

PSI Center for Accelerator Science
and Engineering

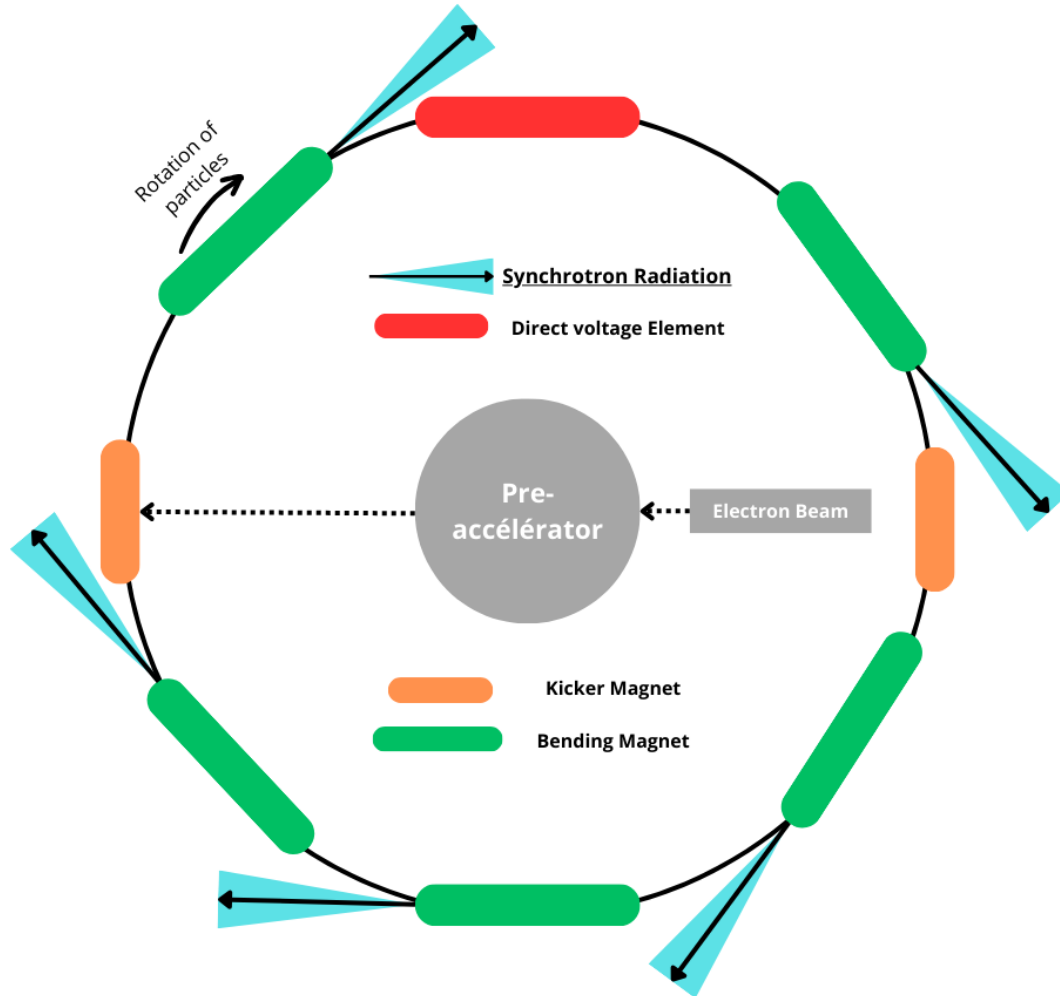
PSB and PPRE at SLS 2.0

Timing modes operations for users

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Synchrotron Radiation



EM waves radiation

A charged particle undergoing acceleration radiates energy in the form of electromagnetic waves.

Acceleration is pointed inwards to the ring at every bending magnet (source point). **Radiation is tangent to the particle's trajectory.**

