

# Starting Out With AIPS Tutorial

James M Anderson

This tutorial session is intended to get people familiar with the basic concepts of radio interferometry. The student will be introduced to interferometry data, visibilities, the  $(u,v)$  plane, calibration, and imaging.

## Step 1 --- Figure Out What to Observe (Reduce)

I decided to try to make an image of the Sun, as the Solar KSP is a significant part of GLOW. The NRAO image archive has a nice image of the Sun at 1400 MHz located at <http://images.nrao.edu/8>



Image courtesy of NRAO/AUI

Let's try to reduce the data ourselves.

## Step 2 --- Download the Data From the Archive

Conveniently, the NRAO image archive gives details about the observations used to make the image, so I downloaded the data from the NRAO data archive, making sure to select the "AIPS friendly" filename option.

This has resulted in two files on my hard drive in my current directory:

```
ls -l
total 54164
-rw-r-- 1 anderson zeall 21002240 2008-11-11 14:40 GD_1
-rw-r-- 1 anderson zeall 34392064 2008-11-11 14:41 GD_2
```

## Step 3 --- Start up AIPS

aips

I have chosen to use user ID 100, at semi-random selection.

At first, most of the arcane syntax used to enter commands to AIPS will be difficult. As this is a tutorial session which intends to teach you about radio interferometry, and not how to use AIPS, we will gloss over the technical challenges of interacting with AIPS.

In AIPS you the user interact with something called POPS. You give POPS information by setting variables called ADVERBS to specific values. You can tell POPS which TASK you plan to run by setting a TASK ADVERB. If you want to check the values of ADVERBs for the current TASK, you ask for INPUTS. Because POPS will try to figure out what you mean if you only input the first few letters of an ADVERB or VERB, you can often abbreviate this to just INP. Also note that since AIPS is case-insensitive by default, you could also just type inp. If you want help on a specific topic, ask for HELP. If you want even more explanation for something, say EXPLAIN. If you don't know what it is you are trying to do, but you have some vague notion, say APROPOS SOMETHING. Note that apostrophes, and in certain locations, the lack of an apostrophe are significant.

```
dowait=true  
dohist=1  
docrt=132  
dotv=1
```

## Step 4 --- Initial look at data

### FILLM

The AIPS task to read raw VLA data into AIPS is called FILLM.

```
task 'fillm'  
datain = 'PWD:GD_  
nfiles=0  
ncount=2  
vlamode='S '  
band 'l'  
doweight=10  
doconcat=true  
douvcomp=0  
cparm(2)=16  
cparm(4)=28  
cparm(8)=10./60  
dparm 0  
bparm 0  
timer 0  
calcode ' '  
clron  
go
```

This sets us up to read the data, sets the VLA mode to Solar, tells AIPS not to change the source if the position appears to be moving (which the Sun does), sets the shadowing limit to 28 meters, and sets

the CL table interval to 10 seconds.

## Header information

pcat

```
AIPS 1: Catalog on disk 1
AIPS 1: Cat Usid Mapname      Class  Seq Pt      Last access      Stat
AIPS 1:    1  100 19810926    .L BAND.      1 UV 14-NOV-2008 21:35:31
```

getn 1

imhe

```
AIPS 1: Image=MULTI      (UV)      Filename=19810926    .L BAND.    1
AIPS 1: Telescope=VLA      Receiver=VLA
AIPS 1: Observer=GD      User #= 100
AIPS 1: Observ. date=26-SEP-1981    Map date=14-NOV-2008
AIPS 1: # visibilities    556884    Sort order  TB
AIPS 1: Rand axes: UU-L-SIN  VV-L-SIN  WW-L-SIN  BASELINE  TIME1
AIPS 1:      SOURCE  FREQSEL
AIPS 1: -----
AIPS 1: Type      Pixels  Coord value      at Pixel      Coord incr  Rotat
AIPS 1: COMPLEX      3    1.0000000E+00      1.00    1.0000000E+00    0.00
AIPS 1: STOKES      4   -1.0000000E+00      1.00   -1.0000000E+00    0.00
AIPS 1: FREQ      1    1.4461500E+09      1.00    1.2500000E+07    0.00
AIPS 1: IF      1    1.0000000E+00      1.00    1.0000000E+00    0.00
AIPS 1: RA      1      00 00 00.000      1.00      3600.000    0.00
AIPS 1: DEC      1      00 00 00.000      1.00      3600.000    0.00
AIPS 1: -----
AIPS 1: Coordinate equinox    0.00
AIPS 1: Maximum version number of extension files of type HI is    1
AIPS 1: Maximum version number of extension files of type AN is    1
AIPS 1: Maximum version number of extension files of type NX is    1
AIPS 1: Maximum version number of extension files of type SU is    1
AIPS 1: Maximum version number of extension files of type FQ is    1
AIPS 1: Maximum version number of extension files of type CL is    1
AIPS 1: Maximum version number of extension files of type TY is    1
AIPS 1: Maximum version number of extension files of type WX is    1
AIPS 1: Maximum version number of extension files of type OF is    1
AIPS 1: Keyword = 'CORRMODE' value = '      '
AIPS 1: Keyword = 'VLAI FS ' value = 'AC      '
AIPS 1: Keyword = 'CORRCOEF' value =          -1
```

## LISTR --- scan listing

task 'listr'

indi 1

```
getn 1
optype 'scan'
docrt=132
flagver 0
sources ' '
stokes ' '
docalib 0
gainuse 1
dopol -1
dparm 0
go
```

```
vlb054    LISTR(31DEC08)    100    14-NOV-2008  21:42:46    Page    1
File = 19810926    .L BAND.    1 Vol = 1  Userid =    100
Freq = 1.446150006 GHz    Ncor = 4    No. vis =    556884
Scan summary listing
```

| Scan        | Source  | Qual   | Calcode | Sub | Timerange               | FrqID |
|-------------|---------|--------|---------|-----|-------------------------|-------|
| START VIS   | END VIS |        |         |     |                         |       |
| 1 1148-001  |         | : 0000 | C       | 1   | 0/13:53:25 - 0/13:53:25 | 1     |
| 1           | 351     |        |         |     |                         |       |
| 2 1148-001  |         | : 0000 | C       | 1   | 0/13:53:35 - 0/13:54:35 | 1     |
| 352         | 2808    |        |         |     |                         |       |
| 3 SUN       |         | : 0000 |         | 1   | 0/13:59:05 - 0/13:59:35 | 1     |
| 2809        | 4212    |        |         |     |                         |       |
| 4 SUN       |         | : 0000 |         | 1   | 0/14:05:15 - 0/14:09:35 | 1     |
| 4213        | 13689   |        |         |     |                         |       |
| 5 1148-001  |         | : 0000 | C       | 1   | 0/14:18:05 - 0/14:19:35 | 1     |
| 13690       | 17199   |        |         |     |                         |       |
| 6 SUN       |         | : 0000 |         | 1   | 0/14:20:15 - 0/14:24:35 | 1     |
| 17200       | 26676   |        |         |     |                         |       |
| 7 SUN       |         | : 0000 |         | 1   | 0/14:30:05 - 0/14:34:35 | 1     |
| 26677       | 36504   |        |         |     |                         |       |
| 8 1148-001  |         | : 0000 | C       | 1   | 0/14:43:05 - 0/14:44:35 | 1     |
| 36505       | 40014   |        |         |     |                         |       |
| 9 SUN       |         | : 0000 |         | 1   | 0/14:45:15 - 0/14:49:35 | 1     |
| 40015       | 49491   |        |         |     |                         |       |
| 10 SUN      |         | : 0000 |         | 1   | 0/14:55:05 - 0/14:59:25 | 1     |
| 49492       | 58968   |        |         |     |                         |       |
| 11 1148-001 |         | : 0000 | C       | 1   | 0/15:07:55 - 0/15:09:25 | 1     |
| 58969       | 62478   |        |         |     |                         |       |
| 12 SUN      |         | : 0000 |         | 1   | 0/15:10:05 - 0/15:14:25 | 1     |
| 62479       | 71955   |        |         |     |                         |       |
| 13 SUN      |         | : 0000 |         | 1   | 0/15:19:55 - 0/15:24:25 | 1     |
| 71956       | 81783   |        |         |     |                         |       |
| 14 1148-001 |         | : 0000 | C       | 1   | 0/15:32:55 - 0/15:34:25 | 1     |
| 81784       | 85293   |        |         |     |                         |       |
| 15 SUN      |         | : 0000 |         | 1   | 0/15:35:05 - 0/15:39:25 | 1     |
| 85294       | 94770   |        |         |     |                         |       |
| 16 SUN      |         | : 0000 |         | 1   | 0/15:44:55 - 0/15:49:25 | 1     |

|        |          |   |      |   |   |                         |   |
|--------|----------|---|------|---|---|-------------------------|---|
| 94771  | 104598   |   |      |   |   |                         |   |
| 17     | 1148-001 | : | 0000 | C | 1 | 0/15:57:55 - 0/15:59:25 | 1 |
| 104599 | 108108   |   |      |   |   |                         |   |
| 18     | SUN      | : | 0000 |   | 1 | 0/16:00:05 - 0/16:04:15 | 1 |
| 108109 | 117234   |   |      |   |   |                         |   |
| 19     | SUN      | : | 0000 |   | 1 | 0/16:09:45 - 0/16:14:15 | 1 |
| 117235 | 127062   |   |      |   |   |                         |   |
| 20     | 1148-001 | : | 0000 | C | 1 | 0/16:22:45 - 0/16:24:15 | 1 |
| 127063 | 130572   |   |      |   |   |                         |   |
| 21     | SUN      | : | 0000 |   | 1 | 0/16:24:55 - 0/16:29:15 | 1 |
| 130573 | 140049   |   |      |   |   |                         |   |
| 22     | SUN      | : | 0000 |   | 1 | 0/16:34:45 - 0/16:39:15 | 1 |
| 140050 | 149877   |   |      |   |   |                         |   |
| 23     | 1148-001 | : | 0000 | C | 1 | 0/16:47:45 - 0/16:49:15 | 1 |
| 149878 | 153387   |   |      |   |   |                         |   |
| 24     | SUN      | : | 0000 |   | 1 | 0/16:49:55 - 0/16:54:15 | 1 |
| 153388 | 162864   |   |      |   |   |                         |   |
| 25     | SUN      | : | 0000 |   | 1 | 0/16:59:45 - 0/17:04:05 | 1 |
| 162865 | 172341   |   |      |   |   |                         |   |
| 26     | 1148-001 | : | 0000 | C | 1 | 0/17:12:35 - 0/17:14:05 | 1 |
| 172342 | 175851   |   |      |   |   |                         |   |
| 27     | SUN      | : | 0000 |   | 1 | 0/17:14:45 - 0/17:19:05 | 1 |
| 175852 | 185328   |   |      |   |   |                         |   |
| 28     | SUN      | : | 0000 |   | 1 | 0/17:24:35 - 0/17:29:05 | 1 |
| 185329 | 195156   |   |      |   |   |                         |   |
| 29     | 1148-001 | : | 0000 | C | 1 | 0/17:37:35 - 0/17:39:05 | 1 |
| 195157 | 198666   |   |      |   |   |                         |   |
| 30     | SUN      | : | 0000 |   | 1 | 0/17:39:45 - 0/17:44:25 | 1 |
| 198667 | 208845   |   |      |   |   |                         |   |
| 31     | SUN      | : | 0000 |   | 1 | 0/17:50:15 - 0/17:54:05 | 1 |
| 208846 | 217269   |   |      |   |   |                         |   |
| 32     | 1148-001 | : | 0000 | C | 1 | 0/18:02:25 - 0/18:03:55 | 1 |
| 217270 | 220779   |   |      |   |   |                         |   |
| 33     | SUN      | : | 0000 |   | 1 | 0/18:04:35 - 0/18:08:55 | 1 |
| 220780 | 230256   |   |      |   |   |                         |   |
| 34     | SUN      | : | 0000 |   | 1 | 0/18:14:25 - 0/18:18:55 | 1 |
| 230257 | 240084   |   |      |   |   |                         |   |
| 35     | 1148-001 | : | 0000 | C | 1 | 0/18:27:25 - 0/18:28:55 | 1 |
| 240085 | 243594   |   |      |   |   |                         |   |
| 36     | SUN      | : | 0000 |   | 1 | 0/18:29:35 - 0/18:33:55 | 1 |
| 243595 | 253071   |   |      |   |   |                         |   |
| 37     | SUN      | : | 0000 |   | 1 | 0/18:39:35 - 0/18:44:05 | 1 |
| 253072 | 262899   |   |      |   |   |                         |   |
| 38     | 1148-001 | : | 0000 | C | 1 | 0/18:52:35 - 0/18:53:55 | 1 |
| 262900 | 266058   |   |      |   |   |                         |   |
| 39     | SUN      | : | 0000 |   | 1 | 0/18:54:45 - 0/18:59:05 | 1 |
| 266059 | 275535   |   |      |   |   |                         |   |
| 40     | SUN      | : | 0000 |   | 1 | 0/19:04:25 - 0/19:08:45 | 1 |
| 275536 | 285012   |   |      |   |   |                         |   |
| 41     | 1148-001 | : | 0000 | C | 1 | 0/19:17:25 - 0/19:18:45 | 1 |
| 285013 | 288171   |   |      |   |   |                         |   |

