

Dipole Simulations

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Dipole field

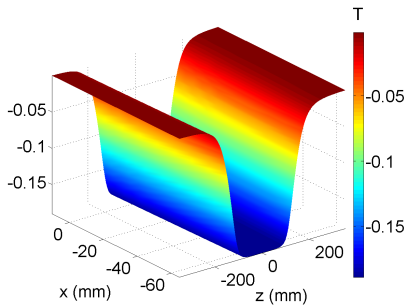
- Use field map from measurements
- Use formula that fits the measurements

Starting point

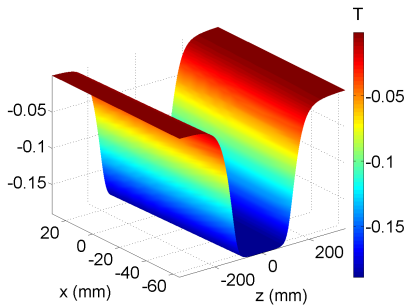
- $x=0$ mm
- $x=30$ mm

- Origin measurements cover -350 mm to 350 mm in z and -65 mm to 10 mm in x
- Measurements were done with -30 mm displacement in x , so we should start from $x=30$ mm instead of 0 mm in dipole simulations
- Extend field map to 30 mm in x , keeping the field's edge angle to be 11.25 degree

Field map, 3D

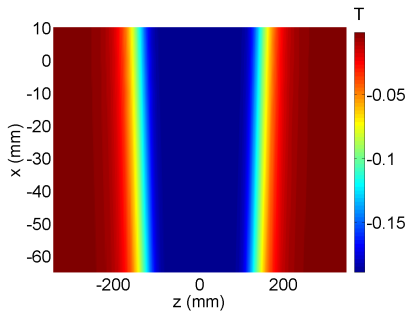


(a) Origin

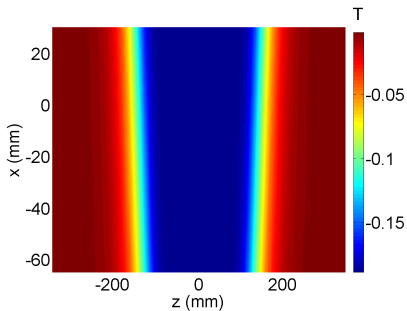


(b) Extended

Field map, 2D

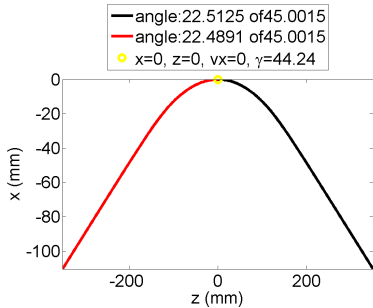


(a) Origin

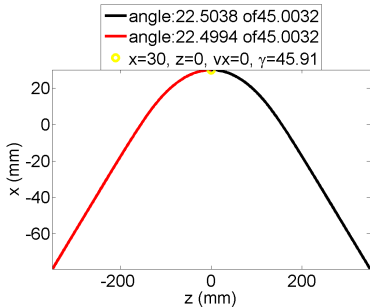


(b) Extended

Trajectory

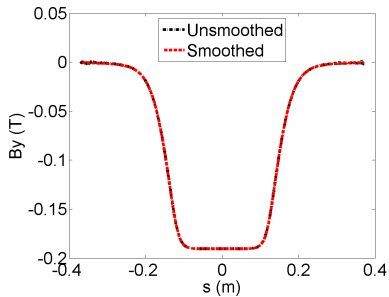


(a) $x_0 = 0$

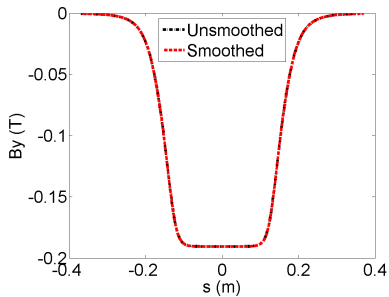


(b) $x_0 = 30$

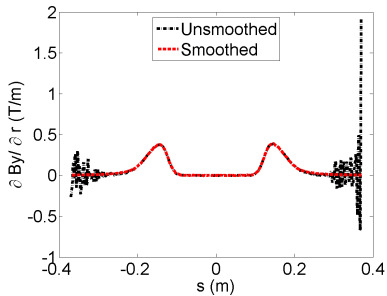
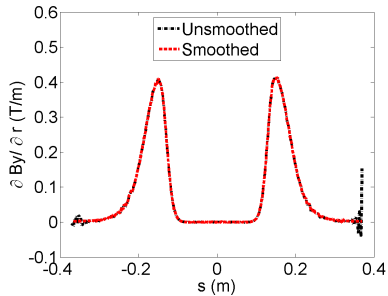
Smooth By



