

IMPEDANCE BUDGET – EXTRACTION KICKER

A. Ghigo

CTF3 Impedance Contributing Elements (Very preliminary)

1. Phenomena' (not discontinuities).

- a) Coherent Synchrotron Radiation**
- b) Space Charge**
- c) Resistive Walls**

2. Big Vacuum Chamber Objects.

- a) RF Deflectors**
- b) Extraction Kicker**
- c) BPMs or Striplines**
- d) Synchrotron Radiation Port**
- e) Injection Port**
- f) Extraction Port**
- g) RF Cavity (if necessary)**

3. Small Discontinuities

- a) Tapers**
- b) Pumping Slots**
- c) Valves**
- d) Flanges**
- e) Shielded Bellows**
- f) Surface Roughness**

Resistive Wall Impedance and Wake

$$\frac{Z}{L}(\omega) = (1 + j) \frac{\omega Z_0 \delta}{c 4\pi b} F_0\left(\frac{b}{a}\right)$$

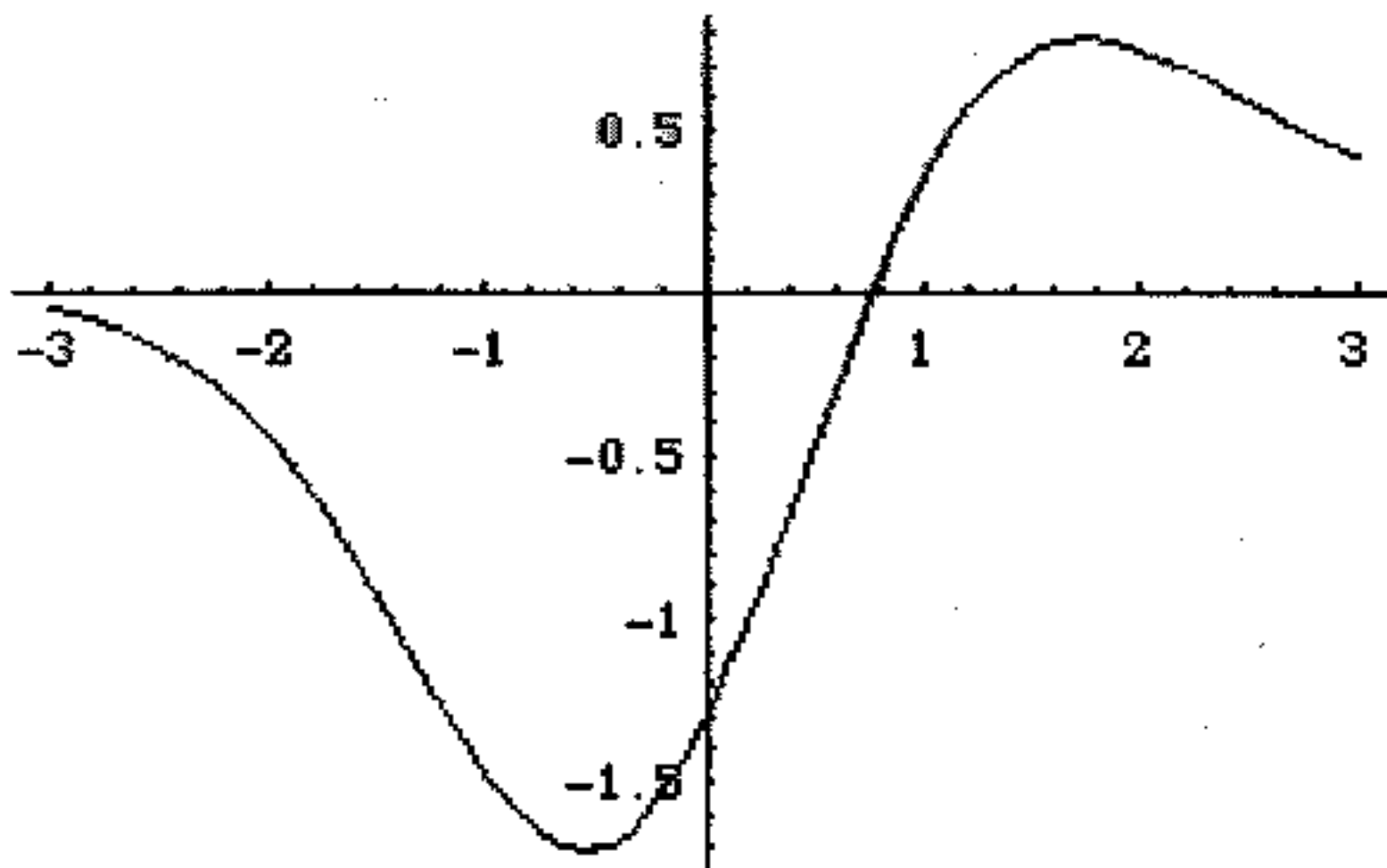
$$\frac{dk}{dL} = \frac{c}{4\pi^2 b \sigma_z^{3/2}} \sqrt{\frac{Z_0 \rho}{2}} \Gamma\left(\frac{3}{4}\right) F_0\left(\frac{b}{a}\right)$$

$$W(s) = \frac{Bc^{3/2}}{4\sigma_z^{3/2}} \left(\frac{|s|}{\sigma_z}\right)^{3/2} \exp\left\{-\frac{s^2}{4\sigma_z^2}\right\} \times$$

$$\left\{ I_{-3/4}\left(\frac{s^2}{4\sigma_z^2}\right) - I_{1/4}\left(\frac{s^2}{4\sigma_z^2}\right) \mp I_{-1/4}\left(\frac{s^2}{4\sigma_z^2}\right) \pm I_{3/4}\left(\frac{s^2}{4\sigma_z^2}\right) \right\}$$

