

A I P S L E T T E R

Volume XXII, Number 1: June 30, 2002

A newsletter for users of the NRAO
Astronomical Image Processing System

Written by a cast of *AIPS*

Edited by

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General developments in *AIPS*

Linux news: bad compilers

RedHat has released versions 7.0, 7.1, and 7.2 of their Linux system. The good news is that version 7.1 and beyond contain numerous system improvements including the 2.4.2 kernel. This kernel allows *AIPS* to read and write files larger than 2 Gbytes. The bad news is that these releases include and depend on the “GNU compilers version 2.96.” The quote marks are added because the GNU compiler group never released a version 2.96 and they do not support this “version.” We have found that this *g77* produces optimized code that is unreliable. There are problems with IMAGR, TV window setting, TVFLG, and who knows what else. *Furthermore, we have found that there are problems with GNU’s version 3.0.1 through 3.0.4 compilers — the resultant code is slower and some of it fails.* We do recommend RedHat release 7.2, but you must also install the GNU compiler suite version 2.95 (now 2.95.3) (*but not GNU gcc versions 3.0 or later*) and change your local copies of *FDEFAULT.SH*, *CCOPTS.SH*, and *FDOPTS.SH* to point at it. Some other Linux distributions also include the 2.96 compiler with the same unfortunate results. Instructions for fetching and installing the GNU 2.95.3 compiler are given on the *AIPS* web page.

Current and future releases

We have reinstated the old practice of having formal *AIPS* releases, but on an annual basis with binary releases only for Solaris and Linux. All architectures can do a full installation from the source files. The next release will be called 31DEC02 and remains under development by the (reduced) *AIPS* Group. You may fetch and install a complete copy of this version at any time. This *AIPS Letter* is intended to advise you of developments to date in this new release. Having fetched 31DEC02, you may update your installation whenever you want by running the so-called “Midnight Job” (MNJ) which uses transaction files to copy and compile the code selectively based on the code changes and compilations we have done. We expect users to take the source-only version of 31DEC02 *AIPS* over the Internet (via *anonymous* ftp).

The MNJ has been changed. The secure shell, with all its fragile complexities, is no longer required. Instead mnj.aoc.nrao.edu will serve up *AIPS* incrementally — or as a whole — using the Unix tool *cvs* running with *anonymous* ftp. Linux sites will almost certainly have *cvs* installed; other sites may have installed it along with other GNU tools. Secondary MNJs will still be possible using *ssh* or *rcp* or *NFS* as with previous releases. We have found that *cvs* works very well, although it has one quirk. If a site modifies a file locally but in an *AIPS*-standard directory, *cvs* will detect the modification and attempt to reconcile the local version with the NRAO-supplied version. This usually produces a file that will not compile or run as intended.

AIPS is now copyright © 1995 through 2002 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*.

Improvements of interest to users in 31DEC02

We expect to continue publishing the *AIPS Letter* approximately every six months along with the annual releases. Despite the reduction in personnel, there have been a number of changes in 31DEC02 over its first six months. There are three new tasks: WETHR to plot the contents of the weather table including flagging data based on the contents of the table, BOXES to add Clean boxes to a BOXFILE based on source catalogs, and UVDEC to copy a *uv* data set retaining only every n^{th} spectral channel. There are also three new verbs: TKERASE to clear the contents of the Tektronix emulation display window, SG2RUN to convert the contents of a SAVE/GET file into a RUN file for use on another computer and/or user number, and OUTPUTS to show those adverbs whose values will be changed when running the task. A new RUN file called WRTPROCS provides three procedures for automated writing and reading of FITS disk files.

Other than relatively minor differences, 31DEC02 is compatible in all major ways with the 2001, 2000, 1999, and 15OCT98 releases. There are significant incompatibilities with older versions.

Imaging

IMAGR

IMAGR and all other tasks that use Clean-component models were changed to allow up to 4096 fields (or facets). This change was made mostly to support multi-resolution Clean, but the previous limit of 512 fields was onerous to some low-frequency observations.

Otherwise, almost all changes to IMAGR were in the nature of bug fixes or very minor improvements. It defends itself better against selection of a field with inadequate flux and against bad window parameters. The histogram is now done with better resolution and the BOXFILE is copied at the beginning to any new OBOXFILE. The multi-resolution Clean algorithm received special attention. A bug causing the most important steering parameter to be ignored was corrected. The computations of Gaussians were changed to achieve much improved performance. MAXPIXEL is now allowed to change on a TELL operation. The first TV display now sets the TV size correctly and selects the first image to display with improved information. The histogram is now computed only over all fields of the current resolution, MAXPIXEL is adjusted with IMAGRPRM(16) for different resolutions, and the actual parameters used for each resolution are reported.

BOXES and MFPRT

BOXES is a new task used to convert a source catalog into Clean boxes to be used with IMAGR. It reads any source catalog in the format used by *AIPS* for the NVSS and WENSS surveys, allowing one to start the Clean with boxes around known sources. MFPRT was changed to offer the option of making an output text file in this format. Doing this, one may convert the sources found in a preliminary imaging followed by SAD to a set of boxes to guide a later round of imaging.

Other imaging changes

SAD and IMFIT and JMFIT were all corrected and a patch issued. They used the phase center rather than the pointing position for the primary beam correction and used a linear shift rather than a proper non-linear angle for the delay-beam correction. This had serious effects on images well separated from the phase center.

REGRD was overhauled to function correctly on data cubes and to provide more sensible defaults for the output coordinates. Some tricks to speed the computations were also added.

FLATN was changed to do an unlimited number of pointings, although the value to use for NOISE for pointings in excess of 64 must be taken to be the average of the lower numbered ones.

MAPBM was overhauled to image all four Stokes into separate planes of a cube and to image each selected antenna into a separate output file.

VLBI matters

New VLBA/VLBI calibration procedures in AIPS

With the addition of three procedures, VLBAUTIL, a package of procedures for the reduction of VLBA (and most VLBI) experiments, will handle most VLBA experiments (including spectral line) from loading through fringe fitting. The additional procedures are: (1) VLBASRT, which sorts and indexes a dataset, if needed; (2) VLBAFIX, which will sort, index, split into separate frequency files, deal with subarrays, and fix polarization labeling, as needed; and (3) VLBAMPCL, which does manual phase-cal corrections on one or two scans. VLBAFIX is designed to replace 4 procedures which are already part of the package (VLBASRT, VLBASUBS, VLBAFPOL and VLBAFQS) and can/should be run after loading any dataset, as it only performs the necessary corrections. The procedure which loads VLBA data (VLBALOAD) has also been significantly changed so that it merges TY, GC and PC tables after the data are loaded. Formerly it was necessary to run VLBAMCAL after VLBALOAD to merge these tables, now it is done automatically.

