GENERAL FORMULA FOR THE TRANSVERSE RESISTIVE-WALL IMPEDANCE DERIVED FROM ZOTTER'S FORMALISM

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- **The resistive-wall impedance can be derived without making the approximation $x = k\,b/\gamma << 1$ and without assuming a good conductor for the 1st layer**
- **Application to the SPS MKE kicker**

GENERAL FORMULA DEDUCED FROM ZOTTER'S THEORY (1/2)

$$Z_{\perp,\mathrm{round}}^{\mathrm{RW}} = j\,\frac{L\,Z_0}{\pi\,b^2} \times \frac{\beta\left(1-\dfrac{k\,\mu'\,Q_\eta}{\gamma\,\nu\,P_1}\right)}{\dfrac{a^2\,\beta\,\gamma^2\,I_1(x_1)}{b^2\,I_1^2(s)\,K_1(x_1)\,\beta\,x_1^2\,x_2^2\,\gamma^2\,\nu^2\,P_1\,(P_1-Q_1)} \times \left[(\gamma\,\nu\,x_2-k\,x_1)^2-(\beta\,x_1\,x_2)^2\,(\gamma\,\nu\,P_1-k\,\mu'\,Q_\eta)(\gamma\,\nu\,P_1-k\,\varepsilon'\,Q_\alpha)\right]}$$

$a = \text{Beam radius}$

$b = \text{Radius of the object}$

$L = \text{Length of the object}$

$\mu = \mu_0\,\mu' = \mu_0\,\mu_r\,(1+j\tan\vartheta_M)$

$\varepsilon_c = \varepsilon_0\,\varepsilon' = \varepsilon_0\,\varepsilon_r + \dfrac{\sigma}{j\,2\pi\,f}$

$x_1 = \dfrac{k\,b}{\gamma}$ $\quad s = \dfrac{k\,a}{\gamma}$ $\quad k = \dfrac{2\pi\,f}{\beta\,c}$

$\nu = k\sqrt{1-\beta^2\,\varepsilon'\,\mu'}$ $\quad x_2 = \nu\,b$

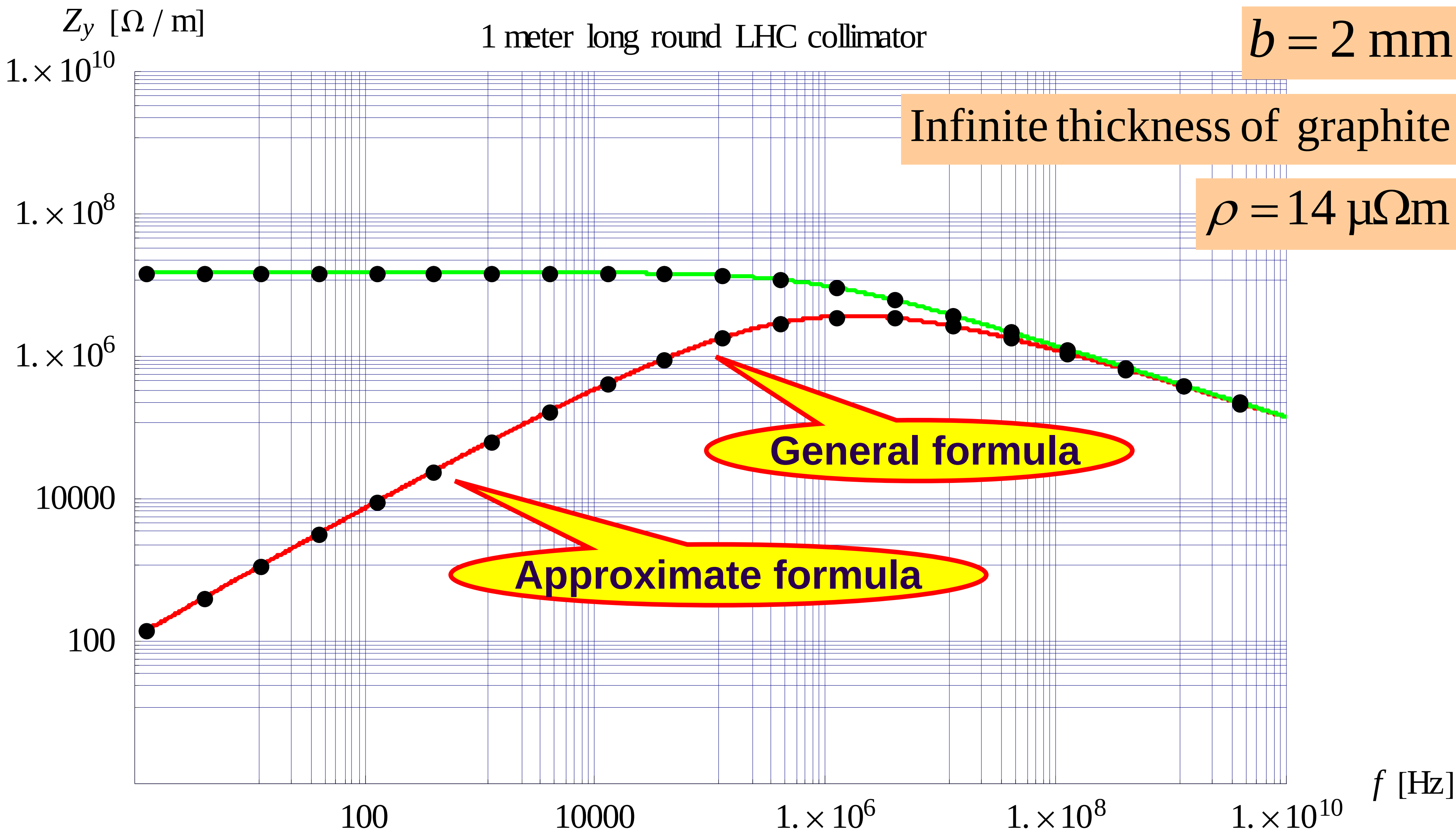
$\delta = \sqrt{\dfrac{1}{\pi\,f\,\mu\,\sigma}}$ $\quad Q_\alpha = \dfrac{Q_2-\alpha_2\,P_2}{1-\alpha_2}$ $\quad Q_\eta = \dfrac{Q_2-\eta_2\,P_2}{1-\eta_2}$

$P_1 = \dfrac{I_1'(x_1)}{I_1(x_1)}$ $\quad Q_1 = \dfrac{K_1'(x_1)}{K_1(x_1)}$ $\quad P_2 = \dfrac{I_1'(x_2)}{I_1(x_2)}$

$Q_2 = \dfrac{K_1'(x_2)}{K_1(x_2)}$ $\quad \gamma = \dfrac{1}{\sqrt{1-\beta^2}}$ $\quad Z_0 = 120\,\pi$

α_2 and η_2 are determined by the boundary conditions at the outer chamber wall $r = d$

GENERAL FORMULA DEDUCED FROM ZOTTER'S THEORY (2/2)



GENERAL FORMULA APPLIED TO THE SPS MKE KICKER