FOCIS Guide

This write-up describes the use of the FOCIS software package to analyze FASR / FST data. FOCIS (for FASR Offline Correlator Implemented in Software) provides the software equivalent of prefiltering and correlating digitized broadband data acquired by the Aqiris system and recorded as FST data files. The output can be used by FOCIS_DISPLAY to display dynamic spectra and other 1-D graphical displays of correlated and uncorrelated data.

INSTALLATION

The current version of FOCIS, supporting IDL modules and other relevant files can be found in the directory at http://sprg.ssl.berkeley.edu/~ghurford/FST/

The modules required from this directory are:
FOCIS.pro
FOCIS_DISPLAY.pro
fst_byte2int
fst_filter.pro
fst_focisout_read
fst_focisout_reformat
fst_focisout_write
fst_process_filterblock.pro
fst_process_analysis_block.pro
fst_overview_plots
fst_spectrogram_display
fst_sim_setup

The following must also be in your IDL path:
the ACQIDL package of routines (written by Gelu Nita) which can be found at
http://ovsa.njit.edu/fasr/fst/Software/ACQ2IDL/
the ssw branch, \ssw\hessi\idl
the ssw branch, \ssw\radio\ovsa\idl

OVERVIEW

The current version of FOCIS does a record-by-record analysis of one file of data. This enables it to analyze large files, while minimizing memory requirements. Output is incrementally written to a temporary output file, focisoutemp.dat. When the initial analysis is completed, fst_focisout_reformat is called from within FOCIS to rewrite this temporary file into a more efficient format. This output is saved as a single structure in a binary file named by outfile. (Default is focisout.sav.) At present, reformatting works only if the frequency range is the same for all input records. Optionally, the output structure can be saved or returned directly. Analysis results can be displayed by the FOCIS_DISPLAY routine, described in part below. [Optional provision to internally call FOCIS_DISPLAY has from within FOCIS has been temporarily removed.] Other applications can read the reformatted FOCIS output file using the fst_focisout_read module.

RUNNING

The calling sequence is: *FOCIS, optional keywords*

Commonly used keywords:

ACQFILE	specifies the input filename. If missing, the user chooses from a display of ACQ*.dat files in the default directory.
CHANNELS	specifies an array of channel numbers (1,2,3,4) to be processed. Default=all channels in the data, (typically [1,2,3]).
CBW=cbw	specifies the correlator bandwidth in MHz. Default is ~1 MHz.
BWOUT	Approximate bandwidth of post-correlation accumulators (MHz). Default is no post-correlation frequency-averaging.
FILTERPARM	specifies a structure that defines the parameters of filters applied to the data prior to correlation. Default is no filtering.
INTEGTIME	Specifies the integration time of post-correlator accumulators (milliseconds). Default = 1 segment
FOCISOUT	Names an output structure to receive output.
OUTFILE	Name of a binary output file to receive output. (Default is 'focisout.dat'.)
SAVEFILE	Name of a binary output file to receive output. (Default is no savefile.)
/NOPSYS	Suppresses normalization to PSYS and PSYSATTEN values.
/NOGEOM	Suppresses processing of geometrical information. Default is to prompt user for geometry filename, if the geometry structure is missing from header.

Less frequently used keywords are:

BLOCKNS=blockns	specifies the integration time in nanoseconds for each correlator block. (Use of CBW is preferred and overrides BLOCKNS.)
DISPLAY_SIZE=display_size	specifies the fractional screen size of the dynamic spectra displays. Default = [0.625, 0.625].

Representative processing time is about one second per 5 MHz of (hard disk) input data. Your mileage may vary depending on the characteristics of the machine, analysis options and data parameters.

FILTER PARAMETERS

Filter parameters are specified in a structure with the following tags:

```
filterparm = { fmode:      1,                    $      ; 0 = no filtering, -1=auto, 1=prespecified frequencies
               fbw:        0,                    $      ; Filter bandwidth
               nbadfreq:   0,                    $      ; Number of bad frequency bands
               badfreq:    FLTARR(nbadfreq),     $      ; center of each bad frequency band in MHz
               badfreqbw:  FLTARR(nbadfreq) }           ; width of each bad frequency band in MHz
```

A recommended approach is to create the structure manually and use IDL's SAVE / RESTORE commands with a unique filterparm structure name so that it is available for future use.
Default is no filtering. (fmode=0)

OUTPUT DISPLAYS (generated by FOCIS_DISPLAY)

Currently dynamic spectra for each channel show:

- Uncorrelated power vs. frequency and time
- Correlated amplitude vs. frequency and time
- Correlated phase vs. frequency and time

The dynamic spectra are displayed by the ssw spectrogram package using the 'PLOTMAN' interface. This enables the user to create plot files, make hard copies, export data, profile, zoom, change color tables, and otherwise manipulate the screen display interactively. See the pull-down windows in the spectrogram output for details.

The overview plots are 2-D plots of:

- Total power dynamic spectra histograms
- Frequency-averaged total power light curves.
- Time-averaged total power spectra.
- Correlated power dynamic spectra histograms
- Frequency-averaged correlated power light curves.
- Time-averaged total power spectra.

NB – Absolute normalization of these displays is not yet implemented.

The program also prints some data parameters, analysis and display timing information in the log window.

CURRENT PROBLEMS

In some cases dynamic spectra can require excessive time and memory. This can be eased somewhat by post-time averaging. Note that after the displays are generated, substantially memory resources are used to maintain the dynamic spectra windows.

Flexibility in the choice of channels to be analyzed has not been tested.

Bug reports and suggestions can be sent to ghurford@ssl.berkeley.edu

FUTURE DEVELOPMENTS

In priority order (adjustable by popular demand):

- Provision to analyze multifile scans.
- Provision to reformat multiband files.
- Generalization of geometrical delay calculations.
- Implementation of overview phase displays.
- Implementation of closure phase displays.
- Reimplementation of optional provision for integrated display in FOCIS.
- Rationalization of keyword names
- Default forcing of analysis and filterblock size to 2^N
- Absolute normalization.
- Poly-phase filtering option
- Re-implementation of provision for analysis of simulated data
- Optional reduction of input bits
- Provision for algorithms to internally generate filter parameters.

FST CORRELATOR PROCESSING SEQUENCE