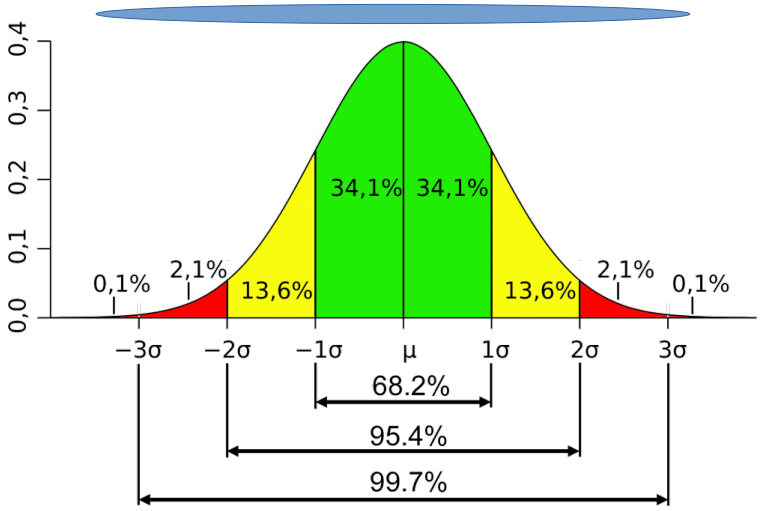
OSC simulation update

Suntao Wang

1/16/2018

Incoherent kick

$$\delta_{ic} = \delta_i + G\,\sin(\Delta\phi_i) + G\sum_{k\neq i}^{N_s}\sin(\Delta\phi_i + \psi_{ik})\ .$$



σ_z=10 mm, λ=1 μm, N=1E9

Average number of particles per slice:

n_slice= 1E9/(6*10E-3/1E-6) = 1.67E4

Now, set z_slice=1 mm in simulation, require N=1E6 to have same number of particles per slice:

n_slice = 1E6/(6*10E-3/1E-3) = 1.67E4

Reality: $\psi_{ik}=k\delta z=2\pi\delta z/\lambda$ → Tracking: $\psi_{ik}= 2\pi\delta z/z\_slice$

