A I P S L E T T E R

Written by a cast of $\mathcal{AIPS}$

Edited by

Eric W. Greisen

National Radio Astronomy Observatory

P.O. Box O, Socorro, NM 87801–0387

575–835–7236; Fax 575–835–7027

daip@nrao.edu
http://www.aips.nrao.edu/

Happy 42$^{\text{nd}}$ birthday $\mathcal{AIPS}$ and FITS, news

The FITS format was devised in a meeting at the VLA site on March 27 and 28, 1979. Don Wells (then of NOAO) and Eric Greisen (still of NRAO) were the primary authors while Barry Clark and other NRAO staff members provided valuable suggestions. The FITS format, enhanced by later extensions, is still in wide spread use in astronomy and is the envy of other scientific fields. Then the FITS format colored the design of the $\mathcal{AIPS}$ internal formats. The $\mathcal{AIPS}$ project was begun officially on July 1, 1979 and has stood the test of time remarkably well.

Due to the outbreak of the COVID-19 pandemic, the NRAO went to "infectious disease operating status" on March 16, 2020. Telescope operations (other than ALMA) continued with a skeleton support staff. The rest of us were expected to work as best we could from home. On June 8, 2020 we began the first steps to return to the new normal. It has taken us another year to begin the process of return to full operations. Fully vaccinated employees may return to their offices and use meeting rooms with no masks. Limited outside user visiting is allowed as of July 1 if fully vaccinated.

Robert Phillips writes *"I've just done (what appears to be) a successful AIPS install on a M1 Mini (running macOS 11.2.3); the only thing I had to do was tell it that the architecture wasn't MACPPC (but MACINT), and have the Rosetta2 translation layer already installed (at least, I'm assuming that's part of it, since it was already installed)."* A native port to the M1 will have to wait until I have access to one and until there is a gfortran for it.

Your editor does find times when he would like interesting things to do. If you find any problems with $\mathcal{AIPS}$ or have any suggestions for new or improved functions, please do not hesitate to e-mail me at daip@nrao.edu.

$\mathcal{AIPSLetter}$ publication

We have discontinued paper copies of the $\mathcal{AIPSLetter}$ entirely, at least for this issue. The $\mathcal{AIPSLetter}$ will be available in PostScript and pdf forms as always from the web site listed above. New issues will be announced in the NRAO eNews mailing and on the bananas and mnj list server.

Current and future releases

We have formal $\mathcal{AIPS}$ releases on an annual basis. While all architectures can do a full installation from the source files, Linux (32- and 64-bit), and MacIntosh OS/X (Intel) systems may install binary versions of recent releases. Binary versions for Solaris and MacIntosh (PPC) are available for the 31DEC17 release

but not for later releases. The last, "frozen" release is called `31DEC20` while `31DEC21` remains under active development. You may fetch and install a copy of these versions at any time using *anonymous* `ftp` for source-only copies and `rsync` for binary copies. This *AIPSLetter* is intended to advise you of improvements to date in `31DEC21`. Having fetched `31DEC21`, you may update your installation whenever you want by running the so-called "Midnight Job" (MNJ) which copies and compiles the code selectively based on the changes and compilations we have done. The MNJ will also update sites that have done a binary installation. There is a guide to the install script and an *AIPS* Manager FAQ page on the *AIPS* web site.

The MNJ for binary versions of *AIPS* now uses solely the tool `rsync` as does the initial installation. For locally compiled ("text") installations, the Unix tool `cvs` running with anonymous ftp is used for the MNJ. Linux sites will almost certainly have `cvs` installed; but other sites may have to install it from the web. 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. For local versions, use a copy of the task and its help file in a private disk area instead.

AIPS is now copyright © 1995 through 2021 by Associated Universities, Inc., NRAO's parent corporation, but may be made freely available under the terms of the Free Software Foundation's General Public License (GPL). This means that User Agreements are no longer required, that *AIPS* may be obtained via anonymous ftp without contacting NRAO, and that the software may be redistributed (and/or modified), under certain conditions. The full text of the GPL can be found in the `15JUL95` *AIPSLetter*, in each copy of *AIPS* releases, and on the web at `http://www.aips.nrao.edu/COPYING`.

Improvements of interest in `31DEC21`

We expect to continue publishing the *AIPSLetter* approximately every six months, but the publication is now primarily electronic. There have been several significant changes in `31DEC21` in the last six months. Some of these were in the nature of bug fixes which were applied to `31DEC20` before and after it was frozen. If you are running `31DEC20`, be sure that it is up to date; pay attention to the patches and run a MNJ any time a patch relevant to you appears. There are number of new tasks and verbs in `31DEC21`. They include `DGAUS` to correct a model visibility file made with a Clean image for the Clean beam, `IANTB` to produce an `ANTAB` file from the `GC` and `TY` tables, `VBRFI` to compute statistics from autocorrelation data, `PLRFI` to make plots from the text file written by `VBRFI`, and `SHAHO` to flag hollography data for shadowing. Several new tasks to process VLBA data using files not included in the standard FITS-IDI file are currently being tested. These will be used to help study issues found in RDBE data. The new verbs are `TVBANDW` to perform several black-and-white enhancement schemes and `TVDATA` (also called `TVFACTS`) to remind the user of the parameters of the TV display. A pipeline `RUN` file was developed to study RFI at the VLBA.

