**Proposal to increase the 1DACTBT Red and Yellow High Limits**

ACIS Ops is proposing that we modify the Caution and Warning limits for 1DACTBT:

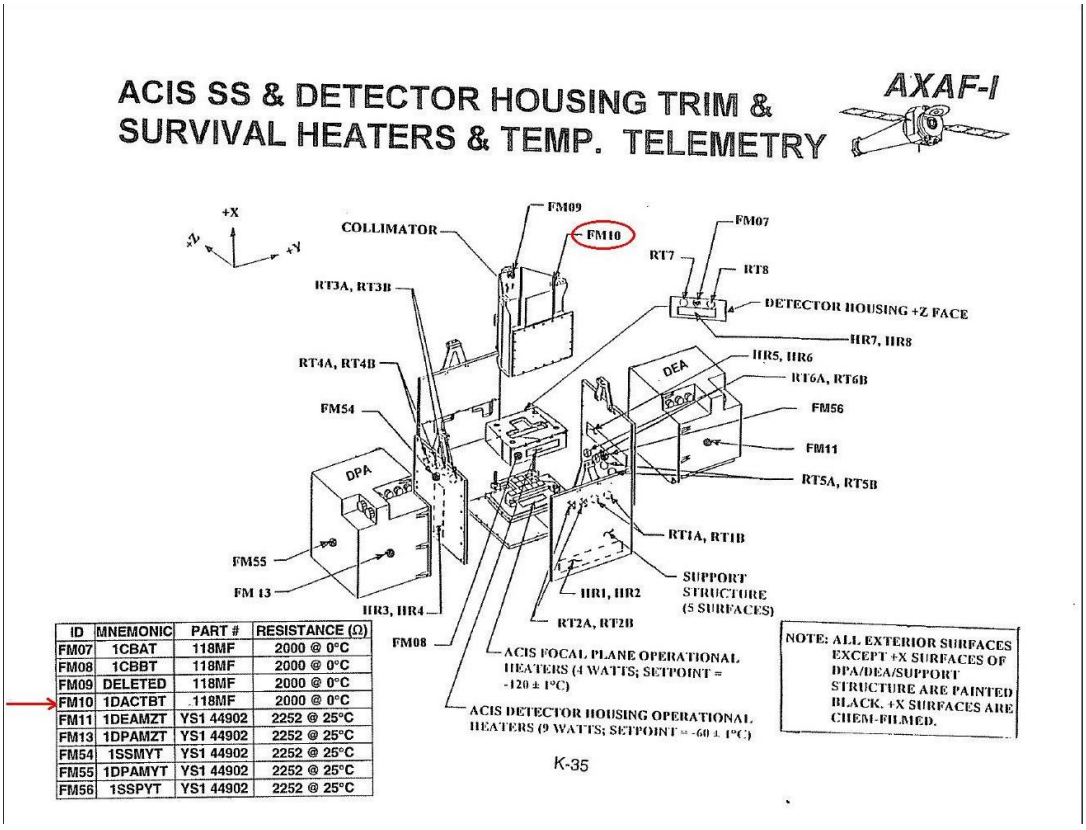
Present high limits:

Yellow Caution = -5.0C
Red Warning = 0.0C

Proposed limits:

Yellow Caution = 0.0C
Red Warning = 5.0C

The ACIS instrument is attached to the Chandra spacecraft through a collimator. This is tapered, approximately 13 inches long, and made of one piece of titanium. The 1DACTBT thermistor is located at the top end of the collimator: labeled FM10 (circled in red) in the following drawing:




| ID | MNEMONIC | PART # | RESISTANCE (Ω) |
|---|---|---|---|
| FM07 | 1CBAT | 118MF | 2000 @ 0°C |
| FM08 | 1CBBT | 118MF | 2000 @ 0°C |
| FM09 | DELETED | 118MF | 2000 @ 0°C |
| FM10 | 1DACTBT | 118MF | 2000 @ 0°C |
| FM11 | 1DEAMZT | YS1 44902 | 2252 @ 25°C |
| FM13 | 1DPAMZT | YS1 44902 | 2252 @ 25°C |
| FM54 | 1SSMYT | YS1 44902 | 2252 @ 25°C |
| FM55 | 1DPAMYT | YS1 44902 | 2252 @ 25°C |
| FM56 | 1SSPYT | YS1 44902 | 2252 @ 25°C |

