

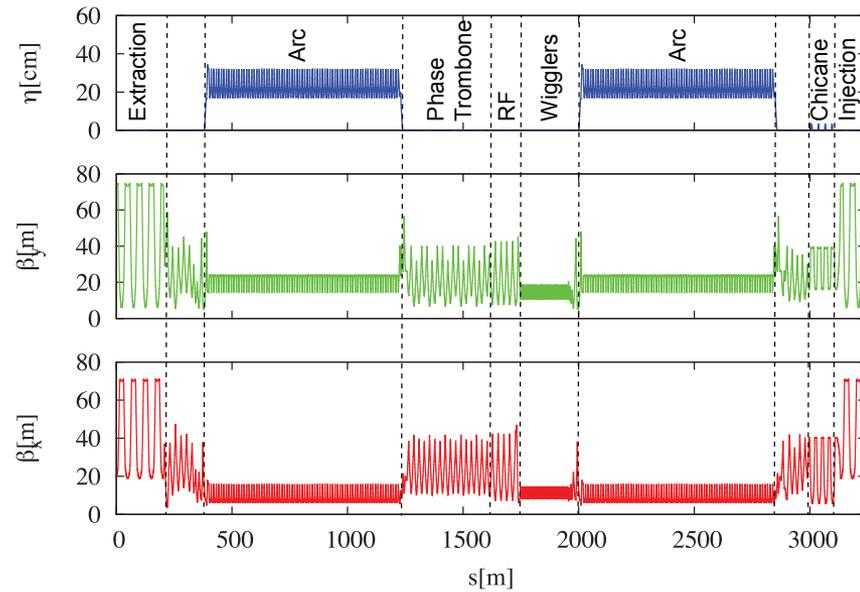
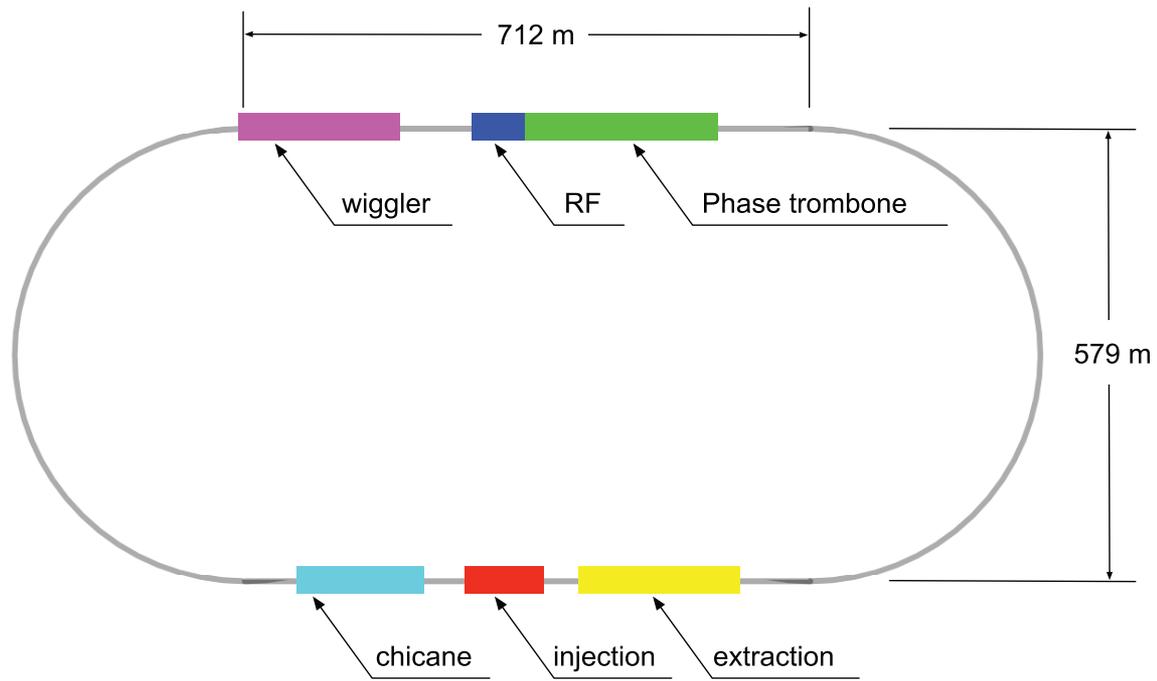
Damping Rings for High Luminosity