`31DEC20` contains a change to the TV display program `XAS` that makes it incompatible with previous releases when characters are displayed. `31DEC14` contains a change to the "standard" random parameters in *uv* data and adds columns to the `SN` table. Note, however, that the random parameters written to FITS files have not been changed. Older releases of *AIPS* cannot handle the new *internal uv* format and might be confused by the `SN` table as well. `31DEC09` contains a significant change in the format of the antenna files, which will cause older releases to do wrong things to data touched by `31DEC09` and later releases. You are encouraged to use a relatively recent version of *AIPS*, whilst those with recent VLA data to reduce should get release `31DEC20` or, preferably, the latest release.

VLBI

RFI monitoring

It is intended that we should monitor RFI at the VLBA sites. To support this, a data reduction pipeline `RUN` file called `VLBARFI` was created. It is based on `VLBARUN` but is aimed to provide calibrated autocorrelation output data sets. It executes the new task `VBRFI` to determine statistical parameters of these data. `VBRFI` writes out a detailed text file containing the mean spectra and rms divided by mean spectra for each antenna.

The maximum, minimum, and mean of these spectra over all scans is written and may be plotted. Another new task, PLRFI, was written to read the text files to make the same plots, should they be needed at a later time.

The full scheme for archiving and accessing such data remains to be developed.

Miscellaneous

VLBARUN was changed to allow for systems in which convert is known not to work. In this case, PostScript plots are copied to the OUTFILE area and the output html does not look for gifs. UVPLT now uses IMSIZE so the procedure has to reset that adverb after every UVPLT. The title line in the output html was corrected. The option to omit the EOP and/or TEC steps was added. The EOP correction could cause the script to fail if the data set is very recent.

ACIMG was changed to make an ANTENNA axis rather than combining all included antennas into one image plane.

IANTB is a new task that writes an ANTAB-format text file from the system temperature (TY) and gain curve (GC) tables.

Display, imaging, and analysis

Remote TV display

During the work from home period, users may be required to access their office computing facilities over a VPN connection. The $\mathcal{AIPS}$ TV display can still work with tv=local causing the XAS window to be displayed through the internet on the home computer. This tends, however, to be rather slow. The "hold" function in the TV allows the calling routines to tell the TV to hold any updates and then to release all updates to the display. This was changed to count the number of hold on commands and hold off commands and to update the screen only after all ons are turned off. A new command to force the update ignoring the counts was added. Numerous tasks were revised to leave the menu display on during more of the operations. Numerous hold operations were changed to reduce the display update operations. Minor changes in function, setting boxes for example, have been noted.

TV enhancement verb changes

A new enhancement verb, called TVBANDW, was added to do enhancements in black and white. Button A does step wedges with the number of wedges controlled by the cursor X position. Button B selects a sine wave function with the cursor X position controlling the starting intensity and number of sine waves. Button C selects a stair step transfer function with the cursor X position controlling the number of steps. In all case, the cursor Y position controls a "gamma" correction.

The circular color scheme in TVPSEUDO (Button B) was changed so that the cursor X position controls the starting color and number of loops (reduced to a maximum of 3). The cursor Y position controls alternatively the saturation and brightness of the colors. This extra control allows the colors to be more or less garish. The verb TV2COLOR has a new second coloring scheme with the two colors separated by 1/2 of a turn in hue. The cursor X position selects the central point separating the two colors and the Y position controls the saturation of the colors. Button A changes the colors by 1/12 of a turn, button B switches between constant intensity and step wedges, and button C switches to the initial coloring scheme.

The standard default scaling of the LUT and OFM transfer functions was adjusted slightly. Also the actual value range of image loads to the TV was expanded by 0.5% to avoid having a non-blank pixel always be black.

Boxcar smoothing

Previously all boxcar smoothing operations in $\mathcal{AIPS}$ were symmetric with weight 0.5 at the edges. Thus a boxcar of width 2 was in fact a Hanning smooth. This has been changed so that even widths are not symmetric and all points in the boxcar have equal weight. Reference pixels are adjusted to compensate for this asymmetry. This change was not made for the application of channel-dependent calibrations to avoid a shift in the bandpass.

Miscellaneous

DFTPL   now allows x-axis parameters elevation, hour angle, LST, parallactic angle, and azimuth as well as the previous parameter time.

TVDATA   is a new verb to remind the user about the size of the TV display window, number of channels, scaling range at the various steps in making the display, and the current graphics plane colors.

