

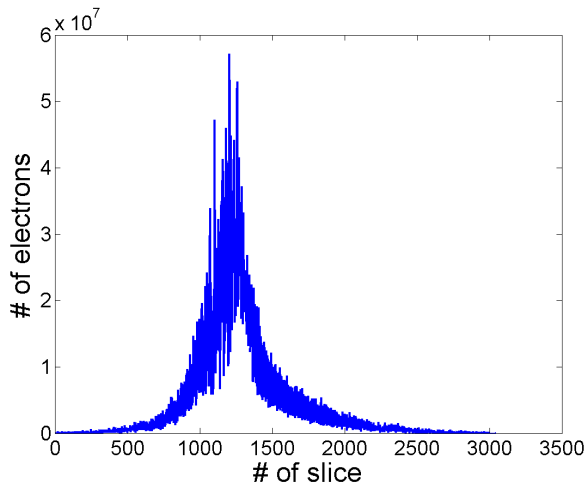
Start-to-end Simulations

Jun Ma, Roman Samulyak

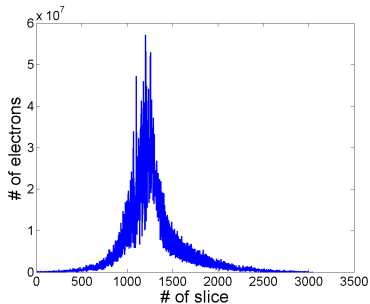
Department of Applied Mathematics and Statistics
Stony Brook University

