Cornell University
Laboratory for Elementary-Particle Physics

Comparison of ECLOUD Calculations in Dipole and Quadrupole Fields (reprise)

Cloud buildup over a full CESR turn (2.5 μsec, 183 bunches)

-- 22 December 09: added buildup plots for two full turns for both 1x45 and 9x1 -- Slides 8-13

Jim Crittenden

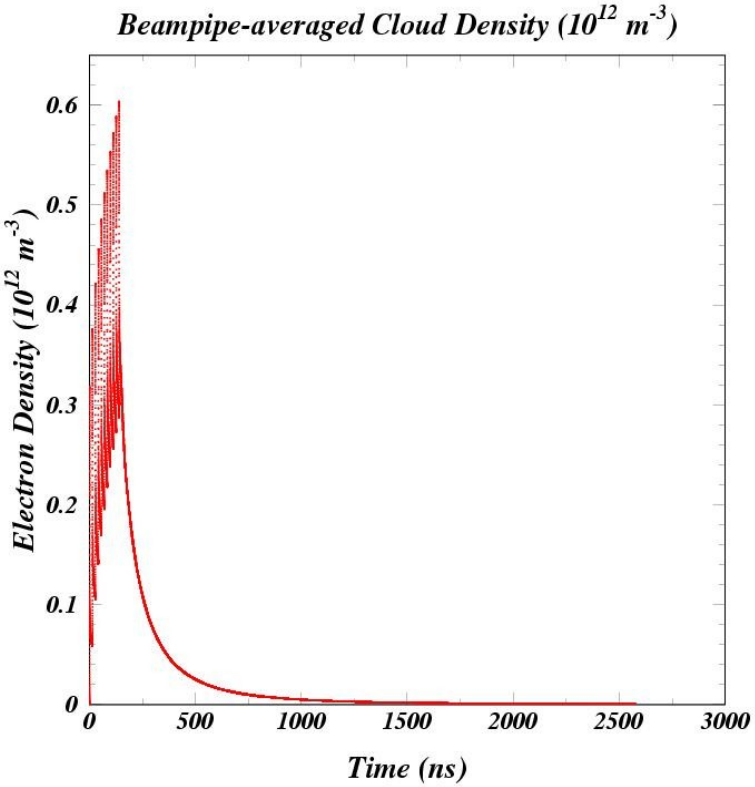
Cornell Laboratory for Accelerator-Based Sciences and Education

Electron Cloud Meeting

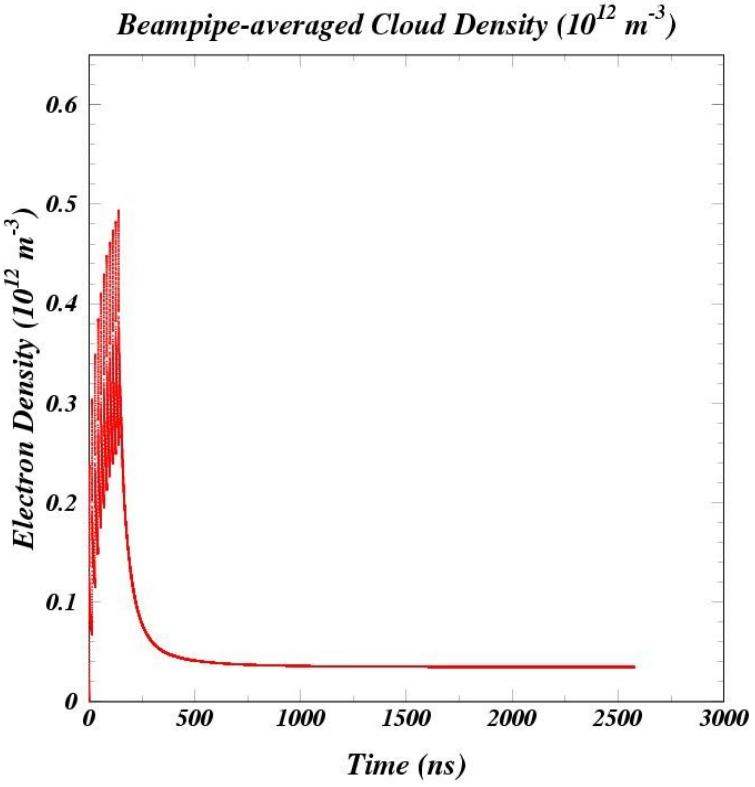
16 December 2009

Time development of cloud density averaged over the 4.5 x 2.5 cm elliptical vacuum chamber

Dipole (0.2 T)



Quadrupole (9.2 T/m)

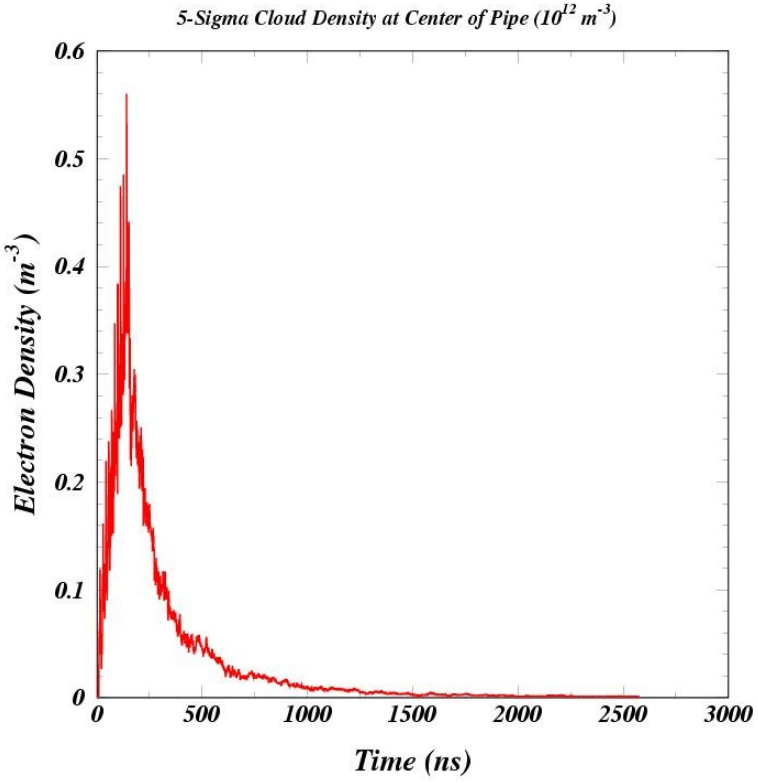


Conditions of June, 2008 tune shift measurements: 5.3 GeV 14-ns spacing 1.2e10 e+/bunch
11 filled bunches followed by 172 empty ones.
Assumed 1.1 photons/m/e (the ring-average for dipoles) and 15% reflectivity.
The SEY model parameters are the PAC2009 values, whereby ECLOUD now includes the rediffused eomponent.

