National Radio Astronomy Observatory
Tucson, Arizona

January 9, 1989

MEMORANDUM

To: Tucson Internal Report Series (and Distribution)

From: P. R. Jewell

Subject: Report on 12 m System Tests, 2 January 1989

On 2 January 1989 I conducted about 12 hours of system tests. We were socked in with fog all day long and were never able to open the dome. Nevertheless, we were able to conduct a number of tests. Duane Clark was the telescope operator.

I. Filter Bank Bad Channels

I went through all the filter banks and cataloged bad channels. For those banks that go through the Switcher, I put each bank in as the first and as the second bank (F1 or F2) to isolate filter bank from Switcher bad channels. Table 1 gives the raw data; conclusions are drawn below.

Table 1
Filter Bank Bad Channels -- Raw Data

Mode	FB	F1/F2	Bad Channels
Series	2 MHz	F1	none
"	Red 2 MHz	F2	186 (same as 71, chans. reversed in computer)
"	1 MHz	F2	239
"	Red 1 MHz	F2	22, 71, 154, 223
"	1 MHz	F2	71
"	500 kHz	F1	187, 239
"	500 kHz	F2	71, 187, 239 (?)
"	250 kHz	F1	none
"	250 kHz	F2	71
"	100 kHz	F1	239, 67 (?)
"	100 kHz	F2	71, 192, 239
"	30 kHz	F2	22, 32, 88, 119
Parallel	100 kHz	F1	146
"	100 kHz	F2	193

(continued next page)

Table 1 (continued)
Filter Bank Bad Channels -- Raw Data

Mode	FB	F1/F2	Bad Channels
Parallel	250 kHz	F1	none
"	250 kHz	F2	"
"	500 kHz	F1	146, 198
"	500 kHz	F2	198
"	1 MHz	F1	146
"	1 MHz	F2	none

Conclusions: (Note: all channels are numbered from 1)

Multiplexer Bad Channels: 146 in first half, as seen in parallel mode.

Switcher bad channels: 100 kHz: 193 in F2 (parallel)

Filter Bank bad channels:
Red 1 MHz: 22, 154, 223 (series mode)
500 kHz: 198 (parallel mode)
30 kHz: 22, 32, 88, 119

Priorities: (1) The multiplexer should be looked at soon, because it affects all configurations.

(2) The Red 1 MHz needs attention as it will be used a great deal during the next few months.

The other banks should be looked at as we have time. A good opportunity to work on the spectrometer system is during the upcoming run B517, 18-26 January, as it is all continuum work.

II. Quadrant Detector

I took a series of measurements with the laser quadrant detector to test its repeatability, to determine if any azimuth effects existed, and to see if the X and Y axes of the instrument were properly aligned. The measurements were made with the dome closed but with the interior dome lights lit. After turning the laser on, there proved to be a lengthy warm-up time (~ 1 hour) before the measurements stabilized. The measurements at low elevations showed less noise on the readout (±0.02 mm) than did those at high elevation (±0.04 mm). This could be the result of stray light entering the detector. Both of the above noise levels

are eye-ball estimates. At 32"/mm, 0.04 mm corresponds to 1.3" on the sky.

The X and Y displacements as a function of elevation angle are displayed graphically in Figure 1, for 90° azimuth, and Figure 2, for 270° azimuth. The two curves are very similar. There is no apparent difference with azimuth angle, within the noise levels. Both curves seem to have a slight bow at mid-range elevations. Measurements were also taken at 0° azimuth with similar results.

We expect response only in the Y direction as the feed legs sag with elevation angle. The response in the X direction could be due to a simple misalignment of the instrument axes or could indicate a real effect, rotation of the mount, for example. To investigate this, I have plotted in Figure 3 the arctangent of the ratio X/Y. If the X response is from an axis misalignment, the ratio X/Y should be constant and the arctangent should give the angle of misalignment. Figure 3 suggests to me that most of the effect is due to a misalignment of about 17°. There may also be some real effects presents, however.

The objective of the laser quadrant detector system is to measure displacements of the prime focus from the norm as the result of differential heating of the feed legs, for example. As a next step in the development of this system, we should get the output of the detector into the telescope FEDAL, and then into a GPIB bus to the VAX. Someone will then have to write some data acquistion software for the GPIB. We need to determine the repeatability of the instrument and the magnitude of excursions that we can associate with feedleg differential heating.

In the long term, I would like to see the quadrant detector in a servo loop with the new subreflector focus/rotation ("Sterling") mount, which I hope will include both North-South and East-West movement.

