



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

20 cm OSC Bypass Development

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Nonlinearities w/o K2

- Optimizing \tilde{J} and \tilde{M}_{56} .

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

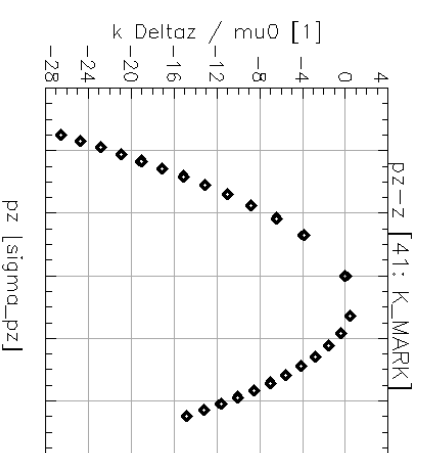
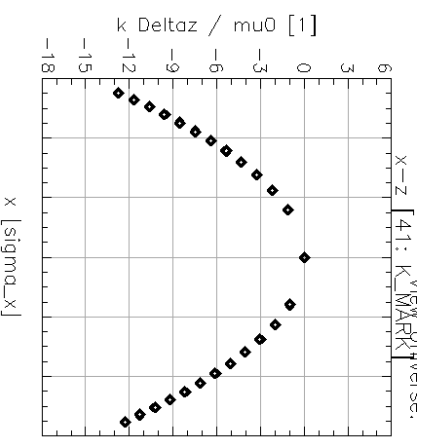
$$\sigma_{\Delta s p}^2 = \left(\frac{\Delta p}{p}\right)^2 \underbrace{(M_{51} D_p + M_{52} D'_p + M_{56})^2}_{\tilde{M}_{56}}$$

- New objective to minimize lengthening due to θ^2 .

$$\Delta s_2 = \frac{1}{2} \int_{-L_c/2}^{L_c/2} \left(\sqrt{\frac{\epsilon}{\beta(s)}} \left(\sin(\mu(s) - \mu_0) + \alpha(s) \cos(\mu(s) - \mu_0) \right) \right)^2 ds$$

- Parameters:

- $\tilde{J} = 3.1 \cdot 10^{-5}$
- $\tilde{M}_{56} = 3.6 \cdot 10^{-7}$
- $\Delta s_2 = 420.0 \text{ m}$
- $M_{56} = 5 \cdot 10^{-4}$

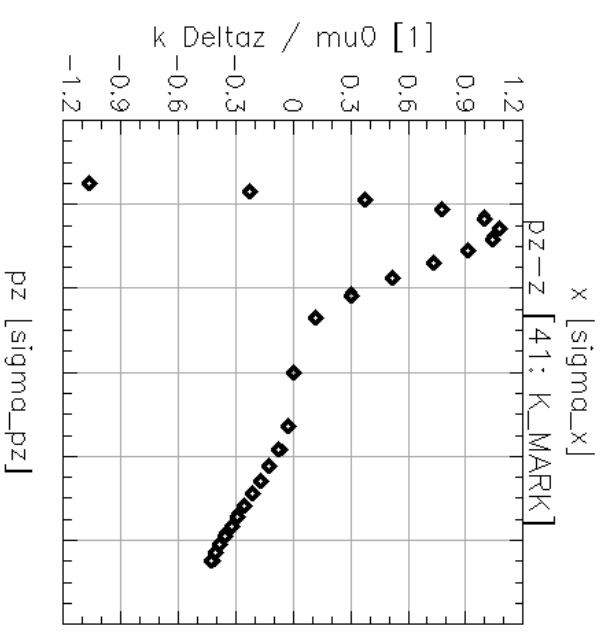
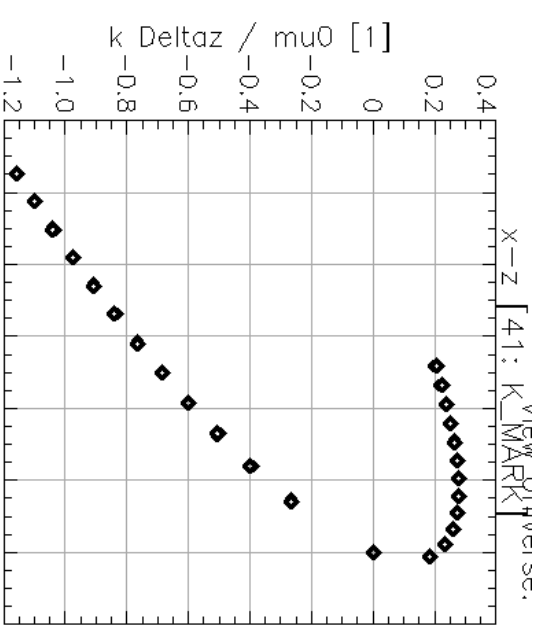




