PRISM with Advanced zero-chromatic FFAG

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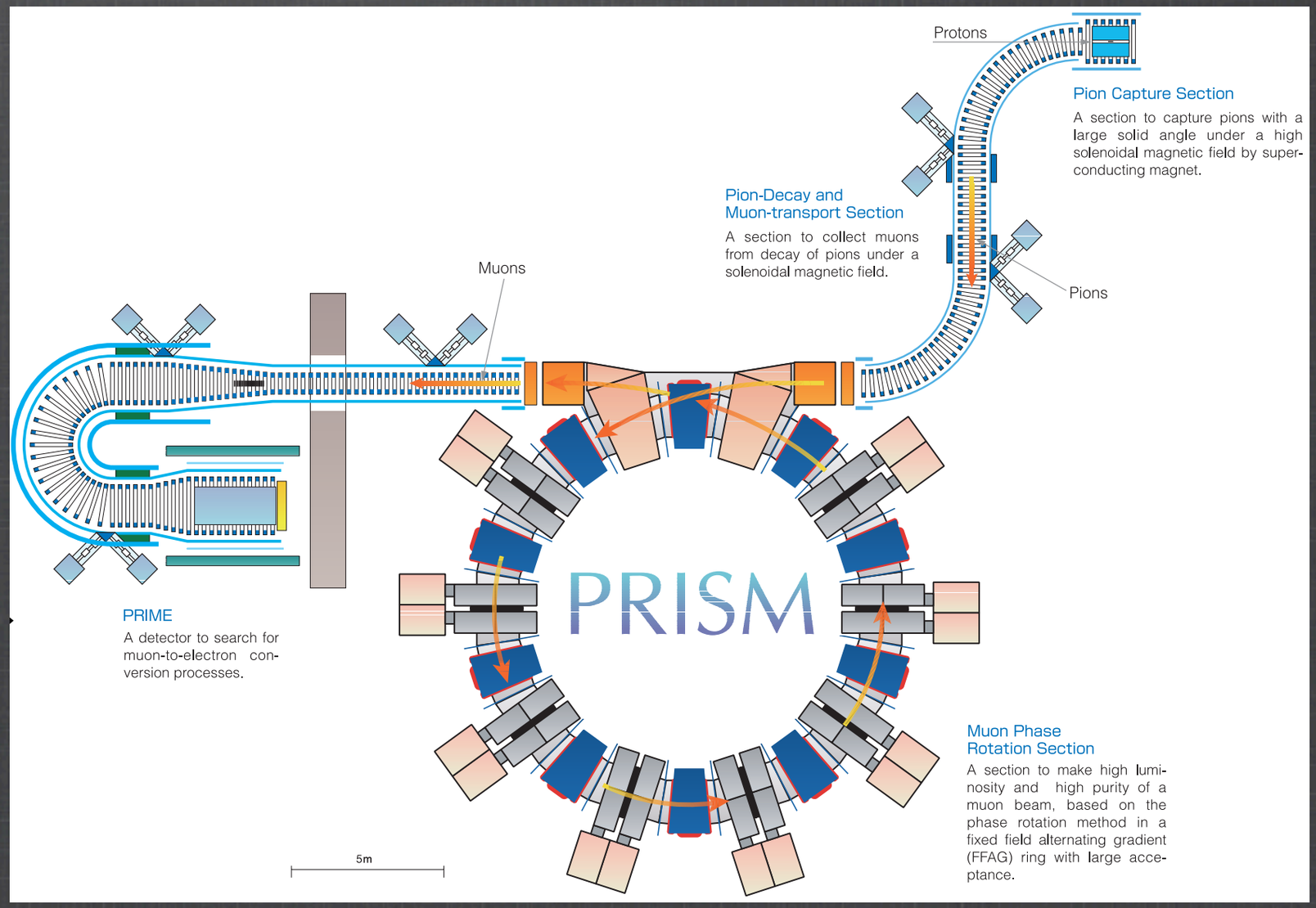
PRISM project