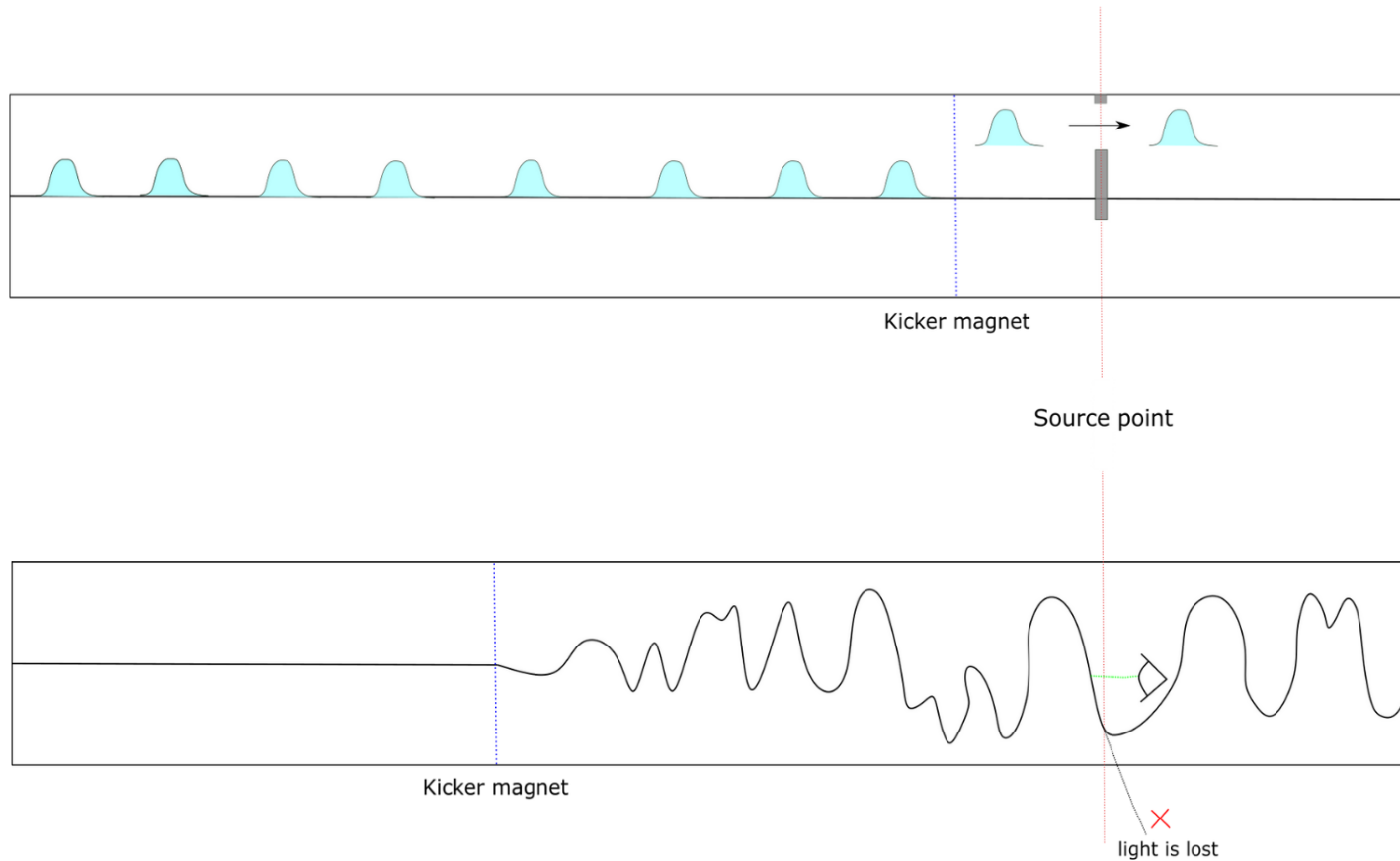
Synchrotron Radiation is of interest for beamline users.



- Biomedical research (e.g. Dr Jörg Stanfuss lecture)
- Probe atomic and electronic structure of matter