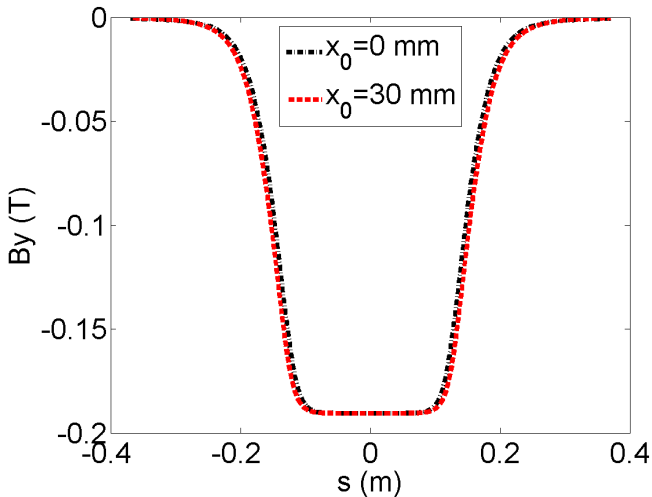
(a) $x_0 = 0$

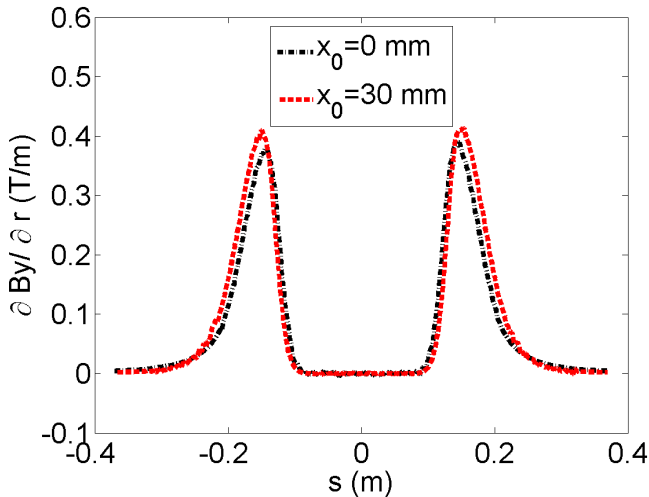


(b) $x_0 = 30$

Smooth $\partial B_y / \partial r$ (a) $x_0 = 0$ (b) $x_0 = 30$

Compare By

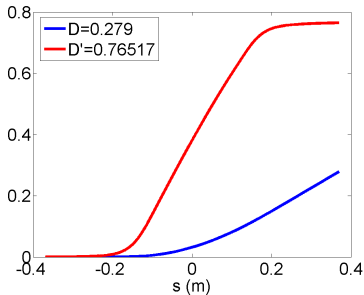


Compare $\partial B_y / \partial r$ 

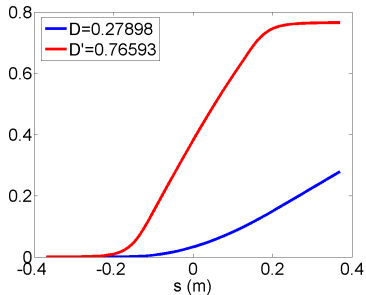
Compare transfer matrix

	M_x	M_y
$x_0 = 0$	$\begin{pmatrix} 0.63094 & 0.59516 \\ -1.0095 & 0.63266 \end{pmatrix}$	$\begin{pmatrix} 0.73574 & 0.66114 \\ -0.69613 & 0.73363 \end{pmatrix}$
$x_0 = 30$	$\begin{pmatrix} 0.6555 & 0.60348 \\ -0.94311 & 0.65729 \end{pmatrix}$	$\begin{pmatrix} 0.73118 & 0.65967 \\ -0.70779 & 0.72909 \end{pmatrix}$

