10/93

Investigation of HSP VIS Loss in Sensitivity

HSP ISR 17

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I. Abstract

The VIS detector in the HSP has been experiencing a loss in sensitivity over the past two years. This report describes the analysis that shows no evidence suggesting an electronic failure in the VIS detector.

II. Background on VIS Detector

The HSP is comprised of five detectors: Four Image Dissector Tubes (IDT's) and one Photo-Multiplier Tube (PMT). Two of the IDT's, UV1 and UV2, are solar blind ultra-violet detectors, whereas the remaining IDT's, POL, VIS and the PMT, are sensitive to light at visible wavelengths.

The VIS detector has a bialkali cathode on suprasil faceplate which is sensitive from 1600 to 7000 A. The plate for the VIS contains thirteen filters mounted in two rows and positioned 36 mm ahead of the ST focal plane. For each filter plate, there is an aperture plate located at the ST focal surface containing 48 apertures arranged in two columns that are postioned directly behind the corresponding columns of filters. Nine of the filters have two 1.0 arcsecond and two 0.4 arcsecond apertures. In addition, the VIS tube has another aperture through which radiation passes to a dichroic filter that sends red light to the PMT and blue light to the IDT.(1)

III. Throughput on the VIS.

University of Wisconsin analysis of science data obtained with the VIS and POL tubes indicate a loss of sensitivity in the VIS, but not in the POL tube. This trend as first noted in HSP ISR 16, HSP 2912 Calibration Report, (2) is represented in Figure 1, a plot of the total flux from observations of VID998 in all four Image Dissector Tubes taken at various times.(3) Since both detectors, the VIS and the POL, use the same photocathode material and operate under similar conditions, both should experience similar degradation of their respective photocathodes. IDT 1 (POL) shows no loss of sensitivity, and in fact has shown a slight increase in sensitivity since launch. Degradation of the VIS tube was first noticed as a gradual decrease in the throughput of the 5500 A filter (F551W). Since then, loss of sensitivity has been seen on the other filters on the the VIS tube.

IV. Measurement of Flux.

The degradation is found by measuring the flux of the star through the finding aperture (VCLRV_T). Two separate targets, VID998 and BD+75, were used as photometric standards. The accuracy of the flux calibrations is at the level of photon counting statistics or better for the test. The VIS tube sensitivity has decreased by about a factor of 3 to 3.5 from April 91 through June 93.(2)

