

NARRABRI S-BAND BEAM PATTERNS

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Recent observations by D McKay have shown that the S-band (2.5 GHz) system at Narrabri is less satisfactory than previously realised. This note outlines some of the problems.

The main symptom is that the beam characteristics have a marked polarisation dependence.

A detailed exploration of the entire beam pattern has yet to be done; we present here a number of profiles taken along the lines parallel to the two probes ... at + and - 45 degrees to the azimuth axis. In the experiment we kept antenna 5 tracking the source 1934-638; the other antennas were scanned across the source first at +45, then at -45 degrees. The subreflector was set to its lowest point, closest to the s-band focus setting.

Figs. 1 and 2 show the problem: the beam widths are quite different. In effect, the beams are elliptical, with axial ratios of ~0.9; the major axis of the X probe is orthogonal to the Y probe's major axis. There is a suggestion of a squint between the beams.

1. The effect is present in all antennas.
2. The Mopra antenna, with the SETI feed shows a similar problem, with variations - there is a similar beam-width difference, but the squint is more pronounced - see figs 3 and 4.
3. The 10 GHz system does not exhibit the same problem. (figs. 5 and 6).
4. The consequences for polarisation imaging are serious.

Figures 7 to 13 show the derived stokes parameters for 1934-638 on baseline 3*4. The on-axis Q and U are about 0.5% (the leakage terms); these rise to 8% in the vicinity of the half-power points. Calibration of this seems problematic: it will be necessary to track the source's trajectory around the beam during the course of the observation, correcting separately Q (XX-YY), U (XY+YX) and V (XY-YX)

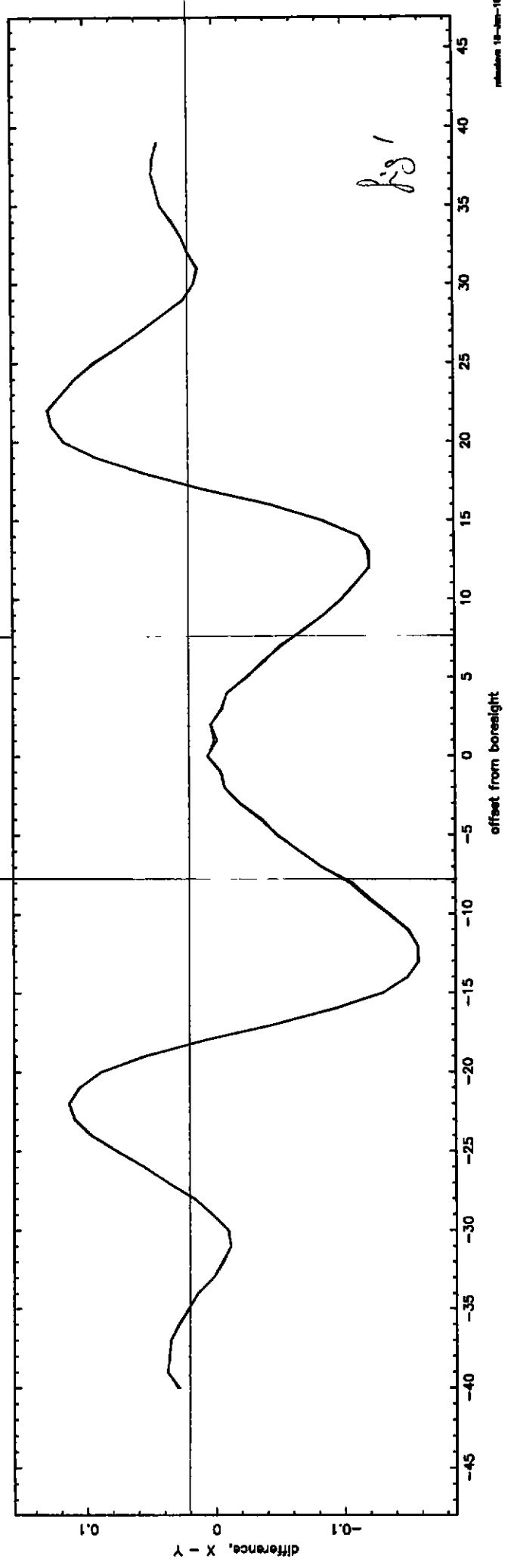
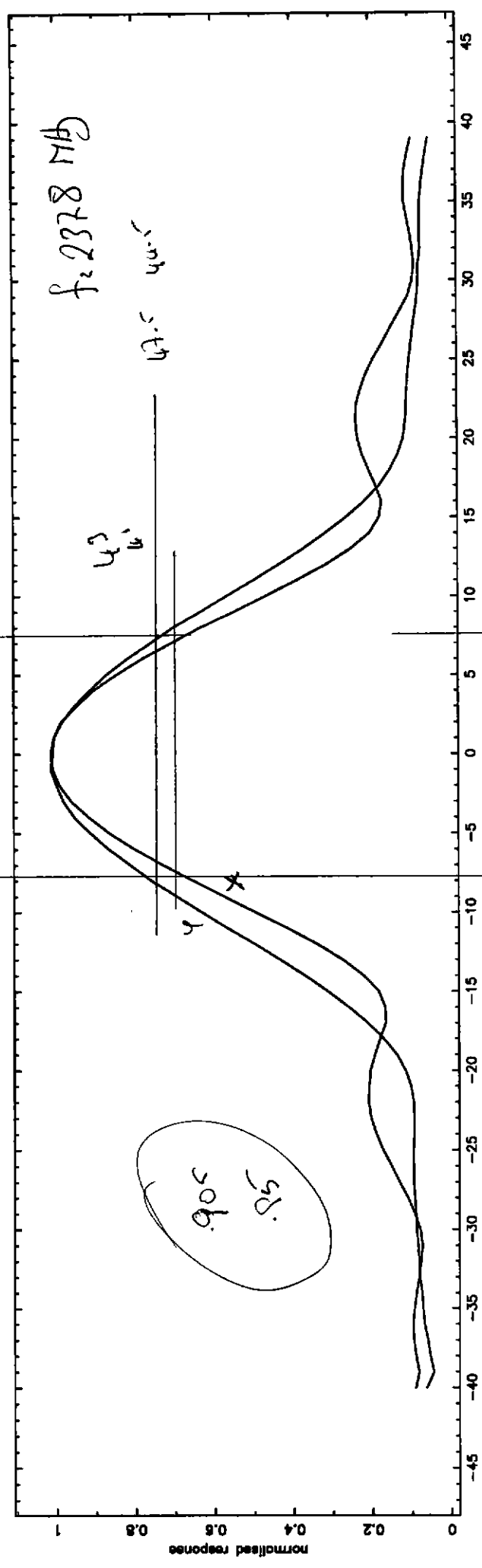
To first order stokes I is unaffected; V shows a small increase.

A correction algorithm seems possible, but we'd prefer a hard-ware solution.