Layout

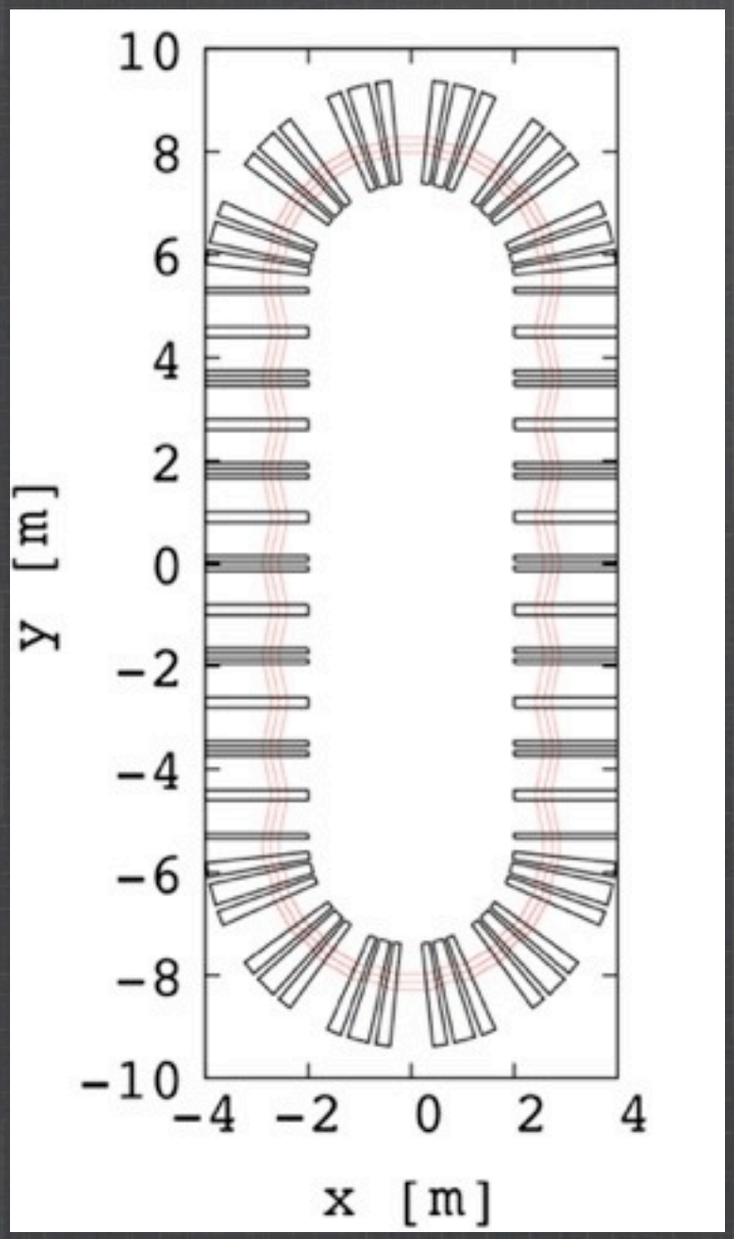
Muon phase rotator (at Osaka University)

- Momentum acceptance:
  68MeV / c ± 20%
- Transverse acceptance:
  - hor.: 30 000π mm.mrad
  - vert.: 3 000π mm.mrad



