A I P S L E T T E R

Volume XLV, Number 1: June 30, 2025

A newsletter for users of the NRAO
$\mathcal{A}$stronomical $\mathcal{I}$mage $\mathcal{P}$rocessing $\mathcal{S}$ystem

Written by a cast of $\mathcal{AIPS}$

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Happy 46$^{\text{th}}$ birthday $\mathcal{AIPS}$ and FITS

The FITS format was devised in a meeting at the VLA site on March 27 and 28, 1979. Don Wells (then of NOAO) and Eric Greisen (still of the NRAO) were the primary authors while Barry Clark and other NRAO staff members provided valuable suggestions. The FITS format, enhanced by later extensions, is still in wide spread use in astronomy and is the envy of other scientific fields. The FITS format then colored the design of the $\mathcal{AIPS}$ internal formats. The $\mathcal{AIPS}$ project was begun officially on July 1, 1979 and has stood the test of time remarkably well.

Your editor does find times when he would like interesting things to do. If you find any problems with $\mathcal{AIPS}$ or have any suggestions for new or improved functions, please do not hesitate to e-mail `daip@nrao.edu`. Do note that the $\mathcal{AIPS}$ web site has become a secure (`https:`) web site.

$\mathcal{AIPSL}$*etter* publication

We have discontinued paper copies of the $\mathcal{AIPSL}$*etter* entirely. The $\mathcal{AIPSL}$*etter* will be available in PostScript and pdf forms as always from the web site listed above. New issues will be announced in the NRAO eNews mailing and on the bananas and MNJ list server. Readers are encouraged to subscribe to one of these low volume mail lists at `https://listmgr.nrao.edu/mailman/listinfo`.

Current and future releases

We have formal $\mathcal{AIPS}$ releases on an annual basis. While all architectures can do a full installation from the source files, Linux (64-bit only), and MacIntosh OS/X (Intel and ARM) systems may install binary versions of recent releases. The last "slushy" release is called `31DEC24`. It gets occasional bug fixes until changes in operating system versions force it to be frozen. `31DEC25` remains under active development. You may fetch and install a copy of these versions at any time using *anonymous* `ftp` for source-only copies and `rsync` for binary copies. This $\mathcal{AIPSL}$*etter* is intended to advise you of improvements to date in `31DEC25`. Having fetched `31DEC25`, you may update your installation whenever you want by running the so-called "Midnight Job" (MNJ) which copies and compiles the code selectively based on the changes and compilations we have done. The MNJ will also update sites that have done a binary installation. There is a guide to the install script and an $\mathcal{AIPS}$ Manager FAQ page on the $\mathcal{AIPS}$ web site.

The MNJ for binary versions of $\mathcal{AIPS}$ now uses solely the tool `rsync` as does the initial installation. For locally compiled ("source") installations, the Unix tool `cvs` running with anonymous ftp was used for the MNJ. That has been replaced with `rsync` to download any changed text files. The only installations to still

use `cvs` are the four machines inside the Socorro Array Operations Center. Do not modify $\mathcal{AIPS}$ text files (*e.g.*, Fortran tasks) in the standard locations since `rsync` will over-write them. For local versions, use a copy of the task and its help file in a private disk area instead.

`31DEC20` contains a change to the TV display program `XAS` that makes it incompatible with previous releases when characters are displayed. `31DEC14` contains a change to the "standard" random parameters in *uv* data and adds columns to the `SN` table. Note, however, that the random parameters written to FITS files have not been changed. Older releases of $\mathcal{AIPS}$ cannot handle the new *internal uv* format and might be confused by the `SN` table as well. You are encouraged to use a relatively recent version of $\mathcal{AIPS}$, whilst those with recent VLA data to reduce should get release `31DEC24` or, preferably, the latest development release.

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The Linux binary version of $\mathcal{AIPS}$ is maintained by a computer running RedHat 8 with 64-bit load modules. The 32-bit Linux binary release was frozen in June 2024 and there is no `31DEC25` 32-bit binary release. The `MACINT` binary version is maintained by an old Intel Mac mini and will be maintained until that machine dies. It cannot be replaced. The `MACARM` binary version is supported by an M1 Mac mini that will have its operating system updated later this year. At that time the `31DEC24` release will be frozen with no more bug fixes so that that version will not be affected by the OS upgrade.

Improvements of interest in `31DEC25`

We expect to continue publishing the $\mathcal{AIPSL}etter$ approximately every six months, but the publication is now primarily electronic. There are six new user tasks, 2 new verbs, and four new service programs in `31DEC25`. The new tasks are `SYHIS` to analyze the contents of SysPower (`SY`) tables, `IM2TX` to write one-dimensional text files from image data, `TX2IM` to create one-dimensional image files from text files, `LISPX` to compute spectral indexes from one-dimensional text files, `SPXMD` to add spectral index models to image cubes, and `OFMPL` to display on the TV all available OFM tables. The new verbs are `OFMCOLOR` to choose from 30 pseudo color tables for the current TV image and `OFMSTRCH` to modify the TV pseudo color table. The new service programs, used mainly by your editor, are `COLOR` to translate publicly available color tables into OFM files, `ADVHLP` and `ADVCHK` to be used by new script `ADVCHK` to make sure that all verbs, task, and procedures are listed in the adverb help files used by them, and `ADVCNT` to check line lengths in all help files.

Display

The $\mathcal{AIPS}$ "TV" display (`XAS`) has a rather complex internal structure which was initially suggested by the old IIS Model 70 that we used in the early days. With the advent of modern computers, we have increased the dimensions of `XAS` considerably. There are 16 memory planes, loaded with images scaled from 0 to 8191. Each enabled memory is passed through a lookup table, called the LUT, in each of the three colors. The LUT translates the inputs to the range 0 to 2045. At that point all outputs of the LUT are summed and put into another three color look up table called the OFM (output function memory). This translates the 0 to potentially 32735 sum into 0 to 255. For simplicity, $\mathcal{AIPS}$ normally uses LUTs that are the same in all three colors to do black-and-white enhancement *e.g.*, with the verb `TVTRANSF`. Also for simplicity, $\mathcal{AIPS}$ normally uses the OFM to add pseudo coloring in the range 0 to 2045 with the same coloring applied to all memory planes. The output from the OFM is in the range 0 to 255 which is all that the actual terminal screen can handle. A gamma correction is applied via the OFM since the response of the terminal is non linear. The verb `TVHUEINT` is the exception to this simplicity. It uses the LUT in three colors to take the log of the input images and the OFM to take the exponential of the sums, effectively multiplying the images through color filters.

AIPS supports the concept of OFM text files which list the values of potential OFM pseudo colorings. There are a number of verbs starting with `OFM` which allow the user to fetch, modify, and save the OFM. Verbs `OFMGET` and `OFMSAVE` were changed to pseudo-verbs, allowing the immediate argument (the name) to be typed without enclosing quite marks, Verbs `OFMADJUS` and `OFMTWEAK` were corrected to work sensibly in the range 0 to 2045. In `31DEC25`, we have added a large number of OFM tables derived from publicly available data using the new service program `COLOR`. To illustrate these tables, plus all previously available tables and any created by the user, a new task called `OFMPL` was developed. It has three display screens, one that shows up to 4 step wedges, one that plots the red, green, and blue functions, and one that shows an image with a selected pseudo coloring. The menu in all three screens lists every available OFM table in multiple columns. A new verb was created called `OFMCOLOR` which allows the user to try out numerous of these new tables; each of buttons A, B, and C can select 10 different OFMs and the verb will list the names of each OFM selected. It is hoped that one or more of these will let the user bring out the desired information in the image. A new verb `OFMSTRCH` lets the user stretch the OFM function to the left and right. That operation is also in `OFMCOLOR`.

