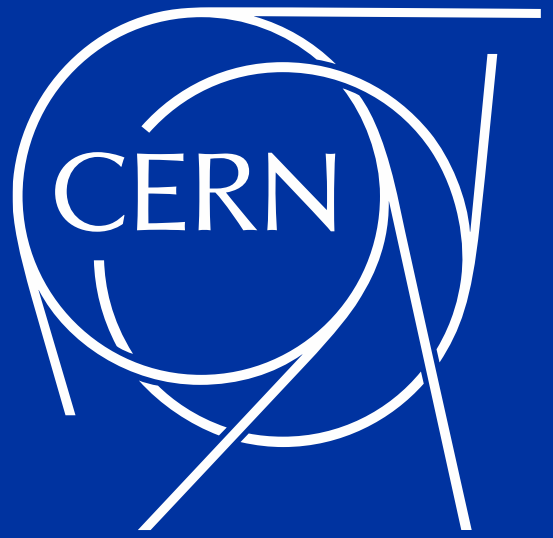
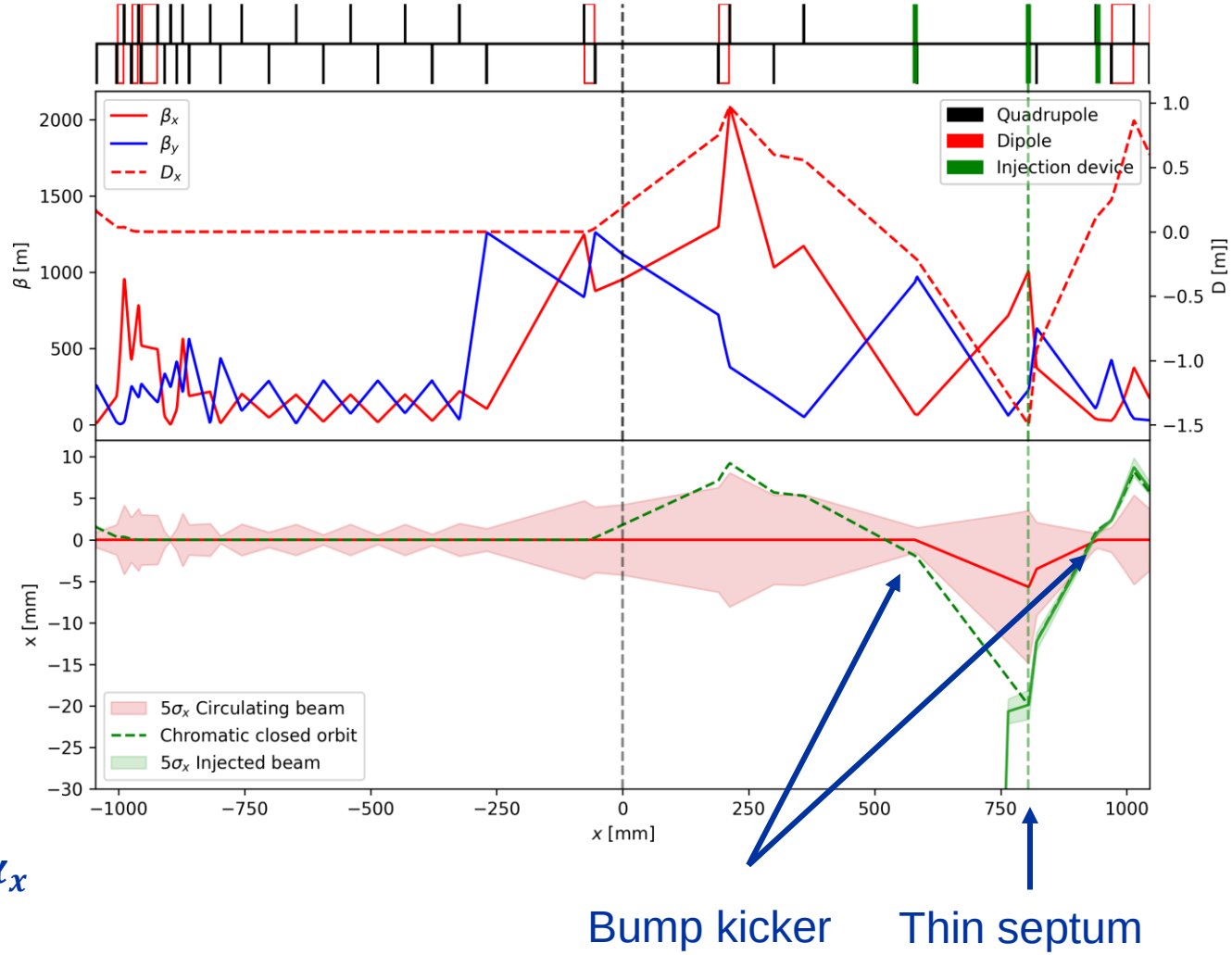

