

Status of optics calculation in IP8 and IP2

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Work description

- 1 opt_0100_0100.madx with $\beta^*=3\text{m}$ in IP8
- 2 opt_0050_0200.madx with $\beta^*=3\text{m}$ in IP8
- 3 opt_0050_0200hv.madx with $\beta^*=3\text{m}$ in IP8 [1]
- 4 opt_0400_0400.madx with $\beta^*=0.50\text{m}$ in IP8
- 5 opt_5500_5500.madx with $\beta^*=10\text{m}$ in IP8 and injection and aperture constraints
- 6 opt_0100_0100.madx with $\beta^*=10\text{m}$ in IP2
- 7 opt_0050_0200.madx with $\beta^*=10\text{m}$ in IP2
- 8 opt_0050_0200hv.madx with $\beta^*=10\text{m}$ in IP2
- 9 opt_0400_0400.madx with $\beta^*=0.5\text{m}$ in IP2 [2]
- 10 opt_5500_5500.madx with $\beta^*=10\text{m}$ in IP2 and aperture constraints.

And the same with new Nb3Sn dipoles.

What to vary and special needs

- 1 triplet: KQX.L8, KTQX1.L8, KTQX2.L8
- 2 quadrupoles: KQT13.L8B1, KQT12.L8B1, KQTL11.L8B1, KQ10.L8B1, KQ9.L8B1, KQ8.L8B1, KQ7.L8B1, KQ6.L8B1, KQ5.L8B1, KQ4.L8B1 and the rights ones
- 3 if possible to have the same phase advance for BEAM1 and BEAM2
- 4 ratio of quadrupole (10 to 4) strengths is between 0.5 and 2
- 5 for job 5: no triplet KQX.L8, KTQX1.L8, KTQX2.L8, no Q4.R8B2 and Q5.R8B2

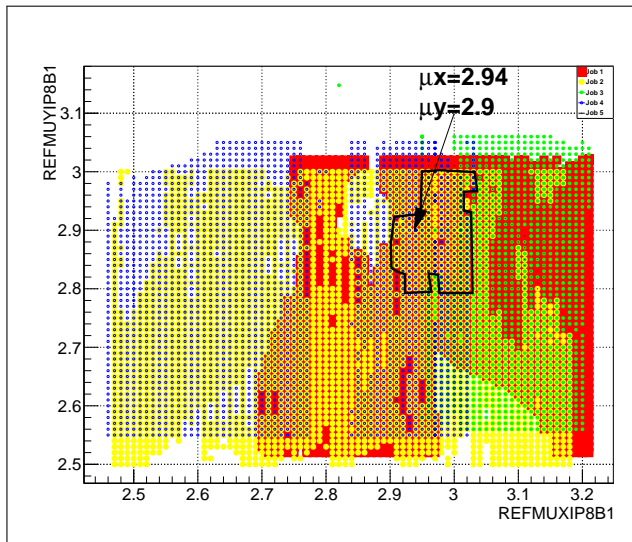
Inner triplet magnet parameters

From

<http://cdsweb.cern.ch/record/514339/files/lhc-project-report-476.pdf>

	MQXA (Q1,Q3)	MQXB(Q2a,Q2b)
Nominal gradient	205 T/m	205 T/m
Nominal current	6450 A	11390 A
Ultimate gradient	221 T/m	221 T/m
Ultimate current	6960 A	12290 A

