

Beam-beam involved effects at SuperKEKB

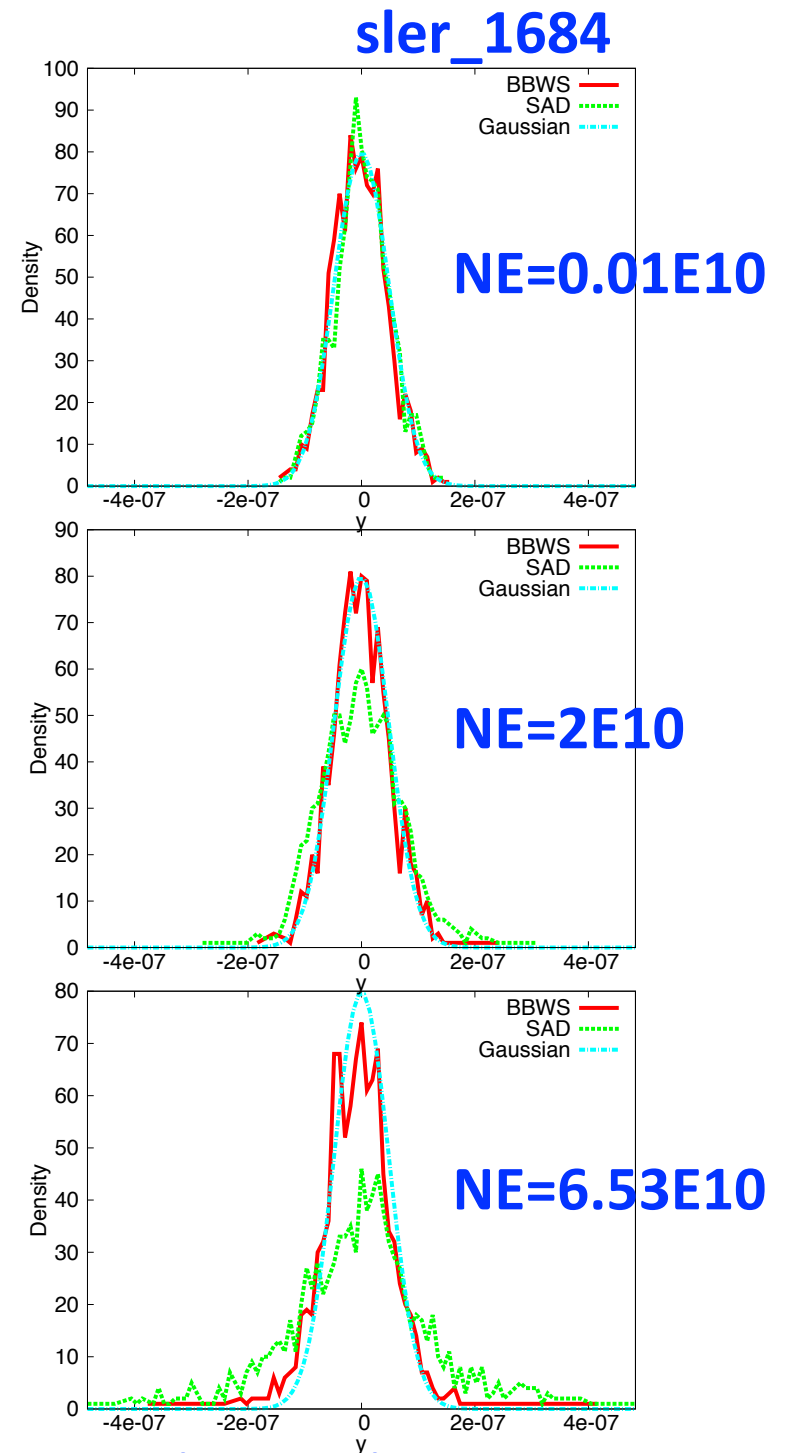
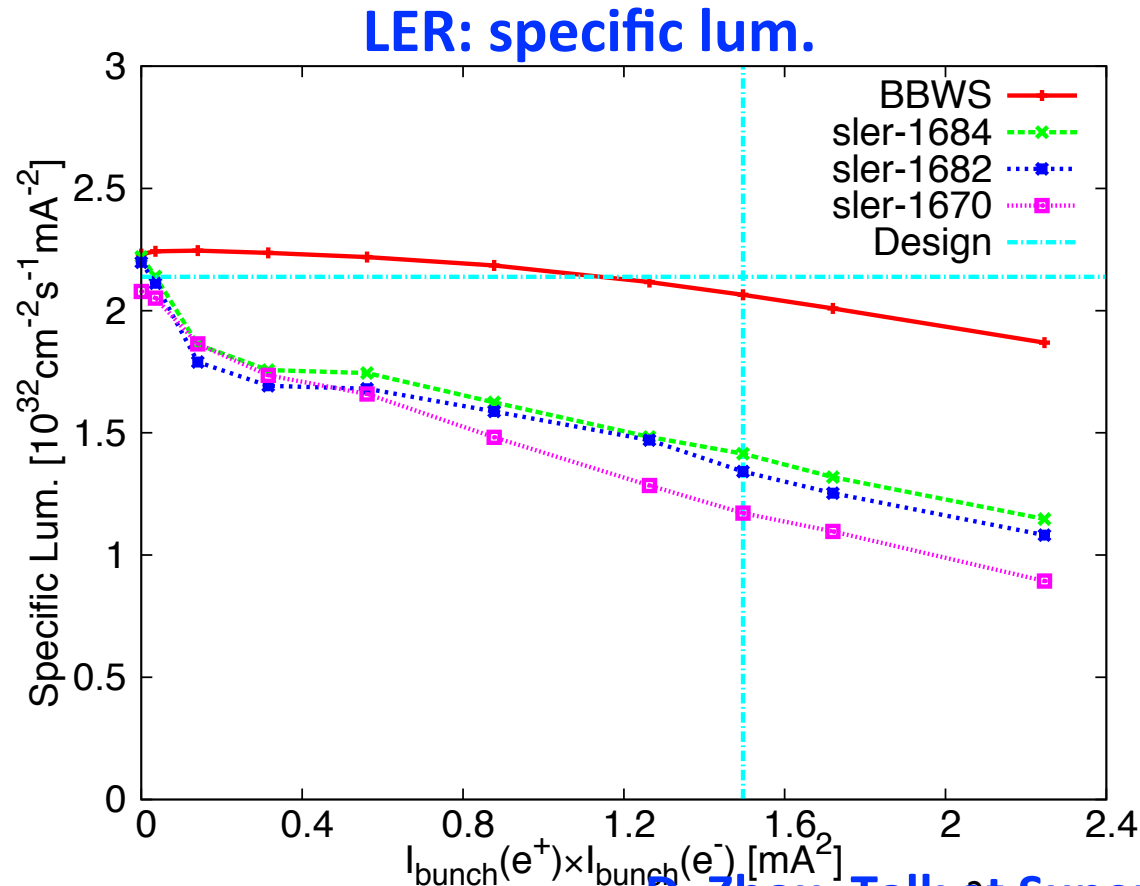
D. Zhou

SuperKEKB optics meeting

Sep. 05, 2013

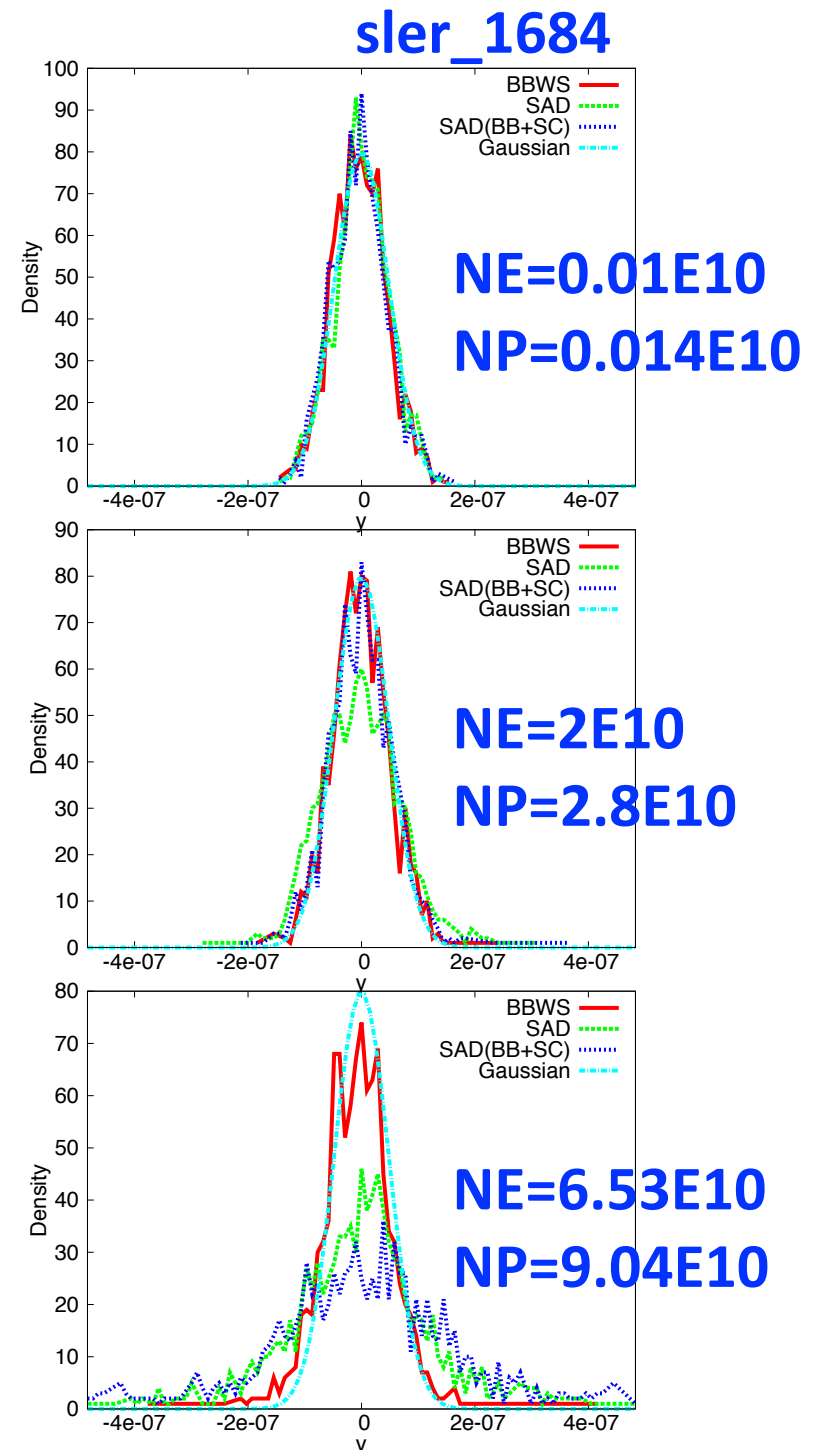
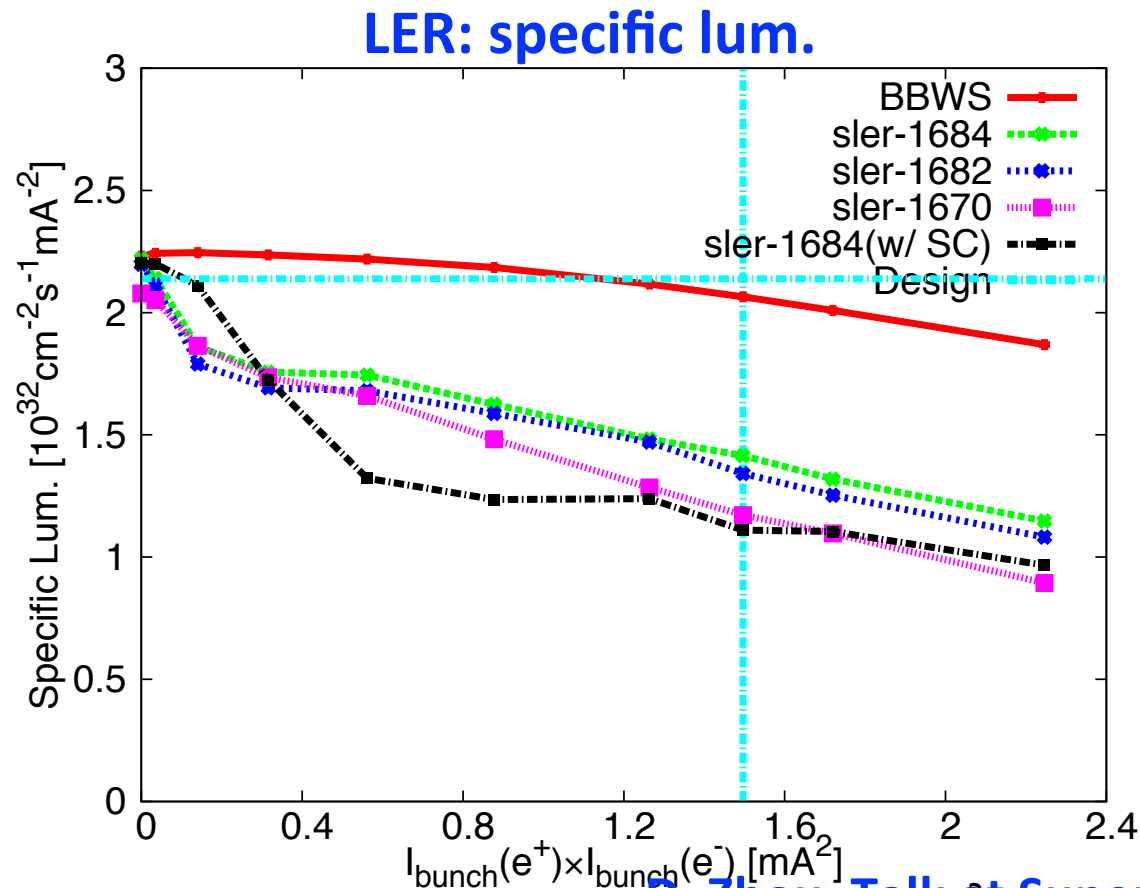
1. LER: BB + LN