Nonlinearities w/ K2

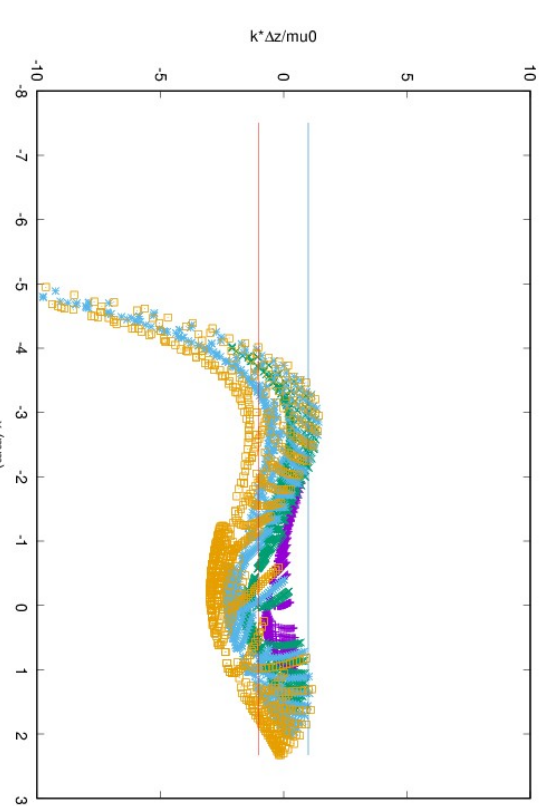
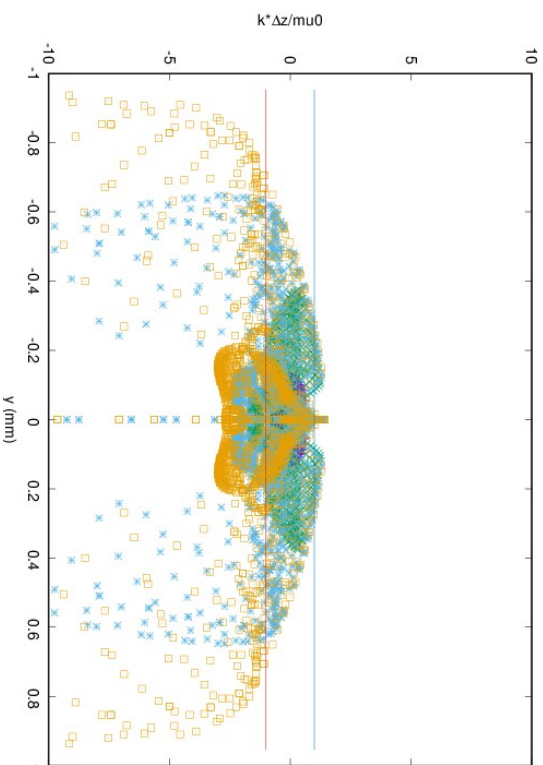
- Optimize directly on number of particles outside TTOSC damping envelope.
- Particles whose normalized z-coordinate is between -1 and +1 are damped by TTOSC process
- Variables are K2L
- Objectives are 2 weighted boundaries on normalized z.
- Test particles out to 3σ

Element	K2*L	Element	K2*L
S1W	4.9	S1W	-6.7
S2W	5.8	S2W	24.5
S3W	0.3	S3W	-0.6
S4W	-0.5	S4W	-6.6
S5W	4.0	S5W	12.2

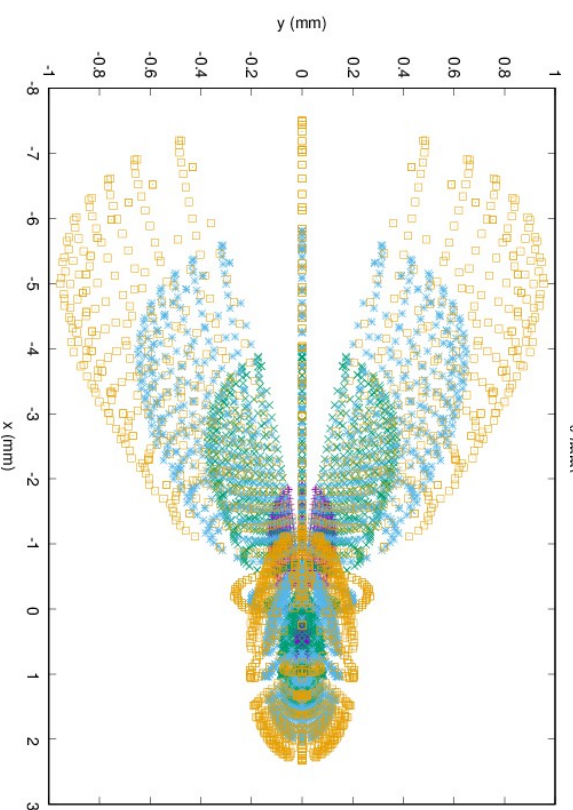


Particle Tracking

- Monte Carlo Result: 65% remain in envelope.



These are surfaces as defined in earlier presentation, after being tracked through bypass.





Next Steps

- Optimize K1, K2, Twiss with Monte Carlo % as objective
 - I.e leave out linear TTOSC params step
- Match into CESR
- IBS & Radiation
- Dynamic Aperture
- Adjust positions to accommodate existing CESR components