A I P S L E T T E R

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

Written by a cast of *AIPS*

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General developments in *AIPS*

Current and future releases

We now have formal *AIPS* releases on an annual basis. Beginning near the end of 2004, we have made available full binary installation methods 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 next release is called 31DEC05 and remains under active development. You may fetch and install a copy of this version at any time using *anonymous* `ftp` for source-only copies and `rsync` for binary copies. This *AIPSLetter* is intended to advise you of developments to date in this new release. Having fetched 31DEC05, you may update your installation whenever you want by running the so-called "Midnight Job" (MNJ) which uses transaction files to copy and compile the code selectively based on the code changes and compilations we have done. The MNJ will also update sites that have done a binary installation using `rsync`. There is a guide to the install script and an *AIPS* Manager FAQ page on the *AIPS* web site.

The MNJ has been changed. It now serves up *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 *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.

Patch Distribution for 31DEC04

Important bug fixes and selected improvements in 31DEC04 can be downloaded via the Web beginning at:

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

Alternatively one can use *anonymous* `ftp` to the NRAO server `ftp.aoc.nrao.edu`. Documentation about patches to a release is placed on this site at `pub/software/aips/`*release-name* and the code is placed in suitable subdirectories below this. 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.

The patch system has changed because we now have binary installations. We now actually patch the master version of 31DEC04, which means that a MNJ run on 31DEC04 after the patch will fetch the corrected code and/or binaries rather than failing. Also, installations of 31DEC04 after the patch date will contain the corrected code.

The 31DEC04 release had a few important patches most of which were released in April when we changed the patch system. These were:

1. `OTFUV, OTFIN` to handle both byte orders of 12m OTF data *2005-01-06*
2. `CXPOLN` procedure, `CXCLN` task need modern image names *2005-04-22*
3. `TVFLG` and `SPFLG` required improved error handling and modern `FLAGVER` default *2005-04-22*
4. `WIPER` function `FLAG AREA` aborted on wrong button push *2005-04-22*
5. `FIXBX` could handle complicated cases but not simple ones *2005-04-22*
6. `POSSM` used wrong units in output text file *2005-04-22*
7. `CL2HF` aborts under Linux *2005-04-22*
8. `TCOPY` used wrong (old) tape LUNs *2005-04-22*
9. `BPASS` gets wrong solutions when channel 1 of of the first source was flagged *2005-04-22*

Binary installations are easy

The *AIPS* binary installation is so easy that it has confused would-be installers. All one really needs to do is visit the web page

`http://www.aoc.nrao.edu/aips/dec05.shtml`

and read the instructions. From this page, download the file `install.pl` putting it in the area you intend to use as `$AIPS_ROOT`. Then type the instruction

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

You will be asked some of the usual questions (see the guide to the Install Wizard available from the cited web page), but 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. Your firewall must allow you to use the `rsync` and `cvs` utilities (ports 873 and 2401, respectively) which are used for installing and updating the binary and text files.

Recent *AIPS* and related Memoranda

The following new *AIPS* Memorandum is available from the *AIPS* home page.

111 **ATMCA**: Phase Referencing using more than one Calibrator
Edward Fomalont & Leonid Kogan, (NRAO)
January 6, 2005
The VLBI astrometric accuracy and image quality of a target source can be improved if more than one reference calibrator is observed with the target. The improvement is obtained by determining the phase gradient in the sky in the region of the sources, mostly caused by an inaccuracy of the troposphere model. Even if the target is sufficiently strong to use self-calibration methods to determine the image, its precise location can be improved with phase referencing. This memo describes the scheduling strategy for multi-calibrator phase referencing, the reduction of the data, and the use of a new *AIPS* task **ATMCA**, which combines the phase or multi-band delay information from the several calibrators.

The following new EVLA Memorandum is available from the NRAO web pages.

