

Simulation of Slip Stacking

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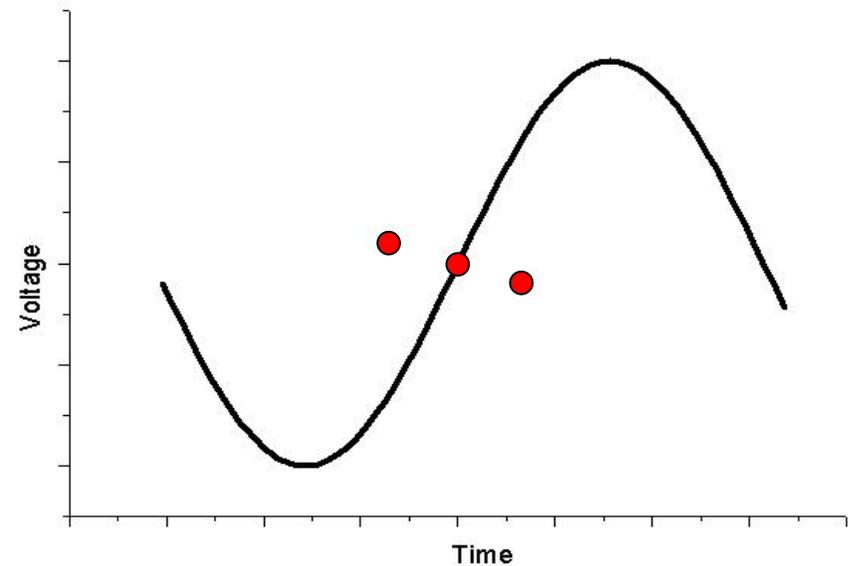
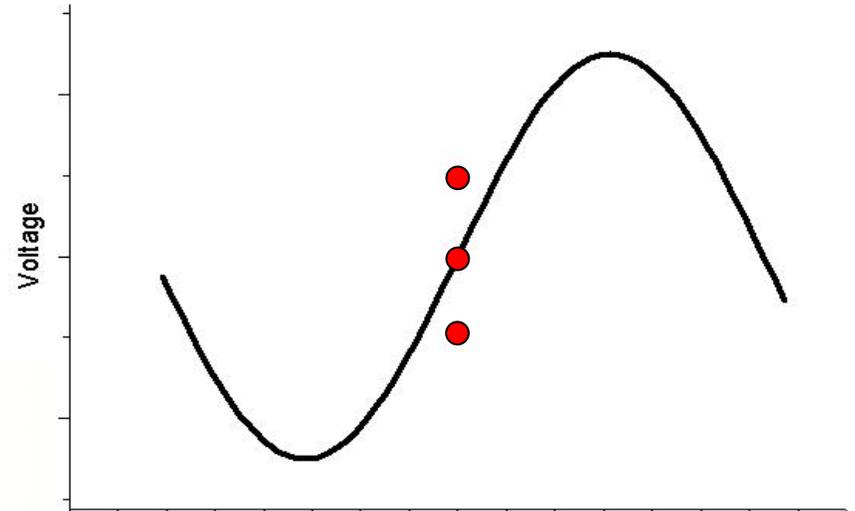
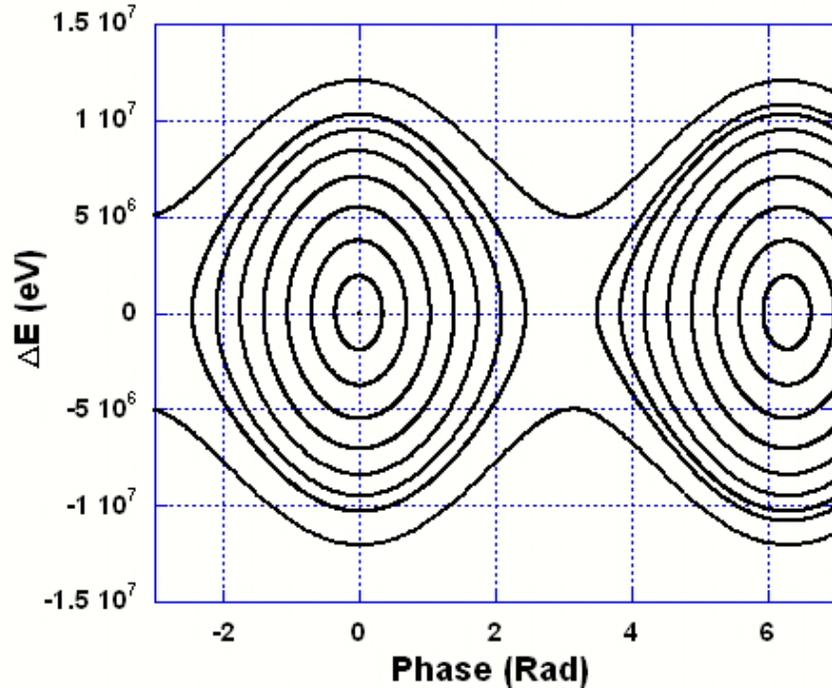
Main task

- **Build a program that could simulate a process of “slip-stacking”.**
- **Make a simple interface for this program so that everybody could use it without recompiling.**
- **Compare results of simulation with the experimental data.**
- **Understand the mechanism of beam loss in both processes of slip stacking and multi-batch stacking.**