where

$$B = \frac{1}{4\pi b} \sqrt{\frac{2\rho Z_0}{c}}$$



For CTF3 Combiner Ring after 5 turns:

$$\mathbf{E \text{ lost} = 13.35 \text{ keV}}$$

$$\mathbf{\Delta E = 35.25 \text{ keV}}$$

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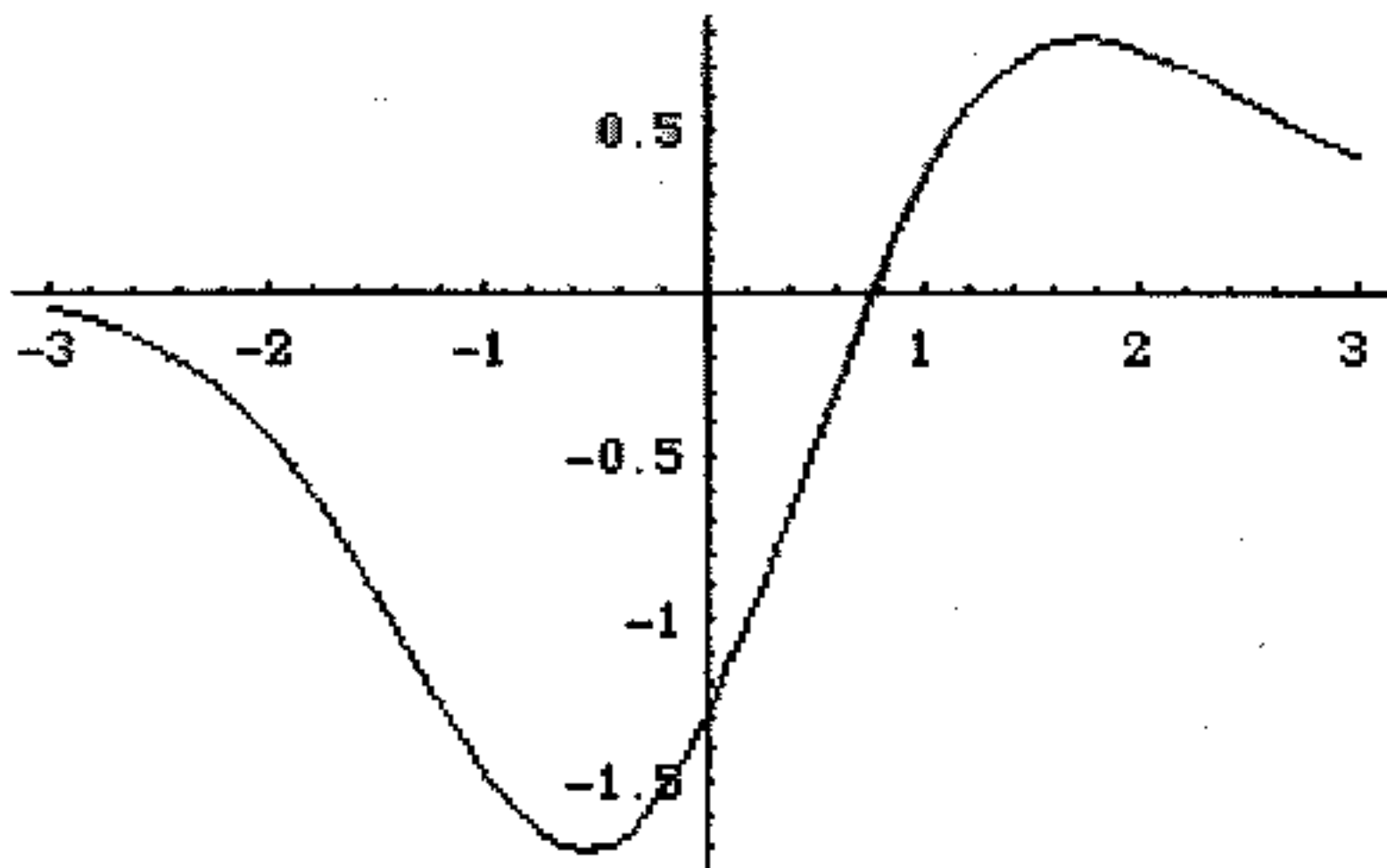
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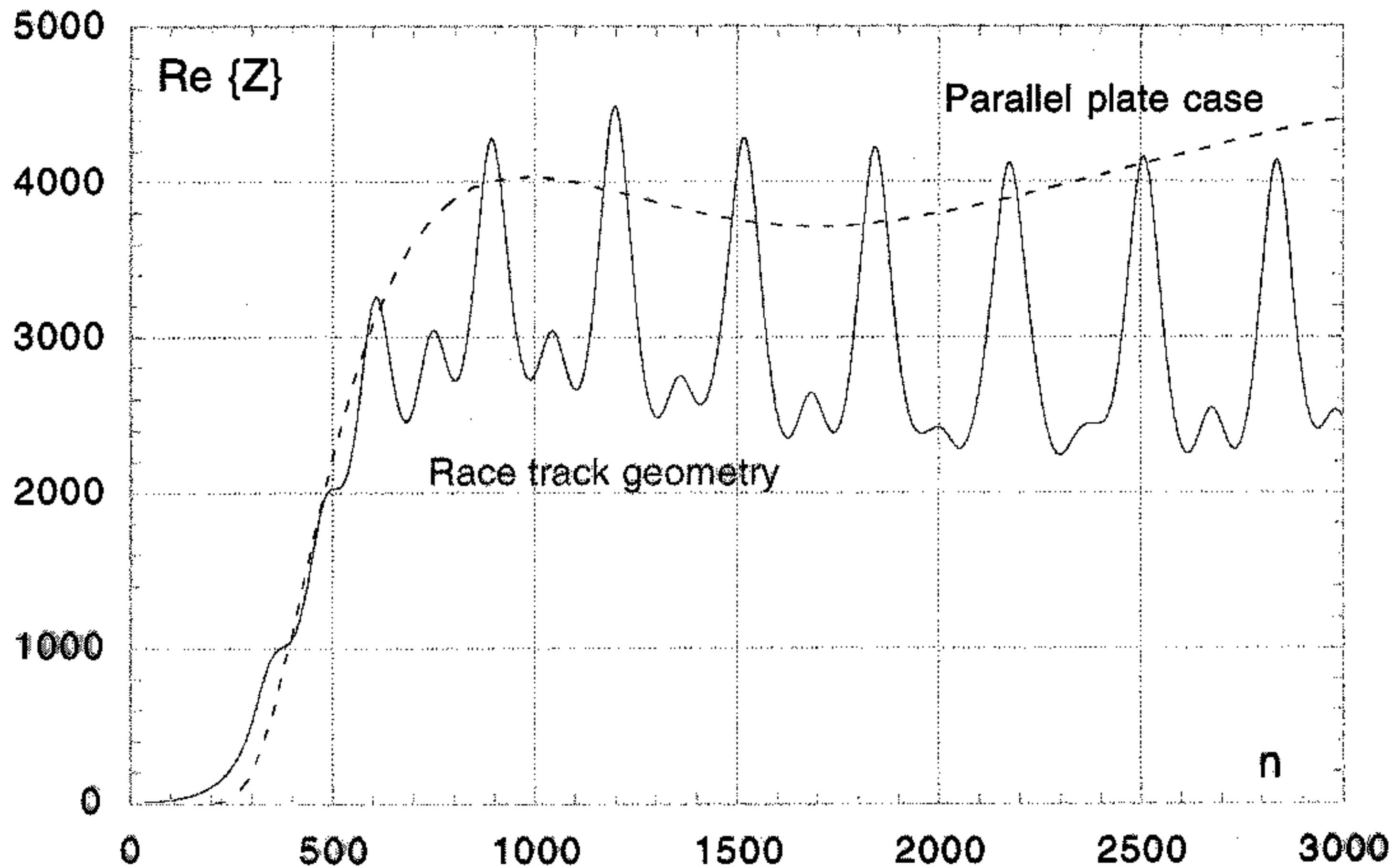


