

# A I P S L E T T E R

Volume XX, Number 1: April 1, 2000

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

520 Edgemont Road, Charlottesville, VA 22903-2475

804-296-0211; Fax 804-296-0278

[aipsmail@nrao.edu](mailto:aipsmail@nrao.edu)

<http://www.cv.nrao.edu/aips>

## General developments in *AIPS*

### Current and future releases

We do not expect to have any further formal releases of *AIPS*. Instead, *AIPS* has been available as the 31DEC99 version since October 1999. This version remains under development by the (reduced) *AIPS* Group to correct and improve this “*AIPS* for the Ages” indefinitely. You may fetch and install a complete copy of this version at any time. Having done so, you may update your installation whenever you want either as a whole or by running the so-called “midnight job” which uses transaction files to copy and compile the code selectively based on the code changes and compilations we have done. We expect that most users will take the source-only version of *AIPS* over the Internet (via *anonymous* ftp), but we can ship it on more traditional media if requested (contact Ernie Allen at the address given in the masthead). *AIPS* is now copyright © 1995 through 2000 by Associated Universities, Inc., NRAO’s parent corporation, but may be made freely available under the terms of the Free Software Foundation’s General Public License (GPL). This means that User Agreements are no longer required, that *AIPS* may be obtained via anonymous ftp without contacting NRAO, and that the software may be redistributed (and/or modified), under certain conditions. The full text of the GPL can be found in the 15JUL95 *AIPS*Letter.

### Personnel

The *AIPS* Group, none of whom work full time on *AIPS*, has consisted of Chris Flatters, Ketan Desai, and Leonia Kogan doing programming and user support at the AOC in Socorro and Eric Greisen and Pat Murphy performing similar roles in Charlottesville. Ernie Allen handles data base and shipping chores for the Group. This is a pretty minimal group to support such a large and widespread software package. Unfortunately, this group has been eroding. Pat is also the Computer Division Head for Charlottesville, a nearly full-time job. Ketan has now left the group to find greener pastures working in the New York City area. We wish him well in his new endeavors, but his departure has left us below minimum strength.

Two actions are being taken to address this. First, Eric is moving to Socorro for the period from April to the middle of October. Second, despite NRAO’s current financial problems, a position to replace Ketan has been announced. The full text of this announcement appears in the following pages. All things being equal, a VLBI-knowledgeable radio astronomer with *AIPS* and software support experience would be our ideal candidate.

## *AIPS* position available

Assistant Scientist - *AIPS* Project  
NATIONAL RADIO ASTRONOMY OBSERVATORY  
Personnel Office  
P.O. Box 0  
Socorro, NM 87801  
Email Submission: [alewis@nrao.edu](mailto:alewis@nrao.edu)  
Attention: A. Lewis

The Astronomical Image Processing System (*AIPS*) is a software package for reducing data from single-dish and array radio telescopes in the US and throughout the world. More information on *AIPS* is available from the *AIPS* home page at <http://www.cv.nrao.edu/aips/>.

The *AIPS* software group has a job vacancy at the National Radio Astronomy Observatory Array Operations Center in Socorro, New Mexico. The duties will be to provide *AIPS* programming support for local and visiting astronomers, participate in software development in support of NRAO instruments and programs, and to coordinate with the scientific staff on data-reduction software issues. We anticipate that up to 20 hours a week of the applicant's time will be required to perform these duties; the remainder will be available for independent research. We are particularly interested in applicants with VLBI experience.

Substantial experience using and programming in *AIPS* is expected. Experience with Unix system administration and/or scientific user support is desirable. A strong background in radio astronomy is required. This position has an initial term of three years; further extension may be possible.

Socorro is a small historic town (pop. 9000) in the mid Rio Grande valley of New Mexico. More information can be obtained from the Socorro Home Page at <http://www.socorro.com>

Further information on NRAO is available from the NRAO Home Page <http://www.nrao.edu>. Please contact Tony Beasley ([tbeasley@nrao.edu](mailto:tbeasley@nrao.edu)) for more information on this position.

Applications should be addressed to A. Lewis at the above address. First consideration of applications will occur May 01 2000. AAE/EOE.

## Simulating *uv* data for an array design

The recently written task UVCON generates a *uv* database for an interferometric array whose configuration is specified by the user. Visibilities corresponding to a specified model with Gaussian noise appropriate for the specified antenna characteristics are calculated. The output is a standard *AIPS* *uv* data file. This task replaces the old simulating procedure which required use of the *AIPS* tasks UVSIM, UVSUB, and UVMOD and verb PUTHEAD. The array geometry can be specified in four different coordinate systems: earth-centered equatorial, local tangent plane, geodetic, and array-centered equatorial. The antenna diameters, efficiency, noise temperature, and number of levels in the digitizer are used to calculate the noise level for the given visibility. An atmospheric contribution to the noise level is now available.

Having simulated the *uv* data, the whole power of *AIPS* can be used for imaging, plotting, printing, and editing. In particular, the standard *AIPS* tasks UVPLT, IMAGR, KNTR, and LWPLA can be used for creating the *uv* coverage, beam pattern, and simulated image files in PostScript format.

The task has successfully used for the array configuration design of the VLA expansion project by R. Perley and ALMA project by Kogan, L., ALMA Memo #247, 1999, ALMA Memo #296, 2000; by Conway, J., ALMA Memo #291, 2000; and by Hedde, S., and Webster, A., ALMA Memo #290, 2000. The last memo "describes some progress that has been made towards automation of simulations using straightforward shell scripts applied while running Linux, with Classic *AIPS* as the core simulation tool." All Memos may be obtained on the WWW at <http://www.alma.nrao.edu/memos/index.html>.

## Improvements of interest to users in 31DEC99

Although we do not intend to have any more formal, frozen releases, we expect to continue publishing the *AIPSLetter* approximately every six months so long as there are things to report and an audience to care. Among the new thing in 31DEC99 over the past six months are two tasks: SCIMG, a multi-field iterative imaging and self-calibration program and FGPLT, a program to illustrate when data are flagged. There are major new options in the main imaging task IMAGR, significant enhancements to interactive editing tasks, and new verbs to help manage slices. Several significant bugs were corrected as well.

31DEC99 is compatible in all major ways with the other 1999 and 15OCT98 releases. There are significant incompatibilities with older versions of *AIPS*.

### Imaging

#### IMAGR

A multi-resolution variant of the Clean algorithm has been added to IMAGR. It takes advantage of the multiple field capabilities to model the source simultaneously as a collection of Gaussian objects of user-specified widths. The same part of the sky is imaged at several different resolutions corresponding to these widths. Clean then selects the strongest field and removes some number of components from it. The only differences from normal Clean are in the tapers applied to the image and the subtraction of a circular Gaussian rather than a point from the  $uv$  data. The present algorithm is based on a description of a “multi-scale” Clean given by Mark Holdaway and Tim Cornwell at an imaging meeting in Socorro in 1999, but it is likely to differ from their algorithm in significant details. The IMAGR version offers two simple adverbs, NGAUSS and WGAUSS, to specify the use of this new technique and offers numerous “knobs” in some of the IMAGRPRM adverb to adjust its behavior. Users should try this new technique with caution — use DOTV true; please report your experiences to [egreisen@nrao.edu](mailto:egreisen@nrao.edu).

The output class names from all imaging tasks were changed; the previous usage of 0-relative, extended hexadecimal was confusing to users. The new names are  $xIMnnn$ ,  $xCLnnn$ , and  $xBMnnn$ , where  $x$  is the Stokes code and  $nnn$  is the field number from 001 to 512. All calibration tasks can recognize either old- or new-style names for modeling, but earlier versions of *AIPS* will not recognize the new names. Writers of procedures should remember that *AIPS* file naming adverbs support a variety of powerful wild-card conventions.

