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August 3, 1973

Mr. J. F. O'Leary, Director
Directorate of Licensing
U.S. Atomic Energy Commission
Washington, D.C. 20545

Subject: Possible Inverted Absorber Tubes in Quad-Cities Control Rods, AEC Dkts 50-254 & 50-265

Dear Mr. O'Leary:

Pursuant to telephone conversations on July 23-25, 1973, with the Directorate of Regulatory Operations, Region III, Commonwealth Edison is submitting this report concerning shutdown margin tests performed on the Quad-Cities reactors in May of 1973. The tests demonstrated adequate shutdown margin and indicate satisfactory reactivity worth of the control rods tested.

The May tests were conducted to verify shutdown margin in the areas of the core which appeared to be most reactive, and to investigate reactivity differences between symmetric core locations.

Section 4.3.A.1 of Appendix A to Operating Licenses DPR-29 and DPR-30 specifies a minimum shutdown margin of 0.25% ΔK with the strongest operable control rod withdrawn and all other operable control rods fully inserted. To demonstrate compliance with this requirement, nine two-rod criticals were performed on the Unit 1 core. A summary of the results of those tests is attached as Attachment 1. A shutdown margin well in excess of 0.25% ΔK was demonstrated in each case. Two locations in the Unit 2 core, including the most reactive, were also tested. The shutdown margins on Unit 2 were demonstrated to be slightly greater than those on Unit 1. The variation between the two cores is due to fuel reactivity variation with core exposure.

Docket 50-254/265

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On the basis of examination of these shutdown margins in the most reactive parts of each of the Quad-Cities cores, it is concluded the effect of any inverted control rod absorber tubes was insignificant, and the reactors continue to operate safely and within all limits imposed by the Technical Specifications.

Very truly yours,

Byron Lee Jr.

Byron Lee, Jr.
Vice-President

cc Mr. Boyce H. Grier
Regional Director
Directorate of Regulatory
Operations - Region III

ATTACHMENT I

SPECIAL TEST SUMMARY

UNIT 1 LOCAL REACTIVITY MEASUREMENTS

MAY 1973

Two rod critical tests were performed on Quad Cities Unit 1 reactor to investigate; a) the magnitude of the shutdown margin and b) the magnitude of a suspected reactivity asymmetry.

The critical tests were performed on Unit 1 reactor with an exposure of 3400 MWD/T on May 2-6, 1973. Figure 1 summarizes the two rod critical positions, the corresponding reactor water temperature and the measured positive periods.

Core reactivity values were determined from positive period measurements, negative period measurements and subcritical multiplication data. Reactivity values become increasingly less reliable as the reactor becomes more shutdown. Subcritical multiplication data adjusted to a measured negative reactivity from negative period data is valid only in aiding the formulation of a rough worth shape curve.

Figure 2 illustrates the gross core reactivity drift and rod worth shape change over the 0-3400 MWD/T lifetime of Unit 1. The same two control rods (G7 and G8) were withdrawn in both cases. The roles of the two rods were interchanged, however.

Figure 3 compares core reactivity versus rod position for three symmetric rods to investigate the suspected power asymmetry between Local Power Range Monitor string 24-09 and symmetrical counterparts. Test results indicate a reactivity difference of .23% ΔK for symmetric rods F-3 and C-6 at position 20, with corresponding adjacent rods fully withdrawn.

The most limiting shutdown margin check was with control rod F-4 at position 18. Unit 1 reactor was supercritical on a 280 second period with a reactor water temperature of 113°F. Calculated values of core reactivity, Figure 4, indicate Unit 1 to be shutdown significantly more than .25% Δ K and probably more than 1.0% Δ K with F-3 fully withdrawn and F4 fully inserted. Determination of an exact value of shutdown reactivity is nearly impossible because of the uncertainty of the calculations as the error bars show.

