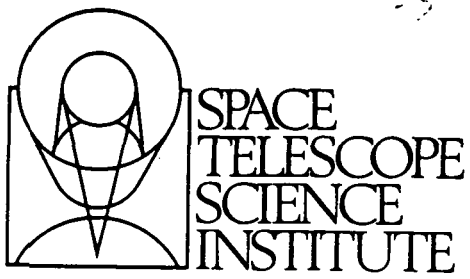


P-158

# Hubble Space Telescope

# Cycle 1 Calibration Plan



**Version 1.0**

**May 1990**

## Revision History

| | |
|---|---|
| Version 1.0 | May 1990; edited by Peggy Stanley & Chris Blades |

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# Proposed Calibration Plan for Cycle 1 Observations for the OTA, FGS's and 5 Scientific Instruments

Prepared by Staff in the Telescope & Instruments Branch
of the Science Programs Division

May 1990

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| | |
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# 1.0 EXECUTIVE SUMMARY

## 1.1 Introduction

The framework for quantitative scientific analysis with HST will be established from a detailed calibration program, and a major responsibility of staff in the Telescope & Instruments Branch (TIB) is the development and maintenance of this calibration for the instruments and the telescope. The first in-orbit calibration will be performed by the SI Investigation Definition Teams (IDTs) during the Science Verification (SV) period in Cycle 0 (expected to start 3 months after launch and last for 5 months). Subsequently, instrument scientists in the TIB become responsible for all aspects of the calibration program. Because of the long lead times involved, TIB scientists have already formulated a calibration plan for the next observing period, Cycle 1 (expected to last a year after the end of SV), which has been reviewed and approved by the STScI Director. The purpose of this document is to describe the contents of this plan.

Our primary aim has been to maintain through Cycle 1 the level of calibration that is anticipated by the end of SV. Anticipated accuracies are given in Table 2.3 of this document—of course, these accuracies can only be best guesses because we do not know how each instrument will actually perform on-orbit. The calibration accuracies are expected to satisfy the normal needs of both the General Observers (GOs) and the Guaranteed Time Observers (GTOs).

A major driving force in defining the plan has been the number of hours expected to be available during Cycle 1 for calibration. Assuming 30 percent observing efficiency, the total number of hours available for spacecraft pointing will be 2628 hours in Cycle 1. The time available for calibration is 10 percent of this time, i.e. 263 hours. Additional time is expected to be available for internal and parallel calibration observations. This is a limited resource and must be handled carefully. There are two working assumptions: namely, that the SV calibration plan is largely achieved with well-calibrated instruments handed over by the IDTs; and, second, that the SIs are stable instruments and will remain stable from SV through Cycle 1, and beyond. (An instrument that exhibits a rapidly changing sensitivity or has unstable apertures will be extremely time consuming and awkward to calibrate and to schedule.) With this philosophy we have been able to minimize the number of repeat calibrations in Cycle 1.

Calibration data and results are needed by three operational systems: the Project Data Base (PDB), the Instruction Management Data Base (IMDB), and the Calibration Data Base (CDB)/Routine Science Data Processing (RSDP) in the Post-Observation Data Processing System (PODPS). These operational systems will not function adequately without current and accurate SI calibration data. Such programs (i.e. aperture location, instrument sensitivity) have the highest priority in the calibration program. We have noted such usage in the individual summary tables.

Our secondary aims have been to improve specific SI calibrations that were not addressed during Cycle 0 but which are needed by the GOs and to find ways to optimize SI usage and make the Observatory perform in a more efficient manner. Information about instrument performance and calibration will appear in the SI Handbooks, Instrument Reports, and ST ScI Newsletter articles.

## 1.2 Scope and Purpose

The purpose of this document is to give the scope of the proposed Cycle 1 calibration plan. In section 2 of this document, we provide the schedule of activities, the timing summaries

and the SV and Cycle 1 calibration goals. In section 3 we present the details of each proposed calibration activity. These are worked out to the level of a Phase II submission and have undergone the normal proposal validation procedures.

### 1.3 Steady State Calibration Flow

Figure 1.3 depicts the basic 4 flows of the calibration process. They show the general flow of the calibration plan from development (phase I), Director's review (phase II), planning and scheduling (phase III) through to operations and analysis (phase IV).

### 1.4 SI Team Structure

We recognize that the calibration program makes use of a substantial amount of HST observing time. Hence we must be responsible in how we use that time and make sure that essentially no time is wasted, for example, by poor calibration design or lack of data analysis. Accordingly, we have assigned named instrument scientists as PIs for each of the individual calibration programs. The assigned scientists, along with the technical assistant(s) working in each instrument team, are responsible for the subsequent data reduction and implementation of results. The members of each instrument team and the calibration teams are given in Figure 1.4.

Data analysis will be performed mainly on the Sun workstations, networked together via a central file server. These machines are now in place and the cluster is called TIB. IRAF/STSDAS/CDBS will be the principal data reduction software. Copies of the replicated instrument pipelines are installed to test new reference files and calibration procedures. The Data Management Facility (DMF) is expected to be an important archive for our calibration work, where reference files and relations, as well as original HST data, will be maintained.

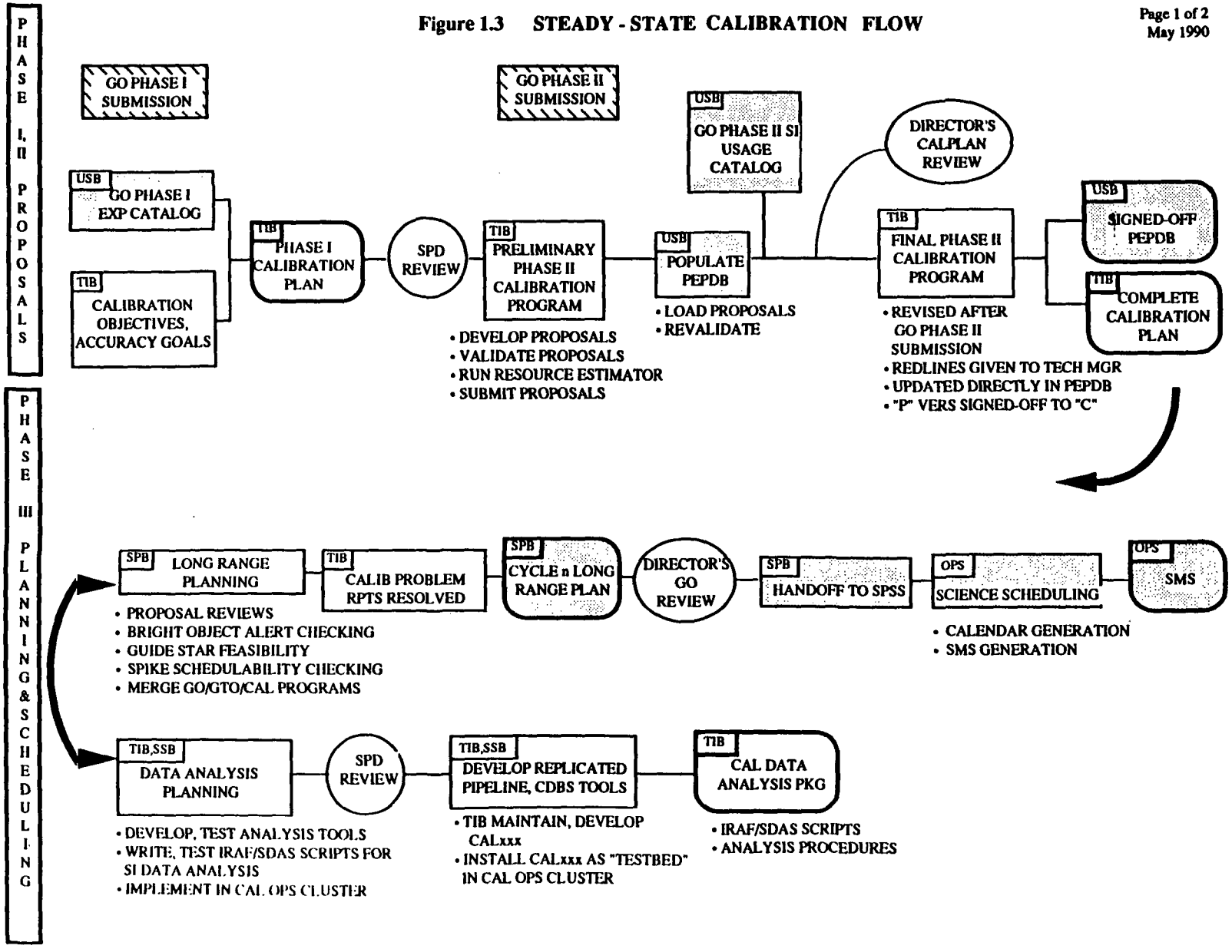
Processing updates to the operational data bases, namely the PDB, IMDB, and PODPS RSDP, will be centralized through the designated Project Lead in the TIB and will be subject to the appropriate level of CCB review. These procedures are currently being established and will be documented separately.

## 2.0 CALIBRATION PLAN SUMMARY

### 2.1 Calibration Plan Development Schedule

Figure 2.1 presents the schedule and timeline for development, review and release of the Cycle 1 calibration plan. Also note that a review cycle is planned near the mid-to-end of SV to assess the stability of the Observatory and to revise our plans for the calibrations planned for the latter half of Cycle 1. For example, if an SI's aperture locations are found to be extremely stable during SV, we might elect to delete a series of repeated aperture location measurements. Or, if the aperture locations are not as stable as predicted, we might have to add repeats. Due to the level of pre- & long-range planning that will already have been performed on the Cycle 1 programs prior to this mid-to-end of SV assessment, revisions to the Calibration Plan will generally only be made to the last 6 months of the program. Revisions to the first 6 months will only be permitted where health & safety concerns arise or where "critical-path" activities are affected, i.e., ability to acquire targets, location of spectra.

## Figure 1.3 STEADY - STATE CALIBRATION FLOW



## Figure 1.3 STEADY - STATE CALIBRATION FLOW

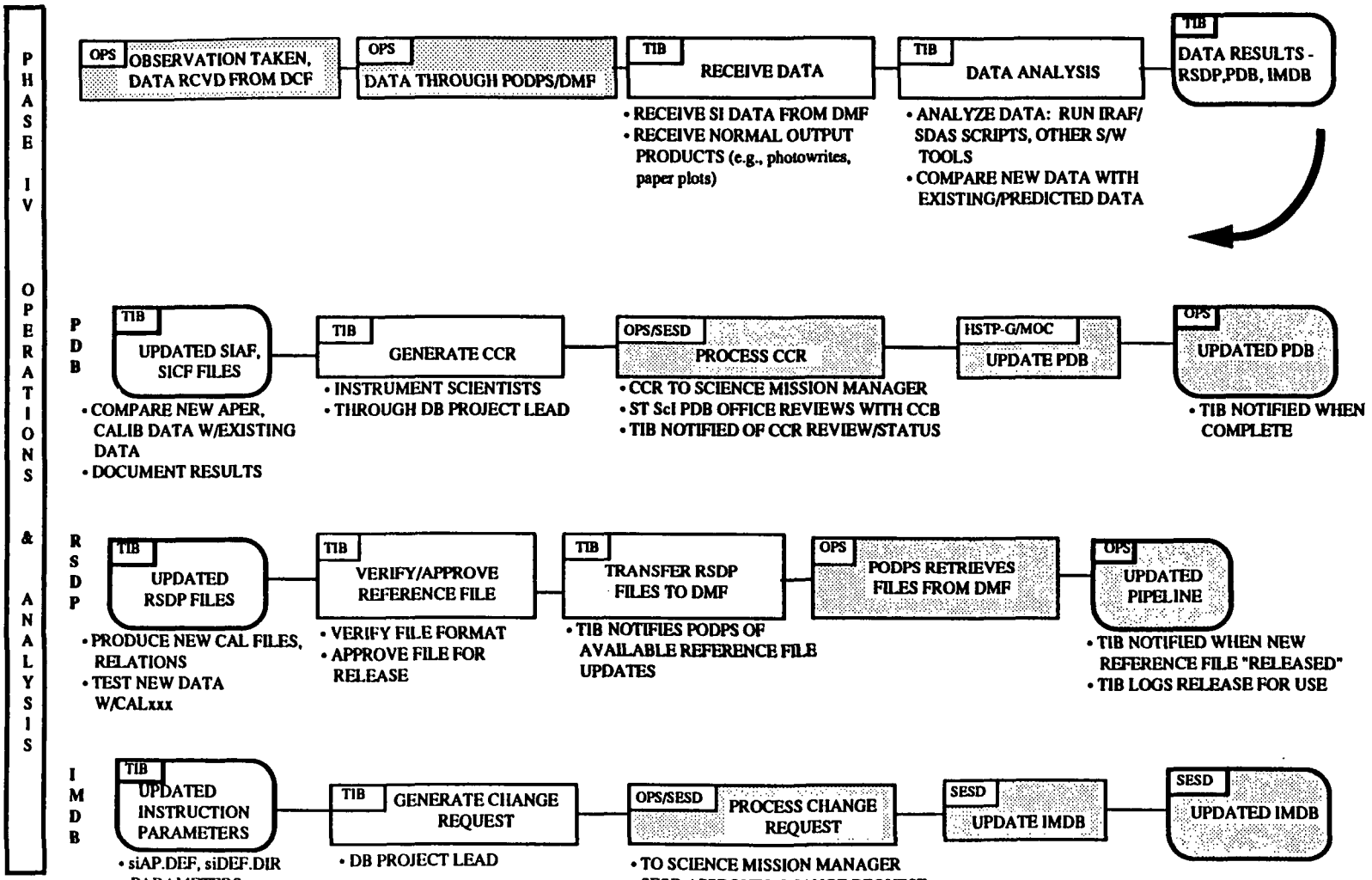
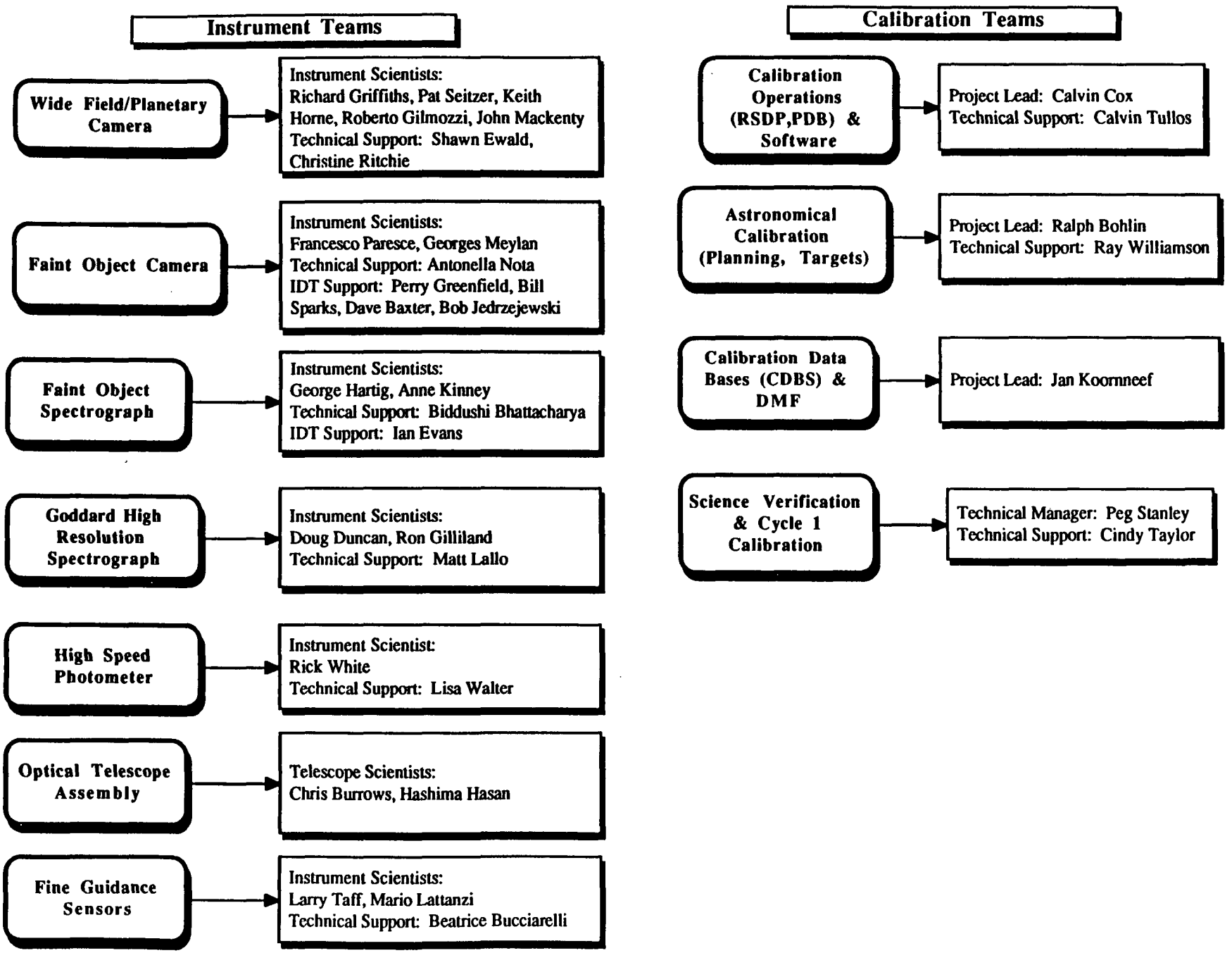
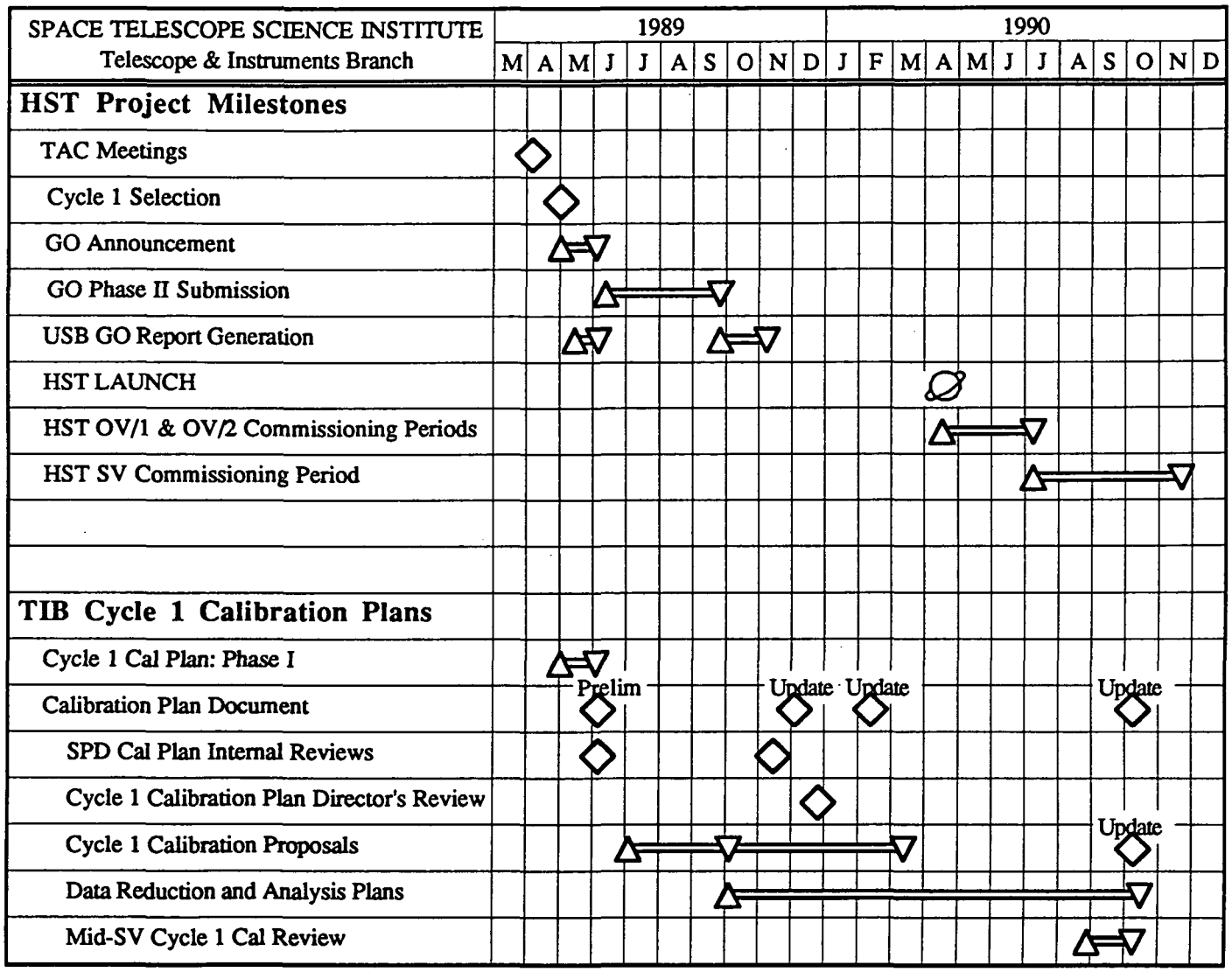


**Figure 1.4 Telescope & Instrument Branch**



## Figure 2.1 CYCLE 1 CALIBRATION PLAN DEVELOPMENT SCHEDULE



## 2.2 Cycle 1 Calibration Timing Summary Charts

Table 2.2 presents the total time proposed for our Cycle 1 calibration plan. Tables 3.1 through 3.7 present the timing summary charts for each SI and the OTA. In these charts, each calibration activity is identified by its Phase II proposal identifier(s), the calibration type/title, the type of result expected, the baseline SV program proposal identifier, the accuracy objectives, estimated prime or non-prime observing time, and the number of GO and GTO exposures supported by the calibration.

## 2.3 End-of-SV Accuracies and Cycle 1 Calibration Goals

Table 2.3 documents the calibration accuracies expected at the end of SV and our goals for maintaining or improving the calibration during Cycle 1. These accuracies reflect the contents of the SV Minimum Plan, as reduced during May 1989 "SV scrub" process.

## 2.4 Cycle 1 Calibration Targets

Table 2.4 lists the standard calibration targets used in our Cycle 1 calibration plan. The table is categorized by Astrometric, Absolute Sensitivity, Wavelength, Flat Field, or Linearity standard. We also present the proposal identifiers that use each target, along with the target position, magnitude, and spectral type. The CDBS LOGICAL entries identify the system logicals used, along with the TARGET ID + a counter, to access calibration data for each target in the CDB. Appendices A and B provide back-up data to this table. Appendix B provides the CR_SPECTRUM flux vs. wavelength plots for the Cycle 1 calibration objects and Appendix C describes the RSDP and CDBS routines available and provides examples of how to use CDBS Logicals.

# 3.0 CALIBRATION PLAN FOR CYCLE 1

The following sections describe the calibration plans for each SI, the OTA and observatory-level calibrations. Following the brief introduction, the timing summary charts described in paragraph 2.2 are presented. A description of each calibration activity extracted from its Phase II proposal cover page and general form entries are provided in Appendix A.

## Table 2.2 PROPOSED CYCLE 1 CALIBRATION PROGRAM SUMMARY

| SI | EXTERNAL OBSERVATIONS (S/C hrs) | | | INTERNAL/PARALLEL OBSERVATIONS (S/C hrs) | | |
|---|---|---|---|---|---|---|
| | CALIBRATION | ENGINEERING | TOTAL | CALIBRATION | ENGINEERING | TOTAL |
| FGS | 27 | 4 | 31 | -- | -- | -- |
| FOC | 27 | 18 | 45 | 33 | 4 | 37 |
| FOS | 36 | 7 | 43 | 8 (minimum... up to 50) | 7 | 15 |
| GHRS | 26 | 1 | 27 | 16 | 7 | 23 |
| HSP | 11 | 14 | 25 | 8 | 41 | 49 |
| WF/PC | 44 | 30 | 74 | 205 | -- | 205 |
| OTA/OLT | 25 | 3 | 28 | 4 | -- | 4 |
| **TOTALS** | **196** | **77** | **273** | **274** | **59** | **333** |

TOTAL HOURS IN CYCLE 1: 8,760
TOTAL EXTERNAL OBSERVATION S/C HOURS IN CYCLE 1 @ 30% EFFICIENCY: 2, 628
"POLICY 13" EXTERNAL OBSERVATION HOURS FOR CALIBRATION : 263

## Table 2.3 Cycle 1 Calibration Accuracy Goals

| FGS => | | MAINTAINED | IMPROVED |
|---|---|---|---|
| Positional Astrometry | 3 MAS | X | |
| (For a relative position based on 10 reference stars - nominal) | | | |
| Single Star Apparent Diameters | 3 MAS for D in [5,50] MAS | X | |
| Single Star Color Index | 0.1 MAG for C in [-1.0,+1.0] MAG | X | |
| Double Star Astrometry | 3 MAS | X | |
| (For separations in the range [5,50] MAS. Comparable relative precision for position angle) | | | |
| Photometry | 1% | X | |

| FOC => | f/96 | f/48 | MAINTAINED | IMPROVED |
|---|---|---|---|---|
| Dark Count | ~5% | ~5% | X | |
| Flat Fields | 5-10% | 5-10% | X | |
| Absolute Calibration | ~10% | 10-25% | X | |
| Geometric Distortion | ~0".005 | | X | |
| Reseau Positions | ~0".002 | | X | |
| Spectrograph Absolute Calibration | | 10-20% | X | |
| Wavelength Calibration | | 15 km s-1 | X | |
| UBV Photometry | ~20% | 20-50% | X | |
| Obj Prism Absolute Cal | 25-50% | 25-50% | X | |
| Polarization | ~15% | | | |

| FOS => | Apertures | Dispersers | | MAINTAINED | IMPROVED |
|---|---|---|---|---|---|
| Flat Fields | 0.3,0.5,1.0 | All | 5% | X | X |
| Absolute Sensitivity | 0.5, 1.0 | Select | 3% | X | X |
| Relative Sensitivity | 0.5, 1.0 | Select | 10% | X | |
| Internal Wavelength | All | All | 0.03 diodes | | |
| External Wavelength | All | All | 0.2 diodes | X | X |
| Polarization Amount | | | 0.1% | X | X |
| Polarization Angle | | | $0^{o}.5$ | X | X |

| GHRS => | | MAINTAINED | IMPROVED |
|---|---|---|---|
| Wavelength Calibration | +/- 1 diode | | |
| | +/- 2 diodes (w/cal lamp obs) | X | |
| Carrousel Repeatability | 0.05 diodes | X | |
| Point Spread Function | 1.0-1.2 diodes | X | |
| Paired-Pulse Correction | ≤ 1% | X | |
| Absolute Flux Calibration | ≤ 10% | X | |

| HSP => | | MAINTAINED | IMPROVED |
|---|---|---|---|
| Relative Photometry | 1% | X | |
| Absolute Photometry | ~1% | X | |

## Table 2.3 Cycle 1 Calibration Accuracy Goals (continued)

| WF/PC => | | | MAINTAINED | IMPROVED |
|---|---|---|---|---|
| Pre-Flash | 2% | (standard level only) | X | |
| Dark Counts | 5% | | X | |
| Flat Field | 2% | (for filters longward of F336W) | X | |
| Absolute Calibration | 3% | (for filters longward of F220W based on obs. of Omega Cen/NGC6752 standard star field) | X | |
| Point Spread Function | TBD | (based on obs. of Omega Cen field) | X | |
| Baum Spot Position | 0.03" pixel | (no measure of attenuation - no flat field within spot.) | X | |
| WF/PC to FGS Offset | 0.03" | | X | |
| Grism Wavelength | TBD | | X | |
| Grism Sensitivity | 10% | | X | |
| UV Observations | TBD | (cal. of filters shortward of F230W will occur immediately after the UV Flood) | X | |

| OTA/OLT => | | MAINTAINED | IMPROVED |
|---|---|---|---|
| SI Focus | 0.4 mm | X | |
| (guaranteed in despace of aperture w.r.t. OCS focal plane- possibly 0.2mm or better) | | | |
| Mid- & Near-Angle Scattering (S/N varies with off axis angle) | S/N of 5 or better | | |
| Baffle Rejection Measurement | Model with results to better than 50% | | |
| Ram Degradation | 3% throughput variations | X | |

**TABLE 2.4**
**Cycle 1 Calibration Targets**

| TARGETID | Proposal ID | $\alpha$ (2000) | $\delta$ (2000) | $V$ | $B-V$ | Spectral Type | CDBS LOGICAL* |
|---|---|---|---|---|---|---|---|
| *ASTROMETRY:* | | | | | | | |
| 47-TUC-F1 | FOC-2807 | $0^h\ 19^m\ 39^s.9$ | $-72°\ 01'\ 03''$ | | | | N/A (Stepping) |
| NGC188-229 | HRS-2839 | 0 39 05.97 | +85 09 21.62 | 12.02 | +0.32 | | CRCLUSTERPOS** |
| NGC188-014 (VID998) | HSP-2864 | 0 42 43.117 | +85 14 14.20 | 9.58 | +0.50 | | CRCLUSTERPOS** |
| NGC188-031 | FOS-2825 | 0 44 59.770 | +85 11 51.21 | 15.08 | +0.64 | | CRCLUSTERPOS** |
| NGC188 | FOC-2807 | 0 46 34.004 | +85 14 34.64 | | | | CRCLUSTERPOS** |
| | FOC-2816 | | | | | | |
| OMEGA-CEN | WFPC-2877 | 13 25 27.0 | −47 35 54 | | | | CRCLUSTERPOS (TBS) |
| *ABSOLUTE SENSITIVITY:* | | | | | | | |
| 47-TUC-F1 | FOC-2838 | 0 19 39.9 | −72 01 03 | | | | CRFIELDS, CRCALSPEC (TBS) |
| BPM16274 | FOC-2808 | 0 50 03.18 | −52 08 17.4 | 14.20 | −0.05 | DA2 | CRCALSPEC |
| | FOC-2810 | | | | | | |
| | FOC-2814 | | | | | | |
| | FOC-2815 | | | | | | |
| 3C48 | FOC-2815 | 1 37 41.28 | +33 09 35.0 | | | | NOT HST STD |
| HZ4 | FOC-2808 | 3 55 21.70 | +9 47 18.7 | 14.52 | +0.08 | DA4 | CRCALSPEC |
| | FOC-2810 | | | | | | |
| | FOC-2814 | | | | | | |
| | FOC-2815 | | | | | | |
| | FOS-2823 | | | | | | |
| | FOS-2824 | | | | | | |

* Calibration data for this target may be accessed by using the system logical listed plus the TARGETID plus a counter which can be found through the database, e.g. crcalspec:hz4_001.tab is the table of calibration spectrophotometry for target HZ4.

** Calibration data for this target is directly installed into the calibration database as a relational table and must be accessed using the IRAF database query task stsdas.stlocal.stdb.cdbsutil.query.

**TABLE 2.4** *Continued*

| Targetname | Proposal ID | $\alpha$ (2000) | $\delta$ (2000) | $V$ | $B-V$ | Spectral Type | CDBS LOGICAL* |
|---|---|---|---|---|---|---|---|
| *ABSOLUTE SENSITIVITY: (Continued)* | | | | | | | |
| LB227 | FOC-2808<br>FOC-2810<br>FOC-2814<br>FOC-2815 | $4^h\ 09^m\ 28^s.76$ | $+17°\ 07'\ 54''.4$ | 15.34 | +0.05 | DA4 | CRCALSPEC |
| HZ2 | FOC-2808<br>FOC-2810<br>FOC-2815 | 4 12 43.51 | 11 51 50.4 | 13.86 | −0.05 | DA3 | CRCALSPEC |
| G191B2B | HSP-2912<br>FOS-2823<br>FOS-2824<br>WFPC-2879 | 5 05 30.62 | +52 49 54.0 | 11.78 | −0.32 | DA0 | CRCALSPEC |
| M42 | WFPC-2875 | 5 35 11 | −5 22 21 | | | | N/A (QEH Monitoring) |
| MU-COL | HRS-2840<br>HRS-2842 | 5 45 59.92 | −32 18 23.4 | 5.17 | −0.28 | O9V | CRCALSPEC |
| BD_75D325 | HRS-2843<br>HSP-2912<br>FOS-2823 | 8 10 49.31 | +74 57 57.5 | 9.54 | −0.32 | O5p | CRCALSPEC |
| AGK_81D266 | HSP-2912<br>WFPC-2874<br>WFPC-2913<br>WFPC-2914 | 9 21 19.06 | +81 43 28.6 | 11.92 | −0.33 | sdO | CRCALSPEC |
| HD93521 | HRS-2840<br>HRS-2843<br>HSP-2912 | 10 48 23.51 | 37 34 12.8 | 7.04 | −0.27 | O9Vp | CRCALSPEC |

**TABLE 2.4** *Continued*

| Targetname | Proposal ID | $\alpha$ (2000) | $\delta$ (2000) | $V$ | $B-V$ | Spectral Type | CDBS LOGICAL* |
|---|---|---|---|---|---|---|---|
| *ABSOLUTE SENSITIVITY: (Continued)* | | | | | | | |
| HZ21 | FOC-2808<br>FOC-2810<br>FOC-2814<br>FOC-2815 | $12^h\ 13^m\ 56^s.42$ | $32°\ 56'\ 30''.8$ | 14.68 | −0.33 | DO2 | CRCALSPEC |
| HZ44 | FOC-2815<br>FOS-2823 | 13 23 35.37 | +36 08 00.0 | 11.66 | −0.29 | sdO | CRCALSPEC |
| OMEGA-CEN | WFPC-2877 | 13 25 27.0 | −47 35 54 | | | | CRFIELDS,<br>CRCALSPEC (TBS) |
| BD_33D2642 | FOS-2823 | 15 51 59.86 | +32 56 54.8 | 10.81 | −0.17 | B2IV | CRCALSPEC |
| NGC6752 | WFPC-2877 | 19 10 08.2 | −59 50 24 | | | | CRFIELDS,<br>CRCALSPEC (TBS) |
| Q2000-330 | FOC-2810 | 20 03 24.12 | −32 51 46.4 | 17.6 | | | NOT HST STD |
| BD_28D4211 | HSP-2912<br>WFPC-2879<br>FOS-2823 | 21 51 11.07 | +28 51 51.8 | 10.51 | −0.34 | Op | CRCALSPEC |
| FEIGE110 | HSP-2912<br>FOS-2823 | 23 19 58.39 | −5 09 56.1 | 11.82 | −0.29 | DOp | CRCALSPEC |
| *WAVELENGTH STANDARD:* | | | | | | | |
| NGC185-1 | FOS-2820 | 0 38 56.77 | +48 19 21.8 | 22.0 | | | CRWAVE† |
| NGC205-8 | FOC-2814<br>WFPC-2879 | 0 40 19.86 | +41 38 23.9 | | | | CRWAVE† |
| M32-1 | FOS-2820 | 0 42 35.92 | +40 53 0.1 | 22.0 | | | CRWAVE† |
| NGC650 | FOC-2809 | 1 42 17.4 | +51 34 13.6 | | | | CRWAVE† |
| Fornax Nebula | FOC-2814 | 2 39 49.11 | −34 32 48.8 | | | | CRWAVE† |

† CRWAVE has not been set up as a system logical. The directory is the subdirectory CRWAVE of the directory with logical CRREFER.

**TABLE 2.4** *Continued*

| Targetname | Proposal ID | $\alpha$ (2000) | $\delta$ (2000) | $V$ | $B-V$ | Spectral Type | CDBS LOGICAL* |
|---|---|---|---|---|---|---|---|
| *WAVELENGTH STANDARD: (Continued)* | | | | | | | |
| HD93521 | HRS-2847<br>HRS-2849 | $10^h\ 48^m\ 23\overset{s}{.}51$ | $+37°\ 34'\ 12\overset{''}{.}8$ | 7.04 | −0.27 | O9Vp | CRCALSPEC |
| 139-TAU (HD40111) | HRS-2847 | 5 57 59.67 | +25 57 13.8 | | | | CRWAVE† |
| YZ-CMI | FOS-2820 | 7 44 40.50 | 3 33 15.3 | 11.24 | | M4.3 | CRWAVE† |
| HD93205 | HRS-2849 | 10 44 33.88 | −59 44 15.1 | | | | CRWAVE† |
| NGC3587 | FOC-2809 | 11 14 49.5 | +55 00 50.12 | | | | CRWAVE† |
| NGC6822-1 | FOS-2820 | 19 45 06.84 | −14 47 41.8 | 22.0 | | | CRWAVE† |
| AT-MIC | FOS-2820 | 20 41 50.52 | −32 25 59.3 | 10.12 | | M4.4E | CRWAVE† |
| *FLAT FIELD:* | | | | | | | |
| SUN | WFPC-2874 | | | | | | N/A |
| EARTH | FOC-2811<br>FOC-2813 | | | | | | N/A |
| *LINEARITY:* | | | | | | | |
| 47-TUC-F1 | FOC-2805 | 0 19 39.9 | −72 01 03 | | | | N/A |
| M42 | WFPC-2915 | 5 35 11 | −5 22 21 | | | | N/A |
| *DARK SIGNAL:* | | | | | | | |
| PMT-DARK-SKY | HSP-2863<br>HSP-2866<br>HSP-2867 | 1 27 11 | −24 19 14 | | | | N/A |
| BARNARD 100 | HSP-2863<br>HSP-2866<br>HSP-2867 | 1 32.6 | −9 03 | | | | N/A |

**TABLE 2.4** *Continued*

| Targetname | Proposal ID | $\alpha$ (2000) | $\delta$ (2000) | $V$ | $B-V$ | Spectral Type | CDBS LOGICAL* |
|---|---|---|---|---|---|---|---|
| *DARK SIGNAL:* | | | | | | | |
| BARNARD 46 | HSP-2863 | $1^h\ 56^m.9$ | $-22°\ 25'$ | | | | N/A |
| | HSP-2866 | | | | | | |
| | HSP-2867 | | | | | | |
| BARNARD 362 | HSP-2863 | 2 24.8 | +50 13 | | | | N/A |
| | HSP-2866 | | | | | | |
| | HSP-2867 | | | | | | |
| BARNARD 5 | HSP-2863 | 3 47.9 | +32 54 | | | | N/A |
| | HSP-2866 | | | | | | |
| | HSP-2867 | | | | | | |
| BARNARD 227 | HSP-2863 | 6 07.4 | +19 42 | | | | N/A |
| | HSP-2866 | | | | | | |
| | HSP-2867 | | | | | | |

## 3.1 Fine Guidance Sensors

The FGS calibration program for cycle 1 generally follows the original SV calibration plan of the HST Astrometry Team. This has made the development of the program simpler and will ensure that the SV data remain a valid baseline for the long-term calibration of the FGS. The FGS Cycle 1 Calibration Plan includes measurements of the *Optical Field Angle Distortion* and *Plate Scale* for the prime astrometry FGS plus full *Transfer Function, Lateral Color,* and *Cross-Filter* calibrations.

There are two principal calibrations for positional astrometry with the Fine Guidance Sensors: the OFAD and Plate Scale. Both will be checked during cycle 1.

There are three levels of OFAD. The least precise is known as mini-OFAD. It is to be performed only in early OV by Perkin-Elmer for the engineering calibration of the FGS's. The second one is known as a super-mini-OFAD and was invented by the ST ScI during the SV scrub to save time from the full-up OFAD. A complete OFAD requires approximately 85 hours of HST time versus about 30 hours for a super-mini-OFAD. The full-up OFAD is the third level of OFAD and produces the best results. Super-mini-OFADs will be done during SV on the two non-astrometry FGS's in such a way that the plate scale results can be transferred without additional observing time and preserving a few milliarcsecond precision. The Cycle 1 program includes a check of the distortion of the prime astrometric FGS.

The plan includes a WF/PC-FGS astrometric cross-calibration to assess the use of the WF/PC for astrometry but this program is included in the WF/PC program as part of its photometric and WF/PC-FGS alignment calibration. In addition to the dedicated FGS calibration described in the following package, the temporal stability and photometric calibration of the FGSs will be performed from available data and enhanced software analysis capabilities.

May 1990

## Table 3.1 FGS CYCLE 1 CALIBRATION SUMMARY

| PROPOSAL ID & TITLE | | RESULTS | BASELINE SV PROGRAM | ACCURACY OBJECTIVES | ESTIMATED S/C TIME (hrs) | | # EXPOSURES SUPPORTED | | COMMENTS |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | PRIME | PAR | GO | GTO | |
| 2832, 2833, 2834 | OVERPLAPPING PLATE FIELD DISTORTION (OFAD) | PDB | 1567 | CHECK | 8.0 | | A | A | |
| 2831 | MOVING TARGET PLATE SCALE | PDB | 1415 | MAINTAIN | 2.9 | | A | A | Only STAT can reduce data |
| 2835 | TRANSFER FUNCTION CALIB | PDB,SDAS | 1416 | MAINTAIN & (IMPROVE) | 13.0 (10.0) | | ~67 | ~268 | Support for GO, GTO; functional use by PCS. |
| 2836 | CROSS-FILTER CALIBRATION | SDAS | 1417 | MAINTAIN & (IMPROVE) | 4.0 (10.0) | | M | M | Req to support GO,GTO multi-filter usage |
| N/A | PHOTOMETRIC CALIBRATION | SDAS | new | IMPROVE | 0.0 | | None | None | Obtained from available data |
| N/A | TEMPORAL STABILITY | FUNCTION | 1418 | MAINTAIN | 0.0 | | A | A | Obtained from available data |
| 2921 | FGS/FGS ALIGNMENT | PDB | 2785 | MAINTAIN | 3.5 | | A | A | |
| | | | | **TOTAL** | **31.4 (20.0)** | | | | |

A = Essentially ALL proposals require this calibration (TOTAL # EXPS: GO=668 GTO=2,686)
M = MOST proposals require this calibration

## 3.2 Faint Object Camera

The observations requested in this steady state calibration plan include those observations which populate the PDB, those critical for RSDP and several characterization activities that are required to determine user guidelines for observing with the FOC.

The FOC Cycle 1 Calibration Program is divided into engineering-type calibrations and scientific calibrations. The engineering-type calibrations include maintaining *Detector* and *Optical Focus Calibrations* and the *FOC/FGS Aperture* and *Finger Alignments* determined during SV. All internal and earth calibrations can be performed in non-prime S/C time (parallel or interleaved). To minimize spacecraft time, we have decreased the number of repeats of the Detector and Optical Focus Calibrations from once per month to twice during the year. This reduction assumes that the telescope and FOC focus remains stable after the SV/GTO Cycle 0 period. If a loss of focus is detected, these calibrations will have to performed immediately to achieve valid science with the FOC.

The scientific calibrations performed in this program include maintaining the *Plate Scale and Distortion* values in the PDB, *External and Internal Relative DQE Calibrations, Absolute Sensitivity, Long Slit Wavelength Calibration, Long Slit* and *UBV Photometric Calibrations* , and *Objective Prism Calibration* coefficients in RSDP. In addition, calibrations are performed to determine the instrumental *Point Source* and *Flat Field Linearity* and *Point Spread Function* necessary to establish and update FOC GO observing guidelines. The plan does not include any Polarization Calibration. A very small number of spectropolarimetry observations have been requested from the GO and GTO pool and the minimal calibration performed during the SV/GTO Cycle 0 period should be sufficient to support these.

## Table 3.2 FOC CYCLE 1 CALIBRATION SUMMARY

| PROPOSAL ID & TITLE | | RESULTS | BASELINE SV PROGRAM | ACCURACY OBJECTIVES | ESTIMATED S/C TIME (hrs) | | # EXPOSURES SUPPORTED | | COMMENTS |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | PRIME | PAR | GO | GTO | |
| 2804 | DETECTOR FOCUS (F/96,F/48) | PDB | 1506 | MAINTAIN | | 3.07 | A | A | |
| 2919 | OPTICAL FOCUS (F/96,F/48) | PDB | 1507 | MAINTAIN | 10.44 | | A | A | |
| 2807 | PLATE SCALE & DISTORTION | PDB | 1510 | MAINTAIN | 4.15 | | A | A | |
| 2813 | MODE II TARGET ACQUISITION | PDB | 1517 | MAINTAIN | | 0.67 | ~20% | ~20% | |
| 2816 | APERTURE LOC/FINE ALIGNMENT | PDB | 2764 | MAINTAIN | 7.70 | | A | A | |
| 2808 | ABSOLUTE SENSITIVITY (F/96,F/48) | RSDP | 1511 | MAINTAIN | 4.14 | | A | A | |
| 2809 | LONG-SLIT WAVELENGTH CAL | RSDP | 1513 | MAINTAIN | 2.32 | | M | M | |
| 2810 | LONG-SLIT PHOTOMETRIC CAL | RSDP | 1514 | MAINTAIN | 2.97 | 0.25 | M | M | |
| 2811 | RELATIVE DQE CALIBRATION | RSDP | 1515 | MAINTAIN | | 11.11 | A | A | |
| 2812 | INTERNAL RELATIVE CALIB | RSDP | 1516 | MAINTAIN | | 16.67 | A | A | |
| 2814 | OBJECTIVE PRISM CALIBRATION | RSDP | 1519 | MAINTAIN | 1.97 | | ~20% | ~20% | |
| 2920 | POINT SPREAD FUNCTION | CHAR | 1520 | MAINTAIN | 2.92 | | M | M | |
| 2838 | UBV PHOTOMETRIC CALIBRATION | CHAR | 1518 | MAINTAIN | 3.75 | | M | M | |
| 2805 | POINT SOURCE LINEARITY | CHAR | 1508 | MAINTAIN | 3.61 | | M | M | |
| 2806 | FLAT FIELD LINEARITY | CHAR | 1509 | MAINTAIN | | 5.42 | M | M | |
| | | | | | | | | | |
| | | | | TOTAL | 44.64 | 37.19 | | | |

A = Essentially ALL proposals require this calibration (TOTAL # EXPs => GO: 246 GTO: 421)
M = MOST proposals require this calibration

## 3.3 Faint Object Spectrograph

The Faint Object Spectrograph is one of the two most requested ST instruments. Out of a total of 1581.5 hours of requests in high priority accepted GO programs, there were requests for 478 hours of FOS time, utilizing most of the valid instrument modes and configurations. The plan presented here includes all the calibrations that we think are necessary for maintaining the level of calibration achieved after Science Verification (SV) plus fundamental calibrations which were not done in SV due to time constraints. They are prioritized according to the importance of the calibration. This plan requires 42.8 hours of spacecraft time; 22.15 for maintaining the accuracies achieved in SV, and 20.65 hours for extending the calibrations performed in SV.

