A I P S L E T T E R

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General developments in $\mathcal{AIPS}$

$\mathcal{AIPSL}$etter publication

We have decided to discontinue paper copies of the $\mathcal{AIPSL}$etter other than for libraries and NRAO staff. The $\mathcal{AIPSL}$etter will be available in PostScript and pdf forms as always from the web site listed above. It will be announced in the NRAO e-News mailing and on the bananas list server.

Current and future releases

We have formal $\mathcal{AIPS}$ 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 31DEC10 while 31DEC11 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 $\mathcal{AIPSL}$etter is intended to advise you of improvements to date in 31DEC11. Having fetched 31DEC11, 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 $\mathcal{AIPS}$ Manager FAQ page on the $\mathcal{AIPS}$ web site.

The MNJ serves up $\mathcal{AIPS}$ incrementally using the Unix tool cvs running with anonymous ftp. The binary MNJ also uses the tool rsync as does the binary installation. 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 $\mathcal{AIPS}$-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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Improvements of interest in `31DEC11`

We expect to continue publishing the *AIPSLetter* approximately every six months along with the annual releases. Henceforth, this publication will be primarily electronic. There have been several significant changes in `31DEC11` in the last six months. Some of these were in the nature of bug fixes which were applied to `31DEC10` before and after it was frozen. If you are running `31DEC10`, be sure that it is up to date to sometime this year (a MNJ after June 8 would be best). New tasks in `31DEC11` include `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 average spectrally, `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. 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`. 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.

`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. `31DEC08` contains major changes to the display software. Older versions may use the `31DEC08` display (`XAS`), but `31DEC08` code may not use older versions of `XAS`. Magnetic tape logical unit numbers changed with `31DEC04`. You are encouraged to use a relatively recent version of *AIPS*, whilst those with EVLA data to reduce must get the latest release.

Lion

Apple has announced a new major revision of OS X called Lion (10.7). The VAO in Socorro has made a new, beautifully equipped iMac available to us for testing. It was found to install and run the existing `MACINT` load modules with no difficulty. We then tried using the latest Intel compiler (12.0.4 dated 20110503) with the x86_64 architecture. This version ran a little bit faster than the 32-bit version, but not enough faster to justify making a new `MAC64` "architecture" with a new NRAO computer to support it.

EVLA UV-data calibration and handling

A great many changes have been stimulated by the commissioning effort now underway with the new EVLA WIDAR correlator. A new appendix (E) to the *CookBook* has been written to describe EVLA data reduction. It has been available on the web and is now incorporated into the *AIPS* release. Note that this document is a work in progress and it will of necessity evolve with time.

RFLAG

RFI is frequently characterized by rapid variability in both time and frequency. `RFLAG` looks for this and flags the data accordingly. Using a floating buffer in time (usually just 3 or 5 integrations), it 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 N times the rms will also be flagged. To assist in setting the time cutoff and the value of N, `RFLAG` will plot the histograms of values of the time rms and the spectral deviations instead of writing a flag table. `RFLAG` flags spectral channels individually, while `FLAGR` deletes whole spectral windows depending on trends in the average and rms of the spectral channels.

Polarization and right minus left matters

RLDLY finds the difference in delay between right and left polarizations. This can be large even if little or no delay correction is needed for the parallel-hand data. Bugs were fixed that caused the answers to be compromised especially when dividing the IFs into halves to get one AC and one BD delay. It was changed to copy and correct the CL table that it applied to the data rather than the highest CL version. It was changed to get correct phase offsets for each IF, so that phases will remain continuous across the full band.

After correcting the right minus left delay, one can solve for antenna polarization using PCAL. The model computation in PCAL was found to be in error for Clean component models of Q and U and was corrected. Unfortunately, since PCAL does not solve for a right minus left phase difference but the data contain this difference, the use of a fixed model for the calibrator in PCAL cannot work.

