AIPSLETTER

Volume XXXVI, Number 1: June 30, 2016

A newsletter for users of the NRAO
*A*stronomical *I*mage *P*rocessing *S*ystem

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 37th 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 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), Solaris, and MacIntosh OS/X (PPC and Intel) systems may install binary versions of recent releases. The last, "frozen" release is called `31DEC15` while `31DEC16` 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 `31DEC16`. Having fetched `31DEC16`, 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. Use a copy of the task and its help file in a private disk area instead.

AIPS is now copyright © 1995 through 2016 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 31DEC16

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 31DEC16 in the last six months. Some of these were in the nature of bug fixes which were applied to 31DEC15 before and after it was frozen. If you are running 31DEC15, 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. The "Midnight Job" was changed so that binary installations are no longer required to use the cvs tool. Only rsync is used by default, although cvs may be requested. New tasks in 31DEC16 include TVSPC to review the contents of spectral cubes interactively, SLPRT to print the contents of slice files, and UVGIT to fit models to *uv* data. The new verb DAYNUMBR returns the day number in the year of the observation of the cataloged file.

Tasks in preparation at the moment include an interactive *uv* editor much like EDITA but using bandpass tables called BPEDT. VLBI correlators are now capable of producing numerous pulse cals per spectral window. Tasks to edit these tables interactively and to use them for delay and phase calibration are in the planning stage. The old computer used to prepare the binaries for Mac OS/X will soon be replaced. It will have to run OS version El Capitan (10.11) but the load modules will be prepared on a virtual machine of some, yet-to-be-determined older version, probably 10.8.

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 31DEC15 or, preferably, the latest release.

Analysis

TVSPC is a powerful new task to help you discover the contents of your data cubes. It takes as inputs one or two data cubes plus a single plane image that is meaningful in the context of the cubes. That plane image could be a moment zero image, a continuum image, a total polarization image, or any other that has meaning to the user. The image is displayed on the TV and a menu offers the option to display spectra. When invoked, the TV cursor on the 2-D image selects a pixel in the cube and the spectrum at that pixel is displayed. This option is highly interactive, allowing you to explore quickly the spectra throughout the cube. A second cube may be explored simultaneously when appropriate, such as in Zeeman observations (cubes of I and V polarization) or rotation measure observations (cubes of Q and U polarizations). Spectra so displayed may be fit with Gaussians and saved as slice files.

This task should make it easier to use the relatively new model fitting tasks XGAUS, RMFIT, and ZEMAN. Advance knowledge of the spectral structure of the cube can inform you about how to divide up the fitting problem. As with the fitting tasks, an *AIPS* Memo (number 120) has been written to detail the inputs and functions of TVSPC.

SLPRT is a new task to print the contents of slice files including the model fit (if any).

UVGIT is a new task to fit models to visibility data. It is a version of UVFIT which employs a different mathematical fitting process and hence may converge when UVFIT does not.

UVMOD now has a more clearly defined meaning for the FLUX adverb setting the noise to be added. Now, when the original data are omitted (FACTOR=0), FLUX is simply the noise level in Jy.

TRANS was altered to be more forgiving when parsing adverb TRANSCOD while adding checks to make sure the transposition is specified fully and correctly.

STARS was enhanced to allow star positions in the form of RASHIFTs and DECSHIFTs.

MFPRT was changed to honor the adverb DOHMS and to give it an added value meaning the shifts for the new option in STARS. It was also changed to use the component offsets to find the component pixel, a change that should make it immune to changes in image and cell size.

UV-data

FRING was changed to solve for delays in more than one group of IFs while also solving for dispersion.

PCAL was corrected for an error in picking up the new antenna parameters. It was changed to treat an absence of model at some time as a warning when the weight is zero and to avoid losing the ionospheric calibration data when doing the spectral mode.

UVFIX was corrected to compute uvw in wavelengths at the header frequency rather than the actual observed frequency.

RFLAG now supports data pre-averaging with the YINC adverb.

TYAPL now offers the option to flag SY, TY, and SN tables when applying flags to the uv data.

TVFLG, SPFLG, and FTFLG can now do all four polarizations on one execution if STOKES = 'FULL'.

EDITA, EDITR, and SNEDT were corrected to take BIF into account when doing 3-color plots and to use a better coloring when 2 polarizations are plotted with only one IF. They were corrected to handle source number zero from tables and to do a more reasonable expansion of times when writing flags.

APCAL was corrected to check gain table record differences correctly.

DBCON was corrected to stop re-instating flagged table rows.

RLDLY was corrected to write a new SN table always.

UVFLG was changed to offer an option for the input text file that defines a frequency range to flag. This will allow text files to be prepared for known RFI frequencies and then used with more than one uv file.

PBEAM was changed to display IRING-like plots of the beam data and model including differences and to print the fits in greater detail.

