Impact of Magnetic Cable Tray on Harmonics Measurements of Collared Coil Assemblies in ICB

TS-SSC 92-015
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April 9, 1992

I. INTRODUCTION

A cable tray was mounted on the aluminum table used for mole measurements of collared coil assemblies in Industrial Center Building. It was later found that the cable tray material is magnetic. The tests reported on here were done to establish whether or not the presence of the cable tray has any effect on the measured harmonics. The conclusion is that the cable tray DOES NOT affect the harmonics measurably.

II. EXPERIMENT

The harmonic coefficients of collared coil assembly DCA318 were measured with the magnet right-side-up (that is, with the upper coils pointing up), and up-side-down. Measurements were taken at three longitudinal positions along the magnet. In both orientations, the magnet was positioned on the aluminum table surface so that it was as close as possible to the cable tray, which runs along one side of the table about six inches below the horizontal surface as shown in Figure 1.

The data were taken with a vme-based da system provided by the SSCL. The harmonic probe used was the BNL B2 mole. At each longitudinal position, five readings with +10 A and five readings with -10 A were taken.

All harmonics up to the 10-pole were graphed and compared for the right-side-up and up-side-down data. For compactness, only a1, b1, and the "allowed" harmonics b2, b4, b6, b8, and b10 are shown in the Figures attached to this memo. (Note that b1 appears on the page with b10.) In the figures, the hollow squares are the data taken with the magnet right-side-up, and the hollow diamonds are the up-side-down data. The uncertainty bars are the rms about the mean for the five +/- 10A readings at each longitudinal location.

III. DISCUSSION

If magnetization of the cable tray affects the field in the aperature measurably, then the right-side-up and up-side-down harmonics should be systematically different. In particular, we might expect some skew and normal a1 and b1 which would change sign when the magnet was flipped over. (b1 would arise from a right-left asymmetry, a1 from an up-down asymmetry.) However, since the cable tray occupies only a narrow range of azimuthal angle, its magnetization might be expected to contribute to higher order harmonics as well.

None of the harmonics shows a significant difference between the right-side-up and up-side-down readings, with the

possible exception of b10; this harmonic is quite sensitive to the centering correction. The last two figures show the x and y centering corrections for the mole, obtained by zeroing a7 and b7 iteratively, assuming that any measured a7 and b7 comes from feed-down from a8-10 and b8-10.

IV. CONCLUSION:

The conclusion is that the cable tray does not affect the harmonics significantly, so that measurements may continue on the ICB setup without moving the cable tray. A more quantitative treatment of the affect of magnetic material in the vicinity of a collared coil would be interesting, however.

