Path length

Twiss parameters at pickup

M = Bypass − pickup to kicker

Dependence of path length

$$\Delta s = A_x \sin(\theta_x + \theta_{xt}) + A_x \sin(\theta_z + \theta_{zt})$$

$$A_x = a_x \left[M_{51}^2 \beta_x + M_{52}^2 \gamma_x - 2 M_{51} M_{52} \alpha_x \right]^{1/2}$$

$$A_z = a_z (M_{51}\eta + M_{52}\eta' + M_{56}) \gamma_z{}^{1/2}$$

Cooling range

$$k A_x < \mu_1 \rightarrow a_x < \frac{\mu_1}{\left[M_{51}^2 \beta_x + M_{52}^2 \gamma_x - 2 M_{51} M_{52} \alpha_x \right]^{1/2}}$$

$$k A_z < \mu_0 \rightarrow a_z < \frac{\mu_0}{(M_{51}\eta + M_{52}\eta' + M_6) \gamma_z{}^{1/2}}$$

Cooling

$$\frac{\Delta p}{p} = \xi \sin(k\Delta s)$$

$$\Delta a_x^2 = -2(\Delta p/p) E_x \sin(\theta_{xk} + \theta_{xc})$$

$$E_x = a_x(\eta^2\gamma + \beta(\eta')^2 + 2\alpha\eta'\eta)^{1/2}$$

Horizontal emittance

$$\mathcal{H} = (\eta^2\gamma + \beta(\eta')^2 + 2\alpha\eta'\eta)^{1/2}$$

$$I_5 = \oint \frac{\mathcal{H}}{|\rho^3|} ds \qquad I_2 = \oint \frac{1}{\rho^2} ds$$

$$\epsilon = C_q \gamma^2 \frac{I_5}{I_2}$$

Lattice constraints

T_k - full turn at kicker
T_p - full turn at pickup

M_{pk} – bypass from pickup to kicker

Matrices are related as

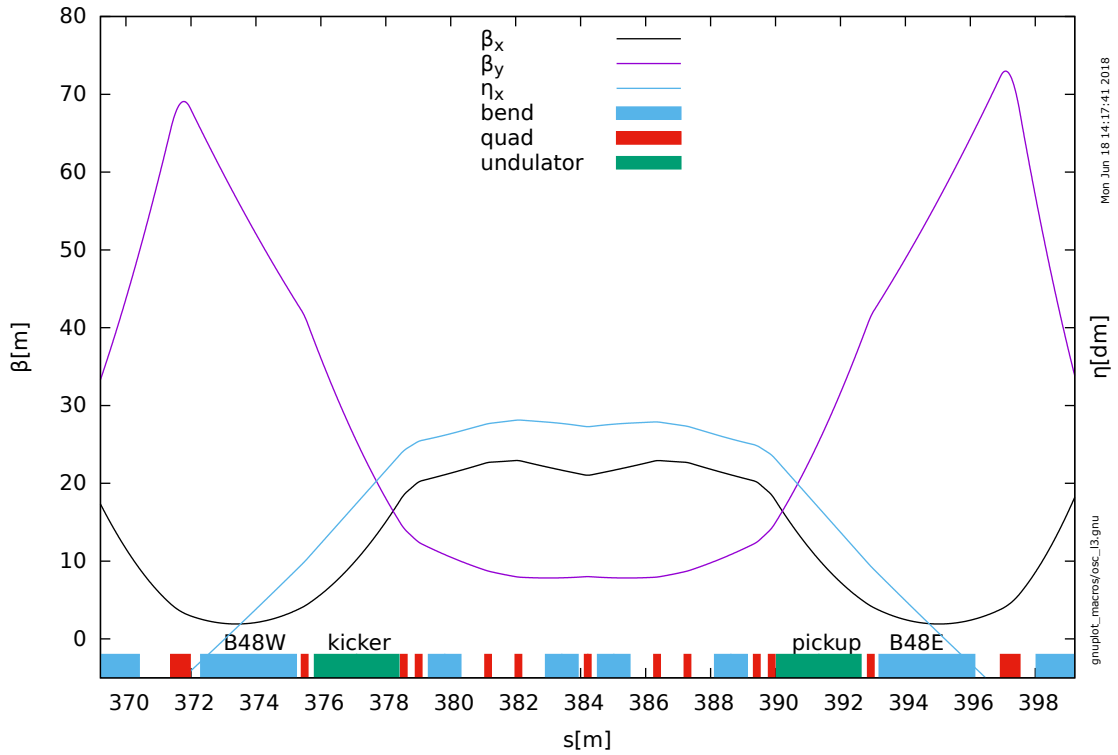
$$T_k = M_{pk} T_p M_{pk}^{-1}$$

If phase advance through bypass is 180° then

$$M_{pk} = \begin{pmatrix} -1 & 0 & 0 & -M_{52} \\ 0 & -1 & 0 & M_{51} \\ M_{51} & M_{52} & 1 & M_{56} \\ 0 & 0 & 0 & 1 \end{pmatrix}$$

