SuperKEKB e^+ source

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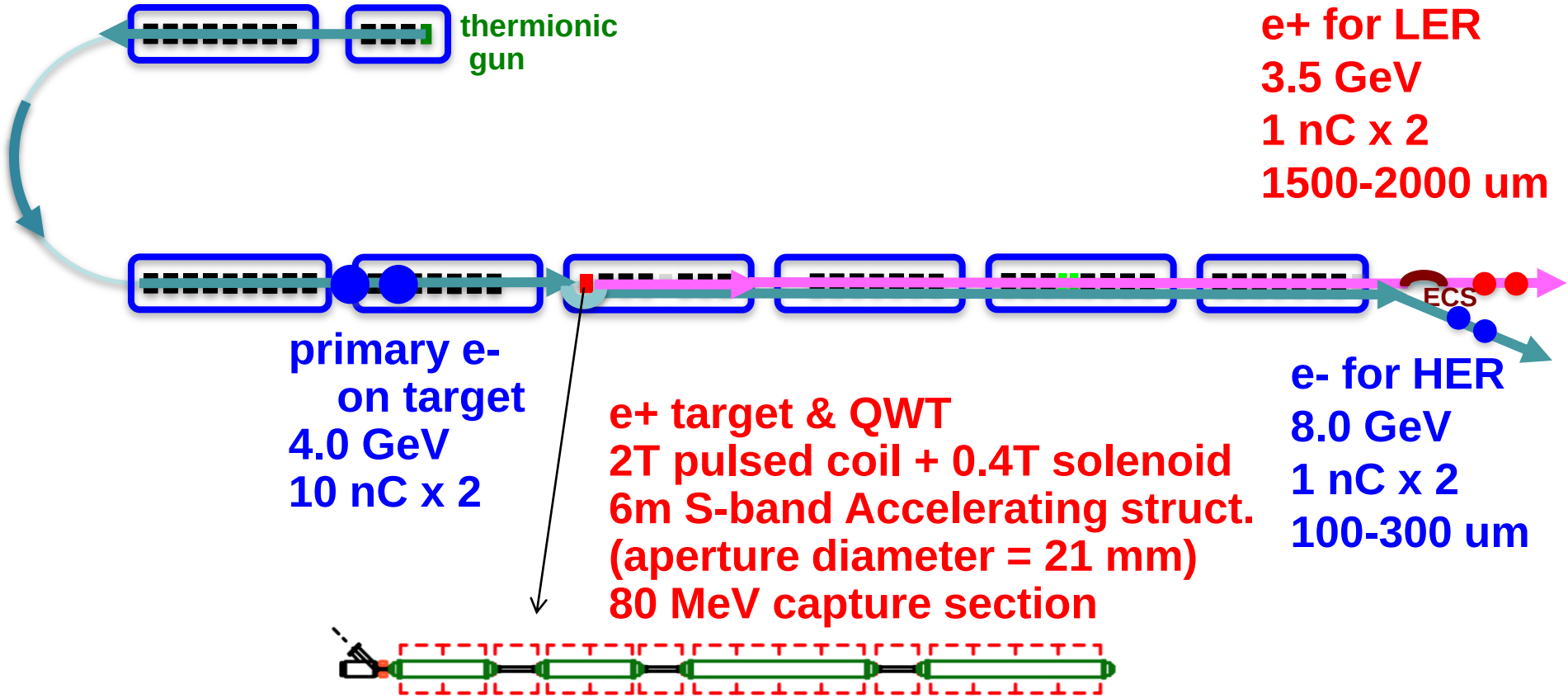
KEKB Injector & e+ source

