Appendix B cacor reference

The CACOR program controls the correlator and correlator functions It runs on CACCC1 and is normally displayed on a VNC display.

CACOR will normally already be running before you start observing. If it isn't, start it by typing:

CACOR> cacor

A display similar to the one below should be generated on the CACCC VNC window.

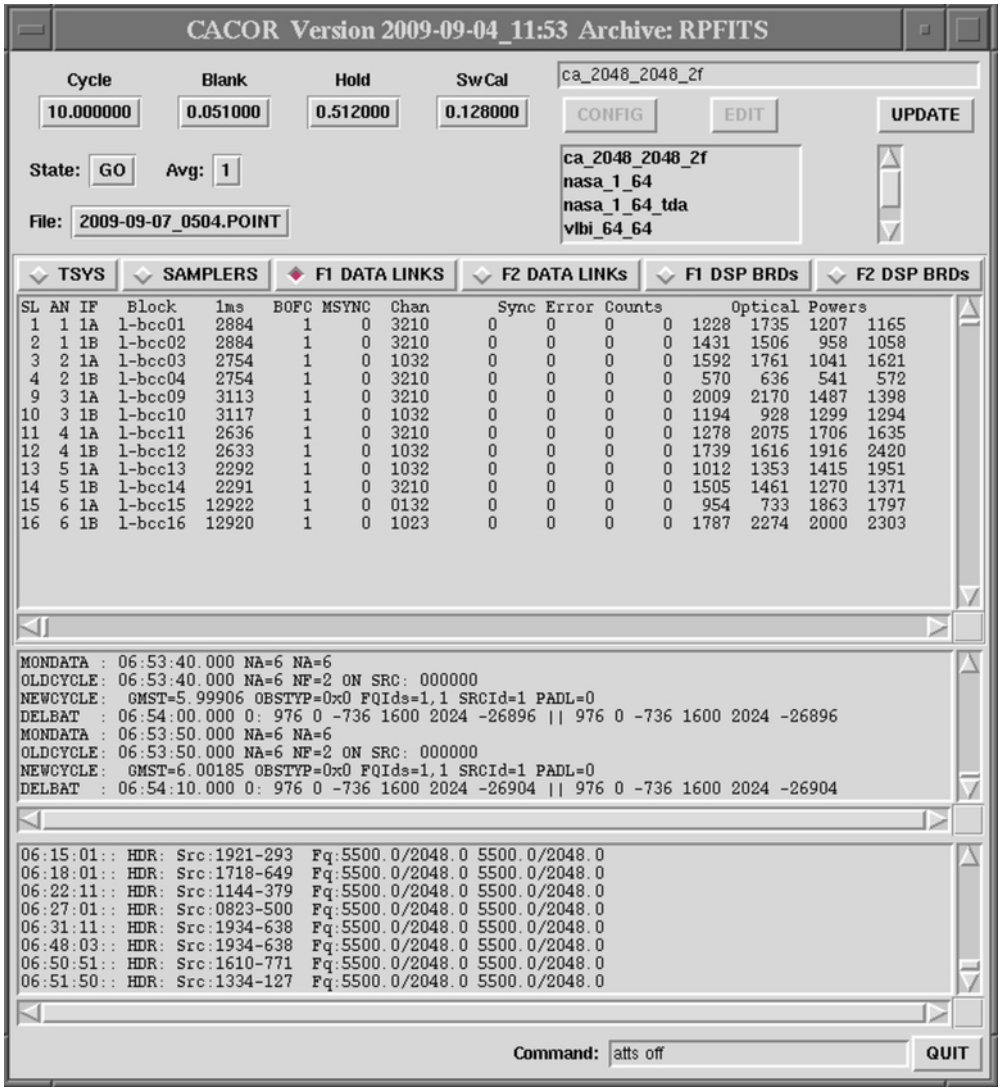

Figure B.1: A typical CACOR display.

The CACOR window has five panels:

B.1 Cacor Status Panel

The top panel in the CACOR GUI gives information on the correlator status.

B.2 Cacor Data Panel

B.3 Cacor Timing Panel

B.4 Cacor Log Panel

B.5 Cacor Command Panel

B.6 Cacor Commands

`abph[ase] #1 #2`

Set the desired phase (in degrees) to insert between the A and B polarisations of each antenna. The phase will not be inserted however until a `pcal a` command is issued.

