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MAJER

TITLE: Procedure Used for Testing RSDP Algorithms

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ABSTRACT

The procedures used to verify the HSP RSDP calibration algorithms are described. The results are reported for tests carried out in November 1987. The same series of tests can be used to verify new releases of RSDP.

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Procedure Used for Testing RSDP Algorithms

Richard L. White, 17 December 1987

The RSDP algorithms were tested by setting up reference relations for the HSP which (if evaluated correctly) give known values for all calibration parameters. The values derived for these parameters (which are given in the header files .C*H for the calibrated data) were compared with the predicted values. The calibrated data values were compared with the raw data values (in the .C*D and .D*D files, respectively) to see whether the calibration was applied to the data correctly.

Enough information is given in this description to allow these tests to be performed again using the same data when future versions of the RSDP software are released. It may be worth noting that it is not safe to assume that everything that worked in previous versions will work in new versions.

Reference Relations

The data relations are defined in a set of .IQL files which were built using the Calibration Data Base Data Design document (SO-11, version 3.0, April 30 1987). These files are found in directory SDAS_USER_DK_1:[HSPIDT.IQL] on SCIF4. The reference relations were defined only for detector 1. A listing of all the installed relations is attached. The following scheme was used to generate a set of values which give nice predicted answers:

- (1) For relations which include polynomial coefficients, the following values were used:

$$\begin{aligned}(A00,A01,A02,A03) &= (1, \frac{1}{2}, \frac{1}{4}, \frac{1}{8}) \\(A10,A11,A12,A13) &= \frac{1}{4} (1, \frac{1}{2}, \frac{1}{4}, \frac{1}{8}) \\(A20,A21,A22,A23) &= \frac{1}{16} (1, \frac{1}{2}, \frac{1}{4}, \frac{1}{8}) \\(A30,A31,A32,A33) &= \frac{1}{64} (1, \frac{1}{2}, \frac{1}{4}, \frac{1}{8})\end{aligned}$$

These coefficients were chosen so that for a time difference $\Delta t = 2$ MJD and a temperature difference $\Delta T = 4^\circ$ C, the polynomial scale factor is

$$f = \sum_{i=0}^3 \Delta T^i \sum_{j=0}^3 A_{ij} \Delta t^j = 16$$

- (2) The base value for each parameter is chosen to be unique so that when the parameter is extracted and multiplied by the polynomial it is easy to determine whether the correct parameter was used. The extracted values (which are equal to the base values times 16 for those parameters with polynomial coefficients) are given in Table 1.
- (3) The base time was set to the time of the observation minus 2 days (*i.e.*, 31460.750), so that $\Delta t = 2$ as required.

- (4) The base temperature was set to 1 for parameters in CCP1, CCP4, and CCP5 (which depend on the detector temperature VTPDET1) and was set to 2 for parameters CCP2, CCP3, and CCP7 (which depend on the detector electronics temperature VTPDEA1).

GEIS Format Data

The input data for the calibration is in a set of files with the rootname V00Y5501R in directory SDAS_USER_DK_1:[HSPIDT.DATA] on SCIF4. In that directory are files with extensions SHH, SHD (standard header packet), D0H, D0D, D1H, D1D (star and sky data), ULH, ULD (Unique Log), TRL (trailer), and DQX. A partial listing of the D0H, D1H, and SHH files is attached; only those files get modified during the test procedure described here.

Table 2 lists the initial values of those parameters in the header files which get changed during the testing. The only other parameters with special values are VTPDEA1=6 and VTPDET1=5 in .SHH. These values are chosen to make $\Delta T = 4^\circ\text{C}$ with the base temperatures discussed above.

The Tests

The generic procedure for testing is as follows:

- (1) Install all IQL files.
- (2) Run CALHSP to calibrate the data.
- (3) Check the calibration parameters in *output.C0H*, *.C1H* to make sure they are correct.
- (4) Check the calibrated data values in *output.C0D*, *C1D* to make sure that calibration was applied correctly.
- (5) Modify V00Y5501R.SHH, .D0H, .D1H for next test.
- (6) Go to (2).

Tests of Data Parameter Extraction

Tests of whether the data parameters are extracted correctly (including polynomial evaluation, interpolation between voltages, etc.) are performed by running the calibration routine and compared the values given for the parameters in the header files for the calibrated data (*.C0H*, *.C1H*) with the predicted values for those parameters. Here are the tests which were performed to check that the data parameters were extracted correctly:

- (1) With initial setup for data, values of calibration parameters should be those given in Table 1 for the selection parameters *APER_NAME = VCLRV_E* (*.C0H*) or *VP90F327* (*.C1H*), *TYPE = DIGITAL*, and *VGAIN = 0*. The high voltage scale factor and the dark count rate values should be the mean of those given for *VOLTAGE = 1000* and

VOLTAGE = 2000 (because VOLTAGE = 1500 in the data). The sample times should be 2.0 seconds (.C0H) and 4.0 seconds (.C1H).

Results: All values were as expected for both .C0H and .C1H.

- (2) Change the high voltage to VHVPSM1 = 1000 in SHH. Expected results as in (1), but with values of dark and HV scale factor for VOLTAGE = 1000 in Table 1.

Results: All values as expected.

- (3) Change gain to VGAIN = 8 in D0H, D1H. Expect to see error message from calibration software because there is no calibration data from this setting (it is illegal, in fact).

Results: No error message was issued. Garbage values (0.8424300E+21) were supplied for both gain and CVC offset. This is apparently a bug in RSDP.

- (4) Change gain to VGAIN = 2 in D0H, D1H. Expected results as in (2), but with gain and CVC offset for VGAIN = 2 in Table 1.

Results: All values as expected.

- (5) Switch to analog data: in D0H, set FILETYPE = 'AST'; in D1H, set FILETYPE = 'ASK'; in both, set DEADTIME = 'OMIT', TRUE_CNT = 'OMIT', TRUE_PHC = 'PERFORM', and DATA_TYPE = 'DIGITAL'. Expected results are as in (4), but with values for TYPE = ANALOG instead of DIGITAL.

Results: All values as expected.

