

Independence of BNL B2 Mole Harmonics on
Orientation of Mole Encoder Relative to
the Vertical

TS-SSC 92-014
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April 9, 1992

For a long time, it was standard practice when making mole measurements that before harmonics readings were taken at a given longitudinal position, the BNL B2 mole encoder platform was oriented to within +/- .05 degrees of the vertical, using readings from an electronic "gravity sensor." Since the mole gives harmonics relative to the dominant field component, in this case the dipole, there was some question as to the necessity of this careful orientation, unless the mole device were to be used to measure relative field angles from position to position along the magnet, which it is not.

As time passes between maintenances, it becomes more and more difficult to orient the encoder platform as precisely as the "standard practice" requires. This is due to stiffness in some parts, so that it is more difficult (sometimes impossible) to rotate the encoder platform in one or both directions. Worse, it has become unclear time how reliable the absolute measurements of the gravity sensors are.

These doubts motivated us to find out whether or not the measured harmonics actually do change if measurements are made at various angles with respect to the vertical. The data show that between about +60 degrees and -60 degrees, they do NOT, within random measurement errors. This frees us to use a far less stringent orientation criterion before making each measurement. We now typically orient the mole to some fraction of a degree from the vertical, which puts the angle within the dynamic range of one of the "sensitive" gravity sensors.

The data shown in the attached figures were taken with the B2 mole and a vme-based da system provided by the SSCL. The magnet used was collared coil assembly DCA318. Five +10 A and five -10 A records were written for each of eight angles of the encoder platform relative to the vertical, as measured by the gravity sensors, all at a single longitudinal position within the magnet. The +10 A and -10 A records are analyzed in pairs, to correct for the effects of the earth's magnetic field. Note that for all of the measurements except 0.0 degrees, the "coarse" gravity sensor gives the angle reading.

For compactness, only a1, b2, b4, b6, b8, and b10 are shown in the graphs. The last two figures show the calculated offsets of the mole probe from field center in the horizontal and vertical directions. These are obtained using the feed-down from a8, b8, a10, and b10 to a7 and b7. At this time, no uncertainty bars are available for these parameters, so that it is unclear whether for example the upward trend in delta-Y with increasing angle from the vertical is real.







