Status BI-TL MADX Optics Studies

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Goal

- **MADX version of the BI-TL optics: all optics and all 4 rings!**
  - Crosscheck with “PATH” optics
  - Check layout (quads positions etc.)
  - Define effect of SC
  - Provide MADX optics for quick checks (aperture, steering, etc.)

Optics

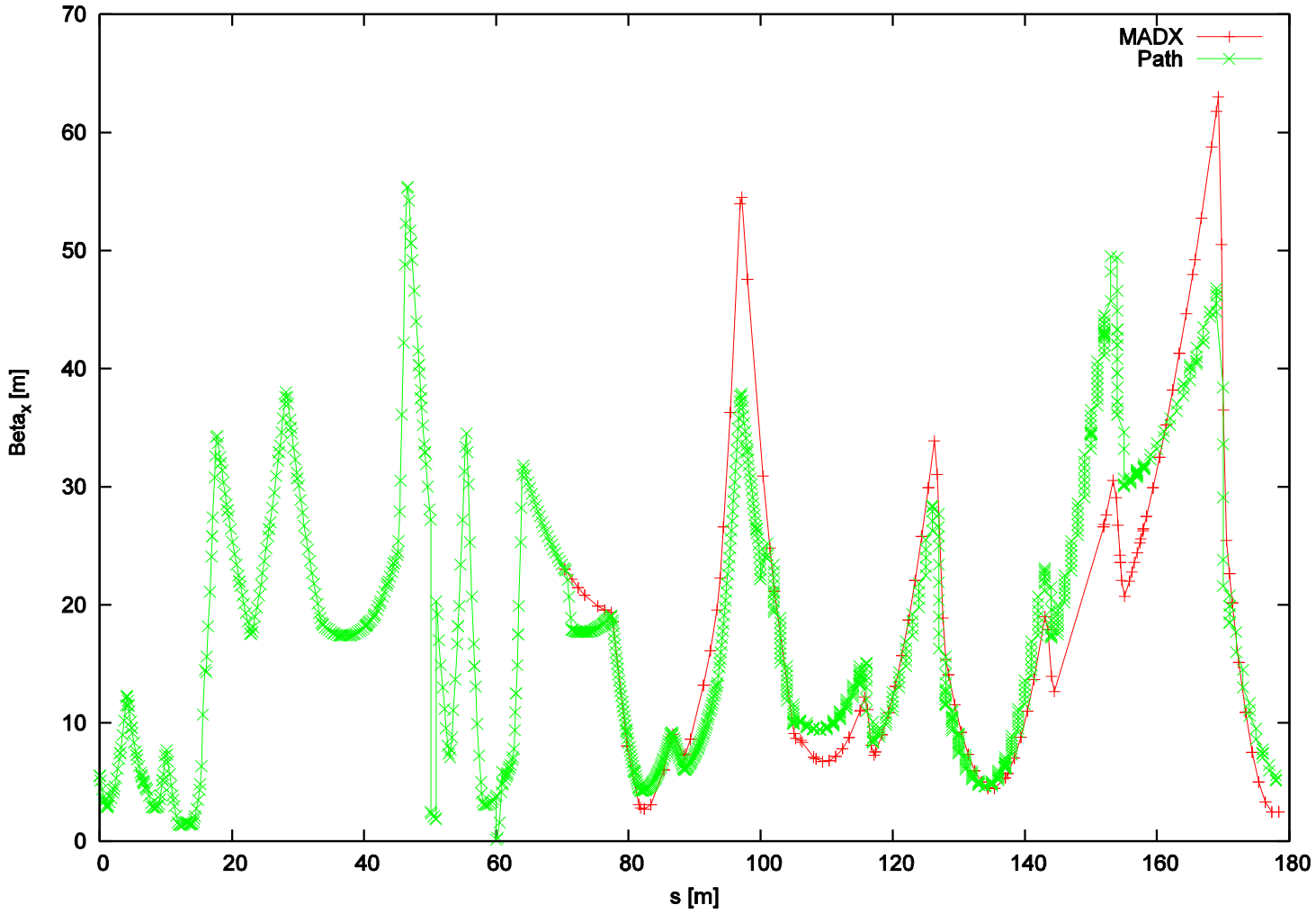
- Lattice manually derived from “Path” output
- “s” coordinates not rechecked wrt existing TL
- Quads strengths and initial conditions (start of BHZ20) given by Alessandra

