GLOW Interferometry Tutorial: Wednesday

We will reduce the 3C129 polarization continuum dataset from the 2008 NRAO summer school. (See http://casa.nrao.edu/Tutorial/SIworkshop2008/) The summer school used CASA for the data reduction. You are welcome to try to use CASA for the data reduction on your own (but see also the warnings about what to do what CASA crashes frequently), but we will do the basic reduction in AIPS.

2010 Nov 16: JMA updated for 31DEC10 AIPS

Web Image of 3C129

Wide-field 90 cm image of the large head-tail radio galaxy 3C129 (right). The bright source at the left is 3C129.1. From Lane et al., AJ, 123, 2985, 2002.

The 5 GHz observations being reduced here will only look at the central, brightest, portion of this source.

Data Reduction

Remember, the purpose f this exercise is not to teach you how to reduce radio interferometry data with AIPS. Consider all of the arcane incantations below as just that, magic incantations. You should instead try to figure out what each step is actually doing to the data. The AIPS Cookbook has quite a bit of information to help guide you. Check out chapters 4 and 5. (Note that you probably have a copy of the cookbook in your local AIPS installation if you don't have full web access.) However, at some of the most important points, the cookbook is relatively useless for **understanding what is going on**, as opposed to knowing which buttons to push, so ask your tutorial leader for help in this area.

Download the data from http://casa.nrao.edu/Data/VLA/3C129/3c129data.tgz and untar it in some directory. (If you are in Garching, there should be a local copy. Ask Sven.) Then, from that same directory, start aips. Login with a new user ID number.

Basic Environment

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

Load the raw data: FILLM

```
task 'fillm'
default
nfiles 0
prtlev 0
datain 'PWD:AT166_
doconcat true
clron
doweight 10
ncount 2
cparm(4)=28
cparm(8)=10./60
dparm 0
bparm 0
timer 0
vlamode = ' '
band = ' '
calcode ' '
clron
outdisk 1
go
```

Check where it went. You will need the C band version at 5 GHz

```
indi 1
pcat
getn 4
imhe
```

```
<AIPS 1: Got(1)   disk= 1  user= 100   type=UV   19940725.C BAND.2
AIPS 1: Image=MULTI     (UV)         Filename=19940725    .C BAND.   2
AIPS 1: Telescope=VLA                Receiver=VLA
AIPS 1: Observer=AT166               User #=  100
AIPS 1: Observ. date=25-JUL-1994     Map date=16-NOV-2010
AIPS 1: # visibilities    216975     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   4.8851000E+09       1.00  5.0000000E+07    0.00
AIPS 1: IF           2   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 1950.00
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 OF is   1
AIPS 1: Keyword = 'CORRMODE'  value = '        '
AIPS 1: Keyword = 'VLAIFS  '  value = 'ABCD    '
AIPS 1: Keyword = 'CORRCOEF'  value =           -1
```

Print out some useful information

```
task 'listr'
default
getn 4
optype 'scan'
doweight 1
docrt=132
flagver 0
sources ' '
stokes ' '
docalib 0
gainuse 1
dopol -1
dparm 0
antenna 0
basel 0
stokes ' '
inext ' '
inver 0
bif 0
eif 0
uvrange 0
go
```

```
AIPS 1: Got(1)   disk= 1  user= 101   type=UV   19940725.C BAND.2
 vlb054    LISTR(31DEC08)    101     13-NOV-2008  15:25:41    Page    1
File = 19940725    .C BAND.   2 Vol = 1  Userid =  101
Freq =  4.885100000 GHz   Ncor =  4   No. vis =    216975
Scan summary listing

Scan      Source      Qual  Calcode Sub         Timerange          FrqID
START VIS  END VIS
   1 2345-167        : 0003  A        1  0/07:41:45 -   0/07:43:25     1
1       2917
   2 A2597           : 0003           1  0/08:00:25 -   0/08:02:35     1
2918       6788
```

```
   3 2345-167        : 0003  A        1  0/08:21:05 -   0/08:22:45     1
6789       9709
   4 A2597           : 0003           1  0/08:39:45 -   0/08:41:55     1
9710      13605
   5 2345-167        : 0003  A        1  0/09:00:25 -   0/09:02:05     1
13606      16505
   6 A2597           : 0003           1  0/09:19:05 -   0/09:21:15     1
16506      20401
   7 2345-167        : 0003  A        1  0/09:39:45 -   0/09:41:25     1
20402      23322
   8 A2597           : 0003           1  0/09:58:25 -   0/10:00:35     1
23323      27218
   9 2345-167        : 0003  A        1  0/10:19:05 -   0/10:20:45     1
27219      30140
  10 A2597           : 0003           1  0/10:37:45 -   0/10:39:55     1
30141      34036
  11 2345-167        : 0003  A        1  0/10:58:25 -   0/11:00:05     1
34037      36957
  12 A2597           : 0003           1  0/11:17:05 -   0/11:19:15     1
36958      40832
  13 2345-167        : 0003  A        1  0/11:37:45 -   0/11:39:25     1
40833      43702
  14 0420+417        : 0003  B        1  0/11:48:25 -   0/11:50:05     1
43703      46624
  15 3C129           : 0003           1  0/12:12:55 -   0/12:23:05     1
46625      66120
  16 0420+417        : 0003  B        1  0/12:27:25 -   0/12:29:05     1
66121      69041
  17 3C129           : 0003           1  0/12:50:05 -   0/12:56:05     1
69042      80412
  18 3C129           : 0003           1  0/12:56:25 -   0/13:00:15     1
80413      88498
  19 0420+417        : 0003  B        1  0/13:04:35 -   0/13:06:15     1
88499      91419
  20 3C129           : 0003           1  0/13:29:05 -   0/13:39:15     1
91420     109415
  21 0420+417        : 0003  B        1  0/13:43:35 -   0/13:45:15     1
109416     112112
  22 3C129           : 0003           1  0/14:06:15 -   0/14:16:25     1
112113     130108
  23 0420+417        : 0003  B        1  0/14:20:45 -   0/14:22:25     1
130109     132636
  24 3C129           : 0003           1  0/14:45:15 -   0/14:55:25     1
132637     150081
  25 0420+417        : 0003  B        1  0/14:59:45 -   0/15:01:25     1
150082     152778
  26 3C129           : 0003           1  0/15:18:25 -   0/15:25:35     1
152779     164366
  27 0420+417        : 0003  B        1  0/15:30:05 -   0/15:31:45     1
164367     166846
```

```
  28 3C129           : 0003           1  0/15:55:05 -   0/16:05:15     1
166847     183403
  29 0420+417        : 0003  B        1  0/16:10:05 -   0/16:11:45     1
183404     185861
  30 3C129           : 0003           1  0/16:34:55 -   0/16:45:05     1
185862     203522
  31 0420+417        : 0003  B        1  0/16:49:35 -   0/16:51:15     1
203523     206216
  32 0518+165        : 0003  C        1  0/17:06:35 -   0/17:09:45     1
206217     211608
  33 0134+329        : 0003  C        1  0/17:21:45 -   0/17:24:55     1
211609     216975

Source summary
Velocity type = '        '    Definition = '        '

  ID Source           Qual  Calcode RA(1950.0)     Dec(1950.0)   IFlux
QFlux   UFlux   VFlux  No. vis
   1 2345-167        : 0003   A     23:45:27.6823 -16:47:52.600   0.000
0.000   0.000   0.000   20372
             IF( 2)                                               0.000
0.000   0.000   0.000
   2 A2597           : 0003         23:22:43.7000 -12:23:56.000   0.000
0.000   0.000   0.000   23330
             IF( 2)                                               0.000
0.000   0.000   0.000
   3 0420+417        : 0003   B     04:20:27.9370  41:43:08.045   0.000
0.000   0.000   0.000   24318
             IF( 2)                                               0.000
0.000   0.000   0.000
   4 3C129           : 0003         04:45:31.6950  44:55:19.950   0.000
0.000   0.000   0.000  138196
             IF( 2)                                               0.000
0.000   0.000   0.000
   5 0518+165        : 0003   C     05:18:16.5320  16:35:26.900   0.000
0.000   0.000   0.000    5392
             IF( 2)                                               0.000
0.000   0.000   0.000
   6 0134+329        : 0003   C     01:34:49.8320  32:54:20.520   0.000
0.000   0.000   0.000    5367
             IF( 2)                                               0.000
0.000   0.000   0.000

  ID Source            Freq(GHz) Velocity(Km/s) Rest freq (GHz)
   1 All Sources          4.8851         0.0000          0.0000
     IF(  2)              4.5851         0.0000          0.0000

Frequency Table summary
FQID IF#      Freq(GHz)      BW(kHz)   Ch.Sep(kHz)  Sideband
   1   1       4.88510000   50000.0039  50000.0039      1
       2       4.58510000   50000.0039  50000.0039      1
```

```
AIPS 1: Resumes
```

Where are the antennas located?

```
go prtan
```

```
                      Location Of VLA Antennas

                               N36 (26)
                               N32 ( 1)
                               N28 (19)
                               N24 (11)
                               N20 (15)
                               N16 (25)
                               N12 (13)
                               N8  (27)
                               N4  (14)
                          (12) W4   E4  (22)
                       ( 8) W8       E8  ( 4)
                     ( 3) W12          E12 (16)
                   (28) W16              E16 ( 7)
                 ( 2) W20                  E20 (17)
               (21) W24                      E24 (24)
             (10) W28                          E28 ( 5)
           (18) W32                              E32 (23)
         (20) W36                                  E36 ( 6)
                        VLA:_OUT ( 9)
                        VPT:_OUT (29)
```

Flag some bad data. Just run the commands.

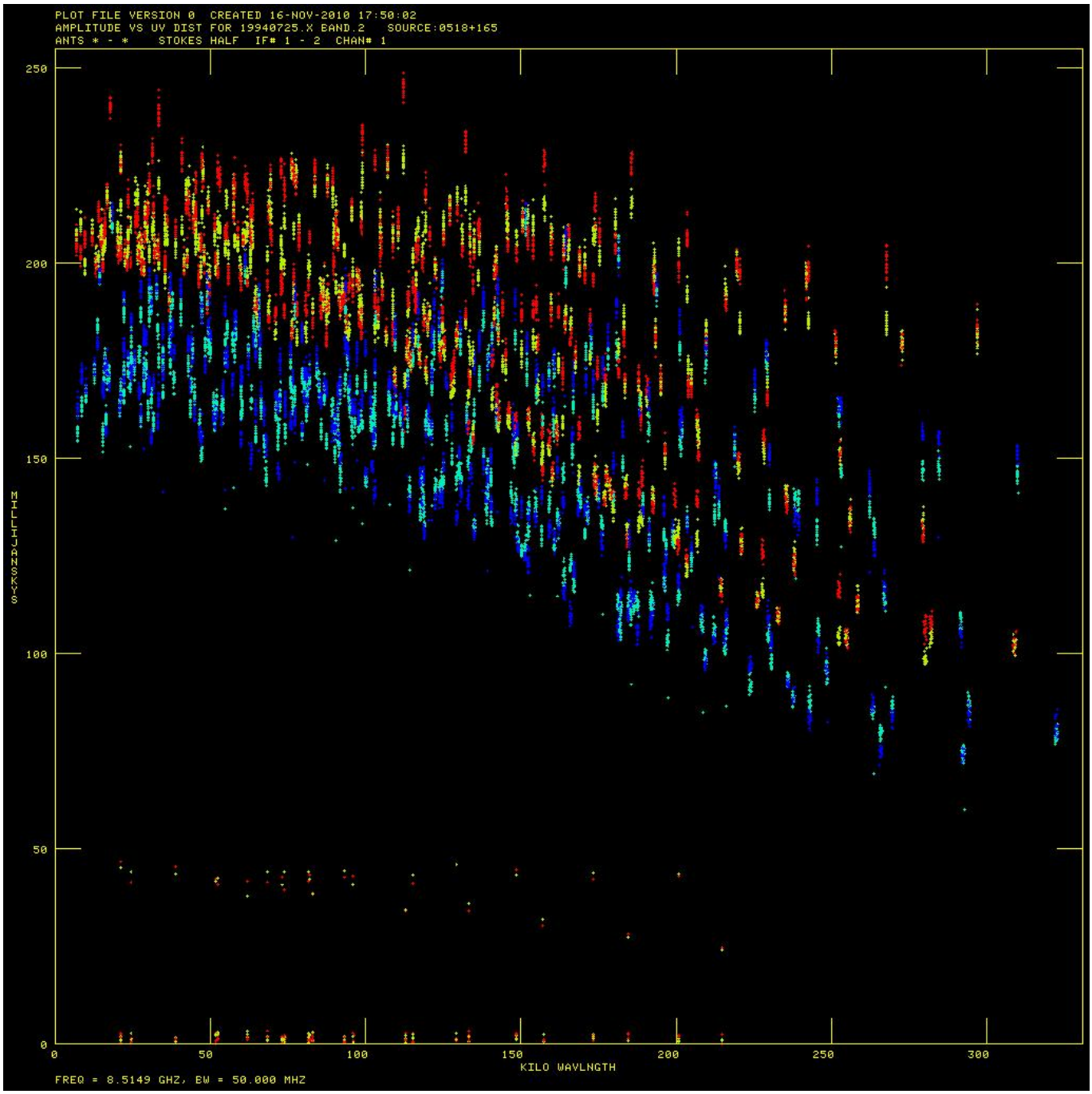
```
task 'uvflg'
default
dohist 1
getn 4
antenna 1,0
basel 0
timer 0 13 45 20 0 15 0 0
stokes ' '
opcode 'flag'
reason 'bad ant'
outfgver 1
go
antenna 14,0
timer 0 16 50 50 0 16 51 0
go
```

```
timer 0
```