The beam-pipe-averaged density indeed shows the cloud to be trapped in quadrupoles.

Cloud density averaged over a region extending over 5-sigma of the beam size

Dipole (0.2 T)



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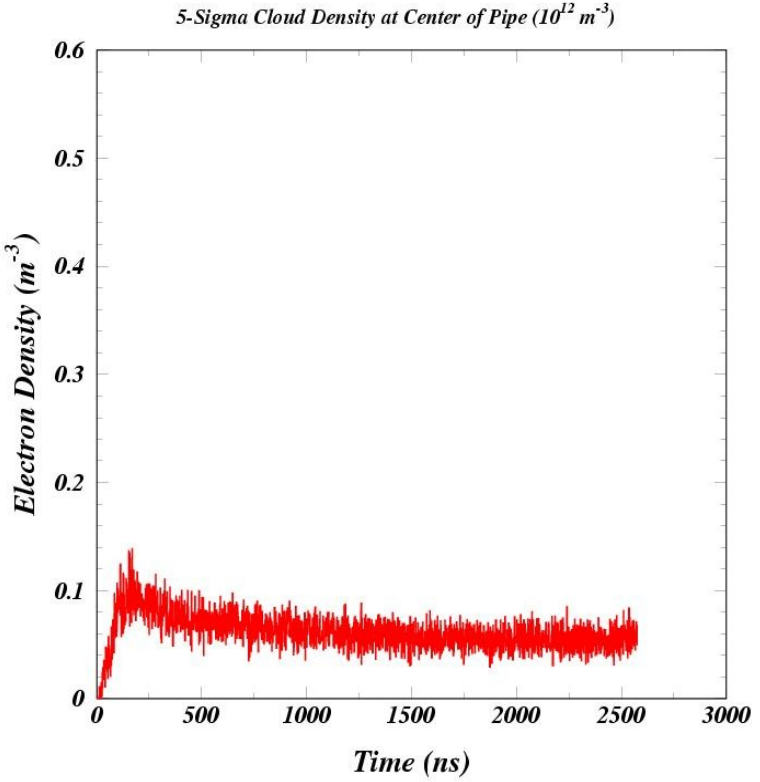
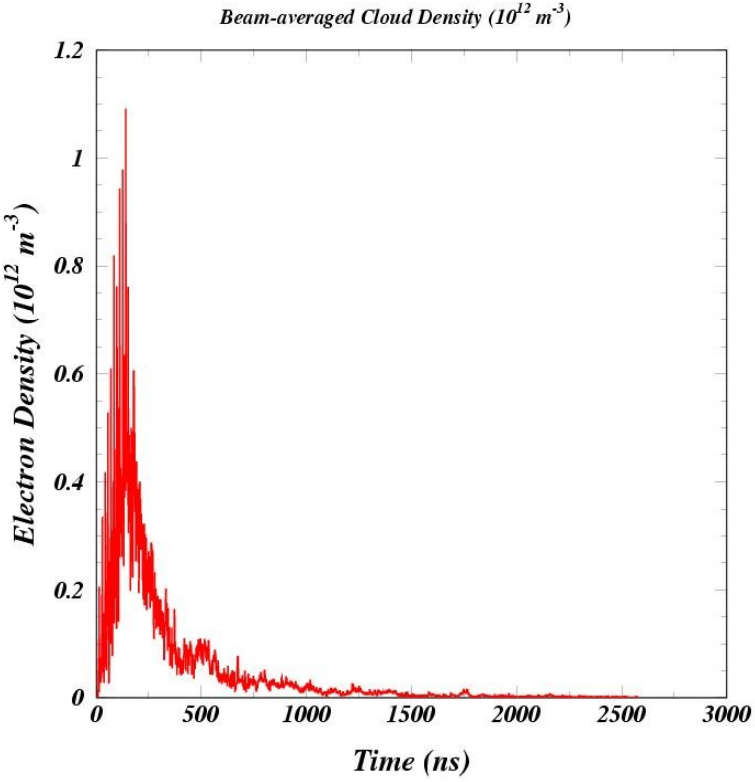


Some of the trapped cloud remains in the beam region.

Cloud density averaged over the transverse bunch charge distribution

Dipole (0.2 T)