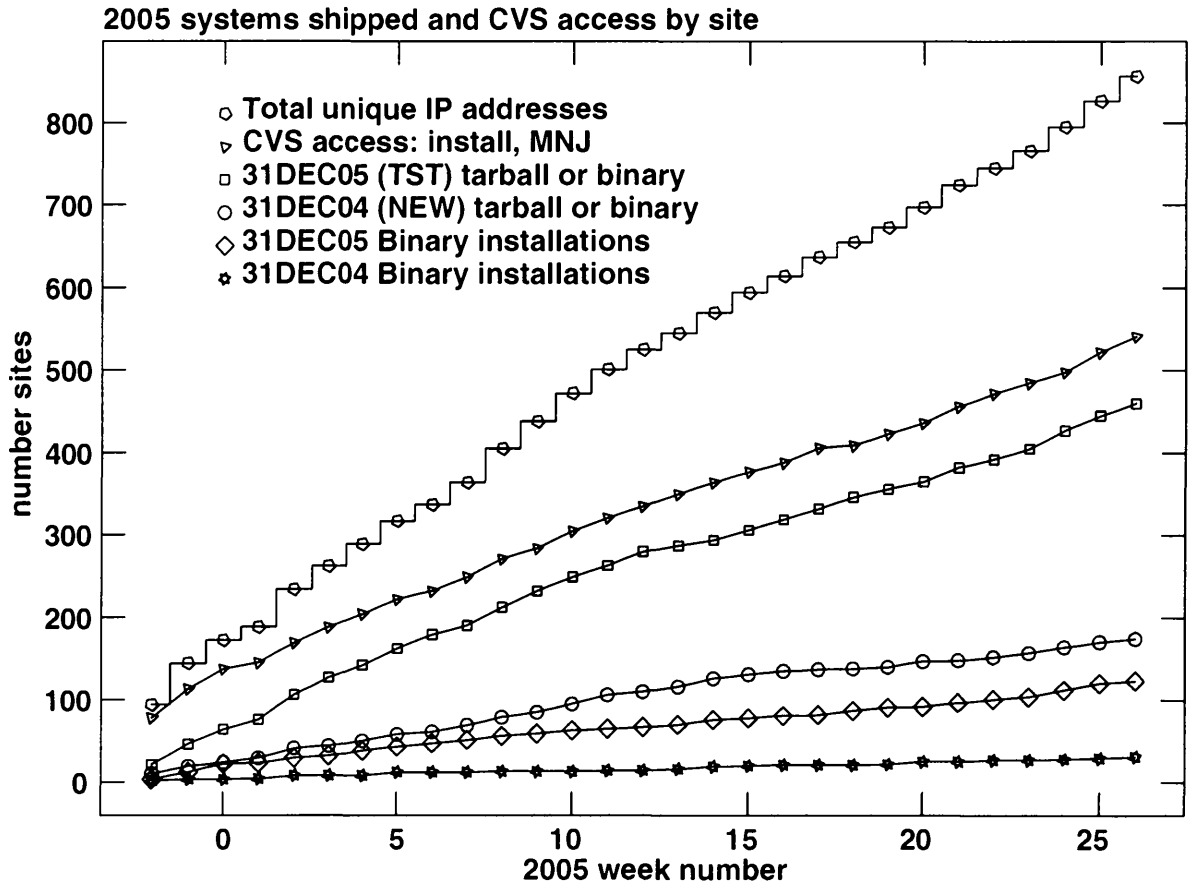
93 Optimization of the LWA Antenna Station Configuration Minimizing Side Lobes
Leonid Kogan & Aaron Cohen
May 4, 2005
This memo is a duplicate of LWA memo #21 and is posted here as well because of its relevance to the optimization of the EVLA phase II arrays. The algorithm for optimization of an array configuration to minimize side lobes, designed by Leonid Kogan, has been applied to optimize the configuration of a dipole station of the Long Wavelength Array (LWA). The results of optimization are given for different areas of optimization on the sky including full sky semi-sphere; for different minimum spacing between the station antennas. For an array phased to zenith, the optimization is done to minimize sidelobes all the way to the horizons by optimizing in a circle defined by the radius $|\sin(z)| \leq 1$, where z is the angle from zenith. *For an array that will potentially be phased to any location above the horizon, the optimization radius should be twice as large to optimize the beam pattern over the entire sky.* Thus for the whole semisphere optimization with a range of array pointings covering the whole semisphere as well, optimization at zenith pointing must be done for $|\sin(z)| \leq 2$!

The following paper has been approved for inclusion in the FITS Standard by the regional committees. Submission to *A&A*, *astroph*, and the IAU FITS Committee will follow. It is currently available from Eric Greisen's home page: `http://www.aoc.nrao.edu/~egreisen`

III Representations of spectral coordinates in FITS
E. W. Greisen (NRAO), M. R. Calabretta (ATNF), F. G. Valdes (NOAO), and S. L. Allen (UCO/Lick)
24 May 2005
Greisen & Calabretta (2002) describe a generalized method for specifying the coordinates of FITS data samples. Following that general method, Calabretta & Greisen (2002) describe detailed conventions for defining celestial coordinates as they are projected onto a two-dimensional plane. The present paper extends the discussion to the spectral coordinates of wavelength, frequency, and velocity. World coordinate functions are defined for spectral axes sampled linearly in wavelength, frequency, or velocity, linearly in the logarithm of wavelength or frequency, as projected by ideal dispersing elements, and as specified by a lookup table.

AIPS Distribution

We are now able to log apparent MNJ accesses and downloads of the tar balls. We count these by unique IP address. Since dial-up connections may be assigned different IP addresses at different times, this will be a bit of an over-estimate of actual sites/computers. However, a single IP address is often used to provide *AIPS* to a number of computers, so these numbers are probably an under-estimate of the number of computers running current versions of *AIPS*. 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 2005, there have been a total of 541 IP addresses so far that have accessed the NRAO cvs master. Each of these has at least installed `31DEC05` and 152 appear to have run the MNJ on `31DEC05` at least occasionally. During 2005 more than 174 IP addresses have downloaded the frozen form of `31DEC04`, 31 in binary form, while more than 460 IP addresses have downloaded `31DEC05`, 123 in binary form. The attached figure shows the cumulative number of unique sites, cvs access sites, and binary and tar-ball download sites known to us as a function of week — so far — in 2005.



Improvements of interest to users in 31DEC05

We expect to continue publishing the *AIPSLetter* approximately every six months along with the annual releases. There has been a modest number of changes in 31DEC05, essentially all in the form of bug fixes and minor enhancements.

31DEC04 and 31DEC05 use 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 one of these two releases. Other than this, 31DEC05 is compatible in all major ways with the with the 15OCT98 and later releases. There are significant incompatibilities with older versions.

