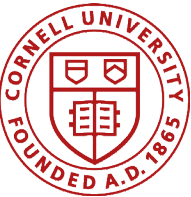


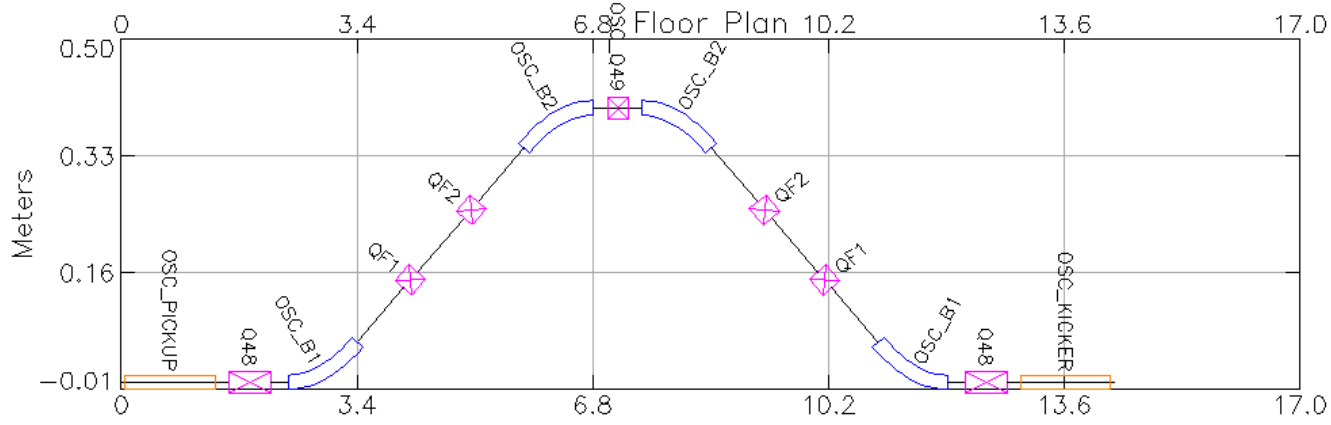
Cornell Laboratory for
Accelerator-Based Sciences
and Education (CLASSE)

E/TT OSC Design, 40 cm depth

Michael Ehrlichman, Jim Shanks, et. al.

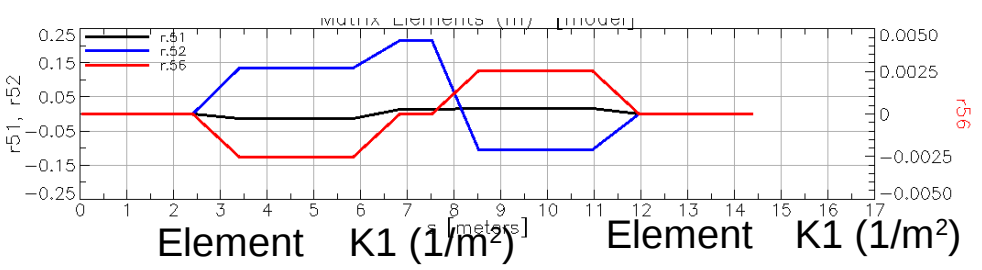
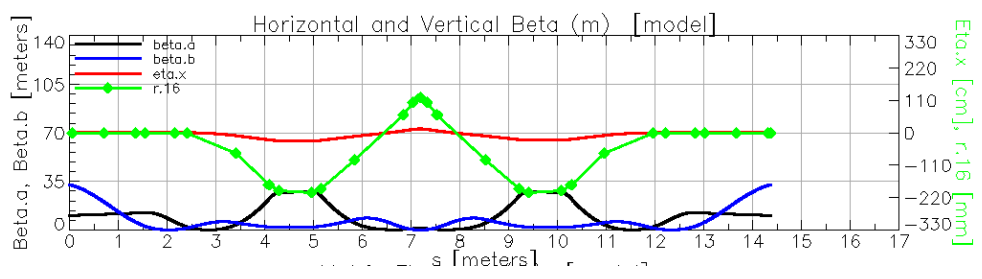