Compare dispersion



(a) $x_0 = 0$

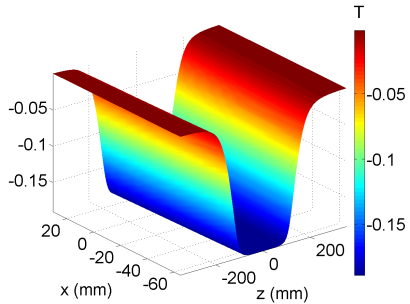


(b) $x_0 = 30$

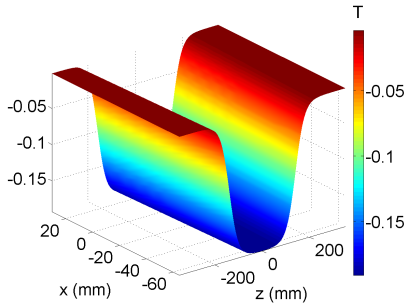
Fitting function

$$B_y = -0.002733 - 0.1903 / \\ (1 + \exp(4 * 0.9808 * (z - 152.2 - x * 0.1989) / 74.05)) / \\ (1 + \exp(4 * 0.9808 * (-152.2 - x * 0.1989 - z) / 74.05))$$

Compare field

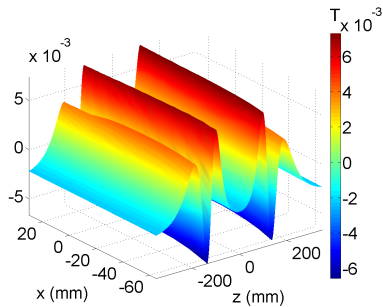


(a) Field map

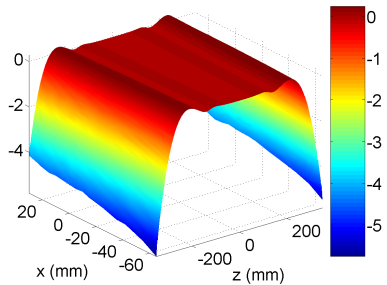


(b) Formula

Field error

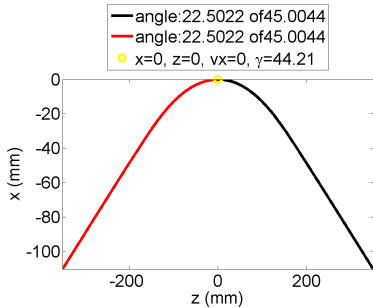


(a) Absolute

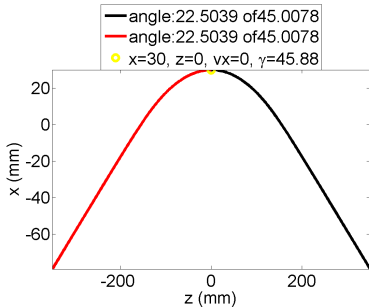


(b) Relative

Trajectory

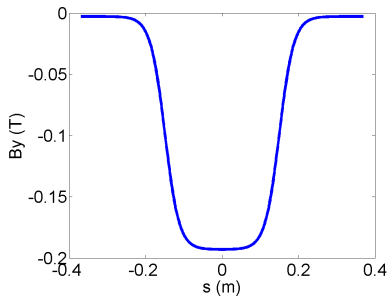
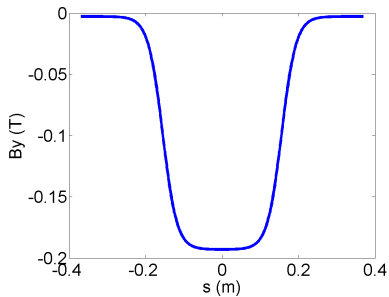


