

MEMORANDUM

Date: May 2, 2006  
From: Joe DePasquale  
To: SOT/FOT  
Subject: Justification for Proposed Changes to ACIS DEA/DPA Thermal Limits

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## 1 Introduction

The ACIS Detector Electronics Assembly (DEA) and Digital Processor Assembly (DPA) continue to exhibit a well known increase in maximum temperature over the course of the mission that is strongly correlated to the pitch angle of the spacecraft as measured through the Solar Array Angle (SAA). Because of the conservative limits currently in place, and the increasing frequency of limit trips, we recommend raising the yellow high thermal limits for three DEA/DPA thermistors. This memo is intended to summarize the 2005/2006 perihelion thermal limit trips/excursions of 1DEAMZT, 1DPAM[Y/Z]T, and to provide justification for raising their thermal limits. This new set of limits will be contained in the ACIS limit set V1.4.

## 2 DEA/DPA Thermal Limit Trips

Table 1 lists the mission high temperatures for 1DEAMZT, 1DPAM[Y/Z]T. These trips were all violations of the yellow high limits imposed by the ACIS Operations Team, with the exception of 1DPAMYT which did not exceed its yellow high limit. 1DEAMZT has reached a maximum high temperature of +14.19 C, however, it has tripped its yellow high limit well over 30 times since August of 2005. The current 1DEAMZT data quality yellow high limit of +12.0 C was purposefully set at a conservative temperature to alert the SOT to changes in the spacecraft's thermal environment. Having fulfilled that role, its yellow high limit should be adjusted to provide early warning of further changes in the thermal environment. Figures A.1 to A.6 in appendix A show the temperature versus time curves for 1DEAMZT and 1DPAM[Y/Z]T for the trips listed in table 1. Included in these plots is also the SAA in red and a brief summary of the limit trip.

Table 1: **ACIS DEA/DPA Mission Highs**

Mnemonic	MAX T (C)	Pitch (deg)
1DEAMZT	+14.19	137.73
1DPAMYT	+17.32	147.49
1DPAMZT	+20.17	147.49

### 3 Recommended Limit Changes

After analysis of these data and discussions with the MIT ACIS team, we recommend the following changes to the ACIS DEA/DPA yellow high limits for 1DEAMZT, 1DPAMZT, and 1DPAMYT. We would like to increase the yellow high limit for all three mnemonics to +30.0 C for both Data Quality and Health & Safety limit sets. This would change the current 1DEAMZT Data Quality yellow high limit from +12.0 C to +30.0 C and the Health & Safety limit from +20.0 C to +30.0 C. The 1DPAM[Y/Z]T yellow high limits for both Data Quality and Health & Safety are currently +20.0 C and would be increased to +30.0 C. Table 2 below summarizes these changes.

Table 2: **ACIS DEA/DPA Proposed Limit Changes**

Mnemonic	Current DQ YH(C)	Current HS YH(C)	New DQ & HS YH(C)
1DEAMZT	12.0	20.0	30.0
1DPAMYT	20.0	20.0	30.0
1DPAMZT	20.0	20.0	30.0