- BB: weak-strong
- Direct vert. emit. growth
- Current dependent
- Lattice dependent



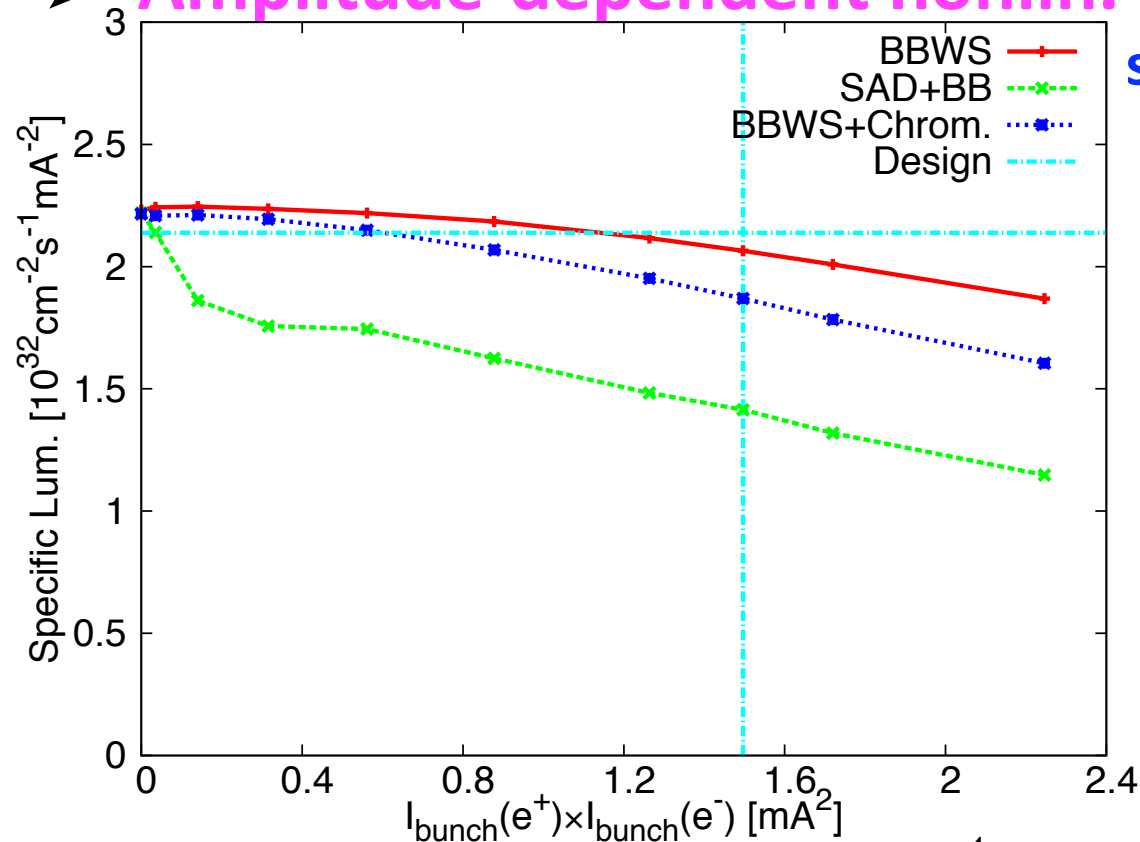
1. LER: BB + LN + SC

- SC causes lum. degradation
- BB + SC: compensate at low current?



1. LER: BB + Chromatic effect

- Chromatic effect: KEKB experiences
- Momentum nonlinearities controlled in lattice design of LER [H. Sugimoto]
- Chromatic effect can not explain the lum. loss
- Amplitude-dependent nonlin. more important?

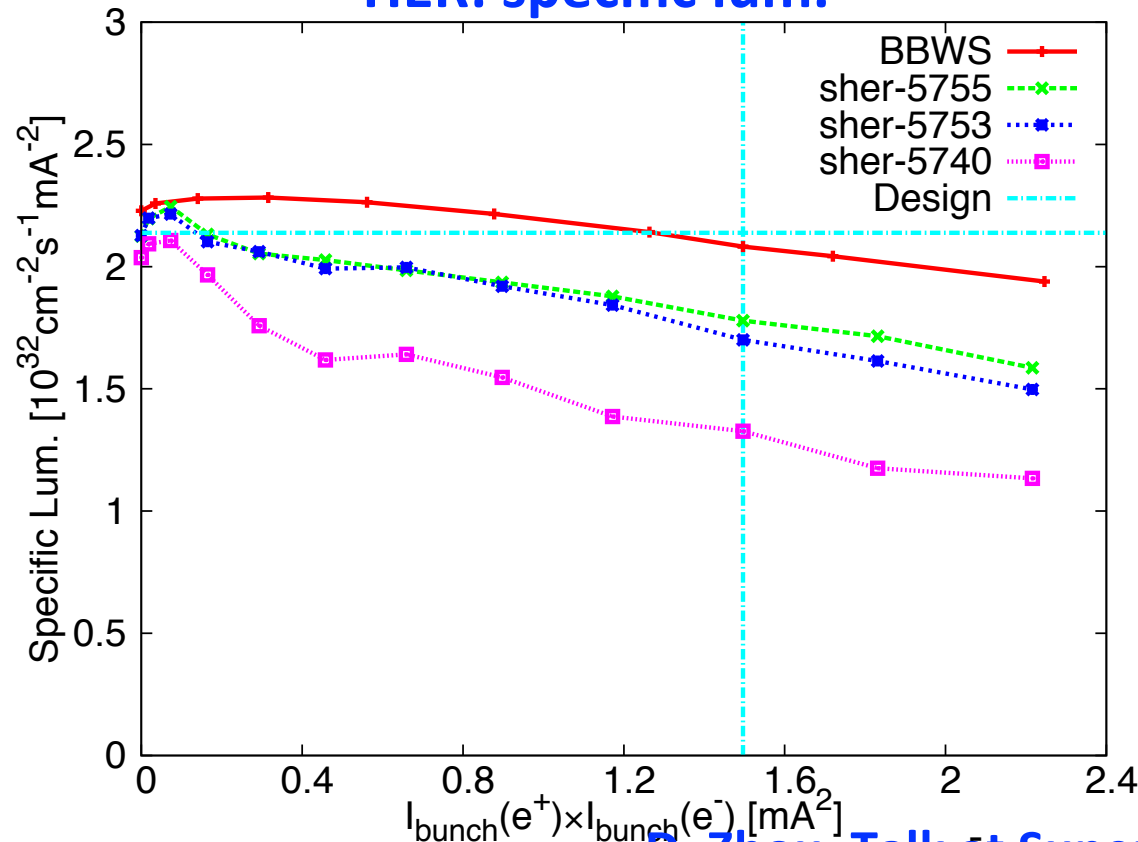


sler_1684

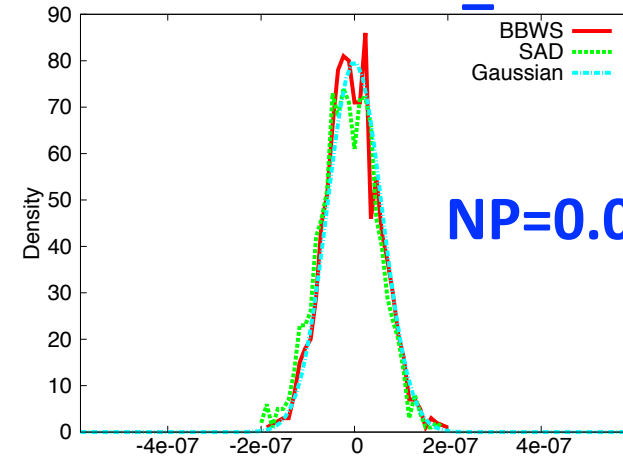
1. HER: BB + LN

- BB: weak-strong
- Direct vert. emit. growth
- Current dependent
- Lattice dependent

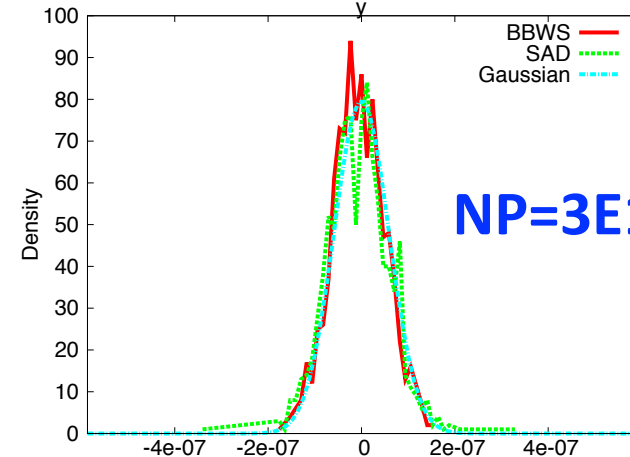
HER: specific lum.



