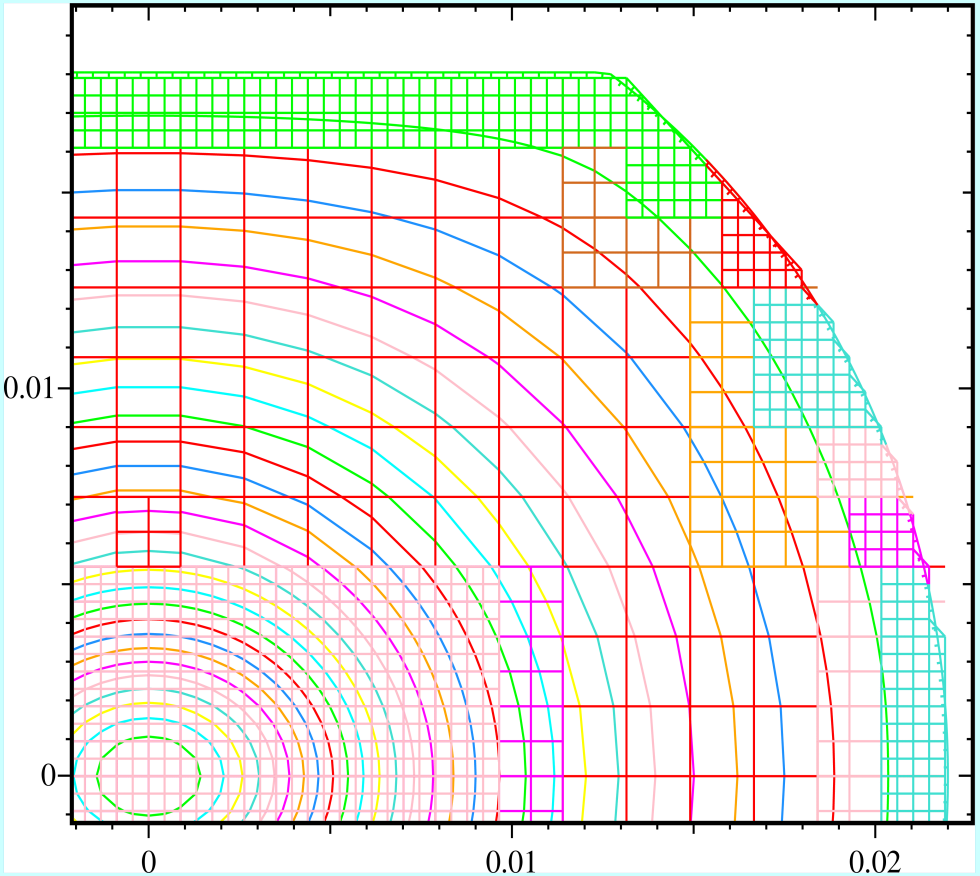
Faktor2: Electrostatic PIC in 2D/3D

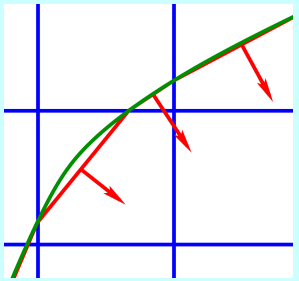
Warner Bruns, CERN



For each timestep:
- Charge deposition on the grid.
- Solution of Poissons equation to obtain electrostatic force.
- Integrating Newtons law to obtain new particle positions.

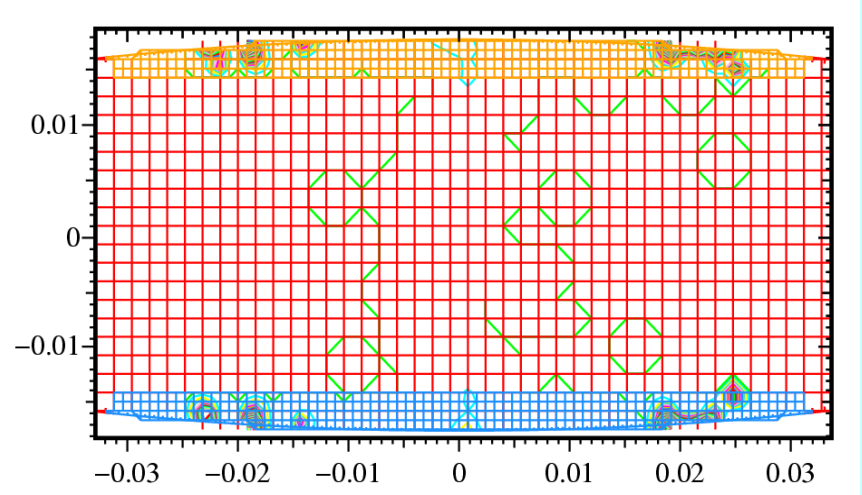
The mesh is recursively refined.
The spacing decreases by a factor of 2 per refinement level.
Electrons and Ions of arbitrary mass are tracked.
The exciting beam may have any cross section.
Arbitrary 3D magnetostatic fields may be applied.