III. New Weather Instruments

We have recently purchased two accurate weather instruments, a mercury thermometer on the Celsius scale and a sling psychrometer (wet/dry bulb). The two instruments are intended to calibrate our analog temperature and humidity chart recorders in the dome and the electronic weather equipment under development. I have mounted the thermometer on the side of the white weather instrument box in the dome. The psychrometer is on the upper left-hand shelf in the little lab / kitchenette in the dome. I would like to set up a program for the operators to take measurements with the two instruments a few times a week and compare them to the chart recorder readings. Accurate measurement of temperature and humidity are important because they affect the

pointing refraction coefficient. My first measurements indicated that the temperature scale of the chart recorder was accurate to 1-2° F but that the humidity scale might be off a little. It was very wet (RH = 80-90 %) so the day of the test was atypical of normal observing weather, however.

IV. New Catalog Transmission Program

I experimented with the program to transmit source catalogs from the PC to FORTH that Tom and Chris worked out. I thought it worked very well. I tried Chris's 'catparse' procedure and Tom's menu-driven transfer program. Both worked exellently. We need to improve the documentation somewhat; for example, catalogs on the PC must have the file extension '.CAT' for Tom's program to work. That has already caused some problems, unfortunately.

Aside from documentation, we need a few things to complete the facility. The most important one is a line printer, so we can get hard copies of the catalogs. I would also like to get a new keyboard for that PC, as the current one drives me bananas. We also need to write some instructions for line editors to be used in entering the catalogs (PC-Write, Norton Editor, etc.). We should buy a copy of the Norton Editor (~$35).

