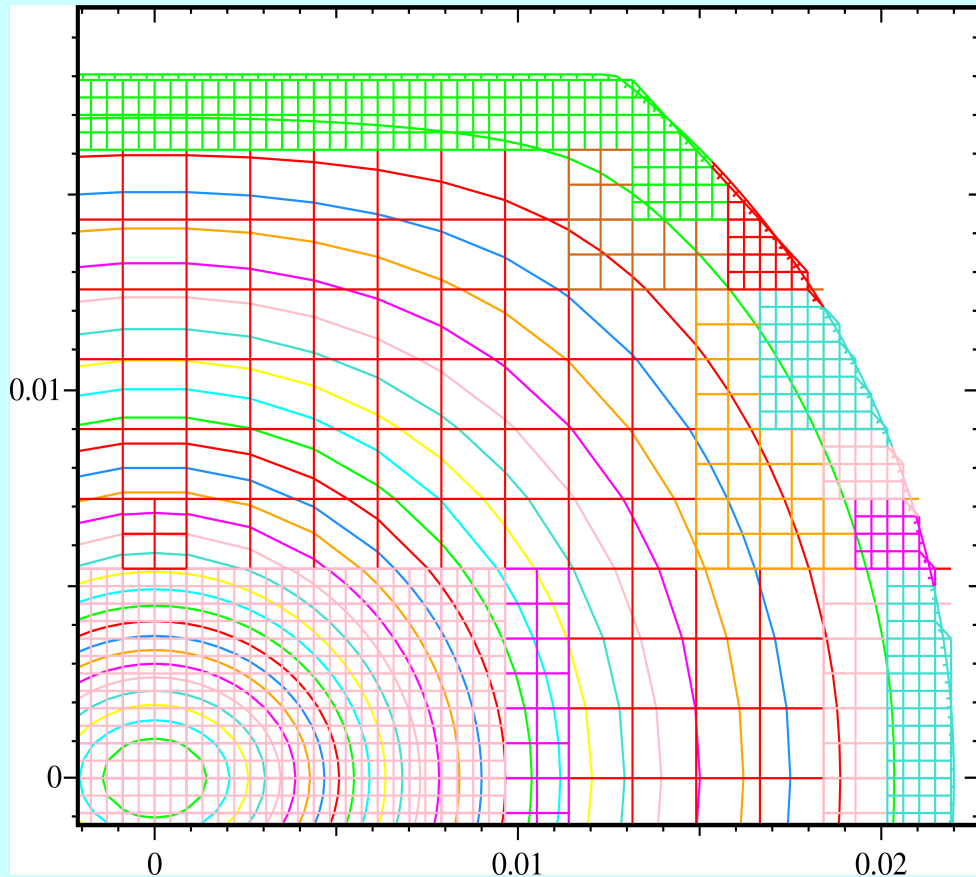


Faktor2: Electrostatic PIC in 2D/3D



For each timestep:

Charge deposition on the grid.

Solution of Poissons equation to obtain electrostatic force.

Integrating Newtons law to obtain new particle positions.

The mesh is recursively refined.

The spacing decreases by a factor of 2 per refinement level.

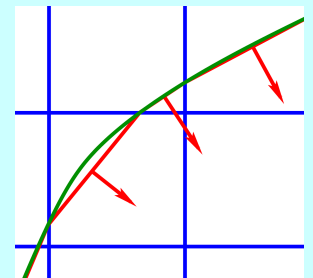
Electrons and Ions of arbitrary mass are tracked.

The exciting beam may have any cross section.

Arbitrary 3D magnetostatic fields may be applied.

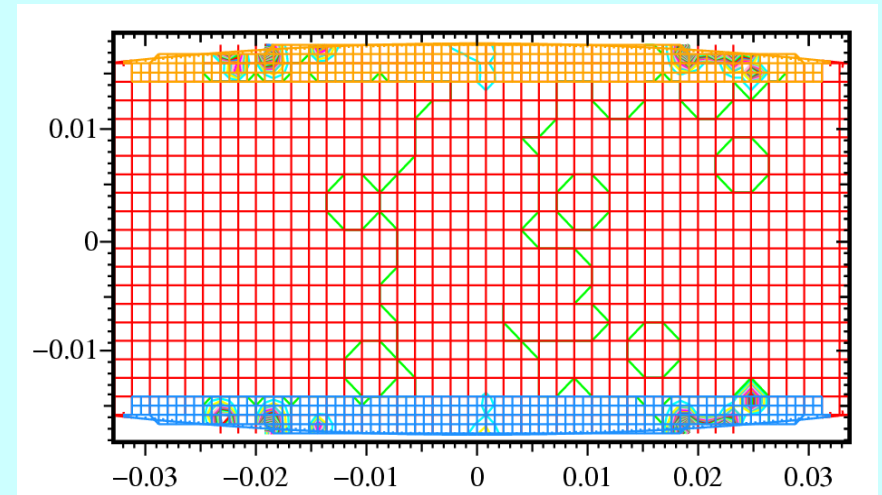
Secondary Emission Yield depends on the impact angle.

Collision of particles with the boundary is detected by computing the distance to the nearest boundary segment.

