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HST Data Handbook

Volume I: Current Instruments

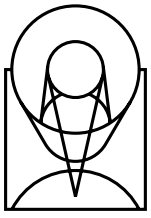

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Table of Contents

Preface: How to Use this Handbook xvii
Handbook Structure xvii
Handbook Updates xix
Typographic Conventions xx
Visual Cues xx
Keystrokes xx
Comments xx

Part I: Introduction to HST Data

Chapter 1 Getting HST Data 1-1
Archive Overview 1-1
Accessing the Archive 1-2
Registering to Retrieve Hubble Data 1-3
Authorization to Retrieve Proprietary Data 1-3
Archive Documentation and Help 1-3
Getting Your Data Quickly 1-4
Getting Data with StarView 1-4
Welcome Screen 1-5
Command Usage and Screen Interaction 1-5
Searching the Catalog 1-6
Retrieving Datasets From the Archive 1-12
Exiting StarView 1-17
Transferring Your Data with FTP 1-17
Running StarView via Remote Access 1-18
Identifying Calibration Reference Files 1-19
Reading HST Data Tapes 1-22
Loading Packages 1-22
Mounting the Tape 1-23

Setting File Format 1-23
Using strfits 1-23

Updated March 1998, v. 3.1
Chapter 2 HST File Formats 2-1
Historical Perspective 2-2
FITS File Format 2-3
Working with FITS Image Extensions 2-4
Working with FITS Table Extensions 2-7
GEIS File Format 2-10
Converting FITS to GEIS 2-11
GEIS Data Groups 2-11
Working with GEIS Files 2-11

Chapter 3 STSDAS Basics 3-1
Navigating STSDAS 3-1
STSDAS Structure 3-2
Packages of General Interest 3-2
Displaying HST Images 3-4
The display Task 3-4
Working with Image Sections 3-7
Analyzing HST Images 3-8
Basic Astrometry 3-9
Examining and Manipulating Image Data 3-10
Working with STIS and NICMOS Imsets 3-12
Photometry 3-15
Displaying HST Spectra 3-17
FOS and GHRS Spectra 3-17
STIS Spectra 3-18
Producing Hardcopy 3-19
Analyzing HST Spectra 3-21
Preparing FOS and GHRS Data 3-21
Preparing STIS Spectra for Analysis 3-23
General Tasks for Spectra 3-25

STSDAS fitting Package 3-29
specfit 3-32
References 3-32
Available from STScI 3-32
Available from NOAO 3-32
Other References Cited in This Chapter 3-33

Part II: FOC

Chapter 4 FOC Instrument Overview 4-1
Spatial Resolution and PSF 4-2
Filters 4-4
Formats & Fields of View 4-4
Sensitivity 4-5
Polarization & Spectroscopy 4-6
What to Expect 4-7

Chapter 5 FOC Data Structures 5-1
File Suffixes 5-1
Header Keywords 5-2
Relationship to Proposed Observations 5-7
Paper Products 5-10

Chapter 6 FOC Calibration 6-1
FOC Pipeline Processing 6-1
FOC Calibration Switches 6-2
Dezooming of Zoomed Images (PIXCORR) 6-2
Absolute Sensitivity Correction (WAVCORR) 6-3
Geometric Correction (GEOCORR) 6-5
Flatfield Correction (UNICORR) 6-7
Reasons to Recalibrate 6-8
Absolute Sensitivity Keywords 6-8

Flatfields 6-9
Geometric Correction Files 6-9
Improved Pipeline Algorithms 6-10
User Calibrations 6-10
How to Recalibrate 6-10

Chapter 7 FOC Error Sources 7-1
Overview of FOC Characteristics 7-1
Nonlinearity 7-2
Geometric Correction 7-4
Flatfield Residuals 7-5
Border Effects 7-5
Video and Digitizing Defects 7-7
Reseau Marks, Scratches, and Blemishes 7-8
Pattern Noise 7-8
Large Scale Variations 7-9
Time Variability 7-9
Format-Dependent Effects 7-9
Format-Dependent Sensitivity 7-10
Background 7-11
Detector Background 7-11
Geocoronal Emission Lines 7-12
Zodiacal Light and Diffuse Galactic Background 7-12
Scattered Stray Light 7-12
Filter Induced Image Shifts 7-13
Errors in Absolute Photometry (f/96) 7-14
Absolute Sensitivity of the f/48 Detector 7-15

