Trip report KEK

First ILC Workshop

"Towards an International Design of a Linear Collider,"
13.-15.11.04

http://lcdev.kek.jp/ILCWS/

My contributions:
"Brief Statement from CERN to ILC WG4 (BDIR)" (invited, WG4)
"Collective Effects and Instabilities in the ILC Damping Rings" (invited, WG3)
"BDIR Configuration Model" (with T. Markiewicz, invited, WG4)

Summaries of WGs3&4 presented in CLIC seminar Monday 22.11.04

6th Workshop on a Higher Luminosity B Factory

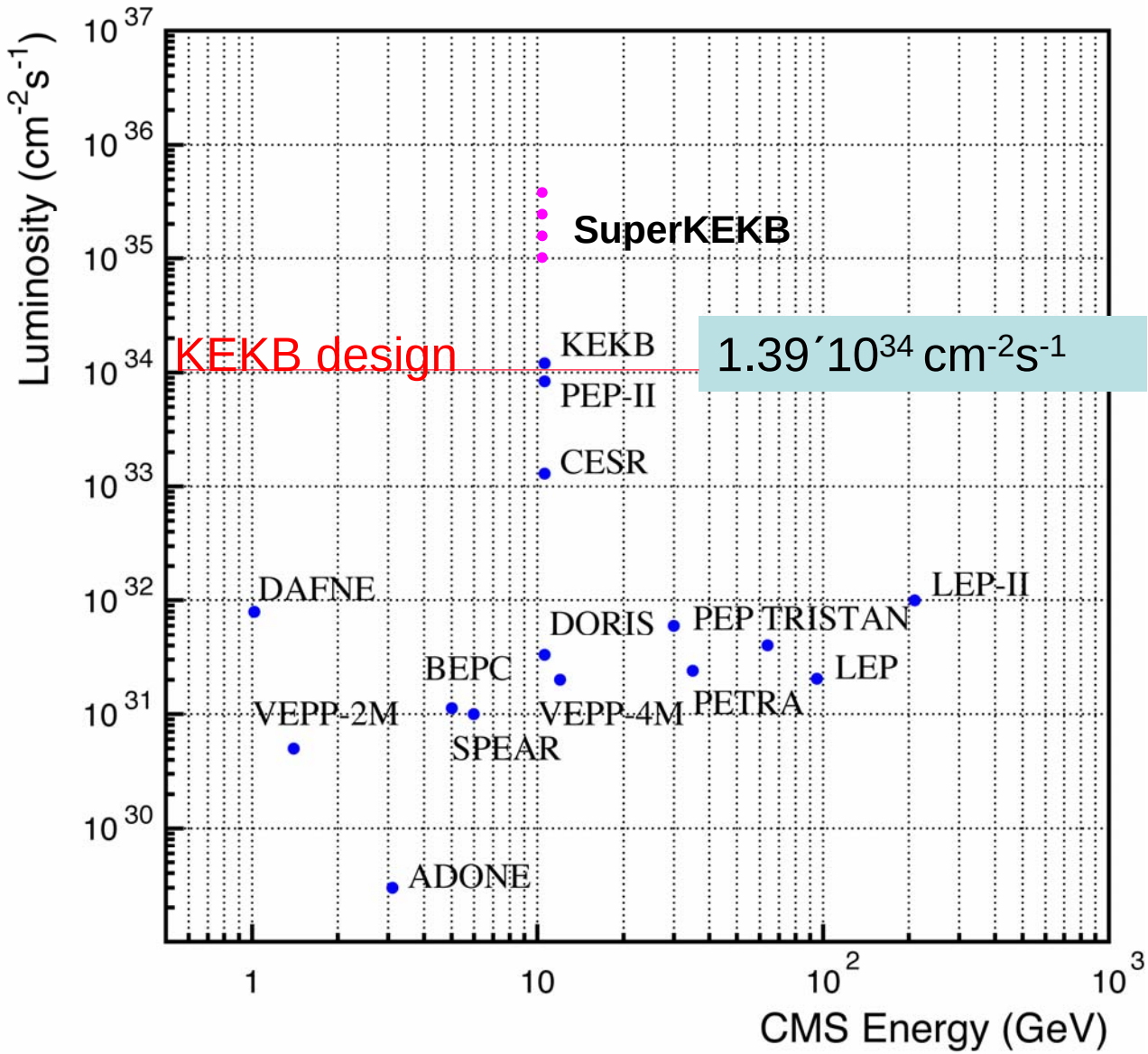
16-18.11.04

http://belle.kek.jp/superb/workshop/2004/HL6/

My contributions:
"LHC - Overview & Prospects" (invited)
"Possible Role of Ions in Electron Cloud Effects"
"Special Topic: Nonlinear Collimation"