The option `OFMCOLOR` has been added to numerous interactive tasks along with `TVPHLAME` when not already present. This includes `XGAUS`, `AGAUS`, `RMFIT`. `ZEMAN`. `ZAMAN`, `TVFLG`, `SPFLG`, `FTFLG`, `UFLAG`, `TVSPC`, and `TVIEW`. Numerous *AIPS* Memos were revised to illustrate their new menus. `TVIEW` was revised to display either a reference image or spectra with a menu option to switch between them. Windows applied to one of the displays now apply to all appropriately.

AIPS reserves the value zero in all lookup tables for magic blank pixels in the image. `TVLOAD` offers the option of interpolating the input image with `TXINC` and/or `TYINC` less than zero. That interpolation was corrected to honor the zeros strictly rather than allowing zero to be interpolated with non-blanked pixel values.

XPLOT was changed to do plotting in the normal way as well as n the previous plot methods.

SYPRT was corrected to handle looping over IFs, polarizations, and data types.

POSSM did not separate IFs correctly when they were not in a complete and regular sequence.

UV data

`SPFLG`, `FTFLG`, and `TVFLG` have received considerable attention also. They were fixed to record output flags correctly when doing clip operations in a sub window. The displays were correct but the output flags were not. Pseudo coloring `TVPHLAME` and `OFMCOLOR` were added. The waterfall plots were given the option to zoom via interpolation in both axes when the TV display is large enough to allow it. `TVFLG` also has that option but only in the time (y) axis since interpolating between baselines is meaningless. These `ALLOW X Y ZOOM ?` options complicated the clearing of flagged data, but the problems with it were solved. Clip operations now only apply to the voxel being clipped. Options to flag additional IFs, channels, baselines, *et al.* are ignored. `TVFIDDLE` was replaced by `TVZOOM` since `TVTRANSF` is better for black-and-white enhancement. A long overdue *AIPS* Memo 127 was written to describe these tasks in detail.

`SYHIS` is a new task that attempts to auto edit the SysPower (`SY`) table while providing a large amount of diagnostic information. It first measures and plots `SY` histograms. It then clips the `SY` data and runs a median window filter through the values. It compares the data to the MW filtered values and generates new histograms which it can plot and evaluate statistically. It can then clip based on the MW difference. Finally it can run a general smooth operation through the `SY` values and replace the clipped points or all points with the smoothed values. This is `TYSMO` but with smarts and the ability to use different values for each IF, polarization, and antenna. It should be regarded as experimental.

The adverb `DOBAND` was added to numerous procedures in `VLBAUTIL`. Then `DOBAND` and new adverb `BPSOLINT` were added to `VLBARUN` to allow time-dependent bandpass solutions. `VLBARUN` was also changed to plot bandpass solutions separately for each time in the `BP` table. `VLBARUN` was also given the `IN2NAME` *et al.* adverbs and `NMAPS` to allow a source model to be used in bandpass solutions.

LISTR did not check solution weights in the GAIN mode to make sure the data are valid.

NOIFS had an error in frequency computation causing the output to have one too many channels with the reference channel being one too high.

TECOR was provided with a new model of the Earth's magnetic field. IGRF14 is an updated version of IGRF13 released because we have aged another 5 years.

VLAMP and DOVLAMP were changed to handle wide-band EVLA data by selecting those IFs that are needed with the VLBA data.

Analysis

Spectral index computations received attention with TVSPX getting several new options. These included CLEAR LIST and CHAR MULT in the main menu, IMSTAT in the image menu, and CHAN RANGE, RESET CHANS, and QUIT in the redo menu. A new task LISPX is similar to TVSPX but takes its input from a one-dimensional text file which can contain a third data column to give the uncertainty. It writes an output text file that can be used as an input text file to the task. New task SPXMD was written to add models containing spectral index to new or existing image cubes. These tasks are described in the new *AIPS* Memo 126. PLOTR was given the option to read a third data column and plot it as error bars.

One dimensional text files containing spectra (or other data types) can now be read into *AIPS* as one dimensional images using new task TX2IM. The new task IM2TX reverses this process, making text files that can be read by PLOTR, LISPX, and other *AIPS* or non-*AIPS* programs.

The spectral model fitting tasks XGAUS, AGAUS, ZEMAN, ZAMAN, and RMFIT have been modified significantly. In the edit stage, they were given the OFMCOLOR option and an option to add a blotch region to the pixel list for later flagging or re-fitting. The REDO ALL and REDO LIST operations only do pixels that are bright enough. AGAUS now resets the optical depth spectrum array for each pixel to guarantee the correct spectrum when setting an initial guess. Commands are now given only with TV menus; the awkward option to type on the terminal for basic fitting was dropped. When fitting spectra in the edit stage, *i.e.*, when doing REDO ALL or REDO LIST, an additional option to flag channels is offered both before and after a fit is attempted (except for RMFIT). That option has its own menu and allows the user to flag and unflag ranges of channels interactively. The flagged and unflagged data are plotted in different colors. During the initial fitting, one can choose to turn off the TV to let the task try fitting pixels more quickly. When it gets in trouble, it will turn TV interaction back on, often dropping directly into setting a new guess. XGAUS, AGAUS, and RMFIT were changed so that the plot is in a different color when setting a new guess, thereby making it obvious that this mode has been entered. *AIPS* Memos 118 and 122 have been revised for all of these changes.

Imaging

SETFC can recommend image sizes and cell spacings. It also can make a list of overlapping facets on an hexagonal pattern. An option to generate that pattern in a rotated fashion was added. This may produce a better pattern of facets than the default. Use CHKFC and FLATN to evaluate. The TV display of images in IMAGR, SCIMG and SCMAP was enhanced with a labeled step wedge on the right hand side. It is displayed whenever the image is labeled (abs(LTYPE)$\geq$ 3).

DFTIM and DFTPL were given the adverbs ANTENNAS and BASELINE to limit the data included. Adverb OPTYPE was added to allow the tasks to image data types other than the DFT (which is the real part of the visibility after the shift). DFTIM only was given additional OPTYPEs to measure the difference between the current data value and an average of the surrounding points.

General

The documentation provided with *AIPS* has been systematically maintained as well. The new service program `ADVCNT` was written to check for long lines in all help files. A new service script `ADVCHK` was written, using new service programs `ADVHLP` and `ADVCHK`, to examine all help files to insure that all adverb help files report all verbs, tasks, and procedures that use them. A great many help files were edited as a result. Pre-existing service programs were used to update the `ABOUT` files and TAB-completion file. The *CookBook* was updated systematically in February and May.

AIPS plot (`PL`) and slice (`SL`) files have complex formats that do not lend themselves to FITS tables. Nonetheless, in order to allow *AIPS* users to back up these files and recover them at a later time, `FITTP` and `FITAB` were changed to write them as FITS tables. Each 1024-byte record is written as a row in this pseudo table format which is then read back by `FITLD`, `IMLOD`, and `UVLOD`. These "tables" are expected to be meaningless to other software systems, but do allow users to retain these potentially valuable extension files.

