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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 39th birthday *AIPS*

AIPSLetter publication

We have discontinued paper copies of the *AIPSLetter* other than for libraries and NRAO staff. 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 `31DEC18`. The last, "frozen" release is called `31DEC17` while `31DEC18` 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 `31DEC18`. Having fetched `31DEC18`, 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 31DEC18

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 31DEC18 in the last six months. Some of these were in the nature of bug fixes which were applied to 31DEC17 before and after it was frozen. If you are running 31DEC17, 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. New tasks in 31DEC18 include TLCAL to convert VLA telcal files into an initial SN table, XYDIF to solve for the X minus Y phase difference for linear polarization data, PLOTC to display the colors used by various tasks on DO3COLOR TRUE with labeling to show which polarization, spectral window, channel, and/or source goes with which color, and SPFIX to make a spectral cube from the intensity and spectral index images produced by SPIXR.

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 31DEC17 or, preferably, the latest release.

UV-data

EDITA

The edit class was changed to allow viewing and editing upon solution weights for SN and CL tables. The weight becomes another variable that can be displayed and edited along with amplitude, phase, and delay. EDITA and SNEDT also offer the option with these tables of displaying and editing only multi-band delay. That option had corrections made to the menu display and to force the 3-color option to false. Dispersion was added as another one-parameter only option like multi-band delay.

EDITA will, when ANTENNAS is not specified, check the antenna table and mark any antennas labeled OUT or with zero for coordinates as ones to be avoided. Code was added to determine the median and median-absolute-deviation of all plotted parameters. If FLAG ABOVE or FLAG BELOW as specified will flag too close to the median, the user is prompted to make sure the command is not in error. The display of flagged data on DO3COLOR displays was changed to white and the logic governing the plotting of valid and invalid data was altered to insure correctness.

Linear polarization

The VLA receivers at around 1 and 4 meters wavelength (P and 4 bands) have linearly polarized feeds. To support this, code was added to 31DEC17 to do a proper conversion from linear polarizations to true Stokes. Then in 2018, *AIPS* was corrected to apply the parallactic angle to linears only in this new routine and not also in the routine where circular polarizations are corrected for parallactic angle. The ubiquitous warning message about linear polarization not being calibrated was changed to appear only if Stokes Q, U, and/or V are produced with DOPOL false.

PCAL has been found to work with linear polarizations rather better using SOLTYPE = 'APPR' than with the linear-polarization specific model. Why this should be joins the other mysteries of polarization calibration. Like circular polarization, the phase difference between the two parallel polarizations has to be calibrated. A new task called XYDIF was written to perform this operation. RLDIF uses the measured RL and LR phases after calibration plus the known position angles of certain calibration sources to measure the R-L phase correction. XYDIF uses instead the fact that this phase correction in linear polarization rotates signal from Stokes U to Stokes V. If the calibration source has no circular polarization ($V = 0$) but has a measurable U, then this rotation allows the phase difference to be determined. There are limitations to this because there are few calibration sources that are polarized at these low frequencies and these may have a significant rotation measure, causing Stokes U to be very small over some ranges of frequency. Because of these limitations and uncertainties of 180 degrees in the answers, XYDIF should be viewed as experimental rather than well established. In developing XYDIF it became apparent that the error bars in the spectral mode of RLDIF were too large and that was corrected.

Miscellaneous

TLCAL is a new task to read the text file containing VLA "telcal" gain and delay solutions done in real time at the telescope. They are converted to a solution (SN) table which may be used for editing, GETJY, and application to the calibration (CL) table with CLCAL.

UVRANGE has BEEN applied DIRECTLY to the uv values recorded with each sample. These are correct only for the reference frequency given in the header and so can be a factor of 2 off at the high end of current spectra. This option was changed to apply on a per spectral-window basis which, while not perfectly accurate, is much closer to what is intended.

UVSUB had difficulties computing the model as the sole output. Several patches were required to get all facets into the model, to get correct weights, and to work on both compressed and uncompressed data.

SETJY was corrected to quote error bars only when appropriate. The explain file was overhauled to describe the current state of the code in detail.