Distribution: J. Carson, J. DiMarco, J. Strait

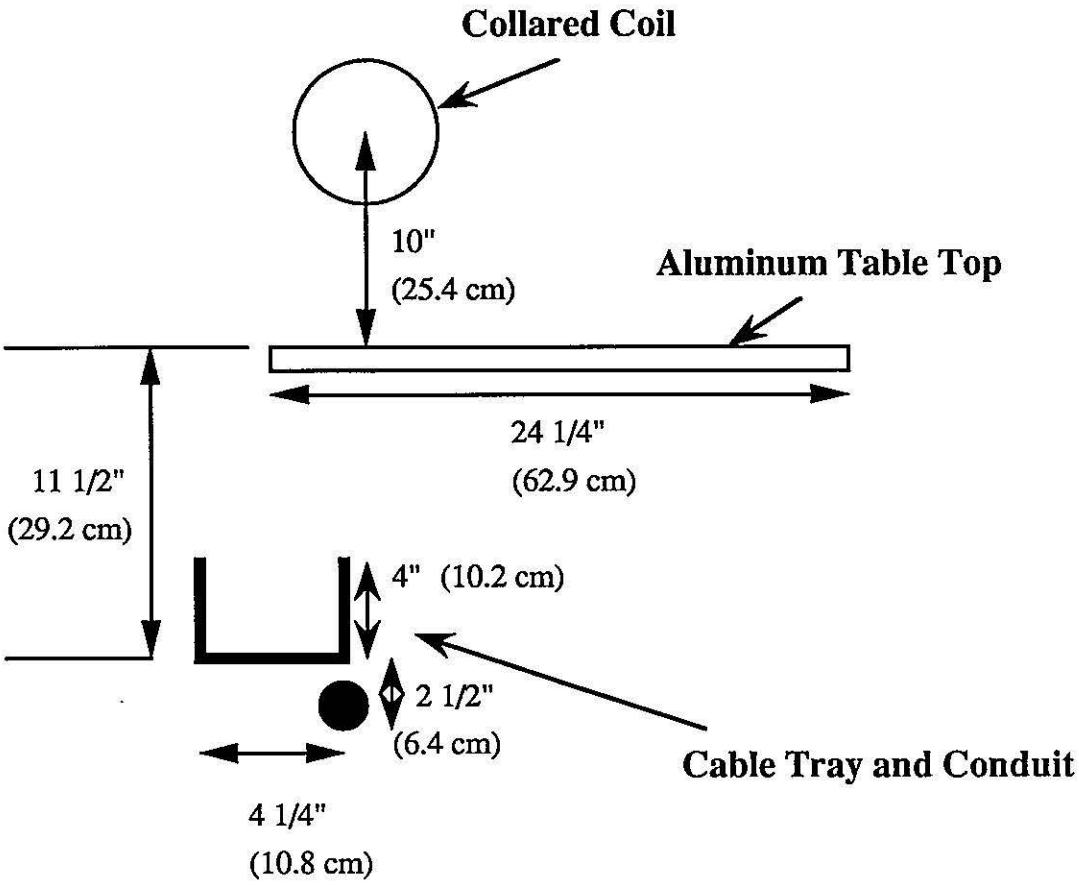