50 Hz (e+ or e-)
pulse-by-pulse
mode switching

primary e- for e+ prod.
10 nC x 2
HER inj. e-
1 nC x 2



e+ for LER
3.5 GeV
1 nC x 2
1500-2000 um

primary e-
on target
4.0 GeV
10 nC x 2

e+ target & QWT
2T pulsed coil + 0.4T solenoid
6m S-band Accelerating struct.
(aperture diameter = 21 mm)
80 MeV capture section

e- for HER
8.0 GeV
1 nC x 2
100-300 um

SuperKEKB Injector & e+ source

50 Hz (e+ or e-)
pulse-by-pulse
mode switching

primary e- for e+ prod.
10 nC x 2
HER inj. e-
5 nC x 2

photo cathode
RF gun

1.1 GeV
Damping Ring
circ. 136 m

e+ DR

BCS

ECS

S-band
linac

1.6

e+ for LER
4.0 GeV
4 nC x 2
$92_{[H]}/7_{[V]}$ um

ECS

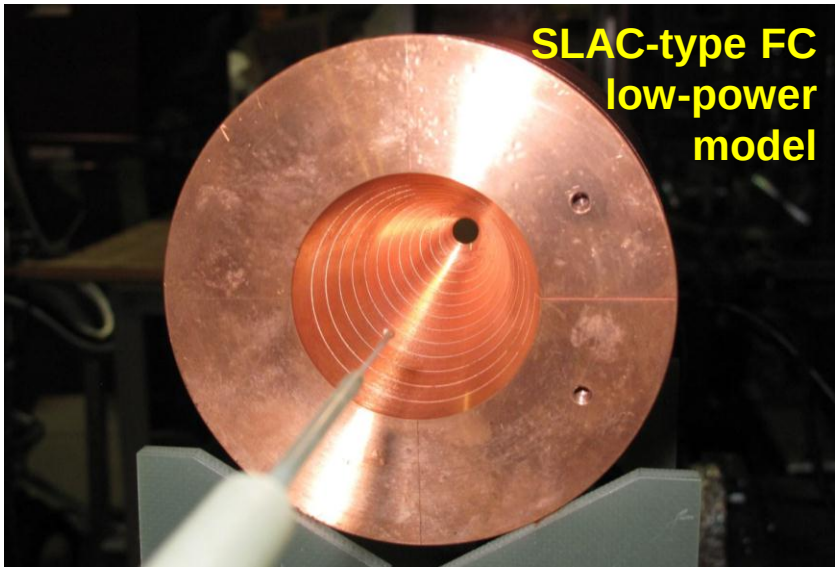
primary e-
on target
3.2 GeV
10 nC x 2

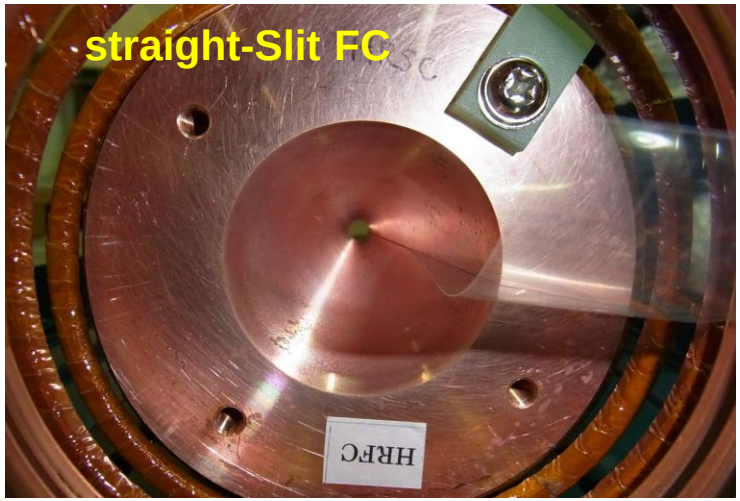
e+ target & AMD
5T FC + 0.4T solenoid
12m L-band structure (35mm)
or Large Aperture S-band (30mm)
120 MeV capture section

e- for HER
7.0 GeV
5 nC x 2
20 um

Flux Concentrator

- 2-T pulse coil QWT system will be replaced by a 5-T FC AMD
- a BINP-type FC is under inspection of discharging problem
- a prototype of the SLAC-type spiral-slit FC is in fabrication
- straight-slit FC is also considered, larger transverse field but higher peak field

