



muon storage ring with racetrack scaling FFAG

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Outline

● Scaling FFAG

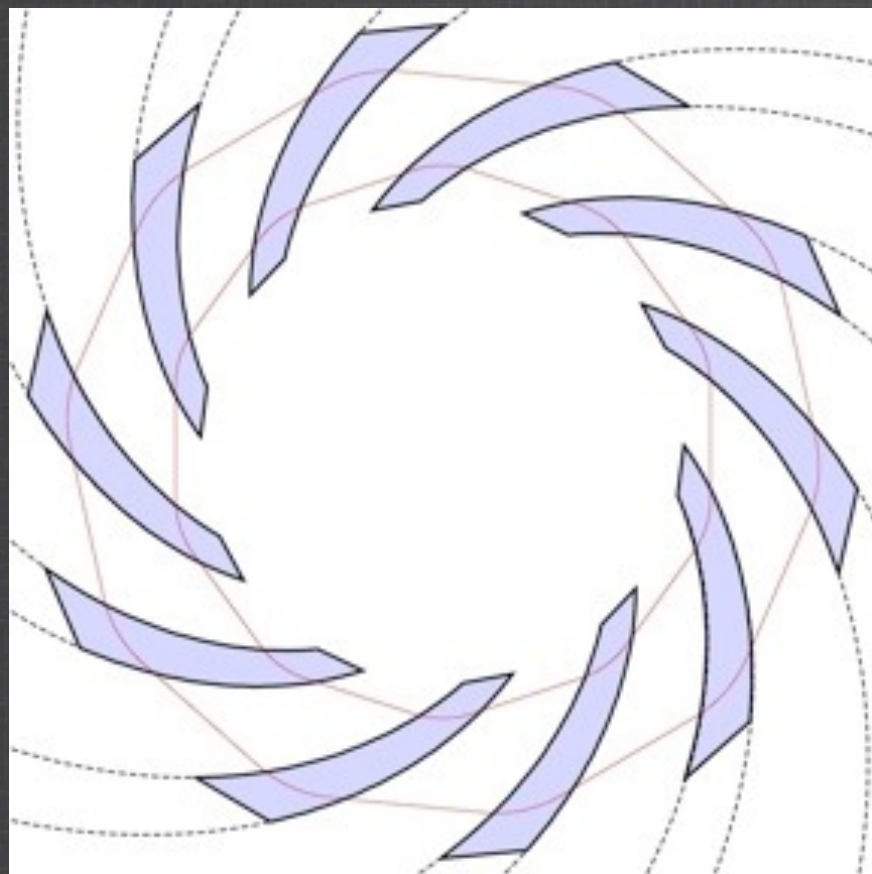
● Racetrack FFAG muon storage ring

● Summary

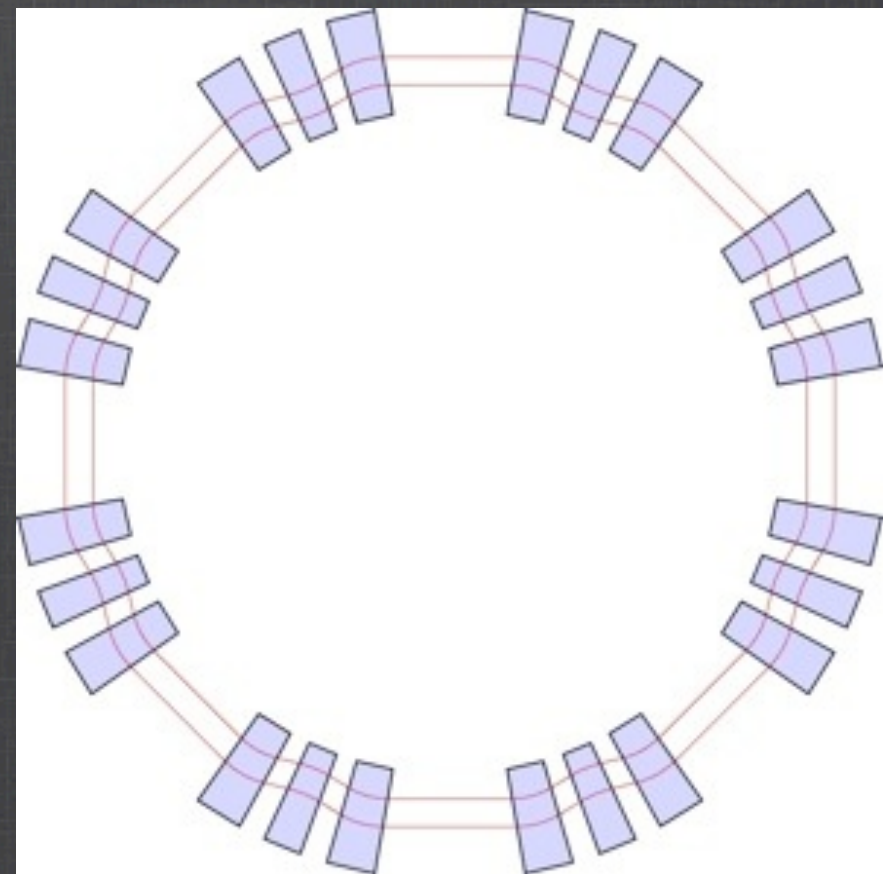
Circular scaling FFAG

Geometrical field index: $k = \frac{R}{\bar{B}} \frac{d\bar{B}}{dR}$

$$B(r, \theta) = B_0 \left(\frac{r}{r_0} \right)^k \cdot \mathcal{F}\left(\theta - \tan \zeta \ln \frac{r}{r_0}\right)$$