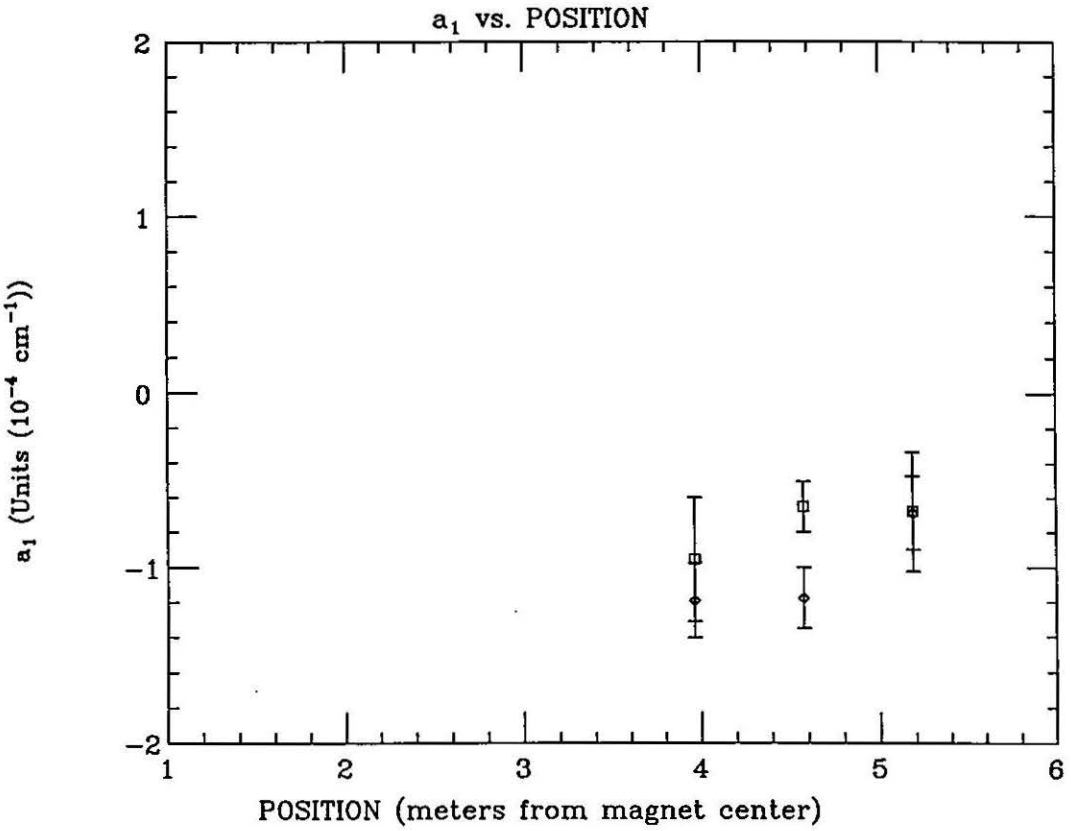
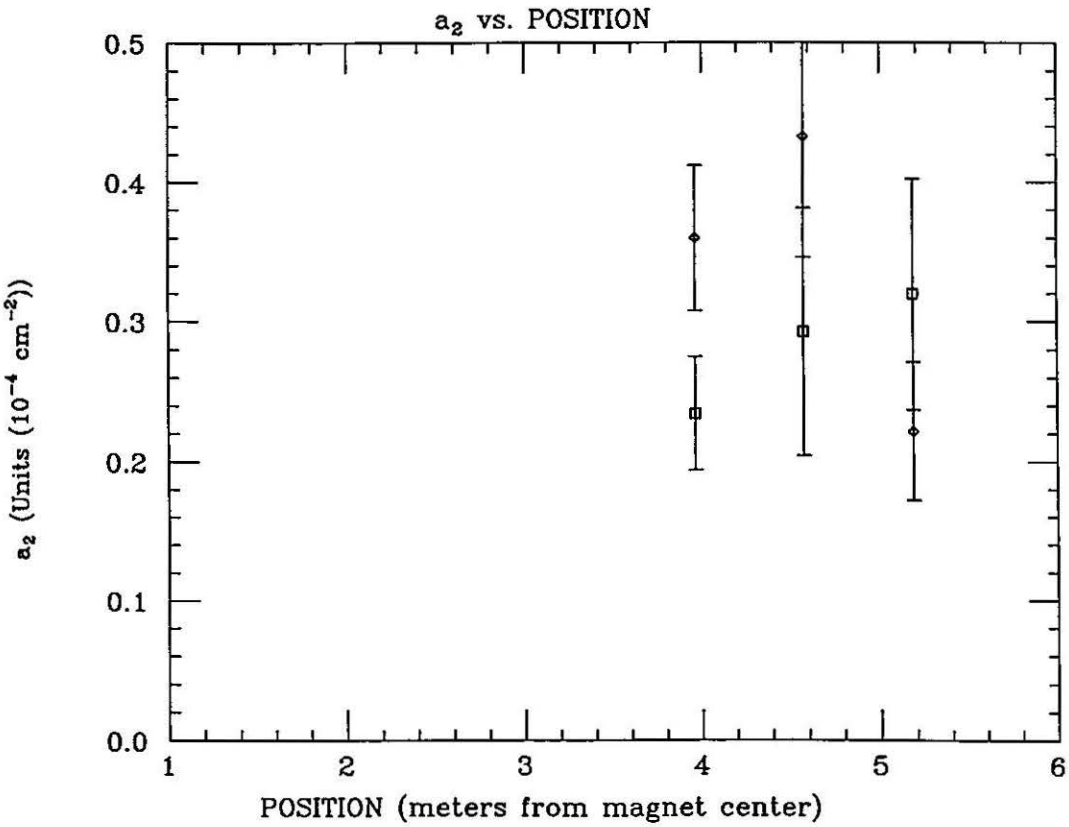


