CERL 7.0: Complete linear and second-order optics

First optics since CERL 3.0. Now uses CESR with existing layout. 22 X-ray beamlines.

Jim Crittenden (for Chris Mayes, Carol Johnstone and Georg Hoffstaetter)

ERL @ CESR, 11December 2008

I. Brief Discussion of the Optics

See Chris's detailed description in the CDR section A.1 for more

II. Diagram and plot options for the CDR

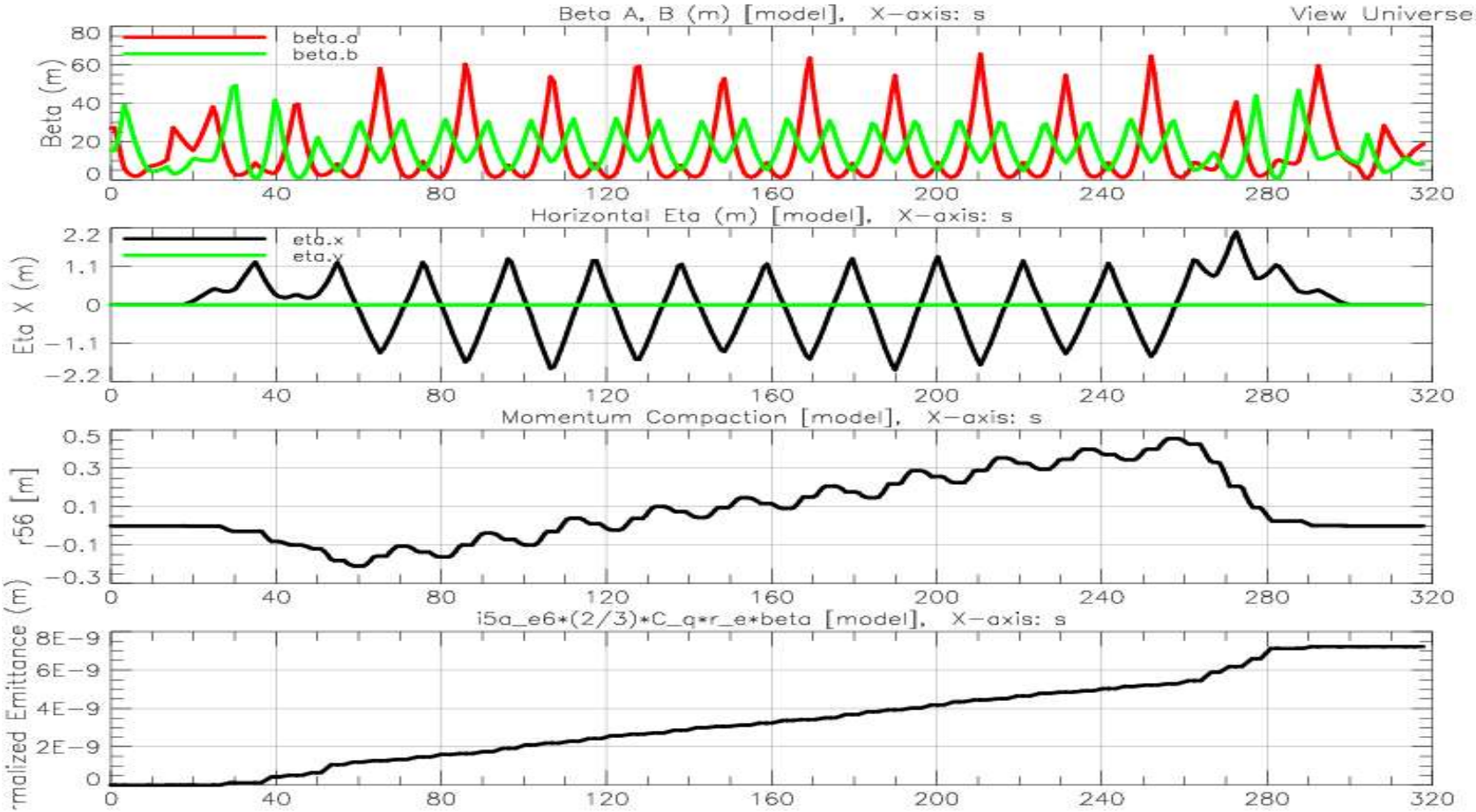
III. Work list

Progress since CERL 6.9

- *Redesigned TA/TB linear and second-order optics for r56=0 and t166=t566=0.*
- *Re-optimized SA, NA sextupoles using step size reduced from 20 cm to 1 cm*
- *Set t166 and t566=0 from beginning of SA to end of NA with new step size, using the last 7 CE sextupoles. All k2 values in the ERL are below 150 m^-3.*
- *Established CE cell naming conventions.*
- *Replaced s.c. wiggler elements in CE with drifts.*
- *Established element naming conventions in CE for bends, quads, sextupoles, kickers. Replaced skew elements, octupoles, separators, bumpers and pingers with drifts. Added CE elements to spreadsheet.*

