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Interim Report on Vertical Survey

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Subject: Interim Report on Vertical Survey

SUMMARY

One vertical survey was run around the AGS using pins in the pile caps as monuments. The precision achieved was about 0.0025 inches per shot which is good. Future runs will study the stability of this monument system. The labor involved in making this survey was considerably more than we had hoped it would be.

PURPOSE of the EXPERIMENT

The vertical elevation of the AGS magnets is determined by measuring from point to point around the ring. Since each measurement has an error associated with it, the resulting elevations involve a statistical accumulation of errors. Thus the results of one survey may differ considerably from the results of another survey on purely statistical grounds. A random walk analysis of this problem is discussed in detail in TN 237. One way to reduce the statistical problem is to establish a set of permament, unmoveable monuments and then to take repeated measurements of this monument system, averaging the results. An unmovable monument system is of course an idealization, since at the precision normally achieved by the Survey Group, everything moves all of the time. However, each pair of magnets is mounted on a steel girder, and the girders are supported on pile caps, which are supported on 50 foot piles. This system of piles and pilecaps should be very stable. Fortunately there is a survey pin mounted in each pile cap. The purposes of the present experiment are to see how easily we can use these pins as a vertical monument system, what precision we can achieve, and how stable they are. This note analyses the results of the first survey and speaks to the first two questions.

SURVEY PROCEDURE

The instrument was set up opposite one pile cap and and the elevations of the nearest five caps were measured. The instrument was then moved three caps down and the process repeated for a total of forty setups. Thus there was a double overlap and we achieved in principle two independent surveys. In practice a large number of pins were not availabe and the two surveys were not completly independent. The complete circuit took three days which is too long to enable us to accumulate a statisticlly large sample, and we shall have to see if experience speeds the process up or if the procedures have to be modified.

RESULTS

The pin elevations are entirely arbitrary and for the first survey the only data to be examined are certain overlap regions. Thus there are forty pairs of pins(25 are available in practice) whose displacements in elevation are measured by two separate instrument set ups. Figure 1 shows a histogram of the differences of these displacements. The rms width is about 0.005 inches, and since there are 4 shots to a measurement the accuracy of each shot is about 0.0025 inches, which is good. The rms distribution of closing errors for a complete 80 shot circuit of the ring should be about 0.020 to 0.025 inches. Figures 2 and 3 show pin elevations for two somewhat independent cicuits of the ring. The closing errors are -0.047 and -0.020 inches, which are in reasonable agreement with the predicted distribution.

CONCLUSIONS

The precision is good, the procedure is slower and harder than we had hoped, and only with time will we determine the stability.