IP8 was done with wrong quadrupoles limits

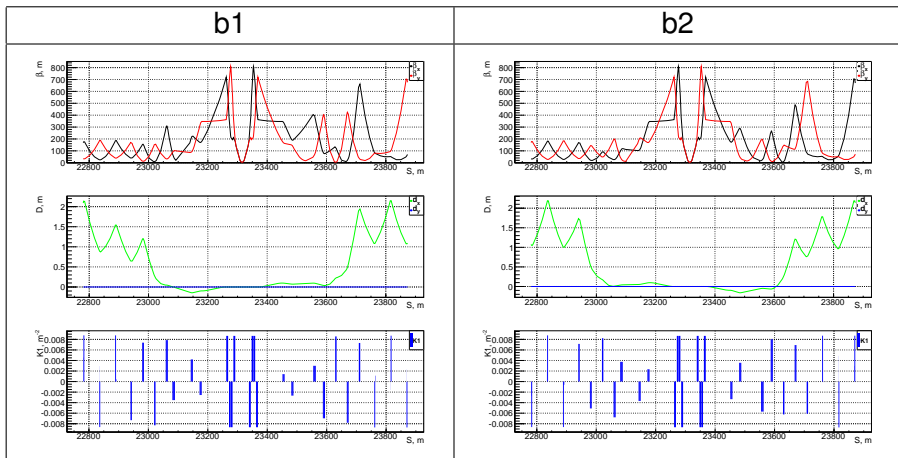


$$KTQX1 = KTQX2 = 0, \mu_x = 2.94, \mu_y = 2.9$$

	$KQX \cdot B\rho$	Note
1	202.38 T/m	$\frac{kq4.r8b1}{kq4.r8b2} = 0.42$
2	202.67 T/m	$\frac{kq4.r8b1}{kq4.r8b2} = 0.25, \frac{kq6.r8b1}{kq6.r8b2} = 0.49$
3	204.64 T/m	
4	203.8 T/m	
5	fixed 14 T/m	aperture constraints?

Job 1: IP8 $\beta^* = 3$ m, opt_0100_0100.madx

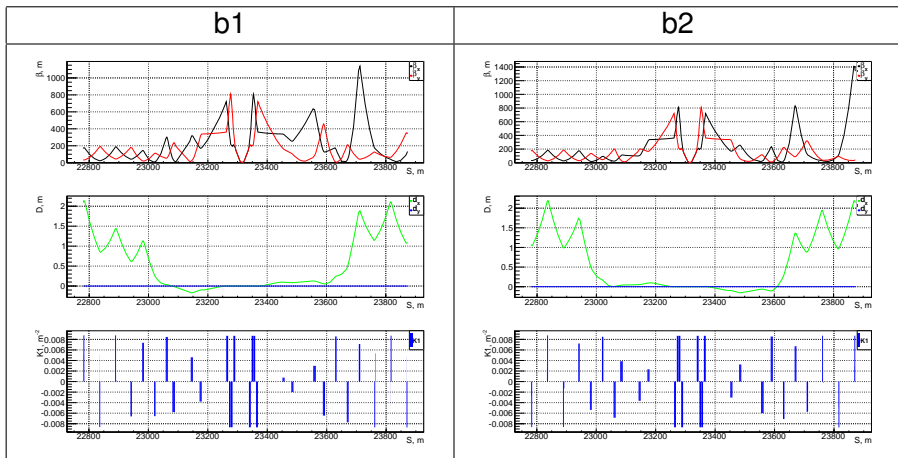
$$\beta^* = 3 \text{ m}, \mu_x = 2.94, \mu_y = 2.9$$