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FIGURE 1

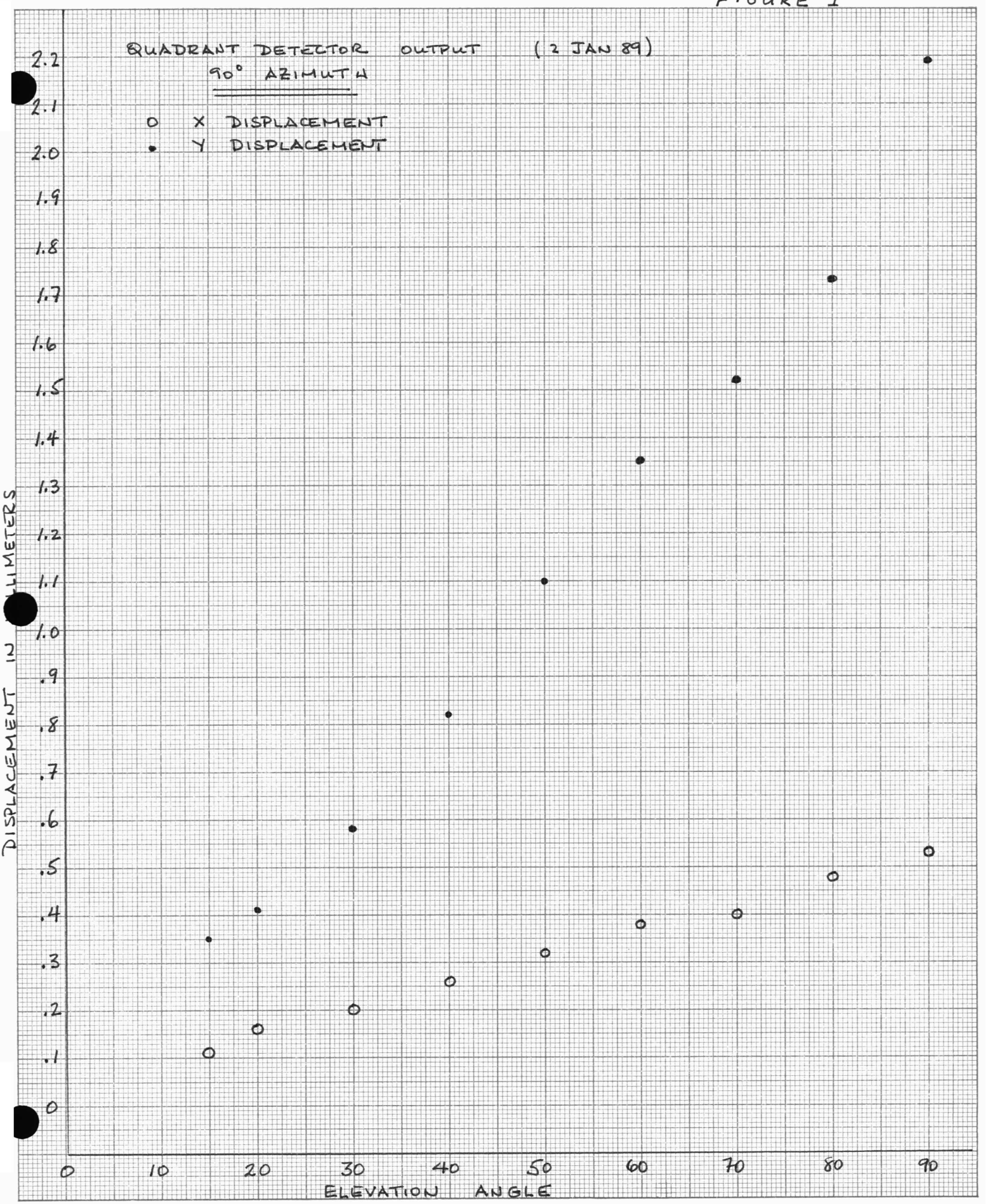
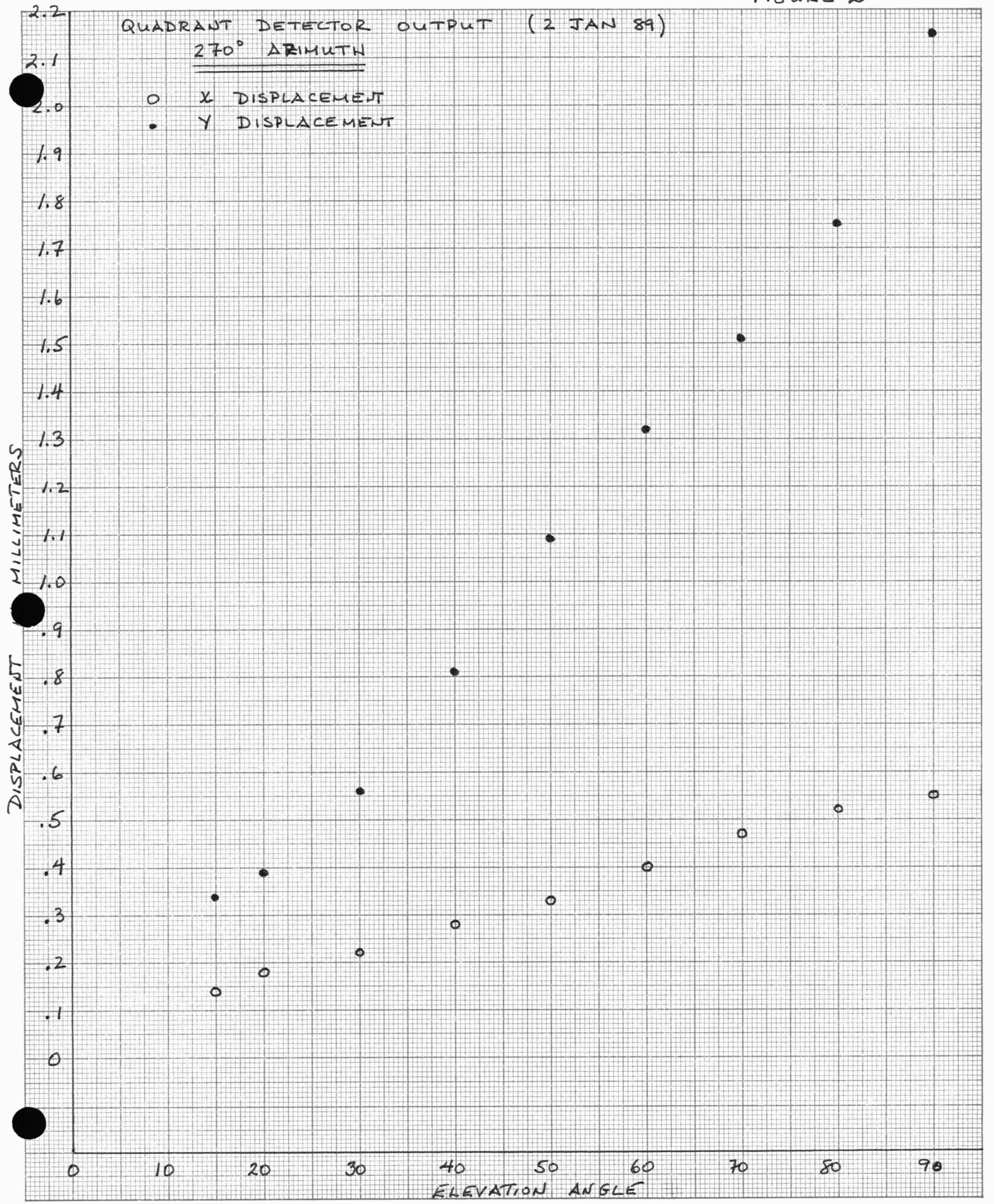

QUADRANT DETECTOR OUTPUT (2 JAN 89)
90° AZIMUTH
O X DISPLACEMENT
• Y DISPLACEMENT
DISPLACEMENT IN MILLIMETERS
2.2
2.1
2.0
1.9
1.8
1.7
1.6
1.5
1.4
1.3
1.2
1.1
1.0
.9
.8
.7
.6
.5
.4
.3
.2
.1
0
0
10
20
30
40
50
60
70
80
90
ELEVATION ANGLE