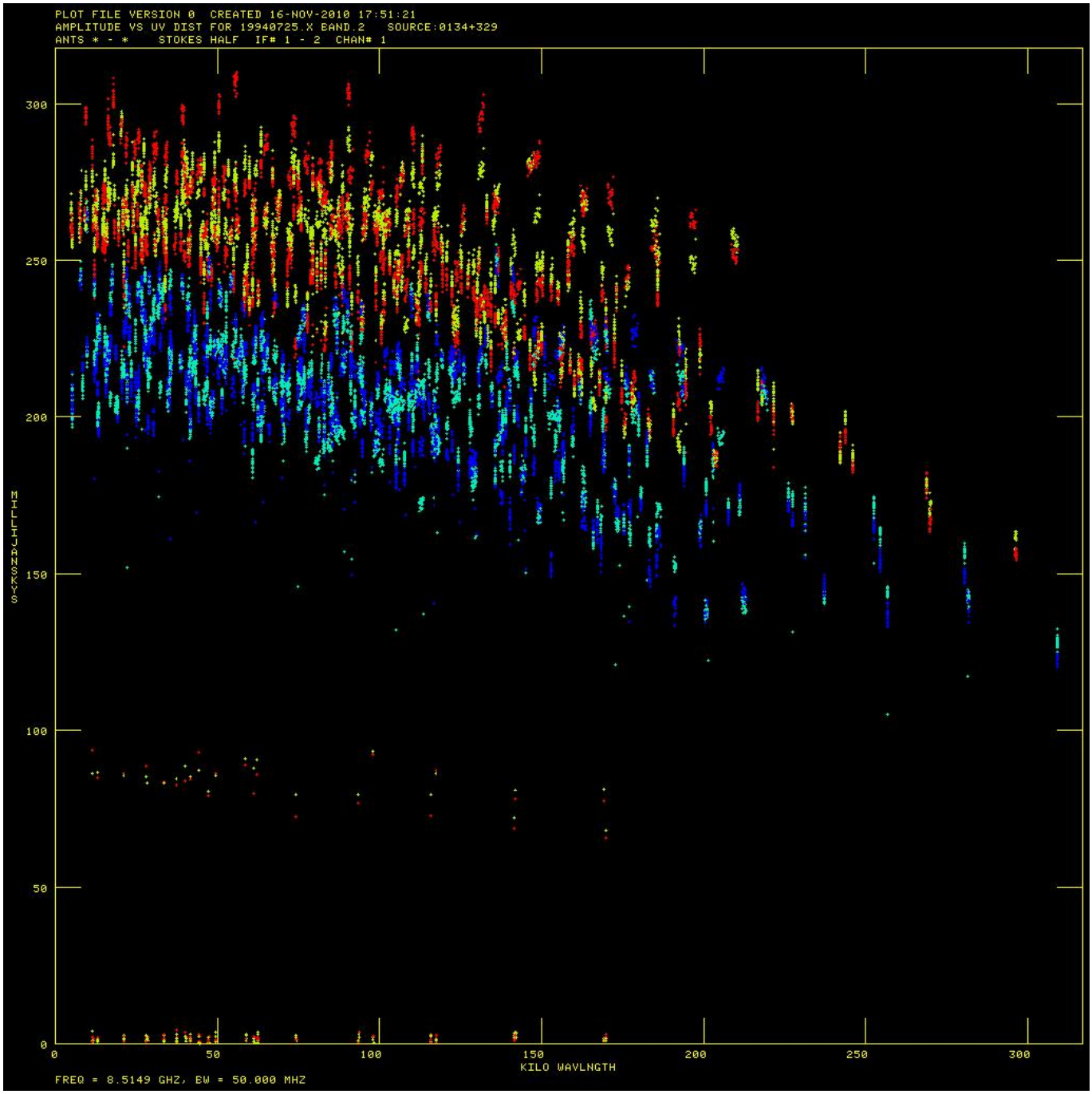
Investigate the data

Plots

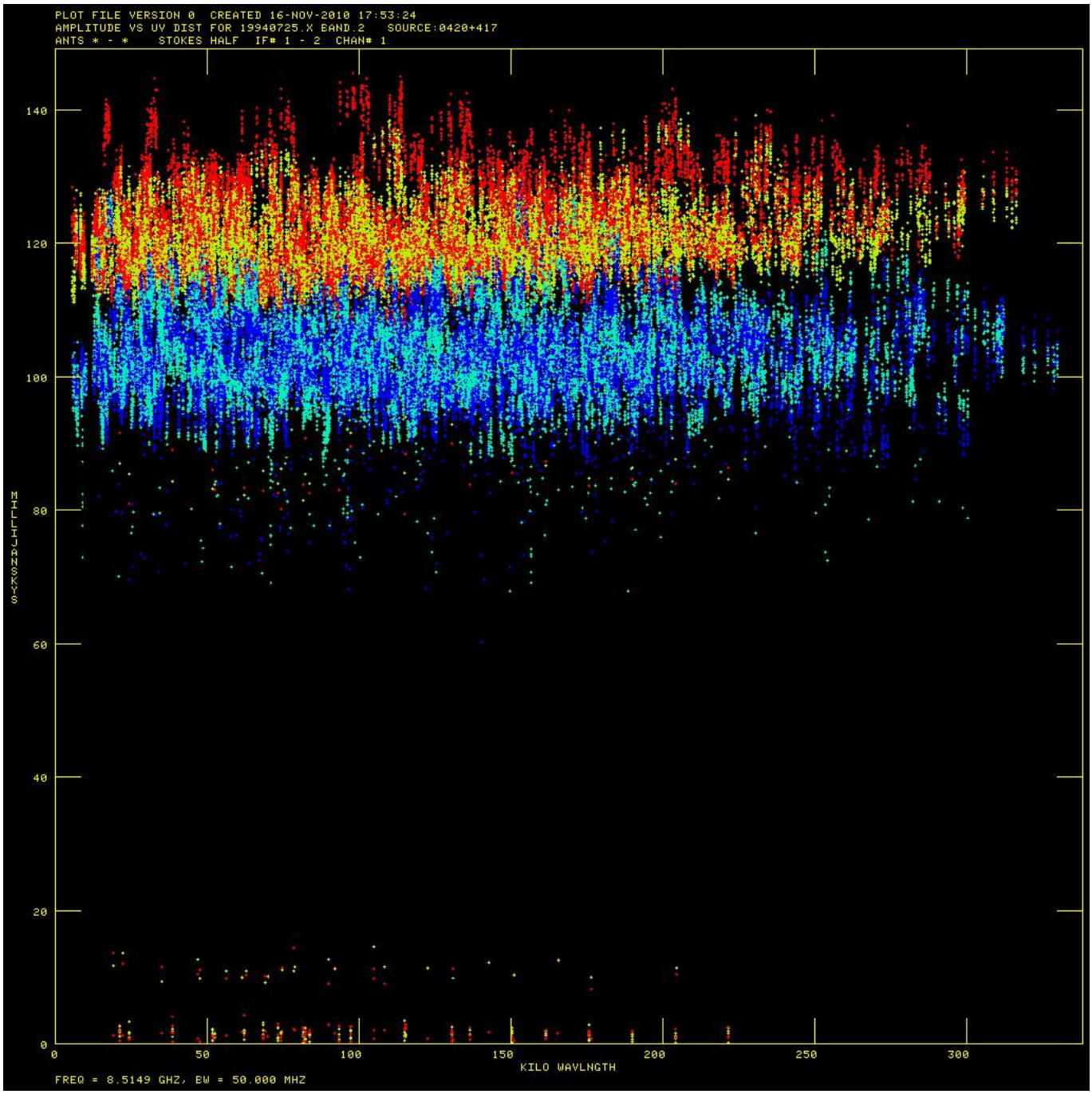
```
task 'uvplt'
source '0518+165',' '
calcode ' '
stokes 'half'
timer 0
uvrange 0
bif 0
eif 0
docalib 0
gainuse 1
bparm 0 1
aparm 0
refant 22
do3col 1
dotv 1
tvinit
go
```




```
source '0134+329',' '
tvinit
go
```




```
source '0420+417', ' '
tvinit
go
```

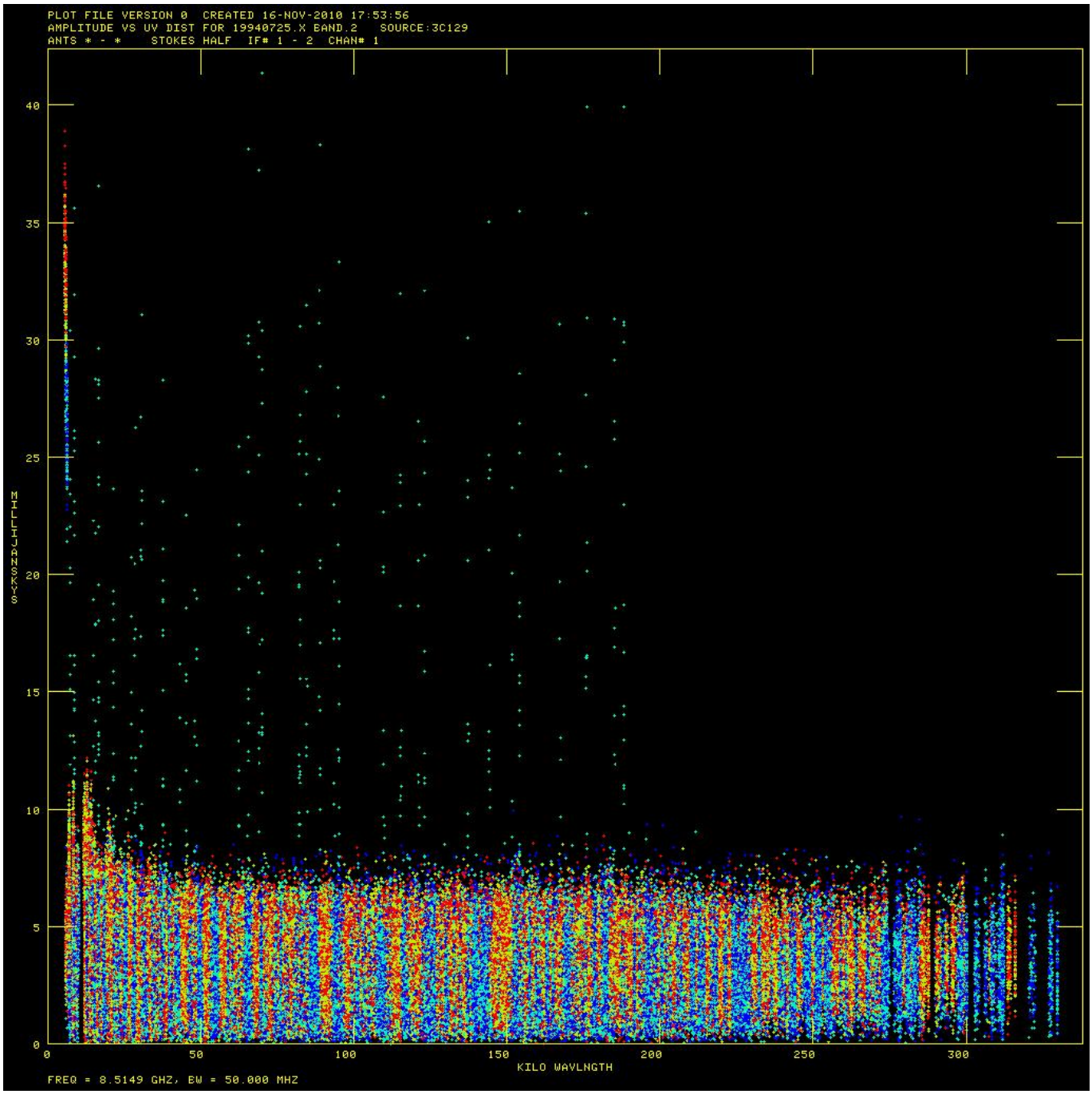


Note that the VLA Calibrator Manual says for this source:

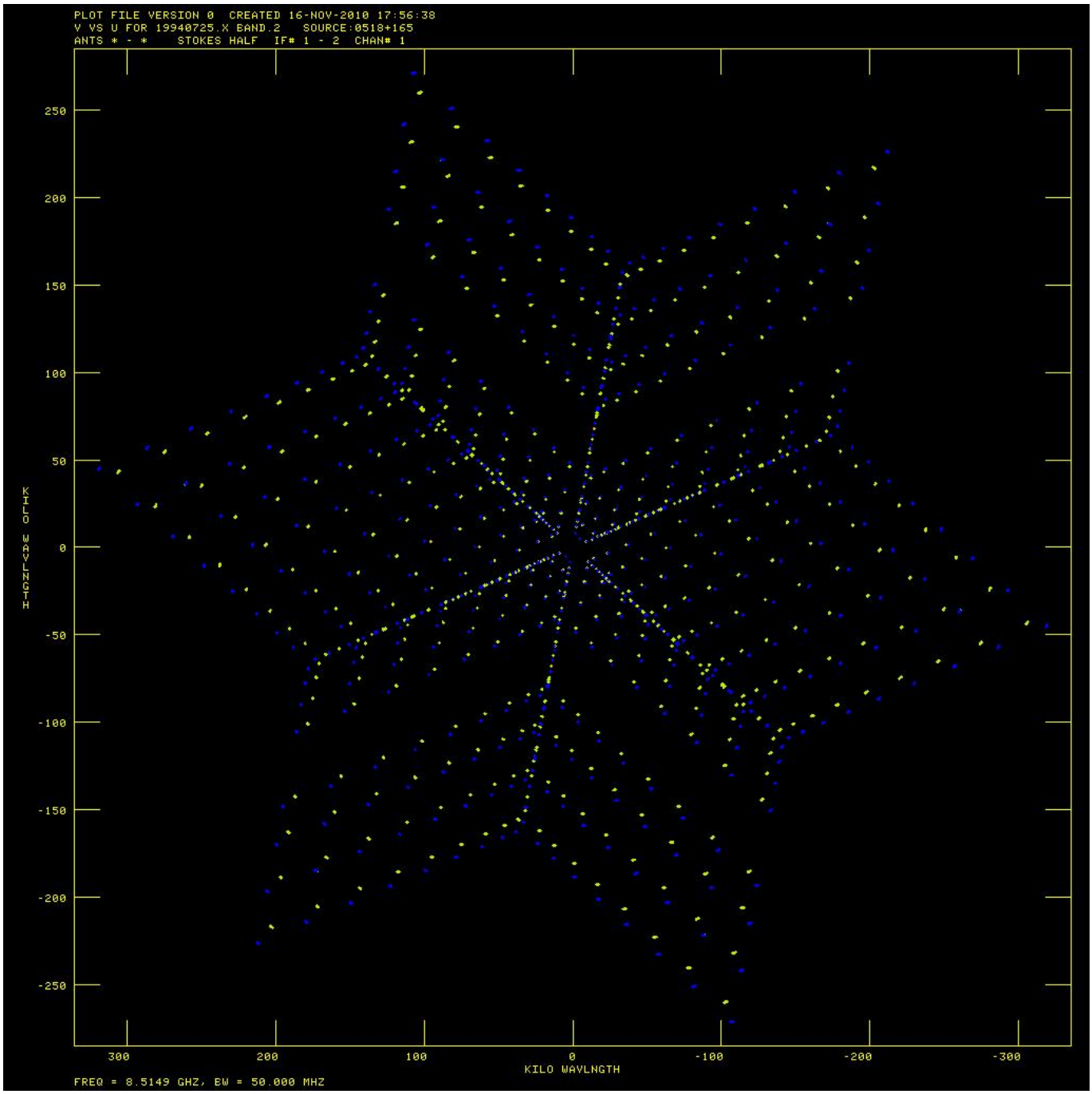
```
0423+418   J2000  A 04h23m56.009795s  41d50'02.712770"  Aug01
0420+417   B1950  A 04h20m27.936900s  41d43'08.039000"
-----------------------------------------------------
BAND        A B C D    FLUX(Jy)    UVMIN(kL)  UVMAX(kL)
=====================================================
 20cm    L  X X P P       2.00                      visplot
3.7cm    X  P P P P       1.12                      visplot
  2cm    U  P P P P       0.72                      visplot
0.7cm    Q  S S S S       1.00                      visplot
```

