AIPSLETTER

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A newsletter for users of the NRAO
Astronomical Image Processing System

Written by a cast of *AIPS*

Edited by
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General developments in *AIPS*

Linux news: bad compilers

RedHat has released versions 7.0, 7.1, and 7.2 of their Linux system. The good news is that version 7.1 and beyond contain numerous system improvements including the 2.4.2 kernel. This kernel allows *AIPS* to read and write files larger than 2 Gbytes. The bad news is that these releases include and depend on the "GNU compilers version 2.96." The quote marks are added because the GNU compiler group never released a version 2.96 and they do not support this "version." We have found that this `g77` produces optimized code that is unreliable. There are problems with `IMAGR`, TV window setting, `TVFLG`, and who knows what else. *Furthermore, we have found that there are problems with GNU's version 3.0.1 through 3.0.4 compilers — the resultant code is slower and some of it fails.* We do recommend RedHat release 7.2, but you must also install the GNU compiler suite version 2.95 (now 2.95.3) (*but not GNU gcc versions 3.0 or later*) and change your local copies of `FDEFAULT.SH`, `CCOPTS.SH`, and `FDOPTS.SH` to point at it. Some other Linux distributions also include the 2.96 compiler with the same unfortunate results. Instructions for fetching and installing the GNU 2.95.3 compiler are given on the *AIPS* web page.

Current and future releases

We have reinstated the old practice of having formal *AIPS* releases, but on an annual basis with binary releases only for Solaris and Linux. All architectures can do a full installation from the source files. The next release will be called `31DEC02` and remains under development by the (reduced) *AIPS* Group. You may fetch and install a complete copy of this version at any time. This *AIPSLetter* is intended to advise you of developments to date in this new release. Having fetched `31DEC02`, you may update your installation whenever you want by running the so-called "Midnight Job" (MNJ) which uses transaction files to copy and compile the code selectively based on the code changes and compilations we have done. We expect users to take the source-only version of `31DEC02` *AIPS* over the Internet (via *anonymous* ftp).

The MNJ has been changed. The secure shell, with all its fragile complexities, is no longer required. Instead `mnj.aoc.nrao.edu` will serve up *AIPS* incrementally — or as a whole — using the Unix tool `cvs` running with anonymous ftp. Linux sites will almost certainly have `cvs` installed; other sites may have installed it along with other GNU tools. Secondary MNJs will still be possible using `ssh` or `rcp` or NFS as with previous releases. We have found that `cvs` works very well, although it has one quirk. If a site modifies a file locally but in an *AIPS*-standard directory, `cvs` will detect the modification and attempt to reconcile the local version with the NRAO-supplied version. This usually produces a file that will not compile or run as intended.

Improvements of interest to users in 31DEC02

We expect to continue publishing the *AIPSLetter* approximately every six months along with the annual releases. Despite the reduction in personnel, there have been a number of changes in 31DEC02 over its first six months. There are three new tasks: WETHR to plot the contents of the weather table including flagging data based on the contents of the table, BOXES to add Clean boxes to a BOXFILE based on source catalogs, and UVDEC to copy a *uv* data set retaining only every n^{th} spectral channel. There are also three new verbs: TKERASE to clear the contents of the Tektronix emulation display window, SG2RUN to convert the contents of a SAVE/GET file into a RUN file for use on another computer and/or user number, and OUTPUTS to show those adverbs whose values will be changed when running the task. A new RUN file called WRTPROCS provides three procedures for automated writing and reading of FITS disk files.

Other than relatively minor differences, 31DEC02 is compatible in all major ways with the 2001, 2000, 1999, and 15OCT98 releases. There are significant incompatibilities with older versions.

Imaging

IMAGR

IMAGR and all other tasks that use Clean-component models were changed to allow up to 4096 fields (or facets). This change was made mostly to support multi-resolution Clean, but the previous limit of 512 fields was onerous to some low-frequency observations.