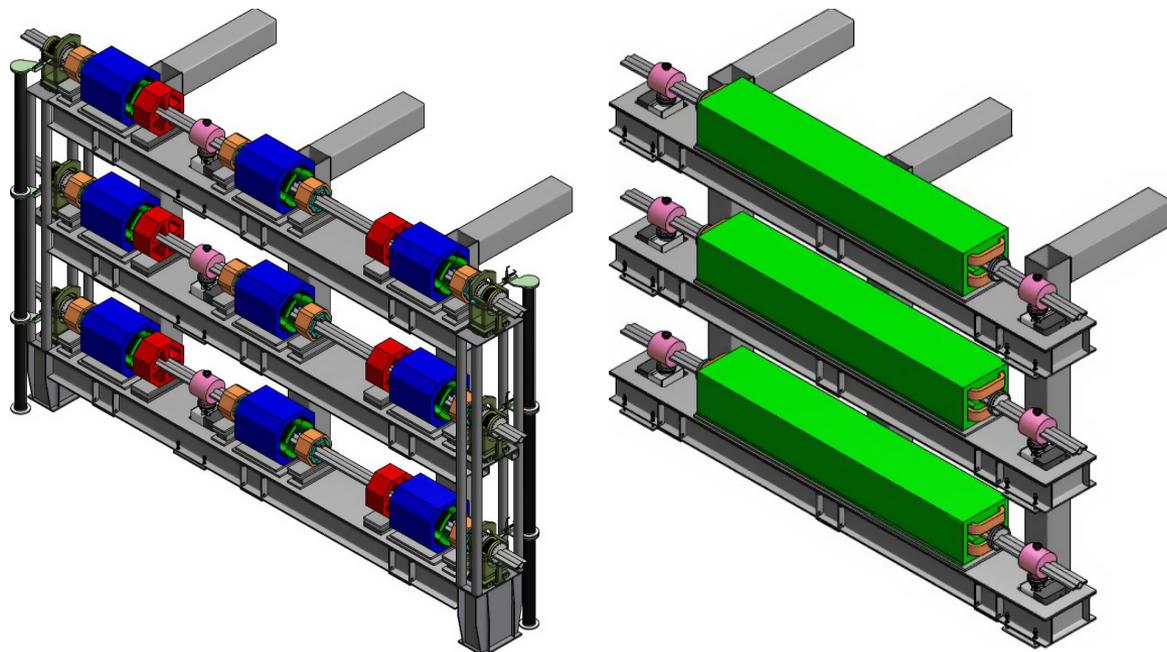
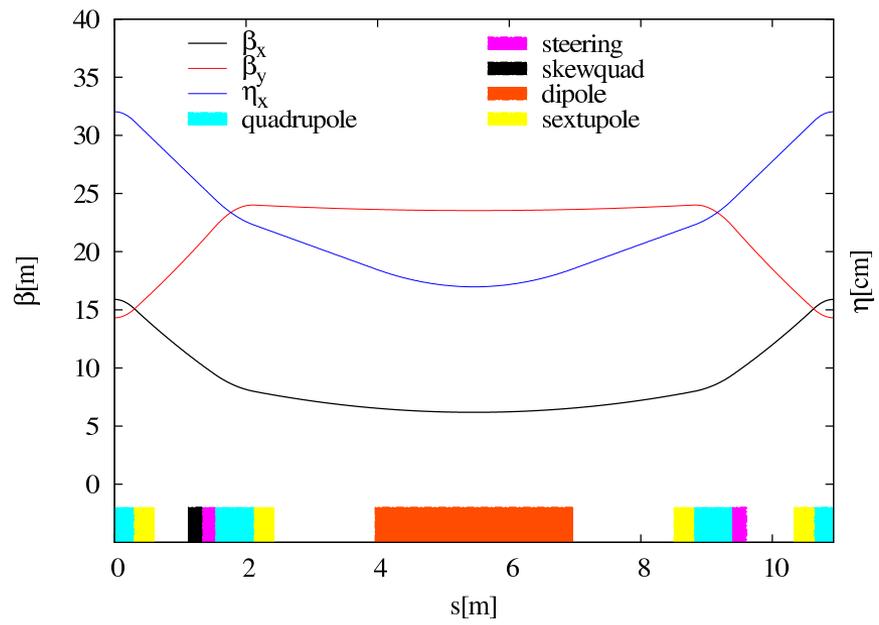
D. Rubin