For CTF3 Combiner Ring after 5 turns:

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$$\mathbf{\Delta E = 35.25 \text{ keV}}$$

CSR in EPA magnets

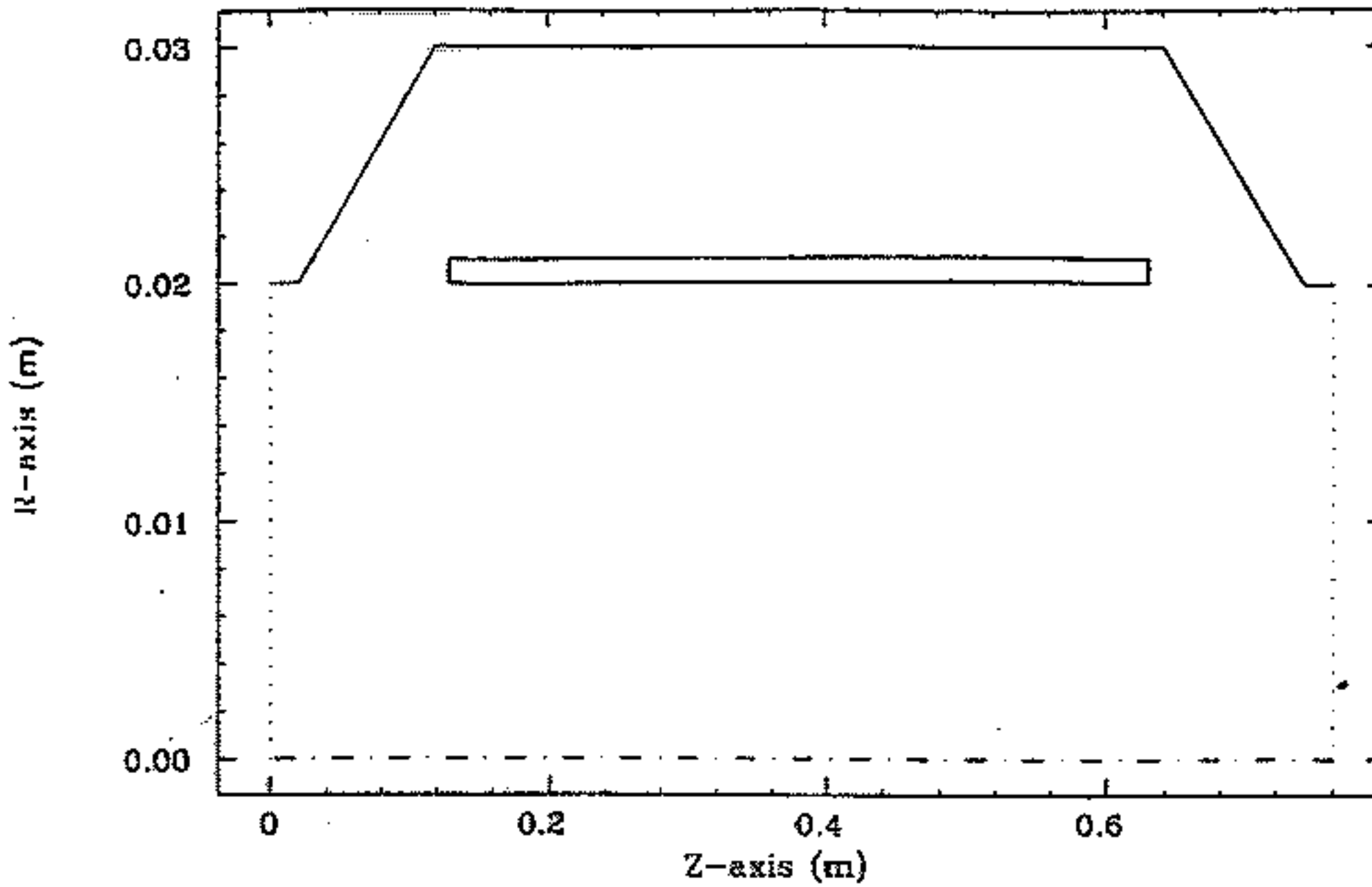


