Loss factor measurement at KEKB LER @ 2009.10.26

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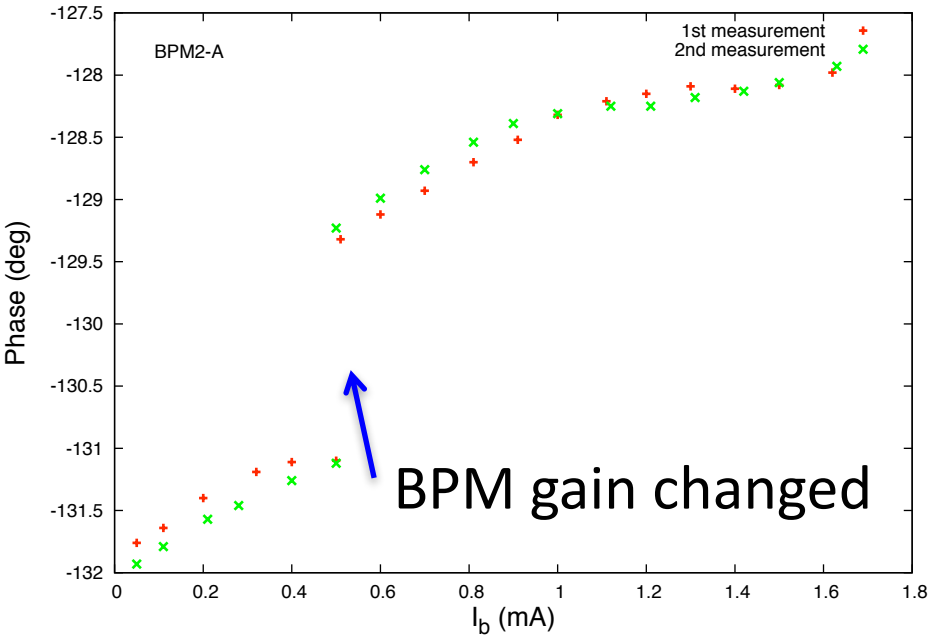
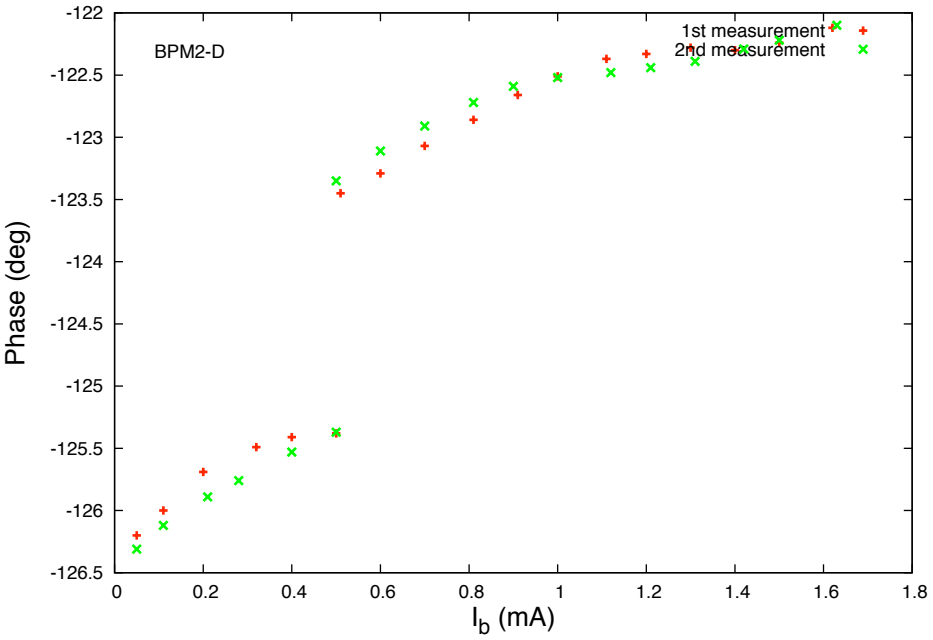
Introduction

- Loss factor
  - Beam phase shift (Ieiri-san)
  - RF power balance
  - GdfidL calculation
- Bunch length
  - streak camera (Flanagan-san)
  - MWI simulation

Beam phase shift (Raw data)