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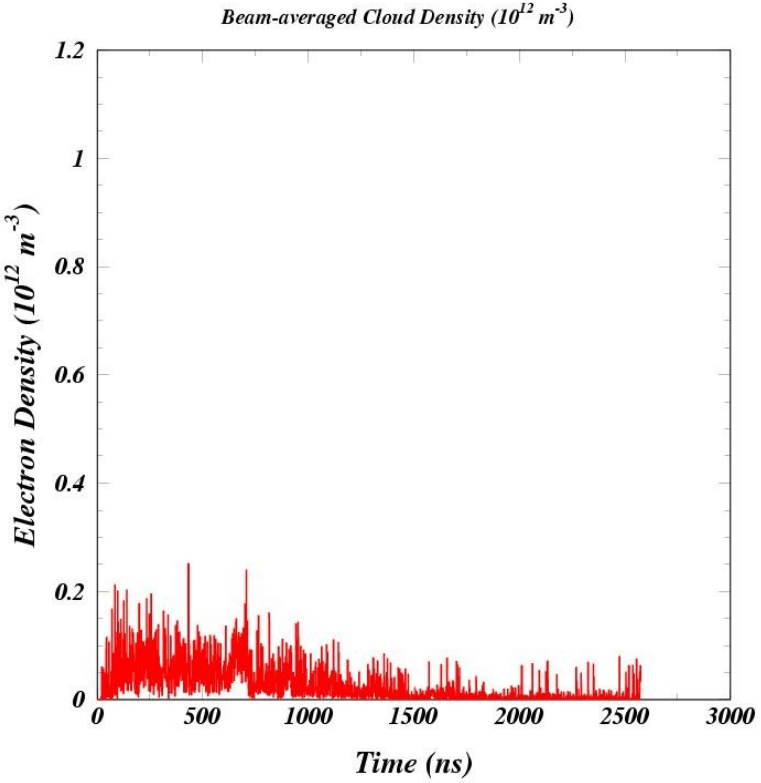
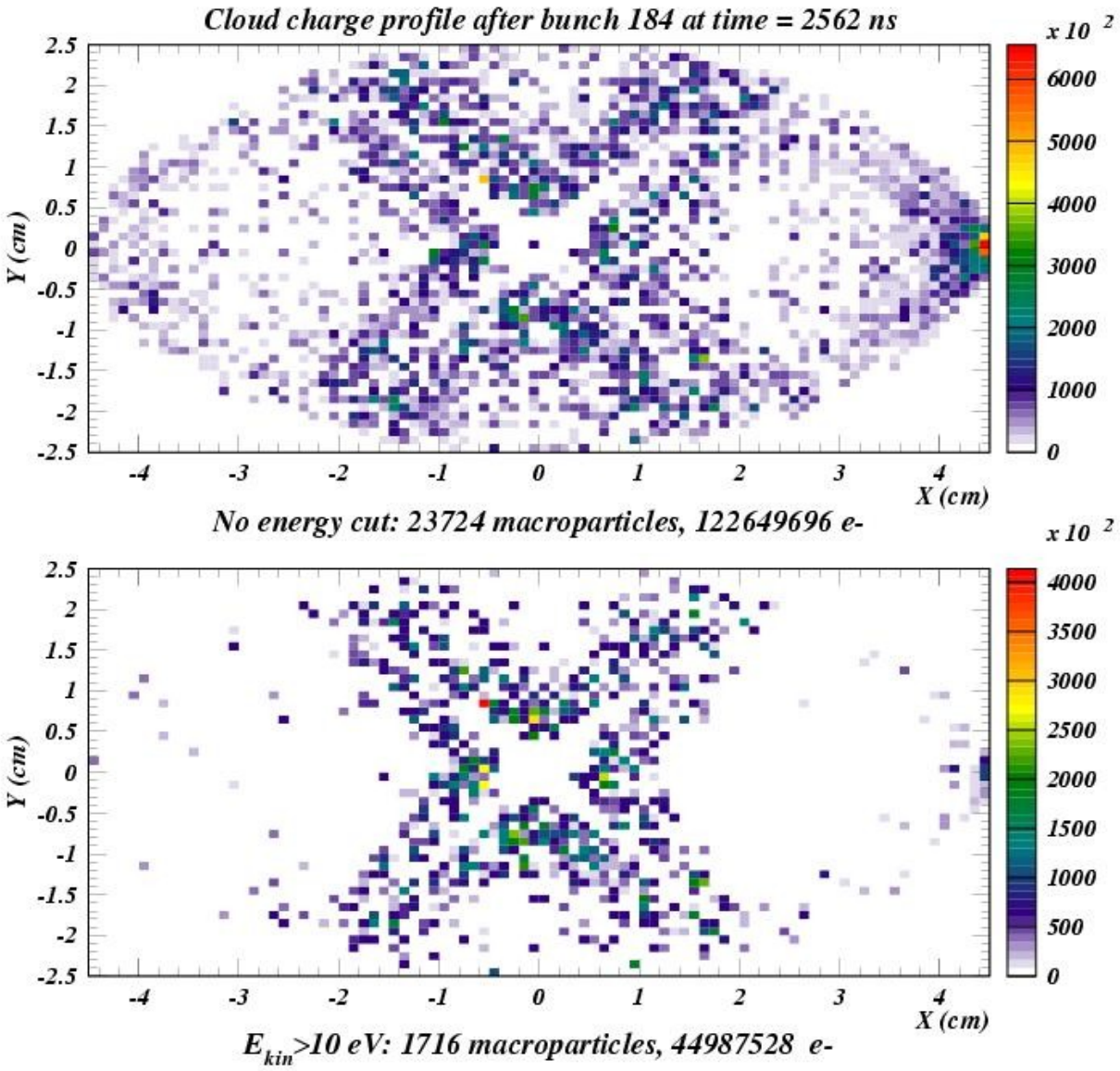
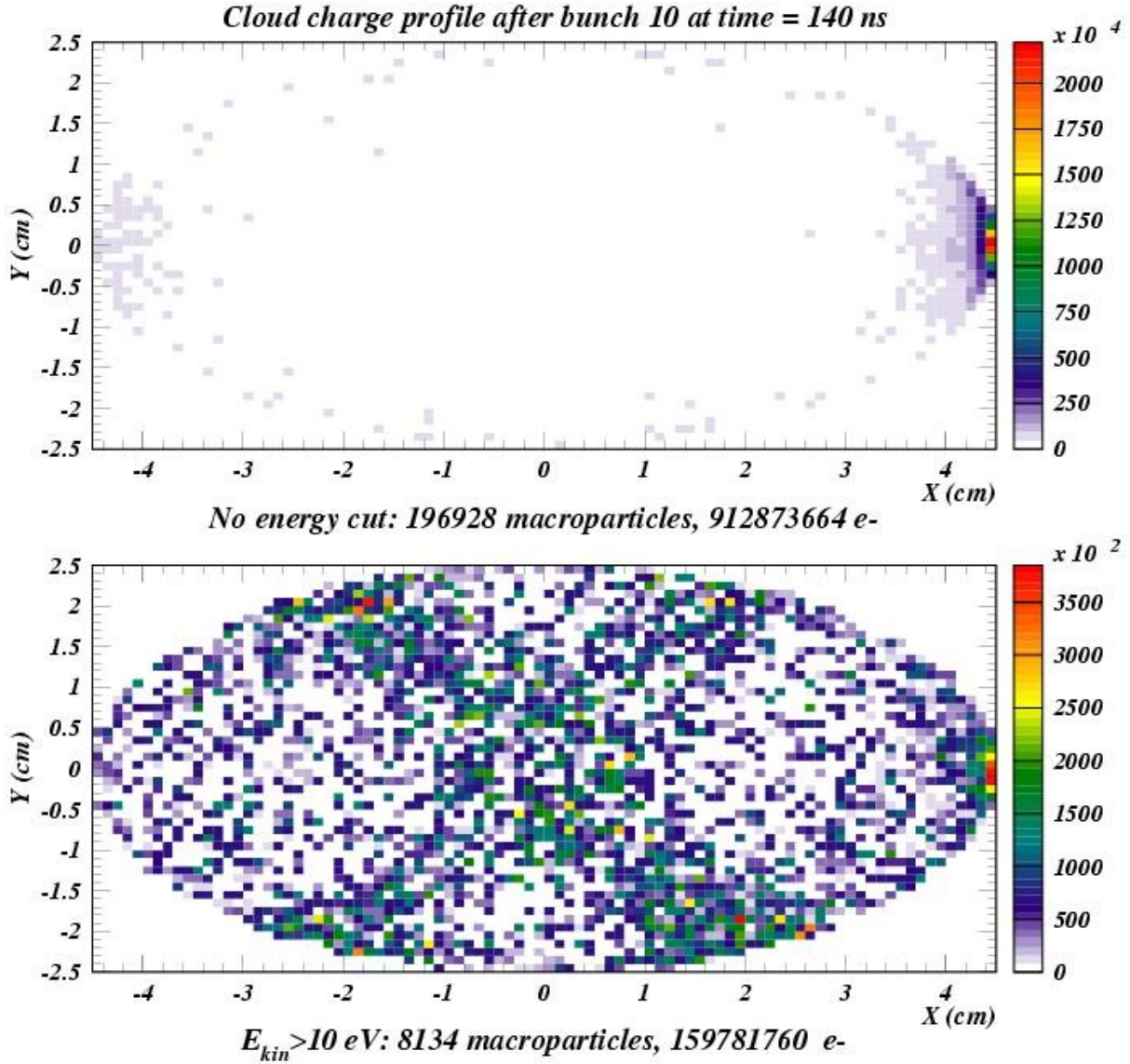