|               |          |   |                         |   |
|---------------|----------|---|-------------------------|---|
| 42 SUN        | : 0000   | 1 | 0/19:19:25 - 0/19:23:45 | 1 |
| 288172 297648 |          |   |                         |   |
| 43 SUN        | : 0000   | 1 | 0/19:29:15 - 0/19:33:45 | 1 |
| 297649 307476 |          |   |                         |   |
| 44 1148-001   | : 0000 C | 1 | 0/19:42:15 - 0/19:43:45 | 1 |
| 307477 310986 |          |   |                         |   |
| 45 SUN        | : 0000   | 1 | 0/19:44:25 - 0/19:53:05 | 1 |
| 310987 329589 |          |   |                         |   |
| 46 SUN        | : 0000   | 1 | 0/19:54:25 - 0/19:58:45 | 1 |
| 329590 339066 |          |   |                         |   |
| 47 1148-001   | : 0000 C | 1 | 0/20:07:05 - 0/20:08:35 | 1 |
| 339067 342576 |          |   |                         |   |
| 48 SUN        | : 0000   | 1 | 0/20:09:15 - 0/20:13:35 | 1 |
| 342577 352053 |          |   |                         |   |
| 49 SUN        | : 0000   | 1 | 0/20:19:05 - 0/20:23:35 | 1 |
| 352054 361881 |          |   |                         |   |
| 50 1148-001   | : 0000 C | 1 | 0/20:32:05 - 0/20:33:35 | 1 |
| 361882 365391 |          |   |                         |   |
| 51 SUN        | : 0000   | 1 | 0/20:34:15 - 0/20:38:35 | 1 |
| 365392 374868 |          |   |                         |   |
| 52 SUN        | : 0000   | 1 | 0/20:44:05 - 0/20:48:35 | 1 |
| 374869 384696 |          |   |                         |   |
| 53 1148-001   | : 0000 C | 1 | 0/20:57:05 - 0/20:58:35 | 1 |
| 384697 388206 |          |   |                         |   |
| 54 SUN        | : 0000   | 1 | 0/20:59:15 - 0/21:03:35 | 1 |
| 388207 397657 |          |   |                         |   |
| 55 SUN        | : 0000   | 1 | 0/21:08:55 - 0/21:13:25 | 1 |
| 397658 407485 |          |   |                         |   |
| 56 1148-001   | : 0000 C | 1 | 0/21:21:55 - 0/21:23:25 | 1 |
| 407486 410969 |          |   |                         |   |
| 57 SUN        | : 0000   | 1 | 0/21:24:05 - 0/21:28:25 | 1 |
| 410970 420446 |          |   |                         |   |
| 58 SUN        | : 0000   | 1 | 0/21:33:55 - 0/21:38:25 | 1 |
| 420447 430274 |          |   |                         |   |
| 59 1148-001   | : 0000 C | 1 | 0/21:47:05 - 0/21:48:25 | 1 |
| 430275 433433 |          |   |                         |   |
| 60 SUN        | : 0000   | 1 | 0/21:49:05 - 0/21:53:25 | 1 |
| 433434 442858 |          |   |                         |   |
| 61 SUN        | : 0000   | 1 | 0/21:58:55 - 0/22:03:25 | 1 |
| 442859 452686 |          |   |                         |   |
| 62 1148-001   | : 0000 C | 1 | 0/22:11:45 - 0/22:13:15 | 1 |
| 452687 456196 |          |   |                         |   |
| 63 SUN        | : 0000   | 1 | 0/22:13:55 - 0/22:18:15 | 1 |
| 456197 465647 |          |   |                         |   |
| 64 SUN        | : 0000   | 1 | 0/22:23:55 - 0/22:28:15 | 1 |
| 465648 475124 |          |   |                         |   |
| 65 1148-001   | : 0000 C | 1 | 0/22:36:55 - 0/22:38:15 | 1 |
| 475125 478283 |          |   |                         |   |
| 66 SUN        | : 0000   | 1 | 0/22:38:55 - 0/22:43:15 | 1 |
| 478284 487734 |          |   |                         |   |

|                                                                                               |            |                |                 |               |       |            |   |            |   |
|-----------------------------------------------------------------------------------------------|------------|----------------|-----------------|---------------|-------|------------|---|------------|---|
| 67                                                                                            | SUN        |                | : 0000          |               | 1     | 0/22:48:55 | - | 0/22:53:25 | 1 |
| 487735                                                                                        | 497562     |                |                 |               |       |            |   |            |   |
| 68                                                                                            | 1148-001   |                | : 0000          | C             | 1     | 0/23:01:55 | - | 0/23:03:15 | 1 |
| 497563                                                                                        | 500721     |                |                 |               |       |            |   |            |   |
| 69                                                                                            | SUN        |                | : 0000          |               | 1     | 0/23:03:55 | - | 0/23:08:05 | 1 |
| 500722                                                                                        | 509847     |                |                 |               |       |            |   |            |   |
| 70                                                                                            | SUN        |                | : 0000          |               | 1     | 0/23:13:45 | - | 0/23:18:05 | 1 |
| 509848                                                                                        | 519324     |                |                 |               |       |            |   |            |   |
| 71                                                                                            | 1148-001   |                | : 0000          | C             | 1     | 0/23:26:45 | - | 0/23:28:05 | 1 |
| 519325                                                                                        | 522249     |                |                 |               |       |            |   |            |   |
| 72                                                                                            | SUN        |                | : 0000          |               | 1     | 0/23:28:45 | - | 0/23:33:05 | 1 |
| 522250                                                                                        | 531700     |                |                 |               |       |            |   |            |   |
| 73                                                                                            | SUN        |                | : 0000          |               | 1     | 0/23:38:45 | - | 0/23:43:05 | 1 |
| 531701                                                                                        | 540450     |                |                 |               |       |            |   |            |   |
| 74                                                                                            | 1148-001   |                | : 0000          | C             | 1     | 0/23:51:45 | - | 0/23:53:05 | 1 |
| 540451                                                                                        | 543350     |                |                 |               |       |            |   |            |   |
| 75                                                                                            | SUN        |                | : 0000          |               | 1     | 0/23:53:45 | - | 0/23:58:05 | 1 |
| 543351                                                                                        | 552125     |                |                 |               |       |            |   |            |   |
| 76                                                                                            | SUN        |                | : 0000          |               | 1     | 1/00:01:15 | - | 1/00:01:15 | 1 |
| 552126                                                                                        | 552450     |                |                 |               |       |            |   |            |   |
| 77                                                                                            | SUN        |                | : 0000          |               | 1     | 1/00:07:25 | - | 1/00:07:55 | 1 |
| 552451                                                                                        | 553725     |                |                 |               |       |            |   |            |   |
| 78                                                                                            | 3C286      |                | : 0000          | B             | 1     | 1/00:21:35 | - | 1/00:22:55 | 1 |
| 553726                                                                                        | 556884     |                |                 |               |       |            |   |            |   |
| Source summary                                                                                |            |                |                 |               |       |            |   |            |   |
| Velocity type = '                    '                    Definition = '                    ' |            |                |                 |               |       |            |   |            |   |
|                                                                                               |            |                |                 |               |       |            |   |            |   |
| ID Source                                                                                     | Qual       | Calcode        | RA( 0.0)        | Dec( 0.0)     | IFlux |            |   |            |   |
| QFlux UFlux VFlux                                                                             | No. vis    |                |                 |               |       |            |   |            |   |
| 1 1148-001                                                                                    | : 0000     | C              | 11:48:10.1300   | -00:07:13.300 | 0.000 |            |   |            |   |
| 0.000 0.000 0.000                                                                             | 84072      |                |                 |               |       |            |   |            |   |
| 2 SUN                                                                                         | : 0000     |                | 12:10:30.1272   | -01:08:22.648 | 0.000 |            |   |            |   |
| 0.000 0.000 0.000                                                                             | 469653     |                |                 |               |       |            |   |            |   |
| 3 3C286                                                                                       | : 0000     | B              | 13:28:49.6570   | 30:45:58.640  | 0.000 |            |   |            |   |
| 0.000 0.000 0.000                                                                             | 3159       |                |                 |               |       |            |   |            |   |
|                                                                                               |            |                |                 |               |       |            |   |            |   |
| ID Source                                                                                     | Freq(GHz)  | Velocity(Km/s) | Rest freq (GHz) |               |       |            |   |            |   |
| 1 All Sources                                                                                 | 1.4462     | 0.0000         | 0.0000          |               |       |            |   |            |   |
| Frequency Table summary                                                                       |            |                |                 |               |       |            |   |            |   |
| FQID IF#                                                                                      | Freq(GHz)  | BW(kHz)        | Ch.Sep(kHz)     | Sideband      |       |            |   |            |   |
| 1 1                                                                                           | 1.44615001 | 12500.0010     | 12500.0010      | 1             |       |            |   |            |   |
| AIPS 1: Resumes                                                                               |            |                |                 |               |       |            |   |            |   |

PRTAN

Print the Antenna positions — useful for thinking about calibration.

go prtan

vlb054 PRTAN(31DEC08) 100 14-NOV-2008 21:45:10 Page 1  
File=19810926 .L BAND. 1 An.ver= 1 Vol= 1 User= 100  
Array= VLA Freq= 1446.150006 MHz Ref.date= 26-SEP-1981

Array reference position in meters (Earth centered)

Array BX= -1601185.36500 BY= -5041977.54700 BZ= 3554875.87000

Polar X = 0.00000 Polar Y = 0.00000 arcsec

Earth rotation rate = 360.9856449713 degrees / IAT day

GST at UT=0 = 364.7139688925 degrees

UT1-UTC= 0.0000000 Data time(IAT )-UTC= 0.0000000 seconds

Solutions not yet determined for a particular FREQID

Ant 1 = VLA:\_N2 BX= -30.0602 BY= -4.7835 BZ= 45.7022  
Mount=ALAZ Axis offset= 0.0000 meters IFA IFB  
Feed polarization type = R L

Ant 2 = VLA:\_E5 BX= 51.8719 BY= 195.8466 BZ= -75.1013  
Mount=ALAZ Axis offset= 0.0000 meters IFA IFB  
Feed polarization type = R L

Ant 3 = VLA:\_E9 BX= 139.6430 BY= 536.8956 BZ= -207.7424  
Mount=ALAZ Axis offset= -0.0033 meters IFA IFB  
Feed polarization type = R L

Ant 4 = VLA:\_E6 BX= 70.6548 BY= 267.7575 BZ= -102.8996  
Mount=ALAZ Axis offset= 0.0078 meters IFA IFB  
Feed polarization type = R L

Ant 5 = VLA:\_N3 BX= -52.4373 BY= -8.2629 BZ= 78.6643  
Mount=ALAZ Axis offset= 0.0000 meters IFA IFB  
Feed polarization type = R L

Ant 6 = VLA:\_W2 BX= 14.7735 BY= -37.1404 BZ= -20.2135  
Mount=ALAZ Axis offset= 0.0000 meters IFA IFB  
Feed polarization type = R L

Ant 7 = VLA:\_W3 BX= 28.9195 BY= -74.4876 BZ= -41.0524  
Mount=ALAZ Axis offset= -0.0036 meters IFA IFB  
Feed polarization type = R L

Ant 8 = VLA:\_W1 BX= 22.9920 BY= 3.4974 BZ= -32.4864  
Mount=ALAZ Axis offset= 0.0084 meters IFA IFB  
Feed polarization type = R L

