



vSTORM muon storage ring

Jean-Baptiste LAGRANGE

Outline

● vSTORM project

● Racetrack FFAG muon storage ring

● Summary

The "Collaboration"

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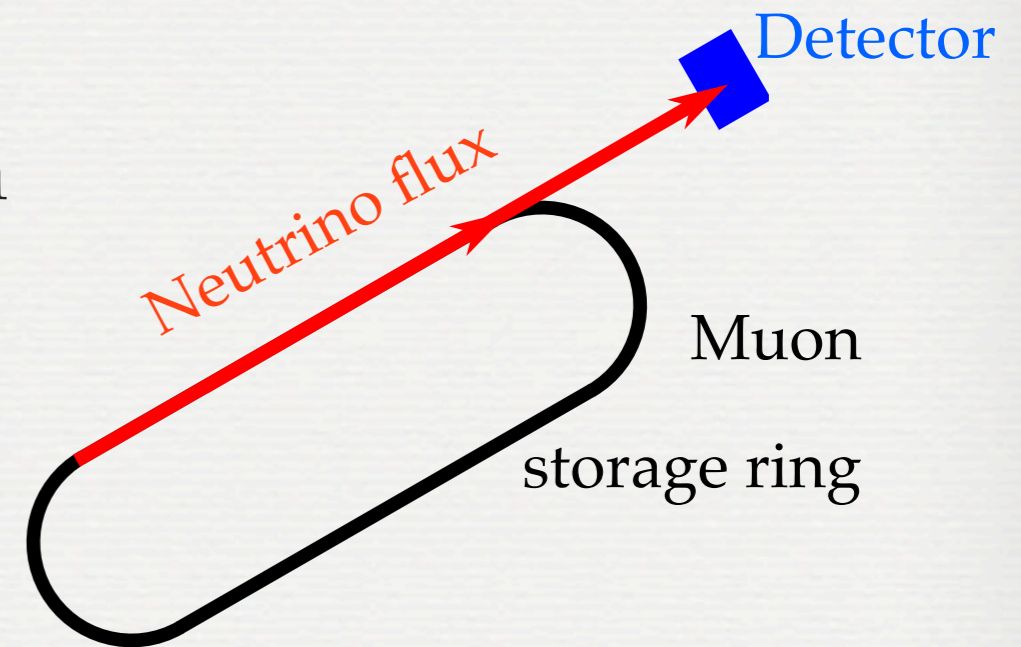
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Racetrack FFAG

Very low energy neutrino factory with a muon storage ring is investigated for neutrino experiments (neutrino mixing matrix).