The most useful purpose for this command is to switch between linear polarisation (for which #1 and #2 are both 0) and circular polarisation, which requires a phase shift of $\pm 90^{\circ}$ between the linear feeds. This is most commonly used for VLBI experiments and NASA tracking, which record circular polarisation. Example:

```
abph -90 -90
```

This command will produce circular polarisation output from the tied array units, for all bands except 20/13cm.
Related commands: `pcal, catie pol`

`acal #1 #2 [a]`

Tells the correlator that the current amplitude at the centre of the `tvchannel` range is #1 in IF1, and #2 in IF2. The correlator uses this information when calculating the system temperature that it writes into the RPFITS files. If the command is given with the trailing `a` modifier, then the correlator will apply the calibration.
Related commands: `dcal, pcal, tvchannels, reset acal, calband`

`att{1,2} ca0n #1 #2`

Set the CABB attenuators on IF1 (`att1`) or IF2 (`att2`), antenna `n` to #1 for polarisation A and #2 for polarisation B. The current CABB attenuator settings are shown in the "Sampler Levels" tab in the data panel. There is an automatic attenuator servoing command for doing this rapidly without user intervention, called `atts`.
Related commands: `atts`

`atts[ervo] [{on,off}]`

Attenuator servoing will make the correlator attempt to bring the sampler/GTP statistics into line with the target that was set with `tatts`. It does this by adding or removing attenuation on a per-antenna, per-polarisation, per-IF basis. It may take a relatively large number of cycles (more than 5) to accomplish this, and may not be able to precisely meet the target specified.

Without arguments, this command returns the current state of the attenuator servoing mechanism (which can also be found in the status panel). To start/stop the servoing mechanism, issue this command with the `on/off` argument respectively. It is important to check the resultant attenuation levels (shown on the "Sampler Levels" tab in the data panel) for potential problems during this process.
Related commands: `tatts, userms, usegtp, atts`

`calband [#1 #2]`

This command changes the IFs that the correlator uses to determine the delays, phases and amplitudes. In normal observing with a configuration that provides both 2 GHz continuum IFs (eg. **CFB 1M-0.5k**), these quantities should be calculated from the continuum IFs. To ensure this, #1 and #2 should both be set to 0:

```
calband 0 0
```

If the correlator configuration does not provide the 2 GHz continuum IFs (eg. **cfb64_2f_zm1**), then it is necessary to use the zoom bands to correct the delays and phases. In this case, for example, it would be necessary to issue the command:

```
calband 3 4
```

After this command, all the variables that normally apply to the continuum bands (eg. `tvchannels`, `dcal`, `pcal`, `acal`, `delavg`) will now apply to the first and second zoom bands respectively.
Related commands: `acal`, `dcal`, `pcal`, `tvchannels`, `abphase`, `delavg`, `tatts`, `atts`

`calf[req] [{1,2}]`
Specify the IF to use when manually correcting the delay with the `doffset` command. Without arguments, this command will return the currently selected IF.
Related commands: `calpol`, `doffset`

`calp[ol] [{a,b}]`
Specify the polarisation to use when manually correcting the delay with the `doffset` command. Without arguments, this command will return the currently selected polarisation.
Related commands: `calfreq`, `doffset`

`calrefant [ca0n]`
Set the antenna to reference all other antenna against for calibration. As with `refant`, this is usually best set to antenna 2, if it is included in the array. If this command is issued without arguments, it returns the current setting of this variable.
Related commands: `refant`

`[ca]tie` Shows the current catie settings.
Related commands: `catie reset`, `catie gain`, `catie pol`.

`[ca]tie array #1 #2`
Tie the output of antenna(s) # into the tied array output. Example:

```
tie array 123456 123456
```

This command would tie the signals from all the ATCA antennas together.
Related commands: `catie reset`, `catie gain`, `catie pol`.

`[ca]tie pol {c,l} {c,l}`
Sets the output to have circular or linear polarisation for each IF. Example:

```
tie pol c c
OR
tie pol l l
```

Related commands: `catie reset`, `catie gain`, `catie array`.

`[ca]tie gain {#1 #2,auto}`
Sets the gain for the tied array output for each IF. If all antennas are tied, a gain of 0.1 is recommended. The gain can be set to change automatically by specifying `auto` instead of the IF gains.
Related commands: `catie reset`, `catie pol`, `catie array`.

