

Australia Telescope Compact Array Spectral Performance at 8 GHz

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Recent observations of the 8-9 GHz spectrum with the Compact Array achieved the noise level expected of a 12 hour observation of about 250 μ Jy. During the observations, *trapped modes* in the 3cm feed were identified.

In July 1993 Anantharamaiah *et al* (project C273) made observations to detect radio recombination lines in certain southern galaxies. The expected weakness of the signal meant that care was needed in choosing the observing frequency and the correct bandpass calibration strategy. The primary aim of the observation was to detect the recombination line, not to image the line emitting region. A 750 m array configuration was chosen to best match the expected spatial extent of the line source.

Two baseline calibrators were observed. 2251+158 has an 8GHz flux of 11 Jy and was observed for 50 minutes. 1226+023 (3C273) has a flux of 27.5 Jy and was observed for 15 minutes. The program source was observed for about 12 hours.

Initially the observations targetted transitions near 8.8 GHz but the band shape was found to contain two strong negative features near 8850 MHz. These have been identified as *trapped modes* in the 6/3 cm feed. Being designed to accomodate 6 cm propogation, the feed is expected to support resonant modes at particular frequencies in the 3 cm band. These observations present the first evidence of the existence of such modes. Figures 1 and 2 show the bandpass for antennas 5 and 6. The plots show two features about 2 MHz wide and whose frequencies differ between antennas. The remainder of the observations were made near 8.3 GHz.

The two bandpass calibrators were used to reduce the data. When calibrated against 3C273, the bandpass shape was unsatisfactory. Figure 3 shows a large gradient over part of the band. The size of this feature, ~ 15 mJy, is much greater than the expected line strength. When calibrated with 2251+158 the band shape was flat with a noise variation of about 250 μ Jy (figure 4). Figure 5 shows a successful detection of a 5 mJy line.

