AIPSLETTER

Volume XXIV, Number 2: December 31, 2004

A newsletter for users of the NRAO
Astronomical Image Processing System

Written by a cast of *AIPS*

Edited by
Eric W. Greisen
National Radio Astronomy Observatory
P.O. Box O, Socorro, NM 87801–0387
505–835–7236; Fax 505–835–7027
`daip@nrao.edu`
`http://www.aoc.nrao.edu/aips`

General developments in *AIPS*

Spam and e-mail

We receive on the order of 200 "spam" e-mails each day. Please, if you need to reach us via e-mail, put a subject line that will be obviously concerned with AIPS installation or execution difficulties. If you do not hear from us in a few days, send the e-mail again with an improved subject line. We hit the "d" key all too rapidly these days.

Current and future releases

We now have formal *AIPS* releases on an annual basis. Beginning very recently, we offer a full binary installation method for both the frozen and development versions for MacIntosh OS/X, Solaris, and Linux. All architectures can do a full installation from the source files. The current release is called `31DEC04` and is now frozen. If you took a development copy of this version at some earlier date, you may use the "Midnight Job" (MNJ) to bring it up to date. You need to run a MNJ only once in 2005 to convert your copy of `31DEC04` into the now frozen version. This *AIPSLetter* is intended to advise you of developments in this release.

We have begun a new version, called `31DEC05`, 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 `31DEC05`, you may update your installation whenever you want by running the MNJ which uses transaction files to copy and compile the code selectively based on the code changes and compilations we have done. We expect users to take the source-only version of `31DEC05` *AIPS* over the Internet (via *anonymous* ftp). Alternatively, one may copy only the installation procedure by ftp and then use the binary installation method which will be discussed in more detail below.

The MNJ has been changed. The secure shell, with all its fragile complexities, is no longer required. Instead `mnj.aoc.nrao.edu` will serve up *AIPS* incrementally — or as a whole — using the Unix tool `cvs` running with anonymous ftp. Binary MNJs also use the `rsync` tool. 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.

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 installation has been seen to work. 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 `$HOME/.AIPSRC` file may be left in place, but it will need to be edited. The lines giving the `DOWNLOADED` and `UNPACKED` parameters should be deleted and the `CCOMOPT` line should be changed to point to the current release rather than the previous one — the `-I` parameter really should be `-I$INC` but that seems to confuse `install.pl`. Therefore, for now, the `$INC` has to be given in its full path name, which forces a re-edit with each release. If you have made special versions of `UPDCONFIG` and `do_daily.`*host*, you should preserve them under new names and restore them after the install. The `$AIPS_ROOT/AIPSPATH.*SH` files may need to be edited after the install to set the desired versions of *AIPS*.

For Linux, Solaris Ultra, and MacIntosh systems, a binary installation is available from CDrom, supported by `install.pl`. Alternatively, the frozen version may be installed with the binary installation method now present in `install.pl`. The ftp site for downloading files directly has been eliminated.

Patch Distribution for 31DEC03

As before, important bug fixes and selected improvements in `31DEC03` can be downloaded via the Web beginning at:

`http://www.aoc.nrao.edu/aips/patch.html`

Alternatively one can use *anonymous* `ftp` on the NRAO CPU `ftp.aoc.nrao.edu`. Documentation about patches to a release is placed in the anonymous-ftp area `pub/software/aips/`*release-name* and the code is placed in suitable subdirectories below this. Information on patches and how to fetch and apply them is also available through the World-Wide Web pages for *AIPS*. As bugs in `31DEC05` are found, they are simply corrected since `31DEC05` remains under development. Corrections and additions are made with a midnight job rather than with manual patches. Remember, no matter when you received your copy of `31DEC03` or `31DEC04` *you must* fetch and install its patches if you require them.