### A DEA/DPA Temperature Plots

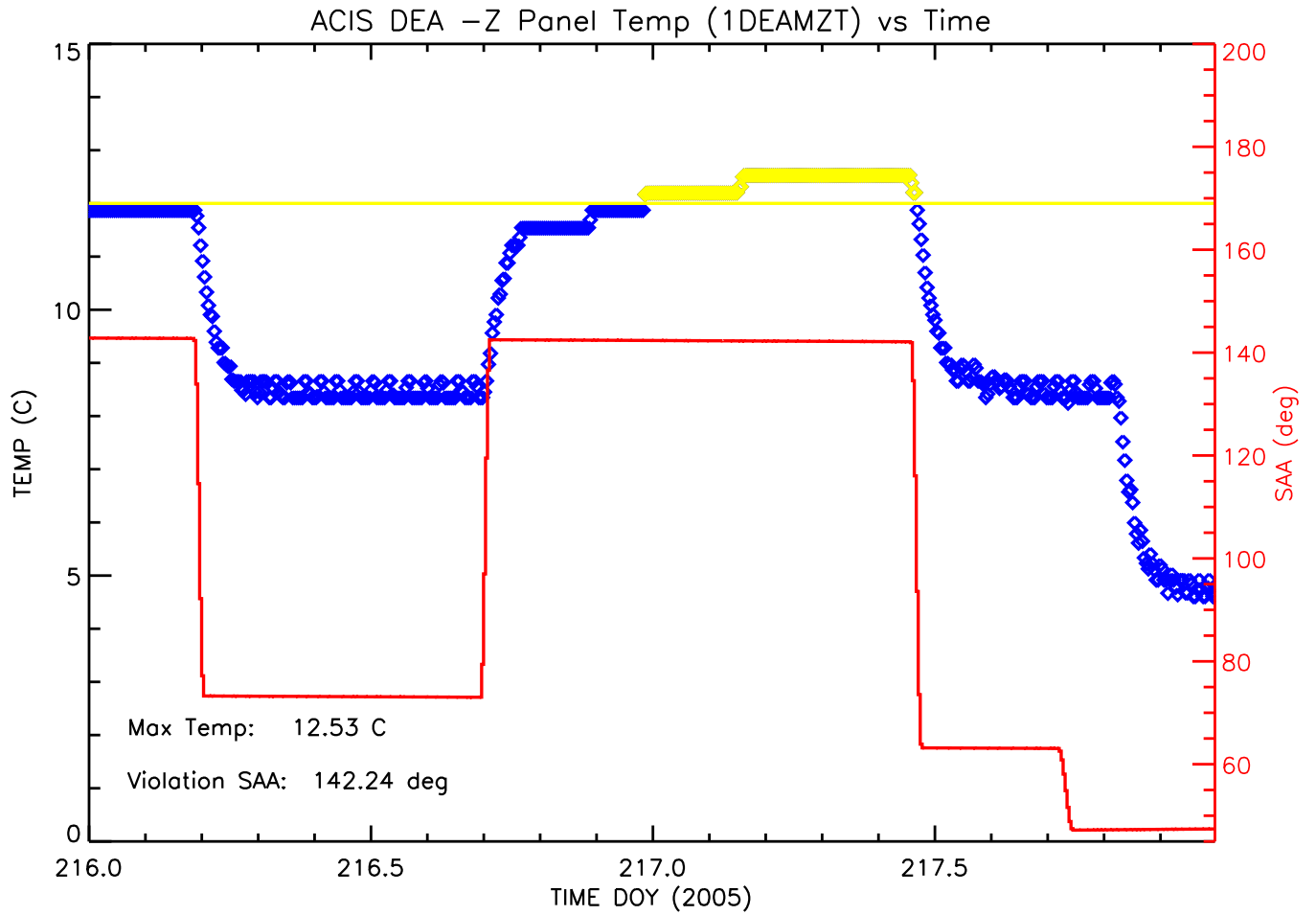


Figure A.1: Plot of temperature versus time for 1DEAMZT during a yellow high limit trip on day 216 of 2005. Included in red on this plot is the SAA for the duration of the trip. The duration listed on the plot is the total time that 1DEAMZT spent above the yellow limit regardless of temperature fluctuations above this level.