The long term FOS calibration plan is based on the SV plan developed by the FOS IDT and coordinated by Ron Downes.This cycle 1 plan includes some calibrations that will *probably* not be carried out in SV because they are designated to the"delta" plan. This plan also includes as many of the calibrations that are obviously required by GO programs as possible. We expect that the FOS Cycle 1 calibration program will have to be modified based on the experience obtained during SV.

The FOS Calibration Program for Cycle 1 is based on the assumption that the telescope and instruments will behave in a fairly stable manner. The table below summarizes the smallest units of calibration in case certain modes have to be monitored more than expected, listed in order of importance. For example, the absolute photometric calibration program takes 6.3 hours to touch all commonly used configurations of detector and grating. If the detector is much less stable than expected, a standard update of the calibration into the 1.0" aperture would take about 6.3 hours. The table below should serve as a guideline for the amount of calibration time needed to update any troublesome area of calibration.

| Program | Frequency/Year | Time per Calibration |
|---|---|---|
| Aperture Location | 3 | 2.2 hours |
| Y-Base Measurements | 4 | parallel |
| Absolute Photometric (single apertures only) | 2 | 3.3 hours |
| Flat Fields (all apertures) | 1 | 7.6 hours |
| Wavelength Offsets | 1 | 2.7 hours |

The most critical calibrations are those that are required before any spectra can be taken with FOS. These programs include determination of the locations of the FOS apertures, the locations of the spectra on the photocathode (Y-Base) and a check of PERIOD mode. More complete versions of both tests are scheduled in SV. The first two tests run every few months to verify repeatability and to track any long-term drift in the instrument. The PERIOD mode check will be done only if it is not carried out in SV, which is quite likely because it is a "delta" plan test.

The calibrations to populate the pipeline provide fundamental calibration of the instrument. They include absolute photometric calibration, flat fielding, and wavelength calibration. Lower priority calibrations include pulse height analysis, permitting optimal setting of the detector discriminator levels, polarimetric calibration, a scattered light test through the occulting apertures, and dark count and sky measurements.

## Table 3.3 FOS CYCLE 1 CALIBRATION SUMMARY

| PROPOSAL ID & TITLE | | RESULTS | BASELINE SV PROGRAM | ACCURACY OBJECTIVES | ESTIMATED S/C TIME (hrs) | | # EXPOSURES SUPPORTED | | COMMENTS |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | PRIME | PAR | GO | GTO | |
| 2825 | APERTURE LOC/FINE ALIGNMENT | PDB | 1527 | MAINTAIN | 6.5 | 2.4 | A | A | |
| 2817 | Y-BASE MEASUREMENTS | PDB | 1309 | MAINTAIN | | 1.9 | A | A | |
| 2826 | DISCRIMINATOR TEST | IMDB | 2774 (OV) | MAINTAIN | | 3.0 | A | A | |
| 2820 | WAVELENGTH CALIBRATION | RSDP | 1317 | MAINTAIN & IMPROVE | 5.30 | | A | A | |
| 2821 | SPECTRAL FLAT FIELDS | RSDP | 1318 | MAINTAIN & IMPROVE | 11.20 | | A | A | |
| 2823 | ABSOLUTE PHOTOMETRY | RSDP | 1320 | MAINTAIN & IMPROVE | 13.2 | | A | A | |
| 2824 | POLARIMETRIC CALIBRATION | RSDP | 1430 | MAINTAIN & IMPROVE | 3.4 | 2.0 | 35 | 29 | |
| 2819 | DARK, BACKGROUND COUNTS | RSDP | 1316 | MAINTAIN | | 8.0 minimum | M | M | Up to 50.0 hours requested |
| 2818 | VERIFICATION OF TIME RESOLVED MODE | FUNCTION | 1315 | SV DELTA | 1.4 | | 2 | 1 | Only done if not in SV |
| | | | | **TOTAL** | **42.80** | **17.3** | | | |

A = Essentially ALL proposals require this calibration (TOTAL # EXPOSURES = GO: 1072 GTO: 706)
M = MOST proposals require this calibration

## 3.4 Goddard High Resolution Spectrograph

The observations requested in this steady state calibration plan generally include only those observations which populate the PDB or those critical for RSDP. The goal of this program is to provide the baseline calibration accuracy described in Section 2.3 (i.e., maintaining the calibration accuracy which should be available at the end of SV). Some characterization and performance trending information will be deduced from the observations as well, but no tests are designed for this purpose alone. All internal wavelength calibrations, stability checks and other engineering type discriminator settings can be accomplished using non-prime observing time (parallel or interleaved observations). All proposed observations are derived from baseline OV/SV proposals.

This program includes Geometric Calibrations, Detector Calibrations, Radiometric Calibrations and Wavelength Calibrations. The *Geometric Calibrations* are those intended to populate the PDB and RSDP with aperture location, alignment with the FGS's and offsets between the LSA and SSA. Geometric calibrations not explicitly included in this plan as mask edge scans obtained every time the high voltage is turned on and deflection calibrations obtained at the start of every target acquisition.

*Detector Calibrations* are intended to populate the PDB and IMDB with nominal detector discriminator settings and RSDP with photocathode granularity. Included in this plan are *Pulse Height Analysis*, *Threshold Verification* and *Dark Noise Monitoring*. In addition to these engineering activities, focus tests and digicon flat fields are obtained each time the high voltage is turned on. The GHRS SV program does not provide an adequate determination of *Photocathode Granularity* even though the RSDP pipeline performs a correction for this. In Cycle 1, we will run a pilot program to assess the feasibility of this calibration.

*Radiometric Calibrations* are maintained during Cycle 1 for the low and intermediate resolution gratings and the echelles. Time variances of the calibrations will be obtained by repeated measurement of UV Flux standard targets.

There are two important strategies in the *Wavelength Calibration* plan which will allow very good wavelength calibration with minimum use of prime S/C observing time. The first is that observations of the internal spectral calibration lamps will be run in either the parallel or interleaved observing mode. The second, innovative part of this plan, is to routinely take one standard calibration lamp observation the first time a sequence of observations is begun using any GHRS grating. The strategy is based on the premise that the shape of the wavelength calibration curves are not expected to change much, but the zero points will change primarily due to thermal effects. A single observation at any carrousel rotation of a given grating can remove the zero point offset of that grating. This strategy will allow us to guarantee enough flux for a good, quick spectrum y-balance (SPYBAL) and provide for wavelength zero-point monitoring at the same time. The observer is guaranteed wavelength accuracy of a diode or better, as we have promised, and we automatically build up a standardized set of data for understanding instrument performance. The wavelength calibrations included in this plan are not needed to analyze thermally caused wavelength shifts but are proposed to check and update the wavelength calibration polynomials in RSDP.

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## Table 3.4 GHRS CYCLE 1 CALIBRATION SUMMARY

| PROPOSAL ID & TITLE | | RESULTS | BASELINE SV PROGRAM | ACCURACY OBJECTIVES | ESTIMATED S/C TIME (hrs) | | # EXPOSURES SUPPORTED | | COMMENTS |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | PRIME | PAR | GO | GTO | |
| 2839 | APERTURE LOC/FINE ALIGNMENT | PDB | 2765 | MAINTAIN | 1.28 | | A | A | |
| 2851/ 2852 | DISCRIMINATOR SETTINGS | PDB | 1459,2487 (OV) | MAINTAIN | | 7.17 | A | A | |
| 2841 | DARK NOISE MONITORING-HRS/HSP | RSDP | 1408 | MAINTAIN | | 7.47 | M | M | |
| 2848 | LOW/MED RES ABS PHOTOMETRY | RSDP | 1356 | MAINTAIN | 4.31 | | ~400 | ~195 | |
| 2842 | ECHELLE PHOTOMETRIC SENS | RSDP | 1357 | MAINTAIN | 3.28 | | ~865 | ~420 | |
| 2843 | INTERMEDIATE/LOW RES X-CALIB | RSDP | 1355 | MAINTAIN | 3.33 | | M,1 | M,1 | |
| 2844/ 2845 | SPECTRAL CAL WAVELENGTH | RSDP | 2767, 2766 | MAINTAIN | | 8.05 | M | M | |
| 2847 | APER OFFSETS & ECHELLE WAVE | RSDP | 1562 | MAINTAIN | 7.33 | | ~865 | ~420 | |
| 2849 | APER OFFSETS & 1st ORDER WAVE | RSDP | 2097 | MAINTAIN | 5.33 | | ~400 | ~195 | |
| 2840 | PHOTOCATHODE GRANULARITY | RSDP | 1359,2167 | MAINTAIN+IMPR | 1.43 | | 300 | 100 | |
| 2880 | SPATIAL DEPENDENT FLAT FIELDS | RSDP | none | MAINTAIN+IMPR | 0.27 | | 150 | 0 | |
| | | | | | | | | | |
| | | | | TOTAL | 26.56 | 22.69 | | | |

A = Essentially ALL proposals require this calibration (TOTAL # EXPOSURES= GO: 2011 GTO: 976 )

M = MOST proposals require this calibration

1 = This is the only observation which ties the FOS and GHRS wavelength scales together

## 3.5 High Speed Photometer

The calibration plan generally include only those which populate the PDB or those critical for RSDP. The goal is to maintain the baseline calibration accuracy presented in Table 2.3. Some characterization and performance trending information will be deduced from the observations as well, but no tests are designed for this purpose alone.

The HSP Cycle 1 Calibration Program is divided into engineering-type calibrations and scientific calibrations. The engineering-type calibrations include maintaining the *Pulse Height Distribution* settings determined in OV and SV and maintaining both the *HSP Focus and Relative Aperture Locations* and the *HSP/FGS Aperture Alignment.* The SV Delta Plan *RIU Polling Test* is not included in this program but will have to be performed if the SV Delta Plan is not accomplished and problems arise with RIU noise.

Much of the time required for HSP calibration is parallel time. The original HSP calibration plan called for up to 69 hours of dark time assuming these observations could truly have been done in parallel. With the expected limitation on parallel observing in early cycle 1, this plan now reflects a minimum number of dark counts of 8 hours. As the HSP has no shutter, dark locations have been identified in the PDB for each aperture except the PMT. Dark locations in the sky must be used for dark observations with the PMT and accounts for the prime time requested in observations normally performed as internals.

The other major non-prime time program is the Focus and Aperture Mapping. This program is carried out entirely via observations of the bright earth. Since we know that the thermal bending of the HSP will cause the aperture images to move around on the photocathodes of the detectors, it is important to measure the positions of the apertures as often as possible. Reducing the time dedicated to this program will directly affect the accuracy of HSP photometry. The data for this program can only be collected during time when the HST is otherwise unused (i.e., during Earth occultations) so the observing time should not be further reduced.

Two proposals contribute almost all of the prime observing time required for the HSP Cycle 1 calibration: *HSP/FGS Fine Alignment* and *Photometric Calibration.* The aperture alignment proposal originally consisted of 3 repeats of a minimal alignment observation for each detector. For each of the 4 IDTs (which have separate aperture plates), positions were determined for 3 apertures allowing one to calculate the positions for all the other apertures on the face plate. This original program was significantly reduced from the SV version but still required 6 hours per repeat for a total of 18 hours. To reduce the time required for this observation, we have reduced the number of apertures calibrated on each detector. By adopting this approach, we will have insufficient data to solve for aperture positions independently on each aperture plate; however we will still be able to solve for all aperture positions by assuming that the entire HSP focal plan structure is moving rigidly. The reductions taken provide for observing 3 apertures on 2 of the IDTs and 1 on each of the others.

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## Table 3.5 HSP CYCLE 1 CALIBRATION SUMMARY

| PROPOSAL ID & TITLE | | RESULTS | BASELINE SV PROGRAM | ACCURACY OBJECTIVES | ESTIMATED S/C TIME (hrs) | | # EXPOSURES SUPPORTED | | COMMENTS |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | PRIME | PAR | GO | GTO | |
| 2863 | DETECTOR DARK COUNTS | RSDP | 1379 | MAINTAIN | 1.65 | 8.00 | A | A | |
| 2867 | PULSE HEIGHT DISTRIBUTION | PDB | 2768 | MAINTAIN | 1.91 | 8.70 | A | A | |
| 2869 | FOCUS & APERTURE MAPPING | PDB | 1526 | MAINTAIN | | 32.54 | A | A | |
| 2864 | APERTURE LOC/FINE ALIGNMENT | PDB | 1524 | MAINTAIN | 12.00 | | A | A | See Note 1 below |
| 2912 | PHOTOMETRIC CALIBRATION | RSDP | 1385,1474 | MAINTAIN | 9.00 | | A | A | See Note 2 below |
| | | | | | | | | | |
| | | | | **TOTAL** | **24.56** | **49.24** | | | |

A = Essentially ALL proposals require this calibration (TOTAL # EXPs => GO: 20 GTO: 4.275)
M = MOST proposals require this calibration

Note 1: 12.00 hours assumes that the HSP focal plane structure moves rigidly and only 3 apertures on 2 Image Dissector Tubes and 1 on each of the others are checked.

Note 2: 9.00 hours assumes that we can effectively customize the calibration pgoram to match exactly the GO/GTO program at the the right time in the planning/scheduling process. Otherwise, we require 19.25 hours to achieve the required calibration accuracy.

## 3.6 Wide Field/Planetary Camera

The WF/PC is the primary instrument on HST, and will be used for ~65% of the primary observations in GO Cycle 1. The WF/PC will also be used extensively to support target acquisitions for other SIs. The plan presented here attempts to ensure that photometric and astrometric accuracy will be maintained at all times, despite the history of instability which has become manifest during laboratory testing. The plan is thus a minimum plan to achieve the GO needs and assumes best-case conditions for instrumental stability.

The plan is based on the filters and modes used by the GOs in Cycle 1, taking into account the advertised accuracies expected at the end-of-SV.

### *UV FLOOD AND QEH MONITORING*

The WF/PC *UV Flood* is an expensive procedure required to overcome the QEH defect in the WF/PC camera. This procedure should be performed once near the start of cycle 1. If the WF/PC CCD detectors are permitted to warm up, as they are during safe mode, the beneficial effects of the UV Flood may be lost and the procedure may have to be repeated. The UV Flood may also decay at normal operating temperatures. The *QEH Monitoring* proposal checks for the onset of QEH.

UV Flood is our major contingency situation. This is the reason for the QEH Monitoring proposal. If the HST goes into frequent or extended safe modes during Cycle 1, then additional floods may become necessary in order to eliminate QEH, especially at blue wavelengths. The loss of QE, and the return of QEH, occurs differentially over the face of each CCD, with major differences from CCD to CCD, and is also a function of wavelength.

### *BASIC CALIBRATIONS*

Our basic calibrations assume stability in the WF/PC instrument. However, the proposals are designed to permit the detection of variations in the instrument. We are assuming that the filters themselves are quite stable and only the CCD detectors contribute to the photometric variations. Hence the proposals calibrate a key set of 5 filters monthly and most other filters only once per year. In the presence of variation with timescales of several months, we are assuming that the calibration can be bootstrapped from the 5 key filters onto the remaining filters.

The basic calibrations include *Internal Calibrations* to maintain all of the RSDP reference files used by the pipeline (5 types) other then the flat field and AtoD (obtained from GO observations and flat fields) reference files. Nearly all GO observations require pre-flash and dark reference files. We have sufficient dark-current monitoring to observe the expected build-up of "dark spikes" with exposure to cosmic ray primaries and secondaries, and the proposed photometric observations will be used to monitor any degradation in the instrumental PSF, which may start to become observable in Cycle 1 as a result of the build-up of proton-induced traps in the CCD's. The *Flat Fields Calibration* maintains the flat field reference files used by the RSDP pipeline. A specific flat field is required for every filter and camera combination used by the GOs and GTOs.

Another basic calibration is the *Photometry/Astrometry Calibration* which observes a standard star field on a monthly basis to maintain the calibration of the 5 most important broad band filters and to monitor the overall QE curve. Most other filters used by the GOs are calibrated *only once* during Cycle 1. Some of the most popular filters are calibrated several times during Cycle 1. The filter frequencies are as defined in the following table.

The astrometric calibration is obtained from the same observations as the photometry at no additional cost.

## *PHOTOMETRY/ASTROMETRY CALIBRATION*

### WFC FILTER CALIBRATIONS

| | | | | | |
|---|---|---|---|---|---|
| F230W | F336W | F439W | F555W | F785LP | 12 times |
| F656N | | | | | 6 times |
| F547M | | | | | 4 times |
| F368M | F502N | F658N | F675W | | 2 times |
| | | | | | |
| F284W | F375W | F413M | F487N | F492M | 1 time |
| F569W | F606W | F622W | F631N | F648M | |
| F664N | F673N | F702W | F725LP | F791W | |
| F814W | F889N | F1042M | | | |

### PC FILTER CALIBRATIONS

| | | | | | |
|---|---|---|---|---|---|
| F230W | F336W | F439W | F555W | F785LP | 12 times |
| F547M | | | | | 7 times |
| F791W | | | | | 6 times |
| F675W | | | | | 4 times |
| F413M | F517N | F718M | | | 3 times |
| F375N | F502N | | | | 2 times |
| | | | | | |
| F284W | F368M | F437N | F469N | F487N | 1 time |
| F492M | F569W | F606W | F622W | F631N | |
| F648M | F656N | F658N | F664N | F673N | |
| F702W | F725LP | F850LP | F875M | F889N | |
| F1042M | F1083N | | | | |

The photometric calibration is being derived solely from the observations of globular cluster fields. The IDT is conducting an additional calibration using a blue cluster which should provide superior photometric transformations. We are assuming that these will be well determined by the IDT in SV and will remain constant.

## *SPECIAL CALIBRATIONS*

The *Grism Calibration* proposal calibrates the three grisms in the instrument. These are not calibrated during SV but are used by both the GOs and GTOs in Cycle 1. The *Linearity Test* proposal is the SV Delta Plan proposal which measures the linearity and readout noise of all CCD detectors in the instrument. In view of degradation in CCD performance (charge transfer efficiency) observed in proton radiation tests, this observation is recommended at least once in Cycle 1.

The *UV Campaign* includes a low temperature decontamination (UV Prep I) and post-decontamination UV baseline observations (UV Prep II). UV Prep I temporarily removes the UV absorber from the WF/PC optics and measures a UV spectrophotometric standard star with the G200L grism on each CCD detector. The second proposal, UV Prep II, measures the same spectrophotometric standard star following the science observations to provide a basis for interpolation. We are not directly observing UV flux standards as part

of the UV Campaign. Rather we use the UV grism and depend upon the cross calibration between the UV grism and the UV filters established during SV.

The *Grism Photometric Calibration Pilot Project* calibrates several WF/PC filters directly by taking grism spectra of the bright spectrophotometric standard star G191B2B with and without filters in the beam. Simulations indicate that photometric transformations based on Omega Cen cannot be accurate to better that 10-50% for non-standard WF/PC filters, while this more direct method can approach 1%. This pilot study in Cycle 1, which calibrates the most heavily utilized filters in the GO and GTO program, will verify whether the expected high accuracy can be realized in practice prior to more extensive use in future cycles. Although narrow band interference filters are known to experience shifts in the central wavelength of their passbands, we are only proposing to calibrate the throughput of these filters. The Grism Photometric Calibration Pilot Project is a beginning in addressing this issue which will become more important as the filters age.

## Table 3.6 WF/PC CYCLE 1 CALIBRATION SUMMARY

| PROPOSAL ID & TITLE | | RESULTS | BASELINE SV PROGRAM | ACCURACY OBJECTIVES | ESTIMATED S/C TIME (hrs) | | # EXPOSURES SUPPORTED | | COMMENTS |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | PRIME | PAR | GO | GTO | |
| 2874 | DECONTAMINATION/FLOOD | OPERATION | 1431 | MAINTAIN | 29.4 | 32.0 | 30% | 20% | Required to support all exposures at <5000 A |
| 2913<br>2914 | UV CAMPAIGN | FUNCTION | 2751 | MAINTAIN | 4.54 | | 15 WITH 30 | 18 F230W 29 | Assumes two campaigns |
| 2875 | QEH MONITORING | CHAR | 1323 | MAINTAIN | 3.3 | 6.00 | 30% | 20% | Monitor need for additional flood(s) |
| 2878 | FLAT FIELDS | RSDP | 2125 | MAINTAIN | | 62.7 | A | A | |
| 2876 | INTERNAL CALIBRATIONS | RSDP | 2125 | MAINTAIN | | 104.0 | A | A | |
| 2877 | ABSOLUTE PHOTOMETRIC & WF/PC TO FGS ALIGNMENT | RSDP, PDB | 1321 | MAINTAIN | 24.00 | | A | A | Program under review |
| 2879 | GRISM CALIBRATION | RSDP | 1324 | DELTA PLAN | 5.6 | | 41 | 113 | 48 out of 113 are WF/PC IDT |
| 2915 | LINEARITY | CHAR | 1325 | MAINTAIN | 5.59 | | A | A | |
| 2917 | GRISM PHOTOMETRY PILOT PROJECT | RSDP | 1321<br>1322 | IMPROVE TECHNIQUE | 1.57 | | N/A | N/A | Experiment to decrease Photometry time in cycle 2 and improve quality |
| | | | | **TOTAL** | **74.00** | **204.7** | | | |

A = Essentially ALL proposals require this calibration (TOTAL # EXPOSURES = GO: 2,826 GTO: 989)

## 3.7 Optical Telescope Assembly/Observatory Level Tests

The observations requested in this steady state calibration plan include those observations which populate the PDB, those critical for RSDP and CDBS and several activities that are required to determine both operations and user guidelines for observing with the HST. The goal is to maintaining the calibration accuracy which should be available at the end of SV).

All internal and earth calibrations can be performed in non-prime S/C time (parallel or interleaved).

As the optimum secondary mirror position has been established during SV and is expected to be stable, the Cycle 1 program includes a single execution of the *SI Focus Verification* to confirm the position. If a serious problem with the focus is identified prior to the planned execution, the measurement will have to be moved up in time to allow for optimization of the focus which represents a compromise for the relevant SIs. A second execution of the test may then also become necessary if the focus is deemed unstable.

By the end of SV, the desorption of the metering truss should be largely finished. Two *OCS Focus Calibration* operations are expected to be necessary during Cycle 1, as long as the following conditions are met:

- SV is complete 7 months after deployment
- 0.2mm of focus error is regarded as acceptable (as in SV)
- OCS focus is only necessary every second SM adjustment (the other adjustments done by trending).

The requisite accuracy is such that pre-launch estimates are likely to be inaccurate. The number of focus operations is likely to increase if the telescope does not perform as expected, or if other unexpected effects (creak, thermal, ...) cause secondary mirror movement.

The *SI Aperture Cross-Calibration* is required to support SI Assisted Target Acquisitions with a high success rate. This calibration concentrates primarily on measurement of the WF/PC to FOS and GHRS offsets with data also taken to enable FOC Assisted Target Acquisitions.

The *RAM Degradation/OTA Throughput Monitoring* calibration performed during SV will enable us to determine the condition of the $MgF_2$ coating on the OTA primary mirror and give a measure of the OTA Throughput. Unless this test shows evidence of OTA throughput degradation, other FOS and GHRS Cycle 1 calibrations using target BD+75D325 will be used to monitor OTA throughput. If these observations indicate a loss of OTA throughput, it will be necessary to perform our contingency proposal 2827 to determine the amount of degradation.

The *Near- and Mid-Angle Scattering Measurement* proposal is another contingency proposal that will need to be performed only if its execution in SV indicates that the effect of internal HST light scattering is significant. The test will give an estimate of the light scattered by dust particles and the mirror microroughness in the form of power law parameters.

The *HSP Radiation Monitoring OLT* has been deleted from the SV program due to the delay in parallel science implementation. A full contour map of the SAA with the HSP may be useful when the goal is no longer bringing new capabilities on-line but improving efficiency. Since it is no longer being performed in SV, a single execution in Cycle 1 has been included as a contingency proposal.

May 1990

## Table 3.7 OTA/OLT CYCLE 1 CALIBRATION SUMMARY

| PROPOSAL ID & TITLE | | RESULTS | BASELINE SV PROGRAM | ACCURACY OBJECTIVES | ESTIMATED S/C TIME (hrs) | | COMMENTS |
|---|---|---|---|---|---|---|---|
| | | | | | PRIME | PAR | |
| 2918 | SI APERTURE CROSS-CALIBRATION | OPS, CDBS | NONE | IMPROVE | 14.43 | | |
| TBA | OCS FOCUS CALIBRATION | OPS | 2784 | MAINTAIN | ~3.00 | | Proposal submission required from LMSC/MOC |
| 2828 | SI FOCUS VERIFICATION | OPS | 2143 | MAINTAIN | 10.78 | 3.70 | |
| 2830 | NEAR & MID-ANGLE SCATTERING | OPS, CDBS | 2144 | MAINTAIN | (5.61) | | *CONTINGENCY PROPOSAL:* Will only be done if SV program fails to yield required data |
| 2829 | HSP RADIATION MONITORING | PDB | 2169 | IMPROVE | | (14.78) | *CONTINGENCY PROPOSAL:* Will only be done if map of SAA still needed. |
| 2827 | RAM DEGRADATION/OTA THROUGHPUT | PDB | 2142 | MAINTAIN | (2.00) | | *CONTINGENCY PROPOSAL:* Plans are to obtain data from FOS & HRS calibrations using BD+75D325 |
| | | | | **TOTAL** | 28.26 * | 3.70 * | |

* **TOTAL** times do not inlcude contingency proposals.

# APPENDIX A
# CYCLE 1 CALIBRATION PROPOSALS BY DISCIPLINE IN NUMERICAL ORDER

**FGS:**

2831 Determine Moving Target Plate Scale
2832 Overlapping Plate Field Distortion Calibration
2835 Verify & Calibrate Transfer Function
2836 Cross-Filter & Lateral Color Calibration
2921 FGS-FGS-FGS Alignment with Rolls

**FOC:**

2804 Detector Focus
2807 Plate Scale & Distortion
2808 Absolute Sensitivity (F/96 Relay)
2809 F/48 Long Slit Spectrograph - Wavelength Cal
2810 F/48 Long Slit Spectrograph - Photometric Cal
2811 Relative DQE Calibration
2812 Relative Calibration
2813 Mode II Target Acquisition/Fingers Alignment
2814 Objective Prism Calibration
2816 Aperture Location
2919 Optical Focus
2920 Point Spread Function

**FOS:**

2817 Location of Spectra: Y-Base Maps
2818 Verification of Time Resolved Modes
2819 Dark & Sky Backgrounds
2820 Wavelength Calibration: Internal/External Offsets
2821 Spectral Flat Fields
2823 Absolute Photometry
2824 Polarimetric Calibration
2825 Aperture Locations: Phase IV A Fine Positions
2826 Discriminator Test

**GHRS:**

2839 HRS/FGS Fine Alignment
2840 1st Order Grating Photocathode Granularity
2841 Dark Noise Monitoring
2842 Echelle Photometric Sensitivity
2843 Intermediate/Low Resolution Cross-Cal
2844 Echelle Spectral Cal Lamp Mini-Functional
2845 1st Order Grating Spectral Cal Lamp Minis
2847 Aperture Offsets & Echelle Wavelength Cal
2848 Low & Intermediate Grating Photometric Cal
2849 Aperture Offsets & 1st Order Grating Wave Cal
2851 Pulse Height Analysis
2852 Threshold Adjustment
2880 Photocathode Granularity - Enhanced Flat Fields

**HSP:**

2863 Detector Dark Counts
2864 FGS/HSP Fine Alignment
2867 Pulse Height Analysis
2869 Focus and Aperture Mapping
2912 Photometric Calibration

**WF/PC:**

2874 UV Flood
2875 QEH Monitoring
2876 Internal Calibrations
2877 Photometry/Astrometry
2878 Flat Fields
2879 Grism Calibration
2913 UV Prep I
2914 UV Prep II
2915 Linearity Check
2916 Grism Filter Pilot Calibration

**OTA/OLT:**

TBA OTA Desorption Focus Adjustment
2827 RAM Degradation/OTA Throughput
2828 SI Focus Verification Test
2829 Radiation Monitoring OLT
2830 Mid- & Near-Angle Scattering Measurement
2918 SI Aperture Cross-Calibration

PROPOSAL FOR HUBBLE SPACE TELESCOPE OBSERVATIONS

COVER PAGE

ST Sci Use ID 2831(P)
Received 03-Oct-89
Date: NOV 27, 1989 08:03

1.Proposal Title:
DETERMINE MOVING TARGET PLATE SCALE

---

2.Scientific Category | 3.Proposal for: CAL/FGS | 4.Proposal type: | 5.(If relevant) Continuation of: 0 Remote ID: 2273

---

| 6.Principal Investigator | Institution | Country | Telephone |
|---|---|---|---|
| DR. LAURENCE G. TAFF | STSCI | USA | 301-338-4799 |

---

7.Abstract
The goal of this procedure is to measure the plate scale of the FGSs to 0.002 arcsec over the length of the FGSFOV by measuring a minor planet as it traverses the FGSFOV. Only the prime astrometry FGS plate scale will be checked.

---

9.Est obs time (hours) pri: 2.90 par: 0.00 10.Num targs pri: 11 par: 0

---

11.Instruments requested: FGS

---

12.Special sched req: Time-crit Obs Spec orient

---

13.Description of proposed observations:
Set all FGS filters to yellow for Astrometry measurements.
1) Point HST so that the moving target is near one extreme of the FGS FOV for FGS 2 and the spacecraft is oriented so that the direction of motion of the moving target is is along the long dimension of the FOV.
2) Acquire Guide Stars in FGS 1 and 3. Acquire the moving target in POS mode.
3) Take data for 5 minutes. Measure up to 10 stars for reference.
4) Reacquire the moving target in POS mode. Take data for 5 minutes.
5) Repeat steps 2-7 five times evenly spaced over the period it takes the moving target to traverse the length of the FOV

---

17.Description of plans for data reduction and analysis
ADRS in SDAS will be used to derive the positions of the minor planet as a function of time. These will be compared with the expected ephemeris motion, corrected for the usual known observational effects. These numbers, their attendant errors, and the covariance matrix of the solution will be entered in the Project Data Base and the CDBS to be used with SDAS analysis.

PROPOSAL FOR HUBBLE SPACE TELESCOPE OBSERVATIONS

COVER PAGE

ST Sci Use
ID 2832(P)
Received 03-Oct-89
Date: FEB 26, 1990 10:29

1.Proposal Title:
OVERLAPPING PLATE FIELD DISTORTION CALIBRATION

---

2.Scientific Category | 3.Proposal for: CAL/FGS | 4.Proposal type: | 5.(If relevant) Continuation of: 0 Remote ID: 2274

---


6.Principal Investigator | Institution | Country | Telephone
DR. LAURENCE G. TAFF | STSCI | USA | 301-338-4799


---


7.Abstract
The goal of this activity is to check the optical field angle distortions of the three FGS units to within an arbitrary scale factor, with a level of accuracy sufficient to support an overall astrometry error budget of +/- 0.002 arcseconds rms. The actual solutions will provide the Project Data Base with the significant terms, their values, and their covariances including errors, which may then be applied to general FGS observations to reduce them for field angle distortions, except scale, alignment, and color corrections. This proposal consists of three parts, one to calibrate each FGS unit.


---

9.Est obs time (hours) pri: 8.00 par: 0.00 10.Num targs pri: 114 par: 0

---

11.Instruments requested: FGS

---

12.Special sched req: Spec orient

---

3.Description of proposed observations:
Acquire guide stars in the FGS units selected for guiding. With each position and orientation of the FGS, measure from 20-35 stars in the astrometry FGS with the yellow filter. The exact number of stars measured will depend on the date of observation and the offset used (see below). The stars have been chosen to be well distributed about the FGS FOV. The offsets described below will move the stars about the FGS FOV, sampling the distortions at different positions. Guide stars should be changed as needed.
Successively offset target #1 relative to the center of the FGS FOV, as described below. (x,y) means an offset of x arcseconds in the FGS X direction and y arcseconds in the FGS Y direction. The offsets are (0,0), (60,0), (-60,0), (40,60), (40,-60), (-40,60), (-40,-60), (120,-10), (-120,-10), (240,-10), (-240,-10), (240,-70), (-240,-70), (360,-60),(-360,-60), (360,-120), (-360,-120). At each of the pointings, measure the stars from the target list that fall in the FGS FOV. Some stars will leave the FOV at each new position and others will enter it. It is estimated that an average of 25 stars will be within the FGS FOV at each pointing.

---

7.Description of plans for data reduction and analysis
Data reduction will be performed using the STSDAS. The data will be put into SDAS Table format for analysis using the GaussFit module. Initial values of the field distortion parameters will come from OV & SV. The scale value used will also come from that OV calibration. The initial model will come from the physical model of the FGS as a start, with the results from OV & SV folded in for the initial guesses at the parameter values. Ground calibration of the short wavelength terms will be examined for consistency with the data. The data will be insufficient to derive a complete map of the short wavelength variations. Different polynomial and/or spline approximations will be tried to determine the most appropriate representation of the data. Sufficient data should be available to give a good solution. The covariances and residuals will be examined to determine a "best fit" solution. The terms, their values, their errors, and their covariances will be put into the Project Data Base for Standard Astrometric observations.

PROPOSAL FOR HUBBLE SPACE TELESCOPE OBSERVATIONS

COVER PAGE

ST Sci Use
ID 2835(P)
Received 03-Oct-89
Date: NOV 27, 1989 08:02

1.Proposal Title:
VERIFY AND CALIBRATE TRANSFER FUNCTION

---

2.Scientific Category | 3.Proposal for: CAL/FGS | 4.Proposal type: | 5.(If relevant) Continuation of: 0 Remote ID: 59

---

6.Principal Investigator | Institution | Country | Telephone
DR. LAURENCE G. TAFF | STSCI | USA | 301-338-4799

---

7.Abstract

One of the astrometric uses of the FGSs is to measure non-point-like and binary star parameters. These measurements require an accurate knowledge of the transfer function of the interferometer. An empirical transfer function fround ground-based measurements is know for each Koester Prism/PMT system. However, the realignment of the optical system on orbit, coupled with outgassing and changing PMT characteristics, leads tohe requirement to observe the transfer function directly on real "single" stars and known multiple systems.

The goal of this procedure is to empirically determine the "S-curve" for each interferometer, using "known single" stars, and to look for systematic effects by measuring double stars with known characteristics. These S-curve determinations will go into the Calibration Data Base for deconvolution studies, and for monitoring long-term changes in the FGS behavior. The positions of these "single" stars will also be measured in POS mode to determine any systematic offset in the position determined by the FGE and by a Transfer Function Scan.

---

9.Est obs time (hours) pri: 13.0 par: 0.00 10.Num targs pri: 6 par: 0

---

11.Instruments requested: FGS

---

12.Special sched req:

---

3.Description of proposed observations:

1) Acquire G.S. in FGSs 1 and 3 for single early type star.
2) Set appropriate filter. Command FGS 2 to Coarse Track, TF. Locate centroid of star. (ACQ-MODE=SEARCH in TRANS). Backoff 1/2 scan length. Ramp up to scan rate. Take data for scan length/scan rate. Ramp down to zero. Repeat scan for a total of 5 observations.
3) Go to the single star with FGS astrometer. Lock on in POS mode. Take data for 1 minute.
4) Repeat steps 2-5 with 2nd filter, if appropriate.
5) Repeat steps 1-6 for FGS 3 as astrometer.
6) Repeat steps 1-6 for FGS 1 as astrometer.
7) Repeat steps 1-8 for 1 late type single star, 1 Bright Binary, and 1 faint binary with appropriate filters.

---

7.Description of plans for data reduction and analysis

ADRS within SDAS will be used to derive separation plus magnitude data. The FORM of the "S-curve" will be generated and a "table look-up" routine will be "filled out" from the single star data. This information should reside in the CDBS available to SDAS for TF analysis.

PROPOSAL FOR HUBBLE SPACE TELESCOPE OBSERVATIONS

COVER PAGE

ST Sci Use
ID 2836(P)
Received 03-Oct-89
Date: NOV 27, 1989 08:02

1.Proposal Title:
CROSS FILTER AND LATERAL COLOR CALIBRATION

---

2.Scientific Category | 3.Proposal for: CAL/FGS | 4.Proposal type: | 5.(If relevant) Continuation of: 0 Remote ID: 2326

---

| 6.Principal Investigator | Institution | Country | Telephone |
|---|---|---|---|
| LAURENCE G. TAFF | STSCI | USA | 301-338-4799 |

---

7.Abstract

Several GO observing programs and most GTO programs are using many FGS filters requiring this calibration to be supported in full. The goal of this procedure is to determine the positional offsets produced by the FGS filters, and to determine any distortions produced by the individual filters.

HST astrometric observations are normally using more than one filter in order to derive the colors of the stars being measured or to compensate for the brightness difference between components of double star systems with unequal magnitudes and widely differing colors. In fact, it is necessary to determine the colors for all stars observed with the FGS since there is a substantial correction (~10%) to the position of a star that depends on the color of the star being measured. In some cases, the different bandpass filters will be used to reduce the magnitudes of the principal target star to a level that is comparable to that of the reference stars. In all cases, it will be necessary to determine the offset and distortion corrections between the various filters in each FGS.

---

9.Est obs time (hours) pri: 4.0 par: 0.00 10.Num targs pri: 0 par: 0

---

11.Instruments requested: FGS

---

12.Special sched req:

---

13.Description of proposed observations:
This calibration determine the optical offset and distortion introduced into the optical path by used of the different filters in the prime FGS (FGS 2). An aread of the sky centered on a position which includes the open cluster NGC 3532 has been selected since it contains a number of stars that lie within the small region of the sky accessible to the FGS at one pointing and within a convenient range of magnitudes that can be observed with all of the FGS filters.

---

17.Description of plans for data reduction and analysis
ADRS within SDAS will be used to analyse the data, in particular to fit the data from one filter-FGS to the "yellow" filter data for that FGS. The data will be fit with increasing order polynomials until the 0.002 arcsec rms residual level is reached. The simplest model (constant offset) will be assumed to start. The terms, and their derived values, for each filter will be incorporated in the CDBS to be used by SDAS to hold parameters used in the reductions for differences between filters.

PROPOSAL FOR HUBBLE SPACE TELESCOPE OBSERVATIONS

COVER PAGE

ST Sci Use
ID 2921(P)
Received 29-Jan-90
Date: FEB 22, 1990 11:10

1.Proposal Title:
CAL/FGS-FGS-FGS ALIGNMENT WITH ROLLS

---

2.Scientific Category | 3.Proposal for: CAL/AST | 4.Proposal type: | 5.(If relevant) Continuation of: 0 Remote ID: 2875

---

6.Principal Investigator | Institution | Country | Telephone
LAURENCE G. TAFF | STSCI | USA | 301-338-4799

---

7.Abstract
This activity will provide data for use in calculating the high accuracy solution to the FGS/FGS/FGS alignment. Note this proposal is based on the OV and SV proposals developed by Perkin-Elmer and HSTP-G.

---

9.Est obs time (hours) pri: 3.50 par: 0.00 10.Num targs pri: 5 par: 0

---

11.Instruments requested: FGS

---

12.Special sched req: Real-time Obs

---

13.Description of proposed observations:
Position the HST to an astrometric field at an off-normal roll of -30 degrees and map the reference stars in the FGS2 FOV. Keeping the same +V1 pointing, rotate the HST in roll by 60 degrees (to approx +30 degs off-normal roll orientation) and repeat the mapping. With the same V1 axis pointing, rotate the HST by -30 degrees (to approx. normal roll orientation). At this orientation, map the reference stars in the FGS2 FOV multiple times, using different pairs of the reference stars measured by FGS2 at the rolled attitudes and now in FGS1 and FGS3, as Guide Stars. PASS will process the data and obtain the FGS/FGS/FGS alignments.For each pair of Guide Stars the stars should lie approximately on a line parallel to the V2 axis. Each Guide Star acquisition should be a one-pair acquisition.

---

14.Description of plans for data reduction and analysis
The data for FGS alignment will be reduced by the initial data reduction function of the OTA calibration software as each observation set is taken. After all observation sets are reduced, the FGS alignment function of the software calculates the revised alignments for FGS1 and FGS3. The revised alignments in the form of a misalignment from nominal will be available for uplink to the HST.

PROPOSAL FOR HUBBLE SPACE TELESCOPE OBSERVATIONS

COVER PAGE

ST Sci Use
ID 2804(P)
Received 29-Sep-89
Date: NOV 27, 1989 08:06

1.Proposal Title:
FOC DETECTOR FOCUS

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2.Scientific Category | 3.Proposal for: CAL/FOC | 4.Proposal type: | 5.(If relevant) Continuation of: 0 Remote ID: 2130

---

6.Principal Investigator | Institution | Country | Telephone
DR. FRANCESCO PARESCE | SPACE TELESCOPE SCIENCE INSTITUTE | USA

---

7.Abstract

The procedure adopted to check the detector focus is given in full detail in the ESA FOC document AV-FC-001/3 in Annex V (f/48) and VI (f/96), only a brief summary will be given here.

The exposures required to carry out a detector focus use the the on-board LEDs--so the activity should be carried out with FOC in parallel mode. The data required for analysis are contained within the engineering data stream. A more extensive version of the same test is executed in OV and SV.

---

9.Est obs time (hours) pri: 0.00 par: 2.50 10.Num targs pri: 0 par: 0

---

11.Instruments requested: FOC

---

12.Special sched req:

---

3.Description of proposed observations:

See AV-FC-001/3 App. V, Section 2 (f/48), See AV-FC-001/3 App. VI, Section 2 (f/96).

In this procedure the FOC is set to histogram mode. The histogram mode gives the numbers of photon events in certain size categories (i.e., 2x2, 2x3, pixels, etc.). By stepping the focus coil, and the trim coil through their allowed ranges, it is possible to determine their optimum settings from analysis of these histogram data.

These tests do not study the focus of the first stage of the intensifier unit. If, as a result of the above steps it is determined that the first stage is out of focus, then it will be necessary to devise a test using a known star field (47 Tuc) to optimise the intensifier first stage focus.

This test serves as verification that the optimum focus settings determined during OV and SV are indeed the most appropriate values. Analysis of the histogram data will be performed off-line using CDBS and SDAS.

---

7.Description of plans for data reduction and analysis

The data are contained within the engineering data stream. The relevant parts will be extracted and analysed using SDAS software tools, with the results being put into CDBS.

PROPOSAL FOR HUBBLE SPACE TELESCOPE OBSERVATIONS

ST Sci Use ID 2807(P)
Received 29-Sep-89
Date: NOV 27, 1989 08:06

COVER PAGE

1.Proposal Title:
FOC PLATE SCALE AND DISTORTION

---

2.Scientific Category | 3.Proposal for: CAL/FOC | 4.Proposal type: | 5.(If relevant) Continuation of: 0 Remote ID: 2131

---

6.Principal Investigator | Institution | Country | Telephone
DR. FRANCESCO PARESCE | SPACE TELESCOPE SCIENCE INSTITUTE | USA

---

7.Abstract
The aim of these tests is to check the values of the plate scale of the FOC f/48, f/96 and f/288 modes obtained during SV, and to check the stability of the distortion over the field. A rich field in the globular cluster 47 Tuc is used, which will be placed in different positions on the detector.

---

9.Est obs time (hours) pri: 4.15 par: 0.00 10.Num targs pri: 0 par: 0

---

11.Instruments requested: FOC

---

12.Special sched req:

---

13.Description of proposed observations:
The philosophy is to take three exposures of a rich stellar field and control the displacement of the individual exposures with the FGS to obtain the plate scale and its variation over the FOV.
To achieve adequate coverage, the 512 x 1024 format (square pixels, 8-bit) is used.

