National Radio Astronomy Observatory   Tucson, Arizona

To:	Observers
From:	Jeff Mangum
Subject:	GAG Software at the 12m

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A Little History

The GAG software (Groupe d'Astrophysique de Grenoble) was originally installed on the VAXstation Chimp by Mark Gordon and Phillipe André back in May of 1992. This software includes the CLASS reduction program, the GreG (Grenoble Graphics) plotting program, the Gildas image processing program, and the ASTRO observation preparation program. At the NRAO 12m, the GAG software operates as a post-time processor rather than a real-time processor. Therefore, one must go through a conversion process in order to reduce 12m data in the GAG software programs. Through a series of revisions to the FITS interface of the CLASS program (called CFITS) made by Thierry Forveille, CFITS can now read FITS files produced by the UniPOPS program (SDD-FITS). This has greatly improved the interface between 12m data and the CLASS program.

Please understand that the NRAO staff can offer only limited support for CLASS. CLASS is maintained entirely by GAG. Questions concerning use of the GAG software should be directed to them or to Jeff Mangum (jmangum@as.arizona.edu). The following is a revision of a series of memos written by Mark Gordon describing the GAG software available at the 12m telescope.

Getting Your Data Into CLASS

Any of the UniPOPS files can be converted to CLASS format. If, for example, you wish to convert only scans 69 through 696 to CLASS format, you should first put them into a UniPOPS KEEP. The first step is to open a virgin UniPOPS KEEP file using the CHNGFILE command. Next, assuming that you haven't previously set any of the UniPOPS SELECT adverbs, write the scans to the new KEEP file using the following series of UniPOPS commands:

```
LineF>scan_min=69


LineF>scan_max=696


LineF>select ondata


LineF>scalar i


LineF>for i=1 to acount;get astack(i);keep;end
```

Next, you need to convert the KEEP file to a FITS file. This is done <u>within</u> UniPOPS by using the following command...

```
>system uni2fits
```

...and from <u>outside</u> UniPOPS by using the command...

```
% uni2fits
```

This program will ask you a series of questions, most of which are self-explanatory. For example, you will be asked for the name of the UniPOPS data file to translate (like LDATA, LSAVE, or LKEEP). When asked whether you want to write frequency or velocity as the third axis, use frequency (which is the default). Using velocity will *not* translate correctly to the CLASS program.

Once you have created a FITS file of your scans, you can enter the CFITS program by issuing the following command at the system prompt...

```
% cfits
```

Once you are in CFITS, you must open an output file which will eventually contain your converted 12m data. Use the following command to open this output file...

```
CFITS> file out outputfilename new
```

...where "outputfilename" is the name of the output file. Now you are ready to read the FITS data into CFITS and write it to the output file. This is done with the following command...

```
CFITS> read fitsfilename
```

...where "fitsfilename" is the name of the FITS file that you gave to the uni2fits program. CFITS may give a number of messages during the reading process, most of which you can ignore. When the read command finishes, you can exit CFITS.

You now have a CLASS-format data file which contains your 12m spectra.

Starting CLASS
The CLASS manual lies in the second section of this notebook. Read pages 7 to 25 of the manual (chapters 1, 2, and 3) if you have never used CLASS.

The GAG software is now available on Bohemia. To run the class program, just type **class** while logged into the obs acount. CLASS may respond with the following questions...

```
remove /home/sun/obs/class.mes ?
```

```
remove /home/sun/obs/class.log ?
```

...to which you should respond **yes**.

Because CLASS operates as a database, it provides criteria to select your spectra to allow easy manipulation of a large volume of data. This facility is particularly convenient for reducing mapping observations. For instance, at any time during your run at the telescope, it may be used to take a quick look at all the spectra

you have obtained for a particular source (cf. "CLASS Spectral Line Maps with the 12m Telescope" in the following memo).

IMPORTANT NOTE: The current version of CFITS has a bug in it which causes the frequency axis for each scan to be incorrectly specified. This bug is caused by the fact that CFITS specifies the frequency as both the RESTFREQ and CRVALi keywords in FITS. Within CLASS, this causes the FOFF and RESTF variables to be set to the same value, which causes the frequency axis scaling problem. Until this bug is fixed, spectra can be patched within CLASS by using the following commands after using the FIND command to put all of the scans you want to modify into the list and opening an output file into which these modified scans can be placed...

```
LAS> set variable spectro write <cr>


LAS> let foff = 0 <cr>


LAS> write <cr>
```

Data processing will be much easier if you use macros and know how to develop them. Useful examples of macros reside in the directory /usr/local/gildas/proc. These can be copied to the directory you are working in, or accessed from your subdirectory on Bohemia by prefixing *proc:* to your call to the macro (see example below). You can also make your own macros with any of the editors available on Bohemia. The filename should be something like "name.class", where "name" is the name you want to use when calling it from CLASS. The proper syntax for macros (e.g., loops) is based on the *SIC* command interpretor. You may thus want to consult Chapter 2 of the *SIC* manual, before writing your own macros.