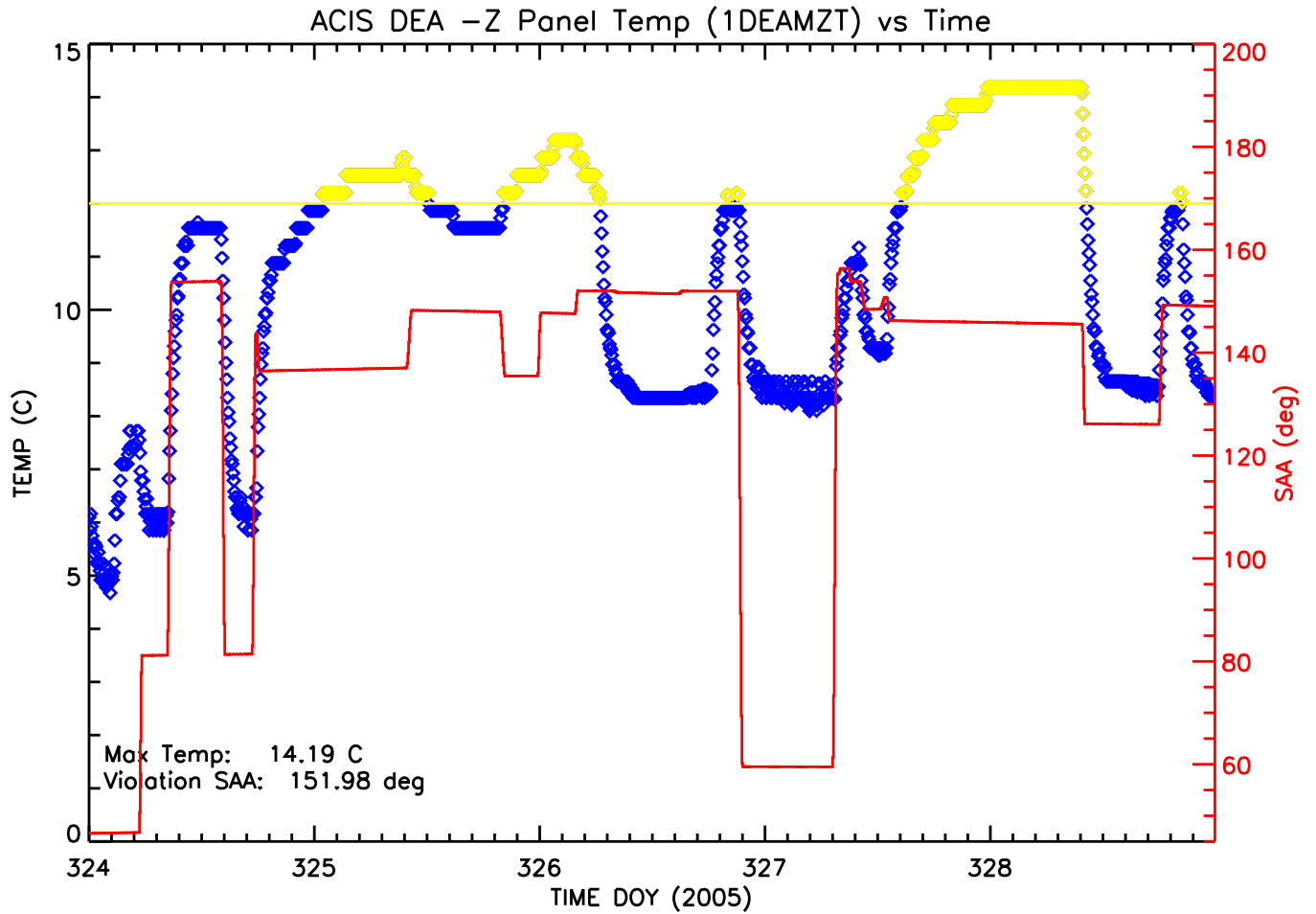


Figure A.2: Plot of temperature versus time for 1DEAMZT yellow high limit trip on days 324-328 of 2005. Included in red on this plot is the SAA for the duration of the trip. The duration listed on the plot is the total time spent above the yellow limit regardless of temperature fluctuations above this level.

