



FFAG HI accelerator for j-parc

JB. Lagrange, Y. Mori

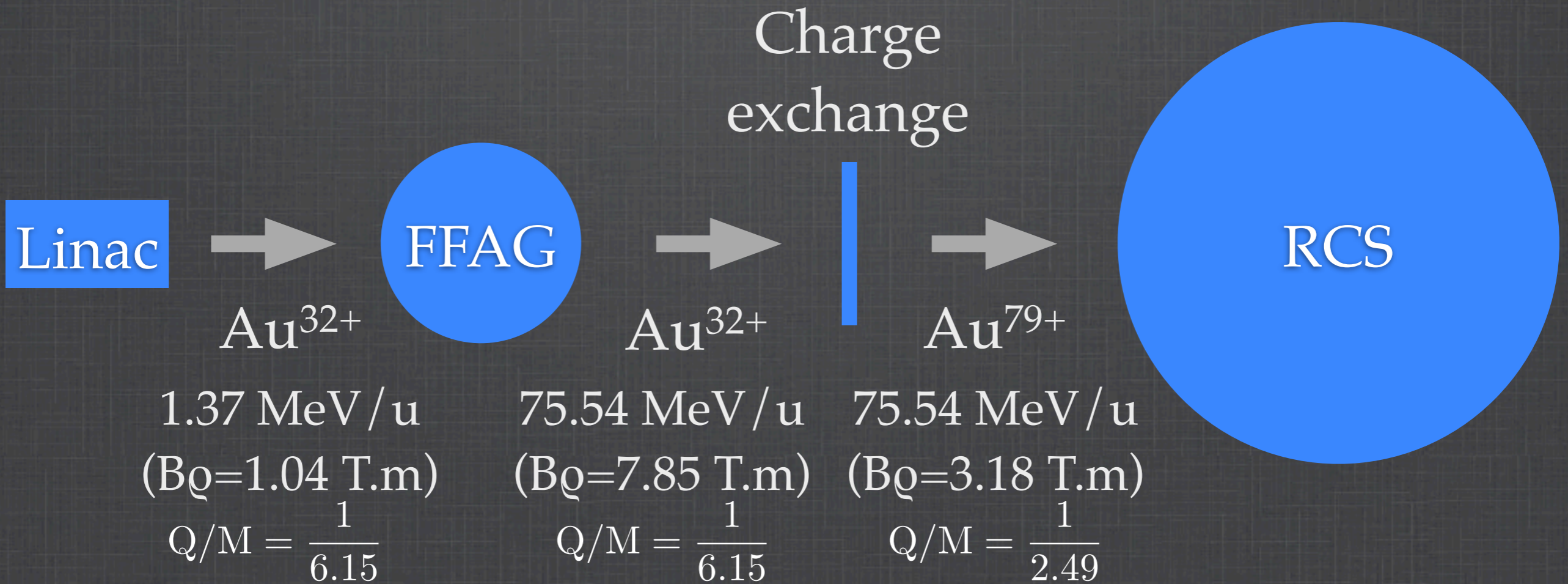
Outline

● Scheme proposal #1

● Scheme proposal #2

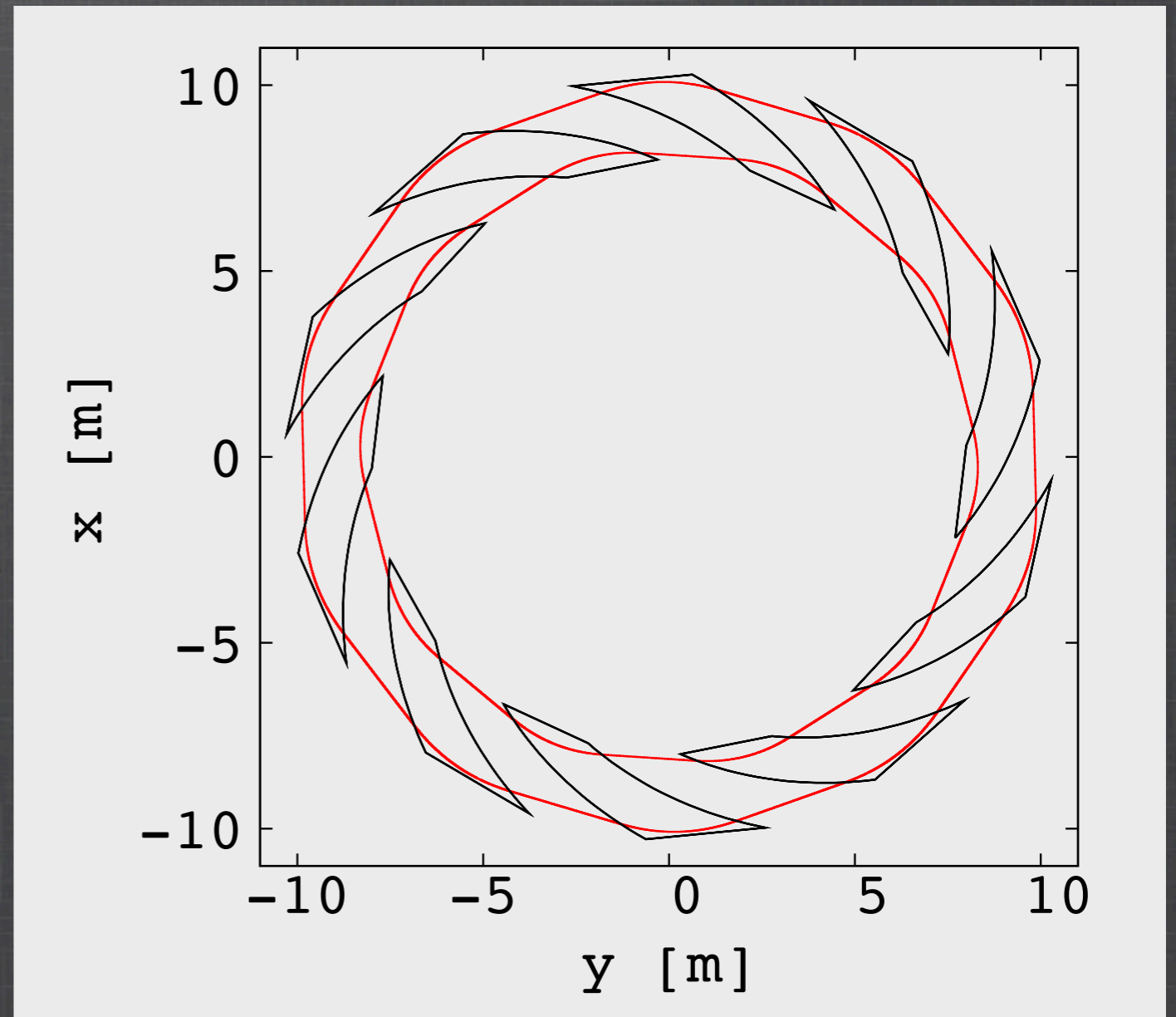
● Comparison

Scheme proposal #1



FFAG spiral

Type	spiral
Number of cells	10
Packing factor	0.5
k-value	9.5
Spiral angle [deg]	64.5
Inj. kinetic energy [MeV/u]	1.37
Ext. kinetic energy [MeV/u]	75.54
Max. energy radius [m]	9.9
Excursion [m]	1.7
Max. magnetic field [T]	1.6
Hor. cell tune [deg]	143.4
Vert. cell tune [deg]	28.1