After PCAL, the D-terms are applied to the data from a source of known polarization position angle and the remaining right minus left phases are found and corrected. RLDIF is the main task for this and it had to be fixed to change the spectral-line D-term file (PD) and the continuum mode tables (SU, AN, CL) properly. RLDIF can now read a text file with the Q and U spectrum in order to do its calibration. RLDIF had incorrect position angles for known sources 3C48, 3C138, and 3C147. Handling of blanked solutions and smoothing was also improved.

RLDIF can be instructed to correct the relevant $\mathcal{AIPS}$ tables in either continuum or spectral modes. It can also, in continuum mode only, leave the corrections to be run later in CLCOR. That task corrects the antenna table (D-term solutions) and CL table and now also corrects the source table Q and U values.

RLDIF assumes that the right minus left phase difference is constant with time. At high precision, this is often not the case. A new task RLCAL was written to compare visibility data with models of Q and U to determine and correct this phase difference as a function of time. It should be possible to feed this back into the original data set to improve the polarization and RLDIF solutions and therefore the new set of images.

Dynamic scheduling of observations means that the user cannot count on having observations of the best polarization calibration sources in every data set. Two new tasks were written to assist the user desperately trying to calibrate the data anyway. QUOUT prepares a text file of Q and U for a calibration source from another, well-calibrated data set or from a Q/U image cube. RLDIF can read this file to allow this previously unknown calibration source to be used. The new task QUFIX assumes that the user has a well-calibrated Q/U image cube from one day and a second Q/U image cube from a day lacking the polarization angle calibrator. Comparing the position angles over areas in the two cubes at each spectral channel, the task determines and applies the right-minus left correction.

OBIT in $\mathcal{AIPS}$

The software package known as OBIT, written by Bill Cotton, offers capabilities not available elsewhere. Two stand-alone procedures have been available to translate data from the Science Data Model/Binary Data Format file tree into $\mathcal{AIPS}$ for those users who have OBIT available. These question-and-answer scripts, with requirements on the users' setup, have been replaced with AIPS verbs. The adverb values are prepared in the usual way inside AIPS and the functions invoked by entering the verb names BDFLIST and BDF2AIPS. They invoke OBIT programs and leave log files in the user's home area. The DOWAIT adverb is very useful here, causing AIPS to display the output from the OBIT programs as it occurs and returning control of the AIPS window to the user only when the process has finished.

EVLA SysPower table

The units of the EVLA SysPower table were examined and changed on February 24. They were a Psum and Pdif *divided* by a "gain" normally recorded as having value 512. In fact, this was a fiction with the real gain involving other factors as well. Beginning February 24, the Psum and Pdif are the true values *times* a gain (as advertised) and the true gain is recorded. TYAPL was changed to use the new scaling for observations beginning February 24 and to use the former scaling for older data. TYAPL was also changed to offer the option of scaling the visibilities but leaving the weights untouched. In computing weights, it now uses the INTTIM random parameter when available as the integration time and ignores the incoming data weights.

Those incoming data weights can include channel averaging, which TYAPL already includes from the channel width in the header, causing the resulting weights to be in error if the incoming weights are used. SPLAT was corrected to insure that the INTTIM values would be correct.

TYSMO, which prepares SY tables for TYAPL, now uses Tsys rather than Tsys/Tcal for clipping and applies a flag table optionally to the SY and TY data as they are read. Blanking of all parameters in the SY table when any one is bad is now handled properly.

Two new tasks were written to allow manipulation of SY tables. SYCOP averages SY table values from "good" IFs and replaces the values in "bad" IFs with them. RFI can cause bad SY values in heavily affected frequency ranges. For experimentation purposes, SY2TY was written to translate SY tables into TY tables for use by tasks that only understand the latter.

Miscellaneous EVLA-driven matters

DOOSRO is a new RUN file which enables a pipeline to reduce EVLA data taken in forms not too much larger than the old VLA.

REWAY now has the option to use the INTTIM random parameter rather than the incoming weights or 1.0. The output weights do not seem to change much with this option.

