

Title:

Analytical Formulae to Compute the Contribution to the Magnetic Field of a Cylindrical Ferromagnetic Yoke or Tube Surrounding or Enclosed by an Accelerator Magnet Coil

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Abstract :

Accelerator magnet coils are usually surrounded by a ferromagnetic yoke to limit stray fields and enclose a stainless steel pipe where the particle beam circulates. Both yoke and beam pipe contribute and/or distort the magnet main field. When the yoke is not saturated and has a cylindrical geometry with an infinite outer radius, its contribution can be computed using the well-known image current method. We present here a generalization of this computation to the cases of a cylindrical iron yoke of finite thickness and of a ferromagnetic tube localized inside the magnet aperture. In each case, we derive practical analytical formulae that can be used to determine the contributions of the ferromagnetic medium to the various multipole field coefficients