Chapter 8 FOC Data Analysis 8-1
Photometry 8-1
Point Spread Function 8-2
Photometric Accuracy 8-3
Astrometry 8-6
Polarimetry 8-7

Objective-Prism Spectroscopy 8-10

Long-Slit Spectroscopy 8-14
Tribulations of the f/48 Spectrograph 8-15
Reduction of f/48 Spectra 8-16
Accuracy of f/48 Spectroscopy 8-16
Summary of FOC Accuracies 8-17

Part III: FGS

Chapter 9 FGS Overview 9-1
FGS Capabilities 9-2
FGS Design 9-3
FGS Optics 9-3
FGS Aperture 9-6
S-curves 9-8
FGS 1R 9-13
FGS Control 9-15
Target Acquisition and Tracking 9-16
Search 9-17
CoarseTrack 9-17
FineLock 9-18
Transfer Scans 9-21
FGS Guiding 9-21
FGS Astrometry 9-22
Astrometry with FGS 3 9-23

Chapter 10 FGS Data Structures 10-1
Engineering Telemetry Data 10-1
FGS Astrometry Files 10-2
Relationship to Phase II Request 10-6

Jitter Files 10-6
SMS Support Data 10-7

Chapter 11 FGS Calibration 11-1
The Visit 11-1
Initial Data Processing 11-2
POSITION Mode Pipeline 11-3
Position Mode Observations 11-3
Processing Individual Observations 11-4
Assembling the Visit 11-5
TRANSFER Mode Pipeline 11-7
TRANSFER Mode Dataset 11-7
Mapping TRANSFER Mode to POSITION Mode 11-7
Limitations of the TRANSFER Mode Pipeline 11-8
POSITION Mode Pipeline Output 11-8

Chapter 12 FGS Error Sources 13
Levels of POSITION Mode Errors 13
Observation-Level POSITION Errors 14
Rotation Angle Errors 14
Centroiding Errors 14
Locating Interferometric Null 17
Optical Field Angle Distortion 19
Lateral Color Error 20
Cross Filter Effect 21
Differential Velocity Aberration 22
Lever Arm Length and Offset Angle 22
Visit-Level POSITION Errors 23
POSITION Mode De-jittering Errors 23
Drift Correction Errors 24
Field-Level POSITION Errors 25
TRANSFER Mode Errors 26

Chapter 13 FGS Data Analysis 29
Analyzing Individual Observations 29
Plate Overlays 31
Resolving Structure with TRANSFER Mode 33
FGS Response to a Binary 34
TRANSFER Mode Data Reduction 37
Uncertainties in TRANSFER Mode Data 38

Part IV: NICMOS

Updated March 1998, v. 3.1
Chapter 14 NICMOS Instrument Overview 14-1
Instrument Overview 14-1
Detector Readout Modes 14-2
MULTIACCUM 14-3
ACCUM 14-4
BRIGHTOBJ 14-4
RAMP 14-5

Updated March 1998, v. 3.1
Chapter 15 NICMOS Data Structures 15-1
NICMOS Data Files 15-1
File Name Suffixes 15-2
Science Data Files 15-3
Auxiliary Data Files 15-9
Header Keywords 15-10
Working with NICMOS Files 15-15
From the Phase II Proposal to Your Data 15-21
Paper Products 15-22

Chapter 16 NICMOS Calibration 16-1
Pipeline Processing 16-1
NICMOS Calibration Software 16-2
The Calibration Pipeline 16-2
Grism Spectroscopy 16-3
Basic Data Reduction: calnica 16-3
Mosaicing: Calnicb 16-10
Input Files 16-11
Output Files 16-12
Processing 16-13
Grism Data Reduction: Calnicc 16-16
Input Files 16-16
Output Files 16-16
Processing 16-18
Recalibration 16-21
Why Recalibrate? 16-21
Recalibrating the Data 16-22
Calculating Absolute Sensitivity 16-24