Note that the time bias algorithm was not fully tested here. There are 16 possible settings for the time bias: if the bus director expansion flag is 0, then the time bias is zero (that was tested). Otherwise, the time bias is selected by the combination of the instrument mode (SCP, SSP1, or SSP2, where the 1 and 2 refer to the number of detectors being used for star and sky) and the data format (BYTE, WORD, LWORD, ALOG, or ALL). Only a couple of different mode/format combinations were tested. A different set of test data needs to be arranged in order to do the complete time bias test efficiently.

Tests of Application of Calibration

Tests of whether the calibration was correctly applied to the data are performed by running the calibration routine and compared the values of the calibrated data (in files .COD, .CID) with the predicted values for those data. The data files contain binary floating point numbers. They can be easily listing using the program MYDUMP which can be found in directory SDAS_USER_DK.1:[HSPIDT.COMMANDS]. Use the following VMS commands to set up MYDUMP as a command (this is done automatically if you log onto account HSPIDT):

```
$ DEFINE COMMANDS SDAS_USER_DK.1:[HSPIDT.COMMANDS]
$ SET COMMAND COMMANDS:MYDUMP.CLD
```

The contents of the file can be listed by typing `# MYDUMP filename`.

Here are the tests which were performed to check that the calibration was applied correctly to the data:

(1) Reset the data parameters to digital. Set `VGAIND = 0` in `.D0H`, `.D1H`, and `VHVPSM1 = 1000` in `.SHH`. Set `DEADTIME = 'OMIT'`, `TRUE_CNT = 'PERFORM'`, and `TRUE_PHC = 'OMIT'`. Expected values for star (`.C0H`) are in Table 3a (labeled "Step 1") and for sky (`.C1H`) are in Table 3b. The first three values in the output file are given.

Results: All values as expected.

(2) Change `PTSRCFLG` to 'E' in `.D0H`. Expected values for sky are same as (1); expected values for star are given in Table 3a ("Step 2").

Results: All values as expected.

(3) Change `PTSRCFLG` back to 'P' in `.D0H`. Change parameters in `.D0H` and `.D1H` to analog as described above. Expected values for star, sky are given in Tables 3a,b ("Step 3").

Results: All values as expected.

(4) Change `PTSRCFLG` to 'E' in `.D0H`. Expected values for sky are same as (3); expected values for star are given in Table 3a ("Step 4").

Results: All values as expected.

(5) Set `DEADTIME = 'PERFORM'`, `TRUE_CNT = 'OMIT'`, and `TRUE_PHC = 'OMIT'` in `.D0H`. Using the deadtime (`CCG2`) parameters `TAU1 = 0`, `EPS = 1.E-5`, `THRESHOLD = -1.`, `Q0 = 42.E-9`, `Q1 = 0.`, `F = 1.E9`, `ITERATIONS = 1500`, perform the deadtime calibration of the data. Expected results are given in Table 3a.

Results: All values as expected.

(6) Set `INT_TIME = 19480` (which gives a sample time of 0.02 sec with the time bias = 1000) and run the deadtime calibration. Expected results are given in Table 3a.

Results: All values as expected.

(7) Set `INT_TIME = 3096` (which gives a sample time of 0.004 sec with the time bias = 1000) and run the deadtime calibration. Expected results are given in Table 3a.

Results: All values as expected.

Note that the deadtime algorithm has not been fully tested here. The HSP RSDP is expected to use deadtime parameters like those in Steps 5-7, so that is what was thoroughly checked. Presumably HRS, which uses the more complicated deadtime parameters, will test the algorithm thoroughly.

Table 1: Extracted Values for All Reference Relations

<i>Relation</i>	<i>Description</i>	<i>Selection Parameters</i>	<i>Value</i>
CCP0	Aperture size	APER_NAME=VCLRV_E	2
		APER_NAME=VP90F327	2
CCP1	HV scale factor	TYPE=DIGITAL, VOLTAGE=1000	1
		TYPE=ANALOG, VOLTAGE=1000	2
		TYPE=DIGITAL, VOLTAGE=2000	1.5
		TYPE=ANALOG, VOLTAGE=2000	2.5
CCP2	Gain	VGAIN=0	2
		VGAIN=2	20
CCP3	Preamp noise	TYPE=DIGITAL	4
		TYPE=ANALOG	8
CCP4	Point Efficiency	APER_NAME=VCLRV_E, TYPE=DIGITAL	8
		APER_NAME=VCLRV_E, TYPE=ANALOG	16
		APER_NAME=VP90F327, TYPE=DIGITAL	32
		APER_NAME=VP90F327, TYPE=ANALOG	64
CCP4	Extended Efficiency	APER_NAME=VCLRV_E, TYPE=DIGITAL	16
		APER_NAME=VCLRV_E, TYPE=ANALOG	32
		APER_NAME=VP90F327, TYPE=DIGITAL	64
		APER_NAME=VP90F327, TYPE=ANALOG	128
CCP5	Dark count	APER_NAME=VCLRV_E, TYPE=DIGITAL, VOLTAGE=1000	0.5
		APER_NAME=VCLRV_E, TYPE=ANALOG, VOLTAGE=1000	1
		APER_NAME=VCLRV_E, TYPE=DIGITAL, VOLTAGE=2000	1.5
		APER_NAME=VCLRV_E, TYPE=ANALOG, VOLTAGE=2000	3
		APER_NAME=VP90F327, TYPE=DIGITAL, VOLTAGE=1000	2.5
		APER_NAME=VP90F327, TYPE=ANALOG, VOLTAGE=1000	5
		APER_NAME=VP90F327, TYPE=DIGITAL, VOLTAGE=2000	3.5
		APER_NAME=VP90F327, TYPE=ANALOG, VOLTAGE=2000	7
CCP6	Time bias		1000
CCP7	CVC offset	VGAIN=0	6
		VGAIN=2	60