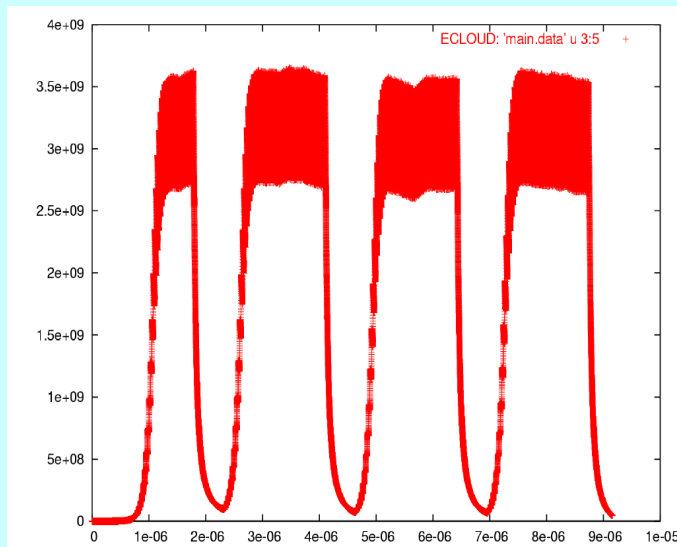


Electron cloud buildup

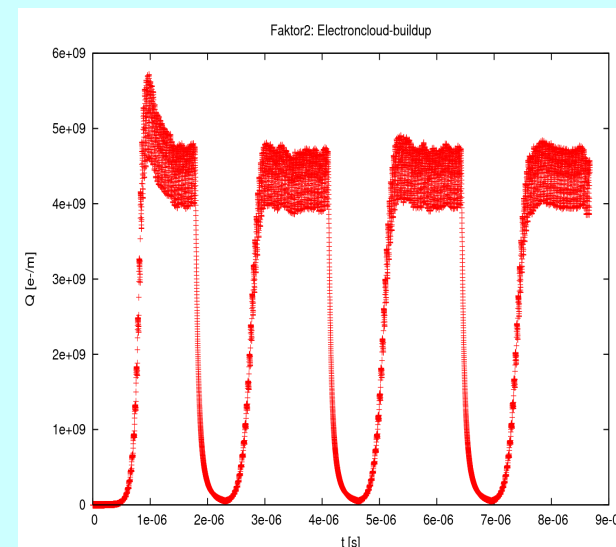
- 2D Results comparable with EPCLOUD



Snapshot of charge density



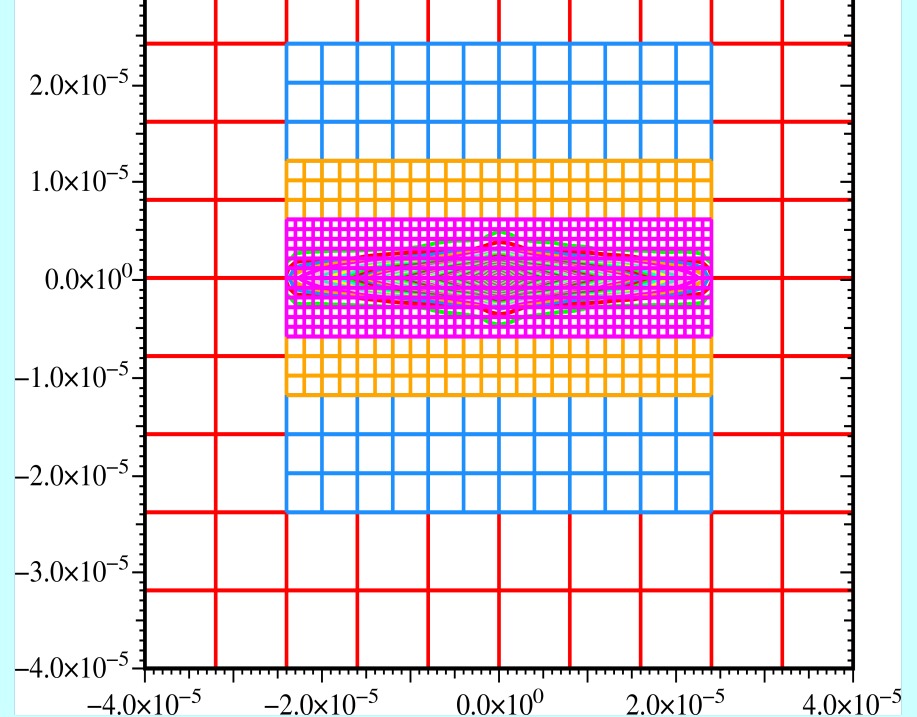
e-/m, computed by EPCLOUD



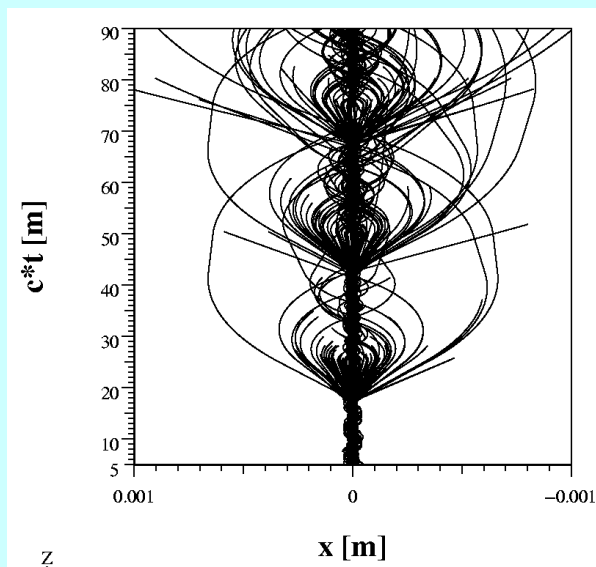
e-/m, computed by Faktor2

Ion-Trapping

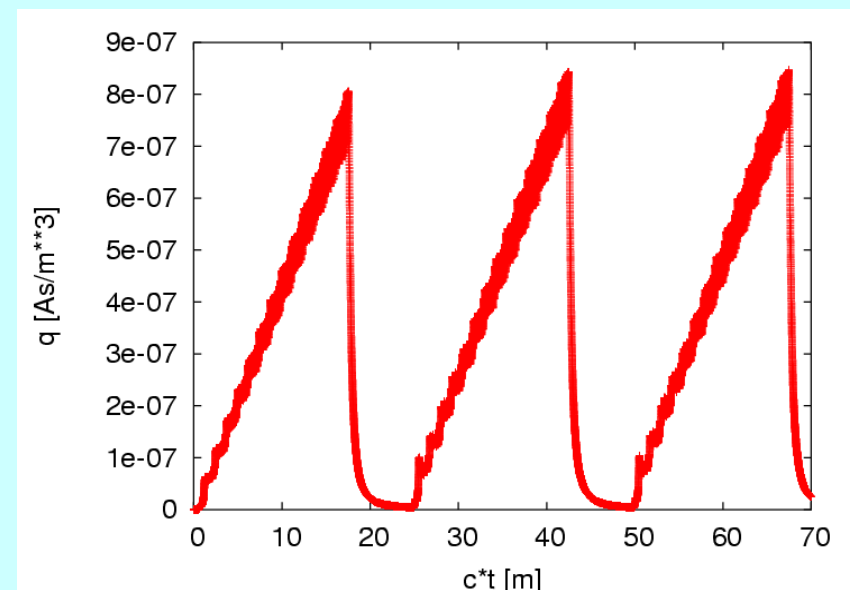
- Recursively refined mesh allows resolution of tiny beam extensions.
- Ion-Trapping can be simulated.



Snapshot of charge density of CO-Ions



CO-Trajectories

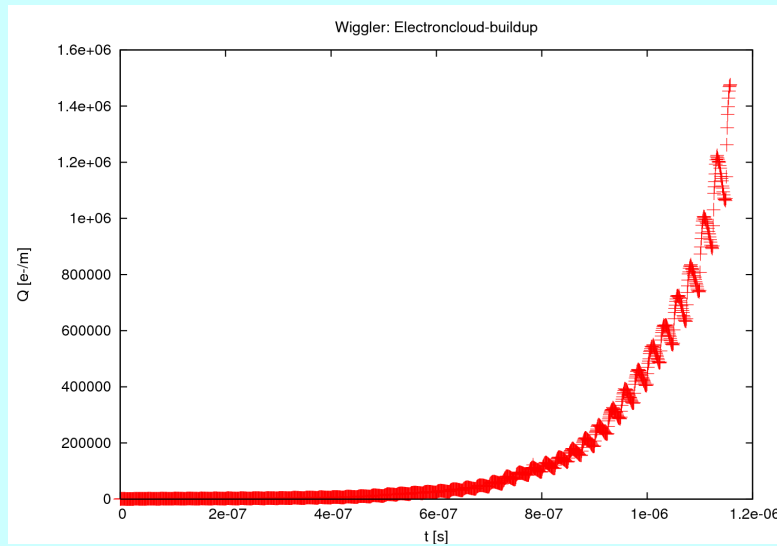


Density of CO-Ions on the axis

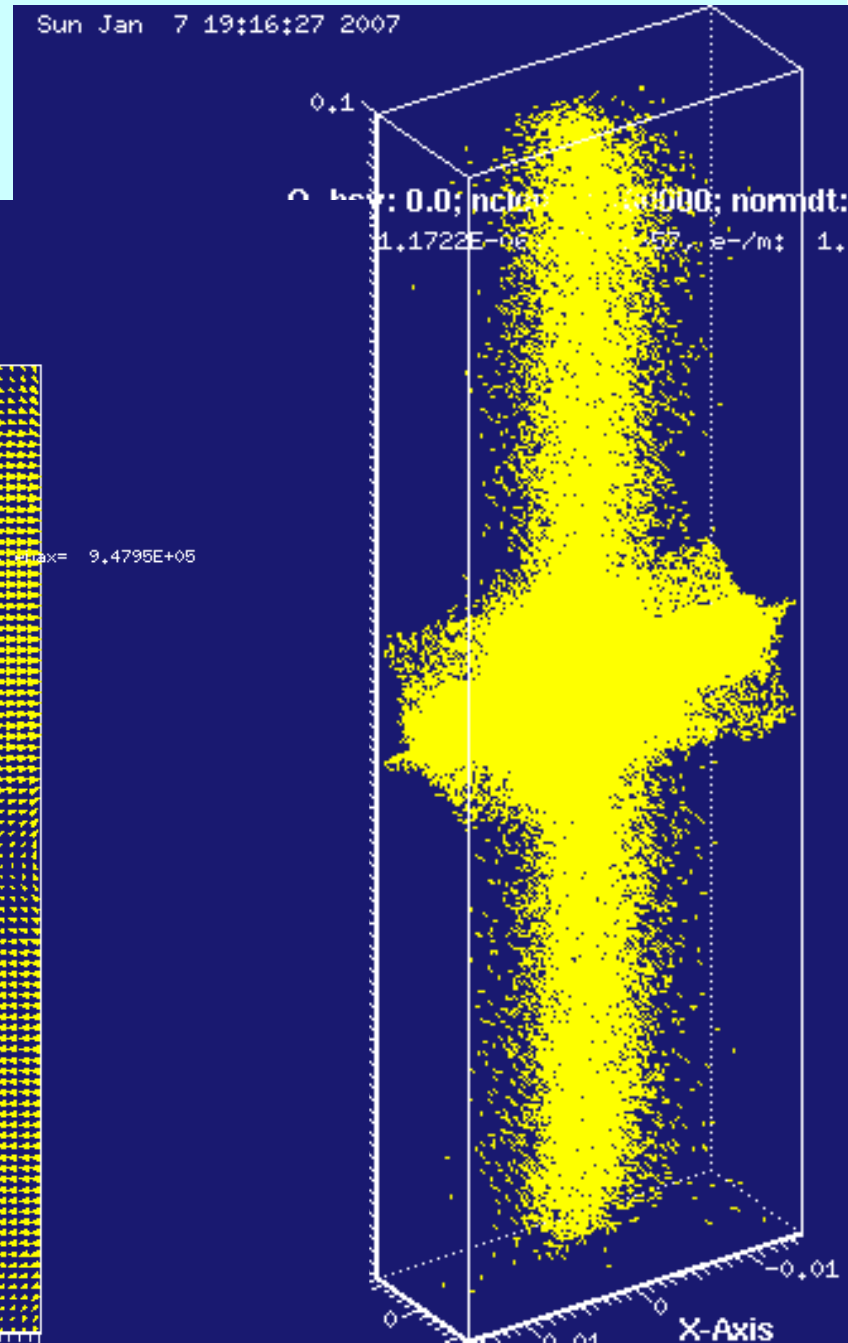
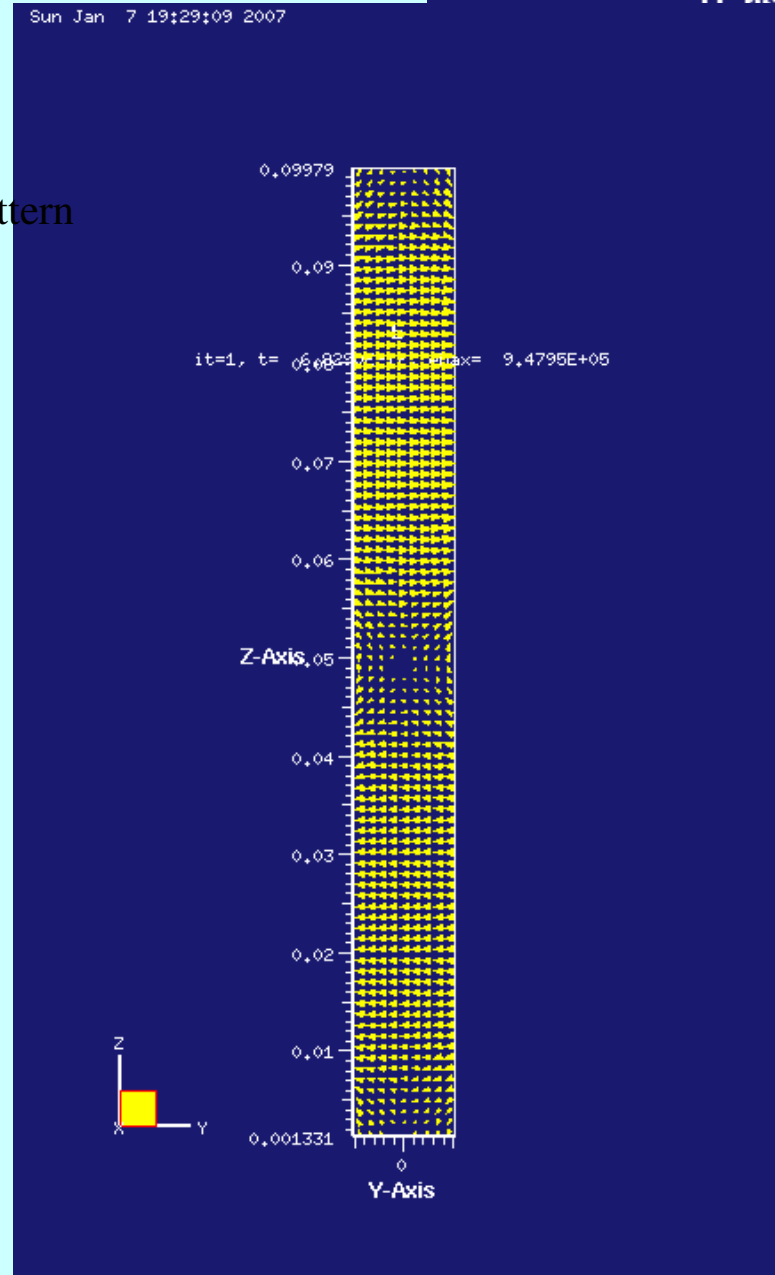
Electron cloud in wiggler

