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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 next release

The April 15, 1999 release of Classic *AIPS* is now available. It may be obtained via *anonymous* ftp or by contacting Ernie Allen at the address given in the masthead. **15APR99** is also available on CDrom as well as the more traditional tape media. *AIPS* is now copyright ©1995 through 1999 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** *AIPSLetter*. A convenient order form is found from our Web page at **http://www.cv.nrao.edu/aips**. A paper order form and the ftp address appear on the last page of this *AIPSLetter*.

The next release of *AIPS* will be **15OCT99**. It is possible to get early access to, and remain current with, this release by running a "midnight job"; see the *AIPS* home page for further details. Note that this allows your site to receive the latest improvements and bug fixes, at the cost of also receiving the latest bugs. The latter can and will be fixed as rapidly as possible when the programmers are notified of them at **daip@nrao.edu**.

Highlights

There are only five new tasks and one new verb in this release. The most important new task is **FITAB** which should eventually replace **FITTP** for writing both *uv* and image data. The new verb, **TAPES**, will let you see the choices you have for both local and remote tape devices.

Because so many significant bugs have been found and corrected, we recommend that you seriously consider replacing whatever release of *AIPS* you are currently using with **15APR99**. A long-standing error in gridded model subtraction and serious errors in the the *uv* gridding routines were fixed. A long list of problems, some subtle and some catastrophic, in the calibration application routines were also repaired. Users should check their data for bad bandpass solutions and bad phases when applying polarization calibration as well as more subtle affects due to the use of calibrations from not quite the right times. The gridded-model subtraction bug could produce low-level stripes in images, or even, in a well-chosen example, divergent deconvolutions. Read the following pages carefully to see if your data may have been affected.

Improvements of interest to users in 15APR99

The **15APR98** *introduced numerous changes which are not compatible with previous releases. Disk files written by previous versions are read transparently by* **15APR98** *and later releases (including* **SAVE/GET** *files), but users must not attempt to read disk files written by any of the modern versions with earlier versions.* **15APR98** *and later* **AIPS** *cannot start previous versions of tasks and the TV displays of the versions are incompatible. The TV displays of* **15OCT98** *and* **15APR98** *are also not fully compatible.* **SAVE/GET** *files for* **15OCT98** *and* **15APR99** *cannot be read by* **15APR98** *and earlier releases;* **15OCT98** *and later releases will translate old* **SAVE/GET** *files when they encounter them.*

General matters

FITAB

FITAB is a new *AIPS* task intended to replace **FITTP** (gradually). It has a number of advantages over **FITTP** and would replace it directly except that its output cannot be read by older versions of *AIPS* and by other software systems which do read *AIPS* random-groups *uv*-data format. The advantages of **FITAB** are:

- For images, **FITAB** allows the specification of the value of the least bit. Integer and floating output FITS files are very much more compressible if the least bit is controlled to have a value related to the image's rms (*e.g.*, rms/4). **FITTP** uses the full range of integer and floating output values and is, therefore, not particularly compressible. When shipping a FITS file over the Internet, it helps to make a smaller file via Gnu or Unix compression. **FITAB** will use the integer format appropriate to the selected least bit and image range when **FORMAT** 1 or 2 is requested.
- For *uv* data, **FITAB** writes out the data in a binary-tables form rather than in a random-groups form. This has the advantage that the data may be written in "compressed"" format identical to that used on disk inside *AIPS*. FITS files that take advantage of this option can be as much as three times smaller than those written by **FITTP**. Non-*AIPS* software is much more likely to understand binary tables rather than random groups, although some (*i.e.*, **difmap**) are able to read **FITTP**'s random groups.
- For *uv* data, **FITAB** is able to break up the output into multiple files, each containing a "piece" of the *AIPS* file. Each of these files contain the full contents of many of the descriptive files (source, flag, index, antenna) as well as the corresponding time range for any calibration files (**CL**, **SN**, **IM**, **TY**, etc.). These tables appear in the files before the *uv* data. Each piece of an *AIPS* data set can be read and used individually or together with some or all of the other pieces. If parity error, or other problems like end of tape, affect the writing of a large file, recovery of some or all of the information is simplified with the new capability. **FITAB** can write multiple disk files for the multiple pieces and all FITS readers (**FITLD**, **UVLOD**, **PRTTP**) can read and understand multiple-piece disk and tape structures.

The main disadvantages of **FITAB** are:

- For *uv* data, **FITAB**'s output is not understood by **15OCT98** and earlier versions of *AIPS*. It is also not understood so far by other software packages such as AIPS#, **difmap**, *et al.*
- For image data, a poor choice of least bit in **FITAB** can lead to a serious degradation in image quality.

TAPES

A new verb called **TAPES** was written to display information about which tape devices are available. If the **REMHOST** adverb is blank, it looks for information on the current computer, using the standard **$NET0/TPDEVS.LIST** file. If **REMHOST** specifies some other computer, then that computer is sought in the file instead. If it is not found there, then the verb attempts to acquire the information using the **TPMON1** dæmon running on the remote host. If it is running and is at least a **15APR99** dæmon, then the remote **TPDEVS.LIST** file is read and the selected information returned. In this way, users do not have to remember which tape drive is which long after they have started up their **AIPS** session.

Serious FITTP bug on LINUX

When certain subroutines were compiled under the LINUX EGCS g77 Fortran compiler versions 1.1 and 1.1.1, seemingly random and non-deterministic errors were found to occur. Specifically, the routines **ZR32RL** and **ZRLR32** which translate floating-point values between local and FITS-standard format, were found to add one bit on occasion to one of the bytes of some of the values. This would often cause only a modest change in the value, but could turn the value into a 10^{30} if the bit happened to be in the exponent. Data written by **FITTP** and then read with **FITLD**, **UVLOD**, and **PRTTP** were most affected. Usually no error message would appear until the data read back were processed in some way *e.g.*, by **IMAGR**. Data files written with this bug are unrecoverable. Versions of the EGCS compiler prior to 1.1 do not have this problem. *AIPS* Z routines were changed to avoid any use of **INTEGER*2** at the end of December 1998 in **15APR99** and, so far as we know, there are now no problems in this release with the the EGCS compiler versions 1.1 and beyond. Users of **HF2SV** and **HFPRT** should be aware that the format supported by **HF** files requires **INTEGER*2** and so there may still be problems with these tasks if EGCS compilers are used.

Miscellaneous changes

XHELP has been improved. When you type **XHELP** *taskname*, the help file for the task will be displayed in your network browser. All adverb names that occur in the inputs and help sections of the file will be highlighted as links to the adverbs' help files.

RUN The **VERSION** adverb may now be used to point at run files belonging both to the login user and to user number 1.

COMPRESS This verb, which is the quick way to pick up new *POPS* symbols and to clean up procedure editing, had the unfortunate affect of making all character string values into upper-case letters. It now preserves case.

Batch A Y2K-like bug caused the start times for batch jobs started with a delay to be 1900 years too large. Batch jobs are sometimes vulnerable to **CTRL-C**'s and the like. They should be avoided when running tasks and batch jobs.

VLBI data processing

FITLD: Calibration transfer

All FITS export tapes written by the VLBA correlator after April 1, 1999 contain calibration and flagging information. **FITLD** will load these data automatically into **TY**, **PC**, FG, and **GC** tables. Each FITS file contains an independent copy of the calibration information so you will often end up with duplicated information. This may cause some *AIPS* tasks to fail. Therefore, if you process VLBA data, you should type **RUN MERGECAL** to define the **AIPS** procedure **MERGECAL**. You should then run the **MERGECAL** procedure on all VLBA data immediately after loading it to remove redundant calibration data. This function will eventually be incorporated into **FITLD**.

The calibration data from the VLBA correlator may be incomplete if you have used non-VLBA stations. Refer to `http://www.nrao.edu/vlba/html/OBSERVING/cal-transfer/cal-transfer.html` for procedures to follow in these circumstances. The Memo defining the FITS-IDI format including calibration transfer appears in this release and *AIPS* Memo No. 102.

FITLD: other changes

Many fixes have been incorporated into the **15APR99** version of **FITLD**. These include

- The **BIF**, **EIF**, **BCHAN**, and **ECHAN** adverbs are no longer used if they specify IFs and channels outside the range in the input file. Previously, they were used to select non-existent data.

- WTTHRESH can now be used to flag data within individual IFs rather than flagging entire visibility records.
- FITLD no longer fails if asked to append data to a file that does not contain data from the VLBA correlator.
- VLBA source positions are precessed to the observing date for the apparent coordinate columns of the source table.
- Explicit subarray numbers are no longer discarded in interferometry data interchange files.
- The way in which FITLD chooses an observing date has been improved so that it is less likely to omit an observing date from the header of an output file.
- The restrictions on the time order of data in a FITS-IDI file have been relaxed so that data may occur in any order within a single UV_DATA table provided that the table does not span a midnight boundary.

