

AIPSL 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*

Edited by

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Happy 37th birthday *AIPS*

*AIPS*Letter publication

We have discontinued paper copies of the *AIPS*Letter other than for libraries and NRAO staff. The *AIPS*Letter 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 *AIPS*Letter 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.

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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.

MFPR 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 *FRING*-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 *ATPS* 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 *00CAL RUN* file to execute *IM2CC*, followed by *00CAL*, and finally followed by a clean-up step. *00CAL* uses *00SUB* 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 $\text{DOCRT} \leq 0$, 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

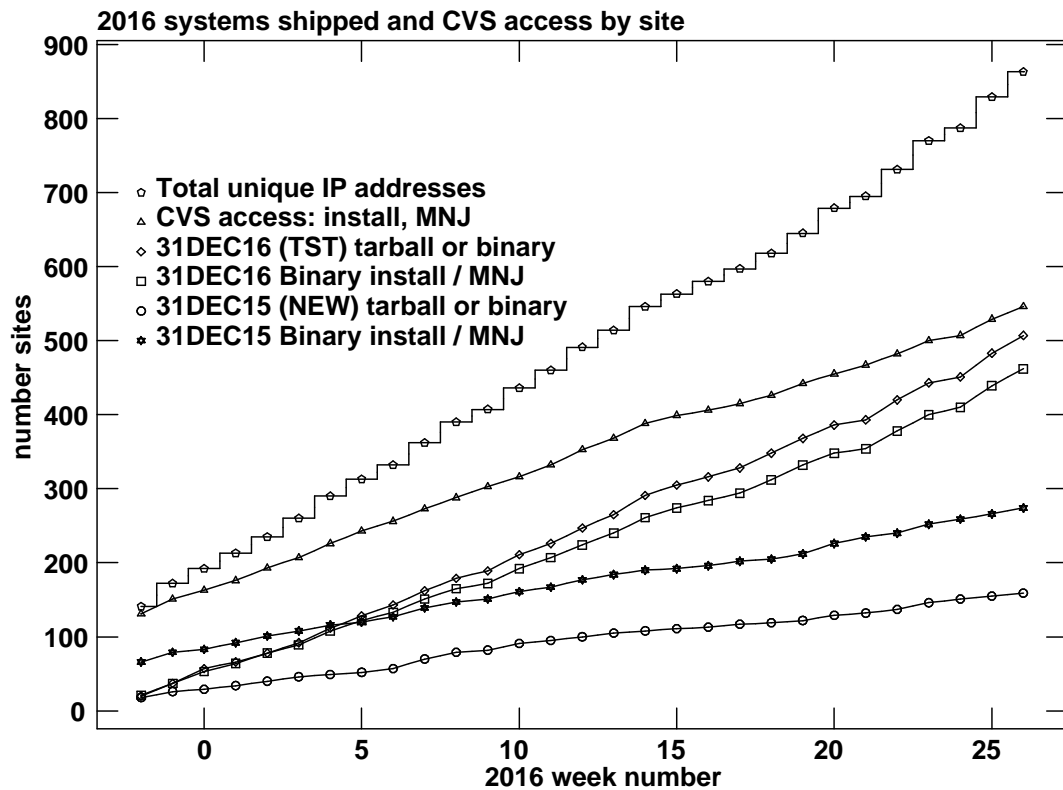
Important bug fixes and selected improvements in 31DEC15 can be downloaded via the MNJ or from the Web beginning at: <http://www.aoc.nrao.edu/aips/patch.html>

Alternatively one can use *anonymous ftp* to the NRAO server [ftp.aoc.nrao.edu](ftp://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 $\text{IMSIZE}(2) < \text{IMSIZE}(1)$. 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