`[ca]tie reset`
Resets the output from the tied array output module in the correlator.
Related commands: `catie gain`, `catie pol`, `catie array`.

`cf [#1 [#2]]`
Without arguments, this command prints the current setting of the CABB local oscillator for each continuum IF. With arguments, this command allows you to set the CABB local oscillator frequency (specified in MHz) for each continuum IF. The LOs can be set to frequencies between 4928 - 10928 MHz.

`cfoffset [#1 #2]`

This command can be used to place the 64 MHz channels available in the **vlbi_64_64_tda** and **vlbi_64_1_tda** configurations away from the normal central frequency of the band. The `#1` and `#2` parameters can be one of `-1,0,1`, which shifts the central frequency of the 64 MHz channel away from the central frequency listed in the schedule by -512,0,512 channels respectively. Whether each shift corresponds to an increase or decrease in real frequency is determined by the sideband of the IF.

This is especially useful in the 20/13cm band, where the LO can only be tuned down to a central frequency of ∼1750 MHz. To allow for the 64 MHz VLBI channel to cover the neutral hydrogen frequencies, the central frequency is specified as 1912 MHz (1400 + 512), and the `cfoffset` is set to `1 1` (as 20/13cm is lower-sideband). **Note:** this command must be issued before the scan is started in the VLBI configurations.
Related commands: `tvchannels`

`[no]czabs`

This command enables (with `czabs`) or disables (with `noczabs`) the correlator's auto-correction and online application of the zoom bandpasses. Since the zoom bands are digitally constructed, their bandpass shapes can be accurately determined during the observation, and corrected before being written out to the data file. Use this command to disable this behaviour, as it is enabled by default.

`dcal [a]` Tells the correlator to estimate the delay in each of the first two IFs, using the data in the `tvchannels` range, averaged by `delavg` channels for the previous 3 cycles. If the a modifier is included, then the correlator will apply the appropriate correction to bring the delay in each IF back to 0.
Related commands: `acal, pcal, tvchannels, delavg, calband, nncal, reset delay`

`delavg [#]`

Set the number of channels to average together within the `tvchannels` range, in order to increase the accuracy of the delay determination by the correlator. The correlator calculates the delay by attempting to fit a straight line to the phase as a function of frequency across the tvchannels. If the source is not very bright, then the signal-to-noise ratio of the phase values will be small, and the delay fit will not be well constrained. By increasing the `delavg` quantity, the number of points used for the fit will decrease, but the amount of data contributing into each point will increase, hence improving the signal-to-noise ratio, and helping to constrain the fit.

This command is especially useful at higher frequencies, and is almost necessary in the 3mm band, due to the lower sensitivity of that receiver.
Related commands: `tvchannels, dcal`

`delcorr fn`

Recover the delay settings used for the current frequency configuration, after the correlator has been reprogrammed. This is known to work when going between the standard **CFB 1M-0.5k** configuration and any of **nasa_1_64_tda** (NASA tracking), **vlbi_64_64_tda** and **vlbi_64_1_tda** (VLBI). It works on a single IF at a time, and the correlator should be allowed to settle for a few cycles after a reprogram before this command is issued.
Related commands: `dcal, pcal, abphase, cfoffset`

`delscan fN offset,incr`

Start the correlator scanning through additional delay offsets. Example:

```
delscan f1 -40 4
```

This command will make the correlator subtract 40ns of delay from each antenna (except the reference antenna), and then add 4ns of delay per subsequent cycle. By looking at the

amplitudes at each cycle, it is then possible to determine which offset is closest to the systemic delay for each antenna. These offsets can be added into the correlator with the `doffset` command. This command will continue to operate until the `nodelscan` command is issued.

This command is not usually necessary during normal setup procedures.
Related commands: `doffs, dcal, nodelscan`

`diginit {all,ca0n [{1,2}{a,b}]}`

Resets the digitisers out at the specified antennas. These digitisers can either be specified as:

`all` Reset all digitisers.

`ca0n` Resets all digitisers associated with antenna `n`.

`ca0n {1,2}{a,b}`
Reset a single digitiser. Example:

```
diginit ca02 2b
```

This will reset only the digitiser associated with antenna 2, second IF, B polarisation.

