TLEP Interaction Region design

Hector Garcia Morales[1,2], Rogelio Tomas Garcia[2]
thanks to B.Holzer

[1] Universitat Politècnica de Catalunya, Barcelona
[2] CERN, Geneve

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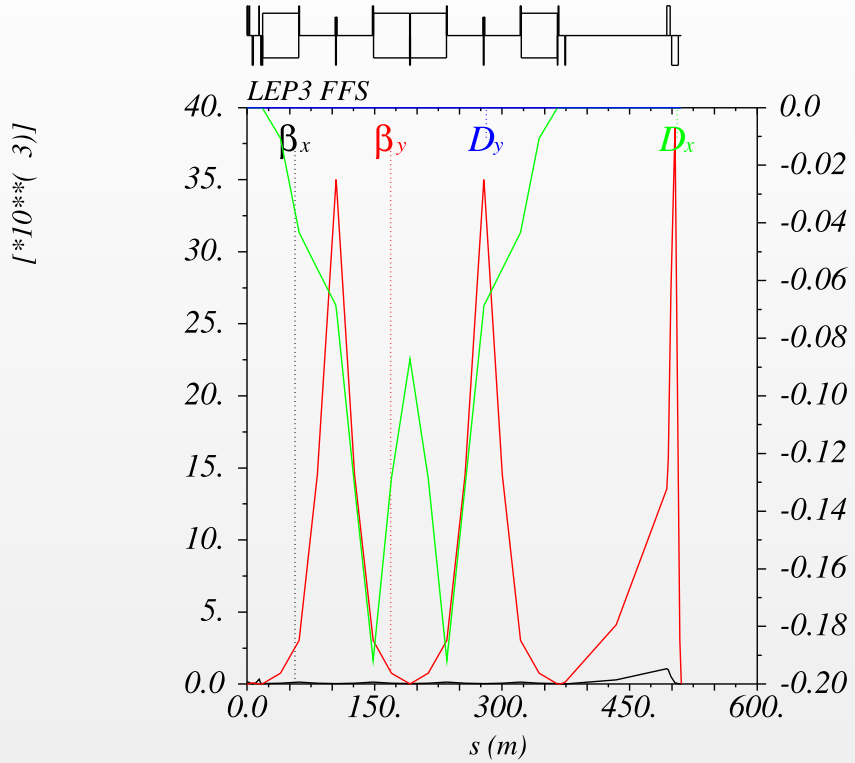
New parameters

Parameter	[**Units**]	TLEP t A	TLEP t B
Beam energy E_{beam}	[GeV]	175	175
Circumeference f_{rep}	[km]	100	100
Bunch population N_e	$[10^{11}]$	0.88	7.0
Number of bunches n_b		160	20
Bunch length σ_z	[mm]	0.77	1.95
IP beam size σ_x^*/σ_y^*	[μm]	45/0.045	126/0.126
Emittance (IP) ϵ_x/ϵ_y	[nm]	2.0/0.002	16.0/0.016
Beta functions (IP) β_x^*/β_y^*	[m]	1.0/0.001	1.0/0.001
Luminosity $\mathcal{L}_{\mathrm{T}}$	$[10^{34}\mathrm{cm}^{-2}s^{-1}]$	1.32	1.04

Final Focus Design

FFS facts

- Consider dedicated chromatic correction scheme.
- Since the horizontal beta function β_x^* is very large there is no need of horizontal chromatic correction section (CCX).
- Vertical correction is performed using horizontal dispersion and normal sextupoles.



FFS parameters

- $L_{\mathrm{FFS}} = 511\,\mathrm{m}$
- $L^* = 3.5\,\mathrm{m}$
- $L_{\mathrm{QD0}} = 7.90\mathrm{m}$
- $k_{\mathrm{QD0}} = -0.034262\mathrm{m}^{-2}$

Bending section

- Bending Angle, bending magnet length and dispersion comparable to the arc.
- $B_{\mathrm{dip}} = 0.06\,\mathrm{T}$, $D_x^{\mathrm{max}} = 0.19\,\mathrm{m}$