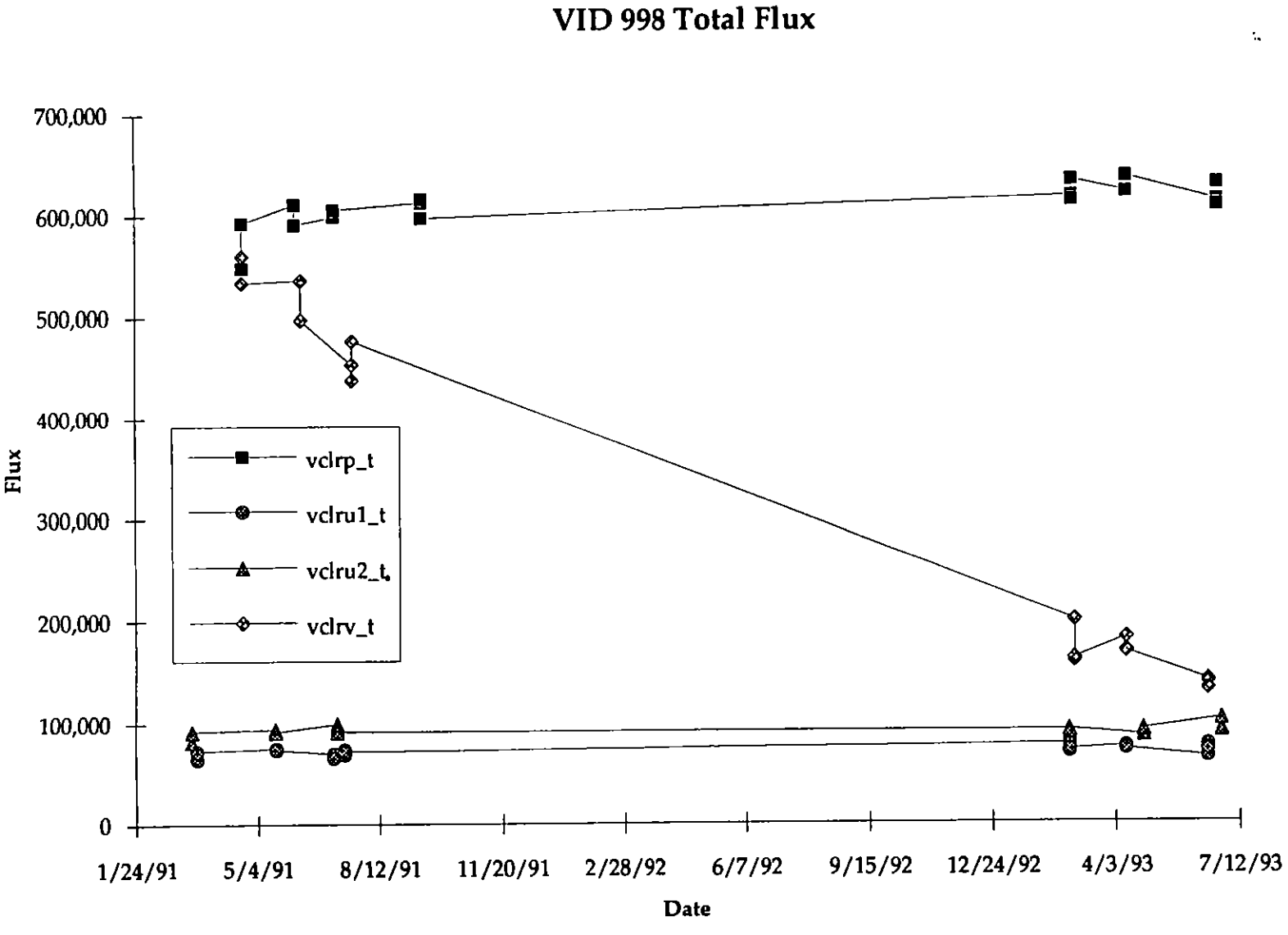


Figure 1: Total Flux from Observations of VID998

V. Trending of HSP Engineering Data for Detector 3.

The electro-mechanical performance for the VIS tube has been trended since January 1991. The detector 3 telemetry parameters monitored are included in table 1. The data were extracted from HSP_SAVE files processed by OMS from AEDP files. Data are incomplete for the period between launch, April 1990, until the end of October 1990 when the OMS system became fully operational. Data drop-outs in the telemetry exist where an HST safing event occured. The plots were generated by using the IRAF task SGRAPH. Figures 2 through 4 show the detector 3 temperature from January 1991 until July 1993. Figures 5 through 7 show the system controller temperature from January 1991 until July 1993.

VI. Conclusions

There has been no trend detected in the performance of any of the HSP Detector 3 electronic components and thermal parameters. Since 1991, the VIS tube engineering data has been nominal. There is no evidence in telemetry to suggest a electro-mechanical failure in the VIS tube.

VII. References

1. Bless, R.C., Richards, E.E., Dolan, J.F., Elliott, J.L., Nelson, M.J., Percival, J.W., Robinson, E.L., Taylor, M.J., Van Citters, G.W., and White, R.L., "The Hubble Space Telescope's High Speed Photometer", 1993, in preparation.