CERN

Injection point change

Sen Yue (SY-ABT-BTP)

Conventional on-axis injection scheme

- Two set of bump kickers to make a π mode orbit bump
- **Thin septum located inside of F quad: qi6.1**
  - Dx: 1.5 m, β_x: 1000 m
  - Small **Dpx, α_x: ~ 0**
- Possible solutions for septum installation
  - Split the F quad ➡ Redesign lattice
  - Put the septum at upstream with large **Dpx, α_x**



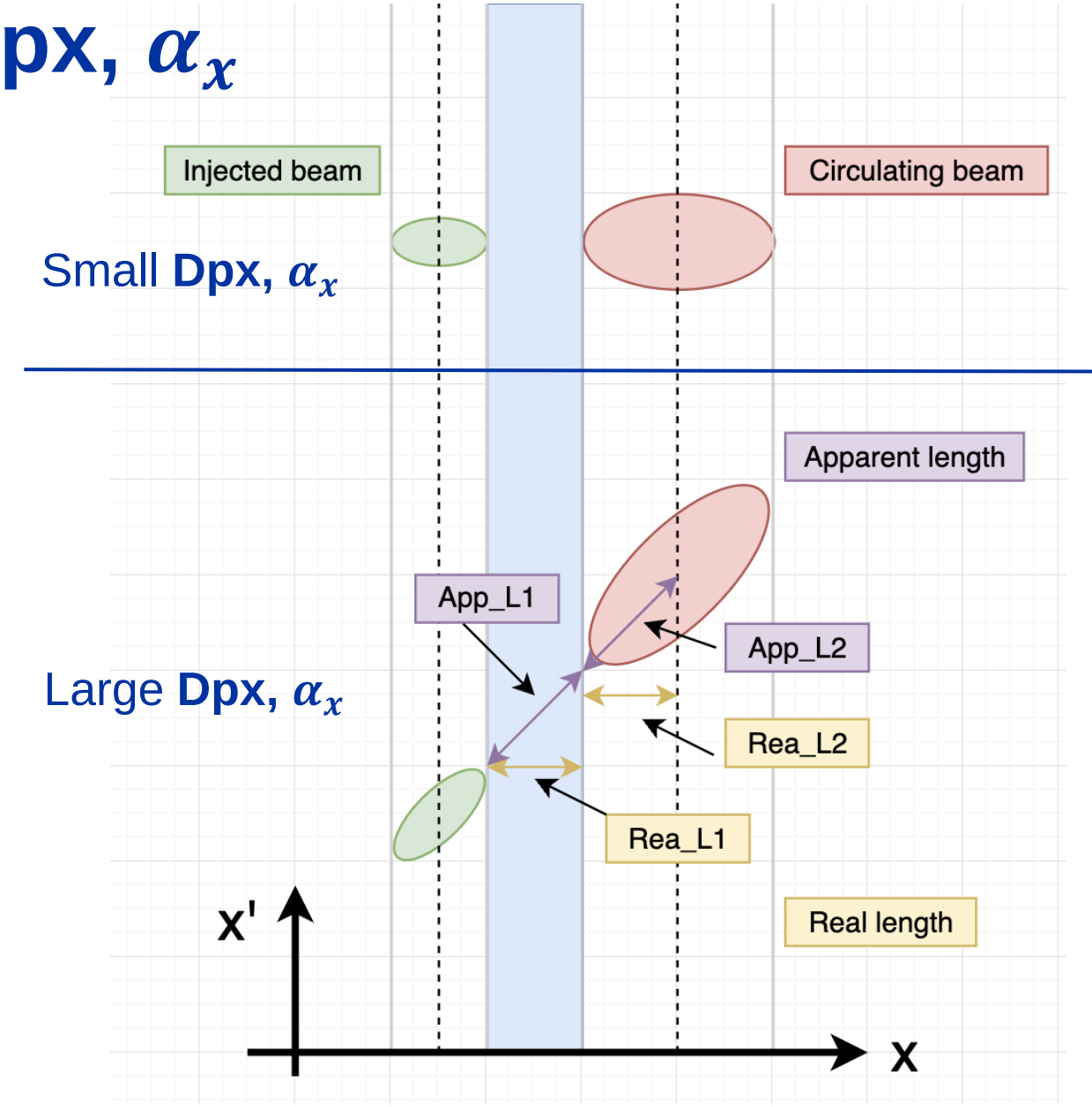
Injection point with large Dpx, α_x