Introduction

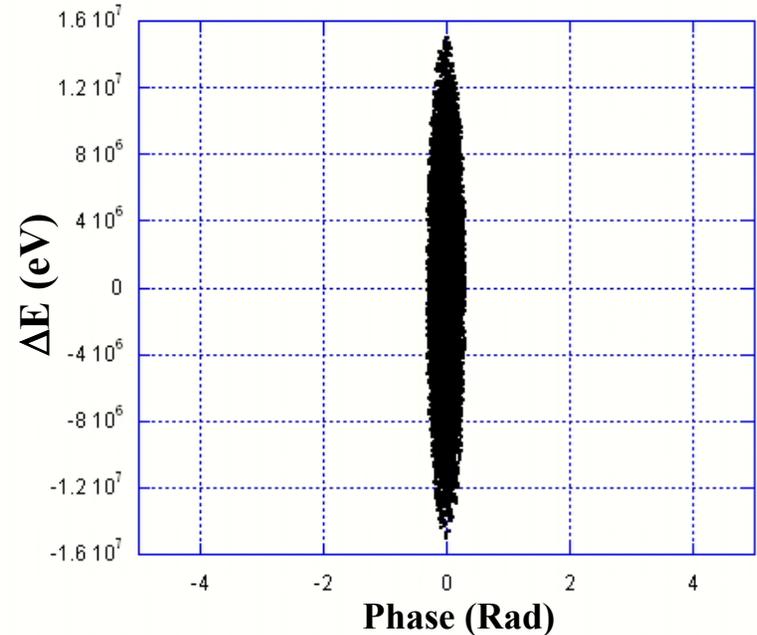
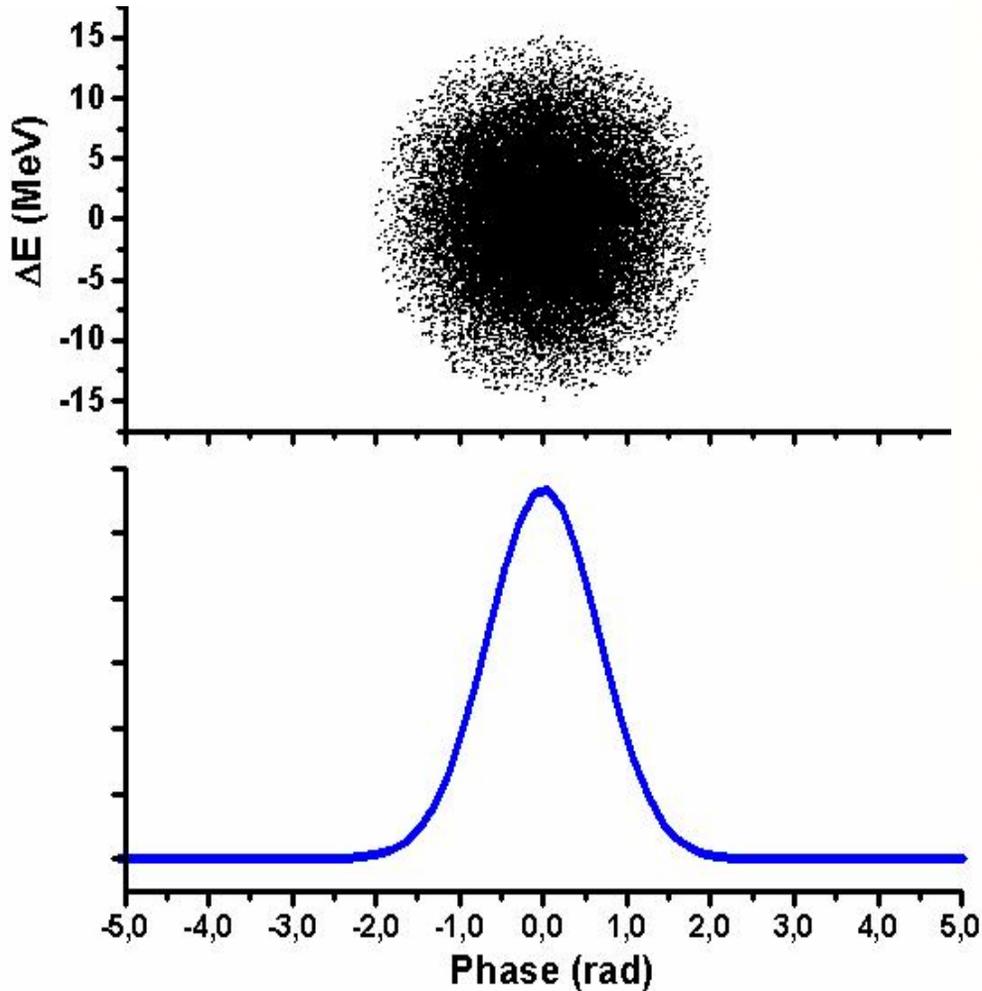
$$\phi_{n+1} = \phi_n + \frac{2\pi\hbar\eta c^2}{\nu^2 E_s} \Delta E_{n+1}$$