---

17.Description of plans for data reduction and analysis
The observations will be analyzed off-line using CDBS, and the analysis will be used to update the FOC reference files in SOGS.

PROPOSAL FOR HUBBLE SPACE TELESCOPE OBSERVATIONS

COVER PAGE

ST Sci Use
ID 2808(P)
Received 29-Sep-89
Date: NOV 27, 1989 08:06

1.Proposal Title:
FOC ABSOLUTE SENSITIVITY (F/96 RELAY)

---

2.Scientific Category | 3.Proposal for: CAL/FOC | 4.Proposal type: | 5.(If relevant) Continuation of: 0 Remote ID: 2134

---

6.Principal Investigator | Institution | Country | Telephone

DR. FRANCESCO PARESCE | SPACE TELESCOPE SCIENCE INSTITUTE | USA

---

7.Abstract

Aim is to establish the throughput of the F96/F288 relay. In both the F96 and F288 modes--which must be done separately--we propose to observe a UV-optical spectrophotometric standard star through narrow-band filters, spanning the wavelength range of the instrument. A single camera format is required. Targets are drawn from the ST ScI lists.

---

9.Est obs time (hours) pri: 4.14 par: 0.00 10.Num targs pri: 0 par: 0

---

11.Instruments requested: FOC

---

12.Special sched req:

---

13.Description of proposed observations:

To measure the throughput of the OTA + FOC we shall image UV-optical spectrophotometric standards through medium and wide band filters. The filters have been precisely calibrated at the unit level. As we know their transmisison characteristics extremely accurately, and we know the flux of the standard star, we can determine the sensitivity of the OTA + FOC from the observed FOC photon counts.

The throughput must be evaluated at a number of different wavelengths. We shall use a smaller FOC format than usual (i.e., 256 x 256) which will allow a higher count rate.

---

17.Description of plans for data reduction and analysis

The data will be reduced using APPHOT in CDBS. Results will be used to update XCAL for CALFOC.

PROPOSAL FOR HUBBLE SPACE TELESCOPE OBSERVATIONS

COVER PAGE

ST Sci Use
ID 2809(P)
Received 29-Sep-89
Date: NOV 27, 1989 08:06

1.Proposal Title:
FOC F/48 LONG SLIT SPECTROGRAPH--WAVELENGTH CALIBRATION

---

2.Scientific Category | 3.Proposal for: CAL/FOC | 4.Proposal type: | 5.(If relevant) Continuation of: 0 Remote ID: 2135

---

6.Principal Investigator | Institution | Country | Telephone

DR. FRANCESCO PARESCE | SPACE TELESCOPE SCIENCE INSTITUTE | USA

---

7.Abstract

The aim of this task is to reevaluate the wavelength calibration of the spectrograph using an external source, namely a planetary nebula. There is no internal wavelength calibration for the spectrograph.

Both echelle and filter modes will be studied.

---

9.Est obs time (hours) pri: 2.32 par: 0.00 10.Num targs pri: 0 par: 0

---

11.Instruments requested: FOC

---

12.Special sched req:

---

13.Description of proposed observations:

A large-diameter galactic planetary nebula will be placed on the slit and spectra obtained in both the echelle and filter modes of the f/48 spectrograph. The emission line spectra will allow the wavelength dispersion constants to be determined.

The image of the planetary nebula will cover the long-slit, and hence provide a wavelength calibration over the entire length (20 arcsec).

The exposure sequence is as follows:
First make an LED exposure to allow the geometric distortion to be measured via the reseau. Then take a series of exposures of the planetary nebula, using the three f/48 spectral-order blocking filters, then the prism (echelle-type mode). Conclude with a second LED exposure to monitor geometric stability.

All exposures are to be in f/48 256x1024 pixel = 50 x 25 (zoom).

---

14.Description of plans for data reduction and analysis

The resulting data will be used to update, if needed, the SOGS RSDP files for routine processing of FOC images.

PROPOSAL FOR HUBBLE SPACE TELESCOPE OBSERVATIONS

COVER PAGE

ST Sci Use
ID 2810(P)
Received 29-Sep-89
Date: NOV 27, 1989 08:05

1.Proposal Title:
FOC F/48 LONG-SLIT SPECTROGRAPH--PHOTOMETRIC CALIBRATION

---

2.Scientific Category | 3.Proposal for: CAL/FOC | 4.Proposal type: | 5.(If relevant) Continuation of: 0 Remote ID: 2136

---

6.Principal Investigator | Institution | Country | Telephone

DR. FRANCESCO PARESCE | SPACE TELESCOPE SCIENCE INSTITUTE | USA

---

7.Abstract

The aim of this task is to check the spectrophotometric response of the FOC f/48 spectrograph. Two standard stars will separately be placed at a number of different positions along the slit length to determine the sensitivity of the spectrograph--with respect to wavelength and to slit position.

The experiment needs to be done for both echelle and filter modes.

---

9.Est obs time (hours) pri: 2.97 par: 0.00 10.Num targs pri: 0 par: 0

---

11.Instruments requested: FOC

---

12.Special sched req: Real-time

---

3.Description of proposed observations:

Standard stars will be placed on the slit, in both echelle and filter modes, and used to calibrate the photometric response of the f/48 spectrograph with wavelength. The standards have absolute flux measures from IUE and ground-based studies which in combination cover the required wavelength region from 1200-6000 A. The observed counts will lead directly to the derivation of a sensitivity curve. Comparison with the predicted OTA+FOC throughput for different wavelengths will enable any deterioration of FOC response to be measured and monitored.

The targets will be placed at different positions along the slit. These spectra will yield the plate scale of the spectrograph and the photometric response of the spectrograph in the spatial direction.

---

7.Describe plans for data reduction and analysis

If necessary, the data will be used updating the SOGS RSDP calibration files.

PROPOSAL FOR HUBBLE SPACE TELESCOPE OBSERVATIONS

COVER PAGE

ST Sci Use
ID 2811(P)
Received 29-Sep-89
Date: NOV 27, 1989 08:05

1.Proposal Title:
FOC RELATIVE DQE CALIBRATION

---

2.Scientific Category | 3.Proposal for: CAL/FOC | 4.Proposal type: | 5.(If relevant) Continuation of: 0 Remote ID: 2137

---

6.Principal Investigator | Institution | Country | Telephone
DR. FRANCESCO PARESCE | SPACE TELESCOPE SCIENCE INSTITUTE | USA

---

7.Abstract
The relative pixel-to-pixel response with wavelength of the FOC over the entire field of view will be measured using the daylit Earth.

---

9.Est obs time (hours) pri: 0.00 par: 11.11 10.Num targs pri: 0 par: 0

---

11.Instruments requested: FOC

---

12.Special sched req:

---

3.Description of proposed observations:
In non-prime observing time, the sunlit earth will be used to generate an F/96 flat field at 3400A and 2400A. The daylit earth can be used with the automatic S/C scan across the disk using a combination of filters to suppress red leak.

---

7.Description of plans for data reduction and analysis
The data are required to update the FOC photometric files used in SOGS pipeline processing.

PROPOSAL FOR HUBBLE SPACE TELESCOPE OBSERVATIONS

COVER PAGE

ST Sci Use
ID 2812(P)
Received 29-Sep-89
Date: NOV 27, 1989 08:05

1.Proposal Title:
FOC RELATIVE CALIBRATION

---

2.Scientific Category | 3.Proposal for: CAL/FOC | 4.Proposal type: | 5.(If relevant) Continuation of: 0 Remote ID: 2138

---

6.Principal Investigator | Institution | Country | Telephone

DR. FRANCESCO PARESCE | SPACE TELESCOPE SCIENCE INSTITUTE | USA

---

7.Abstract

The relative pixel to pixel response of the FOC over the entire field of view will be measured using the onboard LEDs.

Observations should be performed in parallel mode, using internal sources.

---

9.Est obs time (hours) pri: 0.00 par: 16.67 10.Num targs pri: 0 par: 0

---

11.Instruments requested: FOC

---

12.Special sched req:

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3.Description of proposed observations:
The LED exposures will allow us to map the relative DQE over the face of the individual detectors at the pixel level.

---

7. Description of plans for data reduction and analysis
The data will be used to update "master" DQE files in CDBS for use by the RSDP pipeline processing.

PROPOSAL FOR HUBBLE SPACE TELESCOPE OBSERVATIONS

COVER PAGE

ST Sci Use
ID 2813(P)
Received 29-Sep-89
Date: NOV 27, 1989 08:05

1.Proposal Title:
MODE II TARGET ACQUISITION/FINGERS ALIGNEMENT

---

2.Scientific Category | 3.Proposal for: CAL/FOC | 4.Proposal type: | 5.(If relevant) Continuation of: 0 Remote ID: 2139

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6.Principal Investigator | Institution | Country | Telephone

DR. FRANCESCO PARESCE | SPACE TELESCOPE SCIENCE INSTITUTE | USA

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7.Abstract

The aim of this activity is to check the stability of the positions of the f/96 occulting fingers and of the f/48 slit notch in detector coordinates. External flat fields on the sunlit earth will be used for the purpose.

---

9.Est obs time (hours) pri: 0.00 par: 0.67 10.Num targs pri: 0 par: 0

---

11.Instruments requested: FOC

---

12.Special sched req:

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13.Description of proposed observations:

Procedure is as follows; for each of the f/96 fingers in turn:

1. Illuminate finger using earth, take image, read to ground, measure current position of finger center in detector coords.

---

17.Description of plans for data reduction and analysis

Data will be reduced by S/W tools already developed for ground based data and residing in FOCUTILITY. The results will be used to update the coordinates for the fingers in the PDB.

PROPOSAL FOR HUBBLE SPACE TELESCOPE OBSERVATIONS

COVER PAGE

ST Sci Use
ID 2814(P)
Received 29-Sep-89
Date: NOV 27, 1989 08:05

1.Proposal Title:
FOC OBJECTIVE PRISMS--WAVELENGTH AND PHOTOMETRIC CALIBRATION

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2.Scientific Category | 3.Proposal for: CAL/FOC | 4.Proposal type: | 5.(If relevant) Continuation of: 0 Remote ID: 2140

---

6.Principal Investigator | Institution | Country | Telephone

DR. FRANCESCO PARESCE | SPACE TELESCOPE SCIENCE INSTITUTE | USE

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7.Abstract

FOC objective prism calibration. The basic aim of this program is to determine the wavelength positions and dispersions, to measure the photometric response, and to verify the value of position offsets for all 5 prisms on the FOC.

---

9.Est obs time (hours) pri: 1.97 par: 0.00 10.Num targs pri: 0 par: 0

---

11.Instruments requested: FOC

---

12.Special sched req:

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13.Description of proposed observations:
The objective prisms will be calibrated using NGC205 as a wavelength standard. The FUVOP and the NUVOP will be calibrated photometrically with the standards LB227, HZ4, and HZ21 using the F140M and F195W filters.

---

17. Description of plans for data reduction and analysis
The data will be analyzed with the SW tools developed for this purpose residing in CDBS.

PROPOSAL FOR HUBBLE SPACE TELESCOPE OBSERVATIONS

COVER PAGE

ST Sci Use
ID 2816(P)
Received 29-Sep-89
Date: DEC 21, 1989 07:18

1.Proposal Title:
FOC APERTURE LOCATION

---

2.Scientific Category | 3.Proposal for: CAL/FOC | 4.Proposal type: | 5.(If relevant) Continuation of: 0 Remote ID: 2143

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6.Principal Investigator | Institution | Country | Telephone

DR FRANCESCO PARESCE | SPACE TELESCOPE SCIENCE INSTITUTE | USA

---

7.Abstract

Aim is to check the positions of the of the 0.4 and 0.8 arcsec f/96 occulting fingers and the f/48 spectrograph slit finger in the V2V3 coordinate system.

Procedure is to do a 6x6 spatial scan with a standard astro metric star over each of the fingers in turn. Raster steps should be in intervals of either 0.2 or 0.4 arcsec (0.8 finger) with the FOC exposing throughout the entire spatial scan. Subsequent analysis should enable the extent of each finger to be determined in V2V3.

---

9.Est obs time (hours) pri: 7.70 par: 0.00 10.Num targs pri: 1 par: 0

---

11.Instruments requested: FOC

---

12.Special sched req:

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13.Description of proposed observations:

The procedure is as follows:

1. Take an external flat field, with the camera scan over the selected finger, using the earth through suitable solar and attenuator filters , to allow the determination of the finger coordinates in SDS, i.e., detector, coordinates. Downlink images for on-line analysis.
2. Maneuver standard astrometric star to nominal center of 512x512-F0.4 field of view. Take image, downlink, determine position of the star in SDS coordinates.
3. Maneuver standard star to start position of spatial scan,
4. Take an internal LED exposure--as a check on geometric stability.
5. Carry out 6x6 spatial scan, with step = 0.2 or 0.4 arcsec and dwell = 50sec, FOC exposing for entire scan.
6. Complete sequence with a second internal LED exposure.
7. Repeat steps 2-6 for 512x512-F0.8 field of view.

For the f/48 detector perform steps 1-6 using a 512x512 camera format placed over the slit finger (this will require a special offset).

---

14. Description of plans for reduction and analysis.

From the analysis of these scans we derive approximate V2V3 coordinates of the center of the slit. During the second visit the scan is performed on the slit with a fine grid, in two different locations. These values will be used to update the SIAF files in the PDB.

PROPOSAL FOR HUBBLE SPACE TELESCOPE OBSERVATIONS

COVER PAGE

ST Sci Use
ID 2919(P)
Received 26-Jan-90
Date: FEB 21, 1990 13:42

1.Proposal Title:
FOC OPTICAL FOCUS

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2.Scientific Category | 3.Proposal for: CAL/FOC | 4.Proposal type: | 5.(If relevant) Continuation of: 0 Remote ID: 2914

---

6.Principal Investigator | Institution | Country | Telephone
DR. FRANCESCO PARESCE | SPACE TELESCOPE SCIENCE INSTITUTE | USA

---

7.Abstract

The objective of this test is to check the optimum setting of the FOC refocusing mechanism, using a rich star field.

The procedure will be performed twice per chain. Real-time analysis and the uplinking of a revised focus mechanism position will be required.

---

9.Est obs time (hours) pri: 10.44 par: 0.00 10.Num targs pri: 0 par: 0

---

11.Instruments requested: FOC

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12.Special sched req: REAL-TIME

---

13.Description of proposed observations:

The focussing procedure will be first carried out during OV, and SV. This proposal describes the procedures for f/48, and f/96. For F/96 the procedure is based on 5 observations of a rich stellar field, one taken at the nominal focus setting, two taken at increments of 50 steps in the positive direction of the refocussing mechanism, two more at settings in the negative direction. Because of backlash it will be necessary to step the refocus mechanism in the same direction every time. At the completion of a focussing cycle the mechanism will be returned to its nominal position. For f/48 relay 8 exposures will be used. At completion of the exposures, the images should be read down for real-time analysis. We need to inspect the images on a VDU, draw cross-cuts through the stellar images, and have hard copy output. Best focus position can

PROPOSAL FOR HUBBLE SPACE TELESCOPE OBSERVATIONS

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ST Sci Use
ID 2920(P)
Received 26-Jan-90
Date: FEB 21, 1990 13:49

1.Proposal Title:
FOC POINT SPREAD FUNCTION

---

2.Scientific Category | 3.Proposal for: CAL/FOC | 4.Proposal type: | 5.(If relevant) Continuation of: 0 Remote ID: 2886

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6.Principal Investigator | Institution | Country | Telephone

DR. FRANCESCO PARESCE | SPACE TELESCOPE SCIENCE INSTITUTE | USA

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7.Abstract
The aim is to measure the ST/FOC instrumental point spread function (PSF) in the f/96 around the f0.8 finger.

The structure of the PSF has to be measured with high photometric accuracy, otherwise it is not possible to discriminate fine structure of the PSF and fine structure that may be intrinsic to the astronomical object itself.

---

9.Est obs time (hours) pri: 2.92 par: 0.00 10.Num targs pri: 1 par: 0

---

11.Instruments requested: FOC

---

12.Special sched req:

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3.Description of proposed observations:
It is necessary to measure the ST/FOC PSF with high photometric accuracy for the following reasons:

(a) determination of the ST resolution and intensity profile of star images
(b) discrimination between fine structure of the PSF and fine structure of the astronomical object
(c) deconvolution experiments
(d) determination of contrast discrimination.

Especially critical is the exact shape of the PSF for the observations of objects with high intensity contrasts since the wings of the PSF may be of similar brightness as faint parts of the astronomical target. Such objects are all QSOs with faint underlying galaxy, all Seyfert galaxies, planets of nearby stars (magnitude difference more than 17m), gas and dust shells around stars, and the like.

PROPOSAL FOR HUBBLE SPACE TELESCOPE OBSERVATIONS

COVER PAGE

ST Sci Use
ID 2817(P)
Received 29-Sep-89
Date: FEB 23, 1990 10:03

1.Proposal Title:
FOS LOCATION OF SPECTRA: Y-BASE MAPS

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2.Scientific Category | 3.Proposal for: CAL/FOS | 4.Proposal type: | 5.(If relevant) Continuation of: 0 Remote ID: 2010

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6.Principal Investigator | Institution | Country | Telephone
GEORGE HARTIG | STSCI | USA | 301-338-4966


---


7.Abstract
Locations of spectra are measured in OV twice and in SV 7 times (once with a measurement in all apertures at two grating settings plus all grating settings in two apertures, and 6 times with one aperture at all grating settings). In cycle 1 we will measure the locations of spectra for the 0.3" aperture at all grating settings once every 3 months to verify repeatability and to measure any long-term drift. This test has the highest priority because our ability to acquire spectra depends on our knowledge of Y_Base values.


---

9.Est obs time (hours) pri: 0.00 par: 1.90 10.Num targs pri: 0 par: 0

---

11.Instruments requested: FOS

---

12.Special sched req:

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3.Description of proposed observations:
In this test, we will obtain data on the internal Pt-Ne lamps. Data will be obtained through the 0.3" apertures for 8 dispersers. The observations will map the face of the photocathode using 24 y-steps and 1 x-step. The program is to be performed for a total of 4 times, once every 90 days (plus or minus 5 days).

---

7.Description of plans for data reduction and analysis
Data reduction and analysis will be performed at the STScI. This is a verification of ground-based analysis, so no data will need to be added to the PODPS pipeline. However, this program will determine the correct y-deflections to be used in obtaining data, and this information will need to be updated after any change in position is measured.

PROPOSAL FOR HUBBLE SPACE TELESCOPE OBSERVATIONS

COVER PAGE

ST Sci Use
ID 2818(P)
Received 29-Sep-89
Date: FEB 23, 1990 10:10

1.Proposal Title:
FOS VERIFICATION OF TIME-RESOLVED MODES

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2.Scientific Category | 3.Proposal for: CAL/FOS | 4.Proposal type: | 5.(If relevant) Continuation of: 0 Remote ID: 2022

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6.Principal Investigator | Institution | Country | Telephone
ANNE KINNEY | STSCI | USA | 301-338-4831


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7.Abstract
The testing of PERIOD mode is in the delta SV plan. If the test is not carried out (which is not at all unlikey) then PERIOD mode must be tested in cycle 1. In order to verify the functionality of the mode, aa stable high-frequency variable star with a well-measured period will be observed. The PERIOD mode constitutes a minority of FOS observations, but forms one of the features that is unique to the instrument. We plan to observe one of two standards - the Crab Pulsar or DQ-Her -- using synchronous time-resolved mode.


---

9.Est obs time (hours) pri: 1.40 par: 0.00 10.Num targs pri: 1 par: 0

---

11.Instruments requested: WF/PC FOS

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12.Special sched req: Time-crit Obs

---

13.Description of proposed observations:
In this test, we will observe one (1) high-speed variable star to verify the functionality of the time-resolved modes of the FOS. We will observe the Crab pulsar for ~1 hour or DQ Her for ~2 hours (including overhead) in the synchronous time-resolved mode.

---

17.Description of plans for data reduction and analysis
Data reduction and anaylsis will be performed at the STScI.

PROPOSAL FOR HUBBLE SPACE TELESCOPE OBSERVATIONS

COVER PAGE

ST Sci Use
ID 2819(P)
Received 29-Sep-89
Date: NOV 27, 1989 08:04

1.Proposal Title:
FOS DARK AND SKY BACKGROUNDS

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2.Scientific Category | 3.Proposal for: CAL | 4.Proposal type: | 5.(If relevant) Continuation of: 0 Remote ID: 2023

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| 6.Principal Investigator | Institution | Country | Telephone |
|---|---|---|---|
| GEORGE HARTIG | STSCI | USA | 301-338-4966 |

---

7.Abstract

Measurements of the background, both internal (dark) and external (sky), will be obtained with the FOS when other SIs are prime. The sky data will be obtained at high galactic latitude, low galactic latitude, and in the ecliptic plane, to determine if there are any differences in the sky spectrum. These observations will allow us to determine when sky measurements will be required for science data. Some sky observations will be read from two different portions of the photocathode, to check if the dark count is position dependent. If it is not, then normal science dark measurements can be obtained by changing the y-base, rather than closing the entrance aperture, thus allowing for more efficient observing.

The dark measurements will be obtained with a variety of SIs prime, to test for any EMI problems, and during SAA passages, to determine if science observations are possible during this period. Because these parallel observations require very complicated scheduling and commanding, we do not know how much of the SV program will have been completed by the end of SV. This plan requires a minimum of 8 hours of dark and sky measurements with up to 50.0 hours desirable.

---

9.Est obs time (hours) pri: 0.00 par: 8.00 | 10.Num targs pri: 0 par: 0

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11.Instruments requested: FOS

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12.Special sched req: Unint long exp

---

13.Description of proposed observations:

In this test, we will obtain data on the sky and dark backgrounds. Sky measurements will be obtained at high galactic latitude, low galactic latitude, and the ecliptic plane, using the low dispersion gratings and the prism. Both detectors will be used, and data read from two different positions on the photocathode. The observations will be repeated as often as possible.

Dark measurements will be obtained using both detectors. Data will be obtained with a variety of SIs prime, to test for an EMI problems, and data will be taken inside the SAA, to see if it may be possible to observe in this area. The observations will be repeated as often as possible.

Although the DARK measurements will be used to determine the average level of dark counts to subtract from the science data, the primary purpose of the DARKs is to determine which FOS channels should be disabled. It is clear that all channels which exceed spec continually or intermittently should be turned off. Even though we have much information from ground-based tests, those data, taken at room temperature, may have listed as good channels which will be bad at operating temperatures. There may also be channels which are noisy on the ground that will be good under operating conditions.

These channels could improve either because the temperature is lower or because the (intermittent) noise was due to interference from something in the environment which will not be present on orbit. For this reason, all channels should be enable for these DARK observations. Because of the intermittent nature of the noise in the channels (some bad channels showed up in only one or

PROPOSAL FOR HUBBLE SPACE TELESCOPE OBSERVATIONS

COVER PAGE

ST Sci Use
ID 2820(P)
Received 29-Sep-89
Date: FEB 23, 1990 10:58

1.Proposal Title:
WAVELENGTH CALIBRATION: INTERNAL/EXTERNAL OFFSETS

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2.Scientific Category | 3.Proposal for: CAL/FOS | 4.Proposal type: | 5.(If relevant) Continuation of: 0 Remote ID: 2922

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6.Principal Investigator | Institution | Country | Telephone
GEORGE HARTIG | STSCI | USA | 301-338-4966

---

7.Abstract
Offsets between internal and external wavelength scales will be measured in SV for 3 gratings on the blue side and for 6 gratings on the red side. In cycle 1, wavelength offsets will be measured for G270H on the blue side and G190H on the red side to fill in gaps in the coverage in SV. Wavelength offsets will be re-measured for two of the configurations measured in SV (G190H on the blue side and G570H on the red side) to verify the stability of the offsets.

This test will be performed using the 0.3" and the 0.1-PAIR-B apertures and two external sources. Derived offsets can be applied to the polynomial fit of pixel number versus wavelength determined from the lines in the internal Pt/Cr-Ne lamp. Unresolved lines in a planetary nebula and in a dMe star will be used to determine the FOS + ST Line Spread Function. The internal sources make up only 5% of the exposure time and must be acquired at the same time as the external sources, so they cannot be scheduled as parallel observations.

---

9.Est obs time (hours) pri: 5.30 par: 0.00 10.Num targs pri: 2 par: 0

---

11.Instruments requested: FOS

---

12.Special sched req:

---

3.Description of proposed observations:
In this test, we will obtain spectra of external and internal wavelength calibration sources, and compare the resulting channel versus wavelength relationships to search for any offset between the two. Both the external objects, as well as the internal Pt-Ne lamp, will be observed through one aperture.

---

7.Description of plans for data reduction and analysis
Data reduction and analysis will be performed at the STScI. Wavelength offsets found between in internal and external sources will need to be incorporated into the dispersion coefficients used by the PODPS pipeline.

PROPOSAL FOR HUBBLE SPACE TELESCOPE OBSERVATIONS

COVER PAGE

ST Sci Use
ID 2821(P)
Received 29-Sep-89
Date: FEB 23, 1990 11:08

1.Proposal Title:
SPECTRAL FLAT FIELDS

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2.Scientific Category | 3.Proposal for: CAL/FOS | 4.Proposal type: | 5.(If relevant) Continuation of: 0 Remote ID: 2923

---

6.Principal Investigator | Institution | Country | Telephone
ANNE KINNEY | STSCI | USA | 301-338-4831

---

7.Abstract

The diode to diode variations and photocathode non- uniformities of the FOS detectors will be determined in SV for spectra obtained through the single apertures. Additional flat field calibrations will be performed in cycle 1 to verify stability and to extend the calibration to include the paired aperture spectra. In this test, we will obtain spectra of G191-B2B, which is known to have a very smooth, relatively featureless spectrum. The star will be observed in every useful detector/disperser combination (a total of 14) through single apertures, and with the most useful dispersers at the photocathode locations corresponding to paired aperture spectra. Spatial scanning in the dispersion direction is used to shift the spectra, so that instrumental and features can be distinguished. The most useful polarizer configurations are also calibrated. A second star, BD+28D4211, is also observed in the same manner, about 6 months later, to establish photometric and flat-field stability.

---

9.Est obs time (hours) pri: 11.20 par: 0.00 10.Num targs pri: 6 par: 0

---

11.Instruments requested: FOS

---

12.Special sched req:

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3.Description of proposed observations:
G191-B2B will be observed with the spectral images at the locations on the photocathode corresponding to target positioning in the single apertures, for each useful detector/disperser combination (a total of 14), and corresponding to paired aperture spectra with the most utilized dispersers. A spatial scan will be used to shift the location of the spectra in the dispersion direction, so that intrinsic features of the stellar spectrum can be distinguished from detector nonuniformities. The data will also be obtained with three ysteps, to assure photometric accuarcy, since the same data are also useful for inverse sensitivity calibration. The most useful polarizer configurations will also be calibrated. These observations must be scheduled as early as possible in Cycle 1 to support RSDP calibration of science data, especially those obtained with the paired apertures. A second star, BD+28D4211, also a photometric standard with relatively smooth spectral distribution, will be observed, preferably near the mid-point of Cycle 1, to improve the flat-field accuracy and establish the photometric and flat-field stability.

---

7.Description of plans for data reduction and analysis
Data reduction and analysis will be performed at the STScI. These data will be used primarily to determine the spectral flat field calibration files for FOS RSDP processing.

PROPOSAL FOR HUBBLE SPACE TELESCOPE OBSERVATIONS

COVER PAGE

ST Sci Use
ID 2823(P)
Received 29-Sep-89
Date: FEB 23, 1990 11:11

1.Proposal Title:
ABSOLUTE PHOTOMETRY

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2.Scientific Category | 3.Proposal for: CAL/FOS | 4.Proposal type: | 5.(If relevant) Continuation of: 0 Remote ID: 2924

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6.Principal Investigator | Institution | Country | Telephone
GEORGE HARTIG | STSCI | USA | 301-338-4966


---

7.Abstract


The absolute sensitivity of the FOS will be determined in SV by observing 2 stars at 3 epochs, first in 3 apertures (1.0", 0.5", and 0.3" circular) and then in 1 aperture (1.0" circular). In cycle 1, one star, BD+28D4211 will be observed in the 1.0" aperture to establish the stability of the sensitivity and flat field characteristics and improve the accuracy obtained in SV. This star will also be observed through the paired apertures since these are not calibrated in SV. The stars will be observed in most detector/grating combinations. The data will be averaged to form the inverse sensitivity functions required by RSDP.


---

9.Est obs time (hours) pri: 13.2 par: 0.00 10.Num targs pri: 3 par: 0

---

11.Instruments requested: FOS

---

12.Special sched req:

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3.Description of proposed observations:
In this test, we will obtain spectra of BD+28D4211, a spectrophotometric standard with smooth spectral distribution. Observations will be made with all of the most utilized detector-grating combinations. To assure registration of the spectrum on the diode array, the stars will be observed at 3 y-bases with ~8 micron separation. This star will be observed with all of the paired apertures, along with the 1.0" single aperture. Measurements will also be made with the most useful polarizer configurations, to provide photometric and flat-field calibrations. The light leakage from a point source behind the occulting apertures will also be quantified.

---

7.Description of plans for data reduction and analysis
Data reduction and analysis will be performed at the STScI. This is a calibration; the resulting data will be used by the PODPS pipeline. Inverse sensitivity and spectral flat field files in CDBS will be updated.

PROPOSAL FOR HUBBLE SPACE TELESCOPE OBSERVATIONS

COVER PAGE

ST Sci Use
ID 2824(P)
Received 29-Sep-89
Date: NOV 27, 1989 08:04

1.Proposal Title:
FOS POLARIMETRIC CALIBRATION

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2.Scientific Category | 3.Proposal for: CAL/FOS | 4.Proposal type: | 5.(If relevant) Continuation of: 0 Remote ID: 2027

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| 6.Principal Investigator | Institution | Country | Telephone |
|---|---|---|---|
| ANNE L. KINNEY | STSCI | USA | 301-338-4831 |

---

7.Abstract
By the end of SV, 7 combinations of detector, disperser, and waveplate will be calibrated (G130H and G160L on the blue side with the B waveplate and the Prism on the blue side with the A wavelplate andf G270H and G190H on the red side with the B waveplate and the Prism on the red side with both the A and the B waveplate). The Y-Bases are measured for these combinations, along with the throughput and the instrumental polarization, and spectral flat fields and wavelength calibrations are performed. To maintain this level of calibration for cycle 1, the same parallel-time calibrations will be performed but the observations of external target will be greatly reduced by observing at only one angle of the waveplate and at only one position angle. The waveplate parameters are used to update the CDBS reference files CYCCS4R and retardation is referenced by the relation CYRETR.

---

9.Est obs time (hours) pri: 3.40 par: 2.00 10.Num targs pri: 1 par: 0

---

11.Instruments requested: FOS

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12.Special sched req: Unint long exp

---

3.Description of proposed observations:
Part 1. Measurements of the internal Pt-Ne lamps will be used to locate the two oppositely polarized spectra that occur with the polarimeter. The positions of the split spectra will be compared to those of spectra taken without the polarimeter. The data will be used to determine a wavelength scale for the most commonly used modes of the polarimeter.

Part 2. The instrumental polarization, flat-field corrections, and throughput of the polarimeter will be measured by observing the polarimetric and photometric standard G191-B2B. Note: Observations in Part 1 can be done in parallel with another instrument prime.

---

7.Description of plans for data reduction and analysis
Data reduction and analysis will be performed at the ST ScI. This program is a calibration, so the resulting data will need to be added to the PODPS pipeline.

PROPOSAL FOR HUBBLE SPACE TELESCOPE OBSERVATIONS

COVER PAGE

ST Sci Use
ID 2825(P)
Received 29-Sep-89
Date: FEB 23, 1990 09:57

1.Proposal Title:
FOS APERTURE LOCATIONS - PHASE IV A FINE POSITIONS

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2.Scientific Category | 3.Proposal for: CAL/FOS | 4.Proposal type: | 5.(If relevant) Continuation of: 0 Remote ID: 2018

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6.Principal Investigator | Institution | Country | Telephone
ANNE KINNEY | STSCI | USA

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7.Abstract
Aperture locations and sizes are measured in 4 phases (described in detail in "Aperture Locations and Sizes for the Space Telescope Science Instruments" by O. Lupie, R. Bohlin, and A. Holm) in OV and SV. A trimmed down version of the SV aperture location measurement will be done every 4 months (performed in only the 0.1-PAIR_B aperture and using onboard acquisition) on both the red and the blue sides in cycle 1 to verify repeatability and to measure any long-term drift in the aperture locations. This program has the highest priority because all FOS observations depend on our knowledge of aperture location.

---

9.Est obs time (hours) pri: 6.50 par: 2.40 10.Num targs pri: 1 par: 0

---

11.Instruments requested: WF/PC FOS

---

12.Special sched req:

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3.Description of proposed observations:
Cycle 1 test of Aperture Locations will provide a fine measure of the FOS aperture locations in V2V3 by rastering a star on a fine grid to find the maximum throughput for small apertures. This technique provides the most precise V2V3 locations and may provide the most precise locations of the larger apertures from the relative positions of Phase I. A refined plate scale and orientation can be derived from the V2V3 separation of the lower 0.1 arcsec apertures.

The grid for the 0.1 arcsec apertures is 0.1x0.1 arcsec with 0.02 arcsec steps.

Each detector side should begin and end with flat field aperture maps to determine the current detector coordinates of the apertures used. A WF/PC image of the stellar field should be obtained in parallel with FOS observations of the star for boresight testing.

---

7.Description of plans for data reduction and analysis
Data reduction will be performed at the ST ScI. The results of this aperture location calibration are relevant to the project data base, so that the priority is very high.

PROPOSAL FOR HUBBLE SPACE TELESCOPE OBSERVATIONS

COVER PAGE

ST Sci Use
ID 2826(P)
Received 29-Sep-89
Date: FEB 23, 1990 10:08

1.Proposal Title:
FOS DISCRIMINATOR TEST

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2.Scientific Category | 3.Proposal for: CAL/FOS | 4.Proposal type: | 5.(If relevant) Continuation of: 0 Remote ID: 2028

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6.Principal Investigator | Institution | Country | Telephone
GEORGE HARTIG | STSCI | U.S.A. | 301-338-4966

---

7.Abstract
The optimal discriminator settings will be determined in OV. Because both the noise and gain are known to be temperature sensitive, it is likely that some fraction of the channels wil experience some change in their optimal discriminator settings on orbit. The discriminator/noise test should be run twice in cycle 1 to verify the stability of those settingxs. The FOS high voltage will be brought to approximately one-half the nominal operating voltage (12750 KV), with the REFDAC=250 and the trim focus current at 0. A 60s wait will allow the high voltage to stabilize. The command block YTDN will be run, with the INTFLAT as the source.

---

9.Est obs time (hours) pri: 0.00 par: 3.00 10.Num targs pri: 0 par: 0

---

11.Instruments requested: FOS

---

12.Special sched req:

---

3.Description of proposed observations:
The FOS high voltage will be brought to approximately one-half the nominal operating voltage (12750 KV), with the REFDAC=250 and the trim focus current at 0. A 60S wait will allow the high voltage to stabilize. The command block YTDN will be run, with the INTFLAT as the source, for the following parameters:

| FOS/RD | FOS/BL |
|---|---|
| DAC values 100-255 | DAC values 100-255 |
| 1 unit per step | 1 unit per step |
| 10s exposure time | 30s exposure time |
| 26M total exposure time | 78M total exposure time |
| 13M total overhead | 13M total overhead |

The exposure time in lines 1.0 and 10.0 is based on running command blocks YSHDLV (8:37) and YSHVON (1:41).

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7.Description of plans for data reduction and analysis
Data reduction and analysis will be performed at the ST ScI.

PROPOSAL FOR HUBBLE SPACE TELESCOPE OBSERVATIONS

COVER PAGE

ST Sci Use
ID 2839(P)
Received 09-Oct-89
Date: NOV 27, 1989 08:02

1.Proposal Title:
CYCLE 1 TEST FOR HRS/FGS FINE ALIGNMENT

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2.Scientific Category | 3.Proposal for: CAL/HRS | 4.Proposal type: | 5.(If relevant) Continuation of: 0 Remote ID: 2340

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| 6.Principal Investigator | Institution | Country | Telephone |
|---|---|---|---|
| RONALD L GILLILAND | ST SCI | USA | 301-338-4454 |

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7.Abstract

This proposal defines the HRS/FGS Fine Alignment Calibration. The goals of this test are: (1) to determine the coordinates of the LSA and SSA in V2/V3 coordinates with an accuracy of 0.02 arcsec, (2) to locate the SSA in V2/V3 coordinates, and (3) to refine the measurement of the plate scale and aperture orientation.

This proposal is a copy of 1397 (OV HRS/FGS Fine Alignment) and SV 2765 (except no real time acq required).

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9.Est obs time (hours) pri: 1.28 par: 0.00 10.Num targs pri: 1 par: 0

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11.Instruments requested: HRS FGS

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12.Special sched req:

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13.Description of proposed observations:

There are three parts to this test. In the first part the probe star is acquired and centered in the LSA using a Mode I target acquisition. It is scanned across one edge of the aperture in a series of fine step and dwell maneuvers executed by DF-244. A direct downlink HRS observation is started to continuously monitor the flux through the aperture with accurate time resolution. The flux will be correlated with the V2/V3 position of the image during data reduction. The HRS must be instructed to continue to take scientific data while the telescope is moving. The direct downlink observation must be terminated by setting HRS event flag 2. This procedure will be repeated for all four edges of the LSA. The second part of the test locates the SSA. A series of step and dwell maneuvers will move the probe star over a grid of closely spaced points centered on the expected position of the aperture. A direct downlink observations will be in progress monitoring the flux as a function of time. In the third part the probe star will be returned to the nominal center of the LSA and a single field map will be obtained.

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17.Description of plans for data reduction and analysis

The flux vs. position data will be analyzed to determine precise locations of aperture edges. The center of each aperture will be inferred from te edge positions. The plate scale and orientation will be inferred from the difference between the centers of the two apertures.

The locations of the two apertures will be entered into the project data base.

PROPOSAL FOR HUBBLE SPACE TELESCOPE OBSERVATIONS

COVER PAGE

ST Sci Use
ID 2840(P)
Received 09-Oct-89
Date: NOV 27, 1989 08:02

1.Proposal Title:
FIRST ORDER GRATING PHOTOCATHODE GRANULARITY

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2.Scientific Category: CALIBRATION

3.Proposal for: CAL/HRS

4.Proposal type:

5.(If relevant)
Continuation of: 0
Remote ID: 2341

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6.Principal Investigator: RONALD L. GILLILAND
Institution: ST SCI
Country: USA
Telephone: (301)338-4454


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7.Abstract
CYCLE 1 calibration of photocathode granularity for domains covered by first order gratings. The signal-to-noise attainable with GHRS in standard ACCUM modes will normally be limited to a few percent by uncalibrated sensitivity variations on the photocathodes. With prior calibration this limitation can be alleviated. This proposal covers only D1 for which the granularity is to be a severe limitation. Diode to diode sensitivity only is derived for a stellar source on D2.


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8.Scientific Key Words: HRS, CALIBRATION, CYCLE 1

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9.Est obs time (hours) pri: 7.01 par: 0.00 10.Num targs pri: 2 par: 0

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11.Instruments requested: HRS

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12.Special sched req:

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13.Description of proposed observations:
Mu-Col for G140M and HD 93521 for G140L will be observed over the full range of wavelength for each grating, where the given grating is the most efficient choice. The spacing between wavelength settings in a WSCAN will be chosen such that vertical offsets of 50 microns on the photocathode will occur in order to map out both dimensions of granularity variation in a fully wavelength dependent sense. FPSPLITs will be used to determine the granularity at any wavelength setting.

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17.Description of plans for data reduction and analysis
Over the FP-SPLITs the photocathode granularity will be manifested as fixed pattern noise that moves through the spectra at the SPLIT cadence. It is then possible to simultaneously solve for both the fixed pattern noise (granularity) and the stellar spectrum.

PROPOSAL FOR HUBBLE SPACE TELESCOPE OBSERVATIONS

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ST Sci Use
ID 2841(P)
Received 09-Oct-89
Date: NOV 27, 1989 08:02

1.Proposal Title:
DARK NOISE MONITORING HRS-HSP

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2.Scientific Category | 3.Proposal for: CAL/HRS | 4.Proposal type: | 5.(If relevant) Continuation of: 0 Remote ID: 2342

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6.Principal Investigator | Institution | Country | Telephone
RONALD L. GILLILAND | ST SCI | USA | 301-338-4454


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7.Abstract
CYCLE 1 test for routine monitoring of detector dark noise. This proposal will provide the primary means of checking on health of the GHRS detector systems through frequent monitoring of the background count rate. Parallel HSP observations are taken to allow tracking of GHRS background against HSP particle count rates.


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9.Est obs time (hours) pri: 0.00 par: 49.80 10.Num targs pri: 0 par: 0

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11.Instruments requested: HRS HSP

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12.Special sched req:

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3.Description of proposed observations:
Engineering mode "Photoscan" can be used. An integration time of 10 seconds with 7 bins produces a readout every 70 seconds. 16 of these observations provides 18.7 minutes of dark count data. All deflection are 2048, 2048. If possible, parallel HSP observations will be made, but this should not restrict the running of frequent GHRS dark counts.

---

7.Description of plans for data reduction and analysis
Basically the same as for test HRS-i5, but with long term trend analysis and improvement of statistical accuracy as the main goals.

PROPOSAL FOR HUBBLE SPACE TELESCOPE OBSERVATIONS

COVER PAGE

ST Sci Use
ID 2842(P)
Received 09-Oct-89
Date: NOV 27, 1989 08:01

1.Proposal Title:
ECHELLE PHOTOMETRIC SENSITIVITY

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2.Scientific Category: CALIBRATION

3.Proposal for: CAL/HRS

4.Proposal type:

5.(If relevant)
Continuation of:
0
Remote ID: 2343

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6.Principal Investigator: RONALD L. GILLILAND
Institution: ST SCI
Country: USA
Telephone: (301)338-4454


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7.Abstract
CYCLE 1 calibration of Echelle sensitivity using standard star. This is a repeat of SV 1357 to maintain radiometric calibration.


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9.Est obs time (hours) pri: 3.28 par: 0.53 10.Num targs pri: 1 par: 0

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11.Instruments requested: HRS

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12.Special sched req:

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13.Description of proposed observations:
Mu-Col will be acquired using mirror A1, and centered in the Large Science Aperture. A field map will be taken to confirm the centering. The carousel will be rotated to position Echelle a at the peak of the blaze sensitivity =mLambda=56200. Observations of orders 47-33 will be made with four samples per resolution element and two samples on the interorder background. The shutter will be closed and spectral lamp SCI will be measured at the same wavelengths. The star will be translated to the Small Aperture, and the same sequence of observations repeated. It will then be returned to the Large Aperture, and all fifteen orders will be measured at each of three other carousel positions. The four carousel positions will be at approximately mLambda=55600, 56200, 57200 and 57800. The same type of sequence will be repeated with Echelle B and detector D2.

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17.Description of plans for data reduction and analysis
Photometric sesitivities vs. order number will be derived for the balze maximum of each order. Results will be entered into calibration data base for reduction of raw data.

PROPOSAL FOR HUBBLE SPACE TELESCOPE OBSERVATIONS

COVER PAGE

ST Sci Use
ID 2843(P)
Received 09-Oct-89
Date: NOV 27, 1989 08:01

1.Proposal Title:
HRS INTERMEDIATE/LOW RESOLUTION CROSS-CALIBRATION

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2.Scientific Category: CALIBRATION

3.Proposal for: CAL/HRS

4.Proposal type:

5.(If relevant) Continuation of: 0
Remote ID: 2344

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| 6.Principal Investigator | Institution | Country | Telephone |
|---|---|---|---|
| RONALD L. GILLILAND | ST SCI | USA | 301-338-4454 |


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7.Abstract
This proposal defines tests to cross calibrate the HRS low and intermediate resolution modes. Intermediate/low resolution standards will be observed with the G140L, G140M, G160M, G200M, and G270M grating. One of the two primary objects is an FOS calibration star; This is the only proposal that will provide cross-calibration of GHRS and FOS. Primary purpose is to provide time history with two independent external sources. An independent CAL proposal with the brighter star mu Col as target will be used to monitor flux differences between LSA and SSA and at a higher density of wavelengths.


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9.Est obs time (hours) pri: 3.33 par: 0.00 10.Num targs pri: 2 par: 0

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11.Instruments requested: HRS

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12.Special sched req:

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3.Description of proposed observations:
Observe BD+75D325 and HD 93521 as follows:
1.) Acquire target using on-board acquisition. 2.) Center in LSA and make focus diode aperture map. 3.) Obtain G140L spectra as follows: (a.) 4 carrousel settings on 200 A centers (1100, 1300, 1500, 1700A), (b.) 2 substeps/diode, integrations <5s/substep (c.) ~10 percent of integration time on background. 4.) Obtain G140M spectra as follows: one carrousel setting at 1300 (b.) 2 substeps/diode, integrations <5s/substep (c.) 10 percent integration time on background. 5.) Obtain G160M data spectra as follows: one carrousel setting at 1600 (b.) 2 substeps/diode, 5 to 20s substep integrations (c.) 10 percent integration time on background. G200M at 2100 10 to 20s substep integrations G270M at 2600 5 to 10s substep integrations

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7.Description of plans for data reduction and analysis
Data will be reduced at ST SCI. This will provide time history information on absolute sensitivity of the GHRS.