Ant 9 = VLA:\_E2 BX= 11.3328 BY= 40.6638 BZ= -15.1624  
Mount=ALAZ Axis offset= 0.0000 meters IFA IFB  
Feed polarization type = R L

|                          |                |     |           |     |           |
|--------------------------|----------------|-----|-----------|-----|-----------|
| Ant 10 = VLA:_OUT BX=    | 0.0000         | BY= | 0.0000    | BZ= | 0.0000    |
| Mount=ALAZ Axis offset=  | 0.0000 meters  | IFA |           | IFB |           |
| Feed polarization type = |                | R   |           | L   |           |
| Ant 11 = VLA:_E8 BX=     | 114.4257       | BY= | 438.6941  | BZ= | -169.4880 |
| Mount=ALAZ Axis offset=  | 0.0048 meters  | IFA |           | IFB |           |
| Feed polarization type = |                | R   |           | L   |           |
| Ant 12 = VLA:_E3 BX=     | 21.9945        | BY= | 81.5250   | BZ= | -30.9498  |
| Mount=ALAZ Axis offset=  | 0.0000 meters  | IFA |           | IFB |           |
| Feed polarization type = |                | R   |           | L   |           |
| Ant 13 = VLA:_E7 BX=     | 91.5227        | BY= | 348.8871  | BZ= | -134.4449 |
| Mount=ALAZ Axis offset=  | 0.0000 meters  | IFA |           | IFB |           |
| Feed polarization type = |                | R   |           | L   |           |
| Ant 14 = VLA:_W7 BX=     | 121.6261       | BY= | -319.1264 | BZ= | -177.5842 |
| Mount=ALAZ Axis offset=  | 0.0000 meters  | IFA |           | IFB |           |
| Feed polarization type = |                | R   |           | L   |           |
| Ant 15 = VLA:_W9 BX=     | 186.8061       | BY= | -491.1158 | BZ= | -273.5624 |
| Mount=ALAZ Axis offset=  | 0.0000 meters  | IFA |           | IFB |           |
| Feed polarization type = |                | R   |           | L   |           |
| Ant 16 = VLA:_E4 BX=     | 35.6150        | BY= | 133.6310  | BZ= | -51.1099  |
| Mount=ALAZ Axis offset=  | -0.0051 meters | IFA |           | IFB |           |
| Feed polarization type = |                | R   |           | L   |           |
| Ant 17 = VLA:_W8 BX=     | 152.7524       | BY= | -401.2839 | BZ= | -223.4146 |
| Mount=ALAZ Axis offset=  | 0.0000 meters  | IFA |           | IFB |           |
| Feed polarization type = |                | R   |           | L   |           |
| Ant 18 = VLA:_E1 BX=     | 45.3386        | BY= | 7.0026    | BZ= | -65.4888  |
| Mount=ALAZ Axis offset=  | 0.0000 meters  | IFA |           | IFB |           |
| Feed polarization type = |                | R   |           | L   |           |
| Ant 19 = VLA:_N7 BX=     | -193.6105      | BY= | -30.2503  | BZ= | 286.4580  |
| Mount=ALAZ Axis offset=  | -0.0030 meters | IFA |           | IFB |           |
| Feed polarization type = |                | R   |           | L   |           |
| Ant 20 = VLA:_N1 BX=     | 0.6703         | BY= | 0.0144    | BZ= | 0.5135    |
| Mount=ALAZ Axis offset=  | 0.0045 meters  | IFA |           | IFB |           |
| Feed polarization type = |                | R   |           | L   |           |
| Ant 21 = VLA:_N8 BX=     | -243.6039      | BY= | -38.0389  | BZ= | 360.0340  |
| Mount=ALAZ Axis offset=  | 0.0000 meters  | IFA |           | IFB |           |
| Feed polarization type = |                | R   |           | L   |           |
| Ant 22 = VLA:_W5 BX=     | 68.6012        | BY= | -179.2282 | BZ= | -99.5242  |
| Mount=ALAZ Axis offset=  | 0.0000 meters  | IFA |           | IFB |           |
| Feed polarization type = |                | R   |           | L   |           |

|                          |                            |               |               |
|--------------------------|----------------------------|---------------|---------------|
| Ant 23 = VLA:_N5         | BX= -108.4301              | BY= -16.9862  | BZ= 161.0152  |
| Mount=ALAZ               | Axis offset= 0.0000 meters | IFA           | IFB           |
| Feed polarization type = |                            | R             | L             |
|                          |                            |               |               |
| Ant 24 = VLA:_N9         | BX= -298.3837              | BY= -46.5620  | BZ= 440.6260  |
| Mount=ALAZ               | Axis offset= 0.0000 meters | IFA           | IFB           |
| Feed polarization type = |                            | R             | L             |
|                          |                            |               |               |
| Ant 25 = VLA:_N6         | BX= -148.4545              | BY= -23.2162  | BZ= 219.9871  |
| Mount=ALAZ               | Axis offset= 0.0000 meters | IFA           | IFB           |
| Feed polarization type = |                            | R             | L             |
|                          |                            |               |               |
| Ant 26 = VLA:_N4         | BX= -74.8318               | BY= -11.7331  | BZ= 111.6208  |
| Mount=ALAZ               | Axis offset= 0.0000 meters | IFA           | IFB           |
| Feed polarization type = |                            | R             | L             |
|                          |                            |               |               |
| Ant 27 = VLA:_W6         | BX= 93.5170                | BY= -245.0012 | BZ= -136.2284 |
| Mount=ALAZ               | Axis offset= 0.0000 meters | IFA           | IFB           |
| Feed polarization type = |                            | R             | L             |
|                          |                            |               |               |
| Ant 28 = VLA:_W4         | BX= 46.9220                | BY= -122.0267 | BZ= -67.6047  |
| Mount=ALAZ               | Axis offset= 0.0000 meters | IFA           | IFB           |
| Feed polarization type = |                            | R             | L             |
|                          |                            |               |               |
| Ant 29 = VPT:_OUT        | BX= 0.0000                 | BY= 0.0000    | BZ= 0.0000    |
| Mount=ALAZ               | Axis offset= 0.0000 meters | IFA           | IFB           |
| Feed polarization type = |                            | R             | L             |

#### Location Of VLA Antennas

|                 |  |  |
|-----------------|--|--|
| N9 (24)         |  |  |
| N8 (21)         |  |  |
| N7 (19)         |  |  |
| N6 (25)         |  |  |
| N5 (23)         |  |  |
| N4 (26)         |  |  |
| N3 ( 5)         |  |  |
| N2 ( 1)         |  |  |
| N1 (20)         |  |  |
| ( 8) W1 E1 (18) |  |  |
| ( 6) W2 E2 ( 9) |  |  |
| ( 7) W3 E3 (12) |  |  |
| (28) W4 E4 (16) |  |  |
| (22) W5 E5 ( 2) |  |  |
| (27) W6 E6 ( 4) |  |  |
| (14) W7 E7 (13) |  |  |
| (17) W8 E8 (11) |  |  |
| (15) W9 E9 ( 3) |  |  |
| VLA:_OUT (10)   |  |  |
| VPT:_OUT (29)   |  |  |

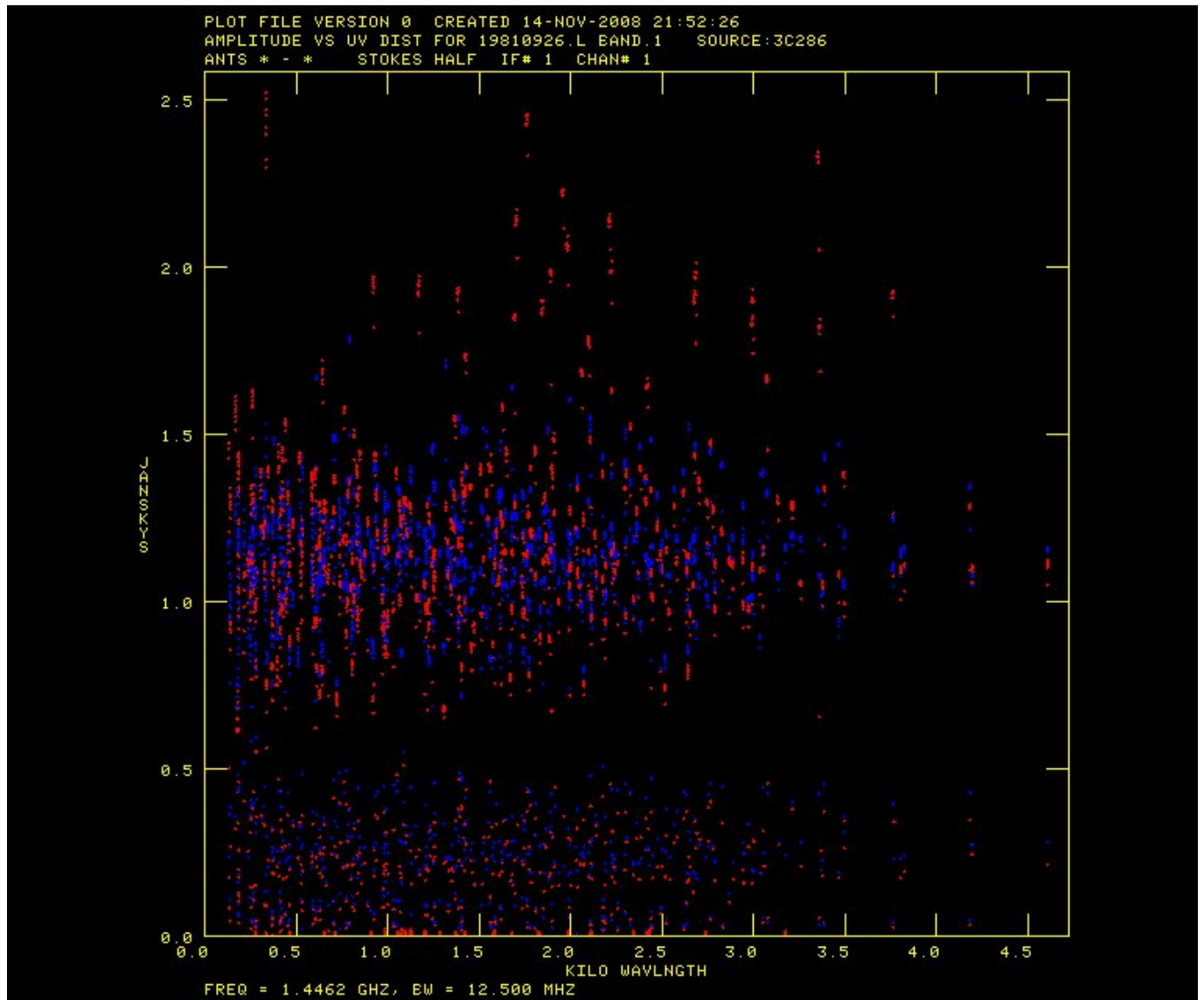
## AIPS 1: Resumes

The really important part for you, the data reducer, is the antenna layout at the bottom. This tells you in a nice graphical form where each antenna is located. This helps you to figure out which baselines are small, and which baselines are long. This is also useful for figuring out other things related to antenna position and baseline direction.

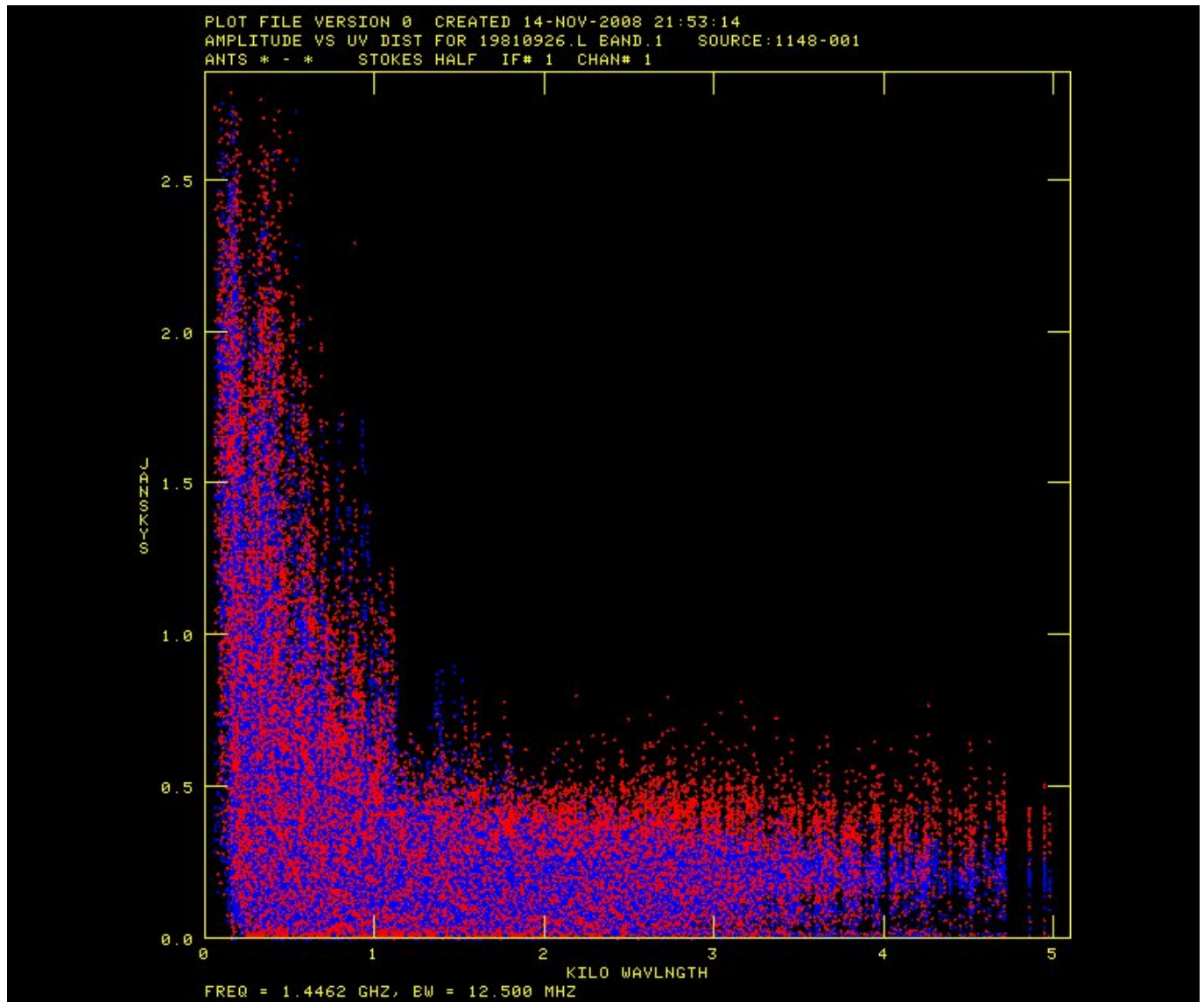
## UVPLT

Let's have a look at the information about the visibilities.

```
task 'uvplt'  
source '3c286', ' '  
stokes 'half'  
calcode ' '  
uvrange 0  
antennas 0  
basel 0  
xinc 1  
aparm 0  
bparm 0  
doweight 1  
refant 3  
do3col 1  
dotv 1  
tvinit  
go
```

