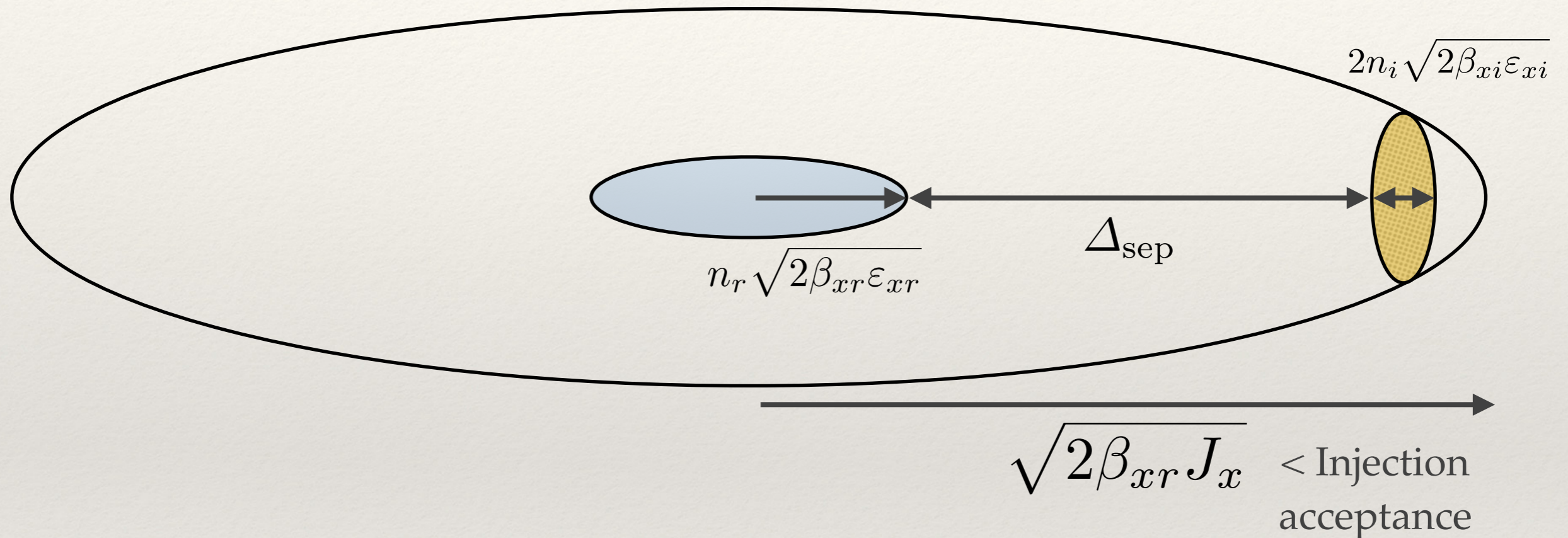

Injection, etc.