Another new option is encoded in the new ALLOKAY adverb. This allows the user to reassure IMAGR that the pre-existing beam images and even the pre-existing IMAGR work file do not need to be recomputed. For restarts with multiple beam images and with large numbers of components, this can be a considerable savings in time. The previous version of IMAGR limited a user to 256 Clean boxes per field no matter how many fields were in use. This has been changed to allow up to 2048 boxes per field up to 64 fields. If there are more fields, then the maximum in any field is  $(131072 / NFIELD)$ . When imaging more than one field, a field status line will appear above the menu on the TV display.

A number of subtle bugs — with unsubtle consequences — were corrected. A compiler peculiarity in round off affected only Linux systems (see programmer section) and caused the uniform weighting to fail on rare occasions. If the first field was small enough to be gridded in core, the creation of scratch files for later, larger fields was compromised. The routine that decided how big to make the gridding and gridded subtraction scratch files did not use the same formulation as the routines that use the files. In some cases, this could result in a failure due to a too-small scratch file. The Clean component filtering routine had an error causing it to over-write memory near but not in the designated array. This too could appear as a data- and architecture-dependent failure.

#### Other imaging changes

**SCIMG** is a new task to image and self-calibrate a  $uv$ -dataset iteratively. It allows large numbers of fields and most of the multi-field options of IMAGR, but does not include (as yet) the experimental variations on Clean found there. SCMAP is single-field version, retained for simplicity.

**MAPPR** is a new standard procedure which provides a simplified access to IMAGR. It is for a single field image on pre-calibrated data without the experimental options.

**CMETHOD** adverb allows the user to have the task select DFT or gridded subtraction depending on which is faster. This option was added to FRING and KRING. It was found that the formulas used were no longer appropriate to modern workstations. Much worse was the fact that in almost all calibration-like tasks, the grid size was not set when the decision was made. This was a serious bias in favor of gridded subtraction. We made timing measurements, changed the formula, and saw to it that all parameters are known before the decision is made.

**SETFC** did not use the correct coordinates for multi-source files and did not handle “negative” right ascensions and even negative declinations correctly. The task was changed to use, for the center fly’s eye, a grid of field centers in a -SIN projection like geometry. The attempt to be linear in RA and declination did not work near the poles.

## Interferometric data editing

### EDITR, EDITA, et al.

The object-based EDIT class in *AIPS* was changed to allow for very rapid editing of multiple-IF, multiple-polarization data. This edit class is found directly in the tasks EDITR, EDITA, and SNEDT and is available as a menu option in the self-calibration and imaging tasks SCIMG and SCMAP. The biggest change was to allow, under control of the CROWDED adverb, the simultaneous display of both polarizations and/or all IFs in the data. The tasks begin with a “crowded” display, but the user may select interactively whatever combination of single or multiple IFs and polarizations are desired for the current display and editing. A new menu option, NEXT CORRELATOR, was added to assist in this selection. The crowded display posed significant complications in determining what data sample is being selected by the TV cursor. In some cases, multiple samples are plotted on the same TV pixel and, in these cases, all samples on that pixel are selected when the pixel is selected. Getting all samples deleted, including the affects of the ALL-IF, ALL-POL, and antenna selection flags, posed several interesting challenges.

Tasks EDITA, EDITR, and SNEDT had adverbs REASON and ANTUSE added to allow the user to select the initial “reason” string and initially displayed antennas. Both of these may then be changed interactively. The ability to specify amplitude displays from 0 to maximum rather than minimum to maximum was added. If these tasks start with EXPERT true, certain display limits and flag settings are now different than in the menu-driven mode. The computation of differences between the data and a running mean of the data was postponed until just before it is needed for display. This avoids potentially long waits for these data which may never be displayed with the current settings.

### SPFLG

SPFLG was substantially revised so that the horizontal axis contains all selected spectral channels for all selected IFs. This avoids have to display one IF after another while editing. It is tedious enough to have to loop over polarization and baseline without this extra loop and modern TV displays are usually wide enough to encompass the longer rows. The task is aware of which IF and channel are being selected and does appropriate displays and deletions depending on the setting of the ALL-IF flag. The SWITCH ALL-BL FLAG option from current vs all baselines to a 4-position switch with all baselines to each 1 of the antennas included as choices.

During this upgrade, a number of error in SPFLG (and TVFLG) were uncovered. An error in the declaration of the FC table common and I/O buffer caused the flag listing to be peculiar and caused Linux systems at least to die on UNFLAG operations. An error recording the current Stokes caused later REDO flag operations to behave incorrectly. TVFLG now requires the user to type an IF or channel number only if there are more than two of them.

## VLBI and interferometric data handling

### Phase re-referencing

The subroutine used by CALIB, CLCAL, FRING, and KRING (at least) to bring the SN tables to a common phase reference was rewritten. CALREF changes the reference antenna for a single IF, polarization, and subarray. It interpolates between or extrapolates from tabulated values of the phase, delay, and rate corrections for the old reference antenna relative to the new one that have been extracted from the table and smoothed using boxcar functions in time. It uses the smoothed rate corrections to provide time derivatives for the phase and delay corrections during interpolation/extrapolation. CALREF now reports an error if the old and new reference antennae cannot be related to one another; it no longer fails if there is only one solution linking the two. Delays are now interpolated using the rate as the first derivative of delay with respect to time. The correct interpolation tables are now used if the smoothing times are small and smoothing times now conform to the header comments. It no longer applies a spurious delay correction, it avoids overflows in computing ATAN2 properly and excess arguments (including a large work array) have been removed.

Both FRING and KRING had errors which caused them to fail to change the reference antenna for the second polarization. The calling tasks now allocate needed memory dynamically to handle the table being modified. They issue warnings but continue when CALREF finds no connection between the old and new reference antennae. This is often triggered by the use of different reference antennae in different subarrays.

### FILLM and DOCALIB = 2

FILLM has offered the option to set the weights using the antenna temperatures recorded with the data. This option was deprecated since the absolute calibration of the system temperatures is unreliable for the frequency and date of observation. Ketan Desai found that the “nominal sensitivity” is recorded with the data. This is the system level information used to scale the visibilities approximately to deciJanskys prior to calibration. If one uses these sensitivities also to set the weights, and then applies the flux calibration to the those weights, the resulting weights should represent  $1/\sigma^2$  which is desired in averaging and imaging. At present, the user has to instruct FILLM to use this option with the third bit in CPARAM(2), *i.e.*, set CPARAM(2) = 8 + other options. All calibration tasks were changed to have DOCALIB = 2 mean to apply the calibration to the visibilities and the weights, while DOCALIB = 1 calibrates only the visibilities in *all* tasks. Previously, some VLBI-oriented tasks applied weight calibration, SPLIT and SPLAT offered the choice, and the rest never calibrated the weights.

### DBCON

DBCON has the thankless task of trying to combine two datasets that may actually be rather different. One thing it can do is combine data sets with different numbers of polarizations. A patch was issued correcting errors in handling that case. Position shifting is done with the best estimate of the frequency of each channel; obsolete information about options to avoid this was removed. Previously, DBCON retained the two sets of frequency identifier numbers unchanged and only issued a mild warning if this seemed likely to be wrong. Now, it renumbers the FQ values for the second data set to match (or add to) the first data set.

### Other *uv*-data changes

**UVCOP** failed to subtract the 5-day offset correctly when making a single subarray dataset from a multiple subarray one. It produced times a bit greater than -5 days. It also was able to get the wrong subarray due to an inadequate round up.