2017.4.6

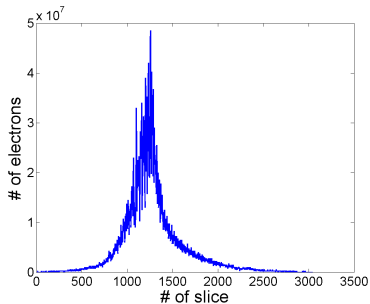
n_z from beam dynamics simulations



n_z of 3042 slices before modulator

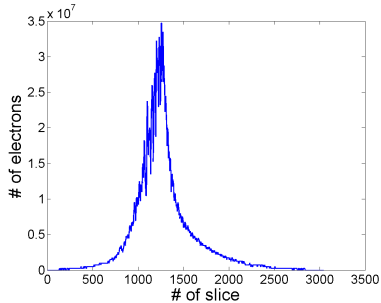


(a) No smooth

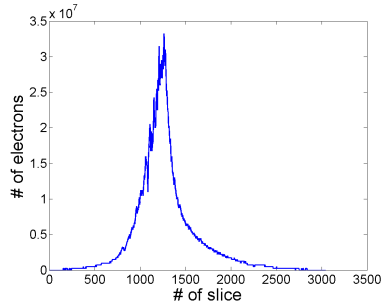


(b) Smooth over 2 slices

n_z of 3042 slices before modulator

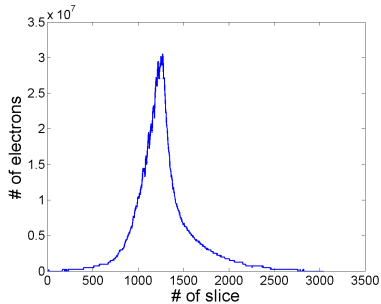


(a) Smooth over 5 slices

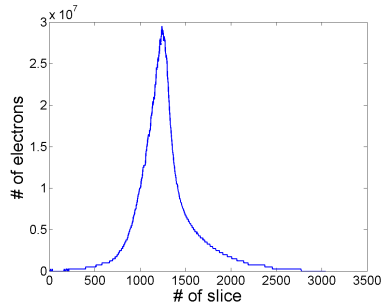


(b) Smooth over 10 slices

n_z of 3042 slices before modulator

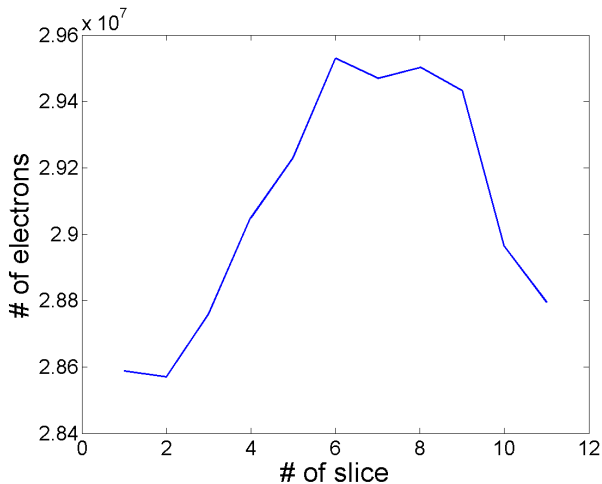


(a) Smooth over 20 slices

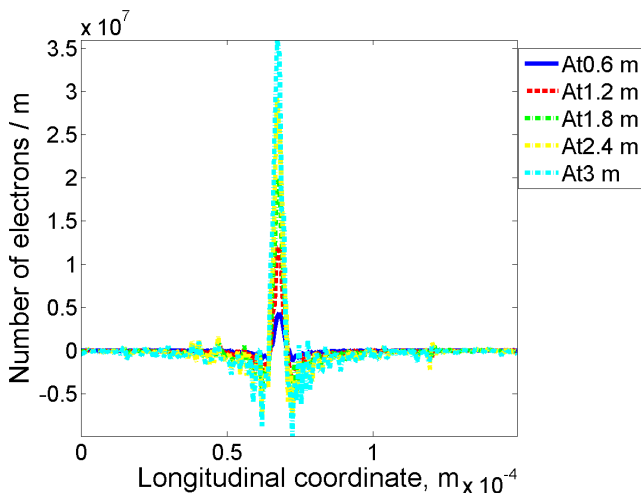


(b) Smooth over 40 slices

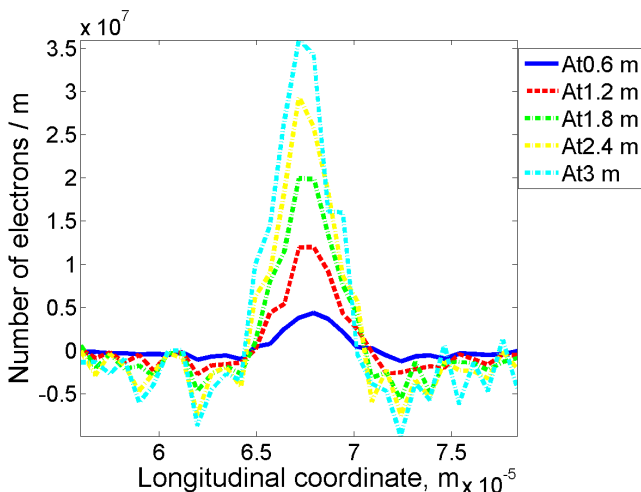
- We use the smoothing over 40 slices
- Choose the center 10 / 1 slice(s)
- Increase the number of particles by 2 orders
- Use the 10 / 1 slice(s) for modulator simulations

