



# Investigations of the phase space at the collimators (B2V)

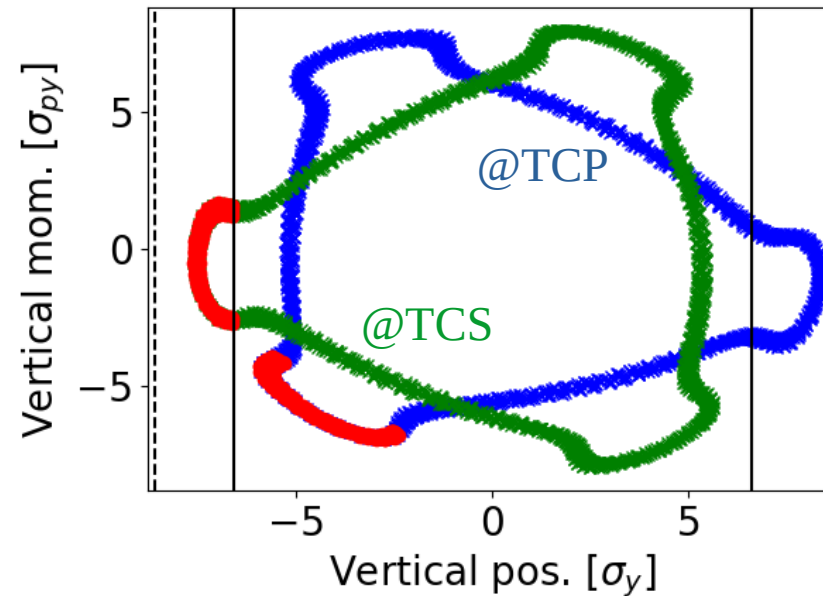
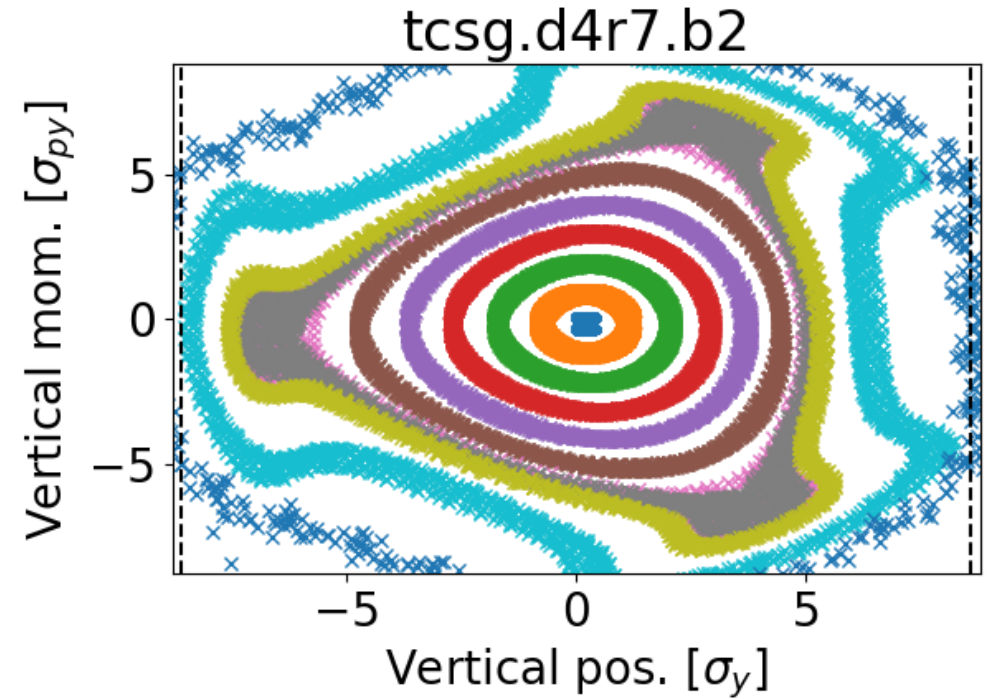
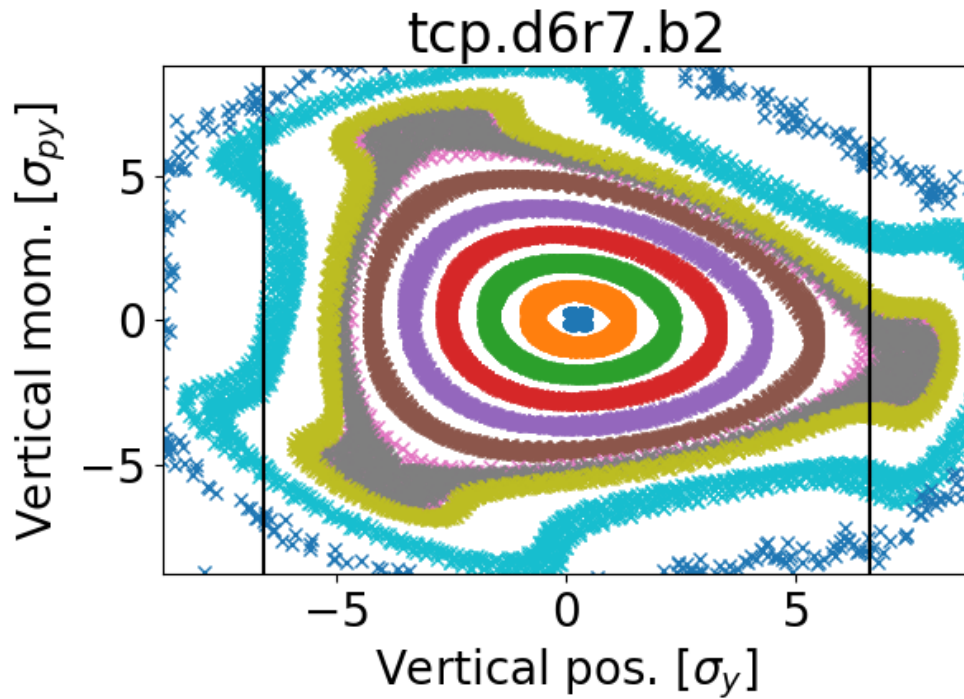
X. Buffat and K. Paraschou

