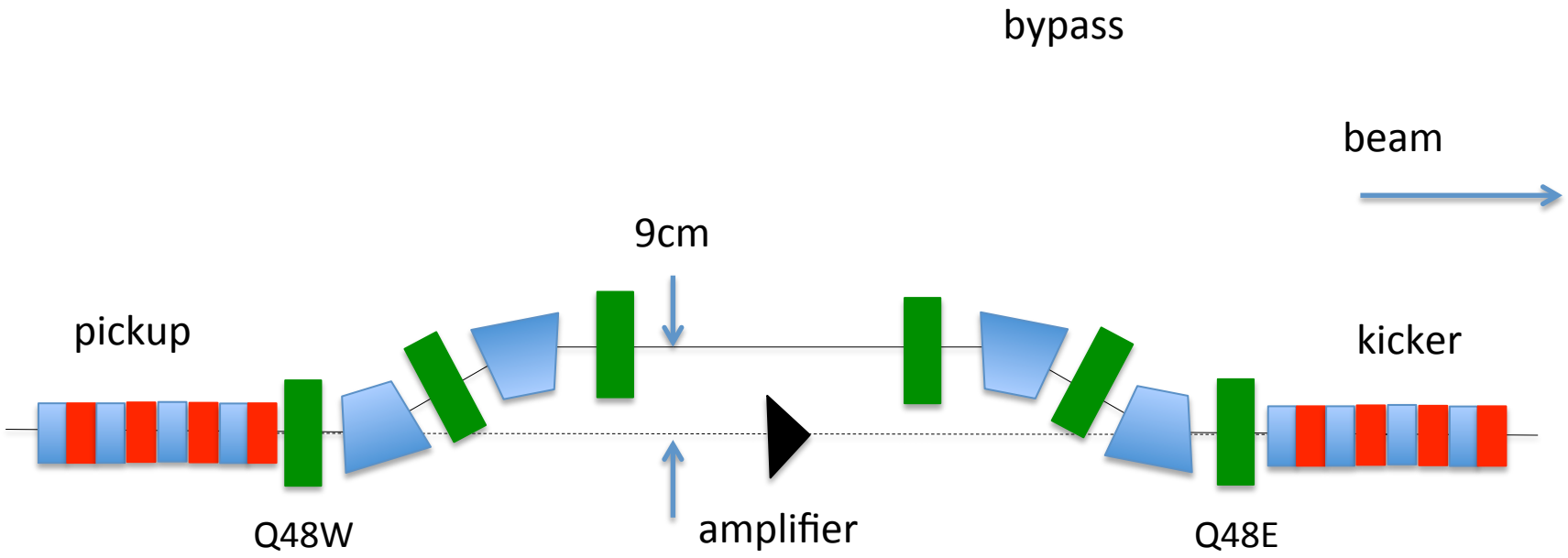
Test of Optical Stochastic Cooling in CESR