Imaging

There are users who wish to do self-calibration in *AIPS* who have source models (with or without spectral index) in the form of large images. The task IM2CC was written some time ago to break the model image into suitable facets with Clean Component files containing all pixels above some specified level. During the reporting period, this task was revised to write only those facets with actual Clean Components. A procedure called IMSCAL was written as part of the OOCAL RUN file to execute IM2CC, followed by OOCAL, and finally followed by a clean-up step. OOCAL uses OOSUB to divide the calibrator data by the model including spectral index and then to run CALIB on the divided data set, finally copying the resulting SN table to the input uv file.

Tests of IMSCAL revealed that the implementation of the model division needed some generalizations. The primary beam and spectral index routines now read the spectral index image(s) into memory to improve performance. The routines also needed to be informed about which frequencies were used in the model and in the spectral index image. In IMAGR bandwidth synthesis, all frequencies enter into the model and this is used to scale each component to the averaged component value. In IMSCAL, however, the model is usually computed for a specific frequency (or group of frequencies).

IMAGR was corrected for an error which affected auto-boxing when the y image dimension was less than the x dimension. Components would only be found on the left-hand side of the image.

Rick Perley has re-measured the primary beam patterns of the VLA antennas at all bands and documented them in EVLA Memo 195. He finds that the new beam parameters depend on band but also on frequency within the band. This has been implemented in the PBCALC subroutine used extensively throughout *AIPS*. PATGN was given a new option to help select which primary beam is desired. Tasks which use this routine range from PBCOR and FLATN to model fitting (SAD, JMFIT, IMFIT, TVSAD, SPIXR) to moment fitting XMOM, MOMNT) to facet preparation (BOXES, FACES, SETFC) and to imaging (IMAGR, OOSUB).

General

Because of repeated unfortunate experiences, almost all *AIPS* tasks which are capable of printing directly to a line printer have been changed. They now determine how many lines will be printed before printing any and require permission from the user to proceed if the line count exceeds 500. This means that print tasks resume AIPS promptly only when DOCRT ≤ 0, OUTPRINT is not blank, and, of course, DOWAIT is false.

There really is no reason to require the "Midnight Jobs" of binary installations to use cvs. The MNJ scripts have been changed to use rsync not just for binary files, but also for text files including both source code and documentation. The cvs package is no longer required for binary installations although it is used for text installations.

The *CookBook* was updated to include TVSPC and to overhaul the low-frequency Appendix L. The latter still needs further improvements. The FITS reading tasks IMLOD and FITTP were changed to be able to read a file containing only a table. Source catalogs are frequently available in this form. They often contain a large number of columns. *AIPS* will read the first 127 columns only. A new verb DAYNUMBR was written to return the day number within the year corresponding to the observation date in a cataloged uv data set or image.