May 8, 2019

ILC baseline

	5 Hz (e+)	10 Hz (e+)
Circumference [km]	3.2	3.2
Beam Energy [GeV]	5.0	5.0
Horizontal emittance [nm]	0.57	0.64
Vertical emittance [pm]	2	2
Energy spread	0.1×10^{-4}	0.14×10^{-4}
Current [A]	0.39/0.78	1.0 /0.85
Bunches	1312/2625	1576
Particles/bunch	2×10^{10}	2×10^{10}
Long damping time [ms]	12	6.4
Bunch length [mm]	6.0 (4.7)	4.8
Current/bunch [mA]		0.5
Energy loss/turn [MeV]	4.5	8.4





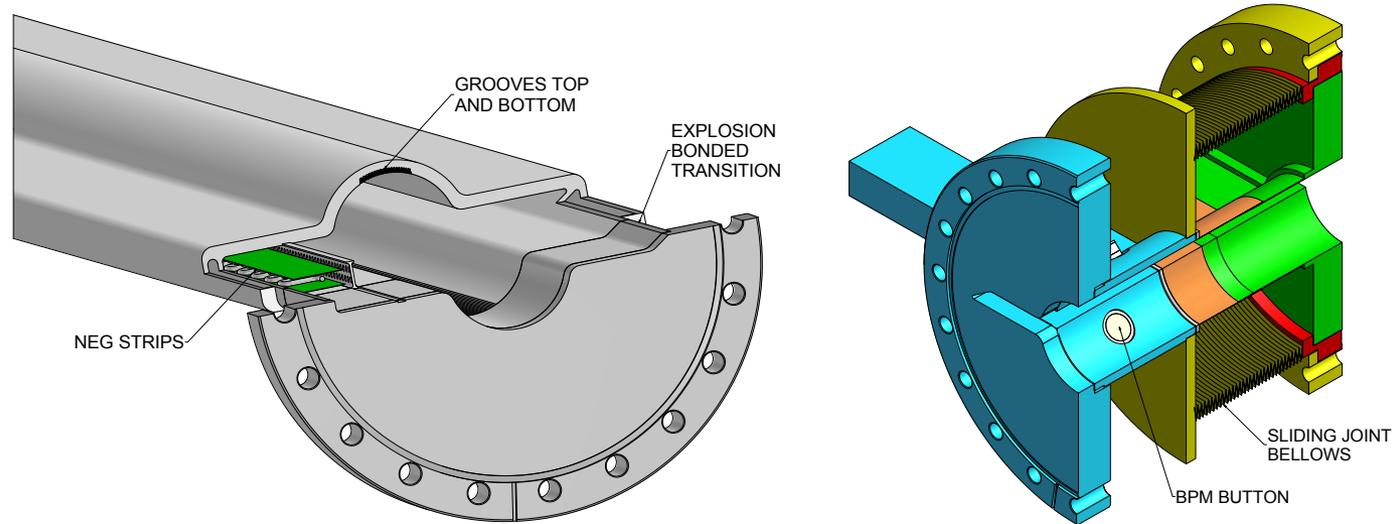
ILC baseline

	5 Hz (e+)	10 Hz (e+)	SuperKEKB
Circumference [km]	3.2	3.2	3.0
Beam Energy [GeV]	5.0	5.0	4.0
Horizontal emittance [nm]	0.57	0.64	3.2 (1.9)
Vertical emittance [pm]	2	2	8.64
Energy spread	0.1×10^{-4}	0.14×10^{-4}	7.9×10^{-4}
Current [A]	0.39/0.78	1.0 /0.85	3.6
Bunches	1312/2625	1576	2500
Particles/bunch	2×10^{10}	2×10^{10}	9×10^{10}
Long damping time [ms]	12	6.4	23
Bunch length [mm]	6.0 (4.7)	4.8	6.0 (4.7)
Current/bunch [mA]	0.3	0.5	
Energy loss/turn [MeV]	4.5	8.4	
Bunch spacing [ns]	6.2/3.1		
RF power [MW]	2.0	3.8	