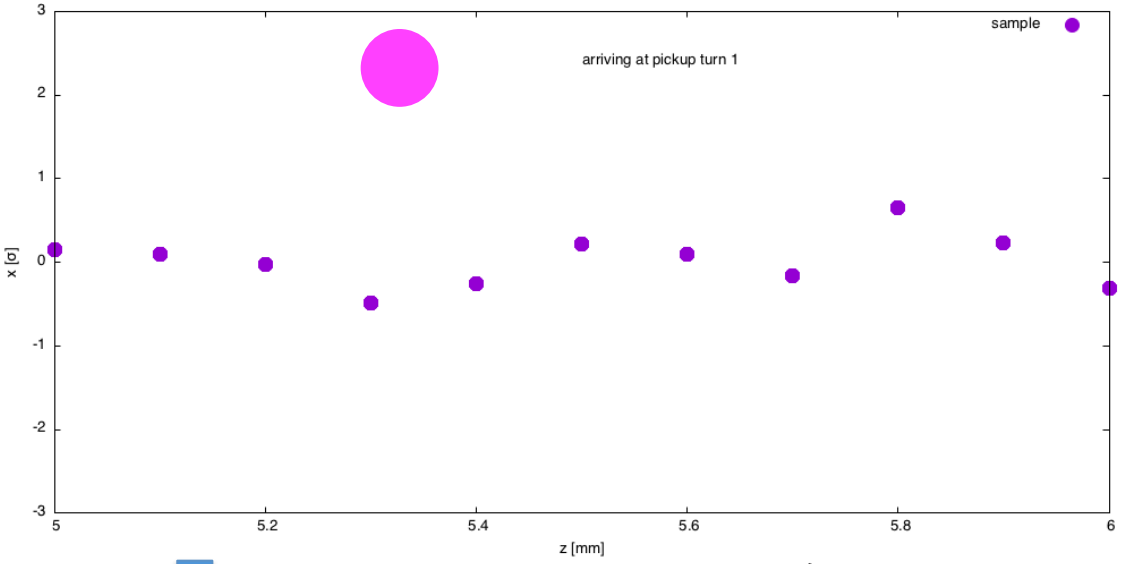
September 19, 2017

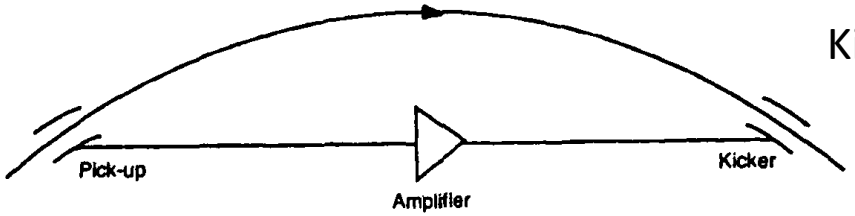


$\Delta S = 2mm$

L3

Multi bunch Feedback

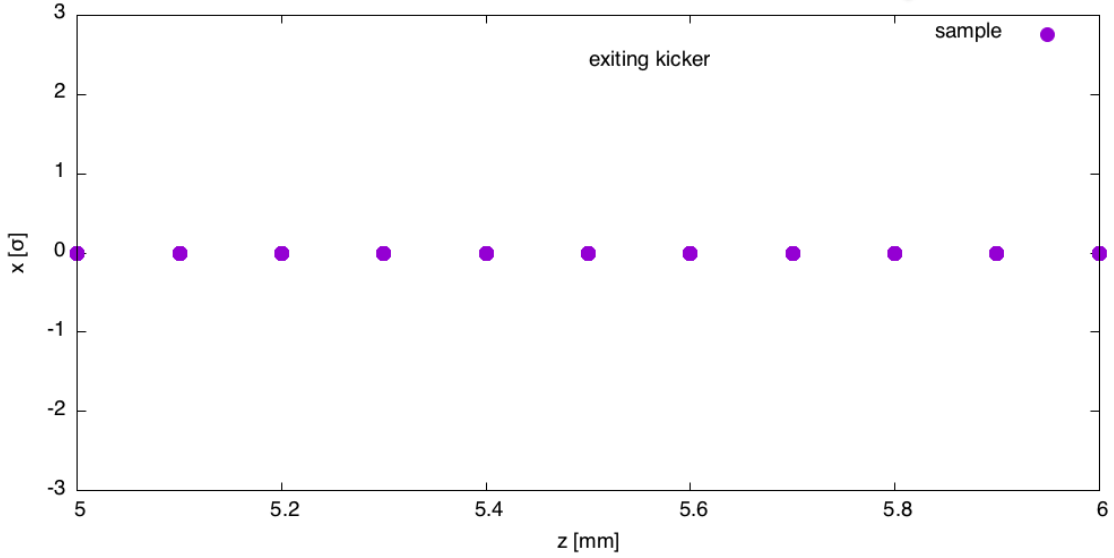




Kicker corrects offset

Pickup measures offset

Each ● represents centroid of distributon of particles



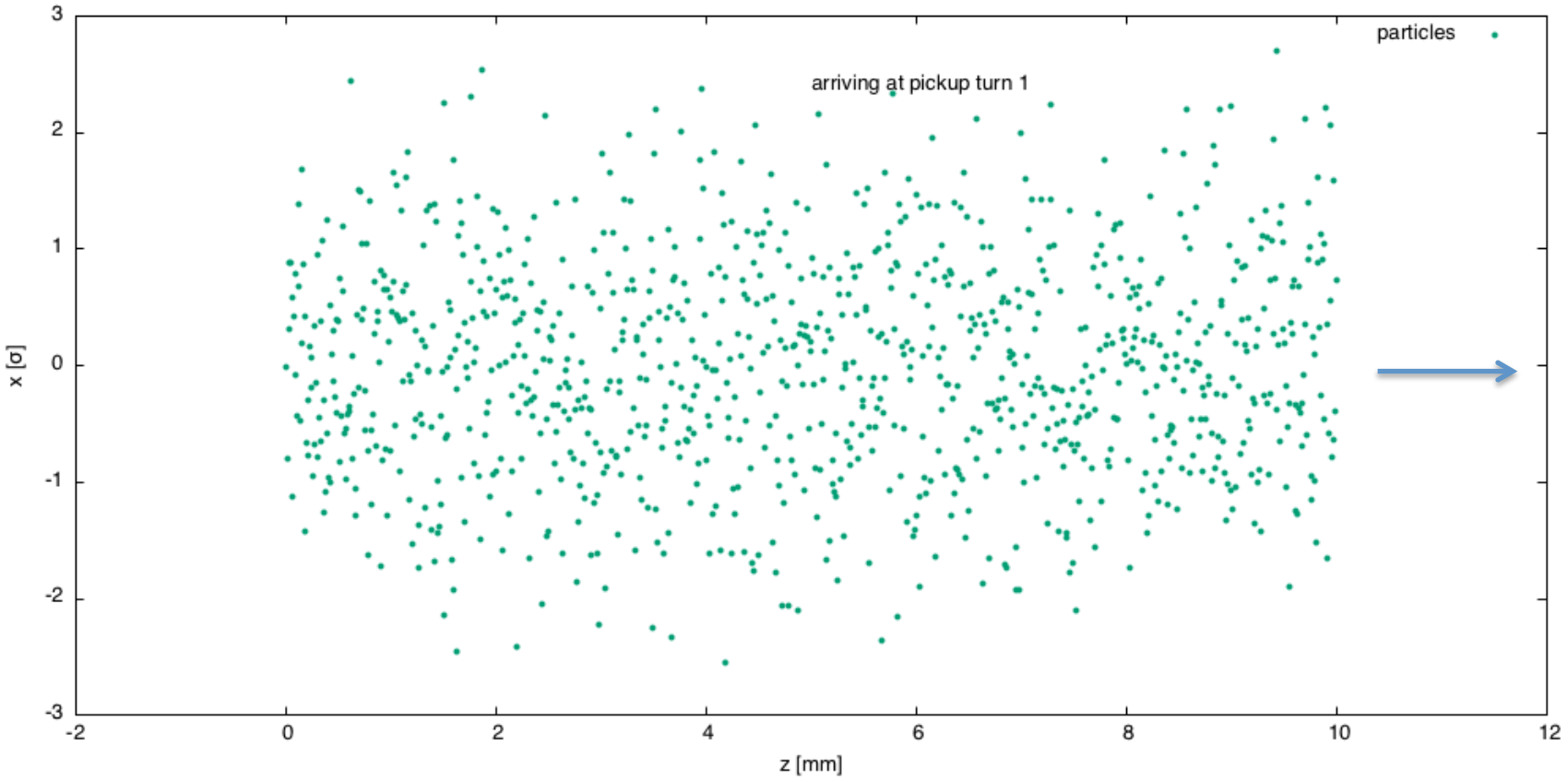
Each bunch is a collection of particles

Goal: reduce bunch width (emittance)

