OSC Lattice Design Update

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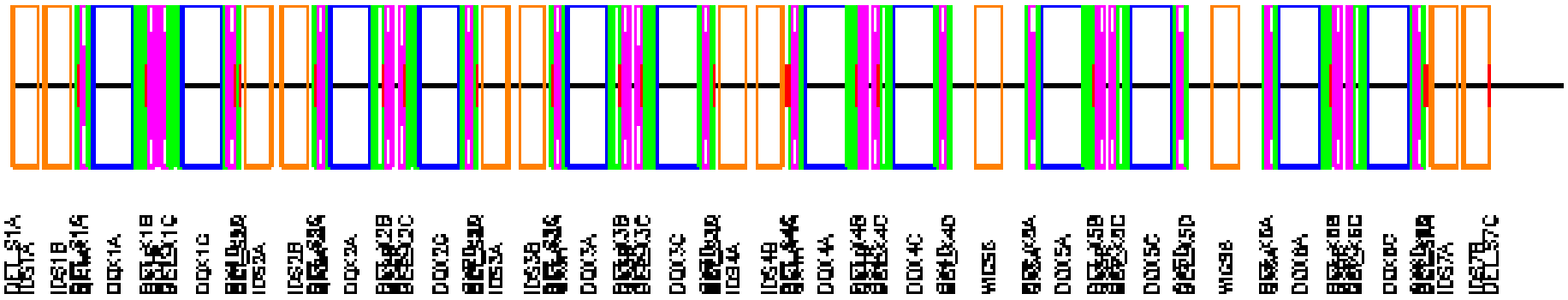
Overview

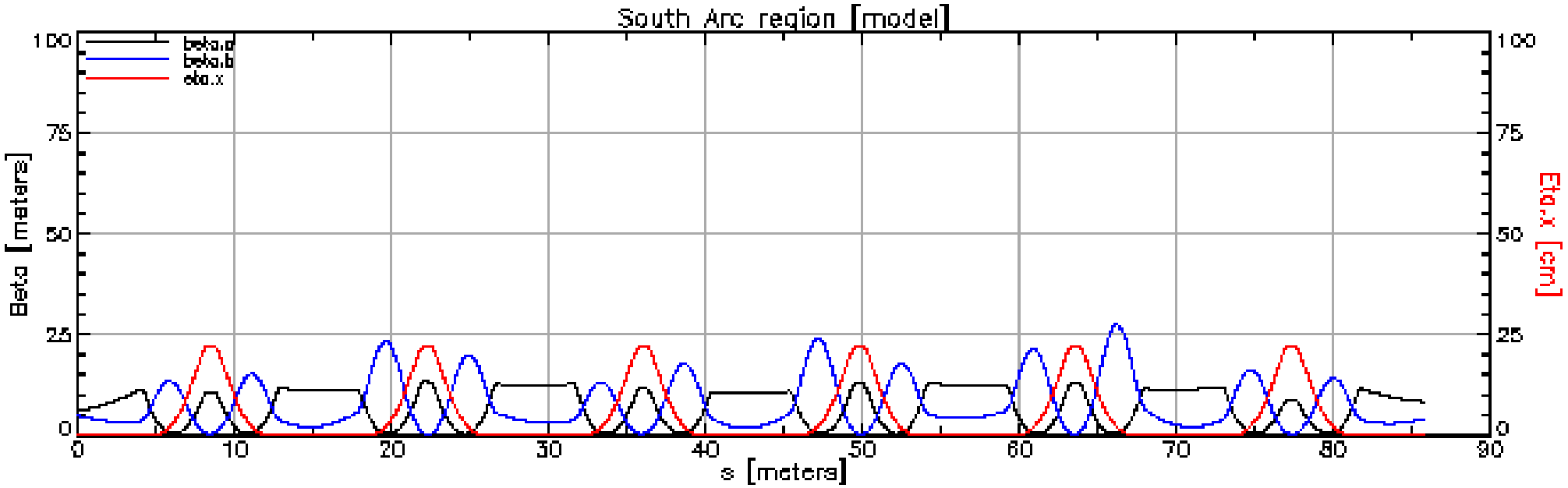
- Several designs in-process:
  - Arc Pretzel (present layout), with six SC wigglers (in arcs)
  - CHESS-U, with 8 CCUs (and one 24-pole PM wiggler) → 2018/19 configuration
  - CHESS-U, with 10 CCUs – B=0.45T
  - CHESS-U, with 10 CCUs – B=0.952T (full-field)
- For now, target 500MeV (middle-of-the-road)
  - Could easily scale to 300-1000MeV
- Lattices shown today are conceptual; could be fleshed out into a full design