PROPOSAL FOR HUBBLE SPACE TELESCOPE OBSERVATIONS

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ST Sci Use
ID 2844(P)
Received 09-Oct-89
Date: NOV 27, 1989 08:01

1.Proposal Title:
GHRS ECHELLE SPECTRAL LAMP MINI-FUNCTIONAL TEST

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2.Scientific Category | 3.Proposal for: CAL/HRS | 4.Proposal type: | 5.(If relevant) Continuation of: 0 Remote ID: 2345

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6.Principal Investigator | Institution | Country | Telephone
RONALD L. GILLILAND | ST SCI | USA | 301-338-4454


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7.Abstract
This proposal defines the spectral lamp test for Echelle A, and B. It is an internal test which makes measurements of the wavelength lamp SC2. It calibrates the carrousel function, Y deflections, resolving power, sensitivity, and scattered light. It will be run every 4 months. The carrousel function and Y deflection function coefficients will be updated in the project data base. The wavelength calibration dispersion constants will be updated in the PODPS calibration data base.


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9.Est obs time (hours) pri: 0.00 par: 4.05 10.Num targs pri: 0 par: 0

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11.Instruments requested: HRS

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12.Special sched req:

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3.Description of proposed observations:
Observations made for each Echelle, at 5 carousel positions and 5 different orders per configuration: Echelle A: mLAMBDA = 55246,55690,56142,56591,57046 and orders m = 34,37,40,43,and 46. Echelle B: mLAMBDA = 54668,55418,56169,56915,57662 and orders m = 18,21,24,27,and 30. At each position lamp SC2 will be observed for a total of 50 observations. Each will use substep pattern 7, for 4 samples per diode. Two point COMB addition will be used. A new spectrum Y balance offset will be calculated and applied for each observation.

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7.Description of plans for data reduction and analysis
1. Coefficients for the carrousel function and Y deflection function are determined and entered into the PDB.
2. Wavelength calibration dispersion constants are entered into the PODPS calibration data base.
3. Other parameters are derived for performance monitoring.

PROPOSAL FOR HUBBLE SPACE TELESCOPE OBSERVATIONS

COVER PAGE

ST Sci Use
ID 2845(P)
Received 09-Oct-89
Date: NOV 27, 1989 08:01

1.Proposal Title:
GHRS 1ST ORDER GRATING SPECTRAL LAMP TEST

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2.Scientific Category | 3.Proposal for: CAL/HRS | 4.Proposal type: | 5.(If relevant) Continuation of: 0 Remote ID: 2346

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6.Principal Investigator | Institution | Country | Telephone
RONALD GILLILAND | ST SCI | USA | 301-338-4454


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7.Abstract
This proposal defines the spectral cal lamp mini-functional test for the first order gratings. It is an internal test which makes measurements of the lamp (SC2). It is used to calibrate the carrousel function, Y deflections, resolving power, sensitivity, and scattered light. It will be run for basic calibrations. The carrousel and Y deflection function coefficients are determined and the PDB will be updated. The wavelength calibration dispersion constants will be updated in the PODPS calibration data base.


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9.Est obs time (hours) pri: 0.00 par: 4.00 10.Num targs pri: 0 par: 0

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11.Instruments requested: HRS

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12.Special sched req:

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13.Description of proposed observations:
Observations will be made for the following first order gratings: Grating G1 (G140M), at 6 carrousel positions, for central wavelengths 1165, 1255, 1330, 1405, 1525, and 1705 Angstroms. Grating G2 (G160M), at 6 carrousel positions, for central wavelengths 1240, 1400, 1520, 1640, 1780, and 1940 Angstroms. Grating G3 (G200M), at 6 carrousel positions, for central wavelengths 1780, 1940, 2100, 2240, 2380, and 2500 Angstroms. Grating G4 (G270M), at 6 carrousel positions, for central wavelengths 2375, 2500, 2700, 2900, 3050, and 3200 Angstroms. Grating G5 (G140L), at 4 carrousel positions, for central wavelengths 1200, 1400, 1600, 1800 Angstroms.
At each position, one spectral lamp (sc2) will be observed . Each observation will use substep pattern 3, with 4 samples per diode. The 2 point comb addition feature will be used, and a new spectrum Y balance offset will be calculated for each observation.

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14.Description of plans for data reduction and analysis
1. Coefficients for the carrousel function and Y deflection function are determined and entered into the project database. These coefficients will be used to construct OSTs for subsequent observations using this grating.
2. Wavelength calibration dispersion constants are entered into the PODPS calibration database.
3. Other parameters are derived for performance monitoring.

PROPOSAL FOR HUBBLE SPACE TELESCOPE OBSERVATIONS

COVER PAGE

ST Sci Use
ID 2847(P)
Received 09-Oct-89
Date: NOV 27, 1989 08:01

1.Proposal Title:
APERTURE OFFSETS AND ECHELLE WAVELENGTH CALIBRATIONS

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2.Scientific Category: CALIBRATION

3.Proposal for: CAL/HRS

4.Proposal type:

5.(If relevant) Continuation of: 0
Remote ID: 2386

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6.Principal Investigator: DOUGLAS K. DUNCAN
Institution: STSCI
Country: USA
Telephone: 301-338-4935

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7.Abstract
The purpose of the test is to calibrate the geometrical offsets between the Large Science Aperture and the Small Science Aperture, so that dispersion constants derived for the SSA may be used to assign accurate wavelengths to spectra obtained with the LSA. The target is a Hobbs-York wavlength std. to tie the internal GHRS wavelength scale to the external world, providing the fundamental HST wavelength scale.

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9.Est obs time (hours) pri: 4.31 par: 0.00 10.Num targs pri: 1 par: 0

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11.Instruments requested: HRS

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12.Special sched req:

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13.Description of proposed observations:
OBSERVATION: The star will be acquired using an On-board (Mode II) acquisition, and will be centered in the LSA. A field map will be taken to measure the precise location in the aperture, after which the LSA shutter will be closed. The carrousel will then be rotated to position the Echelle for the appropriate m-lambda. Spectral lamp SC1 will be turned on and its spectrum will be recorded, including deriving a new SPYBAL offset. The shutter will then be opened and the spectrum of the star in the LSA will be recorded. The shutter will be closed again, the star translated to the SSA, and its spectrum will be recorded through that aperture. Each of these spectral observations will actually record several orders. It is important that the carrousel not be moved between these three sets of observations. After the SSA spectrum the carrousel will be rotated to the acquisition mirror, and a field map of the SSA will be obtained. After this map the star will be returned to the center of the LSA. This sequence will be repeated at four or five carrousel positions for each Echelle mode. Each position will be selected to bring a particular interstellar line into the field of view. The spectrum will contain many deep and narrow interstellar absorption lines in each order. The precise locations of many lines will be compared to derive the offset of the LSA spectrum with respect to the SSA spectrum. The offsets will be calibrated for each Echelle as functions of carrousel position, Echelle order and sample position.

---

17.Description of plans for data reduction and analysis
The target spectrum contains hundreds of narrow absorption lines from the interstellar material. The observations of the SC1 lamp will establish a precise wavelength scale for the SSA at each carrousel position. The positions of many lines across the entire diode array will be measured in the stellar spectra observed through both the LSA and the SSA. The field maps of the apertures will provide information about the precise location of the star within each aperture. The observed offsets will be parameterized as functions of carrousel position and diode number (or sample).

PROPOSAL FOR HUBBLE SPACE TELESCOPE OBSERVATIONS

COVER PAGE

ST Sci Use
ID 2848(P)
Received 09-Oct-89
Date: NOV 27, 1989 08:01

1.Proposal Title:
GHRS LOW AND INTERMEDIATE RESOLUTION GRATING ABSOLUTE PHOTOMETRIC CALIBRATION

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2.Scientific Category: CALIBRATION

3.Proposal for: CAL/HRS

4.Proposal type:

5.(If relevant)
Continuation of: 0
Remote ID: 2454

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| 6.Principal Investigator | Institution | Country | Telephone |
|---|---|---|---|
| DOUGLAS K. DUNCAN | STSCI | USA | 301-338-4935 |

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7.Abstract
This proposal defines a test to evaluate the HRS low and intermediate resolution gratings for absolute sensitivity. Measurements in the large and small aperture will be evaluated.

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9.Est obs time (hours) pri: 7.88 par: 0.00 10.Num targs pri: 1 par: 0

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11.Instruments requested: HRS

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12.Special sched req:

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3.Description of proposed observations:
Description of proposed observations:
Observe Mu Col (HD38666) or HD 93521 as follows:
1. Acquire target using on-board acquisition.
2. Center in LSA and make focus diode aperture map.
3. Obtain G140L spectra as follows: 8 carrousel settings from 1100-1800A; step-patt=10
4. Obtain G140M spectra as follows: 7 carrousel settings from 1100-1700A; step-patt=4
5. Obtain G160M spectra as follows: 9 carrousel settings from 1200-2000A; step-patt=4
6. Obtain G200M spectra as follows: 9 carrousel settings from 1600-2400A; step-patt=4
7. Obtain G270M spectra as follows: 11 carrousel settings from 2200-3200A; step-patt=4
8. Make ST SAM followed by target acquisition peak up to center target in SSA.
9. Repeat steps 3 through 7.

---

7.Description of plans for data reduction and analysis
Data will be reduced at using STSDAS to obtain the following:
1. absolute and relative sensitivity for the G140M, G160M, G200M, G270M modes (and their stability).
2. small aperture light loss for each intermediate resolution mode

PROPOSAL FOR HUBBLE SPACE TELESCOPE OBSERVATIONS

COVER PAGE

ST Sci Use
ID 2849(P)
Received 09-Oct-89
Date: NOV 27, 1989 08:00

1.Proposal Title:
PART 1-APERTURE OFFSETS AND FIRST-ORDER WAVELENGTH CALIBRATIONS

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2.Scientific Category: CALIBRATION

3.Proposal for: CAL/HRS

4.Proposal type:

5.(If relevant)
Continuation of: 0
Remote ID: 2384

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6.Principal Investigator: DOUGLAS K. DUNCAN
Institution: STSCI
Country: USA
Telephone: 301-338-4935


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7.Abstract
The purpose of the test is to calibrate the geometrical offsets between the Large Science Aperture and the Small Science Aperture, so that dispersion constants derived for the SSA may be used to assign accurate wavelengths to spectra obtained with the LSA. Proposal 2849 observes the same star as the IDT does in SV; Prop. 2850 one of the Hobbs-York wavelength standard stars to tie GHRS wavelengths to the external world (this is the fundamental HST wavelength standard).


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9.Est obs time (hours) pri: 5.33 par: 0.00 10.Num targs pri: 1 par: 0

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11.Instruments requested: HRS

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12.Special sched req:

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13.Description of proposed observations:
OBSERVATION: The star will be acquired using an On-board (Mode II) acquisition, and will be centered in the LSA. A field map will be taken to measure the precise location in the aperture. The carrousel will then be rotated to position the desired grating at the chosen wavelength. Spectral lamp SC1 will be turned on and its spectrum will be recorded, including deriving a new SPYBAL offset. The spectrum of the star in the LSA will be recorded next. The star will then be translated to the SSA, and its spectrum will be recorded. It is important that the carrousel not be moved bwtween these three observations. After the SSA spectrum, the carrousel will be rotated to position the acquisition mirror, and a field map of the SSA will be obtained. After this map, the star will be returned to the center of the LSA. This sequence will be repeated at four or five wavelengths (carrousel positions) for each of the four medium resolution first order gratings. The spectrum will contain many deep and narrow interstellar absorption lines at each of the selected wavelengths. The precise locations of many lines will be compared to derive the offset of the LSA spectrum with respect to the SSA spectrum. The offsets will be calibrated for each grating as functions of carrousel angle and sample position.

---

17.Description of plans for data reduction and analysis
The target spectrum contains many narrow absorption lines from interstellar material. The observations of the SC1 lamp will establish a precise wavelength scale for the SSA at each carrousel position. The positions of many lines across the entire diode array will be measured in the stellar spectra observed through both the LSA and the SSA. The field maps of the apertures will provide information about the precise location of the star within each aperture. The observed offsets will be parameterized as functions of carrousel position and diode number (or sample).

PROPOSAL FOR HUBBLE SPACE TELESCOPE OBSERVATIONS

COVER PAGE

ST Sci Use
ID 2851(P)
Received 09-Oct-89
Date: NOV 27, 1989 08:00

1.Proposal Title:
HRS PULSE HEIGHT ANALYSIS (PHA)

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2.Scientific Category: CALIBRATION

3.Proposal for: CAL/HRS

4.Proposal type:

5.(If relevant) Continuation of: 0
Remote ID: 2381

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| 6.Principal Investigator | Institution | Country | Telephone |
|---|---|---|---|
| DOUGLAS K. DUNCAN | STSCI | USA | 301-338-4935 |

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7.Abstract

This test performs a pulse height analysis to determine individual diode response as a function of threshold for each HRS detector. Based on this evaluation new thresholds may be determined for optimal HRS operation, and the ZCTFLIT1, 2 command blocks will be updated accordingly.

This test will be repeated twice during the year. Also included is one ion test which is a PHA of twice normal threshold to look for ion events (which accelerate back up the 22 kV potential of the tube, liberate electrons from the phocathode, and produce events of twice normal energy (this should be a very low, stable rate) (at least until the Digicon dies

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9.Est obs time (hours) pri: 0.00 par: 0.67 10.Num targs pri: 0 par: 0

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11.Instruments requested: HRS

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12.Special sched req:

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3.Description of proposed observations:
The HRS DEBs are turned on, and the ZCOPHA1 command block is executed to generate the required science data. The default thresholds are then reloaded and verified.

The above steps are repeated for side 2.

One time an ion count will be performed in addition to the PHA. The same command block (ZCOPHA) is used for both the PHA and the ion count.

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7.Description of plans for data reduction and analysis
1. The science data will be reduced offline to generate new thresholds.

The load threshold command blocks in project database will be updated with the new thresholds.

PROPOSAL FOR HUBBLE SPACE TELESCOPE OBSERVATIONS

COVER PAGE

ST Sci Use
ID 2852(P)
Received 09-Oct-89
Date: NOV 27, 1989 08:00

1.Proposal Title:
HRS THRESHOLD ADJUSTMENT TEST

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2.Scientific Category: CALIBRATION

3.Proposal for: CAL/HRS

4.Proposal type:

5.(If relevant) Continuation of: 0
Remote ID: 2382

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6.Principal Investigator: DOUGLAS K. DUNCAN
Institution: STSCI
Country: USA
Telephone: 301-338-4935


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7.Abstract
This test will determine the optimal, non-standard discriminator thresholds for the few anomalous channels on each HRS detector. A 15 second flat field observation followed by a 210 second dark count is performed at each of 10 discriminator threshold values for each detector. The result of the test will be the optimal threshold values to be entered into the PDB. The flat is extended to 35 s. at the lowest discriminator settings to get enough counts for the small focus diodes.


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9.Est obs time (hours) pri: 0.00 par: 6.50

10.Num targs pri: 0 par: 0

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11.Instruments requested: HRS

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12.Special sched req:

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13.Description of proposed observations:
The HRS is configured for high voltage operation on side 1, and the most recent, default thresholds are loaded and verified. Next, a 10 second flat field followed by a 210 second dark count are taken to verify default threshold performance. A series of 10 sets of flat field and dark count data are then acquired for thresholds of 35 through 80 by increments of 5. The PHA processor is used to load each set of thresholds. Finally, the side 1 default thresholds are reloaded. The procedure is then repeated for side 2.

This is an internal test, and requires no special pointing of the telescope.

---

17.Description of plans for data reduction and analysis
Count rates during the dark and flat field exposures will be measured as functions of threshold level. Thresholds for the special channels will be derived which bring their response as close as possible to the mean of other channels.

Unuseable channels will be entered in the flight software bad diode table and/or the cross-talk table. Noisy and anomalous channels will be identified in the data reduction software.

The threshold load PLCP groups in the PDB will be updated with the results.

PROPOSAL FOR HUBBLE SPACE TELESCOPE OBSERVATIONS

COVER PAGE

ST Sci Use
ID 2880(P)
Received 27-Nov-89
Date: NOV 30, 1989 13:26

1.Proposal Title:
PHOTOCATHODE GRANULARITY 2 - ENHANCED GHRS FLAT FIELDING

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2.Scientific Category: CALIBRATION

3.Proposal for: CAL/HRS

4.Proposal type:

5.(If relevant) Continuation of: 0
Remote ID: 2684

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6.Principal Investigator: DR. DOUGLAS K. DUNCAN
Institution: SPACE TELESCOPE SCIENCE INSTITUTE
Country: USA
Telephone: (301)-338-4935


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7.Abstract
Calibrate GHRS photocathode granularity at one wavelength. Uses a proposal of Hobbs et al. for (external) target acq. Hobbs et al. to assist in data reduction.


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9.Est obs time (hours) pri: 0.27 par: 0.00 10.Num targs pri: 6 par: 0

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11.Instruments requested: HRS

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12.Special sched req:

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13.Description of proposed observation
A flat-spectrum of an early-type star will be centered in the small science aperture observed at one wavelength setting with Echelle-A. It will then be deliberately moved off the center of the aperture +/- 0.06 arceseconds with a small angle maneuver and re-observed. The same 3 observations will be done at one wavelength setting for Echelle-B.

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17.Description of plans for data reduction and analysis
Hobbs et al will analyze the spectra and the ST ScI will divide the spectra obtained at the nominal center and offset positions. This will produce a measure of the photocathode granularity on scales which affect small science aperture observations.

PROPOSAL FOR HUBBLE SPACE TELESCOPE OBSERVATIONS

COVER PAGE

ST Sci Use
ID 2863(P)
Received 01-Nov-89
Date: NOV 27, 1989 08:00

1.Proposal Title:
HSP DETECTOR DARK COUNT TEST

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2.Scientific Category | 3.Proposal for: CAL/HSP | 4.Proposal type: | 5.(If relevant) Continuation of: 0 Remote ID: 2506

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6.Principal Investigator | Institution | Country | Telephone
DR. RICHARD L. WHITE | SPACE TELESCOPE SCIENCE INSTITUTE | USA | (301) 338-4797


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7.Abstract
This proposal defines the procedure for monitoring the dark count on each of the HSP detectors to determine the instrumental noise characteristics. It is an internal test intended to become a routine procedure. Each of the four IDTs will be sampled at three different cathode locations; the PMT will be monitored as well.


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9.Est obs time (hours) pri: 1.65 par: 8.00 10.Num targs pri: 1 par: 0

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11.Instruments requested: HSP

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12.Special sched req:

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13.Description of proposed observations:
This test is to be performed during dark time, and during the PMT portion of the test the ST should be pointing at a dark sky target.

1) IDTs (i=1,4): the HSP is to be configured in the single-color, one aperture mode (HSP/x, SINGLE) with the detector at nominal high voltage and PAD settings. Each detector is to be sampled at the central cathode position and at two other positions along the edge of the cathode, none of which correspond to any aperture. These three positions have the following detector coordinate positions:

(a) (H,V) = (2000,1900)
(b) (H,V) = (3600,1900)
(c) (H,V) = (2000,3000)

An integration of 5 minutes in length, sampling at 0.1 second samples, is to be obtained at each position. The detector high voltage will then be turned off and a fourth 5 minute integration made at (H,V) = (2000, 1900)

2) PMT: Operating at the nominal high voltage the dark current is to be sampled for 5 minutes. The PMT high voltage will then be turned off and a second 5 minute integration made. Data are to be taken in the ALL format.

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14.Description of plans for data reduction and analysis
The data reduction is planned as follows: for each of the detectors the mean dark count rate (digital mode) will be determined as a function of cathode position. After the test is performed enough times, for each cathode position the mean values will be plotted as a function of (a) detector temperature and (b) observation time. The data analysis will consist of performing a trend analysis on the various data series from the data reduction process in order to determine the potential hysteresis (if any) and to monitor the temporal development of the noise properties of the various detectors.

PROPOSAL FOR HUBBLE SPACE TELESCOPE OBSERVATIONS

COVER PAGE

ST Sci Use
ID 2864(P)
Received 01-Nov-89
Date: NOV 27, 1989 08:00

1.Proposal Title:
FINE FGS/HSP ALIGNMENT (PHASE III)

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2.Scientific Category | 3.Proposal for: CAL/HSP | 4.Proposal type: | 5.(If relevant) Continuation of: 0 Remote ID: 2581

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6.Principal Investigator | Institution | Country | Telephone
DR. RICHARD L. WHITE | SPACE TELESCOPE SCIENCE INSTITUTE | USA | (301) 338-4797

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7.Abstract
Using a standard star (V8.2 mag.) in the CVZ near the open cluster NGC188, the instantaneous locations of the centers of the acquisition aperture and various small science apertures will be determined with respect to the V2V3 reference system. The ultimate goal of this third part of the Mission Support Calibration (MSC) procedure is to locate the aperture centers relative to the V2V3 reference frame with an uncertainty not exceeding 0.05 arcsec. It is preceded by Phase I (Deflection Coordinate Calibration) and Phase II (Coarse Alignment).

Similar tests were used for SV (1524) and OV (1504).

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9.Est obs time (hours) pri: 12.00 par: 0.00 10.Num targs pri: 1 par: 0

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11.Instruments requested: HSP

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12.Special sched req:

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3.Description of proposed observations:
The observations will begin with the visual IDT (VIS) configured in the single aperture, acquisition mode and proceed as follows:

1) Mode II target acquisition to position the star (Near NGC 188) in the finding aperture (10 arcsec); 2) Take area scan image with star in center of aperture to verify position Also record FGS encoder readings; 3) Command the telescope to execute step and dwell maneuvers across the edge of the aperture while the detector is in SCP mode. The telescope will be commanded to do a step and dwell scan of the finding aperture with 0.25 arcsecond steps and centered on the edge of the aperture where the stellar image will disappear. Each step and dwell maneuver should begin at a radius of 4.8 arcsec from the aperture center and be 0.4 arcsec in length, sampled at 0.05 arcsec steps. At each step the flux in the image is collected and the FGS encoder positions are recorded. 4) Offset to a selected 1.0 arcsec aperture. Command the telescope to perform step and dwell maneuvers, as described in step 3 above. Each step and dwell maneuver should begin at a radius of 0.3 arcsec from the center and each axis length should again be 0.4 arcsec, sampled at 0.05 arcsec steps; 5) Repeat step (4) for two additional apertures. For IDT#3(VIS) the selected apertures are: 1.0-B/F450W, 1.0-A/F160LP, 1.0-A/F620W 6) Repeat steps (1) - (5) for UV2 using the following apertures: 1.0-A/F160LP, 1.0/F140LP, 1.0-B/F248M 7) Repeat steps (1) - (5) for POL , using the following apertures: 0.65-D/F160LP, F327M/POL0, F277M/POL135 and changing the parameters in the following steps: Step (1-2): finding aperture is 6.1 arcsec. Step (3): begin step and dwell 2.8 arcsec from center. 8) Repeat steps (1) - (5) for UV1 using the following apertures: 1.0/F140LP, 1.0-A/F240W, 1.0-B/F248M All scans are in spacecraft coordinates.

---

7.Description of plans for data reduction and analysis
Data reductiqn consists of deriving the count rates (or flux) for all the apertures on each IDT and associating these values with the appropriate step and dwell grid point coordinates. These data are displayed as an intensity versus position plot.

PROPOSAL FOR HUBBLE SPACE TELESCOPE OBSERVATIONS

COVER PAGE

ST Sci Use
ID 2867(P)
Received 01-Nov-89
Date: NOV 27, 1989 08:00

1.Proposal Title:
HSP PULSE HEIGHT DISTRIBUTION TEST

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2.Scientific Category | 3.Proposal for: CAL/HSP | 4.Proposal type: | 5.(If relevant) Continuation of: 0 Remote ID: 2584

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6.Principal Investigator | Institution | Country | Telephone
DR. RICHARD L. WHITE | SPACE TELESCOPE SCIENCE INSTITUTE | USA | (301) 338-4797

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7.Abstract

This proposal defines the procedure for determining the optimum pulse amplifier discriminator (PAD) threshold setting for each of the IDTs and the PMT on the HSP when configured in the digital mode. The bright earth will be used to test each of the detectors; powered to their nominal operating voltages each IDT will integrate on the target through a selected 1.0 arcsec aperture for twelve different PAD settings. After each integration a dark count is taken. The PMT will also observe the bright earth at twelve different PAD settings, but must observe a dark target for its corresponding dark counts. The entire process is done at each of the three standard gain settings: 0.5, 1.0, and 2.0 x 10E6

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9.Est obs time (hours) pri: 1.91 par: 8.70 10.Num targs pri: 1 par: 0

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11.Instruments requested: HSP

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12.Special sched req:

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13.Description of proposed observations:
The bright and dark earth is to be used for this test and the following 1.0 arcsec apertures are to be used to test the different IDTs:
1) POL: F327M (use position POLO)
2) UV-1: F140LP
3) VIS: F551W (use position 3I4)
4) UV-2: F140LP
Each IDT is configured with the high voltage at the three standard settings. With the bright earth illuminating the appropriate 1.0 arcsec aperture, integrations are obtained at twelve (12) different pulse amplifier discriminator (PAD) settings; first a 30 second integration is taken at the selected aperture and then another 30 second integration is performed at the dark position (H,V)=(2000,1900). The PAD settings to be used for the IDTS are: PAD = 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12 The PMT will observe the bright earth in the same fashion but through the F320N aperture on the VIS IDT which feeds the beamsplitter at all 12 PAD set- tings with 30 second integrations. The dark earth is then observed in the same manner. The PAD values to be used for the PMT are: PAD = 10, 12, 14, 16, 17, 18, 19, 20, 21, 22, 24, 26. The test is to be done two detectors at a time to save overhead time. A sample time of 0.01 sec is used for all detectors for EARTH-CALIB exposures, 1 sec for DARK exposures.

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17.Description of plans for data reduction and analysis
The data reduction and analysis will consist of determining the mean number of counts detected through the appropriate aperture and the dark counts at each of the twelve (12) PAD settings for the IDTs and the PMT. The optimal PAD setting yielding the best signal to noise ratio for each detector will be determined and the results will be supplied to the PDB.

PROPOSAL FOR HUBBLE SPACE TELESCOPE OBSERVATIONS

COVER PAGE

ST Sci Use
ID 2869(P)
Received 01-Nov-89
Date: NOV 27, 1989 07:59

1.Proposal Title:
HSP FOCUS AND APERTURE MAPPING TEST (PHASE I)

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2.Scientific Category | 3.Proposal for: CAL/HSP | 4.Proposal type: | 5.(If relevant) Continuation of: 0 Remote ID: 2582

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6.Principal Investigator | Institution | Country | Telephone
DR. RICHARD L. WHITE | SPACE TELESCOPE SCIENCE INSTITUTE | USA | (301) 338-4797

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7.Abstract

This proposal defines the procedure for mapping in deflection space the projected aperture locations on the cathode faceplates of each of the four (4) IDTs on the HSP. In addition, the focus of each of the IDTs will be tested by commanding the sample beam to step across the edge of the finding aperture. The aperture mapping will be accomplished using the bright earth to illuminate the aperture plate for each IDT; an IDT area scan of several apertures will be made. These data will be compared with the deflection coordinates determined from ground based testing in order to map out any systematic offsets or stretching of the projected aperture pattern as a function of the combined ST/HSP operating environment.

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9.Est obs time (hours) pri: 0.00 par: 32.54 10.Num targs pri: 0 par: 0

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11.Instruments requested: HSP

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12.Special sched req:

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13.Description of proposed observations:

The observations consist of illuminating the aperture plates of each IDT, using the bright earth, and performing an IDT area scan of all filter strips and selected apertures. Using the bright earth for illumination, IDT scans of all filter strips and selected apertures will be performed. The scan of the filter strips will be 12 X 80 pixels in size, taken at 0.4 arcsec steps, with a sample time of 10 msec. A 20 X 20 step area scan using 0.6 arcsec steps, each with 10 msec integration times, will be made over the finding apertures. The beam will then be deflected to a 1 arcsec aperture and a 20X20 scan taken at 0.1 arcsec steps with 10 msec integration times will be carried out. The same procedure will be performed at each of the specified apertures on the IDT. This entire process will then be repeated with the integration time increased to 100 msec. IDTs #1, 2, 3, and 4 (POL, UV1, VIS and UV2, respectively) will be calibrated in this fashion. In addition to all the filter strips and the finding apertures on each IDT, the following 1.0 arcsec apertures will be scanned on each of the IDTs VIS: F750W/F320N (entrance to PMT), F419N-B, F160LP-B(3F3), F551W-PRISM, F240W-PRISM, F240W-B, F184W-B, F551W-B UV-1: F278N-B, F220W-B, F152M-B, F248M-PRISM, F135W-PRISM, F145M-B, F184W-B, F218M-B; UV-2: F152M-B, F218M-B, F184W-B, F262M-PRISM, F145M-PRISM, F160LP-B(4E2), F278N-B, F284M-B; POL: F327M-POL0, F277M-POL0, F237M-POL0, F216M-POL0, F216M-POL135, F237M-POL135, F277M-POL135, F327M-POL135.

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14.Description of plans for data reduction and analysis

The data reduction and analysis procedures are the same for each IDT: the two-dimensional cathode faceplate intensity images produced by the area scanning process will be examined and the center of each of the apertures determined using an intensity-weighted centroiding algorithm. The (x,y)-image coordinates of the aperture centers will be transformed into the appropriate deflection coordinate system for each detector. The derived aperture locations will be compared with the results from ground-based testing to check for possible translations or rotations of the aperture pattern. The differential distortions that become apparent will be correlated with the detector temperature, and appropriate results supplied to the Calibration Data Base

PROPOSAL FOR HUBBLE SPACE TELESCOPE OBSERVATIONS

COVER PAGE

ST Sci Use
ID 2912(P)
Received 15-Jan-90
Date: MAR 02, 1990 08:55

1.Proposal Title:
HSP PHOTOMETRIC CALIBRATION

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2.Scientific Category | 3.Proposal for: CAL/HSP | 4.Proposal type: | 5.(If relevant) Continuation of: 0 Remote ID: 2688

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6.Principal Investigator | Institution | Country | Telephone
DR. RICHARD L. WHITE | SPACE TELESCOPE SCIENCE INSTITUTE | USA | (301) 338-4797


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7.Abstract
This proposal performs the absolute calibration of the HSP for filters used in the GO or GTO Cycle 1 program. One of 6 relatively bright photometric standards (7 < V < 12) is observed at through all the filters being used on each detector. The observation is repeated every 2 months to monitor the calibration and to allow interpolation to points in between the measurements.


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9.Est obs time (hours) pri: 9.00 par: 0.00 10.Num targs pri: 6 par: 0

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11.Instruments requested: HSP

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12.Special sched req:

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3.Description of proposed observations:
All the standard stars to be used have similar colors in the visual and UV range; they are all white dwarfs or peculiar O stars with good ground and space-based photometric calibrations. A sequence is defined for each HSP detector with the relative exposure times in each filter specified. When the sequence is used, the exposure times are multiplied by a scale factor which depends on the brightness of the particular standard star being observed. The exposure times (with the multiplier) are chosen to give about 1E6 counts per filter, so that the signal-to-noise ratio of the measurement should be about 1000. Data is always collected using DATA-FORMAT=ALL so that the analog-to-digital conversion can be calibrated for filters with higher count rates.

The total exposure time for the observation of a star will usually be determined by the overhead time required to slew from one filter to another; the stars were chosen to be bright enough that the actual time spent collecting data will not be large. Since the slew time between filters is about 30 s, reducing the exposure times below about 10s is a wasteful efficiency. The sample times for each exposure were set at 10 s so that the minimum exposure time in any filter will be 10 s.

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7.Description of plans for data reduction and analysis
The data will be reduced by comparing the count rates in the various observations with synthetic photometry based on the HSP filter and detector response curves and the absolute spectrophotometry of our standard stars in CDBS. If HSP is very stable (as is hoped), then these HSP observations can be used to improve the relative calibration of the HST standards.

Results from the analysis will be used to populate the relative sensitivity parameters in CDBS for use in pipeline calibration of HSP data.

PROPOSAL FOR HUBBLE SPACE TELESCOPE OBSERVATIONS

COVER PAGE

ST Sci Use
ID 2874(P)
Received 21-Nov-89
Date: NOV 27, 1989 07:59

1.Proposal Title:
WF/PC CYCLE 1 CALIBRATION: UV FLOOD

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2.Scientific Category | 3.Proposal for: CAL/WFC | 4.Proposal type: | 5.(If relevant) Continuation of: 0 Remote ID: 2652

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6.Principal Investigator | Institution | Country | Telephone
DR. JOHN W. MACKENTY | STSCI | USA | (301)338-4559

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7.Abstract
To achieve stable quantum efficiency performance for the overthinned areas of the CCDs, the chips must be flooded with ultraviolet light. This will produce a uniform quantum efficiency response over the entire CCD. The quantum efficiency stability is chiefly dependent on temperature. The exact amount of charging required to eliminate quantum efficiency instability will be determined in ground tests and SV.

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9.Est obs time (hours) pri: 29.4 par: 32.0 10.Num targs pri: 2 par: 0

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11.Instruments requested: WF/PC

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12.Special sched req: Time-crit Obs Unint long exp Spec orient

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13.Description of proposed observations:
The HST will be pointed directly away from the sun (plus a small angle TBS) so that the ultra-violet light can be piped onto the CCDs. The time required for the UV flood is 4 orbits for the WF and 15 orbits for the PC.

The scenario for the UV Flood is as follows:

Flood the WFC - 4 orbits. Take a WFC image (SUNPIX)
Flood the PC - 15 orbits. Flip the mirror back to WFC. Take a WFC image (SUNPIX). Take 10 bias frames
Wait 2-6 hours then take UV Baseline images of UV Standard.

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14.Description of plans for data reduction and analysis
These data will be archived at ScI and a report on the outcome of the observations will be prepared as an WF/PC Instrument Report by the TIB.

PROPOSAL FOR HUBBLE SPACE TELESCOPE OBSERVATIONS

COVER PAGE

ST Sci Use
ID 2875(P)
Received 21-Nov-89
Date: NOV 27, 1989 07:59

1.Proposal Title:
WF/PC CYCLE 1 CALIBRATION: QEH MONITORING

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2.Scientific Category | 3.Proposal for: CAL/WFC | 4.Proposal type: | 5.(If relevant) Continuation of: 0 Remote ID: 2653

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6.Principal Investigator | Institution | Country | Telephone
DR. JOHN W. MACKENTY | STSCI | USA | (301) 338-4559


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7.Abstract
The appearance of the QEH problem in the WF/PC CCD Detectors is monitored on a monthly basis. This is accomplished by observing a field in M-42 (Orion) which fully illuminates the WF/PC FOV. A sequence of three exposures is taken, followed by a 20 minute wait, followed by 2 additional exposures. The exposures are taken in the F439W filter. In addition, the same sequences is performed using the internal flat field lamp. When M-42 is not available, only the internal flat exposures are obtained. If the internal flats prove sufficient, the M-42 exposures will be dropped in future cycles.


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9.Est obs time (hours) pri: 6.3 par: 0.00 10.Num targs pri: 0 par: 0

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11.Instruments requested: WF/PC

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12.Special sched req:

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7.Description of plans for data reduction and analysis
These data will become part of the ScI archive and the results will be reported in a TIB Instrument Report.

PROPOSAL FOR HUBBLE SPACE TELESCOPE OBSERVATIONS

COVER PAGE

ST Sci Use
ID 2876(P)
Received 21-Nov-89
Date: NOV 27, 1989 07:59

1.Proposal Title:
WF/PC CYCLE 1 CALIBRATION: INTERNAL CALIBRATIONS

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2.Scientific Category | 3.Proposal for: CAL/WFC | 4.Proposal type: | 5.(If relevant) Continuation of: 0 Remote ID: 2654

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6.Principal Investigator | Institution | Country | Telephone
DR. JOHN W. MACKENTY | STSCI | USA | (301) 338-4559

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7.Abstract

These observations maintain the bias, pre-flash, and dark (with serial clocks both ON and OFF), and superpurge reference files in CDBS which are used by the WF/PC pipeline in RSDP.

The sequence is repeated for each camera every 12 days to provide approximately 30 calibrations per year. Since the calibrations require the co-adding of about 30 frames, this results in the calibrations being updated once per year.

Each sequence consists of a Pre-Flash image, a 30 minute dark with clocks off, a 30 minute dark with clocks on, and a Bias. The last is followed by a purge. A final 10 minute dark is obtained 20 minutes after the start of the purge to observe the purge's afterimage.

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9.Est obs time (hours) pri: 0.00 par: 104.0 10.Num targs pri: 0 par: 0

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11.Instruments requested: WF/PC

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12.Special sched req:

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13.Description of proposed observations:
These observations maintain the bias, pre-flash, and dark (with serial clocks both ON and OFF), and superpurge reference files in CDBS which are used by the WF/PC pipeline in RSDP.

The sequence is repeated for each camera every 12 days to provide approximately 30 calibrations per year. Since the calibrations require the co-adding of about 30 frames, this results in the calibrations being updated once per year.

Each sequence consists of a Pre-Flash image, a 30 minute dark with clocks off, a 30 minute dark with clocks on, and a Bias. The last is followed by a purge. A final 10 minute dark is obtained 20 minutes after the start of the purge to observe the purge's afterimage.

---

17.Description of plans for data reduction and analysis
These data will be used by the TIB to maintain the bias, preflash, dark, and superpurge reference files in the CDB. These files are needed by the RSDP WF/PC pipeline. Also, these data monitor instrument behavior. They will become part of the ScI archive and the results will be reported in a TIB Instrument Report.

PROPOSAL FOR HUBBLE SPACE TELESCOPE OBSERVATIONS

COVER PAGE

ST Sci Use
ID 2877(P)
Received 21-Nov-89
Date: NOV 27, 1989 07:59

1.Proposal Title:
WF/PC CYCLE 1 CALIBRATION: PHOTOMETRY/ASTROMETRY

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2.Scientific Category | 3.Proposal for: CAL/WFC | 4.Proposal type: | 5.(If relevant) Continuation of: 0 Remote ID: 2655

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6.Principal Investigator | Institution | Country | Telephone
PATRICK O. SEITZER | STSCI | USA | (301) 338-4943

---

7.Abstract

The objective of this calibration test is to observe a field of stars that will allow an adequate number of calibrated stars to appear in each CCD to efficiently produce an instrument-defined photmetric system for each filter. The selected fields lie in the outer regions of the globular clusters NGC 5139 and NGC 6752. Ground-based measurements of these fields have been made with a detector and filter set identical to the WF/PC. In addition, these observations serve for astrometric measurements and determing the PSF (point spread function) in all filters used by the GO/GTOs during cycle 1.

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9.Est obs time (hours) pri: 41.59 par: 0.00 10.Num targs pri: 0 par: 0

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11.Instruments requested: WF/PC

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12.Special sched req:

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13.Description of proposed observations:

In order to verify the scientific photometric measurement capabilities of each filter in the WF/PC and determine the spectral and spatial properties, all the filters will be used in this calibration. However, only a subset will be used to look at time variations and geometric stability measurements. The set of filters used to monitor the stability are: F230W, F336W, F439W, F555W, and F785LP. Observations through additional filters are made immediately after the basic set of 5, followed by a Kelsall dot exposure at the end of each complete sequence in both the WFC and the PC. Sequences are done every 27 days in both the WFC and PC.

The frequency of observations through any filter beyond the basic 5 depends on how often it is requested in the GO/GTO proposal pool.

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14.Description of plans for data reduction and analysis

These data will be part of the calibration data base at the ScI and will be used to determine the photometric sensitivity of each of the CCDs through each of the filters.

PROPOSAL FOR HUBBLE SPACE TELESCOPE OBSERVATIONS

COVER PAGE

ST Sci Use
ID 2878(P)
Received 21-Nov-89
Date: NOV 27, 1989 07:59

1.Proposal Title:
WF/PC CYCLE 1 CALIBRATION: FLAT FIELDS

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2.Scientific Category | 3.Proposal for: CAL/WFC | 4.Proposal type: | 5.(If relevant) Continuation of: 0 Remote ID: 2656

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6.Principal Investigator | Institution | Country | Telephone
P. O. SEITZER | STSCI | USA | (301) 338-4943

---

7.Abstract
This proposal is designed to take "uniform illuminated" pictures of the earth. These data will be used to characterize the WF/PC instrument signature for flat field corrections. Six frames are taken to try to obtain data with the proper exposure and different roll angles. These frames are taken in three sets of 2 in every filter.

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9.Est obs time (hours) pri: 0.00 par: 62.7 10.Num targs pri: 0 par: 0

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11.Instruments requested: WF/PC

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12.Special sched req:

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13.Description of proposed observations:
These data are taken to characterize the flat field properties of the WF/PC instrument. They will be taken several times in order to get various track angles. They should be scheduled whenever the HST views the Earth on the lighted side. Ideally, the exposure levels should be adjusted to obtain a "flat field exposure" of between one-half and three-quarters full scale, based on the results of the 1483 "Check Flats." The exposures shown here are based on cloud albedos. It may be that they will be up to 5 times longer based on 1483 data. If exposures become long, we will remove the F122M "Neutral Density Filter" to shorten them. These data must be taken frequently to characterize the flat field stability. A basic set of filters (F555W, F439W, F336W, and F785LP are taken every month in both the WFC and the PC, while remaining filters are done less often but proportional to their use in the GO filter pool and at least once a year. No UV filters, grisms, or polarizors are done in this proposal.

PROPOSAL FOR HUBBLE SPACE TELESCOPE OBSERVATIONS

COVER PAGE

ST Sci Use
ID 2879(P)
Received 21-Nov-89
Date: NOV 27, 1989 07:59

1.Proposal Title:
WF/PC CYCLE 1 CALIBRATION: GRISM CALIBRATION

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2.Scientific Category | 3.Proposal for: CAL/WFC | 4.Proposal type: | 5.(If relevant) Continuation of: 0 Remote ID: 2657

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6.Principal Investigator | Institution | Country | Telephone
DR. KEITH D. HORNE | STSCI | USA | (301) 338-4964


---


7.Abstract
A hot white dwarf and an extragalactic planetary nebula are observed to provide flux and wavelength calibrations for WFC and PC grism observations.


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9.Est obs time (hours) pri: 5.60 par: 0.00 10.Num targs pri: 1 par: 0

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11.Instruments requested: WF/PC

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12.Special sched req:

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PROPOSAL FOR HUBBLE SPACE TELESCOPE OBSERVATIONS

ST Sci Use

COVER PAGE

ID 2913(P)
Received 15-Jan-90
Date: FEB 27, 1990 15:51

1.Proposal Title:
WF/PC CYCLE 1 CALIBRATION: UV PREP I

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2.Scientific Category | 3.Proposal for: CAL/WFC | 4.Proposal type: | 5.(If relevant) Continuation of: 0 Remote ID: 2707

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6.Principal Investigator | Institution | Country | Telephone
DR. JOHN W. MACKENTY | STSCI | USA | (301)338-4559


---


7.Abstract
This calibration warms the optical bench and CCDs of the WF/PC and drives off possible contamination. A UV calibration will be preformed to determine the quantum efficency of the detectors. This test should be coupled to each science observation that plans to do photometric measurements with filters F122M, F157W, F194W, or G200L (in the UV).

The UV sequence should look like:
UV PREP I ... Science Observations ... UV PREP II


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9.Est obs time (hours) pri: 3.00 par: 0.00 10.Num targs pri: 0 par: 0

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11.Instruments requested: WF/PC

---

12.Special sched req:

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13.Description of proposed observations:
A WF system baseline is established through a multi-step sequence: 1) UV baseline calibration; 2) Turning TEC pwr off (for WF & PC); 3) CCD heaters are turned on; 4) Wait for eight hours set for a temperature of -82 degrees C.

- HJ teps must be < -20 C before turning TEC's on
- CJ temps must be < -82 C to continue (after TEC turn-on)
- Repeat UV Calibration measurements after detectors reach -82 C and again after the UV observation.

PROPOSAL FOR HUBBLE SPACE TELESCOPE OBSERVATIONS

COVER PAGE

ST Sci Use
ID 2914(P)
Received 15-Jan-90
Date: FEB 27, 1990 15:43

1.Proposal Title:
WF/PC CYCLE 1 CALIBRATION: UV PREP II

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2.Scientific Category | 3.Proposal for: CAL/WFC | 4.Proposal type: | 5.(If relevant) Continuation of: 0 Remote ID: 2708

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6.Principal Investigator | Institution | Country | Telephone
DR. JOHN W. MACKENTY | STSCI | USA | (301) 338-4559


---


7.Abstract
This calibration is a continuation of UV PREP I.