Otherwise, almost all changes to IMAGR were in the nature of bug fixes or very minor improvements. It defends itself better against selection of a field with inadequate flux and against bad window parameters. The histogram is now done with better resolution and the BOXFILE is copied at the beginning to any new OBOXFILE. The multi-resolution Clean algorithm received special attention. A bug causing the most important steering parameter to be ignored was corrected. The computations of Gaussians were changed to achieve much improved performance. MAXPIXEL is now allowed to change on a TELL operation. The first TV display now sets the TV size correctly and selects the first image to display with improved information. The histogram is now computed only over all fields of the current resolution, MAXPIXEL is adjusted with IMAGRPRM(16) for different resolutions, and the actual parameters used for each resolution are reported.

BOXES and MFPRT

BOXES is a new task used to convert a source catalog into Clean boxes to be used with IMAGR. It reads any source catalog in the format used by *AIPS* for the NVSS and WENSS surveys, allowing one to start the Clean with boxes around known sources. MFPRT was changed to offer the option of making an output text file in this format. Doing this, one may convert the sources found in a preliminary imaging followed by SAD to a set of boxes to guide a later round of imaging.

Other imaging changes

SAD and IMFIT and JMFIT were all corrected and a patch issued. They used the phase center rather than the pointing position for the primary beam correction and used a linear shift rather than a proper non-linear angle for the delay-beam correction. This had serious effects on images well separated from the phase center.

REGRD was overhauled to function correctly on data cubes and to provide more sensible defaults for the output coordinates. Some tricks to speed the computations were also added.

FLATN was changed to do an unlimited number of pointings, although the value to use for `NOISE` for pointings in excess of 64 must be taken to be the average of the lower numbered ones.

MAPBM was overhauled to image all four Stokes into separate planes of a cube and to image each selected antenna into a separate output file.

VLBI matters

New VLBA/VLBI calibration procedures in *AIPS*

With the addition of three procedures, `VLBAUTIL`, a package of procedures for the reduction of VLBA (and most VLBI) experiments, will handle most VLBA experiments (including spectral line) from loading through fringe fitting. The additional procedures are: (1) `VLBASRT`, which sorts and indexes a dataset, if needed; (2) `VLBAFIX`, which will sort, index, split into separate frequency files, deal with subarrays, and fix polarization labeling, as needed; and (3) `VLBAMPCL`, which does manual phase-cal corrections on one or two scans. `VLBAFIX` is designed to replace 4 procedures which are already part of the package (`VLBASRT`, `VLBASUBS`, `VLBAFPOL` and `VLBAFQS`) and can/should be run after loading any dataset, as it only performs the necessary corrections. The procedure which loads VLBA data (`VLBALOAD`) has also been significantly changed so that it merges `TY`, `GC` and `PC` tables after the data are loaded. Formerly it was necessary to run `VLBAMCAL` after `VLBALOAD` to merge these tables, now it is done automatically.

For a detailed description on how to use all these procedures see a recent version of the *AIPS CookBook*, Chapter 9 and Appendix C.

Other changes

FITLD would occasionally report mysterious problems with `BA` bandpass tables which are not actually supported on the VLBA Correlator data tapes. This was due to a name collision with *AIPS*' batch files, so VLBA bandpass tables will now be named `BT` should they ever appear. The scaling of the visibilities turns out to be different for each of the VLBA, Penticton, and EVN correlators, requiring some changes to be made to `FITLD`. The VLBA Correlator jobs can have errors that cause unexpected `FQ`ids to occur in some tables — those not actually processed in the correlator. Some code to avoid self-destruction was added to `FITLD`, although this does not restore the calibration data to correctness.

CVEL and `BPASS` were changed to shift the second antenna for data from the EVN correlator, while the first antenna is used for all others. Actually, neither is shifted at this stage for the VLBA Correlator.

