A I P S L E T T E R

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

Written by a cast of *AIPS*

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General developments in *AIPS*

Help desk, COVID-19

Users of the NRAO Science help desk, will notice a changed appearance. We are using new software to manage helpdesk tickets, but we hope to continue to provide help to our users as we have done. Use `https://help.nrao.edu`, the same as before.

Due to the outbreak of the COVID-19 pandemic, the NRAO went to "infectious disease operating status" on March 16, 2020. Telescope operations (other than ALMA) continued with a skeleton support staff. On June 8 we began the first steps to return to the new normal. Primarily, this means that those employees who could not do their jobs properly from home have returned to work with numerous safety precautions. Telescope operations have continued and we have even managed VLA re-configurations safely. Those of us who can work from home will continue to do so indefinitely.

This status means that your editor does find times when he would like interesting things to do. If you find any problems with *AIPS* or have any suggestions for new or improved functions, please do not hesitate to e-mail me.

AIPSLetter publication

We have discontinued paper copies of the *AIPSLetter* entirely, at least for this issue. The *AIPSLetter* 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.

Current and future releases

We have formal *AIPS* releases on an annual basis. We recommend a full binary installation method for both the frozen and development versions for MacIntosh OS/X (Intel chips only), and Linux (32- and 64-bit) systems, but all architectures can do a full installation from the source files. There are no longer binary versions available for Solaris and Mac PPC chip architectures. If you develop *AIPS* code locally *or have system managers that forbid the use of* `rsync` or `cvs`, you will need to do a source-level installation. The current release is called `31DEC20` and is now "frozen." 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 2021 to convert your copy of `31DEC20` into the frozen version. However, when patches to `31DEC20` are announced in 2021, 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 31DEC21, 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 31DEC21, you may update your installation whenever you want by running the MNJ. This uses cvs, rsync, and/or transaction files 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 31DEC21 *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 175-Mbyte 31DEC21.tar.gz compressed tar file. Binary installations use only rsync, while locally compiled versions also use cvs. 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. Use a new name for the task or put a copy of the task and its help file in a private disk area instead.

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Installing a new version

If compiling locally, new releases must be installed from the tar ball for that release. 31DEC15 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 *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 *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).

31DEC09 contains a change in the format of antenna files. Previous releases will not understand the antenna coordinates for arrays that were traditionally left-handed (VLBI primarily). The format change occurs automatically when any 31DEC09 or later antenna-file specific code reads the file, after which older releases will have difficulties. 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 31DEC20; even 31DEC19 will no longer be changed.

Improvements of interest to users in 31DEC20

In the latter half of 2020, new tasks appeared including FTARS to do Q/U fitting of TARS Faraday rotation data, SYPRT to print the contents of SysPower SY tables in detail, MASKS to make a mask image from an *AIPS* boxfile for input to CASA, OFUDG to process a UV data file applying a user-created algorithm to the data (FUDGE without calibration), FIXFR to reorder the frequencies in the spectral and IF axes to be in one direction, BPEPL to plot bandpass functions with multiple times over-plotted, ACIMG to make a frequency-time image from auto-correlation *uv* data, RIRMS to find the mean and rms of the real and imaginary parts of visibility data as a function of time and baseline, and CDFIX to repair catalog file headers that have been corrupted in the keyword records. A new verb called TV2COLOR implements a 2-color scheme for the *AIPS* TV display. A new RUN file called CXIMAGR implements an experimental complex imaging process. In the first six months of the year new tasks appeared including UVRMS to compute statistics on a time series of selected averaged visibility data, SPRMS to plot the spectra of mean and standard deviation of selected visibility data, MOD3D to convert a set of facet Clean Component files into a single "3-dimensional" CC table, PDPLT to plot polarization D-term spectra from multiple antennas and/or data sets, DENAN to report and remove NaNs from data sets, MTARS to compute rotation measure models for input to TARS (the test task for FARS), and RMTFC to plot the convolution of the complex rotation measure transfer function with various RM thickness models.