A UV calibration will be preformed to determine the quantum efficency of the detectors. This test should be coupled to each science observation that plans to do photometric measurements with filters F122M, F157W, F194W, or G200L (in the UV).

The UV sequence should look like:
UV PREP I ... Science Observations ... UV PREP II


---

9.Est obs time (hours) pri: 1.54 par: 0.00 10.Num targs pri: 0 par: 0

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11.Instruments requested: WF/PC

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12.Special sched req:

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3.Description of proposed observations:
See UV PREP I

PROPOSAL FOR HUBBLE SPACE TELESCOPE OBSERVATIONS

COVER PAGE

ST Sci Use
ID 2915(P)
Received 15-Jan-90
Date: FEB 27, 1990 15:56

1.Proposal Title:
WF/PC CYCLE 1 CALIBRATION: LINEARITY CHECK

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2.Scientific Category | 3.Proposal for: CAL/WFC | 4.Proposal type: | 5.(If relevant) Continuation of: 0 Remote ID: 2706

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6.Principal Investigator | Institution | Country | Telephone
DR. JOHN W. MACKENTY | STSCI | USA | (301) 338-4559

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7.Abstract
A series of pairs of exposures of increasing duration will be taken of a diffuse target (M-42) to establish the WF/PC light transfer characteristics. These data will be used to determine the linearity and instrument readout noise level for each CCD.

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9.Est obs time (hours) pri: 5.59 par: 0.00 10.Num targs pri: 0 par: 0

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11.Instruments requested: WF/PC

---

12.Special sched req:

---

13.Description of proposed observations:
A series of pairs of exposures of increasing duration will be taken of a diffuse target (M-42) to establish the WF/PC light transfer characteristics. These data will be used to determine the linearity and instrument readout noise level for each CCD. This series of exposures will be obtained as close in time as possible and should go to the tape recorder.

Linearity Test- Obtain a bias frame followed by images with F606W at increasing exposure time (from 12s to 200s for WFC and from 60s - 10s for PC on diffuse object and point source.

---

17.Description of plans for data reduction and analysis
These data will be reduced and the numbers and plots included in a WF/PC instrument report.

PROPOSAL FOR HUBBLE SPACE TELESCOPE OBSERVATIONS

COVER PAGE

ST Sci Use
ID 2917(P)
Received 25-Jan-90
Date: FEB 27, 1990 15:59

1.Proposal Title:
WF/PC CYCLE 1 CALIBRATION: GRISM FILTER PILOT CALIBRATION

---

2.Scientific Category | 3.Proposal for: CAL/WFC | 4.Proposal type: | 5.(If relevant) Continuation of: 0 Remote ID: 2873

---

6.Principal Investigator | Institution | Country | Telephone
DR. KEITH D. HORNE | STSCI | USA | (301) 338-4964

---

7.Abstract

This proposal calibrates several WF/PC filters directly by takin grism spectra of the right spectrophotometric standard star G191B2B with and without filters in the beam. This more direct approach may improve the accuracy of the calibration from the 10-50% achieved using Omega Cen to 1%. This pilot study, which calibrates the most heavily used filters in the GO and GTO programs, will verify whether the expected high accuracy can be realized in practice prior to more extensive use in future cycles.

---

9.Est obs time (hours) pri: 1.57 par: 0.00 10.Num targs pri: 0 par: 0

---

11.Instruments requested: WF/PC

---

12.Special sched req:

---

3.Description of proposed observations:
Exposures of varying time furations are taken with each of G200,G450, and G800 grisms. Exposures are then taken with 8 filter and grism combinations at varying time durations plus exposures are taken with 2 filters (F555W and F547W) in combination with both G450 and G800 prisms. This yields a total of 15 exposures.

---

7.Description of plans for data reduction and analysis
The results from this pilot project will determine if this calibration technique is a viable alternative to the IDT Omega Cen technique for populating the photometric transformation tables that will reside in CDBS by the end-of-SV.

PROPOSAL FOR HUBBLE SPACE TELESCOPE OBSERVATIONS

COVER PAGE

ST Sci Use
ID: PROP NEEDED FROM MOC
Received 11-Jul-89
Date: JAN 26, 1990 07:43

1.Proposal Title:
OTA DESORPTION FOCUS ADJUSTMENT

---

2.Scientific Category | 3.Proposal for: CAL/MSC | 4.Proposal type: | 5.(If relevant) Continuation of: 0 Remote ID: TBA

---

6.Principal Investigator | Institution | Country | Telephone
TO BE DETERMINED | LMSC/MOC

---

7.Abstract
This activity will provide data on the effects of desorption on the optical alignment of the telescope. The data will permit the calculation of commands for adjusting the secondary mirror to reduce the optical distortions. Mirror adjustments will be made to compensate for the changes in alignment. (Primary mirror adjustments are not anticipated.)

---

9.Est obs time (hours) pri: ~3.00 par: 0.00 10.Num targs pri:TBD par: 0

---

11.Instruments requested: FGS

---

12.Special sched req: Real-time Obs

---

13.Description of proposed observations:
The wavefront errors will be measured using the wavefront sensors in the Normal Mode. The errors determined from the Normal Mode test will be minimized by adjusting the Secondary Mirror. The focus operations will alternate between one wherein only the secondary mirror is adjusted, and one wherein the wavefront errors are measured and then the secondary mirror is adjusted. These operations are started in OV, continued during SV and will be continued in Cycle 1.

---

17.Description of plans for data reduction and analysis
The wavefront sensor software resident in PASS will process the Normal Mode data for each wavefront sensor observation. The results of this processing for Wavefront Sensors #1 and #3 will be evaluated by the actuator control software resident in PASS and will generate the corresponding actuator command directives to move the Secondary Mirror. The actuator command directives will be displayed for operator verification or alteration. IT IS ESSENTIAL THAT THE REPOSITIONING THE SECONDARY MIRROR FOCUS THE TELESCOPE 0.25MM OUTSIDE OF THE NOMINAL FOCAL PLANE SO THAT DESORPTION WILL CAUSE BEST FOCUS TO DRIFT THROUGH THE NOMINAL FOCAL PLANE WITH TIME.

PROPOSAL FOR HUBBLE SPACE TELESCOPE OBSERVATIONS

COVER PAGE

ST Sci Use
ID 2827(P)
Received 29-Sep-89
Date: JAN 16, 1990 09:35

1.Proposal Title:
RAM DEGRADATION/OTA THROUGHPUT MONITORING TEST

---

2.Scientific Category | 3.Proposal for: CAL/OTA | 4.Proposal type: | 5.(If relevant) Continuation of: 0 Remote ID: 2215

---

6.Principal Investigator | Institution | Country | Telephone
HASHIMA HASAN | ST SCI | USA | (301) 338-4519

---

7.Abstract
THIS IS A CONTINGENCY PROPOSAL. It will be used in Cycle 1 if observations from the FOS & GHRS calibration programs indicate a decrease in OTA throughput.

During the normal course of HST operations, HST will experience the "Ram Effect" due to the residual earth's atmosphere present at the HST altitude. For this effect to occur, the HST velocity vector must be in the same direction as the HST pointing vector. At these times, the reflectivity of the primary mirror could change due to the ram effect on the MgF coating. Alterations in the performance would initially appear at short (UV, Lyman alpha) wavelengths and advance towards redder wavelengths with time. This OLT will periodically monitor the spectrum of a very hot star with a near featureless continuum in the UV for possible evidence of HST OTA degradation. Both HST spectrographs will be used starting as early as possible in the OV phase and extending throughout the SV phase. If there is spectroscopic evidence of HST OTA throughput degra- tion then further tests will be devised to determine its severity. Mission constraints also may be imposed on the pointing of the HST.

---

9.Est obs time (hours) pri: 2.00 par: 0.00 | 10.Num targs pri: 1 par: 0

---

11.Instruments requested: FOS HRS

---

12.Special sched req:

---

13.Description of proposed observations:
Test Procedure:
If measurements from the GHRS and FOS Cycle 1 calibration programs indicate a decrease in OTA Throughput, the following steps will be used to obtain a more precise measurement of OTA throughput.

FOS BLUE spectra are taken with the G160L and G270H gratings, and the 1.0 arcsecond aperture. No real time analysis is required. GHRS spectra are taken with the G140L grating and 2.0 arcsecond aperture.

---

17.Description of plans for data reduction and analysis
Off Line Data Analysis Requirements:
- Reduce the HRS and FOS spectra.
- Compare each data set with subsequent data sets to look for changes in the throughput.
- Compare results with predictions as a fuction of wavelength.

PROPOSAL FOR HUBBLE SPACE TELESCOPE OBSERVATIONS

COVER PAGE

ST Sci Use
ID 2828(P)
Received 29-Sep-89
Date: NOV 27, 1989 08:03

1.Proposal Title:
SCIENCE INSTRUMENT FOCUS VERIFICATION TEST

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2.Scientific Category | 3.Proposal for: CAL/OTA | 4.Proposal type: | 5.(If relevant) Continuation of: 0 Remote ID: 2213

---

| 6.Principal Investigator | Institution | Country | Telephone |
|---|---|---|---|
| HASHIMA HASAN | ST SCI | USA | (301)338-451 |

---

7.Abstract
Verify that the best focus position of the secondary as derived in the OCS Focus calibrations is appropriate for the SIs. The test will check the focus for the HRS, FOS, FGS and PC. In the event that the focus does not satisfy SI requirements, a recommendation will be made for optimization of the focus which represents a compromise for all the SIs.

---

9.Est obs time (hours) pri: 10.78 par: 3.70 10.Num targs pri: 7 par: 0

---

11.Instruments requested: WF/PC FOS HRS FGS

---

12.Special sched req: Real-time Obs

---

13.Description of proposed observations:
This test requires placement of the secondary mirror at the OTA best focus condition at the time of its execution. Therefore, it must be scheduled within 24 hours of an OCS focus calibration or adjustment. In the event that the focus does not satisfy SI requirements, a recommendation will be made for optimization of the focus which represents a compromise for all the SIs.

---

17.Description of plans for data reduction and analysis
FOS Data -
o Compute the flux at each offset, as a function of wavelength
o Compute the best focus as a function of wavelength
HRS Data -
o Coordinate with HRS IDT to extract PSF FWHM
o Compute the best focus
PC Data -
o Extract the PSF FWHM for each defocus position
o Compute the best focus
FGS Data -
o Compute the S-curve slope at the origin and modulation
o Deduce the sensitivity to each focus position and the OCS best focus position
Adopted SI focus position offset:
o Coordinate data analysis results with FOS and HRS teams

PROPOSAL FOR HUBBLE SPACE TELESCOPE OBSERVATIONS

COVER PAGE

ST Sci Use
ID 2829(P)
Received 02-Oct-89
Date: JAN 16, 1990 08:57

1.Proposal Title:
RADIATION MONITORING OLT

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2.Scientific Category | 3.Proposal for: CAL/OTA | 4.Proposal type: | 5.(If relevant) Continuation of: 0 Remote ID: 2214

---

6.Principal Investigator | Institution | Country | Telephone
DR. HASHIMA N HASAN | STSCI | USA | (301)3384519

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7.Abstract

THIS IS A CONTINGENCY PROPOSAL. It will only be used in Cycle 1 if a full map of the SAA is desired and parallel science observations are available.

High energy particles trapped in the radiation belts, primarily the South Atlantic Anomaly (SAA) will raise background levels and degrade science data quality. The ground system has the capability to predict entry and exit from the region in order to schedule science observations appropriately. The goals of this test are to measure the flux levels through the SAA with the HSP, to monitor fluctuations in the SAA on timescales of several days, and to identify any other regions of high particle fluxes in the HST orbit. These data will be used to verify the general structure of existing empirical models from which the boundaries used by the ground system will originate, to relate HSP count rates to the particle fluxes, and to scale fluctuations in the fluxes with respect to the HSP.

---

9.Est obs time (hours) pri: 0.00 par: 14.78 10.Num targs pri: 0 par: 0

---

11.Instruments requested: HSP

---

12.Special sched req: Time-crit Obs Unint long exp Spec orient

---

3.Description of proposed observations:
Test Procedure:
1) Select the HSP/PHOT configuration, 2IDT Mode (VIS and UV1), filters F355M-VIS, F240W-UV1, byte format, SAMPLE-TIME=10sec, target DARK.
SPECIAL REQUIREMENTS: Sequence NON-INT
2) First orbit: NUM EXP=9, EXP TIME=10 MIN; Observation must NOT impinge on SAA.
3) Orbits 2 through 9: NUM EXP=72, TIME=10MIN; Orbit #2 must begin prior to SAA entry and continue through the SAA so that remaining 6 orbits occur within the SAA.
4) Last orbit: NUM EXP=9, EXP TIME=10MIN; last orbit to occur after exit from the SAA to look for enduring detector effects.

---

7.Description of plans for data reduction and analysis
The data reduction and analysis will include the following:
- to bin HSP data if necessary and associate count rate with latitude, longitude, and altitude (extracted from OMS).
- to determine mean HSP count rates as a function of position over time and relate the HSP count rates to the mean fluxes predicted by the model (linear relation may be adequate).
- to determine the amplitude and character of fluctuations.

PROPOSAL FOR HUBBLE SPACE TELESCOPE OBSERVATIONS

COVER PAGE

ST Sci Use
ID 2830(P)
Received 02-Oct-89
Date: JAN 16, 1990 08:50

1.Proposal Title:
NEAR AND MID ANGLE SCATTERING MEASUREMENT TEST

---

2.Scientific Category | 3.Proposal for: CAL/OTA | 4.Proposal type: | 5.(If relevant) Continuation of: 0 Remote ID: 2217

---

| 6.Principal Investigator | Institution | Country | Telephone |
|---|---|---|---|
| HASHIMA HASAN | ST SCI | USA | (301) 338-4519 |

---

7.Abstract

Test Objectives - THIS IS A CONTINGENCY PROPOSAL. It will be used to determine the effect of internal HST light scattering if unsatisfactory results are obtained from SV. Use spectroscopic measurements taken within a radius of approximately 40 arc seconds from a bright (V about 7) target star.

The scattering may be due to dust particles or minute surface irregularities in the OTA mirror surfaces. Determine the spectral energy distribution by obtaining low resolution spectra over a wide range of wavelengths. Also determine the radial dependence of the scattered light measurements. Derive the possible impact on HST observations.

---

9.Est obs time (hours) pri: (5.61) par: 0.00 10.Num targs pri: 2 par: 0

---

11.Instruments requested: WF/PC FOS

---

12.Special sched req: Spec orient

---

3.Description of proposed observations:

The scattering measurement test is made up of two overlapping parts. First the detectors of the FOS are used to sample the sky immediately surrounding a bright star. Scattering will be caused by dust particles within the OTA or microscopic irregularities of the OTA mirror surfaces. A series of HST attitudes will be chosen to point the FOS at selected offset positions from the star which lie along a line at 45 degrees to the spider diffraction peaks. Spectroscopic data is taken in both the red and blue FOS channels. The FOS spertures increase in size with distance from the star. Measurements with a new aperture will overlap a portion of those obtained from the previously used aperture to enable the diffraction at the aperture to be accounted for as a function of wavelength.

---

7.Description of plans for data reduction and analysis
Real Time Data Analysis Requirements:
Not anticipated at this time.
Off Line Data Analysis Requirements:
FOS Observations:
o Compare the spectrum taken with the FOS positioned at the sky background position to the spectra obtained at each of the offset positions for each detector and aperture combination.
o Derive the following:
o Intensity ratios at selected wavelengths.
o Intensity ratios at various radial distances.
o Estimate of wavelength dependence of intensity ratios.
o Estimate of radial dependence of intensity ratios.
WFC Observations:
o Choose suitably spaced bins in radius across the FOV. For each bin, find the histogram and remove the tail caused by sources. Extract the background and radial dependence.

PROPOSAL FOR HUBBLE SPACE TELESCOPE OBSERVATIONS

COVER PAGE

ST Sci Use
ID 2918(P)
Received 25-Jan-90
Date: FEB 21, 1990 15:39

1.Proposal Title:
SI APERTURE CROSS CALIBRATION

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2.Scientific Category: CALIBRATION

3.Proposal for: CAL/OLT

4.Proposal type:

5.(If relevant) Continuation of: 0
Remote ID: 2883

---

6.Principal Investigator: DR. ROBERTO GILMOZZI
Institution: STSCI
Country
Telephone

---

7.Abstract
Purpose: to check the stability of the aperture locations using Mode 2 target acquisitions. At the same time this program checks Mode 1 WFPC-assisted target acquisitions and estimates Mode 3 accuracies.

---

9.Est obs time (hours) pri: 14.88 par: 0.65

10.Num targs pri: 1 par: 1

---

11.Instruments requested: WF/PC FOC FOS HRS

---

12.Special sched req:

---

13.Description of proposed observations:
The program must be split in several portions, since it is not possible to check all intruments at once.

As first priority, FOS and GHRS should be tested (once a month the first 6 months - to check for short term variations -, then every two months). HSP calibration probably depends on need, but FOC should be calibrated as well, especially in case FOC-assited target acquisitions become necessary.

# APPENDIX B
# CALIBRATION TARGETS

## Appendix B-1:

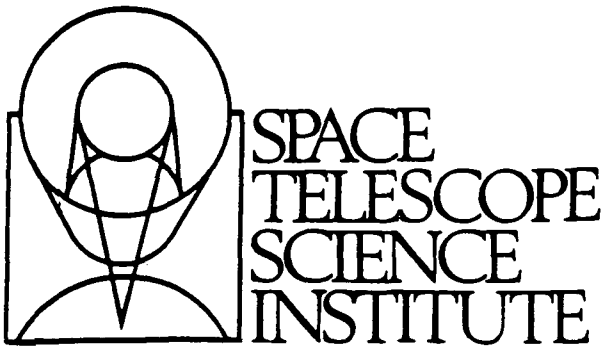
Cover Page, Abstract & Introduction from:
*An Atlas of Hubble Space Telescope Photometric, Spectrophotometric, Polarimetric Calibration Objects*

## Appendix B-2:

Index to &Source Listings for Calibration Targets Spectra

## Appendix B-3:

Calibration Targets CRCALSPEC Spectra Plots

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# AN ATLAS OF HUBBLE SPACE TELESCOPE PHOTOMETRIC, SPECTROPHOTOMETRIC, AND POLARIMETRIC CALIBRATION OBJECTS

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December 1989

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## ABSTRACT

The Hubble Space Telescope (HST) has capabilities for direct imaging, photometry, spectrophotometry, polarimetry, and astrometry. The combined scientific instruments cover the wavelength range from ~ 1150–11,000 Å . This paper presents an overview of the standard astronomical sources, referred to here as calibration targets, which will be used to calibrate HST images, photometry, spectrophotometry, and polarimetry in the UV and optical wavelength regions. Finding charts, accurate coordinates, and other details are presented. References to documents with more detail on HST calibration requirements, calibration targets, and calibration plans are included.

## I. INTRODUCTION

HST requires calibration targets with well-defined magnitudes, fluxes, polarizations, and positions, to achieve and maintain a proper standardization. The goals of the HST calibration program are: (1) to derive the required calibrations with a reliable set of calibration targets and optimize the use of HST observing time, (2) to calibrate all HST science instruments on the same photometric, spectrophotometric, and polarimetric systems so that magnitudes, fluxes, or polarizations measured by one instrument can easily be compared to those measured by another instrument at a known level of accuracy, (3) to provide tie-ins to established ground-based photometric and spectrophotometric systems and polarimetric reference data, and (4) to be consistent with the Science Verification plans of the Investigation Definition Teams, which have chosen the initial HST calibration targets from the findings of HST Calibration Target Working Groups.

A set of six Space Telescope Science Institute (ST ScI) internal documents provide more details on calibration requirements, assignment of calibration targets, and calibration plans. Six different types of calibration targets exist: (1) UV spectrophotometric calibration targets (Bohlin *et al.* 1987), (2) optical spectrophotometric and photometric calibration targets (Turnshek *et al.* 1989), (3) wavelength calibration targets (Ford *et al.* 1984), (4) astrometric calibration targets (Fresneau *et al.* 1986), (5) polarimetric calibration targets (Lupie *et al.* 1985), and (6) targets for spatially flat fields (Cox *et al.* 1987). These targets are used to quantify the calibration of the scattered light, the linearity, the spectral flat field, the sensitivity of photometric and spectrophotometric modes, the point spread function, the wavelength scale, the plate scale, the polarimetric modes, and spatially flat fields for all HST scientific instruments.

The photometric, spectrophotometric, and polarimetric calibration targets discussed in Bohlin *et al.* (1987), Turnshek *et al.* (1989), and Lupie *et al.* (1985) can be grouped into a category of targets for which very accurate flux measurements are necessary. Appropriate flux measurements for these calibration targets either exist or will exist. The calibration targets are not only needed for the calibration of HST but are useful for ground-based calibrations or other space-based calibrations, as well. Therefore, the ST ScI will aid in making the appropriate data available to the astronomical community, once the data are in proper form. As a first step in providing the astronomical community with this information, we present here an atlas of finding charts for HST photometric, spectrophotometric, and polarimetric calibration targets. §II describes the use of each target and contains coordinates, magnitudes, colors, and spectral types. In §III we discuss the HST photometric system and polarimetric calibrations which will establish the physical basis of HST flux measurements. In §IV the

types of measurements are outlined for each calibration target. *While data are being collected for all of the listed targets, some may never be an actual HST calibration target. Operational problems or unforseen difficulties with the astronomical information currently being analyzed may prevent a particular object from becoming a calibration target. The final set of HST calibration targets that are actually observed with HST on a regular basis is likely to be a small subset of the targets presented here.* However, current plans (§V) call for making all data on calibration targets internally consistent and referenced to a single photometric-spectrophotometric system, *i.e.*, the 'HST photometric system.'

Sources for data in CRCALSPEC Spectra

| TARGET | WAVELENGTH RANGE (ANGSTROMS) | SOURCE |
|---|---|---|
| AGK+81D266 | 500-1200 | Model atmosphere, see the XCAL program by Keith Horne for details. |
| | 1200-3200 | IUE Data = crcalobs:agk_81d266_005.tab |
| | 3200-8300 | Oke Data = crcalobs:agk_81d266_006.tab |
| | 8300-12000 | Model atmosphere, see the XCAL program by Keith Horne for details. |
| ALPHA-LYR | 500-1170 | Model atmosphere, see the XCAL program by Keith Horne for details. |
| | 1170-3100 | IUE Data = crcalobs:alpha-lyr_010.tab |
| | 3100-12000 | Model atmosphere, see the XCAL program by Keith Horne for details. |
| BD+28D4211 | 500-1170 | Model atmosphere, see the XCAL program by Keith Horne for details. |
| | 1170-3200 | IUE DATA = crcalobs:bd_28d4211_012.tab |
| | 3200-8000 | OKE DATA = crcalobs:bd_28d4211_017.tab |
| | 8000-12000 | Model atmosphere, see the XCAL program by Keith Horne for details. |
| BD+33D2642 | 500-1700 | Model atmosphere, see the XCAL program by Keith Horne for details. |
| | 1170-3200 | IUE data = crcalobs:bd_33d2642_008.tab |
| | 3200-8000 | Oke Data = crcalobs:bd_33d2642_007.tab |
| | 8100-12000 | Model atmosphere, see the XCAL program by Keith Horne for details. |
| BD+75D325 | 500-970 | Model atmosphere, see the XCAL program by Keith Horne for details. |
| | 970-1170 | Voyager Data = crcalobs:bd_75d325_004.tab |
| | 1170-3200 | IUE Data = crcalobs:bd_75d325_006.tab |
| | 3200-8500 | Oke Data = crcalobs:bd_75d325_007.tab |
| | 8500-12000 | Model atmosphere, see the XCAL program by Keith Horne for details. |
| BPM16274 | 500-1160 | Model atmosphere, see the XCAL program by Keith Horne for details. |
| | 1160-1200 | IUE DATA = crcalobs:bpm16274_002.tab |
| | 1200-1225 | Model atmosphere, see the XCAL program by Keith Horne for details. |
| | 1225-3150 | IUE DATA = crcalobs:bpm16274_002.tab |
| | 3150-12000 | Model atmosphere, see the XCAL program by Keith Horne for details. |
| ETA-UMA | 500-970 | Model atmosphere, see the XCAL program by Keith Horne for details. |
| | 970-1160 | Voyager Data = crcalobs:eta-uma_011.tab |
| | 1160-3200 | IUE Data = crcalobs:eta-uma_012.tab |
| | 3200-12000 | Model atmosphere, see the XCAL program by Keith Horne for details. |
| FEIGE110 | 500-1170 | Model atmosphere, see the XCAL program by Keith Horne for details. |
| | 1170-3200 | IUE Data = crcalobs:feige110_012.tab |
| | 3200-8000 | Oke Data = crcalobs:feige110_015.tab |
| | 8000-12000 | Model atmosphere, see the XCAL program by Keith Horne for details. |

Sources for data in CRCALSPEC Spectra

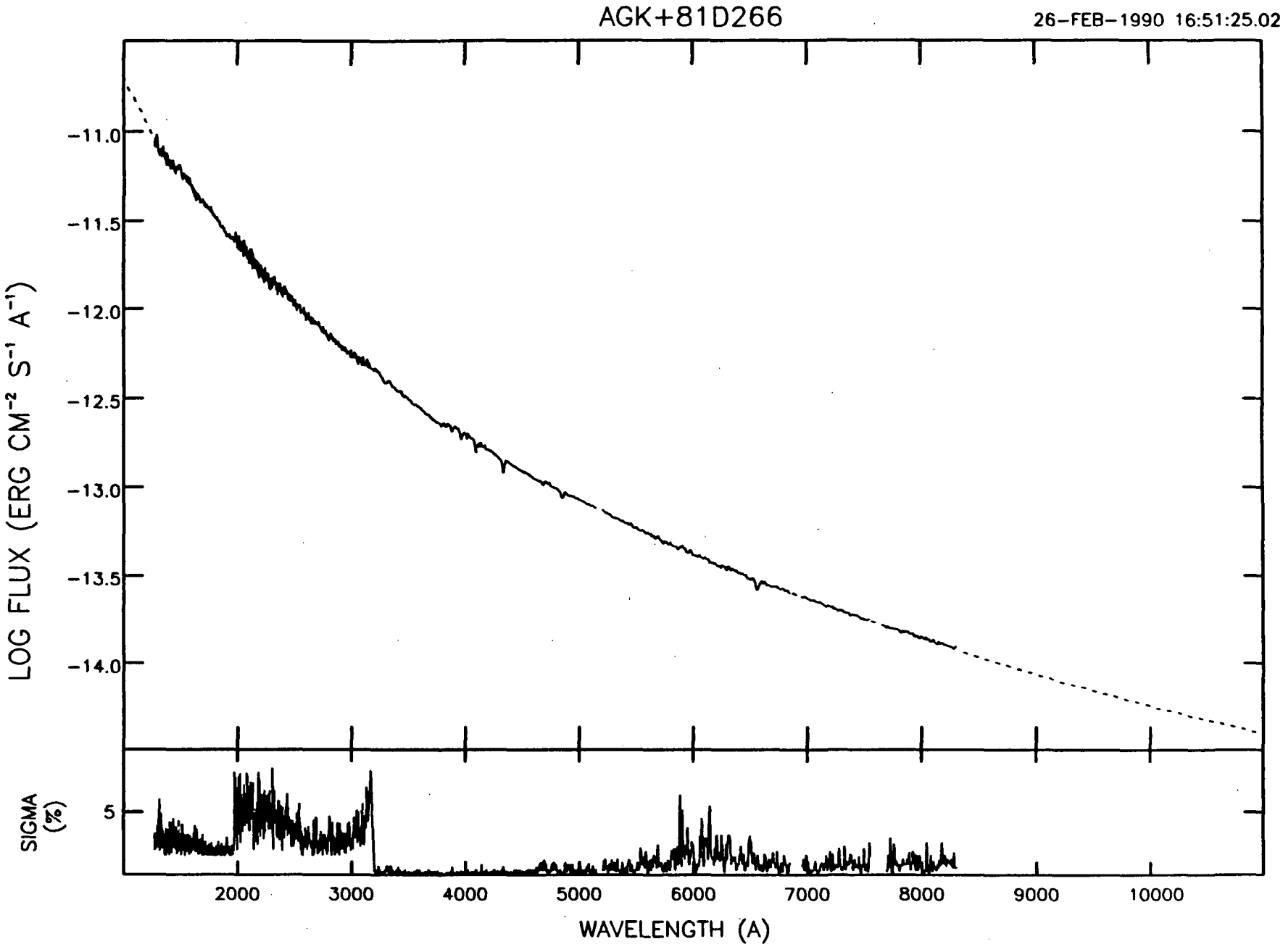
| TARGET | WAVELENGTH RANGE (ANGSTROMS) | SOURCE |
|---|---|---|
| FEIGE34 | 500-1170 | Model atmosphere, see the XCAL program by Keith Horne for details. |
| | 1170-3200 | IUE Data = crcalobs:feige34_013.tab |
| | 3200-7300 | Oke Data = crcalobs:feige34_012.tab |
| | 7300-12000 | Model atmosphere, see the XCAL program by Keith Horne for details. |
| G191B2B | 500-970 | Model atmosphere, see the XCAL program by Keith Horne for details. |
| | 970-1200 | Voyager Data = crcalobs:g191b2b_011.tab |
| | 1200-3200 | IUE Data = crcalobs:g191b2b_014.tab |
| | 3200-8000 | Oke Data = crcalobs:g191b2b_015.tab |
| | 8000-12000 | Model atmosphere, see the XCAL program by Keith Horne for details. |
| G93-48 | 500-1170 | Model atmosphere, see the XCAL program by Keith Horne for details. |
| | 1170-3200 | IUE Data = crcalobs:g93-48_003.tab |
| | 3200-4050 | Model atmosphere, see the XCAL program by Keith Horne for details. |
| | 4050-6750 | Stone Data = crcalobs:g93-48_002.tab |
| | 6750-12000 | Model atmosphere, see the XCAL program by Keith Horne for details. |
| GAMMA-UMA | 500-1200 | Model atmosphere, see the XCAL program by Keith Horne for details. |
| | 1200-3200 | IUE Data = crcalobs:gamma-uma_003.tab |
| | 3200-12000 | Model atmosphere, see the XCAL program by Keith Horne for details. |
| GD50 | 500-1170 | Model atmosphere, see the XCAL program by Keith Horne for details. |
| | 1170-3200 | IUE Data = crcalobs:gd50_008.tab |
| | 3200-6800 | Stone Data = crcalobs:gd50_005.tab |
| | 6800-12000 | Model atmosphere, see the XCAL program by Keith Horne for details. |
| GD108 | 500-1170 | Model atmosphere, see the XCAL program by Keith Horne for details. |
| | 1170-3200 | IUE Data =crcalobs:gd108_007.tab |
| | 3200-8500 | Oke Data = crcalobs:gd108_005.tab |
| | 8500-12000 | Model atmosphere, see the XCAL program by Keith Horne for details. |
| GRW+70D5824 | 500-1175 | Model atmosphere, see the XCAL program by Keith Horne for details. |
| | 1175-1190 | IUE Data = crcalobs:grw_70d5824_006.tab |
| | 1190-1275 | Model atmosphere, see the XCAL program by Keith Horne for details. |
| | 1275-3200 | IUE Data = crcalobs:grw_70d5824_006.tab |
| | 3200-3800 | Model atmosphere, see the XCAL program by Keith Horne for details. |
| | 3800-8000 | Oke Data = crcalobs:grw_70d5824_004.tab |
| | 8000-12000 | Model atmosphere, see the XCAL program by Keith Horne for details. |

Sources for data in CRCALSPEC Spectra

| TARGET | WAVELENGTH RANGE (ANGSTROMS) | SOURCE |
|---|---|---|
| HD49798 | 500-1170 | Model atmosphere, see the XCAL program by Keith Horne for details. |
| | 1170-3200 | IUE Data = crcalobs:hd49798_003.TAB |
| | 3200-12000 | Model atmosphere, see the XCAL program by Keith Horne for details. |
| HD60753 | 500-1170 | Model atmosphere, see the XCAL program by Keith Horne for details. |
| | 1170-3200 | IUE Data = crcalobs:hd60753_002.tab |
| | 3200-12000 | Model atmosphere, see the XCAL program by Keith Horne for details. |
| HD93521 | 500-970 | Model atmosphere, see the XCAL program by Keith Horne for details. |
| | 970-1200 | Voyager Data = crcalobs:hd93521_008.tab |
| | 1200-3200 | IUE Data = crcalobs:hd93521_006.tab |
| | 3200-8000 | Oke Data = crcalobs:hd93521_010.tab |
| | 8000-12000 | Model atmosphere, see the XCAL program by Keith Horne for details. |
| HZ21 | 500-1170 | Model atmosphere, see the XCAL program by Keith Horne for details. |
| | 1170-3200 | IUE Data = crcalobs:hz21_009.tab |
| | 3200-3700 | Model atmosphere, see the XCAL program by Keith Horne for details. |
| | 3700-8000 | Oke Data = crcalobs:hz21_011.tab |
| | 8000-12000 | Model atmosphere, see the XCAL program by Keith Horne for details. |
| HZ2 | 500-1160 | Model atmosphere, see the XCAL program by Keith Horne for details. |
| | 1160-1200 | IUE DATA = crcalobs:hz2_009.tab |
| | 1200-1225 | Model atmosphere, see the XCAL program by Keith Horne for details. |
| | 1225-3200 | IUE DATA = crcalobs:hz2_009.tab |
| | 3200-6800 | Oke Literature Data (Oke 1974) = crcalobs:hz2_002.tab |
| | 6800-12000 | Model atmosphere, see the XCAL program by Keith Horne for details. |
| HZ4 | 500-1300 | Model atmosphere, see the XCAL program by Keith Horne for details. |
| | 1300-3200 | IUE Data = crcalobs:hz4_013.tab |
| | 3200-3600 | Model atmosphere, see the XCAL program by Keith Horne for details. |
| | 3600-8000 | Oke Data = crcalobs:hz4_011.tab |
| | 8000-12000 | Model atmosphere, see the XCAL program by Keith Horne for details. |
| HZ44 | 500-1200 | Model atmosphere, see the XCAL program by Keith Horne for details. |
| | 1200-3200 | IUE Data = crcalobs:hz44_012.tab |
| | 3200-3600 | Model atmosphere, see the XCAL program by Keith Horne for details. |
| | 3600-8000 | Oke Data = crcalobs:hz44_014.tab |
| | 8000-12000 | Model atmosphere, see the XCAL program by Keith Horne for details. |

Sources for data in CRCALSPEC Spectra

| TARGET | WAVELENGTH RANGE (ANGSTROMS) | SOURCE |
|---|---|---|
| LB227 | 500-1300 | Model atmosphere, see the XCAL program by Keith Horne for details. |
| | 1300-3200 | IUE DATA = crcalobs:lb227_003.tab |
| | 3200-6800 | Oke Literature Data (Oke 1974) = crcalobs:lb227_002.tab |
| | 6800-12000 | Model atmosphere, see the XCAL program by Keith Horne for details. |
| LDS749B | 500-1300 | Model atmosphere, see the XCAL program by Keith Horne for details. |
| | 1300-3100 | IUE Data = crcalobs:lds749b_003.tab |
| | 3100-3500 | Model atmosphere, see the XCAL program by Keith Horne for details. |
| | 3500-7200 | Oke Data = crcalobs:lds749b_002.tab |
| | 7200-12000 | Model atmosphere, see the XCAL program by Keith Horne for details. |
| MU-COL | 500-970 | Model atmosphere, see the XCAL program by Keith Horne for details. |
| | 970-1170 | VOYAGER DATA= crcalobs:mu-col_003.tab |
| | 1170-3100 | IUE DATA = crcalobs:mu-col_004.tab |
| | 3100-12000 | Model atmosphere, see the XCAL program by Keith Horne for details. |
| NGC7293 | 500-910 | Model atmosphere, see the XCAL program by Keith Horne for details. |
| | 910-1170 | Voyage Data = crcalobs:ngc7293_002.tab |
| | 1170-3200 | IUE Data = crcalobs:ngc7293_004.tab |
| | 3200-7000 | Oke Data = crcalobs:ngc7293_005.tab |
| | 7000-12000 | Model atmosphere, see the XCAL program by Keith Horne for details. |
| ZETA-CAS | 500-920 | Model atmosphere, see the XCAL program by Keith Horne for details. |
| | 920-1200 | Voyager Data = crcalobs:zeta-cas_005.tab |
| | 1200-3200 | OAO2 Data = crcalobs:zeta-cas_001.tab |
| | 3200-4000 | Model atmosphere, see the XCAL program by Keith Horne for details. |
| | 4000-6500 | Stone Data = crcalobs:zeta-cas_006.tab |
| | 6500-12000 | Model atmosphere, see the XCAL program by Keith Horne for details. |


AGK+81D266
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-12.5
-13.0
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SIGMA (%)
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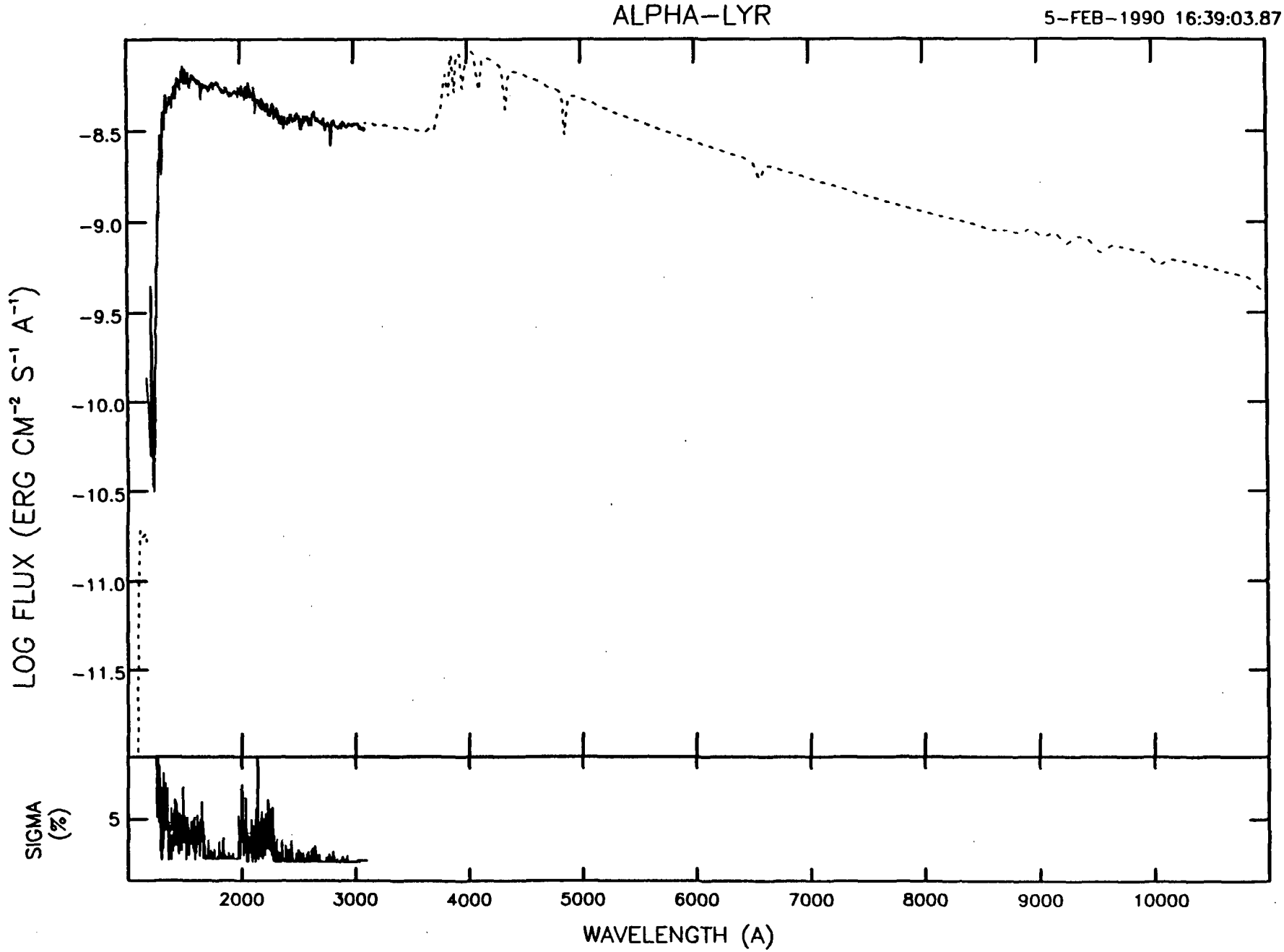
7000
8000
9000
10000
WAVELENGTH (A)