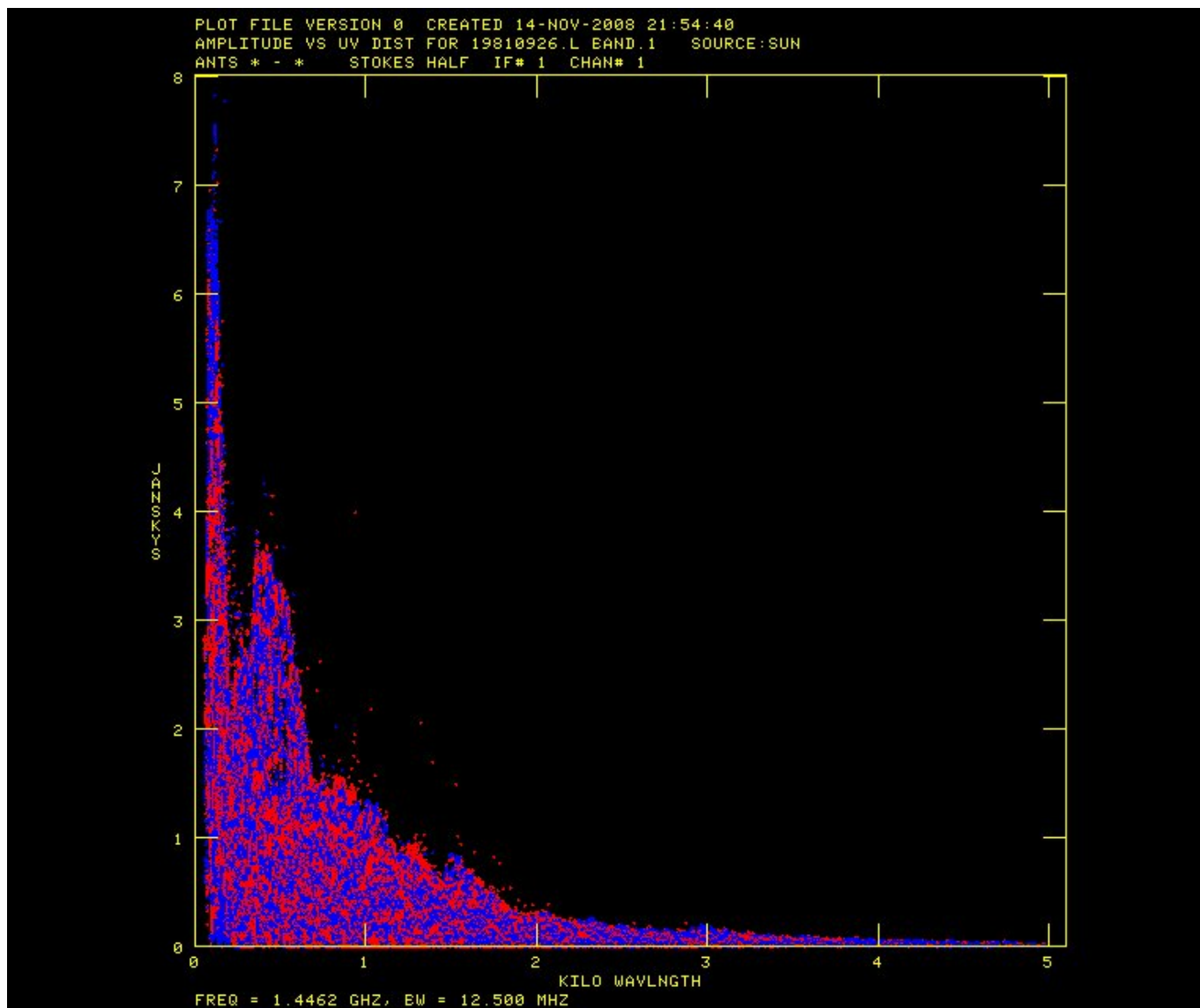


source '1148-001', ' '  
go

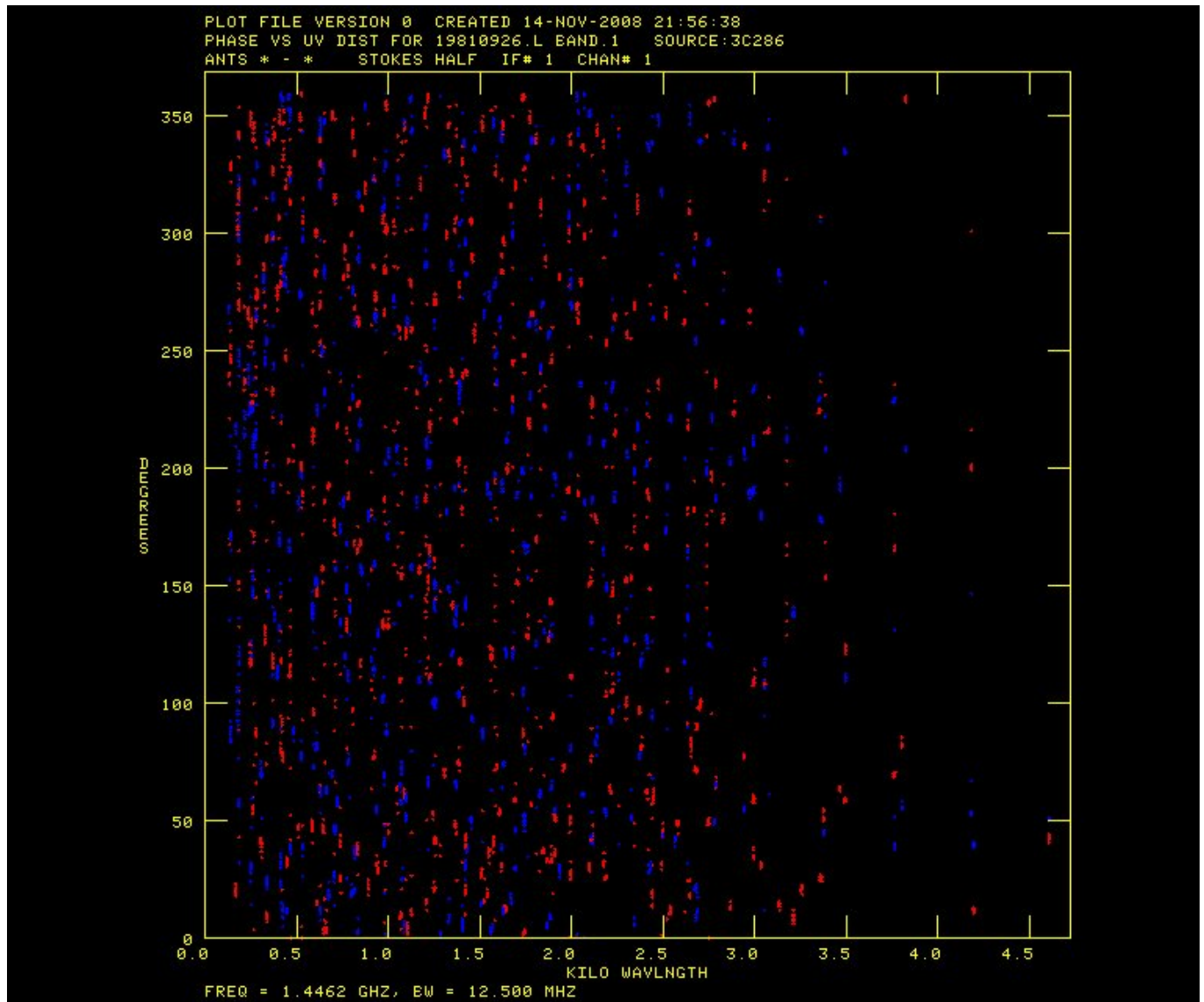


Warning: the next step will take a long time. You are free to skip this, and just look at the picture.

