Classical transverse resistive wall Impedance and Wakefunction:

$$Z^{\perp}_{m=1}(\omega) = (1 - i\,\mathrm{sgn}\,\omega)\,\frac{cL}{\pi b^3}\sqrt{\frac{\mu_o\mu_r}{2\,\sigma}}\cdot\frac{\sqrt{|\omega|}}{\omega}$$
$$= (1-i)\,\frac{cL}{\pi b^3}\sqrt{\frac{\mu_o\mu_r}{2\,\sigma}}\cdot\frac{1}{\sqrt{\omega}}$$

$$W^{\perp}_{m=1}(t<0) = -\frac{cL}{\pi^{3/2}b^3}\sqrt{\frac{\mu_o\mu_r}{\sigma}}\cdot\frac{1}{\sqrt{|t|}}$$

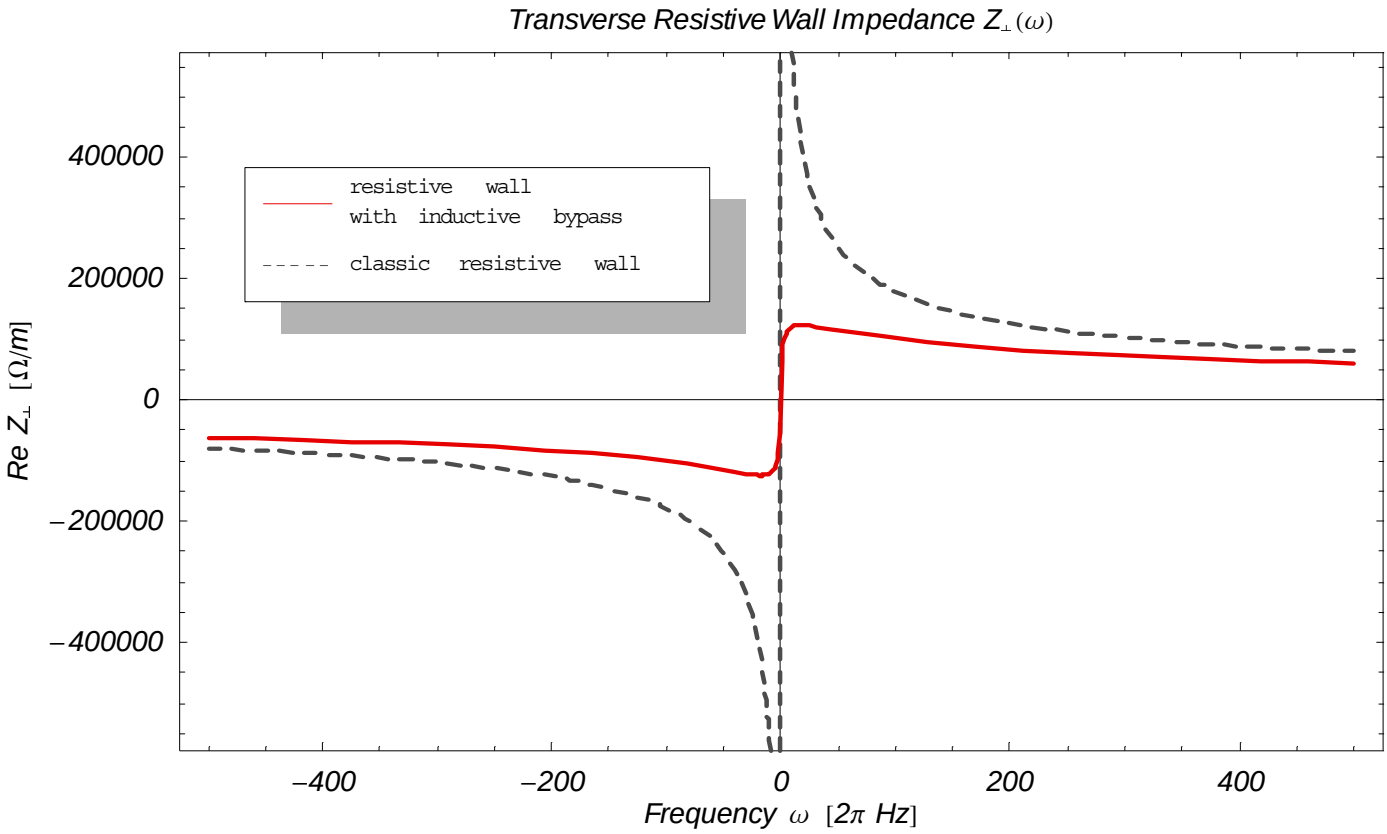
$$Z_{\parallel} = (1 - i\,\mathrm{sgn}\,\omega)\,\frac{1}{\delta_{skin}\sigma}\,\frac{L}{2\pi b}$$
$$\delta_{skin} = \sqrt{\frac{2}{\sigma\mu_0\mu_r|\omega|}}$$
$$Z_{ind} = -i\cdot\frac{L\mu_0}{4\pi}\cdot\omega$$