Race track FFAG PRISM

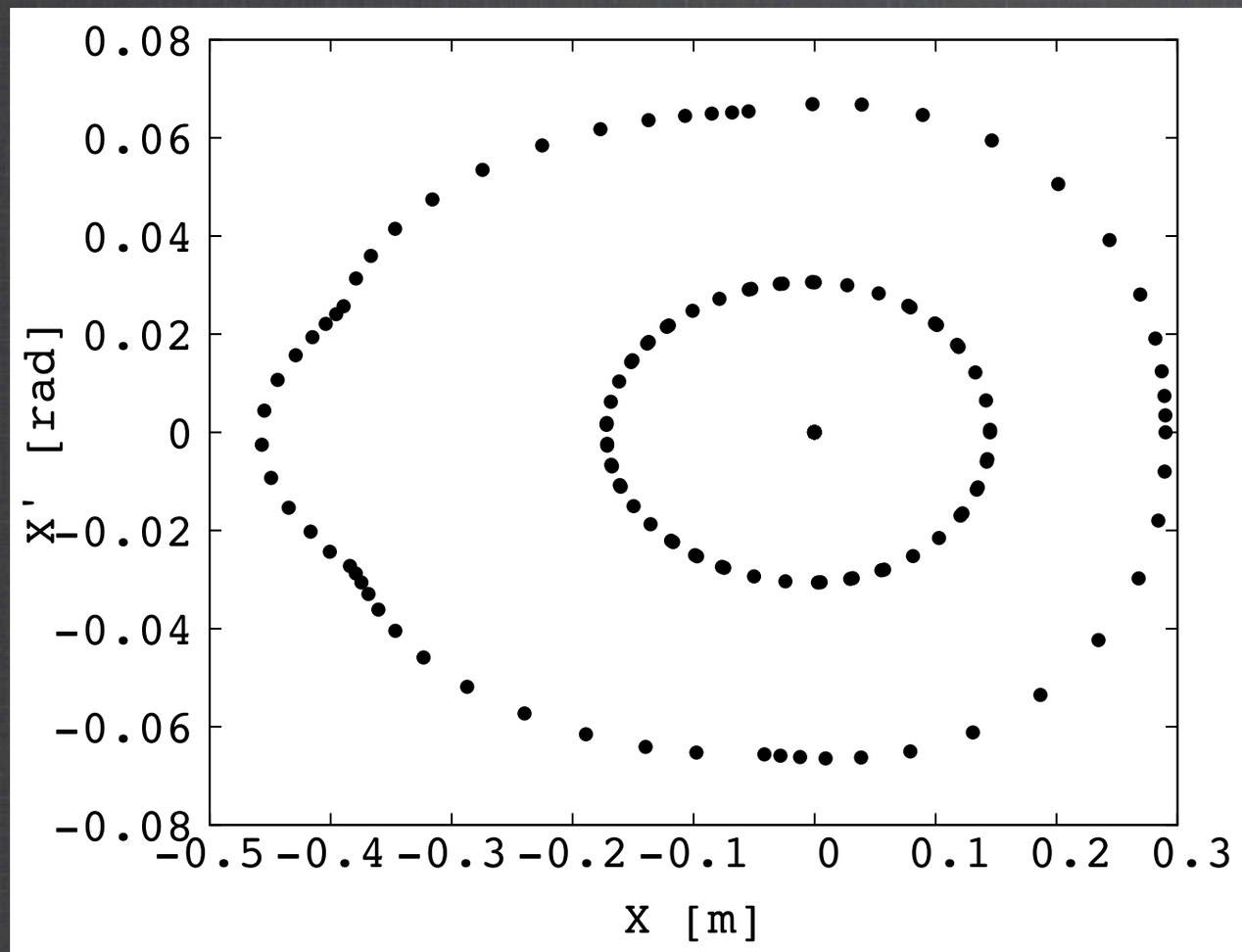
Parameters

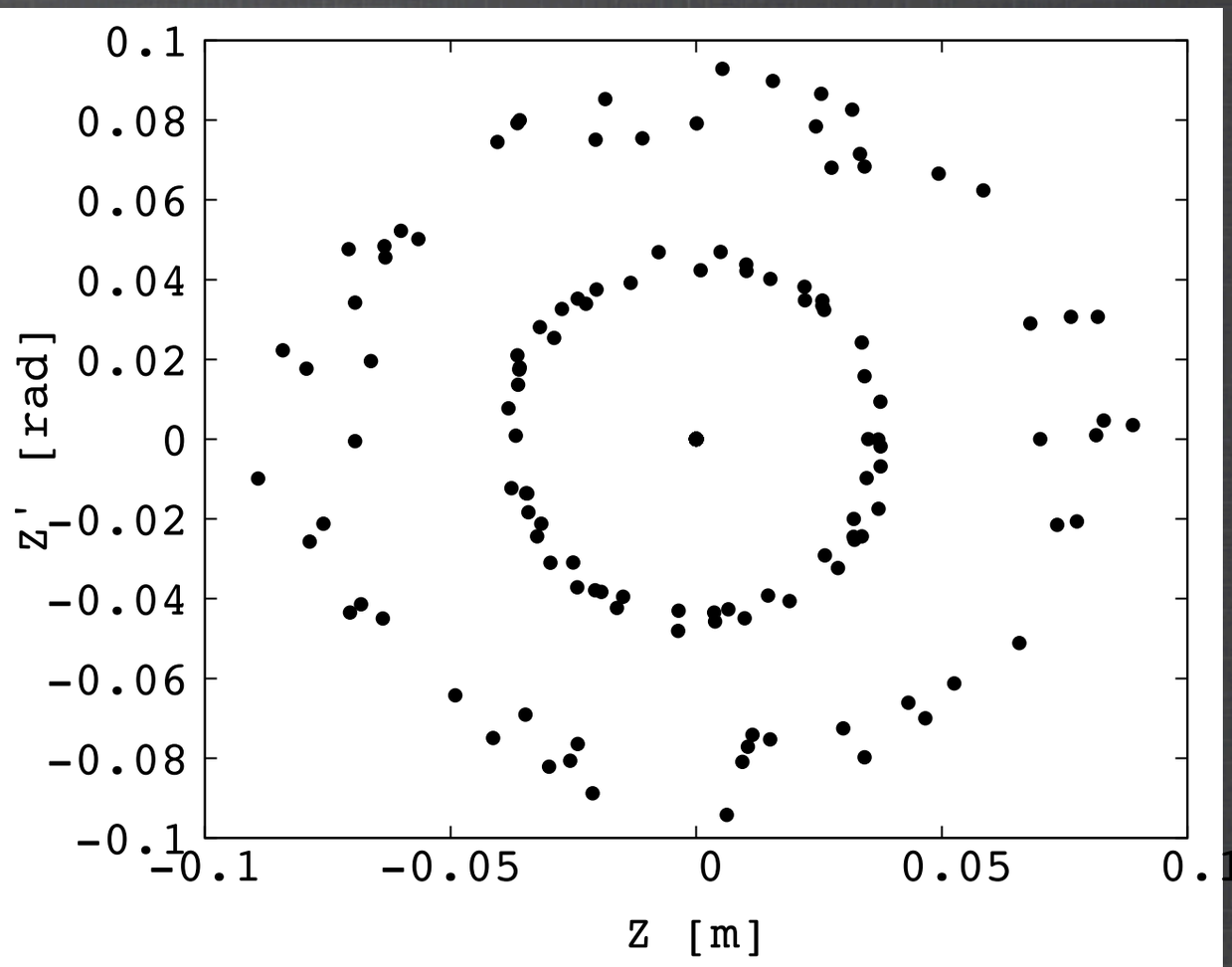


Bending cell FDF triplet	
k-value	2.55
Average radius	2.7 m
Phase advances:	
Horizontal μ_x	60 deg.
Vertical μ_z	90 deg.
Dispersion	0.8 m

Straight cell	
m-value	$1.3\,\mathrm{m}^{-1}$
Length	1.8 m
Phase advances:	
Horizontal μ_x	27 deg.
Vertical μ_z	94 deg.
Dispersion	0.8 m