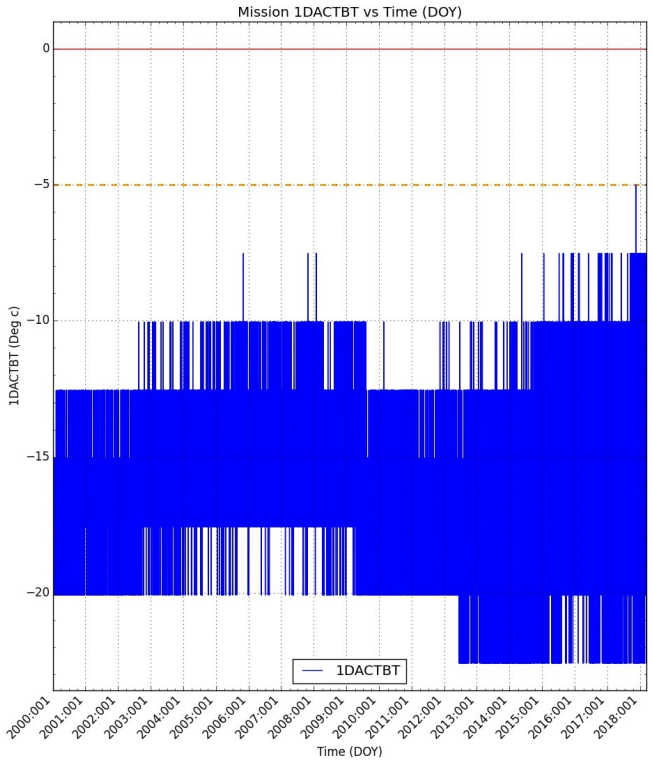
Titanium was selected for its low thermal expansion properties (among other reasons).

Looking at the full plot of 1DACTBT across the mission shows that the temperatures have been trending up. The yellow dashed line is the Yellow Caution high limit; red solid line is the Red Warning high limit.

The number of -8.0C excursions have been increasing over the last few years.

We also notice that the frequency of low temperature excursions below -20C are also increasing.

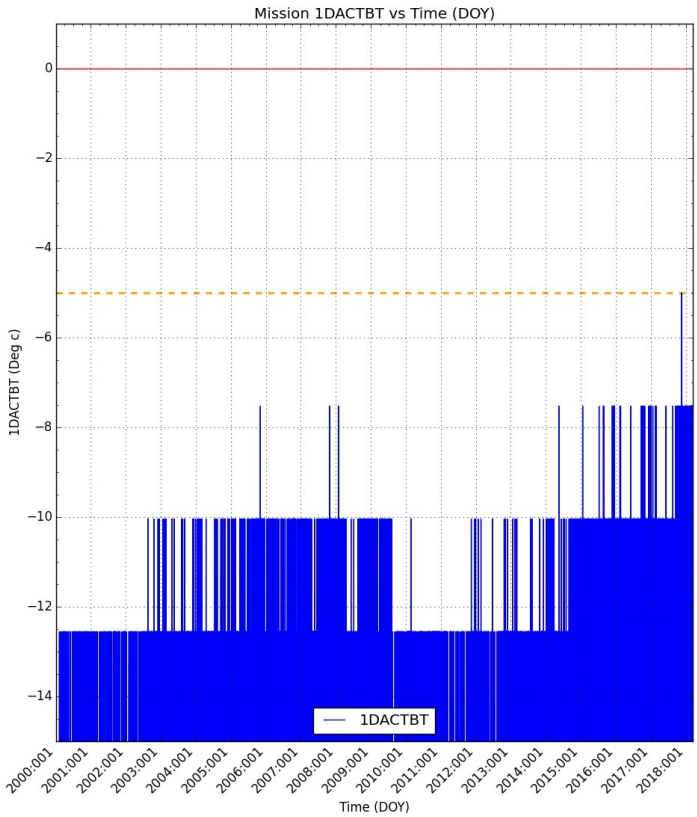
Yellow Low Caution is set at -40.0C; Red Warning low is set to -52.00. There is no concern about these limits