- Model
- Phase-space longitudinally frozen
- Phase-space with longitudinal motion

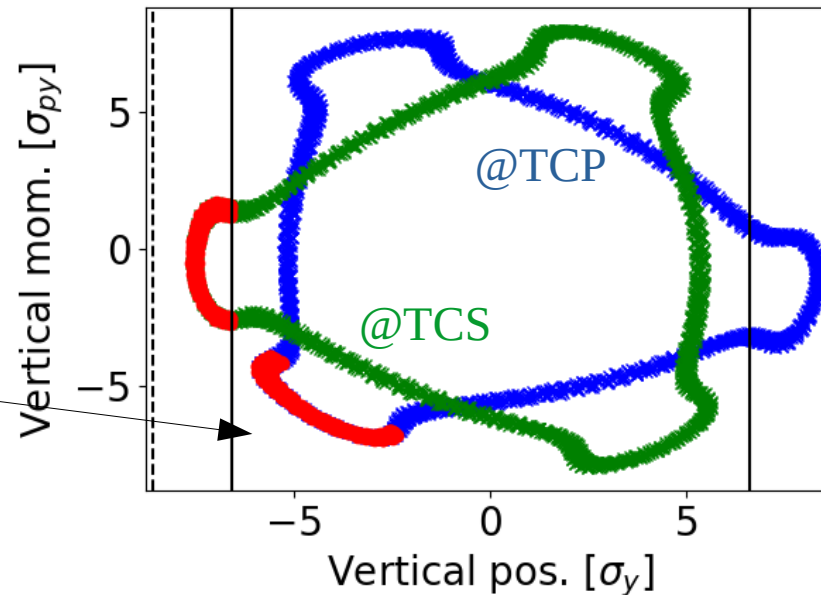
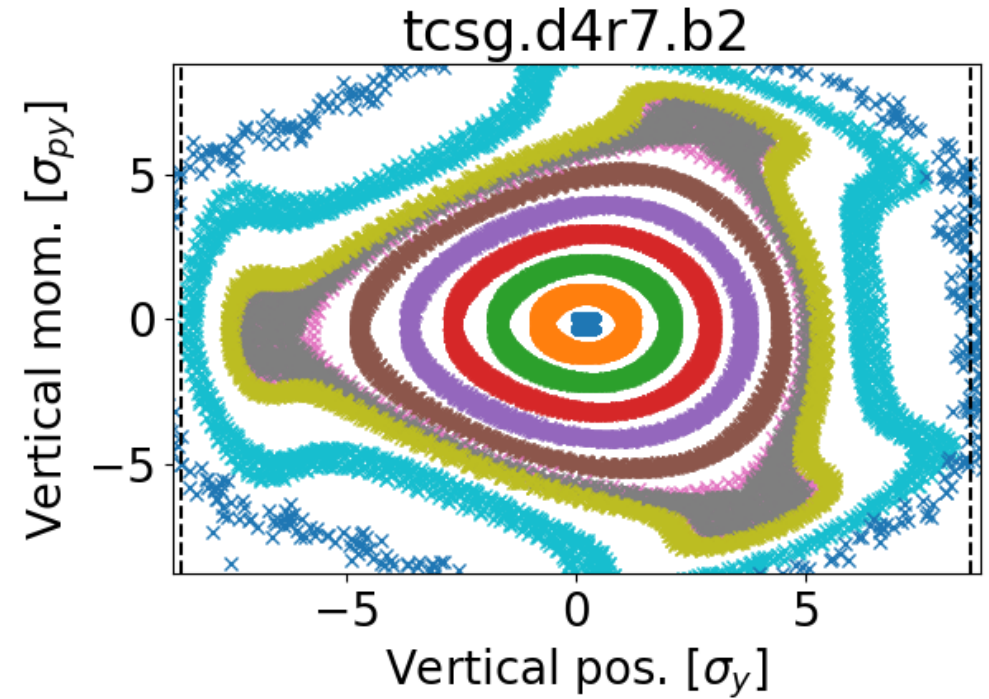
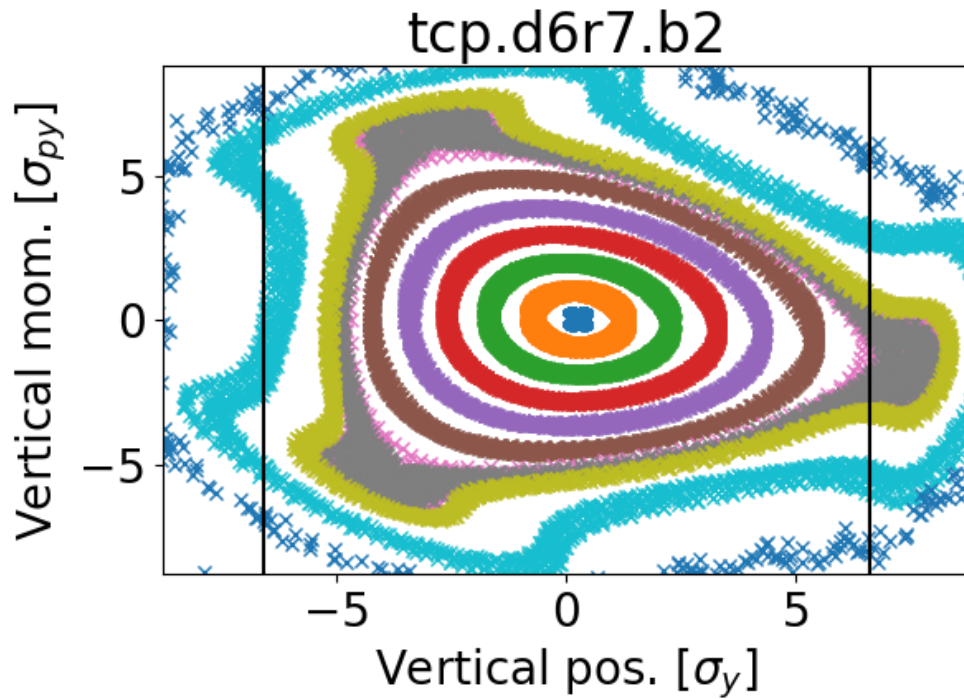
# Model