NOIFS had a significant error in scaling the *uvw*'s causing a scale change in the images corresponding to half of an IF bandwidth.

SOUSP can update the fluxes in the SU table with the fit spectral-index curve under control of a DOCONFRM option.

UVFLG now has QUAL and CALCODE to modify the sources it uses. Assumptions about how to recognize missing antennas were corrected.

UVFND now has adverbs QUAL, CALCODE, ANTENNAS, and BASELINE to modify which data are examined.

VLANT does work for EVLA data as well as VLA data, using different tables and coordinate conventions. The help file used to discourage EVLA users.

More general *uv*-data matters

CALIB was given a NORMALIZ adverb to control how the amplitude gains are normalized. Choices are a global normalization or separate normalizations over subarray, over subarray and IF, or over subarray, IF, and polarization. The average gain modulus can be either the mean of the median. CALIB was changed to make output data sets consistent with *AIPS* structures even when the input files are not entirely normal. It was also given DOAPPLY to control whether the SN table is applied to the data to write out a single-source calibrated data set. The counting of failed solutions was upgraded to separate all polarizations, IFs, and antennas with no data from those that failed for other, more interesting, reasons.

Many more simultaneous flags can now be handled. The normal limit was raised from 6000 to 30000 and the special UVCOP limit was raised from 120000 to 200000.

Stokes selection was not taken into account in copying tables. If a task selected only LL polarization, the RR values from the CL and SN tables would have been applied to it. All table copying now takes the Stokes selection into account.

FRING did not test for failure to get all the pseudo-array memory it needs and so wandered into the weeds in some large cases. The exhaustive search method had an error which caused the answers to be correct only for the first IF.

Index tables are automatically created and filled by many tasks as they copy *uv* data. The method was changed to use the index table of the input file as a guide for the scan break times for the output file. This lets the initial scan structure (if known as with BDF2AIPS) to be preserved. An error when dealing with multiple subarrays was corrected.

FLAGR   can do robust rather than simple averaging on the spectra which will alter what is flagged. A combination of `RFLAG` and `FLAGR` should be very powerful.

REWGT   is a new task to scale data weights with factors depending on subarray or IF.

TIORD   now tests for baseline numbering order as well as time order.

DBCON   now appends `SY` tables and will append all versions of tables found in the inputs to corresponding versions in the output. `CALCODE` is now used to distinguish sources. An index table is made, but it ignores those in the input files.

OOP   tasks processing *uv* data could write things to the wrong files if there was a file of the same output name on the disk with a higher sequence number than that of the current output.

3C138   model for X-band had a position error of 0.25 arc seconds.

Multi   source files are those with a `SOURCE` random parameter. Tasks that confused the presence of a source table as a sure indicator of a multi-source file were corrected.

APCAL   now allows the `ANTENNAS` adverb to convey a list of antennas to be omitted in the usual way. Previous usage allowed only one omitted antenna and was very non-standard.

SPLAT   was corrected to use all 16 characters of the source names and to support source de-selection properly in the SOURCES adverb.

UVCOP   was changed to apply flags to copied `SY` tables (it already did `TY` and `SN`) and corrected to use all characters of the source name. You now have to tell *not* to flag tables should you desire that action.

SETJY   will now issue messages when the current standard calibrator flux differs by more than 3% from the previous standards. Spectral index is reported more clearly in both the messages and the history file.

PRTUV   uses the index table when possible to speed up finding the beginning of the desired data.

Imaging

$\mathcal{AIPS}$ imaging task `IMAGR` received only a little attentions in the last six months. The formula for `FACTOR` used with multi-scale imaging was changed to a more stable one. When doing baseline-length time averaging on the fly, `IMAGR` had an error addressing multiple spectral channels in a bandwidth synthesis. In order to speed the search for the next facet, `IMAGR` actually images multiple facets each time with the number controlled by the size of the work file and limited by user parameter `IMAGRPRM(18)`. This has been found to slow the task down after reaching the stage in which all facets are similar in their peak values. Therefore, `IMAGR` was changed to reduce the number of simultaneously imaged facets as the Clean progresses, but to raise that number again if it encounters difficulties in finding the next facet to Clean.