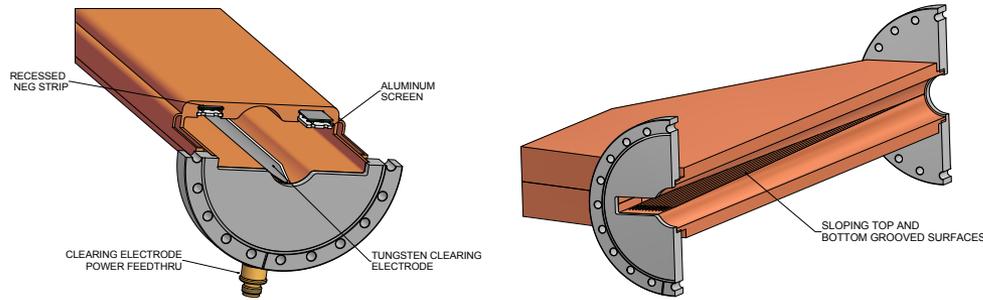
SuperKEKB

	LER (e+)	Phase I & II commissioning
Beam Energy [GeV]	4.0	4.0
Horizontal emittance [nm]	3.2 (1.9)	1.7
Vertical emittance [pm]	8.64	23
Energy spread	7.9×10^{-4}	7.5×10^{-4}
Current [A]	3.6	0.860/1.01
Bunches	2500	1576
Particles/bunch	9×10^{10}	
Long damping time [ms]	23	
Bunch length [mm]	6.0 (4.7)	4.8
Current/bunch [mA]		0.5

Electron cloud

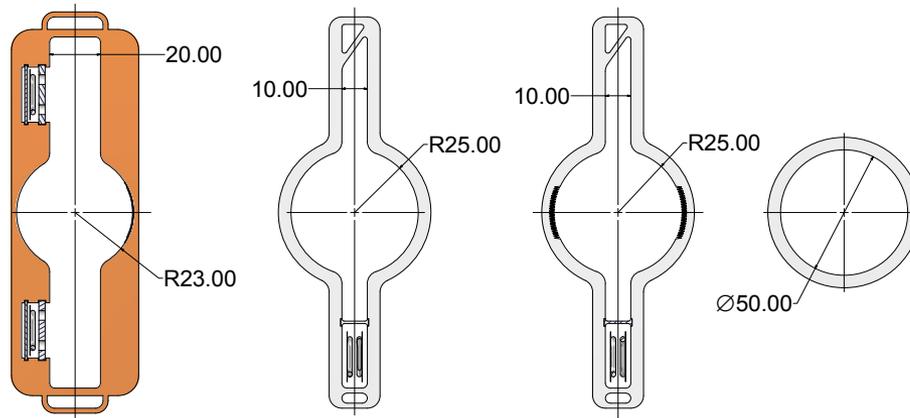


Vacuum chambers



(a)

(b)