Table 2: Values Set in Header Files for Data

<i>File Extension</i>	<i>Parameter</i>	<i>Initial Value</i>	<i>Description</i>
D0H	FILETYPE	'DST '	File contains digital star data
	PTSRCFLG	'P '	Star is point source (not extended)
	DEADTIME	'PERFORM '	Perform deadtime correction
	TRUE_CNT	'PERFORM '	Perform digital mode calibration
	TRUE_PHC	'OMIT '	Omit current mode calibration
	DATA_TYP	'DIGITAL '	Data is digital
	INT_TIME	2047000	Integration time in 1/1.024E6 sec
D1H	VGAIN	0	Current mode gain setting
	FILETYPE	'DSK '	File contains digital sky data
	PTSRCFLG	'P '	Star is point source (not extended)
	DEADTIME	'PERFORM '	Perform deadtime correction
	TRUE_CNT	'PERFORM '	Perform digital mode calibration
	TRUE_PHC	'OMIT '	Omit current mode calibration
	DATA_TYP	'DIGITAL '	Data is digital
SHH	INT_TIME	4095000	Integration time in 1/1.024E6 sec
	VGAIN	0	Current mode gain setting
	VHVPSM1	1.5000000E+03	High voltage on detector 1
	VTPDEA1	6.0000000E+00	Electronics temperature on detector 1
	VTPDET1	5.0000000E+00	Detector 1 temperature

Table 3a: Expected Values For Calibrated Star Data (.C0H)

<i>Step</i>	<i>Value 1</i>	<i>Value 2</i>	<i>Value 3</i>	<i>Function tested</i>
Raw Data	41016.00	41072.00	41128.00	
Step 1	2562.938	2566.644	2569.938	Digital point
Step 2	640.7344	641.6094	642.4844	Digital extended
Step 3	640.5000	641.3750	642.2500	Analog point
Step 4	160.1250	160.3438	160.5625	Analog extended
Step 5	20525.68	20553.73	20581.78	Deadtime
Step 6	2244092.	2247445.	2250799.	Deadtime
Step 7	18010581	18053817	18097142	Deadtime

Table 3b: Expected Values For Calibrated Sky Data (.C1H)

<i>Step</i>	<i>Value 1</i>	<i>Value 2</i>	<i>Value 3</i>	<i>Function tested</i>
Raw Data	24574.00	24573.00	24572.00	
Step 1	47.94531	47.94336	47.94141	Digital point
Step 2	Same as Step 1			Digital extended
Step 3	23.96680	23.96582	23.96484	Analog point
Step 4	Same as Step 3			Analog extended

Partial Listing of V00Y5501R.SHH

```
SIMPLE = F / data conforms to the fits standard
.
.
INSTRUME= 'HSP' / instrument in use
ROOTNAME= 'V00Y5501R' / rootname of the observation set
FILETYPE= 'SHP' / shp, udl, dst, dsk, ast, ask, asd, asa
.
.
VHVPSM1 = 1.5000000E+03 / HVPS 1 output monitor
VHVPSM2 = 0.5000000E+03 / HVPS 2 output monitor
VHVPSM3 = 0.5000000E+03 / HVPS 3 output monitor
VHVPSM4 = 0.5000000E+03 / HVPS 4 monitor output
VHVPSM5 = 0.5000000E+03 / HVPS 5 output monitor
.
.
VTPDEA1 = 6.0000000E+00 / temperature DEA 1
VTPDEA2 = 0.1320700E+03 / temperature DEA 2
VTPDEA3 = 0.1320700E+03 / temperature DEA 3
VTPDEA4 = 0.1320700E+03 / temperature DEA 4
VTPDEA5 = 0.1320700E+03 / temperature DEA 5
VTPDET1 = 5.0000000E+00 / temperature detector 1
VTPDET2 = 0.1320700E+03 / temperature detector 2
VTPDET3 = 0.1320700E+03 / temperature detector 3
VTPDET4 = 0.1320700E+03 / temperature detector 4
VTPDET5 = 0.1320700E+03 / temperature detector 5
.
.
MODE = 'SSP' / instrument mode SCP, SSP, ARS
DETECTOB= 1 / detector in use (0-5) - object data
DETECTSK= 1 / detector in use (0-5) - sky data
PTRSRCFLG= ' ' / point source flag (P=point, E=extended)
.
.
PSTRTIME= '1984.001:10:00:00' / predicted obs. start time (yydddhhmmss)
PSTPTIME= '1984.101:10:00:00' / predicted obs. stop time (yydddhhmmss)
APEROBJ = 'VCLRV_E' / si object aperture id
APERSKY = 'VP90F327' / si sky aperture id
.
.
END
```

Partial Listing of V00Y5501R.D0H

```

SIMPLE = F / data conforms to the fits standard
BITPIX = 32 / bits per data value
DATATYPE= 'REAL*4 ' / datatype of the group array
NAXIS = 1 / number of dimensions in the group array
NAXIS1 = 1500 / first dimension of the group array
GROUPS = T / data has groups
GCOUNT = 1 / number of groups
PCOUNT = 14 / number of parameters
PSIZE = 944 / bits in the parameter block
.
.
.
INSTRUME= 'HSP ' / instrument in use
ROOTNAME= 'V00Y5501R ' / rootname of the observation set
FILETYPE= 'DST ' / shp, udl, dst, dsk, ast, ask, asd, asa
.
.
.
MODE = 'SSP ' / instrument mode SCP, SSP, ARS
DETECTOB= 1 / detector in use (0-5) - object data
DETECTSK= 1 / detector in use (0-5) - sky data
PTSRCFLG= 'P ' / point source flag (P=point, E=extended)
APERTOBJ= 'VCLRV E ' / aperture in use - object data
APERTSKY= 'VP90F327 ' / aperture in use - sky data
.
.
.
DET_CHR = 'PERFORM ' / CALIBRATION SWITCHES: perform,omit,complete
DEADTIME= 'PERFORM ' / retrieve detector characteristics
TRUE_CNT= 'PERFORM ' / deadtime correction
TRUE_PHC= 'OMIT ' / compute the true count rates
.
.
.
DATA_TYP= 'DIGITAL ' / CALIBRATION KEYWORDS
DATA_SRC= 'STAR ' / data type: digital, analog
DATA_FMT= 'WORD ' / data source: star, sky, area scan
WORDS = 250 / data format: byte, word, lwr, alog, all
LINES = 6 / number of HSP words (samples) in a line
INT_TIME= 2047000 / number of lines in a group
.
.
.
DETECTOR= 1 / time of integration (in 1/1.024 microseconds)
.
.
.
END