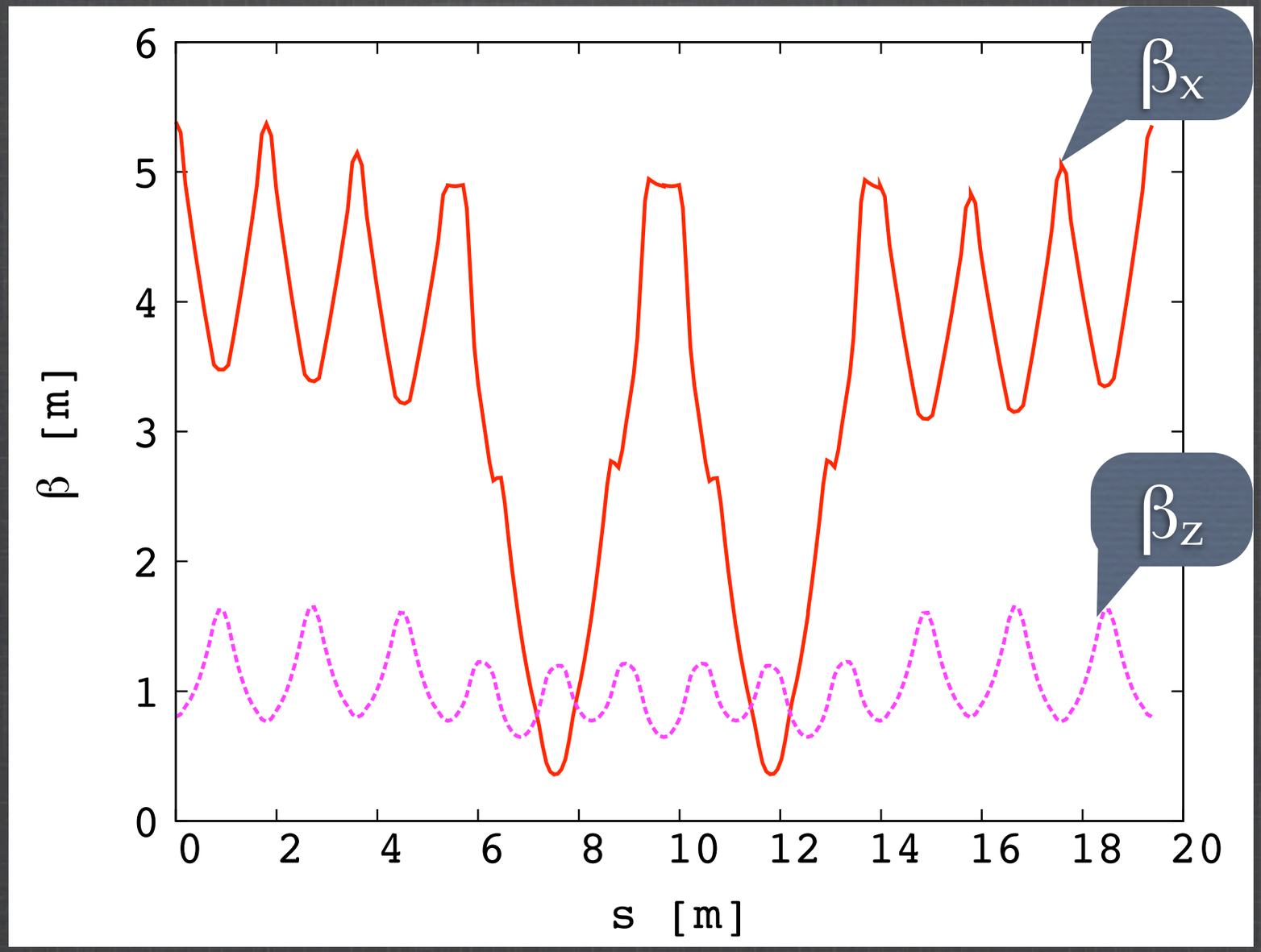
Acceptances



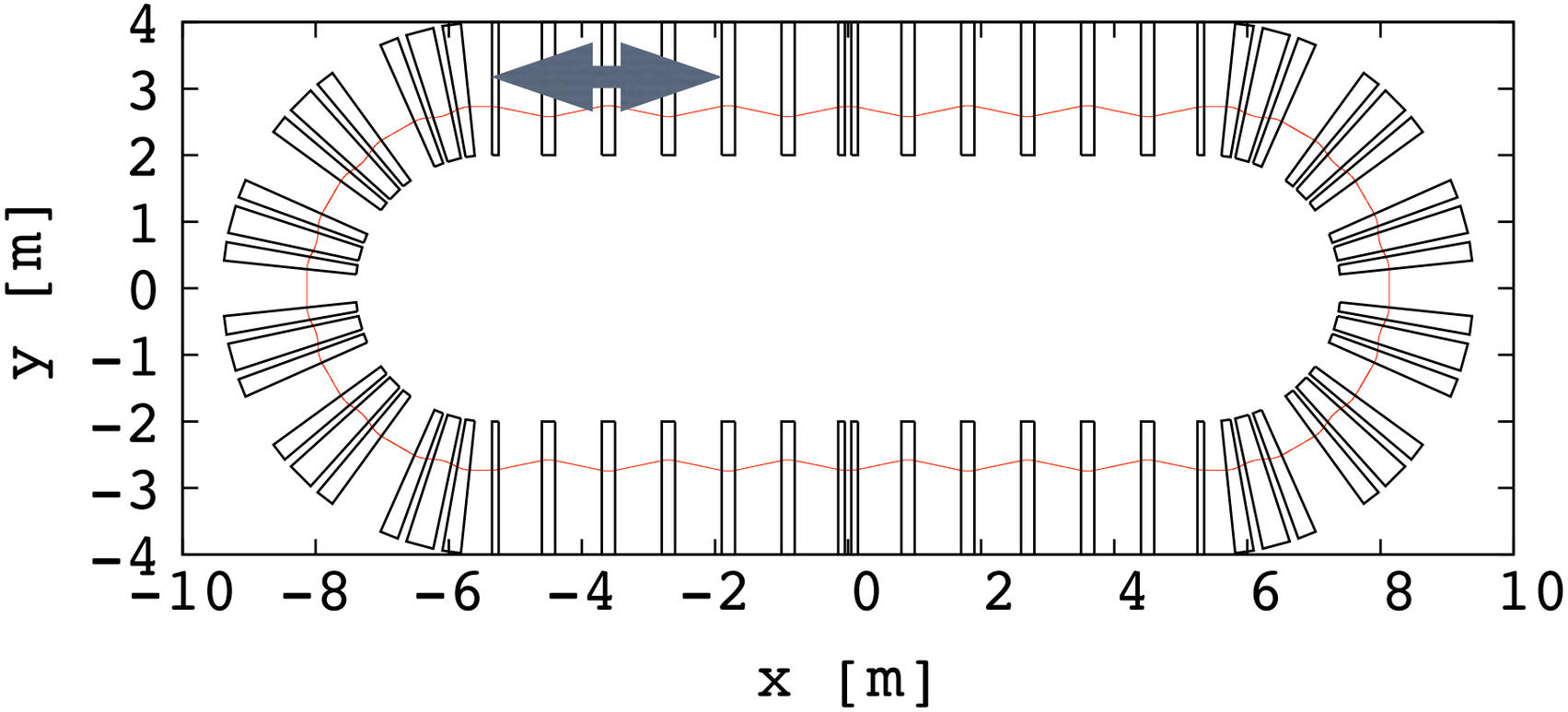


Horizontal (left) and vertical (right) acceptance of the ring over 30 turns
Far collimators identify lost particles