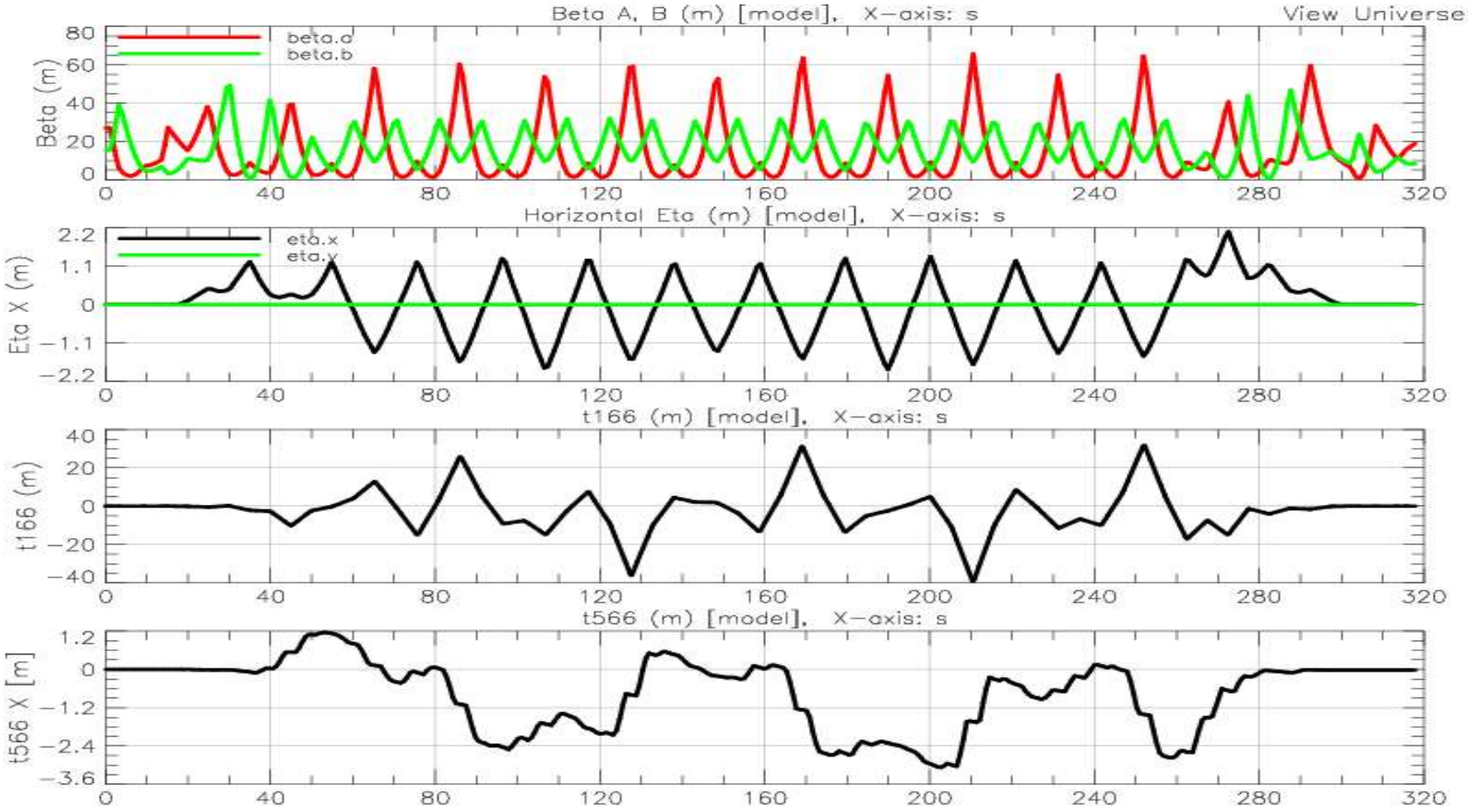
CERL 7.0 Optics

High-energy Turnaround Linear Optics

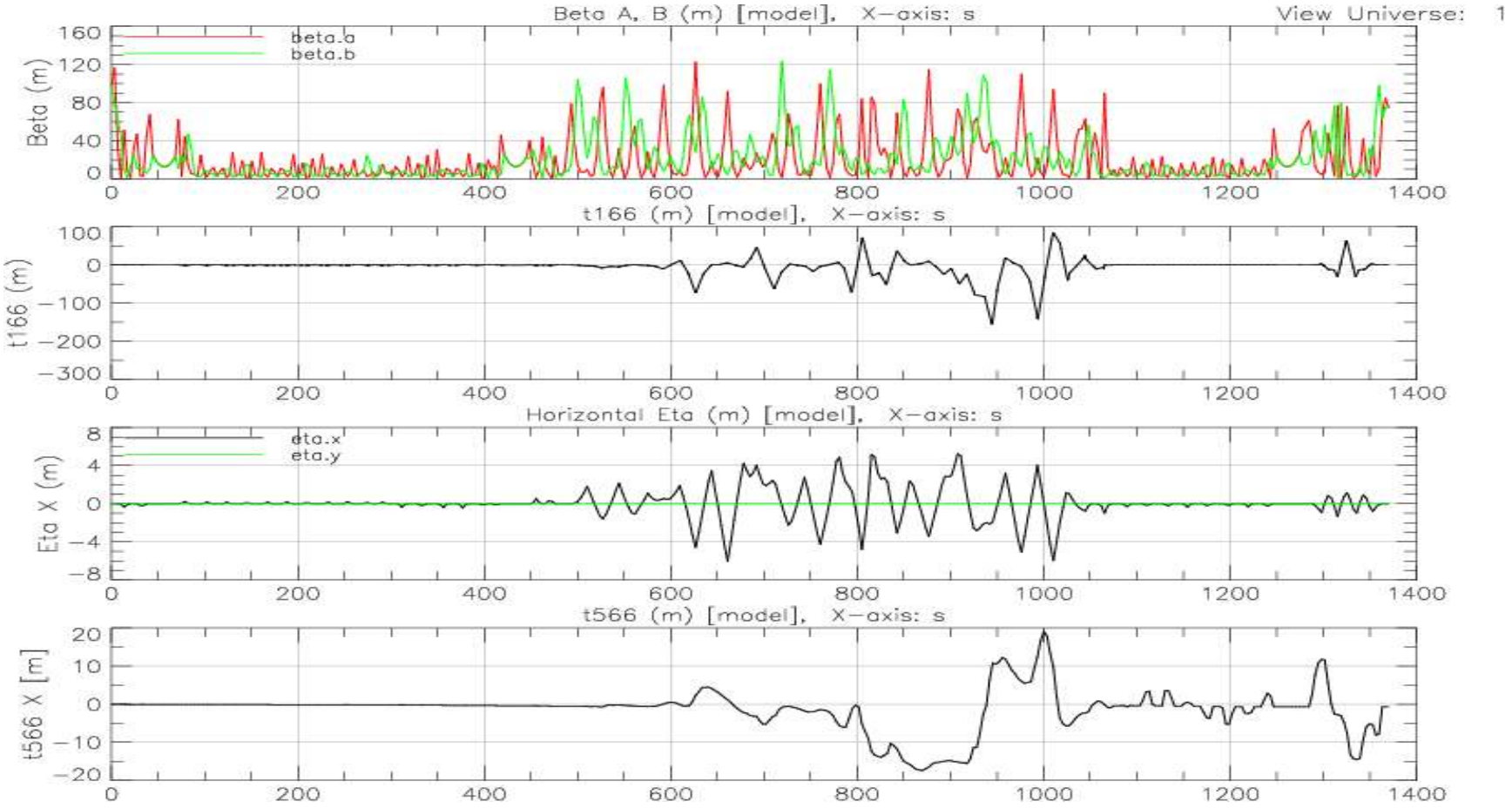


CERL 7.0 Optics