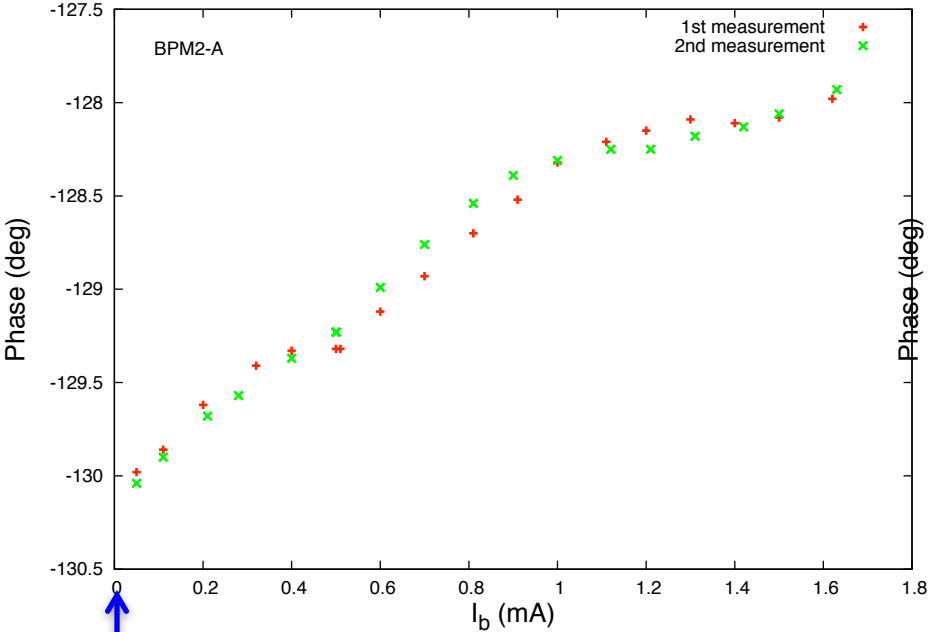


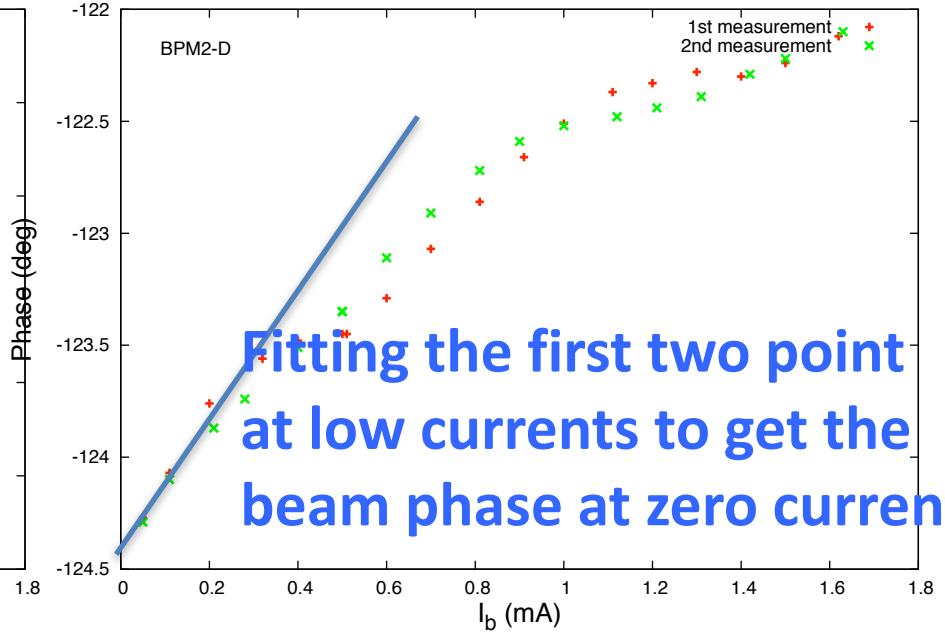


Beam phase shift (Calibrated)

