Resistive wall impedance and wake

2016-5-6

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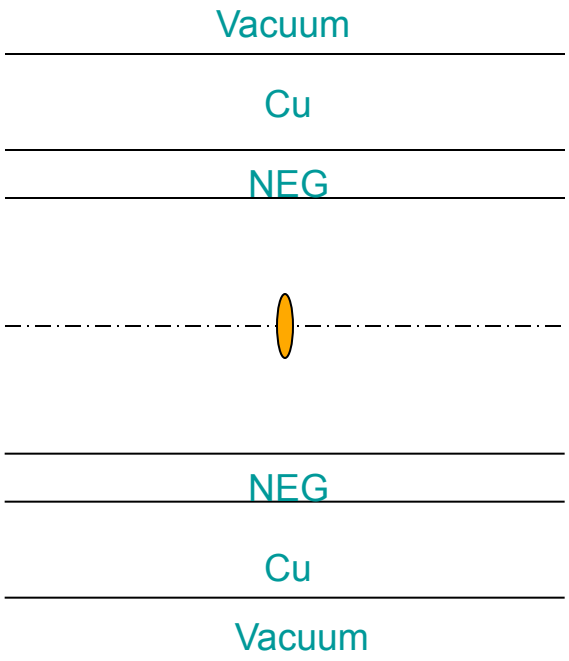
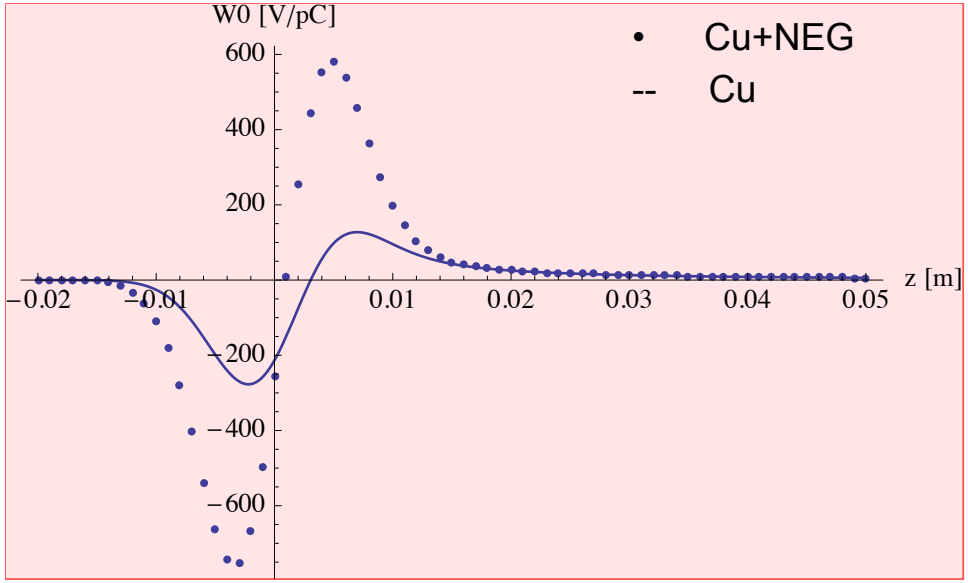
- Transverse impedance and wake contribution from NEG coating.

Layers	Thickness, mm	Conductivity, S/m	ε_r	μ_r
Cu	1	5.9×10^7	1	1
NEG	0.001	1.0×10^6	1	1
Vacuum	∞	0	1	1



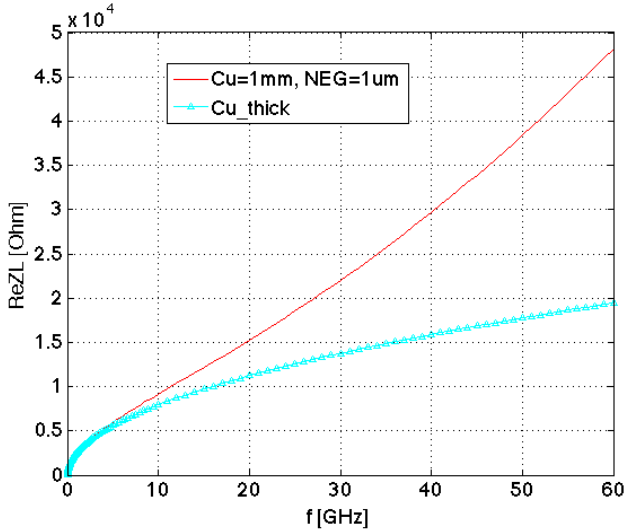
Longitudinal impedance and wake contribution from NEG coating