- 3D magnetostatic field

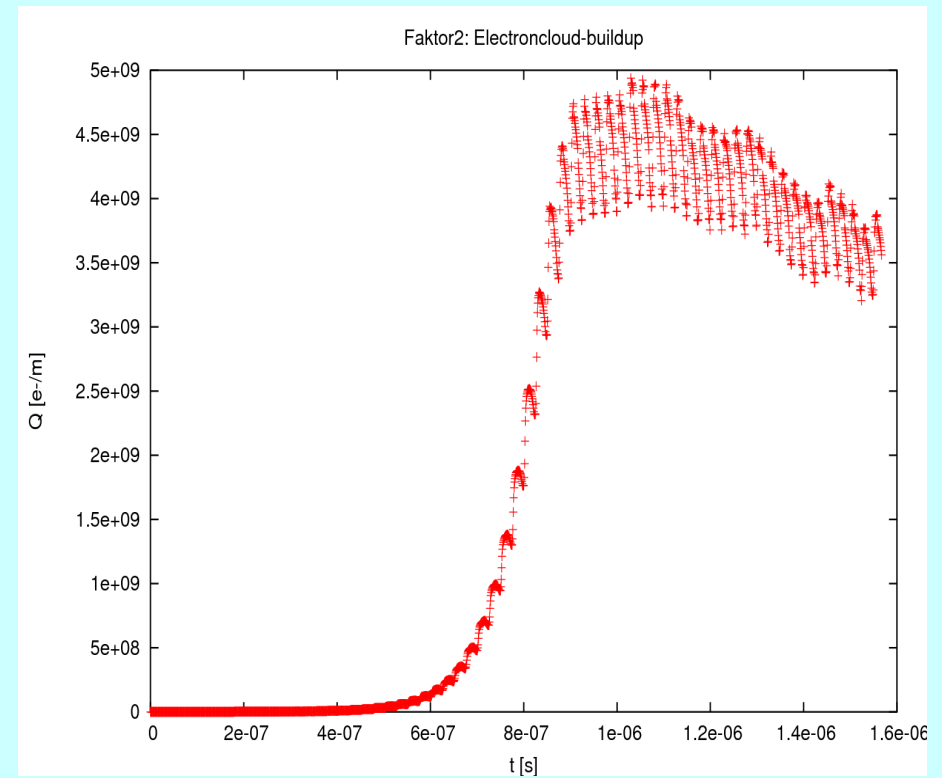
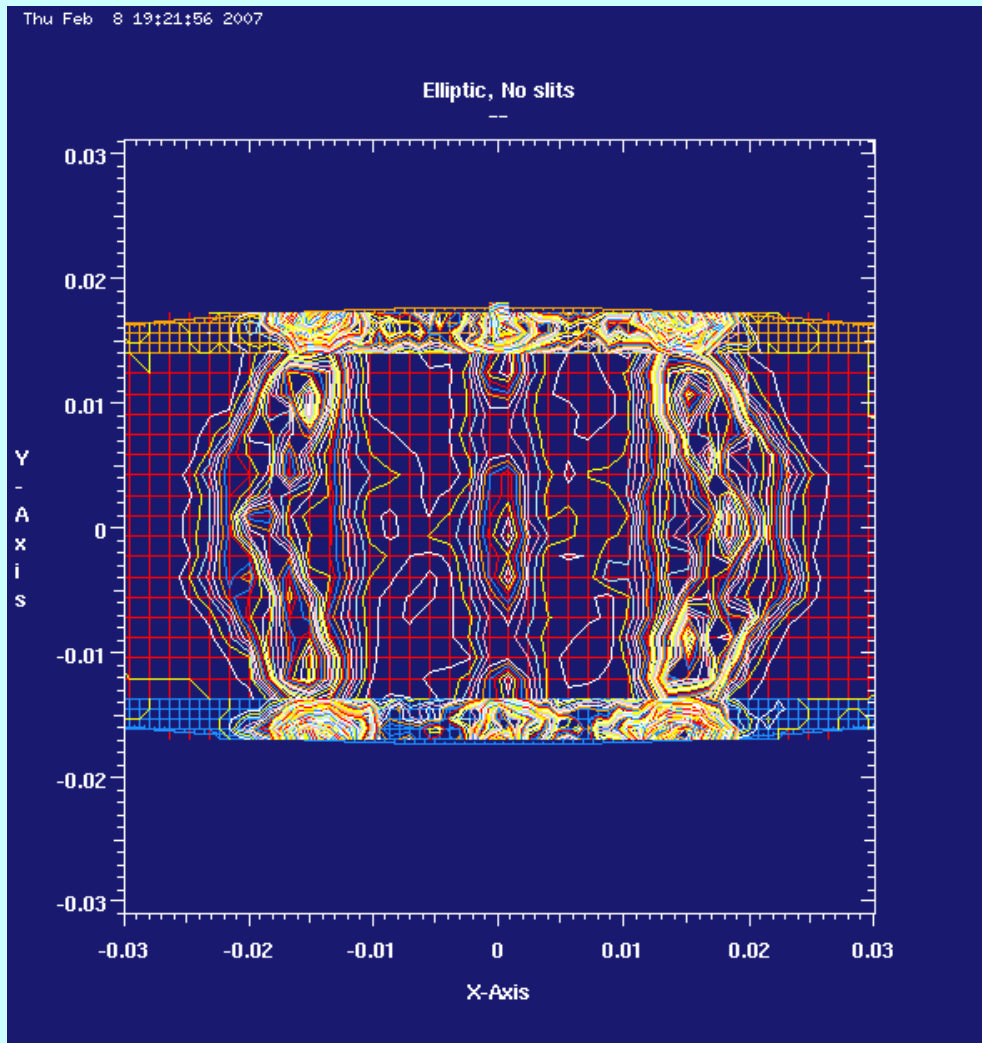
3D magnetostatic field produces 3D charge pattern and 3D trajectories.



Electron cloud buildup in wiggler.
This time range needed 30 cpu hours,
then the computation stopped because
of insufficient disk space :-)

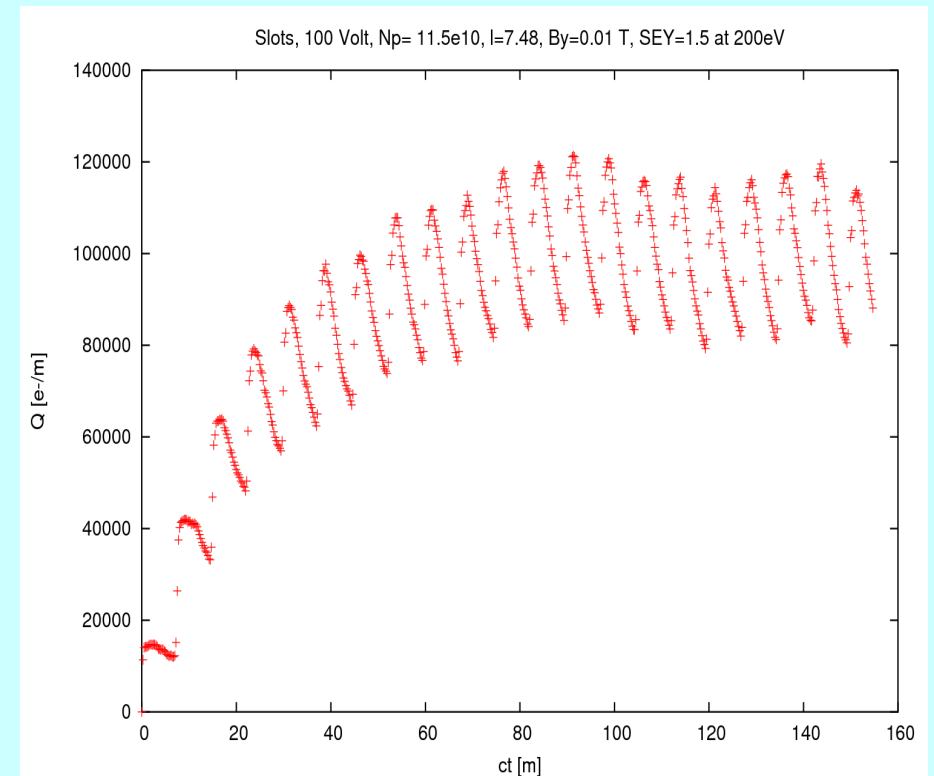
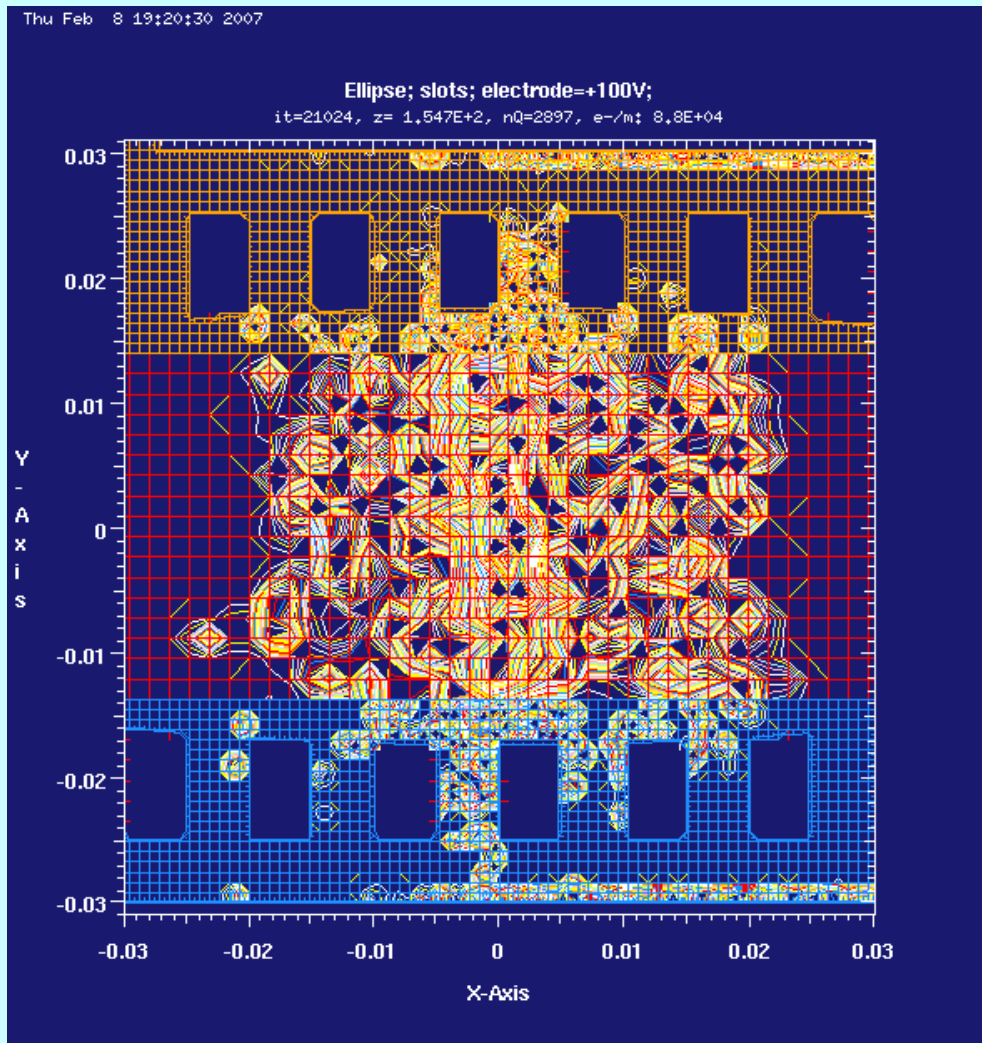