The OBIT software system written and maintained by Bill Cotton at NRAO in Charlottesville contains a variety of interesting programs besides the SDM/BDF reading tasks mentioned above. Perhaps of greatest interest is the program `Imager` which images a full field of view with options for outlying sources, multi-scale Clean, self-calibration, and even peeling. In addition to a variety of algorithmic enhancements, `Imager` can run with multiple threads allowing significant performance advantages over $\mathcal{AIPS}$' single-thread programs. `AIPS` now offers four verbs `OBITMAP`, `OBITIMAG`, `OBITSCAL`, and `OBITPEEL` which expose increasingly complicated interfaces to `Imager`. All of them prepare a "run" file in the user's `$HOME` area and then order `ObitTalk` to execute the run file, writing a log file in the `$HOME` area. If `DOWAIT=2`, `AIPS` will wait for `Imager` to finish and then display the messages under control of `DOCRT`. With `DOWAIT = 1`, which is recommended, `AIPS` will display the log file messages as they are generated and resume when `Imager` is finished. Note that this is a powerful and complex program and is not maintained by the $\mathcal{AIPS}$ Group. It requires that the OBIT package be installed and maintained at your site. This should not be difficult.

Display

HUEWEDGE is a new verb to display a wedge in two dimensions suitable for accompanying a hue-intensity display (such as total hydrogen controls intensity and velocity controls color). The double wedge can be labeled in both axes.

PRTAB was given an option to limit the display to those rows that match (or not match) a specified value in a specified column.

POSSM was changed to use the correct frequencies when applying shifts to the visibilities, to determine the desired Stokes before setting pointers for plotting auto-correlations, to select the desired Stokes for tables and plot all valid data even if one of the Stokes is fully blanked. `FACTOR` got an additional meaning suppress connecting lines when > 100.

OFMGET was changed to allow it to get only one of the colors of an OFM, rather than all three.

LWPLA used an incorrect `'LG'` transfer function; the correct one is much better and matches that used elsewhere.

TVROAM was enhanced to initialize the look-up-tables of all channels to match those of a specified channel and to allow modification of all LUTs during roaming (on button `A`).

SNPLT was changed to read the table to be plotted in order to determine how many records are used for each antenna. It then allocates enough memory dynamically to plot even the largest `SY` tables. A `DOSCAN` option was added to plot marks at scan boundaries as defined by the index table.

FRPLT was changed to allow more times, to determine sensible defaults for start and stop times, to initialize all line drawings to avoid plotting from a non-data point, to handle missing data sensibly rather than over-plotting, to label x axes correctly when plotting more than one IF and/or polarization, to do time binning carefully rather than assuming exact times, to use `FACTOR` to control the plotting of symbols and/or connecting lines, and to display antenna numbers as well as names on each plot panel.

Image analysis

FARS

`FARS` is an experimental task written by Leonia Kogan to perform "Faraday rotation synthesis" on a group of Q and U polarization images taken over a range of frequencies. It performs a Fourier transform at each spatial coordinate of the set of λ^2. It can then do a one-dimensional Clean along this axis. The final output is a cube over rotation measure and two spatial axes of the real part and a second cube of the imaginary part of this operation. A variety of minor improvements were made to `FARS` over the last six months, allowing full Cleaned output, supporting `BLC/TRC` properly, computing frequencies from the `FQ` table or header as appropriate, and so on.

To simplify this operation, a new task `AFARS` was written. It writes out an image at each spatial coordinate of the rotation measure at which the maximum amplitude occurs. It also writes an image of that maximum amplitude or of the phase at that position.

Further simplification is provided by a new `RUN` file `DOFARS`. This procedure runs `RSPEC` (see below), transposes both Q and U cubes with `TRANS`, runs `FARS`, and then transposes the output cubes, leaving both zxy and xyz cubes behind.

