

# Luminosity Boost

(Feb.25 10:35-10:55 H.Koiso)

# Lattice Issues on Super KEKB

2002.2.25 MAC2002

H. Koiso

◇ The present KEKB lattice has a wide range of flexibility on the horizontal emittance  $\epsilon_x$  and the momentum compaction

factor  $\alpha$ . (18 nm in LER, 24 nm in HER at present)

$$\epsilon_x : 10 \sim 36 \text{ nm}, \quad \alpha : -2 \sim 4 \times 10^{-4}$$

◇ The design parameters are able to be achieved without major changes in arcs.

$$\epsilon_x = 33 \text{ nm}, \quad \alpha = \sim 1.7 \times 10^{-4} \quad \leftrightarrow \quad \text{bunch length} = 3 \text{ mm}$$

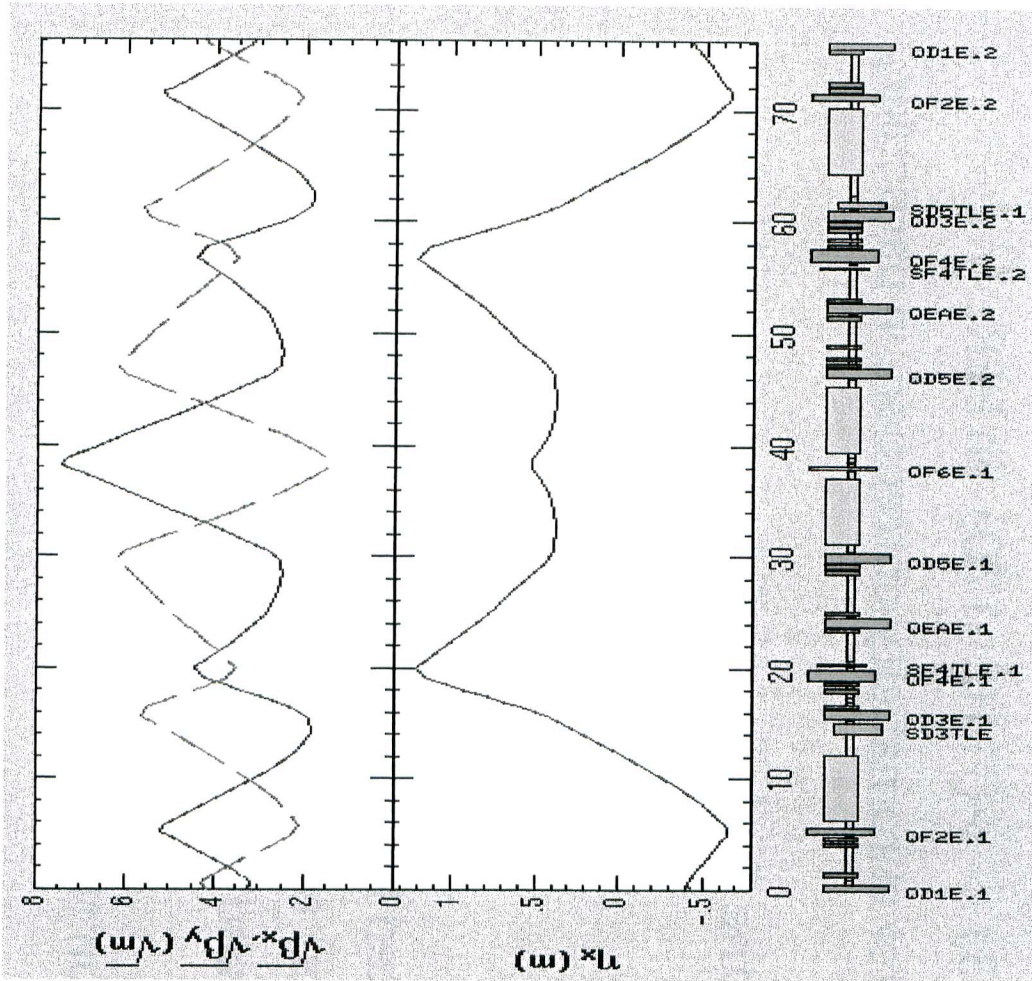
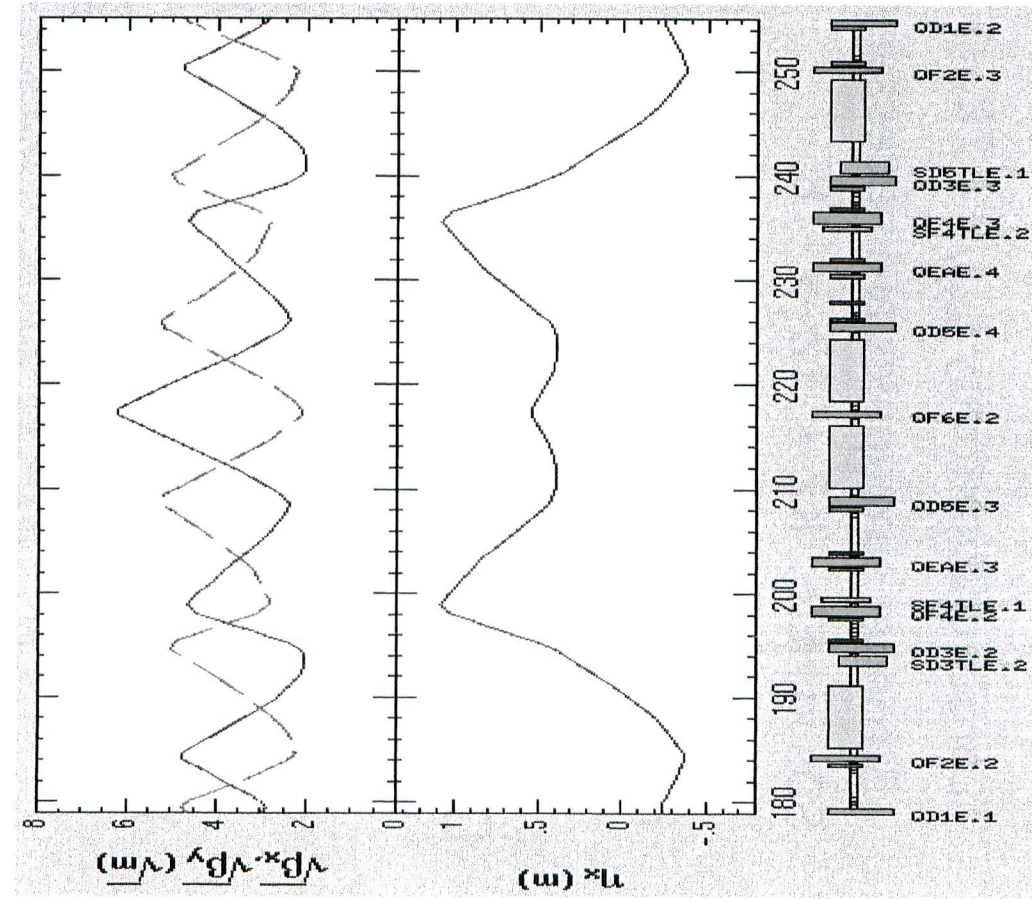
HER has little margin for higher emittance ( higher bunch current, smaller number of bunches).