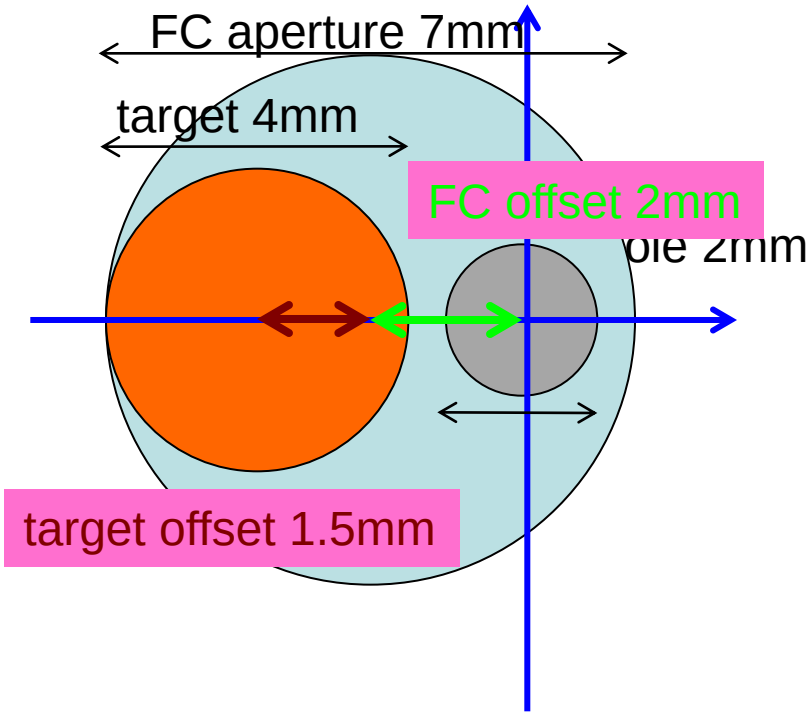




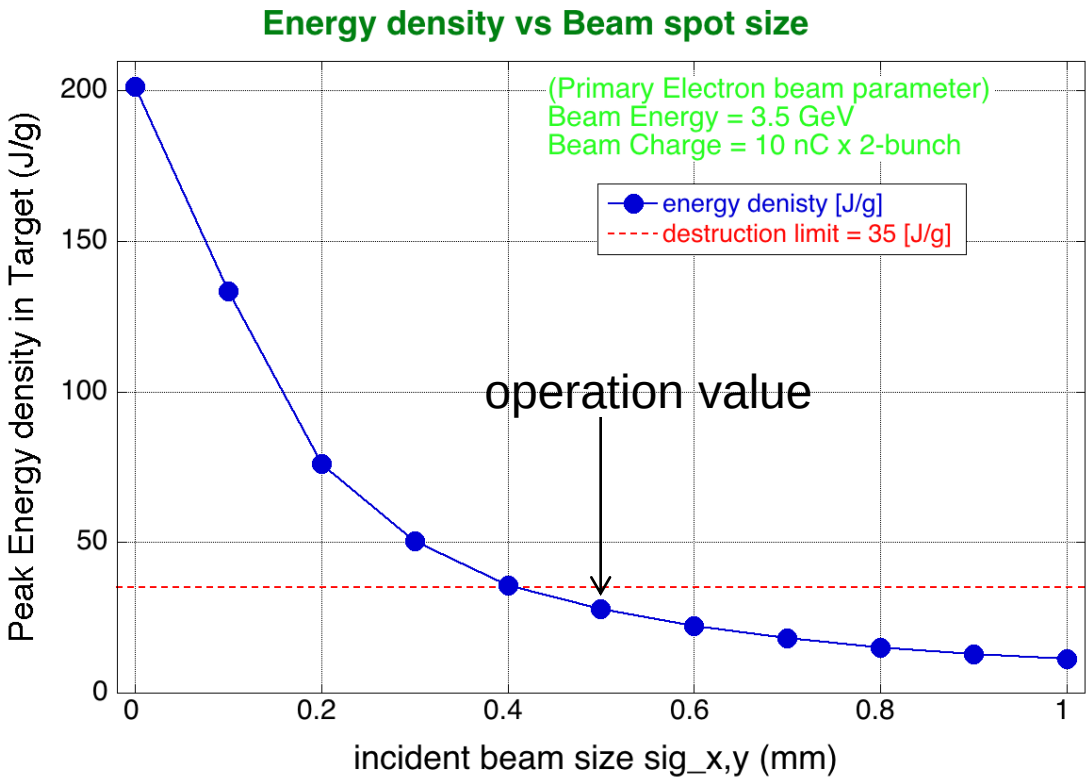
SLAC-type FC	parameters
length	100 mm
outer diameter	100 mm
inner diameter (min.)	7 mm
inner diameter max)	52 mm
peak current (for SKB)	12 kA
pulse width	4 us (half-sine)
peak field	4.4 T
inductance	0.8 uH