Naradihi - Voltage

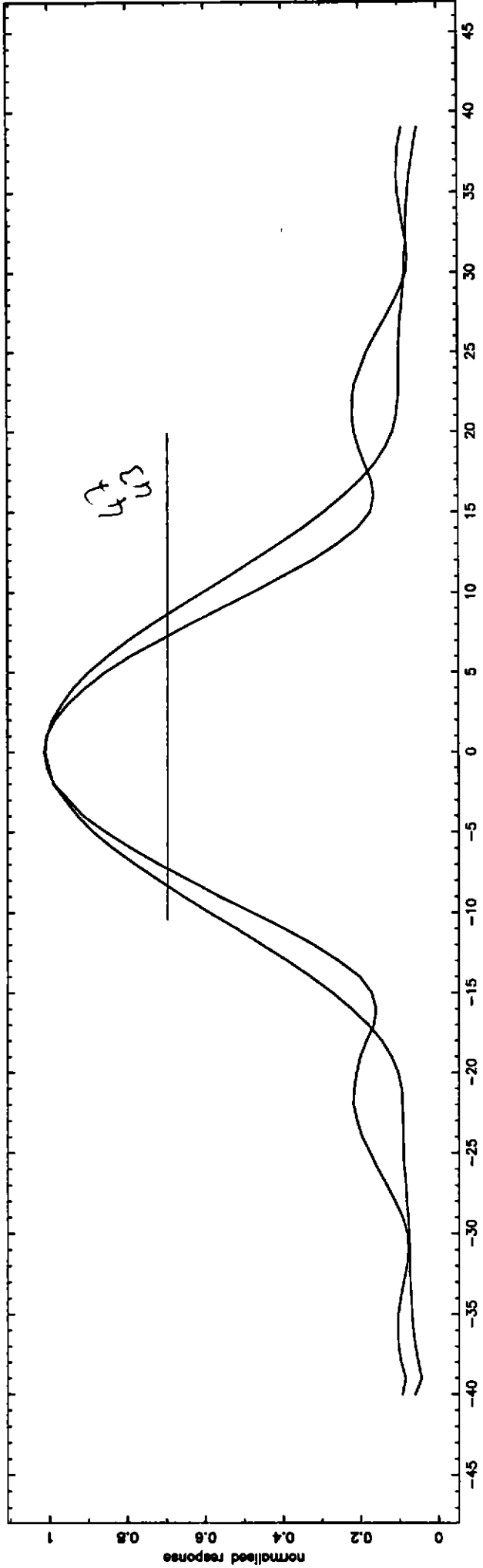
+45°



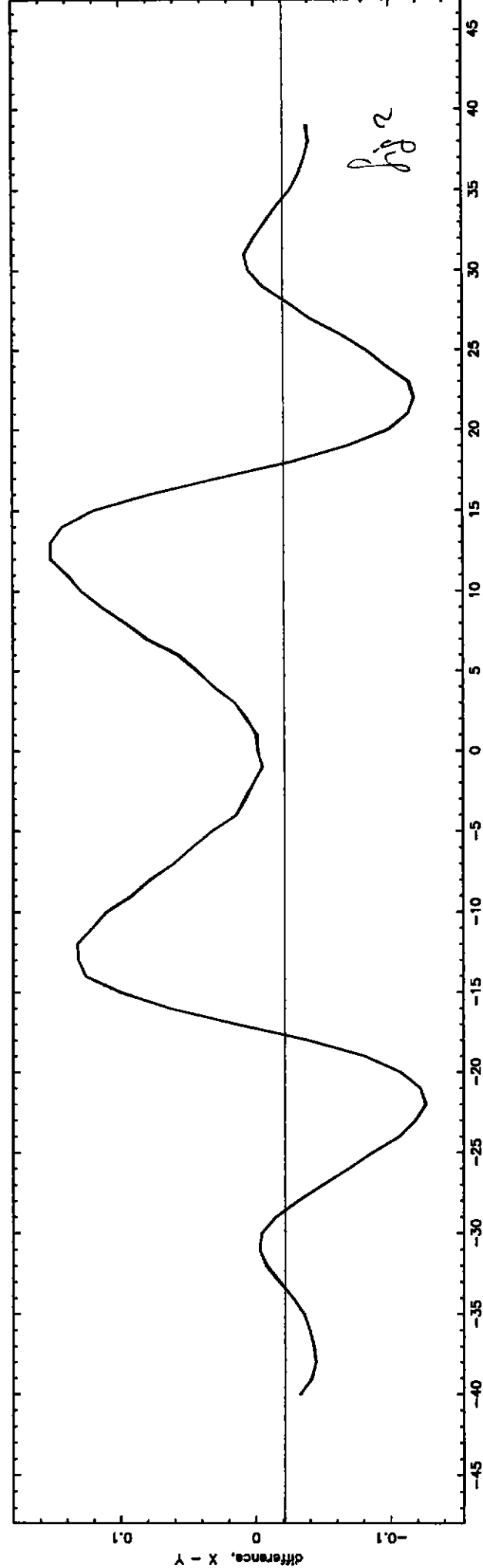


-45°

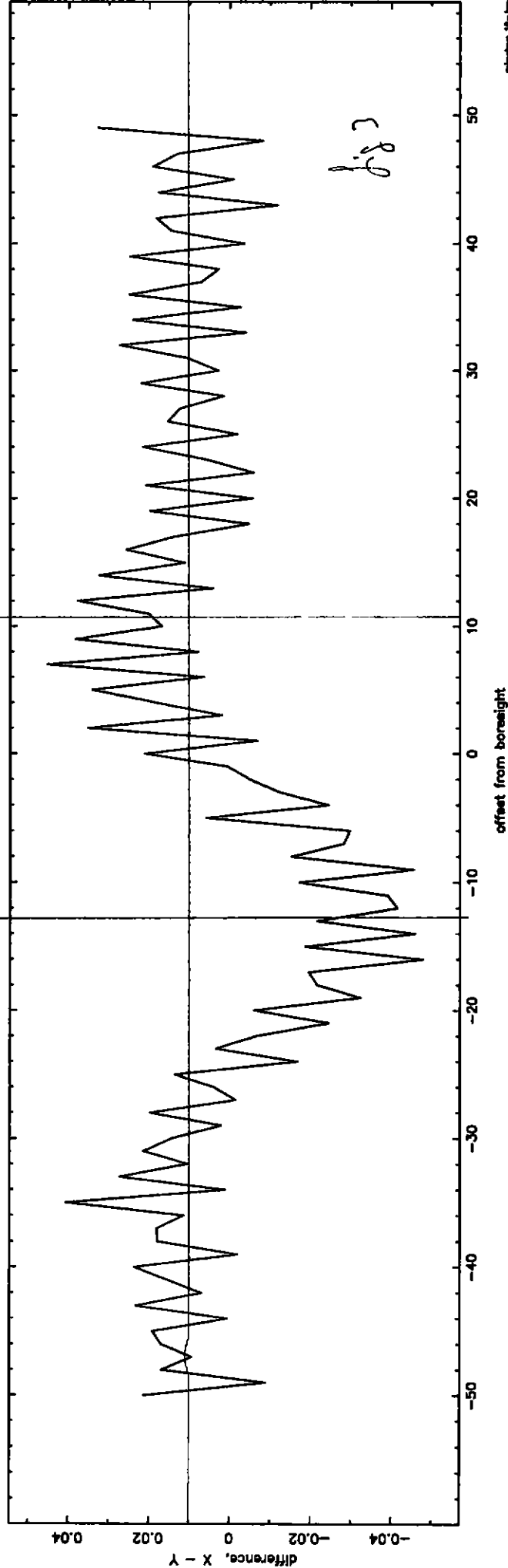