For a detailed description on how to use all these procedures see a recent version of the *AIPS Cookbook*, Chapter 9 and Appendix C.

Other changes

FITLD would occasionally report mysterious problems with BA bandpass tables which are not actually supported on the VLBA Correlator data tapes. This was due to a name collision with AIPS' batch files, so VLBA bandpass tables will now be named BT should they ever appear. The scaling of the visibilities turns out to be different for each of the VLBA, Penticton, and EVN correlators, requiring some changes to be made to FITLD. The VLBA Correlator jobs can have errors that cause unexpected FQids to occur in some tables — those not actually processed in the correlator. Some code to avoid self-destruction was added to FITLD, although this does not restore the calibration data to correctness.

CVEL and BPASS were changed to shift the second antenna for data from the EVN correlator, while the first antenna is used for all others. Actually, neither is shifted at this stage for the VLBA Correlator.

FRPLT was overhauled to allow a wide range of plot options for fringe-rate spectra including multiple plots per page, multiple time intervals per baseline, multiple IFs and/or polarizations together as one long spectrum, and many more.

UV data handling and calibration

WETHR, INDXR, and FILLM

In the previous release, FILLM was given the ability to compute initial values for CL table 1 to correct for the antenna gains and atmospheric opacity. In the present release, these computations were improved with minor improvements to the opacity and vapor pressure computations. A new “seasonal” average opacity model was added, along with an option to use a weighted average of the seasonal opacity and the opacity computed from the surface weather measurements. The two methods are averaged equally by default. The HELP file was improved and the history file now records some of what was done. An addressing bug was corrected for the gains averaged over antenna.

INDXR was revised to be able to redo the opacity and gain corrections done by FILLM while writing a new CL table 1. This requires the weather table to have been written with a short time interval but otherwise removes the dependence on tapes and FILLM in case the CL table 1 is lost or did not contain the corrections.

WETHR is a new task that will plot a wide range of parameters read or computed from the weather (WX) table now provided with both VLA and VLBA data. The same parameters that can be plotted may be used to flag the visibility data. WETHR uses the same subroutines as FILLM and INDXR to compute relative humidity, water column in mm, and zenith opacities at K and Q bands.

Other changes

SPLAT was corrected for a bug that arose when channel averaging was being done. If the number of channels specified by the BCHAN to ECHAN range was not an exact multiple of CHANNEL, then a data addressing error affecting the IFs after the first was possible. The output data for those IFs were simply wrong. A patch for this was announced.

POSSM was corrected to plot and label properly multi-IF plots and the option to include multiple polarizations in one long, correctly labeled, spectrum was added. It can also loop over polarizations. Bandpass plotting was corrected.

DEFLG was corrected to handle 4-polarization input files and to do time integration correctly. It used all of the times which was fine in a test dataset but not in the real world.

BPASS was given the option to normalize after the scan average of the data which is less biased than normalizing on a record-by-record basis. SOLINT defaults to infinity for single-source files rather than dividing by zero.

DBCON was changed to concatenate TY and WX tables as it already does CL and FG tables.

CLIPM was corrected to use the ANTENNAS and BASELINE adverbs which a typo caused it to ignore.

UVDEC is a new task to copy every n^{th} spectral channel of a *uv* dataset. Frequency-smoothing operations done by other tasks do not decrement the number of channels while other tasks average channels while decrementing.

UVMOD was corrected to compute RL and LR models properly.

Miscellaneous matters

WRTPROCS is a new RUN file which contains 3 procedures. FITDISK writes FITS disk files with names reflecting the AIPS logical names. WRTDISK writes FITS disk files with standardized names which can then be read back by READISK looping through numerous files. These procedures are meant to assist in backing up data and in transferring data between computers, particularly computers of dissimilar architecture (*e.g.*, PCs and SUNs).

TKERASE is a new verb to erase the Tektronix-emulation display. If a plot is left in the display, then any expose event on the window causes the full plot to be redrawn. This can occupy the computer for some time during which the user can only wait.

SG2RUN is a new verb to convert the current copy of the AIPS vocabulary to a text file suitable to be RUN on another computer and/or for another user number. A GET *SGname* ; OUTFILE = *out_name* ; SG2RUN will convert a particular SAVE/GET file into a text file, enabling the full contents, including procedure definitions and adverb values, to be transferred elsewhere.

TACOP was changed to copy any type of extension file. Previously, it would try to copy PL and other non-table extension files, but it would fail to do it properly.

External file naming has been changed to allow adverbs such as INFILE to contain the actual file name with directories rather than requiring a logical (or environment) variable name. FITS disk files will again default to the \$FITS area unless a logical name or a full path name (starting with a /) are given.

CookBook chapters have been updated to mention changes in the VLBI procedures, PRTAB, BOXES, SAD *et al.*, RMSD, WETHR, and more. Appendix C was overhauled to emphasize the VLBA procedures rather than the older ways of doing things. A new appendix D on high frequency observing and data reduction techniques was added. The previous Appendix D is now called Appendix F.

PRTAB was given the adverb NDIG to tell it whether normal or extended precision is needed in its displays of floating-point columns.

All sky plotting of coordinates had some problems which were corrected.

UVCON was given the option to multiply the input model by the single-dish primary beam pattern including a shift useful for simulating mosaic observations. It can read antenna positions in up to 4 different coordinate systems.

Adverb pass-back and other programmer tidbits

Adverb values may now be passed back to AIPS by tasks. Each adverb listed in the INPUTS section of a HELP file has a code character in column 10 which tells AIPS what to do with it. An adverb is used by GO (and INPUTS) and/or TELL (and SHOW) and/or the value pass-back (and the new verb OUTPUTS). The codes are

' '	GO	
'*'	GO	TELL
'?'		TELL
'&'	GO	TELL pass-back
'%'		TELL pass-back
'\$'	GO	pass-back
'@'		pass-back

If GO detects an adverb calling for pass-back, it runs the task in DOWAIT 1 mode and then reads back the changed adverb values from the task communication (TD) file. The subroutine PTPARM is used by the task to put the adverb values back in the file as a consecutive array of n values. Since the adverbs involved may not be consecutive in the inputs to the task (or even in the inputs), some care is obviously required.

