Ecloud in quadrupole & Sextupole

Lanfa

parameters

3.2km DR

- Field: 7.5T/m
- Length:0.3m
- Pipe radius: 25mm
- SEY: 0.9~1.4
- Beam Size: (270,5) μm

6.4km DR

- Field: 12T/m
- Length:0.3m
- Pipe radius: 25mm
- SEY: 0.9~1.4
- Beam Size: (360,6) μm

Photon parameters

- Average number of photons emitted per unit length per beam particle in the ARCS are:
  - 0.33 photons/meter/e+ in the ARCS of 6.4 km ring
  - 0.47 photons/meter/e+ in the ARCS of 3.2 km ring

  (Considering an average of 0.204 photons/meter/e+ around each ring and a fractional arc/circumference=4000m/6476m and 1400m/3238m)
- Photoelectric yield: 0.1

Need an improved estimation of the photon distribution in the ring (Cornell code)

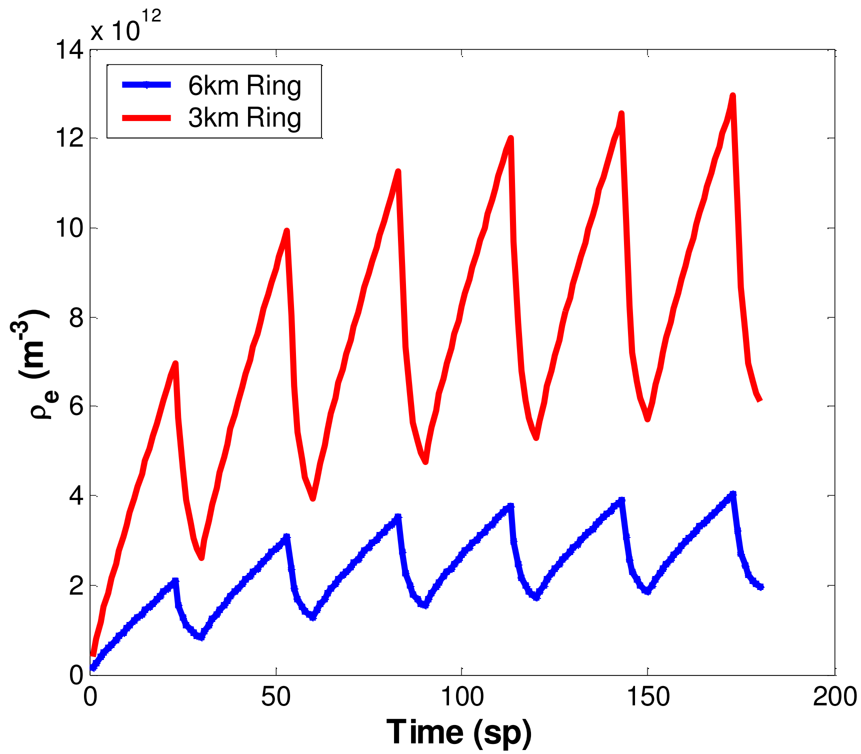
Build Up Input Parameters for CLOUDLAND

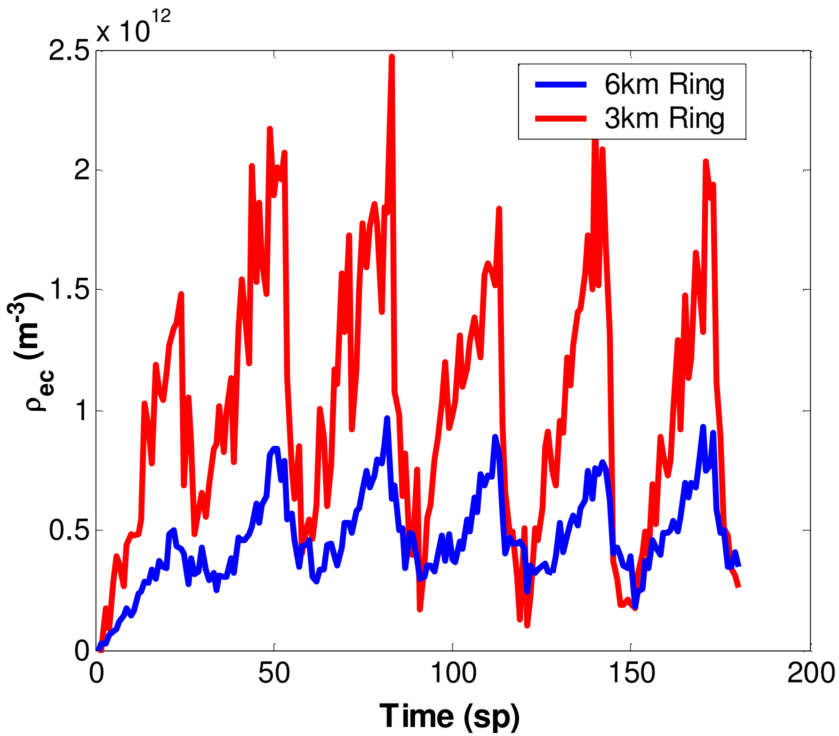
ilc-DR 6.4 Km, 6 ns bunch spacing*.

Bunch population	N_b	2.1x10^{10}
Number of bunches	N_b	23 x 6 trains
Bunch gap	$Ngap$	30
Bunch spacing	$L_{sep}[m]$	1.8
Bunch length	$\sigma_z\,[mm]$	6
Bunch horizontal size	$\sigma_x\,[mm]$	0.26
Bunch vertical size	$\sigma_y\,[mm]$	0.006
Photoelectron Yield	Y	0.1
Photon rate (e^-/e^+/m)	dn_γ/ds	0. 33
Antechamber protection	η	0%
Photon Reflectivity	R	50%
Max. Secondary Emission Yeld	δ_{max}	1.2
Energy at Max. SEY	$E_m\,[eV]$	300
SEY model	Cimino-Collins $(\delta(0)=0.5)$	

*https://wiki.lepp.cornell.edu/ilc/pub/Public/DampingRings/WebHome/DampingRingsFillPatterns.xls

Photon Reflectivity =50%
Antechamber protection =0





Data: ilc_6km_quadsp & ilc_3km_quadsp

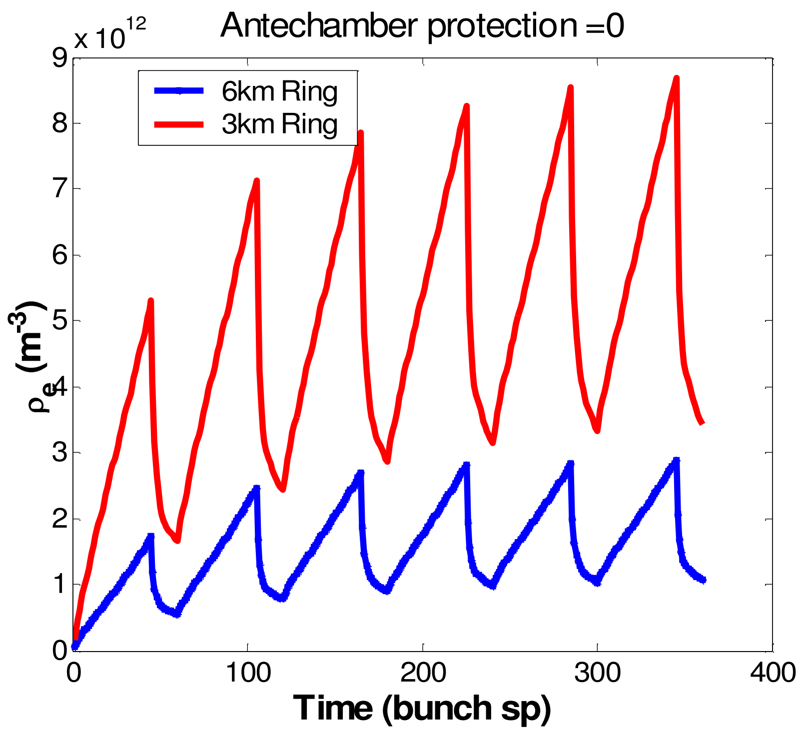
Build Up Input Parameters for CLOUDLAND

ilc-DR 6.4 Km, 6 ns bunch spacing*.