Pseudo-Single-Bunch at SLS 2.0

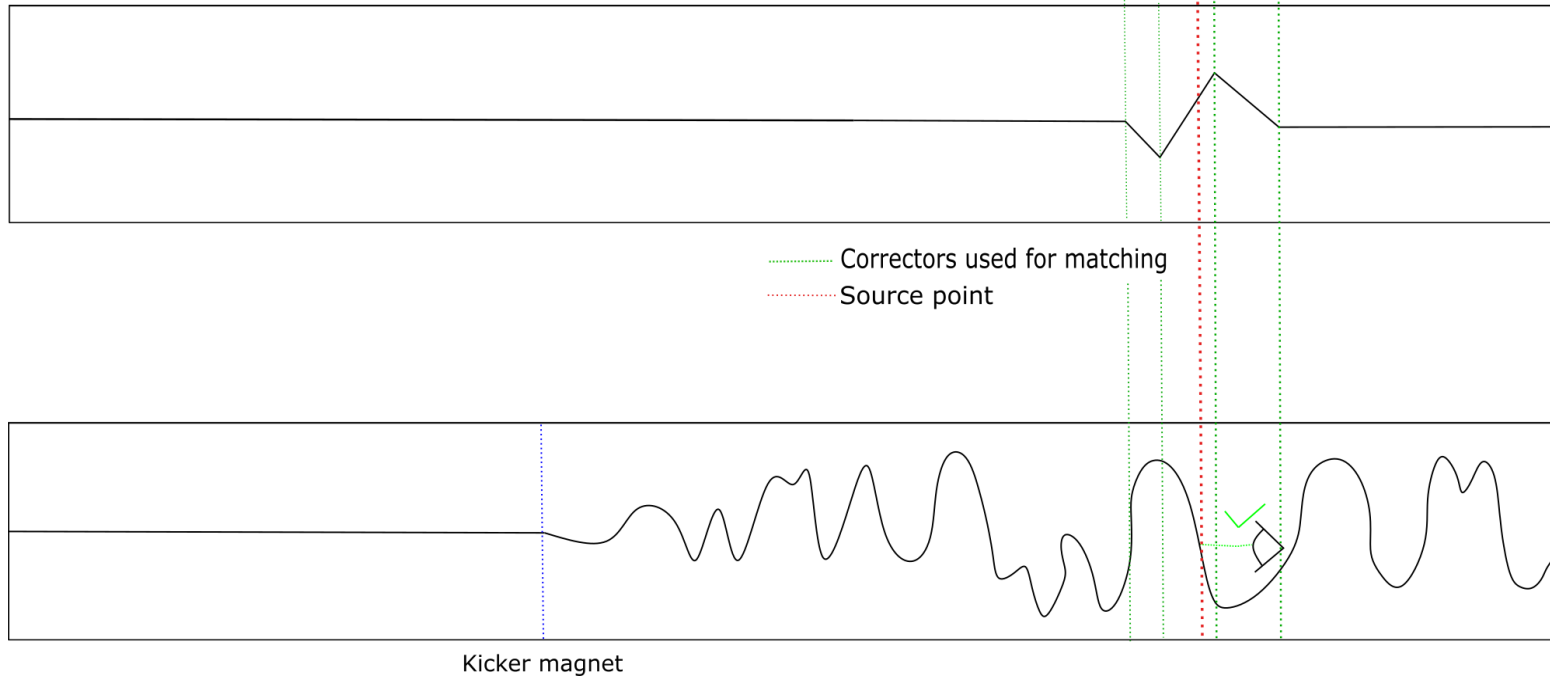
Pseudo-Single-Bunch



Kick a bunch of particles

We kick a bunch of particles out of its initial orbit. It moves the kicked beam radiation away from the unkicked beam one.

Problem : the radiation is not visible by the beam line users



Local Bump : A solution

A constant local bump created by 4 corrector magnets put the kicked bunch on-axis.

Pseudo-Single-Bunch

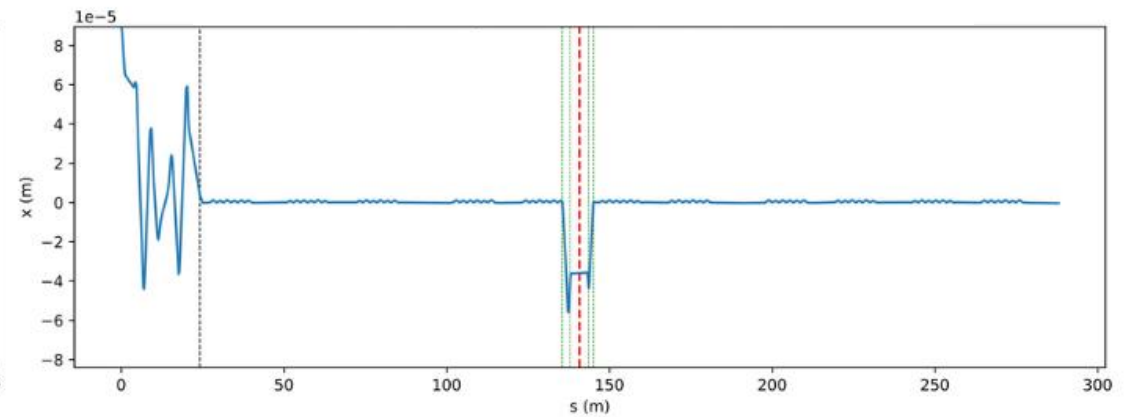
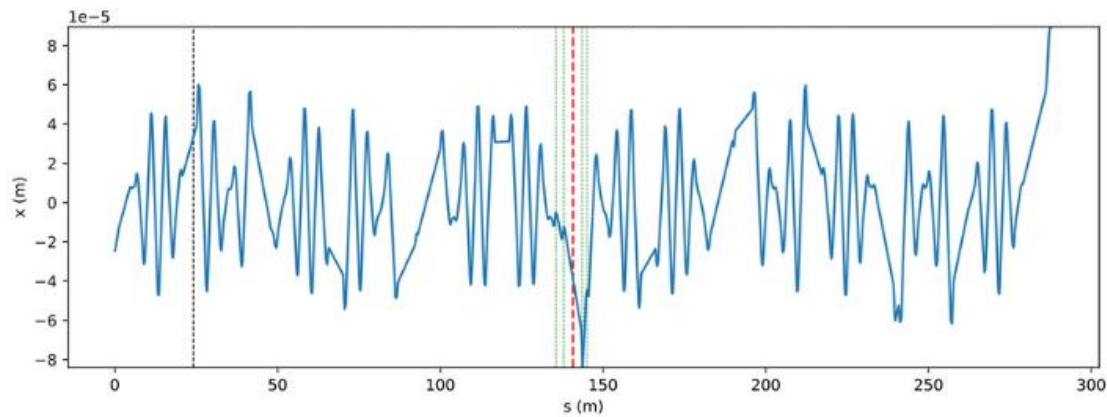
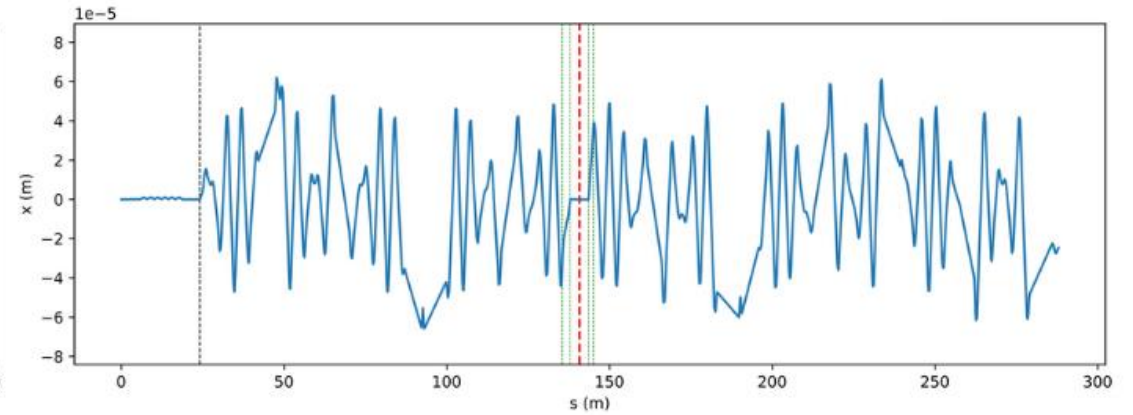
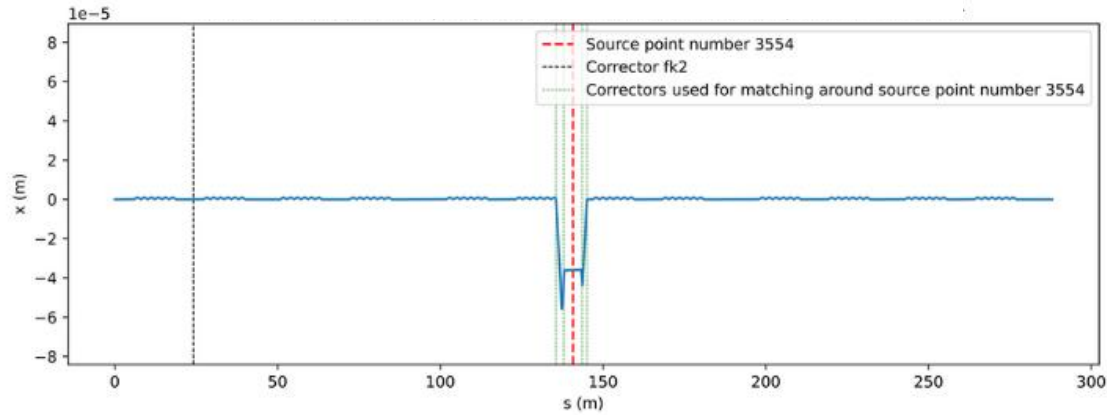


