

Updates on Injection Study

FCC-ee top-up injection monthly meeting
06/03/2025

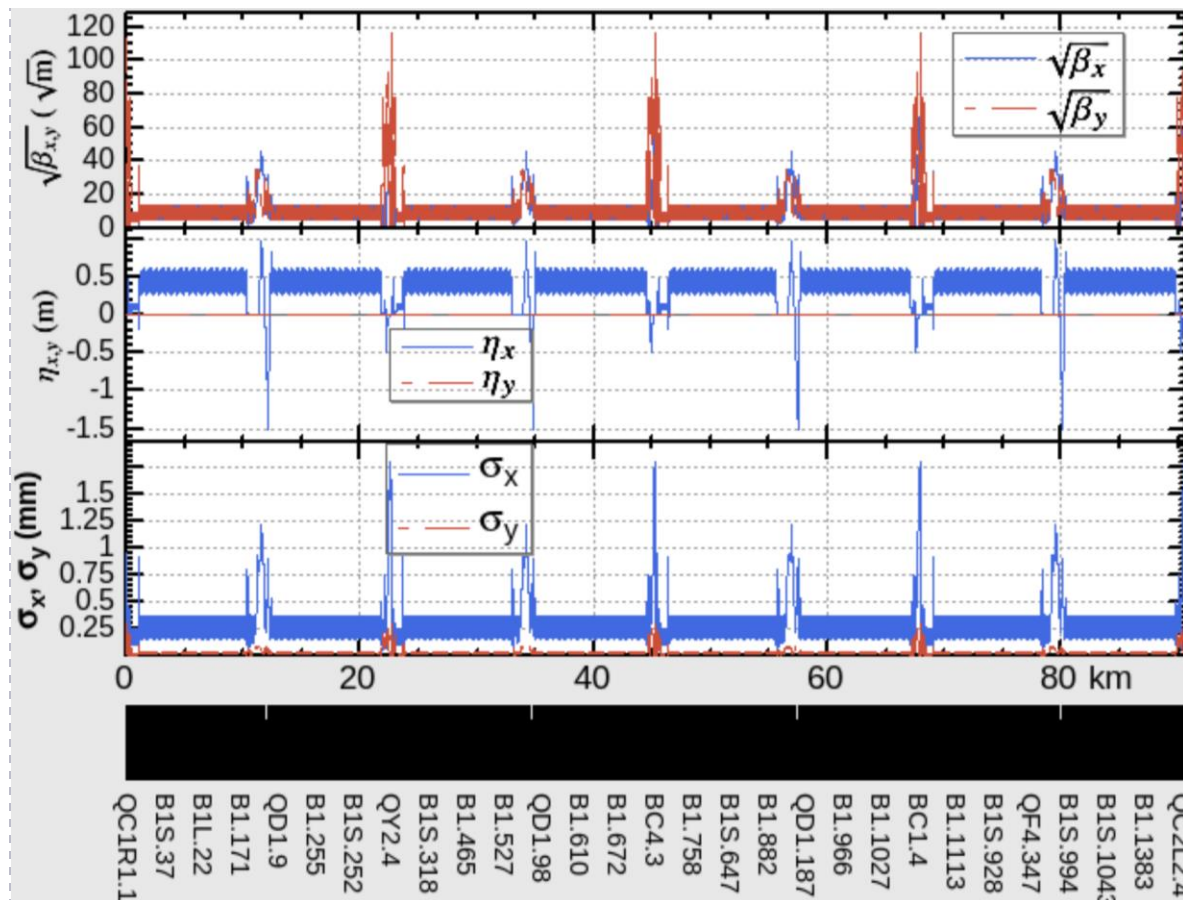
Takashi Mori

Updates overview

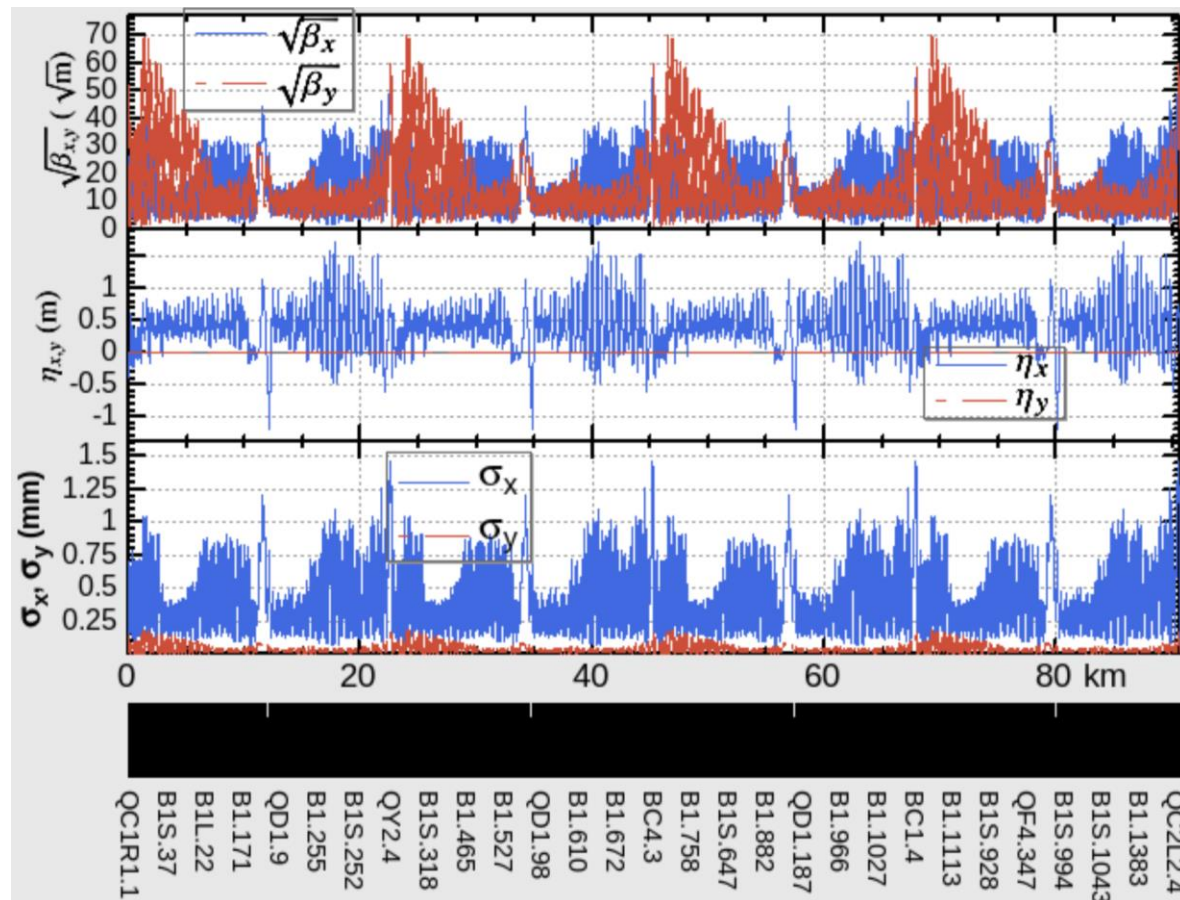
- Pointed out: Optics distortion at $\delta > 0$
 - ◆ Vertical emittance growth without beam-beam effect
- Used lattice change: 615 \rightarrow 624
 - ◆ Survival rate increased 65 \rightarrow 79 %
- z-scan at injection
 - ◆ Survival rate \sim 82 % @ $z = -10$ mm
- Hybrid injection tried
 - ◆ Survival rate \sim 84.5 % @ $\delta = 0.008265$ ($\frac{\Delta\delta}{\delta} = -13$ %)