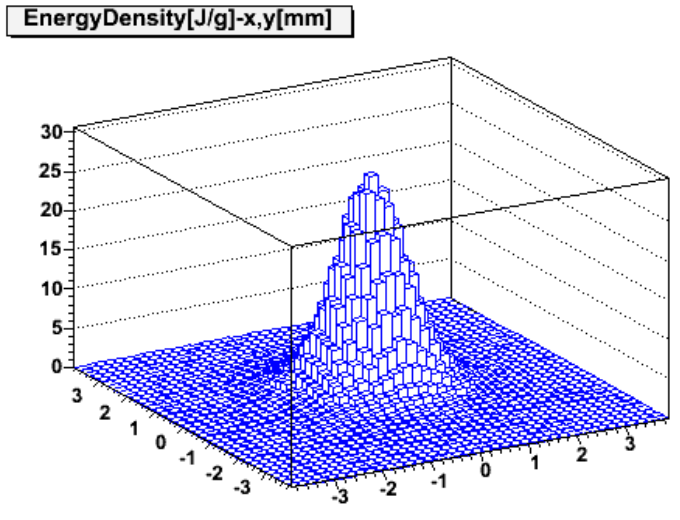
target offset

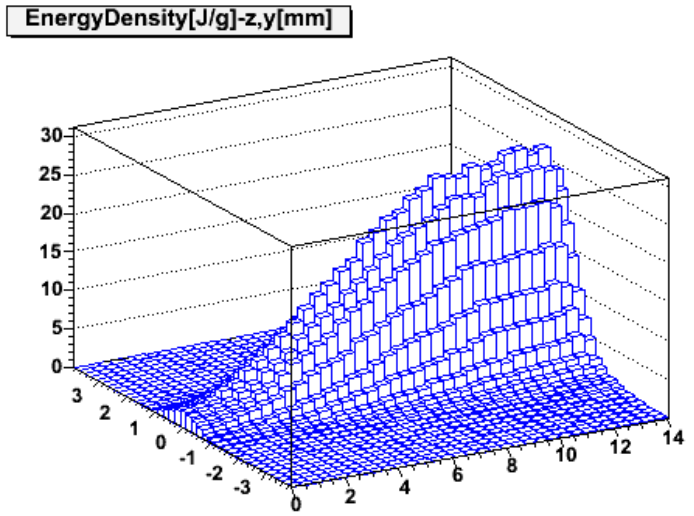
- for e- to pass in the beam line center of DC solenoids to avoid emittance growth, FC center should be offset in 2mm
- target center should be offset in 1.5mm from FC center
- degradation of e+ capture efficiency and beam kick effect by transverse field to be evaluated



target protection







We do not have enough margin in the PEDD !!