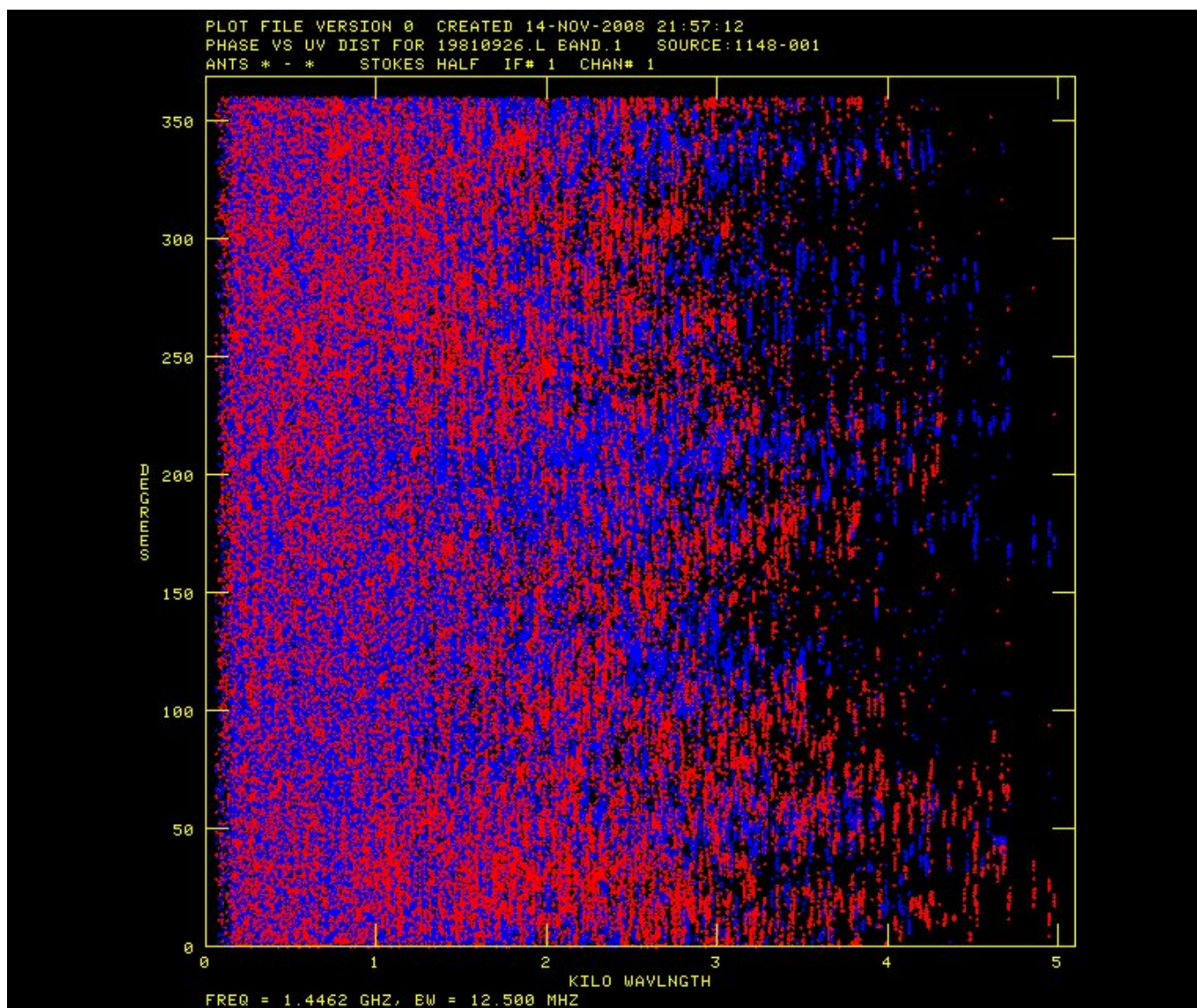
```
source 'sun', ' '
go
```



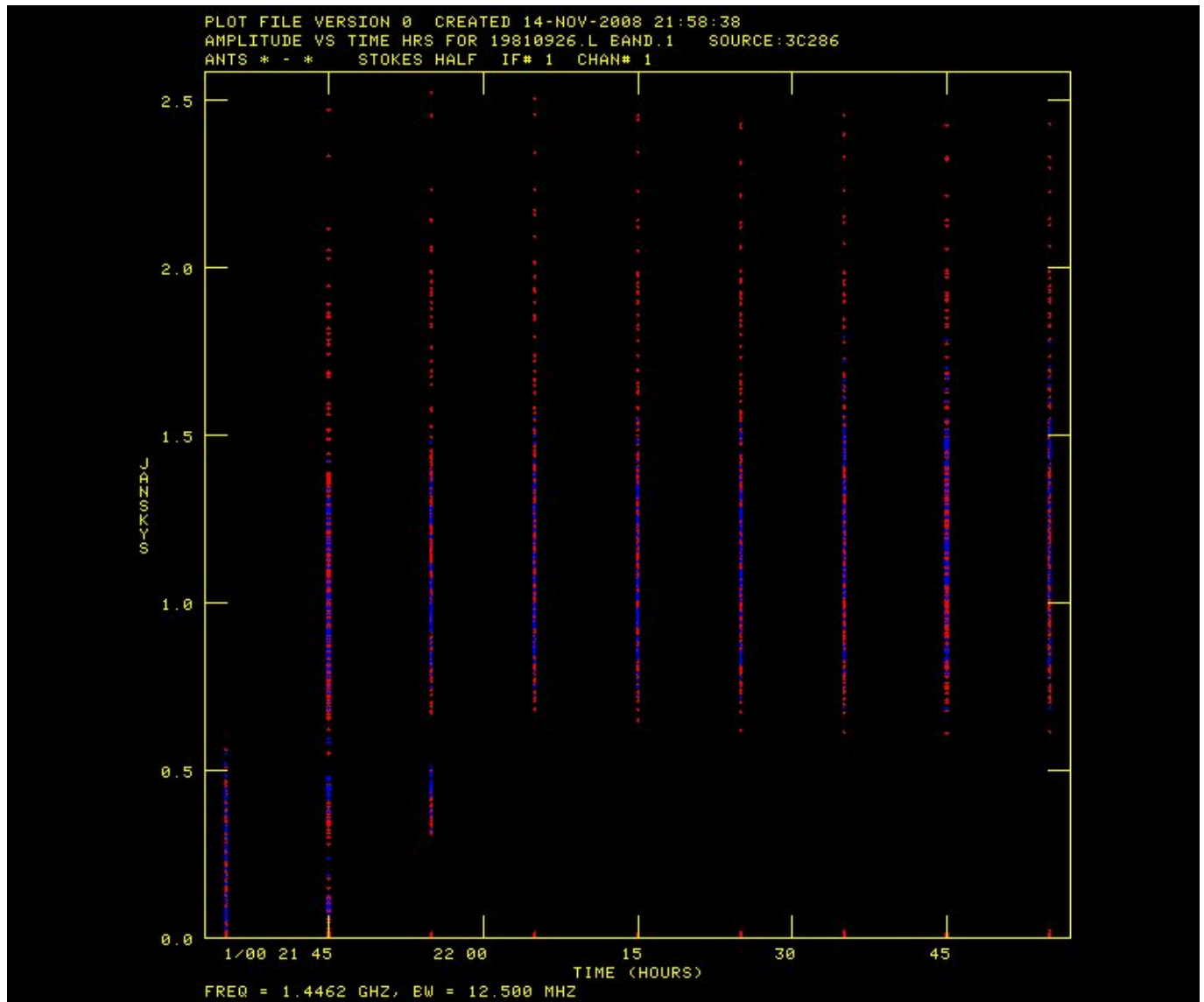
```
source '3c286', ' '  
bparm 0 2  
go
```



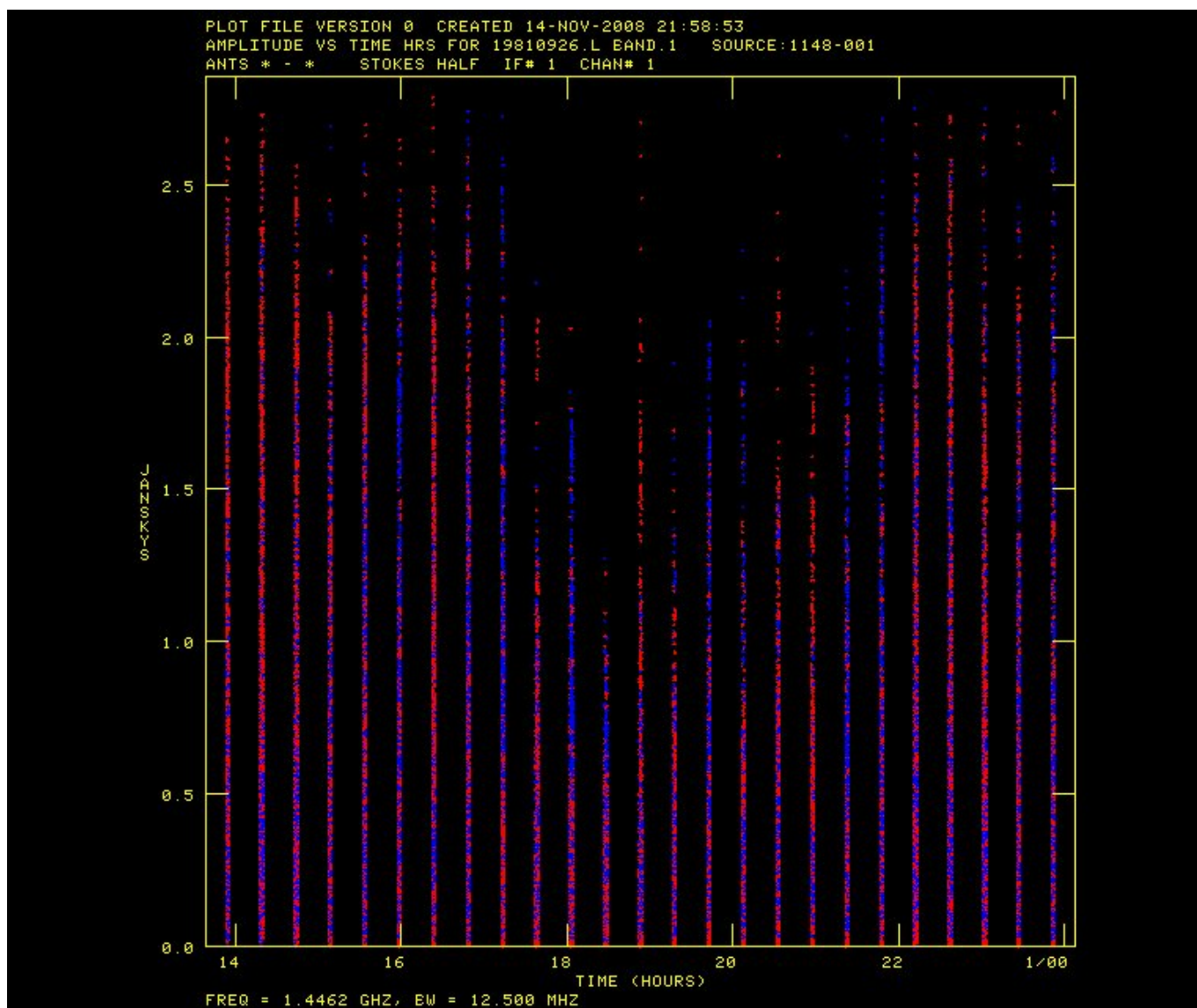
source '1148-001', ' '  
go



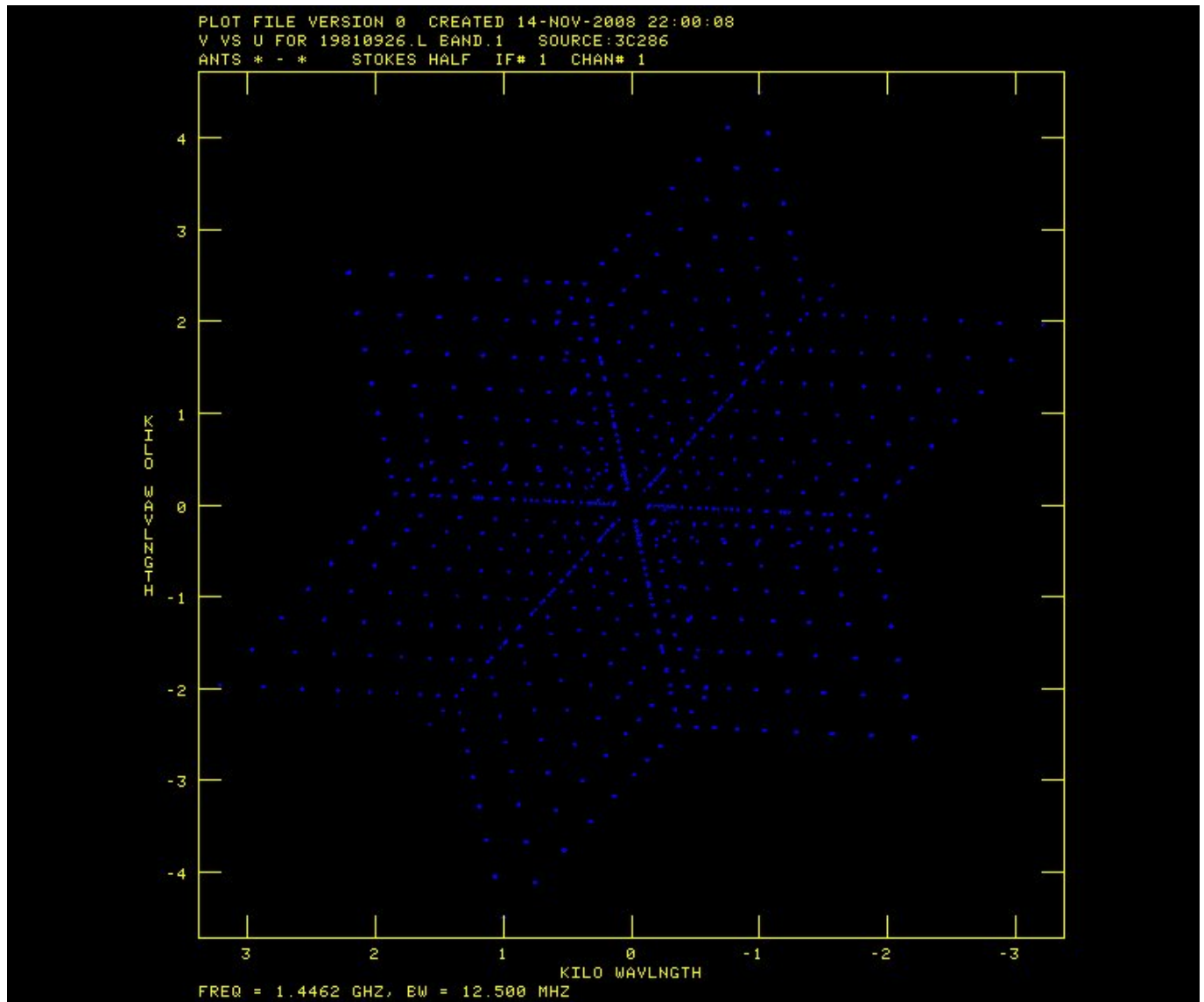
```
source '3c286', ' '  
bparm 11 1  
go
```