```

Partial Listing of V00Y5501R.D1H

```

SIMPLE = F / data conforms to the fits standard
BITPIX = 32 / bits per data value
DATATYPE= 'REAL*4 ' / datatype of the group array
NAXIS = 1 / number of dimensions in the group array
NAXIS1 = 1500 / first dimension of the group array
GROUPS = T / data has groups
GCOUNT = 1 / number of groups
PCOUNT = 14 / number of parameters
PSIZE = 944 / bits in the parameter block
.
.
INSTRUME= 'HSP ' / instrument in use
ROOTNAME= 'V00Y5501R ' / rootname of the observation set
FILETYPE= 'DSK ' / shp, udl, dst, dsk, ast, ask, asd, asa
.
.
MODE = 'SSP ' / instrument mode SCP, SSP, ARS
DETECTOB= 1 / detector in use (0-5) - object data
DETECTSK= 1 / detector in use (0-5) - sky data
PTSRCFLG= 'P ' / point source flag (P=point, E=extended)
APERTOBJ= 'VCLR_V_E ' / aperture in use - object data
APERTSKY= 'VP90F327 ' / aperture in use - sky data
.
.
DET_CHR = 'PERFORM ' / CALIBRATION SWITCHES: perform,omit,complete
DEADTIME= 'PERFORM ' / retrieve detector characteristics
TRUE_CNT= 'PERFORM ' / deadtime correction
TRUE_PHC= 'OMIT ' / compute the true count rates
.
.
DATA_TYP= 'DIGITAL ' / CALIBRATION KEYWORDS
DATA_SRC= 'SKY ' / data type: digital, analog
DATA_FMT= 'WORD ' / data source: star, sky, area scan
WORDS = 250 / data format: byte, word, lwrd, alog, all
LINES = 6 / number of HSP words (samples) in a line
INT_TIME= 4095000 / number of lines in a group
.
.
DETECTOR= 1 / time of integration (in 1/1.024 microseconds)
.
.
APERTURE= ' ' / detector used
.
.
END

```

RANGE OF C IS CCG2_SDAS\G

APPEND CCG2_SDAS (

ENTRY = 1998 ,
USEFLG = 1 ,
DATE_TIME = "19860730:170230" ,
UID = 1 ,
UNM = "HSPIDT " ,
INSTRUMENT = "HSP" ,
DETECTOR = 1 ,
TAU1 = .000000 ,
EPSILON = .00001 ,
THRESHOLD = -1.00 ,
q0 = 42.E-9 ,
q1 = 0.0 ,
f = 1.E9 ,
ITERATIONS = 1500 ,
comment = " these are the standard HSP parameters ")

\G \Q

RANGE OF C IS CCPO_SDAS\G

APPEND CCPO_SDAS (

ENTRY = 1999 ,
USEFLG = 1 ,
DATE_TIME = "19860730:170230" ,
UID = 1 ,
UNM = "HSPIDT " ,
APER_NAME = "VCLRV_E" ,
POINTER = 10 ,
APER SIZE = 2.0 ,
COMMENT = " aperture area = 2 ")

\G \Q

RANGE OF C IS CCPO_SDAS\G

APPEND CCPO_SDAS (

ENTRY = 1998 ,
USEFLG = 1 ,
DATE_TIME = "19860730:170230" ,
UID = 1 ,
UNM = "HSPIDT " ,
APER_NAME = "VP90F327" ,
POINTER = 10 ,
APER_SIZE = 2.0 ,
COMMENT = " aperture area = 2 ")

\G \Q

RANGE OF C IS CCP1_SDAS\G

APPEND CCP1_SDAS (

```
ENTRY           = 2000 ,
USEFLG          = 1 ,
DATE_TIME      = "19850730:170230" ,
UID            = 1 ,
UNM           = "HSPIDT" ,
DET_NUM        = 1 ,
TYPE           = "DIGITAL" ,
VOLTAGE        = 1000.0 ,
POINTER        = 0 ,
BASE_VALUE     = 0.0625 ,
BASE_TEMP      = 1.0 ,
BASE_TIME      = 31460.750 ,
A00            = 1.000000000 ,
A01            = 0.500000000 ,
A02            = 0.250000000 ,
A03            = 0.125000000 ,
A10            = 0.250000000 ,
A11            = 0.125000000 ,
A12            = 0.062500000 ,
A13            = 0.031250000 ,
A20            = 0.062500000 ,
A21            = 0.031250000 ,
A22            = 0.015625000 ,
A23            = 0.007812500 ,
A30            = 0.015625000 ,
A31            = 0.007812500 ,
A32            = 0.003906250 ,
A33            = 0.001953125 ,
COMMENT        = " Evaluates to H=1 when dT=4, dt=2 ")
```

\G \Q

RANGE OF C IS CCP1_SDAS\G

APPEND CCP1_SDAS (

```
ENTRY           = 2010 ,
USEFLG          = 1 ,
DATE_TIME      = "19850730:170230" ,
UID            = 1 ,
UNM           = "HSPIDT" ,
DET_NUM       = 1 ,
TYPE          = "ANALOG" ,
VOLTAGE       = 1000.0 ,
POINTER       = 0 ,
BASE_VALUE    = 0.125 ,
BASE_TEMP     = 1.0 ,
BASE_TIME     = 31460.750 ,
A00           = 1.000000000 ,
A01           = 0.500000000 ,
A02           = 0.250000000 ,
A03           = 0.125000000 ,
A10           = 0.250000000 ,
A11           = 0.125000000 ,
A12           = 0.062500000 ,
A13           = 0.031250000 ,
A20           = 0.062500000 ,
A21           = 0.031250000 ,
A22           = 0.015625000 ,
A23           = 0.007812500 ,
A30           = 0.015625000 ,
A31           = 0.007812500 ,
A32           = 0.003906250 ,
A33           = 0.001953125 ,
COMMENT       = " Evaluates to H=2 when dT=4, dt=2 ")
```

