Sextupole reduction via chaos suppression at NSLS-II

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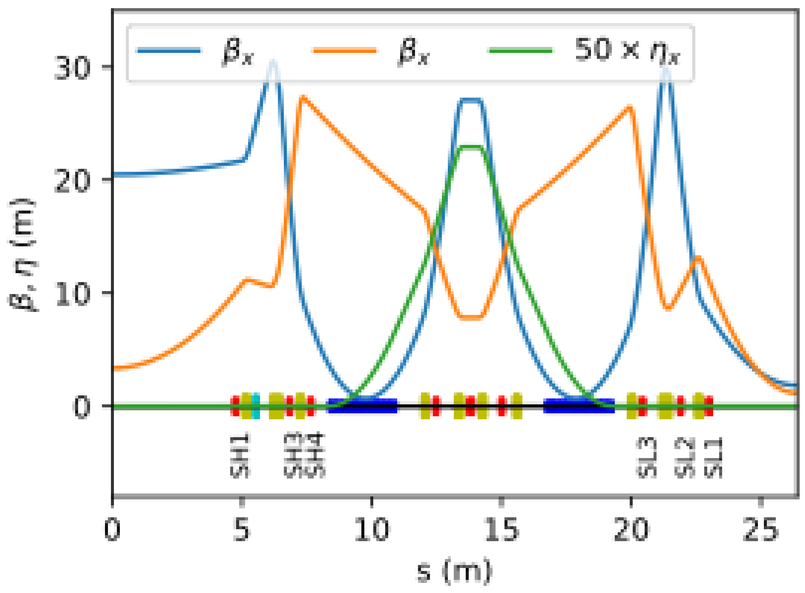
References:
Y. Li et al., Phys. Rev. Accel. Beams **28**, 074001
Y. Li et al., Phys. Rev. Accel. Beams **29**, 034001

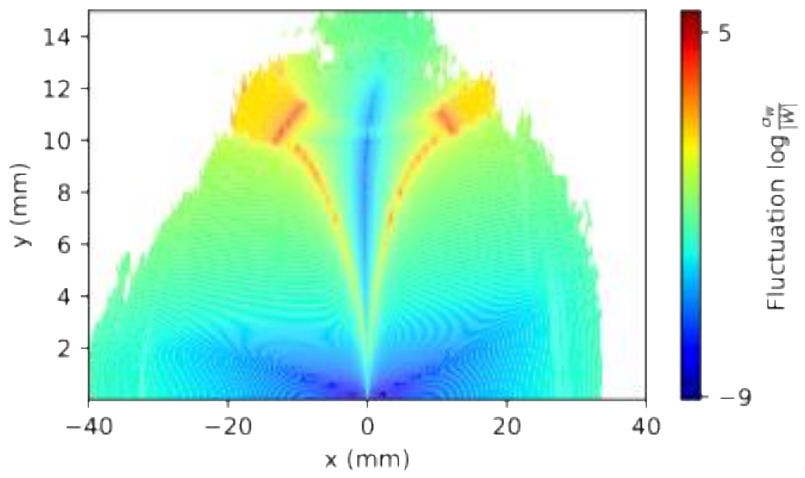


Question to ourselves:
Do we really need so many sextupoles?

Revisit of NSLS-II lattice design
Q: How did we optimize our lattice?
A: Minimizing resonance driving terms (RDT)

