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Moving Magnets to Cancel 9th Harmonic (Horizontal)

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AGS Studies Report

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 Subject Moving Magnets to Cancel 9th Harmonic (Horizontal)

Introduction

Over the summer, the AGS ring components--main ring magnets and straight section devices--have been realigned. Although the ring is now smoother, the uncertainties in the survey can still cause appreciable harmonics in the measured orbit, particularly for the ninth harmonic. Thus, we can improve the orbit by moving a few magnets to cancel the measured ninth harmonic.

Data

The orbits were taken near 20 GeV/c, at several radii. Figure 1 shows a typical horizontal orbit, at a radius of -0.422 cm and a tune of 8.73. From this and several similar orbits, the average ninth harmonic components at an average radius of -0.4 cm (corresponding to the displacement between the PUE system and the optimum central orbit) are:

Cos: 0.185 cm

Sin: 0.151 cm

Amplitude: 0.239 cm

Phase: 39.2 deg

This can be corrected by moving nine magnets, at the peaks (one sign only) of the 9-theta sine wave. To get equal kicks (in normalized coordinates) at all magnets, the magnet move must take into account the gradient sign (F or D), the length, and the beta function.

<u>Magnets</u>	<u>Length</u>	<u>Beta</u>	<u>Move</u>
A, E, I-16	90 in.	12.50 m	+13.5 mils
C, G, K-3	90	10.46	+15.0
D, H, L-10	75	21.00	-12.5

After this move, the orbit was measured again. Figure 2a shows the orbits, before and after, and Figure 2b shows the difference, which appears to be a ninth harmonic of about the expected amplitude. In fact, the harmonic analysis of this difference orbit gives:

<u>Harmonic</u>	<u>Cos</u>	<u>Sin</u>	<u>Amplitude</u>
7	-0.018	0.010	0.021
8	-0.015	-0.005	0.015
9	-0.222	-0.113	0.249
10	-0.008	-0.016	0.018

The changes are close to what was expected, but not perfect. The measurements, however, contain not only the true orbit signal, but also contributions from the PUE calibration errors. We also took data--to be presented in another note--which will help us to disentangle the two.