$\delta z = [-N_{und}\lambda, 0]$

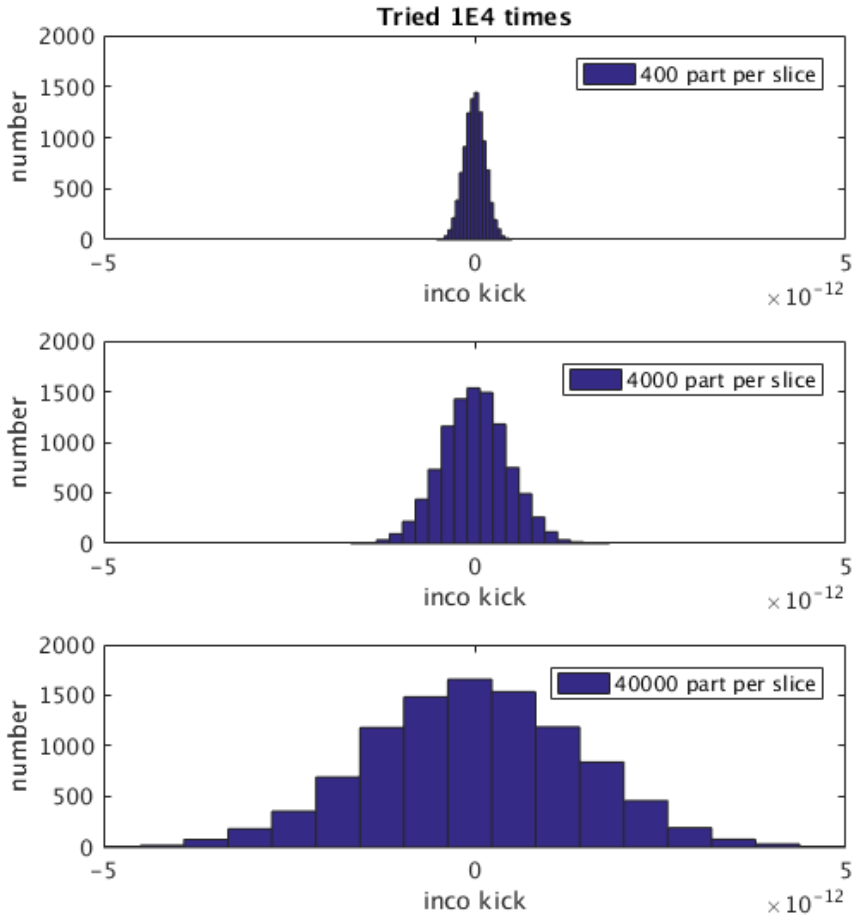
$\delta z = [-N_{und} z\_slice, 0]$

Simulate Incoherent kick

$$\delta_{ic} = \delta_i + G\,\sin(\Delta\phi_i) + G\sum_{k\neq i}^{N_s}\sin(\Delta\phi_i + \psi_{ik})\ .$$

$\psi_{ik}=k\delta z=2\pi\delta z/\lambda$ $\delta z = [-N_{und}\lambda, 0]$ $N_{und}=6$, $\lambda=1$ μm, G=1E-14, $\Delta\phi_i$ can be any number

Random generate δz within $[-N_{und}\lambda, 0]$ for N_s=[4E2, 4E3, 4E4], and take the sum, Simulate 1E4 times and plot the histogram of



The distribution of incoherent kick is Gaussian with zero mean.

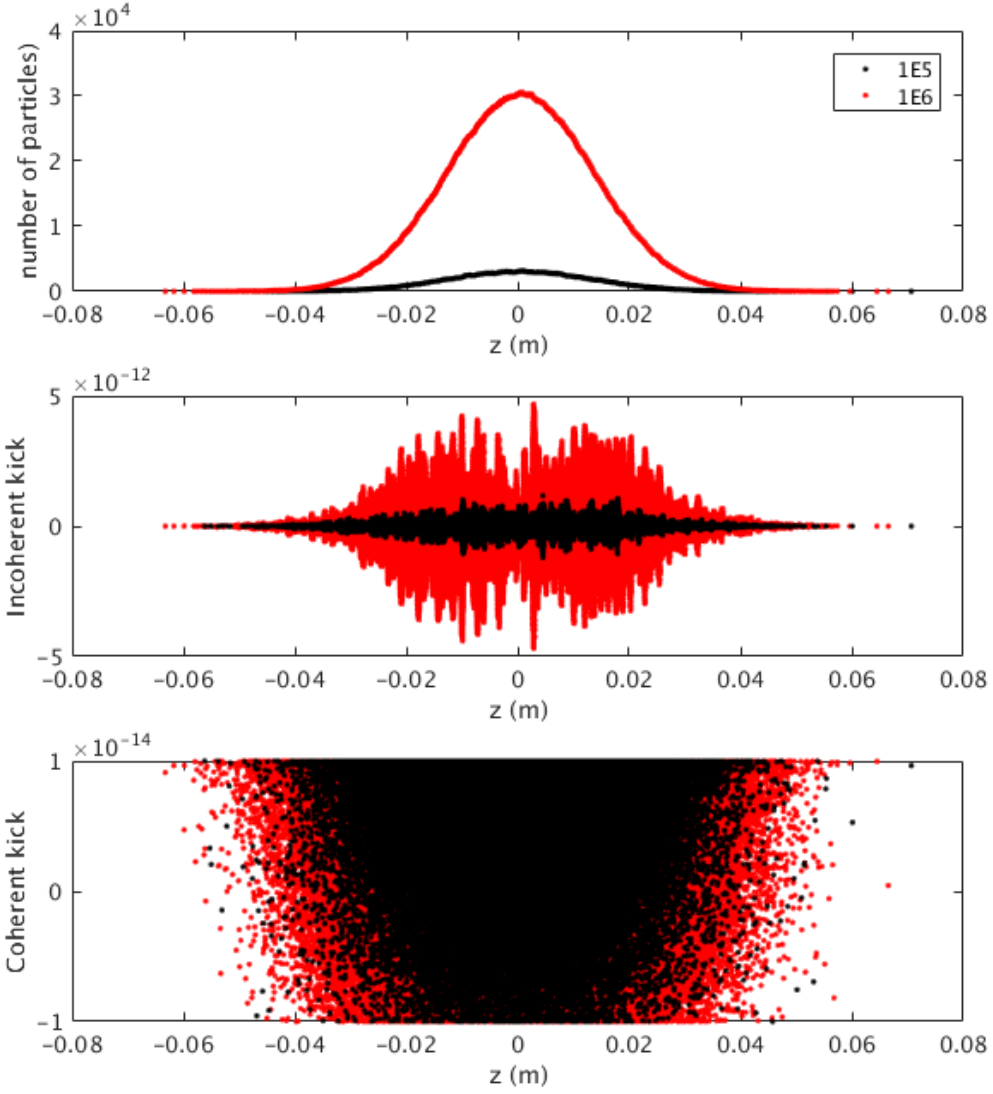
The larger the number of particles within a slice is, the larger the incoherent kick will be.