Optics distortion for $\delta \neq 0$

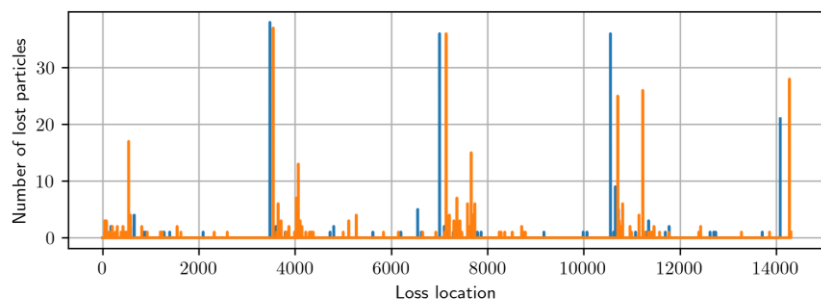
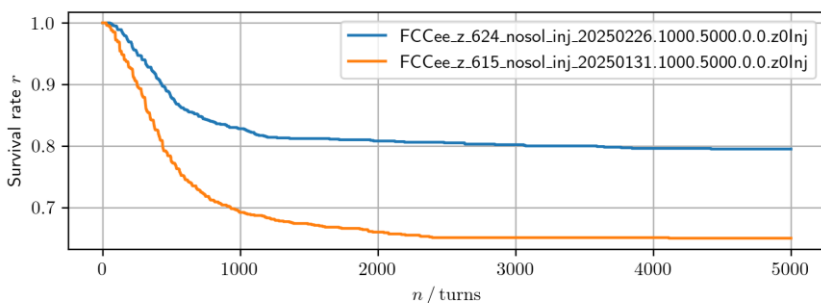
$\delta = 0$



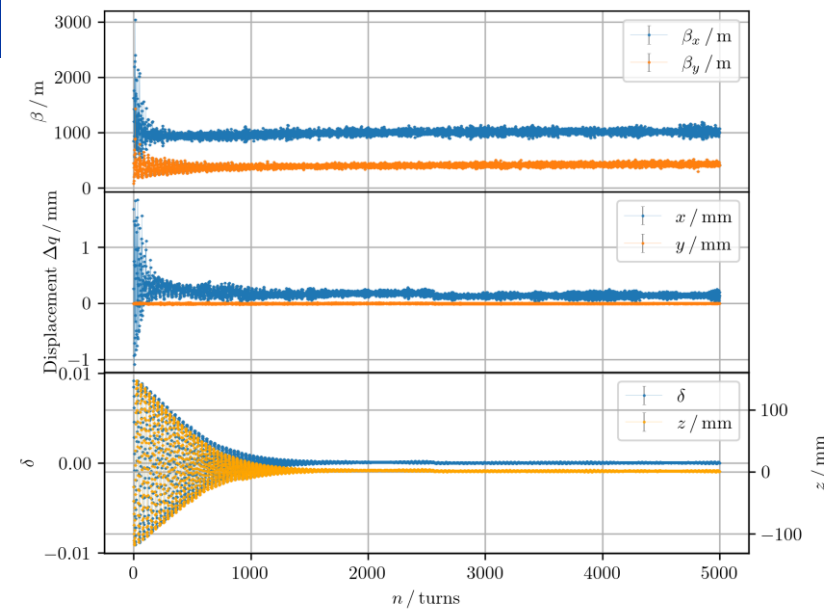
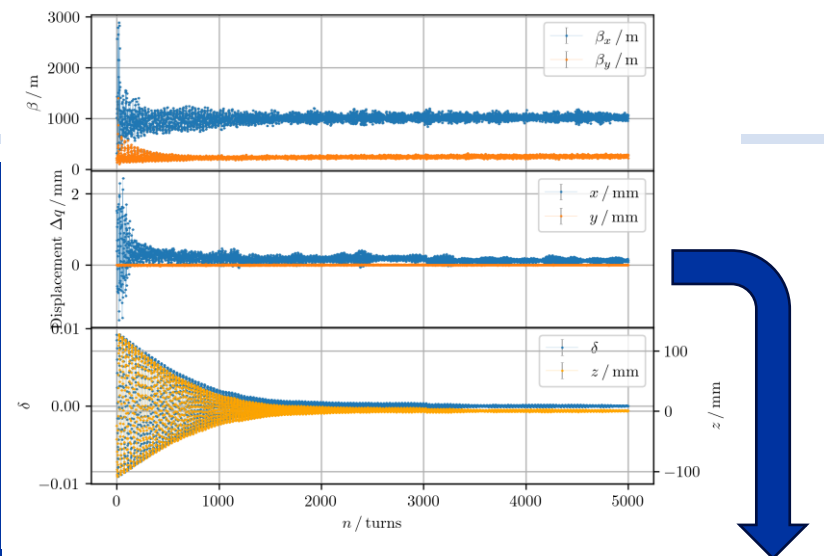
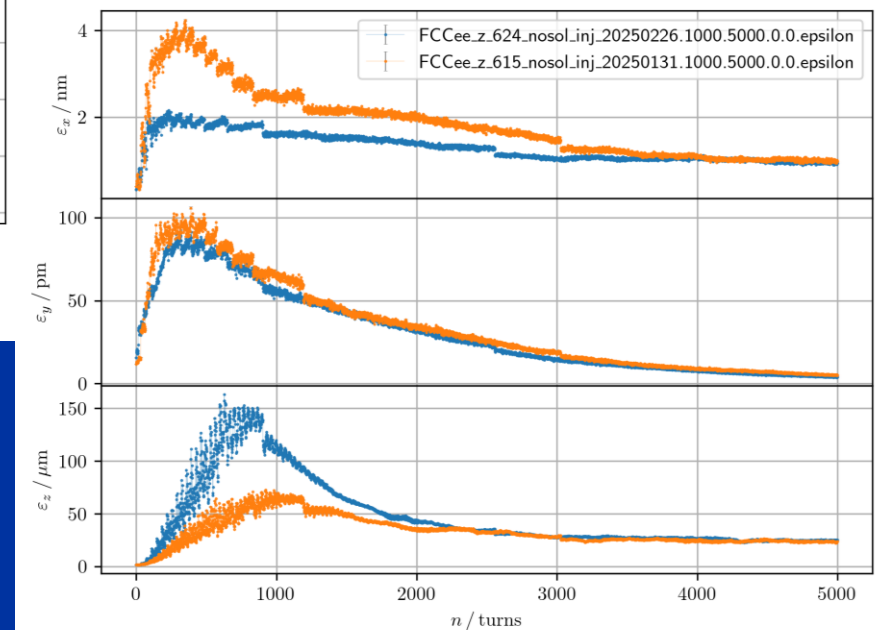
$\delta = 0.0095$