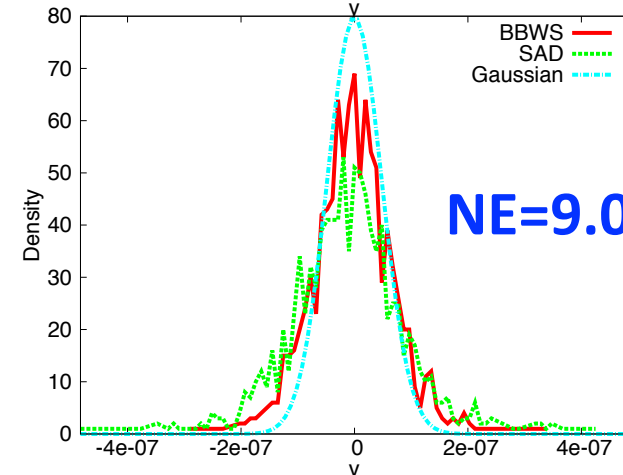
sher_5755



$\text{NP}=0.01\text{E}10$



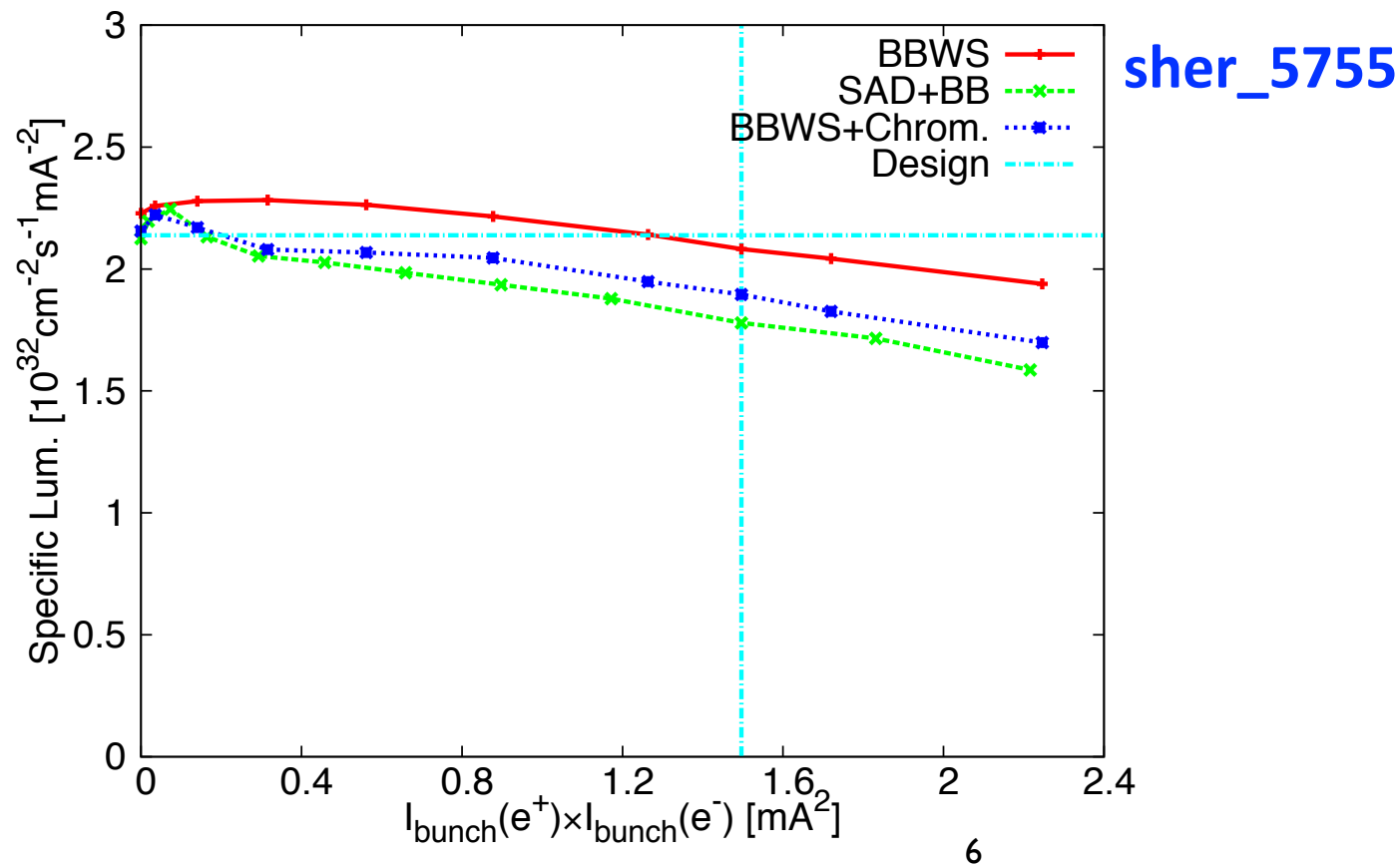
$\text{NP}=3\text{E}10$



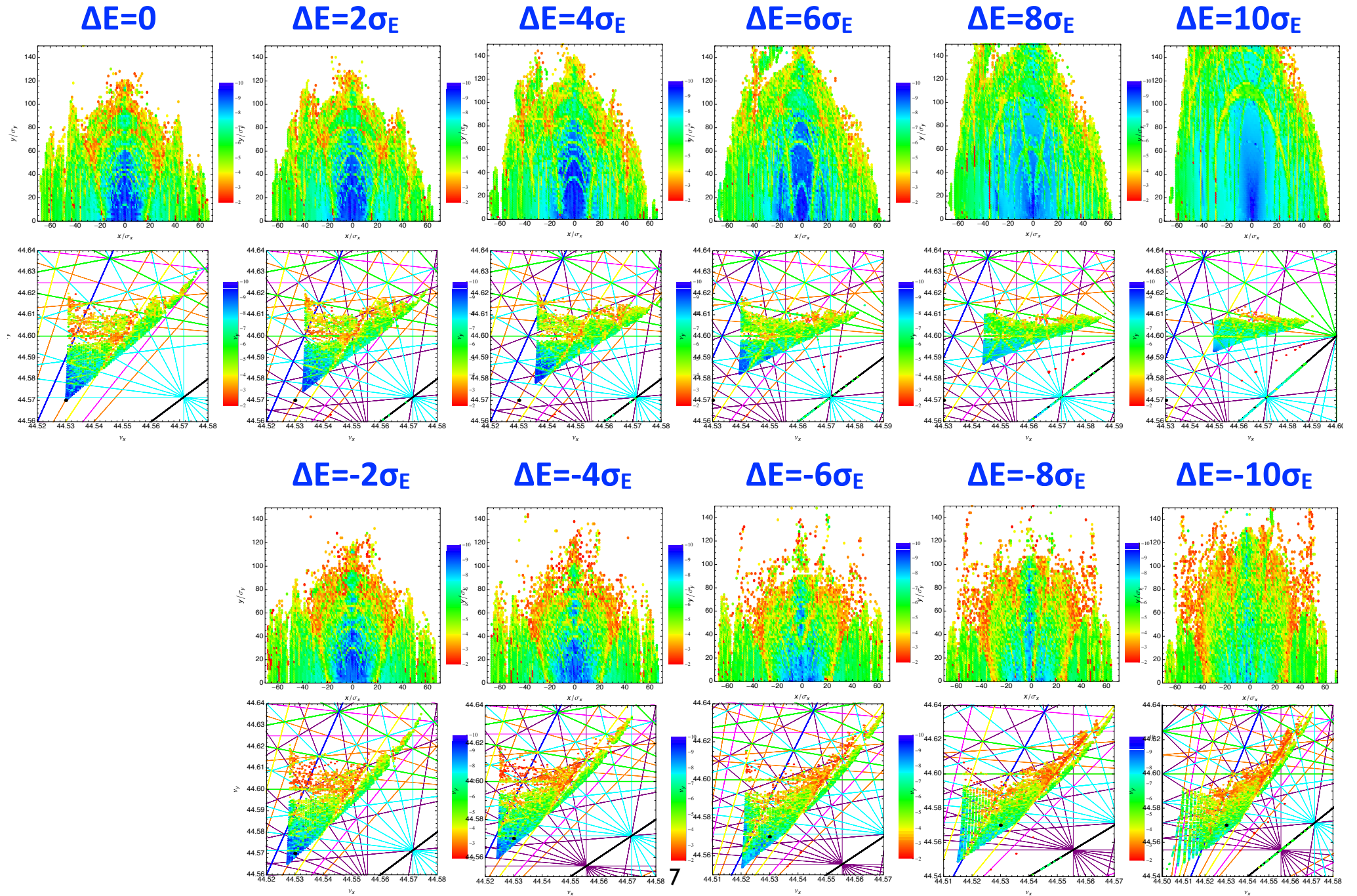
$\text{NE}=9.04\text{E}10$

1. HER: BB + Chromatic effect

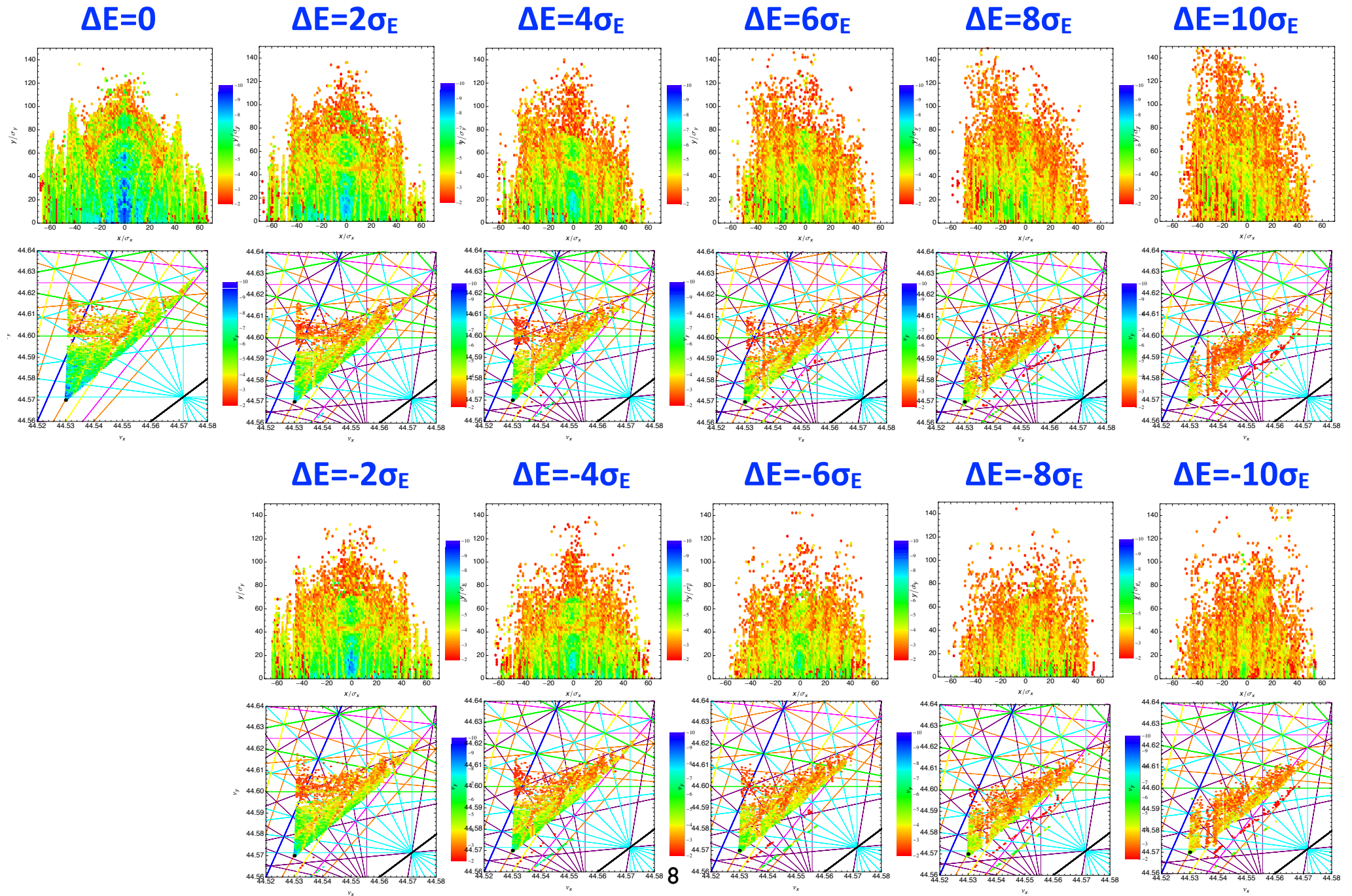
- Chromatic effect: KEKB experiences
- Momentum nonlinearities not controlled in lattice design of HER [H. Sugimoto]