So we are not exactly sure at C band (5 GHz, 6 cm) what the source structure is like for the B configuration from the manual. Is it ok to use? For what (u,v) range?

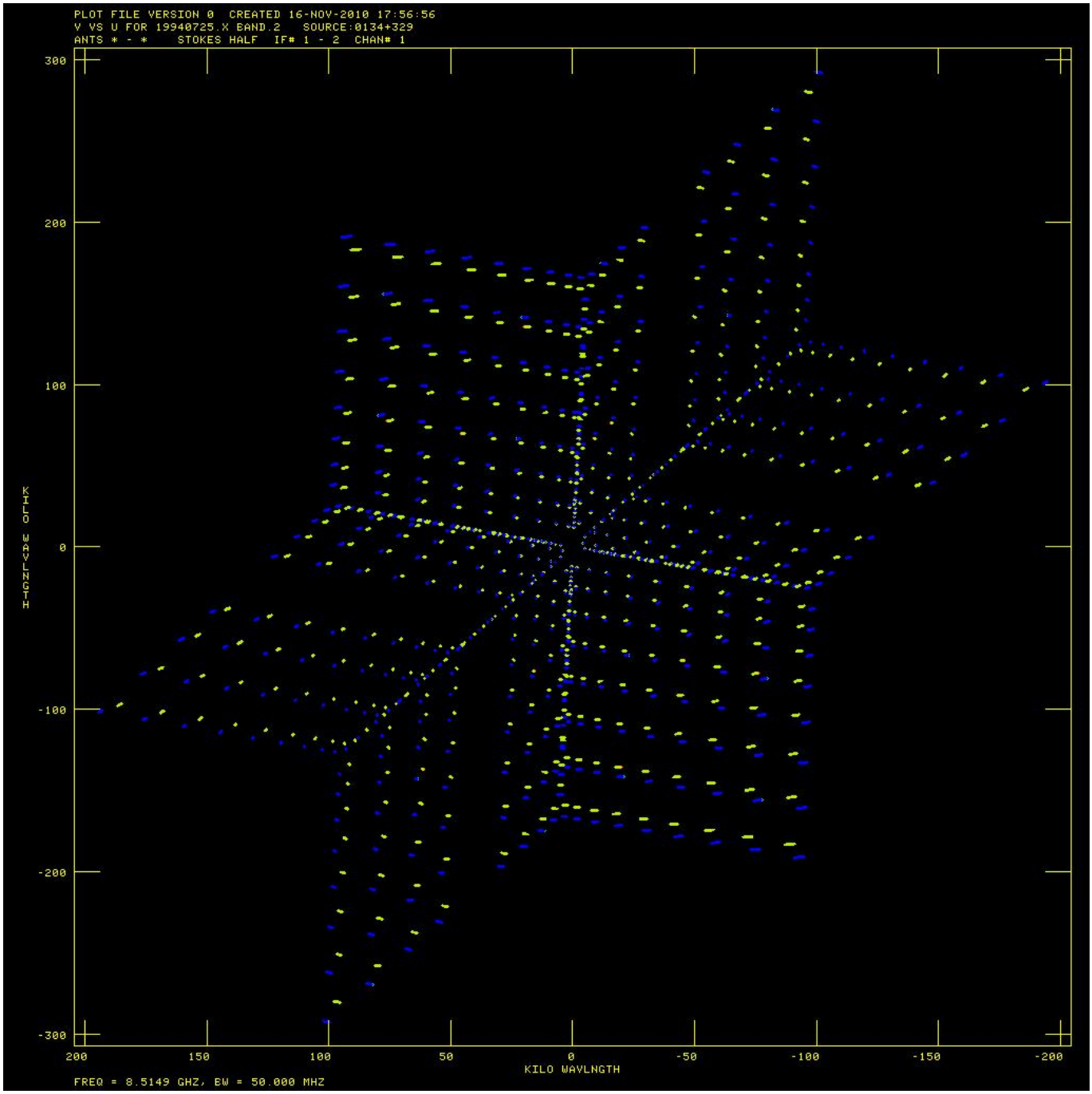
```
source '3C129', ' '
tvinit
go
```



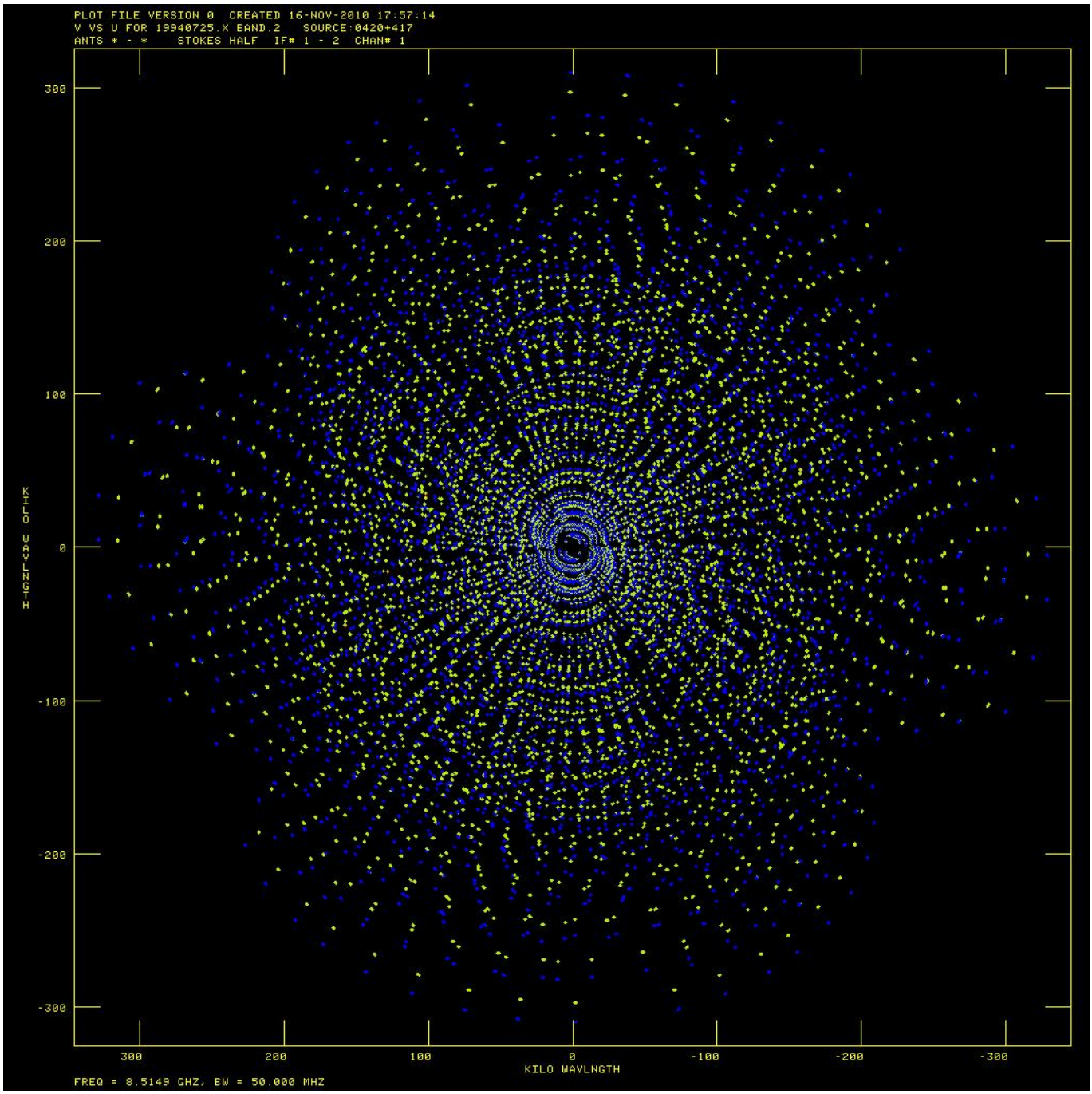

```
bparm 6 7
source '0518+165',' '
tvinit
go
```



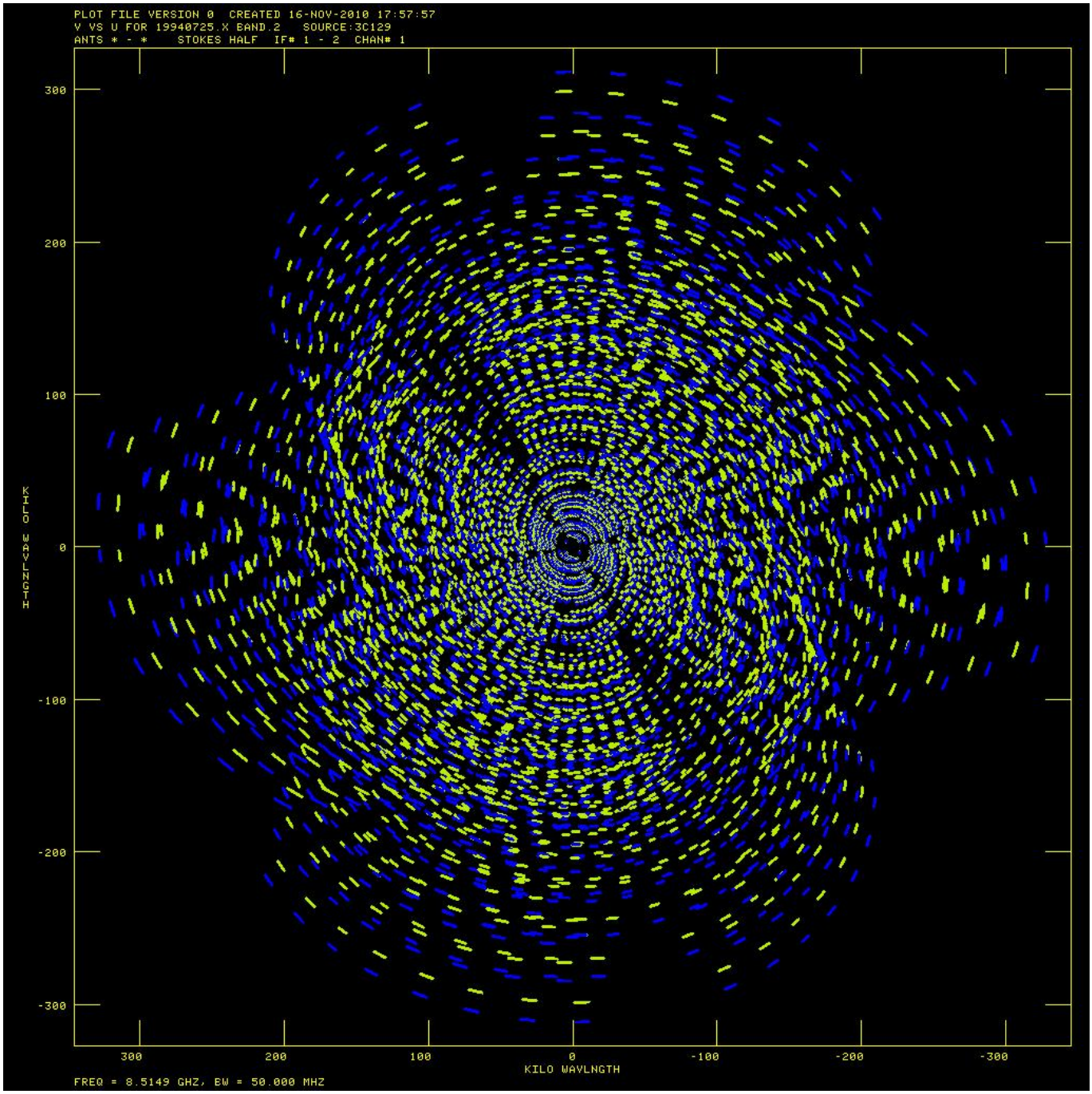

```
source '0134+329',' '
tvinit
go
```