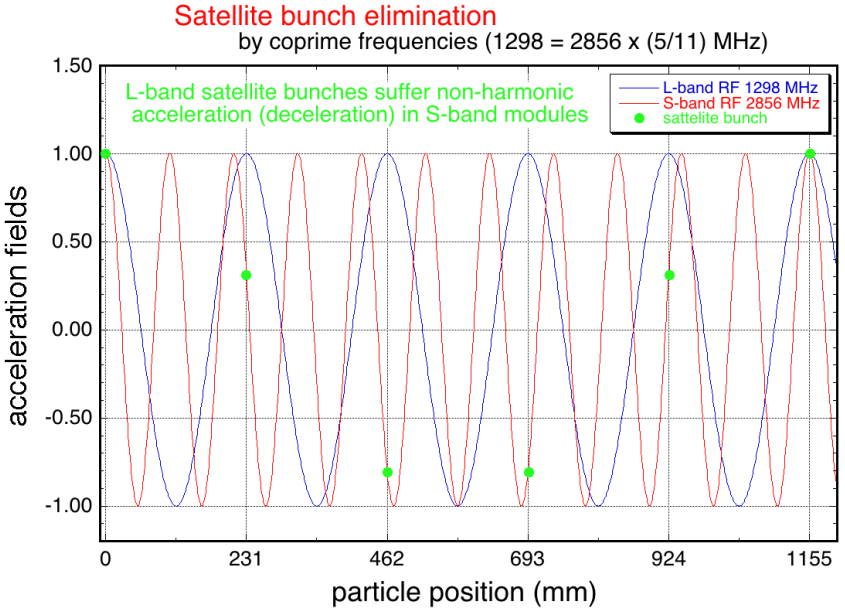
Need idea for target protection.

-> beam spoiler by light material ?

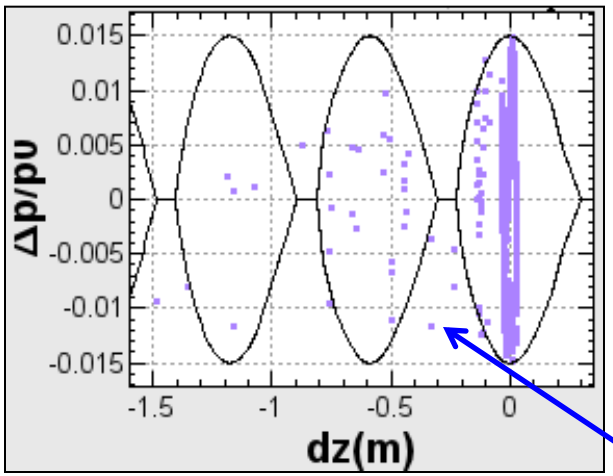
-> beam spoiler by crystals ?

Satellite bunch elimination

- satellite bunches generated in capture section make radiation problem in DR injection
- due to coprime (5:11) frequency relation of L-band (1298 MHz) and downstream S-band (2856MHz), most of L-band satellites are eliminated during S-band acceleration

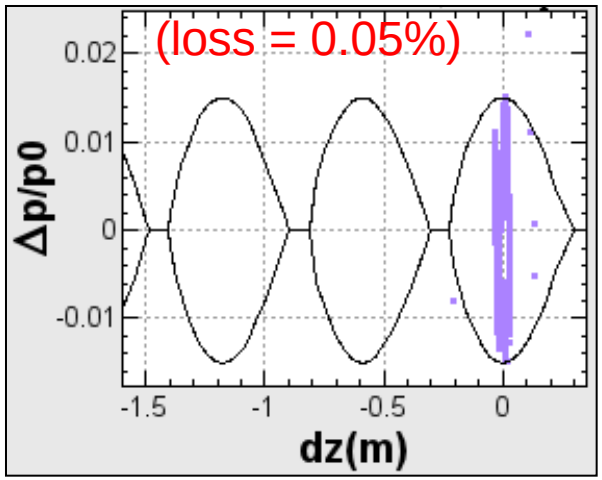


all S-band case (loss = 0.40%)