Betafunctions



Future plan



ERIT WITH MINIMUM VERTICAL BETAFUNCTION

- FFAG ring with internal target.
- limitation in the number of surviving turns in existing ERIT: ionization heating in vertical.

$$\frac{d\varepsilon_y}{ds} = -\frac{1}{\beta^2 E}\frac{dE}{ds}\varepsilon_y + \frac{\beta_y E_s^{\,2}}{2\beta^3 m_p c^2 L_R E}$$

Heating term

Cooling term

- insertion of an element with a small vertical betafunction at a place where the target could be installed.

ERIT WITH MINIMUM VERTICAL BETAFUNCTION

- In order to change the least possible the existing machine, an insertion has been designed.
  - to keep the cavity, the length of the insertion is settled: 1.4m.
  - this length is too small to insert a **π**-section: change the k-value in the arc to make it transparent: k goes from 1.92 to 2.57.
  - 10 cm are kept to install the target.
  - In existing ERIT, vertical betafunction is 0.8m at the target. A reasonable goal would be to decrease this value by a factor 3.

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ERIT WITH MINIMUM VERTICAL BETAFUNCTION

Parameters of the insertion	
Straight scaling FFAG	
Quadruplet DFFD	
n/ρ	$1.52\,m^{-1}$
Length	$1.4\,m$
D magnets length	$16\,cm$
F magnets length	$12\,cm$
Phase advances:	
horizontal μ_x	41 deg.
vertical μ_z	148 deg.

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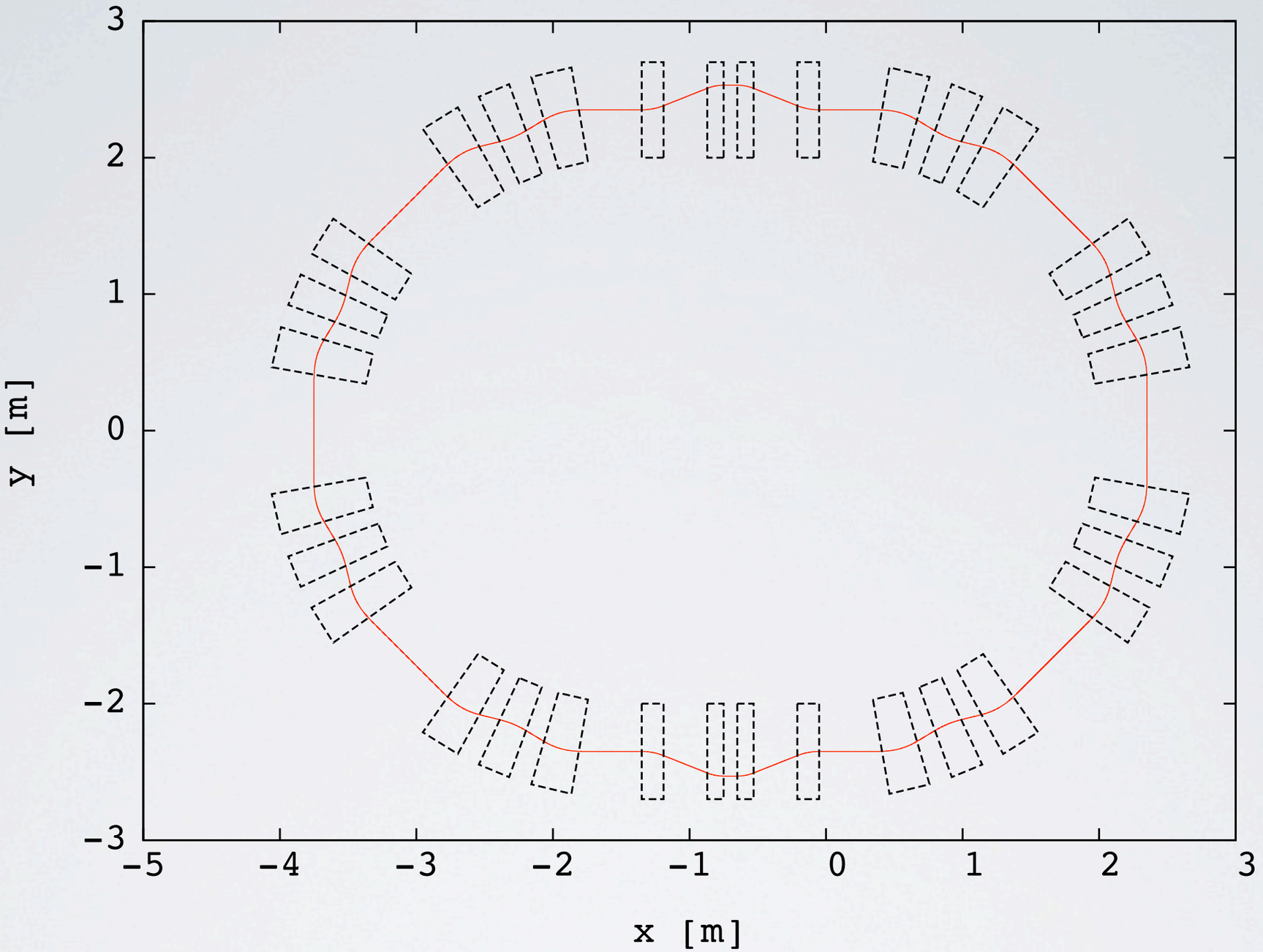