UV data calibration and handling

CALIB

Changes to CALIB, begun with the previous release, were enhanced over the last six months. The various routines that actually do the solutions now return the closure rms of the solution, allowing CALIB to display the average rms and its rms. The robust solution methods drop data from the next iteration down to very tight limits. The user, through CPARM(6), may keep the limits less restrictive. The average gain modulus is always reported now whenever amplitude solutions are obtained. It is saved and used to scale the gains only when CPARM(2) > 0. When CALIB created a new flag table to flag data with poor closure, it was able to forget the fact that it had written a new solution table. This was corrected.

When using standard source models, CALIB scales the total Clean Component flux in the model to match that entered in the source table by SETJY. Since some new models include nearby sources as well as the calibration source, the scaling was changed to include only the Clean Components of the primary source. The new model for 3C48 at C-band (6 cm), now provided with *AIPS*, forced us to make this change to the code.

CLCAL

CLCAL also received some useful attention in 2005. It "merges" multiple solution tables into one which it then smooths and applies to the output calibration table. Previously, the term merging meant only concatenating and sorting into time order. Thus, if two SN tables had values for a particular time, the merged SN table would have two different records for that time. If one of the tables had good solutions only for one IF and/or polarization, while the other table had good solutions for the other IF or polarization, peculiar results could occur due to the apparent bad solutions. A small amount of time smoothing should have corrected this ambiguity, but an error in handling blanked delays led to bad changes to phase. The new version of CLCAL actually merges any records which match in time, source, subarray, et al. Blanked solutions are replaced with any good ones and, if two records match but have different good solutions, an error message is generated. Recent versions of CLCAL extrapolate solutions and weights to times outside the range of the solution table. This extrapolation was changed to limit how far it is willing to go. Previously two good weights could extrapolate to a negative (bad) weight just because they were different.

TECOR

TECOR has assumed that the ionosphere remains roughly fixed with respect to the Sun and so adjusts longitudes in looking up the values for times intermediate between those provided. Using SNPLT to examine the multi-band delays produced by TECOR revealed that this provided very peculiar interpolations between the data for periods in which the ionosphere was relatively stable. These peculiar interpolations led to large, apparently erroneous phase offsets. In many cases much better results come from assuming the ionosphere moves with the Earth or partly in between. A parameter has been added to select the interpolation to be used. Where 0 selects rotation with the Earth and 1.0 rotation fixed with the Sun, a value of 0.3 gave the best results for the tested data. The multi-band delays should be examined with SNPLT after TECOR to make sure that the large corrections it makes appear to have been interpolated reasonably.

The web site used to provide the ionospheric data for TECOR has changed and the help file has been updated. The new data area is at cddis.gsfc.nasa.gov and replaces an area known as cddisa. The latter may no longer be used for any VLBI data access or submission, uploading or downloading.

Other *uv*-related matters

SETJY was changed to allow the user to use APARM(3) times the formal Baars et al. fluxes. The allows for user corrections for resolution in case the user is not using one of the source models.

BPASS was corrected to handle missing data more correctly. If the first channel in the first scan was flagged, the new gain solution methods were not initialized properly. The gains for a missing antenna are now set by the gain solution routines to 1,0 so that those solutions may be recognized later and blanked. Tests were added to stop the task sooner when no data are found.

UVFND and BLAVG were given the SUBARRAY adverb since they apply calibration and must be able to select the relevant subarray.

WIPER was changed to allow the user some control over where the CURVALUE-like display is put (along with the menu). The FLAG AREA function aborted under some user-error conditions and flagged data on button D, contrary to intentions. These bugs were squashed.

TVFLG and SPFLG were corrected to report and ignore missing data when looping over channels, Stokes, baselines, etc. in CLIP BY FORM and REDO FLAGS functions. FLAGVER = 0 now has the meaning of highest version like most other tasks.

UVCOP was changed to copy an extra 30 minutes of data from tables to insure that all table data relevant to the visibility data are copied.

UVCON was enhanced to read and apply elevation-dependent antenna temperatures and efficiencies and to create multi-channel output data sets. The latter may be averaged with other *AIPS* tasks to simulate bandwidth- and time-smearing effects.

CL2HF was corrected for a software error that affected Linux machines. Dave Gordon provided a number of enhancements, mostly to obtain phases from the SN table and to add an adverb to specify the integration time.

MBDLY was also updated by Dave Gordon. It now always passes the phases from FRING and can be told to pass "failed" observations as well.

PBEAM was changed to allow data observed in either row or column order. The attaching of plot files to some data set was clarified.

Imaging

IMAGR was changed to do more interpolation on TV loads for small sub-images and to make decisions for SDI loading based solely on the histogram and maximum of the current facet.

MAXIMG is the parameter that controls the largest image allowed in *AIPS*. It was changed to 32768 to allow CONVL to work on images between 8193 and 16384 in size. IMAGR will probably make such an image now, although multiple smaller facets would be faster and more correct.

CXCLN and the CXPOLN procedure were corrected to use the modern imaging naming conventions. The procedure was corrected to use more bullet-proof code such as is done in the VLBAUTIL procedures.

REGRD also updates the pointing position now.

FIXBX and BOXES were corrected to handle simple cases. Both handled multi-facet, complex cases well but neither knew what to do with a virtually empty initial BOXFILE.

Data display

Point plotting tasks were all changed to use a uniform list of point-type codes including new codes for a true plus sign and a vertical bar. Tasks affected include `LOCIT`, `MFPRT`, `PLOTR`, `SNPLT`, `CLPLT`, `VPLOT`, and all tasks which plot star files.