- Xsuite + Xmask
  - /afs/cern.ch/eng/lhc/optics/runIII/RunIII\_dev/Proton\_2024/opticsfile.43
  - All beam-beam interactions, including separated IP2 and 8, weak-strong model without orbit effect subtracted
  - Tunes: 0.31/.32
  - Chroma 20
  - Octupoles: 300A
  - dpp 2E-4
  - No machine errors

# Off momentum phase space with frozen longitudinal motion

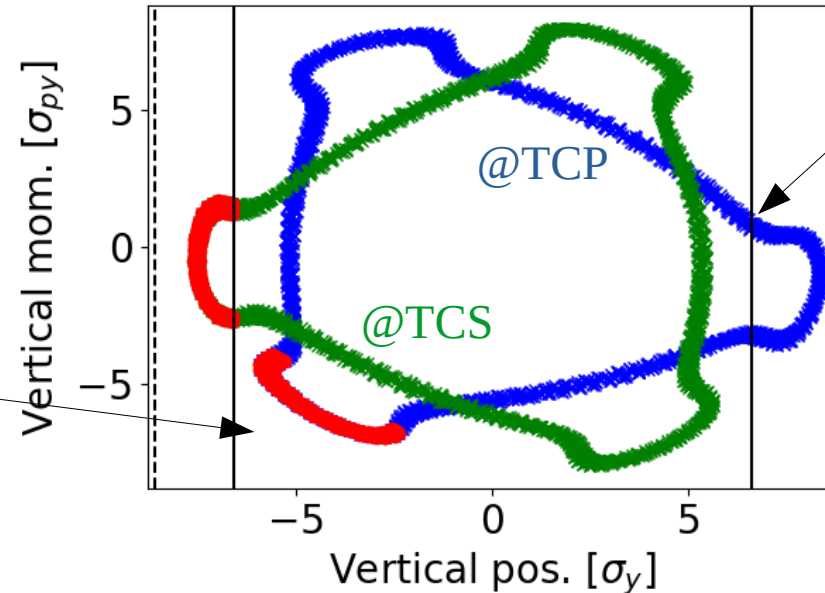
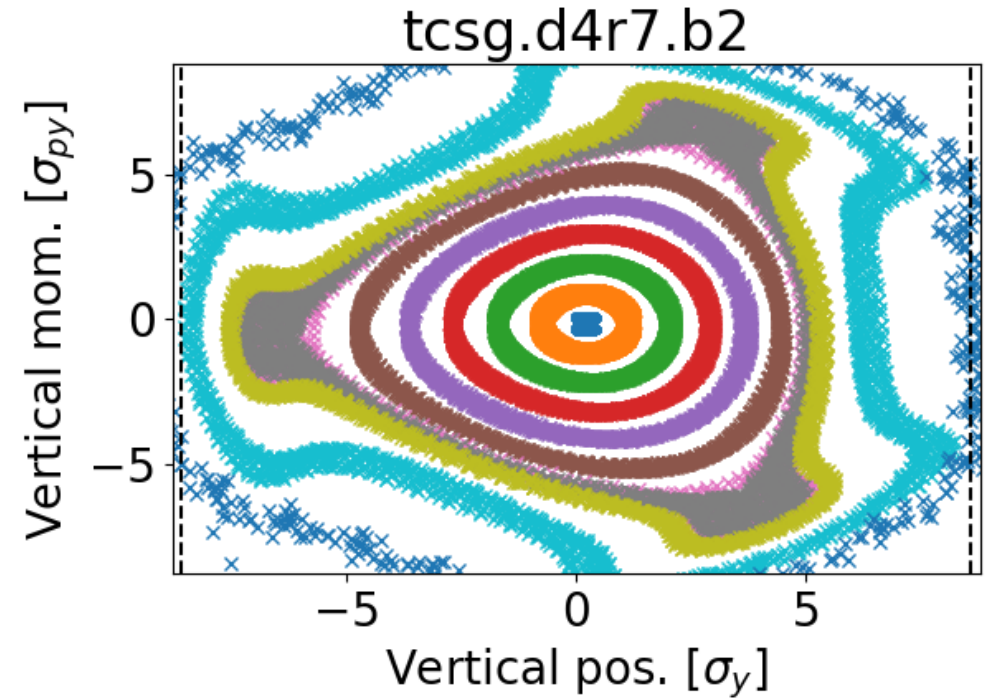
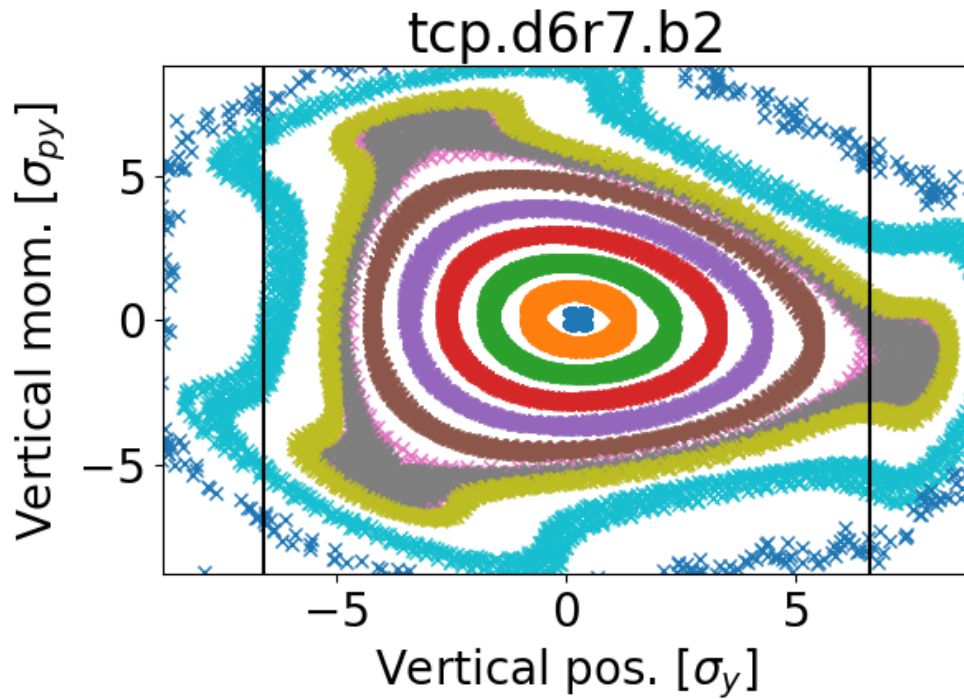