TVFACTS   is another name for `TVDATA`.

CCMOD   was given a new model type which is the product of a disk and a Gaussian. The Moon multiplied by the primary beam is an example of a source needing this model.

IMAGR   now shows the number of iterations and current Clean flux on TV residual images even when there is only one facet. Certain formats were changed to provide more digits when appropriate.

PBCOR   now also allows Gaussian and polynomial beam shapes.

UV-data

Calibration models

Images may be used in source modeling in *e.g.*, `CALIB`, although Clean images, due to the convolution by the Clean beam, will not match the data at larger spacings. CASA, however, provides model images that have not been convolved. It was discovered that the computation of the model from an image only worked correctly when the reference pixel of the image was precisely centered. This has been corrected by a rewrite of the low level routine used to place the image in a rather larger, zero-filled array. Another change was made to allow the image models to be scaled by the IF-dependent total fluxes entered in the source (`SU`) table.

`UVSUB` may be used to make a *uv* data set of a source model. When that model is computed from a Clean image, the longer spacings are reduced in amplitude by the Fourier transform of the Clean beam. `DGAUS` is a new task which may be used to correct the model data set for this issue. It is to be used with caution since the corrections at the longest spacings can become quite large.

Miscellaneous

SPLIT   was changed to prevent confusing messages about which calibrations are applied.

CLIP   was changed to prevent an erroneous error message and to prevent confusing messages about calibrations.

FILLM   was changed to first try to open the input file name as given by the user. Only if that fails does it try names concatenating the file number.

HOLOG   was changed to allow taper when doing the direct Fourier transform rather than only with a grdidded transform. An option to write out an interpolated (via FFT) phase image as well as the interpolated amplitude image was also added.

SHAHO is a new task to flag holography data for shadowing. In holography, one or even both antennas point at a direction other than the source. In smaller configurations at longer wavelengths, this can be a serious issue.

DBCON was altered to avoid confusion from antennas in the antenna files labeled as `OUT` or declared to be exactly at zero. The EVLA always shows 28 antennas in the antenna file, one or more of which are called `OUT`.

General

Time axes are usually in units of days, not the seconds that were assumed by some portion of the code. Plot routines were changed to show times in sexagesimal or in plain hours,

UPDERROR in the midnight job script invoked `mail` rather than the more modern `sendmail`. This was changed to report errors with the same email process as in the final `UPDREPORT`.

OBIT can now support either Python 2 or Python 3. `OBITVERS` was added to all "verbs" that invoke the OBIT package including `BDFLIST`, `BDF2AIPS`, and the four versions of `OBIT` imaging.

Patch Distribution for `31DEC20`

Important bug fixes and selected improvements in `31DEC20` can be downloaded via the MNJ or from the Web beginning at: `http://www.aoc.nrao.edu/aips/patch.html`
Alternatively one can use *anonymous* `ftp` to the NRAO server `ftp.aoc.nrao.edu`. Documentation about patches to a release is placed on this site at `pub/software/aips/`*release-name* and the code is placed in suitable sub-directories below this. As bugs in `31DEC21` are found, they are simply corrected since `31DEC21` remains under development. Corrections and additions are made with a midnight job rather than with manual patches. Because of the many binary installations, we now actually patch the master version of `31DEC20`, meaning that a MNJ run on `31DEC20` after the patch will fetch the corrected code and/or binaries rather than failing. Also, installations of `31DEC20` after the patch date will contain the corrected code. The `31DEC20` release has had a number of patches:

1. `SPLIT` and `CLIP` would always say that is not calibrating anything despite the adverbs. *2021-01-20*

2. `SPRMS` had a slight error in labeling frequency and the Y axis. *2021-02-23*

3. `CLIP` generated a false error message. *2021-04-14*

4. `VLBARUN` needed to reset `IMSIZE` after `UVPLT` calls; also allow PostScript out when `convert` does not work. *2021-04-22*

5. `UVPLT` could decide to plot phases from 0 to 360 ignoring any user-specified range. *2021-04-27*