CTF3 Extraction Kicker

Cavity Shape Input

/10/00 12.51.08

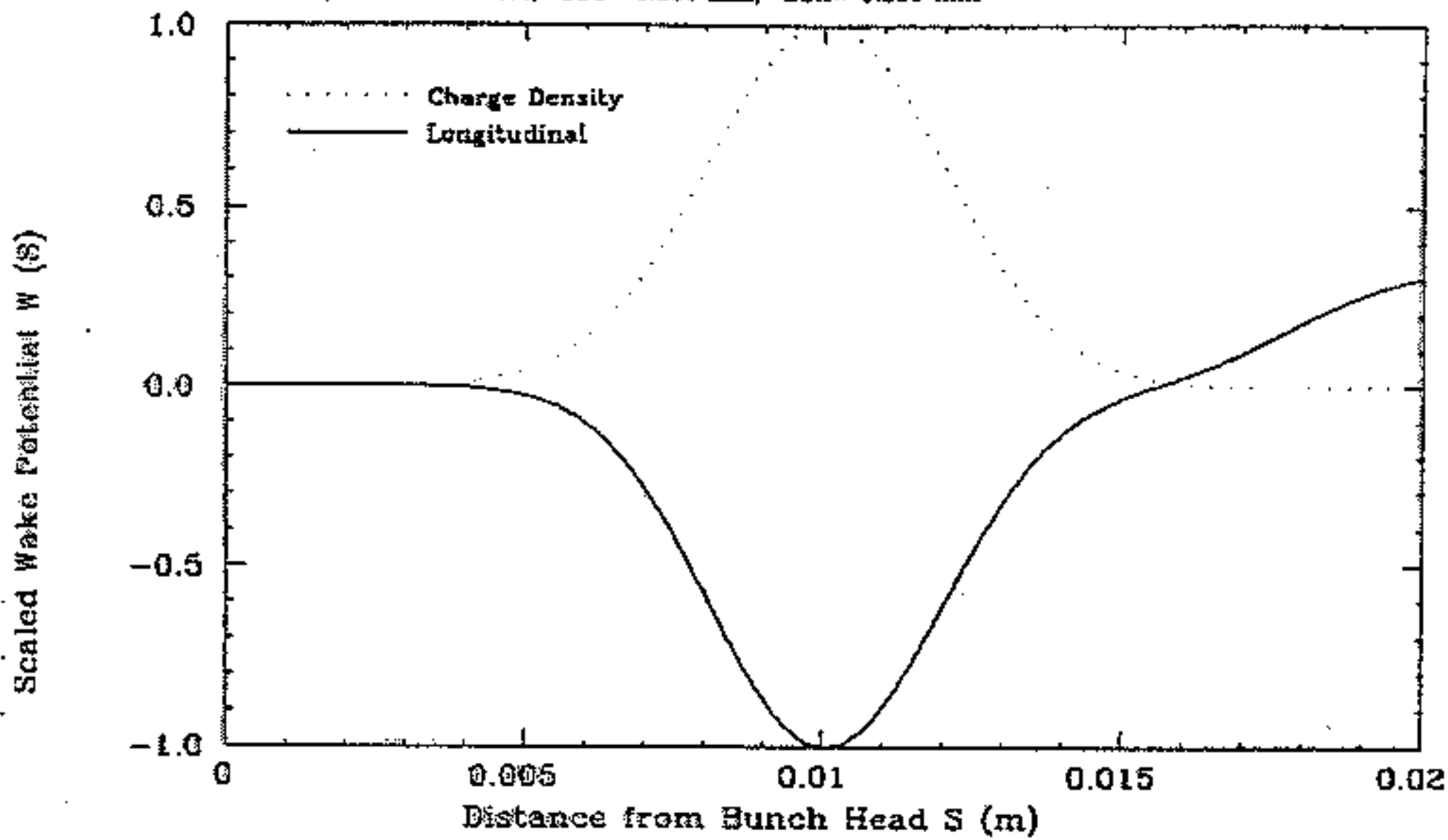
A B C I 8.7 : EXTRACTION KICKER CTF3 COMBINER RING
DDZ= 0.100 mm, DDR= 0.100 mm



