AIPSLETTER

Volume XXXIX, Number 1: June 30, 2019

A newsletter for users of the NRAO
Astronomical Image Processing System

Written by a cast of *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 40th birthday *AIPS* and FITS

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.

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 later releases. The last, "frozen" release is called `31DEC18` while `31DEC19` 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 `31DEC19`. Having fetched `31DEC19`, 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.

Improvements of interest in 31DEC19

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 31DEC19 in the last six months. Some of these were in the nature of bug fixes which were applied to 31DEC18 before and after it was frozen. If you are running 31DEC18, 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 is one new task in 31DEC19 called FGPRT. It prints a matrix of the number of flags applying to each baseline. The counts can be restricted to those applying to selected IFs, channels, times, sources, and the like. There is also one new procedure called VLBAMPHC to calibrate and image data for secondary phase-stopping centers.

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 31DEC18 or, preferably, the latest release.

VLBI

EOPs

The web site at Goddard Space Flight Center long used to provide data on the location of the Earth's pole stopped working late last Fall. Thanks to dedicated GSFC employees, we were able to obtain these data by a back channel to support the VLA and VLBA correlators. We also made these files available on an NRAO (LBO) web page. The standard VLBAEOPS procedure was changed to allow the user to provide the data file instead of automatically downloading it. Finally, in May, a new web site was created to supply the EOP data files and *AIPS* procedures were changed to use it. That web site is

ftp://cddis.gsfc.nasa.gov/vlbi/gsfc/ancillary/solve_apriori/usno_finals.erp

Using 500-day rather than full data files during this time raised an issue in CLCOR. The code was changed to make sure that the observation date did not precede the valid data in the file.

VLBARUN

VLBARUN is a procedure which invokes many other procedures in the VLBARUN file and in the VLBAUTIL file to load VLBA data to disk and then calibrate and image it. Optionally, VLBARUN creates an html file filled with plots generated during the calibration and imaging. It is easy to skim through this html page looking for issues, or simply confirming that everything went well. Starting with the 2020A observing semester, with proposal deadline Aug 1, 2019, NRAO will offer staff assistance to novice VLBA users with the goal of broadening the user base and reducing the steepness of the learning curve. Therefore, a re-examination of VLBARUN was undertaken.

First, the *POPS* language processor was given an increase in memory by a factor of four. This simplified the development of the run files. Then VLBAUTIL was reviewed, but all it required were changes to the typing to make the code and output messages more readable. Then the code of VLBARUN was overhauled. New capabilities were added to allow a-priori flags to be read in at the start from a text file and, before imaging, to run RFLAG on each source individually. Several changes, reported below, were made to RFLAG to enhance its performance in this environment.

More technical changes made to VLBARUN include changing the imaging of line data to make a separate image cube for each IF and to plot only a selected number of channels in KNTR. The output plots and html are now written to a dated sub-directory below the directory to which OUTFILE points. The messages from VLBARUN are now printed to a text file which is accessible from the vlbarun.html file. The background color of the gif files was changed from black to a light grey so that they may be displayed outside of the html environment. The plots appear two across in the html file, making comparisons easier and the file shorter. The VLBA tutorial found at https://go.nrao.edu/vlba-tut2 was updated for the revised VLBARUN and the link to the vlbarun.html file was changed to a modern version.

VLBAMPHC

VLBAMPHC is a new procedure to support DiFX's ability to correlate an observation at multiple phase-stopping centers. DiFX writes the calibrator data, which does not use multiple centers, and the zero-offset position of the multiple center source into the "primary" data file. It then writes additional, smaller data files, one for each "secondary" phase stopping center. After the user calibrates the primary data file, by hand or with VLBARUN, VLBAMPHC may be used to copy the highest CL and BP tables from the primary data set to a secondary data set. Applying this calibration, RFLAG may be run. Then the calibration and new flags are applied to the secondary data in SPLIT and the result imaged in either continuum or line modes. RFLAG plots in living color and the message file are available from a vlbamphc.html file.