Some of the trapped cloud will contribute to tune shifts.

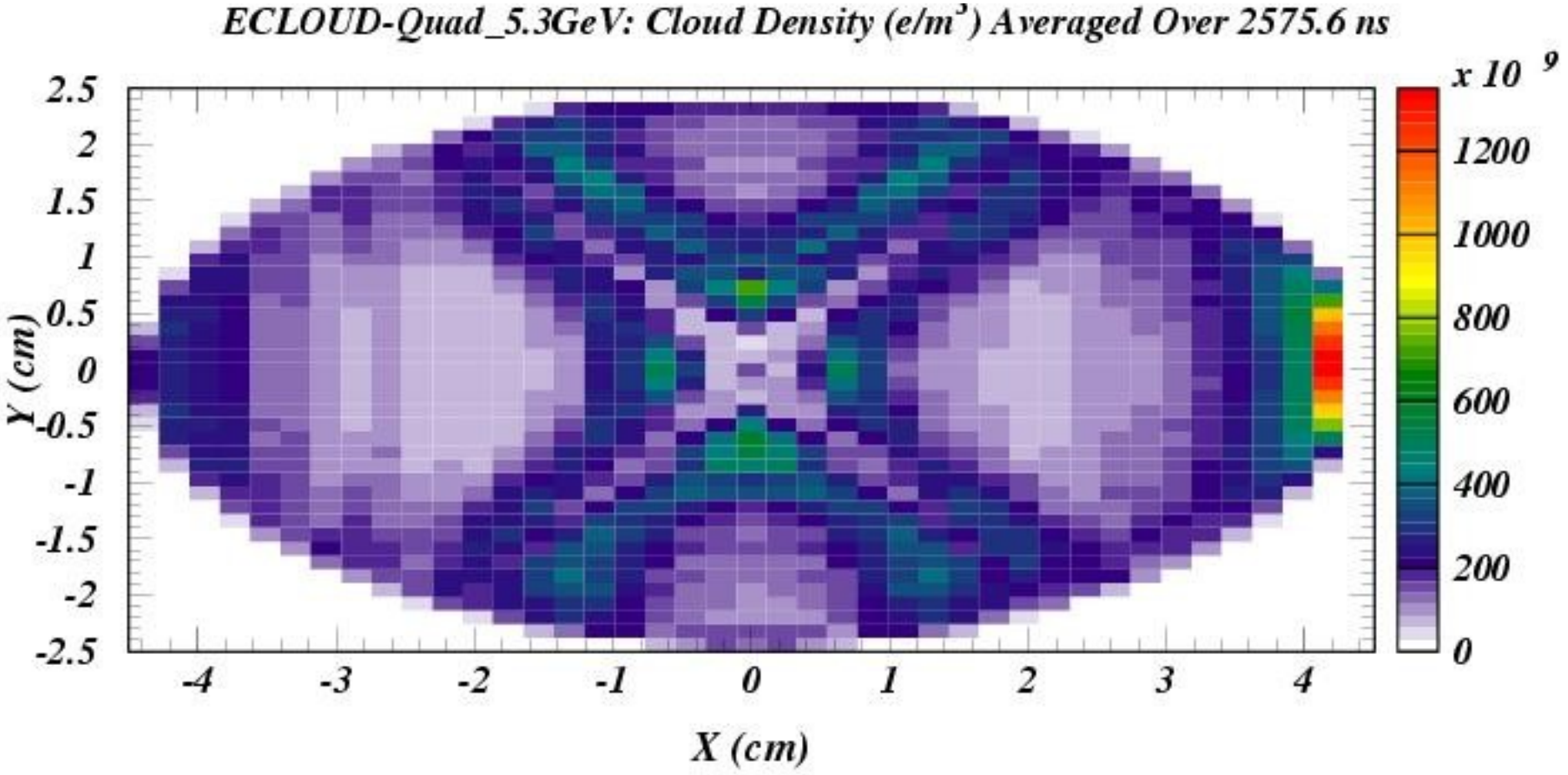
Asymptotic Cloud Profile in the Quadrupole