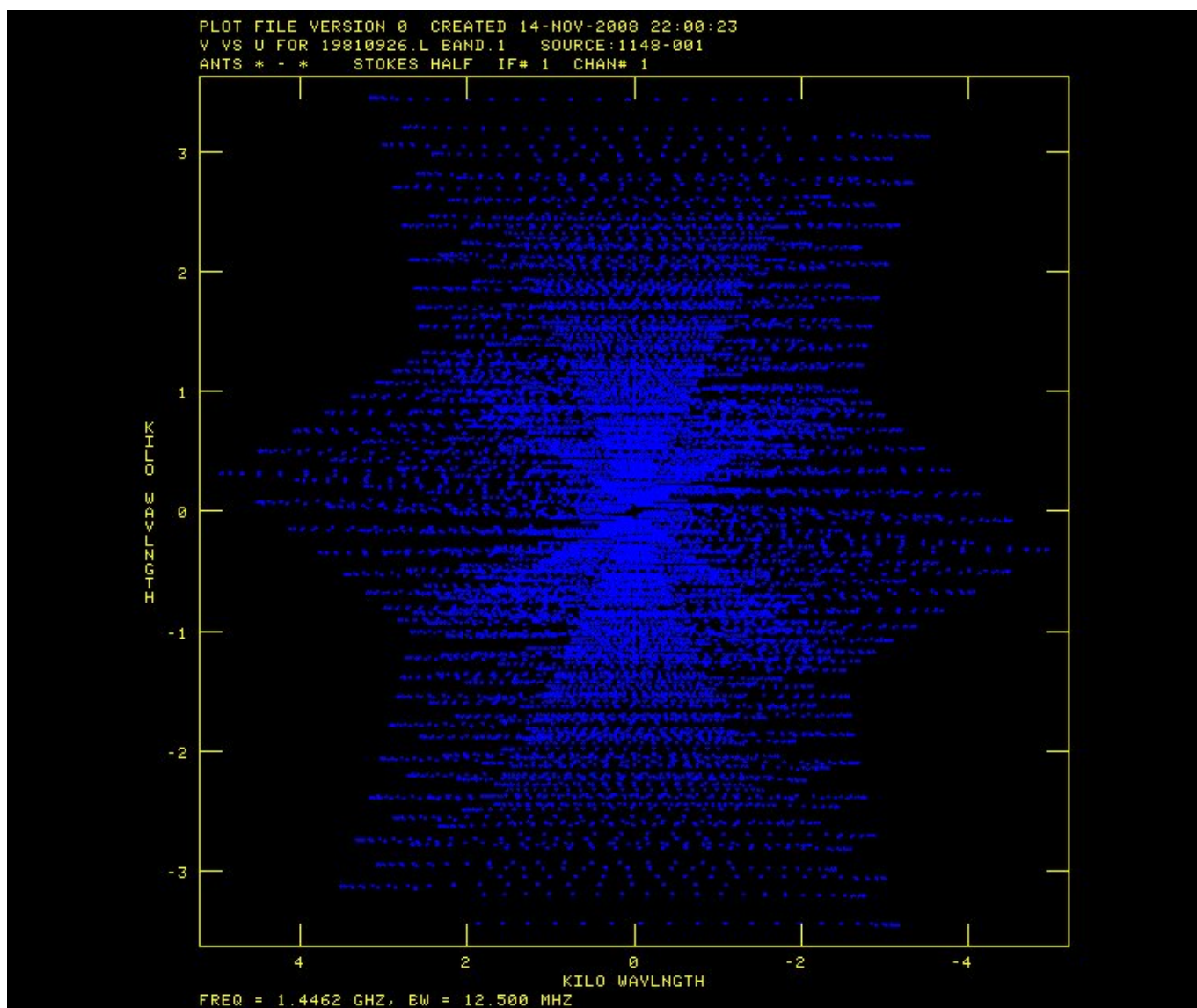
```
source '1148-001', ' '
go
```



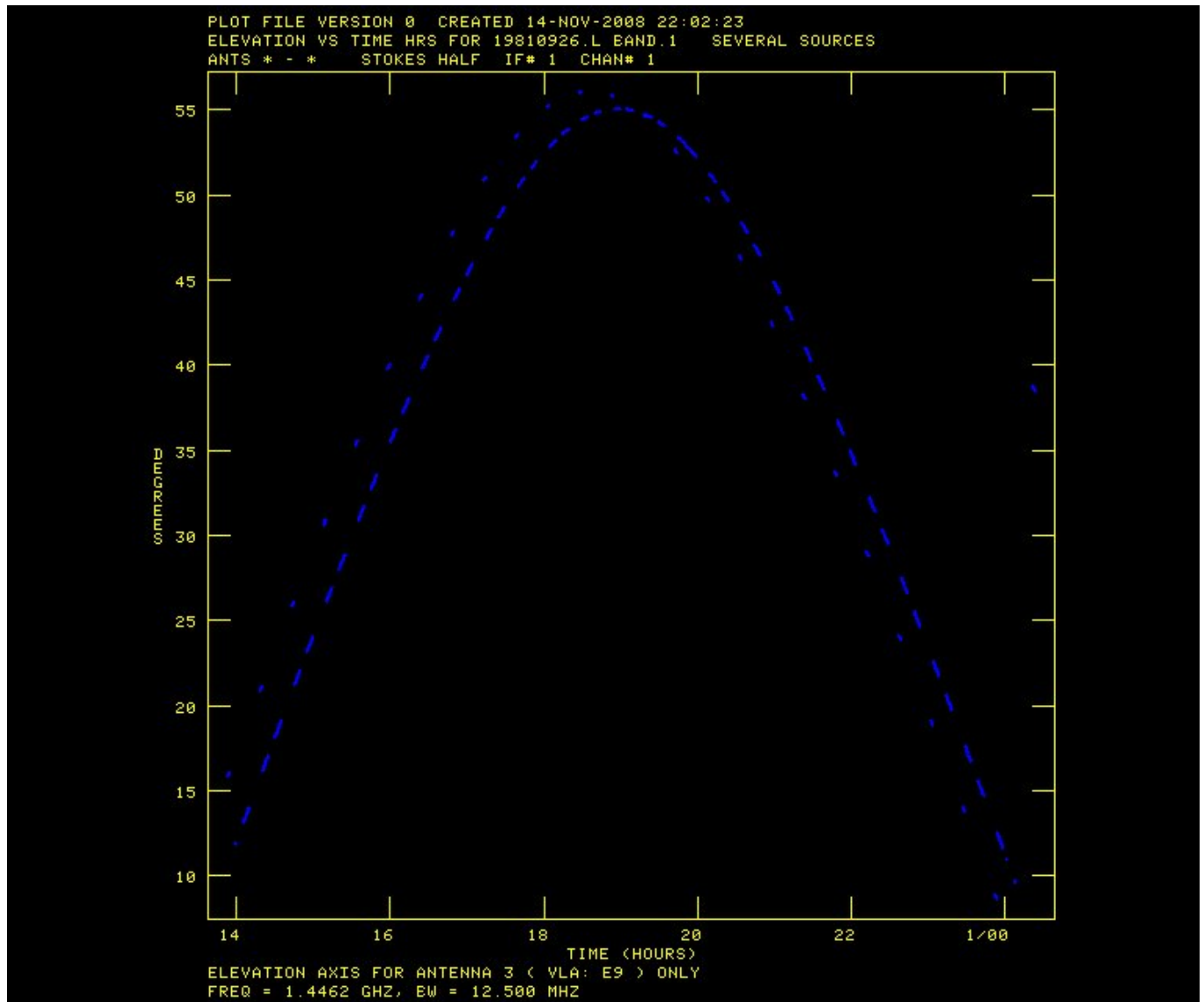
source '3c286', '  
bparm 6 7  
go



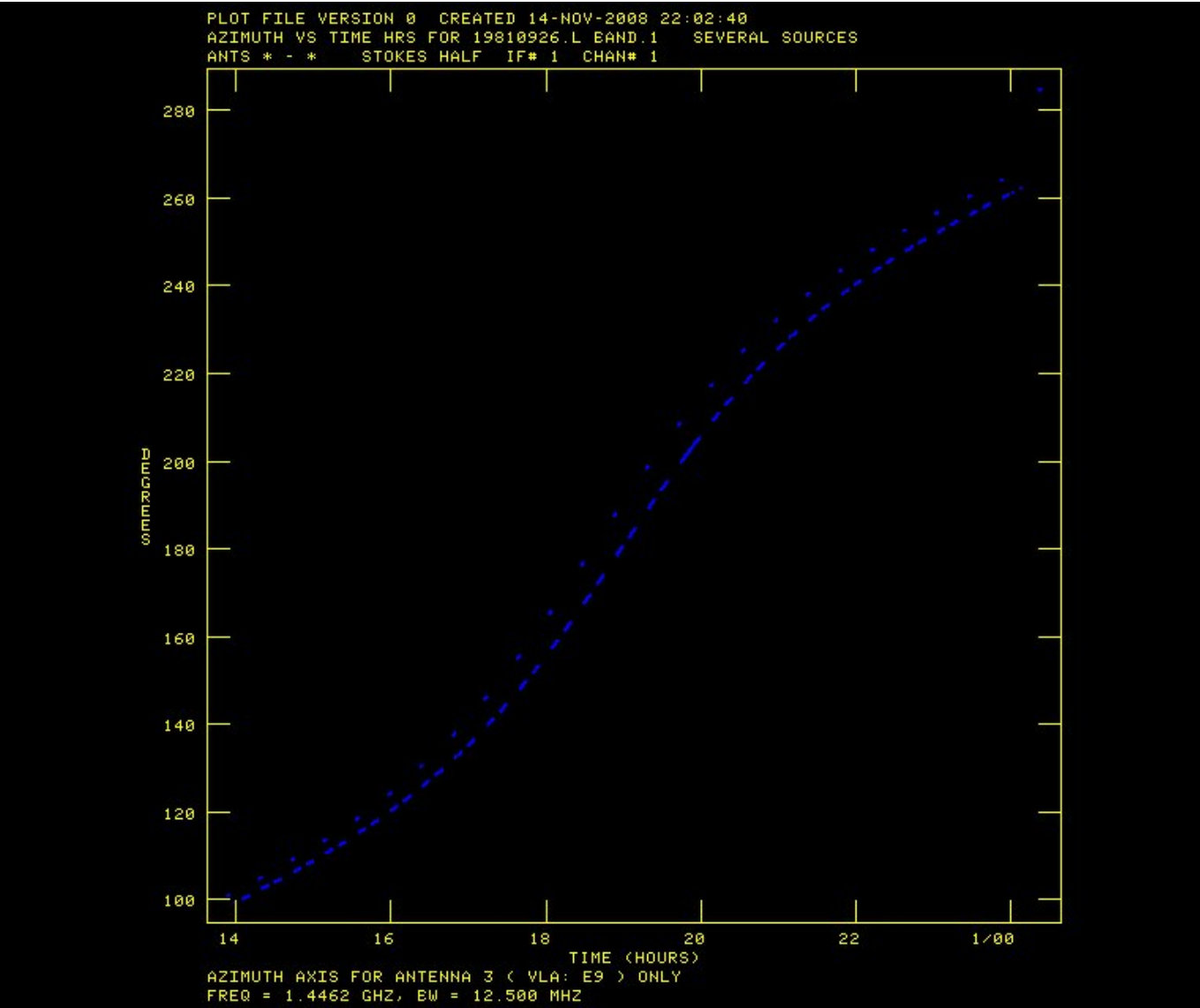
source '1148-001', ' '  
 go



```
source ' '  
bparm 11 15  
xinc 50  
go
```



bparm 11 18  
go



# LISTR

Now let's look at the raw visibility numbers.

```
xinc 1
task 'listr'
optype 'list'
source '3c286', ' '
stokes ' '
bif 0
eif 0
flagver 0
dparm 0
antenna 3,0
go
```

|                 |                |     |             |              |            |      |
|-----------------|----------------|-----|-------------|--------------|------------|------|
| vlb054          | LISTR(31DEC08) | 100 | 14-NOV-2008 | 22:05:45     | Page       | 1    |
| File = 19810926 | .L BAND.       | 1   | Vol = 1     | Userid = 100 | Channels = | 1- 1 |

```

IF = 1
Freq= 1.446150006 GHz   Ncor= 1   No. vis=      3159
Stokes = RR   Subarray = 1

Source=3C286           : 0000, Stokes=RR , IF= 1, Chans= 1- 1
Flux = 0.0000 Jy, Calcode = B , Freq = 1.446150006 GHz
Amplitudes, 1000 = 1.000 Jy, averging type = Vector

Baselines      1 3 2 3 3 4 3 5 3 6 3 7 3 8 3 9 310 311 312 313 314 315 316
317 318 319 320 321 322 323 324 325 326 327 328 329
1/00:21:35 293 259 258 282 45 360 431 333      563 326 247 264 256 469
287 127 283 84 56 455 12 344 307 313 321 347
Amplitudes, 1000 = 10.000 Jy, averging type = Vector
1/00:21:45 195 180 182 168 15 212 234 203      247 135 160 177 169 187
174 156 178 129 66 205 1 185 186 189 158 158
1/00:21:55 206 196 194 176 67 223 246 214      252 139 169 192 183 193
183 185 190 188 205 214 1 192 199 199 165 168
1/00:22:05 209 197 197 179 165 223 246 217      251 144 172 193 185 194
186 186 193 190 235 216 1 193 201 202 167 169
1/00:22:15 205 194 196 178 198 223 244 214      246 140 170 189 182 193
183 186 190 190 235 212 0 193 198 199 164 169
1/00:22:25 206 192 197 177 196 222 243 214      242 139 165 189 180 193
183 184 190 186 231 212 1 191 197 199 164 168
1/00:22:35 207 195 196 178 198 223 246 215      240 140 166 192 182 192
184 185 190 190 233 214 0 192 199 199 165 168
1/00:22:45 206 192 192 177 199 222 243 213      232 141 168 191 183 190
183 185 191 187 233 214 1 191 197 198 164 169
1/00:22:55 206 193 195 179 199 223 243 213      230 140 170 190 182 193
183 185 190 186 233 215 1 191 197 199 164 169
AIPS 1: Resumes

```

## Flagging

Just enter these commands. We can talk later about why they needed to be applied.

```

task 'quack'
sources ' '
stokes ' '
bif 0
eif 0
timer 0
antenna 0
basel 0
flagver 1
opcode 'beg'
reason 'bad start'
aparm 0
aparm(2) 15/60

```

```
go
antenna 6,0
aparm(2) 35/60
go
task 'uvflg'
antenna 23,0
basel 0
timer 0
aparm 0
opcode 'flag'
reason 'bad ant'
dohist 1
go
antenna 26,0
timer 0 18 29 0 0 20 7 20
go
timer 0 0 0 0 0 15 8 10
go
timer 0 21 48 30 0 22 37 10
go
antenna 25,0
timer 0 22 38 20 1 0 21 50
go
```

## More LISTR, now on the phase calibrator

```
task 'listr'
optype 'list'
source '1148-001', ' '
stokes ' '
calcode ' '
bif 0
eif 0
flagver 0
dparm 0
antenna 3,0
go
```

```
vlb054    LISTR(31DEC08)    100    14-NOV-2008  22:35:27    Page    1
File = 19810926    .L BAND.    1 Vol = 1  Userid = 100    Channels = 1-    1
IF = 1
Freq= 1.446150006 GHz    Ncor= 1    No. vis=    84072
Stokes = RR    Subarray = 1
Applying flag table 1
```

```
Source=1148-001    : 0000, Stokes=RR , IF= 1, Chans= 1-    1
Flux = 0.0000 Jy, Calcode = C , Freq = 1.446150006 GHz
```