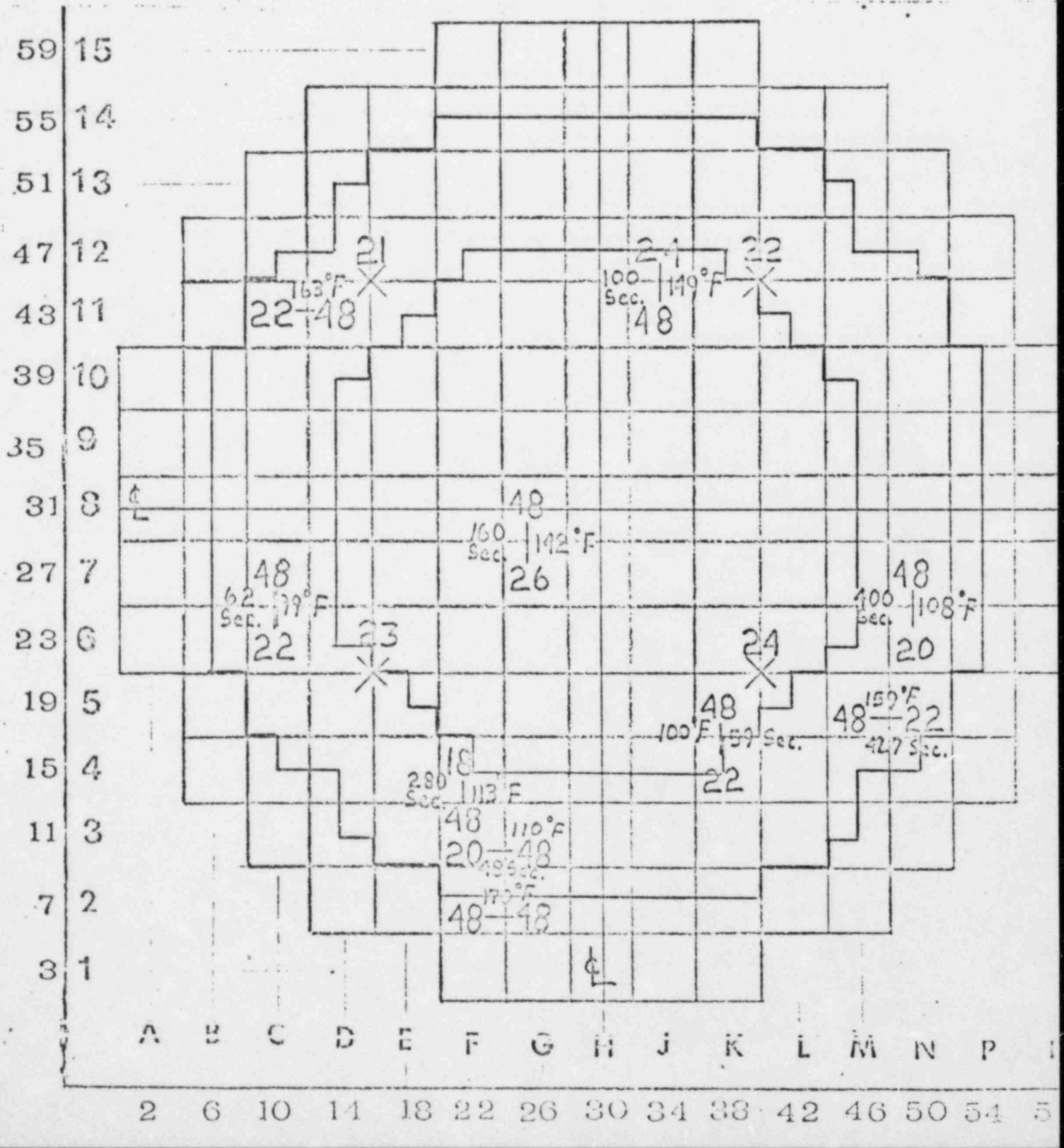
Figure 5 and Figure 6 show the results of the remaining 2 rod critical tests. These criticals are less limiting and Unit 1 reactor appears to be shutdown by much more than 1% Δ K with either G-8 or J-11 withdrawn at 150°F.

Thus, Quad Cities Unit 1 reactor appears to be shutdown with one rod fully withdrawn by about 1% Δ K in the worst case at 113°F. Assuming a temperature coefficient of $8 \times 10^{-4} \frac{\Delta K}{°F}$, the reactor would be shutdown by .57% Δ K at 60°F.