$$\Delta E_{n+1} = \Delta E_n + eV \sin \phi_n$$



Initial distribution of particles

Gaussian distribution of energy and coordinate

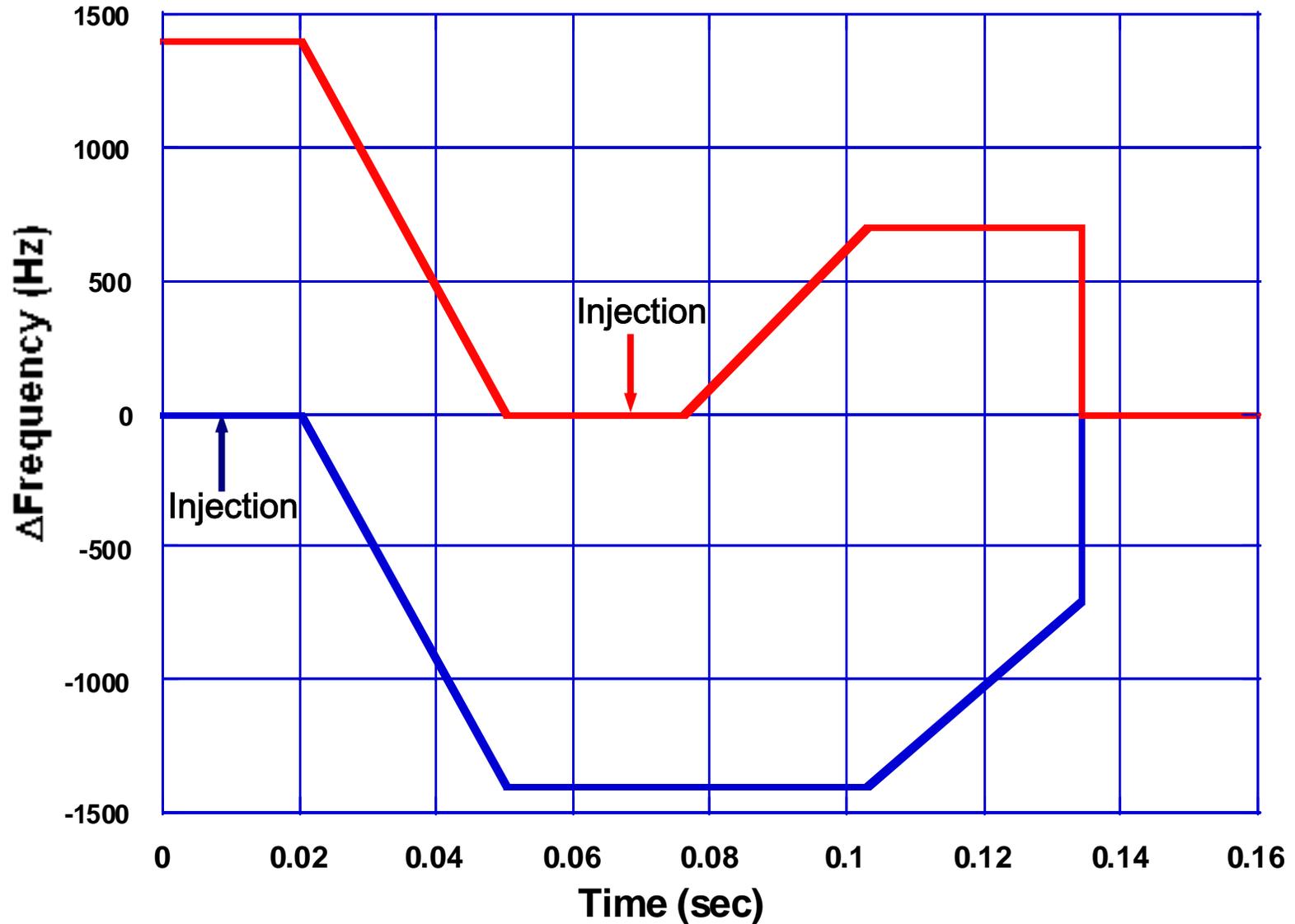


Possibilities to make different distributions of particles:

- Gaussian distribution
- Parabolic distribution
- Setting ΔE (height of beam) and Δphase (width of beam)