FITLD attempted to correct the input for identical frequency IDs. Unfortunately, it only correct for one identical ID and only corrected the visibility data. It now corrects an unlimited number of identical FQIDs in both the visibility data and the many tables. The logic to handle ANTNAME when concatenating was defective and has been re-written in a manner that appears to work.

FRING was corrected to fill in multi-band delay when doing the dispersion option. The default when writing out a single-source output file is now to write all channels, not just a single average channel.

CALIB now allows the use of SMODEL with multi-source data sets.

DBAPP was corrected to use the modern structure for the uv parameter common, to write an proper index (NX) table, and to continue working even when UT1UTC differs between input files.

Dispersion corrections are now made independently for the two polarizations. The values were independent but only the R or X value was used in calibration.

RLDLY was given a true solution interval using SOLINT, with DETIME to indicate integration time. TIMERANGE is honored even with scans and, if appropriate, scans are broken up into equal intervals approximately equal to SOLINT. This allows for investigations to see of the R-L delay difference is a function of time.

DOBAND mode 3 was found to take blanking of one of the two bandpass solutions too seriously. It now takes one of the two applying to a time if the other was blanked. Optimization failed also.

Antenna table writing can require a large number of keywords so the initialization routine was changed to request them, but only when creating a brand new file, not when rewriting an existing table.

SNFLG can now flag on delay and rate values out of range and can flag on failed solutions.

FGSPW now offers control of the averaging interval SOLINT rather than simply doing scan averages. The cutoff values can be in Jy or in scaled Jy/flux (*i.e.*, they are to be multiplied by the source table fluxes before being applied).

PBEAM accepts an option to state that the values come from two moving antennas and hence are in units of power rather than voltage.

UVHOL now does amp/phase by default rather than real/imaginary. It offers an `OPTYPE = 'PLOT'` option to plot amplitude, phase, real, or imaginary with all of the usual plot control adverbs. It can plot multiple plots for multiple input antenna pairs (if they are not averaged). It can handle plotting every single included time or averaging the data at each pointing position.

Display

DO3COLOR and PLOTC

Numerous tasks offer the `DO3COLOR` option, as that adverb is now spelled, to distinguish polarizations, spectral channels, spectral windows ("IFs"), sources, and other matters. The help files for all of these tasks were revised to describe the color schemes used in more detail. Those schemes, particularly in `VPLOT`, were also adjusted. In general, the schemes now start at pure red and go nearly, but not quite, to pure blue. Pure blue tends to be too dark on workstation monitors, so color values go from 0.0 to 0.97. Red is used for lower channels/IFs, blue for higher and the later channels can over-write the earlier. Thus, if all channels have the same value, the plot will be blue.

Since it is still not terribly clear what color goes with what parameter in these tasks, a new task `PLOTC` was written. It makes a TV image or plot file showing all the colors used by the specified task, with appropriate labeling to show which is which. Supported tasks include `ANBPL`, `EDITA`, `EDITR`, `ELFIT`, `SNEDT`, `SNIFS`, `SNPLT`, `UVPLT`, and `VPLOT`. Tasks that are not supported include `GCPLT` and `TARPL` which are not in common use and which employ color to differentiate plots of different inputs. Tasks `BPLOT` and `PCPLT` use color to distinguish times or antennas or to distinguish intensities. The meaning of colors in these cases should be obvious.

SNPLT has new options to plot phase or delay re-referenced to a specified `REFANT`.

ISPEC has new options to plot flux or average on a log-log plot, suitable for spectral index studies.

Imaging

IMAGR now offers an option in the TV menu to determine and display robust and normal statistics for the current residual image. It now also avoids re-computing image facets that are already up to date.

Gridded models require more memory in large cases at stages later than when the memory was obtained. Corrected the code to check and increase the memory if needed.

DFT model computation can now do all four polarizations. The addressing of the parameter telling the routines whether to compute the model or the data minus the model required correcting.

SPIXR was corrected for errors in frequency when `BLC(1)` > 1 and for the output header frequency. Options to flag solutions for excessive uncertainties in the fit parameters were added.

SPFIX is a new task to convert the outputs of `SPIXR` into a well-behaved image cube or a residual image cube.

CONVL will now determine values for the beam parameters from the `CG` table if they are not specified in `OPCODE = 'GAUS'`.

COMB was changed to report in the messages any use of beam-area correction factors; they appeared only in the history file previously. Said factors are no longer used in the `MULT` operation.

