Introduction

Scope

This Guide tells you what you need to know to reduce RXTE data. By reduce, we mean the preparation of data for analysis, which for RXTE entails knowing:

- **How your data are organized in files and how to find the files you want.**
- **How the instrument, mode and configuration determine the nature of your data.**
- **How to run the reduction software to screen and extract the data you want to analyze.**
- **How to apply calibrations to your data.**

Data analysis, i.e. the derivation of scientific results from the data products, is covered elsewhere, although the chapters on spectra and light curves do show how to get started on your analysis.

RXTE Data Reduction: The Basic Scheme

Between receiving RXTE data from the ground station and sending the data to Guest Observers, the XTE Science Data Center (XSDC) converts the data to **FITS format**, arranges the FITS files into a hierarchical set of directories and performs a set of standard calibrations. Also produced at this stage are **filter files** which contain the time-histories of various parameters in reference to which good data can be identified and screened.

RXTE data reduction involves first navigating the directory structure with the GUI-driven program **XDF** (XTE Data Finder) to identify the files which contain the data you want to reduce. Next, you manipulate these FITS files by a set of tasks, called **ftools**, which are tied together in the interactive program **xselect2**.

Xselect2 reads in data files and the accompanying filter file and enables you to produce a list of good time intervals based on various selection criteria you apply. At this stage, you can also specify filters to single out parts of the good data. The final step is to apply the good time intervals and extract data products (light curves or spectra) through the filters. These products can be read into the appropriate data analysis programs (e.g. xronos, xspec - or any others equipped to handle the formats).

How this Guide is Organised and How to Use it

The Overall Scheme

RXTE might seem at first to be a very complicated mission. Not only are the two PI instruments, the PCA and HEXTE, modular, but they can each produce data in an almost endless variety of modes. Fortunately, when you get your data tape, you'll find that the only modes present are the ones you chose for your proposal, plus the so-called "standard modes". Moreover, RXTE science data are packaged in just two broad classes, science array and science event, and only two extractor tools are needed.

The Order and Arrangement of Chapters

After this introduction, comes a chapter dealing with the basic structure of the various RXTE FITS files. Not an exhaustive description of the files and keywords, the chapter focuses instead on the properties of the files that you need to know in order to reduce and analyze your data effectively.

The next chapter describes those aspects of the PCA that pertain to data reduction. Like the chapter on FITS files, the aim is to enable you to understand the properties of your data.

Screening, i.e. getting rid of unwanted or invalid data, is covered in the next chapter which is followed by the chapter on extracting light curves and spectra. A tutorial on how time is defined for RXTE ends this current version.

How to Use this Guide

Before the *ABC of XTE*, you should read the *RXTE Getting Started Guide*.

If you are familiar with ASCA data reduction, please refer to the footnote which discusses the similarities and crucial differences between ASCA and RXTE data reduction.

When finished, the *ABC of XTE* will be a comprehensive reference on RXTE data reduction. However, what many of you want is an easy-to-use set of recipes for basic and advanced data reduction tasks. These recipes will be included in the new *RXTE Cook Book* which will be available in early 1997.

Obtaining Help and Information, Reporting Bugs, Submitting Comments, Receiving Updates

Xtehelp

XDF, xselect2, the ftools and the Xanadu analysis programs are all equipped with extensive on-line help, but if you cannot find the answer to your software question, please send email to **`xtehelp@athena.gsfc.nasa.gov`**

This is also the email address to which you should send bug reports and comments.

Xtenews

Information about software and calibration updates, bug fixes and enhancements is promulgated via the **xtenews** email exploder. Xtenews is also used to distribute the short-term timelines. If you are not on the mailing list of this exploder, please send an email to **`listserv@athena.gsfc.nasa.gov`** which should contain, in the text of the email, the single line:

```
subscribe xtenews Felix Krull
```

provided your name is Felix Krull (if it is not, please substitute your own name).

Please proceed to the *Data Files* chapter. Or return to the *Table of Contents.*

Footnote: Comparison with ASCA Data Reduction

Data Files

Both ASCA and RXTE data files are in FITS format. Where appropriate, the keywords are identical and follow the same OGIP standards. However, there are several differences:

- **RXTE datasets are generally larger.** Mostly because of the higher temporal resolution, typical

RXTE datasets are about 100 times bigger than typical ASCA datasets.

- **RXTE data files contain either regularly accumulated arrays or event-by-event bitmasks.** Neither format was used for ASCA (except for the little-used GIS MPC mode).

- **RXTE data files are arranged in a hierarchical directory structure.** RXTE has more subsystems and instruments than ASCA and its observations are more likely to be split up. Accordingly, a hierarchical directory structure was devised to keep better order of individual files - unlike the case with ASCA.

Software

For ASCA and RXTE, the basic data reduction scheme is the same: start with FITS files containing all the data; screen the files to produce "good" data; filter - if necessary - to get the desired subset of good data, and finally extract and save the data product. Both ASCA and RXTE also require you to generate your own response matrices. However, as in the case of the data files, there are important differences:

- **To navigate RXTE's hierarchical directory structure, a special tool XDF (XTE Data Finder) is provided.** The role of XDF is similar to the **make obscat** command in xselect.

- **RXTE data are screened using xselect2.** Modifying the original xselect to accommodate RXTE data proved more arduous than creating a new program. Xselect2, the successor to xselect, is a GUI-driven object-oriented program written in Tcl/tk. However, until xselect2 is ready for release, RXTE data are screened using Ftools and Perl scripts.

- **Screened light curves and spectra should be extracted from RXTE data, but not screened data files**. Because of their size, extracting screened versions of "raw" RXTE data files is too resource-intensive for typical workstations.

The ABC of XTE *is written and maintained by the RXTE GOF. Please email* `xtehelp@athena.gsfc.nasa.gov` *if you have any questions or comments. This particular page was last modified on Friday, 18-Jul-97 11:55:21 EDT.*