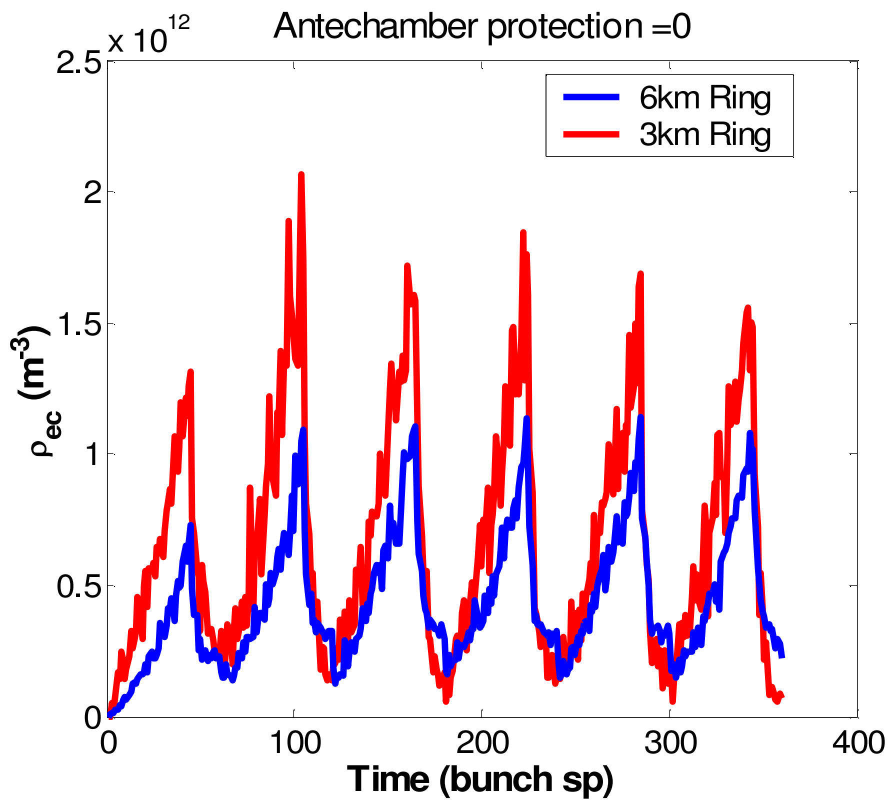
Bunch population	N_b	2.1×10^{10}
Number of bunches	N_b	45 x 6 trains
Bunch gap	$Ngap$	15 bunches (60 buckets)
Bunch spacing	$L_{sep}[m]$	1.8
Bunch length	$\sigma_z\,[mm]$	6
Bunch horizontal size	$\sigma_x\,[mm]$	0.26
Bunch vertical size	$\sigma_y\,[mm]$	0.006
Photoelectron Yield	Y	0.1
Photon rate (e^-/e^+/m)	dn_γ/ds	0. 33
Antechamber protection	η	0%, 90%, 98%
Photon Reflectivity	R	20%
Max. Secondary Emission Yeld	δ_{max}	1.2
Energy at Max. SEY	$E_m\,[eV]$	300
SEY model	Cimino-Collins $(\delta(0)=0.5)$	

*https://wiki.lepp.cornell.edu/ilc/pub/Public/DampingRings/WebHome/DampingRingsFillPatterns.xls

Quadrupole: Photon Reflectivity =20%
Antechamber protection =0



Average density

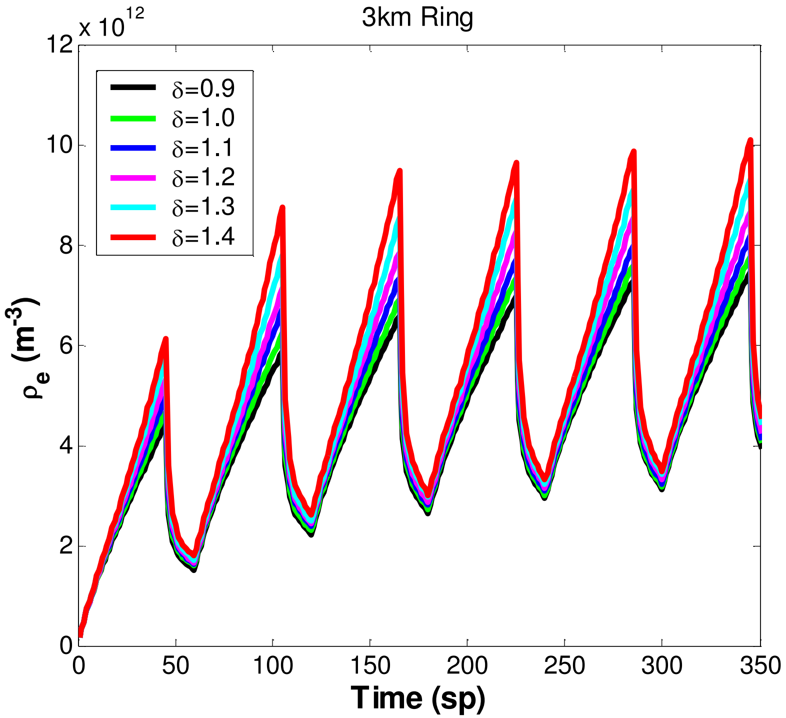


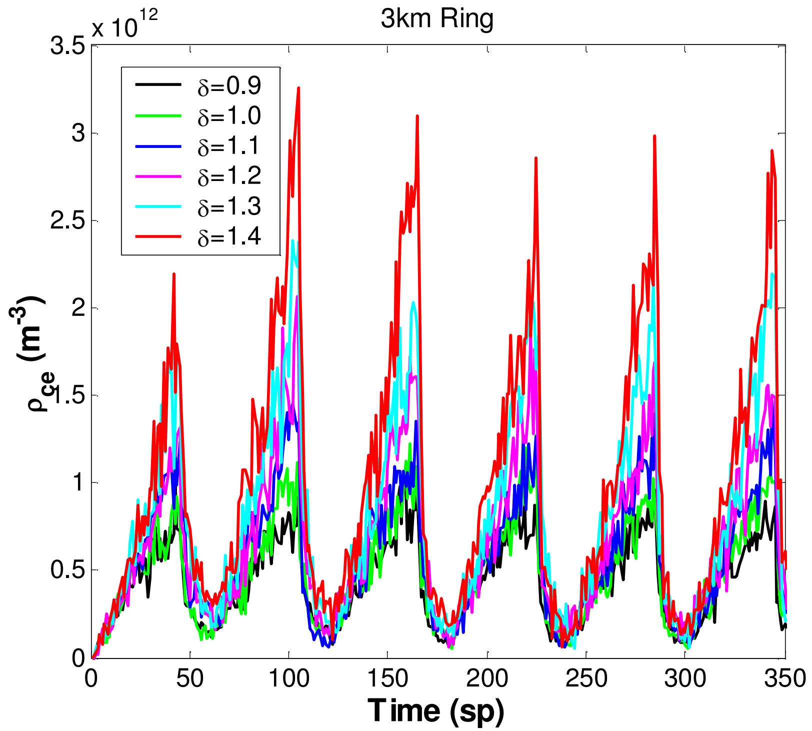
Ecloud density near the beam

Data: ilc_6km_quadspr20atn0 & ilc_3km_quadspr20atn0

SEY effect (3km Ring)