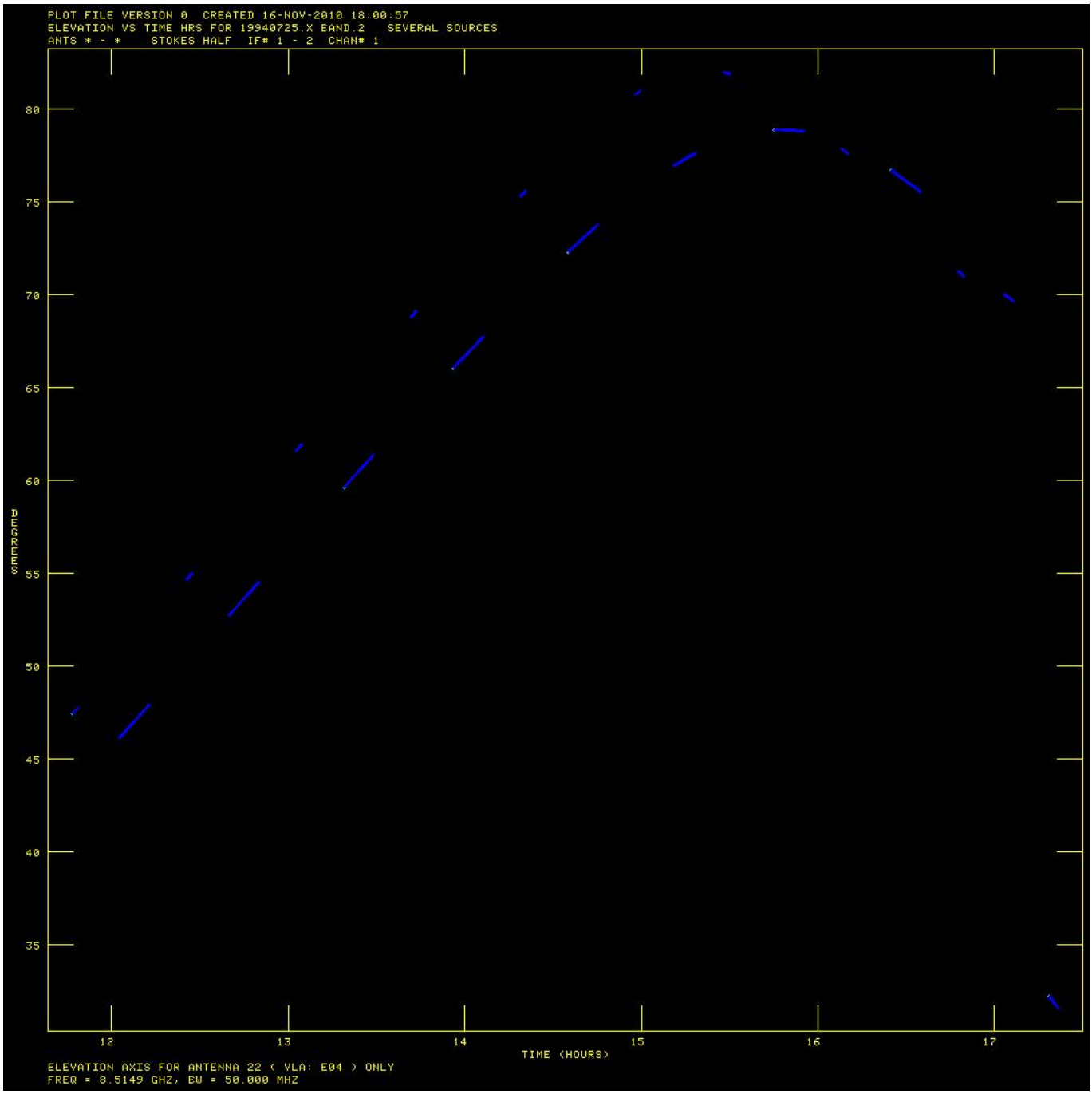

```
source '0420+417', ' '
tvinit
go
```



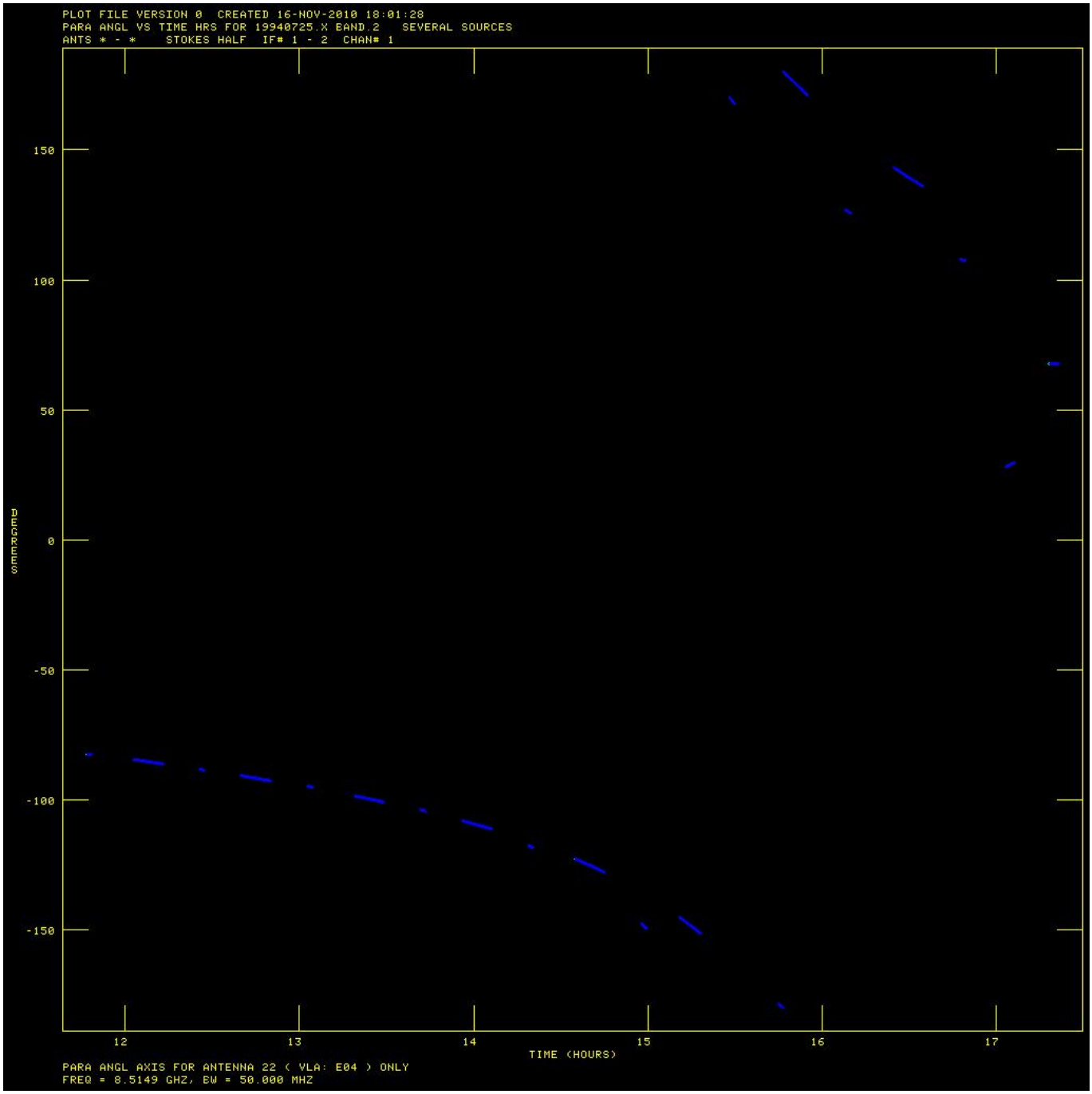

```
source '3C129', ' '
tvinit
go
```




```
bparm 11,15,0
sources '0518+165','0134+329','0420+417','3C129',' '
xinc=10
go
```




```
bparm 11,16,0
go
```




```
xinc=1
bparm 0
```

Raw visibilities

```
task 'listr'
optype 'list'
antenna 22,0
basel 0
sources ' '
calcode '*'
bif 0
eif 0
docalib 0
```

