

# GHRIS Cycle 6 Calibration Close-Out

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## ABSTRACT

*This document summarizes the Cycle 6 calibration program for the GHRIS, both as planned and executed.*

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## 1. Summary

The Tables on the next two pages present the GHRIS Cycle 6 Calibration Plan and the actual calibrations carried out. One difference between the two is that one execution of the Cycle 5 CRIMP1 monitoring program was designated as part of the Cycle 6 program, purely a change in nomenclature, not actual result. Also, we elected to drop the execution of 6901 (PHA etc. test) to save time late in the Cycle. Finally, program 6928, the “NoCo” test, was not run due to the failure of the GHRIS about one week before SM2.

Changes to and updates of GHRIS calibration information may be found on the GHRIS web page at STScI:

[http://www.stsci.edu/ftp/instrument\\_news/GHRIS/topghrs.html](http://www.stsci.edu/ftp/instrument_news/GHRIS/topghrs.html)

**Table 1: GHRS Cycle 6 Calibration Plan**

ID	Proposal Title	Frequency	Estimated Time (orbits)		Required Resources (FTE)	Products	Accuracy	Notes
			“External”	“Internal”				
<b>Routine Monitoring Programs</b>								
6897	CRIMP1	2	2	14	0.24	ISR, DH	2% sensitivity	Side 1 monitor
6898	CRIMP2	2	6	16	0.24	ISR, DH	2% sensitivity	Side 2 monitor
6899	Echelle Wavelength Monitor	1	0	16	0.12	ISR, DH	1 diode	
6900	Echelle and G140M Long-Term Monitor	1	6	0	0.03	ISR, DH	2% sensitivity	
6901	PHA/Ion/Threshold Adjustment Tests	2	0	14	0.03	TIPS		
<b>Special Calibration Programs</b>								
6928	NoCo: Special Sensitivity Measurement	1	8	0	0.30	ISR	2% relative	
<b>TOTAL TIME (including all executions)</b>			22	60	0.96			

## GHR Cycle 6 Calibration Closure

ID	Proposal Title	Time Used (orbits)		Resources Used (FTE)	Products		Accuracy Achieved	Notes
		“External”	“Internal”		Database	Document		
<b>Routine Monitoring Programs</b>								
6897	CRIMP1: Integrated Monitoring Program for Side 1	2	14	0.24	sens.	ISR, DH	2% sens., 1 diode $\lambda$	Nominal instrument performance verified at each execution and reported. Final results in close-out documentation  STSDAS script for correcting fluxes below 1200 Å
6898	CRIMP2: Integrated Monitoring Program for Side 2	6	16	0.24	sens.	ISR, DH	2% sens., 1 diode $\lambda$	
6899	Echelle Wavelength Monitor	0	16	0.12	N/A	ISR, DH	1 diode rms	
6900	Echelle and G140M Long-Term Monitor	6	0	0.03	sens.	ISR, DH	2%	
6901	PHA/Ion/Threshold Adjustment Test	8	0	0.30	N/A	ISR	not run	
<b>Special Calibration Programs</b>								
6896	Far-UV Throughput	4	0	0.05	N/A	ISR, DH		
6928	NoCo Special Sensitivity	0	0	0.30	N/A	ISR, DH		not run due to SI failure
TOTAL TIME (including all executions)		26	46	1.28				

**Program ID 6896: GHRIS Far-UV Throughput with COSTAR Mirrors – Cycle 6 Closeout**

*Plan*

**Purpose:** The purpose of this test was to relate fluxes in the standard stars BD+75 and AGK+81 to those in BD+28.

**Description:** This test was constructed once it was known that SM2 would take place in February, 1997. Because of that timing, it was not possible to observe our usual standard star, BD+28, for the NoCo test 6928. We therefore elected to use BD+75 and AGK+81 as targets for 6928, but that meant tie-in observations were needed to relate their fluxes to BD+28.

The wavelengths have been chosen to emphasize those below about 1200 Å, where the greatest decline in sensitivity has been seen since SMOV. However, the usual series of wavelengths on both Side 1 and Side 2 will be observed so that this program is also a sensitivity monitor close-out. In this case, we will also obtain images of the Large Science Aperture after the acquisition has been made, so that we can verify the quality of the pointing after the fact.

