-60	start seconds ; end seconds

D. OUTPUT

Program output for a successful run will list: requested start and end dates, start and end date in modified julian day, the number of records processed, and the tapes involved. The program should produce one output tape of processed data.

E. ABENDS AND ERROR MESSAGES.

The following is a list of program error and information messages with appropriate user response.

1. ***CHECK TAPES FOR PROBLEM: THE NUMBER OF RECORDS COPIED (XXXXX) IS NOT THE SAME AS THE NUMBER OF RECORDS SKIPPED ON THE INPUT TAPE (XXXXX).

cause : in using the TIMECOPY option, the number of records copied from the previously processed tape is not the same as the number of records skipped on the input tape.

user response : the user should check tapes to insure that the proper tapes are being used, since in the TIMECOPY option, the files of the input and the final outpput tape should correspond.

2. ** UNEXPECTED END OF FILE REACHED, END OF PROCESSING FOOR THIS REQUEST ***

cause : the end of the tape was reached before the requested start time was found.

user response : check input tape and start time entered.

3. *** END OF OUTPUT RECORDS REACHED BEFORE THE REQUESTED TIME INTERVAL WAS FOUND. END PROCESSING FOR THIS REQUEST ***

cause : in the TIMECOPY option, the program copied the entire previously processed tape without reaching the requested start time.

user response : check tape requested to be copied, and the requested start time.

4. *** ERROR DTYPE (XXXXXXXX) NOT THE SAME AS EITHER DTIMES (TIMECOPY) OR DTIMEC (TIMECOPY) SO REQUEST WILL BE IGNORED ***

cause : the option entered did not correspond to either TIMESKIP or TIMECOPY.

user response: check the first eight columns of data card, to make sure the requested option is valid.

5. *** DTAPE OR DTPCPY IS NOT SPECIFIED ***

cause : a tape was not specified for either DTAPE (the input tape) or DTPCPY (the output tape).

user response: check data card (columns 13-20, and 29-36) to make sure that each tape is specified properly, starting

in columns 13 and 29.