Figure 1. Industrial Center Building Aluminum Table Showing Table, Magnet, and Cable Tray Relative Locations During Test





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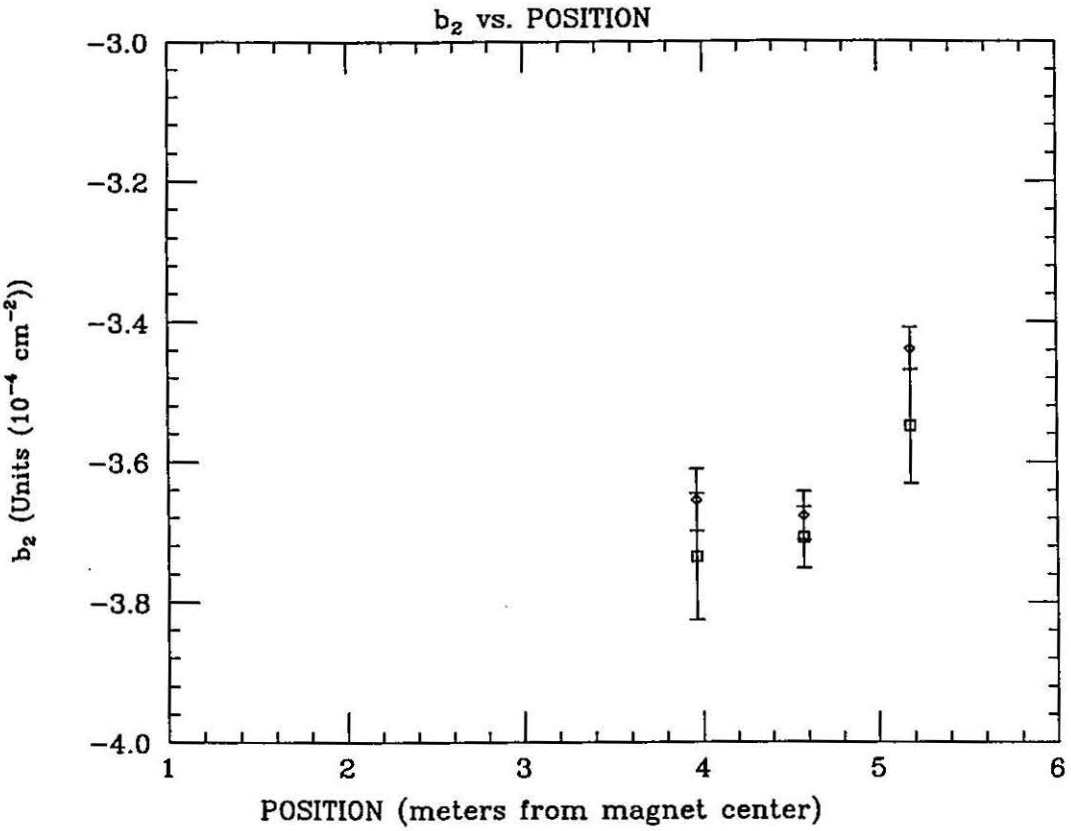
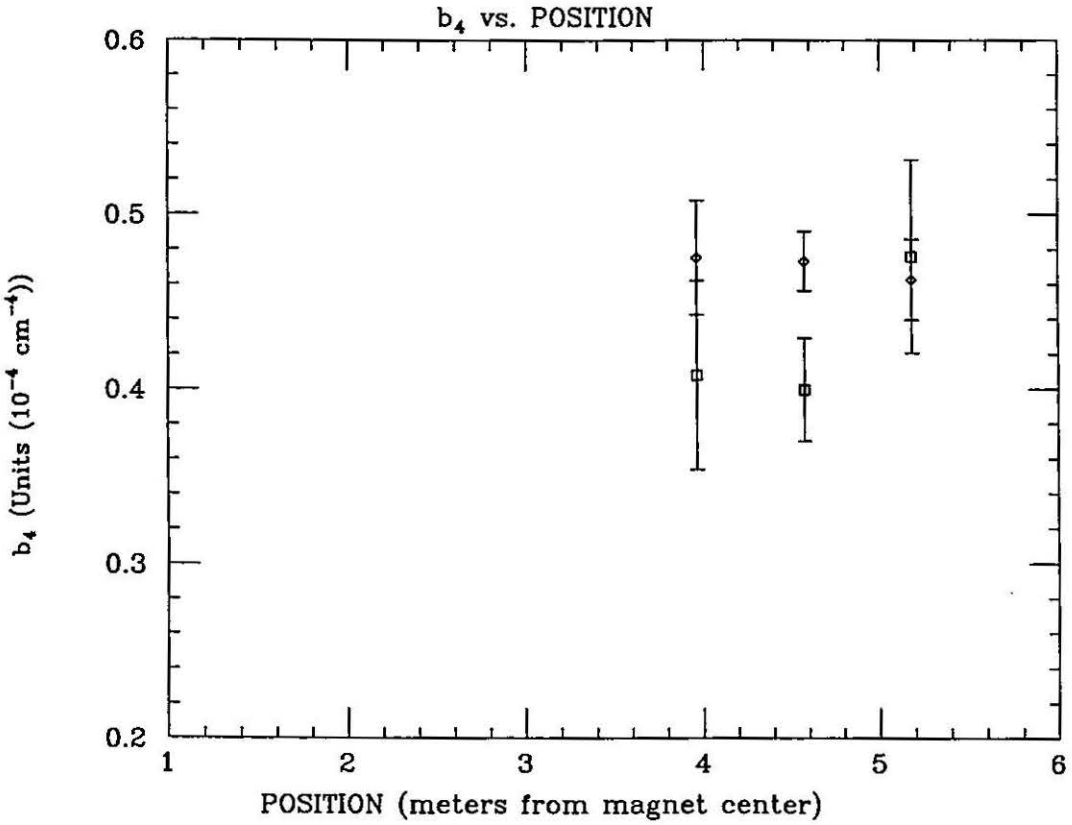
□ DCA318 100 22 Jan 1992 warm data 10. Amps DCA318 Mole Right−Side Up