Used lattice change: 615 → 624



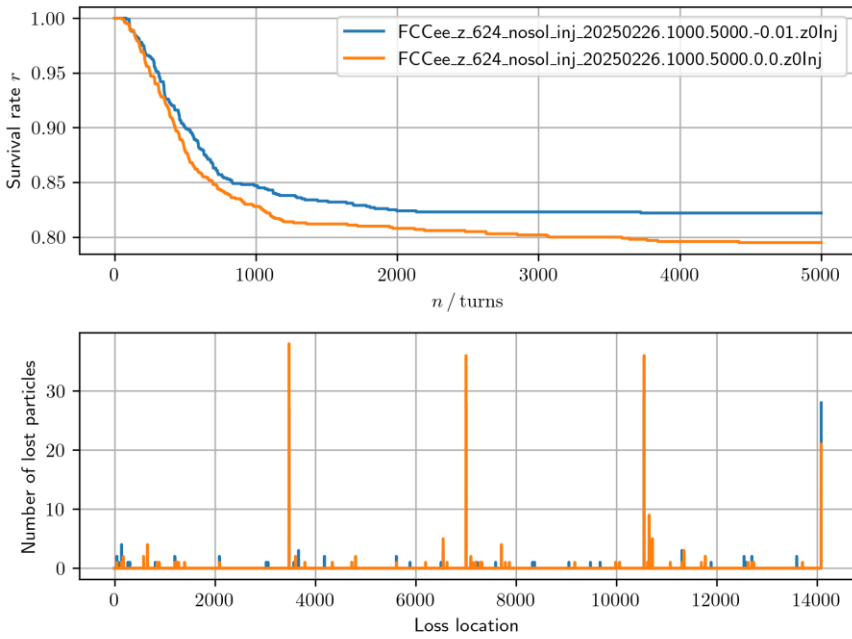
Linear component of the dispersion is removed before the ellipse fitting. $(D_x \delta, D'_x \delta)$
Larger longitudinal emittance but smaller transverse emittances.