Turn 0 : Bump impact on orbit alone.

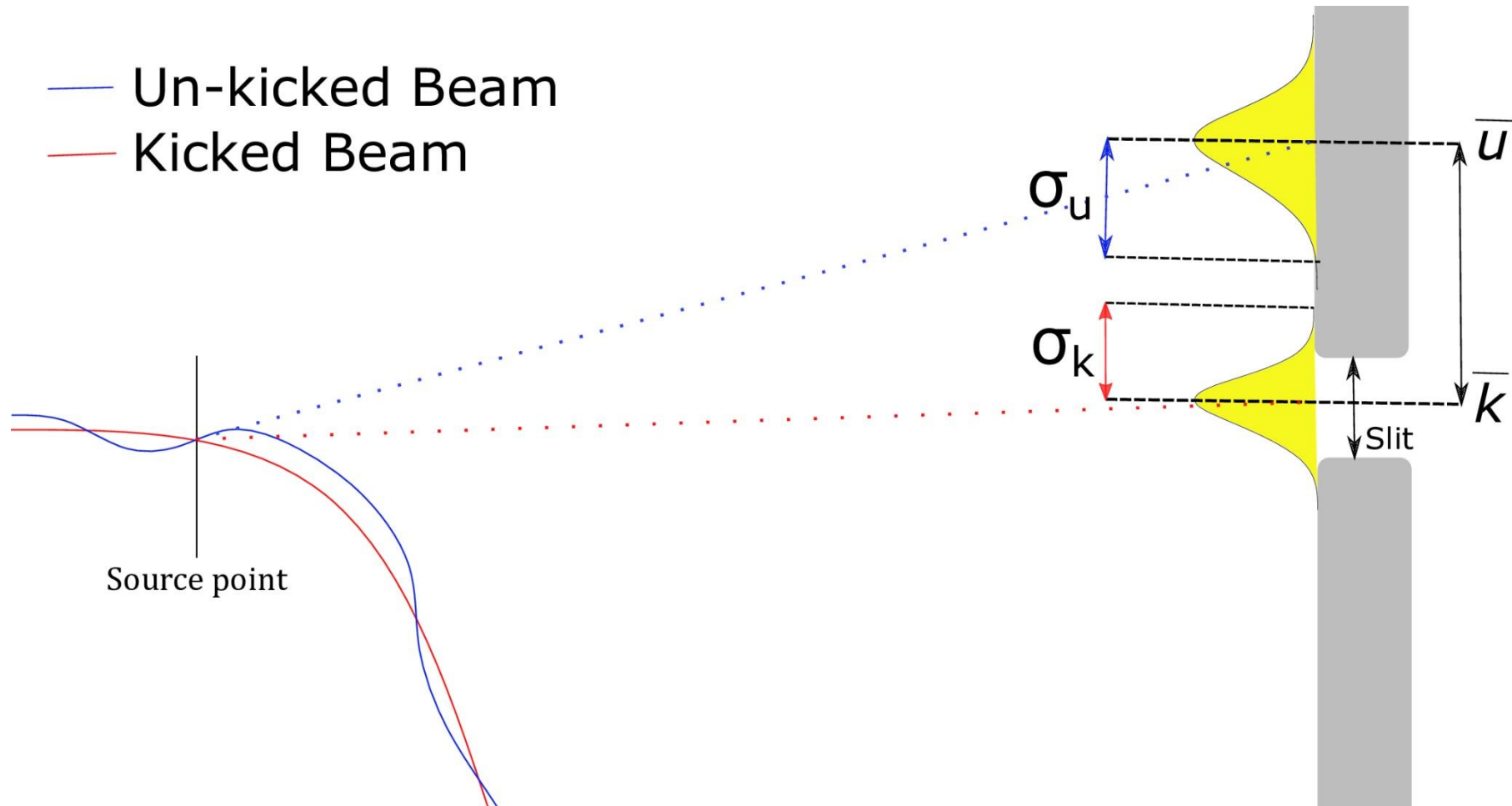
Turn 2 : Kicker is turned off. The particle continues its path