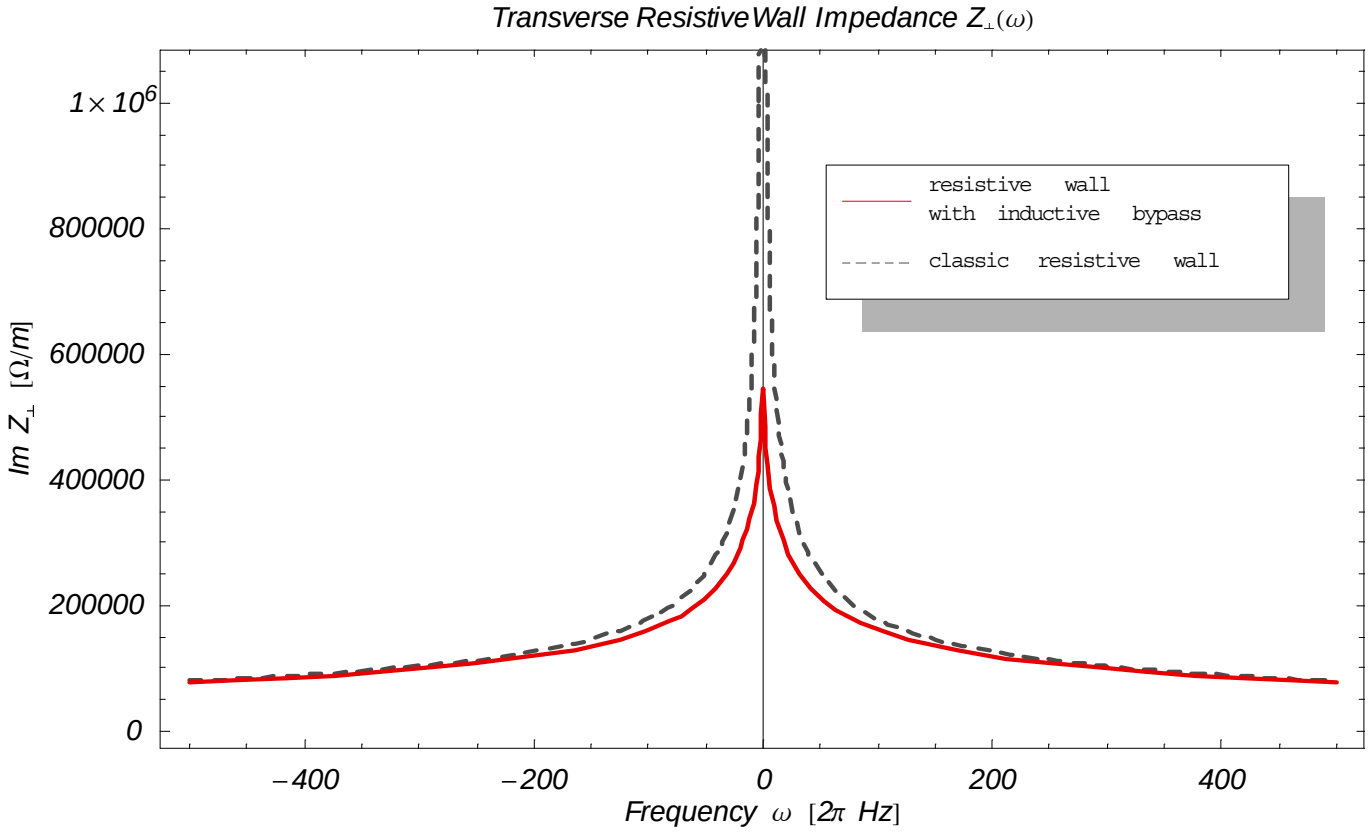
Trans. res. wall Impedance and Wakefunction with inductive bypass:

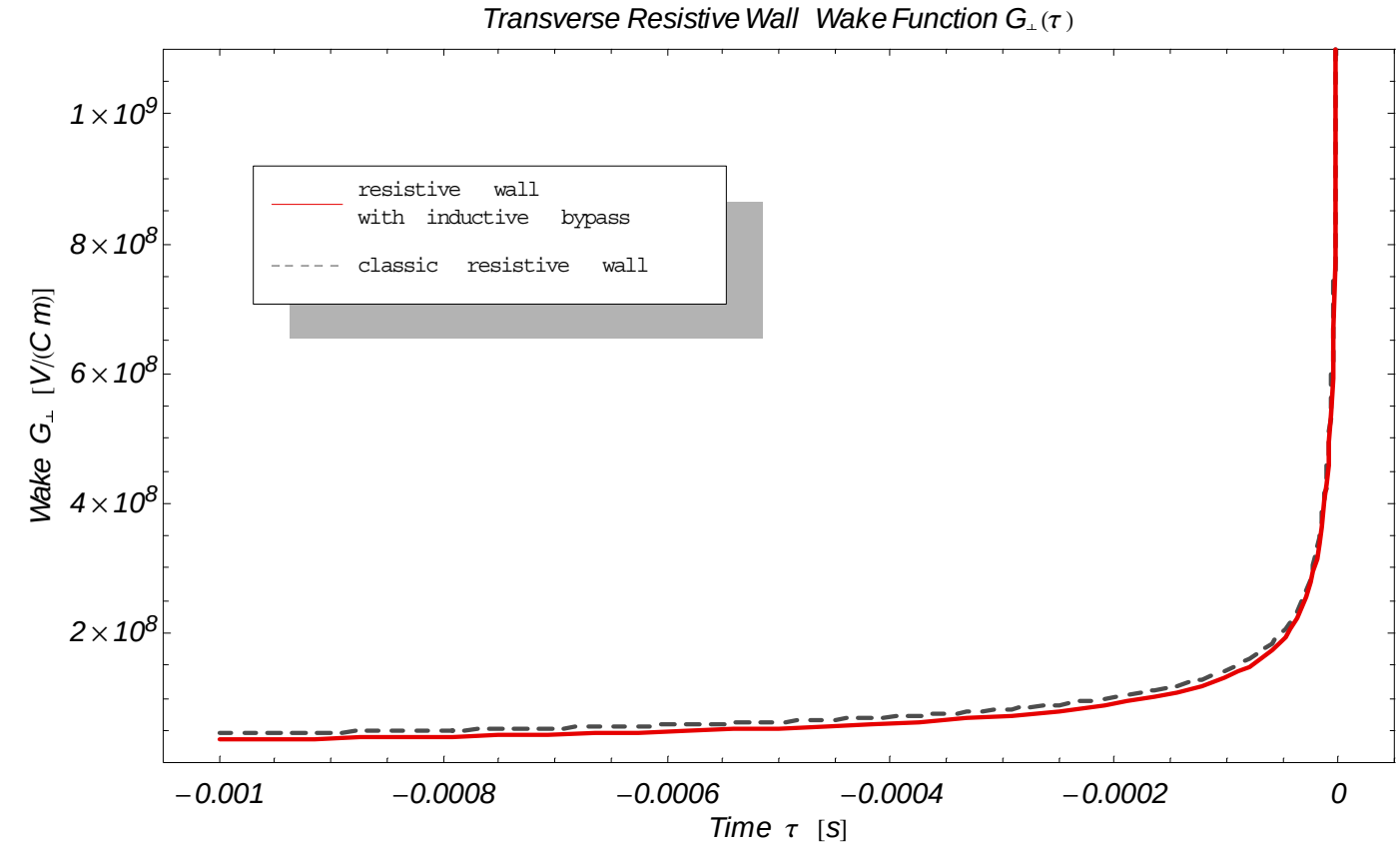
$$Z_{m=1}^{\perp}(\omega) = \frac{Z_{\parallel} \cdot Z_{ind}}{Z_{\parallel} + Z_{ind}} \cdot \frac{2c}{b^2 \omega}$$