$$\frac{kq4.r8b1}{kq4.r8b2} = 0.42$$

Job 2: IP8 $\beta^* = 3$ m, opt_0050_0200.madx

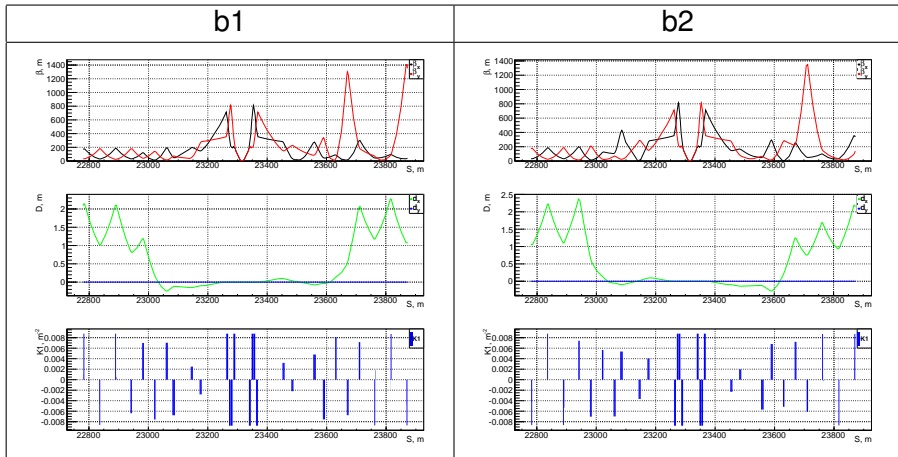
$$\beta^* = 3 \text{ m}, \mu_x = 2.94, \mu_y = 2.9$$



$$\frac{kq4.r8b1}{kq4.r8b2} = 0.25, \quad \frac{kq6.r8b1}{kq6.r8b2} = 0.49$$

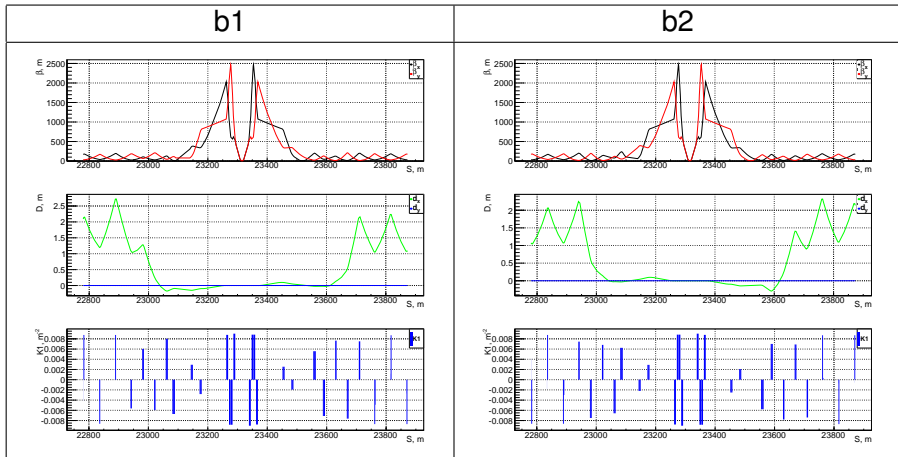
Job 3: IP8 $\beta^* = 3$ m, opt_0050_0200hv.madx

$$\beta^* = 3 \text{ m}, \mu_x = 2.94, \mu_y = 2.9$$



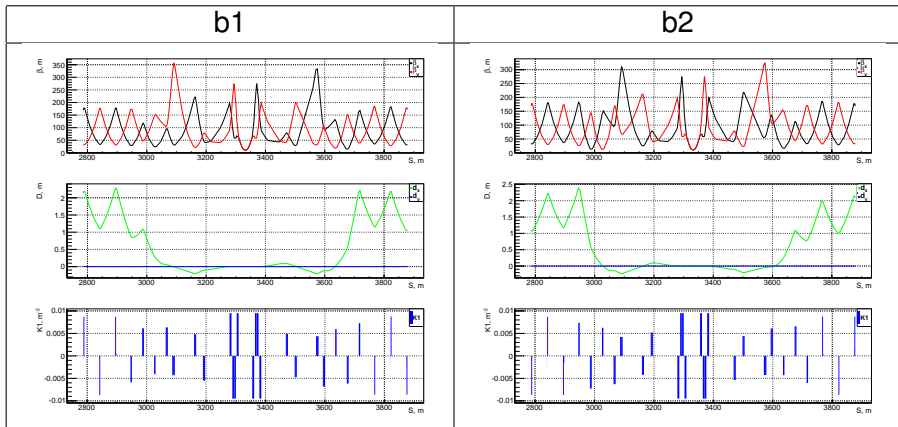
Job 4: IP8 $\beta^* = 0.5$ m, opt_0400_0400.madx