As stated above, you enter CLASS by typing **class** <cr>. You will then get a prompt like LAS>. For easy access to this program, begin your CLASS session by calling the macro *proc:start.class*, which sets some useful defaults. Thus, at the LAS> prompt, type...

```
LAS> @proc:start <cr>
```

This macro will also open an x-window graphics screen for plotting. A listing of this macro is given at the end of this section. To get a hardcopy of a plot, type...

```
LAS> hard/pl <cr>
```

Your hardcopy plot will automatically be sent to the QMS1725 in the control room.

Source selection
To select scans from one source, use quotation marks to enclose the source name, as in...

```
LAS> set source "M345" <cr>
```

If a problem with case sensitivity occurs, this technique will avoid internal conversion of the source name from lower to upper, or from upper to lower case.

———————————————————————————**The CLASS startup macro** ———————————————————————————

```
!

!  Set up the CLASS parameters for running on bohemia.

!

!  Installed on Bohemia 11/20/93 (Jeff Mangum; jmangum@as.arizona.edu)

!

sic verify on

sic edit emacs

sic help page

device xauto

set format long

set ext .dat

set format origin on

set angle s

set unit v f

set plot histo

set align velocity

!

!  Set up some CLASS abbreviations

!

symbol st "set telescope"

symbol smx "set mode x"

symbol smy "set mode y"

symbol fi "file in"

symbol fo "file out"

symbol ss "set source"

symbol sw "set window"

symbol sc "set scan"
```

```
symbol sn "set num"

symbol sl "set line"

symbol so "set offset"

symbol scon "set cursor on"

symbol scof "set cursor off"

symbol su "set unit"

symbol sma "set mask"
```

A Word About Scan Numbers

NRAO uses subscan numbers to identify the receiver configuration for a given scan. For data taken with the filter banks, 1 indicates receiver channel 1 and a series configuration; 2, channel 1 and the second half of a parallel configuration (in this case, 1 would refer to the first half); 3, receiver channel 2 and a series configuration; 4, receiver channel 2 and the second half of a parallel configuration. For the hybrid correlator, the subscan numbers begin with 11. Other numbers indicate different configurations of the correlator. Table 1 shows the specifications for the subscan numbers.

In the table below I list the associated CLASS scan version numbers for each UniPOPS subscan number. **Note that, in general, this ordering will only be true for conversion of the raw (LDATA) data file.** When CFITS reads the SDD-FITS file, it will assign sequential version numbers to each occurrence of a given scan number. For example, if you have, in order, scans 17.11, 17.01, and 17.14 in your LKEEP file and you use uni2fits to write an SDD-FITS file of this LKEEP file, CFITS will read these three scans as 17,1; 17,2; and 17,3 (where the notation is (scan number,version number)). Therefore, one should do a fair amount of bookeeping in order to correctly associate UniPOPS scan numbers and their CLASS counterparts.

TABLE 1

SUBSCAN CODES FOR DATA SCANS

Subscan Number	Associated CLASS Version Number	Parallel Configuration	Series Configuration
Filter Banks			
01	1	IF 1 & First half of filter bank 1	IF 1 & Filter bank 1
02	2	IF 1 & Second half of filter bank 1	
03	3	IF 2 & First half of filter bank 2	IF 2 & Filter bank 2
04	4	IF 2 & Second half of filter bank 2	
Hybrid Spectrometer			
11	5		IF 1
12	6		IF 2
. . .	. . .		. . .
18	12		IF 8

Because of the NRAO scan number format, you will have to select your data using both the scan number and the version number. For example...

```
LAS> get 3240 5 <cr>
```

...will select the first IF channel of the hybrid spectrometer (UniPOPS subscan number 11) for scan number 3240.

_____Sample CLASS session _____

```
@proc:start

file in spectra

find/all

get first

plot

set window -5 10

file out spectrab new

@proc:baseit

file in spectrab

set mode x -10 15

set mode y -3 7

set plot normal

map match/grid/number

hard/pl

file out spectras new

@p:addspe

file in spectras

smx -10 15

smy -1 7

map match/grid

hard/pl

exit
```

GREG

The general purpose plotting program GREG can be run on Bohemia by typing...

```
% greg <cr>
```

...at the system prompt. You should see the prompt GreG>. Hardcopies can be made using the same command used in the CLASS program. See the GreG manual for more information.

ASTRO

The ASTRO part of the GAG software is useful for producing source availability charts. To run this program, issue the following command at the Bohemia system prompt...

```
% astro <cr>
```

See the ASTRO manual for examples and more information.

This memo expands upon a series of earlier memos by P. André and M. A. Gordon.