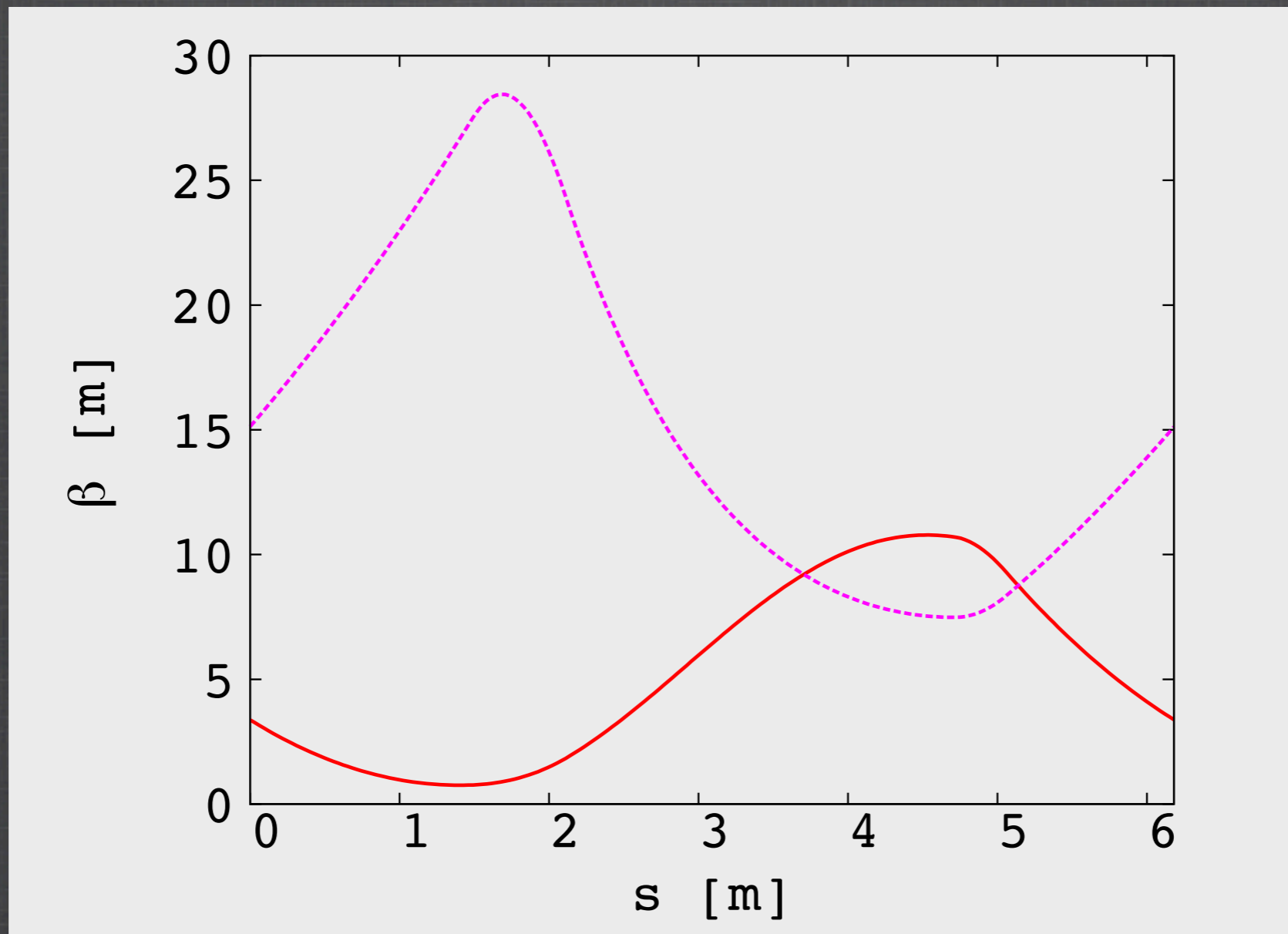


Closed orbits for injection and extraction energies

RF parameters

Revolution frequency inj.~ext.	0.314 MHz ~ 1.827 MHz
harmonic number	1
Acceleration time	40 ms
RF voltage V_{RF}	22.5 kV