40 cm Bypass Layout & Optics



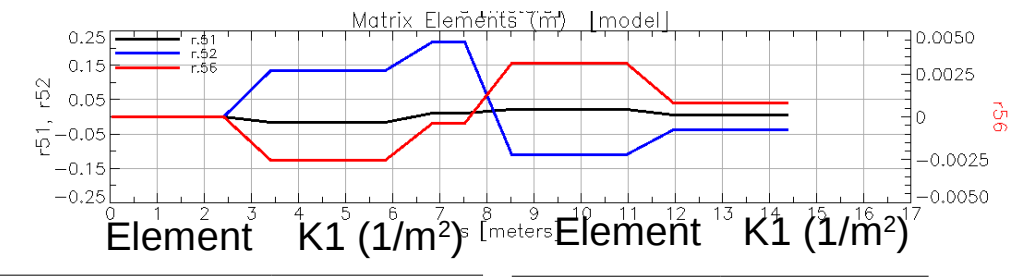
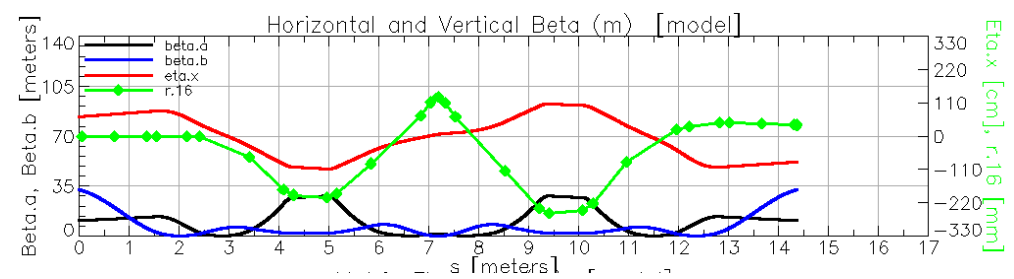
Depth 40 cm
 Δs 4.23 cm
 Bend Angle 6.7°
 $\Delta\phi_x$ 3.452π

Isochronous



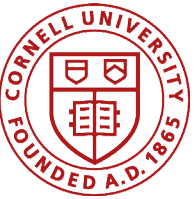
Element	K1 (1/m ²)
Q48	3.9
OSC_B1	-2.1
QF1, QF2	3.9

TTOSC



Element	K1 (1/m ²)
Q48	2.1
OSC_B1	-2.0
QF1, QF2	4.0

Element	K1 (1/m ²)
OSC_B2	-2.2
Q49	1.3



TTOSC Closer Look

Recall from Nov 28 2017 OSC Slides:



Sample Lengthening Parameters

- Recall sample lengthening metrics:

$$\text{action: } \sigma_{\Delta s \epsilon}^2 = J \underbrace{(\beta_p M_{51}^2 - 2\alpha_p M_{51} M_{52} + \gamma_p M_{52}^2)}_{\tilde{J}}$$

$$\text{energy: } \sigma_{\Delta s p}^2 = \left(\frac{\Delta p}{p}\right)^2 \underbrace{(M_{51} D_p + M_{52} D'_p + M_{56})^2}_{\tilde{M}_{56}}$$

Δs	\tilde{M}_{56}		\tilde{J}	
	sym	unsym	sym	unsym
2.7 mm	4.3×10^{-6}	1.0×10^{-6}	1.3×10^{-4}	4.9×10^{-5}
5.3 mm	5.5×10^{-6}	6.1×10^{-8}	2.1×10^{-4}	1.5×10^{-4}
10. mm	6.8×10^{-6}	2.2×10^{-8}	4.5×10^{-4}	2.0×10^{-4}

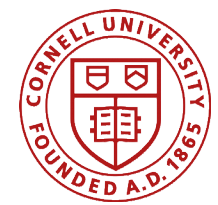
Note: There are higher orders of the energy and action dependence of the sample lengthening that are not described by these quantities.