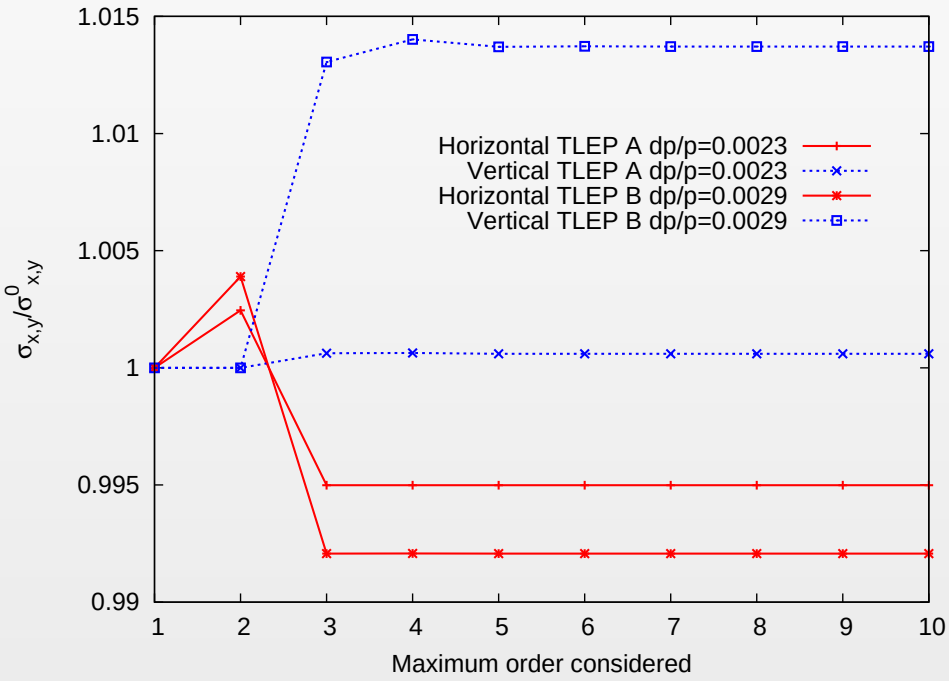
Nonlinear optimization

MAPCLASS Beam sizes

$$\sigma_x^*(A) = 44.50\,\mu\text{m},\ \sigma_y^*(A) = 44.78\text{nm}$$

$$\sigma_x^*(B) = 125.49\,\mu\text{m},\ \sigma_y^*(B) = 128.31\text{nm}$$

- Even without horizontal chromatic correction, the horizontal aberrations are negligible.
- Vertical chromatic correction is almost perfect for TLEP A and the aberration content is below 1.5% of the beam size for TLEP B.