(a) $x_0 = 0$

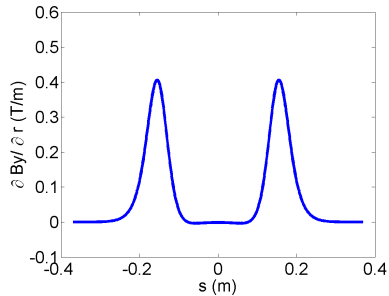


(b) $x_0 = 30$

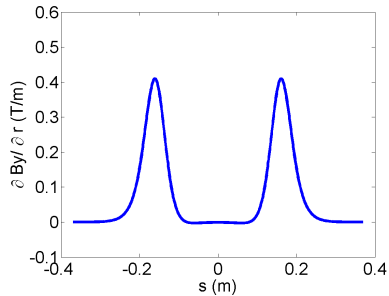
By

(a) $x_0 = 0$ (b) $x_0 = 30$

$$\partial B_y / \partial r$$

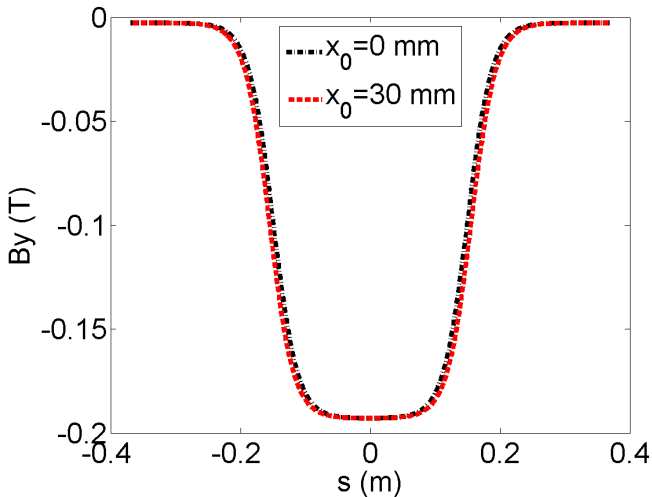


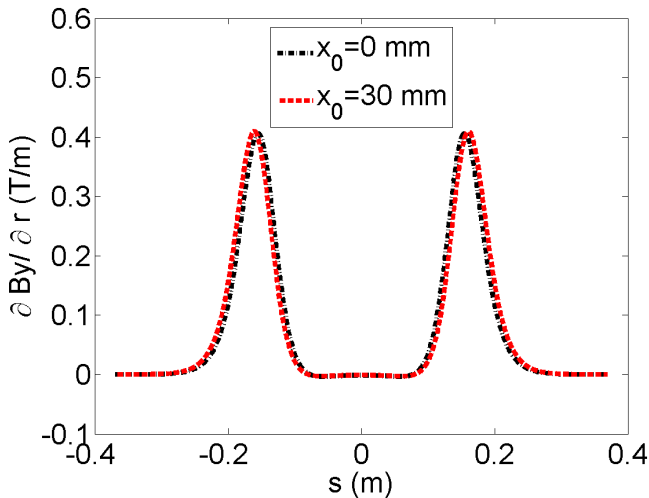
(a) $x_0 = 0$



(b) $x_0 = 30$

Compare By

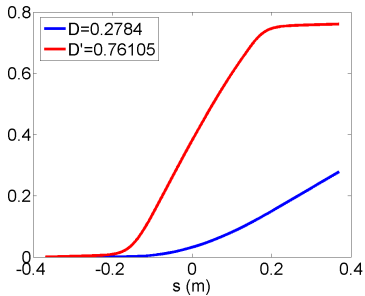


Compare $\partial B_y / \partial r$ 

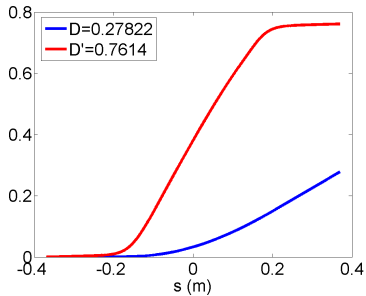
Compare transfer matrix

	M_x	M_y
$x_0 = 0$	$\begin{pmatrix} 0.62384 & 0.59402 \\ -1.0283 & 0.62384 \end{pmatrix}$	$\begin{pmatrix} 0.74428 & 0.6622 \\ -0.67359 & 0.74428 \end{pmatrix}$
$x_0 = 30$	$\begin{pmatrix} 0.63786 & 0.59848 \\ -0.99107 & 0.63786 \end{pmatrix}$	$\begin{pmatrix} 0.74968 & 0.66458 \\ -0.65904 & 0.74968 \end{pmatrix}$