ALPHA–LYR
5–FEB–1990 16:39:03.87
LOG FLUX (ERG CM$^{-2}$ S$^{-1}$ A$^{-1}$)
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−9.5
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−10.5
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SIGMA (%)
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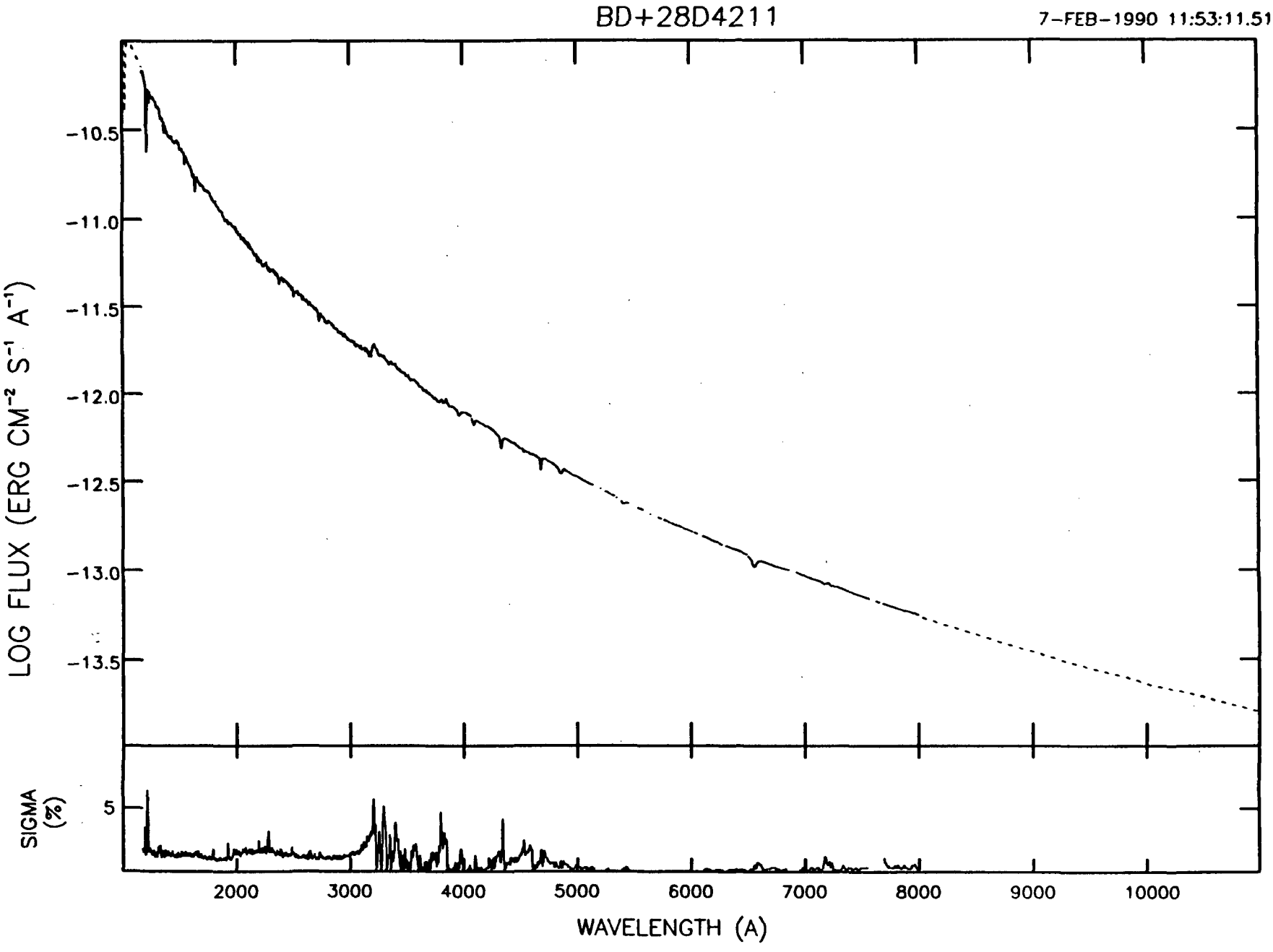
7000
8000
9000
10000
WAVELENGTH (A)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7-FEB-1990 11:53:11.51
LOG FLUX (ERG CM$^{-2}$ S$^{-1}$ A$^{-1}$)
-10.5
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-11.5
-12.0
-12.5
-13.0
-13.5
SIGMA (%)
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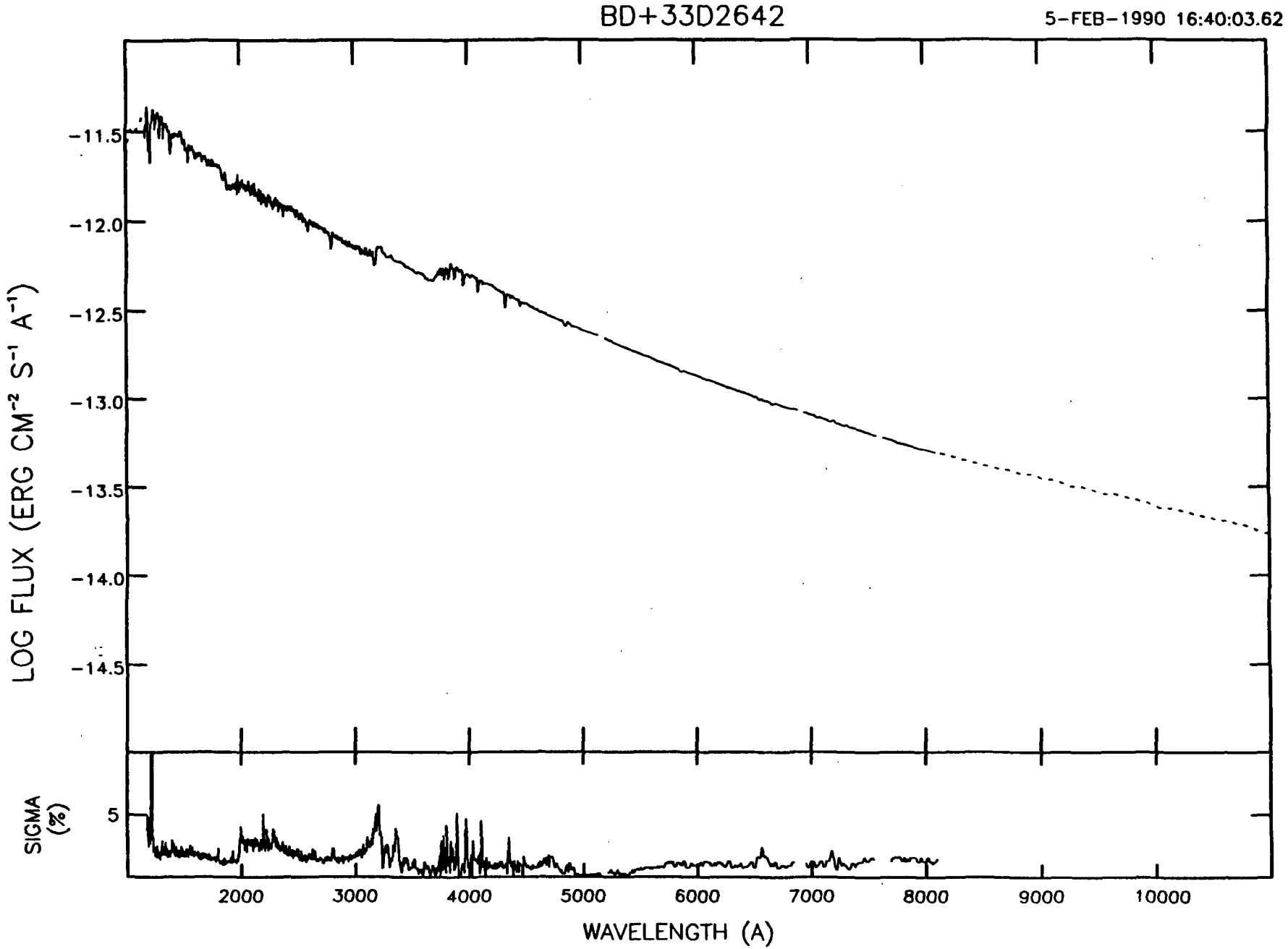
2000
3000
4000
5000
6000
7000
8000
9000
10000
WAVELENGTH (A)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5-FEB-1990 16:40:03.62
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-12.5
-13.0
-13.5
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-14.5
SIGMA (%)
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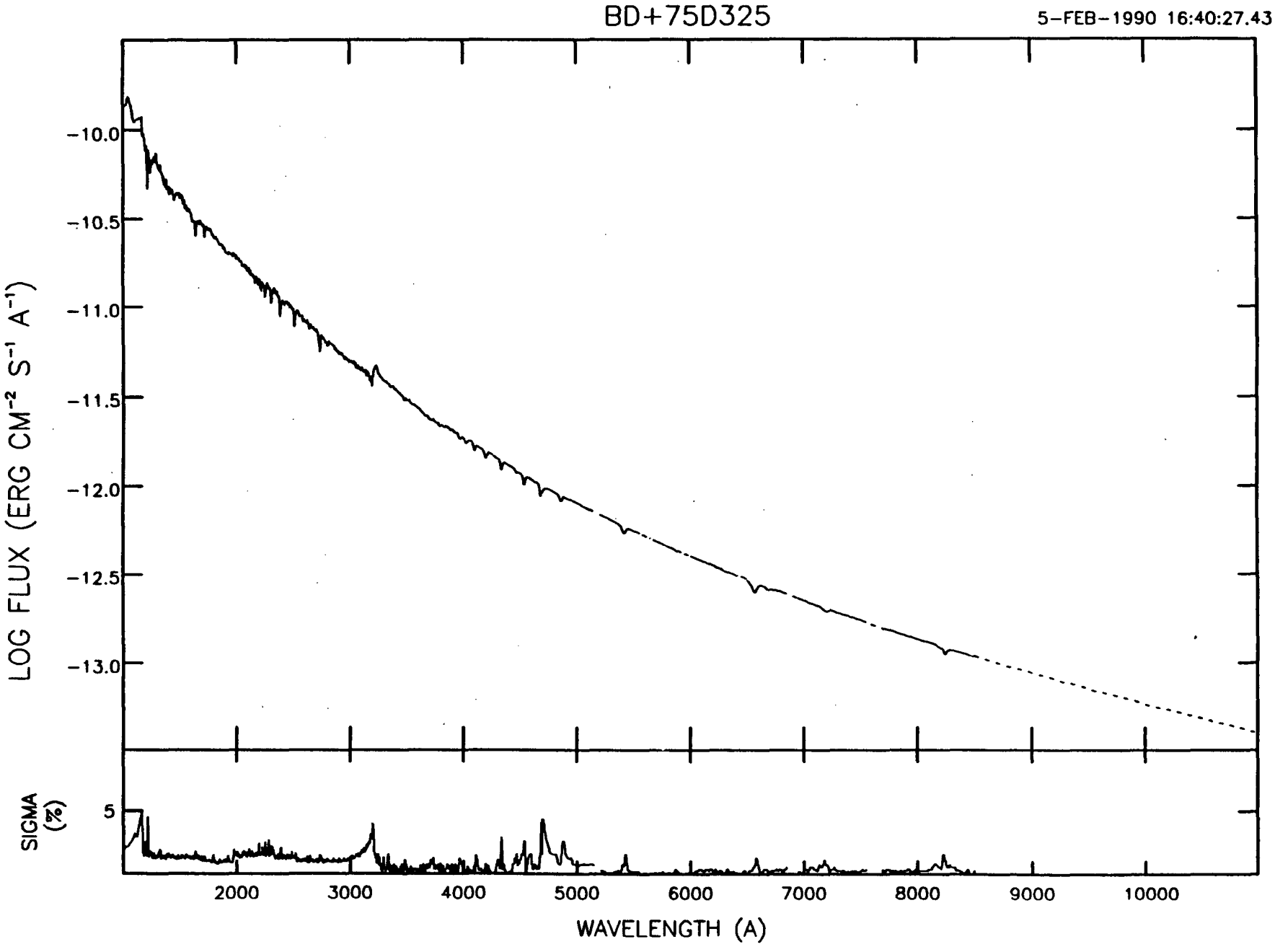
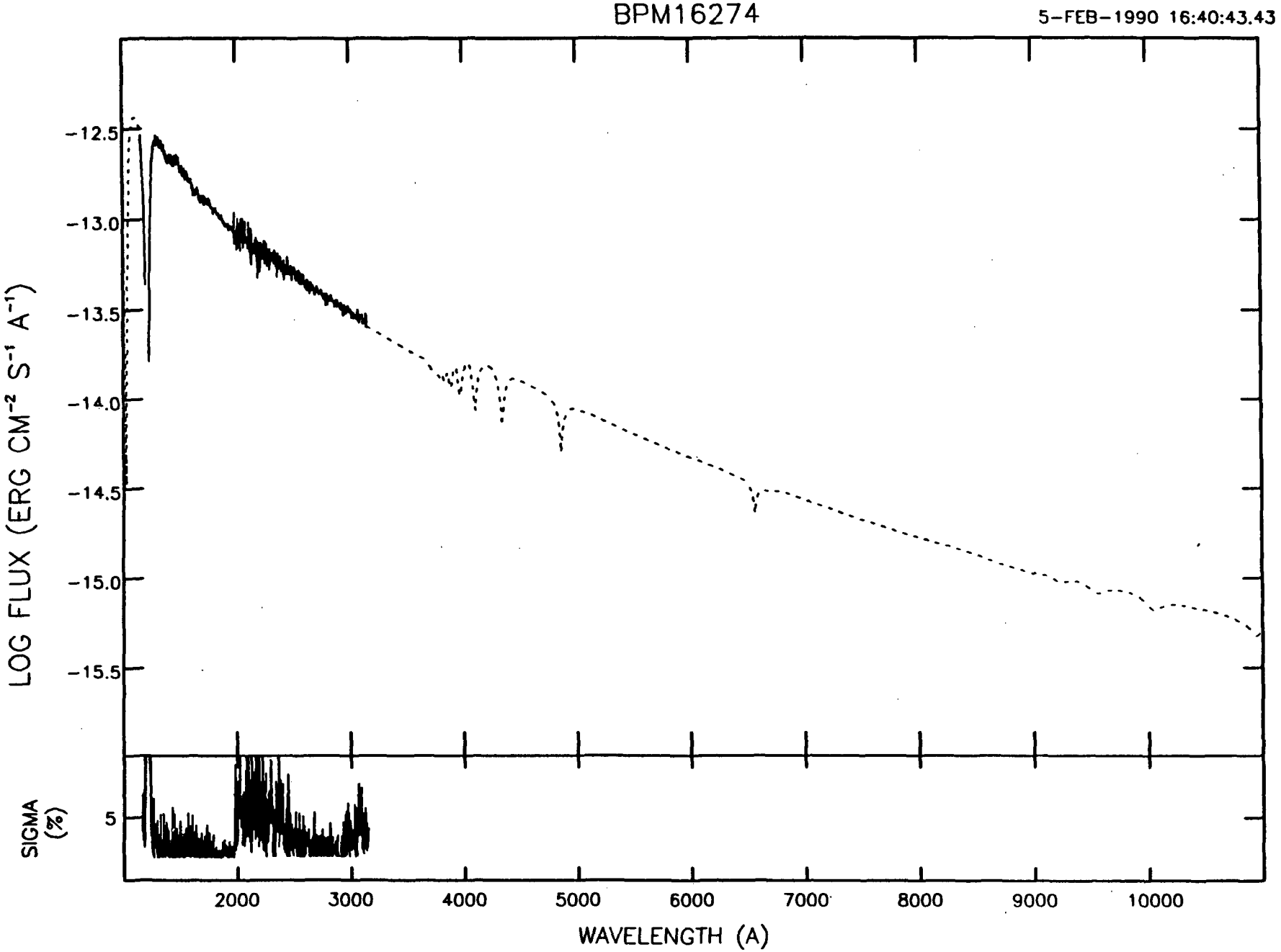
2000
3000
4000
5000
6000
7000
8000
9000
10000
WAVELENGTH (A)


BD+75D325
5-FEB-1990 16:40:27.43
LOG FLUX (ERG CM$^{-2}$ S$^{-1}$ A$^{-1}$)
-10.0
-10.5
-11.0
-11.5
-12.0
-12.5
-13.0
SIGMA (%)
5
2000
3000
4000
5000
6000
7000
8000
9000
10000
WAVELENGTH (A)


BPM16274
5-FEB-1990 16:40:43.43
LOG FLUX (ERG CM$^{-2}$ S$^{-1}$ A$^{-1}$)
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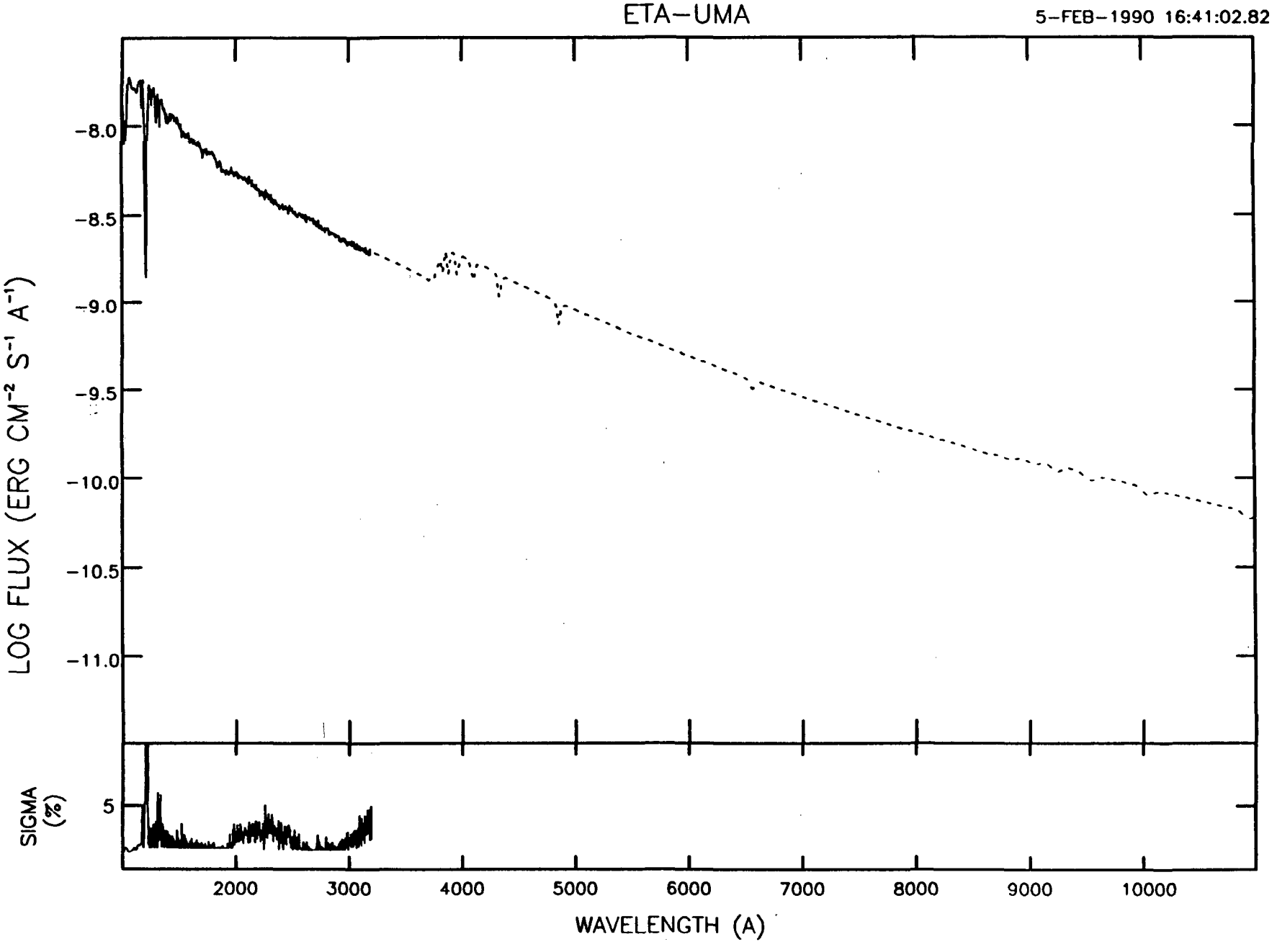
−13.0
−13.5
−14.0
−14.5
−15.0
−15.5
SIGMA (%)
5
2000
3000
4000
5000
6000
7000
8000
9000
10000
WAVELENGTH (A)


ETA–UMA
5–FEB–1990 16:41:02.82
LOG FLUX (ERG CM$^{-2}$ S$^{-1}$ A$^{-1}$)
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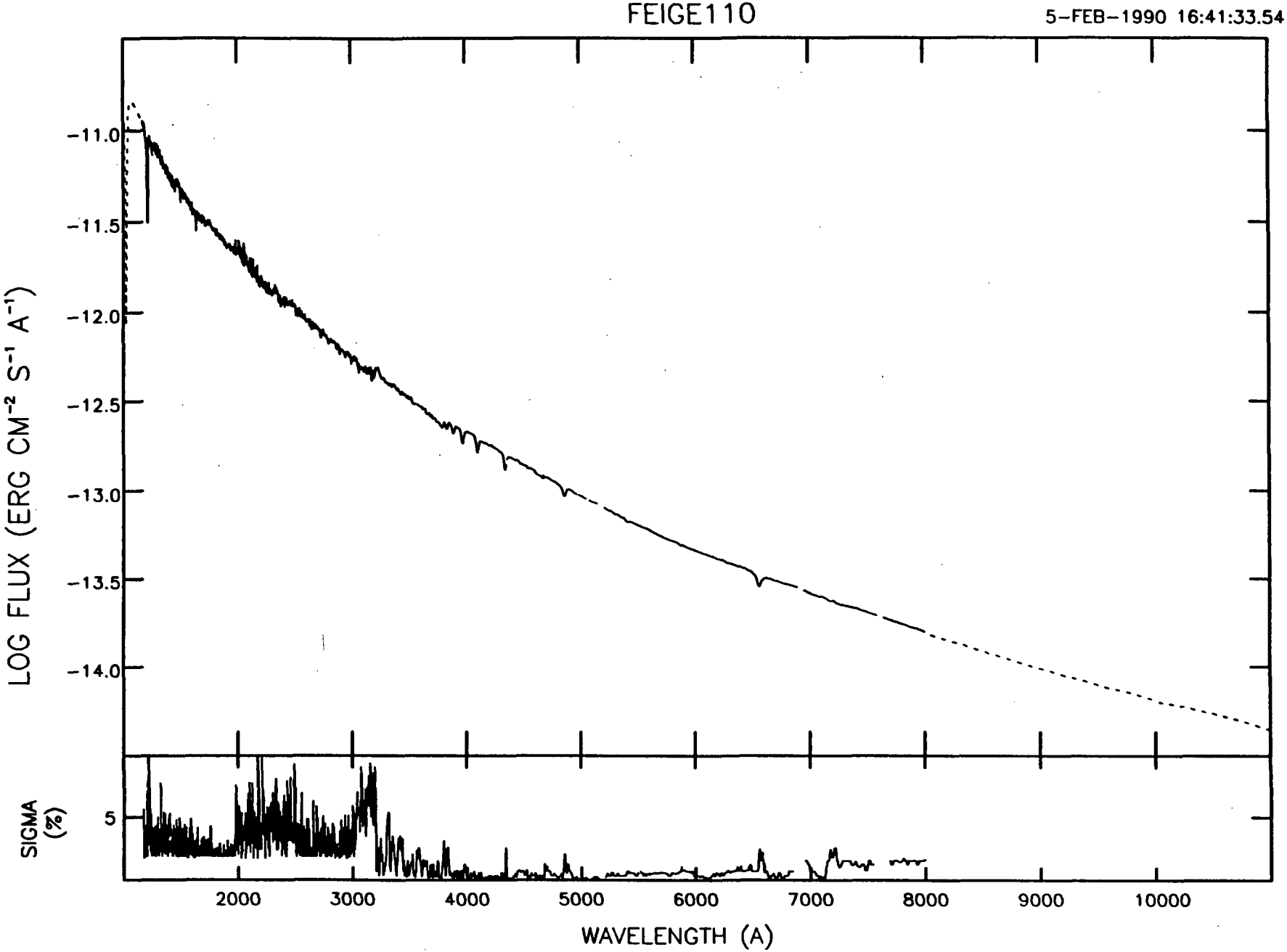
−8.5
−9.0
−9.5
−10.0
−10.5
−11.0
SIGMA (%)
5
2000
3000
4000
5000
6000
7000
8000
9000
10000
WAVELENGTH (A)


FEIGE110
5-FEB-1990 16:41:33.54
LOG FLUX (ERG CM$^{-2}$ S$^{-1}$ A$^{-1}$)
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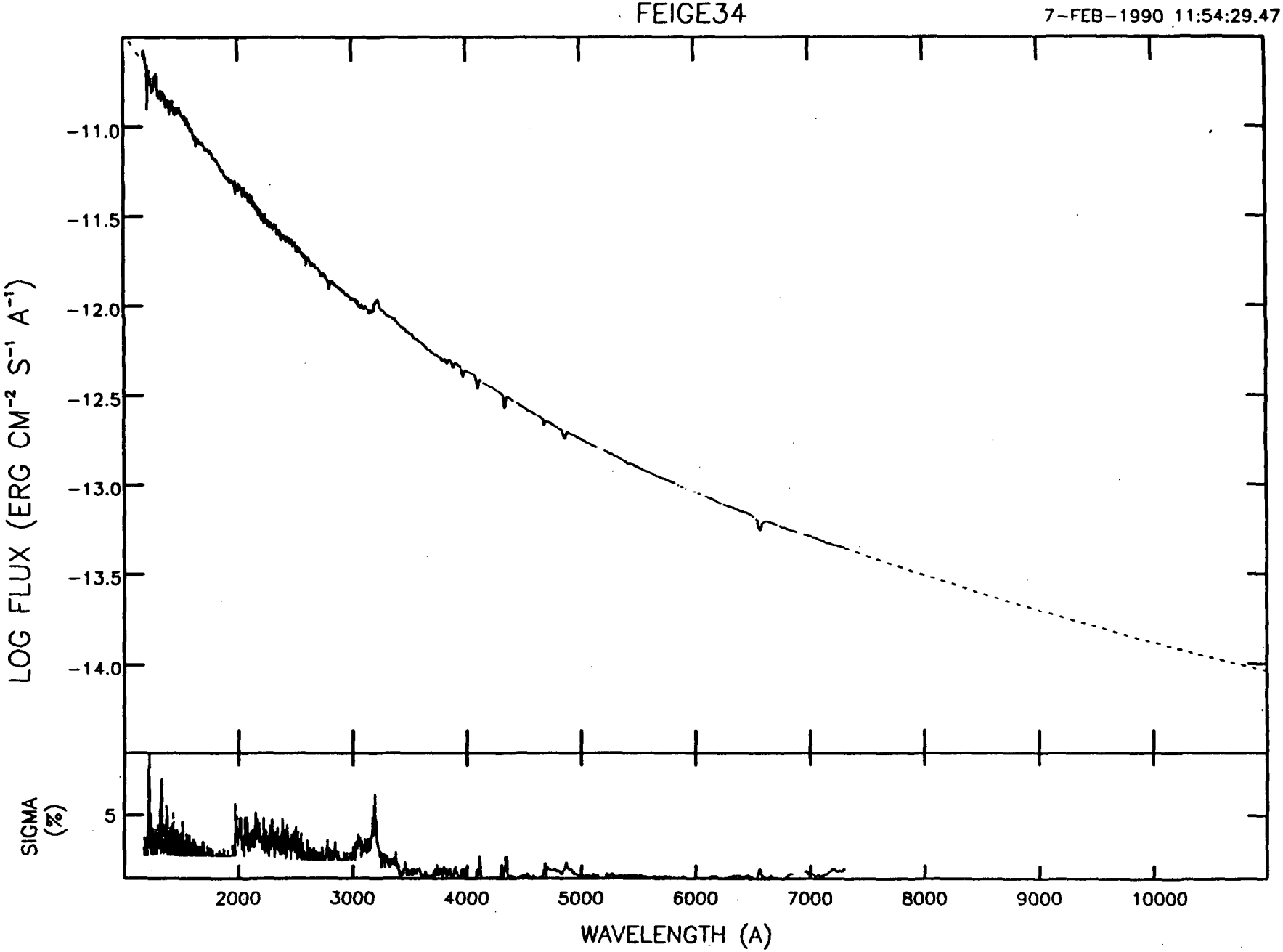
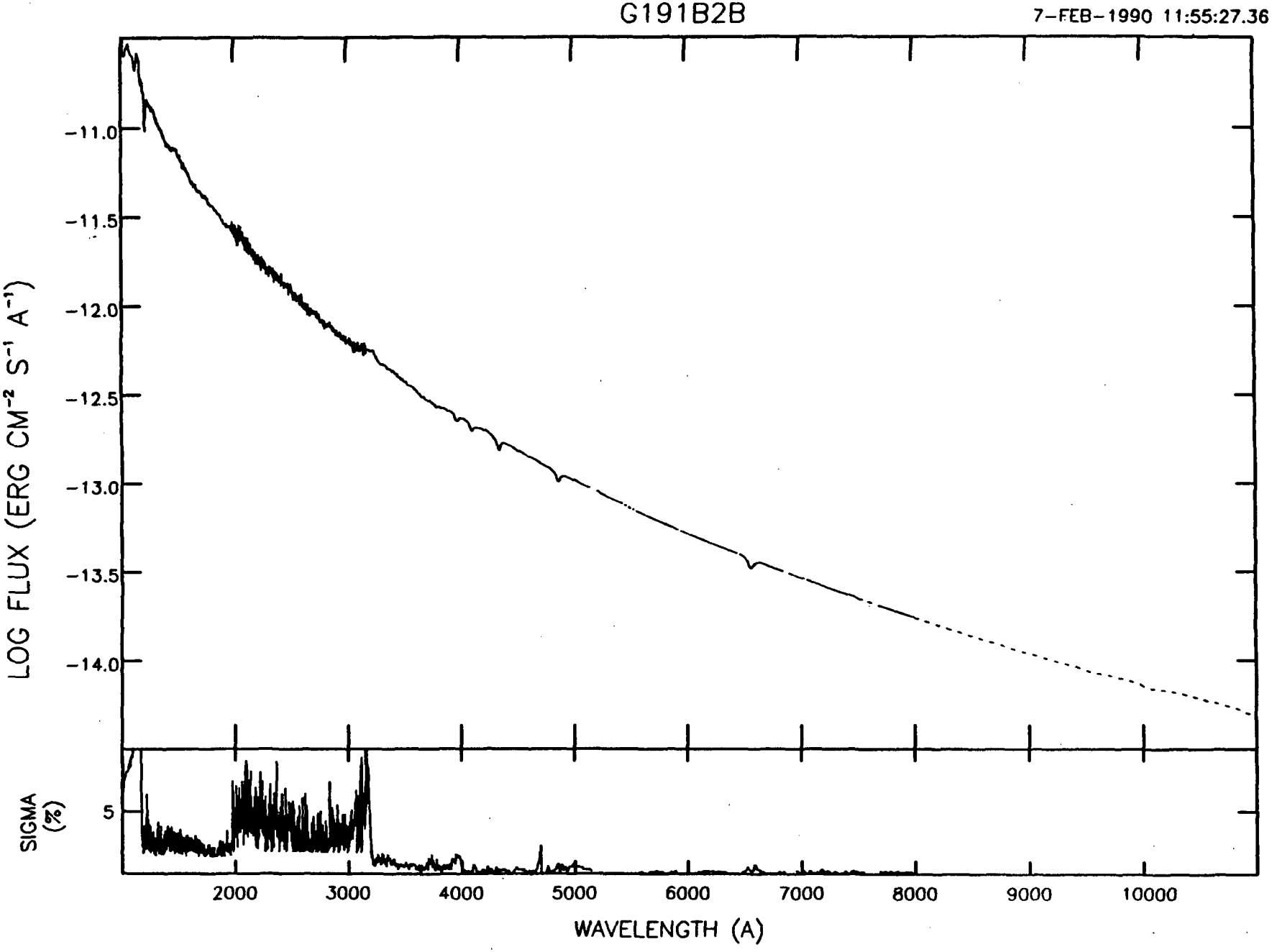
-12.0
-12.5
-13.0
-13.5
-14.0
SIGMA (%)
5
2000
3000
4000
5000
6000
7000
8000
9000
10000
WAVELENGTH (A)


FEIGE34
7-FEB-1990 11:54:29.47
LOG FLUX (ERG CM$^{-2}$ S$^{-1}$ A$^{-1}$)
−11.0
−11.5
−12.0
−12.5
−13.0
−13.5
−14.0
SIGMA (%)
5
2000
3000
4000
5000
6000
7000
8000
9000
10000
WAVELENGTH (A)


G191B2B
7-FEB-1990 11:55:27.36
LOG FLUX (ERG CM$^{-2}$ S$^{-1}$ A$^{-1}$)
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-12.0
-12.5
-13.0
-13.5
-14.0
SIGMA (%)
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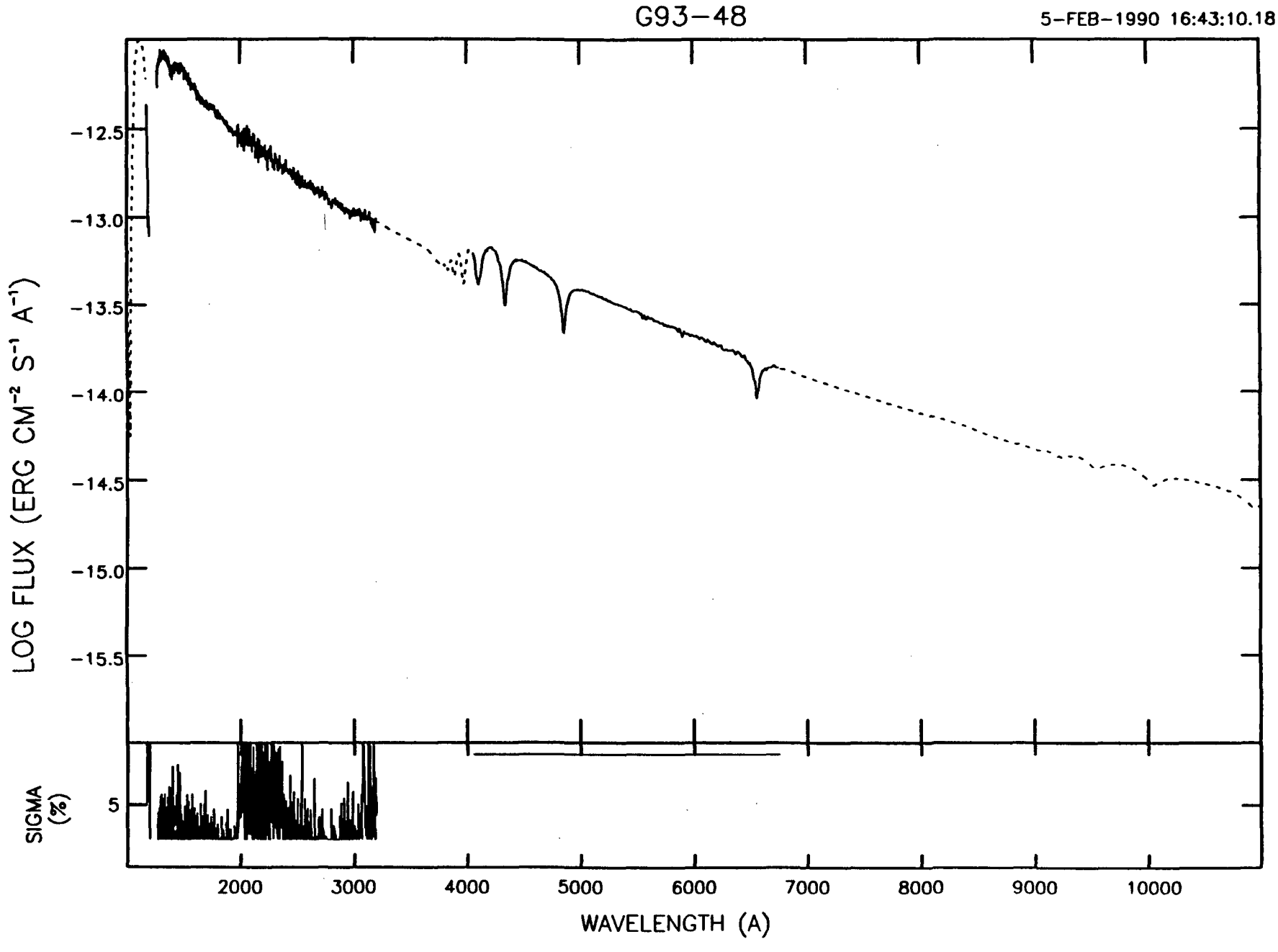
2000
3000
4000
5000
6000
7000
8000
9000
10000
WAVELENGTH (A)


G93-48
5-FEB-1990 16:43:10.18
LOG FLUX (ERG CM$^{-2}$ S$^{-1}$ A$^{-1}$)
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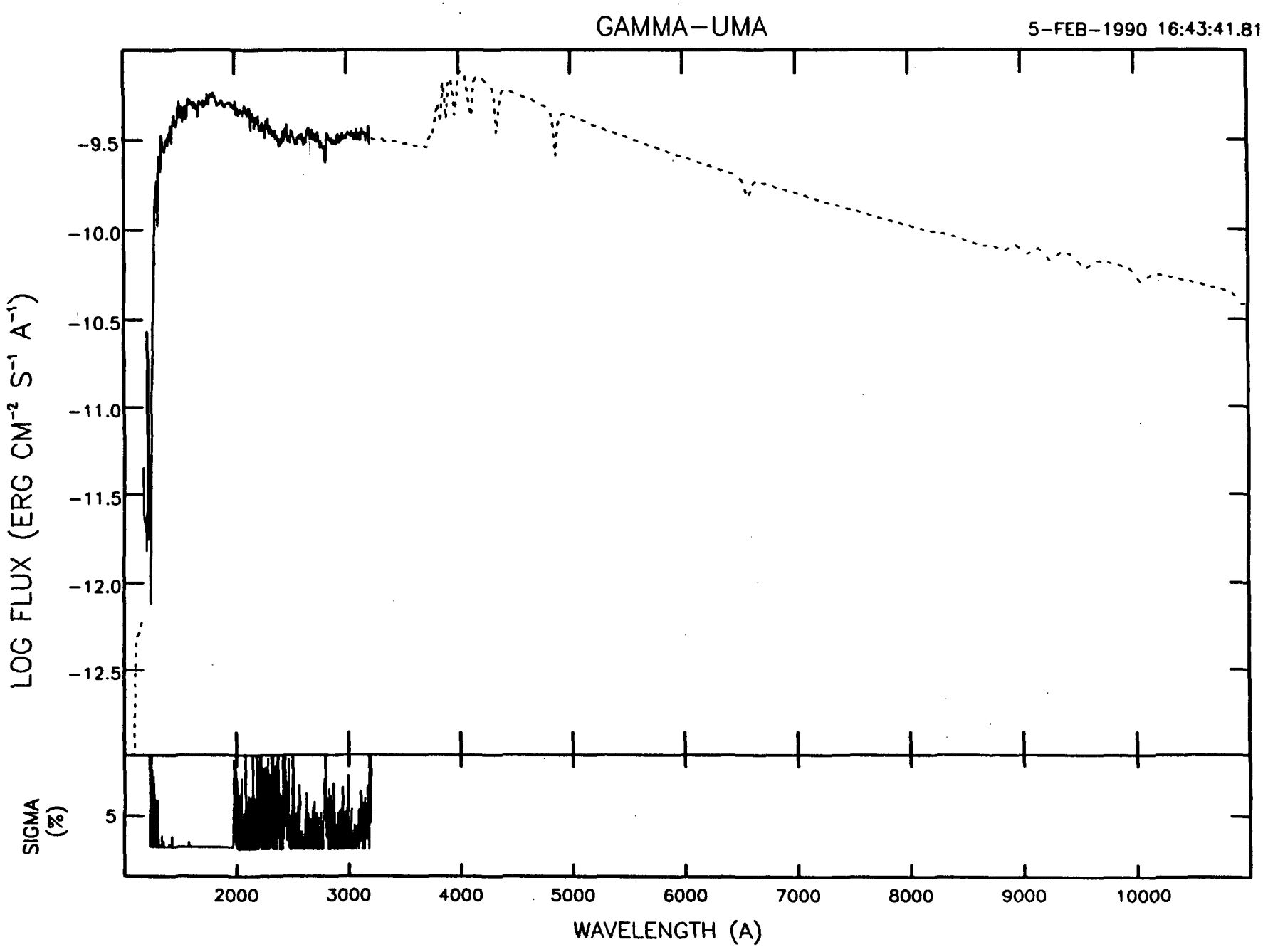
-13.0
-13.5
-14.0
-14.5
-15.0
-15.5
SIGMA (%)
5
2000
3000
4000
5000
6000
7000
8000
9000
10000
WAVELENGTH (A)


GAMMA–UMA
5–FEB–1990 16:43:41.81
LOG FLUX (ERG CM$^{-2}$ S$^{-1}$ A$^{-1}$)
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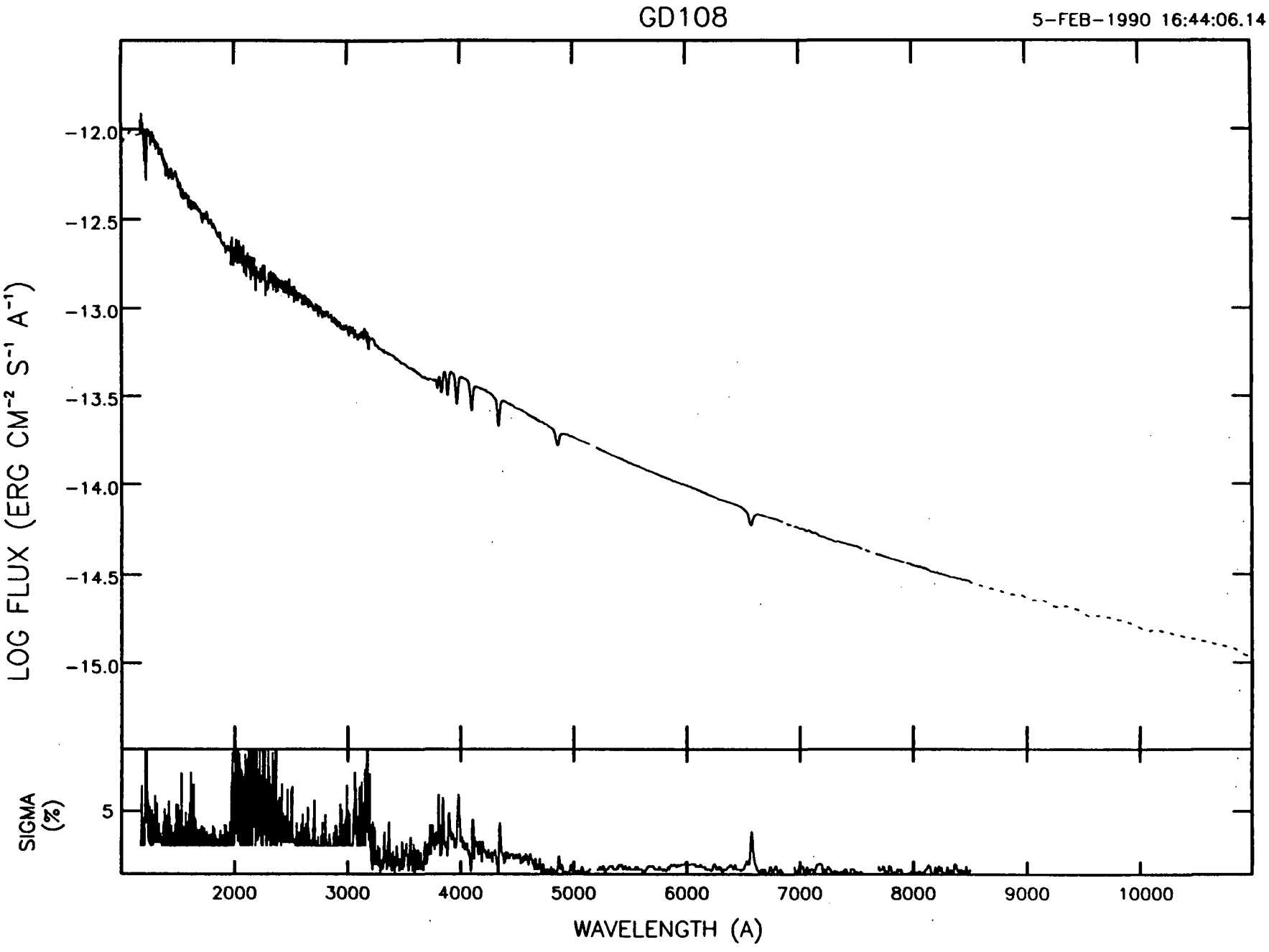
−10.0
−10.5
−11.0
−11.5
−12.0
−12.5
SIGMA (%)
5
2000
3000
4000
5000
6000
7000
8000
9000
10000
WAVELENGTH (A)


GD108
5-FEB-1990 16:44:06.14
LOG FLUX (ERG CM$^{-2}$ S$^{-1}$ A$^{-1}$)
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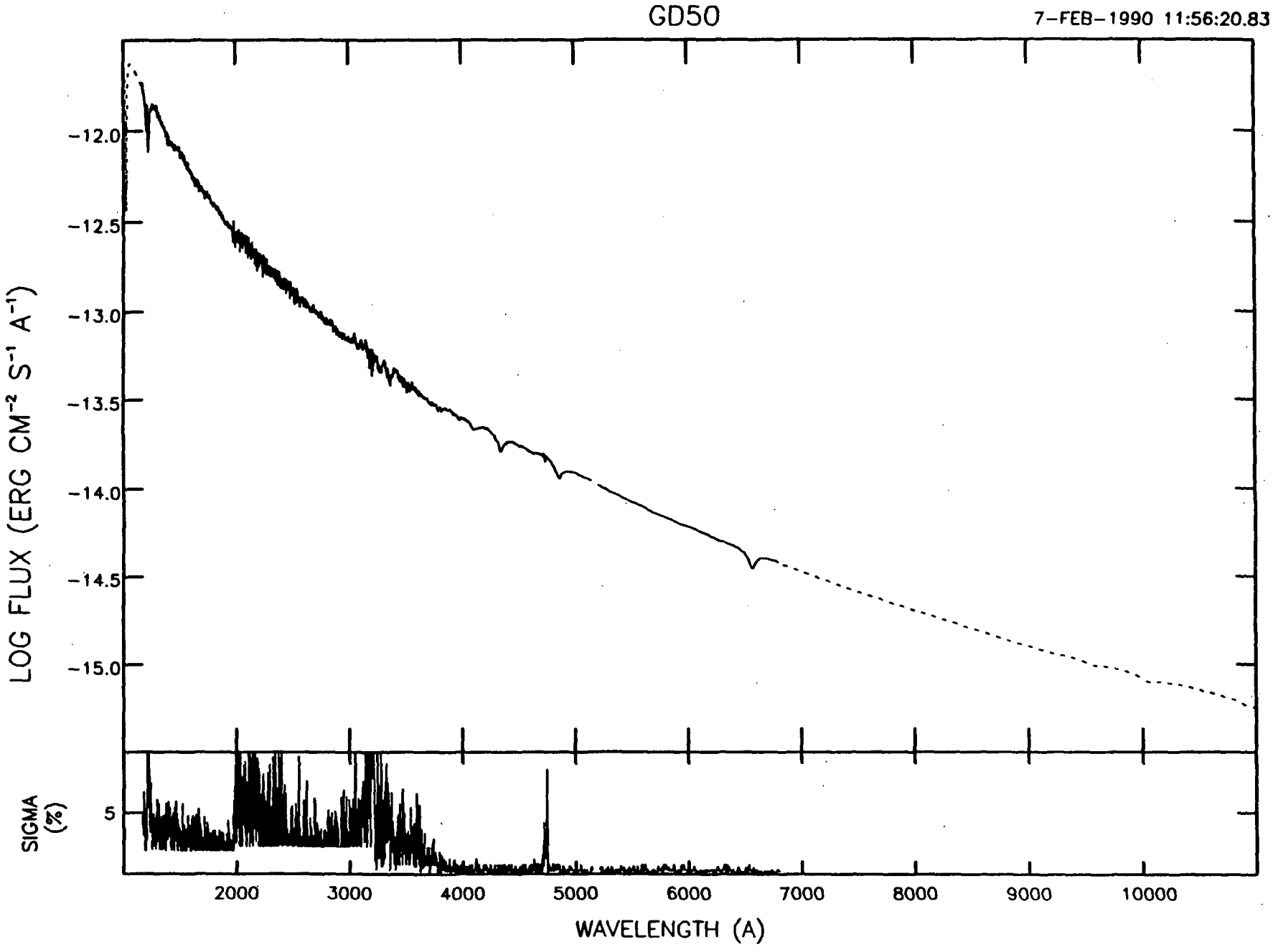
-13.0
-13.5
-14.0
-14.5
-15.0
SIGMA (%)
5
2000
3000
4000
5000
6000
7000
8000
9000
10000
WAVELENGTH (A)