$$\beta^* = 0.5 \text{ m}, \mu_x = 2.94, \mu_y = 2.9$$



Job 5: IP8 $\beta^* = 10$ m, opt_5500_5500.madx

$$\beta^* = 10 \text{ m}, \mu_x = 2.94, \mu_y = 2.9$$

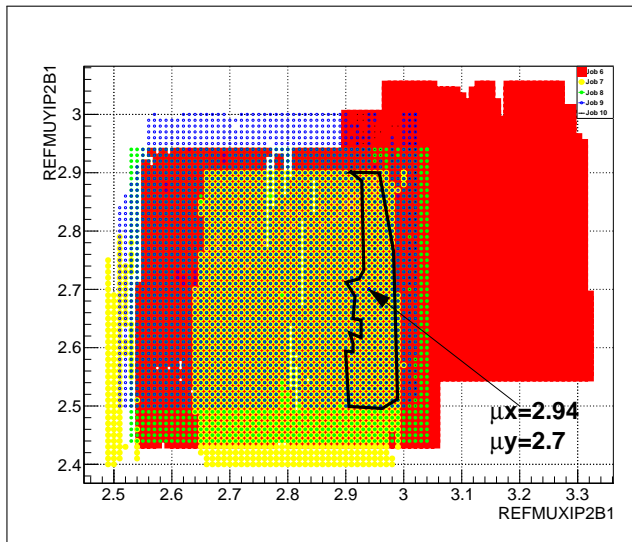


Job 5: IP8 $\beta^* = 10$ m, opt_5500_5500.madx

-(table(twiss tclib.6l8.b2 muy)-table(twiss tdi.4r8.b2 muy))*360 = 347.9

NAME	BETX	BETY	DX	X	Y	N1
H MCBCCH.6L8.B2	404.91	40.37	-0.06	0.00	0.00	6.26
H MQM.6L8.B2	474.48	21.62	-0.06	0.00	0.00	5.82
V MCBCV.10R8.B2	38.33	174.29	0.77	0.00	0.00	6.80
V MCBV.12R8.B2	28.37	179.36	0.99	0.00	0.00	6.77
V MQML.8R8.B2	15.39	179.05	0.23	0.00	0.00	6.74
H MQ.12R8.B1	184.29	28.49	2.24	0.00	0.00	6.91
H MQML.6R8.B1	330.82	50.64	-0.21	0.00	0.00	6.89
H MQT.12R8.B1	179.45	29.38	2.21	0.00	0.00	6.92
V MQM.A7R8.B1	82.02	162.99	-0.12	0.00	0.00	6.76
V MQM.B7R8.B1	81.24	162.59	-0.12	0.00	0.00	6.77
V MQML.10L8.B1	26.62	183.58	0.90	0.00	0.00	6.79

- 1 tried to generate new job-2 at $\{\mu_x = 3.02, \mu_y = 2.8\}$, minimum $\beta = 6$ m. Problems with MQM.B7L8.B2 and MQM.A7R8.B1
- 2 tried to move from $\{\mu_x = 2.94, \mu_y = 2.9\}$ to $\{\mu_x = 3.02, \mu_y = 2.8\}$ achieved only $\mu_x = 2.946$. Need to increase beta functions at MQM.6L8.B1 and MQM.A7R8.B1