High-energy Turnaround Second-order Dispersion



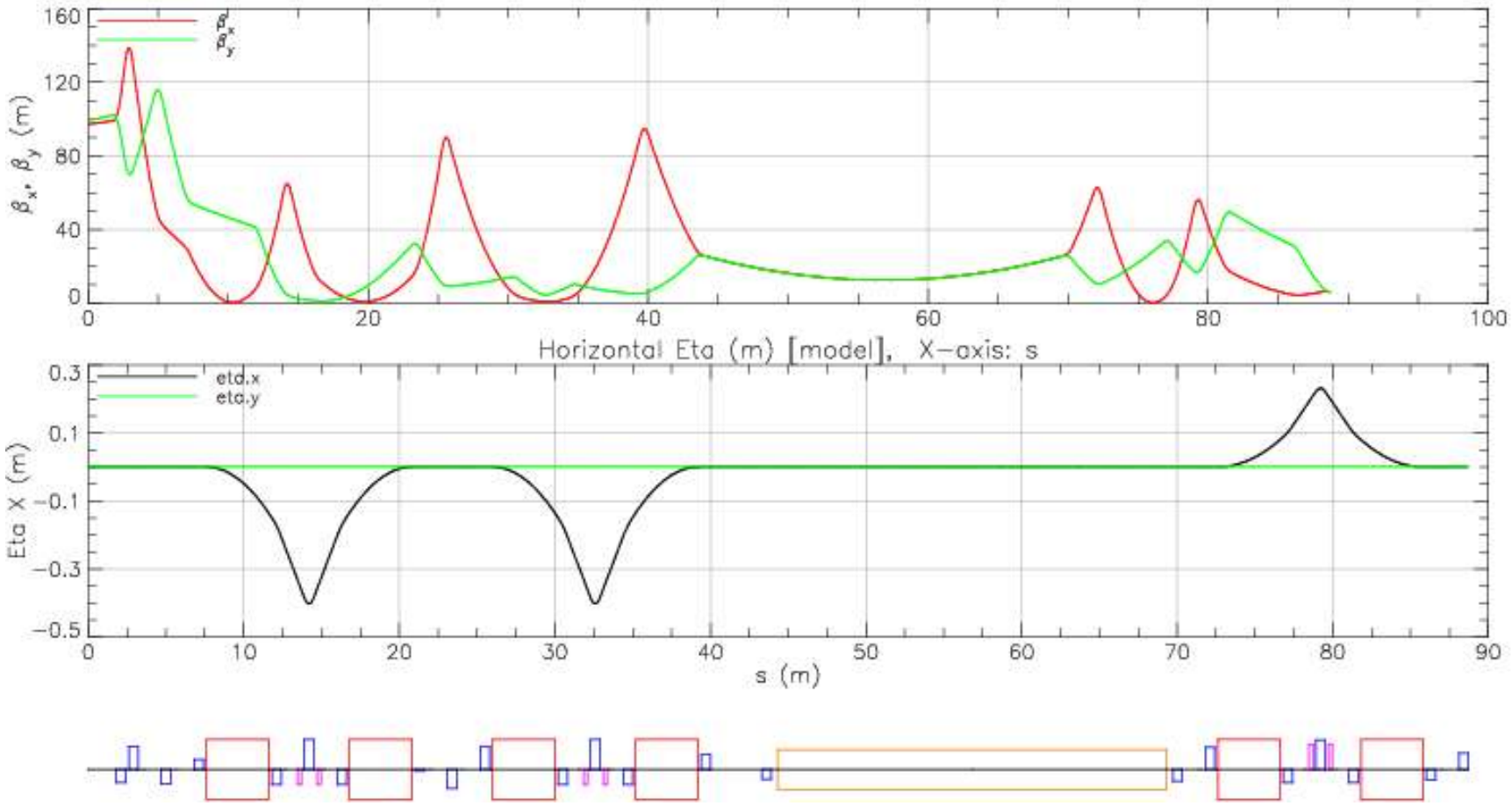
CERL 7.0 Optics
SA-CE-NA Second-Order Dispersion