This command is most appropriately used if the input shown in the "Data Links" tab is coloured red, and an `rtminit` of that input has failed to restore it. That is, it is generally advisable to attempt an `rtminit` before attempting a `diginit`.
Related commands: `rtmreset,rtminit`

`doffs[set] [ca0n=#]`

Allows for manual correction of delay offsets. Without arguments, this command will print all the current delay offset numbers for the current IF (selected by `calfreq`) and polarisation (selected by `calpol`). This command allows for direct setting of these delay offsets. The reference antenna will always have a delay offset of 0. A positive offset then means that the correlator will receive the same wavefront from that antenna before the reference antenna, and a negative offset means that the correlator will receive the same wavefront from that antenna after the reference antenna. Example:

```
calf 1
calp b
doffs ca01=-432
```

This command tells the correlator to expect the antenna 1, IF1, B polarisation signal 432 ns after that of the reference antenna. **Note:** this is not merely a function of geometric delay, but will also include the travel time along the cables from the antenna to the correlator, etc. It is therefore not easily apriori calculable by non-experts.

This command is most useful for rough correction of delay if the phase is wrapping too quickly for the correlator to determine the appropriate delay correction automatically with the `dcal` command. It is not usually necessary for this command to be used.
Related commands: `calfreq, calpol, dcal, delscan`

`f[un]flag f[N] [{#,#1-#2,default,birdies}] ...`

Flag (`fflag`) or unflag (`funflag`) the channel `#`, or channel range `#1-#2` from IF`N`. By flagging a channel, it no longer contributes to the phase, delay or amplitude calculated by the correlator, even if it lies within the `tvchannels` range. A flagged channel also is written out to the RPFITS file as having precisely 0 amplitude, and has its flagged bit set. Example:

```
fflag f1 1187 2001
```

This command would flag out channels 1187 and 2001 from IF1. Example:

`funflag f2 1800-1840`

This command would unflag all channels between 1800 and 1840 inclusive.

There are two arguments – `default` and `birdies` – that flag specific channels that are known to often or always be bad. For `default` these channels are 513, 1025 and 1537. For `birdies` these channels are 129, 157, 257, 641, 769, 1153, 1177, 1281, 1409, 1793 and 1921. The `default` argument is normally not required to be issued, except when changing to the 64 MHz zoom modes. The `birdies` argument is always recommended while using the **CFB 1M-0.5k** configuration. Without arguments, this command returns the current number of unflagged channels in both IFs, which should never be more than 2046 (2049 channels total - 3 always flagged `default` channels).
Related commands: `tvchannels`

`gpib` Connect to the DTT Interface LO synthesizer required for NASA tracking. If the correlator hangs when this command is issued, it is possible that a hardware reset and power cycle of the GPIB box in the screened room is required.

`nncal [#]` This command changes the number of cycles the correlator uses to determine the delays and phases to that specified as #. Normally, this number is 3 (cycles), but for NASA tracking, where self-calibration of the phases is enabled, it is more accurate to only consider the latest cycle, so it is usually set to 1 in this case. Issuing this command without an argument will return the current setting.
Related commands: `selfcal`

`nodelscan`

This command stops the correlator from continuing the delay scanning procedure that was started with the `delscan` command.
Related commands: `delscan`

`pcal [a]` Tells the correlator to estimate the phase in each of the first two IFs, using the data in the `tvchannels` range, for the previous 3 cycles. If the a modifier is included, then the correlator will apply the appropriate correction to bring the phase in each IF back to 0.
Related commands: `acal, dcal, tvchannels, calband, nncal, abphase`

`phoffs[et] [ca0n=#]`

Allows for manual correction of phase offsets. Without arguments, this command will print all the current phase offset numbers for the current IF (selected by `calfreq`) and polarisation (selected by `calpol`). This command allows for direct setting of these phase offsets. Example:

```
calf 1
calp b
phoffs ca01=18
```

These commands tell the correlator to make the phase offset on antenna 1, IF1, B polarisation, 18 degrees.