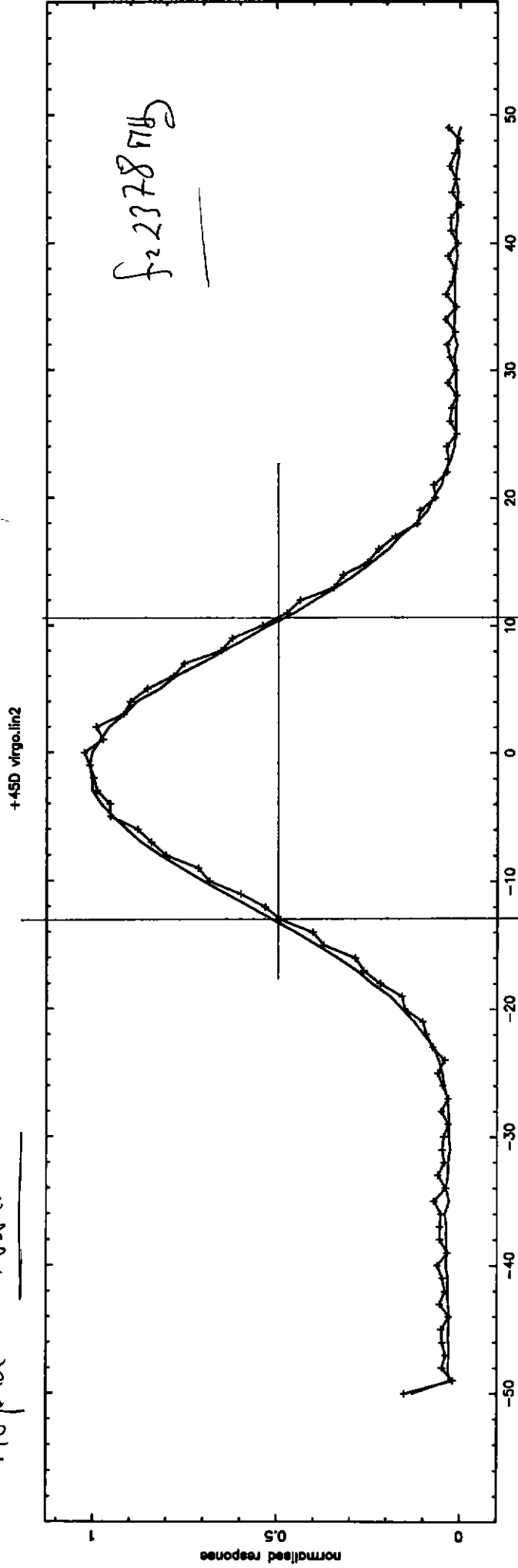
aband35.2

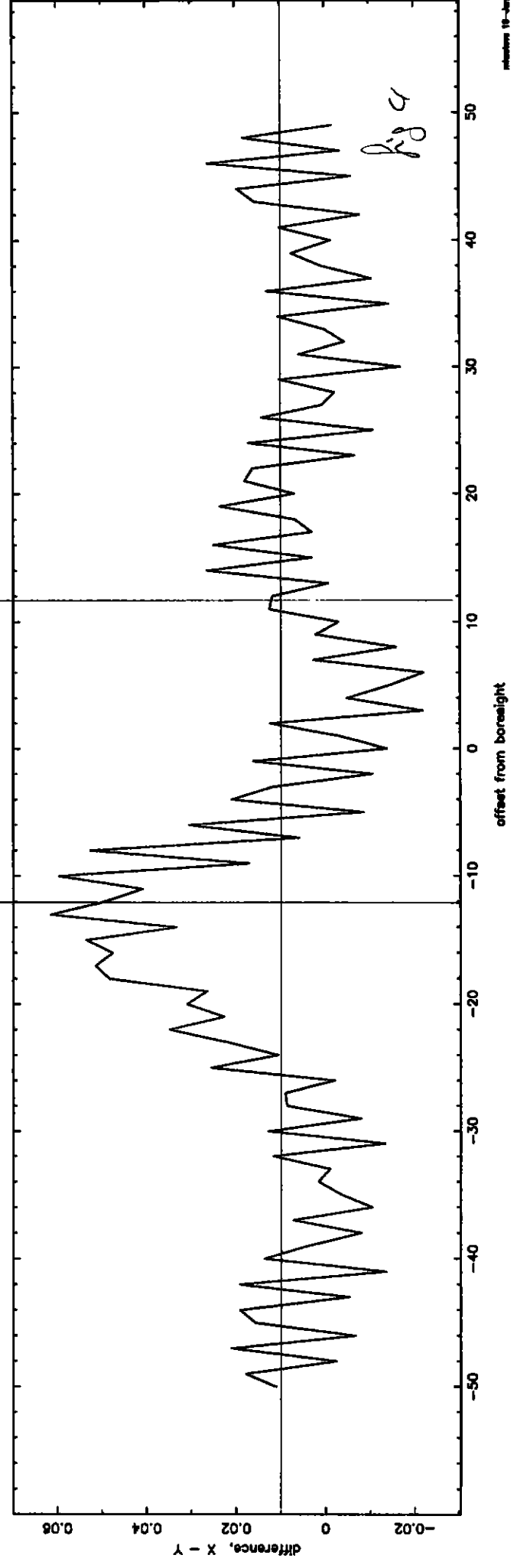
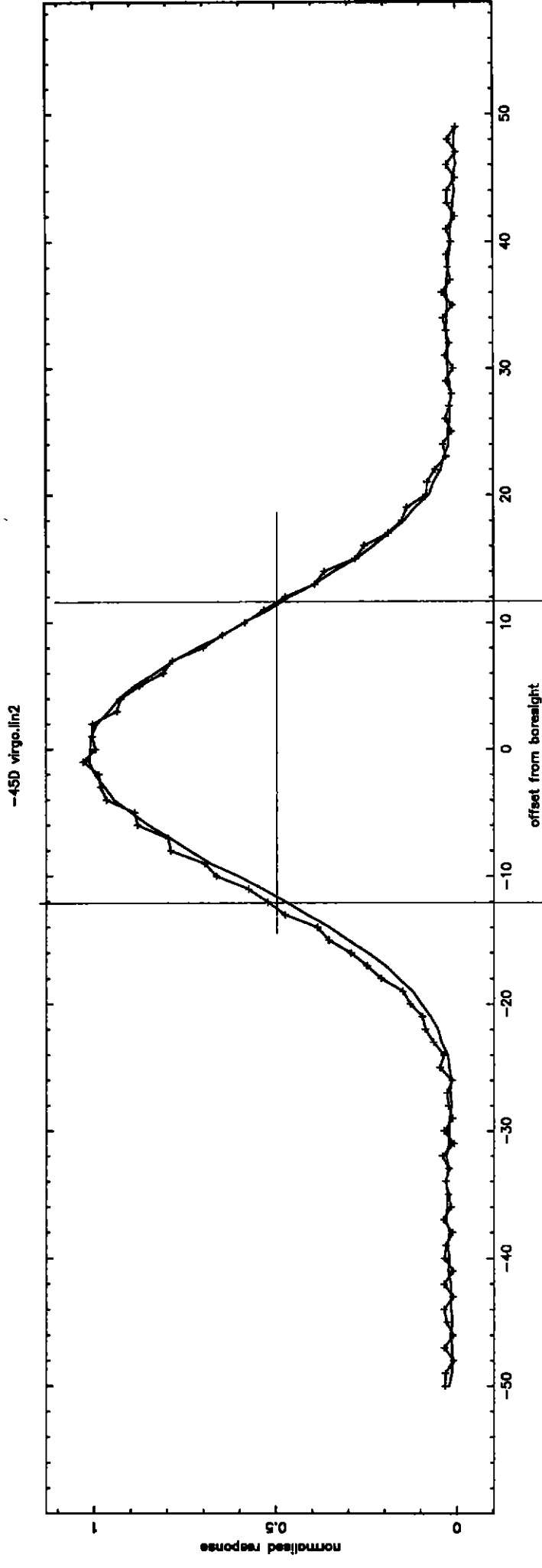


