

National Radio Astronomy Observatory
Socorro, NM 87801

VLA TEST MEMO. 199

ANTENNA POINTING

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INTRODUCTION

During the 1995 Thanksgiving shutdown (1995NOV23), when all the antennas were stowed and left undisturbed for more than 24 hours, we collected monitor data to see the system stability. This also included elevation and azimuth position encoders. Both elevation and azimuth encoders showed variations.

To see whether these are just encoder hardware variations or indication of true pointing changes, we made pointing measurements at X, Q and K bands on 1995NOV27 for about 2.5 hours (from about 16:50 to 19:20 MST) using 2253+161 (3C454.3). These measurements were done starting at about sunset. Pointing changes as large as 35-40" in elevation in ≤ 1 hour, and about 15-20" in azimuth were observed. There was a common pattern of variations in elevation pointing changes for all antennas. Pointing changes in the azimuth appeared to be dependent on the arm of the array (Y). We also made pointing measurements on the VLBA antennas on 1995DEC04 during sunset and on 1995DEC05 during sunrise. This memo describes variations of the encoder readings during the Thanksgiving shutdown and results of the pointing tests.

MONITORING VLA ANTENNAS OVER THANKSGIVING (1995NOV23)

Figures 1 and 2 show variations of elevation encoders for antennas 1 to 14 and 15 to 28 respectively, with antenna location marked on the plots. Similarly figures 3 and 4 show variations in azimuth encoders for antennas 1 to 14 and 15 to 28. From a careful look at these plots we notice following:

- 1) Elevation encoder variations of upto about 35-40".
- 2) Azimuth encoder variations of upto about 10-15".
- 3) Shape of the variations seems dependent on the arm of the array (Y), especially in the elevation.

VLA POINTING MEASUREMENTS ON 1995NOV27

The sequence of measurements was as follows. First do pointing measurements for 6 min. at X-band in reference pointing (IR) mode. Then do pointing measurements for 6 min. at Q-band using previously determined pointing offsets at X-band. After this do pointing for 6 min. at K-band using the pointing offsets determined previously at X-band. Repeat this cycle. Results of the elevation pointing offsets for antenna 11 (located on N12 pad) are shown in Fig. 5. Symbols

X and Y are for the X-band RCP and LCP pointing offsets. Symbols Q and R are for the Q-band RCP and LCP pointing offsets, and K and L are for the K-band RCP and LCP pointing offsets. The elevation pointing shows a large variation of as much as about 40'' in \leq half-an-hour at the beginning. It appears that the Q and K band pointings are essentially following the X-band pointing when the large variations in the X-band pointing was measured.

Following conclusions are derived based on the elevation and azimuth pointing plots for all the antennas:

- 1) Offset pointing at Q and K bands follow the X-band pointing.
- 2) Pointing changes as large as 35-40'' in less than one hour may take place some times.
- 3) Pointing changes in azimuth of upto 15-20'' are monitored.
- 4) Gross shape of the elevation variations is same on all the antennas, but the gross shape of the azimuth pointing variations are dependent on the arm of the Y. During the monitoring we saw a positive going slope for the azimuth pointing changes for the north and west arm antennas but negative slope for the east arm antennas.

VLBA POINTING MEASUREMENTS ON 1995DEC04/05

Pointing measurements were made at PT, LA, FD, NL, OV, BR, HN, MK on 3C84 and 3C286 at X-band for about 3-4 hours each, starting just before sunset on 1995DEC04 and sunrise on 1995DEC05. Plots for these pointing data are shown in Figs. 6a-h. Some general comments from these measurements are as follows:

- 1) Pointing variations as large as 30'' or more are noticed, though the rate of change is generally \leq 15''/hour. MK antenna shows elevation pointing variations of about 30'' in \leq half-an-hour.
- 2) There is no clear relation between sunset/sunrise and pointing variations.

CONCLUSIONS

Reference pointing seems to work for the VLA antennas, but there are times when the pointing changes by as much as 35-40'' in \leq half-an-hour. A good part of these variations appear systematic. Users who need accurate pointing, like Q-band observers and people doing mosaicing, should take note of this.

It was possible to recognise some systematic changes in the VLA antenna pointing variations because there are 27 antennas, all of them exposed to essentially same weather conditions and generally have similar history of weather exposure over previous several hours. On the other hand different VLBA antennas are located in different weather conditions, and are therefore affected differently. This complicates recognising systematic patterns of magnitudes similar to other affects in the pointing behavior. Therefore it may be helpful to learn from the pointing problems of the VLA antennas before trying to improve pointing of the VLBA antennas for the 3 mm observations.