Spiral sector

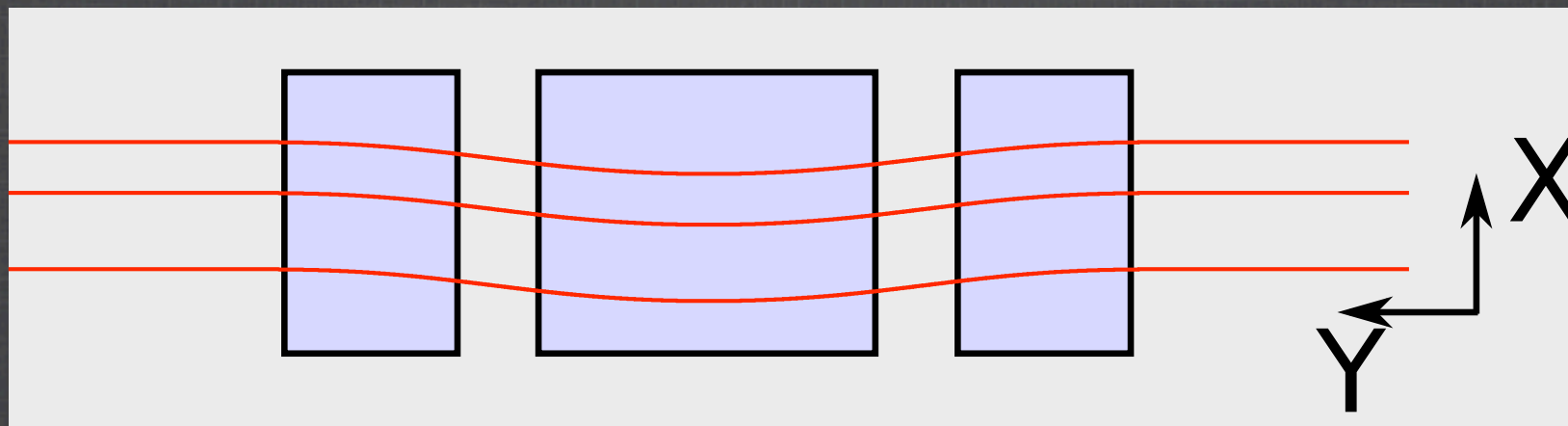


Radial sector

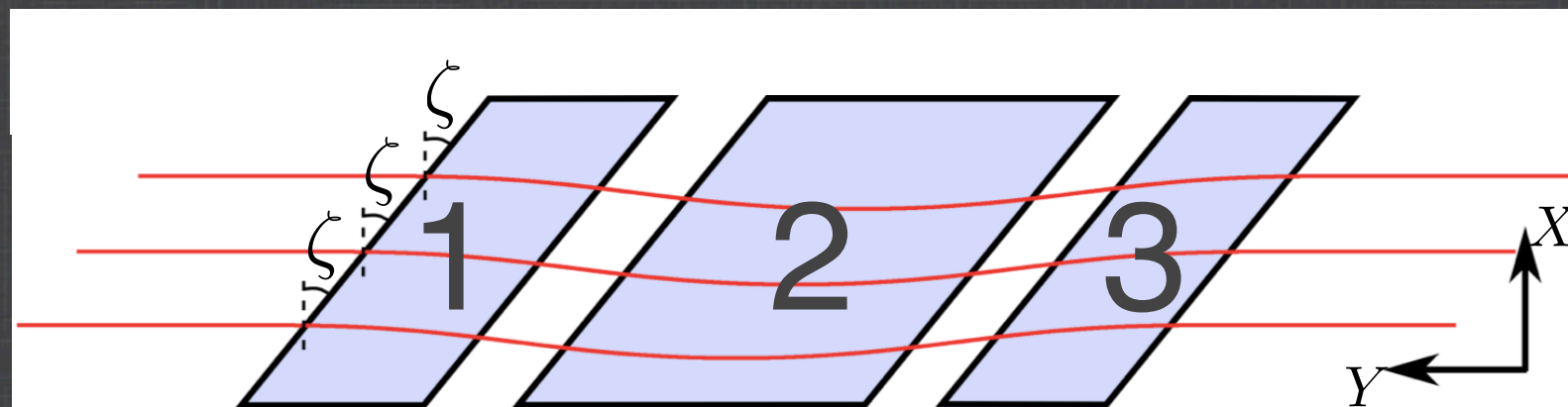
Straight scaling FFAG

Normalized field gradient: $m = \frac{1}{\bar{B}} \frac{d\bar{B}}{d\chi}$

$$B(X, Y) = B_0 e^{m(X-X_0)} \mathcal{F}(Y - (X - X_0) \tan \zeta)$$



Rectangular case



