Dynamic Aperture
for Tau Charm ST20_49

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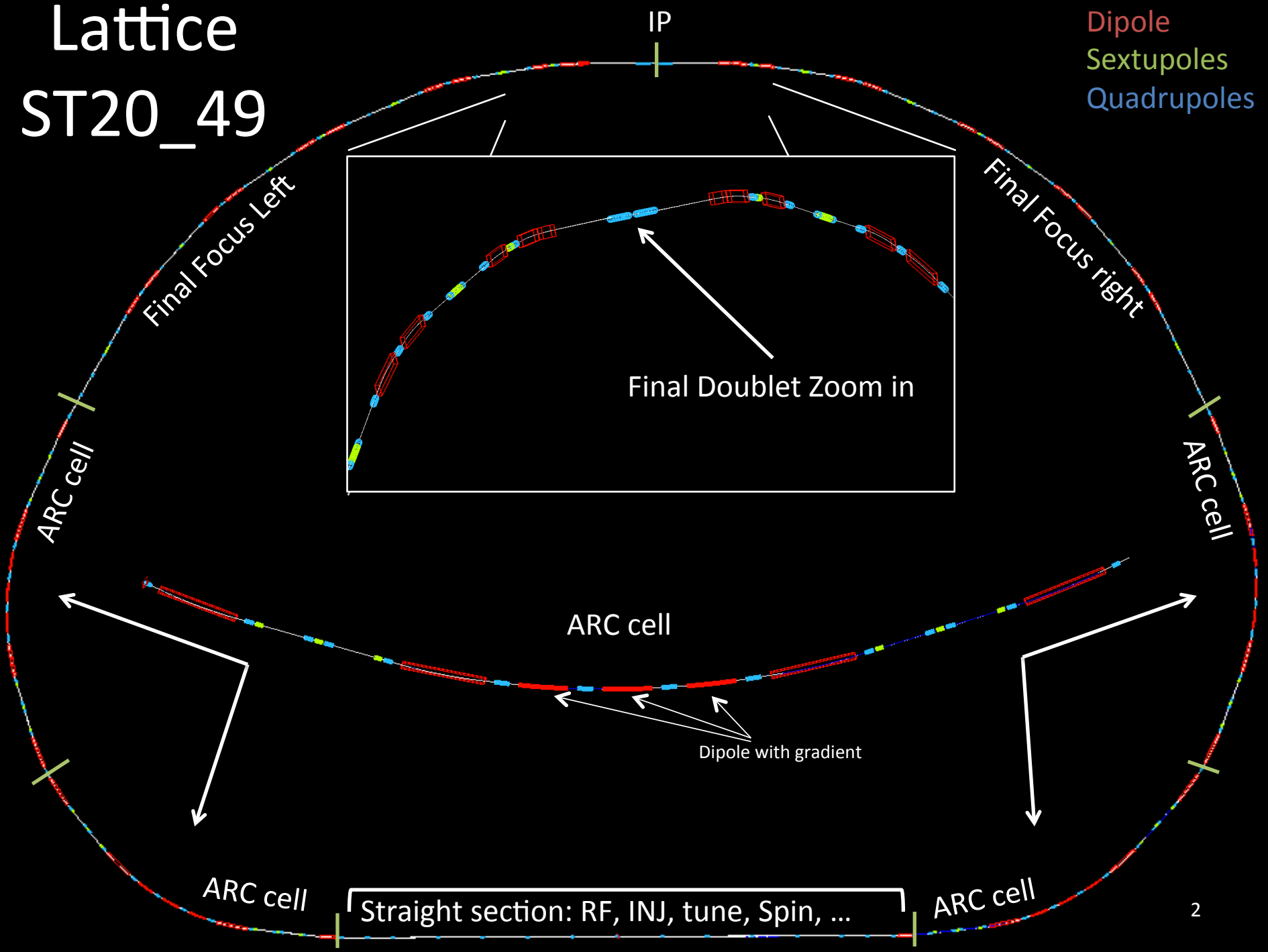
Lattice ST20_49



Non linear terms included in the calculations

Non linearities taken in account:

- Sextupoles
- Octupoles
- Drift description to higher order
- Fringe Fields in quadrupoles and dipoles with gradient (when indicated)

Tracking parameters in MADX and Accelerator Toolbox(AT)

- MADX-PTC exact, kick-drift-kick, hard edge fringe in all magnets
- AT + Fringe in quadrupoles (and dipoles with gradient) + kinematic 1/8(p_x^2+p_y^2)^2 terms
- 50 steps in each magnet for integration.

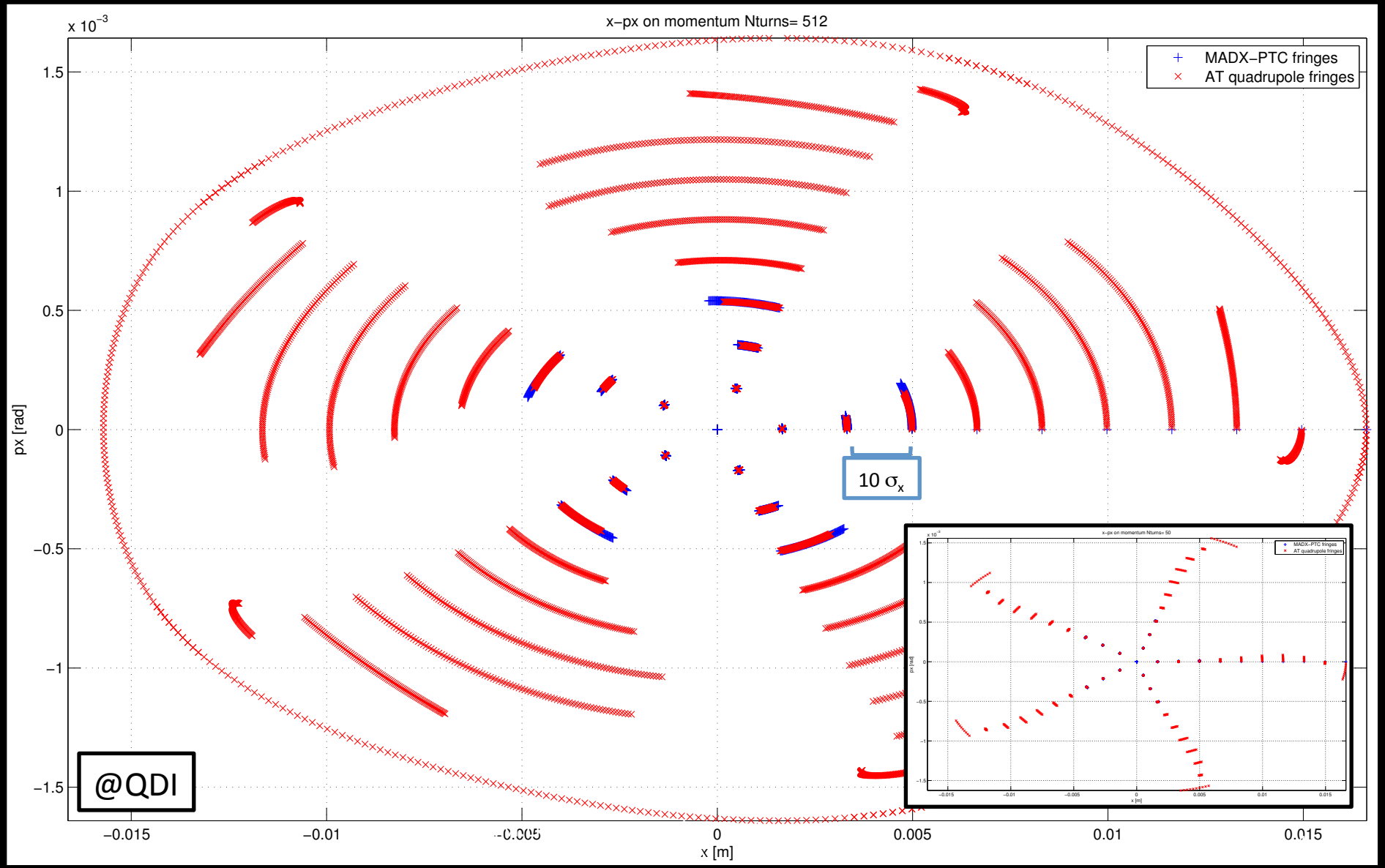
$$H_{drift} = \frac{P_x^2 + P_y^2}{2} + \frac{(P_x^2 + P_y^2)^2}{8}$$

$$x^f = x^i + (P_x + \frac{P_x^3}{2} + \frac{P_x P_y^2}{2})L$$

$$y^f = y^i + (P_y + \frac{P_y^3}{2} + \frac{P_y P_x^2}{2})L$$

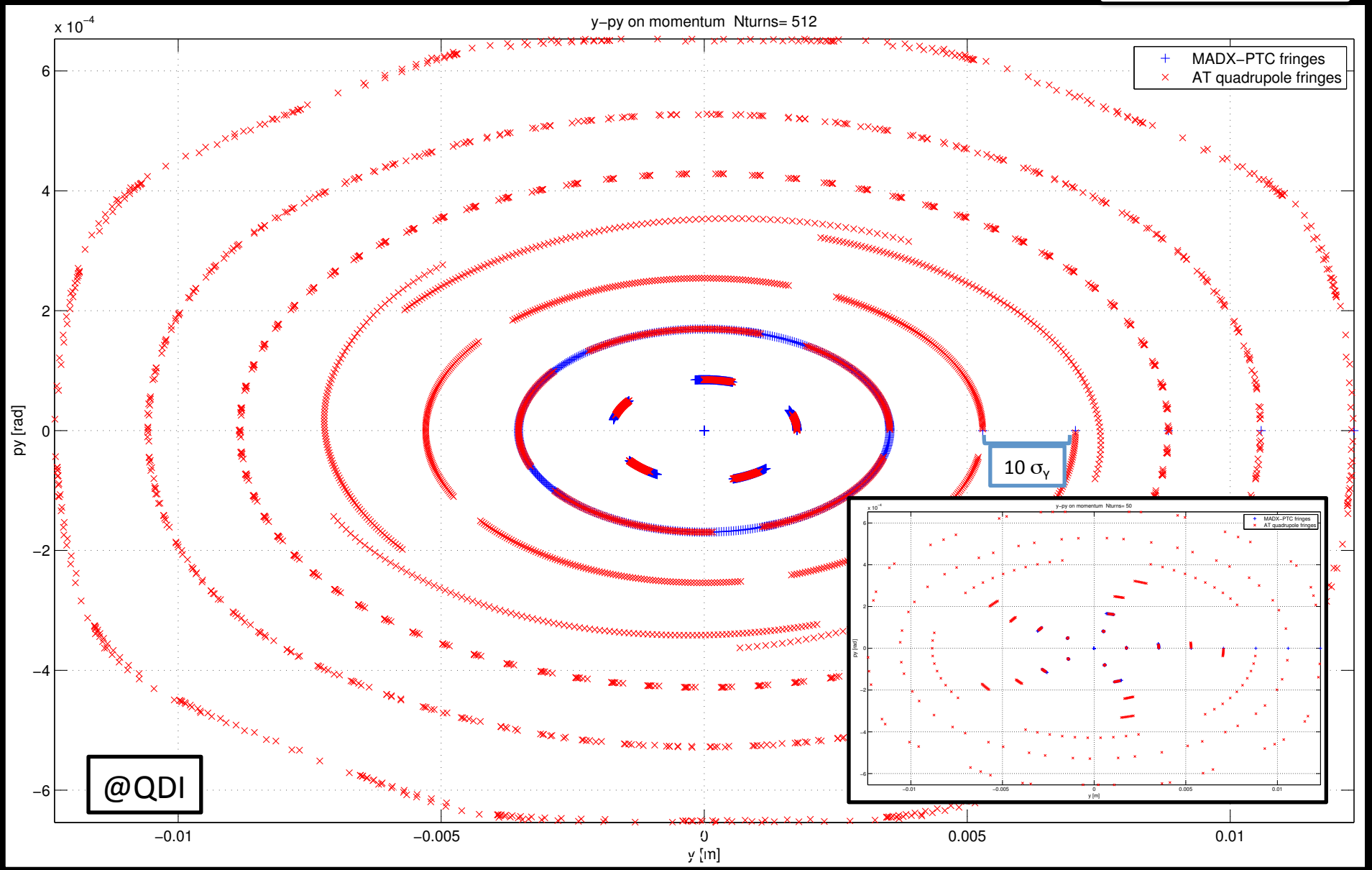
Tracking x-x’