$$V_c \sin(\phi_{s0} + \Delta\phi_s) = U_0/e + k_{//}(\sigma_s) T_0 I_b$$

$$U_0 = 1.82\text{MeV} \quad V_c = 8\text{MV} \quad \phi_{s0} = 13.15\deg$$



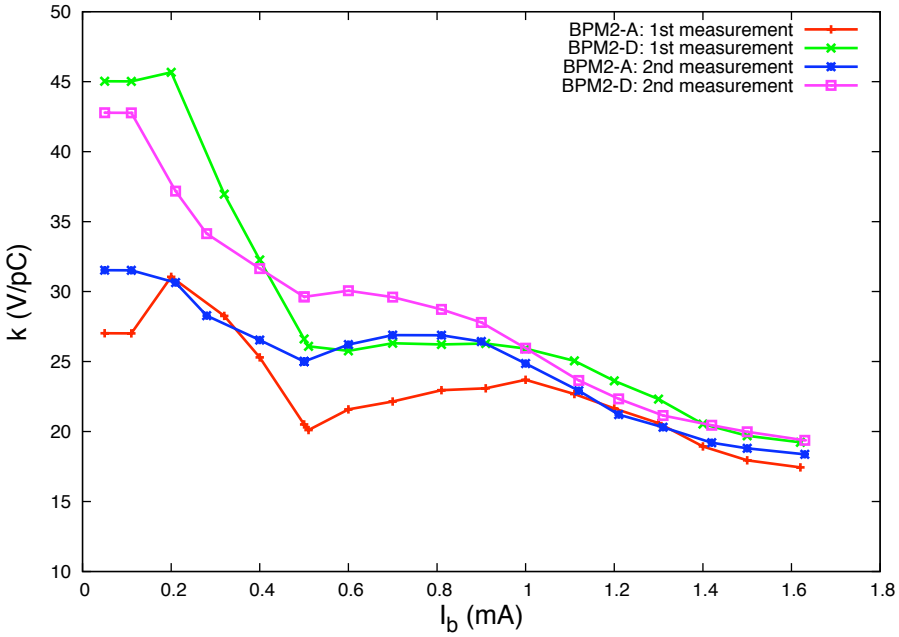


Fitting the first two point at low currents to get the beam phase at zero current

Beam phase at zero current is important…

Loss factor calculated from beam phase shift (1)

$$V_c \sin(\phi_{s0} + \Delta\phi_s)$$
$$= U_0/e + k_{//}(\sigma_s) T_0 I_b$$
$$U_0 = 1.82\text{MeV}$$
$$V_c = 8\text{MV}$$
$$\phi_{s0} = 13.15\text{deg}$$