\G \Q

RANGE OF C IS CCP1_SDAS\G

APPEND CCP1_SDAS (

```
ENTRY           = 2000 ,
USEFLG          = 1 ,
DATE_TIME      = "19850730:170230" ,
UID            = 1 ,
UNM            = "HSPIDT" ,
DET_NUM        = 1 ,
TYPE           = "DIGITAL" ,
VOLTAGE        = 2000.0 ,
POINTER        = 0 ,
BASE_VALUE     = 0.09375 ,
BASE_TEMP      = 1.0 ,
BASE_TIME      = 31460.750 ,
A00            = 1.000000000 ,
A01            = 0.500000000 ,
A02            = 0.250000000 ,
A03            = 0.125000000 ,
A10            = 0.250000000 ,
A11            = 0.125000000 ,
A12            = 0.062500000 ,
A13            = 0.031250000 ,
A20            = 0.062500000 ,
A21            = 0.031250000 ,
A22            = 0.015625000 ,
A23            = 0.007812500 ,
A30            = 0.015625000 ,
A31            = 0.007812500 ,
A32            = 0.003906250 ,
A33            = 0.001953125 ,
COMMENT        = " Evaluates to H=1.5 when dT=4, dt=2 ")
```

\G \Q

RANGE OF C IS CCP1_SDAS\G

APPEND CCP1_SDAS (

```
ENTRY          = 2010 ,
USEFLG         = 1 ,
DATE_TIME     = "19850730:170230" ,
UID           = 1 ,
UNM          = "HSPIDT" ,
DET_NUM      = 1 ,
TYPE         = "ANALOG" ,
VOLTAGE      = 2000.0 ,
POINTER      = 0 ,
BASE_VALUE   = 0.15625 ,
BASE_TEMP    = 1.0 ,
BASE_TIME    = 31460.750 ,
A00          = 1.000000000 ,
A01          = 0.500000000 ,
A02          = 0.250000000 ,
A03          = 0.125000000 ,
A10          = 0.250000000 ,
A11          = 0.125000000 ,
A12          = 0.062500000 ,
A13          = 0.031250000 ,
A20          = 0.062500000 ,
A21          = 0.031250000 ,
A22          = 0.015625000 ,
A23          = 0.007812500 ,
A30          = 0.015625000 ,
A31          = 0.007812500 ,
A32          = 0.003906250 ,
A33          = 0.001953125 ,
COMMENT      = " Evaluates to H=2.5 when dT=4, dt=2 ")
\G \Q
```

RANGE OF C IS CCP2_SDAS\G

APPEND CCP2_SDAS (

```
ENTRY          = 2000 ,
USEFLG         = 1 ,
DATE_TIME     = "19850730:170230" ,
UID           = 1 ,
UNM           = "HSPIDT " ,
DET_NUM       = 1 ,
VGAIN         = 0.00 ,
BASE_VALUE    = 0.125 ,
BASE_TEMP     = 2.0 ,
BASE_TIME     = 31460.750 ,
A00           = 1.000000000 ,
A01           = 0.500000000 ,
A02           = 0.250000000 ,
A03           = 0.125000000 ,
A10           = 0.250000000 ,
A11           = 0.125000000 ,
A12           = 0.062500000 ,
A13           = 0.031250000 ,
A20           = 0.062500000 ,
A21           = 0.031250000 ,
A22           = 0.015625000 ,
A23           = 0.007812500 ,
A30           = 0.015625000 ,
A31           = 0.007812500 ,
A32           = 0.003906250 ,
A33           = 0.001953125 ,
comment       = " evaluates to G=2 when dt=2, dT=4 " )
```

\G \Q

RANGE OF C IS CCP2_SDAS\G

APPEND CCP2_SDAS (

```
ENTRY          = 2001 ,
USEFLG         = 1 ,
DATE_TIME     = "19850730:170230" ,
UID           = 1 ,
UNM           = "HSPIDT " ,
DET_NUM       = 1 ,
VGAIN         = 2.00 ,
BASE_VALUE    = 1.25 ,
BASE_TEMP     = 2.0 ,
BASE_TIME     = 31460.750 ,
A00           = 1.000000000 ,
A01           = 0.500000000 ,
A02           = 0.250000000 ,
A03           = 0.125000000 ,
A10           = 0.250000000 ,
A11           = 0.125000000 ,
A12           = 0.062500000 ,
A13           = 0.031250000 ,
A20           = 0.062500000 ,
A21           = 0.031250000 ,
A22           = 0.015625000 ,
A23           = 0.007812500 ,
A30           = 0.015625000 ,
A31           = 0.007812500 ,
A32           = 0.003906250 ,
A33           = 0.001953125 ,
comment       = " evaluates to G=20 when dt=2, dT=4 " )
```

\G \Q

RANGE OF C IS CCP3_SDAS\G

APPEND CCP3_SDAS (

```
ENTRY           = 2000 ,
USEFLG          = 1 ,
DATE_TIME      = "19850730:170230" ,
UID            = 1 ,
UNM            = "HSPIDT " ,
DET_NUM        = 1 ,
TYPE           = "DIGITAL" ,
BASE_VALUE     = 0.25 ,
BASE_TEMP      = 2.0 ,
BASE_TIME      = 31460.750 ,
A00            = 1.000000000 ,
A01            = 0.500000000 ,
A02            = 0.250000000 ,
A03            = 0.125000000 ,
A10            = 0.250000000 ,
A11            = 0.125000000 ,
A12            = 0.062500000 ,
A13            = 0.031250000 ,
A20            = 0.062500000 ,
A21            = 0.031250000 ,
A22            = 0.015625000 ,
A23            = 0.007812500 ,
A30            = 0.015625000 ,
A31            = 0.007812500 ,
A32            = 0.003906250 ,
A33            = 0.001953125 ,
COMMENT        = " Evaluates to E=4 for dT=4, dt=2 ")
```

