AIPSLETTER

Volume XXXI, Number 2: December 31, 2011

A newsletter for users of the NRAO
Astronomical Image Processing System

Written by a cast of *AIPS*

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General developments in *AIPS*

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, you will need to do a source-level installation. The current release is called `31DEC11` 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 2012 to convert your copy of `31DEC11` into the frozen version. However, when patches to `31DEC11` are announced, you may apply them with the MNJ. This *AIPSLetter* is intended to advise you of corrections and improvements in this release.

We have begun a new version, called `31DEC12`, 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 `31DEC12`, you may update your installation whenever you want by running the MNJ. This uses cvs, rsync, and/or transaction files to copy and 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 `31DEC12` *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 112-Mbyte `31DEC12.tar.gz` compressed tar file. 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.

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AIPSLetter publication

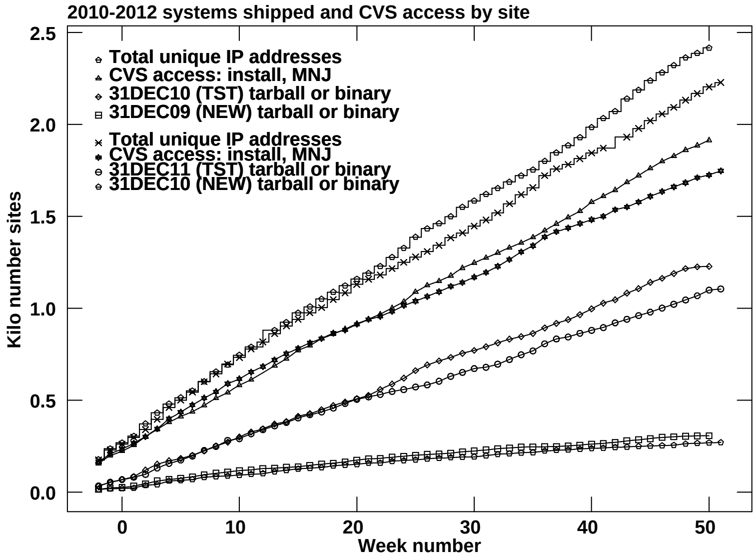
We have decided to discontinue paper copies of the *AIPSLetter* other than for libraries and NRAO staff. The *AIPSLetter* will be available in PostScript and pdf forms as always from the web site listed above and included in all *AIPS* installations. It will be announced in the NRAO e-News mailing and on the bananas and mnj list servers.

Installing a new version

If compiling locally, new releases must be installed from the tar ball for that release. If using the binary installation, a full new installation must also be done with `rsync`. The `cvs` system requires this. 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.

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 2011, a total of 270 different IP addresses downloaded the frozen form of `31DEC10` and 1105 IP addresses downloaded `31DEC11` in tarball or binary form. Fully 1747 IP addresses accessed the NRAO cvs master. Each of these has at least installed some version of *AIPS* and many appear to have run the MNJ at least occasionally. The total number of unique IP addresses in these three lists was 2228. 424 sites accessed `31DEC10` in binary form, while 1064 sites used the binary form of `31DEC11`. The attached figure shows the cumulative number of unique sites, cvs access sites, and tar-ball/binary download sites known to us as a function of week in 2011. The numbers for 2010 are also plotted and show that there has been about a 10% drop this year beginning in the middle of the year. Presumably `CASA` is responsible for this.



Preview of coming attractions

The 31DEC12 release already contains a few changes that we decided were a bit risky or not needed in 31DEC11. LISTR will print SY tables as OPTYPE='GAIN', showing the apparent system temperature or the gains that TYAPL will apply. TV code was changed generally to try to avoid having tasks that are failing end up hanging waiting on the TV display. Handling of the CQ table — used to correct VLBI data for decorrelation occurring in the correlator — has been corrected for large FFT sizes with uniform taper; related error messages were clarified.