Cloud snapshot immediately prior to passage of bunch 11

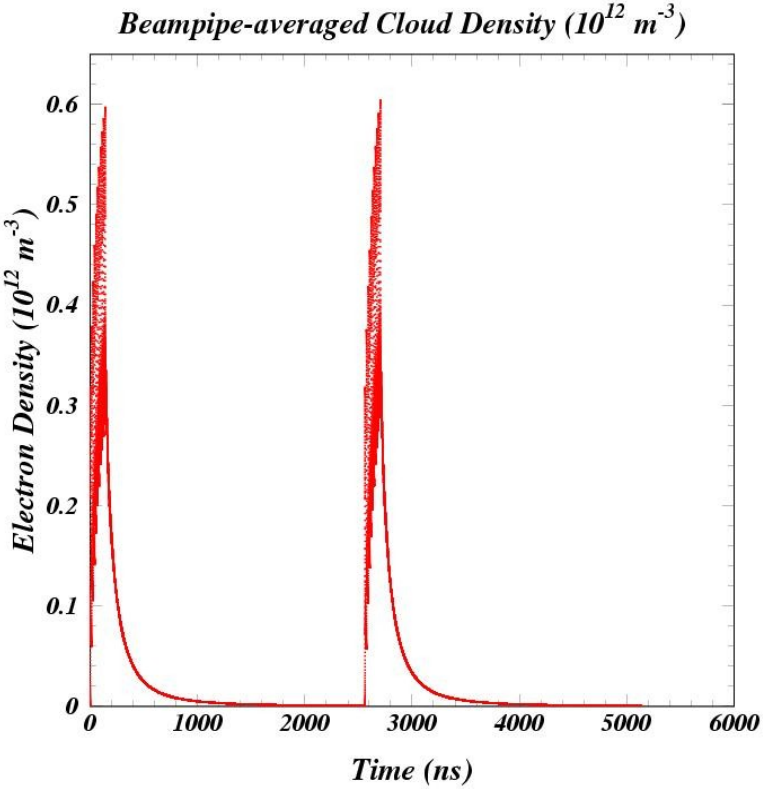


Cloud Density Profile in the Quadrupole Averaged over One Turn (e/m^{-3})

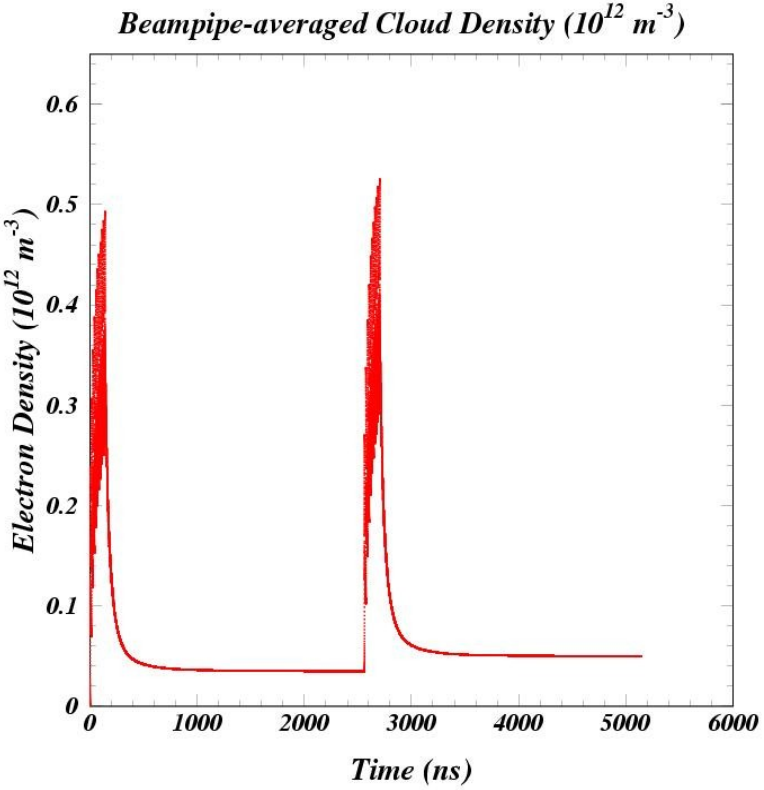


Time development of cloud density averaged over the 4.5 x 2.5 cm elliptical vacuum chamber

Dipole (0.2 T)



Quadrupole (9.2 T/m)



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Two turns, each comprising 11 filled bunches followed by 172 empty ones.
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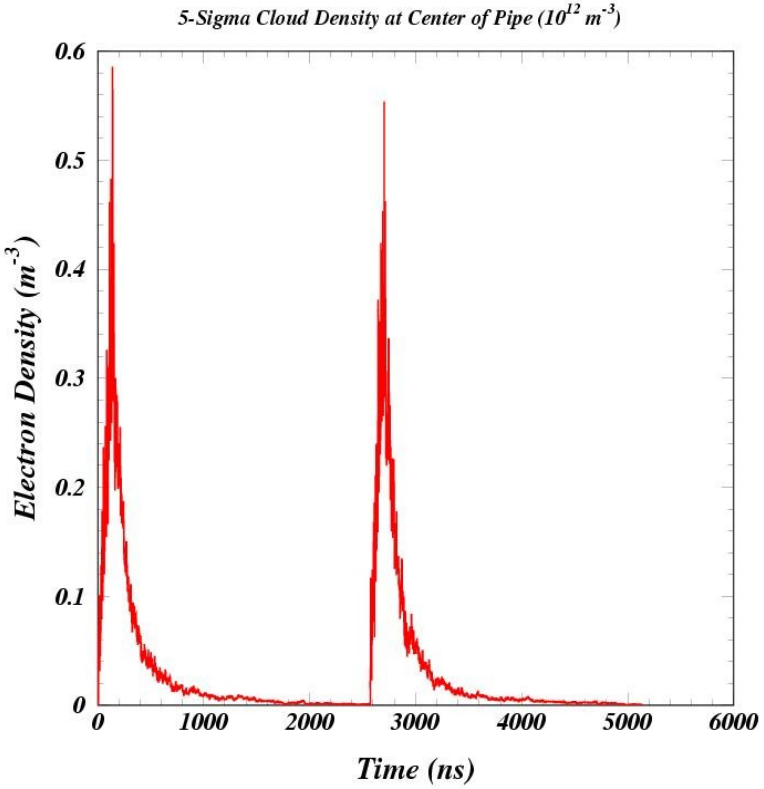
The beam-pipe-averaged density indeed shows cloud trapped in quadrupoles carrying over to the second turn.