CHESS-U, 10 CCUs, B = 0.45T

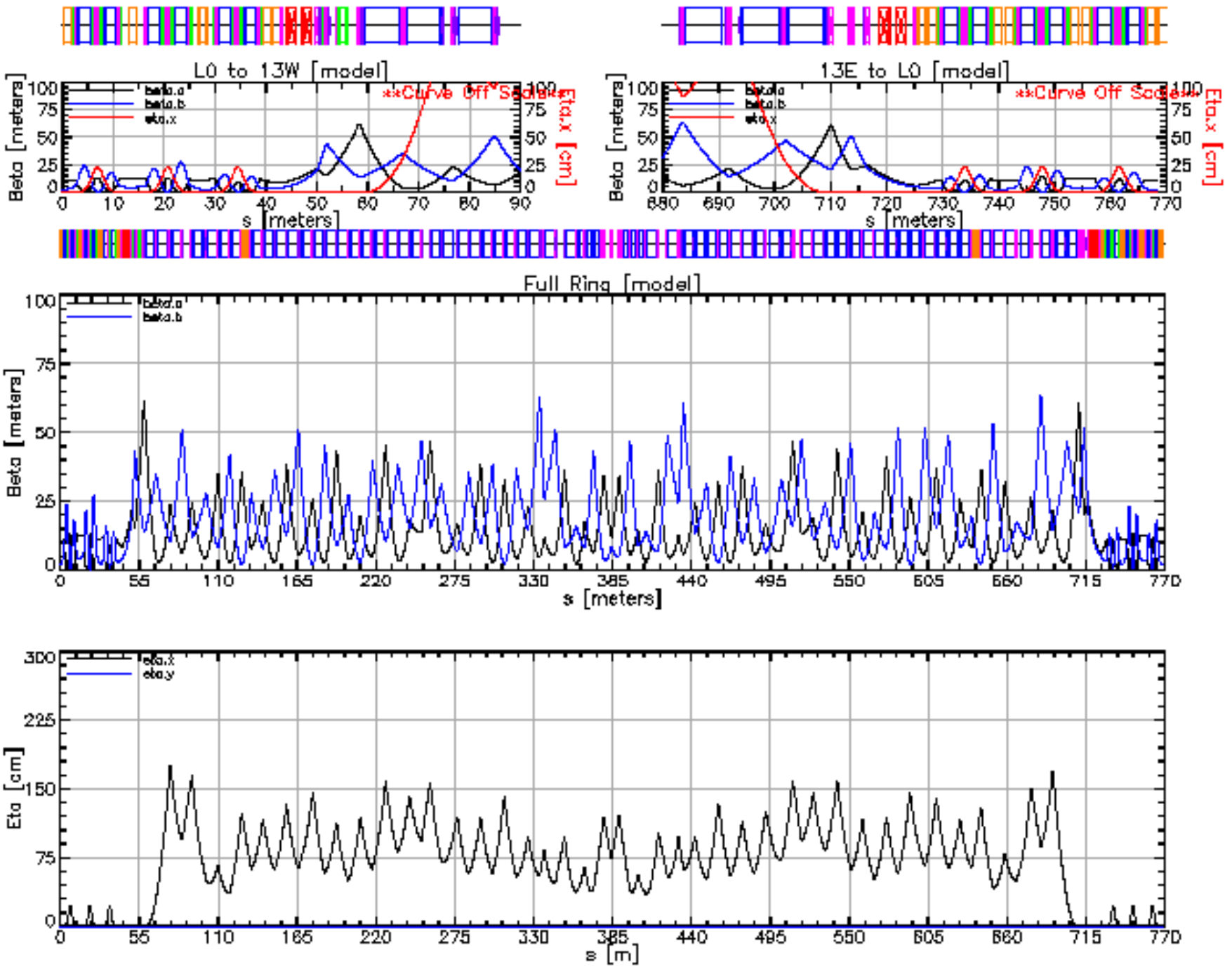
CHESS-U, 10CCUs, B=0.45T

- SCWs off





CHESS-U, 10CCUs, B=0.45T



CHESS-U, 10CCUs, B=0.45T

	X		Y		
	Model	Design	Model	Design	
Q	16.6292	16.6292	12.6428	12.6428	! Tune
Chrom	1.4127	1.4127	1.1764	1.1764	! dQ/(dE/E)
J_damp	1.0392	1.0392	1.0006	1.0006	! Damping Partition #
Emittance	3.990E-11	3.989E-11	6.071E-14	6.071E-14	! Meters
Alpha_damp	5.812E-07	5.812E-07	5.595E-07	5.595E-07	! Damping per turn
I4	-2.493E-02	-2.493E-02	-3.592E-04	-3.592E-04	! Radiation Integral
I5	7.182E-05	7.181E-05	3.266E-38	4.092E-38	! Radiation Integral
I6/gamma^2			4.452E-07	4.452E-07	! Radiation Integral