Antennas 1-14

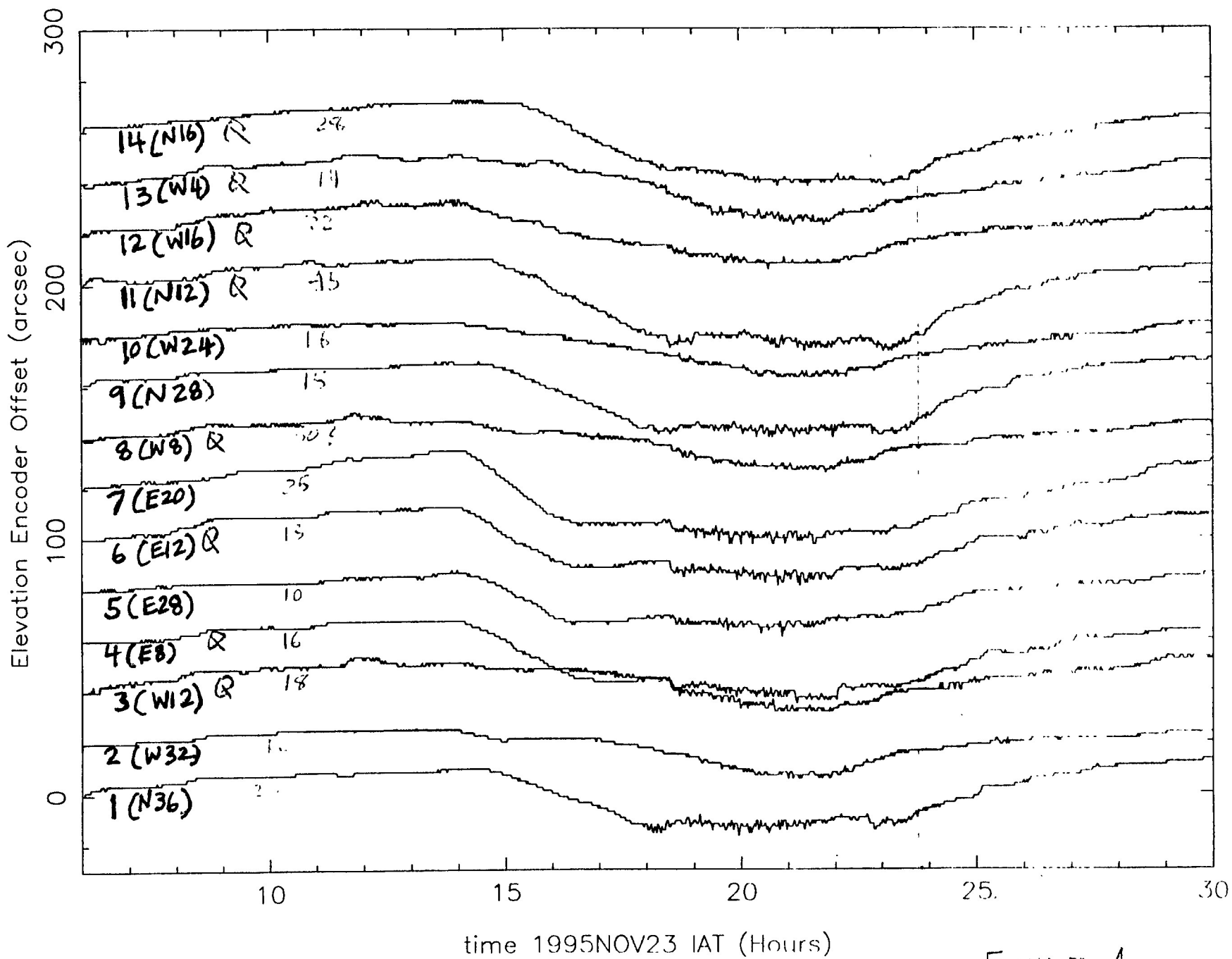


FIGURE 1

Antennas 15-28

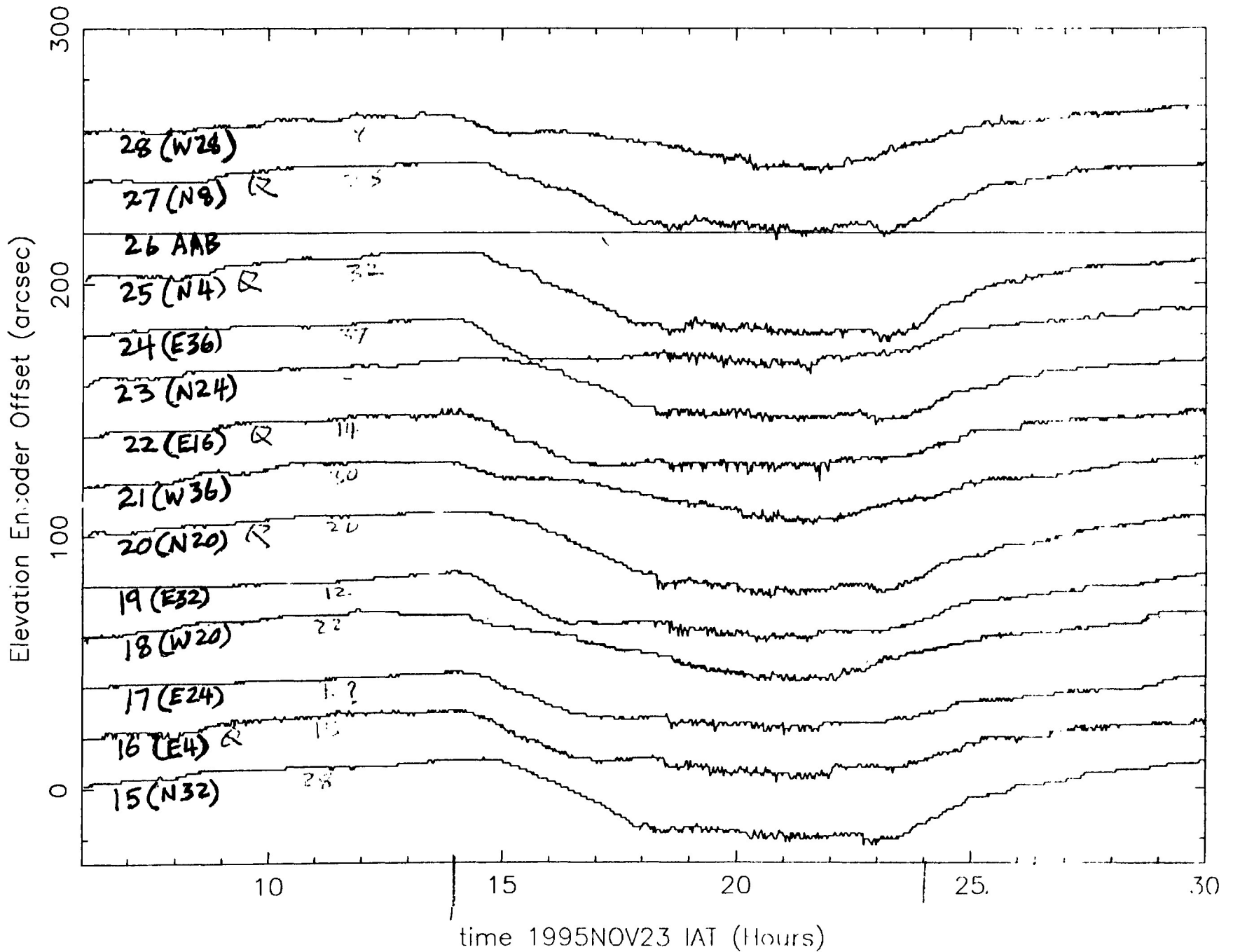


Fig. 2-12

Antennas 1-14

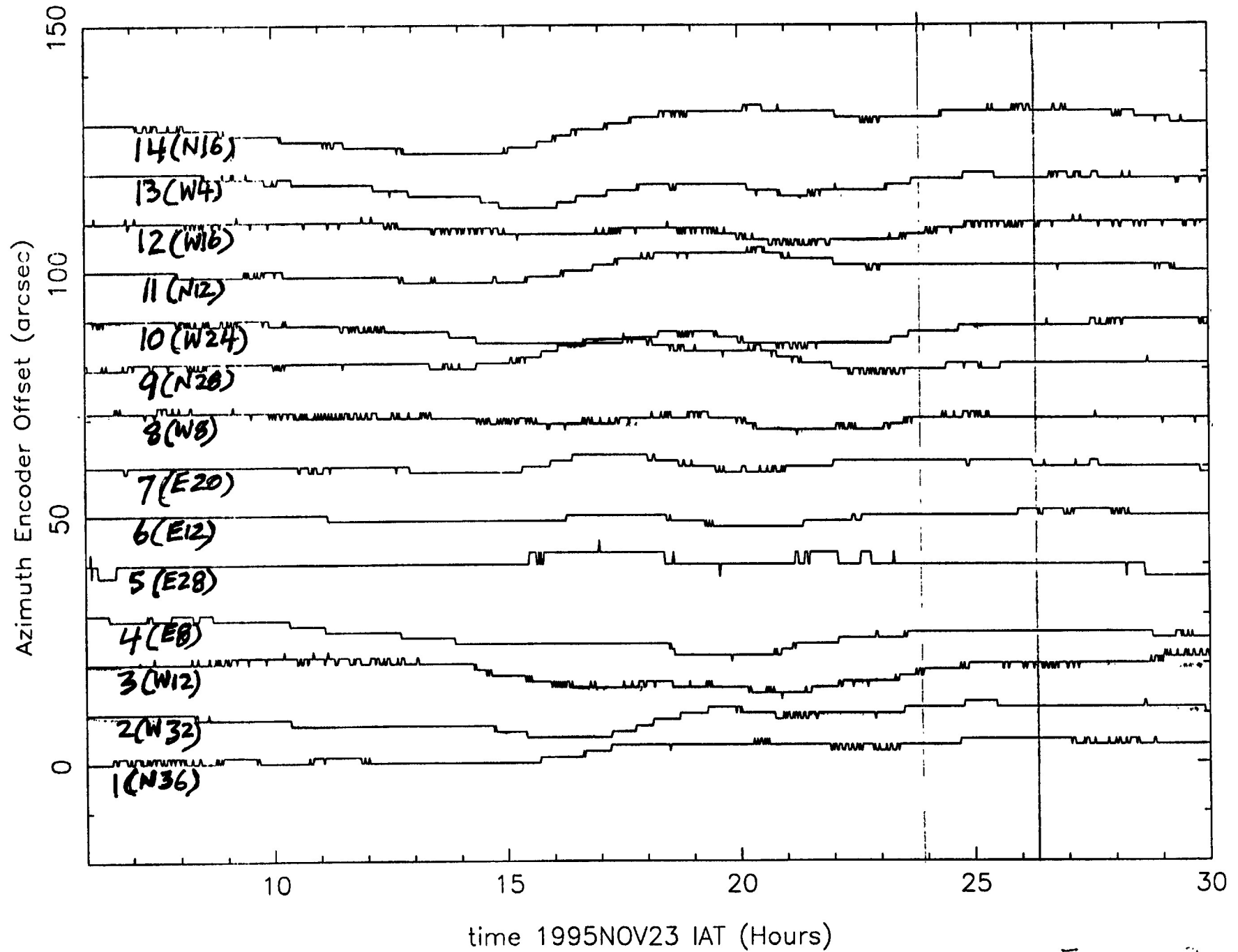