Quadrupole: Photon Reflectivity =20%
Antechamber protection =0



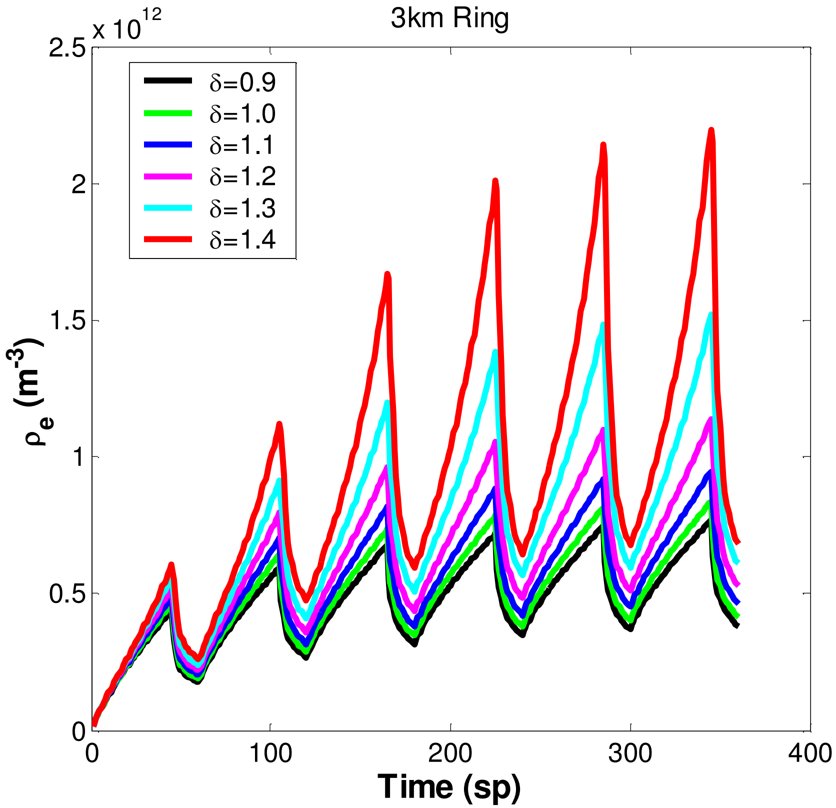


Average density build-up

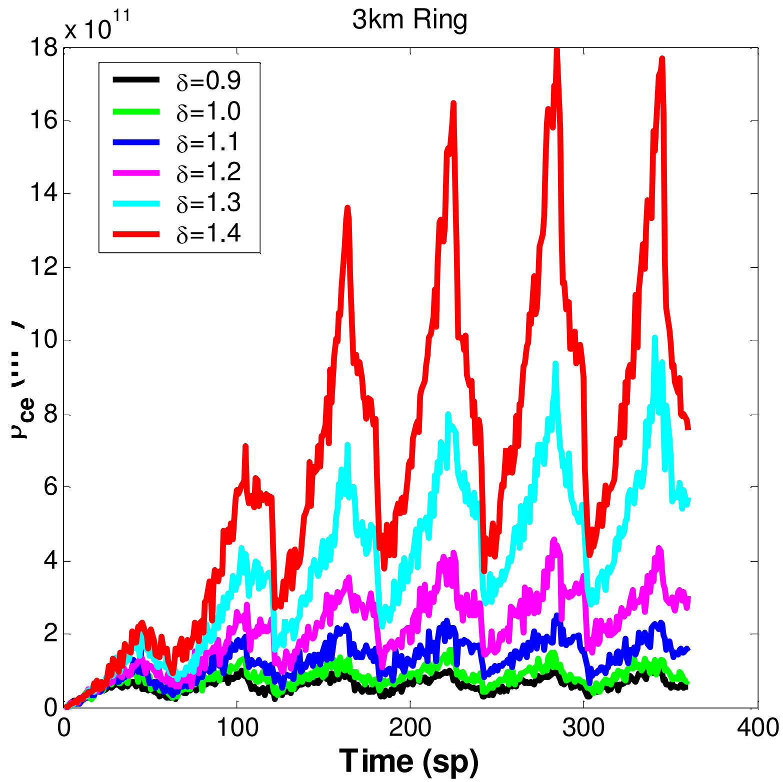
Central density build-up

SEY effect (3km Ring)

Quadrupole: Photon Reflectivity =20%
Antechamber protection =90%



Average density build-up

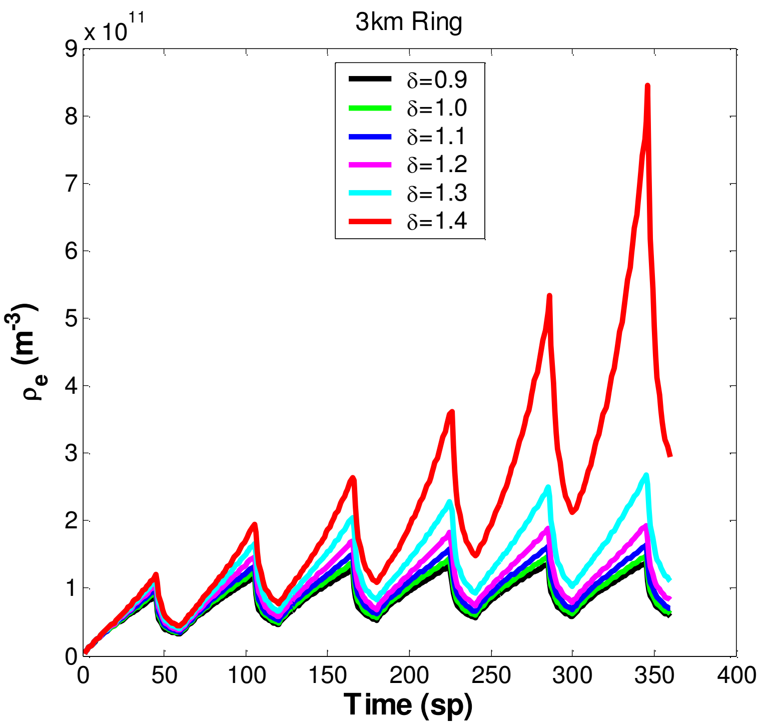


Central density build-up

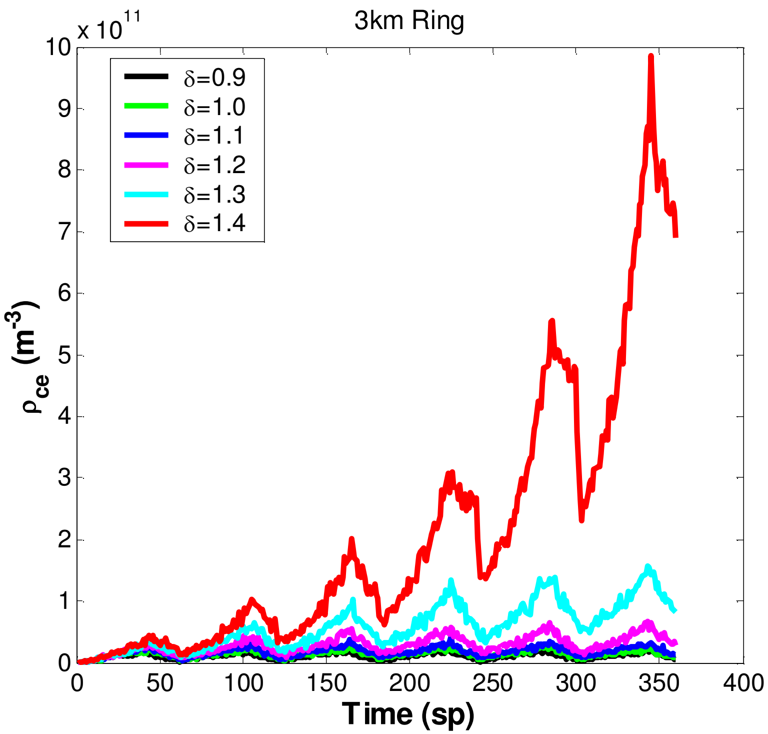
SEY effect (3km Ring)

Quadrupole: Photon Reflectivity =20%
Antechamber protection =98%

Note: ecloud is not saturated for large SEY



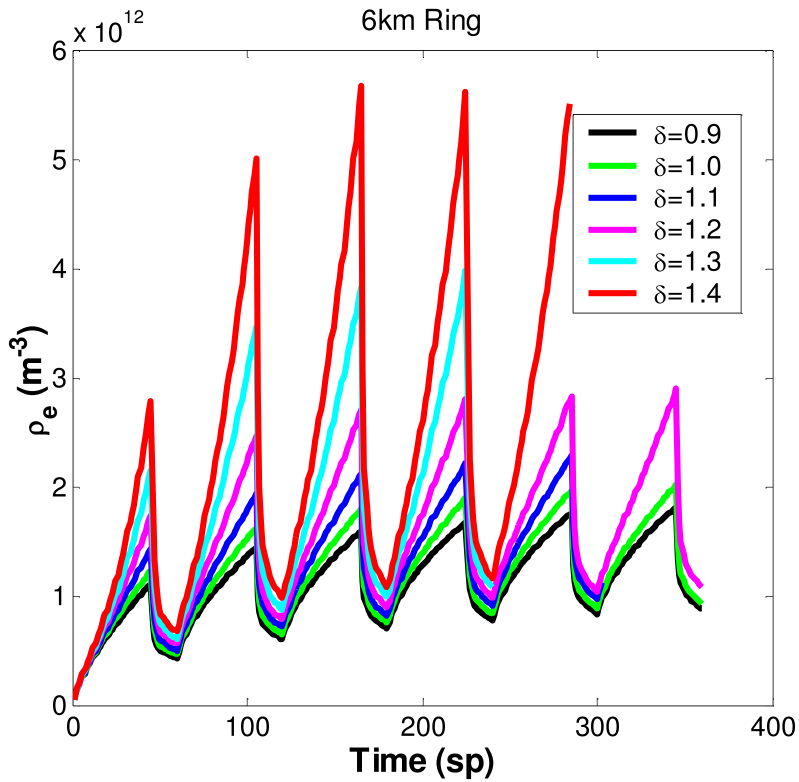
Average density build-up



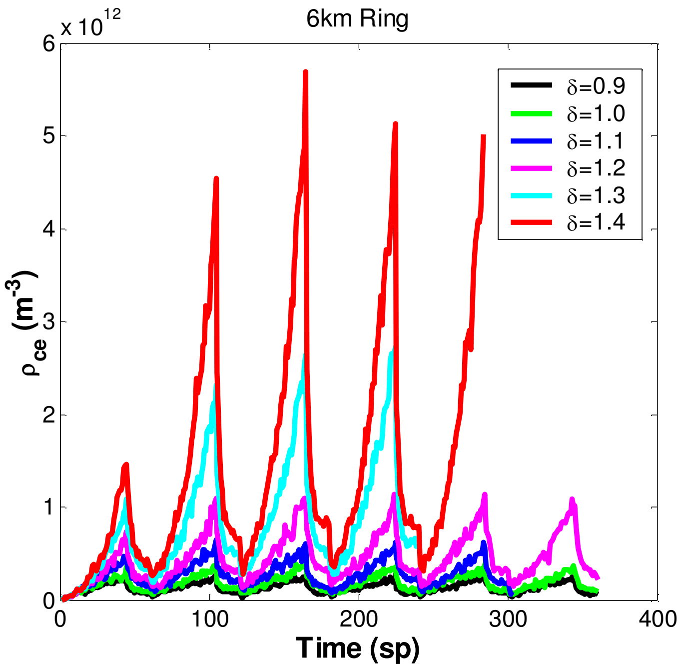
Central density build-up

SEY effect (6km Ring)

