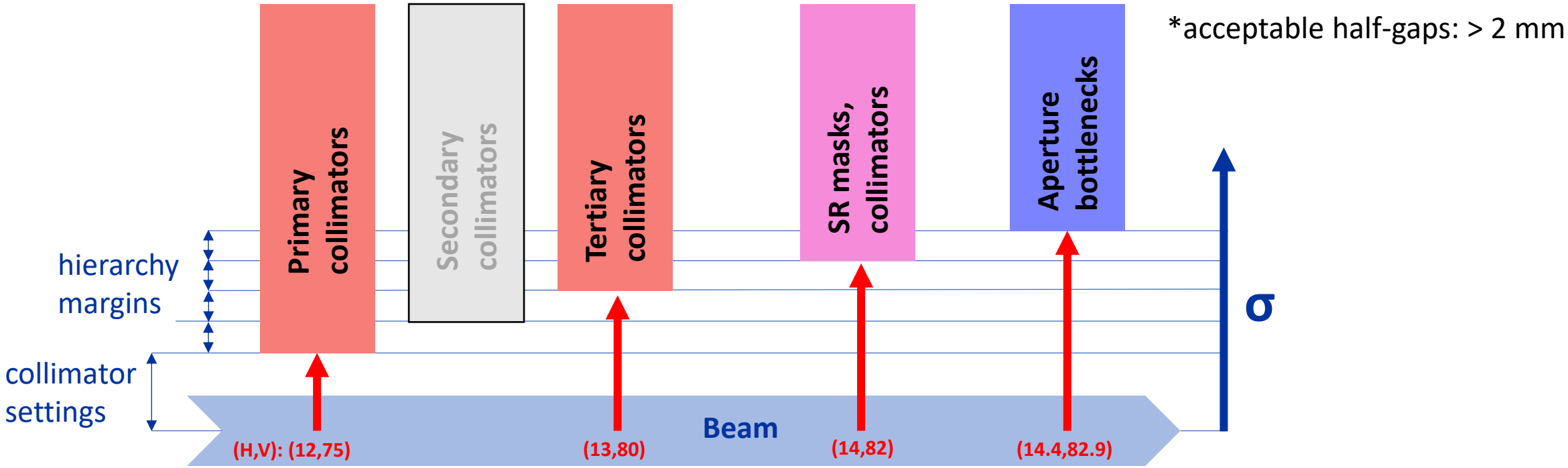
FCC-ee collimation update

FCC-ee Z common LSSs collimation performance

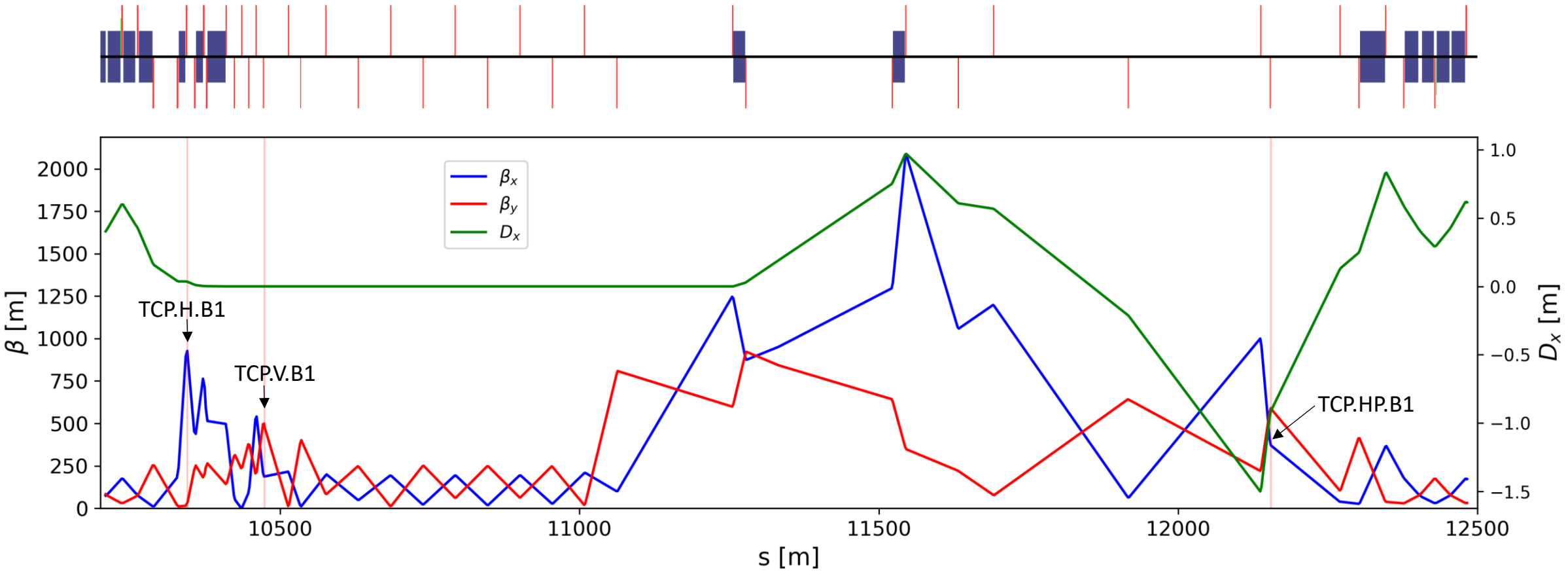
- **Aperture bottlenecks** (assuming 250 µm max. closed orbit distortion, 10% max. β-beating and circular beam pipe)
  - **H plane**: 14.4 sigma (QC2L2)
  - **V plane**: 82.9 sigma (QC1L2)
- Optics in collimation insertion does not allow secondary collimators at good phase advances and acceptable gaps* (beta functions rather low, except for few locations where primary collimators can be placed)