APPENDIX A: PROLOGUES

```
CH1   ROUTINE PFRBIT
CH
CH2   MAKES BIT2ON CORRECTIONS AFTER SKIPPING TO THE REQUESTED DAY
CH2   ON THE INPUT TAPE, OR AFTER COPYING UP TO THE REQUESTED DAY
CH2   FROM A PREVIOUS BIT2ON TAPE AND SKIPPING TO THE SAME DAY ON
CH2   THE INPUT TAPE.
CH
CH4   CALLS: BIT2ON, DRMJD
CH
CH5   VARIABLES:
CH5   DTYPE          R*8          TIMESKIP: TO SKIP ON THE INPUT TAPE
CH5                                         UP TO THE REQUESTED DAY
CH5                               TIMECOPY: TO COPY FROM DTPOUT TO DTPCPY
CH5                                         AND THEN SKIP FORWARD ON DTAPE
CH5   HID            I*2          PIONEER ID, F OR G
CH5   DTAPE          R*8          INPUT TAPE
CH5   DTPOUT         R*8          OLD OUTPUT TAPE TO BE COPIED
CH5   DTPCPY         R*8          NEW OUTPUT TAPE FOR BIT2ON
CH5   HTIME(12)      I*2          HTIME(1-3):START TIME; YEAR, MONTH, DAY
CH5                               HTIME(7-9):END TIME; YEAR, MONTH, DAY
CH5                               IF HTIME(1) IS 0, THE PROGRAM WILL START
CH5                                  AT THE BEGINNING OF THE TAPE.
CH5                               IF HTIME(7) IS 0, THE PROGRAM WILL PROCESS
CH5                                  TO THE END OF THE TAPE.
CH
CH7   L CASSWELL FEBRUARY 1980   (MODIFIED FROM PFRBIT OF ED RONISH 1978)
CH
CH9 PFRBIT ************************************************************
CH
```

```
CH1   SUBROUTINE BIT2ON
CH
CH2   THIS SUBROUTINE CYCLES THROUGH THE SECTORED AND UNSECTORED
CH2   RATES, CALLING BITSS AND BITUS TO TEST FOR EXCEPTIONS AND DO
CH2   THE BIT 2 AND 6 TURNON.  THERE ARE SECTIONS FOR BOTH A AND B
CH2   FORMAT.
CH
CH3   CALLED BY : PFRBIT
CH
CH4   CALLS: BITUS, BITSS
CH
CH7   ED RONISH    1978
CH
CH9  BIT2ON ************************************************************
CH
```

```
CH1   SUBROUTINE BITUS       *** FOR UNSECTORED RATES ***
CH
CH2   THIS SUBROUTINE TESTS FOR EXCEPTIONS, AND THEN ATTEMPTS A BIT 2
CH2   OR A BIT 6 TURNON (IF NOT RATES EXCEPTION).  EXCEPTIONS ARE PAD-
CH2   DED, WHILE OTHER RATES ARE COMPARED TO THE TREND (AFTER BIT TURN-
CH2   ON) TO DETERMINE WHETHER OR NOT BIT TURNONS BRING THE RATES CLOSER
CH2   TO THE TREND.  THE RATES MUST BE CONVERTED BACK TO LOGS BEFORE THE
CH2   BIT TURNON, CONVERTED BACK TO DECIMAL FORM, AND THEN TESTED TO ELIM
CH2   INATE ANY FORBIDDEN LOGS.  THE TREND IS RESET TO THE MOST RECENT
CH2   RATE AT THE END OF THE ROUTINE.
CH
CH3   CALLED BY: BIT2ON
CH
CH4   CALLS: LOGDEC, DECLOG, GETPUT(BTMNP,IGET)
CH
CH5   INPUT VARIABLES:
CH5    IUS - RATE ID SUBSCRIPT
CH5    IRATE - RATE
CH5    L -
CH5    HBTRT - BITRATE
CH5    HFMT - FORMAT
CH
CH7    ED RONISH     1978
CH
CH9BITUS ***********************************************************
CH
```

```
CH1   SUBROUTINE BITSS       *** FOR SECTORED RATES ***
CH
CH    THIS SUBROUTINE TESTS FOR EXCEPTIONS, AND THEN ATTEMPTS A BIT
CH2   2 OR A BIT 6 TURNON (IF NOT RATES EXCEPTION).  EXCEPTIONS ARE
CH2   PADDED, WHILE OTHER RATES ARE COMPARED TO THE TREND (AFTER BIT
CH2   TURN-ON) TO DETERMINE WHETHER OR NOT BIT TURNONS BRING THE RATES
CH2   CLOSER TO THE TREND.  THE RATES MUST BE CONVERTED BACK TO LOGS
CH2   BEFORE THE BIT TURNON, CONVERTED BACK TO DECIMAL FORM, AND THEN
CH2   TESTED TO ELIMINATE ANY FORBIDDEN LOGS.  THE TREND IS RESET TO
CH2   THE MOST RECENT RATE AT THE END OF THE ROUTINE.
CH
CH3   CALLED BY: BIT2ON
CH
CH4   CALLS: LOGDEC, DECLOG, GETPUT(BTMNP,IGET)
CH
CH5   INPUT VARIABLES:
CH5    M -
CH5    IUS - RATE ID SUBSCRIPT
CH5    IRATE - RATE
CH5    L -
CH5    HBTRT - BITRATE
CH5    HFMT - FORMAT
CH
CH7   E RONISH    1978
CH
CH9 BITSS  ************************************************************
```

APPENDIX B: RATES TAPE FORMAT (TAKEN FROM PIODRP MANUAL)

A DESCRIPTION

The rates tapes are 7-track, 800 bpi tapes with standard OS/360 labels written in the binary mode and odd parity with conversion. They contain variable length, blocked records with a maximum buffer length (BLKSIZE) of 8704 bytes and a maximum logical record length (LRECL) of 1740 bytes. These tapes contain the time-ordered Pioneer GSFC/CRT events per seconds (rates) data and related spacecraft information. Each logical record contains selected spacecraft information and all the rates data for one or more pages (each page represents one fourth of an experiment cycle). All rates which fail the trend check will be indicated by a negative rate value. Whenever a rate with the value of zero fails the trend check, it will be indicated by a negative one (-1). Padded rates data will be indicated by the value -20000000.

