

Optics with new geometry

MDI Meeting

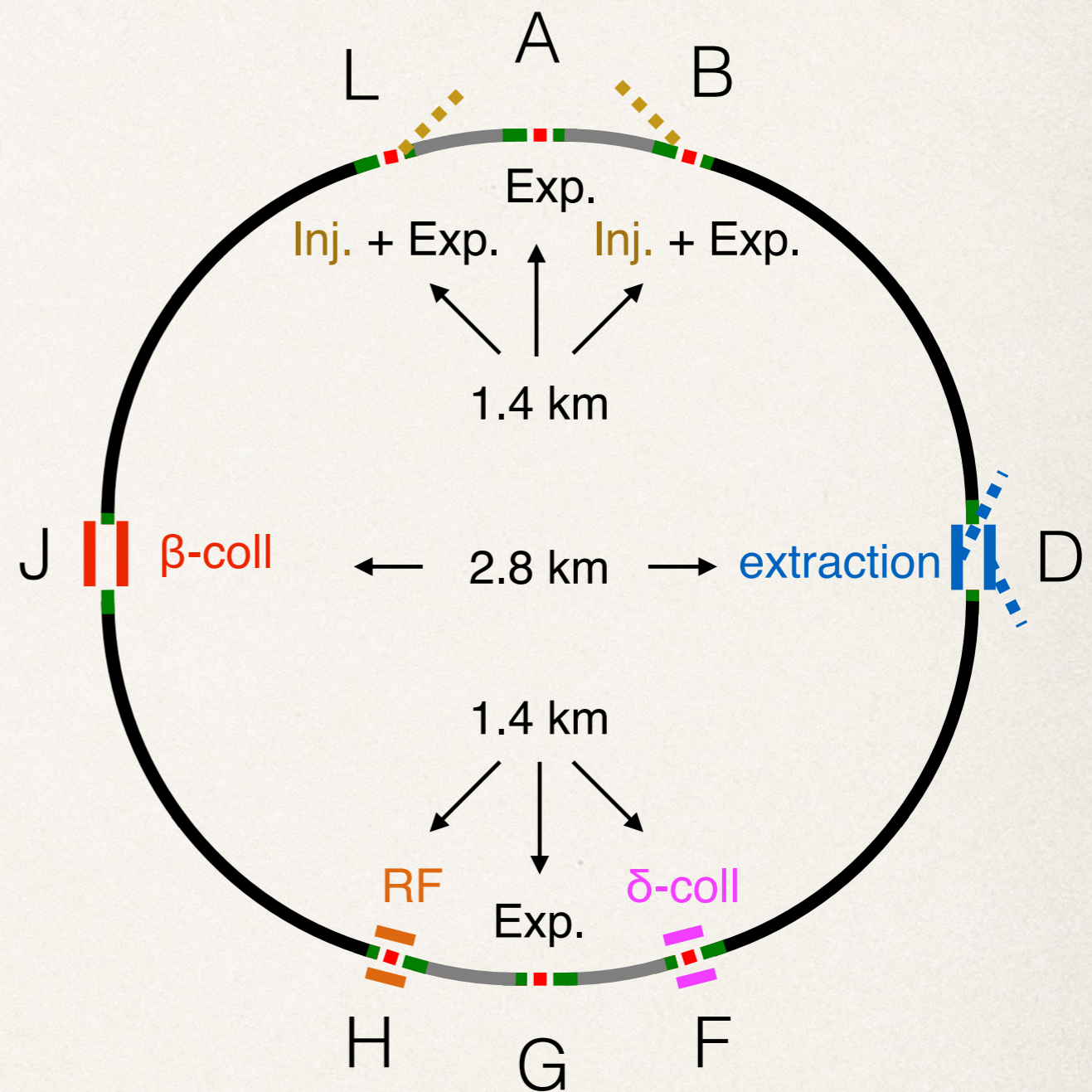
K. Oide (KEK)