# Off momentum phase space with frozen longitudinal motion



Particles highlighted in red end up beyond the primary cut at the secondary in the same turn by about  $1.5\sigma$  → There indeed exists trajectories that can break the hierarchy

# Off momentum phase space with frozen longitudinal motion

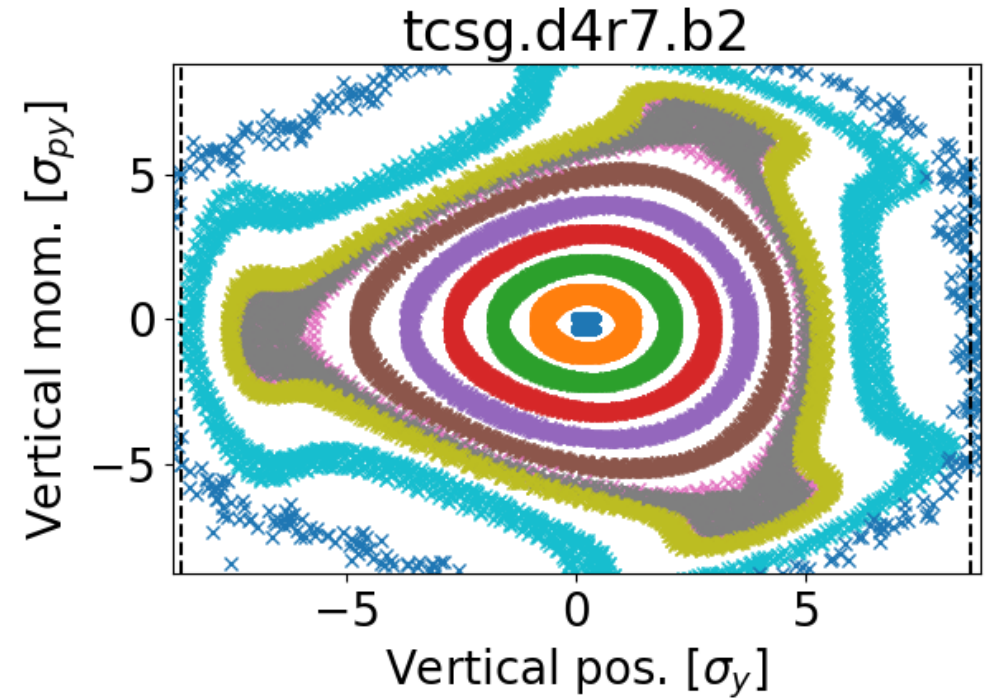
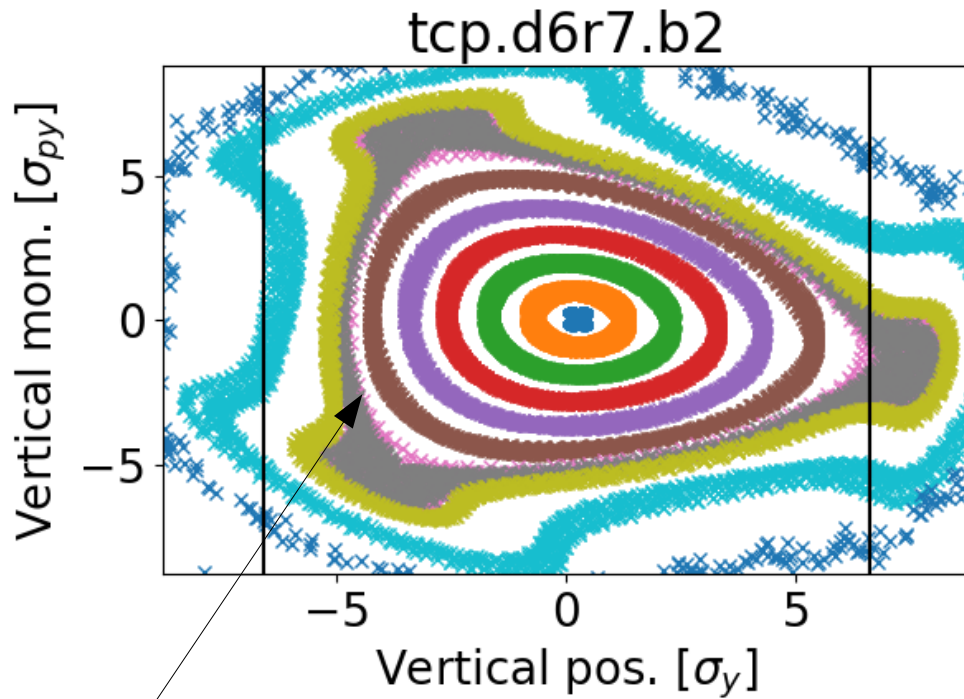