SNPLT was fixed to plot antenna LSTs and hour angles correctly, to offer the option of plotting ionospheric Faraday rotation, and to do simpler and more correct axis labeling. `SNPLT` now offers the choice of point types and can be instructed to connect the points with straight lines.

PLOTR was changed to allow both lines and symbols associated with each data type and to allow full dashed-line drawing.

TAPLT was changed to handle axis labeling more generally, to use degrees rather than radians with arc tangent functions, to allow general scaling and offset of the X axis, to do binned plots with self-scaling, and to plot the sum of the data in bins or the average.

DRAWBOX was changed to plot boxes from a `BOXFILE` if specified, plotting `CLBOX` otherwise.

POSSM was corrected to use km/s correctly in the printed `OUTFILE`.

Analysis

XGAUS, `XBASL` and `XPLOT` were changed to allow plotting and interaction with the TV device instead of the Tektronix emulator. The latter is still available, but is often unreliable at least under Linux. Fixed a bug in `XGAUS` that trashed the header of the first amplitude when no residual image was being written.

MCUBE was revised to allow the user to force a `SEQ.NUM.` axis even when other coordinates differ. The coordinate values on the axis that was ignored will be recorded in the history file.

IMFIT and `JMFIT` were corrected to return baseline parameters when they are fit and to do a better job displaying the baseline parameters and computing their uncertainties.

IMDIST was changed to display the RA and Dec shift parameters between the two points.

Miscellaneous

On the fly data from the former NRAO 12-m telescope are still being generated but they are now written with the Linux byte order rather than Solaris. Changed `OTFUV` and `OTFIN` to automatically recognize either byte order and to handle them correctly.

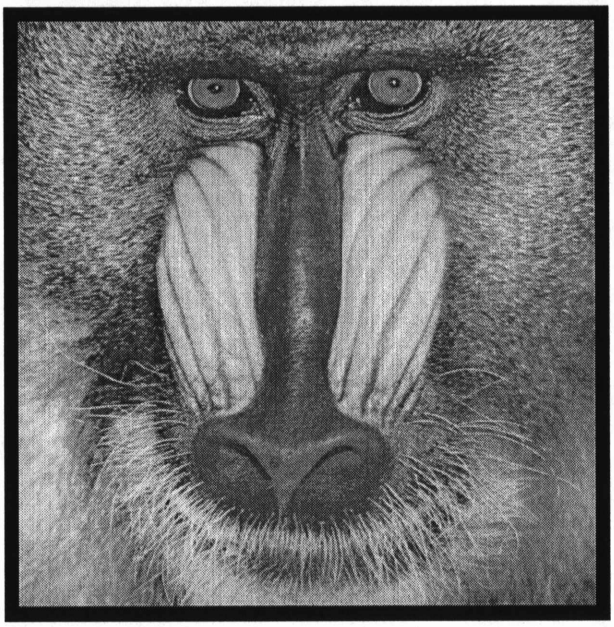
PRINT verb now displays strings only up to the last non-blank character.

EGETHEAD is a new verb that does a `GETHEAD` but sets `ERROR` when there is a missing keyword, rather than causing a procedure-stopping exception to occur. This will allow pipelines to test for the existence of keywords without failing.

TABED was corrected to use the range of line of each file being processed separately. Previously the first file set the maximum line number when that adverb was defaulted.

READLINE is provided with *AIPS*, for those sites that do not have it by more standard routes. We replaced the antique version we were sending with a much more modern version which is more likely to recognize and build on modern operating systems.

MNJ procedures were revised to handle the binary update blocking file correctly and to ignore changes in `READLINE`. Previously, binary MNJs could take place while we were in the process of updating the master areas.



June 30, 2005

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

FIRST CLASS

To:

DATED MATERIAL-DO NOT DELAY

AIPSLETTER

Volume XXV, Number 2: December 31, 2005

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

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General developments in *AIPS*

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 31DEC05 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 2006 to convert your copy of 31DEC05 into the now frozen version. When patches to 2005 are announced, you may apply them with the MNJ. This *AIPSLetter* is intended to advise you of developments in this release.

We have begun a new version, called 31DEC06, 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 31DEC06, 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 their source-only or binary version of 31DEC06 *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 copy the 70-Mbyte `31DEC05.tar.gz` compressed tar file.

From `mnj.aoc.nrao.edu`, the MNJ 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 `$INC` has to be given in its full path name, which forces a re-edit with each release. If you have made special versions of `UPDCONFIG` and `do_daily.`*host*, you should preserve them under new names and restore them after the install. If you have an odd set of AIPS versions, the `$AIPS_ROOT/AIPSPATH.*SH` files may need to be edited after the install to set the desired versions.

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.

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, for SUN's SUNWspro compiler suite, and for Intel's `ifort` compiler. These compilers produce executables that run about 50% faster (30% faster for Intel) 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. The binaries produced by the Intel compiler are quite large because they contain optimizations for modern PIV cpus, older PIV cpus, and for general computers such as AMDs. The specific optimizations to be used are selected at run time.

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.