n_z of the 10 slices before modulator

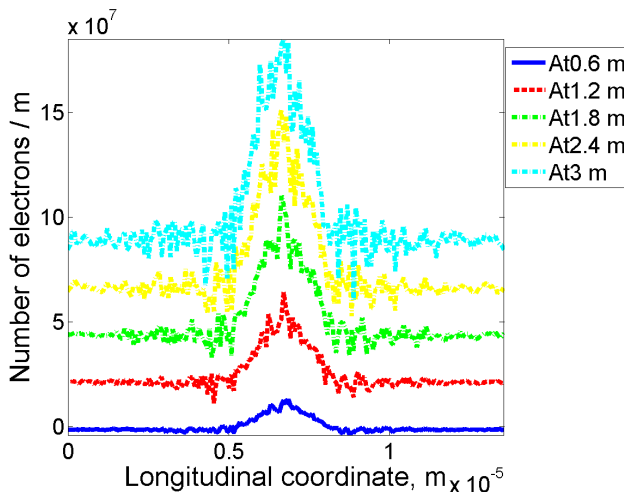
n_z of the 10 slices after modulator



n_z of the 10 slices after modulator, zoom in

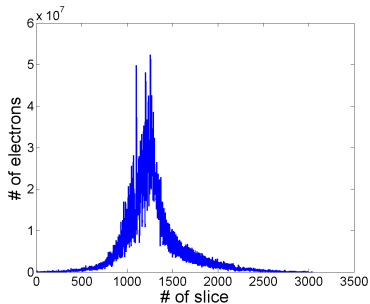


n_z of the 1 slices after modulator

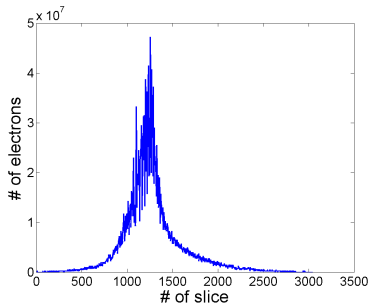


- We let the whole 3042 slices pass through the modulator
- Smooth the beam parameters
- Choose the center 400 slices, and increase particle number by 2 orders
- replace 10 / 1 slice(s) into 400 slices for FEL simulations