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.

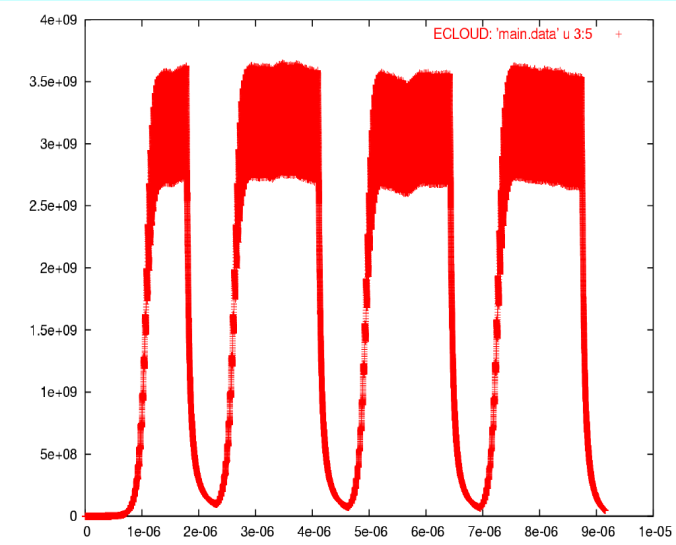


Electron cloud buildup

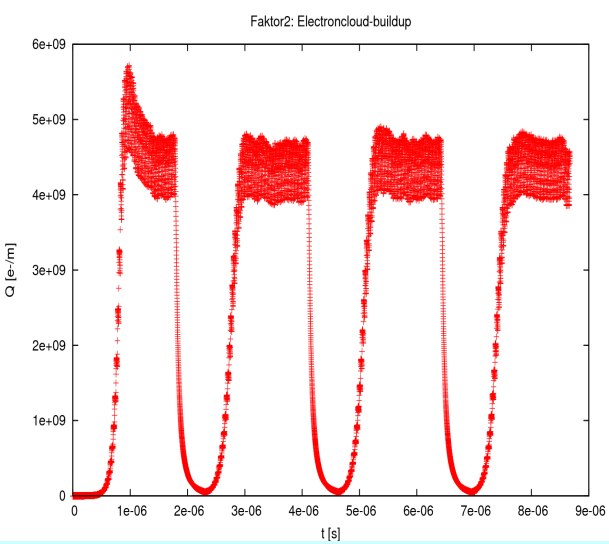
- 2D Results comparable with ECLOUD



Snapshot of charge density



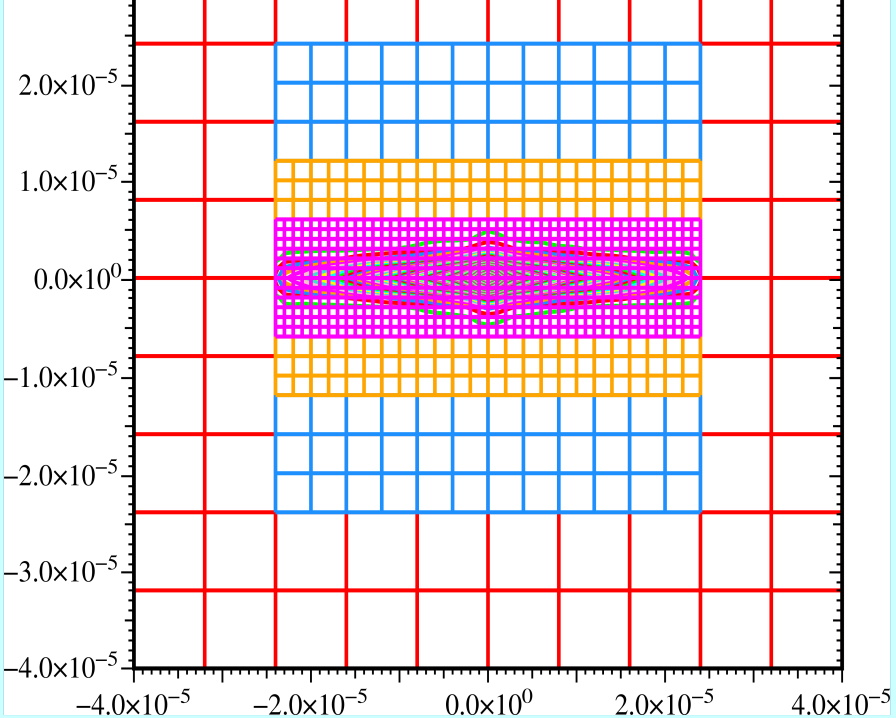