Improvements of interest to users in 31DEC11

We expect to continue publishing the *AIPSLetter* every six months along with the annual releases. There are a few new tasks released in the last six months. New tasks include REFLG to compress flag tables, FGDIF to compare two flag tables, SNIFS to plot table values versus IF, RFARS to correct polarization cubes for rotation measure found in FARS, and NANS to examine data sets and images for NaNs (not-a-number) and magic-value blanks. A QCREATE adverb was added to GO to request that data files be created in a fast method that does not guarantee that the disk space will actually be available when needed.

In the first six months of 31DEC11 the new tasks were REWGT to scale data weights by subarray and/or IF, ACLIP to do clip operations on auto-correlation data, RLCAL to solve for right minus left phase differences as a function of time when good source models are available, SY2TY to make TY tables from SysPower tables, SYCOP to copy good SY table IFs to bad ones, QUOUT and QUFIX to determine right-left calibrations from well-calibrated images, RFLAG to flag data based on rmses measured over short time intervals and on deviations from the spectral average, IM2CC to convert model images into Clean components attached to suitable image facets, and AFARS to extract useful parametric images from the Faraday Rotation synthesis (FARS) output image cubes. The new verb HUEWEDGE draws a step wedge in two dimensions on the TV and even labels it to match a TVHUEINT display. The OBIT programs BDFIn and BDFList have been made accessible to *AIPS* users through "verbs" BDF2AIPS and BDFLIST. These replace earlier stand-alone, question-and-answer scripts far translating EVLA SDM data sets. This worked so well that further "verbs" OBITMAP, OBITIMAG, OBITSCAL, and OBITPEEL have been written to make available increasingly complex portions of the OBIT program Imager. All of these verbs require the OBIT package to be installed on the computer. A new pipeline procedure named DOOSRO has been written to reduce EVLA data taken with less difficult observing parameters ("Open shared risk"). A service program to list assigned user numbers called USERNO was re-created.

Normally, bugs which are created in an *AIPS* TST version and then fixed in that same version before its release get little or no discussion in the *AIPSLetter*. 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 31DEC11 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* web page under documentation. Please do not hesitate to e-mail daip@nrao.edu with any questions or suspicions that there are problems.

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. Note that the only version which we patch for major errors is 31DEC11; even 31DEC10 is no longer changed.

UV data

RFLAG

RFI is frequently characterized by rapid variability in both time and frequency. The relatively new task RFLAG looks for this and flags the data accordingly. It received a great deal of attention in the last 6 months and has become the most important flagging task for EVLA data. Using a floating buffer in time (usually just 3 or 5 integrations), `RFLAG` measures the rms over time in each channel individually. If the rms exceeds a cutoff, the channel is flagged over that time range. `RFLAG` also finds the mean and rms of the real and imaginary parts of the visibility over the channels in each spectral window at each time. The task uses "robust" methods which exclude outliers while finding the "real" mean and rms. Any channel that deviates by more than a cutoff in Jy will also be flagged. To assist in setting the time and spectral cutoffs, `RFLAG` can plot the spectrum of the mean time and spectral rms in each channel and their variance. It uses these to return suggested cutoffs as a function of spectral window (IF). It can also plot the histograms of values of the time rms and the spectral deviations. The task can now do plots finding cutoff levels followed optionally by applying those levels, or it can apply input cutoffs to the data and then optionally make plots showing the results of applying the new flag table.

`RFLAG` has numerous options to do additional flagging beyond the direct application of the cutoffs. It can flag up to n channels between groups of flagged channels. It can flag a channel over all baselines if too large a fraction are flagged by the cutoffs or flag a full spectral window if too many channels are flagged. It also applies a clip operation prior to examining the data for the rmses. `RFLAG` can write a text file with channel weights based on the rmses over time and/or over channel.

`RFLAG` can produce enormous numbers of flags. The new task `REFLG` was written to attempt to compress the flag table by merging channels and time intervals primarily, although it attempts other compressions as well. `REFLG` offers some of the flag extension options of `RFLAG` plus one, which is not available to `RFLAG`, to flag all times for a channel if too large a fraction of the times are flagged. The new task `FGDIF` was written to compare the consequences of two different flag tables and was important in debugging `REFLG`.

