SEADAS SCHEDULES HANDBOOK

Release 0.1

Author: Alessandro Corongiu
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Release notes

Issue	Release date	What's new
01	04/02/2016	Document creation as a plain extraction of relevant sections from Pulsar Observations handbook v 0.4

Document presentation

This document illustrates how seadas schedules are structured and how to build them.

Current version presentation

This is a quick and dirty draft. Obtaiend by simply extracting all necessary informations from a wider document that illustrates how to conduct observations with the Sardinia Radio Telescope. Such informations may not be 100% up to date, since at the time of making this document a new seadas feature is under implementation. A reordered and revised version is planned to be released within a couple of weeks.

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1 - Introduction

2 - The adopted organization

3 - Schedule files

A schedule is a file that contains informations about all observations to be done in an observing run. A schedule file is organized in rows, i.e. each row contains all informations about one and one only observation. Here below is a schedule example:

```
Source = B0329+54 ; ObsLength = 1800 ; Setup = RFITEST/seadas-dfb-Cband.txt
Source = B0355+54 ; ObsLength = 1800 ; Setup = RFITEST/seadas-dfb-Cband.txt
Source = B0950+08 ; ObsLength = 1800 ; Setup = RFITEST/seadas-dfb-Cband.txt
Source = B1929+10 ; ObsLength = 1800 ; Setup = RFITEST/seadas-dfb-Cband.txt
Source = B1933+16 ; ObsLength = 1800 ; Setup = RFITEST/seadas-dfb-Cband.txt
Source = B1952+29 ; ObsLength = 1800 ; Setup = RFITEST/seadas-dfb-Cband.txt
Source = B2020+28 ; ObsLength = 1800 ; Setup = RFITEST/seadas-dfb-Cband.txt
Source = B2021+51 ; ObsLength = 1800 ; Setup = RFITEST/seadas-dfb-Cband.txt
```

Each row contains value assignments to parameters, separated by the semicolon character ';'. There are no limits on the number of lines in a schedule file and of entries in each row. It is strongly recommended to reduce as much as possible the number of entries in each line by making use of setup files. The above schedule example also shows lines with the essential entries, namely the source name, the observation length (keywords Source and ObsLength, see the general setup file section for details) and the global setup file (keyword Setup, see below).

Other parameters can be set only in a schedule file and are NOT allowed in any setup file. These parameters are name and path of the general setup file, the observation's UTC start and stop or the wait time before the data acquisition start.

The general setup file is indicated with the following syntax:

Setup = [projectcode]/[file name]

where [projectcode] is the project code and indicates that the general setup file is placed in /home/corr/setup/[projectcode], and [file name] is the name of the file.

Next section illustrates the structure of a setup file, with all related templates. All parameters that can be set in a schedule file, can be also set in a setup file. They are set by using the same keywords and the same syntax as in the **general setup file**. Backend identification codes are also the same to be used in the **general setup file**.

The observation's UTC start, keyword ObsStartHour, and UTC stop, keyword ObsStopHour, and the observation length, keyword ObsLength, allow to manage the timing of a data acquisition. UTC start and stop allowed values are expressed in the HH:MM:SS format, if the user wants to set a value for them, or assume the value 0 if the user wants to leave them unset. The observation length can be also left unset by setting ObsLength = -1. Several timing options are allowed.

1) ObsLength = [obs. length] ; ObsStartHour = 0 ; ObsStopHour = 0
The observation starts as soon as the telescope tracks the source, and lasts as indicated

by ObsLength.

2) ObsLength = [obs. length] ; ObsStartHour = HH:MM:SS ; ObsStopHour = 0
The observation starts at the UTC indicated by ObsStartHour or as soon as the telescope tracks the source, depending on which condition occurrs last. The observation will last as indicated by ObsLength.

3) ObsLength = [obs. length] ; ObsStartHour = 0 ; ObsStopHour = HH:MM:SS
The observation starts as soon as the telescope tracks the source. It lasts as indicated by ObsLength or at the UTC indicated by ObsStopHour, depending on which condition occurs first.

4) ObsLength = -1 ; ObsStartHour = 0 ; ObsStopHour = HH:MM:SS
The observation starts as soon as the telescope tracks the source, and ends the UTC indicated by ObsStopHour.