- The lum. loss is mainly due to chromatic effect!



2. LER: FMA and DA: RF off



2. LER: FMA and DA: RF on



2. LER: FMA and DA

➤ DA w/o beam-beam

Resonance lines:

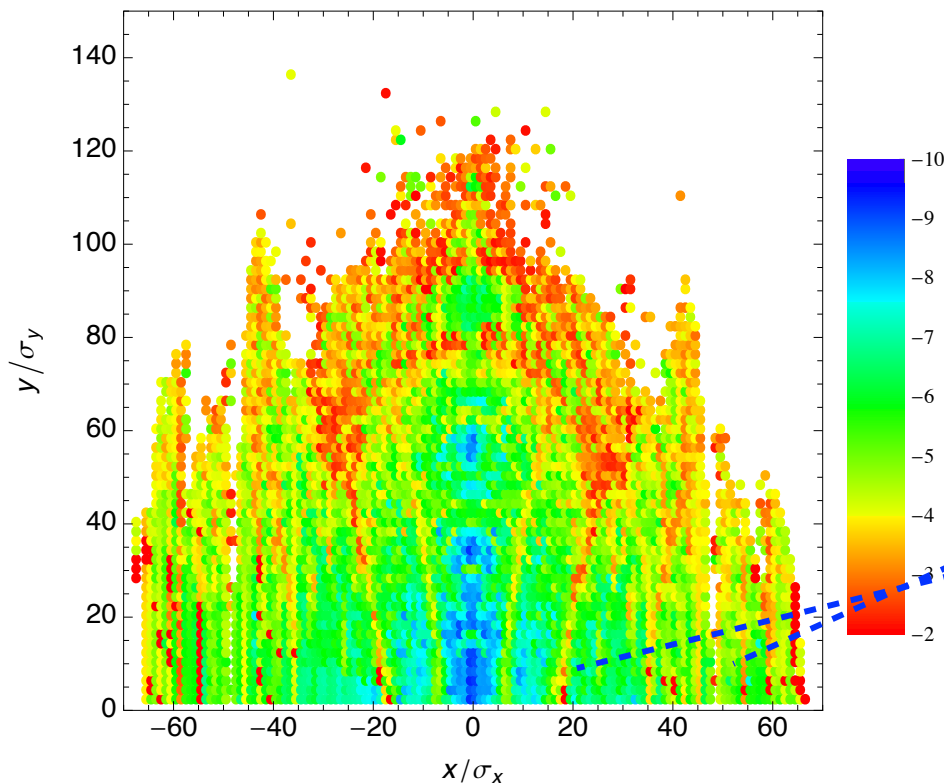
Blue: 4th order

Green: 5th order

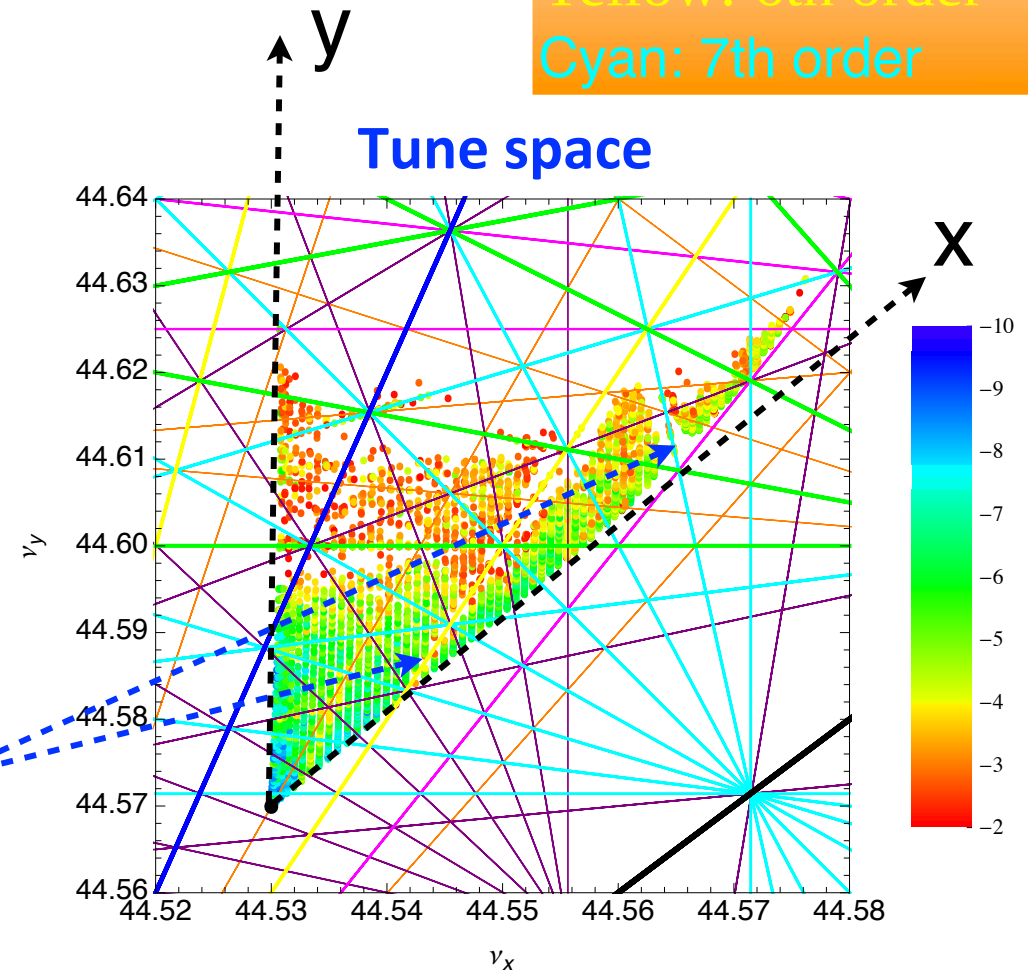
Yellow: 6th order

Cyan: 7th order

Real space



Tune space



2. LER: FMA and DA

➤ DA w/ beam-beam

sler_1670

Resonance lines:

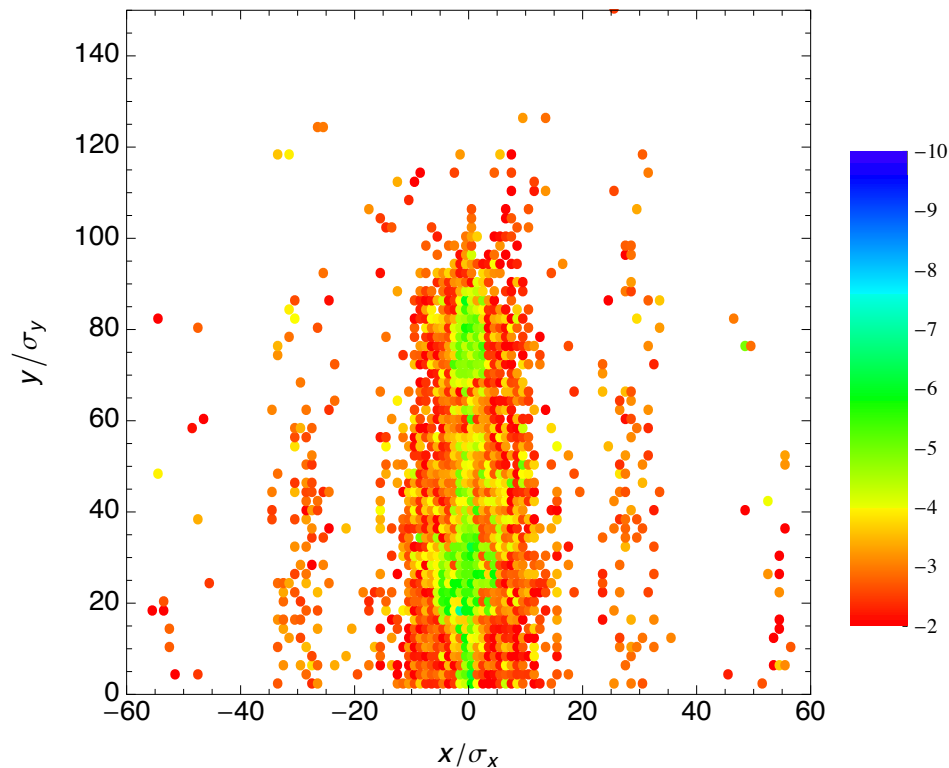
Blue: 4th order

Green: 5th order

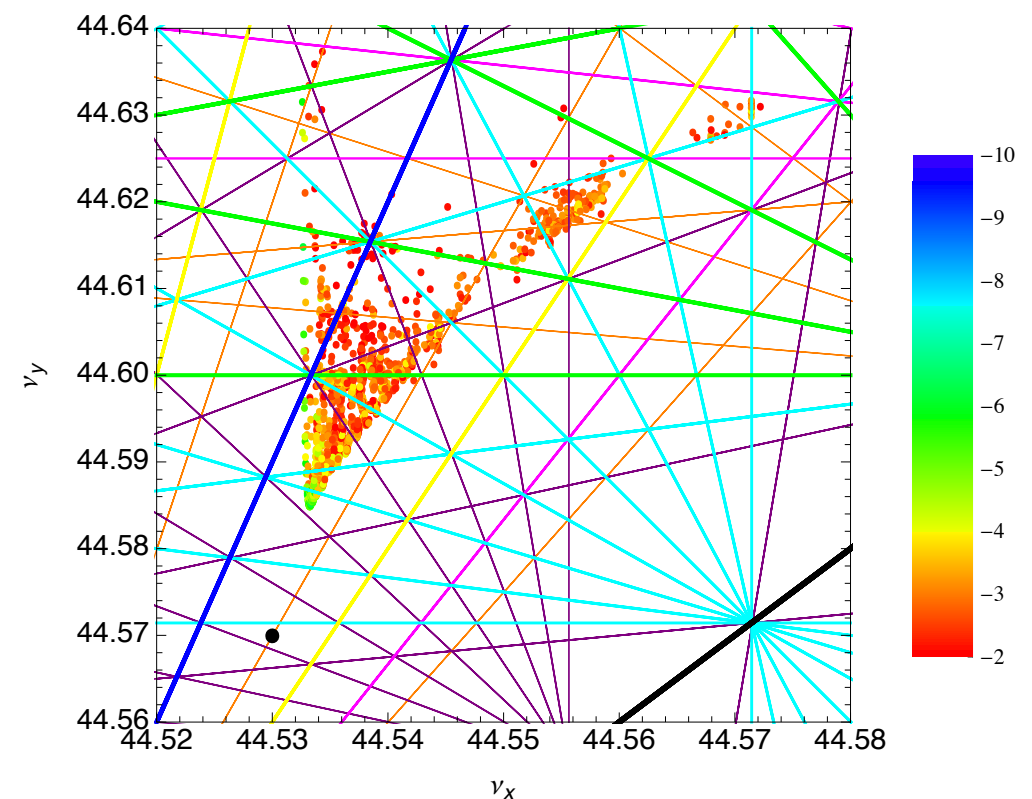
Yellow: 6th order

Cyan: 7th order

Real space



Tune space



2. LER: FMA and DA

➤ DA w/o beam-beam

sler_1670

Resonance lines:

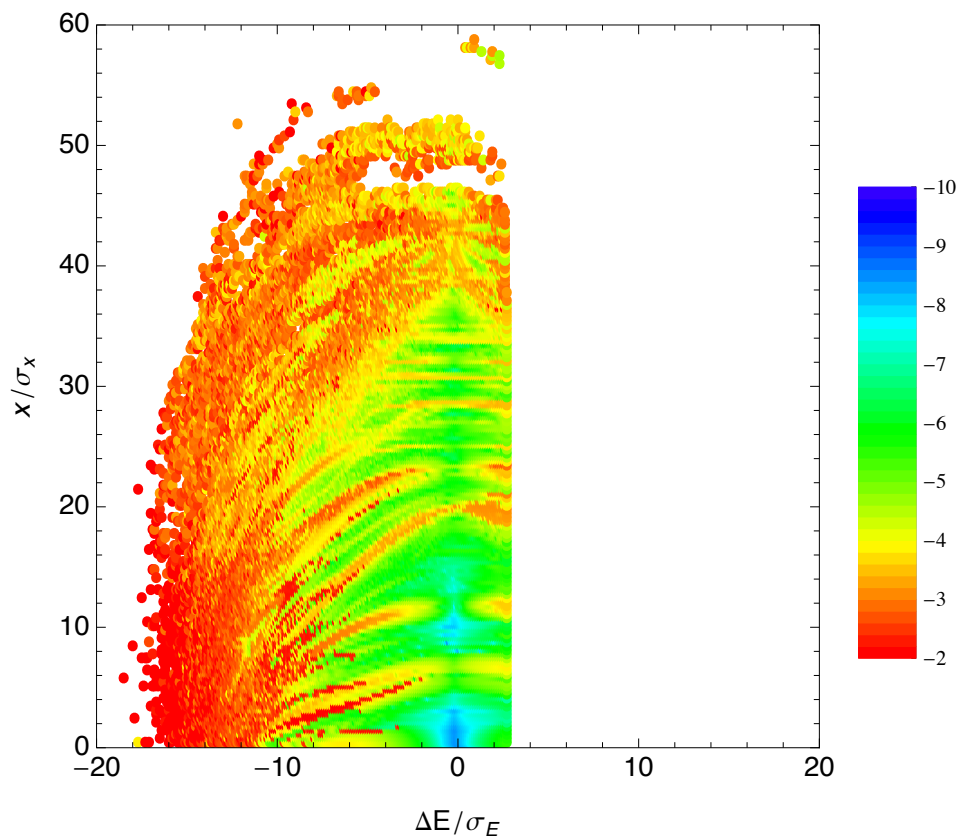
Blue: 4th order

Green: 5th order

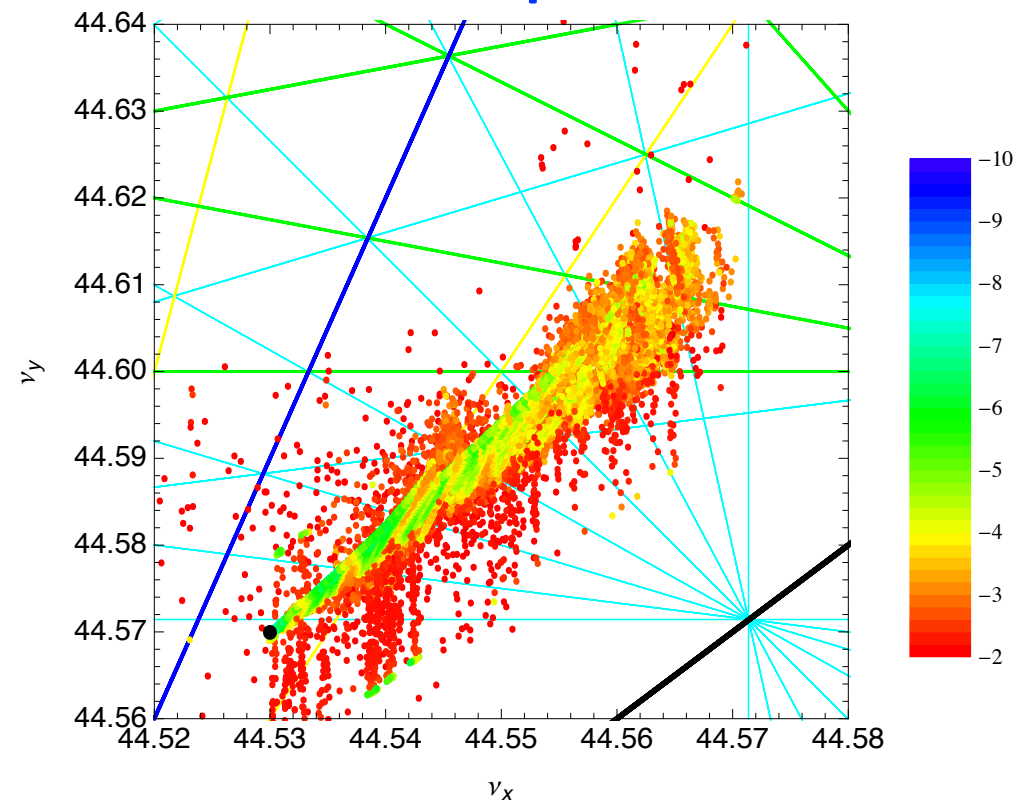
Yellow: 6th order

Cyan: 7th order

δ -x space



Tune space



2. LER: FMA and DA

➤ DA w/ beam-beam

sler_1670

Resonance lines:

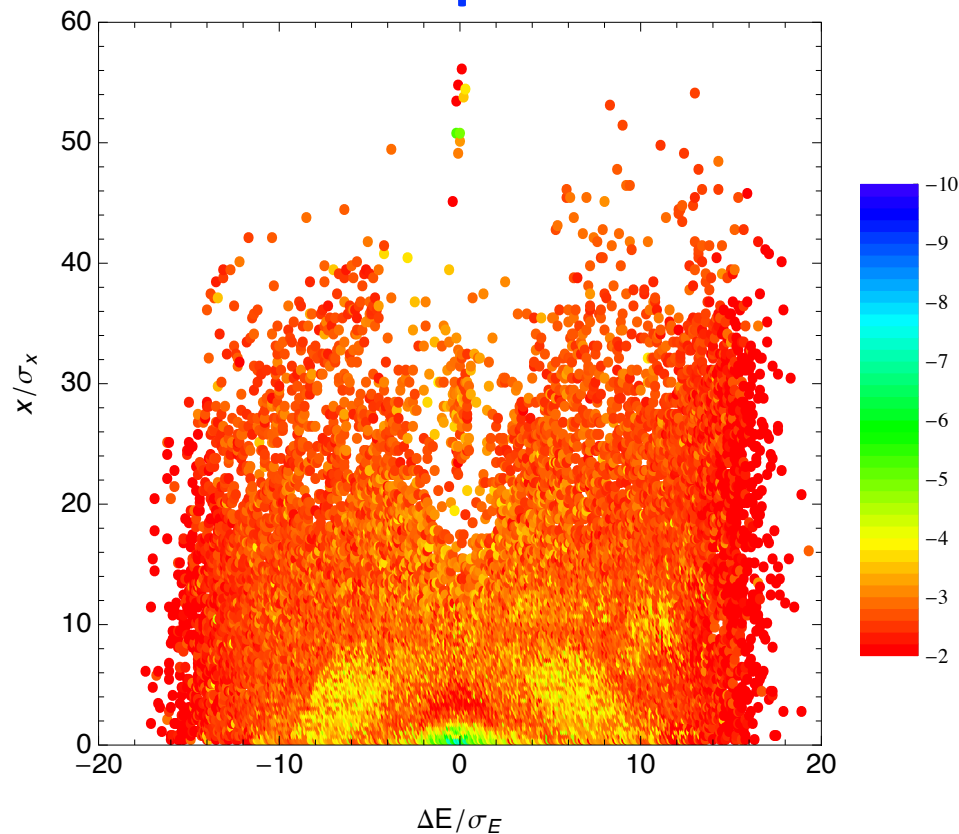
Blue: 4th order

Green: 5th order

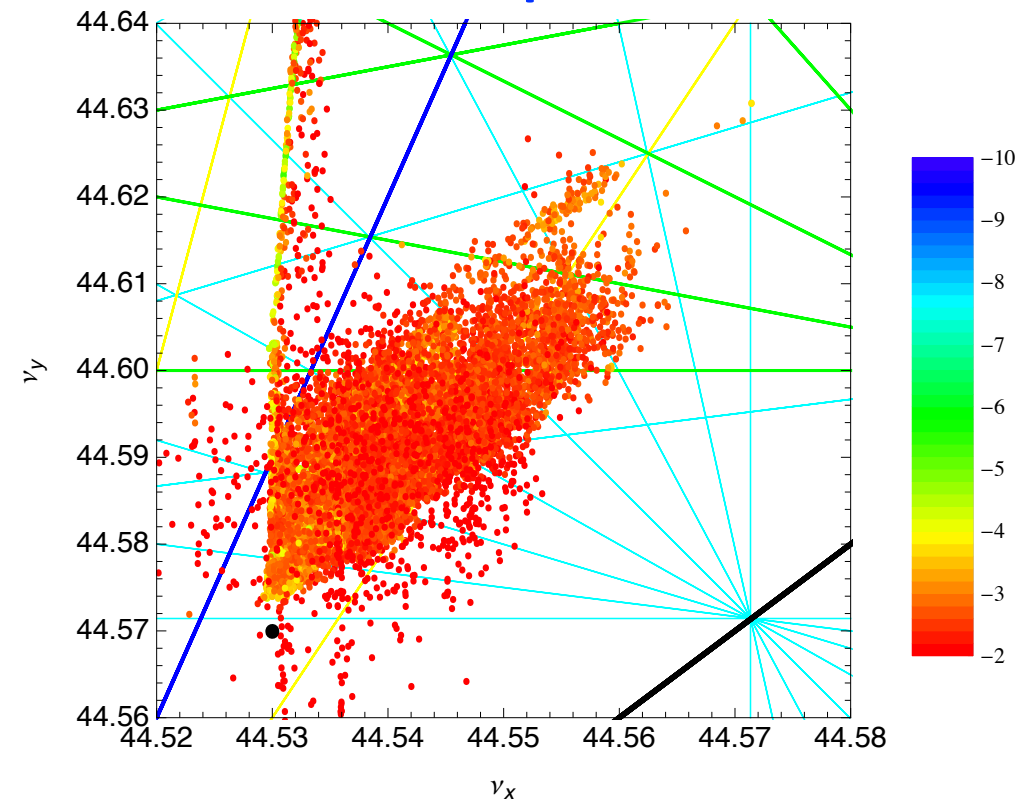
Yellow: 6th order

Cyan: 7th order

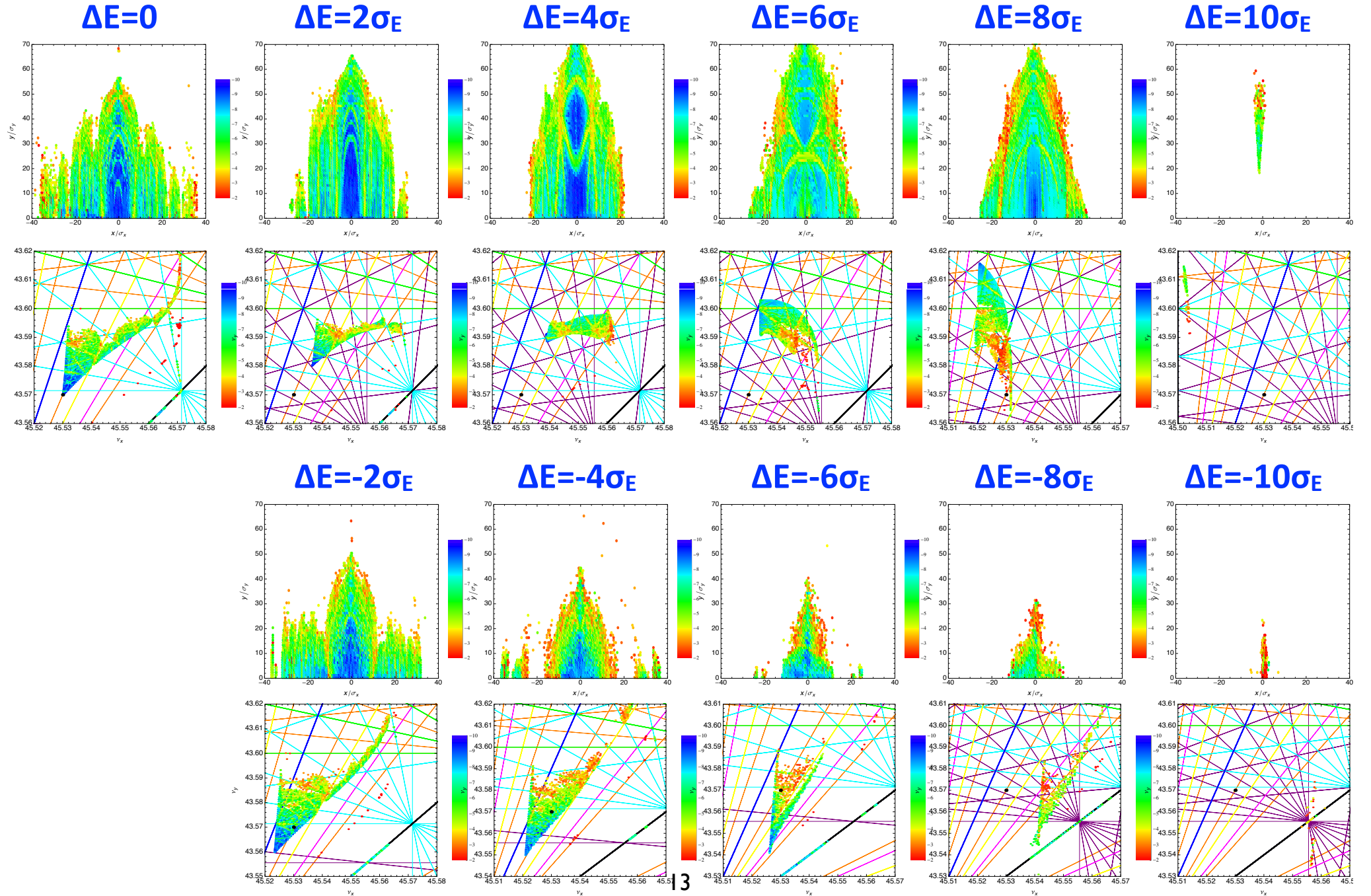
δ -x space



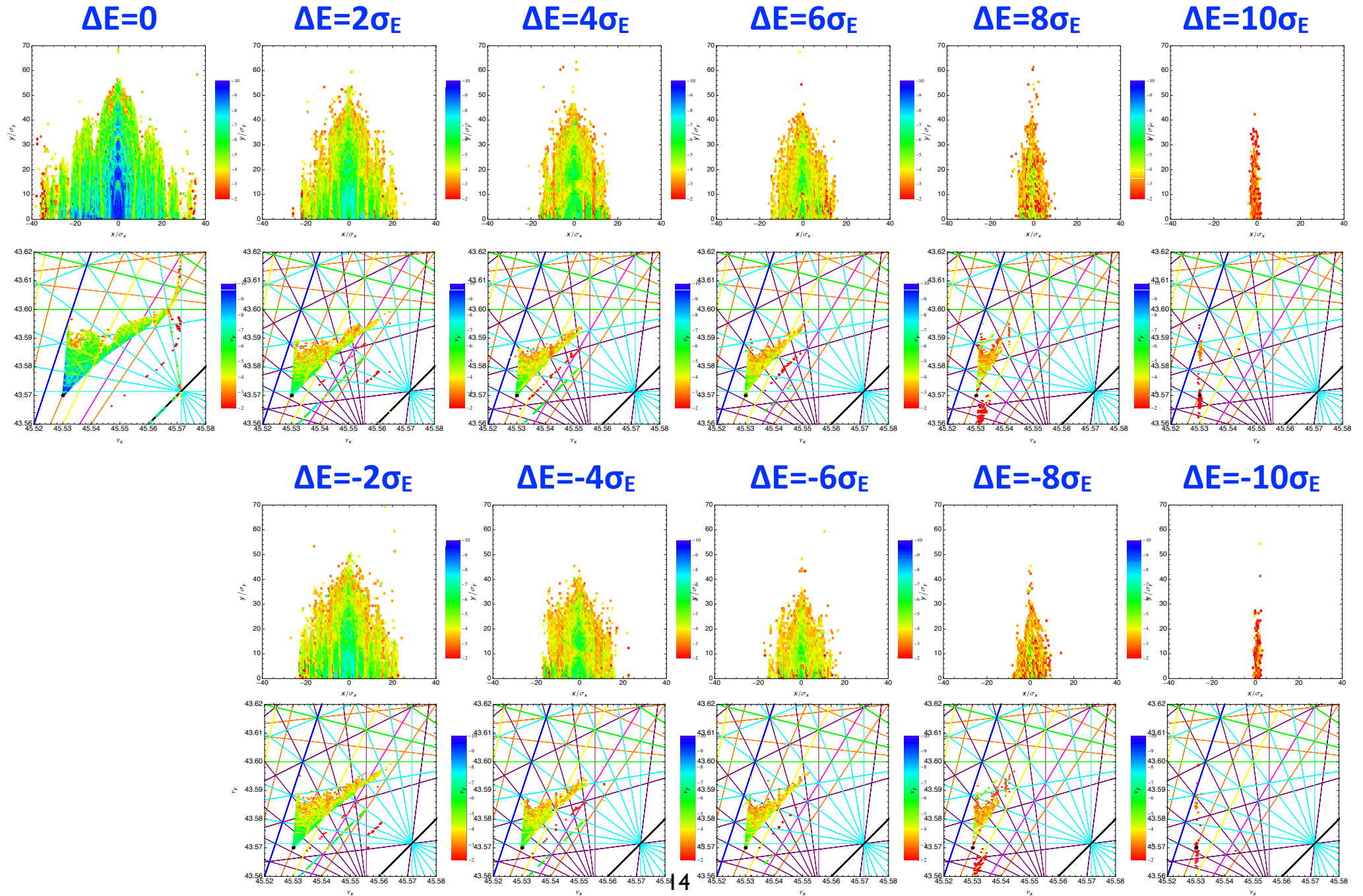
Tune space



2. HER: FMA and DA: RF off



2. HER: FMA and DA: RF on



2. HER: FMA and DA

➤ DA w/o beam-beam

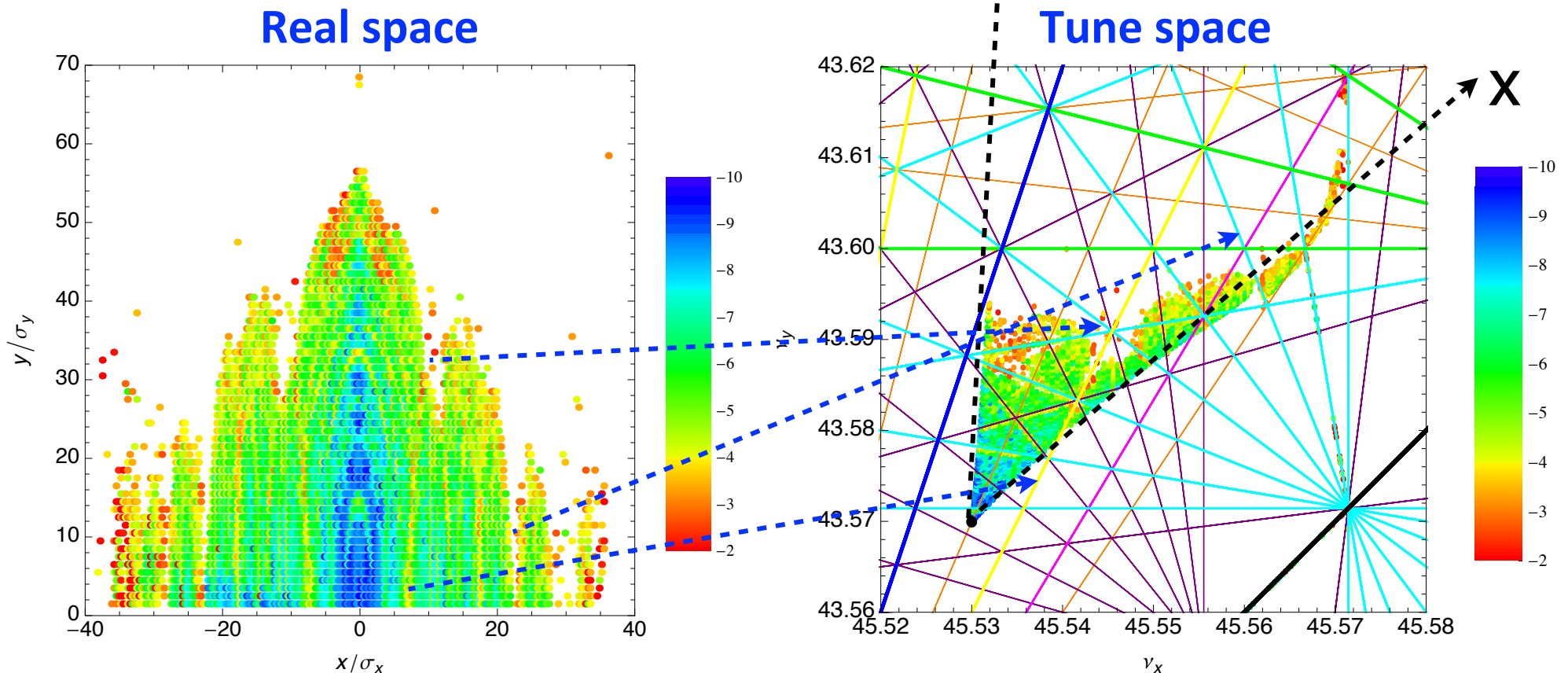