	L [m]	B [T/m]	B [T/m]	B [T/m]
		Large	Nominal	Small
QFN50	0.255	-1.1909	-1.1909	-1.1909
QDN55	0.255	1.3859	1.3859	1.3859
QFN60	0.255	-1.82279	-1.82279	-1.82279
QDN65	0.255	1.15105	1.15105	1.15105
QFW70	0.467	0.401532	0.401532	0.401532
QDN75	0.255	-1.46635	-1.46635	-1.46635
QFN10	0.255	1.0816	1.0816	1.0816
QDN20	0.255	-0.40911	-0.40911	-0.40911
QFW30	0.461	-1.40927	-1.40927	-1.40927
QDW40	0.461	1.65575	1.65575	1.65575
QFW50	0.461	-1.33639	-1.33639	-1.33639
QDW60	0.461	1.06024	1.06024	1.06024
BI.QN10	0.462	-1.04465	-1.28068	-1.04465
BI.QN20	0.462	1.01876	1.22486	1.01876
BI.QN30	0.462	-0.96627	-0.82535	-1.02548
BI-QN40	0.462	0.972508	0.914672	0.99931
BI-QN50	0.466	-1.84028	-2.13851	-1.6121
BI-QN60	0.466	2.015537	2.359182	1.781536

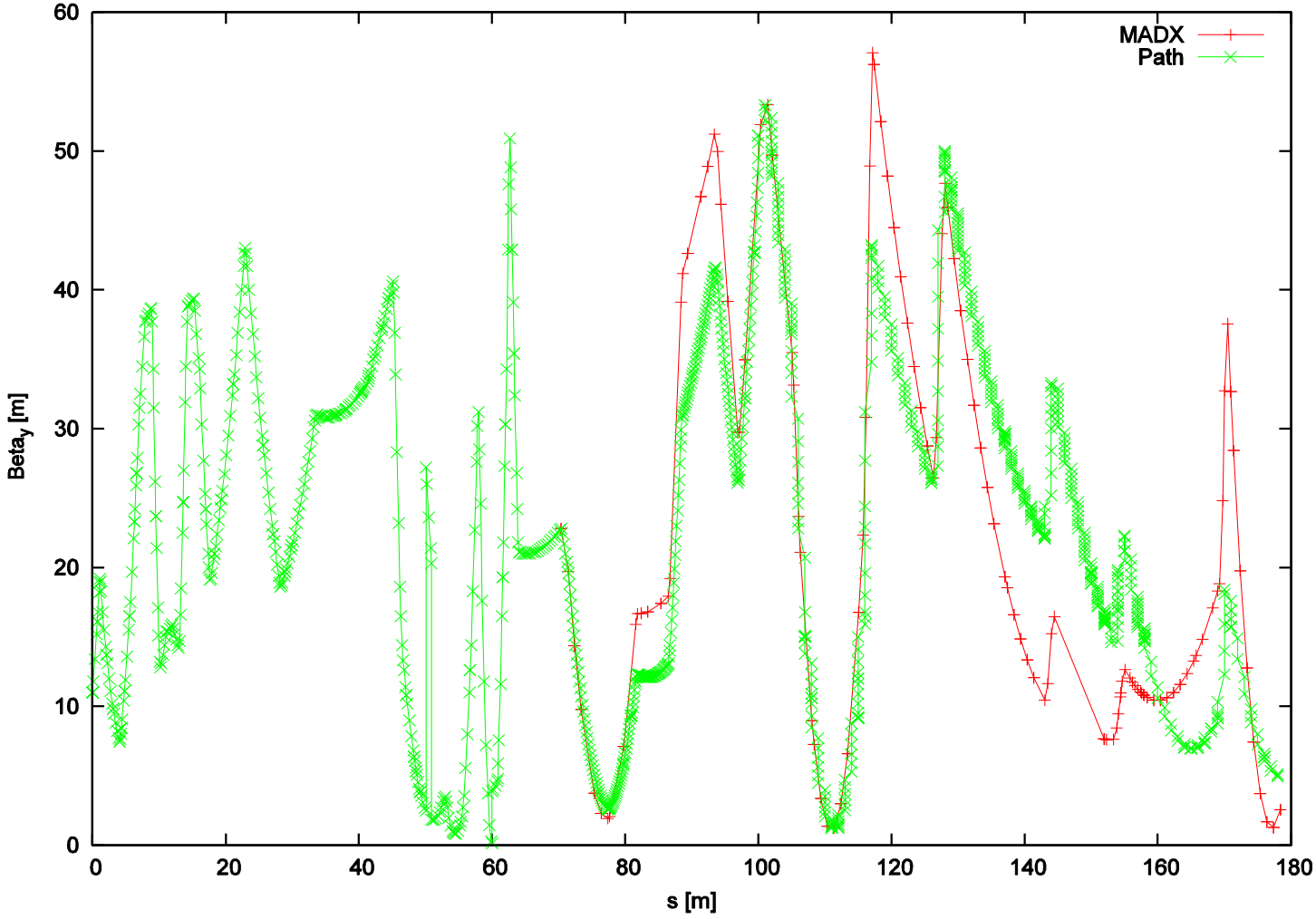
(X,BGX') 100%-Emittance [m.rad]	1.47E-05
(X,BGX') 90%-Emittance [m.rad]	1.36E-06
(X,BGX') RMS-Emittance [m.rad]	3.26E-07
(Y,BGY') 100%-Emittance [m.rad]	9.63E-06
(Y,BGY') 90%-Emittance [m.rad]	1.35E-06
(Y,BGY') RMS-Emittance [m.rad]	3.15E-07
(PHI,dE) 100%-Emittance [deg.MeV]	3.45E+01
(PHI,dE) 90%-Emittance [deg.MeV]	1.09E+00
(PHI,dE) RMS-Emittance [deg.MeV]	2.52E-01
(X,X') Alpha [1]	4.43E-01
(X,X') Beta [m/rad]	2.30E+01
(Y,Y') Alpha [1]	-3.78E-01
(Y,Y') Beta [m/rad]	2.28E+01
(PHI,dE) Alpha [1]	6.34E+00
(PHI,dE) Beta [deg/MeV]	2.74E+03
dx [m]	3.173212
dyp	-0.02713
dy [m]	0.021362
dxp	0.020699