The `31DEC03` release had a few important patches including a new one in March. These were:

1. `DBCON` to handle more extension types for VLBI mostly *2004-01-05*
2. `FITLD` to handle FQ IDs correctly *2004-01-08*
3. `OHGEO` to handle transposed images correctly *2004-01-14*
4. `CLIPM`, `UVMLN` to get correct source numbers *2004-02-21*
5. `EDITR` to correct the antenna numbers that end up flagged *2004-03-03*

Binary installations and updates

GNU has provided compilers for the *AIPS* community at no cost for many years. While remarkably good, these compilers have suffered from both minor errors and from their generality. When some vendor sets out to make a compiler for a very specific architecture, it is possible — not guaranteed — to create a compiler that produces binaries that run faster than those produced by GNU's `g77`. Unfortunately, these vendors have to recover their costs in producing these compilers and so may charge for them at a rate that is difficult or prohibitive for many *AIPS* users. Such is the case with IBM's `xlf` compiler for PPC chips, including the MacIntosh OS/X systems, and SUN's SUNWspro compiler suite. Both compilers produce executables that run about 50% faster than those produced by `g77` on these operating systems and cpus. Fortunately, their licensing agreements allow us to ship executables to our users along with the required run-time libraries. For completeness, we have also made similar provisions for Linux with the GNU `g77` version 2.95.3 compiled on a RedHat 7.2 system. These binaries are known to run well on RedHat 9 systems, but may not work for all the many flavors of Linux now present in the *AIPS* community. We have tested the Intel compilers for Linux some years ago with disappointing results. However, since there are new reports of considerable improvements in the Intel compiler, we will test it again and make its output available, if we are allowed to distribute binaries under its license and if it represents a significant improvement in performance.

The code to implement the binary installation and binary updates via the MNJ is comparatively simple. Every night, a `cron` job run on the master *AIPS* machine in Socorro, does the necessary magic to make the daily cvs snapshot of *AIPS*, builds the tar-ball, orders the three architectures at the AOC to do ordinary text MNJs, and then `rsync`'s the binaries and text to a special area on the computer used for public `ftp` access to NRAO in Socorro. The installation script must be fetched from the AOC anonymous ftp area to your desired `$AIPS_ROOT` area and then executed with

```
perl install.pl -n
```

With the `-n` option, the script will skip fetching and unpacking the tar-ball and the compiler queries and usage. It does a variety of `rsync` commands to fetch a complete copy of the *AIPS* version including libraries and all executables. It marks the installation as a binary one by creating a special 0-byte file in `$SYSLOCAL`. The MNJ then detects this file and replaces the compile steps with `rsync` operations on the binary areas. The `cvs` utility is still used for updating the source code and other text areas.

There are some limitations with binary installations. The AP size will be 20 Megabytes which is a good size for most machines and problems, but too small for the largest-memory computers and biggest problems. Furthermore, without a matching compiler, it will be difficult to develop any local programs as additions to the standard *AIPS* package.

Recent *AIPS* and related Memoranda

All *AIPS* Memoranda are available from the *AIPS* home page. There is one new memorandum in the last six months. Chapters on FITS and *AIPS* written by Eric Greisen have now appeared in *Information Handling in Astronomy — Historical Vistas* edited by André Heck and published by Kluwer Academic Publishers.

110 Strategy for Removing Tropospheric and Clock Errors using `DELZN`
Amy J. Mioduszewski and Leonia Kogan (NRAO)
September 1, 2004
This memo provides a guide to scheduling and reducing phase reference experiments in order to improve the astrometric accuracy and image quality of a target source. The recommended procedure includes occasional short periods of observations of calibrator sources around the sky, interspersed with the desired phase reference observations, from which the troposphere modeling errors can be determined using a new *AIPS* task `DELZN`. The recommended observing procedure, data reduction, running of `DELZN` and application of corrections to the phase reference data are covered.

Improvements of interest to users in 31DEC04

We expect to continue publishing the *AIPSLetter* approximately every six months along with the annual releases. There have been a number of changes in 31DEC04. In the last edition, we reported on a number of new tasks and verbs. These include ATMCA to use multiple calibration sources for improved phase-referencing, RLDIF to return averaged right minus left phase differences for use in polarization calibration, FLAGR to flag data based on the rms within an integration time, and DSORC to renumber sources in a multi-source data set. Also new were the verbs SYSTEM to allow users to communicate to the host operating system from within AIPS and RANDOM (with procedure GRANDOM) to return random numbers. Calibrator source models were added to the *AIPS* distribution with a new verb CALDIR written to list available models and new tasks CALRD and CALWR to read and write them. Fully cross-referenced html and pdf versions of the *AIPS CookBook* also became available.

