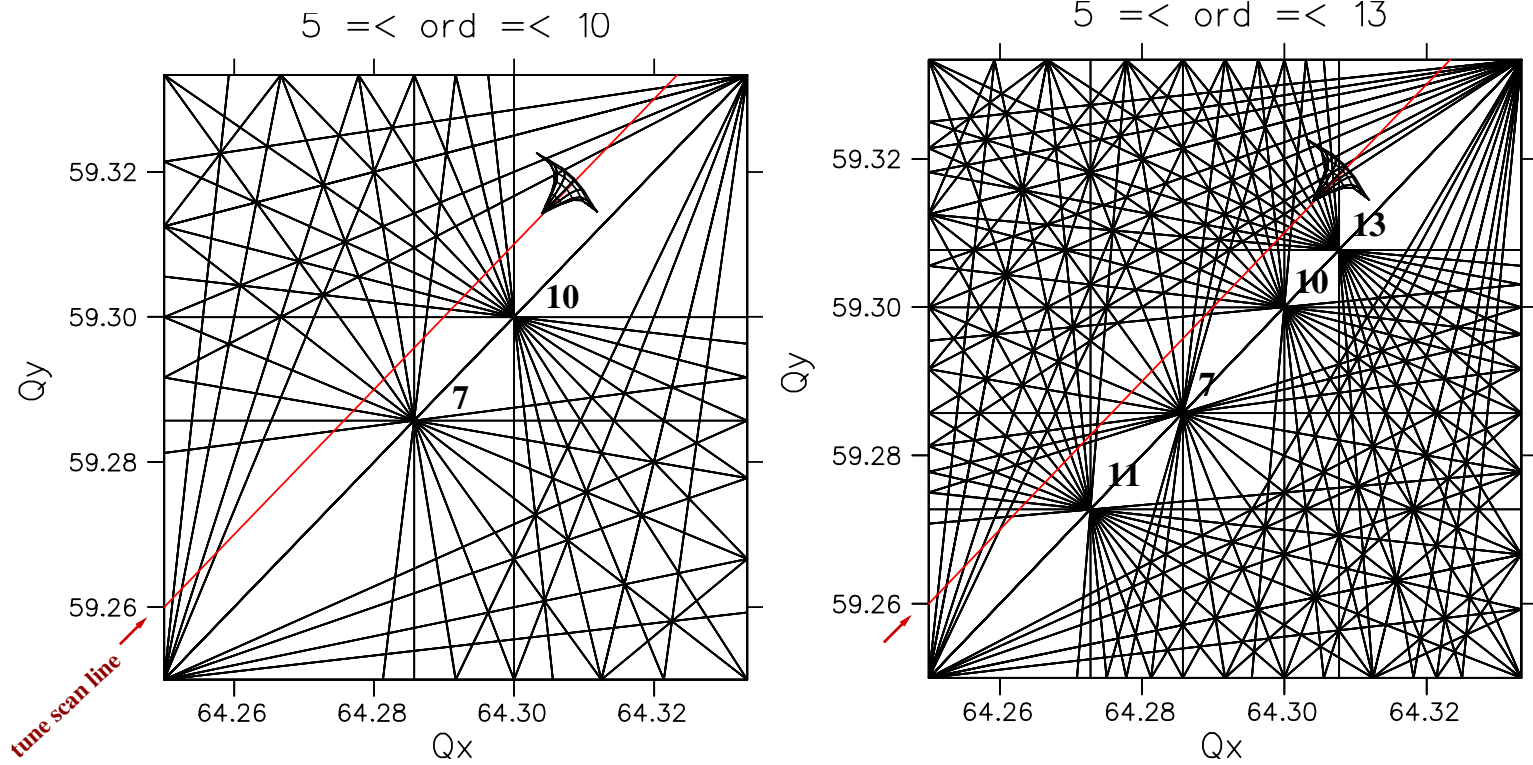


Tune scans from 0.25 to 0.33 with Beam-beam Interactions, Triplet Field Errors and Correction

W.Herr, E.Mcintosh, D. Kaltchev

Dec 2005

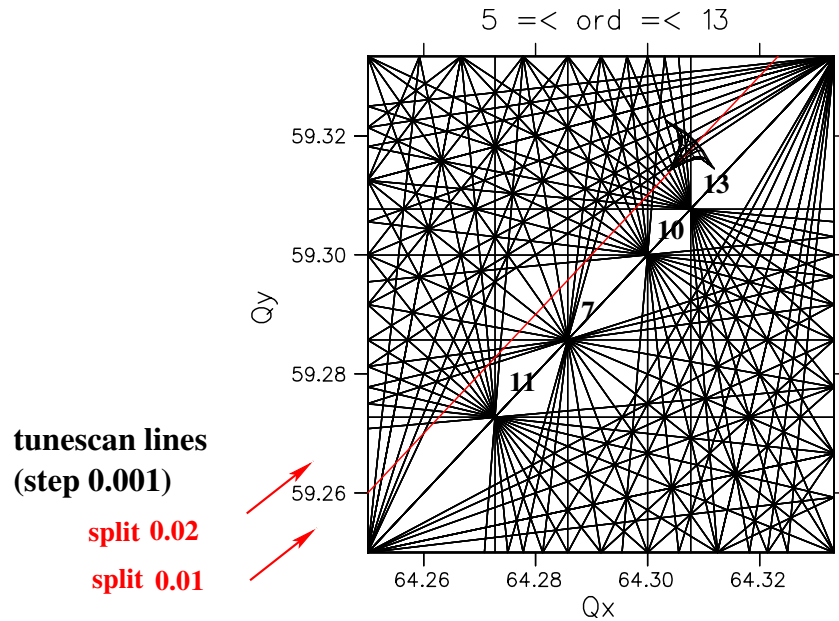
the .25-.33 square



resonances up to order 10 (left) and 13 (right)