Set $\Delta\phi_i$ at different values but the distribution is similar.

N_{und}=1 has similar distribution as N_{und}=6

Incoherent kick from tracking simulation

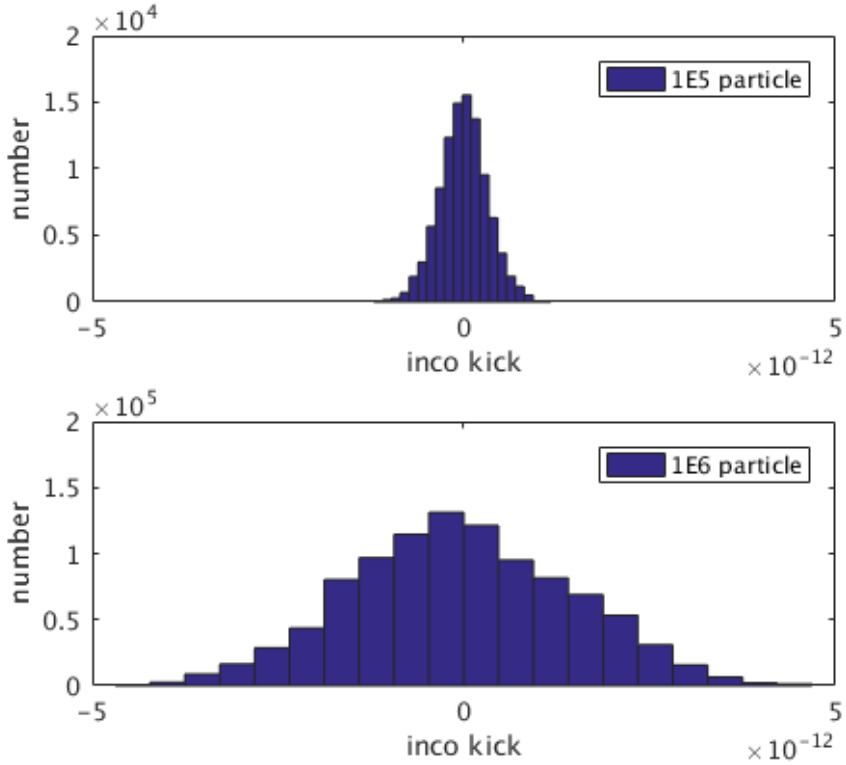
For 1 turn, record the incoherent and coherent kicks of every particle, plot them as a function of z, or histogram them