GD50
7-FEB-1990 11:56:20.83
LOG FLUX (ERG CM$^{-2}$ S$^{-1}$ A$^{-1}$)
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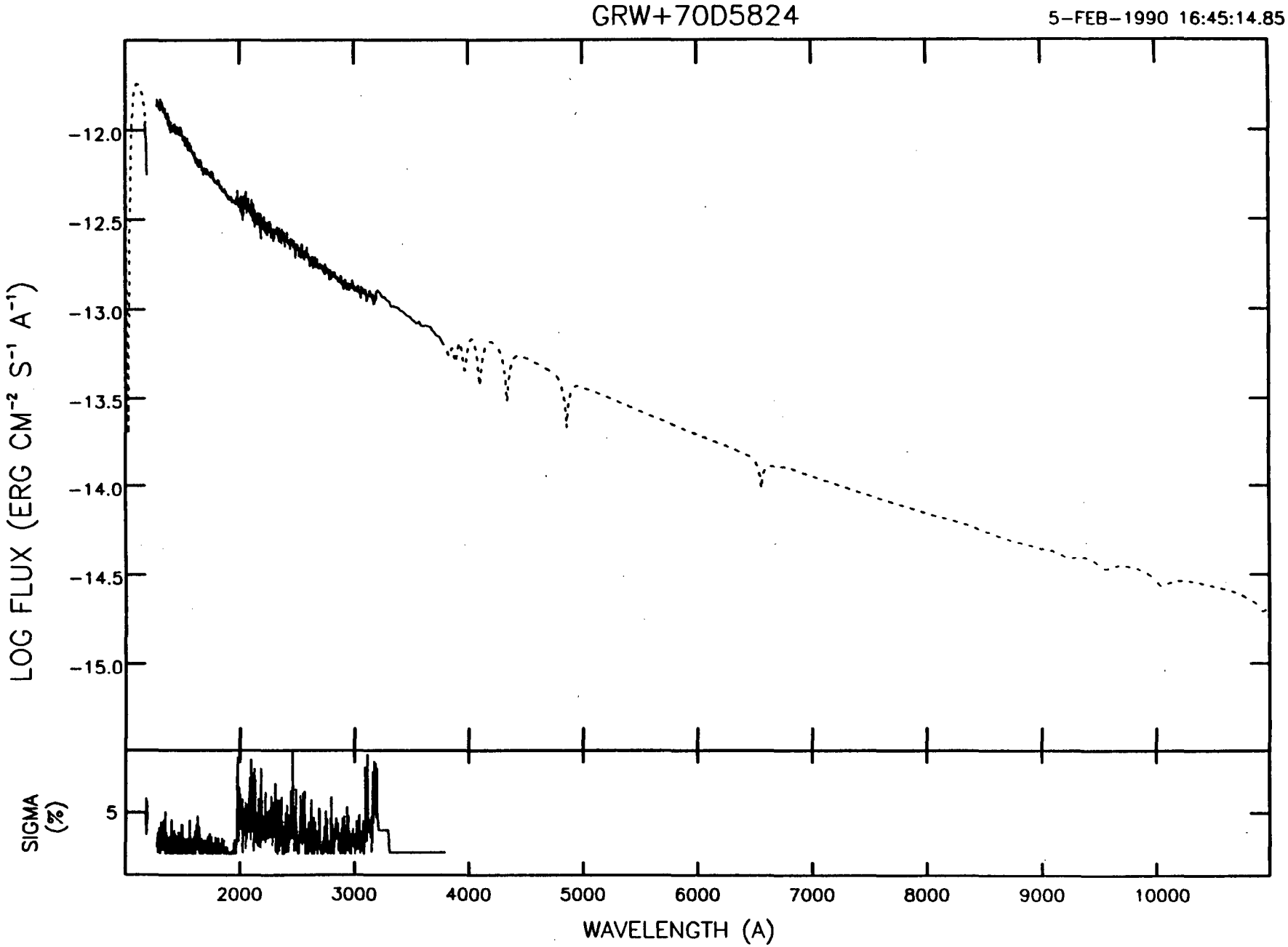
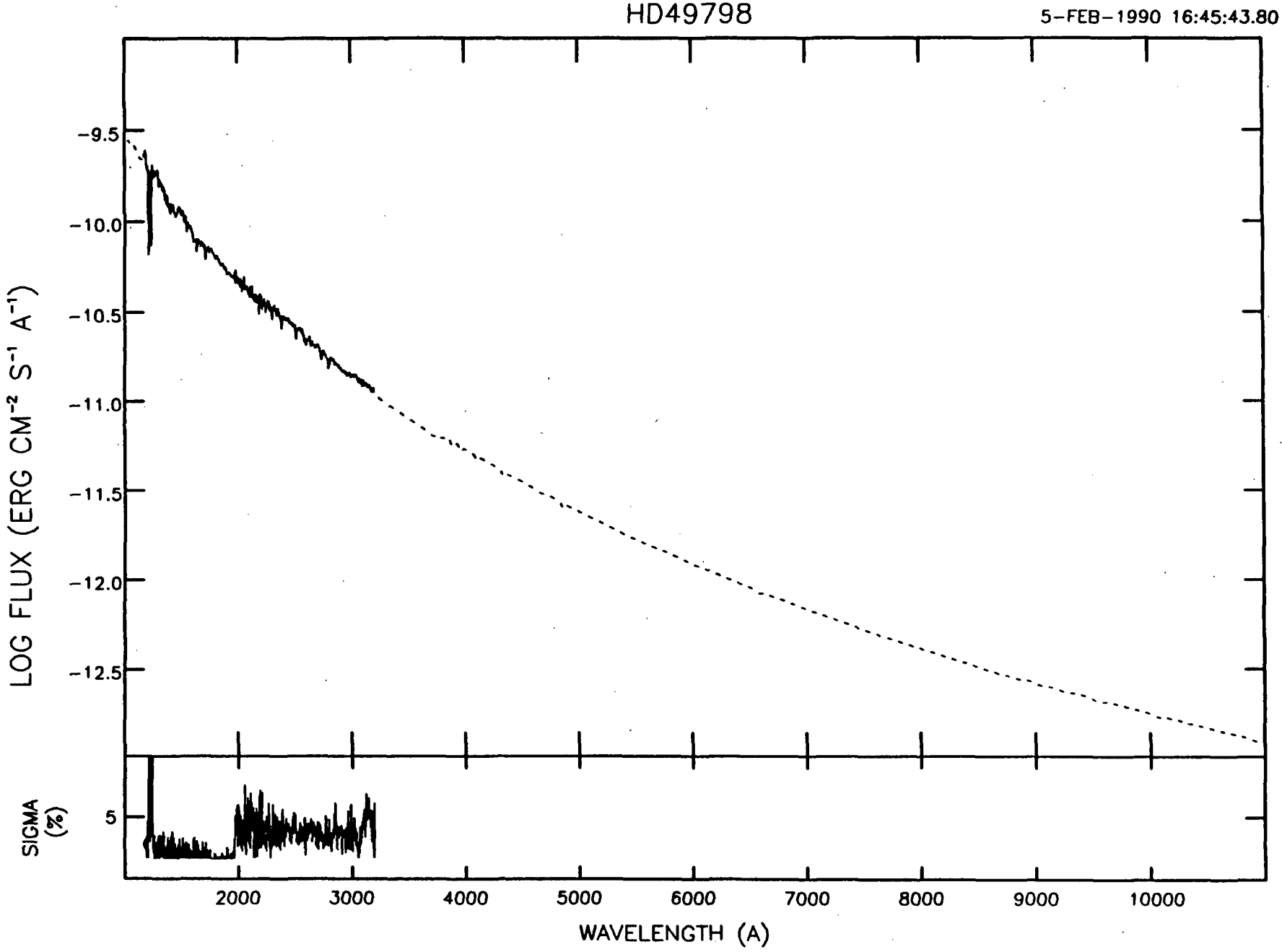
-12.5
-13.0
-13.5
-14.0
-14.5
-15.0
SIGMA (%)
5
2000
3000
4000
5000
6000
7000
8000
9000
10000
WAVELENGTH (A)


GRW+70D5824
5-FEB-1990 16:45:14.85
LOG FLUX (ERG CM$^{-2}$ S$^{-1}$ A$^{-1}$)
-12.0
-12.5
-13.0
-13.5
-14.0
-14.5
-15.0
SIGMA (%)
5
2000
3000
4000
5000
6000
7000
8000
9000
10000
WAVELENGTH (A)


HD49798
5-FEB-1990 16:45:43.80
LOG FLUX (ERG CM$^{-2}$ S$^{-1}$ A$^{-1}$)
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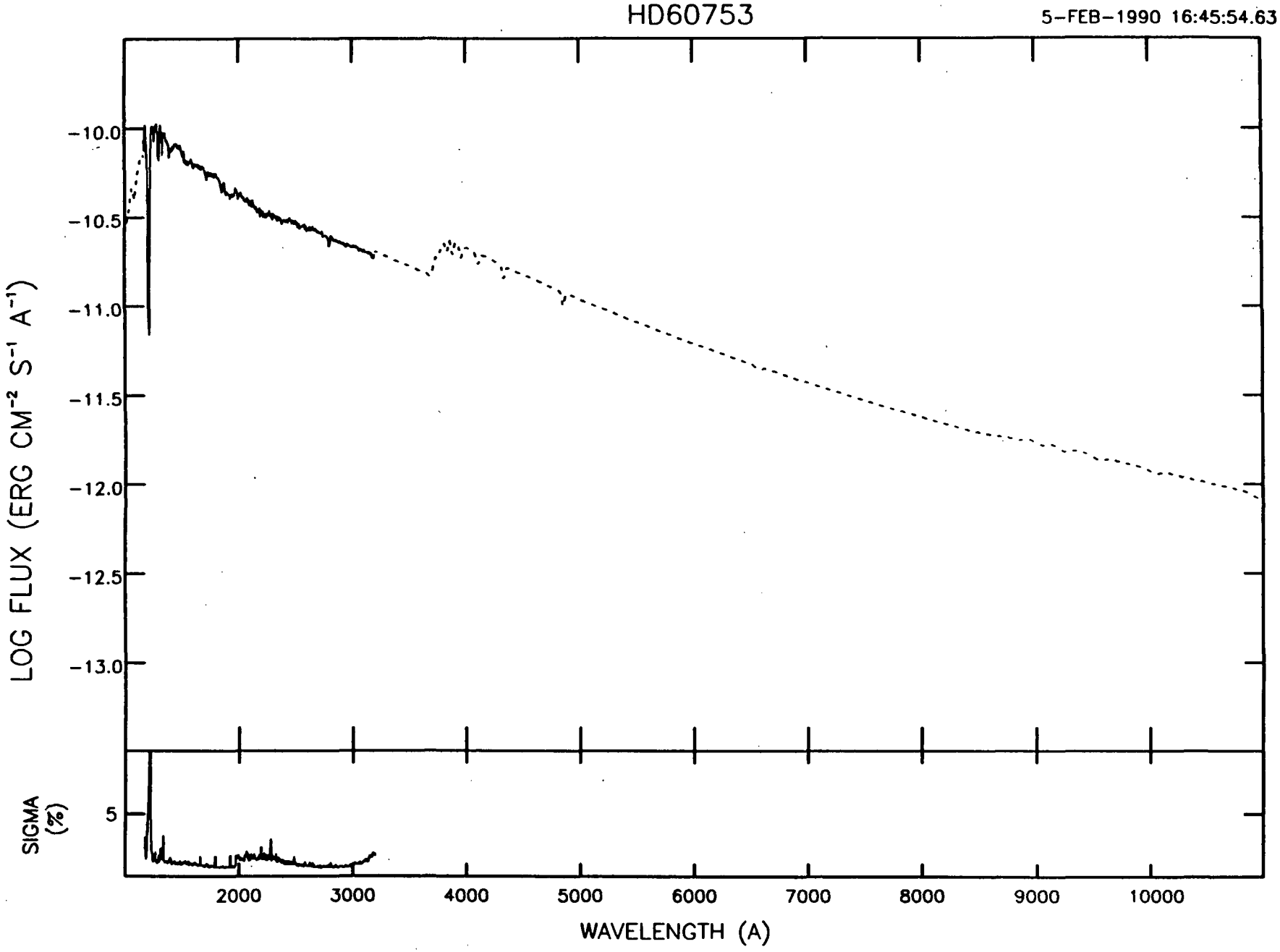
-10.5
-11.0
-11.5
-12.0
-12.5
SIGMA (%)
5
2000
3000
4000
5000
6000
7000
8000
9000
10000
WAVELENGTH (A)


HD60753
5-FEB-1990 16:45:54.63
LOG FLUX (ERG CM$^{-2}$ S$^{-1}$ A$^{-1}$)
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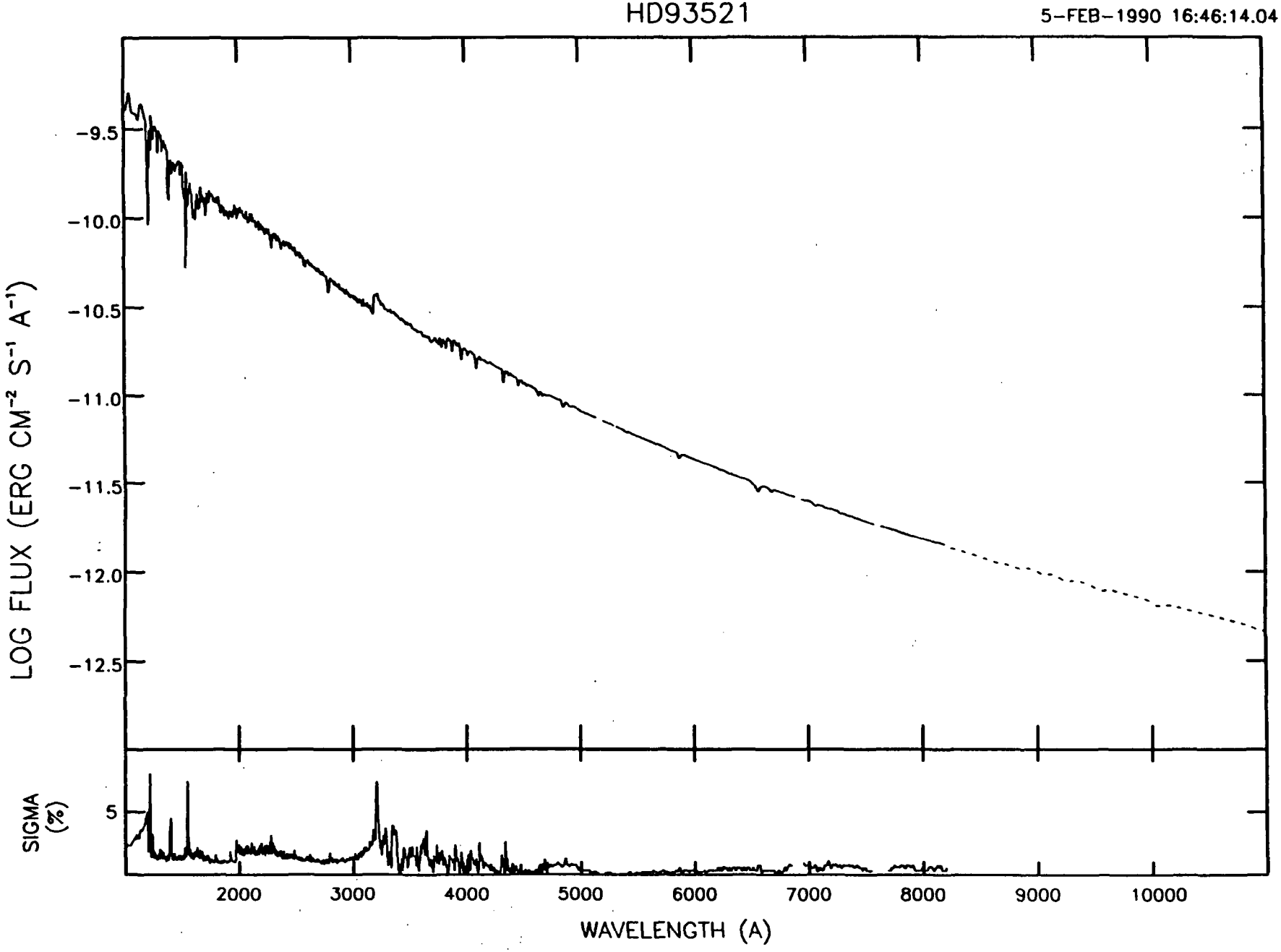
-11.0
-11.5
-12.0
-12.5
-13.0
SIGMA (%)
5
2000
3000
4000
5000
6000
7000
8000
9000
10000
WAVELENGTH (A)


HD93521
5-FEB-1990 16:46:14.04
LOG FLUX (ERG CM$^{-2}$ S$^{-1}$ A$^{-1}$)
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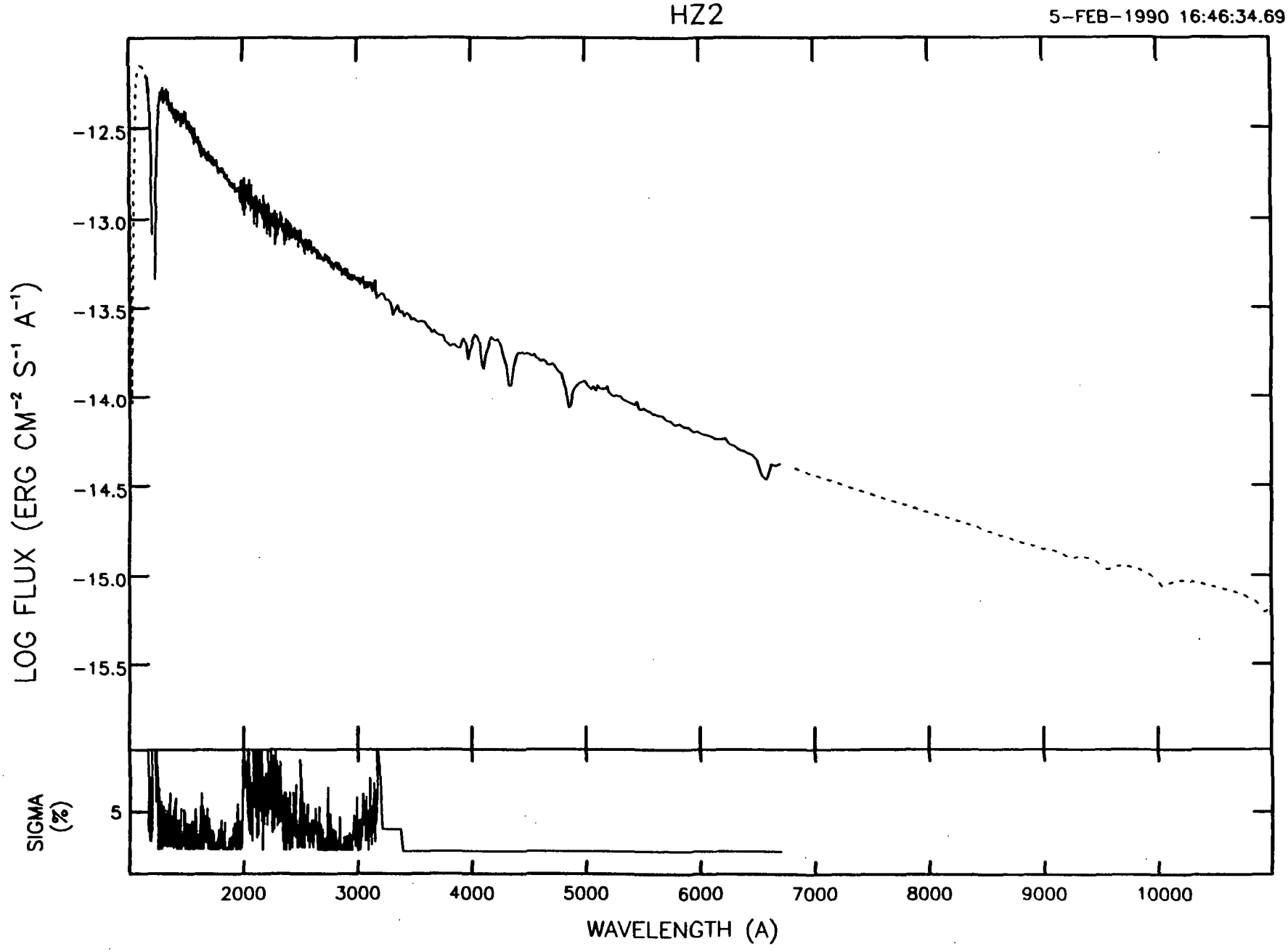
-10.0
-10.5
-11.0
-11.5
-12.0
-12.5
SIGMA (%)
5
2000
3000
4000
5000
6000
7000
8000
9000
10000
WAVELENGTH (A)


HZ2
5-FEB-1990 16:46:34.69
LOG FLUX (ERG CM$^{-2}$ S$^{-1}$ A$^{-1}$)
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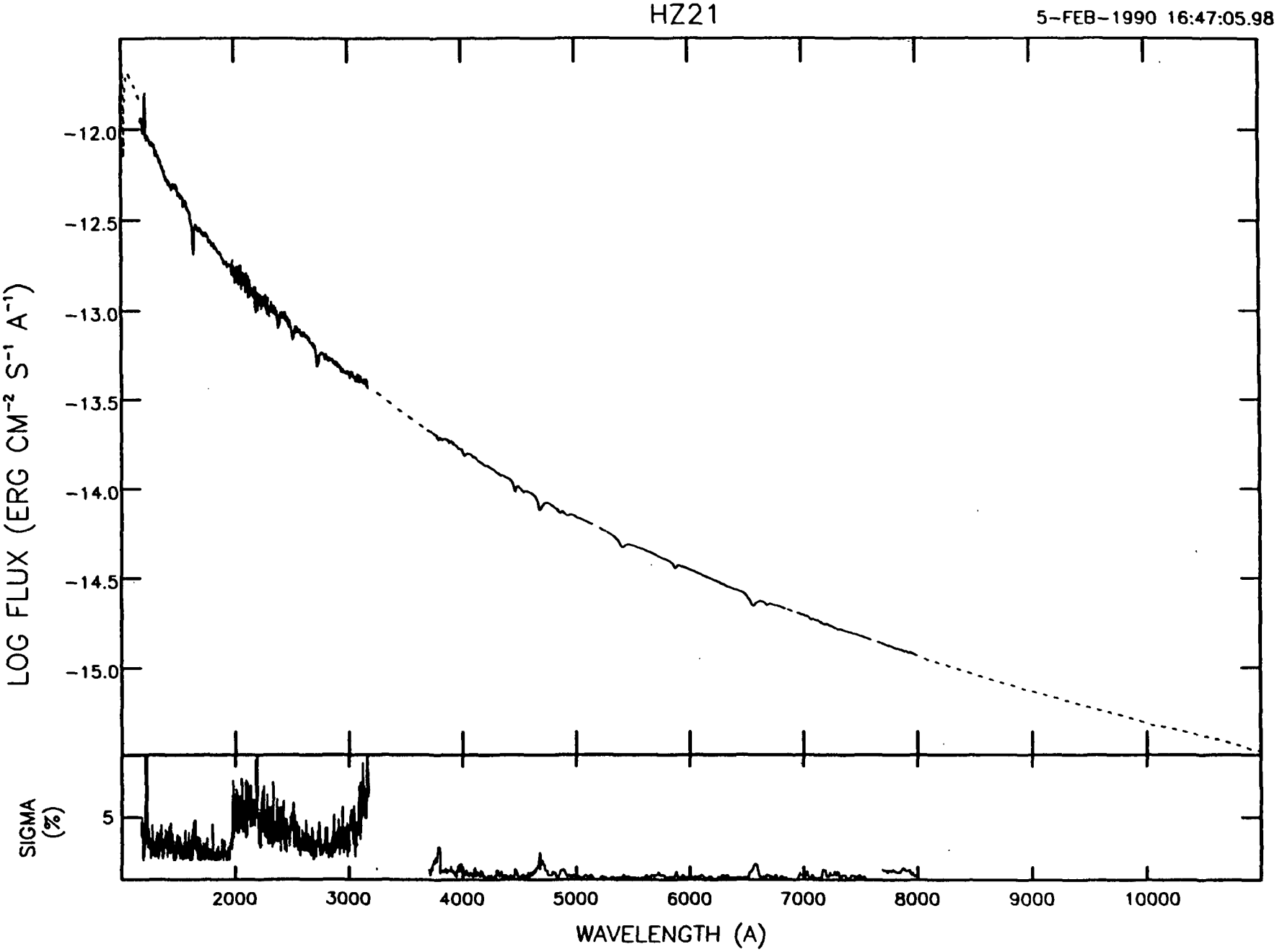
-13.0
-13.5
-14.0
-14.5
-15.0
-15.5
SIGMA (%)
5
2000
3000
4000
5000
6000
7000
8000
9000
10000
WAVELENGTH (A)


HZ21
5-FEB-1990 16:47:05.98
LOG FLUX (ERG CM$^{-2}$ S$^{-1}$ A$^{-1}$)
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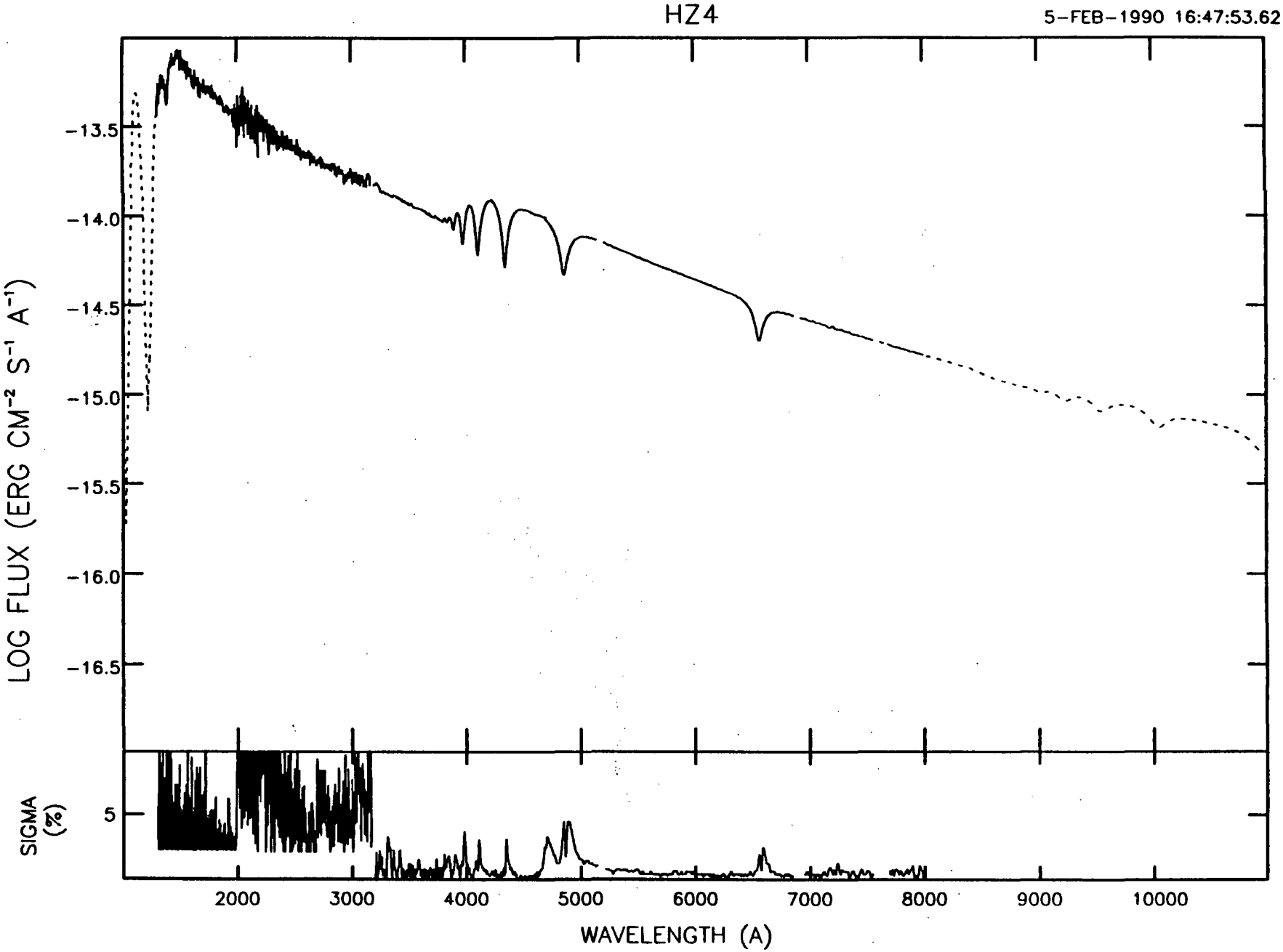
-13.0
-13.5
-14.0
-14.5
-15.0
SIGMA (%)
5
2000
3000
4000
5000
6000
7000
8000
9000
10000
WAVELENGTH (A)


HZ4
5-FEB-1990 16:47:53.62
LOG FLUX (ERG CM$^{-2}$ S$^{-1}$ A$^{-1}$)
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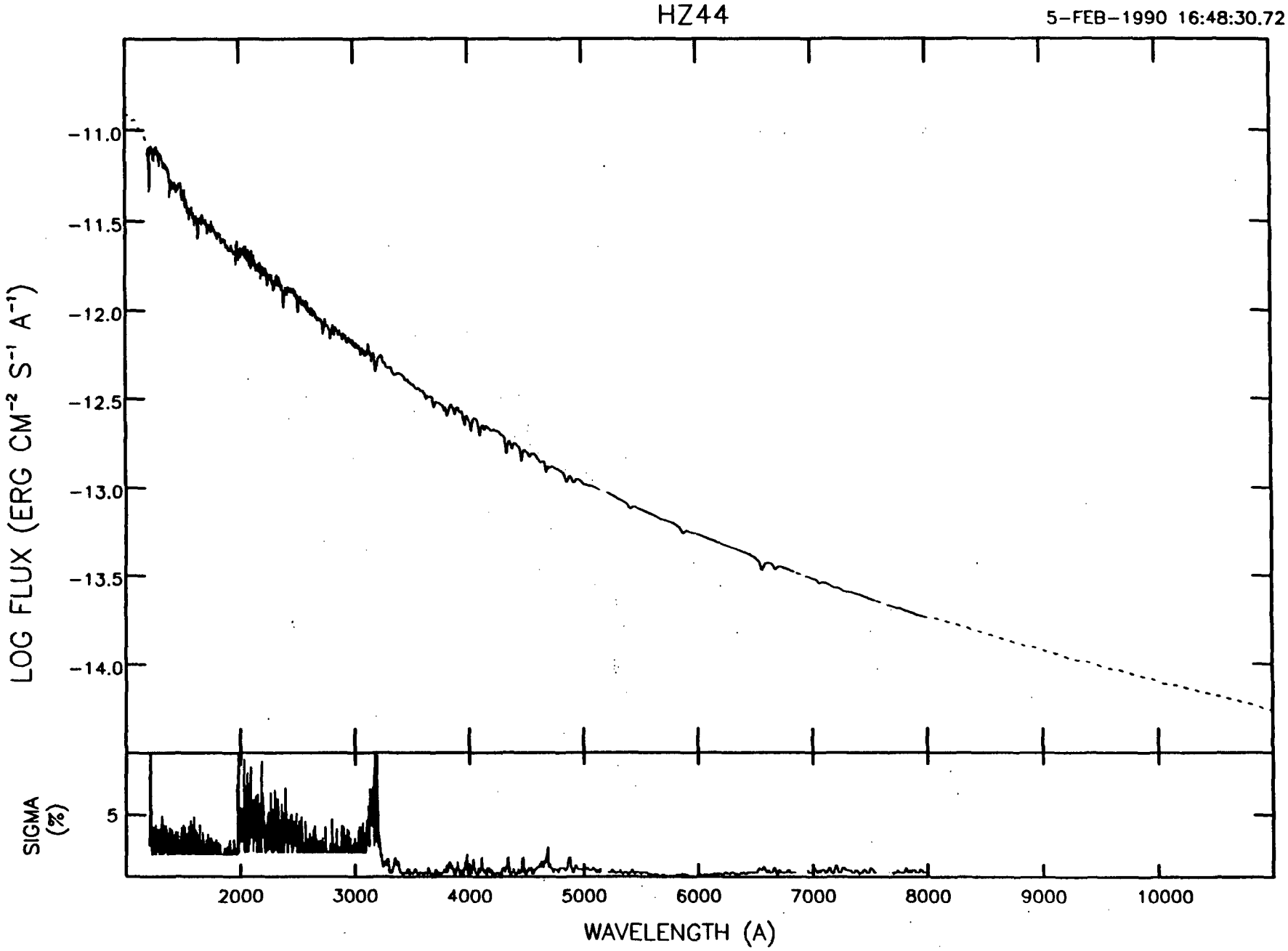
-14.0
-14.5
-15.0
-15.5
-16.0
-16.5
SIGMA (%)
5
2000
3000
4000
5000
6000
7000
8000
9000
10000
WAVELENGTH (A)


HZ44
5-FEB-1990 16:48:30.72
LOG FLUX (ERG CM$^{-2}$ S$^{-1}$ A$^{-1}$)
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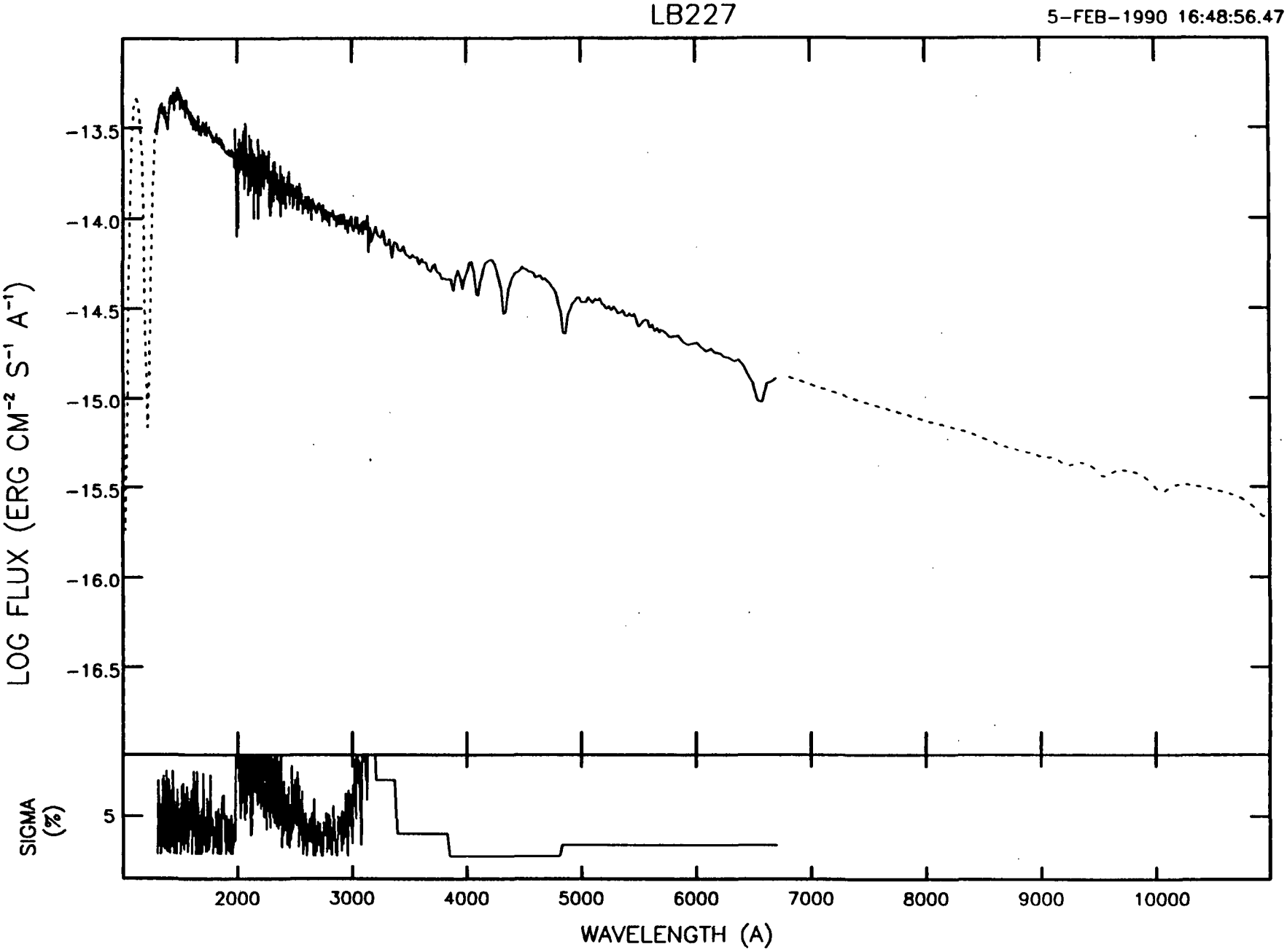
-11.5
-12.0
-12.5
-13.0
-13.5
-14.0
SIGMA (%)
5
2000
3000
4000
5000
6000
7000
8000
9000
10000
WAVELENGTH (A)


LB227
5-FEB-1990 16:48:56.47
LOG FLUX (ERG CM$^{-2}$ S$^{-1}$ A$^{-1}$)
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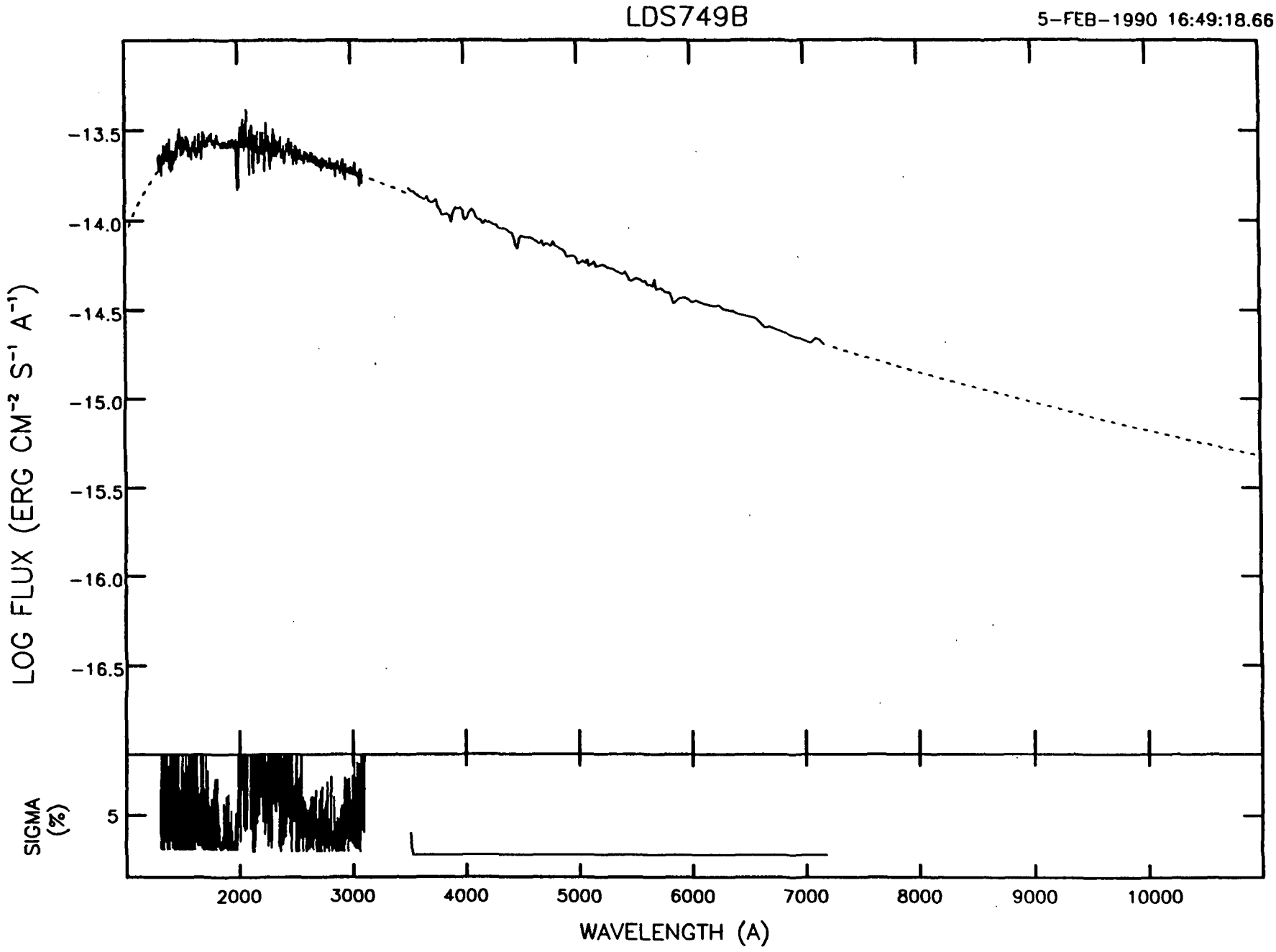
-14.0
-14.5
-15.0
-15.5
-16.0
-16.5
SIGMA (%)
5
2000
3000
4000
5000
6000
7000
8000
9000
10000
WAVELENGTH (A)