Chapter 17 NICMOS Error Sources 17-1
Flatfield Errors 17-1
Thermal-Vacuum versus On-Orbit Flatfields 17-1
Characteristics and Uncertainties of Flatfields 17-2
Color Dependence of Flatfields 17-6
Dark Current Subtraction Errors 17-7
Dark Current Pedestal 17-7
Synthetic MULTIACCUM Darks 17-8
Uncertainties in the Synthetic Darks 17-10
Instrument Artifacts 17-11
Non-Zero Zeroth Read Correction for Bright Sources 17-11
Effects of Overexposure and the “Mr. Staypuft” Anomaly 17-11
Vignetting 17-12
Amplifier Glow 17-12

Intra-Pixel Sensitivity Variations 17-13
Hot Pixels, Cold Pixels, and Grot 17-13
Cosmic Rays 17-14
Calibration Goals 17-14

Chapter 18 NICMOS Data Analysis 18-1
STSDAS Software 18-1
Photometric Calibrations 18-2
Units for NICMOS Photometry 18-3
Fluxes and Magnitude Zeropoints 18-3
Photometric Corrections 18-4
Magnitudes and Photometric Systems Transformations 18-8
Absolute Photometry for Emission Line Filters 18-9
Absolute Spectrophotometry with NICMOS Grisms 18-10
PSF Subtraction 18-11
Analysis of Polarization Images 18-12
Introduction 18-12
Theory 18-13
A Useful Script for Polarization Analysis 18-14

Part V: STIS

Updated March 1998, v. 3.1
Chapter 19 STIS Overview 19-1
Instrument Capabilities and Design 19-1
Basic Instrument Operations 19-4

Updated March 1998, v. 3.1
Chapter 20 STIS Data Structures 20-1
Overview 20-1
STIS File Structures 20-2

STIS FITS Image Extension Files 20-2
Tabular Storage of STIS Data 20-5
Types of STIS Files 20-6
Understanding Associations 20-6
Headers, Keywords, and Relationship to Phase II 20-9
Error and Data Quality Arrays 20-13
The Error Array 20-14
Data Quality Flagging 20-14
STIS Paper Products 20-15

Updated March 1998, v. 3.1
Chapter 21 STIS Calibration 21-1
Pipeline Processing Overview 21-1
Structure of calstis 21-3
Data Flow Through calstis 21-9
Descriptions of Calibration Steps 21-15
Recalibration of STIS Data 21-29
Mechanics of Full Recalibration 21-30
Rerunning Subsets of the Calibration Pipeline 21-33
Updates to calstis 21-35

Chapter 22 STIS Error Sources 22-1
Calibration Goals 22-1
Calibration Accuracy Resources 22-3
Factors Limiting Flux and Wavelength Accuracy 22-5
Flux Accuracy 22-5
Wavelength and Spatial Accuracies 22-6

Updated March 1998, v. 3.1
Chapter 23 STIS Data Analysis 23-1
Data Reduction Applications 23-1

STIS-Specific Reduction and Analysis Tasks 23-2
Working with Two Dimensional Extracted Spectra 23-3
Sensitivity Units and Conversions 23-3
Wavelength and Spatial Information 23-5
TIME-TAG Data 23-6
Target Acquisition Data 23-8

Part VI: WFPC2

Chapter 24 WFPC2 Instrument Overview 24-1

Chapter 25 WFPC2 Data Structures 25-1
Data Files and Suffixes 25-1
Header Keywords 25-3
Correlating Phase II Exposures with Data Files 25-8
WFPC2 Paper Products 25-10

Chapter 26 WFPC2 Calibration 26-1
Overview of Pipeline Calibration 26-3
Standard Pipeline Calibration 26-5
Calibration Files 26-6
Calibration Steps 26-7
Recalibration 26-10
Why and When to Recalibrate 26-10
Assembling the Calibration Files 26-13
Setting Calibration Switches 26-13
Post-Pipeline Calibration 26-15
Warm Pixels 26-16
Removing Cosmic Rays from Co-aligned Images 26-20
Charge Traps 26-22

Chapter 27 WFPC2 Error Sources 27-1

Bias Subtraction Error 27-2
Flatfield Correction Errors 27-2
Dark Current Subtraction Errors 27-3
Electronic Dark Current 27-3
Dark Glow 27-4
Image Anomalies 27-5
Bias Jumps 27-5
Residual Images 27-6
PC1 Stray Light 27-10
Other Anomalies 27-11