A stuck control rod, if one were to occur during operation, would not jeopardize shutdown capability if it were stuck at position 06 or less. If a control rod were to become stuck at position 08 or greater, a shutdown would be necessitated to either; 1) remedy the stuck rod or 2) demonstrate the shutdown margin with the stuck rod considered inoperable, by fully withdrawing the strongest operable rod and a second strongest operable rod to critical in a manner similar to that used in previous shutdown margin tests.

Summary of 2 rod criticals
$E = 3400$ MwD/T

FIGURE 1



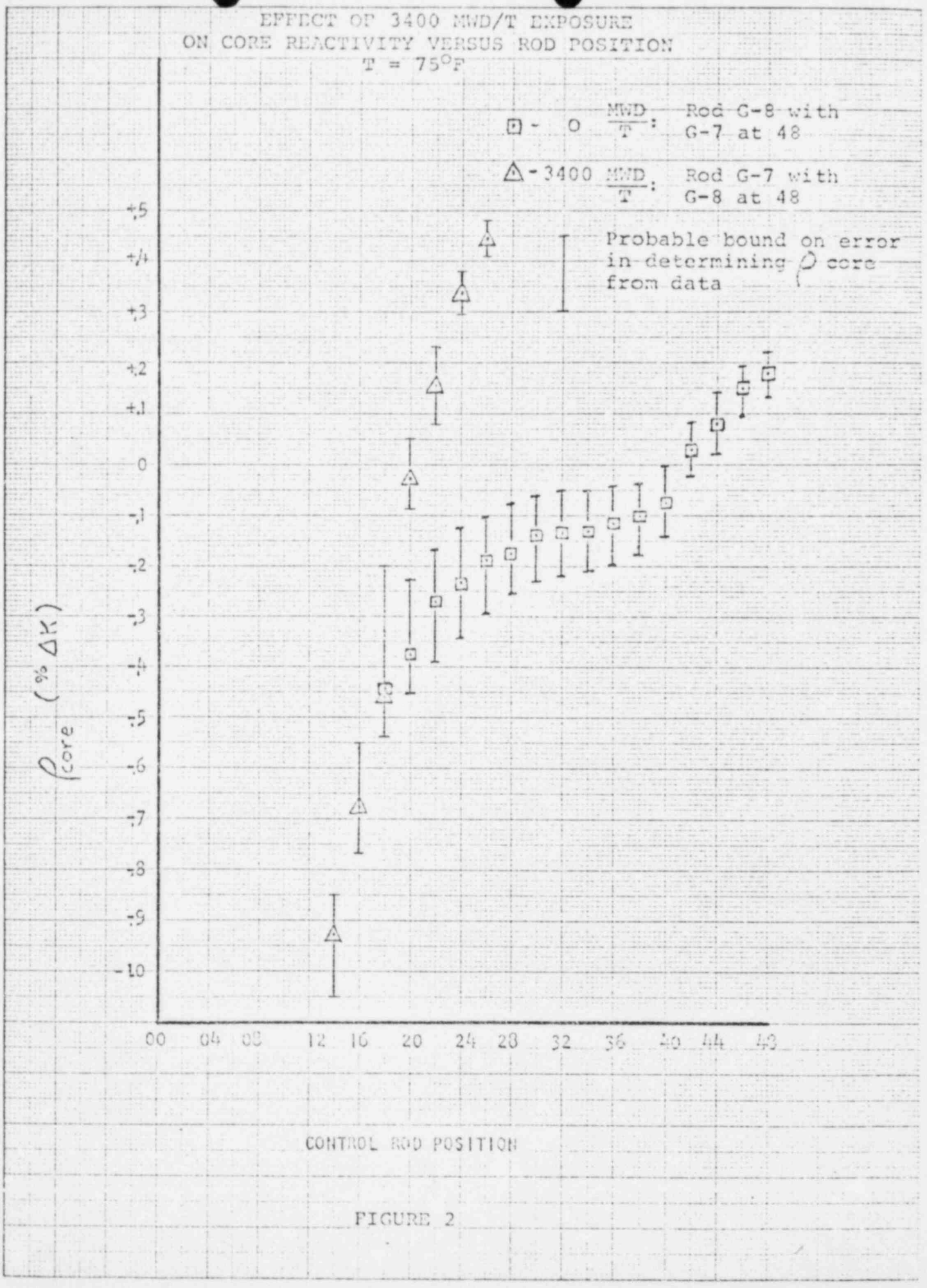

EFFECT OF 3400 MWD/T EXPOSURE
ON CORE REACTIVITY VERSUS ROD POSITION
T = 75°F
□ - 0 MWD/T: Rod G-8 with G-7 at 48
△ - 3400 MWD/T: Rod G-7 with G-8 at 48
Probable bound on error in determining ρ core from data
+5
+4
+3
+2
+1
0
-1
-2
-3
-4
-5
-6
-7
-8
-9
-10
ρcore (% ΔK)
00 04 08 12 16 20 24 28 32 36 40 44 48
CONTROL ROD POSITION

