Quad and Kicker scans with measured B-field

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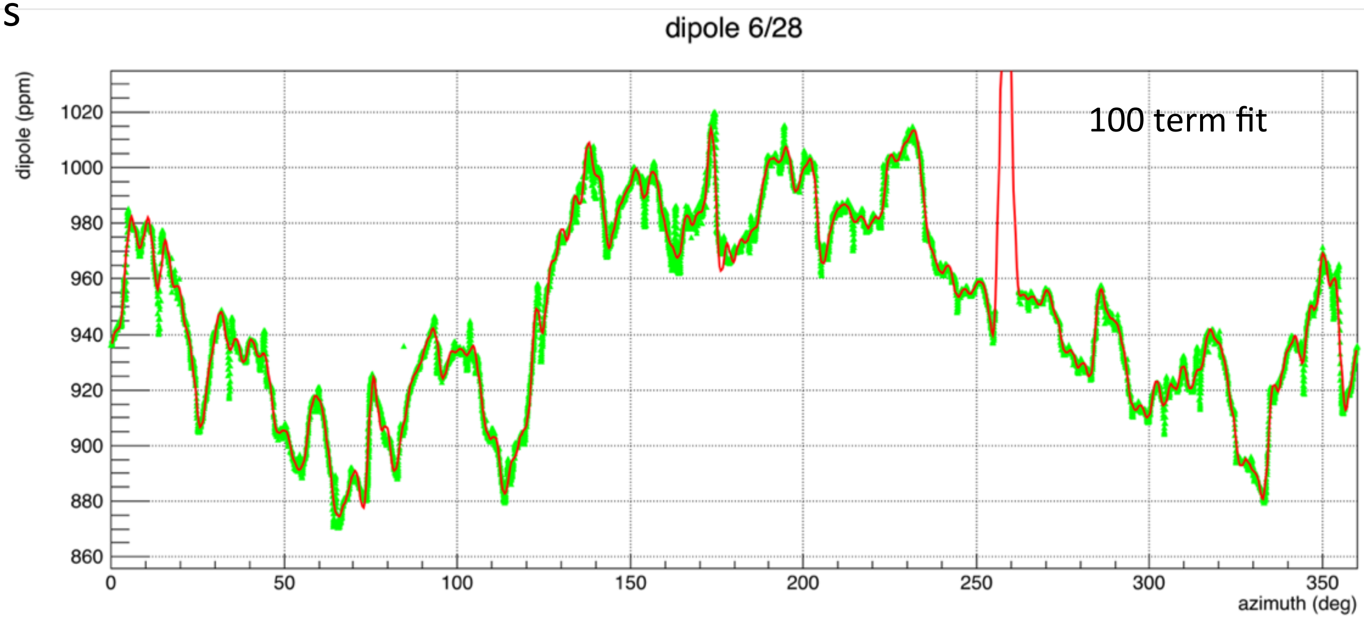
Measured fields

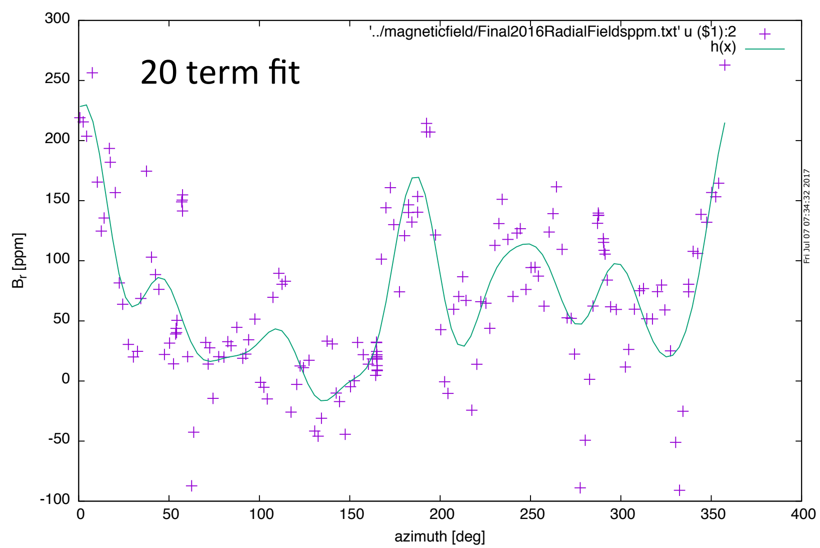
|B|



https://muon.npl.washington.edu/elog/g2/General+Field+Team/983

Radial field

In tracking study to follow average radial B-field is assumed to be zero



https://gm2-docdb.fnal.gov:441/cgi-bin/ShowDocument?docid=4671

Field measurements are assumed along magic radius.
Tracking requires fields defined everywhere.