- Tentatively tried a **"single-stage" collimation system** (i.e., no secondary collimators)
  - 2 primary betatron collimators (H+V)
  - 1 primary off-momentum collimator
  - 2 "tertiary" local protection collimators (H+V) and 6 SR collimators upstream of each IP



*acceptable half-gaps: > 2 mm

FCC-ee Z common LSSs beam halo collimator (PF) parameters and settings

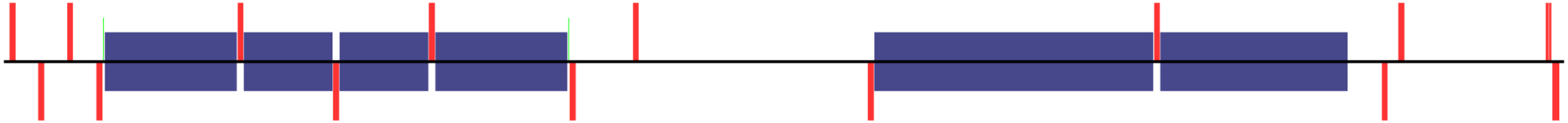
Name	Type	Plane	Material	Length [cm]	Half-gap [σ]	Half-gap [mm]	δ_{cut} [%]
TCP.H.B1	betatron primary	H	MoGr	25	12	9.6	28.9
TCP.V.B1	betatron primary	V	MoGr	25	75	2.3	-
TCP.HP.B1	off-momentum primary	H	MoGr	25	23	11.8	1.3

