

Final Focus Design of CLIC BDS

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Table of contents

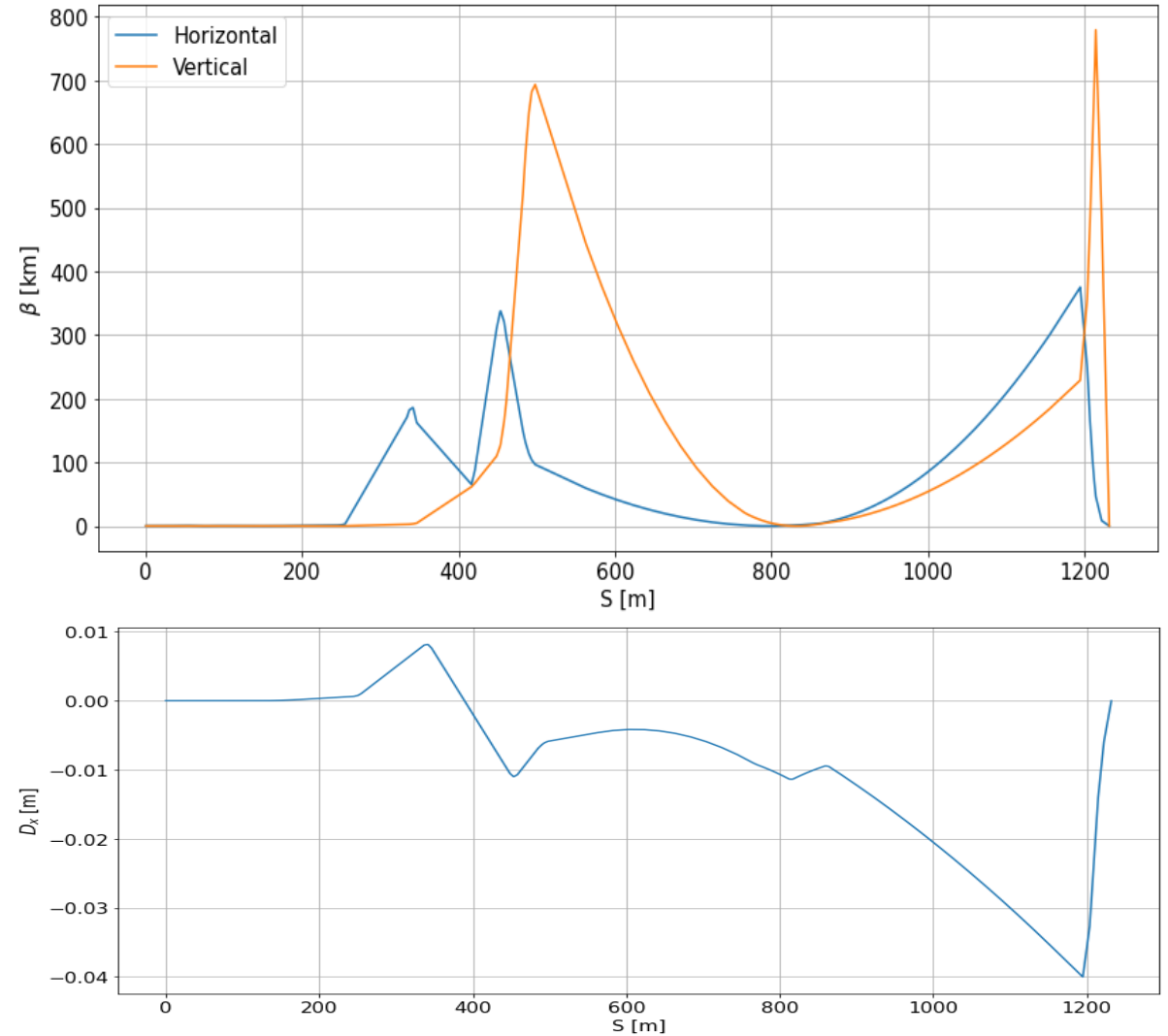
1. Description of the previous design
2. Approach and results
 - a. Reduction of L^*
 - b. Optimization of the IP
3. Conclusions and plans