Fringe fields on



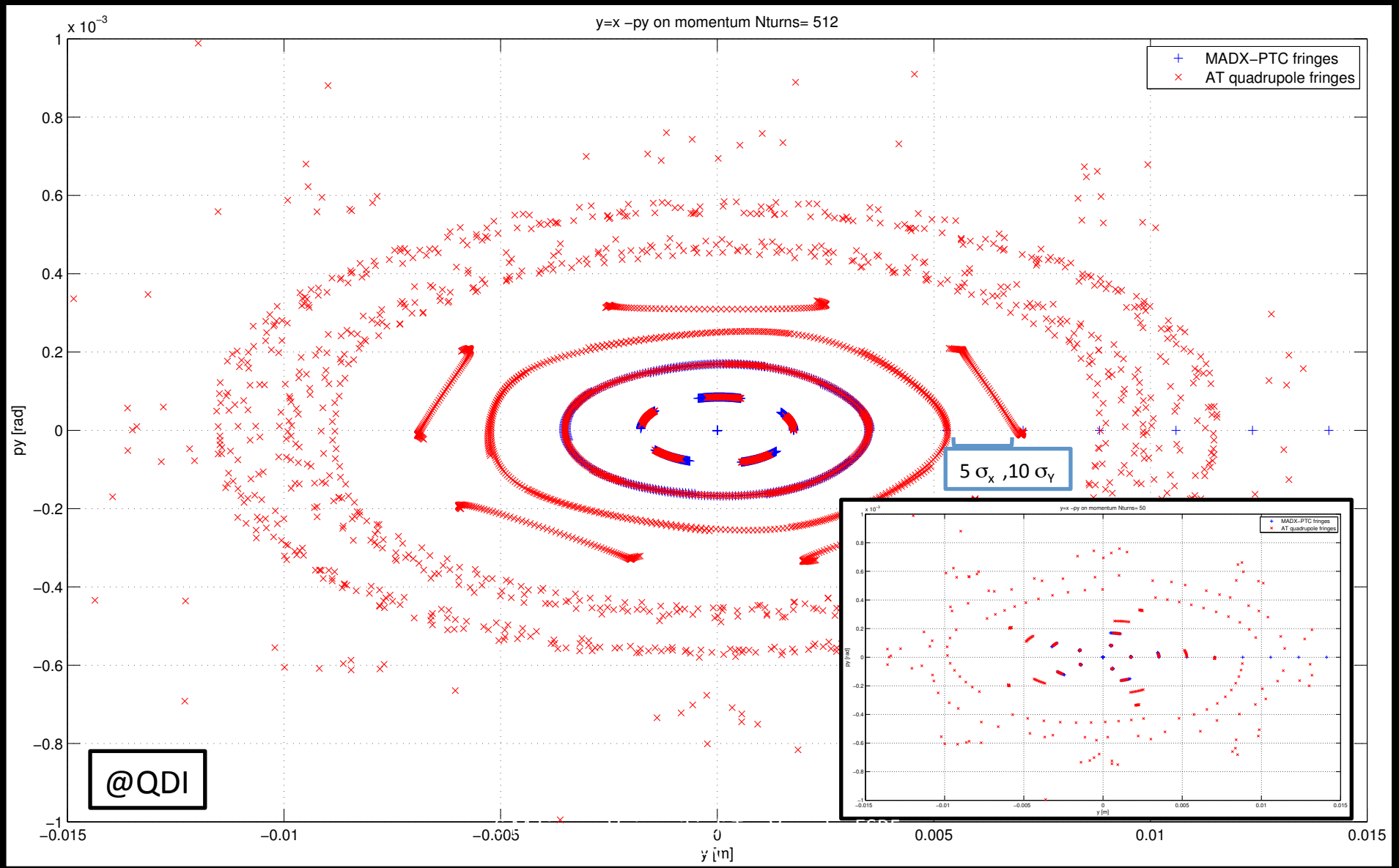
Tracking y-y'

Fringe fields on



Tracking (x=y)-y'