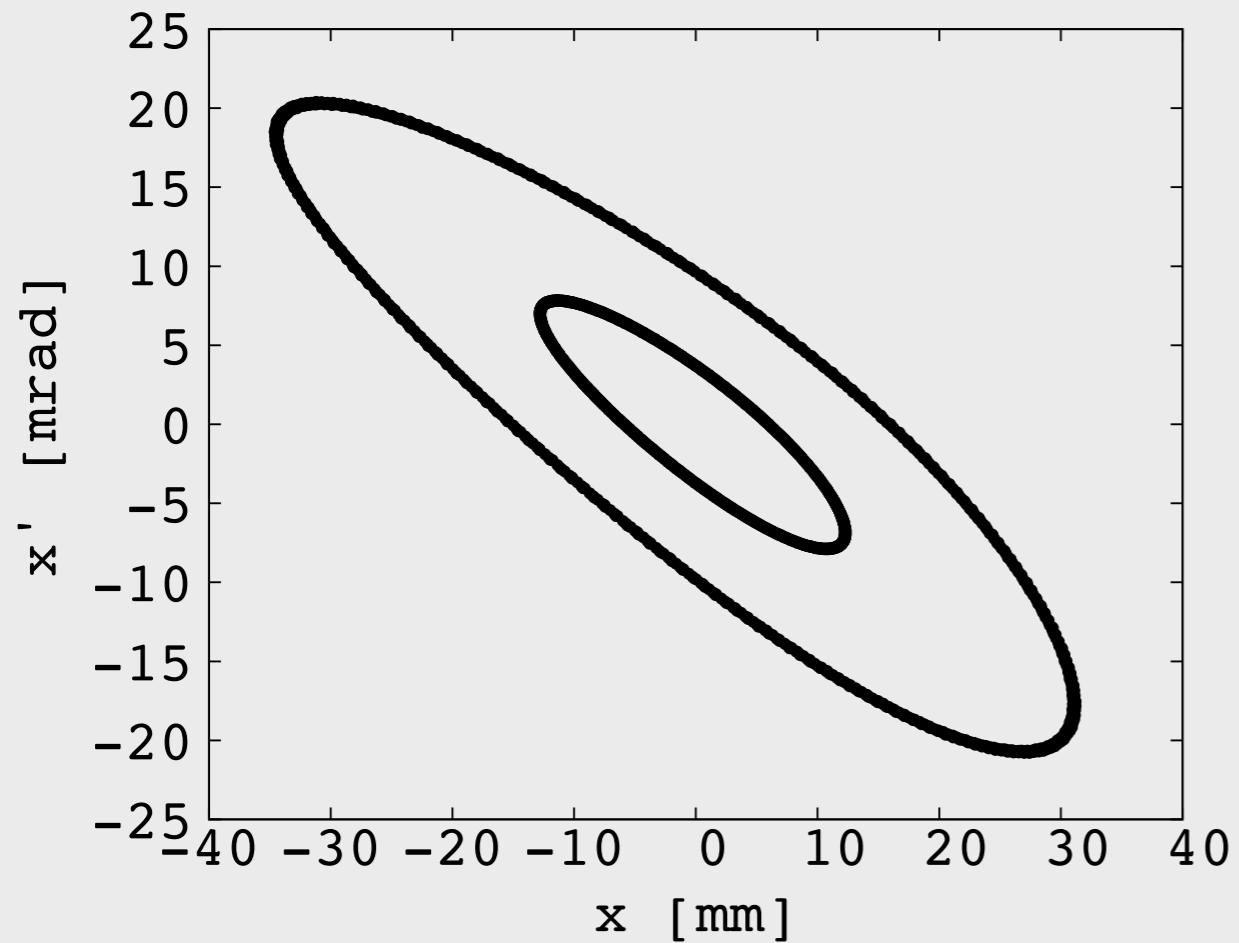
FFAG spiral beta-functions



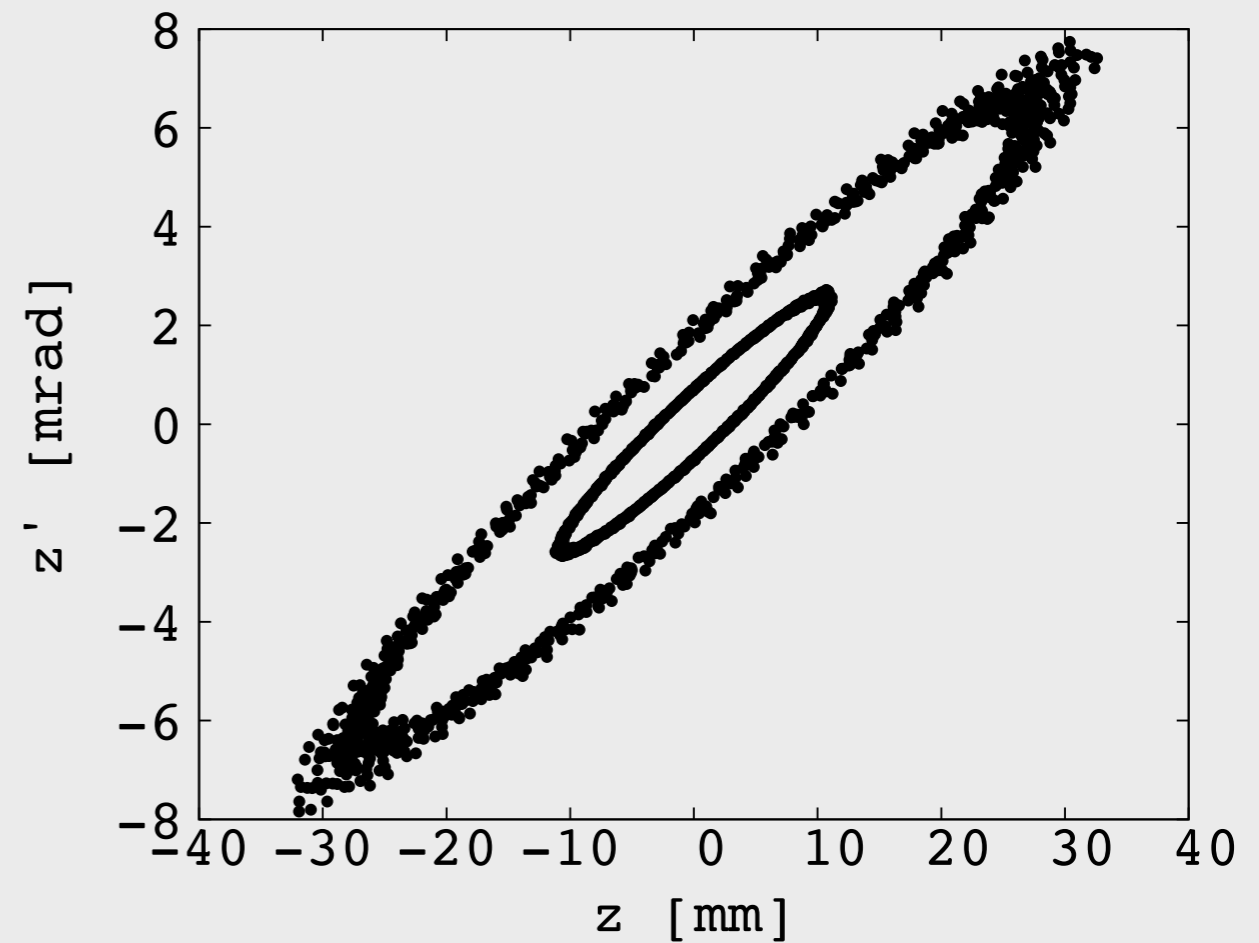
Horizontal (plain red) and vertical (dotted purple) betafunctions for one cell.