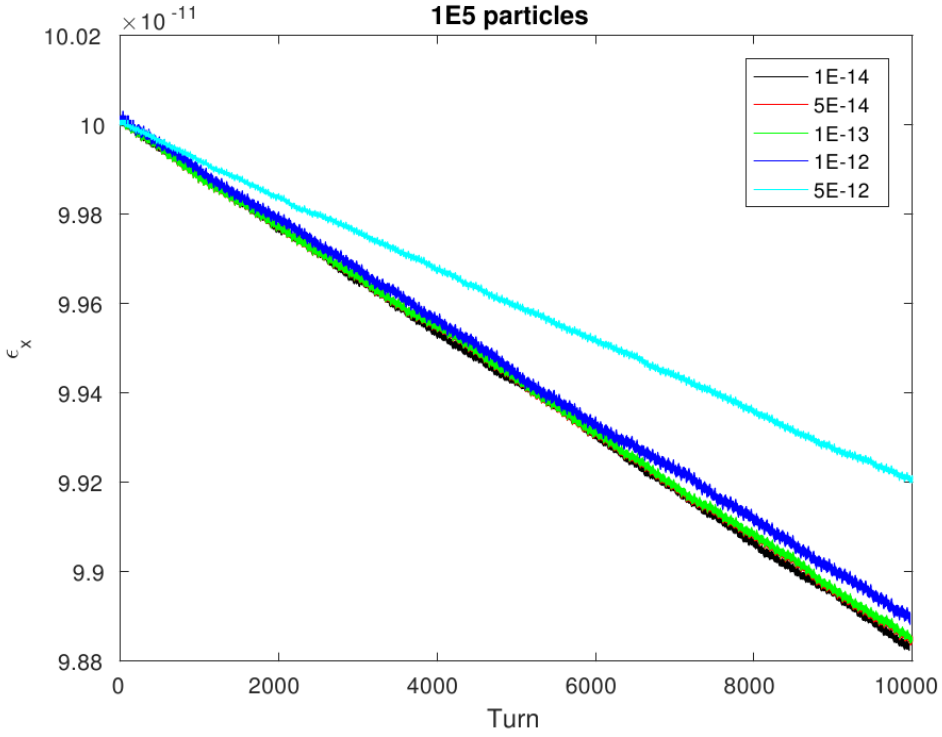
$\psi_{ik} = 2\pi\delta z/z\_slice$, z_slice=1 mm

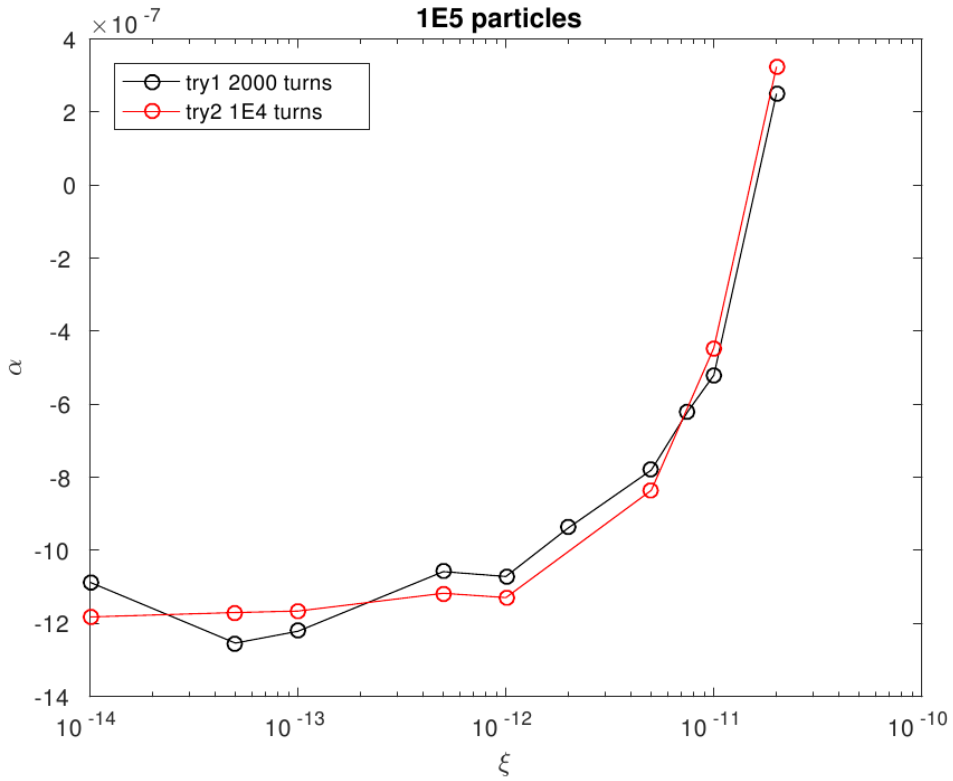
G=1E-14

N=1E5 and 1E6



Track 1E5 particles for 1E4 turns





$\varepsilon=\varepsilon_0 \exp(\alpha\varepsilon)$

α: damp/heat coeff

α_0 = 5.4E-4 @ 1E4 p, ξ=3E-8

α_0 = 1.2E-6 @ 1E5 p, ξ=1E-13

N=1E6 still running,
cooling when ξ < 5E-13, α_0 =?
heating when ξ > 1E-12