Quadrupole: Photon Reflectivity =20%
Antechamber protection =0



Average density build-up



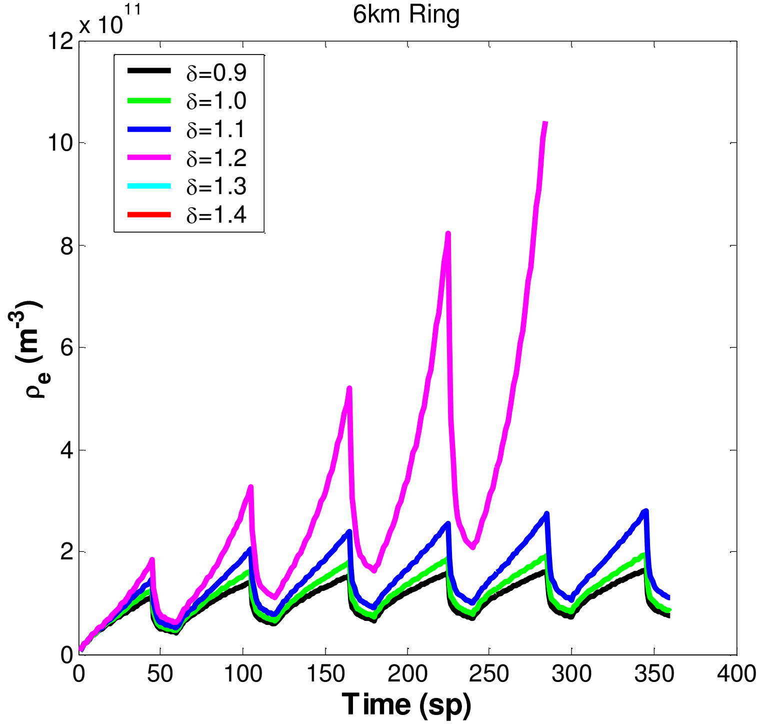
Central density build-up

SEY effect (6km Ring)

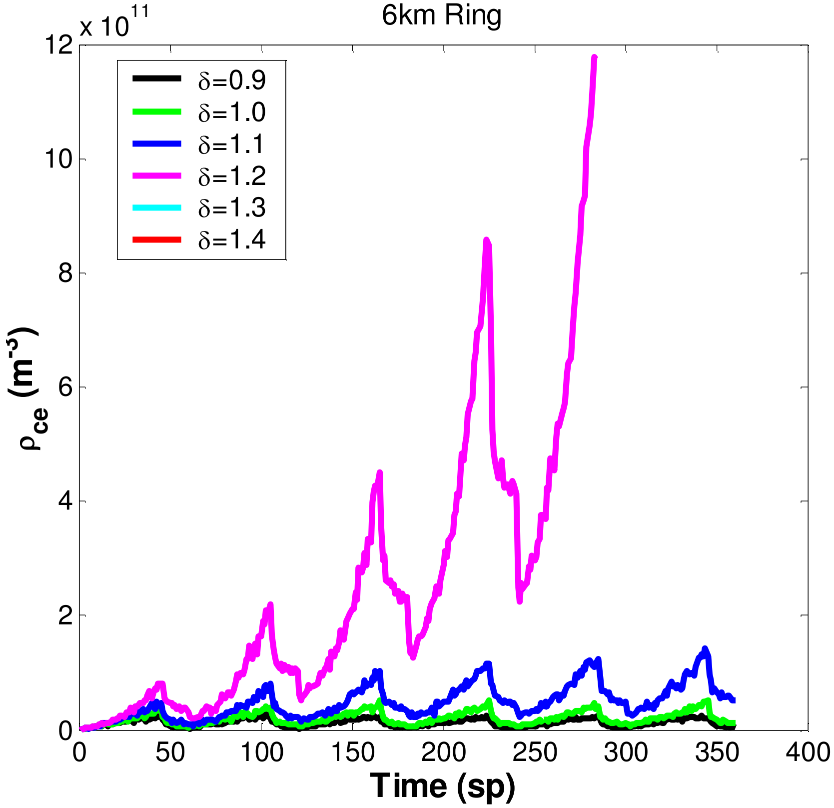
Quadrupole: Photon Reflectivity =20%

Antechamber protection =90%

Note: ecloud is not saturated for large SEY



Average density build-up



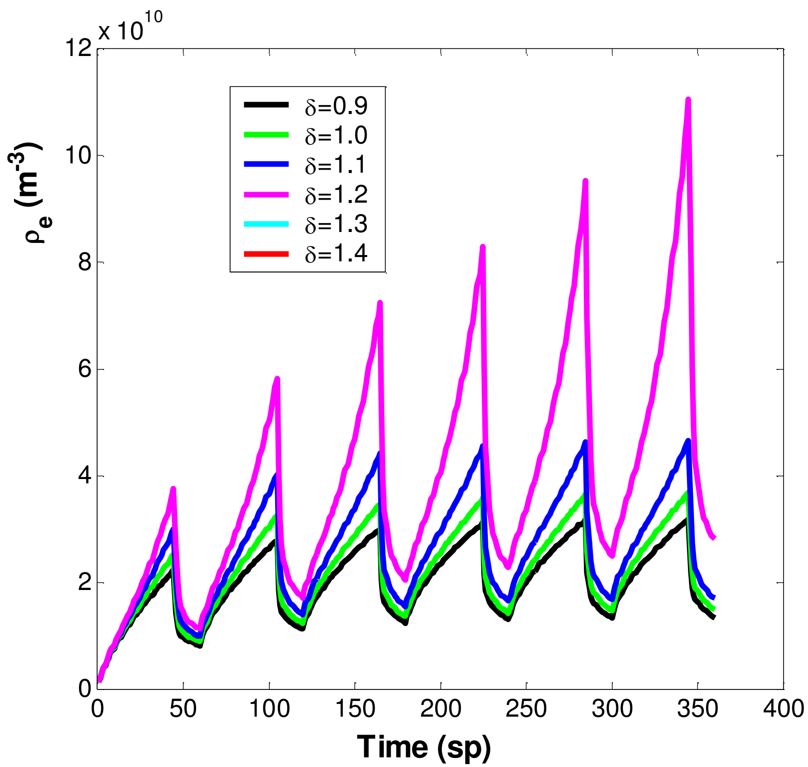
Central density build-up

SEY effect (6km Ring)

