

90 mm and 35 mm Dipoles

Ramesh Gupta

Progress and Status

Questions from the last meeting (35 mm aperture dipole)

Super-imposition of magnetic field from dipole and 3-pole wiggler:

- Check integral field of the two
- What about field harmonics ?

Two field profiles with the same integral field may have vastly different field harmonics.

Generally larger wiggle (more up and down in the field fall-off), indicates a larger peaks in local harmonics and this may also generate larger integral harmonics.

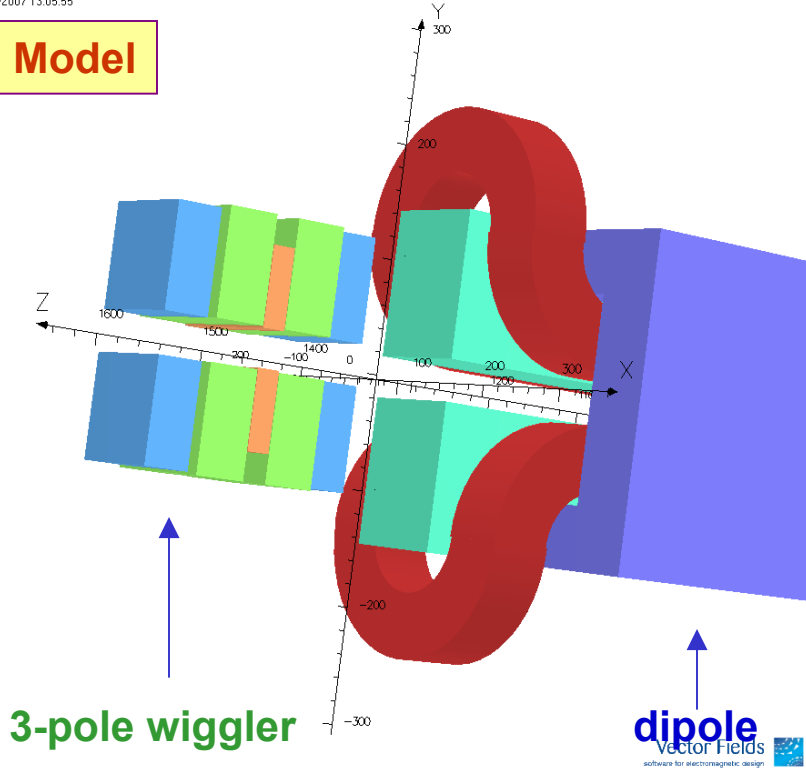
Initial design of larger aperture (90 mm) dipole:

- A number of 2-d designs.
- The desired goal is that the two dipoles (35 mm and 90 mm) run from the power supply.

Interaction between the Dipole and 3-pole Wiggler Fields

21/Mar/2007 13:05:55

Model

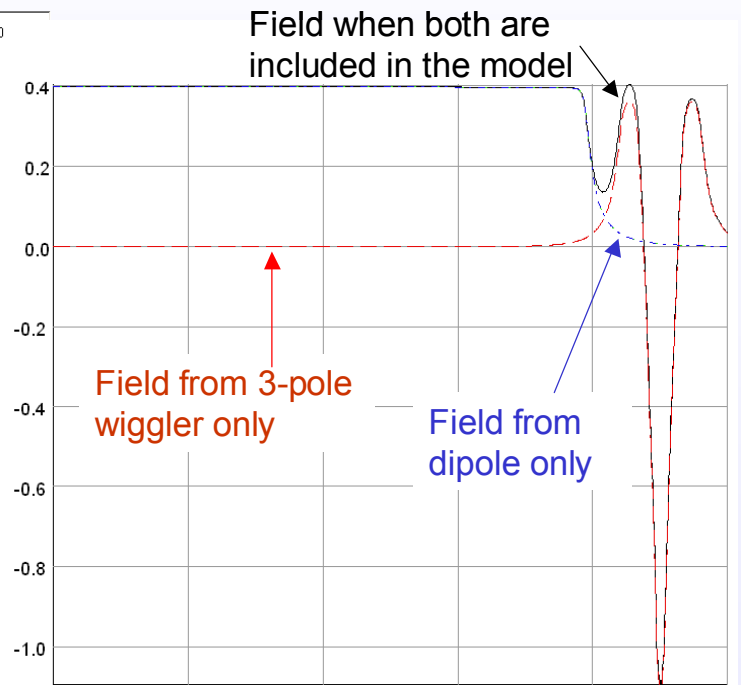


UNITS
Length
Magn Flux Dens
Magn Field
Magn Scalar Pot
Magn Vector Pot
Elec Flux Densit
Elec Field
Conductivity
Current Density
Power
Force
Energy