EVLA-driven changes

PCAL was changed to make an intermediate file of the current spectral window prior to selecting the data for each channel. This can speed up the task by factor of 8 or more. It was revised to handle indeterminate solutions in one or more spectral channels without quitting and to deal with a fully flagged IF. It was changed to force the needed status when writing the solution tables and to set `SOLINT` to 1/3 of a scan when only one scan is requested.

TYAPL was corrected to do the best possible job of interpolation in the presence of extensive flagging in the `SY` or `TY` table. It can now apply to the *uv* data up to 200000 flags applying to a single time.

SETJY was using the reference channel for the frequency at which the flux of each IF was computed. This is not representative if the reference channel is channel 1. An option to chose the channel for the flux was added, with the center of the IF as the default.

SPLAT was changed to apply any flagging to `SY`, `TY`, and `SN` tables that are copied.

UVCOP was changed to apply any flagging to `SY`, `TY`, and `SN` tables that are copied. It was changed to use the index table to speed its operations. The flagging for low weights option was made correct and meaningful. Previously it dropped full records if everything was of low weight, but did not flag low weights when some of the record had higher weight. A bug was corrected that caused `UVCOP` with `SOURCES` specified to fail to flag any *uv* or table data.

TVFLG and `SPFLG` were changed to use the calibration and index tables while finding the times for the work file, greatly speeding that operation in some cases. They use greater precision in displaying times when appropriate. They were corrected to display and flag Stokes types compounded from the input (such as I, V from RR and LL) as requested. In such cases, all input Stokes are flagged. `TVFLG` was given a `FLAG BASELINE-DT` operation.

Warnings about failure to reference one antenna to another were corrected generally. Now, if the message appears, it is a real problem rather than a confusion over IFs, polarizations, subarrays, etc.

RLDLY was changed to copy only the necessary baselines and to use the index table when finding integration times, making it rather faster. An abort only on Macs was corrected. `PRTLEV` was added to allow diagnostics when the solutions fail.

CLCAL failed to reference phases properly when smoothing to replace failed solutions. Corrected it to use the reference data of the good solutions being smoothed.

CALIB was changed to forbid DOCAL true for single-source files since that would force a multiplication of 2 SN tables.

REWGT was given the option of reading a text file of channel weights to apply to the data. RFLAG is able to make such a file from the time rmses.

FLOPM copied tables only over the time range being "flopped" although all *uv* data were copied.

Other changes

DOBAND was incorrect for auto-correlation data. Only the real part of the bandpass was applied. The normal cross-correlation correction function is what is actually needed.

MC table times are actually start times not midpoint times despite indications to the contrary. This led to errors in the CL table version 1 values for clock and atmosphere in the correlator model for VLBI data.

FRING was changed to faster methods of disk I/O when determining the integration time at the beginning. The multi-band delay was set erroneously in the EVLA mode. Error messages about excessive FFT size were clarified. The code was corrected to work for up to 90 antennas, like the rest of *AIPS*.

USUBA had internal limits on NX table entries, number of sources, and number of antennas. Changed these to much larger values.

VPFLG was changed to add meanings to the adverb DOIFS to allow extending the flagging to an IF or even all IFs.

Imaging

IMAGR could get confused, when ONEBEAM was true, about what Clean beam size to use when scaling a particular plane of an output cube. The beam used was correctly recorded in the CG table, but the planes were scaled oddly. The code was corrected to allow ALLOKAY to function properly when doing baseline-length dependent time averaging on the fly. The code was rearranged to loop over SUBARRAY to allow all sub-arrays to be used even with calibration and flagging. The TV timeout periods may now be controlled with adverbs IM2PARM(8) and (9).

Analysis

RFARS is a new task to apply the rotation measures found by FARS and AFARS to the original input cubes. Weak polarization signals may then be averaged to improve the signal-to-noise.