FFAG spiral

Dynamic apertures



Maximum horizontal stable
amplitude over 100 turns
(300π mm.mrad)



Maximum vertical stable
amplitude over 100 turns
(100π mm.mrad)

Outline

- Scheme proposal #1

- Scheme proposal #2

- Comparison

Scheme proposal #2

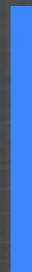
Linac



FFAG



Charge
exchange



MR

Au^{32+}

2 MeV/u

61.1 MeV/c/u

($B\rho=1.25 \text{ T}\cdot\text{m}$)

$$Q/M = \frac{1}{6.15}$$

Au^{32+}

117 MeV/u

481.3 MeV/c/u

($B\rho=9.88 \text{ T}\cdot\text{m}$)

$$Q/M = \frac{1}{6.15}$$

Au^{79+}

117 MeV/u

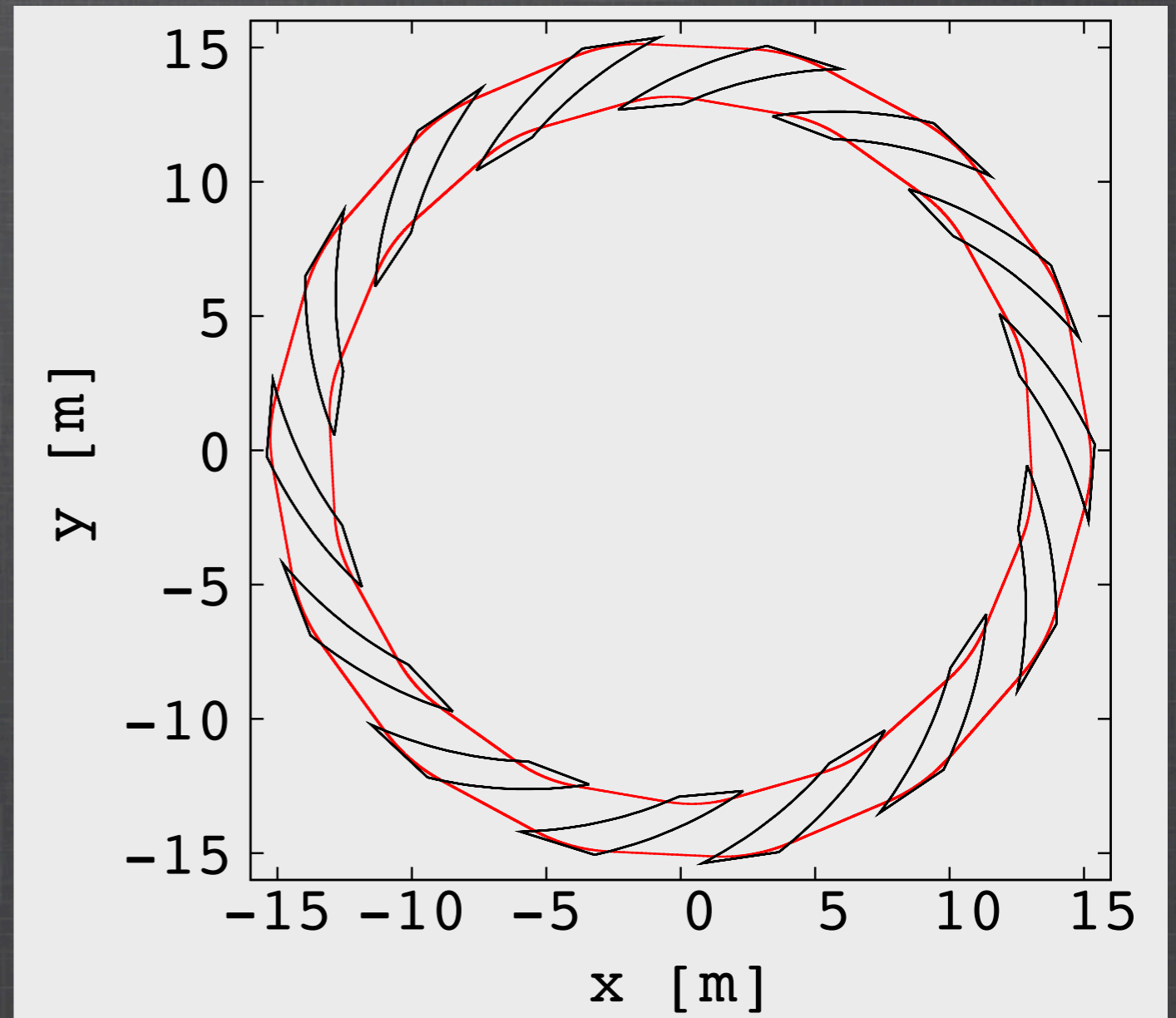
481.3 MeV/c/u

($B\rho=4.00 \text{ T}\cdot\text{m}$)

$$Q/M = \frac{1}{2.49}$$

FFAG spiral

Type	spiral
Number of cells	14
Packing factor	0.42
k-value	13
Spiral angle [deg]	65.6
Inj. kinetic energy [MeV/u]	2
Ext. kinetic energy [MeV/u]	117
Max. energy radius [m]	15.3
Excursion [m]	2.4
Max. magnetic field [T]	1.6
Hor. cell tune [deg]	108.5
Vert. cell tune [deg]	21.7