Cloud density averaged over a region extending over 5-sigma of the beam size

Dipole (0.2 T)



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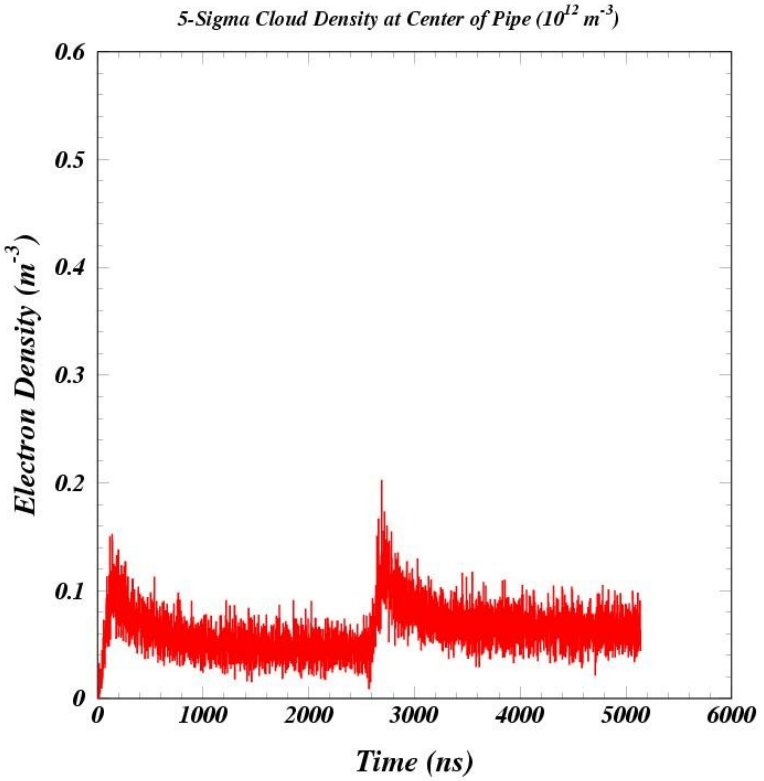
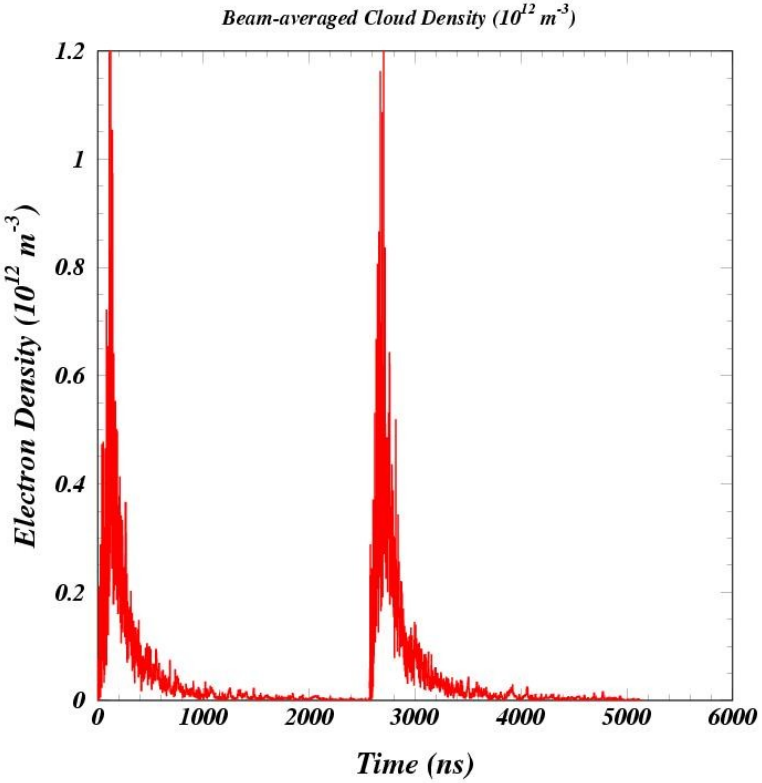


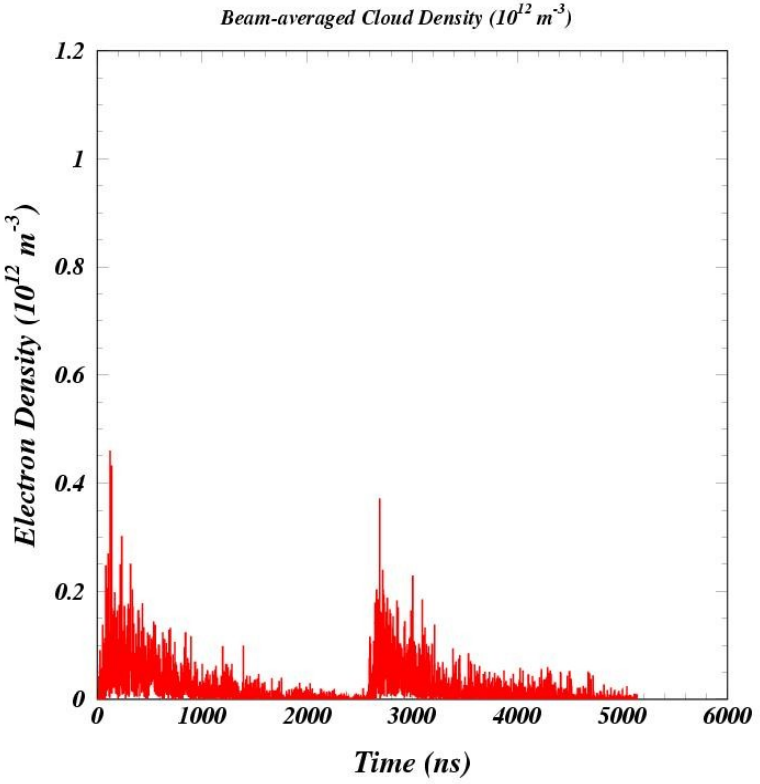
Some of the cloud trapped in the beam region carries over to the second turn.