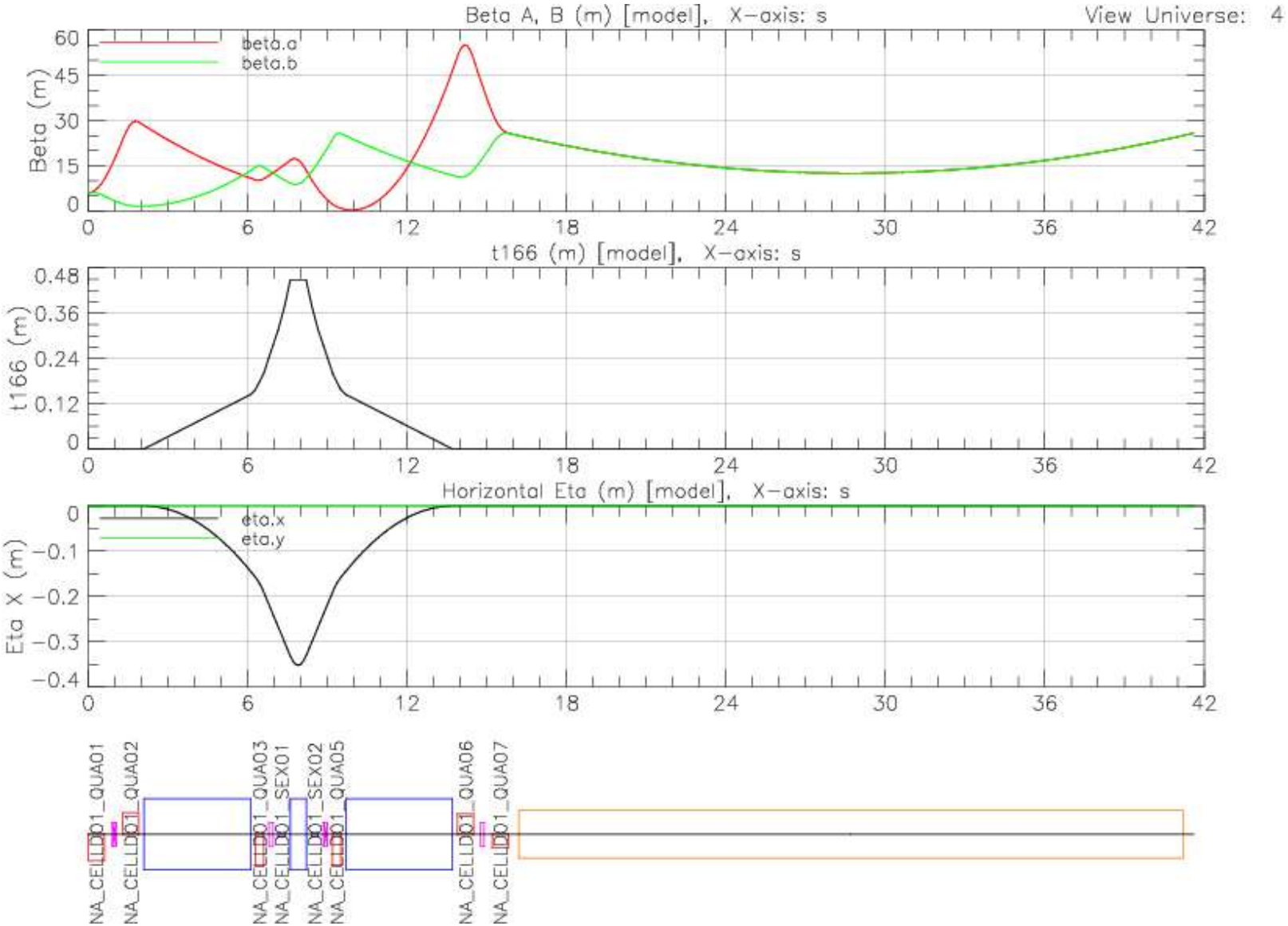
Graphics: Autocad (1)