Slits for catching Electrons (1)



The charges move mainly in y-direction, following the magnetic field lines.
The positions of maximal charge density are such that the electrons hit the opposite wall with an energy where a maximum of the secondary emission yield is.
The position of the maximum varies with the charge of the beam.

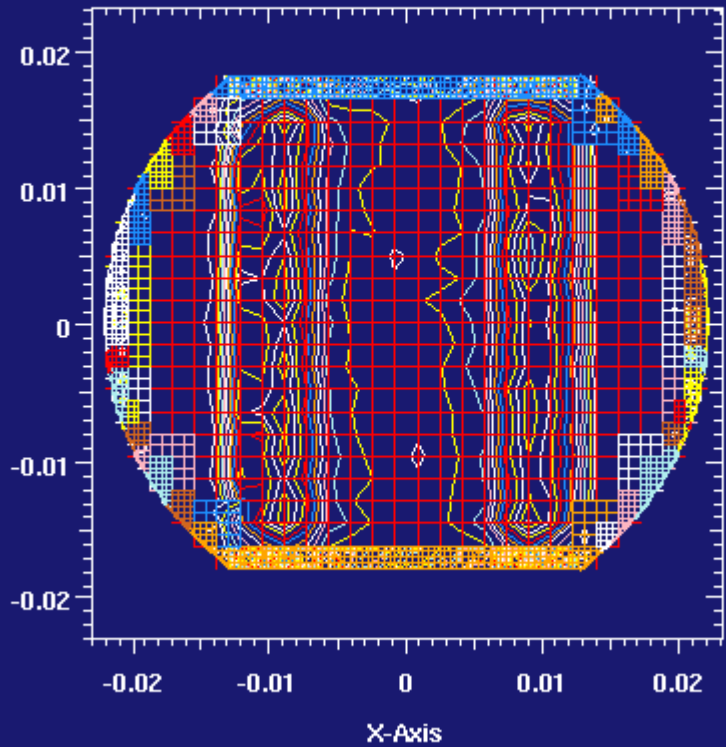
Slits for catching Electrons (2)



When the beampipe is slitted such that electrons which start on a wall end up in slits on the other side of the beampipe, they will not be accelerated out of that slit. The slits have to be wider than the gyro-radius. Clearing electrodes behind the slits may suck the electrons further away from the beampipe.

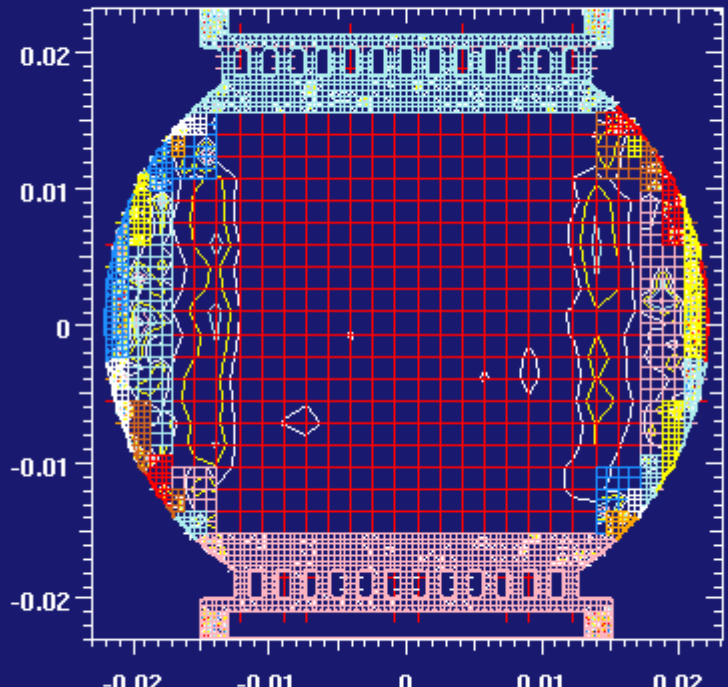
np: 1.05e11; Arc; bsy: 0.2

it=24605, z= 2,229E+2, nQ=50222, e-/m: 3,0E+09

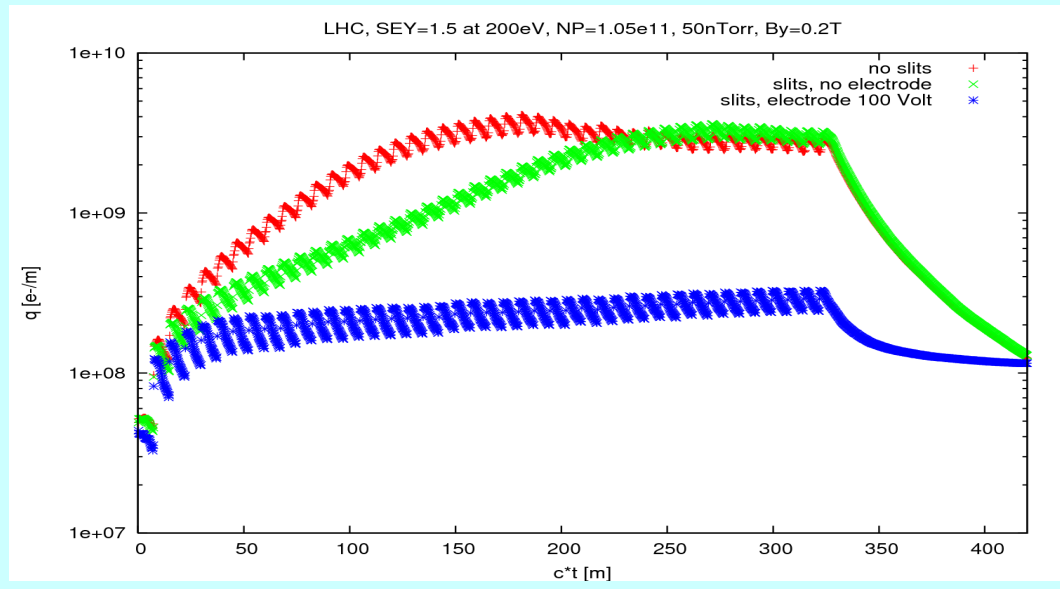


np: 1.05e11; Arc; bsy: 0.2

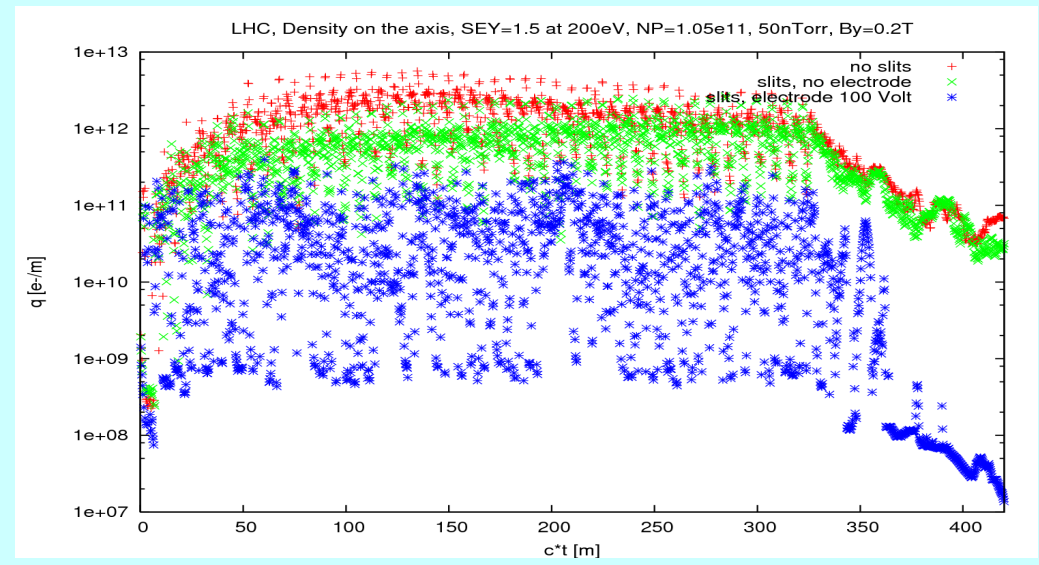
it=24764, z= 2,229E+2, nQ=10703, e-/m: 2,2E+08