SQASH was re-written. Modern disk systems do not work well with the old I/O methods, which once were fine. Added was the ability to find data weights (robustly) from the image planes or by reading a text file in order to make weighted mean and weighted rms images. SQASH was changed to allow squashing even axis 2, producing interesting one-dimensional and, *e.g.*, position-velocity images summed over the other spatial coordinate.

IMEAN was changed to compute an initial guess for fitting the true rms from a robust method rather than using the PIXSTD and PIXAVG adverbs. These are now purely output adverbs from the task.

CONVL now examines the header and CG table and convolves a cube if any channel will convolve to the desired resolution. It fills with magic blanks any channel that cannot be convolved to the desired resolution.

XMOM was given a new OPTYPE = 'MAX' to make images of the maximum pixel value and its location rather than the moment sums. This reveals additional interesting aspects of spectral-line cubes.

UVFIT was given the ability to read an `INLIST` text file for initial guesses of up to 20 components. The file may contain guesses for multiple spectral channels but only those matching `BCHAN` are used. The number of visibilities allowed was raised by a lot and the default `GMAX` was corrected since a value of 0.0 caused the task to fail to iterate. A compact text-file output was added and the task's messages were changed to be more readable.

STFUN now writes out an "rms" image along with the structure function image. The statistics are not simple Gaussian since the function is already squared, but the rms image is still indicative.

Display

SNIFS is a new task to plot tables as a function of IF. It has numerous options controlling time averaging and the plotting of multiple things in a panel, but can still generate a great many plots.

PRTAB now uses `RPARM` to do up to 7 tests on a row to decide whether to display it or not. The handling of the string comparison test was corrected. The task no longer reads all of large files to decide on column formats and makes somewhat better decisions about those formats.

ISPEC now offers the option of natural and base-10 logarithmic vertical scales and options to plot the linear derivative of its basic plots. The latter is especially helpful for Zeeman experiments.

Stars files may now be written containing the fit results of `SAD`, `IMFIT` and `JMFIT`. New adverb `STVERS` is used by the plot tasks to control the plotting of the "stars."

VPLOT, `CLPLT`, and `CAPLT` were changed to allow up to 200000 Clean components in models and were corrected to handle more than 64 fields properly. `VPLOT` was also changed to allow a mammoth number of visibilities.

POSSM and `BPLOT` were given options to plot the difference between right-hand and left-hand polarization bandpasses.

TVHELIX was given the `DOPRINT` option to provide a display of its parameters. This may help to refine one's setting of this rather complicated coloring scheme.

General and system matters

UBUNTU 11.04 systems have shown a variety of odd issues. Apparently X-Windows is not the default screen manager, but needs to be selected to enable *AIPS* display windows to function. These windows can get "lost" if they start in icon form. `XAS` was changed to start open, with an `.XDefaults` option to start in icon form. The `TEK` and `MSG` windows were each given an environment variable that can cause them to start open and in `-hold` mode. The latter means the windows do not die when the *AIPS* program in them terminates. The help files for `XAS`, `TERKSRV`, and `MSGSRV` provide details.

QCREATE is a new adverb to `GO`. It specifies that file creations should be done quickly, rather than by filling the full file with zeros. This runs the risk that the disk space will not actually be available when needed, but can be a great deal faster.

FITTP and `FITAB` were changed to avoid interpreting any floating-point values in *uv* data sets as magic blanks. Previously it was possible for *uv* and data values equal to the "magic value" (3140.89282 on byte-swapped computers) to occur and be written as NaNs (not-a-number) in the output FITS file. This worked okay when the file was read back into *AIPS*, but not when it was read by other packages.

NANS is a new task designed to look for NaNs and magic blanks in *AIPS* files. It was written to explore data sets and tables with potential problems.

CookBook was updated including a new Appendix (E) specifically addressed to EVLA users.