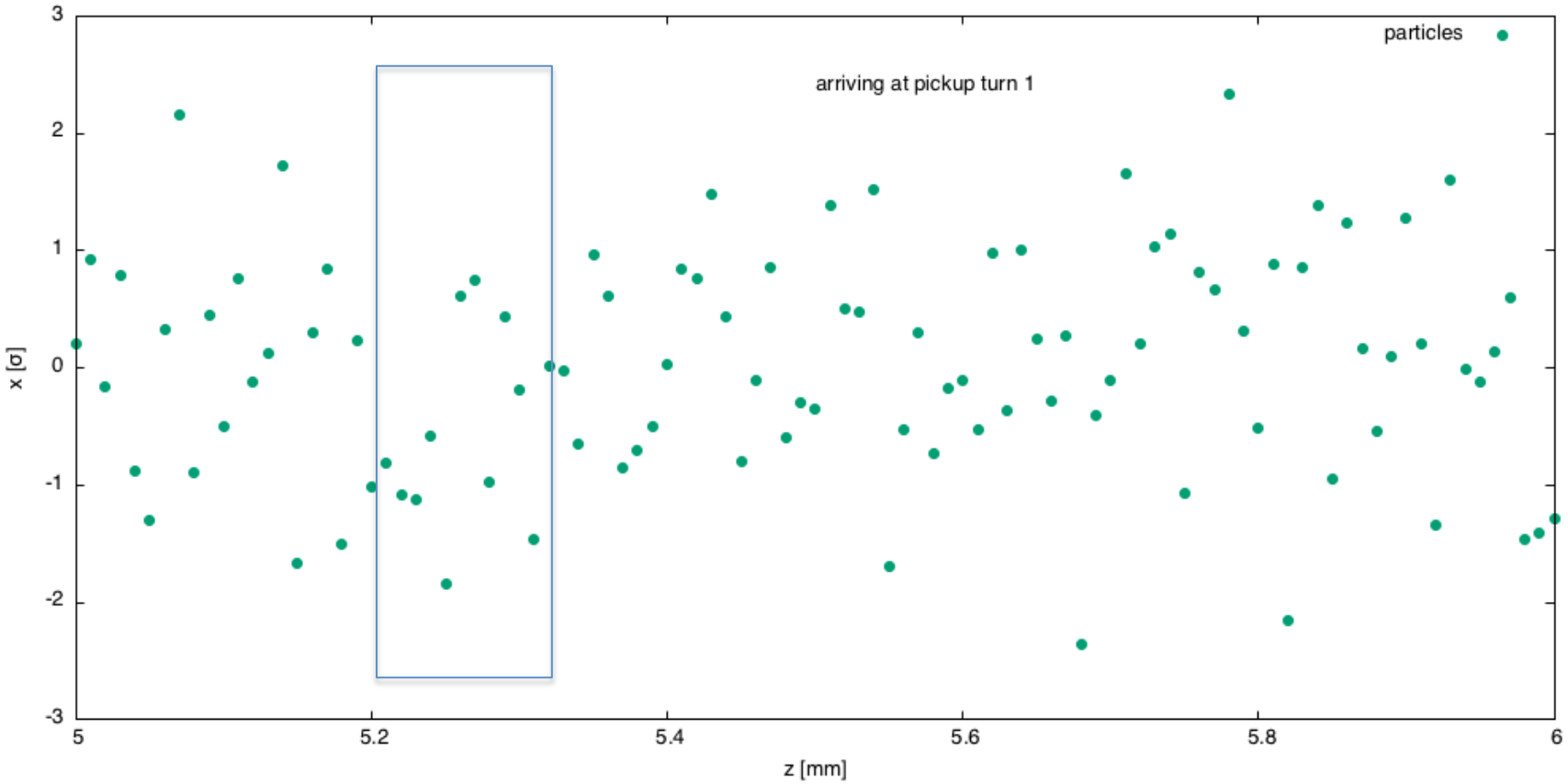
=> cool the beam

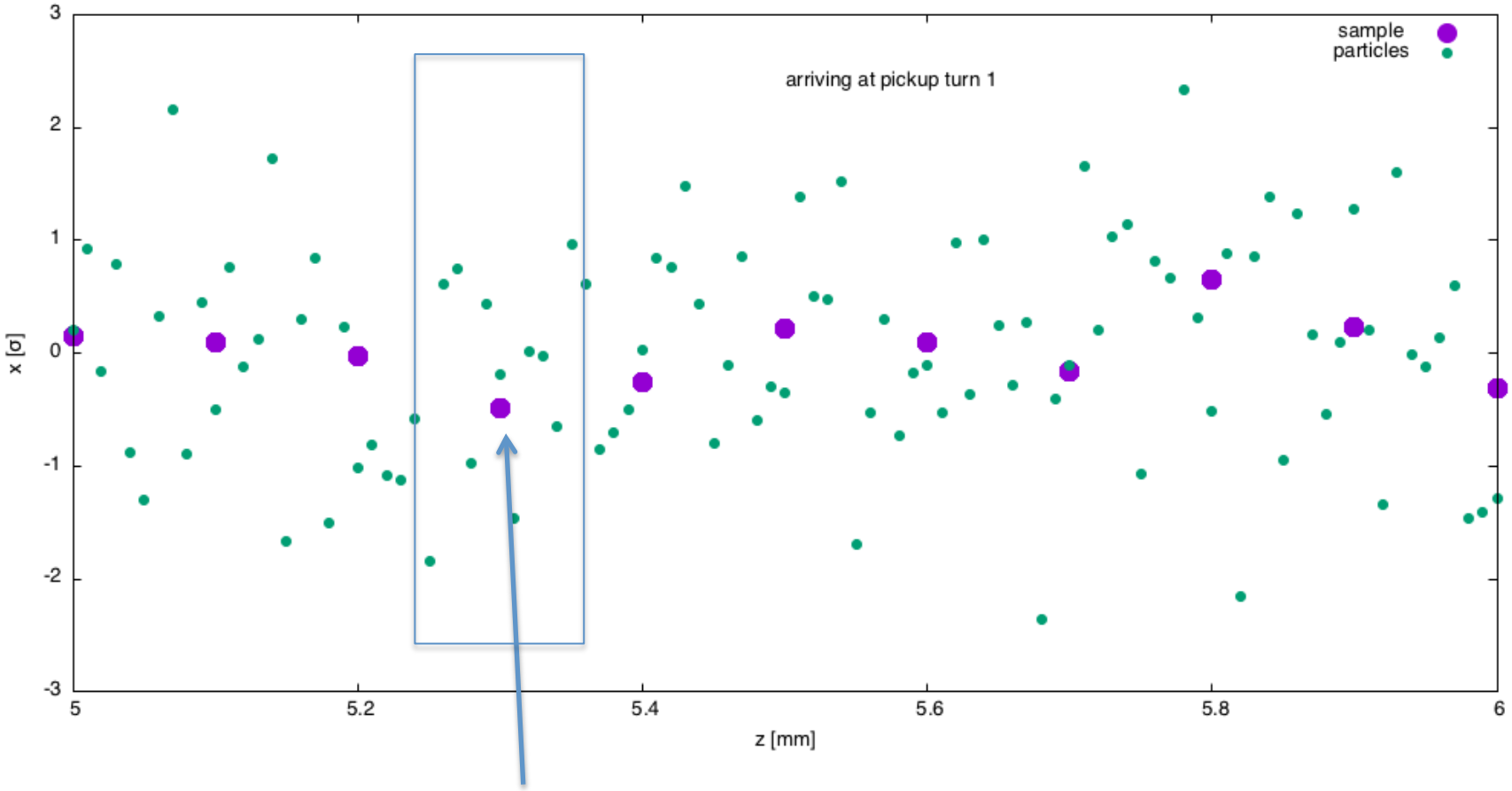
Bunch width $\sigma_x = 1$

Bunch length = 10 mm