dparm 0
go

```
Source=0518+165        : 0003, Stokes=RR  , IF=  2, Chans=   1-   1
Flux =  0.0000 Jy, Calcode = C   , Freq =  4.585100000 GHz
Amplitudes, 1000 =   1.000000 Jy, averging type = Vector

   0/17:06:55  442 464 454         442 462         497     432 454     471
460 430     418     436 456 456 471 443 453
   0/17:07:05  442 463 448 460 456 438 460 441 421 503     435 443     466
452 427 487 415     440 453 455 471 443 452
   0/17:07:15  442 459 446 466 454 437 458 439 421 504     440 445     466
451 423 481 415     442 450 459 476 442 458
   0/17:07:25  443 462 450 464 455 433 460 445 419 502     435 441     465
452 428 483 417     443 453 456 472 441 453
   0/17:07:35  443 464 449 463 455 433 460 442 420 499     435 444     466
451 429 481 420     440 450 457 483 438 456
   0/17:07:45  438 459 451 467 453 433 458 440 420 500     432 443     462
453 426 480 415     441 449 456 478 439 454
   0/17:07:55  441 461 452 467 453 438 460 438 418 504     438 446     468
456 431 480 415     442 451 458 480 443 453
   0/17:08:05  437 460 447 460 454 434 459 445 413 500     439 445     464
454 430 478 419     441 450 458 480 443 453
   0/17:08:15  436 459 447 465 459 434 456 443 419 501     440 445     466
452 429 478 416 451 440 450 459 481 440 456
   0/17:08:25  438 461 448 464 456 437 460 440 415 504     436 444     465
454 429 475 416 452 442 452 459 476 442 451
Type Q to stop, just hit RETURN to continue

 vlb054    LISTR(31DEC10)    100     16-NOV-2010  14:51:57    Page    6
Source=0518+165        : 0003, Stokes=RR  , IF=  2, Chans=   1-   1
Baselines
012202220322042205220622072208221022112212221322142215221622172218221922202221222223222422252226222722228
   0/17:08:35  436 459 445 462 456 434 459 440 418 500     438 438     467
452 431 476 418 455 442 449 462 474 442 455
   0/17:08:45  433 455 449 465 455 440 459 439 414 499     435 444     465
453 430 474 414 454 439 447 456 473 441 451
   0/17:08:55  437 460 447 462 454 436 458 439 418 499     437 442     466
454 428 480 415 454 441 448 460 472 443 452
   0/17:09:05  433 457 448 465 456 436 457 441 416 498     436 445     465
454 433 477 415 451 439 450 459 473 441 456
   0/17:09:15  432 464 447 469 454 436 462 441 419 498     438 445     465
453 431 476 417 455 441 452 464 473 444 456
   0/17:09:25  428 457 449 468 457 436 459 440 418 493     438 438     462
455 428 470 420 455 441 445 462 469 442 453
   0/17:09:35  431 456 446 464 455 434 459 442 414 498     435 441     460
449 426 473 414 449 437 450 458 474 442 454
   0/17:09:45  429 458 445 463 451 434 456 442 415 492     437 445     465
450 429 471 419 452 437 449 459 466 439 457
```

```
Source=0134+329        : 0003, Stokes=RR  , IF=  2, Chans=   1-   1
Flux =  0.0000 Jy, Calcode = C   , Freq =  4.585100000 GHz
Amplitudes, 1000 =   1.000000 Jy, averging type = Vector

Baselines
012202220322042205220622072208221022112212221322142215221622172218221922202221222223222422252226222722282
   0/17:22:05  629 683 677         671 687         719     653         704
677 647 685     695 663 676 661 672 643 658
   0/17:22:15  630 683 673 666 690 669 685 655 630 723     662 653     692
670 646 694 643 689 666 672 664 681 643 659
   0/17:22:25  635 687 671 677 690 671 685 652 631 732     662 651     693
670 646 697 641 694 671 674 664 674 643 660
   0/17:22:35  632 683 669 671 692 669 687 651 632 727     663 651     689
667 642 694 639 692 669 667 662 678 640 657
   0/17:22:45  629 680 675 668 689 672 687 657 639 730     662 653     691
670 645 694 643 693 671 670 664 679 639 657
   0/17:22:55  627 684 670 672 695 669 684 652 629 729     658 651     690
669 644 692 638 684 669 672 664 679 640 656
   0/17:23:05  632 685 673 680 695 669 686 649 640 728     658 653     694
676 646 698 643 689 671 672 668 681 635 659
   0/17:23:15  635 683 670 673 694 675 689 651 637 728     662 652     695
675 643 696 642 695 667 675 663 682 640 656
   0/17:23:25  635 679 672 676 696 667 687 657 631 724     658 648     693
670 649 699 641 694 671 674 662 677 637 664
   0/17:23:35  634 684 668 673 690 662 682 653 634 726     659 648     691
670 640 692 639 692 668 669 662 677 639 656
   0/17:23:45  628 685 668 678 684 666 684 651 638 732     660 650     690
672 643 695 647 693 676 671 664 678 640 660
   0/17:23:55  629 680 672 674 690 671 682 650 637 729     664 655     692
674 643 696 646 692 670 676 666 676 646 659
   0/17:24:05  632 686 672 679 695 672 680 654 639 727     663 656     689
675 647 694 647 692 669 670 665 678 641 658
   0/17:24:15  630 686 672 674 693 671 689 658 636 728     659 653     691
676 649 698 643 690 669 674 661 684 643 656
   0/17:24:25  630 685 674 680 690 676 683 657 637 729     658 652     688
679 645 699 642 697 674 675 666 682 641 659
   0/17:24:35  637 681 673 678 693 670 687 658 634 732     659 655     689
678 644 696 644 691 672 675 668 680 642 658
   0/17:24:45  632 686 670 677 692 670 685 655 634 722     661 653     689
671 646 698 645 691 669 671 662 677 642 660
   0/17:24:55  634 685 675 678 697 675 682 657 632 727     658 654     691
671 643 699 643 693 669 673 666 677 641 658
AIPS 1: Resumes
```

```
dparm 1,0
go
```

```
Source=0518+165        : 0003, Stokes=RR  , IF=  2, Chans=   1-   1
Flux =  0.0000 Jy, Calcode = C   , Freq =  4.585100000 GHz
Phase, 1000 = 1000.00000 degrees, averging type = Vector
```

```
   0/17:06:55  105  80-114         -18-170         123    -164 -93      79
57  45     107    -113-174-124  29 -85 -25
   0/17:07:05  106  81-112 -76 142 -16-169  98  12 124    -162 -93      80
57  46 -84 109    -113-175-125  28 -87 -25
   0/17:07:15  103  78-112 -79 140 -18-169  97  10 121    -164 -95      78
55  43 -86 108    -110-175-124  30 -87 -24
   0/17:07:25  104  78-111 -78 141 -17-168  99   9 120    -164 -95      78
55  43 -85 107    -112-176-124  30 -90 -23
   0/17:07:35  102  77-112 -78 139 -19-169  98   9 121    -164-100      76
54  42 -88 106    -109-174-122  31 -86 -21
   0/17:07:45  102  77-113 -79 138 -19-169  98   9 120    -163-100      75
54  42 -89 106    -109-174-121  31 -86 -21
   0/17:07:55  100  74-116 -77 137 -21-171  97   8 118    -165-100      73
53  41 -89 106    -109-173-119  31 -86 -19
   0/17:08:05  101  76-114 -77 138 -19-171  99   9 122    -163 -98      74
54  43 -88 108    -110-173-120  29 -86 -20
   0/17:08:15  100  78-115 -76 139 -18-171  99  10 121    -163 -98      76
55  44 -89 110 -85-110-174-119  28 -86 -20
   0/17:08:25  101  79-115 -75 139 -19-167 101  10 120    -163 -98      75
55  45 -88 109 -83-111-175-121  28 -88 -21
Type Q to stop, just hit RETURN to continue

 vlb054    LISTR(31DEC10)    100     16-NOV-2010  14:54:07    Page    6
Source=0518+165        : 0003, Stokes=RR  , IF=  2, Chans=   1-   1
Baselines
012202220322042205220622072208221022112212221322142215221622172218221922202221222232224222522262227228
   0/17:08:35  103  80-113 -76 141 -17-167 102  13 120    -160 -95      75
55  47 -87 110 -81-113-177-121  27 -87 -22
   0/17:08:45  106  80-112 -75 140 -16-168 102  15 122    -159 -94      78
55  50 -87 111 -81-114 176-122  26 -88 -23
   0/17:08:55  108  80-110 -76 141 -15-168 106  17 122    -157 -92      79
55  51 -85 111 -79-115 175-123  26 -92 -26
   0/17:09:05  105  77-110 -76 140 -17-169 105  16 121    -158 -94      78
53  49 -87 109 -81-113 176-123  28 -90 -23
   0/17:09:15  105  78-109 -78 139 -18-168 105  17 123    -159 -98      80
53  48 -88 108 -82-113 177-123  29 -92 -24
   0/17:09:25  108  77-108 -77 140 -18-166 107  20 124    -159 -97      81
56  47 -86 109 -81-113 176-123  28 -95 -27
   0/17:09:35  112  80-106 -74 141 -16-165 107  23 126    -156 -94      84
57  48 -84 107 -78-114 180-126  24 -96 -31
   0/17:09:45  108  81-102 -75 140 -15-165 105  22 125    -156 -93      83
57  46 -85 107 -78-114-179-125  25 -96 -28

Source=0134+329        : 0003, Stokes=RR  , IF=  2, Chans=   1-   1
Flux =  0.0000 Jy, Calcode = C   , Freq =  4.585100000 GHz
Phase, 1000 = 1000.00000 degrees, averging type = Vector

Baselines
012202220322042205220622072208221022112212221322142215221622172218221922202221222232224222522262227228
```

```
2122222322242225222622272228
   0/17:22:05   84  88-111          -5-173         107     171          71
41  51 -98     -66-102-153 -91  54 -86 -12
   0/17:22:15   85  88-109 -80 148  -2-172  89  42 110     172-102      76
43  55 -96 145 -70-104-154 -93  51 -88 -12
   0/17:22:25   84  91-108 -84 146  -7-176  86  41 105     172-102      73
40  53-100 142 -76-103-152 -93  52 -85 -10
   0/17:22:35   82  91-110 -85 148  -5-176  85  42 102     175-100      76
41  50-100 143 -80-106-153 -96  50 -84 -10
   0/17:22:45   81  90-113 -83 150  -4-176  84  43 103     176 -99      79
42  53-100 144 -81-108-155 -96  50 -82 -13
   0/17:22:55   81  90-114 -84 152  -2-177  83  43  98     175-106      75
41  53-101 144 -72-111-155 -95  48 -79 -20
   0/17:23:05   79  86-119 -88 151  -3-179  79  39  96     173-109      71
36  50-102 143 -72-110-153 -94  48 -73 -19
   0/17:23:15   82  85-116 -88 154   1-177  84  43  99     175-105      73
36  54 -98 145 -77-116-157 -96  46 -74 -26
   0/17:23:25   87  90-113 -86 159   4-173  88  45  99     179-101      76
38  60 -94 150 -75-118-161 -99  42 -76 -25
   0/17:23:35   90  90-108 -82 161   9-170  89  48 101    -179 -98      78
41  64 -91 152 -73-120-164-101  41 -76 -29
   0/17:23:45   86  82-114 -87 154   6-175  84  42  97     175-103      71
37  60 -93 146 -76-114-161 -99  45 -71 -26
   0/17:23:55   92  81-115 -86 152   5-174  85  40  98     175-102      71
39  62 -92 148 -77-116-162-102  43 -72 -27
   0/17:24:05   99  82-114 -85 152   5-173  87  42  99     177 -98      71
39  66 -90 150 -76-118-164-102  41 -74 -26
   0/17:24:15   96  80-114 -81 155   7-172  88  44 103    -179 -98      72
41  69 -89 154 -73-121-167-107  37 -75 -27
   0/17:24:25   95  78-119 -79 153   4-175  84  39  97     180 -99      69
40  67 -91 153 -76-119-165-105  37 -69 -25
   0/17:24:35   96  79-120 -79 153   5-177  85  41  96    -180 -98      68
42  68 -91 152 -75-118-165-104  35 -68 -20
   0/17:24:45   98  75-117 -80 152   5 179  86  38 100     178 -97      68
43  68 -90 149 -74-118-163-105  34 -68 -15
   0/17:24:55   99  74-117 -81 151   7 178  88  37 100     176-101      67
45  67 -88 150 -74-117-162-104  33 -69 -12
AIPS 1: Resumes
```

```
dparm 0
```

Start the calibration

Set the flux values of the known calibrators

```
task 'setjy'
default
getn 4
```

```
source '0518+165',' '
bif 0
eif 0
optype 'calc'
aparm(2) 3
go
```

```
vlb054> SETJY1: Task SETJY  (release of 31DEC10) 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 is available
vlb054> SETJY1: Consult the help file for CALRD for assistance
vlb054> SETJY1: / Flux calculated using known spectrum
vlb054> SETJY1: BIF =  1 EIF =  2 /Range of IFs
vlb054> SETJY1: '0518+165        ' IF =  1 FLUX = 3.7742 (Jy calcd)
vlb054> SETJY1: '0518+165        ' IF =  2 FLUX = 3.9464 (Jy calcd)
vlb054> SETJY1: / Using (1995.2) VLA or Reynolds (1934-638) coefficients
vlb054> SETJY1: Appears to have ended successfully
vlb054> SETJY1: vlb054       31DEC10 TST: Cpu=       0.0  Real=       0
```

```
bif 1
eif 1
optype ' '
zerosp 3.7742, 0.380, -0.153, 0.0
go
bif 2
eif 2
zerosp 3.9464, 0.397, -0.161, 0.0
go

bif 0
eif 0
zerosp 0
optype 'calc'
source = '0134+329',' '
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: 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 =  2 /Range of IFs
vlb054> SETJY1: '0134+329        ' IF =  1 FLUX = 5.4891 (Jy calcd)
vlb054> SETJY1: '0134+329        ' IF =  2 FLUX = 5.8249 (Jy calcd)
vlb054> SETJY1: / Using (1995.2) VLA or Reynolds (1934-638) coefficients
vlb054> SETJY1: Appears to have ended successfully
```

```
vlb054> SETJY1: vlb054       31DEC08 TST: Cpu=       0.0  Real=       0
```

Get images (and thus clean components) for the calibrators

```
task 'calrd'
object '3c138'
band 'c'
go

object '3c48'
band 'c'
go

pcat
```

```
AIPS 1: Catalog on disk  1
AIPS 1:  Cat Usid Mapname      Class   Seq  Pt     Last access      Stat
AIPS 1:    1  100 19940725    .C BAND.    1 UV 16-NOV-2010 13:15:34
AIPS 1:    2  100 19940725    .X BAND.    1 UV 16-NOV-2010 13:15:34
AIPS 1:    3  100 19940725    .X BAND.    2 UV 16-NOV-2010 13:15:34
AIPS 1:    4  100 19940725    .C BAND.    2 UV 16-NOV-2010 15:02:52
AIPS 1:    5  100 19940725    .U BAND.    1 UV 16-NOV-2010 13:15:34
AIPS 1:    6  100 19940725    .C BAND.    3 UV 16-NOV-2010 13:15:45
AIPS 1:    7  100 19940725    .C BAND.    4 UV 16-NOV-2010 13:15:44
AIPS 1:    8  100 19940725    .X BAND.    3 UV 16-NOV-2010 13:15:44
AIPS 1:    9  100 19940725    .X BAND.    4 UV 16-NOV-2010 13:15:45
AIPS 1:   10  100 3C138_C     .MODEL .    1 MA 16-NOV-2010 15:03:51
AIPS 1:   11  100 3C48_C      .MODEL .    1 MA 16-NOV-2010 15:03:55
```

Convert the (u,v) data to the epoch of the calibration images

Note: it is possible to change the epoch of the calibration image headers to B1950, but there would remain a small error in the rotation of the coordinate system. The proper fix is to convert the (u,v) coordinates or to rotate the images.

```
task 'uvfix'
clron
outdisk 1
shift 0
uvfixprm 0
go
```

Now fix the index table.

```
pcat

task 'indxr' getn 12
cparm 0
cparm(3)= -1
```

```
bparm 0
go
cparm 0
```

Do the actual calibration. Start with 3C138

```
task 'calib'
default
getn 12
calsour '0518+165',' '
uvrange 0
antenna 0
refant 22
minamper 10
minphser 10
weightit 1
get2n 10
ncomp 0
solmode 'A&P'
aparm(6) 2
solint 2
solsub 2
cparm(3) 10
cparm(4) 10
go
clrmsg
```

Calibrate 3C48

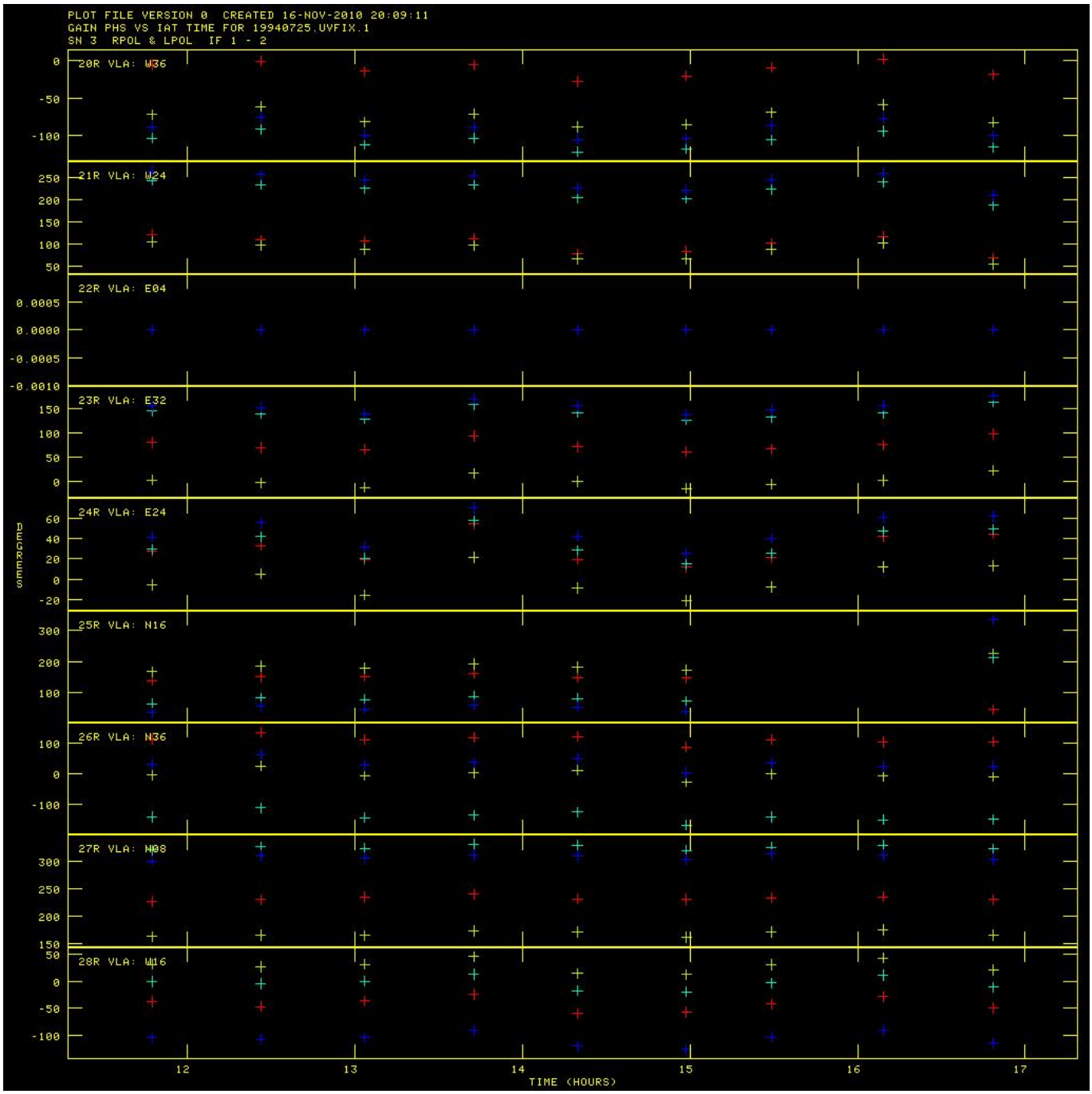
```
calsour '0134+329',' '
get2n 11
go
clrmsg
```