Closed orbit for 11 MeV proton.

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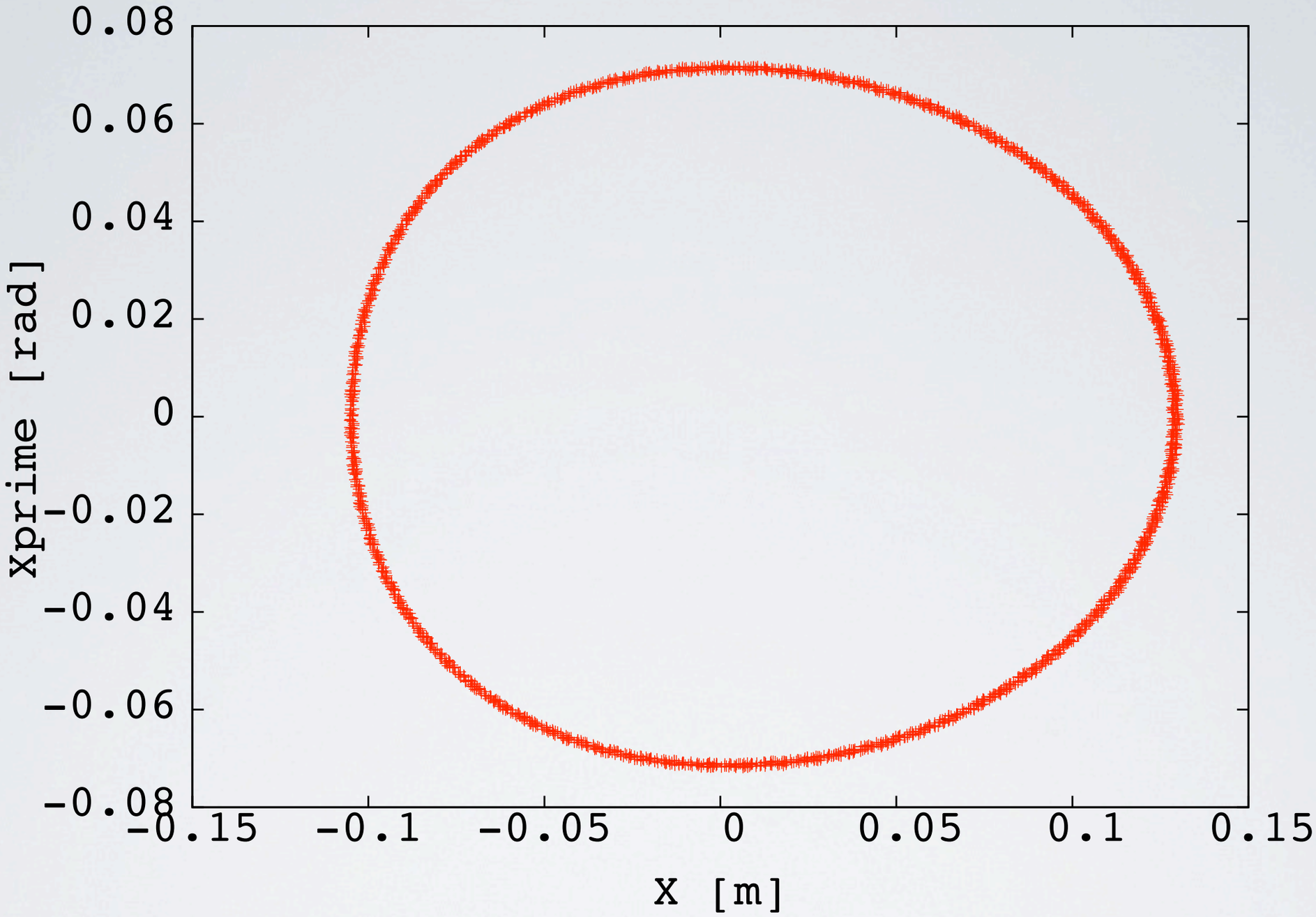

Horizontal Poincarre map after tracking 1000 turns in the new lattice.