- The real distance (septum thickness) between injected and circulating beam is only determined by: Dx, β_x, ϵ_{cir}, ϵ_{inj}, δ_{cir}

$$S = |D_x \times \delta_{cir}| - 5\sigma_{cir} + 5\sigma_{inj}$$

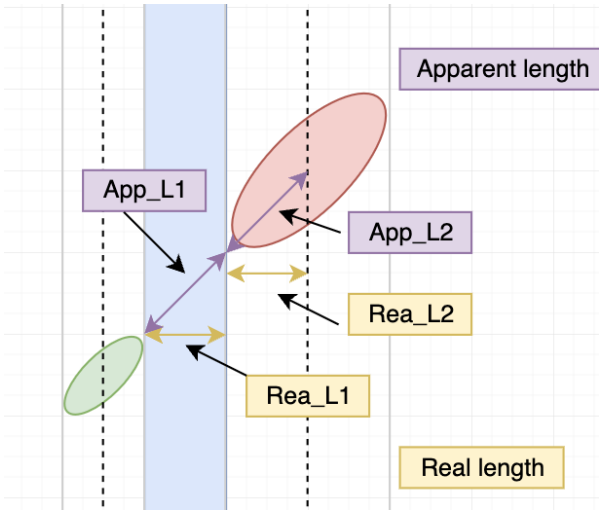
- **Dpx, α_x** can tilt beam in Hor. Phase space
  - Apparent distance larger than real distance

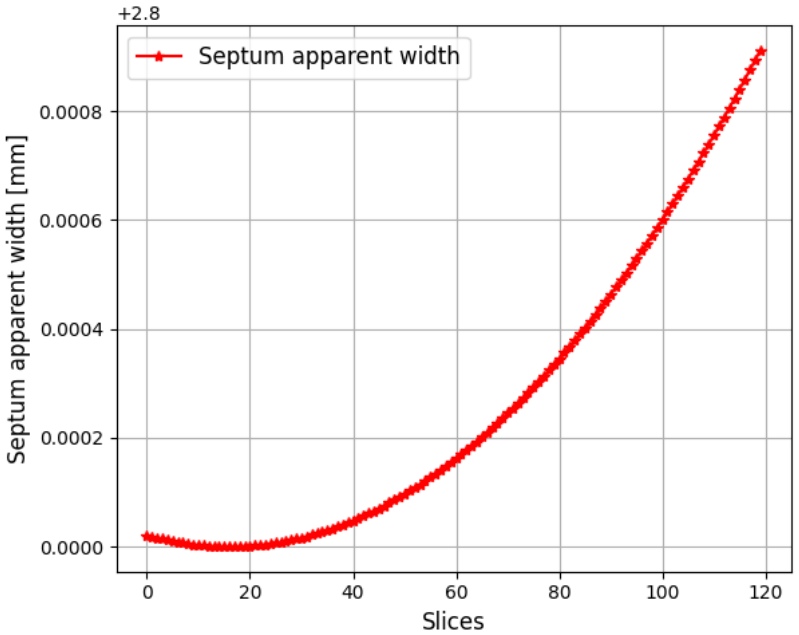
- Need to evaluate the influence of septum location on Apparent distance
  - Focus on the ratio of septum apparent distance to circulating beam size