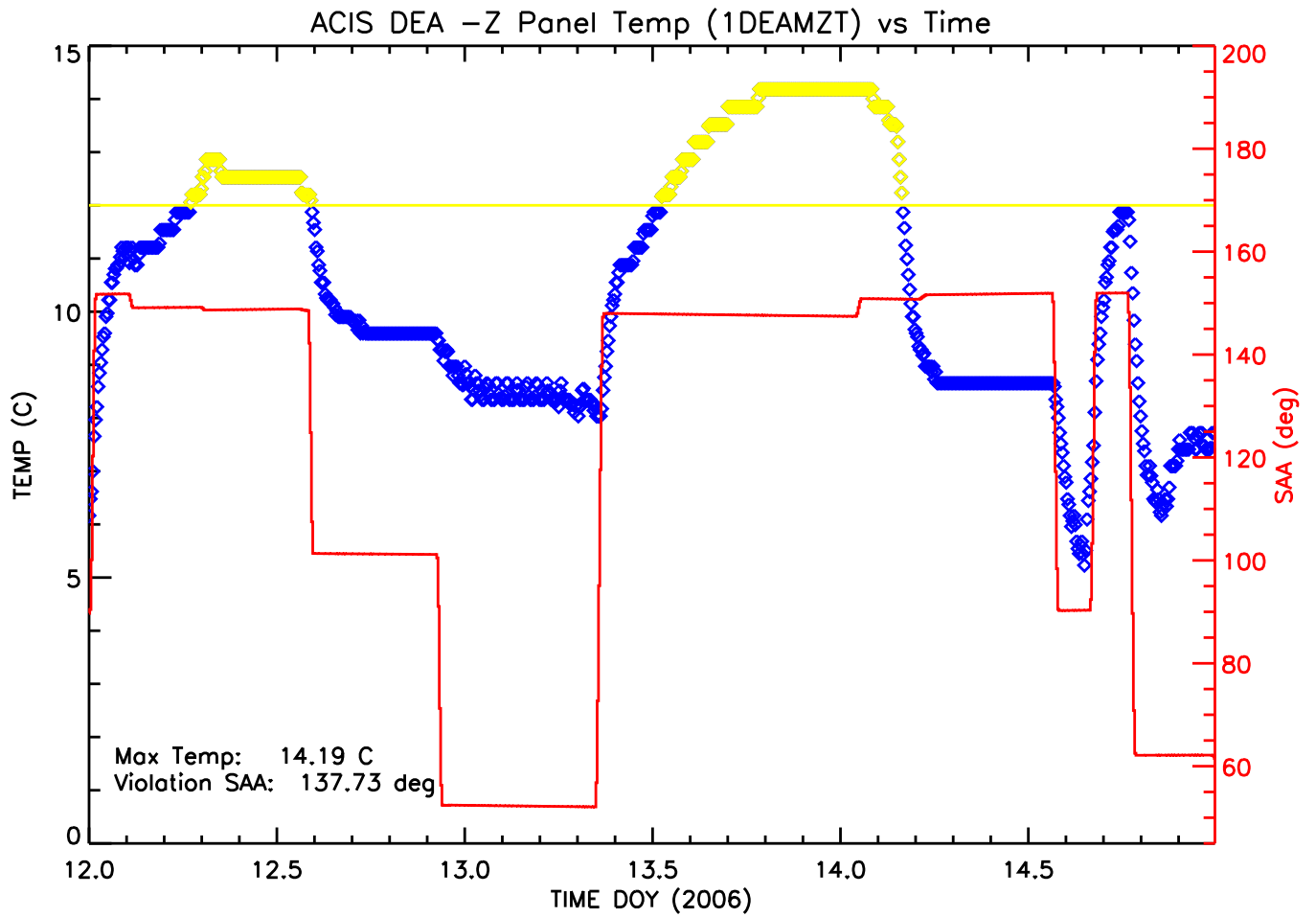


Figure A.3: Plot of temperature versus time for 1DEAMZT during a yellow high limit trip on days 12 and 13 of 2006. Included in red on this plot is the SAA for the duration of the trip. The duration listed on the plot is the total time that 1PIN1AT spent above the yellow limit regardless of temperature fluctuations above this level.