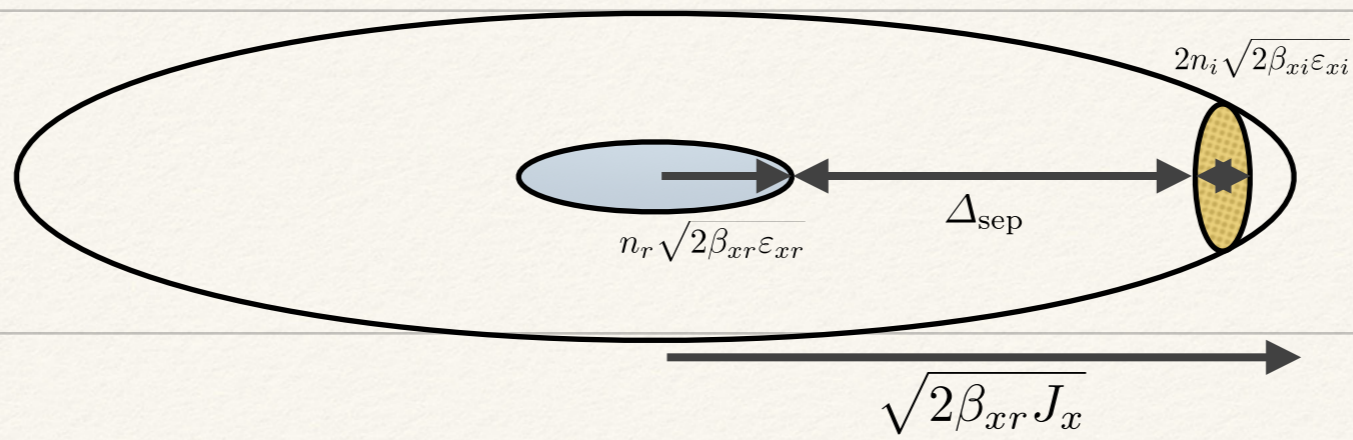
FCC-ee Optics Meeting
11 Sep. 2015

K. Oide (KEK)

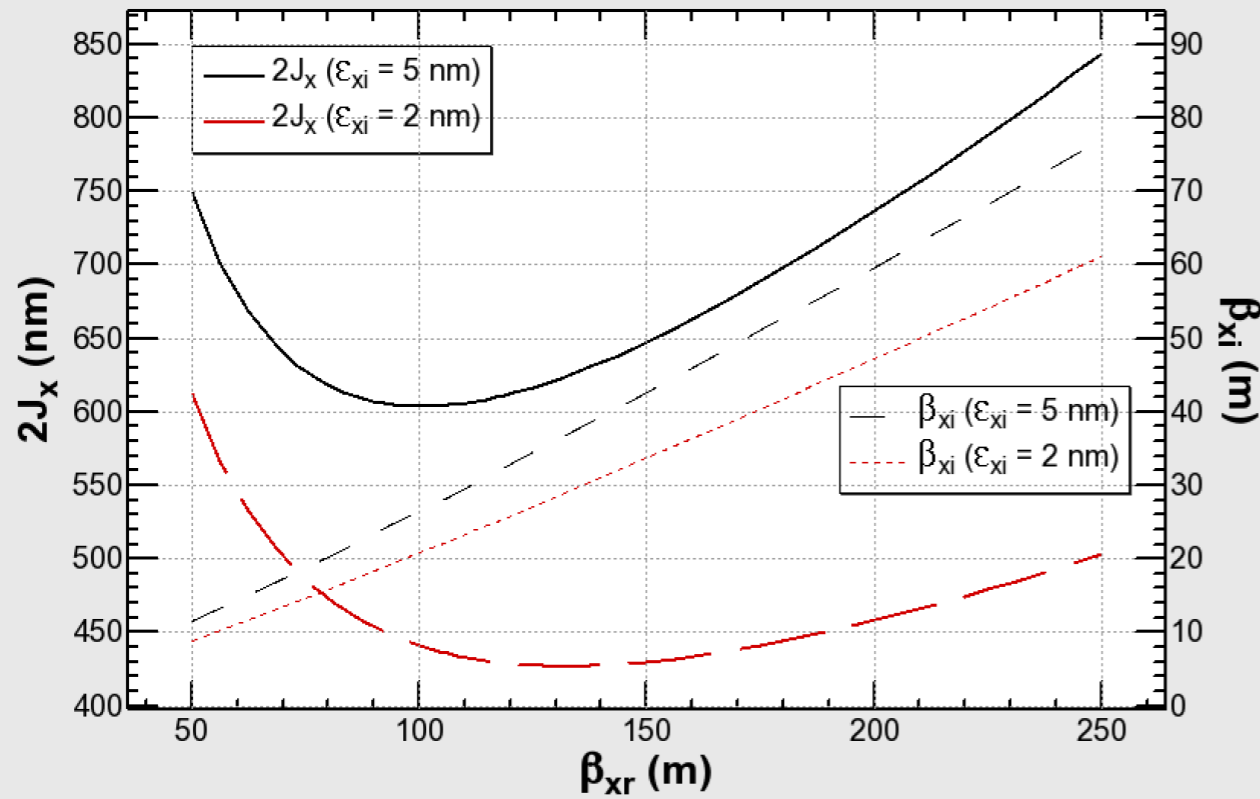
A rough estimation of requirement on injection acceptance



- ❖ β_i is optimized to minimize J_x .to touch the ellipse of the injection beam to the ring ellipse.
- ❖ α does not matter by setting $\alpha_i / \beta_i = \alpha_r / \beta_r$.