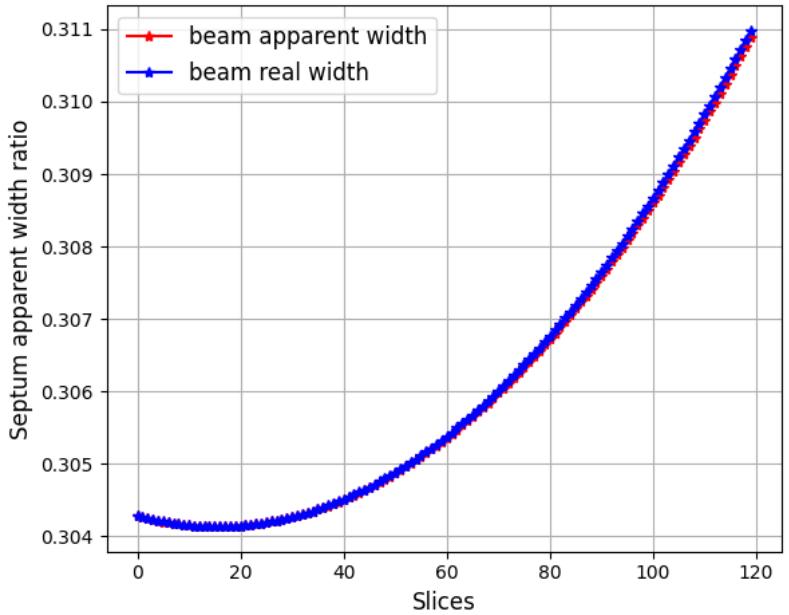


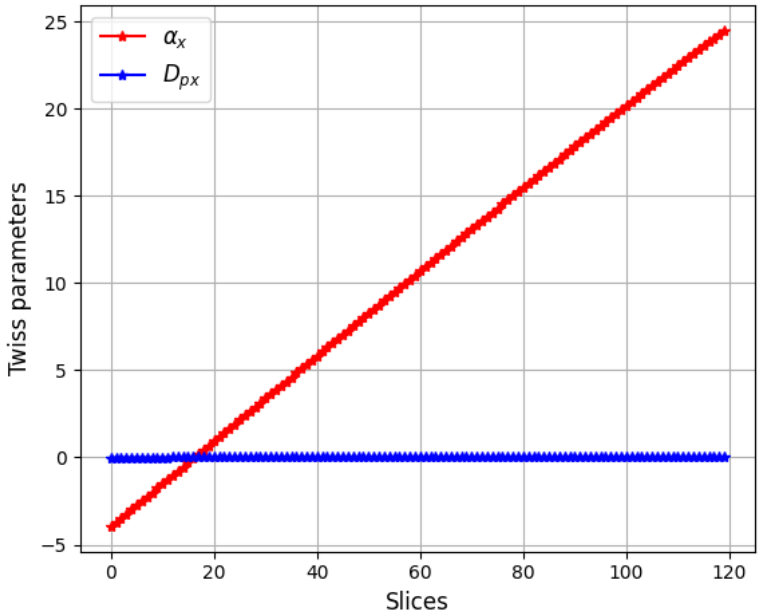
Ratio scan

- **Makethin quad: Qi6.1 to 120 slices**
  - α_x range: -5 to 25
  - Septum width: 2.8 mm
- Due to large β_x (1000 m), α_x has little influence on septum apparent distance
  - It's possible to change injection point