B LOGICAL RECORD FORMAT

Mnemonic	Description
MSPAG1	Time of day (milliseconds) for first page contained in record
MSNEXT	Time of day (milliseconds) for page which is expected to immediately follow last page in record
RMJDP1	Day (relative modified Julian day) for first page contained in record
RMJDEX	Day (relative modified Julian day) for page which is expected to immediately follow last page in record
ABFILE	absolute file number
TCFLAG	Time correction flag = 0, no correction = 7, suspect time or corrected time
NPAGES	Number of pages (one-quarter experiment cycle) included in record (maximum of six for format A and five for format B)
BITRAT	Bit rate (1-16, 2-32, 3-64, 4-128, 5-256, 6-512, 7-1024, 8-2048)
FORMAT	Format (1-A, 2-A/D, 3-B, 4-B/D)
MODE	Mode =0 or 1, real time =2 Or 3, memory readout =4 or 5, telemetry store
DSSID	DSS identification

ESCID	Extended frame counter (ESC subcom ID)
RATFLG	RAT flag (roll attitude timer) =0, good value =1, old value =2, missing value =3, corrected value
SPNFLG	ASPNPDC flag (spin period)
SPFFLG	SPF flag (spin flag period)
RIPFLG	HRIPPHEC flag -- pulse/roll index pulse phase error
ROLLAT	Roll attitude timer (RAT)
SPNPDC	Spin period (ASPNPDC)
RIPPEC	Roll pulse/roll index pulse phase error (ARIPPHEC)
SPSGRR	Spin period sector generator (SPSG) roll reference =0, 0 degrees =1, 180 degrees
SPSGMD	Spin period sector generator (SPSG) mode =0, non-spin averaging =1, ACS =2, spin averaging
MSRAT	Roll attitude time (milliseconds of RAT)
DCVOLT	DC bus voltage
DCCURR	DC bus current
SPTEMP	Spacecraft platform temperature
SNR	Signal-to-noise ratio
SPARE1	Spare (currently set to zero)
SPARE2	Spare (currently set to zero)
N1	All subcom data associated with first page of data contained in record. Refer to Tables A-1 and A-2 in the PIODRP manual for a description of formats A and B, respectively. All rates data associated with first page of data contained in record. Each page consists of four sets (two sectored and two unsectored) of 16 rates which are uniquely identified by corresponding rate sequence IDs appearing in associated set of subcom data. Rates data associated with each page appears in 64 consecutive words as follows: 1 - Sectered rate (first set) SR1(1-8) SR2(1-8) 16 - Sectered rate (first set) 17 - Unsectored rate (first set) R1-R8 R9-R16

	32 - Unsectored rate (first set) 33 - Sectered rate (second set) SR1(1-8) SR2(1-8) 48 - Sectered rate (second set) 49 - Unsectored rate (second set) R1-R8 R9-R16 64 - Unsectored rate (second set) Refer to table A-3 in the PIODRP manual to determine rates data associated with each unsectored and sectored rate sequence ID Note that redundant sectored rates data occurs whenever corresponding sectored rate sequence ID is not updated from previous value =100, format A =112, format B
N2	All subcom and rates data for second page of data contained in record (see description of first page) =356, format A =368, format B
N3	Third page of data =632, format A =656, format B
N4	Fourth page of data =908, format A =944, format B
N5	Fifth page of data =1184, format A =1232, format B
1460	Sixth page of data (format A only)