Muons decay in neutrinos in the storage ring

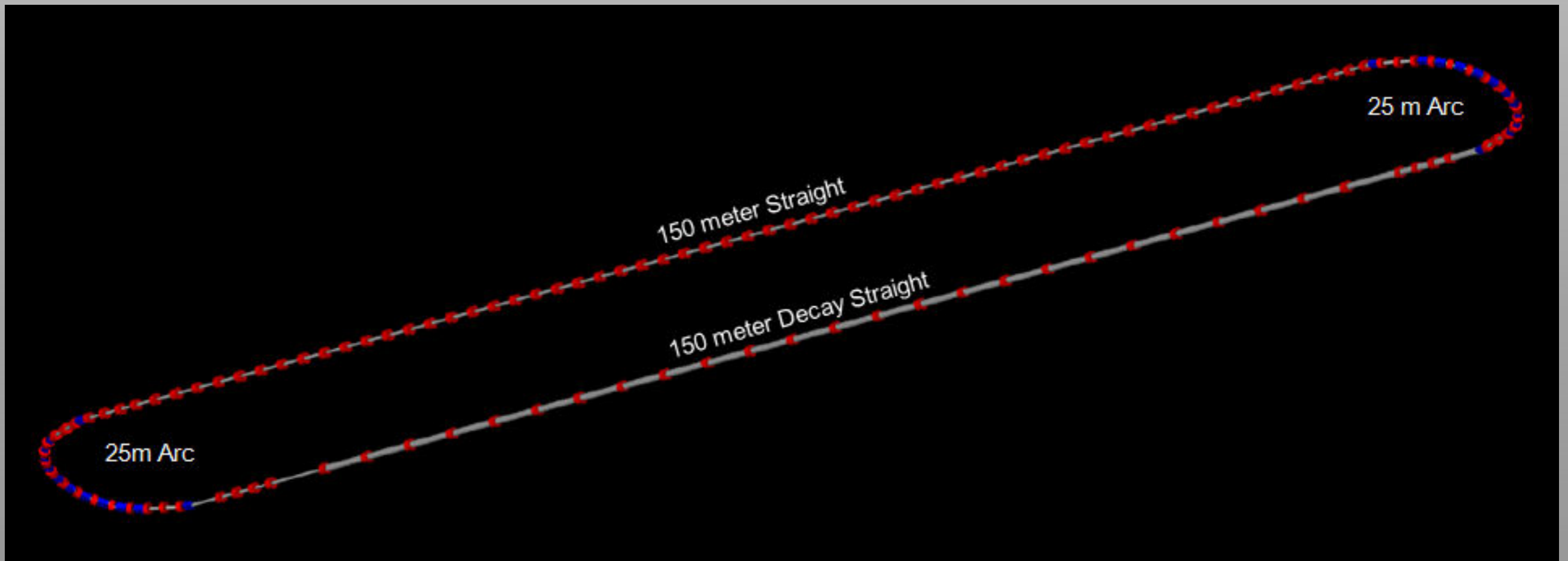
➔ Racetrack to collect the maximum decayed neutrinos.

Conventional racetrack storage ring has small longitudinal acceptance: $\frac{\Delta p}{p} \sim \pm 1\%$

Dramatically reduces the brightness at the detector.

➔ Racetrack FFAG design

FODO Decay ring



3.8 GeV/c – 10% momentum acceptance, circumference = 350 m

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Racetrack FFAG for ν STORM

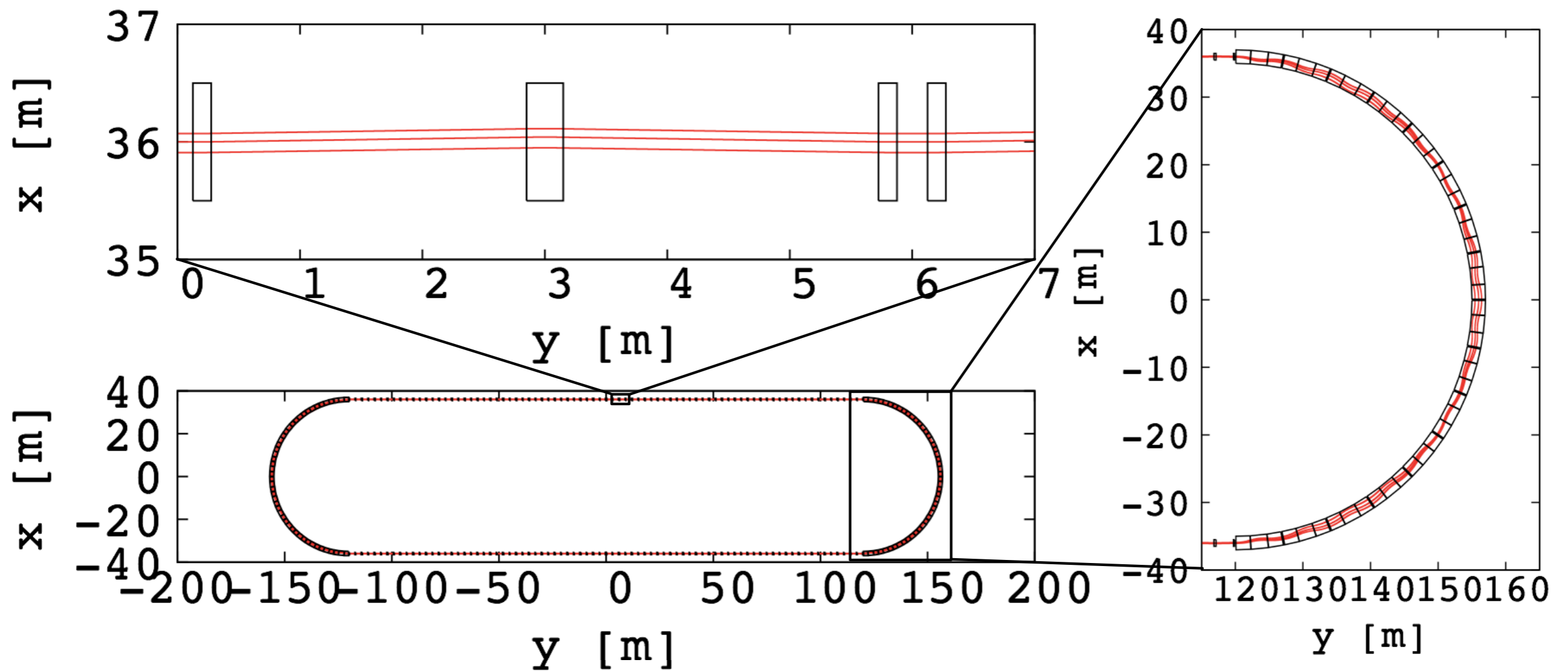
Constraint: in the straight part, the scallop must be as small as possible to have the biggest brightness at the detector. 15 mrad has been chosen as the maximum angle.