Note that the verbs INP and INPUTS only display the adverbs associated with GO; the verb SHOW only displays the adverbs associated with TELL; and the new verb OUTPUTS only displays the adverbs associated with adverb value pass-back. At present, the only task that implements this capability is IMEAN, which passes back the fitted rms and mean.

XAS.SHR was changed in a subtle way to allow the standard Unix utility `sh` to unpack the file into its component parts. The UNSHR program is no longer needed although it is still used for now.

Recent AIPS and related Memoranda

The following new AIPS Memoranda are available from the AIPS home page.

107 KRING versus FRING Tests
Amy J. Mioduszewski (NRAO)
April 8, 2002

This comparison was designed to discover whether KRING or FRING should be used for most, if not all, fringe fitting problems. Within reasonable uncertainty, FRING and KRING performed very similarly. There is some indication that the default signal to noise cutoff in KRING is too low for low signal to noise cases. As one would expect, for high flux density sources the solution interval should be set as low as possible. For low flux density sources the solution interval should be set considering both the ability to find a good solution and to interpolate accurately. The only consistent difference between KRING and FRING is that KRING runs faster than FRING a vast majority of the time, typically by factors of 1.5 to 4.

CURRENT CONTINUUM VLBA CALIBRATION PIPELINE

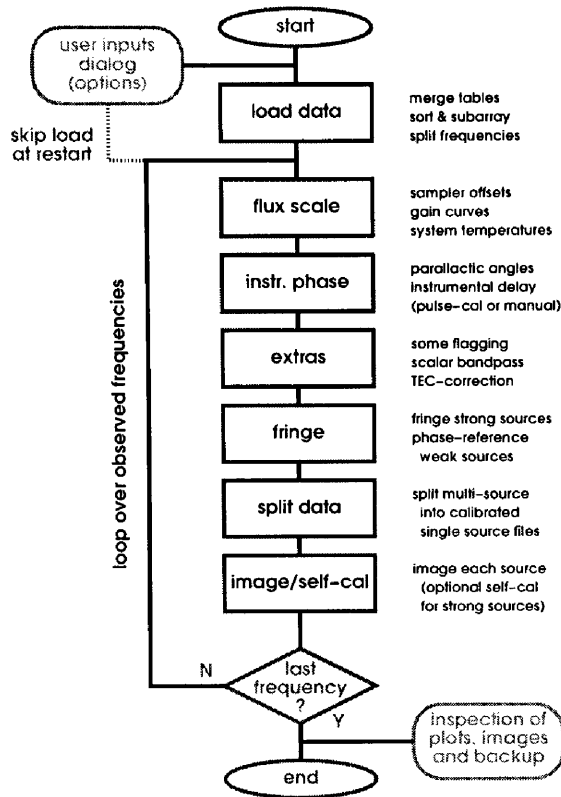


Figure 1: The algorithm chain and the options list.

Calibration/flow options:

- Skip load, (re)start at, or only do certain frequency
- Continuum, pseudo-continuum (e.g. wide field), spectral line
 - PSEU: do not average spectral channels in SPLIT
 - SPEC: manual pulse-cal, and no spectral averaging
- Calibration table interval, reference antenna
- Apply total electron content correction
- Bandpass calibrator (and time range), also used for P-cal
- Sources that can/need to be fringed with optional self-cal
- Phase-reference scheme
- Fringe solution interval (also used for self-cal solution interval)
- Interpolation for phase-reference scheme (2PT, SIMP, AMBG, CUBE)

And to check the calibration:

- image sizes for calibrators and phase-reference targets
- How to show diagnostic plot files (on TV, printer)

Delivered to the user:

- Per frequency one multi-source file with calibration tables
- Per frequency all possible calibrated single-source files
- NO plots or images (there for checking out only; user makes his own)

VLBA data calibration pipeline

Currently we are working on a VLBA data calibration pipeline, as a RUN-file in *AIPS* that is primarily based on the VLBAUTIL procedures. It is intended to perform the calibration tasks and make lots of plots and some simple images to find out whether the calibration has worked — it is not supposed to perform the art of high-fidelity imaging for you. Eventually, the VLBA data calibration pipeline will be available to *AIPS* users as part of the *AIPS* distribution and the MNJ. We will soon advertise its peculiarities and how to obtain a copy and its use on a web page under the VLBA's calibration section.

At the moment the VLBA data calibration pipeline works reasonably well for simple VLBA-only experiments correlated in Socorro, at frequencies between about 1 and 15 GHz, both for (pseudo-)continuum and spectral line experiments. It has been run successfully on higher and lower frequencies, but we're not advertising that yet — in particular the spectral RFI flagging must be improved. The VLBA data calibration pipeline is expected to be extended to work at a wider range of frequencies, to do polarization calibration and more robust data flagging, and to include non-VLBA antennas (in particular the single-dish VLA, GBT, and EB). Keep watching the VLBA data calibration web page for progress reports.

We're starting to run the VLBA data calibration pipeline on every suitable experiment and investigating its use and performance and how to distribute the calibrated multi- and single-source UVFITS files to the users. Images and calibration plots will not be distributed, they are only produced to check the calibration before we distribute the data to the PI. As we distribute single-source UVFITS files, the user could import the files into his/her favorite imaging package (e.g., aips++, difmap) without the need to use *AIPS*.

The VLBA data calibration pipeline will be invoked (after it has been added to *AIPS*) by issuing the procedure RUN command defining the procedures. The user interface is, as for any other task in *AIPS*, an input table with the options available (and an explanatory HELP-file). At the start of the VLBA data calibration pipeline, the procedure checks the inputs, for which there are no defaults, and bombs immediately

if there are errors or unexpected values. If everything is okay, the procedure starts reading the Socorro correlator distribution tape (or from a pre-loaded file), and performs the calibration, fringe-fitting, and imaging as shown in Figure 1, making plots of the most essential steps on the fly, which can be investigated easily after the procedure has finished. Note that there is some coarse flagging done, as well as a bandpass calibration (also for continuum) and an ionospheric electron content correction. The procedure, once it starts, loops over the different frequency bands, and ends when all the images are made. There are several options, such as survey calibration (large number of sources to be fringe fitted), phase-referencing schemes, and an optional self-cal (which is not yet very robust). More options and improvements are likely to be implemented later.