Particles highlighted in red end up beyond the primary cut at the secondary in the same turn by about  $1.5\sigma$  → There indeed exists trajectories that can break the hierarchy

However, when diffusing from the core, I would expect particles to be lost here first (spanning many phases while doing betatron motion)

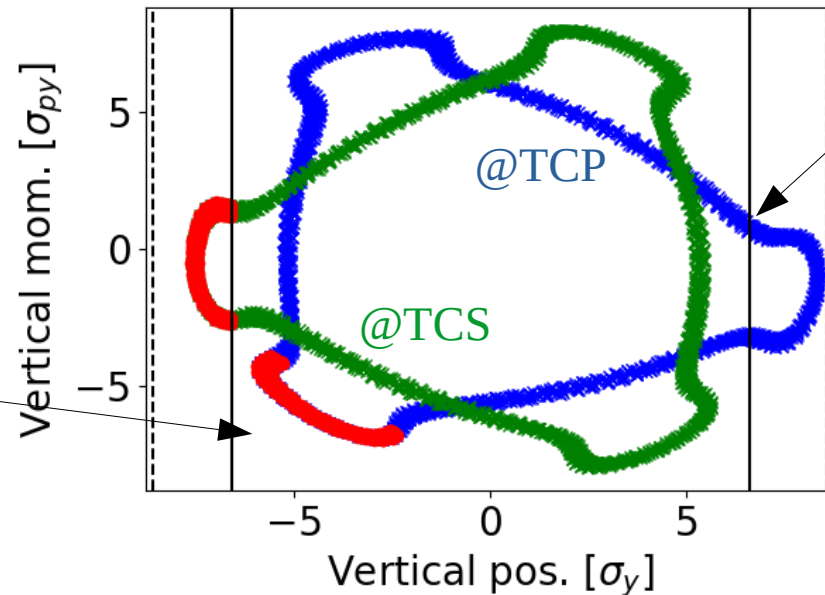


# Off momentum phase space with frozen longitudinal motion



There seems to be a sharp transition from 'regular' trajectories (brown) to distorted ones (pink/grey/yellow). Maybe if the diffusion is fast, some particles manage to avoid the primary and hit the secondary before?

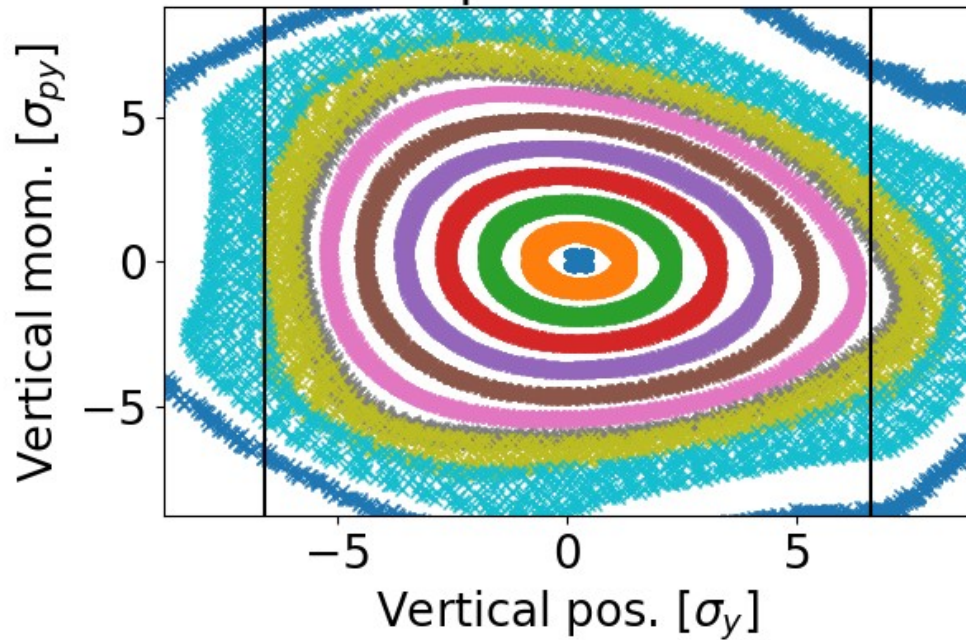
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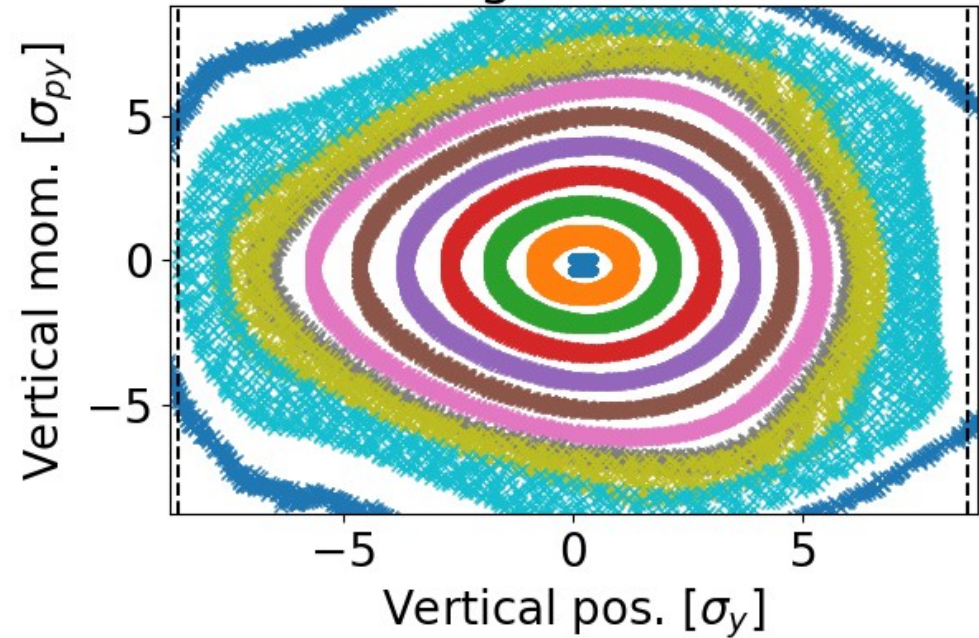
However, when diffusing from the core, I would expect particles to be lost here first (spanning many phases while doing betatron motion)