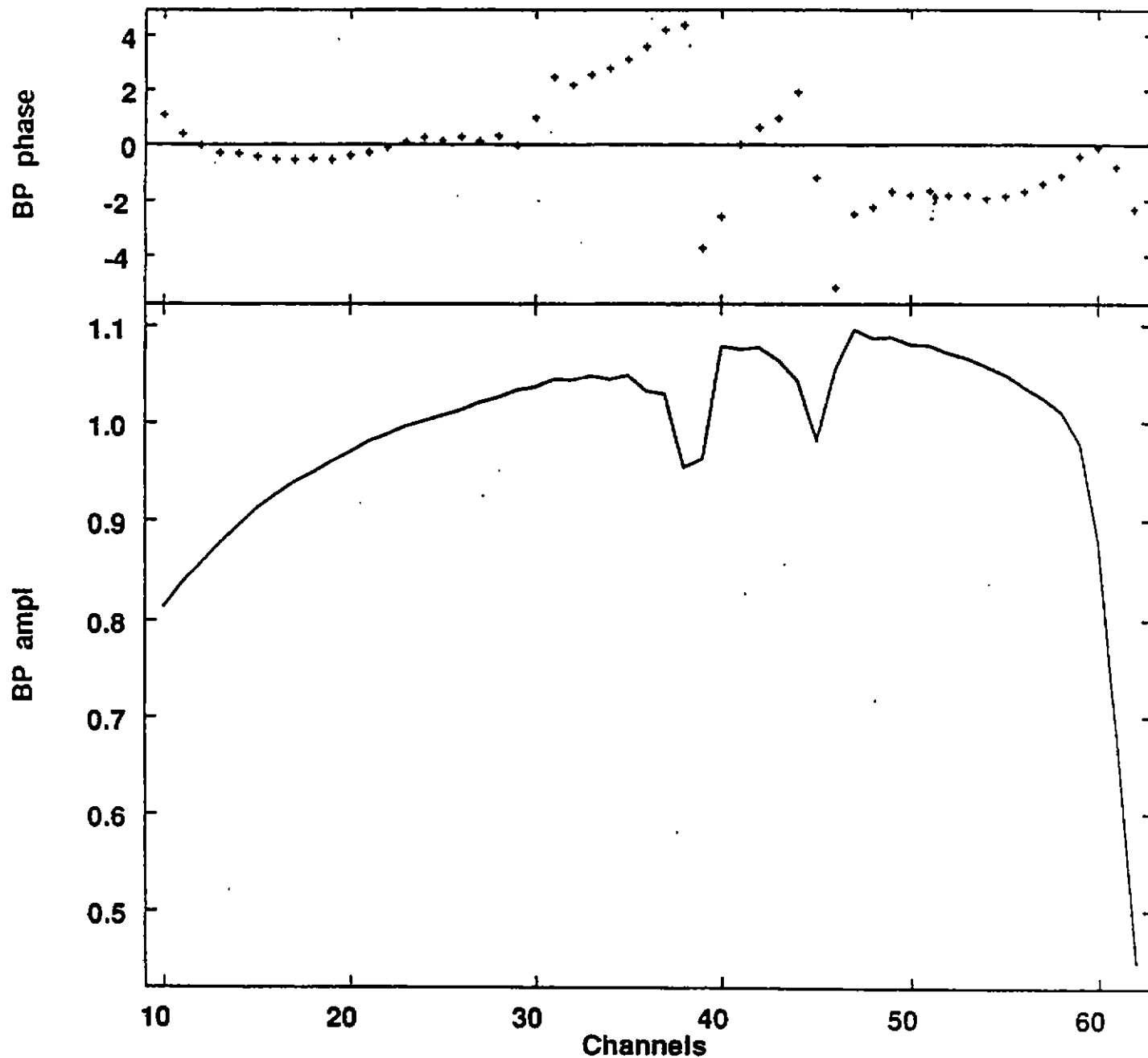
The failure of the bandpass calibration with 3C273 caused some concern. It was eventually concluded that the spatial structure of 3C273 and the consequent dependence of correlated flux on frequency made that source unsuitable for bandpass calibration.