n_z of 3042 slices after modulator

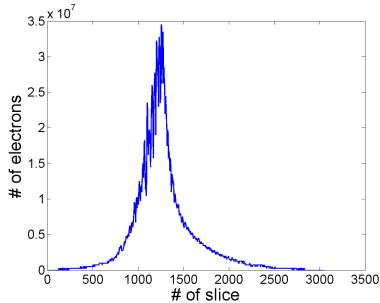


(a) No smooth

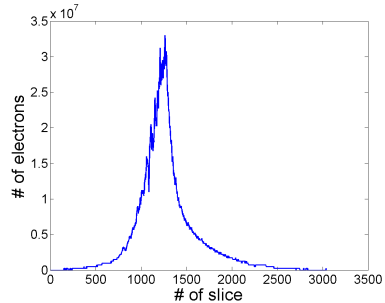


(b) Smooth over 2 slices

n_z of 3042 slices after modulator

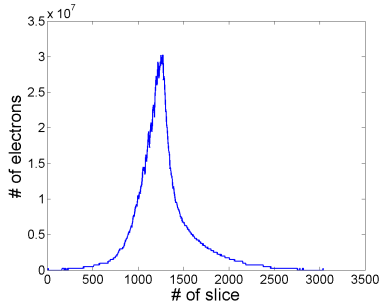


(a) Smooth over 5 slices

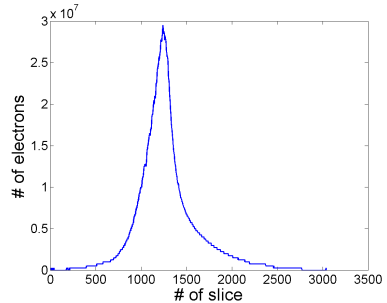


(b) Smooth over 10 slices

n_z of 3042 slices after modulator

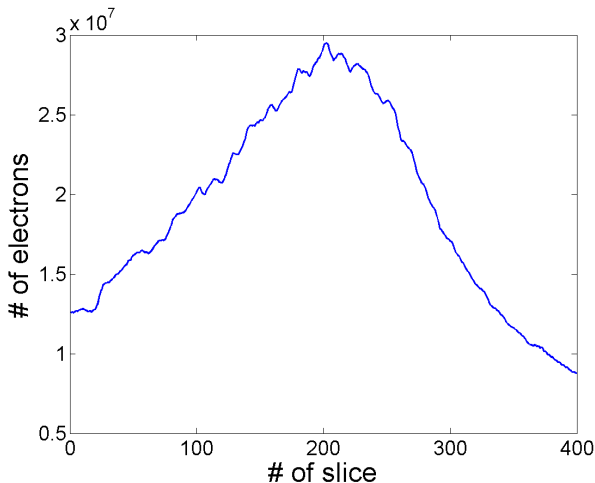


(a) Smooth over 20 slices

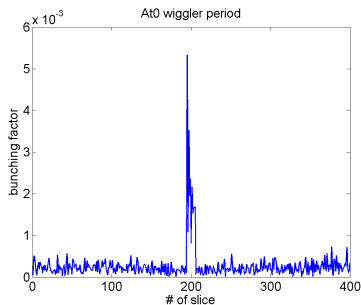


(b) Smooth over 40 slices

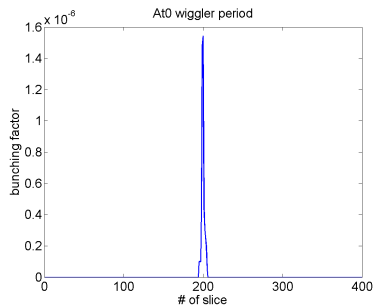
n_z of the 400 slices after modulator



Instant bunching factor



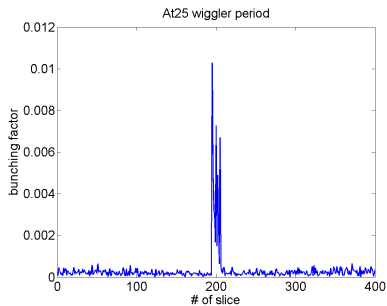
(a) Background



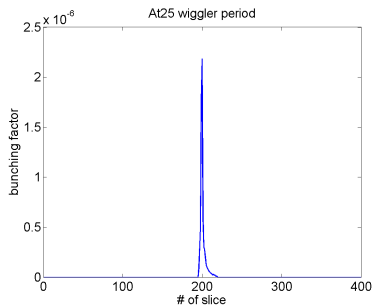
(b) Signal

- The 400 slices are created with correct shot noise
- The center 10 slices are directly from modulator simulations, containing larger shot noise
- In previous work, we use only 1 slice for modulator simulations with periodic boundary in longitudinal. When a particle escapes from one end, it appears on the other end, so it does not affect much on the bunching factor of the slice
- Now we use 10 slices for modulator simulations, and particle motions between slices strongly affect the bunching factor
- Re-generating the 10 slices with correct shot noise is not appropriate here as it introduces noise from randomness and we can not obtain the modulation signal by subtraction