In the last six months, we have developed new tasks FINDR to report on potentially bad data, returning values for use in FLAGR, FIXBX to convert Clean boxes from an old BOXFILE to a new one with different faceting and cell size, and DFQID to renumber frequency IDs within a data set. A new verb DRAWBOX simply draws Clean boxes on a TV graphics plane. Task FLAGR was developed from a one-algorithm preliminary version to support several algorithms for detecting and flagging bad visibility data.

The development version 31DEC05 contains everything to be described for 31DEC04. In addition, it already contains a few new things thought to be a bit risky for a soon-to-be-frozen version. These include changes to CALIB's gain solution routines to report even more information, addition of SUBARRAY to BLAVG and UVFND, technical corrections to FILLM and ATMCA, final removal of all usage of the B1950 precession subroutine, minor to significant improvements in the displays of verb PRINT and tasks WIPER, PLOTR, SNPLT and VPLOT among others, and changes to select and employ the Steer-Dewdney-Ito Clean method more usefully in IMAGR.

31DEC04 uses a new numbering scheme for magnetic tape logical unit numbers that is incompatible with previous versions. Thus all tape tasks and the server TPMON must be from the same release. Other than this, 31DEC04 is compatible in all major ways with the 15OCT98 and later releases. There are significant incompatibilities with older versions.

UV data calibration

CALIB and BPASS

The gain solution routines used by CALIB were changed to support "robust" solution methods. By "robust" we mean a method that uses all data to find an initial solution and rms deviation from that solution. It then iterates using only data within n times the rms of the previous solution; n is reduced as the iterations proceed leading rapidly to a solution that is less affected by bad data. This change to the solution routines means that data that deviate from the final solution, with or without doing the robust method, can be marked as questionable and counted as such. The user controls this last value of n with the new adverb DOFLAG. This adverb is also used, optionally, to have CALIB flag the offending data. The adverb SOLTYPE is used to request robust solutions with all of the previous types. Statistics on closure error found by the gain solution routines are reported.

BPASS was changed to offer the adverb SOLTYPE with all of its new standard values. Previously it used only the method done on SOLTYPE = ' '. It even does the GCON solution method but without the gain constraints that are options in CALIB. Mode 4 in BPASSPRM(10) was added so that complex bandpasses may be normalized over all channels while using only selected channels for the "channel 0" computation.

ATMCA

In normal phase referencing, VLBI observations are quickly alternated between a calibrator and a target source. When the antenna-based phase corrections from the calibrator observations are interpolated to the target, a good quality target image and accurate position is obtained. However, directional-dependent phase errors between the calibrator and target often limit the quality of the image and position.

By observing more than one calibrator in the vicinity of a target, the directional-dependent phase error for each antenna (mainly from the troposphere) can be estimated and then removed from the target to give better quality results. A new AIPS task, ATMCA, is now available to combine the phases of the calibrator observations and then apply them to the target. See AIPS Memo 111 (still in preparation) for details on the selection of calibrators, possible observing schemes, and the data reduction methods.

ATMCA initially required the additional calibration sources to be very well placed in the sky with respect to the target source. This still allows for the best solutions with respect to position. Over the last few months, however, the task was revised to reduce these requirements substantially at the cost, of course, of some accuracy in the result. A new subroutine was written that cleverly attempts to find and correct for phase wraps.

Other calibration changes

WEIGHTIT is a new adverb to control how data are weighted when passed to fitting routines. The "correct" weighting by $1/\sigma^2$ is now done everywhere by default. In some cases, however, data with good source models have trouble finding solutions with this weighting which, in general, reduces the weight of the longest spacings. WEIGHTIT values of $1-3$ select the weight to be $1/\sigma$, $1/\sqrt{\sigma}$, 1.0, respectively, to reduce this effect; otherwise $1/\sigma^2$ is used.