Luminosity goal

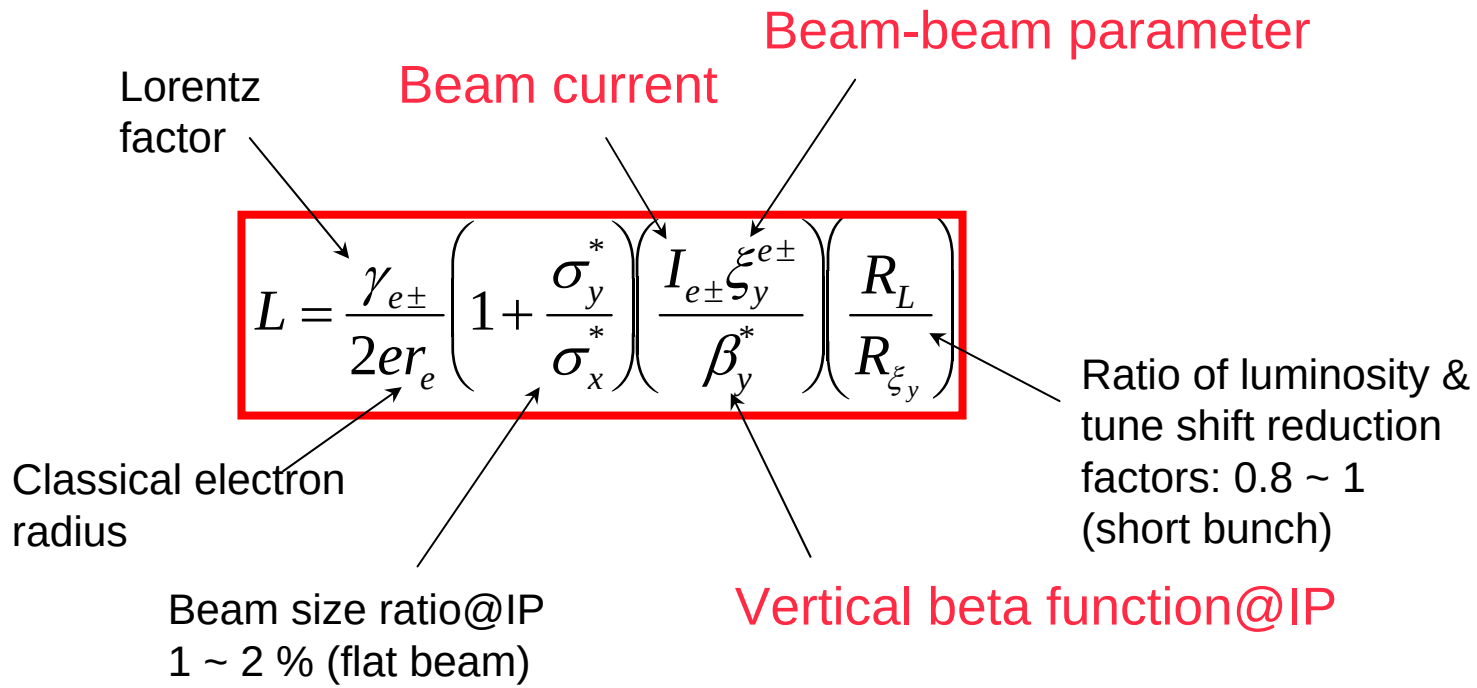
M. Masuzawa



F. Zimmermann, LCE meeting, 26.11.04

Strategy

M. Masuzawa



Increase beam currents

- **1.6 A (LER) / 1.2 A (HER) → 9.6 A (LER) / 4.1 A (HER)**

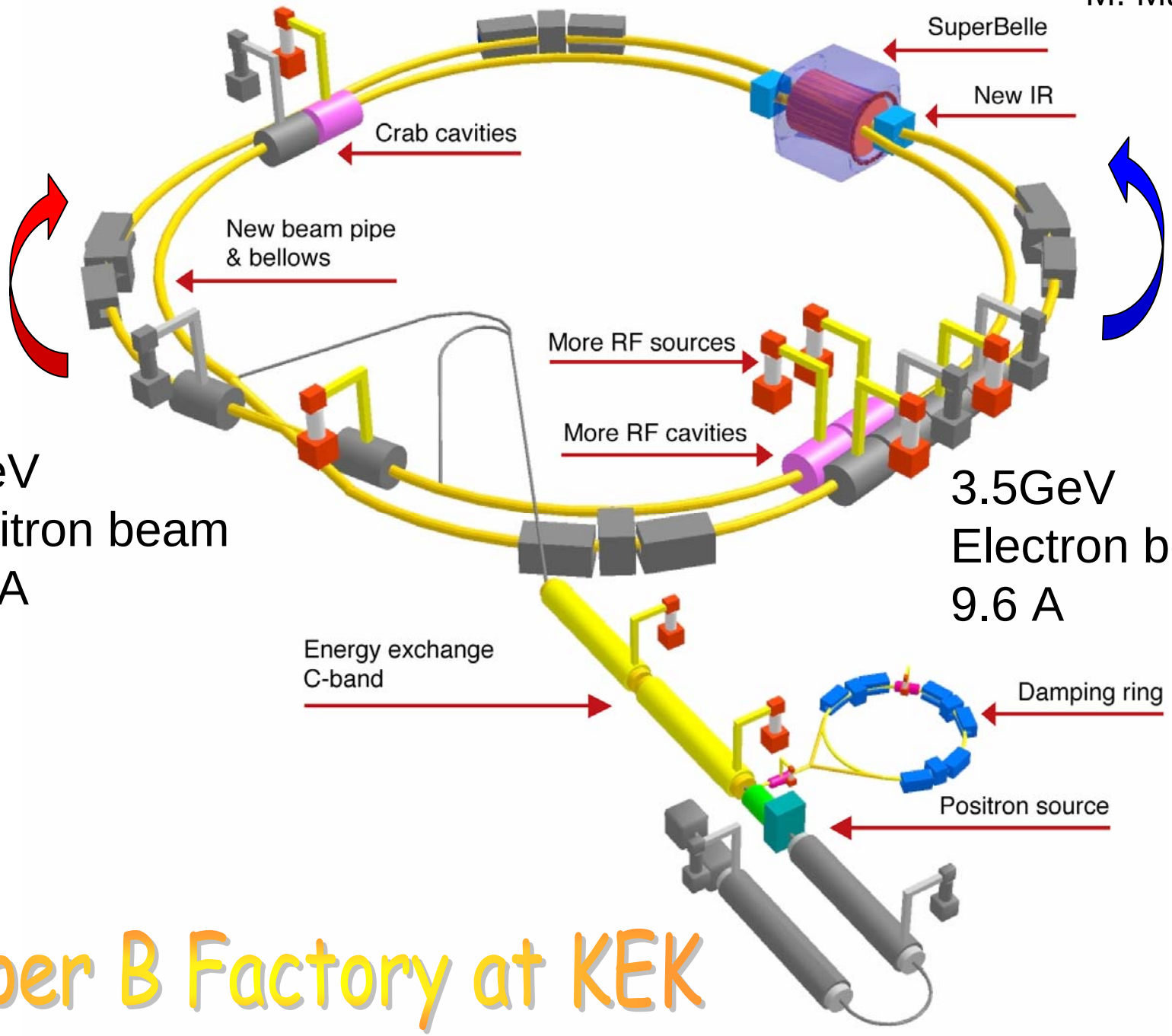
Smaller β_y^*

- **6 mm→3 mm**

Increase ξ_y

- **0.05→0.14**

M. Masuzawa



8GeV
Positron beam
4.1 A

3.5GeV
Electron beam
9.6 A

Super B Factory at KEK

Machine parameters

M. Masuzawa

Parameters		LER/HER	Unit
Beam energy	E	3.5/8.0	GeV
Beam current	I	9.4/4.1	A
Particles/bunch	N	1.18×10^{11}/ 5.13×10^{11}	
Number of bunches	n_b	5018	
Circumference	C	3016.26	m
Bunch spacing	σ_b	0.6	m
Horizontal β at IP	β_x	200	mm
Vertical β at IP	β_y	3	mm
Bunch length	σ_z	3	mm
Radiation loss	U_0	1.23/3.48	MeV/m
Synchrotron tune	ν_s	0.031/0.019	
Horizontal betatron tune	ν_x	45.506/44.515	
Vertical betatron tune	ν_y	43.545/41.580	