Instant bunching factor

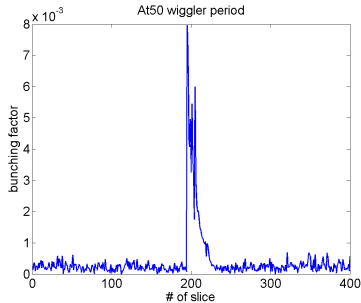


(a) Background

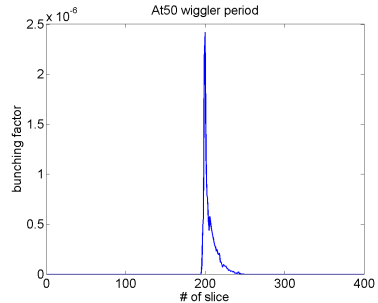


(b) Signal

Instant bunching factor

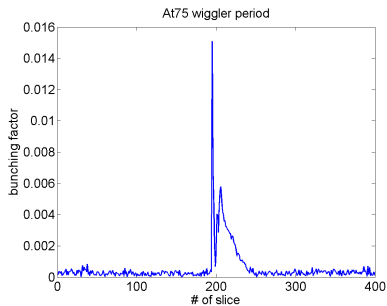


(a) Background

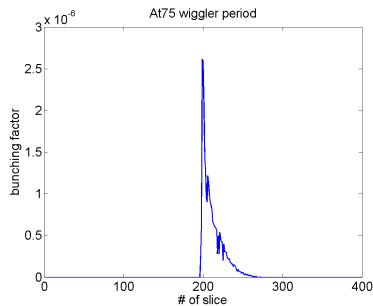


(b) Signal

Instant bunching factor

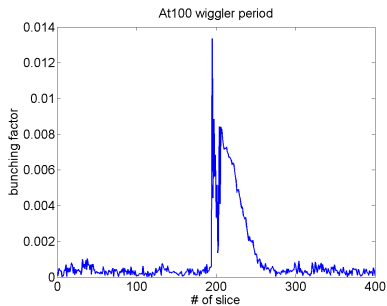


(a) Background

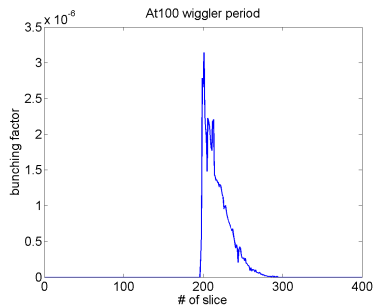


(b) Signal

Instant bunching factor

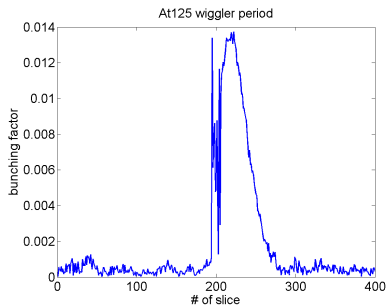


(a) Background

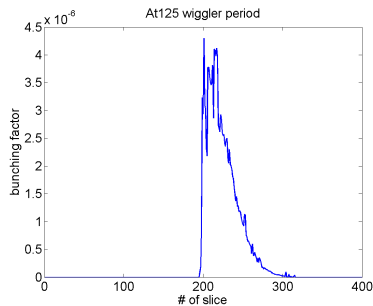


(b) Signal

Instant bunching factor

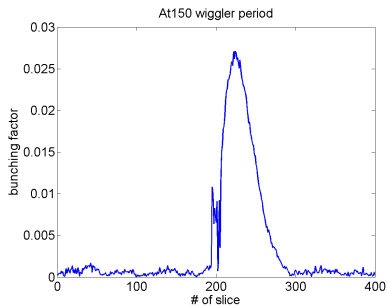


(a) Background

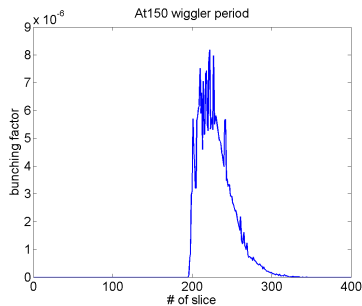


(b) Signal

Instant bunching factor

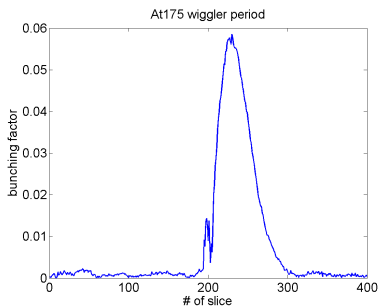


(a) Background

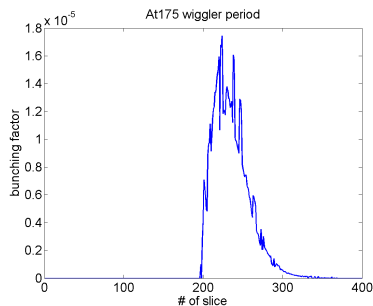


(b) Signal

Instant bunching factor