FRPLT was overhauled to allow a wide range of plot options for fringe-rate spectra including multiple plots per page, multiple time intervals per baseline, multiple IFs and/or polarizations together as one long spectrum, and many more.

UV data handling and calibration

WETHR, INDXR, and FILLM

In the previous release, `FILLM` was given the ability to compute initial values for `CL` table 1 to correct for the antenna gains and atmospheric opacity. In the present release, these computations were improved with minor improvements to the opacity and vapor pressure computations. A new "seasonal" average opacity model was added, along with an option to use a weighted average of the seasonal opacity and the opacity computed from the surface weather measurements. The two methods are averaged equally by default. The `HELP` file was improved and the history file now records some of what was done. An addressing bug was corrected for the gains averaged over antenna.

INDXR was revised to be able to redo the opacity and gain corrections done by FILLM while writing a new CL table 1. This requires the weather table to have been written with a short time interval but otherwise removes the dependence on tapes and FILLM in case the CL table 1 is lost or did not contain the corrections.

WETHR is a new task that will plot a wide range of parameters read or computed from the weather (WX) table now provided with both VLA and VLBA data. The same parameters that can be plotted may be used to flag the visibility data. WETHR uses the same subroutines as FILLM and INDXR to compute relative humidity, water column in mm, and zenith opacities at K and Q bands.

Other changes

SPLAT was corrected for a bug that arose when channel averaging was being done. If the number of channels specified by the BCHAN to ECHAN range was not an exact multiple of CHANNEL, then a data addressing error affecting the IFs after the first was possible. The output data for those IFs were simply wrong. A patch for this was announced.

POSSM was corrected to plot and label properly multi-IF plots and the option to include multiple polarizations in one long, correctly labeled, spectrum was added. It can also loop over polarizations. Bandpass plotting was corrected.

DEFLG was corrected to handle 4-polarization input files and to do time integration correctly. It used all of the times which was fine in a test dataset but not in the real world.

BPASS was given the option to normalize after the scan average of the data which is less biased than normalizing on a record-by-record basis. SOLINT defaults to infinity for single-source files rather than dividing by zero.

DBCON was changed to concatenate TY and WX tables as it already does CL and FG tables.

CLIPM was corrected to use the ANTENNAS and BASELINE adverbs which a typo caused it to ignore.

UVDEC is a new task to copy every n^{th} spectral channel of a *uv* dataset. Frequency-smoothing operations done by other tasks do not decrement the number of channels while other tasks average channels while decrementing.

UVMOD was corrected to compute RL and LR models properly.

Miscellaneous matters

WRTPROCS is a new RUN file which contains 3 procedures. FITDISK writes FITS disk files with names reflecting the *AIPS* logical names. WRTDISK writes FITS disk files with standardized names which can then be read back by READISK looping through numerous files. These procedures are meant to assist in backing up data and in transferring data between computers, particularly computers of dissimilar architecture (*e.g.*, PCs and SUNs).

TKERASE is a new verb to erase the Tektronix-emulation display. If a plot is left in the display, then any expose event on the window causes the full plot to be redrawn. This can occupy the computer for some time during which the user can only wait.

SG2RUN is a new verb to convert the current copy of the AIPS vocabulary to a text file suitable to be RUN on another computer and/or for another user number. A GET *SGname* ; OUTFILE = *out_name* ; SG2RUN will convert a particular SAVE/GET file into a text file, enabling the full contents, including procedure definitions and adverb values, to be transferred elsewhere.

TACOP was changed to copy any type of extension file. Previously, it would try to copy PL and other non-table extension files, but it would fail to do it properly.

External file naming has been changed to allow adverbs such as INFILE to contain the actual file name with directories rather than requiring a logical (or environment) variable name. FITS disk files will again default to the $FITS area unless a logical name or a full path name (starting with a /) are given.

CookBook chapters have been updated to mention changes in the VLBI procedures, PRTAB, BOXES, SAD *et al.*, RMSD, WETHR, and more. Appendix C was overhauled to emphasize the VLBA procedures rather than the older ways of doing things. A new appendix D on high frequency observing and data reduction techniques was added. The previous Appendix D is now called Appendix F.