If, at the end, it turns out that something went wrong, it is very easy to redo the VLBA data calibration pipeline, *e.g.*, after some extra flagging, without the need to reload the data. Remember that when the VLBA data calibration pipeline starts, it does not need any user interaction until it is done, so no matter how long fringe-fitting takes, the user can concentrate on other things while the VLBA data calibration pipeline is running in a background AIPS window.

AIPS Distribution

The web site for downloading the 31DEC01 version of AIPS as well as the 31DEC02 development version was moved to the NRAO Array Operations Center in Socorro, NM. Unfortunately, as of this writing, no logging tools are in place to keep track of how many sites have downloaded these versions of AIPS, nor of how many sites are currently running the “Midnight Job.” It is clear that some sites run the Midnight Job from accounts for which no one reads the resulting e-mail. There are currently at least two sites which are running MNJs that do not work. We receive copies of the error messages on a daily basis (in one case), but are powerless to contact the culprits since no one is reading e-mail sent to the account running the MNJ. Please test your MNJ interactively and read the consequent e-mails.

The MNJ encountered a few difficulties with cvs early on and, at a somewhat later time, one site helped us uncover a subtle problem in timing. The former have been fixed by our cvs-guru, while the latter was corrected by having the NRAO provide the time information to be associated with any particular run of the MNJ. No matter when you run the MNJ, the time stamp in the LASTGOOD.DAT *et al.* files will be the time stamp at which the NRAO cvs master synchronized itself.

Patch Distribution for 31DEC01

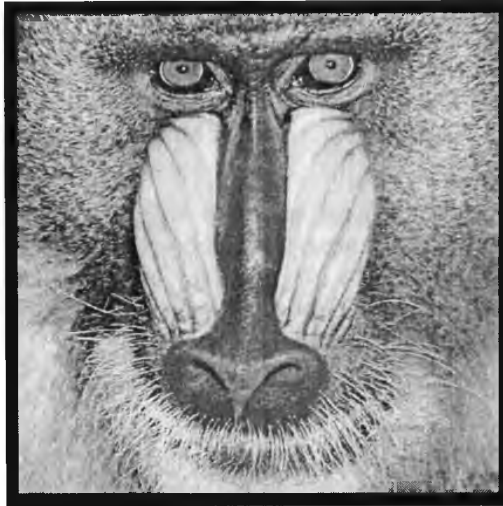
As before, important bug fixes and selected improvements in 31DEC01 can be downloaded via the Web beginning at:

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

Alternatively one can use *anonymous ftp* on the NRAO cpu aips.nrao.edu. 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 31DEC02 are found, they are simply corrected since 31DEC02 remains under development. Corrections and additions are made with a midnight job rather than with manual patches. Remember, no matter when you received your copy of 31DEC01 *you must* fetch and install its patches if you require them.

The 31DEC01 release had a few important patches including a new one in late June. These were:

1. SAD, JMFIT, and IMFIT fail to handle the primary beam correction properly for offset fields 2002-02-11.
2. IMAGR failed to apply the IMAGRPRM(11) parameter to the peak in the Clean windows 2002-02-19.
3. SPLAT failed to average spectral channels properly for multiple IFs 2002-06-20.



June 30, 2002



AIPSLETTER

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FIRST CLASS

To:

DATED MATERIAL-DO NOT DELAY

A I P S L E T T E R

Volume XXII, Number 2: December 31, 2002

A newsletter for users of the NRAO
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Written by a cast of *AIPS*

Edited by

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General developments in *AIPS*

Linux news: bad compilers

Instructions for fetching and installing the GNU 2.95.3 compiler are given on the *AIPS* web page. The tar file is directly available from NRAO. This is needed since the 2.96.x compiler does not optimize code properly and the newer GNU 3.0 through 3.2 versions of g77 produce code that executes up to 20% slower than that produced by the older version.

Current and future releases

We now have formal *AIPS* releases on an annual basis with binary releases only for Solaris and Linux. All architectures can do a full installation from the source files. The current release is called 31DEC02 and is now frozen. If you took a development copy of this version at some earlier date, you may use the "Midnight Job" (MNJ) to bring it up to date. You need to run a MNJ only once in 2003 to convert your copy of 31DEC02 into the now frozen version. This *AIPS Letter* is intended to advise you of developments in this release.

We have begun a new version, called 31DEC03, which is now under development by the (reduced) *AIPS* Group. You may fetch and install a complete copy of this version at any time. Having fetched 31DEC03, you may update your installation whenever you want by running the MNJ which uses transaction files to copy and compile the code selectively based on the code changes and compilations we have done. We expect users to take the source-only version of 31DEC03 *AIPS* over the Internet (via *anonymous* ftp).

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Installing a new version

Some managers of sites that run only the current development version of *AIPS* have asked whether they could upgrade 31DEC02 to 31DEC03 by a simple renaming of the directories and editing of the AIPSPATH files. We have tried this and it did not work. There are a bunch of link files that have to be redone and even then, cvs is too smart and fetches 31DEC02 control files. It might be possible to revise even more files to override this behavior, but at this level it becomes simpler, quicker, and very much more reliable simply to install 31DEC03 from the tar ball.

When installing a new *AIPS* release in a system that already has a previous release, we recommend that `install.pl` be used and that the previous release be left in place, at least until the installation has been seen to work. If you do this, then you will not have to re-edit the disk, printer, and tape lists and can simply skip all those pages in the `install.pl` menus. The old `$HOME/.AIPSRC` file may be left in place, but it will need to be edited. The lines giving the `DOWNLOADED` and `UNPACKED` parameters should be deleted and the `CCOMOPT` line should be changed to point to the current release rather than the previous one — the `-I` parameter really should be `-I$INC` but that seems to confuse `install.pl`. Therefore, for now, the `$INC` has to be given in its full path name, which forces a re-edit with each release. If you have made special versions of `UPDCONFIG` and `do.daily.host`, you should preserve them under new names and restore them after the install. The `$AIPS_ROOT/AIPSPATH.*SH` files will need to be edited after the install if you wish to run multiple different versions of *AIPS*.

For Linux and Solaris Ultra systems only, a binary installation is available from CDrom, supported by `install.pl`. Alternatively, there are binary files which may be downloaded from

`ftp://ftp.aoc.nrao.edu/pub/software/aips/31DEC02.`

With a modern computer, it will probably be faster to recompile the programs locally using `install.pl`.