6. `LISTR` listed single-source velocities incorrectly. *2021-04-27*

$\mathcal{AIPS}$ Distribution

We are now able to log apparent MNJ accesses and downloads of the tar balls. We count these by unique IP address. Since some systems assign the same computer different IP addresses at different times, this will be a bit of an over-estimate of actual sites/computers. However, a single IP address is often used to provide $\mathcal{AIPS}$ to a number of computers, so these numbers are probably an under-estimate of the number of computers running current versions of $\mathcal{AIPS}$. So far in 2021 more than 295 IP addresses have downloaded the frozen form of `31DEC20`, while more than 322 IP addresses have downloaded `31DEC21`. A total of 685 different IP addresses have appeared in one of our transaction log files. These numbers are rather lower than those of last year at this time.
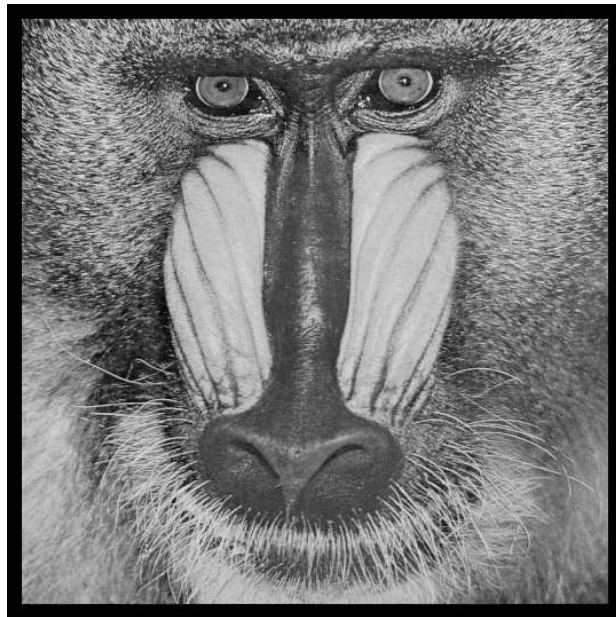
June 30, 2021

AIPSLETTER
National Radio Astronomy Observatory
Post Office Box O
Socorro, NM 87801-0387
USA
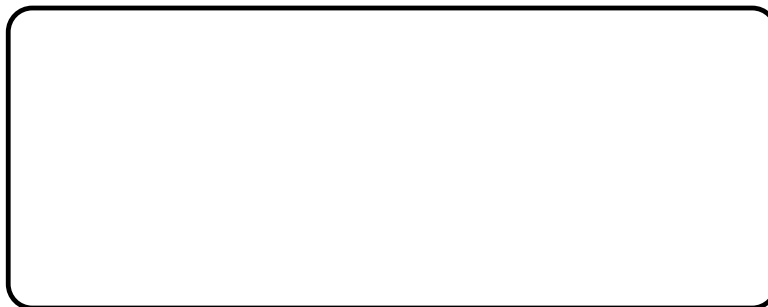
General developments in $\mathcal{AIPS}$

COVID-19

Sadly, the Covid-19 pandemic continues. The NRAO has returned to something like the "new normal." We are required to be fully vaccinated and to wear masks when in public spaces in NRAO facilities. We may remove the masks when in our offices with the door closed. Work from home is permitted and, perhaps, even encouraged. All of this has reduced the normal interactions between staff.

NRAO has purchased a Mac mini with the new ARM M1 chip for $\mathcal{AIPS}$. Work has begun on the port to that architecture. This requires using a very modern version of gfortran (11.0.0), which turns out to treat some things as errors that really are not. With great care, $\mathcal{AIPS}$ code calls subroutines with variables that can be of integer or float type and can be scalars or arrays. Work on trying to satisfy the compiler is continuing. Note that the binary release of $\mathcal{AIPS}$ for Intel Macs works fine on ARM Macs and will continue to do so for several years.

The Covid status means that your editor would like to find additional, preferably interesting, things to do. If you find any problems with $\mathcal{AIPS}$ or have any suggestions for new or improved functions, please do not hesitate to e-mail me.

$\mathcal{AIPSLetter}$ publication

We have discontinued paper copies of the $\mathcal{AIPSLetter}$ entirely, at least for this issue. The $\mathcal{AIPSLetter}$ will be available in PostScript and pdf formats as always from the web site listed above. New issues will be announced in the NRAO eNews mailing and on the bananas and mnj list servers.

Current and future releases

We have formal $\mathcal{AIPS}$ releases on an annual basis. We recommend a full binary installation method for both the frozen and development versions for MacIntosh OS/X (Intel chips only), and Linux (32- and 64-bit) systems, but all architectures can do a full installation from the source files. There are no longer binary versions available for Solaris and Mac PPC chip architectures. If you develop $\mathcal{AIPS}$ code locally *or have system managers that forbid the use of* rsync *or* cvs, you will need to do a source-level installation. The current release is called 31DEC21 and is now "frozen." If you took a development copy of this version at some earlier date, you should use the "Midnight Job" (MNJ) to bring it up to date. You need to run a MNJ only

once in 2022 to convert your copy of `31DEC21` into the frozen version. However, when patches to `31DEC21` are announced in 2022, you may apply them with the MNJ. This $\mathcal{AIPS\,Letter}$ is intended to advise you of corrections and improvements in this release.