12 December 2016

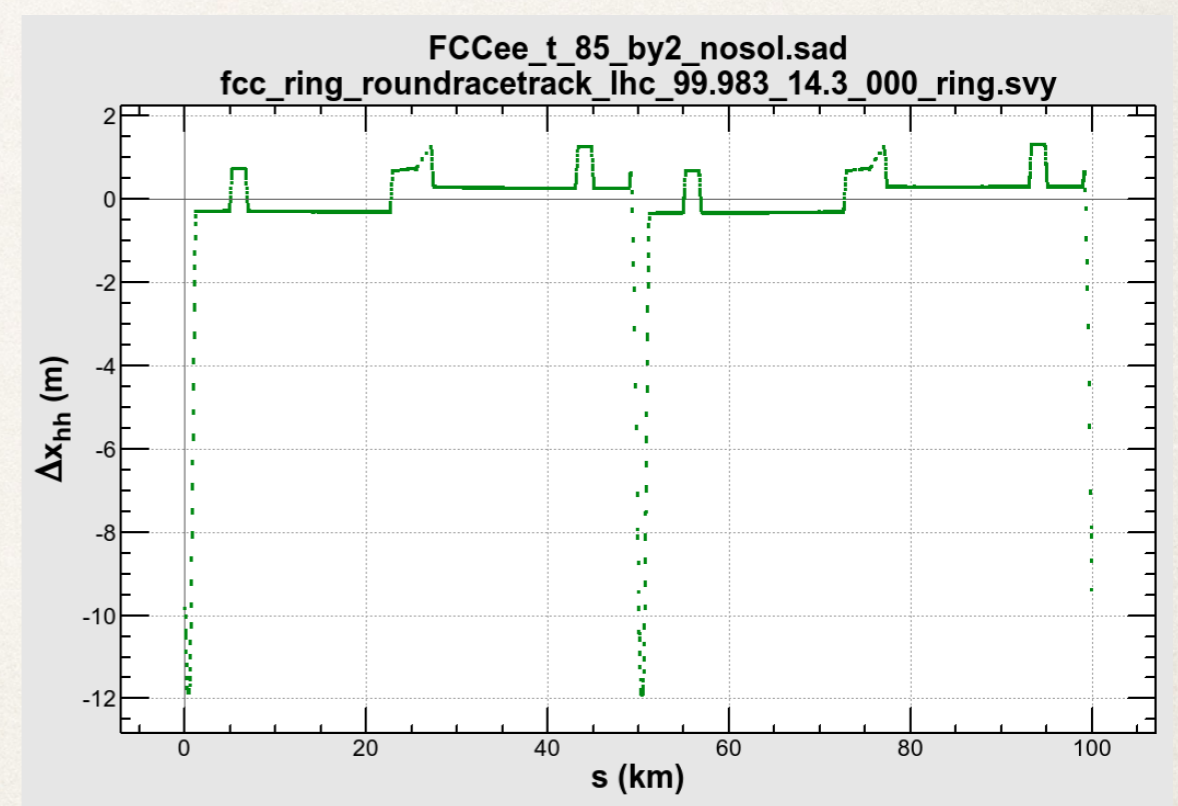