This test was to execute once only during Cycle 6, at the end of the Cycle.

**Fraction of GO Programs Supported:** This test is primarily of benefit to understanding overall telescope performance and is not strictly relevant to GO programs.

**Resources:**

**Observation:** External – 4 orbits.

**Analysis:** 0.05 FTE. These observations required a straightforward interpretation on their own part, but considerable preparation was needed to ensure successful execution. Also, we needed to carefully consider how these new data compare to older sensitivity tests.

**Accuracy:** We expected relative accuracy of 2% or better.

*Result*

**Execution:** The test was run on January 18, 1997 (AGK+81) and December 28, 1996 (BD+75). Both were successful.

**Products:** These observations were used in a comprehensive look at far-UV losses with the GHRIS, in ISR085.

**Proposal ID 6897: GHRIS Cycle 6: CRIMP1— Condensed-Regimen Integrated Monitoring Program for Side 1 of the GHRIS**

*Plan*

**Purpose:** The purpose of this program was to monitor the sensitivity, wavelength and detector calibrations of Side 1.

**Description:** Four times per year (twice in Cycle 6) the following observations have been done:

**DETECTOR CALIBRATIONS:**

- 1) dark count measurement
- 2) focus check at nominal high voltage and tweak current
- 3) flat field exposure at center of photocathode
- 4) coarse sample mapping function at central  $y$  deflection
- 5) coarse line mapping function at central  $x$  deflection

**SENSITIVITY MONITORING:**

The sensitivity calibration of the GHRIS Side 1 grating G140L was monitored with the UV spectrophotometric standard star BD+28D4211.

**WAVELENGTH MONITORING:**

The spectral cal lamp mini-functional test for the first order gratings was done. It is an internal test which makes measurements of the lamp (SC2). It was used to monitor the carousel function,  $Y$  deflections, resolving power, and sensitivity. All observations are with the LSA or the SC2 aperture.

**Fraction of GO Programs Supported:** All GHRIS programs using gratings G140M (10%) and G140L (27%) for wavelengths and sensitivities. The detector calibration part supports ECH-A (11%) in addition to G140L and G140M.

**Resources:**

**Observation:** Internal—14 orbits (7 orbits for each of the 2 executions. Note: the internal orbits are full orbits). External—2 orbits (1 orbit for each of the 2 executions).

**Analysis:** 0.24 FTE. The data was reduced and analyzed by L. E. Sherbert (0.08 FTE) under the supervision of an Instrument Scientist (0.04 FTE per execution for a total of 0.08 FTE).

**Special Requirements:** One complete set of observations (detector + sensitivity + wavelengths) was on one SMS. The detector calibrations themselves were executed within 24 hours. The repeat occurred after  $120 \pm 10$  days.

**Accuracy:** Relative sensitivities were measured to better than 2%. Wavelengths were determined to within 1 diode RMS.

*Result*

**Execution:** This program consists of many visits in order to break it down into manageable components, but those visits are clumped into logical groups. The first group of visits ran on August 28, 30, and 31, 1996. The second group ran November 18, 22, 25, and 26, 1996. An execution of only the sensitivity measurements for BD+28 was made on January 24, 1997, in order to have an additional data point for monitoring far-UV throughput losses. All executions were successful.

**Products:** The results of the test are discussed in ISR 081 (wavelengths), ISR 082 (detector calibrations), and ISR 085 (G140L sensitivity). New CDBS files were created, based on the change of G140L sensitivity with time (see ISR 085). These will also be incorporated into the 1997 Data Handbook

**Program ID 6898: GHRIS Cycle 6: CRIMP2— Condensed-Regimen Integrated Monitoring Program for Side 2 of the GHRIS**

*Plan*

**Purpose:** The purpose of this program was to monitor the sensitivity, wavelength and detector calibrations of Side 2.

**Description:** Four times per year (twice in Cycle 6) the following observations were done:

DETECTOR CALIBRATIONS:

- 1) dark count measurement
- 2) focus check at nominal high voltage and tweak current
- 3) flat field exposure at center of photocathode
- 4) coarse sample mapping function at central  $y$  deflection
- 5) coarse line mapping function at central  $x$  deflection

SENSITIVITY MONITORING

The sensitivity calibration was monitored with the UV spectrophotometric standard star BD+28D4211. The medium resolution gratings measured the standard through the LSA and SSA. 5 observations were made between 1200 and 3000 Å

WAVELENGTH MONITORING

The spectral cal lamp mini-functional test for the first order gratings was done. It is an internal test which makes measurements of the lamp (SC2). It was used to monitor the carousel function,  $y$  deflections, resolving power, and sensitivity.