Slits for catching Electrons (3), LHC, PEY=0.001



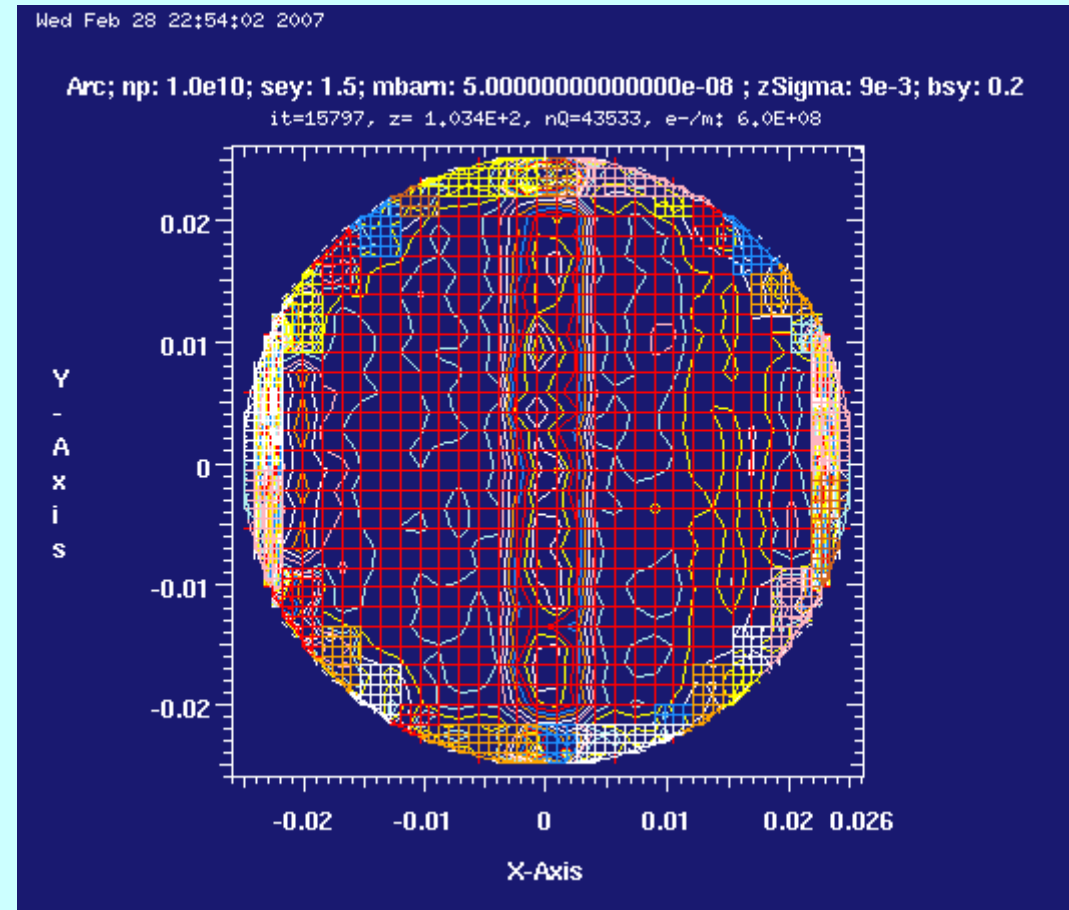
Electrons per metre



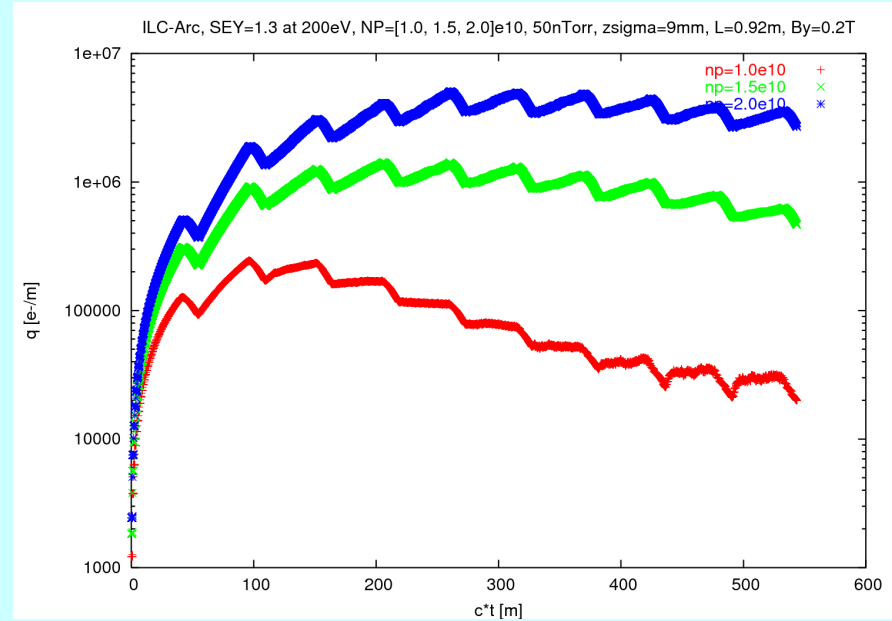
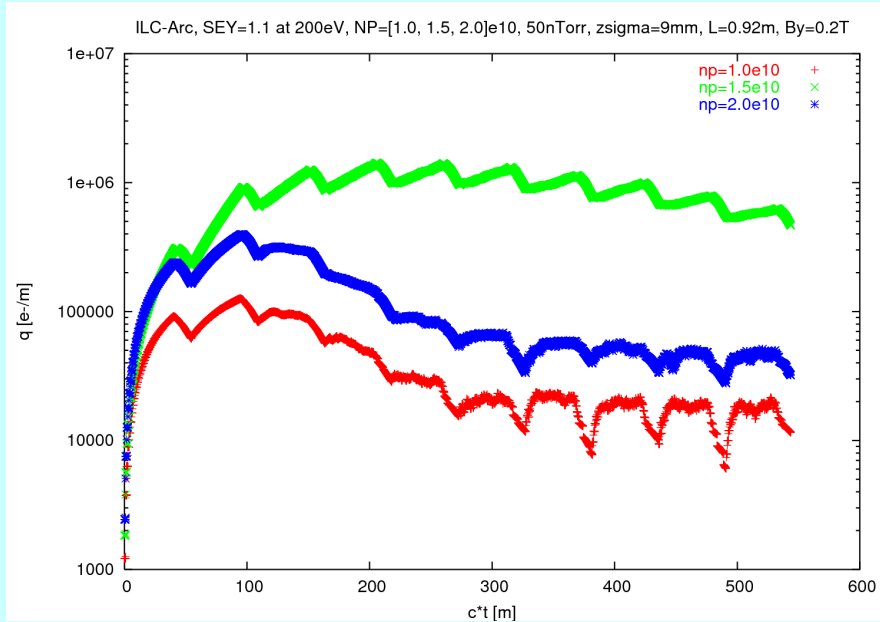
Electrons per cubic metre on the axis

Dependence on SEY, Gasionisation, Photoelectrons

ILC-Arc: diameter of 50 mm
By of 0.2 Tesla
Bunch length of $\sigma=9\text{mm}$
Bunch separation of 0.92 metres
Bunches per minitrain: 44
Gaps per minitrain: 30 buckets

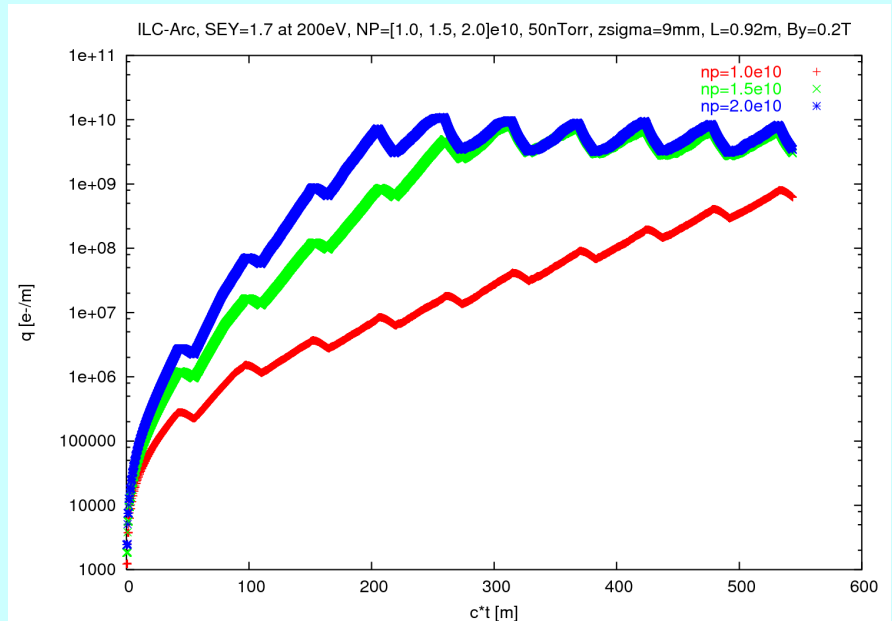
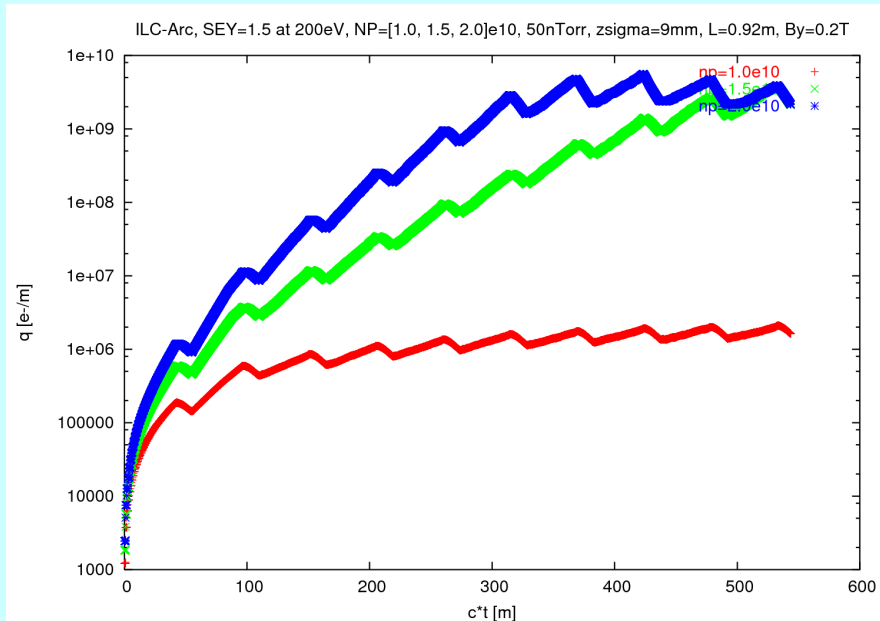