Cloud density averaged over the transverse bunch charge distribution

Dipole (0.2 T)



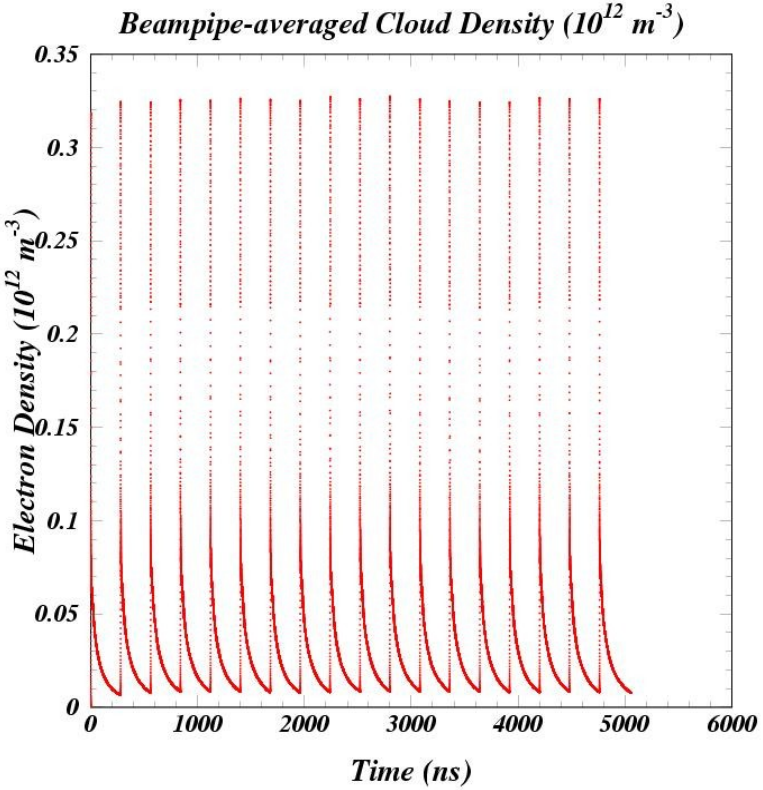
Quadrupole (9.2 T/m)



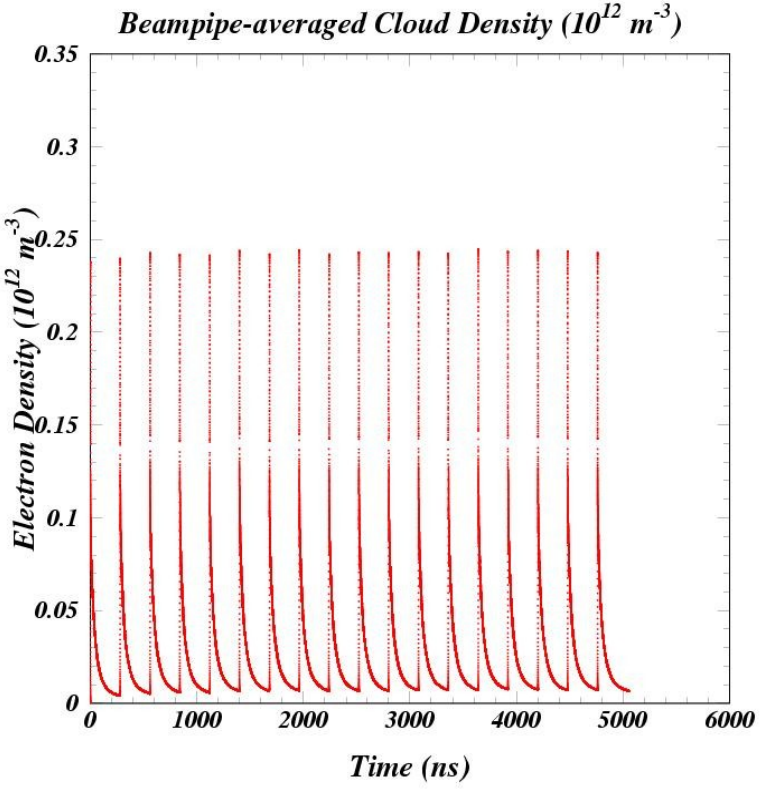
The beam-averaged cloud density does not carry over to a second turn (within statistical fluctuations).

Time development of cloud density averaged over the 4.5 x 2.5 cm elliptical vacuum chamber

Dipole (0.2 T)



Quadrupole (9.2 T/m)



5.3 GeV 14-ns spacing 1.2e10 e+/bunch
Two turns, each comprising 9 sets of 1 filled bunch followed by 19 empty ones (uniformly filled ring).
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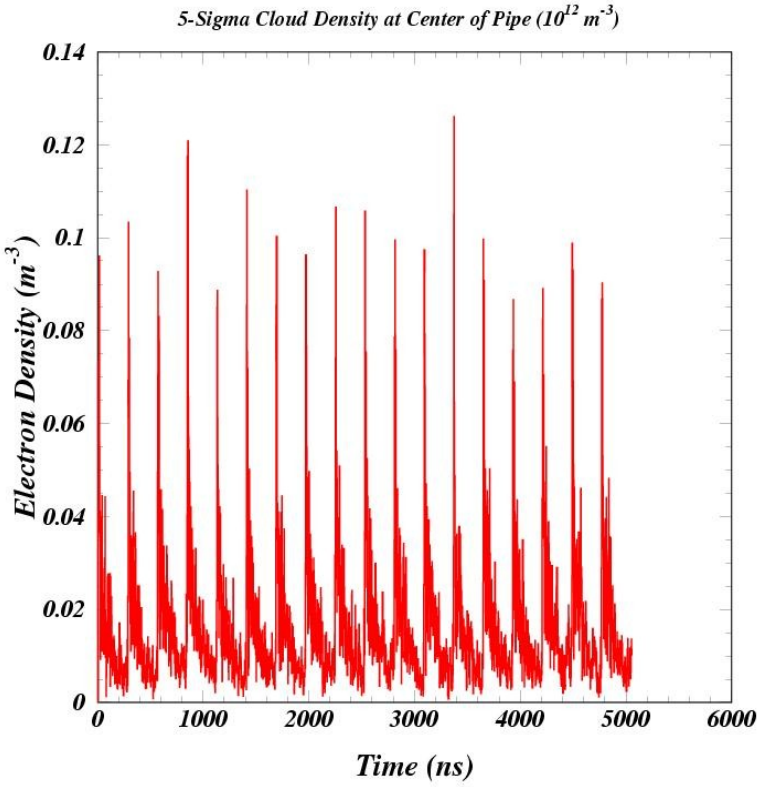