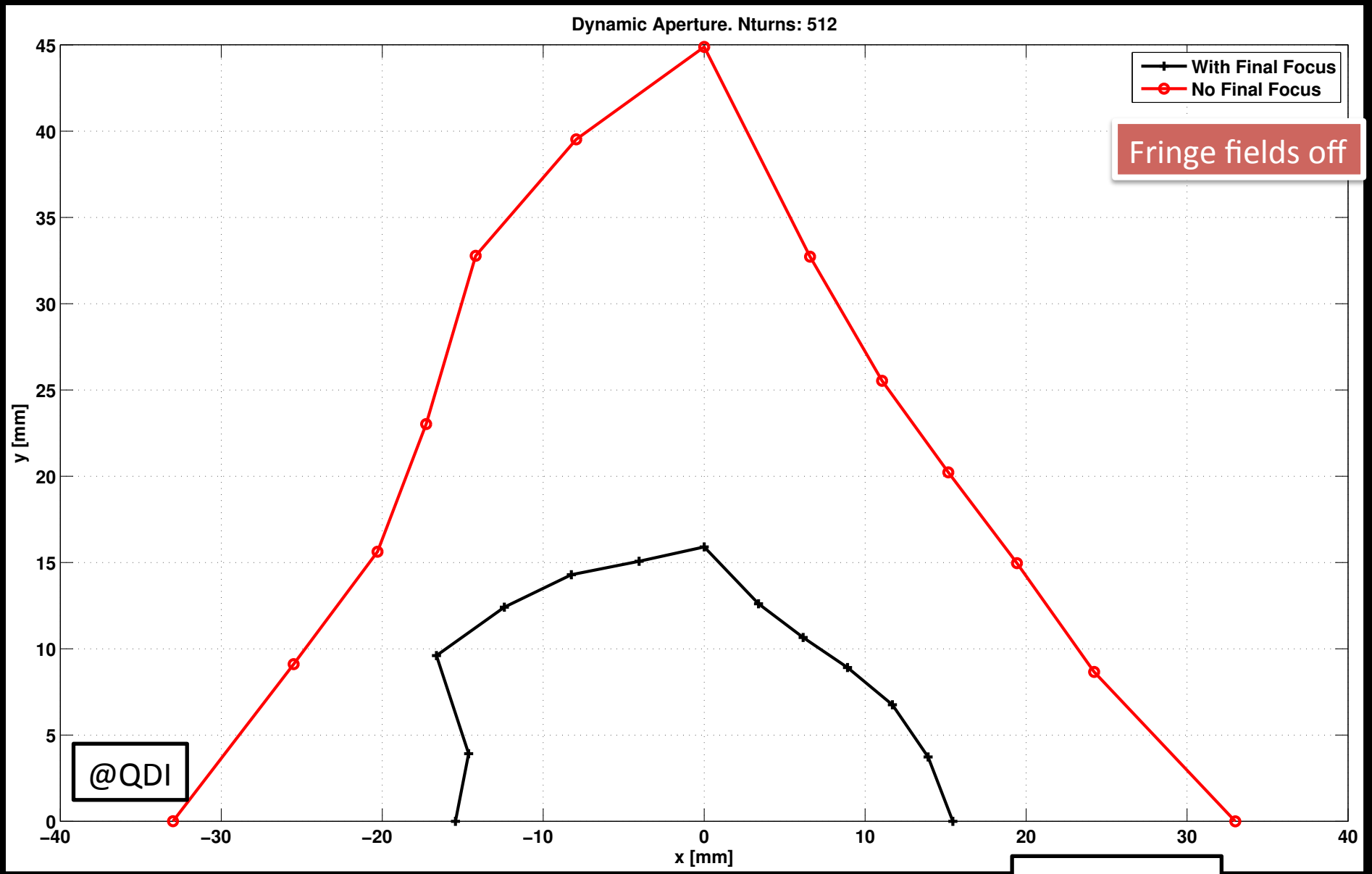
Fringe fields on



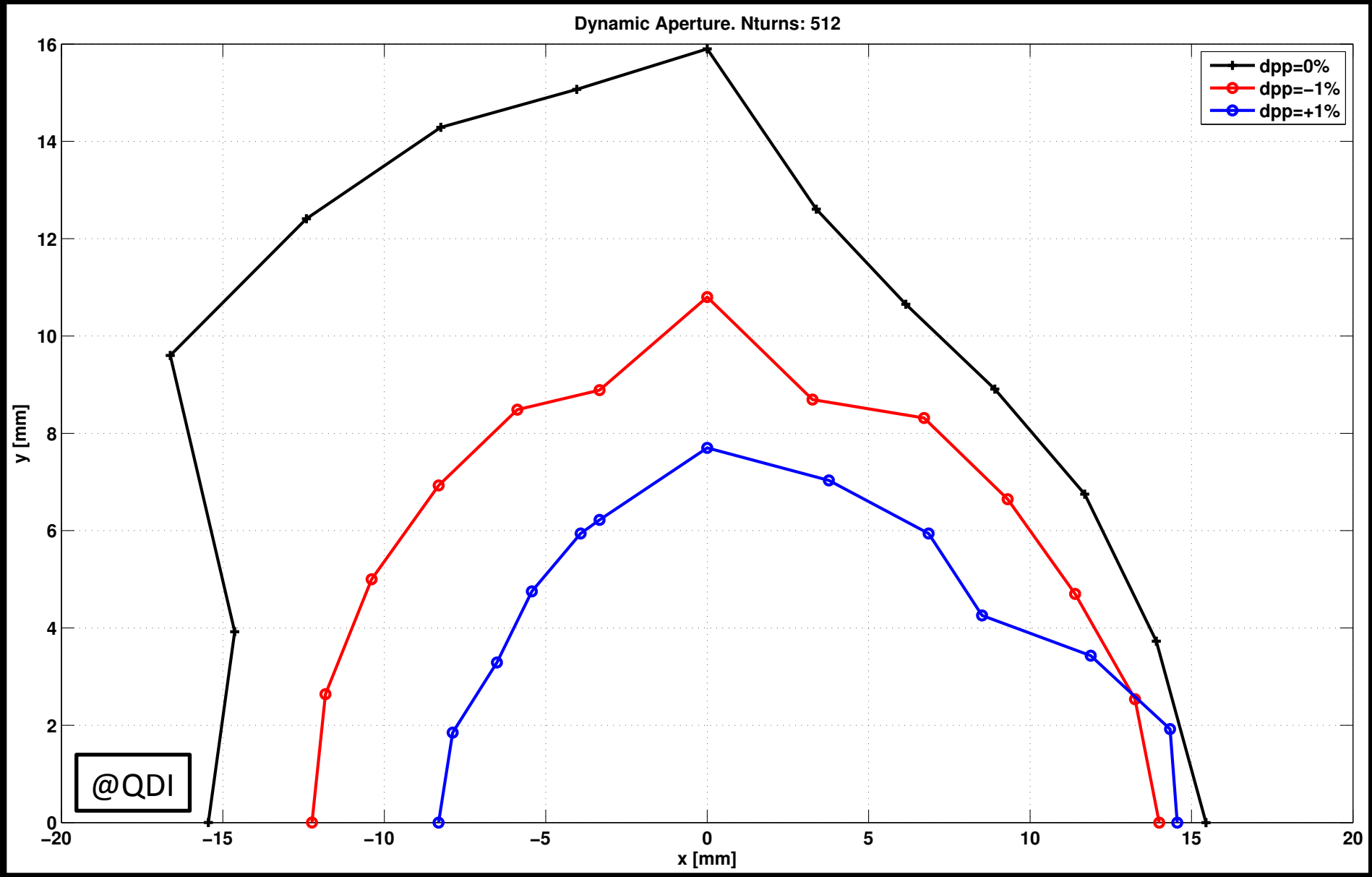
Dynamic Apertures

- ON and OFF momentum, for RING_noff and RING_FF
- Horizontal Dynamic aperture vs Momentum
- Fringe fields effect on dynamic aperture
- Influence of Errors in the lattice
- Maximum amplitude X and Y vs tune
- Frequency Maps