FIGURE 3

Antennas 15-28

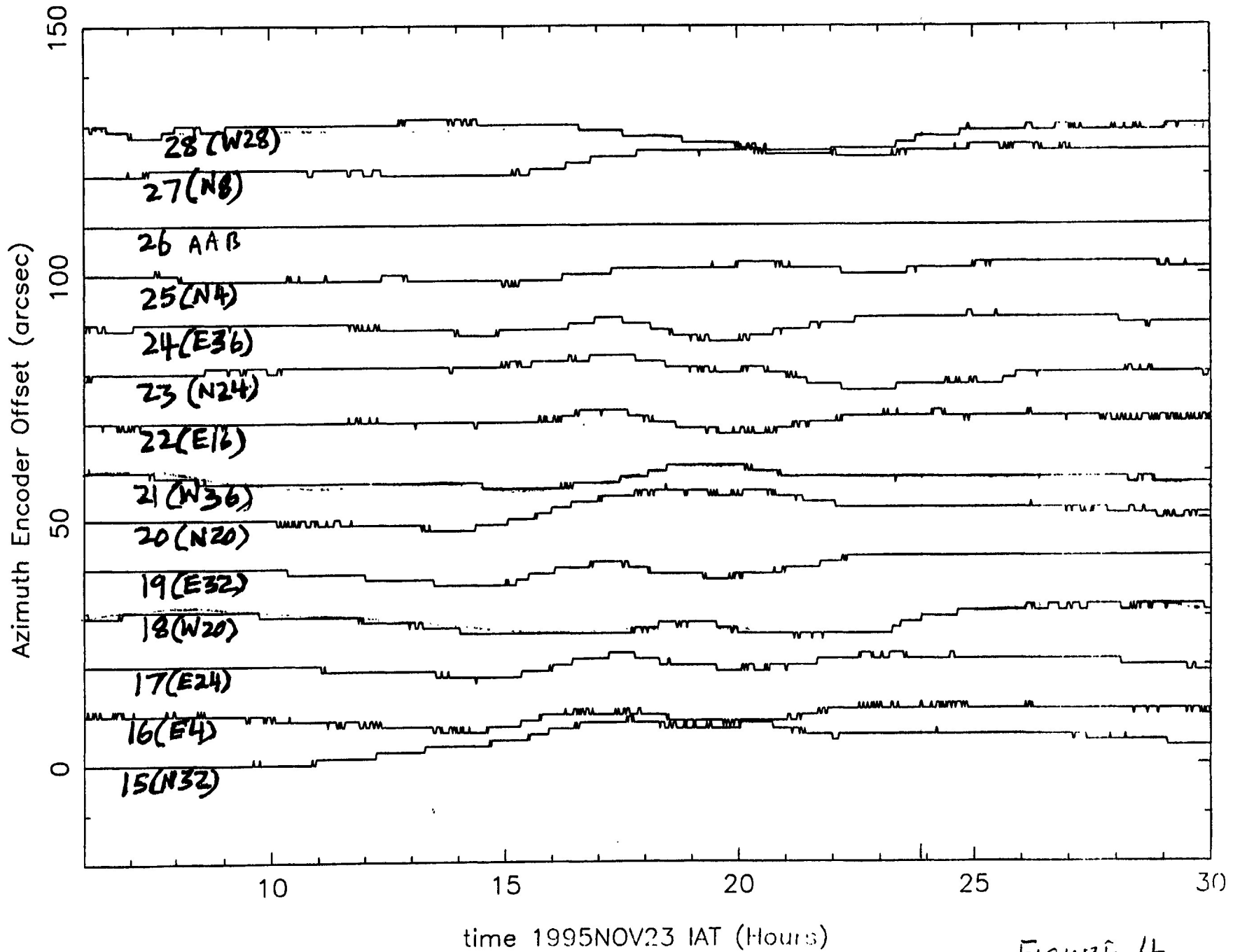


FIGURE 4

Antenna 11 N12

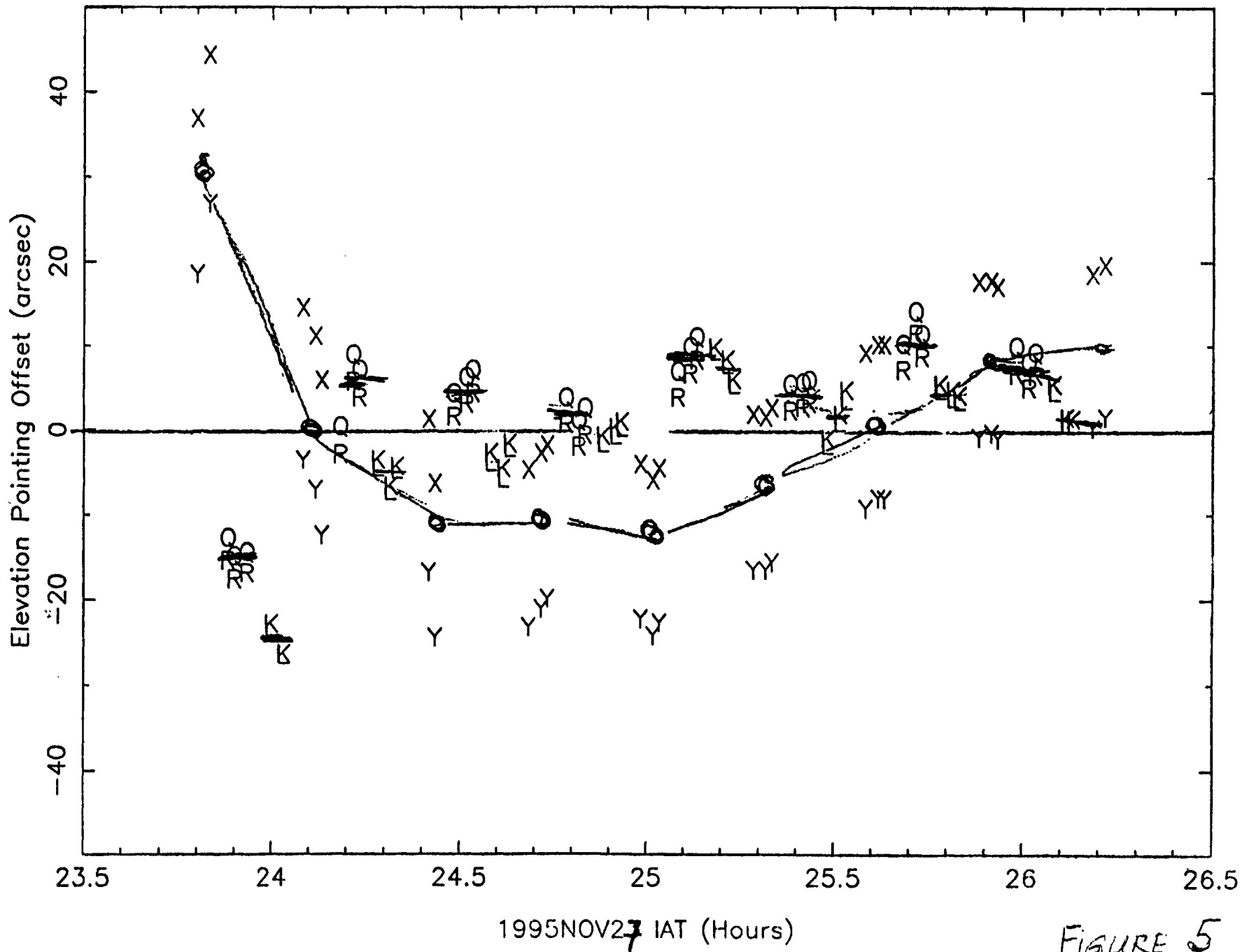
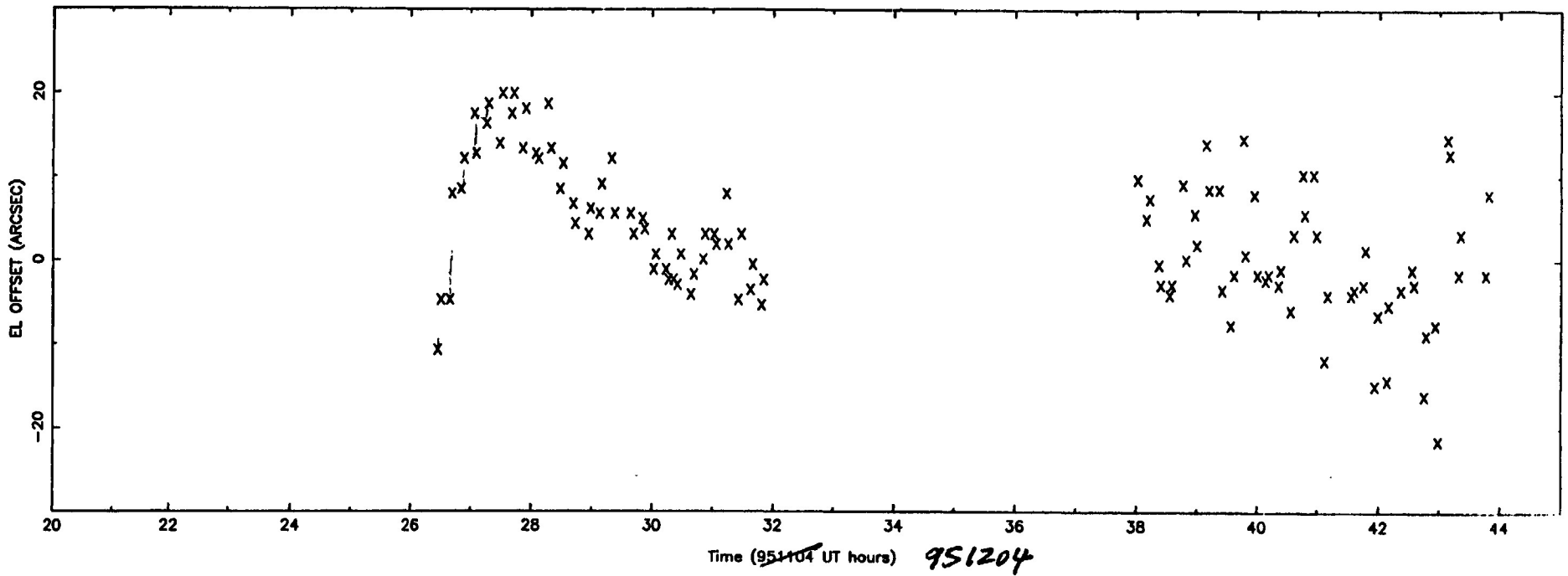