CLCOR

The AIPS task CLCOR corrects the CL table using several options. One of them is a correction for a shift of the source and/or antenna position (option "ANTP"). There were no complaints about this option while it was used for moderate shift (< 1 asec). At the end of 1996, a problem was reported in a VLBA observation at 7mm-wavelength with a position shift of 10 asec. Phil Diamond carried out a test of CLCOR by correlating data at C band with a known shift of 5 asec in declination. He showed that the shifted data after being corrected by CLCOR coincided with the original data. Because some users continued to complain, it was decided to do a deeper analysis of the CLCOR correction for source position and to carry out the new test with bigger shift

Until now, CLCOR calculated the correction of delay and rate using only linear terms in the series as a function of the shift. So CLCOR could be in error because of disregarding the higher-order terms or because of the difference between the simple formulæ used by CLCOR and the more sophisticated formulæ of CALC used by the VLBA correlator. To eliminate the problem of the high terms, the new version of CLCOR calculates the correction of the delay and rate as the difference of the delay and rate in the shifted and original position. The accuracy of CLCOR was also improved when FITLD was modified to record the correct apparent source coordinates in the relevant columns of SU table.

Tests were carried out at wavelengths of 7mm and 6cm. The correlation was provided with shifted source coordinates as large as 20 asec. The known shift was then corrected in AIPS by the improved CLCOR, and the corrected data were compared with original un-shifted data. The tests and our error analysis show that CLCOR corrects delay and rate without visible errors in all practical cases. The error of the corrected phase is explained by the difference between CALC's and CLCOR's formulæ. The error in the phase correction by CLCOR is small if the product of baseline in λ by the shift in asec less than $3 \cdot 10^8$.

Miscellaneous changes

CookBook The VLBI chapter has been updated to include information of calibration transfer and phase re-referencing.

CVEL The Hanning smoothing of autocorrelation spectra was corrected and Hanning smoothing was made an option for both autocorrelation and cross-correlation data under control of APARM(9).

PCCOR The handling of Pcal tones which are not located symmetrically with respect to the edges of the IFs was corrected. This case now arises after recent changes to SCHED.

USUBA This task appears to be fragile for MkIII data in which antennas drop in and out rapidly without switching subarrays. The code was able to break the HP optimizer and so is now no longer complied with optimization on that architecture.

UVPOL This task converts *uv*-data having only one cross-hand polarization in a sample to a form that **IMAGR** will accept and make complex images and beams suitable for **CXCLN**. It was retaining data for which both cross-hand polarizations were flagged, which disturbed the weighting of the data in imaging. Now such data are dropped.

Fringe fitting

The performance of **KRING** was checked extensively with a newly developed test suite. A new **SOLTYPE = 'NOFT'** to disable the FFT stage was added. It allows **KRING** to perform only the least squares and behave just like **CALIB** except that it can also solve for rates, and single-band and multi-band delays. When a solution's SNR falls below the threshold, the solutions are now blanked. Bugs in **FRING** affecting loops over subarray and failed solutions in rate-only fits were corrected. The task **MBDLY** was found to fail or get the wrong answer a lot of the time and was found to use ony the first subarray and first frequency ID. It has been improved, but **KRING** is more reliable in finding multi-band delays.

Interferometric data handling

Ionospheric corrections

This release of *AIPS* includes a new task (**TECOR**) for correcting ionospheric delay and Faraday rotation. This task uses ionospheric data in IONEX format. This is a standard format for maps of ionospheric electron density that is used by the geophysical community. World-wide ionospheric data is available from the Crustal Dynamics Data Information System (**http://cddisa.gsfc.nasa.gov**) in IONEX format with a time resolution of 2 hours. NRAO plans to make data with higher time-resolution available for the continental United States in the near future. You will need a password to retrieve data from the CDDIS. Contact information is provided at the CDDIS web site.

In a related change, the task **GPSDL** has been renamed to **APGPS** (APply GPS) and has been upgraded to allow antenna selection and calculation of dispersive delays.

Calibration application package

For the **15OCT98** release, the calibration application package was generalized to allow calibration data to occur at different times for different antennas. Previously, they all had to occur at the same time, a requirement which caused real problems with some standard modes of VLBI observations. Unfortunately, there were a number of problems with the generalized routines which were found only after they were used on a wide variety of data. For this reason, users of **15OCT98** are encouraged to replace it with **15APR99**.

Changes to the calibration application package included

- The ability to apply dispersive delays, when they are present in a **CL** table, was added to all calibration application tasks.
- An error made in 1992 caused flagged solutions to be ignored with the data then being calibrated with good solutions from (potentially much) earlier times. Now data, for which the solutions are blanked, are flagged as they should be.
- The ionospheric Faraday rotation and dispersive delay terms were not inserted properly into the interpolation tables under a variety of conditions.
- The interpolation routines did not check for blanked Faraday rotation values and hence made gross errors in applying polarization calibration. Note that a magic-value blank is around 10^8 on most machines.
- Data records were not dropped when all data were either previously flagged or flagged due to bad gain solutions.

- There is code designed to avoid computing interpolated solutions for every microscopic change in time or even for every data sample. This code had to be fixed since it failed to recognize that the tables to be interpolated had changed and it failed to interpolate often enough if one or more antennas had a big gap in time with no solutions.

- The bandpass application code contained the dubious assumption that auto-correlations after calibration would be centered about a value of 1.0 and, therefore, subtracted 1.0 to leave, in principle, just the signal from the sky in some sort of units. Unfortunately, the order of the gain and bandpass multiplications actually made the results be centered on values other than 0.0. The subtraction of 1.0 has been removed from the code, leaving autocorrelations with no automatic "baseline" subtraction.

- The logic by which the adverbs **QUAL**, **CALCODE**, and **SOURCES** selected sources produced confusing results when sources were de-selected (*i.e.*, **SOURCES** = '*-xxx*'. The logic was changed so that **CALCODE** and **QUAL** are applied to select a list of possible sources from the source table and then **SOURCES** is applied to reduce the list.

Miscellaneous corrections and additions

BPASS had a very serious bug which was introduced in the **15APR98** release. When one polarization of an antenna was fully flagged, the solution for the other polarization was an erroneous constant for the first half of the channels.

CLINV is a new task which will make a **CL** or **SN** table which is the inverse in amplitude, phase, or both of an input table. The task was created to handle a situation in which a strong source near the antenna half-power point dominated the self-cal solutions. Pointing errors make these solutions incorrect for the other sources in the field and so the calibration needs to be removed after the strong source has been **UVSUB**ed.

FLGIT has a new option to remove data with excessive V polarization before median filtering or fitting baselines. It also has new controls on the levels at which data are flagged with respect to the rms.

SPLIT contained a bizarre bug which under a combination of circumstances could affectively destroy a source table. The number of channels written when frequency smoothing was changed to write as many as possible even if the last one does not get as many input channels averaged into it. If **DOUVC=-1**, as it should with channel-dependent weighting, then the weights will take care of this partial averaging.

UVCOP would occasionally write out fully flagged data even when instructed to avoid doing so. The tests for good data were tightened to include only the included IFs and channels.

EDITR and friends had an error that caused them to ignore times in which only one antenna or baseline occurred. This was most obvious when a single antenna or baseline was included in the editing.

UVINIT had a bug when it had to open a file already larger than 2 Gigabytes in order to append even more data.

Imaging

Miscellaneous imaging changes

Image size The maximum allowed image size was parameterized throughout *AIPS* and was increased to 16384. A number of bugs handling image size were corrected. If you have enough disk and time you are now allowed images up to 16384 on a side. You must have a system capable of handling files > 2 Gbyte if you need to Fourier transform such images.

FLATN The option to omit **EDGSKP** pixels around the edge of each image was added. The gridding was re-arranged to avoid excessive computations, greatly improving performance.

IMAGR and SCMAP

A considerable number of changes have been made to **IMAGR** and **SCMAP** to assist in their use. They include

- The adverb **OBOXFILE** was added to specify a text file in which are kept all of the Clean boxes currently in use. It is updated whenever boxes are changed with the TV display. Lines describing other parameters are kept as well, so **OBOXFILE** can be the same file as the **BOXFILE** used to provide the initial window and field parameters.
- The display routines no longer require that all Clean boxes appear on the display in full or in part although that is the default in setting the display window. The box-setting functions will work on whatever window is currently displayed, allowing you to look at every pixel in each part of the image if you want.
- Menu handling was improved to try to prevent changes in the window size from affecting correct menu reading.
- The color and intensity transfer functions are now initialized only at the beginning of the task. Any transfer function you have set will be retained at the next major cycle.
- **OVERLAP** 2 mode may be used without having to request **DO3DIMAG**.
- Cleaning with **DO3DIMAG** true will continue in **OVERLAP** < 2 modes until each image has had the same number of major cycles even if **NITER** is exceeded.