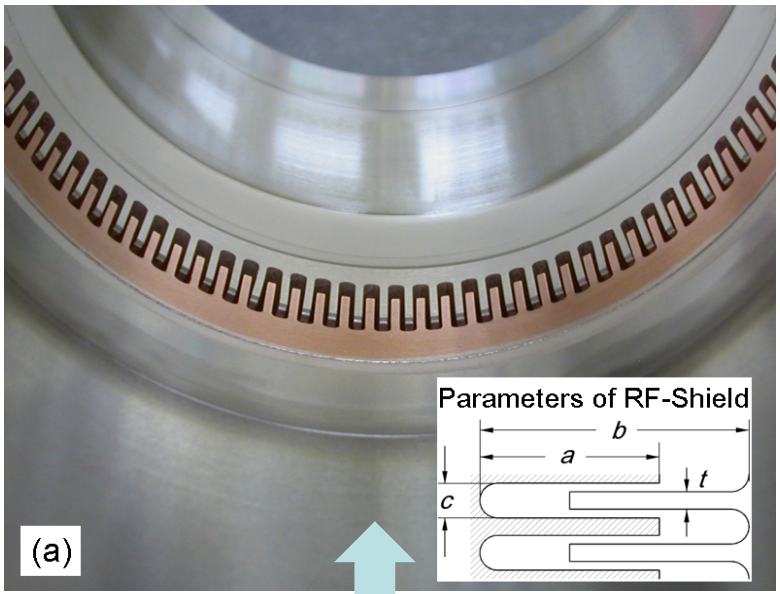
Machine parameters

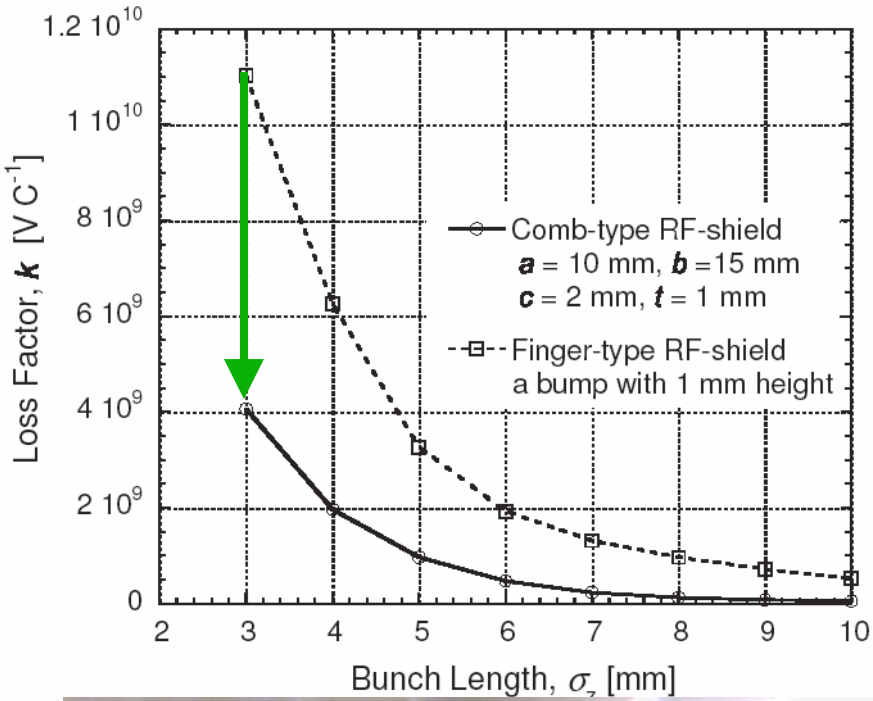
M. Masuzawa

Parameters		Crab cavities; without/with				Unit
Horizontal emittance	ε_x	30/24				nm
Coupling parameter	κ	6/1				%
Crossing angle	θ_x	30/0				mrad
Luminosity reduction	R_L	0.76/0.86				
ξ_x reduction	$R_{\xi x}$	0.73/0.99				
ξ_y reduction	$R_{\xi y}$	0.94/1.11				
Horizontal beam-beam	ξ_x	0.079/0.137				
Vertical beam-beam	ξ_y	0.051/0.218				
Beam-beam simulation model		S-S	W-S	S-S	W-S	
Vertical beam-beam	ξ_y	0.051		0.14	0.28	
Luminosity	L	1		2.5	5	$\times 10^{35}$ cm^{-2} s^{-1}

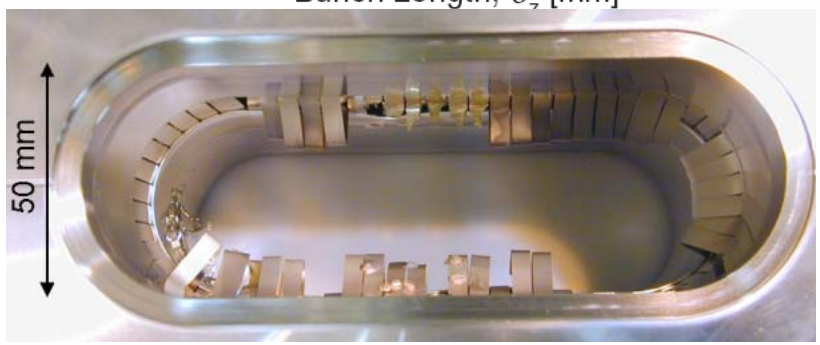
Vacuum components: Bellows chamber with comb type RF-shield

M. Masuzawa





- High thermal strength
- Low impedance
- No sliding contact on the surface facing the beam



Comb-type bellows were installed in the LER (2004).

Crab Cavity Test

- Jan. 2006, Crab cavities will be installed in both rings (1 for each).
- The last step for present KEKB, the first step for SuperKEKB.
- Must achieve $\xi_y > 0.1$ in a few weeks, >0.14 eventually.
- Completely new device with many challenges:
  - High gradient superconducting cavity.
  - Special coaxial HOM coupler to let accelerating mode escape.
  - Electro-plated Nb on Cu pipe for the coupler.
  - Coaxial tuner with moving parts in He temperature.
  - Special main rf coupler.
  - Special cryostat.
  - Dedicated orbit control to keep beam centered.
- Does 1 cavity / ring scheme work?
- PEP-II should prove high ξ_y immediately, as it is pure head-on.

Details matter…

- Count **all impedances** (+CSR), evaluate microwave instability in total.
- New **ceramic collimators** (for both x and y) look critical and need beam tests.
- Vacuum chamber must be **as round as possible** (even for antechamber) to avoid the tune change by beam current to use optimal tune space….

- Is **parasitic collision** safe?
- Beam tail, lifetime, background under **high ξy**.

- **IR** must be reviewed considering background (esp. lum term). Quad locations, crossing angle must be re-optimized.

- HER needs **more dynamic aperture**. Remove crab from IR and install **local chromaticity correction**.
- We need both **sextupole movers and BPM displacement monitor** (relative to sexts).

