BNL-104083-2014-TECH
AGS.SN207;BNL-104083-2014-IR

Measurement of the Influence of the á- quads

L. Ahrens

May 1986

Collider Accelerator Department
Brookhaven National Laboratory

U.S. Department of Energy

USDOE Office of Science (SC)

DISCLAIMER

6/27/86

Number 207

AGS Studies Report

Date(s) May 1, 1986 Time(s) 1700 - 2100

Experimenter(s) L.A. Ahrens, C. Gardner, S. Tanaka, W. van Asselt

Reported by W.K. van Asselt

Subject Measurement of the Influence of the β-quads

Observations and Conclusion

An attempt was made to measure the β-function at the C15 and I15 straight sections by using the fast quads at those positions as a perturbation and measuring the vertical tune with and without the perturbation. For a motivation of the study, see Ref. 1 and 2.

Figure 1 gives the measured change in tune shift as a function of the command in the β-quad strings.

A similar measurement at 8400 GC was used to get a calibration of the strengths of the fast quads, assuming that at that field the β-function was 22 m at the location of the fast quads. Calculation of the β-function in this way, however, yielded unlikely values of more than 10% smaller than 22 m for zero command in the β-quad strings, while it was expected that the β-function was larger than 22 m.

The reason that the measurement of the β-function failed, is the fact that besides the tune shift, a gradient perturbation also introduces a change in the β-function (3,4). A first attempt to correct for this failed because the theoretically required strengths to produce the observed tune shifts did not agree with the experimental values.

Another possible source of error is the fact that the fast quads perturb the orbit. Figure 2 shows the difference between the PUE orbit without a fast quad pulse and the average PUE orbit of 10 cycles, where the fast quad was pulsing every other cycle. Besides a small average displacement, the 9th harmonic content of the orbit is also changed.

Because the conditions during the measurements were the same for different currents in the β-quads, there is some relevant information in the data about the influence of the β-quads. (For the two cases of Fig. 1, the bare tune changed by only 0.005 and 0.003 respectively for a command of 4,000.)

For the two cases, the change in the β-function at injection field (assumed to be at 1100 GC) was determined:

C15 quad: $\Delta\beta = -10.5\%$ @ 1100 GC and CMD = 4000
I15 quad: $\Delta\beta = -11.8\%$ @ 1100 GC and CMD = 4000

This has to be compared with a value of -14.6% as calculated by the program KPBEAM.

Conclusion

The measured and calculated influence of the β-quads do agree sufficiently to conclude that the β-quads do function properly.

The attempt to measure the β-function itself failed, due to the strong influence of the measuring technique on the parameters being studied. A successful measurement will involve strong model dependence or much more precise tune measurements or both.

References

1. E.C. Raka, AGS Studies Report No. 187.
2. J.C. Herrera, M. Month. Internal Report AGSCD-15.
3. S.Y. Lee, private communication.
4. E. Keil, CERN-77-13, p. 52.