Tilted straight case

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- Scaling FFAG

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Racetrack FFAG for ν STORM

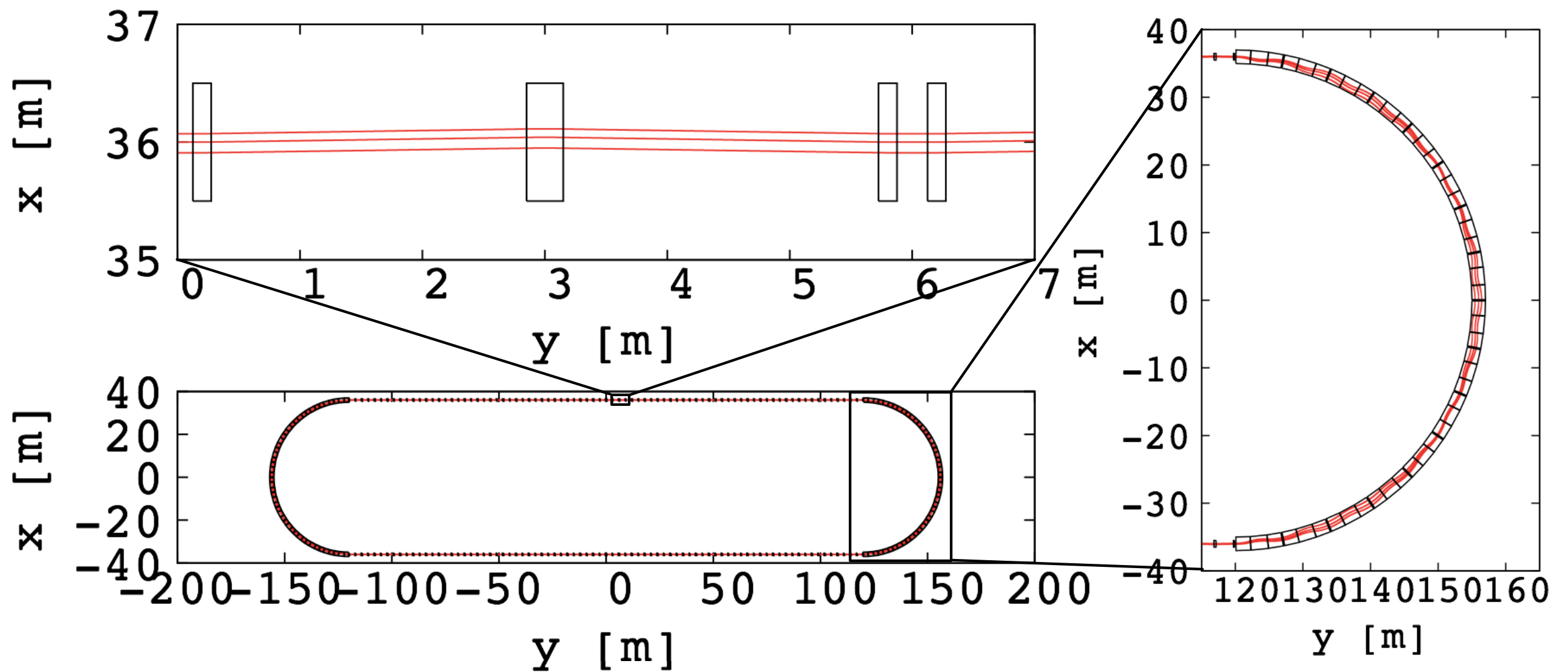
Constraint: in the straight part, the scallop must be as small as possible.