Calibrate the phase calibrator

```
clr2n
calsour '0420+417', ' '
solint 0
uvrange 20 0
go
clrmsg
```

Check the results

```
task 'snplt'
antenna 0
stokes ' '
inext 'sn'
inver 1
sources ' '
timer 0
optype 'amp'
opcode 'alsi'
do3col 1
dotv 1
nplots 9
tvinit
go
optype 'phas'
go
inver 2
optype 'amp'
go
optype 'phas'
go
inver 3
optype 'amp'
go
optype 'phas'
go
```



Apply the calibration to the phase calibrator

```
task 'getjy'
sources '0420+417', ' '
calsour '0518+165','0134+329',' '
calcode ' '
bif 0
eif 0
antenna 0
timer 0
snver 0
go
```

```
vlb054> GETJY1: Task GETJY  (release of 31DEC10) begins
vlb054> GETJY1: Calibrator robust averaging used    200 of    200 gain
samples
vlb054> GETJY1:    Source:Qual      CALCODE IF  Flux (Jy)
vlb054> GETJY1: 0420+417        :  3   B     1    1.46712 +/-   0.00294
0.00294
vlb054> GETJY1:                               2    1.47148 +/-   0.00234
0.00344
vlb054> GETJY1:    Source:Qual    CALCODE    used   total     bad used  tot
bad
vlb054> GETJY1: 0420+417        :  3 B        900     900       0   97  100
0
vlb054> GETJY1: Appears to have ended successfully
vlb054> GETJY1: vlb054       31DEC10 TST: Cpu=       0.0  Real=       0
```

Redo the phase calibrator calibration

Now that the flux density of the phase calibrator has been found, redo its calibration (just to make sure there are no remnants of some subtle assumptions about its flux density left in AIPS).

```
inext 'sn'
inver 3
extdest
inver 0
tget calib
go
clrmsg
```

Apply the calibration to all sources of interest.

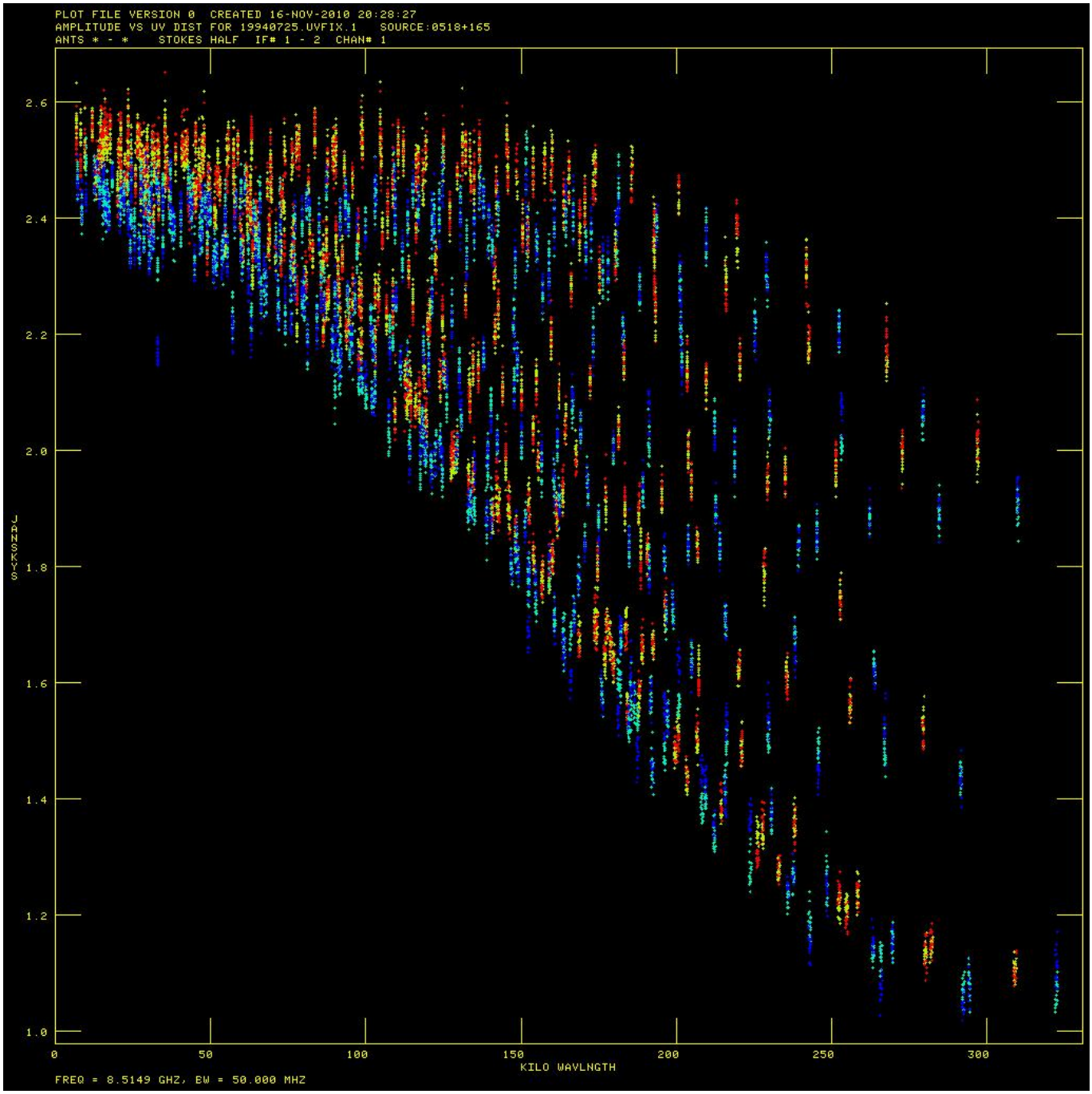
```
task 'clcal'
sources '0518+165','0134+329','0420+417', '3C129', ' '
calsour '0518+165','0134+329','0420+417', ' '
opcode 'cali'
gainver 1
gainuse 2
refant 22
interp '2pt'
doblank 1
go
```

Have a look at the calibration

Plots

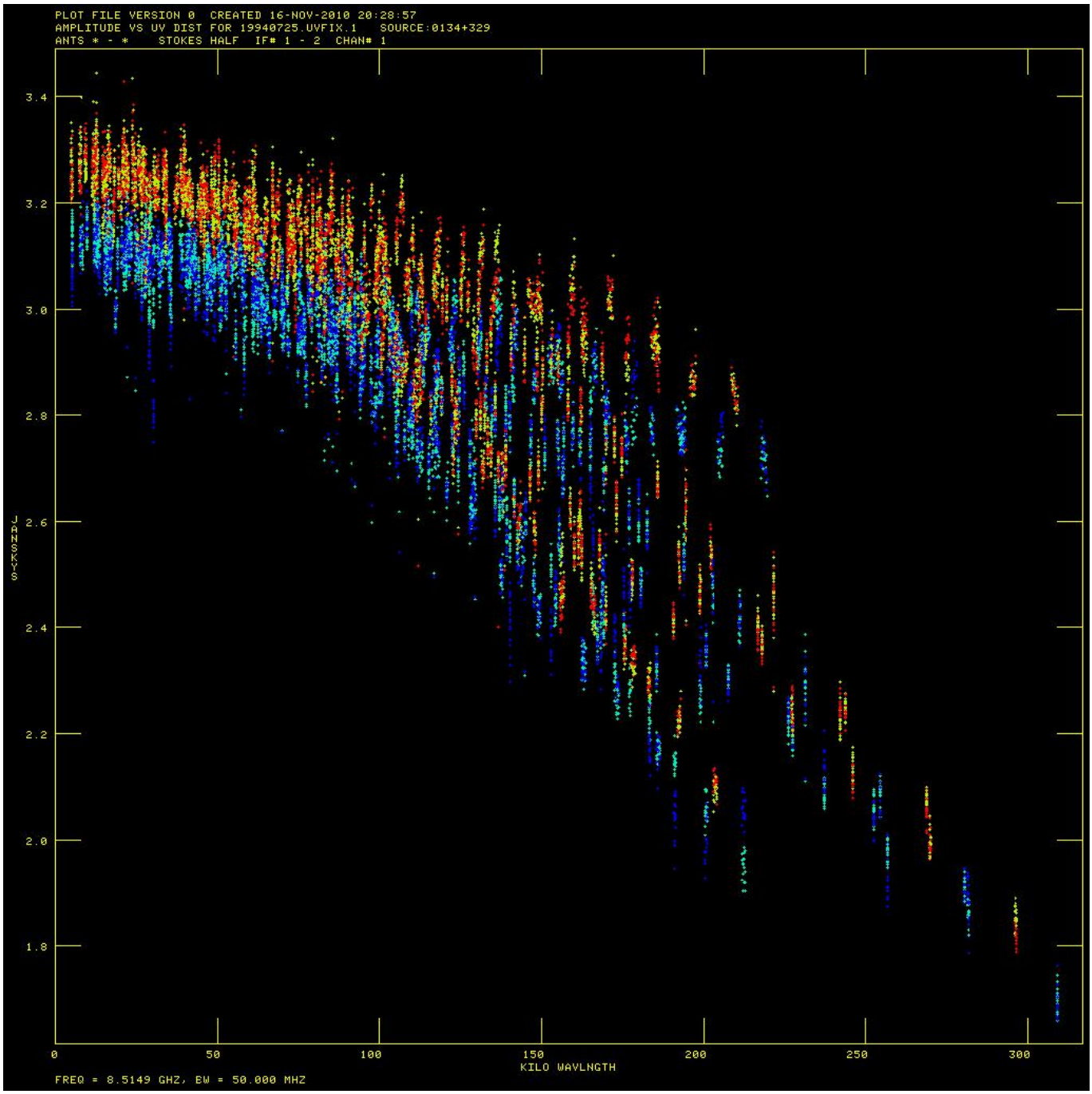
Plots

```
task 'uvplt'
source '0518+165',' '
calcode ' '
stokes 'half'
timer 0
uvrange 0
bif 0
eif 0
docalib 1
gainuse 2
bparm 0 1
aparm 0
refant 22
do3col 1
dotv 1
tvinit
go
```



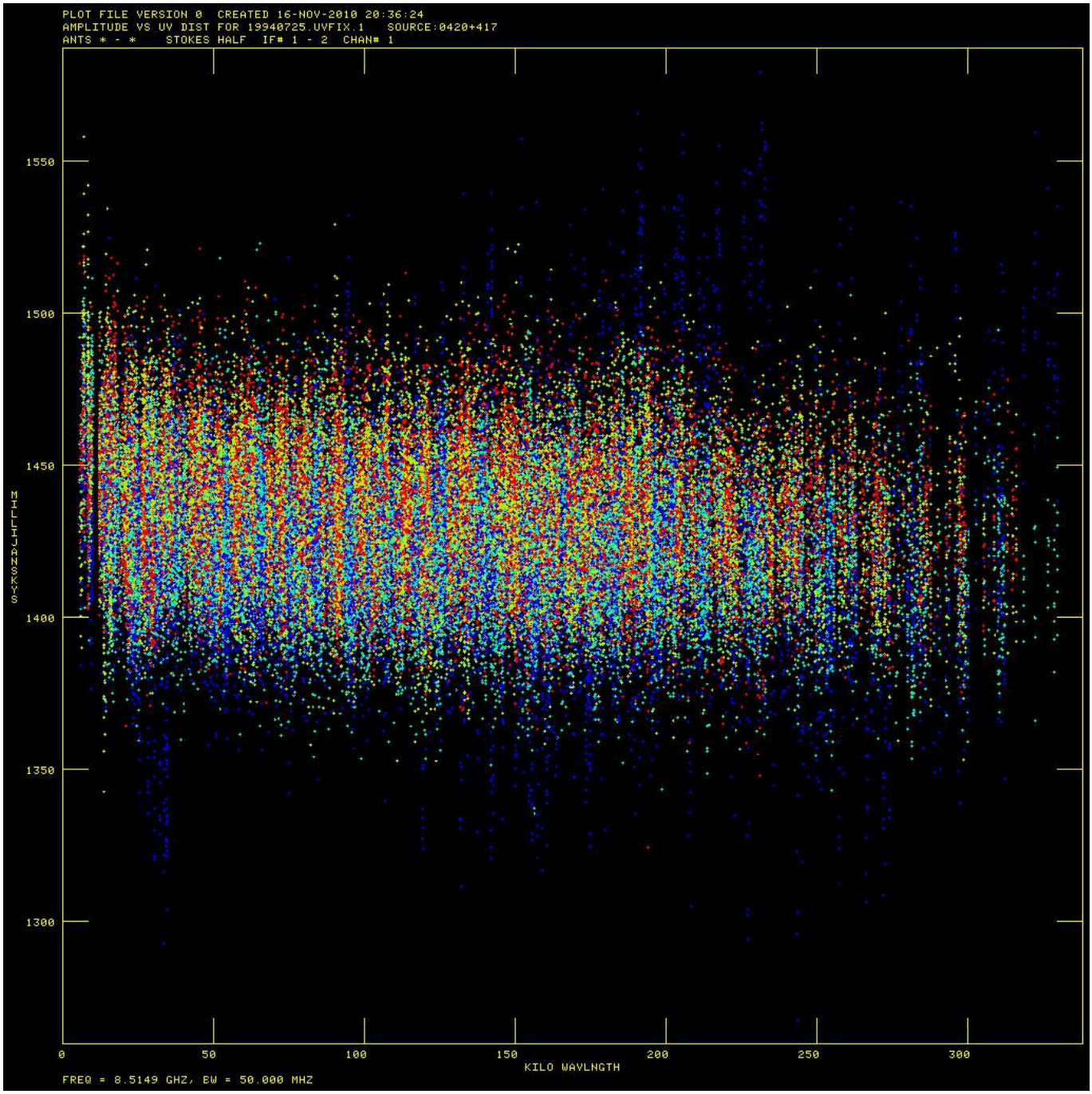
Why are the different colored points for the different subbands and polarizations not overlapping?

```
source '0134+329',' '
tvinit
go
```