FIGURE 2


QUADRANT DETECTOR OUTPUT (2 JAN 89)
270° AZIMUTH
o X DISPLACEMENT
• Y DISPLACEMENT
DISPLACEMENT MILLIMETERS
2.2
2.1
2.0
1.9
1.8
1.7
1.6
1.5
1.4
1.3
1.2
1.1
1.0
.9
.8
.7
.6
.5
.4
.3
.2
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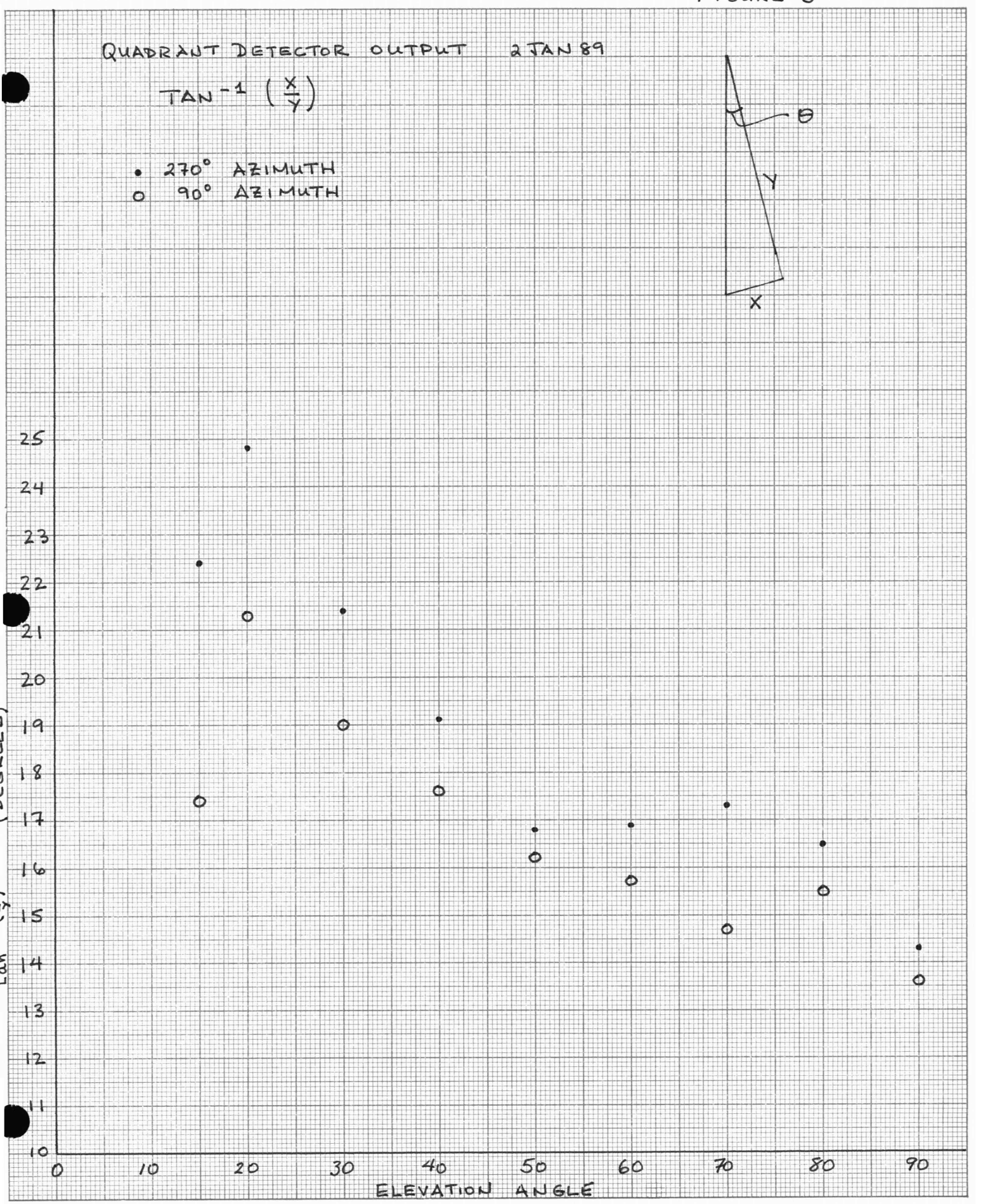
0
0
10
20
30
40
50
60
70
80
90
ELEVATION ANGLE

FIGURE 3


QUADRANT DETECTOR OUTPUT 2 JAN 89
TAN-1 (X/Y)
• 270° AZIMUTH
o 90° AZIMUTH
θ
Y
X
25
24
23
22
21
20
19
18
17
16
15
14
13
12
11
10
tan-1 (X/Y) (DEGREES)
0
10
20
30
40
50
60
70
80
90
ELEVATION ANGLE