Simulation of slip stacking 2 single bunches

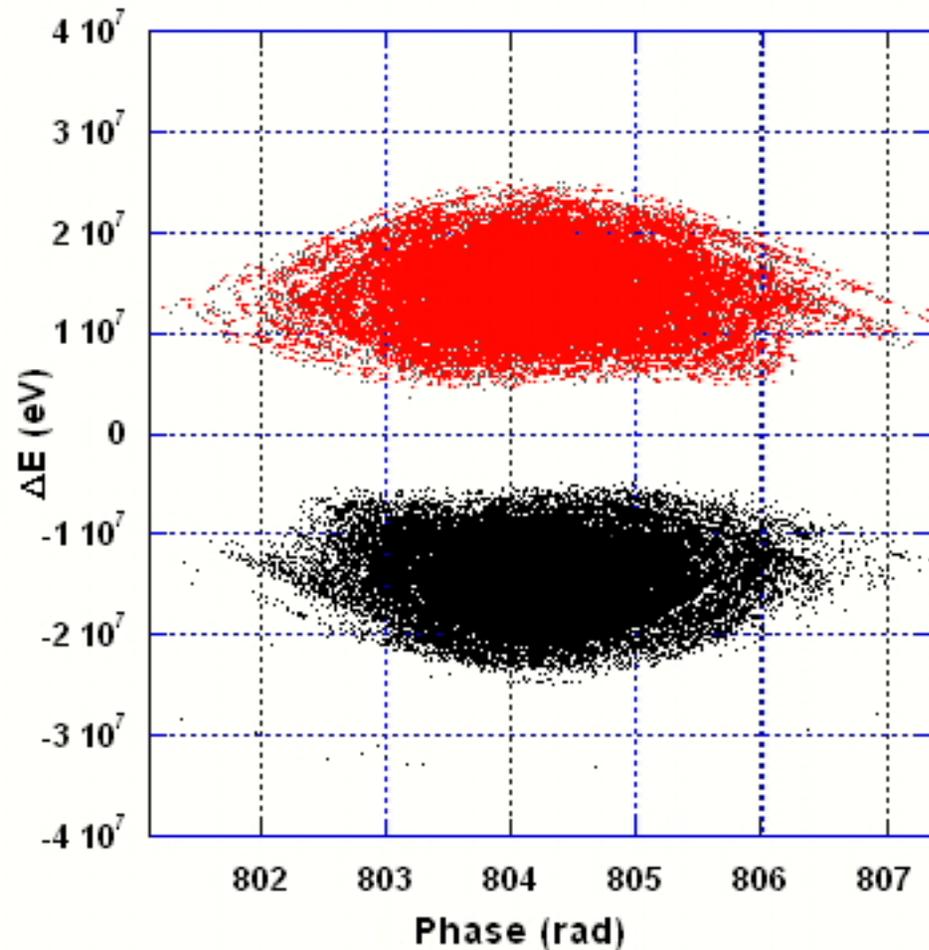
I. FREQUENCY DEPENDENCE



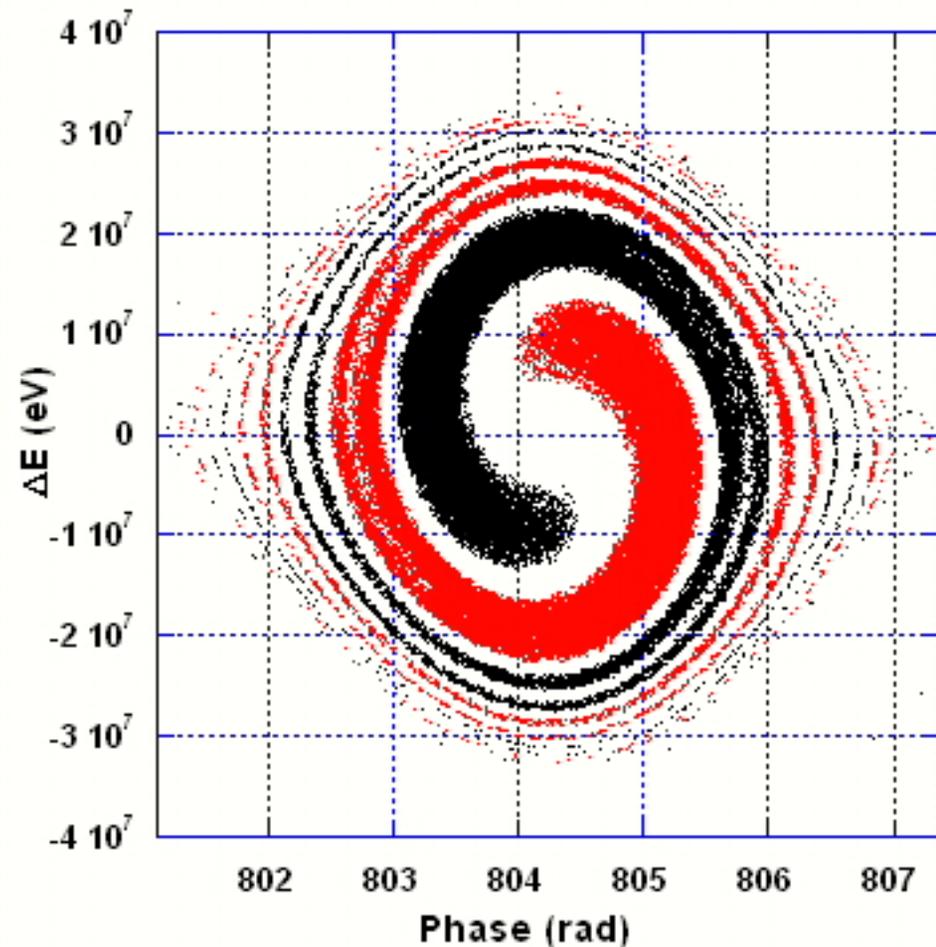
Simulation of slip stacking 2 single bunches