Normally, bugs which appear in an *AIPS* TST version and then are fixed in that same version before its release get little or no discussion in the *AIPSLetter*. Since a rather large number of sites now install the TST version of *AIPS* during its development, this is somewhat of an oversight. We urge you to run the "Midnight Job" at least once after 31DEC20 is frozen 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 *AIPS* documentation web page (http://www.aips.nrao.edu/aipsdoc.html). Please do not hesitate to contact us via the NRAO help desk (https://help.nrao.edu) or via e-mail daip@nrao.edu with any questions or suspicions that there are problems.

VLBI matters

The VLB data reduction pipeline VLBARUN continued to get attention in the reporting period. Since significant bad data can make BPASS find erroneous solutions, the option to run CLIP before the BPASS step was added. CLIP is, optionally, run either just before BPASS or just before the long FRING step. The option to clip bad rates and then smooth the rates was added. It is done on the output of FRING. An option to self-calibrate all of the calibration sources before the final SPLIT was added. This option makes Clean images of each calibration source and then runs FRING one source at a time with the resulting models.

The procedures for automatically downloading EOP (Earth orientation) and TEC (Total electron content) data from NASA have changed. The procedures in RUN files VLBAUTIL and VLAUTIL were revised to use the new method of download (with curl) and the new upper part of the web address. The previous download methods and addresses were discontinued by NASA on November 1, 2020.

FITLD had two significant bugs corrected. The scaling of auto-correlation data from the old VLBA correlator was wrong by a factor of order 10^6 due to the new weight scaling. The value of DIGICOR was damaged for non-VLBA data, causing the correction to be omitted for any included files after the first.

ACIMG is a new task to grid auto-correlation data making an image with frequency and time on the x and y axes, respectively. It should be helpful in examining data sets for RFI. See the color figure at the end of this section.

Imaging and Display

A scheme for imaging data in a fully complex fashion has been implemented. The new RUN file CXIMAGR implements the full process. UVIMG was changed to allow uniform weighting with ROBUST prior to the convolution to the grid. The option to suppress the use of the Hermitian property was added as was the option to make a "beam" image with all the same weighting and convolution options. FFT was given new OPCODEs to make images from the complex uv plane images produced by UVIMG. CXCLN required only minor changes to honor the input reference pixels and to actually honor the option to write a residual image rather than the restored Clean image. CCMRG and PRTCC were changed to handle complex Clean Component (CX) files as well as the usual CC files. The RUN file procedure CXIMAGR then runs UVIMG to make real, imaginary, and beam uv-plane images. It FFT's them to make map-plane images. It rescales those so that the peak of the beam is one. Then it renames them as if they were Q and U images so that CXCLN can, optionally, Clean them. This scheme works rather well but, I suspect, is inferior the the normal imaging done by IMAGR.

UVPLT was given a new axis type "baseline" which plots the data at baseline *i-j* and also at *j-i*. It can be very helpful in finding questionable data. `IMSIZE` was added to allow control of the grid size used.

ISPEC and `RPSEC` were changed to allow numerous circular and rectangular windows with `NBOXES` and `CLBOX`, both of which may be set interactively with `TVBOX`.

MASKS is a new task to make a mask image from *AIPS*' boxes in a `BOXFILE`. CASA requires a mask image rather than the list of circular and rectangular boxes used by *AIPS*.

TV2COLOR is a new verb to implement an interactive, two-color only TV enhancement. It should be useful for images having interesting negative as well as positive values such as images of Q and U polarization, residual images, or images of the deflection of the dish surface from ideal.

TVLABEL was corrected to preserve the data needed to plot the Clean beam.

UV data

RIRMS is a new task to compute the mean and rms of the real and imaginary parts of the visibilities over short time intervals as a function of time and baseline. It prints a matrix of the mean and rms of these for all antennas. It then can plot the time series or the histograms for selected baselines.

SYPRT is a new task to print the contents of the SysPower (`SY`) tables in glorious detail.

BPEPL is a new task to plot bandpass values with multiple times on the same plot. This is like the plots in `BPEDT` but can make plot files. It uses a grid in memory to compute the plot efficiently.