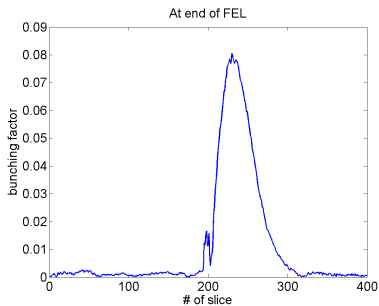


(a) Background

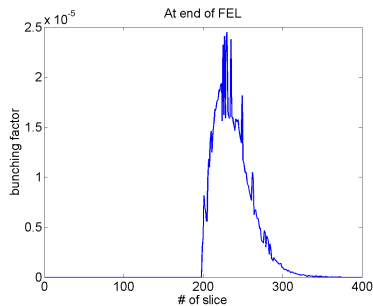


(b) Signal

Instant bunching factor

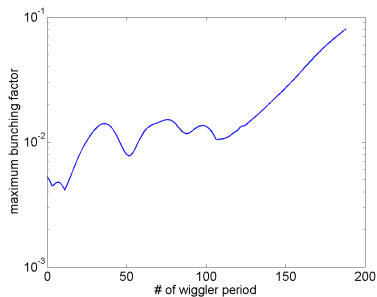


(a) Background

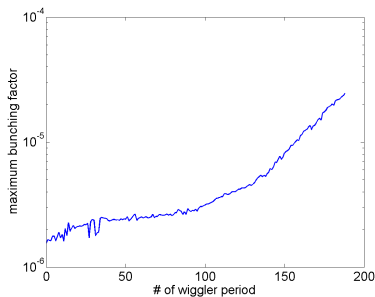


(b) Signal

Bunching factor changes

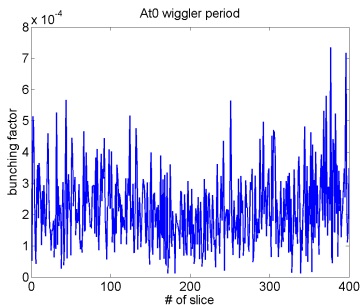


(a) Background

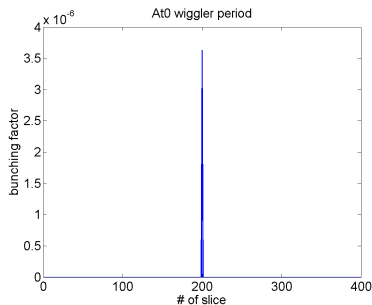


(b) Signal

Instant bunching factor

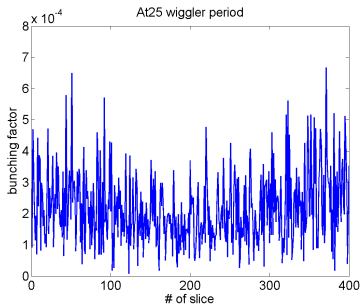


(a) Background

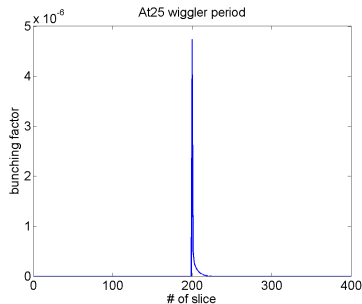


(b) Signal

Instant bunching factor

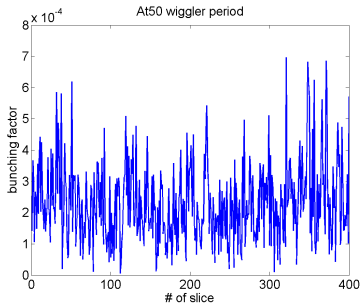


(a) Background

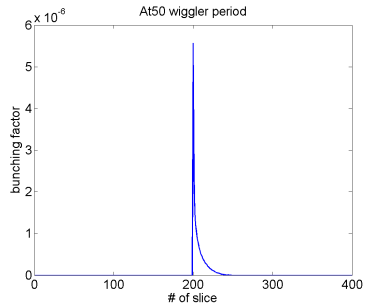


(b) Signal

Instant bunching factor

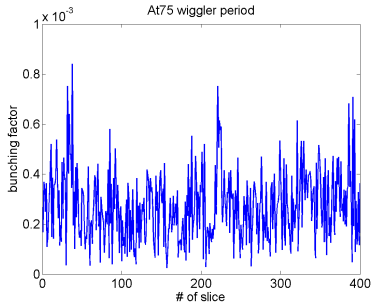


(a) Background

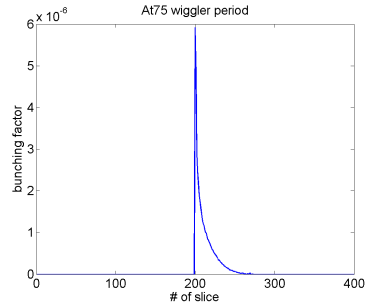


(b) Signal

Instant bunching factor