The verb `PLGET` allows a user to recover the adverbs used to make a plot file and the format of plot files was changed in 2023 to allow this verb to work mostly even if the adverbs to a plot task have changed. The verb `EXTLIST` tries to display information about extension files, especially plot files. Both verbs were updated for changes in plot tasks again this year.

Recent Memoranda

All *AIPS* Memoranda are available from the *AIPS* home page. Memo 126 is a new memo describing spectral index fitting in *AIPS*. Memo 127 is a new memo describing the first interactive flagging tasks in *AIPS* including the latest modifications. Memos 120, 121, and 124 have been updated to describe added display options in interactive tasks. Memos 118 and 122 have been revised to describe the changes in Gaussian, Zeeman and rotation measure fitting tasks. Memo 117 was updated to describe the slice files now written to FITS.

126 **Spectral index fitting in *AIPS***
Eric W. Greisen, NRAO
April 24, 2025
AIPS has had the task `SPIXR` to fit the spectral index of image cubes since 2005. Beginning in the `31DEC24` release, a new interactive task called `TVSPX` became available. It does the same fitting as `SPIXR` but then allows the user to examine the results and to try to improve upon them. This Memo will describe the usage of this new task.

127 **Interactive flagging in *AIPS***
Eric W. Greisen, NRAO
June 12, 2025
The first truly interactive task in *AIPS* was `TVFLG`, introduced in the late 1980s. It enabled interactive editing primarily of continuum data. A similar task suited to spectral line data sets appeared in January 1990. This task, `SPFLG`, has recently undergone some useful changes suggesting that this family of editing tasks should be described in a memo.

117 ***AIPS* FITS File Format**
Eric W. Greisen, NRAO
June 24, 2025 revision, adding slice files in FITS

118 **Modeling Spectral Cubes in *AIPS***
Eric W. Greisen, NRAO
July 2025 revision, describing `XGAUS`, `ZEMAN`, and `RMFIT`

120 **Exploring Image Cubes in *AIPS***
Eric W. Greisen, NRAO
April 20, 2025 revision, describing `TVSPC`

121 Editing on a *uv* grid in *AIPS*
Eric W. Greisen, NRAO
April 30, 2025 revision, describing `UFLAG`

122 Modeling Absorption-line Cubes in *AIPS*
Eric W. Greisen, NRAO
July 1, 2025 revision, describing `AGAUS` and `ZAMAN`

124 Further Exploration of Image Cubes in *AIPS*
Eric W. Greisen, NRAO
April 22, 2025 revision, describing `TVIEW`

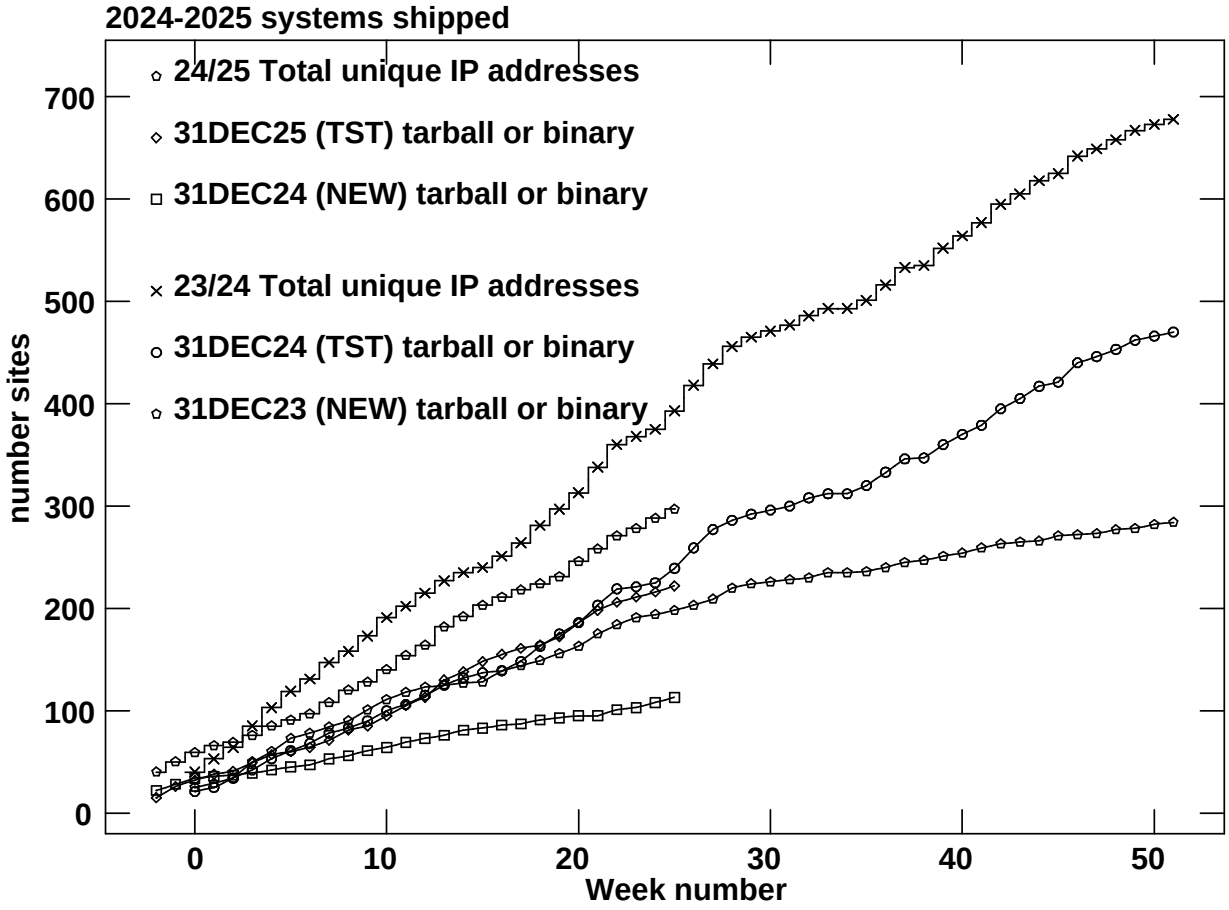
Patch Distribution for `31DEC24`

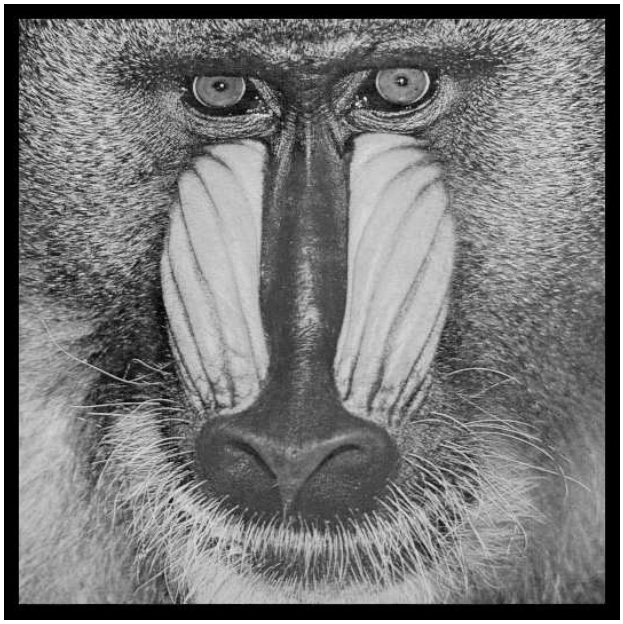
Normally, this section lists the patches that have been released for `31DEC24`. This was based on the assumption that users would want to download individual files to compile them locally. However, the "Midnight Job" (`$HOME/do_daily.`*hostname*) will do this for you on locally-compiled installations. It will also do a proper update for binary installations. Therefore there is no reason to continue the old procedure. Major bug corrections will be moved to `31DEC24` as they occur and users should use the MNJ on occasion on both the `NEW` and `TST` versions of *AIPS*. The `31DEC24` release has had a number of these "patches":