Return adverbs from tasks were changed so that tasks might do the return at an appropriate point and then continue to operate. Previously, `AIPS` waited for the task to finish and then looked for the adverbs.

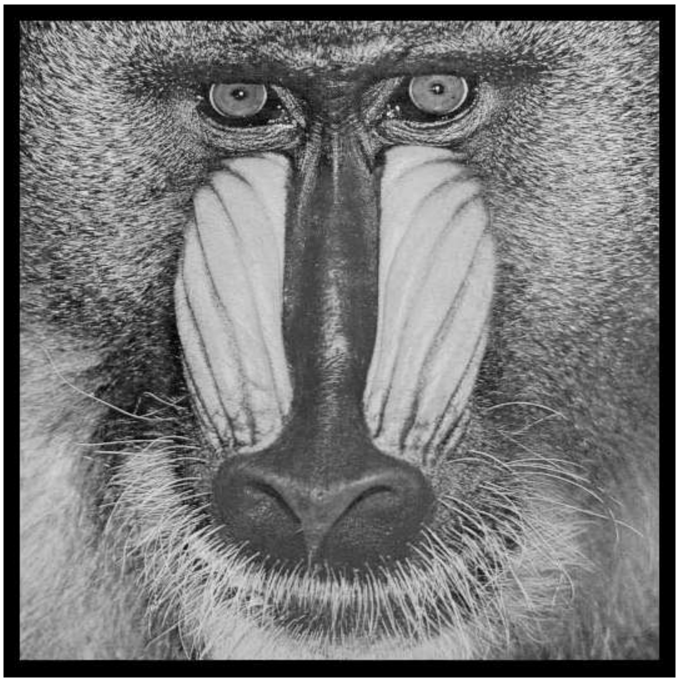
Table sorting code was changed to use dynamic memory in an attempt to do as much as possible in memory. This should be faster and simplifies the use of `TABSRT` in tasks. Larger disk I/O calls are now allowed by the lowest level routines to support this. `TABSRT` now allows the use of array columns as the sort keys, where the calling routine specifies which index in the array(s) is to be used.

Patch Distribution for `31DEC10`

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, `31DEC10` was patched during 2011 and `31DEC11` will be patched as needed during 2012. 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 `31DEC10` 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 2011. They are

1. `UVCOP` used only 12 of the 16 characters of the `SOURCE` adverbs *2011-01-18*
2. `DBCON` was vulnerable to errors in table headers causing absurd disk file size expansions. *2011-01-18*
3. `FRING` got wrong answers from the exhaustive search method for IFs higher than 1. *2011-01-21*
4. OOP-based *uv* tasks could write to the wrong output file. *2011-01-21*
5. `CALIB` failed to build the output header correctly for non-standard single-source data sets. *2011-01-24*
6. `RLDIF` did not handle one source, continuum corrections properly *2011-01-24*
7. `SWAPR` ignored autocorrelation data. *2011-01-24*
8. `SNPLT` did not handle `PC` table phases correctly. *2011-03-23*
9. `IMAGR` did not average multi-channel data correctly when doing on-the-fly baseline-length time averaging. *2011-04-15*
10. `NX` tables were written incorrectly when there were multiple subarrays. *2011-04-25*
11. `IMEAN` did not write the text file output correctly. *2011-06-08*
12. `NOIFS` scaled *uvw*'s incorrectly. *2011-06-14*
13. `CVEL` did not die when it should on fatal errors *2011-06-23*
14. `FITLD` and friends did not read table header character-valued keywords correctly. *2011-06-24*
15. `UVCOP` did not apply flags when `SOURCES` was specified. *2011-07-01*
16. `IMAGR` did not keep the correct Clean beams for facets other than one when making an image cube with `ONEBEAM` true. *2011-07-25*
17. `VPLOT` did not plot models correctly for more than 64 facets. *2011-07-29*
18. `CLCOR` used the wrong sign of the antenna Y position for the `EOPS` and `SUND` operations. *2011-08-04*



December 31, 2011

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