Q: How many RDTs were minimized?
A: About 20-30 objectives

Q: How many objectives are needed while suppressing chaos?
A: 1-2 objectives

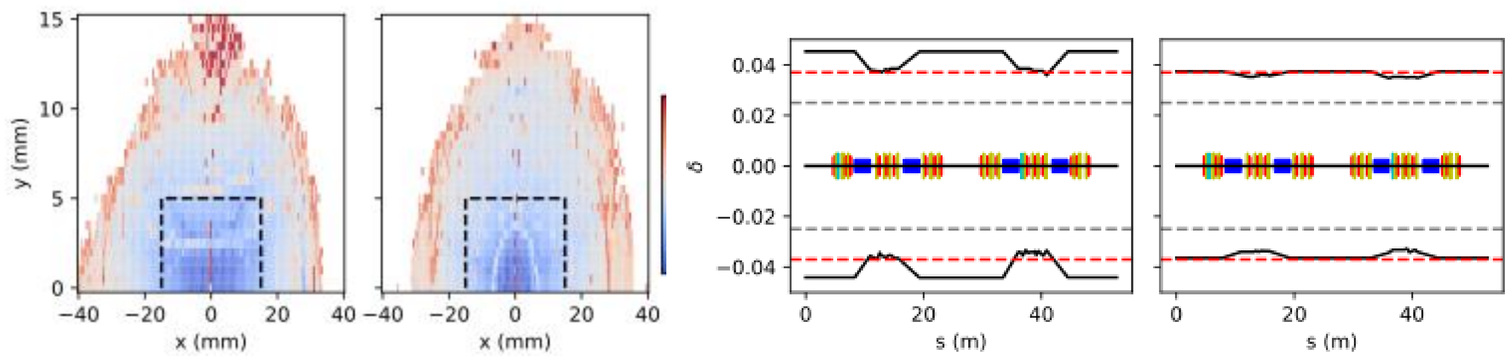


Chaos indicator represented by fluctuation of **approximate invariants**

New optimization method:
Suppress chaos

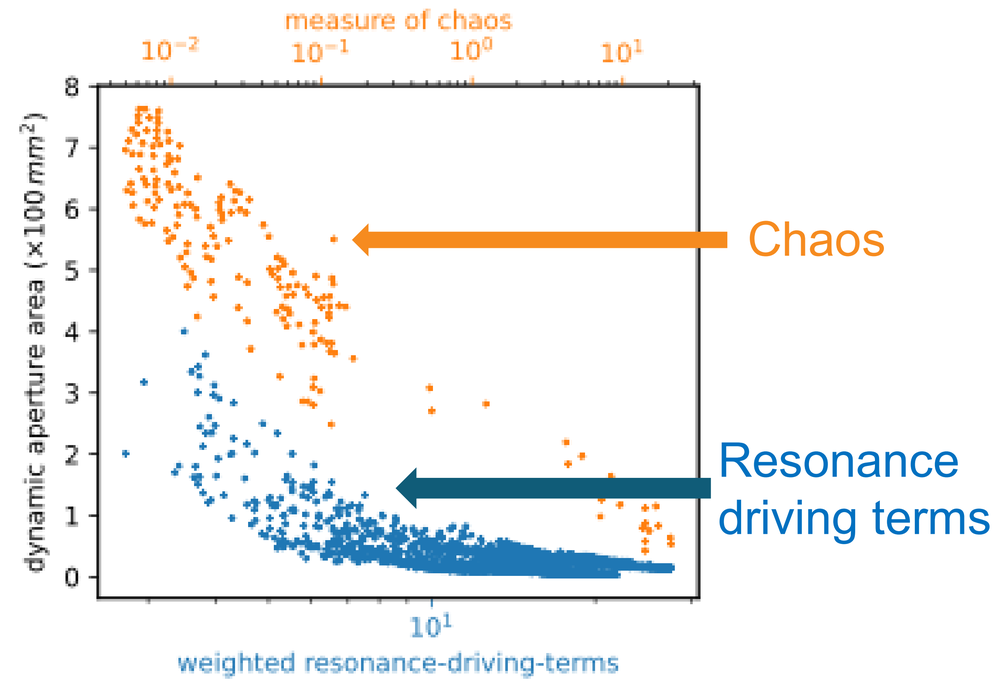
Goal:
Less objectives, less knobs (less sextupoles), however, similar performance

An example: switching off one family sextupoles

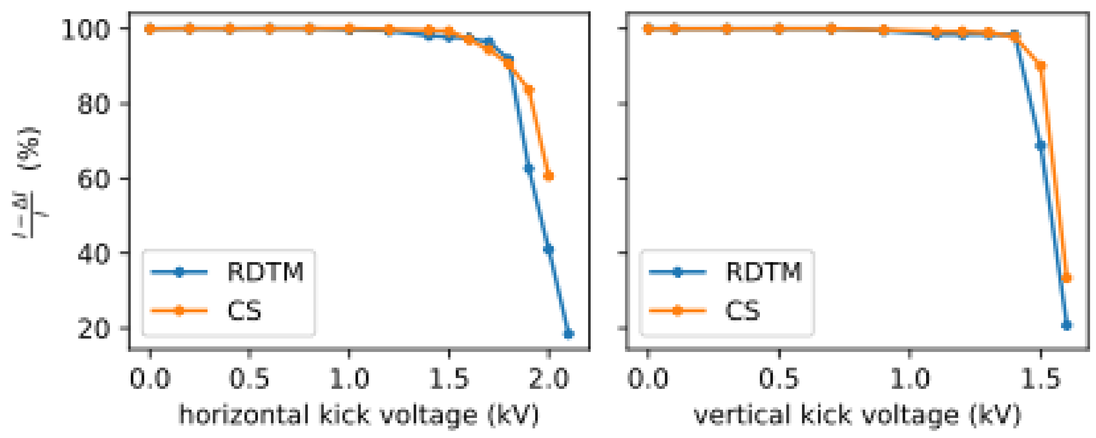


Similar dynamic apertures
6 families vs 5 families

Similar local momentum aperture
6 families vs 5 families

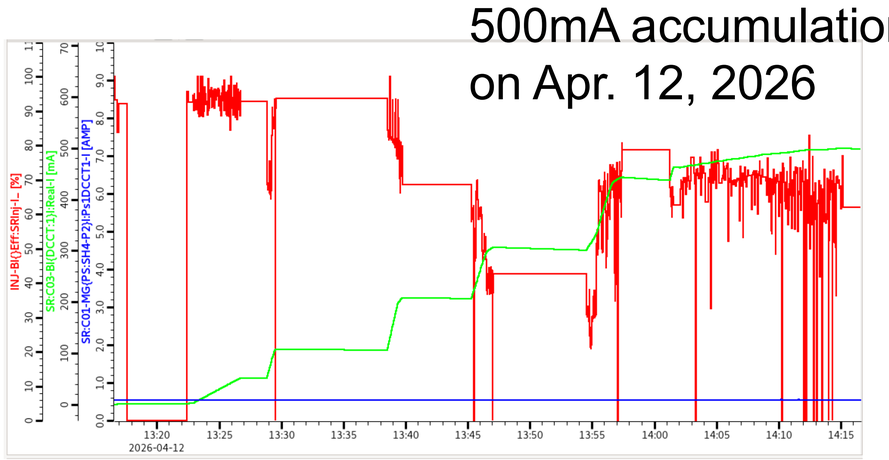


Strong correlation between chaos and DA



Measured DA with beam

500mA accumulation demonstrated on Apr. 12, 2026



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