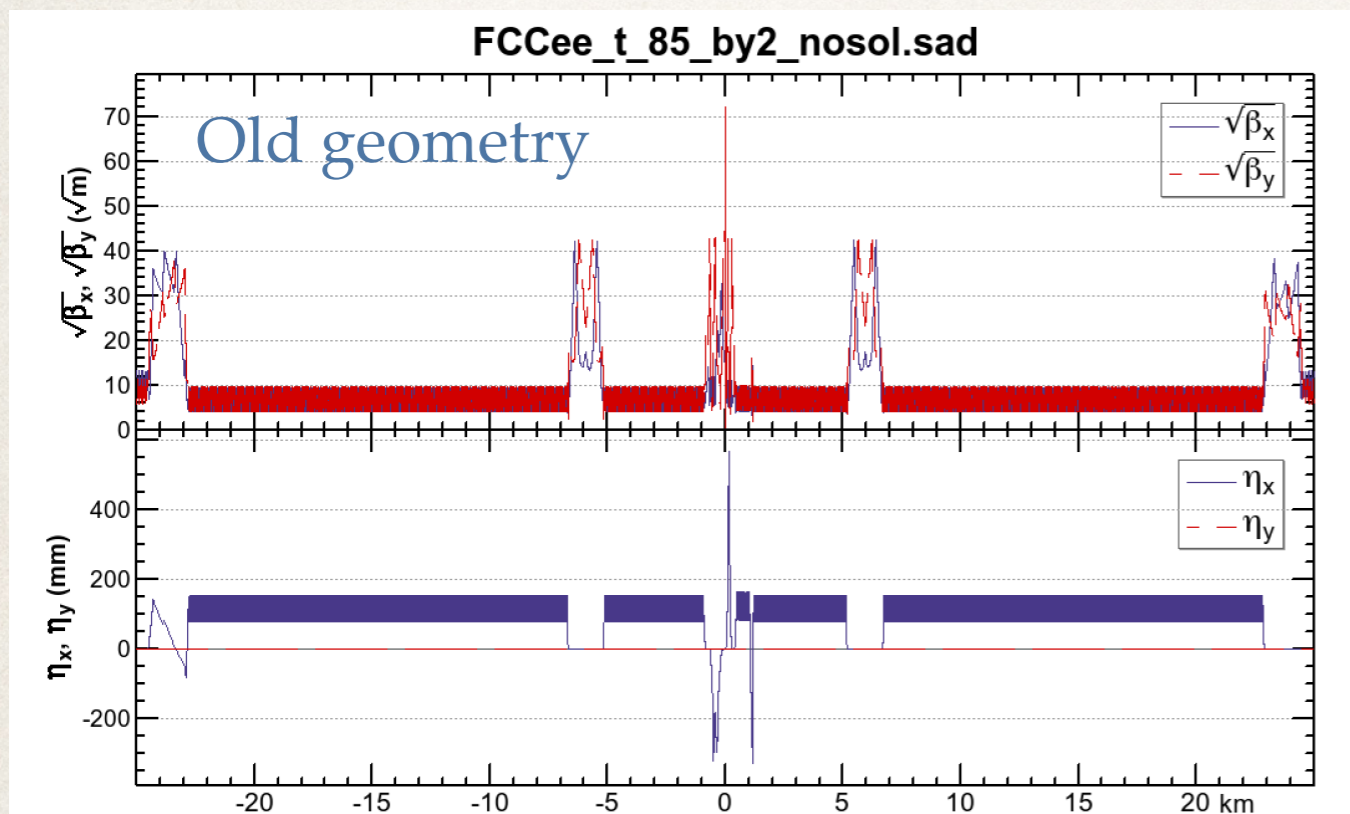
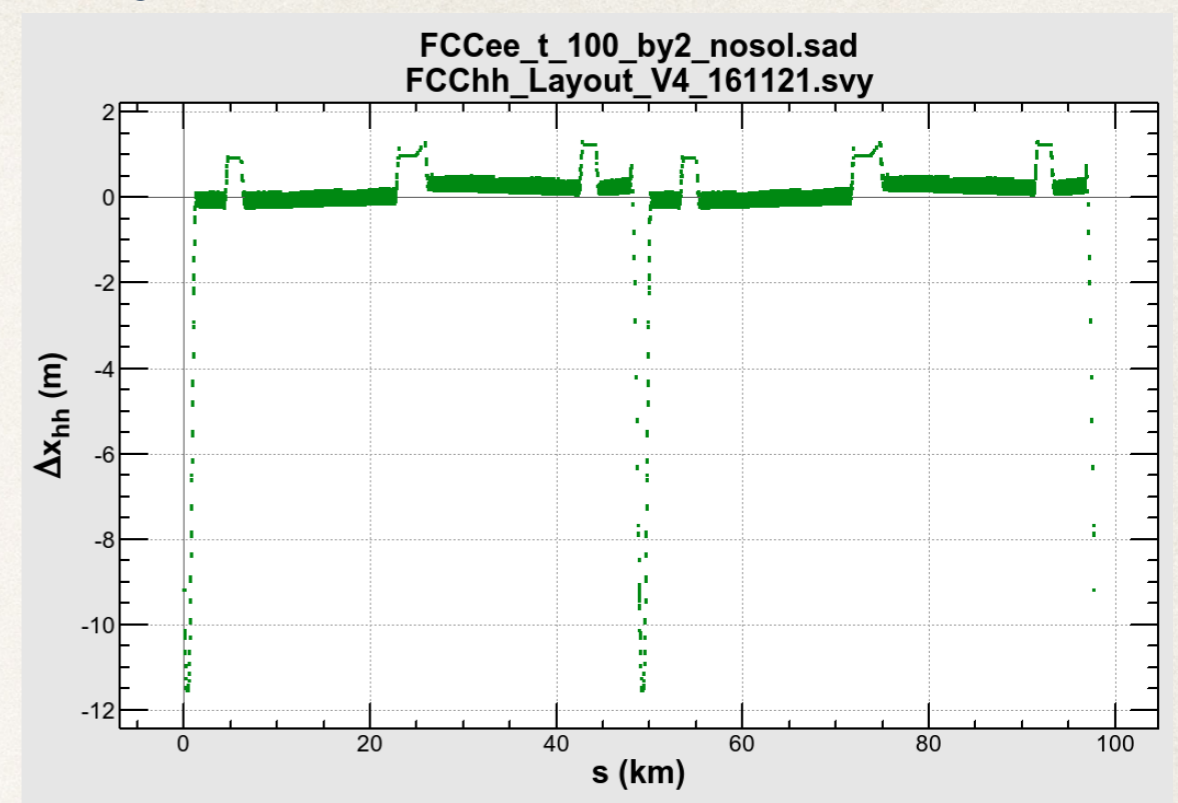