aband35.2



Popa - Power



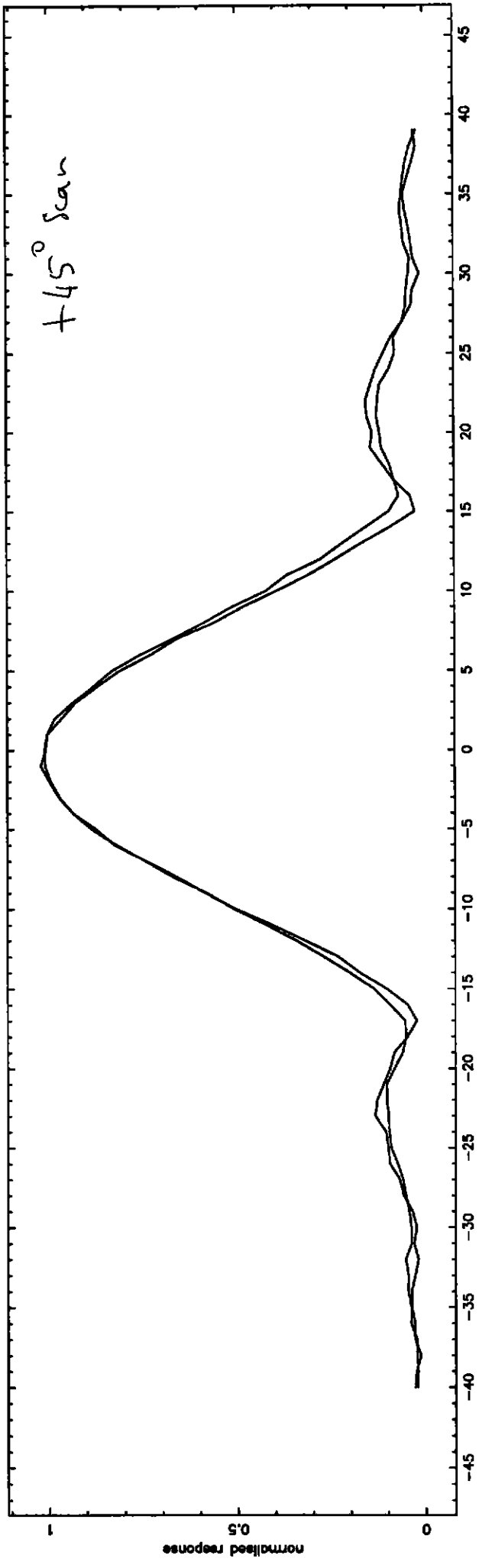


Narudin (Voltage)