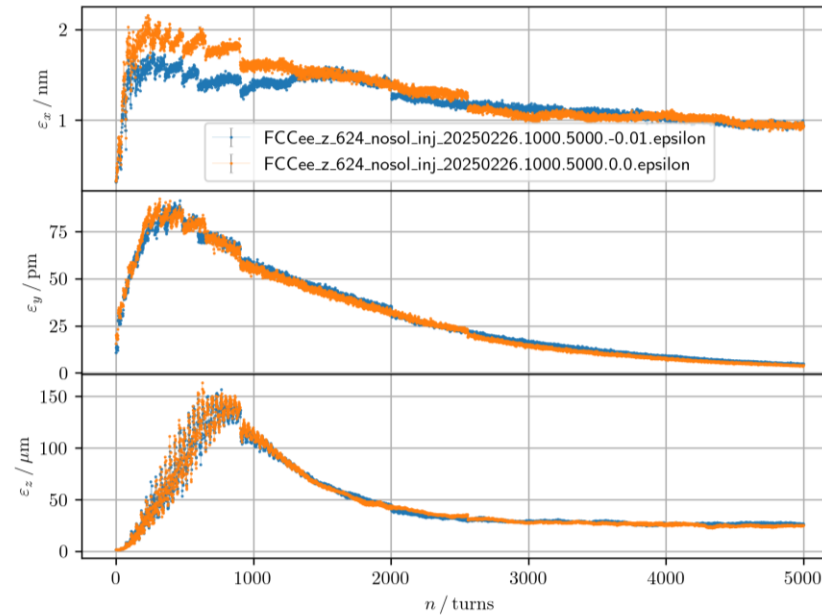
Improved by ~ 14 %

COD?

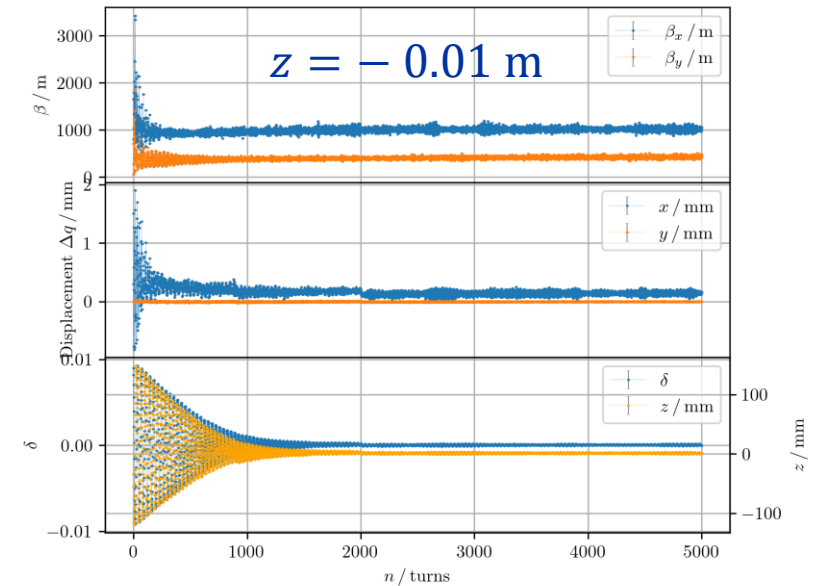
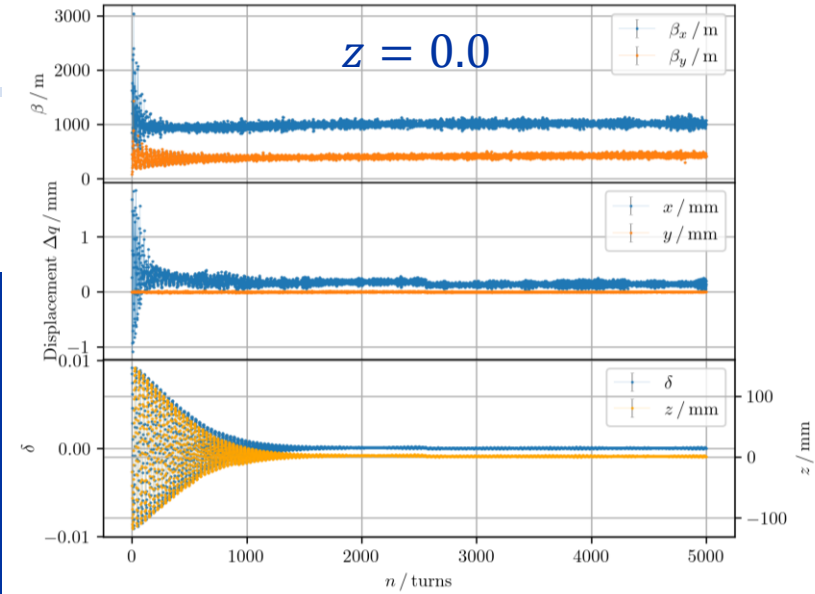
z-scan