In order that fields displaced from magic radius are consistent with Maxwell

- Write solution to Laplace in cylindrical coordinates
- Compute $B_z(\phi)$ and $B_r(\phi)$ on the design orbit and fit to measurements
- Apply boundary condition $B_z(\rho_{backleg}) = 0$

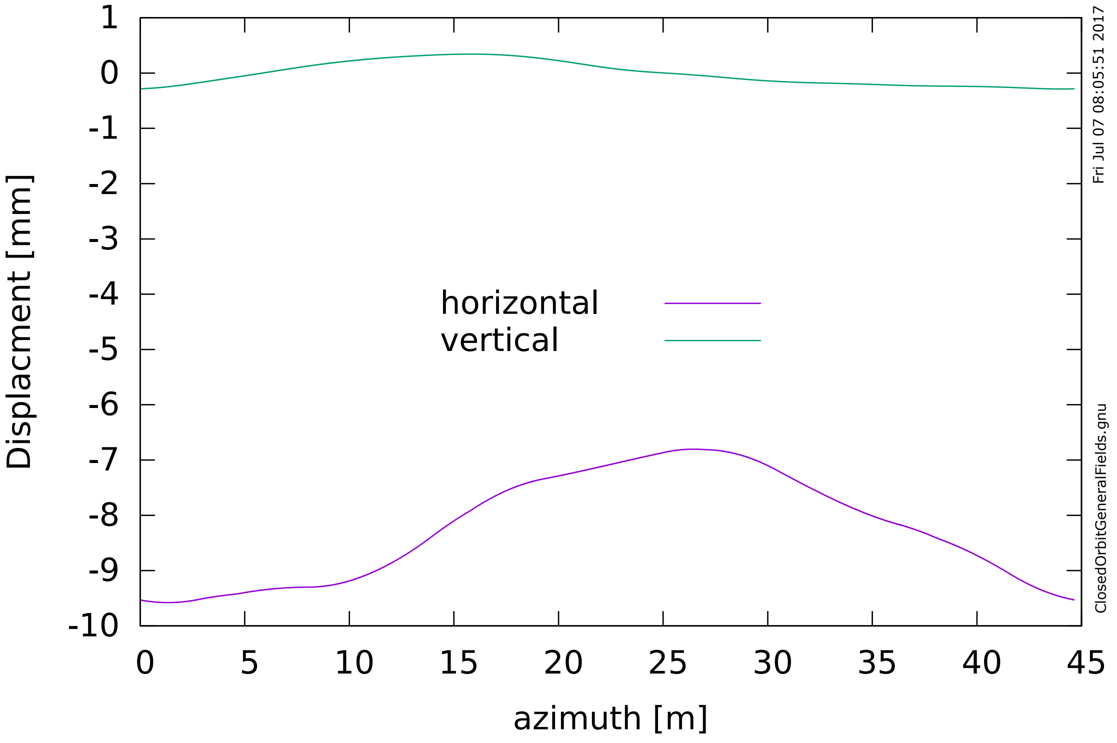
Assume that $|\mathbf{B}| = \mathbf{B_z}$. a_m, b_m and c_m, d_m are the coefficients of the fits to the measured B_z and B_r respectively. Define

$$\begin{aligned}
A_m &= a_m/(J_m(k_{m1}\rho_0)k_{m1}) \\
B_m &= b_m/(J_m(k_{m1}\rho_0)k_{m1}) \\
\\
C_m &= c_m/(\frac{\partial J_m}{\partial \rho}(k_{m1}\rho_0)k_{m1}) \\
D_m &= d_m/(\frac{\partial J_m}{\partial \rho}(k_{m1}\rho_0)k_{m1})
\end{aligned}$$

