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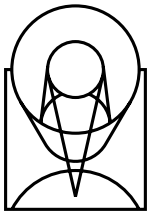
HST Data Handbook

Volume I: Current Instruments



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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..