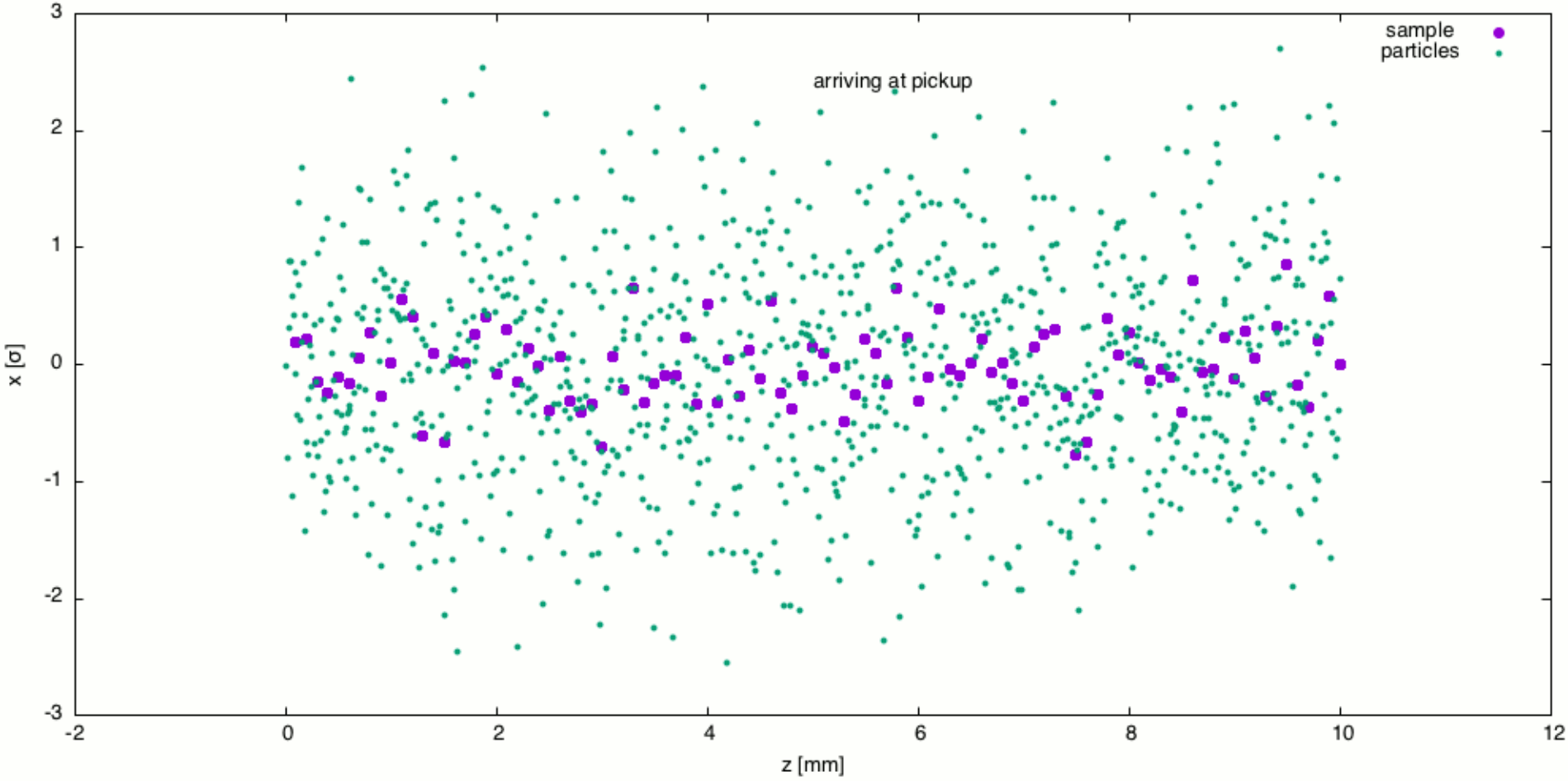


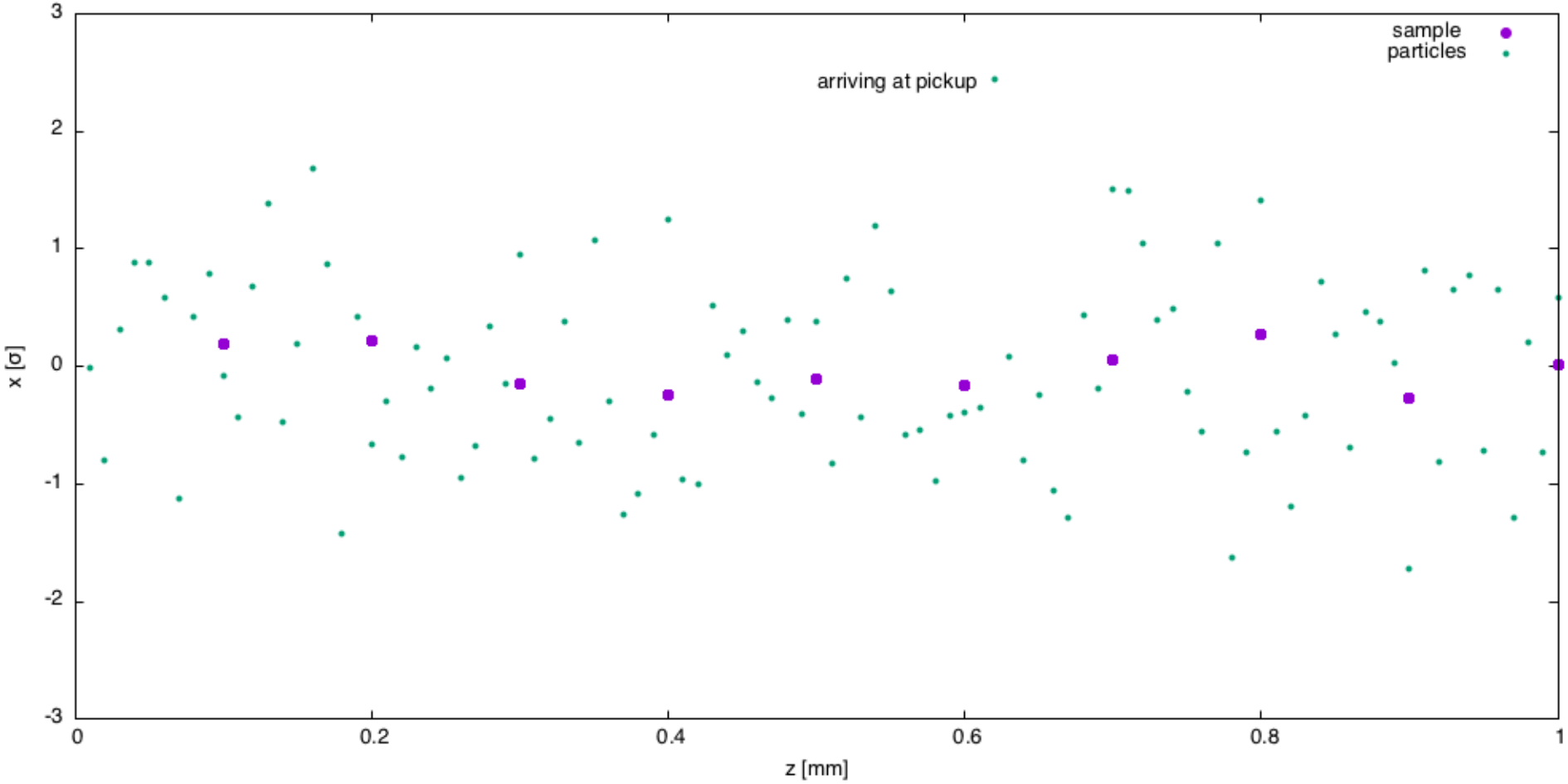
0.1 mm slice of the distributioin

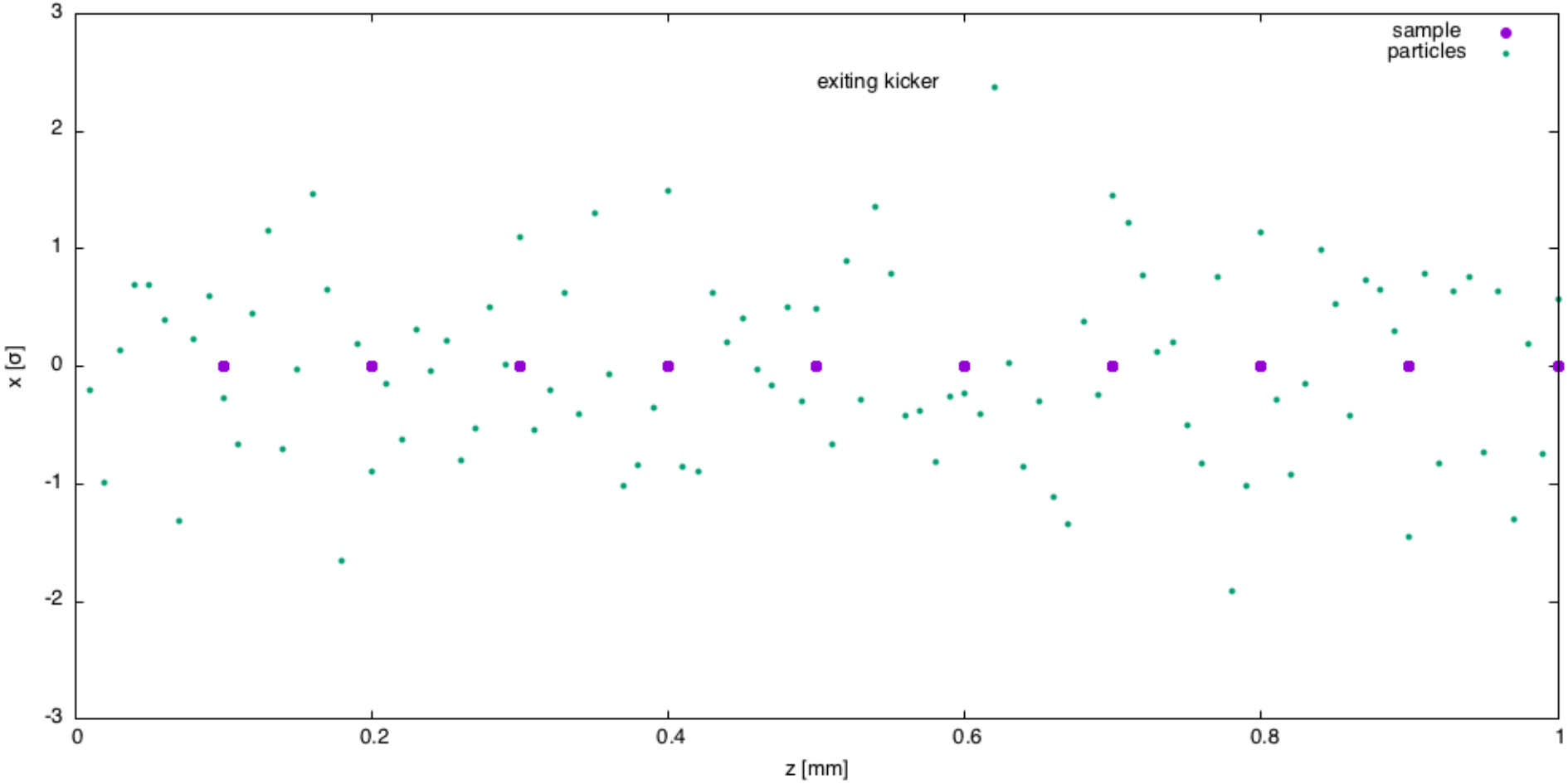


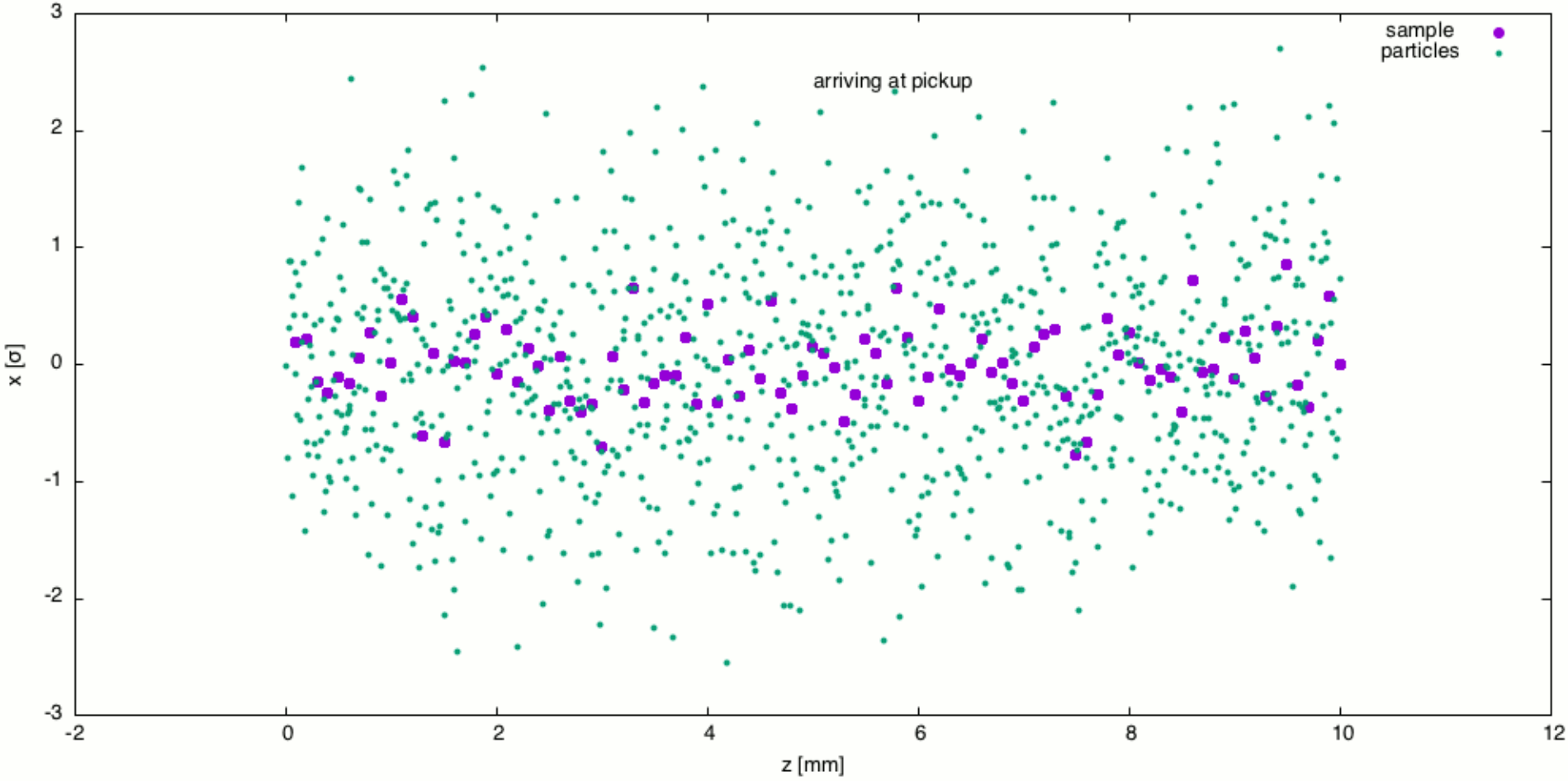