15 mrad has been chosen as the maximum angle.

	Circular Section	Straight Section
Type	FDF	DFD
Cell radius [m]/opening angle [deg] or Length [m]	36/11.25	6
k-value or m-value	24.95	2.65 m ⁻¹
Packing factor	0.96	0.10
Horizontal phase advance /cell [deg]	67.5	13.1
Vertical phase advance /cell [deg]	11.25	16.7
Average dispersion /cell [m]	1.39	0.38
Number of cells /ring	16 × 2	40 × 2

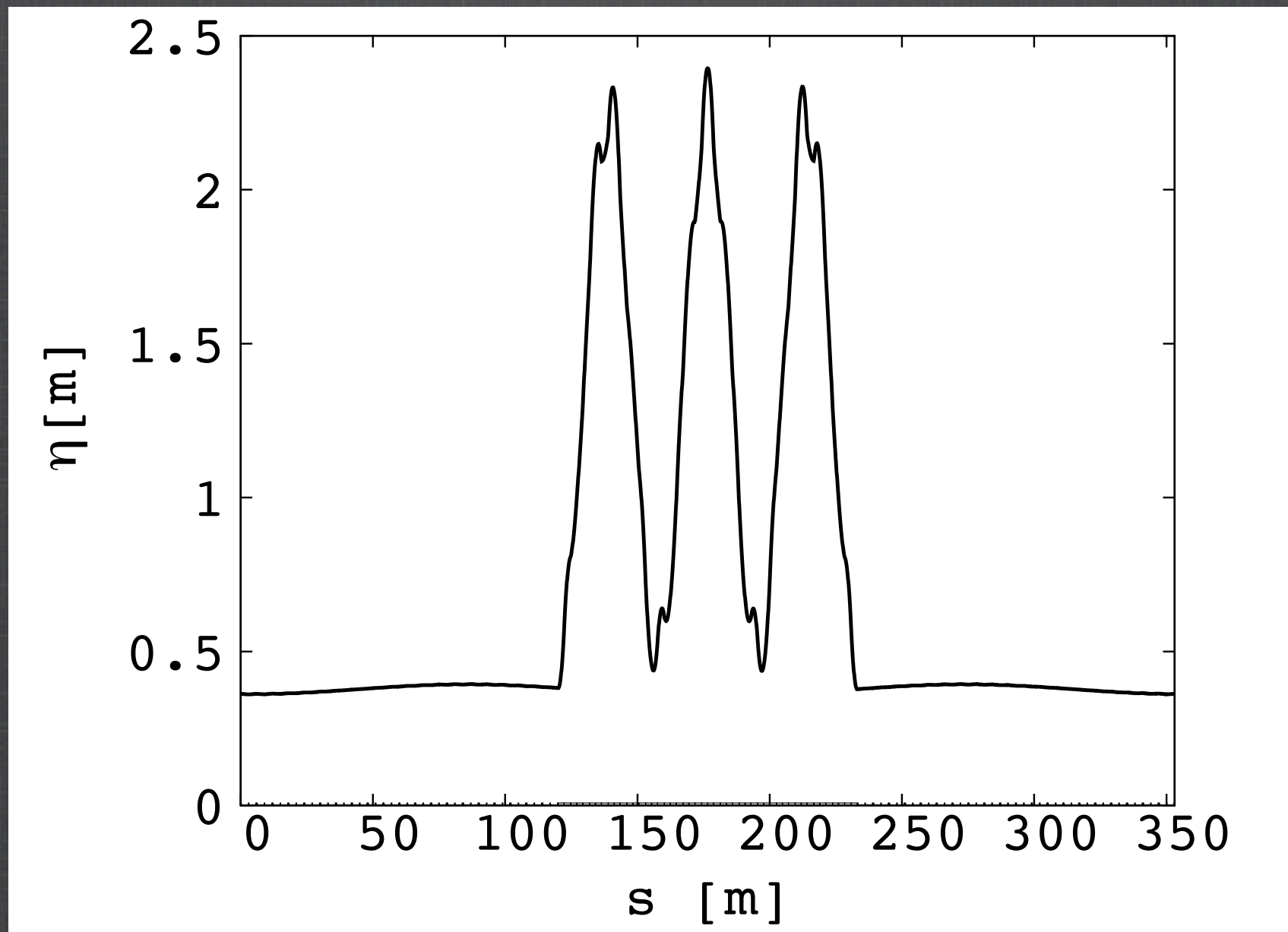
Racetrack FFAG for ν STORM

Layout



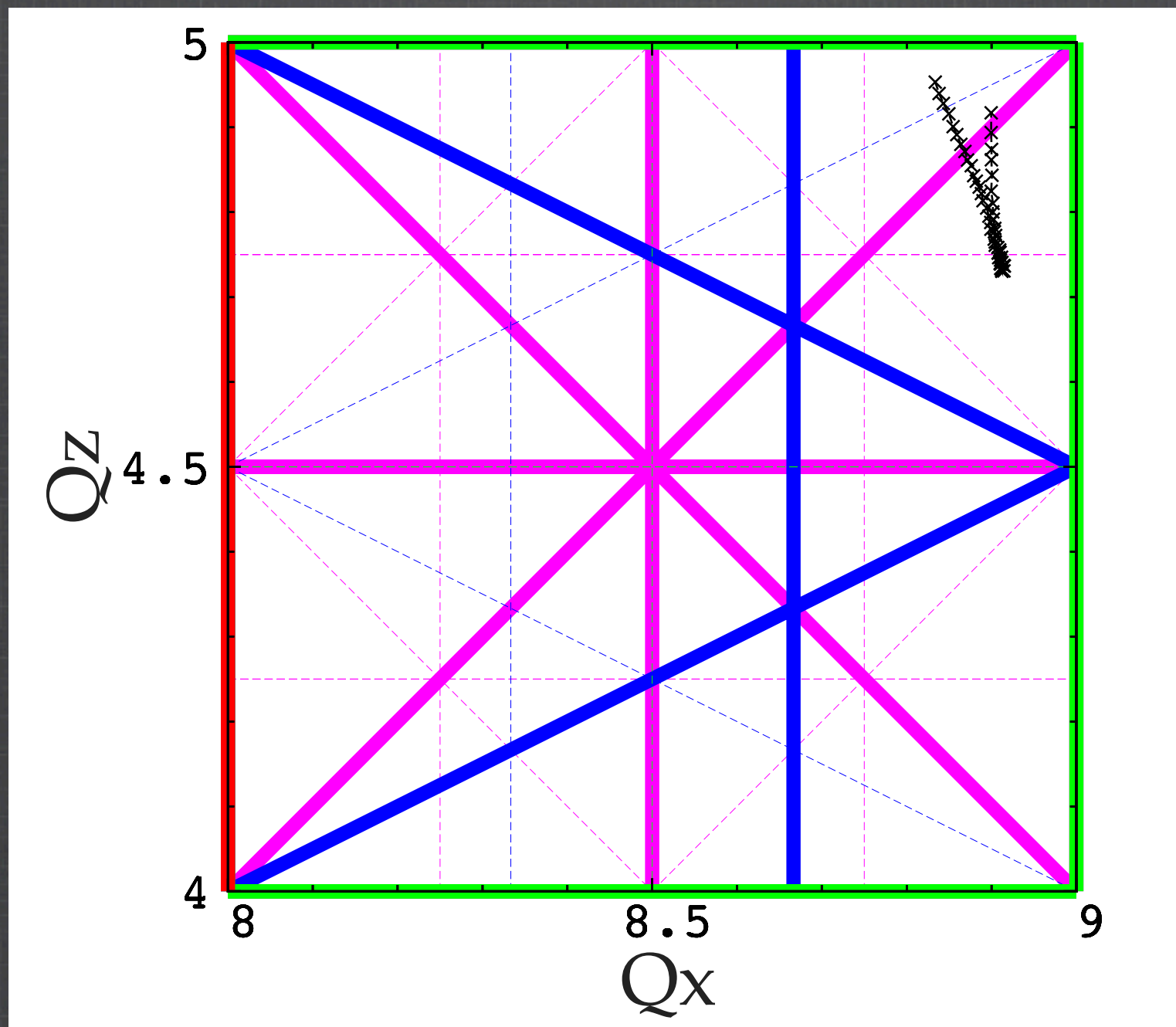
Racetrack FFAG for ν STORM

Dispersion function



Racetrack FFAG for vSTORM

Tune diagram $\frac{\Delta P}{P} = \pm 26\%$