Longitudinal acceptance: $\frac{\Delta P}{P} = 20\%$

	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

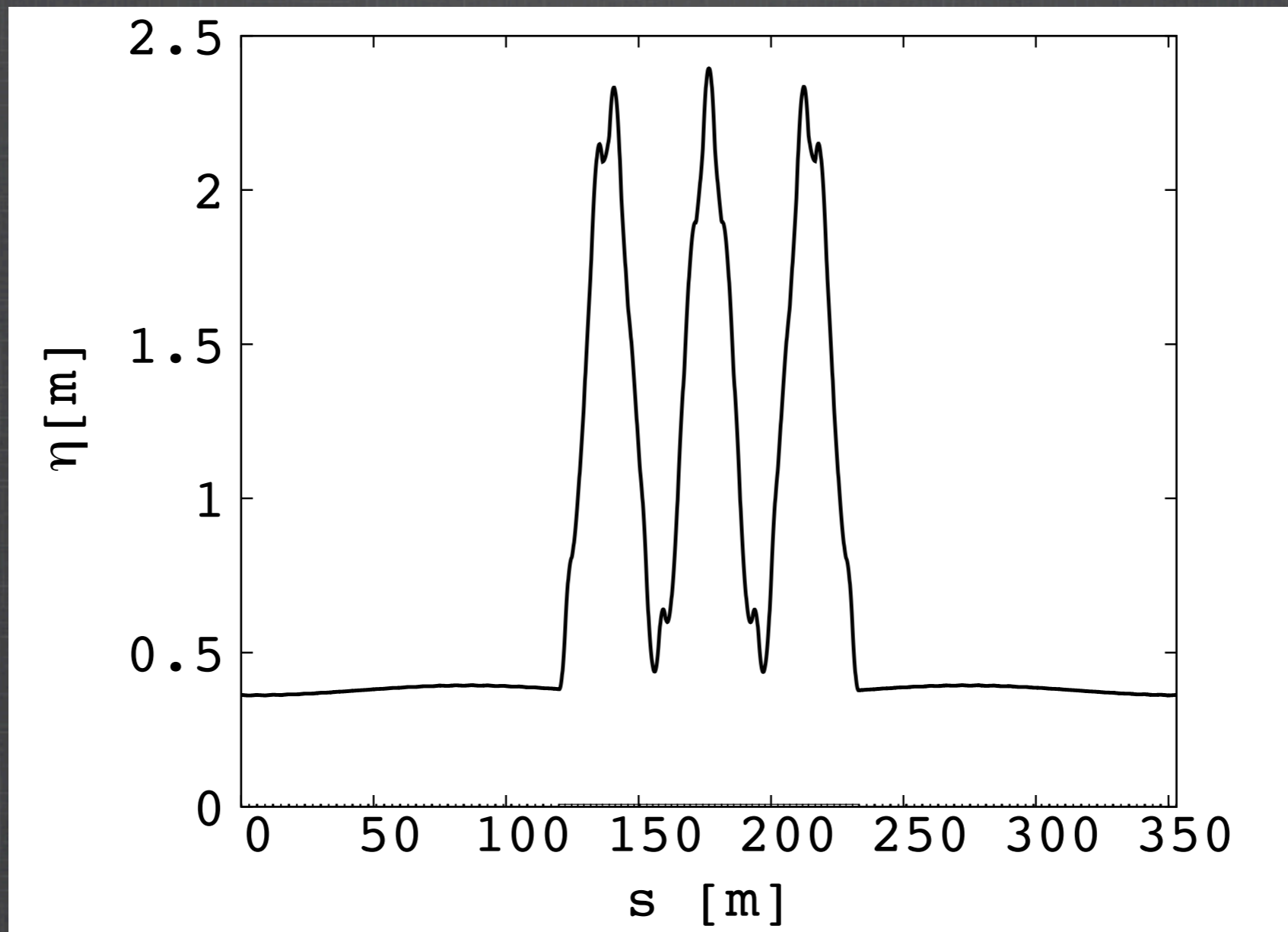