OMFIT was changed to allow many antennas and the usage of dynamic memory was corrected.

FQUBE now writes at most one output `CG` table. It wrote many tables when the input file had none.

General

Chapter 4 of the *CookBook* was completely re-written to describe the modern JVLA. Appendix E was removed since it was both obsolete in some of its wording and replaced entirely by the new Chapter 4. A new Appendix O ("obsolete") was added to describe data reduction for the old VLA using sections from the old Chapter 4. VLB MK III and IV details were also moved from Chapter 9 to Appendix O. Appendix L (low frequency) was given a new, short section on polarization.

Batch in *AIPS* was found to be broken due to bad call sequences. I guess few people use this, but it now works again.

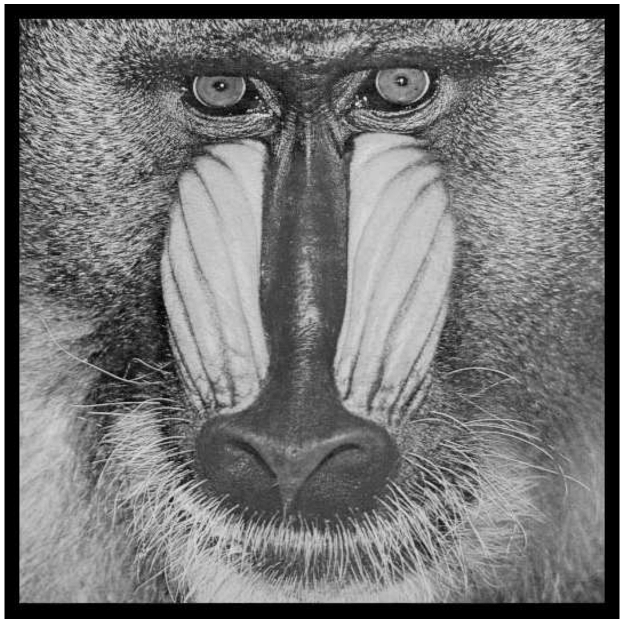
BADDISK was added to a large number of tasks which might have to sort large tables, such a flag, pulse-cal, or SysPower tables.

MacIntosh compilation procedures were given new case statements allowing for gfortran/gcc compilers. A Mac version with gfortran was tested and shown to work. The binaries we provide are still compiled with the Intel compiler. This allows us to ship binaries which will work on older versions of Mac OSX.

Patch Distribution for `31DEC17`

Important bug fixes and selected improvements in `31DEC17` 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 `31DEC18` are found, they are simply corrected since `31DEC18` 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 `31DEC17`, meaning that a MNJ run on `31DEC17` after the patch will fetch the corrected code and/or binaries rather than failing. Also, installations of `31DEC17` after the patch date will contain the corrected code. The `31DEC17` release has had a number of patches:

1. Linear polarization handling applied the parallactic angle twice. *2018-01-09*
2. Batch has not worked for some years. *2018-01-16*
3. `CALIB` would not use `SMODEL` on multi-source data sets *2018-01-16*
4. `UVSUB` did not do `OPCODE 'MODL'` correctly for multiple facets. *2018-01-20*
5. `SETJY` printed erroneous error bars with the latest 2017 flux scale. *2018-03-01*
6. `UVSUB` did not do `OPCODE 'MODL'` correctly; weights came out zero. *2018-03-14*
7. Large gridded models did not allocate sufficient memory. *2018-04-04*
8. Antenna file reformatting in place failed on files with large numbers of IFs. *2018-04-04*
9. `FITLD` did not correct duplicate FQ IDs properly. *2018-04-04*
10. `DBAPP` had an old version of the data pointers and failed to copy modern data properly. *2018-04-09*
11. `FQUBE` wrote many `CG` tables when none were input. *2018-04-23*
12. `FITLD` did not handle antenna files properly when concatenating. *2018-04-24*
13. `DOBAND 3` interpolation flagged too much data with failed bandpass solutions. *2018-04-27*, *2018-06-26*
14. Model computation made errors in DFT mode when 4 polarizations were being computed. *2018-06-20*
15. `UVSUB` did not do `MODL` correctly with compressed data. *2018-06-20*



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