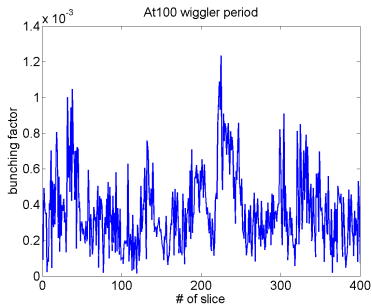


(a) Background

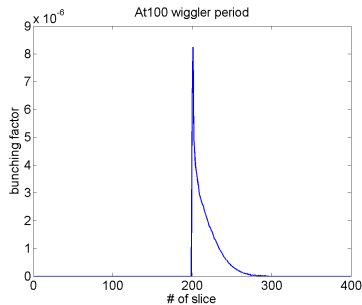


(b) Signal

Instant bunching factor

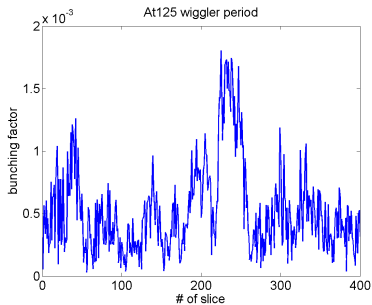


(a) Background

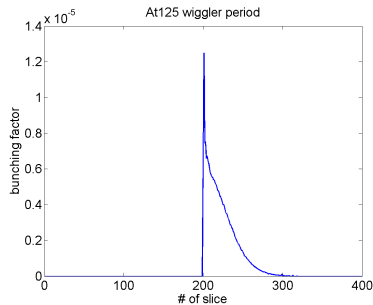


(b) Signal

Instant bunching factor

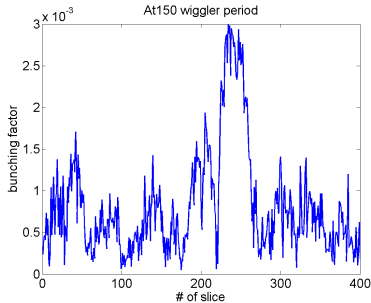


(a) Background

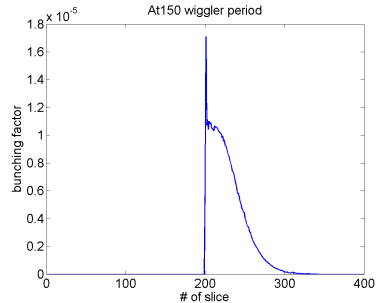


(b) Signal

Instant bunching factor

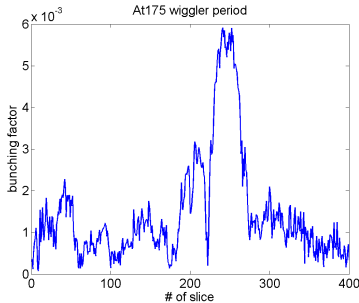


(a) Background

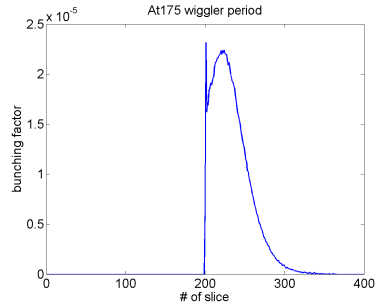


(b) Signal

Instant bunching factor

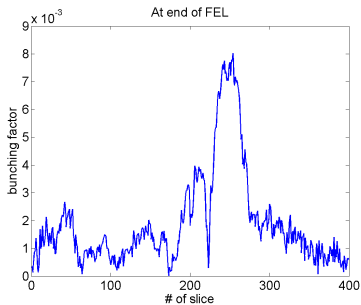


(a) Background

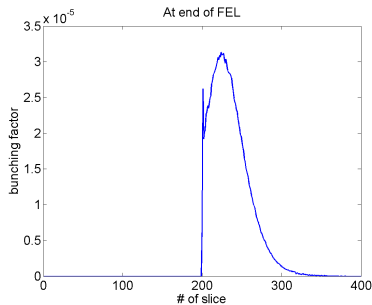


(b) Signal

Instant bunching factor

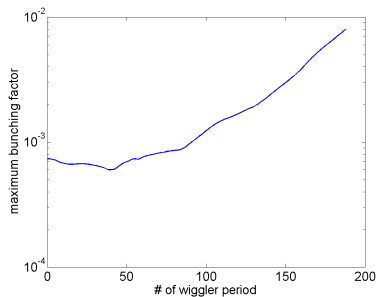


(a) Background

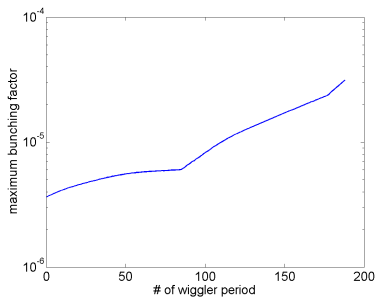


(b) Signal

Bunching factor changes



(a) Background



(b) Signal