Resonance lines:

Blue: 4th order

Green: 5th order

Yellow: 6th order

Cyan: 7th order



2. HER: FMA and DA

➤ DA w/ beam-beam

sher_5740

Resonance lines:

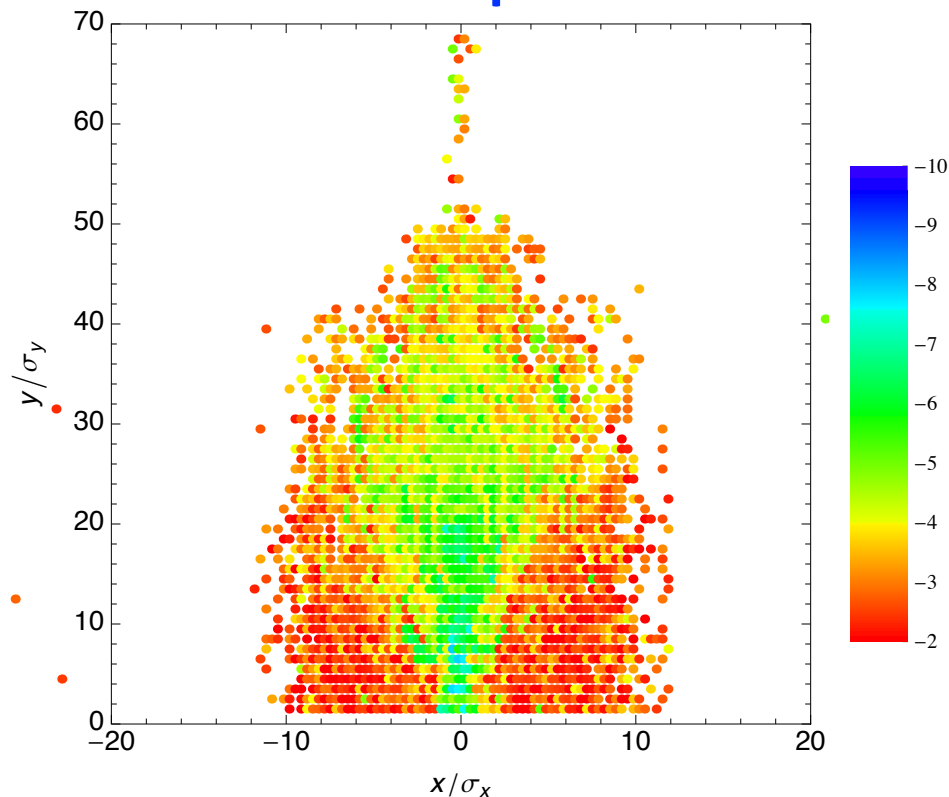
Blue: 4th order

Green: 5th order

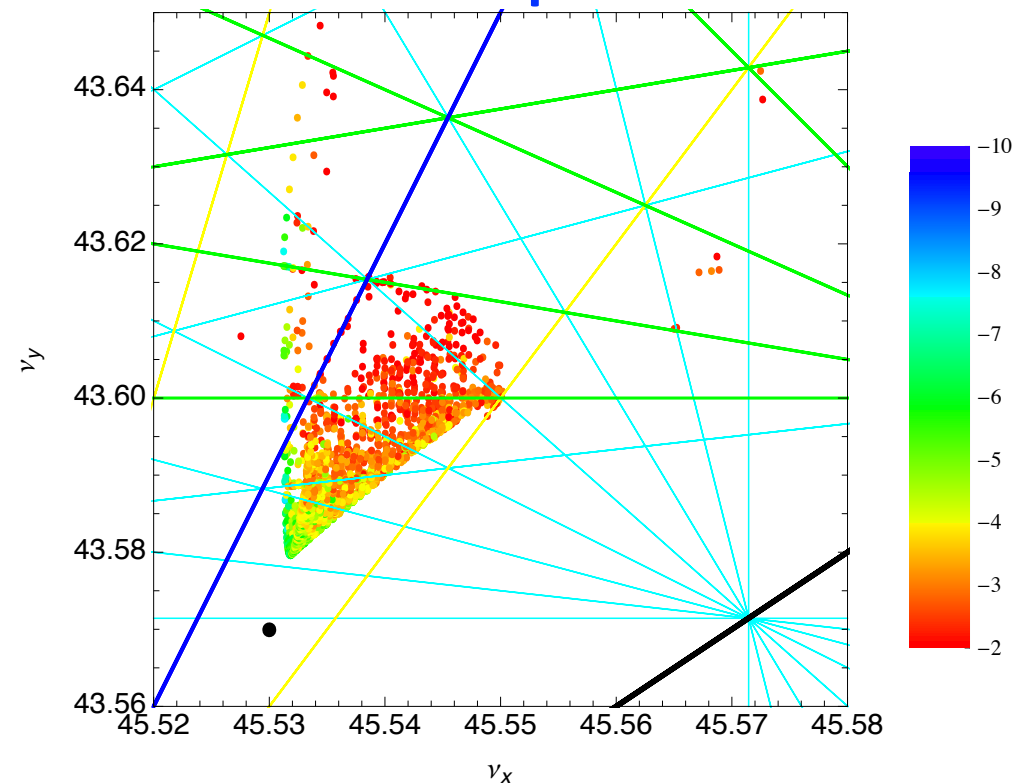
Yellow: 6th order

Cyan: 7th order

Real space



Tune space



2. HER: FMA and DA

➤ DA w/o beam-beam

sher_5740

Resonance lines:

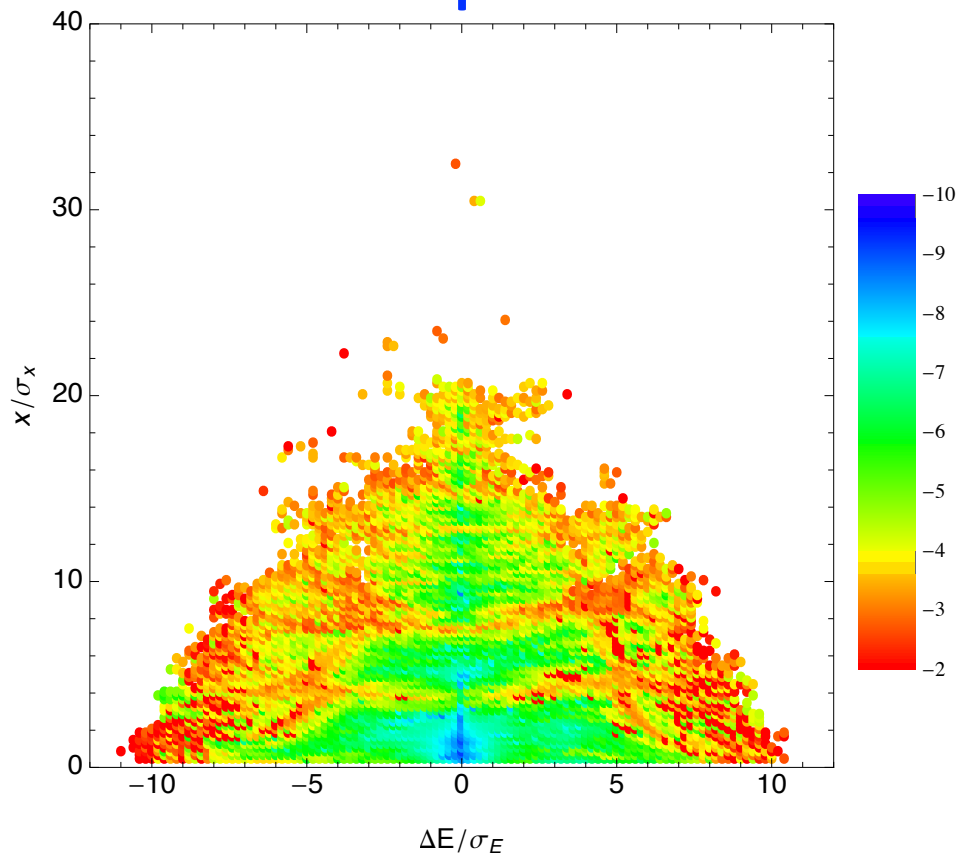
Blue: 4th order

Green: 5th order

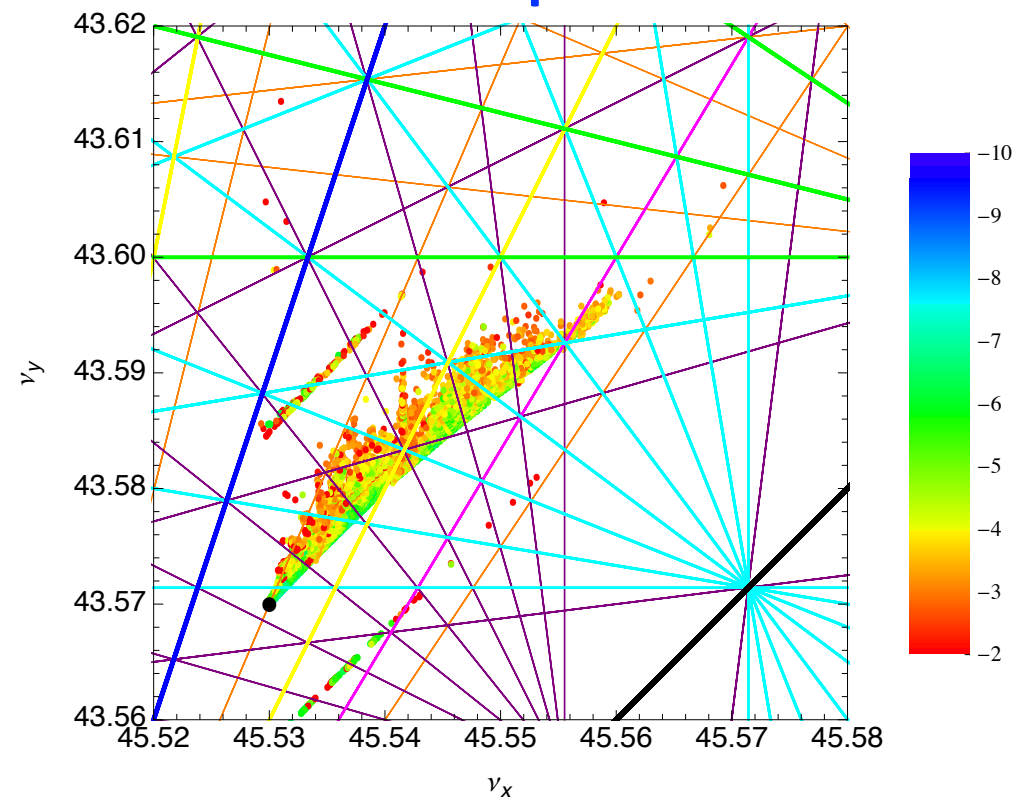
Yellow: 6th order

Cyan: 7th order

δ -x space



Tune space



2. HER: FMA and DA

➤ DA w/ beam-beam

sher_5740

Resonance lines:

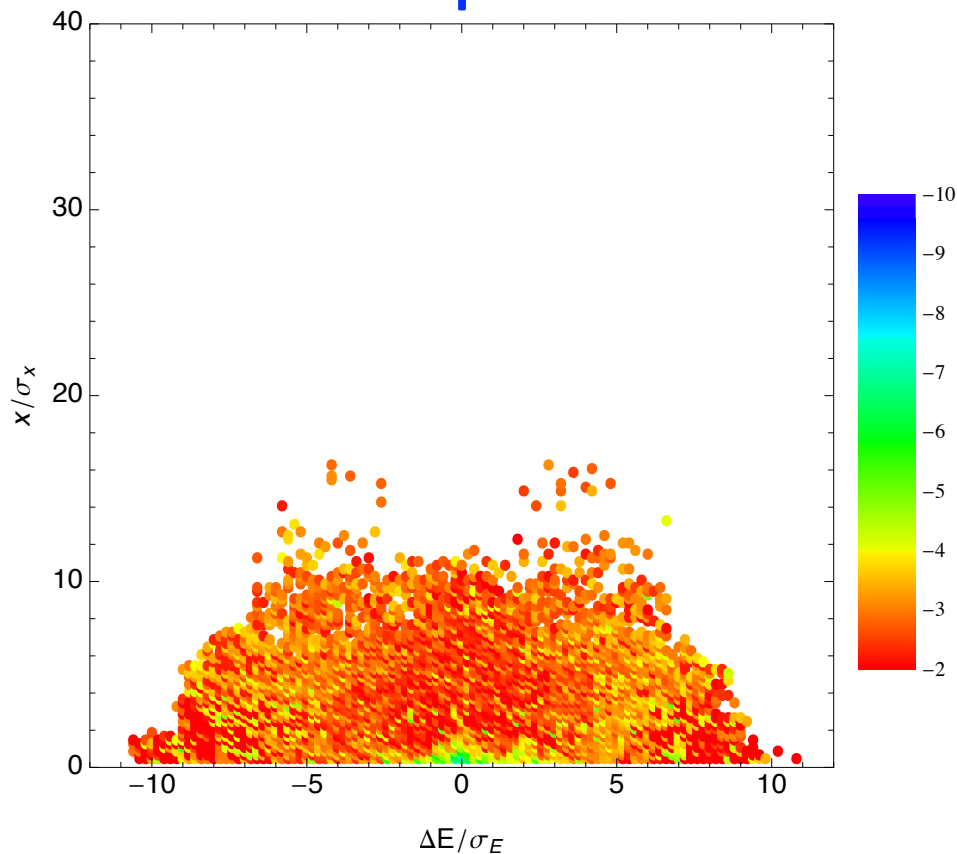
Blue: 4th order

Green: 5th order

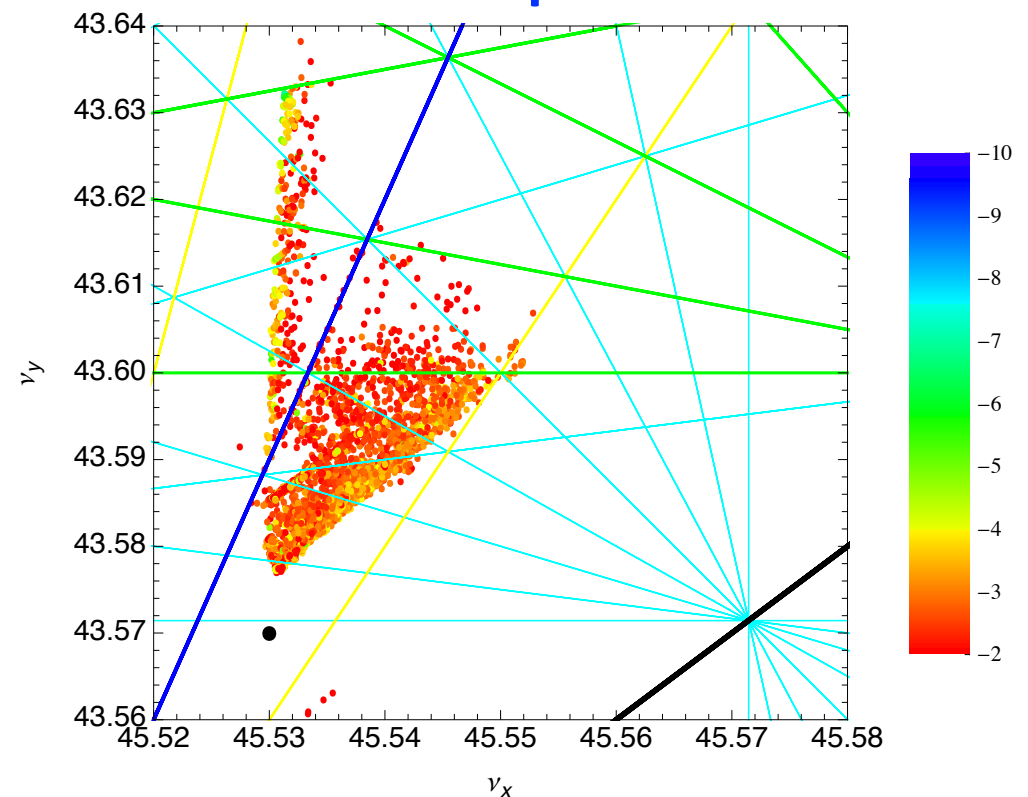
Yellow: 6th order

Cyan: 7th order

δ -x space



Tune space



3. Summary

➤ LER

- Lum. loss w/ LN cannot be attributed to chromatic effect, which has been controlled by skew-sextupole knobs
- Amplitude-dependent nonlin. are important? => Need crab waist?
- Q: Does crab waist work w/ beam-beam and space charge?

➤ HER

- Lum. loss w/ LN can be attributed to chromatic effect, which has not been controlled in lattice design
- Amplitude-dependent nonlin. are not important (?)