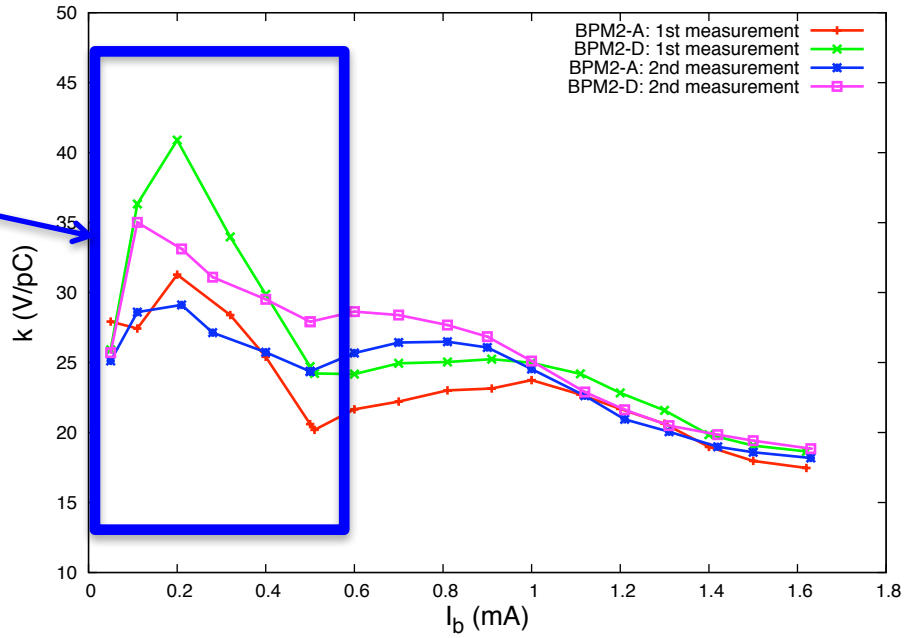


$k_{//} \approx 25$ V/pC @ $I_b = 1$ mA

Beam phase:
Fitting first
2 points

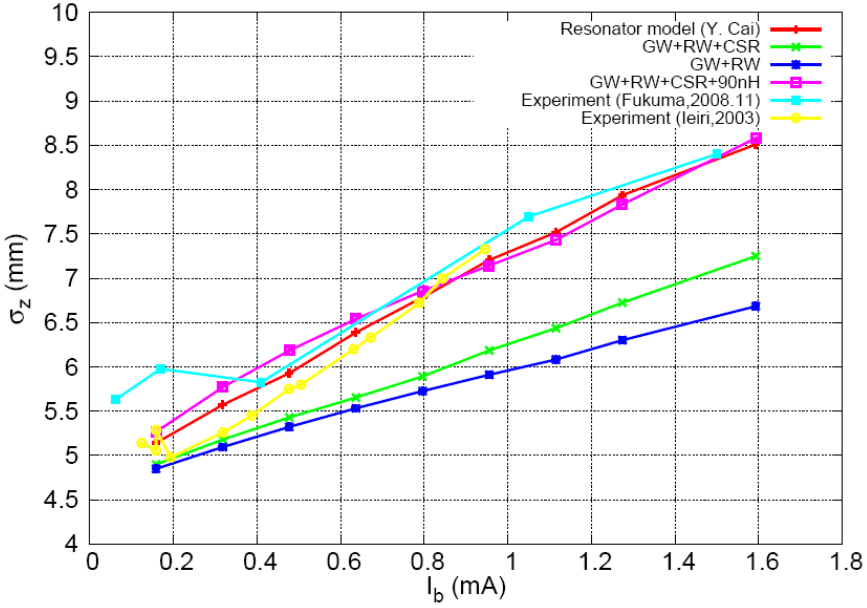
Loss factor calculated from beam phase shift (2)

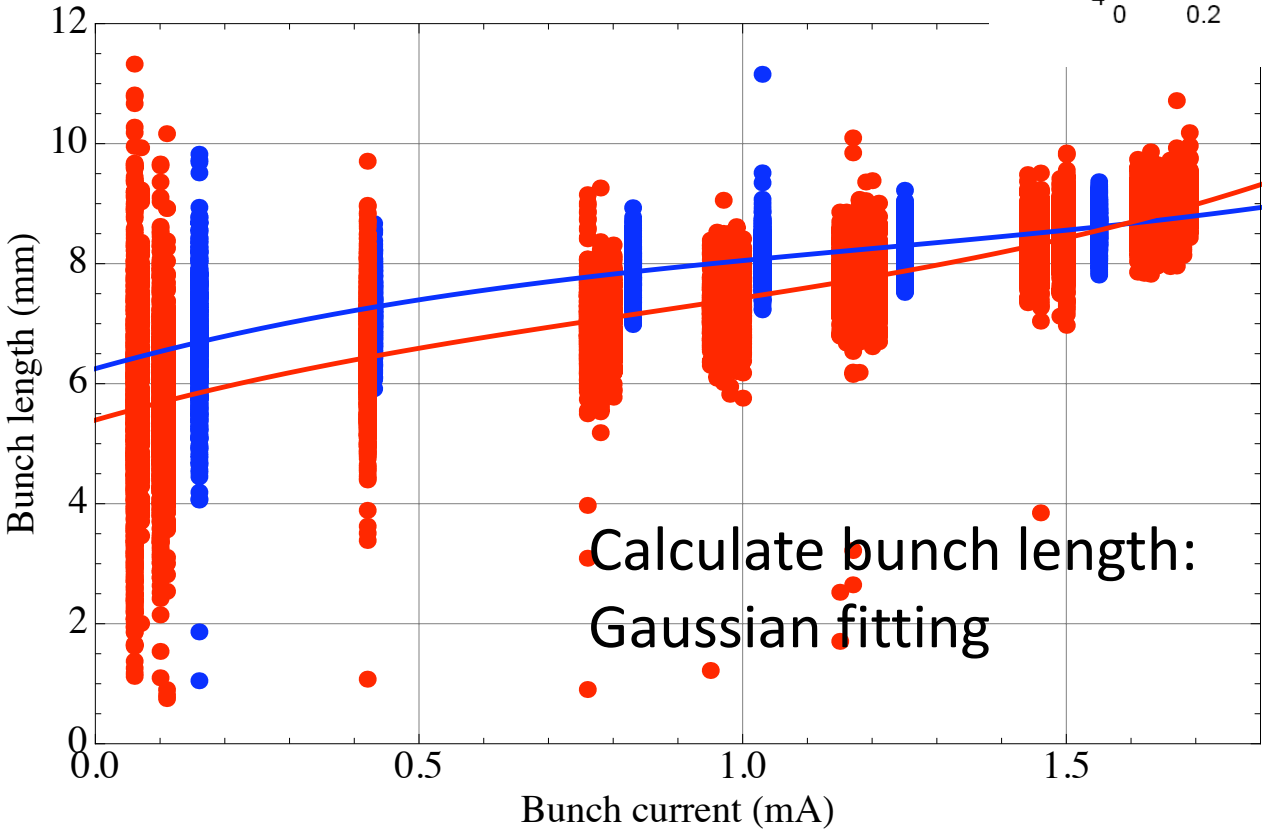
Quite depend on choice of beam phase at zero current