Dynamic Aperture with and without FF



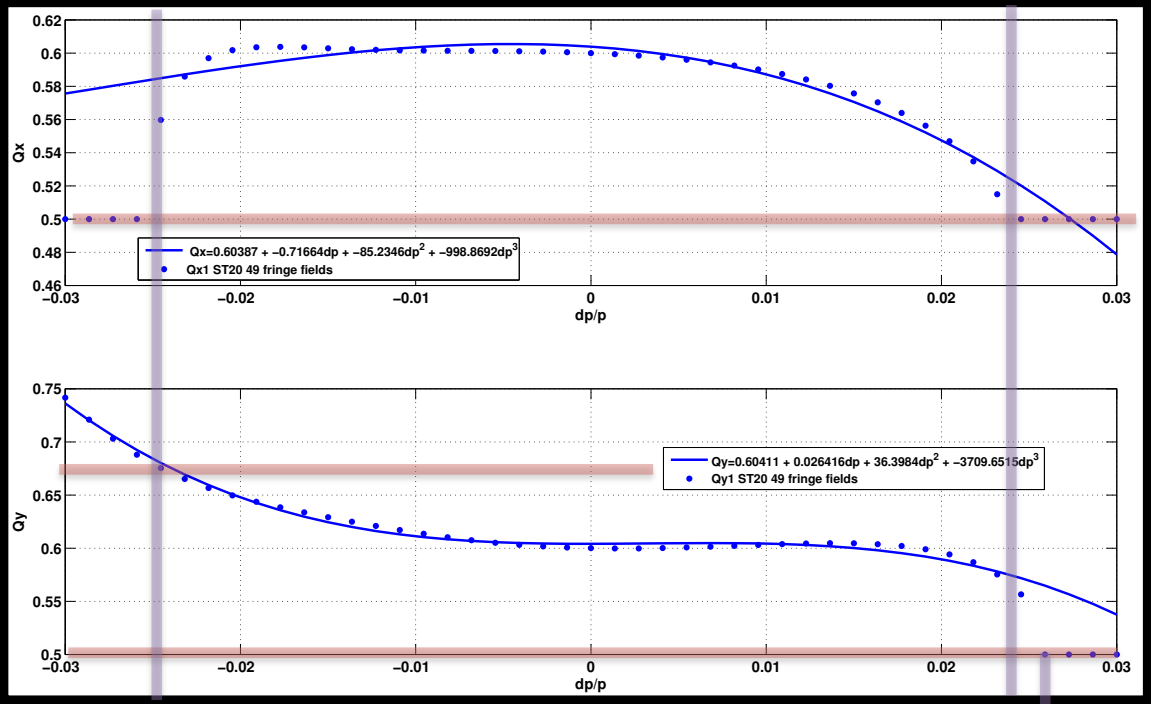
Dynamic Aperture on and off momentum

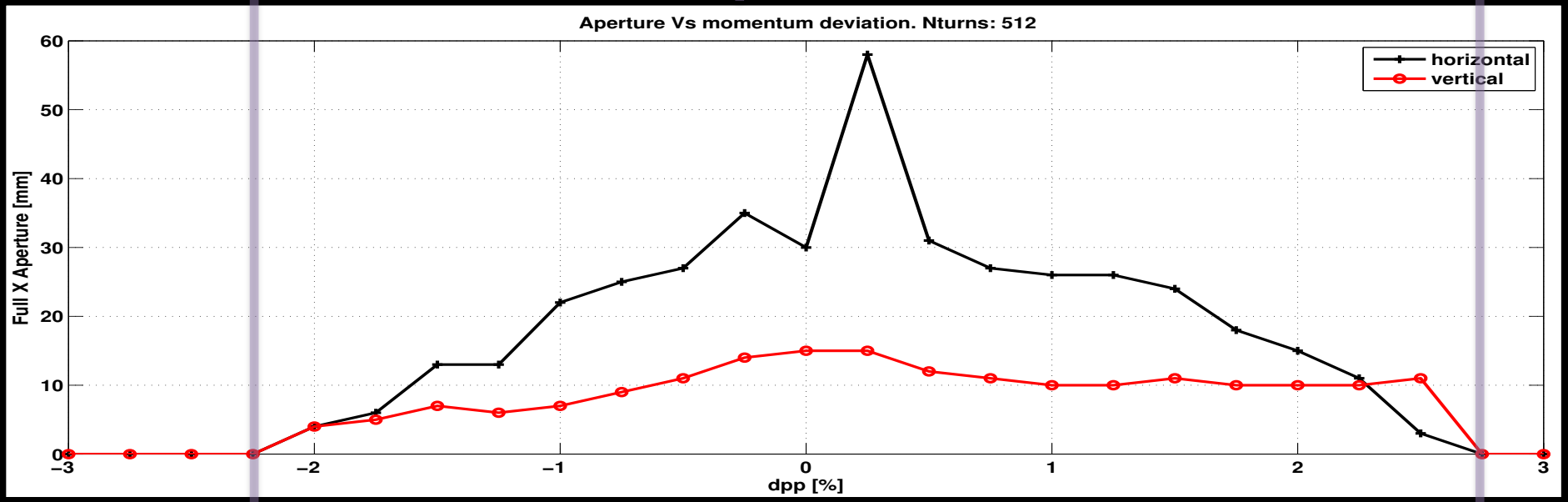


Dynamic aperture vs momentum

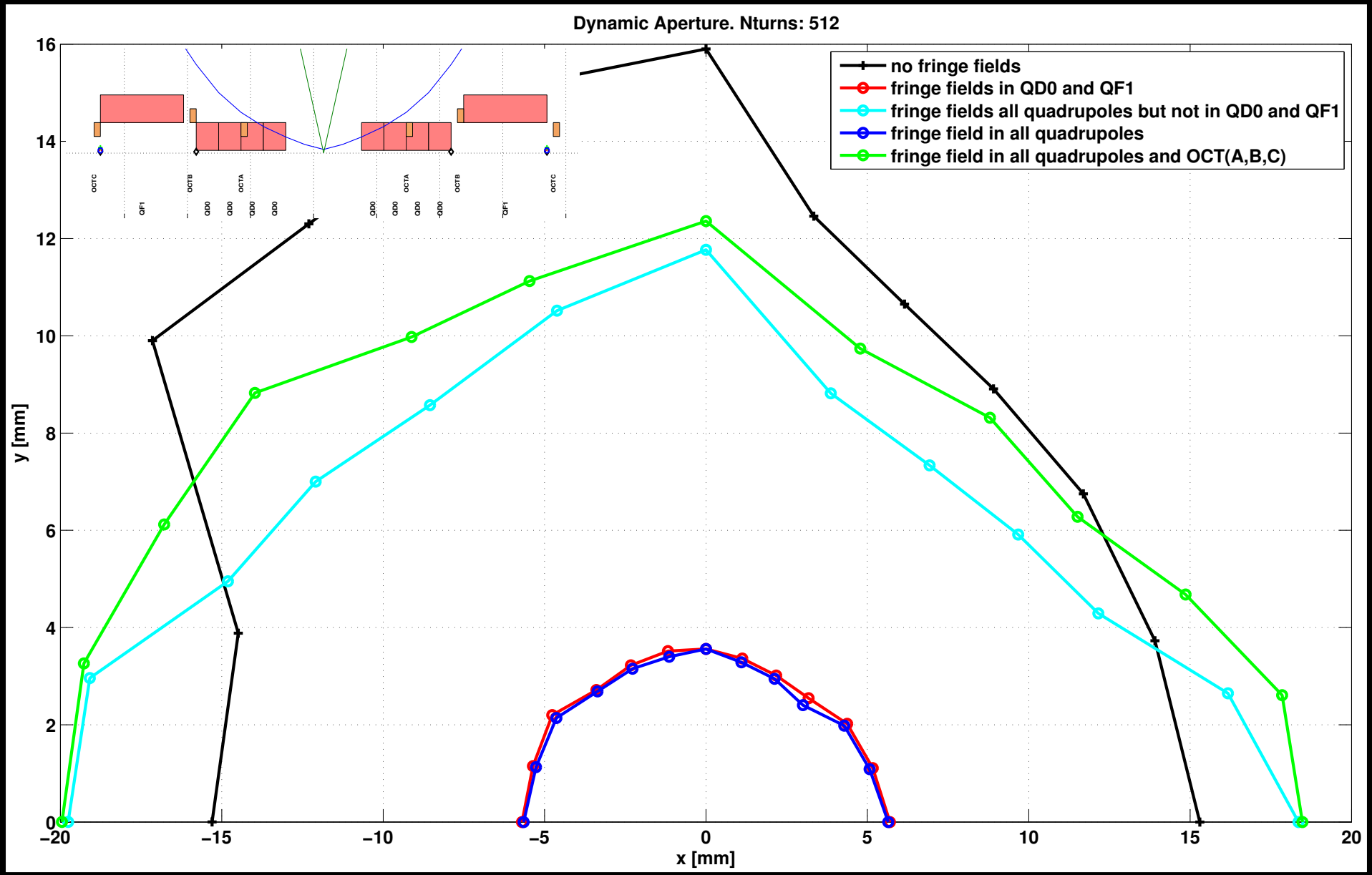
ΔE=[-2%,+2.5%]

Energy acceptance is limited by non linear Chromaticity.
No Physical aperture.