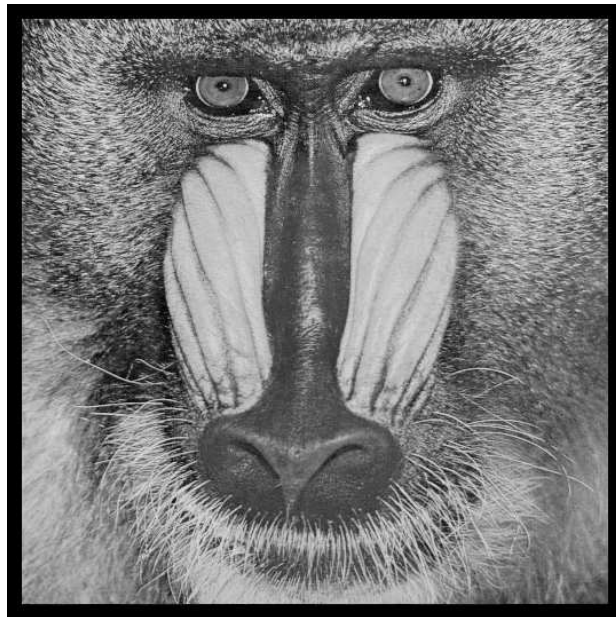
All *AIPS* Memoranda are available from the *AIPS* home page. *AIPS* Memo 120 describing the new *AIPS* task TVSPC has appeared.

120 Exploring Image Cubes in *AIPS*

Eric W. Greisen, NRAO

January 22, 2016

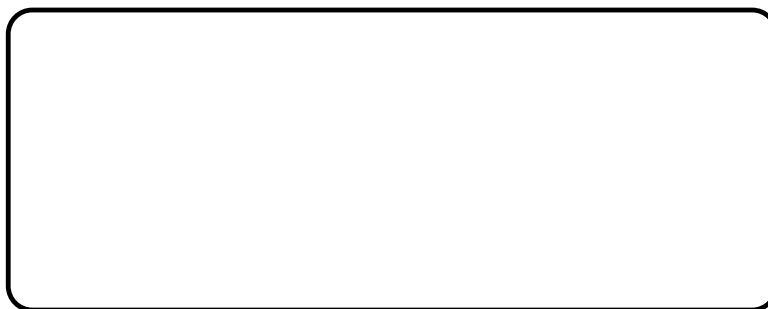
AIPS has recently acquired powerful tasks to fit models to the spectral axis of image cubes. These tasks are easier to run if the user is already familiar with the general structure of the data cube. A new task TVSPC has been written to assist in acquiring this familiarity. This task provides an exploration 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.



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General developments in *AIPS*

Reduction of VLB, VLA and ALMA data in *AIPS*

AIPS continues to be the main software system for the reduction of VLBI data from the VLBA and other telescopes. Since 2010, there have been numerous improvements to *AIPS* that enable full calibration of data from the Karl G. Jansky VLA and most imaging operations as well. The one exception is the wide-band (bandwidth synthesis) deconvolution algorithm (“MSMFS”) being developed in *CASA* by Urvashi Rao Venkata, for which there is no comparable function in *AIPS*. Calibrated *uv* data may be exported from *AIPS* in “UVFITS” format for use in that program. ALMA data may also be reduced in *AIPS*, although the package is not fully qualified to calibrate data from linearly-polarized feeds. See Appendix E of the *AIPS* Cookbook, available via the *AIPS* web site, for details.

*AIPS*Letter publication

We have discontinued paper copies of the *AIPS*Letter other than for libraries and NRAO staff. The *AIPS*Letter will be available in PostScript and pdf forms as always from the web site listed above and will be shipped with all distributions of *AIPS*. It will be announced on the bananas and MNJ list servers and, usually, in the NRAO e-News mailing.

Current and future releases

We have formal *AIPS* releases on an annual basis. We recommend a full binary installation method for both the frozen and development versions for MacIntosh OS/X (PPC and Intel chips), Solaris, and Linux (32- and 64-bit) systems, but all architectures can do a full installation from the source files. If you develop *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 31DEC16 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 2017 to convert your copy of 31DEC16 into the frozen version. However, when patches to 31DEC16 are announced in 2017, you may apply them with the MNJ. This *AIPS*Letter is intended to advise you of corrections and improvements in this release.

We have begun a new version, called 31DEC17, which is now under development by the *AIPS* Group. You may fetch and install a complete copy of this version at any time. Having fetched 31DEC17, 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 31DEC17 *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 131-Mbyte 31DEC17.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 *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.