**Fraction of GO Programs Supported:** All GHRIS programs using gratings G160M (19%), G200M (7%), and G270M (15%).

**Resources:**

**Observation:** Internal—16 orbits (8 orbits for each of the 2 executions. Note: the internal orbits are full orbits). External—6 orbits (3 orbits for each of the 2 executions).

**Analysis:** 0.24 FTE. The data were reduced and analyzed by L. E. Sherbert (0.08 FTE) under the supervision of an Instrument Scientist (0.04 FTE per execution for a total of 0.08 FTE).

**Special Requirements:** One complete set of observations (detector + sensitivity + wavelengths) was on one SMS. The detector calibrations themselves were executed within 24 hours. The 3 repeats occurred every  $120 \pm 10$  days.

**Accuracy:** Relative sensitivities were measured to better than 2%. Wavelengths are good to within 1 diode RMS.

*Result*

**Execution:** This program consists of many visits in order to break it down into manageable components, but those visits are clumped into logical groups. Only one group of visits was executed in Cycle 6 because the same program for Cycle 5 had an execution take place in August, 1996. That one group was run on November 23, 24, 25, and 26, 1996, and was successful.

**Products:** The results of the test are discussed in ISR 081 (wavelengths), and ISR 082 (detector calibrations). The change in Side 2 sensitivity with time is under investigation. These will also be incorporated into the 1997 Data Handbook

**Program ID 6899: GHRS Cycle 6: Echelle Wavelength Monitor**

*Plan*

**Purpose:** The purpose of this test was to determine the dispersion solution for the GHRS echelle gratings over the full range of wavelengths covered by the echelles.

**Description:**

This test was an internal test which made measurements of the Pt-Ne spectral calibration lamp SC2. The spectra obtained were used to calibrate the carousel function, y deflection function, resolving power, and scattered light. This proposal defines the spectral lamp test for both Ech-A and Ech-B.

This test was executed once during Cycle 6.

**Fraction of GO Programs Supported:** This test supports all echelle observations (22% of all GHRS observations).

**Resources:**

**Observation:** External–0 orbits, internal 6 orbits, once in Cycle 6.

**Analysis:** 0.12 FTE. Data will be reduced and analyzed by L. E. Sherbert (0.08 FTE) and D. Soderblom (0.04 FTE).

**Special Requirements:** Some wavelengths are out of the nominally useful range but are used in determining the calibration.

**Accuracy:** Requirement: 1 diode RMS for pipeline calibrated wavelengths.

*Result*

**Execution:** This program executed once, on December 9, 10, and 11, 1996, and was successful.

**Products:** ISR081 showed that wavelengths from the first-order gratings are satisfactory. In the limited time available in the close-out phase of the GHRS, the echelle wavelengths will not be examined in any further detail.

## **Program ID 6900: GHRS Cycle 6: Echelle and G140M Long-term Monitor**

### *Plan*

**Purpose:** The purpose of this program is to monitor the long-term stability (time-scale: 1 year) of the sensitivity of Ech-A, Ech-B, and G140M.

**Description:** This proposal defines a series of observations that will continue the long-term monitor of Ech-A, G140M, and Ech-B. Ech-A and G140M observations will be made both through the LSA and the SSA. Ech-B observations are through the LSA only.  $\mu$  Col is used for all observations. For the echelles, OSCAN observations will measure the sensitivity near the blaze peak. The setups for Ech-B are chosen to be the same as those used in SV, to maintain traceability to the original calibrations. WSCAN observations will scan across order 20 in Ech-B. Ech-A is used with an OSCAN at the blaze peak ( $m\lambda = 56100$ ), plus 1 WSCAN. G140M is used at 1100, 1200, 1300, 1400, 1500, and 1600 Å.

**Fraction of GO Programs Supported:** All GHRS programs using Ech-A (11%), Ech-B (11%), and G140M (10%) in Cycles 4, 5, and 6.