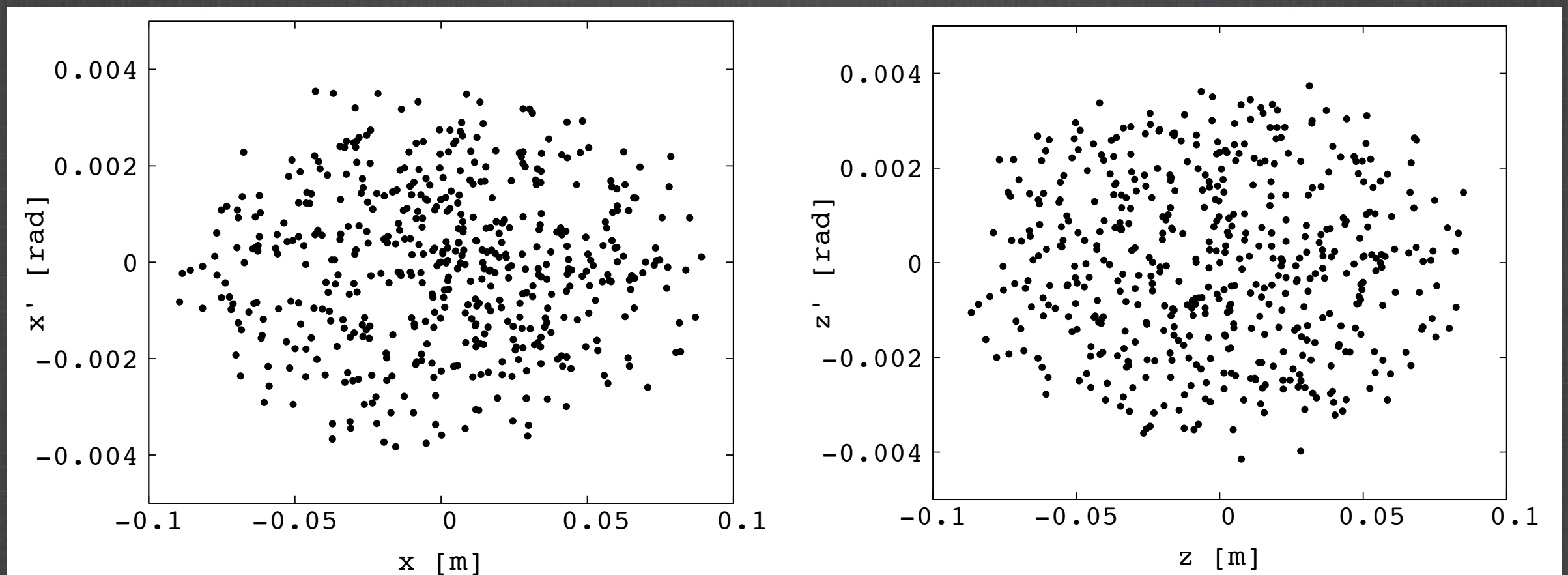


Racetrack FFAG for ν STORM

Multi-particle tracking without dispersion matching.

500 particles with a Waterbag distribution. Unnormalized emittances are $400 \pi \text{ mm.mrad}$ in transverse planes.

Momentum uniformly distributed around $3.8 \text{ GeV}/c \pm 16\%$.