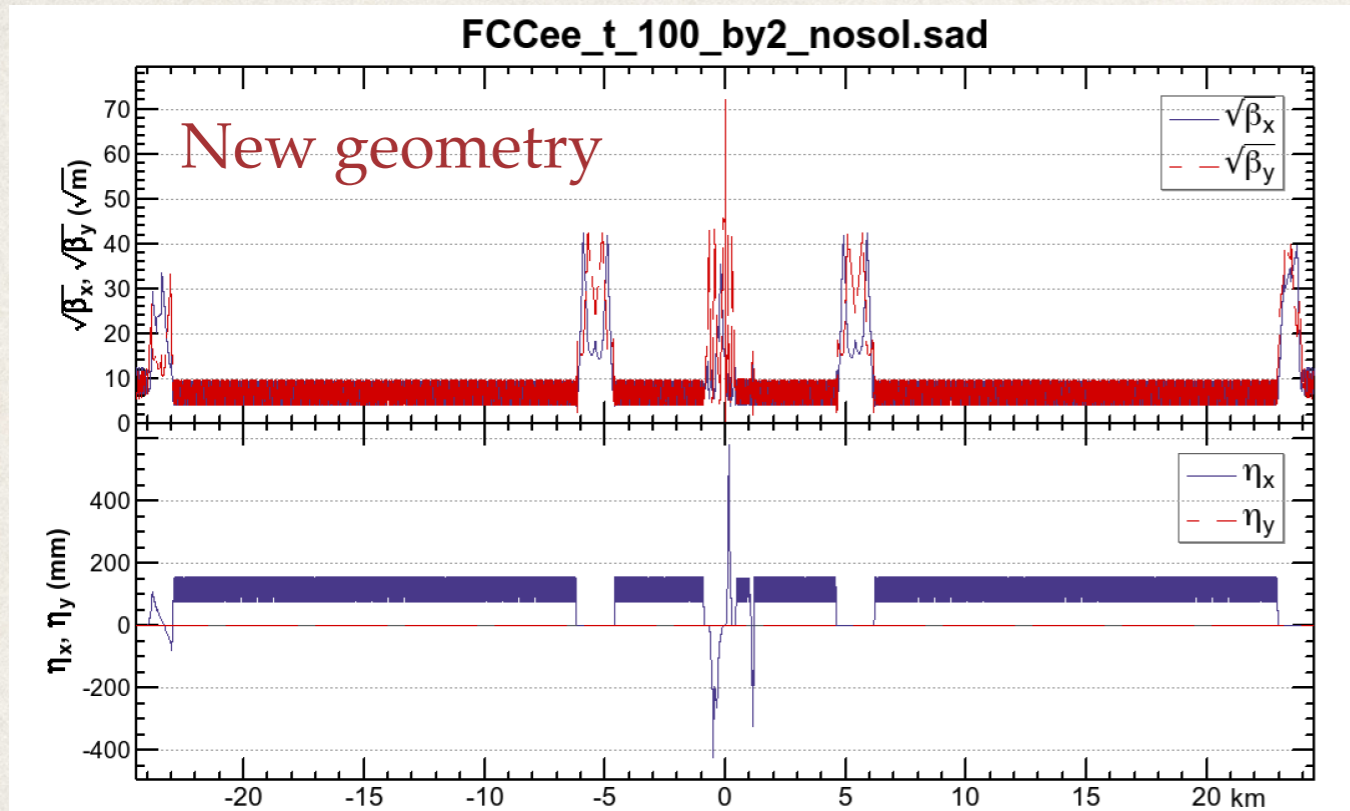
Thank to Andy S. Langner and D. Schulte for FCC-hh layout.