A number of significant bugs were found and corrected. They are

- The gridded model subtraction routines failed to scale the W term for any frequency difference between the first channel being used and the reference frequency. This tends to arise if **BIF** is not 1 and when the primary-beam correction option is invoked. The error is particularly prominent at low declinations with fields north or south of the pointing position. Multi-channel subtractions were handled correctly if the first channel is at the reference frequency. Note that this error appears to have been present since gridded model subtraction first appeared in *AIPS* and affects all tasks that do that operation.
- The 3D gridding routine had a gross error that would arise when it had to do multiple passes in the gridding and there was a gap between one swath in $|u|$ and the next. This error caused very bad intensity levels and other obvious defects in the images.
- A similar gridding bug in both routines arose when there were no samples in the very last swath of $|u| \approx 0$. Its affects were also obvious.
- The tests to decide whether data had to be sorted before weighting, gridding, or Cleaning were corrected for several minor flaws that could result in data not being sorted when it needed to be.
- The primary beam correction had a bug causing it to fail when **DO3DIMAG** was true. It also did not handle coordinates properly especially in the 3D case.
- Source tables contain frequency offsets for each source with respect to the frequency offsets in the **FQ** table. These are often small, but are not required to be. Unfortunately, they were ignored by most tasks except inside the calibration system and in **SPLIT**. Among other possible affects, this oversight caused a scaling error in images made by **IMAGR** from multi-source data sets. It would also make scaling errors when applying a model with **CALIB**, **FRING**, *et al.*

Modeling

UVCON

The new task **UVCON** was written to simplify simulation of *uv*-data for designing array configurations. It generates a *uv* database for an interferometric array whose configuration is specified by the user. Visibilities corresponding to a specified model and Gaussian noise appropriate for the specified antenna characteristics are calculated for each visibility. The output is a standard AIPS *uv*-data file. AIPS has several tasks which assist with this problem, but none of them are complete. They are **UVSIM** which simulates *uv*-data without a source model or noise, **UVSUB** adds a model to an existing *uv*-data file without simulation, **UVMOD** which adds noise and a simple model to an existing *uv*-data file without simulation, and **DTSIM** which simulates *uv*-data with only simple models and without noise. **DTSIM** is intended to test calibration defects in VLBI and is thus too complicated for the array design purposes. **UVCON** replaces a procedure which used AIPS tasks **UVSIM**, **UVSUB**, and **UVMOD** along with the **PUTHEAD** verb. The array geometry can be specified in three different coordinate systems: equatorial, local horizon, and geodetic. There is an option of using set of different frequencies to simulate better *uv* coverage. **UVCON** has been used successfully to simulate *uv*-data for ALMA (the new name for the MMA) and for the VLA upgrade and can be recommended for other projects.

SLIME

An updated version of SLIME, the interactive model-fitting "plug-in" for AIPS is now available. Pre-built packages are available for SPARC workstations running Solaris 2.5 or later and for ALPHA/AXP workstations running Digital UNIX 4.0. These packages have been built against the **15OCT99** version of AIPS but should work with any version of AIPS from **15APR98** onwards. The packages for **15OCT97** and earlier have been withdrawn.

This version fixes some memory leaks that caused SLIME to fail under Digital UNIX under some circumstances and offers improved messages that provide better advice on what to to if a least-squares solution fails to converge. In addition the Digital UNIX version no longer requires the GNU C++ runtime libraries to be installed.

The updated version of SLIME may be downloaded from the SLIME home page at

http://www.nrao.edu/~cflatter/SLIME/index.htm

Data analysis and display

UVHOL is a new task to perform the holography functions previously, but no longer, done by **UVPRT**. It selects the last **NPOINTS** samples of each dwell position (as indicated by the value of w) which is a more reliable method of selection than used previously.

PRTUV has a new set of options to specify the data scaling in order to avoid reading some of the data set to find the necessary scaling information.

KNTR has a new adverb **NY** to specify the number of frames in the y direction. The default is still to make as square a display as possible.

POSSM failed to plot bandpass functions produced by **CPASS** properly and wrote all over itself. It does better now.

DFTPL used data weights incorrectly in computing the rms and expected error.

XMOM now retains the first axis (making it the last 1-point axis) so that coordinate pairs will not be lost.

REBOX and **FILEBOX** now handle Clean boxes that are partially or fully off of the display area. The order of the boxes is retained and any that are fully visible may be changed.

XAS has displayed a funny line at the bottom of the screen for a very long time. A correction in the screen initialization routine has finally gotten rid of it.

Improvements in system matters in 15APR99

AIPS Manager related items

XHELP has a new cgi perl script that should be installed in a local form in the cgi area used by your computers. **INSTEP1** now attempts to do this and explains the need to do so. Otherwise, **XHELP** fetches its data from Charlottesville.

LINUX EGCS g77 Fortran compilers $\geq$ 1.1 were found to make errors compiling routines containing **INTEGER*2** statements. These compilers must not be used with versions of *AIPS* prior to **15APR99**. Because of this problem, we re-issued the **15OCT98** CDrom of *AIPS* using serial numbers $\geq$ 100.

LINUX version of **ZMOUN2** failed to close the device on a number of error conditions. When this happened, the device was locked until the **AIPS** process was terminated.

LINUX libraries were found to have a range of versions in which the **getservbyname** function left an open file behind. After about 80 TV opens/closes, the open file limit was hit and things stopped working. The latest libraries have corrected this bug, but we have left in a work-around since we have found that remembering the host and service rather than finding them each time is much faster, at least when they have to be found via yellow pages.

USUBA was found to be fragile in optimization and the optimizations had to be turned off for HP systems. This is done in the file **$SYSUNIX/OPTIMIZE.LIS**.

Programming considerations

Image size is parameterized in the **PMAD.INC** file with the maximum image dimension **MAXIMG** set to 16384 and the buffer size parameters **MABFSS** and **MABFSL** set to 16384 and 65536. All *AIPS* subroutines and tasks should now use this include to set buffer dimensions.

Table floating-point keywords are now all stored as double-precision values. Routines that read table keywords should test the type and handle the returned value properly in case it is a single or a double for a floating-valued keywords.

Frequency offsets are also a function of source in the source table and of time in the **CL** table. Both have been ignored widely, but it is not acceptable to ignore the first. After an **INIT** call to **UVGET** is made, the source offsets for each IF are found in the **DSEL.INC** common variable **SFREQS(MAXIF)**. The call sequence to **CHNCOP** was changed to include this array. **UVGET** has always used the source offsets in setting the new reference frequency, but any output **FQ** table needs to take the offsets at each IF not just the first into account. **SPLIT** did all this correctly, but, until this release, most other tasks did not.

Recent *AIPS* Memoranda

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

102 The FITS Interferometry Data Interchange Format
Chris Flatters
December 3, 1998
The FITS Interferometry Data Interchange (FITS-IDI) format is a variant of FITS that may be used to archive raw radio interferometry data and to transport it between institutions. It may be used to store both interferometry data and calibration data that is associated with it.

Improving *AIPS* Performance Under Solaris

Disk writing under Solaris 2.x is governed be a "write throttle" algorithm that tries to limit the amount of memory that can be consumed by buffered data waiting to be written to disk. If a process has more than a certain amount of data in the buffer waiting to be written to disk, Solaris will hold up that process until some of that data has been written out. The default value of this threshold is rather low and imposes a considerable penalty on *AIPS* which tends to write a lot of data to scratch files. Fortunately, this threshold can be changed.

If you have a Solaris system that is predominantly used by a single *AIPS* user and you have at least 100 megabytes of main memory, then you should see a significant improvement in performance if you add the following lines to **/etc/system** and reboot (you will need to do this as root).

```
set ufs:ufs_HW=6291456
set ufs:ufs_LW=4194304
```

Tests show improvements from about 10% to more than 30% in the **DDT** benchmark with higher-performance machines receiving the greater improvements. It is likely that the low default settings are largely responsible for the performance deficit observed running the **DDT** benchmark on UltraSPARC systems without using **/tmp** for scratch files.

If you process a lot of spectral line or VLBI data and you have a large amount of memory, then it is possible that you could benefit from even larger values of these settings but you should exercise caution when changing them and make sure that **ufs_HW** is always larger than **ufs_LW**.

If you have 64 megabytes of memory or less, changing these settings will not improve your performance significantly and may cause some degradation. If your system is often used by more than one person at the same time, then you should also avoid this change. When several programs are trying to write data at the same time, this change tends to increase the performance of programs with high data rates at the cost of programs with lower data rates. This may be unpopular with other users.

You can find more information about the write throttle in Chapter 8 of "Sun Performance and Tuning, 2nd Edn" by Adrian Cockcroft and Richard Pettit (Prentice Hall, 1998).

Patch Distribution

As before, important bug fixes and selected improvements in **15APR99** can be downloaded via the Web at:

http://www.cv.nrao.edu/aips/15APR99/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 **15APR99** are found, the patches will be placed in the **ftp**/Web area for **15APR99**. No matter when you receive your **15APR99** "tape," *you must* fetch and install these patches if you require them.