Updated March 1998, v. 3.1

Chapter 28 WFPC2 Data Analysis 28-1

Photometric Zero Point 28-2
Photometric Systems Used for WFPC2 Data 28-2
Determining the Zero Point 28-4
Photometric Corrections 28-6
Time-Dependent Corrections 28-6
Position-Dependent Corrections 28-11
Other Photometric Corrections 28-13
An Example of Photometry with WFPC2 28-15
Polarimetry 28-16
Astrometry 28-18
Dithering 28-19
Accuracy of WFPC2 results 28-24
References 28-25

Appendixes

Appendix A IRAF Primer A-1

Initiating IRAF A-1

Setting Up IRAF A-2
Starting and Stopping an IRAF Session A-3

IRAF Basics A-4

Loading Packages A-4
Running Tasks A-5
Getting Help A-6
Setting Parameters A-8
Setting Environment Variables A-10
File Management A-11
Troubleshooting A-13

Getting IRAF and STSDAS A-13

Retrieving the IRAF and STSDAS Software A-14
Getting the Synphot Database A-15
Extracting the synphot Unix Tar Files A-15

Updated March 1998, v. 3.1

Appendix B HST File Names B-1

Appendix C Observation Logs C-1

Observation Log Files C-1

Retrieving Observation Logs C-8

Using Observation Logs C-9

Guiding Mode C-9
Guide Star Acquisition Failure C-10
Moving Targets and Spatial Scans C-11
High Jitter C-11

Appendix E Resources on the Internet E-1

Glossary F-1

Index IX-1

Preface

How to Use this Handbook

Welcome to the third edition of the *HST Data Handbook*. The goal of this handbook, as in previous editions, is to show you how to work with HST data files, from acquiring them through the Archive, to displaying them on your workstation, to analyzing them with the IRAF and STSDAS software packages. New to this edition are chapters on HST's recently installed instruments—STIS and NICMOS—plus entirely new versions of the FGS chapters and an introduction to the FITS file format that will be standard for STIS and NICMOS data. This handbook assumes no previous knowledge of HST data, IRAF, or STSDAS beyond that needed to compose a successful HST observing proposal, but if you are unfamilar with IRAF, a basic primer is provided in Appendix A.

The material presented in this handbook provides an overview of the data reduction process, explaining what has been done to HST data files before you receive them and describing effective ways to analyze them. It collects all the basic information needed to analyze HST data into one place, focusing on the most crucial and commonly used tasks, and pointing toward other sources of more detailed information when needed. Additional help with HST data is always available via email to the STScI Help Desk at `help@stsci.edu`.

If you have no previous experience with HST, you should read the first three chapters of this handbook before proceeding to the chapters on the specific instruments. Appendixes B, C, and E, describe HST file names, Observation Logs, and Internet resources, respectively, and contain information of general interest. STIS and NICMOS observers who are already familiar with HST data should read at least section 2.2 of Chapter 2, which explains the new FITS format used for STIS and NICMOS data, and section 3.3.3 of Chapter 3, which introduces some new tasks for working with STIS and NICMOS data. The rest of this Preface provides more complete information on using the *HST Data Handbook*.

Handbook Structure

This edition of the *HST Data Handbook* is organized into two volumes. Volume 1 provides general information on retreiving and reducing HST data and

includes the more specific information needed to analyze data from the instruments currently on board the spacecraft (FOC, FGS, NICMOS, STIS, and WFPC2). Volume 2 covers the instruments that have been retired (FOS, GHRS, HSP, and WF/PC-1).

Part 1 of Volume 1 leads observers through the following three-step process, applicable to HST data files from any instrument:

- Chapter 1 on *Getting HST Data* demonstrates how to search the HST Archive for proprietary observations or other observations of interest and to download them to your machine.

  If you already know how to search for and download HST data, or if all the data files you need are present on your disk, you can skip Chapter 1.

- Chapter 2 on *HST File Formats* describes the FITS and GEIS formats used for transferring and reducing HST data. It explains how HST data are stored in these files and shows how to access these data. STIS and NICMOS observers especially should read this chapter, as the procedures for accessing these data differ from those for other instruments. Observers working with FOC, FOS, FGS, GHRS, HSP, WF/PC-1, or WFPC2 data will need to convert the FITS files they receive from the Archive into GEIS format, and section 2.3 shows how to perform this conversion.