Previous design - FFS

- $L_{\text{FFS}} = 1232 \text{ m}$
- $\beta_x^* / \beta_y^* [\text{mm}] = 11 / 0.19$
- $\sigma_x^* / \sigma_y^* [\text{nm}] = 32.9 / 0.75$
- $\delta_{p,\text{rms}} = 0.3\%$
- $\delta_{p,\text{FW}} = 1\%$
- $\mathcal{L}_{\text{tot}} / \mathcal{L}_{\text{peak}} [\text{cm}^{-2}\text{s}^{-1} \cdot 10^{34}] = 7.68 / 2.67$
- $L^* = 9.5 \text{ m}$

Goals

- $\mathcal{L}_{\text{tot}} > 8 \text{ cm}^{-2}\text{s}^{-1} \cdot 10^{34}$
- $L^* = 6 \text{ m}$



Approach

1. Initial parameters:

$$L_{\text{FFS}}[\text{m}] / L^*[\text{m}] = 1232 / 9.5 , \quad \beta_x^* / \beta_y^* [\text{mm}] = 11 / 0.19 , \quad \sigma_x^* / \sigma_y^* [\text{nm}] = 32.9 / 0.75$$

2. FFS length scaling:

$$L_{\text{FFS}}[\text{m}] / L^*[\text{m}] = 1018 / 8 , \quad \beta_x^* / \beta_y^* [\text{mm}] = 8.5 / 0.17 , \quad \sigma_x^* / \sigma_y^* [\text{nm}] = 28.6 / 0.7$$