Graphics: Autocad (2)

Graphics: TAO (1)
Chris's CDR Style

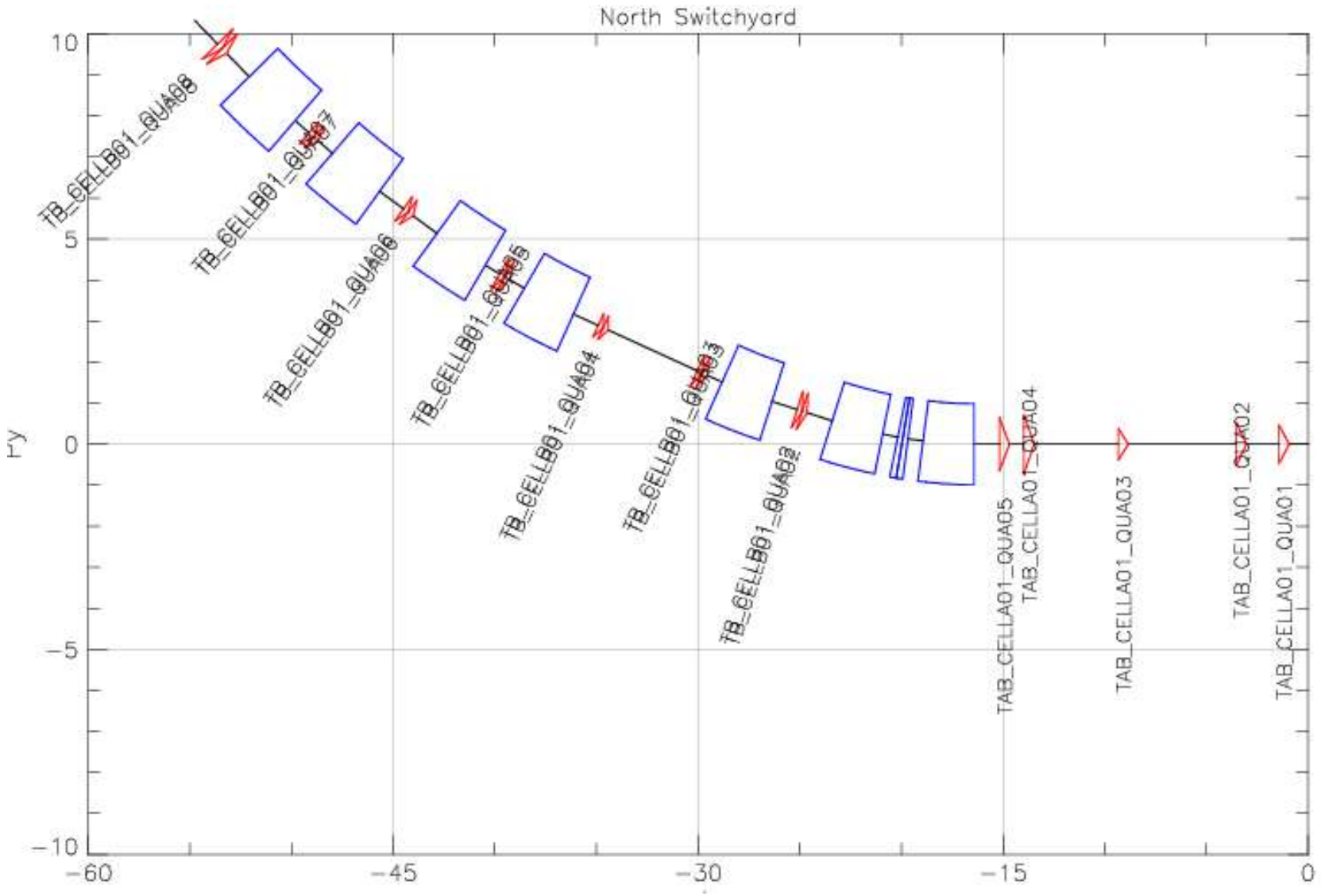


Graphics: TAO (2)
Optics & Linear Layout



Graphics: TAO (3)

Floor Plan (Low-energy Turnaround)



Work List

I. Improve section naming convention for consistency and hardware logic

II. Define aperture to be 1-inch diameter everywhere except CE (Autocad script uses this value)

III. Simplify turnaround matching sections

IV. Re-design the turnarounds to use 4-m dipole lengths rather than 2.5-m

V. Adjust dipole strengths in (NA/SA), CE, and TA/TB to each use a single power supply

VI. Improve CESR linear and second-order optics. Reduce beta's and emittance

VII. Define IN and DU shared bends as multi-pass. Make DU a BMAD "branch"

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IX. Remove double-counting of multi-pass sections from spreadsheet. Add sextupole table