  If you are not using STIS or NICMOS data and are already familiar with the standard GEIS format for HST data, you can skip Chapter 2.

- Chapter 3 on *STSDAS Basics* introduces you to some software packages designed specifically for HST data and gives a few examples.

  If you are already familiar with STSDAS, you can skip this chapter and proceed to the relevant instrument chapters.

Parts 2 through 10 present five-chapter sequences on each HST instrument, consisting of the following topics:

- *Instrument Overview*, providing a fundamental understanding of the instrument and the vocabulary associated with it.

  If you are not already familiar with the details of your chosen instrument, you should begin here.

- *Data Structures*, describing the contents of the various data files, the meanings of selected header keywords, and the relationship of the data products to the original Phase II proposal.

  If you are not familiar with the filenames, header keywords, or contents of the data files from this particular instrument, you should read this chapter next.

- *Calibration*, describing how the calibration pipeline processes your observations before they enter the Archive, how to determine if your data files need recalibration, and how to recalibrate them.

  If you do not know how your data have been calibrated, you should read this chapter.

- *Error Sources*, describing the various sources of error afflicting pipeline calibrated data.

  All observers using a given instrument should read this chapter to acquaint themselves with the peculiarities of the data that remain after pipeline calibration.

- *Data Analysis*, describing certain methods and IRAF/STSDAS tasks for analyzing the data.

  Most observers will find this chapter useful when determining how they should reduce their data.

Five Appendixes to this handbook, found in Volume 1, provide some additional general information that you might find useful:

- Appendix A, the *IRAF Primer*, is an introduction to IRAF and is intended for those who have no prior experience with this data reduction software.
- Appendix B, on *HST File Names*, shows how to interpret the names of the files you receive from the Archive and explains why certain STIS and NICMOS observations belong to associations of exposures.
- Appendix C, on *Observation Logs*, discusses the files created by the Observatory Monitoring System (OMS); these files record information on guiding, such as spacecraft jitter, during a given observation.
- Appendix D, the *Task Example Index*, provides pointers to the examples of various IRAF/STSDAS tasks scattered throughout the book.
- Appendix E, listing *Resources on the Internet*, indicates where you can access some of the many valuable tools and documents available through the STScI Web pages.

Handbook Updates

Our understanding of HST's instruments and the data they produce continues to grow. In order to keep up with this evolving understanding, we have organized this handbook so that its chapters are modular. You will be able to update your handbook simply by removing old chapters and indexes and replacing them with new ones. In fact, you may want to customize your handbook by placing only the chapters you need into a looseleaf notebook. When updated chapters become available, we will announce them on the HST Web pages and in the electronic Space Telescope Analysis Newsletters (STANs). You can then download these updates via the Internet or request paper copies from the Help Desk (`help@stsci.edu`). Users of STIS, NICMOS, and FGS should pay particular attention to these updates, because the chapters supporting these instruments will change most quickly.

Typographic Conventions

To help you understand the material in the *HST Data Handbook*, we will use a few consistent typographic conventions.

Visual Cues

The following typographic cues are used:

- **bold** words identify a STSDAS or IRAF task or package name.
- `typewriter-like` words identify a file name, system command, or response that is typed or displayed as shown.
- *italic* type indicates a new term, an important point, or a mathematical variable.
- ALL CAPS identifies a header keyword or a table column.

Keystrokes

Keystroke commands and sequences are identified by the following formats.

- Shift-Q - When two keys are linked by a *dash*, both keys should be pressed at the same time.
- Esc D - When a *space* separates two keys, a sequence is indicated. Press one key, release it, then press the other.
- M - Press *only* the key. If we meant that you should press shift with the key, we would say so, such as in the first example, above.

Comments

Occasional side comments point out three types of information, each identified by an icon in the left margin.

Tip: No problems...just another way to do something or a suggestion that might make your life easier.

Heads Up: Here is something that is often done incorrectly or that is not obvious.

Warning: You could corrupt data, produce incorrect results, or create some other kind of severe problem..