Tracking setup:

1. optics V6.4 (MCX2 corrector moved);
2. crossing at IP1 and IP5: either HV or HH (2 cases) ← W.Herr's scripts (MadX)
3. head-on and long-range ← same scripts
4. either nominal or pacman bunch (2 cases) ← same scripts
5. error table is 0210
6. field errors to triplet quads MQX and MQXL (all on-flags > 2 ord. = 1)
7. triplet correction is on in all four IPs ← Stephane's script
8. Sixtrack: 10^6 turns, 20 seeds



tunescan lines
(step 0.001)

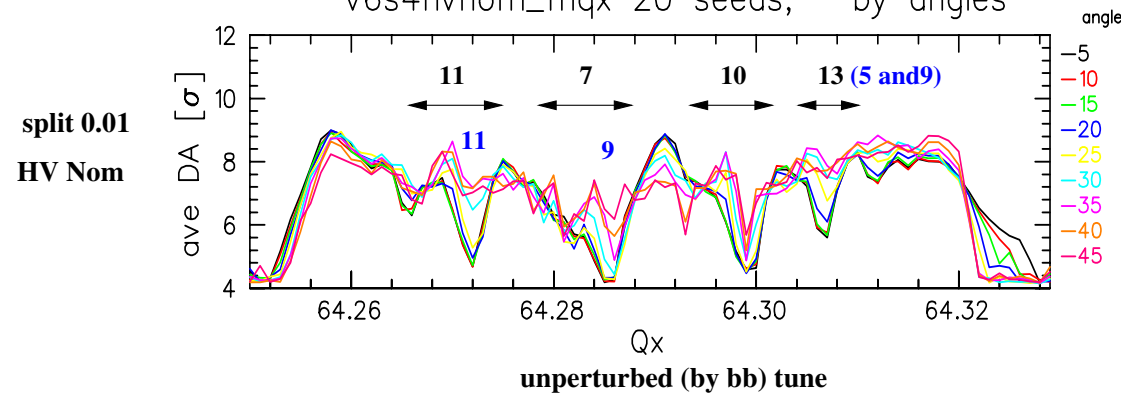
split 0.02

split 0.01

Average Dyn. Aperture (DA), 10^6 turns

20 seeds triplet errors and corr. nominal bunch hor.-vert. crossing IP1 and 5
shown angles 0 - 45 deg