PROBLEM DATA
bedstd-3pole-6h.
TOSCA Magneto
Nonlinear materi
Simulation No 1 c
2628527 element
445743 nodes
5 conductors
Nodally interpole
Activated in glob
Reflection in XY p
Reflection in ZX p

Field Point Loc
Local = Global

21/Mar/2007 08:16:00



X coord	50.0	52.2086223	58.8340983	69.875256	85.3301421	105.191
Y coord	0.0	0.0	0.0	0.0	0.0	0.0
Z coord	0.0577E-12	332.099659	664.140567	996.063983	1327.81119	1659.3

— Component: BY, Integral = 530.878028067497
 - - - Component: BY, Integral = -0.5699705835207
 - - - Component: BY, Integral = 532.108379900017

- Compare the integral field of the two when they are close and when they are far off (only dipole)
- But what about the field harmonics ?

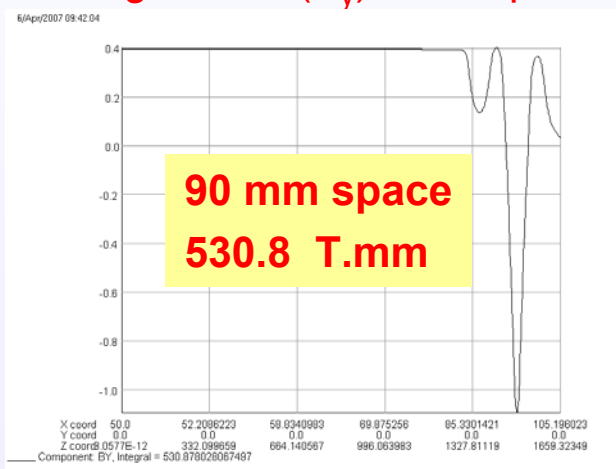
Two field profiles with the same integral field may have vastly different field harmonics.

Generally more up and down in the field fall-off, indicates larger peaks in local harmonics (however, integral harmonics may be more relevant)

Comparison of Integral Field

**Superconducting
Magnet Division**

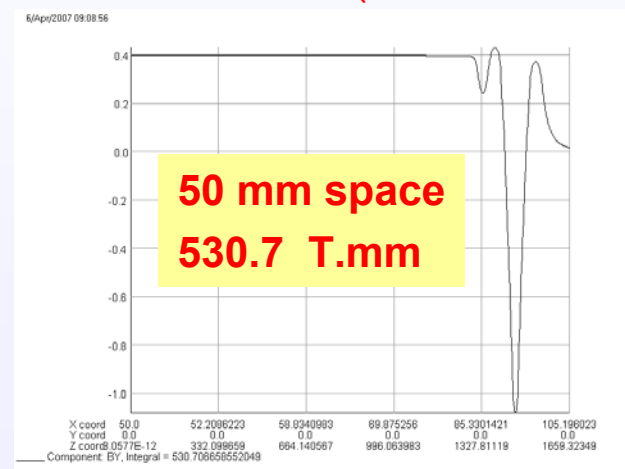
Integral field (B_y) of $\frac{1}{2}$ dipole by itself in this model is: 531.8 T.mm (error ~ 0.6 T.mm).



UNITS	
Length	mm
Magn Flux Density	T
Magn Field	A m ⁻¹
Magn Scalar Pot	A
Magn Vector Pot	Wb m ⁻¹
Elec Flux Density	C m ⁻²
Elec Field	V m ⁻¹
Conductivity	S mm ⁻¹
Current Density	A mm ⁻²
Power	W
Force	N
Energy	J

PROBLEM DATA	
Isidat5-3pole-6A.op3	
TOSCA Magnetostatic	
Nonlinear materials	
Simulation No 1 of 1	
522927 elements	
448143 nodes	
5 conductors	
Nodally interpolated fields	
Activated in global coordinates	