$f = 9500 \text{ Hz}$

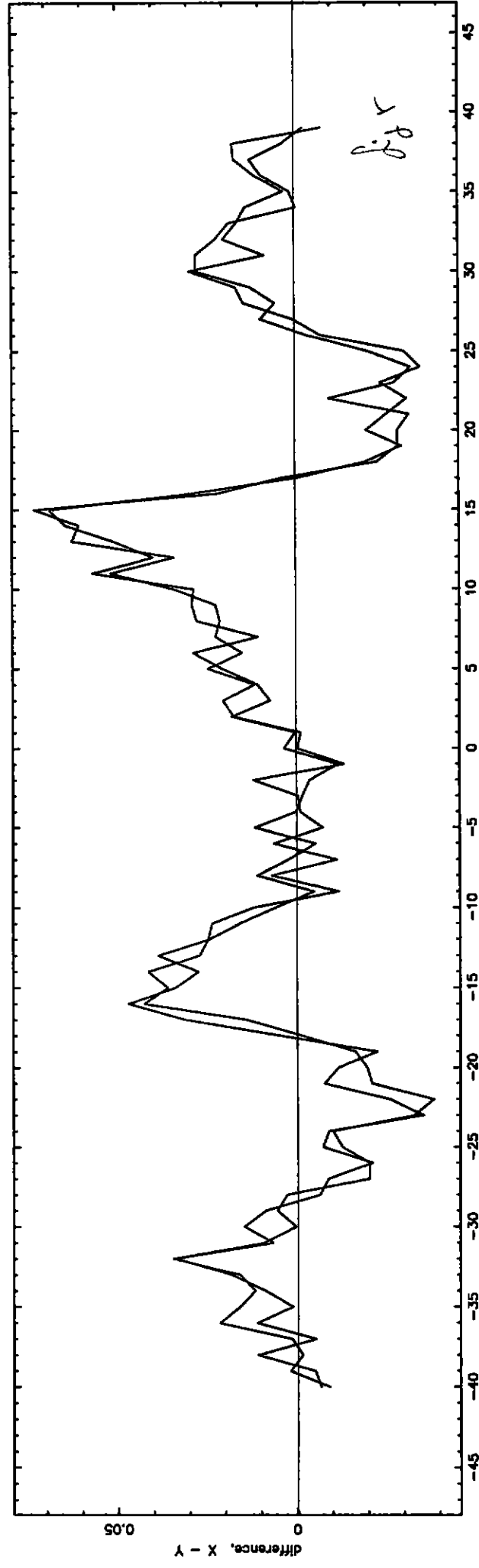
xband35.1

+45° scan



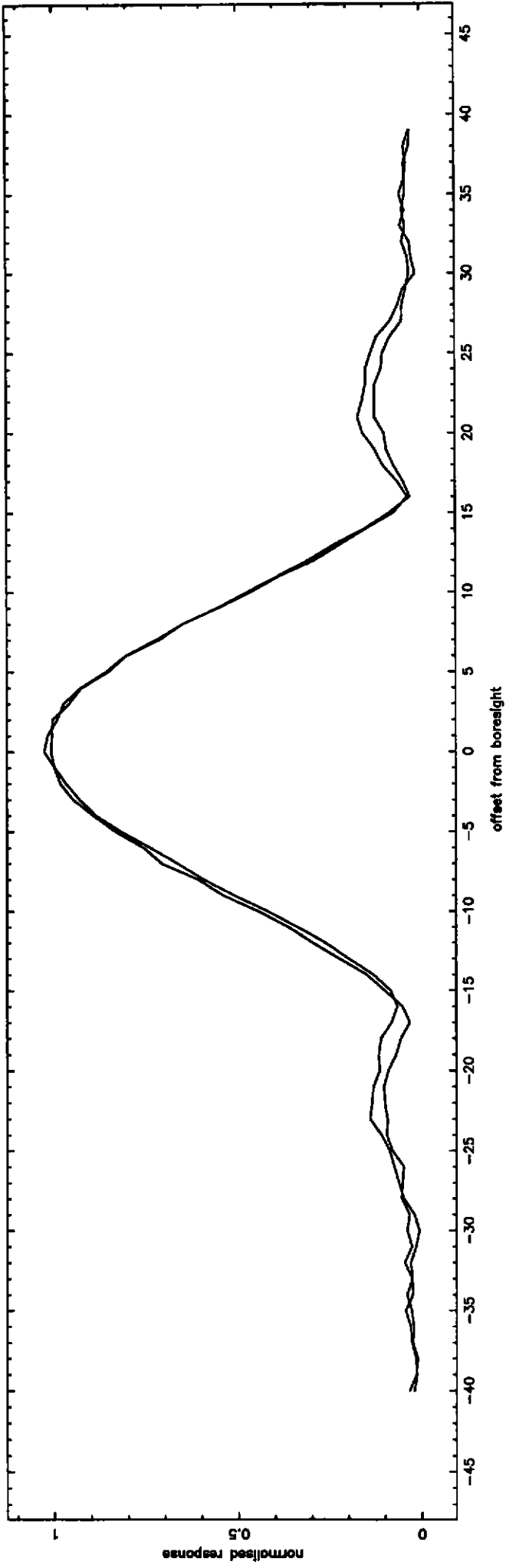
xband35.1

fig 5

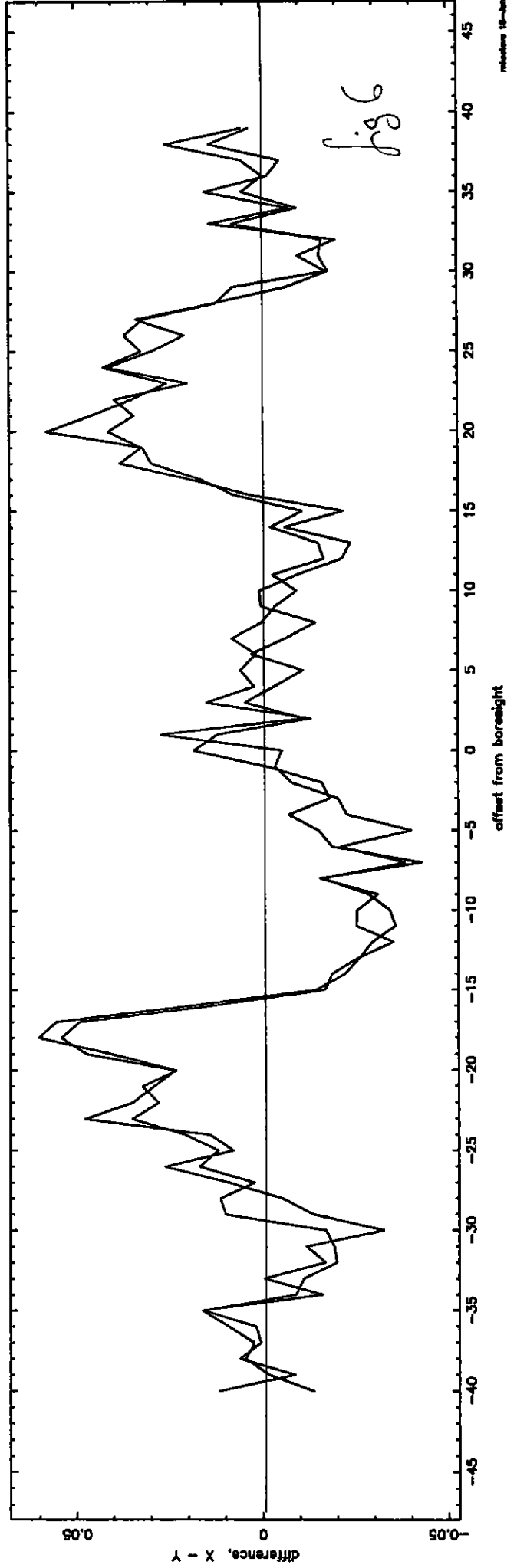