Emittance comparison



$z = 0.0 \rightarrow -0.01 \text{ m}$
 Small improvement
 if $z @ \text{injection}$ changed

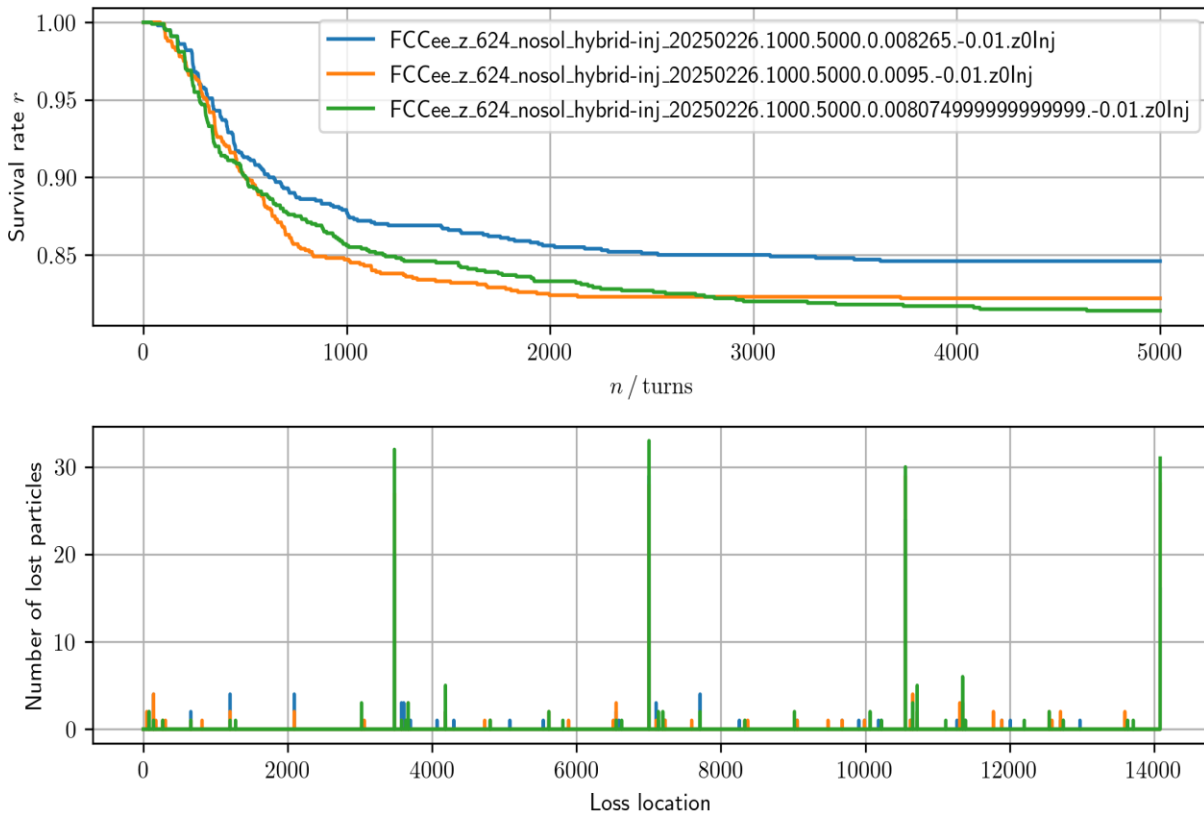


Hybrid injection

Lifetime comparison

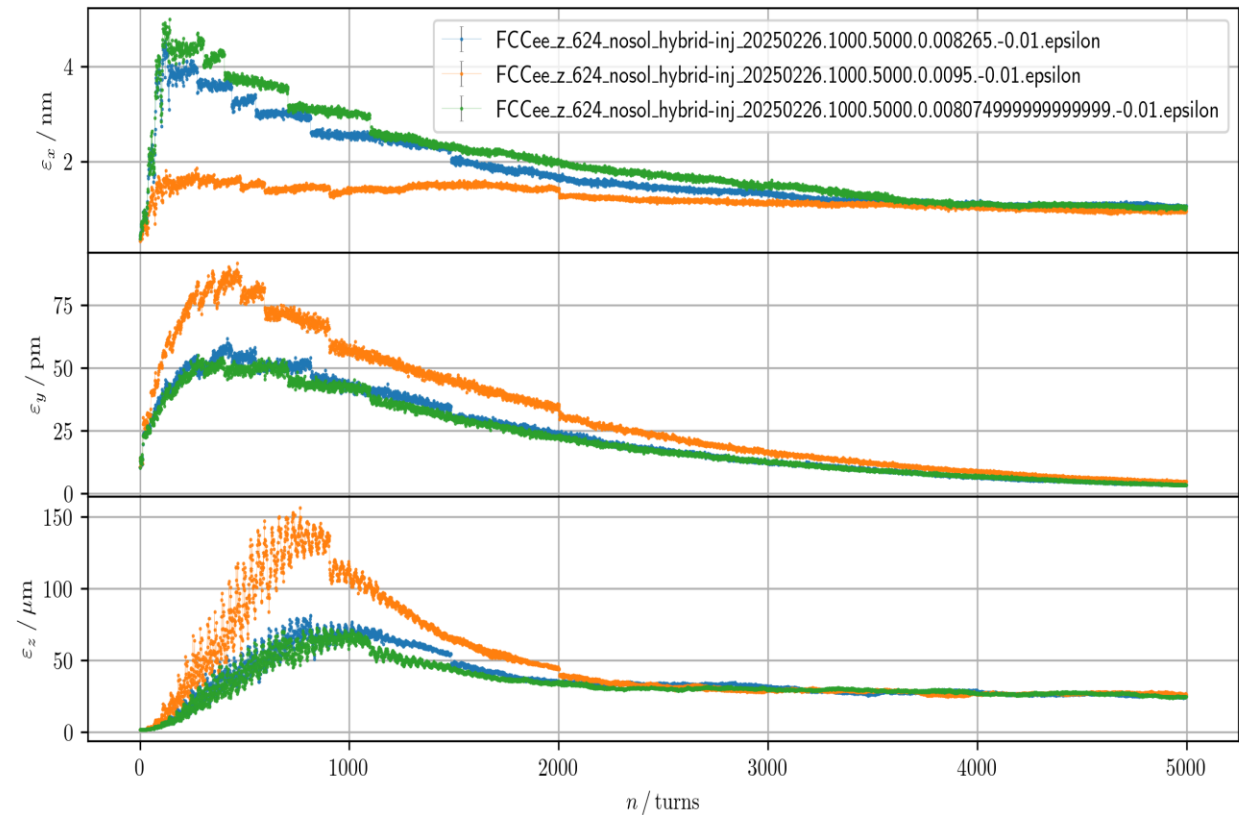