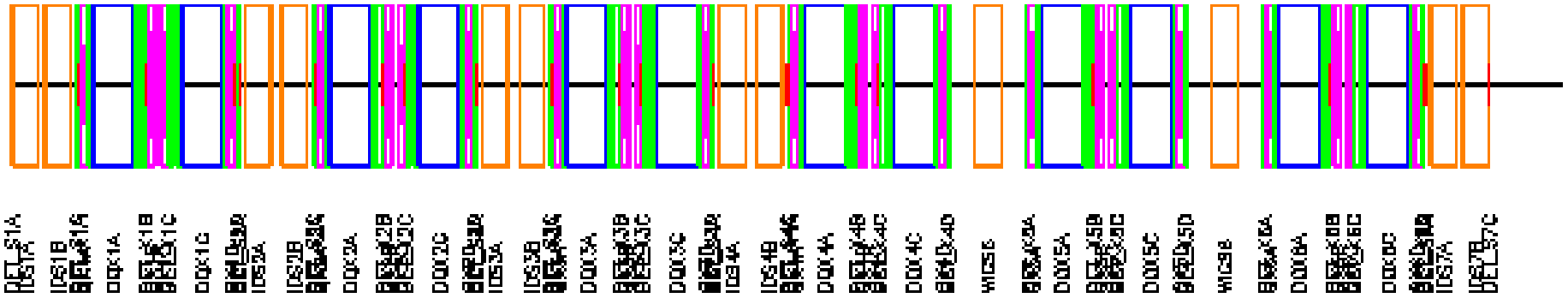
	Model	Design	
Z_tune:	0.0000	0.0000	! The design value is calculated with RF on
Sig_E/E:	1.919E-04	1.919E-04	
Sig_z:	1.000E+30	1.135E-03	! Only calculated when RF is on
Energy Loss:	5.592E+02	5.592E+02	! Energy_Loss (eV / Turn)
J_damp:	1.960E+00	1.960E+00	! Longitudinal Damping Partition #
Alpha_damp:	1.096E-06	1.096E-06	! Longitudinal Damping per turn
Alpha_p:	5.719E-03	5.719E-03	! Momentum Compaction
I0:	7.908E+03	7.908E+03	! Radiation Integral
I1:	4.395E+00	4.395E+00	! Radiation Integral
I2:	6.355E-01	6.355E-01	! Radiation Integral
I3:	1.250E-01	1.250E-01	! Radiation Integral
<pz>:	0.000E+00	0.000E+00	! Average closed orbit pz (momentum deviation)