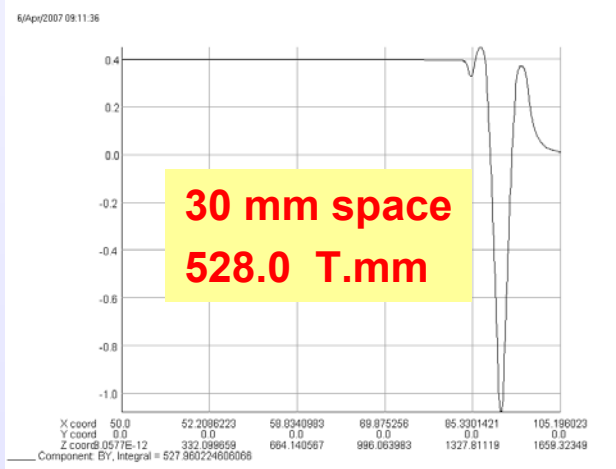
Field Point Local Coordinates	
Local = Global	



UNITS	
Length	mm
Magn Flux Density	T
Magn Field	A m ⁻¹
Magn Scalar Pot	A
Magn Vector Pot	Wb m ⁻¹
Elec Flux Density	C m ⁻²
Elec Field	V m ⁻¹
Conductivity	S mm ⁻¹
Current Density	A mm ⁻²
Power	W
Force	N
Energy	J

PROBLEM DATA	
Isidat5-3pole-6A.op3	
TOSCA Magnetostatic	
Nonlinear materials	
Simulation No 1 of 1	
255232 elements	
44888 nodes	
5 conductors	
Nodally interpolated fields	
Activated in global coordinates	

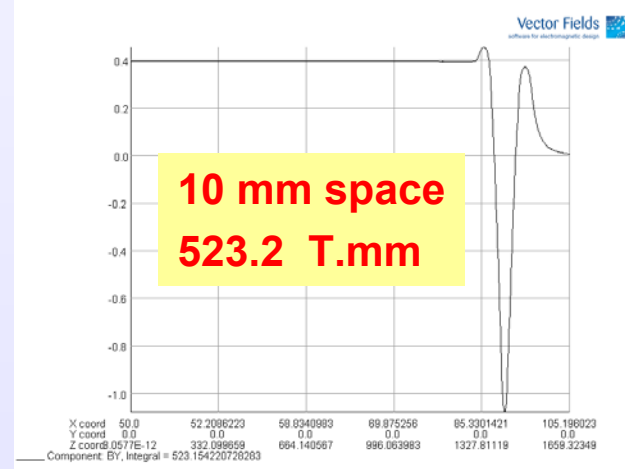
Field Point Local Coordinates	
Local = Global	



UNITS	
Length	mm
Magn Flux Density	T
Magn Field	A m ⁻¹
Magn Scalar Pot	A
Magn Vector Pot	Wb m ⁻¹
Elec Flux Density	C m ⁻²
Elec Field	V m ⁻¹
Conductivity	S mm ⁻¹
Current Density	A mm ⁻²
Power	W
Force	N
Energy	J

PROBLEM DATA	
Isidat5-3pole-6A.op3	
TOSCA Magnetostatic	
Nonlinear materials	
Simulation No 1 of 1	
257157 elements	
453160 nodes	
5 conductors	
Nodally interpolated fields	
Activated in global coordinates	