Change sign in MADX (H^-)

Nominal Betax Ring3

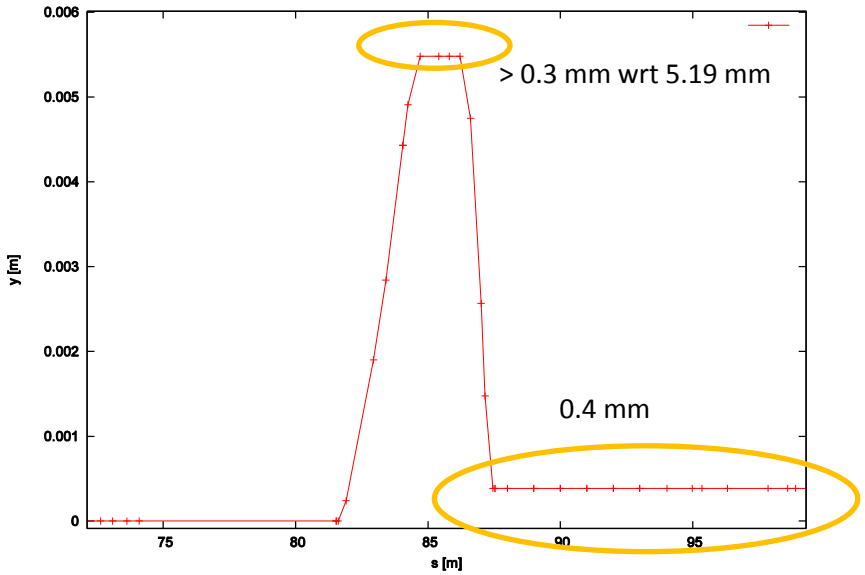


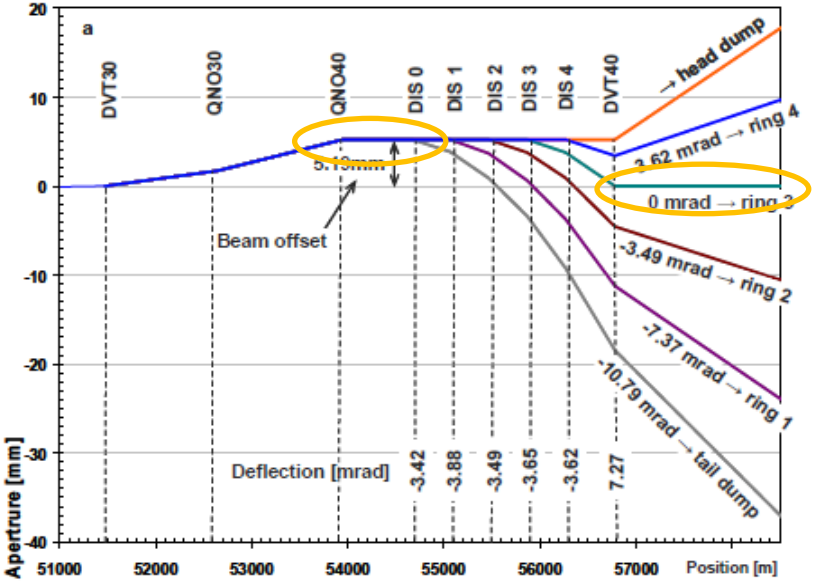
Nominal Bety Ring3



Bump to DIS

- QN30 and QN40 (off-centered ➔ SBENDS)