The new layout for FCC-hh

- ❖ The short straights B,L/F,H came closer to the IP A/G by about 550 m.
- ❖ The length of straights D and J becomes shorter by about 1.4 km each.
- ❖ The circumference: FCC-hh: 97.75 km = 11/3 of LHC. FCC-ee (this design): 97.747 km
- ❖ The average radius of curvature was nearly unchanged.
- ❖ The usage for each straight sections are changed as in the figure.
- ❖ Parameters related to the IP basically unchanged: $\ell^* = 2.2$ m.



The new FCC-ee with the new layout

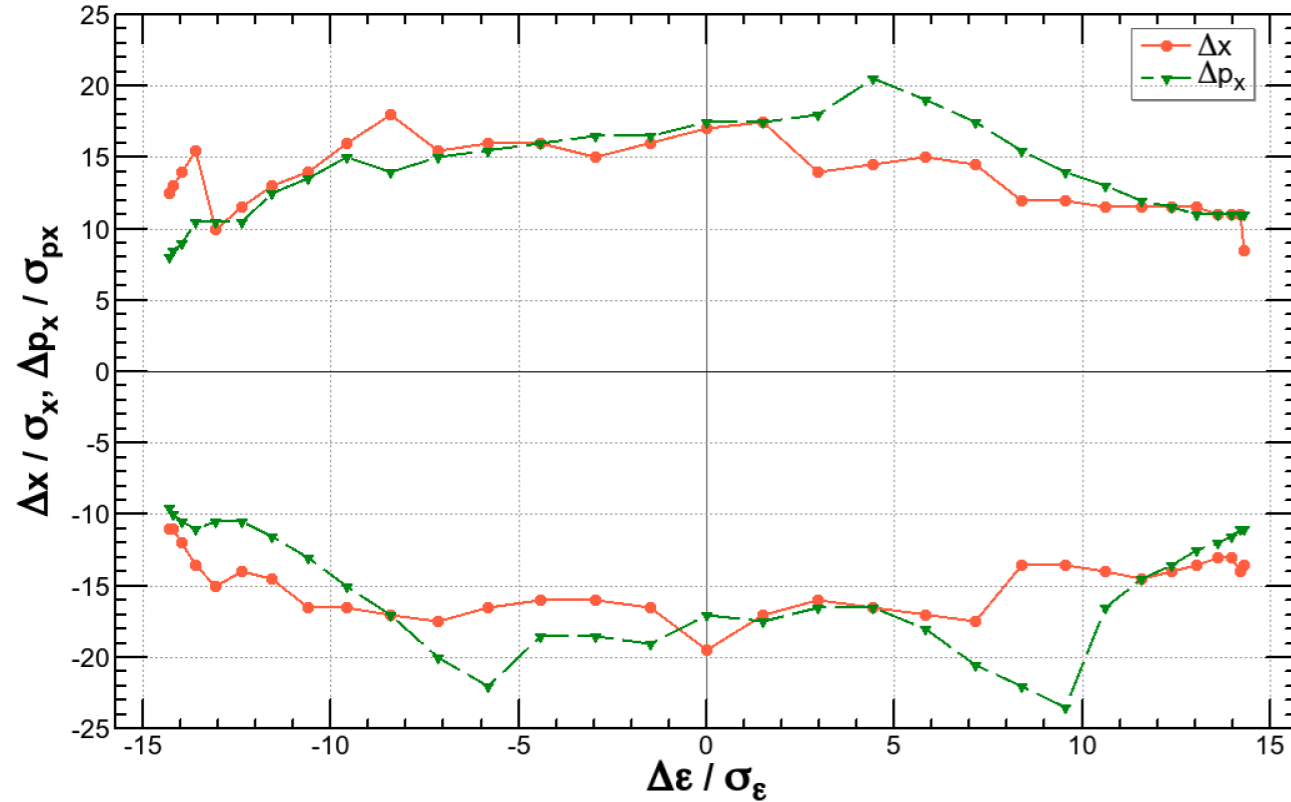


- ❖ The wiggling in Δx_{hh} in the arc of new geometry may be due to coarse data points in the new layout file.
- ❖ The separation between e+e- rings was set to 32 cm for the new layout. It was 60 cm before.