Other analysis changes

RSPEC was changed to offer the option to output a signal-to-noise image rather than plotting/writing the spectrum of noise. To support `FARS`, the option to write a text file of normalized weights as a function of channel was added.

IMFIT, `JMFIT` and `SAD` were changed to use the actual Clean beam for the particular channel and to display results in Jy/headerbeam and Jy/actualbeam.

IM2CC   is a new task to convert a model image (Jy/pixel) over a wide area into multiple facets with Clean component files. This should make it easier to use models generated with other software systems in $\mathcal{AIPS}$ tasks such as `CALIB`.

General

RMS   computations are found generally to be quite demanding and `DOUBLE PRECISION` is now used in all such computations within $\mathcal{AIPS}$.

CookBook   chapter 4 was updated to reflect the revisions in `TVFLG`. Appendix E changed to describe `PCAL` and `RLDIF` more correctly, to describe the use of Tsys in `SY` tables, and the flagging of tables in `SNEDT` and `TYSMO`.

USERNO   is a re-created program to process user number lists into an interesting format for printing.

ZMI2.C   file size error messages needed additional format control for 64-bit computers.

Patch Distribution for `31DEC10`

Important bug fixes and selected improvements in `31DEC10` can be downloaded via the Web beginning at:

<div align="center">http://www.aoc.nrao.edu/aips/patch.html</div>

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 `31DEC11` are found, they are simply corrected since `31DEC11` remains under development. Corrections and additions are made with a midnight job rather than with manual patches. Since we now have many binary installations, the patch system has changed. We now actually patch the master version of `31DEC10`, which means that a MNJ run on `31DEC10` after the patch will fetch the corrected code and/or binaries rather than failing. Also, installations of `31DEC10` after the patch date will contain the corrected code.

The `31DEC10` release has had a number of important patches:

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` ignore 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` did not scale the UVW's correctly *2011-06-14*

13. `CVEL` did not die on fatal errors such as missing bandpasses *2011-06-23*

14. `FITLD` and friends did not read table header character-valued keywords correctly *2011-06-24*
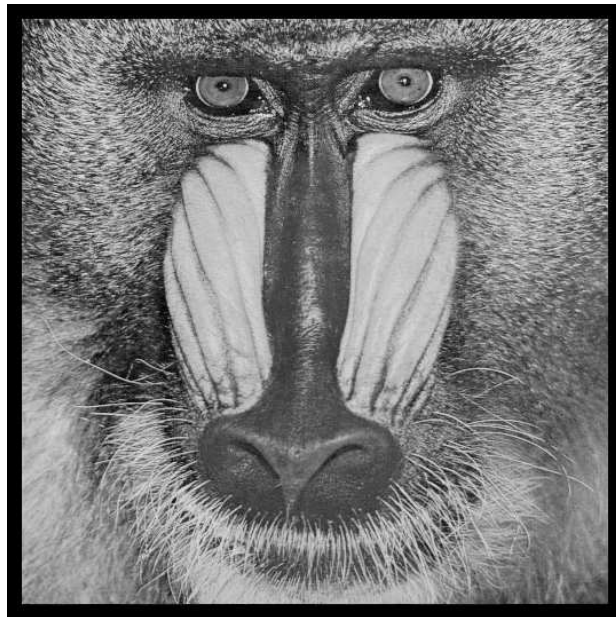
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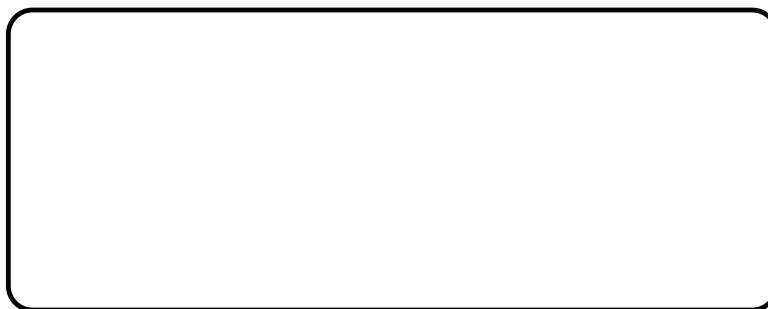
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General developments in $\mathcal{AIPS}$