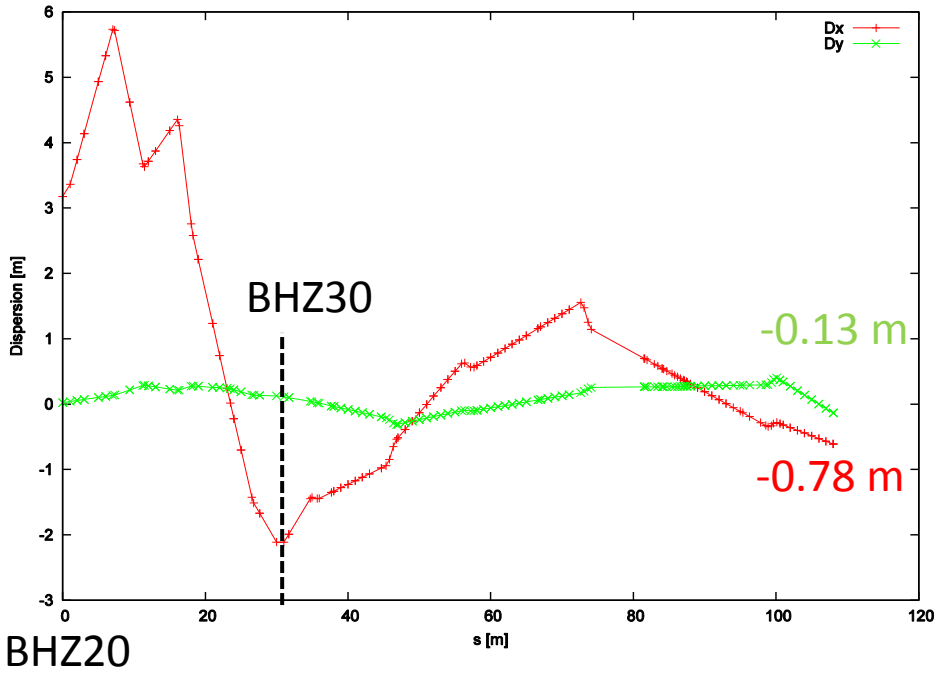


Check mutual distance QN30-QN40……(or DVT30 strength)

Dispersion

Case 1 : dispersion zero.

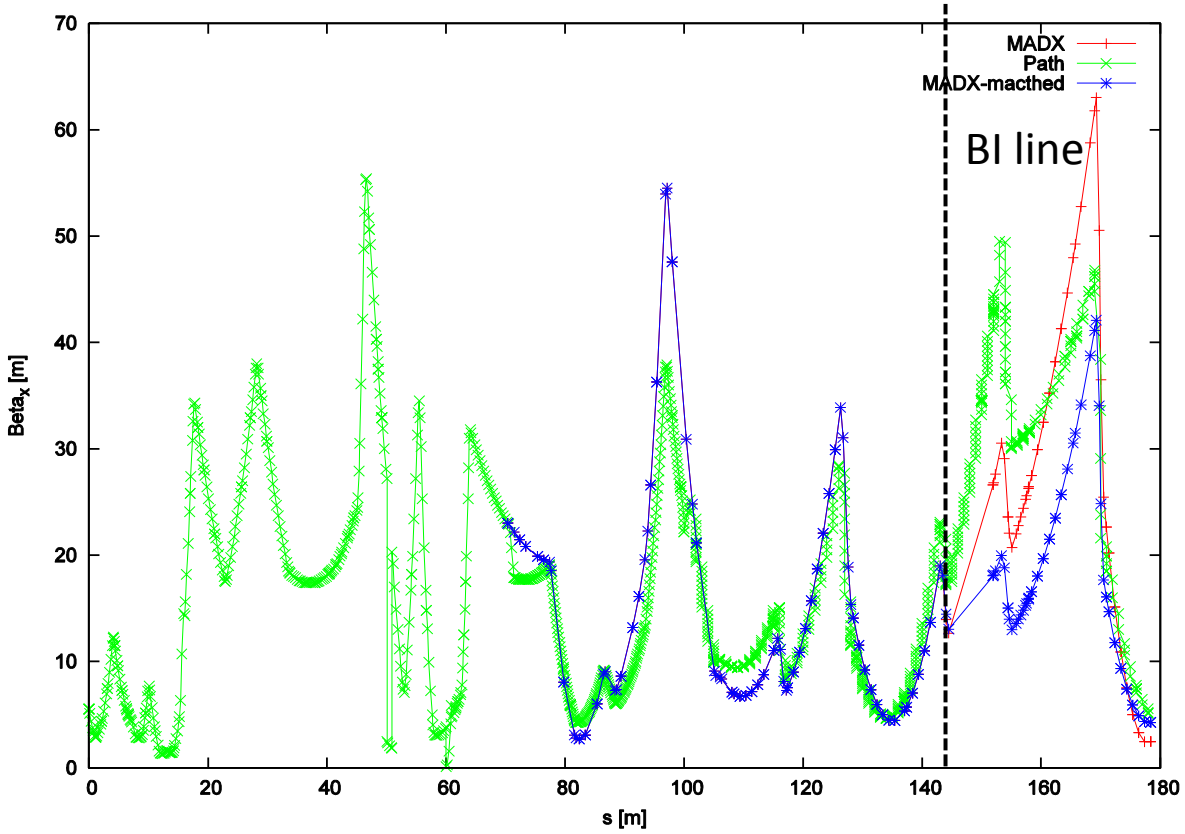
The cases where the dispersion is nullified are somehow simpler as the matching of the dispersion and the matching of the beta function is completely decoupled. In particular the dispersion and its derivative are matched to zero after BHZ30 and then they stay zero until the foil. The quadrupoles of the BI line are used to obtain the big/medium/small beta function.