Improvements of interest to users in 31DEC05

We expect to continue publishing the *AIPSLetter* approximately every six months along with the annual releases. There have been a number of changes in 31DEC05. In the last six months, we have developed new tasks CLCOP to copy CL table data between IFs, REAMP to rescale fluxes in uv data, SPIXR to fit spectral indices to image cubes, and CCRES to remove and restore Clean components from images. Two new VLBAUTIL procedures were written to download from the web and apply to VLBI data measurements of the ionosphere and earth orientation. A service program REUSE was written to convert public catalog *AIPS* installations to user-private installations. The new verb QINP allows users to resume looking at INPUTS at the last page they were examining. 31DEC06 already has a change in UVCON to model interferometers which have position-dependent primary beam patterns. This change was judged too significant to put into nearly frozen code.

31DEC04 and 31DEC05 use 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 one of these two releases. Other than this, 31DEC05 is compatible in all major ways with the with the 15OCT98 and later releases. There are significant incompatibilities with older versions.

UV data calibration

Calibrator models

In the 30JUN04 edition of the *AIPSLetter* we announced the availability of VLA flux calibrator models for the 3 highest frequency bands observed with the VLA in *AIPS*. Here we announce the availability of flux calibrator models at all bands from K through L for 3C48 and 3C286, in addition to the models at K, Q and U for 3C138 and 3C147. Models for 3C138 and 3C147 at the lower frequencies should become available over the next year. To see what models are available in *AIPS* type CALDIR; to load a model use the task CALRD.

Now that most VLA primary flux calibrators have models, their use should be the default way to obtain amplitude calibration for the VLA. See the *AIPS CookBook* for details. The VLA primary flux calibrators are resolved at most frequencies and configurations. Even in the configurations and frequencies where they are not resolved (*e.g.*, L band in D array) there are many confusing sources, so in *all situations* a model will make the flux calibration more accurate. Note that multiple facets were required to image the calibrators and confusing sources at the lower frequencies. We have found, however, that the Clean components from the exterior facets may be included in the CC table of the primary facet with no loss of accuracy in calibration. When using the models, there is no need to limit the *uv* range or antennas in CALIB, making automated data reduction even easier.

When working with the calibrator models, we discovered a serious problem with the way models are computed from images. In order to handle coordinate rotation, the central pixel and the reference pixel of the image are both relevant to model phase computation. Before mid November 2005, *AIPS* had no mechanism to retain the central pixel information when images are changed in size, *e.g.*, by SUBIM. All calibrator models were corrected on November 1, 2005 to have their central pixel be the original central pixel even though the images have been reduced significantly in size. Prior to that date, the calibrator models would get the correct amplitude calibration but would introduce a position shift into the phases. Fortunately, the primary amplitude calibrators are rarely if ever used to to provide phases for the target sources.

The VLBA and the Earth Orientation Parameters

When VLBI data are correlated, the position of the Earth's North pole and the offset between Earth rotation time and clock time must be known. Unfortunately, these parameters must be calculated using measurements taken on the day in question, so the best estimates are not determined for several weeks after the fact. Given the cost of VLBI recording media, the data must be correlated using predicted EOPs rather than the final, good estimates. Compounding this basic problem, it was found recently that the VLBA correlator had a systematic error in selecting the Earth Orientation Parameters (EOP) estimate it used, causing a very preliminary estimate to be used from May 2003 to August 2005. Fortunately, the parameters that were used

are recorded in the previously unused CT table. FITLD was revised to handle this table more carefully and to add to it information on the *uv*-data time range to which each entry applies.

The task CLCOR was given a new OPCODE='EOPS' to read a text file containing the latest EOP parameters and to correct phases for any differences between them and the parameters used at correlation. A procedure called VLBAEOPS was added to the VLBAUTIL RUN file. It can fetch the latest EOP data from the USNO over the web and then use them in CLCOR. This correction should be run on all VLBA data that require accurate phases, particularly phase-reference observations. For details see VLBA Test Memo 69 by R. C. Walker, V. Dhawan, W. Brisken, J. Benson, L. Kogan, and J. Romney from http://www.vlba.nrao.edu/memos/test/.

Other VLBI changes

In addition to VLBAEOPS mentioned above, a number of other changes were made to the VLBAUTIL RUN package. New procedure VLBATECR downloads the electron content data from the web that applies to the data set and then runs TECOR. These two procedures make clever use of the SYSTEM verb to fetch and apply information from the web. Procedure VLBALOAD now allows data to be taken from disk and VLBAMPCL defends itself against a common form of user input.

SNSMO is the task recommended for smoothing VLBI solutions since it does a better job of handling delays and rates with their effects on phase. However, SNSMO adopted the heavy-handed assumption that all rates should be the same and so averaged all polarizations and IFs producing identical output rates. This was changed to have SMOTYPE 'VLBI' average over polarization to avoid changing apparent instrumental polarization, but to keep IFs separate. A new SMOTYPE 'VLRI' was added to retain the previous averaging over IFs.

FITLD was changed to recognize that a station named "Y" with a sensitivity of 1.0 is actually the phased VLA. In that case, the recorded $T_{\rm sys}$ is actually $T_{\rm sys}/T_{\rm ant}$, a fact that is signaled by setting the antenna temperature to -1.0 in the TY table. Prior to this correction, very wrong amplitude calibrations would be found for the phased VLA. Errors corrected in FITLD include a date comparison that could cause the task to skip data files rather than loading them, uninitialized extension file version numbers in numerous subroutine calls, and a rearrangement of code to allow proper file management when trying to close down gracefully after an error occurs.