UV-data

RFLAG

RFLAG was given two new options, both of which are used in the new and revised VLBA procedures. The first, hidden away as FPARM(17), flags all times for a channel if more than FPARM(17) of the times have been flagged. Unlike normal flags written by RFLAG, such flags are restricted to the specified source. The second option, FPARM(18) requests that the clip levels, usually set in NOISE and SCUTOFF, be instead computed and used on a baseline basis. This requires a new attached table, called NS, which like the adverbs is computed in the DOPLOT > 0 pass of RFLAG and then applied in the DOPLOT < 0 pass. The computation of the table and its application can be done in one pass if DOPLOT > 0 and DOFLAG > 0. The usual plots and adverbs, averaged over baselines, are still output as well (but not used) even when FPARM(18) is invoked.

A subtle bug was found in the code which could in some cases make very non-subtle results (NaNs and infinities in NOISE and SCUTOFF). The bug also caused a large number of useless flags to be written. Masking portions of the summing arrays when a baseline has no data in a time interval solved the issue. Applying the pre-clip parameter FPARM(13) is also a good idea. The help file recommends it now and the VLBA procedures use it.

Miscellaneous

FGPRT is a new task to count flags by baseline applying to user specified ranges of IF, channels, sources, times, etc. A matrix display is produced.

Planets are now supported wherever a coordinate is required so long as a proper PO table is available to describe the time-varying coordinates.

Linear polarization required a reversal of the sign of the parallactic rotation formulae when converting linear polarization data to Stokes. We believe we finally have the sign correct.

FRING was changed for EVLA data to have the default for DPARM(9) be to not compute rates. EVLA users can overlook this important option and then be very puzzled by the wild swings in the phases.

TYSMO has a new option DOSCALE to normalize the values in each scan for the median-window filter clipping. That clipping was changed to be applied both before and after the median window operation. Psum was flagged mysteriously due to testing on Psys, when no such test was requested. Corrected to flag only when requested.

The SY table format was changed some time ago to add a solar data indicator. Several tasks, especially TYSMO when flagging the SY table, were corrected to handle the new format properly.

SPLIT was given a ROTMEAS option to apply a rotation measure correction to the cross-hand polarization data written. The value used is added to the output file's header keywords. This option will allow averaging of spectral channels in the cross hands.

BDF2AIPS has a new option DOSTOKES to select the desired data when the desired configuration contains data with different numbers of Stokes.

SETJY has a new option SRCALIAS to give source name aliases so that a user's name for a source does not have to match the official name(s) of the source in 'CALC'. SRCALIAS(*i*) must be an official name for the SOURCES(*i*).

BPWAY was given the NORMALIZ option to avoid the rms spectrum normalization if desired. It was corrected to write the correct *uvw*'s when BIF > 1.

BPASS has additional normalization options (BPASSPRM(10)) to use the median rather than the mean.

VBCAL was corrected to write out valid data. The default values for the *x*PARM adverbs were corrected and the help file improved.

IM2CC was given the IMSIZE option to allow the output image to be bigger than the minimum size. The image size controls the accuracy of gridded modeling and larger is much better.

OOSUB was corrected in its division mode for an error that zeroed channels too early. Other corrections were made to zero only the current channels and Stokes when computing a 'MODL'. The DFT routine and lower-level Q routines were changed to keep better track of whether a normal or a 'MODL' computation was being done. The decision on DFT versus GRID mode was also improved.

Display and imaging

IMAGR was given NEXT FIELD and LAST FIELD options in the TV menu to make examining a large number of fields easier. The STOP FLD and ALLOW FLD options now appear with all values of OVERLAP.

FILIT was corrected to enable the menu after loading an image, rather than simply loading the images to the display in an infinite loop. The roam function was also corrected.

RESCALE was given a DOCC option to apply the re-scale factor to any CC files as well as the image.