### **Resources:**

**Observation:** External—6 orbits (3 orbits for Ech-A + G140M, and 3 orbits for Ech-B).

**Analysis:** 0.03 FTE. The data will be reduced and analyzed by a A. Gonnella (0.02 FTE) and an Instrument Scientist (0.01 FTE). The reduction and analysis will be completed within 2 weeks of test execution, assuming 50% effort of the DA and 20% of the IS during that time.

**Special Requirements:** This test should be executed in the middle of Cycle 6 ( $\pm 2$  months).

**Accuracy:** The goal of this program is to monitor and document the long-term behavior of the echelle and G140M sensitivities. The sensitivities found in this program will be compared to previous measurement obtained for the same star and with the same instrument configuration. The relative accuracy will be at least 2%.

### *Result*

**Execution:** This program executed once, on December 28 and 29, 1996, and was successful.

**Products:** The results of the test were incorporated into ISR088, which discusses sensitivity for G140M and Echelle-A.

## **Program ID 6901: GHRIS Cycle 6: PHA/Ion/Threshold Adjustment Tests**

### *Plan*

**Purpose:** The purpose of this test was to determine the optimal threshold settings for the GHRIS detector diodes.

**Description:** This internal test performs a pulse height analysis to determine individual diode response as a function of threshold for GHRIS detectors 1 and 2. Based on this evaluation new thresholds may be determined for optimal GHRIS operation. 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 photocathode, and produce events of twice normal energy (this should be a very low, stable rate)). The final test will determine the optimal, non-standard discriminator thresholds for the few anomalous channels on both detectors. 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. Cross-talk tables are disabled at the start of this test and re-enabled at the end.

This test will execute twice during Cycle 6, near the beginning and end of the Cycle.

**Fraction of GO Programs Supported:** This test supports 100% of GHRIS observations.

### **Resources:**

**Observation:** Internal—14 orbits.

**Analysis:** These data were reduced by A. Schultz (0.01 FTE) and L.E. Sherbert (0.02 FTE) and analyzed by the GHRIS Instrument Engineer, who is responsible for making the necessary database updates.

**Special Requirements:** None.

**Accuracy:** No specific requirement.

### *Result*

**Execution:** This program would have run once in Cycle 6 but we elected not to execute it because the information returned was of little practical value near the end of the instrument's planned lifetime.

**Products:** Command blocks ZCTFLIT1 and ZCTFLIT2 (PLCP threshold files PZTHR1 and PZTHR2) in the PDB will be updated accordingly. ISR082 documents detector calibrations.

## **Program ID 6928: GHRM Cycle 6: NoCo Special Sensitivity Measurement without the COSTAR Mirrors**

### *Plan*

**Purpose:** The purpose of this test is to determine the degree to which the COSTAR mirrors have reduced the throughput of the GHRM, particularly at wavelengths below Lyman- $\alpha$ .

**Description:** This test will observe two ultraviolet standard stars at a series of wavelengths. Both stars will be observed shortly before the COSTAR mirrors are withdrawn (within 10 days), as well as within the brief interval between that withdrawal and the Servicing Mission. Two stars are observed in order to provide some redundancy for a set of observations that is impossible to repeat.

The wavelengths have been chosen to emphasize those below about 1200 Å, where the greatest decline in sensitivity has been seen since SMOV. However, the usual series of wavelengths on both Side 1 and Side 2 will be observed so that this program is also a sensitivity monitor close-out. In this case, we will also obtain images of the Large Science Aperture after the acquisition has been made, so that we can verify the quality of the pointing after the fact.

This test will execute once only during Cycle 6, at the end of the Cycle.

**Fraction of GO Programs Supported:** This test is primarily of benefit to understanding overall telescope performance and is not strictly relevant to GO programs.

### **Resources:**

**Observation:** External—8 orbits.

**Analysis:** 0.30 FTE. These observations required a straightforward interpretation on their own part, but considerable preparation was needed to ensure successful execution. Also, we needed to carefully consider how these new data compare to older sensitivity tests.

**Special Requirements:** The pre-SMOV aperture locations needed to be loaded into the PDB for this to execute. This was done by O. Lupie.

**Accuracy:** We expected relative accuracy of 2% or better.

### *Result*

**Execution:** The test was not run because of premature failure of the GHRM shortly before SM2.

**Products:** No documentation will be produced.