FIGURE 2

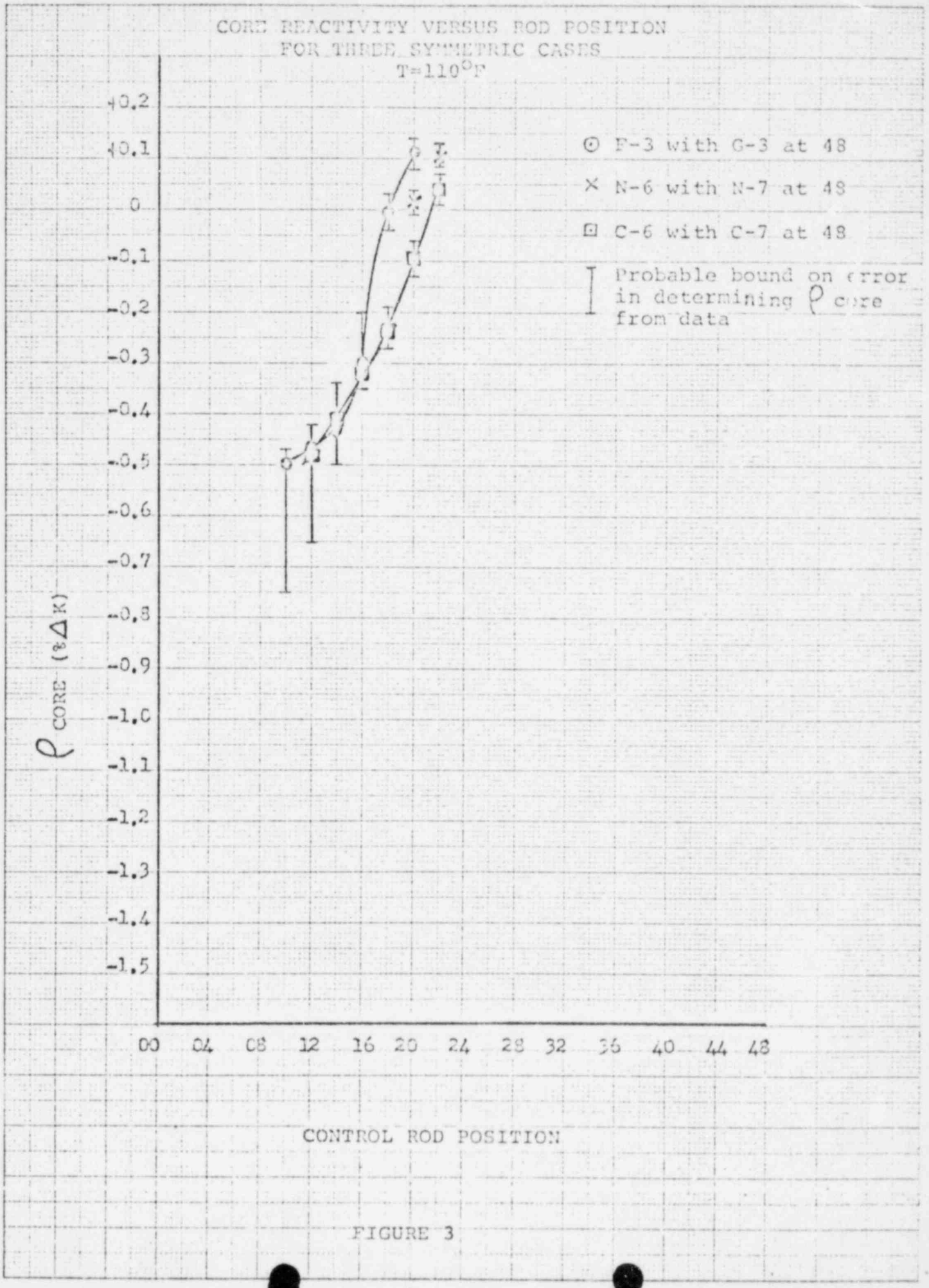