Turn 1 : Particle gets kicked + bump ensures to be on-axis

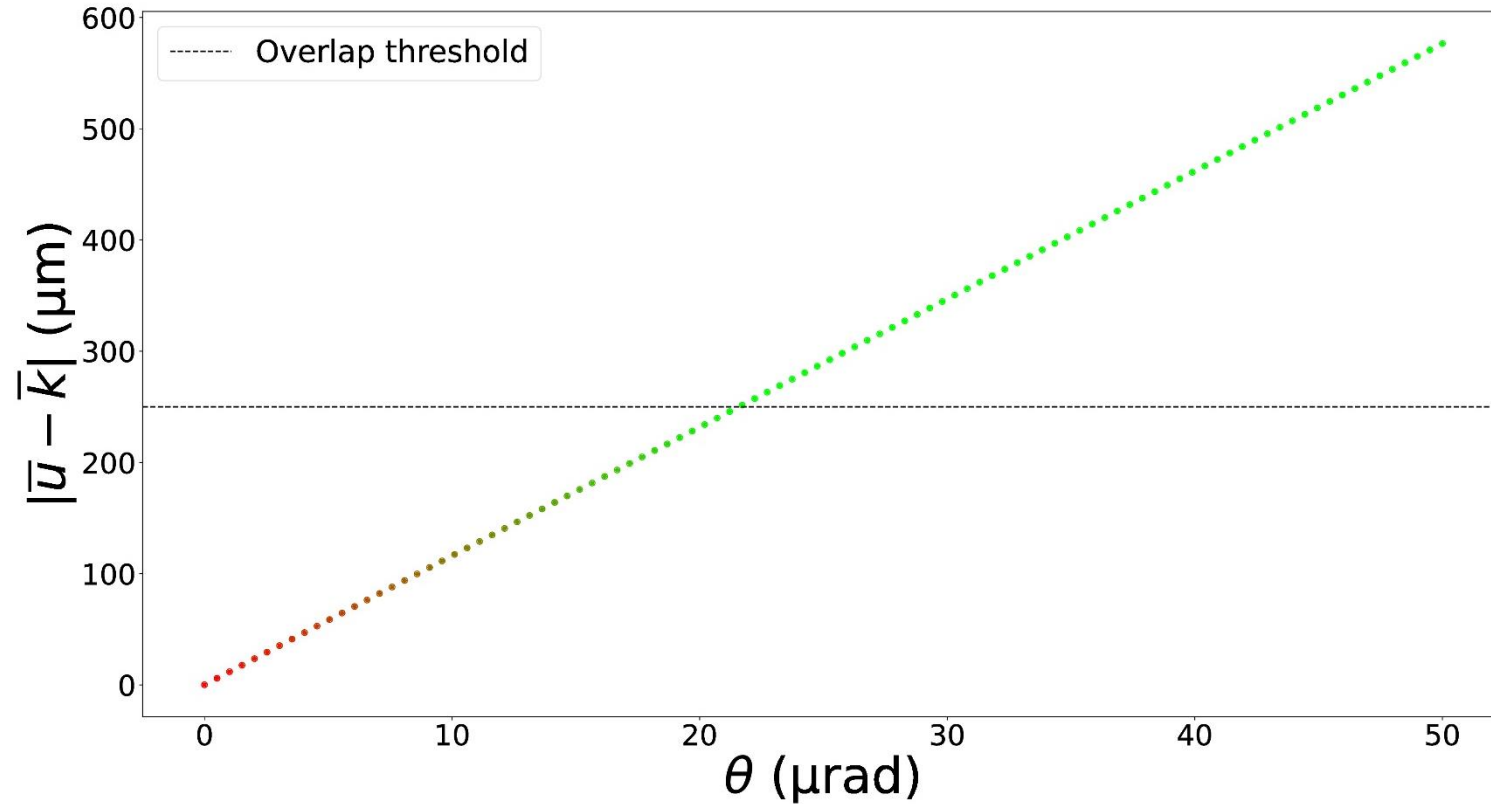
Turn 3 : Particle gets counter kicked. Bump has no impact