Other *uv*-data changes

FLAGR and FINDR were changed to regard a failed solution (when finding antenna-based amplitudes, phases, weights) as grounds for deleting the data. This simple fix seems to have made this into a quite useful flagging task using essentially only default adverb values.

CLCOP is a new task to copy the calibration for one polarization into that for the other. It can swap them and even write a 2-polarization file from a 1-polarization input file.

REAMP is a new task to rescale amplitudes and weights.

RESEQ was completely rewritten to allow complicated antenna renumbering operations.

FILLM was changed to get the correct bandwidth for modes 8 and 9 which is $50/2^8$ MHz. The previous value (half as large) led to wrong reference channels, bandwidths, and other minor errors.

CALIB was changed to count "failed" solutions differently. Previously, missing data were counted as failed which is more than a little confusing.

CPASS was changed to accept error returns from the fitting subroutines. It will quit on one of the errors, but will write the solutions into the BP table even when the fitting routines say they did not converge. It is not clear that this task has ever worked.

Imaging

Managing box files

IMAGR has a rather complicated set of adverbs plus BOXFILE options which may be used to define facets, resolutions, and Clean boxes. There are several tasks which have been written to help manage these parameters, primarily the BOXFILE content. Initially, these tasks were fairly simple but they have been changed to handle most of the options that are used in IMAGR. BOXES was written to add Clean boxes to a BOXFILE which defined the facets, but with the addition of NFIELD, RASHIFT, and DECSHIFT the facets may be defined in other ways. FIXBX was written to correct the boxes of one BOXFILE which defined its facets to those facets defined in another BOXFILE. But, with the addition of NMAPS, NOISE, PBSIZE, NBOXES, CLBOX and NGAUSS to describe old imaging parameters (along with INFILE) and NFIELD, RASHIFT, and DECSHIFT to describe new imaging parameters *along with BOXFILE) the faceting may be described completely with adverbs. CHKFC was initially written to test the BOXFILE output of SETFC, but can now define the facets and boxes with NFIELD, RASHIFT, DECSHIFT, NBOXES, and CLBOX.

Miscellaneous matters

CCRES is a new task to add or subtract Clean components from an image. Unlike RSTOR, there is no requirement that the components lie on cells or that the image be a power of 2 in size.

RSTOR was revised to subtract as well as add Clean components to an image.

IMAGR was corrected. The user's MINPATCH value was lost when cleaning a small window and not restored when next cleaning a large window.

Single-dish imaging was changed. SELSD and GRIDR were removed along with the concept of "projected" coordinates in the *uv* location. Galactic and Ecliptic as well as the usual celestial coordinates are now allowed in SDIMG. A path to import GBT data into *AIPS* for imaging is available in Green Bank.

Analysis

Spectral index

With the development of the EVLA, interest in spectral-index issues has grown. IMMOD was changed to allow the addition of up to four model images per execution. UVMOD was changed to allow different spectral-indices for each of the up to four model objects. MCUBE was changed to allow the user to force the creation of a SEQ.NUM. axis ignoring some axis coordinate that differs in an irregular way. This axis is called FQID when the coordinate is frequency and the values of the coordinate are stored in a FQ table attached to the output image cube. The coordinates of any type that are ignored on such an axis are stored in the history file.

A new task named SPIXR was written. It reads a transposed cube (frequency axis first) and fits to it an image of spectral index and, optionally, spectral index curvature using least squares. Early testing of this task indicates that issues of spatial resolution and blanking will be important in its use. It is intended to use the output of SPIXR as an optional input to IMAGR to correct for spectral index while doing bandwidth synthesis imaging of continuum sources.

Miscellaneous

CCEDT was overhauled so that its less known option of automatic box splitting might actually work. Corrected handling of boxes for images of less common types.

RMSD was given the option to output the local mean value instead of the local rms.

SAD was given the option to read an image of the rms.

Plotting

TVCPS was generalized to read one image from disk for each image plane that is visible. This will allow large images to be written to the output PostScript file for hue-intensity and three-color displays.

SNPLT was corrected to select IFs correctly when plotting PC tables.

Point plotting was further clarified, making a consistent set of symbols across all tasks using the standard list of available symbols.

General items

QINP is a new verb. It resumes the previous INP or INPUTS with the last page viewed. Thus, after viewing a page and changing the adverbs on the page, the user may re-view that page without having to start back at page 1

SYSTEM is a powerful verb that invokes a command to the operating system. It was enhanced with additional adverbs to allow for very long commands.

APROPO will now include all task, verb, adverb, and procedure names as well as the words in the one-line comments of the help files

Miscellaneous matters for programmer types

Dynamic memory now uses LONGINT as the data type for the array offset parameter. This translates to INTEGER*8 on 64-bit computers where it has been tested. The trick of using the pseudo-AP routines with dynamic memory will not work on some of these computers because the 1000s of variables which are pointers into the pseudo-AP have not been translated to LONGINTs.

REUSE is a new service program. It translates an *AIPS* system that was set up with public (multiple user) catalogs into a system with separate catalogs and files names for each user. FILAIP was changed to make the error of having public catalogs very unlikely.

install.pl was changed for the changes in FILAIP and to recognize AMD 64s making corrections in FORTOPT and in the XAS Makefile.