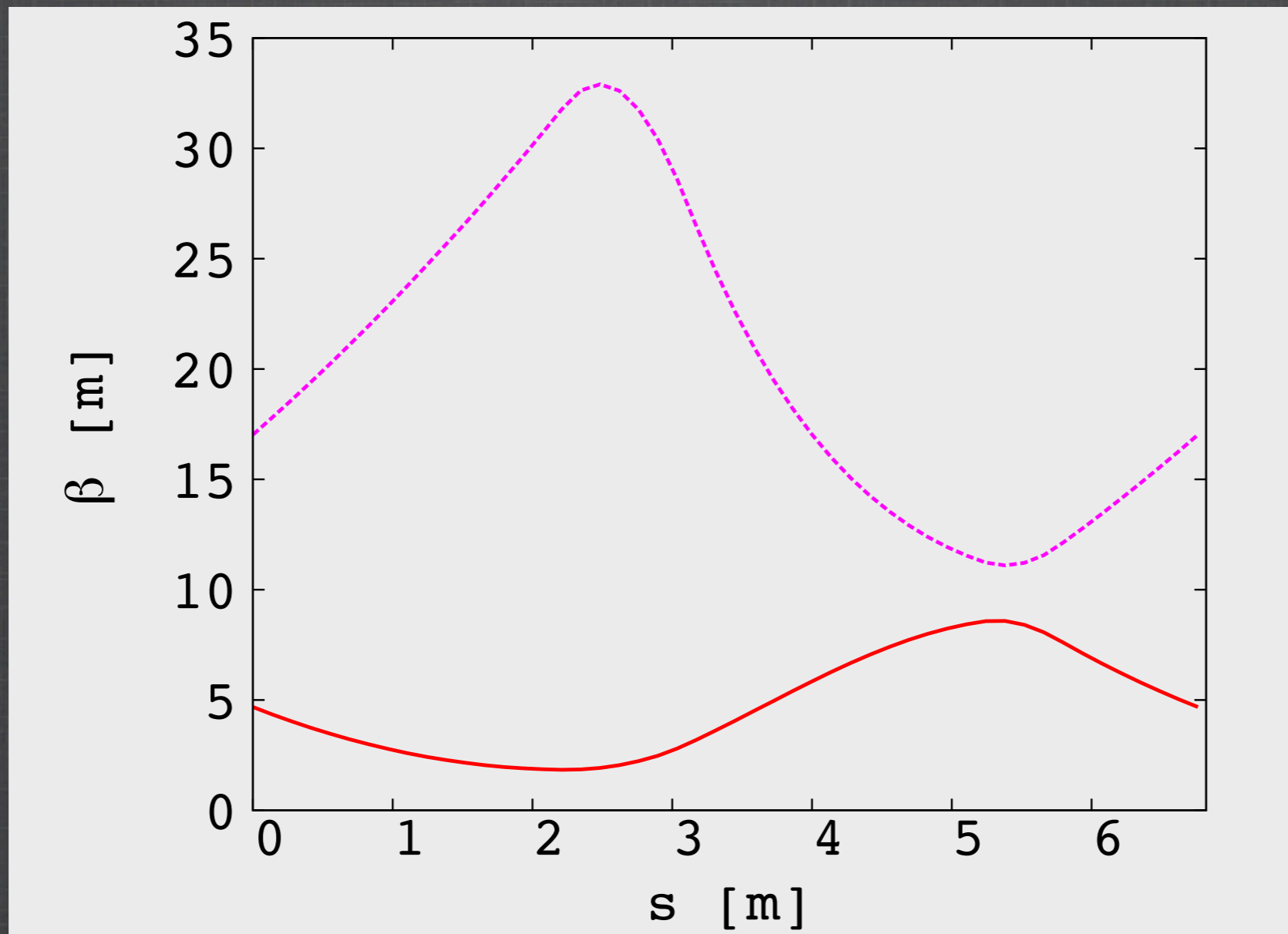


Closed orbits for injection and extraction energies

RF parameters

Revolution frequency inj.~ext.	0.218 MHz ~ 1.442 MHz
harmonic number	1
Acceleration time	40 ms
RF voltage V_{RF}	45 kV