mvh

COMPARISON, RT40-RT13

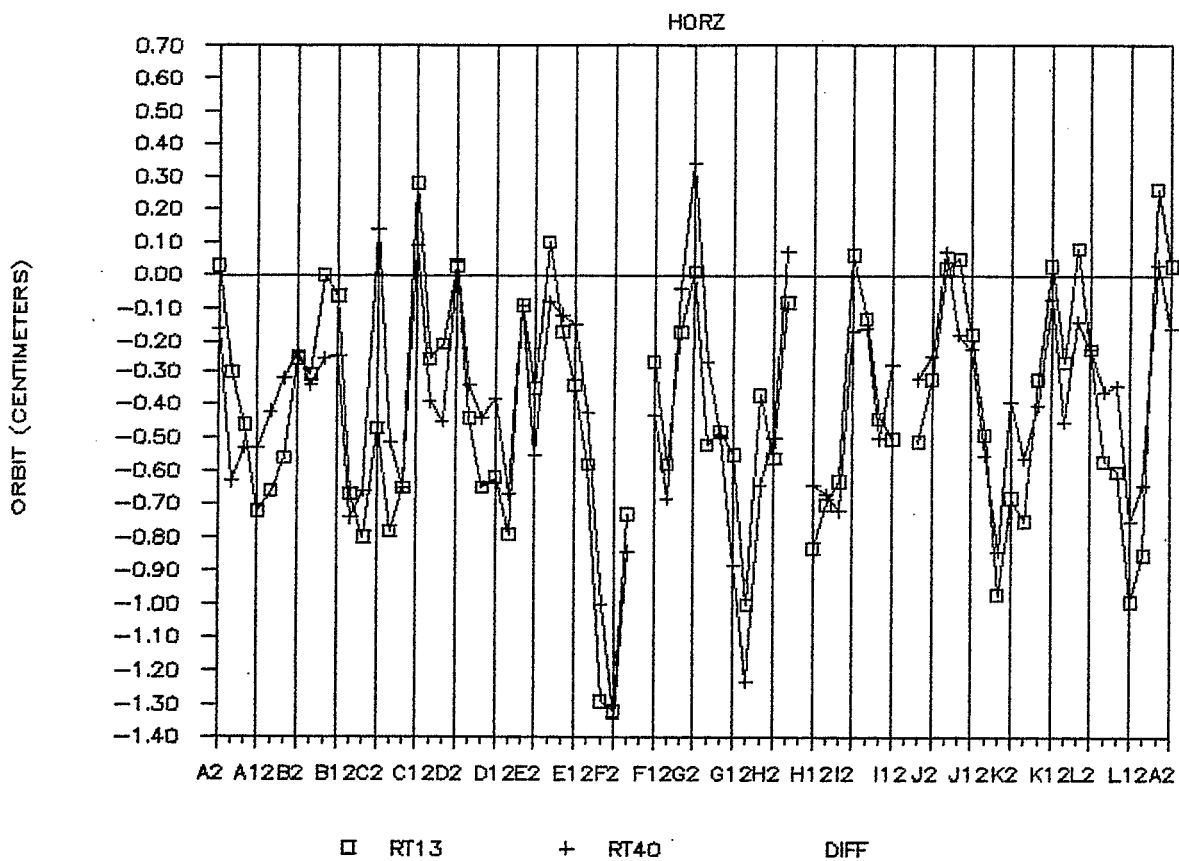


FIGURE 2a

COMPARISON, RT40-RT13

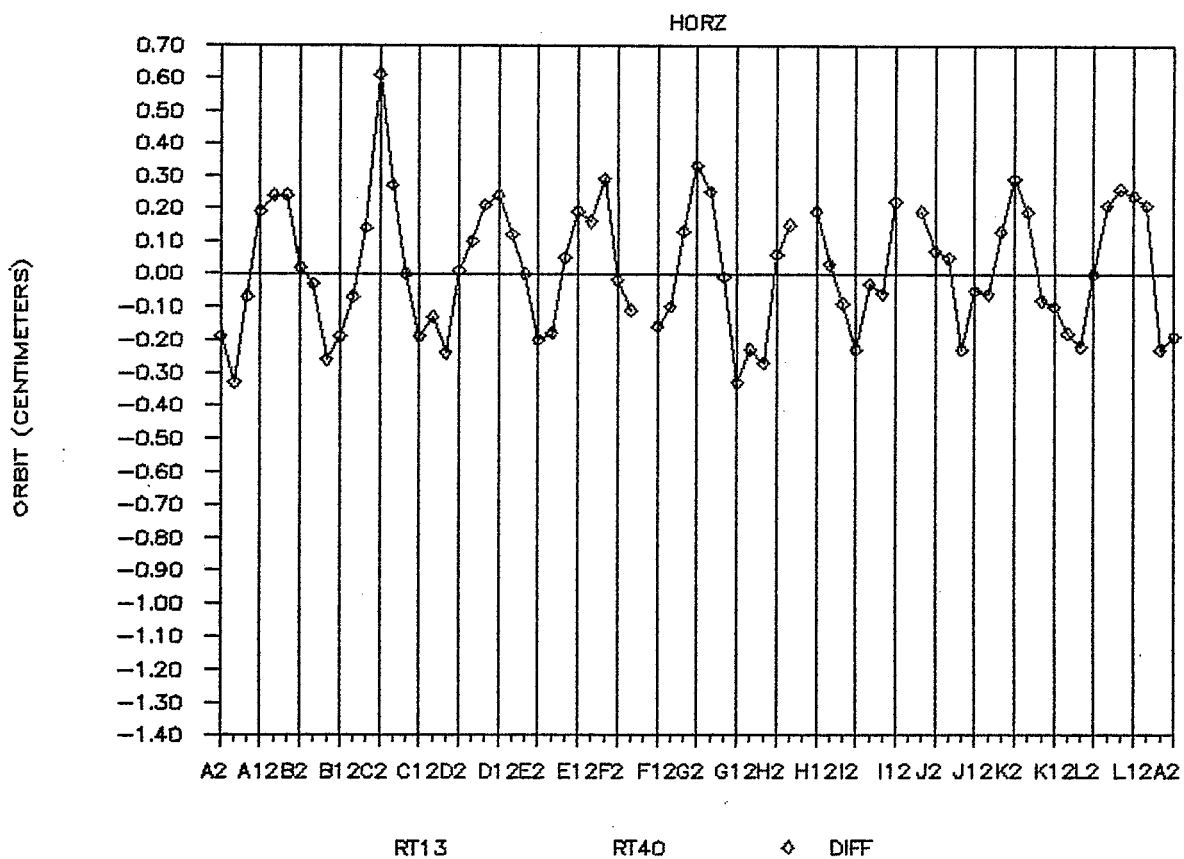


FIGURE 2b