Wake Potentials

Cpu Time Used: 0.666E+01(s)
30/10/00 12.36.17

A B C I 8.7 : EXTRACTION KICKER CTF3 COMBINER RING
MROT= 0, SIG= 0.200 cm, DDZ= 0.200 mm, DDR= 0.200 mm



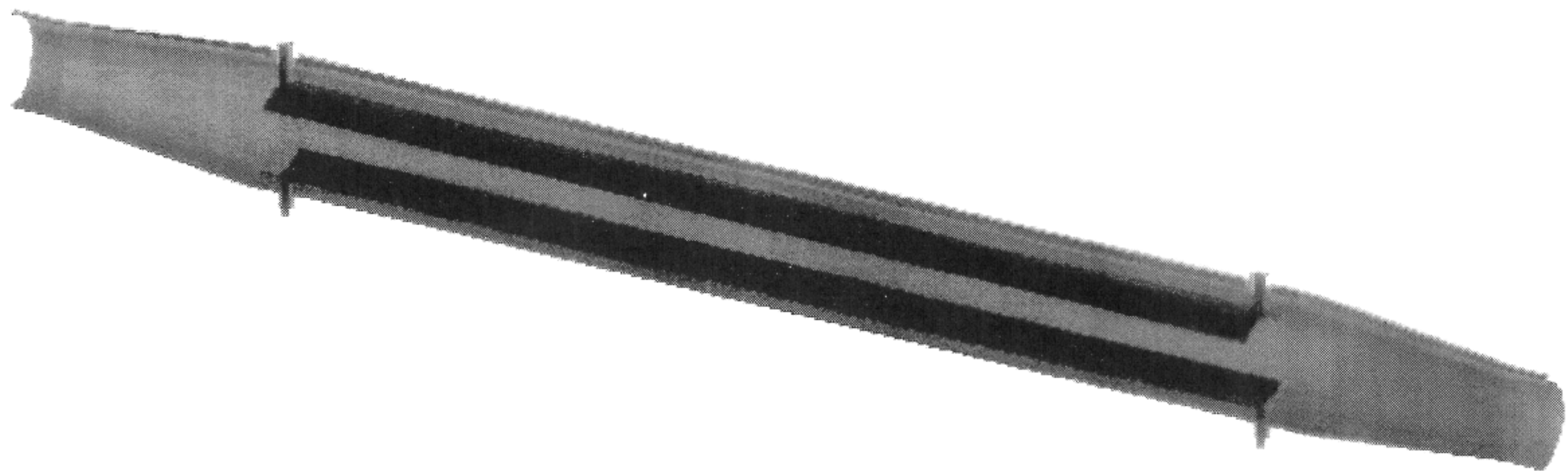
Longitudinal Wake Min/Max= -2.215E+00/ 6.905E-01 V/pC, Loss Factor= -1.544E+00 V/pC

σ_z, mm	$Ke, \frac{\text{V}}{\text{C}}$	W_{MAX}	$W_{\text{min}}, \frac{\text{V}}{\text{C}}$
0.5	$5.914 \cdot 10^{12}$	$5.667 \cdot 10^{11}$	$-9.667 \cdot 10^{12}$
1	$3.008 \cdot 10^{12}$	$9.420 \cdot 10^{10}$	$-4.205 \cdot 10^{12}$
2	$1.544 \cdot 10^{12}$	$6.905 \cdot 10^{11}$	$-2.215 \cdot 10^{12}$
3	$9.897 \cdot 10^{11}$	$7.935 \cdot 10^{11}$	$-1.429 \cdot 10^{12}$

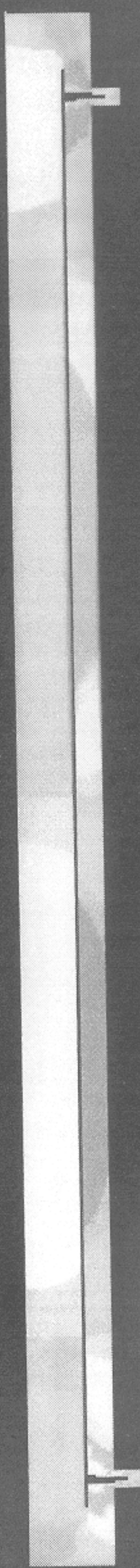
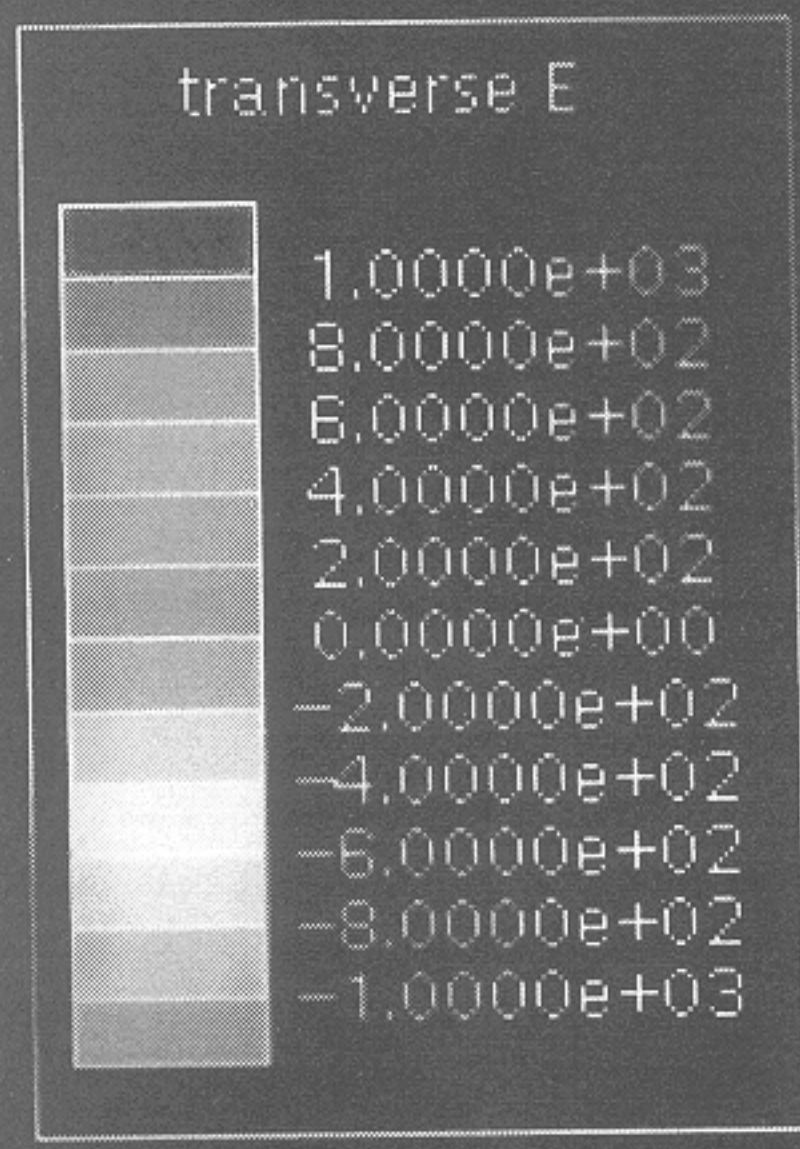
After 5 turns with $Q = 2.33 \text{ nC}$:

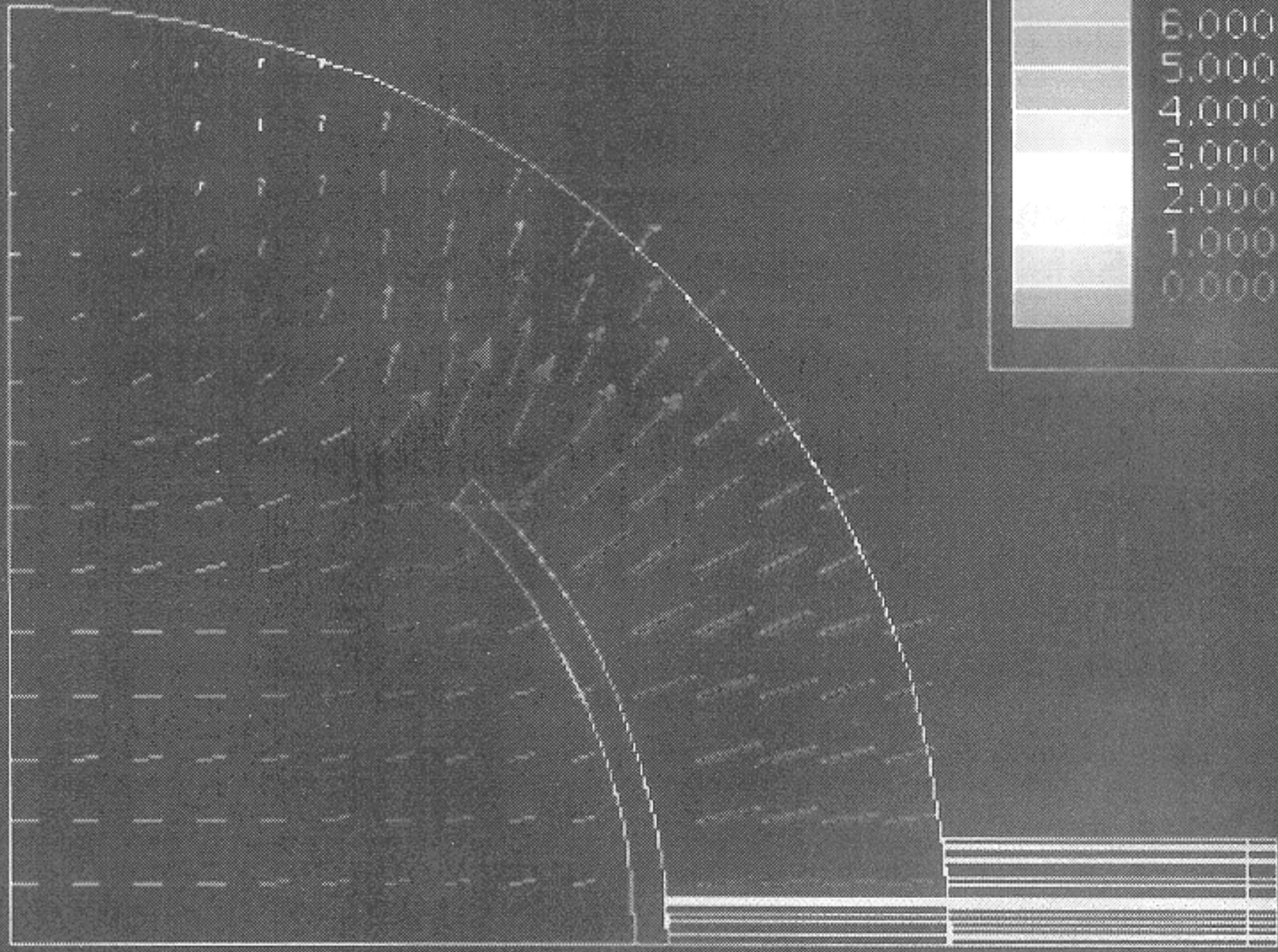
$E_{\text{lost}} = 18 \text{ keV}$
 $\Delta E_{\text{MAX}} = 34 \text{ keV}$