We have begun a new version, called `31DEC22`, which is now under development by the $\mathcal{AIPS}$ Group. You may fetch and install a complete copy of this version at any time. Having fetched `31DEC22`, you may update your installation whenever you want by running the MNJ. This uses `cvs`, `rsync`, and/or transaction files to copy all changed text files and then to copy the binary files or to compile the code selectively based on the code changes and compilations we have done. We expect users to take their source-only or binary version of `31DEC22` $\mathcal{AIPS}$ over the Internet (via *anonymous* ftp). Both versions require you to copy the installation procedure `install.pl` via `ftp`; the source-only version also requires you to ftp the 175-Mbyte `31DEC22.tar.gz` compressed tar file. Binary installations use only `rsync`, while locally compiled versions also use `cvs`. 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 $\mathcal{AIPS}$-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. Use a new name for the task or put a copy of the task and its help file in a private disk area instead.

$\mathcal{AIPS}$ is now copyright © 1995 through 2021 by Associated Universities, Inc., NRAO's parent corporation, but may be made freely available under the terms of the Free Software Foundation's General Public License (GPL). This means that User Agreements are no longer required, that $\mathcal{AIPS}$ may be obtained via anonymous ftp without contacting NRAO, and that the software may be redistributed (and/or modified), under certain conditions. The full text of the GPL can be found in the `15JUL95` $\mathcal{AIPS\,Letter}$ and is included with every distribution in file `$AIPS_ROOT/`*release-name*`/COPYING`.

Installing a new version

If compiling locally, new releases must be installed from the tar ball for that release. `31DEC15` and later versions contain improvements to the code which should make local compilation more reliable. If using the binary installation, a full new installation must also be done with `rsync`. When installing a new $\mathcal{AIPS}$ release in a system that already has a previous release, we recommend that `install.pl` be used and that the previous release be left in place, at least until the new installation has been verified. If you do this, then you will not have to re-edit the disk, printer, and tape lists and can simply skip all those pages in the `install.pl` menus. The old `$HOME/.AIPSRC` file may be left in place, but it will need to be edited. The lines giving the `DOWNLOADED` and `UNPACKED` parameters should be cleared and the `CCOMOPT` line should be changed to point to the current release rather than the previous one. If you have made a special version of `do_daily.`*host*, you should preserve it under a new name and restore it after the install. If you have an odd set of $\mathcal{AIPS}$ versions, the `$AIPS_ROOT/AIPSPATH.*SH` files may need to be edited after the install to set the desired versions. The file `$SYSLOCAL/UPDCONFIG` also needs to be edited to correct your e-mail address(es).

`31DEC09` contains a change in the format of antenna files. Previous releases will not understand the antenna coordinates for arrays that were traditionally left-handed (VLBI primarily). The format change occurs automatically when any `31DEC09` or later antenna-file specific code reads the file, after which older releases will have difficulties. `31DEC15` contains a change in the headers of *uv* data sets which will not be understood by previous versions. `31DEC20` contains a change to the `XAS` TV server which will cause problems with older versions. Note that the only version which we will patch for major errors is `31DEC21`; even `31DEC20` will no longer be changed.

Improvements of interest to users in `31DEC21`

In the latter half of 2021, new tasks appeared including `CMPLX` to perform complex mathematical operations on pairs of complex images, `DT2PD` to convert the new D-term text files to `PD` tables, `MARSP` to find the rotation measure affecting a planetary polarization image, `PCABL` to fill in cable cal values to a `PCLOD`-created `PC` table, `PCDIV` to change pulse-cal table amplitudes from `TY` or `SY` system temperatures, and `VLBSY` and `VLBCD` to create `SY` and `CD` tables from VLBA secondary text files. In the first six months of the year

new tasks appeared including `DGAUS` to correct a model visibility file made with a Clean image for the Clean beam, `IANTB` to produce an `ANTAB` file from the `GC` and `TY` tables, `VBRFI` to compute statistics from autocorrelation data, `PLRFI` to make plots from the text file written by `VBRFI`, and `SHAHO` to flag holography data for shadowing. The new verbs are `TVBANDW` to perform several black-and-white enhancement schemes and `TVDATA` (also called `TVFACTS`) to remind the user of the parameters of the TV display. A pipeline `RUN` file, called `VLBARFI`, was developed to study RFI at the VLBA sites.

Normally, bugs which appear in an $\mathcal{AIPS}$ TST version and then are fixed in that same version before its release get little or no discussion in the $\mathcal{AIPS Letter}$. Since a rather large number of sites now install the TST version of $\mathcal{AIPS}$ during its development, this is somewhat of an oversight. We urge you to run the "Midnight Job" at least once after `31DEC21` is frozen to bring it up to date and to fix all bugs of this sort. We urge active sites to use the MNJ and, when something odd occurs, to examine `CHANGE.DOC` using the cgi tool available from the $\mathcal{AIPS}$ documentation web page (`http://www.aips.nrao.edu/aipsdoc.html`). Please do not hesitate to contact us via the NRAO help desk (`https://help.nrao.edu`) or via e-mail `daip@nrao.edu` with any questions or suspicions that there are problems.