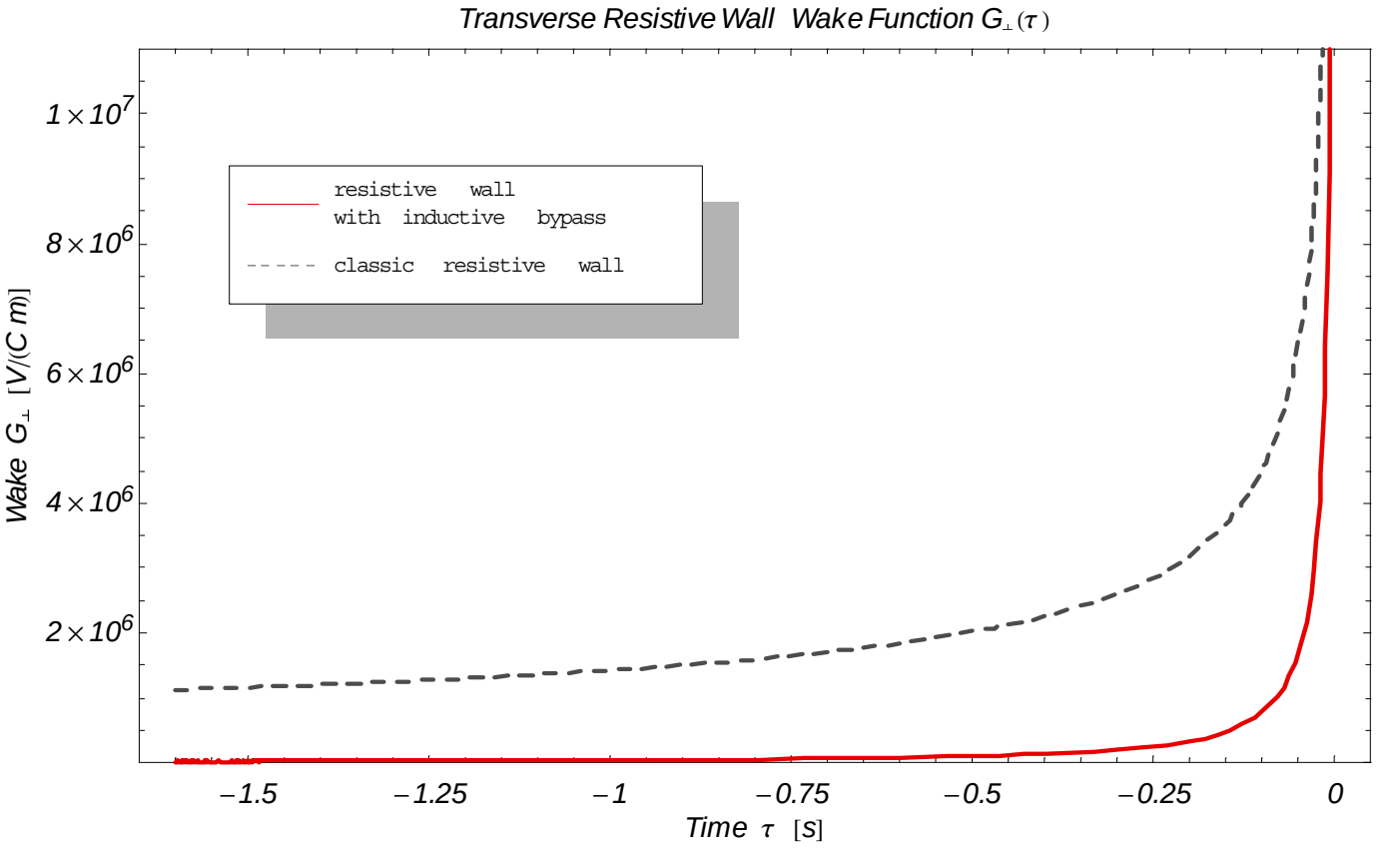
$$Z_{m=1}^{\perp}(\omega) = (1-i)\,\frac{cL}{\pi b^2}\,\frac{\mu_0}{\left(2 + 2\,i + b\sqrt{\frac{2\sigma\mu_0}{\mu_r}}\right)} \cdot \frac{1}{\sqrt{\omega}}$$