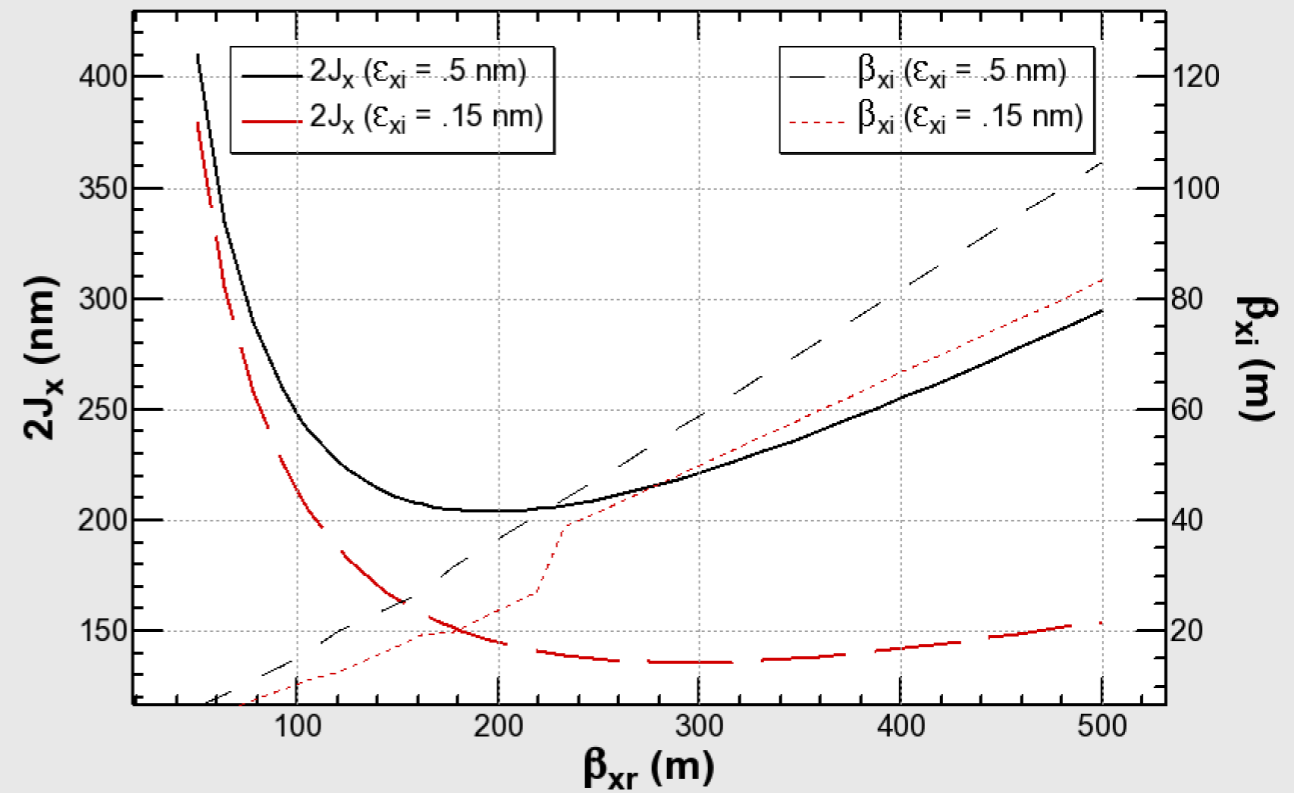
$\epsilon_{xr} = 2 \text{ nm}, \Delta_{sep} = 4 \text{ mm}, n_r = 2.5, n_i = 2.5$



$E = 175 \text{ GeV}$

$2 J_x = 425 \text{ nm} (14.6\sigma_x)$

$\epsilon_{xr} = .15 \text{ nm}, \Delta_{sep} = 4 \text{ mm}, n_r = 2.5, n_i = 2.5$