FIGURE 5

MK-EL pointing



MK-AZ pointing

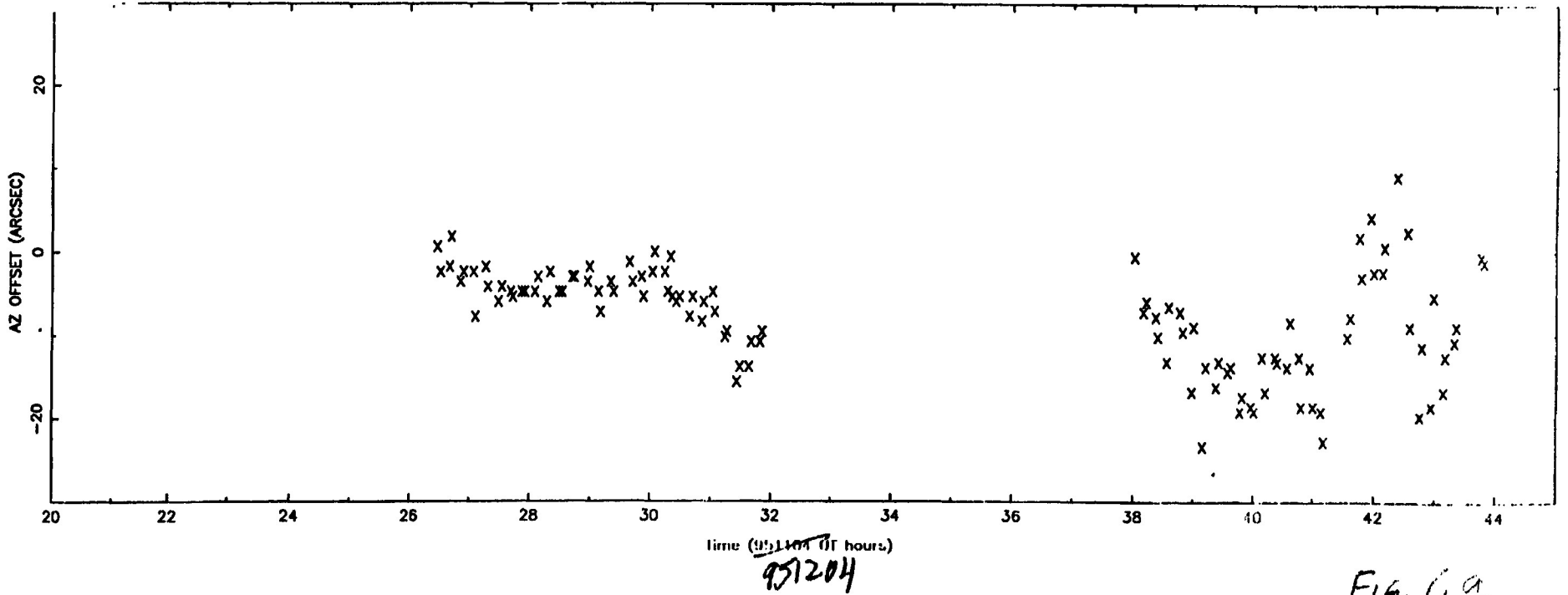
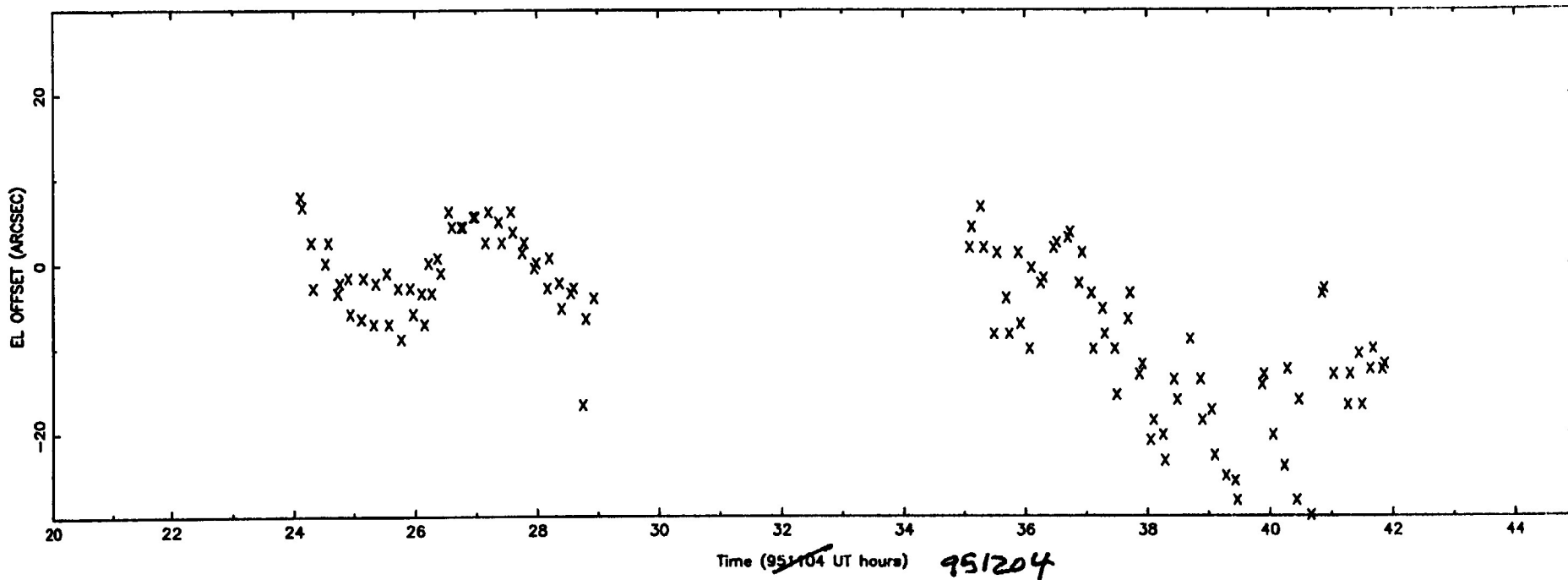