5) ObsLength = [obs. length] ; ObsStartHour = HH:MM:SS ; ObsStopHour = HH:MM:SS
The observation starts at the UTC indicated by ObsStartHour or as soon as the telescope tracks the source, depending on which condition occurrs last. It lasts as indicated by ObsLength or at the UTC indicated by ObsStopHour, depending on which condition occurs first.

Instead of explicitly setting the UTC start, the data acquisiton start can be delayed by inserting in the observation line the string:

Wait = [delay]

where [delay] is espressed in seconds. The antenna and backend configuration, as well as the telescope's slewing to the source coordinates, will begin when the schedule line is read. In this way the given delay is, within few seconds, the effective time lag since the end of the previous data acquisition to the beginning of the current one.

A schedule line is processed only after the previous observation (if any) is finished. This means that in order to be sure that an observation starts at a given UTC, the schedule line for the previous one should contain an opportune UTC stop value.

Schedule files must placed in folder /home/corr/scheds/**[project code]** where **[project code]** is the **code** assigned to the project by the TAC. If it does not exist, this folder can be created by the user as subfolder of /home/corr/scheds folder. It can be in turn organized in subfolders, and files can be placed in any of them.

4 - Setup files

Setup files are useful tools in both running a manual observation and preparing a schedule. In the first situation, the user can set in SEADAS all observation's parameters by loading a text file, instead of manually setting them all in the GUI. In the second situation, the structure of a schedule becomes very simple, straightforward human readable.

Setup files must be placed in folder /home/corr/setup/**[project code]** where **[project code]** is the **code** assigned to the project by the Time Allocation Comitee (TAC). This folder can be created by the user, it can be also organized in subfolders, and files can be placed in any of them.

All necessary informations can be in principle written in a single file, but this option may result in files containing several tens of rows. For this reason setup files can be organized in a hierarchical scheme, namely:

1) **GENERAL** setup file, where all session parameters are set, and the **ANTENNA** and **BACKENDS** setup files are indicated;
2) **ANTENNA** setup file, where all paramters are set for configuring the antenna;
3) **BACKEND** setup files, where all data acquisition parameters are set for the related bakend.

It is strongly recommended to adopt the hierarchical scheme when preparing the observation/schedule setup file. All settings for a given backend have to be placed in the same file; settings for different backends must be placed in separated files.

In setup files the syntax for setting a parameter takes the form of a value assignment:

[keyword] = [value(s)]

where [keyword] is keyword that identifies the parameter to be set and [value(s)] is a string containing the value(s) to be assigned. Here is an example:

ProjectCode = RFITEST

A given keyword may require one or more values to be specified. In the latter case, values are separated by the comma ',' character. Example:

Source = J0737-3039A , J2000 , 07:37:51.248419 , -30:39:40.71431

Unless explicitly indicated, a keyword requires one value only to be specified. A file line can contain the value assignment for one keyword only. Comments are also allowed in setup files. Any text placed at the right side of the # character is a comment. Examples:

Source = B0329+54 # this is a comment
# this is another comment

The general setup file

The general setup file contains all informations about the observing session, the antenna configuration and the backend(s) to be used. It can also contain the name of a source to be observed, possible pointing offsets with respect to the source coordinates, the telescope azimuth sector and the observation length.

In the general setup file, settings for the antenna have the following sintax:

ANTENNA > [antenna setting]

where [antenna setting] can be:

1) Setup = [projectcode]/[file name]: this line loads the antenna's setup file, which is mandatory located in folder /home/corr/setup/[projectcode] **,**or a subfolder of it.
2) [keyword] = [value(s)]: this line assigns the value [value(s)] to the antenna's parameter identified by the keyword [keyword] (see antenna sections for allowed keywords and related sintax).

Similarly, settings for backends have the following sysntax:

[backend identification code] > [backend setting]

where [backend identification code] is a three character code that identifies the backend, and [backend setting] is one of the following strings:

1) DISABLE or ENBLE: this line disables/enables the backend
2) Setup = [projectcode]/[file name]: this line loads the backend's setup file, which is mandatory located in folder /home/corr/setup/[projectcode] **,**or a subfolder of it.
3) [keyword] = [value(s)]: this line assigns the value [value(s)] to the backend's parameter identified by the keyword [keyword] (see backends' sections for allowed keywords and related sintax).