2. Nelson, M.J., HSP ISR 016, "HSP 2912 Calibration Report", Dec. 1992. Space Astronomy Laboratory, 4514 Sterling Hall, University of Wisconsin, Madison, Wisconsin, 53706

3. Evan E. Richards Space Science and Engineering Center, 1225 West Dayton Street, University of Wisconsin, Madison, Wisconsin 53706

TELEMETRY	DESCRIPTION	ABSOLUTE LIMITS MIN	MAX	LEAST SIGNIFICANT BIT EQUALS
V320	HVPS 3 OUTPUT MONITOR	1400	2590 V	5.5 V
V321	Threshold 3	-31	4205 mV	16.6 mV
V324	Focus 3	63	93 mAmps	0.11 mAmps
V325	Detector Suppy 3 P15	0.0	17.0 Volts	0.07 V
V326	Detector Supply 3 M15	0.0	-17.0 Volts	0.07 V
V327	Detector Supply 3 P05	0	5.34 Volts	0.02 V
V328	Temp Detector 3	-61	68 DegC	0.5 DegC
V329	Temp DEA 3	-61	68 DegC	0.5 DegC
V350	System Controller	-61	68 DegC	0.5 DegC
V372	Current-Voltage Amp 3	0	12.5 Volts	0.05 V

Table 1: Detector 3 telemetry parameters monitored.