Parameters of TTOSC Bypass on previous page:

$$\tilde{J} = 2.2 \times 10^{-4}$$

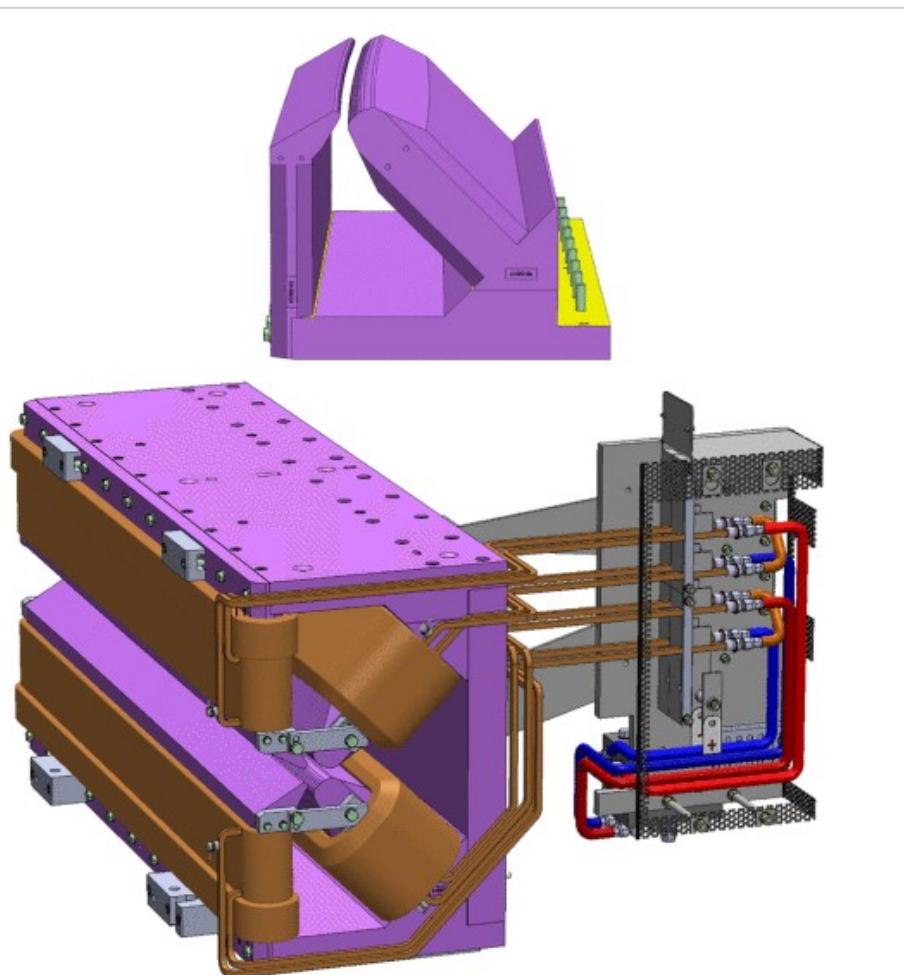
$$\tilde{M}_{56} = 5.8 \times 10^{-7}$$

$$M_{56} = 8.2 \times 10^{-4}$$

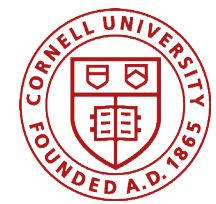


Gradient Dipole Options

Name	Field	Gradient	Length
	[T]	[T/m]	[mm]
DQ1	0.56	36.8	1028
DQ2	0.39	31.2	800



- “Magnets for the ESRF Diffraction-Limited Light Source Project,” Dec. 18, 2015.
- This OSC design requires bend $K_1 \sim 2$ or 3 m^{-2} .
 - $K_1(500 \text{ MeV}) = 3$ or 5 T/m .
- For Comparison CHESS-U
 $K_1 = 0.438$



Conclusion

- With strong quadrupole moments in the bends, the linear optics of a 40 cm depth bypass are compatible with both EOC & TTOSC.
 - Except that π phase advance is not met.
 - Seems reasonable to assume shallower bypasses also OK or better.
- Open issues:
 - Particle tracking & nonlinearities not checked.
 - Matching into CESR.