Super-B:
Be pipe heating.

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Super-B parameters. March 3, 2010

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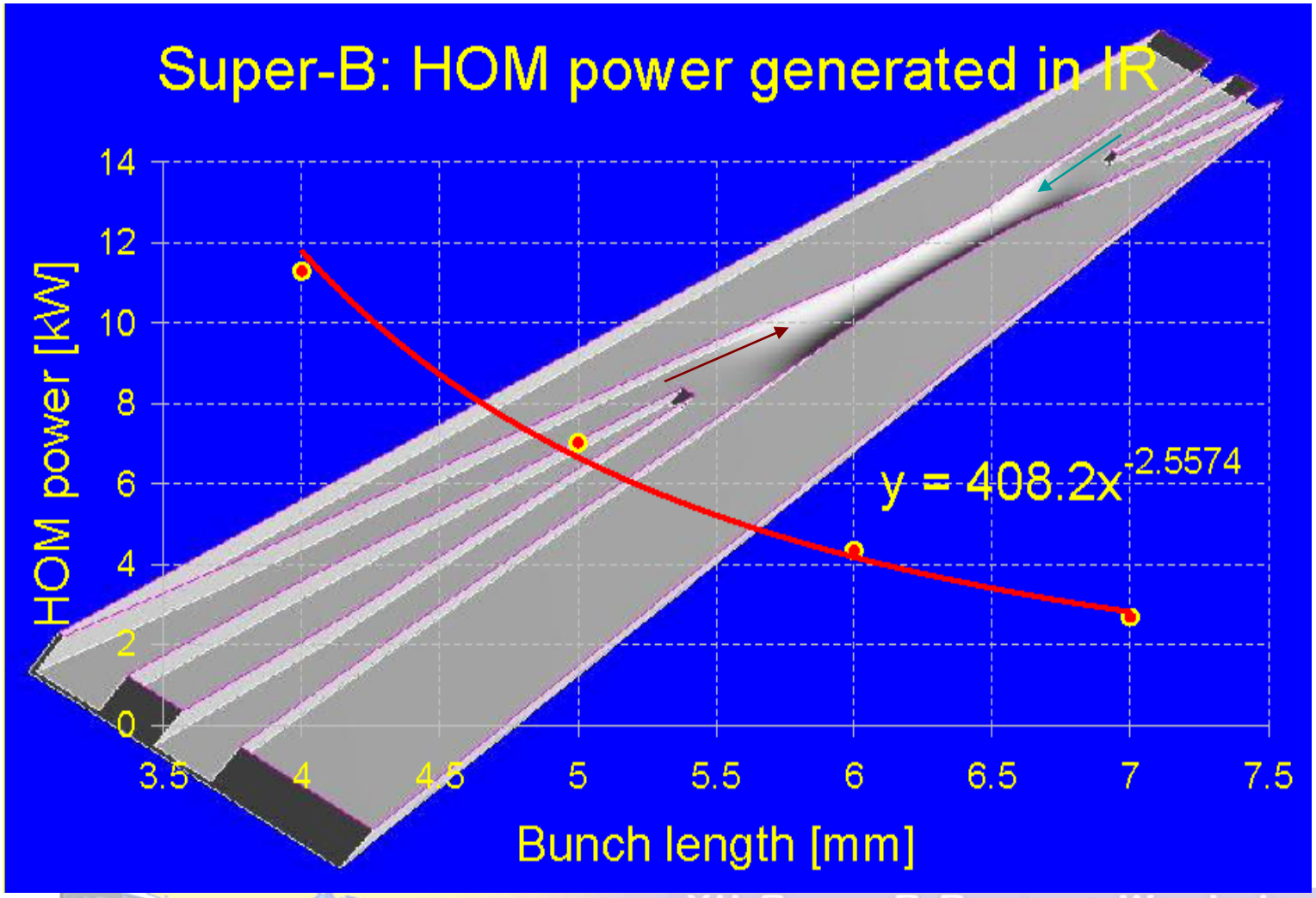
(Bold: computed values)		Base Line		Low Emittance		High Current		Tau/Charm (prelim.)	
Parameter	**Units**	**HER (e+)**	**LER (e-)**	**HER (e+)**	**LER (e-)**	**HER (e+)**	**LER (e-)**	**HER (e+)**	**LER (e-)**
Energy	**GeV**	6.7	4.18	6.7	4.18	6.7	4.18	2.58	1.61
Circumference	**m**	1258.4		1258.4		1258.4		1258.4	
Bunch length (zero current)	**mm**	4.69	4.29	4.73	4.34	4.03	3.65	4.75	4.36
Bunch length (full current)	**mm**	5	5	5	5	4.4	4.4	5	5
Beam current	**mA**	1892	2447	1460	1888	3094	4000	1365	1766
N. Buckets distance		2	2	2	2	1	1	1	1
Ion gap	**%**	2	2	2	2	2	2	2	2
RF frequency	**Hz**	4.76E+08	4.76E+08	4.76E+08	4.76E+08	4.76E+08	4.76E+08	4.76E+08	4.76E+08
Revolution frequency	**Hz**	**2.38E+05**		**2.38E+05**		**2.38E+05**		**2.38E+05**	
Harmonic number	**#**	**1998**		**1998**		**1998**		**1998**	
Number of bunches	**#**	**978**		**978**		**1956**		**1956**	
N. Particle/bunch	**#**	**5.08E+10**	**6.56E+10**	**3.92E+10**	**5.06E+10**	**4.15E+10**	**5.36E+10**	**1.83E+10**	**2.37E+10**