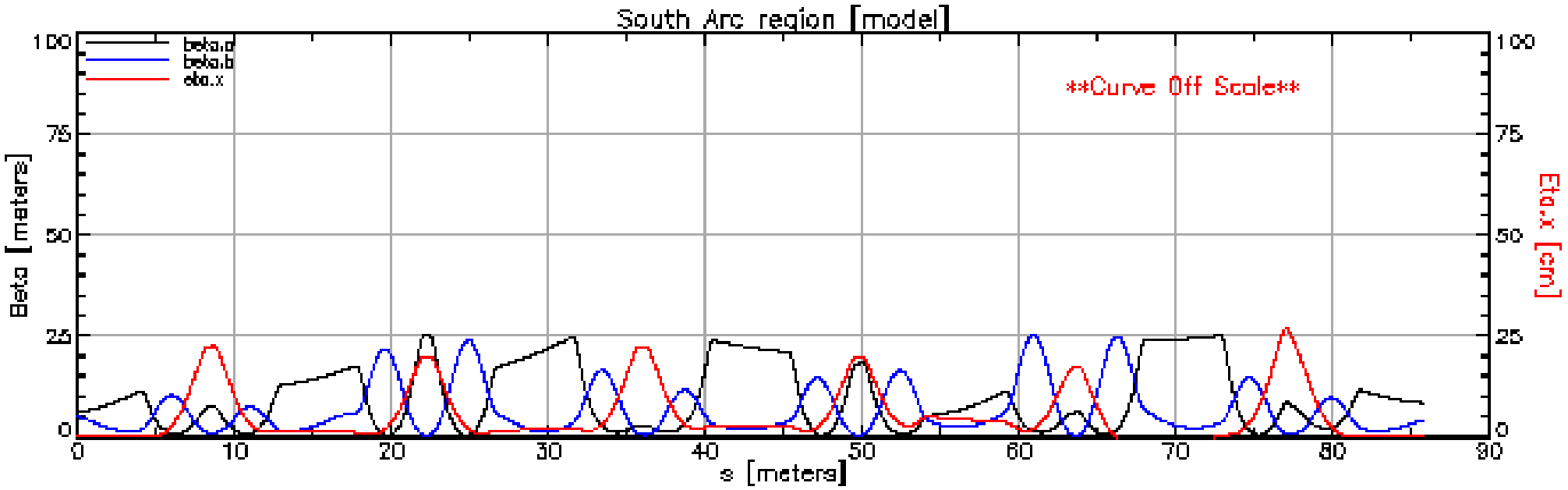
τ_{damp} = 4.4 sec

CHESS-U, 10 CCUs, B = 0.952T (full field)

