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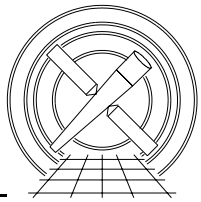

MEMORANDUM

Date: July 21, 2006
From: SOT ACIS OPS Team
To: CXCDS,ARCOPS,CUS
Subject: OBSCAT and SACGS Changes to Allow the Use of Optional CCDs
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1 Introduction

The ACIS Power Supply and Mechanism Controller (PSMC) has been operating at higher temperatures as the Science Instrument Module (SIM) has been getting warmer over the course of the mission. The PSMC temperature excursions are most pronounced when the spacecraft pitch angle is between 45 and 60 degrees. The DEA side A Power Supply board in the PSMC (1PDEAAT) has been approaching its Yellow High limit of +57.0 C when the spacecraft attitude is in this range. For a more detailed discussion of these excursions, see the memo: "`http://asc.harvard.edu/acis/memos/psmc_numCCDs.ps`". Under current thermal conditions and assuming an initial temperature for 1PDEAAT of less than +30 C, observations at pitch angles less than 60 degrees which are longer than $\sim$ 50 ks and which consume maximum power within ACIS (6 CCDs clocking) are likely to approach or exceed the Yellow High limit for 1PDEAAT. The time to reach the limit is obviously less/more if the initial temperature is higher/lower. We expect these times to decrease as the SIM temperatures continue to increase.

2 Changes in the Operations

In order to prevent 1PDEAAT from exceeding its Yellow High limit, it will be necessary to restrict the amount of time the spacecraft will spend at pitch angles between 45 and 60 degrees and/or to reduce the ACIS power consumption while at such pitch angles. There are three ways in which this can be accomplished:

1. If multiple pitch angles are possible for a given observation, schedule the observation at pitch angles larger than 60 degrees.
2. If an observation must use 6 CCDs and the observation can only be executed at a pitch angle of less than 60 degrees, split the observation into shorter pieces.
3. Reduce the number of CCDs operating for the observation

3 Changes in the Specification of Observations

In order to provide ACIS Ops and SOT MP with the information necessary to implement item three listed above, it would be necessary to include additional information for each observation in the OBSCAT. Specifically, the number of required and optional CCDs for an observation would need to be included. The observer will need to specify the number of required and optional CCDs for each observation.

This change affects at least seven areas: 1) the Observation Catalogue (OBSCAT), 2) the ACIS Commanding software (SAGCS), 3) the SOT MP scheduling SW and OR format, 4) Verification and Validation (V&V), 5) ChaSer/WebChaSer, 6) the MIT "get-obsid" web procedure and 7) the RPS forms.

4 Proposed Changes to OBSCAT

Here we present a quick summary of the proposed changes followed by a more detailed discussion.

The proposed changes to the OBSCAT are:

1. Create a new parameter called "Dropped Chip Count"
2. Change the allowed entries for the individual CCD specifications to be "Y", "N", and "O#"
3. Remove the "Standard Chips" parameter.

The starting assumptions for the change are:

1. The observers will be allowed to specify Required, Optional and Off CCDs.
2. Observers may request a total of up to 6 Required or Optional CCDs, at least one of which must be Required. Up to 9 CCDs can be requested as Off.
3. ACIS Ops and/or USINT will have the authority to change the Optional CCDs to Off if the thermal predictions indicate that the Yellow limit for 1PDEAAT will be violated.
4. FAST TOOs and DDTs will continue to follow the current rules of needing to use an existing SI_MODE.

This leads to a change in OBSCAT parameters. There is currently a parameter for every CCD which can be "Y" for On and "N" for Off. The valid entries for this parameter should be changed to :

- "Y" for required
- "O#" for optional and the number "#" (1 through 5) of the CCDs in the order that the observer wants to have the CCDs turned off. For example, O1 would be the first optional CCD meaning that it should be the first optional CCD to be turned off
- "N" for NO, the CCD is required to be off
- The "Standard Chips" flag should be removed. This parameter no longer works with the new changes.

In addition to this change, a new parameter will be added: "Dropped Chip Count". This parameter records the number of CCDs that are dropped to create the SI_Mode used on board and must be set to create an SI_Mode. This is set to "0" as a default and only changed if an optional CCD(s) needs to be dropped to maintain safe operating temperatures for ACIS.

These new parameters are subject to the following rules:

- Legitimate values for "Dropped Chip Count" are 0..5, default 0.
- CCD fields are "Y", "N", and "O1" through "O5".

- No more than a total of 6 CCD fields can contain "Y" or "O#".
- At least one field must contain "Y".
- Optional "O#" values must be unique and start at "O1". Gaps are not permitted, i.e., if "O3" is assigned, so must "O1" and "O2".