\G \Q

RANGE OF C IS CCP3_SDAS\G

APPEND CCP3_SDAS (

```
ENTRY           = 2010 ,
USEFLG          = 1 ,
DATE_TIME      = "19850730:170230" ,
UID            = 1 ,
UNM            = "HSPIDT " ,
DET_NUM        = 1 ,
TYPE           = "ANALOG" ,
BASE_VALUE     = 0.50 ,
BASE_TEMP      = 2.0 ,
BASE_TIME      = 31460.750 ,
A00            = 1.000000000 ,
A01            = 0.500000000 ,
A02            = 0.250000000 ,
A03            = 0.125000000 ,
A10            = 0.250000000 ,
A11            = 0.125000000 ,
A12            = 0.062500000 ,
A13            = 0.031250000 ,
A20            = 0.062500000 ,
A21            = 0.031250000 ,
A22            = 0.015625000 ,
A23            = 0.007812500 ,
A30            = 0.015625000 ,
A31            = 0.007812500 ,
A32            = 0.003906250 ,
A33            = 0.001953125 ,
COMMENT        = " Evaluates to E=8 for dT=4, dt=2 ")
```

\G \Q

RANGE OF C IS CCP4_SDAS\G

APPEND CCP4_SDAS (

```
ENTRY          = 1893 ,
USEFLG         = 1 ,
DATE_TIME     = "19860730:170230" ,
UID           = 1 ,
UNM           = "HSPIDT " ,
APER_NAME     = "VCLRV_E" ,
TYPE          = "DIGITAL" ,
pt_BASE_VALu  = 0.5 ,
ex_base_valu  = 1.0 ,
BASE_TEMP     = 1.0 ,
BASE_TIME     = 31460.750 ,
A00           = 1.000000000 ,
A01           = 0.500000000 ,
A02           = 0.250000000 ,
A03           = 0.125000000 ,
A10           = 0.250000000 ,
A11           = 0.125000000 ,
A12           = 0.062500000 ,
A13           = 0.031250000 ,
A20           = 0.062500000 ,
A21           = 0.031250000 ,
A22           = 0.015625000 ,
A23           = 0.007812500 ,
A30           = 0.015625000 ,
A31           = 0.007812500 ,
A32           = 0.003906250 ,
A33           = 0.001953125 ,
COMMENT       = " Evaluates to R=8(pt), 16(ex) for dT=4 dt=2 ")
```

\G \Q

RANGE OF C IS CCP4_SDAS\G

APPEND CCP4_SDAS (

```
ENTRY          = 1903 ,
USEFLG         = 1 ,
DATE_TIME      = "19860730:170230" ,
UID            = 1 ,
UNM            = "HSPIDT " ,
APER_NAME      = "VCLRV E" ,
TYPE           = "ANALOG" ,
pt_BASE_VALu   = 1.0 ,
ex_base_valu   = 2.0 ,
BASE_TEMP      = 1.0 ,
BASE_TIME      = 31460.750 ,
A00            = 1.000000000 ,
A01            = 0.500000000 ,
A02            = 0.250000000 ,
A03            = 0.125000000 ,
A10            = 0.250000000 ,
A11            = 0.125000000 ,
A12            = 0.062500000 ,
A13            = 0.031250000 ,
A20            = 0.062500000 ,
A21            = 0.031250000 ,
A22            = 0.015625000 ,
A23            = 0.007812500 ,
A30            = 0.015625000 ,
A31            = 0.007812500 ,
A32            = 0.003906250 ,
A33            = 0.001953125 ,
COMMENT        = " Evaluates to R=16(pt), 32(ex) for dT=4 dt=2 "
```

\G \Q

RANGE OF C IS CCP4_SDAS\G

APPEND CCP4_SDAS (

```
ENTRY          = 2001 ,
USEFLG         = 1 ,
DATE_TIME      = "19850730:170230" ,
UID            = 1 ,
UNM            = "HSPIDT " ,
APER_NAME      = "VP90F327" ,
TYPE           = "DIGITAL" ,
pt_BASE_VALu   = 2.0 ,
ex_base_valu   = 4.0 ,
BASE_TEMP      = 1.0 ,
BASE_TIME      = 31460.750 ,
A00            = 1.000000000 ,
A01            = 0.500000000 ,
A02            = 0.250000000 ,
A03            = 0.125000000 ,
A10            = 0.250000000 ,
A11            = 0.125000000 ,
A12            = 0.062500000 ,
A13            = 0.031250000 ,
A20            = 0.062500000 ,
A21            = 0.031250000 ,
A22            = 0.015625000 ,
A23            = 0.007812500 ,
A30            = 0.015625000 ,
A31            = 0.007812500 ,
A32            = 0.003906250 ,
A33            = 0.001953125 ,
COMMENT        = " Evaluates to R=32(pt), 64(ex) for dT=4 dt=2 "
```

\G \Q

RANGE OF C IS CCP4_SDAS\G

APPEND CCP4_SDAS (

```
ENTRY          = 2011 ,
USEFLG         = 1 ,
DATE_TIME     = "19850730:170230" ,
UID           = 1 ,
UNM           = "HSPIDT " ,
APER_NAME     = "VP90F327" ,
TYPE          = "ANALOG" ,
pt_BASE_VALu  = 4.0 ,
ex_base_valu  = 8.0 ,
BASE_TEMP     = 1.0 ,
BASE_TIME     = 31460.750 ,
A00           = 1.000000000 ,
A01           = 0.500000000 ,
A02           = 0.250000000 ,
A03           = 0.125000000 ,
A10           = 0.250000000 ,
A11           = 0.125000000 ,
A12           = 0.062500000 ,
A13           = 0.031250000 ,
A20           = 0.062500000 ,
A21           = 0.031250000 ,
A22           = 0.015625000 ,
A23           = 0.007812500 ,
A30           = 0.015625000 ,
A31           = 0.007812500 ,
A32           = 0.003906250 ,
A33           = 0.001953125 ,
COMMENT       = " Evaluates to R=64(pt) , 128(ex) for dT=4 dt=2 ")
```