Bunch current	**mA**	**1.935**	**2.502**	**1.493**	**1.930**	**1.582**	**2.045**	**0.698**	**0.903**
Energy Loss/turn	**MeV**	2.11	0.865	2.11	0.865	2.11	0.865	0.4	0.166
Momentum compaction		4.36E-04	4.05E-04	4.36E-04	4.05E-04	4.36E-04	4.05E-04	*4.36E-04*	*4.05E-04*
Energy spread (zero current)	**dE/E**	6.31E-04	6.68E-04	6.31E-04	6.68E-04	6.31E-04	6.68E-04	*6.31E-04*	*6.68E-04*
Energy spread (full current)	**dE/E**	6.43E-04	7.34E-04	6.43E-04	7.34E-04	6.43E-04	7.34E-04	*6.94E-04*	*7.34E-04*
CM energy spread	**dE/E**	**5.00E-04**		**5.00E-04**		**5.00E-04**		**5.26E-04**	
Energy acceptance		0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Synchrotron frequency	**kHz**	3.01	2.8	2.97	2.77	3.54	3.26	2.96	2.77
Synchrotron tune		0.0126	0.0118	0.0125	0.0116	0.0148	0.0137	0.0124	0.0116
SR power loss	**MW**	**3.99**	**2.12**	**3.08**	**1.63**	**6.53**	**3.46**	**0.55**	**0.29**
RF Wall Plug Power (SR only)	**MW**	**12.22**		**9.43**		**19.98**		**1.68**	
Total RF Wall Plug Power	**MW**	17.08		12.72		30.48		3.11	
Number of cavities		12	8	12	8	20	12	6	4
Number of Klystrons		6	4	6	4	10	6	3	2
Total Number of klystrons		10		10		16		5	
RF Voltage	MV	7.01	5.25	6.88	5.13	9.3	7.2	2.54	1.94
R_s	MΩ								
Q_0									
β									