Racetrack FFAG for ν STORM

Layout



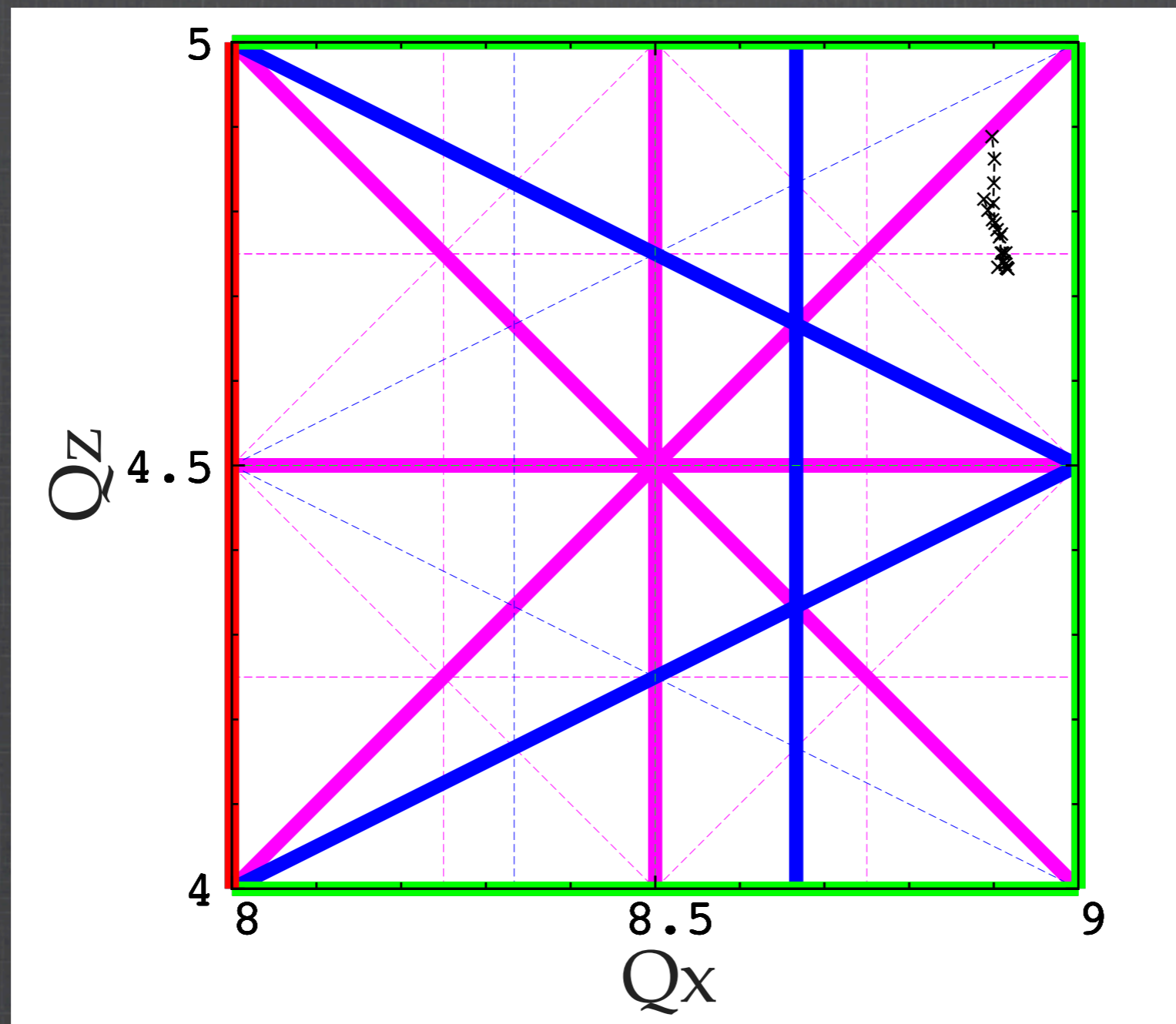
Racetrack FFAG for ν STORM

Dispersion function



Racetrack FFAG for vSTORM

