Preliminary 2-d Design and 3-d Investigation of 95 mm Dipole

Ramesh Gupta
New 95 mm Aperture Dipole (earlier design was for 90 mm)

- Same conductor is chosen for 35 mm and 95 mm aperture dipoles.
- Number of turns are adjusted - 16 turns (4 X 4) in 35 mm aperture case and 44 turns (4 X 11) in 95 mm aperture case (it was 40 turn for 90 mm).
- Transfer function of the two dipoles is similar (goal is to match integral field to ~1%).
- These constraints will not be applicable if two magnets use different power supplies.

Note: 95 mm (minimum pole gap) is the nominal aperture of the dipole.
Adjust aperture to match transfer function in case the same power supply is used for both magnets.
The design meets the following stated requirements:

- Nominal Field – \( B_0 = 0.40 \, \text{T} \) (upgradeable to 0.48 T)
- Field Homogeneity \( B_X, B_Y = 1 \times 10^{-4} \)
- Good field region \( B_X \pm 20 \, \text{mm}, \, B_Y \pm 10 \, \text{mm} \)
- Nominal Current density in the coil cross section 2 Amps/mm\(^2\)

Note: 95 mm is the minimum pole gap. The pole gap is 100 mm at the center of the magnet.

Field harmonics are < 1 part in \( 10^4 \). More discussion to follow with AP friends.
Iron Saturation at Design Field

Nominal design field is 0.4 T (obtained at a current of ~360 A)

UNITs:
- Length: mm
- Flux density: T
- Field strength: A/m
- Potential: V/m
- Conductivity: S/m
- Source density: A/mm²
- Power: W
- Force: N
- Energy: J
- Mass: kg

PROBLEM DATA:
- E: 0.0065 W/m²
- Linear elements: 5
- XY symmetry: 1
- Vector potential: 0
- Magnetic fields: 1
- Static solution: 1
- Scale factor: 1.0
- 5120 elements
- 3115 nodes
- 26 regions

Component: BMOD
- 1.16285E-06
- 0.941162376
- 1.88232359
Iron Saturation in 95 mm Aperture Dipole

Nominal design current ~360 A

- Design field
- 20% over the design field
- 60% over the design field

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Slide No. 5
Preliminary 3-d Investigation of ~95 mm Aperture Dipole

Circular Ends

Racetrack Ends
(to reduce mechanical length of the coil/magnet)

Work in progress