Wake field simulations for the Super-B Interaction Region



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Beryllium pipe

- The longitudinal resistive–wall wake fields have been investigated in the IR Be chamber for two cases:
- Case 1
- Radius to inner surface 10 mm conductivity 10^6 ohm-1 m-1
- 1st layer Au 4 um 48.8
- 2nd layer Be 0.5mm 25
-
- Case 2
- Radius to inner surface 10 mm
- 1st layer Au 4 um 48.8
- 2nd layer Be 0.4mm 25
- 3rd layer Ni 7 um 14.6

Longitudinal field

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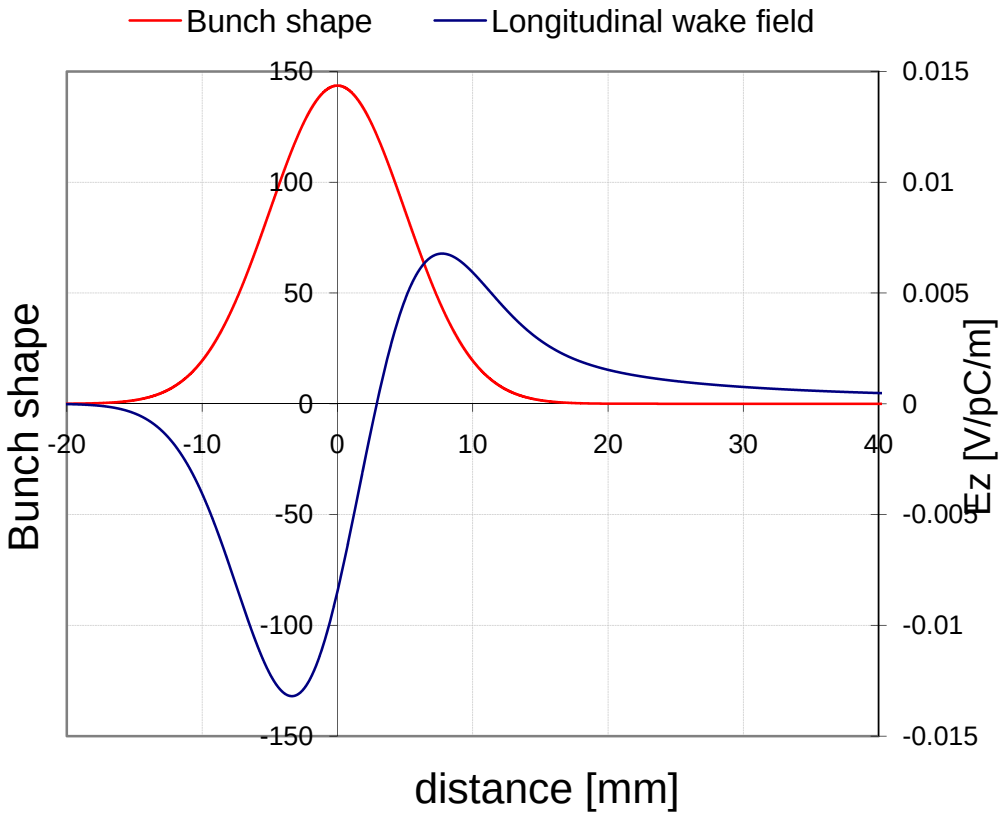