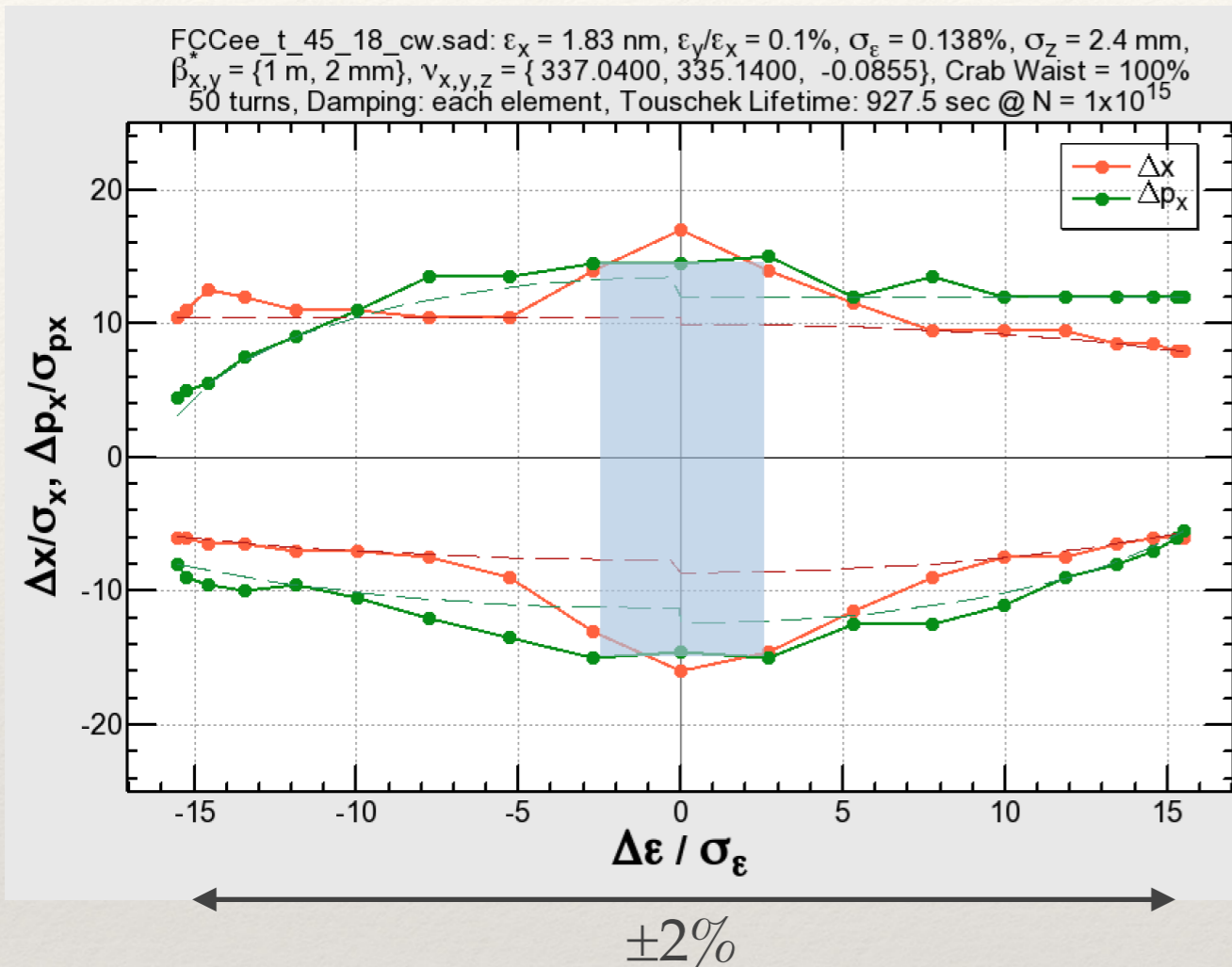


$E = 45.6 \text{ GeV}$

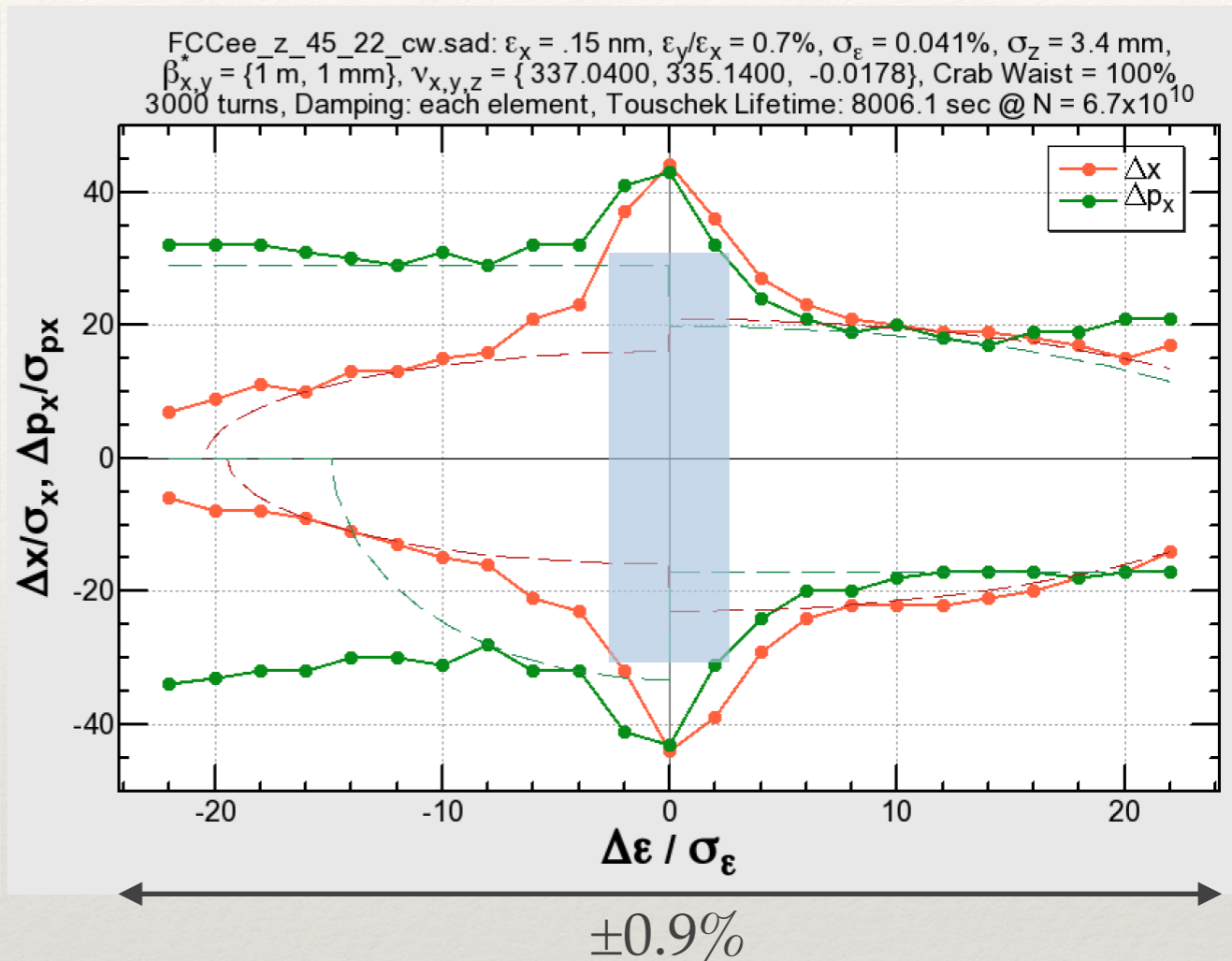
$2 J_x = 135 \text{ nm} (30\sigma_x)$

$J_y/J_x = (2.5^2 \times 0.015 \text{ nm}) / 2J_x = 0.07\%$

Comparison with dynamic aperture



$E = 175$ GeV, $\pm 14.6\sigma_x$ & $\pm 2.5\sigma_\epsilon$

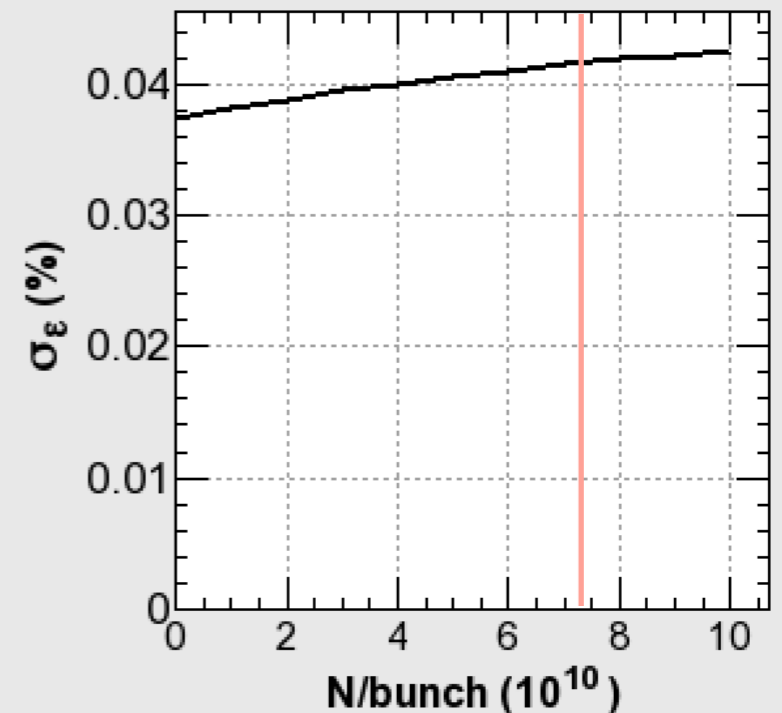
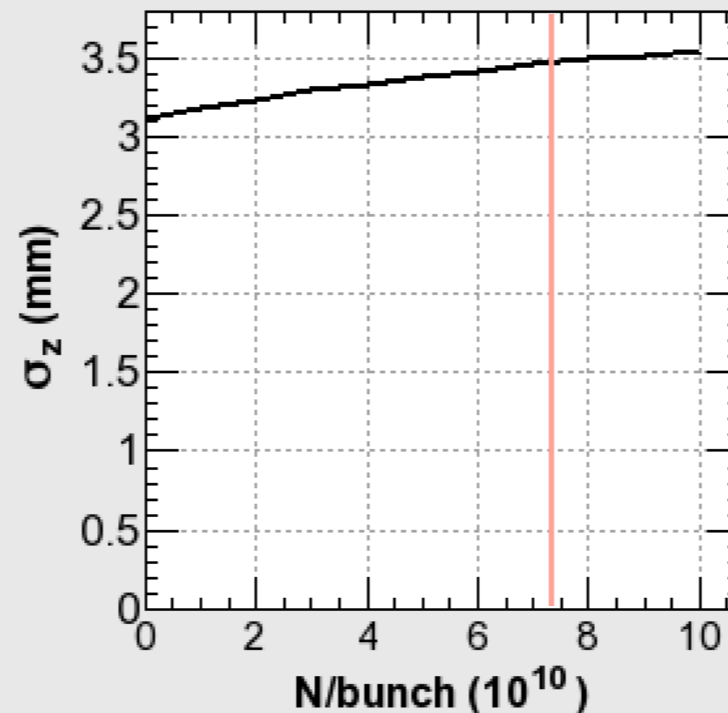
