JUAS22: Accelerator Design Workshop - Lattice Design

Group 10

Marvin Noll Javier Olivares Adrien Plaçais

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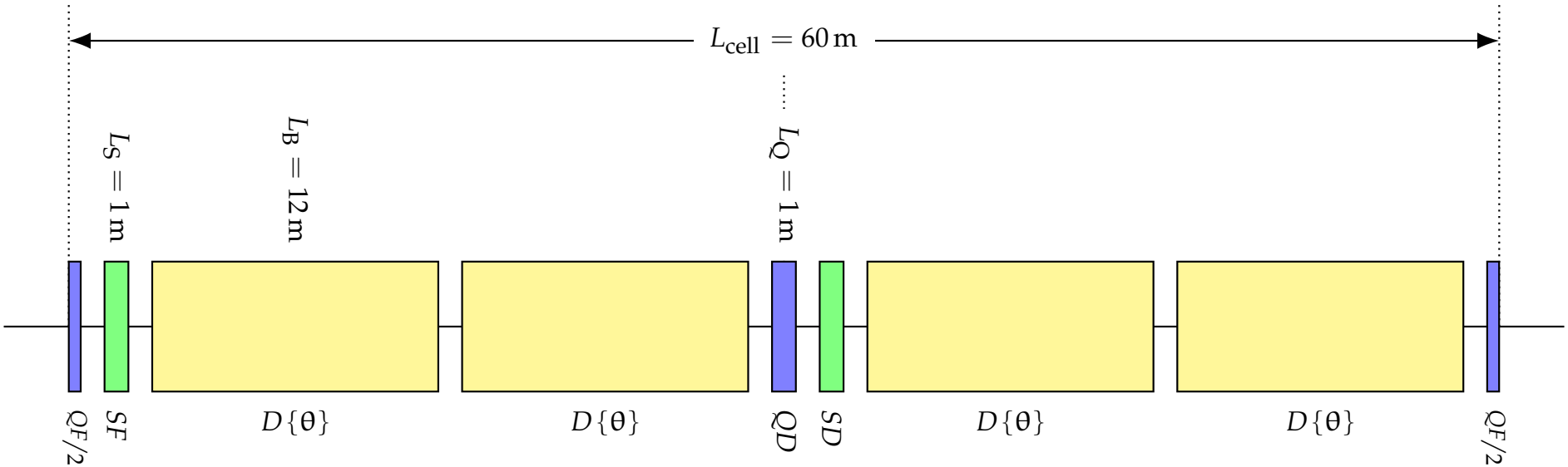
Design of Arc Cell (1): Cell layout



- Cell type: **FODO**
- Phase advance: $\mu = 90°$

Design of Arc Cell (2): θ and k_1

- Bending angle θ:

$$\epsilon_x = \frac{C_q}{J_x}\,\gamma^2\,\theta^3\,F, \quad \text{with: } F = F_{\text{FODO}} = \frac{1}{2\sin\mu}\,\frac{5+3\cos\mu}{1-\cos\mu}\,\frac{L_{\text{cell}}}{L_B}$$