Matching 1

Matching: bx_foil = 5, by_foil = 4, ax_foil = 0, ay_foil = 0
Only BI Quads but QN30-QN40 (not affect bump to DIS)

Variable	Final Value	Initial Value	Lower Limit	Upper Limit
kbiqn1_1	6.32244e-01	6.75462e-01	-1.00000e+20	1.00000e+20
kbiqn1_2	-4.98718e-01	-6.43309e-01	-1.00000e+20	1.00000e+20
kbiqn2_1	1.11152e+00	1.12317e+00	-1.00000e+20	1.00000e+20
kbiqn2_2	-1.22745e+00	-1.23907e+00	-1.00000e+20	1.00000e+20



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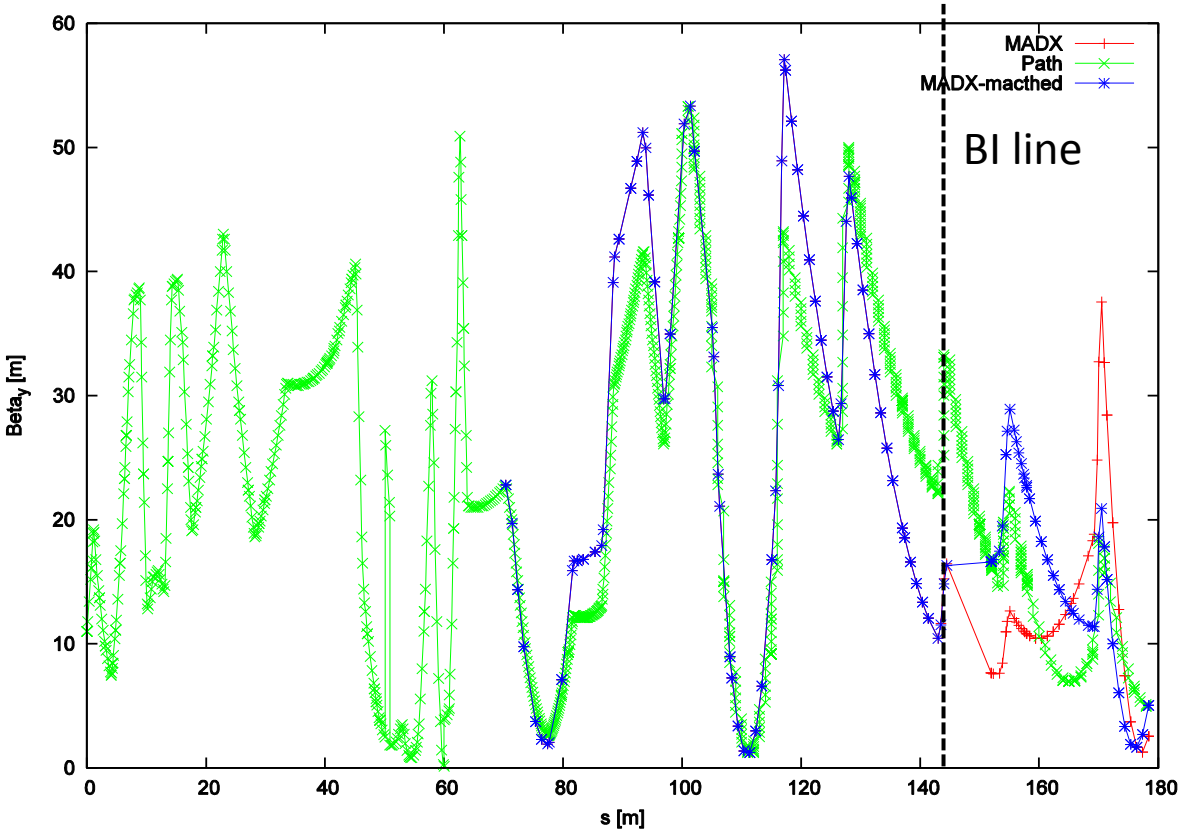
kbiqn2_1	1.11152e+00	1.12317e+00	-1.00000e+20	1.00000e+20
kbiqn2_2	-1.22745e+00	-1.23907e+00	-1.00000e+20	1.00000e+20