Plots from several basic tasks labeled brightnesses as "flux". This was corrected to "brightness."

General

The memory for the *POPS* language processor was increased by a factor of 4. POPSGN and the SAVE and GET pseudo-verbs were improved to handle such changes in a manner that will be mostly transparent to the user.

QCREATE was changed so that the default is to create disk files quickly. Many users are unaware of this adverb to GO and suffer needless delays in their processing. It may still be set negative to force a new file to be filled with zeros thereby insuring that the disk space is available when needed.

CookBook updates were made for the labeling of figures plus changes described here and new tasks from last year TVIEW and SNBLP.

MOVE was given a new OPCODE = 'COPD' to copy a catalog entry, allowing duplicate names, and then delete the input file.

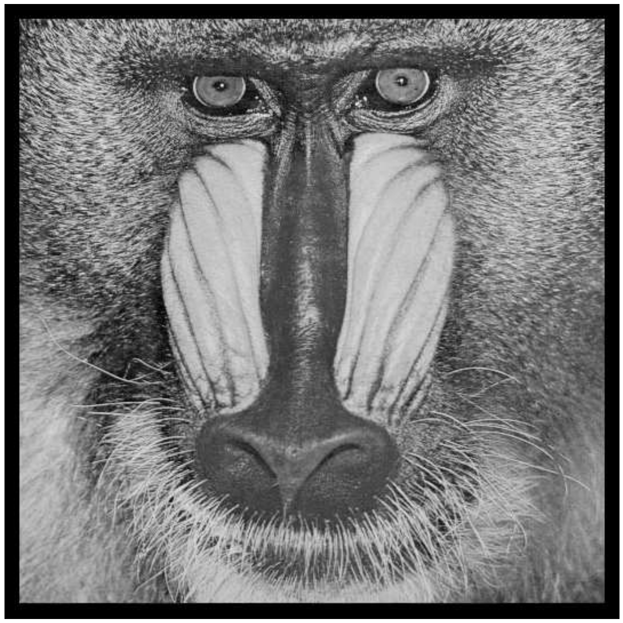
Patch Distribution for 31DEC18

Important bug fixes and selected improvements in 31DEC18 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 31DEC19 are found, they are simply corrected since 31DEC19 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 31DEC18, meaning that a MNJ run on 31DEC18 after the patch will fetch the corrected code and/or binaries rather than failing. Also, installations of 31DEC18 after the patch date will contain the corrected code. The 31DEC18 release has had a number of patches:

1. VBCAL did not write the output data set. *2019-01-18*
2. TYCOP and other tasks had the old number of columns for the SY table. *2019-02-13*
3. Model computation had problems when computing multiple CC models. *2019-03-05*
4. Conversion of linear polarization to Stokes had a wrong sign. *2019-03-05*
5. TYSMO applied clipping and flags inconsistently. *2019-03-05*
6. FILIT had an infinite loop displaying the image facets and did not handle the roam function properly *2019-03-28*
7. KNTR and other tasks truncated one of the "brightness" strings *2019-04-03*
8. OOSUB did not do channel dependent division correctly. *2019-04-10*
9. SPIXR did not handle sub-images with an FQ axis correctly. *2019-05-03*
10. RFLAG did not handle missing data correctly, making too many flags. *2019-06-14*
11. KNTR computed the number of planes to plot poorly *2019-06-14*
12. BPWAY, RLCOR did not change uvw for BIF greater than one.*2019-06-14*
13. TAPLT tested for no data backwards and so did not do good plots. *2019-06-21*

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 2019 more than 263 IP addresses have downloaded the frozen form of 31DEC18, while more than 396 IP addresses have downloaded 31DEC19. The binary version was accessed for installation or MNJs by 253 sites for 31DEC18 and 352 sites for 31DEC19. A total of 671 different IP addresses have appeared in one of our transaction log files. The numbers for 31DEC19 are essentially the same as last year while the total and 31DEC18 numbers are slightly lower than last year at this time.



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