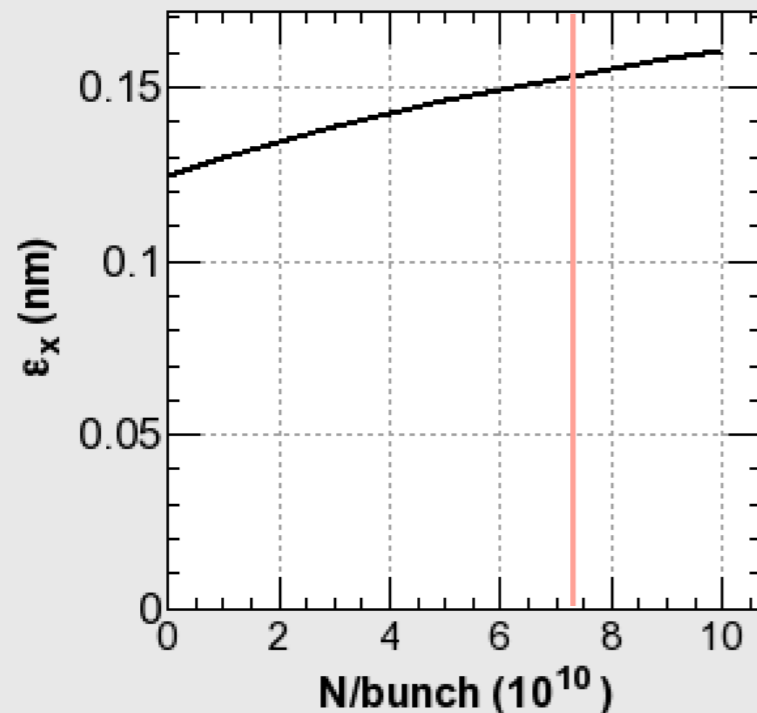


$E = 45.6$ GeV, $\pm 30\sigma_x$ & $\pm 2.5\sigma_\epsilon$

- The amplitude of the injected beam almost fits within the dynamic aperture, both for 175 GeV and 45.6 GeV.
- The required vertical emittance of the injected beam:
 - $\epsilon_{yi} / \epsilon_{xi} < 1.7\%$ (@175 GeV), $< 100\%$ (@45.6 GeV).

Emittance growth due to intrabeam scattering

FCCee_z_45_22_cw.sad,
 $E_{\text{beam}} = 45.6 \text{ GeV}$, $\varepsilon_y/\varepsilon_x = .7 \%$



- There will be a non-negligible emittance growth, by 20%, due to intrabeam scattering at 45.6 GeV.
- The beamstrahlung increases the bunch length, which reduces the intrabeam, but the increase of the energy spread also makes the emittance growth stronger.