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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 *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 `$HOME/.AIPSRC` file may be left in place, but it will need to be edited. The lines giving the `DOWNLOADED` and `UNPACKED` parameters should be cleared and the `CCOMOPT` line should be changed to point to the current release rather than the previous one. If you have made a special version of `do.daily.host`, you should preserve it under a new name and restore it after the install. If you have an odd set of *AIPS* versions, the `$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. Note that the only version which we patch for major errors is 31DEC16; even 31DEC15 is no longer changed.

Improvements of interest to users in 31DEC16

In the first six months of 31DEC16 the "Midnight Job" was changed so that binary installations use only *rsync*; *cvs* is no longer required. A number of improvements to the MNJ were done in the last six months in support of this change. New tasks in this period include *UFLAG* to edit data interactively on a *uv* grid, *BPEDT* to flag *uv* data based on bandpass table problems found interactively, *FGTAB* to prepare fixed frequency flags for input to *UVFLG*, *FGCNT* to compare the effects of two flag tables on the amount of data remaining, and a suite of new tasks to handle pulse-cal data for VLBI observations. These are *PCFLG* to edit a PC table with a frequency-time grey-scale display, *PCEDT* to edit a PC table with a graphical display, *PCPLT* to plot PC table spectra, *PCASS* to compute bandpass correction tables from PC table data, and *PCFIT* to write phase and delay calibration information based on the PC table phases. Two new verbs, *TVCOMPS* and *TVACOMPS* were added to plot slice model components on the TV. New tasks in the first six months include especially *TVSPC* to review the contents of spectral cubes interactively plus *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.

Normally, bugs which appear in an AIPS TST version and then are fixed in that same version before its release get little or no discussion in the AIPS Letter. Since a rather large number of sites now install the TST version of AIPS during its development, this is somewhat of an oversight. We urge you to run the “Midnight Job” at least once after 31DEC16 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 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.

UV data: Pulse-cal tables for VLBI

The DiFX correlator is now capable of providing pulse-cal tones at every MHz. These complex data are written into text files archived in full at the correlator site and may be written in the FITS-IDI output files. Since these data have very high signal-to-noise ratio, they should be used wherever possible to assist with calibration. Beginning in July 2016, AIPS was changed to support this capability. In fact, AIPS can now handle up to 256 tones per spectral window, which is way more than needed at present. The first task changed for these numerous pulse-cal tones was POSSM which now offers an option to plot pulse-cal spectra with its usual data averaging options. PCLOD was also changed to read the new DiFX pulse-cal text file format, writing a modern PC table.

The pulse-cal spectra show both an amplitude shape resembling the bandpass shape and “bad” channels, *i.e.*, channels with amplitudes and phases differing from those expected from their neighbors. Thus, new tasks were written to edit the PC tables. PCFLG is very similar to SPFLG, showing in gray-scale pulse-cal channel on the X axis and time on the Y axis. Unlike SPFLG, which is used to edit visibility data, PCFLG writes out an edited version of the input PC table. Numerous display types are available including phase corrected for delay and phase fit to the input data (“residual phase”). The fits may be re-done after some editing in case leaving out the bad channels has a significant effect on the fits. PCEDT is a graphical editor to do the same operation. The graphical perspective is good, but if there is a large number of times, editing with PCFLG will be faster. PCEDT does have the capability of computing and re-computing residual phases as well. Another new task, PCPLT, resembles BPLOTT in that it can plot pulse-cal spectra for all antennas, one time per page, or for all times, one antenna per page. This is another way to examine your pulse-cal data to look for bad channels in amplitude, phase, or residual phase with a variety of difference options as well. Another new task for pulse-cal data is PCFIT, which does the fitting for delay/phase and then writes out both a PC table with residual phases and an SN table with either the fit delays and phases or with the difference between the fits at time t and the fits at the first time in the PC table. It appears that the delays in the PC table are very large (100’s of ns) and quite different between antennas. Thus, the fit delays are probably not suitable to apply to the visibility data directly, but changes to the pulse-cal delays are expected to reflect changes to the delay affecting the visibility data. Finally, another new task is called PCASS to compute bandpass-correction tables from the PC table amplitudes with or without the residual phases.

These new capabilities still need testing with real data, but they offer significant opportunities for more accurate calibration of VLB data.