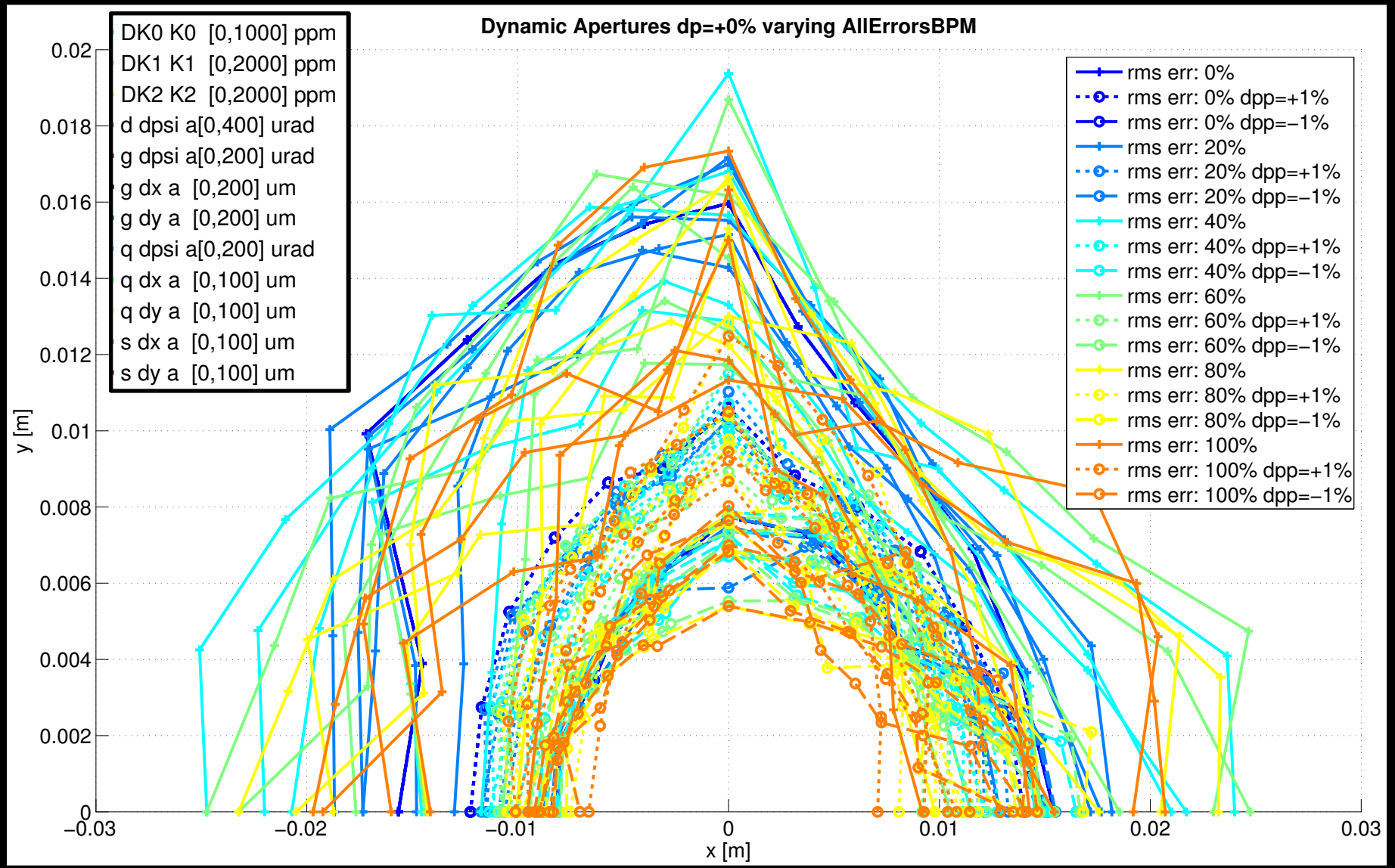




Dynamic Aperture with Fringe Fields

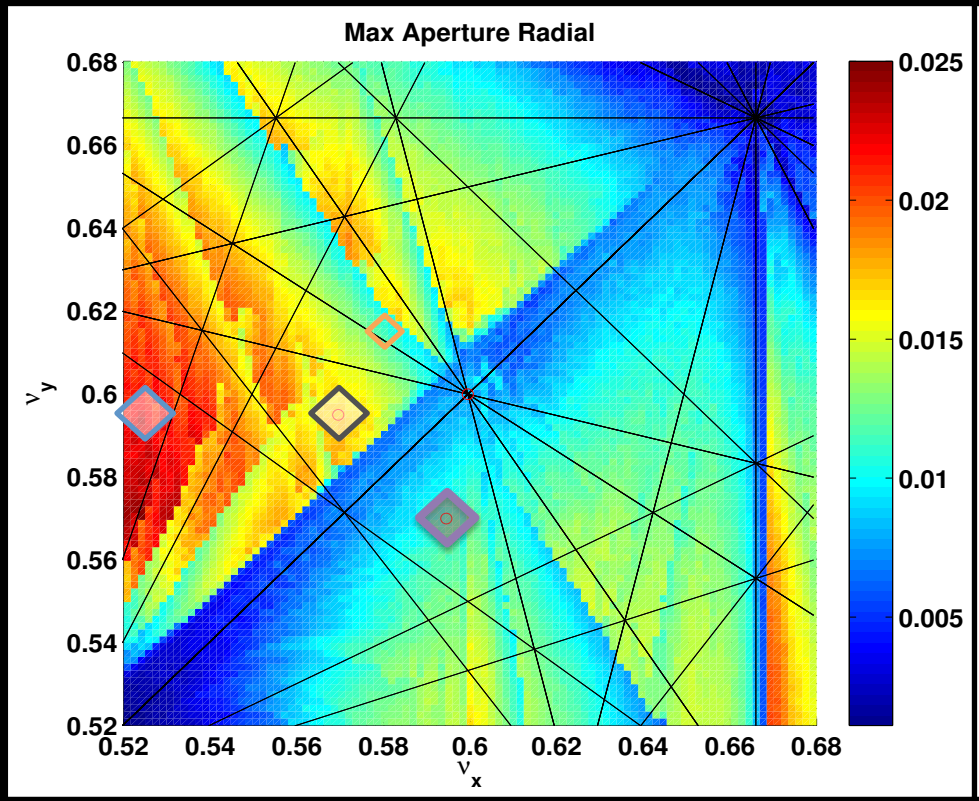


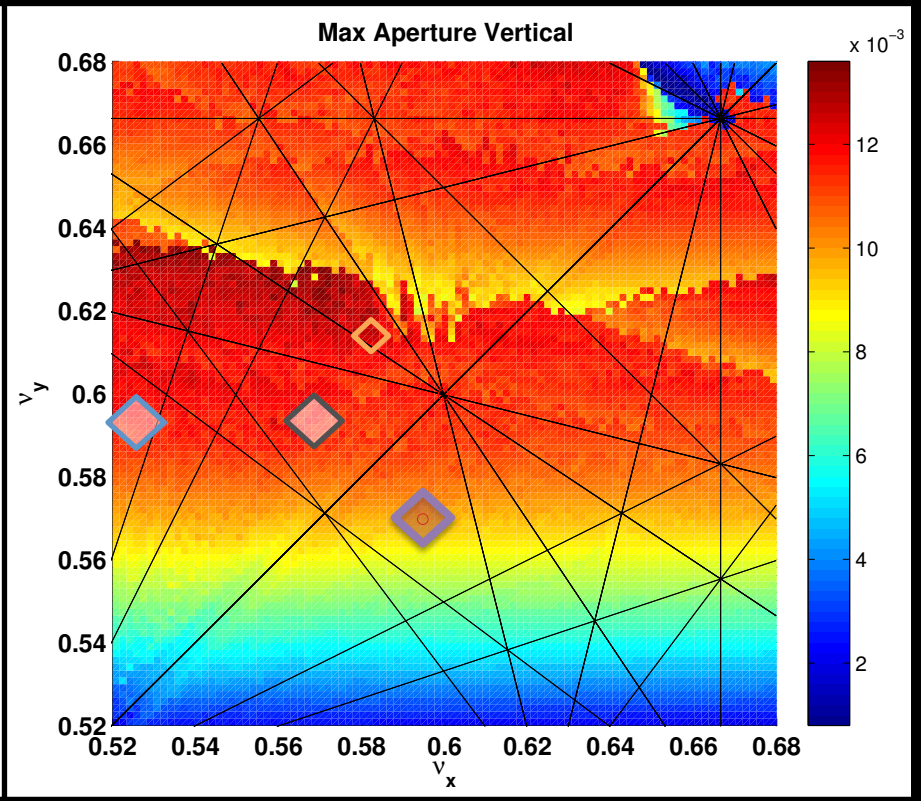
Dynamic Aperture with Errors



Max Amplitude X and Y versus tune

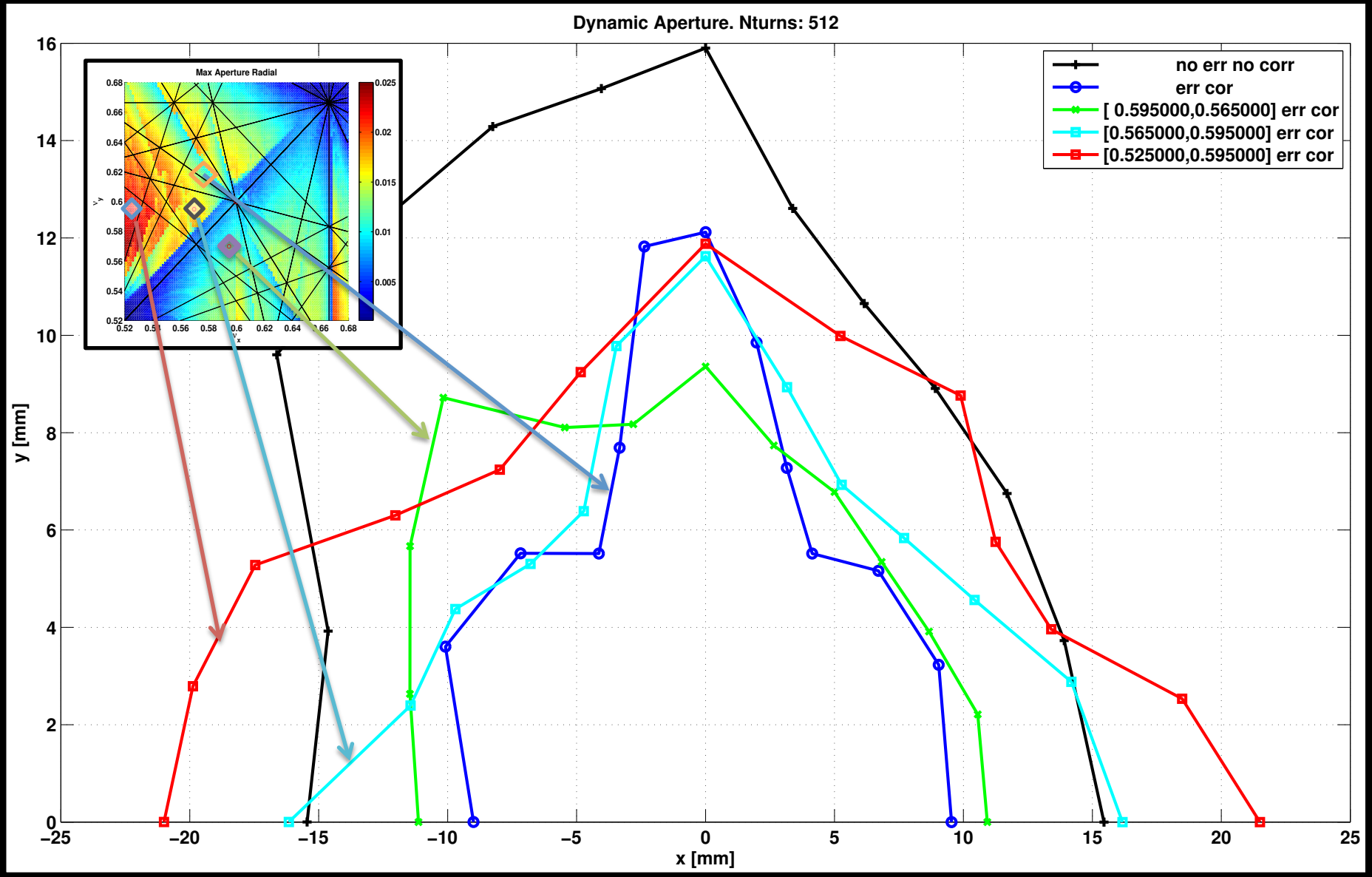
- Tune used for Dynamic apertures (16.58 9.62)
- Good Point: (0.525,0.595)
- Good Point: (0.595,0.56)
- Good Point: (0.56,0.595)



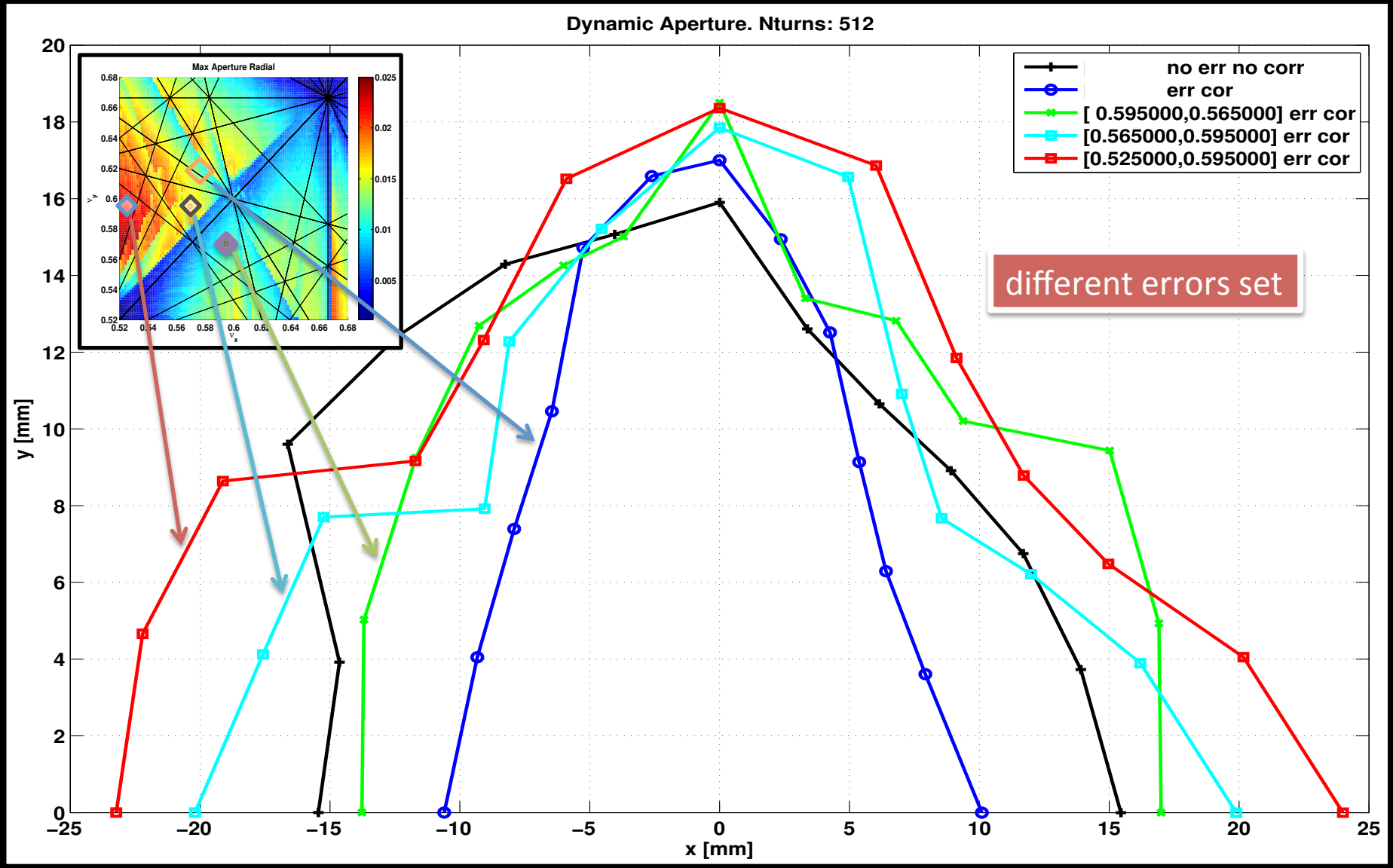


With fringe fields. With Errors. Tune changed with matching routine.