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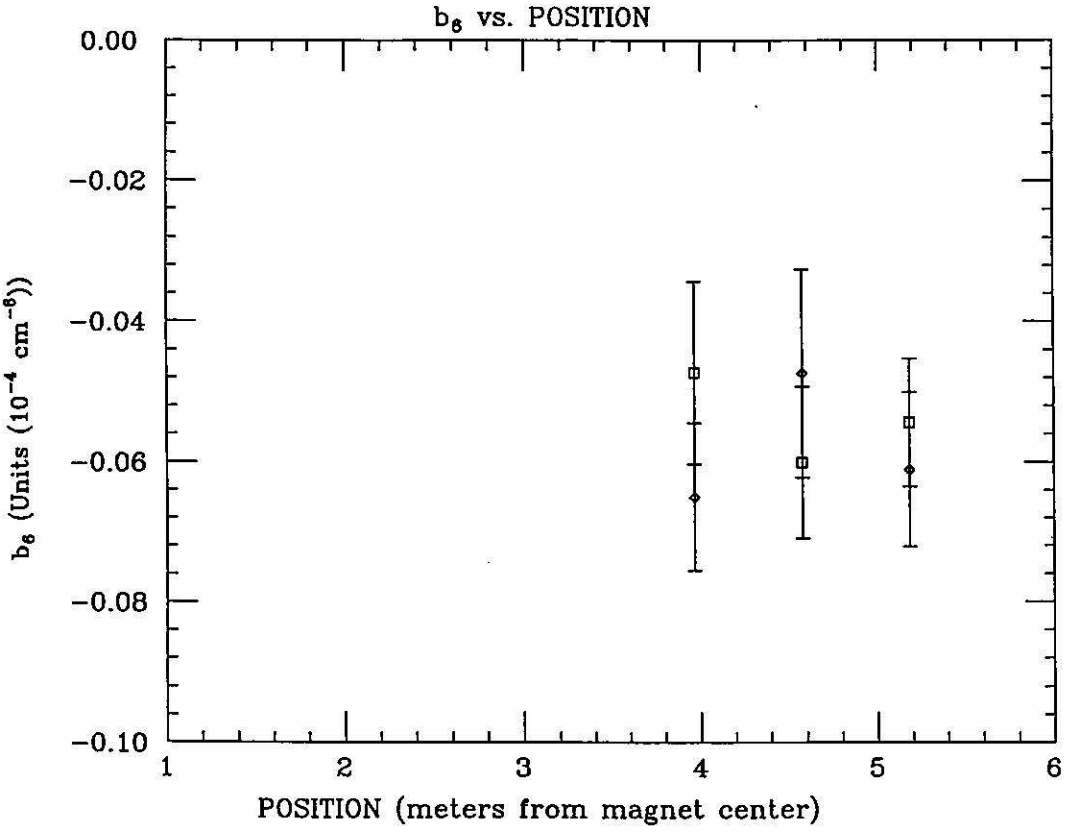
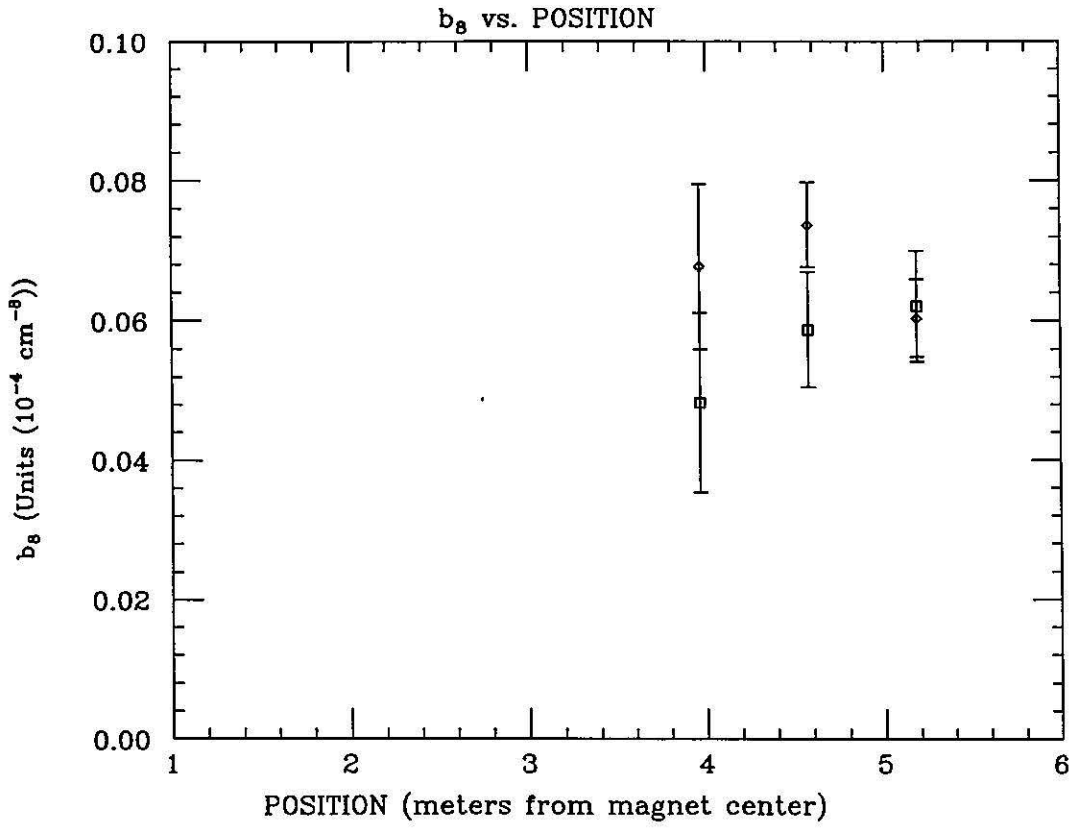