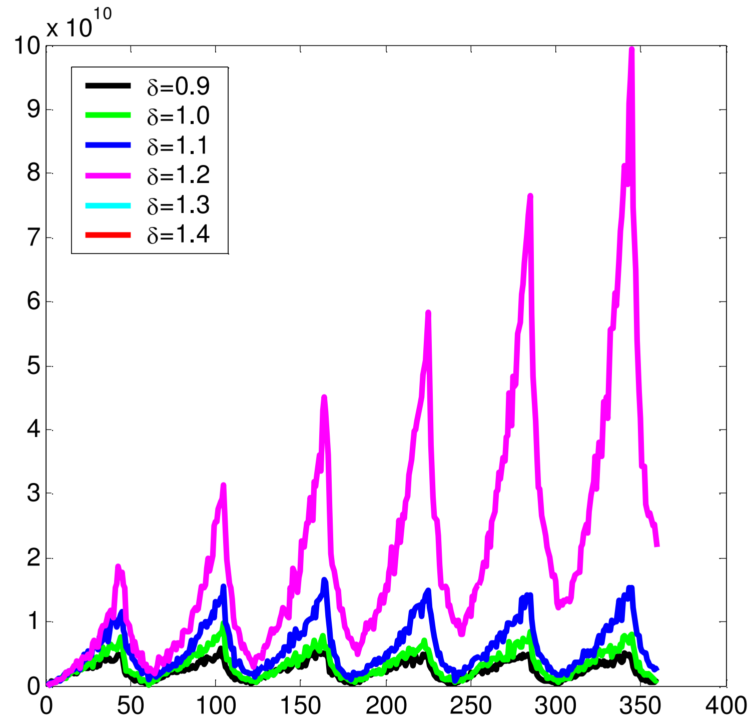
Quadrupole: Photon Reflectivity =20%

Antechamber protection =98%

Note: ecloud is not saturated for large SEY

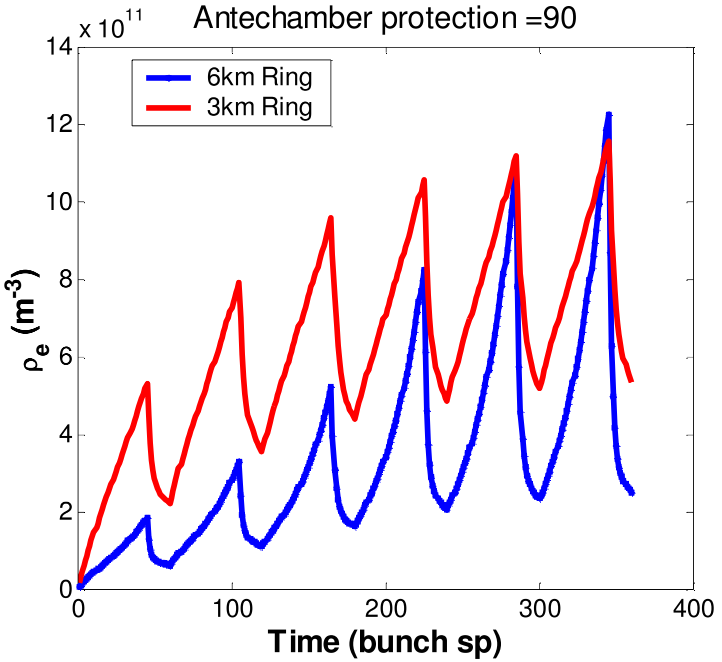


Average density build-up

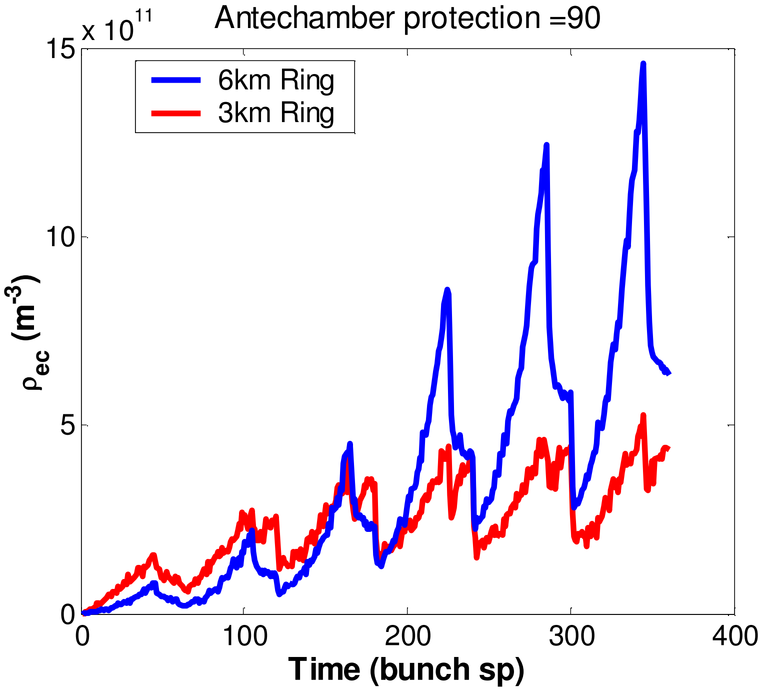


Central density build-up

Quadrupole: Photon Reflectivity =20%
Antechamber protection =90



Average density



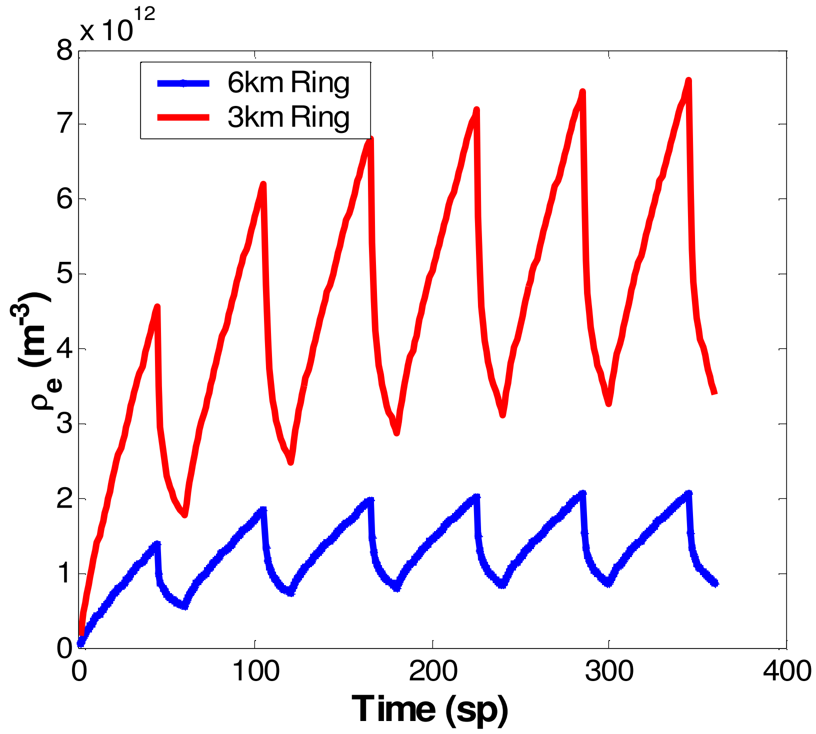
Ecloud density near the beam

Data:ilc_6km_45b_quadr20atn90 & **ilc_3km_45b_quadr20atn90**

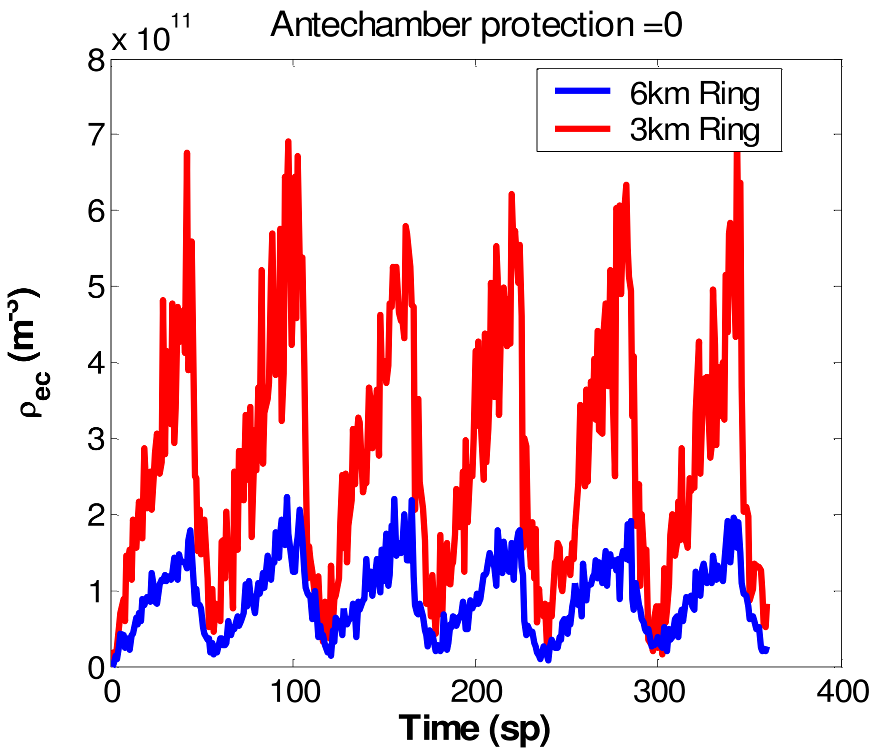
ECLOUD IN SEXTUPOLE

Sextupole : Photon Reflectivity =20%