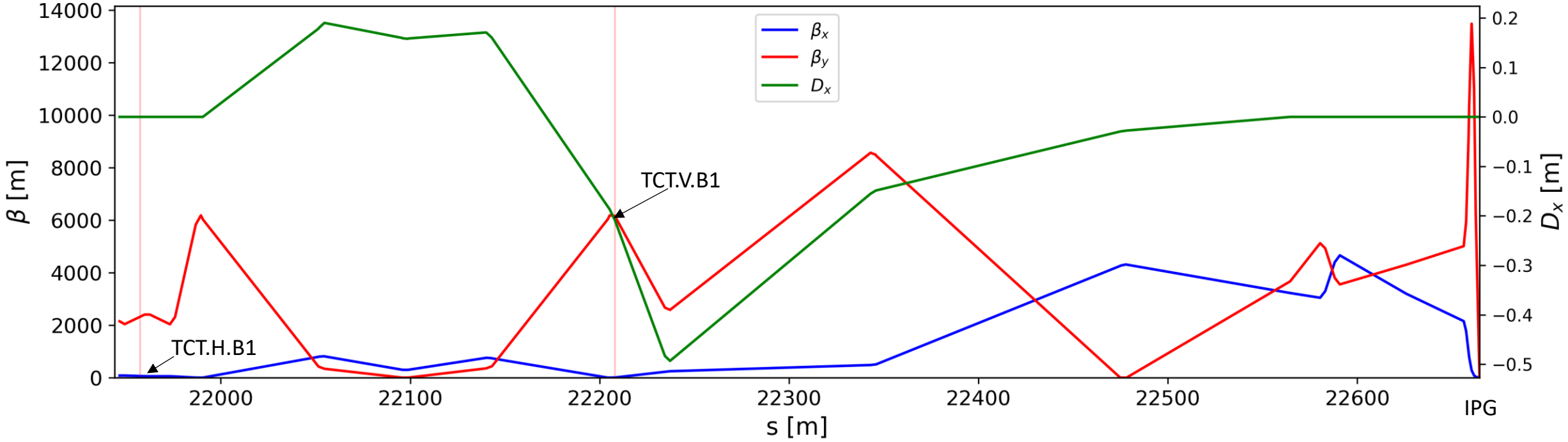


FCC-ee Z common LSSs tertiary local protection collimators parameters and settings

Name	Type	Plane	Material	Length [cm]	Half-gap [σ]	Half-gap [mm]	δ_{cut} [%]
TCT.H.B1	tertiary local protection	H	MoGr	25	13	2.8	442
TCT.V.B1	tertiary local protection	V	MoGr	25	80	8.6	-

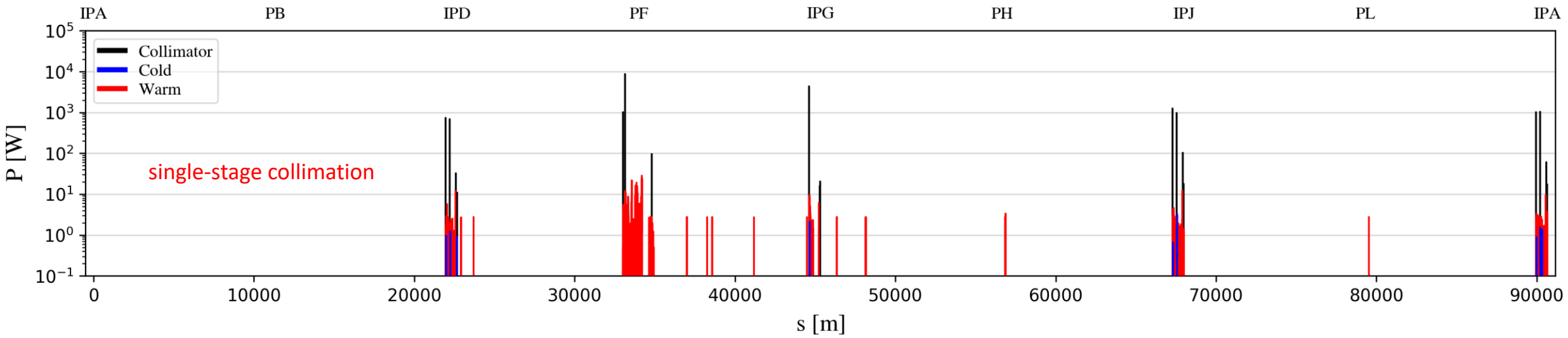
TCT location chosen for optimal phase advance (multiple of π) between TCTs and
- SR collimators
- aperture bottlenecks (QC quadrupoles)