Imaging and Display

IMAGR was corrected to handle the situation where `FLUX > 0` with no Clean boxes yet defined. This caused the task to stop Cleaning before it started when auto-boxing was requested, as in `VLBARUN`.

UVPLT was given the option to do time averaging prior to plotting the data.

Axis labeling was reviewed systematically to insure that the upper and lower level routines deciding on which ticks get plotted were doing it both correctly and with the same algorithms. Numerous corrections were made.

Contour plots will now display only those contour levels actually used. This change was made in a variety of secondary tasks and has now been made in the main tasks, `KNTR`, `PCNTR`, `GREYS`, and `CNTR`.

RGBLEVS will now be displayed by `KNTR` and `PCNTR` in normal fonts rather than the line-drawing fonts. The addition of an intensity for characters in the `XAS` display server made this change possible.

UV data

BPASS was corrected for a bad error in which the reference antenna could change part way through the spectrum due to channel-level flagging. The reference antenna is now chosen once for each solution. It now writes the calibration and `BP` version information to the history even for single-source files.

BPEDT was given the option to edit the `BP` table itself rather than just the *uv* data. Blanked channels may be given interpolated values on output. A `SET TIME RANGE` option was added as well, including to `PCEDT`.

TVFLG, `SPFLG`, and `FTFLG` had the sizes of their large buffers corrected. It is not clear how they were able to function previously. These tasks now warn the user when a pre-existing grid file is being used.

WIPER was given the complicated option to display the data on a baseline number axis (both 1-2 and 2-1 are displayed).

DOPOL application routines did not understand the codes from the `PD` table read routine. Accordingly, they would die when they should not when some but not all solutions are flagged.

PP tables are created by `RLDIF` and `XYDIF` in spectral mode, saving the phase correction spectrum. The format of the table was changed to include a column of the uncertainties. `POSSM` was changed to plot the `PP` data including the error bars and to forbid `NPLOTS > 0` for such tables.

Index tables are now written by a number of tasks that could not do so previously.

VLBI matters

The VLB data reduction pipeline VLBARUN continued to get attention in the reporting period. This caused several changes to be made to the VLBAUTIL procedures. These are (1) VLBAAMP will skip the ACSCL step if there is no BP table and supports the ICHANSEL adverb used by ACSCL, (2) VLBALOAD to support the DOCONCAT adverb rather than forcing it to be true, and (3) VLBABPSS to support a new adverb BPASS5 to control the normalization of the data, setting BPASSPRM(5).

VLBARUN changes include

1. DOCONCAT is false when calling VLBALOAD

2. CHKNAME was replaced with NAMEGET which is more reliable and one place that assumed INSEQ was 1 was corrected.

3. The TEC section now deletes the /tmp/jpl* data file it read.

4. Corrected DOPLOT = 2 mode to plot the correct CL and SN tables and to report the correct plot file numbers at the end. The RFLAG plot files are now also reported.

5. Added a procedure to set the correct Stokes; VPLOT does not accept 'HALF' when there is only 1 polarization.

6. Changed to delete any pre-existing message output file.

7. Changed to display the output of LISTR 'SCAN' mode after the INPUTS in the message output file.

8. Changed the UVPLT section to display 3 plots: channel averaged data time smoothed, fully time and channel averaged data versus baseline length, and no averaging versus baseline length.

9. Changed auto-boxing in IMAGR to take only one box per major cycle.

10. Added BPASS5 to allow control of BPASSPRM(5).

11. Corrected handling of CALSOUR(2) = '*'.

12. Corrected the usage of the procedure that finds the main input file name.

13. Fixed the loop running RFLAG to prevent an infinite loop.

14. Dropped the use of the TV to set the colors for the RFLAG plots.

15. An option to use CALIB rather than FRING in the time-dependent calibration and/or the self-cal was added.

VLBARFI had the meaning of DOPLOT changed to allow better selection of plots and to allow DOBAND < 0 to omit BPASS. It was then modified to support a generic calling procedure by finding CALSOUR and TIMERANG where possible. Changes like those listed above were also made. A script named VLBAWIDE was written to invoke VLBARFI on a set of input data sets such as could be observed to cover much of the VLBA's available frequencies.

Four new tasks were written to enable testing of VLBA matters, particularly the issue of fluxes from RDBE 2. PCABL copies the cable cal values from the small PC table shipped with the data to the large PC table created by PCLOD from a secondary text file. VLBSY reads a VLBA total power text file to create an EVLA-like SY table while VLBCD reads a VLBA cal text file to extract the noise tube values into an EVLA-like CD table. These two tables are widely understood in $\mathcal{AIPS}$. PCDIV copies a PC table multiplying or dividing by the system temperature found from a TY pr SY table.

VBGLU   was changed to allow the second data set to have been observed on a completely different day. It can then be used to join two data sets with different frequencies so long as they have the same number of spectral channels in each spectral window and the same number of spectral windows ("IFs" in $\mathcal{AIPS}$-speak). IMAGR cannot handle two independent input files, so, at the cost of wasted disk space, this option allows an image to be made from two or more data sets.

