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**Title**
WALL HEATING DUE TO BEAM BUNCH FIELDS

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**Publication Date**
1982
WALL HEATING FOR A GAUSSIAN BUNCH IN A CYLINDRICAL PIPE, PER WORTON & WILSON - AATF 17/15 (SLAC), IS GIVEN BY:

\[
\begin{align*}
P_{\text{tot}} &= \frac{\Gamma^{(3/4)} T_r I_0^2}{\Delta_{e}^{3/2} 4\pi^2} \left( \frac{\Lambda_0}{2\Delta_e} \right)^{1/2} L \quad \text{[Watts]} \\
&+ \frac{P_A}{2\pi \alpha L} \quad \text{[Watts/m²]}
\end{align*}
\]

WHERE:
- \(\Delta_e\) = DC CONDUCTION \(\left(\frac{1}{\text{ohm}}\right)\)
- \(I_0\) = PERMITTIVITY = \(4\pi \times 10^{-7} \text{ (F/m)}\)
- \(\Gamma_{(3/4)} = 1.2254\)
- \(Q = RADIUS (m)\)
- \(L = LENGTH (m)\)
- \(I_0 = AVERAGE \text{ CURRENT (AMPS)}\)
- \(\Delta_e = BUNCH \text{ LENGTH (FWHM)} \text{ (SEC)}\)
- \(T_r = \text{BUNCH SPREAD Zones (SEC)}\)

WALL HEATING:

FOR THE WIGGLEM CL. CONSIDER THE VACUUM CHAMBER A TUBE WITH RADIUS \(a\) (CONSERVATIVE). USE SS:

\[
\Delta_{\text{DC}} = 1.39 \times 10^6 \quad (1/\text{ohm})
\]
Foilスペクトル:

\[ I_0 = 100 \text{mA} \quad (n=4 \text{ bunches}) \]

基于 \[ I_0 = 50 \text{mA} \quad n^{1/2} \]

\[ \Delta t = (200 - 400) \text{ps} \quad \Delta x = (1.86 - 1.12) \text{m} \]

\[ T_{1/2} = \frac{1}{50} n = \frac{1}{1.28 \text{MHz}} \quad 4 = 195 \text{ns} \]

Foil Beam:

- Foil \( a = 1.01 \text{m} \)

\[ \frac{P_{\text{tot}} \text{ [Watts/m]}}{L} = \frac{(1.25 \times 10^{-4}) (195 \times 10^{-9} \text{sec}) (1 \text{ amp})}{(200 \times 10^{-12} \text{m})^{3/2}} \left( \frac{4 \pi \times 10^{-7} \text{H/m}}{2(1.39 \times 10^{-3} \text{m})} \right) \]

\[ = 1.44 \text{ [Watts/m]} \]

- Foil \( a = 1.003 \text{m} \)

\[ \frac{P_{\text{tot}}}{L} = 4.75 \text{ Watts/m} \quad \text{small!} \]

Skin Depth:

\[ \delta = \sqrt{\frac{1}{\sigma \Delta t / \pi f}} \quad (\text{m}) \]

For SS @ 1.28 MHz:

\[ \delta = \sqrt{\frac{1}{(1.39 \times 10^{-6} \text{S/m})(4 \pi \times 10^{-7} \text{H/m})(4.28 \times 10^{6} \text{W/m})}} \]

\[ = 3.77 \times 10^{-4} \text{m} = 0.37 \text{mm} \]
This report was done with support from the Department of Energy. Any conclusions or opinions expressed in this report represent solely those of the author(s) and not necessarily those of The Regents of the University of California, the Lawrence Berkeley Laboratory or the Department of Energy.

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