SMOOTH is the adverb used to request spectral smoothing in tasks which apply calibration. If the bandpass correction was not smoothed, then it is an error to smooth before applying that correction. Therefore, new modes were added to specify that the smoothing be done after the correction, while the previously defined modes are done before the correction as always.

Source models for primary flux calibration sources are now provided with AIPS. The use of these models should improve initial amplitude calibration of VLA data significantly. During the last six months, X-band (3.6-cm) models for 3C48 and 3C286 have been added. There is an interfering source in the field of 3C48 whose inclusion in the model was significant. Because of this source, high accuracy observations at X-band may have to use reference pointing or avoid using 3C48.

CMETHOD is the adverb that controls whether a DFT or gridded model subtraction or division is done in CALIB and elsewhere. When it is blank, the task chooses. For the calibrator models, which are small sub-images of the original images, the default always led to a gridded subtraction. Unfortunately, with a small image, the *uv* cells become very large and the gridded subtraction becomes seriously inaccurate. The handling of the default was changed universally so that small images, especially those not powers of two, lead to the slower, but accurate, DFT method.

CLCOR was found to do inaccurate position shifts with B1950 coordinates. The subroutine that does J2000 precession was improved to handle B1950 as well. A new OPCODE = 'SUND' was added to handle gravitational deflection within the Solar System primarily for sources also located in the Solar System.

UV data handling

FILLM received a number of minor adjustments. The most important was to have FILLM compute the source apparent positions rather than to use those provided by the on-line system. The latter include diurnal aberration which varies through the observation and which is not properly accounted for in AIPS' usual precession routines. Since the apparent position is primarily used by CLCOR, it was judged most important to have an initial value consistent with that task. FILLM was corrected to notice that a fixed frequency was selected for the observation; previously that fixed frequency was confused with a velocity in the source table. The detection of which antennas are "out" was corrected, reducing the number of data sets that are written because the antennas have changed. If the telescope coordinates are not recognized, then the correction for Q-band Pie Town observations is tried even when the observation appears not to be at Q-band. An error trap was added to detect and report that a real-time FILLM function was requested in a version not link edited to do those functions.

The new task `DFQID` was added to renumber frequency IDs in a data set. Its primary use will be to renumber some of the IDs to some of the others to correct for a data-reading program applying too narrow a criterion for frequency agreement.

UV data editing

FLAGR and FINDR

`FLAGR` is a new, somewhat experimental, task designed to examine *uv* data for internal consistency and then flag those data which fail to meet a wide range of criteria. It is hoped that this task can be used to edit calibrator data automatically, although at the moment it is best driven cautiously by hand. In general, all operations will flag all data in some time interval when more than some fraction of the data in that interval are regarded as "questionable." Furthermore, any data that are regarded as "bad," in that they exceed some greater criteria, are flagged. Some methods involve measuring the rms over a time interval either on a baseline or antenna basis and then flagging the high values. Other methods compute the average amplitudes and rmses in time intervals on an antenna basis and compare the values over the full time range. Outliers are flagged including those with excessive "closure error." Still more methods compute the vector difference of samples with the average of their neighbors (in time) on an antenna or baseline basis. Outliers are flagged. User-specified ranges of acceptable amplitudes and weights are also used to flag the data.

`FINDR` is also a new task designed to help users use `FLAGR`. It implements some of the methods of `FLAGR` to find "normal" values and statistics on outliers and then reports them to the printer and returns some of the values in an *AIPS* adverb for later use. The methods implemented are the one that computes average amplitudes and rmses over time intervals and then compares them over the full time range and the antenna- and baseline-based vector difference methods. Significant `EXPLAIN` files have been written to explicate the methods in some detail. The *AIPS* group would be interested in hearing your experiences with these new, admittedly complicated, tasks.

