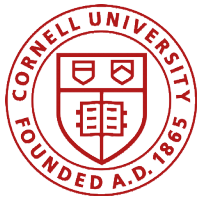


Cornell Laboratory for
Accelerator-Based Sciences
and Education (CLASSE)

Demonstration of DA Optimization via RDT Minimization in tao

Michael Ehrlichman

Introduction

- Recall: Summation and PTC methods of RDT calculation implemented and vetted in tao.
- Recall: This work driven by general tao development and need to optimize OSC lattice.

- These slides show RDT minimization works to optimize DA, then shows OSC results.

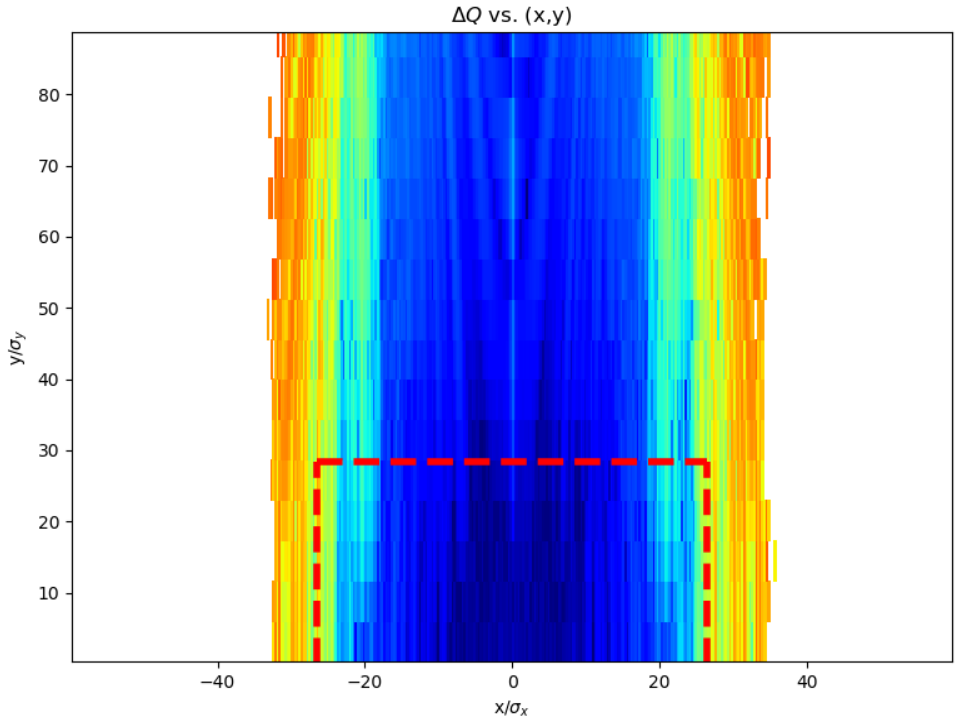
Optimization Steps

1) Use chromaticity response matrix (CRM) to find least squares solution to set chromaticity to +1, +1.

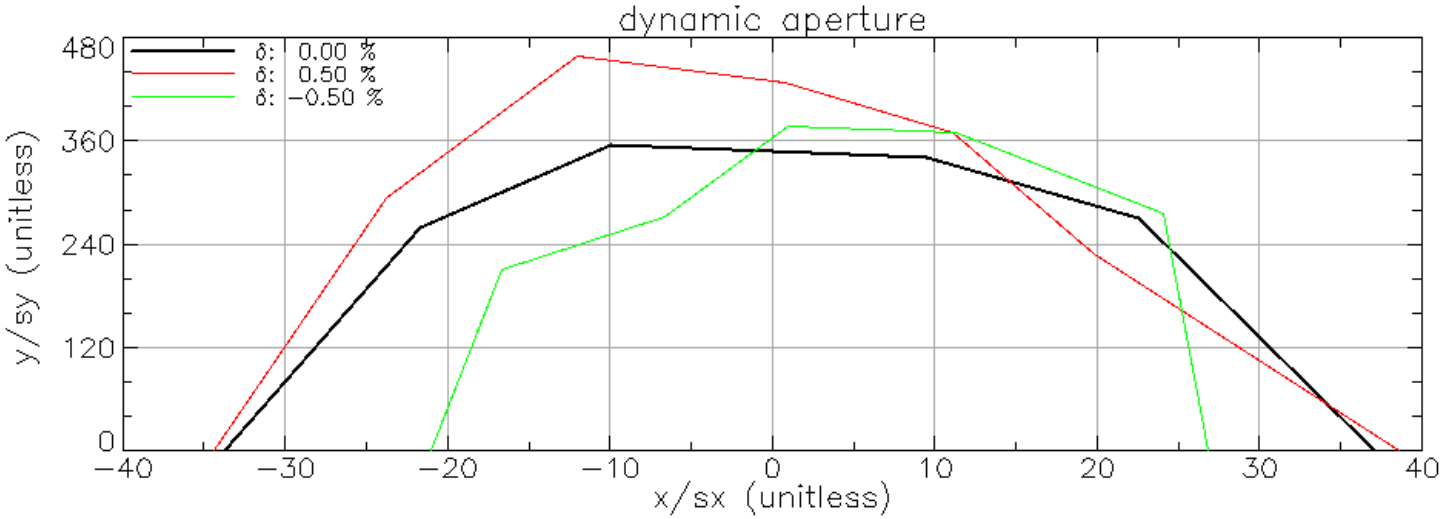
2) Use tao to minimize weighted sum of 7 geometric RDTs and 3 ADTS terms.
   - Weighted boundary for sextupoles.
   - A good solution requires about ~1 hour of CPU time.
     - Experience so far: “drilling away” with lots of CPU time has not yielded useful improvements.