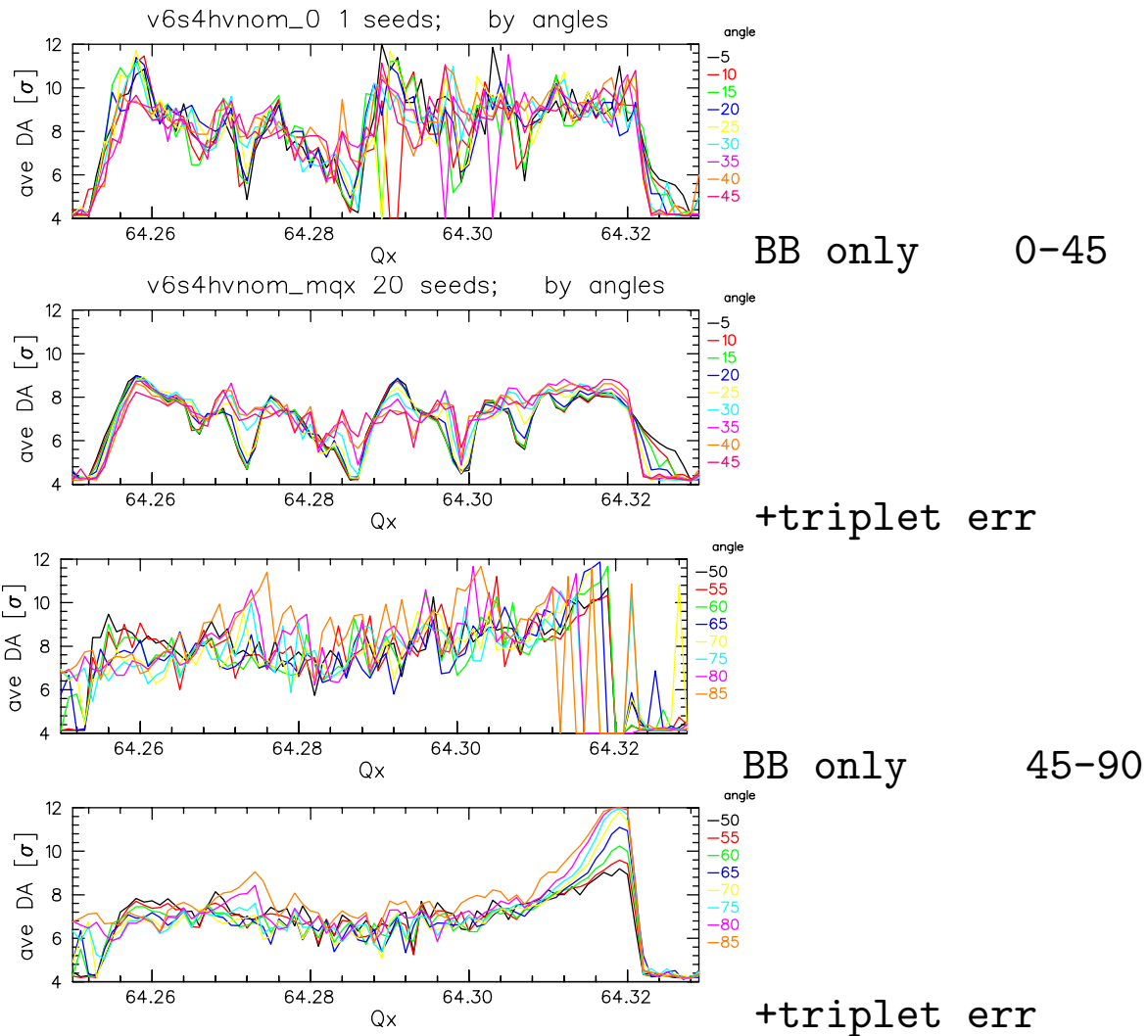
v6s4hvnom_mqx 20 seeds; by angles

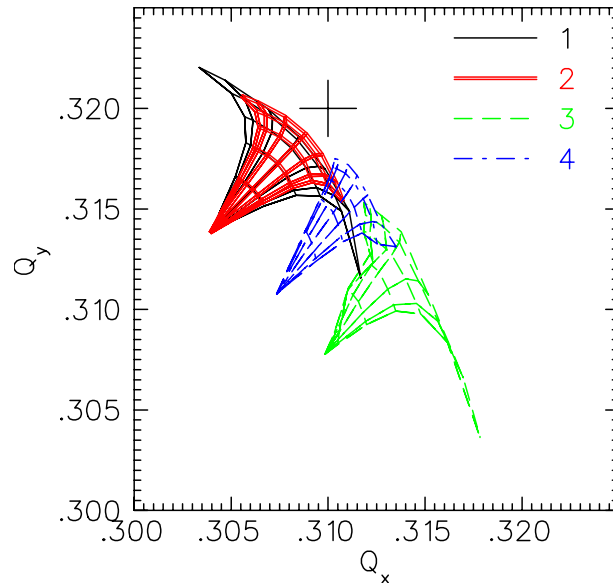


BB-only compared with BB + corrected triplet field err. (20 seeds)

Very similar tune dependence! (here case HV-Nom; split=0.01)

top two: 0-45 deg; bottom two: 45-90 deg





case		IP 1-5 crossing	bunch
1	HV Nom	vertical-horizontal	nominal
2	HV Pac	vertical-horizontal	pacman
3	HH Nom	horizontal-horizontal	nominal
4	HH Pac	horizontal-horizontal	pacman

here “pacman” = extreme pacman (all parasitic coll. are off on the right of IP)

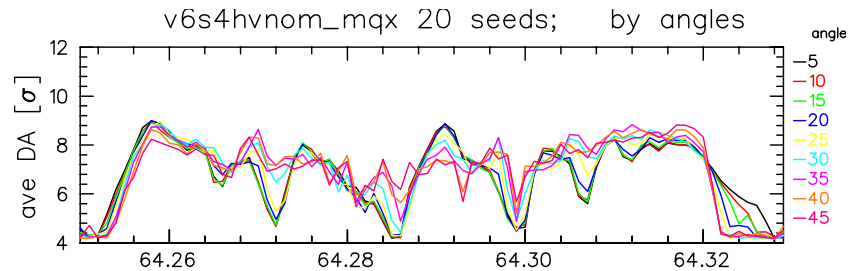
During tracking all 4 are placed in equal cond. w.r.t. resonances

⇒ we put sharp ends on the same tune-scan point.

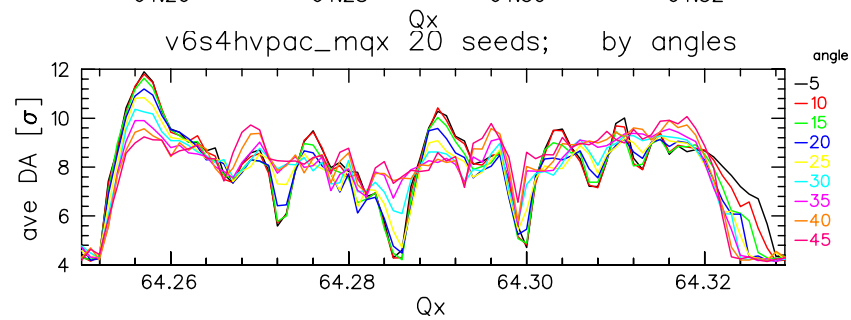
We keep in mind that this favors the HH Pac (case 4) a little.

**In reality, a HH machine is tuned wrt nominal (3), so the HH Pac (4) falls into
higher tune and dense resonances**

The 4 cases (split 0.01): BB+tripl.err+corr.(20 seeds). Average DA angles 0-45 deg.

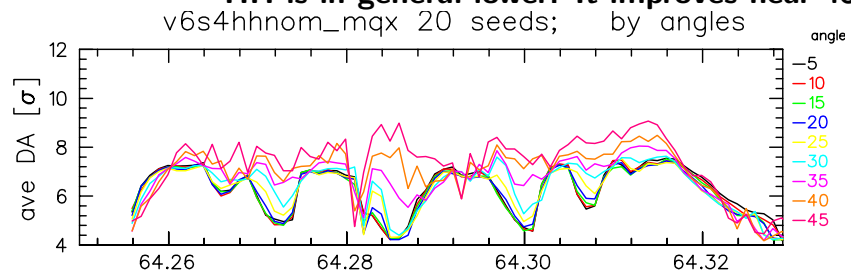


HV Nom

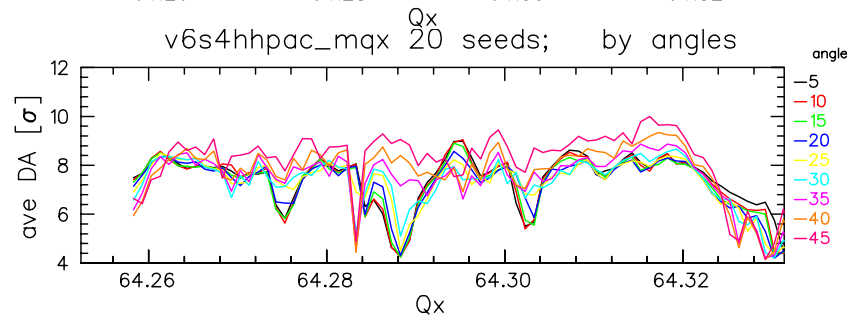


HV Pac

HH is in general lower. It improves near 45:



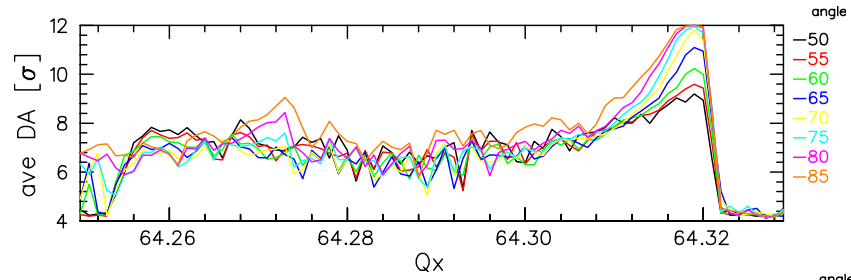
HH Nom



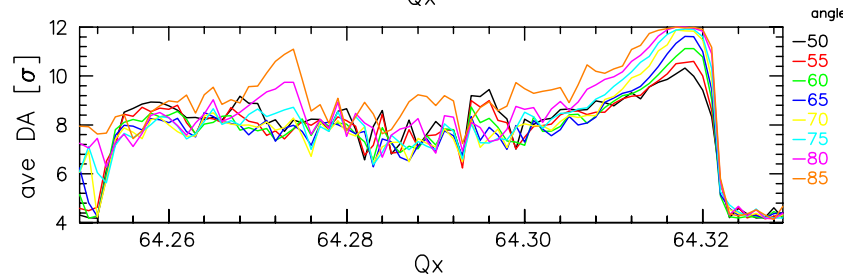
HH Pac

The same 4 cases (split 0.01): Average DA

angles 45-90 deg.

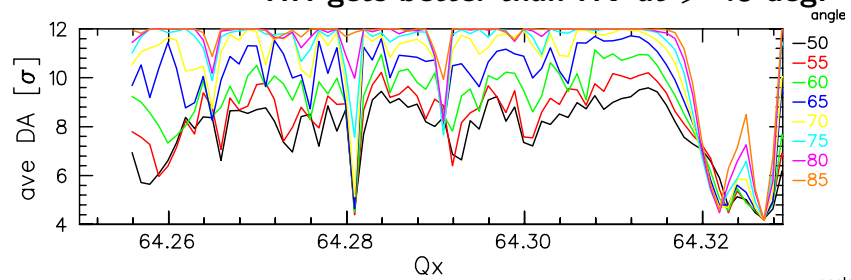


HV Nom

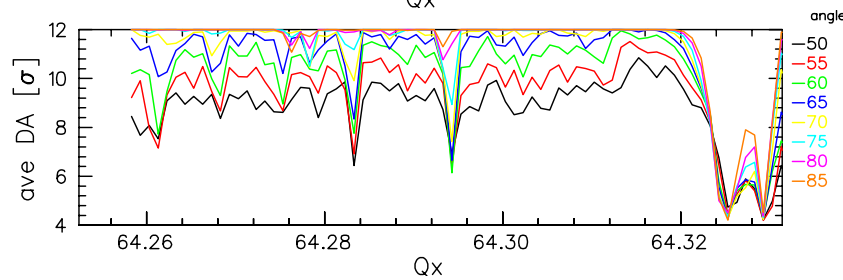


HV Pac

HH gets better than HV at > 45 deg:



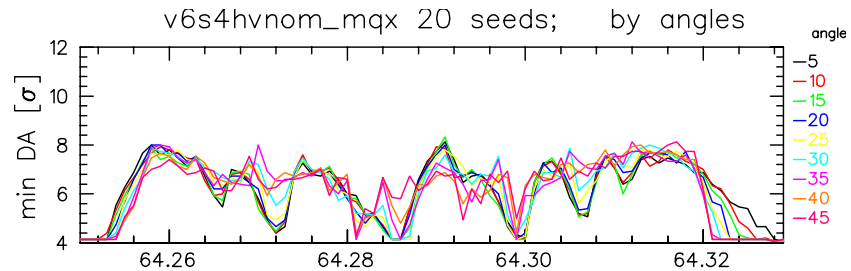
HH Nom



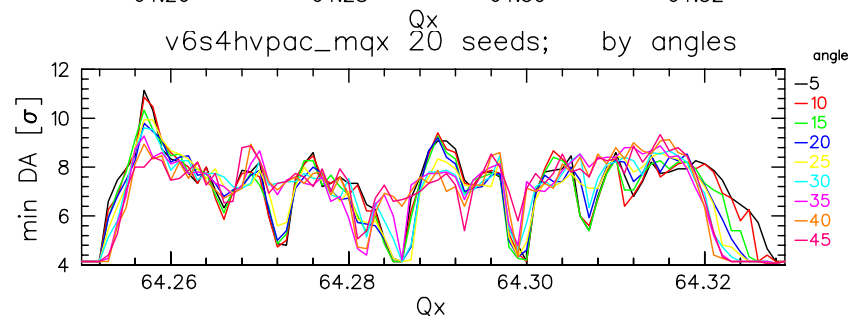
HH Pac

The same 4 cases (split 0.01): Min DA

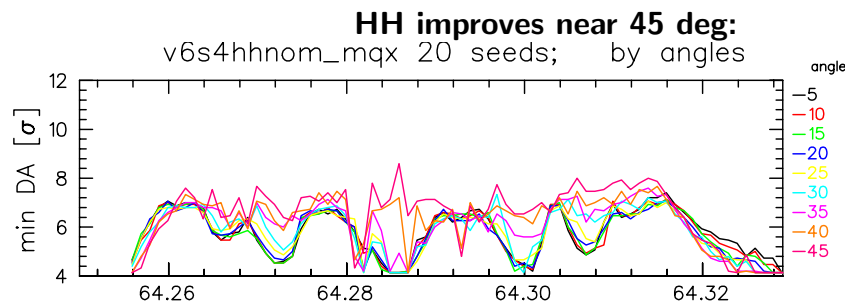
angles 0-45 deg.