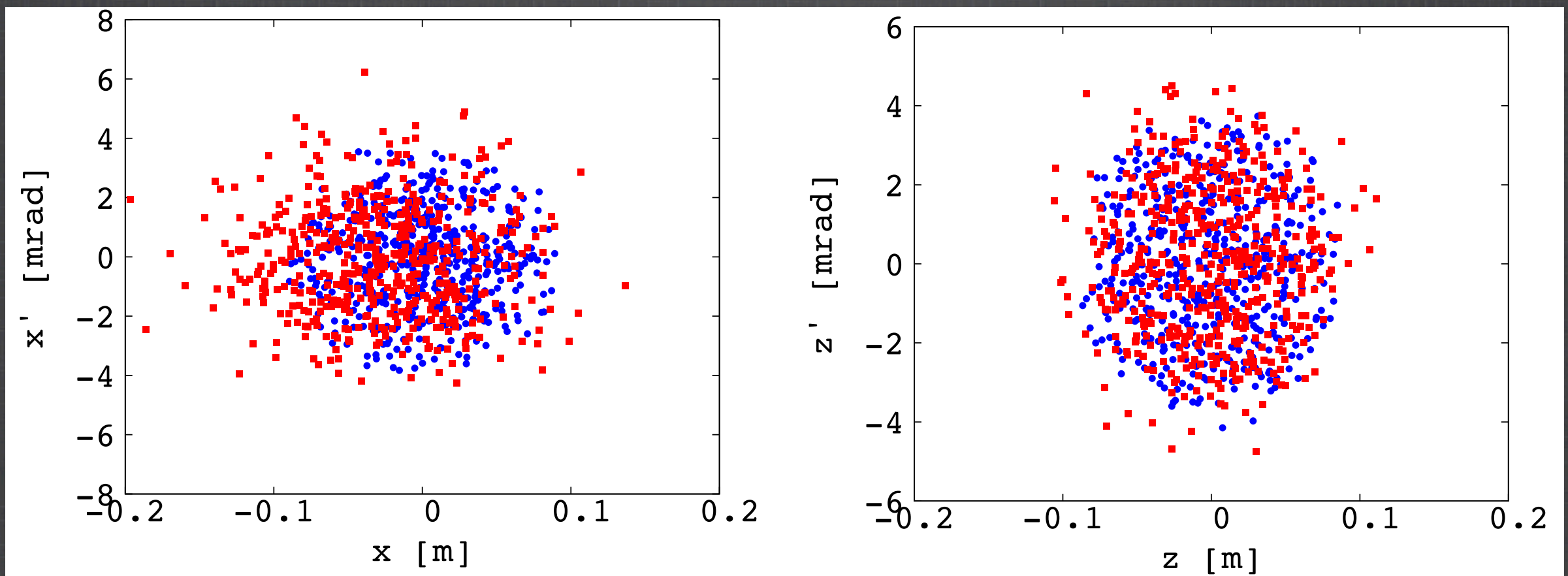
Injected Beam in the horizontal (left) and vertical (right) phase spaces

Racetrack FFAG for ν STORM

Multi-particle tracking without dispersion matching.

After 60 turns \longrightarrow no particle lost.

(no muon decay implemented in the simulation).



Results in the horizontal (left) and vertical (right) phase spaces

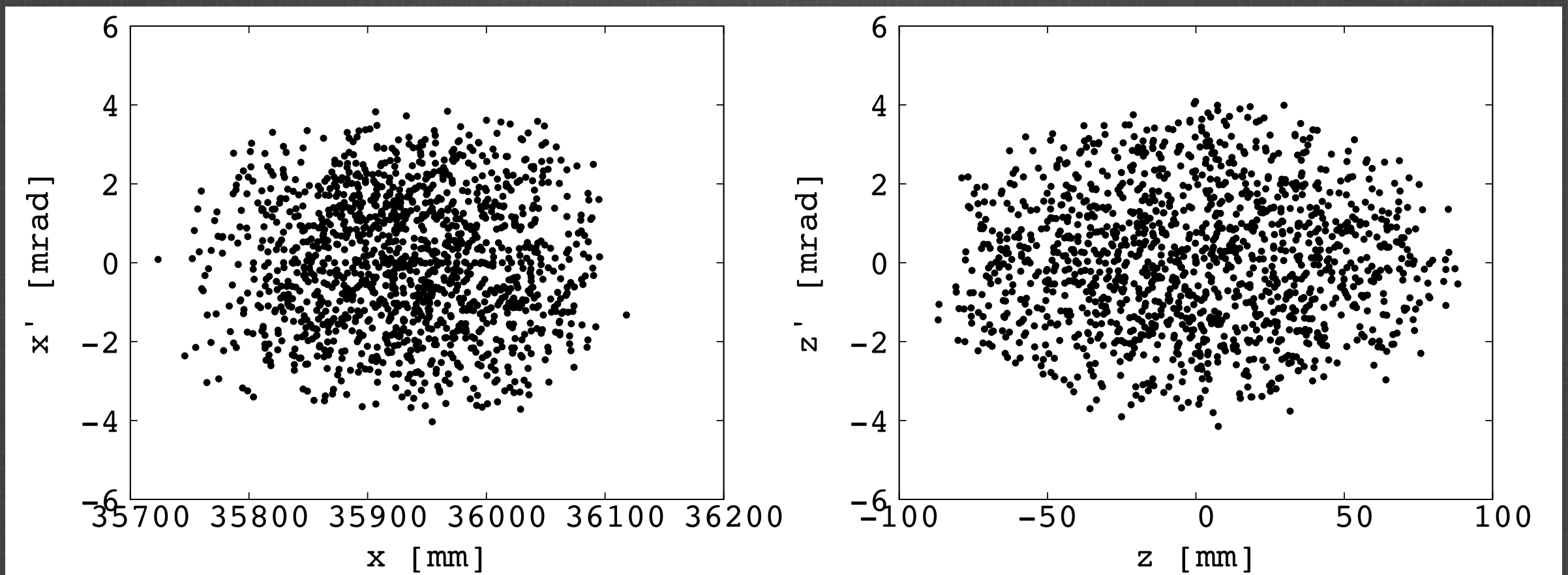
■ extraction
● injection

Racetrack FFAG for ν STORM

Multi-particle tracking with dispersion matching.

