12 METER MILLIMETER WAVE TELESCOPE

MEMO No. 236

THE EDGE-BALLS RE-MEASURED

J. W. Findlay

December 2, 1983

1. Introduction

The elevations of all the edge-balls used to support the template for setting and measuring the surface were measured four times at the end of September 1982. This was before the surface was emplaced. The method used (NIII observations from the center) became impossible after the surface was put in place.

From these 1982 measurements, the EB numbers which give the elevation above or below the best-fit plane in rounded microns were put into the setting and measuring programs and have been used since. From the scatter of the four sets of measurements, I estimated that we knew any EB number to about 27 μm (1σ value).

2. We have tried various ways to remeasure the EB numbers, because we have worried that the edge of the dish might have changed shape. On November 6, 1983, John Payne and I tried a simple stepping method. We measured the angles of tilt between balls No. N and No. N+1 all the way round the edge. We rotated the telescope in azimuth (with the elevation stow pin in place), so as to bring each ball in turn onto a fixed (in space) radius. We applied the azimuth brake for each tilt angle measurement. The angles were read as tilts from a gravity horizontal using the Schaevitz ± 15° tiltmeter.

3. I derived the step-lengths (only to about ± 1%) by using the known ball azimuths and by assuming they lie on a circle of radius 6.06 m. (This is not exactly true, and sometime I will measure the step lengths directly). From the measured angles and these lengths, I derived the ball elevations from a gravity plane by choosing the tiltmeter zero to close the circle of elevation. This process could, in principle, give the required EB values, but it does require that the telescope azimuth bearing is very well-behaved. We tested this method after trying a more difficult one suggested by A. Lazenby in the hope that the simpler one might work.

4. In Figure 1, I have plotted* the individual EB elevations and the best-fit sine curve put through them. We concluded that the sine curve fit was very good; i.e., the bearing seemed very well-behaved.

So, in Figure 2, I have plotted the EB numbers from September 1982 (red) and those from Figure 1 (black). The agreement is remarkably good, as Figure 3 shows when the differences between September 1982 and November 1983 are plotted. The mean value of this difference is 3.3 μm and the RMS is 40.5 μm. These numbers suggest that we do, in fact, know the EB values to about 30 μm.

---

* All plotted points should not, of course, be joined by lines, but this makes them easier to see.

5. Note in Figure 3 that balls Nos. 63 through 67 were not measured, but only estimated, in September 1982, and these show three big differences in the 1983 results. The area of the dish between radii 59 and 70 is one where holography and mechanical measures do not agree well, and Figure 3 may show why. Unfortunately, the other area of disagreement, between radii 125 through 144 to 5, does not seem bad in Figure 3.

6. However, it does seem we have a method by which the shape of the telescope edge and the behaviour of the azimuth bearing can be monitored occasionally. The whole measurement can be done in less than two hours.

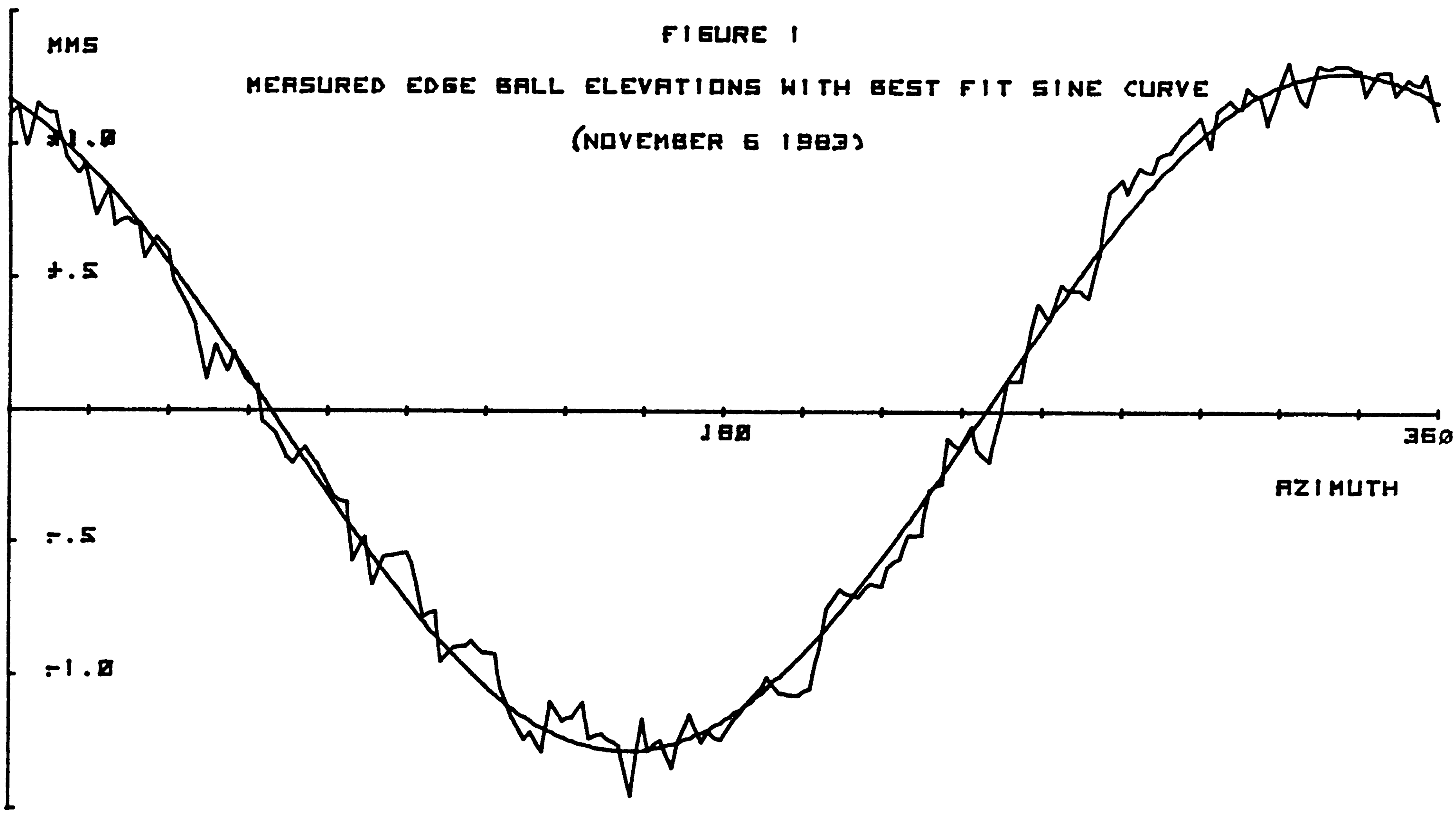
FIGURE 1
MEASURED EDGE BALL ELEVATIONS WITH BEST FIT SINE CURVE
(NOVEMBER 6 1983)
MMS
+1.0
+.5
-.5
-1.0
180
360
AZIMUTH