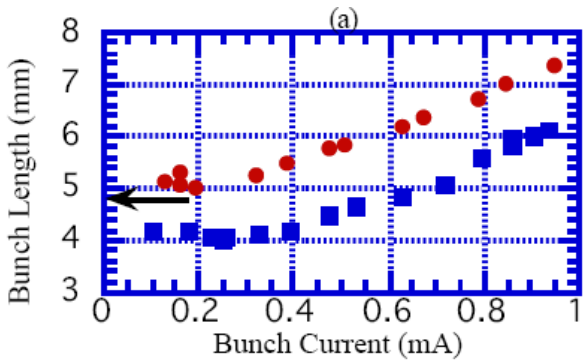


Beam phase:
Fitting first
4 points

Bunch length vs. bunch current (2009.10.26, Flanagan-san)

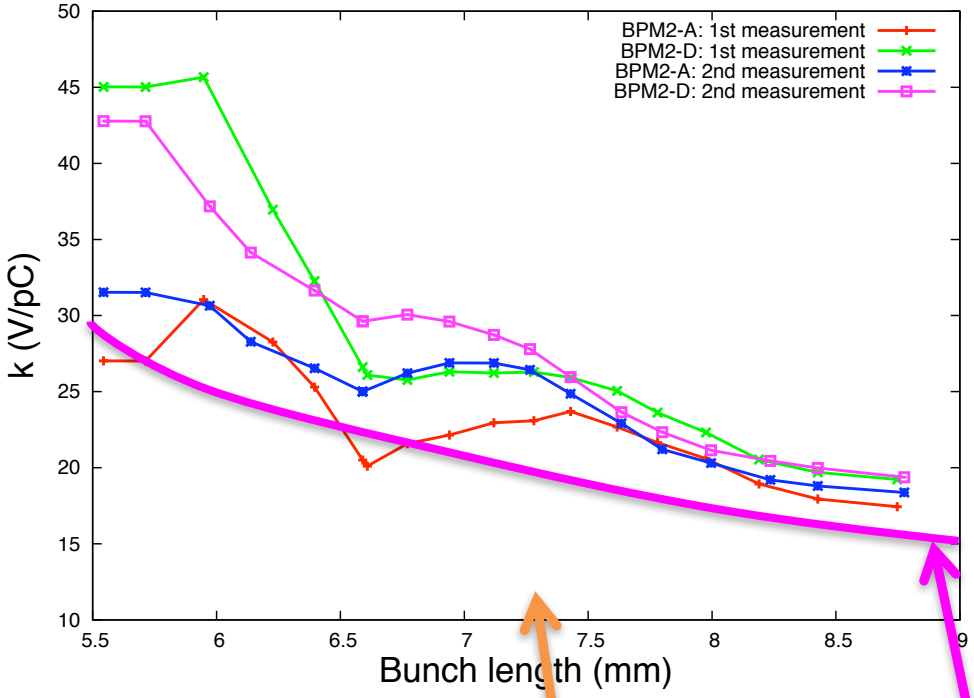


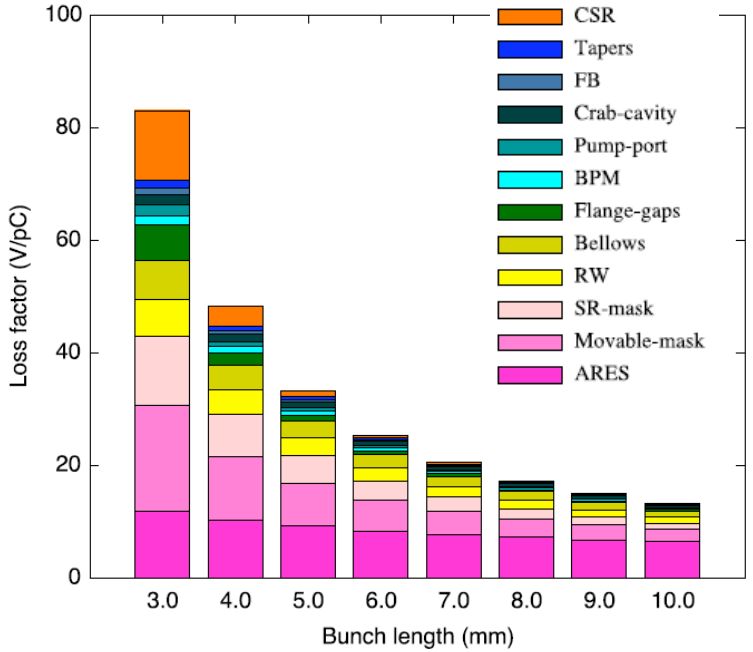