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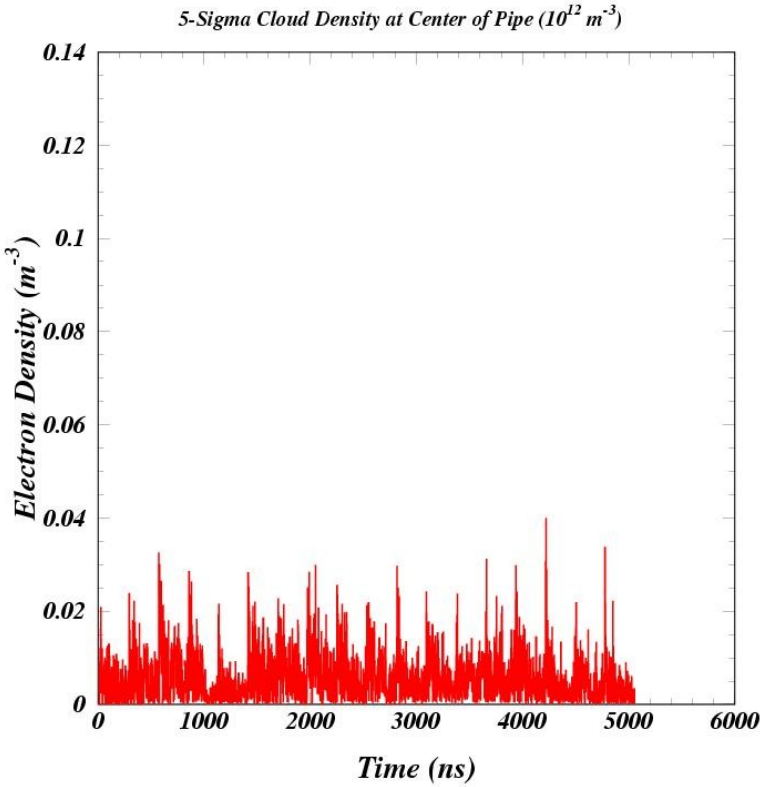
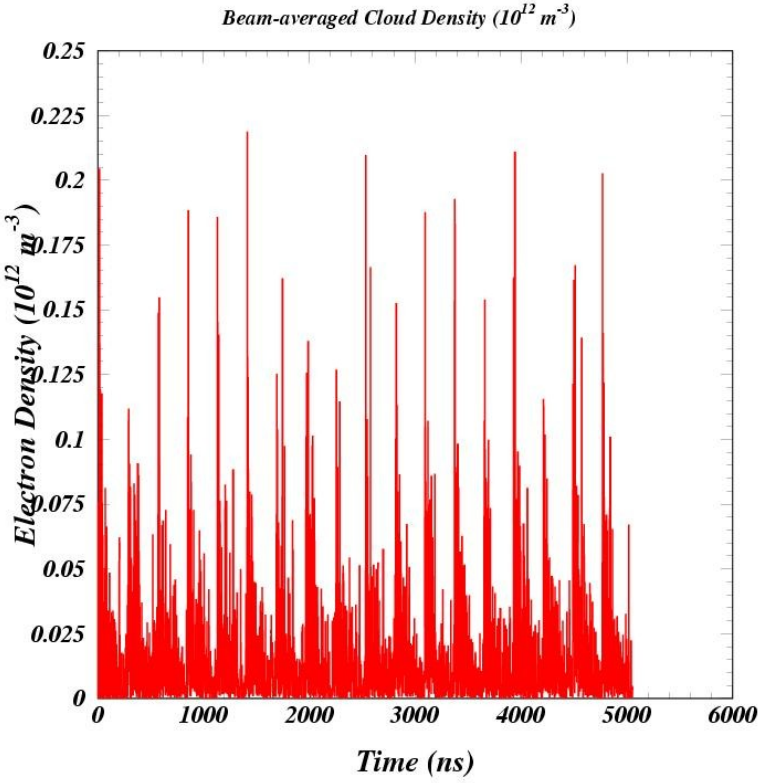


No evidence of cloud trapping in the beam region.

Cloud density averaged over the transverse bunch charge distribution

Dipole (0.2 T)



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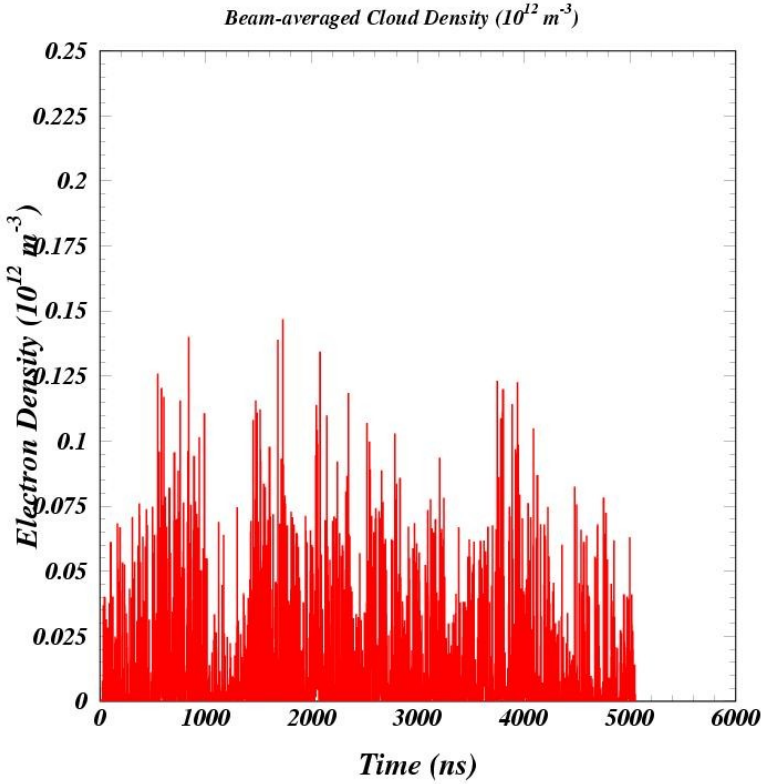

The beam-averaged cloud does not show trapping.