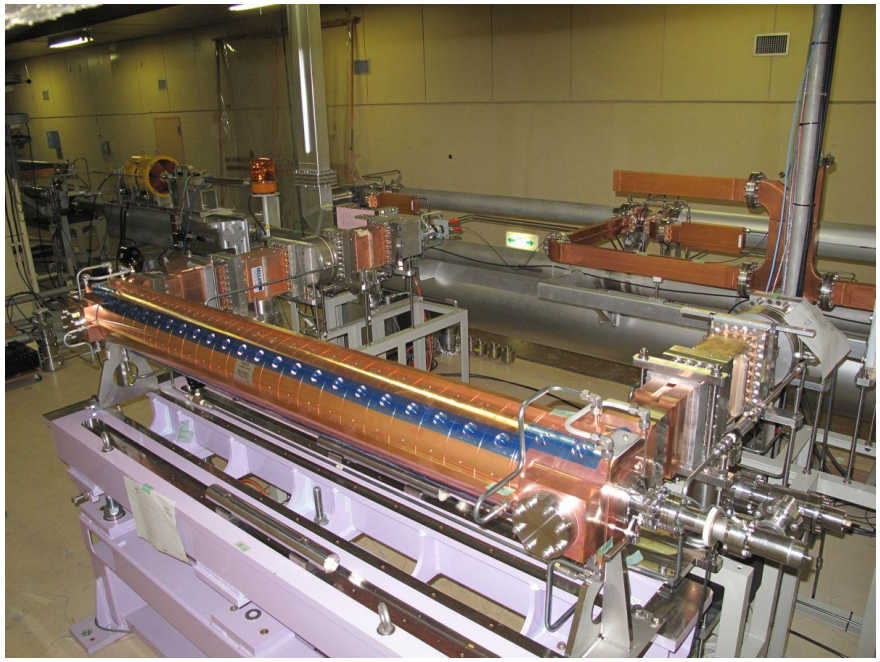
particles outside the separatrix are lost at DR injection

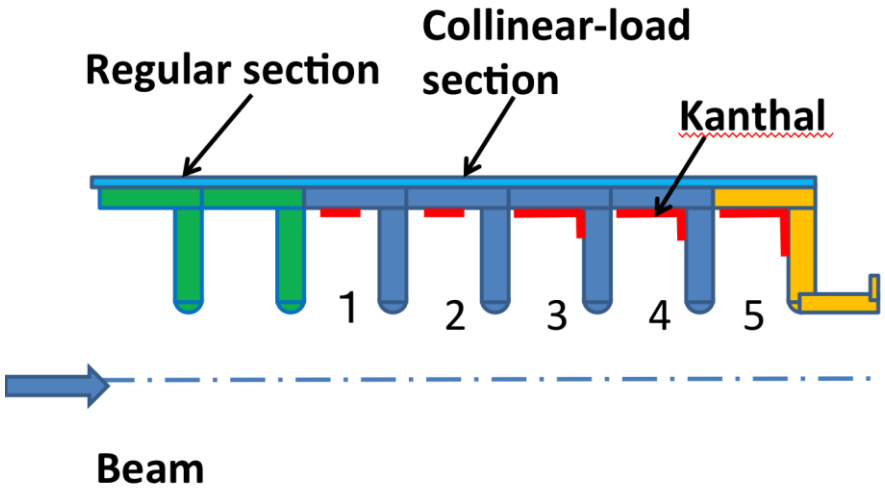
L-band capture section + 1.0GeV S-band linac case