II. TRANSFORMATION OF BEAM WITH TIME

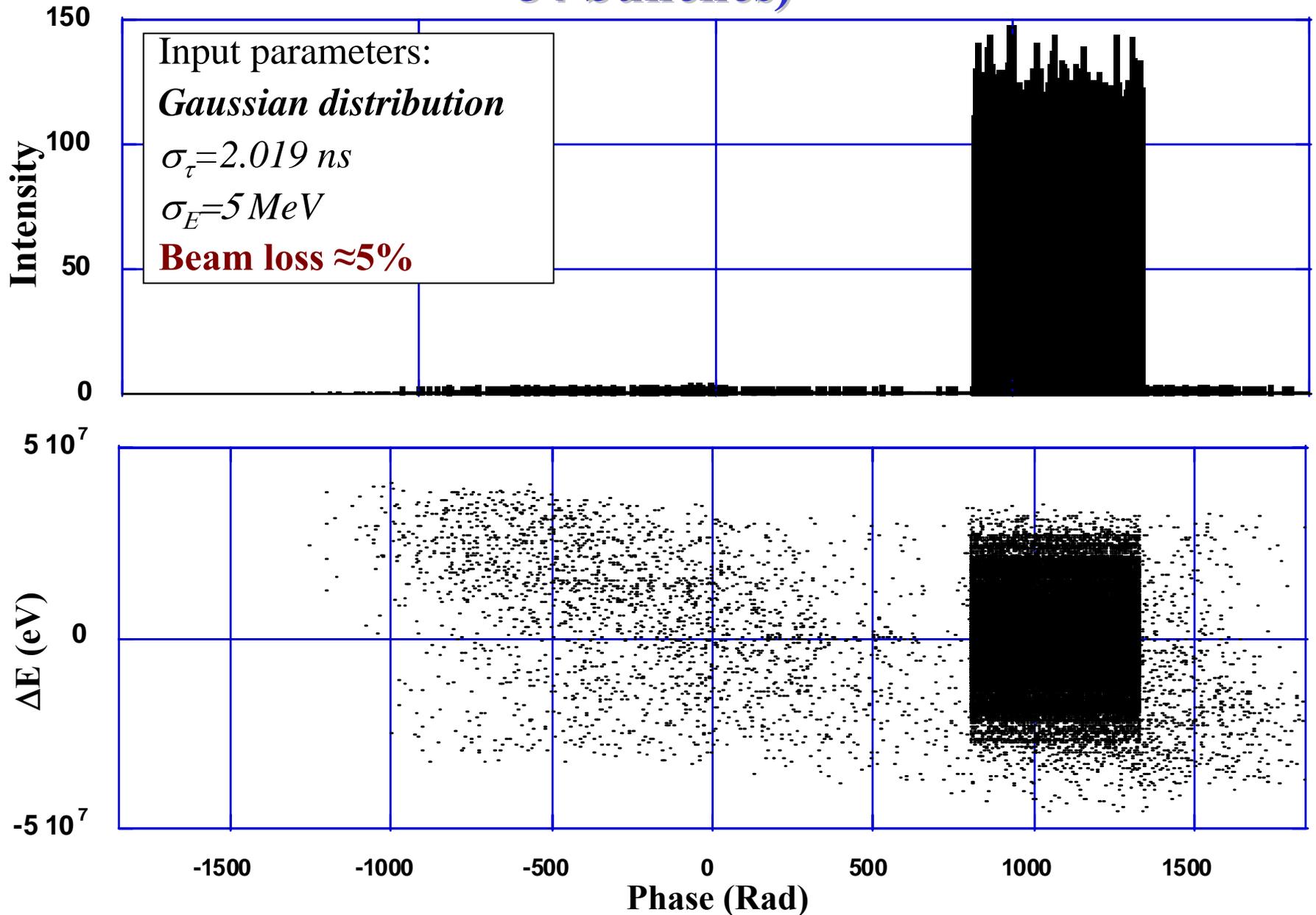
Beams before capturing



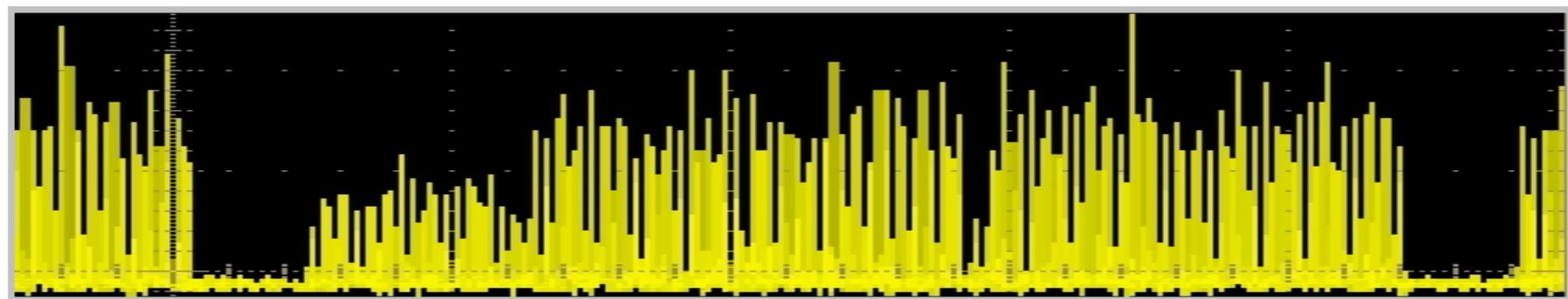
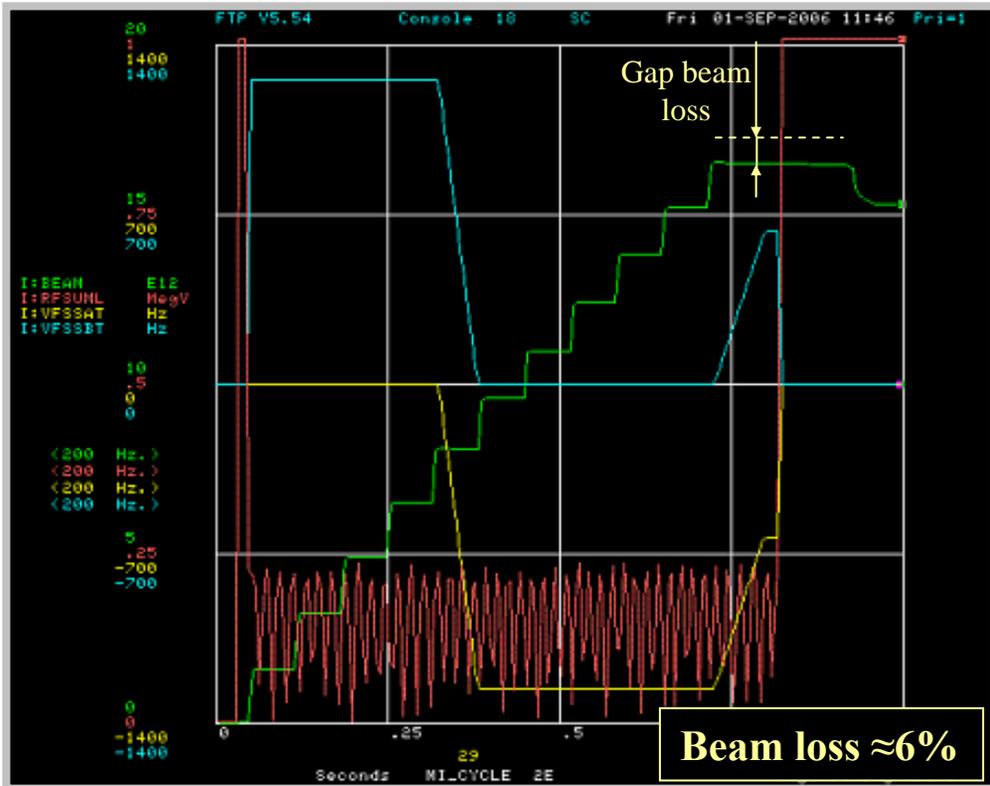
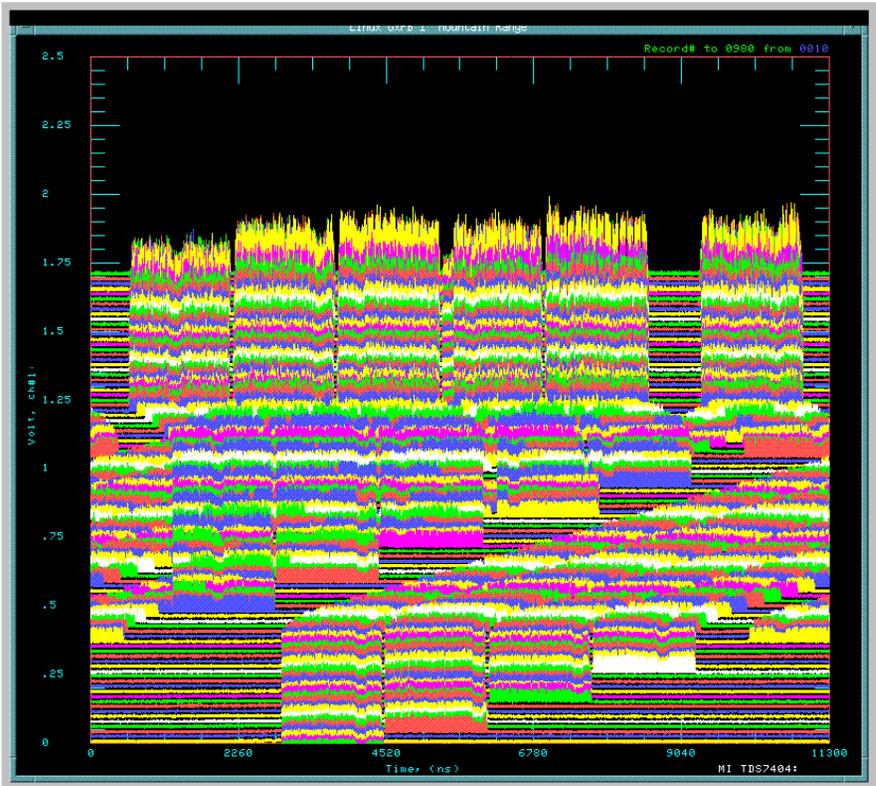
Beams after capturing