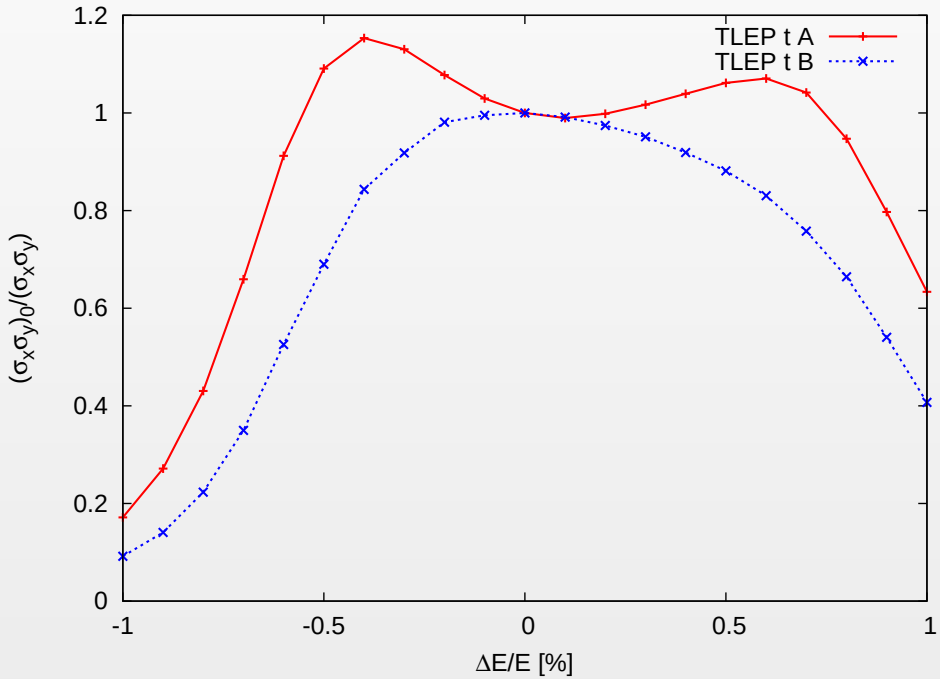


Performance at the IP

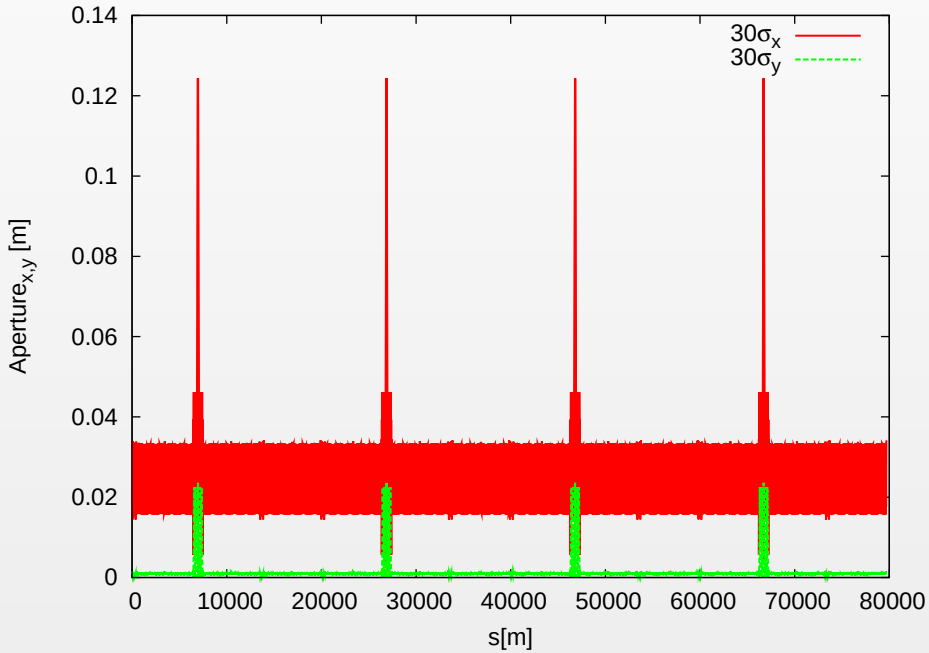
PLACET Beam sizes

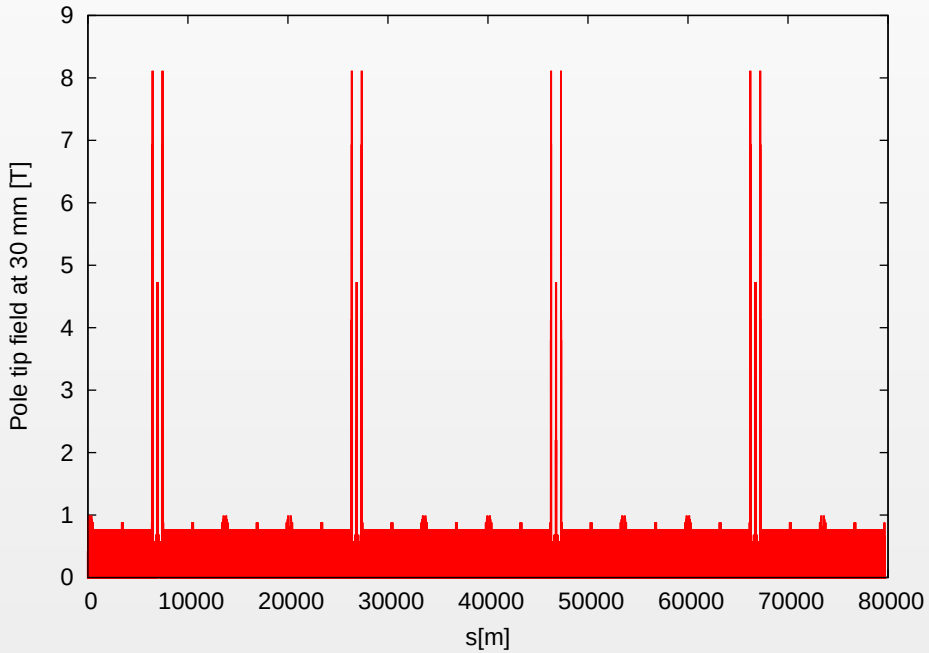
$$\sigma_x^*(A) = 44.67\,\mu\text{m},\ \sigma_y^*(A) = 44.66\text{nm}$$