(a) WIGGLER CHAMBER

(b) ARC CHAMBER

(c) DIPOLE CHAMBER

(d) DRIFT CHAMBER

Electron cloud - SuperKEKB

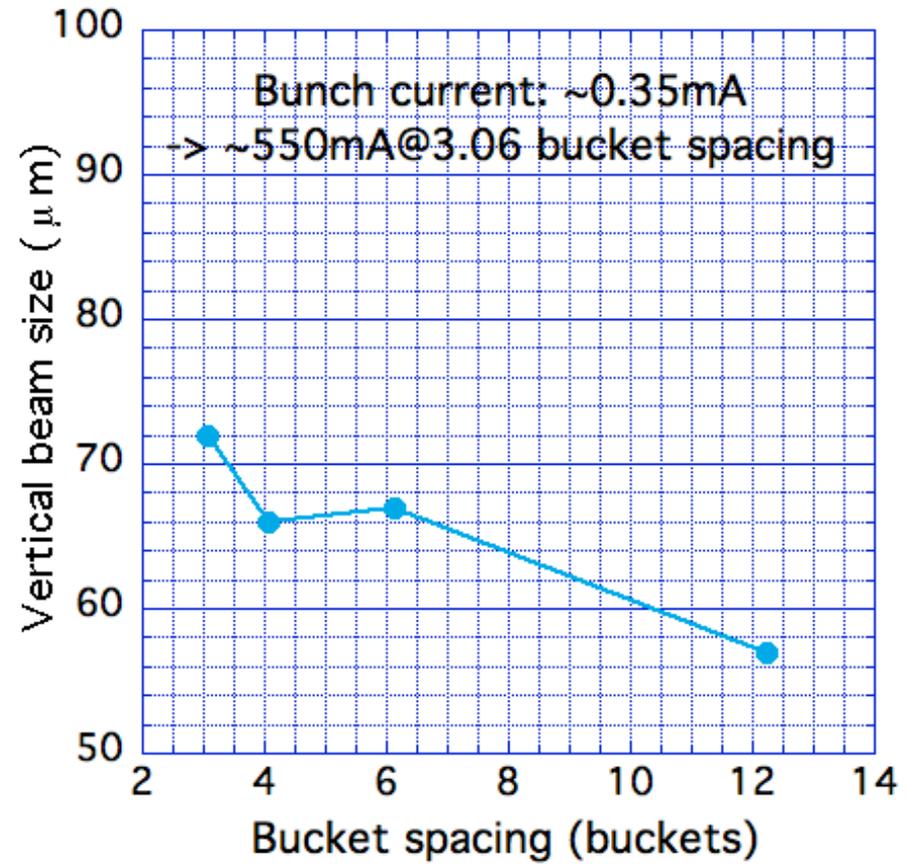
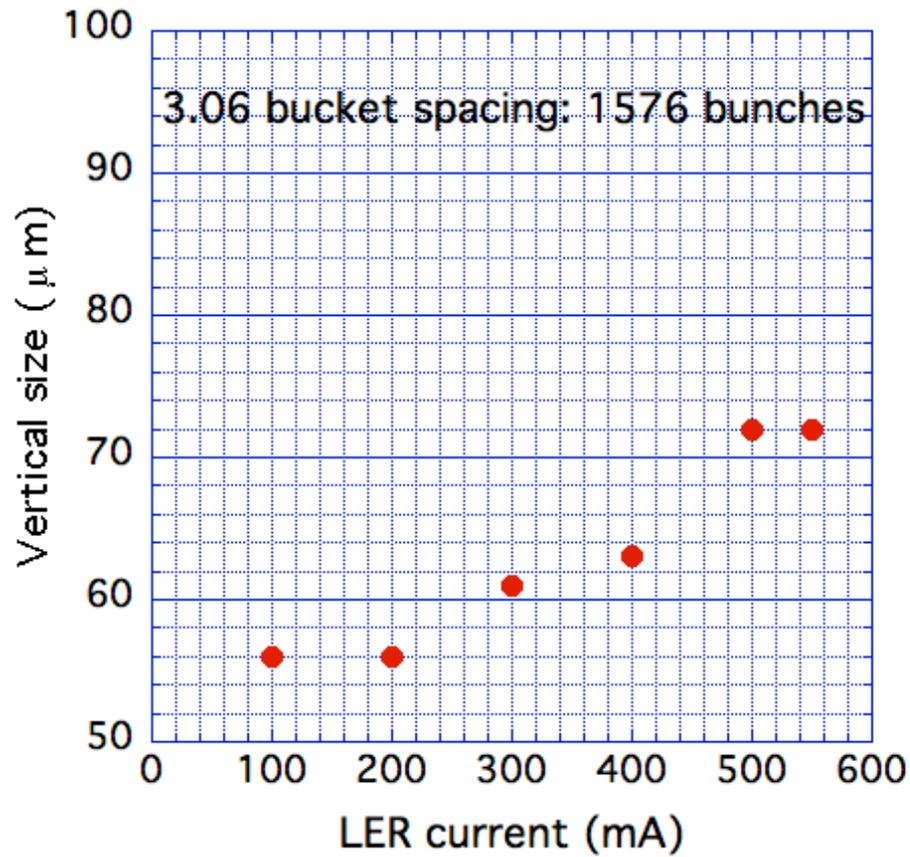
- The electron cloud effect was observed in Phase 1 although the ante-chambers and TiN coating were adopted in the LER.
- Solenoid-like permanent magnets installed to suppress cloud in drifts
- Vertical beam size measured by the X-ray beam size monitor in the LER.
- Beam blowup due to ECE was not observed up to 0.4 mA as $I/nb/nsp$.
- Threshold more than twice 0.2 mA threshold observed in Phase 1.
- Mode of coupling bunch instability changes and the growth rate is reduced with installation of additional permanent magnets.

Aluminum bellows chambers along the ring without TiN coating.

The bellows chamber has a length of 0.2 m and located every 3 m on average.

■ Counter-measure

- Installation of solenoid magnets at the bellows.
- A preliminary test showed that this method should work.



Injection and extraction

- Bunch spacing limited by rise and fall of kicker pulse.
- Electron cloud

RTML