Simulation of stacking 2 bunches (each batch contains 84 bunches)

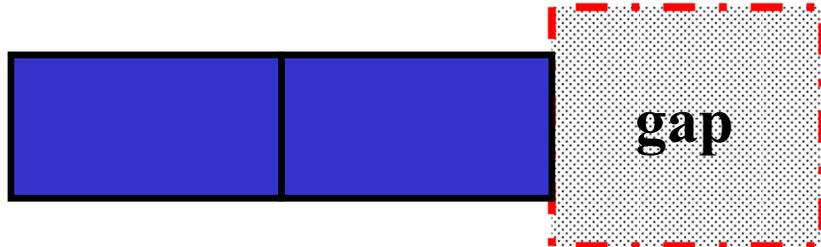
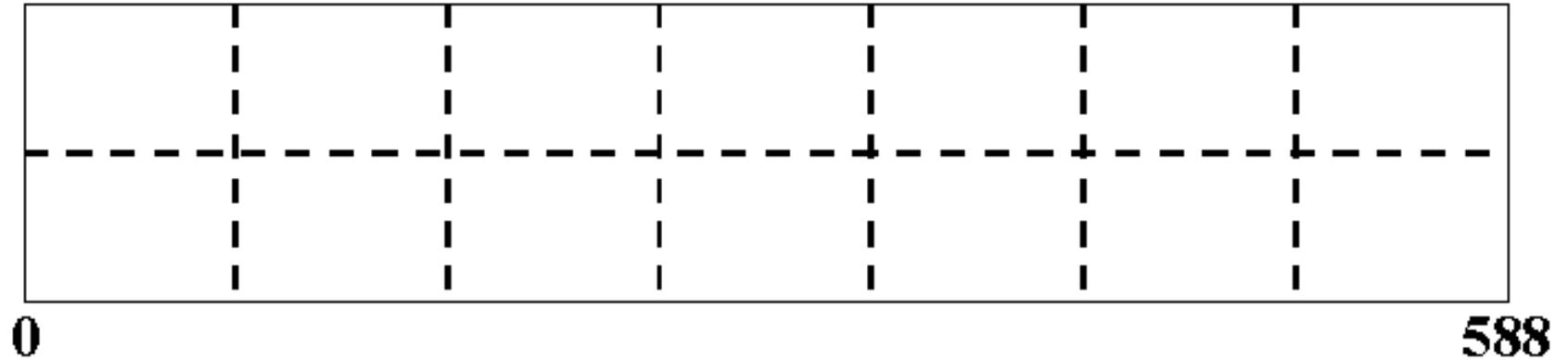