The **15OCT98** release had a number of important patches announced and probably should have had more. Repairs to the general calibration system are so complex that we hesitate to announce them even when they might be serious. The announced corrections were:

1. **FTPGET** incorrectly indicates **DA00** status. 1998-11-25.
2. Error in gridded Clean-component modeling. 1999-01-05.
3. Error in appending to very large UV data files. 1999-01-19.
4. Error in copying VLBI files in **FLGIT**. 1999-01-20.
5. Revised documentation for calibration transfer. 1999-03-30.

Progress on a world-coordinates standard

At the ADASS meeting held in Boston in the Fall of 1992 it was decided that a standard for conveying coordinate information within the FITS format needed to be developed. Eric Greisen was, in his absence, volunteered for the effort. Versions of possible standards authored by Greisen and Mark Calabretta (of the ATNF in Australia) appeared in 1993 (June AAS meeting in Berkeley) and in 1994 (September ADASS meeting in Baltimore). Other revisions through about 1996 were available off the World-Wide Web. The subject has languished for a while since then, but has now become serious due to agreements reached in principle at the November 1998 ADASS meeting in Champaign-Urbana. The paper is now divided into three parts: a general paper, a celestial-coordinates paper, and a spectral-coordinates paper. All three of these are available via the WWW and we encourage you to fetch and read them. When these are adopted — and something very much like them will become part of the FITS standard — they will affect the ways in which we think about astronomical data. For that reason alone, they are important and we solicit your comments (**egreisen@nrao.edu** and **mcalabre@atnf.csiro.au**). The papers are:

I. Representations of world coordinates in FITS, by Greisen and Calabretta
(**ftp://ftp.cv.nrao.edu/NRAO-staff/egreisen/wcs.ps.gz**)

II. Representations of celestial coordinates in FITS, by Calabretta and Greisen
(**ftp://ftp.cv.nrao.edu/NRAO-staff/egreisen/ccs.ps.gz**)

III. Representations of spectral coordinates in FITS, by Greisen
(**ftp://ftp.cv.nrao.edu/NRAO-staff/egreisen/scs.ps.gz**)

AIPS on CDrom

Starting with **15APR98**, we have made *AIPS* available on CDrom. The initial tests using recordable CD's were very successful, and resulted in a CD with source code, two binary versions (Linux and Solaris), all **DDT** files, and a GNU-zipped version of the documentation (**TEXT**) area. It is possible to either perform a full installation on disk (*i.e.*, copying the binaries from CD to local disk), or to run from the CD. In the latter case, the "footprint" on the local disk is under 10 Megabytes! (This figure does not include user data, obviously.) Furthermore, the setup script was given the ability to switch between a "run from CD" installation and a "full" installation. The fact that 71 copies of the CDrom were distributed suggests that this functionality, and the availability of *AIPS* on this new medium, are of considerable use to the Astronomical Community.

AIPS Distribution

A total of 263 copies of the **15OCT98** release were distributed to 239 non-NRAO sites. Of these, 114 were in source code form and 149 were distributed as binary executables. This is about the same as that of **15APR98** (278 copies) and rather more than those of **15OCT97** (107 copies), **15OCT96** (222 copies), and **15APR97** (148 copies), perhaps reflecting the lower rate of developments in previous releases and the new capabilities of the 1998 releases.. The figures on computers using *AIPS* are affected by the percentage of *AIPS* users that register with NRAO. Of 239 non-NRAO sites receiving **15OCT98** only 82 (34%) 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 **15OCT98** were distributed and includes both source-code distributions and binary distributions. The second table below is based on registered installations of **15OCT98**. 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, 45% of our users answered Solaris and 41% answered Linux. This indicates how far Linux has penetrated as the system used on the more powerful computers used by astronomers today. The third table gives information about the geographic distribution of the systems shipped.

ftp	CDrom	8mm	4mm	ZIP	Floppy
184	71	7	1	0	0

Operating System	No.	15OCT98 %	15APR98 %	15OCT97 %	15APR97 %	15OCT96 %
Solaris/SunOS 5	243	63	66	50	66	46
PC Linux	112	25	19	23	16	19
HP-UX	21	5	2	3	6	4
Dec Alpha	14	3	7	9	6	10
IBM /AIX	10	2	1	0	0	4
SunOS 4	3	1	4	14	5	13
SGI	3	1	3	1	1	5
Alpha Linux	1	0				
Total	449					

ftp sites			physical media sites	
Domain	Location	Number	Location	Number
at	Austria (Republic of)	1	Argentina	5
au	Australia	4	Brazil	3
be	Belgium (Kingdom of)	2		
br	Brazil (Federative Republic of)	2	Bulgaria	2
ca	Canada	8	Chile	1
com	U.S.A. (commercial)	11	China	3
de	Germany (Federal Republic of)	8	Finland	2
edu	U.S.A. (education)	52	France	1
es	Spain (Kingdom of)	4	Germany	2
fi	Finland (Republic of)	4	Hungary	1
fr	France (French Republic)	4	India	3
gov	U.S.A. (government)	4	Israel	1
in	India (Republic of)	1	Italy	1
it	Italy (Italian Republic)	5	Japan	1
jp	Japan	20	Netherlands	2
kr	Korea (Republic of)	1		
mil	U.S.A. (military)	2	Poland	1
mx	Mexico (United Mexican States)	7	Spain	3
net	Network (largely U.S.A.)	3	Taiwan	1
nl	Netherlands	6	United Kingdom	6
nz	New Zealand	1	U.S.A.	21
org	Organization (largely U.S.A.)	3	Denmark	1
ru	Russia (Russian Federation)	4	Russia	2
se	Sweden (Kingdom of)	4		
tw	Taiwan	3		
uk	United Kingdom (Great Britain)	12		
		176		63
	Totals: USA=90, foreign=149			

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

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Sparc Ultra 2/SunOS 5.5/21, etc. _____

5. DDT test package (15JAN94 version): ..... ☐ (includes small, medium, and large tests;

(FITS tape) NOTE: Also available via ftp on 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`

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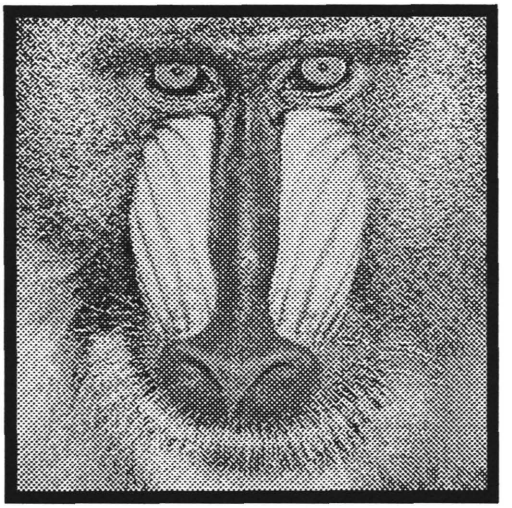
15 APRIL 1999



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AIPSLETTER

Volume XIX, Number 2: October 15, 1999

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

The October 15, 1999 release of Classic *AIPS* is now available. It may be obtained via *anonymous* ftp or by contacting Ernie Allen at the address given in the masthead. 15OCT99 is also available on CDrom as well as the more traditional tape media. *AIPS* is now copyright © 1995 through 1999 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 *AIPSLetter*. A convenient order form is found from our Web page at http://www.cv.nrao.edu/aips. A paper order form and the ftp address appear on the last page of this *AIPSLetter*.

We do not intend to have any further formal releases. Instead, the next "release" of *AIPS* is called 31DEC99 and is already available via the Internet. We will continue to correct and improve *AIPS* in this "*AIPS* for the Ages" version 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. See articles later in this *AIPSLetter* for details of this change in procedure and for information on new tools to make such installations very much easier to do. Note that the midnight job allows your site to receive the latest improvements and bug fixes, at the cost of also receiving the latest bugs. The latter can and will be fixed as rapidly as possible when the programmers are notified of them at daip@nrao.edu.

Highlights

The October 15, 1999 version contains only three new tasks and as many new pseudoverbs. Of these, the most significant is SETFC which prepares field description cards for input to IMAGR including outlier fields taken from a summary of strong sources in the NVSS, a copy of which is now provided with *AIPS*. IMAGR itself was changed to allow up to 512 fields, to allow very large shifts, to do the SDI Clean method optionally, and to filter away weak, isolated Clean components. CLIPM is a version of CLIP for multi-source files and EXTAB replaces TAPQL for preparing contents of *AIPS* tables for use in spread sheets and the like. Print routines, run interactively, can now adjust themselves to the width of the user's display window. Significant bugs related to FITAB, UVCOP, IMAGR, and CLIP were corrected and released as patches to 15APR99.