PRTAB was given the adverb NDIG to tell it whether normal or extended precision is needed in its displays of floating-point columns.

All sky plotting of coordinates had some problems which were corrected.

UVCON was given the option to multiply the input model by the single-dish primary beam pattern including a shift useful for simulating mosaic observations. It can read antenna positions in up to 4 different coordinate systems.

Adverb pass-back and other programmer tidbits

Adverb values may now be passed back to AIPS by tasks. Each adverb listed in the INPUTS section of a HELP file has a code character in column 10 which tels AIPS what to do with it. An adverb is used by GO (and INPUTS) and/or TELL (and SHOW) and/or the value pass-back (and the new verb OUTPUTS). The codes are

' '	GO		
'*'	GO	TELL	
'?'		TELL	
'&'	GO	TELL	pass-back
'%'		TELL	pass-back
'$'	GO		pass-back
'@'			pass-back

If GO detects an adverb calling for pass-back, it runs the task in DOWAIT 1 mode and then reads back the changed adverb values from the task communication (TD) file. The subroutine PTPARM is used by the task to put the adverb values back in the file as a consecutive array of n values. Since the adverbs involved may not be consecutive in the inputs to the task (or even in the inputs), some care is obviously required.

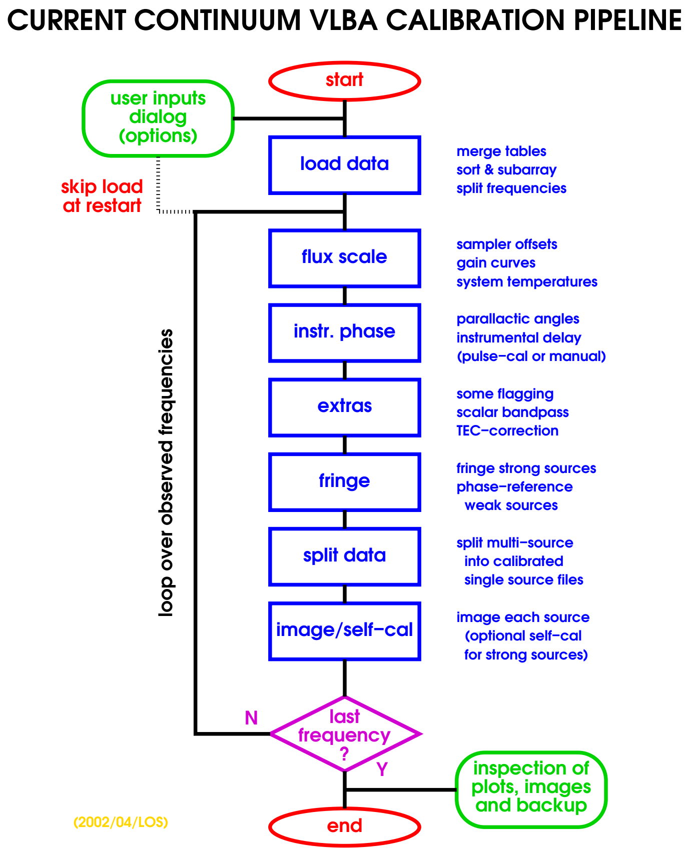
Note that the verbs INP and INPUTS only display the adverbs associated with GO; the verb SHOW only displays the adverbs associated with TELL; and the new verb OUTPUTS only displays the adverbs associated with adverb value pass-back. At present, the only task that implements this capability is IMEAN, which passes back the fitted rms and mean.

XAS.SHR was changed in a subtle way to allow the standard Unix utility sh to unpack the file into its component parts. The UNSHR program is no longer needed although it is still used for now.

Recent *AIPS* and related Memoranda

The following new *AIPS* Memoranda are available from the *AIPS* home page.