Experimental results of multi-batch stacking



Simulation of multi-batch stacking

I. MECHANISM OF MULTI-BATCH STACKING



“Kicking” particles
from the gap

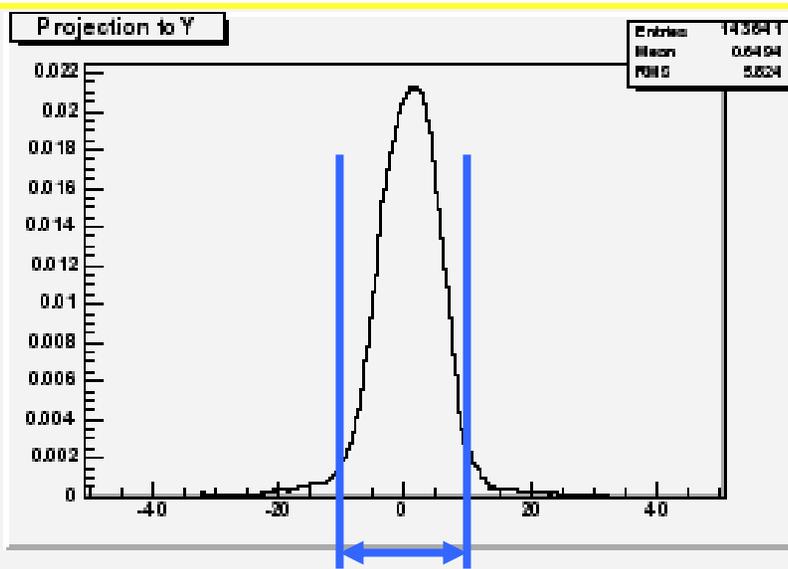


Injecting a new batch



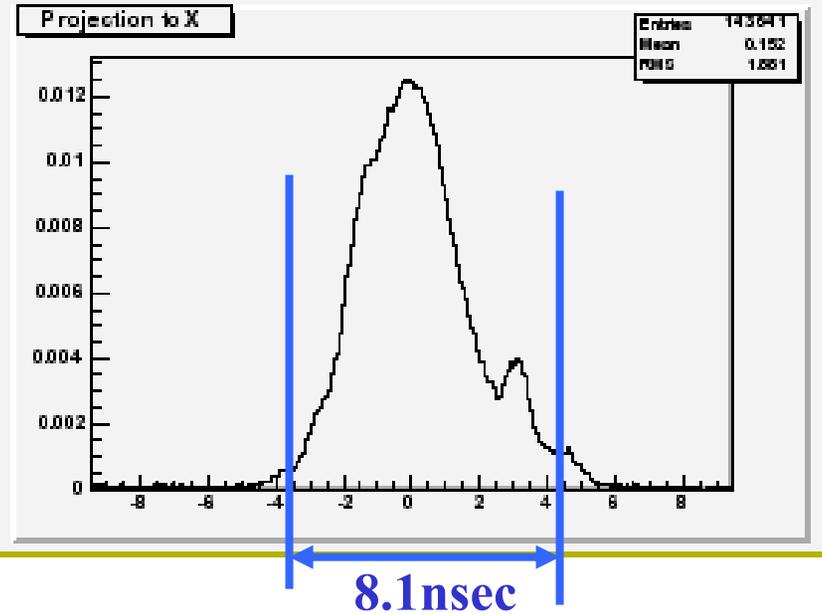
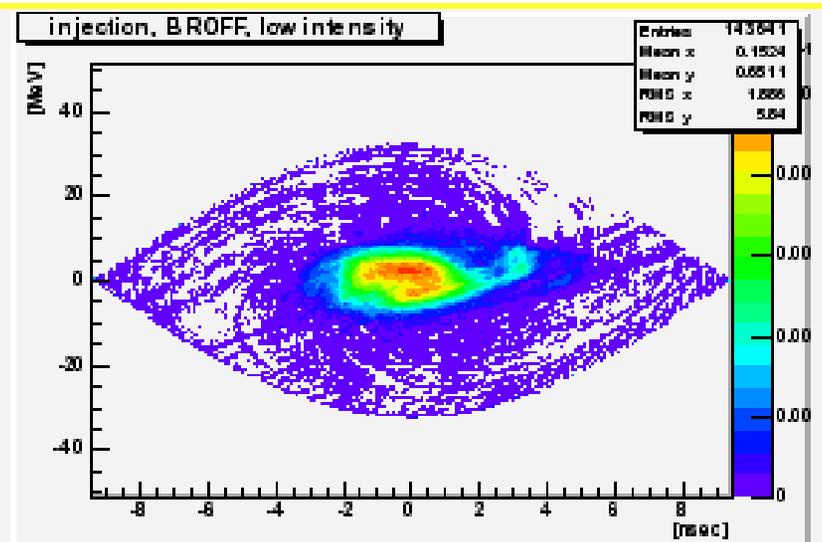
Simulation of multi-batch stacking