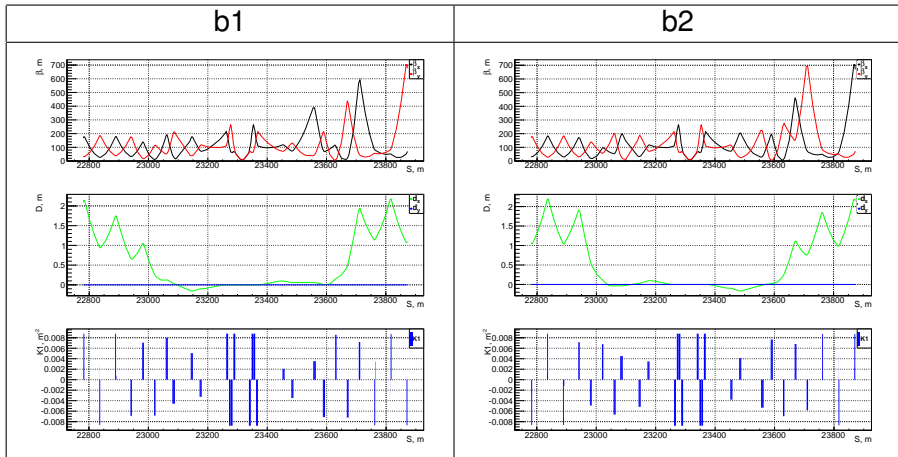


$$KTQX1 = KTQX2 = 0, \mu_x = 2.94, \mu_y = 2.7$$

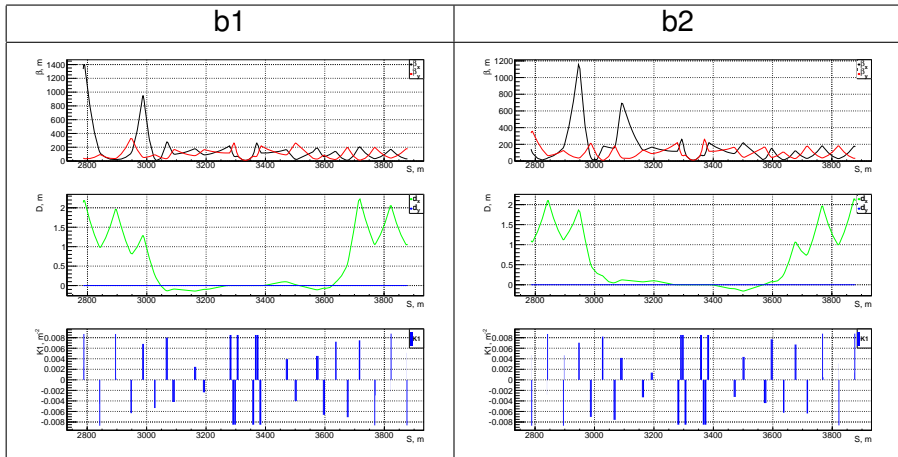
	$KQX \cdot B\rho$	Note
6	202.89 T/m	
7	198.79 T/m	
8	202.45 T/m	
9	205 T/m	
10	198 T/m	

