A I P S L E T T E R

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A newsletter for users of the NRAO
Astronomical Image Processing System

Written by a cast of *AIPS*

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Happy 42$^{\text{nd}}$ birthday *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 *AIPS* internal formats. The *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 *AIPS* or have any suggestions for new or improved functions, please do not hesitate to e-mail me at `daip@nrao.edu`.

AIPSLetter publication

We have discontinued paper copies of the *AIPSLetter* entirely, at least for this issue. The *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 *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.

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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 *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 *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.

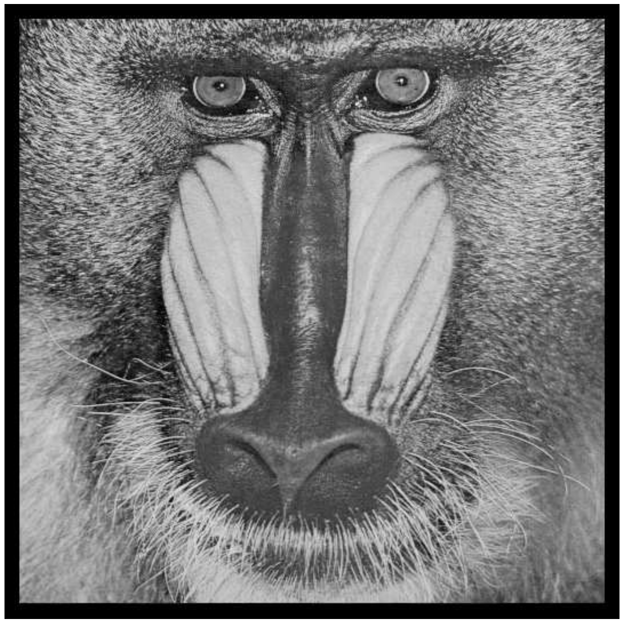
Patch Distribution for `31DEC20`

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*

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 *AIPS* to a number of computers, so these numbers are probably an under-estimate of the number of computers running current versions of *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.



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