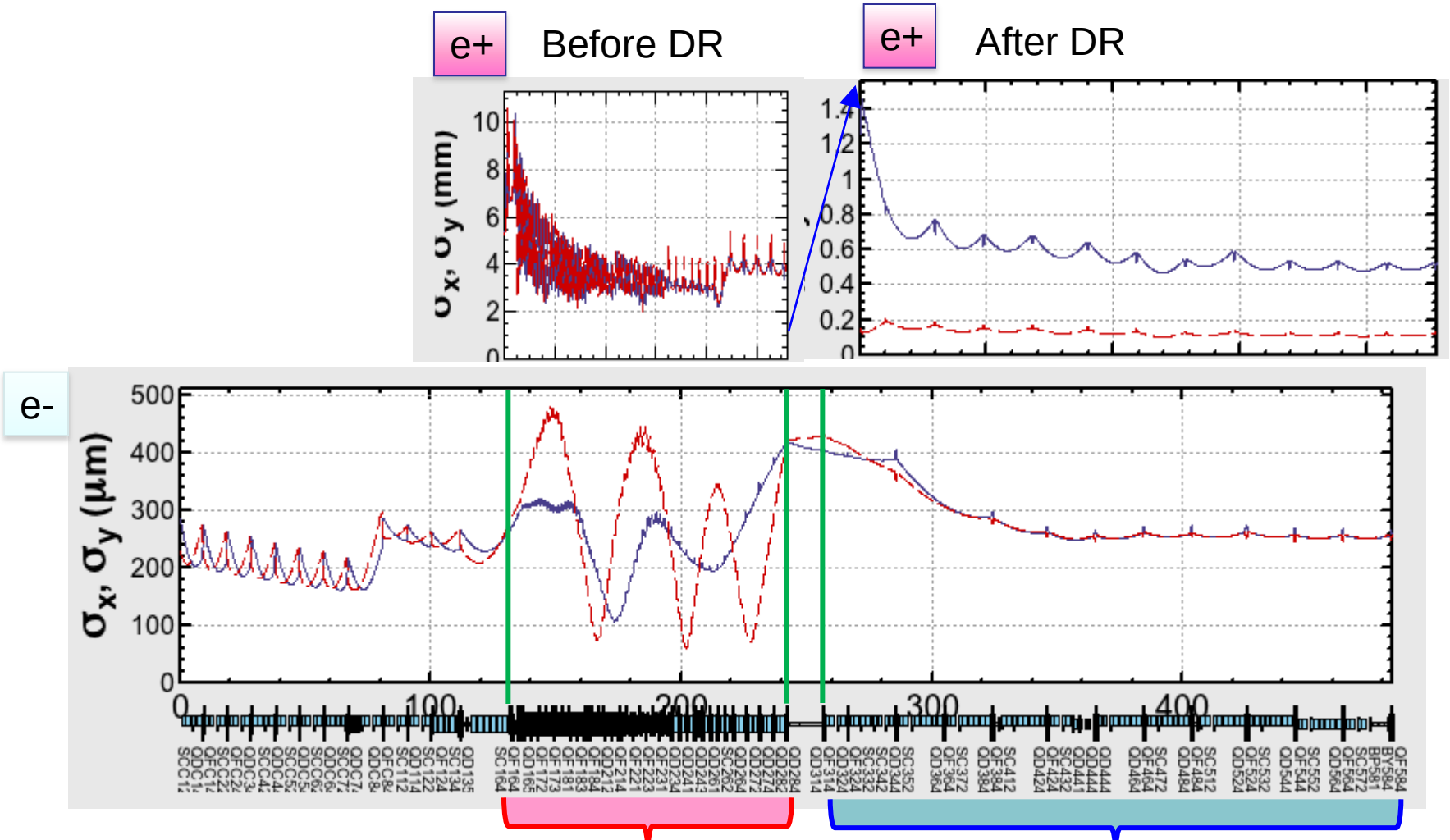
L-band R & D

- First L-band accelerating structure under high-power test now (in 2012) with an L-band 30 MW klystron.
- DC solenoid for this structure will be huge in diamater and power eating.
- By removing output coupler with a collinear dummy load, solenoid can be compact.
- However, LAS will be used in the commissioning for initial cost reduction.
- Need idea for satellite elimination with S-band.