$$\delta = 0.0095, 0.008265, 0.008075$$

$z \equiv -0.01$ m: optimum z might be different



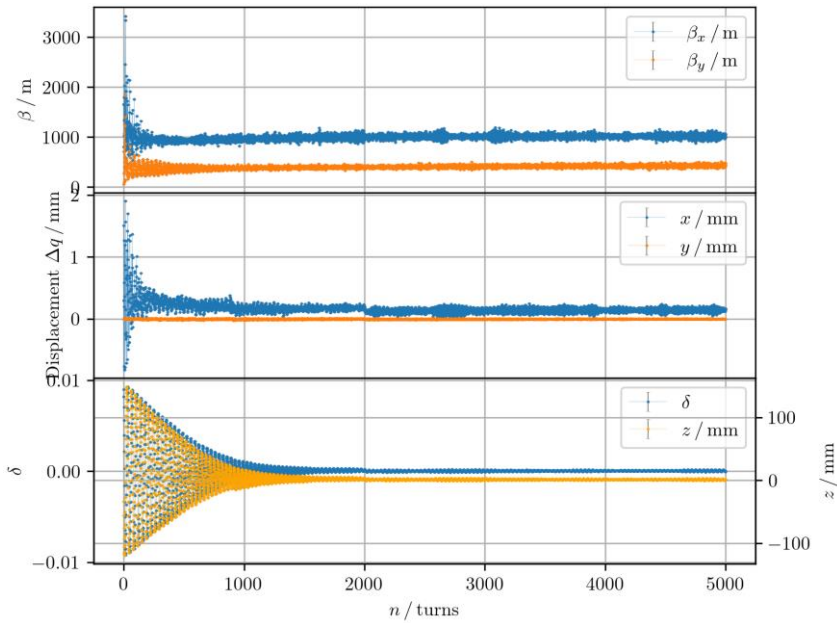
Emittances

Vertical size reduction with momentum difference reduction

