TIMING ANALYSIS PROGRAMS AT IFCTR

USERS' HANDBOOK

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1. Introduction and general utilities

1.1 Foreword

This document is the Users' Guide of a collection of programs developed and/or used at IFCTR Milano for timing analysis, mainly in the framework of the Exosat project, but in line of principle applicable to any suitable time series (they have been in fact applied also to optical photometric and spectroscopic data).

There are four families of programs mentioned below, of which two are described here in detail, and the other two described elsewhere:

Programs of the IFCTR Exosat analysis system (recalled here, but described in Chiappetti & Garilli, The IFCTR Exosat analysis system, Users' Handbook, Version 3a, October 1988, hereafter EUH)

Timing analysis program developed at IFCTR (with the substantial participation of T.Belloni and C.Del Gratta), mainly within the Exosat framework (described here in chapters 2 and 3): the folding and Fourier transform software.

Some additional utilities developed at IFCTR, described in section 4 below.

The TINTE package developed by L.Stella at the Exosat Observatory, ESOC, and (partially) installed at IFCTR on the HP computer, briefly recalled in chapter 5 (but see its own documentation for more details).

1.2 Syntax and notation conventions

This document is intended as a Users' Guide, not as a treatise on temporal analysis, therefore each program is briefly described in a section, containing a brief outline of the purpose of the program, an accurate explanation of the calling sequence, of the intrinsic limitations, of the format of output files and, when applicable, any additional information.

The use of **boldface** characters indicates names of commands and files which have to be typed exactly as they appear here.

The use of *italics* indicates variable parameters, which have to be substituted with appropriate values.

*Underlining* is freely used to emphasize particular items.
2. Folding analysis programs

Please note that the majority of the folding programs below work in arbitrary phase and with non-heliocentric times. An utility to shift a folded light curve is described in 4.4. Conversion to heliocentric times is described in 4.2.

Folding related items may also be fits with sinusoids (see 4.5), and the production of hardness ratio folded light curves in cases where it is not possible to use TOPERA to produce an hardness ratio time series (see 4.7).

2.1 Folding at fixed period

Purpose

This program performs a folding of a time series at an user-selected fixed period, in an user-selected number of phase bins, and produces a PABLO file containing the folded light curve.

Calling sequence

The program is equally implemented on IBM (as FOLDING) and HP (as FOLDA), and is called with the following sequences:

```
FOLDING cfile infname inftype outfile extrainfo period nbins
FOLDA, cfile,infile, ,outfile,extrainfo,period,nbins
```

The meaning of the compulsory and optional parameters is as follows (note that extrainfo may be altogether missing if the input file is a RATE file):

cfile is the command file name (may be omitted on HP, or replaced by an hyphen on IBM)

infname is the input file name (on HP; on IBM one specifies both the filename infname and the filetype inftype). The input file may be either a RATE or a PABLO file (on IBM the filetype info is used; on HP the program automatically recognizes the kind of file).

outfile is the output file name (on IBM this is of type PABLO)

extrainfo is present only if infile is a PABLO file, in a number of alternate formats. It is a sequence of further parameters, separated by blanks on IBM and by commas on HP. Some parameters are required only in dependence on previous parameters.

Folding
3. Fourier analysis programs

3.1 Direct Fourier transform with Deeming's method

Purpose

This program produces a periodogram of a time series in an user-selected frequency range, according to the method of Deeming (T.J.Deeming, 1975, Ap.Space Sci., 36, 137), and produces a PABLO file containing the periodogram (power spectrum).

Calling sequence

The program is equally implemented on IBM (as FOURDEEM) and HP (as FOUR), and is called with the following sequences:

FOURDEEM cfile infname inftype outfile extrainfo freqs
FOUR, cfile, infile, ,outfile, extrainfo, freqs

The meaning of the compulsory and optional parameters is as follows (note that extrainfo may be altogether missing if the input file is a RATE file):

cfile is the command file name (may be omitted on HP, or replaced by an hyphen on IBM)

infile is the input file name (on HP; on IBM one specifies both the filename infname and the filetype inftype). The input file may be either a RATE or a PABLO file (on IBM the filetype info is used; on HP the program automatically recognizes the kind of file).

outfile is the output file name (on IBM this is of type PABLO)

extrainfo is present only if infile is a PABLO file, in a number of alternate formats. It is a sequence of further parameters, separated by blanks on IBM and by commas on HP.

nhead iferr xcol ycol

nhead is the number of header lines in the PABLO file (defaults to 13 lines)

iferr is a 0 (default) if the file has errors, and a 1 if the file is without errors
4. Miscellaneous utilities

4.1 Date conversion

Purpose

To convert dates in days of the year into dates in days of the month and month, and vice versa.

Calling sequence

The program is available on the HP only with one of the following syntaxes, according to the case wished:

\[ \text{DAY}, yday, \text{year} \]
\[ \text{DAY}, \text{day}, \text{month}, \text{year} \]

Note that the year has to be specified in full (four figures, YYYY, i.e. 1989, not 89).

Limitations

The calculation is valid for normal and leap years, but not for secular years in the Gregorian calendar, when they differ from the Julian one (i.e. 1700, 1800, 1900).

Output files

None.

Additional information

The converted date is displayed on the terminal.
5. Introduction to TINTE

TINTE (Timing INTEractive) is a package written by L.Stella at the Exosat Observatory (then at ESOC) and running on HP systems (it is being superseded by a VAX package called XRONOS now).

It was designed for the ESOC Exosat environment, and therefore only a subset of its functionalities are available in Milano, with some differences.

There is a manual by L.Stella, available c/o L.Chiappetti, and an on-line help facility, similar to the standard (HP) EXOSAT one. To run it just do:

TINTE

and use command ?? to enter the help system, in a self-explanatory way.

TINTE commands are two-letter codes, some of them correspond to a program, others are internal, however they can all be run with the usual Exosat syntax, either passing arguments in the run string, or being prompted interactively. There is also a command file (macro) facility for the TINTE program itself.

The following commands, corresponding to external programs not part of TINTE, are not available in Milano (use our own folding and Fourier transform commands): PT, FT, F2, FD.

The input to TINTE is provided by rate files. The program supports a variety of rate file formats, of which only one, the oldest, is supported in Milano. Actually there are some differences between the "old" ESOC rate format and the Milano one (mainly concerning number of header lines, as well as internal data representation): the defaults in TINTE have been adjusted to be suitable for the Milano format.

There are two implications in this:

In order to use a rate file, you must convert it from the IBM to the HP representation, running RCONV once on each file file, in either form:

```
RCONV, file
```

before running TINTE

```
FG,RU,RCONV, file
```

within TINTE

The first data record is 3 (as records 1 and 2 are header)

There may be subtler differences, regarding the different ways dead time and background subtraction are handled in Milano and in TINTE, which may affect (or preclude) a meaningful interpretation of the results.

Also plotting device names have been adapted to our configuration.