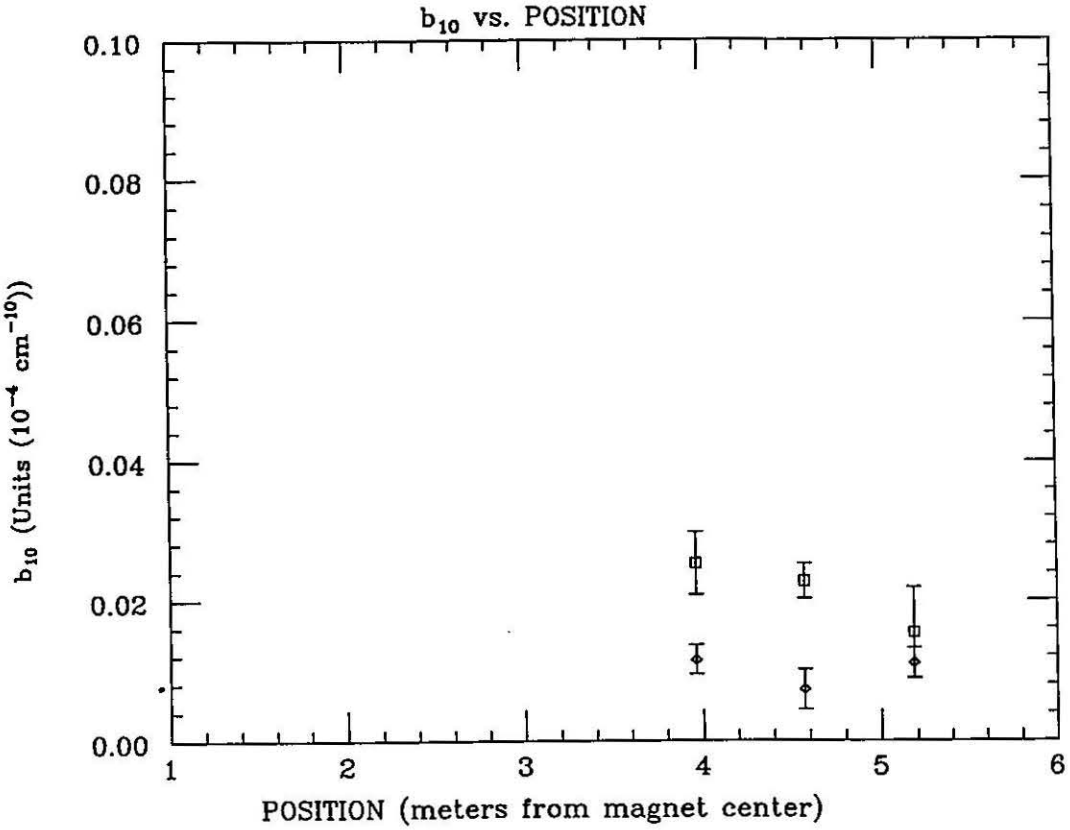
□ DCA318 100 22 Jan 1992 warm data 10. Amps DCA318 Mole Right-Side Up