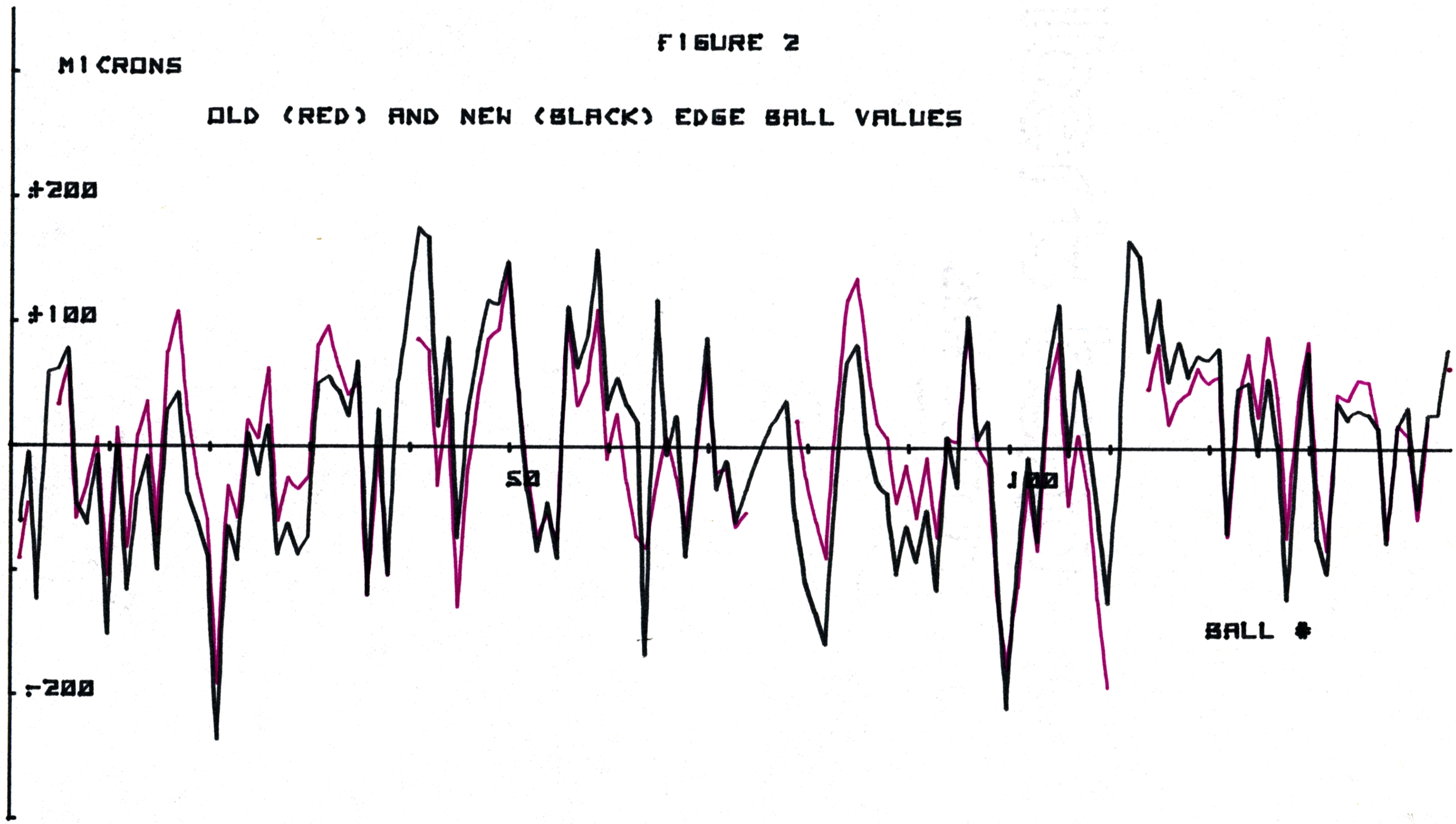

FIGURE 2
MICRONS
OLD (RED) AND NEW (BLACK) EDGE BALL VALUES
+200
+100
50
100
-200
BALL #

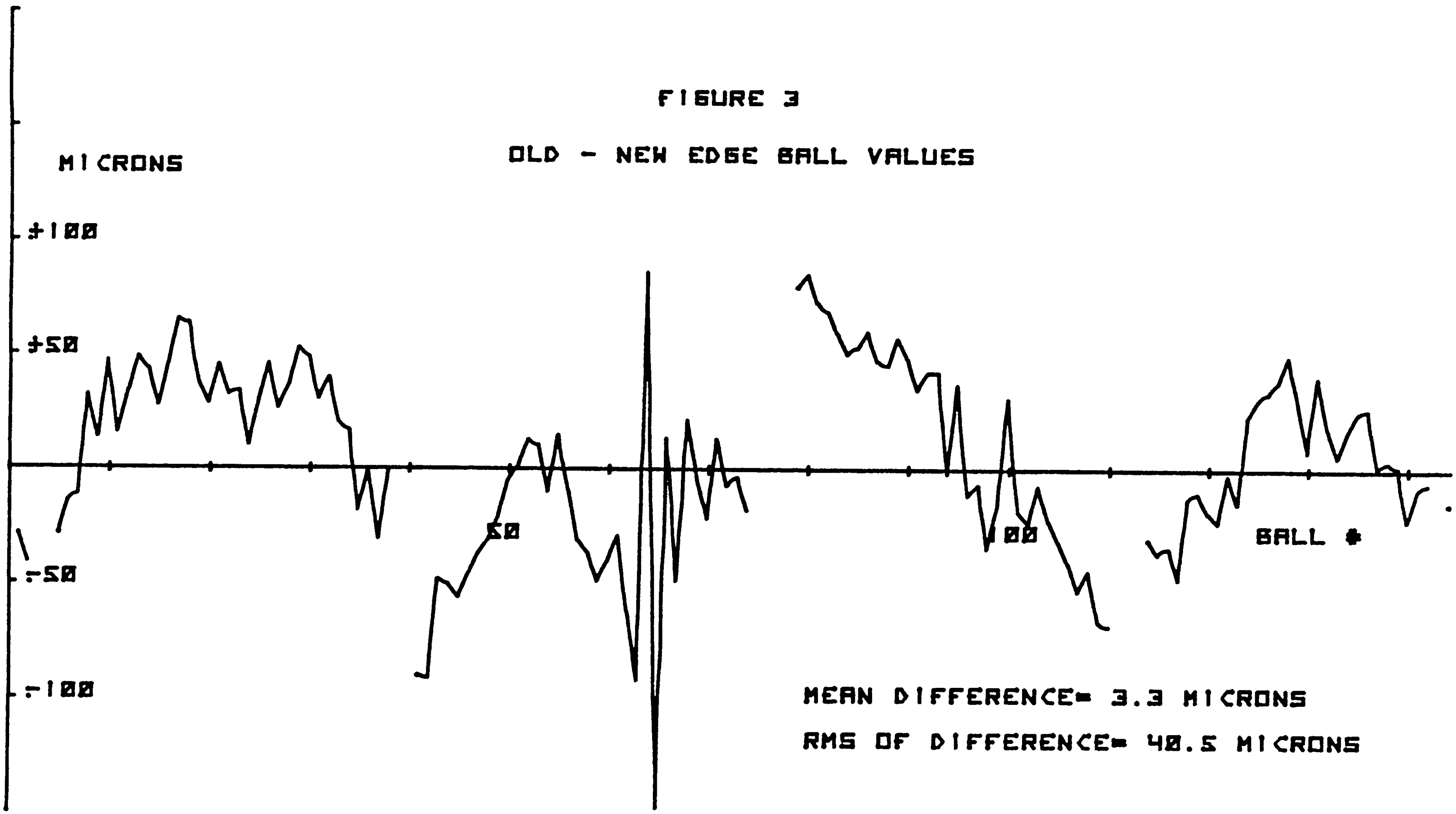
FIGURE 3
OLD - NEW EDGE BALL VALUES
MICRONS
+100
+50
-50
-100
50
100
BALL #
MEAN DIFFERENCE= 3.3 MICRONS
RMS OF DIFFERENCE= 40.5 MICRONS