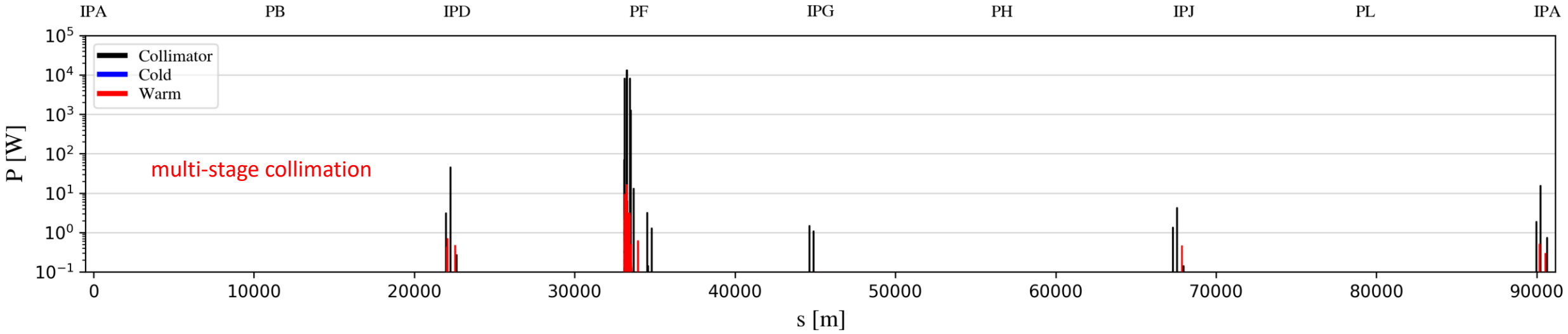


NOTE: The layout is the same upstream of each IP

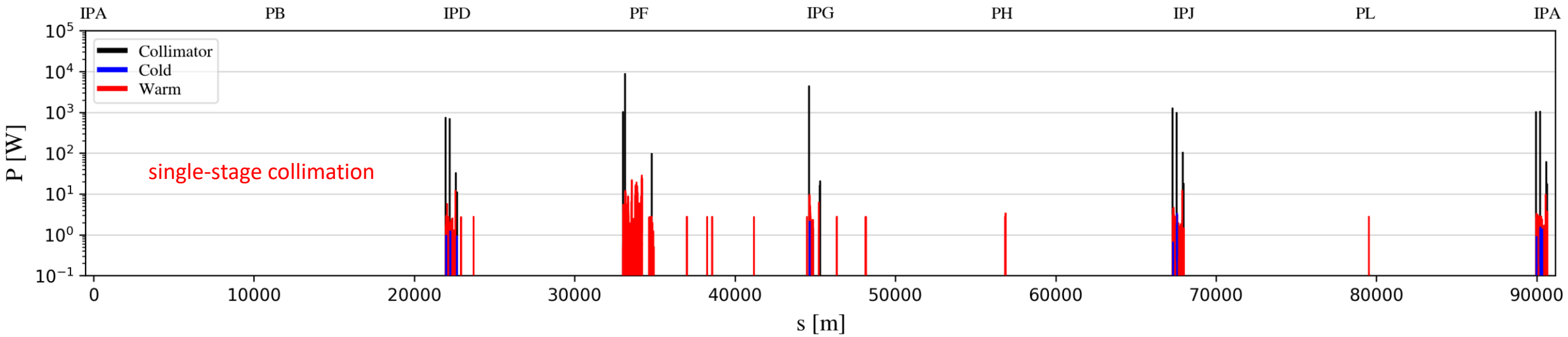
- FCC-ee Z common LSSs collimation performance for horizontal betatron losses (assuming lifetime drop to 5 min)



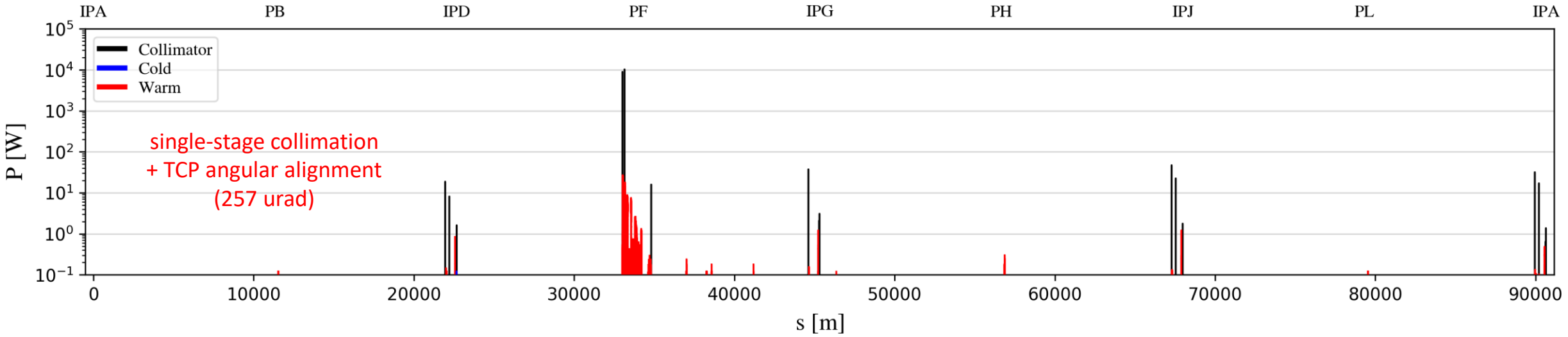
- FCC-ee Z V23 collimation performance for horizontal betatron losses (assuming lifetime drop to 5 min)