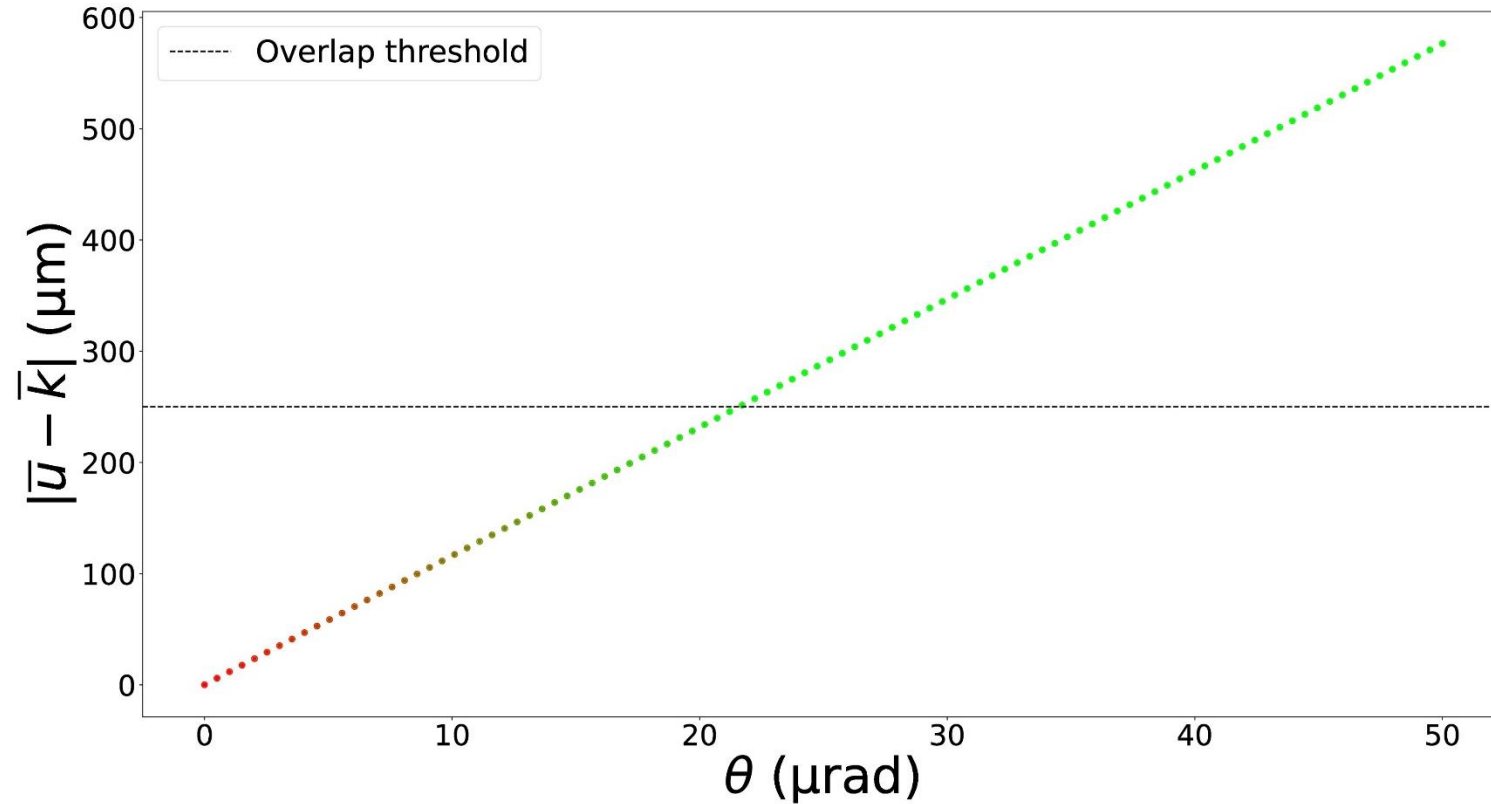
Pseudo-Single-Bunch



Outcome of the research for PSB



Outcome of the research for PSB



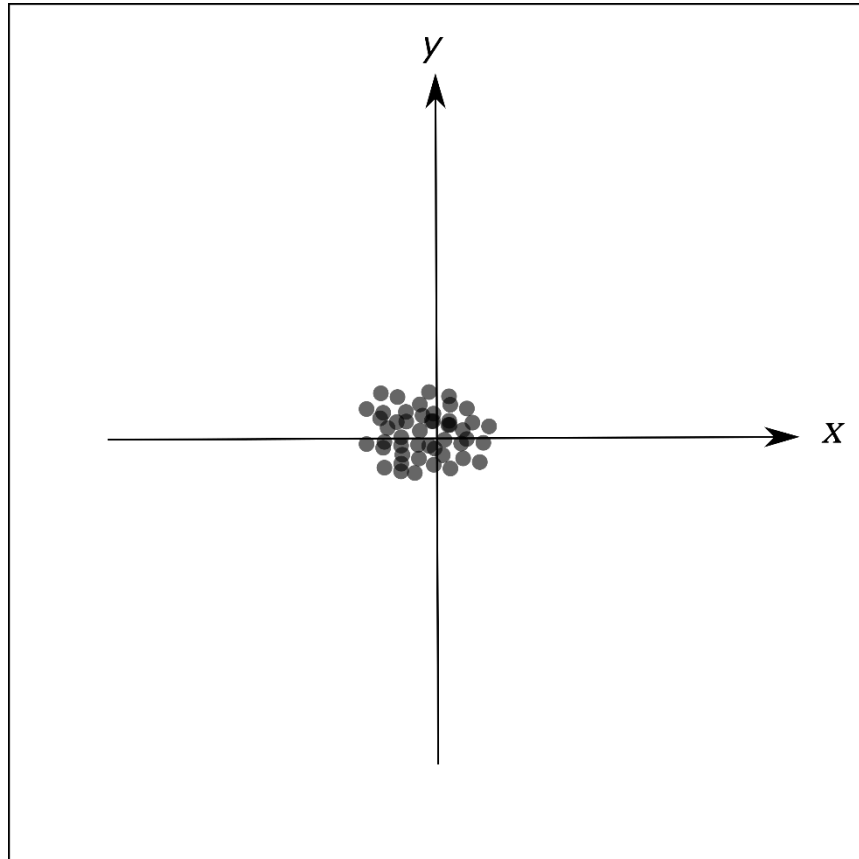
SIM	1	2	3	4	5
x/θ	-0.42	-1.45	1.85	0.01	-0.00
x'/θ	-2.79	-2.51	5.33	0.02	-0.02
y/θ	3.56	-1.61	-1.95	-0.00	-0.00
y'/θ	-2.38	0.28	2.10	-0.00	0.00