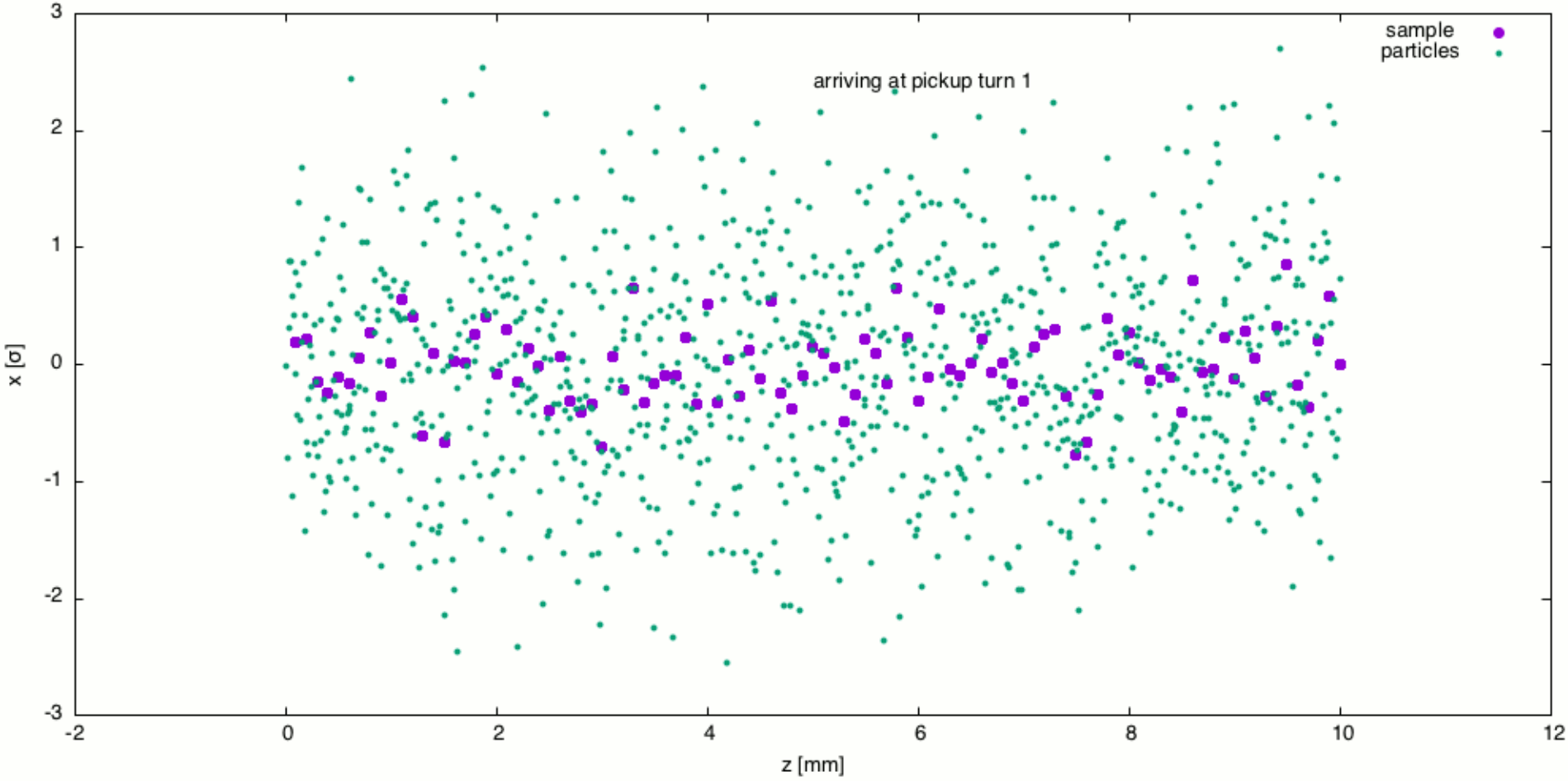
Centroid of 0.1mm sllice


arriving at pickup
sample
particles
x [σ]
z [mm]
3
2
1
0
-1
-2
-3
-2
0
2
4
6
8
10
12


sample
particles
arriving at pickup
x [σ]
z [mm]
3
2
1
0
-1
-2
-3
0
0.2
0.4
0.6
0.8
1


sample
particles
exiting kicker
x [σ]
z [mm]
3
2
1
0
-1
-2
-3
0
0.2
0.4
0.6
0.8
1