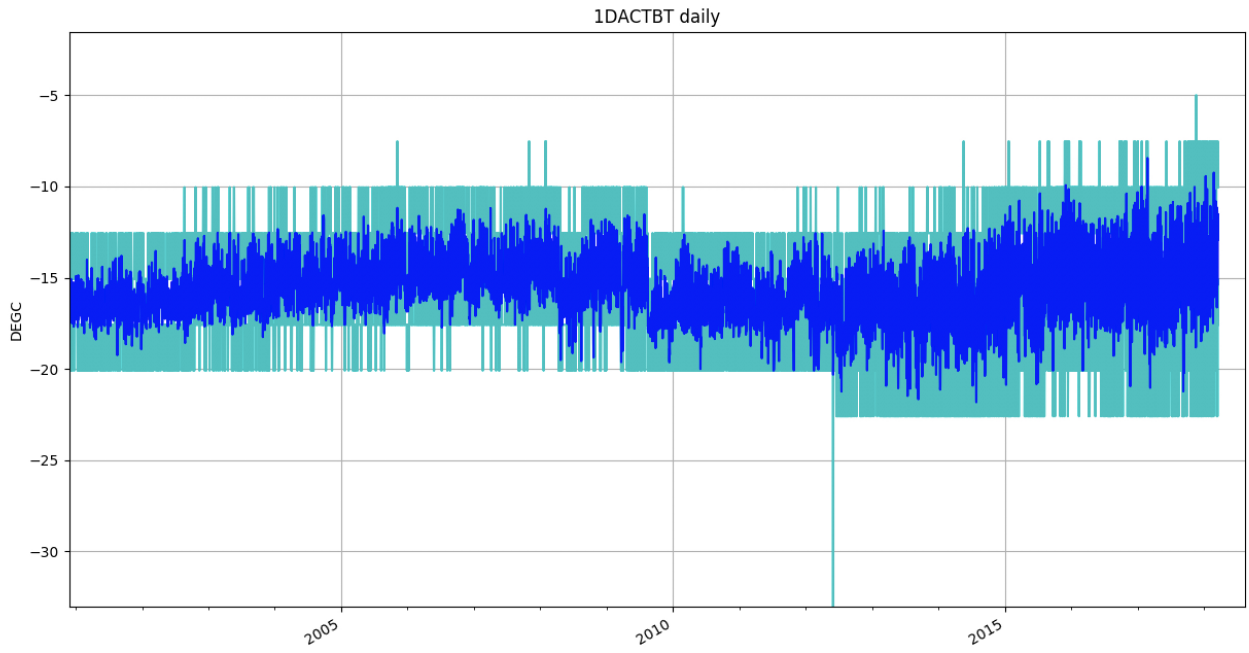

This plot of 1DACTBT across the mission (upper temperatures only) shows that the temperatures have been trending up.

Near the end of 2017 (2017:321:23:47:39.607), the temperature came very close to the Yellow Caution limit (~.0055C).

Each bit of the digitized 1DACTBT readout represents 2.5 degrees C, so we are one bit away from a Yellow Caution violation.



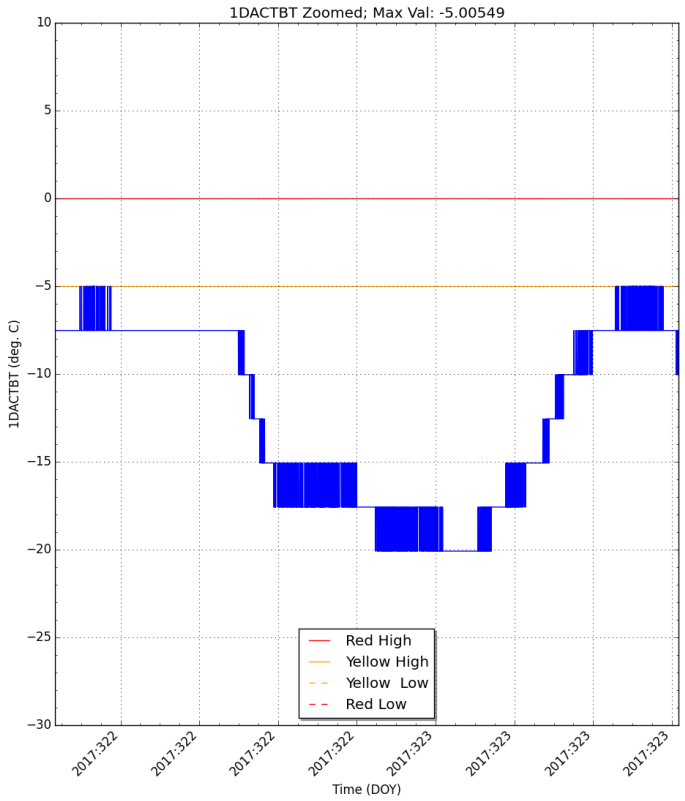
This is a plot of 1DACTBT across the mission with daily averages overplotted:




Plot provided by Matt Dahmer

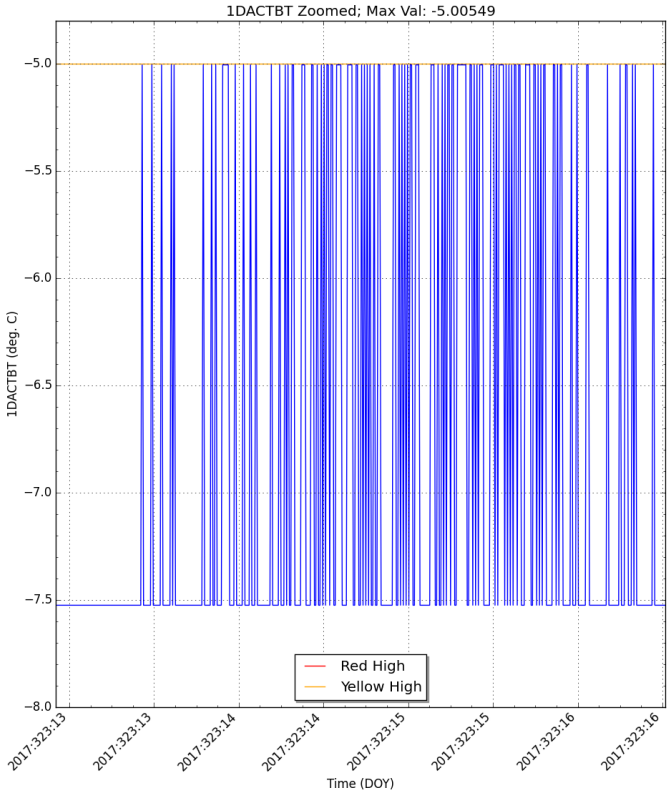
An upward trend is discernable.

What looks like 1 event Where 1DACTBT came close to the Yellow Caution high limit is really two:




If you zoom in closer to the second of the two excursions you see how close we came to the Yellow Caution high limit. The area shaded green denotes the end of the Comm at that time.

There is quite a bit of 1 bit bouncing.



The 1DACTBT limits do not represent a health and safety issue for the ACIS instrument. The operating min/max values were established during ground testing. Page 3 of AXAF-056.pdf shows the min/max operating limits for 1DACTBT as -26.0/+25.0 degrees C:

TABLE 1: ACIS DETECTOR ASSEMBLY AND PSMC TEMPERATURE (°C) LIMITS

| LOCATION | FLIGHT MNEMONIC | SURVIVAL MIN/MAX | OPERATING MIN/MAX |
|---|---|---|---|
| Cold Radiator A | 1CRAT | -155/+40 | -130/+25 |
| Cold Radiator B | 1CRBT | -155/+40 | -130/+25 |
| Detector Assy Camera Body A | 1CBAT | -76/+40 | -61/+25 |
| Detector Assy Camera Body B | 1CBBT | -76/+40 | -61/+25 |
| Detector Assy Collimator Top A | 1DACTAT | -56/+40 | -26/+25 |
| Detector Assy Collimator Top A | 1DACTBT | -56/+40 | -26/+25 |
| Open Actuator Housing Temp A | 1OAHAT | -60/+40 | -38/+25 |
| Open Actuator Housing Temp B | 1OAHBT | -60/+40 | -38/+25 |
| Warm Radiator Temp A | 1WRAT | -107/+40 | -90/+25 |
| Warm Radiator Temp B | 1WRBT | -107/+40 | -90/+25 |
| PSMC DEA Power Suppy Temp A | 1PDEAAT | -40/+62 | -25/+62 +70 (A) |
| PSMC DEA Power Suppy Temp B | 1PDEABT | -40/+62 | -25/+62 +70 (A) |
| PSMC Temp 1A | 1PINIAT | -40/+40 | -25/+35 +46 (Protoflt) (A) |

Notes: (A) Temperature during ISIM TV test with 6 ACIS CCDs operating with HRC in the view position shall not exceed 46°C for 1PINIAT and 70°C for 1PDEAAT and 1PDEABT. For all other ISIM Observatory testing, temperature of 1PINIAT will be maintained below 35°C, and temperature of 1PDEAAT and 1PDEABT will be maintained below 62°C.

CONCUR: _____

NEIL TICE (LMA) ELLEN SEN (MIT)

Therefore increasing the Red High limit to 5.0C will not infringe on the +25.0C limit.

The one impact that an increasing temperature may have is to expand the length of the collimator. Richard Edgar of the ACIS Ops team estimated the thermal expansion of the collimator, and assessed the impact on ACIS focus. The calculation and conclusions can be read in detail in the file:

collimator_expansion.pdf – attached to this Twiki.

The conclusion drawn in the memo is that a 10 degree increase is not a factor on ACIS focus.

Therefore the ACIS Ops team recommends that the 1DACTBT Yellow Caution and Red Warning limits both be raised by 5 degrees, in order to forestall Yellow Caution violation alerts.