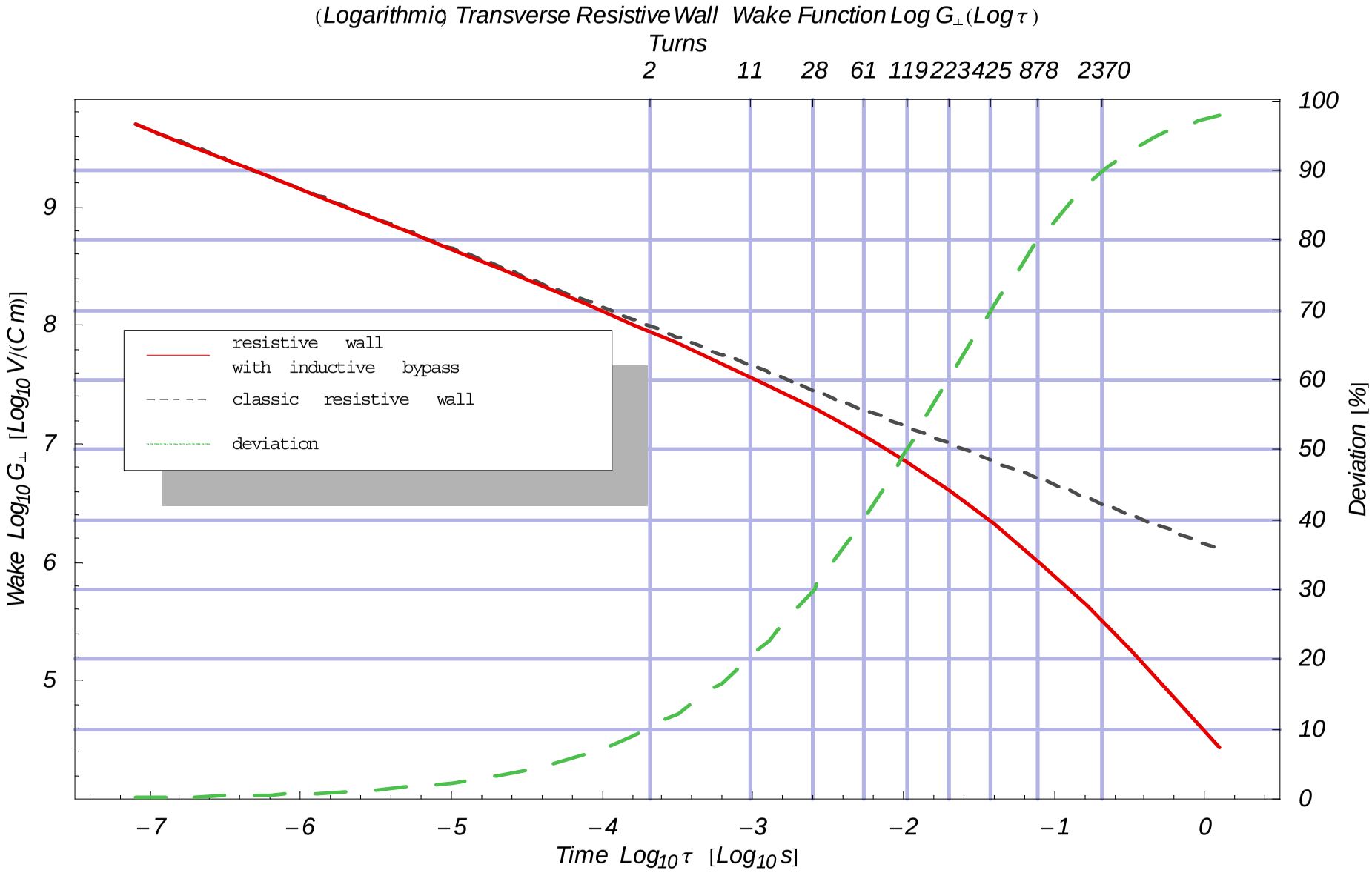
$$W_{m=1}^{\perp}(t<0) = -\frac{cL}{\pi^{3/2} b^3}\sqrt{\frac{\mu_o \mu_r}{\sigma}} \cdot \frac{1}{\sqrt{|t|}}$$
$$+ \exp\left[\frac{4\mu_r}{b^2\sigma\mu_0}\,|t|\right]\,\frac{2cL}{b^4\pi}\,\sqrt{\frac{\mu_r}{\sigma^2}}$$
$$+ \exp\left[\frac{4\mu_r}{b^2\sigma\mu_0}\,|t|\right]\,\frac{2cL}{b^4\pi}\,\sqrt{\frac{\mu_r^2}{\sigma^2}} \cdot \mathrm{erfi}\sqrt{\frac{4\mu_r}{\sigma\mu_0 b^2}t}$$