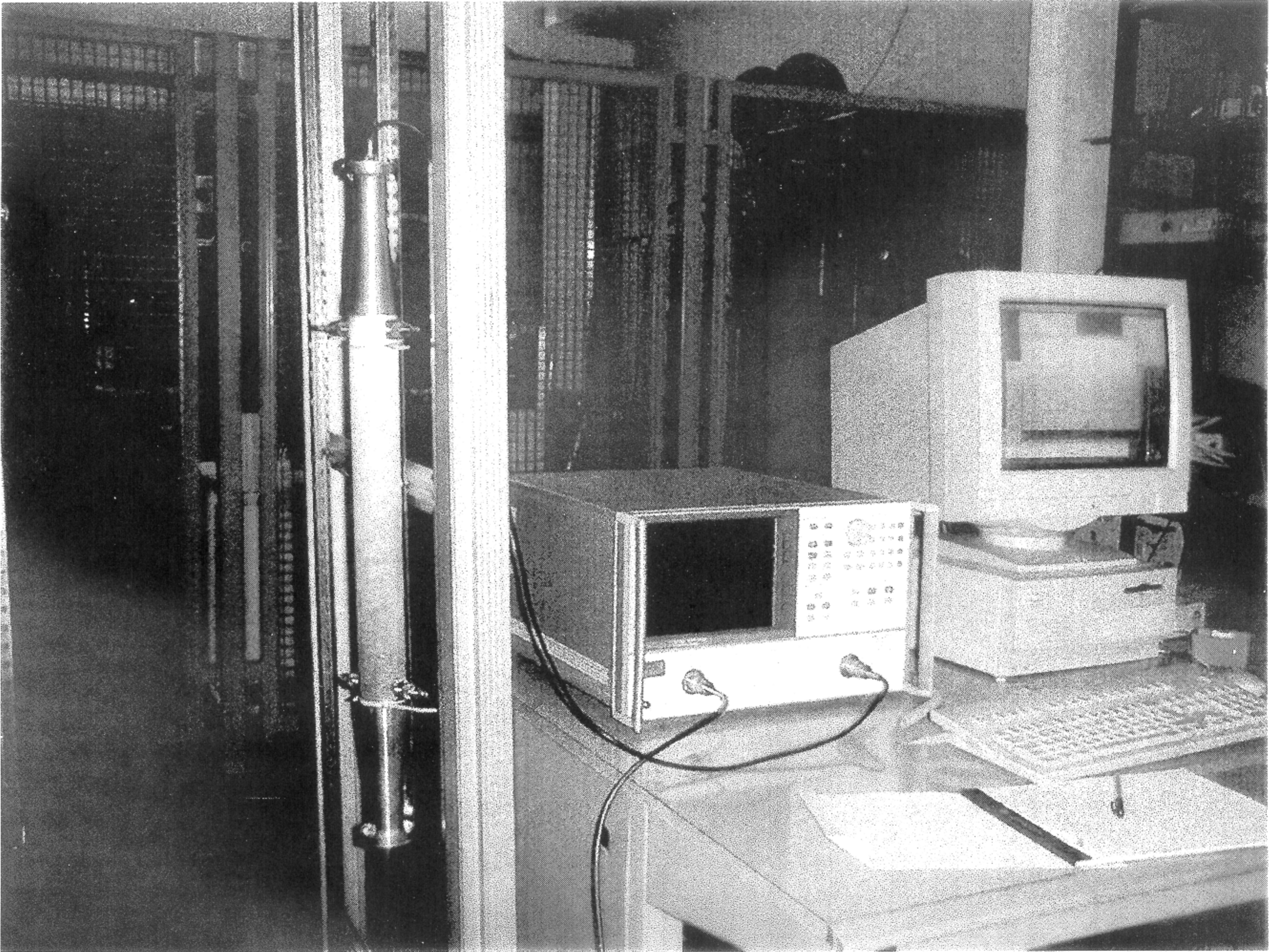
for $\sigma_z = 2 \text{ mm}$



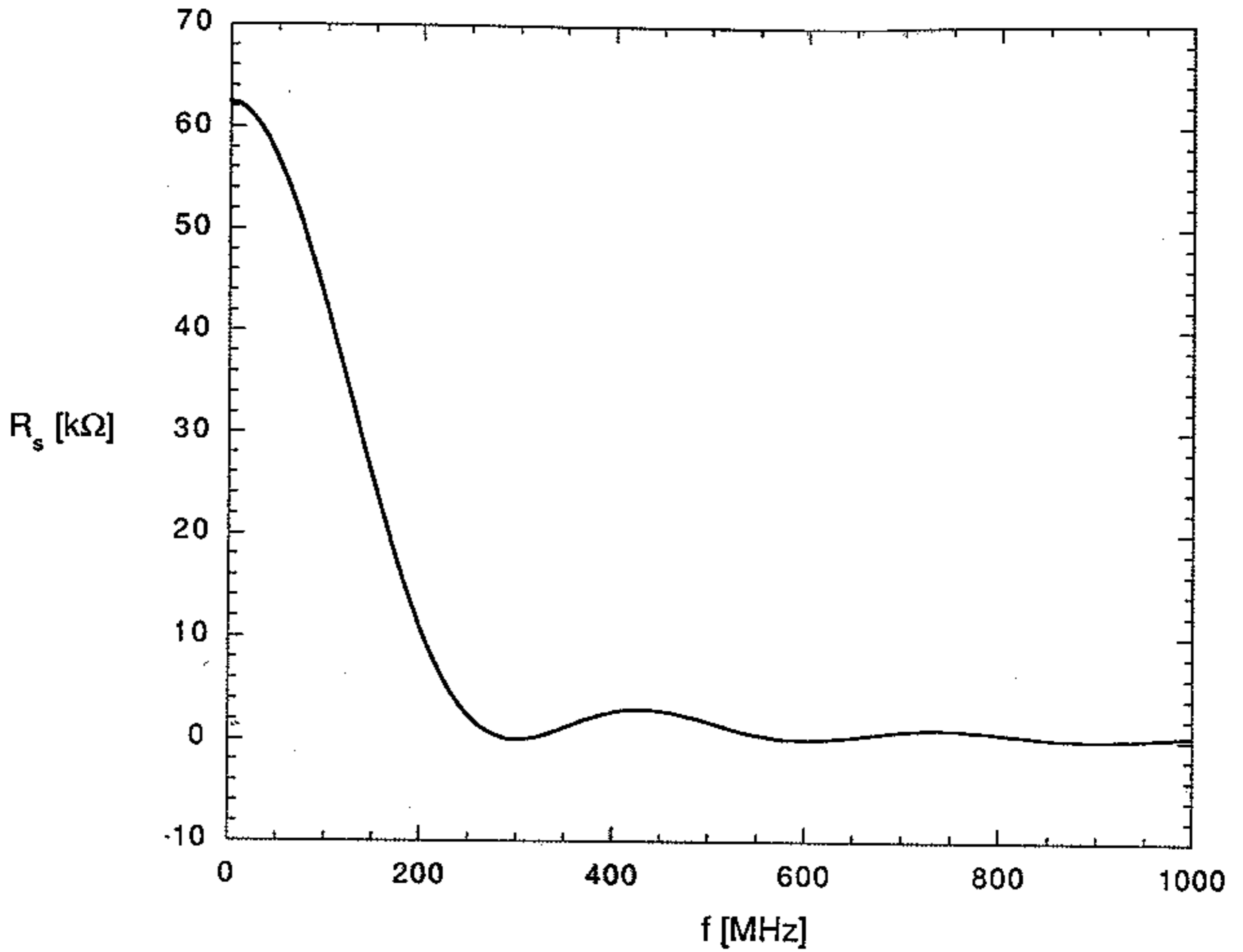
F. MARCELLINI







transverse shunt impedance



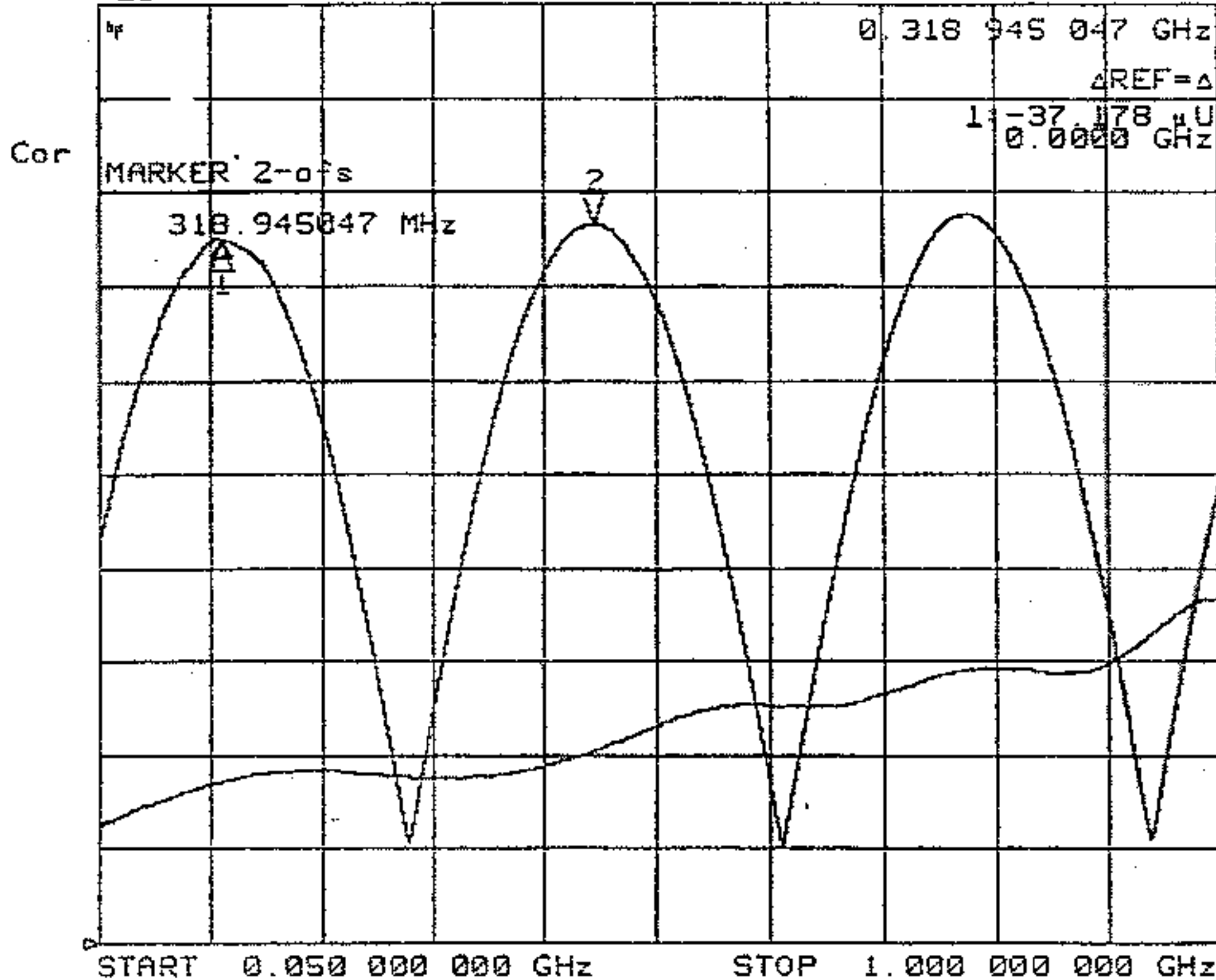
$$R_s^{\perp} = 2 Z_0 \frac{\sin^2(kl)}{kh^2}$$

$Z_0 = 50 \Omega$
 $l = 50 \text{ cm}$
 $h = 2 \text{ cm}$

No HOM (TRANSVERSE) TRAPPED UP TO 3 GHz

HOM LONGITUDINAL: SOME MODE TRAPPED BETWEEN 4 AND 5 GHz (TAPERS)

CH1 S21&M 11n MAG 10 mU/ REF -10 mU 2: 1.6661 mU



CH1 S21/M log MAG 10 dB/ REF 0 dB 1: 20.158 dB