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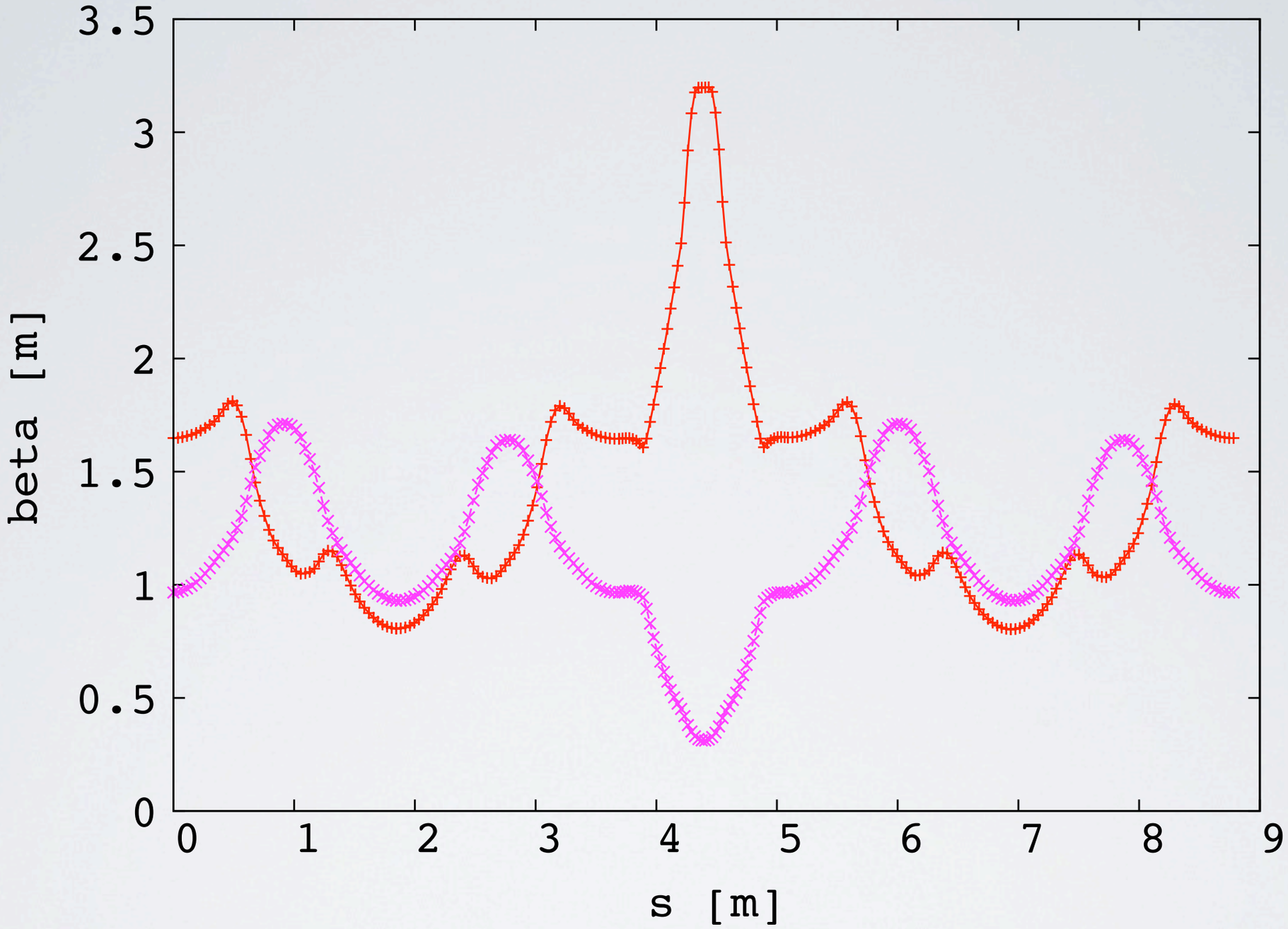

Horizontal (red) and vertical (purple) betafunctions of half of the ring. At the target, βx=3.2m and βz=0.29m

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Thank you for your attention