— 45° scan

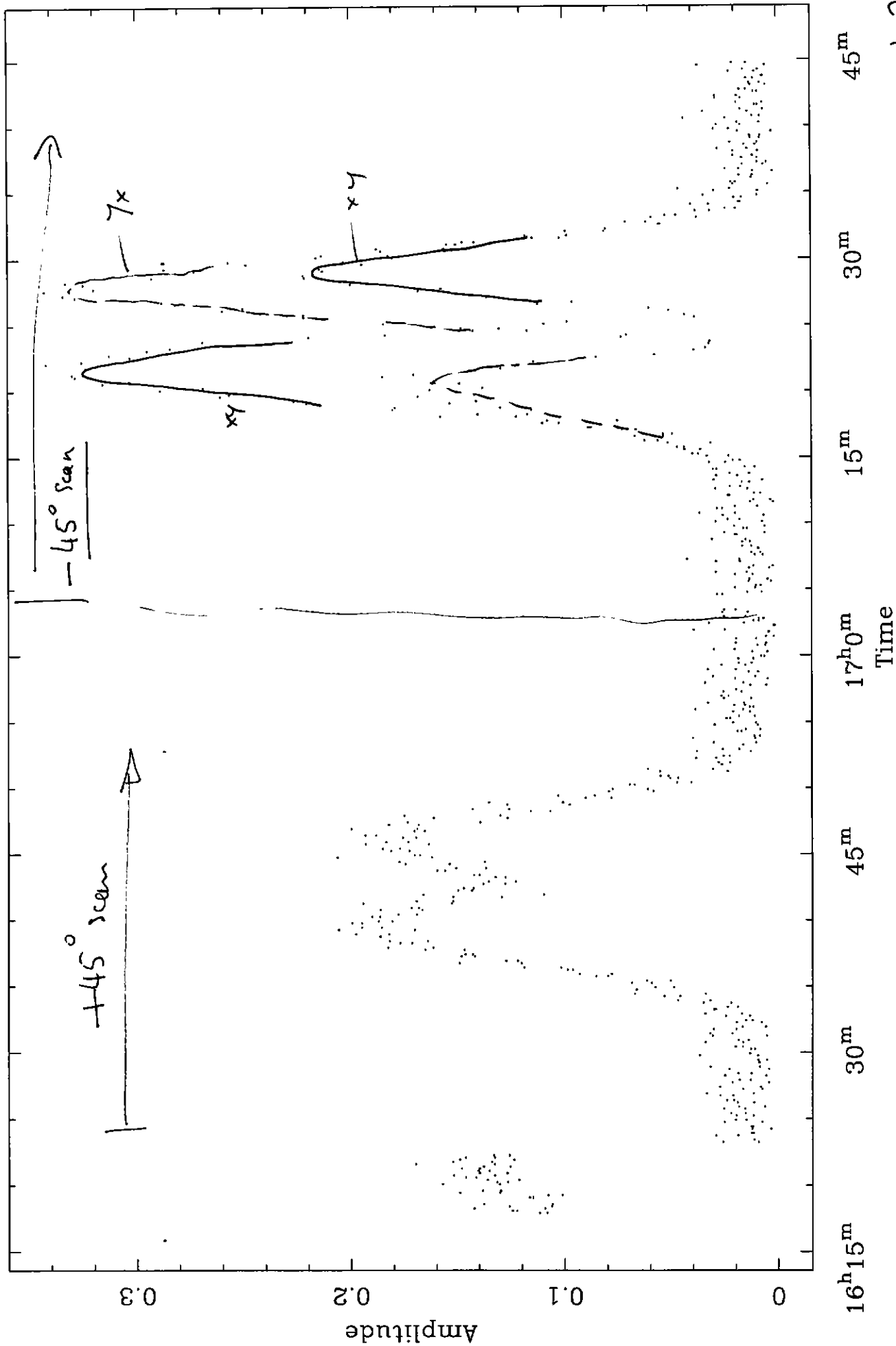
xband35.2



xband35.2

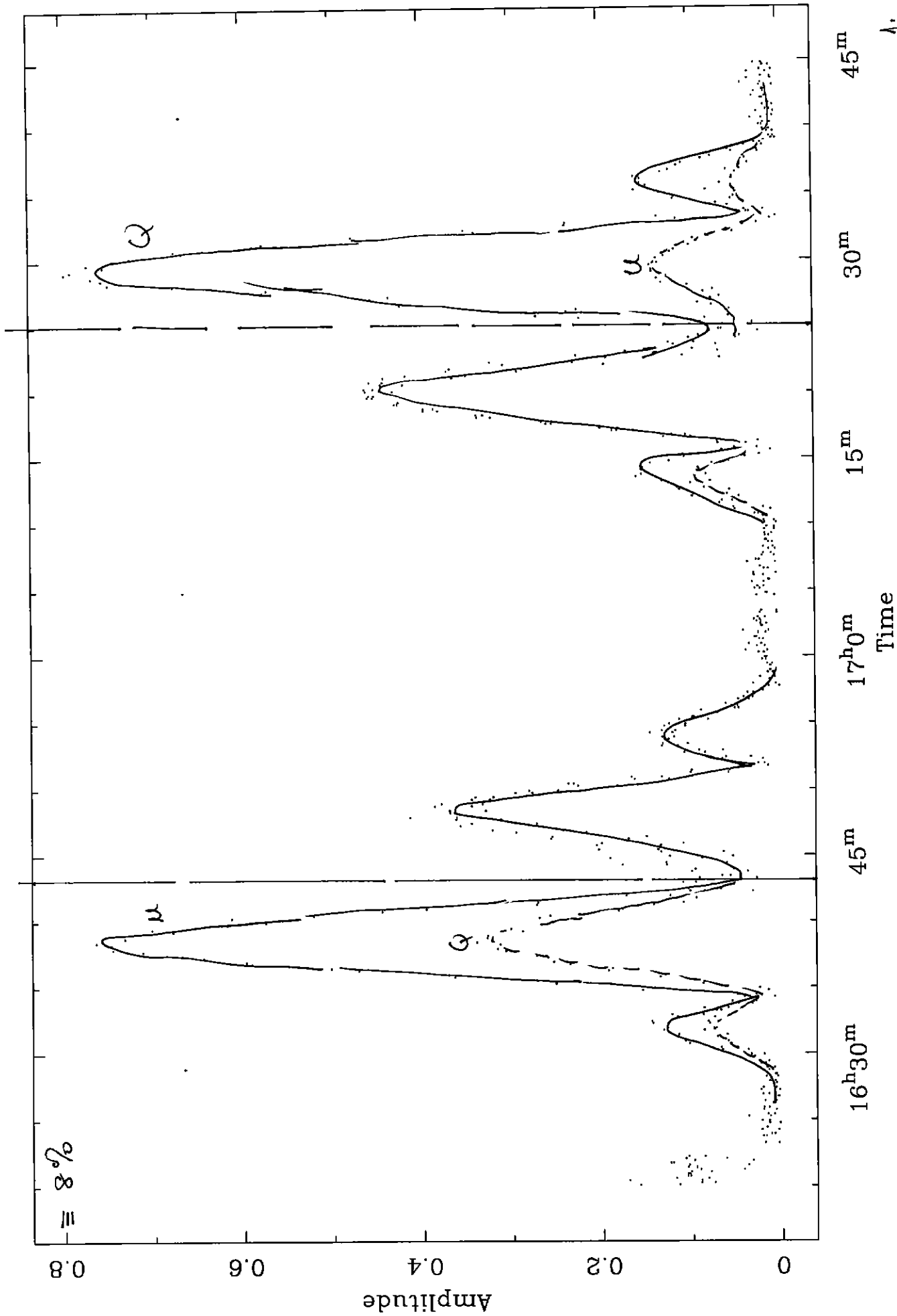


XY YX s_band 2.3740 GHz 3-4 - - - Both