**UVFIX** corrected phases using the first channel as the reference channel rather than the correct channel. The computation of projected baselines was changed to the aberrated source direction which seems to improve some astrometric results. (Unexplained variations in the “plate solutions” with epoch for VLA images still remain.)

**UJOIN** was changed to put the IF selection in the copied tables. The flagging of data under the DOWEIGHT was corrected and the meaning of DOWEIGHT was changed. Additional explanatory messages and frequency checks were added and the help file was made clearer.

**CALIB** and **BPASS** were changed to check for inconsistencies in the user parameters and to refuse to proceed when in doubt as to the intentions.

**TI2HA** was changed to correct times for subarray number (under user control) and to use the output name adverbs.

**UVMTH** was changed to handle compressed data, to use whatever dynamic memory is needed, and to handle the two data sets independently. It and **DIFUV** were made more immune to differences between the two input data sets.

**TBIN** had trouble with flagged rows in the table when reading the tables some columns at a time. In that mode it must, and now does, flag the row only when writing the last columns.

## Data display

### FGPLT

**FGPLT** is a new task to display the times when *uv*-data samples are flagged. The vertical axis is correlator from the selected portion of the data set. Horizontal lines are drawn to illustrate the times at which each correlator is flagged in the FG table. Since the VLBA Correlator now generates the initial FG table for its output, this task was conceived as a means to evaluate the observing and correlation success of a data set. General users should find it interesting when evaluating the consequences of the various non-interactive editing tasks in *AIPS*. Tasks like **CLIPM** and **UVLMM**, in particular, write FG tables which could be explored with **FGPLT**.

### Other data display changes

**VPLOT** was changed to allow the plotting of more data points, to allow flagging all channels based on the data of one spectral channel, and to plot a wider choice of parameters with time averaging.

**adverbs** for numerous tasks were changed. The adverb **NCOUNT** had migrated to so many functions that users were tripping over themselves. New adverbs **BPRINT**, **EPRINT**, **NPRINT**, and **NPLOTS** were created and put in place of the overworked adverbs.

**general** The tick mark algorithm was given a little more work to insure that at least two labeled tick marks appear even in small plots.

**Clean box** display and setting had several minor bugs corrected. The most mysterious caused boxes outside the display area to move during the **FILEBOX** operation.

**POSSM** had two errors corrected which were due to using the wrong version of the data header. One caused frequencies in plots 2 - **NPLOTS** on each page to be wrong; the first plot was correct.

## Analysis and documentation

### Slices

*AIPS* has been using an `xterm` or similar XWindows terminal emulation program to emulate the old Tektronix display device. While this works very well for display, it appears to be unreliable on all systems for cursor reading. It works just enough to be interesting and then returns incorrect values for the cursor position. The most significant use of the TK cursor reading was in setting the inputs for fitting Gaussians to slices. To get around the TK unreliability, we have written a parallel set of TV verbs for all the TK slice operations. These are TVSLICE, TVASLICE, TVMODEL, TVAMODEL, TVRESID, TVARESID, TVGUESS, and TVAGUESS for plotting slices, models, residuals, and guesses and TVSET and TV1SET for setting the guess parameters.

In testing the new verbs, the display of fit values and uncertainties by SLFIT was improved. The internal and “scientific” units are both displayed and labeled. Note that the units of the adverbs to SLFIT remain the “scientific” (actually plot) units, namely those displayed on the TKSLICE or TVSLICE plot, *e.g.*, mJy and asec.

### Other analysis changes

**CONF1** is being used to study array configurations for ALMA and other telescopes. New configuration optimization and constraint options were added in support of this. It was revised to handle the new ALMA site topography file that has both better resolution and a much larger coverage. Control over which antennas are to be held fixed was generalized.

**UVHOL** was revised to allow removal of samples at both ends of each holography scan.

**JMFIT** was corrected to report the offset term in the correct units; it was correctly computed. The default handling of GMAX was corrected to match the help file and IMFIT.

**IRING** used an incorrect convention for position angle. It has been corrected to measure East from North even in rotated images.

**BSMOD** was changed to generate single-dish, beam-switched continuum datasets without requiring an input dataset..

**BSCLN** is a new task to Clean beam-switched continuum images. The one-dimension task BSTST also has new Clean options. The Cleaning is described in ADASS talks at <ftp://ftp.cv.nrao.edu/egreisen/SWpaper.ps.gz> and <ftp://ftp.cv.nrao.edu/egreisen/SWposter.my.ps.gz>.

### Documentation

Unfortunately, the files used by ABOUT require manual intervention to update. We remember to do this on occasion and have done so at least once for 31DEC99 already. There are enough changes to software since the last major revision of the *CookBook* that we also have revised virtually all chapters to the 31DEC99 version. They are available from the WWW Table of Contents at <http://www.cv.nrao.edu/aips/cook.html> which also has summaries of the changes made on a chapter-by-chapter basis. The main reasons for changes included VPUT, VGET, FITAB, TAPES, DEFAULT, numerous new options in EDITR and IMAGR, PRINTER, new adverb and class names, CLIPM, UVMLN, and TV connectivity and start-up changes.

*Going AIPS* has not been revised since 1990. But it is still surprisingly useful. It has been made available on a chapter-by-chapter basis from the WWW Table of Contents at <http://www.cv.nrao.edu/aips/goaips.html>.

We are toying with the idea of upgrading some of the material.

We have run out of pre-printed covers for the *CookBook* and for *Going AIPS* and do not plan to print more. PostScript and jpg versions of the covers are available from the *AIPS* WWW pages.

## Programmer tidbits

**Round off** is handled differently by different compilers/architectures. In particular, the sequence  $A = B * C$  followed by  $I = A + 0.5$  gets a different result than  $I = B * C + 0.5$ . Therefore, when two computations are required to get the same result, *i.e.*, in computing offsets into an array, they must be expressed in the same fashion.

**Linux** compiler options were changed to test for unused and uninitialized variables. The egcs compiler is not fooled by a DATA statement into thinking that a variable is used.

**Long long** variables in C, such as those used for byte offsets into data files in those systems allowing files larger than 2 Gbyte, require a different format identifier (`%lld` rather than `%d`). This seems to work on all architectures but alphas where it will not be needed.

**Y2K police** have been busily reading all the precursor comments throughout the *AIPS* code. To forestall further complaints, we have changed the precursor comments a few places to match the already correct code. No actual problems have been found.

## New AIPS Installation Wizard

In order to make the installation of the 31DEC99 version of *AIPS* easier, the whole installation process has been overhauled and re-thought. While the old `INSTEP1` procedure was a significant improvement over what came before, it is now eight years old and is difficult to maintain or improve incrementally. The new approach is inspired somewhat by the intermediate `update.pl` perl script that some of you have used to install 31DEC99, and also by what one typically encounters with modern software installs. The `update.pl` script is limited in that it expects you to have an older version of *AIPS* already installed.

Based on the experience of `update.pl`, we decided to stick with perl as the language in which to write the new wizard. Given that perl is now ubiquitous, comes with Linux in most, if not all, distributions, and is otherwise freely available under the Artistic License, it is our hope that the requirement of having perl (version 5) should not cause undue hardship for our users. You may find copies of perl at <http://www.perl.org/>.

Some features of the new `install.pl` script include:

- Gathers all information before doing anything.
- Offers to retrieve and unpack the distribution if not already done.
- Does system “Search and Discovery” with significant improvements over previous installation codes.
- Allows you to save configuration and continue later.
- Permits “back”, “next”, and “quit” at each step.
- Does *not* use a GUI; uses short plain text menus instead.