Other changes

TVFLG and `SPFLG` were changed to offer the display/edit data types vector amplitude rms and vector amplitude rms divided by the vector average amplitude. This adds to the previous rms modes which are computed by scalar methods. The status line now shows the current pixrange of the display. `SPFLG` now has the menu option `LAST BASELINE` to do the reverse of the existing option `NEXT BASELINE`.

CLIPM was changed to flag on weights above an upper limit as well as below a lower limit.

UVFND was corrected to work as intended in the `VCLP` mode.

WIPER was changed to draw a line around the plot and at coordinate zero if it occurs in the plot.

Imaging

FIXBX is a new task to read in two `BOXFILE`s, converting the Clean boxes of one into Clean boxes for the other. Since Clean boxes are specified in pixels, this task is needed to make even the simplest changes in cell size or facet locations.

IMAGR was changed to control the selection of the Steer-Dewdney-Ito (SDI) Clean method better. SDI Clean is selected when the fraction of pixels having residual value greater than half the peak residual exceeds `IMAGRPRM(4)` (when it is > 0). One may now force SDI or BGC Clean in the next cycle without the penalty of being stuck in that method. The beam shape is now examined to limit the dynamic range of pixels loaded for minor-cycle Cleaning, but this can be altered with `IMAGRPRM(19)`. Without this limit, the initial major cycles frequently were too deep. The final Clean flux over all facets and in the present facet (including components found in other facets) are stored as keywords in the image header. The initial subtraction of pre-existing components lacked proper initialization to select between gridded and DFT methods until now.

WENSS catalogs include not only all components of complex sources but also a single "summary" source. The latter were removed from the WENSS catalogs provided with AIPS.

SETFC was changed to allow the user control over image points per synthesized beam width and maximum allowed phase error. The actual maximum w value is now used rather than its approximation by B_{max}.

GAL was changed to handle much larger images, to plot the fit with scaled points centered correctly, to use `SOLCON` to control the convergence criteria, and to return the model fit in the adverb used to provide initial guesses.

PATGN was corrected to use standard reference pixels and to take all inputs in arc seconds. Previously some were in pixels and some in arc seconds.

Optical images are often fit with coordinates that contain a small degree of skew. AIPS cannot handle this as yet, but the FITS-reading programs were changed to make a better estimate of the axis parameters to use for such images.

Plotting

Clean beams may be plotted in the corners of contour and grey-scale images. `GREYS` was changed to offer this option and all such tasks were changed to offer the option of blanking the rest of the plot in the area in which the Clean beam is plotted.

DRAWBOX is a new verb to plot the Clean boxes (in adverb `CLBOX`) on a TV graphics plane.

LISTR now allows the user to control the scaling of phase displays, with default integer degrees.

SNPLT now offers the options to plot the real and imaginary parts of complex gains.

EXTLIST was corrected to match all current plot-file inputs.

TVALL cleared fixed graphics channel numbers rather than `GRCHAN` it now uses.

TVLOD now honors the users' request for an interpolated image display even if it has to select a smaller sub-image to fit on the screen.

Buffered TV operation had a bug which caused it to hang. If the environment variable `AIPS_TV_BUFFERED` is set to `YES` when `AIPS` and the TV are started, then this mode will be used. It may help in the case of slow connections between the compute server and the display server.

General items

CookBook chapters were updated to reflect the changes made to AIPS in this release and to improve the advice for using `BPASS`.

REHEX and `EHEX` verbs were enhanced with input/output adverbs to allow their use in procedures.

Miscellaneous matters for programmer types

Floating point arithmetic must always be treated as inaccurate. Aggressive optimization, in particular, may cause computations to be inexact in the last one or even two bits. Thus, a perfect 1.0 might end up as 1.0 ± 10^{-7}. If that result is subtracted from a perfect 1.0 and then multiplied by, say, a magic blank, a number around 10.0 may arise rather than a perfect 0.0. Of course, no arithmetic should be done with image pixel values, visibility gains, or any other number that might be blanked, without first testing for the magic blank value.