This approach will provide:

- A record of the original request from the observer,
- A record of the final configuration executed on the spacecraft,

while requiring only one new parameter in the OBSCAT and one change in allowed values for another parameter.

This approach will require at least the following changes to SW:

- SACGS will need to change to read the "dropped chip count" and accept "O#" as valid parameters.
- SACGS will need to interpret "O#" as the CCD should be turned on unless the "dropped chip count" exceeds zero. In that case, the O# is interpreted as the CCD that should be turned off for the first N optional chips where N is specified in the "dropped chip count". For example, if "dropped chip count"=2, the CCDs identified as "O1" and "O2" will be turned off.
- V&V will also need to make these changes to allow for the correct checking of parameters.

NOTE: SACGS would still generate/assign only one SIMODE per observation

4.1 Implementation

The above changes would need to work with scheduling. This involves careful communication between FOT MP, SOT MP, USINT and ACIS Ops. Note this process is to be followed in all command loads with observations including fast TOOs as observations may move temporally and cause a change in the thermal conditions.

1. SOT MP would access the information on number of required CCDs when generating the LTS and attempt to minimize the number of observations which have 6 CCDs operating for durations longer than the maximum allowed for the given pitch angle. (Notes: 1. Currently this applies only to pitch angles 45 to 60 degrees. 2. Depending on the predicted starting temperature in the actual schedule, ACIS still may not be allowed an uninterrupted observation with 6 chips operating.)

   In addition, the OR shall include the information on optional CCDs for ALL observations. This will pass the information needed in the next item to FOT MP.

2. As the preliminary schedule is laid out (and presumably before running through the OFLS, TBD), the FOT MP shall take cognizance of optional chips and may consider them as dropped in order to lay out a schedule with does not violate thermal guidelines. Any changes to chip configuration would be determined by FOT MP and reported in the preliminary schedule for the ACIS Ops team to take action.

3. ACIS Ops would change the Dropped Chip Count parameter to reduce the number of operating CCDs and re-assign the SIMODE with fewer CCDs operating. The archive would be changed to allow the ACIS Ops team to have the permission to change the Dropped Chip Count parameter. ACIS Ops would contact the USINT personnel for this observation to alert the observer to the change.(Note: This item is open for discussion as to if the observer is notified a priori or post facto in the V&V report.)

SOT MP will need to use a script to be provided by ACIS Ops to identify possible thermal violations. FOT will supply ACIS Ops with updated thermal predictions at TBD intervals.

Table 1 is an example of the communication time line between the different CXC groups. We use the July 24, 2006 command load as the example.

DATE	**Event**	**Comments**
03JUL06	preliminary OR list released	Min and max pitch angles known, ACIS Ops and/or SOT MP IDs observations which are likely to violate thermal limits including pool targets Optional CCDs are included for all ACIS observations in the OR.
10JUL06	Final OR list released	ACIS Ops and/or SOT MP check observations which have been added since preliminary OR list
12JUL06	preliminary schedule released	sequence of observations known, FOT thermal model has been run and a prediction of temperatures for the week generated, observations which violate thermal limits identified, decision to drop a CCD or split the observation is made by FOT MP
12JUL06	ACIS Ops makes OBSCAT change OR a new OR list generated with split observation	ONLY IF NECESSARY
13JUL06	ACIS Ops builds new SIMODE or assigns an existing one	ONLY IF NECESSARY
14JUL06	revised schedule released	ONLY IF NECESSARY, ACIS Ops and FOT verify that temperatures are not predicted to exceed limits
14JUL06	Post-final OR list released	ONLY IF NECESSARY
17JUL06	release of A products	final check on predicted temperatures
21JUL96	load approved	SOE file archived
24JUL06	load starts execution on spacecraft	

Table 1: Example Time line for ACIS/FOT/SOT mission planning coordination.

4.2 Open Implementation Issues

1. ACIS Ops and SOT MP need to track rescheduled observations. For example, an observation might be scheduled at a bad pitch, but the observation could be postponed to a later time when the pitch is better and vice-versa.
2. ACIS Ops and SOT MP need to monitor pool targets and adjust SI_Modes in the preliminary OR list if necessary.
3. ACIS Ops needs to continue the analysis on thermal time constants for predicting possible thermal violations.

5 Time constraints

It is desirable to incorporate these changes in time for the AO 8 ingest.

6 References

Depasquale, J. "PSMC Thermal Studies", Chandra Memo, June 21, 2006.
"`http://asc.harvard.edu/acis/memos/psmc_numCCDs.ps`".