Transverse Resistive Wall Impedance $Z_\perp(\omega)$
resistive wall
with inductive bypass
classic resistive wall
400000
200000
0
−200000
−400000
Re $Z_\perp$ [Ω/m]
−400
−200
0
200
400
Frequency ω [2π Hz]


Transverse Resistive Wall Impedance $Z_\perp(\omega)$
resistive wall
with inductive bypass
classic resistive wall
1×10^6
800000
600000
400000
200000
0
Im $Z_\perp$ [Ω/m]
−400
−200
0
200
400
Frequency ω [2π Hz]


Transverse Resistive Wall Wake Function $G_\perp(\tau)$
resistive wall
with inductive bypass
classic resistive wall
Wake $G_\perp$ [V/(C m)]
1×10^9
8×10^8
6×10^8
4×10^8
2×10^8
−0.001
−0.0008
−0.0006
−0.0004
−0.0002
0
Time τ [s]


Transverse Resistive Wall Wake Function $G_\perp(\tau)$
resistive wall
with inductive bypass
classic resistive wall
Wake $G_\perp$ [V/(C m)]
1×10^7
8×10^6
6×10^6
4×10^6
2×10^6
−1.5
−1.25
−1
−0.75
−0.5
−0.25
0
Time τ [s]


(Logarithmic) Transverse Resistive Wall Wake Function Log $G_\perp(\text{Log}\,\tau)$
Turns
2
11
28
61
119
223
425
878
2370
resistive wall
with inductive bypass
classic resistive wall
deviation
Wake $\text{Log}_{10} G_\perp$ [Log_{10} V/(C m)]
Deviation [%]
Time $\text{Log}_{10}\tau$ [Log_{10} s]
9
8
7
6
5
100
90
80
70
60
50
40
30
20
10
0
−7
−6
−5
−4
−3
−2
−1
0