Y2K tests were enhanced with a new `HUGE` test and with new data for all other test sizes. The new data take into account changes in some of the tasks and in the adverbs used, especially for `VTESS`. The `HUGE` test took nearly an hour to run on a computer rated at 133 AIPSMarks$^{(00)}$.

OOP code now has a standard close down routine to call which will allow adverbs to be passed back to `AIPS`. It is called `OUT2AV`.

DISPLAY environment variable setting was adjusted yet again to avoid undoing user-set values such as "1.0" for an alternate screen.

PP was changed to allow `LONGINT` declarations for `INTEGER*8` variables which may be used in future for dynamic memory. At present, *AIPS* does not work on some 64-bit memory computers because their algorithm for allocating new *virtual* memory puts it more than 2 billion bytes from the memory used by the compiled program.

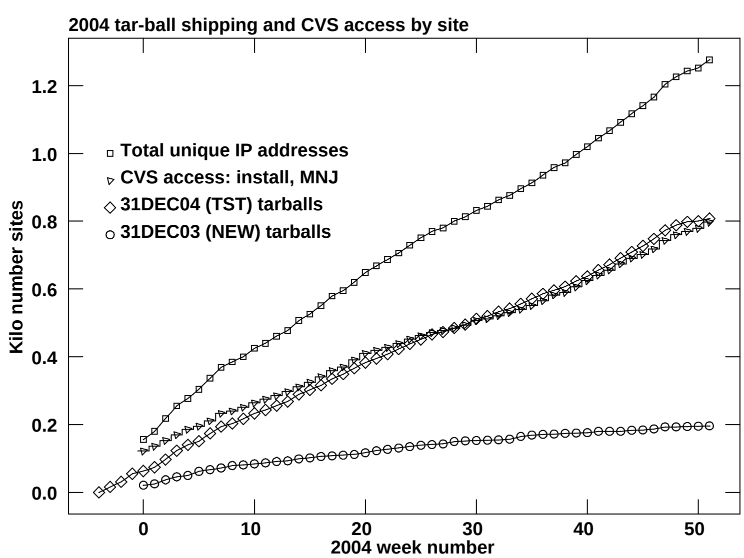
UPDUPDATE is a new function in the MNJ that will do various operations which used to require manual intervention by *AIPS* Managers. It rebuilds `XAS`, runs `POPSGN` for new vocabulary, moves and edits certain files to `$AIPS_ROOT`, and now copies any files put back in `$UPDUNIX` to the local MNJ update area. The last are now copies rather than links, while the `$AIPS_ROOT` functions are only done on the machine that did the file copying, not on secondary hosts.

CDSETUP is the script that performs *AIPS* installations from CDs. It calls `install.pl` after doing its initial operations. It was changed to ask the user additional questions since one of its tests was found to be unreliable. The whole business of installing from CD has not been properly tested.

install.pl was corrected for a grammar error affecting CD installation and for the change in default AP size to 20 Megabytes. The new binary installation process require significant changes to `install.pl` and MNJ scripts `AIPSUPD` and `UPDCONFIG` as well as two new scripts called `MAKE.BMNJ` to initialize the MNJ for binary installs and `UPDRSYNC` to do the `rsync` operations for binary MNJs.