UV Data: Editing on a uv grid and with bandpass tables

When making images of newly-calibrated data, it is not uncommon to see sine waves in the image particularly when Cleaning down toward the image noise level. Previously, to find the bad data, one had to use tasks FFT plus COMB to make an image of the data on a uv grid. Then the uv coordinates of the peaks in that image had to be found and translated into locations in the visibility data set with UVFND. Finally, UVFLG had to be run multiple times. This was tedious at best and not very reliable.

The whole process has now been replaced with the new task UFLAG. It grids selected visibility data onto a uv grid and displays images of the scalar average amplitude, the vector average amplitude, the difference

of these two, and the average phase, all of which may be used to edit the data. One may simply choose to flag a cell which will flag all visibilities contributing to that cell. But one may also examine each of the visibilities contributing to a cell and flag only those that you choose to delete. There are even automated methods to flag all visibilities outside desired ranges from cells selected by various criteria. All of these options are driven via a TV menu plus question and answer sessions for the automated flagging. The task is described fully in *AIPS* Memo 121 (see below).

Another new task is BPEDT with resembles EDITA and friends. It uses a graphical display of bandpass table data with the X axis being frequency rather than time. The amplitude or phase is displayed in an edit window for the particular antenna and time, with comparison windows of the other parameter for the particular antenna and the same parameter for chosen comparison antennas. Bad channels in the solution may then be marked and used to flag the visibility data for the bandpass calibrator or all sources.

UV data: Fixing a VLA issue

From August 9 until November 15, 2016, the on-line system at the VLA had an error in the atmospheric delay correction. While this correction should probably include elaborate weather models over each antenna, the actual correction that is done is purely geometric. The task VLANT was changed to make the correction to the CL table for this error for data in the above time range. It was put in VLANT so that most users will run it with no new instructions required. The error caused observations at low elevation to have a shifted centroid and, if the elevations varied a lot through the observation, to be rather smeared out. The correction is a tiny change in delay at each antenna, but the phase change between calibrator scans and target scans can be quite significant.

UV data: Miscellaneous

WIPER was changed to keep track of up to 25 baselines per image pixel, to display small (sub)images with pixel replication, to report how much is flagged, and to improve the display of axis labels and other cosmetic items.

FGCNT is a new task that compares the effect of two different flag tables by counting the visibility samples that get through them separately for each source, polarization, and IF.

FGTAB is a new task to extract suitable flags from an existing FG table and write them as frequency-range flags in a text file suitable for input to UVFLG.

CLCAL was changed to re-reference phases only if they need to be and to correct some issues with reading the input SN table.

UVMG was given an additional adverb to tell it to use the full convolution functions rather than a simple pill-box (which users will almost certainly prefer).

ACSCAL was changed to use the SUBARRAY adverb and to be able to loop over all subarrays if it is zero. Handling of the last scan was corrected including in ACCOR.

Subarrays were limited in the code to no more than 50. The new format allows an unlimited number, so this limit was changed to 512 in numerous places in the code.

IMSCAL and **00CAL** procedures were changed to write history records in the input file, since all output files in these procedures are temporary and are deleted.

FITLD and **UVL0D** were changed to handle compressed data correctly when **DOKEEP** is false.

UVFLG was changed to compute the flags for shadowing correctly. The choice of which antenna of a pair was the shadowed one used an incorrect variable.

Analysis: Miscellaneous

- TVSPC** was enhanced to allow axis labeling in channels and to select the display channel range interactively during execution. *AIPS* Memo 120 was updated for the changes.
- PBCOR** was corrected to tell the truth in the history file about the parameters actually used. All tasks that compute the primary beam now have full information in the help files and will print information about the parameters used during execution. The new VLA P-band parameters were corrected — they require 4 terms while all other bands require only 3.
- XGAUS** was given the option to plot individual model components and the handling of the XG (and ZE) tables was improved to guarantee correct coordinates.
- XG2PL** was changed to display all needed values from the fit, to handle missing XG and/or ZE files, and to print the chosen axis coordinates in the output text file.
- DFTPL** now honors all standard data selection and calibration adverbs.
- UVHGM** was changed to allow more total boxes, to set the default plot range for real, imaginary, and amplitude to match the actual data, and to allow choices in how the histogram is plotted.
- PLGET** and **EXTLIST** were made current with changes in some plot tasks and support for 5 newer tasks was added.
- SLICE** was improved to allow non-integer x and y pixel values when constructing a slice along the z axis. A proper interpolation is now done.
- TVCOMPS** and **TVACOMPS** are new verbs to plot slice model components on the TV display.
- Slice** fitting was changed to allow fitting of a spectral baseline in **SLFIT** and **TVSPC** and all slice display routines were changed to include any baseline in the display.
- RMSD** was given two new operations. One returns an image of the median value in the sliding window and the other returns an image of the median absolute deviation from the median (the “MAD” statistic) scaled to be like an rms.