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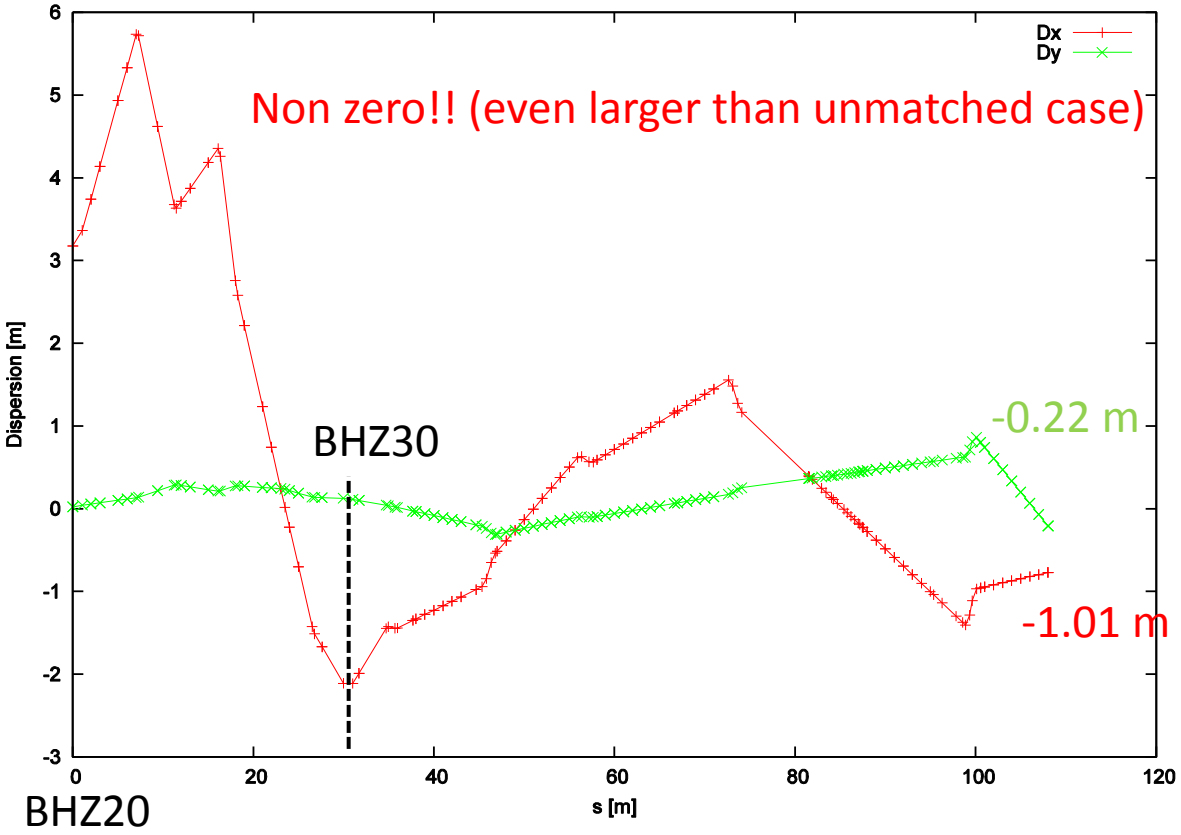
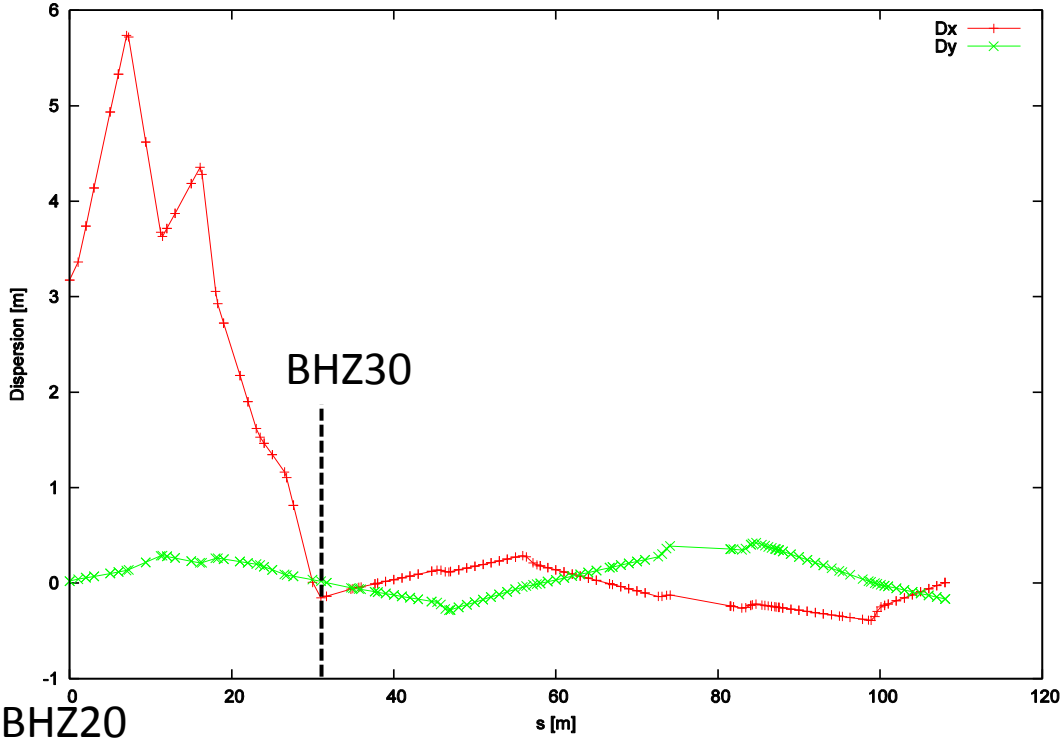
kbiqn2_1	1.11152e+00	1.12317e+00	-1.00000e+20	1.00000e+20
kbiqn2_2	-1.22745e+00	-1.23907e+00	-1.00000e+20	1.00000e+20