antennas in motion



FSP
A.7

QU s_band 2.3740 GHz 3-4



I s_band 2.3740 GHz 3-4

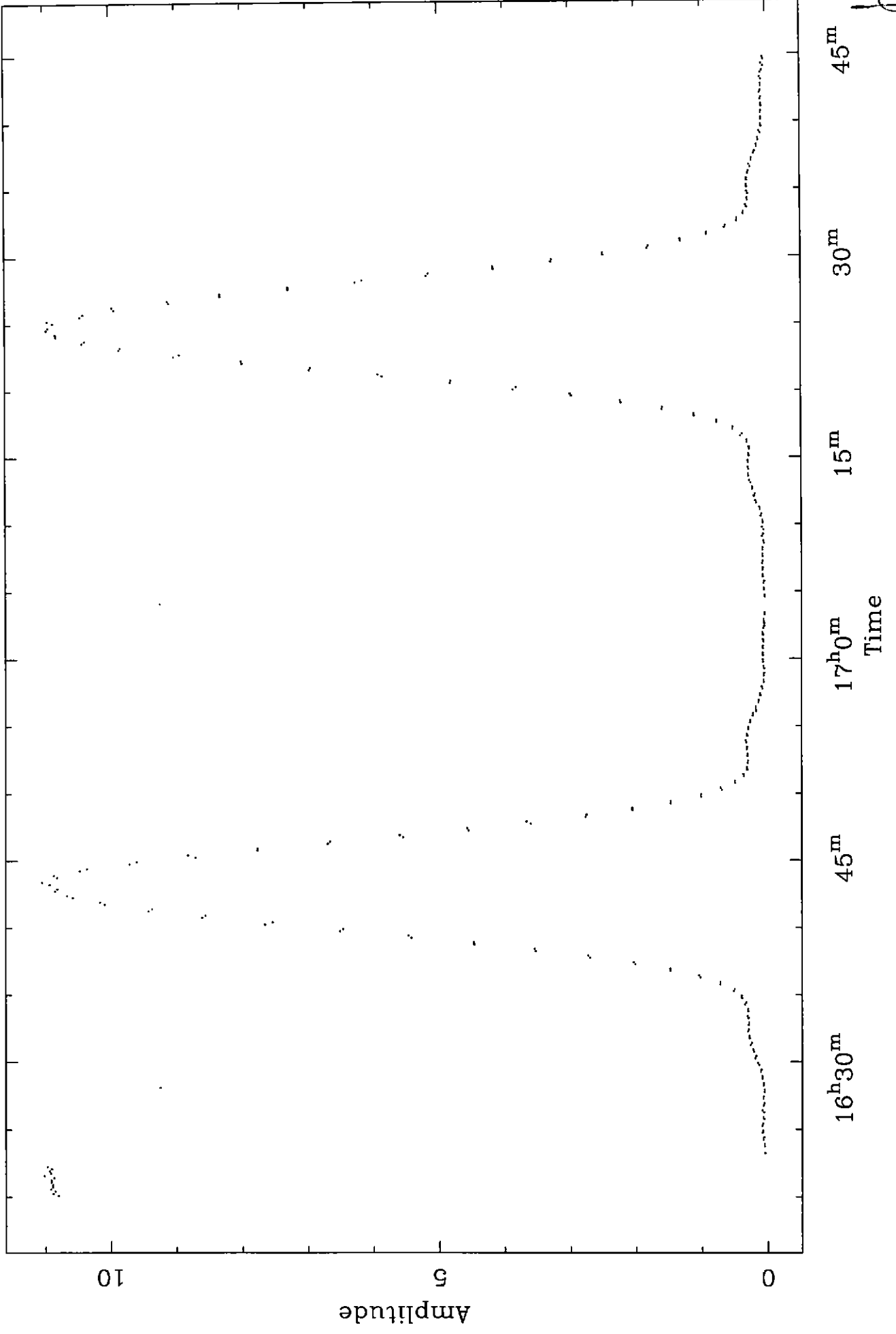
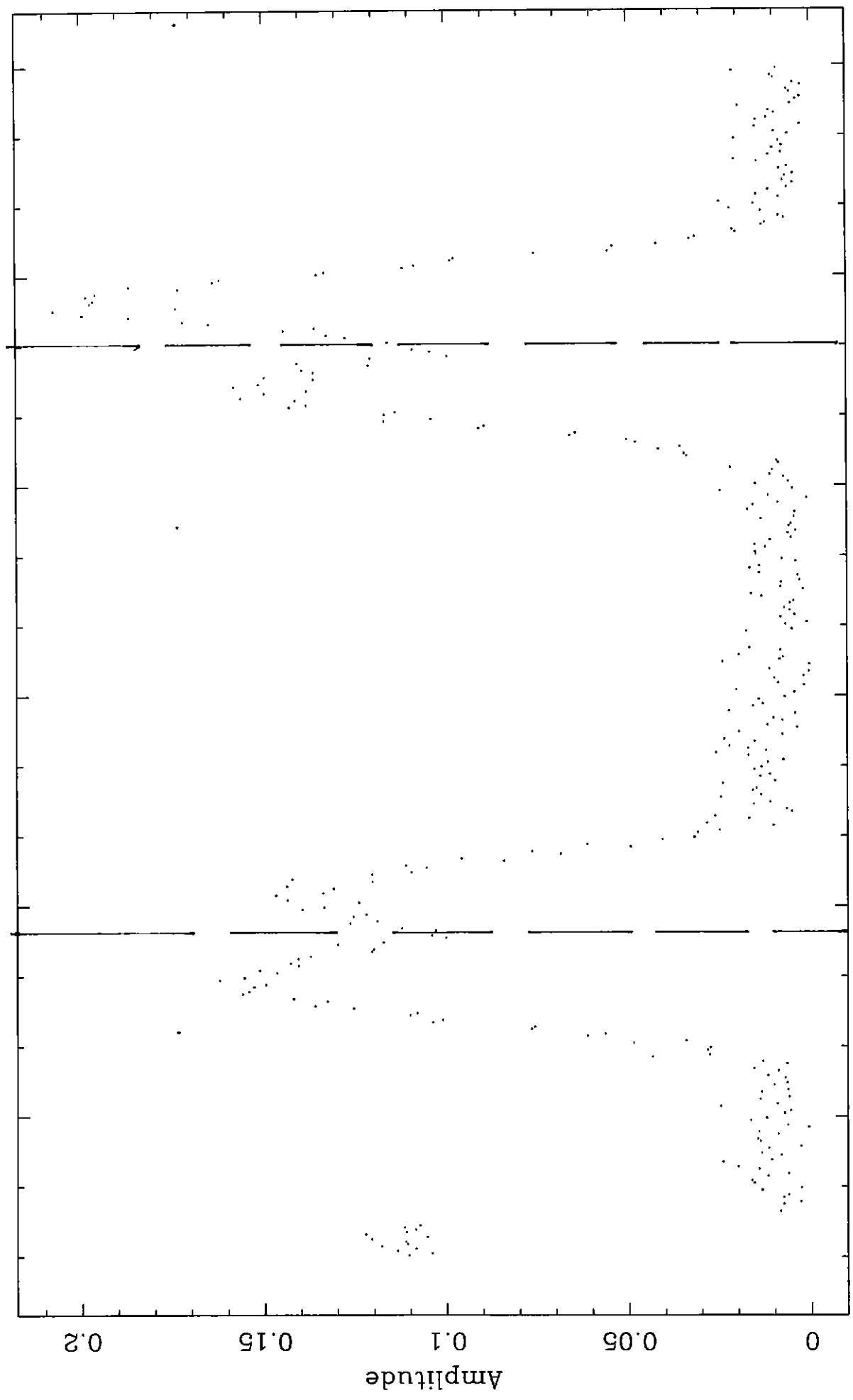