Section Naming Conventions

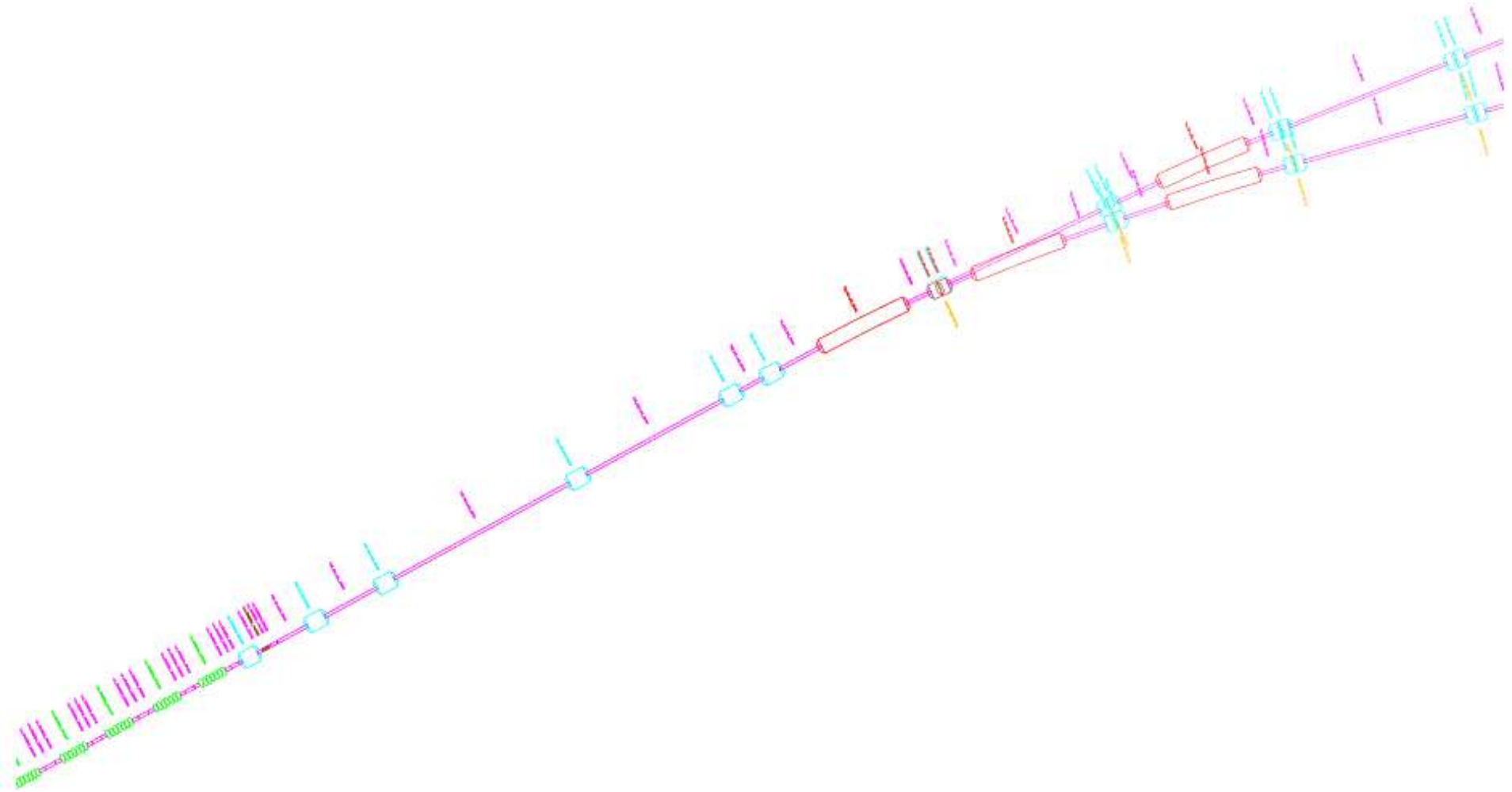
Now

IN LA TA LB SA CE NA LA TB LB DU

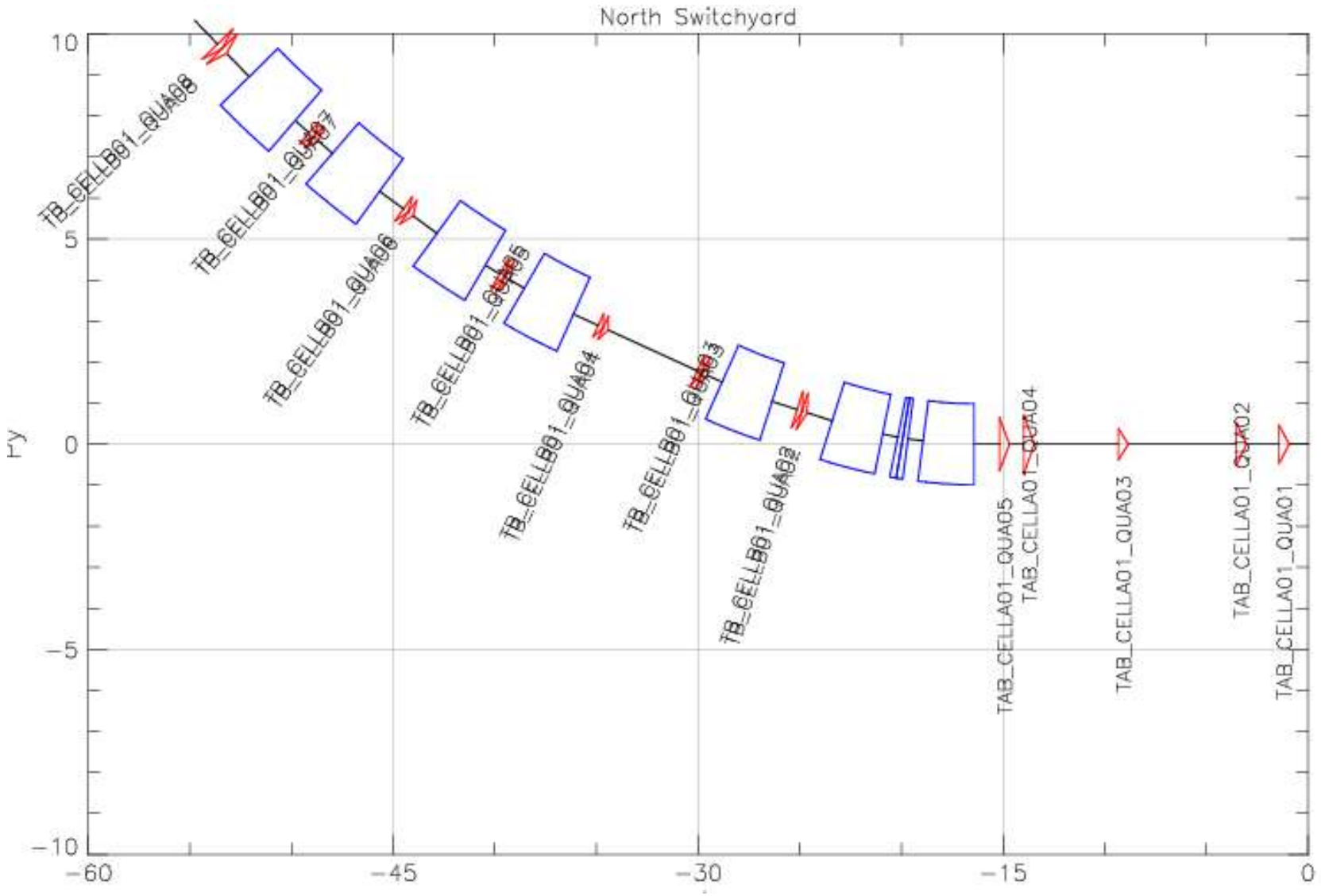
Proposed

IN NL NS ET SS SL SA CE NA NL NS WT SS SL DU

Simplify Turnaround Matching Sections



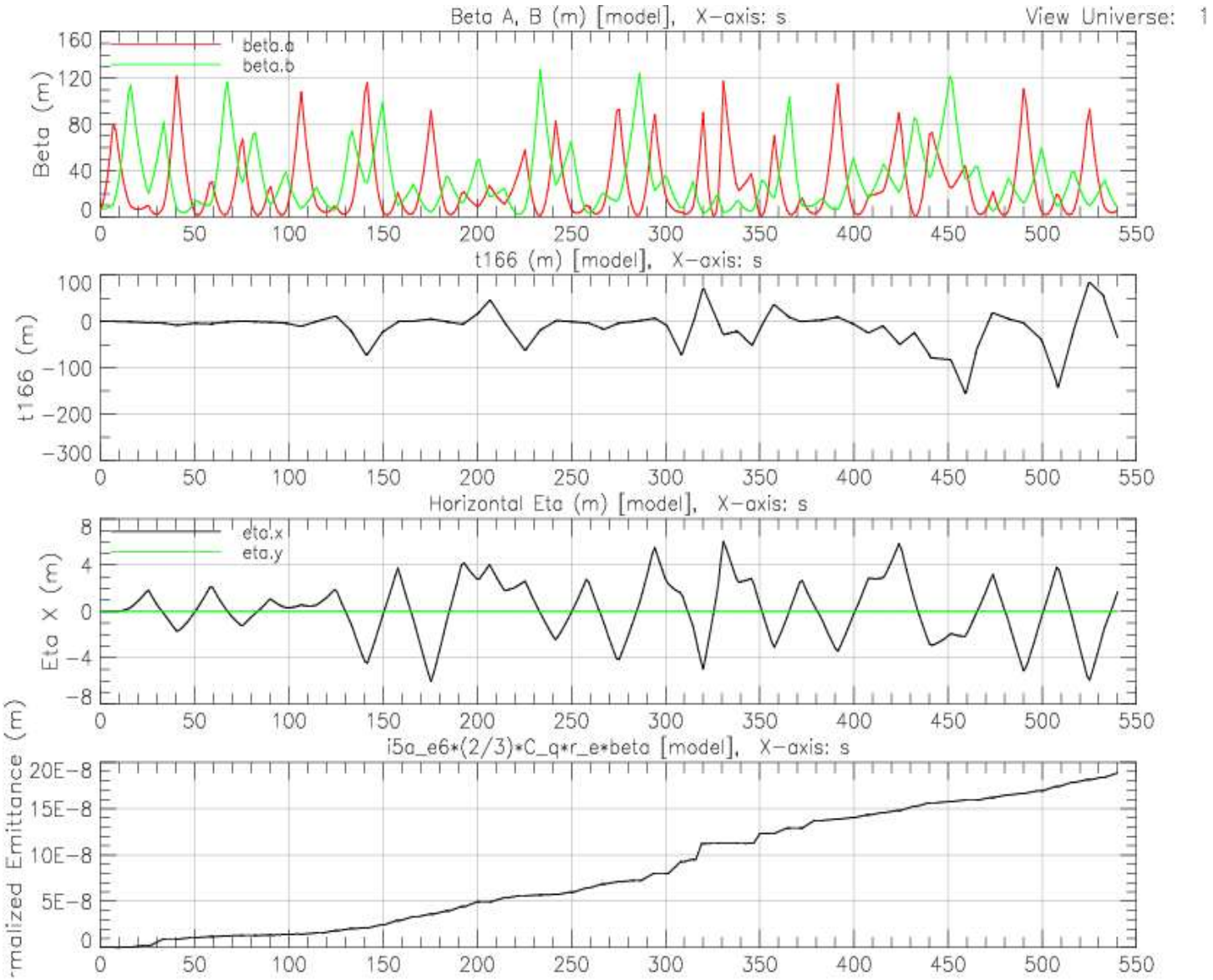
Simplify Turnaround Matching Sections



Dipole Length Modifications (DHR)

Dipole parameters type #	qty	field [T]	length [m]	radius [m]	T-m	TA	SA	NA	TB	Orig. Turns	Mod Turns	Mod Length	Amps	Volts	Total Volts	Total Pwr (kW)
														Turnaround A	**449.0**	**277.0**
														South Arc	**369.1**	**300.8**
														North Arc	**191.1**	**133.2**
														Turnaround B	**343.9**	**228.7**
1	1	0.03	0.26	0.98	0.01	0	0	0	0							