Trapped modes

Plot file version 5 created 28-JUL-1993 10:06:33

1226+023 N4945-A1.UVDATA.1

Freq = 8.8570 GHz, Bw = 65.000 MHz



Bandpass table spectrum IF number: 2

Antenna: CA05 (5) Stokes: I

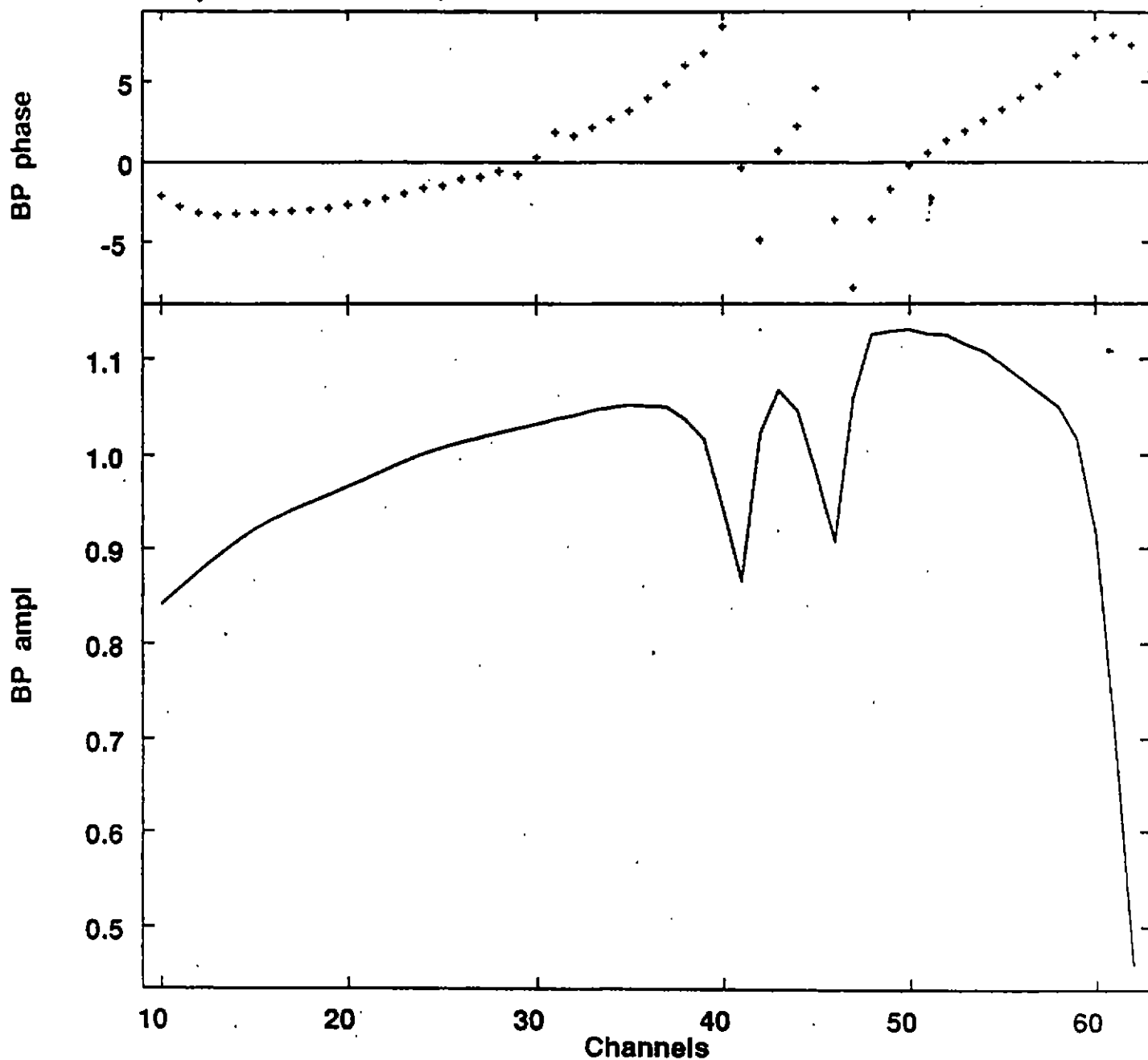
FIGURE 1 *Trapped modes - Antenna 5*

Trapped modes.