# Impact of lower tunes: 0.305/0.315

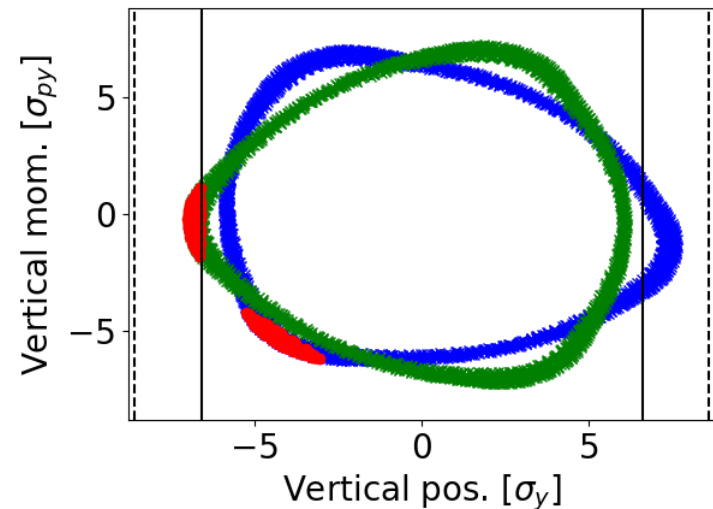
tcp.d6r7.b2



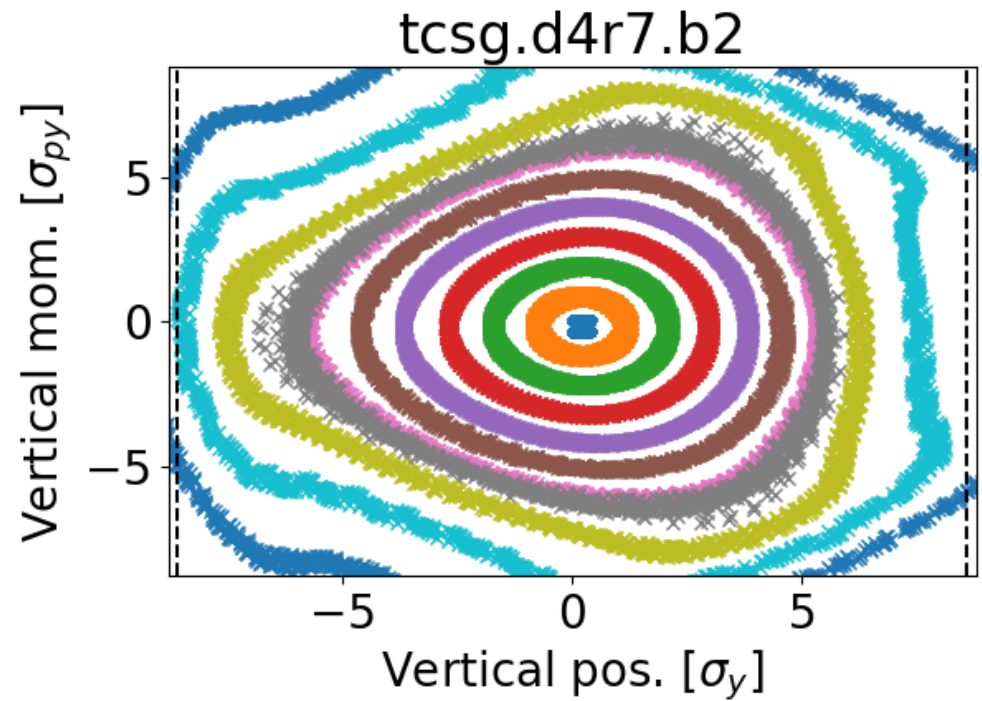
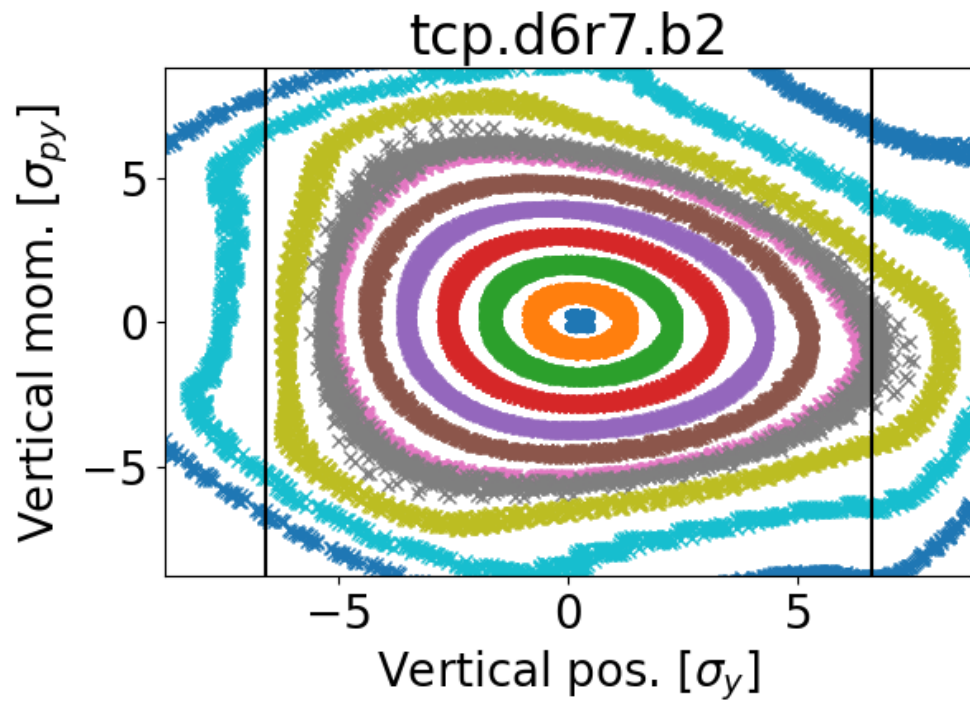
tcsg.d4r7.b2