Field Point Local Coordinates	
Local = Global	



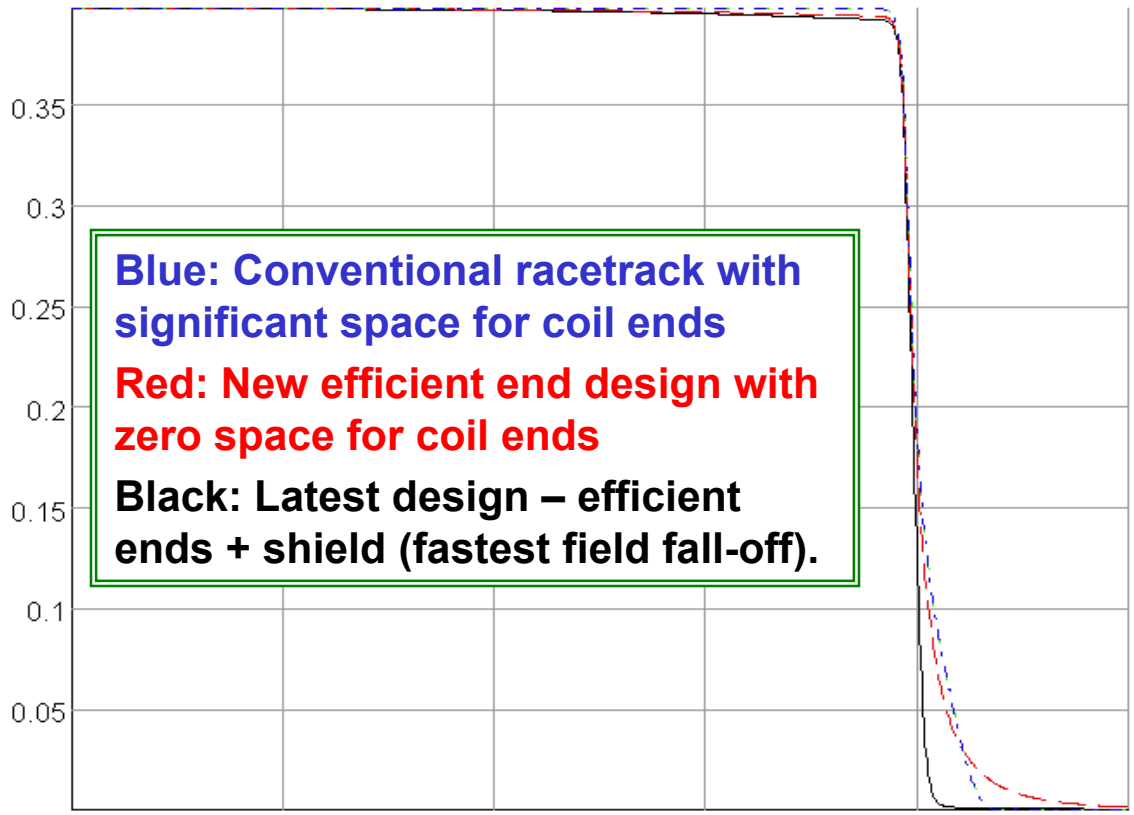
UNITS	
Length	mm
Magn Flux Density	T
Magn Field	A m ⁻¹
Magn Scalar Pot	A
Magn Vector Pot	Wb m ⁻¹
Elec Flux Density	C m ⁻²
Elec Field	V m ⁻¹
Conductivity	S mm ⁻¹
Current Density	A mm ⁻²
Power	W
Force	N
Energy	J

PROBLEM DATA	
Isidat5-3pole-6A.op3	
TOSCA Magnetostatic	
Nonlinear materials	
Simulation No 1 of 1	
255404 elements	
44982 nodes	
5 conductors	
Nodally interpolated fields	
Activated in global coordinates	

Field Point Local Coordinates	
Local = Global	



Comparison of the End Fields in Various Designs



Blue: Conventional racetrack with significant space for coil ends
Red: New efficient end design with zero space for coil ends
Black: Latest design - efficient ends + shield (fastest field fall-off).

Length	mm
Magn Flux Density	T
Magn Field	A m ⁻¹
Magn Scalar Pot	A
Magn Vector Pot	Wb m ⁻¹
Elec Flux Density	C m ⁻²
Elec Field	V m ⁻¹
Conductivity	S mm ⁻¹
Current Density	A mm ⁻²
Power	W
Force	N
Energy	J

PROBLEM DATA
 racetrk-only-6l.op3
 TOSCA Magnetostatic
 Nonlinear materials
 Simulation No 1 of 1
 2671597 elements
 453160 nodes
 3 conductors
 Nodally interpolated fields
 Activated in global coordinates

Field Point Local Coordinates
 Local = Global

X coord	50.0	52.2086223	58.8340983	69.875256	85.3301421	105.196023
Y coord	0.0	0.0	0.0	0.0	0.0	0.0
Z coord	3.0577E-12	332.099659	664.140567	996.063983	1327.81119	1659.32349

- Component: BMOD, Integral = 524.711552367817
- Component: BMOD, Integral = 531.804875860282
- Component: BMOD, Integral = 533.087048290844
- Component: BMOD, Integral = 533.087048290844