\G \Q

RANGE OF C IS CCP5_SDAS\G

APPEND CCP5_SDAS (

```
ENTRY          = 1972 ,
USEFLG         = 1 ,
DATE_TIME     = "19860730:170230" ,
UID           = 1 ,
UNM           = "HSPIDT" ,
APER_NAME     = "VCLRV E" ,
TYPE         = "DIGITAL" ,
VOLTAGE       = 1000.0 ,
POINTER       = 0 ,
BASE_VALUE    = 0.03125 ,
BASE_TEMP     = 1.0 ,
BASE_TIME     = 31460.750 ,
A00           = 1.000000000 ,
A01           = 0.500000000 ,
A02           = 0.250000000 ,
A03           = 0.125000000 ,
A10           = 0.250000000 ,
A11           = 0.125000000 ,
A12           = 0.062500000 ,
A13           = 0.031250000 ,
A20           = 0.062500000 ,
A21           = 0.031250000 ,
A22           = 0.015625000 ,
A23           = 0.007812500 ,
A30           = 0.015625000 ,
A31           = 0.007812500 ,
A32           = 0.003906250 ,
A33           = 0.001953125 ,
COMMENT       = " Evaluates to D=0.5 for dT=4 dt=2 ")
```

\G \Q

RANGE OF C IS CCP5_SDAS\G

APPEND CCP5_SDAS (

```
ENTRY          = 1982 ,
USEFLG         = 1 ,
DATE_TIME     = "19860730:170230" ,
UID           = 1 ,
UNM           = "HSPIDT" ,
APER_NAME     = "VCLRV_E" ,
TYPE         = "ANALOG" ,
VOLTAGE       = 1000.0 ,
POINTER       = 0 ,
BASE_VALUE    = 0.0625 ,
BASE_TEMP     = 1.0 ,
BASE_TIME     = 31460.750 ,
A00           = 1.000000000 ,
A01           = 0.500000000 ,
A02           = 0.250000000 ,
A03           = 0.125000000 ,
A10           = 0.250000000 ,
A11           = 0.125000000 ,
A12           = 0.062500000 ,
A13           = 0.031250000 ,
A20           = 0.062500000 ,
A21           = 0.031250000 ,
A22           = 0.015625000 ,
A23           = 0.007812500 ,
A30           = 0.015625000 ,
A31           = 0.007812500 ,
A32           = 0.003906250 ,
A33           = 0.001953125 ,
COMMENT       = " Evaluates to D=1 for dT=4 dt=2 ")
```

\G \Q

RANGE OF C IS CCP5_SDAS\G

APPEND CCP5_SDAS (

```
ENTRY          = 1971 ,
USEFLG         = 1 ,
DATE_TIME     = "19860730:170230" ,
UID           = 1 ,
UNM           = "HSPIDT" ,
APER_NAME     = "VCLRV_E" ,
TYPE         = "DIGITAL" ,
VOLTAGE       = 2000.0 ,
POINTER       = 0 ,
BASE_VALUE    = 0.09375 ,
BASE_TEMP     = 1.0 ,
BASE_TIME     = 31460.750 ,
A00           = 1.000000000 ,
A01           = 0.500000000 ,
A02           = 0.250000000 ,
A03           = 0.125000000 ,
A10           = 0.250000000 ,
A11           = 0.125000000 ,
A12           = 0.062500000 ,
A13           = 0.031250000 ,
A20           = 0.062500000 ,
A21           = 0.031250000 ,
A22           = 0.015625000 ,
A23           = 0.007812500 ,
A30           = 0.015625000 ,
A31           = 0.007812500 ,
A32           = 0.003906250 ,
A33           = 0.001953125 ,
COMMENT       = " Evaluates to D=1.5 for dT=4 dt=2 ")
```

\G \Q

RANGE OF C IS CCP5_SDAS\G

APPEND CCP5_SDAS (

```
ENTRY          = 1981 ,
USEFLG         = 1 ,
DATE_TIME     = "19860730:170230" ,
UID           = 1 ,
UNM           = "HSPIDT" ,
APER_NAME     = "VCLRV_E" ,
TYPE         = "ANALOG" ,
VOLTAGE       = 2000.0 ,
POINTER       = 0 ,
BASE_VALUE    = 0.1875 ,
BASE_TEMP     = 1.0 ,
BASE_TIME     = 31460.750 ,
A00           = 1.000000000 ,
A01           = 0.500000000 ,
A02           = 0.250000000 ,
A03           = 0.125000000 ,
A10           = 0.250000000 ,
A11           = 0.125000000 ,
A12           = 0.062500000 ,
A13           = 0.031250000 ,
A20           = 0.062500000 ,
A21           = 0.031250000 ,
A22           = 0.015625000 ,
A23           = 0.007812500 ,
A30           = 0.015625000 ,
A31           = 0.007812500 ,
A32           = 0.003906250 ,
A33           = 0.001953125 ,
COMMENT       = " Evaluates to D=3 for dT=4 dt=2 ")
```

\G \Q

RANGE OF C IS CCP5_SDAS\G

APPEND CCP5_SDAS (

```
ENTRY          = 2001 ,
USEFLG         = 1 ,
DATE_TIME     = "19850730:170230" ,
UID           = 1 ,
UNM           = "HSPIDT" ,
APER_NAME     = "VP90F327" ,
TYPE          = "DIGITAL" ,
VOLTAGE       = 1000.0 ,
POINTER       = 0 ,
BASE_VALUE    = 0.15625 ,
BASE_TEMP     = 1.0 ,
BASE_TIME     = 31460.750 ,
A00           = 1.000000000 ,
A01           = 0.500000000 ,
A02           = 0.250000000 ,
A03           = 0.125000000 ,
A10           = 0.250000000 ,
A11           = 0.125000000 ,
A12           = 0.062500000 ,
A13           = 0.031250000 ,
A20           = 0.062500000 ,
A21           = 0.031250000 ,
A22           = 0.015625000 ,
A23           = 0.007812500 ,
A30           = 0.015625000 ,
A31           = 0.007812500 ,
A32           = 0.003906250 ,
A33           = 0.001953125 ,
COMMENT       = " Evaluates to D=2.5 for dT=4 dt=2 ")
```