CHESS-u 5.6.2

- Sext mirror symmetry
- Comparable to existing “2 stage method” results
  - Demonstrates this technique works.
- For scaling:
  - εx = 30.65 nm
  - εy = 30.65 pm

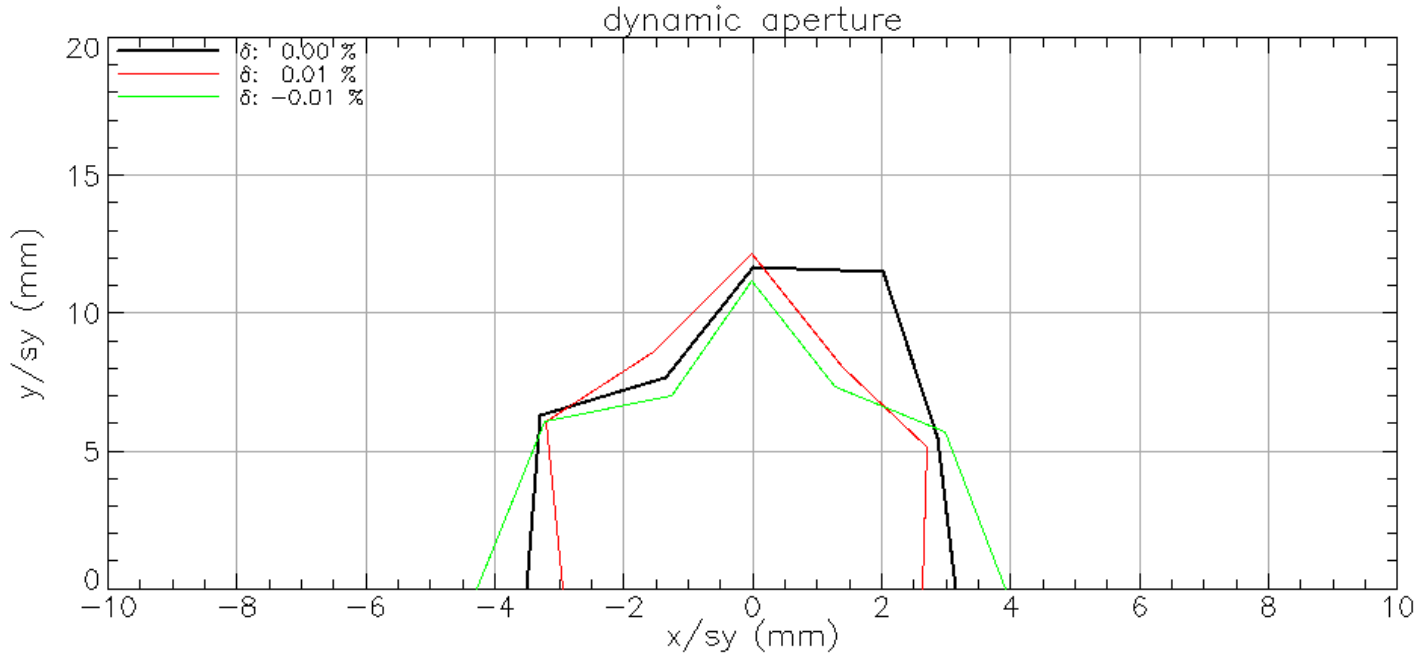


Largest Sext K2	
SEX_31W	3.975E+00
SEX_31E	3.975E+00
SEX_29W	3.975E+00
SEX_29E	3.975E+00
SEX_41W	3.975E+00
SEX_41E	3.975E+00
SEX_27W	3.926E+00
SEX_27E	3.926E+00
SEX_47E	3.799E+00
SEX_47W	3.799E+00



OSC ambi-40cm

- For scaling
- $\varepsilon_x = \varepsilon_y = 5.6\ \text{nm} / \text{sqrt}(2) = 4\ \text{nm}$



Largest Sext K2	
SEX_18E	5.889E+01
SEX_26W	5.338E+01
SEX_34W	3.223E+01
SEX_34E	3.077E+01
SEX_26E	3.057E+01
SEX_12W	2.895E+01
SEX_40E	2.614E+01
SEX_32E	2.290E+01
SEX_20W	2.273E+01
SEX_38E	1.582E+01

Going Forward

- Optimizing summation RDT terms in tao is one method for reliable, fast method for optimizating DA in CHESS-u lattices.
- tao/PTC w/ lattice hybridication in the works.
  - Higher orders.
  - Optimization w/ Fringes, Undulator Fields
  - Potentially Faster (for higher orders)
- ambi-20cm OSC bypass is in the works.
  - Many strikes against ambi-40cm: marginal TTOSC acceptance, eye-brow raising bend radiation, daunting sextupole strengths, doubtful DA.
  - Techniques have been implemented and ready to apply:
    - Bypass depth setting w/ correct lattice floor locations for closure.
    - OSC K1 strengths for EOC & TTOSC operation.
    - OSC K2 strengths for optimizing nonlinear TOF.
    - CESR Matching.
    - CESR K2 strength optimization to compensate OSC nonlinearities & optimize DA.