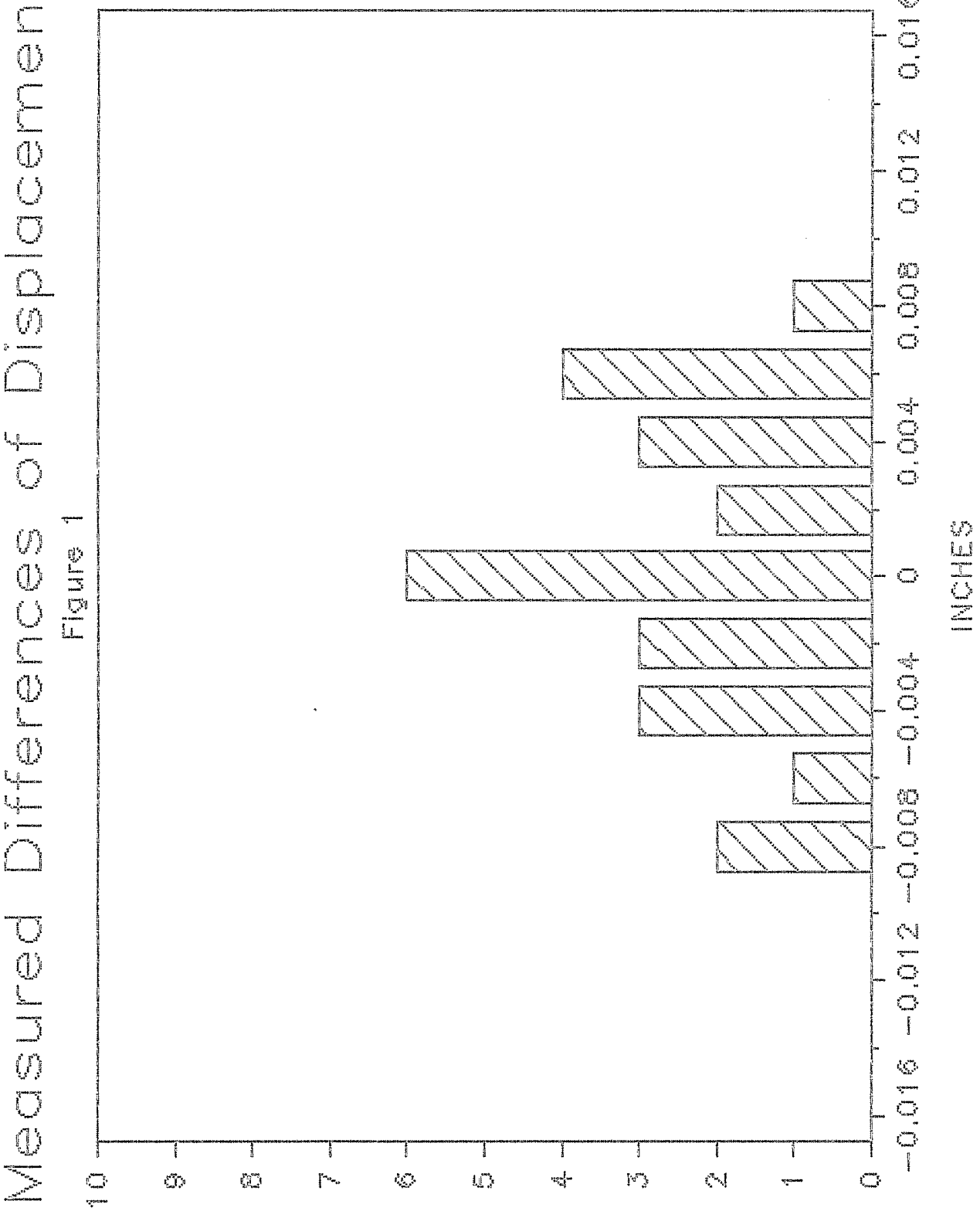
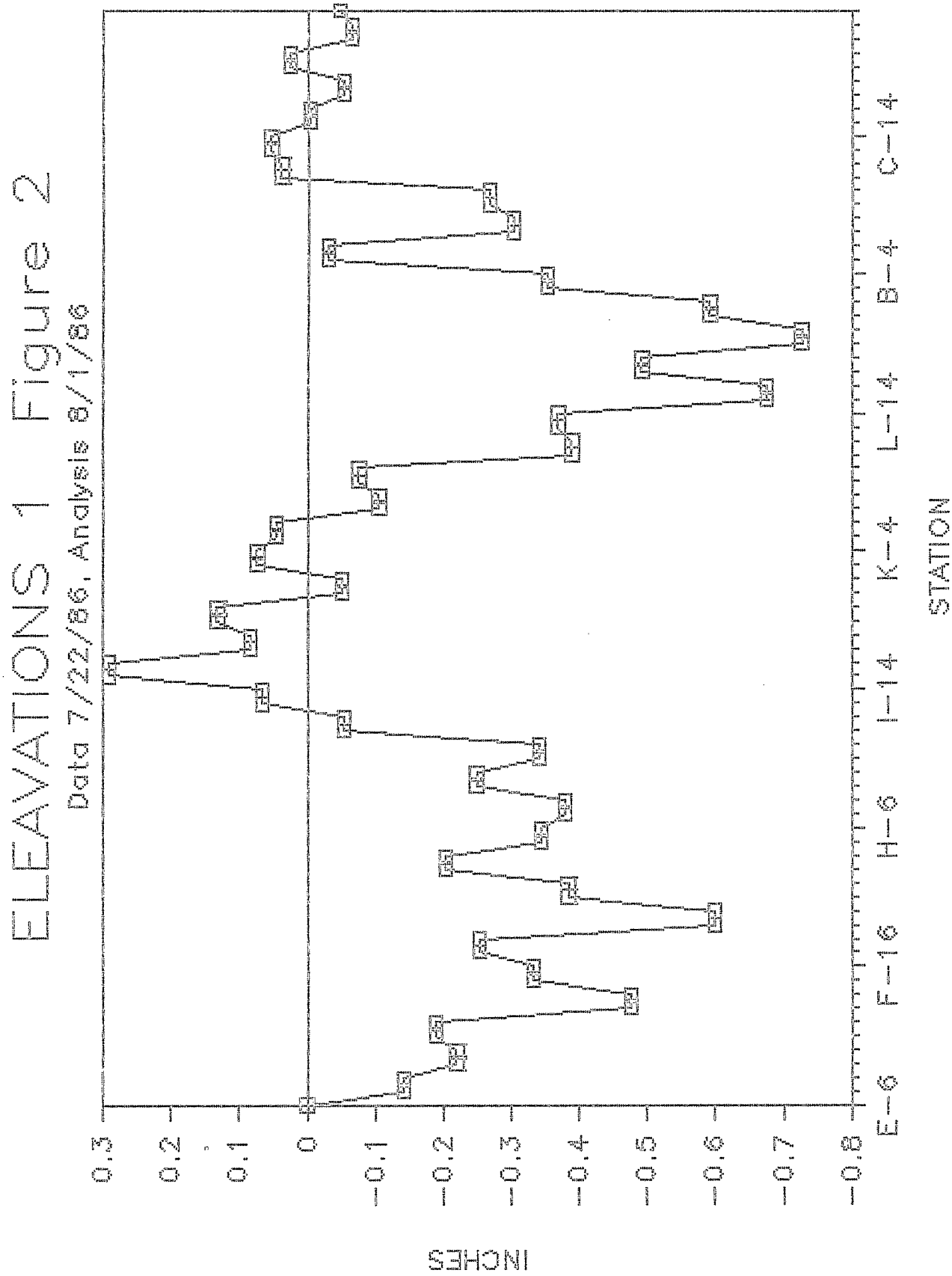
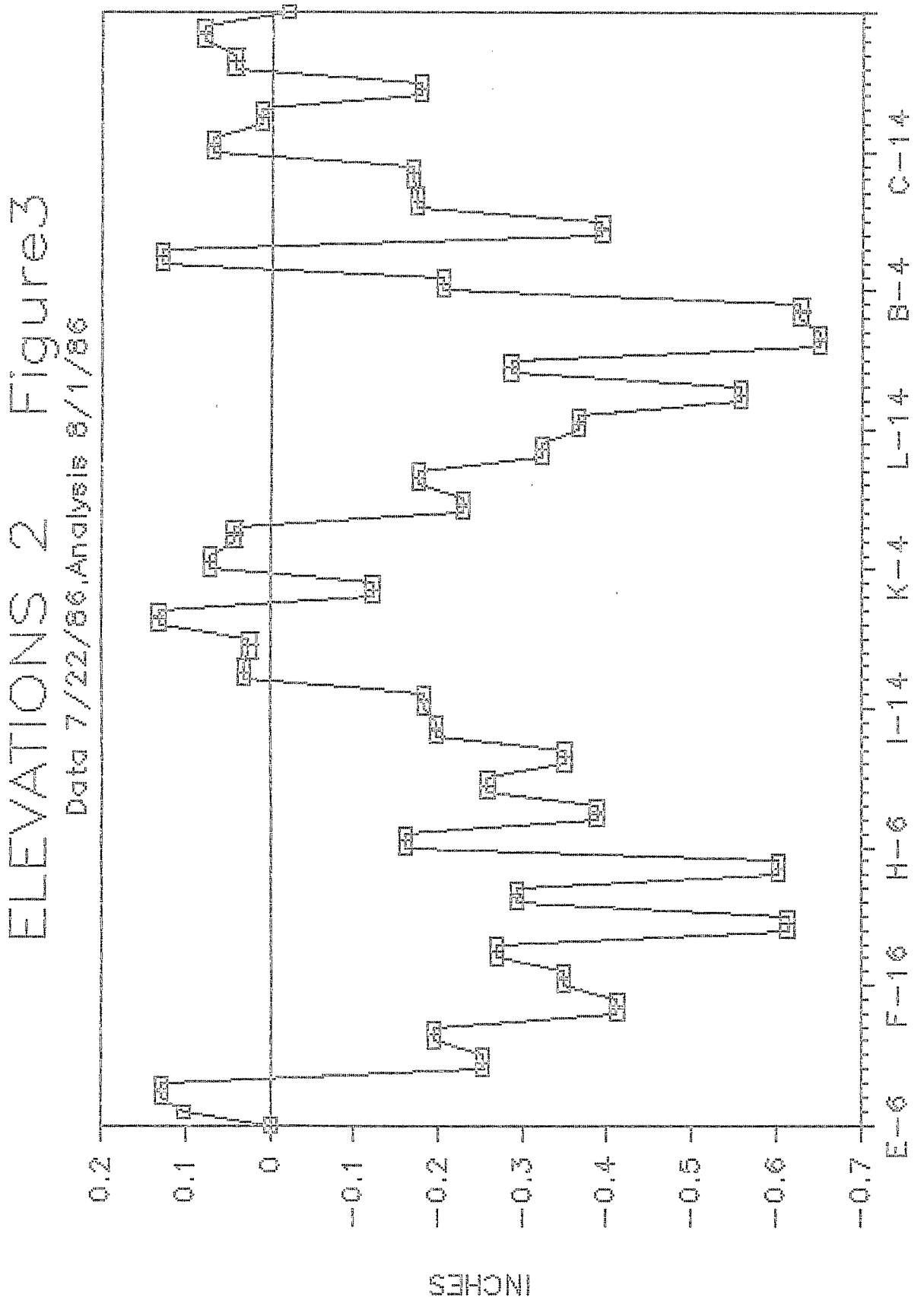

Measured Differences of Displacements
0
1
2
3
4
5
6
7
8
9
10
-0.016
-0.012
-0.008
-0.004
0
0.004
0.008
0.012
0.016
INCHES

Figure 1


ELEAVATIONS 1 Figure 2
Data 7/22/86, Analysis 8/1/86
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
-0.4
-0.5
-0.6
-0.7
-0.8
INCHES
E-6
F-16
H-6
I-14
K-4
L-14
B-4
C-14
STATION


ELEVATIONS 2 Figure3
Data 7/22/86,Analysis 8/1/86
0.2
0.1
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
INCHES
E-6
F-16
H-6
I-14
K-4
L-14
B-4
C-14
STATION