- FCC-ee Z common LSSs collimation performance for horizontal betatron losses (assuming lifetime drop to 5 min)



- FCC-ee Z common LSSs collimation performance for horizontal betatron losses (assuming lifetime drop to 5 min)

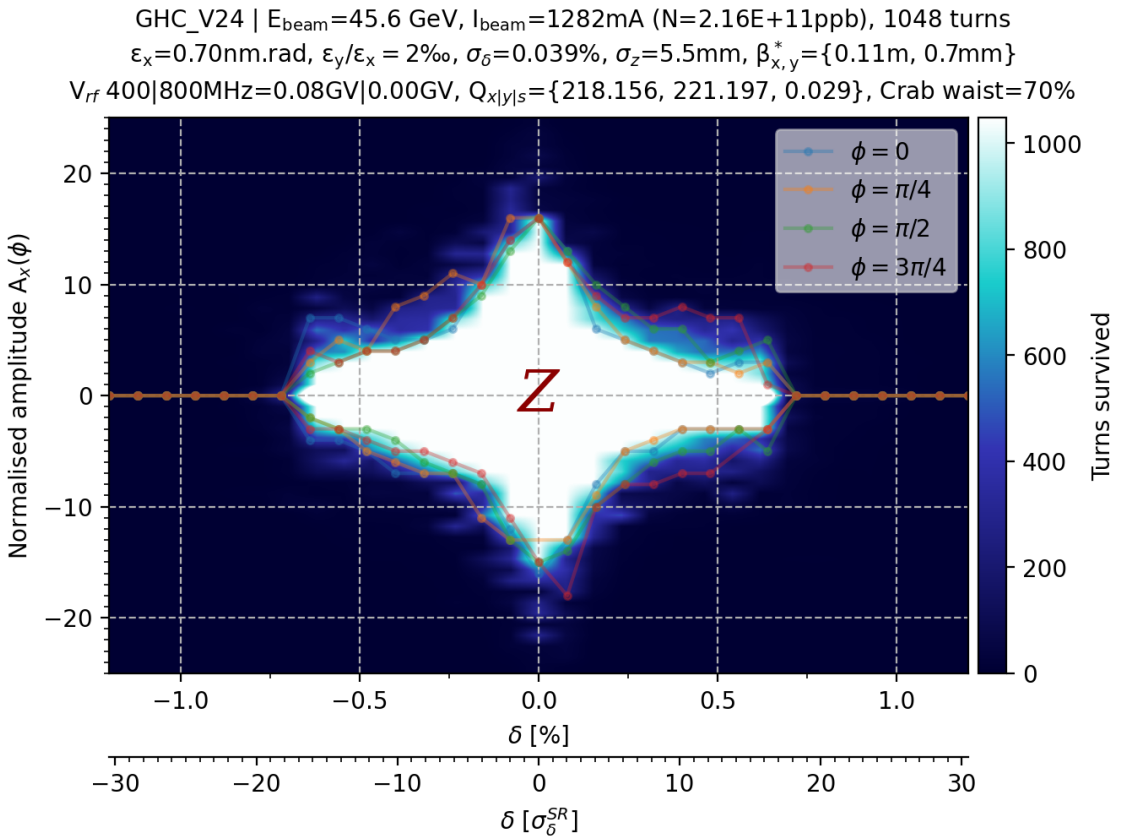


- Angular sensitivity scan ongoing, shower absorbers?, TCS (even at non optimal phases) ?