This command is most useful for rough correction of phase. It is not usually necessary for this command to be used.
Related commands: `calfreq, calpol, pcal`

`refant [n]`

Set antenna `ca0n` as the reference antenna. For most arrays and setups, CA02 is most useful as the reference antenna. If the argument is not given, the current reference antenna is displayed.
Related commands: `calrefant`

`reset` **DO NOT ISSUE THIS COMMAND. THIS WILL CAUSE THE CORRELATOR GUI TO FAIL (REQUIRING A RESTART) AND THE UNIVERSE TO MORPH INTO A CATERPILLAR.**

`reset abdel[ay]`

Reset only the cross-polarisation delays.
Related commands: `reset delays`

`reset acal`

Reset the gain to amplitude scaling factors that are set after doing an `acal`.
Related commands: `acal`

`reset delays`

Reset the correlator delay offsets back to their geometric default. This command can be useful if a `dcal` has apparently made the delay worse, to the point that it has become very difficult or impossible for the correlator to calculate the remaining delay.
Related commands: `reset abdelay`

`rtminit {all,ca0n [{1,2}{a,b}]}`

Resets the "rapid transport module" (RTM) on the specified inputs. These inputs can either be specified as:

`all` Reset all RTMs.

`ca0n` Resets all RTMs associated with antenna `n`.

`ca0n {1,2}{a,b}`
Reset a single RTM. Example:

```
rtminit ca02 2b
```

This will reset only the RTM associated with antenna 2, second IF, B polarisation.

This command is most appropriately used if the `1ms` values for some input(s) (shown in the "Data Links" tabs) are very much different from the expected values.
Related commands: `rtmreset,diginit`

`rtmr[eset]`

Reset the sync error counts in the "Data Links" tabs in the data panel. This can be useful if the error counts are high, but it is not clear whether they are continuing to increase. This command will immediately (ie. on the next cycle) reset the counts to 0, so if any counts remain non-zero after this command, errors are still present.
Related commands: `rtminit, diginit`

`selfcal [{#1 #2,{on,off}}]`

The correlator is able to continuously adjust the phases on a cycle-by-cycle basis in order to keep them as close to zero as possible. This is only possible while observing a bright calibrator or spacecraft, and is only really useful for VLBI and NASA tracking.

The command format `selfcal #1 #2` instructs the correlator to use the phases determined from IF#1 to correct IF1, and the phases determined from IF#2 to correct IF2. For NASA tracking, where IF1 is configured to be 2 GHz, 2048 channels, and IF2 is configured to be 64 MHz, 1 channel, the appropriate `selfcal` command is:

```
selfcal 1 1
```

This is because the incoming phase of the signal coming in from a spacecraft (which will only be a few MHz wide) can not be determined from a single 64 MHz channel.

The command format `selfcal {on,off}` is used to enable or disable the self-calibration process. Issuing the command without arguments will return the current self-calibration state (which is also shown in the status panel).
Related commands: `nncal, tvchannels`

`tatts [#1 #2]`

Sets the target sampler/GTP levels to #1 for IF1 and #2 for IF2. After these targets have been altered, the command `atts` should be issued. Issuing `tatts` without arguments will return the current targets. The default sampler level target is 20.0 for each IF.
Related commands: `atts, calband, userms, usegtp`

`tvchan[nels] [fn] [# #] ...`

Set the 'TV' channels. The channels in the `tvchannels` range are averaged together to produce the quantities that VIS displays, that ASSISTANCE checks, that CATAG uses for pointing corrections, that contribute to the correlator GTP values, etc. If the IF to alter is specified with `fn` (where `n` is one of the available IFs), then only 1 set of tvchannels should be specified. Example:

```
tvchannels f1 500 1600
```

This will set the IF1 tvchannels to cover the range 500-1600. If the IF is not specified, then 1 set of tvchannels should be specified for each available IF. Example:

```
tvchannels 500 1600 900 1400
```

This will set the IF1 tvchannels to cover the range 500-1600, and the IF2 tvchannels to cover the range 900-1400. If there are more IFs than this, the command will produce an error message in the log panel, but the tvchannels will still be changed for the specified IFs.

The default tvchannels usually cover the entire central half of the band (ie. channels 513-1537). To reset the tvchannels to this, substitute the channel specification with `def[ault]`.

To determine what the tvchannels are currently set to, either look at the status panel, or issue this command without arguments.
Related commands: `delavg`

`usegtp` This command causes the correlator to display the gated total power (GTP) in the `tvchannels` range for each input (antenna, IF, polarisation) in the "Sampler Levels" tab in the data panel.
Related commands: `userms, tatts, atts`

`userms` This command causes the correlator to display the voltage RMS value from the samplers on each input (antenna, IF, polarisation) in the "Sampler Levels" tab in the data panel.
Related commands: `usegtp, tatts, atts`