Figure 2: **HSP DETECTOR 3 TEMPERATURE DURING 1991**

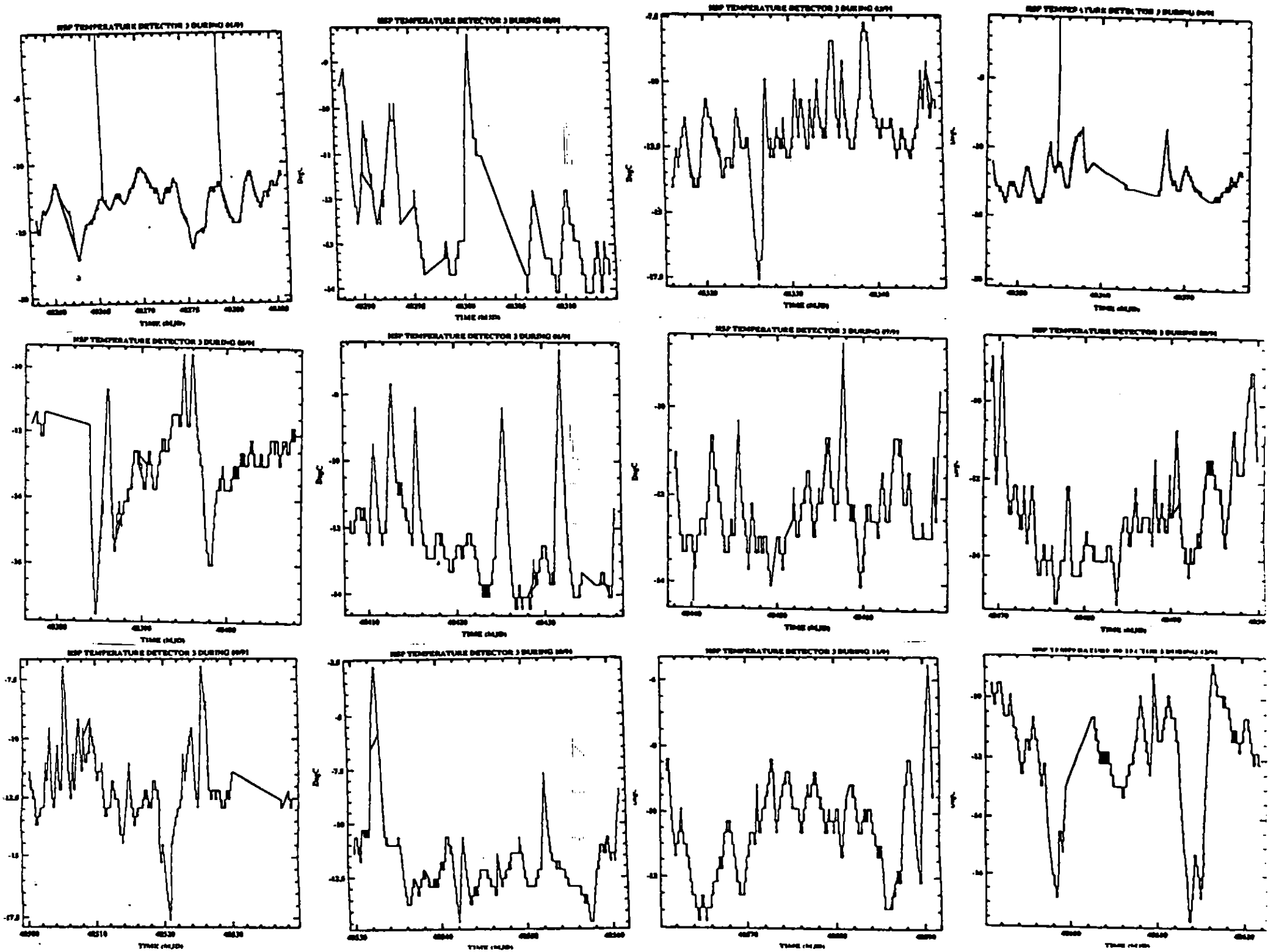


Figure 3:

HSP DETECTOR 3 TEMPERATURE DURING 1992

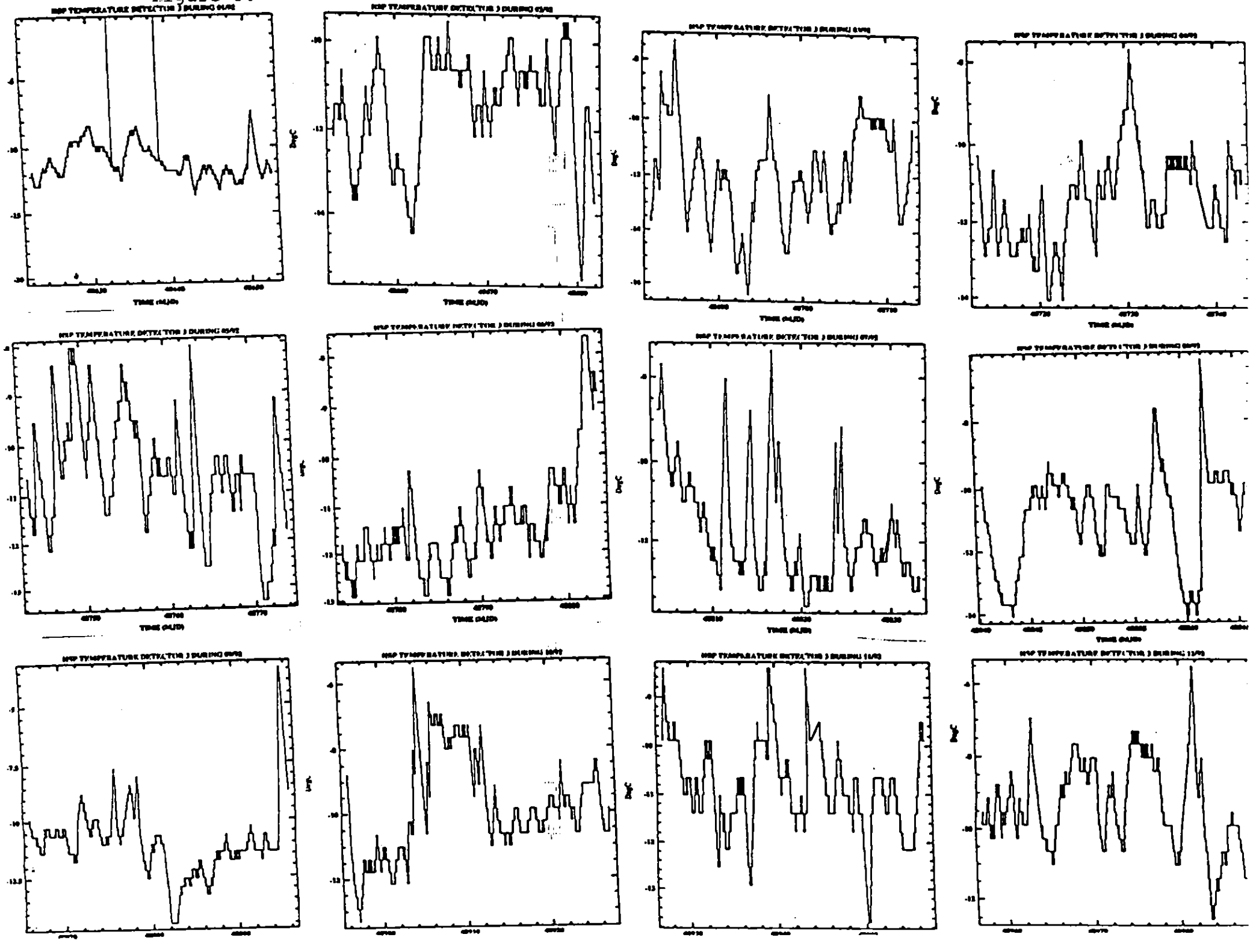
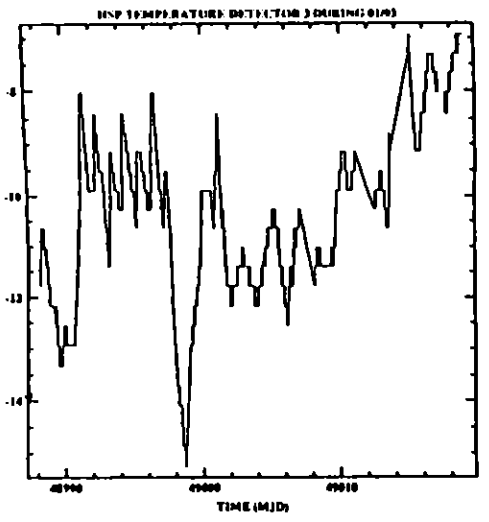