Table 5: Slopes values for beam line SIM. Tune is here set to ($Q_x = 0.33, Q_y = 0.33$). The counter kick is applied on turn 4 according to Table 1.


Pulse-Picking by Resonant Excitation at SLS 2.0



Pulse-Picking by Resonant Excitation

Turn 1

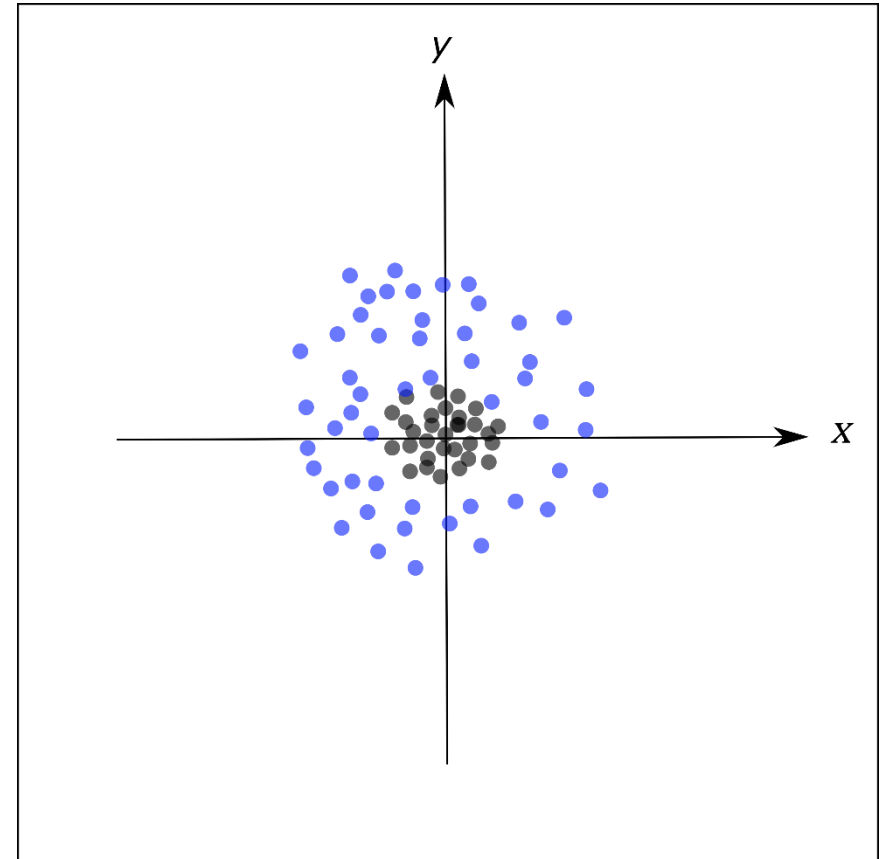


PPRE Operation


Beam size
growth

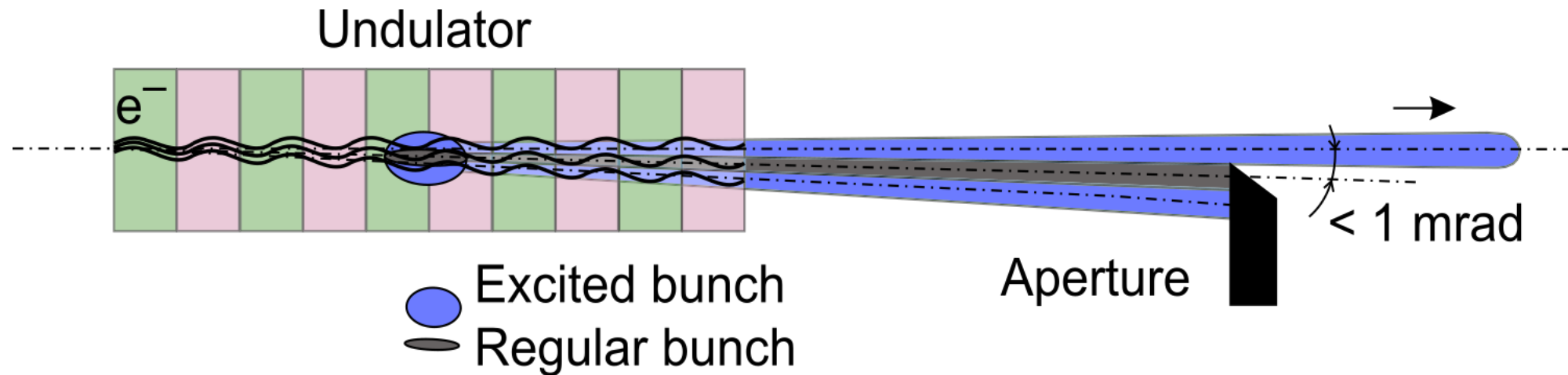
-  Excited Electrons
-  Unexcited Electrons