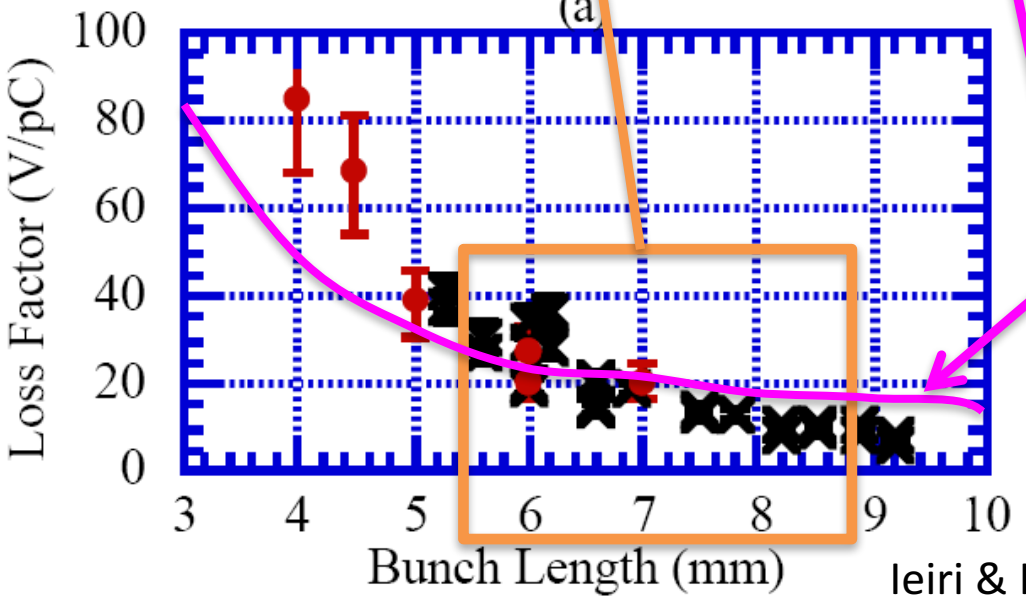
Ieiri & Koiso, 2003

Loss factor vs. bunch length





GdfidL calculation

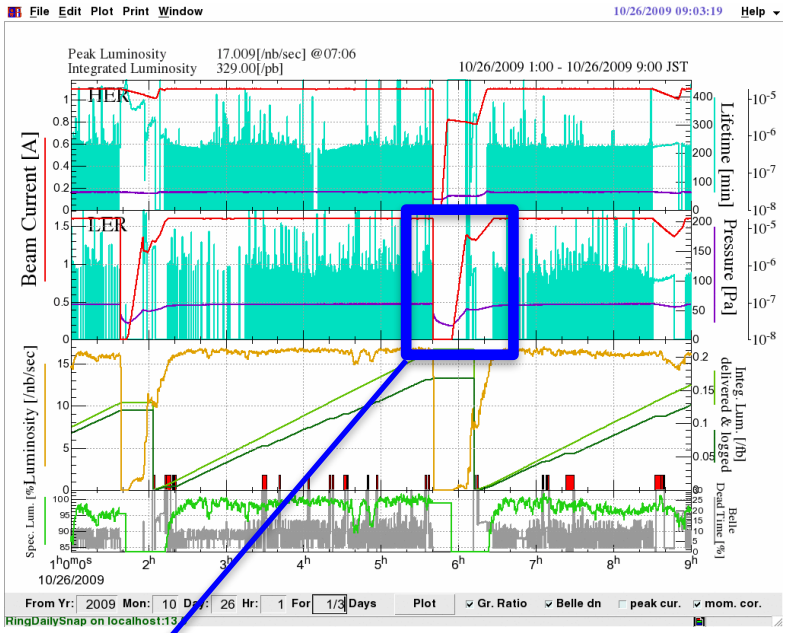


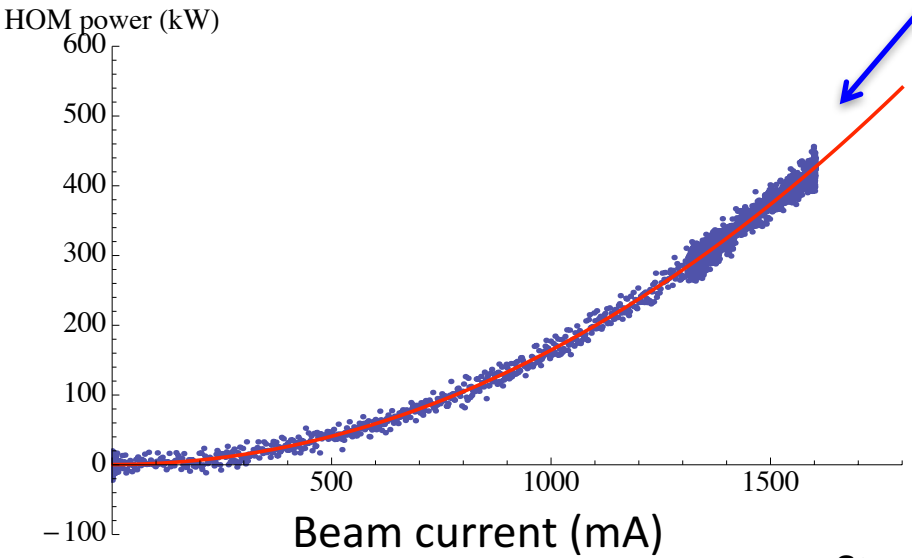
GdfidL calculation