BASRM is designed to fit a polynomial baseline to autocorrelation data and remove it. The task was substantially rewritten and now does what it is supposed to do.

VLA and Analysis

CMPLX is a new task to perform addition, multiplication, and division on two "complex" images where a complex image is actually two images either real and imaginary or amplitude and phase.

DT2PD is a new task to convert a D-term text file to a standard spectral polarization D-term (`PD`) table. This is the first of a number of tasks to implement absolute D-term calibration of VLA data.

ELINT was changed to allow data from all IFs to be included in a single fit, to plot multiple IFs in a single plot, to scale the fits to 1.0 at a specified elevation, and to improve the displays of the fits and the coloring of the plots. Updating a `CL` table is now only an option.

HOLOG now can use `CELLSIZE` to set the image cell size, avoiding the standard, frequency-dependent cell sizes.

PBEAM now can plot the smooth model with data samples and the residuals versus radius, avoiding the foibles of the gridding process. Changed to read multiple groups of data, allowing the construction of spectral cubes. Additional annotation including which contour levels were used was added to the plots. Fitting of power data (moving antenna with moving antenna) was corrected and the option to fit in power was added.

PANEL was given a new plot type to show which panel corner is which over the entire antenna surface. The theoretical gain displayed was corrected.

MARSP is a new task which compares the polarization angles around an image of a planet to measure how far off they are from radial. In other words, to determine what rotation measure affected the data.

BDF2AIPS was given the `DOALL` option to allow writing of the pointing (`PT`) table. These tables are now written every 0.1 seconds and so are grossly large and of no use to $\mathcal{AIPS}$. Therefore, the default is to omit these tables.

General

Input lines to `AIPS` may now be 128 characters in length, up from the classical 80.

DELAY now takes an optional immediate argument for the time delay.

STALIN now limits the deleted history records to those matching `PRTASK`.

Documentation was updated systematically, including the $\mathcal{C}ook\mathcal{B}ook$, `ABOUT` files, the `TAB`-completion file, and numerous adverb help files. Verbs `EXTLIST` and `PLGET` were changed for changes in plot tasks.

FREESPAC had its format changed to allow for even larger disk areas such as on NRAO's Lustre systems.

Patch Distribution for `31DEC20`

Because of the extensive use of binary installations, we now patch the master copy of the most recently frozen version. Older versions are not corrected even for egregious errors. Thus, `31DEC20` was patched during 2021 and `31DEC21` will be patched as needed during 2022. Your copy of them may be corrected simply by running a Midnight Job. Information about patches and the code may be found using links from the main *AIPS* web page or by *anonymous* `ftp` to the NRAO server `ftp.aoc.nrao.edu`. Documentation about patches to a release is placed on this site at `pub/software/aips/`*release-name* and the code is placed in suitable sub-directories below this. Patches to older releases are kept here as well, but they will require local compilation.

The `31DEC20` release is no longer available for installation and will no longer receive patches even for egregious errors. It had a number of important patches during 2021. They are

1. `SPLIT` and `CLIP` would always say that it is not calibrating anything despite the adverbs. *2021-01-20*

2. `SPRMS` had a slight error in labeling frequency and the Y axis. *2021-02-23*

3. `CLIP` generated a false error message. *2021-04-14*

4. `VLBARUN` needed to reset `IMSIZE` after `UVPLT` calls; also allow PostScript out when `convert` does not work. *2021-04-22*

5. `UVPLT` could decide to plot phases from 0 to 360 ignoring any user-specified range. *2021-04-27*

6. `LISTR` listed single-source velocities incorrectly. *2021-04-27*

7. `BPASS` could change reference antenna in the middle of a spectrum. *2021-07-16*

8. `TVFLG, SPFLG, FTFLG` did not define enough memory. *2021-07-26*

9. `IMAGR` could quit at the start when a flux limit was specified with auto boxing *2021-10-22*

$\mathcal{AIPS}$ Distribution

From the NRAO system logs, we count apparent MNJ accesses, downloads of the tar balls, and `rsync` accesses by unique IP address. Since DSL and some university and other connections may be assigned different IP addresses at different times, this will be a bit of an over-estimate of actual sites. However, a single IP address is often used to provide $\mathcal{AIPS}$ to a number of computers, so these numbers are at the same time an under-estimate of the number of computers running current versions of $\mathcal{AIPS}$. In 2021, a total of 399 different IP addresses downloaded the frozen form of `31DEC20` and 659 IP addresses downloaded `31DEC21` in tarball or binary form. With the change to the MNJ (rsync only) we are unable even to guess how many sites have run the MNJ. The total number of unique IP addresses in these five lists was 1215. The plot of numbers versus time and the table shows that 2021 was substantially behind 2020.