Dynamic Aperture @ 175 GeV

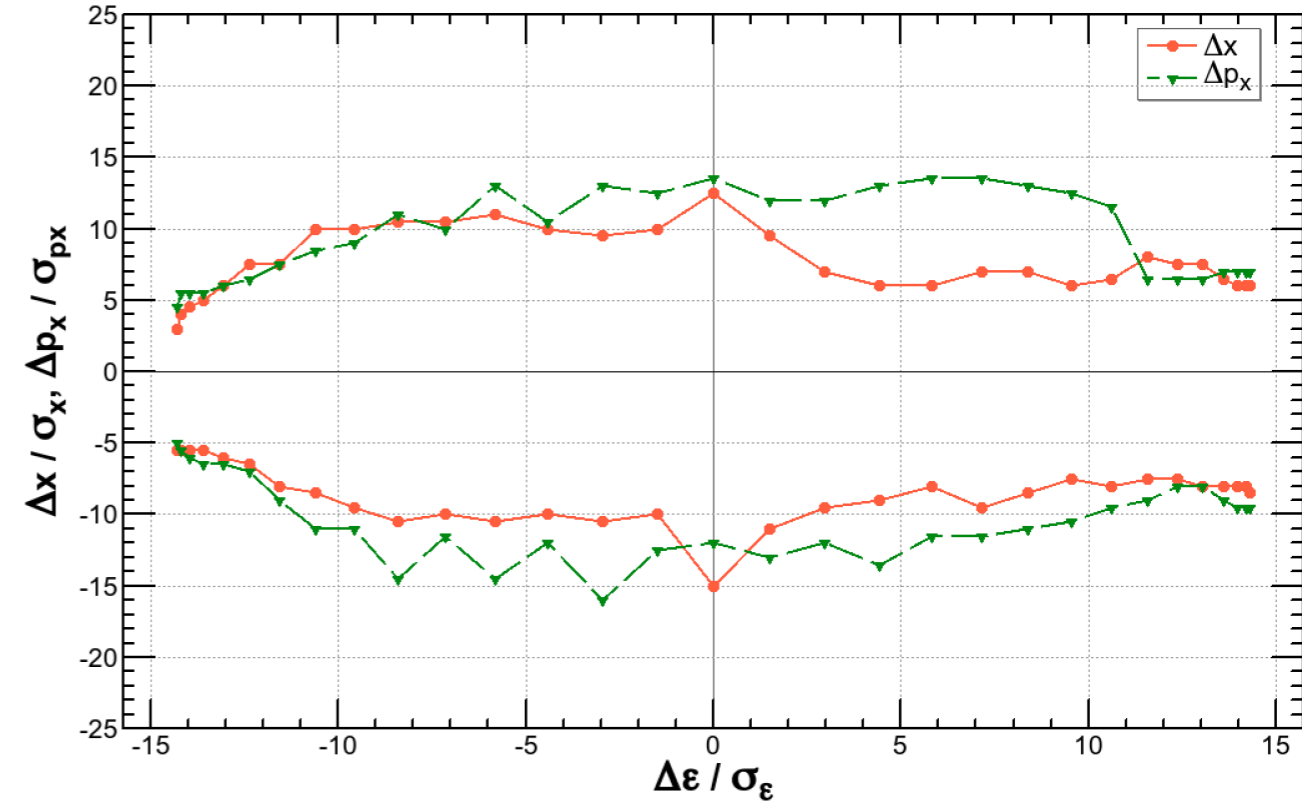
$$\beta^*_{x,y} = (1 \text{ m}, 2 \text{ mm})$$

FCCee_t_104_by2_nosol.sad: $\epsilon_x = 1.25 \text{ nm}$, $\epsilon_y/\epsilon_x = 0.5\%$, $\sigma_\epsilon = 0.147\%$, $\sigma_z = 2.6 \text{ mm}$,
 $\beta_{x,y} = \{1 \text{ m}, 2 \text{ mm}\}$, $v_{x,y,z} = \{387.0882, 389.1745, -0.0688\}$, Crab Waist = 100%
50 turns, Damping: each element, Touschek Lifetime: $1.62\text{E}8 \text{ sec}$ @ $N = 1 \times 10^{10}$



$$\beta^*_{x,y} = (0.5 \text{ m}, 1 \text{ mm})$$

FCCee_t_105_by1_nosol.sad: $\epsilon_x = 1.26 \text{ nm}$, $\epsilon_y/\epsilon_x = 0.5\%$, $\sigma_\epsilon = 0.147\%$, $\sigma_z = 2.9 \text{ mm}$,
 $\beta_{x,y} = \{0.5 \text{ m}, 1 \text{ mm}\}$, $v_{x,y,z} = \{387.0881, 389.1712, -0.0659\}$, Crab Waist = 100%
50 turns, Damping: each element, Touschek Lifetime: $7.99\text{E}7 \text{ sec}$ @ $N = 1 \times 10^{10}$