Amplitudes, 1000 = 10.000 Jy, averging type = Vector

| Baselines  | 1   | 3   | 2   | 3   | 3   | 4   | 3   | 5   | 3   | 6   | 3   | 7   | 3 | 8 | 3 | 9 | 310 | 311 | 312 | 313 | 314 | 315 | 316 |
|------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|---|---|---|---|-----|-----|-----|-----|-----|-----|-----|
| 317        | 318 | 319 | 320 | 321 | 322 | 323 | 324 | 325 | 326 | 327 | 328 | 329 |   |   |   |   |     |     |     |     |     |     |     |
| 0/13:53:55 |     |     |     | 57  | 126 | 58  | 53  |     |     | 86  | 123 | 73  |   |   |   |   | 195 | 32  | 57  | 13  | 23  | 66  |     |
| 30         | 36  | 27  | 75  | 30  | 89  |     | 24  | 20  | 28  | 45  | 103 |     |   |   |   |   |     |     |     |     |     |     |     |
| 0/13:54:05 |     |     |     | 67  | 134 | 66  | 24  |     |     | 65  | 155 | 47  |   |   |   |   | 213 | 26  | 66  | 28  | 28  | 92  |     |
| 30         | 53  | 35  | 60  | 26  | 63  |     | 28  | 33  | 55  | 77  | 103 |     |   |   |   |   |     |     |     |     |     |     |     |
| 0/13:54:15 |     |     |     | 43  | 124 | 77  | 29  | 43  | 26  | 144 | 44  |     |   |   |   |   | 184 | 36  | 77  | 40  | 29  | 96  |     |
| 19         | 39  | 29  | 34  | 31  | 34  |     | 26  | 34  | 76  | 62  | 134 |     |   |   |   |   |     |     |     |     |     |     |     |
| 0/13:54:25 |     |     |     | 6   | 104 | 91  | 62  | 40  | 68  | 96  | 73  |     |   |   |   |   | 177 | 59  | 93  | 30  | 30  | 87  |     |
| 35         | 4   | 26  | 41  | 45  | 78  |     | 32  | 31  | 74  | 14  | 139 |     |   |   |   |   |     |     |     |     |     |     |     |
| 0/13:54:35 |     |     |     | 28  | 84  | 94  | 70  | 21  | 93  | 69  | 80  |     |   |   |   |   | 191 | 56  | 104 | 19  | 31  | 61  |     |
| 34         | 50  | 31  | 68  | 42  | 94  |     | 31  | 24  | 41  | 46  | 99  |     |   |   |   |   |     |     |     |     |     |     |     |

Source=1148-001 : 0000, Stokes=RR , IF= 1, Chans= 1- 1  
 Flux = 0.0000 Jy, Calcode = C , Freq = 1.446150006 GHz  
 Amplitudes, 1000 = 10.000 Jy, averging type = Vector

| Baselines  | 1   | 3   | 2   | 3   | 3   | 4   | 3   | 5   | 3   | 6   | 3   | 7   | 3 | 8 | 3 | 9 | 310 | 311 | 312 | 313 | 314 | 315 | 316 |
|------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|---|---|---|---|-----|-----|-----|-----|-----|-----|-----|
| 317        | 318 | 319 | 320 | 321 | 322 | 323 | 324 | 325 | 326 | 327 | 328 | 329 |   |   |   |   |     |     |     |     |     |     |     |
| 0/14:18:25 |     |     |     | 37  | 65  | 58  | 31  |     |     | 101 | 107 | 83  |   |   |   |   | 230 | 68  | 57  | 35  | 34  | 81  |     |
| 33         | 90  | 40  | 56  | 18  | 32  |     | 32  | 45  | 69  | 32  | 47  |     |   |   |   |   |     |     |     |     |     |     |     |
| 0/14:18:35 |     |     |     | 4   | 65  | 55  | 22  |     |     | 78  | 85  | 80  |   |   |   |   | 191 | 67  | 58  | 28  | 28  | 78  |     |
| 26         | 58  | 28  | 58  | 33  | 50  |     | 29  | 39  | 28  | 17  | 39  |     |   |   |   |   |     |     |     |     |     |     |     |
| 0/14:18:45 |     |     |     | 36  | 62  | 56  | 30  | 17  | 32  | 45  | 47  |     |   |   |   |   | 128 | 48  | 57  | 28  | 32  | 61  |     |
| 32         | 48  | 24  | 31  | 44  | 48  |     | 34  | 26  | 18  | 29  | 17  |     |   |   |   |   |     |     |     |     |     |     |     |
| 0/14:18:55 |     |     |     | 54  | 54  | 70  | 40  | 24  | 39  | 15  | 18  |     |   |   |   |   | 194 | 27  | 61  | 30  | 36  | 28  |     |
| 33         | 80  | 34  | 6   | 45  | 27  |     | 34  | 25  | 52  | 36  | 35  |     |   |   |   |   |     |     |     |     |     |     |     |
| 0/14:19:05 |     |     |     | 48  | 27  | 87  | 54  | 30  | 90  | 70  | 24  |     |   |   |   |   | 176 | 21  | 56  | 29  | 47  | 14  |     |
| 39         | 114 | 42  | 29  | 50  | 42  |     | 43  | 44  | 63  | 24  | 47  |     |   |   |   |   |     |     |     |     |     |     |     |
| 0/14:19:15 |     |     |     | 38  | 7   | 105 | 40  | 33  | 117 | 116 | 67  |     |   |   |   |   | 113 | 59  | 63  | 42  | 43  | 51  |     |
| 44         | 105 | 45  | 70  | 51  | 62  |     | 44  | 58  | 66  | 29  | 39  |     |   |   |   |   |     |     |     |     |     |     |     |
| 0/14:19:25 |     |     |     | 23  | 48  | 112 | 35  | 30  | 75  | 117 | 92  |     |   |   |   |   | 198 | 80  | 50  | 46  | 44  | 84  |     |
| 46         | 57  | 38  | 74  | 59  | 63  |     | 47  | 48  | 21  | 50  | 30  |     |   |   |   |   |     |     |     |     |     |     |     |
| 0/14:19:35 |     |     |     | 58  | 72  | 99  | 36  | 26  | 39  | 70  | 66  |     |   |   |   |   | 123 | 60  | 31  | 38  | 40  | 86  |     |
| 34         | 35  | 41  | 42  | 49  | 31  |     | 42  | 27  | 33  | 46  | 35  |     |   |   |   |   |     |     |     |     |     |     |     |

Source=1148-001 : 0000, Stokes=RR , IF= 1, Chans= 1- 1  
 Flux = 0.0000 Jy, Calcode = C , Freq = 1.446150006 GHz  
 Amplitudes, 1000 = 10.000 Jy, averging type = Vector

| Baselines  | 1   | 3   | 2   | 3   | 3   | 4   | 3   | 5   | 3   | 6   | 3   | 7   | 3 | 8 | 3 | 9 | 310 | 311 | 312 | 313 | 314 | 315 | 316 |
|------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|---|---|---|---|-----|-----|-----|-----|-----|-----|-----|
| 317        | 318 | 319 | 320 | 321 | 322 | 323 | 324 | 325 | 326 | 327 | 328 | 329 |   |   |   |   |     |     |     |     |     |     |     |
| 0/14:43:25 |     |     |     | 32  | 32  | 95  | 40  |     |     | 47  | 27  | 55  |   |   |   |   | 237 | 14  | 83  | 30  | 33  | 58  |     |
| 31         | 33  | 38  | 40  | 20  | 35  |     | 34  | 35  | 13  | 28  | 35  |     |   |   |   |   |     |     |     |     |     |     |     |
| 0/14:43:35 |     |     |     | 34  | 56  | 91  | 30  |     |     | 44  | 48  | 60  |   |   |   |   | 173 | 29  | 80  | 34  | 33  | 46  |     |
| 32         | 29  | 36  | 38  | 35  | 37  |     | 34  | 33  | 38  | 29  | 37  |     |   |   |   |   |     |     |     |     |     |     |     |
| 0/14:43:45 |     |     |     | 27  | 59  | 103 | 14  | 27  | 21  | 51  | 54  |     |   |   |   |   | 130 | 51  | 66  | 25  | 25  | 72  |     |
| 24         | 23  | 22  | 14  | 27  | 26  |     | 21  | 23  | 48  | 23  | 26  |     |   |   |   |   |     |     |     |     |     |     |     |
| 0/14:43:55 |     |     |     | 22  | 49  | 112 | 29  | 24  | 18  | 35  | 23  |     |   |   |   |   | 182 | 49  | 43  | 19  | 26  | 95  |     |

|    |            |    |    |    |    |     |    |    |    |    |    |     |    |    |    |    |     |  |  |
|----|------------|----|----|----|----|-----|----|----|----|----|----|-----|----|----|----|----|-----|--|--|
| 23 | 30         | 20 | 9  | 30 | 28 |     | 27 | 22 | 32 | 20 | 21 |     |    |    |    |    |     |  |  |
|    | 0/14:44:05 |    |    | 39 | 59 | 141 | 41 | 28 | 42 | 36 | 2  | 163 | 35 | 32 | 32 | 33 | 112 |  |  |
| 31 | 32         | 37 | 35 | 41 | 35 |     | 34 | 35 | 29 | 30 | 30 |     |    |    |    |    |     |  |  |
|    | 0/14:44:15 |    |    | 36 | 49 | 157 | 37 | 23 | 50 | 28 | 29 | 179 | 16 | 17 | 31 | 32 | 98  |  |  |
| 32 | 31         | 38 | 44 | 36 | 34 |     | 29 | 33 | 18 | 28 | 35 |     |    |    |    |    |     |  |  |
|    | 0/14:44:25 |    |    | 27 | 28 | 159 | 25 | 22 | 37 | 38 | 54 | 200 | 17 | 17 | 30 | 29 | 71  |  |  |
| 28 | 26         | 27 | 38 | 33 | 31 |     | 27 | 28 | 36 | 28 | 31 |     |    |    |    |    |     |  |  |
|    | 0/14:44:35 |    |    | 28 | 1  | 150 | 20 | 31 | 23 | 47 | 60 | 242 | 39 | 22 | 29 | 30 | 42  |  |  |
| 28 | 29         | 27 | 22 | 39 | 34 |     | 30 | 29 | 51 | 28 | 27 |     |    |    |    |    |     |  |  |

Source=1148-001 : 0000, Stokes=RR , IF= 1, Chans= 1- 1  
Flux = 0.0000 Jy, Calcode = C , Freq = 1.446150006 GHz  
Amplitudes, 1000 = 10.000 Jy, averging type = Vector

|           |            |     |     |     |     |     |     |     |     |     |     |     |   |   |   |   |     |     |     |     |     |     |     |
|-----------|------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|---|---|---|---|-----|-----|-----|-----|-----|-----|-----|
| Baselines | 1          | 3   | 2   | 3   | 3   | 4   | 3   | 5   | 3   | 6   | 3   | 7   | 3 | 8 | 3 | 9 | 310 | 311 | 312 | 313 | 314 | 315 | 316 |
| 317       | 318        | 319 | 320 | 321 | 322 | 323 | 324 | 325 | 326 | 327 | 328 | 329 |   |   |   |   |     |     |     |     |     |     |     |
|           | 0/15:08:15 |     |     | 17  | 35  | 52  | 25  |     |     | 33  | 42  | 35  |   |   |   |   | 148 | 14  | 29  | 28  | 29  | 49  |     |
| 29        | 31         | 30  | 27  | 15  | 38  |     |     | 29  | 32  | 35  | 25  | 33  |   |   |   |   |     |     |     |     |     |     |     |
|           | 0/15:08:25 |     |     | 29  | 38  | 64  | 22  |     |     | 27  | 33  | 32  |   |   |   |   | 146 | 14  | 38  | 27  | 25  | 52  |     |
| 25        | 31         | 33  | 18  | 29  | 30  |     |     | 27  | 22  | 23  | 22  | 35  |   |   |   |   |     |     |     |     |     |     |     |
|           | 0/15:08:35 |     |     | 33  | 25  | 70  | 27  | 23  | 25  | 27  | 25  |     |   |   |   |   | 135 | 25  | 35  | 21  | 25  | 49  |     |
| 21        | 29         | 26  | 17  | 30  | 25  |     |     | 24  | 19  | 18  | 18  | 29  |   |   |   |   |     |     |     |     |     |     |     |
|           | 0/15:08:45 |     |     | 50  | 35  | 91  | 34  | 35  | 42  | 44  | 43  |     |   |   |   |   | 185 | 32  | 52  | 37  | 34  | 49  |     |
| 34        | 34         | 30  | 38  | 45  | 40  |     |     | 36  | 39  | 43  | 33  | 33  |   |   |   |   |     |     |     |     |     |     |     |
|           | 0/15:08:55 |     |     | 30  | 28  | 84  | 30  | 32  | 37  | 43  | 34  |     |   |   |   |   | 188 | 26  | 53  | 32  | 33  | 26  |     |
| 32        | 26         | 29  | 42  | 37  | 40  |     |     | 32  | 36  | 41  | 27  | 26  |   |   |   |   |     |     |     |     |     |     |     |
|           | 0/15:09:05 |     |     | 21  | 27  | 72  | 28  | 31  | 37  | 46  | 35  |     |   |   |   |   | 185 | 26  | 56  | 31  | 32  | 9   |     |
| 31        | 27         | 37  | 36  | 37  | 39  |     |     | 32  | 30  | 35  | 29  | 35  |   |   |   |   |     |     |     |     |     |     |     |

dparm 1,0  
go

vlb054 LISTR(31DEC08) 100 14-NOV-2008 22:36:24 Page 1  
File = 19810926 .L BAND. 1 Vol = 1 Userid = 100 Channels = 1- 1  
IF = 1  
Freq= 1.446150006 GHz Ncor= 1 No. vis= 84072  
Stokes = RR Subarray = 1  
Applying flag table 1