Improvements of interest to users in 15OCT99

The 15APR98 *release introduced numerous changes which are not compatible with previous releases. Disk files written by previous versions are read transparently by* 15APR98 *and later releases (including* SAVE/GET *files), but users must not attempt to read disk files written by any of the modern versions with earlier versions.* 15APR98 *and later* AIPS *cannot start previous versions of tasks and the TV displays of the versions are incompatible. The TV displays of* 15OCT98 *and* 15APR98 *are also not fully compatible.* SAVE/GET *files for* 15OCT98 *and later releases cannot be read by* 15APR98 *and earlier releases;* 15OCT98 *and later releases will translate old* SAVE/GET *files when they encounter them. Releases prior to* 15OCT98 *are not fully Y2k compliant.*

Imaging

SETFC

The new task SETFC has been written to prepare field-descriptor cards for input to IMAGR in its BOXFILE option. The work on this task was begun by T. Joseph W. Lazio (NRL) and continued by Bryan Butler (NRAO) before being completed by the *AIPS* group. The task first prepares a list of fields to sample fully the center of the region toward which the array was pointed. Then, optionally, it searches the NVSS (21-cm NRAO VLA Sky Survey) catalog for strong sources near the pointing position and puts fields on them. Finally, if the Sun is near the pointing position, it puts a field on it. User adverbs control the size of the fields, the degree of overlap, and the definitions of "strong" and "near." The NVSS catalog is provided in a minimal form (only the coordinates and the flux) in text files supplied with the *AIPS* release. The full NVSS catalog and image data base may be accessed through `http://www.cv.nrao.edu/~jcondon/nvss.html`.

IMAGR

The Steer-Dewdney-Ito (SDI) flavor of the Clean algorithm is designed to handle extended objects. At some stage in every deep Clean, the residual image will have had all small-diameter objects removed and will effectively contain only extended areas of emission. An option to switch from the familiar Clark-Cotton-Schwab Clean to the SDI Clean at this point has been added to IMAGR. It is triggered by a user parameter specifying how negligible the high-flux tail of the histogram of the residual must be to use SDI rather than BGC Clean. The task can actually switch back and forth between the two methods. Rather than taking a single component at the peak of the residual image, the SDI method takes components at all pixels in the residual image having flux above some current level. If the same gain is applied to all such components, the residual image after they are subtracted will have bright rims around each extended region since less flux is subtracted at the edges than is subtracted when all adjacent pixels have components. *AIPS* task SDCLN uses a rather expensive algorithm to adjust the gains of the components to try to avoid this problem. IMAGR's algorithm is much faster but less effective. Nonetheless, the SDI method does help avoid the corrugations which standard Cleans add to extended sources.

Clean has been found to remove flux from real sources and to place it instead in pixels selected by noise bumps and sidelobes. The task CCSEL was devised to eliminate weak, isolated Clean components from a CC file. An improved version of this algorithm has now been added to IMAGR. Clean components which have flux less than a user-specified amount within a user-specified radius are removed from the CC files before the Clean components are restored to the output images. The filtering action may also be selected from the TV menu during the Clean, when it will likely be more useful.

IMAGR and all tasks which accept image Clean components as models can now handle up to 512 fields. The various field-specifying adverbs (FLDSIZE, RASHIFT, BCOMP, etc.) retain the old dimension of 64. You must use the BOXFILE option to specify these adverbs to IMAGR. A new kind of card has been added to this option so that all of the BCOMPs may be specified. At the same time, the meaning of RASHIFT, DECSHIFT, and SHIFT was changed for IMAGR and many other tasks. These are no longer shifts in arc seconds in the -SIN projection. Instead they are "simple" shifts in the -GLS projection:

$$\texttt{RASHIFT} \;=\; (\alpha - \alpha_0) * \cos(\delta_0)$$

$$\texttt{DECSHIFT} \;=\; \delta - \delta_0$$

This new convention allows for the very large shifts required at low frequency to which the -SIN projection cannot be applied. (Users of large projections will of course set DO3DIMAG to true when using IMAGR.) All tasks were also corrected at this time to recognize the -NCP projection used by East-West interferometers and to do the correct phase shifts for this projection.

Lesser changes to IMAGR included:

- IMAGR now deletes its work file on exiting unless one of IN2NAME, IN2CLASS, or IN2SEQ are set. The work file is sometimes useful for finding bad data through excessive residuals seen in various *uv* printing and plotting tasks.
- The methods by which IMAGR selects the next field to Clean in OVERLAP 2 mode were improved and a bug that caused it to re-select fields that had just been done was corrected.
- A TV option to override IMAGR's selection of the next field to Clean was added. You may specify the next field and have it recomputed rather than having to force all fields to be recomputed. This option is available when the number of fields is > 64 or when the user specifies DOWAIT true before starting IMAGR.
- Two bugs in the data weighting routine were corrected. In one, microscopic differences in round off could cause it to seek incorrect rows and get into all sorts of trouble. In the other, the absence of data near $|u| \approx 0$ could cause memory addressing problems and incorrect results.

Data display

PLOTR is a new task designed to read a text file containing plot labels and $x - y$ data and make an *AIPS*-standard plot file. Up to 5 different data types each with its own symbol may be plotted.

DOCRT was changed in all printing tasks and verbs to request the actual width of the terminal window so long as $0 <$ DOCRT ≤ 72. Larger values of DOCRT are used without regard for the window width as before.

FUNCTYPE = 'SQ' for a square-root transfer function was added to all TV displays using this adverb. It is often a good compromise between linear and logarithmic transfer functions, showing both low and high levels.

LWPLA was changed to allow multiple plot files to be written in a single job to the printer or a saved output file. Plots may be added to the latter in later jobs. Such multi-page plot files are then not encapsulated and may have to be broken apart if you need to include them in a paper.

SNPLT was changed to plot dispersive delay. It was then substantially rewritten. It can now plot multiple polarizations and/or IFs and is able to plot them separately or plot both polarizations and/or all IFs on single plots (per antenna).

POSSM was corrected to plot small time averages efficiently. Previously, when SOLINT was specified, the task could spend vast amounts of time looking at and calibrating data it did not need. Problems caused by the first plot on a page having no data were corrected.

UVHGM had the PIXRANGE adverb added.

General and miscellaneous matters

New task to export table data

It is sometimes useful to be able to analyze *AIPS* table data outside *AIPS*. The new task EXTAB will write *AIPS* table data to a simple text file that can easily read by other programs such as spreadsheets, database programs, and data analysis programs like IDL. You may select specific rows and columns to be exported in the same way as you select rows and columns to be printed in PRTAB. The task TAPQL was deleted; it exported data for a specific database format which is no longer used.

New pseudoverbs

Three new pseudoverbs were written to help users manipulate the task-specific adverbs. If you enter DEFAULT followed by a task name, the adverb values for that task alone are changed to the values they would have on a full initialization (RESTORE 0) without changing any other adverb values. Prior to 15OCT98, adverb values were stored only in a single TPUT/TGET files and were over-written on any TPUT or GO for that task. These files function as always in the new release, but users may set up parallel VPUT/VGET files specified by adverb VNUMBER from 1 through 35 for their own use in storing and retrieving adverb values in a task-specific way. No special meaning is attached to any of these files by *AIPS*, although some canned procedures may (in future) use one or more of them. GO does not write into these files; otherwise their use is the same as TPUT and TGET. The new verb VGINDEX will list the contents of the specified VPUT/VGET file.

Tape problems

The relatively new task FITAB was found to have several errors and a rather complex "gotcha." If a *uv* file was written by FITAB, then read back in and modified in some way (*e.g.*, UVCOP), and then written out by FITTP, the output would not be read correctly thereafter. The problem arose from a liberal use of *AIPS* history cards in FITAB and the retention of these histories by the FITS readers. After the correction, old *AIPS* history cards are no longer written by FITTP and FITAB. Before the correction, FITAB had no problems because it wrote the current information after the history file, but FITTP had to write the current file descriptors before the history, thereby confusing the FITS readers. If you have files which may have this problem, try setting the new ERROR adverb in the FITS readers (UVLOD, IMLOD, FITLD) to 2 after encountering a problem reading the file with ERROR set at any other value. This bypasses the history parsing to avoid the bug.

Two serious errors caused the output of FITAB to be useless under different conditions. Quantized images did not have meaningful data written. Tables with no time column were written with no data when a *uv* file was being written out in multiple pieces. Both of these errors crept in after most of the testing due to "simple" fixes. FITAB now writes the coordinates in both an *AIPS*-normal fashion and in the new proposed FITS keywords for tables extensions.