Job 6: IP2 $\beta^* = 10$ m, opt_0100_0100.madx

$$\beta^* = 10 \text{ m}, \mu_x = 2.94, \mu_y = 2.7$$

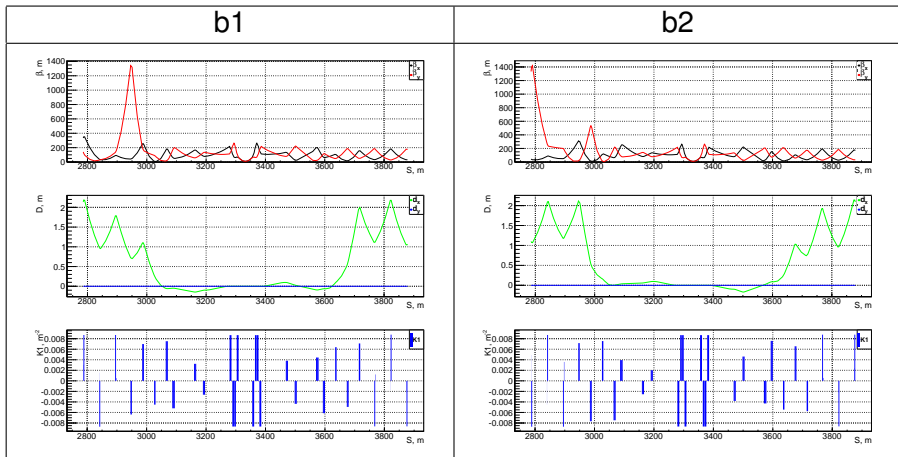


$$\beta^* = 10 \text{ m}, \mu_x = 2.94, \mu_y = 2.7$$



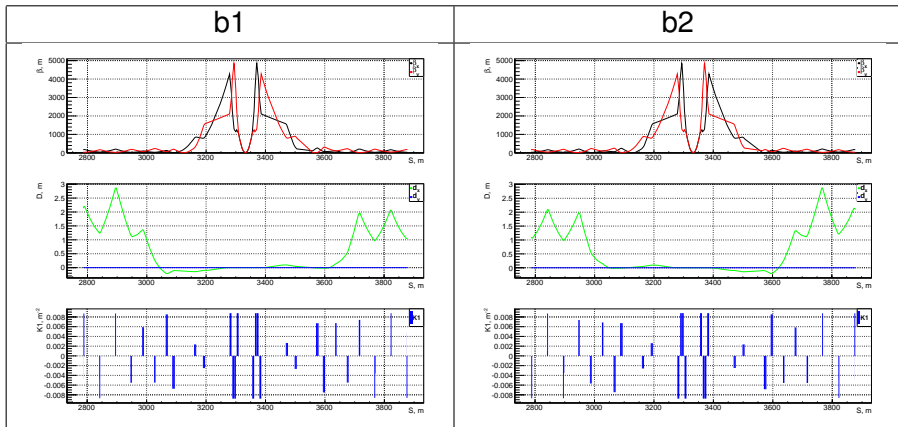
Job 8: IP2 $\beta^* = 10$ m, opt_0050_0200hv.madx

$$\beta^* = 10 \text{ m}, \mu_x = 2.94, \mu_y = 2.7$$



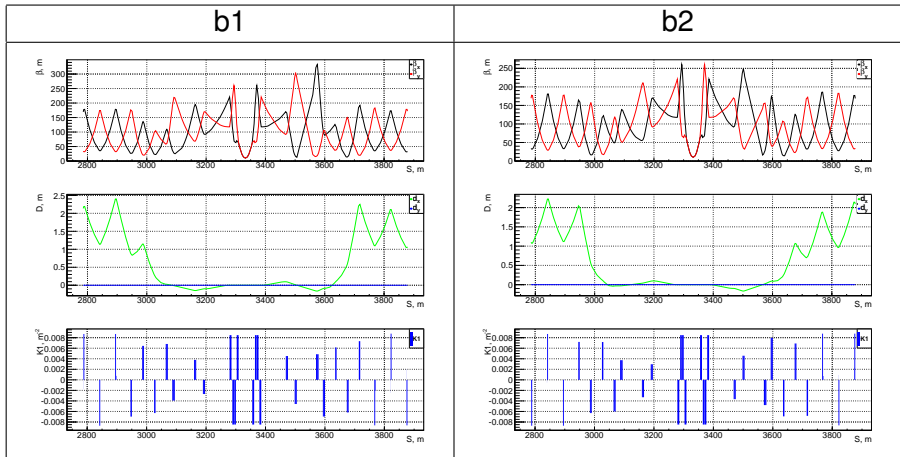
Job 9: IP2 $\beta^* = 0.5$ m, opt_0400_0400.madx

$$\beta^* = 0.5 \text{ m}, \mu_x = 2.94, \mu_y = 2.7$$



Job 10: IP2 $\beta^* = 10$ m, opt_5500_5500.madx

$$\beta^* = 10 \text{ m}, \mu_x = 2.94, \mu_y = 2.7$$



MADX files and pictures of optical functions are in

`/afs/cern.ch/user/b/bogomyag/public/status-4`