Antechamber protection =0



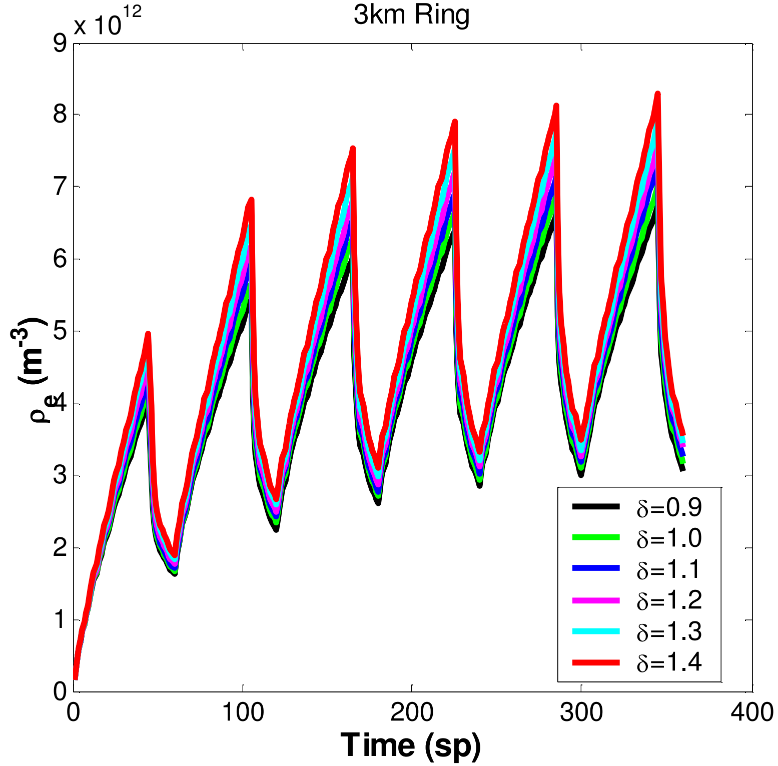
Average density



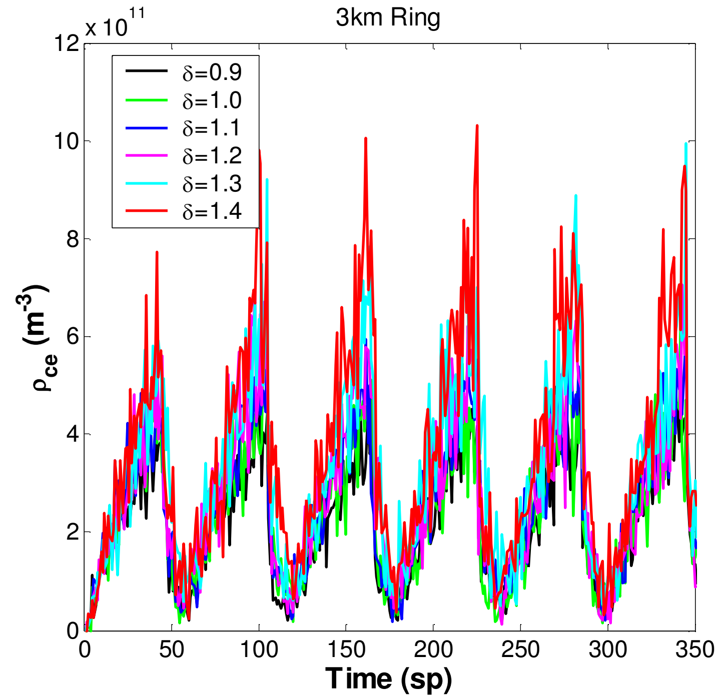
Ecloud density near the beam

SEY effect (3km Ring)

Sextupole: Photon Reflectivity =20%
Antechamber protection =0



Average density build-up

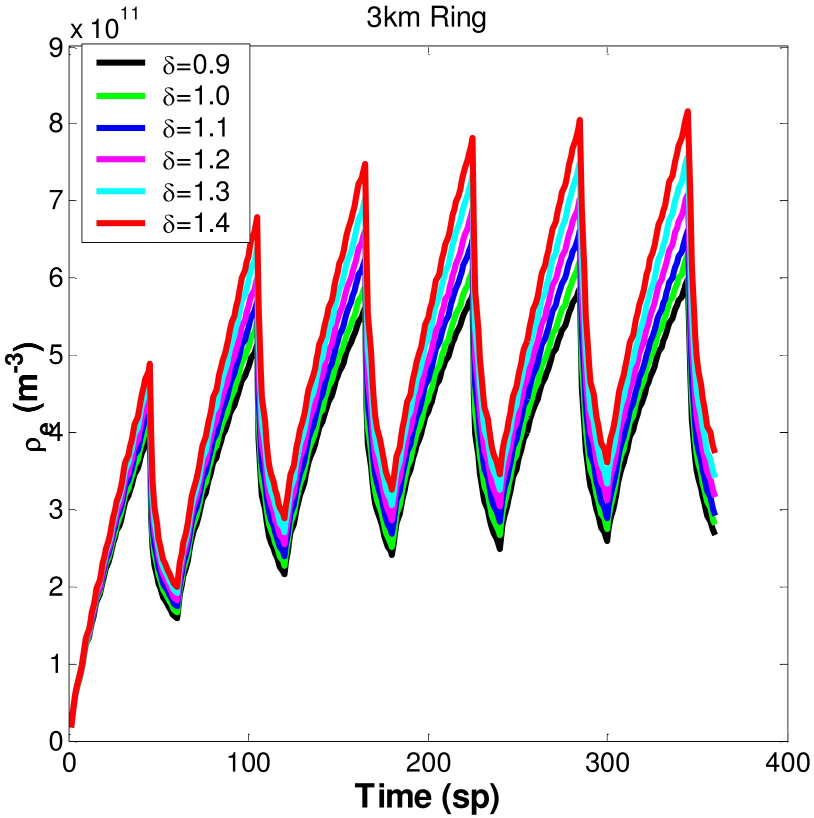


Central density build-up

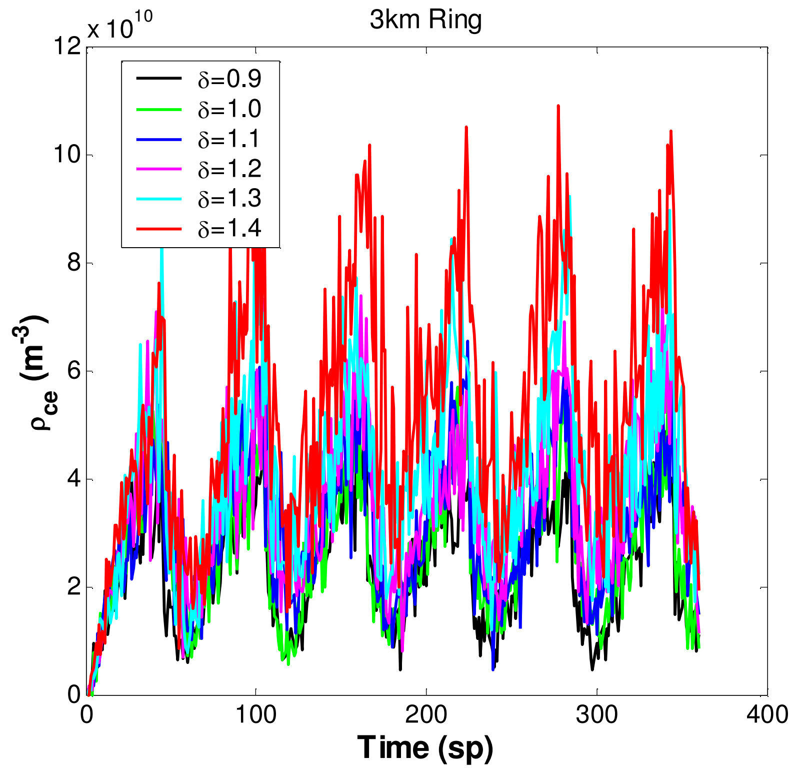
SEY effect (3km Ring)

Sextupole: Photon Reflectivity =20%

Antechamber protection =90%



Average density build-up

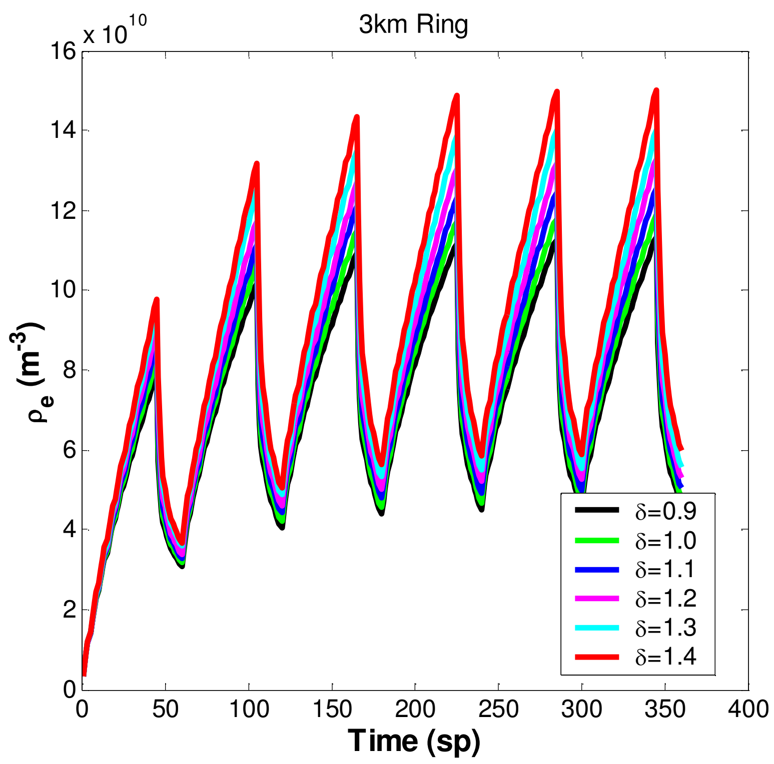


Central density build-up

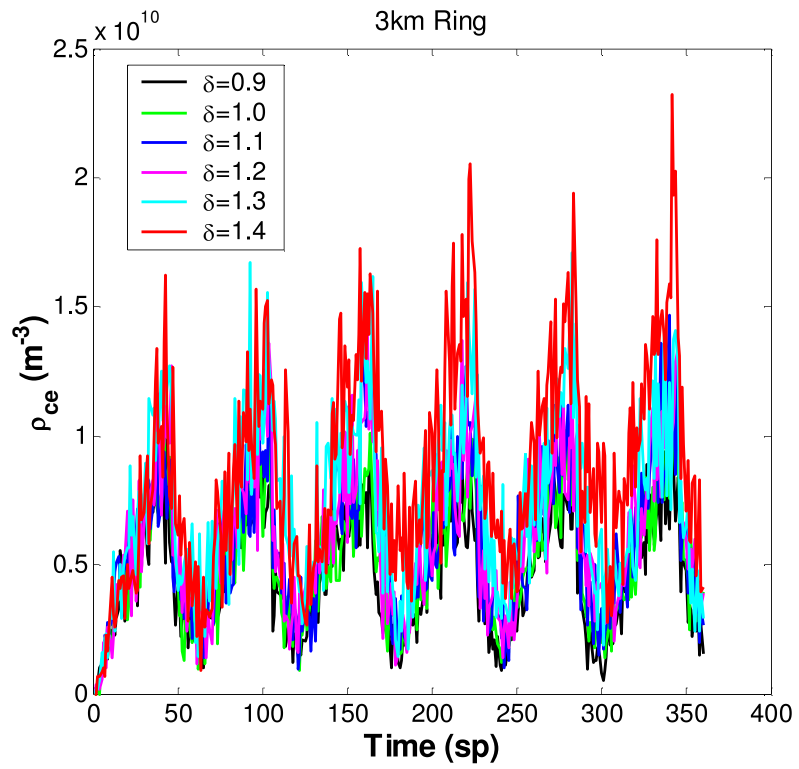
SEY effect (3km Ring)