General: Miscellaneous

- Mac** binary distributions are now solely for 64-bit Macs running OS/X version 10.7 or greater. 31DEC15 is the last of the 32-bit binaries since the old machine that computed them will soon be decommissioned.
- MNJ** procedures for binary installations were updated to insure that essential maintenance operations, such as running **POPSGN** whenever new verbs or adverbs are created, are actually done.
- TABED** was changed to copy all rows to the output table except when the user explicitly says not to (**APARM**(10) > 0). Previously operations had unexpected actions when writing to a new table.
- HINOTE** can now pre-pend a user-specified task name rather than simply pre-pending “HISTORY”.
- CookBook** was updated for changes noted above.

Recent *AIPS* Memoranda

All *AIPS* Memoranda are available from the *AIPS* home page. *AIPS* Memo 120 describing the new *AIPS* task **TVSPC** has been updated to describe the **SET CHANNELS** option and other changes. Furthermore, *AIPS* Memo 121 describing the new task **UFLAG** has appeared.

120 Exploring Image Cubes in *AIPS*

Eric W. Greisen, NRAO

October 28, 2016 (revised)

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.

121 Editing on a *uv* grid in *AIPS*

Eric W. Greisen, NRAO

September 12, 2016

Since its beginning, *AIPS* has offered users methods to identify and delete bad data samples. Modern interferometers observe over wide bandwidths and so must include spectral regions polluted by radio-frequency interference (“RFI”). Numerous tasks, both interactive and automated, have appeared to assist the modern user in this operation. A new one, called UFLAG, has been written to allow the user to explore the data as it appears when gridded in the *uv* plane. This memo is intended to assist users in navigating the new task.

Patch Distribution for 31DEC15

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, 31DEC15 was patched during 2016 and 31DEC16 will be patched as needed during 2017. 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.

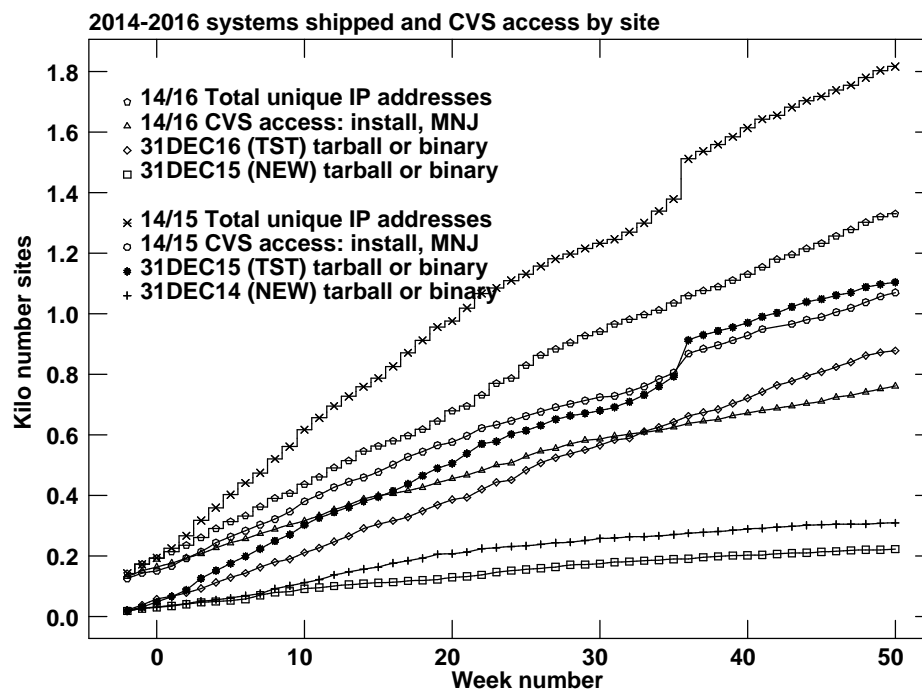
The 31DEC15 release is no longer available for installation and will no longer receive patches even for egregious errors. It had a number of important patches during 2016. They are