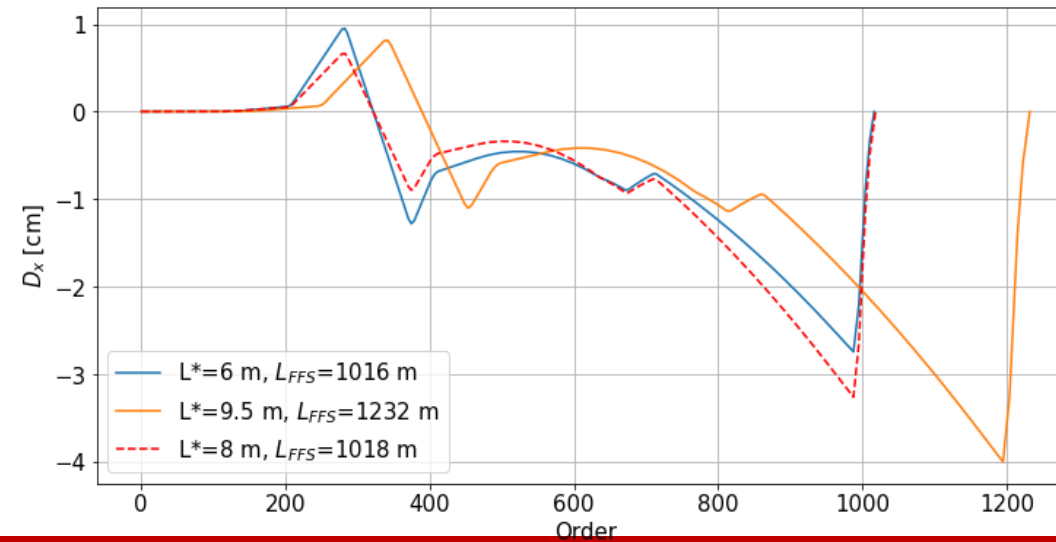
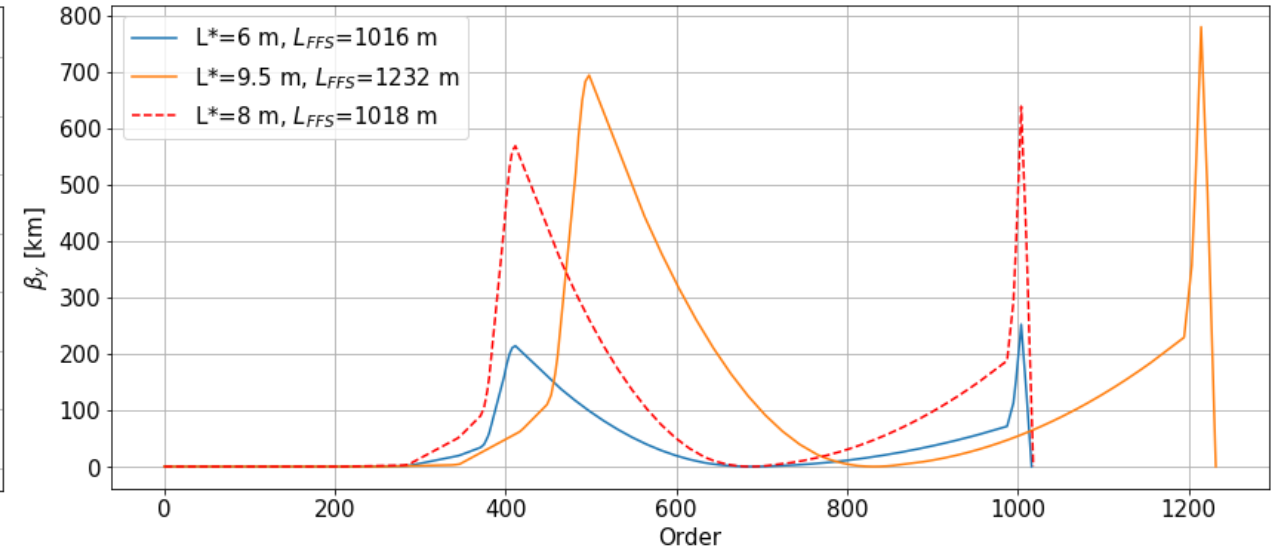
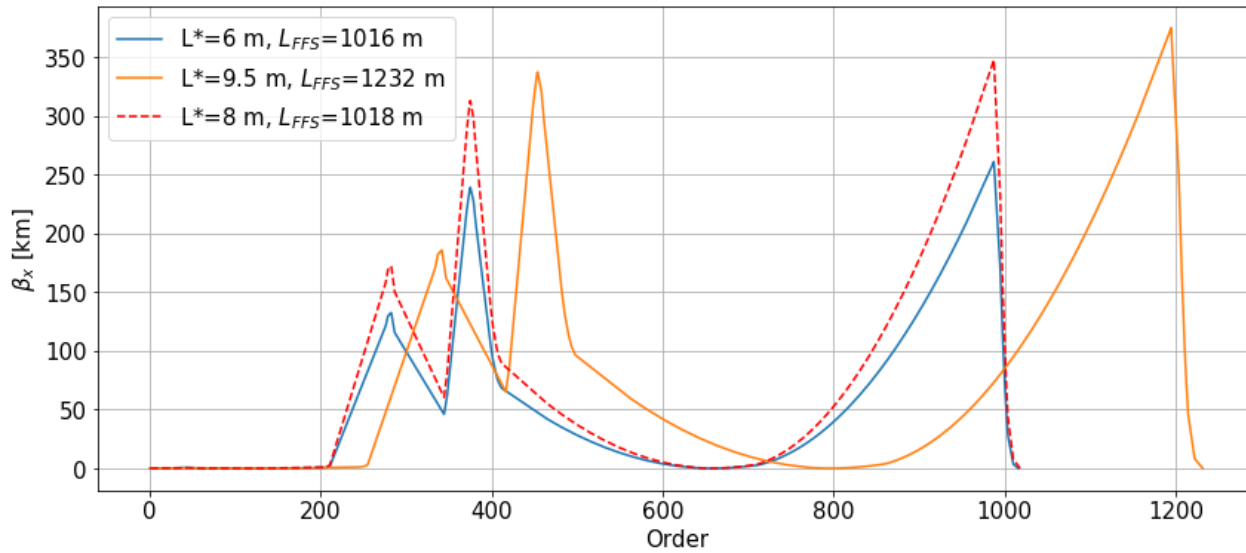
3. L^* scaling:

$$L_{\text{FFS}}[\text{m}] / L^*[\text{m}] = 1016 / 6 , \quad \text{fixed } \beta^*$$