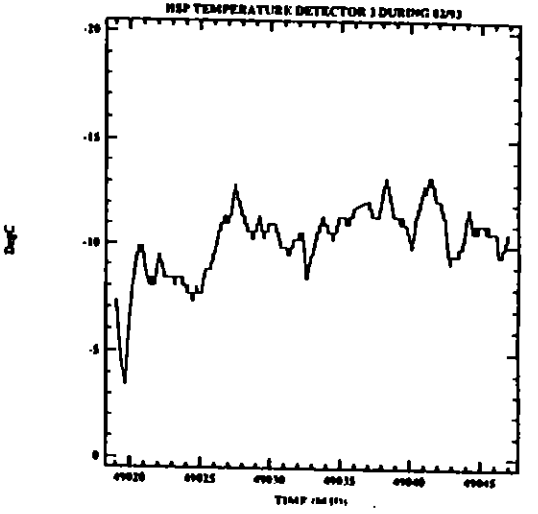
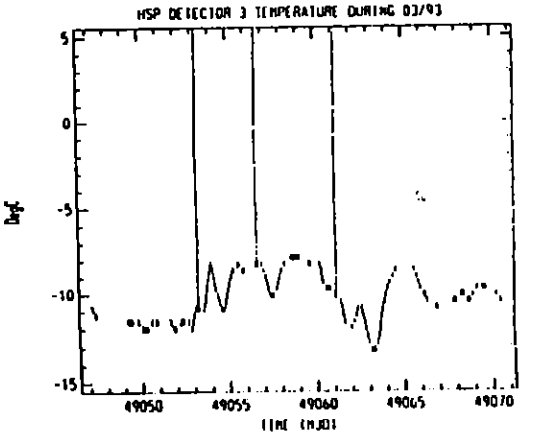
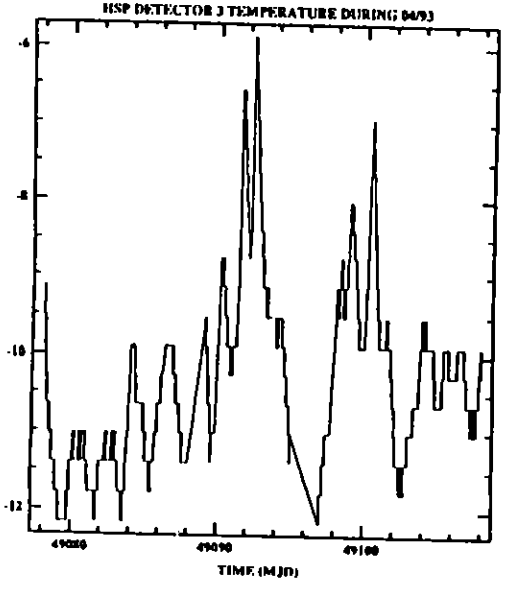