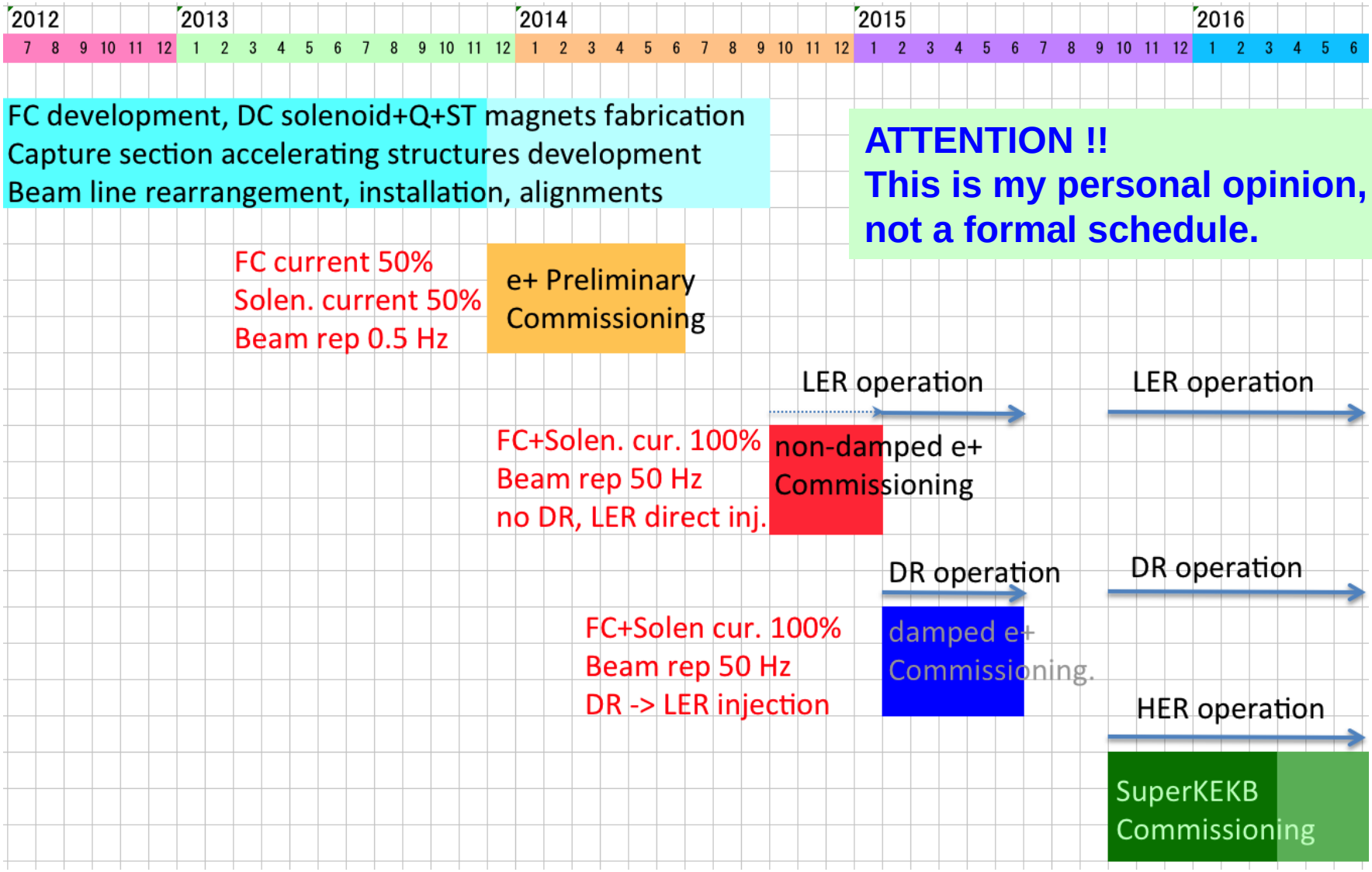




e+/e- compatible beam optics



SuperKEKB e+ Schedule



Summary

1) SuperKEKB: e+ source upgrade
   intensity 2 x (1 -> 4 nC), emittance 2000 -> 100/7 um
2) DR is introduced for low emittance e+
3) FC is introduced for wider e+ energy acceptance (QWT->AMD)
4) SLAC type FC and straight slit FC are in development
5) large aperture accelerating structures are introduced for wider transverse acceptance (L-band or Large Aperture S-band [LAS])
6) L-band component development is underway
7) 11:5 L-band frequency is effective in satellite elimination, but LAS capture section is used for initial cost reduction
8) e+/e- are transported
   in compatible (compromised) optics in the linac before DR,
   in independent optics after DR by pulse Qs