Dynamic Aperture at Best Points

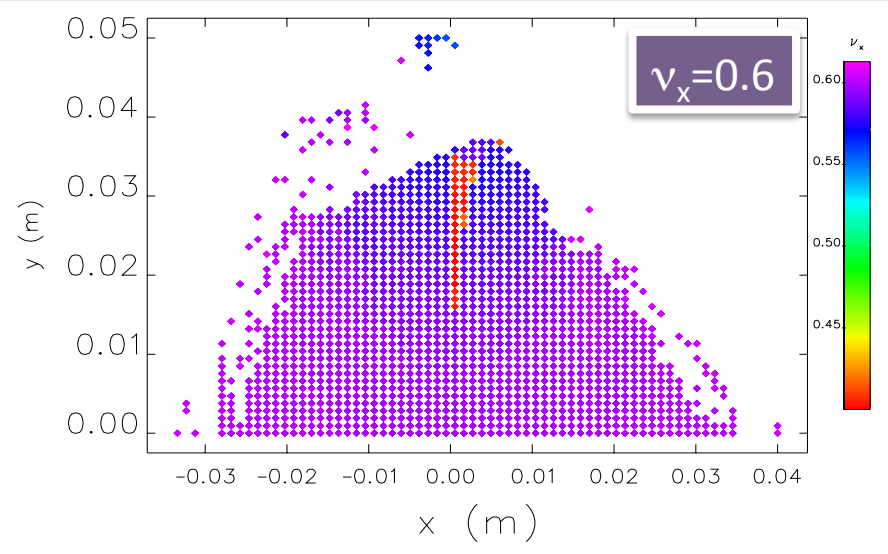


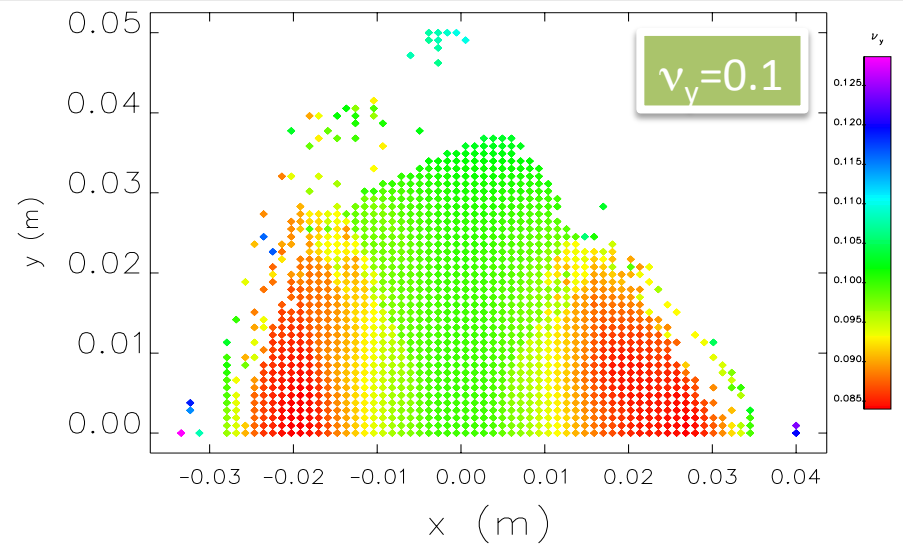
Dynamic Aperture at Best Points

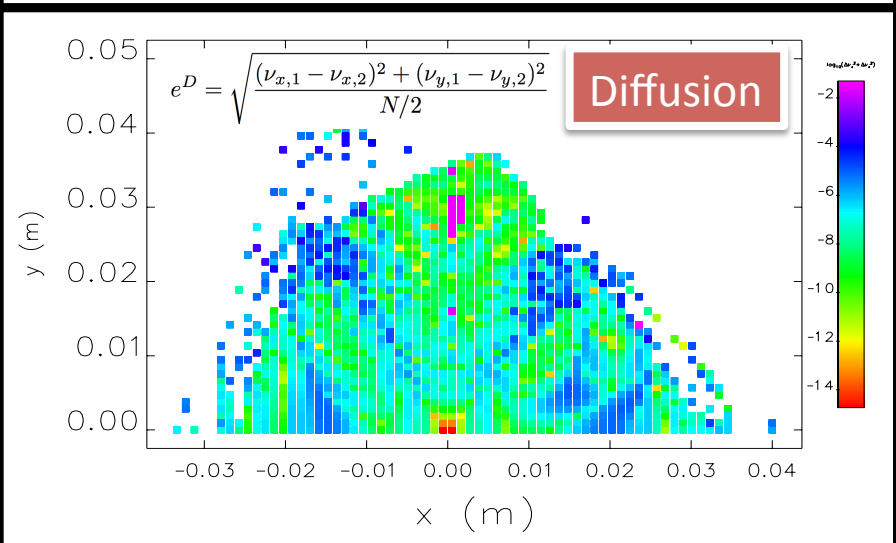


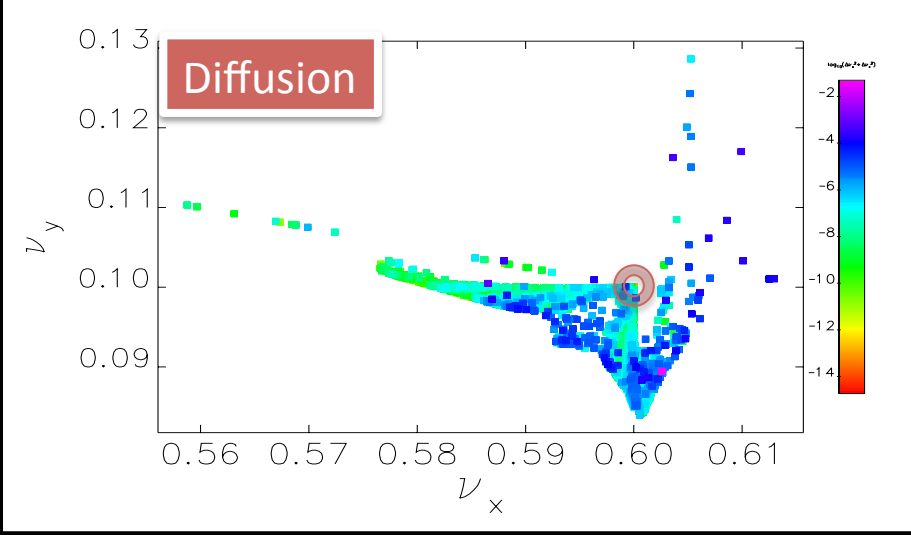
ST20_49 512 turns, no errors

Frequency Maps Without Final Focus









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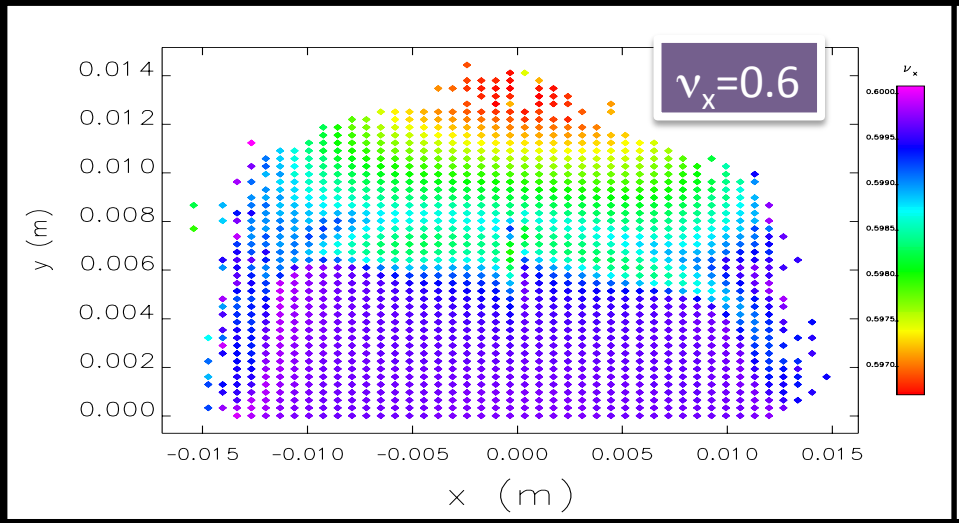
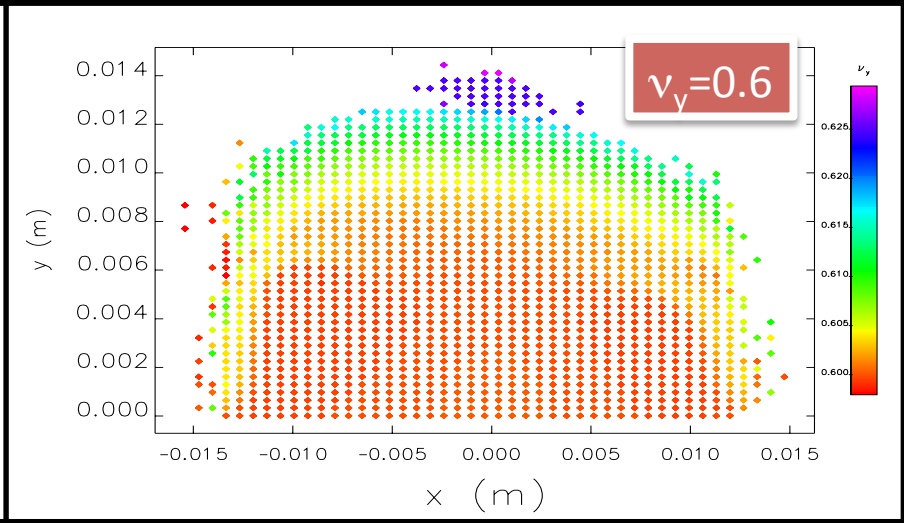
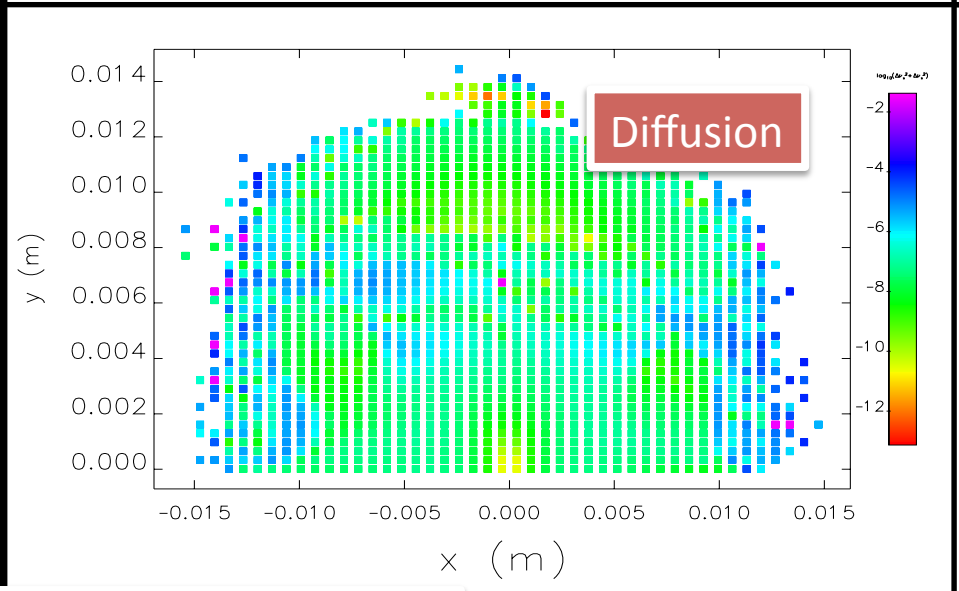
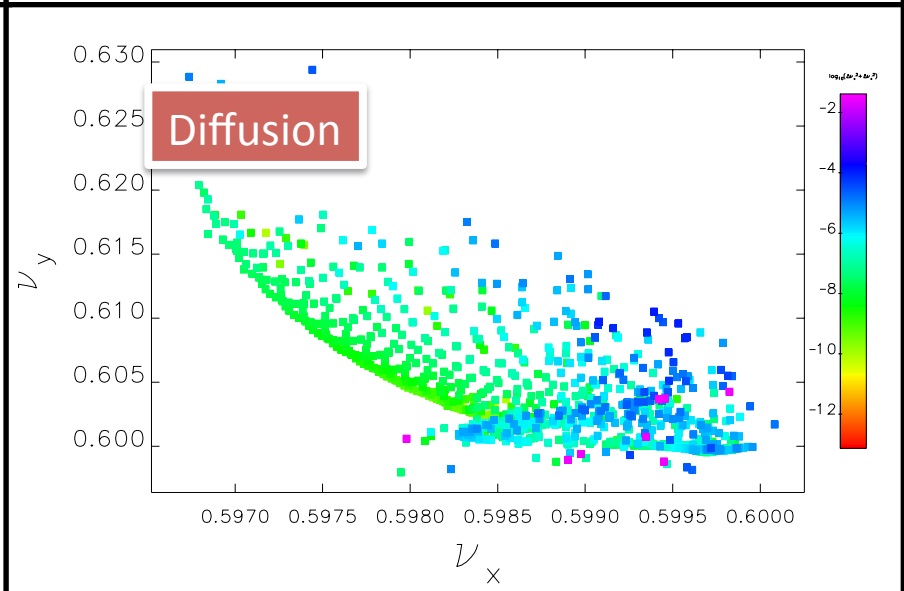
ST20_49 512 turns, no errors