Single dish

OTFUV was found to have an internal limit to the number of channels. It was changed to use the global MAXCHA and MAXCHA was changed to 16384, the same as MAXCIF which is the product of channels, IFs, and polarizations. The single-dish data translation and indexing routines were fixed to run correctly on byte-swapped computers. The tasks used for beam-switched imaging were enhanced. BSGRD now allows two different convolution functions for the two convolutions it has to do (to azimuth-elevation and then to RA-Dec) and it corrects for a rotation in the switch direction with a shift rather than a rotation (which was a wrong thing to do). A new modeling task BSMOD was installed to generate totally artificial data to test various aspects of this observing mode. A poster was presented at ADASS IX on the subject by Eric Greisen. The four-page paper may be accessed at `ftp://ftp.cv.nrao.edu/egreisen/SWpaper.ps.gz` and the poster at `ftp://ftp.cv.nrao.edu/egreisen/SWposter.my.ps.gz`. Pat Smiley did a nicer version of the poster but it is a large file found at `ftp://ftp.cv.nrao.edu/egreisen/PatPost.eps.gz`.

Miscellaneous

CCEDT had its CPARMs reordered and changed to allow circular as well as rectangular apertures. It was corrected to handle CC tables with 7 as well as 3 columns. It now uses image increment based tolerances and defaults and uses dynamic memory so that it can try to handle any size of problem.

XTRAN was changed to do only its "plate-solution" mode. There are several better tasks for re-gridding image geometries. An option to copy the image and alter only the output header was added to avoid any re-gridding. Finally serious errors in the re-gridding and in the handling of sub-images were corrected. This task is still not correct for large images, but it now works very much better for smaller ones.

ORDER is a new adverb to specify the order of a polynomial fit. It is used by FLGIT, UVLSF, UVLIN, IMLIN, and other tasks. The first 3 of these were changed to allow 0-order as well as first-order fits.

IMEAN was changed to be able to write the actual rms and mean into the image header under control of the adverb DOCAT. The ACTNOISE header parameter is used by SAD, IMFIT, and JMFIT in evaluating the errors in their Gaussian fits.

IRING was changed to take APARM as relative to the reference pixel rather than the "center" of the current sub-image.

COMB had a bug handling blanked pixels in the MEAN operation corrected.

VLBI data processing

FITLD

The handling of VLBA weights in FITLD has been improved. The weights assigned to VLBA data are now proportional to their integration time so that data from baselines using shorter integrations are not weighted too highly relative to those from baselines using longer integration times.

Miscellaneous changes

CVEL now supports the QUAL adverb to improve the selection of which sources are shifted.

PCCOR allows selection of IFs for the case when two separate bands are observed simultaneously. Selection of good data was improved.

ANTAB was modified to attempt to cope with Tsys measurements made by non-NRAO telescopes between scans. The adverb OFFSET was added to allow the user to specify the amount of time that should be added to both ends of a scan to include the Tsys measurements in the apparent scan range.

COHER was given the option to solve for a variable coherence time as a function of baseline and time. The output is in a format suitable for direct input to BLING. This option is likely to be particularly relevant at millimeter wavelengths.

CL2HF was modified at GSFC by Dave Gordon and the modifications installed in the official release. Good results have been reported.

Fringe fitting

This release fixes a number of errors associated with the exhaustive baseline search option of FRING which is controlled by DOFIT and APARM(9). These errors caused the least-squares routines to be called with faulty starting estimates for the delays and rates with the result that the exhaustive baseline search would sometimes fail to find fringes that would have been found in the default mode or would sometimes arrive at an incorrect delay and rate.

Some errors in the allocation of array processor memory that caused FRING to claim that it was out of memory when channels were selected using BCHAN and ECHAN have also been fixed in this release.

The least-squares stage of KRING has now been completely replaced. This was necessary for reworking the SNR calculation to use the same methods as found in the FFT. For test data, the two stages now produce SNRs that agree to within 1%. Many inputs were removed from KRING including the ability to create/fill an output file for single source data. Since KRING requires an NX table, this was disallowed anyway. Averaging the frequencies within an IF is not allowed anymore either; KRING's more efficient use of memory renders this sort of option unnecessary. The default SNR cutoff threshold has been lowered to 3. The help file has been updated somewhat but likely still needs some user input. The output format has been cleaned up as well to be more readable and the print levels consolidated.

Interferometric data handling

Data modeling

When CC files are used as a source model, the model computations may be controlled with NCOMP. A previously undocumented feature of this was the ability to cut off the computation at the first negative in each CC file if any of the NCOMP was specified as a negative number. This feature has now been documented and a new, scientifically correct, cut off method has been added. The adverb FLUX was added to all such tasks to specify the minimum absolute value of the component flux to be used in modeling.

Editing

A new task called CLIPM was written to edit multi-source files. It writes entries in the flag table based on amplitudes out of range for observations selected and calibrated with all of the usual (numerous) adverbs. For spectral-line data, it works hard to keep the number of flags minimal. Nonetheless, a great many may be created. UVCOP is able to apply up to 50000 flags to a single time which allows users to avoid the 5000 limit in the rest of *AIPS*. An option to flag all channels if $\geq n$ are clipped was added to both CLIPM and the older CLIP used on single-source files. An error handling compressed data from the VLBA correlator was corrected in CLIP.

The interactive editing tasks EDITA, EDITR and SNEDT received some attention. The adverb EXPERT was added to instruct these tasks to begin in "expert" (keyboard input) rather than menu (mouse input) mode. Bugs applying current flags to data in the one antenna at a time mode, in getting the correct value of DOTWO in TY editing, in recognizing the new FLAG QUICKLY function, and in flagging the first point in that mode were corrected. The method used to handle times was revised; the old method should have failed frequently but only did so on Linux systems. The defaults for SOLINT and DETIME were changed to plot every point.

Ugly error in UVCOP

UVCOP set a mask to select the desired spectral channels and IFs. Unfortunately, it used the increments in the output data set rather than the input data set. If the frequency axis precedes the IF axis, data selection errors occurred if both BIF > 1 and BCHAN/ECHAN selected fewer than all of the spectral channels. The error appeared in 15OCT98 on August 24, 1998 when a line of code a long ways away was changed to correct another problem and that changed variables in a COMMON. We can hope that people do not normally sub-select both IFs and channels at the same time.

Miscellaneous corrections and additions

CALIB has a new adverb ANTUSE to control which antennas are used in the calculation of the mean gain modulus. An error applying an Lpol-only model to data with all polarizations was corrected.

QUACK has a new option to flag data at the end of each scan. The handling of times was corrected and some control given to the user for data with short integration times.

SPLAT and UVAVG had their handling of random parameters generalized to handle all current ones and to do something reasonable with future ones. An unnecessary operation was removed from SPLAT and the program now runs very much faster when averaging.

LDGPS and APGPS continued to be developed and tested. They load GPS data to a GP table and then use the GPS delay data to calculate phase corrections due to the excess path length of the ionosphere and to calculate the ionospheric Faraday rotation.

Matters of interest to programmers and *AIPS* Managers

Support for the Intel Platform Edition of Solaris

The 15OCT99 release of *AIPS* includes support for the Intel Platform Edition of Solaris. This is the version of Solaris that is used on PC-compatible computers. Sun have made both the Intel platform and the SPARC platform editions of Solaris available to non-commercial users for the cost of media, shipping and handling. See `http://www.sun.com/developers/tools/solaris/solarispromo.html` for details on this offer.

There are no precompiled *AIPS* binaries for this platform so you will have to build *AIPS* from the sources using INSTEP2 and INSTEP4. The default configuration assumes that you are using the GNU Compiler Collection. Prebuilt versions of the GNU Compiler Collection (as well as other useful tools) are available at `http://www.sunfreeware.com` for both SPARC and Intel.

As is the case with the SPARC Platform Edition of Solaris, the Intel Platform Edition is not optimally configured to run *AIPS* efficiently as shipped. Some hints on tuning Solaris for *AIPS* are available at `http://www.aoc.nrao.edu/ cflatter/solaris-.html`.

Problems with GNU FORTRAN Under Solaris

We have recently uncovered a fault in the Solaris implementation of the standard C library that gives rise to a minor problem in versions of *AIPS* that have been compiled using GNU FORTRAN 77 under Solaris. If you append output text to an existing file in programs that have an OUTFILE-like adverb, then you will lose some of the data in that file. There is no problem if you always specify a new output file so few *AIPS* users are likely to be inconvenienced by this problem.

We are still investigating this problem and will publish any further information to the `alt.sci.astro.aips` newsgroup and the **bananas** mailing list as it becomes available. This problem is known to occur under all versions of Solaris from 2.5.1 onwards (both platform editions) but does not occur if you are using the Sun compilers.

Brief items

AIPSEXEC now allows the user to specify the debugger (*e.g.*, `debug=dbx`) on the `aips` command line. If AIPS itself is to be debugged, the command becomes, for example, `debug=gdb:aips`. The prompt for debugger name failed occasionally under Linux.

NETSP warnings for disks not defined have been restricted to the AIPS program itself.

MNJ Midnight jobs will henceforth be required to use the secure shell (`ssh`). The methods used previously lacked security and would not be able to expand to meet the expected increase in demand.