The choice not to use a Graphical User Interface for this wizard was partly pragmatic and partly philosophical. Adding such a feature would have entailed much additional work, requiring resources (people, time) not currently available to the *AIPS* Group. Any added functionality would have been questionable at best given the cost in such resources.

At the time of writing, this wizard is still in preparation. We expect to have it available sometime in April 2000; please watch the *AIPS* home page at <http://www.cv.nrao.edu/aips/> for news on its testing and release.

## Patch Distribution for 15OCT99

As before, important bug fixes and selected improvements in 15OCT99 can be downloaded via the Web at:

<http://www.cv.nrao.edu/aips/15OCT99/patches.html>

Alternatively one can use *anonymous ftp* on the NRAO cpu `aips.nrao.edu`. Documentation about patches to a release is placed in the anonymous-ftp area `pub/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 31DEC99 are found, they are simply corrected since 31DEC99 remains under development. Corrections and additions are made with a midnight job rather than with manual patches. Remember, no matter when you received your 15OCT99 “tape,” *you must* fetch and install its patches if you require them. Also note that we do not expect to make any more patches to 15OCT99.

The 15OCT99 release had only a few important patches announced. These were:

1. DBCON fails combining data sets with different numbers of polarizations. 1999-11-23.
2. IMAGR fails when gridding large fields after gridding small fields. 1999-12-14
3. IMAGR fails when filtering Clean components for large fields. 2000-02-04

## AIPS Distribution

By March 30, 2000, 76 sites have taken copies of 31DEC99 via ftp. A few of them have begun taking updates regularly via the “midnight job.” We recommend this to all serious *AIPS* users.

A total of 301 copies of the 15OCT99 release were distributed to 276 non-NRAO sites. Of these, 145 were in source code form and 156 were distributed as binary executables. The figures on computers using *AIPS* are affected by the percentage of *AIPS* users that register with NRAO. Of 276 non-NRAO sites receiving 15OCT99 only 42 (15%!!) have registered. We remind serious *AIPS* users that registration is required in order to receive user support. The first table below shows the breakdown of how the copies of 15OCT99 were distributed and includes both source-code distributions and binary distributions. The second table below is based on the disappointing number of registered installations of 15OCT99. It lists total numbers of computers and indicates that the distribution over operating systems was heavily weighted toward Solaris with Linux as a distant second. However, when asked about “primary” architecture, 48% of our users answered Linux and 33% answered some flavor of Sun OS. This indicates how far Linux has penetrated as the system used on the more powerful computers used by astronomers today.

	ftp	CDrom	8mm	4mm	ZIP	Floppy
15OCT98	242	71	8	1	0	0
15APR99	290	69	0	2	0	0
15OCT99	227	72	0	2	0	0

OS	15OCT99 No.	15OCT99 %	15APR99 %	15OCT98 %	15APR98 %	15OCT97 %	15APR97 %	15OCT96 %
Solaris	84	56	53	61	66	50	66	46
PC Linux	43	29	27	27	19	23	16	19
HP-UX	10	7	2	5	2	3	6	4
SGI	9	6	13	1	3	1	1	5
SunOS 4	2	1	1	1	4	14	5	13
Alpha Linux	2	1	0	0				
Dec Alpha	1	1	4	3	7	9	6	10
IBM /AIX	0	0	0	2	1	0	0	4
Total	151							

## Recent *AIPS* Memoranda

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

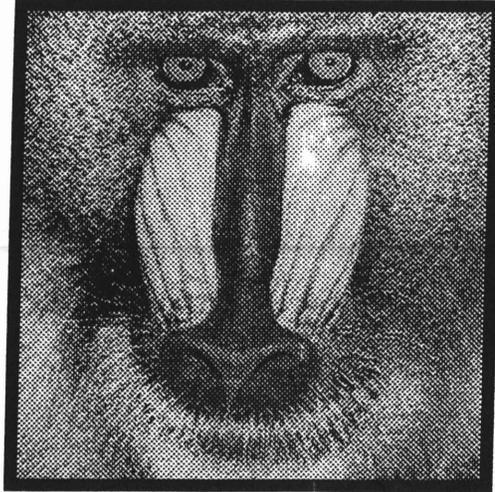
103 Weighting data in AIPS

Ketan M. Desai

March 21, 2000

This memo describes the “correct” calculation of weights for VLA and VLBA data based primarily on phenomenological considerations with a light sprinkling of theoretical grounding.





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

**FIRST CLASS**

**To:**

**Library  
Natl Radio Astronomy Obs.  
520 Edgemont Road,**

**DATED MATERIAL-DO NOT DELAY**

# A I P S L E T T E R

Volume XX, Number 2: December 31, 2000

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

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

[aipsmail@nrao.edu](mailto:aipsmail@nrao.edu)

<http://www.cv.nrao.edu/aips>

## General developments in *AIPS*

### Current and future releases

We had not expected to have any further formal releases of *AIPS*. Instead, *AIPS* has been available as the 31DEC99 version since October 1999. However, *AIPS* continues to be heavily used and will likely remain in use with limited development for some years to come. Therefore, we have reinstated the old practice of having formal *AIPS* releases. These will be done on an annual basis and there will be a binary release only for Solaris and Linux. All architectures can do a full installation from the source files. Therefore, we have changed 31DEC99 to 31DEC00 and it is now, or soon will be, available as a frozen release. Tape and CDrom copies will be available; see the *AIPS* web page or use the order form at the back of this *AIPS*Letter.

The next release will be called 15DEC01 and remains under development by the (reduced) *AIPS* Group. You may fetch and install a complete copy of this version at any time. Having done so, you may update your installation whenever you want either as a whole or by running the so-called "midnight job" 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 15DEC01 *AIPS* over the Internet (via *anonymous* ftp).

*AIPS* is now copyright © 1995 through 2000 by Associated Universities, Inc., NRAO's parent corporation, but may be made freely available under the terms of the Free Software Foundation's General Public License (GPL). This means that User Agreements are no longer required, that *AIPS* may be obtained via anonymous ftp without contacting NRAO, and that the software may be redistributed (and/or modified), under certain conditions. The full text of the GPL can be found in the 15JUL95 *AIPS*Letter.

### Personnel

The *AIPS* Group, none of whom work full time on *AIPS*, consisted a year ago of Chris Flatters, Ketan Desai, and Leonia Kogan doing programming and user support at the AOC in Socorro and Eric Greisen and Pat Murphy performing similar roles in Charlottesville. Ernie Allen handles data base and shipping chores for the Group. This was a pretty minimal group to support such a large and widespread software package. Unfortunately, this group has been eroding. Pat is also Head of the Charlottesville Computing Division, a nearly full-time job. This summer, Chris left the group to join Ketan (who left in the spring) both to find greener pastures working in the New York City area. We wish them well in their new endeavors, but their departures have left us well below minimum strength. The position advertised, among other places, in the previous *AIPS*Letter received very few applicants and was not filled.

Three actions are being taken to address these problems. First, Eric has moved to Socorro on a permanent basis. Second, with the bulk of the applications support now being done in Socorro, Jim Ulvestad replaced Tony Beasley as the nominal supervisor of the *AIPSLetter* Group in May. Third, despite NRAO's current financial problems, a position to replace Ketan and/or Chris was announced and advertised via bananas, various web pages, and the AAS. Amy Mioduszewski has accepted the position and will begin work in Socorro in mid January.