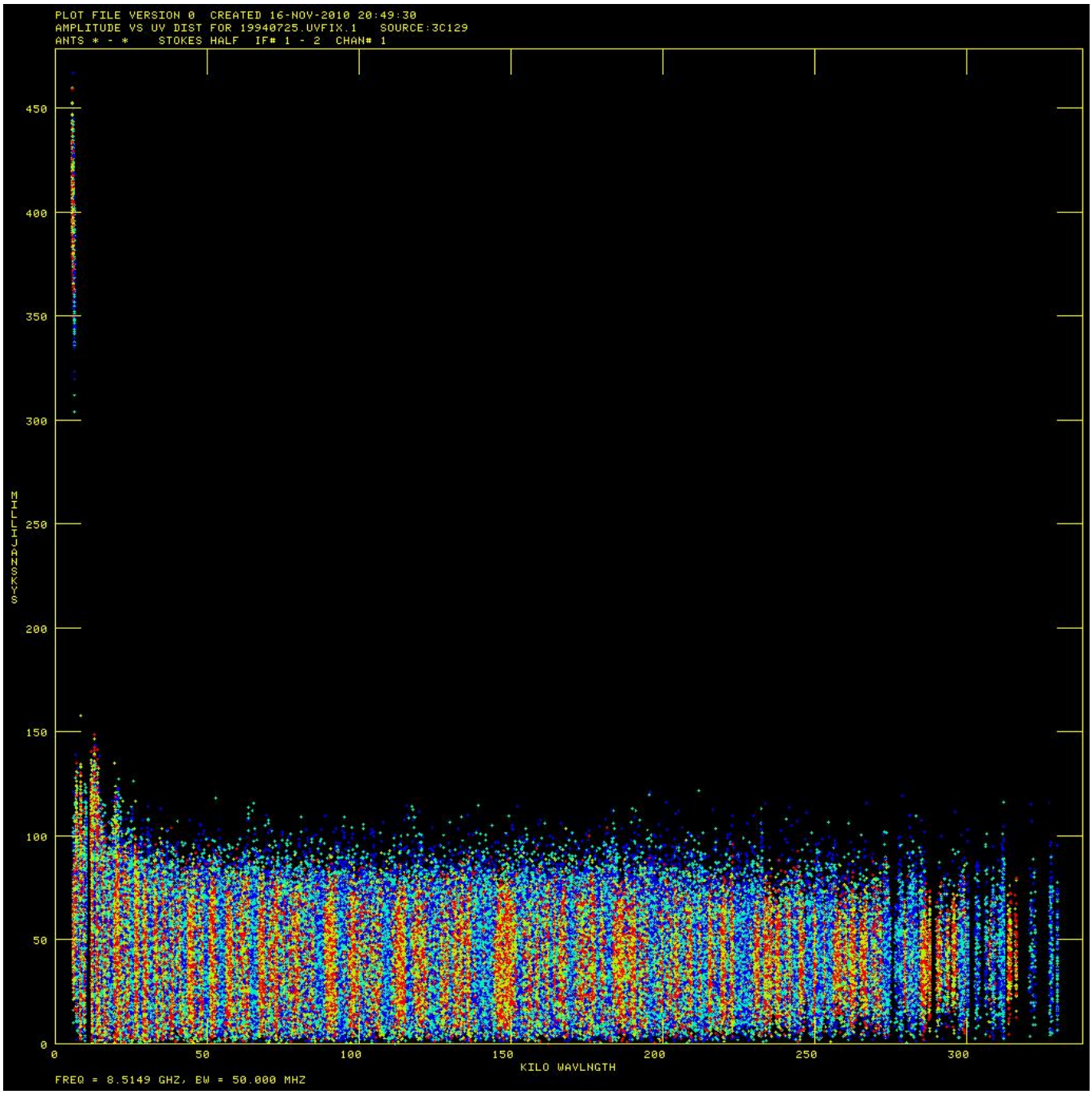
Again the different colors do not overlap. Why not?

```
source '0420+417', ' '
tvinit
go
```



But here they do overlap. Why? How has this changed from before?

```
source '3C129', ' '
tvinit
go
```



Start the polarization calibration

Check the parallactic angle change

```
task 'listr'
sources '0518+165','0134+329','0420+417', ' '
inext 'cl'
inver 2
optype 'gain'
dparm 9,0
go
```

Make a backup of calibration values, in case we mess up

```
task 'tasav'
clro
go
```

Now do the polarization calibration using the phase calibrator

```
task 'pcal'
calsour '0420+417', ' '
timer 0
antenna 0
uvrange 20,0
bif 0
eif 0
docalib 1
gainuse 2
clr2n
pmodel 0
solint 3
soltype 'appr'
prtlev 1
refant 22
bparm 0
cparm 0
go
clrmsg
```

```
vlb054> PCAL 1: Calibration source   1
vlb054> PCAL 1:   Q+iU=(  -0.01035,   0.03766) +/- (  0.000106,  0.000106)
Jy
vlb054> PCAL 1:   Pol. inten. =   0.03905 +/-  0.000150 Jy, angle =  52.68
+/-
vlb054>         0.078 deg
vlb054> PCAL 1: 0420+417         I,Q,U,V =   1.4647 -0.01035  0.03766
0.00000 J
vlb054>         y
vlb054> PCAL 1: Calibration source   1
vlb054> PCAL 1:   Q+iU=(  -0.03423,   0.00815) +/- (  0.000114,  0.000114)
Jy
vlb054> PCAL 1:   Pol. inten. =   0.03519 +/-  0.000161 Jy, angle =  83.31
+/-
vlb054>         0.093 deg
vlb054> PCAL 1: 0420+417         I,Q,U,V =   1.4651 -0.03423  0.00815
0.00000 J
vlb054>         y
```

Using the calibration, check the difference between polarizations on a polarized calibrator

```
task 'rldif'
source '0518+165', ' '
timer 0
antenna 0
uvrange 0,45
docalib 1
gainuse 2
dopol true
go
```

```
Ampscalar average of matrix  =   -30.19(  0.081) sigma =  1.160
Ampscalar average of matrix  =    33.93(  0.097) sigma =  1.389
```

outputs

```
AIPS 1: RLDIF:  Task to return Right - Left phase difference
AIPS 1: Adverbs     Values                 Comments
AIPS 1: ------------------------------------------------------------
AIPS 1: CLCORPRM    -30.1863     33.9257   R-L phase difference returned
AIPS 1:            *rest 0
```

Another save, just in case

```
task 'tasav'
clro
go
```

What is the angle supposed to be for this calibrator?

Polarization data for C band from http://www.vla.nrao.edu/astro/calib/polar/1999/

Correct number is -21.71

Correct the measured values

```
for i=1 to 2;clcorp(i) = -21.71 - clcorp(i);end
```

Apply them

```
task 'clcor'
```

```
source ' '
antenna 0
timer 0
bif 0
eif 0
gainver 2
gainuse 0
opcode 'polr'
stokes 'l'
go
```

Check that the angles match what we expect

```
task 'rldif'
source '0518+165', ' '
timer 0
antenna 0
uvrange 0,45
docalib 1
gainuse 3
dopol true
go
```

Look at what AIPS gave back

```
outputs
```

```
AIPS 1: RLDIF:  Task to return Right - Left phase difference
AIPS 1: Adverbs     Values                  Comments
AIPS 1: ------------------------------------------------------------------
AIPS 1: CLCORPRM    -21.71      -21.71     R-L phase difference returned
AIPS 1:            *rest 0
```

```
################
```

Now start with the smaller array data. Load it in

FILLM

```
task 'fillm'
default
nfiles 2
prtlev 0
datain 'PWD:AT166_
doconcat true
clron
```

```
doweight 10
ncount 1
cparm(4)=28
cparm(8)=10./60
go
```

Check where it went

```
pcat
```

```
AIPS 1: Catalog on disk  1
AIPS 1:  Cat Usid Mapname      Class   Seq  Pt     Last access      Stat
AIPS 1:    1  101 19940725    .C BAND.    1 UV 13-NOV-2008 17:24:12
AIPS 1:    2  101 19940725    .X BAND.    1 UV 13-NOV-2008 17:24:13
AIPS 1:    3  101 19940725    .X BAND.    2 UV 13-NOV-2008 17:24:13
AIPS 1:    4  101 19940725    .C BAND.    2 UV 13-NOV-2008 17:24:13
AIPS 1:    5  101 19940725    .U BAND.    1 UV 13-NOV-2008 17:24:13
AIPS 1:    6  101 3C138_C     .MODEL .    1 MA 13-NOV-2008 16:16:53
AIPS 1:    7  101 3C48_C      .MODEL .    1 MA 13-NOV-2008 16:19:09
AIPS 1:    8  101 19940725    .TASAV .    1 UV 13-NOV-2008 17:24:13
AIPS 1:    9  101 19940725    .TASAV .    2 UV 13-NOV-2008 17:24:13
AIPS 1:   10  101 19941103    .C BAND.    1 UV 13-NOV-2008 17:24:36
AIPS 1:   11  101 19941103    .X BAND.    1 UV 13-NOV-2008 17:24:36
AIPS 1:   12  101 19941103    .X BAND.    2 UV 13-NOV-2008 17:24:36
AIPS 1:   13  101 19941103    .C BAND.    2 UV 13-NOV-2008 17:24:36
```

Makre sure we have the right one

```
getn 13
imhe
```

Get the scan information

```
task 'listr'
default
getn 13
optype 'scan'
doweight 1
go
```

```
 vlb054    LISTR(31DEC08)    101     13-NOV-2008  17:25:15    Page    1
File = 19941103    .C BAND.   2 Vol = 1  Userid =  101
Freq =  4.885100000 GHz   Ncor =  4   No. vis =     52167
Scan summary listing

Scan      Source      Qual  Calcode Sub         Timerange          FrqID
```

```
START VIS  END VIS
   1 0134+329        : 0003  C        1  0/04:05:15 -   0/04:07:25     1
1         36
   2 0420+417        : 0003  B        1  0/07:33:35 -   0/07:35:15     1
37       3169
   3 0518+165        : 0003  C        1  0/07:42:35 -   0/07:45:45     1
3170       9457
   4 3C129           : 0003           1  0/08:18:05 -   0/08:23:25     1
9458      20308
   5 0420+417        : 0003  B        1  0/08:27:35 -   0/08:29:15     1
20309      22845
   6 0420+417        : 0003  B        1  0/08:49:25 -   0/08:51:05     1
22846      25972
   7 3C129           : 0003           1  0/09:07:05 -   0/09:12:25     1
25973      35132
   8 0420+417        : 0003  B        1  0/09:17:05 -   0/09:18:45     1
35133      38213
   9 3C129           : 0003           1  0/09:40:25 -   0/09:45:05     1
38214      47664
  10 0420+417        : 0003  B        1  0/09:49:35 -   0/09:51:55     1
47665      52167

Source summary
Velocity type = '        '    Definition = '        '

  ID Source           Qual  Calcode RA(1950.0)     Dec(1950.0)   IFlux
QFlux   UFlux   VFlux  No. vis
   1 0134+329        : 0003   C     01:34:49.8320  32:54:20.520   0.000
0.000   0.000   0.000      36
             IF( 2)                                               0.000
0.000   0.000   0.000
   2 0420+417        : 0003   B     04:20:27.9370  41:43:08.045   0.000
0.000   0.000   0.000   16381
             IF( 2)                                               0.000
0.000   0.000   0.000
   3 0518+165        : 0003   C     05:18:16.5320  16:35:26.900   0.000
0.000   0.000   0.000    6288
             IF( 2)                                               0.000
0.000   0.000   0.000
   4 3C129           : 0003         04:45:31.6950  44:55:19.950   0.000
0.000   0.000   0.000   29462
             IF( 2)                                               0.000
0.000   0.000   0.000

  ID Source           Freq(GHz) Velocity(Km/s) Rest freq (GHz)
   1 All Sources         4.8851         0.0000          0.0000
     IF(  2)             4.5851         0.0000          0.0000

Frequency Table summary
FQID IF#      Freq(GHz)      BW(kHz)   Ch.Sep(kHz)  Sideband
   1   1       4.88510000   50000.0039  50000.0039      1
```

```
       2       4.58510000   50000.0039  50000.0039      1
AIPS 1: Resumes
```

Get antenna positions

```
go prtan
```

```
                        Location Of VLA Antennas

                                 N18 (26)
                                 N16 ( 1)
                                 N14 ( 9)
                                 N12 (11)
                                 N10 (15)
                                 N8  (27)
                                 N6  (25)
                                 N4  (14)
                                 N2  (13)
                              ( 3) W2   E2  ( 4)
                            (12) W4       E4  (22)
                          (21) W6           E6  (16)
                        ( 8) W8               E8  (17)
                      ( 2) W10                  E10 (24)
                    (10) W12                      E12 ( 5)
                  (18) W14                          E14 (23)
                (28) W16                              E16 ( 7)
              (20) W18                                  E18 ( 6)
                              VLA:_OUT (19)
                              VPT:_OUT (29)
AIPS 1: Resumes
```