Frequency Maps With Final Focus









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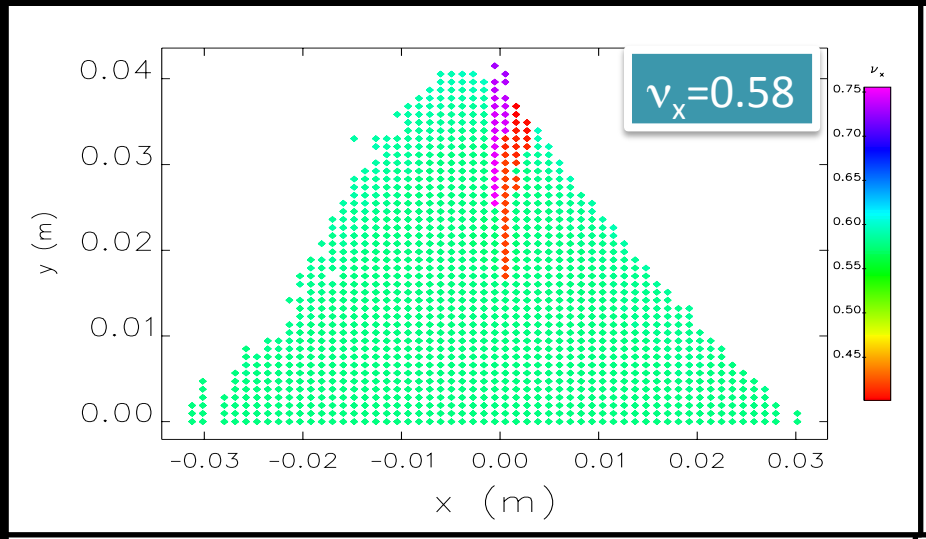
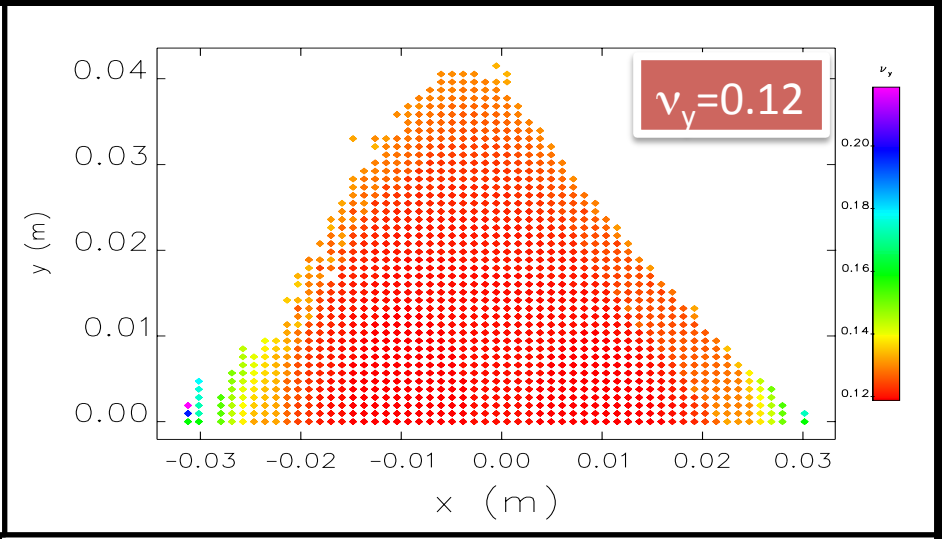
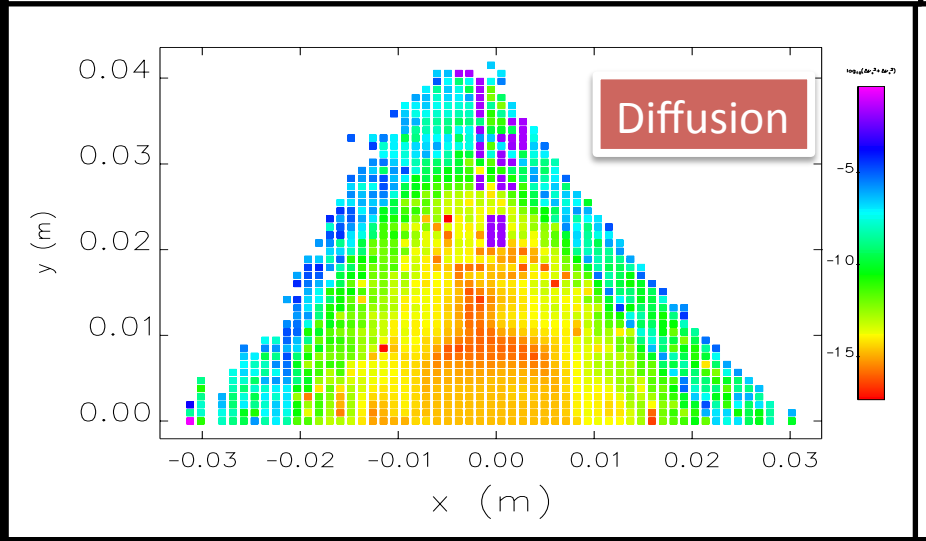
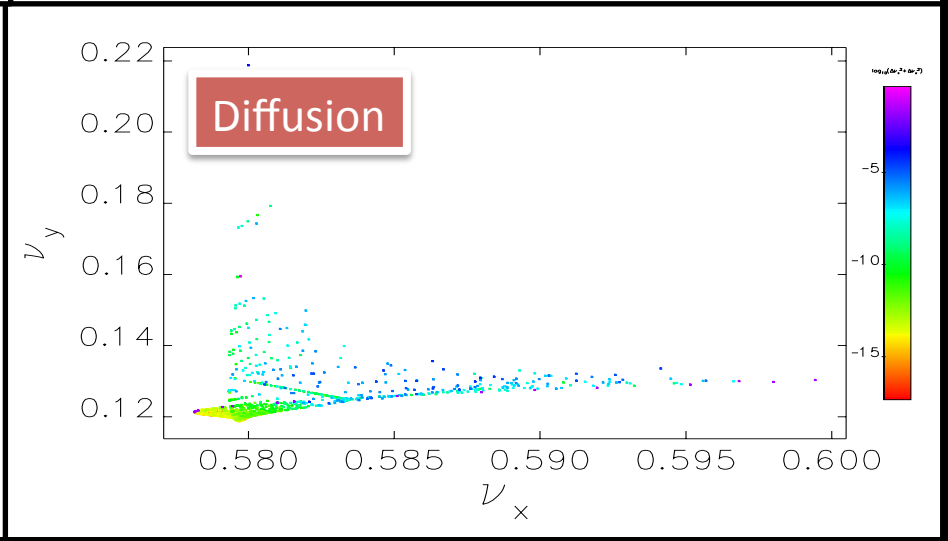
ST20_49 512 turns, with errors

Frequency Maps Without Final Focus









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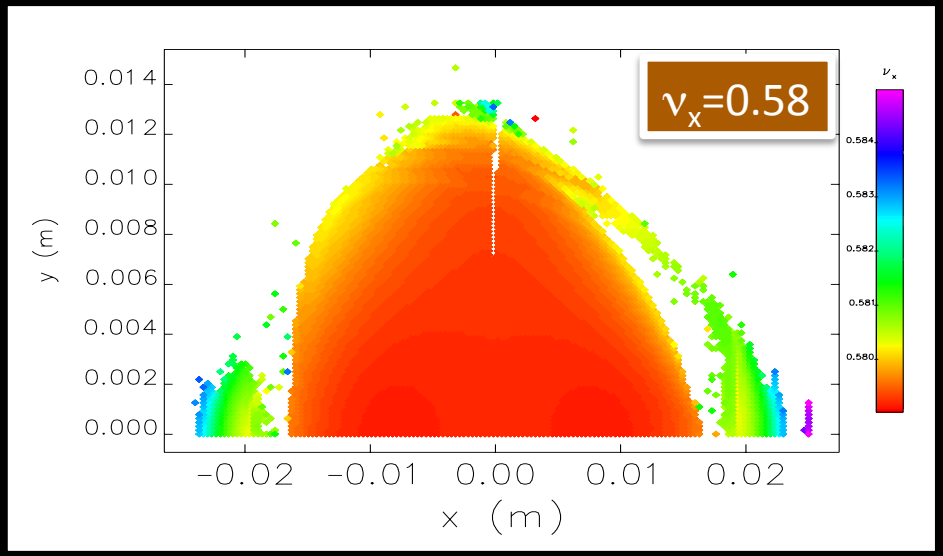
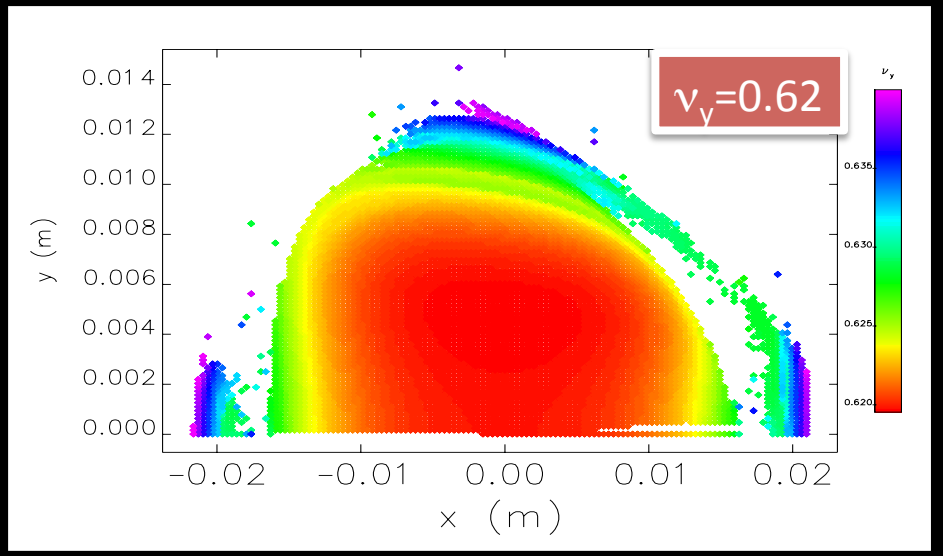
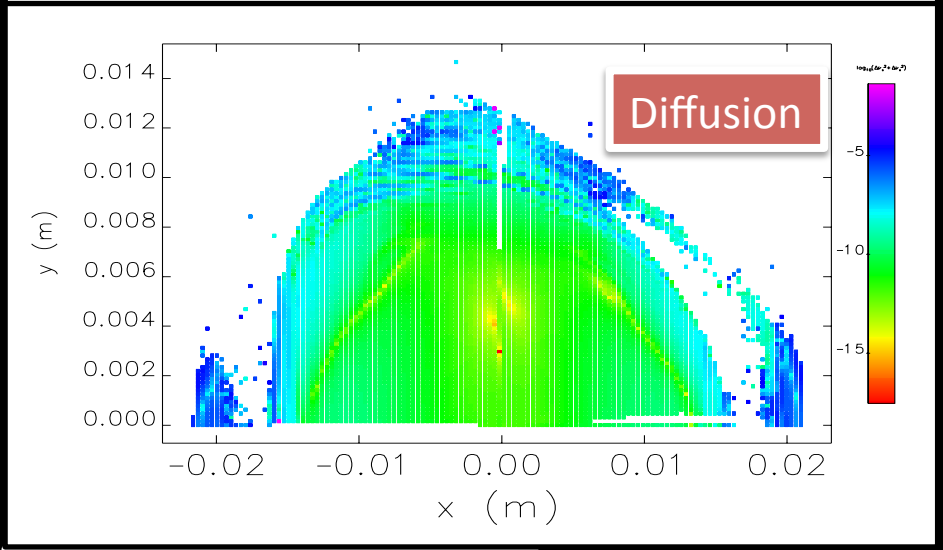
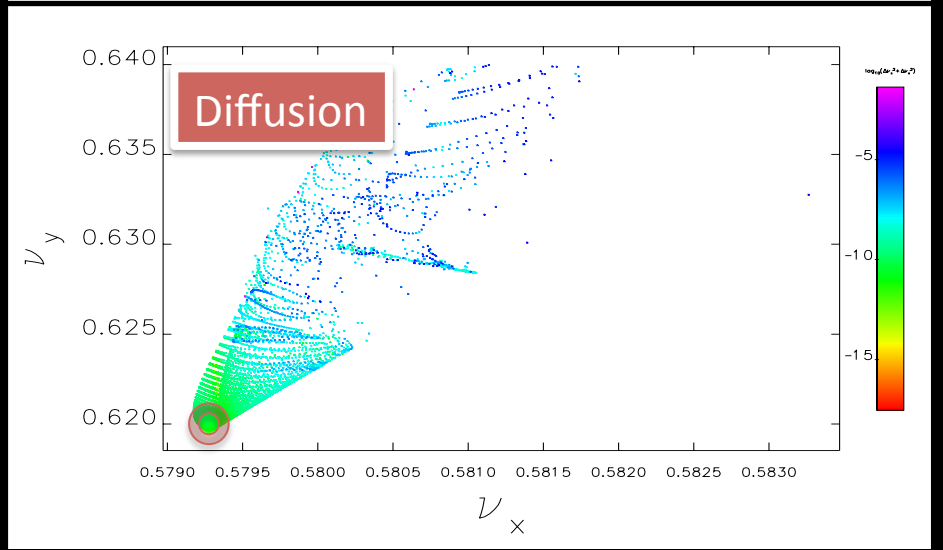
ST20_49 512 turns, with errors