LER has a larger tuning range of  $\epsilon_x$ , since half of the wiggler magnets will remain.

$$\epsilon_x = \frac{(L_{\text{arc}} \epsilon_{\text{arc}} + L_{\text{wig}} \epsilon_{\text{wig}})}{(L_{\text{arc}} + L_{\text{wig}})} \quad L_{\text{wig}} \sim 1/2 L_{\text{arc}}$$

Negative  $\alpha$  lattice may be useful to suppress the bunch-lengthening.

HER cell with  $\epsilon_x = 24$  (left: KEKB), 33(right: SuperKEKB) nm



◇ Smaller  $\beta_x^* / \beta_y^*$  (61/59, 0.70/0.65)  $\rightarrow$  (15~30, 0.3) cm

Larger chromaticity  $\xi_{x,y}$  (-72, -113)  $\rightarrow$   $\sim$ (-110, -170) in HER

Stronger sextupoles are necessary for chromaticity correction, in particular, SDs in HER : K2 = -12  $\rightarrow$  -18.

Reoptimization of IR lattice all over the Tsukuba straight section will be necessary.

## ◇ Dynamic apertures

The transverse aperture will be limited by multipole components of final quadrupoles (QCSs, QC1s(HER), QC2s) as the present KEKB lattice.

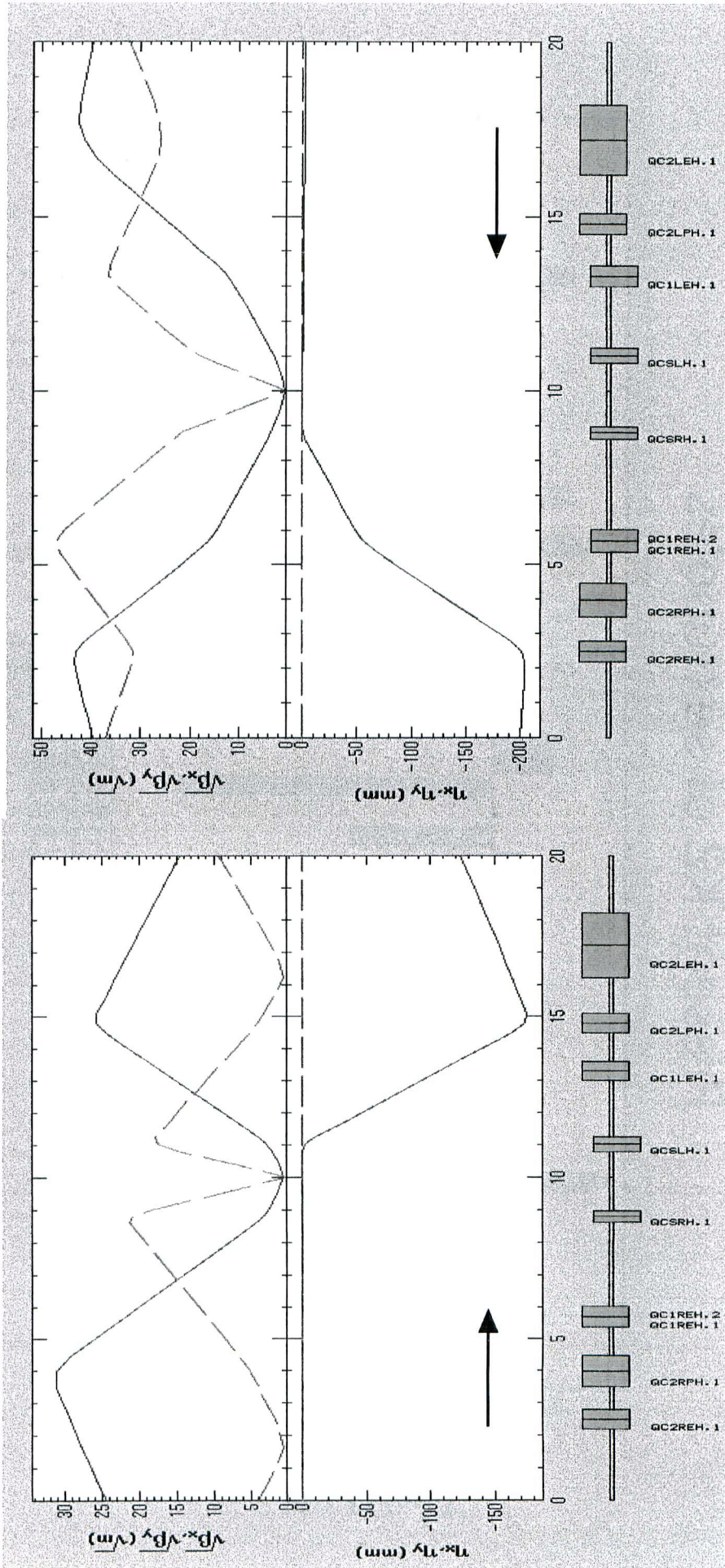
Higher multipoles ( $\sim$  K15,  $\sim$  SK15) and overlap with solenoid have been incorporated in modeling with SAD.

The momentum aperture depends on the performance of chromaticity correction (sextupole optimization).

Octupoles and decapoles may be helpful to improve the dynamic aperture.

◆ Realistic lattice design and the estimation of the dynamic aperture are now being studied.

IR Lattice with  $BX^* = 15$  cm,  $BY^* = 0.3$  cm LER(left), HER(right)



# Present K2 of sextupoles