Keywords list and syntax

AzSector(*) - The telescope's azimuth sector to be used for pointing the antenna. Allowed values are CW for the clockwise sector, CCW for the couterclockwise sector, NEUTRAL for letting the pointing system to automatically choose the best sector. If unsure use the value NEUTRAL.

ObserverName - The name of the observers. Any text string is an allowed value.

ObsLength - The observation length in seconds. Its allowed values are integer numbers only.

Offsets(*) - Pointing offsets with respect to the source coordinates. Two sintaxes are

allowed:

Offsets = OFF
No offsets are applied to the source coordinates.

Offsets = [coordinate system],[long. offset],[lat. offset]
[coordinate system] is the coordinate system in which offsets value are expressed. Allowed values are J2000 (clestial coordinates) and AZ/EL (horizontal coordinates). [long. offset] is the offset in decimal degrees to be applied to the right ascension or the azimuth coordinate while [lat. offset] is the offset in decimal degrees to be applied to the declination or the elevation coordinate, accordingly to the the value of [coordinate system].

ProjectCode - The project code, i.e. the code assigned by the TAC.

ProjectName - The project name. Any text string is an allowed value.

Source(*) - The source name and its coordinates. Two syntaxes are allowed.

Source = [source name]
The source whose name is [source name] is set with its J2000 catalogue coordinates.

Source = [source name],[coordinate system],[longitude],[latitude]
The source whose name is [source name] is set with coordinates [longitude] and [latitude], expressed in the [coordinate system] coordinate system. Allowed values for [coordinate system] are J2000 (clestial coordinates), GALACTIC (Galactic coordinates) and AZ/EL (horizontal coordinates). [longitude] is the right ascension, the Galactic longitude or the azimuth value, [latitude] is the declination, the Galactic latutide or the elevation value, accordingly to the value for [coordinate system].

Keywords indicated by the (*) mark denote parameters, whose values can be set in both the general and the antenna setup file. The sintax is the exactly the same, regardless on the file where settings for these parameters are placed.

General setup file template:

ProjectCode = RFITEST
ProjectName = RFI investigation tests
ObserverName = Bachisio Angius
ObsLength = 7200
Source = B0329+54
AzSector = CCW
Offsets = J2000,0.5,1.5
ANTENNA > Setup = RFITEST/antenna-setup.txt
DFB > ENABLE
DFB > Setup = RFITEST/dfb-search.txt
DFB > Bandwidth = 512.000
ROACH > DISABLE

The antenna setup file

The antenna setup file contains the entries for selecting and configuring the receiver, enabling or disabling the calibration source, and setting the active surface shape. In this setup file, entries are also allowed for the Source name and coordinates (keyword Source), the pointing offsets (keyword Offsets), and the azimuth track sector (keyword AzSector); see previous section for details about their sintax.

Keywords list and syntax

ActiveSurface - The shape and behaviour of the active surface. Allowed values are:

- Parabolic - The shape is set to parabolic and the surface is continuously controlled.
- ParabolicFixed - The shape is set to parabolic and the surface is kept fixed.
- Shaped - The shape is set to shaped and the surface is continuously controlled.
- ShapedFixed - The shape is set to shaped and the surface is kept fixec.
- ReceiverDefault - Each receiver has been assigned a default configuration for the active surface. These defaults are ParabolicFixed for the L-Band, P-Band and LP-DUAL receiver, Shaped for the C-BAND receiver. If unsure use this value.

CalSource - This keyword allows to switch ON and OFF the calibration source. It must be placed after the Receiver keyword. Values are ON and OFF, with an obvious meaning. **N.B.: The use of the calibration source is a bit involved, since it needs to be enabled in the antenna control, but its fast switching is actually controlled by the DFB backend. Appendix A illustrates in detail all necessary steps to perform a calibration data acquisition.**

Receiver - The receiver to be used and its configuration parameters. Its sintax is:

Receiver = [receiver name],[receiver parameters]

where [receiver name] is the name of the desidered receiver and [receiver parameters] is a sequence of comma separated values. The number and meaning of these values depend on the selected receiver.