## Improvements of interest to users in 31DEC00

We expect to continue publishing the *AIPSLetter* approximately every six months along with the annual releases. Despite the reduction and disruption in personnel, there have been a surprising number of changes in 31DEC00 over the past six months. There are three new tasks: *FACES* to convert a coordinate and NVSS catalog into an initial set of images and Clean components, *OOSRT* to sort *uv* data, *MATCH* to change a *uv* data set to have *FREQID*, source, and antenna numbers matching another data set, and *PBEAM* to fit observations of the primary beam. New verbs are *COPIXEL* to convert between physical and pixel coordinates and  $\sim$ , the tilde sign, to assign a list of values to an array starting at any specified subscript.

31DEC00 treats data weights in different ways than earlier releases (see below) and has a variety of changed adverb names and the like. Other than these relatively minor ways, 31DEC00 is compatible in all major ways with the other 1999 and 15OCT98 releases. There are significant incompatibilities with older versions.

### Imaging and Clean models

#### IMAGR

*IMAGR* was given the option to remake all fields automatically every  $n$  major cycles in the "OVERLAP  $n$ " mode, where  $n > 2$  is the (new) user-specified value of *OVERLAP*. This option is likely to be used when Cleaning without use of the TV. The task was changed to restore only the width-zero fields when Cleaning with the multi-resolution algorithm. The method of restoration used means that the other versions of the fields only differ by having smoother noise. Whenever *IMAGR* has just computed all fields in the *OVERLAP*  $\geq 2$  mode, it will load the TV with the field it will Clean next (unless the user changes the boxes). Previously, it loaded the last one displayed. *IMAGR* was also given the ability to have *no* Clean boxes in a field, indicated initially by setting *FLDSIZ* for that field less than zero. The final Cleaned flux in each field is now reported..

A few bugs affecting only *IMAGR* were fixed. Tapering was not done when natural weighting was specified. When "3D" imaging using *OVERLAP*  $< 2$ , the computation of the histogram of residuals was done only on the first field. This was able to confuse things badly, allowing way more than *MAXPIXEL* pixels to be loaded to the AP and ending up in nearly infinite loops. Now the histogram is done over all images. *IMAGR* was filtering the Clean Components if that option was requested at the beginning, even if a *TELL* was used to turn it off later. A bug was corrected in the gridding of data. This bug was most likely to affect sparse data being gridded for a large image using a small pseudo-AP memory.

#### Clean-component modeling

Many of the same routines are used to subtract Clean components while finding them in *IMAGR* and later to use them for modeling and calibration in *UVSUB*, *CALIB*, and numerous other tasks. Some potentially significant bugs were found and corrected. A change to allow parallel operation in *DFT* point component division changed the meaning of the array used to scale from the first to later frequencies. Unfortunately, the calling routines that prepare this array and other similar *Q* routines that also use it were not changed. They are now all consistent. This bug could, among other things, reduce the ability of a Clean model to eliminate a distant interfering source.

The gridded subtraction routine for time-baseline sorted data had an annoying habit in large cases of looping through all the data once for each spectral channel and *IF* and each of several swaths in the *uv* plane. The routine, *ALGSTB*, was changed to overlap the swaths to allow all frequencies to be subtracted at once.

For some time, the model subtraction and division using a user-specified **SMODEL** has failed. This option is only supported by the **DFT** routines, but the gridded ones were called. Therefore, the output data did not have the model subtracted or divided.

The model-using tasks were changed to allow use of the model from one or more consecutive fields beginning with field  $n$ , where  $n$  does not have to be 1. Previously, the new naming convention for fields did not allow for excluding low-numbered fields from the model.

### Using survey catalogs

The task **SETFC** is designed to determine the “faces” or fields needed to image the primary beam area fully and to image any interfering sources if they are likely to be strong enough. It writes a **BOXFILE** for use by **IMAGR**. **SETFC** has been improved since the last *AIPSLetter* by adding 1950 as well as 2000 catalogs, by adding a flux cutoff control, and by including the Westerbork Sky Survey (**WENSS**) as a catalog as well as several **NRAO VLA D-Array Survey (NVSS)** flux-limited catalogs. Also inserted were schemes suggested by Bill Cotton for selecting cell and image sizes and for positioning the “fly’s eye” faces to cover the primary beam. The task now writes to the **BOXFILE** an inscribed circular Clean box for each of the fly’s eye faces and, optionally, small circular Clean boxes for each of the interfering sources. A new task called **FACES** has been written. It is designed to read the catalog files and create a set of images with associated Clean components files based on what it finds in the catalog. These **CC** files may then be used as an initial guess to calibrate the first self-cal cycle of the corresponding observation. It uses Bill’s schemes as well.

Both of these tasks plus **PBCOR** and **PATGN** need to have a correct antenna power pattern. The beam computation has been pulled into a single subroutine (called **PBCALC**) used by all these tasks. To improve the form used and the default values, new observations have been made with the VLA by Rick Perley and a new task (**PBEAM**) has been written by Leonia Kogan to fit the observations. The results of the fitting have been installed in these tasks and the fitting task has been made available. Wavelengths longer than 21cm remain to be done with the new tools.

### UVCON

**UVCON** generates a  $uv$  data set from a user-specified array geometry and a source model specified in the usual ways (Clean components, image, or **SMODEL**). **DFT** is used to compute the model visibilities. This task has been used to study **ALMA** configurations and other array design questions. In June, the ability to study the effects of pointing error was added. Three types of primary beam are offered: flat illumination (like the VLA), illumination down by 10db at the dish edge, and illumination down by 15db. Three kinds of pointing error are offered as well: a constant error for all antennas and times (*i.e.*, a source position error), an error that is constant in time but random among antennas, and errors that are random in time and between antennas. Preliminary results from this task suggest that modest random pointing errors are less important than were previously thought.

### Other imaging changes

**HGEOM** and **OHGEO** gave the user little control over the reference pixel in the output image. The output reference pixel is now controlled by adverbs and the defaults were changed to be more consistent. The output header in **OHGEO** was corrected to contain the coordinates of the first image for axes 3–7. An I.O error, which caused the output of all **\*GEOM** tasks to be wrong for large cubes, was corrected.

**XTRAN** was changed to give it a **DOOUT = -2** mode to test what it would do when just changing the header. The computation of header parameters was corrected and a second report of their accuracy compared to the full fit was added. The re-gridding was changed to use the full  $x$  and  $y$  fits even when only three parameters are found. This seems to handle skew to some extent. Corrected handling of **BLC** and **TRC** and made the task use only those star positions inside the sub-image being fit rather than all the positions in the text file.

**CONVL** needed larger buffers to handle images up to 8192 on a side. It cannot handle larger images and a warning about this was added.

**IRING** had its coordinates fixed just before the last *AIPSLetter*, but that left the beam area negative. Corrected this and fixed an error handling BLC.

**FLATN** has been upgraded to do both multiple pointings, using the new beam pattern routine, and multiple fields. LTESS plus HGEMD may no longer be required for mosaics.

## Interferometric data handling

### VLA data weights

Data weights are supposed to be, or at least be proportional to, one over the rms uncertainty squared. In the past, there seemed to be little, if any, effective way to measure this, so a simple count of the number of 10-second records was used with VLA data. The on-line measurements of system temperature are known to suffer from systematic errors in their calibration and so were thought not to be useful. However, Ketan Desai (*AIPS* Memo 103) pointed out that the “nominal sensitivity” which is measured on-line is the scaling applied to the visibilities to convert them roughly to deciJy. The nominal sensitivity is then a measure of the rms uncertainty that suffers from the *same* calibration errors as the data themselves. Thus, if the calibrations found by CALIB and friends are applied to weights initially set by the nominal sensitivity then, after calibration, these weights will be proportional to  $1/\sigma^2$  as desired. In the previous *AIPSLetter*, we described how the VLA task FILLM is able to set these weights and how all calibration application tasks can use DOCALIB=2 to signal the desire to calibrate both data and weights. The DOWEIGHT adverb has since been added to FILLM after this scheme was found to be effective. Compression of *uv* data eliminates the differences in weights between IFs and polarizations within each data sample. Since, in the new scheme, these weights can differ substantially, uncompressed data should probably be used where feasible.