FIGURE 3

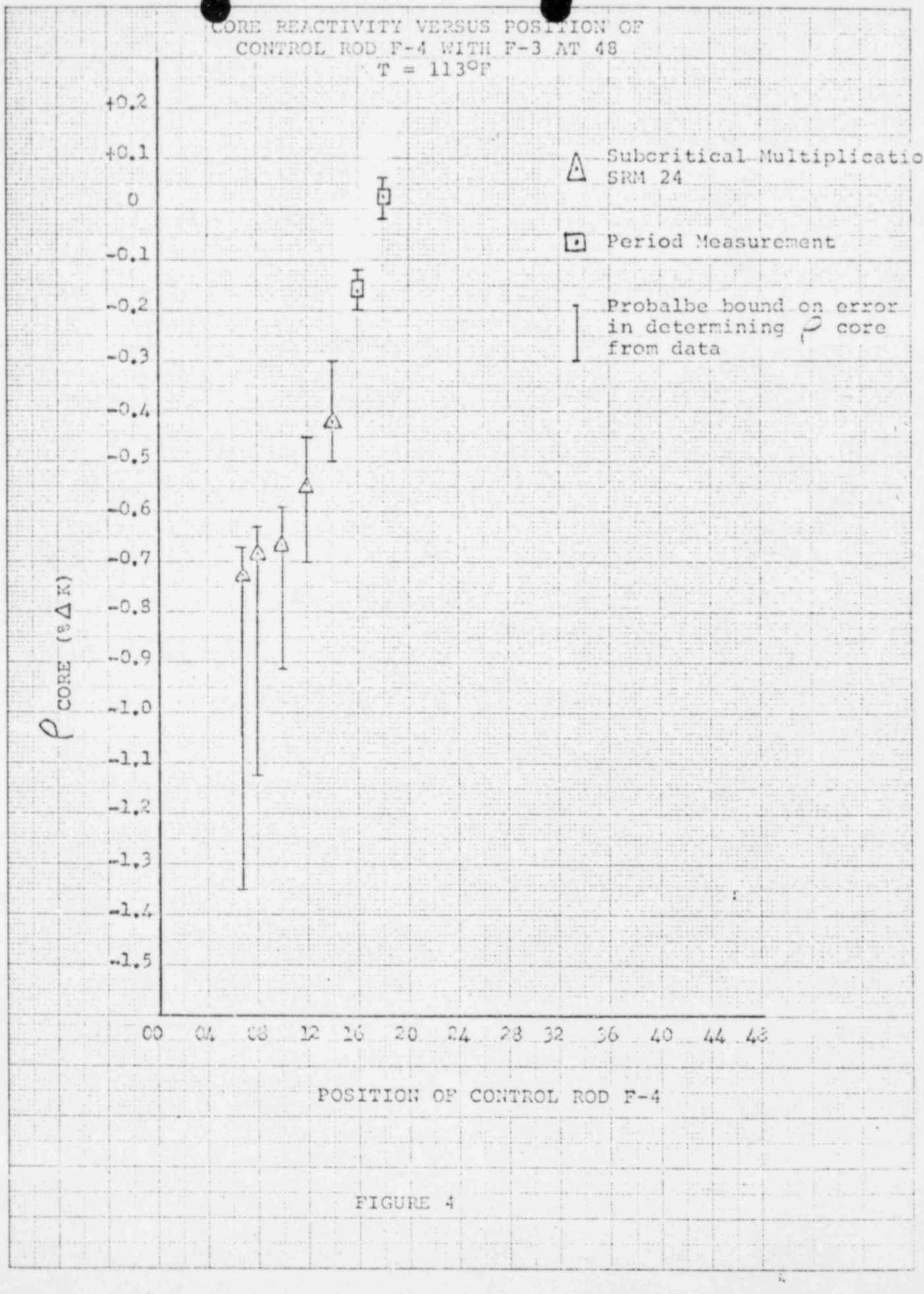