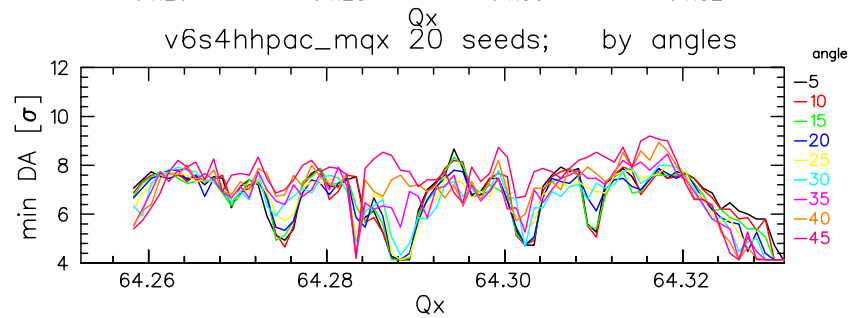
HV Nom



HV Pac



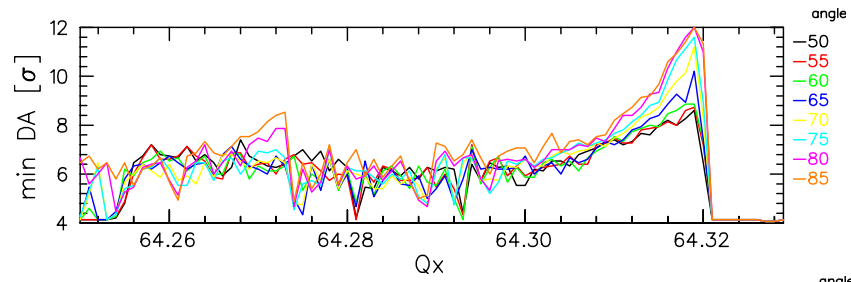
HH Nom



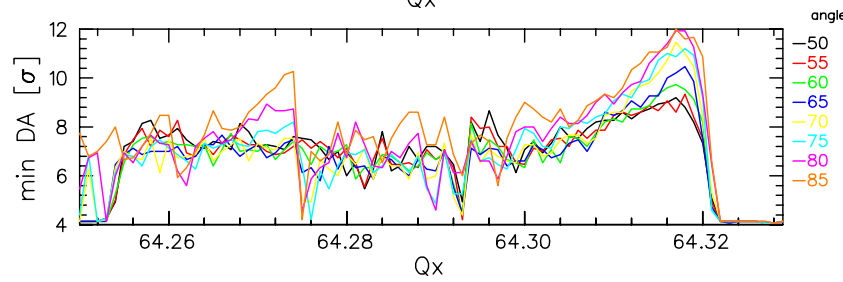
HH Pac

The same 4 cases (split 0.01): Min DA

angles 45-90 deg.

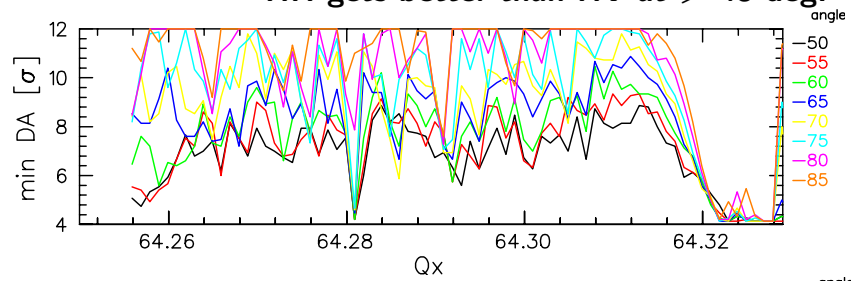


HV Nom

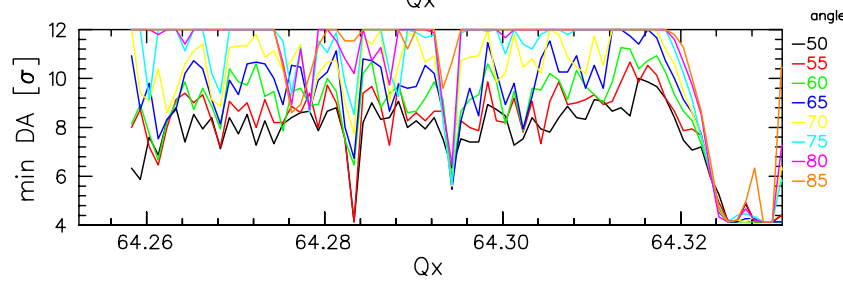


HV Pac

HH gets better than HV at > 45 deg:



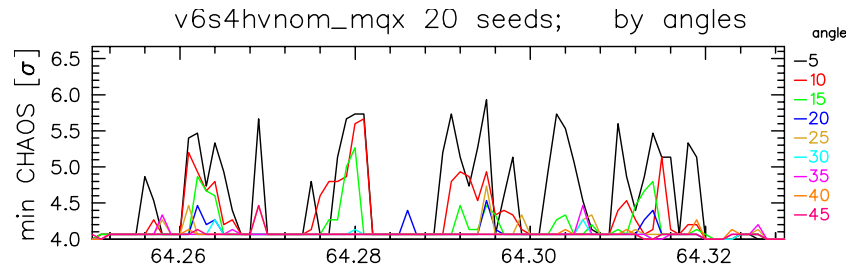
HH Nom



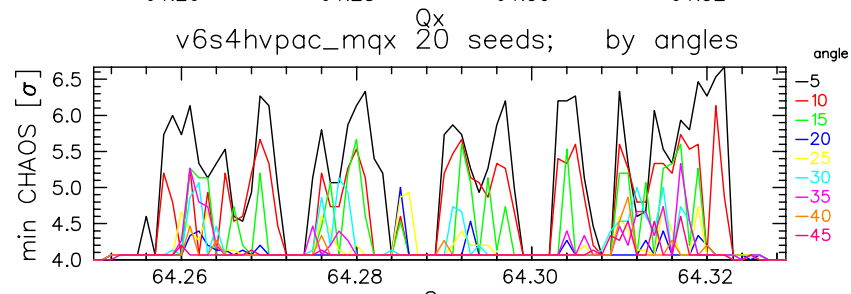
HH Pac

The same 4 cases (split 0.01): Min CHAOS border

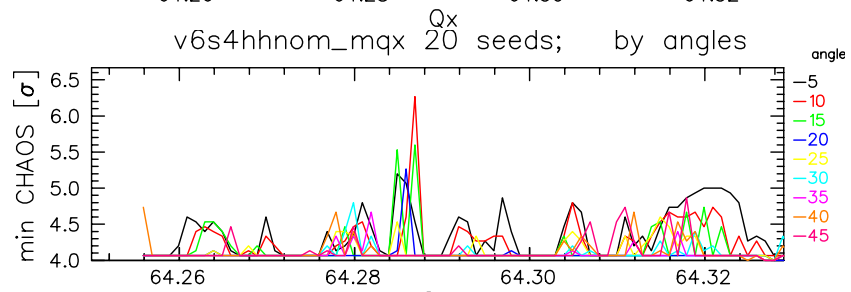
angles 0-45 deg.



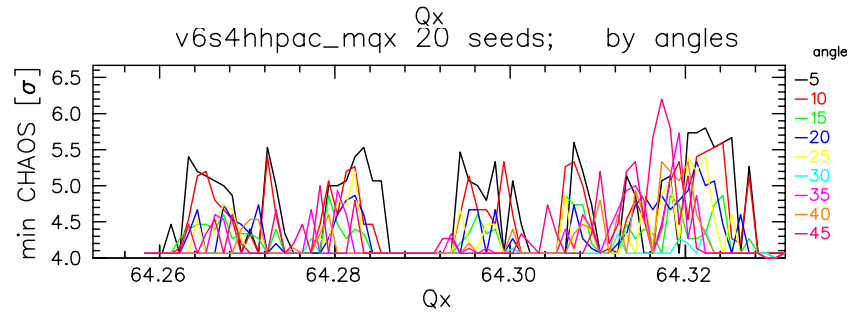
HV Nom



HV Pac



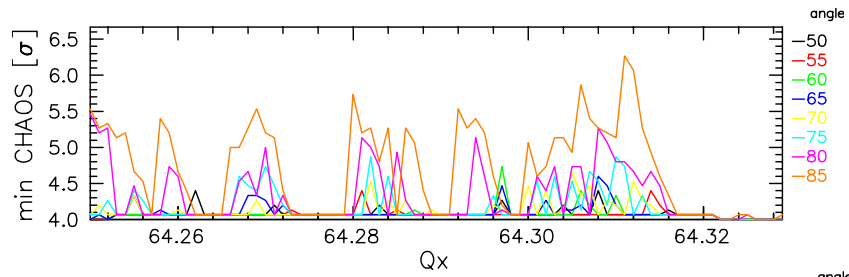
HH Nom



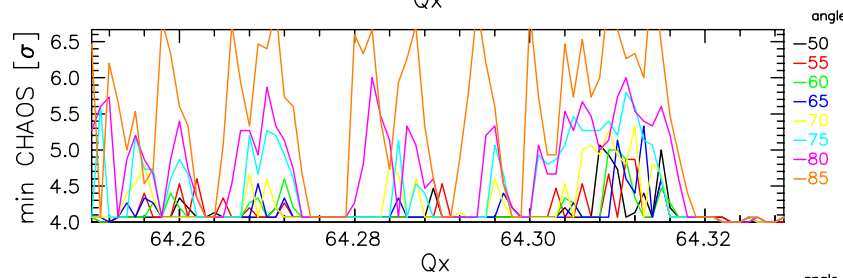
HH Pac

The same 4 cases (split 0.01): Min CHAOS border

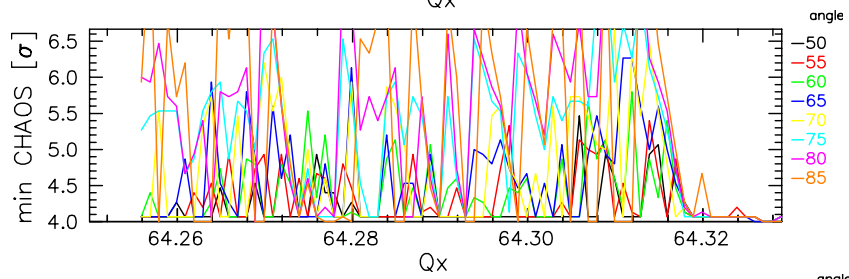
angles 45-90 deg.