Plot file version 6 created 28-JUL-1993 10:06:40

1226+023 N4945-A1.UVDATA.1

Freq = 8.8570 GHz, Bw = 65.000 MHz



Bandpass table spectrum IF number: 2

Antenna: CA06 (6) Stokes: I

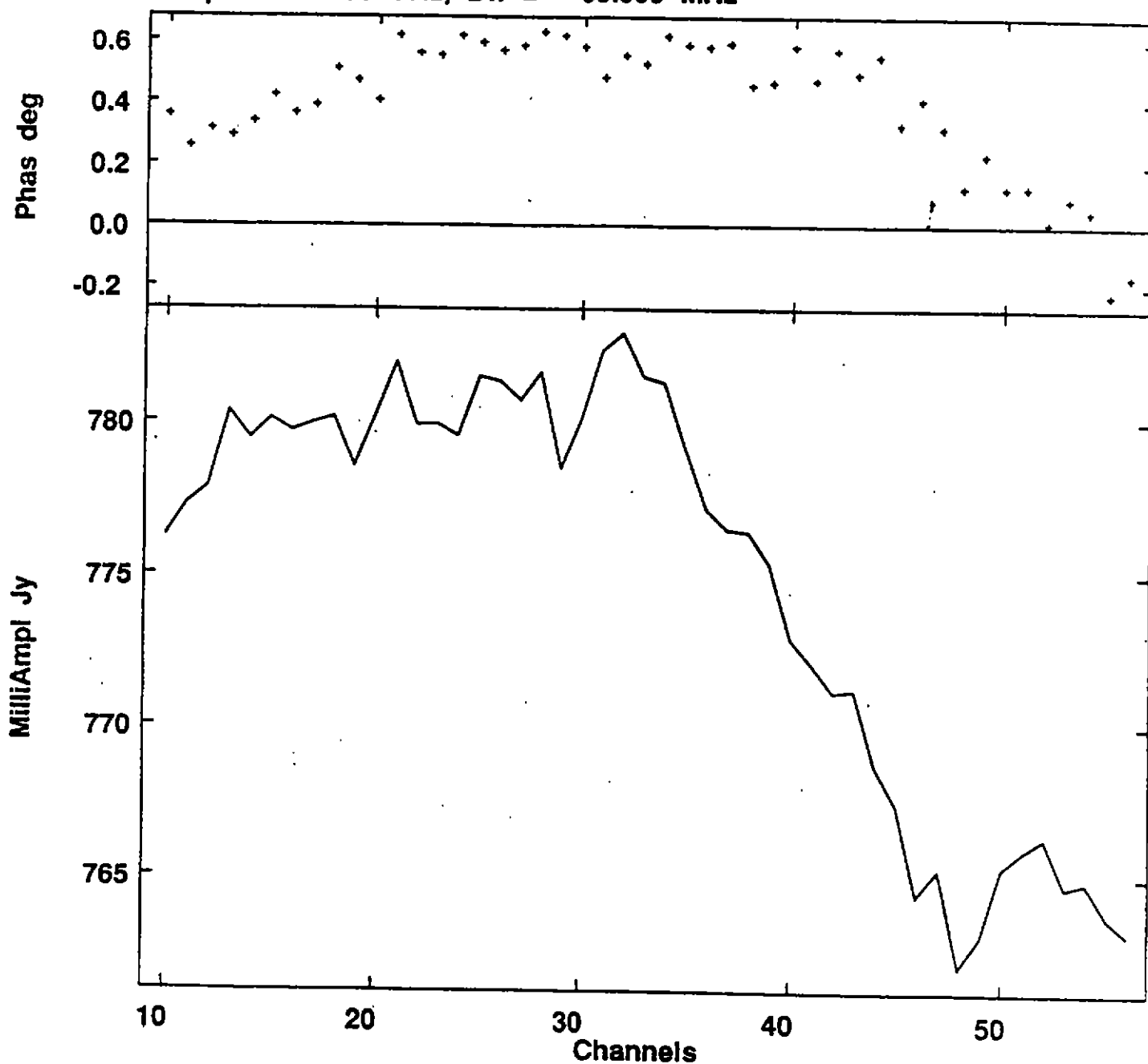
FIGURE 2 Trapped modes - Antenna 6

only 3C273

Plot file version 9 created 27-JUL-1993 20:24:44

NGC4945 N4945-A2.UVDATA.1