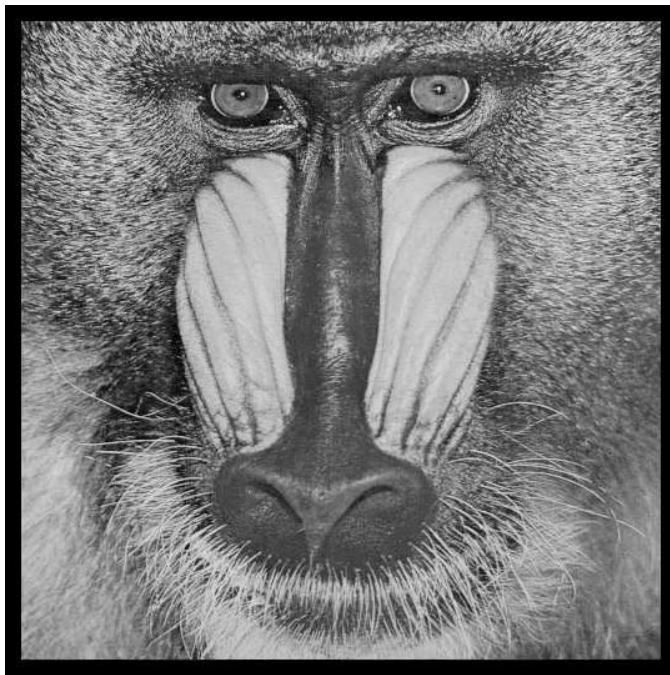
1. GC table used to allow 200 values in the gain curve; restore this limit. 2016-01-07, 2016-01-15
2. PBEAM scaled Stokes I data incorrectly when adding right and left data files. 2016-01-12
3. DBCON re-instated flagged table rows. 2016-01-28
4. DTSUM did not handle the new internal UV format correctly. 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
11. UVL0D, FITLD did not find the subarray value accurately enough. 2016-08-25
12. SPLIT did not write the correct header frequency when averaging IFs with BIF greater than 1. 2016-08-26
13. FITLD and UVL0D did not test data flagging correctly when writing and reading UV tables in compressed format. 2016-08-31

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 *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 *AIPS*. In 2016, a total of 222 different IP addresses downloaded the frozen form of 31DEC15 and 878 IP addresses downloaded 31DEC16 in tarball or binary form. Fully 761 IP addresses accessed the NRAO cvs master. Each of these has at least installed some version of *AIPS*, but with the change to the MNJ we are unable even to guess how many sites have run the MNJ. The total number of unique IP addresses in these three lists was 1330. The 31DEC16 numbers are about 80 percent, while others numbers are around 72%, of the previous year. This suggests that CASA has made inroads into our user base. The table below shows these numbers as a function of year since we began recording them. The attached figure shows the cumulative number of unique sites, cvs access sites, and download sites known to us as a function of week in 2016. The numbers for 2015 are also plotted and show a decrease in 2016 in all cases.

year	TST name	NEW name	TST	NEW	TST binary	NEW binary	cvs	Total unique
2004	31DEC04	31DEC03	808	196			797	1276
2005	31DEC05	31DEC04	832	246	299	48	982	1460
2006	31DEC06	31DEC05	806	191	402	94	1050	1398
2007	31DEC07	31DEC06	965	277	669	161	1385	1811
2008	31DEC08	31DEC07	1058	246	986	303	1667	2107
2009	31DEC09	31DEC08	1228	307	1082	478	1855	2399
2010	31DEC10	31DEC09	1228	307	1203	477	1914	2416
2011	31DEC11	31DEC10	1105	270	1064	424	1747	2228
2012	31DEC12	31DEC11	940	284	1028	396	1309	1698
2013	31DEC13	31DEC12	1014	307	990	443	1264	1937
2014	31DEC14	31DEC13	1045	333	848	431	1023	1843
2015	31DEC15	31DEC14	1104	309	1001	350	1070	1817
2016	31DEC16	31DEC15	878	222	788	372	761	1330





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