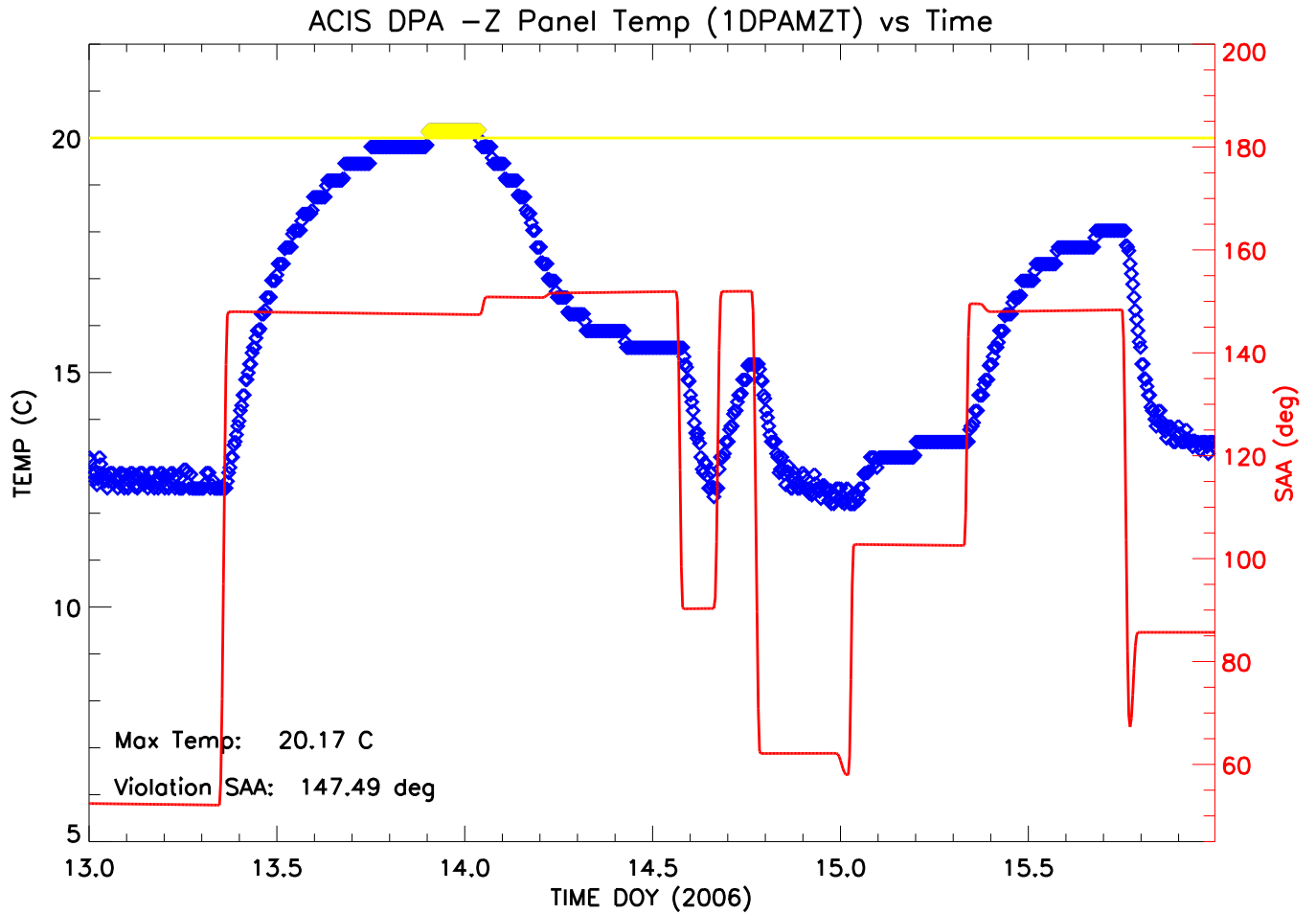


Figure A.4: Plot of temperature versus time for a 1DPAMZT yellow high limit trip on day 13 of 2006. Included in red on this plot is the SAA for the duration of the trip. Notice the extremely sensitive dependence of this thermistor to a small change in SAA.