On July 7, 2000, Chris Carilli reported:

*As promised, the following is a summary of the use of the “VLA weight cal transfer” for some recent 43 GHz data from the VLA. Overall, the process works properly, and will make the calibration, flagging, and imaging procedures significantly easier, and improve the sensitivity of the final image.*

*In review, the process is needed in order to have proper data weights based on measured  $T_{sys}$  values and antenna gains. The current implementation is very simple, requiring a value of CPARAM(2) = 8 (or DOWEIGHT = 1) in FILLM, then follow the normal calibration procedure, then use DOCAL = 2 in SPLIT. This process is extremely useful at 43 GHz and 22 GHz, where the system response varies by more than a factor two from the best to the worst antennas, but is also useful at 1.4 GHz where the  $T_{sys}$  increases due to spill-over at low elevation.*

*I loaded data from project A179 (high redshift CO at 43 GHz) in both the usual way, and in the new proper cal-transfer way. I ran CALIB and found that antennas 17, 20, and 24 all had much higher (poorer) gains than most antennas, by a factor between 3 and 5. After splitting with DOCAL = 2, the weights for baselines involving these antennas were lower by similar factors than for other baselines. A good example of this was antenna 26, which had a gain factor about two times higher than good antennas. After splitting, baselines involving antenna 26 had weights about two times lower than those for good antennas.*

*In terms of image noise, the results for the rms on NA weighted images are:*

<i>All data with weight transfer:</i>	0.178 mJy/beam
<i>All data without weight transfer:</i>	0.310 mJy/beam
<i>Without ant 17,20,24 with weight transfer:</i>	0.185 mJy/beam
<i>Without ant 17,20,24 without weight transfer:</i>	0.220 mJy/beam

### Calibration problems

**CALIB** takes the times from the NX table and rounds them outward by a little to be certain to include all the data from that scan. Unfortunately, a “little” was 4.32 sec, rather more than the comment claimed, and able to overlap into the next scan in phase-switching experiments (which may be separated by only 3 seconds). The result was a series of good solutions separated by rather poor ones from the couple of seconds of overlap.

**CL table** and BP table weights were not examined by most calibration application routines although they are used to flag solutions by SNEDT and other routines.

**NX tables** may be missing and the calibration routines try to function without them. This is actually the normal case for single-source files, but now gets a warning on multi-source files. Source-specific data selection and flagging were failing in this case and required generalization.

**INDXR** was capable of getting the wrong antenna and subarray numbers from the internal code in, one hopes, rare circumstances.

**CALIB** now supports the minus sign convention for DOFIT to mean all but those listed.

**GETJY** had an error causing the antenna deselection option to fail on some computers.

**FG table** copying with UVCOP and other tasks failed to delete records correctly when they fell outside the selected range of IF and spectral channel.

### Simplified VLBI data reduction

A new RUN file called VLBAUTIL has been added to the system along with all supporting HELP files including one for VLBAUTIL itself. The procedures contained in the file are intended to simplify the reduction of normal VLBA data. The procedures are

VLBALOAD	loads VLBA data with simplified inputs
VLBASUBS	finds subarrays in VLBA data
VLBAMCAL	removes redundant calibration data from tables
VLBAFQS	copies frequency IDs to separate files
VLBAFPOL	fixes polarization labelling for common cases
VLBACALA	determines a-priori amplitude corrections
VLBAPANG	determines phase corrections for parallactic angles

A new appendix to the *CookBook* has been written to represent a simplified approach to VLBA data reduction. It has been released as a VLBA Memo (see below) and will become part of the *CookBook* shortly. This memo includes a brief description of when the above procedures should be run in data reduction process. Within the next few months we plan to add a procedure to apply pulse-cal tones and to improve the procedure used for polarization D-term (leakage) calibration.

### VLBI data handling

**MATCH** is a new task. It copies a data set renumbering the sources, antennas, and FREQIDs to match those in a second data set. The task may be needed to align data sets from multiple files or extra-wide bandwidth observations processed with the VLBA correlator.

**FXPOL** was completely re-written. At the expense of a more complicated user interface, it is now able to rearrange and correct the labeling for polarizations in all possible combinations produced by VLBI correlators around the world. In order to do this, it is necessary for the task to make a new copy of the data set, rather than modifying it in place.

**FRING** now uses dynamic memory to allocate the space needed to do wide fringe searches. There are therefore fewer limits on such searches for machines with lots of real and virtual memory.

**FRING** takes the times from the NX table and rounds them outward by a little to be certain to include all the data from that scan. Unfortunately, a "little" was 1.0 sec, rather more than the comment claimed, and able to cause some confusion about which data is which.

**APCAL** was corrected to stop adding a scan between every solution interval and to function correctly when the TY table contains data for a source not in the source table. An option to limit plots to < APARAM(5) in sec(z) was added.

**FITLD** made errors when attempting to select IFs which we believe have been corrected. This selection of IF and ones done later may have different results due to the reordering of IFs done by FITLD.

**MK3IN** put weights of zero which mean “no good” in the CL table even though it also put in a useful a priori phase calibration.

### Other *uv*-data changes

**Ionospheric** data handling from IONEX data files by TECOR was corrected. A package of source code for a stand-alone utility to combine several IONEX files into one for TECOR was placed in \$APLCONTR under the name cationex.\*. An html file describes how to construct and use the package.

**FILLM** will now stop in end-of-tape conditions without trying to do all requested files. It will load pointing data only if the right bit is set in CPARAM(2) (= 16). A number of errors in the detection of changes in correlator configuration were repaired. They caused data to be written to the wrong output file. In solar mode, the nominal sensitivities applied to the data confused polarizations which are in a different order on the tape and inside *ALPS*. Only RR was correct, RL was applied to LL, etc.

**OOSRT** is a new task to sort *uv* data. It uses the OOP sort routines but seems to have no serious advantage over UVSRT.

**UVFLG** can now flag a range of elevations rather than just data from below a specified elevation.

**FLGIT** had a bad error in the handling of the user inputs causing it to flag below  $\sqrt{\text{APARM}(4)}\sigma$  rather than  $\text{APARM}(4)\sigma$ . Also, the V polarization test was done too soon which made it seem more important than it should be.

**EDITR** and other EDIT OOP class tasks had problems handling the all-polarization and all-IF modes when the data were allowed to be crowded. The REDO and UNDO options also needed some repair.

**IBLED** did not apply correctly the option to “flag all baselines with one antenna” when applying flags directly to the data.

**UVFIX** precessed only the first subarray to J2000 and used the time of the first sample rather than the first sample of the current subarray. The former caused serious problems in imaging multi-subarray data sets after UVFIX.

**DBCON** failed to copy CL and FG tables if one of the files did not have any and failed to correct the subarray number and times. It also failed when combining LL-only data with RR/LL while writing a compressed output. The output RR data was not zeroed properly.

**UVCOP** failed to flag data properly if the selected FREQID was bigger than 1.

### General items

~ — the tilde sign — is a new verb to assign a list of values to *POPS* memory beginning at a scalar address. This is the way to get around the limit on the size of a *POPS* input line. Thus,

RASHIFT = -200, -150, -100, -50, 0, 50, 100, 150, 200

RASHIFT(10) ~ -200, -150, -100, -50, 0, 50, 100, 150, 200

RASHIFT(19) ~ -200, -150, -100, -50, 0, 50, 100, 150, 200

fills in 27 values of RASHIFT in three lines.