Matching 2

Matching: bx_foil = 5, by_foil = 4, ax_foil = 0, ay_foil = 0

Variable	Final Value	Initial Value	Lower Limit	Upper Limit
kqfn1	6.25473e-01	6.25473e-01	5.00378e-01	7.50567e-01
kqdn1	-7.27889e-01	-7.27889e-01	-8.73466e-01	-5.82311e-01
kqfn2	8.05558e-01	9.57348e-01	7.65878e-01	1.14882e+00
kqdn2	-6.04543e-01	-6.04543e-01	-7.25452e-01	-4.83634e-01
kqfw1_1	-2.10889e-01	-2.10889e-01	-2.53066e-01	-1.68711e-01
kqdn3	7.70142e-01	7.70142e-01	6.16113e-01	9.24170e-01
kqfn3	-5.68067e-01	-5.68067e-01	-6.81681e-01	-4.54454e-01
kqdn4	2.14869e-01	2.14869e-01	1.71895e-01	2.57842e-01
kqfw2_1	7.40163e-01	7.40163e-01		
kqdw1	-8.69617e-01	-8.69617e-01		
kqfw2_2	7.01886e-01	7.01886e-01		
kqdw2	-5.56849e-01	-5.56849e-01		



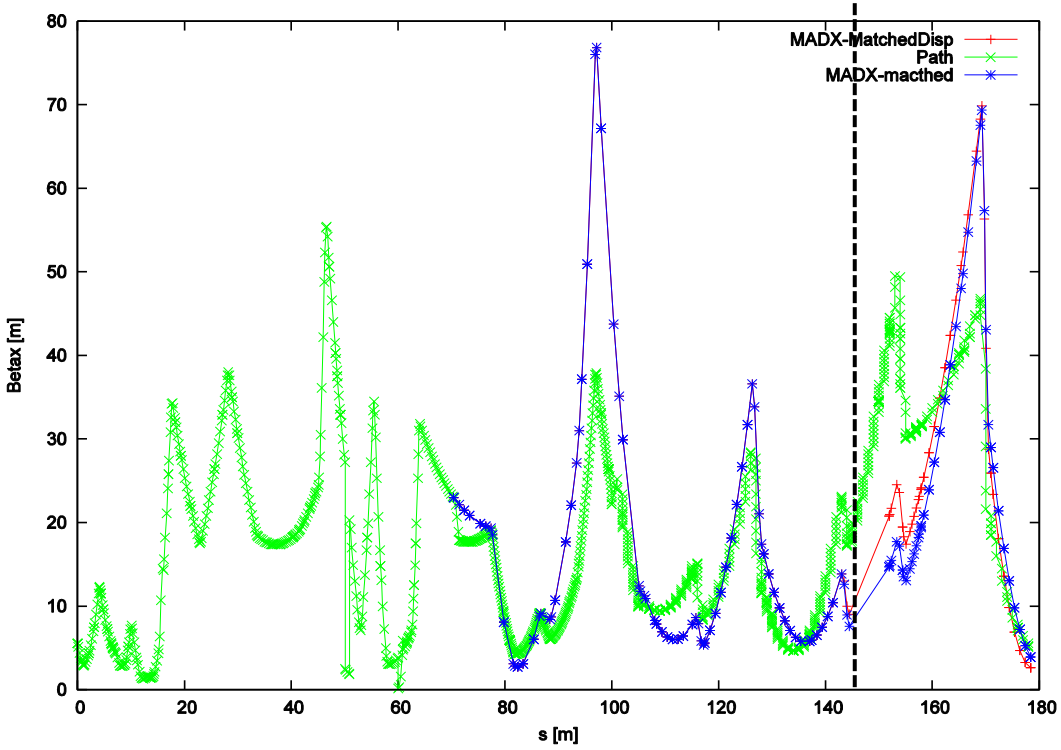
Matching 2

Matching: bx_foil = 5, by_foil = 4, ax_foil = 0, ay_foil = 0

Variable	Final Value	Initial Value	Lower Limit	Upper Limit
kqfn1	6.25473e-01	6.25473e-01	5.00378e-01	7.50567e-01
kqdn1	-7.27889e-01	-7.27889e-01	-8.73466e-01	-5.82311e-01
kqfn2	8.05558e-01	9.57348e-01	7.65878e-01	1.14882e+00
kqdn2	-6.04543e-01	-6.04543e-01	-7.25452e-01	-4.83634e-01
kqfw1_1	-2.10889e-01	-2.10889e-01	-2.53066e-01	-1.68711e-01
kqdn3	7.70142e-01	7.70142e-01	6.16113e-01	9.24170e-01
kqfn3	-5.68067e-01	-5.68067e-01	-6.81681e-01	-4.54454e-01
kqdn4	2.14869e-01	2.14869e-01	1.71895e-01	2.57842e-01
kqfw2_1	7.40163e-01	7.40163e-01		
kqdw1	-8.69617e-01	-8.69617e-01		
kqfw2_2	7.01886e-01	7.01886e-01		
kqdw2	-5.56849e-01	-5.56849e-01		