FSTVS3 is a variable in the DSEL.INC calibration commons that was not used seriously before. It is now a counter of the true visibility record number. A new subroutine FINDUV uses this variable to find the next desired time interval in a data set and the corresponding range of visibility numbers.

AIPS for the Ages

The 15OCT99 release of Classic *AIPS* will be the last formal release of *AIPS*. The current distribution model for *AIPS* of periodic releases continues to serve the community well. However, faced with declining *AIPS* staffing levels, we feel it is necessary to reduce the amount of system work and concentrate on application programming and bug-fixes. The final "release" of *AIPS* will be 31DEC99, the so-called "*AIPS* for the Ages" (*AIPS* for the Aged?). This version is already available, for complete download or for incremental updates, from the *AIPS* Web page. Bug-fixes and new tasks will implemented in 31DEC99 (and the *AIPSLetter* will continue to appear approximately every six months) until the NRAO user community completes the transition to the recently-released AIPS++.

Installing Aips for the Ages

We are intending to make the installation and updating of 31DEC99 as painless as possible. As we see it, there are four categories of installation situations:

1. installing 31DEC99 as the site's first *AIPS* installation,
2. installing 31DEC99 for the first time, but the site has earlier *AIPS* version(s) installed,
3. installing all of 31DEC99 over the top of an old installation of 31DEC99, and
4. installing any updated pieces of 31DEC99 over the top of a relatively current copy of 31DEC99.

In the first 3 categories, the *AIPS* Manager begins by obtaining a copy of `31DEC99.tar.gz` via our Web pages. This Gnu-zipped "tarball" is created every night and contains a current copy of all *AIPS* source code and documentation. It is currently 31 Mbytes in size and can usually be copied over the Internet in a reasonable time. The on-line *AIPS* Order Form will eventually provide a way to order 31DEC99 on CDrom.

At present, the Manager in category 1 has to install *AIPS* in the usual sequence of steps. This involves downloading and unpacking the tarball, running the `INSTEP1` script, optionally downloading binaries from Charlottesville or compiling them locally, and setting up and initializing the *AIPS* control files using `FILAIP`, `POPSGN`, and `SYSETUP`. All of this is well documented in the installation summary (`http://www.cv.nrao.edu/aips/install.ps`). *In the future,* a new `install.pl` perl script will permit a much easier installation process. Watch the *AIPS* Web site for an announcement of this script.

The Manager faced with category 2 or 3 problems can already use a new and tested perl script called `update.pl`. Category 3 is really category 2 except for a first step of renaming the old 31DEC99 directory tree to something else before creating the new one. Category 4 is particularly simple. The installation procedures now create (or will when category 1 is upgraded) files needed to run what is known as the "midnight job" (MNJ, so named as it should be run between midnight and 8 a.m. US/Eastern time). This "job" detects changes to the *AIPS* transaction files in Charlottesville, and then performs any needed operations for the local site. This may include copying modified files from Charlottesville, compiling subroutines, and linking tasks. The job ends by generating a nice report which shows what it did and all new entries in `CHANGE.DOC` made by the *AIPS* Group. This midnight job is usually run as a `cron` job at a regular time every day, week, or month. In addition or instead, it can be run manually whenever the Manager decides to do so.

The above-mentioned `update.pl` script for a category 2/3 update greatly simplifies the process. The Manager (1) gets the tarball and puts it in the `$AIPS_ROOT` area, and then (2) copies `update.pl` to disk, makes it executable, and runs it. `update.pl` won't (yet) run `INSTEP2` or `INSTEP4` or `POPSGN` for you, but it does just about everything else, Anything left over is summarized for you in a checklist that is printed out when the script ends. This will be a *very small* subset of the work *AIPS* Managers had to contend with in previous updates. The first line of `update.pl` will need to be edited if perl is not located at `/usr/local/bin/perl`. The script requires perl version 5 or better.

`update.pl` runs `MAKE.MNJ` to prepare for later use of the midnight job. Sites with "legacy" entries in the master `UPDCONFIG` file should delete the `$SYSLOCAL/UPDCONFIG` that `MAKE.MNJ` now creates; new MNJ sites will use this local file.

The requirements for the new midnight job are:

- A moderately recent version of the `ssh` client is available on your system (*e.g.*, 1.2.25).
- You have already set up a key for the account which will run the *AIPS* midnight job by running the `ssh-keygen` program.
- You chose `$HOME/.ssh/` as a location for the keys when you ran `ssh-keygen` (this is the default).
- You *only* want to use the secure version of the MNJ for your primary access to `mnj.cv.nrao.edu`.
- You have gotten the "MNJ" private key (a binary file) from Pat Murphy, preferably via secure mail (PGP preferred; his public key is available on the web at

`http://www.cv.nrao.edu/~pmurphy/plan.html`).
Place the MNJ file in the `$HOME/.ssh/` directory, and `chmod` it to mode 0600.

- You have set up a `do_daily.`*xxxx* script to run your MNJ on computer *xxxx*. If you plan to run it via `cron`, make sure the script sets `$PATH` enough that `ssh` and other basic utilities are found. A sample `do_daily` script is given below.

- You are not running the ssh-agent program; if the variable `SSH_AGENT_PID` is *not* set, then you can proceed to the next step. You can check if it's set by typing the command: `echo $SSH_AGENT_PID`. If this command only shows a blank line, you are not running an agent. If it shows a number like 20415, you are. If you are, you *must* first invoke the command: `ssh-add -D` before proceeding to the next step. This command temporarily deletes all identities from your agent. You can add them back after the next step; it's only necessary when first setting up the MNJ (or if running the job by hand when you have an agent running; ssh likes to use your main identity even when told to use the MNJ one).

- "Prime" the system by giving the command:
  `ssh mnj.cv.nrao.edu -i .ssh/mnj -l aipsmgr /AIPS/31DEC99/COPYING`
  (do this from your home directory, or alter the path to the `.ssh/` directory) and answer "yes" when it asks if you want to add `mnj.cv.nrao.edu` to the list of known hosts. If this command is successful, it will print out a copy of the *AIPS* General Public License (The "GNU GPL"). Once you have verified this ssh command works, you can add back any identities to your agent if you deleted them.

- Run your `do_daily.`*xxxx* script interactively, check the logs, look for the output from `AIPSUPD` in the log that says `AIPSUPD - Using the SECURE SHELL for copying`. If there are no other obvious errors (and files were really copied!) then you're ready to run the MNJ whenever you want. Otherwise you may need to contact Pat Murphy for assistance.

A site may run more than one midnight job. In that case, typically, the site will have only one copy of the *AIPS* source code and one computer will run a "primary" MNJ to Charlottesville. After that has run, other computer architectures may run "secondary" MNJs using NFS access to the single copy of the source code and running only the compilation and link edit parts of the transactions. In this way, a site's storage of *AIPS* is kept simple by having a single copy serving more than one architecture and the load on the Charlottesville computers is kept to a minimum. Converting secondary MNJ jobs to use the secure shell can be tricky; contact Pat Murphy if you really want to do this. The following is a sample `do_daily.`*xxxx*:

```
#!/bin/sh
#                                   fix path for cron, etc.
######################## Change for local account names/files
[ "$HOME" = "" ] && HOME=/home/jenlan/egreisen
. $HOME/.profile.path
########################
# following assumes "something.hostname" as name of file
myname=`basename $0 | awk -F. '{print $2}'`
[ "`uname -n | awk -F. '{print $1}'`" = "$myname" ] || exit
#                                   set AIPS logicals
######################## Change for local $AIPS_ROOT
cd /home/analysis/aips
########################
. ./LOGIN.SH
$CDTST >/dev/null 2>&1
#                                   remove any old binaries
(cd $LOAD; find . -name '*.EXE.OLD' -atime +2 -exec rm -f {} \;)
#                                   Go to MNJ area
cd $AIPS_VERSION/$ARCH/UPDATE
#                                   Now do the MNJ
./AIPSUPD TST
```

Patch Distribution

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

`http://www.cv.nrao.edu/aips/15APR99/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 15OCT99 are found, the patches will be placed in the `ftp`/Web area for 15OCT99. No matter when you receive your 15OCT99 "tape," *you must* fetch and install these patches if you require them.

The 15APR99 release had a number of important patches announced. These were:

1. TVCPS and other tasks that use the image catalog (1999-05-14, 1999-06-18).
2. APGPS and TECOR (delay calibration modes) (1999-05-14).
3. CLIP, RESEQ, DTCHK problems with compressed data (1999-05-25).
4. REGRD crashed under Solaris, others (1999-07-06).
5. UVCOP errors selecting channels (1999-07-21).
6. IMAGR in OVERLAP 2 mode selects wrong fields (1999-07-22).
7. FITAB followed by FITTP makes unreadable files (1999-07-27).
8. FITAB did not write image tables and quantized floating images (1999-08-09).
9. PRTTP patched code did not convert DOCRT to reasonable values (1999-09-07).