mvh

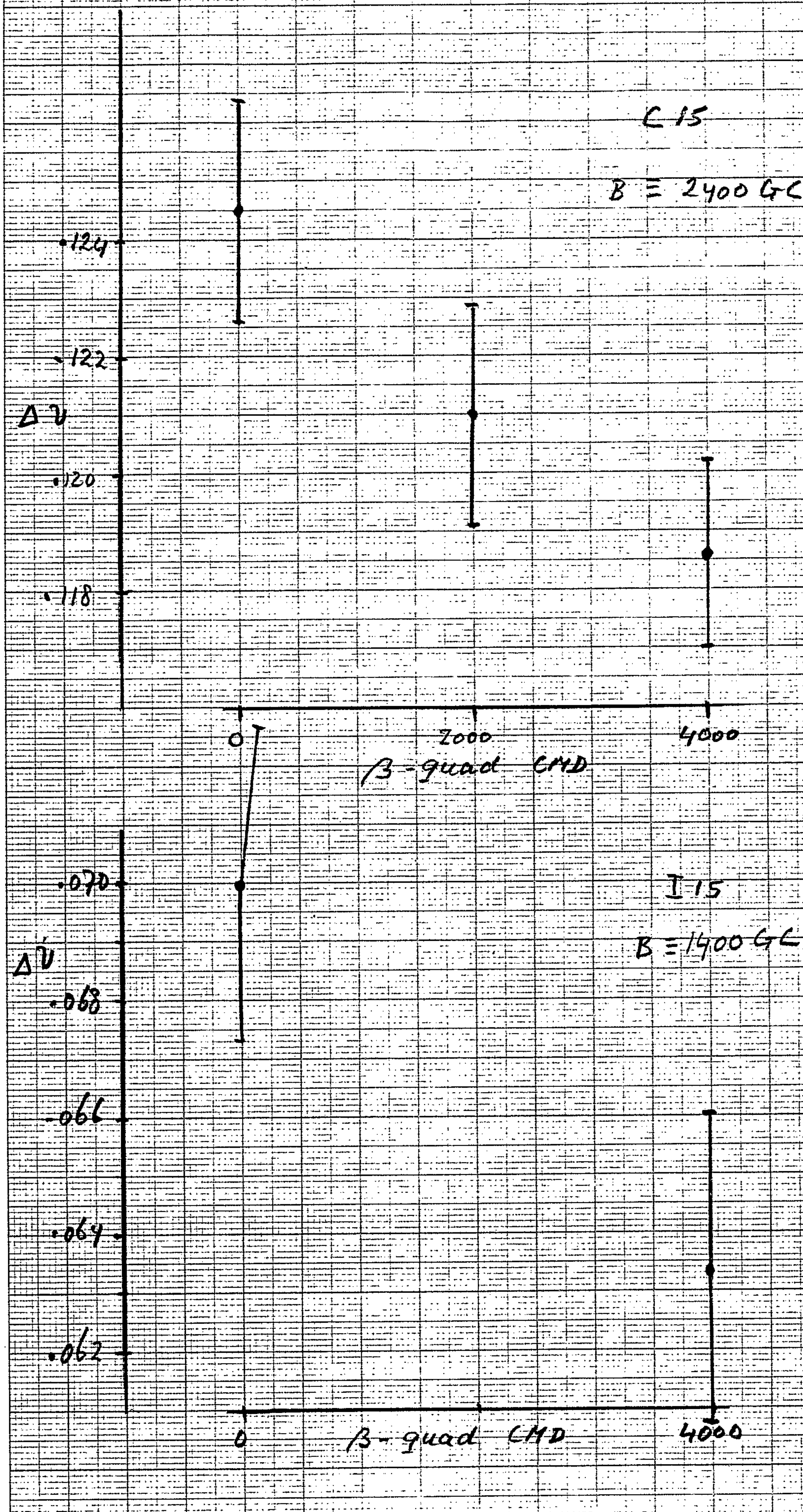
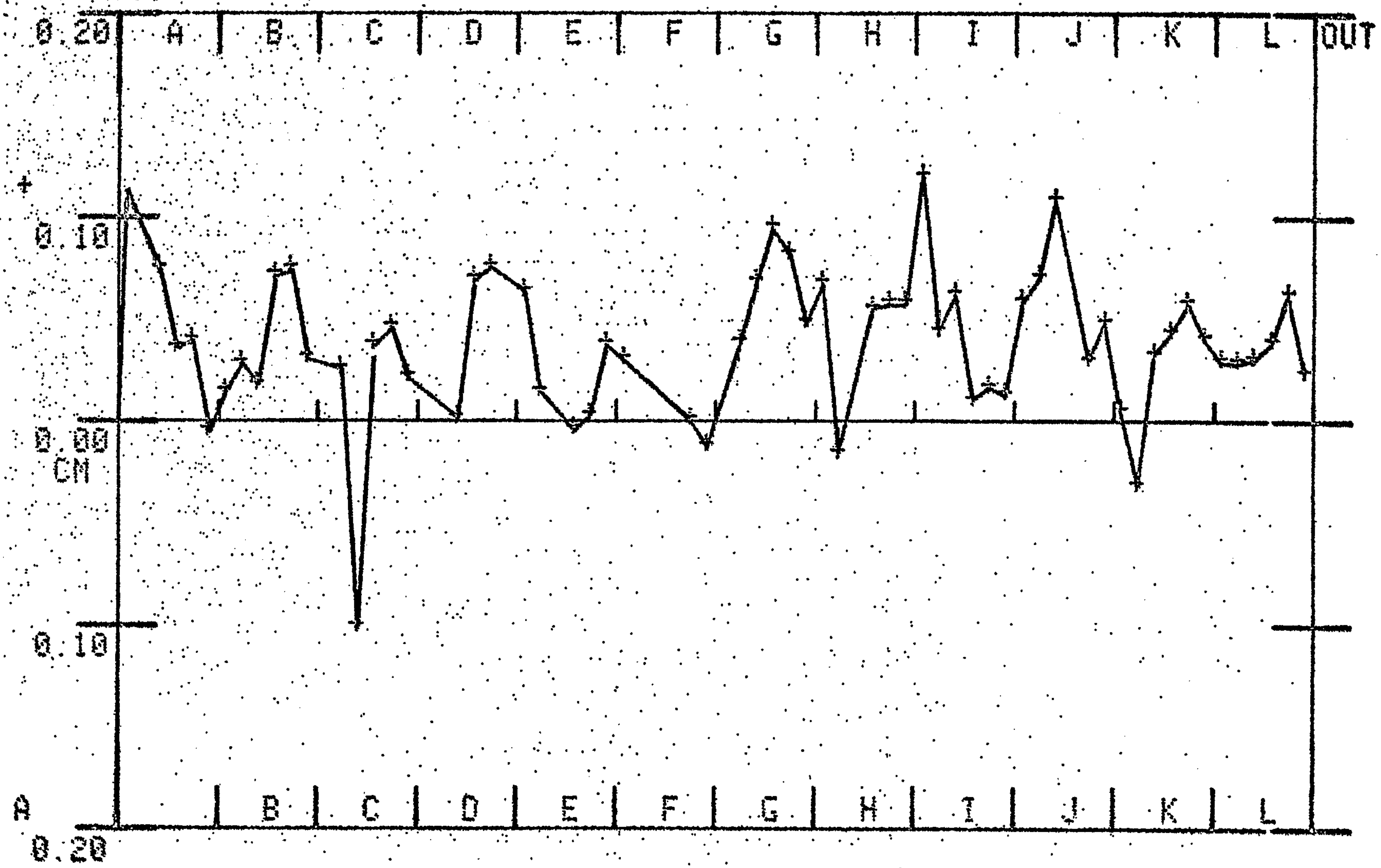

C 15
B = 2400 GC
.124
.122
Δν
.120
.118
0
2000
4000
β - quad CMD
I 15
B = 1400 GC
.070
Δν
.068
.066
.064
.062
0
β - quad CMD
4000

figure 1

***** DIFFERENCE PLOT USING FILE REFE2 *****
12-MAY-86 12:52 HOR. ORBIT @ 66 EXTNL NAVE:10
NORM BY L20CT = 1582 REFER L20CT = 1564
AVERAGE DIFF= 0.038



R(RESTART),E(EXIT),S(SAVE FILE),N(NO OUTPUT),L(LOOP),C(NORMC),<CR>(LOOP O
NCE):

Figure 2