$$\sigma_x^*(B) = 123.74\,\mu\text{m},\ \sigma_y^*(B) = 131.7\text{nm}$$



Inserting the FFS in the ring lattice



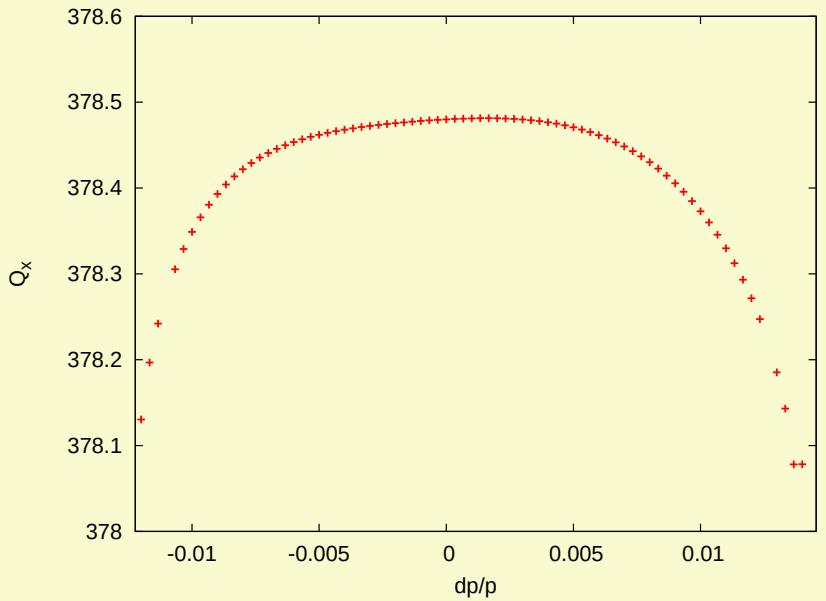


Open issues

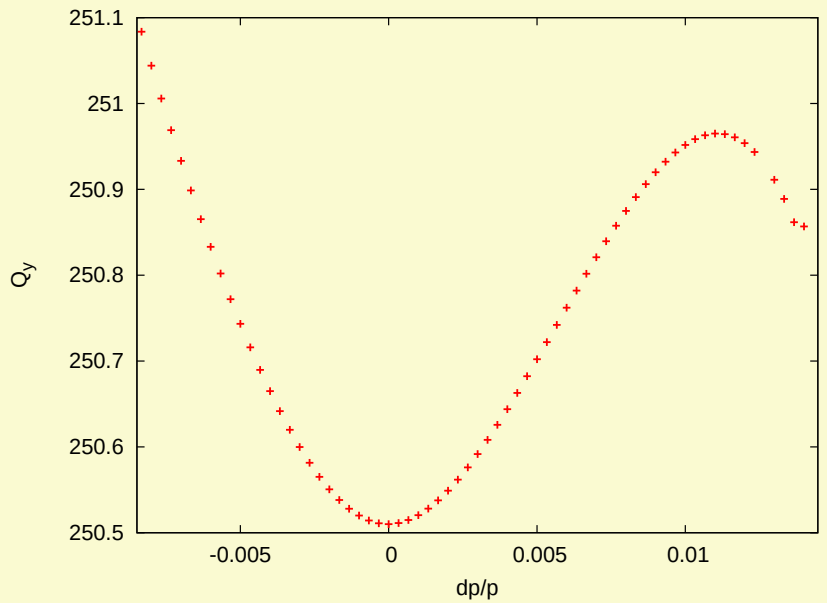
- Pole tip field at QF1 is quite high. Field of 8 T at 7σ.