Fig. 6a

LA-EL pointing



LA-AZ pointing

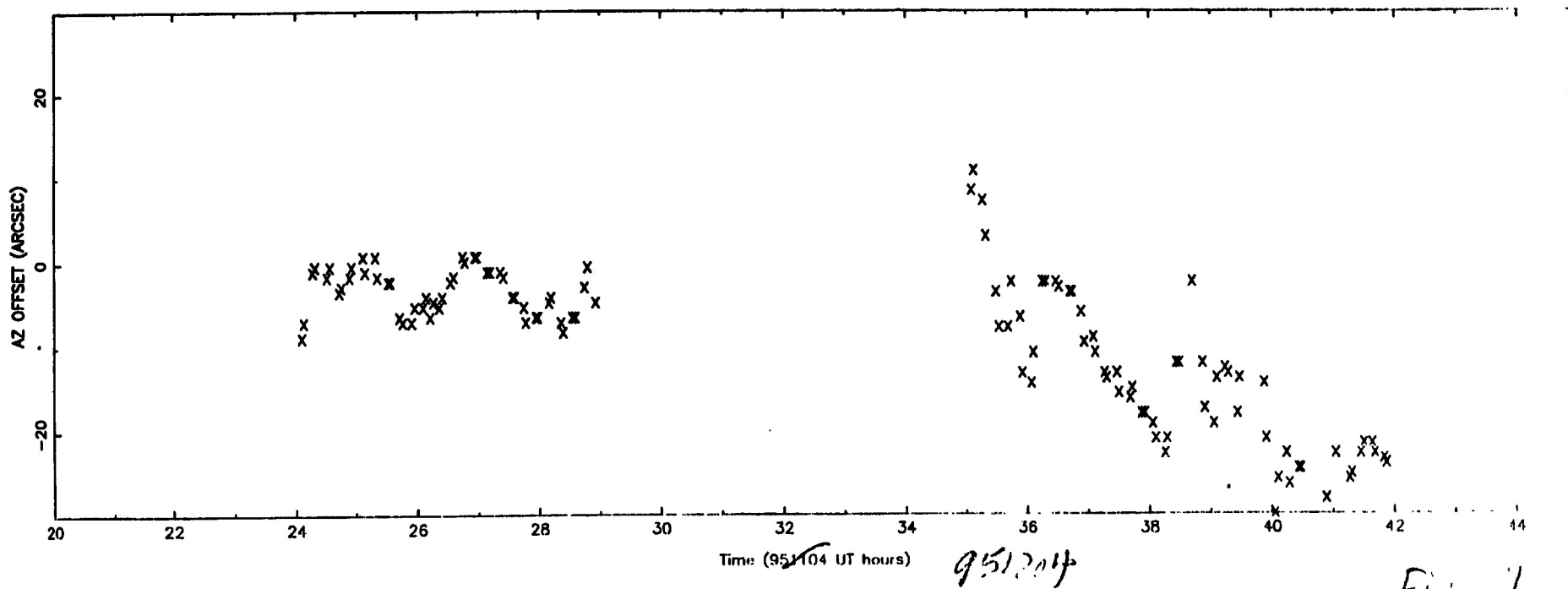
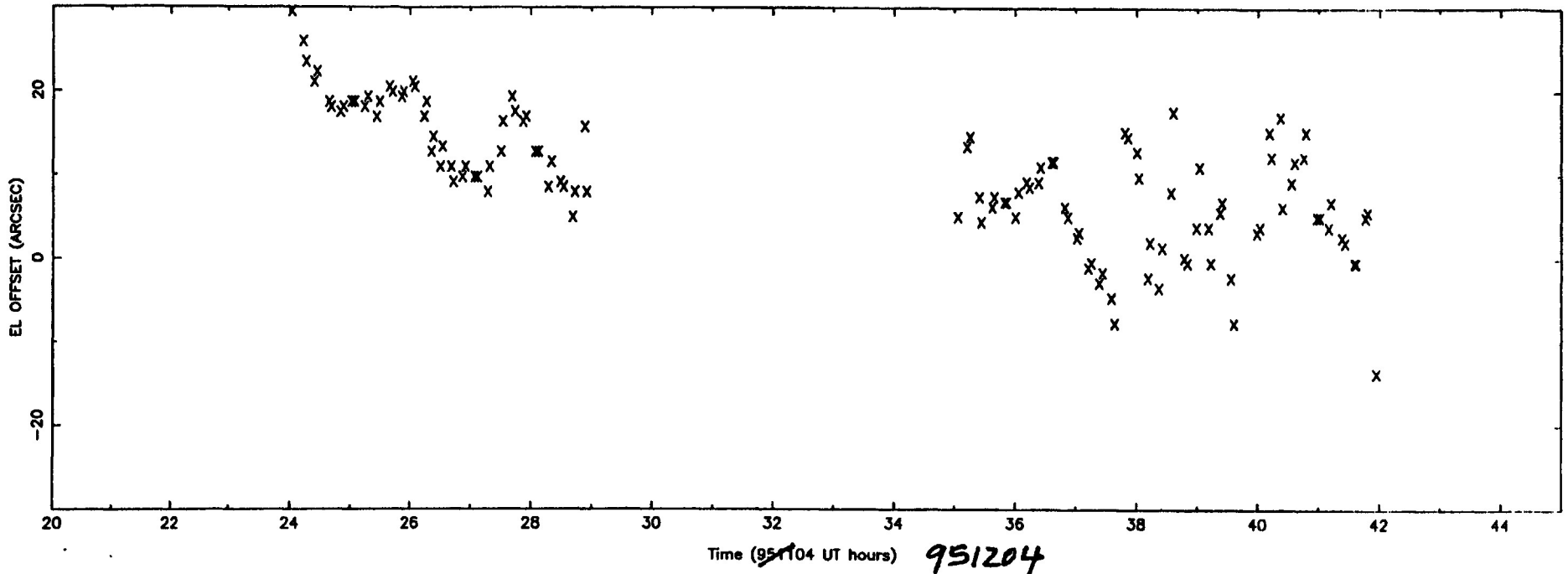
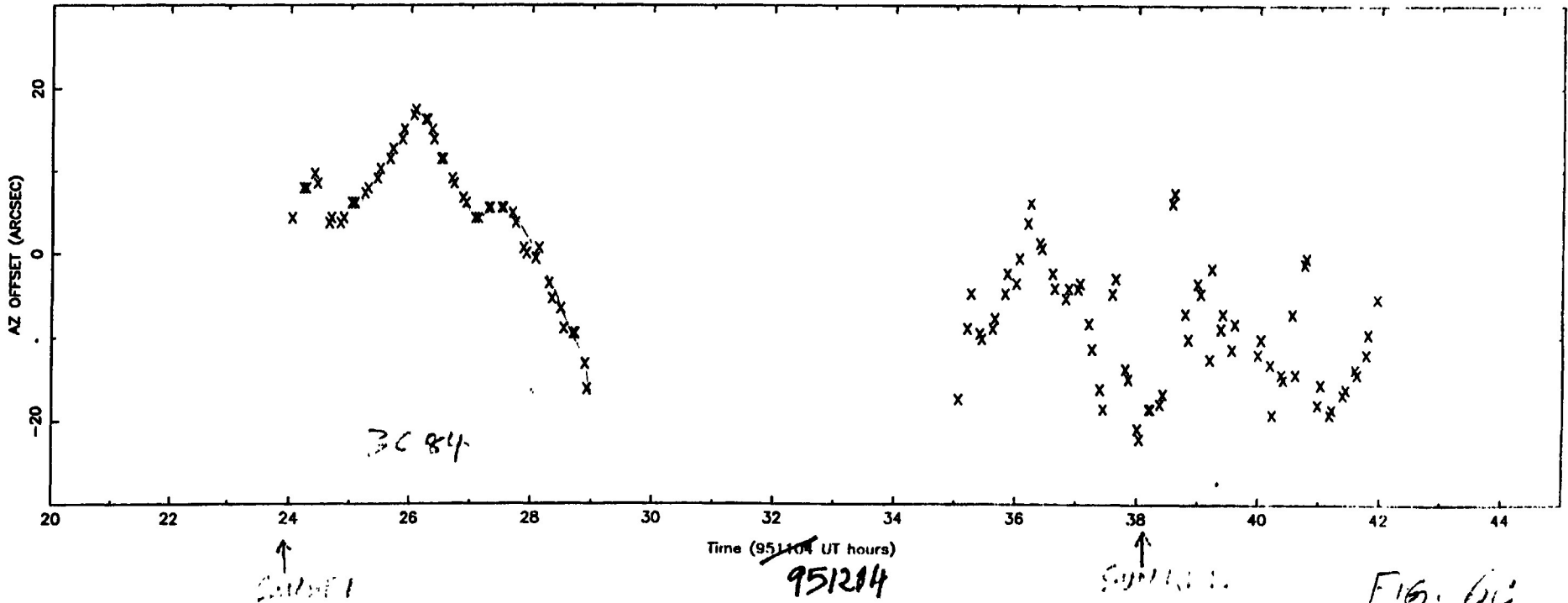