107 KRING versus FRING Tests
Amy J. Mioduszewski (NRAO)
April 8, 2002
This comparison was designed to discover whether KRING or FRING should be used for most, if not all, fringe fitting problems. Within reasonable uncertainty, FRING and KRING performed very similarly. There is some indication that the default signal to noise cutoff in KRING is too low for low signal to noise cases. As one would expect, for high flux density sources the solution interval should be set as low as possible. For low flux density sources the solution interval should be set considering both the ability to find a good solution and to interpolate accurately. The only consistent difference between KRING and FRING is that KRING runs faster than FRING a vast majority of the time, typically by factors of 1.5 to 4.



Calibration/flow options:

Skip load, (re)start at, or only do certain frequency

Continuum, pseudo–continuum (e.g. wide field), spectral line

PSEU: do not average spectral channels in SPLIT

SPEC: manual pulse–cal, and no spectral averaging

Calibration table interval, reference antenna

Apply total electron content correction

Bandpass calibrator (and time range), also used for P–cal

Sources that can/need to be fringed with optional self–cal

Phase–reference scheme

Fringe solution interval (also used for self–cal solution interval)

Interpolation for phase–reference scheme (2PT, SIMP, AMBG, CUBE)

And to check the calibration:

Image sizes for calibrators and phase–reference targets

How to show diagnostic plot files (on TV, printer)

Delivered to the user:

Per frequency one multi–source file with calibration tables

Per frequency all possible calibrated single–source files

NO plots or images (here for checking out only; user makes his own)

Figure 1: The algorithm chain and the options list.

VLBA data calibration pipeline

Currently we are working on a VLBA data calibration pipeline, as a `RUN`-file in *AIPS* that is primarily based on the `VLBAUTIL` procedures. It is intended to perform the calibration tasks and make lots of plots and some simple images to find out whether the calibration has worked — it is not supposed to perform the art of high-fidelity imaging for you. Eventually, the VLBA data calibration pipeline will be available to *AIPS* users as part of the *AIPS* distribution and the MNJ. We will soon advertise its peculiars and how to obtain a copy and its use on a web page under the VLBA's calibration section.

At the moment the VLBA data calibration pipeline works reasonably well for simple VLBA-only experiments correlated in Socorro, at frequencies between about 1 and 15 GHz, both for (pseudo-)continuum and spectral line experiments. It has been run successfully on higher and lower frequencies, but we're not advertising that yet — in particular the spectral RFI flagging must be improved. The VLBA data calibration pipeline is expected to be extended to work at a wider range of frequencies, to do polarization calibration and more robust data flagging, and to include non-VLBA antennas (in particular the single-dish VLA, GBT, and EB). Keep watching the VLBA data calibration web page for progress reports.

We're starting to run the VLBA data calibration pipeline on every suitable experiment and investigating its use and performance and how to distribute the calibrated multi- and single-source UVFITS files to the users. Images and calibration plots will not be distributed, they are only produced to check the calibration before we distribute the data to the PI. As we distribute single-source UVFITS files, the user could import the files into his/her favorite imaging package (*e.g.*, aips++, difmap) without the need to use *AIPS*.

The VLBA data calibration pipeline will be invoked (after it has been added to *AIPS*) by issuing the procedure `RUN` command defining the procedures. The user interface is, as for any other task in *AIPS*, an input table with the options available (and an explanatory `HELP`-file). At the start of the VLBA data calibration pipeline, the procedure checks the inputs, for which there are no defaults, and bombs immediately if there are errors or unexpected values. If everything is okay, the procedure starts reading the Socorro correlator distribution tape (or from a pre-loaded file), and performs the calibration, fringe-fitting, and imaging as shown in Figure 1, making plots of the most essential steps on the fly, which can be investigated easily after the procedure has finished. Note that there is some coarse flagging done, as well as a bandpass calibration (also for continuum) and an ionospheric electron content correction. The procedure, once it starts, loops over the different frequency bands, and ends when all the images are made. There are several options, such as survey calibration (large number of sources to be fringe fitted), phase-referencing schemes, and an optional self-cal (which is not yet very robust). More options and improvements are likely to be implemented later.