Patch Distribution for 31DEC01

As before, important bug fixes and selected improvements in 31DEC01 can be downloaded via the Web beginning at:

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

Alternatively one can use *anonymous* ftp on the NRAO CPU `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 31DEC03 are found, they are simply corrected since 31DEC03 remains under development. Corrections and additions are made with a midnight job rather than with manual patches. Remember, no matter when you received your copy of 31DEC01 or 31DEC02 *you must* fetch and install its patches if you require them.

The 31DEC01 release had a few important patches including a new one in September. These were:

1. SAD, JMFIT, and IMFIT fail to handle the primary beam correction properly for offset fields *2002-02-11*.
2. IMAGR failed to apply the `IMAGRPRM(11)` parameter to the peak in the Clean windows *2002-02-19*.
3. SPLAT failed to average spectral channels properly for multiple IFs *2002-06-20*.
4. BPASS failed to include the first record of each SOLINT *2002-09-16*.

Improvements of interest to users in 31DEC02

We expect to continue publishing the *AIPSLetter* approximately every six months along with the annual releases. Despite the reduction in personnel, there have been a number of changes in 31DEC02. In the last edition, we reported on three new tasks: WETHR to plot the contents of the weather table including flagging data based on the contents of the table, BOXES to add Clean boxes to a BOXFILE based on source catalogs, and UVDEC to copy a *uv* data set retaining only every n^{th} spectral channel. There were also three new verbs: TKERASE to clear the contents of the Tektronix emulation display window, SG2RUN to convert the contents of a SAVE/GET file into a RUN file for use on another computer and/or user number, and OUTPUTS to show those adverbs whose values will be changed when running the task. A new RUN file called WRTPROCS provides three procedures for automated writing and reading of FITS disk files.

In the last six months, we have developed two new tasks: WIPER to edit *uv* data interactively from a UVPLT-like display and LOCIT to solve for antenna positions. For the VLA, the latter replaces an ad hoc pair of programs that only ran on Solaris and were no longer maintainable. The VLBA pipeline reduction VLBAPIPE package has been publicly released. “Color” was added to *AIPS*’ plotting. This allows contrasting symbols and contour and polarization lines to be drawn on top of gray-scales. Full pseudo- and true-coloring were also made available. A wide variety of tasks were enhanced in some way.

Other than relatively minor differences, 31DEC02 is compatible in all major ways with the 2001, 2000, 1999, and 15OCT98 releases. There are significant incompatibilities with older versions.

Plotting in color

Several new plot command codes have been developed: line type (values 1–4), dark vector, write RGB gray-scale, initialize for color gray-scales, and write bright and dark characters inside plot area. These allow different line types to be assigned different colors both when they are bright or when they need to be “dark” because they are drawn over significant gray-scale brightness. They allow the labeling, contouring, polarization vector drawing, and “star” plotting routines to draw in a contrasting color when the background gray-scale is strong. They allow the conversion of gray-scales with a color table (called an “output-function-memory” or “OFM”) to pseudo colors and the full display of a true-color (RGB) image such as those produced by TVHUI and RGBMP. Examples of color plotting are given at the end of this *AIPSLetter*.

All plot tasks in *AIPS* were changed to use the line-type command. GREYS was changed to support FUNCTYPE, to do dark vectors when needed to plot contours and stars, to read an OFM to color the gray-scale image, and to construct and display RGB images from an input RGB image or 3 different input images. PCNTR was changed to plot gray-scales optionally including FUNCTYPE, OFM coloring, true RGB image display, and dark vectors in the contours, polarization vectors and stars. KNTR was also changed to plot polarization vectors and to do the full range of gray-scale plotting including all the dark vectors and true- and pseudo-color displays.

The task that makes RGB images from images used as images of intensity, hue, and (optionally) saturation is called TVHUI. It was revised to handle axis increments correctly and to offer the SQ transfer function. RGBMP makes RGB cubes by weighted summing of image planes along the *Z* axis. It had an addressing error that caused it to weight the red and blue images unequally and it previously ignored the actual direction of the *Z* axis coordinate so that red and blue had nothing to do with red-shifted and blue-shifted. Those bugs were corrected and a number of experimental methods for doing the summing were added.

The plot rendering tasks TKPL and TXPL were revised to do what little they can do with the new commands. TVPL was changed to implement most of the new commands, giving the user the choice of rendering all dark vectors as black or leaving them bright. Since it puts them in colored graphics overlay planes, they may not require the use of black. TVPL and all plot tasks with DOTV = TRUE were revised to use either a single graphics overlay for all lines and characters or to use graphics overlays 1 through 4 for the four different line types. The usage of line types varies by plot task. As a general rule, type 1 is labeling, type 2 is contours, type 3 is vector drawings such as polarization vectors, and type 4 is for symbols such as stars or visibility samples. LWPLA is the main task for converting plot files to paper, transparencies, and journals. The scaling options for gray-scales were retained, but they will normally not be needed since it is more natural to apply them in the plot tasks. Pseudo-coloring of gray scales was added to LWPLA as was the new adverb DOCOLOR.

If it is true, then the new adverb array `PLCOLORS(3,10)` is used to color the 4 line types in bright vectors, the 4 line types in dark vectors, the characters drawn outside of the main plot, and the background of the full plot, respectively. Some journals prefer the “CMYK” color representation used in printing to the usual RGB scheme. `LWPLA` now offers the option to use CMYK rather than RGB, but RGB remains the default since it uses less disk. The positioning of vertical strings by `LWPLA` was corrected.

All plot tasks had subtle changes made to the spacing of labels and plot borders. `POSSM` was corrected for residual errors related to plotting multiple IFs and polarizations in a single panel. It was made better at actually stopping when done and at honoring `NPLOTS`. `PROFL` was corrected to choose its plot scaling in a way more likely to fill the page and to be less sensitive to certain inevitable plotting errors. `UVPLT` was given the option to plot both individual samples and binned averages and the `DOWEIGHT` adverb was added to control the averaging. `TVCPS` was changed to handle very large images when read from disk.

UV data handling and calibration

WIPER

`WIPER` is a new task to wipe out (flag) bad data using a `UVPLT`-like display of the data. A circular eraser of user-controlled diameter is used to erase samples from the plot — or to restore previously erased samples. During the interactive phase of the operation, the samples cannot be identified individually, but their coordinates in the two axes of the display are shown. When the interactive session is terminated, a new flag table is created containing all previous flags plus the new, potentially numerous, flags generated by `WIPER`.