Current and future releases

We have formal $\mathcal{AIPS}$ 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 $\mathcal{AIPS}$ 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 $\mathcal{AIPS Letter}$ 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 $\mathcal{AIPS}$ 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 $\mathcal{AIPS}$ 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 $\mathcal{AIPS}$-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.
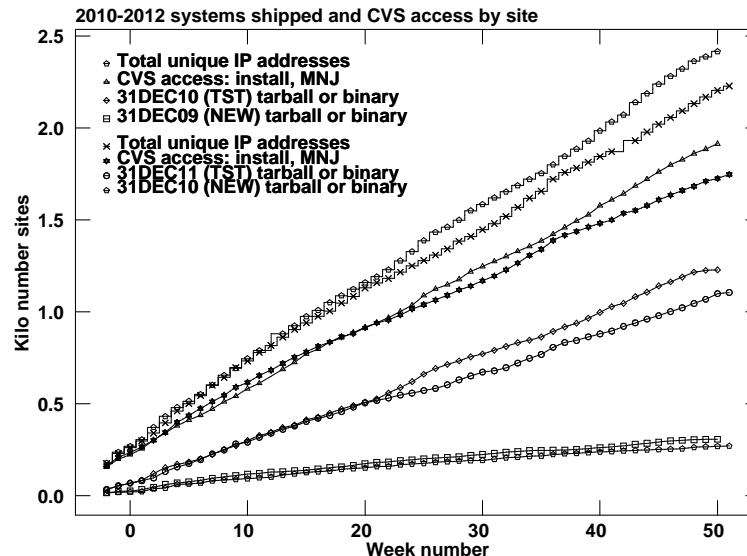
Preview of coming attractions

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 $\mathcal{AIPS}\mathcal{L}etter$ 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 $\mathcal{AIPS}$ 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 $\mathcal{AIPS}$ `TST` version and then fixed in that same version before its release get little or no discussion in the $\mathcal{AIPS}\mathcal{L}etter$. Since a rather large number of sites now install the `TST` version of $\mathcal{AIPS}$ 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 $\mathcal{AIPS}$ 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 $\mathcal{AIPS}$.

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 $\mathcal{AIPS}$ 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*
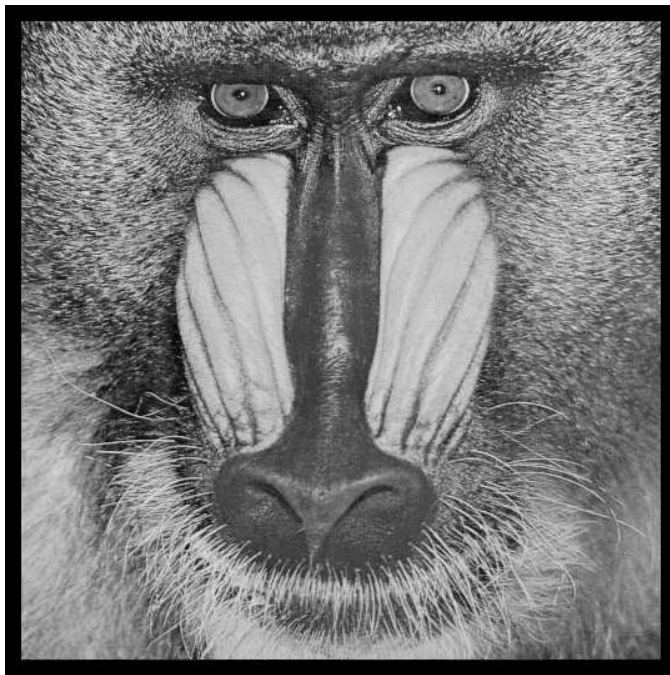
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