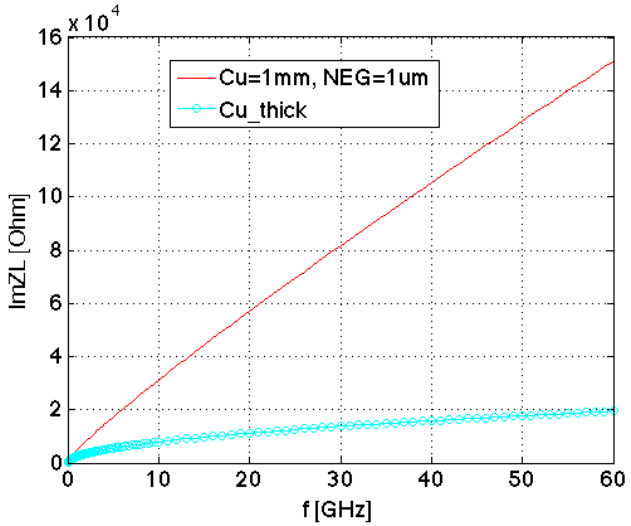
- Longitudinal wake



σ_z=4mm

- Longitudinal impedance





Compute transverse bunch wake from impedance

$$W_\perp = \frac{-i}{2\pi}\int_{-\infty}^{\infty} d\omega e^{i\omega z/c} Z_\perp(\omega)$$

$$W_{\perp\lambda}(\tau) = \int_{-\infty}^{\infty} dt\, \lambda(\tau - t) W_\perp(t)$$

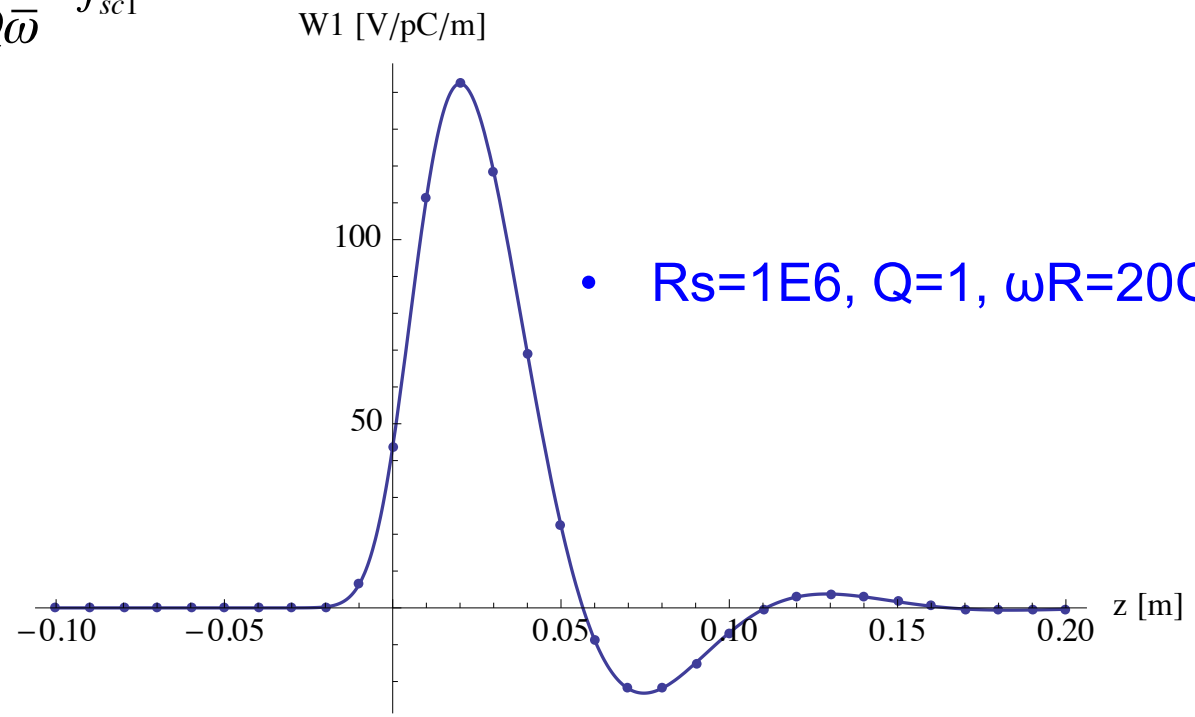
$$W_{\perp\lambda}(\tau) = \int_{-\infty}^{\infty} dt\, \lambda(\tau - t) \frac{-i}{2\pi}\int_{-\infty}^{\infty} d\omega e^{i\omega t} Z_\perp(\omega)$$

Cross check with High Order modes

$$Z_\perp = \frac{c}{\omega}\frac{R_s}{1+iQ\left(\frac{\omega_R}{\omega}-\frac{\omega}{\omega_R}\right)}$$

$$f_{sc1} = \frac{1}{2}e^{-\frac{\sigma_z^2}{2}(k_r^2-\alpha_r^2)-\alpha_r\sigma_z x}\,\mathrm{Im}\left(e^{ik_r\sigma_z(x-\alpha_r\sigma_z)}\left(1+Erf\left(\frac{(ik_r-\alpha_r)\sigma_z+x}{\sqrt{2}}\right)\right)\right)\Big|_{x=s/\sigma_z}$$

$$W_\perp(z) = \frac{cR_s\omega_R}{Q\bar{\omega}}f_{sc1}$$



- Rs=1E6, Q=1, ωR=20GHz

Transverse impedance and wake contribution from NEG coating

- Transverse wake
- Transverse impedance