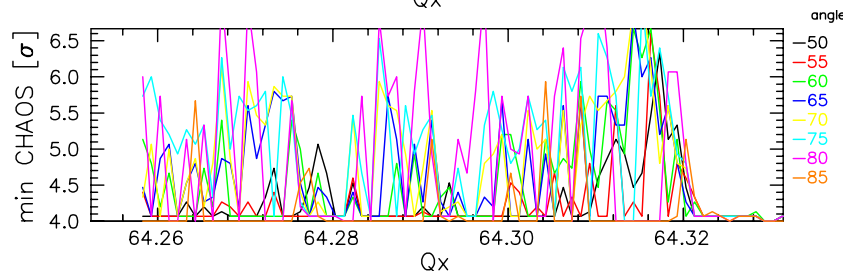
HV Nom



HV Pac

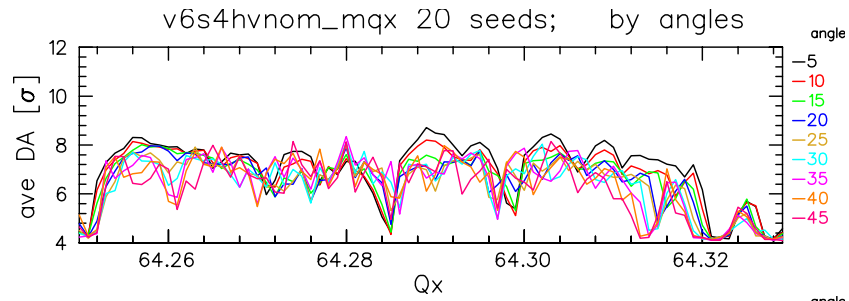


HH Nom

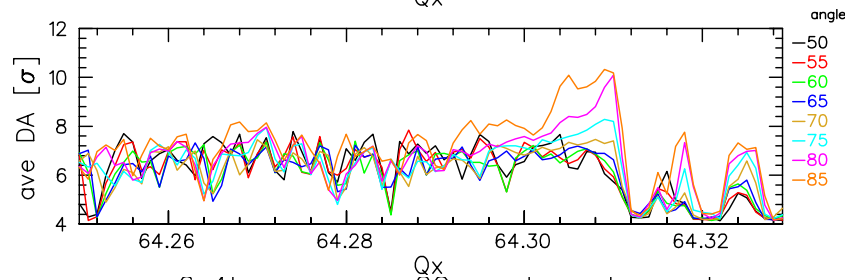


HH Pac

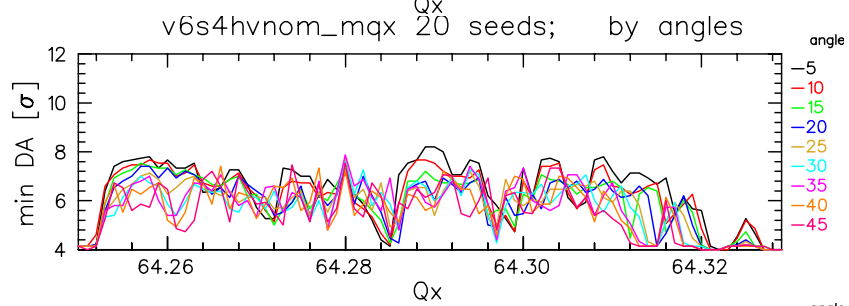
split=0.02 Case 1 (HV Nom) only; Ave DA and Min DA angles 0-90 deg.