Fig. 16

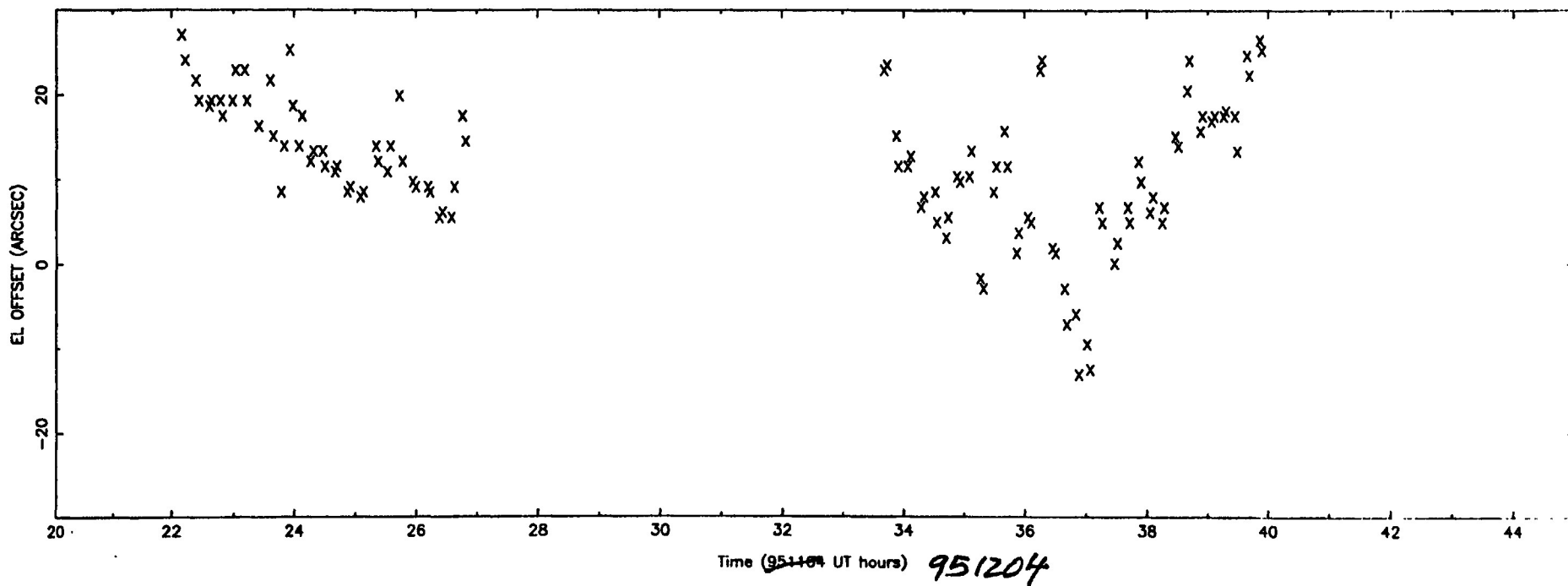
PT-EL pointing



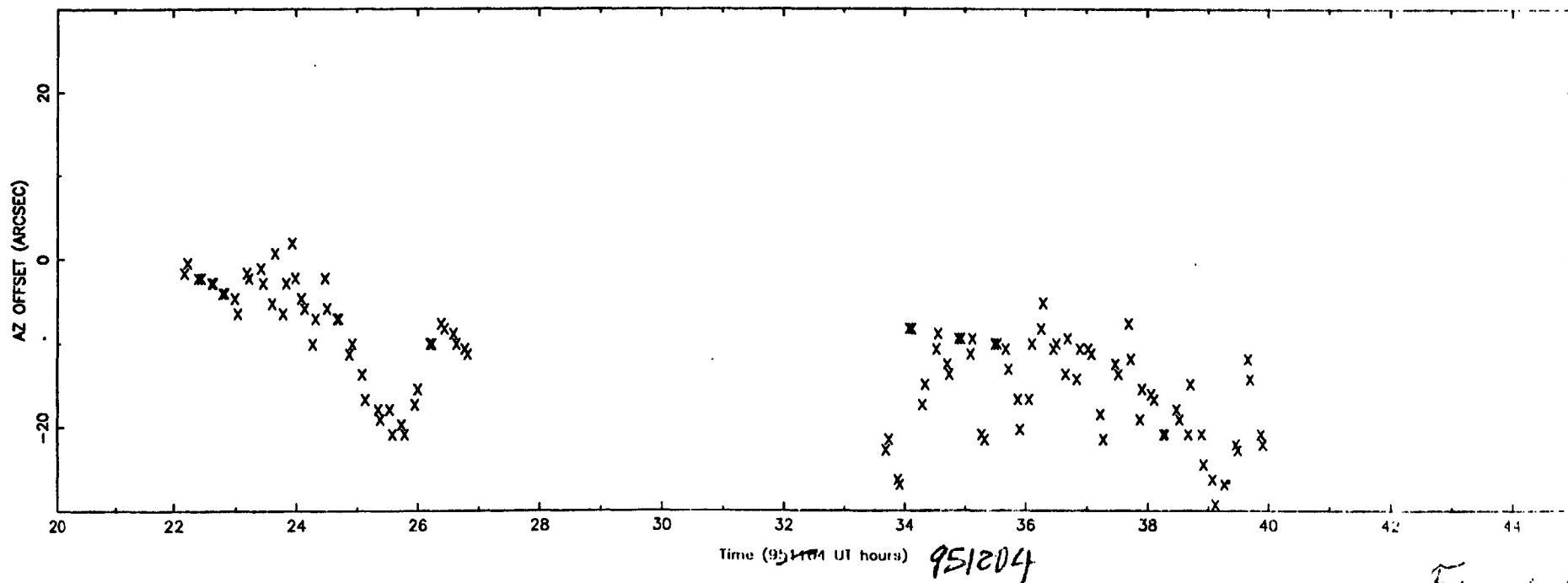
PT-AZ pointing



HN-EL pointing

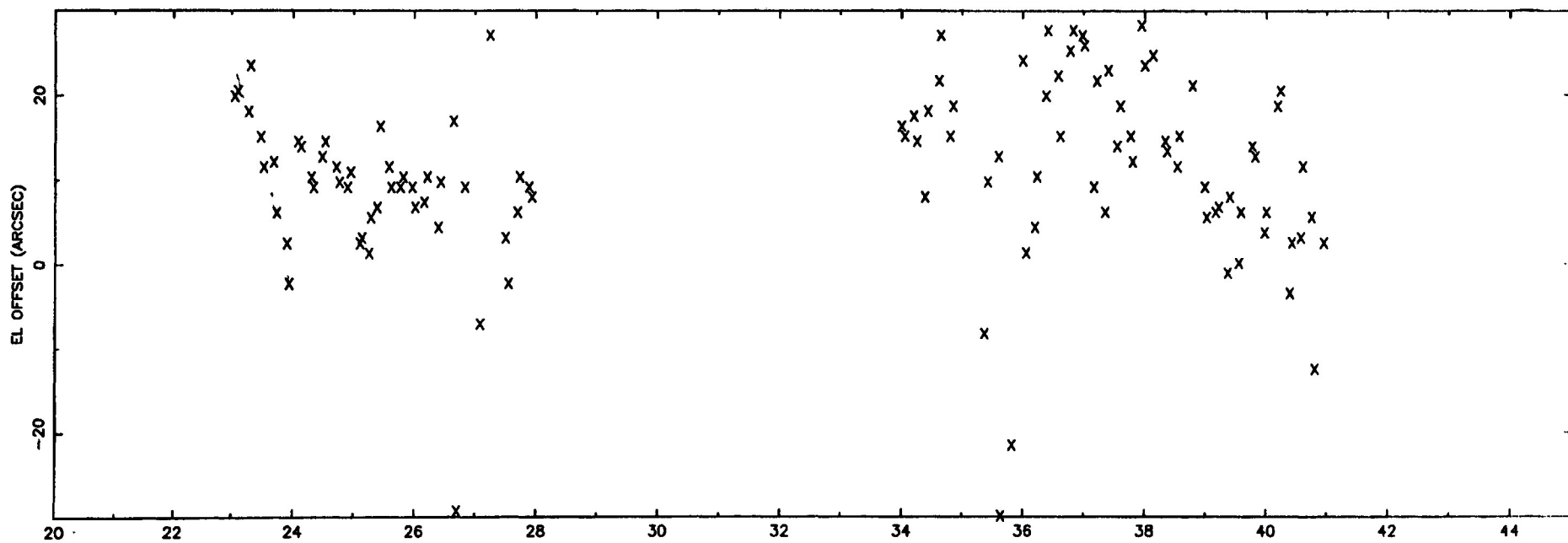


HN-AZ pointing



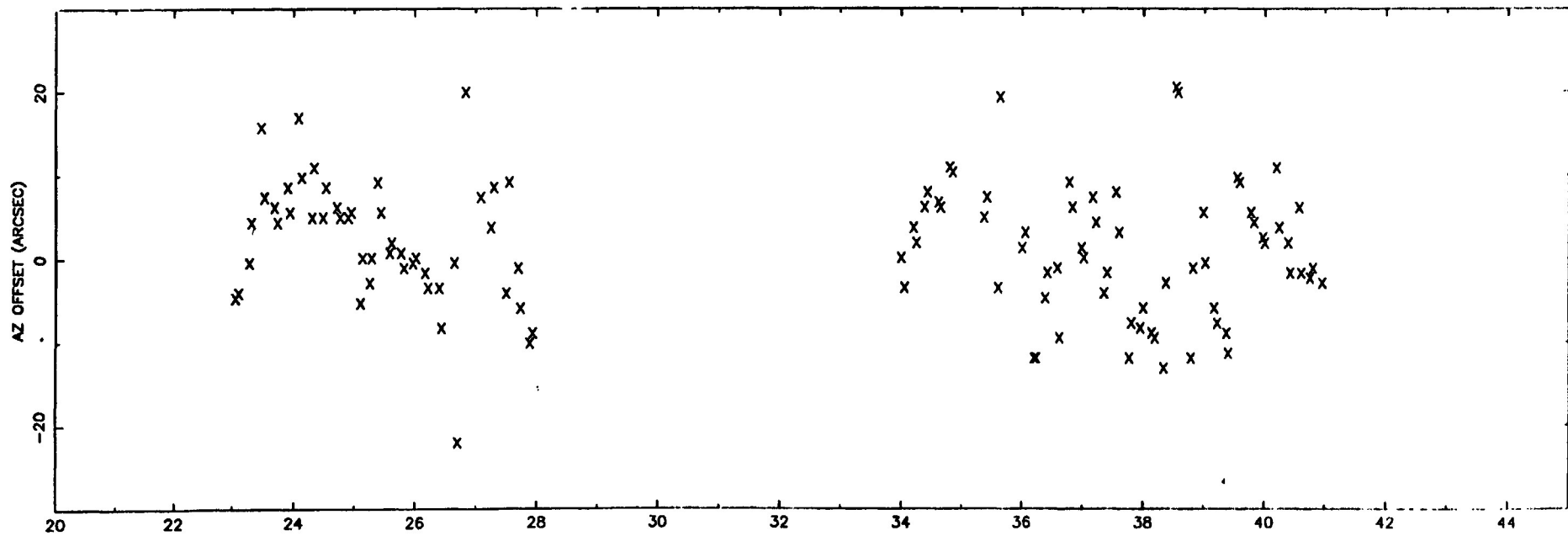
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NL-EL pointing