FIGURE 4

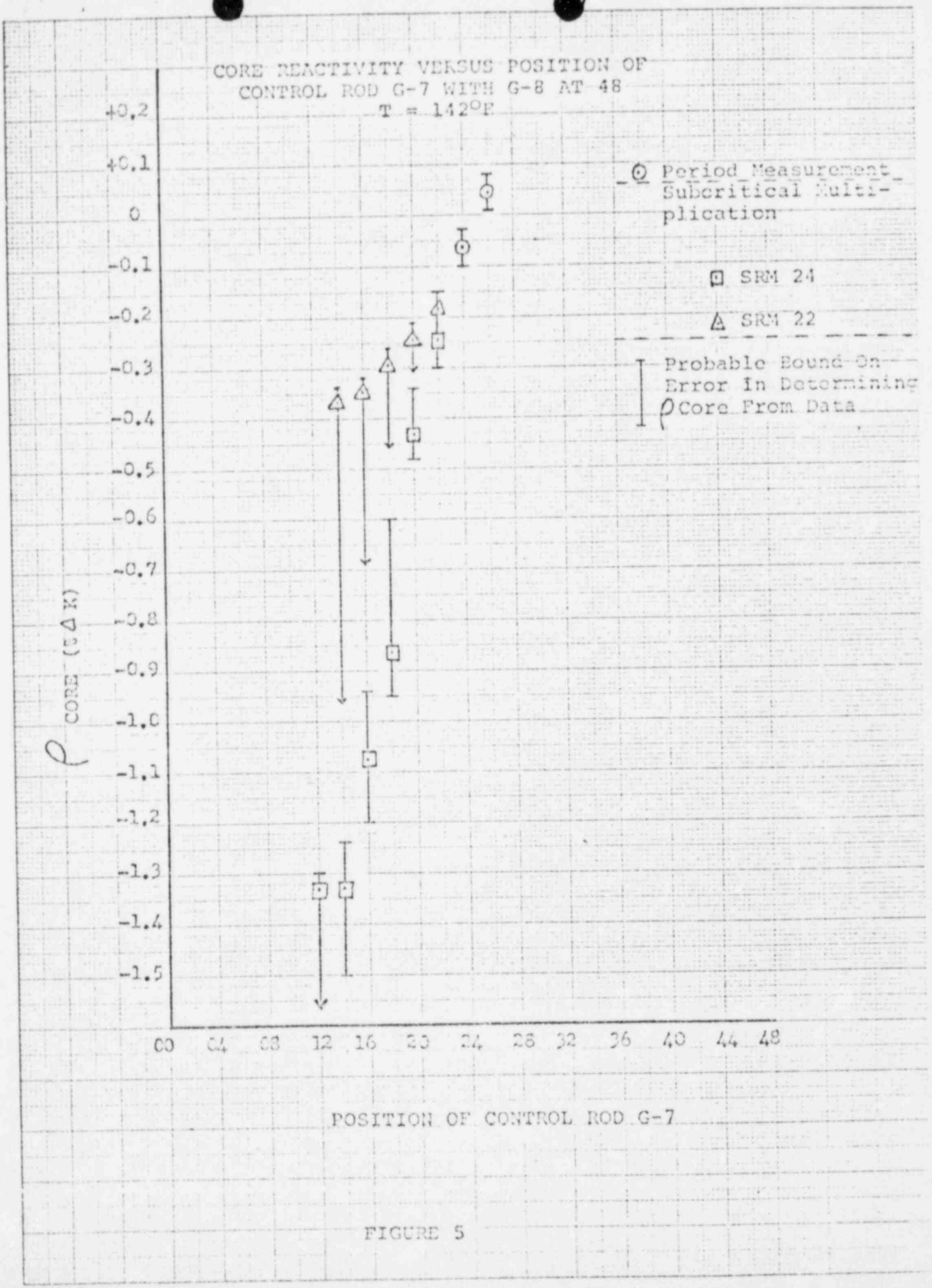


FIGURE 5