e-/m, computed by ECLOUD



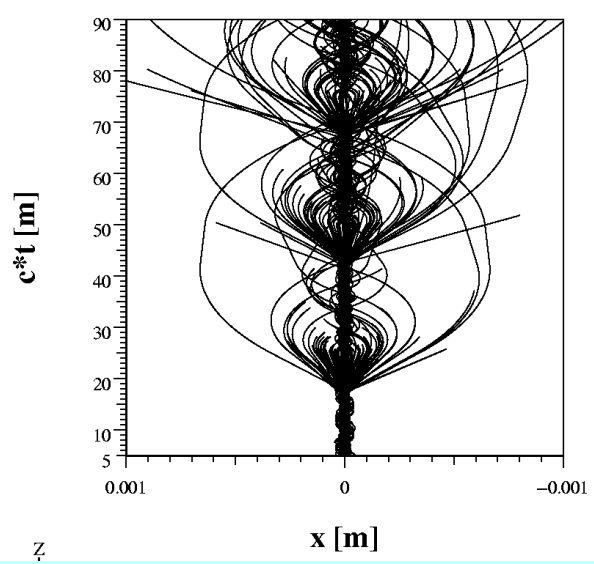
e-/m, computed by Faktor2

Ion-Trapping

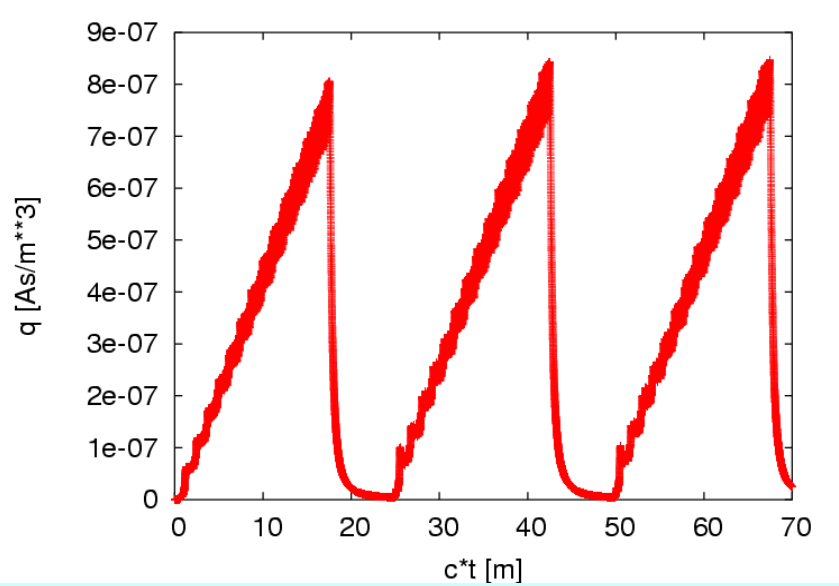
- Recursively refined mesh allows resolution of tiny beam extensions.
- Ion-Trapping can be simulated.