1. `TVSPX` was given new options and corrected for handling zoom and large images. *2025-01-23*
2. `QBEAM` was corrected for number of adverbs and its handling of `CUTOFF`. *2025-01-28*
3. `AU8A` (`EXTLIST` verb) was corrected for its handling of 30-value adverbs in `PLOTR`. *2025-01-28*
4. `TECOR` was changed to issue a warning about leaving the reliable model behind (date $>$ 2025.0) only once. *2025-01-19*
5. `TEPLT` was changed to use finer plot range limits on `DIFF`. *2025-01-19*
6. `ZACTV9.C` had a C error preventing compilation on the latest compilers. *2025-01-19*
7. `FITTP` and `FITAB` were changed to write Slice (`SL`) files as pseudo-FITS tables. `FITLD`, `UVLOD`, and `IMLOD` were changed to read them back in. *2025-03-06*
8. `SYPRT` was corrected to handle page size limitations and to loop over IFs, polarizations, and data types properly. *2025-13-11*
9. `POSSM` had issues with frequency labeling when the IFs were not all contiguous. *2025-03-12*
10. `PLRFI`, `VBRFI`, `VLBRF` did not make plot files properly with more than one subplot per page. *2025-03-18*
11. `PRTSY` did not sort the `SY` table correctly. *2025-03-19*
12. `SGDESTR` left a file open, blocking many functions in `AIPS`. *2025-03-19*
13. `FITAB` and `FITTP` attempted to write the history file as a table making an error message. *2025-03-26*
14. New OFMs have been added for use in `OFMGET`. *2025-04-03*
15. `SPFLG`, `FTFLG` wrote incorrect flags to the flag table when doing clip in sub-images. *2025-04-23*
16. `NOIFS` output one too many channels and set the reference channel one too high. *2025-05-05*
17. `LISTR` did not handle arrays with more than 50 antennas well. Fixed both `LIST` and `MATX` listings. *2025-05-07*
18. `BPEDT` did not check times when deleting `BP` table records. *2025-06-23*

AIPS Distribution

We log apparent MNJ accesses and downloads of the tar balls and binary installations. We count these by unique IP address. Since some systems assign the same computer different IP addresses at different times, this will be a bit of an over-estimate of actual sites/computers. However, a single IP address is often used to provide *AIPS* to a number of computers, so these numbers are probably an under-estimate of the number of computers running current versions of *AIPS*. So far in 2025 more than 217 IP addresses have downloaded the now slushy form of `31DEC24`, while more than 223 IP addresses have downloaded `31DEC25`. A total of 297 different IP addresses have appeared in one of our transaction log files. These numbers are rather less than those of last year at this time although the numbers for `TST` are fairly close.





June 30, 2025

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A I P S L E T T E R

Volume XLV, Number 2: December 31, 2025

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General developments in *AIPS*

AIPSLetter publication

We have discontinued most paper copies of the *AIPSLetter* entirely. The *AIPSLetter* will be available in PostScript and pdf formats as always from the web site listed above. New issues will be announced on the `bananas` and `mnj` list servers and sometimes in the NRAO eNews.

Current and future releases

We have formal *AIPS* releases on an annual basis. We recommend a full binary installation method for both the "slushy" and "development" versions for MacIntosh OS/X (Intel *and* ARM chips), and Linux (64-bit) systems, but all architectures can do a full installation from the source files. There are no longer binary versions available for 32-bit Linux, Solaris, and Mac PPC chip architectures. If you develop *AIPS* code locally *or have system managers that forbid the use of* `rsync`, you will need to do a source-level installation. The current release is called `31DEC25` and is now "slushy." If you took a development copy of this version at some earlier date, you should use the "Midnight Job" (MNJ) to bring it up to date. You need to run a MNJ only once in 2026 to convert your copy of `31DEC25` into the slushy version. However, when patches to `31DEC25` are announced in 2026, you may apply them with the MNJ. This *AIPSLetter* is intended to advise you of corrections and improvements in this release.

We have begun a new version, called `31DEC26`, which is now under development by the *AIPS* Group. You may fetch and install a complete copy of this version at any time. Having fetched `31DEC26`, you may update your installation whenever you want by running the MNJ. This uses `rsync` to copy all changed text files and then to copy the binary files or to compile the code selectively based on the code changes and compilations we have done. We expect users to take their source-only or binary version of `31DEC26` *AIPS* over the Internet (via *anonymous* ftp). Both versions require you to copy the installation procedure `install.pl` via `ftp`; the source-only version also requires you to ftp the 201-Mbyte `31DEC26.tar.gz` compressed tar file.

If compiling locally, new releases must be installed from the tar ball for that release. 31DEC22 and later versions contain improvements to the code which should make local compilation more reliable. If using the binary installation, a full new installation must also be done with rsync. When installing a new $\mathcal{AIPS}$ 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 new installation has been verified. 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 cleared and the CCOMOPT line should be changed to point to the current release rather than the previous one. If you have made a special version of do_daily.*host*, you should preserve it under a new name and restore it after the install. If you have an odd set of $\mathcal{AIPS}$ versions, the $AIPS_ROOT/AIPSPATH.*SH files may need to be edited after the install to set the desired versions. The file $SYSLOCAL/UPDCONFIG also needs to be edited to correct your e-mail address(es). A new installation will not change your current $\mathcal{AIPS}$ data files.

31DEC15 contains a change in the headers of *uv* data sets which will not be understood by previous versions. 31DEC20 contains a change to the XAS TV server which will cause problems with older versions. Note that the only version which we will patch for major errors is 31DEC25; even 31DEC24 will no longer be changed.

Improvements of interest to users in 31DEC25

In the latter half of 2025, four new tasks, four new verbs, and 2 new procedures appeared. The tasks are DFTQU to make an image in Q and U polarizations of a point as a function of time, XG2XG to copy an XG or ZE table to a new one with a different number of possible components, RESOU to renumber sources in a data set, and PRPLT to plot image "profiles" which are the average of the image over 2 axes as a function of the third. The new verbs are CAT2LOG through CAT5LOG to do the CATALOG operation with the second through fifth sets of file name adverbs. The new procedures are TV3LOD to load and display on the TV an RGB image cube and a large RUN file called VLBAPIPE to reduce VLBI data with tasks in a different order than that used in VLBARUN.