\G \Q

RANGE OF C IS CCP5_SDAS\G

APPEND CCP5_SDAS (

```
ENTRY           = 2011 ,
USEFLG          = 1 ,
DATE_TIME      = "19850730:170230" ,
UID            = 1 ,
UNM            = "HSPIDT" ,
APER_NAME      = "VP90F327" ,
TYPE           = "ANALOG" ,
VOLTAGE        = 1000.0 ,
POINTER        = 0 ,
BASE_VALUE     = 0.3125 ,
BASE_TEMP      = 1.0 ,
BASE_TIME      = 31460.750 ,
A00            = 1.000000000 ,
A01            = 0.500000000 ,
A02            = 0.250000000 ,
A03            = 0.125000000 ,
A10            = 0.250000000 ,
A11            = 0.125000000 ,
A12            = 0.062500000 ,
A13            = 0.031250000 ,
A20            = 0.062500000 ,
A21            = 0.031250000 ,
A22            = 0.015625000 ,
A23            = 0.007812500 ,
A30            = 0.015625000 ,
A31            = 0.007812500 ,
A32            = 0.003906250 ,
A33            = 0.001953125 ,
COMMENT        = " Evaluates to D=5 for dT=4 dt=2 ")
```

\G \Q

RANGE OF C IS CCP5_SDAS\G

APPEND CCP5_SDAS (

```
ENTRY          = 2000 ,
USEFLG         = 1 ,
DATE_TIME     = "19850730:170230" ,
UID           = 1 ,
UNM           = "HSPIDT" ,
APER_NAME     = "VP90F327" ,
TYPE          = "DIGITAL" ,
VOLTAGE       = 2000.0 ,
POINTER       = 0 ,
BASE_VALUE    = 0.21875 ,
BASE_TEMP     = 1.0 ,
BASE_TIME     = 31460.750 ,
A00           = 1.000000000 ,
A01           = 0.500000000 ,
A02           = 0.250000000 ,
A03           = 0.125000000 ,
A10           = 0.250000000 ,
A11           = 0.125000000 ,
A12           = 0.062500000 ,
A13           = 0.031250000 ,
A20           = 0.062500000 ,
A21           = 0.031250000 ,
A22           = 0.015625000 ,
A23           = 0.007812500 ,
A30           = 0.015625000 ,
A31           = 0.007812500 ,
A32           = 0.003906250 ,
A33           = 0.001953125 ,
COMMENT       = " Evaluates to D=3.5 for dT=4 dt=2 ")
```

\G \Q

RANGE OF C IS CCP5_SDAS\G

APPEND CCP5_SDAS (

```
ENTRY           = 2010 ,
USEFLG          = 1 ,
DATE_TIME       = "19850730:170230" ,
UID             = 1 ,
UNM             = "HSPIDT" ,
APER_NAME       = "VP90F327" ,
TYPE            = "ANALOG" ,
VOLTAGE         = 2000.0 ,
POINTER         = 0 ,
BASE_VALUE      = 0.4375 ,
BASE_TEMP       = 1.0 ,
BASE_TIME       = 31460.750 ,
A00             = 1.000000000 ,
A01             = 0.500000000 ,
A02             = 0.250000000 ,
A03             = 0.125000000 ,
A10             = 0.250000000 ,
A11             = 0.125000000 ,
A12             = 0.062500000 ,
A13             = 0.031250000 ,
A20             = 0.062500000 ,
A21             = 0.031250000 ,
A22             = 0.015625000 ,
A23             = 0.007812500 ,
A30             = 0.015625000 ,
A31             = 0.007812500 ,
A32             = 0.003906250 ,
A33             = 0.001953125 ,
COMMENT         = " Evaluates to D=7 for dT=4 dt=2 ")
```

\G \Q

RANGE OF C IS CCP6_SDAS\G

APPEND CCP6_SDAS (

ENTRY = 1999 ,
USEFLG = 1 ,
DATE_TIME = "19860730:170230" ,
UID = 1 ,
UNM = "HSPIDT" ,
DATA_FMT = "WORD" ,
MODE = "SSP1" ,
TIME_BIAS = 1000.0 ,
comment = " bias = 1000 ")

\G \Q

RANGE OF C IS CCP7_SDAS\G

APPEND CCP7_SDAS (

```
ENTRY          = 1999 ,
USEFLG         = 1 ,
DATE_TIME     = "19860730:170230" ,
UID           = 1 ,
UNM          = "HSPIDT " ,
DET_NUM       = 1 ,
VGAIN         = 0.0 ,
BASE_VALUE    = 0.375 ,
BASE_TEMP     = 2.0 ,
BASE_TIME     = 31460.750 ,
A00           = 1.000000000 ,
A01           = 0.500000000 ,
A02           = 0.250000000 ,
A03           = 0.125000000 ,
A10           = 0.250000000 ,
A11           = 0.125000000 ,
A12           = 0.062500000 ,
A13           = 0.031250000 ,
A20           = 0.062500000 ,
A21           = 0.031250000 ,
A22           = 0.015625000 ,
A23           = 0.007812500 ,
A30           = 0.015625000 ,
A31           = 0.007812500 ,
A32           = 0.003906250 ,
A33           = 0.001953125 ,
COMMENT       = " Evaluates to I=6 for dT=4, dt=2 ")
```

\G \Q

RANGE OF C IS CCP7_SDAS\G

APPEND CCP7_SDAS (

```
ENTRY          = 2010 ,
USEFLG         = 1 ,
DATE_TIME     = "19860730:170230" ,
UID           = 1 ,
UNM          = "HSPIDT " ,
DET_NUM       = 1 ,
VGAIN         = 2.0 ,
BASE_VALUE    = 3.75 ,
BASE_TEMP     = 2.0 ,
BASE_TIME     = 31460.750 ,
A00           = 1.000000000 ,
A01           = 0.500000000 ,
A02           = 0.250000000 ,
A03           = 0.125000000 ,
A10           = 0.250000000 ,
A11           = 0.125000000 ,
A12           = 0.062500000 ,
A13           = 0.031250000 ,
A20           = 0.062500000 ,
A21           = 0.031250000 ,
A22           = 0.015625000 ,
A23           = 0.007812500 ,
A30           = 0.015625000 ,
A31           = 0.007812500 ,
A32           = 0.003906250 ,
A33           = 0.001953125 ,
COMMENT       = " Evaluates to I=60 for dT=4, dt=2 ")
```

\G \Q