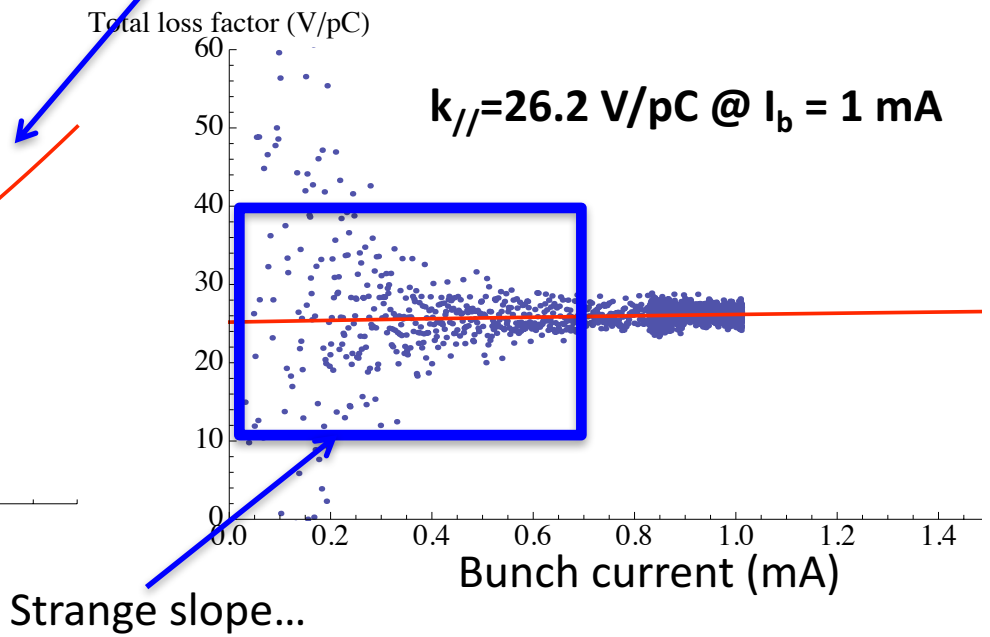
Ieiri & Koiso, 2003

RF power balance method
E=3.594074 GeV @ Y(5S)
(2009.10.26)

At I_b=1 mA, the $k_{//}$ results are similar from the RF power balance method and beam phase shift method