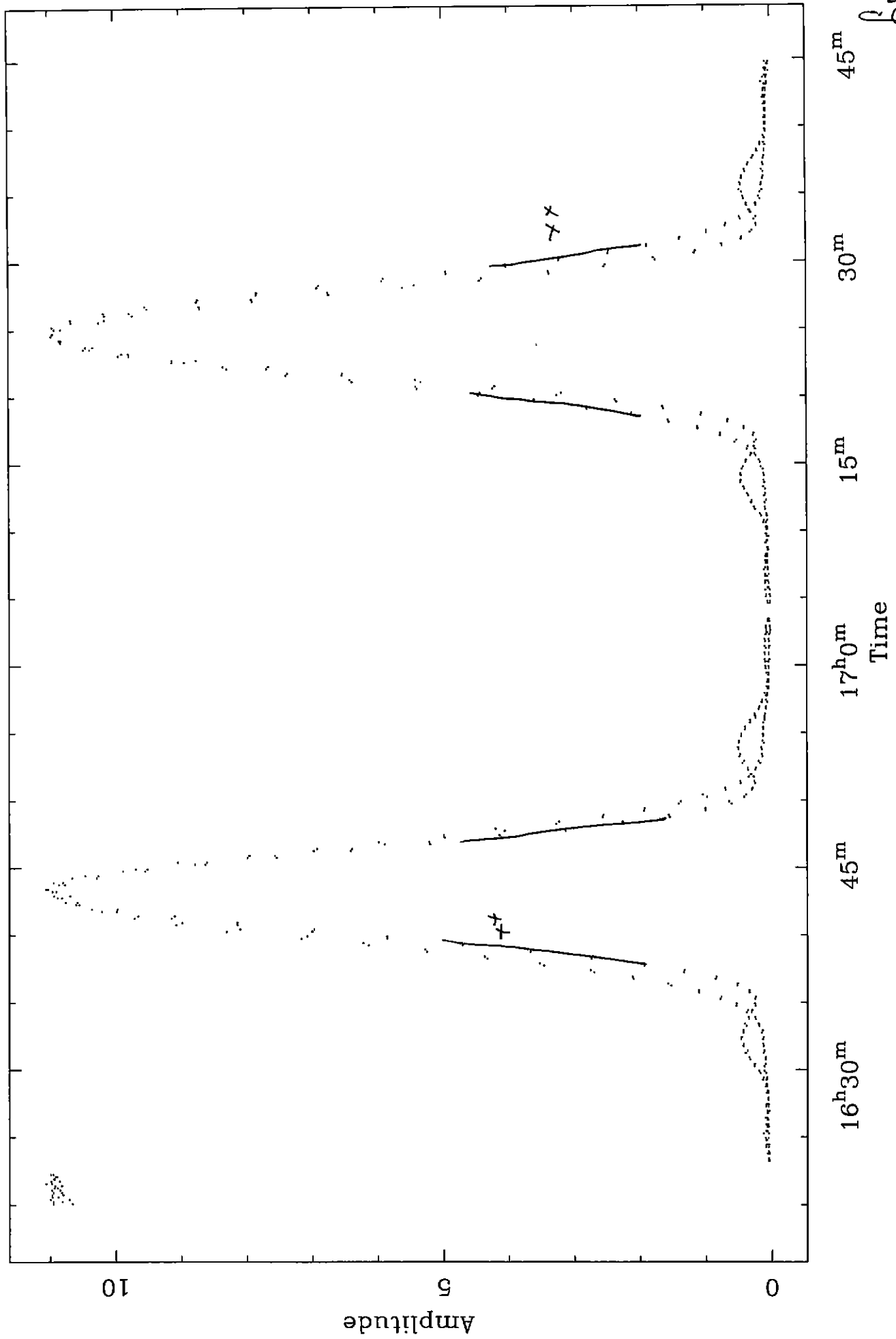
fig 9

V s_band 2.3740 GHz 3-4



10
10

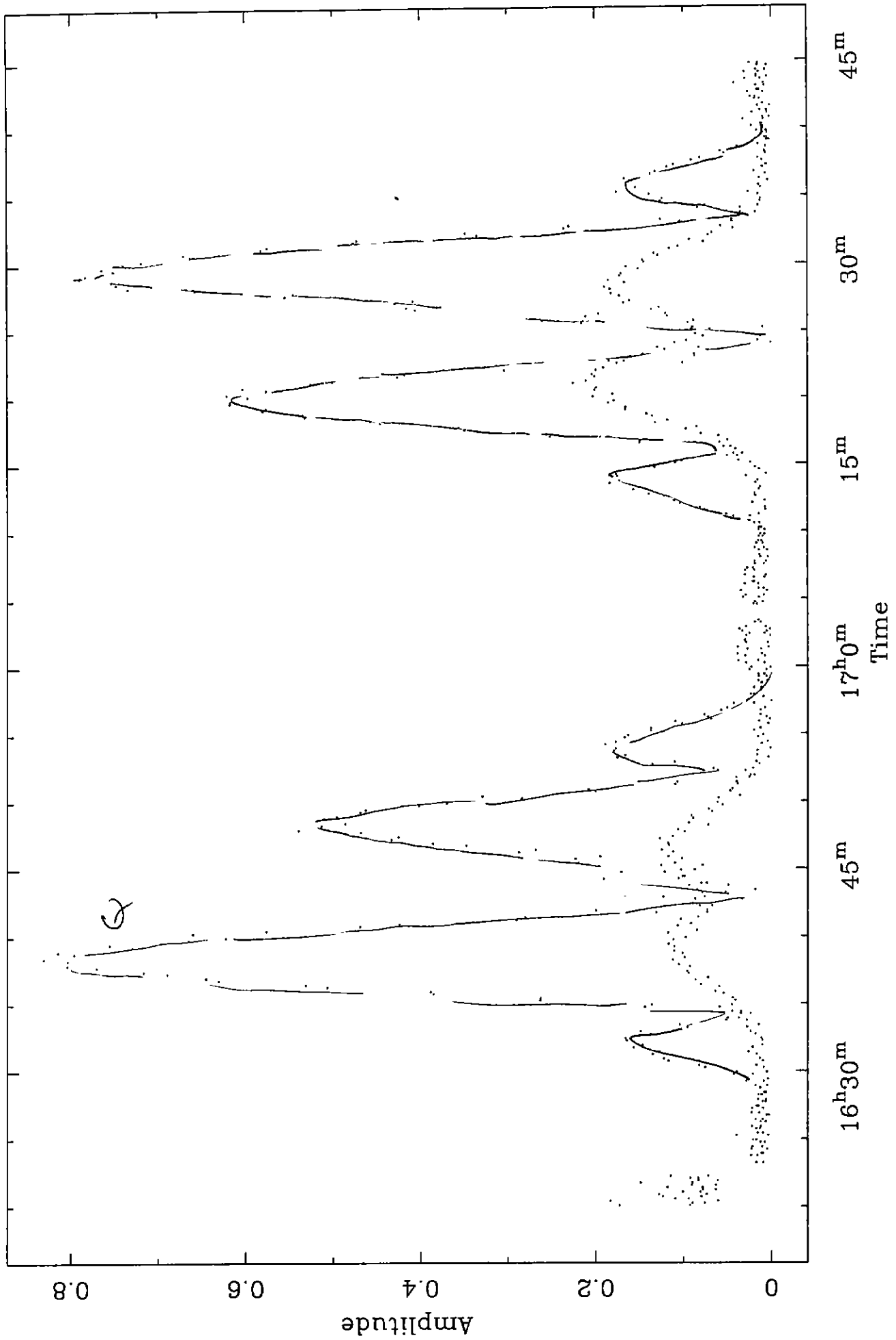
XX YY s_band 2.3740 GHz 5-4



1.89

Evaluated with χ^2

QU s_band1 2.3740 GHz 3-



Evaluated with χ^2_0

Q s_band1 2.3740 GHz 3--