year	TST name	NEW name	TST	NEW	TST binary	NEW binary	Total unique
2004	31DEC04	31DEC03	808	196			1276
2005	31DEC05	31DEC04	832	246	299	48	1460
2006	31DEC06	31DEC05	806	191	402	94	1398
2007	31DEC07	31DEC06	965	277	669	161	1811
2008	31DEC08	31DEC07	1058	246	986	303	2107
2009	31DEC09	31DEC08	1228	307	1082	478	2399
2010	31DEC10	31DEC09	1228	307	1203	477	2416
2011	31DEC11	31DEC10	1105	270	1064	424	2228
2012	31DEC12	31DEC11	940	284	1028	396	1698
2013	31DEC13	31DEC12	1014	307	990	443	1937
2014	31DEC14	31DEC13	1045	333	848	431	1843
2015	31DEC15	31DEC14	1104	309	1001	350	1817
2016	31DEC16	31DEC15	878	222	788	372	1330
2017	31DEC17	31DEC16	874	408	768	386	1383
2018	31DEC18	31DEC17	684	368	603	343	1099
2019	31DEC19	31DEC18	754	406	686	388	1155
2020	31DEC20	31DEC19	796	434	750	470	1230
2021	31DEC21	31DEC20	659	399	604	376	1215

2019-2021 systems shipped and CVS access by site
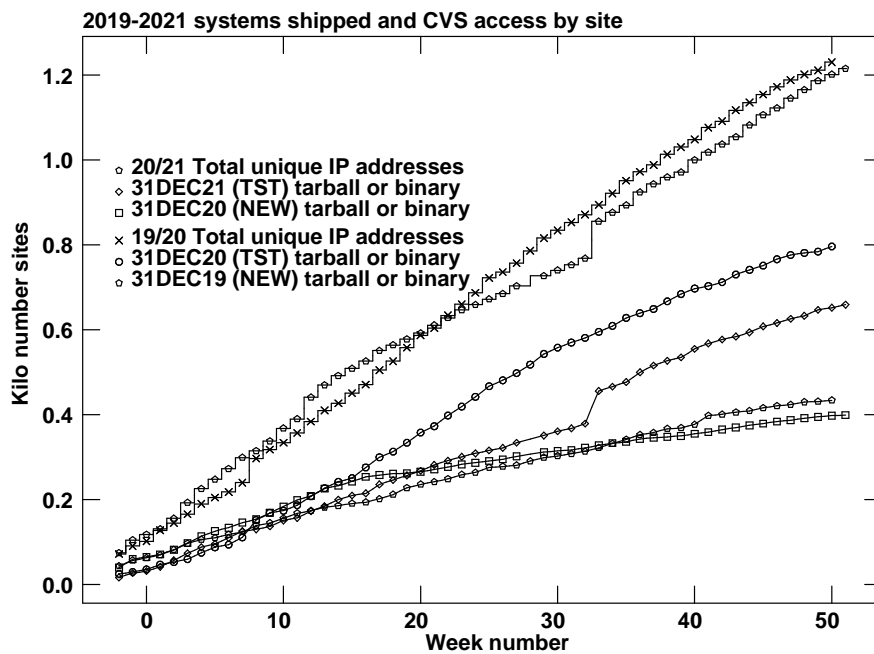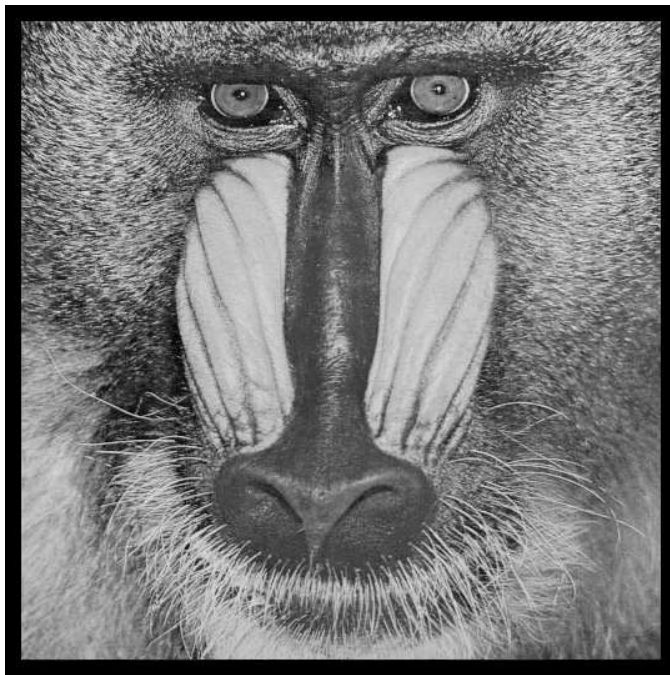
December 31, 2021

AIPSLETTER
National Radio Astronomy Observatory
Post Office Box O
Socorro, NM 87801-0387
USA