If, at the end, it turns out that something went wrong, it is very easy to redo the VLBA data calibration pipeline, *e.g.*, after some extra flagging, without the need to reload the data. Remember that when the VLBA data calibration pipeline starts, it does not need any user interaction until it is done, so no matter how long fringe-fitting takes, the user can concentrate on other things while the VLBA data calibration pipeline is running in a background *AIPS* window.

AIPS Distribution

The web site for downloading the `31DEC01` version of *AIPS* as well as the `31DEC02` development version was moved to the NRAO Array Operations Center in Socorro, NM. Unfortunately, as of this writing, no logging tools are in place to keep track of how many sites have downloaded these versions of *AIPS*, nor of how many sites are currently running the "Midnight Job." It is clear that some sites run the Midnight Job from accounts for which no one reads the resulting e-mail There are currently at least two sites which are running MNJs that do not work. We receive copies of the error messages on a daily basis (in one case), but are powerless to contact the culprits since no one is reading e-mail sent to the account running the MNJ. Please test your MNJ interactively and read the consequent e-mails.

The MNJ encountered a few difficulties with `cvs` early on and, at a somewhat later time, one site helped us uncover a subtle problem in timing. The former have been fixed by our `cvs`-guru, while the latter was corrected by having the NRAO provide the time information to be associated with any particular run of the MNJ. No matter when you run the MNJ, the time stamp in the `LASTGOOD.DAT` *et al.* files will be the time stamp at which the NRAO `cvs` master synchronized itself.

Patch Distribution for `31DEC01`

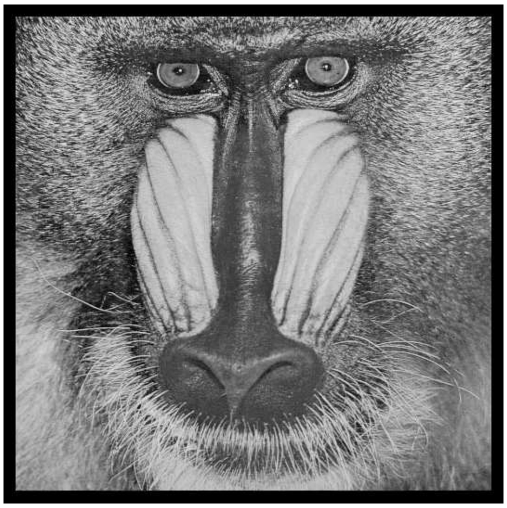
As before, important bug fixes and selected improvements in `31DEC01` can be downloaded via the Web beginning at:

`http://www.cv.nrao.edu/aips/patch.html`

Alternatively one can use *anonymous* `ftp` on the NRAO cpu `aips.nrao.edu`. Documentation about patches to a release is placed in the anonymous-ftp area `pub/aips/`*release-name* and the code is placed in suitable subdirectories below this. Information on patches and how to fetch and apply them is also available through the World-Wide Web pages for *AIPS*. As bugs in `31DEC02` are found, they are simply corrected since `31DEC02` remains under development. Corrections and additions are made with a midnight job rather than with manual patches. Remember, no matter when you received your copy of `31DEC01` *you must* fetch and install its patches if you require them.

The `31DEC01` release had a few important patches including a new one in late June. These were:

1. `SAD`, `JMFIT`, and `IMFIT` fail to handle the primary beam correction properly for offset fields *2002-02-11*.
2. `IMAGR` failed to apply the `IMAGRPRM(11)` parameter to the peak in the Clean windows *2002-02-19*.
3. `SPLAT` failed to average spectral channels properly for multiple IFs *2002-06-20*.



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FIRST CLASS

To:

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