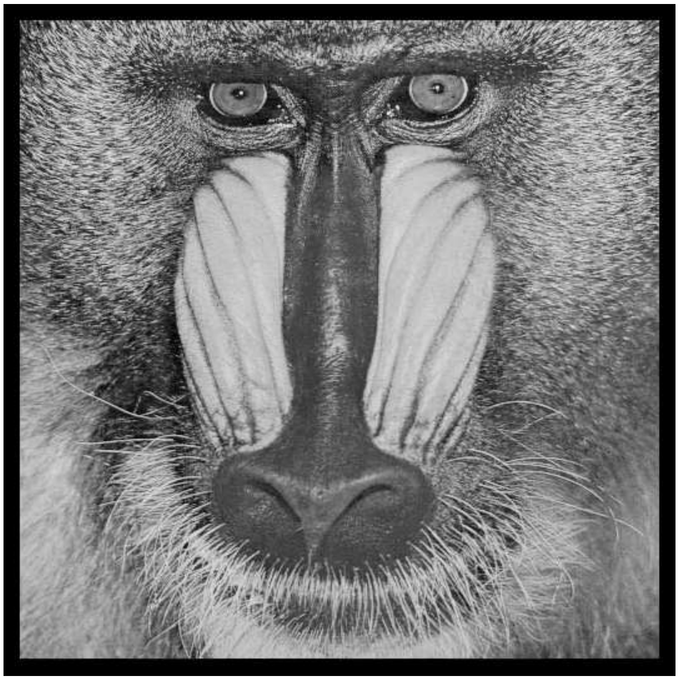
AIPS Distribution

We are now able to log apparent MNJ accesses, downloads of the tar balls and `rsync` accesses. We count these by unique IP address. Since dial-up 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 probably an under-estimate of the number of computers running current versions of *AIPS*. We have abandoned the registration system since the software that managed the database is broken and appeals to have it fixed have fallen on deaf ears. In 2004, a total of 196 different IP addresses downloaded the frozen form of `31DEC03` and 808 IP addresses downloaded one or more copies of the `31DEC04` tarball. Fully 797 IP addresses accessed the NRAO cvs master. Each of these has at least installed `31DEC04` and 231 appear to have run the MNJ on `31DEC04` at least occasionally. The total number of unique IP addresses in these three lists was 1276. The attached figure shows the cumulative number of unique sites, cvs access sites, and tar-ball download sites known to us as a function of week in 2004.



Since the registration system, always under-utilized, has now been abandoned, we are left with analysis by IP address. The table below lists the IP addresses for 2004 by the final qualifier for shipments of the `31DEC04` tarball, the `31DEC03` tarball, and access to the cvs site. The numbers in the cvs column include those sites that install `31DEC04`, run a midnight job for `31DEC04`, or run a final "catch-up" MNJ for `31DEC03`. The comments come from what appears to be a semi-official list of Internet codes. Sorting on the "unique" column, which counts unique IP addresses over the other three columns:

Code	31DEC03	31DEC04	cvs site	unique	Comments
edu	32	195	219	310	US Educational
net	13	57	50	91	Network
jp	9	42	46	64	Japan
com	6	36	24	51	US Commercial
uk	12	30	23	51	United Kingdom
it	8	29	23	39	Italy
es	5	24	23	38	Spain
au	7	21	21	35	Australia
de	7	15	13	28	Germany
org	1	15	17	22	Non-Profit Organization
ca	2	15	16	21	Canada
gov	2	18	14	20	US Government
nl	1	14	13	19	Netherlands
fr	4	14	9	18	France
pl	2	11	9	17	Poland
kr	2	13	11	17	Korea (South)
mil	2	12	8	15	US Military
mx	6	9	7	13	Mexico
ru	2	9	5	12	Russian Federation
in	3	8	9	12	India
tw	8	3	2	10	Taiwan
se	0	8	6	9	Sweden
fi	0	6	5	8	Finland
be	1	5	6	7	Belgium
br	1	3	3	6	Brazil
cn	5	3	1	5	China
pt	1	3	1	5	Portugal
ar	2	2	1	4	Argentina
ie	0	4	2	4	Ireland
gr	0	4	1	4	Greece
ch	0	2	2	3	Switzerland
za	0	1	3	3	South Africa
nz	0	1	2	3	New Zealand (Aotearoa)
hu	0	1	1	2	Hungary
mu	0	1	1	2	Mauritius
cl	1	0	0	1	Chile
no	0	1	0	1	Norway
sk	0	1	0	1	Slovak Republic
co	0	1	0	1	Colombia
ua	0	1	0	1	Ukraine
il	0	1	0	1	Israel
us	0	1	0	1	United States
None	1	23	42	47	
Unknown	50	145	158	254	
Total	196	808	797	1276	



December 31, 2004

AIPSLETTER
National Radio Astronomy Observatory
520 Edgemont Road
Charlottesville, VA 22903-2475
USA

FIRST CLASS

To:

DATED MATERIAL-DO NOT DELAY