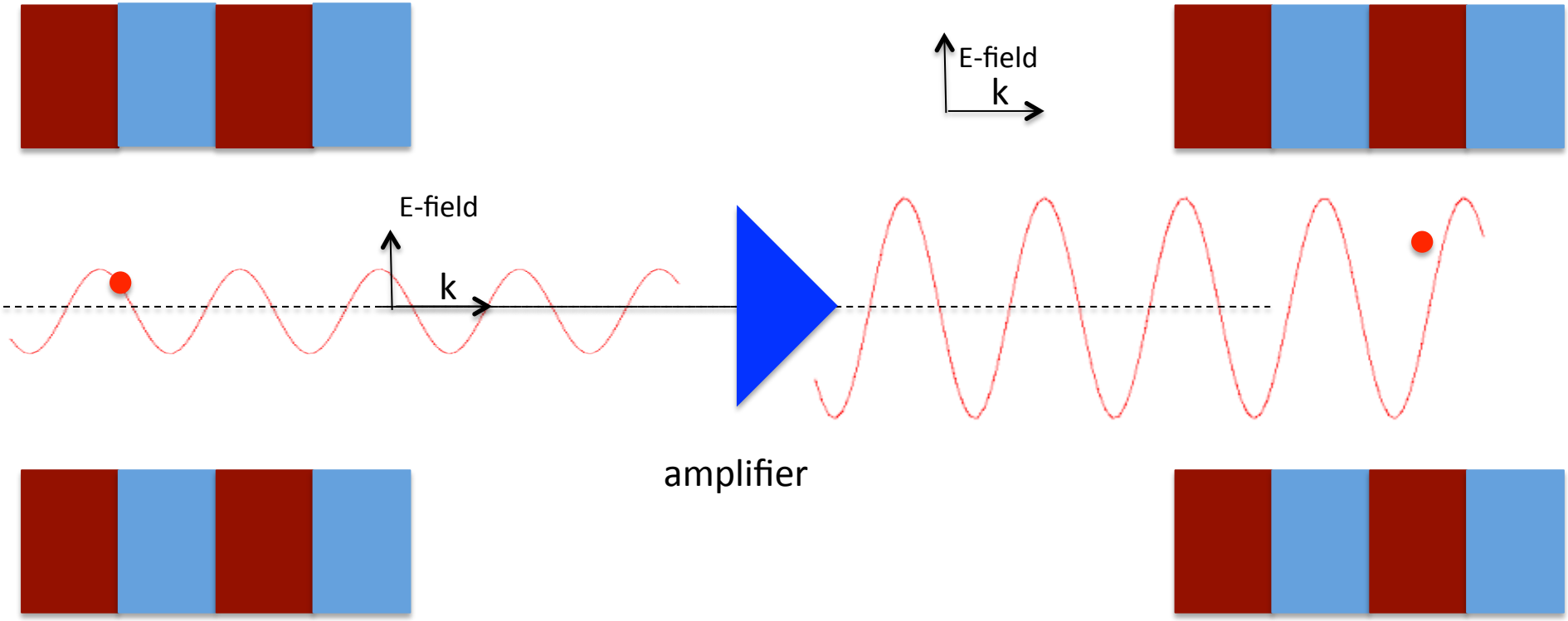

arriving at pickup
sample
particles
x [σ]
z [mm]
3
2
1
0
-1
-2
-3
-2
0
2
4
6
8
10
12


arriving at pickup turn 1
sample
particles
x [σ]
z [mm]
3
2
1
0
-1
-2
-3
-2
0
2
4
6
8
10
12

Pickup

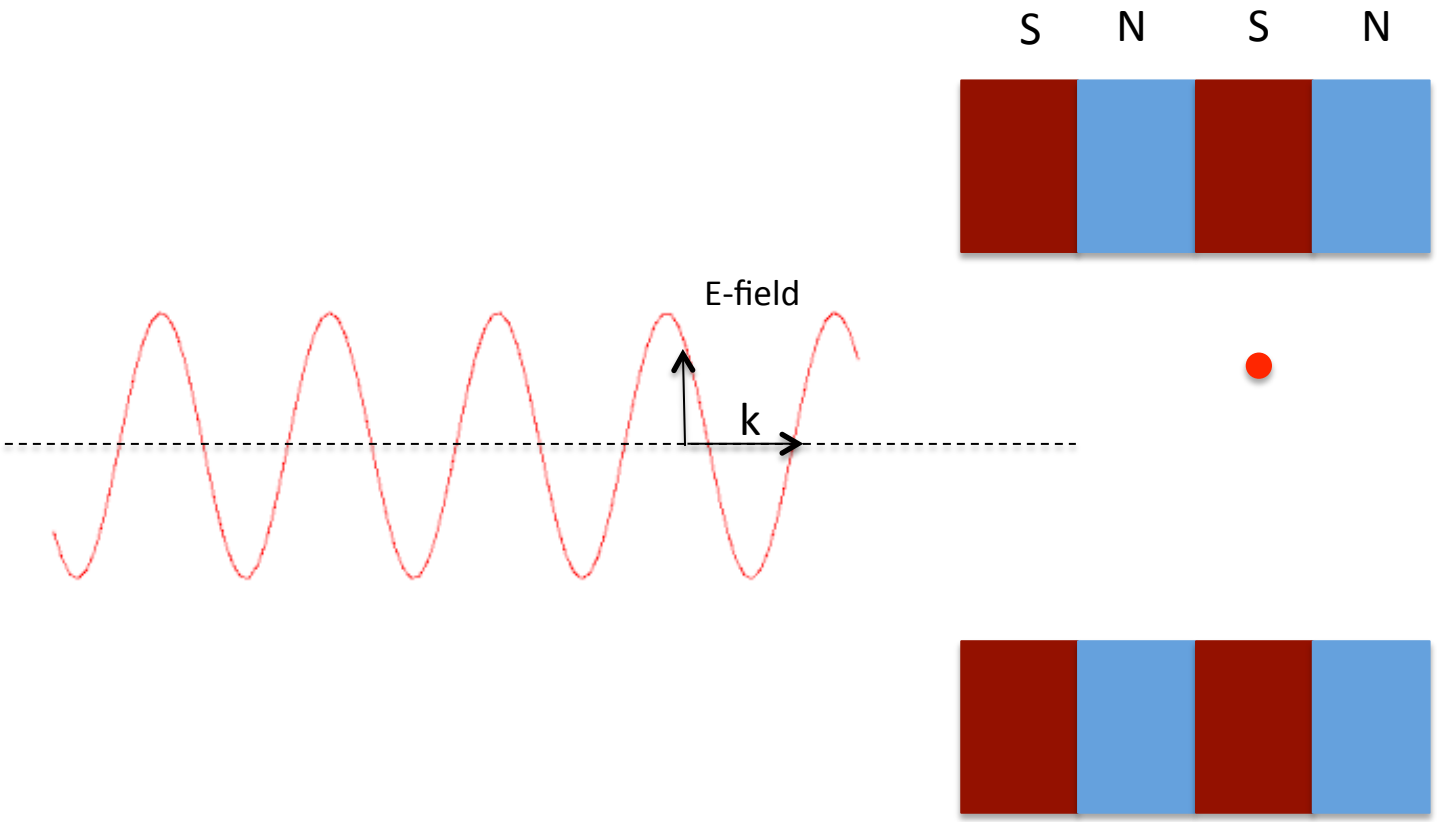
Particles oscillate transversely in pickup undulator.