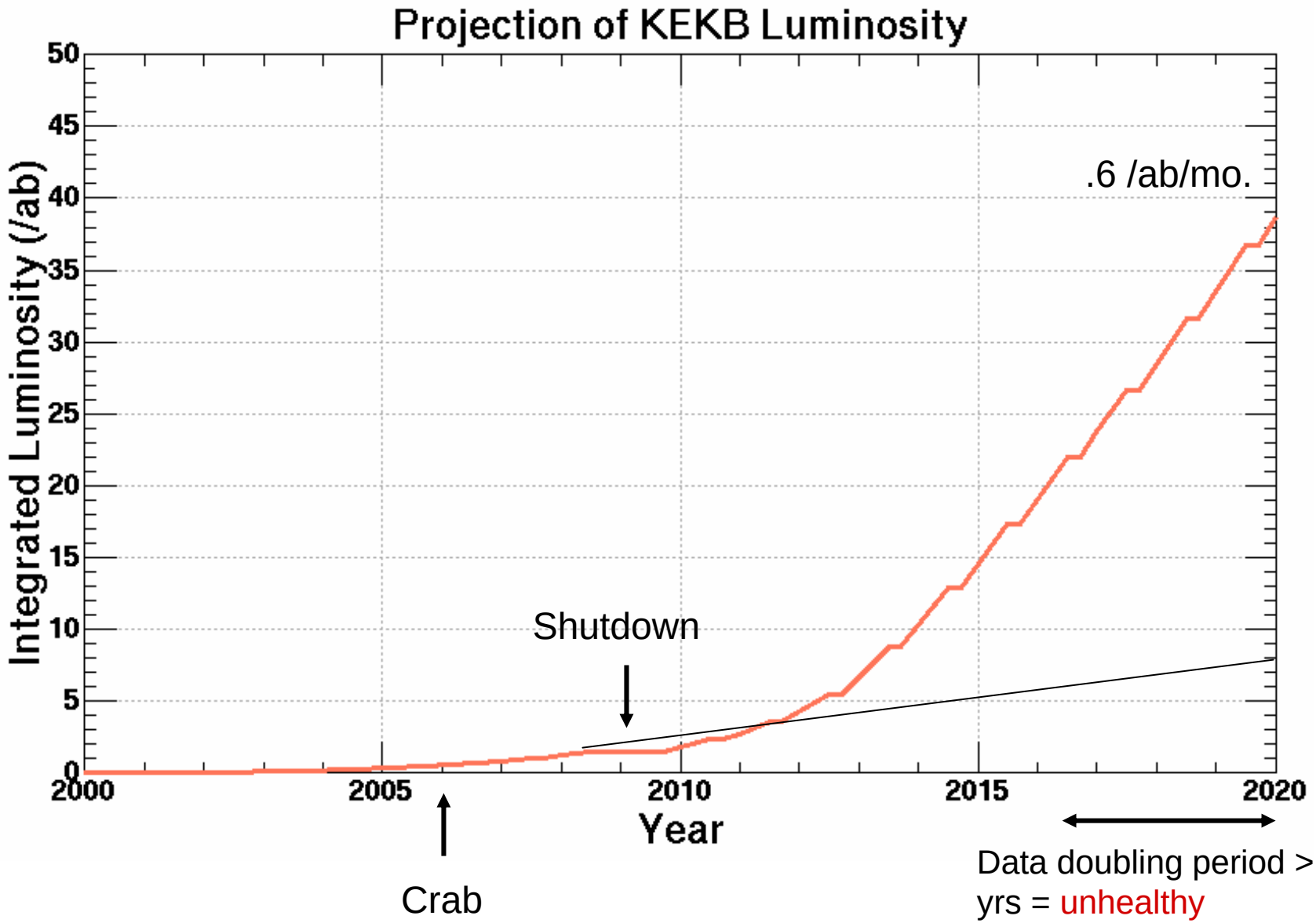
- **Longitudinal b x b feedback** must be realized in KEKB.

- Separation of **PF/PF-AR** injection.
- Detailed engineering for **damping ring**, **pulse magnets, abort system,** etc.

- **Renewal of existing components** needed (magnets, power supplies, rf components, cooling system, buildings, people, etc.)

K. Oide

How long should we run?