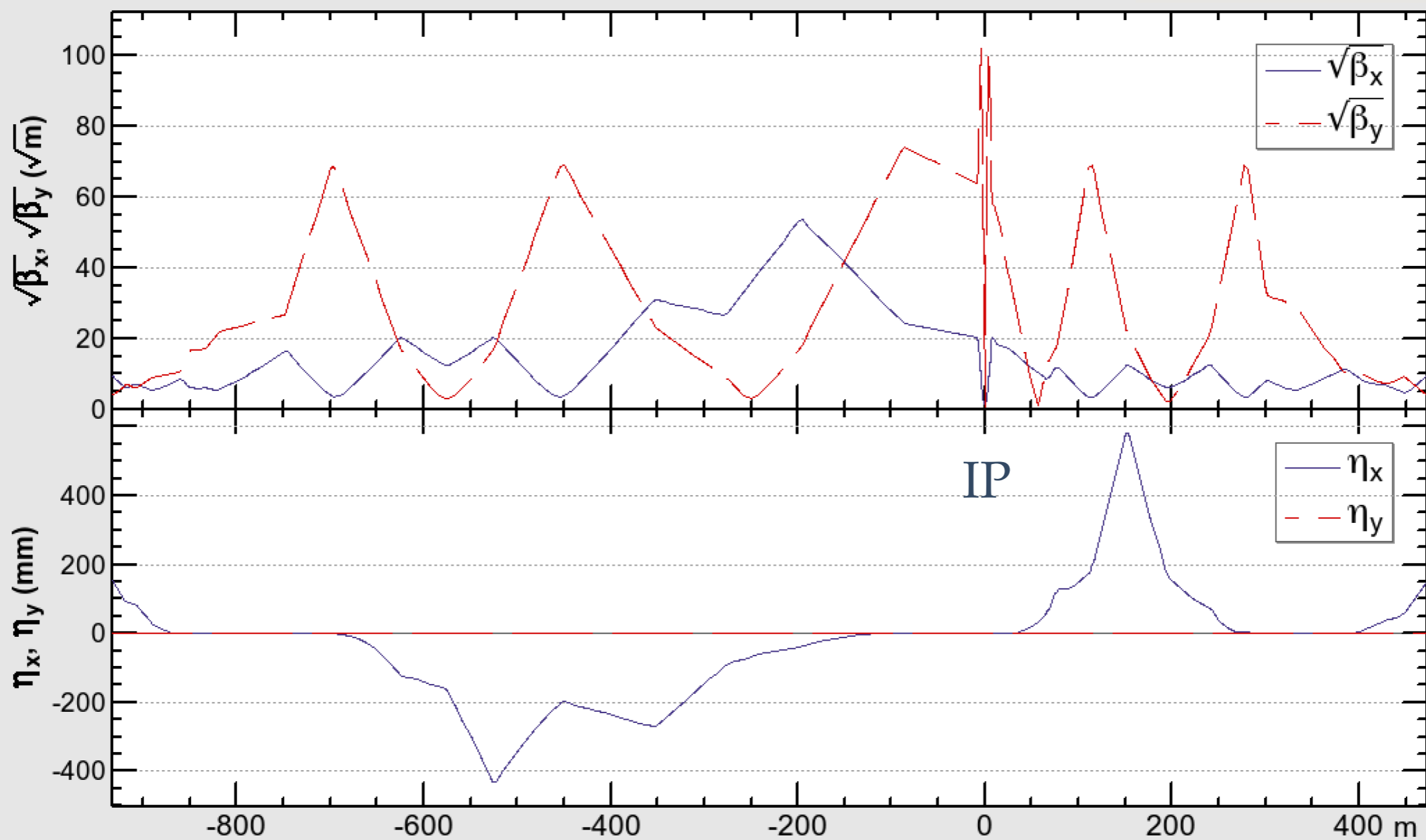
- ❖ The dynamic aperture at 175 GeV looks OK.
- ❖ Solenoids have been temporarily removed.
- ❖ Optimization for 45.6 GeV is on going.

Synchrotron Radiation around IP

$\beta^*_{x,y} = (0.5 \text{ m}, 1 \text{ mm})$

175 GeV, 6.6 mA

FCCee_t_105_by1_nosol.sad



u_c (kV)	843	585.9	585.9	231.3	100.0	99.6	796.2	1207	1389	895.9
P (kW)	12.9	14.5	14.5	2.3	0.47	0.57	15.3	28.3	40.5	8.1