II. INPUT PARAMETERS FOR SIMULATION



$\pm 10 \text{ MeV}$

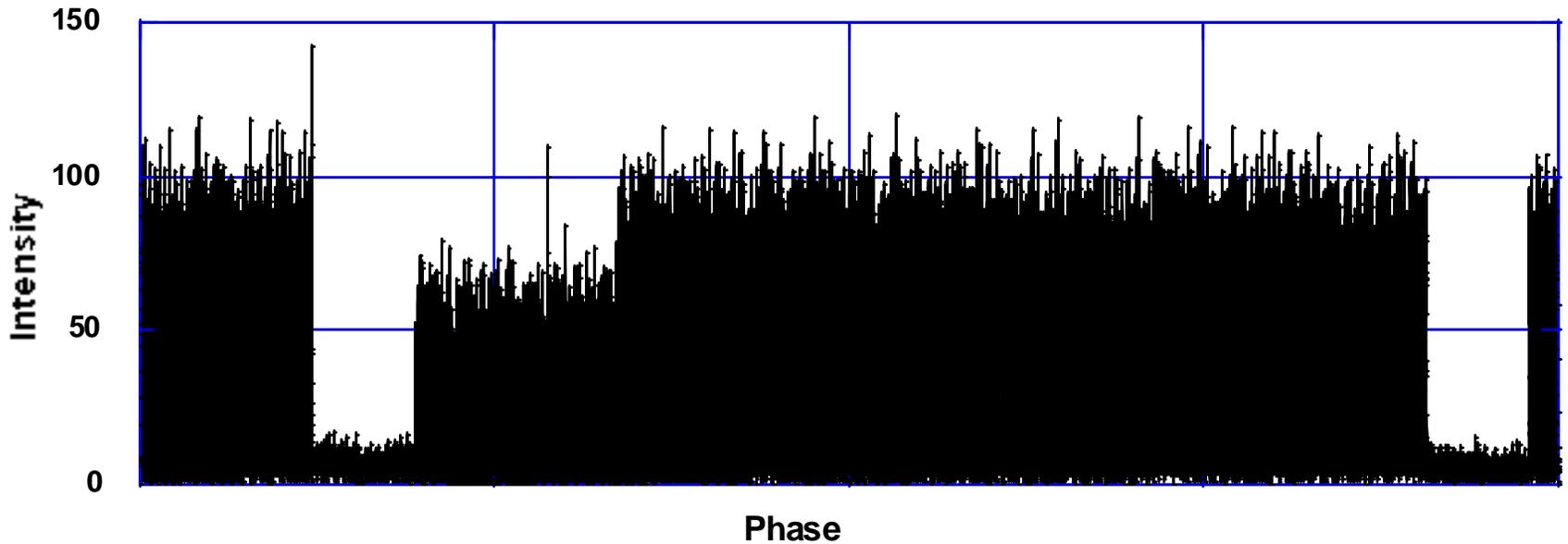
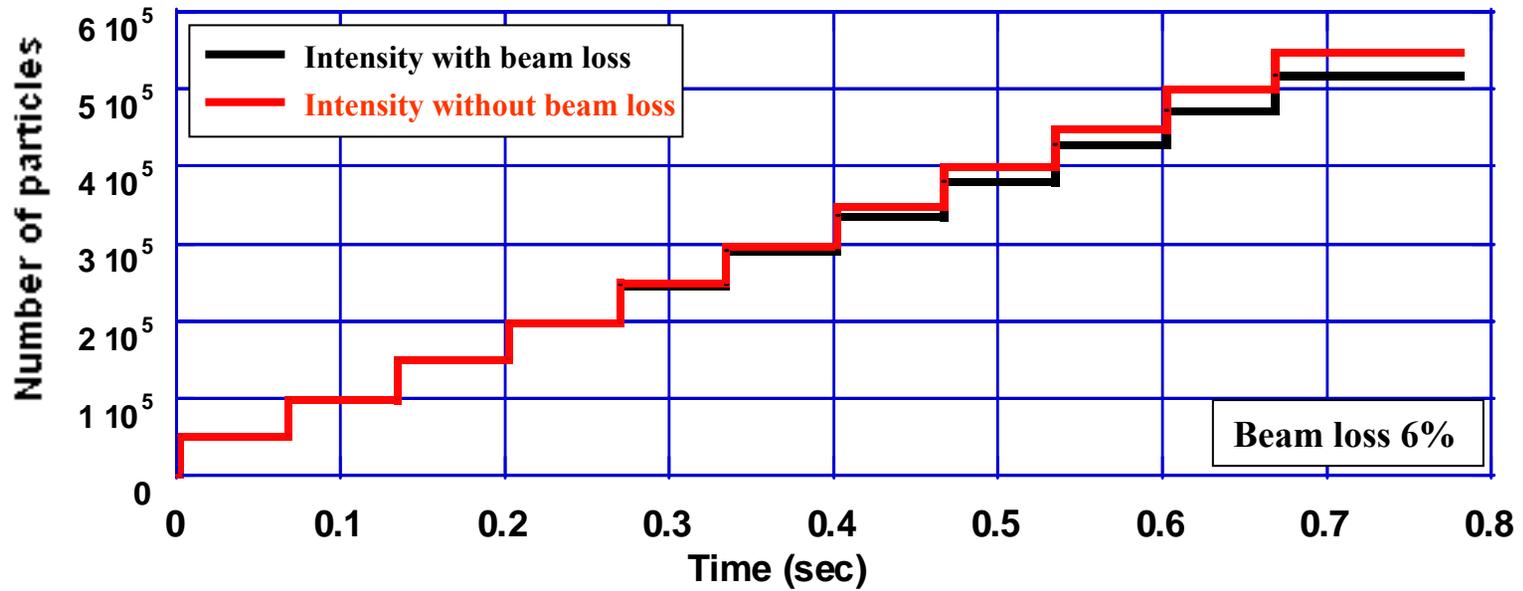
Approximation:
Gaussian distributions
 $\sigma_E = 5 \text{ MeV}$
 $\sigma_t = 2.025 \text{ nsec}$



8.1nsec

Simulation of multi-batch stacking

III. RESULTS



Conclusion

- During this summer there was made a computer program, that is able to simulate the process of “slip stacking” and multi-batch stacking with different input parameters.
- Comparison the experimental data with the simulated data shows that the result of simulation agrees with the experiment in case of two 84 batches. With this program we can estimate the amount of “gap” beam loss in process of multi-batch stacking.