F. Zimmermann, LCE meeting, 26.11.04

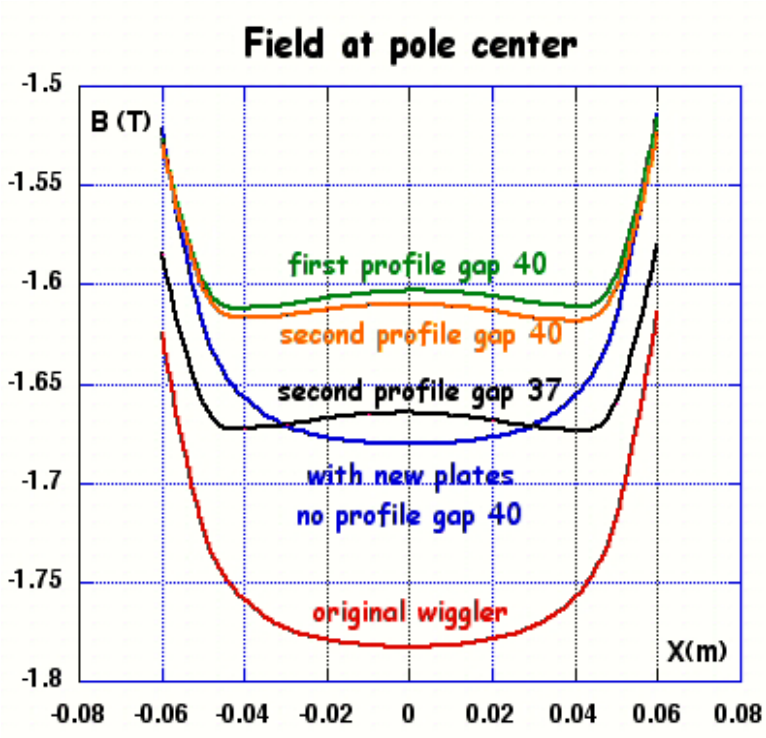
DAFNE

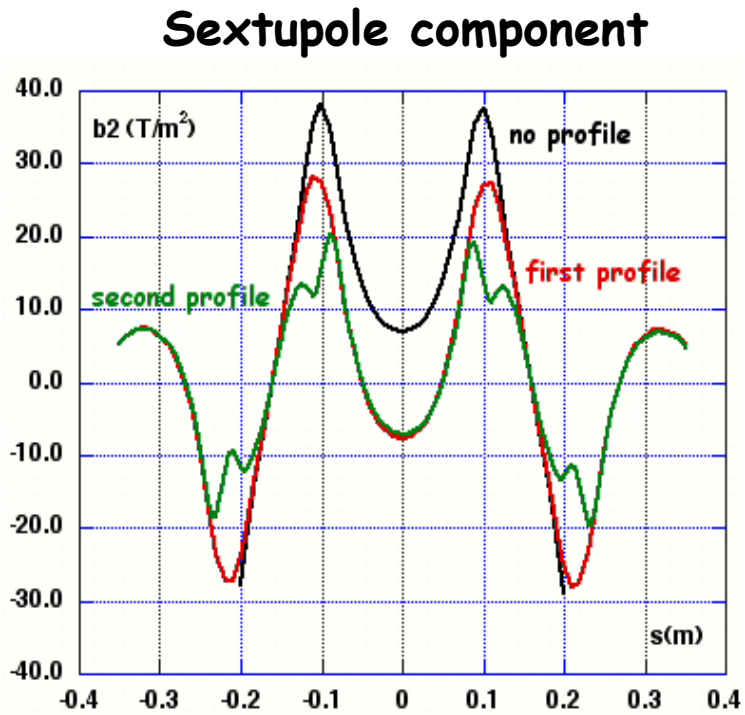
from discussions with P. Raimondi and M. Zobov

- e+ current limited to 1.2 A in collision by strong instability (~10 μs rise time); in previous years reached 2.5 A
- large positive tune shift with current in e+ ring, not seen in e- ring
- wound solenoids in field-free sections to combat e-cloud w/o any effect
- main change for 2004 was wiggler field modification; suspicion that e- are created and trapped by the wiggler field
- asked Pantaleo to send us 3D wiggler field before & after modification (for ECLOUD simulations?)
- important for CLIC damping ring

DAFNE
Raimondi

Wiggler field modifications





Reduction of the dynamic aperture due to:

- Strong sextupole components (~x^2 like)
- Field roll off at large offsets (~x^6 like)

other discussions & studies while at KEK

- performed CSR instability simulations for CLIC damping ring with T. Agoh (K. Yokoya's student); found that bunch lengthening due to CSR is modest ~5% at 2-cm chamber radius and ~20% for 4-cm radius; no instability in either case

- discussed with Y.-H. Chin whether MOSES can treat impedances other than single BBR; he thinks there should be no problem, will check