Variable	Final Value	Initial
kbiqn1_1	8.10554e-01	6.75462
kbiqn1_2	-7.71970e-01	-6.43309
kbiqn2_1	1.03581e+00	1.12317
kbiqn2_2	-1.07940e+00	-1.23907

BI line



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kqdn1	-7.27889e-01	-7.27889e-01	-8.73466e-01	-5.82311e-01
kqfn2	8.05558e-01	9.57348e-01	7.65878e-01	1.14882e+00
kqdn2	-6.04543e-01	-6.04543e-01	-7.25452e-01	-4.83634e-01
kqfw1_1	-2.10889e-01	-2.10889e-01	-2.53066e-01	-1.68711e-01
kqdn3	7.70142e-01	7.70142e-01	6.16113e-01	9.24170e-01
kqfn3	-5.68067e-01	-5.68067e-01	-6.81681e-01	-4.54454e-01
kqdn4	2.14869e-01	2.14869e-01	1.71895e-01	2.57842e-01
kqfw2_1	7.40163e-01	7.40163e-01		
kqdw1	-8.69617e-01	-8.69617e-01		
kqfw2_2	7.01886e-01	7.01886e-01		
kqdw2	-5.56849e-01	-5.56849e-01		

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kbiqn1_1	8.10554e-01	6.75462
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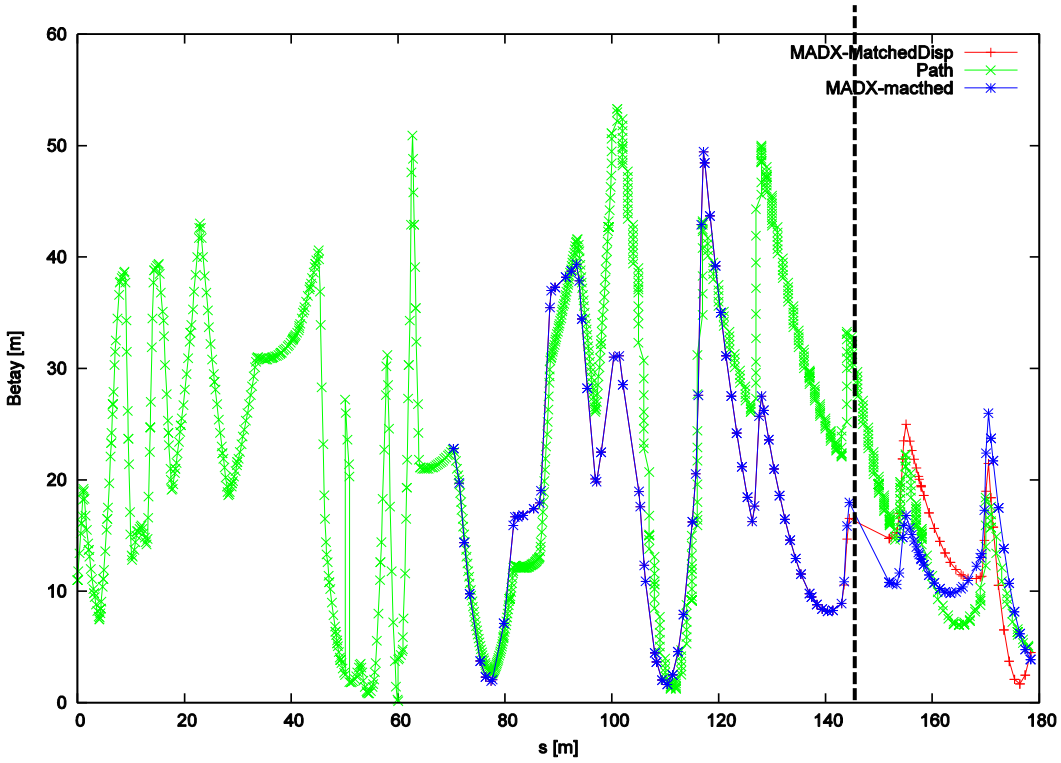
BI line



Next Steps

- Agree on matching (Dispersion ok?)
- Define how to take into account SC
- Check “s” coordinates (close bump towards DIS)
- Optics for TL to 4 rings
- Check other optics for all rings (0 dispersion, large and small beta + -1.4 m dispersion, nominal, large, small beta)