Source=1148-001 : 0000, Stokes=RR , IF= 1, Chans= 1- 1  
Flux = 0.0000 Jy, Calcode = C , Freq = 1.446150006 GHz  
Phase, 1000 = 1000.00 degrees, averging type = Vector

|           |            |     |     |      |     |      |      |     |     |     |     |     |   |   |   |   |     |      |     |     |     |     |     |
|-----------|------------|-----|-----|------|-----|------|------|-----|-----|-----|-----|-----|---|---|---|---|-----|------|-----|-----|-----|-----|-----|
| Baselines | 1          | 3   | 2   | 3    | 3   | 4    | 3    | 5   | 3   | 6   | 3   | 7   | 3 | 8 | 3 | 9 | 310 | 311  | 312 | 313 | 314 | 315 | 316 |
| 317       | 318        | 319 | 320 | 321  | 322 | 323  | 324  | 325 | 326 | 327 | 328 | 329 |   |   |   |   |     |      |     |     |     |     |     |
|           | 0/13:53:55 |     |     | -154 | 176 | 177  | -145 |     |     | 82  | 59  | -83 |   |   |   |   | -35 | -118 | -77 | 101 | 41  | 3   |     |
| 59        | 63         | 114 | 69  | -97  | 80  |      |      | 76  | 88  | -57 | 67  | 121 |   |   |   |   |     |      |     |     |     |     |     |
|           | 0/13:54:05 |     |     | 163  | 138 | -130 | -83  |     |     | 141 | 119 | -21 |   |   |   |   | -20 | -30  | -50 | 52  | 43  | 52  |     |

```

78  97 122 122-106 147      78  88  46 166-137
    0/13:54:15 127 100 -91 65-134-101 172  78    -173  44 -26  79  44  90
51 137 129-158-129 -79      72 102  95-124 -55
    0/13:54:25 118  61 -61 125 -91  13-128 145    172 105  -3  99  45 126
51-125 122 -51-119  21      73 111 140   2  12
    0/13:54:35 -125   9 -32 168 -49  68 -31-164    161 144  17  64  39 167
75  31 115  12-106  79      77  97-174 142  90

```

Source=1148-001 : 0000, Stokes=RR , IF= 1, Chans= 1- 1  
 Flux = 0.0000 Jy, Calcode = C , Freq = 1.446150006 GHz  
 Phase, 1000 = 1000.00 degrees, averging type = Vector

```

Baselines      1 3 2 3 3 4 3 5 3 6 3 7 3 8 3 9 310 311 312 313 314 315 316
317 318 319 320 321 322 323 324 325 326 327 328 329
    0/14:18:25 135 174  69 167      66 121-173    51 109  26  75  39  58
61 136 118  27-117  30      73  88 140-157  -8
    0/14:18:35 -72 153 124 160      123 168-128    93 145  32  67  42  93
49-154 126  72-128  56      67 111-158 177  13
    0/14:18:45 -131 132 173 146-116-171-153 -91    147-177  42  68  36 129
50 -56 105 107-120  83      73 112  25 160 -43
    0/14:18:55 -165 103-132 149-123 -19  -9 -18    6-122  55  73  40 167
61  23 101-175-110  89      76  81  66-175 -41
    0/14:19:05 162  87 -88 160-120  46  81 143    -37  33  72  73  37  23
53  78 112  -3-118  46      73  83 112-159 -16
    0/14:19:15 141 -86 -66 164-116  89 113 174    -114  69  87  66  40  22
49 120 122  26-126  54      73  98 143 165  -7
    0/14:19:25 -137-143 -42 155-114 141 151-151    118 111  94  69  35  50
56 167 112  65-120  78      73 111 155 166 -18
    0/14:19:35 -139-164 -20 142-130 -91-161-118    166 144 107  72  37  79
55 -66  99 109-114  88      78  99  37-168 -38

```

Source=1148-001 : 0000, Stokes=RR , IF= 1, Chans= 1- 1  
 Flux = 0.0000 Jy, Calcode = C , Freq = 1.446150006 GHz  
 Phase, 1000 = 1000.00 degrees, averging type = Vector

```

Baselines      1 3 2 3 3 4 3 5 3 6 3 7 3 8 3 9 310 311 312 313 314 315 316
317 318 319 320 321 322 323 324 325 326 327 328 329
    0/14:43:25 -174-121 103 162      65 109 166    41  37  70  66  32-169
49  86  97  42-121  64      64  91  89-178 -29
    0/14:43:35 -169-148 150 173      81 104-159    138  70  88  65  32 -85
48  76 109  66-129  60      67  92  71 178 -20
    0/14:43:45 -165-171-168 150-127  97 120-123    116 107 114  64  28 -20
54  69 109  87-132  61      56  94  90 170 -18
    0/14:43:55 -170 163-127 133-123  58 147 -84    90 142 139  68  35  32
53  74  91   6-133  61      58  85 121 175 -25
    0/14:44:05 -177 139 -92 148-112  53 149 -32    72 177 164  69  35  70
47  82  97  19-127  64      64  90 134-174 -30
    0/14:44:15 180 123 -62 162-122  68 116 147    62-116-143  65  32 105
54  81 109  35-124  64      66  90  87 175 -30
    0/14:44:25 -176 101 -37 168-136  85 105 177    51  15 -85  66  30 145
50  76 112  59-132  57      64  88  72 171 -20

```

```
0/14:44:35 -162 105 -7 146-133 79 117-152 41 68 -46 68 30-163
47 71 96 67-132 61 59 87 97 173 -24
```

```
Source=1148-001 : 0000, Stokes=RR , IF= 1, Chans= 1- 1
Flux = 0.0000 Jy, Calcode = C , Freq = 1.446150006 GHz
Phase, 1000 = 1000.00 degrees, averging type = Vector
```

```
Baselines      1 3 2 3 3 4 3 5 3 6 3 7 3 8 3 9 310 311 312 313 314 315 316
317 318 319 320 321 322 323 324 325 326 327 328 329
0/15:08:15 -152 172-105 148 73 125-161 -32 127 -46 69 28 39
48 65 87 38-129 62 62 93 108 179 -40
0/15:08:25 -136 152 -86 139 76 126-157 -27 89 -36 66 28 63
53 80 95 41-139 66 61 96 114 175 -30
0/15:08:35 -164 140 -63 149-130 64 135-148 -15 107 -11 67 22 87
50 78 114 9-134 60 67 80 93 177 -17
0/15:08:45 178 144 -39 151-126 66 128-148 -3 119 9 68 28 106
51 90 108 12-127 58 65 82 91-177 -16
0/15:08:55 167 150 -18 151-124 70 124-149 9 132 23 69 27 121
48 70 87 27-127 57 62 87 101-179 -33
0/15:09:05 -160 162 3 151-129 72 126-157 21 135 33 65 28 74
51 48 93 40-134 67 61 96 111 177 -36
```

## Calibration

### SETJY

```
task 'setjy'
source '3c286',' '
optype 'calc'
aparm 0
aparm(2)=3
zerosp 0
go
```

```
vlb054> SETJY1: Task SETJY (release of 31DEC08) begins
vlb054> SETJY1: **WARNING: OPCODE=CALC AND FREQID = -1
vlb054> SETJY1: FREQID WILL BE RESET TO 1, CHECK YOUR RESULTS CAREFULLY
vlb054> SETJY1: A source model for this calibrator may be available
vlb054> SETJY1: Use the verb CALDIR to see if there is one
vlb054> SETJY1: / Flux calculated using known spectrum
vlb054> SETJY1: BIF = 1 EIF = 1 /Range of IFs
vlb054> SETJY1: '3C286 ' IF = 1 FLUX =14.5979 (Jy calcd)
vlb054> SETJY1: / Using (1990) VLA or Reynolds (1934-638) coefficients
vlb054> SETJY1: Appears to have ended successfully
vlb054> SETJY1: vlb054 31DEC08 TST: Cpu= 0.0 Real= 0
```

## CALRD

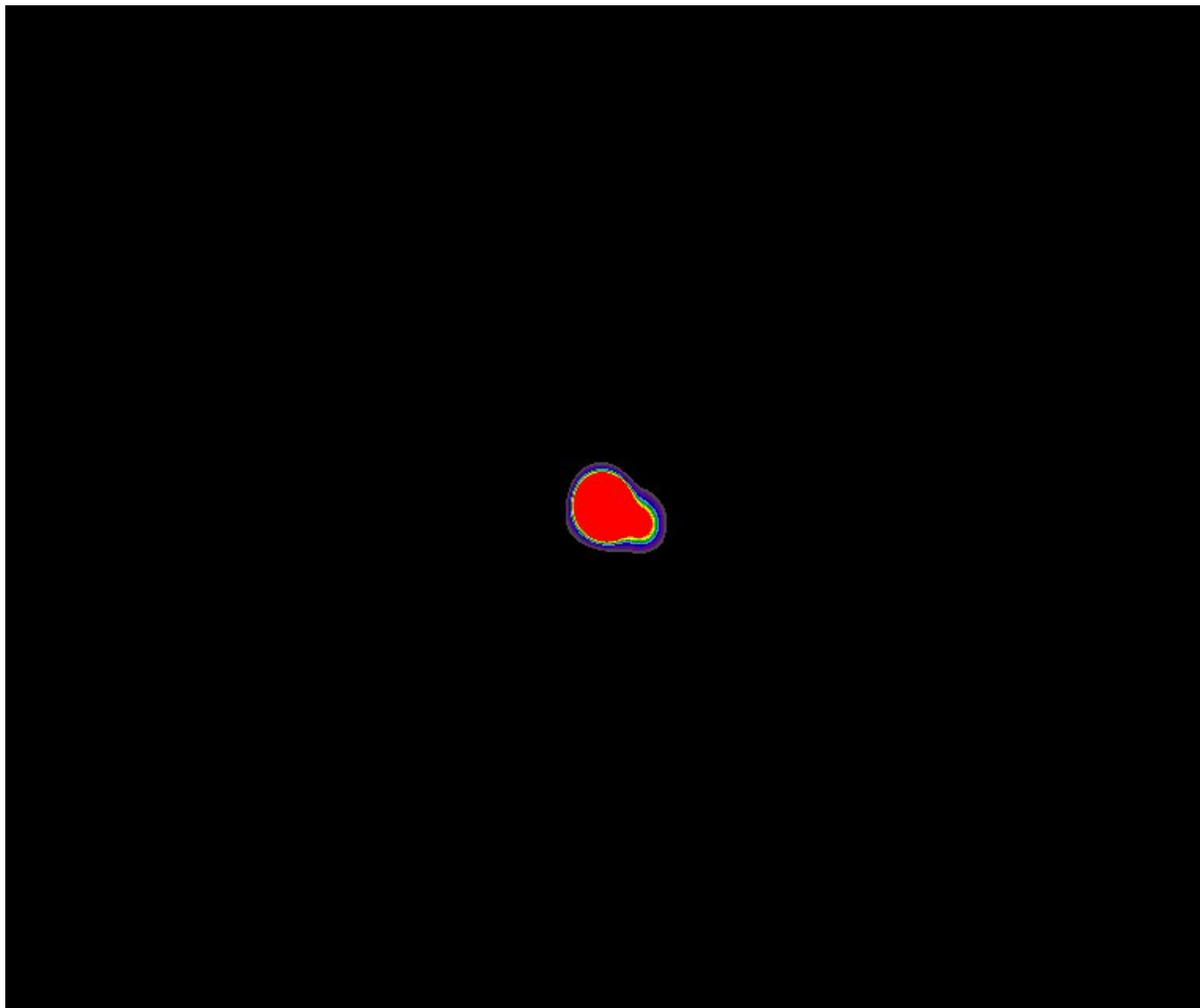
```
task 'calrd'  
object '3c286'  
band 'l'  
go
```

```
vlb054> CALRD1: Task CALRD (release of 31DEC08) begins  
vlb054> CALRD1: Reading disk file AIPSTARS:3C286_L.MODEL  
vlb054> CALRD1: Create 3C286_L .MODEL . 1 (MA) on disk 1 cno 2  
vlb054> CALRD1: Appears to have ended successfully  
vlb054> CALRD1: vlb054 31DEC08 TST: Cpu= 0.0 Real= 0
```

So it looks like the calibration data image was put into catalog entry number 2.

Let's have a look at it.

```
getn 2  
tvinit  
tvlod  
tvfiddle
```



## CALIB

```
task 'calib'  
getn 2  
calsour '3c286', ' '  
uvrange 0  
antennas 0  
refant 24  
weightit 1  
in2di 1  
get2n 5  
ncomp 0  
solmode 'A&P'  
aparm(6) 2  
minamper 10  
minphser 10  
docalib 1
```

```
solint 1  
solsub 2  
cparm(3) 10  
cparm(4) 10
```

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