EDITA and `EDITR`, `BPEDT`, `SNEDT`, and `PCEDT` were changed to allow use of an in-core dynamic memory to compute each plot before displaying it on the TV. In complex cases, this will speed up the operation significantly.

FIXFR is a new task to re-order spectral windows and spectral channels so that the frequency all goes in one direction. The VLA can produce spectral windows in seemingly arbitrary order.

VLANT was enhanced with `DETIME` to limit how long after an observation one allows corrections to be made.

Calibration tasks now emit a message to say to what parameters calibration is being, and is not being, applied.

Analysis

FTARS is a new task to fit Q/U values to the input spectrum supplied to the rotation-measure synthesis study task `TARS`. It uses the algorithms of `RMFIT` with the input and output files of `TARS` to fit a complex rotation measure and polarization model to the data.

HOLOG had the math for reference pointed observations improved including a new option for the slope. The default magnification was changed to 13 which is correct for the VLA. The `OFFSET` equal to the distance from the prime focus and the bottom of the sub-reflector was added as an option with 0.522 meters (VLA value) as the default. The tilt parameters are now in degrees and the Cassegrain offsets may be included in the model.

UVHOL was changed to be more tolerant of small offsets from pure horizontal and vertical scans.

IMFIT and `JMFIT` now allow a 40000 pixel window.

General

Help files for adverbs were systematically updated to reference all verbs, tasks, and procedures using the adverb.

CookBook was updated on October 21 to account for numerous changes to help files and to mention new tasks and other changes.

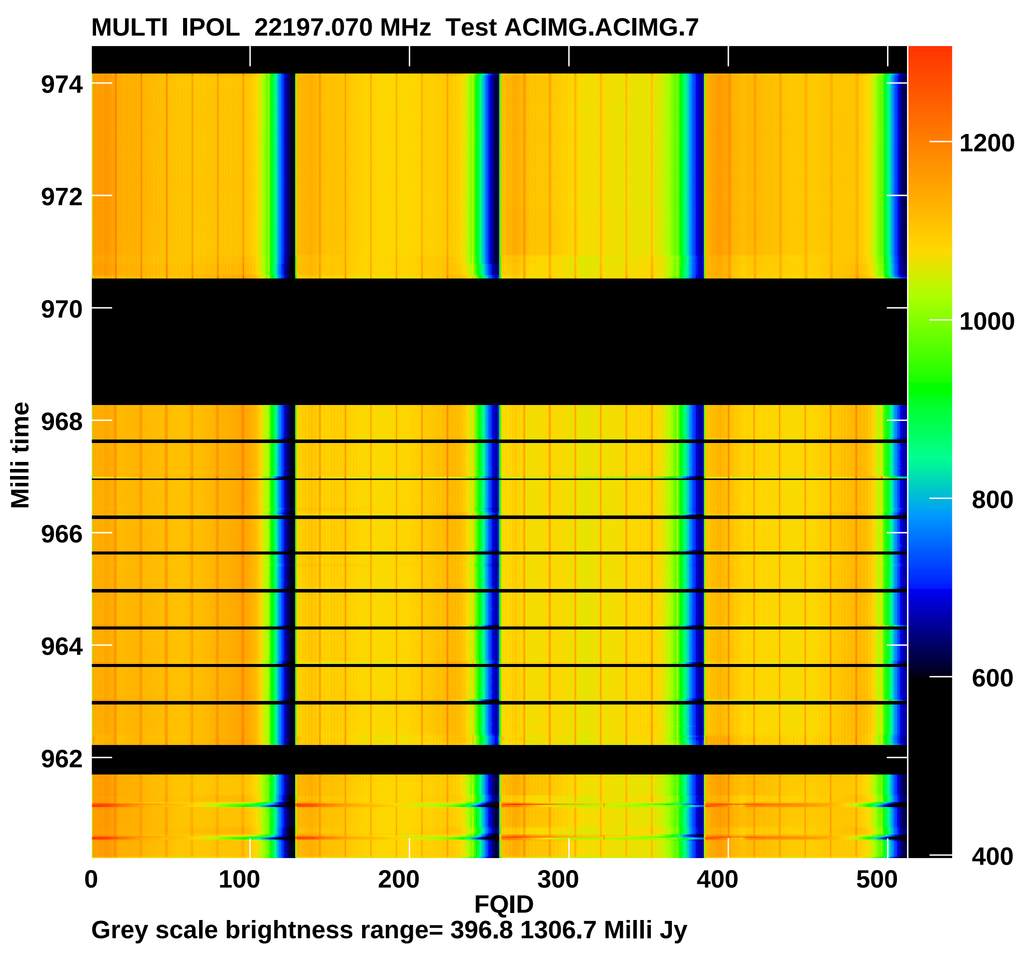
EXTLIST and `PLGET` were updated to account for changes to existing plot tasks and for the new ones.