Sextupole: Photon Reflectivity =20%

Antechamber protection =98%



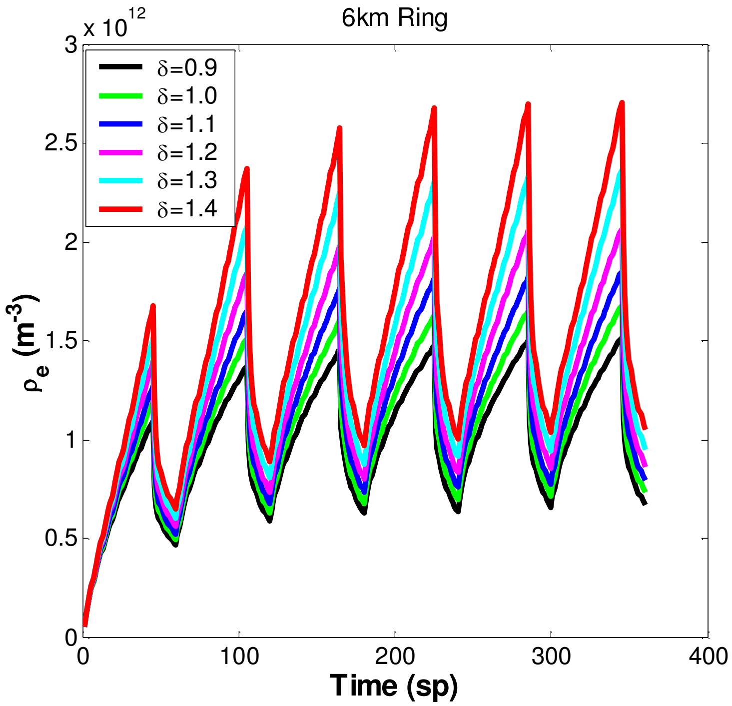
Average density build-up



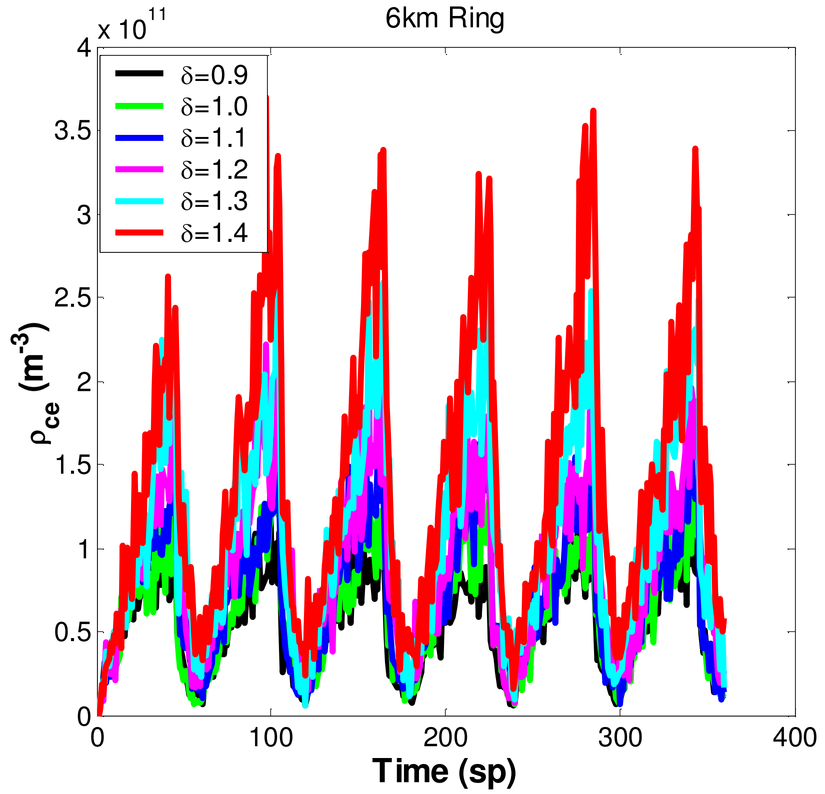
Central density build-up

SEY effect (6km Ring)

Sextupole: Photon Reflectivity =20%
Antechamber protection =0



Average density build-up

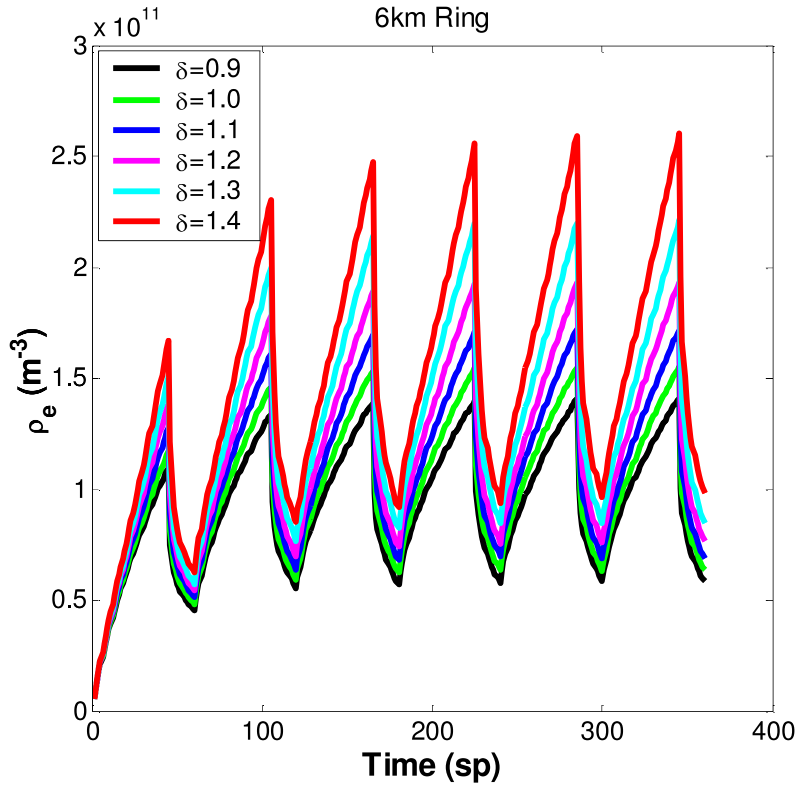


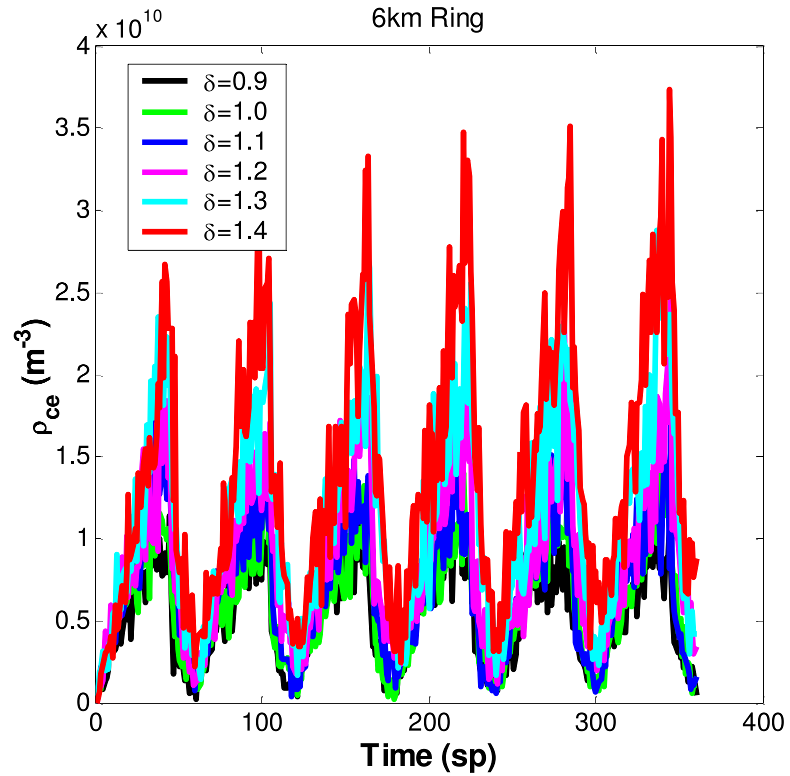
Central density build-up

SEY effect (6km Ring)