Dæmon mysteries

Two mysteries have arisen affecting the *AIPS* dæmons. The first affects the message and Tektronix servers. They are run as programs inside an xterm. At at least one site, we found that the command has to be invoked as

```
xterm -e '$LOAD/MSGSRV.EXE ' &
```

with quote marks and a blank character ahead of the close quote. At most sites, this grammar is apparently acceptable if not required. But, at all Solaris and some Linux sites, this grammar causes the command to fail. Does anyone out there understand what is going on?

The second mystery concerns the performance of the *AIPS* TV XAS. Compared to RedHat 9 and previous systems, the performance appears to be compromised under RedHat Enterprise. It is acceptable, but noticeably slower, using tv=local Unix sockets. Using Inet sockets, the communication to XAS appears to be very erratic, with rapid response for short intervals followed by no response for comparable intervals. This occurs only when the computer is actually looping back to itself; the communication between computers appears to be as fast as ever. Any suggestions?????

Patch Distribution for 31DEC04

As before, important bug fixes and selected improvements in 31DEC04 and 31DEC05 can be downloaded via the Web beginning at:

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

Alternatively one can use *anonymous* `ftp` to the NRAO server `ftp.aoc.nrao.edu`. Documentation about patches to a release is placed on this site at pub/software/aips/*release-name* and the code is placed in suitable subdirectories below this. As bugs in 31DEC06 are found, they are simply corrected since 31DEC06 remains under development. Corrections and additions are made with a midnight job rather than with manual patches.

The patch system has changed because we now have binary installations. We now actually patch the master copy of the frozen version. This means that a MNJ run on 31DEC04 after the patches listed below will fetch the corrected code and/or binaries rather than failing. Similarly, patches announced for 31DEC05 during the next year will be available via MNJ as well as `ftp`. Installations of 31DEC04 and 31DEC05 after the patch date will contain the corrected code.

The 31DEC04 release is no longer available for installation. It had a few important patches most of which were released in April when we changed the patch system. For correcting existing 31DEC04 releases, the patches are:

1. `OTFUV`, `OTFIN` to handle both byte orders of 12m OTF data *2005-01-06*
2. `CXPOLN` procedure, `CXCLN` task need modern image names *2005-04-22*
3. `TVFLG` and `SPFLG` required improved error handling and modern `FLAGVER` default *2005-04-22*
4. `WIPER` function `FLAG AREA` aborted on wrong button push *2005-04-22*
5. `FIXBX` could handle complicated cases but not simple ones *2005-04-22*
6. `POSSM` used wrong units in output text file *2005-04-22*
7. `CL2HF` aborts under Linux *2005-04-22*
8. `TCOPY` used wrong (old) tape LUNs *2005-04-22*
9. `BPASS` gets wrong solutions when channel 1 of of the first source was flagged *2005-04-22*
10. `BOXES` could handle complicated cases but not simple ones *2005-08-16*
11. `CALIB` looses track of the `SN` table when writing a `FG` table *2005-08-16*
12. `FITLD` wrongly concluded data were too early and did not handle cal transfer correctly for the phased VLA *2005-08-16*

Recent *AIPS* and related Memoranda

The following new EVLA Memorandum is available from the NRAO web pages (`http://www.aoc.nrao.edu/evla/memolist.shtml`)

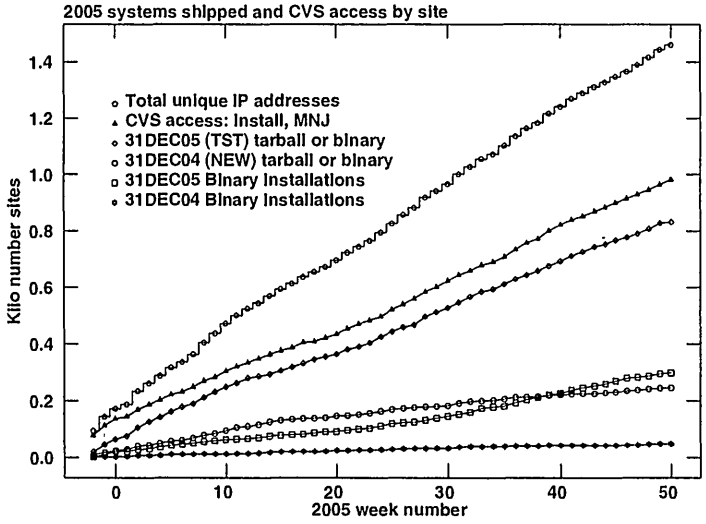
96 Imaging at Wide Field of View for a Plane Array
Leonid Kogan
9/20/2005
We consider the array located at a plane. The coordinate system we chose has U, V axes at the array plane, and W axis perpendicular to the array plane. W components of the baselines are equal zero and therefore expressions describing the Fourier transform pairs: IMAGE $<->$ VISIBILITIES do not include the W component of the vector directed to the current point at the source. As a result this Fourier transform is becoming two dimensional at the whole semi sphere of the sky. This is obviously true for a snapshot observation. The method to connect different time snapshot observations is given.