P-BAND

Syntax: Receiver = P-BAND,[frequency filter],[polarization],[IF distrib filter]

[frequency filter]: a one digit number that identifies the receiver's frequency filter (see NURAGHE manual for details);
[polarization]: values are Circular or Linear with obvious meaning;
[IF distrib filter]: values are: UNFILTERED, NARROW,MEDIUM,WIDE

L-BAND

Syntax: Receiver = L-BAND,[frequency filter],[polarization],[local oscillator frequency],[IF distrib filter]

[frequency filter]: a one digit number that identifies the receiver's frequency filter (see NURAGHE manual for details);
[polarization]: values are Circular or Linear with obvious meaning;
[local oscillator frequency]: the frequency in MHz of the local oscillator for signal's downconversion (see NURAGHE manual for the range of allowed values).
[IF distrib filter]: values are: UNFILTERED, NARROW,MEDIUM,WIDE

LP-DUAL

Syntax: Receiver = LP-DUAL,[P-BAND frequency filter],[P-BAND polarization],[L-BAND frequency filter],[L-BAND polarization],[L-BAND local oscillator frequency],[IF distrib filter]

[P-BAND frequency filter]: a one digit number that identifies the P-BAND receiver's frequency filter (see NURAGHE manual for details);
[P-BAND polarization]: P-BAND polarization mode: Circular or Linear;
[L-BAND frequency filter]: a one digit number that identifies the L-BAND receiver's frequency filter (see NURAGHE manual for details);
[L-BAND polarization]: L-BAND polarization mode: Circular or Linear;
[L_BAND local oscillator frequency]: the frequency in MHz of the local oscillator for the L-BAND signal's downconversion (see NURAGHE manual for the range of allowed values).
[IF distrib filter]: values are: UNFILTERED, NARROW,MEDIUM,WIDE

C-BAND

Syntax: Receiver = C-BAND,[local oscillator frequency],[bandwidth]

[local oscillator frequency]: the frequency in MHz of the local oscillator for signal's downconversion (see NURAGHE manual for the range of allowed values).
[bandwidth]: the width in MHz of the receiver's frequency filter. NURAGHE manual contains the allowed values. Due to a still unfixed bug, values have to be specified with only one decimal digit. Example: if the desidered bandwidth is 300MHz, the string 300**.0** has to be specified.

Antenna setup file templates:

P-BAND template:

ActiveSurface = ReceiverDefault
Receiver = P-BAND,2,Linear,NARROW
CalSource = OFF

L-BAND template:

ActiveSurface = ReceiverDefault
Receiver = L-BAND,4,Linear,2316.000,MEDIUM
CalSource = OFF

LP-DUAL template:

ActiveSurface = ReceiverDefault
Receiver = LP-DUAL,2,Linear,4,Linear,2316.000,WIDE
CalSource = OFF

C-BAND template:

ActiveSurface = ReceiverDefault
Receiver = C-BAND,5800.0,730.0
CalSource = OFF

The backend setup file

The backend setup file contains entries for setting the data acquisition parameters for a given backend. Data acquisition parameters can be divided in two groups. To the first one those parameters belong, that are common to any backend (e.g. the central value and width of the frequency band, the nuber of frequency channels, etc.). The value for any parameter of this group may be set or not in the setup file, accordingly to the backend's own way for setting its parameters. Any parameter must be considered as settable through a setup file, unless explicitly indicated in the specific backend's dedicated section.

To the second group those parameters belong, that are specific for a given backend (e.g. the cycle period for the Pulsar Digital Filterbank). Keywords for first group parameters are illustrated in this section, while keywords for second group parameters are illustrated in the related backend section. Complete templates are provided for each backend at the end of the related sections.

Keyword list and syntax

Bandwidth - The width in MHz of the frequency band (e.g. 512.000).

BitsPerSample - The number of bits to represent each data sample (1,2,4,8)

ChannelWidth - The width in MHz of each frequency channel (e.g. 0.500).

Frequency - The value in MHz of the central frequency (e.g. 1548.000).

InvertedFreqs - YES if the observing band is inverted after signal's down conversion, else NO (case insensitive).

Mode - The data acquisition mode. See each backend section for the allowed values .

NumberOfChannels - The number of channels in the frequency band (e.g. 512).

NumberOfPols - The number of polarization to be recorded. values are 1 = total intensity , 2 = left and right intensity only, 4 = left and right intensity and phase

ProfileBins - The number of bins in profile (pulsar FOLD mode only, integer powers of 2)

SubintTime - The subintegration's time (seconds, pulsar FOLD mode only)

SamplingTime - The sampling time (microseconds, pulsar SEARCH mode only)

DedispersionMode – The way dedispersion is performed (COHERENT/INCOHERENT)

DispersionMeasure – The value of the dispersion measure for dedispersion (pc cm^{-3}).