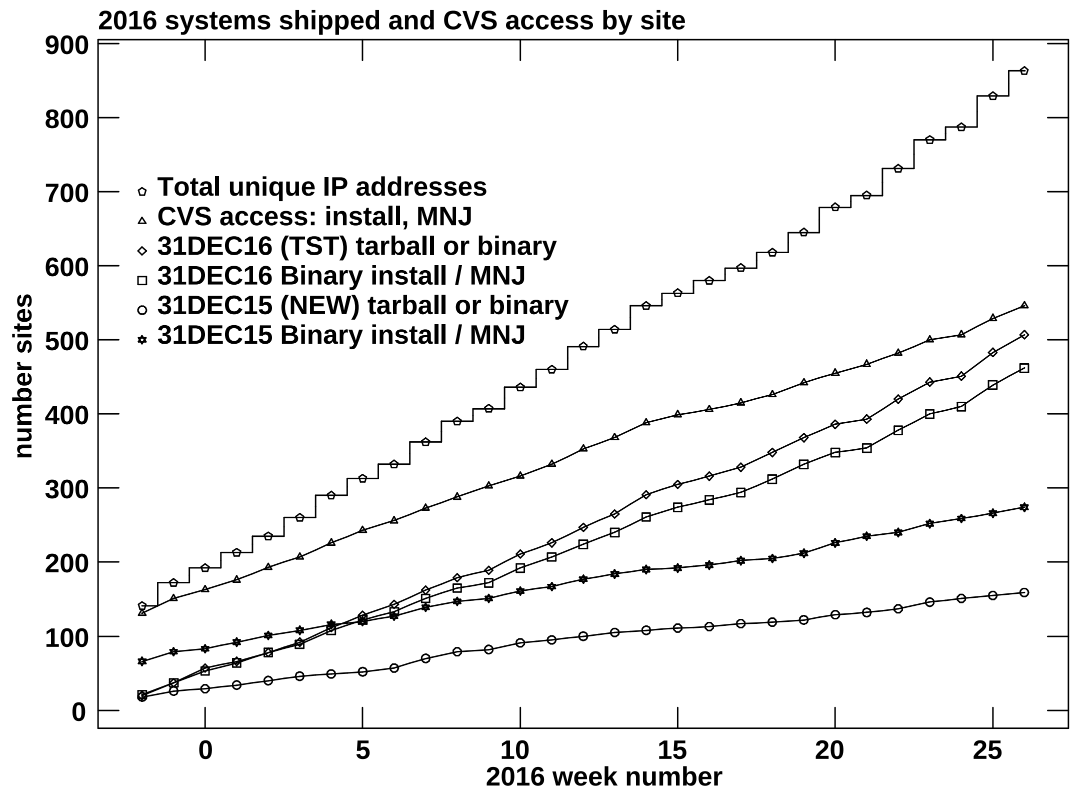
Patch Distribution for 31DEC15

Important bug fixes and selected improvements in 31DEC15 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 31DEC16 are found, they are simply corrected since 31DEC16 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 31DEC15, meaning that a MNJ run on 31DEC15 after the patch will fetch the corrected code and/or binaries rather than failing. Also, installations of 31DEC15 after the patch date will contain the corrected code. The 31DEC15 release has had a number of important patches:

1. GC table used to allow 200 values in the gain curve; restore this limit. *2016-01-07*, *2016-01-15*
2. PBEAM scaled Stokes I data incorrectly when adding right and left data files. *2016-01-12*
3. DBCON re-instated flagged table rows. *2016-01-28*
4. DTSUM did not handle the new internal UV format correctly. *2016-02-09*
5. PCAL typo caused errors in antennas used with the new ANTENNA1, ANTENNA2 format. *2016-04-15*
6. PCAL lost Faraday Rotation calibration when doing SPECTRAL solutions. *2016-04-29*
7. IMAGR found automatic boxes in only part of the image when IMSIZE(2) < IMSIZE(1). *2016-05-10*
8. OOP editing had trouble with source number zero sometimes found in tables. *2016-05-19*
9. UVFIX used the actual observing frequency rather than the one in the header to scale uvw. *2016-06-20*
10. OOSUB and other model subtraction/division could get the scaling between frequency channels wrong. *2016-06-24*

AIPS Distribution

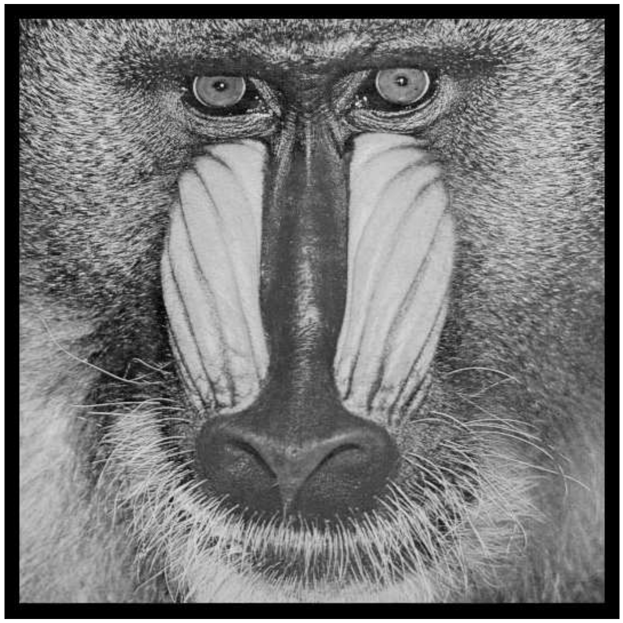
We are now able to log apparent MNJ accesses and downloads of the tar balls. We count these by unique IP address. Since some systems assign the same computer different IP addresses at different times, this will be a bit of an over-estimate of actual sites/computers. However, a single IP address is often 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*. In 2016, there have been a total of 546 IP addresses so far that have accessed the NRAO cvs master. Each of these has at least installed *AIPS*. During 2016 more than 159 IP addresses have downloaded the frozen form of 31DEC15, while more than 507 IP addresses have downloaded 31DEC16. The binary version was accessed for installation or MNJs by 274 sites in 31DEC15 and 462 sites in 31DEC16. A total of 863 different IP addresses have appeared in one of our transaction log files. These numbers are significantly lower than last year.



Recent *AIPS* Memoranda

All *AIPS* Memoranda are available from the *AIPS* home page. *AIPS* Memo 120 describing the new *AIPS* task TVSPC has appeared.

120 **Exploring Image Cubes in *AIPS***
Eric W. Greisen, NRAO
January 22, 2016
AIPS has recently acquired powerful tasks to fit models to the spectral axis of image cubes. These tasks are easier to run if the user is already familiar with the general structure of the data cube. A new task TVSPC has been written to assist in acquiring this familiarity. This task provides an exploration tool within the *AIPS* environment, rather than requiring users to export their cubes to one or more of the many excellent visualization tools now available.



June 30, 2016

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