Fixed gasionisation, varying Bunchpopulation and SEY, 50 nTorr, no PEY



SEY=1.1, 50 nTorr, nP=1e10,1.5e10,2e20

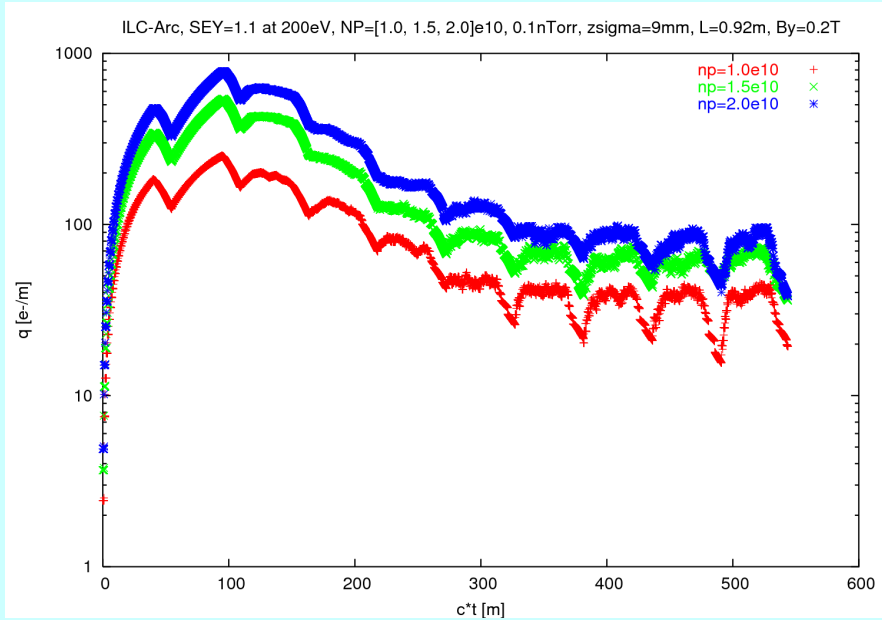
SEY=1.3, 50 nTorr, nP=1e10,1.5e10,2e20



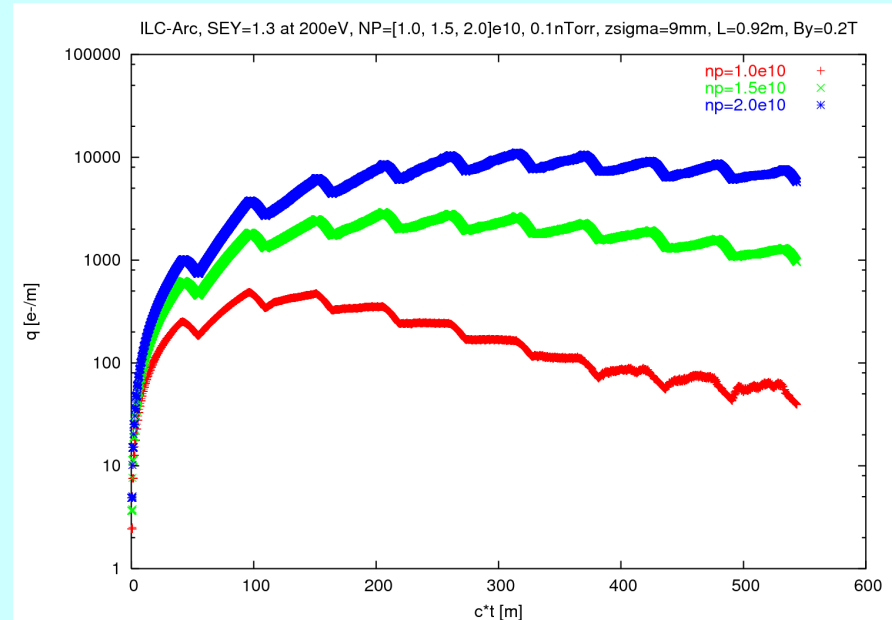
SEY=1.5, 50 nTorr, nP=1e10,1.5e10,2e20

SEY=1.7, 50 nTorr, nP=1e10,1.5e10,2e20

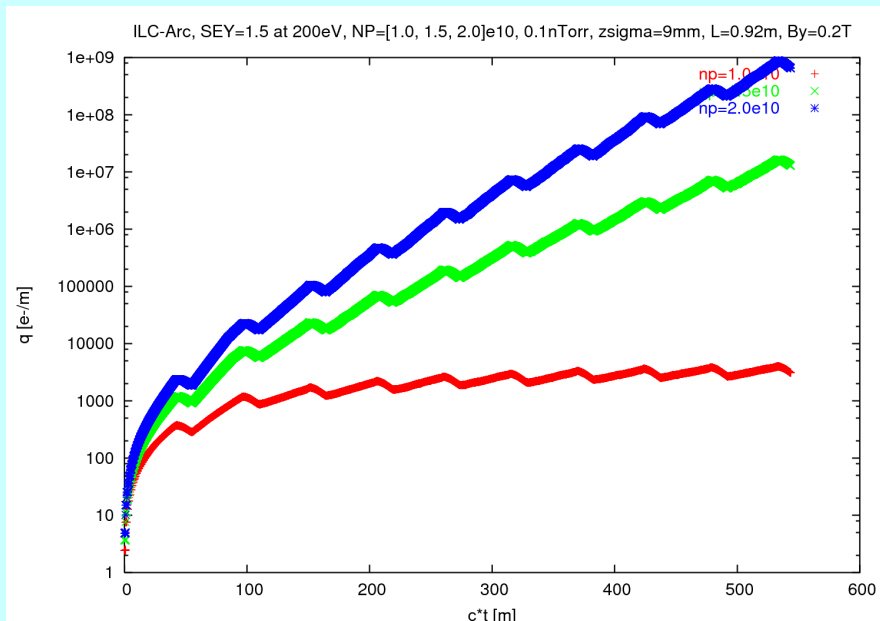
Fixed gasionisation, varying Bunchpopulation and SEY, 0.1nTorr, no PEY