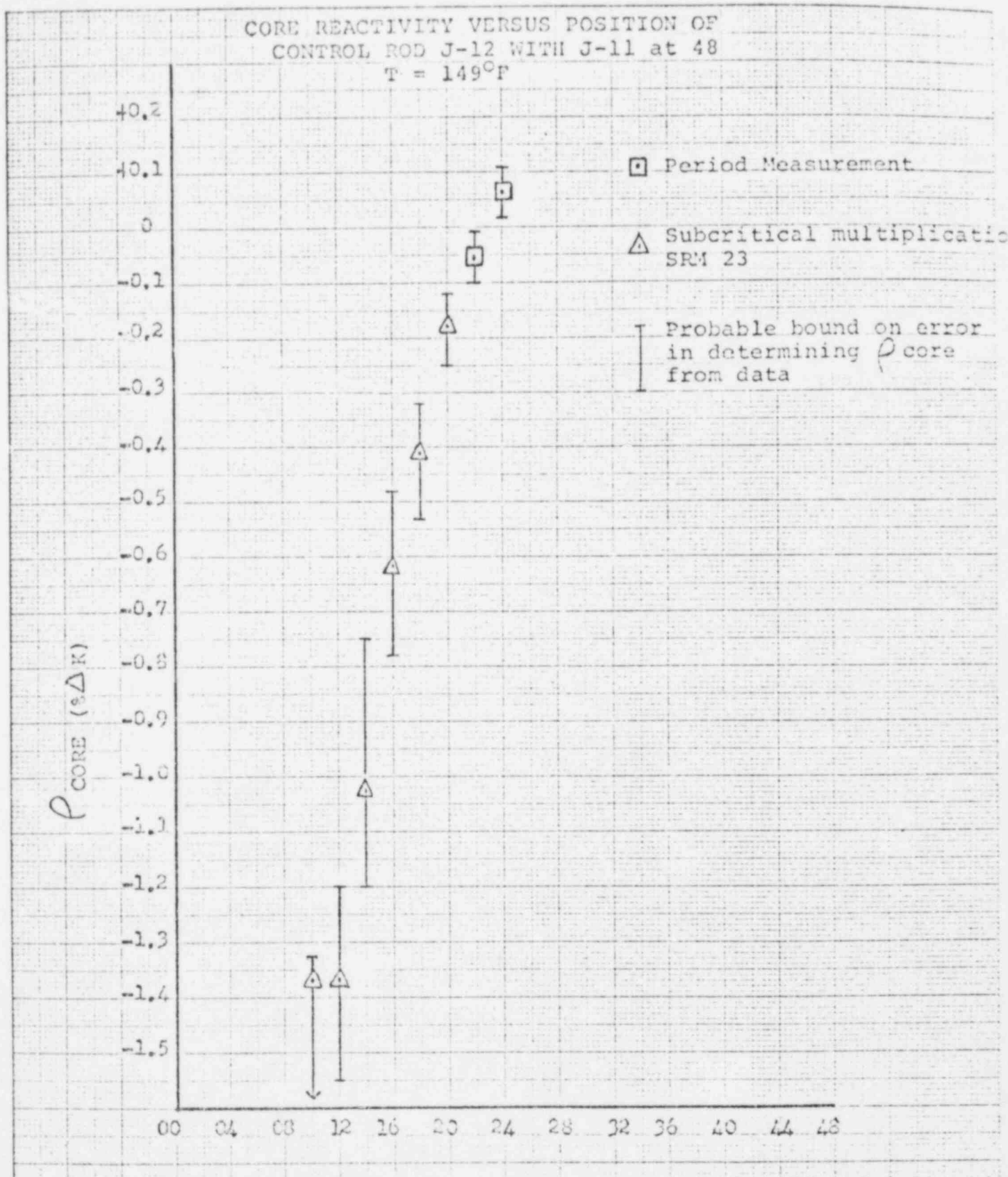


FIGURE 6