Tune diagram $\frac{\Delta P}{P} = \pm 20\%$

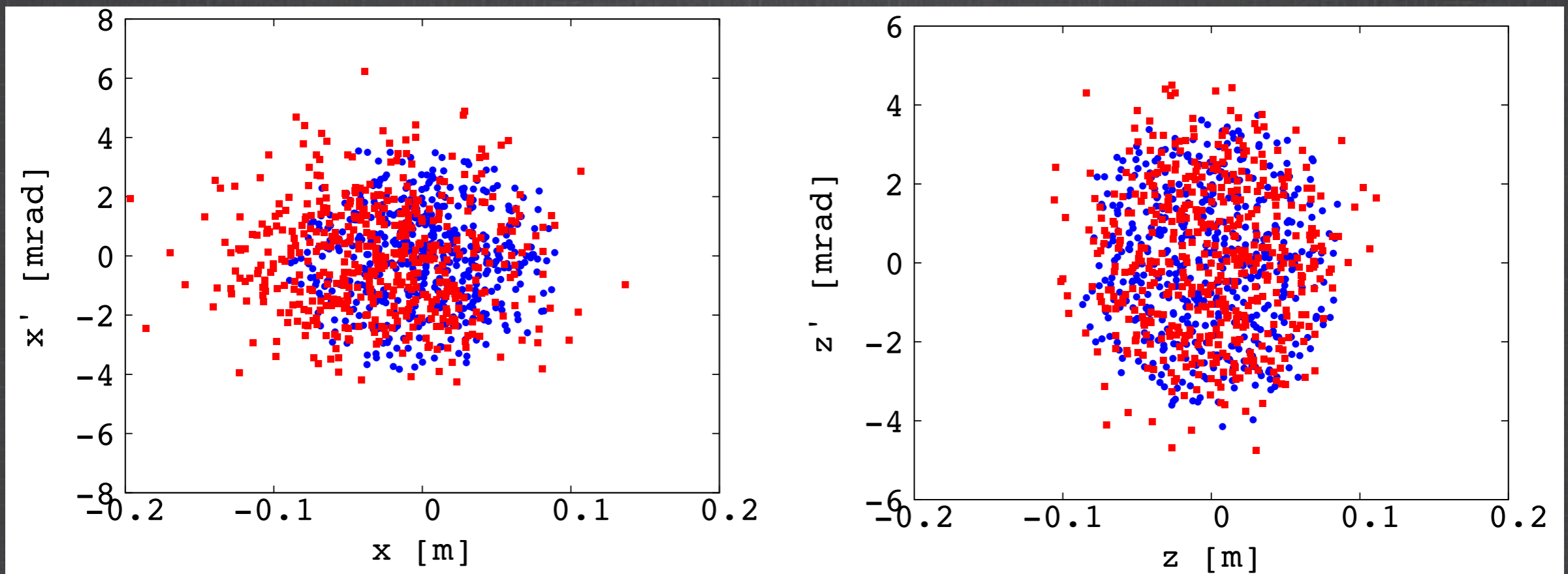


Racetrack FFAG for ν STORM

Multi-particle tracking without dispersion matching.