Freq = 8.2950 GHz, Bw = 65.000 MHz



Vector averaged cross-power spectrum IF number: 2

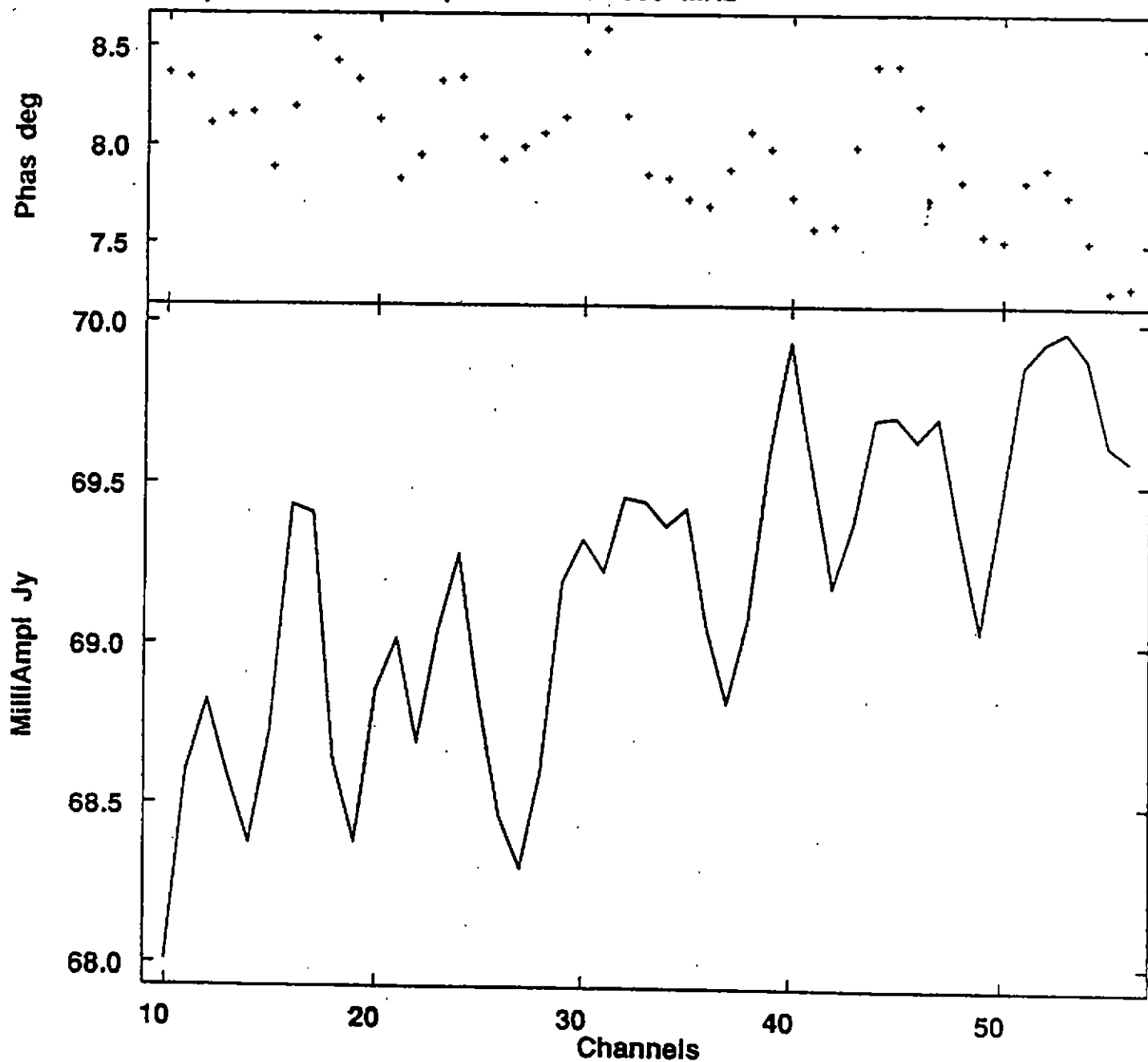
Baseline: * - * Stokes: I

Figure 3 . Poor bandpass calibration
with 3C273

Plot file version 6 created 28-JUL-1993 02:08:19

CIRCINUS CG-X2.UVDATA.1

Freq = 8.2950 GHz, Bw = 65.000 MHz



Vector averaged cross-power spectrum IF number:

Baseline: * - * Stokes: I

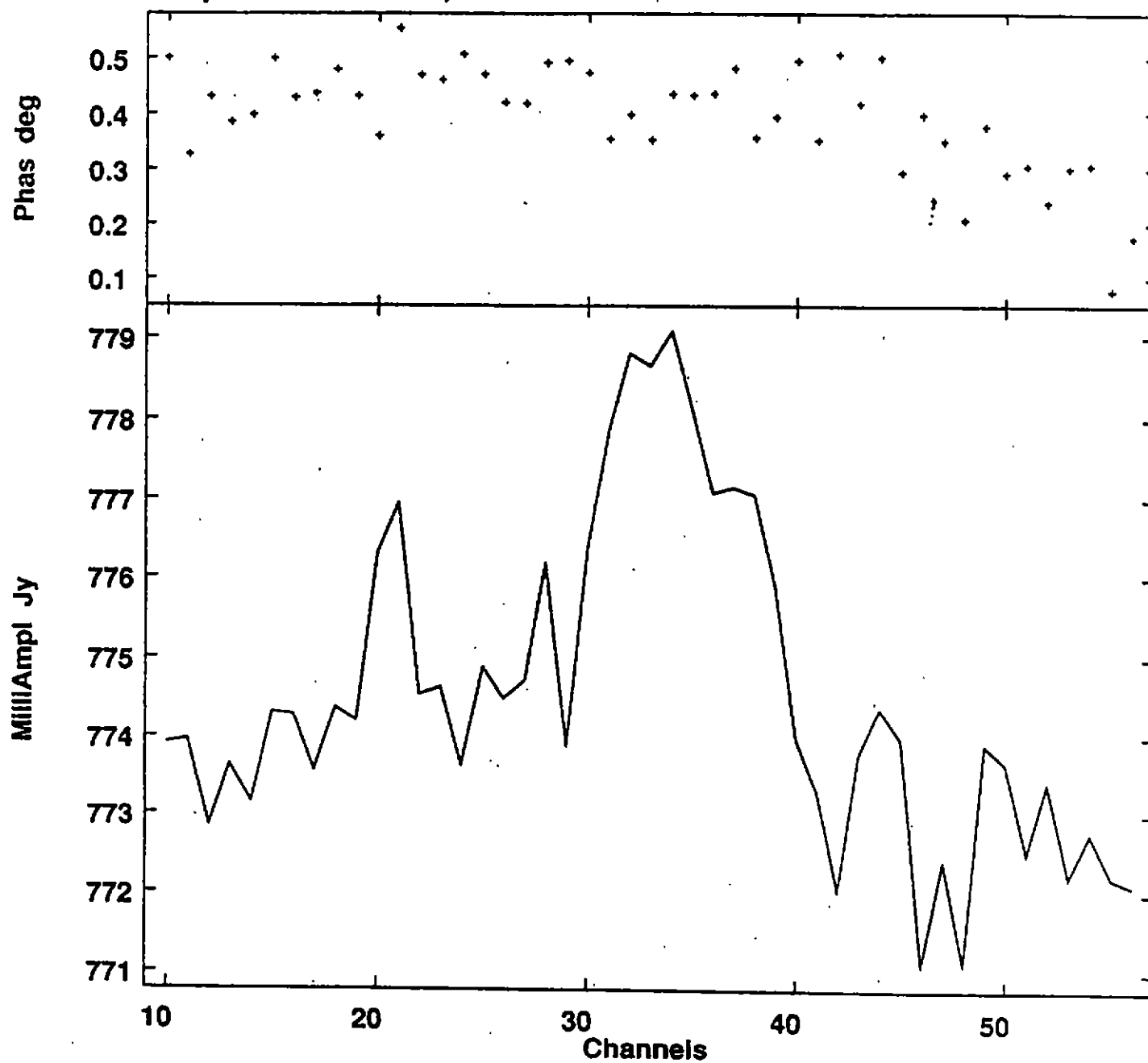
FIGURE 4 Good bandpass calibration
with 2251 + 158

Bpcal using
only 2251+158

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NGC4945 N4945-A2.UVDATA.1

Freq = 8.2950 GHz, Bw = 65.000 MHz



Vector averaged cross-power spectrum IF number:

Baseline: * - * Stokes: I

Figure 5 Detection of 5mly line.