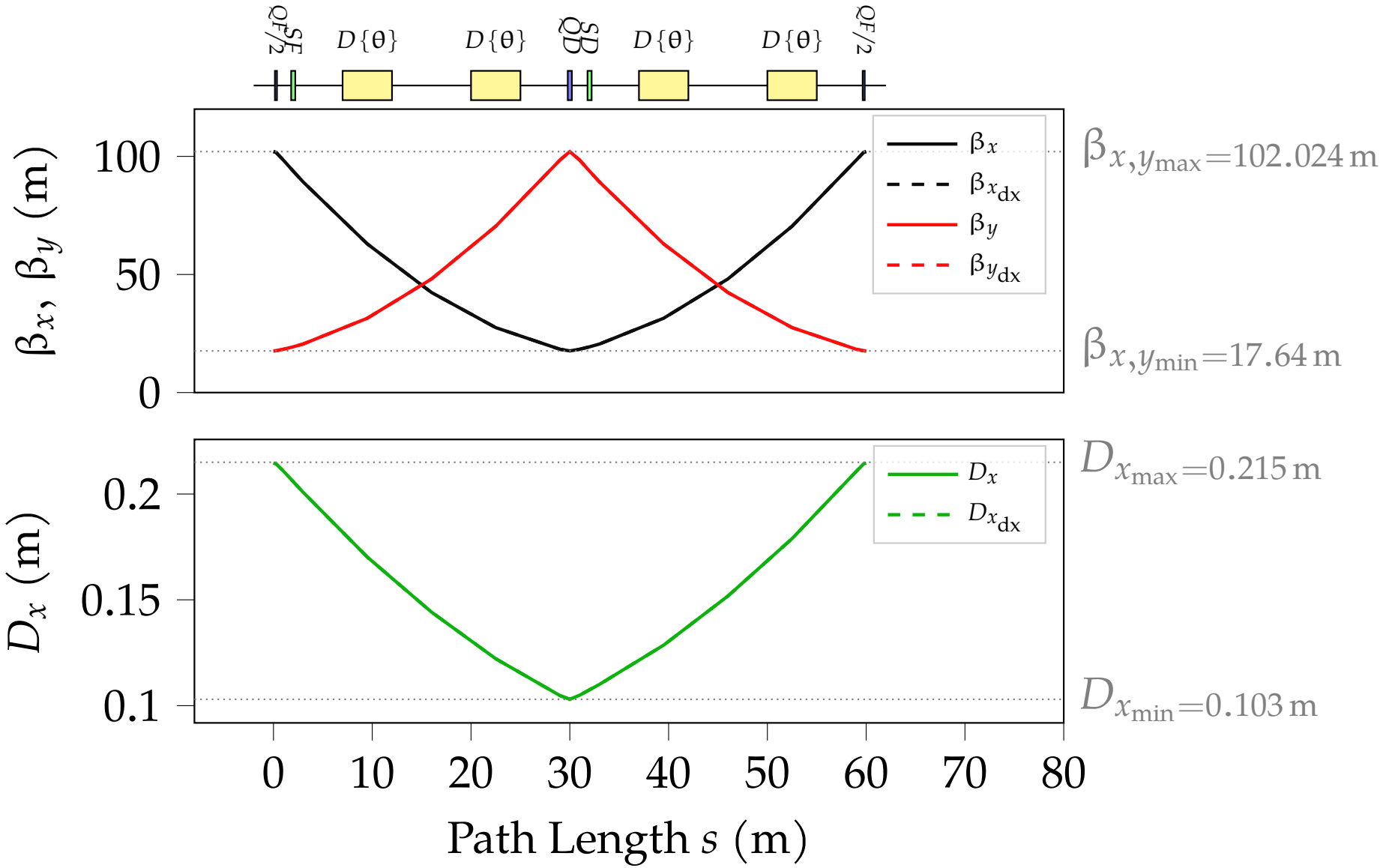
$$\Leftrightarrow \theta = 1.323\,\text{mrad}$$

- Quadrupole strength k_1:

$$\sin\frac{\mu}{2} = \frac{L_Q}{4f}, \quad \text{and } \frac{1}{f} = k_1\,L_Q$$

$$\Leftrightarrow k_1 = 0.057\,14\,\text{m}^{-2}$$

Design of Arc Cell (3): β-Functions and Dispersion



Design of Arc Cell (4): Synchrotron Radiation and Emittance

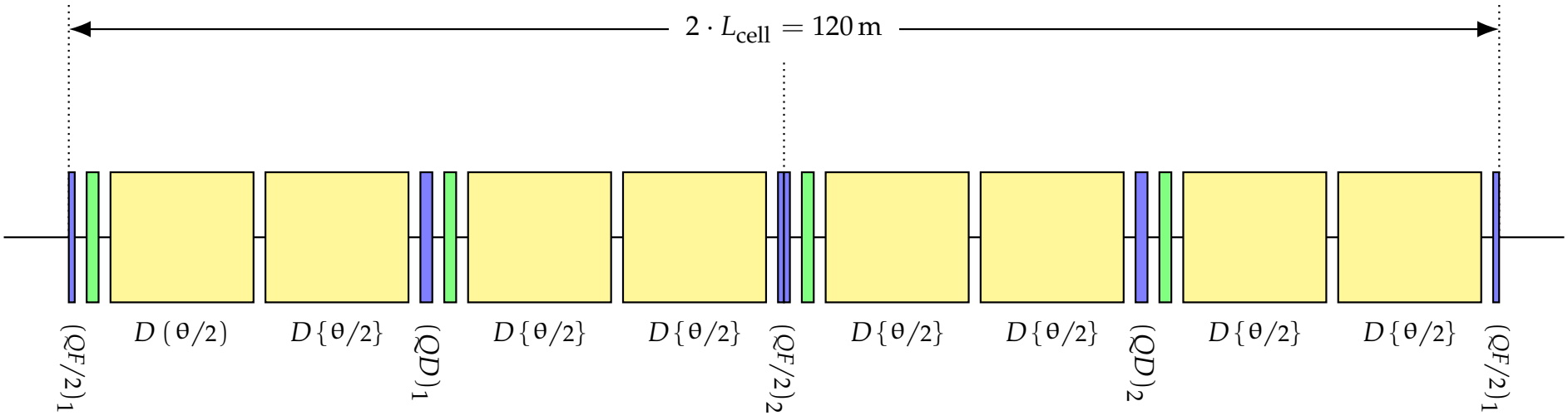
- Energy loss:

$$U_0 = \frac{C_q \, E^4 \, I_2}{2\,\pi} = 3.96 \times 10^{-8}\,\mathrm{J}$$

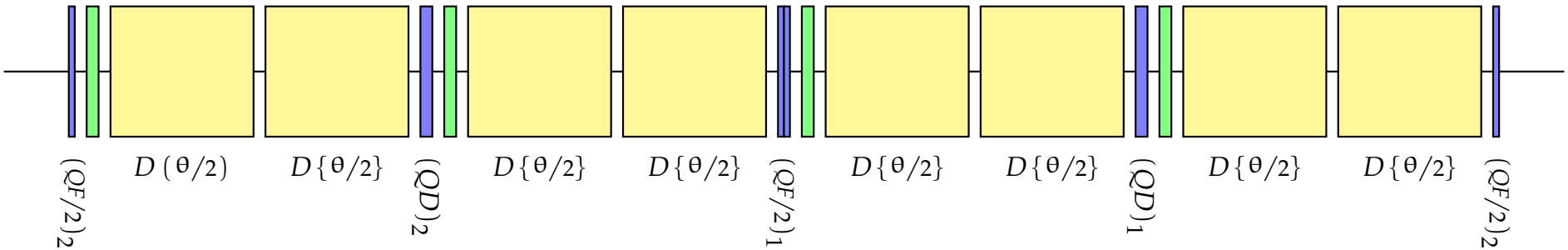
- Emittance:

$$\epsilon_x = \frac{C_q \, \gamma_L^2 \, I_5}{J_x \, I_2} = 2.58\,\mathrm{nm\,rad}$$