In the first six months, there were six new user tasks, 2 new verbs, and four new service programs in 31DEC25. The new tasks are SYHIS to analyze the contents of SysPower (SY) tables, IM2TX to write one-dimensional text files from image data, TX2IM to create one-dimensional image files from text files, LISPX to compute spectral indexes from one-dimensional text files, SPXMD to add spectral index models to image cubes, and OFMPL to display on the TV all available OFM tables. The new verbs are OFMCOLOR to choose from 30 pseudo color tables for the current TV image and OFMSTRCH to modify the TV pseudo color table. The new service programs, used mainly by your editor, are COLOR to translate publicly available color tables into OFM files, ADVHLP and ADVCHK to be used by the new script also named ADVCHK to make sure that all verbs, tasks, and procedures are listed in the adverb help files used by them, and ADVCNT to check line lengths in all help files.

Normally, bugs which appear in an $\mathcal{AIPS}$ TST version and then are fixed in that same version before its release get little or no discussion in the $\mathcal{AIPSL}$etter. Since a rather large number of sites now install the TST version of $\mathcal{AIPS}$ during its development, not describing temporary bugs in TST is somewhat of an oversight. We urge you to run the "Midnight Job" at least once after 31DEC25 is turned slushy to bring it up to date and to fix all bugs of this sort. We urge active sites to use the MNJ and, when something odd occurs, to examine CHANGE.DOC using the cgi tool available from the $\mathcal{AIPS}$ documentation web page (http://www.aips.nrao.edu/aipsdoc.html). Please do not hesitate to contact us via the NRAO science user help desk (https://help.nrao.edu) or via e-mail daip@nrao.edu with any questions or suspicions that there are problems.

System matters

Due to the "end of life" for RedHat 7, we chose to freeze 31DEC23 completely in June 2024. In this way, the binary version for LNX64 could remain as produced by RedHat 7. 31DEC24 for 64-bit Linux was then re-compiled with RedHat 8, producing a binary version incompatible with the older operating system. At the same time, we discontinued any development of the 32-bit Linux binary version. That version is available in binary form but only up to June 20, 2024. 31DEC25 does not contain a binary version for 32-bit Linux.

Old Linux systems left behind by these actions should note that it is relatively easy to compile all of *AIPS* on whatever machine you may have. Versions of `gfortran` at least 4.8, but better 6 or more, are required. The latest `gfortran` versions should also work.

The `MACARM` binary version of `31DEC25` is computed on a machine that was upgraded to "Sequoia" (OS version 15.6.1) with a gfortran upgraded to version 12.2. The load modules should work on any system at OS 13.0 or greater. The `31DEC23` version was frozen at the previous operating system level. The `MACINT` binary version continues to be developed, but if the computer used to produce it dies, our support for that binary version will halt. Again, you should note that compiling *AIPS* locally should go right on working.

`LNX64` now requires two "containers" to support the new task `ALBUS`. They should be copied by rsync either by `install.pl` or in the MNJ even for text (locally-compiled) installations. These files are large, one is 373 Mbytes, the more recent one is almost 410 Mbytes. These containers are not available for Macs.

UV data

Work on the `ALBUS` task revealed that *AIPS* has used a simple geometric computation to compute antenna longitude and latitude from the antenna (X,Y,Z) location parameters. All of *AIPS* was changed to use the "geodetic latitude" instead using a new subroutine. The geometric latitude of the VLA differs from the geodetic latitude by about 11 arc minutes or about 20 km to the South.

The *AIPS* task called `ALBUS` was given further attention. The desired GPS stations may now be specified with a new adverb, sensibly named `STATIONS`. The stations actually used in the solution are listed in the message file and written to the history file. Each station is listed only once unless a new antenna is specified (as in VLBI). The file `$AIPSIONS/ALBUS.stations` provides an enormous list of GPS stations which might be used by the program. That list was upgraded to drop duplicates, correct West longitudes (previously specified without a minus sign!), and to contain a description of the station location. The reading of negative latitudes from this file was corrected to handle the pernicious -00 degrees issue. Note that the `31DEC24` version of `ALBUS` did not receive these changes other than the upgraded stations file. The default `TECRTYPE` was changed to the model called `G01` which seems best for VLA data.

A new VLBI `RUN` file "pipeline" called `VLBAPIPE` was written. It borrows heavily from `VLBARUN` but does some of the steps in a different order. The most important of these is to do the full (every scan) run of `FRING` before doing the `BPASS` step. When the user has more than one scan on the bandpass calibrator this can make quite a difference. Extensive discussion on these pipelines can be found from the VLBA section of the web site listed at the start of this *AIPSLetter*. Both pipelines were changed to use `LISUN` rather than `LISTR` to generate the summary of the data set written to the output message file. The `RUN` files for `VLBAUTIL` and both pipelines were changed to allow the procedures to be run from multiple *AIPS* numbers for a single user number and output data area.

The interactive data display and editing task `EDITR` was given a new `CLIP EVERYTHING` menu option that uses the `FLAG ABOVE` interaction to set a clip level which is then applied to *every* baseline in the IFs, polarizations, and times currently displayed in the edit window. It displays what it is doing while running and automatically updates the display when it finishes. `EDITR` was also changed to display and edit upon a "coherence" parameter defined as the scalar averaged amplitude divided by the vector averaged amplitude minus 1.0. Note that this parameter requires data to be time averaged on the fly. `EDITR` was also corrected to handle the optional second data set properly. The "expert" mode was not changed and probably should be deleted.

The new task `DFTQU` is similar to `DFTPL` and `DFTIM` but writes out an image cube with Stokes Q and U and RGB color as the axes. The image contains the image of the Q and U Stokes of the data at a user selected celestial coordinate. Time is then used to set the color. This task should allow analysis of time-variable polarized sources of small diameter.

VPLOT was corrected to compute amplitude rms properly and plotting of phase rms was added. An option to extend the rms computation over spectral channels as well as time was added. An optional text file output was also added.

LISTR was given a phase rms option in the `'MATX'` and `'LIST'` operations. The rms options in `'LIST'` were corrected to do a proper computation since the "count" parameter in the code was actually a sum of weights. The handling of antenna selection was changed to honor the *AIPS*-standard specification allowing the list to be inclusive or exclusive.

LISUN was enhanced with a listing of the antennas in the array. Antenna number, station name, (X,Y,Z) coordinates, and longitude and latitude are given.

UVFLG was given an option to flag scans too close to the Sun. Changed the code to allow elevation, shadowing, pulse cal, and Sun distance to be done all at once, although in separate passes through the data.

RESOU is a new task to allow the changing of up to 30 source numbers while copying a data set. It is very similar to `DSORC` and parts of `MATCH` without some of their complications.

CLPLT was changed to do all of the optional `OUTTEXT` output before any plotting. This guarantees that all print out is obtained even when `DOTV=1` displays are terminated early. A bug was fixed that caused the last tine sample to be lost. The bad computation and plotting of error bars was corrected.

CAPLT was changed to have an `OUTTEXT` option and its computation and plotting of error bars was corrected.

UVDIF was changed to include or exclude auto-correlation and cross-correlation data.

DIFUV was given a new option to to compute the difference of the two data sets divided by the second. Output displays of mean, rms, max, and min were added along with a control of the writing of an output data set.

UVHGM and `UVHIM` were given a channel averaging option.

TVFLG, `SPFLG` and `FTFLG` were corrected to handle I/O with short rows. `TVFLG` was corrected to record the upper time properly in the `ANTENNA-DT` operation.