Sextupole: Photon Reflectivity =20%

Antechamber protection =90%





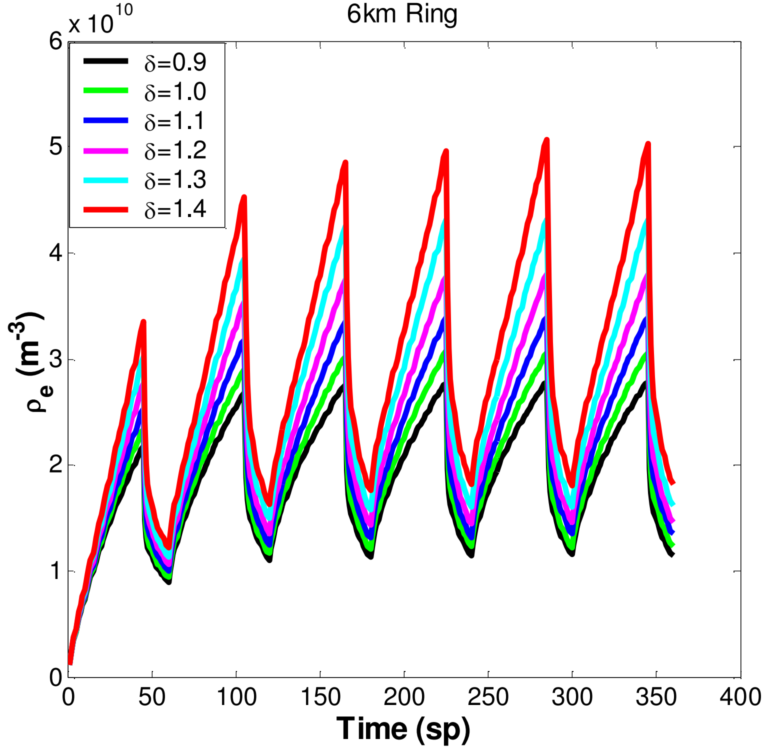
Average density build-up

Central density build-up

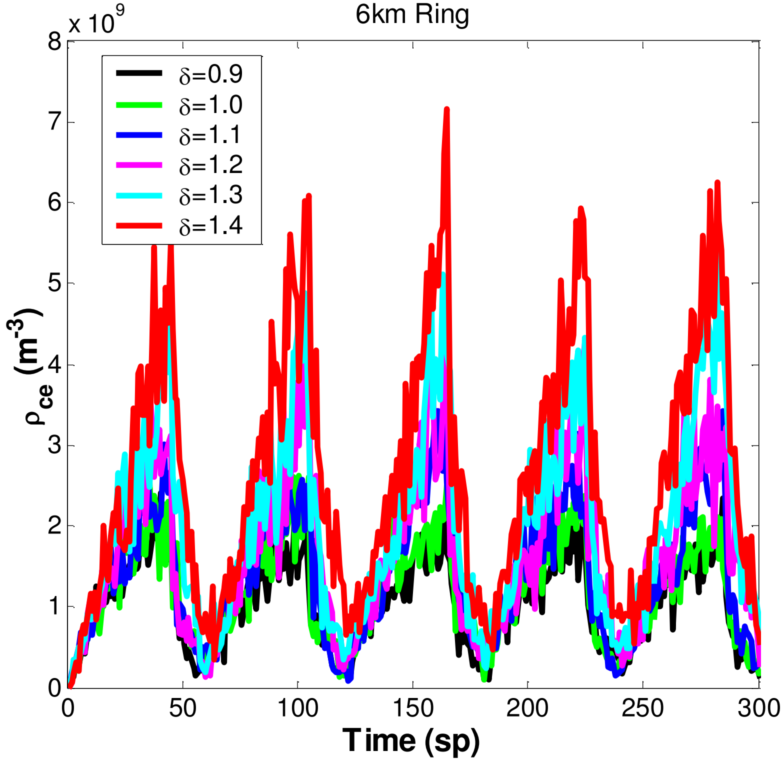
SEY effect (6km Ring)

Sextupole: Photon Reflectivity =20%

Antechamber protection =98%

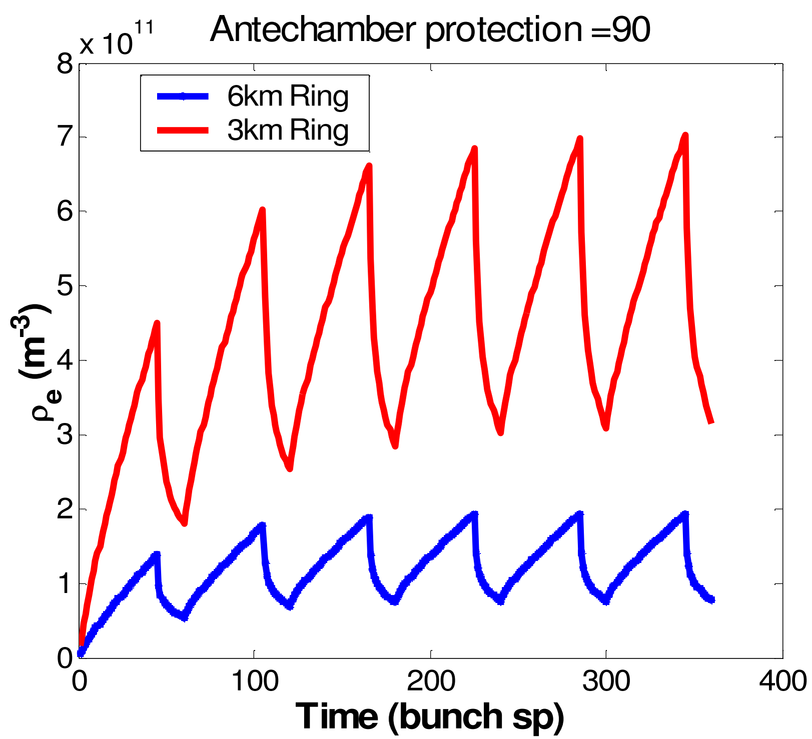


Average density build-up

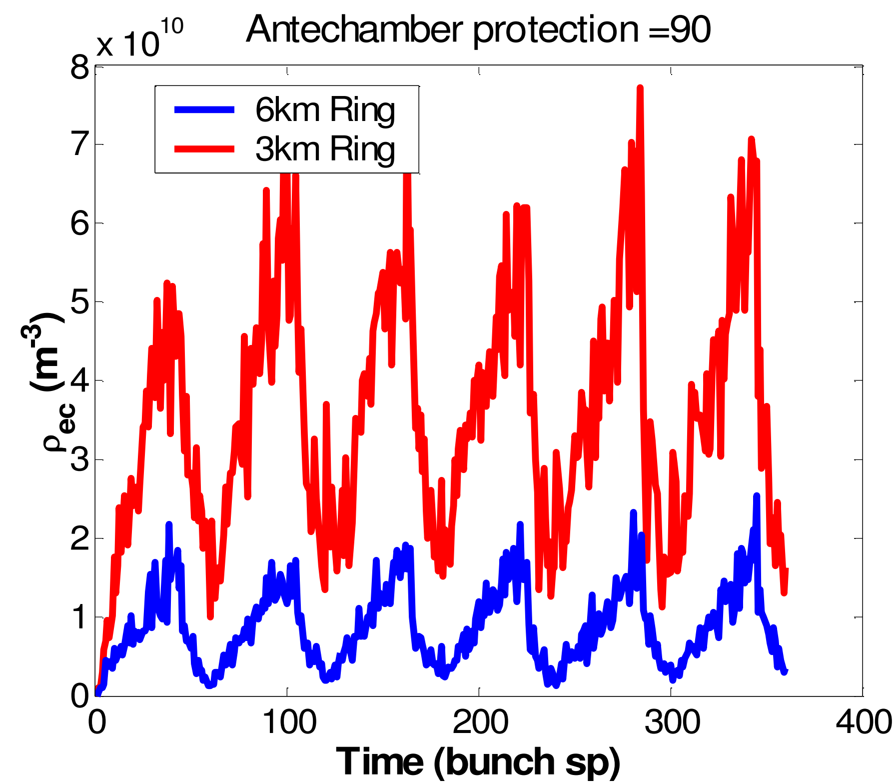


Central density build-up

Sextupole : Photon Reflectivity =20%
Antechamber protection =90



Average Ecloud density



Ecloud density near the beam

Summary

- Estimation of impedance of grooves and SEY to define ILC DR needs
  - Low integrated impedance for triangular grooves (in magnets). Larger impedance overall for rectangular grooves (in straights).
  - 2mm triangular grooves SEY << 1
  - 1mm triangular grooves work very good with r=50um
  - 10-15% SEY of grooves with magnetic field within ILC DR dipole/wiggler field variation
- Trapping in quadrupole and sextupole
  - Very long e- trapping in CesrTA >> 1 turn
  - Estimation in ICL DR qad & sext to compare with beam instability thresholds (see Pivi presentation next) for 6 km and 3 km rings: 3km lower cloud density.