Then the fields

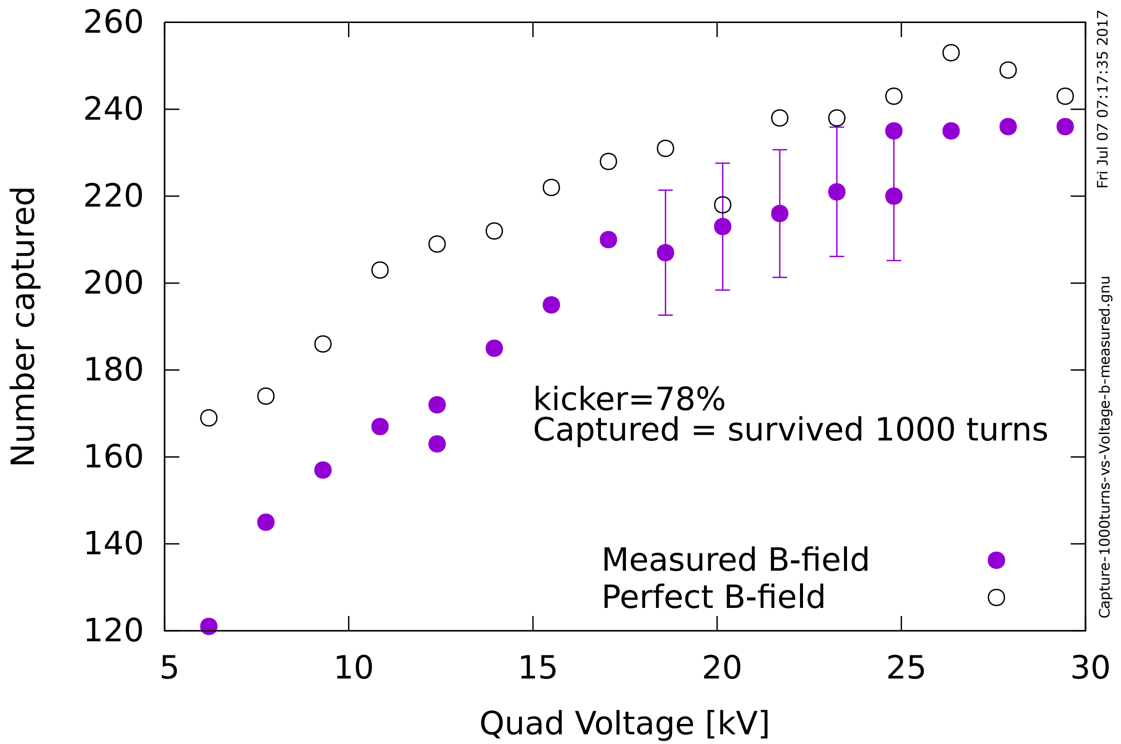
$$\begin{aligned}
B_z &= \sum_{m=0}^{\infty} J_m(k_m\rho)k_m \left(\cosh(k_m z)(A_m \sin m\phi + B_m \cos m\phi)\right. \\
&\quad \left. - \sinh(k_m z)(C_m \sin m\phi + D_m \cos m\phi)\right) \\
B_\rho &= \sum_{m=0}^{\infty} \frac{\partial J_m}{\partial \rho}(k_m\rho) \left(\sinh(k_m z)(A_m \sin m\phi + B_m \cos m\phi)\right. \\
&\quad \left. + \cosh(k_m z)(C_m \sin m\phi + D_m \cos m\phi)\right) \\
B_\phi &= \sum_{m=0}^{\infty} \frac{J_m(k_m\rho)}{\rho} m \left(\sinh(k_m z)(A_m \cos m\phi - B_m \sin m\phi)\right. \\
&\quad \left. + \cosh(k_m z)(C_m \cos m\phi - D_m \sin m\phi)\right)
\end{aligned}$$

Closed orbits with fitted (measured) B-fields



Average radial field is assumed to be zero

Quad voltage scan with fitted (measured) vs perfect B-field



Average radial field is assumed to be zero

Kicker scan

Measured – includes measured field errors

Uniform – no field errors

Quads at 18 kV