LDS749B
5-FEB-1990 16:49:18.66
LOG FLUX (ERG CM$^{-2}$ S$^{-1}$ A$^{-1}$)
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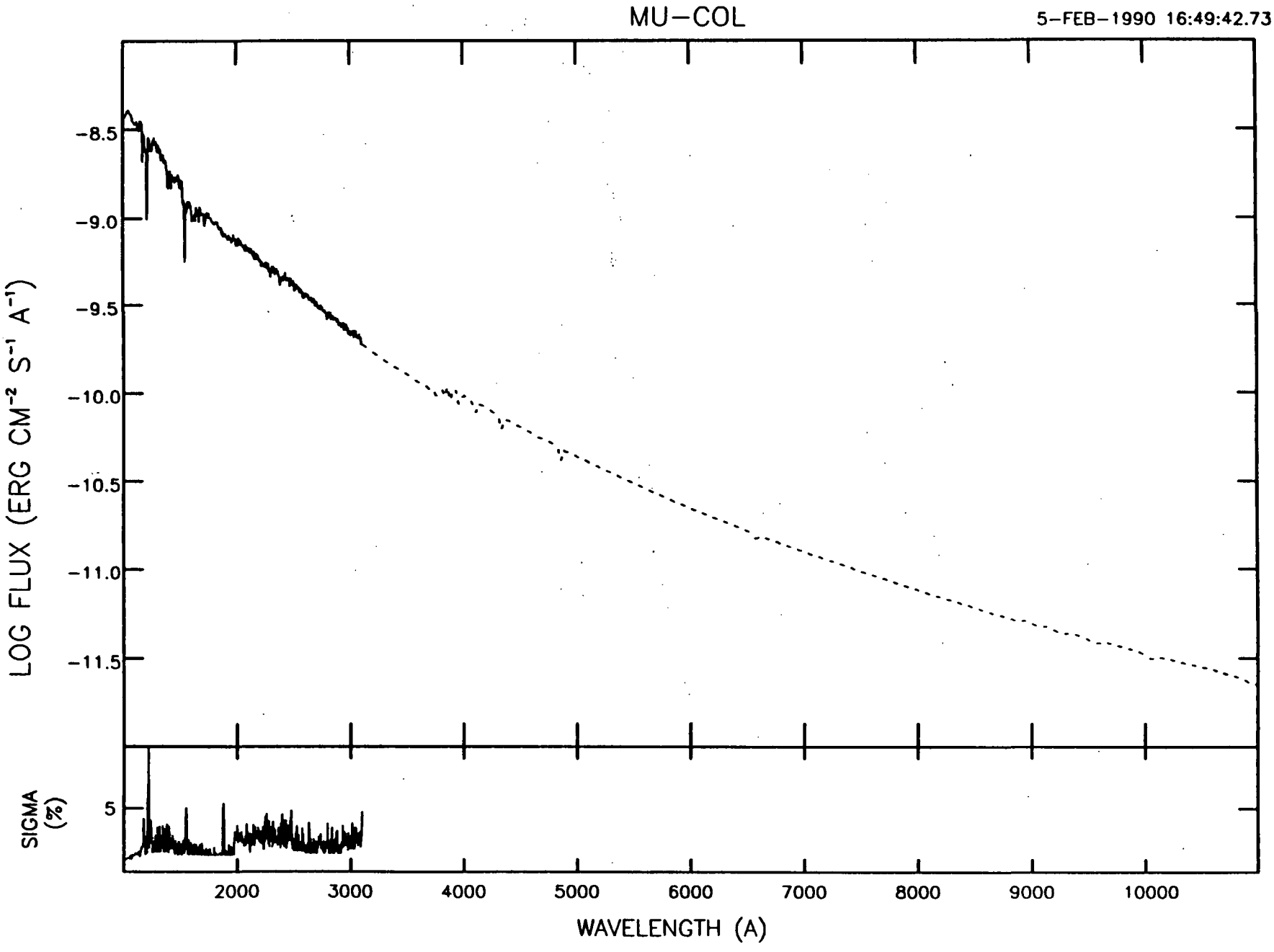
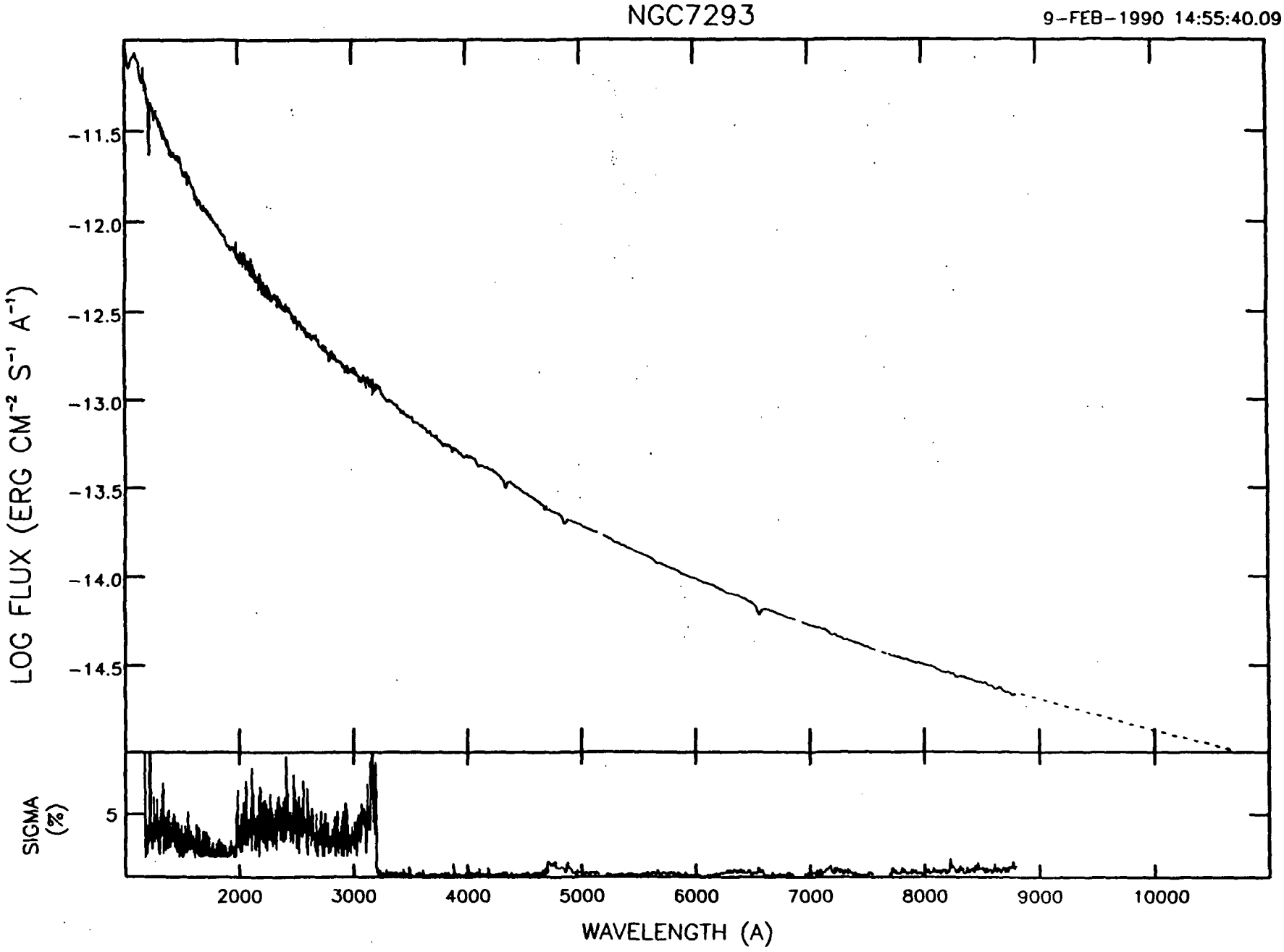
-14.0
-14.5
-15.0
-15.5
-16.0
-16.5
SIGMA (%)
5
2000
3000
4000
5000
6000
7000
8000
9000
10000
WAVELENGTH (A)


MU–COL
5–FEB–1990 16:49:42.73
LOG FLUX (ERG CM$^{-2}$ S$^{-1}$ A$^{-1}$)
−8.5
−9.0
−9.5
−10.0
−10.5
−11.0
−11.5
SIGMA (%)
5
2000
3000
4000
5000
6000
7000
8000
9000
10000
WAVELENGTH (A)


NGC7293
9-FEB-1990 14:55:40.09
LOG FLUX (ERG CM$^{-2}$ S$^{-1}$ A$^{-1}$)
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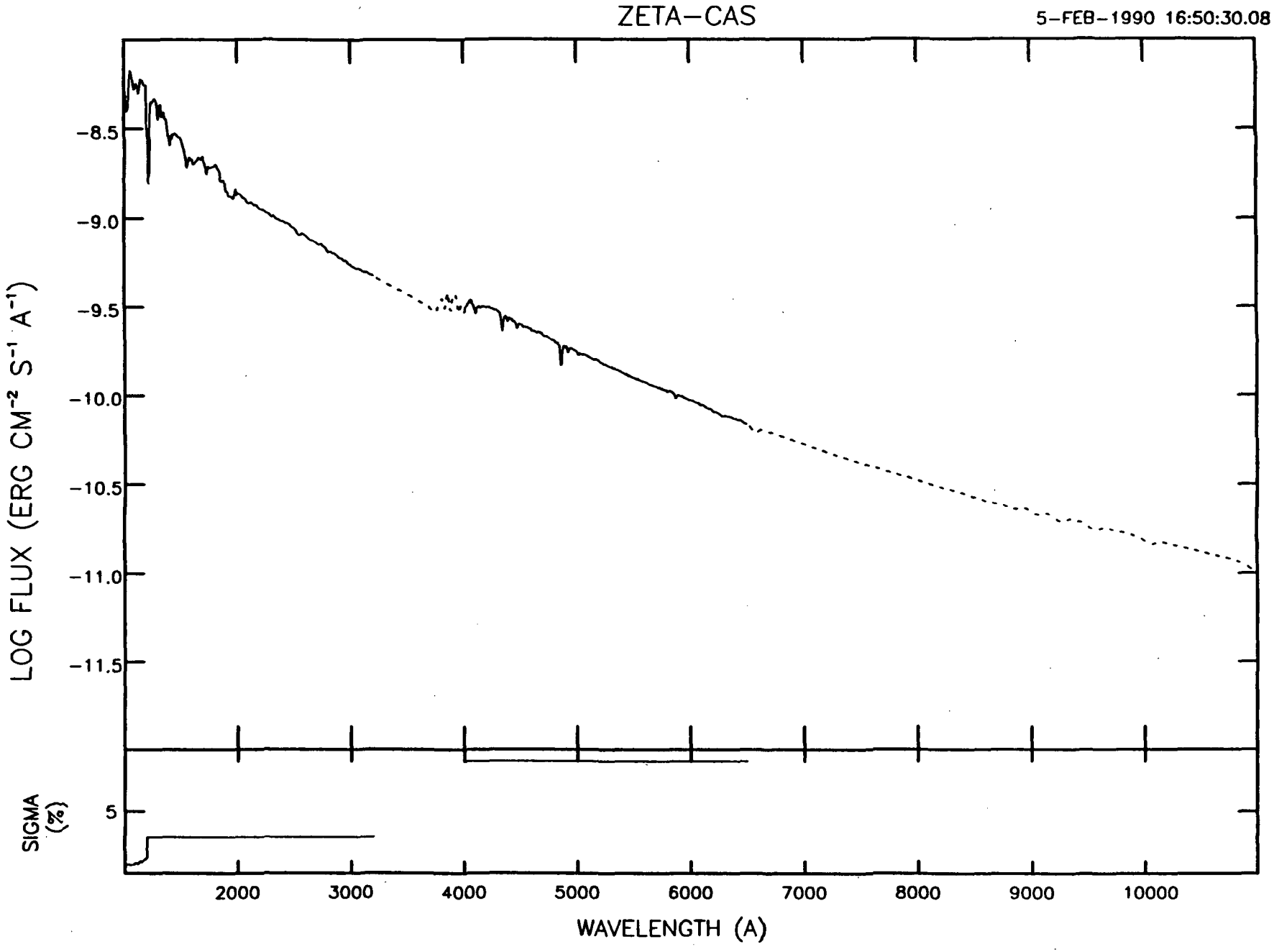
-12.0
-12.5
-13.0
-13.5
-14.0
-14.5
SIGMA (%)
5
2000
3000
4000
5000
6000
7000
8000
9000
10000
WAVELENGTH (A)


ZETA–CAS
5–FEB–1990 16:50:30.08
LOG FLUX (ERG CM$^{-2}$ S$^{-1}$ A$^{-1}$)
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−9.0
−9.5
−10.0
−10.5
−11.0
−11.5
SIGMA (%)
5
2000
3000
4000
5000
6000
7000
8000
9000
10000
WAVELENGTH (A)

# APPENDIX C
# RSDP & CDBS

**Appendix C-1:**

RSDP Pipeline & CDBS Utility Descriptions

**Appendix C-2:**

Example Scenarios for Use of "CDBS Logicals"

FOC CALIBRATION

CALFOC (Jul89) stsdas.foc.focutility CALFOC (Jul89)

NAME
calfoc -- RSDP pipeline replacement

DESCRIPTION
The task assumes that the processing parameters are in the image header, either directly from RSDP preprocessing, or inserted by task cloadrsdpx or loadrsdpx. The processing parameters govern which correction steps are to be performed, and which calibration files are to be used.

The processing order is:

NORMAL IMAGING
BACCORR - dark count subtraction

ITFCORR - pseudo ITF correction
actually removes format dependent effects from the image

UNICORR - relative DE correction

WAVCORR - absolute DE correction

GEOCORR - geometric correction

SPECTROGRAPH MODE

BACCORR - dark count subtraction

ITFCORR - pseudo ITF correction
actually removes format dependent effects from the image

GEOCORR - geometric correction

SDECORR - absolute (and relative) DE correction

LED FLAT FIELDS
RESCORR - locate reseau marks in the image

The other CDBS tasks are divided int three packages as follows:

FOC.FOCGEOM
---
Menu for the package stsdas.foc.focgeom
findresx - Locate approximate positions of reseau marks.
geomcorrx - Geometrically correct an image.
optdist - Apply optical distortion to a reseau entry.
rdprint - Print the difference between a pair of reseau entries.
rappendx - Append reseau entries from one file to another.
rdifferx - Plot histogram of differences between entries in separate files.
rdirectoryx - Print directory of all entries in a reseau file.
revalfitx - Evaluate, at certain points, the fit produced by 'rfitx'.

```
      rfindx - Locate reseau marks in an image.
       rfitx - Calculate fit of distorted coordinates to reference coordinates.
       rfixx - Fix holes in reseau file entries.
       rgenx - Generate a reseau file or entry.
     rinterx - Perform simple interpolation between reseau grids.
    rmarkerx - Interactively find approximate location of reseau marks.
      rplotx - Plot magnified vector differences between reseau grids.
     rprintx - Print out reseau mark coordinates.
      rtodbx - Put reseau data in a form suitable for 'images' package
               geometry tasks.
 rtransformx - Perform linear transformations on reseau coordinates.
  slitanglex - Measure the angle of long slit spectrum to AXIS1.


FOC.FOCPHOT:
------------
Menu for the package stsdas.foc.focphot
      darkx - Create a FOC dark count image.
    dezoomx - Dezoom an image, doubling line length in one dimension.
   dqenormx - Normalise a detective efficiency file to unity.
   fixnoise - Create a fixed-pattern noise image.
 formatdepx - Create a format-dependent nonuniformity image.
      ratiox - Divide two or more images prior to relative DE
               corrections.
   rremovex - Fill in reseau marks with cosmetic data.
   wfactorx - Calculate inverse sensitivity prior to using RSDP.

FOC.FOCUTILITY:
---------------
Menu for the package stsdas.foc.focutility
    calfoc - this is the RSDP pipeline calibration
cloadrsdpx - examine, alter and then load RSDP parameters into image header
 dumprsdpx - dump RSDP parameters from image header to pset par file
    gencon - set names of calibration files in FOC image header
 loadrsdpx - load RSDP parameters from par file into an image header
 overflowx - correct image for 8 bit overflow
  rsdpbacx - creates RSDP format BAC file for FOC
  rsdpfmtx - creates RSDP format FMT file for FOC
  rsdpgeox - creates RSDP format GEO file for FOC
  rsdpmodx - creates RSDP format MOD file for FOC
  rsdpresx - creates RSDP format RES file for FOC
  rsdpsdex - creates RSDP format SDE file for FOC
  rsdpunix - creates RSDP format UNI file for FOC
 rsdp2resx - converts a RSDP GEO format file to a reseau table
   satsinx - reads SATS format data from tape
    sdsinx - reads SDS  format data from tape
   sdsoutx - writes FOC images to tape in SDS format
   testimx - generates FOC test data images with RSDP like labels
  rsdpparx - pset with RSDP parameters
```

FOS CALIBRATION

CALFOS (Feb90) stsdas.fos.calfos CALFOS (Feb90)

NAME
calfos -- Calibrate Faint Object Spectrograph (FOS) data.

USAGE
calfos input output

DESCRIPTION
The 'calfos' task performs the routine calibration of FOS data. The calibration steps carried out by 'calfos' are determined by the values of certain keywords in the science data header. (The science data header file has the extension '.doh'. The science data header file must be edited with the 'cfospar' task to change the values of the keywords ('hedit' in the 'images' package can also be used), to select the desired calibration steps. These keywords may contain either of two value: 'OMIT' or 'PERFORM'. Some processing steps require the use of reference tables and files. The header keywords for these reference files must be edited to contain the appropriate reference file names (including their directory paths). The keywords for reference tables must be edited to contain the table root name (including the directory path but excluding the extension).

CALIBRATION STEPS
The calibration steps, listed by keyword, are carried out in the following fixed order.

CNT_CORR
Convert from raw counts to count rates by dividing each data point by the exposure time and correcting for disabled diodes. If 'DEFDDTBL' is is true, the disabled diodes are taken from the Unique Data Log (UDL), otherwise, disabled diodes are found in the file 'DDTHFILE'.

PPC_CORR
Correct the raw count rates for saturation in the detector electronics. Requires table 'CCG2' containing the paired-pulse correction table.

BAC_CORR
Subtract the background from sky and object spectra. If no background was taken, a default reference background, 'BACHFILE', is used. The observed background is smoothed with a median, followed by a mean filter before subtraction. The filter widths are contained in table 'CCS3'. No smoothing is done to the reference file background if used.

FLT_CORR
Remove diode-to-diode sensitivity variations and fine structure by multiplying by the flat field response. Requires the flat field response file 'FL1FILE'. A second flat field file, 'FL2HFILE', is required for paired-aperture or spectropolarimetry observations.

SKY_CORR
Subtract the sky from the object spectra. The routine smooths the sky using a median and mean filter, scales the sky by the aperture size, and shifts the sky before the subtraction. The routine requires table 'CCS3' containing the filter widths, the aperture size table, 'CCS0', the emission line position table, 'CCS2', and the sky shift table, 'CCS5'.

WAV_CORR
Compute a vacuum wavelength scale for each object or sky spectra. Wavelengths are computed using coefficients stored in table 'CCS6'.

FLX_CORR
Convert the object spectra to absolute flux unit by multiplying by the inverse sensitivity vector. Requires the inverse sensitivity file 'IV1FILE'. A second inverse sensitivity file, 'IV2HFILE', is required for paired aperture or spectropolarimetry observations.

ERR_CORR
Compute the propagated error at each point in the spectrum.

MOD_CORR
Perform ground software mode dependent reductions for time-resolved, spectropolarimetry, and rapid-readout observations. The spectropolarimetry reductions require the the Wollaston and Waveplate parameter table, 'CCS4', and the retardation reference file, 'RETHFILE'.

Other utilities for FOS are in the package stsdas.fos

Menu for the package stsdas.fos

```
      absfity - Smooth an FOS sensitivity curve.
      absseny - Compute the FOS sensitivity curve.
     aperlocy - Analyze a target acquisition image.
      apscale - Scale aperture parameters.
       calfos - Pipeline calibration for FOS
      cfospar - Pset of calibration keyword values.
   deadtimey - Compute paired-pulse time coefficients.
    dispfity - Compute wavelength dispersion coefficients.
  fitoffsety - Correct dispersion coeff. for wavelength offsets.
   flatfield - Compute flat field response.
   getfospar - Load calibration keyword values from header into pset.
    linefind - Find spectral lines for wavelength calibration.
    parthity - Find particle hits and compute dark rate.
        phay - Pulse height analysis and discriminator thresholds.
   putfospar - Load calibration keyword values from pset into header.
      unwrap - Remove the 'wrap' from data that has exceeded the internal
               counter
  waveoffset - Compute wavelength offset between two spectra.
       ybase - Compute Y-base for aperture centers.
```

HRS CALIBRATION

NAME

calhrs -- Calibrate High Resolution Spectrograph (HRS) data sets.

DESCRIPTION

This task performs the routine calibration of HRS data. The calibration steps carried out by 'calhrs' are determined by the values of certain keywords in the science data header file. This file is identified by the extension '.D0H'. The science data header file must be edited with the 'hedit' task to change the values of keywords, thus selecting the desired calibration steps. These keywords may contain either of two values: "OMIT" or "PERFORM".

Some processing steps require the use of reference tables and files. Keywords that contain names of reference files must be edited to refer to the desired reference files (the file name must include the directory path). The keywords for reference tables must be edited to contain the table root name (including the directory path, but excluding the extension).

CALIBRATION STEPS

The calibration steps, listed by keyword, are carried out in the following fixed order:

DQI_CORR

Apply data quality initialization using the reference file, 'DQIHFILE'.

EXP_CORR

Divide by the exposure time to convert to count rates.

DIO_CORR

Divide the count value by the diode's response to correct for diode nonuniformity. This requires the diode response file, 'DIOHFILE'.

PPC_CORR

Correct the raw count rates for saturation in the detector electronics. Requires the table 'CCG2' containing the paired-pulse correction table.

MAP_CORR

Perform the photocathode mapping function. Requires tables 'CCR1' and 'CCR2' containing the photocathode line mapping and sample parameters.

DOP_CORR

Correct for on-board Doppler compensation when removing photocathode nonuniformities and vignetting.

PHC_CORR

Remove photocathode nonuniformity by dividing the count value by the photocathode response contained in the 'PHCHFILE' file.

VIG_CORR

Remove vignetting and wavelength-dependent photocathode variations by dividing each count value by the vignetting response contained in the 'VIGHFILE' file.

MER_CORR
    Merge the substep bins.

MDF_CORR
    Use a median filter on the background.

MNF_CORR
    Use a mean filter on the background.

BCK_CORR
    Subtract the background counts from the raw counts of the diode array.

ADC_CORR
    Convert the sample positions on the photocathode to wavelengths by applying the dispersion constants. Requires tables 'CCR5', 'CCR6', and 'CCR7' containing spectral order, dispersion, and thermal constants.

IAC_CORR
    Adjust the zero-point of the wavelength scale for the large science aperture and the two spectral lamp apertures. Requires table 'CCR8' containing incidence angle coefficients.

ECH_CORR
    If one of the echelle gratings is used, divide the flux value by the normalized grating efficiency to remove the echelle ripple. Requires tables 'CCR9' and 'CCRA' containing echelle ripple constants.

FLX_CORR
    Calculate the absolute flux by dividing the flux by the absolute flux coefficients. Requires interpolation in the absolute flux file, 'ABSHFILE', and corresponding wavelength file, 'NETHFILE'.

HEL_CORR
    Convert wavelengths to the heliocentric coordinate system.

VAC_CORR
    Apply vacuum-to-air correction to the wavelengths.

Menu for the package stsdas.hrs

```
   absfitz - Compute a smooth sensitivity curve.
   abssenz - Compute the absolute sensitivity.
 apershift - Shift the  wavelengths for an object that is not
               centered in the aperture.
     calhrs - Pipeline calibration for HRS
  carrousel - Calibrate carrousel positions for central wavelengths.
cathodemap - Compute photocathode granularity.
centerflux - Compute flux values at the center of the diode array.
   chrspar - Pset containing calibration keywords.
 deadtimez - Compute paired-pulse time coefficients.
  diodemap - Compute diode to diode response non-uniformities.
     focusz - Estimate detector focus.
 gethrspar - Load calibration keyword values from header into pset.
 incidence - Correct incidence angle for wavelengths.
```

HSP CALIBRATION

CALHSP (Feb90) stsdas.hsp CALHSP (Feb90)

NAME

calhsp -- Perform pipeline calibration corrections for HSP data files.

DESCRIPTION

This task calculates the following High Speed Photometer (HSP) calibration factors: (1) dark signal, (2) pre-amplifier noise, (3) high voltage factor, (4) cathode efficiency, (5) gain factor, (6) current-to-voltage converter (CVC) offset, and (7) dead time. The first six factors are third-order polynomial functions of temperature and epoch. This task reads these polynomial coefficients from each of the calibration tables and evaluates the corrections according to the time and temperature at the observation. The last factor (dead time) is a function of detector ID, pulse discriminator threshold setting, detector temperature (linear dependency), and high voltage setting.

Menu for the package stsdas.hsp

```
    abssenv - Calculate digital absolute sensitivity.
  analoglin - Verify the analog linearity of HSP detectors.
    apercen - Find the aperture center (location phase I).
     calhsp - Perform pipeline calibration correction of HSP data files.
      darkv - Calculate dark signals of individual observations.
  deadtimev - Calibrate the deadtime (digital linearity).
       flex - Calibrate HSP optical bench flexure as functions
              of temperatures.
     focusv - Determine electronic focus calibration.
    gainfac - Calculate analog gain factors.
   imgscale - Calibrate aperture plate scale (location phase II).
  lgaperloc - Calibrate location of a large aperture (location
              phase III).
    monitor - Reduce particle monitor data obtained from HSP.
   parthitv - Remove particle event.
       phav - Calibrate discriminator threshold setting.
    poleffv - Calculate polarization efficiency.
     polpav - Calibrate position angle offset.
  polverify - Verify polarimetry calibrations.
  polyepoch - Fit polynomials to coefficients as functions of the epoch.
   polyeval - Evaluate calibration corrections.
    polyfit - Fit a polynomial to a specified quantity.
     posvel - Calculate position and velocity vector of the spacecraft.
     relsen - Calculate relative sensitivity (including instrumental
              polarization).
   scatterv - Calculate scattered light contribution.
  smaperloc - Calibrate location of a small aperture (location
              phase III).
     taflat - Calculate target acquisition aperture flat field.
twodpolyfit - Two dimensional polynomial fit of temperature and epoch.
    voltfac - Calculate high voltage factors.
     warmup - Calculate dark signal as a function of warmup time.
```

```
      lmap - Compute photocathode mapping function (line direction).
 mergecar - Merge and bin spectra from different carrousel positions.
odeadtimez - Compute paired-pulse time coefficients.
 parthitz - Find particle events and compute dark rate.
      phaz - Analyze pulse height distribution.
 puthrspar - Load calibration keyword values from pset into header.
   quality - Generate data quality vector for the diode array.
    ripple - Compute the echelle ripple coefficients.
      smap - Compute photocathode mapping function (sample direction).
tacarrousel - Calibrate target acquisition mode carrousel.
tadiodepos - Find aperture diode position on the main array.
    tamode - Analyze a target acquisition field map.
   tascale - Scale aperture parameters.
vigcompute - Compute vignetting function
    vigfit - Fit a smooth curve to the vignetting function
   wavecal - Compute wavelength dispersion coefficients.
  woffsets - Find the wavelength offsets using cross-correlation.
    wshift - Find wavelength offset from the spectral line template.
     yfind - Find Y-deflections of spectral orders.
      yfit - Compute Y-deflection calibration coefficients.
```

WFPC CALIBRATION

CALWFP (Jun89) stsdas.wfpc.calwfp CALWFP (Jun89)

NAME

calwfp -- performs routine calibration of HST Wide Field Planetary Camera images. This is identical to the RSDP module "calwfp" in SOGS/PODPS.

DESCRIPTION

CALWFP provides routine calibration in both SOGS/PODPS Routine Science Data Processing (RSDP) and IRAF/STSDAS. CALWFP performs a standard sequence of processing steps on individual WF/PC camera observations designed to remove most of the known instrumental signature. CALWFP does the AtoD fixup, determines and removes the global bias level, subtracts bias, preflash, dark, and superpurge frames (after appropriate scaling), and applies the flat field frame. The input data quality file (DQF) is updated with pixels observed to be saturated, and with the DQF of known bad pixels (static mask), and with the DQFs of any images used inthe processing sequence. Histograms of the input data, the data following AtoD correction, and the output data are generated. Operation of this program is accomplished via keywords in the header of the input image.

## EXAMPLE OF USE OF CDBS LOGICAL WHERE LOGICAL IS NAME OF A DATABASE RELATIONAL TABLE

Example: Find the coordinates listed in the database for target N188-229 in the relational table CRCLUSTERPOS and find all stars in this table that are within a 0.5 degree box around the star.

First, get into IRAF, and then load all of the packages required: stsdas, stlocal, stdb, and cdbsutil.

```
DCL> cl
```

```
STScI VMS/IRAF Revision 2.8EXPORT Fri Jun 30 21:51:59 MST 1989
This is the STScI development version of VMS/IRAF version 2.8
+-----------------------------------------------------------+
|   For questions about IRAF and STSDAS, please contact     |
|   the STSDAS group.  We have one person assigned to the   |
|   'hot seat', whom you should try to contact first.       |
|                                                           |
|       In the HOT SEAT  Jan 8 - Jan 19 is Bernie Simon     |
|    phone: x4726 room: N414  sunmail: bsimon, VAX: BSIMON  |
+-----------------------------------------------------------+

There are now two DeAnzas, both on Kepler.  Make sure you use
the configure task before running any other tasks in vdisplay.
The logical device names are "a" for EPA0 (to the right as you
enter the room) and "b" for EPB0 (left).


     apropos     images      local       sdas        system
     dataio      language    noao        softools    utilities
     dbms        lists       plot        stsdas


cl> stsdas
     astrometry  foc         gasp        problems    stplot      ttools
     fgs         fos         hrs         statistics  synphot     vdisplay
     fitsio      fourier     hsp         stlocal     tools       wfpc

st> stlocal
     dmf         playpen     stdb        sun2vax     vax2sun
     dst         redshift    stsurfphot  tconvert    xtract

st> stdb
     cdbsdemo  fgsdb     fosdb     hspdb     wfpcdb
     cdbsutil  focdb     hrsdb     syndb

st> cdbsutil
     dbformat    inquiry     query       refdat      stopar
     despar      lodpar      rdsiaf      shopar      treformat
     getpdb      parhis      refcheck    stohis      verify
```

The two tasks we want to use are the database querying tasks: inquiry and query. Inquiry is an interactive task and is good for looking up information on one object at a time. Query will do any size search and put it on the scrren or into an sdas table using the optional output file parameter. One can also pipe the screen data into an ASCII file using the pipe command in IRAF, which we will see.

Before any queries are done the parameter file "cdbspar" must be set up. eparam cdbspar and for username put "cdbsuser" and the database name is cdb1.

```
st> epar cdbspar
```

```
 I R A F
 Image Reduction and Analysis Facility
 PACKAGE = cdbsutil

   TASK = inquiry

 PF2  for HELP
(user=  cdbsuser)                User name
(dbas=  cdb1)                    Database name
(errfile=         )              Diagnostic file name
(errlvl=          )              Diagnostic message level
(mode=           a)
```

First, do the inquiry to find the positon in the database for N188-229.

*st>inquiry crclusterpos*

Put "N188-229" in for the targetid field, hit return, then a colon and s for search.

```
            CRCLUSTERPOS
            row_no =
            time =
            version=
            sdas_tab =
            targetid =
            vid=
            deldate =
            source =
            epoch =
            equinox =
            v_mag =
            bmv_mag =
            ra =
            e_ra =
            pmx =
            e_pmx =
            dec =
            e_dec =
            pmy =
-------------------------------------------------------------------

            CRCLUSTERPOS
            v_mag =
            bmv_mag =
            ra =
            e_ra =
            pmx =
            e_pmx =
            dec =
            e_dec =
            pmy =
            e_pmy =
            membership =
            comment =
-------------------------------------------------------------------------
```

Quit, edit, or search database

s

Working ...

```
            CRCLUSTERPOS
```

```
            row_no = 1032
            time = 19891102:13255400
            version = 1032
            sdas_tab = ngc1883rddel.tab
            targetid = n188-229
            vid =      684
            deldate = 19890401:00000
            source = vanaltena/lee/girard
            epoch = 1950.
            equinox = 1950.
            v_mag = 12.02
            bmv_mag = 0.32
            ra = 0.57492607831999997
            e_ra = 8.0000000000000002e-3
            pmx = -3.0000000000000001e-3
            e_pmx = 6.0000000000000006e-4
            dec = 84.881179809569999
            e_dec = 1.3599999999999999e-2
            pmy = -8.9999999999999993e-3
-------------------------------------------------------------


            CRCLUSTERPOS
            v_mag = 12.02
            bmv_mag = 0.32
            ra = 0.57492607831999997
            e_ra = 8.0000000000000002E-3
            pmx = -3.0000000000000001E-3
            e_pmx = 6.0000000000000006E-4
            dec = 84.881179809569999
            e_dec = 1.3599999999999999E-2
            pmy = -8.9999999999999993E-3
            e_pmy = 6.0000000000000006E-4
            membership = 5.
            comment = astrometric positions and proper motions from van altena
-------------------------------------------------------------------------------


Now that we have the information for the target, the search inthe 0.5
deg box around the star, which would be 0.25 deg on each side of
the star.


Since the query statement is long, we will put it in a file called
query.dat and put that in for the query qualifier "qual" with an "@" before it.
Put in a tablename for the parameter "output" to put the data in an sdas
table, or to STDOUT to have the data listed on the screen.  To redirect
the output from the screen to an ASCII file, pipe it to a file using the
">" symbol + the filename.

cd> ty query.dat

 RA .ge. 0.558 and RA .le. 0.592 and DEC .ge. 84.63 and DEC .le. 84.90

cd> query params=crclusterpos output=STDOUT qual=@query.dat >cluster.dat

cd> ty cluster.dat

     row_no              time     version          sdas_tab   targetid
        vid         deldate                    source
          epoch         equinox           v_mag         bmv_mag
                  ra                        e_ra                          pmx
                          e_pmx             dec             e_dec
                    pmy                     e_pmy           membership
                                                  comment
```

EXAMPLE OF USE OF VALUE IN "CDBS LOGICAL" COLUMN OF TABLE

Example: We want to find,look at, and plot the data found in relation CRCALSPEC for spectrophotometric standard FEIGE34 and dump the table into an ASCII file for non-IRAF use.

PROCEDURE:

First, use the CDBS logical to see what is in the directory:

```
DCL> dir crcalspec

Directory DISK$REFERENCE:[CDBSDATA.REFER.CALSPEC]

10-LAC_001.TAB;1     AGK_81D266_001.TAB;1                      ALPHA-LYR_001.TAB;1
BD_28D4211_001.TAB;1                       BD_33D2642_001.TAB;1
BD_75D325_001.TAB;1  BPM16274_001.TAB;1   ETA-AUR_001.TAB;1    ETA-UMA_001.TAB;1
FEIGE110_001.TAB;1   FEIGE34_001.TAB;1    G191B2B_001.TAB;1    G93-48_001.TAB;1
GAMMA-UMA_001.TAB;1  GD108_001.TAB;1      GD50_001.TAB;1
GRW_70D5824_001.TAB;1                      HD49798_001.TAB;1    HD60753_001.TAB;1
HD93521_001.TAB;1    HZ21_001.TAB;1       HZ2_001.TAB;1        HZ2_002.TAB;1
HZ4_001.TAB;1        LAM-LEP_001.TAB;1    LB227_001.TAB;1      LDS749B_001.TAB;1
MU-COL_001.TAB;1     NGC7293_001.TAB;1    ZETA-CAS_001.TAB;1

Total of 30 files.
```

We see the file FEIGE34_001.TAB;1 there, which is the data we want. Make a copy of the file in our working directory:

```
DCL> set def [.working]
DCL> copy crcalspec:feige34_001.tab *
DCL> dir

Directory DISK$MYDISK:[ME.WORKING]

LOGIN.CL;234         FEIGE34_001.TAB;1

Total of 2 files.
```

Since most of what we want is done using IRAF tools, a LOGIN.CL file is also included to run IRAF:

```
DCL> cl
```

```
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+-----------------------------------------------------------+
|   For questions about IRAF and STSDAS, please contact     |
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|                                                           |
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the configure task before running any other tasks in vdisplay.
The logical device names are "a" for EPA0 (to the right as you
enter the room) and "b" for EPB0 (left).
```

```
      apropos     images      local       sdas        system
      dataio      language    noao        softools    utilities
      dbms        lists       plot        stsdas
```

First, load the stsdas package:

```
cl> stsdas
      astrometry  foc         gasp        problems    stplot      ttools
      fgs         fos         hrs         statistics  synphot     vdisplay
      fitsio      fourier     hsp         stlocal     tools       wfpc
```

Many of the tasks we want to use are in the package ttools. Load this.

```
st> ttoo
      keypar      tcalc       tdiffer     tintegrate  told        trebin
      keytab      tchcol      tdump       tjoin       tprint      trename
      parkey      tchsize     tedit       tlcol       tproduct    tselect
      partab      tcopy       texpand     tlinear     tproject    tsort
      tabkey      tcreate     thistogram  tmerge      tquery      tstat
      tabpar      tdelete     tinfo       tmidas      tread       tupar
```

To look at the header parameters, use the task tupar:

```
tt> tupar feige34_001.tab
feige34_001.tab
:?

The options are:

   q, g, p, d, r, t, l

   (quit, get, put, delete, replace, type, list)

  q    exit the task (and save any changes)

  g keyword          get parameter with keyword 'keyword'

  p keyword value    put parameter 'keyword'

  d keyword          delete parameter 'keyword'

  r keyword          replace parameter 'keyword'

  t                  type the parameters

  l                  list parameters and show par numbers

      see help for further info about these instructions

:l

 1 DBTABLE  t CRSPECTRUM
 2 TARGETID t feige34
 3 DESCRIP  t feige34.tab
 4 COMMENT  t 14-AUG-89 14:12:11 IUE and Oke data and Blackbody fit
 5 COMMENT  t 14-AUG-89 14:12:11 500
 6 COMMENT  t 14-AUG-89 14:12:11 MODEL = @feige34.FIT
 7 COMMENT  t 14-AUG-89 14:12:11 1170
 8 COMMENT  t 14-AUG-89 14:12:11 IUE = crcalobs:feige34_013.tab
 9 COMMENT  t 14-AUG-89 14:12:11 3200
```

```
10 COMMENT  t 14-AUG-89 14:12:11 oke = crcalobs:feige34_012.tab
11 COMMENT  t 14-AUG-89 14:12:11 7300
12 COMMENT  t 14-AUG-89 14:12:11 MODEL = @feige34.FIT
13 COMMENT  t 14-AUG-89 14:12:11 12000
14 HISTORY  t 14-AUG-89 14:12:11 IUE and new Oke data, BB T=58295.4 X 30.88
:q
```

To list the columns found in the table, use the task tlcol:

```
tt> tlcol nlist=4 feige34_001

# feige34_001.tab
WAVELENGTH        R         %10.2f  ANGSTROMS
FLUX              R         %12.5g  STMAG
STATERROR         R         %12.5g  STMAG
SYSERROR          R         %12.5g  STMAG
FWHM              R         %10.2f  ANGSTROMS
```

Here, the list is 1) Column Name, 2) Format (R=Real) 3) Display Format (f10.2 for the first column) 4) Units of column.

We also want to read the data in the table. This is done using the task tread (or tedit if it is desired to change values).

```
tt> tread feige34_001.tab
```

| Column | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| Label | WAVELENGTH | FLUX | STATERROR | SYSERROR | FWHM |
| 1 | 500.00 | 4.0748 | INDEF | INDEF | INDEF |
| 2 | 500.83 | 4.0749 | INDEF | INDEF | INDEF |
| 3 | 501.67 | 4.075 | INDEF | INDEF | INDEF |
| 4 | 502.51 | 4.0751 | INDEF | INDEF | INDEF |
| 5 | 503.35 | 4.0752 | INDEF | INDEF | INDEF |
| 6 | 504.19 | 4.0753 | INDEF | INDEF | INDEF |
| 7 | 505.03 | 4.0754 | INDEF | INDEF | INDEF |
| 8 | 505.87 | 4.0755 | INDEF | INDEF | INDEF |
| 9 | 506.72 | 4.0757 | INDEF | INDEF | INDEF |
| 10 | 507.56 | 4.0759 | INDEF | INDEF | INDEF |
| 11 | 508.41 | 4.0761 | INDEF | INDEF | INDEF |
| 12 | 509.26 | 4.0763 | INDEF | INDEF | INDEF |
| 13 | 510.11 | 4.0765 | INDEF | INDEF | INDEF |
| 14 | 510.96 | 4.0767 | INDEF | INDEF | INDEF |
| 15 | 511.81 | 4.077 | INDEF | INDEF | INDEF |
| 16 | 512.67 | 4.0772 | INDEF | INDEF | INDEF |
| 17 | 513.52 | 4.0775 | INDEF | INDEF | INDEF |
| 18 | 514.38 | 4.0778 | INDEF | INDEF | INDEF |
| 19 | 515.24 | 4.0781 | INDEF | INDEF | INDEF |
| 20 | 516.10 | 4.0784 | INDEF | INDEF | INDEF |

PF2 (on keypad) for help

(This is the first page of the file)

Typing PF2 (Keypad Function Key #2) will give you a short help screen for getting around in the table reader. Some commands in particular:

1) To go to a particular line type PF1 Keypad-7 <row number>

Example: Go to row 600 of the same file:

Command (quit, help, goto row col): PF1 Keypad-7 600

| | | | | | |
|---|---|---|---|---|---|
| 595 | 1270.20 | 5.8335 | 0.021858 | INDEF | 6.00 |
| 596 | 1271.40 | 5.7938 | 0.026581 | INDEF | 6.00 |
| 597 | 1272.60 | 5.7215 | 0.024359 | INDEF | 6.00 |
| 598 | 1273.80 | 5.6971 | 0.026274 | INDEF | 6.00 |
| 599 | 1274.80 | 5.81 | 0.02186 | INDEF | 6.00 |
| 600 | 1276.00 | 5.8199 | 0.02186 | INDEF | 6.00 |
| 601 | 1277.20 | 5.7976 | 0.021858 | INDEF | 6.00 |
| 602 | 1278.40 | 5.7793 | 0.021862 | INDEF | 6.00 |
| 603 | 1279.60 | 5.7984 | 0.021862 | INDEF | 6.00 |
| 604 | 1280.80 | 5.8087 | 0.021194 | INDEF | 6.00 |
| 605 | 1282.00 | 5.8322 | 0.028088 | INDEF | 6.00 |
| 606 | 1283.20 | 5.8392 | 0.021193 | INDEF | 6.00 |
| 607 | 1284.40 | 5.7688 | 0.02186 | INDEF | 6.00 |
| 608 | 1285.60 | 5.782 | 0.021862 | INDEF | 6.00 |
| 609 | 1286.60 | 5.7618 | 0.02186 | INDEF | 6.00 |
| 610 | 1287.80 | 5.7053 | 0.02627 | INDEF | 6.00 |
| 611 | 1289.00 | 5.6592 | 0.026272 | INDEF | 6.00 |
| 612 | 1290.20 | 5.6465 | 0.026274 | INDEF | 6.00 |
| 613 | 1291.40 | 5.6939 | 0.027346 | INDEF | 6.00 |
| 614 | 1292.60 | 5.7209 | 0.047092 | INDEF | 6.00 |

2) To search a column for a particular value type PF1-PF3 <expression>

Example: From row 600, search upward for the value of the wavelength which is 972.69.

PF5 (tells it to search in reverse)
PF1-PF3

Give expression: WAVELENGTH=972.69

| | | | | | |
|---|---|---|---|---|---|
| 395 | 964.62 | 4.981 | INDEF | INDEF | INDEF |
| 396 | 966.23 | 4.985 | INDEF | INDEF | INDEF |
| 397 | 967.84 | 4.9891 | INDEF | INDEF | INDEF |
| 398 | 969.45 | 4.9931 | INDEF | INDEF | INDEF |
| 399 | 971.07 | 4.9972 | INDEF | INDEF | INDEF |
| 400 | 972.69 | 5.0013 | INDEF | INDEF | INDEF |
| 401 | 974.32 | 5.0053 | INDEF | INDEF | INDEF |
| 402 | 975.94 | 5.0094 | INDEF | INDEF | INDEF |
| 403 | 977.57 | 5.0135 | INDEF | INDEF | INDEF |
| 404 | 979.20 | 5.0176 | INDEF | INDEF | INDEF |
| 405 | 980.84 | 5.0217 | INDEF | INDEF | INDEF |
| 406 | 982.48 | 5.0258 | INDEF | INDEF | INDEF |
| 407 | 984.12 | 5.0299 | INDEF | INDEF | INDEF |
| 408 | 985.76 | 5.034 | INDEF | INDEF | INDEF |
| 409 | 987.40 | 5.0381 | INDEF | INDEF | INDEF |
| 410 | 989.05 | 5.0422 | INDEF | INDEF | INDEF |
| 411 | 990.70 | 5.0464 | INDEF | INDEF | INDEF |
| 412 | 992.36 | 5.0505 | INDEF | INDEF | INDEF |
| 413 | 994.01 | 5.0546 | INDEF | INDEF | INDEF |
| 414 | 995.67 | 5.0588 | INDEF | INDEF | INDEF |

Found here

3) Keypad-7 pages the next page forward (or back)
4) PF4 makes searches and direction of paging go downward (forward)
5) PF5 makes searches and direction of paging go upward (reverse)

6) PF1-Keypad-7 goes into command mode
7) PF1-Keypad-7 QUIT quits editing
8) PF1-Keypad-7 EXIT writes a new copy of the table reflecting changes
    (tedit only)

PLOTTING DATA:

STSDAS tables can be plotted directly using the sgraph task in
the package stplot in stsdas.

```
st> stplot

      catlim      fieldplot   grplot      igi         sgraph
      colnames    grlist      grspec      pltpar      skymap
```

Sgraph and its accompanying parameter file pltpar have many parameters
to help to customize your plot.  Type "epar sgraph" to see the parameters
for sgraph and "pltpar" for different parameters for the plot itself.
These parameters can also be changed from the command line, which is
what the example shows.

Example: Plot Wavelength versus flux for the table FEIGE34_001.TAB:

First, set the parameter stdgraph to your particular type of terminal
(for plots on the screen) or stdplot to your favorite har copy device
for a hard copy and set the parameter "device" to either stdgraph or
stdplot:

```
st> set stdgraph=vt240
st> sgraph 'feige34_001.tab "WAVELENGTH" "FLUX"' device=stdgraph yflip+
  xlabel ='WAVELENGTH [ANGSTROMS]' ylabel ='FLUX [STMAG]'
   title  ='CALIBRATION SPECTRUM FOR FEIGE 34'
```

(yflip+ means to flip the y axis since brighter magnitudes are smaller)

or to the printer:

```
st> set stdplot=3c_t2400
st> sgraph 'feige34_001.tab "WAVELENGTH" "FLUX"' device=stdplot yflip+
  xlabel ='WAVELENGTH [ANGSTROMS]' ylabel ='FLUX [STMAG]'
   title  ='CALIBRATION SPECTRUM FOR FEIGE 34'
```

(see the accompanying plot for this example plotted)

CHANGING FORM OF THE FLUX OF THE TABLE:

To change the form of the flux, use the task "specform" in the package
stsdas.synphot

```
st> synphot

      barlam      evalspec    grafcheck   loadfilt    ratespec    specform
      effstim     extspec     graflist    loadspec    reform      unit
      evalband    fwhmlam     grafpath    pivlam      rmslam      wavtab
```

Example: Change the tab feige34_001.tab from its present flux form of
STMAG to FLAM:

```
sy> specform source=feige34_001.tab form=flam sink=feige34_flam.tab
```

The output file feige34_flam will have both the fluxes and the errors

converted to FLAM units (Note: This task only works for tables in the format of crcalspec tables).

Finally, we want to dump all of the information from the table to an ASCII file for non-IRAF use. This is done using the ttdump task in the ttool package of stsdas:

>Example: Dump the table FEIGE34_001.TAB and put the data in an ASCII file called dat.dat, the header parameters in a file called head.dat and the format of the columns in a file called col.dat:

```
tt> tdump table=feige34_001.tab cdfile=col.dat pfile=head.dat
datafile=dat.dat
```

STScI/IRAF V2.8EXPORT WILLIAMSON@scivax Tue 16:29:21 23-Jan-90

CALIBRATION SPECTRUM FOR FEIGE34