Loss factor and power

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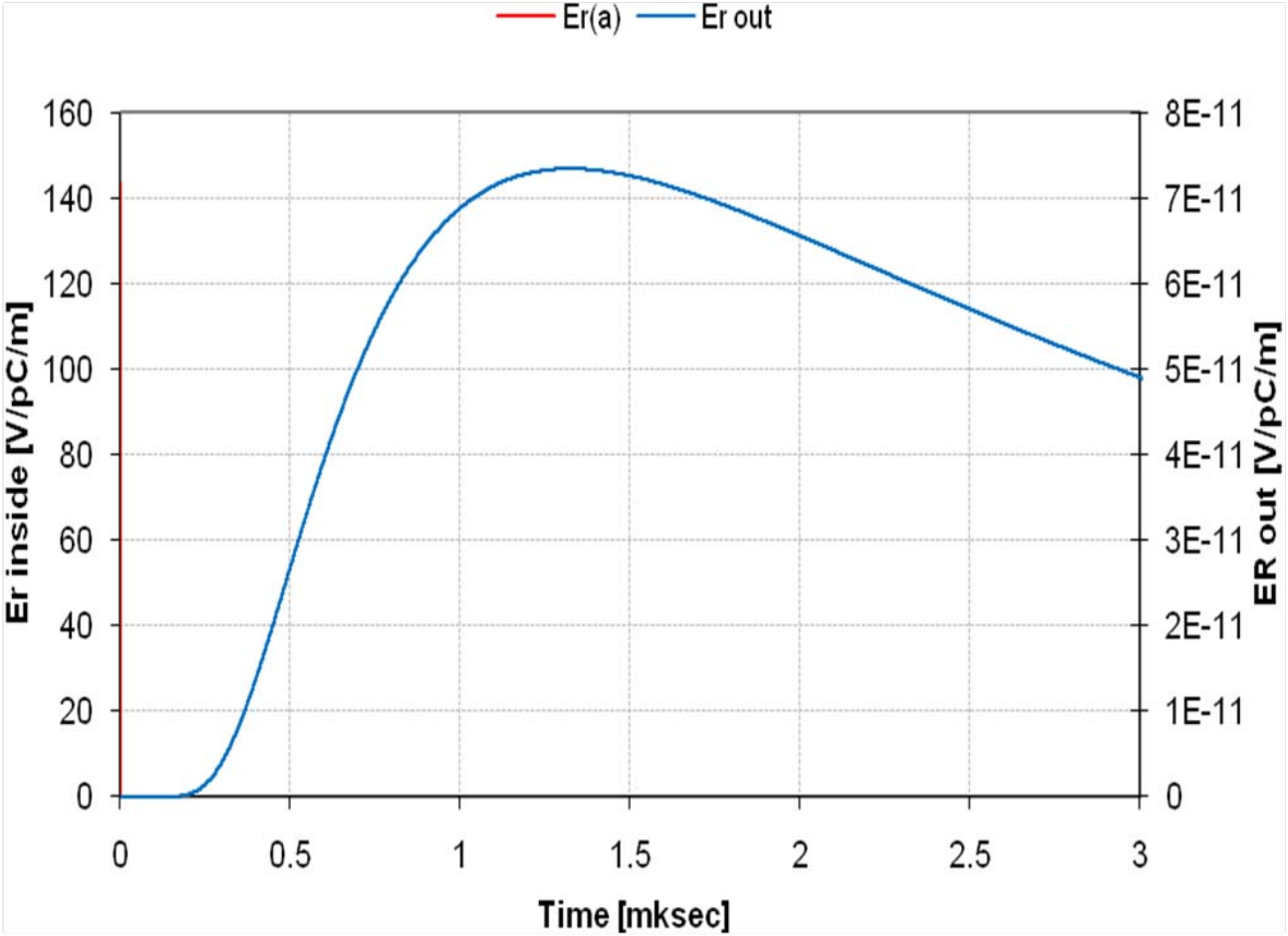
Loss factor [V/pC/m]	Bunch [mm]	inner radius [mm]	wall thickness [mm]	Q nC	I	P [kW/m]
5.07E-03	5	10	0.504	9.18E+00	2.20E+00	0.2062

Single bunch transverse field



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Estimates

$$\frac{\partial E}{\partial t} \approx \frac{c}{Z_0 \sigma} \frac{\partial^2 E}{\partial x^2}$$

Solution for initial conditions $E = \delta(x)$

$$E = \sqrt{\left(\frac{Z_0 \sigma}{4\pi c t}\right)} \exp\left(-\frac{Z_0 \sigma}{4ct} x^2\right)$$

diffusion "time"

$$\frac{Z_0 \sigma}{4ct_d} d^2 \sim 1 \quad t_d \sim \frac{Z_0 \sigma}{4c} d^2$$

$$t_d = \frac{120\pi \cdot 25 \cdot 10^6}{4 \cdot 3 \cdot 10^8} \left(5 \cdot 10^{-4}\right)^2 = \pi \cdot 10^{-1} \cdot 25 \cdot 25 \cdot 10^{-8} = 1963 \cdot 10^{-9} \approx 2\mu s$$