Pulsar Digital Filterbank setup file

The Pulsar Digital Filterbank is identified in the general setup file by the keyword **DFB**. Its custom parameters' keywords are illustrated here below. The following parameters cannot be directly set, since their values are already indicated in the DFB configuration file (keyword ConfigFile):

Bandwidth
ChannelWidth
NumberOfChannels
ProfileBins

These parameters are ignored since they cannot be managed by the DFB

DedispersionMode
DispersionMeasure

Keywords NumberOfPols and BitsPersample can be set only in *search* and *searchset* modes, while in *fold* and *psrcal* modes their values remain to their defaults:

NumberOfPols = 4
BitsPerSample = 8

Keyword list and syntax

CalPars - Parameters for the calibration source. The syntax is:
CalPars = [cal phase],[cal width]
where [cal phase] is the pulse phase at which the cal signal rises, and [cal width] is the width of the cal signal. Both values are float numbers between 0.0 and 1.0 in units of the pulsar period.

ChannelRange - The channel range to be acquired. Values are all => all channels, ch1-ch2 => channel range (e.g. 20-980)

ConfigFile - The Pulsar Digital Filterbank configuration file. See the related documentation for the allowed configurations.

Cycle - The cycle period, between 2 and 30 seconds.

MaxFileLength - The maximum file length in seconds (pulsar SEARCH mode only, integer values, 0 = unlimited length)

Mode - The data acquisition mode. Allowed values for this backend are FOLD,PSRCAL, SEARCH, SEARCHSET.

ObservationType - The observation type: NORMAL, WBPSR. Set WBPSR for all pulsar modes.

SamplesSubint - The number of samples for each data block (SEARCH mode only, integer power of 2)

TimeConstant - The time to calculate the average bandpass in seconds (integer values greater or equal to 1. If unsure use 1)

writeFile - YES means that data are written on file, NO means that no file is open for writting data. Ignored in SEARCHSET mode.

Pulsar Digital Filterbank template for pulsar FOLD mode

Mode = FOLD
Frequency = 1548.000
InvertedFreqs = No
SubintTime = 60
ObservationType = WBPSR
ConfigFile = pdfb3_512_512_512
ChannelRange = all
writeFile = YES
Cycle = 10.000

Pulsar Digital Filterbank template for pulsar PSRCAL mode

Mode = PSRCAL
Frequency = 1548.000
InvertedFreqs = No
SubintTime = 60
ObservationType = WBPSR
ConfigFile = pdfb4_512_512_512
ChannelRange = all
writeFile = YES
Cycle = 10.000
CalPars = 0.25,0.50

Pulsar Digital Filterbank template for pulsar SEARCH mode

Mode = SEARCH
Frequency = 1548.000
InvertedFreqs = NO
SamplingTime = 125
NumberOfPols = 1
BitsPerSample = 1
ObservationType = WBPSR
ConfigFile = srch_512_128
ChannelRange = all
TimeConstant = 1
MaxFileLength = 0
writeFile = YES
Cycle = 10.000
SamplesSubint = 512

Pulsar Digital Filterbank template for pulsar SEARCHSET mode

Mode = SEARCHSET
Frequency = 1548.000
InvertedFreqs = NO
SamplingTime = 125
NumberOfPols = 1
BitsPerSample = 1
ObservationType = WBPSR
ConfigFile = srch_512_128
ChannelRange = all
TimeConstant = 1
MaxFileLength = 0
Cycle = 10.000
SamplesSubint = 512

ROACH setup file

The ROACH backend is identified in the general setup file by the keyword **ROACH**. The Keyword ChannelWidth is not used for this backend.

The bandwidth must be an integer multiple of 16 MHz, not grater than 128MHz. The central freqeuncy is adjusted so that the requested bandwitdh is along entire 16 MHz sub-bands. The number of channels is adjusted so that it is an integer power of 2 times the number of requsted subbands. All these adjustmens are done to the closest value that matches the mentioned requirements.

The coherent dedispersion can be requested in FOLD and SEARCH mode only. In SEARCH mode the value for the DM is mandatory, while in FOLD mode this value is the one included in the ephemeris file.