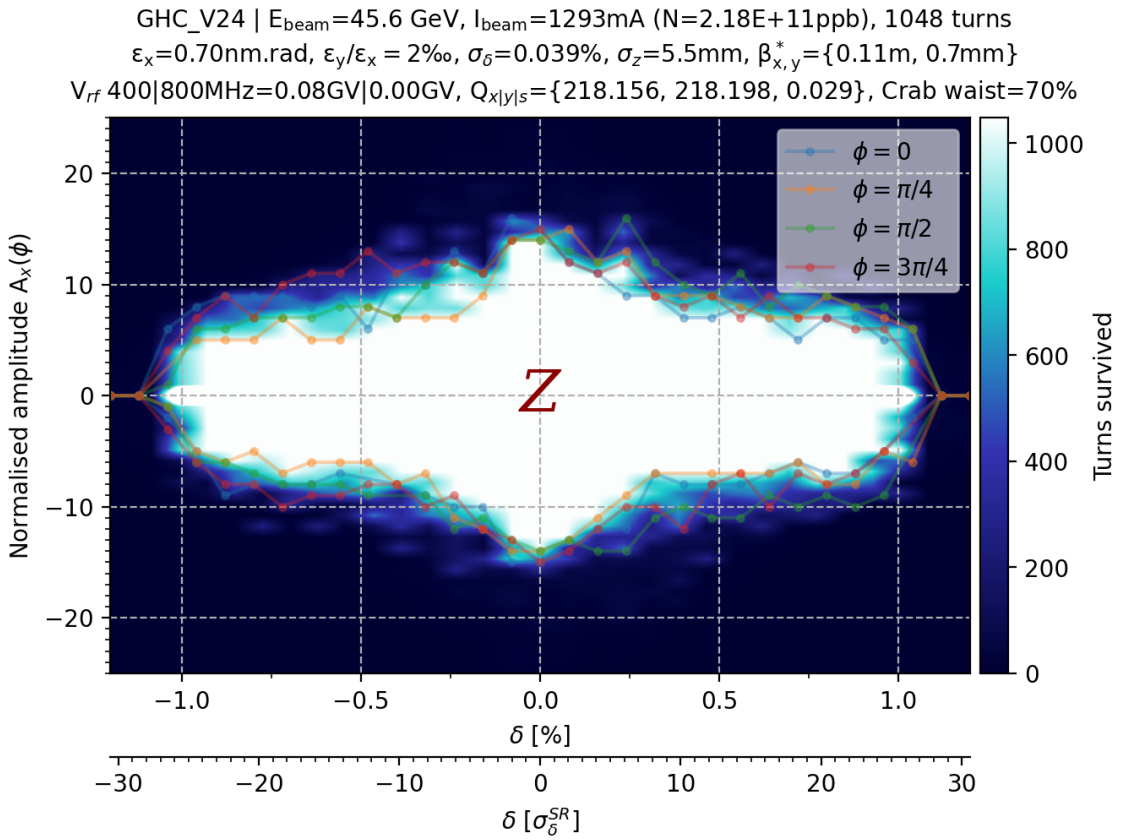
Momentum acceptance

Courtesy K. Andre

GHC + dedicated collimation insertion optics

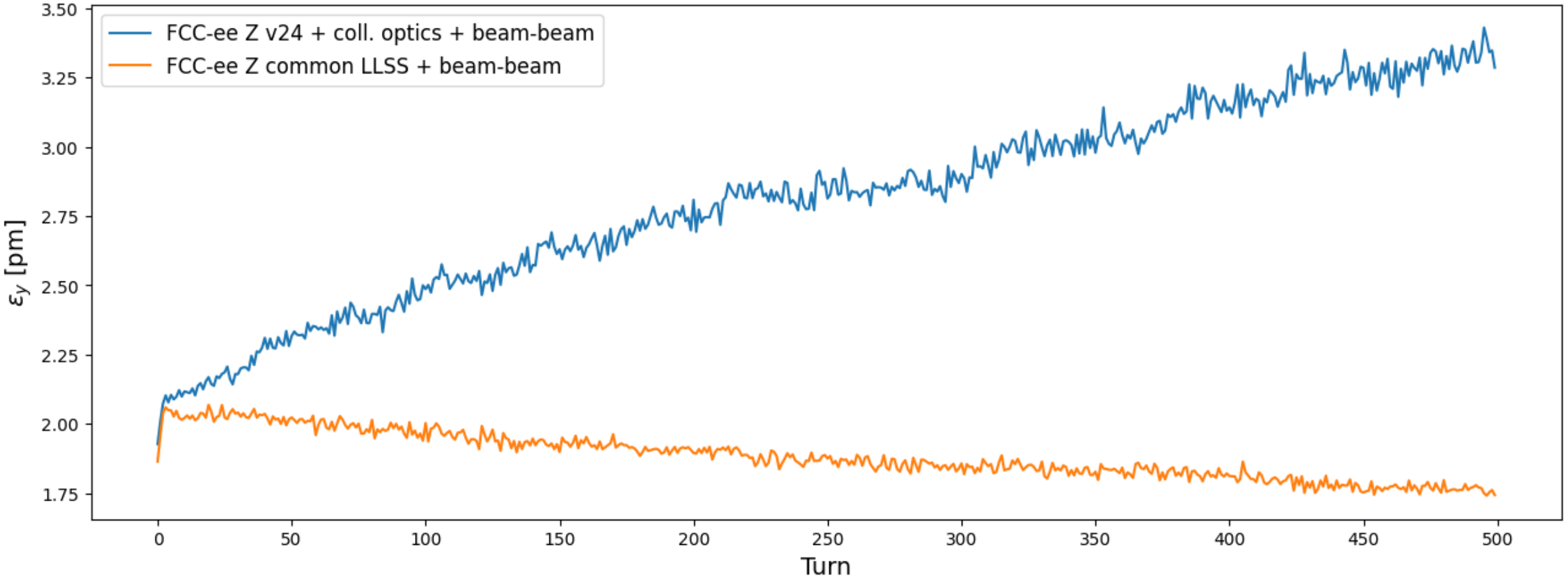


GHC common LLSS optics



- Sextupole optimization not performed consistently between the two – might explain poorer MA with dedicated collimation optics