Frequency Maps With Final Focus









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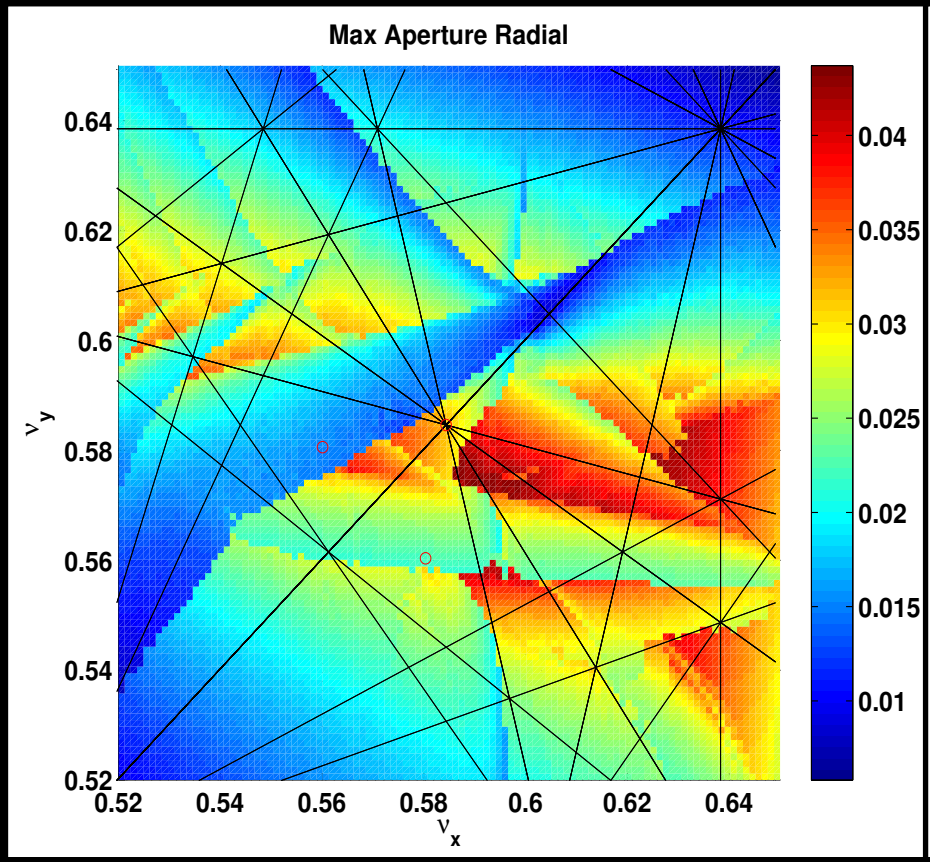
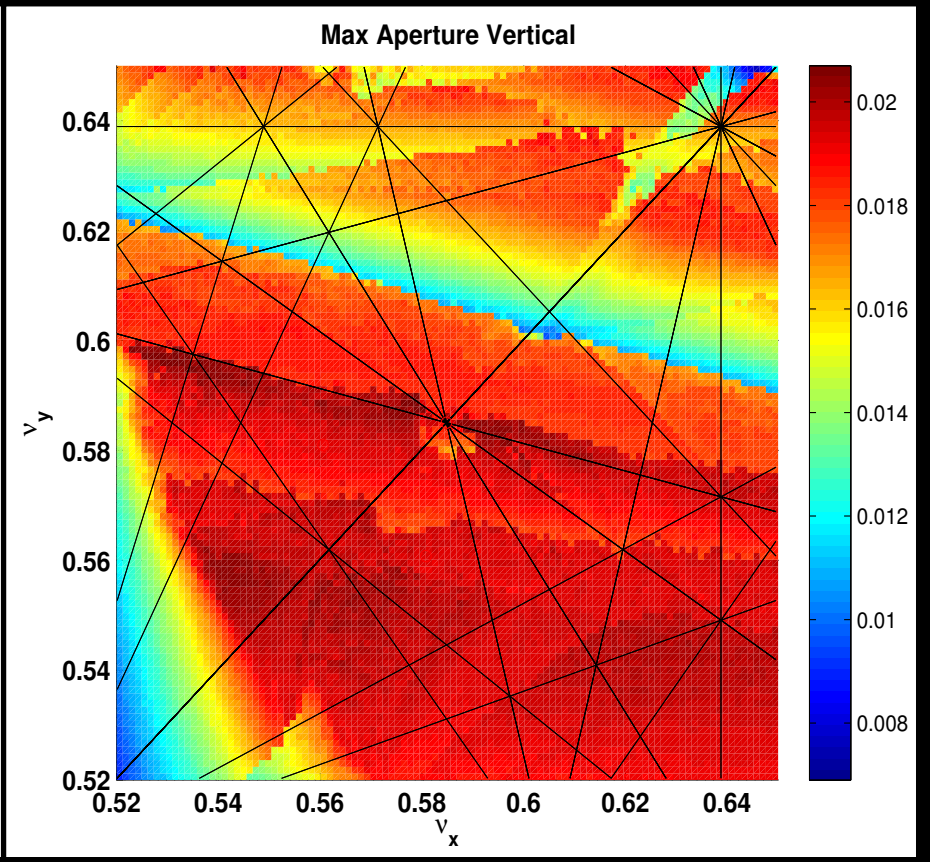
Conclusion

- ST20_49 tracking requires the inclusion of fringe fields and kinematic terms, particularly influent in the QD0 and QF1.
- Energy acceptance at more than +-2%
- Effect of fringe field is mostly due to the FF doublet.
- Influence of errors (see next presentation)
- Dynamic apertures H 15 mm V 15 mm with FF
- DA vs Tune scan shows alternative points with larger apertures. True for various error seeds with correction.
- Frequency map show small detuning in all directions and small diffusion

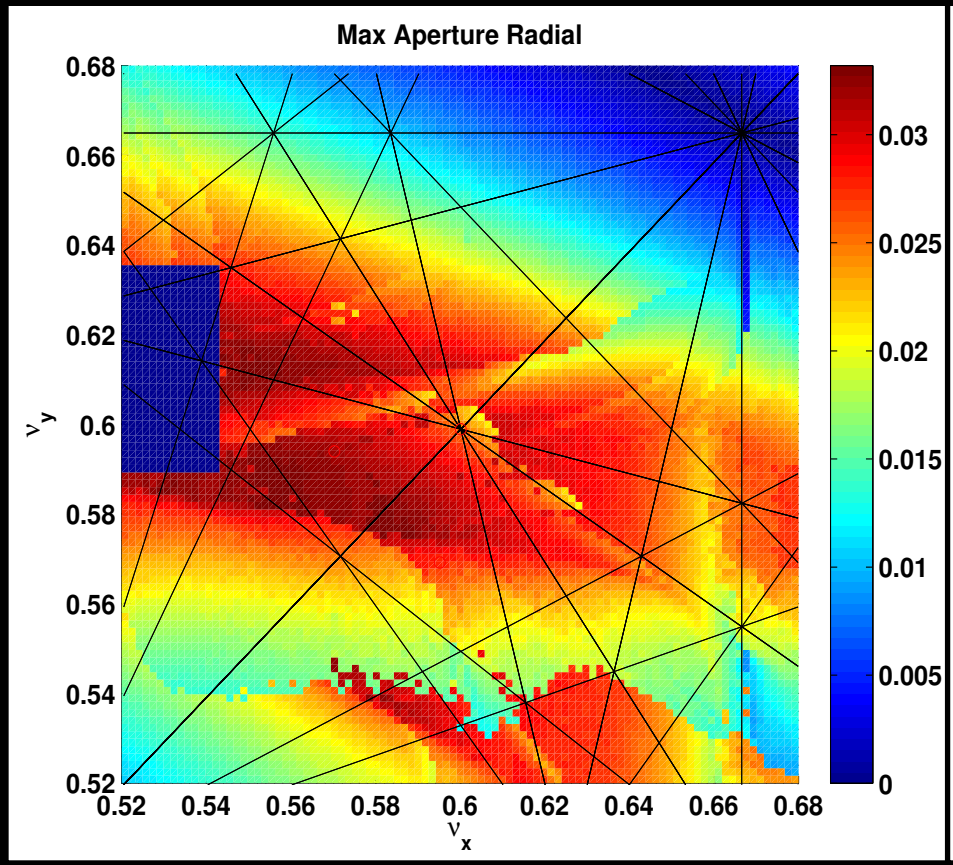
Max Amplitude X and Y versus tune

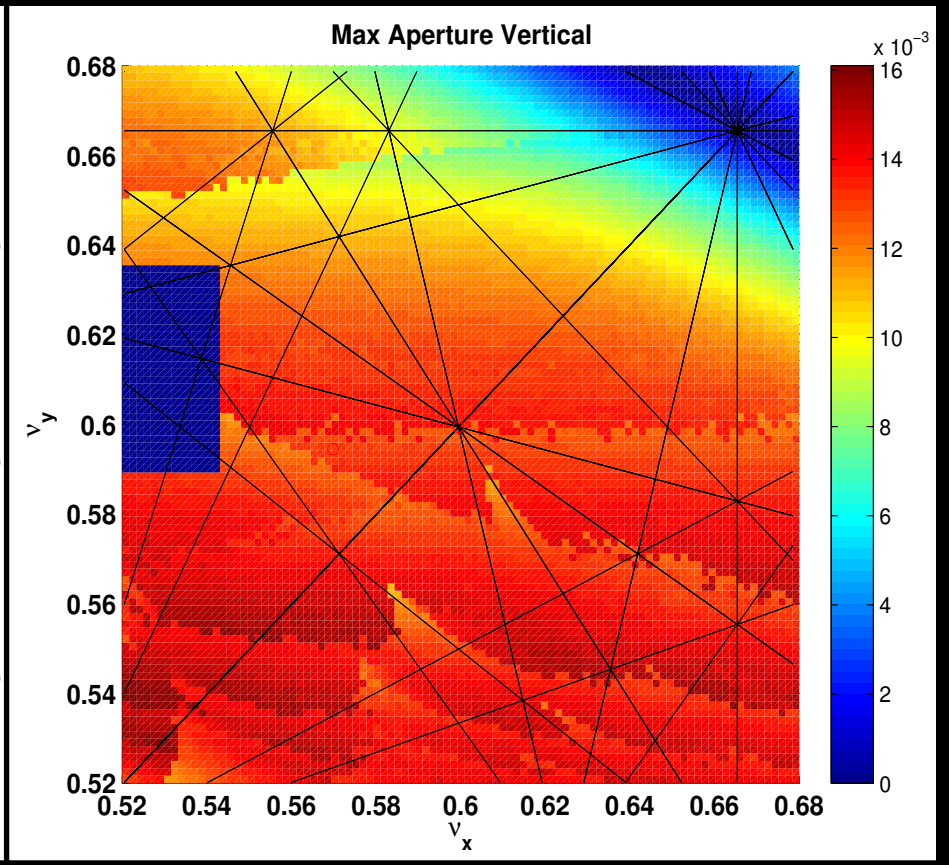




No fringe fields. No Errors. Tune changed with matching routine.

Max Amplitude X and Y versus tune





With fringe fields. No Errors. Tune changed with matching routine.