Time (95104 UT hours) 951204

NL-AZ pointing

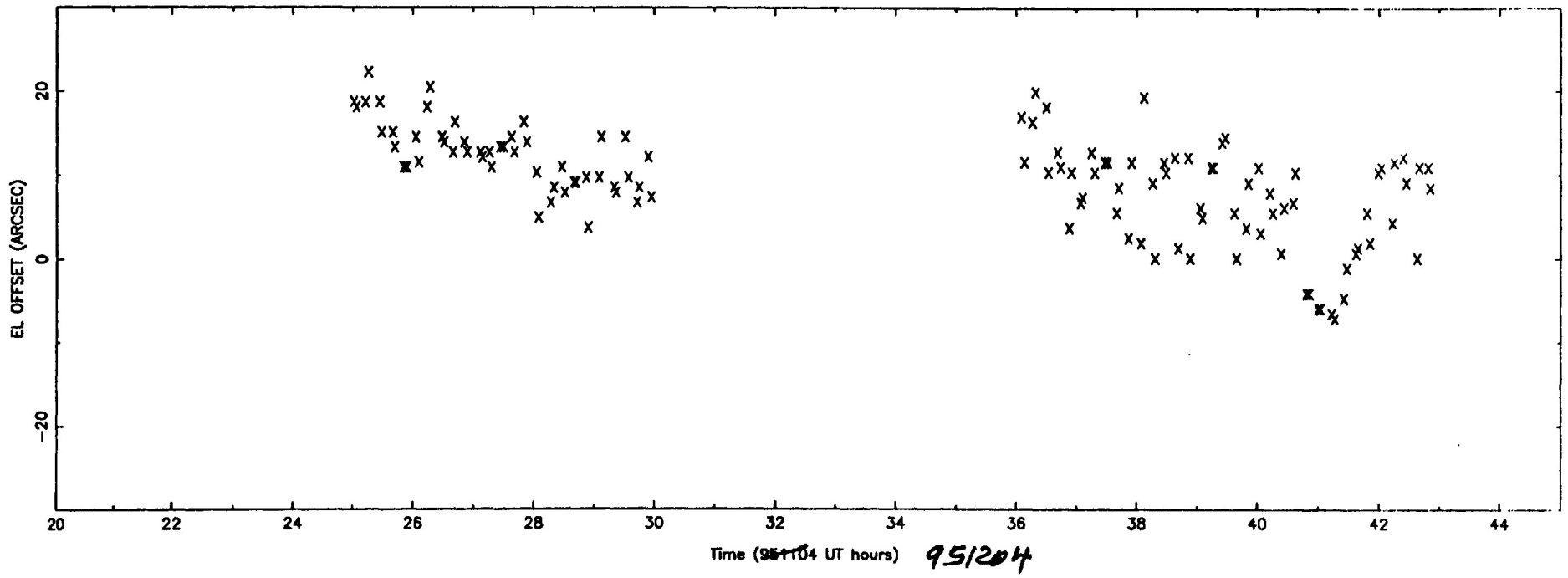


Time (95104 UT hours)

951204

Fig. 10

BR-EL pointing



BR-AZ pointing

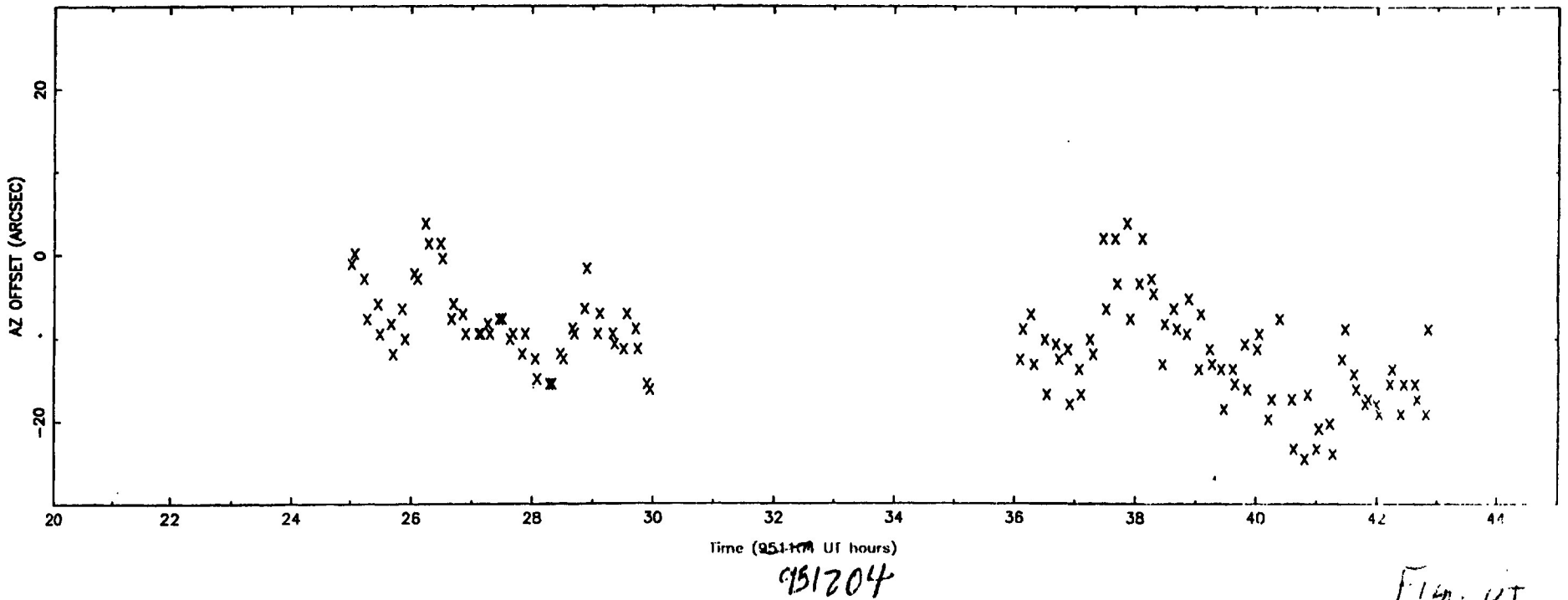
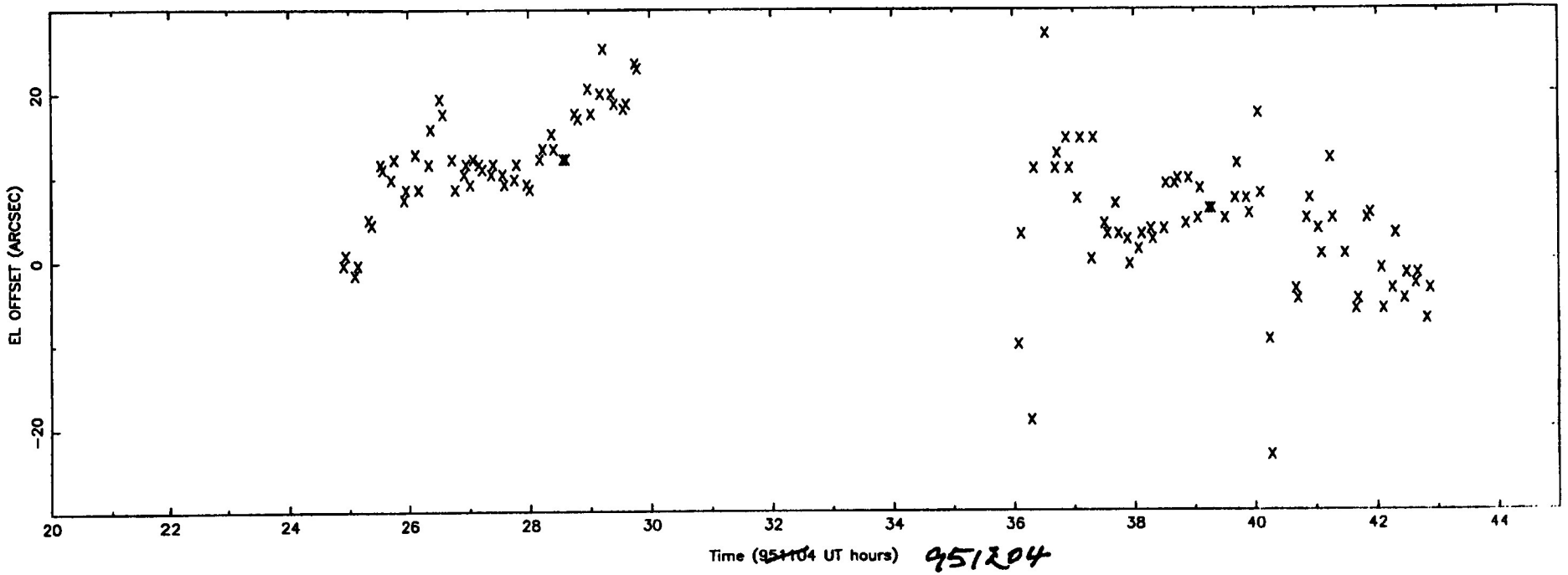
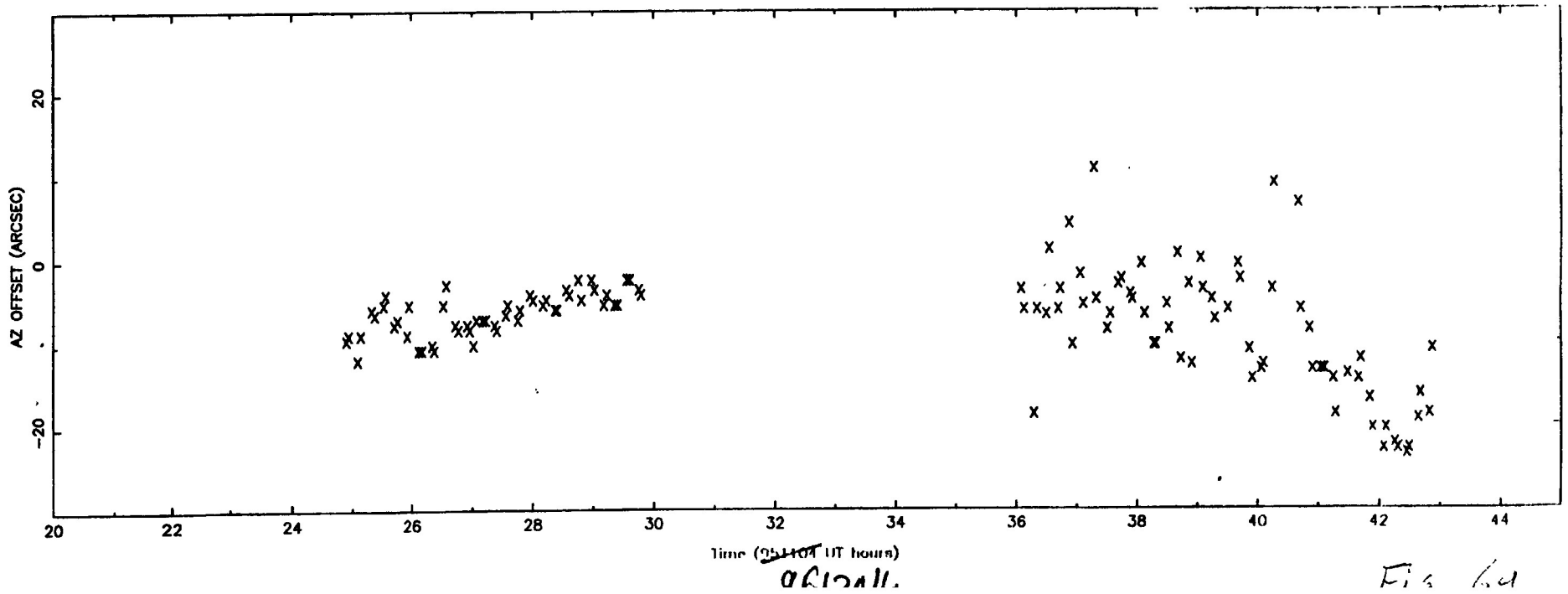