Turn 35000



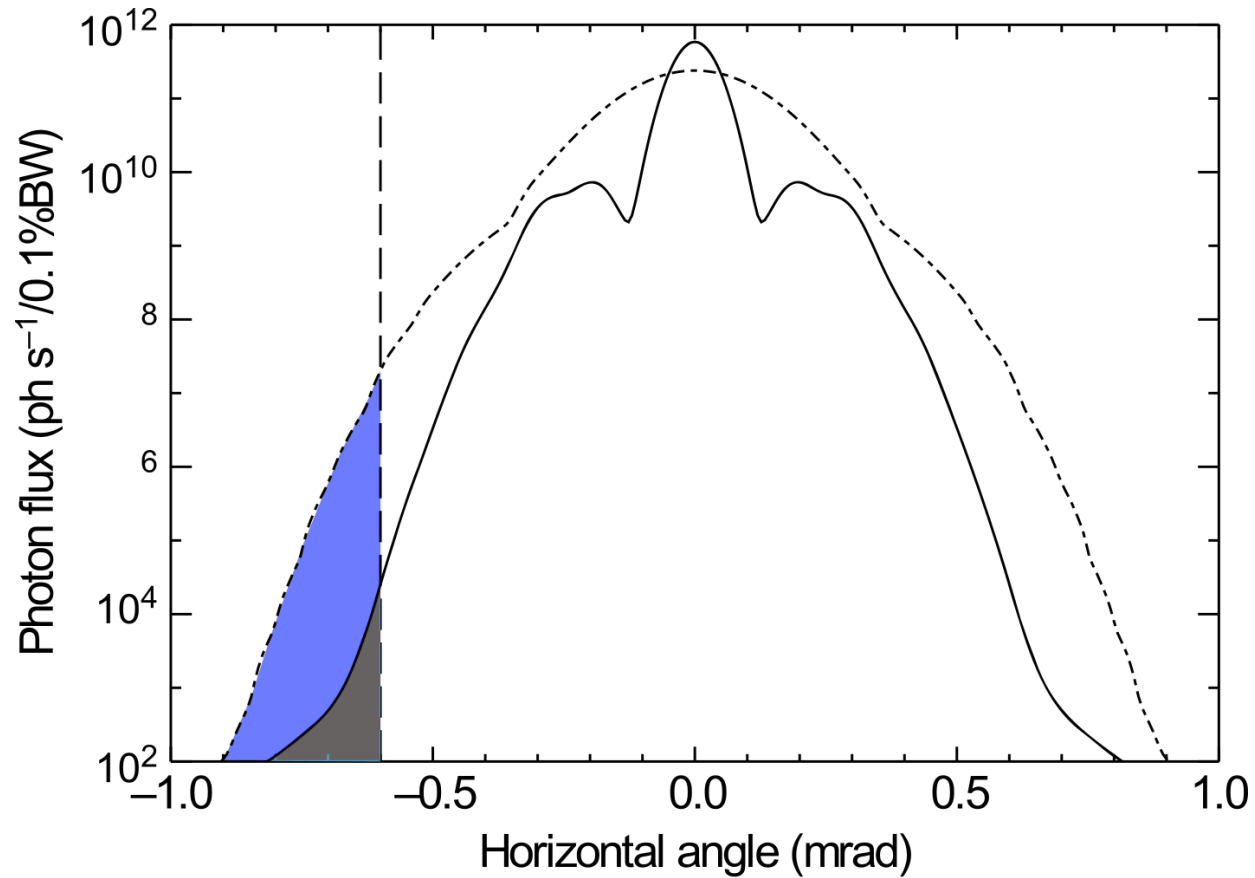
Pulse-Picking by Resonant Excitation

- Local bump, as in PSB, to be on-axis
- An aperture is used to split the bunch



NATURE COMMUNICATIONS | DOI: 10.1038/ncomms5010
Nature communications, Single Bunch X-ray pulses on demand from a multi-bunch synchrotron radiation source, K. Holldack al.

Outcome of the research for PPRE



Purity measurement

$$\frac{\textit{Excited bunch flux}}{\textit{Whole Photon flux}}$$

NATURE COMMUNICATIONS | DOI: 10.1038/ncomms5010

Nature communications, Single Bunch X-ray pulses on demand from a multi-bunch synchrotron radiation source, K. Holldack & al.

Thank you for your attention