Multi-bunch transverse field

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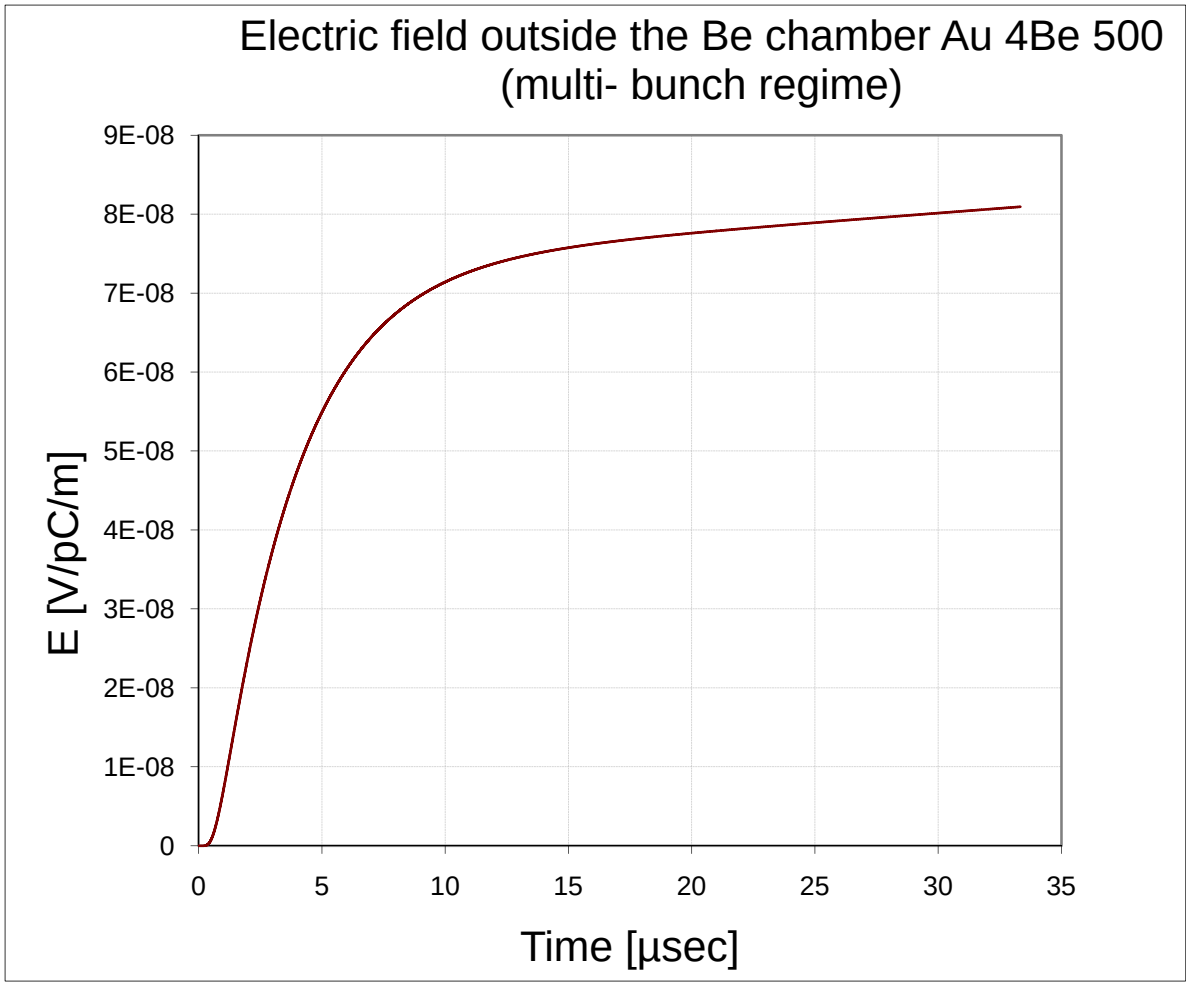

Fields outside 10mm tube Au 4 Be 400 Ni 7

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