The following new VLBA Test Memorandum is available from the NRAO web pages (`http://www.vlba.nrao.edu/memos/test/`)

69 Inappropriate EOP on the VLBA Correlator
R. C. Walker, V. Dhawan, W. Brisken, J. Benson, L. Kogan, & J. Romney
10/06/2005
A bug has been found in the job generator for the VLBA correlator that caused it to use predicted rather than measured Earth Orientation Parameters (EOP) between May 2003 and August 2005. The errors introduced often are sufficiently large to adversely affect phase referencing observations and other observations that rely on an accurate correlator model. The nature of the problem and its impact are discussed in this memo. Correcting data is straightforward using the new EOPS option in the AIPS task CLCOR. Users just wishing to make corrections without worrying about the gory details can consult Section 2, or simply follow the CLCOR help file. It has become apparent while dealing with this problem that even occasional projects from outside the time period of the bug have been correlated with poor EOP. Usually this is because their job scripts were prepared too close to the observe date. So any user depending on an accurate correlator model may wish to check their EOP.

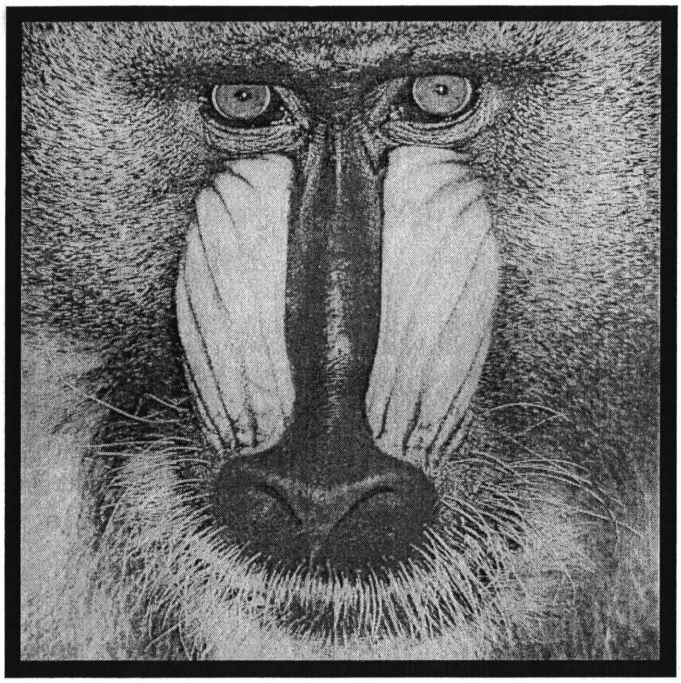
AIPS Distribution

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 as obsolete and onerous. In 2005, a total of 246 different IP addresses downloaded the frozen form of `31DEC04` and 832 IP addresses downloaded `31DEC05` in tarball or binary form. Fully 982 IP addresses accessed the NRAO cvs master. Each of these has at least installed `31DEC05` and 252 appear to have run the MNJ on `31DEC05` at least occasionally. The total number of unique IP addresses in these three lists was 1460. 48 sites accessed `31DEC04` in binary form, while 299 sites used the binary form of `31DEC05`. The attached figure shows the cumulative number of unique sites, cvs access sites, tar-ball/binary download sites and binary access sites known to us as a function of week in 2005.



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 2005 by the final qualifier for shipments of the `31DEC05` tarball, the `31DEC04` tarball, and access to the cvs site. The numbers in the cvs column include those sites that install `31DEC05`, run a midnight job for `31DEC05`, or run a final "catch-up" MNJ for `31DEC04`. The comments come from what appears to be a semi-official list of Internet codes. Sorting is on the "unique" column, which counts unique IP addresses over the other three columns:

Code	31DEC04	31DEC05	cvs site	unique	Comments
edu	55	199	283	382	US Educational
net	14	68	90	131	Network
uk	11	58	51	82	United Kingdom
jp	20	50	44	78	Japan
com	9	32	34	54	US Commercial
org	1	10	52	54	Non-Profit Organization
au	7	28	26	46	Australia
es	1	33	37	45	Spain
it	5	21	13	33	Italy
de	4	17	18	31	Germany
ca	4	18	19	29	Canada
gov	8	13	20	27	US Government
mil	5	17	13	22	US Military
pl	2	13	9	18	Poland
in	6	10	7	16	India
nl	4	8	9	14	Netherlands
fr	3	10	2	14	France
tw	6	7	7	10	Taiwan
cn	3	4	3	8	China
br	3	4	1	7	Brazil
kr	2	5	5	7	Korea (South)
mx	2	6	5	6	Mexico
pt	2	4	3	5	Portugal
ru	1	3	2	5	Russian Federation
inva	0	0	5	5	(Germany, key invalid)
se	1	2	1	4	Sweden
ar	1	2	2	4	Argentina
fi	0	3	4	4	Finland
ie	0	4	4	4	Ireland
cl	1	1	1	3	Chile
be	1	0	2	3	Belgium
il	0	3	1	3	Israel
za	0	1	3	3	South Africa
ch	1	0	1	2	Switzerland
at	2	0	0	2	Austria
hu	1	2	0	2	Hungary
dk	0	2	2	2	Denmark
co	0	2	0	2	Colombia
th	0	2	0	2	Thailand
cz	0	1	0	1	Czech Republic
yu	0	1	0	1	Yugoslavia
id	0	1	0	1	Indonesia
gr	0	1	1	1	Greece
mu	0	1	0	1	Mauritius
hr	0	1	0	1	Croatia (Hrvatska)
sk	0	1	0	1	Slovak Republic
None	1	7	13	14	
Unknown	59	156	189	270	
Total	246	832	982	1460	



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AIPSLETTER
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Charlottesville, VA 22903-2475
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