Vertical emittance with beam-beam

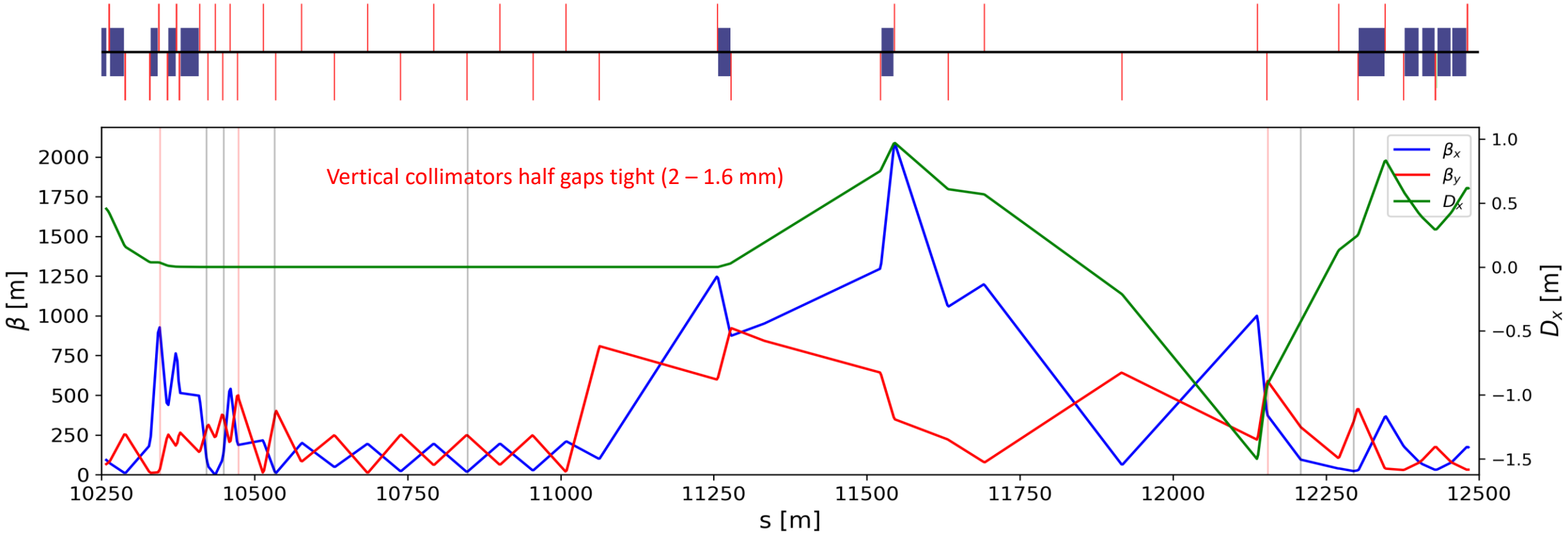


Common LLSS collimation + TCS

- Tentatively placed TCS with max. tolerance ~20° from optimal phase and considering more optimal phases

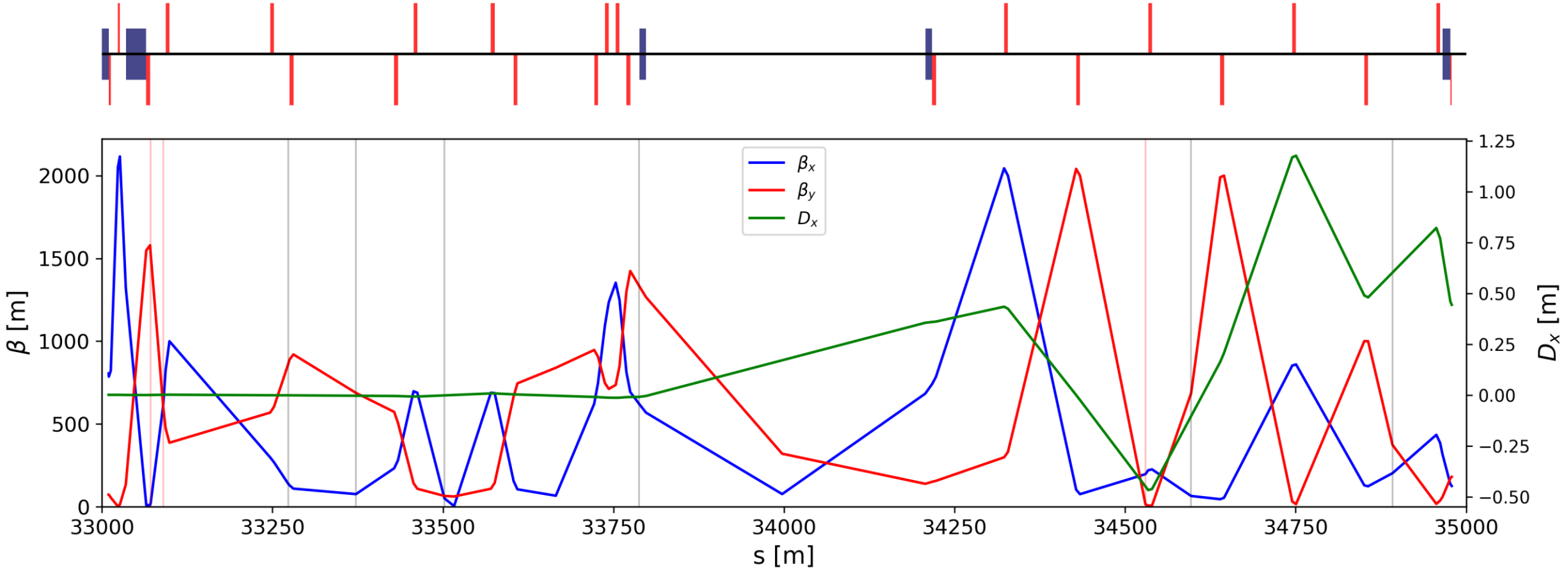
$$\mu = \tan^{-1}\left(\frac{\sqrt{n_2^2 - n_1^2}}{n_1}\right)$$

mu_opt + 2pi, mu_opt + 4pi, …



- Collimation performance with this layout is under study

FCC-ee V24 collimation



- Collimation performance with this layout is under study