If symmetric, $T_k(\alpha, \beta, \eta, \eta') = T_p(-\alpha, \beta, \eta, -\eta')$ then

$$\begin{aligned} M_{51} &= 0 \\ M_{52} &= -2\eta \end{aligned}$$



Optical stochastic cooling insert parameters

Beam Energy = 1.0000E+09 gamma_e = 1.9570E+03

Wiggler: B_max = 1.4000E-01 T wiggler_period = 3.2500E-01 m K_param = 4.2479

Optical wavelength = 8.0810E-07

Pickup: beta/alpha/gamma = 9.8129E+00, 6.1811E-01, 1.4084E-01

kicker: eta/etap = 8.5232E-01 -2.7230E-01

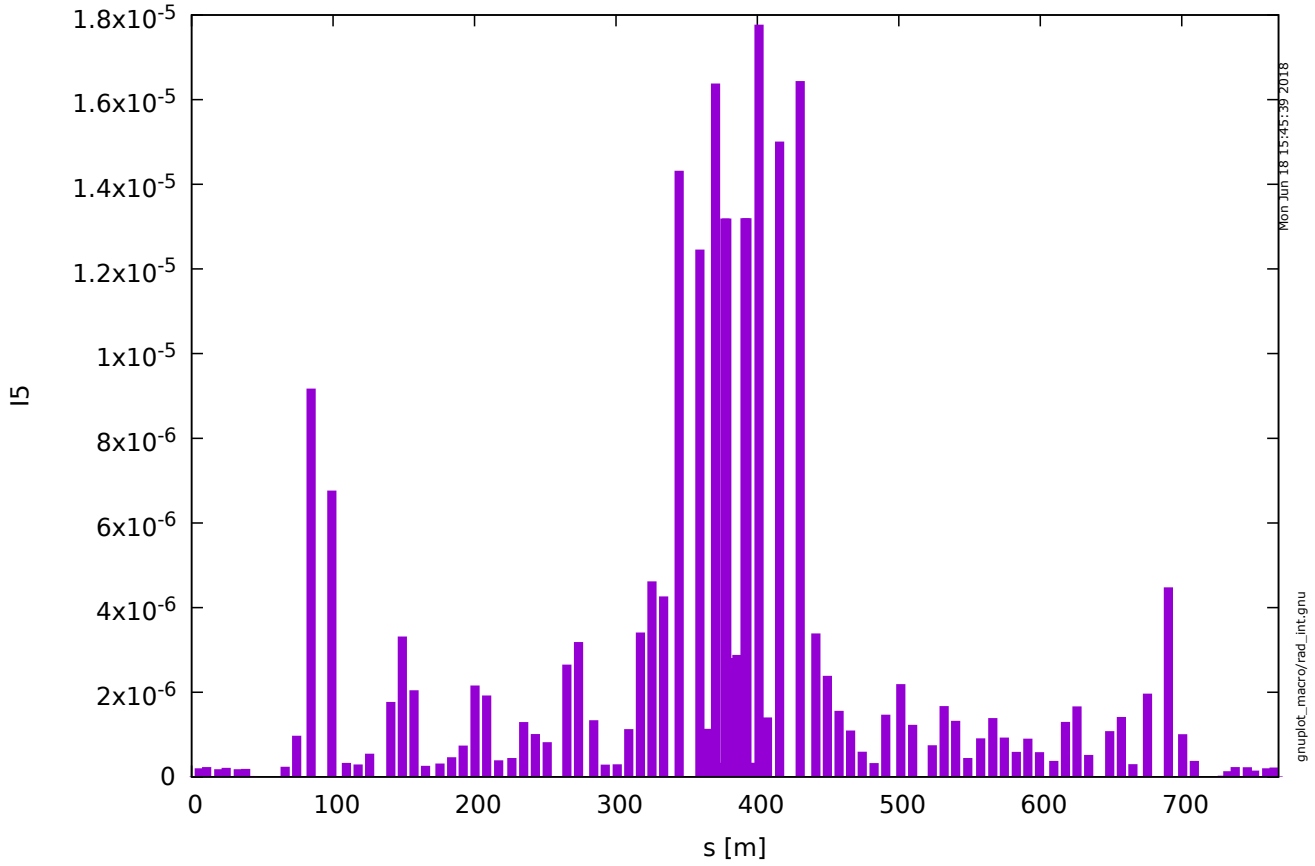
kicker: Curly H = 7.3688E-01

Horizontal emittance = 5.5136E-10 emit_max = 4.2810E-09