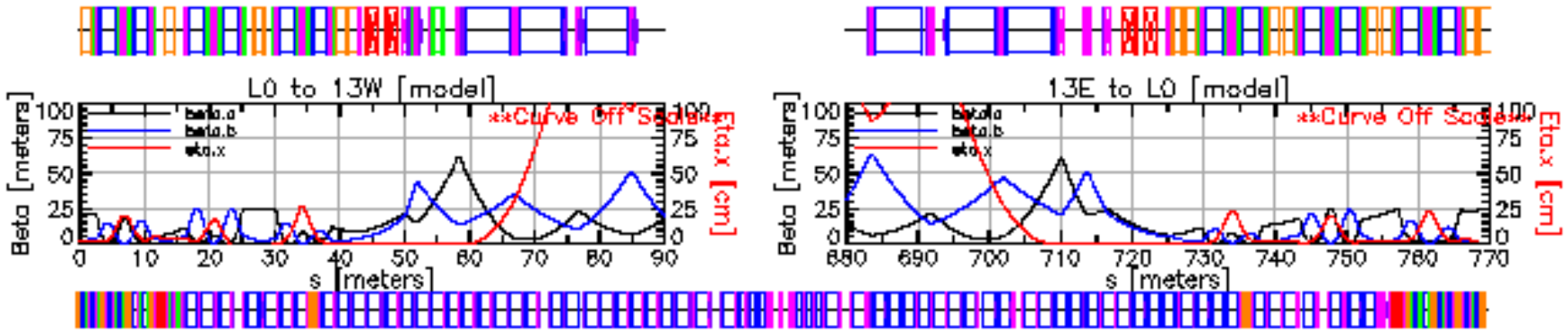
CHESS-U, 10CCUs, B=0.952T

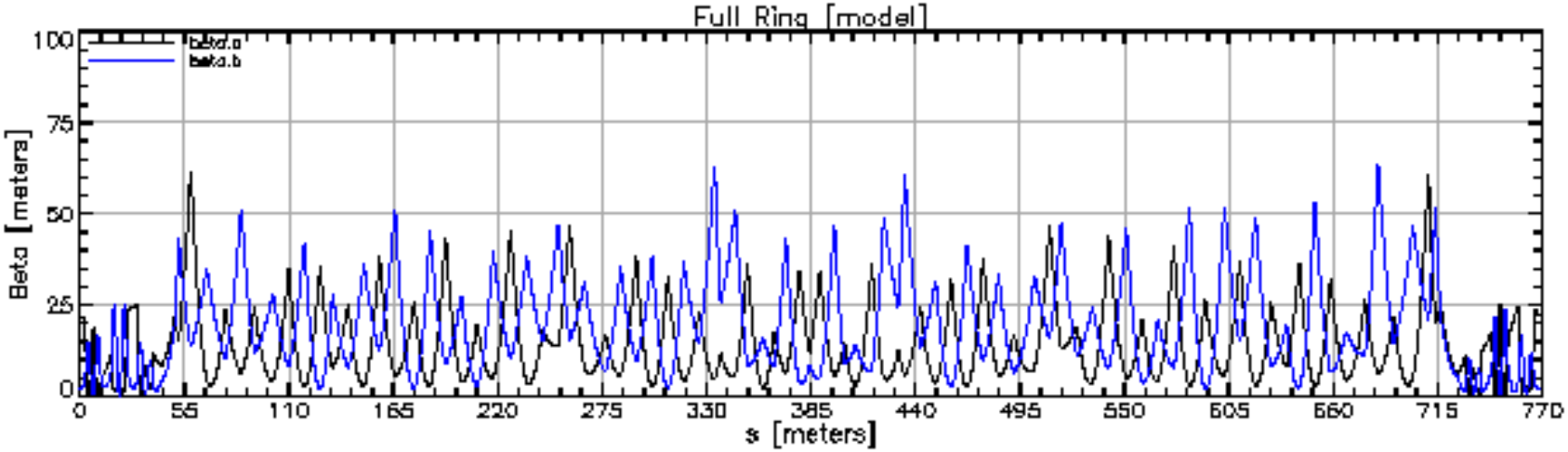
- SCWs off

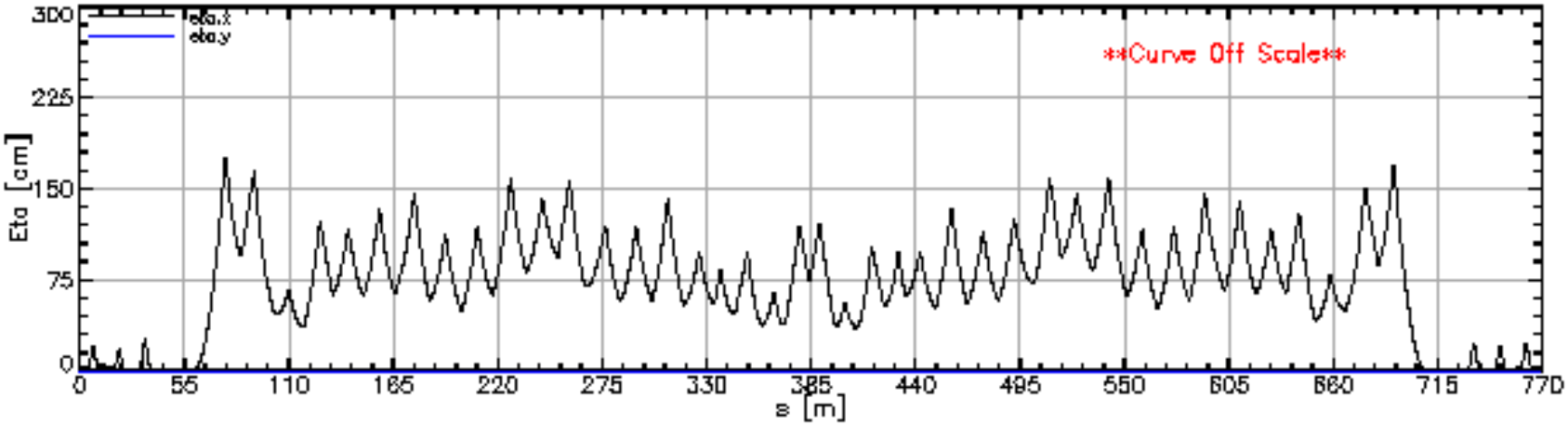




CHESS-U, 10CCUs, B=0.952T







CHESS-U, 10CCUs, B=0.952T

	X		Y		
	Model	Design	Model	Design	
Q	16.1623	16.1623	13.1751	13.1751	! Tune
Chrom	0.2863	0.2863	1.7121	1.7121	! dQ/(dE/E)
J_damp	1.0107	1.0107	1.0001	1.0001	! Damping Partition #
Emittance	2.029E-11	2.029E-11	1.124E-13	1.124E-13	! Meters
Alpha_damp	2.227E-06	2.227E-06	2.204E-06	2.204E-06	! Damping per turn
I4	-2.668E-02	-2.668E-02	-3.592E-04	-3.592E-04	! Radiation Integral
I5	1.399E-04	1.399E-04	3.637E-37	1.038E-36	! Radiation Integral
I6/gamma^2			3.245E-06	3.245E-06	! Radiation Integral

	Model	Design	
Z_tune:	0.0000	0.0000	! The design value is calculated with RF on
Sig_E/E:	2.933E-04	2.933E-04	
Sig_z:	1.000E+30	1.735E-03	! Only calculated when RF is on
Energy Loss:	2.203E+03	2.203E+03	! Energy_Loss (eV / Turn)
J_damp:	1.989E+00	1.989E+00	! Longitudinal Damping Partition #
Alpha_damp:	4.383E-06	4.383E-06	! Longitudinal Damping per turn
Alpha_p:	5.722E-03	5.722E-03	! Momentum Compaction
I0:	9.871E+03	9.871E+03	! Radiation Integral
I1:	4.397E+00	4.397E+00	! Radiation Integral
I2:	2.504E+00	2.504E+00	! Radiation Integral
I3:	1.168E+00	1.168E+00	! Radiation Integral
<pz>:	0.000E+00	0.000E+00	! Average closed orbit pz (momentum deviation)

τ_{damp} = 1.2 sec

Comments

- Specific requirements for lattice, aside from injection and stability?
- Asymmetry in south arc optics results from trying to preserve achromat condition
  - Achromat condition fully constrains strength of QXnB/C quads
  - Achromat condition broken for full-field lattice (slides 7-10); still have unevenness in betas
  - Could probably relieve some of the quirks by allowing quads to vary in matching regions
- Beginning to look at Arc Pretzel-based lattice
  - Starting from a 6-wiggler 2.085GeV lattice, updating with newest layout, and ramping down energy to 500MeV
  - Work-in-progress

To Do

- Arc Pretzel-based lattice
- Quad regulation limit
- Dipole regulation
- Pulsed injection element regulation