**COPIXEL** is a new verb to convert between physical coordinate values (adverb COORDINA) and pixel coordinates (adverb PIXXY)

**PUTTHEAD** is now allowed to add keywords to a table header. Previously it was only allowed to modify pre-existing ones.

**ICHANSEL** is a new adverb replacing CHANSEL in a large number of tasks. ICHANSEL(4,*i*) specifies the IF for which the other spectral channel selections apply. IF 0 implies all IFs. ICHANSEL also replaces NBOXES and BOX in some tasks.

**FITAB** had an egregious error that destroyed the first part of input *uv* data files on occasion; see programmer section. The error handling in FITTP and FITAB now keeps tape errors in writing tables so that the task will actually quit.

*CookBook* was updated in April along with other general documentation files.

**Web site** The main *AIPS* page <http://www.cv.nrao.edu/aips/> was reorganized to match the style of the top level NRAO main pages; in addition, a section for special notices — currently with the position announcement — and a table of contents were inserted near the top of the page.

## Data display

**XAS** can now work on true-color displays that use 24 bits for the pixel values as well as those that use 32 (wasting 8). Errors causing it not to repaint all pixels in zoomed split screens and to abort for using bad addresses in high zoom plots have also been corrected.

**UVPLT** can now plot data weights, elevation, hour angle, and parallactic angle. For the last 3 of these, it offers the option of using the value at REFANT rather than the average of the two antennas of each baseline. (This makes a big difference in VLBI.) In fixed-scale plotting, the display of source name, the handling of the scales, and any looping over subarrays were corrected. It will now try one subarray when there are no AN files. When looping over subarrays and FREQIDs, it will not die if there are no data for some of the combinations.

**TVLABEL** and **TVWLABEL** now offer a choice of the graphics channel to be used for labeling.

**BLSUM** now offers the option of writing a text file suitable for use with PLOTR to plot the spectra from up to 5 blotch regions.

**ISPEC** will reverse the *z* axis in plots if ZINC < 0.

**KNTR** had an improbable error in determining end points of line segments that would cause an excessively long line to be drawn on rare occasions. Long straight lines were drawn with many short segments, making plot files 10–40% too large. Formats were made large enough to handle more general plots.

**PRTUV** has a new option to print random parameter values rather than the data.

**VPLOT** was corrected for errors computing models for VLA data and models at time-averaged data samples.

**IMEAN** attempts to fit the histogram of noise to determine the true rms. Bad user inputs or initial guesses can cause the fitting to fail; additional tests to recognize this failure were added.

**Tick** mark routines failed to return an error alerting the task to skip the tick plotting in some cases leading to rather messed up plots.

**EXTLIST** was corrected for KNTR and PCNTR.

## Programmer tidbits

**Y2K** A new test suite similar to DDT has been developed. The LARGE test in this suite is about an order of magnitude more demanding than the LARGE DDT test. IMAGR has replaced UVMAP and MX in the new tests. *AIPS* Memo No. 104 was written to document the new test; for information see below and the *AIPS* Web pages.

**MAXIF** The maximum number of “IFs” allowed in *AIPS* has been raised from 28 to 90. This change exposed some programs that, for ease of coding, simply dimensioned already large arrays with an extra MAXIF. The increase added 20 to more than 30 Mbytes to some tasks. With judicious recoding and use of dynamic memory, these tasks (*e.g.*, APCAL, FLGIT, IBLED) were made significantly smaller than they were before the increase in MAXIF.

**AP tasks** FRING can have enormous memory requirements for use by the “AP” subroutines. These routines perform their operations on ranges of subscripts in the large COMMON array called APCORE. Since these “Q” routines all take subscript values for arguments, one can allocate dynamic memory relative to APCORE and send the dynamic memory subscripts to these routines rather than using only pre-allocated memory. This means that the worst-case situations in FRING do not need to control how much “AP” memory is compiled into all the other “AP” tasks (*e.g.*, IMAGR and CALIB).

**Errors** It was discovered that certain error codes returned from low-level routines were being ignored systematically. This is a very bad idea and meant that a programming error that should have been found quickly without problems damaged a number of users’ data sets.

**Counters** In the old days, counters in *AIPS* had to be REALs if their values exceeded 32767. Now, counters must be INTEGERS since REALs cannot count by 1 past 16777215.

**PPC** *AIPS* may now be used on PowerMac G3 and G4 systems running Linux/PPC. Much of the porting work was done by Craig Lewis and Chris Flatters finished it off.

## VLA flux scale updated — SETJY

Rick Perley and Greg Taylor have derived new coefficients to be used in deriving flux densities of primary flux calibrators at the VLA. The flux densities shown in the table for frequencies below 10 GHz are based on the Baars *et al.* value for 3C295. For frequencies above 10 GHz, the flux densities are based on a model of Mars, provided by Bryan Butler. The values shown for 3C295 above 10 GHz are based on the Mars model — agreement with the Baars *et al.* scale is better than 1% at 15 GHz. The values shown for Mars below 10 GHz are based on the Baars *et al.* scale, and agree with the model to within 4% at all frequencies. There are significant discrepancies between these scales at Q-band (43 GHz), which is not surprising. More worrisome is that the measured flux density of the planetary nebula NGC7027, using the Mars-based scale, is 8% below that expected from extrapolating the 15 GHz value, where it is known to be optically thin, with the expected  $-0.1$  spectral slope. The origin of this discrepancy is not understood, and users must treat the 43 GHz flux density scale with suitable scepticism. The new numbers make a significant change in the flux scale at the high frequencies. What follows is an excerpt from the revised VLA Calibrator Manual:

“Since the planets and 3C295 are too heavily resolved for most VLA observing programs, the flux density of a small set of calibrators is carefully measured with respect to 3C295 and the planets in the “D” configuration every few years. These more compact sources have been found to be only slowly variable (with some exceptions at the highest frequencies). Below we provide the current (1999.2) best analytic expression for their flux densities.

$$\log S = A + B \log \nu + C(\log \nu)^2 + D(\log \nu)^3$$

where  $S$  is the flux density in Jy and  $\nu$  is the frequency in GHz. These expressions are valid between 300 MHz and 50 GHz.

Source	$A$	$B$	$C$	$D$
3C48	1.31752	-0.74090	-0.16708	+0.01525
3C138	1.00761	-0.55629	-0.11134	-0.01460
3C147	1.44856	-0.67252	-0.21124	+0.04077
3C286	1.23734	-0.43276	-0.14223	+0.00345
3C295	1.46744	-0.77350	-0.25912	+0.00752

The 31DEC00 version of *AIPS* program SETJY with OPTYP = 'CALC' and APARM(2) = 0 (the default) will calculate and insert the flux densities based on the above expression and parameters into a VLA database. Alternatively, SETJY can be told to use the old Baars *et al.* (1977) expression and parameters, or the 1995.2, or 1990 coefficients. *AIPS* versions 15OCT89 through 15JAN96 use the 1989.9 coefficients or the Baars coefficients. With versions of *AIPS* prior to 15OCT89, the flux density of the calibrators must be set with OPTYP = ' ' for each IF. Do not use SETJY with OPTYPE 'CALC' if you are switching frequencies within the observing run. In this case you must calculate and insert the appropriate values for each frequency and IF with OPTYP = ' '. You may find it more convenient to split the databases into single FQid components.”

## New AIPS Installation Wizard

The previous *AIPS Letter* described our plans for a new installation script or “*wizard*” with the promise that it would be available soon. At the time of writing, it is available through the 31DEC00 web page, and a separate ChangeLog for the script has been created (one cannot rely on fixes through the Midnight Job for this script anymore than one can rely on a cart to pull a horse).