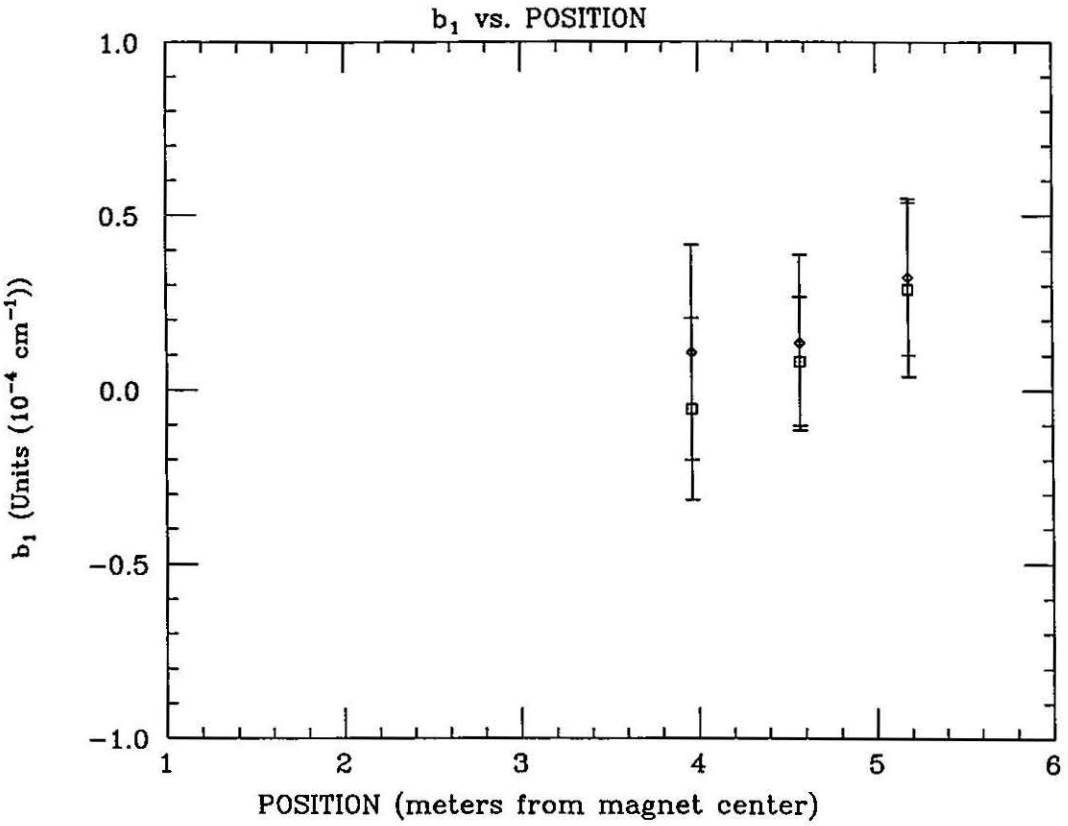


Cable Tray Test 9-APR-92 11:50:21



◇ DCA318 101 22 Jan 1992 warm data 10. Amps DCA318 Mole Up−Side Down
□ DCA318 100 22 Jan 1992 warm data 10. Amps DCA318 Mole Right−Side Up





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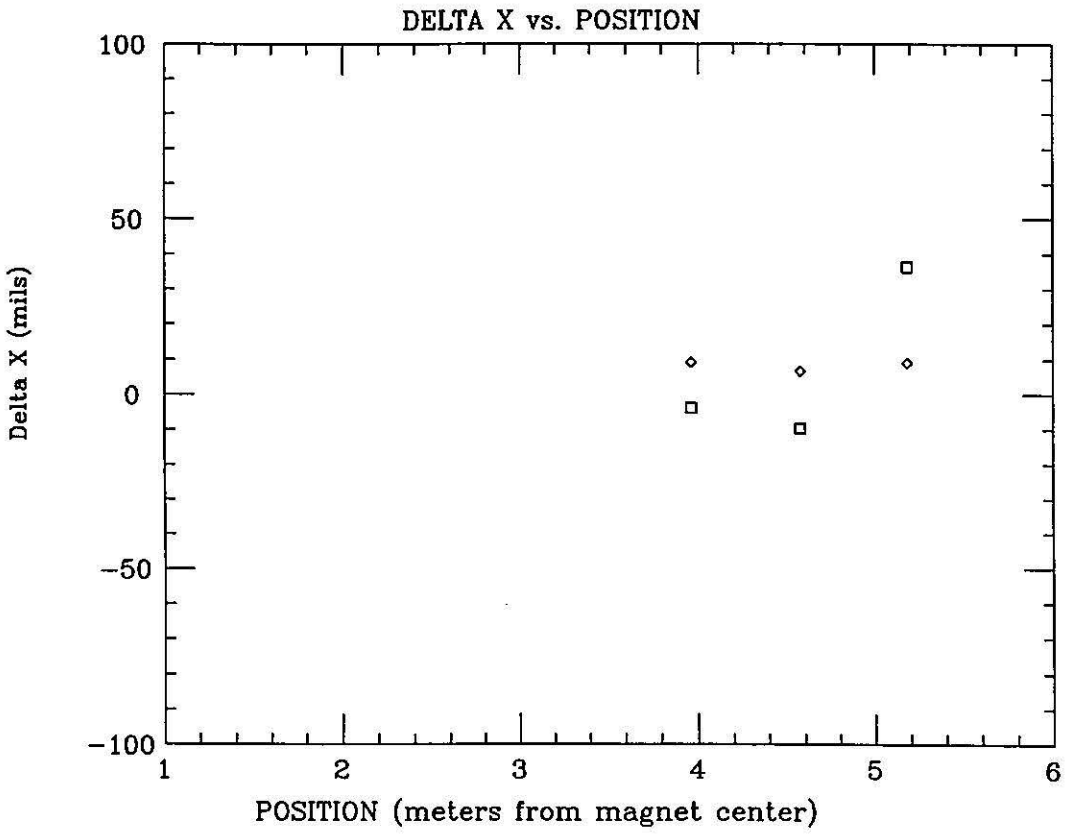