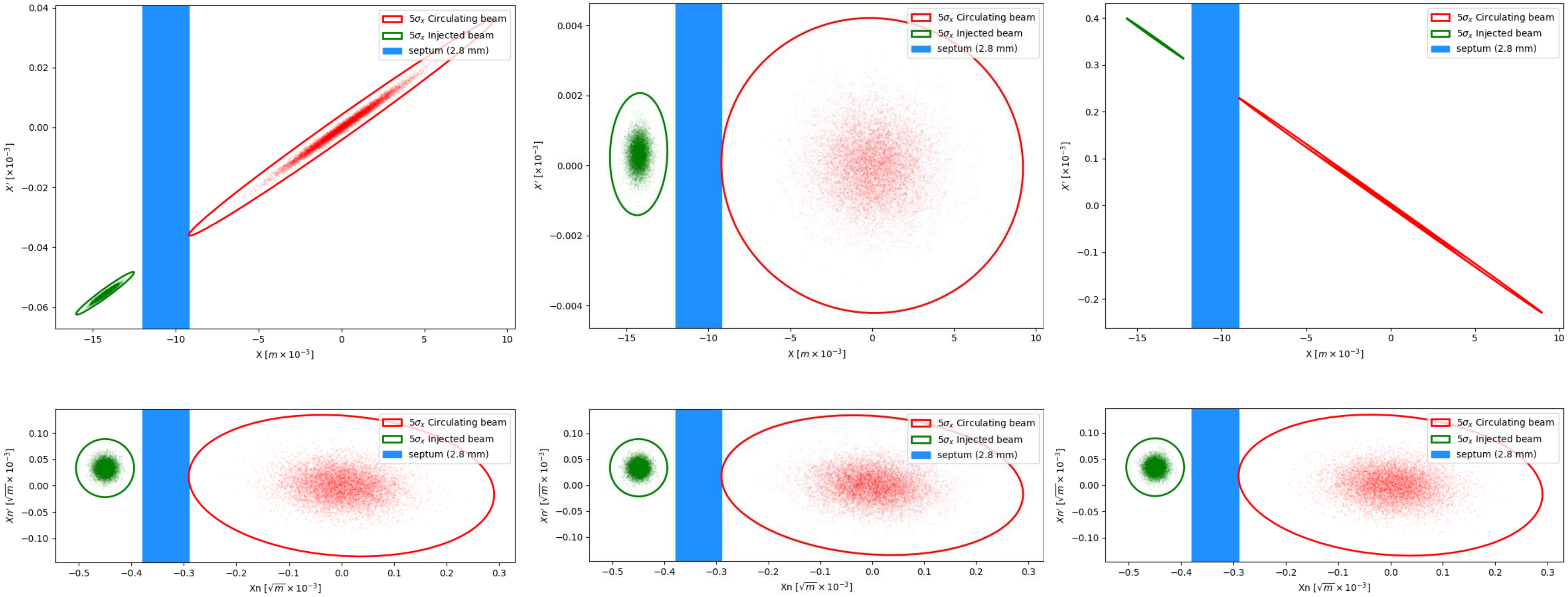
Horizontal phase space at injection point

It is possible to change injection point baseline from 17th slice to the upstream of qi6.1

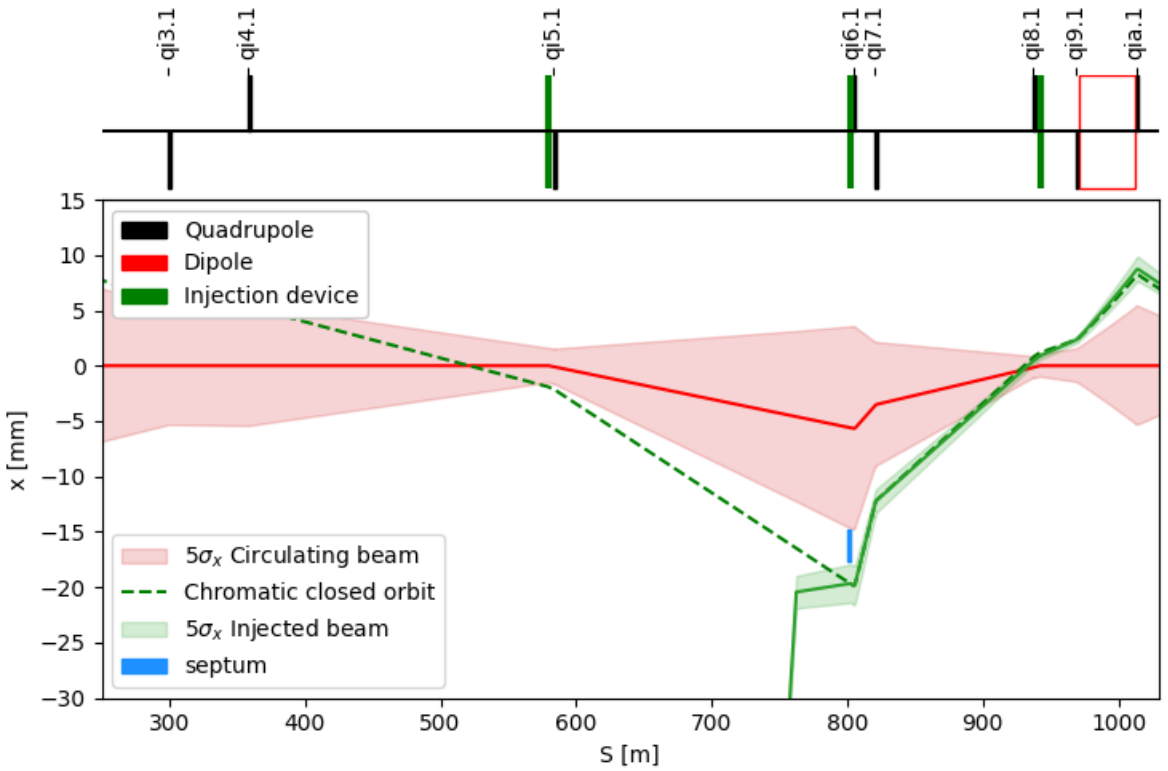
First slice for qi6.1 | 17th slice for qi6.1 | 120th slice for qi6.1