LOCIT

`LOCIT` is a new task to solve for antenna locations from an `SN` table. It works best if a series of observations of calibrators is made with a wide variety of elevations and hour angles. `CALIB` then finds the `SN` table for this sequence of scans. `LOCIT` works by assuming that the phase of each IF is relatively stable and that the phases are mostly due to antenna location errors. Plots and printer displays of the residuals and solutions are available. A new `RUN` file called `BASFIT` sets “normal” adverb values for a sequence of `CALIB`, `LOCIT`, and `LWPLA` to be used primarily by the VLA analysts. `LOCIT` is based on older programs written by Rick Perley and Gustaaf van Moorsel but offers greater maintainability and several new options.

VLA archive data

The archive of raw VLA data is being placed on-line by the `e2e` project at the NRAO. The information to select which data you need is available from NRAO’s web site and methods to select all data from a specific project are being developed. From the *AIPS* perspective, this development made it desirable to read archive data from disk as well as tape. `PRTP` and `FILLM` have both been revised to read one or more data files from a user-specified disk directory. The file names must all be the same except for an appended “tape-file” number.

A number of generally minor errors in `FILLM` were corrected while the disk reading was being tested. The most serious was in the handling of ends of file, which could cause the task to get the wrong file number and to fail to stop as requested. Odd conditions on-line could cause `FILLM` to write fewer channel-0 samples than spectral samples, which was confusing to users. The data in such cases was always bad. History writing was improved as well.

Other changes

FITLD failed to apply the General Relativity correction to source coordinates, giving small errors in the apparent coordinates.

QUACK was given the option “`TAIL`” to flag all sources for a specified time following a scan. This covers the case in which the array thinks it has moved on to the next source but some antennas have not yet gotten the message and so think themselves still on source (actually the last one).

BPASS had a serious error which caused it to miss the first record of each **SOLINT** integration period except the very first. This usually affected one baseline very much more than the rest. An option to rescale the bandpass solutions to correct for the spectral index of the calibrator was added.

CLCAL was given adverb **DOBLANK** to control whether blanked values in an **SN** table are replaced or left blanked when smoothing is requested.

UVDIF was changed to allow checking for differences in weights, to allow the ignoring of flagging differences, and to allow some header differences to be ignored.

FUDGE was given the option to scale the visibility amplitudes as it copies the data.

SPLAT copied tables for all included IFs even if IF averaging was done and copied the **CL** table even when it was applied. Dropped the excess parts of the copies.

VLBA data calibration pipeline

As announced in the previous *AIPS Letter*, the first version of the VLBA Data Calibration Pipeline (RUN file **VLBAPIPE**) has now been included in the *AIPS* distributions of 31DEC02 and later. Although some anticipated features, such as polarization calibration, are not yet incorporated, this version of the VLBA Data Calibration Pipeline will let you reduce your data almost blindly for most VLBA-only experiments. These include low and high frequency observations, with and without phase-referencing.

A full description of the current status and limitations of the VLBA Data Calibration Pipeline can at all times be obtained from the VLBA astronomer web page

<http://www.aoc.nrao.edu/vlba/html/vlbahome/observer.html>

under “Calibration and Imaging.” This page will be describing new features as the VLBA Data Calibration Pipeline gets updated through the *AIPS* Midnight Job in the 31DEC03 version.

Questions and suggestions are welcome at lsjouwer@aoc.nrao.edu.

Imaging, modeling, analysis

IMAGR

IMAGR has been changed to allow up to 4096 fields. This is mostly to allow multiple resolutions while also imaging a large number of facets. **IMAGR** was changed to tolerate a small number of Clean “errors” in which no pixels get Cleaned for a facet before all images are re-made, often at great expense. The adverb **FGAUSS** was mishandled, causing the zero-width set of fields to have no flux cutoff. A bug in the histogram handling caused fields that should have been treated as done to be Cleaned one extra time. A serious bug copying Clean boxes to the fields of multiple resolutions was able to mess up all the boxes. We also fixed the selection of which image to display at the start of the Clean.

Miscellaneous

VTES and other tessellation routines were revised to handle up to 4096 pointings. Some limit larger than 55 was needed to test designs for a compact VLA configuration.

FFT was revised to handle large images. It had ignored the *AIPS*-wide maximum image parameter (16384).

UVCON was overhauled to simulate mosaic (multiple pointing) observations and the handling of shifts was upgraded to allow very large-angle shifts. The addition of random phases has also been added.

Phase shifts for angles greater than 90° were corrected. The existing code was correct for smaller angles but got the wrong sign for a square root for really large angles.

UVMOD was corrected to use the standard angular shifts, rather than the now deprecated projected-angle shifts.

- SAD** confused position angles again, effectively swapping the uncertainties in the X and Y positions.
- XMOM** was changed to allow the clip levels to vary spatially as expected from the single-dish beam pattern. This allows XMOM to run on the output of PBCOR with correct frequency-dependent beam patterns.
- HGEOM** and other *GEOM tasks had their work space increased. They should be able to handle images up to 1536 on a side with worst-case rotations.
- PATGN** was given two more patterns to generate, a radial polynomial (RADI) and a polynomial in X and Y (POLY).

General items

- CookBook** was updated for a changed adverb name (NCHAV) in numerous tasks as well as changes in FILLM, WIPER, INDXR, IMAGR, IMEAN, QUACK, CLCAL, FRPLT, and SG2RUN.
- RENAME** verb had a feature that allowed it to name a MA file the same name as a UV file, thereby confusing quite a number of verbs and tasks.
- Installation** process was improved a bit to make a better recommendation of AP size, to create standard FITS and OFM directories, and to set the start date of the MNJ as it says it will.
- Compile** scripts in Solaris received an option for gcc/g77 that is not fully tested and in Linux for the Intel compiler. The SEARCH script that finds which file to compile was made insensitive to extra dots in the path name.