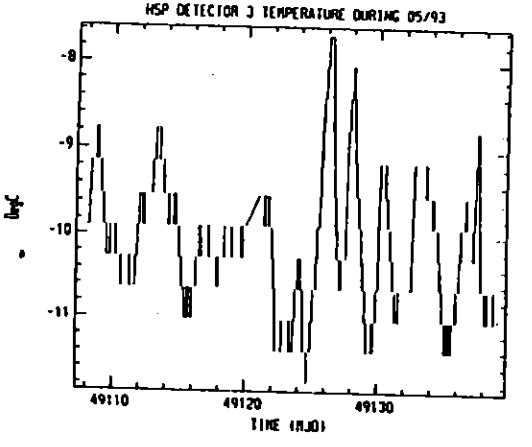
Figure 4: **HSP DETECTOR 3 TEMPERATURE DURING 1993**

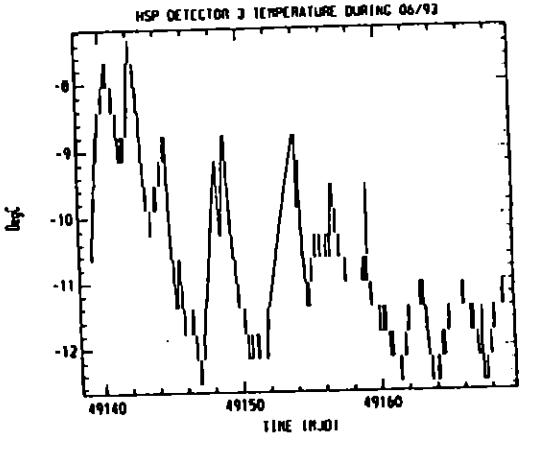












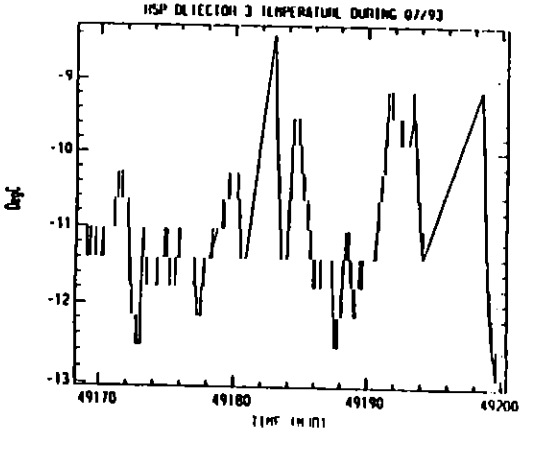


Figure 5: **HSP SYSTEM CONTROLLER TEMPERATURE DURING 1991**