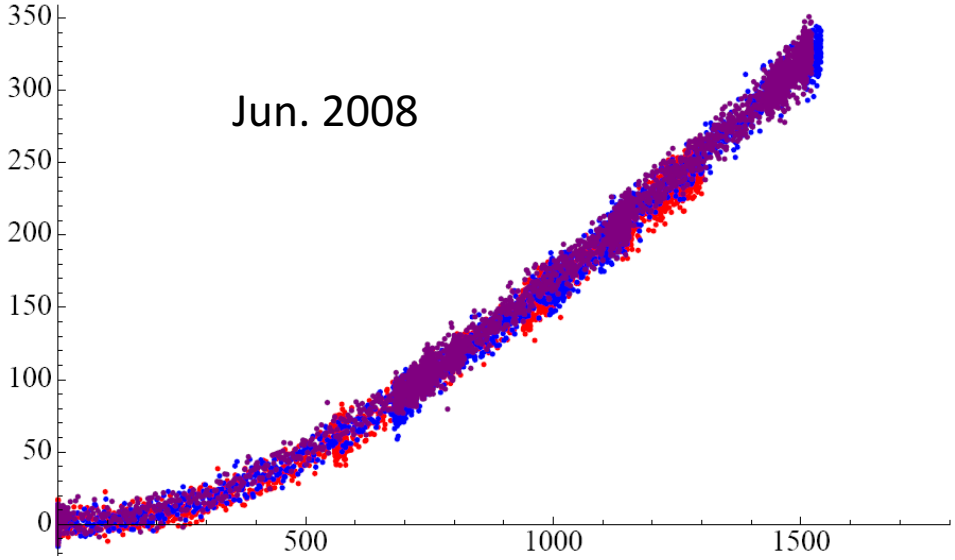


$k_{//}$=26.2 V/pC @ I_b = 1 mA

Strange slope…

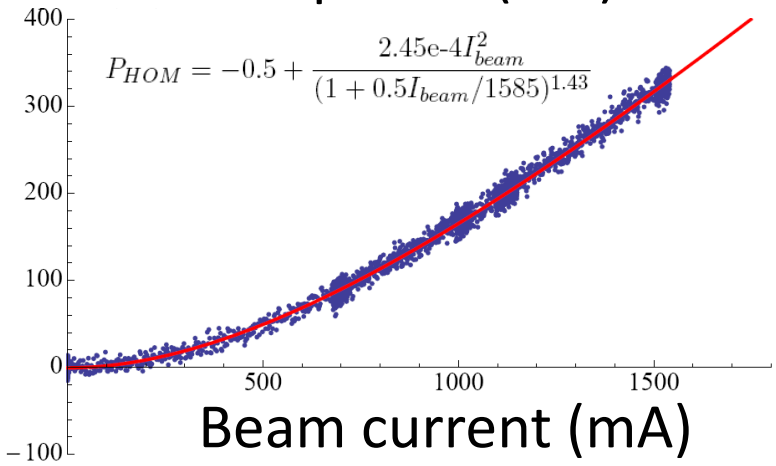
E=3.128585 GeV

Total HOM power (kW)



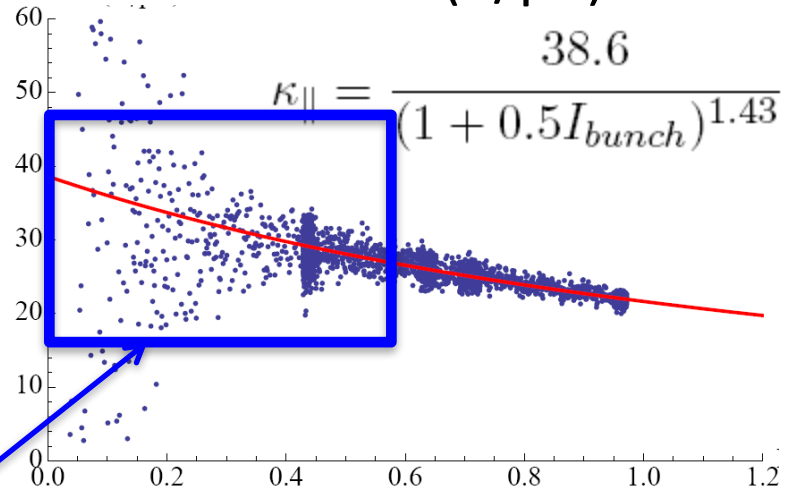
Beam current (mA)

Total HOM power (kW)



Beam current (mA)

Total Loss factor (V/pC)



Reasonable slope…

Bunch current (mA)

Conclusions

- Loss factor
  - Beam phase shift method and RF power balance method agree at I_b=1 mA.
  - Measured loss factors (Oct. 26, 2009) at KEKB LER were higher GdfidL calculations (?)
- Bunch length
  - Streak camera data showed similar bunch lengthening as experiments in Nov., 2008
- Future work
  - Find other impedance sources (CSR calculation)
  - Improve RF power balance method?