Flag some bad data. Just run the commands and think about this later.

```
task 'uvflg'
default
dohist 1
getn 13
antenna 0
basel 0
timer 0 0 0 0 0 4 8 0
stokes ' '
opcode 'flag'
reason 'bad scan'
outfgver 1
go
```

```
timer 0 8 18 0 0 8 30 0
go
antenna 0
timer 0 9 10 0 0 9 15 0
go
reason 'bad ant
antenna 4,0
timer 0
```

Check out some properties of the raw data

Plots

```
task 'uvplt'
source '0518+165',' '
calcode ' '
stokes 'half'
timer 0
uvrange 0
bif 0
eif 0
docalib 0
gainuse 1
bparm 0 1
do3col 1
dotv 1
tvinit
go
source '0420+417', ' '
tvinit
go
source '3C129', ' '
tvinit
go
bparm 6 7
source '0518+165',' '
tvinit
go
source '0420+417', ' '
tvinit
go
source '3C129', ' '
tvinit
go
bparm 0
```

Raw numbers

```
task 'listr'
optype 'list'
antenna 4,0
basel 0
sources ' '
calcode '*'
bif 0
eif 0
docalib 0
stokes ' '
dparm 0
go
```

Begin the calibration

Apply the flux densities for the known calibrators

```
task 'setjy'
default
getn 13
source '0518+165',' '
bif 0
eif 0
optype 'calc'
aparm(2) 2
go
```

```
vlb054> SETJY1: BIF =  1 EIF =  2 /Range of IFs
vlb054> SETJY1: '0518+165        ' IF =  1 FLUX = 3.7742 (Jy calcd)
vlb054> SETJY1: '0518+165        ' IF =  2 FLUX = 3.9464 (Jy calcd)
vlb054> SETJY1: / Using (1995.2) VLA or Reynolds (1934-638) coefficients
```

```
bif 1
eif 1
optype ' '
zerosp 3.7742, 0.380, -0.153, 0.0
go
bif 2
eif 2
zerosp 3.9464, 0.397, -0.161, 0.0
go

bif 0
eif 0
```

```
zerosp 0
optype 'calc'
```

Run the calibration for 3C138

```
task 'calib'
default
getn 13
calsour '0518+165',' '
uvrange 0
antenna 0
refant 4
minamper 10
minphser 10
weightit 1
get2n 6
ncomp 0
solmode 'A&P'
aparm(6) 2
solint 2
solsub 2
cparm(3) 10
cparm(4) 10
go
clrmsg
```

Calibrate the phase calibrator

```
clr2n
calsour '0420+417', ' '
solint 0
uvrange 0
go
clrmsg
```

Check the results

```
task 'snplt'
antenna 0
stokes ' '
inext 'sn'
inver 1
sources ' '
timer 0
optype 'amp'
opcode 'alsi'
do3col 1
```

```
dotv 1
nplots 9
tvinit
go
optype 'phas'
go
inver 2
optype 'amp'
go
optype 'phas'
go
```

Use the amplitude calibrator to get the phase calibrator flux density

```
task 'getjy'
sources '0420+417', ' '
calsour '0518+165',' '
calcode ' '
bif 0
eif 0
antenna 0
timer 0
snver 0
go
```

```
vlb054> GETJY1: Task GETJY  (release of 31DEC08) begins\\
vlb054> GETJY1:    Source:Qual      CALCODE IF  Flux (Jy)
vlb054> GETJY1: 0420+417        :  3   B     1    1.33893 +/-   0.00641
vlb054> GETJY1:                               2    1.34714 +/-   0.00525
vlb054> GETJY1: Appears to have ended successfully
vlb054> GETJY1: vlb054       31DEC08 TST: Cpu=       0.0  Real=       0
```

Redo the phase calibrator calibration

Now that we know the flux density of the phase calibrator, run through its calibration again, just to be sure AIPS doesn't have some information left around from calibrating before with an unknown flux density.

```
inext 'sn'
inver 2
extdest
inver 0
tget calib
go
clrmsg
```

Apply the calibration to all sources

```
task 'clcal'
sources '0518+165','0420+417', '3C129', ' '
calsour '0518+165','0420+417', ' '
opcode 'cali'
gainver 1
gainuse 2
refant 4
interp '2pt'
doblank 1
go
```

Check the results

Plots

```
task 'uvplt'
docalib 1
gainuse 2
source '0420+417', ' '
stokes 'half'
aparm 0
bparm 0 1
doweight 1
uvrange 0
tvinit
go
```

Now start the polarization calibration

Check the paralactic angles

```
task 'listr'
sources '0518+165','0420+417', ' '
inext 'cl'
inver 2
optype 'gain'
dparm 9,0
go
```

Make a backup of calibration information

```
task 'tasav'
clro
go
```

Run the polarization calibration on the phase calibrator

```
task 'pcal'
calsour '0420+417', ' '
timer 0
antenna 0
uvrange 0
bif 0
eif 0
docalib 1
gainuse 2
clr2n
pmodel 0
solint 3
soltype 'appr'
prtlev 1
refant 4
bparm 0
cparm 0
go
clrmsg
```

```
vlb054> PCAL 1: Calibration source   1
vlb054> PCAL 1:   Q+iU=(   0.00444,  -0.04706) +/- (  0.000273,  0.000273)
Jy
vlb054> PCAL 1:   Pol. inten. =   0.04727 +/-  0.000386 Jy, angle = -42.30
+/-
vlb054>         0.165 deg
vlb054> PCAL 1: 0420+417         I,Q,U,V =   1.3389  0.00444 -0.04706
0.00000 J
vlb054>         y
vlb054> PCAL 1: Calibration source   1
vlb054> PCAL 1:   Q+iU=(   0.02002,   0.03901) +/- (  0.000277,  0.000277)
Jy
vlb054> PCAL 1:   Pol. inten. =   0.04385 +/-  0.000392 Jy, angle =  31.42
+/-
vlb054>         0.181 deg
vlb054> PCAL 1: 0420+417         I,Q,U,V =   1.3471  0.02002  0.03901
0.00000 J
vlb054>         y
```

Check the phase difference between polarizations on a polarization calibrator

```
task 'rldif'
source '0518+165', ' '
timer 0
antenna 0
uvrange 0,45
docalib 1
gainuse 2
dopol true
go

outputs
```

```
AIPS 1: RLDIF:  Task to return Right - Left phase difference
AIPS 1: Adverbs     Values                 Comments
AIPS 1: ------------------------------------------------------------------
AIPS 1: CLCORPRM    132.6554    -74.984    R-L phase difference returned
AIPS 1:            *rest 0
```

Make backups again

```
task 'tasav'
clro
go
```

Find out what the polarization angle on the sky is supposed to be

Polarization data for C band from http://www.vla.nrao.edu/astro/calib/polar/1999/

Correct number is -21.71

Correct the measured values

```
for i=1 to 2;clcorp(i) = -21.71 - clcorp(i);end
```

Apply the corrections

```
task 'clcor'
source ' '
antenna 0
timer 0
bif 0
eif 0
gainver 2
gainuse 0
opcode 'polr'
stokes 'l'
```

```
go
```

Check that the angles are now correct

```
task 'rldif'
source '0518+165', ' '
timer 0
antenna 0
uvrange 0,45
docalib 1
gainuse 3
dopol true
go
```

outputs

```
AIPS 1: RLDIF:  Task to return Right - Left phase difference
AIPS 1: Adverbs     Values                 Comments
AIPS 1: ------------------------------------------------------------------
AIPS 1: CLCORPRM    -21.71      -21.71     R-L phase difference returned
AIPS 1:            *rest 0
```

```
############################
```

Work on just the target data now

Run SPLIT on the two datasets

```
task 'split'
getn 4
source '3C129', ' '
timer 0
bif 0
eif 0
docalib 1
gainuse 3
dopol true
stokes ' '
douvcomp false
aparm 0
go
getn 13
go
clrmsg
```

Check for where the new datafiles are stored

```
pcat
```

```
AIPS 1: Catalog on disk  1
AIPS 1:  Cat Usid Mapname      Class   Seq  Pt     Last access      Stat
AIPS 1:    1  101 19940725    .C BAND.    1 UV 13-NOV-2008 17:24:12
AIPS 1:    2  101 19940725    .X BAND.    1 UV 13-NOV-2008 17:24:13
AIPS 1:    3  101 19940725    .X BAND.    2 UV 13-NOV-2008 17:24:13
AIPS 1:    4  101 19940725    .C BAND.    2 UV 13-NOV-2008 18:24:07
AIPS 1:    5  101 19940725    .U BAND.    1 UV 13-NOV-2008 17:24:13
AIPS 1:    6  101 3C138_C     .MODEL .    1 MA 13-NOV-2008 17:51:33
AIPS 1:    7  101 3C48_C      .MODEL .    1 MA 13-NOV-2008 16:19:09
AIPS 1:    8  101 19940725    .TASAV .    1 UV 13-NOV-2008 17:24:13
AIPS 1:    9  101 19940725    .TASAV .    2 UV 13-NOV-2008 17:24:13
AIPS 1:   10  101 19941103    .C BAND.    1 UV 13-NOV-2008 17:24:36
AIPS 1:   11  101 19941103    .X BAND.    1 UV 13-NOV-2008 17:24:36
AIPS 1:   12  101 19941103    .X BAND.    2 UV 13-NOV-2008 17:24:36
AIPS 1:   13  101 19941103    .C BAND.    2 UV 13-NOV-2008 18:24:18
AIPS 1:   14  101 19941103    .TASAV .    1 UV 13-NOV-2008 17:54:20
AIPS 1:   15  101 19941103    .TASAV .    2 UV 13-NOV-2008 17:56:30
AIPS 1:   16  101 3C129       .SPLIT .    1 UV 13-NOV-2008 18:24:07
AIPS 1:   17  101 3C129       .SPLIT .    2 UV 13-NOV-2008 18:24:18
```

Combine the two different observations into one big one

```
task 'dbcon'
getn 16
get2n 17
go
pcat
```

```
AIPS 1:   18  101 3C129       .DBCON .    1 UV 13-NOV-2008 18:28:31
```

Imaging

IMAGR is the standard imaging tool for AIPS

This will start up an imaging/cleaning session. Draw boxes and clean the source structure. Do this for all 4 Stokes parameters. (Unfortunately, IMAGR requires separate runs for the different Stokes parameters.)

```
task 'imagr'
getn 18
stokes 'i'
dopol 0
```

```
cellsize 0.25,0.25
imsize 2048,2048
clr2n
do3dimag 1
docalib 0
uvrange 0
niter 20000
overlap 1
go
clrmsg
stokes 'q'
go
clrmsg
stokes 'u'
go
clrmsg
stokes 'v'
go
clrmsg
```

Check where the files went

```
pcat
```

```
AIPS 1:   29  101 3C129       .IBM001.    3 MA 13-NOV-2008 19:46:00
AIPS 1:   30  101 3C129       .ICL001.    5 MA 13-NOV-2008 19:46:00
AIPS 1:   31  101 3C129       .QBM001.    1 MA 13-NOV-2008 19:47:30
AIPS 1:   32  101 3C129       .QCL001.    1 MA 13-NOV-2008 19:47:30
AIPS 1:   33  101 3C129       .UBM001.    1 MA 13-NOV-2008 19:49:06
AIPS 1:   34  101 3C129       .UCL001.    1 MA 13-NOV-2008 19:49:06
AIPS 1:   35  101 3C129       .VBM001.    1 MA 13-NOV-2008 19:49:39
AIPS 1:   36  101 3C129       .VCL001.    1 MA 13-NOV-2008 19:49:39
```

Polarization images

Combine Q and U to get linear polarization

```
task 'comb'
opcode 'polc'
getn 32
get2n 34
aparm 0
bparm(1) 28E-6
bparm(2) 28E-6
go
```

Get the linear polarization angle

```
opcode 'pola'
go
```

Check where file went

```
pcat
```

```
AIPS 1:   28  101 3C129       .PPOLC .    1 MA 13-NOV-2008 19:59:45
AIPS 1:   37  101 3C129       .PANG  .    1 MA 13-NOV-2008 20:00:28
```

Look at the images

Linear Polarization

```
getn 28
tvinit
tvlod
tvfiddle
tvstat
```

```
AIPS 1: Mean= 1.3417E-05 rms= 2.8180E-05 JY/BEAM   over  178694. pixels
```

Polarization Angle

```
getn 37
tvinit
tvlod
tvfiddle
```

I

```
getn 30
tvinit
tvlod
tvfiddle
tvstat
```

Clip the data so we only see information where there is good S/N

```
task 'comb'
getn 37
```

```
get2n 28
opcode 'clip'
aparm(1) 100E-6
aparm(10) 100E-6
bparm 0
outclass 'PANGC'
go
task 'comb'
getn 28
get2n 28
opcode 'clip'
aparm(1) 100E-6
aparm(10) 100E-6
bparm 0
outclass 'POLCC'
go
```

Check where these files went

```
pcat
```

```
AIPS 1:   38  101 3C129       .PANGC .    1 MA 13-NOV-2008 20:31:21
AIPS 1:   39  101 3C129       .POLCC .    1 MA 13-NOV-2008 20:31:21
```

Look at the polarization angle

```
getn 38
tvinit
tvlod
tvfiddle
```

Plotting your data

Plot I contours and P greyscale

```
task 'kntr'
getn 30
get2n 28
docont 1
dogrey 2
dovect 0
pixrange 0 1E-3
clev 28E-6
levs=-16,-8,8,16,32,64,128,256,512,1024
```

```
dowedge true
cbplot 1
dotv 1
blc 950 950
trc 1500 1500
go
```

Plot I contours and colors for polarization angle

```
task 'pcntr'
getn 30
get2n 32
get3n 34
docont 1
dogrey 2
dovect 1
pixrange 0 1E-3
clev 28E-6
levs=-16,-8,8,16,32,64,128,256,512,1024
factor 5
pol3col 1
pcut 80E-6
icut 0
dowedge 0
cbplot 1
dotv 1
blc 950 950
trc 1500 1500
go
```

Final Images