Fractional energy spread = 4.0658E-04 dp/p_max = 7.0781E-03

Ratio transverse/longitudinal rate = 3.3145E+01

M_{51} = 3.1722E-04 M_{52} = -1.3786E-02 M_{56} = 3.5886E-03 tilde_M_{56} 1.0510E-04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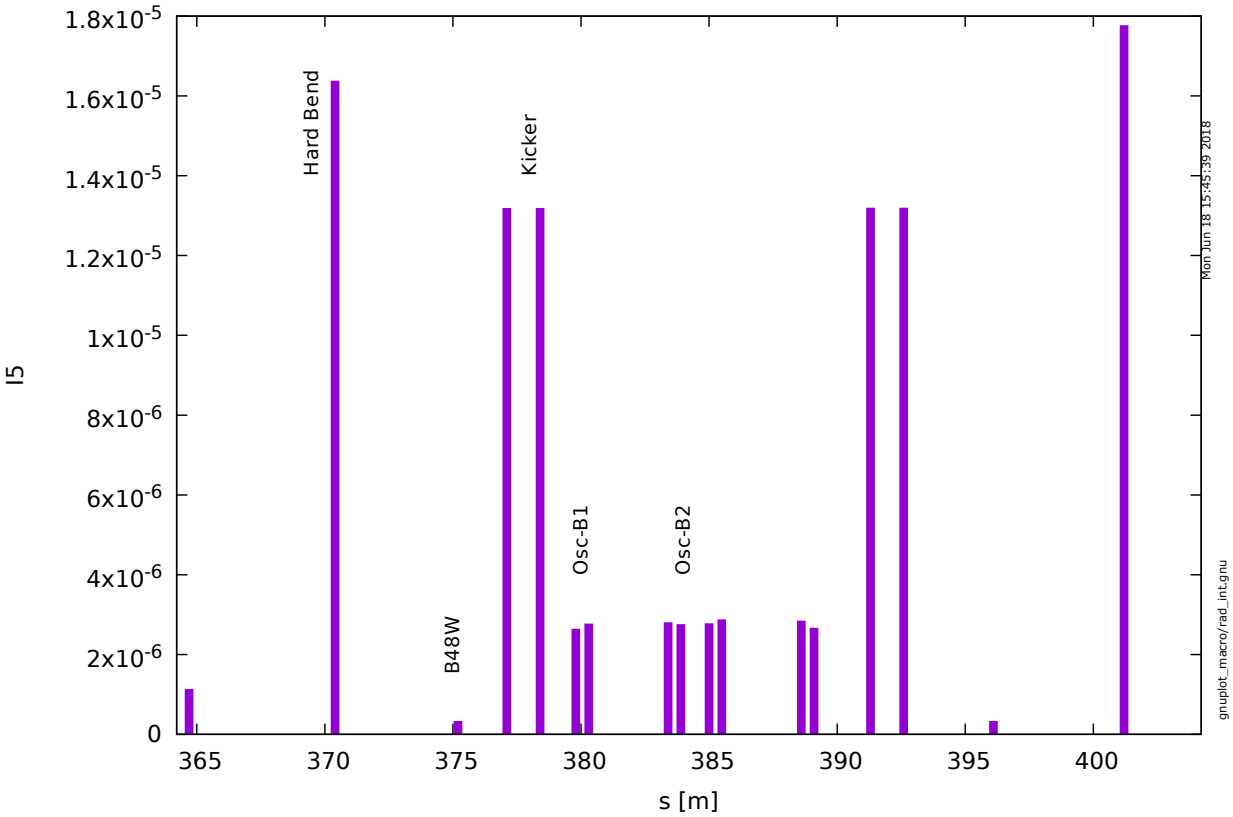
1.6x10-5
1.4x10-5
1.2x10-5
1x10-5
8x10-6
6x10-6
4x10-6
2x10-6
0
I5
0
100
200
300
400
500
600
700
s [m]
Mon Jun 18 15:45:39 2018
gnuplot_macro/rad_int.gnu


1.8x10-5
1.6x10-5
1.4x10-5
1.2x10-5
1x10-5
8x10-6
6x10-6
4x10-6
2x10-6
0
I5
Hard Bend
Kicker
B48W
Osc-B1
Osc-B2
365
370
375
380
385
390
395
400
s [m]
Mon Jun 18 15:45:39 2018
gnuplot_macro/rad_int.gnu