The main weaknesses of the script to date are that the automatic fetching of the 31DEC00.tar.gz file — which only kicks in if you have not already downloaded it — is not working, and that the in-built help and documentation within the wizard needs some improvement. Additionally, there is some (understandable) confusion generated when following the instructions to prime the ssh key, specifically when you are asked to issue the “ssh-add -D” command. This command will remove all stored identities in any running SSH agent, but it issues an error message if there is no agent running. This message can be safely ignored!

For those of you who have contributed feedback on the wizard, thank you and rest assured we will attempt to fix any weaknesses you have pointed out.

## *AIPS* Distribution

By December 18, 2000, 449 sites have taken copies of 31DEC00 (407 of them as 31DEC99), via ftp. Of these, 22 sites took copies on more than one occasion. A few of the sites have begun taking updates regularly via the “midnight job.” We recommend this to all serious *AIPS* users. Of the 64 sites registering, a remarkable 54% of the installations were done under Linux. The primary architecture at 77% of these sites was Linux.

The distribution of 15OCT99 has been terminated. A total of 382 copies of the 15OCT99 release were distributed to 348 non-NRAO sites. Of these, 165 were in source code form and 217 were distributed as binary executables. The figures on computers using *AIPS* are affected by the percentage of *AIPS* users that register with NRAO. Of 348 non-NRAO sites receiving 15OCT99 only 57 (16%!!) have registered. For 31DEC00, the preliminary numbers are 64 of 449. We remind serious *AIPS* users that registration is expected in order to receive user support. The first table below shows the breakdown of how the (frozen) copies of 15OCT99 and (preliminary) copies of 31DEC00 were distributed. The second table below is based on the disappointing number of registered installations of the various releases. It indicates that the distribution over operating systems was heavily weighted toward Solaris previously, but that Linux is now preferred. However, when asked about “primary” architecture, 49% of our users answered Linux for 15OCT99 (77% for 31DEC00) and 32% (19%) answered some flavor of Sun OS. Linux has, for the moment, won.

	ftp	CDrom	8mm	4mm	ZIP	Floppy
15OCT98	242	71	8	1	0	0
15APR99	290	69	0	2	0	0
15OCT99	277	102	1	2	0	0
31DEC00	449	-	-	-	-	-

OS	31DEC00 %	15OCT99 %	15APR99 %	15OCT98 %	15APR98 %	15OCT97 %	15APR97 %	15OCT96 %
PC Linux	54	33	27	27	19	23	16	19
Solaris	38	54	53	61	66	50	66	46
Dec Alpha	3	1	4	3	7	9	6	10
SGI	3	4	13	1	3	1	1	5
HP-UX	1	5	2	5	2	3	6	4
SunOS 4	1	1	1	1	4	14	5	13
Alpha Linux	0	1	0	0				
IBM /AIX	0	0	0	2	1	0	0	4

## Recent *AIPS* and related Memoranda

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

- 104 Y2K, a new DDT, and AIPSMark<sup>(00)</sup> Measurements  
Eric W. Greisen  
September 8, 2000

The *AIPS* certification and benchmarking package known as DDT has lost its usefulness as computers have become faster. A similar package, called Y2K, has been constructed to use the *AIPS* imaging tasks now in greatest favor on a significantly larger problem. This should let us keep up with computer development for a few years. In this Memo I present the results of performance tests made with the 31DEC00 release of *AIPS* using both the old DDT and new Y2K on a variety of computer architectures. A new "*AIPS* Mark" is defined.

The following VLBA Scientific Memo is available from the Web page  
<http://www.aoc.nrao.edu/vlba/html/MEMOS/scimemos.html>

- 25 A Step-by-Step Guide to VLBA Data Calibration in *AIPS*  
Jim Ulvestad  
August 14, 2000

This memo provides a step-by-step guide to calibrating many types of VLBA experiments. Continuum strong-sources or phase-referencing observations are included, as are simple spectral-line observations. The memo applies specifically to VLBA-only data sets, but includes an appendix describing modifications for VLBA+VLA data sets. It may be used (with some modifications in loading amplitude data) for data sets containing other antennæ.

## Patch Distribution for 150CT99

As before, important bug fixes and selected improvements in 150CT99 can be downloaded via the Web beginning at: <http://www.cv.nrao.edu/aips/patch.html> Alternatively one can use *anonymous* ftp on the NRAO cpu [aips.nrao.edu](http://aips.nrao.edu). Documentation about patches to a release is placed in the anonymous-ftp area `pub/aips/release-name` and the code is placed in suitable subdirectories below this. The 150CT99 release had a few important patches including a new one in August. These were:

1. DBCON fails combining data sets with different numbers of polarizations. 1999-11-23.
2. IMAGR fails when gridding large fields after gridding small fields. 1999-12-14
3. IMAGR fails when filtering Clean components for large fields. 2000-02-04
4. FITAB would overwrite the incoming *uv* data file when sorting tables to time order. 2000-08-07

**AIPS Order Form for 31DEC00 (Unix, "tar" format)**

Available under the Free Software Foundation's General Public License

Order online: <http://www.cv.nrao.edu/aips/forms/aipsorder.html>

AIPS is available via anonymous  
ftp to [aips.nrao.edu](ftp://aips.nrao.edu) ([ftp.cv.nrao.edu](ftp://cv.nrao.edu))

1. Name and address of Contact Person: \_\_\_\_\_

Check here if address on back is ok. \_\_\_\_\_

(Include street address for UPS delivery) \_\_\_\_\_

**I  want  do not want to receive paper copies of the Aipsletter**

**The latest AIPSletter is always online at:** <http://www.cv.nrao.edu/aips/>

2.  New order  ReOrder

Have you registered previously?  Yes  No

(Registration is free to educational/research sites and is required on every release if you want support from NRAO)

3. Media desired: .....  CDROM (includes Y2K/DDT test package)

**We reserve the right to institute a  
media charge at any time**

Exabyte (5GB)  Exabyte (2.2G)

4mm DDS DAT

3a. Binaries on media: .....  Intel Linux (g77/egcs, glibc)

Sparc Ultra (SUL) 2.6/SC4.2

4. Computer(s) make, model and OS version: \_\_\_\_\_

Include hardware/software/quantity info, e.g. \_\_\_\_\_

Pentium III/Linux 2.2, etc. \_\_\_\_\_

5. Y2K test package (31DEC00 version): .....  (includes small, medium, large data sets; FITS tape)

NOTE: Also available via ftp on [aips.nrao.edu](ftp://aips.nrao.edu) in `/aips/DDT/*` and on the CDROM

6. Printed Documents Requested: .....  AIPS Cookbook (<http://www.cv.nrao.edu/aips/cook.html>)

AIPS Memos: \_\_\_\_\_ Going AIPS (15APR90)  Vol 1 )  Vol 2

(See separate list at <ftp://aips.nrao.edu/pub/aips/TEXT/PUBL/AIPSMEMO.LIST>)

Send this order form (or an electronic equivalent) to:

**AIPS Group**  
**National Radio Astronomy Observatory**  
**520 Edgemont Road**  
**Charlottesville, VA 22903-2475**  
**USA**

**Network Addresses**  
E-Mail: [aipsmail@nrao.edu](mailto:aipsmail@nrao.edu)  
Web: <http://www.cv.nrao.edu/aips/>  
Anonymous ftp: [aips.nrao.edu/pub/aips/](ftp://aips.nrao.edu/pub/aips/)



December 31, 2000



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

**FIRST CLASS**

**To:**

Library  
Natl Radio Astronomy Obs.  
520 Edgemont Road,

**DATED MATERIAL-DO NOT DELAY**