The keyword AdvancedOptions is available in FOLD and SEARCH mode, and needs some explanations that are addressed to users who are expert in the use of codes dspsr (fold) and/or digifil (search): the codes that process the baseband data files and create the final files. Not expert users are encouraged to use the value *none* for this keyword and tune the basic options only. The statement “basic options” needs, of course, to be well detailed. Here below there is the list of those options that are considered as “basic options”.

FOLD mode – routine dspsr

-F <N>[:D] create an N-channel filterbank [with coherent dedispersion]
-b nbin number of phase bins in folded profile
-L seconds create integrations of specified duration

SEARCH mode - routine digifil

-b bits number of bits per sample output to file
-F <N>:D] create an N-channel filterbank (voltages only) [with coherent dedispersion]
-D dm set the dispersion measure
-t nsamp decimate in time
-d npol 1=PP+QQ, 2=PP,QQ, 3=(PP+QQ)^2 4=PP,QQ,PQ,QP

Not all other options can be selected by the user, since some of them have no impact on the final file. Those that can be selected, which we refer to as “advanced options” are listed after the setup file templates.

The sintax for keyword AdvancedOptions is simple: it's a string containing the requested adavanced options as they are indicated in dspsr/digifil terminal command line. An example may better clarify the concept. Let's assume that ths user requests a fold mode data processing with advanced options, and that the correspondent dspsr command is this:

dspsr -L60 -b1024 -F512:D -skz -skzm 32 -skzs 3 -Z FFTW3

In such a line there are three basic options, -L60 -b1024 -F512:D, and four advanced options, -skz -skzm 32 -skzs 3 -Z FFTW3. Therefore, the corresponding line in the setup file is:

AdvancedOptions = -skz -skzm 32 -skzs 3 -Z FFTW3

ROACH template for BASEBAND mode

Mode = BASEBAND
Frequency = 1548.000
Bandwidth = 512.000
InvertedFreqs = No

ROACH template for pulsar FOLD mode

Mode = FOLD
Frequency = 1548.000
Bandwidth = 128.000
ProfileBins = 1024
InvertedFreqs = No
SubintTime = 10
NumOfChannels = 2048
DedispersionMode = coherent
AdvancedOptions = -Z FFTW3

ROACH template for pulsar PSRCAL mode

Mode = PSRCAL
Frequency = 1548.000
Bandwidth = 128.000
ProfileBins = 1024
InvertedFreqs = No
SubintTime = 10
NumOfChannels = 2048

ROACH template for pulsar SEARCH mode:

Mode = SEARCH
Frequency = 1548.000
Bandwidth = 128.000;
InvertedFreqs = NO
SamplingTime = 125
NumberOfPols = 1
BitsPerSample = 1
DedispersionMode = coherent
DispersionMeasure = 37.235
AdvancedOptions = none

Selectable advanced options

FOLD mode – routine dspsr

Processor options:
-Z lib choose the FFT library ('-Z help' for availability)
-dump op dump time series before performing operation
-order order data optimally when possible [default:true]

RFI removal options:
-2 code * unpacker options ("2-bit" excision)
-skz apply spectral kurtosis filterbank RFI zapping
-noskz_too also produce un-zapped version of output
-skzm samples samples to integrate for spectral kurtosis statistics
-skzs stddevs number of std deviations to use for spectral kurtosis excisions
-skz_start chan first channel where signal is expected
-skz_end chan last channel where signal is expected
-skz_no_fscr do not use SKDetector Fscrunch feature
-skz_no_tscr do not use SKDetector Tscrunch feature
-skz_no_ft do not use SKDetector despeckeler
-sk_fold fold the SKFilterbank output

Dispersion removal options:
-G nbin create phase-locked filterbank
-cyclic N form cyclic spectra with N channels (per input channel)
-cyclicoversample M use M times as many lags to improve cyclic channel isolation (4 is recommended)
-D dm over-ride dispersion measure
-K remove inter-channel dispersion delays
-x nfft|minX over-ride optimal transform length
-R apply time-variable narrow-band RFI filter
-pac dbase * pac database for phase-coherent matrix convolution
-fft-bench use benchmark data to choose optimal FFT length

Detection options:
-d npol 1=PP+QQ, 2=PP,QQ, 3=(PP+QQ)^2 4=PP,QQ,PQ,QP

-n ndim [experimental] ndim of output when npol=4
-4 compute fourth-order moments