Snapshot of charge density of CO-Ions



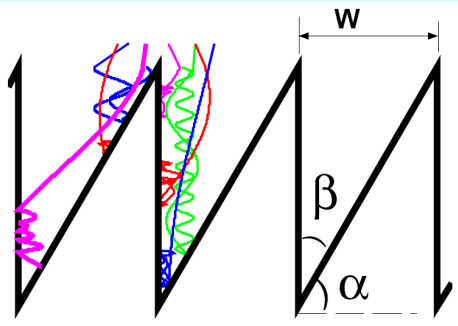
CO-Trajectories



Density of CO-Ions on the axis

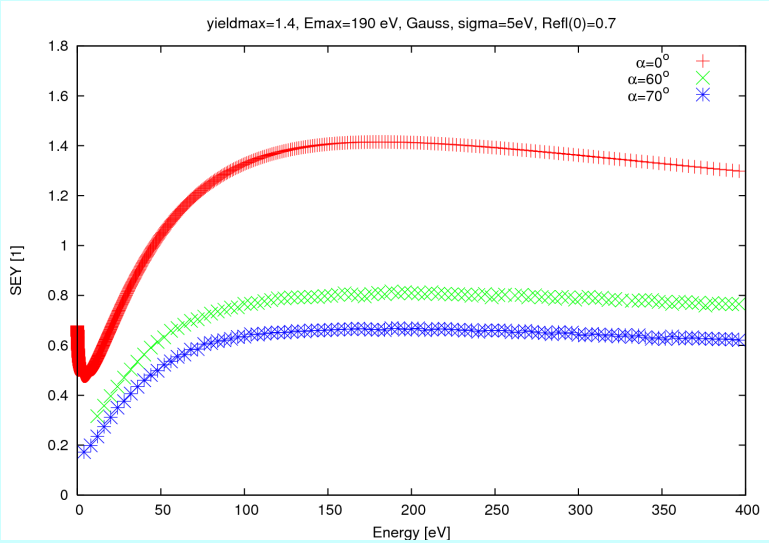
SEY of grooved surfaces

Comparison with results published by L. Wang.

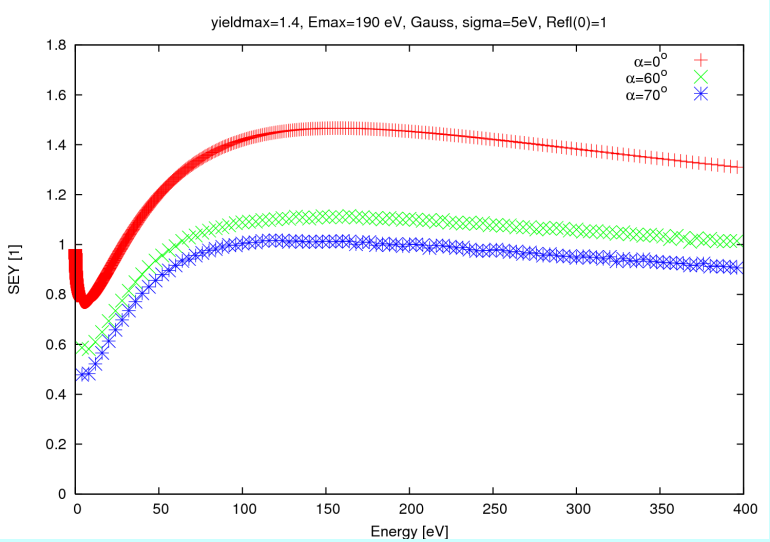


Principle: Particles hitting a surface create secondary particles which hit the surface again with a lower energy. They are partly absorbed before they can exit the surface region.

- Effective SEY of grooved surfaces is less than that of a flat surface.
- Reduction strongly depends on SEY at zero energy.



Effective SEY of grovved surface with W=0.38mm. When the reflectivity of electrons with zero energy is 0.7, the effective SEY of the grooved surface stays below 1 already for slope angles larger than 60 degrees.