Compare dispersion



(a) $x_0 = 0$

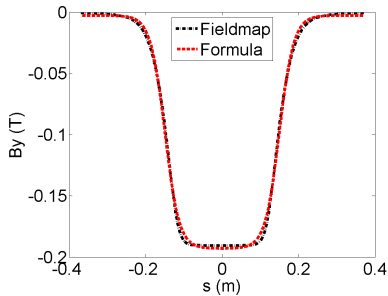


(b) $x_0 = 30$

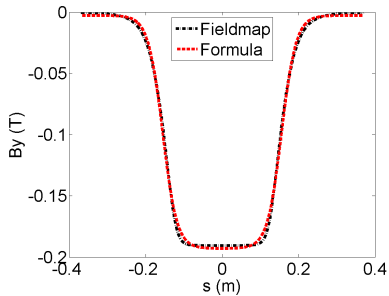
Compare γ

	Field map	Formula
$x_0 = 0$	44.24	44.21
$x_0 = 30$	45.91	45.88

Compare By

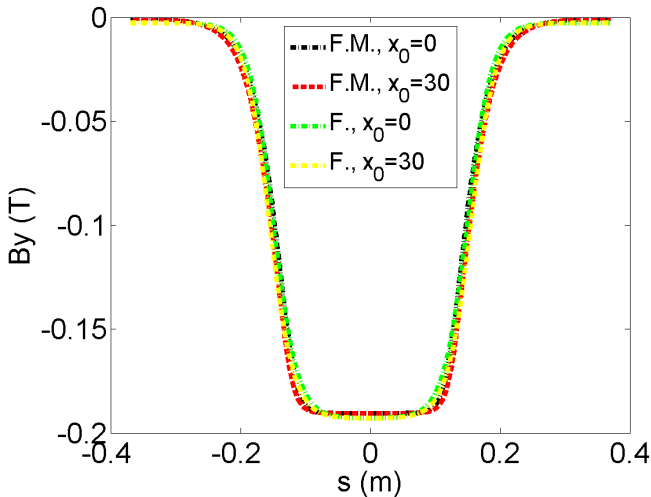


(a) $x_0 = 0$

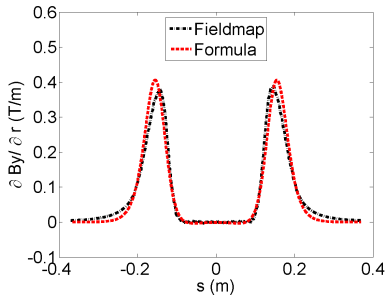


(b) $x_0 = 30$

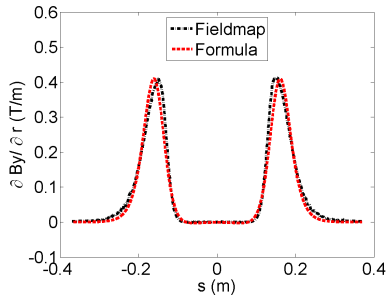
Compare By



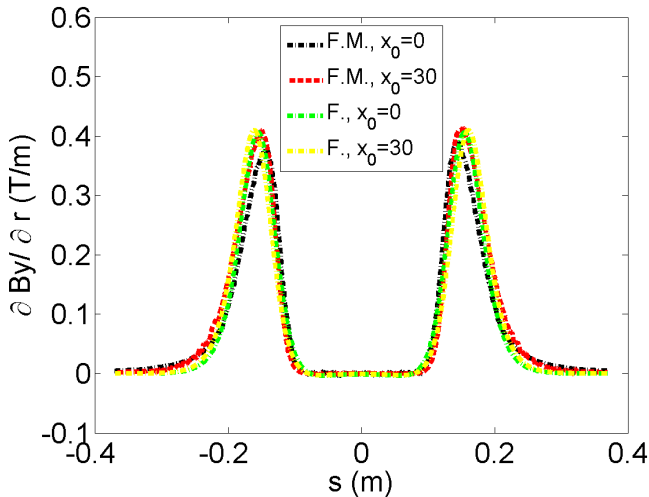
Compare $\partial B_y / \partial r$



(a) $x_0 = 0$



(b) $x_0 = 30$

Compare $\partial B_y / \partial r$ 

Compare transfer matrix M_x

	Field map	Formula
$x_0 = 0$	$\begin{pmatrix} 0.63094 & 0.59516 \\ -1.0095 & 0.63266 \end{pmatrix}$	$\begin{pmatrix} 0.62384 & 0.59402 \\ -1.0283 & 0.62384 \end{pmatrix}$
$x_0 = 30$	$\begin{pmatrix} 0.6555 & 0.60348 \\ -0.94311 & 0.65729 \end{pmatrix}$	$\begin{pmatrix} 0.63786 & 0.59848 \\ -0.99107 & 0.63786 \end{pmatrix}$

Compare transfer matrix My

	Field map	Formula
$x_0 = 0$	$\begin{pmatrix} 0.73574 & 0.66114 \\ -0.69613 & 0.73363 \end{pmatrix}$	$\begin{pmatrix} 0.74428 & 0.6622 \\ -0.67359 & 0.74428 \end{pmatrix}$
$x_0 = 30$	$\begin{pmatrix} 0.73118 & 0.65967 \\ -0.70779 & 0.72909 \end{pmatrix}$	$\begin{pmatrix} 0.74968 & 0.66458 \\ -0.65904 & 0.74968 \end{pmatrix}$

Compare dispersion

	Field map	Formula
$x_0 = 0$	0.279	0.2784
$x_0 = 30$	0.27898	0.27822