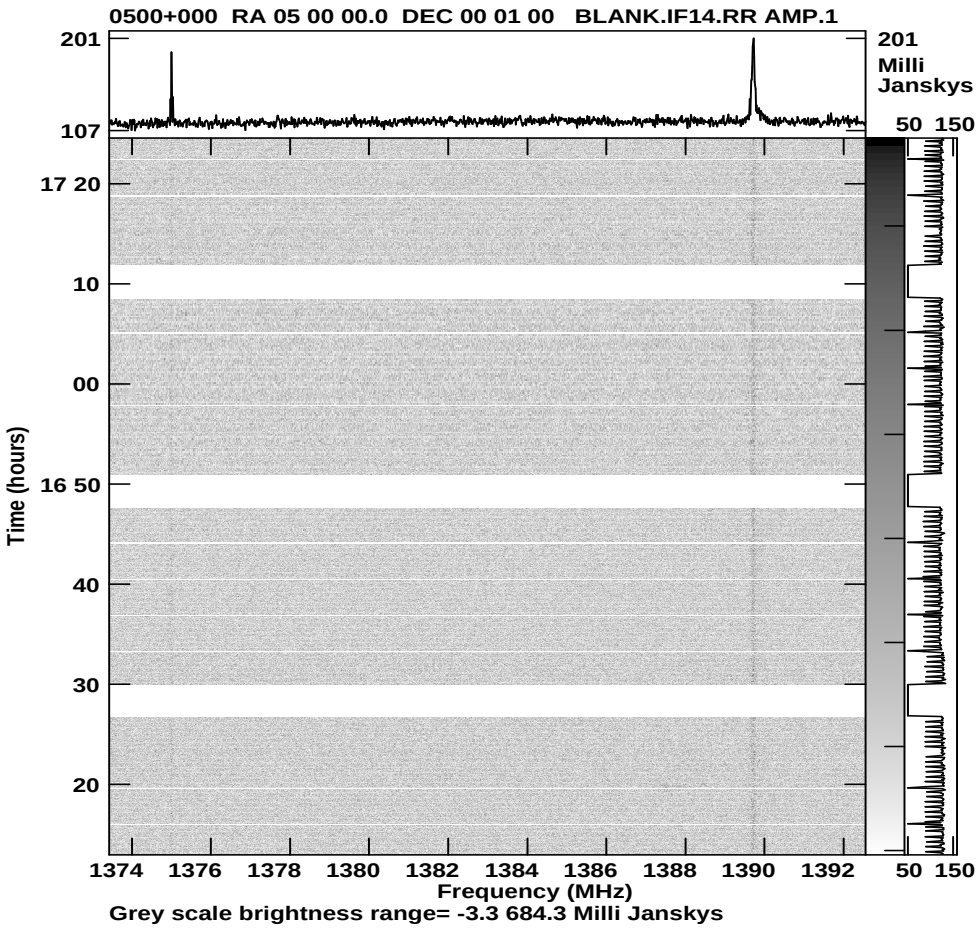
ELINT was corrected to copy the one IF solution to all IFs.

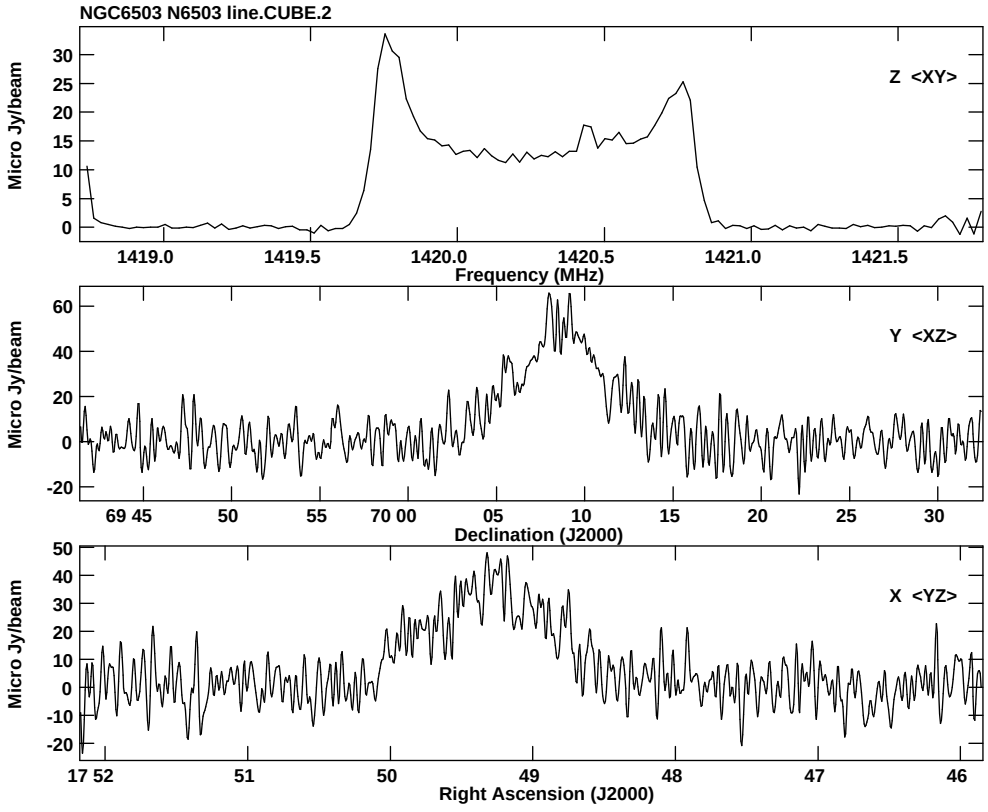
CLCOR was changed when doing the `EOPS` correction to assume the usual values when the (old) `CT` tables have all times equal to zero.

Imaging, Analysis, and Display

`XGAUS`, `ZEMAN`, `AGAUS` and `ZAMAN` are used to fit spectra with Gaussians and measure Zeeman splitting. They received a number of changes reported in the previous *AIPSLetter* and several more in the last six months. `XGAUS` was changed from always allowing only eight components to allowing up to 32 with the number to be allowed set when the `XG` table is created. This forced changes to the menu operations when the number of allowed components becomes large. The task now also computes an image of the rms of the residual after fitting which can be used in the editing stage and written to a cataloged file. `AGAUS` which fits absorption spectra was changed similarly. The Zeeman tasks now respond to the number of Gaussians in the `XG` table used when `OPTYPE = 'GAUS'`. Because a user may expend considerable effort on an `XG` or `ZE` file, a new task `XG2XG` was written to copy one of these tables to another with a change to the maximum number of components allowed. The task `XG2PL` was changed to accommodate the changes in these tables.

The concept of an image "profile" was added to the `GREYS` task. The profile in `GREYS` is the average in each column of the image which is then plotted along the top and/or the average in each row which is then plotted to the right. An example is shown in the accompanying figure. This image was produced by `DFTIM` for a study by Emmanuel Momjian of the new VLA online RFI excision. A new task called `PRPLT` has also been written to plot any or all three profiles from an image cube. An example plot of an HI galaxy cube is illustrated. The plot from the image x axis being the average over all (y, z), the plot from the image y axis being the average over all (x, z), and the plot along the z axis being the average over all (x, y).


