J. Magnets for the SNS Synchrotron, M. R. Harold, RL

The 50-Hz SNS dipole magnets, which are 4.4-m long and have a 7-m radius of curvature are combined function magnets having a low gradient $\beta'/\beta\rho$ = $-0.68\ m^{-2}$. The magnets are split horizontally in order to allow the flanged ceramic vacuum chamber to be fitted. The H-section laminations will be fanned and resin-impregnated to prevent chatter. Short (~30-cm long) blocks will be formed in this manner and straps welded along the outside to provide flexural strength. The blocks will then be mounted on a massive concrete base, care being taken to ensure that tolerances are maintained, and the blocks tied together with welded straps. The upper blocks will then be mounted and strapped together in a similar manner. Top and bottom halves will be clamped by bolts, and a lifting frame used to remove the top half when necessary.

The coil conductor will be formed from four water-cooled subconductors which are insulated from one another; the conductor will be transposed at intervals to prevent excessive eddy current loss. A glass-mica epoxy insulation will be used.

The programs TRIM, GFUN, and BIM have been used to optimize the shims and ends of the magnet. Field quality must be maintained such that $\Delta\beta/\beta \approx 1$ or 2×10^{-4}. GFUN and BIM agree quite well and for the moment we have more confidence in these two programs. GFUN (3D) has been found to give excellent results at CERN on at least two very short quadruples.

The dipole has just gone out to tender. Two of the three quadrupole types are now on order; design of the third is almost complete and that of the octupoles and beam bump magnets well under way. All the magnets, apart from the dipoles, are short compared with their apertures, so that end effects have to be compensated for by extra shimming. Our dependence on 3D magnet programs is therefore very great but as a backstop we shall be ordering prototypes of all magnets.

Magnet parameters and further details are given in Ref. 1.

Reference

1. R. T. Elliott, J. A. Lidbury, and M. R. Harold, "Synchrotron Magnets for the SNS," paper presented at the 1979 Accelerator Conference.