2	1	0.03	0.25	0.97	0.01	0	0	0	0							
3	1	0.03	0.26	0.98	0.01	0	0	0	0							
4	2	0.19	2.5	49.16	0.48	2	0	0	0	8.63	9	2.397	617		6.5	12.9	8.0
5	2	0.25	2.5	38.28	0.61	2	0	0	0	11.09	12	2.310	617		8.3	16.6	10.3
6	4	0.32	2.5	29.67	0.79	4	0	0	0	14.3	15	2.384	617		10.7	42.9	26.5
7	4	0.35	2.5	26.52	0.89	4	0	0	0	**16**	16	2.500	617		12	48.0	29.6
8	40	0.24	2.5	38.75	0.61	40	0	0	0	10.95	11	2.489	617		8.2	328.5	202.7
9	4	0.28	4	59.22	1.13	0	4	0	0	9.63	10	3.853	815		10.1	40.5	33.0
10	22	0.17	4	100	0.67	0	22	0	0	5.71	6	3.803	815		6	132.0	107.6
11	4	0.31	4	53.55	1.25	0	4	0	0	10.65	11	3.873	815		11.2	44.8	36.5
12	4	0.41	4	40.53	1.65	0	4	0	0	14.07	15	3.753	815		14.8	59.2	48.3
13	4	0.22	4	77.49	0.86	0	4	0	0	7.36	8	3.680	815		7.7	31.0	25.2
14	4	0.47	4	35.65	1.87	0	4	0	0	**16**	16	4.000	815		15.4	61.6	50.2
15	2	0.16	6.57	106.13	1.03	0	0	2	0	6.28	7	5.894	697		5.3	10.7	7.4
16	3	0.3	6.57	55.56	1.97	0	0	3	0	**12**	12	6.570	697		10.2	30.6	21.3
17	14	0.29	4	57.59	1.16	0	0	14	0	11.58	12	3.859	697		6.0	83.9	58.5
18	2	0.3	4	55.56	1.2	0	0	2	0	12	12	4.000	697		6.2	12.4	8.7
19	10	0.26	4	64.48	1.03	0	0	10	0	10.34	11	3.760	697		5.4	53.5	37.3
20	4	0.19	2.5	38.28	0.48	0	0	0	4	**8**	8	2.500	665		6.5	26.0	17.3
21	2	0.16	2.5	44.46	0.41	0	0	0	2	6.89	7	2.459	665		5.6	11.2	7.4
22	8	0.18	2.5	39.94	0.46	0	0	0	8	7.67	8	2.395	665		6.2	49.8	33.1
23	40	0.19	2.5	38.75	0.47	0	0	0	40	7.9	8	2.470	665		6.4	256.9	170.8
24	2	0.07	0.25	0.48	0.02	0	0	0	0							

CESR optics can be improved



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