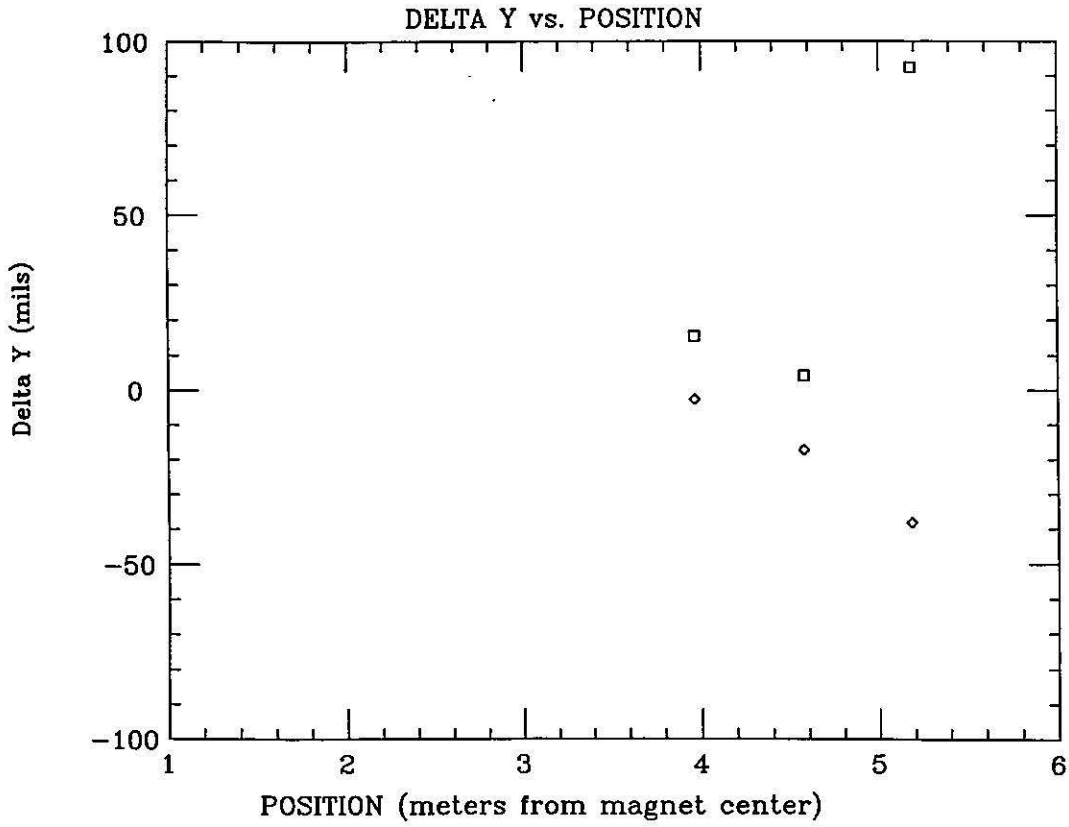

◇ DCA318 101 22 Jan 1992 warm data 10. Amps DCA318 Mole Up-Side Down
□ DCA318 100 22 Jan 1992 warm data 10. Amps DCA318 Mole Right-Side Up