Real space

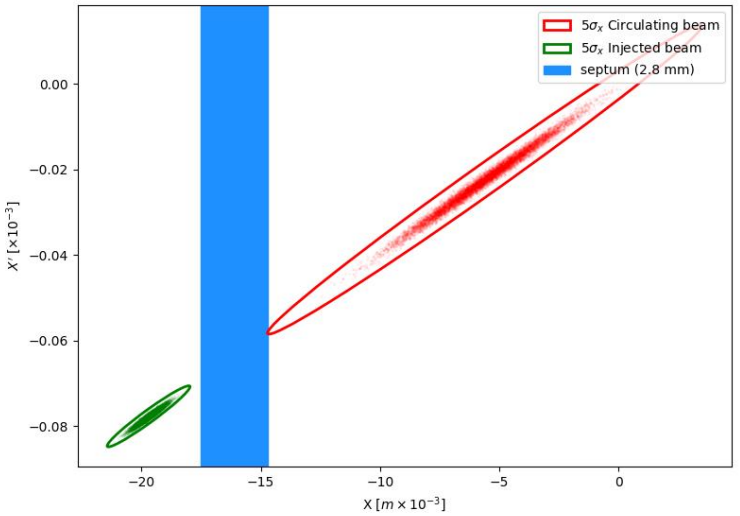
Normalized phase space



On-axis injection with new injection position baseline



- **Thin septum is 2 m upstream of qi6.1**
- Beam parameter changes
  - $\beta_x = 988\ m$, D_x = 1.48 m
  - D_{px} = -0.0058, $\alpha_x = -3.94$
- Septum thickness: 2.8 mm