AIPSPATH scripts were changed to put *AIPS* directories at the end of $PATH and $LD_LIBRARY_PATH variables. Because Mac OS X does not differentiate on case when executing procedures, new procedure names `AIPP`, `AIFC`, and `AILINK` were created to replace the now-conflicted names for pre-processing, compiling, and linking *AIPS* Fortran.

OFUDG is a "new" paraform task to process a *uv* data set through a user-created algorithm without the complication of all the calibration adverbs.

CDFIX is a new stand-alone program to repair catalog header files which have had the keyword section (records 2 and perhaps up) damaged.

RedHat 6 is no longer supported. All Linux binaries are now computed on a RedHat 7 system. Mac OS binaries are now computed on a 10.15 system but with an option that should allow systems as old as 10.10 to use the load modules.

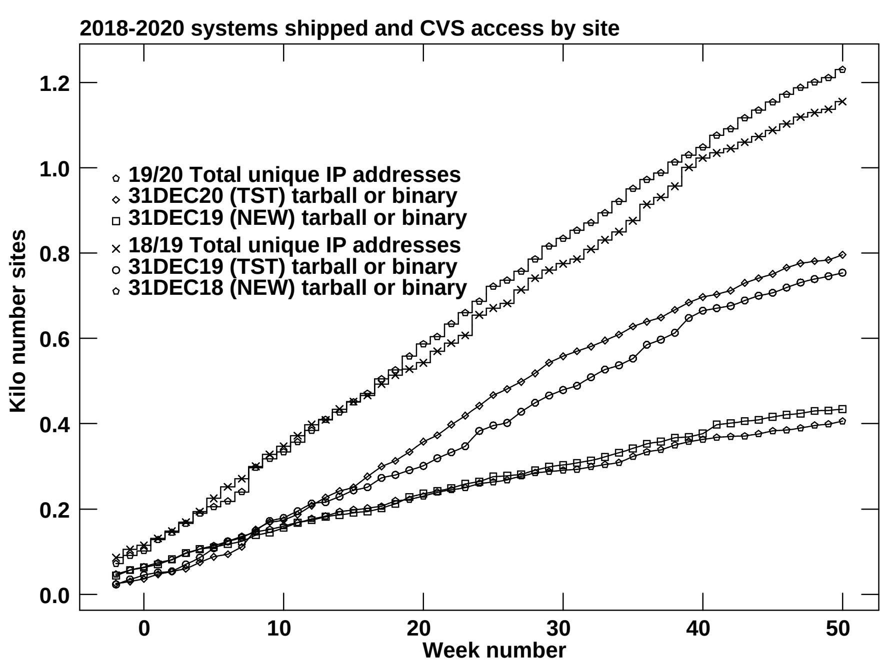


Example of output from `ACIMG`. The x axis is FQID (frequency ID number) because the channel increments over all 4 spectral windows is not entirely regular. The time axis is labeled in days.

AIPS Distribution

From the NRAO system logs, we count apparent MNJ accesses, downloads of the tar balls, and `rsync` accesses by unique IP address. 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 2020, a total of 434 different IP addresses downloaded the frozen form of `31DEC19` and 796 IP addresses downloaded `31DEC20` 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 1230. The table below shows these numbers as a function of year since we began recording them. The plot of numbers versus time shows that 2020 exceeded 2019, perhaps from people installing AIPS to run from home.