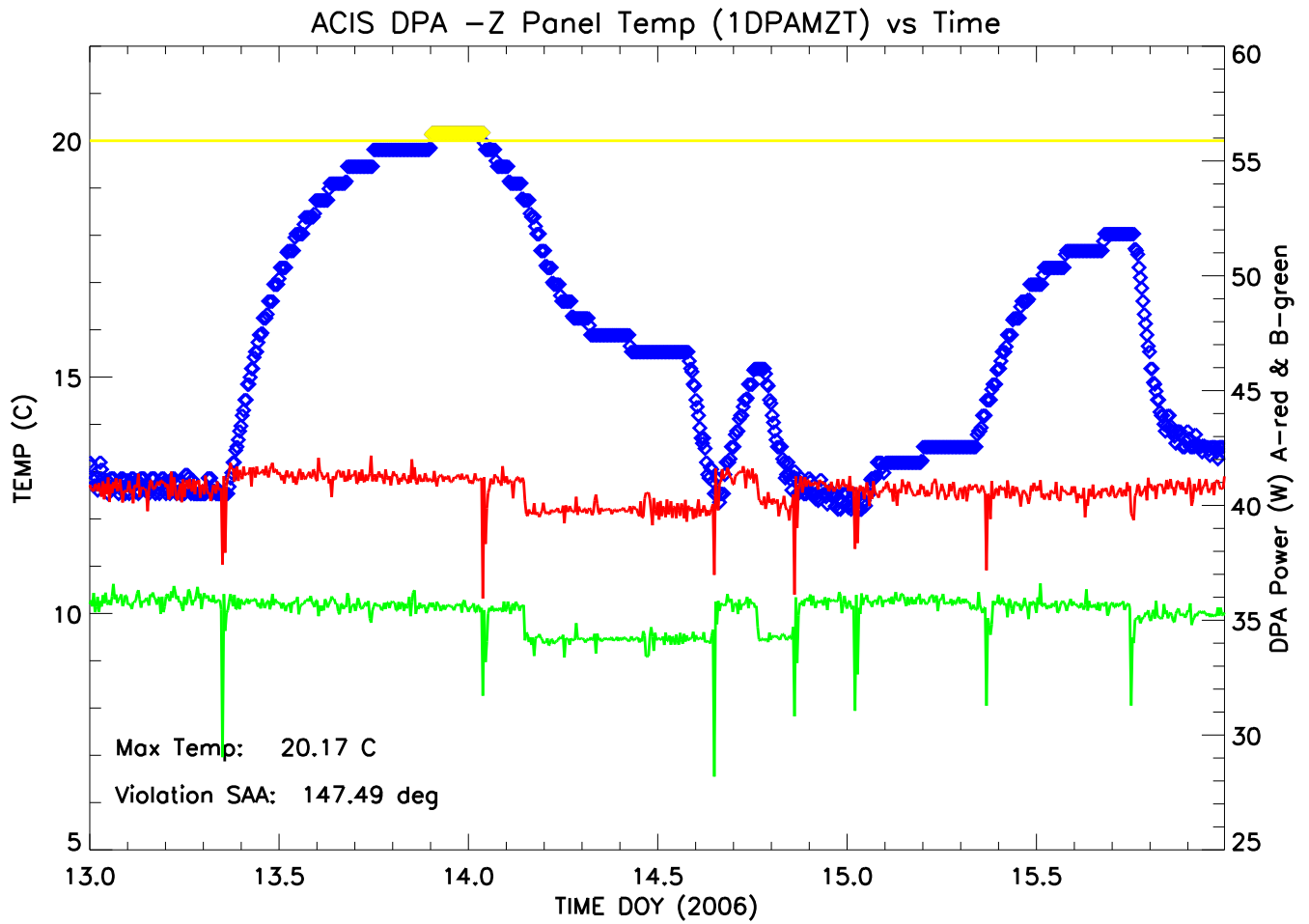


Figure A.5: Another plot of temperature versus time for 1DPAMZT during a yellow high limit trip on day 13 of 2006. Included in red and green on this plot is the DPA power consumption. The slight drop in power after the trip is indicative of commanding the ACIS CCDs for a calibration observation while entering perigee.