Folding options:
-p phase reference phase of rising edge of bin zero
-E file pulsar ephemeris used to generate predictor
-P file phase predictor used for folding
-w file phase predictors used for folding.
-X name additional pulsar to be folded

Time division options:
-s create single pulse sub-integrations
-turns N create integrations of specified number of spin periods
-Lepoch MJD start time of first sub-integration (when -L is used)
-Lmin seconds minimum integration length output
-y output partially completed integrations

Output archive options:
-a archive output archive class name
-e ext output filename extension
-no_dyn disable dynamic extensions
-j job psrsh command run before output
-J a.psh psrsh script run before output

Options not listed as basic nor as advanced will be ignored.

SEARCH mode - routine digifil

Processor options:
-Z lib choose the FFT library ('-Z help' for availability)
-dump op dump time series before performing operation
-c keep offset and scale constant
-x nfft backward FFT length in voltage filterbank
-K remove inter-channel dispersion delays
-d npol 1=PP+QQ, 2=PP,QQ, 3=(PP+QQ)^2 4=PP,QQ,PQ,QP
-P ipol process only a single polarization of input
-l secs rescale interval in seconds
-s fac data scale factor to apply
-p revert to FPT order

Appendix A - Calibration source acquisition

The use of the noise source for calibration purposes requires a dedicated setup that is planned to be fully automated in SEADAS in the near future. Given the current lack of such automatization, the user has to follow one of the following procedures while preparing the schedule. The first one is addressed to the user who wishes to use the PDFB for the data acquisition; conversely, the second one must be followed by the user who is not interested in using the PDFB.

C.1. The user wants to acquire data with the PDFB, and maybe other backends.

The schedule line for the calibration observation is the same as for the on-source folding mode observation, but for the following changes:

Source = [source name]_R,J2000,[offset RA],[offset DEC]

Explanation: The source name must be followed by the _R suffix, the coordinates system must be always J2000, the telescope must be pointed at about one degree offset position with respect to the source position

DFB > Mode = PSRCAL

Explanation: The PDFB must be instructed to operate in PSRCAL mode, in order to command the fast switching of the calibration source.

ANTENNA > CalSource = ON

Explanation: The calibration source must be enabled in the antenna control procedures

Example (to be put in one single line in the schedule):

```
Source = B0329+54_R,J2000,03:33:00.000,+55:30:00.000 ; Setup =
S1234/mySetup.stp , DFB > Mode = PSRCAL ; ANTENNA > CalSource = ON
; ObsLength = 120
```

C.2. The user is not interested to acquire data with the PDFB.

The fast switching on and off of the calibration source is triggered by the PDFB. For this reason this backend should be enabled and some settings should be given to it. As in the previous case, the schedule line for the calibration observation is the same as for the on-source folding mode observation, but for the following changes:

Source = [source name]_R,J2000,[offset RA],[offset DEC]

Explanation: The source name must be followed by the _R suffix, the coordinates system must be always J2000, the telescope must be pointed at about one degree offset position with respect to the source position

ANTENNA > CalSource = ON

Explanation: The calibration source must be enabled in the antenna control procedures

DFB > ENABLED

Explanation: The PDFB must be enabled so that the nouse source can be fast switched on and off

DFB > Setup = PDFBCal.txt

Explanation: Settings for the PDFB are indicated in a text file called PDFBCal.txt, which must be plasec in the directory /home/corr/setup/**[project code]**. The content of this file is the following:

Mode = PSRCAL
Frequency = 1548.000
InvertedFreqs = No
SubintTime = 10
ObservationType = WBPSR
ConfigFile = pdfb4_512_512_512
ChannelRange = all
writeFile = NO
Cycle = 10.000
CalPars = 0.25,0.50

Example (to be put in one single line in the schedule):

```
Source = B0329+54_R,J2000,03:33:00.000,+55:30:00.000 ; Setup = S1234/mySetup.stp , DFB > ENABLED ;
DFB > Setup = PDFBCal.txt ; ANTENNA > CalSource = ON ; ROACH > ENABLED; ObsLength = 120
```

N.B. The schedule line for the on-source observation MUST contain the statement:

DFB > DISABLED

Example (to be put in one single line in the schedule):

```
Source = B0329+54 ; Setup = S1234/mySetup.st ; DFB > DISABLED ; ROACH > ENABLED; ObsLength = 3600
```