0500+000 RA 05 00 00.0 DEC 00 01 00 BLANK.IF14.RR AMP.1
201
107
Milli
Janskys
50 150
17 20
10
00
16 50
40
30
20
Time (hours)
1374 1376 1378 1380 1382 1384 1386 1388 1390 1392
Frequency (MHz)
Grey scale brightness range= -3.3 684.3 Milli Janskys


NGC6503 N6503 line.CUBE.2
Micro Jy/beam
Z <XY>
1419.0 1419.5 1420.0 1420.5 1421.0 1421.5
Frequency (MHz)
Y <XZ>
69 45 50 55 70 00 05 10 15 20 25 30
Declination (J2000)
X <YZ>
17 52 51 50 49 48 47 46
Right Ascension (J2000)

IMAGR was changed to put the version numbers of the tables actually used for calibration and flagging into the history file. The imaging TV display was changed to prevent excess initialization of the look-up tables when the timeout option is used.

IMEAN was corrected to count "overflow" pixels properly and to display the Gaussian fit parameters when that option is selected.

TV3LOD is a new procedure automatically available to load an RGB image to 3 TV planes and turn them on in proper colors.

BLANK was given a simple `'BOX'` option to select or deselect up to 10 circular or rectangular areas.

LEVS contour levels are displayed whenever contours are drawn. The routine to generate the display string did unfortunate things to `LEVS` greater than 1000.

Verbs, general, and documentation

The old verb `CATALOG` was changed to ignore `INTYPE` when displaying all catalog entries matching the other name parameters. New verbs `CAT2LOG`, `CAT3LOG`, `CAT4LOG` and `CAT5LOG` were created to perform the same function with the other sets of name parameters.

Verb `PLGET`, which fills in the adverbs used to create a plot file, was revised as needed to match changes in plot tasks. Another little-known verb `EXTLIST`, which provides information on the contents of extension files, was revised as needed.

The *CookBook* was systematically updated in February, May, July, October, and November. Display problems with the `ABOUT` lists of Chapter 13 in the web-capable pdf and html versions were corrected. The TAB completion, `APROPOS`, and `ABOUT` text files were updated at the same time. The help files for adverbs contain lists of the verbs, procedures, and tasks which use them. These were also updated regularly and were revised so that the same format is used in all such files.

Recent Memoranda

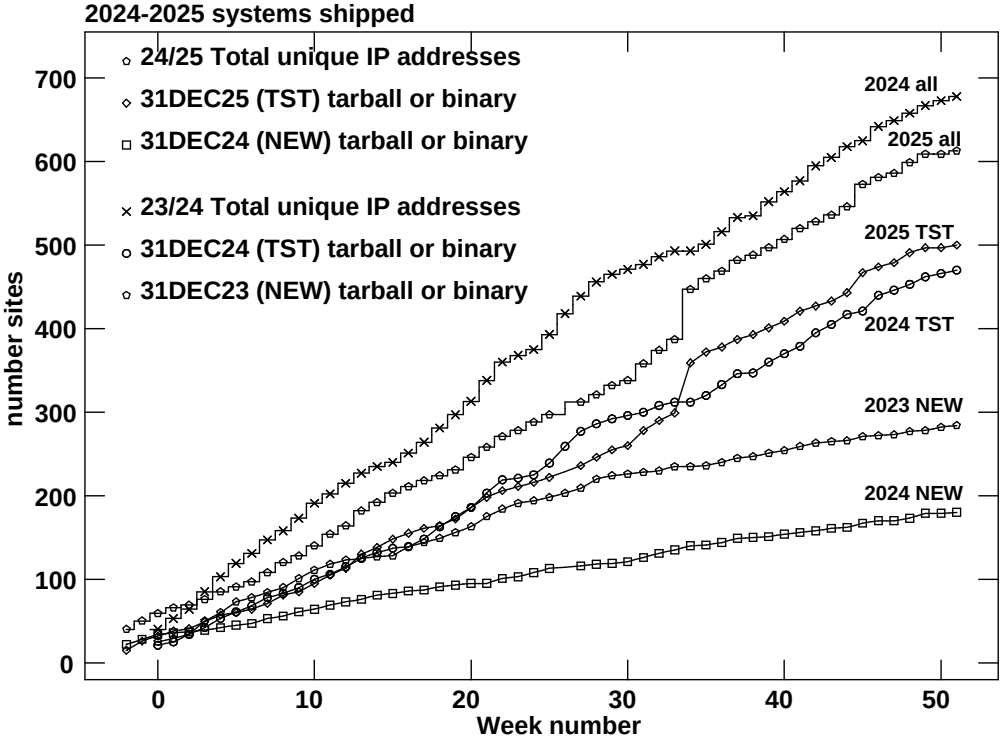
All *AIPS* Memoranda are available from the *AIPS* home page. Memo 117 which details the FITS format used by *AIPS* was updated for changes in the `XG` and `ZE` tables. Memo 118 and 122 which describe the interactive spectral-fitting tasks in *AIPS* were updated substantially to account for the numerous changes in these tasks.

118 Modeling Spectral Cubes in *AIPS*
Eric W. Greisen, NRAO
October 6, 2025 revision
AIPS has done Gaussian fitting along the x-axis of image cubes with task `XGAUS` since the 1980s. That task was overhauled in 2013 to be much easier to use and much more capable. In like fashion, tasks `ZEMAN` and `RMFIT` were developed. The former fits the standard leakage and scaling terms for Stokes V cubes, including a new option to do this for each of the Gaussians found by `XGAUS`. The latter fits polarization models to Stokes Q and U cubes, using the output of Faraday Rotation Measure Synthesis (*AIPS* task `FARS`) to assist with initial guesses. The models can contain multiple components each with a polarization flux, angle, rotation measure, and rotation measure "thickness." The present memo will describe the functions of these tasks in some detail with numerous graphical examples. A revision of this memo discusses changes made for the `31DEC15` release and two new tasks to plot spectra with model fits and a number of tasks which make visibility and image model files. The November 2017 revision includes new display options in `RMFIT`. The April and July 2025 revisions add display and edit options and correct display and pixrange setting. The September 2025 revision contains changes made to allow more than 8 components in `XGAUS` and `ZEMAN`.

122 Modeling Absorption-line Cubes in *AIPS*
Eric W. Greisen, NRAO
October 6, 2025 revision
AIPS does Gaussian fitting of spectral lines with overhauled task `XGAUS` and can fit V polarization image cubes for Zeeman splitting with the task `ZEMAN`. Both of these tasks are designed for emission spectra in which the noise is not a function of spectral channel. In absorption, however, the noise in optical depth becomes high when the optical depth is high. Therefore, new tasks `AGAUS` and `ZAMAN` have been written to provide similar functions but with mathematics suitable for absorption lines. This memo describes the new tasks in some detail and includes a description of a new, simplified modeling task `MODAB` which may also be useful. That task has shown that the results of these four tasks are biased by the presence of the Zeeman splitting and need modest correction if they are meant to describe the actual pre-splitting line widths and magnetic field.