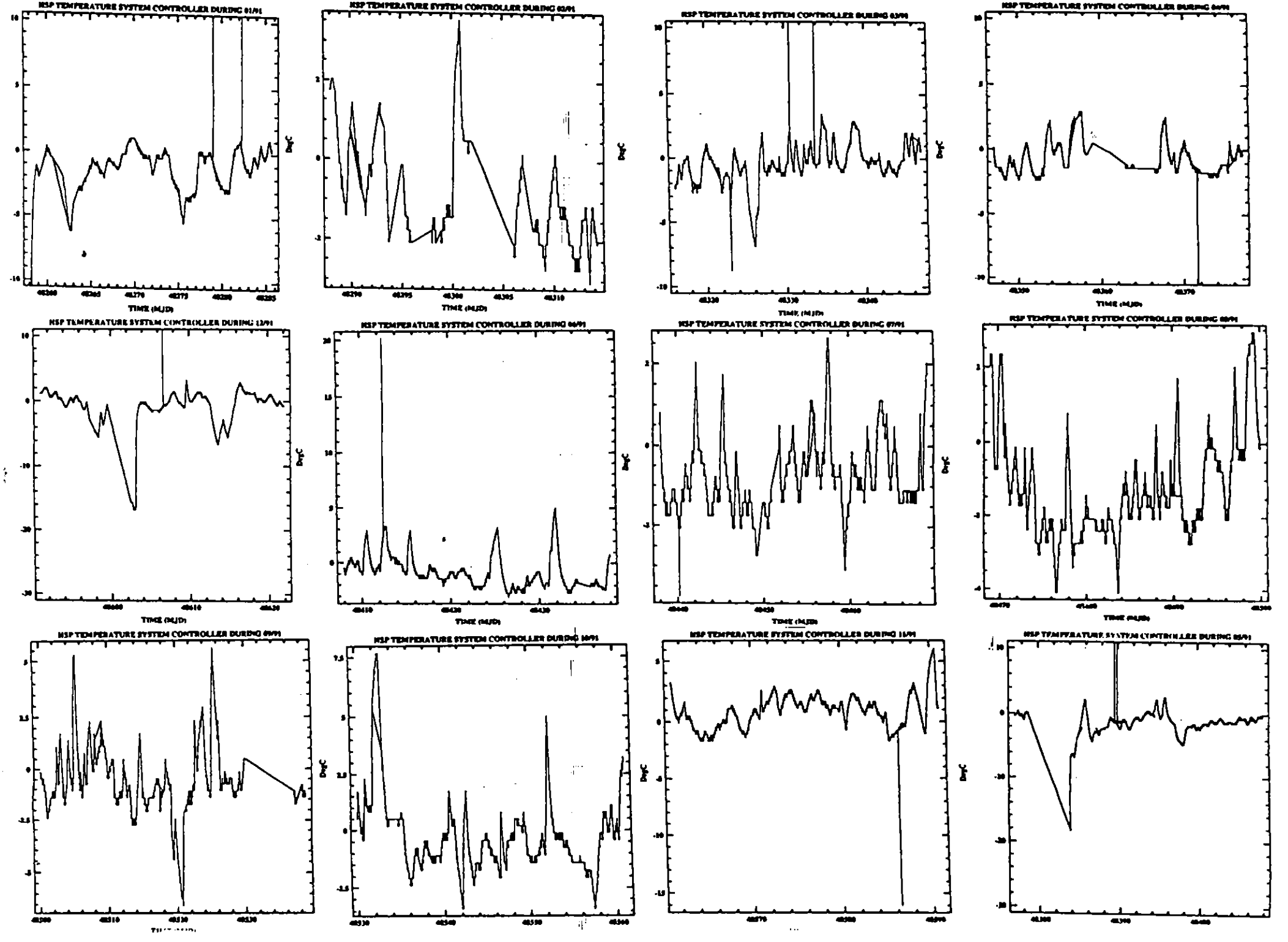


Figure 6: **HSP SYSTEM CONTROLLER TEMPERATURE DURING 1992**

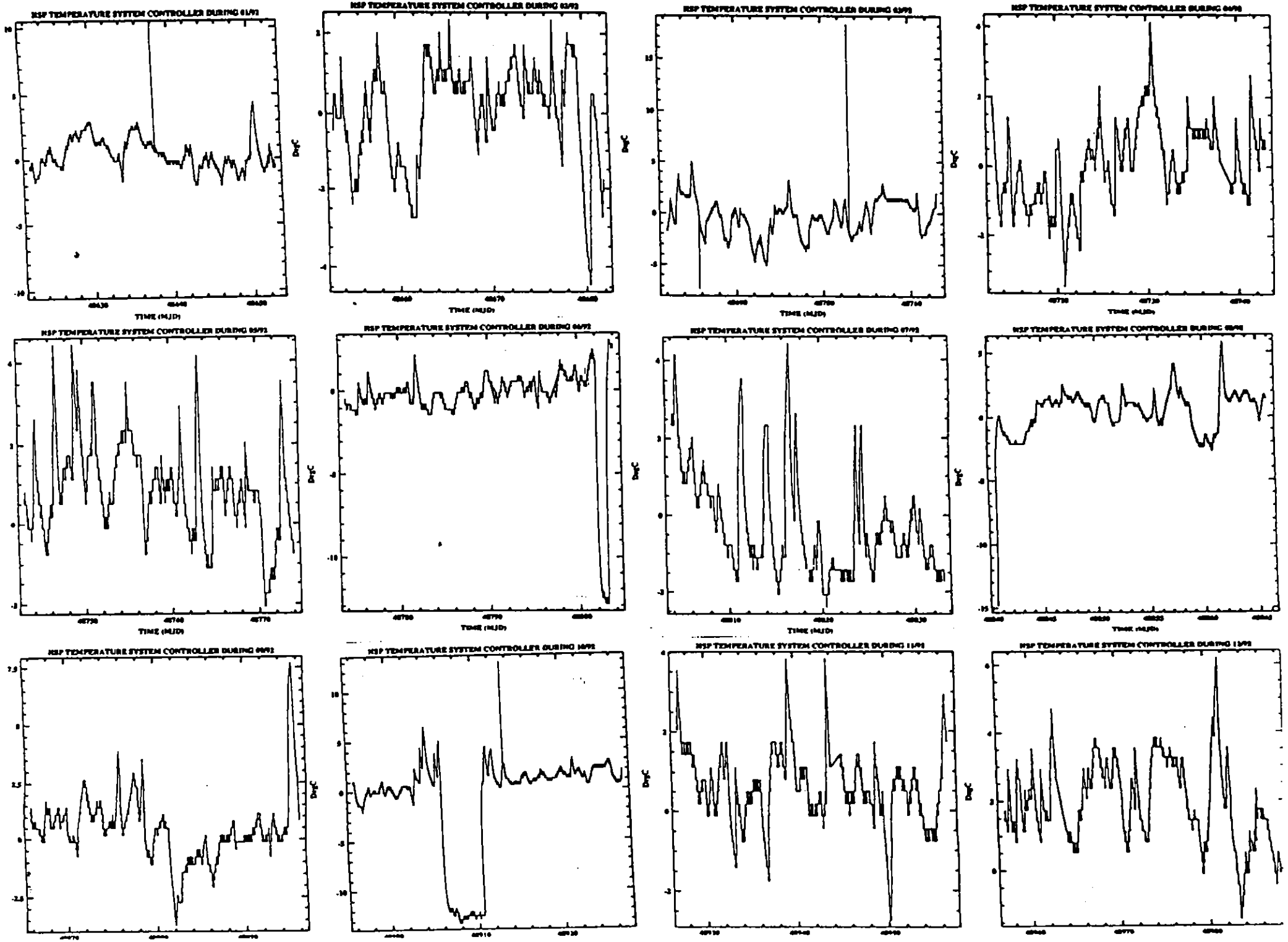


Figure 7: **HSP SYSTEM CONTROLLER TEMPERATURE DURING 1993**