Recent *AIPS* and related Memoranda

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

107 KRING versus FRING Tests

Amy J. Mioduszewski (NRAO)

April 8, 2002

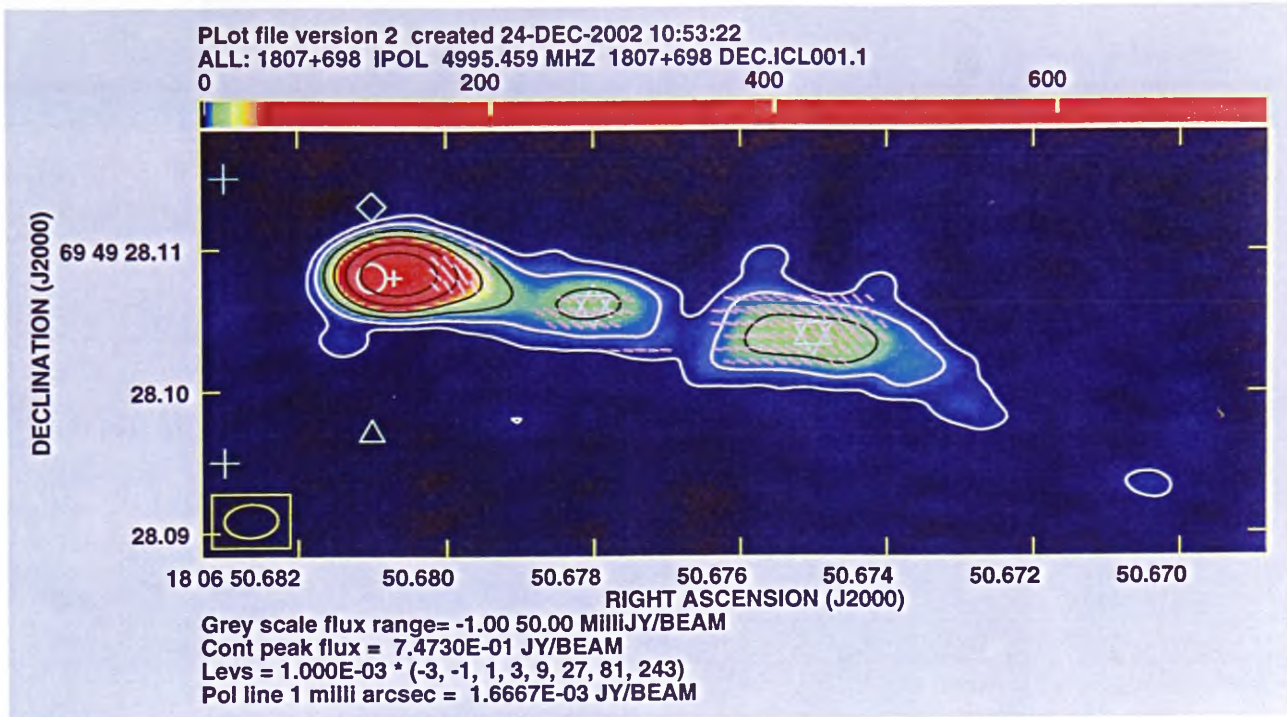
This comparison was designed to discover whether KRING or FRING should be used for most, if not all, fringe fitting problems. Within reasonable uncertainty, FRING and KRING performed very similarly. There is some indication that the default signal to noise cutoff in KRING is too low for low signal to noise cases. As one would expect, for high flux density sources the solution interval should be set as low as possible. For low flux density sources the solution interval should be set considering both the ability to find a good solution and to interpolate accurately. The only consistent difference between KRING and FRING is that KRING runs faster than FRING a vast majority of the time, typically by factors of 1.5 to 4.

Readers of the *AIPSLetter* have been informed of the attempt to develop an international standard for the representation of coordinates in FITS over the more than 10 years of that effort. You will be amazed to hear that the first two WCS papers have been published and have been accepted into the FITS standard by the IAU FITS Working Group (following acceptance by the North American, Japanese, and European FITS Committees). Eric Greisen has had two chapters accepted for a book on the history of information processing in astronomy. He also gave an invited paper on Wide-Field Imaging in Classic *AIPS*. All are available from his home page: <http://www.aoc.nrao.edu/~egreisen>.

AIPS Distribution

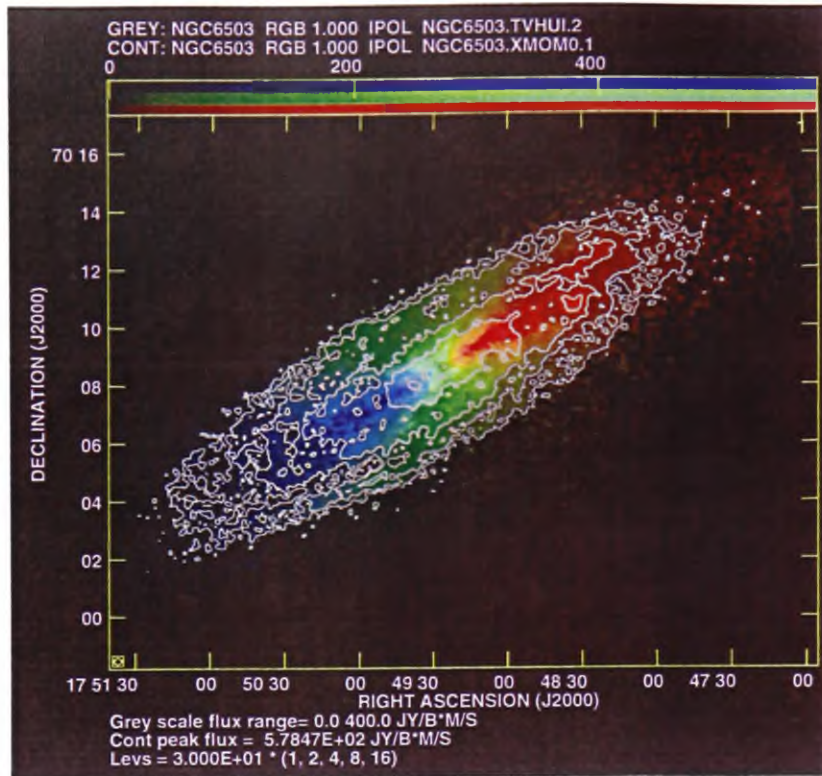
We are now able to log apparent MNJ accesses but have no working tools to count downloads of the tar balls or to manage the registration database. There appear to be about 48 sites/machines running the MNJ at least occasionally.