Fig. 10

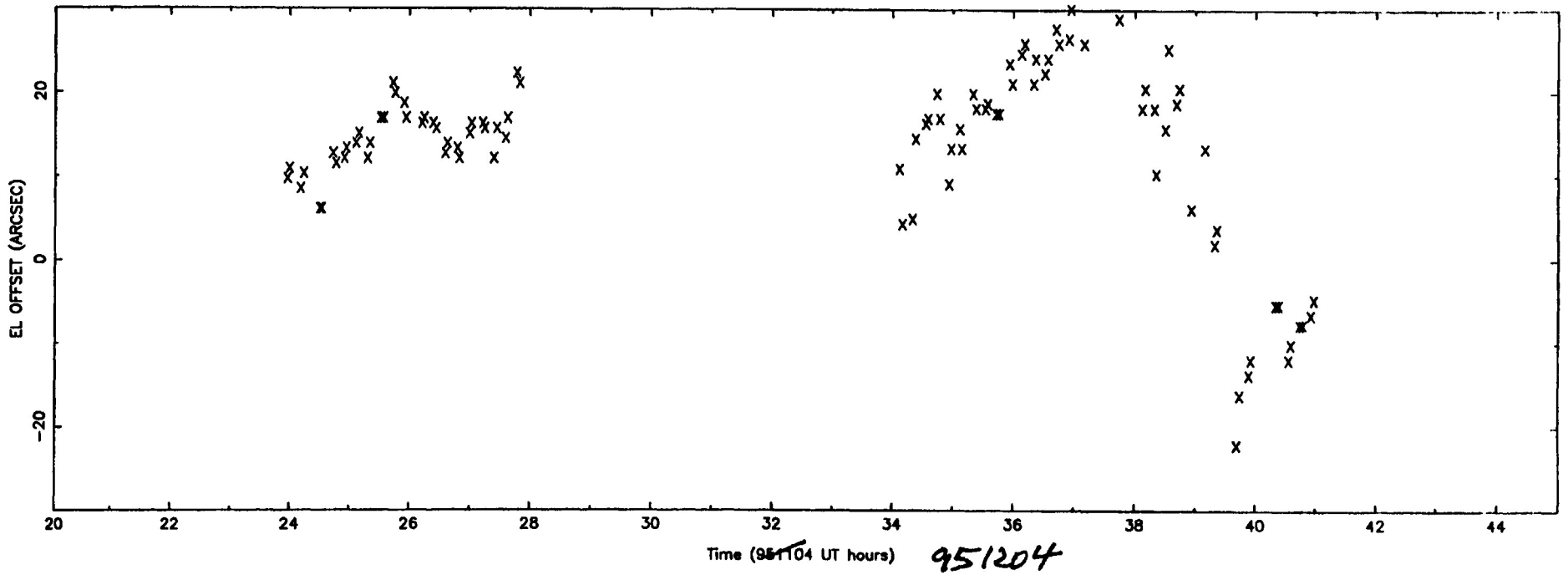
OV-EL pointing



OV-AZ pointing



FD-EL pointing



FD-AZ pointing

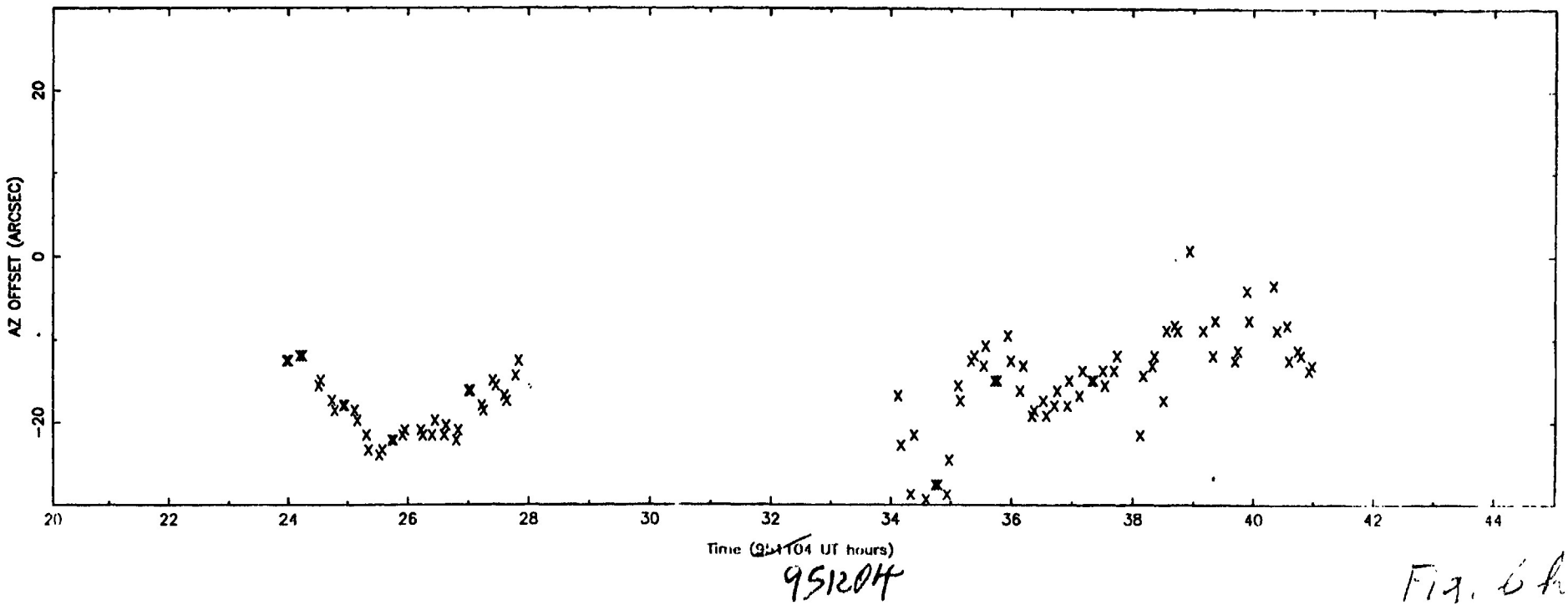


Fig. 6h