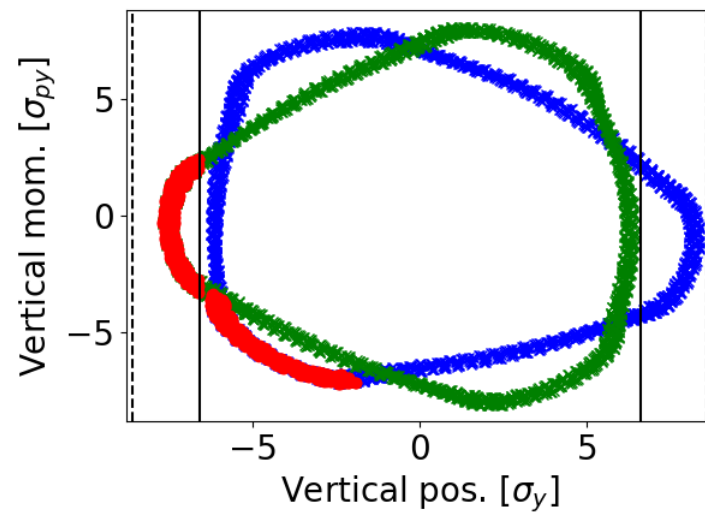
If the weird excursions are the issue, moving the working points away from the diagonal helps



# Impact of lower chroma: 5

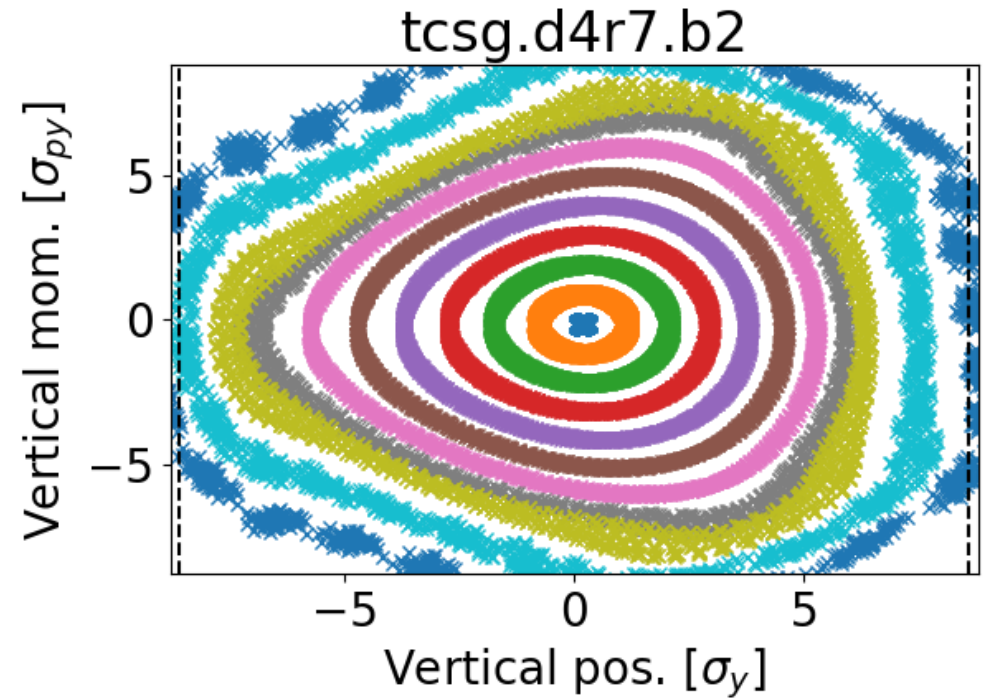
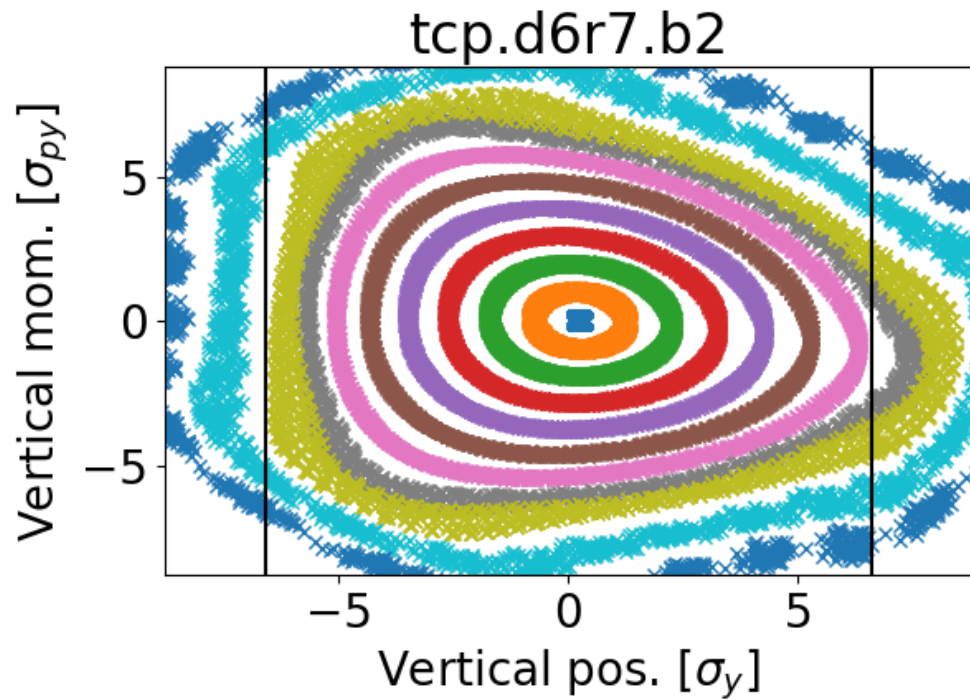