Stability: Tunes

$Q_x = 378.48$

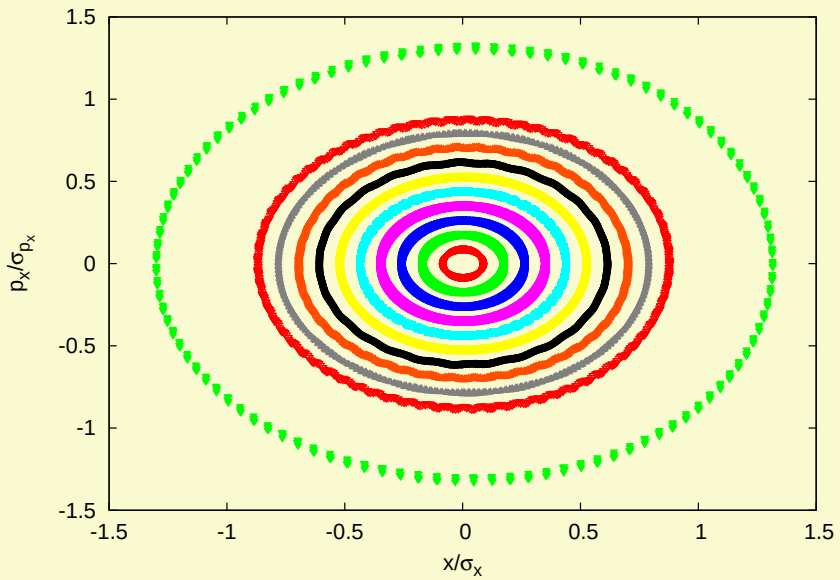


$Q_y = 250.51$

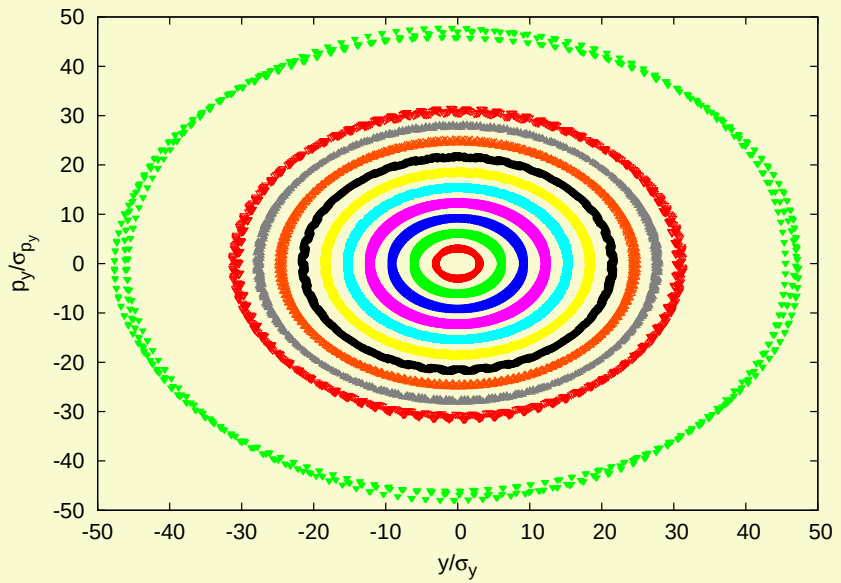


Stability: Phase space after 1000 turns

$dp/p = 0.29\%$



$dp/p = 0.29\%$



Conclusions and future prospects

- We have designed a Final Focus System based on the dedicated correction scheme.
- The corrections of the nonlinearities is quite good. No need of horizontal correction section.
- Integration in the TLEP lattice is good. Stability above $dp/p = 1\%$ is reached. Is 2% possible?
- Still need some improvements and tests concerning synchrotron radiation.