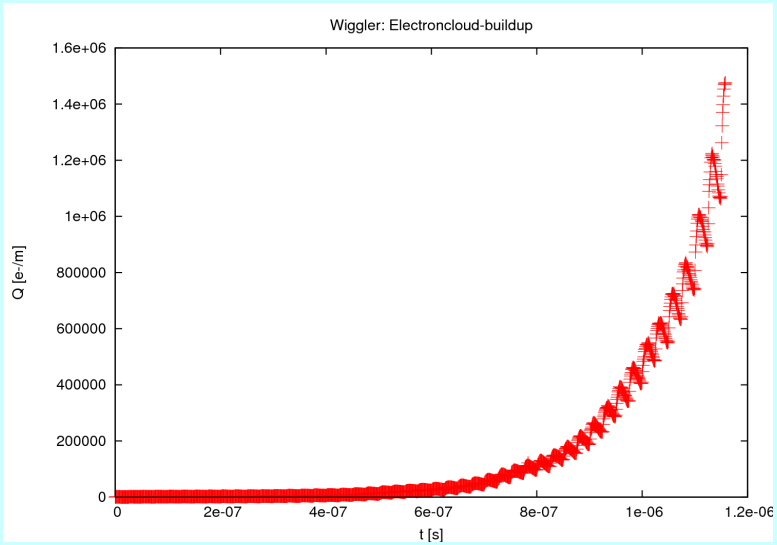


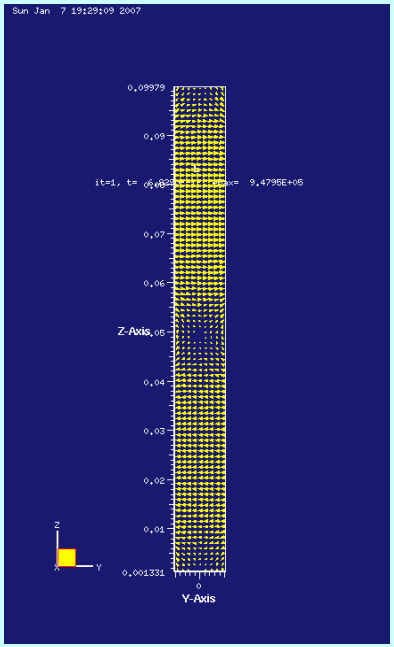
When the reflectivity of electrons with zero energy is 1, the effective SEY of the grooved surface stays below 1 only for slope angle larger than 70 degrees.

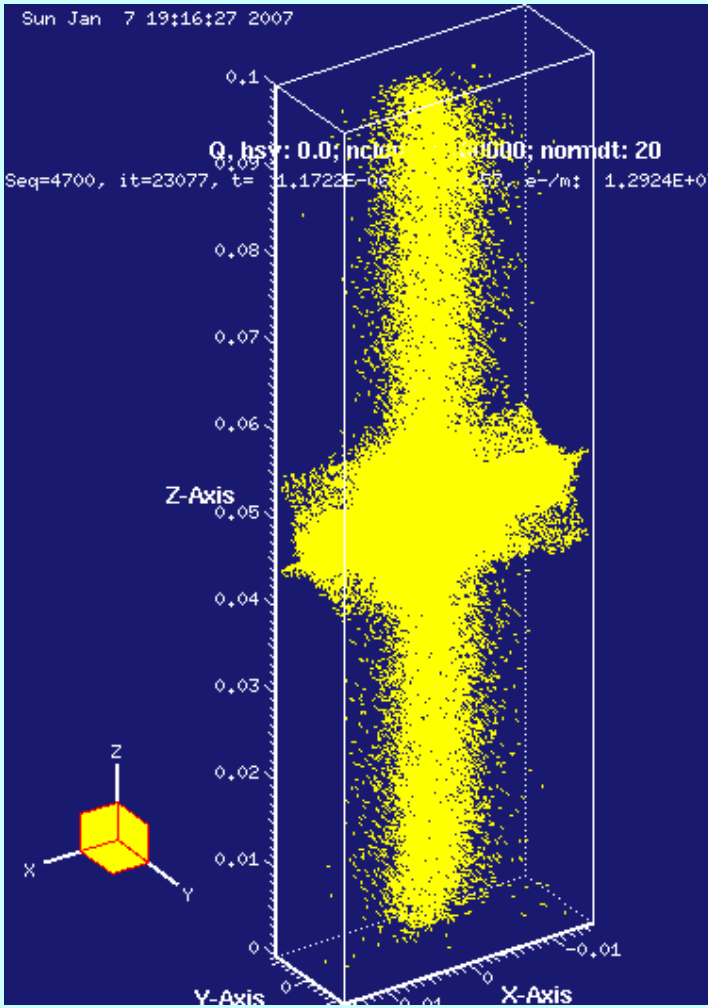
Electron cloud in wiggler

- 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 :-(