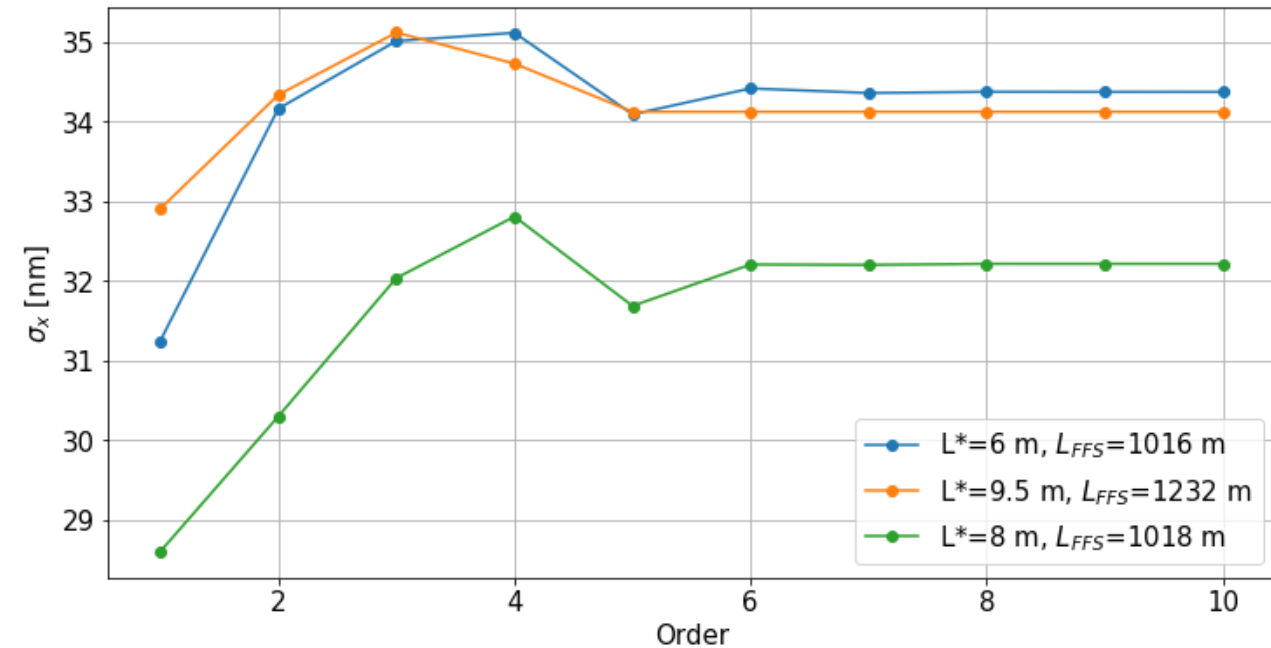
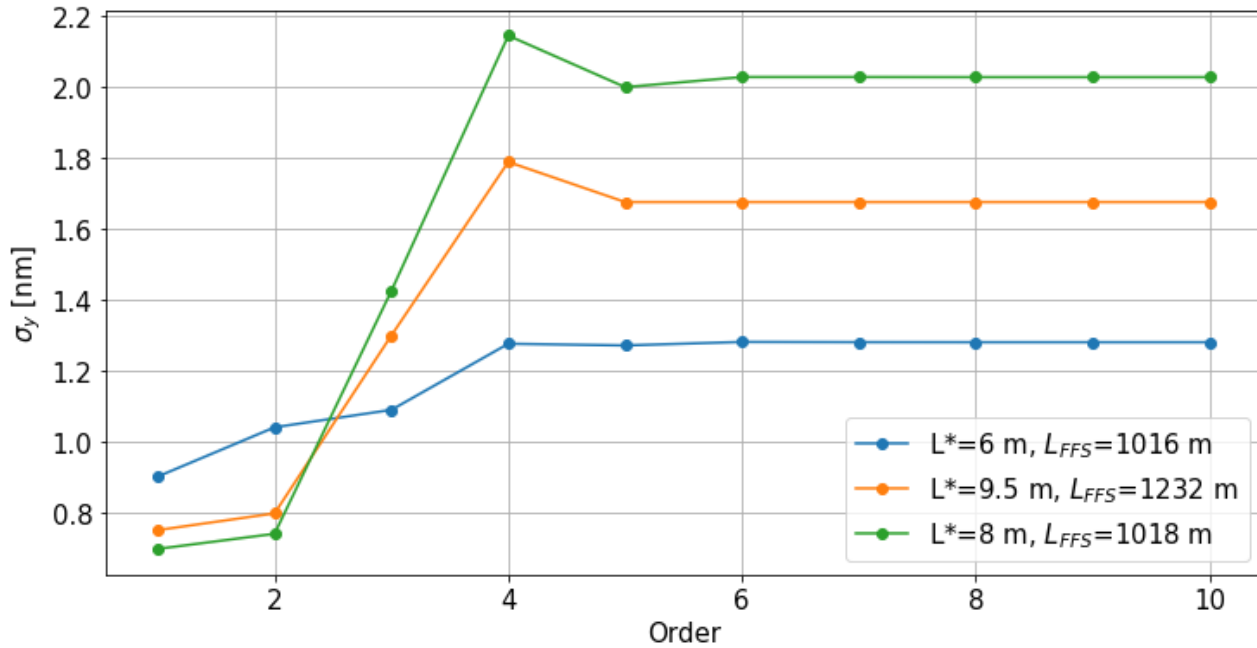
4. Higher order optimization:

- a. Variation of quadrupole and sextupole strengths.
- b. Octupoles and decapoles not in the FFS.

Final Focus - Twiss



Final Focus - IP



$$\beta_x^* / \beta_y^* [\text{mm}] = 10 / 0.28$$

$$\sigma_x^* / \sigma_y^* [\text{nm}] = 31.2 / 0.9$$

$$FFS: \mathcal{L}_{\text{tot}} / \mathcal{L}_{\text{peak}} [\text{cm}^{-2}\text{s}^{-1} \cdot 10^{34}] = 9 / 2.8$$

BDS parameters

- $L_{\text{FFS}} = 1016 \text{ m}$
- $L_{\text{BDS}} = 4942 \text{ m}$
- $L^* = 6 \text{ m}$
- $\beta_x^* / \beta_y^* [\text{mm}] = 10 / 0.28$
- $\sigma_x^* / \sigma_y^* [\text{nm}] = 31.2 / 0.9$
- *SR ON* : $\sigma_x^* / \sigma_y^* [\text{nm}] = 41.6 / 1.71$
- *FFS*: $\mathcal{L}_{\text{tot}} / \mathcal{L}_{\text{peak}} [\text{cm}^{-2}\text{s}^{-1} \cdot 10^{34}] = 9 / 2.8$
- *Full BDS*: $\mathcal{L}_{\text{tot}} / \mathcal{L}_{\text{peak}} [\text{cm}^{-2}\text{s}^{-1} \cdot 10^{34}] = 8.1 / 2.6$

Conclusion and plans

Done:

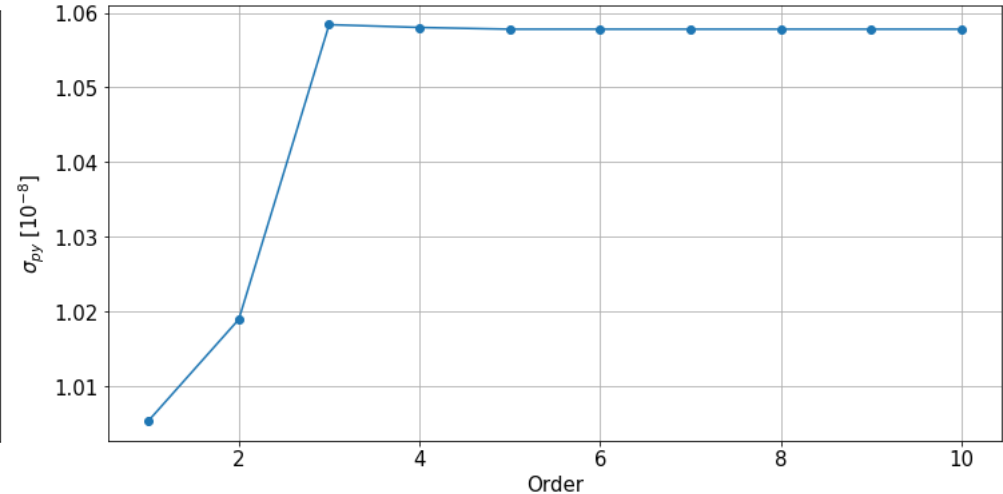
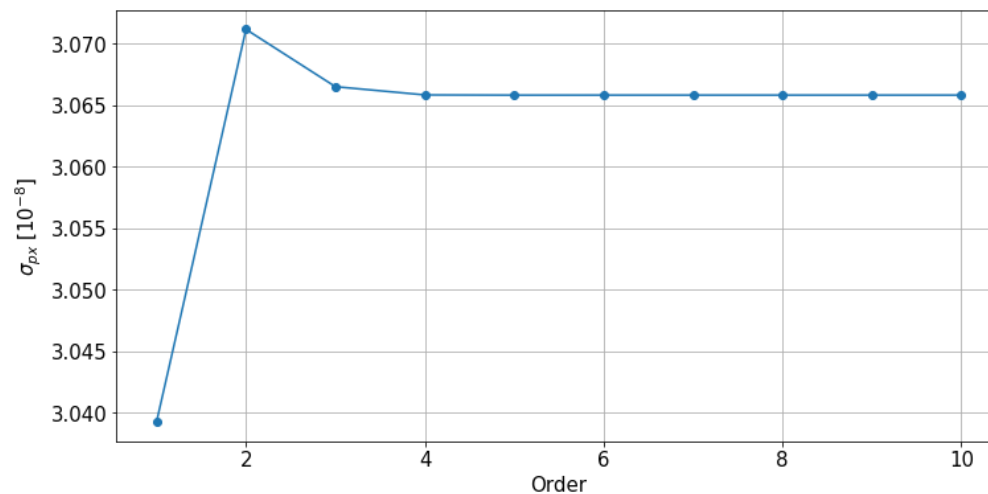
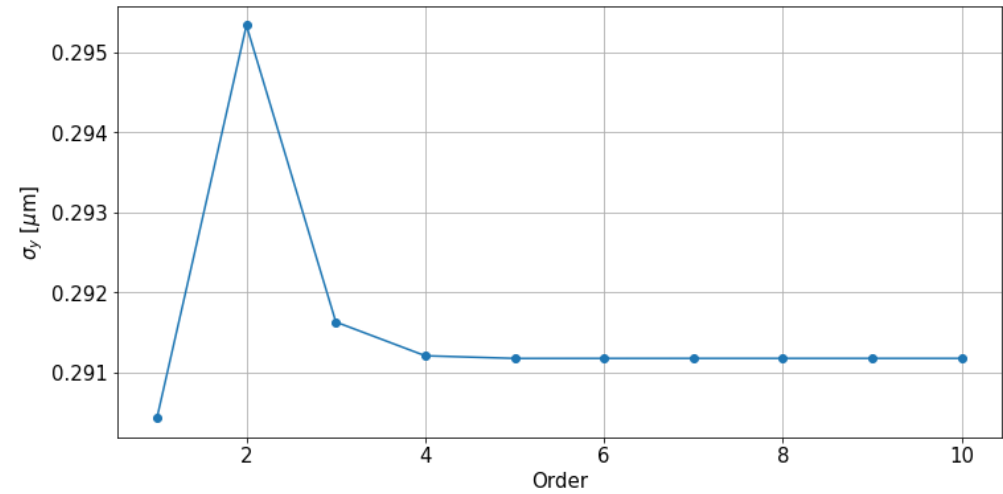
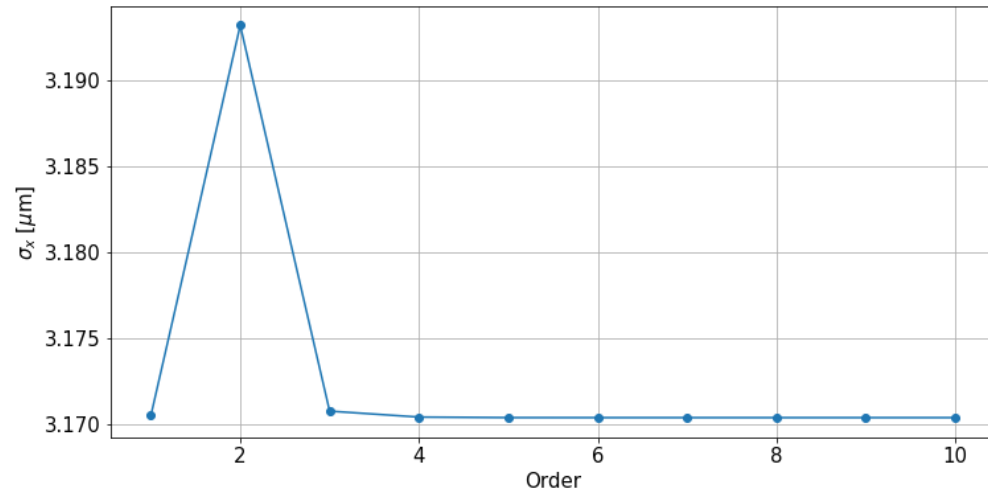
- Scaling of L^* to the design value of 6 m.
- Optimization of quadrupoles and sextupoles for the chromaticity correction.
- Reached a luminosity higher than $8 \text{ cm}^{-2} \text{ s}^{-1} \cdot 10^{34}$ for the full BDS.