Examples of color plotting



KNTR: Task to generate a plot file for a contour and grey plot					
DOCONT	1	> 0 => do contours (1 or 2 => which name)	PCUT	0.001	Pol. vector cutoff. P units.
DOGREY	1	> 0 => do grey scale (1 pr 2 => which name)	ICUT	0.001	Int. vector cutoff. I units.
DOVECT	1	> => do polarization vectors (1 or 2 => which is IPOL) Contour or grey or IPOL	DOWEDGE	3	= 3 => put on top using full range of image values
INNAME	'1807+698 DEC'	First image name (cube?)	STFACTOR	1	Scale star sizes: 0 => none.
INCLASS	'ICL001'	First image class	CBPLOT	1	Position for beam plot:& 1: lower left (default)
INSEQ	1	First image seq. #	DARKLINE	0.33	Switch to dark lines when grey-scale > DARKLINE 0-1
INDISK	3	First image disk drive #			
IN3NAME	'1807+698 DEC'	Polarization intensity image: (name) blank => INNAME	LWPLA:	Sends plot file(s) to a PostScript printer or file	
IN3CLASS	'QCL001'	(class) blank => 'PPOL'	INNAME	'1807+698 DEC'	Image name (name)
IN3SEQ	1	(seq. #) 0 => high	INCLASS	'ICL001'	Image name (class)
IN3DISK	3	Disk drive #, 0 => any	INSEQ	1	Image name (seq. #)
IN4NAME	'1807+698 DEC'	Polarization angle image: (name) blank => INNAME	INDISK	3	Disk drive #
IN4CLASS	'UCL001'	(class) blank => 'PANG'	PLVER	2	Version # of PL file. 0=>last
IN4SEQ	1	(seq. #) 0 => high	FUNCTIONTYPE	' '	'NE','LG','NG','SQ','NQ' else linear
IN4DISK	3	Disk drive #, 0 => any	DPARM	*all 0	(1,2) Clip recorded grays
PIXRANGE	-1.00E-03 0.05	Min,Max of image intensity	DODARK	1	Paint dark vectors as "dark"
FUNCTIONTYPE	'SQ'	Image intensity transfer func	OFMFILE	'RAINBOW'	Color grey scales....
OFMFILE	' '		DOCOLOR	1	Use PLCOLORS ?
LTYPE	3	Type of labeling: 3 standard	PLCOLORS	1 1	Line, character, background colors - see HELP.
DOALIGN	1	> 0 => images must line up		0 1	
CLEV	0.001	Absolute value for levs		1 0	1 0.5
LEVS	-3 -1	Contour levels (up to 30).		0 0	0 0
	1 3	9 27		0 0	0 0
	81 243	*rest 0		0 0	0 0
FACTOR	1000	Mult. factor for Pol vector		0 0	0 0.8
XINC	3	X-inc. of Pol vectors. 0=>1		0.8 1	
YINC	3	Y-inc. of Pol vectors. 0=>1			

KNTR does polarization lines, contours, and grey-scale. Then LWPLA converts the grey-scale to pseudo-color and colors the lines making dark contours dark but dark polarization lines and stars bright.



KNTR: Task to generate a plot file for a contour & grey plot

```
DOCONT      2      > 0 => do contours
                (1 or 2 => which name)
DOGREY      1      > 0 => do grey scale
                (1 pr 2 => which name)
INNAME      'NGC6503' First image name (cube?)
INCLASS     'TVHUI'  First image class
INSEQ       2      First image seq. #
INDISK      3      First image disk drive #
IN2NAME     'NGC6503' Second image name
IN2CLASS    'XMOM0'  Second image class
IN2SEQ      1      Second image seq. #
IN2DISK     3      Second disk drive #
PIXRANGE    0      400 Min,Max of image intensity
FUNCTYPE    'SQ'    Image intensity transfer func
                    'SQ' Square root
DOCOLOR     1      Do RGB images as 3-color?
LTYPE       -3      Type of labeling: 3 standard
                    <0 -> no date/time
DOALIGN     1      > 0 => images must line up
                    (see HELP DOALIGN)
DOBLANK     -1      Draw boundary between blanked
                    areas and good areas?
DOWEDGE     3      = 3 => put on top using full
                    range of image values
CBPLOT      1      Position for beam plot:
                    1: lower left (default)
DODARK      1      Plot dark vectors as black?
DARKLINE    0.33   Switch to dark lines when
                    grey-scale > DARKLINE 0-1
```

```
LWPLA: Sends plot file(s) to a PostScript printer or file
INNAME     'NGC6503' Image name (name)
INCLASS    'TVHUI'  Image name (class)
INSEQ      2      Image name (seq. #)
INDISK     3      Disk drive #
PLVER      2      Version # of PL file. 0=>last
FUNCTYPE   ' '     'NE','LG','NG','SQ','NQ'
                    else linear
DPARAM     *all 0  (1,2) Clip recorded grays
DODARK      1      Paint dark vectors as "dark"
OFMFILE     *all ' ' Color grey scales....
DOCOLOR     1      Use PLCOLORS ?
PLCOLORS    1      Line, character, background
                    colors - see HELP.
                    0      0.67      0      0
                    0      0      0      0
                    0      0      0      0.67
                    0.67      0.67      0      0
                    0      0      0      0
                    1      0.7      1      0
                    0.1      0
```

KNTR interprets the output of TVHUI as a three-color RGB image and overlays moment-0 contours. LWPLA adds coloring to the lines, using a less than pure white for both bright and dark contours so that they are not so dominant.

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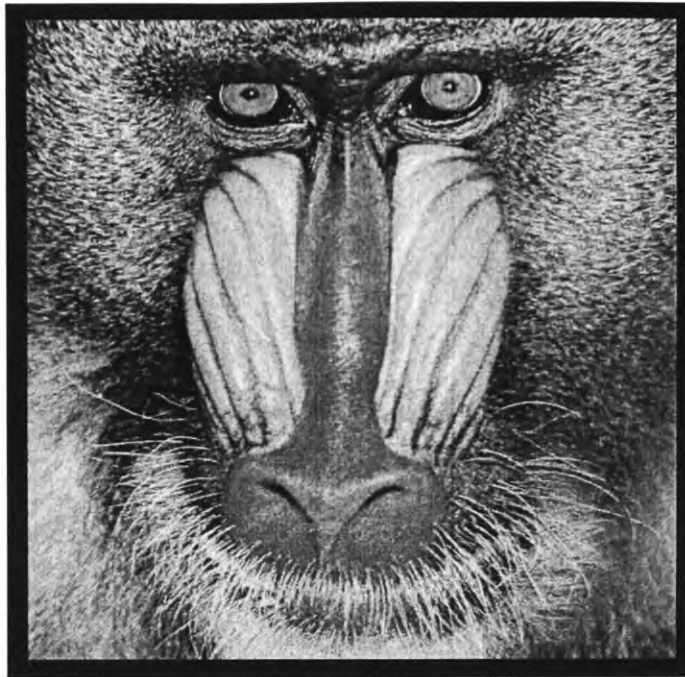
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December 31, 2002



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