Real phase space at injection point

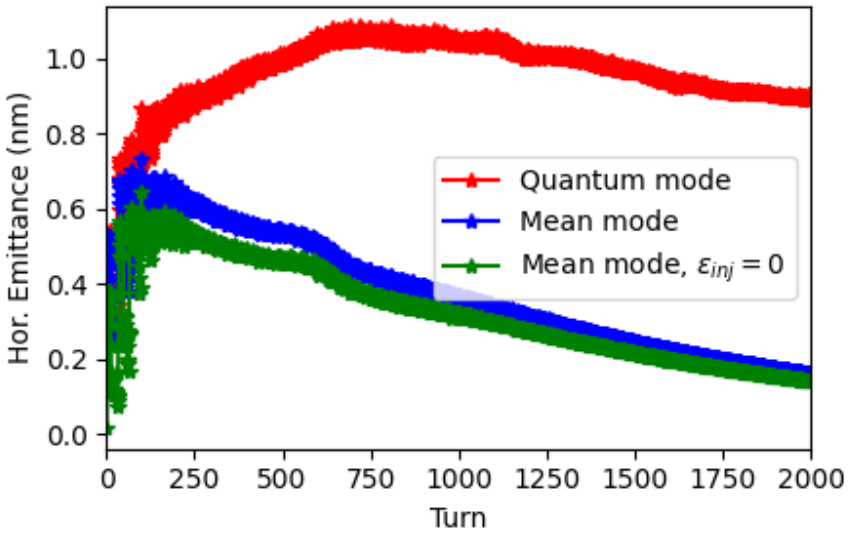
Energy offset: 0.95 %

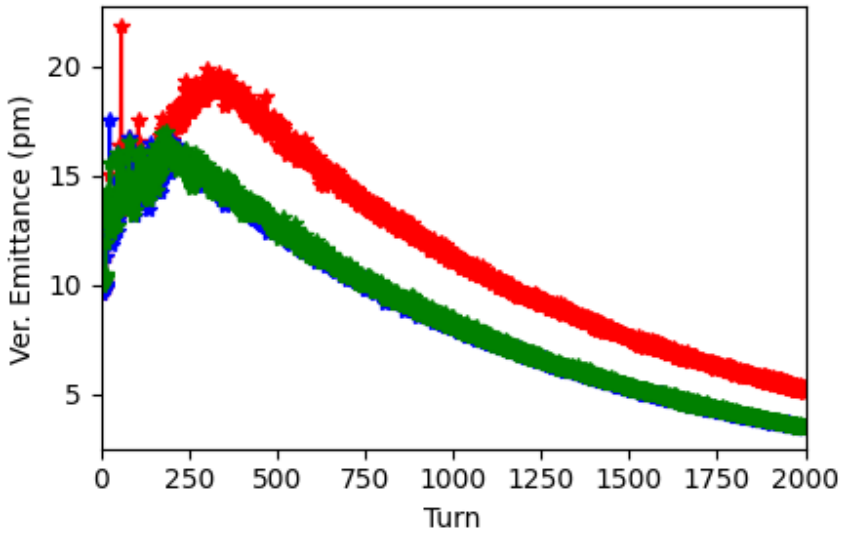
Lattice version: V24.4_GHC

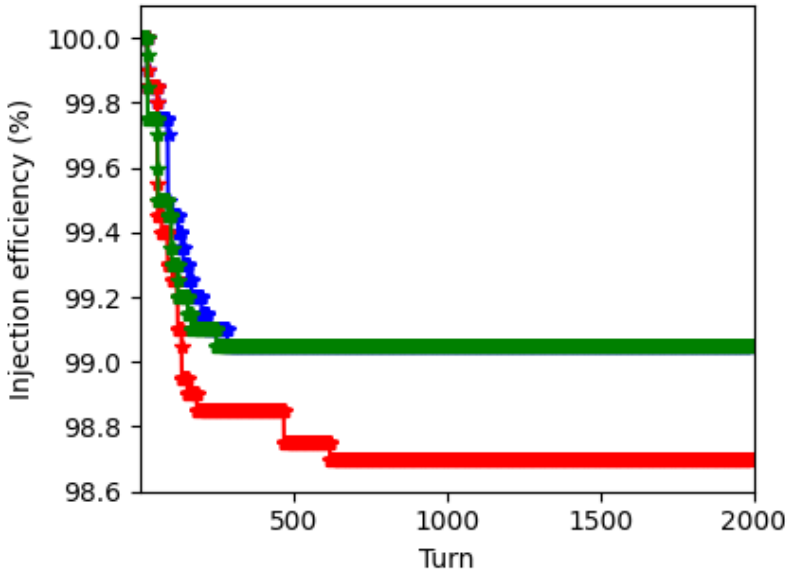
Tracking results

- Only consider SR effect, injection position is 2 m upstream of qi6.1
- The H&V emittance blow up in mean SR mode is smaller than that in quantum mode
  - **Reduce the injected beam emittance** can't mitigate the emittance blow up
- On-axis injection has good injection efficiency
  - **Little influence of location change** on injection efficiency

Energy offset: 0.95 %







Conclusion

- **Thin septum location is moved to 2 m upstream of qi6.1, in conventional on-axis injection scheme**
- **Beam parameter changes**
  - $\beta_x = 988\ m$, D_x = 1.48 m
  - D_{px} = -0.0058, $\alpha_x = -3.94$
- **Tracking results shows little influence of location change on injection efficiency**

Backup

Nonlinear effect at injection point and interaction point