To do:

- Possibility to reduce the beam sizes.
- Optimization of the Collimation and of the full BDS.

Extra

Previous design - End of Collimation



Phase advance

3 TeV		
NAME	MUX	MUY
SF6	4.227849	7.243695
SD5	4.727758	7.244884
SF5	4.727791	7.244950
SD4	4.727821	7.244963
SF1	5.227793	7.744952
SD0	5.227812	7.744961

7 TeV		
NAME	MUX	MUY
SF6	4.100514	7.326528
SD5	4.600409	7.329722
SF5	4.600448	7.329899
SD4	4.600482	7.329934
SF1	5.100451	7.829908
SD0	5.100475	7.829931

SD0 - SD4 (X)

3 TeV 9.05200000023143e-06

7 TeV 7.648000000415323e-06

SF1 - SF5 (X)

3 TeV -1.972000000627361e-06

7 TeV -3.4030000000129235e-06

SF5 - SF6 (X)

3 TeV 5.728799999982215e-05

7 TeV 6.65739999998749e-05

SD0 - SD4 (Y)

3 TeV 1.9039999994419077e-06

7 TeV 3.0989999997288464e-06

SF1 - SF5 (Y)

3 TeV -2.3409999991841346e-06

7 TeV -8.818000000410109e-06

SF5 - SF6 (Y)

3 TeV 0.0012541830000003529

7 TeV 0.003371183999999694