Weird excursions are also attenuated by lower chroma, but not fully





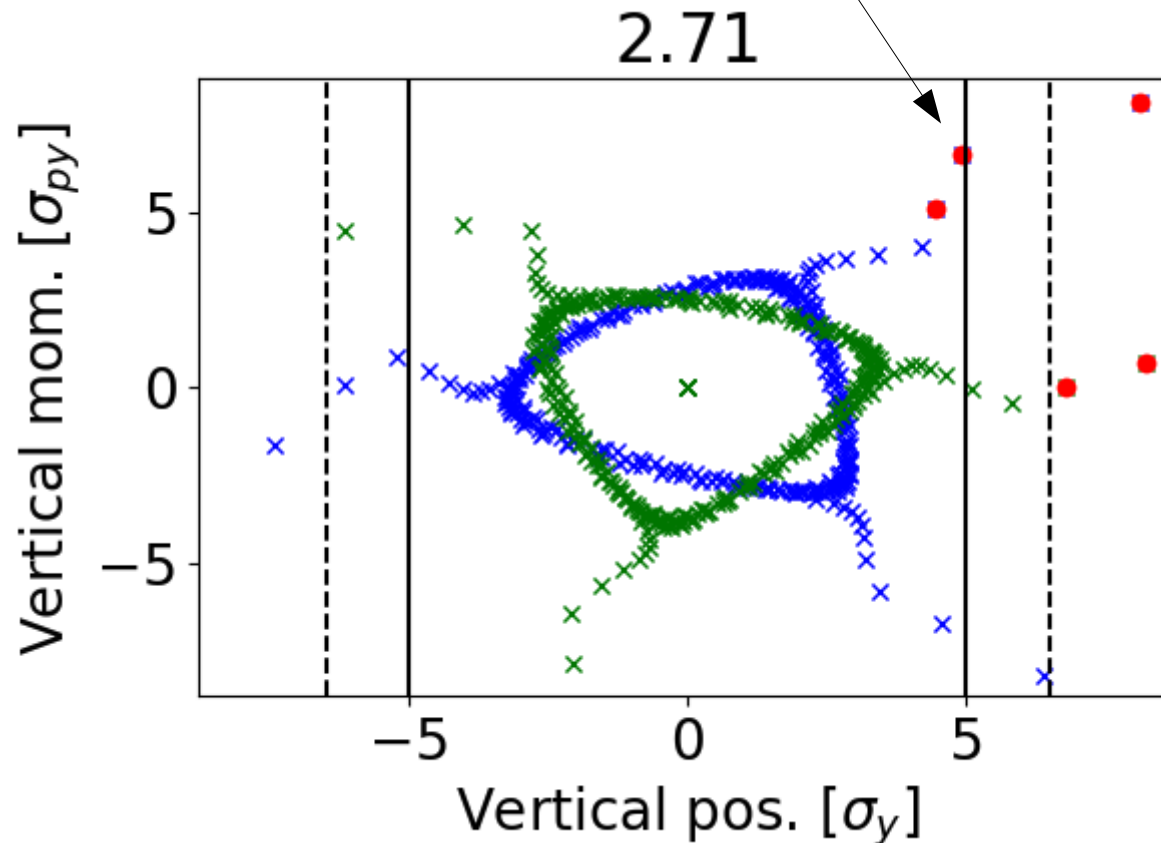
# Impact of octupoles: 0A



Removing octupoles also helped (which wasn't the case in the end-of-fill tests. However I suspect that an interplay with the triplet non-linearities could change the picture...)

# With longitudinal motion and some triplet errors

After the separatrix, the diffusion (rather extraction?) may occur in few turns, thus missing the TCP



→ Need to refine error model and understand what proportion of phase space can be lost in this manner

# Same as first slide but on momentum