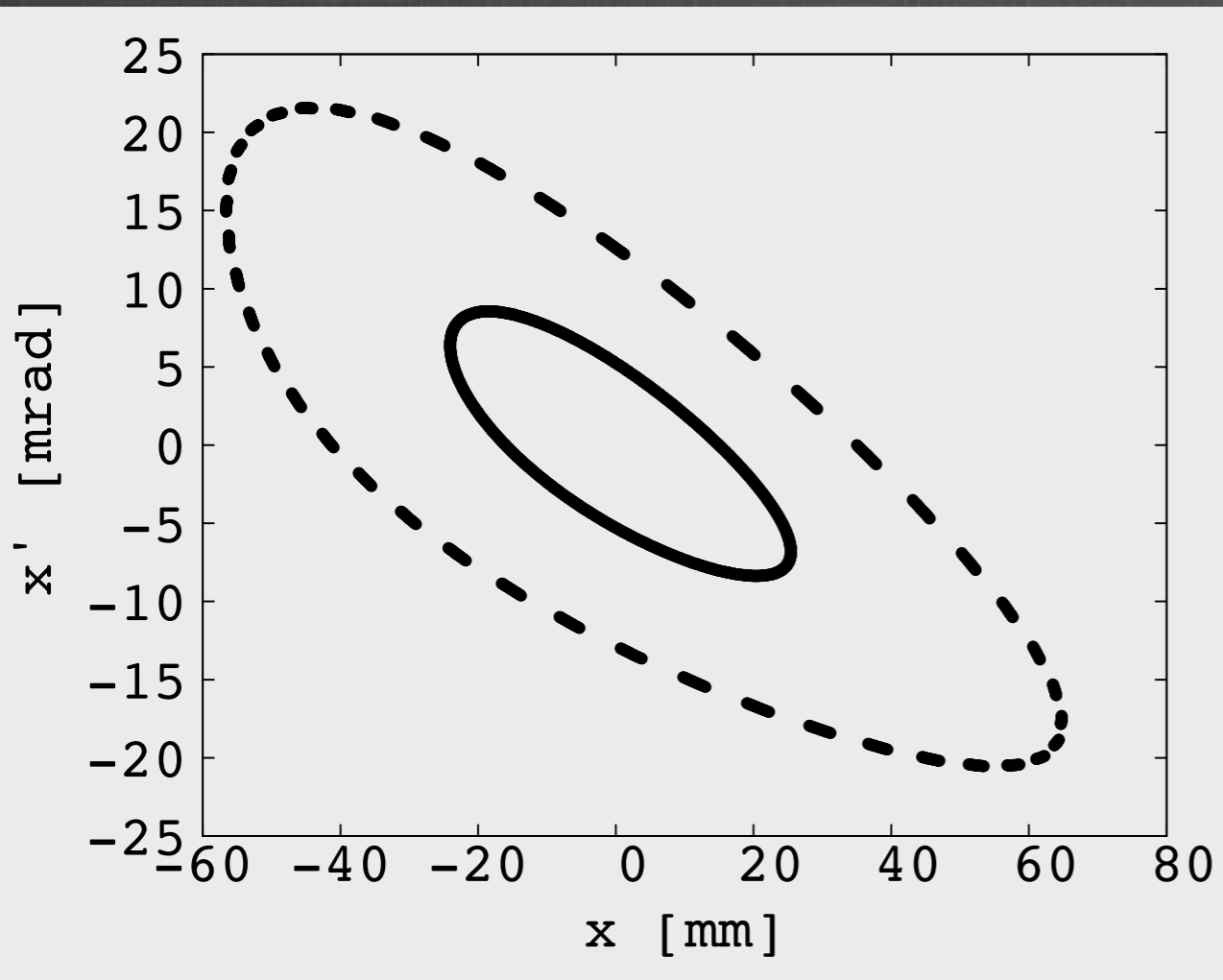
FFAG spiral beta-functions



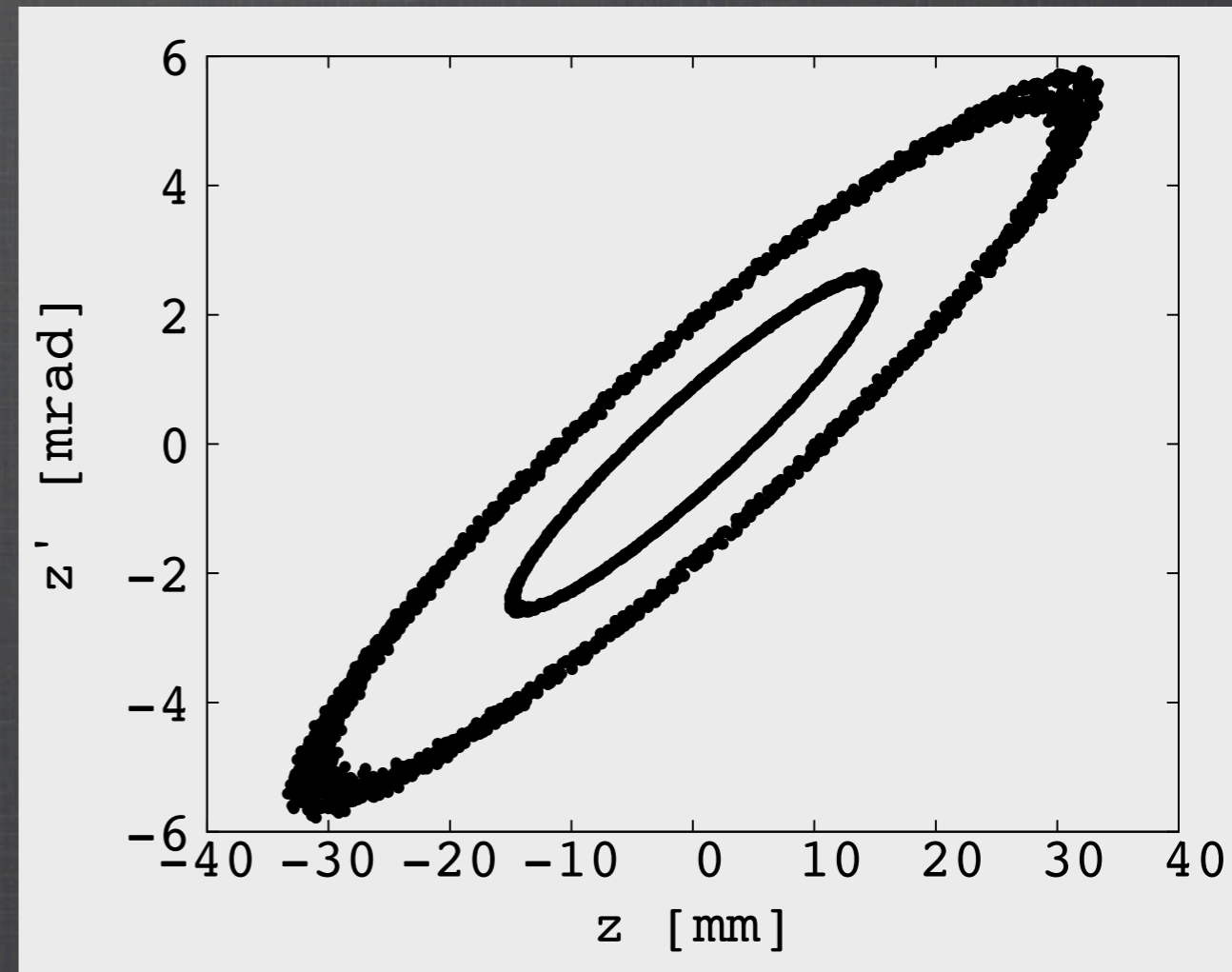
Horizontal (plain red) and vertical (dotted purple) betafunctions for one cell.

FFAG spiral

Dynamic apertures



Maximum horizontal stable
amplitude over 100 turns
(800π mm.mrad)



Maximum vertical stable
amplitude over 100 turns
(80π mm.mrad)

Summary

- FFAG is a good candidate for HI injector.
- Can be used before RCS (cheapest solution)
- Can be used before MR (best user solution)

Thank you for your attention