Progress on a world-coordinates standard

At the ADASS meeting held in Boston in the Fall of 1992 it was decided that a standard for conveying coordinate information within the FITS format needed to be developed. Eric Greisen was, in his absence, volunteered for the effort. Versions of possible standards authored by Greisen and Mark Calabretta (of the ATNF in Australia) began appearing in June 1993 and have appeared at irregular intervals since. At the 1999 ADASS meeting held in Kona Hawaii, Eric and Mark were instructed to make a few minor corrections to the current drafts of the papers and then to submit them for formal review by the U.S., European, and Japanese FITS Committees. The paper is now divided into three parts: a general paper, a celestial-coordinates paper, and a spectral-coordinates paper. All three of these are available via the WWW and we encourage you to fetch and read them. When these are adopted — and something very much like them will become part of the FITS standard — they will affect the ways in which we think about astronomical data. For that reason alone, they are important and we solicit your comments (`egreisen@nrao.edu` and `mcalabre@atnf.csiro.au`). The papers are:

I. Representations of world coordinates in FITS, by Greisen and Calabretta
(`ftp://ftp.cv.nrao.edu/NRAO-staff/egreisen/wcs.ps.gz`)

II. Representations of celestial coordinates in FITS, by Calabretta and Greisen
(`ftp://ftp.cv.nrao.edu/NRAO-staff/egreisen/ccs.ps.gz`)

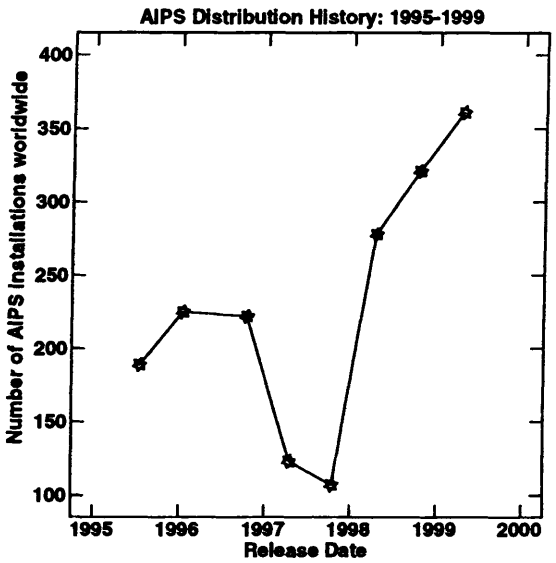
III. Representations of spectral coordinates in FITS, by Greisen
(`ftp://ftp.cv.nrao.edu/NRAO-staff/egreisen/scs.ps.gz`)

The 1999 ADASS poster on WCS is also available as a

- 4-page summary (`ftp://ftp.cv.nrao.edu/NRAO-staff/egreisen/Paper99.ps.gz`)
- poster (`ftp://ftp.cv.nrao.edu/NRAO-staff/egreisen/Poster99.ps.gz`)

AIPS Distribution

The total distribution of the 15OCT98 release was under-reported in the last *AIPSLetter* due to a glitch in accessing log files following an upgrade to our FTP server. Instead of 263 copies, we actually distributed 321. The *AIPS* distribution history over the last few years is plotted in the accompanying figure (prepared with the new PLOTM task) and shows a gratifying and continued increase over the last year and a half. This increase probable reflects both the new capabilities in *AIPS* and the improvements in the installation process.



A total of 361 copies of the 15APR99 release were distributed to 344 non-NRAO sites. Of these, 187 were in source code form and 174 were distributed as binary executables. The figures on computers using *AIPS* are affected by the percentage of *AIPS* users that register with NRAO. Of 344 non-NRAO sites receiving 15APR99 only 85 (25%) 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 15APR99 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 15APR99. 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, 46% of our users answered Linux and 40% 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. The third table gives information about the geographic distribution of the systems shipped.

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

Operating System	15APR99 No.	15APR99 %	15OCT98 %	15APR98 %	15OCT97 %	15APR97 %	15OCT96 %
Solaris/SunOS 5	196	53	61	66	50	66	46
PC Linux	99	27	27	19	23	16	19
SGI	47	13	1	3	1	1	5
Dec Alpha	14	4	3	7	9	6	10
HP-UX	7	2	5	2	3	6	4
SunOS 4	3	1	1	4	14	5	13
IBM /AIX	1	0	2	1	0	0	4
Alpha Linux	0	0	0				
Total	367						

Domain	Location	ftp sites Number	physical media sites Number
ar	Argentina	1	4
au	Australia	6	
be	Belgium (Kingdom of)	1	
br	Brazil (Federative Republic of)	1	
bg	Bulgaria	1	1
ca	Canada	14	2
com	U.S.A. (commercial)	29	
	China		3
de	Germany (Federal Republic of)	5	1
edu	U.S.A. (education)	81	
es	Spain (Kingdom of)	10	
fi	Finland (Republic of)	3	
fr	France (French Republic)	4	
gov	U.S.A. (government)	5	
gr	Greece	1	
hu	Hungary	1	1
in	India (Republic of)	3	2
	Israel		1
it	Italy (Italian Republic)	6	2
jp	Japan	20	1
kr	Korea (Republic of)	2	1
mil	U.S.A. (military)	2	
mx	Mexico (United Mexican States)	3	
net	Network (largely U.S.A.)	42	
nl	Netherlands	7	1
no	Norway	1	
pt	Portugal	2	
org	Organization (largely U.S.A.)	4	
ru	Russia (Russian Federation)	2	1
se	Sweden (Kingdom of)	6	
tw	Taiwan	5	
	United Arab Emirates		1
uk	United Kingdom (Great Britain)	8	7
us	United States of America	1	36
za	South Africa	1	
	TOTAL	278	65
	Totals: USA=200, foreign=143		

AIPS on CDrom

Starting with 15APR98, we have made AIPS available on CDrom. The initial tests using recordable CD's were very successful, and resulted in a CD with source code, two binary versions (Linux and Solaris), all DDT files, and a GNU-zipped version of the documentation (TEXT) area. It is possible to either perform a full installation on disk (*i.e.*, copying the binaries from CD to local disk), or to run from the CD. In the latter case, the "footprint" on the local disk is under 10 Megabytes! (This figure does not include user data, obviously.) Furthermore, the setup script was given the ability to switch between a "run from CD" installation and a "full" installation. The fact that 69 copies of the 15APR99 CDrom were distributed suggests that this functionality, and the availability of AIPS on this new medium, are of considerable use to the Astronomical Community.

AIPS Order Form for* 15OCT99 *(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 (192.33.115.108)

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 Do you have an old User Agreement? ☐ Yes ☐ No

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. Tape "media" desired: ..... ☐ CDROM (with Linux and Solaris binaries, and DDT package)

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

☐ Exabyte (5GB) ☐ Exabyte (2.2G) ☐ 4mm DDS DAT

☐ Check here for BINARY TAPE (load and go), exabyte or DAT only, and indicate OS/hardware

☐ Sparc/Solaris 2.6 (SC4.2) ☐ Sparc Ultra (SUL) 2.6/SC4.2 ☐ HP-UX (HP2, 9000/780 up)

☐ Intel Linux (g77/egcs, glibc) ☐ Alpha Linux (g77/egcs, glibc) ☐ Silicon Graphics IRIX 6.4

☐ Dec Alpha/OSF-1 4.0

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

Include hardware/software/quantity info, e.g. _____

Sparc Ultra 2/SunOS 5.5/21, etc. _____

5. DDT test package (15JAN94 version): ..... ☐ (includes small, medium, and large tests;

(FITS tape) NOTE: Also available via ftp on 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`

7. Custom 3-ring binders may be requested when you register your copy of AIPS.

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

AIPS Group

National Radio Astronomy Observatory

520 Edgemont Road

Charlottesville, VA 22903-2475

USA

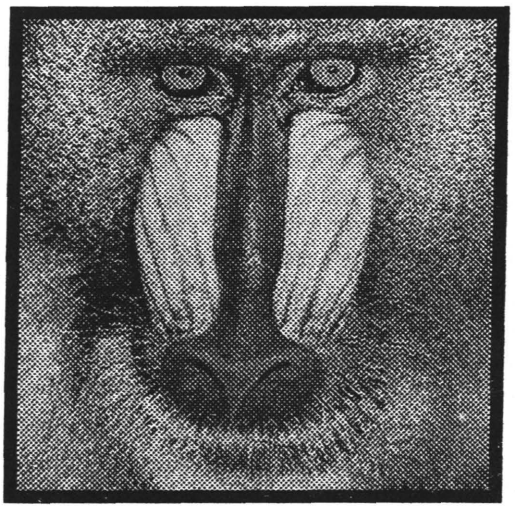
Network Addresses

Internet: aipsmail@nrao.edu

UUCP: ...uunet!nrao.edu!aipsmail

Web: http://www.cv.nrao.edu/aips/

Anonymous ftp: aips.nrao.edu/pub/aips/



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