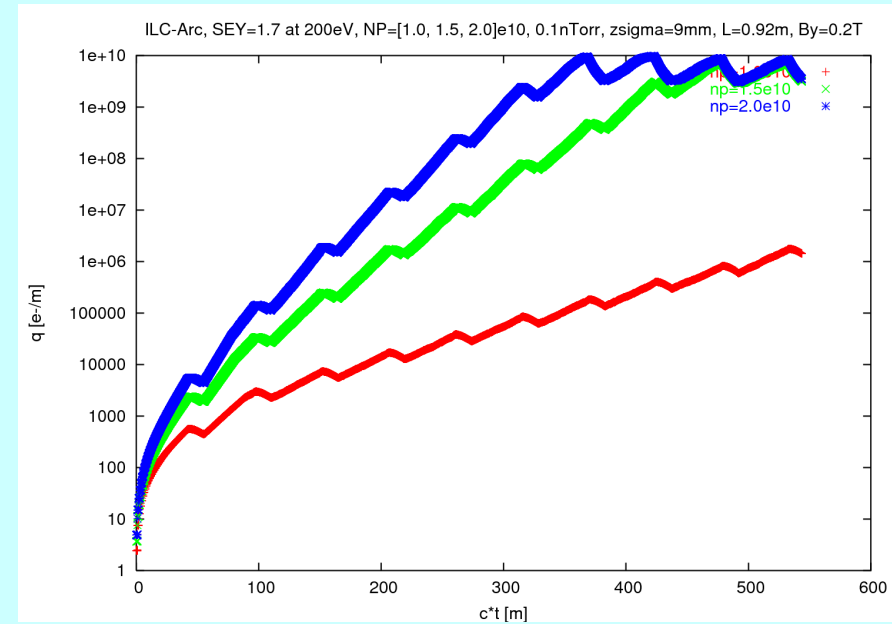
SEY=1.1, 0.1 nTorr, nP=1e10,1.5e10,2e20



SEY=1.3, 0.1nTorr, nP=1e10,1.5e10,2e20

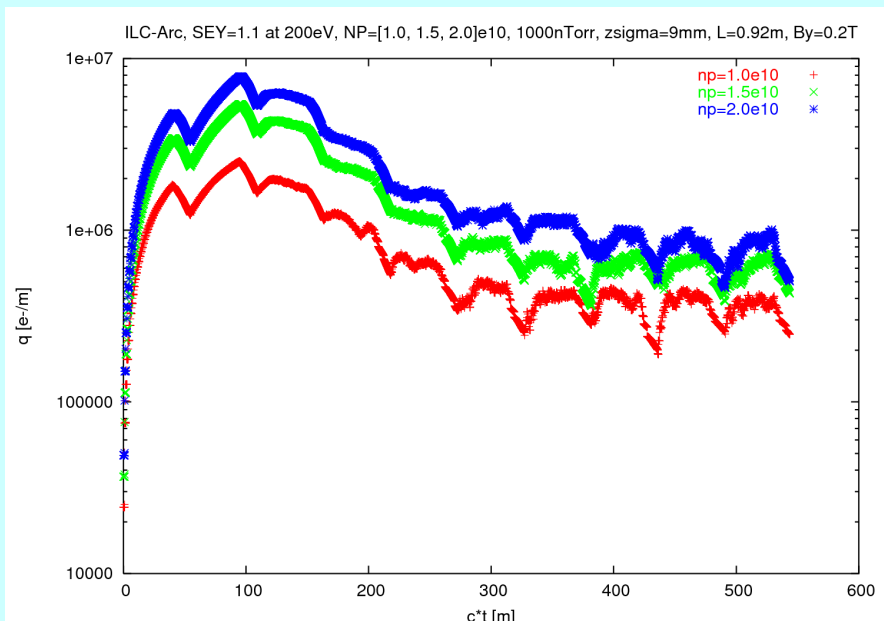


SEY=1.5, 0.1 nTorr, nP=1e10,1.5e10,2e20

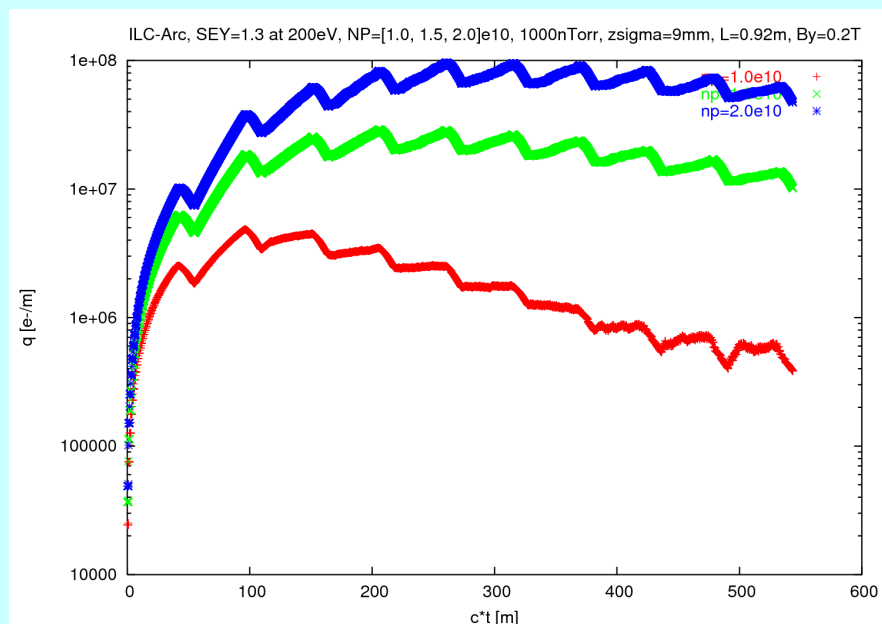


SEY=1.7, 0.1 nTorr, nP=1e10,1.5e10,2e20

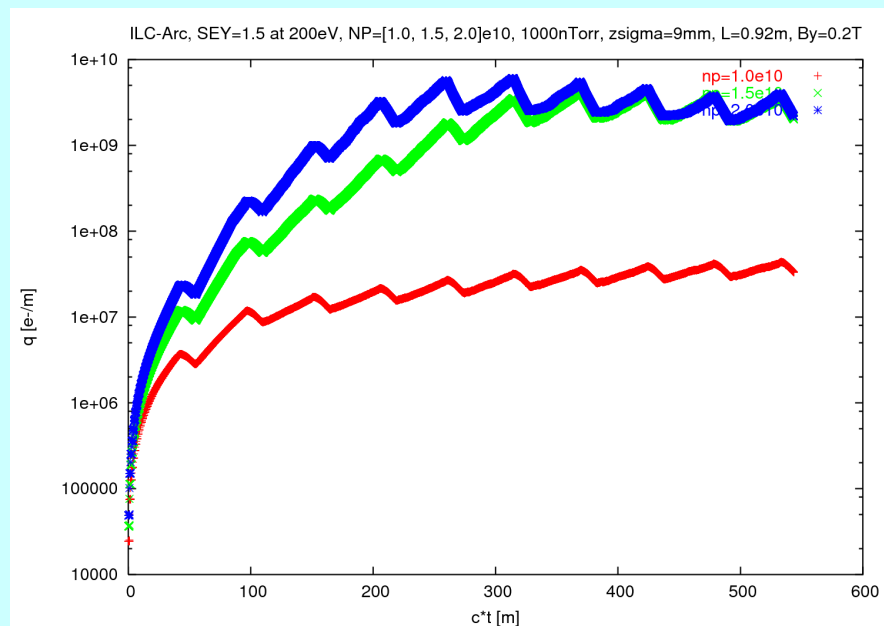
Fixed gasionisation, varying Bunchpopulation and SEY, 1000nTorr, no PEY



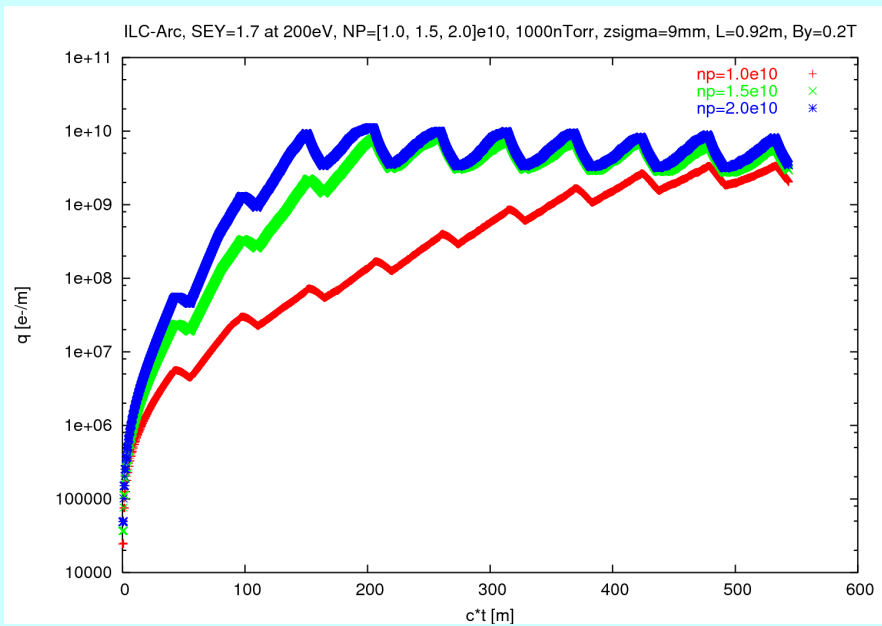
SEY=1.1, 1000 nTorr, nP=1e10,1.5e10,2e20



SEY=1.3, 1000 nTorr, nP=1e10,1.5e10,2e20

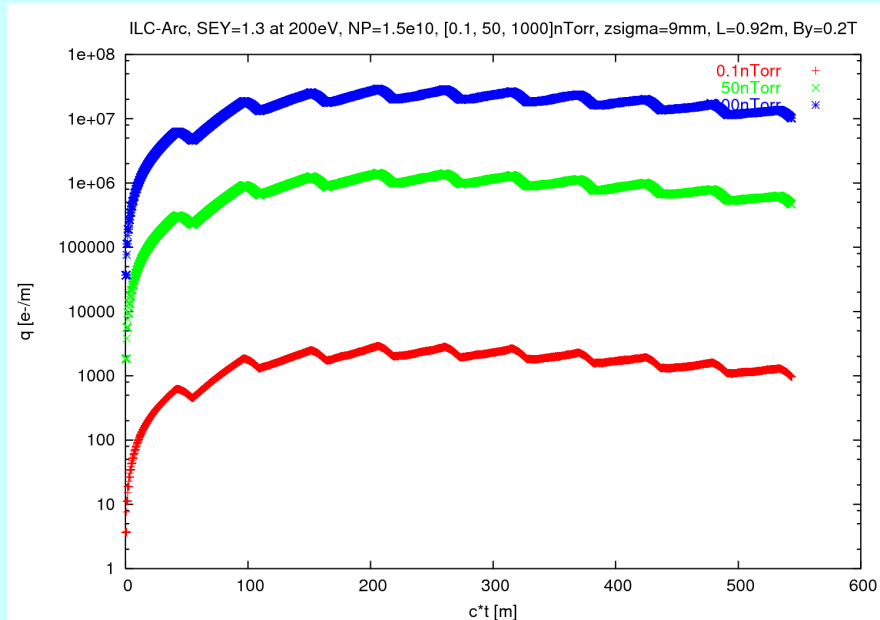


SEY=1.5, 1000 nTorr, nP=1e10,1.5e10,2e20



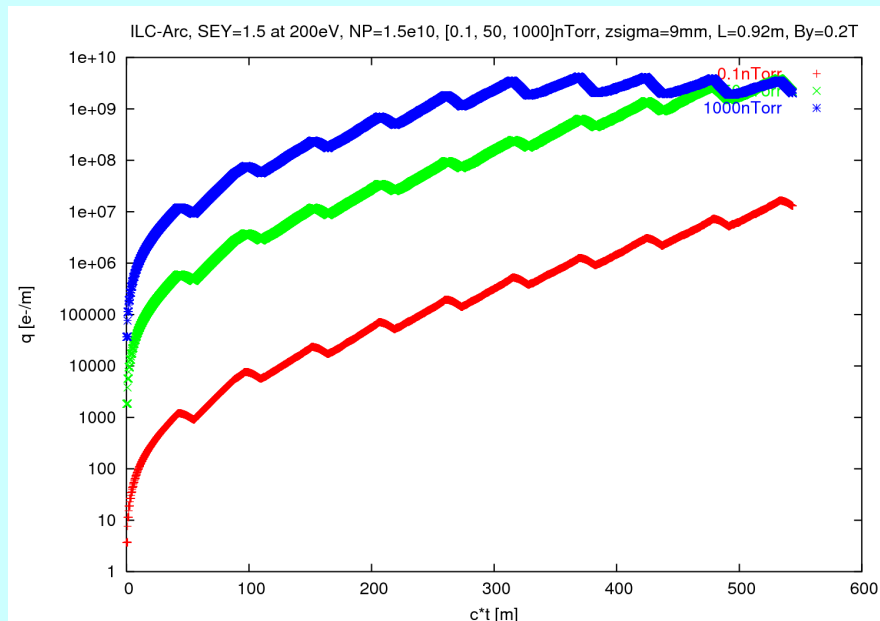
SEY=1.7, 1000 nTorr, nP=1e10,1.5e10,2e20