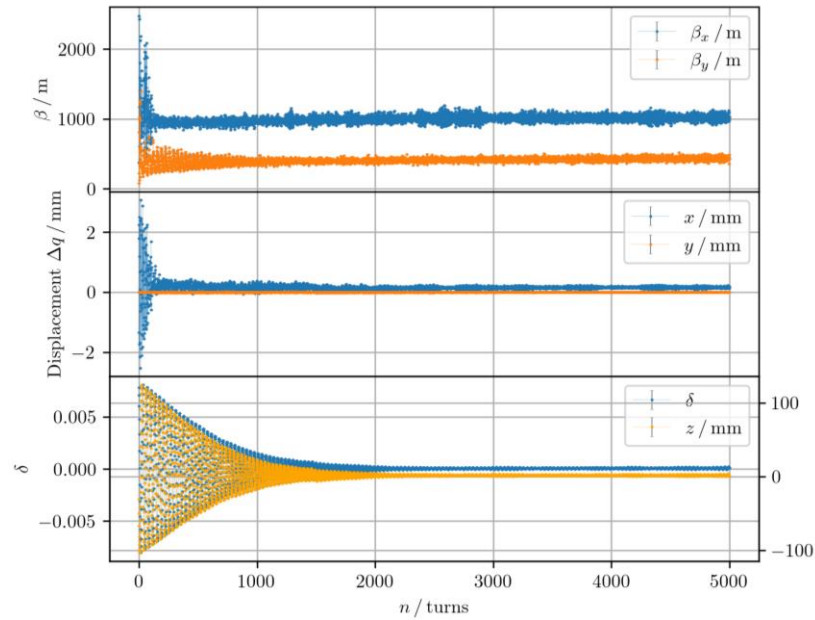


β , orbit, δ

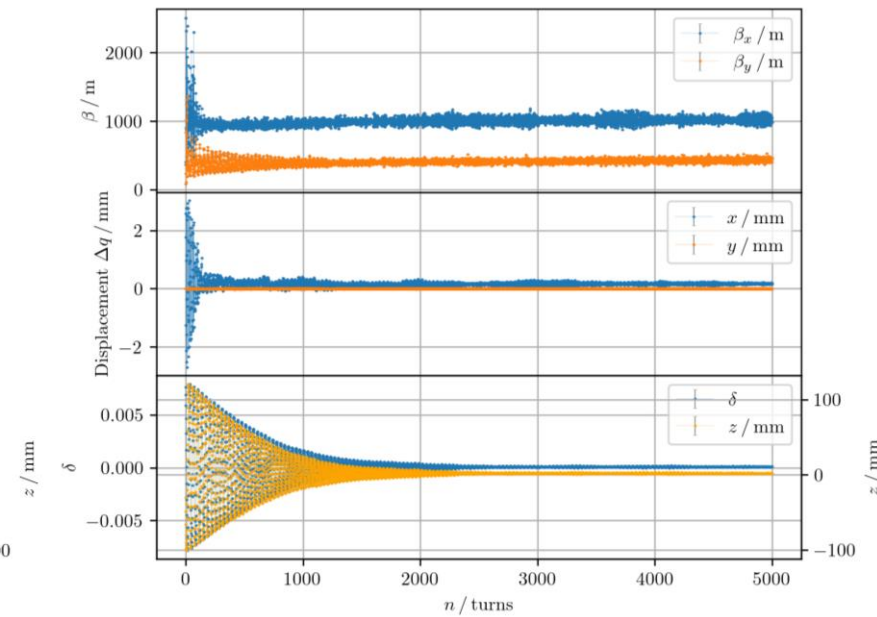
$\delta = 0.0095$



$\delta = 0.008265$



$\delta = 0.008075$





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Thank you!