1350 particles with a Waterbag distribution. Unnormalized emittances are $400 \pi \text{ mm.mrad}$ in transverse planes.

Momentum uniformly distributed around $3.8 \text{ GeV}/c \pm 26\%$.

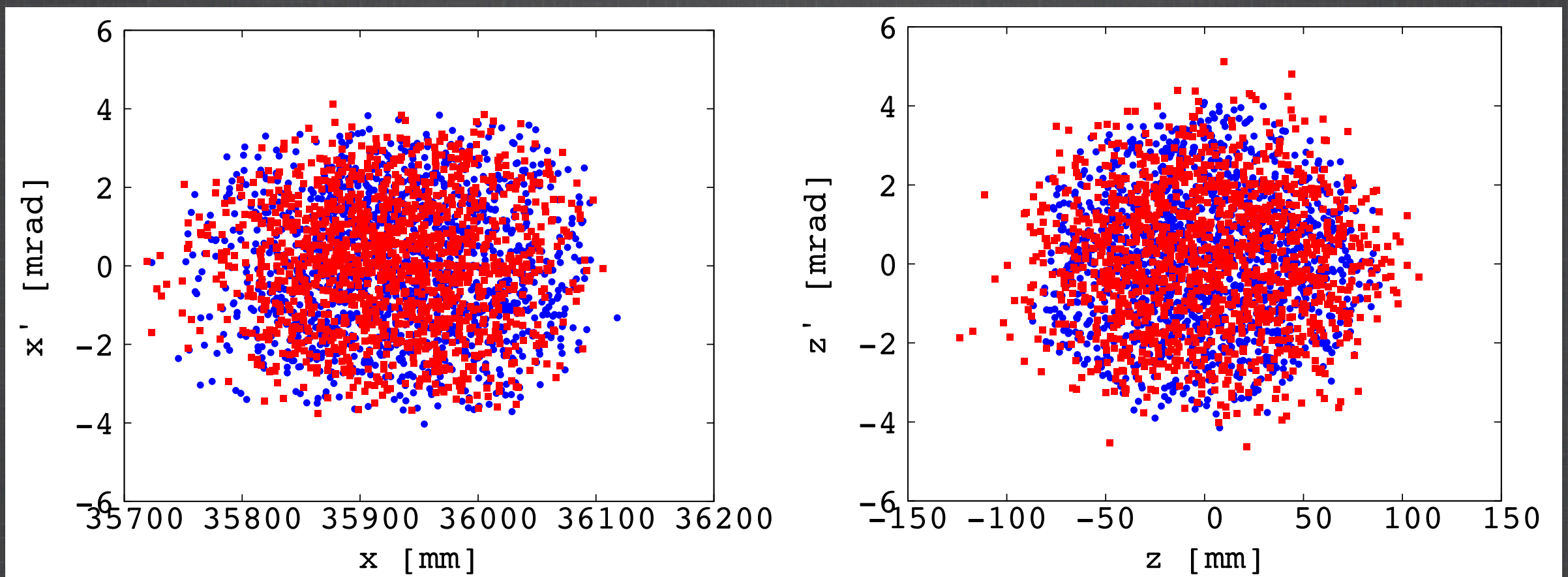


Injected Beam in the horizontal (left) and vertical (right) phase spaces

Racetrack FFAG for ν STORM

Multi-particle tracking with dispersion matching.

After 60 turns \longrightarrow 10 particles (0.7%) lost
(no muon decay implemented in the simulation).



Results in the horizontal (left) and vertical (right) phase spaces

■ extraction
● injection

Outline

- vSTORM project

- Racetrack FFAG muon storage ring

- Summary

Summary

- Promising results for racetrack FFAG ring as a muon storage ring.
- Large momentum acceptance.
- Possible improvements:
 - Spiral / tilted straight lattice
 - Different k with different radii in circular section

Thank you for your attention