Fixed SEY, varying Gaspressure and Bunchpopulation, no PEY

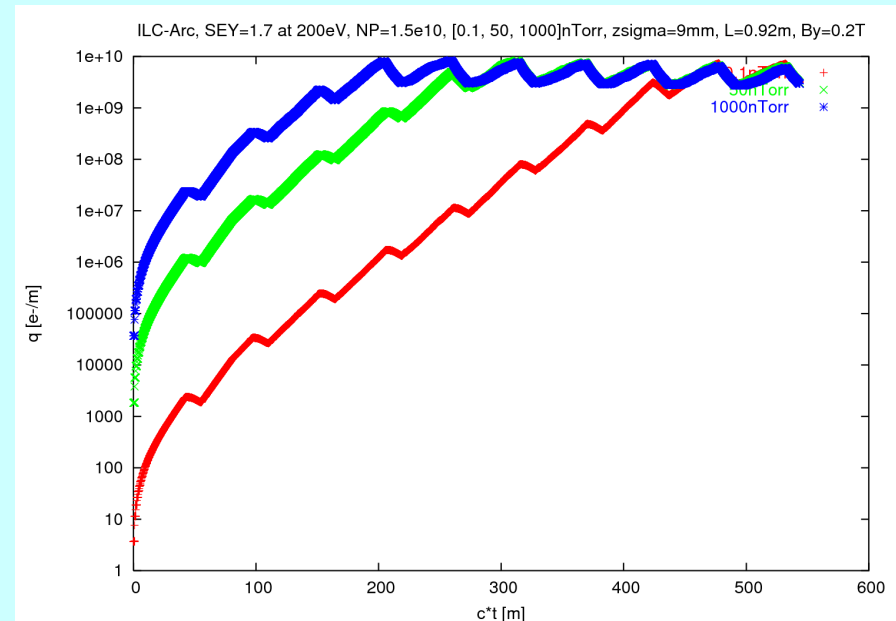


(Results have mysteriously disappeared)

SEY=1.3, [0.1,50,1000] nTorr, nP=1.5e10

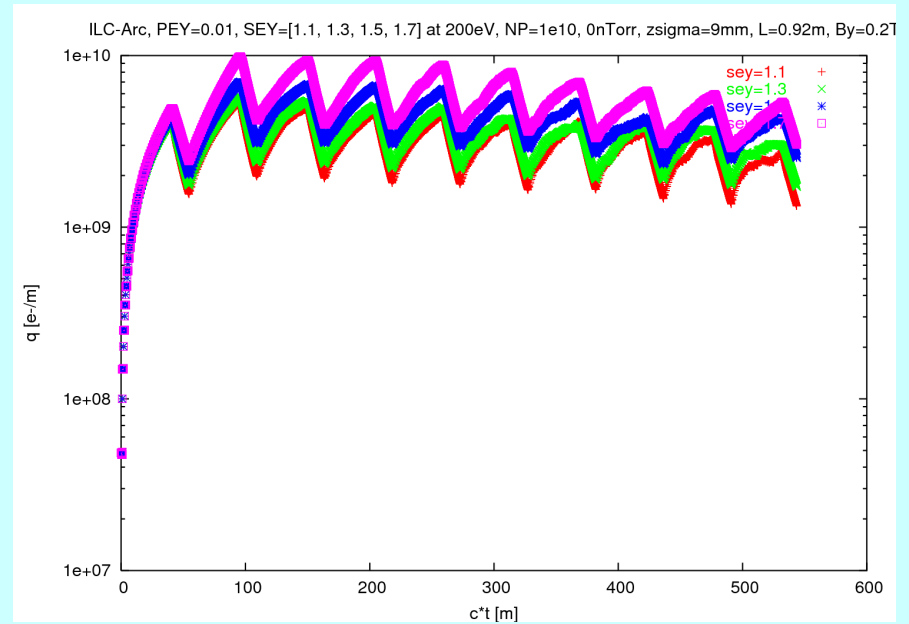
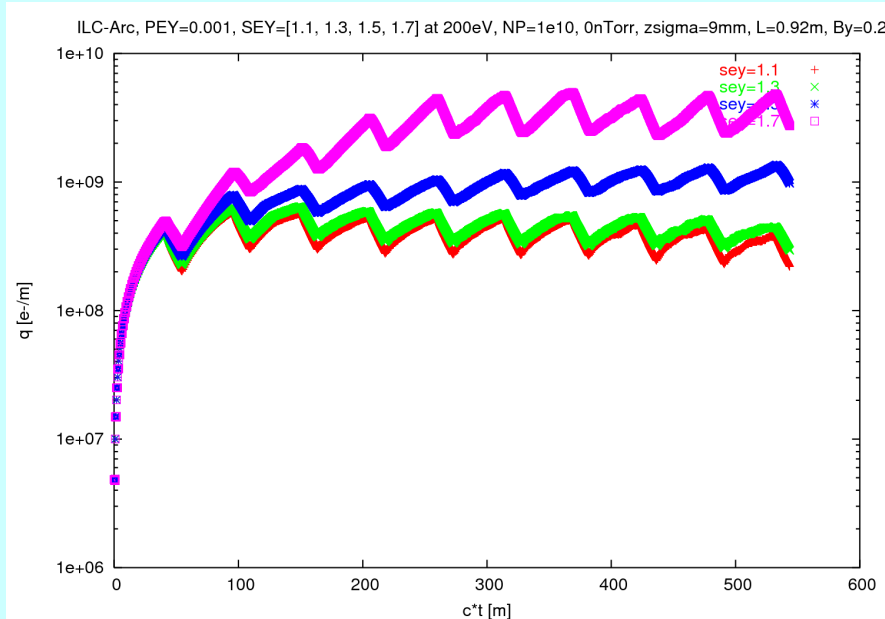


SEY=1.5, [0.1, 50, 1000]nTorr, nP=1.5e10



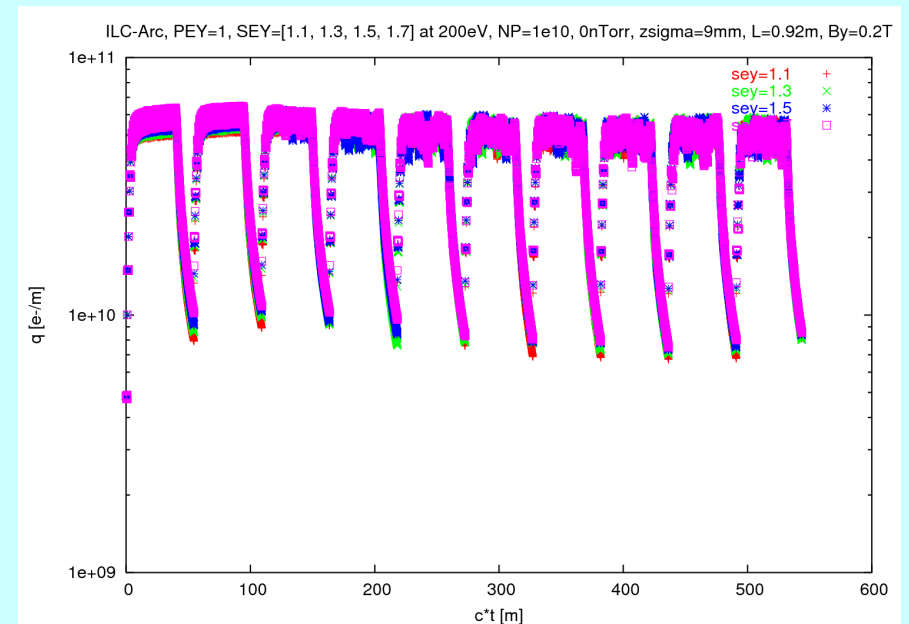
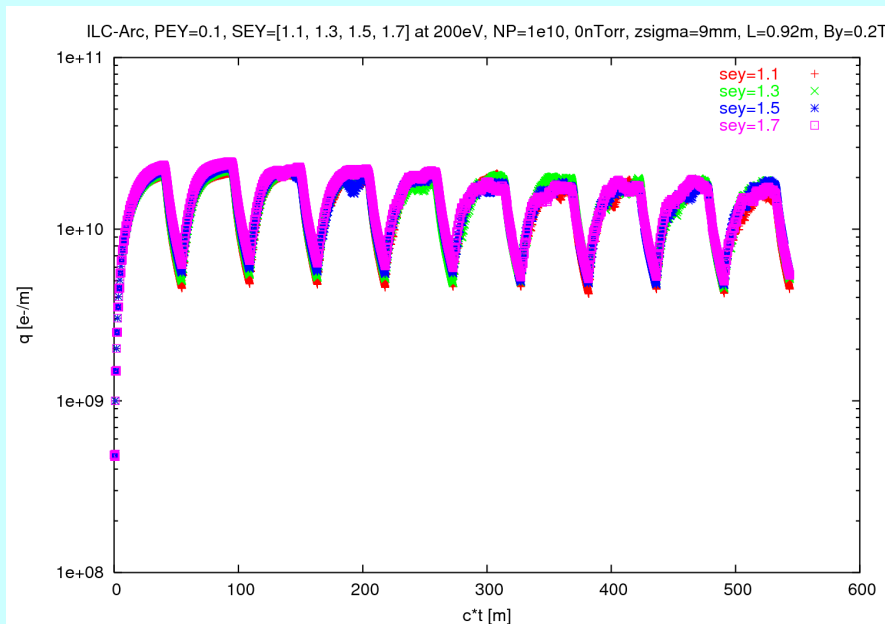
SEY=1.7, [0.1, 50, 1000]nTorr, nP=1.5e10

Fixed PEY, varying SEY and Bunchpopulation, no Gaspressure



PEY=0.001, SEY=[1.3,1.5,1.7], nP=1e10

PEY=0.01, SEY=[1.3,1.5,1.7], nP=1e10



PEY=0.1, SEY=[1.3,1.5,1.7], nP=1e10

PEY=1, SEY=[1.3,1.5,1.7], nP=1e10