AIPS Distribution

From the NRAO system logs, we count apparent MNJ accesses, downloads of the tar balls, and `rsync` accesses by unique IP address. In November 2025 one of our counting cron jobs stopped working; recovery of the counts may not be totally accurate. Mysteriously, the number counted for binary is slightly larger than the count intended to represent all. Since DSL and some university and other connections may be assigned different IP addresses at different times, this will be a bit of an over-estimate of actual sites. However, a single IP address is often used to provide *AIPS* to a number of computers, so these numbers are at the same time an under-estimate of the number of computers running current versions of *AIPS*. In 2025, a total of 187 different IP addresses downloaded the slushy form of `31DEC24` and 512 IP addresses downloaded `31DEC25` in tarball or binary form. With the change to the MNJ (rsync only) we are unable even to guess how many sites have run the MNJ. The total number of unique IP addresses in these five lists was 613, about 90 % of last year. The plot of numbers versus time and the table shows that 2025 was a bit ahead of 2024 in the `TST` version, but rather behind in the `NEW` version numbers. A new scheme to count `rsync` uses of `$ARCH/LOAD` was developed in the hope of learning which architectures are used for *AIPS*, The results were confusing, but clearly show `LNX64` as very popular with `TST MACARM` following rather far behind.



Patch Distribution for 31DEC24

Normally, this section lists the patches that have been released for 31DEC24. This was based on the assumption that users would want to download individual files to compile them locally. However, the "Midnight Job" (`$HOME/do_daily.`*hostname*) will do this for you on both locally-compiled and binary installations. Therefore there is no reason to continue the old procedure. Major bug corrections were moved to 31DEC24 as they occur and users should use the MNJ on occasion on both the NEW and TST versions of *AIPS*.

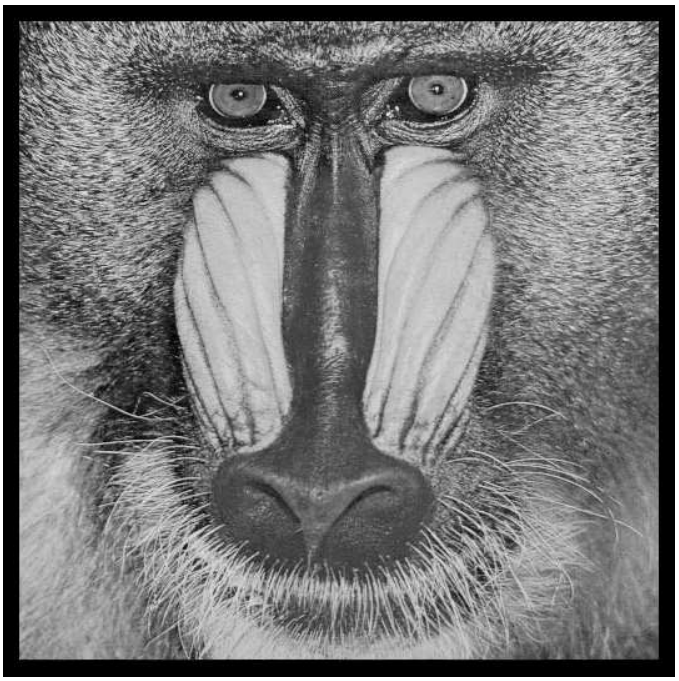
The 31DEC24 release is still available for installation, but is not recommended and will no longer receive patches even for egregious errors. It had a number of important patches during 2025. The patches are

1. TVSPX was given new options and corrected for handling zoom and large images. *2025-01-23*
2. QBEAM was corrected for number of adverbs and its handling of CUTOFF. *2025-01-28*
3. AU8A (EXTLIST verb) was corrected for its handling of 30-value adverbs in PLOTR. *2025-01-28*
4. TECOR was changed to issue a warning about leaving the reliable model behind (date > 2025.0) only once. *2025-01-19*
5. TEPLT was changed to use finer plot range limits on DIFF. *2025-01-19*
6. ZACTV9.C had a C error preventing compilation on the latest compilers. *2025-01-19*
7. FITTP and FITAB were changed to write Slice (SL) files as pseudo-FITS tables. FITLD, UVLOD, and IMLOD were changed to read them back in. *2025-03-06*
8. SYPRT was corrected to handle page size limitations and to loop over IFs, polarizations, and data types properly. *2025-13-11*
9. POSSM had issues with frequency labeling when the IFs were not all contiguous. *2025-03-12*
10. PLRFI, VBRFI, VLBRF did not make plot files properly with more than one subplot per page. *2025-03-18*
11. PRTSY did not sort the SY table correctly. *2025-03-19*
12. SGDESTR left a file open, blocking many functions in AIPS. *2025-03-19*
13. FITAB and FITTP attempted to write the history file as a table making an error message. *2025-03-26*
14. New OFMs have been added for use in OFMGET. *2025-04-03*
15. SPFLG, FTFLG wrote incorrect flags to the flag table when doing clip in sub-images. *2025-04-23*
16. NOIFS output one too many channels and set the reference channel one too high. *2025-05-05*
17. LISTR did not handle arrays with more than 50 antennas well. Fixed both LIST and MATX listings. *2025-05-07*
18. BPEDT did not check times when deleting BP table records. *2025-06-23*
19. IMEAN counted overflow pixels in the highest plotable box rather than one higher.*2025-07-16*
20. ELINT in DOPLOT=3 mode did not copy the solution to all IFs. *2025-07-18*
21. CLCOR died when the CT table times are all zero as in old VLBA data sets. *2025-07-31*
22. BPLOT confused linear polarization V with Stokes V. Labels improved also. *2025-08-06*
23. FITLD passed the wrong array to find the MC table parameters. HANNING tapered data were affected. Added code to detect 256-level antennas and skip the DIGICOR for them. *2025-09-11*
24. VPLOT did not compute amplitude rms correctly. Added phase rms to the possible plot items. *2025-10-14*

AIPS systems shipping

Rather than produce a blank page, we include the chart of systems shipped.

year	TST name	NEW name	TST	NEW	TST binary	NEW binary	Total unique
2004	31DEC04	31DEC03	808	196			1276
2005	31DEC05	31DEC04	832	246	299	48	1460
2006	31DEC06	31DEC05	806	191	402	94	1398
2007	31DEC07	31DEC06	965	277	669	161	1811
2008	31DEC08	31DEC07	1058	246	986	303	2107
2009	31DEC09	31DEC08	1228	307	1082	478	2399
2010	31DEC10	31DEC09	1228	307	1203	477	2416
2011	31DEC11	31DEC10	1105	270	1064	424	2228
2012	31DEC12	31DEC11	940	284	1028	396	1698
2013	31DEC13	31DEC12	1014	307	990	443	1937
2014	31DEC14	31DEC13	1045	333	848	431	1843
2015	31DEC15	31DEC14	1104	309	1001	350	1817
2016	31DEC16	31DEC15	878	222	788	372	1330
2017	31DEC17	31DEC16	874	408	768	386	1383
2018	31DEC18	31DEC17	684	368	603	343	1099
2019	31DEC19	31DEC18	754	406	686	388	1155
2020	31DEC20	31DEC19	796	434	750	470	1230
2021	31DEC21	31DEC20	659	399	604	376	1215
2022	31DEC22	31DEC21	590	226	572	221	965
2023	31DEC23	31DEC22	597	239	596	243	896
2024	31DEC24	31DEC23	470	284	480	272	678
2025	31DEC25	31DEC24	500	180	512	187	613



December 31, 2025

AIPSLETTER
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