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

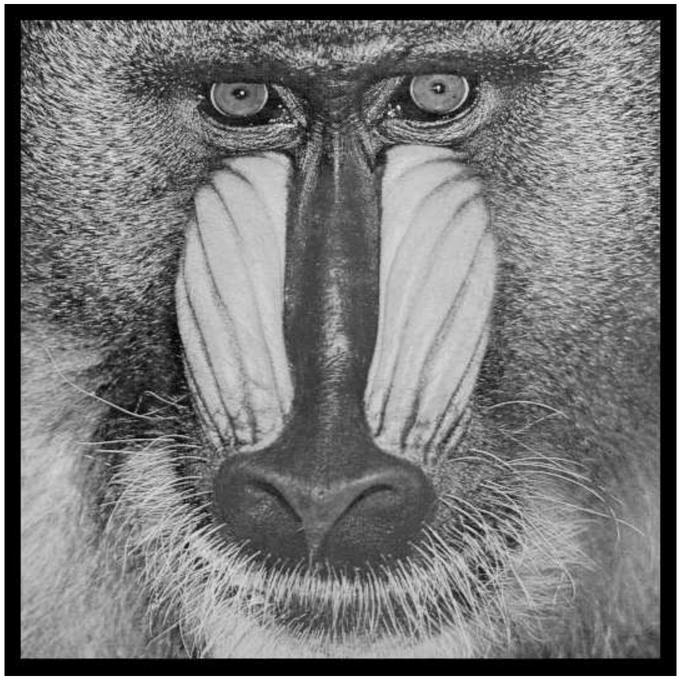


Patch Distribution for 31DEC19

Because of the extensive use of binary installations, we now patch the master copy of the most recently frozen version. Older versions are not corrected even for egregious errors. Thus, 31DEC19 was patched during 2020 and 31DEC20 will be patched as needed during 2021. Your copy of them may be corrected simply by running a Midnight Job. Information about patches and the code may be found using links from the main *AIPS* web page or by *anonymous* ftp to the NRAO server ftp.aoc.nrao.edu. Documentation about patches to a release is placed on this site at pub/software/aips/*release-name* and the code is placed in suitable sub-directories below this. Patches to older releases are kept here as well, but they will require local compilation.

The 31DEC19 release is no longer available for installation and will no longer receive patches even for egregious errors. It had a number of important patches during 2020. They are

1. BPASS had a bad call sequence causing aborts. *2020-01-22*
2. FACSET did not include all the flux of standard calibration source models. *2020-01-27*
3. UVFIX did not compute the aberration correction properly, especially when converting from B1950 to J2000. *2020-02-28*
4. EVAUV did not compute the DFT subtraction model correctly, aborting due to a call sequence error. *2020-03-02*
5. RENUMBER aborted if the catalog file required expansion. *2020-03-03*
6. CLIP over counted cross-hand flags when cross-hands are flagged because of parallel hands. *2020-03-25*
7. CLPLT, CAPLT died when trying to self-scale plots with only one point. *2020-04-07*
8. VLBAUTIL had an error when trying to use curl to fetch the EOP file. *2020-04-21*
9. VLBARUN had 2 errors when trying DOPLOT=2 to make a very large number of plots. *2020-05-07*
10. RLDLY had an error when selecting data. *2020-06-10*
11. PRTSY sorted on the wrong column when OPCODE was set. *2020-06-12*
12. CLCOR got confused on EOPS when the CT table had multiple nearly identical entries. *2020-06-19*
13. OMFIT had 3 FORMAT statements that were improper when writing to character string variables. *2020-06-29*
14. VLBAUTIL was changed for changes in the location and access of the data files needed by VLBAEOPS and VLBATECR. *2020-07-22*
15. IMEAN and TVLABEL needed minor fixes. *2020-07-29*
16. FITLD had a bad scaling for auto-correlations from the old VLBA hardware correlator. *2020-09-02*
17. FITLD messed up DIGICOR for non-VLBA data for all files after the first. *2020-12-21*



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