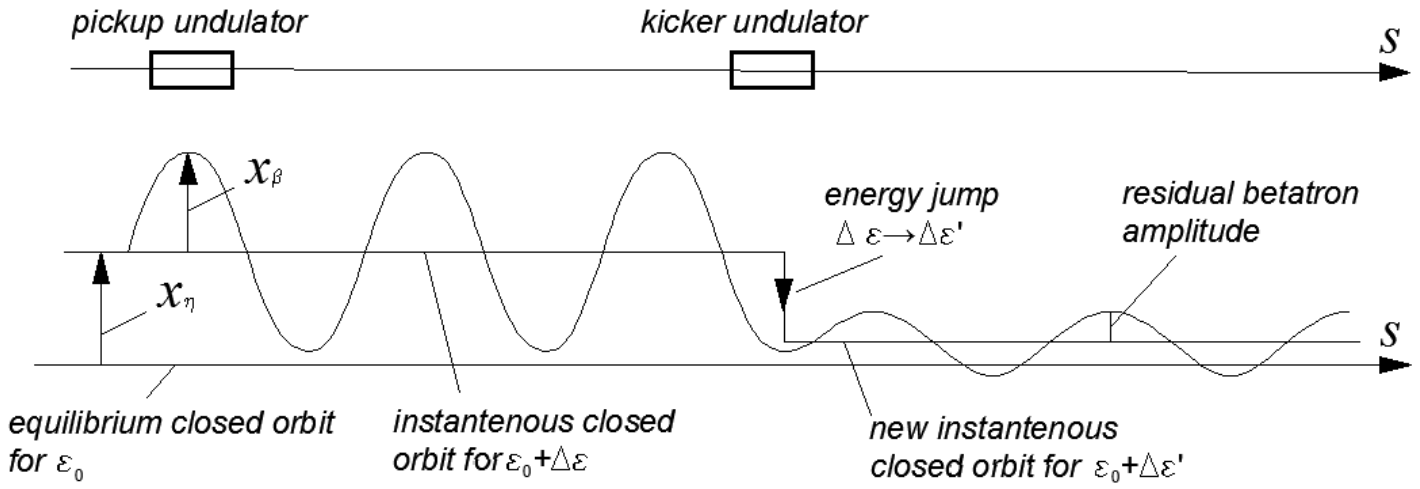
The wavelength of the radiation $\lambda \sim \frac{\lambda_u}{2\gamma^2 n}$

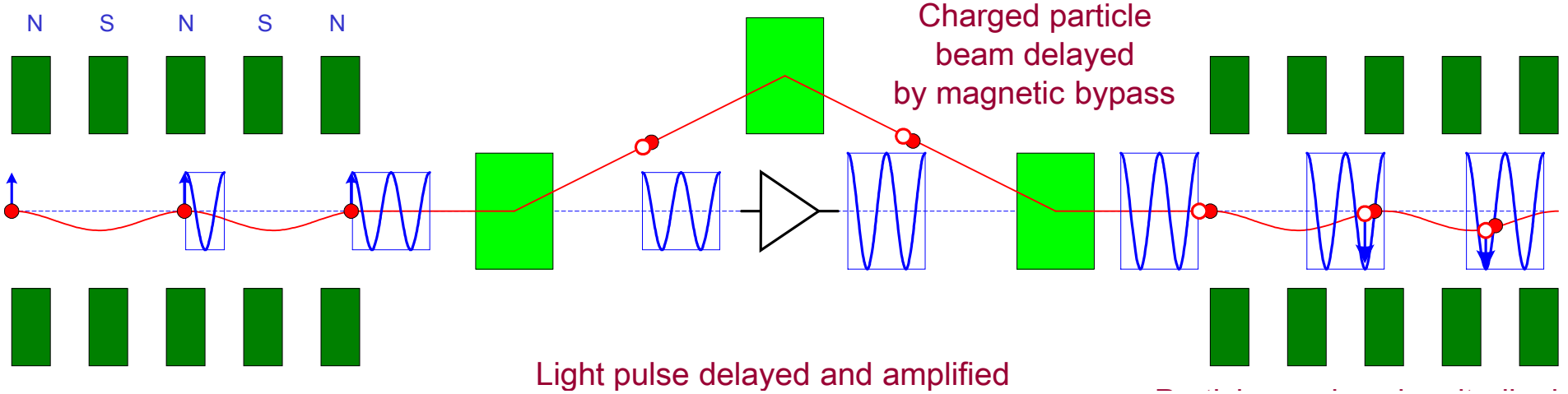


Kicker

Particles oscillate transversely in kicker undulator.




pickup undulator
kicker undulator
s
x_β
x_η
energy jump
$\Delta\,\varepsilon \rightarrow \Delta\varepsilon'$
residual betatron amplitude
s
equilibrium closed orbit for ε_0
instantenous closed orbit for $\varepsilon_0+\Delta\varepsilon$
new instantenous closed orbit for $\varepsilon_0+\Delta\varepsilon'$


N
S
N
S
N
Charged particle beam delayed by magnetic bypass
Light pulse delayed and amplified