Dispersion Suppressor (1): Layout

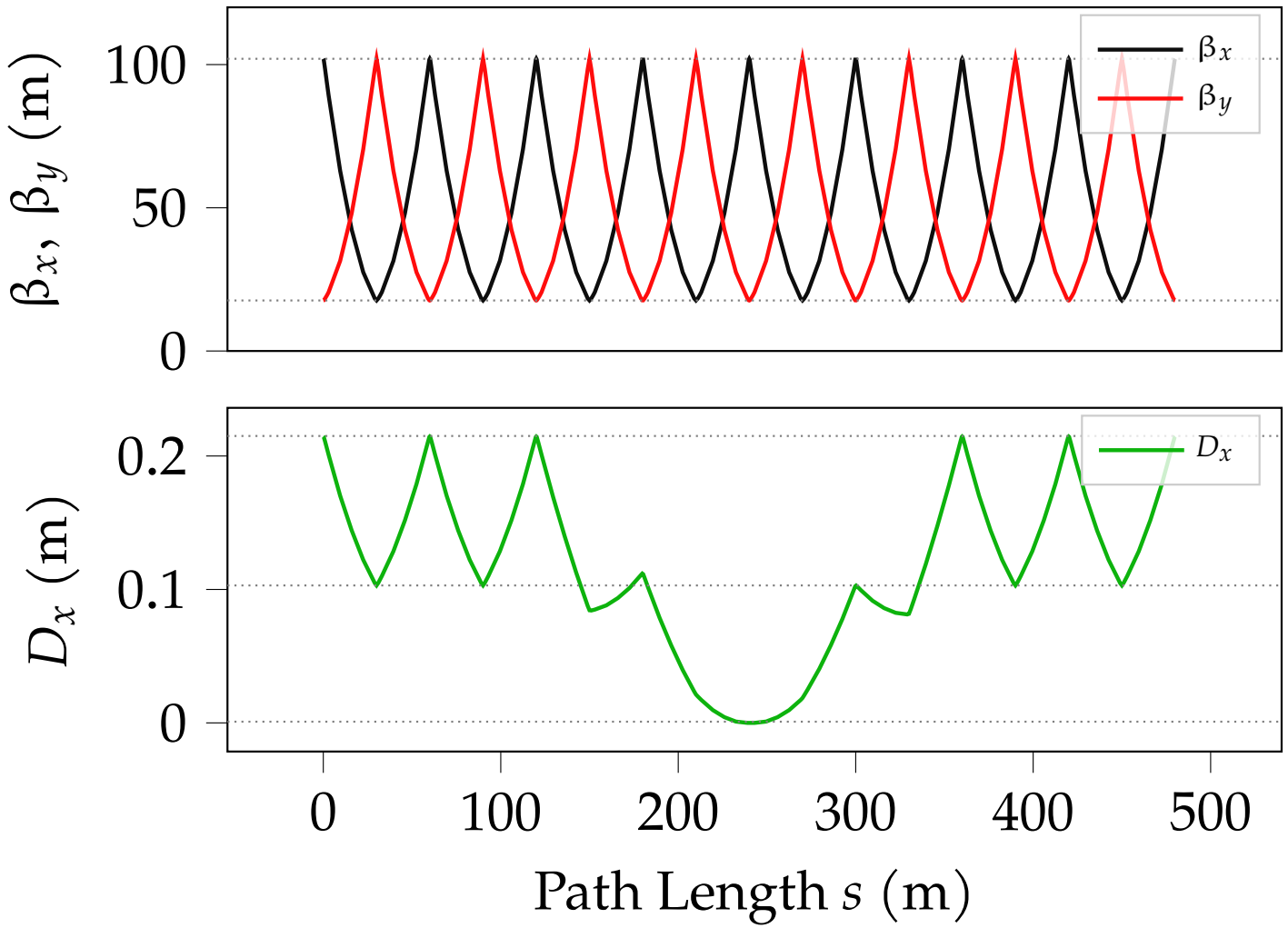


(a) DSL (Dispersion Suppressor Left)



(b) DSR (Dispersion Suppressor Right)

Dispersion Suppressor (2): β-Functions and Dispersion



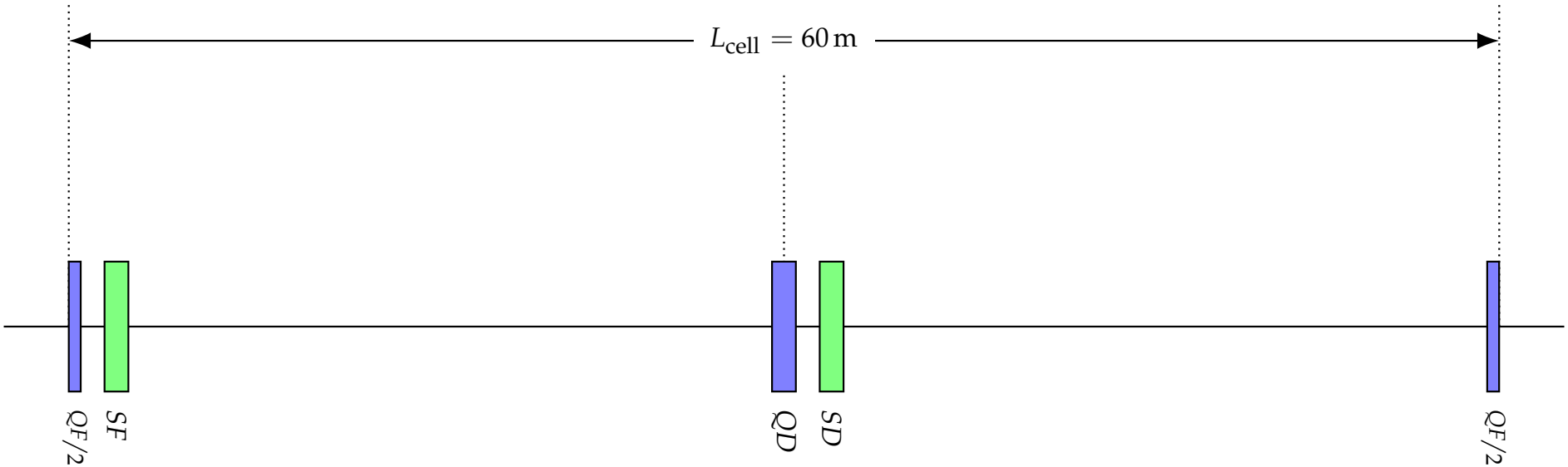
$\beta_{x,y_{\max}} = 102.024\,\mathrm{m}$

$\beta_{x,y_{\min}} = 17.64\,\mathrm{m}$

$D_{x_{\max}} = 0.215\,\mathrm{m}$

$D_{x_{\min}} = 0.0009\,\mathrm{m}$

Straight Sections (1): Layout



Straight Sections (2): β-Functions and Dispersion