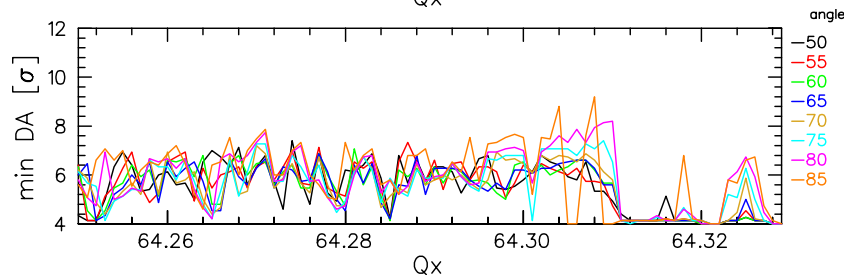
Ave DA



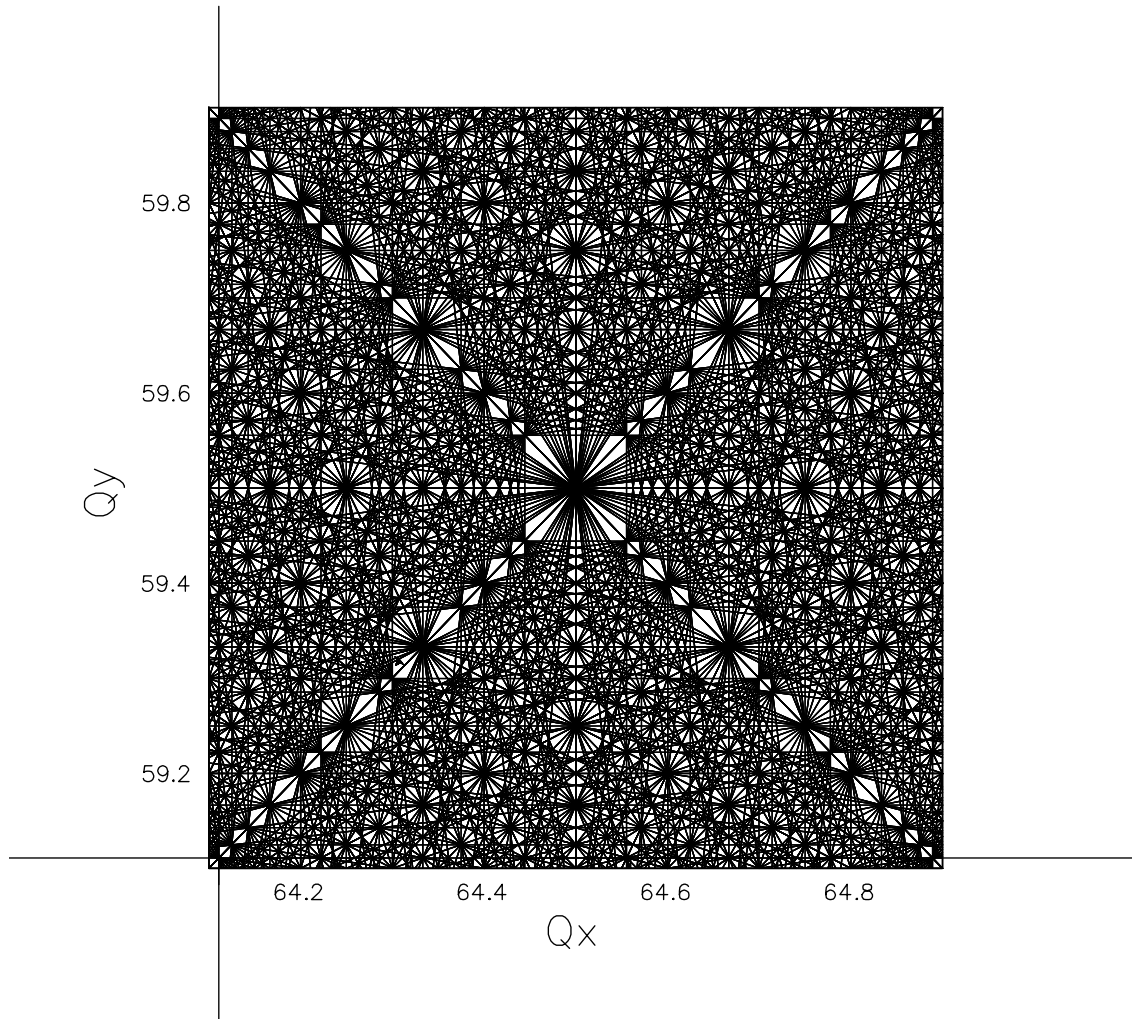
Ave DA



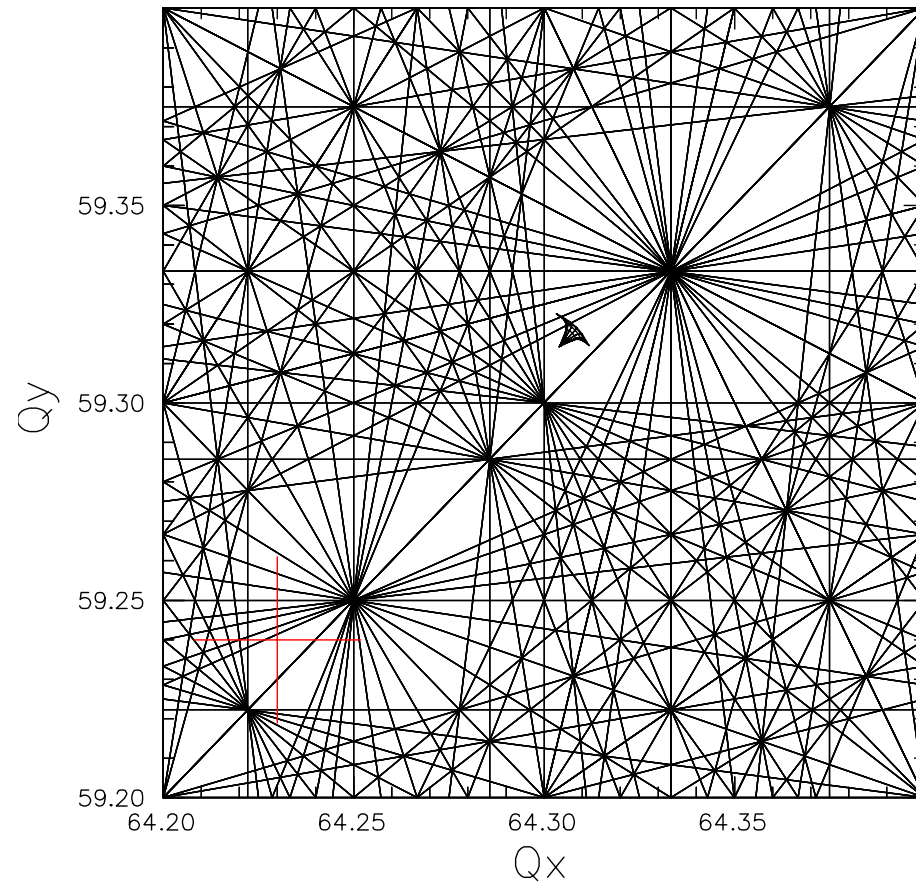
Min DA



Min DA



resonances ord 5 to 10



in future: possible scan near $Q_x=64.23$

Observations

1. BB force versus triplet field errors
 - with corrected triplet field errors the tune dependence of DA is dominated by the Beam-Beam forces;
 - well seen the effect of dense-resonance regions, as well as individual res. such as orders 7 and 9
 - the above effect is mostly in the horizontal plane
2. HV compared to HH
 - no significant difference
 - DA of HH has large spread in angles, it is better in the vert. plane
 - in any case HH has a larger tune-print
 - there is no better alternative working point for HH
 - HH seems less stable – chaos border too low below 45 deg