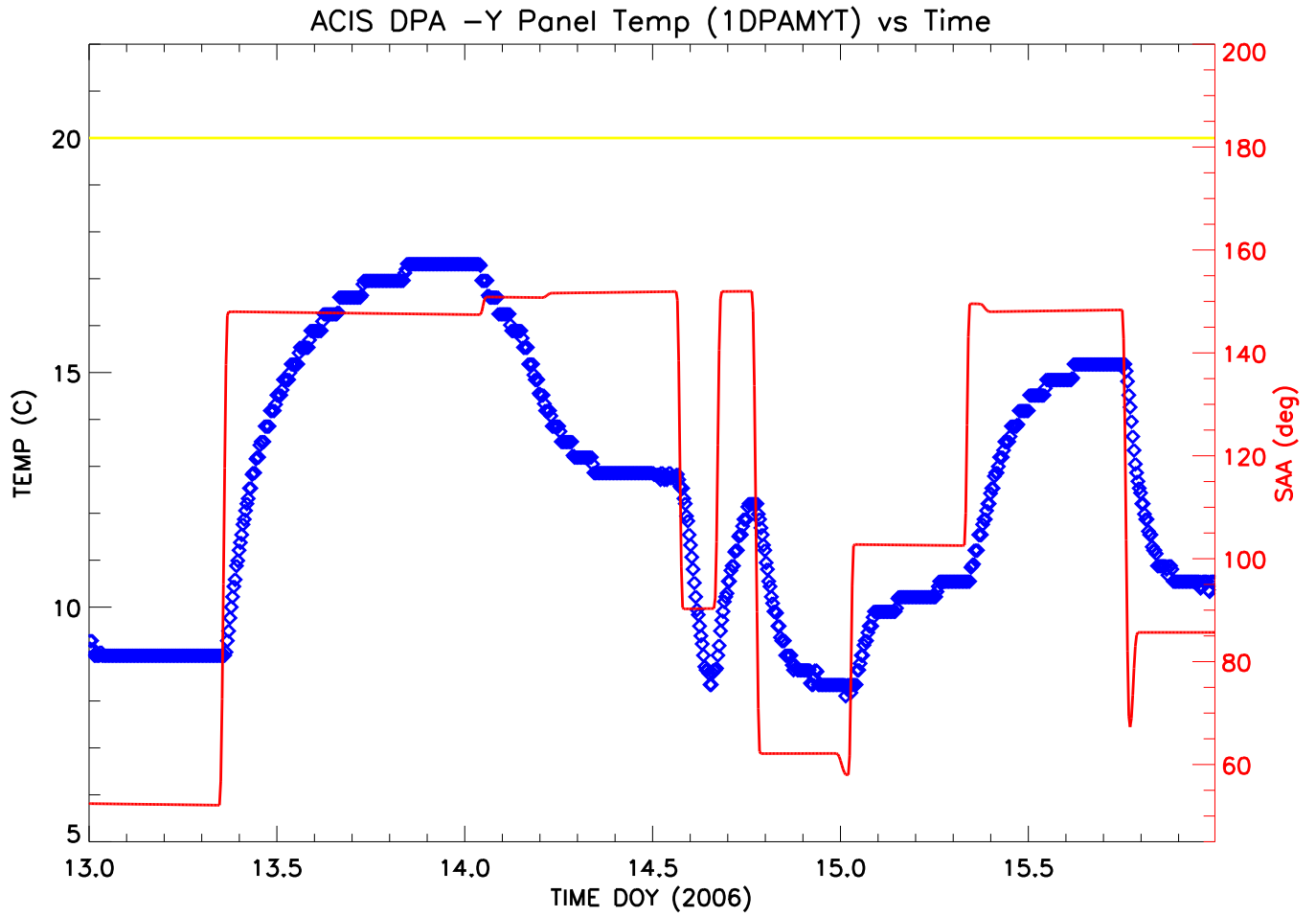


Figure A.6: Plot of temperature versus time for a 1DPAMYT during the 1DPAMZT yellow high limit trip on day 13 of 2006. Included in red on this plot is the SAA for the duration of the trip. Notice the extremely sensitive dependence of this thermistor to a small change in SAA.