AUXILIARY MAGNETS AND WINDINGS IN THE MAIN ACCELERATOR

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A meeting was held between G. Danby, A. Maschke and L. Teng on September 26, 1967 to discuss the requirements of correcting elements in the main accelerator. The following is a summary of the result of the discussion.

1. Trimming Coils on the Cell Bending Magnets

These can be either pole-face or back-leg windings and are for the following purposes:

A. To correct for the radial distortion of the close-orbit.

B. To serve as the drive-end of a servo-loop to eliminate the radial wobble of the close-orbit on the flat-top caused by ripples in the magnet power supply.

These coils should be capable of making a $\pm$ 0.1% adjustment on the bending magnet field.

2. Vertical Close-Orbit Deflecting Magnets

These are separate small dipole magnets located in the short (mini-) straights to correct for the vertical distortion of the close-orbit. These magnets should be capable of producing an integrated radial field $\pm$ 0.1% the integrated field of the cell bending magnets. For example, we can install one such magnet per cell with a length of 1 ft and a maximum field strength of $\pm$ 3 kG.

3. Trimming Coils on the Cell Quadrupole Magnets

These can be either pole-face or back-leg windings and are used for the following purposes:

A. To compensate for the differential saturation between the cell quadrupoles and the cell bending magnets so that their fields will track properly and that ν will not wander across undesirable resonances.

B. To serve as the drive-end of a servo-loop to eliminate the ν wobble due to magnet ripple on the flat-top and to lock ν onto a predetermined value close to the resonance used for extraction.

These coils should be capable of making a $\pm$ 5% correction on the quadrupole magnet field.

4. Separate Trimming Quadrupole Magnets

These are small quadrupoles located in the short (mini-) straights and will serve as the drive-end of the servo-loop to control the precise motion of ν onto the extraction resonance for uniform beam spill during slow extraction. These quadrupoles should be capable of producing an integrated magnetic field gradient $\pm$ 0.2% that of the cell quadrupoles. For example, we can put one such quadrupole in each of the short (mini-) straights (namely, two per cell) with a length of 1/2 ft and a maximum field gradient of $\pm$ 7 kG/m.

5. Sextupole Magnets

These sextupole magnets are located in the short (mini-) straights and are for the following purposes:

A. To compensate for the radial dependence of ν resulting from $\frac{\Delta p}{p}$.

B. For deliberately introducing radial dependence to ν which may be required for damping of coherent beam oscillations.

C. To compensate for the sextupole component in the field of the cell bending magnet caused by saturation of the magnet iron.

The magnitude of the last requirement depends on the ultimate energy (hence the top field in the beinding magnet) we intend to reach and is generally much larger than the first two requirements. For the initial phase one sextupole in each short (mini-) straight (namely, two per cell) with a length of 1 ft and a maximum $\frac{d^2B}{dx^2}$ for $\pm$ 2000 kG/m^2 (corresponding to a field of 2.5 kG at 5 cm from axis) is adequate.

In addition to these five types of auxiliary magnets and windings there will be special magnets such as kicker magnets, bumper magnets, etc. for injection, extraction, and other specific purposes. These magnets will be discussed separately under "Special Magnets in the Main Accelerator."