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

Momentum of the particles uniformly distributed around $3.8 \text{ GeV}/c \pm 16\%$. \longrightarrow no particle lost in 60 turns.

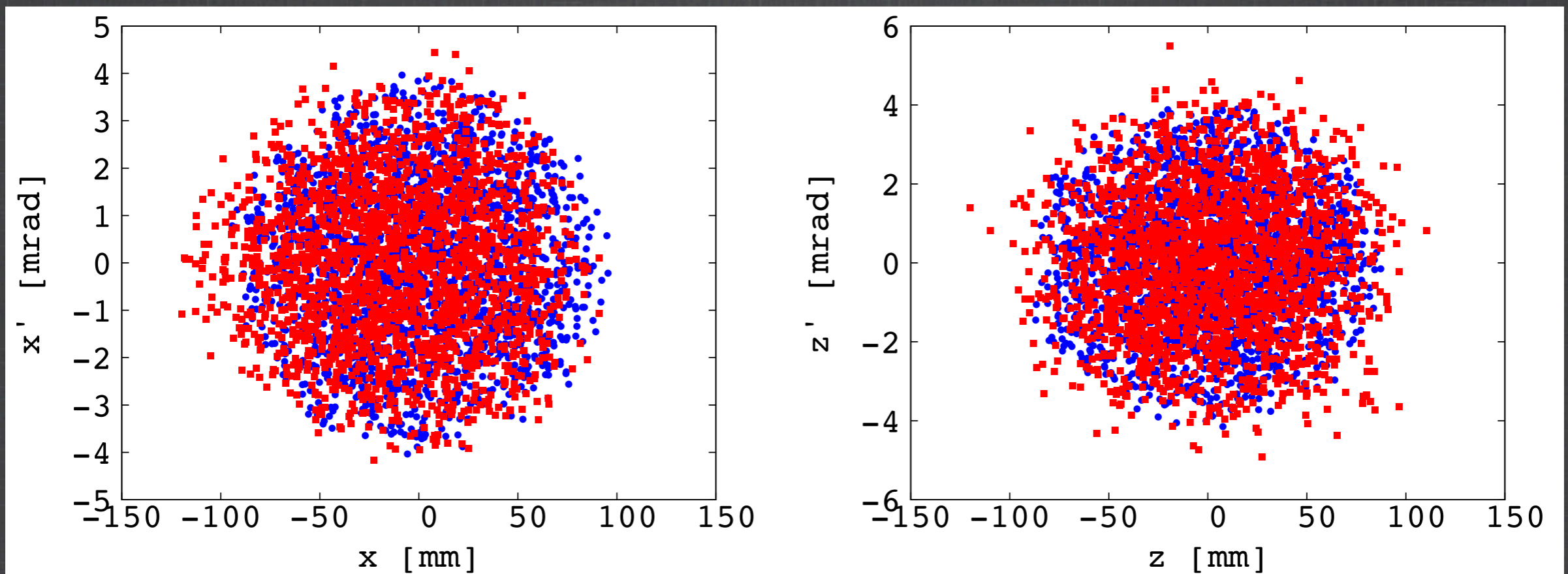


Racetrack FFAG for ν STORM

Multi-particle tracking with dispersion matching.

2100 particles with a Waterbag distribution. Unnormalized emittances are $400 \pi \text{ mm.mrad}$ in transverse planes.

Momentum of the particles uniformly distributed around $3.8 \text{ GeV}/c \pm 20\%$. \longrightarrow no particle lost in 60 turns.



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- Promising results for racetrack FFAG ring as a muon storage ring.
- Large momentum acceptance compared with FODO lattice.

Concerns - Improvements?

- Non realistic fringe field fall offs (linear).
- Size is quite big (x2 FODO).
- Different k with different radii in circular section ?
- Spiral + tilted straight lattice ?
- Injection scheme ?

Thank you for your attention